The performance figures quoted are typical and are subject to normal manufacturing and service tolerances.

The right is reserved to alter the equipment described in this manual in the light of future technical development.

WARNING

Certain semi-conductor devices used in this equipment contain Beryllium Oxide. If inhaled, dust from this oxide can be toxic. No danger can arise from normal handling but no attempt should be made to tamper with these devices. They should not be discarded with industrial or domestic waste.

WARNING

The power supply module has been designed to meet relevant safety requirements. If it is necessary to replace any safety conscious component only the item quoted in the Parts List MUST be fitted. Ensure that these components are securely fastened and that all insulators and covers are fitted after servicing. Check that all warning labels are in place. If any re-wiring of the mains input supply cables is necessary the specified type MUST be used and alterations to the routeing or connections MUST NOT be made.

BASE STATION
TYPE FX5000

ISSUE 1 JULY 1990

Printed in England TP94

AMENDMENT LIST

Changes made to the equipment described in this manual are published as amendments which are dated and consecutively numbered.

Reprints of the manual will incorporate all the amendments to date and an entry to this effect will be recorded on the amendment list below. Each page affected by amendment action will bear the amendment number as a suffix to the manual reference number e.g. TP123/4 indicates that the page has been corrected by amendment number 4.

Should it be necessary to raise the issue of a manual the amendment numbering will recommence with No. 1.

Amend't No.	Date	Initials	Remarks

ERRORS & OMISSIONS

The usefulness of this Service Manual depends upon its accuracy. Whilst every endeavour has been made to minimise errors, some may exist. It is therefore requested that any errors or omissions noted be advised as follows:

Please quote:

a) Title of manual

b) TP No. and Issue No.

c) Last amendment No. received

d) Page and/or Fig. No. in error

Please send to:

Philips Radio Communication Systems Ltd.
Publications Department
P.O. Box 24 St Andrews Road
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England

CONTENTS

Remote Control Option AT14920

CTCSS/Voting/Piptone Option AT29061

Ancillaries Shelf

Appendix 1

Metering Panel

FORMAT OF THE MANUAL

Division of Information

This service manual is divided into two parts. Part One deals with the general aspects of the overall equipment and is sub-divided into four sections:- Product Support Policy, General Information, Commissioning-Installation-Maintenance and Spares Details. Part Two details the modules which make-up the overall equipment with each sub-section dealing with a specific unit, piece part or variant of an assembly.

Some sub-sections or variant information may not be applicable to, or required for, specific equipments supplied to a customer. Sufficient information is, however, given to enable the specific variants to be identified and the relevant information extracted.

Page Numbering

The page numbering in Part One is in the form 1.1, 1.2, 1.3 etc; where the section number preceeds the page number. In Part Two the the page numbering system is in the form (AT04878/-) 1; where the page number is preceded by the module assembly Part No.

Part Numbering

Each assembly used in this equipment will be allocated a Consumer Services Number in 12NC format.

A list of modules giving a cross reference from the Alpha-numeric Part No. to a Philips RCS Cambridge 12NC Spares Part No. is included in Part I Section 4 of this publication.

A separate Part List for each module is given in the appropriate sub-section of Part Two. A list of mechanical items which comprise the shelf assembly is given in section 4 of Part One.

Note: *Unless otherwise stated, all the mechanical items given in the Parts Lists are available as 'spares'. Items NOT listed are NOT available.*

Test Equipment

A list of test equipment suitable for carrying out the test and alignment procedures detailed in this service manual is given on pages 3.15 and 3.16 in Part I of this manual. Thereafter the equipments are listed in abbreviated form only
(eg: 11. Marker oscillator) and assume a cross reference to this list.

Amendments

Amendments to this service manual will generally take the form of updated replacement pages; a record of amendments incorporated should be entered on the page provided.

PART I

OVERALL EQUIPMENT DETAILS

SECTION 1
PRODUCT SUPPORT POLICY

EQUIPMENT COVERED

The service policy covers the following ranges of equipment;

(a) FX5000 multi-channel synthesized base station - VHF bands, E,A,B and UHF bands U,T,W.

(b) Base station option cards - CTCSS/Assort and M80RCM.

FX5000 OUTLINE DESCRIPTION

The FX5000 comprises a range of base station equipments. It is of modular construction, each of the functional units being housed in a separate module and plugged into the common shelf from the front to both maximise the flexibility of options and to simplify the service and repair procedure.

The following is a list of the units of which the FX5000 is comprised;

Power supply unit	: AT04878/- used on all versions
Control Module	: AT04872/- used on all versions
Receiver Module	: AT04880/- (VHF and UHF synthesized)
Transmitter Driver	: AT04881/- (VHF and UHF synthesized)
Power Amplifier	: AT04874/- (VHF 30W); AT04879/- (VHF 50W); AT04882/- (UHF 25W); AT04883/04 (E Band 50W)
Shelf/backplane unit	: AT04875/- used on all versions
M80RCM option	: AT14920
CTCSS/Assort option	: AT29061

For the purposes of this service policy all of the above units are repairable and available as Field Exchange Units (FEU's).

SERVICE LEVELS

MINIMUM TRAINING REQUIREMENT

It is essential that this product is only serviced (to any of the following four levels defined) by Philips RCS trained and authorised service workshops personnel.

LEVEL 1 SERVICE/MAINTENANCE

(a) Recommended Field actions

The first level of on-site service and maintenance of the above equipment may involve:-

(i) Routine monitoring of meter points.
(ii) Fault diagnosis by local alarm interpretation.
(iii) Checking of RF, Audio and logic interface connection integrity to the base station.
(iv) Adjustment of the following parameters in accordance with handbook information:-

Tx deviation.
Rx and Tx frequencies.
Rx audio output level and Tx audio sensitivity.
Rx squelch level.

(v) Replacement of the following field exchange parts:-
Unit front panels, fasteners and control knobs.
Externally-accessible fuses.

(b) Test Equipment Requirements

(i) F5000 metering panel.
(ii) AF 600Ω level test set.
(iii) Multimeter.
(iv) Modulation meter.
(v) Field service manual.
(vi) Frequency counter.
(vii) F5000 handset.

Note: Refer to Section 3, Table 3.1, for suitable types.

LEVEL 2 SERVICE/MAINTENANCE

(a) Recommended Field and Service Depot actions:-

As for level 1, and additionally:-

(i) Mechanical repairs

(ii) Replacement of following field exchange parts:-
Tx and Rx Unit crystals.
Tx and Rx Crystal oven assembly.

(iii) Replacement of following FEU's:-
Control module audio card.
Control module logic card.
Control module front panel and PCB assembly.
M80RCM Option assembly.
CTCSS/Assort Options card.
Power supply unit.
Receiver unit.
Transmitter driver unit.
Transmitter power amplifier.
Control module.

(iv) Replacement of the following workshop exchange unit:-
Power amplifier control board

(v) Adjustment of replacement modules as in level 1, but in addition;
Setting of RF output power.
Measurement of Rx sensitivity.
Distortion measurement. (Tx & Rx)
Customisation of control module by link selection.
Adjustment of metering controls.
Station checks and air check.
Alignment of replacement RF units on customer frequency.

(b) Test Equipment requirements

Additional to level 1:-

(i) RF power meter and attenuators.
(ii) RF signal generator.
(iii) Distortion analyser.

Note: Refer to Section 3, Table 3.1, for suitable types.

LEVEL 3 SERVICE/MAINTENANCE

Level 3 is defined as 'servicing of boards and modules to component level'.

Workshop Facilities Required

Level 3 Service/Maintenance is to be undertaken at well equipped workshops with suitable skill level available and necessary environment and equipment to maintain the original quality standards for the product.

Test Equipment requirements

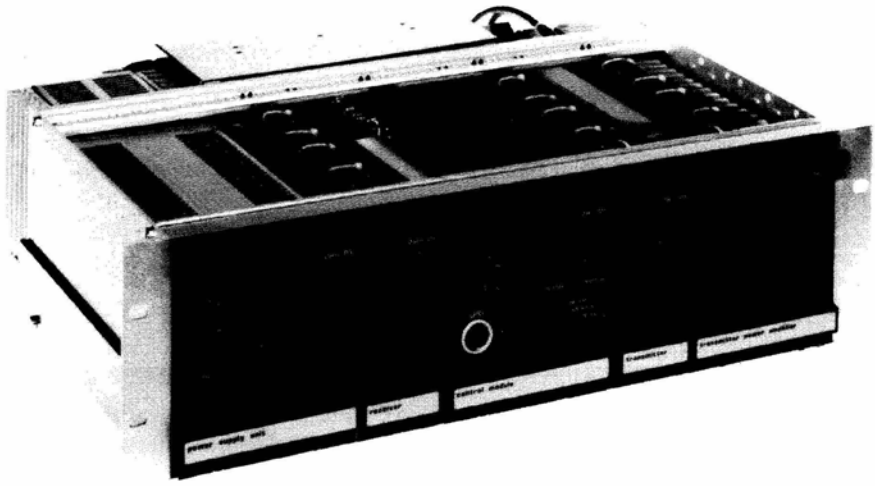
(i) Full Service Manual (TP94)
(ii) Full complement of test equipment as detailed in TP94, Section 3, Table 3.1.

LEVEL 4 SERVICE/MAINTENANCE

This level of repair is carried out at a Central Repair Unit and is intended to cover the complete cosmetic, electrical and mechanical repair of faulty radio units.

The units repaired by the Central Repair Unit are designated as Field Exchange Units (FEU's). All faulty and repaired FEU's shall be routed to and from the Central Repair Unit via Consumer Service. It is essential that faulty and repaired units are packed in a manner that prevents any damage during transit.

SECTION 2
GENERAL INFORMATION



INTRODUCTION

The FX5000 series of frequency modulated base station equipments is designed to meet a wide range of requirements for high quality, versatility and adaptability in the VHF and UHF frequency bands.

A modular approach to the construction of the FX5000 series has been adopted with sub-units sliding into proprietary shelf fittings. Interconnection between units is via flexible ribbons interfaced on a backplane PCB. Flexible coaxial cables allow external receiver and transmitter connections to be made to the fixed shelf bulkhead, and enable all but the power supply module to be withdrawn from the front of the shelf whilst the base station is operational.

Five modules are fitted into FX5000 series shelf:

- Power supply
- Receiver
- Control
- Transmitter driver
- Transmitter power amplifier

The use of individual modules provides for rapid on site repair by module replacement and enables faulty units to be repaired and aligned in a workshop environment.

All 'site' level adjustments are carried out on the control module; all other units are pre-aligned. Faulty units can, therefore, be replaced with the minimum of user disruption.

SUMMARY OF DATA

General

Bands	A9 146-174MHz BO 132-156MHz EO 66-88MHz TI 405-440MHz UO 440-470MHz WM 470-520MHz	
Temperature Range	-30 to +60°C	
Operational Temperature Range	-30 to +70°C (Performance to specification not guaranteed)	
Storage Temperature Range	-40 to +80°C	
Power Supply (AC)	115V or 220-240V ±10% 47-60Hz (Fitted with 24V DC standby)	
Power Supply (DC)	24V -10% +20% +ve or -ve chassis	
Channel Spacing	12,5kHz 20kHz 25kHz	
No. of Channels	Up to 128	
Frequency Stability	±2ppm	
Connectors	Engineers Handset	7 way DIN
	600Ω lines	5 way DIN
	AC Supply input	3 way IEC
	DC Supply input	3 way AMP
	RX RF input	N type
	TX RF output	N type
	Facilities	37 way D
	Metering	15 way D
Indicators	Power supply module:	DC supply on
		AC supply
		DC supply
	Control module:	Squelch
		Tx on
		Talkthrough
		Alarm
		Normal
		Manual

Note: Reference should be made to Part II of this manual for individual detailed module specifications.

CRYSTAL INFORMATION

The transmitter uses a 10MHz fundamental series mode crystal to specification YE00922.

The receiver uses an 8,4MHz fundamental paralled mode crystal to specification YE00923.

Both crystals are 80°C oven crystals giving a stability of ±2ppm over the range -30°C to +60°C.

MECHANICAL CONSTRUCTION

The mechanical design of the equipment is based on the use of a standard 483mm (19 inch) rack or a 4, 6 or 12 unit cabinet. All interconnections are made via the backplane so sufficient space should be allowed on installation for the withdrawal of equipment.

The base station comprises five sub-modules - power supply, receiver, control, transmitter driver and transmitter power amplifier. Each module is supported on a runner and is withdrawn from the front of the shelf.

Interconnection between modules is via flexible ribbon cables connected to the backplane. Flexible coaxial cables allow external connections to the receiver and transmitter to be made on the fixed shelf bulkhead. With the exception of the power supply module, checks and adjustments may be made on withdrawn modules whilst the equipment remains operational.

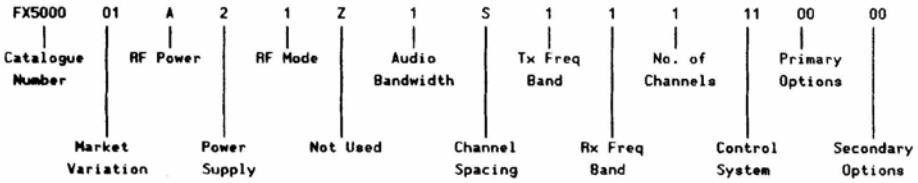
ANCILLARY EQUIPMENT

The following ancillary equipment is available for use with the FX5000 base station. These items are not listed as standard options, are not supplied with the standard equipment and do not form part of the equipment code structure.

Handset	Part No. FH00653
Metering Panel	Refer to page 2.12 for Part No.

EQUIPMENT CODING

The 17-digit code structure comprises a number of options and allows any version of this equipment to be specified. This code is shown on the equipment label, attached to the rear of the unit. A typical code number and its breakdown are given below.



Market Code

01	Standard production
T1	Trunking Applications only

RF Power

A	50 Watts	E0, A9 and B0 Bands only
1	30 Watts	E0, A9 and B0 Bands only
2	25 Watts	
3	15 Watts	
4	10 Watts	
5	6 Watts	
6	1 Watt	
N	Less Tx Modules, No Tx Driver, No Tx PA (Std. Var 2 Code N only)	

Power Supply

1	AC mains 220/240V with 24V DC standby +ve or -ve chassis
2	AC mains 110-115V with 24V DC standby +ve or -ve chassis
3	24V DC only +ve or -ve chassis
4	As code 1 less loudspeaker
5	As code 2 less loudspeaker
6	As code 3 less loudspeaker

RF Mode - ancillaries tray

The following options do not include an ancillaries tray:-

1	Single antenna working with changeover relay (simplex operation only)
2	Two antenna working

The following options include an ancillaries tray:-

3	Single antenna working with changeover relay and Tx isolator (bandwidth up to 0,25%) (simplex operation only)
4	Single antenna working with changeover relay and Tx isolator (bandwidth up to 4,5%) (simplex operation only)
5	Two antenna working with Tx isolator (bandwidth up to 0,25%)
6	Two antenna working with Tx isolator (bandwidth up to 4,5%)
7	Single antenna working with Duplexer (bandwidth - see note) includes Tx isolator

8 As 1, with Fan
9 As 2, with Fan
A As 3, with Fan
B As 4, with Fan
C As 5, with Fan
D As 6, with Fan
E As 7, with Fan

Note: (i) Bandwidth and Duplexer Tx-Rx frequency spacing must be within the following limits:-

E Band bandwidth up to 0,25%, within 5-10MHz spacing
A,B and K Band bandwidth up to 0,25%, within 4,5-9MHz spacing
T,U and W Band bandwidth up to 0,1%, within 4,5-20MHz spacing

(ii) Fan assisted cooling is only necessary when greater than 4 x F5000(30W) or 2 x F5000(50W) equipments are stacked in one cabinet. The ancillary fan shelf must be centrally located within the FX5000 equipments. Spacing between equipments, in all cases, must be at least 1u and vented. The use of ancillary shelves is permissable if fronted with a 1u vented panel.

Not Used

Audio Bandwidth

1 300-3000Hz

Channel Spacing

S 12,5kHz
R 20kHz
V 25kHz

TX Frequency Band

2 146 to 174MHz A9 Band
3 132 to 156MHz B0 Band
4 68 to 88MHz E0 Band
5 405 to 440MHz T1 Band
6 440 to 470MHZ U0 Band
7 470 to 520MHz WM Band
N Less Tx modules. No Tx Driver, no Tx PA (with blank front panels)

RX Frequency Band

2 146 to 174MHz A9 Band
3 132 to 156MHz B0 Band
4 68 to 88MHz E0 Band
5 405 to 440MHz T1 Band
6 440 to 470MHz U0 Band
7 470 to 520MHz WM Band
N Less Rx Module (with blank front panel)

Number of Channels

T	Frequency not defined
1	1 RF Channel programmed
2	2 RF Channels programmed
3	3 RF Channels programmed
9	9 RF Channels programmed
X	10 RF Channels programmed
A	11 RF Channels programmed
B	12 RF Channels programmed
C	13 RF Channels programmed
D	14 RF Channels programmed
E	15 RF Channels programmed
F	16 RF Channels programmed
G	Greater than 16 RF Channels programmed (up to 128 channels)

Control System

00	Less control module

Series 10 - Extended Control

11	Standard systems base station or link for control by on-site interconnected equipment (600Ω audio + DC). Maximum distance 100 metres Simplex, duplex or T/T, 4-wire only.

Note: Less local 2970Hz keytone detection and generation.

12	As code 11 plus local 2970Hz keytone detection and generation plus 2-wire line controlled limited facility (Tx/Rx only).
13	As code 11 plus local 2970Hz keytone detection and generation plus 4-wire line controlled limited facility. (Tx/Rx only).

Series 20 Remote Control M80 Signalling 2-Wire

21	Transmit/Receive + Channel change control, 2-wire
22	Transmit/Receive + 3 Facilities (Line intercom + squelch defeat + controlled T/T) + Channel change control, 2-wire
23	Transmit/Receive + 3 Facilities + Simple line fail T/T + Channel change control, 2-wire
24	Transmit/Receive + 3 Facilities + Simple line fail T/T + Supervisories + Channel change control, 2-wire

Series 30 Remote Control M80 Signalling 4-Wire

31	Transmit/Receive + Channel change control, 4-wire
32	Transmit/Receive + 3 Facilities (Line intercom + squelch defeat + controlled T/T) + Channel change control, 4-wire
33	Transmit/Receive + 3 Facilities + Simple line fail T/T + Channel change control, 4-wire
34	Transmit/Receive + 3 Facilities + Simple line fail T/T + Supervisories + Channel change control, 4-wire

Primary Options (Installation)

00	Less installation items
01	Mounting for stack rack, less connectors
04	Mating connectors
05	01 + 04

Secondary Option 1 (High stability Tx oscillator)

0	Less high stability Tx oscillator.
1	Driver linked for use with 10MHz external oscillator (not provided)
2	With 5MHz high stability oscillator* (See Note)
3	Using external high stability source of arbitary frequency. (Not supplied, external phase-lock board required).

**Note: High stability oscillator module must be ordered under its 12NC code (3513 505 03161)*

Secondary Option 2 (Selective calling)

0	No selective calling
1	Voting Encoder/CTCSS Encoder/Decoder
2	Voting Encoder
3	CTCSS Encoder/Decoder
4	CTCSS Decoder only

Note: Secondary option 2 codes 1+2 not available with 2-wire systems. 2970Hz Rx call should not be used with voting.

OUTLINE TECHNICAL DESCRIPTION

Power Supply Unit

Three versions of this module provide for operation from an AC supply of either 115V or 240V, or from a nominal 24V DC supply. In each, an unregulated 24V DC output is provided for use on the transmitter power amplifier module whilst dual regulators provide two +18V outputs for use on the other modules.

Front panel LEDs indicate the availability of AC and DC inputs; a further LED indicates the presence of the DC outputs to the other modules within the equipment (as controlled by the On/Off switch). If both AC and DC supplies are present, the relay circuit will select the AC supply. Otherwise it will select the DC supply. However, in the event of an AC over-voltage, the relay circuit will select the DC supply. This module also houses the AF monitor amplifier and optional loudspeaker. Provision is made for connection of an external loudspeaker.

Receiver (All frequency bands, refer to the Receiver Block Diagram in Part II)

The received signal from the antenna is routed through the varicap-diode tuned input filters to the mixer. Inter-stage RF amplification is provided on UHF bands only. This signal is then mixed with the injection signal to an IF of 21,4MHz.

The reference frequency is provided by an 8,4MHz oven controlled crystal oscillator, which is fed directly into the frequency synthesizer.

A Voltage controlled oscillator operating at the final injection frequency is buffered and split to drive both the injection mixer and the prescaler, whose output is fed to the frequency synthesizer. Incoming channel selection information in 7-line parallel format is applied to the PROM which contains the customer frequency information. This PROM transfers the frequency information to the synthesizer, controlling the divide ratios as required for the channel frequency selected.

The synthesizer outputs an error voltage which controls the frequency of the VCO. The RF tuned filters are 'slaved' to this same voltage.

The 21,4MHz IF output from the mixer is filtered (FL1), mixed down the second IF frequency of 455MHz, filtered again (FL2) and applied to the discriminator (by which time it has been amplitude limited).

Audio from the discriminator is routed as follows:-

(i) Via a variable gain amplifier to the Rx AF processing circuit on the control module audio board.

(ii) Via the noise amplifier and filter to provide an input to the noise operated squelch gate on the logic board of the control module.

A carrier level DC output from the discriminator is applied to the metering amplifier, producing a DC output which controls the carrier level squelch gate on the logic board on the control module. Offset and slope controls are provided to adjust the RF signal level/DC output level characteristic to that required. This voltage is also used for external carrier level metering and assort voting tone selection.

Control Module

The local control module comprises an audio board, logic board and front panel assembly. The module houses all the AF processing and switching circuits for both the receiver and transmitter, the squelch control circuits, the logic for the switching circuits and status indicators. The audio inputs may be carried on either 2-wire or 4-wire lines.

Audio routeing for the receiver and transmitter is achieved using a series of gates which are controlled by outputs from the logic board.

Unprocessed audio from the receiver module is filtered, de-emphasised and passed to the squelch gate. This gate is controlled by the carrier and noise squelch circuits on the logic board which are derived from either the filtered noise output or carrier level monitor output on the receiver module. Audio from the squelch gate is applied to the line driver amplifiers and then fed via the line transformers to the 600Ω line. It is also fed to the engineer's handset and monitor amplifier.

Tx audio is derived from either the 600Ω line or the engineer's handset. The latter is applied directly to the pre-emphasis amplifier. The line audio is amplified and then fed, via the sensitivity control, to a high-pass filter and on to the line audio gate. The gated audio is pre-emphasised and passed to the limiting circuit. The output from the limiter is used to control a compressor which in turn adjusts the gain of the pre-emphasis amplifier. Further amplification, controlled by the deviation pot, is followed by a summing network which combines the audio with the CTCSS input.

A low pass filter removes the unwanted harmonics. The output is matched, via a buffer amplifier, to the transmitter driver.

The control module front panel houses the status indicators and provides for the connection of an engineer's handset (EHS). Used in conjunction with the manual/normal switch, the EHS is able to control the operation of the equipment and provide a number of engineering functions.

All front panel indicators are controlled from the logic board, whilst audio routeing for the EHS is carried out on the audio board.

The equipment functions, determined by pre-set links, and all 'site' level adjustments are made at the control module thus restricting any 'on site' adjustments to one module. This allows servicing and maintenance to be performed without disruption to the user.

Transmitter Driver (All frequency bands, refer to the Transmitter Driver Block Diagram in Part II)

The transmitter driver converts the audio signal processed by the control module into a phase modulated signal providing a 2W (UHF) or 1W (VHF) signal for connection either to the power amplifier or directly to the antenna for low power applications. Incoming audio is fed, via the deviation control, to the audio amplifier and modulation monitor circuit.

The transmitter frequency stability is derived from a 10MHz ovened crystal oscillator. Provision is made for phase-locking this oscillator to a high stability 5 or 10MHz externally-supplied frequency source, via an SMC connector. Alternatively, a sample of the 10MHz internal oscillator may be fed to this connector to drive an externally-located phase-lock circuit. The frequency control voltage from this circuit is fed back via the same socket to control the oscillator. In this way the driver stablity may be locked to an external source of arbitrary frequency. The selection of frequency stability option is made by way of on-board solder links.

The transmitter driver uses two voltage controlled oscillators which are phase-locked together at a constant offset frequency of 20MHz.

The first VCO, the 'offset' VCO is locked onto a frequency 20MHz away from the final required frequency, by the synthesizer. Incoming channel selection in 7-wire parallel format is fed to the PROM containing the customer frequencies. This PROM controls the divide ratios within the synthesizer. The synthesizer receives divided-down signals from both the crystal oscillator and the offset VCO, and generates an error signal which controls the offset VCO frequency, locking it to a frequency 20MHz away from the customer required frequency.

The second VCO, the 'modulation' VCO operates at the final RF frequency. It is locked to the offset VCO in the following manner;

Buffered samples from each oscillator are fed to the RF and LO ports of a balanced mixer. The IF port of this mixer contains the sum and difference frequencies of the two VCO's. This signal is applied to a 20MHz low-pass filter to remove the sum component. The filtered signal (20 MHz when in the locked condition) is then divided down to 625kHz, and fed to one input of a phase comparator. The other input is derived by dividing the 10MHz crystal reference to 625kHz *(see below). The filtered error signal from this comparator is then used to control the frequency of the modulation oscillator.

Modulation is applied to the modulation oscillator by pulse-width modulation of the divided-down 625kHz reference signal * (see above).

The modulated, final frequency output from the modulation oscillator is then amplified to give an output power of 2 watts for UHF frequency bands, or 1 watt at VHF frequencies.

Transmitter keying can be achieved either by keying on the amplifier stages of the driver, or by keying on the modulation VCO together with the amplifier stages. This latter case is normally preferred for single-frequency simplex working, when a continuously-running oscillator would interfere with the common-frequency receiver. Key-on time is extended due to the requirement for the modulation oscillator to achieve lock.

The output power from the wideband RF amplifier stages is monitored by a power detector. Output from this detector is used to adjust the gain of the stages, to maintain the output power preset by means of a potentiometer. An inability to maintain the required output produces an on-board LED power alarm. This alarm is combined with lock-alarms from the two phase-locked loops (and also from the crystal reference phase-locked loop when an external high-stability source is used) and the oven temperature alarm signal to produce a transmitter driver alarm signal. This signal is fed via the 15-way connector to the monitoring circuit within the control module.

Internal circuitry monitors the presence of the on-board regulated +12V and +5V supplied, lighting an LED when these are present. Supply failure from those detectors is also fed to the supply connector, for monitoring within the control module.

Transmitter Power Amplifier

The 50W power amplifier delivers a minimum of 50W into a 50Ω load; on 30 Watt versions the transmitter power amplifier output is greater than 30W into a 50Ω load and may be continuously adjusted down to 6W using the POWER SET control. In the case of the 30W module, the 24V unregulated DC supply applied to the module is used by the switching regulator to provide the voltage rail for the power amplifier circuit. This arrangement enables the RF output level to be controlled by adjusting the supply rail via the POWER SET feedback loop on the PA control board. An external control line enables the power to be remotely adjusted.

50 Watt modules are slightly different, in that the output stage is fed directly from the 24V unregulated supply, with power control being achieved via the driver transistor only.

A two-tier thermal protection circuit enables the module to register an initial over-temperature condition but continue operating at half power, or shutdown completely if the temperature increase is continued.

CHANNEL FREQUENCY INFORMATION

The channel frequency information for the receiver and transmitter driver units is held within a 512kb PROM (Programmable Read-Only Memory) located in the respective radio unit. These PROMs are normally identical for the transmitter and receiver within a basestation, and may be exchanged to assist fault-finding if they are labelled identically. A known good PROM may be copied using a suitable PROM programmer. The blank PROM to be used for this should be Part No. 3513 993 28002. A label, marked exactly as the original should be fixed onto the new PROM before use, a suitable label is Part No. 3513 903 71491.

PROM programming software is available as Part No. 3513 506 10360, which includes the instructions for operating the software.

Test frequencies are 'blown' into all PROMs to facilitate unit alignment, these are stored in a memory area of the PROM which is separate from that containing the customer frequencies. Details of how to access these frequencies are contained within the alignment procedure for the individual unit.

Note: Care must be taken to ensure that only the customer frequencies are accessed when the unit alignment is complete.

Each transmitter and receiver is capable of being switched to any one of up to 127 radio frequency channels. The two radio units are addressed simultaneously by 7 lines (C0-C6) entering the units via the 15-way 'D' connector.

These 7 lines (address lines) select the area of memory within the PROM from which the frequency is to be read. Since the transmitter and receiver units have independently-programmed PROMS, neither is 'slaved' to the other, despite the fact that both use the same address lines.

To access 128 channels, each of the address lines can be switched to a logic '1' (+5V) state or a logic '0' (0V) state. The designated 'channel number' corresponds to the decimal value of the binary coded number formed by lines C6 to C0 taking the values 0 or 2. Hence:-

Address line:	C6	C5	C4	C3	C2	C1	C0	Channel No
Logic state:	0	0	0	0	0	0	1	1
Similarly	0	0	0	0	0	1	0	2
	0	0	0	0	0	1	1	3
	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:
	1	1	1	1	1	1	1	127

Where C0 = 2^0, C1 = 2^1, C2 = 2^2 etc.

Channel 0 (consisting of logic 0 on all lines) is not used.

The radio frequency held in each used memory location within each Prom is determined at the time the PROM is programmed or 'blown'. This information normally forms part of the customer's order information. Should it be required to change this information, the PROM should be removed and replaced with a PROM containing the new required frequency information.

The only constraints on the usable frequencies are that they should all be on integral multiples of 5kHz or 6,25kHz and that they should all be within the 'switched bandwidth' of the equipment; for the FX5000 series of base stations this is 4,5% i.e.:-

$$\frac{2(fmax - fmin)}{(fmax + fmin)} \times 100 = 4,5$$

Channel Selection.

(a) Single Channel only operation.

If it is required to operate the equipment on one fixed channel only, this can be achieved as follows:-

(i) Transmitter Driver unit.

The seven plug-in links (Part No. FC99060) within the module (LK301 to LK307) in positions B-C connect the PROM address lines to the 'D' connector to enable control external to the unit. However, they may be used in position A-B to selectively pull down to 0V any of the lines C0 to C6. Since each line is pulled up to +5V, omitting a link puts a logic 1 on the associated line, whereas fitting a link pulls it down to 0V. By fitting only those links required to access the channel number containing the wanted frequency information and discarding the other links, the channel control is isolated from the C0-C6 control lines on the 'D' connector

(ii) Receiver Unit.

Removal of the ribbon cable between plugs PLD and PLC on the receiver board isolates the PROM address lines from the input connector. These lines, which are all pulled up to +5V by RN1, may then selectively be pulled down by fitting links (Part No. FC99060) as required between the pins of PLC. Channel lines are identified by the legend printed on the PCB.

(b) Multi-channel operation.

(i) Local control

The address lines are accessible on the channel switch plug PLX on the rear panel of the equipment. Control lines C0 to C6 are accessible on pins 1 to 7 respectively on modification state 0 equipment, and 0V is available on pin 12 for pull-down. C0 to C6 appear on pins 3,5,7,9,11,13 and 15 and the 0V appears on pins 19 and 20. Local channel control of the 127 channels can be obtained by extending these lines to 7 binary switches.

If control of only 7 channels is required a 7-way single pole switch may be used for channel selection. Since this enables only one line to be pulled down at any time, only the following channel numbers are accessible in this way:-

Ch No.	C6	C5	C4	C3	C2	C1	C0
63	0	1	1	1	1	1	1
95	1	0	1	1	1	1	1
111	1	1	0	1	1	1	1
119	1	1	1	0	1	1	1
123	1	1	1	1	0	1	1
125	1	1	1	1	1	0	1
126	1	1	1	1	1	1	0

This latter method of channel control is available using the FX5000 metering panel, (Part No. 9525 700 62005 for modification state 0 equipments; 9525 700 62006 for modification state 1 equipments). Although only the lower 6 of the above channels can be controlled from the 6-way front panel switch. For further information, refer to the metering panel information in the ancillaries section.

Alternatively, on modification state 0 equipment only, the channel control lines can be transferred from the channel switch connector to the facilities connector on the rear panel by fitting a linking socket (Part No. 3513 505 02951) into the channel switch plug PLX. Reference should be made to the backplane interconnection diagram to determine the facilities connector pin numbers.

For modification state 1 equipment, channel selection from the rear panel of the equipment is possible by using shorting links (Part No. FC99060) between row A (negative) and row B (C0-C6) selectively as required.

(ii) Extended Control.

Extended control over 600Ω lines of up to 6 channels is possible (the lower 6 channel numbers in the above table) if the remote control option (AT14920) is fitted to the control module.

For modification state 0 equipment, this requires the fitting a linking socket (Part No. 3513 505 02961) to transfer the control lines to the remote control module. For modification state 1 equipment, control is transferred by fitting seven shorting link connectors (Part No. FC99060) between the channel lines (Row B, pins 3,5 7,9,11,13 and 15) and the control module inputs (Row C, pins 4,6,8,10,12,14 and 16)

CAUTION

A shorting link should <u>not</u> be fitted between Row B pin 1 and Row C pin 2, since this will connect the negative supply to the chassis.

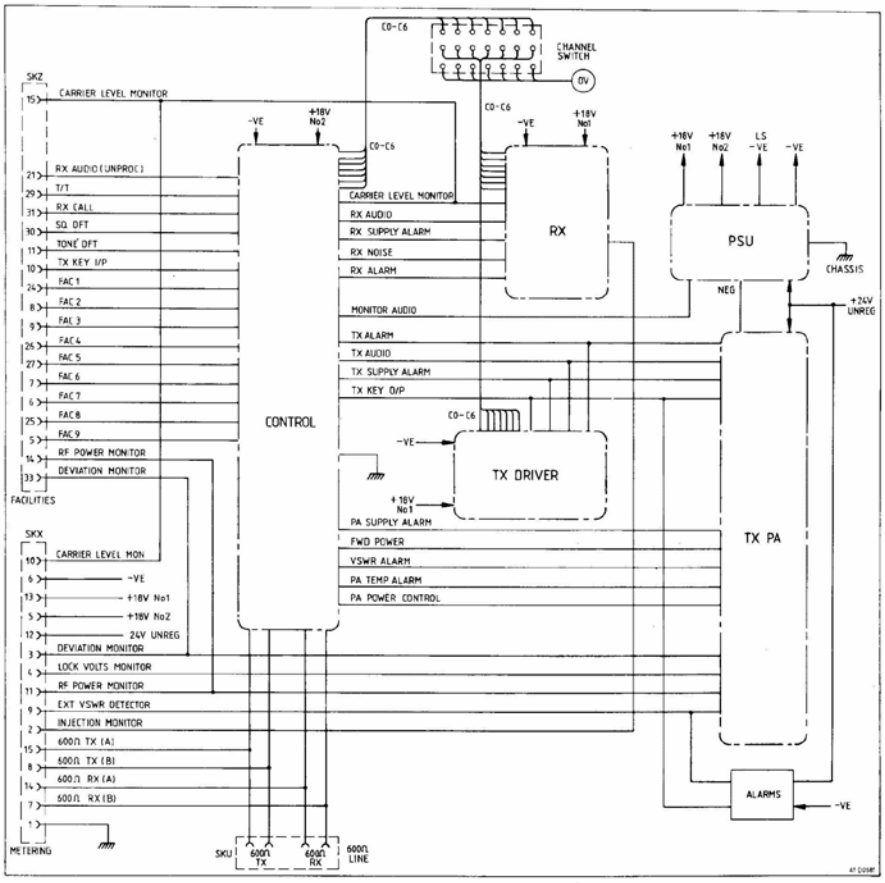


Fig.2.1 Outline Block Diagram - Local Control

LINKING INFORMATION

Links are provided on the backplane PCB assembly, the TX driver and control modules to enable the control functions and characteristics of the equipment to be altered. These are factory set according to the options specified when the equipment is ordered. Further customisation in the field may be carried out.

Backplane Links

LK1 INTERNAL LS

Internal loudspeaker operation.

A-B Internal loudspeaker enabled
B-C Internal loudspeaker disabled

LK2 PA SUPPLY ALARM

Operation of PA supply alarm.

A-B Alarm enabled
B-C Alarm disabled (for when the PA module is not fitted)

LK3 TX ON INDICATION

Connects TX ON indication (and TX power alarm circuit) to either FORWARD POWER (PA fitted) or TX KEY (PA not fitted).

A-B TX KEY (PA not fitted)
B-C FORWARD POWER (PA fitted)

PLV-T-W 600Ω LINKING

Provides 600Ω interface connection at either the Krone block (for direct connection to line) or at the 37-way facilities connector (for connection to local equipment).

PLV-PLT 600Ω in/out on Krone block
PLV-PLW 600Ω in/out on FACILITY socket (local control)

TX Driver Module Links

Two types of links are used within the Tx driver module; customising links and test/alignment links. Details of the latter type are to be found in the Tx alignment procedure in section 2 of this handbook.

CUSTOMISING LINKS

LK101,102,103,104,LK501: Frequency source selection.

The following three options of frequency source are available, dependent upon the required frequency stability:-

Option 1. Transmitter frequency locked to internal ovened crystal oscillator, giving ±2ppm over the temperature range -30°C to 60°C.

Option 2. Transmitter frequency locked to externally-supplied 10MHz frequency source (option 2A) or externally-supplied 5MHz frequency source (option 2B)

Note: Secondary option 1 Code 1 provides a transmitter driver linked to accept an external 10MHz source, but no such source is supplied with the equipment. Code 2 provides a high stability 5MHz source mounted on the rear of the equipment.

Option 3. An external source of arbitrary frequency may be used to lock the internal oscillator. This requires provision of external phase-lock circuitry, independent of the FX5000 Equipment.

The linking arrangements for these three options are shown below:

	LK101	LK102	LK103	LK104	LK501
Option 1	A-B	*	*	*	Open
Option 2A	B-C	A-C	A-B	A-B	Closed
Option 2B	B-C	A-C	A-B	A-C	Closed
Option 3	B-C	A-B	B-C	*	Open

*Note:- * Indicates 'Don't care'*

Unless Secondary option code 1-3 is requested, standard ex-factory linking is:- LK101 A-B; LK102 A-C; LK103 A-B; LK104 A-B; LK501 open.

LK502; Deviation Monitor.

Externally-available metering of deviation, or generation of a logic alarm output when the deviation drops below a preset level is available: link LK502 A-B for analogue monitoring, or LK502 A-C for logic alarm output.

LK403 Tx Key Mode

For use in single-frequency simplex systems, the key off command can be used to switch off the modulator oscillator, thereby preventing interference to the common-frequency receiver. Key-on time is, however, extended. LK403 not connected selects single-frequency simplex mode. For duplex systems the key-off command can be used to switch off the RF amplifier stages whilst leaving the oscillator running, thereby reducing the key-on time. For this option, connect link LK403.

Control Module Links

LK1 REM/LOC FAC SELECTION

Local Control versions do not require any links to be fitted.

Basic M80 remote system only requires two links to be fitted (Squelch Defeat + Talkthrough).

All 15 links factory fitted in remote position.

For each option:

A-B Remote
B-C Local

LK2 DISABLE REMOTE

Used only when an RCM is fitted. Temporarily restores local control for all functions, mainly used as a test facility. Control defaults to local if RCM is not fitted.

A-B	Remote enabled (standard)
B-C	Remote disabled

LK3 UNDEDICATED FAC LINKING

The facility connections on PLB can be reconfigured, if necessary, to provide alternative functions which are available on pins distributed around (mainly) the logic PCB. The primary functions are linked to these pins by 9 links which would normally all be fitted. Any number of these links may be removed in order to link in the alternative functions required using a Berg-Berg wire link.

LK3 pin 1A to pin 9A FAC1 to FAC9 on facility connector

Primary functions - Normally linked directly to LK3 pins 1A to 9A:

LK3 pin 1B **Manual Alarm**

Open collector output. Pulls low to indicate MANUAL mode selected from the front panel (ie: external control disabled).

LK3 pin 2B **Disable TX**

Control input. Prevents the transmitter from being keyed (including remote keying using 2970Hz tone) except for talkthrough operation and keying from the front panel as an engineering function.

LK3 pin 3B **Station Alarm**

Open collector output. Combined TX/RX alarm. Normally pulled down, releases to indicate an alarm condition in the transmitter driver module, PA module, receiver module or equipment connected to Ext. Alarm input.

LK3 pin 4B **Disable ASSORT**

Control input. Disable ASSORT encoder.

LK3 pin 5B **Disable CTCSS Tone**

Control input. Prevents CTCSS tone encoder (internal or external) from modulating transmitter.

LK3 pin 6B **Disable Talkthrough**

Control input. Prevents talkthrough from being selected (including CTCSS controlled talkthrough) except from the front panel as an engineering function.

LK3 pin 7B — Ext. Alarm Input

Control input. To signal alarm from ancillary equipment. Generates station alarm output.

LK3 pin 8B — Disable RX

Control input. Disables receiver audio and logic outputs. (Unprocessed RX audio and carrier level monitor remain active).

LK3 pin 9B — Tone Controlled Facility

Open collector output. Pulls low when signal with valid CTCSS tone is received.

Alternative functions - available on individual pins which may be linked to LK3 pins 1A to 9A using a wire link:

Note: With the exception of pins P16, P25 and P26, these pins are located on the control logic PCB.

P1 — -ve

P2 — On Line Data Enable

Control input. Interrupts RX audio to line and enables On Line Data input for sending to line.

P3 — Carrier Cont. Facility

Open collector output. Pulls low when signal received with or without valid CTCSS tone

P4 — Ext. CTCSS Tone

Audio input for CTCSS tone generated internally.

P5 — Carrier SQ DEF

Control input. Defeats carrier squelch but leaves noise squelch operational.

P6 — Carrier SQ Desens

Control input. Desensitises carrier squelch setting by 6db.

P7 — PA Power Control

Control input. Reduces the transmitter output power by 3dB (not 1W version).

P8 — PA Power Control

Control input. Reduces the transmitter output power by 6dB (not 1W version).

	P24	Carrier SQ Open collector output (when linked via TR1 or TR16 on the logic board). Independent output from carrier squelch detector only. Pulls low to indicate carrier squelch threshold exceeded.
	P25	-ve - (on Control Audio PCB)
	P26	Ext CTCSS Tone - on control audio board.
	TP10	2970Hz Detector Open collector output (when linked via TR1 or TR16 on the logic board). Pulls down when a 2970Hz TX KEY tone has been detected.
	LK29(pin A)	On-line Data Audio input. Sends data to line via line level control. Gated by On-line data enable.

LK4 TT HANG TIME

Provides an optional 2 second hang time before carrier drops out.

A-B No hangtime
B-C 2 seconds hangtime (standard)

LK5 SQ OPEN TIME

Selects squelch open and closing time option.

Note: The slow open/fast close setting, whilst reducing squelch tail, may reduce intelligibility on weak signals with flutter.

A-B Slow open/fast close
B-C Fast open/slow close (standard)

LK6 DISCONNECT CARRIER SQ

Disconnects the carrier squelch signal from the internal squelch logic. Used for systems where the carrier squelch detector is used to drive external logic only.

A-B Carrier squelch connected (standard)
B-C Carrier squelch disconnected.

LK7 DISCONNECT RX ALARM

Disconnects RX alarm signal from STATION ALARM output and from front panel alarm indication.

A-B RX alarm connected (standard)
B-C RX alarm disconnected

LK8 SIMPLEX

Mutes the receiver during transmissions for single frequency simplex operation. Also inhibits talkthrough.

	P24	Carrier SQ Open collector output (when linked via TR1 or TR16 on the logic board). Independent output from carrier squelch detector only. Pulls low to indicate carrier squelch threshold exceeded.
	P25	-ve - (on Control Audio PCB)
	P26	Ext CTCSS Tone - on control audio board.
	TP10	2970Hz Detector Open collector output (when linked via TR1 or TR16 on the logic board). Pulls down when a 2970Hz TX KEY tone has been detected.
	LK29(pin A)	On-line Data Audio input. Sends data to line via line level control. Gated by On-line data enable.

LK4 TT HANG TIME

Provides an optional 2 second hang time before carrier drops out.

A-B No hangtime
B-C 2 seconds hangtime (standard)

LK5 SQ OPEN TIME

Selects squelch open and closing time option.

Note: The slow open/fast close setting, whilst reducing squelch tail, may reduce intelligibility on weak signals with flutter.

A-B Slow open/fast close
B-C Fast open/slow close (standard)

LK6 DISCONNECT CARRIER SQ

Disconnects the carrier squelch signal from the internal squelch logic. Used for systems where the carrier squelch detector is used to drive external logic only.

A-B Carrier squelch connected (standard)
B-C Carrier squelch disconnected.

LK7 DISCONNECT RX ALARM

Disconnects RX alarm signal from STATION ALARM output and from front panel alarm indication.

A-B RX alarm connected (standard)
B-C RX alarm disconnected

LK8 SIMPLEX

Mutes the receiver during transmissions for single frequency simplex operation. Also inhibits talkthrough.

Linked by factory for duplex except for single antenna working option or when TX frequency = RX frequency.

A-B Simplex operation
B-C Duplex operation

LK9 DISABLE RX ON RX ALARM

Mutes the receiver when an RX alarm is present (eg: while crystal oven is warming up).

A-B RX disabled on RX alarm
B-C RX not disabled on RX alarm (standard).

LK10 CTCSS CONTROL SELECT

Selects function to be controlled by the CTCSS decoder. Factory linked for squelch except on CTCSS controlled talkthrough option.

1A-1B Squelch
2A-2B Talkthrough
3A-3B RCM facility A
4A-4B RCM facility B

Note: An open collector output is available for CTCSS control of external equipment regardless of link position.

LK11 RX CALL TYPE

Allows SQ DEFEAT to generate an RX CALL signal to provide downward compatibility with 4000 series equipments.

A-B SQ DEF generates RX CALL
B-C SQ DEF does not generate RX CALL (standard)

LK12 PIPTONE ENABLE

Provides transmitter keying whenever squelch opens to enable the transmission of piptone generated on option PCB.

A-B Piptone enabled
B-C Piptone not enabled (standard)

LK13 RX CALL TONE ENABLE

Provides control of 2970Hz generator either from RX CALL (to give 2970Hz RX CALL tone superimposed on RX audio when squelch opens), or from alternative source. (ie: EHS pressel for use as ASSORT override). Output must also be linked for this alternative.

A-B RX CALL tone enabled
B-C RX CALL tone not enabled (standard)

See also LK31.

LK14 INT/EXT CTCSS TONE

Selects either internal or external CTCSS tone.

A-B Internal CTCSS tone (standard)
B-C External CTCSS tone

LK15 TX PRE-EMPHASIS

Allows TX audio response to be set to flat instead of pre-emphasised (for possible link applications).

A-B Pre-emphasised TX audio (standard)
B-C Flat TX audio

LK16 TX NOTCH ALIGN

Normally fitted. Removal disables Notch 2 to facilitate alignment of Notch 1.

LK17 TX NOTCH ALIGN

Normally fitted. Removal disables Notch 1 to facilitate alignment of Notch 2.

LK18 TX NOTCH IN/OUT

Selects 2970Hz notch filter in TX audio path.

A-B Notch filter enabled (standard for remote)
B-C Notch filter disabled (standard for local)

LK19 TX CHAN SPACING

Controls transmitter deviation. Factory linked according to channel spacing.

1A-1B 12,5kHz spacing
2A-2B 20kHz spacing
3A-3B 25kHz spacing

LK20 TX 600Ω INPUT ATTENUATION

Provides 20dB gain reduction for high line input levels.

A-B Attenuation out
B-C Attenuation in (standard)

LK21 2-WIRE/4-WIRE OPERATION

Selects 2-wire or 4-wire operation

A-B 4-wire (standard)
B-C 2-wire

LK22 2970HZ DETECTOR NARROW/WIDE

Allows 2970Hz tone detector to detect 2300Hz and 2500Hz FSK tones (as per RCP80).

A-B Narrow (standard)
B-C Wide

LK23 2970HZ DETECTOR ENABLE

Enables 2970Hz TX tone detector. Factory linked to DISABLE for local control options, ENABLE for M80 remote options.

A-B Detector disabled
B-C Detector enabled

LK24 4-WIRE INTERCOM

Provides an intercom path between contollers on a 4-wire M80 system.

1A-1B Intercom path post notch
2A-2B Intercom path pre-notch
3A-3B No intercom path (standard)

LK25 RX AF PATH

RX audio routed either directly or via CTCSS options PCB. Factory linked for 'direct' except when CTCSS option PCB is fitted.

A-B Direct RX audio
B-C RX audio via options PCB

LK26 RX DE-EMPHASIS

Allows RX audio response to be set to flat instead of pre-emphasised (for possible link applications).

A-B De-emphasised RX audio (standard)
B-C Flat RX audio

LK27 RX NOTCH IN/OUT

Selects 2970Hz notch filter in RX audio.

A-B Notch filter disabled (standard for local)
B-C Notch filter enabled (standard for remote)

LK28 RX 600Ω OUTPUT ATTENUATION

Provides 20dB or 40dB of attenuation of RX 600 Ω output for low output level applications.

1A-1B 40dB attenuation
2A-2B 20dB attenuation
3A-3B Attenuation out (standard)

LK29 INT/EXT LINE DATA

Allows data to line to be fed from external source (special applications only).

A-B Internal line data (standard)
B-C External line data

LK30 SUPPLY ALARM DEFEAT

Prevents continuous alarms from being generated when the equipment is to be operated with one or more modules missing.

Can also be used as a fault finding aid by short circuiting each pair in turn to determine which module is generating a supply alarm.

Factory set with no links fitted.

1A-1B Defeat PA supply alarm
2A-2B Defeat TX driver supply alarm
3A-3B Defeat RX supply alarm

See also backplane link LK2.

LK31 DISABLE RX CALL OSCILLATOR

Disables 2970Hz RX CALL generator master oscillator to avoid unnecessary spurious radiation when not in use.

A-B Oscillator disabled (standard)
B-C Oscillator enabled

See also LK13.

Table 2.1 - Control Module Standard Linking

LK1	Remote/local facility	-	
LK2	Disable remote	A-B	Enabled
LK3	Undedicated Facilities	-	
LK4	T/T hang time	B-C	Long
LK5	SQ open time	B-C	Fast open/slow close
LK6	Disconnect carrier SQ	A-B	Connected
LK7	Disconnect RX alarm	A-B	RX alarm connected
LK8	Simplex	A-B	Simplex
LK9	Disable RX on RX alarm	B-C	Not disabled
LK10	CTCSS control select	1A-1B	Squelch
LK11	RX call type	B-C	Normal
LK12	Piptone enable	B-C	Not enabled
LK13	RX call tone enable	B-C	Not enabled
LK14	Int/ext CTCSS tone	A-B	Internal
LK15	TX pre-emphasis	A-B	Pre-emphasised
LK16	TX notch align	IN	Non alignment mode
LK17	TX notch align	IN	Non alignment mode
LK18	TX notch in/out	B-C	Local control
LK19	TX channel spacing	1A-1B	12,5kHz
LK20	TX 600 Ω I/P attenuator	B-C	In
LK21	2-wire/4-wire operation	A-B	4-wire
LK22	2970Hz detector narrow/wide	A-B	Narrow
LK23	2970Hz detector enable	A-B	Disabled
LK24	4-wire intercom	3A-3B	No intercom
LK25	RX AF path	A-B	Direct
LK26	RX de-emphasis	A-B	De-emphasised
LK27	RX notch in/out	A-B	Local control
LK28	RX 600 Ω O/P attenuator	3A-3B	Attenuation out
LK29	Int/ext line data	A-B	Internal
LK30	Supply alarm defeat	OUT	No defeat
LK31	Disable RX call oscillator	A-B	Disabled

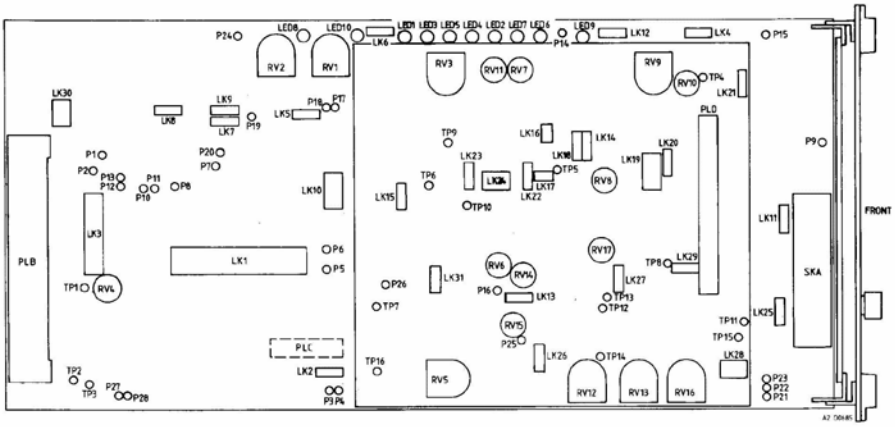


Fig. 2.2 Control Module Links

SECTION 3
INSTALLATION-COMMISSIONING-MAINTENANCE

INSTALLATION

Unpacking & Checking

Equipments are despatched and transported in tailored cardboard packages as detailed in Fig. 3.1.

Note: It is strongly recommended that the packaging is retained for future transportation of modules.

The overall packaging caters for a single equipment complete with all acessories and ancillary items (e.g.: Handset, Duplexer etc.) in a single package.

The 'heavier' units of the base station (power supply unit and transmitter power amplifier) are removed from the shelf housing and individually packed in tailored cartons, with an additional carton provided for the 'accessories'. The shelf with other units fitted is packed in a separate carton. These inner packages are then fitted into a single outer carton fitted with suitable packing material.

On unpacking, each item should be checked against the contents list and thoroughly inspected for any signs of physical damage.

Note: The Company, or their authorised agents, must be advised by letter, within ten days of equipment receipt, of any damage or shortages found.

Shelf Installation

The base station shelf is supplied for installation into either a standard 483mm (19 inch) rack or a 4, 6 or 12 unit cabinet. All external interconnections are made via the backplane and sufficient space all around the unit should be allowed for access when in the withdrawn position. A depth of approximately 300mm in front of the equipment should be allowed for the withdrawal of the base station.

CAUTION

Do not transport the base station as a complete installation in the shelf housing. Failure to comply with this recommendation may lead to damage to the shelf housing.

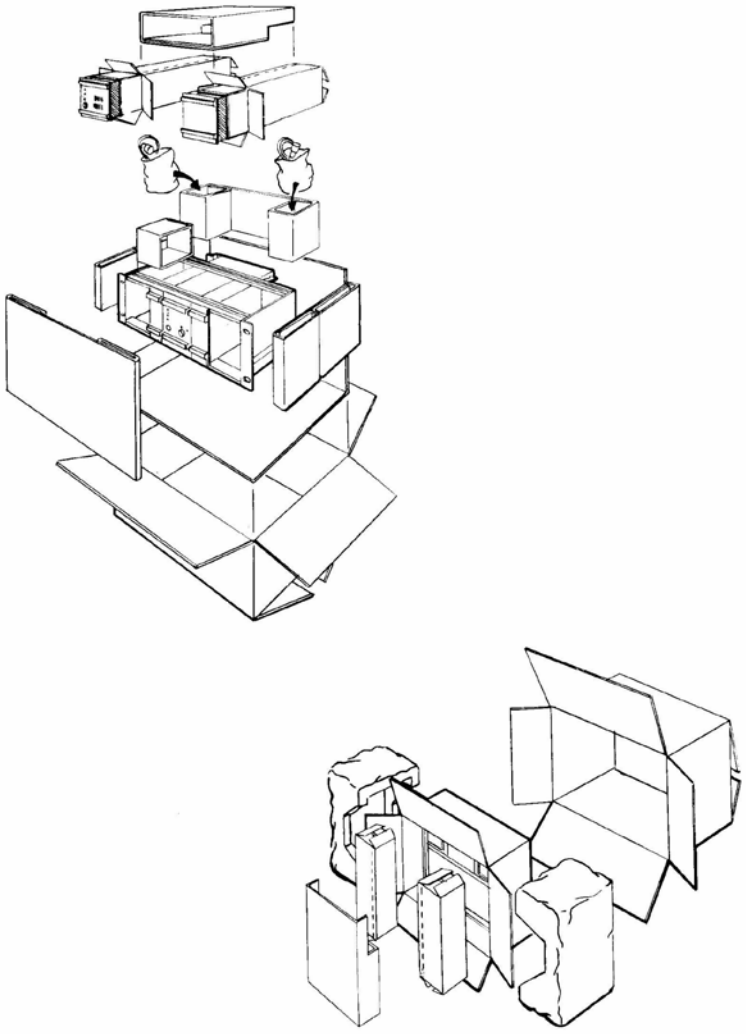


Fig. 3.1. Packaging Arrangements

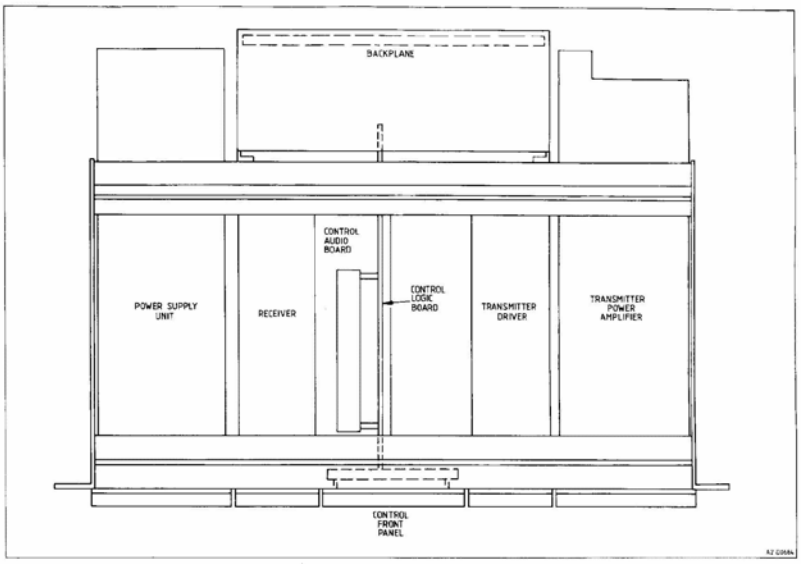


Fig. 3.2 Shelf Layout Diagram

Installation of Units

The power supply and transmitter power amplifier modules are packed separately and require to be installed into the main unit.

1. Power Supply Module

(a) Check that the power supply module is the correct version for the local supply.

(b) AC operated versions

(i) Check that the unit fuse rating is correct.

Supply Voltage	Module Version	Fuse Rating
240V AC	/01,07	2,5A
115V AC	/02,08	5A

(ii) If the DC standby supply is not connected ensure that the selector plug is fitted into the DC input connector. This connects the PSU -Ve line to chassis earth.

(iii) If a DC standby supply is connected refer to para.(d).

(c) 24V DC operated versions

(i) Connect the 24V supply to the DC input connector using the socket and lead assembly supplied with the PSU.

(ii) Fit an 'in-line' fuse (supplied with the equipment bagged items) to each (+Ve and -Ve) DC supply line.

(d) DC standby supply

WARNING

Most types of battery contain corrosive liquids and emit explosive gases. Therefore, when installing or charging such types of battery it is essential to follow the battery manufacturers safety recommendations.

(i) This equipment is capable of being supplied from a 24V DC standby source in the event of a mains failure; it is essential that only a professionally designed standby source is used to provide the standby supply to the equipment. Any DC supply requirement should be met by using the 24V DC only versions of the equipment.

(ii) At regular intervals it is advisable to check that the standby supply is functioning correctly by switching off the AC supply and operating the equipment solely from the standby supply.

(e) Locate and secure the power supply module in position at the left-hand end of the shelf.

(f) Make the appropriate supply connections and check the operation of the power switch and indicators.

(g) With power removed make the connection to the equipment backplane.

2. Transmitter Power Amplifier Module

(a) Locate and secure the module in position at the right-hand end of the shelf.

(b) Make the connections to the transmitter driver, antenna socket and backplane.

Interconnections

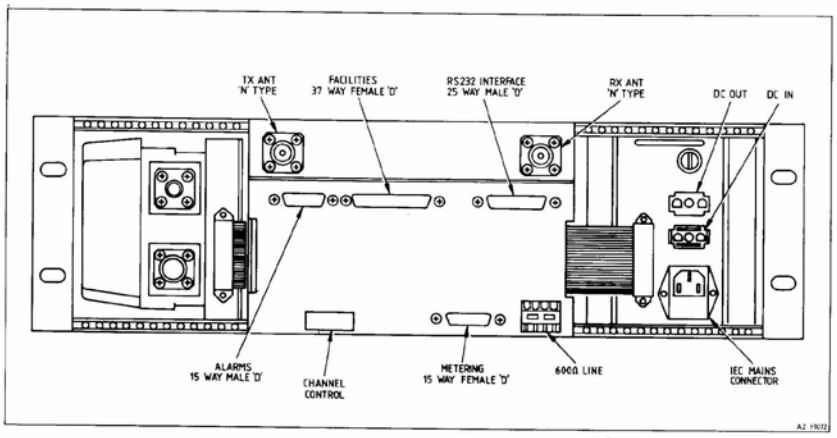


Fig. 3.3 Rear Panel Connections

All external connections to the equipment (including power supply, 600Ω lines, facilities and metering) are made at the rear of the equipment. Separate transmitter and receiver antenna connections are made on the rear of the shelf frame. The rear panel connector layout is shown in Fig. 3.3. Fig.4.2 details the interconnections on the backplane assembly.

Linking Checks

Equipment functions are defined by pre-set links located on the backplane and within the transmitter driver and control modules. Although these are set during manufacture it is advisable, before proceeding with the functional tests, to check that the correct links have been selected against the system requirements. Refer to Linking information starting on page 2.14.

Rack or Cabinet Mounted Installation

The base station may be installed in a 19in rack or in a cabinet. Modules can be withdrawn clear of the rack or cabinet for "in situ" servicing, or removed completely for bench testing or major repairs.

COMMISSIONING

Preliminaries

1. Equipments should be thoroughly checked for signs of physical damage during transit as part of the installation procedure.

2. The power supply unit and transmitter module should be installed and correctly connected.

3. An electrical check of the power supply unit, under 'no-load' conditions should be carried out (refer to 'Installation of Units').

4. Ensure that all equipment links are correctly set against operational requirements.

Test Equipment

Note: Items quoted relate to 'Table 3.1 - List of Recommended Types'

2	AF generator	13	Modulation meter
10	RF signal generator	15	Thruline wattmeter
12	Frequency counter	19	SINAD meter

Functional Checks

Note: (i) To ensure that equipment has reached a stable operating temperature, it must be switched on for at least one hour prior to commencing checks.

(ii) The 600Ω line level used by this equipment is a nominal -14dBm and this is the level used throughout these checks. If the system under test uses a different audio level this may be used as an alternative to the -14dBm.

(iii) msd = maximum system deviation, = 2,5kHz for 12,5kHz channel spacing equipment, 4kHz for 20kHz spacing and 5kHz for 25kHz channel spacing.

(iv) All adjustments (RV16,RV1,RV2,RV9,RV3 and RV5 are located within the control module).

1. **Receiver Checks**

(a) Select Receiver centre frequency

(b) Connect the RF signal generator to the Rx antenna socket,and adjust to receive frequency. Modulate the RF input 1kHz at 60% msd, output 1mV.

(c) Check for audio level of -14dBm across the Rx 600Ω line. Adjust RV16 (LINE LEVEL) as necessary.

(d) Reduce the RF input level to 0,3µV PD and check SINAD is better than 12dB.

(e) Reduce the RF input level to give 10dB SINAD.

(f) Set RV1 (CARRIER LEVEL SQUELCH) fully clockwise and adjust RV2 (NOISE SQUELCH) such that the squelch is just open.

(g) Reduce the RF input level by 6dB and check the squelch is closed.

(h) Increase the RF input level to 1mV. Switch off the modulation; check that the fall in the audio level is greater than 50dB.

(i) The above checks may be repeated on the customer extreme frequencies, if required.

(j) Disconnect and remove all test equipment.

Note: *If a squelch level less sensitive than 0,3µV is required adjust RV1 (CARRIER LEVEL SQUELCH) to the desired level.*

2.Transmitter Checks

Note: *In order to modulate the carrier signal the manual function switch must be set to Tx ON and the PTT switch, on the engineers handset, operated.*

(a) Connect the wattmeter and modulation meter to the TX antenna socket and loosely couple the frequency counter.

(b) Connect the AF generator set to 1kHz at -14dBm to the TX 600Ω line.

(c) Connect the engineer's handset to the control module front panel and set the manual function switch to Tx ON. Select Customer centre frequency on the transmitter.

(d) Check that the power output is greater than the minimum specified for the unit, and the carrier is within 2ppm of the allocated frequency.

(e) Operate the PTT switch (to modulate the carrier) and check for an output deviation of 60% msd. Adjust RV9 (LINE SENSITIVITY) as necessary.

(f) Increase the AF input by 20dB and sweep the frequency between 300Hz and 8kHz. Check that the deviation (+ve and -ve) does not exceed the msd. Adjust RV3 (DEVIATION) as necessary.
If RV3 requires adjustment repeat step (e).

(g) The above test may be repeated at the customer extreme frequencies, if required.

(h) Disconnect and remove all test equipment.

3. **Talkthrough Level**

(a) Connect the RF signal generator to the Rx antenna socket and the thruline wattmeter and modulation meter to the Tx antenna socket.

(b) Modulate the RF input signal 1kHz at 60% msd, output 1mV.

(c) Connect the engineer's handset to the control module front panel and set the manual function switch to T/T.

(d) Check for an RF output of greater than the minimum specified for the unit with deviation of 60% msd. If necessary, set deviation using RV5 on control audio board AT29024/-.

(e) Disconnect and remove all test equipment.

4. **Notch Filter - optional (M80 series signalling)**

Note: The notch filters and detector tuned filter are aligned in the factory and should not normally require adjustment. If, however, excessive keying tone is present on the transmitter modulation or the transmitter cannot be keyed from the control unit the following alignment may be carried out:

Notch 1 and 2

(a) The Rx Call generator is used to provide the 2970Hz tone for this test. Enable the generator by removing link LK13 A-B and connecting LK13A to the -ve line (P25). Remove link LK21 and connect the generator output (P16) to the TX audio line LK21B. Set link LK18 B-C.

(b) Connect the AC voltmeter to TP6 and check for the presence of a 2970Hz tone. Note this reading.

(c) Set link LK18 A-B.

(d) Link LK16-IN, LK17-OUT. Check TP6 for a level 50dB down on that noted in step(b). Link LK16-OUT, LK17-IN and repeat. Adjust RV7(NOTCH 1) /RV8 (NOTCH 2) as necessary.

2970Hz Detector

(e) Connect the AC voltmeter to TP9 and tune RV11 (2970 DET) for maximum output.

Notch 3

(f) Disconnect the receiver module from the control module. Connect the generator output (P16) to the RX audio line (TP11). Set link LK27 A-B .

(g) Connect the AC voltmeter to TP15 and check for the presence of a 2970Hz tone. Note this reading.

(h) Set link LK27 B-C.

(i) Check TP15 for a level 50dB down on that noted in step (g). Adjust RV17 (NOTCH 3) as necessary.

Conclusion

(j) Disconnect all test equipment and remove the connection between P16/TP11 and P25/LK13. Re-connect the receiver module.

(k) Refit links LK13,LK16-18,LK27 according to operational requirements.

5. **Hybrid Balance - optional (2-wire systems)**

Note: *The hybrid circuit requires balancing for the particular 600Ω line to be used, therefore, this procedure should be carried out with the base station and control equipment fully installed.*

(a) Disconnect the receiver module and remove link LK21.

(b) Apply a 1kHz tone at -14dBm (nominal) across the RX 600Ω line. Note the AC voltmeter reading at LK21C.

(c) Remove the AF generator, re-connect the receiver module and the control equipment. Connect the RF signal generator to the RX antenna socket.

(d) Modulate the RF input signal 1kHz at 60% msd, output 1mV. Check LK21C for minimum level. Adjust RV13 (BALANCE R) as necessary.

(e) Modulate the RF input signal 3kHz at 60% msd, output 1mV. Check LK21C for minimum level. Adjust RV12 (BALANCE X) as necessary.

(e) Modulate the RF input signal with 1kHz, 2kHz, 3kHz in turn. Check LK21C for the 'best achievable rejection' across the audio frequency range - better than 20dB down on the level noted in step (b).

(f) Disconnect and remove all test equipment and refit link LK21 according to operational requirements.

MAINTENANCE

Routine Checks

The Performance Checks detailed in the preceding pages should be carried out at regular intervals, as operational requirements permit, to ensure that optimum performance is obtained from the equipment.

A detailed log book should be kept of all data derived from these tests, as this will show any deterioration in performance.

Fault Location

The in-built 'local' supervisory system, contained within the control module, incorporates a number of alarm indicators (LED's), visible when the module is withdrawn fron the equipment. The alarm inputs to these indicators are combined on the logic board to provide a common alarm indication on the front panel of the module. This enables the existence and location of a fault to be quickly identified. See section 'Local Diagnostics' on pages 3.12 to 3.14.

'On-site' Repair & Replacement

Modular construction has been adopted throughout the equipment to simplify maintenance as far as possible. Any suspect module can be easily and quickly removed and replaced with a serviceable spare. The equipment can thus be returned to service with a minimum of delay and a thorough check and repair of the faulty unit or sub-assembly carried out under workshop conditions.

Facilities are available which enable units and sub-assemblies to be tested under operational conditions. Interconnection between modules is via flexible ribbon cables and coaxial cables enabling all but the power supply unit to be withdrawn with the equipment operational.

Note: Care must be taken to avoid damage to interconnecting cables or connectors when withdrawing or replacing modules.

Workshop Repair and Alignment

A comprehensive list of test equipment tools is given in this section; 'break-out' connectors which enable test equipment to be connected to the ribbon cable outputs.

It is advised that under no circumstances should field repairs at component level be attempted with this equipment. Servicing and repairs to this level should only be carried out by a workshop which has been fully certified by the equipment manufacturers (refer to page 1.3). Failure to observe this stipulation will result in invalidation of the product warranty.

Control Module

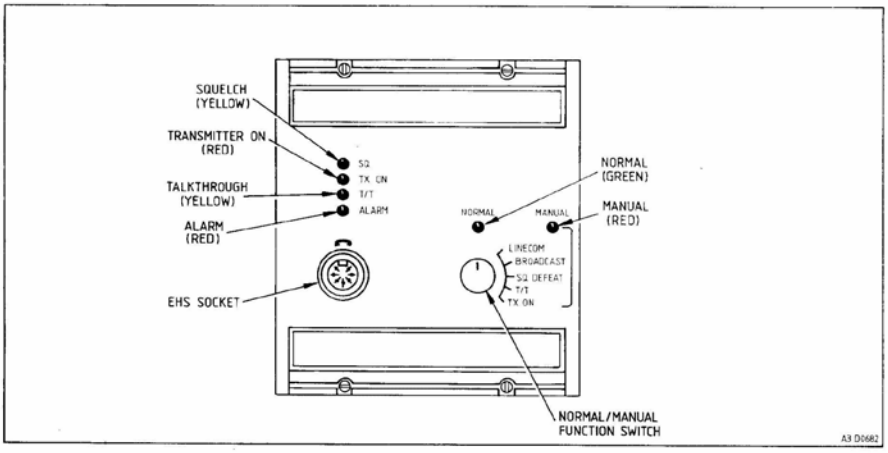


Fig. 3.4 Control Module Front Panel

A six position switch is provided on the front panel of the control module which, in conjunction with an engineers handset (EHS), overrides the local on-site control and provides basic control for alignment, testing and communicating 'over-the-air' or via the 600Ω audio interface. When the EHS is connected (via a 7-pin DIN socket on the front panel) the switch provides the following functions:

POSITION	FUNCTION	OPERATION
1	NORMAL	Normal operating position when EHS not in use. EHS pressel is inoperative. See note (iii).
2	LINECOM	Allows communication between EHS and control equipment connected to 600Ω line. Operate pressel to talk 'down-line'. The 600Ω line input is monitored on the loudspeaker and EHS when enabled by the TX KEY signal from the control equipment.
3	BROADCAST	Allows communication over the air between EHS and mobiles/other end of link. Operate pressel to talk 'over-the-air'. The 600Ω line input will not modulate the transmitter.
4	SQUELCH DEFEAT	Opens squelch to check/align receiver. Operate pressel to talk 'over-the-air'. The 600Ω line input will not modulate the transmitter.
5	TALKTHROUGH	Selects talkthrough mode for setting of talkthrough level. Operate pressel to override talkthrough and talk 'over-the-air'. The 600Ω line input will not modulate the transmitter.

6	TX ON	Keys transmitter to give continuous unmodulated carrier for transmitter alignment. Operate pressel to modulate transmitter from 600Ω line input and adjust line sensitivity and CTCSS level. EHS microphone is not enabled.

Note: (i) With the handset connected and the switch in positions 2 to 6 the control module is in 'MANUAL' mode and control from any other source is inhibited. The receiver 600Ω output is also inhibited so as to effectively isolate the base station from the control equipment during engineering functions (i.e. servicing/ alignment).

(ii) When the handset is disconnected, the module defaults to 'NORMAL' mode irrespective of the switch position.

(iii) An engineer may use the EHS to communicate 'over-the-air' overriding any outgoing traffic, by connecting the EHS ENABLE pin on the control logic PCB to -ve. Control equipment inputs are not inhibited.

Also provided on the control module front panel are seven LED indicators:

FUNCTION (Colour)	OPERATION
TX ON (Red)	Indicates that RF power is being generated by the PA module. See note.
T/T (Yellow)	Talkthrough mode has been selected.
ALARM (Red)	Flashes to indicate that an alarm condition exists. (See ALARMS section).
NORMAL (Green)	The module is in NORMAL mode.
MANUAL (Red)	Flashes to show that the module is in MANUAL mode.

Note: A link on the backplane enables modification of the TX ON indicator to show TX KEY. This is normally only fitted on low power option equipment (i.e.: when a PA is not fitted, otherwise fault monitoring on the RF PA output is lost).

Alarms

A system of alarms is provided for station monitoring and to assist in fault diagnosis. Various parameters are monitored within the receiver, transmitter driver and PA module with alarm information being fed to the control module. This information is displayed on a row of LEDs inside the control module. The alarm lines are combined to generate a single alarm line to drive the front panel ALARM indicator and also a STATION FAIL output at the facilities socket. Linking is provided to enable additional TX and RX alarm outputs to be accessed, if required.

Local Diagnostics

The front panel alarm indicator will flash when any of the following alarm signals are generated:

	TX forward power alarm
*	TX supply alarm
	TX driver alarm
*	PA supply alarm
	PA temperature alarm
	VSWR alarm
	TX alarm latch
*	RX supply alarm
	RX alarm
	External alarm

With the exception of those marked thus * the above alarms are indicated on the row of LEDs within the control module. The source of the alarm condition can therefore be traced by withdrawing the control module and observing which, if any, of the seven internal LEDs are lit. If none are lit then the alarm must be a supply fail on one of the other modules. This can be confirmed by bridging the supply alarm disable link for that module (LK30 on the control module).

Note: *(i) A disconnected module will cause a supply fail alarm to be generated, providing this alarm has been enabled by selection of LK30.*

(ii) At switch on, the ALARM indicator will flash for approximately three minutes while the crystal ovens warm up.

Facility Socket Alarm Outputs

The following alarm outputs are available on the facility socket:

(i) STATION ALARM - a summation of:

TX supply alarm
TX driver alarm
PA supply alarm
PA O/P alarm
VSWR alarm
TX alarm latch
RX supply alarm
RX alarm
External alarm

(ii) DC STANDBY ALARM - Indicates that the DC supply input is being used to power the base station.

(iii) MANUAL ALARM - Indicates that manual mode has been selected.

Additionally, the following subsets of STATION ALARM can be brought out by linking within the control module:

(iv) TX ALARM OUTPUT - a summation of:

TX supply alarm
TX driver alarm
PA supply alarm
PA O/P alarm
VSWR alarm
TX alarm latch

(v) RX ALARM OUTPUT - a summation of:

RX supply alarm
RX alarm

Alarm Descriptions

PA Supply Alarm — Indicates that the PA regulator voltage is low or that the module has been disconnected.

PA Output Alarm — Indicates that the power control loop in the PA can no longer maintain the correct RF output power. Also indicates the presence of an RF output when the transmitter is not keyed.

Note: For the two stages of temperature shutdown in the PA, complete shutdown will generate a PA O/P alarm, whereas partial shutdown (3dB) will not.

TX Supply Alarm — Indicates that the Tx driver regulator voltage is low or that the module has been disconnected.

TX Driver Alarm — Indicates an alarm generated by TX driver, caused by:

cold oven
RF fail
Synthesizer out of lock
loss of external hi-stab drive (when used).

PA Temperature Alarm — Indicates high temperature in the PA module resulting in either 3dB or total shutdown. (PA O/P ALARM will show which).

VSWR Alarm — Indicates that the VSWR at the PA output exceeds approximately 3:1 and proportional shutdown is operative.

TX Alarm Latch — When enabled, indicates that one of the following alarms is, or has been, active;

TX supply alarm
TX driver alarm
PA supply alarm
PA O/P alarm
VSWR alarm

Can be reset by temporarily disabling. Used only in simple main/standby configurations.

RX Supply Alarm	Indicates that the Rx regulator voltage is low or that the module has been disconnected.
RX Alarm	Indicates alarm (other than supply alarm) generated by RX module, caused by: injection fail synthesizer out of lock
External Alarm	Indicates alarm signal present on external alarm input.
DC Standby Alarm	Indicates that the DC supply input is being used to power the base station.
Manual Alarm	Indicates that MANUAL mode has been selected from the front panel and therefore the local control inputs have been disabled.

Power Supply Unit

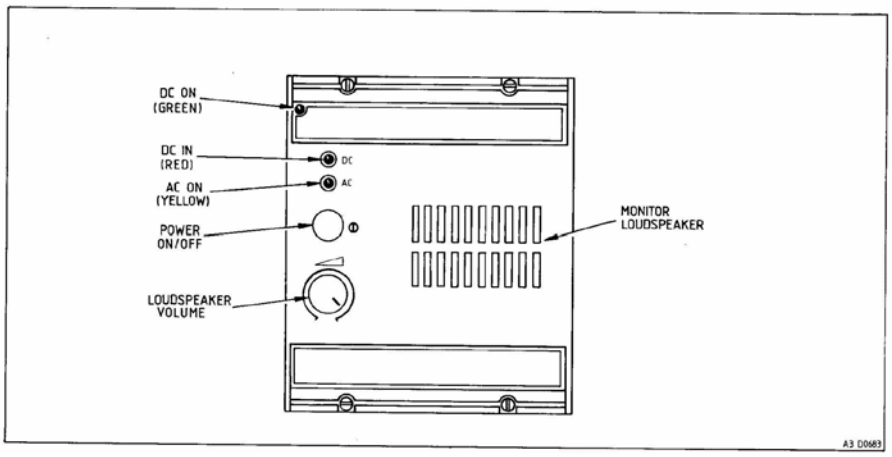


Fig. 3.5 Power Supply Unit Front Panel

The power supply unit houses the power on/off switch and three LEDs which indicate the availability of power supplies. The monitor loudspeaker (optional) and associated volume control are also located within this module.

FUNCTION (Colour)	**OPERATION**
AC ON (Yellow)	AC supply is present on the module
DC IN (Red)	DC supply is present on the module
DC OUT (Green)	An unregulated 24V DC output is available from the module

TEST EQUIPMENT

Note: The module descriptions given in Part II of this service manual refer only to Item No. and Description of test equipment, therefore, cross reference must be made to this list for full details of suitable types.

The following is a list of test equipment suitable for the maintenance of the FX5000 series of equipments. Equivalent types may be used where those listed are not available, provided that corrections are made for any differences in characteristics.

Table 3.1 - List of Suitable Types of Test Equipment

Item	Description	Outline Parameters	Suitable Type
1	DC power supply	0-40V, 1A	
2	AF generator (with output millivoltmeter)		Marconi TF1101
3	Variable DC load	6A at 26V; 1,5A at 18V	Zenith TS (open)
4	Digital Voltmeter	-	Philips 2517X
5	Oscilloscope	General purpose	Hameg 203.5
6	Multimeter	-	AVO 8X
7	Metrohm		Edgecombe Peebles
8	AF power meter	2W at 8Ω	Marconi TF893B
9	Distortion meter		Lyons Instruments D10
10	RF signal generator	0-520MHz	H-P 8640B
11	Marker oscillator	21,4MHz	Part No. SH10042
12	Frequency counter	10Hz-520MHz	Racal 9916
13	Modulation meter	0-520MHz	Marconi TF2300B
14	AC voltmeter		H-P 400FL
15	Thruline wattmeter	100-520MHz	Bird 4314
16	Spectrum analyser	0-520MHz	Advantest TR4131
17*	Return loss bridge	0-520MHz	Wiltron 60NF50
18	50Ω load(includes sniffer)	3W	Stabilock 4040
19	SINAD Meter		H-P 333A
20	'D' type 'Break-out' connector	9,15, 25 & 37 way	Part No SH10087

21*	Input test lead	-	(local manufacture)
22	Dummy Load	50Ω, 5-150W	Bird Termaline 6154

* required only for optional antenna filter alignment.

H-P Hewlett Packard

SECTION 4
SPARES DETAILS

INTRODUCTION

Service support for this equipment is available at two levels - complete station or module replacement and component level repair. The 'Spares' that are available reflect this policy. However, the exceptions to this are the control module which has complete PCB assemblies available from Spares Sales, and the power amplifier, for which spare a PA control PCB assembly is available.

PCBs & COMPONENTS

Component parts and PCB assemblies are available through Spares Sales using the part numbers listed in this service manual.

Part numbers pertaining to individual modules are given in the module descriptions in Part II whilst those parts which form the shelf and backplane assembly are listed in this section.

ORDERING OF 'SPARES'

When ordering spares please quote the Description and Part Number of the item together with the equipment code number.

The right is reserved to fit alternative types of component with equal or improved performance to those quoted in the Parts List.

SPARE MODULES

The modules listed below are available on an exchange basis. Individual modules are ordered, via Consumer Services, using the module 12NC Part Number e.g. if a 24V DC version of the Power Supply Module (Part Number AT04878/03) is required Part No. 3513 578 00021 should be ordered.

Note:

Where PROMs fitted to modules contain customer specific frequencies the PROM should be removed and retained before the module is dispatched. It is essential that modules are packed in a manner that prevents damage in transit.

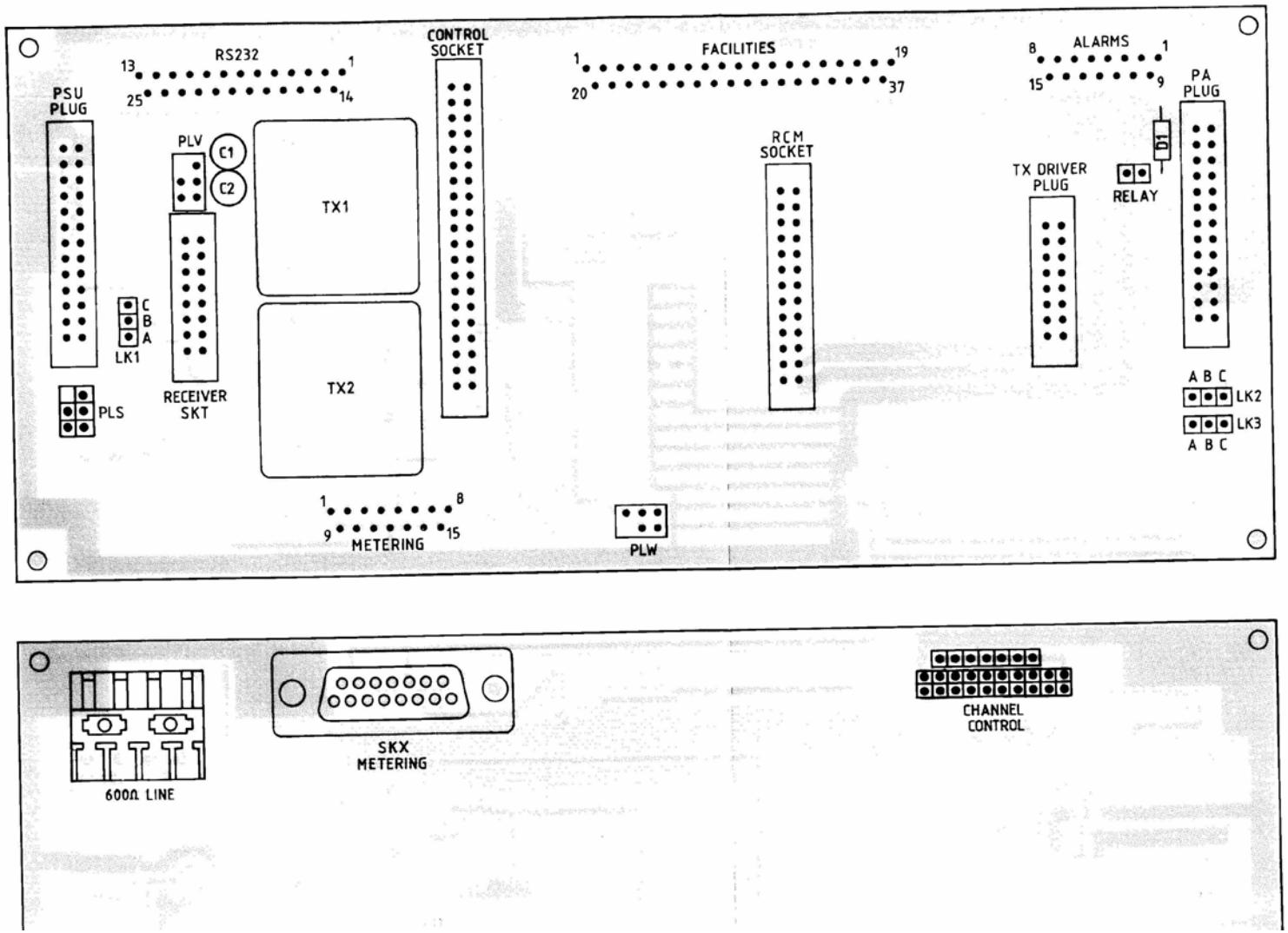
Module	Alpha-numeric No.	12NC No.
PSU AC 240V	AT04878/01	3513 578 00001
PSU AC 110-115V	AT04878/02	3513 578 00011
PSU DC 24V	AT04878/03	3513 578 00021
PSU AC 240V (Less Loudspeaker)	AT04878/07	3513 578 00031
PSU AC 110-115V (Less Loudspeaker)	AT04878/08	3513 578 00041
PSU DC 24V (Less Loudspeaker)	AT04878/09	3513 578 00051
Tx PA 50W E0 Band	AT04883/04	3513 578 00061
Tx PA 50W A9 Band	AT04879/02	3513 578 00071
Tx PA 50W B0 Band	AT04879/03	3513 578 00081
Tx PA 30W A9 Band	AT04874/02	3513 578 00091
Tx PA 30W B0 Band	AT04874/03	3513 578 00101
Tx PA 25W U0 Band	AT04882/06	3513 578 00111
Tx PA 25W T1 Band	AT04882/05	3513 578 00121
Tx PA 25W WM Band	AT04882/07	3513 578 00131
Tx Driver A9 and B0 Bands	AT04881/02	3513 578 00141
Tx Driver E0 Band	AT04881/04	3513 578 00151

Module	Alpha-numeric No.	12NC No.
Tx Driver T1 and U0 and WM Bands	AT04881/05	3513 578 00161
Rx Module A9 Band 12,5kHz	AT04880/02	3513 578 00171
Rx Module B0 Band 12,5kHz	AT04880/03	3513 578 00181
Rx Module E0 Band 12,5kHz	AT04880/04	3513 578 00191
Rx Module T1 Band 12,5kHz	AT04880/05	3513 578 00201
Rx Module U0 Band 12,5kHz	AT04880/06	3513 578 00211
Rx Module WM Band 12,5kHz	AT04880/07	3513 578 00221
Rx Module A9 Band 25kHz	AT04880/12	3513 578 00231
Rx Module B0 Band 25kHz	AT04880/13	3513 578 00241
Rx Module E0 Band 25kHz	AT04880/14	3513 578 00251
Rx Module T1 Band 25kHz	AT04880/15	3513 578 00261
Rx Module U0 Band 25kHz	AT04880/16	3513 578 00271
Rx Module WM Band 25kHz	AT04880/17	3513 578 00281
Rx Module A9 Band 20kHz	AT04880/22	3513 578 00291
Rx Module B0 Band 20kHz	AT04880/23	3513 578 00301
Rx Module E0 Band 20kHz	AT04880/24	3513 578 00311
Rx Module T1 Band 20kHz	AT04880/25	3513 578 00321
Rx Module U0 Band 20kHz	AT04880/26	3513 578 00331
Rx Module WM Band 20kHz	AT04880/27	3513 578 00341
M80 Signalling Assembly	AT14920	3513 574 00621
Voting/CTCSS PCB Assembly	AT29061	3513 570 01251
Front Panel Assembly Control	AT14818	3513 574 00631
Control Module, 300-3000Hz, 2 Wire, Ext. Control, No Sel Call	AT04872/01	3513 578 00351
Control Module, 300-3000Hz, 2 Wire, Ext. Control, Option Card	AT04872/05	3513 578 00361
Control Module, 300-3000Hz, 2 Wire, M80 Sig., Tx/Rx + Chan Change, No Sel Call	AT04872/06	3513 578 00371
Control Module, 300-3000Hz, 2 Wire, M80 Sig., Tx/Rx + Chan Change, Option Card	AT04872/07	3513 578 00381
Control Module, 300-3000Hz, Ext. Control, Less 2970Hz Keytone, No Sel Call	AT04872/08	3513 578 00391
Control Module, 300-3000Hz, Ext. Control, Less 2970Hz Keytone, Option Card	AT04872/10	3513 578 00401
Control Module, 300-3000Hz, Ext. Control, Less 2970Hz Keytone, Option Card	AT04872/11	3513 578 00411
Control Module, 300-3000Hz, Ext. Control, Less 2970Hz Keytone, Option Card	AT04872/09	3513 578 00421
Backplane PCB	AT28996	3513 570 01221
Tx PA Control PCB	AT28991/01	3513 570 01241
Control Logic PCB	AT29023	3513 570 01261
Control Audio PCB	AT29024/01	3313 570 01271
Control Audio PCB, Less 2970Hz Keytone	AT29024/05	3313 570 01281

SHELF ASSEMBLY
MISCELLANEOUS PARTS LIST

Cct.Ref	Description	Part No.	Remarks
SUB-ASSEMBLIES			
	Power supply unit	AT04878/-	
	Receiver module synthesized	AT04880/-	
	Control module	AT04872/-	
	Transmitter driver synthesized	AT04881/-	
	Transmitter power amplifier	AT04874/-	30W A9 and B0 Bands
	Transmitter power amplifier	AT04879/-	50W A9 and B0 Bands
	Transmitter power amplifier	AT04882/-	25W T1, WM and U0 Bands
	Transmitter power amplifier	AT04883/-	50W E0 Band
	Front panel, blank	AT14907	
INSTALLATION ITEMS			
	Bracket Backplane Support LH	BT11433/01	1/Backplane
	Bracket Backplane Support RH	BT11433/02	1/Backplane
	Clip anti-vibration	FR31604	
	Cover Dust	BT15937	1/Backplane
	Guide rail	FR31656	
	Guide Rail Hd 220mm	FR31613	4
	Horizontal Rail Front	FR31615	2
	Horizontal Rail Rear	FR31614	2
	Insert Threaded	FR31679	2/Horizontal Rail Rear
	Label Unit	BT38209/01	1/Rear Panel Printed
	Panel Rear Printed	BJ30990	Backplane
	Panel Vent	BT23759	
	Plate Cover	BT20261	1/Rear Panel
	Plate Earthing	BT20259	1/Lh Backplane Support
	Side Plate 3 Unit x 220mm	FR31616	2
	Spring	BT50531	1/PSU
	Cover, protective	3513 901 10311	
	Label information	3513 903 71451	600Ω termination
	P clip 3/16"	QA00509	Lead - backplane PCB
	Cable tie	QA04427	BT lines connection
	Shelf support LH	BT26636/01	
	Shelf support RH	BT26636/02	
	Bagged items	AT36927	
	comprising:		
	Rack runner LH	BT24870/01	
	Rack runner RH	BT24870/02	
	Link assy	AT14874	4/control unit
	Fuse 7,5	FF06810	2/DC supply
	Fuseholder	FH02881	2/DC supply
	Scr st pan pozi M5 x 16mm	QJ11934/C)	
	Cage nut	QA16471)-	4/Rack - cabinet
	Fibre washer	CT87184)	
	Scr st tap pozi No6 x 9,5mm	QJ07697/X	4/runners - rack
	PCB assy backplane	AT28996	Not available as spare
	Cable assy 25 & 37-way D type	AT70160	1/control module
	Cable assy 25-way D type plug	AT70162	1/PSU
	Scr st tap pozi No4 x 6,5mm	QJ08227/X	3/rear panel - brackets, 4/protective cover
	Scr st tap pozi No4 x 9,5mm	QJ08243/X	1/rear panel - bracket
	Scr st pan pozi M2,5 x 6mm	QJ11945/B	2
	Scr st pan pozi M2,5 x 8mm	QJ11946/B	4/rear rails - support brackets
	Scr skt Hd M5 x 12mm Zn plate	FR31609	4
MATING CONNECTORS			
	Connector free rewireable	FS99060	AC Mains
	Cover connector D Type 15 Way	FC15761	Alarms & metering
	Cover connector D Type 37 Way	FC15762	Facilities
	Plug & lead assembly 24V DC	AT70179	24V DC
	Plug 15-way fixed	FP99013	Metering
	Plug 37-way D Type fixed	FP99015	Facilities
	Plug N free str 50Ω	FP99109	PA RF O/P; Rx RF I/P
	Socket fixed 15-way	FS99063	Alarms

Cct.Ref	Description	Part No.	Remarks
		PCB ASSEMBLY BACKPLANE AT28996	
D1	Diode GP 1N4148	FV05808	
LK1-3	Link connectorector	FC99060	
T1,2	Transformer 600Ω	FT05324	
PLA-D	Plug PCB mtd str 2 x 3	FP99174	
PLE	Header str male 2 pos'n	FC00837/02	
PLR	Plug 15-way D type	FP99031	
PLX	Header rt angle 26 pos'n - ears	FP99243	
PLY	Plug 25-way D type	FP99032	
SKX	Socket D type fixed 15-way	FS99069	
SKZ	Socket D type fixed 37-way	FS99071	
C1,2	Capacitor 22 elec	PS99862	
	Hdr str less ears 16 pos'n	FP99221	1/Rx,1/Tx Driver
	Hdr str less ears 26 pos'n	FP99223	1/PSU,1/RCM,1/PA
	Hdr str less ears 40 pos'n	FP99225	1/Control
	Hdr str male 3 pos'n	FC00837/03	Lk1-3,1/TP1-2 Tx 600Ω
	Label mod state	BT18917	
	Lead assy 600Ω	AT70178	
	Spacer tapped	BT27241]_	2/D type connectorectors
	Screw lock assy	FC15763]	
	Scr st pan 4/40 UNC	QJ08228/X	2/spacer - PCB


PSU PLUG
RS232
13
1
25
14
CONTROL SOCKET
FACILITIES
1
19
20
37
ALARMS
8
1
15
9
PA PLUG
PLV
C1
C2
TX1
TX2
RCM SOCKET
TX DRIVER PLUG
D1
RELAY
C
B
A
LK1
PLS
RECEIVER SKT
A B C
LK2
LK3
A B C
1
8
9
15
METERING
PLW
600Ω LINE
SKX METERING
CHANNEL CONTROL

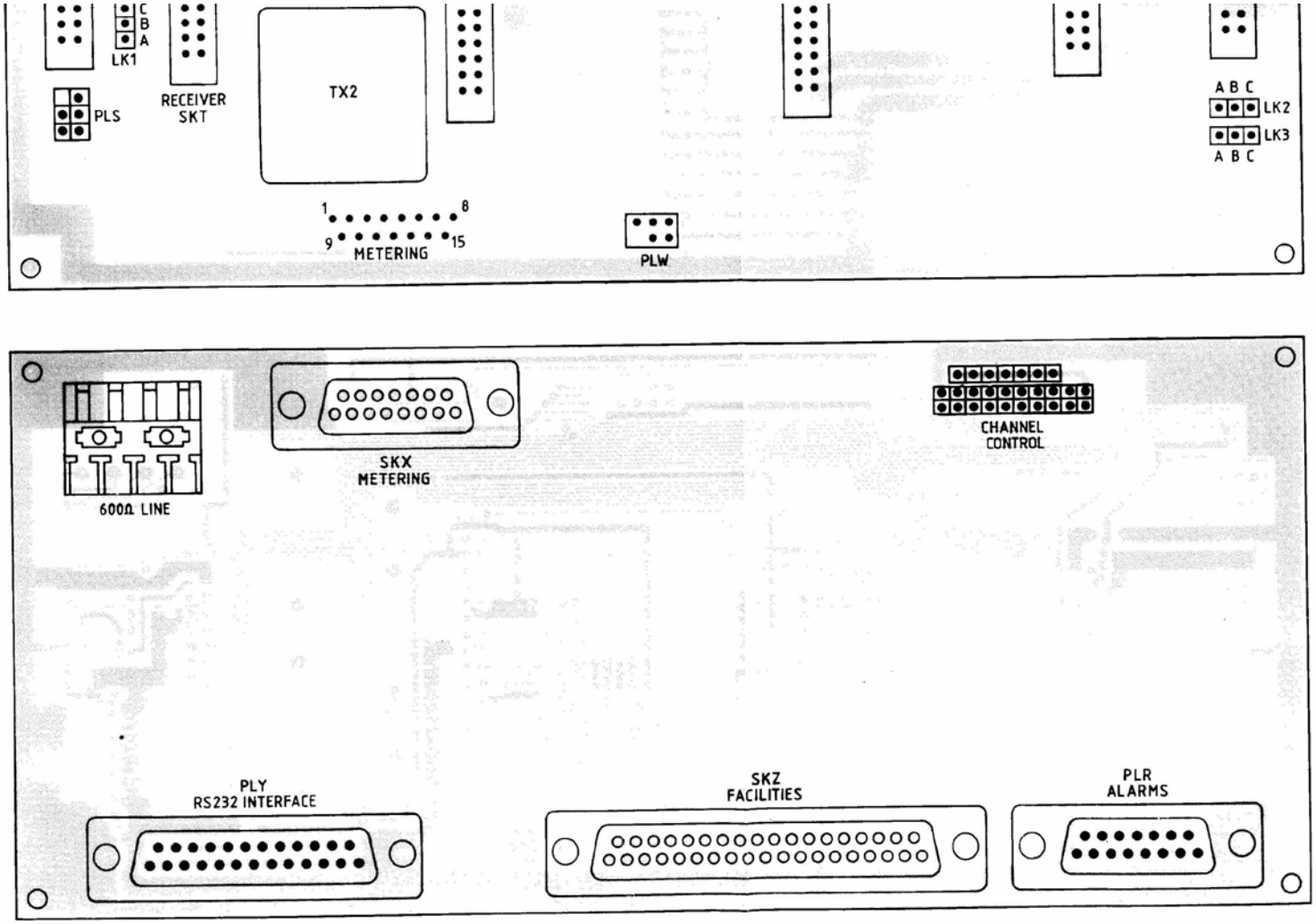


FIG.4.1 BACKPLANE LAYOUT DIAGRAM

PART II

MODULES

POWER SUPPLY MODULE
AT04878/-

WARNING

This power supply module has been designed to meet relevant safety requirements.
If it is necessary to replace any safety conscious component only the item quoted in the Parts List MUST be fitted.
Ensure that these components are securely fastened and that all insulators or covers are fitted after servicing. Check that all warning labels are in place.
If any re-wiring of the mains input supply cables is necessary the specified type MUST be used and alterations to the routeing or connections MUST NOT be made.

INTRODUCTION

Three versions of this module provide for operation from an AC supply of either 115V or 220/240V, or from a 24V nominal DC supply. In each version an unregulated 24V DC output is provided for use on the transmitter power amplifier whilst two regulators each produce an output of +18V DC.

This module also houses the monitor amplifier and loudspeaker (optional).

DETAILED DESCRIPTION

AC Supply

The AC input is applied, via [0]FS1, to the step-down transformer [0]T1. The secondary voltage is rectified in [0]D1 and smoothed by [0]C1; [0]FS2 protects the rectified voltage which is applied to the regulator board across SP6 and SP1.

Rectification provided by [1]D1 and [1]D2 is smoothed by [1]C2 to produce a voltage which lights [0]LED1 (AC ON), causes [1]TR1 to conduct inhibiting the 'DC POWER IN USE' line, provides a supply for [1]RLA via [1]D10 and is fed to [1]IC2 pin6. Contact [1]RLA1 ([1]RLA energised) connects the rectified voltage on SP6, via the on/off switch SA, to:

(i) provide an unregulated 24V output across SP3 and SP4

(ii) light [0]LED3 (DC OUT) indicating the presence of an unregulated voltage

(iii) supply an input to the 18V regulators [0]IC1 and [0]IC2

DC Supply

The DC supply is connected to SKC and applied to the regulator board across SP5 and SP2. [1]D3 provides reverse polarity protection and [0]LED2 indicates the presence of a DC input.

The input voltage is routed via contact [1]RLA1 ([1]RLA de-energised) and the on/off switch as described under 'AC Supply'. The voltage also causes [1]TR2 to conduct to provide an active 'low' on the 'DC POWER IN USE' line.

Supply Monitoring Circuits

The supply monitoring circuits which comprise [1]IC2 and its associated components provide three functions:-

(i) selects the AC supply as a priority

(ii) in the event of an AC over-voltage selects the DC supply

(iii) in the absence of an AC supply holds on the DC supply.

[1]IC2(a) monitors the DC input from SP5 whilst [1]IC2(b) monitors the AC voltage via [1]D1,D2. On the application of AC power [1]IC2(b) senses the voltage at [1]D1,D2, the output from [1]IC2(b) pin7 causes [1]TR3 and hence [1]TR4 to conduct, energising [1]RLA. If an AC over-voltage occurs it is sensed by [1]IC2(b) which causes [1]TR3 and hence [1]TR4 to cut off, de-energising [1]RLA thus disconnecting the rectified AC at SP6 and connecting the external DC input at [0]SKC (unless an over-voltage is also present on the DC input, in which case the output from [1]IC2(a) will maintain [1]TR4 in the conducting state).

With a DC but no AC input connected to the PSU the output of [1]IC2(a) holds [1]TR4 in the cut off state and [1]RLA remains de-energised, should a DC over-voltage occur under these conditions [1]IC2(a) will cause [1]RLA to energise removing the DC supply to the base station.

Regulator

The dual regulators [0]IC1 and [0]IC2 are similar in operation, each 18V output is set by a potentiometer, [1]RV2 and [1]RV1 respectively.

Monitor Amplifier and Loudspeaker

The AF monitor input from the control module is fed, via the front panel volume control [0]RV1, to amplifier [1]IC1. The AF output and LS 0V lines are routed to the rear panel connector [0]SKA, enabling either the use of an internal loudspeaker by linking pins 16 and 14 or an external loudspeaker (connected across pins 6 and 16).

SPECIFICATION

AC Input

115, 220, or 240V ±10% 47-60Hz
Fuse integral with IEC connector

DC Input

24V -10% +20% +ve or -ve chassis
Fuses in line with supply lead

Power consumption

AC Supply 200VA max.
DC Supply 160W max.

DC outputs

(i) 25V (nominal) unregulated
5A maximum
Ripple less than 3V pk-pk

Used for:

PA module	4A max
C/O relay	(35mA)
External equip	200mA max

(ii) 18V ± 0,5V
1,3A maximum
Ripple less than 1mV pk-pk

Used for:

TX Driver	0,8A max
RX module	0,5A max

(iii) 18V ± 0,5V
0,9A maximum
Ripple less than 1mV ptp

Used for:

Local control	0,5A max
Remote control	0,3A max
Monitor Amp	0,1A max

DC fuse on back panel

Monitor Amplifier

Sensitivity	300mV (for 1W into 15Ω)
Freq Response	300Hz to 3kHz ±1dB
Power Output	2W into 8Ω

Internal Loudspeaker

1W, 16Ω, 2,5 inch

Connectors

AC input	3 pin IEC male
Interface/DC output	25 way D plug
DC input *	3 pin AMP female
DC output **	3 pin AMP male

* Also used for +ve/-ve chassis linking
** For use as stand-alone PSU

TEST PROCEDURE

Test Equipment required

Note: Refer to Part I, Table 3.1 for suitable types.

1. DC Power Supply
2. AF Generator (with output millivoltmeter)
3. Variable DC Load
4. Digital multimeter
5. Oscilloscope.
6. Multimeter
7. Metrohm
8. AF Power Meter
20. 'Break-out' connector 25way

1. Remove the module cover and connect DC supply at 25V to SKC.

2. With front panel switch 'off' check that the green front panel DC ON indicator is not lit.
With front panel switch 'on', check that both the red DC IN and the green DC ON indicators are lit.

3. Set RV2 to give 18,3V unloaded across SKA pins 2 and 18.
Connect DC load, set to 1,3A, across SKA pins 2 and 18.
Check voltage on SKA pin 2 is greater than 17,5V.

4. Set RV1 to give 18,3V unloaded across SKA pins 4 and 18.
Connect DC load, set to 1,3A, across SKA pins 4 and 18.
Check voltage on SKA pin 6 is greater than 17,5V.

5. Increase DC supply to 32V and check that the green DC ON indicator is lit.
Increase supply to 40V and check that green indicator extinguishes.
Reduce DC supply to 25V.

6. Set front panel volume control fully counter-clockwise.
Connect AF generator set to 300mV at 1kHz across SKA pins 1 and 7.
Connect oscilloscope and AF power meter (set to 8Ω) between SKA pins 6 and 16.
Adjust volume control so that AF waveform is just below clipping level.
Check AF power is greater than 2W.

7. Connect variable load, set to 1A, across the un-regulated 24V output PLD; check output is greater than 31V
Increase current to 6A; check output is greater than 24V.

8. Set variable load to minimum.
Remove all connectors and check for isolation between SKC earth terminal and negative terminal.
Check for continuity between SKC earth terminal and SKA pin 21 and to PLD earth terminal.

9. AC Supply Only

Re-fit plug into SKC linking negative to earth.

10. Remove all items of test equipment and refit the module cover.

POWER SUPPLY UNIT

AT04878/01 240V AC with Loudspeaker
AT04878/02 110V AC with Loudspeaker
AT04878/03 24V DC with Loudspeaker
AT04878/07 240V AC less Loudspeaker
AT04878/08 110V AC less Loudspeaker
AT04878/09 24V DC less Loudspeaker

♦ Denotes safety conscious component

Cct Ref	Description	Part No	Remarks
COMMON ITEMS			
PLD	DC socket & lead assy	AT14751	
SKC	DC socket & lead assy	AT14752	
	Knob printed	BJ30904/03	1/RV1 (Volume)
RV1	5k ±20% Pot log	PL09220	Volume
SA	Switch power c/w bracket	FS50951	On/off
LED2	LED red	3513 993 47000	DC input
LS1	Loudspeaker 15Ω	FS11215	/01-03
	Spring retaining LS	BT50521	/01-03
	Cloth LS panel	BT27318	
	Button black	FR10750	1/SA
	Bush LED panel mounting	QA99007	1/LED2
	Heatsink assembly	AT14757	
	Front panel assembly	AT14816	
	Cover PSU	BT15914	
	Pillar round M3	BT27210	2/SA
	Label, unit	BT38209/01	Unit label
	Nut st hex M2,5	QA11604/B	2/mains plug - chassis (/01,02,04,05), 2/blanking plate (/03,06)
	Scr st tap pozi No6 x 9,5mm	QJ07697/X	3/heatsink - chassis, 3/regulator heatsink - chassis, 4/front panel - chassis, 4/PSU cover - chassis
	Scr st pan pozi M3 x 10mm	QJ11903/X	2/SA
		AT04878/01 240V AC	
		AT04878/02 110V AC	
		AT04878/07 240V AC	
		AT04878/08 110V AC	
	PCB Assy, regulator & h'sink	AT14901/01	
T1	♦ Transfomer mains	AL21473	
	Plug assy	AT14814	SKC - -Ve
	Lead assy AC	AT70234/01	LEDs & vol switch - PCB
	Wire kit	AT70156	
	Lead assy	AT70180	AC on/off - mains plug
LK1	Wire link assembly	AT14923	
C1	15000 -10% +30% Cap elec	PS68022	
FS1	♦ Fuse 2,5A, time lag, mains	FF99042	/01,07 only
FS1	♦ Fuse 5A, mains	FF99038	/02,08 only
FS2	Fuse 10A	FF99021	
PLB/FS1	♦ Plug mains c/w fuseholder	FP11522	
LED1	LED yellow	FV05930	AC ON
	Accessories style CEE22	FS41518	1/AC mains plug retainer
	♦ Strap	BT27069	1/T1
	♦ Label 'LIVE TERMINALS ENCLOSED'	BT37403/01	
	♦ Label 'DISCONNECT POWER LEAD'	BT37404/01	
	Label, Warning	3513 903 40031	
	♦ Cover mains transformer	BT15941	
	Fuse holder panel mounting	FH99100	1/FS2
	Shroud insulating	FH99102	1/FS2 fuseholder
	♦ Boot insulating	FR10953	1/PLB & FS1
	♦ Sleeve pink neoprene	FS22515	3/Mains plug connections
	Cap, protection	FC11916	1/C1 terminals
	Bush LED panel mounting	QA99007	1/LED1
	Washer st M6	QA15010/X	1/strap - transformer
	Scr st tap pozi No6 x 9,5mm	QJ07697/X	2/strap - chassis
	Scr st csk pozi M2,5 x 6mm	QJ11601/B	2/mains plug - chassis
	Scr st hex M6 x 12mm	QJ13328/X	1/strap - transformer 1/transformer - chassis
		AT04878/03,09 24V DC ONLY	
	PCB assy regulator & h'sink	AT14901/02	
LK1	Wire link assembly	AT14923	
	Lead assy DC	AT70234/02	Volume switch - PCB

Cct Ref	Description	Part No	Remarks
	Plate blanking	BT20260	For mains connector
	Hole plug black	FG02576	For FS2 fuseholder
	Hole plug black	FG02737	For LED1
	Strap	BT27069	1/Baseplate
	Scr st tap pozi No6 x 9,5mm	QJ07697/X	2/strap - baseplate
	Scr st pan pozi M2,5 x 6mm	QJ11945/B	2/plate blanking

FRONT PANEL ASSEMBLY PSU
AT14816

	Panel, front, printed	BT30973	
	Handle	BT35950	
	Label, PSU	BT38206/01	1/Handle
	Label, Philips	BT38208/01	1/Handle
	Housing, double row, 4 pos'n	FC00821/04	1/LED3
LED3	LED, green	FV05931	DC Power
	Fastener	BT17284	4/PSU-shelf
	Contact, male crimp	FC00839	3/LED wires
	Scr st tap pozi No.4 x 8mm	QJ08241/X	3/Handle-front panel

REGULATOR PCB AND HEATSINK ASSEMBLY

AT14901/01 AC
AT14901/02 DC

	PCB Assembly Regulator	AT29060	
IC1	IC Volt reg 317	FU99119	
D1	Rectifier bridge 26MB40A	9337 195 10682	/01
	Heatsink	BT45159	
	Pillar hexagon	BT04411	
	Nut st hex M3	QA11605/X	1/IC1
	Nut st hex M4	QA11607/X	1/D1 (/01 only)
	Scr st pan pozi M3 x 5mm	QJ11900/X	4/Regulator PCB - pillars
	Scr st pan pozi M3 x 8mm	QJ11902/X	4/Heatsink - pillars
	Scr st pan pozi M3 x 10mm	QJ11903/X	1/IC1
	Scr st pan pozi M4 x 20mm	QJ11921/X	1/D1 (/01 only)
	Washer st form A M3	QA15005/X	1/IC1
	Washer st form A M4	QA15007/X	1/D1 (/01 only)
	Bush insulating (TO-220)	QA99024	1/IC1
	Washer insulating (TO-220)	QA99025	1/IC1

AT29060
PCB ASSEMBLY REGULATOR

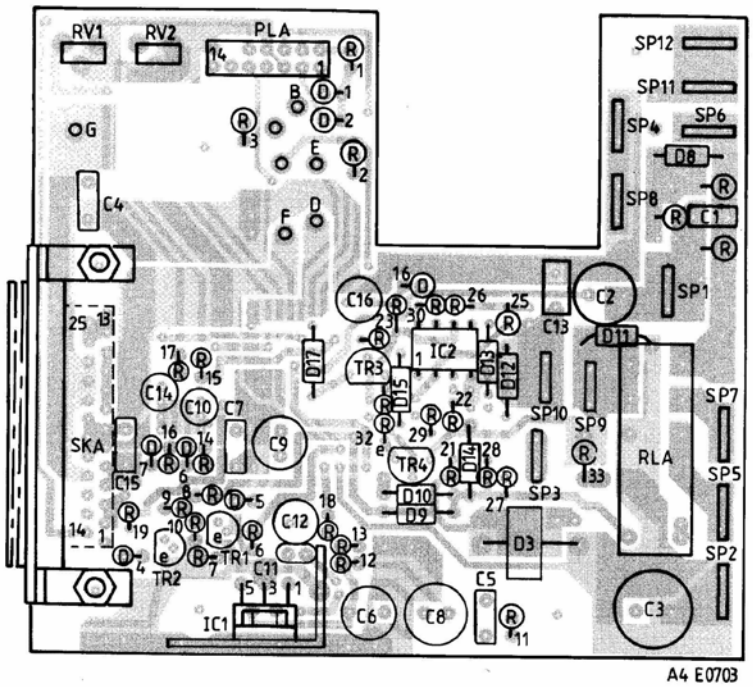
Semiconductors & IC's

IC1	IC Audio amp 2002	FU08027
IC2	IC Dual op amp 1458	FU99092
TR1,2	Transistor BC337 GP	FV05896
TR3	Transistor GP BC547	FV05889
TR4	Transistor BC337 GP	FV05896
D1,2	Diode GP BYW54	FV05892
D3	Diode MR751	FV08961
D4	Diode GP 1N4448	FV05874
D5	Diode GP BYW54	FV05892
D6-8	Diode GP 1N4448	FV05874
D9-11	Diode GP BYW54	FV05892
D12	Diode zener 13V ±5%	FV05871
D13	Diode zener 18V ±5%	FV05873
D14	Diode GP BYW54	FV05892
D15	Diode GP 1N4448	FV05874
D16	Diode GP BYW54	FV05892
D17	Diode GP 1N4448	FV05874

Resistors

R1-3	1k8	0,5W ±2%	m oxide	PL99308
R4	2k2	0,5W ±2%	m oxide	PL99309
R5	3k16	0,25W ±2%	m film	PM99092
R6	18k	0,25W ±2%	m film	PM99312
R7	1k	0,25W ±2%	m film	PM99282
R8	4k7	0,25W ±2%	m film	PM99298
R9	2k2	0,25W ±2%	m film	PM99290
R10	1k	0,25W ±2%	m film	PM99282
R11	1	0,25W ±2%	m film	PM99210
R12	220	0,25W ±2%	m film	PM99266
R13	10	0,25W ±2%	m film	PM99234

Cct Ref	Description	Part No.	Remarks
Resistors (Cont'd)			
R14	240 0,25W ±2% m film	PM99267	
R15	2k7 0,25W ±2% m film	PM99292	
R16	240 0,25W ±2% m film	PM99267	
R17	2k7 0,25W ±2% m film	PM99292	
R18	4k7 0,25W ±2% m film	PM99298	
R19	1 0,25W ±2% m film	PM99210	
R20	180 0,25W ±2% m film	PM99264	
R21	18k 0,25W ±2% m film	PM99312	
R22	12k 0,25W ±2% m film	PM99308	
R23	18k 0,25W ±2% m film	PM99312	
R24	12k 0,25W ±2% m film	PM99308	
R25	1k 0,25W ±2% m film	PM99282	
R26	33k 0,25W ±2% m film	PM99318	
R27	18k 0,25W ±2% m film	PM99312	
R28	1k3 0,25W ±2% m film	PM99285	
R29	150k 0,25W ±2% m film	PM99334	
R30	18k 0,25W ±2% m film	PM99312	
R31	6k8 0,25W ±2% m film	PM99302	
R32	560 0,25W ±2% m film	PM99276	
R33	180 0,25W ±2% m film	PM99264	
RV1/2	1k ±20% Pot skel lin	PL01483	
Capacitors			
C1	100n ±10% 63V pes	PQ99511	
C2	100 ±20% 50V elec	PS99440	
C3	470 ±20% 35V elec	PS99433	
C4,5	100n ±10% 63V pes	PQ99511	
C6	470 ±20% 16V elec	PS99416	
C7	100n ±10% 63V pes	PQ99511	
C8,9	100 ±20% 25V elec	PS99424	
C10	22 ±20% 25V elec	PS99421	
C11	470p ±20% cer	PN99933	
C12	2µ2 ±20% 100V elec	PS99456	
C13	100n ±10% 63V pes	PQ99511	
C14	22 ±20% 25V elec	PS99421	
C15	100n ±10% 63V pes	PQ99511	
C16	47 ±20% 50V elec	PS99439	
Miscellaneous			
PLA	Plug PCB mtd straight 2 x 7	FP99290	
RLA	Relay 2 pole changeover	FR21714	
SKA	Socket 25-way D type angle	FS99082	
	Heatsink	BT37523	1/IC1
	Insulating bead	FJ00007	1/R5
	Nut st hex M3	QA11605/X	2/SKA, 1/IC1
	Scr st pan pozi M3 x 6mm	QJ11901/X	1/IC1
	Scr st pan pozi M3 x 10mm	QJ11903/X	2/SKA



REGULATOR AT29060
LAYOUT DIAGRAM

RECEIVER MODULE (UHF)
AT04880/05-07,15-17,25-27

INTRODUCTION

The receiver module converts the RF signals at the antenna into audio which is processed in the control module. Carrier level squelch and noise squelch outputs are also provided to the control module. The injection frequency is derived from an oven controlled crystal oscillator.

DETAILED DESCRIPTION

RF Head

RF signals at the antenna are routed via low-pass filter L1,L2 and C1 to a two-stage bandpass varicap tuned filter comprising L3, L4, C6-C14 and D1-D8. RF amplification is provided by TR1, the output of which is fed to a further four stages of varicap tuned bandpass filtering L4, L6-L8, D9-D24 and C20-C48. Preset variables C6, C14, C20, C30, C38 and C47 allow the head response to be optimised over the frequency band in use. RV2 and RV3 optimise the tracking of the voltage controlled filters and oscillator.

Crystal Oscillator

A crystal oscillator, TR9 and XL2, operating at 8,4MHz in a fundamental paralled mode, provides the reference frequency and determines the frequency stability of the receiver. The crystal is enclosed in a temperature-controlled oven assembly (AT28910/04) which maintains the temperature at 80°C ±2°C over the temperature range of -30°C to +60°C, and provides a stability of ±2ppm. The output of this oscillator is fed into the synthesizer, IC11, on pin 8.

Voltage Controlled Oscillator

TR4 is configured as a voltage controlled oscillator, operating at the final injection frequency, under the influence of the ¼-wavelength dielectric resonator CR1, preset capacitor C95 and varicap diode D26. Output from the oscillator is amplified by TR5 and then fed via TR9 to the mixer, and via TR6 to the prescaler IC9 and onwards to synthesizer IC11.

Synthesizer

Customer channel frequency information is contained within the PROM, IC13. Channel selection is achieved by addressing the PROM via the 7 parallel address lines C0 to C6 which are connected, via pull-up resistor network RN1 to the 15-way supply connector.

IC12, a custom EPLD (Electronically programmable logic device) detects any channel change and instructs the synthesizer to strobe the EPROM for the new channel information.

Channel information is fed from the EPROM to the synthesizer in the form of eight separate four-bit words (D0-D3) on synthesizer pins 11-14. This channel information selects the correct divide ratios in the crystal oscillator and VCO input paths, for the frequency requested. The two signals, suitably divided, are then fed to a phase comparator within IC11, the resultant error signals on pin 2 (coarse) and pin 1 (fine) are then filtered and amplified in IC8, the output of which is used to control the VCO frequency (via D26) and the front-end filter frequency (via IC1, RV2, RV3 and D9-D24). Failure of the receiver to achieve lock is signalled on IC11 pin 3. This illuminates on-board LED1 and provides, via TR11, a lock fail alarm to PLA pin 12.

IF Stages

The RF signal from the RF head is mixed with the buffered VCO output in the RMS1 mixer. The IF output of the mixer (21,4MHz) is stepped up in impedance (L9,C49, C50) and applied to dual-gate FET amplifier TR2. FL1, a crystal filter, provides the first IF selectivity. Preset controls L11, L12 and C58 allow optimisation of the matching to this filter. IC4 contains an oscillator (controlled by XL1) and mixer, which converts the incoming 21,4MHz signal to the second IF of 455kHz. This is then filtered (FL2) and fed to IC5, which further amplifies, limits and demodulates the signal. Further inter-stage filtering is provided by FL3 and ensures a good metering sensitivity.

IC5 provides a DC signal strength output on pin 5 and the demodulated audio appears on pin 6.

Audio Stages

The demodulated signal from IC5 is amplified by IC6; this stage incorporates some temperature-dependent level compensation. The audio signal is then split, IC14 and RV5 providing a suitable audio output for further processing by the control module; IC14 and IC15 filtering and amplifying the higher-frequency noise components of the signal for use with the noise-operated squelch circuitry within the control module. Gain adjustment of this noise is provided by RV6.

Metering Circuit

The DC level on IC5 pin 5 is dependent upon the incoming RF signal strength. This signal is buffered and processed by IC8 and fed to connector PLA pin 4 for use in the carrier mute circuitry of the control module, and to provide signal strength metering. Thermistor R99 provides temperature-dependent compensation, whilst RV7 and RV8 provide level shift and slope adjustment.

Regulation

IC7 regulates the incoming 18V down to a 14V (adjustable by RV1), whilst IC3 and IC10 provide separate internal 5V supplies. The presence of the 14V supply is detected by TR8 the output of which is fed to PLA pin 3 for external monitoring.

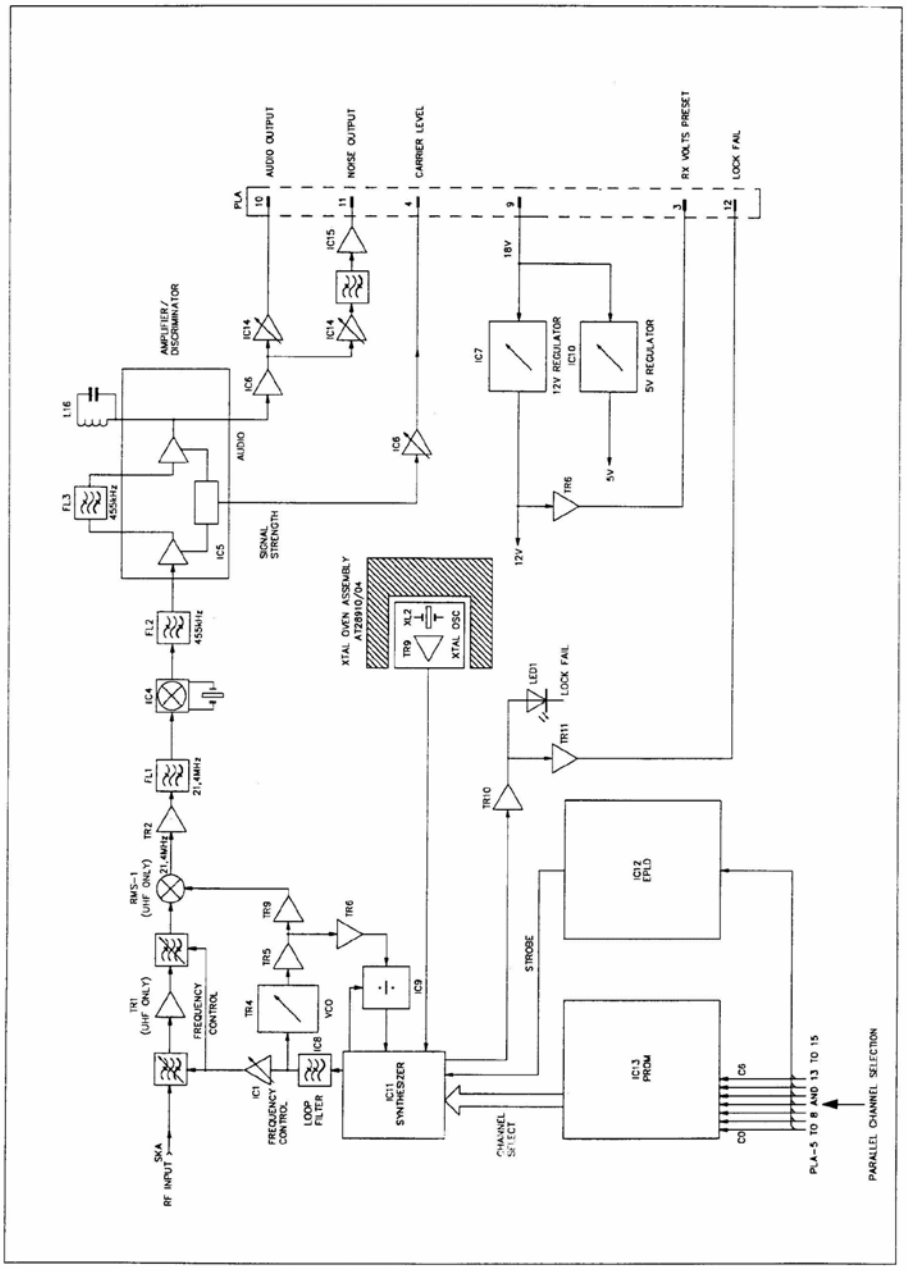


Fig.1 Rx Block Diagram AT0488O/-

TEST PROCEDURE (AT0488O/05-07, 15-17, 25-27)

Note:

The following test procedure, which should not be attempted without the specified test equipment, is for full alignment of the unit to ex-factory standard; re-tuning to this level should not normally be required in the field.

Test Equipment

Item	Description	Requirement	Suitable Type
	Test jig	see Fig.2	-
1	Power supply	18V 1A	Kingshill
	Ammeter	50µA, 1A FSD	Select-test 50 or Philips PM2519
	Voltmeter	Very high input impedence, 100kΩ/V min.	Philips PM2519
5	Oscilloscope	general purpose (diagnostic only)	Hamed 203.5
6	SINAD meter	resolution to 0,1%	HP 333A
10	Signal generator	-	HP 8640B
11	Marker oscillator	21,4MHz or 2nd harmonic of 10,7MHz marker.	TCL PT507
	Psophometer	-	HP3556A

1 Preliminary

(a) Set all PCB pots to mid-range, and the test jig switches S1 to leakage, S2 to position 1, S3 to position 1, S4 to test, S10-16 to '0'.

(b) Check that an EPROM (memory) IC has been fitted to the PCB under test. Note that all EPROMS blown to spec AT60171 have, in addition to any customer information, a set of 128 test frequencies blown into them, and that testing is accomplished using these test frequencies (see Table 1 for frequency listing).

(c) Connect the unit to be tested to the test jig, and with the PSU switched on, check the chassis leakage current as measured by the ammeter is no greater than 5µA

(d) Set the ammeter to 1A FSD, and set S1 to 'supply', check that the ammeter reading is no greater than 0,4A.

(e) Connect the voltmeter probe to TP1, and adjust RV1 for a voltmeter reading of 14V.

(f) Check that the PCB 'lock fail' LED and the test jig 'lock fail' and 'Rx supply volts present' LEDs are all lit.

2 **Synthesizer alignment**

(a) From customer information, determine the highest receiver frequency and set switches S10-16 on the test jig to the next highest test channel frequency, as indicated in Table 1. If no customer information is available, select a test channel equivalent to the top band edge frequency.

(b) Set S2 on the test jig to position 2. The voltmeter will now read the synthesizer loop control voltage.

(c) Adjust the multiturn VCO trimmer C95 through its range until the PCB 'lock fail' LED extinguishes. Check that the test jig 'lock fail' LED is also extinguished. The synthesizer is now in lock.

(d) As the VCO trimmer is adjusted within lock, the reading on the voltmeter will change. Adjust for a 12V reading.

(e) Reset test jig switches S10-16, to the channel twenty lower (see paragraph 2(f) if this is not possible). Check voltmeter reading is between 2V and 5V.

(f) If paragraph 2(e) would require selecting a channel lower than 0, set to channel 0. Check voltmeter reading is 2V minimum.

(g) Check that the test jig 'lock fail' LED is still extinguished.

(h) Reset switches S10-16 to produce original channel [as paragraph 2(a)], and S2 on the test jig set to position 3, the voltmeter will now read the head volts.

(j) Adjust RV2 for a voltmeter reading of 12V.

3 **General alignment**

(a) Ensure that the receiver has been switched on for at least two minutes before this check is attempted.

Set the signal generator to the required frequency with no modulation. Increase the generator level until the 'scope indicates that the receiver is 'quieting'. If, even with 1V output, quieting is not observed, adjust the multiturn trimmer C177 until it is found. Net the receiver onto channel using the 21,4MHz marker by adjusting C177 for zero beat.

(b) Apply 1kHz modulation at 60% system deviation, and adjust trimmers C6, 14,20,30,38 and 47 for the best SINAD, reducing the generator output as necessary. Likewise, adjust L9 for best SINAD.

(c) Increase the signal generator output by 60dB, and adjust L11, L12 and C58 for best SINAD, minimum value 35dB.

(d) Reset the signal generator output level to 0,3µV and re-measure the SINAD (psophometrically), minimum value 20dB.

(e) Set S3 to position 2, and adjust RV5 on the PCB to produce a distortion analyser voltmeter reading of 300mV.

(f) Set S3 to position 3 and set the generator level to give 20dB psophometric SINAD, adjust RV6 on the PCB to produce a distortion analyser voltmeter reading of 100mV.

(g) Set S2 on the test jig to position 4, the voltmeter will now read carrier level volts.

(h) With the signal generator frequency still off channel, set RV8 to mid-travel and adjust RV7 for maximum voltmeter reading.

(j) Return the signal generator frequency onto channel frequency at a level of 0,3µV. Adjust RV8 for a voltmeter reading of 4V.

(k) Set the signal generator level to zero and check that the voltmeter reading is no greater than 3,3V.

(l) Set the signal generator level to 10µV and check that the voltmeter reading is between 7,5V and 8,8V

4 Front-end Tracking

(a) Set the receiver to the highest frequency channel as in paragraph 2(a).

(b) Set S2 on the test jig set to position 2, check that the voltmeter reads 12V. (adjust C95 slightly, if required).

(c) Reset the test jig switches S10-16 to the channel twenty lower, as in paragraph 2(e), and set the signal generator to this channel frequency.

(d) Adjust RV3 for best SINAD, and with the generator output set to 0,5µV, measure the SINAD (psophometrically), minimum value 20dB.

(e) Return the receiver and signal generator to the channel and frequency indicated in paragraph 4(a), reset RV2, if necessary, for best SINAD, with the generator output at 0,5µV measure the SINAD (psophometrically), minimum value 20dB.

(f) Repeat paragraph 4(d).

(g) Set S4 on the test jig to 'customer', and check that the psophometric SINAD (for a generator level of 0,5µV) for all customer channels is 20dB minimum.

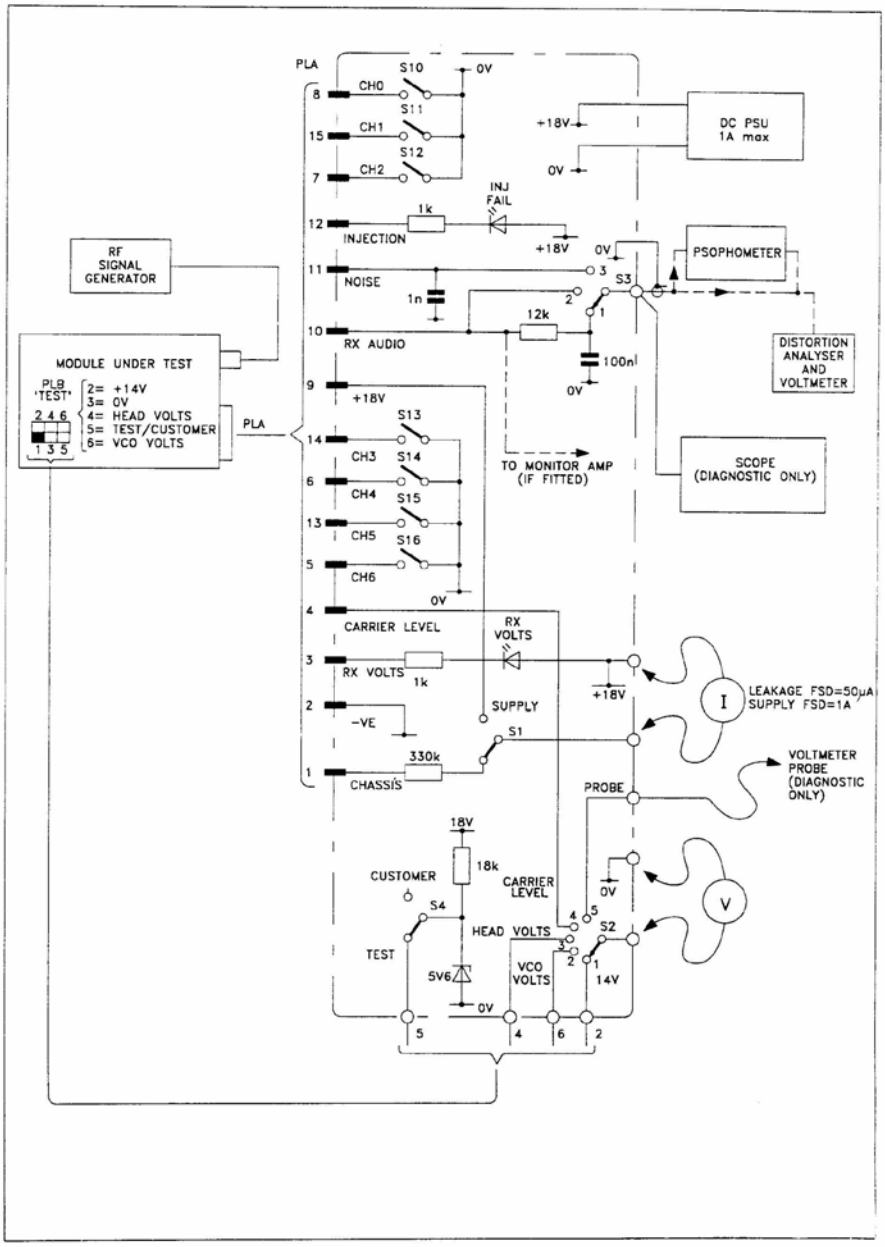


Fig.2 Test Jig

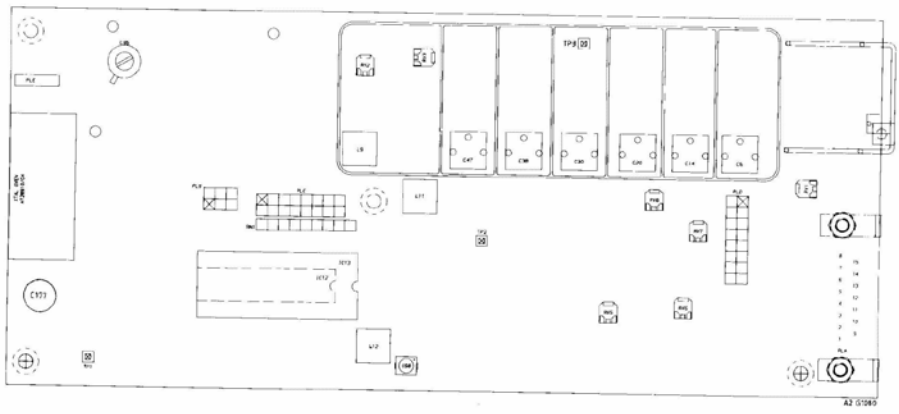


Fig.3 UHF Receiver Alignment Diagram

RECEIVER MODULE (VHF)
AT04880/02-04,12-14,22-24

INTRODUCTION

The receiver module converts the RF signals at the antenna into audio which is processed in the control module. Carrier level squelch and noise squelch outputs are also provided to the control module. The injection frequency is derived from an oven controlled oscillator.

DETAILED DESCRIPTION

RF Head.

RF signals at the antenna socket SKA are routed via low-pass filter L33,L24 and C39, C115 to a multi-stage bandpass varicap tuned filter comprising L9-L12 (L9-L11 E Band), CV4-CV7 (CV4-CV6 E Band) and D7-D14 (D7-D12 E Band). The preset variables allow the head response to be optimised over the frequency band in use, while RV2 and RV3 optimise the tracking of the voltage controlled filters. The filtered RF signal is then mixed with the local oscillator signal in the dual-gate mixer TR8.

Crystal Oscillator

A crystal oscillator, TR6 and XL1, operating at 8,4MHz in a fundamental parallel mode, provides the reference frequency and determines the frequency stability of the receiver. The crystal is enclosed in a temperature controlled oven assembly (AT28910/04) which maintains the temperature at 80°C ± 2°C over the temperature range of -30°C to +60°C and provides a stability of ±2ppm. The output of this oscillator is fed to the synthesizer, IC3 on pin 8.

Voltage Controlled Oscillator

TR1 is configured as a voltage controlled oscillator, operating at the final injection frequency, under the influence of coil L1, preset capacitor CV1 and varicaps D1 and D2. Output from the oscillator is amplified by TR3 and split to feed the mixer (via amplifier TR2 and filter L32, CV3, D5 and D6) and the prescaler IC2 (via amplifier TR4).

Synthesizer

Customer channel information is contained within the PROM IC13. Channel selection is achieved by addressing the PROM via the seven parallel address lines C0 to C6 which are connected, via pull-up resistor network RN1 to the 15-way connector.

IC10, a custom EPLD (Electronically programmable logic device) detects the channel change command and instructs the synthesizer to strobe the EPROM for the new channel information.

Channel information is fed from the EPROM to the synthesizer in the form of eight separate four-bit words (D0-D5) on synthesizer pins 11-14. This channel information selects the correct divide ratios in the crystal oscillator and VCO paths, for the frequency requested. The two signals, suitably divided, are then fed to a phase comparator within IC3, the resultant error signals on pin 2 (coarse) and pin 1 (fine) are then filtered and amplified in IC1b, the output of which is used to control the VCO frequency (via D1,D2) and the front-end filter frequency, via IC4a and b, and D7-D14 (D7-D12 E Band). Failure of the receiver to achieve lock is signalled on IC3 pin 3. This illuminates an on-board LED and provides, via TR7, a lock fail alarm to PLA pin 12.

IF Stages

The IF output (21,4MHz) from mixer TR8 is matched by C60, C103, L32 and R56 into crystal filter FL1 which provides the first IF selectivity. L32 and LV2 allow optimisation of the matching to this filter. The filtered output is buffered by TR9, and fed to IC5, which contains an oscillator (controlled by XL2) and mixer, which converts the incoming 21,4MHz signal to the second IF of 455kHz. This is filtered (FL2) and fed to IC6, which further amplifies, limits, and demodulates the signal. Further inter-stage filtering is provided by FL3 which also ensures good metering sensitivity.

IC6 provides a DC signal strength output on pin 5 and the demodulated audio appears on pin 6.

Audio Stages

The demodulated signal from IC6 is amplified by IC7 a,b and c; this stage incorporates some temperature dependent level compensation, and provides a suitable audio output for further processing by the control module; IC7d, IC8a and b filter and amplify the higher-frequency noise components of the signal for use with the noise-operated squelch circuitry within the control module. Gain adjustment of this noise is provided by RV4.

Metering Circuit

The DC level on IC6 pin 5 is dependent upon the incoming RF signal strength. This signal is buffered and amplified by IC9b and d and fed to connector PLA pin 4 for use in the carrier mute circuitry of the control module, and to provide signal strength metering. Thermistor TH2 provides temperature-dependent compensation, whilst RV6 and RV7 provide slope and level offset adjustment respectively.

Regulation

IC12 regulates the incoming 18V down to 14V (adjustable by RV1), whilst IC11 provides a separate 5V supply. The presence of the 14V supply is detected by TR10, the output of which is fed to PLA pin 3 for external monitoring.

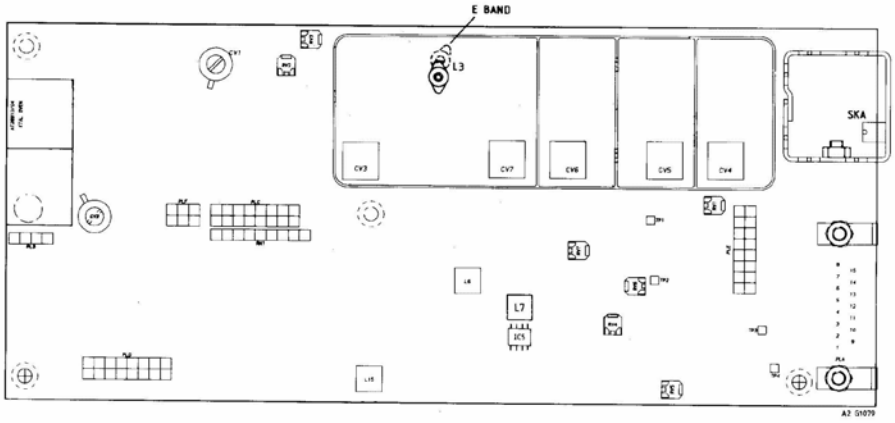


Fig.1 VHF Receiver Alignment Diagram

TEST PROCEDURE (AT04880/02-04,12-14,22-24) /3

Test Equipment

Item	Description	Requirement	Suitable Type
	Test jig	see Fig.2 of AT04880(UHF)	-
1	Power supply	18V 1A	Kingshill
	Ammeter	50µA, 1A FSD	Select-test 50 or Philips PM2519
	Voltmeter	Very high input impedence, 100kΩ/V min.	Philips PM2519
5	Oscilloscope	general purpose (diagnostic only)	Hamed 203.5
6	SINAD meter	resolution to 0,1%	HP 333A
10	Signal generator	-	HP 8640B
11	Marker oscillator	21,4MHz or 2nd harmonic of 10,7MHz marker.	TCL PT507
	Psophometer	-	HP3556A

Preliminary

1 Set all PCB potentiometers to mid-position and set the Test Jig switches as follows:-

S1 leakage; S2 position 1; S3 position 1; S4 test; S10-16 '0'.

2 Check that an EPROM has been fitted to the Rx module under test.

3 Connect Test Jig and switch on PSU. Check that the chassis leakage current as read by the ammeter is 5µA or less.

4 Adjust RV1 for a voltmeter reading of 14V.

5 Temporarily unplug crystal oven (PLB), set ammeter to 1A FSD and S1 to supply, check that the supply current is 0,2mA or less. Reconnect crystal oven (PLB).

6 Check that the PCB 'lock fail' LED and the Test Jig 'inj fail' LED are illuminated, if necessary adjust CV1. Check that the 'Rx supply volts present' LED on the Test Jig is illuminated.

Synthesiser Alignment

1 Determine the mean of the customer's highest and lowest frequencies, note the PROM test Channel closest to this frequency. This will be the centre channel for alignment purposes unless ±2,25% of this frequency is outside the band edge. In this case use the following as the centre channel:-

A BAND	B BAND	E BAND
149,49MHz	134,97MHz	69,6MHz
169,95MHz	152,46MHz	86MHz

Determine the test channels closest to ±2,25% of the centre channel ('high' and 'low' channels).

2 Set S2 on the Test Jig to position 2, the voltmeter will now show the VCO control voltage. Select the centre channel on the Rx.

3 Adjust CV1 for 6V VCO control voltage, check that the PCB 'lock fail' LED and the 'inj fail' LED on the Test Jig are not illuminated.

4 Select the low channel, check that the VCO voltage is 1,3V minimum. Select the high channel, check that the VCO voltage is 12V maximum. If necessary adjust CV1 to meet these conditions.

General Alignment

Note:

(i) All RF levels are in PD

(ii) Unless otherwise stated, modulation is 60% deviation at 1kHz

(iii) On E Band ignore references to CV7.

1 Set the RF signal generator output to 1V, deviation 60% at 1kHz.
Set S3 to position 2 to measure the audio output.
Adjust L15 (discriminator) for maximum output.
Adjust RV5 to give 300mV audio.

2 Set S2 to position 4, the DC voltmeter will now read carrier level volts (RSSI).
Adjust the RF level to give approximately 5V RSSI reading.
Adjust L3, L6 and L7 for maximum RSSI reading.

Note: The crystal oven must have been 'on' for at least 5 minutes before carrying out the following check.

3 Select the centre channel on the Rx and signal generator, switch off the modulation. Set S3 to position 2, adjust the RF level and observe quieting on the oscilloscope, if quieting is not observed, even with 1V RF level, adjust crystal trimmer CV2.
Hold the 21,4MHz marker oscillator close to IC5 and adjust CV2 for 'zero beat' on the oscilloscope.

4 Set S2 to position 2; DC voltmeter will now read RF head voltage, from the appropriate graph determine the required head voltage for the centre channel. Adjust RV2 (and RV3 if necessary) to obtain this voltage.

5 Set S3 to position 1 (de-emphasis on), switch on the modulation. Set the distortion analyser to measure SINAD with CCITT weighting; adjusting the RF level as necessary, adjust CV3, CV7, CV6, CV5 and CV4 for best SINAD until no further improvement is possible.

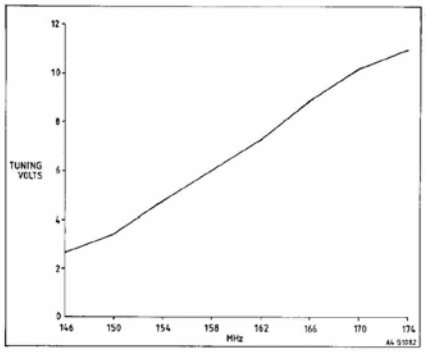
6 Set S2 to position 4 (RSSI), adjust RF level to give approximately 5V RSSI reading. Adjust CV3 for maximum RSSI level. Check that the SINAD with 0,5µV RF level is at least 20dB.

7 Adjust the RF level to give 20dB SINAD, set S3 to position 3 and measure the noise level. Adjust RV4 to give 100mV of noise.

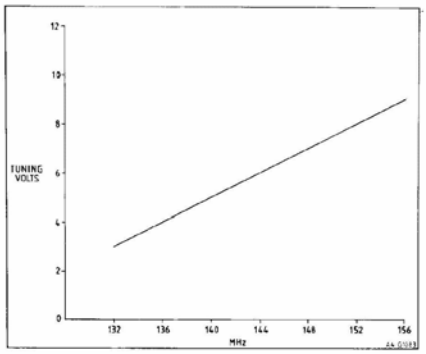
8 Set the RF signal generator to give 1mV modulated output, set S3 to position 1 and measure the distortion without CCITT weighting. On 12,5kHz and 20kHz channel spacing equipments only adjust L6 for minumum distortion.

9 Set S2 to position 4 (RSSI), with 0,3µV RF input adjust RV7 to give 4V RSSI. Increase RF level to 30µV; if RSSI voltage is less than 10V adjust RV6 clockwise, if RSSI voltage is greater than 10V adjust RV6 counter-clockwise. Adjust RV6 and RV7 until 4V and 10V RSSI are obtained for RF levels of 0,3µV and 30µV respectively.

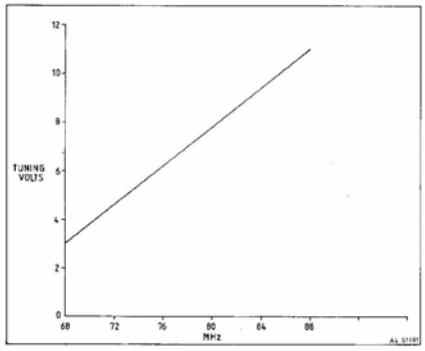
10 Set S3 to position 2, with an RF input of 1mV modulated, note the audio output level on the dB scale (0dB reference).
Set the modulating frequency to 300Hz and check that the audio level is within ±0,5dB.
Set the modulating frequency to 3kHz and check that the audio level is within ±0,5dB.



A Band RF Head Tuning



B Band RF Head Tuning



E Band RF Head Tuning

Front-end Tracking

1 Set S2 to position 3 (head volts) and S3 to position 1 (de-emphasis on), record head voltage on centre channel. Select low channel on Test Jig and RF signal generator, set RF input to 0,5µV modulated. Switch on CCITT weighting.

2 Adjust RV2 (and if necessary RV3) for best SINAD, record head voltage.

3 Repeat step 2 but with the high channel.

4 Adjust RV2 and RV3 so that the voltage noted in steps 2 and 3 are obtained when the low and high channels are selected.

5 Select the centre channel on the Test Jig, compare the head voltage with that noted in step 1. If there is more than 0,3V difference adjust RV2 to halve the error.

6 Check that the SINAD on all three channels is 20dB minimum.

VHF RECEIVER ADJUSTMENTS

The following is a list of the tunable components within the unit together with the parameter for which they are adjusted;

Component	Parameter	
RV1	Set for 14V on TP1	
RV2	Front-end tracking offset	Refer to alignment procedure.
RV3	Front-end tracking gain	
RV4	Set for 100mV noise on TP3 with RF level set to give 20dB psophometric SINAD.	
RV5	Audio level. Set for 300mV audio on TP4 with 1mV RF level, modulation 60% at 1kHz.	
RV6	RSSI slope	Set for DC levels on TP2: 4V for 0,3µV RF level. 10V for 30µV RF level.
RV7	RSSI gain	
CV1	VCO trimmer. Set for 6V DC on PLF pin 6 on centre channel.	
CV2	Crystal oscillator. Set for zero beat with marker oscillator.	
CV3	Injection filter. Adjust for maximum DC level on TP2 with RF level set to give approximately 5V on TP2.	

Component	Parameter
CV4-6 CV7 (A/B Band only)	RF front-end. Refer to alignment procedure.
L3 L7	1st IF. Adjust for maximum DC level on TP2 with RF level set to give approximately 5V on TP2.
L6	1st IF. Adjust for lowest distortion (12,5 and 20kHz channel spacing) with 1mV RF level, modulation 60% at 1kHz. On 25kHz channel spacing adjust for maximum DC level on TP2 with RF level set to give approximately 5V on TP2.
L15	Discriminator coil. Adjust for maximum audio level on TP4 with 1mV RF level, modulation 60% at 1kHz.

RECEIVER MODULE AT04880/-
ALL VARIANTS

CRYSTAL INFORMATION

All frequency variants, AT04880/02-07, 12-17, 22-27, use an 8,4Mhz crystal to Philips specification YE00923.

SPECIFICATION

Bands	A9 146-174MHz T1 405-440MHz B0 132-156MHz U0 440-470MHz E0 66-88MHz WM 470-520MHz
Channel Spacing	12,5kHz (/02-07) 25kHz (/12-17) 20kHz (/22-27)
Input Impedance	50Ω nominal
Maximum RF input level	2V from 50Ω source
Number of Channels	Up to 128
Audio Response *	300 Hz to 3kHz +1 -3dB rel to level at 1kHz and 6dB/oct de-emphasis
Distortion	Less than 2,5% (60% deviation at 1kHz)
Signal/Noise ratio	Greater than 46dB at 1mV RF input measured de-emphasised, psophometric.
Line O/P impedance *	600Ω balanced
Supply Input	18V ±0,5V at 0,5A max.
Line O/P level *	4-Wire -37 to +47dBm (for 60% deviation at 1kHz) adjustable 2-Wire (remote) -16 to 0dBm (for 60% deviation at 1kHz) adjustable *Note: On 2-Wire system, O/P level should be within 6dB of TX input level*
Unprocessed RX Audio O/P level	300mV into 10k (for 60% deviation at 1kHz) not de-emphasised

* measured via control unit

INTERNAL MODULE INDICATIONS

Lock fail	Indicates that the synthesizer is unlocked.

RECEIVER TEST FREQUENCIES.

Note: *For access to these test frequencies, refer to the alignment procedure for the relevant unit.*

TABLE 1 (Part)

Channel	Switch position 10	11	12	13	14	15	16	'Test freq' MHz U,T,W Bands	'Test freq' MHz A,B Bands	'Test freq' MHz E Band
0	0	0	0	0	0	0	0	400	132	68
1	0	0	0	0	0	0	1	401	132,335	68,2
2	0	0	0	0	0	1	0	402	132,67	68,4
3	0	0	0	0	0	1	1	403	133,005	68,6
4	0	0	0	0	1	0	0	404	133,34	68,8
5	0	0	0	0	1	0	1	405	133,675	69
6	0	0	0	0	1	1	0	406	134,01	69,2
7	0	0	0	0	1	1	1	407	134,345	69,4
8	0	0	0	1	0	0	0	408	134,68	69,6
9	0	0	0	1	0	0	1	409	135,015	69,8
10	0	0	0	1	0	1	0	410	135,35	70
11	0	0	0	1	0	1	1	411	135,685	70,2
12	0	0	0	1	1	0	0	412	136,02	70,4
13	0	0	0	1	1	0	1	413	136,355	70,6
14	0	0	0	1	1	1	0	414	136,69	70,8
15	0	0	0	1	1	1	1	415	137,025	71
16	0	0	1	0	0	0	0	416	137,36	71,2
17	0	0	1	0	0	0	1	417	137,695	71,4
18	0	0	1	0	0	1	0	418	138,03	71,6
19	0	0	1	0	0	1	1	419	138,365	71,8
20	0	0	1	0	1	0	0	420	138,7	72
21	0	0	1	0	1	0	1	421	139,035	72,2
22	0	0	1	0	1	1	0	422	139,37	72,4
23	0	0	1	0	1	1	1	423	139,705	72,6
24	0	0	1	1	0	0	0	424	140,04	72,8
25	0	0	1	1	0	0	1	425	140.375	73
26	0	0	1	1	0	1	0	426	140,71	73,2
27	0	0	1	1	0	1	1	427	141,045	73,4
28	0	0	1	1	1	0	0	428	141,38	73,6
29	0	0	1	1	1	0	1	429	141,715	73,8
30	0	0	1	1	1	1	0	430	142,05	74
31	0	0	1	1	1	1	1	431	142,385	74,2
32	0	1	0	0	0	0	0	432	142,72	74,4
33	0	1	0	0	0	0	1	433	143,055	74,6
34	0	1	0	0	0	1	0	434	143,39	74,8
35	0	1	0	0	0	1	1	435	143,725	75
36	0	1	0	0	1	0	0	436	144,06	75,2
37	0	1	0	0	1	0	1	437	144,395	75,4
38	0	1	0	0	1	1	0	438	144,73	75,6
39	0	1	0	0	1	1	1	439	145,065	75,8
40	0	1	0	1	0	0	0	440	145,4	76
41	0	1	0	1	0	0	1	441	145,735	76,2
42	0	1	0	1	0	1	0	442	146,07	76,4
43	0	1	0	1	0	1	1	443	146,405	76,6
44	0	1	0	1	1	0	0	444	146,74	76,8
45	0	1	0	1	1	0	1	445	147,075	77
46	0	1	0	1	1	1	0	446	147,41	77,2
47	0	1	0	1	1	1	1	447	147,745	77,4

TABLE 1 (Cont'd)

Channel	Switch position 10	11	12	13	14	15	16	'Test freq' MHz U,T,W Bands	'Test freq' MHz A,B Bands	'Test freq' MHz E Band
48	0	1	1	0	0	0	0	448	148,08	77,6
49	0	1	1	0	0	0	1	449	148,415	77,8
50	0	1	1	0	0	1	0	450	148,75	78
51	0	1	1	0	0	1	1	451	149,085	78,2
52	0	1	1	0	1	0	0	452	149,42	78,4
53	0	1	1	0	1	0	1	453	149,755	78,6
54	0	1	1	0	1	1	0	454	150,09	78,8
55	0	1	1	0	1	1	1	455	150,425	79
56	0	1	1	1	0	0	0	456	150,76	79,2
57	0	1	1	1	0	0	1	457	151,095	79,4
58	0	1	1	1	0	1	0	458	151,43	79,6
59	0	1	1	1	0	1	1	459	151,765	79,8
60	0	1	1	1	1	0	0	460	152,1	80
61	0	1	1	1	1	0	1	461	152,435	80,2
62	0	1	1	1	1	1	0	462	152,77	80,4
63	0	1	1	1	1	1	1	463	153,105	80,6
64	1	0	0	0	0	0	0	464	153,44	80,8
65	1	0	0	0	0	0	1	465	153,775	81
66	1	0	0	0	0	1	0	466	154,11	81,2
67	1	0	0	0	0	1	1	467	154,445	81,4
68	1	0	0	0	1	0	0	468	154,78	81,6
69	1	0	0	0	1	0	1	469	155,115	81,8
70	1	0	0	0	1	1	0	470	155,45	82
71	1	0	0	0	1	1	1	471	155,785	82,2
72	1	0	0	1	0	0	0	472	156,12	82,4
73	1	0	0	1	0	0	1	473	156,455	82,6
74	1	0	0	1	0	1	0	474	156,79	82,8
75	1	0	0	1	0	1	1	475	157,125	83
76	1	0	0	1	1	0	0	476	157,46	83,2
77	1	0	0	1	1	0	1	477	157,795	83,4
78	1	0	0	1	1	1	0	478	158,13	83,6
79	1	0	0	1	1	1	1	479	158,465	83,8
80	1	0	1	0	0	0	0	480	158,8	84
81	1	0	1	0	0	0	1	481	159,135	84,2
82	1	0	1	0	0	1	0	482	159,47	84,4
83	1	0	1	0	0	1	1	483	159,805	84,6
84	1	0	1	0	1	0	0	484	160,14	84,8
85	1	0	1	0	1	0	1	485	160,475	85
86	1	0	1	0	1	1	0	486	160,81	85,2
87	1	0	1	0	1	1	1	487	161,145	85,4
88	1	0	1	1	0	0	0	488	161,48	85,6
89	1	0	1	1	0	0	1	489	161,815	85,8
90	1	0	1	1	0	1	0	490	162,15	86
91	1	0	1	1	0	1	1	491	162,485	86,2
92	1	0	1	1	1	0	0	492	162,82	86,4
93	1	0	1	1	1	0	1	493	163,155	86,6
94	1	0	1	1	1	1	0	494	163,49	86,8
95	1	0	1	1	1	1	1	495	163,825	87
96	1	1	0	0	0	0	0	496	164,16	87,2
97	1	1	0	0	0	0	1	497	164,495	87,4
98	1	1	0	0	0	1	0	498	164,83	87,6
99	1	1	0	0	0	1	1	499	165,165	87,8

TABLE 1 (Cont'd)

Channel	Switch position							'Test freq' MHz U,T,W Bands	'Test freq' MHz A,B Bands	'Test freq' MHz E Band
	10	11	12	13	14	15	16			
100	1	1	0	0	1	0	0	500	165,5	88
101	1	1	0	0	1	0	1	501	165,835	
102	1	1	0	0	1	1	0	502	166,17	
103	1	1	0	0	1	1	1	503	166,505	
104	1	1	0	1	0	0	0	504	166,84	
105	1	1	0	1	0	0	1	505	167,175	
106	1	1	0	1	0	1	0	506	167,51	
107	1	1	0	1	0	1	1	507	167,84	
108	1	1	0	1	1	0	0	508	168,18	
109	1	1	0	1	1	0	1	509	168,515	
110	1	1	0	1	1	1	0	510	168,85	
111	1	1	0	1	1	1	1	511	169,185	
112	1	1	1	0	0	0	0	512	169,52	
113	1	1	1	0	0	0	1	513	169,855	
114	1	1	1	0	0	1	0	514	170,19	
115	1	1	1	0	0	1	1	515	170,525	
116	1	1	1	0	1	0	0	516	170,86	
117	1	1	1	0	1	0	1	517	171,195	
118	1	1	1	0	1	1	0	518	171,53	
119	1	1	1	0	1	1	1	519	171,865	
120	1	1	1	1	0	0	0	520	172,2	
121	1	1	1	1	0	0	1		172,535	
122	1	1	1	1	0	1	0		172,87	
123	1	1	1	1	0	1	1		173,205	
124	1	1	1	1	1	0	0		173,54	
125	1	1	1	1	1	0	1		173,875	
126	1	1	1	1	1	1	0		174	
127	1	1	1	1	1	1	1		156	

RX MODULE SYNTHESIZED

AT04880/02	A9 BAND 12,5KHZ CHANNEL SPACING
AT04880/03	B0 BAND 12,5KHZ CHANNEL SPACING
AT04880/04	E0 BAND 12,5KHZ CHANNEL SPACING
AT04880/05	T1 BAND 12,5KHZ CHANNEL SPACING
AT04880/06	U0 BAND 12,5KHZ CHANNEL SPACING
AT04880/07	WM BAND 12,5KHZ CHANNEL SPACING
AT04880/12	A9 BAND 25KHZ CHANNEL SPACING
AT04880/13	B0 BAND 25KHZ CHANNEL SPACING
AT04880/14	E0 BAND 25KHZ CHANNEL SPACING
AT04880/15	T1 BAND 20/25KHZ CHANNEL SPACING
AT04880/16	U0 BAND 20/25KHZ CHANNEL SPACING
AT04880/17	WM BAND 20/25KHZ CHANNEL SPACING
AT04880/22	A9 BAND 20KHZ CHANNEL SPACING
AT04880/23	B0 BAND 20KHZ CHANNEL SPACING
AT04880/24	E0 BAND 20KHZ CHANNEL SPACING

Cct Ref	Description	Part No	Remarks
	PCB Assembly Rx UHF	AT29076/-	See Separate Headed List
	PCB Assembly Rx VHF	AT29081/-	See Separate Headed List
	PCB Assembly Rx VHF	AT29084/-	See Separate Headed List
	Box RF sealed	BT36126	/02-04,12-14,22-24
	Cover Plate Rear	BT15913	
	Front Panel Assy Rx	AT14817	
	Housing modified	4313 328 30151	/05-07,15-17
	Label Alignment Frequency	BT38238	
	Label Unit	BT38209/01	
	Lid	3513 903 20181	/02-04,12-14,22-24
	Lid Assembly	3513 504 03911	/05-07,15-17
	Seal RF	BT29999	
	Pillar micro M2,5	2513 719 06001	/05-07,15-17; 4/Box-PCB
	Nut st hex M2,5	QA11604/X	/05-07,15-17; 4/micro-pillars
	Scr st pan pozi M2,5 x 8mm	QJ11946/X	
	Scr st csk pozi M2,5 x 5mm	QJ11600/B	/05-07,15-17; 4/micro-pillars
	Scr st tap pan M3 x 6mm	QJ11550/X1	
	Scr st tap pan M3 x 8mm	QJ11551/X1	
	Scr st tap pozi No.4 x 4,5mm	QJ08219/X	
	Washer M3	3913 080 50220	/05-07,15-17; 4/micro-pillars

FRONT PANEL ASSEMBLY RX
AT14817

	Fastener	BT17284	2/Rx-shelf
	Handle	BT35949	
	Label, Philips	BT38216/01	1/handle
	Label, Rx	BT38205/01	1/handle
	Panel Front	BT23740	
	Scr st tap pozi No.4 x 8mm	QJ08241/X	2/handle-front panel

PCB ASSEMBLY RX UHF

AT29076/05	T1 Band 12,5kHz channel spacing
AT29076/06	U0 Band 12,5kHz channel spacing
AT29076/07	WM Band 12,5kHz channel spacing
AT29076/15	T1 Band 20/25kHz channel spacing
AT29076/16	U0 Band 20/25kHz channel spacing
AT29076/17	WM Band 20/25kHz channel spacing

Semiconductors & ICs

IC1	IC LM258	SMD	3513 999 45008
IC2	Mixer rms1	SMD	2722 162 90133
IC3	IC 7805 Volt reg & fix		3513 993 34014
IC4	IC SA602D	SMD	9337 488 50605
IC5	IC SA604AD	SMD	9339 489 30623
IC6	IC LM324-HDL	SMD	3513 999 45005
IC7	IC LM317		FU99119
IC8	IC LS204	SMD	3513 999 45011
IC9	IC SP8703 Prescaler		9339 208 20682
IC10	IC 7805 Volt reg & fix		3513 993 34014
IC11	IC NJ8820	SMD	4313 324 70001
IC12	EPLD assy programmed		AT60170
IC13	PROM assy programmed		AT60171
IC14	IC LM348D	SMD	3513 999 45003
IC15	IC LM258	SMD	3513 999 45008
TR1	Transistor NE41137		3513 990 00008
TR2	Transistor ON977/TI	SMD	3513 999 05007
TR3	Transistor BFR93	SMD	3513 999 00027
TR4	Transistor MMBFU310	SMD	3513 999 05009
TR5,6	Transistor ON977/TI	SMD	3513 999 05007

Cct Ref	Description	Part No	Remarks
Semiconductors & ICs (Cont'd)			
TR7,8	Transistor BCX19	3513 999 00016	
TR9	Transistor BFR93 SMD	3513 999 00027	
TR10,11	Transistor BCX19	3513 999 00016	
D1	Diode BB405B	9333 182 80113	
D2	Diode BB405B	9333 182 80113	/05,06,15,16
D3	Diode BB405B	9333 182 80113	
D4,5	Diode BB405B	9333 182 80113	/05,06,15,16
D6,7	Diode BB405B	9333 182 80113	
D8	Diode BB405B	9333 182 80113	/05,06,15,16
D9	Diode BB405B	9333 182 80113	
D10	Diode BB405B	9333 182 80113	/05,06,15,16
D11	Diode BB405B	9333 182 80113	
D12	Diode BB405B	9333 182 80113	/05,06,15,16
D13	Diode BB405B	9333 182 80113	
D14,15	Diode BB405B	9333 182 80113	/05,06,15,16
D16,17	Diode BB405B	9333 182 80113	
D18,19	Diode BB405B	9333 182 80113	/05,06,15,16
D20,21	Diode BB405B	9333 182 80113	
D22,23	Diode BB405B	9333 182 80113	/05,06,15,16
D24	Diode BB405B	9333 182 80113	
D25	Diode BAV99 SMD	3513 999 15002	
D26	Diode 1T32 Varactor SMD	3508 100 10300	
D27	Diode BAV99 SMD	3513 999 15002	
Resistors			
R1-4	100k ±5% 0,125W SMD	3513 999 80060	
R5	47 ±5% 0,125W SMD	3513 999 80020	
R6	3k9 ±5% 0,125W SMD	3513 999 80043	
R7	1k ±5% 0,125W SMD	3513 999 80036	
R8	330 ±5% 0,125W SMD	3513 999 80030	
R9	150 ±5% 0,125W SMD	3513 999 80026	
R10-17	100k ±5% 0,125W SMD	3513 999 80060	
R18	22 ±5% 0,125W SMD	3513 999 80016	
R19	150 ±5% 0,125W SMD	3513 999 80026	
R20	22 ±5% 0,125W SMD	3513 999 80016	
R21	47 ±5% 0,125W SMD	3513 999 80020	
R22	10k ±5% 0,125W SMD	3513 999 80048	
R23	68k ±5% 0,125W SMD	3513 999 80058	
R24	220 ±5% 0,125W SMD	3513 999 80028	
R25	47k ±5% 0,125W SMD	3513 999 80056	
R26	1k8 ±5% 0,125W SMD	3513 999 80039	
R27	2k2 ±5% 0,25W c film	3513 992 00188	/05,06,07
R28	47 ±5% 0,125W SMD	3513 999 80020	
R29	4k7 ±5% 0,125W SMD	3513 999 80044	
R30	100k ±5% 0,125W SMD	3513 999 80060	
R31	10k ±5% 0,125W SMD	3513 999 80048	
R32,33	1k ±5% 0,125W SMD	3513 999 80036	
R34	10k ±5% 0,125W SMD	3513 999 80048	
R35	47k Thermistor	2322 642 62473	
R36	100k ±5% 0,125W SMD	3513 999 80060	
R37	39k ±5% 0,125W SMD	3513 999 80055	
R38	220 ±5% 0,125W SMD	3513 999 80028	
R39	1k8 ±5% 0,125W SMD	3513 999 80039	
R40	10k ±5% 0,125W SMD	3513 999 80048	
R41,42	100k ±5% 0,125W SMD	3513 999 80060	
R43	39k ±5% 0,125W SMD	3513 999 80055	
R44	68k ±5% 0,125W SMD	3513 999 80058	
R45,46	10k ±5% 0,125W SMD	3513 999 80048	
R47	220 ±5% 0,125W SMD	3513 999 80028	
R48	2k2 ±5% 0,125W SMD	3513 999 80040	
R49	470 ±5% 0,125W SMD	3513 999 80032	
R50	22 ±5% 0,125W SMD	3513 999 80016	
R51	1k ±5% 0,125W SMD	3513 999 80040	
R53	47 ±5% 0,125W SMD	3513 999 80020	
R54	47 ±5% 0,125W SMD	3513 999 80020	
R55	68k ±5% 0,125W SMD	3513 999 80058	
R56,57	100k ±5% 0,125W SMD	3513 999 80060	
R58	22 ±5% 0,125W SMD	3513 999 80016	
R59	68k ±5% 0,125W SMD	3513 999 80058	
R60	47k ±5% 0,125W SMD	3513 999 80056	
R61	100k ±5% 0,125W SMD	3513 999 80060	
R62	820k ±5% 0,125W SMD	3513 999 80071	
R63	150 ±5% 0,125W SMD	3513 999 80026	
R64	220 ±5% 0,125W SMD	3513 999 80028	
R65	1k5 ±5% 0,125W SMD	3513 999 80038	

Cct Ref	Description	Part No	Remarks
Resistors (Cont'd)			
R66	560 ±5% 0,125W SMD	3513 999 80033	
R67	100k ±5% 0,125W SMD	3513 999 80060	
R68	27k ±5% 0,125W SMD	3513 999 80053	
R69-71	10k ±5% 0,125W SMD	3513 999 80048	
R72-78	10k ±2% 0,1W SMD	3513 999 80236	
R79-81	4k7 ±5% 0,125W SMD	3513 999 80044	
R82	27k ±5% 0,125W SMD	3513 999 80053	
R83	10k ±5% 0,125W SMD	3513 999 80048	
R84	47k ±5% 0,125W SMD	3513 999 80056	
R85	4k7 ±5% 0,125W SMD	3513 999 80044	
R86	220 ±5% 0,125W SMD	3513 999 80028	
R87	10k ±5% 0,125W SMD	3513 999 80048	
R88	4k7 ±5% 0,125W SMD	3513 999 80044	
R89	10k ±5% 0,125W SMD	3513 999 80048	
R90	4k7 ±5% 0,125W SMD	3513 999 80044	
R91	10k ±5% 0,125W SMD	3513 999 80048	
R92	1k5 ±5% 0,125W SMD	3513 999 80038	
R93	220 ±5% 0,125W SMD	3513 999 80028	
R94	4k7 ±5% 0,125W SMD	3513 999 80044	
R95	10k ±5% 0,125W SMD	3513 999 80048	
R96	27k ±5% 0,125W SMD	3513 999 80053	
R97	100k ±5% 0,125W SMD	3513 999 80060	
R98	10k ±5% 0,125W SMD	3513 999 80048	
R99	47k Thermistor	2322 642 62473	
R100	4k7 ±5% 0,125W SMD	3513 999 80044	
R101	1k5 ±5% 0,125W SMD	3513 999 80038	
R102	6k8 ±5% 0,125W SMD	3513 999 80046	
R104	47 ±5% 0,125W SMD	3513 999 80020	
R105	3k3 ±5% 0,25W c film	3513 992 00190	
R106	3k3 ±5% 0,125W SMD	3513 999 80042	
R107	680k ±5% 0,25W c film	3513 992 00218	
R108,109	1k ±5% 0,125W SMD	3513 999 80036	
R110,111	10k ±5% 0,125W SMD	3513 999 80048	
R112	1k8 ±5% 0,125W SMD	3513 999 80039	
R113	27k ±5% 0,125W SMD	3513 999 80053	
R114	3k3 ±5% 0,125W SMD	3513 999 80042	
R115	330 ±5% 0,125W SMD	3513 999 80030	
R116	47 ±5% 0,125W SMD	3513 999 80020	
R117	4k7 ±5% 0,125W SMD	3513 999 80044	
R118,119	1k5 ±5% 0,125W SMD	3513 999 80038	
R120	1k ±5% 0,125W SMD	3513 999 80036	
R123	27k ±5% 0,125W SMD	3513 999 80053	
RV1	1k ±25% pot cermet	3513 999 95003	
RV2,3	100k ±25% pot cermet	3513 999 95013	
RV5	50k ±25% pot SMD	3513 999 95011	
RV6'7	10k ±25% pot cermet	3513 999 95007	
RV8	50k ±25% pot SMD	3513 999 95011	
RN1	100k ±5% 9-pin sil	RN99531	
Capacitors			
C1	6p8 ±0p25 cer hi-q	3513 999 55538	
C2	390p ±5% 50V SMD	3513 999 55332	
C3	100n ±10% 50V SMD	3513 999 55017	
C4,5	390p ±5% 50V SMD	3513 999 55332	
C6	1p4 - 5p5 variable	PV99004	
C7	6p8 ±0p25 cer hi-q	3513 999 55538	
C8	1p8 ±0p25 SMD	3513 999 55304	
C10-12	1p8 ±0p25 SMD	3513 999 55304	
C13	6p8 ±0p25 cer hi-q	3513 999 55538	
C14	1p4-5p5 variable	PV99004	
C15-19	390p ±5% 50V SMD	3513 999 55332	
C20	1p4-5p5 variable	PV99004	
C21	6p8 ±0p25 cer hi-q	3513 999 55538	
C22	390p ±5% 50V SMD	3513 999 55332	
C23	1p ±0p25 SMD	3513 999 55301	
C24	2p7 ±0p25 cer	3513 991 06005	/05,06,15,16
C25-27	1p ±0p25 SMD	3513 999 55301	
C28	6p8 ±0p25 cer hi-q	3513 999 55538	
C29	390p ±5% 50V SMD	3513 999 55332	
C31	1p ±0p25 SMD	3513 999 55301	
C30	1p4-5p5 variable	PV99004	
C32	1p ±0p25 cer	3513 991 06000	/05,06,15,16
C33,34	1p ±0p25 SMD	3513 999 55301	
C36	1p ±0p25 SMD	3513 999 55301	
C37	6p8 ±0p25 cer hi-q	3513 999 55538	

Cct Ref	Description				Part No	Remarks
Capacitors (Cont'd)						
C38	1p4-5p5	variable			PV99004	
C40	1p	±0p25		SMD	3513 999 55301	
C41	1p	±0p25		cer	3513 991 06000	/05,06,15,16
C42,43	1p	±0p25		SMD	3513 999 55301	
C45	1p	±0p25		SMD	3513 999 55301	
C46	6p8	±0p25		cer hi-q	3513 999 55538	
C47	1p4-5p5	variable			PV99004	
C48	1p	±0p25		cer	3513 991 06000	/05,06,15,16
C49	18p	±5%	50V	SMD	3513 999 55316	
C50	10p	±5%	50V	SMD	3513 999 55313	
C51,52	10n	±10%	50V	SMD	3513 999 55492	
C53	10p	±5%	50V	SMD	3513 999 55313	
C54	33	±20%	16V	elec	PS99409	
C55	390p	±5%	50V	SMD	3513 999 55332	
C56	18p	±5%	50V	SMD	3513 999 55316	
C57	10p	±5%	50V	SMD	3513 999 55313	
C58	4p5-20p	variable		SMD	3513 999 70002	
C59,60	10n	±10%	50V	SMD	3513 999 55492	
C61	82p	±5%	50V	SMD	3513 999 55405	
C62	39p	±0p5	50V	SMD	3513 999 55401	
C63	10n	±10%	50V	SMD	3513 999 55492	
C64	1n	±5%	50V	SMD	3513 999 55418	
C65	100n	±10%	50V	SMD	3513 999 55017	
C66	33	±20%	16V	elec	PS99409	
C67-71	100n	±10%	50V	SMD	3513 999 55017	
C72	10n	±10%	50V	SMD	3513 999 55492	
C73	10p	±5%	50V	SMD	3513 999 55313	
C74,75	100n	±10%	50V	SMD	3513 999 55017	
C76,77	150p	±5%	50V	SMD	3513 999 55408	
C78,79	100n	±10%	50V	SMD	3513 999 55017	
C80	33	±20%	16V	elec	PS99409	
C81	1n	±5%	50V	SMD	3513 999 55418	
C82-84	33	±20%	16V	elec	PS99409	
C84	47	±20%	25V	elec	PS99423	
C85-91	390p	±5%	50V	SMD	3513 999 55413	
C92	100n	±10%	50V	SMD	3513 999 55017	
C93	8p2	±0p5	50V	SMD	3513 999 55312	
C94	18p	±5%	50V	SMD	3513 999 55316	
C95	0p8-10pf	variable			4313 326 10081	
C96,97	6p8	±0p25		cer hi-q	3513 999 55538	
C98,99	4p7	±0p25	50V	SMD	3513 999 55309	
C100-102	390p	±5%	50V	SMD	3513 999 55413	
C103	5p6	±0p5	50V	SMD	3513 999 55310	
C104	1p	±0p25		SMD	3513 999 55301	
C105-107	390p	±5%	50V	SMD	3513 999 55413	
C108	1n	±5%	50V	SMD	3513 999 55418	
C109	390p	±5%	50V	SMD	3513 999 55413	
C110	33	±20%	16V	elec	PS99409	
C111	390p	±5%	50V	SMD	3513 999 55413	
C112	33	±20%	16V	elec	PS99409	
C113	390p	±5%	50V	SMD	3513 999 55413	
C114	33	±20%	16V	elec	PS99409	
C115,116	100n	±10%	50V	SMD	3513 999 55017	
C117	33	±20%	16V	elec	PS99409	
C118	10n	±10%	50V	SMD	3513 999 55492	
C119,120	390p	±5%	50V	SMD	3513 999 55413	
C121,122	100n	±10%	50V	SMD	3513 999 55017	
C123-125	1n	±5%	50V	SMD	3513 999 55418	
C126	10n	±10%	50V	SMD	3513 999 55492	
C127	1n	±5%	50V	SMD	3513 999 55418	
C128	150p	±5%	50V	SMD	3513 999 55408	
C129	1n	±5%	50V	SMD	3513 999 55418	
C130	390p	±5%	50V	SMD	3513 999 55413	
C131	2n2	±5%	50V	SMD	3513 999 55003	
C132,133	1n	±5%	50V	SMD	3513 999 55418	
C134	100n	±10%	50V	SMD	3513 999 55017	
C135	10n	±10%	50V	SMD	3513 999 55492	
C136,137	390p	±5%	50V	SMD	3513 999 55413	
C138	1n	±5%	50V	SMD	3513 999 55418	
C139	100n	±10%	50V	SMD	3513 999 55017	
C140	33	±20%	16V	elec	PS99409	
C141	10n	±10%	50V	SMD	3513 999 55492	
C142	33	±20%	16V	elec	PS99409	
C143	10n	±10%	50V	SMD	3513 999 55492	
C144,145	390p	±5%	50V	SMD	3513 999 55413	
C146	100n	±10%	50V	SMD	3513 999 55017	

Cct Ref	Description	Part No	Remarks
Capacitors (Cont'd)			
C147	33 ±20% 16V elec	PS99409	
C148	100n ±10% 50V SMD	3513 999 55017	
C149-160	390p ±5% 50V SMD	3513 999 55413	
C161	1n ±5% 50V SMD	3513 999 55418	
C162	33 ±20% 16V elec	PS99409	
C163	100n ±10% 50V SMD	3513 999 55017	
C164,165	1n ±5% 50V SMD	3513 999 55418	
C166	10n ±10% 50V SMD	3513 999 55492	
C167	1n ±5% 50V SMD	3513 999 55418	
C168	470n ±5% pes	3513 991 08016	
C169	1n ±5% 50V SMD	3513 999 55418	
C170	33 ±20% 16V elec	PS99409	
C171	10n ±10% 50V SMD	3513 999 55492	
C176	10p ±5% 50V SMD	3513 999 55313	
C177	0p8-10pf variable	4313 326 10081	
C178	47p ±5% 50V SMD	3513 999 55402	
C179	150p ±5% 50V SMD	3513 999 55408	
C180	18p ±5% 50V SMD	3513 999 55316	
C181	10n ±10% 50V SMD	3513 999 55492	
C182	390p ±5% 50V SMD	3513 999 55413	
C183	10n ±10% 50V SMD	3513 999 55492	
C184	1n ±5% 50V SMD	3513 999 55418	
C185	10n ±10% 50V SMD	3513 999 55492	
C185,186	100p ±5% 500V SMD	3513 999 55663	/05-07,15-17
C189	100n ±10% 50V SMD	3513 999 55017	
Inductors			
L1	Coil, air spaced	3513 509 00651	
L2-4	Coil	3513 509 00091	
L5-8	Coil	3513 509 00081	
L9	Coil assy 7mm	FT99200/02	
L10	Inductor 10µh ±10% SMD	3513 999 98092	
L11,12	Coil assy 7mm	FT99200/02	
L13-15	Inductor 10µh ±10% SMD	3513 999 98092	
L16	Coil 455kHz	4313 328 00031	
L17	Inductor 10µh ±10% SMD	3513 999 98092	
L18	Choke assy	AT31684	
L19	Inductor 10µh ±10% SMD	3513 999 98092	
L20-22	Inductor 220nh ±5% SMD	3513 999 98044	
L23	Inductor 15nh ±20% SMD	3513 999 98066	
L24-27	Inductor 10µh ±10% SMD	3513 999 98092	
L28	Choke assy	AT31684	
L29-40	Inductor 10µh ±10% SMD	3513 999 98092	
Miscellaneous			
CR1	Resonator ceramic 480MHz	3513 993 56600	/05,15
CR1	Resonator ceramic 520MHz	3513 993 56601	/06,16
CR1	Resonator ceramic 600MHz	3513 993 56603	/07,17
FL1	Xtal filt 12,5kHz	FC03547	/05,06,07
FL1	Xtal filt 25kHz	FC03528	/15,16,17
FL2,3	Cer filt 455kHz nom/12,5kHz	3513 993 56537	/05,06,07
FL2,3	Cer filt 455kHz nom/25kHz	3513 993 56535	/15,16,17
LED1	Led red	3513 993 46000	
PLA	Plug 15-way 'D' rt angle	FP12115	
PLB	PL PCB mtd straight 2 x 3-way	FP99174	
PLC,D	PL PCB mtd straight 2 x 8-way	FP99182	
XL1	Xtal 20,945MHz	4313 320 90021	
XL2	Xtal 8,4MHz	3513 900 70081	
	Bracket Antenna	3513 900 40231	
	Bush Ins	QA99024	1/IC7
	Cable Assy Channel	AT70251	1/PLC-PLD
	Can Screen - Rx	3513 901 30021	
	Core Cup	FC02121	1/L16
	Hdr str male 1-pos'n	3513 504 00121	1/TP1,2,3
	Hdr str male 4-pos'n	3513 504 00151	1/PLE
	PCB Assy Crystal Oven	AT28910/04	1/XL2
	Pillar Hexagon	BT04132	1/PCB-Crystal Oven Assy
	Screen Mixer Underside	BT26374	
	Skt BNC Type	FS43779	1/Antenna Bracket
	Sleeving Heatsink 6mm Id	FS23168	1/L16
	Socket Modified to 14-way	BJ34101/14	2/IC13
	Socket Xtal	FS42611	2/XL2
	Nut st hex M3	2522 401 64008	2/PLA; 1/IC3,7,10
	Scr st pan pozi M3 x 10mm	QJ11903/X	2/PLA; 1/IC3,7,10
	Washer Thermal TO-220	QA99111	1/IC7

PCB ASSEMBLY RX VHF

AT29081/02	A9 BAND, 12,5KHZ CHANNEL SPACING
AT29081/03	B0 BAND, 12,5KHZ CHANNEL SPACING
AT29081/12	A9 BAND, 25KHZ CHANNEL SPACING
AT29081/13	B0 BAND, 25KHZ CHANNEL SPACING
AT29081/22	A9 BAND, 20KHZ CHANNEL SPACING
AT29081/23	B0 BAND, 20KHZ CHANNEL SPACING

Cct Ref	Description	Part No	Remarks
Semiconductors & ICs			
IC1	IC, SMD LS204	3513 999 45011	
IC2	IC, SMD SP8792T	3513 999 45017	
IC3	IC, SMD NJ88206G	4313 324 70001	
IC4	IC, SMD LM258	3513 999 45008	
IC5	IC, SMD SA602D	9337 488 50605	
IC6	IC, SMD SA604AD	9339 489 30623	
IC7	IC, SMD LM348D	3513 999 45003	
IC8	IC, SMD MC1458D-	3513 999 45004	
IC9	IC, SMD LM324-HDL	3513 999 45005	
IC10	EPLD assembly programmed	AT60170	
IC11	IC, 7805 Volt reg & fix	3513 993 34014	
IC12	IC, LM317-	FU99119	
IC13,14	PROM assembly programmed	AT60171	
TR1	Transistor, SMD MMBFU310	3513 999 05009	
TR2-4	Transistor, SMD ON977/TI	3513 999 05007	
TR5	Transistor, BCX19	3513 999 00016	
TR6	Transistor, SMD MMBT918	3513 999 00036	
TR7	Transistor, BCX19	3513 999 00016	
TR8	Transistor, SMD ON977/TI	3513 999 05007	
TR9	Transistor, SMD MMBFU310	3513 999 05009	
TR10	Transistor, BCX19	3513 999 00016	
D1,2	Diode, BB809	9335 154 20113	
D3	Diode, SMD BAV99	3513 999 15002	
D4	LED, red	3513 993 46000	
D5-14	Diode, BB809	9335 154 20113	
D25	Diode, SMD BAV99	3513 999 15002	
Resistors			
R1	1k ±5% 0,125W SMD	3513 999 80036	
R2	68k ±5% 0,125W SMD	3513 999 80058	
R3	1k ±5% 0,125W SMD	3513 999 80036	
R4	39k ±5% 0,125W SMD	3513 999 80055	
R5	15k ±5% 0,125W SMD	3513 999 80050	
R6	270 ±5% 0,125W SMD	3513 999 80029	
R8	68k ±5% 0,125W SMD	3513 999 80058	
R9	15k ±5% 0,125W SMD	3513 999 80050	
R10	39k ±5% 0,125W SMD	3513 999 80055	
R11	68k ±5% 0,125W SMD	3513 999 80058	
R12	470 ±5% 0,125W SMD	3513 999 80032	
R13	270 ±5% 0,125W SMD	3513 999 80029	
R14	10 ±5% 0,125W SMD	3513 999 80012	
R15	470 ±5% 0,125W SMD	3513 999 80032	
R16	5k6 ±5% 0,125W SMD	3513 999 80045	
R17	330 ±5% 0,125W SMD	3513 999 80030	
R18	1k ±5% 0,125W SMD	3513 999 80036	
R19,20	100k ±5% 0,125W SMD	3513 999 80060	
R21	1k ±5% 0,125W SMD	3513 999 80036	
R22	3k3 ±5% 0,125W SMD	3513 999 80042	
R23	1k8 ±5% 0,125W SMD	3513 999 80039	
R24	680k ±5% 0,125W SMD	3513 999 80070	
R25	560 ±5% 0,125W SMD	3513 999 80033	
R26,27	470 ±5% 0,125W SMD	3513 999 80032	
R28,29	10k ±5% 0,125W SMD	3513 999 80048	
R30	1M ±5% 0,125W SMD	3513 999 80072	
R31	10k ±5% 0,125W SMD	3513 999 80048	
R32	47k ±5% 0,125W SMD	3513 999 80056	
R33	1k ±5% 0,125W SMD	3513 999 80036	
R34	3k3 ±5% 0,125W SMD	3513 999 80042	
R35	10k ±5% 0,125W SMD	3513 999 80048	
R36	47k ±5% 0,125W SMD	3513 999 80056	
R37	47k ±5% 0,125W SMD	3513 999 80056	
R38	100k ±5% 0,125W SMD	3513 999 80060	
R39	27k ±5% 0,125W SMD	3513 999 80053	
R40	150k ±5% 0,125W SMD	3513 999 80062	
R41,42	10k ±5% 0,125W SMD	3513 999 80048	
R43	22k ±5% 0,125W SMD	3513 999 80052	
R44-51	100k ±5% 0,125W SMD	3513 999 80060	

Cct Ref	Description				Part No	Remarks
Resistors (Cont'd)						
R52	68k	±5%	0,125W	SMD	3513 999 80058	
R53	4k7	±5%	0,125W	SMD	3513 999 80044	
R54,55	47	±5%	0,125W	SMD	3513 999 80020	
R56,57	1k8	±5%	0,125W	SMD	3513 999 80039	
R58	470	±5%	0,125W	SMD	3513 999 80032	
R59	270	±5%	0,125W	SMD	3513 999 80029	
R60	47k	±5%	0,125W	SMD	3513 999 80056	
R61	3k3	±5%	0,125W	SMD	3513 999 80042	
R62	47k	±5%	0,125W	SMD	3513 999 80056	
R63	100k	±5%	0,125W	SMD	3513 999 80060	
R64	6k8	±5%	0,125W	SMD	3513 999 80046	
R65	39k	±5%	0,125W	SMD	3513 999 80055	
R66,67	4k7	±5%	0,125W	SMD	3513 999 80044	
R68	27k	±5%	0,125W	SMD	3513 999 80053	
R69	18k	±5%	0,125W	SMD	3513 999 80051	
R70	68k	±5%	0,125W	SMD	3513 999 80058	
R71	100k	±5%	0,125W	SMD	3513 999 80060	
R72	33k	±5%	0,125W	SMD	3513 999 80054	
R73	2k2	±5%	0,125W	SMD	3513 999 80040	
R74	15k	±5%	0,125W	SMD	3513 999 80050	
R75	6k8	±5%	0,125W	SMD	3513 999 80046	
R76	15k	±5%	0,125W	SMD	3513 999 80050	
R77	6k8	±5%	0,125W	SMD	3513 999 80046	
R78	100k	±5%	0,125W	SMD	3513 999 80060	
R79	4k7	±5%	0,125W	SMD	3513 999 80044	
R80,81	10k	±5%	0,125W	SMD	3513 999 80048	
R82	330	±5%	0,125W	SMD	3513 999 80030	
R83	1k	±5%	0,125W	SMD	3513 999 80036	
R84	27k	±5%	0,125W	SMD	3513 999 80053	
R85	10k	±5%	0,125W	SMD	3513 999 80048	
R86	6k8	±5%	0,125W	SMD	3513 999 80046	
R87	4k7	±5%	0,125W	SMD	3513 999 80044	
R88	15k	±5%	0,125W	SMD	3513 999 80050	
R89	2k2	±5%	0,125W	SMD	3513 999 80040	
R90	68k	±5%	0,125W	SMD	3513 999 80058	
R91	15k	±5%	0,125W	SMD	3513 999 80050	
R92	39k	±5%	0,125W	SMD	3513 999 80055	
R93	68k	±5%	0,125W	SMD	3513 999 80058	
R94	470	±5%	0,125W	SMD	3513 999 80032	
R95	220	±5%	0,125W	SMD	3513 999 80028	
R96	1k8	±5%	0,125W	SMD	3513 999 80039	
R98,99	4k7	±5%	0,125W	SMD	3513 999 80044	
R100-102	10k	±5%	0,125W	SMD	3513 999 80048	
R103	82k	±5%	0,125W	SMD	3513 999 80059	
R104	4k7	±2%	0,1W	SMD	3513 999 80232	
R105	47k	±2%	0,1W	SMD	3513 999 80244	
R106	10k	±5%	0,125W	SMD	3513 999 80048	
R107-113	10k	±2%	0,1W	SMD	3513 999 80236	
R114	100k	±5%	0,125W	SMD	3513 999 80060	
R115	18k	±5%	0,125W	SMD	3513 999 80051	
R116	2k2	±5%	0,125W	SMD	3513 999 80040	
R117,118	4k7	±5%	0,125W	SMD	3513 999 80044	
R119-120	100k	±2%	0,1W	SMD	3513 999 80248	
R121	22k	±5%	0,125W	SMD	3513 999 80052	
RN1	100k	±5%	Res 9-pin sil		RN99531	
RV1	1k	±25%	Pot cermet		3513 999 95003	
RV2	10k	±25%	Pot cermet		3513 999 95007	
RV3	100k	±25%	Pot cermet		3513 999 95013	
RV4,5	50k	±25%	Pot SMD		3513 999 95011	
RV6,7	10k	±25%	Pot cermet		3513 999 95007	
TH1,2	47k		Thermistor		2322 642 62473	
Capacitors						
C1	5p6	±0p5	50V	SMD	3513 999 55310	
C2	10p	±5%	50V	SMD	3513 999 55313	
C3	22	±20%	25V	elec	3513 991 00079	
C4	1n	±5%	50V	SMD	3513 999 55418	
C5	22	±20%	25V	elec	3513 991 00079	
C6	1n	±5%	50V	SMD	3513 999 55418	
C7	100n	±20%			3513 991 06095	
C8-10	1n	±5%	50V	SMD	3513 999 55418	
C13	470p	±5%		SMD	3513 999 55414	
C14,15	1n	±5%	50V	SMD	3513 999 55418	
C16	22	±20%	25V	elec	3513 991 00079	
C17	470n	±5%		pes	3513 991 08016	

Cct Ref	Description				Part No	Remarks
Capacitors (Cont'd)						
C18	1n	±5%	50V	SMD	3513 999 55418	
C19,20	33	±20%	16V	elec	PS99409	
C21,22	10n	±10%		SMD	3513 999 55492	
C23,24	1n	±10%	50V	SMD	3513 999 55459	
C25	1n	±5%	50V	SMD	3513 999 55418	
C26	100p	±5%		SMD	3513 999 55406	
C27	1n	±5%	50V	SMD	3513 999 55418	
C28	27p	±5%	50V	SMD	3513 999 55318	
C29	8p2	±0p5	50V	SMD	3513 999 55312	
C30	15p	±5%		cer	PN99941	
C31	150p	±5%	50V	SMD	3513 999 55408	
C32	10n	±10%		SMD	3513 999 55492	
C33	47p	±5%	50V	SMD	3513 999 55402	
C34	1n	±10%	50V	SMD	3513 999 55459	
C35	4n7	±10%	50V	SMD	3513 999 55467	
C36	82p	±5%	50V	SMD	3513 999 55324	
C37	1n	±10%	50V	SMD	3513 999 55459	
C38	1n	±5%	50V	SMD	3513 999 55418	
C39	15p	±5%		cer	3513 991 06014	/02,12,22
C39	18p	±5%		cer	3513 991 06015	/03,13,23
C40	1n	±5%	50V	SMD	3513 999 55418	
C41	15p	±5%		cer	3513 991 06014	/02,12,22
C41	22p	±5%			3513 991 06016	/03,13,23
C42	3p3	±0p25			3513 991 06006	/02,12,22
C42	4p7	±0p25			3513 991 06008	/03,13,23
C43	2p2	±0p25			3513 991 06004	
C44	6p8	±0p25			3513 991 06010	/03,13,23
C44	8p2	±0p25			3513 991 06011	/02,12,22
C46	15p	±5%		cer	3513 991 06014	/02,12,22
C46	22p	±5%			3513 991 06016	/03,13,23
C47	1n	±5%	50V	SMD	3513 999 55418	
C48	1p	±0p25			3513 991 06000	
C49	1p8	±0p25			3513 991 06003	
C50	1p8	±0p25			3513 991 06003	
C52	1p	±0p25			3513 991 06000	
C53	15p	±5%		cer	3513 991 06014	/02,12,22
C53	22p	±5%			3513 991 06016	/03,13,23
C54	1n	±5%	50V	SMD	3513 999 55418	
C55	2p7	±0p25			3513 991 06005	/02,12,22
C55	4p7	±0p25			3513 991 06008	/03,13,23
C56	1p	±0p25			3513 991 06000	/03,13,23
C56	1p2	±0p25			3513 991 06001	/02,12,22
C57	1p	±0p25			3513 991 06000	/03,13,23
C57	1p8	±0p25			3513 991 06003	/02,12,22
C59	15p	±5%		cer	3513 991 06014	/02,12,22
C59	22p	±5%			3513 991 06016	/03,13,23
C60	68p	±5%	50V	SMD	3513 999 55323	
C61	1n	±10%	50V	SMD	3513 999 55459	
C62	22	±20%	25V	elec	3513 991 00079	
C63	100n	±10%	50V	SMD	3513 999 55498	
C64	15p	±5%	50V	SMD	3513 999 55315	
C65	10	±20%	63V	elec	PS99445	
C66	10n	±10%		SMD	3513 999 55492	
C67	18p	±5%	50V	SMD	3513 999 55316	
C68	100p	±5%		SMD	3513 999 55406	
C69	100n	±10%	50V	SMD	3513 999 55498	
C70	150p	±5%	50V	SMD	3513 999 55408	
C71	39p	±5%	50V	SMD	3513 999 55401	
C72,73	100n	±10%	50V	SMD	3513 999 55498	
C74	10	±20%	63V	elec	PS99445	
C75	100n	±10%	50V	SMD	3513 999 55498	
C76	150p	±10%	50V	SMD	3513 999 55408	
C77,78	100n	±10%	50V	SMD	3513 999 55498	
C79	150p	±5%	50V	SMD	3513 999 55408	
C80	27p	±5%	50V	SMD	3513 999 55318	
C81,82	100n	±10%	50V	SMD	3513 999 55498	
C83	10n	±10%	50V	SMD	3513 999 55492	
C84	2n2	±5%	50V	SMD	3513 999 55003	
C85	1n5	±5%		cer	PN99901	/02,03
C86	33	±20%	16V	elec	PS99409	
C87	47p	±5%	50V	SMD	3513 999 55402	
C88	1n	±5%	50V	SMD	3513 999 55418	
C89	10n	±10%	50V	SMD	3513 999 55492	
C90-93	2n2	±5%	50V	SMD	3513 999 55003	
C94	100n	±10%	50V	SMD	3513 999 55498	
C95,96	47p	±5%	50V	SMD	3513 999 55402	

Cct Ref	Description	Part No	Remarks
Capacitors (Cont'd)			
C98	1n ±5% 50V SMD	3513 999 55418	
C100	1n ±5% 50V SMD	3513 999 55418	
C101	33p ±5% 50V SMD	3513 999 55319	
C102	1n ±5% 50V SMD	3513 999 55418	
C103	1n ±10% 50V SMD	3513 999 55459	
C104,105	100n ±10% 50V SMD	3513 999 55498	
C106	47 ±20% 25v elec	PS99423	
C107	100n ±10% 50V SMD	3513 999 55498	
C108	33 ±20% 16V elec	PS99409	
C109	1n ±10% 50V SMD	3513 999 55459	
C110	47 ±20% 25V elec	PS99423	
C111,112	1n ±5% 50V SMD	3513 999 55418	
C113	100n ±10% 50V SMD	3513 999 55498	
C115	4p7 ±0p25 50V SMD	3513 999 55309	
C117	10n ±10% 50V SMD	3513 999 55492	
C118	10n ±10% SMD	3513 999 55492	
C119	33 ±20% 16V elec	PS99409	
C120	10n ±10% SMD	3513 999 55492	
C121	33 ±20% 16V elec	PS99409	
C122	100n ±10% 50V SMD	3513 999 55498	
C132	1n ±10% 50V SMD	3513 999 55459	
C133	10n ±10% SMD	3513 999 55492	
C134	33 ±20% 16V elec	PS99409	
C135	100n ±10% 50V SMD	3513 999 55498	
C138-140	10n ±10% SMD	3513 999 55492	
C141	100n ±10% 50V SMD	3513 999 55498	
C143	10n ±10% 50V SMD	3513 999 55492	
C145	18p ±5% 50V SMD	3513 999 55316	
C147	18p ±5% 50V SMD	3513 999 55316	
C148	82p ±5% 50V SMD	3513 999 55405	
C149	10n ±10% 50V SMD	3513 999 55492	
C151	82p ±5% 50V SMD	3513 999 55324	
CV1,2	1p5-14p Cap var	3513 991 04042	
CV3	2p-18p Cap var PCB mtg	PV99006	
CV4-7	2p-9p Cap var pwb mtg	3513 991 04046	
Inductors			
L1	Coil	2413 535 00845	/02,12,22
L1	Coil 0µ23 green	FT06604	/03,13,23
L3	Coil assy	3513 509 00281	
L4	1 ±10% SMD	3513 999 98041	
L5	120n ±10% SMD	3513 999 98059	
L6,7	Coil 21,4MHz 332pn-1661	2422 535 97264	
L8	Choke	FT99102	
L9	Coil	3513 509 00341	
L10	Coil	3513 509 00331	
L11	Coil	3513 509 00341	
L12	Coil	3513 509 00331	
L13	100n ±10% SMD	3513 999 98057	
L13	Choke	3513 993 22506	
L14	Choke	FT99102	
L15	Coil 455khz 5plc-1217z	4313 328 00031	
L16-20	10 ±10% SMD	3513 999 98092	
L21	Choke	FT99102	
L22,23	Choke assembly	AT31684	
L24	Coil	3513 509 01521	
L25-31	10 ±10% SMD	3513 999 98092	
L32	Coil assembly	AT32080/11	/02,12,22
L32	Coil assembly	AT32061/04	/03,13,23
L33	Coil	3513 509 01531	
Miscellaneous			
PLA	Plug 15-way D rt angle	FP12115	
PLB	Hdr str male 4 pos'n	3513 504 00151	
PLC-E	Plug PCB mtd straight 2 x 8	FP99182	
PLF	Plug PCB mtd straight 2 x 3	FP99174	
SKA	Socket BNC	FS43779	
XL1	Xtal 8,4MHz	3513 900 70081	
XL2	Xtal 20,945MHz	4313 320 90021	
FL1	Xtal filt 21,4MHz-12,5kHz	2722 172 90049	/02,03
FL1	Xtal filt 21,4MHz-20kHz	2722 172 90074	/22,23
FL1	Xtal filt 21,4MHz-25kHz	2722 172 90024	/12,13
FL2	Cer filt 455kHz nom/12,5kHz	3513 993 56537	/02,03
FL2	Cer filt 455kHz nom/25kHz	3513 993 56535	/12,13,22,23

Cct Ref	Description	Part No	Remarks
Miscellaneous (Cont'd)			
FL3	Cer filt 455kHz nom/12,5kHz	3513 993 56537	/02,03
FL3	Cer filt 455kHz nom/25kHz	3513 993 56535	/12,13,22,23
TP1-4	Header	3513 504 00121	
	Bush Ins(TO-220)	3513 990 16014	1/IC12
	Cable assembly	AT70251	1/PLC-PLE
	Can	FT03521	
	Can assembly	AT29407/02	
	Cover	3513 901 10351	
	Core cup	FC02121	1/L15
	Link connector	3513 993 07000	
	Nut st hex M3	2522 401 64008	2/PLA-PCB, 1/IC11, 1/IC12
	PCB Assembly Crystal Oven	AT28910/04	
	Pillar Hexagon	BT04132	1/Xtal Oven
	Screen	BT26313	
	Screen	BT26374	
	Screen	3513 906 20231	
	Scr st pan pozi M3 x 10mm	QJ11903/X	2/PLA-PCB
	Scr st pan pozi M3 x 8mm	2522 178 20059	1/IC11, 1/IC12, 1/Xtal Oven-Pillar
	Scr st pan tapt M2,5 x 5mm	2511 001 11123	
	Socket modified to 14-way	BJ34101/14	2/IC10
	Socket Xtal	FS42611	2/X11
	Washer Thermal TO-220	3513 990 16254	1/IC12

PCB ASSEMBLY RX EO BAND
AT29084/04 12,5KHZ CHANNEL SPACING
AT29084/14 25KHZ CHANNEL SPACING
AT29084/24 20KHZ CHANNEL SPACING

Semiconductors & ICs		
IC1	IC, SMD LS204	3513 999 45011
IC2	IC, SMD SP8792T	3513 999 45017
IC3	IC, SMD NJ8820GG	4313 324 70001
IC4	IC, SMD LM258	3513 999 45008
IC5	IC, SMD SA602D	9337 488 50605
IC6	IC, SMD SA604AD	9339 489 30623
IC7	IC, SMD LM348D	3513 999 45003
IC8	IC, SMD MC1458D	3513 999 45004
IC9	IC, SMD LM324	3513 999 45005
IC10	EPLD assembly programmed	AT60170
IC11	IC, 7805 Volt reg & fix	3513 993 34014
IC12	IC, LM317	FU99119
IC13	PROM assembly programmed	AT60171
TR1	Transistor, SMD MMBFU310	3513 999 05009
TR2-4	Transistor, SMD ON977/TI	3513 999 05007
TR5	Transistor, BCX19	3513 999 00016
TR6	Transistor, SMD MMBT918	3513 999 00036
TR7	Transistor, BCX19	3513 999 00016
TR8	Transistor, SMD ON977/TI	3513 999 05007
TR9	Transistor, SMD MMBFU310	3513 999 05009
TR10	Transistor, BCX19	3513 999 00016
D1,2	Diode, BB809	9335 154 20113
D3	Diode, SMD BAV99	3513 999 15002
D4	LED, red	3513 993 46000
D5-12	Diode, BB809	9335 154 20113
D25	Diode, SMD BAV99	3513 999 15002
Resistors		
R1	1k ±5% 0,125W SMD	3513 999 80036
R2	68k ±5% 0,125W SMD	3513 999 80058
R3	1k ±5% 0,125W SMD	3513 999 80036
R4	39k ±5% 0,125W SMD	3513 999 80055
R5	15k ±5% 0,125W SMD	3513 999 80050
R6	270 ±5% 0,125W SMD	3513 999 80029
R7	330 ±5% 0,125W SMD	3513 999 80030
R8	68k ±5% 0,125W SMD	3513 999 80058
R9	15k ±5% 0,125W SMD	3513 999 80050
R10	39k ±5% 0,125W SMD	3513 999 80055
R11	68k ±5% 0,125W SMD	3513 999 80058
R12	470 ±5% 0,125W SMD	3513 999 80032
R13	270 ±5% 0,125W SMD	3513 999 80029
R14	10 ±5% 0,125W SMD	3513 999 80012
R15	470 ±5% 0,125W SMD	3513 999 80032
R16	5k6 ±5% 0,125W SMD	3513 999 80045
R17	330 ±5% 0,125W SMD	3513 999 80030

Cct Ref	Description	Part No	Remarks
Resistors (Cont'd)			
R18	1k ±5% 0,125W SMD	3513 999 80036	
R19,20	100k ±5% 0,125W SMD	3513 999 80060	
R21	1k ±5% 0,125W SMD	3513 999 80036	
R22	3k3 ±5% 0,125W SMD	3513 999 80042	
R23	1k8 ±5% 0,125W SMD	3513 999 80039	
R24	680k ±5% 0,125W SMD	3513 999 80070	
R25	560 ±5% 0,125W SMD	3513 999 80033	
R26,27	470 ±5% 0,125W SMD	3513 999 80032	
R28,29	10k ±5% 0,125W SMD	3513 999 80048	
R30	1m ±5% 0,125W SMD	3513 999 80072	
R31	10k ±5% 0,125W SMD	3513 999 80048	
R32	47k ±5% 0,125W SMD	3513 999 80056	
R33	1k ±5% 0,125W SMD	3513 999 80036	
R34	3k3 ±5% 0,125W SMD	3513 999 80042	
R35	10k ±5% 0,125W SMD	3513 999 80048	
R36,37	47k ±5% 0,125W SMD	3513 999 80056	
R38	100k ±5% 0,125W SMD	3513 999 80060	
R39	27k ±5% 0,125W SMD	3513 999 80053	
R40	100k ±5% 0,125W SMD	3513 999 80060	
R41,42	10k ±5% 0,125W SMD	3513 999 80048	
R43	22k ±5% 0,125W SMD	3513 999 80052	
R44-49	100k ±5% 0,125W SMD	3513 999 80060	
R52	68k ±5% 0,125W SMD	3513 999 80058	
R53	4k7 ±5% 0,125W SMD	3513 999 80044	
R54,55	47 ±5% 0,125W SMD	3513 999 80020	
R56,57	1k8 ±5% 0,125W SMD	3513 999 80039	
R58	470 ±5% 0,125W SMD	3513 999 80032	
R59	270 ±5% 0,125W SMD	3513 999 80029	
R60	47k ±5% 0,125W SMD	3513 999 80056	
R61	3k3 ±5% 0,125W SMD	3513 999 80042	
R62	47k ±5% 0,125W SMD	3513 999 80056	
R63	100k ±5% 0,125W SMD	3513 999 80060	
R64	6k8 ±5% 0,125W SMD	3513 999 80046	
R65	39k ±5% 0,125W SMD	3513 999 80055	
R66,67	4k7 ±5% 0,125W SMD	3513 999 80044	
R68	27k ±5% 0,125W SMD	3513 999 80053	
R69	18k ±5% 0,125W SMD	3513 999 80051	
R70	68k ±5% 0,125W SMD	3513 999 80058	
R71	100k ±5% 0,125W SMD	3513 999 80060	
R72	33k ±5% 0,125W SMD	3513 999 80054	
R73	2k2 ±5% 0,125W SMD	3513 999 80040	
R74	15k ±5% 0,125W SMD	3513 999 80050	
R75	6k8 ±5% 0,125W SMD	3513 999 80046	
R76	15k ±5% 0,125W SMD	3513 999 80050	
R77	6k8 ±5% 0,125W SMD	3513 999 80046	
R78	100k ±5% 0,125W SMD	3513 999 80060	
R79	4k7 ±5% 0,125W SMD	3513 999 80044	
R80,81	10k ±5% 0,125W SMD	3513 999 80048	
R83	1k ±5% 0,125W SMD	3513 999 80036	
R84	27k ±5% 0,125W SMD	3513 999 80053	
R85	10k ±5% 0,125W SMD	3513 999 80048	
R86	6k8 ±5% 0,125W SMD	3513 999 80046	
R87	4k7 ±5% 0,125W SMD	3513 999 80044	
R88	15k ±5% 0,125W SMD	3513 999 80050	
R89	2k2 ±5% 0,125W SMD	3513 999 80040	
R90	68k ±5% 0,125W SMD	3513 999 80058	
R91	15k ±5% 0,125W SMD	3513 999 80050	
R92	39k ±5% 0,125W SMD	3513 999 80055	
R93	68k ±5% 0,125W SMD	3513 999 80058	
R94	470 ±5% 0,125W SMD	3513 999 80032	
R95	220 ±5% 0,125W SMD	3513 999 80028	
R96	1k8 ±5% 0,125W SMD	3513 999 80039	
R97	100k ±5% 0,125W SMD	3513 999 80060	
R98,99	4k7 ±5% 0,125W SMD	3513 999 80044	
R100-102	10k ±5% 0,125W SMD	3513 999 80048	
R103	100k ±5% 0,125W SMD	3513 999 80060	
R104	4k7 ±5% 0,125W SMD	3513 999 80044	
R105	47k ±5% 0,125W SMD	3513 999 80056	
R106-113	10k ±2% 0,1W SMD	3513 999 80236	
R114	10k ±5% 0,125W SMD	3513 999 80048	
R115	18k ±5% 0,125W SMD	3513 999 80051	
R116	2k2 ±5% 0,125W SMD	3513 999 80040	
R117,118	4k7 ±5% 0,125W SMD	3513 999 80044	
R119,120	100k ±5% 0,125W SMD	3513 999 80060	
R121	22k ±5% 0,125W SMD	3513 999 80052	
RN1	100k ±5% Res 9-pin sil	RN99531	

Cct Ref	Description				Part No	Remarks
Resistors (Cont'd)						
RV1	1k	±25%	Pot cermet		3513 999 95003	
RV2	10k	±25%	Pot cermet		3513 999 95007	
RV3	100k	±25%	Pot cermet		3513 999 95013	
RV4,5	50k	±25%	Pot SMD		3513 999 95011	
RV6,7	10k	±25%	Pot cermet		3513 999 95007	
TH1,2	47k		Thermistor		2322 642 62473	
Capacitors						
C1,2	5p6	±0p5	50V	SMD	3513 999 55310	
C4	1n	±5%	50V	SMD	3513 999 55418	
C5	22	±20%	16V	elec	3513 991 00046	
C6	1n	±5%	50V	SMD	3513 999 55418	
C7	100n	±20%			3513 991 06095	
C8-10	1n	±5%	50V	SMD	3513 999 55418	
C13	470p	±5%		SMD	3513 999 55414	
C14,15	1n	±5%	50V	SMD	3513 999 55418	
C16	22	±20%	25V	elec	3513 991 00079	
C17	470n	±5%		pes	3513 991 08016	
C18	1n	±5%	50V	SMD	3513 999 55418	
C19,20	33	±20%	16V	elec	PS99409	
C21,22	10n	±10%		SMD	3513 999 55492	
C23,24	1n	±10%	50V	SMD	3513 999 55459	
C25	1n	±5%	50V	SMD	3513 999 55418	
C26	100p	±5%		SMD	3513 999 55406	
C27	1n	±5%	50V	SMD	3513 999 55418	
C28	27p	±5%	50V	SMD	3513 999 55318	
C29	8p2	±0p5	50V	SMD	3513 999 55312	
C30	15p	±5%	50V	SMD	3513 999 55315	
C31	150p	±5%	50V	SMD	3513 999 55408	
C32	10n	±10%		SMD	3513 999 55492	
C33	47p	±5%	50V	SMD	3513 999 55402	
C34	1n	±10%	50V	SMD	3513 999 55459	
C35	4n7	±10%	50V	SMD	3513 999 55467	
C36	68p	±5%	50V	SMD	3513 999 55323	
C37	1n	±10%	50V	SMD	3513 999 55459	
C38	1n	±5%	50V	SMD	3513 999 55418	
C40	10n	±10%		SMD	3513 999 55492	
C41	18p	±5%			3513 991 06015	04,14,24
C42	3p3	±0p25			3513 991 06006	04,14,24
C43	2p2	±0p25			3513 991 06004	
C44	8p2	±0p25			3513 991 06011	04,14,24
C45	5p6	±0p25			3513 991 06009	04,14,24
C46	18p	±5%			3513 991 06015	04,14,24
C47	10n	±10%		SMD	3513 999 55492	
C48	1p	±0p25			3513 991 06000	
C49,50	1p8	±0p25			3513 991 06003	
C51	3p9	±0p25			3513 991 06007	04,14,24
C52	1p	±0p25			3513 991 06000	
C53	18p	±5%			3513 991 06015	04,14,24
C54	10n	±10%		SMD	3513 999 55492	
C55	2p7	±0p25			3513 991 06005	04,14,24
C56	1p2	±0p25			3513 991 06001	04,14,24
C57	1p8	±0p25			3513 991 06003	04,14,24
C58	2p2	±0p25			3513 991 06004	
C59	18p	±5%			3513 991 06015	04,14,24
C60	47p	±5%	50V	SMD	3513 999 55321	
C61	1n	±10%	50V	SMD	3513 999 55459	
C62	22	±20%	25V	elec	3513 991 00079	
C63	100n	±10%	50V	SMD	3513 999 55498	
C64	15p	±5%	50V	SMD	3513 999 55315	
C65	10	±20%	63V	elec	PS99445	
C66	10n	±10%		SMD	3513 999 55492	
C67	18p	±5%	50V	SMD	3513 999 55316	
C68	100p	±5%		SMD	3513 999 55406	
C69	100n	±10%	50V	SMD	3513 999 55498	
C70	150p	±5%	50V	SMD	3513 999 55408	
C71	39p	±5%	50V	SMD	3513 999 55401	
C72,73	100n	±10%	50V	SMD	3513 999 55498	
C74	10	±20%	63V	elec	PS99445	
C75	100n	±10%	50V	SMD	3513 999 55498	
C76	150p	±5%	50V	SMD	3513 999 55408	
C77,78	100n	±10%	50V	SMD	3513 999 55498	
C79	150p	±5%	50V	SMD	3513 999 55408	
C80	27p	±5%	50V	SMD	3513 999 55318	
C81,82	100n	±10%	50V	SMD	3513 999 55498	

Cct Ref	Description				Part No	Remarks
Capacitors (Cont'd)						
C83	10n	±10%		SMD	3513 999 55492	
C84	2n2	±5%	50V	SMD	3513 999 55003	
C85	1n5	±5%			PN99901	/04
C86	33	±20%	16V	elec	PS99409	
C87	47p	±5%	50V	SMD	3513 999 55402	
C88	1n	±5%	50V	SMD	3513 999 55418	
C89	10n	±10%		SMD	3513 999 55492	
C90-93	2n2	±5%	50V	SMD	3513 999 55003	
C94	100n	±10%	50V	SMD	3513 999 55498	
C95,96	47p	±5%	50V	SMD	3513 999 55402	
C98	1n	±5%	50V	SMD	3513 999 55418	
C100	1n	±5%	50V	SMD	3513 999 55418	
C101	47p	±5%	50V	SMD	3513 999 55321	
C102	1n	±5%	50V	SMD	3513 999 55418	
C103	1n	±10%	50V	SMD	3513 999 55459	
C104,105	100n	±10%	50V	SMD	3513 999 55498	
C106	47	±20%	25V	elec	PS99423	
C107	100n	±10%	50V	SMD	3513 999 55498	
C108	33	±20%	16V	elec	PS99409	
C109	1n	±10%	50V	SMD	3513 999 55459	
C110	47	±20%	25V	elec	PS99423	
C111,112	1n	±5%	50V	SMD	3513 999 55418	
C113	100n	±10%	50V	SMD	3513 999 55498	
C114	10n	±10%		SMD	3513 999 55492	
C116	1n	±5%	50V	SMD	3513 999 55418	
C117,118	10n	±10%		SMD	3513 999 55492	
C119	33	±20%	16V	elec	PS99409	
C120	10n	±10%		SMD	3513 999 55492	
C121	33	±20%	16V	elec	PS99409	
C122	100n	±10%	50V	SMD	3513 999 55498	
C124-131	1n	±5%	50V	SMD	3513 999 55418	
C132	1n	±10%	50V	SMD	3513 999 55459	
C133	10n	±10%		SMD	3513 999 55492	
C134	33	±20%	16V	elec	PS99409	
C135	100n	±10%	50V	SMD	3513 999 55498	
C136	1n	±5%	50V	SMD	3513 999 55418	
C138-140	10n	±10%		SMD	3513 999 55492	
C143	10n	±10%		SMD	3513 999 55492	
C145	18p	±5%	50V	SMD	3513 999 55316	
C146	1n	±5%	50V	SMD	3513 999 55418	
C147	18p	±5%	50V	SMD	3513 999 55316	
C148	82p	±5%	50V	SMD	3513 999 55405	
C151	68p	±5%	50V	SMD	3513 999 55323	
CV1,2	1p5-14p		Cap var		3513 991 04042	
CV3	2p-18p		Cap var	PCB mtg	PV99006	
CV4-6	2p-9p		Cap var	PCB mtg	3513 991 04046	
Inductors						
L1	Coil 0µ389 violet				FT06435	
L2	1	±10%		SMD	3513 999 98041	
L3	Coil assy				3513 509 00281	
L4	1	±10%		SMD	3513 999 98041	
L5	120n	±10%	SMD		3513 999 98059	
L6,7	Coil 21,4MHz 332pn-1661				2422 535 97264	
L8	1µ5	±10%	Choke RF min		FT99103	
L9-11	Coil				3513 509 00351	
L13	15	±10%	Choke RF min		3513 993 22506	
L14	1µ5	±10%	Choke RF min		FT99103	
L15	Coil 455kHz 5plc-1217z				4313 328 00031	
L16-20	10	±10%		SMD	3513 999 98092	
L21	1µ5	±10%	Choke RF min		FT99103	
L22,23	Choke assy				AT31684	
L25-31	10	±10%		SMD	3513 999 98092	
Miscellaneous						
PLA	Plug 15-way D rt angle				FP12115	
PLB	Hdr str male 4 pos'n				3513 504 00151	
PLC-E	Plug PCB mtd straight 2 x 8				FP99182	
PLF	Plug PCB mtd rt angle 2 x 3				FP99175	
SKA	Socket BNC type				FS43779	
FL1	Xtal filt 21,4MHz-12,5kHz				2722 172 90049	/04
FL1	Xtal filt 21,4MHz-20kHz				2722 172 90074	/24
FL1	Xtal filt 21,4MHz-25kHz				2722 172 90024	/14
FL2	Cer filt 455kHz nom/12,5kHz				3513 993 56537	/04

Cct Ref	Description	Part No	Remarks
Miscellaneous (Cont'd)			
FL2	Cer filt 455kHz nom/25kHz	3513 993 56535	/14,24
FL3	Cer filt 455kHz nom/12,5kHz	3513 993 56537	/04
FL3	Cer filt 455kHz nom/25kHz	3513 993 56535	/14,24
XL1	Xtal 8,4MHz	3513 900 70081	
XL2	Xtal 20,945MHz	4313 320 90021	
	Bush Ins(TO-220)	3513 990 16014	1/IC12
	Can Screen Assembly	3513 504 04051	
	Can	FT03521	1/L32
	Cover	3513 901 10351	
	Nut st hex M3	2522 401 64008	2/PLA-PCB, 1/IC11, 1/IC12
	PCB Assembly Crystal Oven	AT28910/04	
	Pillar hexagon	BT04132	1/Xtal Oven
	Scr st pan pozi M3 x 10mm	QJ11903/X	2/PLA-PCB
	Scr st pan pozi M3 x 8mm	2522 178 20059	1/IC11, 1/IC12, 1/Xtal Oven-Pillar
	Screen	3513 906 20231	
	Socket modified to 14-way	BJ34101/14	2/IC10
	Socket Xtal	FS42611	2/XL1
	Washer Thermal To-220	3513 990 16254	1/IC12

PCB ASSEMBLY CRYSTAL OVEN
AT28910/04

TR1	Transistor power GP BD436	FV05886	
TR2	Transistor small signal BC327	FV05975	
R1	82 ±5% 0,25W c film	PM01423	
R2	1Ω8 ±5% 0,25W c film	PM01403	
C1	4n7 ±20% cer	PN99919	
TH1	Thermistor PTC 70°	PL23137	
	Mica insulator	BT36934/01	1/TR1 - heatsink
	Holder crystal (oven)	BT45138	
	Retainer	BT48021	
	Scr st pan pozi M2,5 x 5mm	QJ11944/B	
	Scr st pan pozi M2,5 x 6mm	QJ11945/B	

TRANSMITTER DRIVER MODULE
AT048881/-

INTRODUCTION

The transmitter driver module converts the processed audio from the control unit into a phase modulated signal to provide a nominal 1W RF output (2W on UHF) to the transmitter power amplifier. The module provides RF power monitoring and control circuits, modulation monitoring and RF fail detection. The oscillator crystal is temperature controlled using an oven assembly.

UNIT DESCRIPTION

These units produce a phase modulated output carrier of 2W minimum in the UHF bands, or 1W minimum in the VHF bands. Each channel frequency (up to a maximum of 128) is pre-programmed into the on-board PROM and is selected via the channel control lines C0 to C6 connected to the unit 'D' socket.
Selection of on-board links facilitates the unit alignment, and permits various customising options to be selected.

Customising links

By selection of on-board solder links the following options are available:-

(a) Frequency stability: (LK101-LK104,LK501)

(i) Output frequency locked to internal 10MHz ovened crystal only.
Link LK101 A-B.

(ii) Output frequency locked to internal 10MHz ovened crystal which is in turn locked to an externally-supplied 5MHz or 10MHz source.
Link LK101 B-C
LK102 A-C
LK103 A-B
LK501 connected
and either LK104 A-B for an external 10MHz source,
or LK104 A-C for an external 5MHz source.

(iii) Output frequency locked to internal 10MHz ovened crystal which is in turn locked to an externally supplied source of arbitrary frequency; this option requires an external phase-lock board.
Link LK101 B-C
LK102 A-B
LK103 B-C
LK104 A-B
LK501 not connected

(b) Deviation monitor (LK502)

External analogue metering of deviation or generation of logic alarm when deviation drops below a preset level.
Link LK502 A-B for analogue monitoring
or LK502 A-C for logic alarm output.

(c) Tx key mode (LK403)

(i) For use in single-frequency simplex systems, the key-off command can be used to switch off the modulation oscillator, thereby preventing interference to the common-frequency receiver. Key-on time however, is extended.
Link LK403 not connected.

(ii) For duplex systems the key-off command can be used to switch off the RF amplifier stages, whilst leaving the oscillator running, thereby reducing the key-on time.
Link LK403 connected. ✓

Test and alignment links

The following links are used in the alignment of the unit, either to enable access to internal circuitry interfaces or to select the correct interconnections for the frequency band in use.

LK301 to LK307:- in position B-C these plug-in links connect the channel control lines of the PROM to the incoming lines C0 to C6 on the 'D' connector. When removed, they disconnect the external control, and can be used to selectively pull down the control lines by inserting in positions A-B.

LK308:- disconnects the offset oscillator output from the mixer input, enabling oscillator power output to be measured. *IN*

LK309:- insertion of this link permits access to the test frequencies within the PROM; removal allows access to the customer frequencies.

LK401, LK402:- select frequency injection high or frequency injection low, depending on the frequency band of operation. See 'TEST PROCEDURES, Preliminary' for linking details. (Applies to UHF bands only).

LK503:- disables the lock detector to ease alignment.

LK601 (UHF only):- link in permits amplifier tuning between 450 and 520MHz.

LK602:- opens the power amplifier gain control loop while stage alignment is in progress.

LK603:- disconnects the supply rail from the output amplifier stages when aligning the frequency generation stages.

LK604:- disconnects the modulation oscillator output from the PA input, enabling oscillator output power to be measured.

Unit Part Numbers

UHF Frequency bands U0, T1 and WM	: AT04881/05
VHF Frequency bands A9, B0	: AT04881/02
VHF Frequency band E0	: AT04881/04

CIRCUIT DESCRIPTION (Refer to Tx Driver Block Diagram Fig.1)

Power Supply

The 18V supply voltage on pin 15 of the 'D' connector is regulated down to +12V and +5V by IC502 and IV503 respectively. The presence of these two voltages is indicated by LED D503 being illuminated. In the event of a power supply loss an alarm is fed to the 'D' connector pin 5.

Reference Oscillator

The internal reference oscillator (component coding series 100) comprises a 10MHz crystal situated in a temperature controlled oven to give the required frequency stability. Optionally, the oscillator can be locked to an external high-stability source. The oscillator output is in the form of two square-wave signals of 1,25MHz and 625 kHz which are used as references for the offset and modulation loops respectively.

Offset Loop

The offset loop (component coding series 300) comprises a VCO (TR305 and TR306) the frequency of which is determined by the VCO control diodes. The VCO output is amplified and buffered by TR303 and TR304 to give a stage output of approximately -5dBm. A further amplifier and buffer (TR307 and TR308) are used to drive the prescaler (IC302) and the synthesizer (IC304). The feedback loop is completed by filter/amplifier IC303 which routes the error signals to the oscillator varicap diodes to control the oscillator frequency.

The required channels are selected on lines C0 to C6. These are routed to IC306 and IC307 and to the PROM IC305 which contains the customer channel information. This information used to control the divide ratios in the synthesizer, IC304.

The output frequency of the offset loop is 20MHz above the final RF frequency, except for UHF bands U0 and WM when it is 20MHz below the final frequency. For UHF bands only, selection of high or low injection is made by links LK401 and 402, these are not present on VHF bands. The offset loop output signal is fed to the RF port of mixer IC404.

Modulation Loop

The modulation loop (component coding series 400) comprises the final frequency VCO (TR417 and TR418) whose output is amplified and buffered by TR420, TR421 and TR422 to give an output level of approximately +15dBm to the output amplifier stages. A further buffer/amplifier feeds the output from the oscillator to the LO port of mixer IC404 at a level of +7dBm.

The difference signal between the modulation and offset VCOs (20MHz) from the mixer is taken via a 20MHz low-pass filter (L401-L404 and C401-C404 or C401-C408 on E band). After amplification by TR401, TR402 it is divided by 32 to 625kHz and fed (via LK401/LK402 on UHF bands only) to phase comparator IC401.

The 625kHz square wave from the reference oscillator is then width-modulated by the incoming audio signal, amplified and level-adjusted by IC403 and R473 respectively. This pulse-width modulation is accomplished by TR404-TR414 and D402-D407. The 625kHz width-modulated reference signal is then fed, via LK401 and LK402 (UHF bands only), into the other input of phase comparator IC401.

The error signal from IC401 is filtered in L405-L407 and C425-C427, amplified by TR415 and TR416 and fed to the VCO frequency control diodes D414-D417 (D413-D417 and D421 on E band) to lock the modulation oscillator to a frequency 20MHz away from that of the offset oscillator.

Loss of lock is signalled from IC401 to diodes D508 and D509 where it is combined with similar lock alarm signals from the synthesizer, the external frequency lock circuit and the oven warming alarm to produce a combined lock alarm which both drives an alarm LED (D512) and disables the RF output stages. D512 is illuminated for an 'in-lock' condition.

Output Stages

The RF signal from the modulation loop is delivered to the output amplifier at a level of +13dBm to +17dBm (typically +15dBm). A removable solder link (LK601) allows the input level at this point to be measured.

The signal is amplified in two wideband stages, TR604 and TR607. A toroidal directional coupler followed by a detector (D607) monitors the forward power, amplifies the rectified signal, and feeds it back to the collector of TR604 to provide automatic gain control. Power output is set by using R622 incorporated in the feedback loop. Failure of the loop to maintain the required output level is signalled by D609 being illuminated. This alarm is combined with the loop lock alarms to provide a unit alarm on pin 6 of the supply connector.

The coupler is followed by a low pass filter to remove the harmonics of the output signal. The carrier signal is then fed to the output BNC connector.

Alarms

The following unit frequency alarms are generated:-

(1) Oven cold alarm - indicates that the oven has not reached its operating temperature of 80°C.

(2) Offset loop lock alarm - indicates that the offset synthesizer loop has failed to lock.

(3) Modulation lock alarm - indicates that the modulation loop has not achieved lock.

(4) External source lock alarm - indicates that the internal 10 MHz oscillator is not locked to the incoming high stability source. This alarm is disabled by removing LK501 when an external hi-stab source is not being used.

These four alarms are combined to form a lock/oven alarm; LED512 will fail to illuminate if an alarm is present on any of them, and the RF amplifiers will be inhibited. In the single frequency simplex case (LK403 out) the modulation oscillator will also be inhibited. LK505 allows the lock/oven alarm to be inhibited whilst alignment is in progress.

A power alarm is generated should the output stages fail to deliver the power required of them by the setting of power control R622. This alarm illuminates LED609.

The lock/oven alarm is combined with the power alarm to give a transmitter driver alarm. This appears on SK501 pin 6.

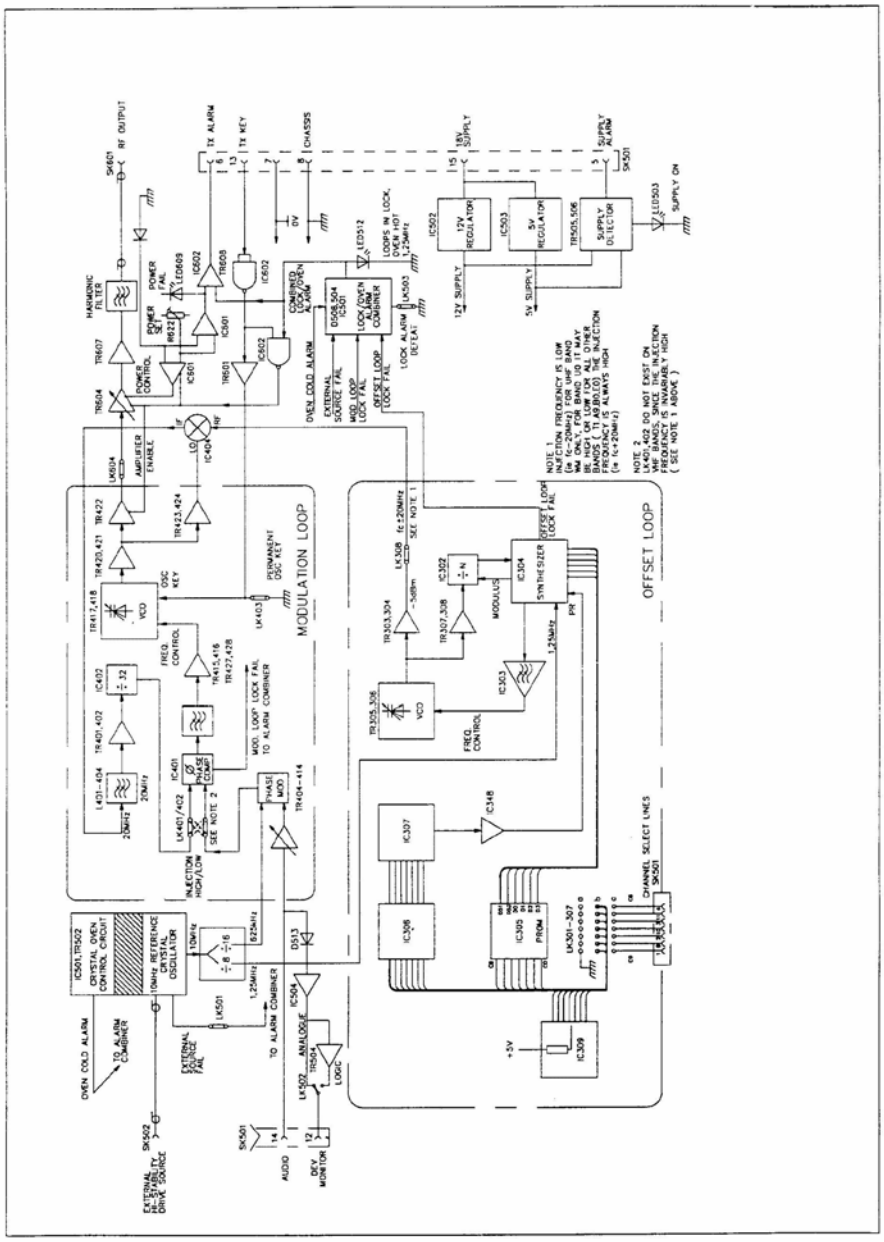


Fig.1 Tx Driver Block Diagram

SPECIFICATION

Frequency range	:	66 - 88MHz (E band) 132 - 174MHz (VHF bands A & B) 405 - 520MHz (U,T,W Bands)
Power output	:	2,0W minimum(UHF); 1,0W minimum(VHF)
Temperature range	:	-30°C to +60°C
Channel capacity	:	1 to 127
Switched bandwidth	:	±2,25%
Duty cycle	:	100%
Frequency stability	:	-46dB relative to 60% deviation, de-emphasis and psophometric weighting characteristics
Frequency response	:	±0,5dB 300Hz to 9kHz. 2dB variation 60Hz to 300Hz
Supply Input		18V ±0,5V at 800mA maximum

TEST PROCEDURE

Test Equipment

Description		Type
Digital Voltmeter	:	Fluke 77 or equivalent
DC PSU (18V,1A)	:	
DC PSU (0 - 14V variable)	:	
Temperature probe	:	
Spectrum analyser	:	Advantest R4131B or equivalent
Oscilloscope and probe	:	
Audio signal generator	:)	
RF power meter	:)	
Modulation meter	:)-	Stabilock 4040 or equivalent
Frequency counter	:)	discrete instruments
20dB attenuator, 5W	:)	
Test Jig	:	See Fig.2

Preliminary

Note: (i) In the following procedure, for ease of location, the top side of the PCB is referred to as side 'a' denoted [a]; and the underside side 'b' denoted [b]. Component layout positioning is shown in relevant layout diagram.

(ii) Throughout the following alignment procedure, it is necessary to add and remove solder links, this should only be done with the equipment disconnected from the supply.

(iii) A frequency/options print-out specific to the unit is supplied with the unit, this should provides the following information:-
(a) Tx and Rx frequencies in both decimal and binary format.
(b) Centre and extreme test frequencies in the same format.
(c) A 17-digit code which supplies the relevant information for quasi-sync options as detailed in under 'Customisation'.

1 Remove unit cover (if fitted).

2 Remove internal screen covers (if fitted).

3 Remove the PCB from the casting.

4 Link LK101 A-B, LK102 A-C [a], LK103 A-B [b], LK104 A-C [b], LK308 [a], LK403 [a], LK502 A-B [b], LK503 [a] and LK604 [a].

5 Fit links LK301 to LK307 [a] in position B-C.

6 Open solder links LK602 and LK603, and, for UHF equipments operating below 440MHz, open solder link LK601.

7 For UHF equipment only, by examination of the customer required operating frequencies ensure that LK401 and LK402 are fitted according to the table below:

Customer Frequency Range (Fc)	400-<440MHz	440-520MHz
Insert links;	LK401 a-c LK402 b-d	LK401 a-b LK402 c-d
Offset loop frequency	Fc + 20MHz	Fc - 20MHz

8 Fit plug-in link LK309 to access the test frequencies. Using switches C0 to C6 on the test jig, select the test frequency closest to the customer required centre frequency.

Power Supply

1 Connect the 18V DC power supply to PLA via the test jig and switch on. Check the supply current is less than or equal to 870mA and that LED503 is lit.

2 Ensure that supply current drops below 400mA within 4 minutes of switch-on with Tx keyed off.

Reference Oscillator

1. Using the temperature probe, check that the crystal oven temperature is 80°C ±2°C.

2 Connect the frequency counter, oscilloscope or spectrum analyser via a probe to TP101 [a] and check for approximately 1,25MHz.

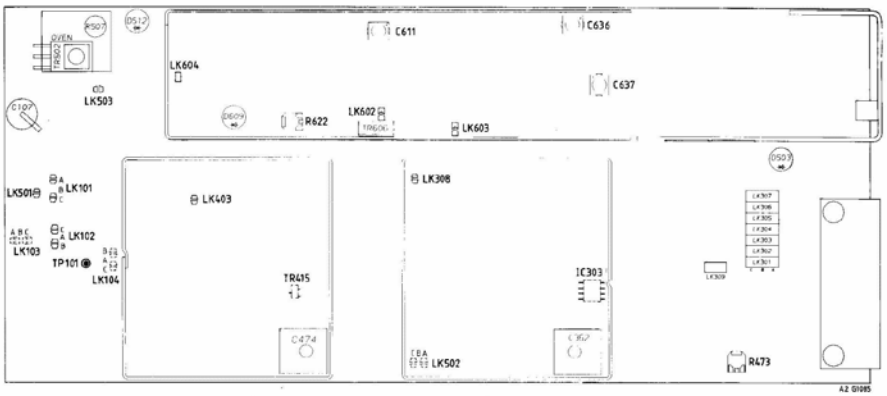
Offset Loop

1 Connect a voltmeter to IC303 pin 6, and adjust C362 (L303 on E Band) for 8,0V

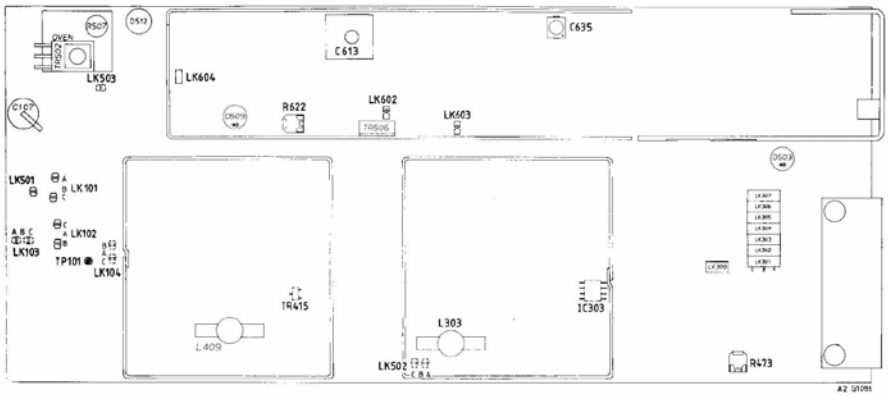
Modulation Loop

1 Key the transmitter on using the test jig.

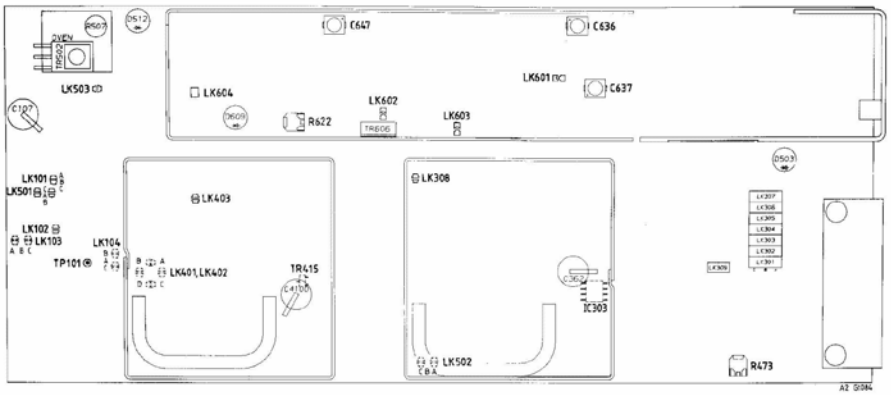
2 Connect a voltmeter to the collector of TR415, and adjust C4100 (UHF) or C474 (VHF A,B) or L409 (E band) for 7,5V



Tx Driver A and B Bands Alignment Diagram



Tx Driver E Band Alignment Diagram



Tx Driver UHF Alignment Diagram

Note: Components and Links on underside of PCB shown dotted

3 Switch off the supply and remove LK503. Switch the supply on, and check that LED512 comes on after a short period, indicating that the two loops are locked and the oven has reached operating temperature.

4 Using switches C0 to C6 on the test jig, select the test frequencies 2,25% above and below the centre frequency in turn (note that these frequencies, together with their binary channel number appear on the information sheet) and ensure that LED512 remains illuminated, indicating that both loops remain in lock. Return to the centre frequency.

Output Stages

1 Switch off the supply, make solder links LK602 and LK603 and turn R622 fully clockwise. For UHF equipment operating in the range 440-520MHz only, make solder link LK601.

2 Key the transmitter and ensure that LED D609 illuminates and that the Test Jig LED indicates a Tx fail. Allow the oven to warm up.

3 Connect the BNC output connector via the Stabilock internal attenuator to the spectrum analyser.

4 **UHF band 400-440MHz only;** select the lowest test frequency within the required switched bandwidth.

5 Tune the following variable capacitors for maximum output
UHF; C647, C636
VHF A,B; C611, C636
VHF E; C613, C635

6 Adjust R622 for output of 2,5W (UHF) or 1,5W (VHF).

7 Connect a voltmeter to TR606 ~~collector~~ EMITTER and tune the following variable capacitor for a ~~maximum~~ MINIMUM voltage:-
UHF C647
VHF A,B; C611
VHF E; C613

8 **UHF and VHF A and B only;** tune C637 for maximum output and then reduce the output by 1dB using the same trimmer.

9 Using R622 set the power output to 2,5W (UHF) or 1,5W (VHF).

10 Check that the LED D609 remains off and that the output at the centre and extremes of the switched bandwidth is always greater than 2,0W (UHF) or 1,0W (VHF).

Modulation Tests

1 Connect an audio signal generator (600Ω o/p, 300mV rms at 1kHz) to the audio input of the test jig.

2 Connect the RF output via a suitable attenuator to a deviation meter tuned to the customer centre frequency.

MOD 1

PHILIPS

PHILIPS TELECOM - PRIVATE MOBILE RADIO CAMBRIDGE

SERVICE BULLETIN
PUBLISHED BY CUSTOMER SERVICES

Date 16.12.93 **Bulletin No:** PN93/407 **No. of Pages** 1

Equipment Affected - Service Manual - FX5000 Base Station 4313 329 12820

Change Note No. (If applicable) 661/431

Originator J. Davis
Department Base Station Pads

Implementation

For information [ ]

When spares or Equipment is available [ ]

On Failure [ ] **Urgent all equipment** [✓]

SUBJECT Test procedure for Transmitter Drive unit.

PROBLEM The procedure is incorrect and using it may cause failure of transistor TR604 and associate components.

SOLUTION Make the following amendments to 4313 329 12820 - Service Manual - FX5000
BASE STATION:-
Part 2 -Modules
Transmitter Drive Module
Page 8 - Output Stages - para (7).
Change to read:-

Connect a voltmeter to TR606 emitter and tune the following variable capacitor for a minimum voltage:-

3 Key the Tx on. Using R473 set the deviation to 60% of the maximum system deviation. Adjust the fequency to 60Hz, 300Hz and 10kHz in turn; check that the deviation is within the limits shown below:-

60Hz;	3kHz ±0,8kHz
300kHz;	3kHz ±0,2kHz
10kHz;	3kHz ±0,2kHz

4 Remove the audio input signal.

External Frequency Source

1 Make solder link LK501 [a], and reset LK101 [a] from A-B to B-C.

2 Connect a 5MHz source (5V p-p) to the external reference input.

3 With the external source connected, ensure that the voltage on LK501 is 4,0V or greater and that LED512 is illuminated.

4 Remove the external source and ensure that LED512 is extinguished and that the voltage on LK501 drops to 2,5V or less.

Customisation

1 **Quasi-synchronous Option**

Set the links as detailed below to select the Option required:-

A Secondary option 1, code 0 - Quasi-synchronous operation not required; open solder link LK501 and link LK101 A-B.

B Secondary option 1, code 1 - Quasi-synchronous operation with 10MHz external source; fit the following links:- LK101 B-C; LK102 A-C; LK103 A-B LK104 A-B; LK501 in.

C Secondary option 1, code 2 - Quasi-synchronous operation with 5MHz external source; fit the following links:-LK101 B-C; LK102 A-C; LK103 A-B; LK104 A-C; LK501 in.

D Secondary option 1, code 3 - Quasi-synchronous operation with arbitrary external source; fit the following links:- LK101 B-C; LK102 A-B; LK103 B-C; LK501 out.

2 **Tx Key Mode**

Set the links as detailed below to select the Option required:-

A Single frequency simplex operation; LK403 not fitted.

B Two-frequency simplex or duplex operation; LK403 fitted.

3 Deviation Monitoring

Either a logic alarm output when the deviation drops below a preset value, or an analogue output for metering purposes can be selected. Unless specific instructions to the contrary are requested, the analogue metering output Option should be selected.

A Deviation logic alarm output; link LK502 A-C

B Deviation analogue metering output; link LK502 A-B

Conclusion

1 Switch off the supply, remove LK309, secure the unit into its casting, secure the covers on the screens, reconnect the supply and recheck the power at the customer extreme frequencies.

2 Connect the RF output to a frequency counter and switch on. Ensure that the unit has been continously powered for at least 4 minutes.

3 Adjust C107[a] for the nominal selected frequency within ±0,5ppm. Fit the cover on the unit, and ensure that the frequency remains within these limits. Switch off the power and remove the tested unit from the test jig.

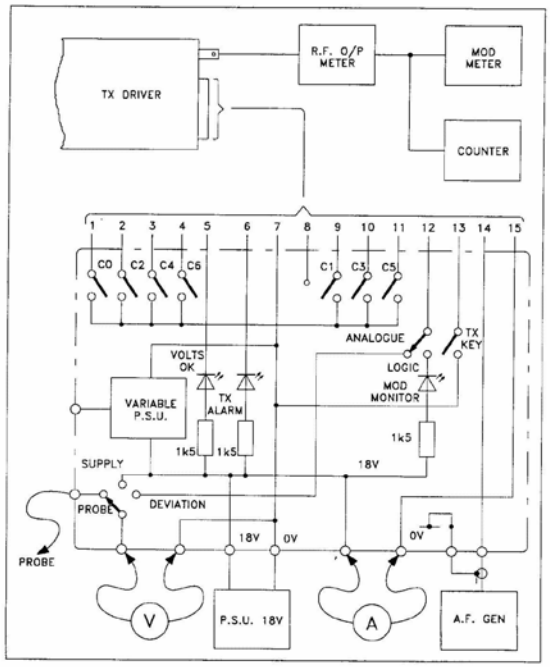


Fig.2 Transmitter Driver Test Jig

TRANSMITTER TEST FREQUENCIES.

Note: For access to these test frequencies, refer to the alignment procedure for the relevant unit.

TABLE 1 (Part)

Channel	Switch position 10	11	12	13	14	15	16	'Test freq' MHz U,T,W Bands	'Test freq' MHz A,B Bands	'Test freq' MHz E Band
0	0	0	0	0	0	0	0	400	132	68
1	0	0	0	0	0	0	1	401	132,335	68,2
2	0	0	0	0	0	1	0	402	132,67	68,4
3	0	0	0	0	0	1	1	403	133,005	68,6
4	0	0	0	0	1	0	0	404	133,34	68,8
5	0	0	0	0	1	0	1	405	133,675	69
6	0	0	0	0	1	1	0	406	134,01	69,2
7	0	0	0	0	1	1	1	407	134,345	69,4
8	0	0	0	1	0	0	0	408	134,68	69,6
9	0	0	0	1	0	0	1	409	135,015	69,8
10	0	0	0	1	0	1	0	410	135,35	70
11	0	0	0	1	0	1	1	411	135,685	70,2
12	0	0	0	1	1	0	0	412	136,02	70,4
13	0	0	0	1	1	0	1	413	136,355	70,6
14	0	0	0	1	1	1	0	414	136,69	70,8
15	0	0	0	1	1	1	1	415	137,025	71
16	0	0	1	0	0	0	0	416	137,36	71,2
17	0	0	1	0	0	0	1	417	137,695	71,4
18	0	0	1	0	0	1	0	418	138,03	71,6
19	0	0	1	0	0	1	1	419	138,365	71,8
20	0	0	1	0	1	0	0	420	138,7	72
21	0	0	1	0	1	0	1	421	139,035	72,2
22	0	0	1	0	1	1	0	422	139,37	72,4
23	0	0	1	0	1	1	1	423	139,705	72,6
24	0	0	1	1	0	0	0	424	140,04	72,8
25	0	0	1	1	0	0	1	425	140.375	73
26	0	0	1	1	0	1	0	426	140,71	73,2
27	0	0	1	1	0	1	1	427	141,045	73,4
28	0	0	1	1	1	0	0	428	141,38	73,6
29	0	0	1	1	1	0	1	429	141,715	73,8
30	0	0	1	1	1	1	0	430	142,05	74
31	0	0	1	1	1	1	1	431	142,385	74,2
32	0	1	0	0	0	0	0	432	142,72	74,4
33	0	1	0	0	0	0	1	433	143,055	74,6
34	0	1	0	0	0	1	0	434	143,39	74,8
35	0	1	0	0	0	1	1	435	143,725	75
36	0	1	0	0	1	0	0	436	144,06	75,2
37	0	1	0	0	1	0	1	437	144,395	75,4
38	0	1	0	0	1	1	0	438	144,73	75,6
39	0	1	0	0	1	1	1	439	145,065	75,8
40	0	1	0	1	0	0	0	440	145,4	76
41	0	1	0	1	0	0	1	441	145,735	76,2
42	0	1	0	1	0	1	0	442	146,07	76,4
43	0	1	0	1	0	1	1	443	146,405	76,6
44	0	1	0	1	1	0	0	444	146,74	76,8
45	0	1	0	1	1	0	1	445	147,075	77
46	0	1	0	1	1	1	0	446	147,41	77,2
47	0	1	0	1	1	1	1	447	147,745	77,4

TABLE 1 (Cont'd)

Channel	Switch position							'Test freq' MHz U,T,W Bands	'Test freq' MHz A,B Bands	'Test freq' MHz E Band
	10	11	12	13	14	15	16			
48	0	1	1	0	0	0	0	448	148,08	77,6
49	0	1	1	0	0	0	1	449	148,415	77,8
50	0	1	1	0	0	1	0	450	148,75	78
51	0	1	1	0	0	1	1	451	149,085	78,2
52	0	1	1	0	1	0	0	452	149,42	78,4
53	0	1	1	0	1	0	1	453	149,755	78,6
54	0	1	1	0	1	1	0	454	150,09	78,8
55	0	1	1	0	1	1	1	455	150,425	79
56	0	1	1	1	0	0	0	456	150,76	79,2
57	0	1	1	1	0	0	1	457	151,095	79,4
58	0	1	1	1	0	1	0	458	151,43	79,6
59	0	1	1	1	0	1	1	459	151,765	79,8
60	0	1	1	1	1	0	0	460	152,1	80
61	0	1	1	1	1	0	1	461	152,435	80,2
62	0	1	1	1	1	1	0	462	152,77	80,4
63	0	1	1	1	1	1	1	463	153,105	80,6
64	1	0	0	0	0	0	0	464	153,44	80,8
65	1	0	0	0	0	0	1	465	153,775	81
66	1	0	0	0	0	1	0	466	154,11	81,2
67	1	0	0	0	0	1	1	467	154,445	81,4
68	1	0	0	0	1	0	0	468	154,78	81,6
69	1	0	0	0	1	0	1	469	155,115	81,8
70	1	0	0	0	1	1	0	470	155,45	82
71	1	0	0	0	1	1	1	471	155,785	82,2
72	1	0	0	1	0	0	0	472	156,12	82,4
73	1	0	0	1	0	0	1	473	156,455	82,6
74	1	0	0	1	0	1	0	474	156,79	82,8
75	1	0	0	1	0	1	1	475	157,125	83
76	1	0	0	1	1	0	0	476	157,46	83,2
77	1	0	0	1	1	0	1	477	157,795	83,4
78	1	0	0	1	1	1	0	478	158,13	83,6
79	1	0	0	1	1	1	1	479	158,465	83,8
80	1	0	1	0	0	0	0	480	158,8	84
81	1	0	1	0	0	0	1	481	159,135	84,2
82	1	0	1	0	0	1	0	482	159,47	84,4
83	1	0	1	0	0	1	1	483	159,805	84,6
84	1	0	1	0	1	0	0	484	160,14	84,8
85	1	0	1	0	1	0	1	485	160,475	85
86	1	0	1	0	1	1	0	486	160,81	85,2
87	1	0	1	0	1	1	1	487	161,145	85,4
88	1	0	1	1	0	0	0	488	161,48	85,6
89	1	0	1	1	0	0	1	489	161,815	85,8
90	1	0	1	1	0	1	0	490	162,15	86
91	1	0	1	1	0	1	1	491	162,485	86,2
92	1	0	1	1	1	0	0	492	162,82	86,4
93	1	0	1	1	1	0	1	493	163,155	86,6
94	1	0	1	1	1	1	0	494	163,49	86,8
95	1	0	1	1	1	1	1	495	163,825	87
96	1	1	0	0	0	0	0	496	164,16	87,2
97	1	1	0	0	0	0	1	497	164,495	87,4
98	1	1	0	0	0	1	0	498	164,83	87,6
99	1	1	0	0	0	1	1	499	165,165	87,8

TABLE 1 (Cont'd)

Channel	Switch position 10	11	12	13	14	15	16	'Test freq' MHz U,T,W Bands	'Test freq' MHz A,B Bands	'Test freq' MHz E Band
100	1	1	0	0	1	0	0	500	165,5	88
101	1	1	0	0	1	0	1	501	165,835	
102	1	1	0	0	1	1	0	502	166,17	
103	1	1	0	0	1	1	1	503	166,505	
104	1	1	0	1	0	0	0	504	166,84	
105	1	1	0	1	0	0	1	505	167,175	
106	1	1	0	1	0	1	0	506	167,51	
107	1	1	0	1	0	1	1	507	167,84	
108	1	1	0	1	1	0	0	508	168,18	
109	1	1	0	1	1	0	1	509	168,515	
110	1	1	0	1	1	1	0	510	168,85	
111	1	1	0	1	1	1	1	511	169,185	
112	1	1	1	0	0	0	0	512	169,52	
113	1	1	1	0	0	0	1	513	169,855	
114	1	1	1	0	0	1	0	514	170,19	
115	1	1	1	0	0	1	1	515	170,525	
116	1	1	1	0	1	0	0	516	170,86	
117	1	1	1	0	1	0	1	517	171,195	
118	1	1	1	0	1	1	0	518	171,53	
119	1	1	1	0	1	1	1	519	171,865	
120	1	1	1	1	0	0	0	520	172,2	
121	1	1	1	1	0	0	1		172,535	
122	1	1	1	1	0	1	0		172,87	
123	1	1	1	1	0	1	1		173,205	
124	1	1	1	1	1	0	0		173,54	
125	1	1	1	1	1	0	1		173,875	
126	1	1	1	1	1	1	0		174	
127	1	1	1	1	1	1	1		156	

TX DRIVER MODULE SYNTHESIZED
AT04881/-

Cct Ref	Description	Part No	Remarks
	PCB Assy Tx Driver VHF	AT29080/02	/02 See Separate Headed List
	PCB Assy Tx Driver VHF	AT29082/04	/04 See Separate Headed List
	PCB Assy Tx Driver UHF	AT29077/05	/05 See Separate Headed List
SK101	Receptacle jack	FS48031	
	Box modified	4313 328 30171	
	Bush insulating	3513 990 16014	2/PA heatsink-chassis
	Cable 50Ω co-axial	FC09031	
	Cover plate rear	BT15913	
	Front panel assy Tx	AT14819	
	Insulator	3513 902 50141	1/PA heatsink-chassis
	Label alignment frequency	BT38238	
	Label unit	BT38209/01	
	Lid sealed box	BT13800	
	Seal RF	BT29999	
	Tag	FT00094	/02,04; 2/H'sink plate earthing
	Nut st hex M2,5	QA11604/X	2/PA heatsink-chassis
	Scr st pan pozi M2,5 x 8mm	QJ11946/X	2/PA heatsink-chassis
	Scr st pan pozi M3 x 4mm	QJ11913/X	/02,04; 2/Heatsink-plate assy
	Scr st tap pan M3 x 6mm	QJ11550/X1	
	Scr st tap pan M3 x 8mm	QJ11551/X1	
	Scr st tap pozi No.4 x 4,5mm	QJ08219/X	
	Scr st tap pozi No.4 x 6,5mm	QJ08227/X	2/Reg heatsink-chassis

FRONT PANEL ASSEMBLY TX
AT14819

	Fastener	BT17284	2/Tx-shelf
	Handle	BT35949	
	Label Philips	BT38216/01	1/Handle
	Label Tx	BT38205/02	1/Handle
	Panel front	BT23740	
	Scr st tap pozi No.4 x 8mm	QJ08241/X	2/Handle-front panel

PCB ASSEMBLY TX DRIVER VHF
AT29080/02

Semiconductors & ICs

IC101	IC 74HC4046	SMD	3513 999 50060
IC102	IC 74HC14-HDL	SMD	3513 999 50056
IC103	IC 74HC4024	SMD	3513 999 50038
IC302	IC MB501LFP		3508 100 16310
IC303	IC TL071ID	SMD	9338 369 60685
IC304	IC NJ8820GG	SMD	4313 324 70001
IC305	PROM assembly programmed		AT60171
IC306	IC 74HC574	SMD	3513 999 50027
IC307	IC 74HC688	SMD	3513 999 50034
IC308	IC 74HC126	SMD	3513 999 50069
IC309	10k ±5% 9-pin sil		RN99528
IC402	IC 74HC4024	SMD	3513 999 50038
IC403	IC TL072ID	SMD	9338 369 30685
IC404	Mixer rms1	SMD	2722 162 90133
IC501	IC LM258	SMD	3513 999 45008
IC502	IC 7812 Volt reg & fix		FU99109
IC503	IC 7805 Volt reg & fix		3513 993 34014
IC504	IC LM324-HDL	SMD	3513 999 45005
IC601	IC LM324-HDL	SMD	3513 999 45005
IC602	IC 74HC00	SMD	3513 999 50000
IC603	IC LM317		FU99119
TR101	Transistor BFT92	SMD	3513 999 00010
TR102,103	Transistor BFR93	SMD	3513 999 00027
TR104,105	Transistor BCW72	SMD	3513 999 00015
TR106	Transistor BFR93	SMD	3513 999 00027
TR301	Transistor BCV62	SMD	9336 772 30215
TR302	Transistor BCW72	SMD	3513 999 00015
TR303-308	Transistor BFR93	SMD	3513 999 00027
TR401	Transistor BCW70	SMD	3513 999 00003
TR402	Transistor BFR93	SMD	3513 999 00027
TR404	Transistor BCV62	SMD	9336 772 30215
TR406	Transistor BFQ17	SMD	3513 999 00022
TR407-412	Transistor BCW72	SMD	3513 999 00015
TR413	Transistor BCW70	SMD	3513 999 00003
TR414	Transistor BFT92	SMD	3513 999 00010
TR415,416	Transistor BCW72	SMD	3513 999 00015
TR417	Transistor BFR93	SMD	3513 999 00027

Cct Ref	Description	Part No	Remarks
Semiconductors & ICS (Cont'd)			
TR418	Transistor BCV62 SMD	9336 772 30215	
TR420	Transistor BFR93 SMD	3513 999 00027	
TR422-424	Transistor BFR93 SMD	3513 999 00027	
TR425	Transistor BCW72 SMD	3513 999 00015	
TR426	Transistor BCW70 SMD	3513 999 00003	
TR427	Transistor BCW72 SMD	3513 999 00015	
TR428	Transistor BCV62 SMD	9336 772 30215	
TR429	Transistor BCW72 SMD	3513 999 00015	
TR501	Transistor BCW72 SMD	3513 999 00015	
TR502	Transistor BD437 Power GP	FV05887	
TR503,504	Transistor BCX19	3513 999 00016	
TR505	Transistor BCW70 SMD	3513 999 00003	
TR506-508	Transistor BCW72 SMD	3513 999 00015	
TR601-603	Transistor BCW72 SMD	3513 999 00015	
TR604	Transistor BFQ17 SMD	3513 999 00022	
TR605	Transistor BCW72 SMD	3513 999 00015	
TR606	Transistor BD437	FV05887	
TR607	Transistor BLY87C	9333 262 90112	
TR608,609	Transistor BCW72 SMD	3513 999 00015	
D101	Diode BBY31 SMD	3513 999 25000	
D102,103	Diode BAV99 SMD	3513 999 15002	
D105	Diode BAV99 SMD	3513 999 15002	
D301-303	Diode BBY40 SMD	3513 999 25001	
D305,306	Diode BAV99 SMD	3513 999 15002	
D307	Diode BBY40 SMD	3513 999 25001	
D308	Diode BBY31 SMD	3513 999 25000	
D401	Diode BAT17	3513 999 15006	
D402	Diode BAV99 SMD	3513 999 15002	
D404	Diode BZX84C2V7	3513 999 20001	
D405,406	Diode BAV99 SMD	3513 999 15002	
D407	Diode BAT17	3513 999 15006	
D409	Diode BAV99 SMD	3513 999 15002	
D410	Diode BBY31 SMD	3513 999 25000	
D412	Diode BAV99 SMD	3513 999 15002	
D414,415	Diode BBY40 SMD	3513 999 25001	
D418,419	Diode HSMP-3820	9313 000 03683	
D420,421	Diode BAV99 SMD	3513 999 15002	
D501,502	Diode BAV99 SMD	3513 999 15002	
D503	Led green	3513 993 47002	
D504	Diode BZX84C6V8	3513 999 20011	
D505	Diode BZX84C2V7	3513 999 20001	
D506,507	Diode BAV99 SMD	3513 999 15002	
D508,509	Diode BAW56	3513 999 15001	
D510	Diode BZX84C6V2 M C	3513 999 20010	
D511	Diode BAV99 SMD	3513 999 15002	
D512	Led green	3513 993 47002	
D513	Diode BAV99 SMD	3513 999 15002	
D514	Led red	3513 993 46000	
D601	Diode BAW56	3513 999 15001	
D603	Diode BAV99 SMD	3513 999 15002	
D604	Diode BZX84C8V2	3513 999 20013	
D605	Diode BZX84C5V6	3513 999 20009	
D606	Diode BZX84C6V8	3513 999 20011	
D607,608	Diode BAT17	3513 999 15006	
D609	Led red	3513 993 46000	
D610	Diode BZX84C8V2	3513 999 20013	
D611,612	Diode BAV99 SMD	3513 999 15002	
Resistors			
R101	820 ±2% 0,1W SMD	3513 999 80223	
R102	12k ±2% 0,1W SMD	3513 999 80237	
R103	680 ±2% 0,1W SMD	3513 999 80222	
R104	100 ±2% 0,1W SMD	3513 999 80212	
R105,106	1k ±2% 0,1W SMD	3513 999 80224	
R107	3k9 ±2% 0,1W SMD	3513 999 80231	
R108	820 ±2% 0,1W SMD	3513 999 80223	
R109	100 ±2% 0,1W SMD	3513 999 80212	
R110,111	470 ±2% 0,1W SMD	3513 999 80220	
R112	10k ±2% 0,1W SMD	3513 999 80236	
R114	47k ±2% 0,1W SMD	3513 999 80244	
R115	120 ±2% 0,1W SMD	3513 999 80213	
R116,117	4k7 ±2% 0,1W SMD	3513 999 80232	
R118	100k ±2% 0,1W SMD	3513 999 80248	
R119	2k2 ±2% 0,1W SMD	3513 999 80228	
R120	4k7 ±2% 0,1W SMD	3513 999 80232	

Cct Ref	Description				Part No	Remarks
Resistors (Cont'd)						
R121,122	2k2	±2%	0,1W	SMD	3513 999 80228	
R123	820	±2%	0,1W	SMD	3513 999 80223	
R127	1k	±2%	0,1W	SMD	3513 999 80224	
R128	6k8	±2%	0,1W	SMD	3513 999 80234	
R129	1k8	±2%	0,1W	SMD	3513 999 80227	
R130	47	±2%	0,1W	SMD	3513 999 80208	
R131	390	±2%	0,1W	SMD	3513 999 80219	
R132	1k	±2%	0,1W	SMD	3513 999 80224	
R133	4k7	±2%	0,1W	SMD	3513 999 80232	
R134	100	±2%	0,1W	SMD	3513 999 80212	
R135	1k	±2%	0,1W	SMD	3513 999 80224	
R136	10k	±2%	0,1W	SMD	3513 999 80236	
R301	33	±2%	0,1W	SMD	3513 999 80206	
R302	100	±2%	0,1W	SMD	3513 999 80212	
R303	2k2	±2%	0,1W	SMD	3513 999 80228	
R304	22k	±2%	0,1W	SMD	3513 999 80240	
R305,306	3k3	±2%	0,1W	SMD	3513 999 80230	
R307	1k8	±2%	0,1W	SMD	3513 999 80227	
R308	100	±2%	0,1W	SMD	3513 999 80212	
R309	8k2	±2%	0,1W	SMD	3513 999 80235	
R310	100	±2%	0,1W	SMD	3513 999 80212	
R311	68	±2%	0,1W	SMD	3513 999 80210	
R312	220	±2%	0,1W	SMD	3513 999 80216	
R313	100	±2%	0,1W	SMD	3513 999 80212	
R314	1k8	±2%	0,1W	SMD	3513 999 80227	
R315	5k6	±2%	0,1W	SMD	3513 999 80233	
R316	120	±2%	0,1W	SMD	3513 999 80213	
R317,318	68	±2%	0,1W	SMD	3513 999 80210	
R319	100	±2%	0,1W	SMD	3513 999 80212	
R320	68	±2%	0,1W	SMD	3513 999 80210	
R322	220	±2%	0,1W	SMD	3513 999 80216	
R323	270	±2%	0,1W	SMD	3513 999 80217	
R324	1k8	±2%	0,1W	SMD	3513 999 80227	
R325	5k6	±2%	0,1W	SMD	3513 999 80233	
R326	100	±2%	0,1W	SMD	3513 999 80212	
R327,328	150	±2%	0,1W	SMD	3513 999 80214	
R329	390	±2%	0,1W	SMD	3513 999 80219	
R330-332	10k	±2%	0,1W	SMD	3513 999 80236	
R333	1M	±2%	0,1W	SMD	3513 999 80260	
R334	3k9	±2%	0,1W	SMD	3513 999 80231	
R335	22k	±2%	0,1W	SMD	3513 999 80240	
R337,338	10k	±2%	0,1W	SMD	3513 999 80236	
R339	22k	±2%	0,1W	SMD	3513 999 80240	
R340	10k	±2%	0,1W	SMD	3513 999 80236	
R347	1k5	±2%	0,1W	SMD	3513 999 80226	
R348	10k	±2%	0,1W	SMD	3513 999 80236	
R357,358	10k	±2%	0,1W	SMD	3513 999 80236	
R360	10k	±2%	0,1W	SMD	3513 999 80236	
R361	12k	±2%	0,1W	SMD	3513 999 80237	
R364-371	10k	±2%	0,1W	SMD	3513 999 80236	
R372	1m	±2%	0,1W	SMD	3513 999 80260	
R373	10k	±2%	0,1W	SMD	3513 999 80236	
R401	47	±2%	0,1W	SMD	3513 999 80208	
R402	56	±2%	0,1W	SMD	3513 999 80209	
R403	1k	±2%	0,1W	SMD	3513 999 80224	
R404	2k7	±2%	0,1W	SMD	3513 999 80229	
R405	100	±2%	0,1W	SMD	3513 999 80212	
R406,407	1k	±2%	0,1W	SMD	3513 999 80224	
R408	220	±2%	0,1W	SMD	3513 999 80216	
R409	10k	±2%	0,1W	SMD	3513 999 80236	
R410	3k9	±2%	0,1W	SMD	3513 999 80231	
R411	560	±2%	0,1W	SMD	3513 999 80221	
R412	1k	±2%	0,1W	SMD	3513 999 80224	
R413	8k2	±2%	0,1W	SMD	3513 999 80235	
R414-416	470	±2%	0,1W	SMD	3513 999 80220	
R417	2k2	±2%	0,1W	SMD	3513 999 80228	
R418	100	±2%	0,1W	SMD	3513 999 80212	
R419	22k	±2%	0,1W	SMD	3513 999 80240	
R420	47	±2%	0,1W	SMD	3513 999 80208	
R421,422	10k	±2%	0,1W	SMD	3513 999 80236	
R423	3k3	±2%	0,1W	SMD	3513 999 80230	
R427	470	±2%	0,1W	SMD	3513 999 80220	
R428	330	±2%	0,1W	SMD	3513 999 80218	
R429	390	±2%	0,1W	SMD	3513 999 80219	
R430	220	±2%	0,1W	SMD	3513 999 80216	
R431-433	1k	±2%	0,1W	SMD	3513 999 80224	

Cct Ref	Description				Part No	Remarks
Resistors (Cont'd)						
R434	1k5	±2%	0,1W	SMD	3513 999 80226	
R436	330	±2%	0,1W	SMD	3513 999 80218	
R437	22k	±2%	0,1W	SMD	3513 999 80240	
R438	100	±2%	0,1W	SMD	3513 999 80212	
R439	22k	±2%	0,1W	SMD	3513 999 80240	
R440	2k2	±2%	0,1W	SMD	3513 999 80228	
R441	100	±2%	0,1W	SMD	3513 999 80212	
R442	33	±2%	0,1W	SMD	3513 999 80206	
R444	1k8	±2%	0,1W	SMD	3513 999 80227	
R445	270	±2%	0,1W	SMD	3513 999 80217	
R446	100	±2%	0,1W	SMD	3513 999 80212	
R447	220	±2%	0,1W	SMD	3513 999 80216	
R448	100	±2%	0,1W	SMD	3513 999 80212	
R450	220	±2%	0,1W	SMD	3513 999 80216	
R451,452	10k	±2%	0,1W	SMD	3513 999 80236	
R453	33	±2%	0,1W	SMD	3513 999 80206	
R454	820	±2%	0,1W	SMD	3513 999 80223	
R455	39	±2%	0,1W	SMD	3513 999 80207	
R456,457	150	±2%	0,1W	SMD	3513 999 80214	
R458	5k6	±2%	0,1W	SMD	3513 999 80233	
R459	1k8	±2%	0,1W	SMD	3513 999 80227	
R460	270	±2%	0,1W	SMD	3513 999 80217	
R461	10k	±2%	0,1W	SMD	3513 999 80236	
R462	33	±2%	0,1W	SMD	3513 999 80206	
R463	5k6	±2%	0,1W	SMD	3513 999 80233	
R464	220	±2%	0,1W	SMD	3513 999 80216	
R465	100	±2%	0,1W	SMD	3513 999 80212	
R466-468	22k	±2%	0,1W	SMD	3513 999 80240	
R469,470	10k	±2%	0,1W	SMD	3513 999 80236	
R471	270k	±2%	0,1W	SMD	3513 999 80253	
R472	6k8	±2%	0,1W	SMD	3513 999 80234	
R473	10k	±25%	Pot cermet		3513 999 95007	
R474	100k	±2%	0,1W	SMD	3513 999 80248	
R478	5k6	±2%	0,1W	SMD	3513 999 80233	
R479	100	±2%	0,1W	SMD	3513 999 80212	
R480	47	±2%	0,1W	SMD	3513 999 80208	
R482	68	±2%	0,1W	SMD	3513 999 80210	
R484	100	±2%	0,1W	SMD	3513 999 80212	
R485	220	±2%	0,1W	SMD	3513 999 80216	
R486	10k	±2%	0,1W	SMD	3513 999 80236	
R487	470	±2%	0,1W	SMD	3513 999 80220	
R488	150	±2%	0,1W	SMD	3513 999 80214	
R489	68	±2%	0,1W	SMD	3513 999 80210	
R491	10k	±2%	0,1W	SMD	3513 999 80236	
R492	47k	±2%	0,1W	SMD	3513 999 80244	
R493,494	10k	±2%	0,1W	SMD	3513 999 80236	
R495	10	±2%	0,1W	SMD	3513 999 80200	
R501	1k	±2%	0,1W	SMD	3513 999 80224	
R502	820k	±2%	0,1W	SMD	3513 999 80259	
R503	680	±2%	0,1W	SMD	3513 999 80222	
R504	470k	±2%	0,1W	SMD	3513 999 80256	
R505	100	±2%	0,1W	SMD	3513 999 80212	
R506	56k	±2%	0,1W	SMD	3513 999 80245	
R507	Thermistor 70°C				PL23137	
R508	4Ω7	±5%	0,125W	SMD	3513 999 80008	
R509	100k	±2%	0,1W	SMD	3513 999 80248	
R510	100	±2%	0,1W	SMD	3513 999 80212	
R511	470	±2%	0,1W	SMD	3513 999 80220	
R512	15k	±2%	0,1W	SMD	3513 999 80238	
R513	3k3	±2%	0,1W	SMD	3513 999 80230	
R514-516	10k	±2%	0,1W	SMD	3513 999 80236	
R517	6k8	±2%	0,1W	SMD	3513 999 80234	
R518	1M	±2%	0,1W	SMD	3513 999 80260	
R519	3k3	±2%	0,1W	SMD	3513 999 80230	
R520	100k	±2%	0,1W	SMD	3513 999 80248	
R521	100k	±2%	0,1W	SMD	3513 999 80248	
R522	1k	±2%	0,1W	SMD	3513 999 80224	
R523	3k9	±2%	0,1W	SMD	3513 999 80231	
R524	470	±2%	0,1W	SMD	3513 999 80220	
R525	390	±2%	0,1W	SMD	3513 999 80219	
R526	4k7	±2%	0,1W	SMD	3513 999 80232	
R527	100k	±2%	0,1W	SMD	3513 999 80248	
R528	56k	±2%	0,1W	SMD	3513 999 80245	
R529	39k	±2%	0,1W	SMD	3513 999 80243	
R530	27k	±2%	0,1W	SMD	3513 999 80241	
R531	47k	±2%	0,1W	SMD	3513 999 80244	

Cct Ref	Description				Part No	Remarks
Resistors (Cont'd)						
R532	4k7	±2%	0,1W	SMD	3513 999 80232	
R533	10k	±2%	0,1W	SMD	3513 999 80236	
R534	47k	±2%	0,1W	SMD	3513 999 80244	
R535	100k	±2%	0,1W	SMD	3513 999 80248	
R536,537	2k2	±2%	0,1W	SMD	3513 999 80228	
R538,539	1k5	±2%	0,1W	SMD	3513 999 80226	
R540	220	±2%	0,1W	SMD	3513 999 80216	
R541,542	2k2	±2%	0,1W	SMD	3513 999 80228	
R547	680k	±2%	0,1W	SMD	3513 999 80258	
R543-545	4Ω7	±5%	0,125W	SMD	3513 999 80008	
R601	10k	±2%	0,1W	SMD	3513 999 80236	
R602	1k	±2%	0,1W	SMD	3513 999 80224	
R603-606	10k	±2%	0,1W	SMD	3513 999 80236	
R607	5k6	±2%	0,1W	SMD	3513 999 80233	
R608	2k2	±2%	0,1W	SMD	3513 999 80228	
R609	1k	±2%	0,1W	SMD	3513 999 80224	
R610	10k	±2%	0,1W	SMD	3513 999 80236	
R611	270	±2%	0,1W	SMD	3513 999 80217	
R612	18	±2%	0,1W	SMD	3513 999 80203	
R613	270	±2%	0,1W	SMD	3513 999 80217	
R614	33	±2%	0,1W	SMD	3513 999 80206	
R615	10	±2%	0,1W	SMD	3513 999 80200	
R616	680	±2%	0,1W	SMD	3513 999 80222	
R617-619	33k	±2%	0,1W	SMD	3513 999 80242	
R620	10k	±2%	0,1W	SMD	3513 999 80236	
R622	10k	±25%	Pot cermet		3513 999 95007	
R623	27k	±2%	0,1W	SMD	3513 999 80241	
R625	100k	±2%	0,1W	SMD	3513 999 80248	
R626	390	±2%	0,1W	SMD	3513 999 80219	
R627	10	±2%	0,1W	SMD	3513 999 80200	
R630	47	±2%	0,1W	SMD	3513 999 80208	
R631,632	2k7	±2%	0,1W	SMD	3513 999 80229	
R633	12k	±2%	0,1W	SMD	3513 999 80237	
R634	4k7	±2%	0,1W	SMD	3513 999 80232	
R635	15k	±2%	0,1W	SMD	3513 999 80238	
R638	15k	±2%	0,1W	SMD	3513 999 80238	
R639	1k	±2%	0,1W	SMD	3513 999 80224	
R640	2k7	±2%	0,1W	SMD	3513 999 80229	
R641	4k7	±2%	0,1W	SMD	3513 999 80232	
R643	8k2	±2%	0,1W	SMD	3513 999 80235	
R644	3k3	±2%	0,1W	SMD	3513 999 80230	
R645	22	±2%	0,1W	SMD	3513 999 80204	
R646	220	±2%	0,1W	SMD	3513 999 80216	
R647	100	±2%	0,1W	SMD	3513 999 80212	
R648,649	6Ω8	±5%	0,25W	c flm	PM01401	
Capacitors						
C101	47n	±10%	50V	SMD	3513 999 55013	
C102	10	±10%	16V	SMD	3513 999 65067	
C103	47n	±10%	50V	SMD	3513 999 55013	
C104,105	1n	±10%	50V	SMD	3513 999 55459	
C106	180p	±5%	cer		3513 991 06056	
C107	0p8-10pf		variable		4313 326 10081	
C108	56p	±5%	50V	SMD	3513 999 55322	
C109	82p	±5%	50V	SMD	3513 999 55324	
C110	47n	±10%	50V	SMD	3513 999 55013	
C111-113	10	±20%	50V	elec	PS99436	
C114	47n	±10%	50V	SMD	3513 999 55013	
C115	10	±20%	50V	elec	PS99436	
C116	10n	±10%	50V	SMD	3513 999 55471	
C117	100n	±10%	50V	SMD	3513 999 55498	
C118,119	47n	±10%	50V	SMD	3513 999 55013	
C120	10	±20%	50V	elec	PS99436	
C121	47n	±10%	50V	SMD	3513 999 55013	
C122,123	100n	±10%	50V	SMD	3513 999 55498	
C124	47n	±10%	50V	SMD	3513 999 55013	
C125	1n	±10%	50V	SMD	3513 999 55459	
C126	10	±20%	50V	elec	PS99436	
C127,128	10n	±10%	50V	SMD	3513 999 55471	
C129	180p	±5%		cer	3513 991 06056	
C301	10	±20%	50V	elec	PS99436	
C302	100n	±10%	50V	SMD	3513 999 55498	
C303	1	±20%	100V	elec	PS99455	
C304	100n	±10%	50V	SMD	3513 999 55498	
C305	10	±20%	50V	elec	PS99436	

Cct Ref	Description				Part No	Remarks
Capacitors (Cont'd)						
C306	1n5	±10%	50V	SMD	3513 999 55461	
C307	100n	±10%	50V	SMD	3513 999 55498	
C309	3p3	±0p25	50V	SMD	3513 999 55307	
C310	10p	±5%	50V	SMD	3513 999 55313	
C311	5p6	±0p5	50V	SMD	3513 999 55310	
C312,313	1n	±10%	50V	SMD	3513 999 55459	
C315	22p	±5%	50V	SMD	3513 999 55317	
C316	15p	±5%	50V	SMD	3513 999 55315	
C317	8p2	±0p5	50V	SMD	3513 999 55312	
C318-320	1n	±10%	50V	SMD	3513 999 55459	
C321	47n	±10%	50V	SMD	3513 999 55013	
C322	8p2	±0p5	50V	SMD	3513 999 55312	
C323	1n	±10%	50V	SMD	3513 999 55459	
C324	10	±20%	50V	elec	PS99436	
C325	47n	±10%	50V	SMD	3513 999 55013	
C326-330	1n	±10%	50V	SMD	3513 999 55459	
C331	47n	±10%	50V	SMD	3513 999 55013	
C332	1n	±10%	50V	SMD	3513 999 55459	
C333	47n	±10%	50V	SMD	3513 999 55013	
C334	2p2	±0p25	50V	SMD	3513 999 55305	
C335	1n	±10%	50V	SMD	3513 999 55459	
C336	8p2	±0p5	50V	SMD	3513 999 55312	
C337	4p7	±0p25	50V	SMD	3513 999 55309	
C348-350	1n	±10%	50V	SMD	3513 999 55459	
C351	47n	±10%	50V	SMD	3513 999 55013	
C352	10	±10%	16V	SMD	3513 999 65067	
C353	1n	±10%	50V	SMD	3513 999 55459	
C354	15p	±5%	50V	SMD	3513 999 55315	
C355	1n2	±10%	50V	SMD	3513 999 55460	
C356	47n	±10%	50V	SMD	3513 999 55013	
C357	47	±20%	25V	elec	PS99423	
C358	1n5	±10%	50V	SMD	3513 999 55461	
C359	270n	±10%	50V	SMD	3513 999 55022	
C360	47n	±10%	50V	SMD	3513 999 55013	
C361	10	±10%	16V	SMD	3513 999 65067	
C362	2p-18p		variable	PCB mtg	PV99006	
C363	22p	±5%	50V	SMD	3513 999 55317	
C364,365	1n	±10%	50V	SMD	3513 999 55459	
C366-368	100n	±10%	50V	SMD	3513 999 55498	
C369	1n	±10%	50V	SMD	3513 999 55459	
C370	15n	±10%	50V	SMD	3513 999 55472	
C371,372	10n	±10%	50V	SMD	3513 999 55471	
C373	270n	±10%	50V	SMD	3513 999 55022	
C374	10n	±10%	50V	SMD	3513 999 55471	
C376	100p	±5%	50V	SMD	3513 999 55325	
C377	10n	±10%	50V	SMD	3513 999 55471	
C378	10	±10%	16V	SMD	3513 999 65067	
C380	270n	±10%	50V	SMD	3513 999 55022	
C381,382	15p	±5%	50V	SMD	3513 999 55315	
C383	100n	±10%	50V	SMD	3513 999 55498	
C401,402	82p	±5%	50V	SMD	3513 999 55324	
C403,404	150p	±5%	50V	SMD	3513 999 55327	
C406,407	100n	±10%	50V	SMD	3513 999 55498	
C408	1n	±10%	50V	SMD	3513 999 55459	
C409	100n	±10%	50V	SMD	3513 999 55498	
C410	10	±10%	16V	SMD	3513 999 65067	
C411	10	±20%	50V	elec	PS99436	
C412	47n	±10%	50V	SMD	3513 999 55013	
C413	100n	±10%	50V	SMD	3513 999 55498	
C414	10	±20%	50V	elec	PS99436	
C415	1	±20%	100V	elec	PS99455	
C416	180p	±5%	50V	SMD	3513 999 55328	
C417	10	±10%	16V	SMD	3513 999 65067	
C418	330p	±5%	50V	SMD	3513 999 55331	
C419	100n	±10%	50V	SMD	3513 999 55498	
C420	15p	±5%	50V	SMD	3513 999 55315	
C421	10	±20%	50V	elec	PS99436	
C425-427	1n2	±10%	50V	SMD	3513 999 55460	
C429	100n	±10%	50V	SMD	3513 999 55498	
C430	1n2	±10%	50V	SMD	3513 999 55460	
C431	47n	±10%	50V	SMD	3513 999 55013	
C432-434	10	±20%	50V	elec	PS99436	
C435	100n	±10%	50V	SMD	3513 999 55498	
C436	10	±20%	50V	elec	PS99436	
C437	1	±20%	100V	elec	PS99455	
C438	47n	±10%	50V	SMD	3513 999 55013	

Cct Ref	Description				Part No	Remarks
Capacitors (Cont'd)						
C439	1n	±10%	50V	SMD	3513 999 55459	
C440	10	±20%	50V	elec	PS99436	
C441,442	1n	±10%	50V	SMD	3513 999 55459	
C443-446	15p	±5%	50V	SMD	3513 999 55315	
C447	1n	±10%	50V	SMD	3513 999 55459	
C448,449	8p2	±0p5	50V	SMD	3513 999 55312	
C450	47n	±10%	50V	SMD	3513 999 55013	
C451	1n	±10%	50V	SMD	3513 999 55459	
C452	10p	±5%	50V	SMD	3513 999 55313	
C453	10	±20%	50V	elec	PS99436	
C454	1n	±10%	50V	SMD	3513 999 55459	
C455	2p7	±0p25	50V	SMD	3513 999 55306	
C456	1n	±10%	50V	SMD	3513 999 55459	
C457	15p	±5%	50V	SMD	3513 999 55315	
C458	8p2	±0p5	50V	SMD	3513 999 55312	
C459	10	±20%	50V	elec	PS99436	
C460	47n	±10%	50V	SMD	3513 999 55013	
C461-463	1n	±10%	50V	SMD	3513 999 55459	
C464	10	±20%	50V	elec	PS99436	
C465	47n	±10%	50V	SMD	3513 999 55013	
C466,467	1n	±10%	50V	SMD	3513 999 55459	
C469	6p8	±0p5	50V	SMD	3513 999 55311	
C471	10	±20%	50V	elec	PS99436	
C472	47n	±10%	50V	SMD	3513 999 55013	
C473	1n	±10%	50V	SMD	3513 999 55459	
C474	5p5-50p		variable PCB mtg		PV99007	
C475	47n	±10%	50V	SMD	3513 999 55013	
C476	8p2	±0p5	50V	SMD	3513 999 55312	
C477	1n	±10%	50V	SMD	3513 999 55459	
C478	15p	±5%	50V	SMD	3513 999 55315	
C479,480	1n	±10%	50V	SMD	3513 999 55459	
C481-483	100n	±10%	50V	SMD	3513 999 55498	
C484,485	10	±20%	50V	elec	PS99436	
C486	100n	±10%	50V	SMD	3513 999 55498	
C487	1n	±10%	50V	SMD	3513 999 55459	
C488	15n	±10%	50V	SMD	3513 999 55472	
C489	1n	±10%	50V	SMD	3513 999 55459	
C490	100p	±5%	50V	SMD	3513 999 55325	
C491	3n3	±10%	50V	SMD	3513 999 55465	
C492	100p	±5%	50V	SMD	3513 999 55325	
C493	22n	±10%	50V	SMD	3513 999 55010	
C494	10	±10%	16V	SMD	3513 999 65067	
C495	10	±20%	50V	elec	PS99436	
C497	1n	±10%	50V	SMD	3513 999 55459	
C498	47n	±10%	50V	SMD	3513 999 55013	
C499	1n	±10%	50V	SMD	3513 999 55459	
C501	10	±20%	50V	elec	PS99436	
C503,504	22	±20%	25V	elec	3513 991 00079	
C505	1	±20%	100V	elec	PS99455	
C506	100	±20	25V	elec	3513 991 00081	
C507	10	±20%	50V	elec	PS99436	
C508	1n	±10%	50V	SMD	3513 999 55459	
C509,510	270n	±10%	50V	SMD	3513 999 55022	
C511-534	100p	±5%	50V	SMD	3513 999 55325	
C535,536	10	±20%	50V	elec	PS99436	
C537	47p	±5%	50V	SMD	3513 999 55321	
C538	10	±10%	16V	SMD	3513 999 65067	
C539	47p	±5%	50V	SMD	3513 999 55321	
C540	22	±20%	100V	elec	PS99456	
C541,542	47p	±5%	50V	SMD	3513 999 55321	
C543	100p	±5%	50V	SMD	3513 999 55325	
C544-550	10n	±10%	50V	SMD	3513 999 55471	
C554-563	10n	±10%	50V	SMD	3513 999 55471	
C564-567	10	±20%	50V	elec	PS99436	
C568,569	10n	±10%	50V	SMD	3513 999 55471	
C570	1n	±10%	50V	SMD	3513 999 55459	
C601	22p	±5%	50V	SMD	3513 999 55317	
C602	10	±20%	50V	elec	PS99436	
C603	22p	±5%	50V	SMD	3513 999 55317	
C604	5p6	±0p5	50V	SMD	3513 999 55310	
C605	1p8	±0p25	50V	SMD	3513 999 55304	
C606	22p	±5%	50V	SMD	3513 999 55317	
C607	27p	±5%	50V	SMD	3513 999 55318	
C608	10	±20%	50V	elec	PS99436	
C609	1n	±10%	50V	SMD	3513 999 55459	
C610	4p7	±0p25	50V	SMD	3513 999 55309	

Cct Ref	Description	Part No	Remarks
Capacitors (Cont'd)			
C611	8p5-40p variable SMD	3513 999 70006	
C612,613	27p ±5% 50V SMD	3513 999 55318	
C614-616	47p ±5% 50V SMD	3513 999 55321	
C617	1 ±20% 100V elec	PS99455	
C618,619	10 ±20% 50V elec	PS99436	
C620	220p ±5% 50V SMD	3513 999 55329	
C621	10n ±10% 50V SMD	3513 999 55471	
C622	47p ±5% 50V SMD	3513 999 55321	
C624	1n ±10% 50V SMD	3513 999 55459	
C625	56p ±5% 50V SMD	3513 999 55322	
C627	47 ±20% 25V elec	PS99423	
C629	1n ±10% 50V SMD	3513 999 55459	
C630	1 ±20% 100V elec	PS99455	
C631	10 ±20% 50V elec	PS99436	
C632	1n ±10% 50V SMD	3513 999 55459	
C634	33p ±5% 50V SMD	3513 999 55319	
C635	8p2 ±0p5 50V SMD	3513 999 55312	
C636	6p5-30p variable SMD	3513 999 70003	
C637	8p5-40p variable SMD	3513 999 70006	
C638	2p2 ±0p25 50V SMD	3513 999 55305	
C639	10p ±5% 50V SMD	3513 999 55313	
C641	15p ±5% 50V SMD	3513 999 55315	
C642	6p8 ±0p5 50V SMD	3513 999 55311	
C643	15p ±5% 50V SMD	3513 999 55315	
C644	8p2 ±0p5 50V SMD	3513 999 55312	
C645-647	10 ±20% 50V elec	PS99436	
C650	8p2 ±0p5 50V SMD	3513 999 55312	
C651	4p7 ±0p25 50V SMD	3513 999 55309	
C652	1 ±20% 100V elec	PS99455	
C654,655	1n ±10% 50V SMD	3513 999 55459	
C657	1n ±10% 50V SMD	3513 999 55459	
C658,659	10 ±20% 50V elec	PS99436	
C660,661	1n ±10% 50V SMD	3513 999 55459	
C662	10 ±20% 50V elec	PS99436	
C663,664	3p3 ±0p25 50V SMD	3513 999 55307	
C665	2n2 ±10% 50V SMD	3513 999 55463	
C680-685	10n ±10% 50V SMD	3513 999 55471	
C686	1n ±5%	PN99900	1/output socket
C4100	1n ±10% 50V SMD	3513 999 55459	
C4101	47n ±10% 50V SMD	3513 999 55013	
C4103	47n ±10% 50V SMD	3513 999 55013	
C4105	10 ±20% 50V elec	PS99436	
Inductors			
L101,102	Choke 100µh ±10%	3513 993 22553	
L301	Inductor 1µ5 ±20% SMD	3513 999 98097	
L302	Inductor 47nh ±20% SMD	3513 999 98081	
L303,304	Inductor 1µ5 ±20% SMD	3513 999 98097	
L305	Inductor 47nh ±20% SMD	3513 999 98081	
L306	Inductor 1µ5 ±20% SMD	3513 999 98097	
L307	Inductor 47nh ±20% SMD	3513 999 98081	
L308	Inductor 1µ5 ±20% SMD	3513 999 98097	
L313,314	Choke 100µh ±10%	3513 993 22553	
L315	Choke 0µ22 ±10%	3513 993 22546	
L316	Inductor 1µ5 ±20% SMD	3513 999 98097	
L317	Coil 0µ114 orange	FT06417	
L401	Inductor 330nh ±20% SMD	3513 999 98098	
L402	Inductor 680nh ±20% SMD	3513 999 98088	
L403	Inductor 330nh ±20% SMD	3513 999 98098	
L404	Inductor 150nh ±20% SMD	3513 999 98085	
L405-407	Inductor 1000µ ±10% SMD	3513 999 98125	
L408	Inductor 150nh ±20% SMD	3513 999 98085	
L409	Coil 0µ23 green	FT06604	
L410,411	Inductor 1µ5 ±20% SMD	3513 999 98097	
L412	Inductor 68nh ±20% SMD	3513 999 98083	
L413	Inductor 1µ5 ±20% SMD	3513 999 98097	
L414	Inductor 47nh ±20% SMD	3513 999 98081	
L415-417	Choke 100µh ±10%	3513 993 22553	
L418	Inductor 47nh ±20% SMD	3513 999 98081	
L419	Inductor 150nh ±20% SMD	3513 999 98085	
L420	Choke 100µh ±10%	3513 993 22553	
L501	Bead 6-hole ferroxcube	4312 020 36700	
L502-513	Inductor 220nh ±20% SMD	3513 999 98086	
L514	Bead 6-hole ferroxcube	4312 020 36700	
L601	Choke assy toroidal	3513 509 00691	

Cct Ref	Description	Part No	Remarks
Inductors (Cont'd)			
L602	Coil	3513 901 00061	
L603	Coil	3513 901 00051	
L604	Coil	3513 901 00041	
L605	Coil	3513 901 00031	
L606	Coil	3513 901 00021	
L607	Coil	3513 901 00011	
L608	Choke RF min 1µh ±10%	FT99102	
L614	Coil	3513 901 00001	
L612	Inductor 1µ5 ±20% SMD	3513 999 98097	
L613	Inductor 1µh ±20% SMD	3513 999 98089	
Miscellaneous			
SK501	Skt 'D' type rt angle 15-way	FS42136	
Y101	Crystal 10mhz to YE00922	3513 900 60521	
	Bracket Antenna	3513 900 40151	
	Bush Ins 1507	3513 990 16014	1/IC502,503,603
	Cover Screen	3513 901 10251	
	Hdr str male 2-posn	FC00837/02	
	Hdr str male 7-posn	FC00837/07	
	Heatsink plate	3513 902 30341	
	Heatsink plate assembly	3513 504 03991	
	Holder Crystal Oven	BT45165	
	Link Connector	FC99060	
	Plug PCB mtd straight 2 x 7	FP99290	
	Retainer	BT48026	1/Xtal Oven
	Screen (Power Amp)	3513 906 20131	
	Screen (VCO)	3513 906 20121	
	Skt BNC Type	FS43779	
	Skt Dil 28-Way	FS99148	1/IC305
	Nut st hex M2,5	QA11604/X	2/15-way plug; 3/IC1,TR606
	Scr pan pozi M2,5 x 6mm Bt Ni	2522 178 16038	1/IC502,503,603; 1/TR606
	Scr st pan pozi M2,5 x 8mm	QJ11946/X	1/Oven; 2/15-way socket
	Scr st tap pozi No.4 x 6,5mm	QJ08227/X	8/VCO covers
	Washer Compression QA99040	1/TR606	
	Washer Insulating TO-126	QA99016	1/TR502,606
	Washer Thermal TO-220	QA99111	1/IC502,503,603

PCB ASSEMBLY TX DRIVER EO BAND
AT29082/04

Semiconductors & ICs			
IC101	IC 74HC4046 SMD	3513 999 50060	
IC102	IC 74HC14-HDL SMD	3513 999 50056	
IC103	IC 74HC4024 SMD	3513 999 50038	
IC302	IC MB501LFP 2-MODL	3508 100 16310	
IC303	IC TL071ID SMD	9338 369 60685	
IC304	IC NJ8820GG SMD	4313 324 70001	
IC305	Prom assy programmed	AT60171	
IC306	IC 74HC574 SMD	3513 999 50027	
IC307	IC 74HC688 SMD	3513 999 50034	
IC308	IC 74HC126 SMD	3513 999 50069	
IC309	Res 9-pin sil 1k ±5%	RN99525	
IC401	IC 74HC4046 SMD	3513 999 50060	
IC402	IC 74HC4060 SMD	3513 999 50040	
IC403	IC TL072ID SMD	9338 369 30685	
IC404	Mixer RMS1 SMD	2722 162 90133	
IC501	IC LM258 SMD	3513 999 45008	
IC504	IC LM324-HDL SMD	3513 999 45005	
IC601	IC LM324-HDL SMD	3513 999 45005	
IC602	IC 74HC00 SMD	3513 999 50000	
IC502	IC 7812 Volt Reg & Fix	FU99109	
IC503	IC 7805 VOLT Reg & Fix	3513 993 34014	
IC603	IC LM317-SMD	FU99119	
TR101	Transistor BFT92 SMD	3513 999 00010	
TR102,103	Transistor BFR93 SMD	3513 999 00027	
TR104,105	Transistor BCW72 SMD	3513 999 00015	
TR106	Transistor BFR93 SMD	3513 999 00027	
TR302	Transistor BCW72 SMD	3513 999 00015	
TR303-308	Transistor BFR93 SMD	3513 999 00027	
TR401	Transistor BCW70 SMD	3513 999 00003	
TR402	Transistor BFR93 SMD	3513 999 00027	
TR406	Transistor BFQ17 SMD	3513 999 00022	
TR407-412	Transistor BCW72 SMD	3513 999 00015	
TR413	Transistor BCW70 SMD	3513 999 00003	

Cct Ref	Description	Part No	Remarks
Semiconductors & ICs (Cont'd)			
TR414	Transistor BFT92 SMD	3513 999 00010	
TR415,416	Transistor BCW72 SMD	3513 999 00015	
TR417	Transistor BFR93 SMD	3513 999 00027	
TR420	Transistor BFR93 SMD	3513 999 00027	
TR422-424	Transistor BFR93 SMD	3513 999 00027	
TR425	Transistor BCW72 SMD	3513 999 00015	
TR426	Transistor BCW70 SMD	3513 999 00003	
TR427	Transistor BCW72 SMD	3513 999 00015	
TR429	Transistor BCW72 SMD	3513 999 00015	
TR501	Transistor BCW72 SMD	3513 999 00015	
TR502	Transistor BD437 Power GP	FV05887	
TR503,504	Transistor BCX19 SMD	3513 999 00016	
TR505	Transistor BCW70 SMD	3513 999 00003	
TR506-508	Transistor BCW72 SMD	3513 999 00015	
TR601-603	Transistor BCW72 SMD	3513 999 00015	
TR604	Transistor BFQ17 SMD	3513 999 00022	
TR605	Transistor BCW72 SMD	3513 999 00015	
TR606	Transistor BD437 Power GP	FV05887	
TR607	Transistor BLY87C	9333 262 90112	
TR608	Transistor BCW72 SMD	3513 999 00015	
D101	Diode BBY31 SMD	3513 999 25000	
D102,103	Diode BAV99 SMD	3513 999 15002	
D105	Diode BAV99 SMD	3513 999 15002	
D301	Diode BBY40 SMD	3513 999 25001	
D302	Diode BBY40 SMD	3513 999 25001	
D305	Diode BAV99 SMD	3513 999 15002	
D401	Diode BAT17	3513 999 15006	
D402	Diode BAV99 SMD	3513 999 15002	
D404	Diode BZX84C2V7	3513 999 20001	
D405,406	Diode BAV99 SMD	3513 999 15002	
D407	Diode BAT17	3513 999 15006	
D409	Diode BAV99 SMD	3513 999 15002	
D412	Diode BAV99 SMD	3513 999 15002	
D413-417	Diode BBY40 SMD	3513 999 25001	
D418,419	Diode HSMP-3820 SMD	9313 000 03683	
D420	Diode BAV99 SMD	3513 999 15002	
D421	Diode BBY40 SMD	3513 999 25001	
D422	Diode BAV99 SMD	3513 999 15002	
D501,502	Diode BAV99 SMD	3513 999 15002	
D503	Led green MV5474C	3513 993 47002	
D504	Diode BZX84C6V8	3513 999 20011	
D505	Diode BZX84C2V7	3513 999 20001	
D506,507	Diode BAV99 SMD	3513 999 15002	
D508,509	Diode BAW56	3513 999 15001	
D510	Diode BZX84C6V2 M C	3513 999 20010	
D511	Diode BAV99 SMD	3513 999 15002	
D512	Led green MV5474C	3513 993 47002	
D513	Diode BAV99 SMD	3513 999 15002	
D514	Led red	3513 993 46000	
D601	Diode BAW56	3513 999 15001	
D603	Diode BAV99 SMD	3513 999 15002	
D604	Diode BZX84C8V2	3513 999 20013	
D605	Diode BZX84C5V6	3513 999 20009	
D606	Diode BZX84C6V8	3513 999 20011	
D607,608	Diode BAT17	3513 999 15006	
D609	Led red	3513 993 46000	
D610	Diode BZX84C6V8	3513 999 20011	
D611	Diode BAV99 SMD	3513 999 15002	
Resistors			
R101	820 ±2% 0,1W SMD	3513 999 80223	
R102	12k ±2% 0,1W SMD	3513 999 80237	
R103	680 ±2% 0,1W SMD	3513 999 80222	
R104	100 ±2% 0,1W SMD	3513 999 80212	
R105,106	1k ±2% 0,1W SMD	3513 999 80224	
R107	3k9 ±2% 0,1W SMD	3513 999 80231	
R108	820 ±2% 0,1W SMD	3513 999 80223	
R109	100 ±2% 0,1W SMD	3513 999 80212	
R110,111	470 ±2% 0,1W SMD	3513 999 80220	
R112	10k ±2% 0,1W SMD	3513 999 80236	
R114	47k ±2% 0,1W SMD	3513 999 80244	
R115	120 ±2% 0,1W SMD	3513 999 80213	
R116,117	4k7 ±2% 0,1W SMD	3513 999 80232	
R118	100k ±2% 0,1W SMD	3513 999 80248	
R119	2k2 ±2% 0,1W SMD	3513 999 80228	

Cct Ref	Description				Part No	Remarks
Resistors (Cont'd)						
R120	4k7	±2%	0,1W	SMD	3513 999 80232	
R121,122	2k2	±2%	0,1W	SMD	3513 999 80228	
R123	820	±2%	0,1W	SMD	3513 999 80223	
R127	1k	±2%	0,1W	SMD	3513 999 80224	
R128	6k8	±2%	0,1W	SMD	3513 999 80234	
R129	1k8	±2%	0,1W	SMD	3513 999 80227	
R130	47	±2%	0,1W	SMD	3513 999 80208	
R131	390	±2%	0,1W	SMD	3513 999 80219	
R132	1k	±2%	0,1W	SMD	3513 999 80224	
R133	4k7	±2%	0,1W	SMD	3513 999 80232	
R134	100	±2%	0,1W	SMD	3513 999 80212	
R135	1k	±2%	0,1W	SMD	3513 999 80224	
R136	10k	±2%	0,1W	SMD	3513 999 80236	
R301	33	±2%	0,1W	SMD	3513 999 80206	
R302	100	±2%	0,1W	SMD	3513 999 80212	
R303,304	22k	±2%	0,1W	SMD	3513 999 80240	
R305	4k7	±2%	0,1W	SMD	3513 999 80232	
R306	3k9	±2%	0,1W	SMD	3513 999 80231	
R307	2k2	±2%	0,1W	SMD	3513 999 80228	
R308	220	±2%	0,1W	SMD	3513 999 80216	
R309	8k2	±2%	0,1W	SMD	3513 999 80235	
R310	56	±2%	0,1W	SMD	3513 999 80209	
R311	47	±2%	0,1W	SMD	3513 999 80208	
R312	390	±2%	0,1W	SMD	3513 999 80219	
R313	270	±2%	0,1W	SMD	3513 999 80217	
R314	3k9	±2%	0,1W	SMD	3513 999 80231	
R315	5k6	±2%	0,1W	SMD	3513 999 80233	
R316	120	±2%	0,1W	SMD	3513 999 80213	
R317,318	68	±2%	0,1W	SMD	3513 999 80210	
R319	1k2	±2%	0,1W	SMD	3513 999 80225	
R320	47	±2%	0,1W	SMD	3513 999 80208	
R322	390	±2%	0,1W	SMD	3513 999 80219	
R323	1k	±2%	0,1W	SMD	3513 999 80224	
R324	3k9	±2%	0,1W	SMD	3513 999 80231	
R325	5k6	±2%	0,1W	SMD	3513 999 80233	
R326	1k2	±2%	0,1W	SMD	3513 999 80225	
R327	22	±2%	0,1W	SMD	3513 999 80204	
R328	1k	±2%	0,1W	SMD	3513 999 80224	
R329	680	±2%	0,1W	SMD	3513 999 80222	
R330	6k8	±2%	0,1W	SMD	3513 999 80234	
R331,332	10k	±2%	0,1W	SMD	3513 999 80236	
R333	1M	±2%	0,1W	SMD	3513 999 80260	
R334	3k9	±2%	0,1W	SMD	3513 999 80231	
R335	22k	±2%	0,1W	SMD	3513 999 80240	
R337,338	10k	±2%	0,1W	SMD	3513 999 80236	
R339	22k	±2%	0,1W	SMD	3513 999 80240	
R340	10k	±2%	0,1W	SMD	3513 999 80236	
R347	1k5	±2%	0,1W	SMD	3513 999 80226	
R348	10k	±2%	0,1W	SMD	3513 999 80236	
R357,358	10k	±2%	0,1W	SMD	3513 999 80236	
R360	10k	±2%	0,1W	SMD	3513 999 80236	
R361	12k	±2%	0,1W	SMD	3513 999 80237	
R364-371	10k	±2%	0,1W	SMD	3513 999 80236	
R372	1M	±2%	0,1W	SMD	3513 999 80260	
R398	10k	±2%	0,1W	SMD	3513 999 80236	
R399	680	±2%	0,1W	SMD	3513 999 80222	
R401	56	±2%	0,1W	SMD	3513 999 80209	
R402	2k7	±2%	0,1W	SMD	3513 999 80229	
R403,404	1k	±2%	0,1W	SMD	3513 999 80224	
R405	100	±2%	0,1W	SMD	3513 999 80212	
R406	1k	±2%	0,1W	SMD	3513 999 80224	
R408	220	±2%	0,1W	SMD	3513 999 80216	
R409	470k	±2%	0,1W	SMD	3513 999 80256	
R410	3k9	±2%	0,1W	SMD	3513 999 80231	
R411	560	±2%	0,1W	SMD	3513 999 80221	
R412	1k	±2%	0,1W	SMD	3513 999 80224	
R413	8k2	±2%	0,1W	SMD	3513 999 80235	
R414-416	470	±2%	0,1W	SMD	3513 999 80220	
R417	2k2	±2%	0,1W	SMD	3513 999 80228	
R418	100	±2%	0,1W	SMD	3513 999 80212	
R419	22k	±2%	0,1W	SMD	3513 999 80240	
R420	47	±2%	0,1W	SMD	3513 999 80208	
R421,422	10k	±2%	0,1W	SMD	3513 999 80236	
R423	3k3	±2%	0,1W	SMD	3513 999 80230	
R427	470	±2%	0,1W	SMD	3513 999 80220	
R428	330	±2%	0,1W	SMD	3513 999 80218	

Cct Ref	Description				Part No	Remarks
Resistors (Cont'd)						
R429	390	±2%	0,1W	SMD	3513 999 80219	
R430	220	±2%	0,1W	SMD	3513 999 80216	
R431-433	1k	±2%	0,1W	SMD	3513 999 80224	
R434	2k2	±2%	0,1W	SMD	3513 999 80228	
R436	330	±2%	0,1W	SMD	3513 999 80218	
R437	22k	±2%	0,1W	SMD	3513 999 80240	
R438	220	±2%	0,1W	SMD	3513 999 80216	
R439	22k	±2%	0,1W	SMD	3513 999 80240	
R440	2k2	±2%	0,1W	SMD	3513 999 80228	
R441	100	±2%	0,1W	SMD	3513 999 80212	
R442	33	±2%	0,1W	SMD	3513 999 80206	
R443	680	±2%	0,1W	SMD	3513 999 80222	
R444	5k6	±2%	0,1W	SMD	3513 999 80233	
R445	1k	±2%	0,1W	SMD	3513 999 80224	
R446	220	±2%	0,1W	SMD	3513 999 80216	
R447	5k6	±2%	0,1W	SMD	3513 999 80233	
R448,449	680	±2%	0,1W	SMD	3513 999 80222	
R450	180	±2%	0,1W	SMD	3513 999 80215	
R451,452	10k	±2%	0,1W	SMD	3513 999 80236	
R453	1k5	±2%	0,1W	SMD	3513 999 80226	
R454	680	±2%	0,1W	SMD	3513 999 80222	
R455	33	±2%	0,1W	SMD	3513 999 80206	
R456,457	150	±2%	0,1W	SMD	3513 999 80214	
R458	5k6	±2%	0,1W	SMD	3513 999 80233	
R459	1k5	±2%	0,1W	SMD	3513 999 80226	
R460	220	±2%	0,1W	SMD	3513 999 80216	
R461	10k	±2%	0,1W	SMD	3513 999 80236	
R462	33	±2%	0,1W	SMD	3513 999 80206	
R464	180	±2%	0,1W	SMD	3513 999 80215	
R465	100	±2%	0,1W	SMD	3513 999 80212	
R466-468	22k	±2%	0,1W	SMD	3513 999 80240	
R469,470	10k	±2%	0,1W	SMD	3513 999 80236	
R471	270k	±2%	0,1W	SMD	3513 999 80253	
R472	6k8	±2%	0,1W	SMD	3513 999 80234	
R473	10k	±25%	Pot Cermet		3513 999 95007	
R474	100k	±2%	0,1W	SMD	3513 999 80248	
R478	6k8	±2%	0,1W	SMD	3513 999 80234	
R479	100	±2%	0,1W	SMD	3513 999 80212	
R480	47	±2%	0,1W	SMD	3513 999 80208	
R482	39	±2%	0,1W	SMD	3513 999 80207	
R484	47	±2%	0,1W	SMD	3513 999 80208	
R485	220	±2%	0,1W	SMD	3513 999 80216	
R486	10k	±2%	0,1W	SMD	3513 999 80236	
R487	470	±2%	0,1W	SMD	3513 999 80220	
R488	150	±2%	0,1W	SMD	3513 999 80214	
R489	100	±2%	0,1W	SMD	3513 999 80212	
R491	10k	±2%	0,1W	SMD	3513 999 80236	
R492	47k	±2%	0,1W	SMD	3513 999 80244	
R493	10k	±2%	0,1W	SMD	3513 999 80236	
R501	1k	±2%	0,1W	SMD	3513 999 80224	
R502	820k	±2%	0,1W	SMD	3513 999 80259	
R503	680	±2%	0,1W	SMD	3513 999 80222	
R504	470k	±2%	0,1W	SMD	3513 999 80256	
R505	100	±2%	0,1W	SMD	3513 999 80212	
R506	56k	±2%	0,1W	SMD	3513 999 80245	
R507	Thermistor ptc 70°C				PL23137	
R508	4Ω7	±5%	0,125W	SMD	3513 999 80008	
R509	100k	±2%	0,1W	SMD	3513 999 80248	
R510	100	±2%	0,1W	SMD	3513 999 80212	
R511	470	±2%	0,1W	SMD	3513 999 80220	
R512	15k	±2%	0,1W	SMD	3513 999 80238	
R513	3k3	±2%	0,1W	SMD	3513 999 80230	
R514-516	10k	±2%	0,1W	SMD	3513 999 80236	
R517	6k8	±2%	0,1W	SMD	3513 999 80234	
R519	3k3	±2%	0,1W	SMD	3513 999 80230	
R522	1k	±2%	0,1W	SMD	3513 999 80224	
R524	470	±2%	0,1W	SMD	3513 999 80220	
R525	390	±2%	0,1W	SMD	3513 999 80219	
R533	10k	±2%	0,1W	SMD	3513 999 80236	
R540	220	±2%	0,1W	SMD	3513 999 80216	
R543-545	4Ω7	±5%	0,125W	SMD	3513 999 80008	
R601	10k	±2%	0,1W	SMD	3513 999 80236	
R602	1k	±2%	0,1W	SMD	3513 999 80224	
R603-606	10k	±2%	0,1W	SMD	3513 999 80236	
R609	1k	±2%	0,1W	SMD	3513 999 80224	
R610	10k	±2%	0,1W	SMD	3513 999 80236	

Cct Ref	Description				Part No	Remarks
Resistors (Cont'd)						
R611,612	180	±2%	0,1W	SMD	3513 999 80215	
R613	33	±2%	0,1W	SMD	3513 999 80206	
R614,615	22	±2%	0,1W	SMD	3513 999 80204	
R616	680	±2%	0,1W	SMD	3513 999 80222	
R620,621	10k	±2%	0,1W	SMD	3513 999 80236	
R624	10k	±2%	0,1W	SMD	3513 999 80236	
R626	270	±2%	0,1W	SMD	3513 999 80217	
R627	10	±2%	0,1W	SMD	3513 999 80200	
R629	10k	±2%	0,1W	SMD	3513 999 80236	
R630	47	±2%	0,1W	SMD	3513 999 80208	
R631,632	2k7	±2%	0,1W	SMD	3513 999 80229	
R636,637	10k	±2%	0,1W	SMD	3513 999 80236	
R639	1k	±2%	0,1W	SMD	3513 999 80224	
R640	2k7	±2%	0,1W	SMD	3513 999 80229	
R642	10k	±2%	0,1W	SMD	3513 999 80236	
R645	22	±2%	0,1W	SMD	3513 999 80204	
R646	220	±2%	0,1W	SMD	3513 999 80216	
R647	68	±2%	0,1W	SMD	3513 999 80210	
R648,649	6Ω8	±5%	0,25W	c film	PM01410	
Capacitors						
C101	47n	±10%	50V	SMD	3513 999 55013	
C102	10	±10%	16V	SMD	3513 999 65067	
C103	47n	±10%	50V	SMD	3513 999 55013	
C104,105	1n	±10%	50V	SMD	3513 999 55459	
C106	180p	±5%		Cer	3513 991 06056	
C107	0p8-10pf		variable		4313 326 10081	
C108	56p	±5%	50V	SMD	3513 999 55322	
C109	82p	±5%	50V	SMD	3513 999 55324	
C110	47n	±10%	50V	SMD	3513 999 55013	
C111-113	10	±20%	50V	elec	PS99436	
C114	47n	±10%	50V	SMD	3513 999 55013	
C115	10	±20%	50V	elec	PS99436	
C116	10n	±10%	50V	SMD	3513 999 55471	
C117	100n	±10%	50V	SMD	3513 999 55498	
C118,119	47n	±10%	50V	SMD	3513 999 55013	
C120	10	±20%	50V	elec	PS99436	
C121	47n	±10%	50V	SMD	3513 999 55013	
C122,123	100n	±10%	50V	SMD	3513 999 55498	
C124	47n	±10%	50V	SMD	3513 999 55013	
C125	1n	±10%	50V	SMD	3513 999 55459	
C126	10	±20%	50V	elec	PS99436	
C127,128	10n	±10%	50V	SMD	3513 999 55471	
C129	180p	±5%		Cer	3513 991 06056	
C301	10	±20%	50V	elec	PS99436	
C302	100n	±10%	50V	SMD	3513 999 55498	
C303	1	±20%	100V	elec	PS99455	
C304	100n	±10%	50V	SMD	3513 999 55498	
C305	10	±20%	50V	elec	PS99436	
C306	1n5	±10%	50V	SMD	3513 999 55461	
C307	100n	±10%	50V	SMD	3513 999 55498	
C309	18p	±5%	50V	SMD	3513 999 55316	
C311	56p	±5%	50V	SMD	3513 999 55322	
C312	33p	±5%	50V	SMD	3513 999 55319	
C313	27p	±5%	50V	SMD	3513 999 55318	
C315	68p	±5%	50V	SMD	3513 999 55323	
C316	27p	±5%	50V	SMD	3513 999 55318	
C317	22p	±5%	50V	SMD	3513 999 55317	
C318,319	1n	±10%	50V	SMD	3513 999 55459	
C320	1n5	±10%	50V	SMD	3513 999 55461	
C321	100n	±10%	50V	SMD	3513 999 55498	
C322	22p	±5%	50V	SMD	3513 999 55317	
C323	10p	±5%	50V	SMD	3513 999 55313	
C324	10	±20%	50V	elec	PS99436	
C325	1n5	±10%	50V	SMD	3513 999 55461	
C326	10	±20%	50V	elec	PS99436	
C327	39p	±5%	50V	SMD	3513 999 55320	
C328	100p	±5%	50V	SMD	3513 999 55325	
C329	1n	±10%	50V	SMD	3513 999 55459	
C330	100n	±10%	50V	SMD	3513 999 55498	
C331,332	1n5	±10%	50V	SMD	3513 999 55461	
C333	10	±20%	50V	elec	PS99436	
C334,335	220p	±5%	50V	SMD	3513 999 55329	
C336	100p	±5%	50V	SMD	3513 999 55325	
C348-350	1n	±10%	50V	SMD	3513 999 55459	

Cct Ref	Description				Part No	Remarks
Capacitors (Cont'd)						
C351	47n	±10%	50V	SMD	3513 999 55013	
C352	10	±10%	16V	SMD	3513 999 65067	
C354	56p	±5%	50V	SMD	3513 999 55322	
C355	1n2	±10%	50V	SMD	3513 999 55460	
C356	47n	±10%	50V	SMD	3513 999 55013	
C357	47	±20%	25V	elec	PS99423	
C358	1n5	±10%	50V	SMD	3513 999 55461	
C359	270n	±10%	50V	SMD	3513 999 55022	
C360	47n	±10%	50V	SMD	3513 999 55013	
C361	10	±10%	16V	SMD	3513 999 65067	
C364	1n	±10%	50V	SMD	3513 999 55459	
C365	10p	±5%	50V	SMD	3513 999 55313	
C366-368	100n	±10%	50V	SMD	3513 999 55498	
C369	1n	±10%	50V	SMD	3513 999 55459	
C370	15n	±10%	50V	SMD	3513 999 55472	
C371,372	10n	±10%	50V	SMD	3513 999 55471	
C373	270n	±10%	50V	SMD	3513 999 55022	
C374	10n	±10%	50V	SMD	3513 999 55471	
C376	100p	±5%	50V	SMD	3513 999 55325	
C377	10n	±10%	50V	SMD	3513 999 55471	
C378	10	±10%	16V	SMD	3513 999 65067	
C380	270n	±10%	50V	SMD	3513 999 55022	
C381	68p	±5%	50V	SMD	3513 999 55323	
C383	100n	±10%	50V	SMD	3513 999 55498	
C399	33p	±5%	50V	SMD	3513 999 55319	
C401	100p	±5%	50V	SMD	3513 999 55325	
C402	82p	±5%	50V	SMD	3513 999 55324	
C403	150p	±5%	50V	SMD	3513 999 55327	
C404	15p	±5%	50V	SMD	3513 999 55315	
C406	100p	±5%	50V	SMD	3513 999 55325	
C407	15p	±5%	50V	SMD	3513 999 55315	
C408	150p	±5%	50V	SMD	3513 999 55327	
C409	82p	±5%	50V	SMD	3513 999 55324	
C410	1n	±10%	50V	SMD	3513 999 55459	
C411	10	±20%	50V	elec	PS99436	
C412	47n	±10%	50V	SMD	3513 999 55013	
C413	100n	±10%	50V	SMD	3513 999 55498	
C414	10	±20%	50V	elec	PS99436	
C415	1	±20%	100V	elec	PS99455	
C416	180p	±5%	50V	SMD	3513 999 55328	
C417	10	±10%	16V	SMD	3513 999 65067	
C418	330p	±5%	50V	SMD	3513 999 55331	
C419	100n	±10%	50V	SMD	3513 999 55498	
C420	15p	±5%	50V	SMD	3513 999 55315	
C421	10	±20%	50V	elec	PS99436	
C425-427	1n2	±10%	50V	SMD	3513 999 55460	
C428	6p8	±0p5	50V	SMD	3513 999 55311	
C429	100n	±10%	50V	SMD	3513 999 55498	
C430	1n5	±10%	50V	SMD	3513 999 55461	
C431	47n	±10%	50V	SMD	3513 999 55013	
C432-434	10	±20%	50V	elec	PS99436	
C435	100n	±10%	50V	SMD	3513 999 55498	
C436	10	±20%	50V	elec	PS99436	
C437	1	±20%	100V	elec	PS99455	
C438	100n	±10%	50V	SMD	3513 999 55498	
C439	2n2	±10%	50V	SMD	3513 999 55463	
C440	10	±20%	50V	elec	PS99436	
C441	100n	±10%	50V	SMD	3513 999 55498	
C442	100n	±10%	50V	SMD	3513 999 55498	
C443	56p	±5%	50V	SMD	3513 999 55322	
C444	68p	±5%	50V	SMD	3513 999 55323	
C445	18p	±5%	50V	SMD	3513 999 55316	
C446	68p	±5%	50V	SMD	3513 999 55323	
C447	1n	±10%	50V	SMD	3513 999 55459	
C448,449	22p	±5%	50V	SMD	3513 999 55317	
C450	1n	±10%	50V	SMD	3513 999 55459	
C451	10	±10%	16V	SMD	3513 999 65067	
C452	18p	±5%	50V	SMD	3513 999 55316	
C453	10	±20%	50V	elec	PS99436	
C454	100n	±10%	50V	SMD	3513 999 55498	
C455	5p6	±0p5	50V	SMD	3513 999 55310	
C456	10	±20%	50V	elec	PS99436	
C457	2n2	±10%	50V	SMD	3513 999 55463	
C458	100n	±10%	50V	SMD	3513 999 55498	
C459	10	±20%	50V	elec	PS99436	
C460	100n	±10%	50V	SMD	3513 999 55498	

Cct Ref	Description				Part No	Remarks
Capacitors (Cont'd)						
C461	2n2	±10%	50V	SMD	3513 999 55463	
C462	6p8	±0p5	50V	SMD	3513 999 55311	
C463	1n	±10%	50V	SMD	3513 999 55459	
C464	10	±20%	50V	elec	PS99436	
C465	10p	±5%	50V	SMD	3513 999 55313	
C466	10	±20%	50V	elec	PS99436	
C467	2n2	±10%	50V	SMD	3513 999 55463	
C469	1n5	±10%	50V	SMD	3513 999 55461	
C471	10	±20%	50V	elec	PS99436	
C474	82p	±5%	50V	SMD	3513 999 55324	
C475	2n2	±10%	50V	SMD	3513 999 55463	
C476	18p	±5%	50V	SMD	3513 999 55316	
C477	100n	±10%	50V	SMD	3513 999 55498	
C478	22p	±5%	50V	SMD	3513 999 55317	
C479	10n	±10%	50V	SMD	3513 999 55471	
C480	1n	±10%	50V	SMD	3513 999 55459	
C481-483	100n	±10%	50V	SMD	3513 999 55498	
C484,485	10	±20%	50V	elec	PS99436	
C486	100n	±10%	50V	SMD	3513 999 55498	
C487	6p8	±0p5	50V	SMD	3513 999 55311	
C488	15n	±10%	50V	SMD	3513 999 55472	
C490	100p	±5%	50V	SMD	3513 999 55325	
C491	3n3	±10%	50V	SMD	3513 999 55465	
C492	100p	±5%	50V	SMD	3513 999 55325	
C493	22n	±10%	50V	SMD	3513 999 55010	
C494	10	±20%	50V	elec	PS99436	
C497	2n2	±10%	50V	SMD	3513 999 55463	
C499	10n	±10%	50V	SMD	3513 999 55471	
C501	100n	±10%	50V	SMD	3513 999 55498	
C503,504	22	±20%	25V	elec	3513 991 00079	
C505	1	±20%	100V	elec	PS99455	
C506	100	±20%	25V	elec	3513 991 00081	
C507	100n	±10%	50V	SMD	3513 999 55498	
C508	1n	±10%	50V	SMD	3513 999 55459	
C509	270n	±10%	50V	SMD	3513 999 55022	
C511-534	100p	±5%	50V	SMD	3513 999 55325	
C535	100n	±10%	50V	SMD	3513 999 55498	
C537	47p	±5%	50V	SMD	3513 999 55321	
C538	10	±20%	50V	elec	PS99436	
C539	47p	±5%	50V	SMD	3513 999 55321	
C540	22	±20%	100V	elec	PS99456	
C541,542	47p	±5%	50V	SMD	3513 999 55321	
C543	100p	±5%	50V	SMD	3513 999 55325	
C544-550	10n	±10%	50V	SMD	3513 999 55471	
C554-563	10n	±10%	50V	SMD	3513 999 55471	
C568,569	10n	±10%	50V	SMD	3513 999 55471	
C570	1n	±10%	50V	SMD	3513 999 55459	
C601	22p	±5%	50V	SMD	3513 999 55317	
C602	100n	±10%	50V	SMD	3513 999 55498	
C603	1n	±10%	50V	SMD	3513 999 55459	
C604	27p	±5%	50V	SMD	3513 999 55318	
C605	47p	±5%	50V	SMD	3513 999 55321	
C606	120p	±5%	50V	SMD	3513 999 55326	
C607	56p	±5%	50V	SMD	3513 999 55322	
C608	100n	±10%	50V	SMD	3513 999 55498	
C609	1n	±10%	50V	SMD	3513 999 55459	
C610	18p	±5%	50V	SMD	3513 999 55316	
C611	1n	±10%	50V	SMD	3513 999 55459	
C612	47p	±5%	50V	SMD	3513 999 55321	
C613	5p5-50p		variable	PCB mtg	PV99007	
C614	27p	±5%	50V	SMD	3513 999 55318	
C615	220p	±5%	50V	SMD	3513 999 55329	
C616	27p	±5%	50V	SMD	3513 999 55318	
C617	1	±20%	100V	elec	PS99455	
C618,619	100n	±10%	50V	SMD	3513 999 55498	
C620	220p	±5%	50V	SMD	3513 999 55329	
C621	10n	±10%	50V	SMD	3513 999 55471	
C622	22p	±5%	50V	SMD	3513 999 55317	
C624	1n	±10%	50V	SMD	3513 999 55459	
C627	47	±20%	25V	elec	PS99423	
C628	100n	±10%	50V	SMD	3513 999 55498	
C629	1n	±10%	50V	SMD	3513 999 55459	
C630	1	±20%	100V	elec	PS99455	
C632	1n5	±10%	50V	SMD	3513 999 55461	
C634	220p	±5%	50V	SMD	3513 999 55329	
C635	8p5-40p		variable		35313 999 70006	

Cct Ref	Description	Part No	Remarks
Capacitors (Cont'd)			
C636	27p ±5% 50V SMD	3513 999 55318	
C637	4p7 ±0p25 50V SMD	3513 999 55309	
C638	3p3 ±0p25 50V SMD	3513 999 55307	
C639	27p ±5% 50V SMD	3513 999 55318	
C641	47p ±5% 50V SMD	3513 999 55321	
C642	12p ±5% 50V SMD	3513 999 55314	
C643	47p ±5% 50V SMD	3513 999 55321	
C644	22p ±5% 50V SMD	3513 999 55317	
C645-648	100n ±10% 50V SMD	3513 999 55498	
C650	10p ±5% 50V SMD	3513 999 55313	
C651	2p2 ±0p25 50V SMD	3513 999 55305	
C652	1 ±20% 100V elec	PS99455	
C654,655	1n ±10% 50V SMD	3513 999 55459	
C657	1n5 ±10% 50V SMD	3513 999 55461	
C660,661	1n ±10% 50V SMD	3513 999 55459	
C663	12p ±5% 50V SMD	3513 999 55314	
C664-667	100n ±10% 50V SMD	3513 999 55498	
C680-685	10n ±10% 50V SMD	3513 999 55471	
C4100	18p ±5% 50V SMD	3513 999 55316	
C4101	100n ±10% 50V SMD	3513 999 55498	
C4106	100n ±10% 50V SMD	3513 999 55498	
C4107	2n2 ±10% 50V SMD	3513 999 55463	
Inductors			
L101,102	Choke 100µh ±10%	3513 993 22553	
L301	Inductor 1µh ±20% SMD	3513 999 98089	
L302	Inductor 220nh ±20% SMD	3513 999 98086	
L303	Coil	2422 549 40727	
L304	Inductor 10µh ±10% SMD	3513 999 98123	
L305	Inductor 220nh ±20% SMD	3513 999 98086	
L306	Inductor 1µh ±20% SMD	3513 999 98089	
L307,308	Inductor 100nh ±20% SMD	3513 999 98084	
L313,314	Choke 100µh ±10%	3513 993 22553	
L315	Choke 0µ22 ±10%	3513 993 22546	
L316	Inductor 100nh ±20% SMD	3513 999 98084	
L401,402	Inductor 1µh ±20% SMD	3513 999 98089	
L403	Inductor 2µ2 ±20% SMD	3513 999 98090	
L404	Inductor 680nh ±20% SMD	3513 999 98088	
L405-407	Inductor 1000µh ±10% SMD	3513 999 98125	
L408	Inductor 3µ3 ±10% SMD	3513 999 98123	
L409	Coil	2422 549 40728	
L410	Inductor 150nh ±20% SMD	3513 999 98085	
L411	Inductor 680nh ±20% SMD	3513 999 98088	
L412	Inductor 150nh ±20% SMD	3513 999 98085	
L413	Inductor 680nh ±20% SMD	3513 999 98088	
L414	Inductor 150nh ±20% SMD	3513 999 98085	
L415-417	Choke 100µh ±10%	3513 993 22553	
L418	Inductor 3µh3 ±20% SMD	3513 999 98099	
L419	Inductor 3µ3 ±10%	3513 999 98123	
L420	Choke 100µh ±10%	3513 993 22553	
L501	Bead 6-hole ferroxcube	4312 020 36700	
L504	Bead 6-hole ferroxcube	4312 020 36700	
L502-513	Inductor 220nh ±20% SMD	3513 999 98086	
L601	Choke assy toroidal	3513 509 00691	
L602	Inductor 47nh ±20% SMD	3513 999 98081	
L603	Inductor 15nh ±20% SMD	3513 999 98078	
L604	Coil	3513 509 01461	
L605	Coil	3513 509 01451	
L606	Coil	3513 509 01441	
L607,608	Choke RF min 1µh ±10%	FT99102	
L609	Coil	3513 509 01431	
L610	Coil	3513 509 01491	
L611	Coil	3513 509 01431	
L612,613	Inductor 10µh ±10%	3513 999 98123	
L614	Coil	3513 509 01421	
Miscellaneous			
XL1	Crystal 10Mhz	3513 900 60521	
	Bracket Antenna	3513 900 40151	
	Bush Ins(TO-220)	3513 990 16014	1/IC502,503,603
	Cover Screen	3513 901 10251	
	Hdr str male 2-pos'n	FC00837/02	
	Hdr str male 7-pos'n	FC00837/07	
	Heatsink plate assembly	3513 504 03991	

Cct Ref	Description	Part No	Remarks
Miscellaneous (Cont'd)			
	Heatsink plate antenna skt	3513 902 30341	
	Heatsink plate PA	3513 902 30351	
	Holder Crystal Oven	BT45165	
	Link Connector	FC99060	
	Nut st Hex M2,5	QA11604/X	
	Plug PCB mtd straight 2 x 7	FP99290	
	Retainer	BT48026	1/Xtal Oven
	Scr pan pozi M2,5 x 6mm Bt Ni	2522 178 16038	1/IC502,503,603; 1/TR606
	Scr st pan pozi M2,5 x 8mm	QJ11946/X	1/Oven 2/15-way socket
	Scr st tap pozi No.4 x 4,5mm	QJ08227/X	8/VCO covers
	Screen PA	3513 906 20131	
	Screen VCO	3513 906 20121	2/
	Skt BNC type	FS43779	
	Skt 'D' type rt angle 15-way	FS42136	
	Skt Dil 28-way	FS99148	1/IC305
	Washer Compression	QA99040	1/TR606
	Washer Insulating TO-126	QA99016	1/TR502,606
	Washer Thermal TO-220	3513 990 16254	1/IC502,503,603

PCB ASSEMBLY TX DRIVER UHF
AT29077/05

Semiconductors & ICs

IC101	IC 74HC4046	SMD	3513 999 50060
IC102	IC 74HC14-HDL	SMD	3513 999 50056
IC103	IC 74HC4024	SMD	3513 999 50038
IC302	IC MB501LFP 2-MODL		3508 100 16310
IC303	IC TL072ID	SMD	9338 369 30685
IC304	IC NJ88206G	SMD	4313 324 70001
IC305	Prom assy programmed		AT60171
IC306	IC 74HC574	SMD	3513 999 50027
IC307	IC 74HC688	SMD	3513 999 50034
IC308	IC 74HC126	SMD	3513 999 50069
IC309	Res 9-pin sil 10k ±5%		RN99528
IC401	IC 74HC404 6	SMD	3513 999 50060
IC402	IC 74HC4024	SMD	3513 999 50038
IC403	IC TL072ID	SMD	9338 369 30685
IC404	Mixer RMS1	SMD	2722 162 90133
IC501	IC LM258	SMD	3513 999 45008
IC502	IC 7812 Volt Reg & Fix		FU99109
IC503	IC 7805 Volt Reg & Fix		3513 993 34014
IC504	IC LM324-HDL	SMD	3513 999 45005
IC601	IC LM324-HDL	SMD	3513 999 45005
IC602	IC 74HC00	SMD	3513 999 50000
IC603	IC LM317	SMD	FU99119
TR101	Transistor BFT92	SMD	3513 999 00010
TR102,103	Transistor BFR93	SMD	3513 999 00027
TR104,105	Transistor BCW72	SMD	3513 999 00015
TR106	Transistor BFR93	SMD	3513 999 00027
TR301	Transistor BCV62	SMD	9336 772 30215
TR302	Transistor BCW72	SMD	3513 999 00015
TR303-308	Transistor BFR93	SMD	3513 999 00027
TR401	Transistor BCW70	SMD	3513 999 00003
TR402	Transistor BFR93	SMD	3513 999 00027
TR404	Transistor BCV62	SMD	9336 772 30215
TR406	Transistor BFQ17	SMD	3513 999 00022
TR407-412	Transistor BCW72	SMD	3513 999 00015
TR413	Transistor BCW70	SMD	3513 999 00003
TR414	Transistor BFT92	SMD	3513 999 00010
TR415,416	Transistor BCW72	SMD	3513 999 00015
TR417	Transistor BFR93	SMD	3513 999 00027
TR418	Transistor BCV62	SMD	9336 772 30215
TR420	Transistor BFR93	SMD	3513 999 00027
TR421	Transistor SMD BF992		9336 150 00115
TR422-424	Transistor BFR93	SMD	3513 999 00027
TR425	Transistor BCW72	SMD	3513 999 00015
TR426	Transistor BCW70	SMD	3513 999 00003
TR427	Transistor BCW72	SMD	3513 999 00015
TR428	Transistor BCV62	SMD	9336 772 30215
TR429	Transistor BCW72	SMD	3513 999 00015
TR501	Transistor BCW72	SMD	3513 999 00015
TR502	Transistor BD437 Power GP		FV05887
TR503,504	Transistor BCX19		3513 999 00016
TR505	Transistor BCW70	SMD	3513 999 00003
TR506-508	Transistor BCW72	SMD	3513 999 00015

Cct Ref	Description	Part No.	Remarks
Semiconductors & ICs (Cont'd)			
TR601-603	Transistor BCW72 SMD	3513 999 00015	
TR604	Transistor MRF559	9337 939 60682	
TR605	Transistor BCW72 SMD	3513 999 00015	
TR606	Transistor BD437	FV05887	
TR607	Transistor BLU99 UHF POWER	9336 678 40112	
TR608	Transistor BCW72 SMD	3513 999 00015	
D101	Diode BBY31 SMD	3513 999 25000	
D102,103	Diode BAV99 SMD	3513 999 15002	
D105	Diode BAV99 SMD	3513 999 15002	
D301,302	Diode BBY31 SMD	3513 999 25000	
D303	Diode BAV99 SMD	3513 999 15002	
D305,306	Diode BAV99 SMD	3513 999 15002	
D307	Diode BBY31 SMD	3513 999 25000	
D401	Diode BAT17	3513 999 15006	
D402	Diode BAV99 SMD	3513 999 15002	
D404	Diode BZX84C2V7	3513 999 20001	
D405,406	Diode BAV99 SMD	3513 999 15002	
D407	Diode BAT17	3513 999 15006	
D409	Diode BAV99 SMD	3513 999 15002	
D410	Diode BBY31 SMD	3513 999 25000	
D412	Diode BAV99 SMD	3513 999 15002	
D414,415	Diode BBY31 SMD	3513 999 25000	
D418,419	Diode HSMP-3820	9313 000 03683	
D420,421	Diode BAV99 SMD	3513 999 15002	
D501,502	Diode BAV99 SMD	3513 999 15002	
D503	Led green MV5474C	3513 993 47002	
D504	Diode BZX84C6V8	3513 999 20011	
D505	Diode BZX84C2V7	3513 999 20001	
D506,507	Diode BAV99 SMD	3513 999 15002	
D508,509	Diode BAW56	3513 999 15001	
D510	Diode BZX84C6V2 M C	3513 999 20010	
D511	Diode BAV99 SMD	3513 999 15002	
D512	Led green MV5474C	3513 993 47002	
D513	Diode BAV99 SMD	3513 999 15002	
D514	Led red	3513 993 46000	
D601	Diode BAW56	3513 999 15001	
D603	Diode BAV99 SMD	3513 999 15002	
D604	Diode BZX84C8V2	3513 999 20013	
D605	Diode BZX84C5V6	3513 999 20009	
D606	Diode BZX84C6V8	3513 999 20011	
D607,608	Diode BAT17	3513 999 15006	
D609	Led red	3513 993 46000	
D610	Diode BZX84C8V2	3513 999 20013	
Resistors			
R101	820 ±2% 0,1W SMD	3513 999 80223	
R102	12k ±2% 0,1W SMD	3513 999 80237	
R103	680 ±2% 0,1W SMD	3513 999 80222	
R104	100 ±2% 0,1W SMD	3513 999 80212	
R105,106	1k ±2% 0,1W SMD	3513 999 80224	
R107	3k9 ±2% 0,1W SMD	3513 999 80231	
R108	820 ±2% 0,1W SMD	3513 999 80223	
R109	100 ±2% 0,1W SMD	3513 999 80212	
R110,111	470 ±2% 0,1W SMD	3513 999 80220	
R112	10k ±2% 0,1W SMD	3513 999 80236	
R114	47k ±2% 0,1W SMD	3513 999 80244	
R115	120 ±2% 0,1W SMD	3513 999 80213	
R116,117	4k7 ±2% 0,1W SMD	3513 999 80232	
R118	100k ±2% 0,1W SMD	3513 999 80248	
R119	2k2 ±2% 0,1W SMD	3513 999 80228	
R120	4k7 ±2% 0,1W SMD	3513 999 80232	
R121,122	2k2 ±2% 0,1W SMD	3513 999 80228	
R123	820 ±2% 0,1W SMD	3513 999 80223	
R127	1k ±2% 0,1W SMD	3513 999 80224	
R128	6k8 ±2% 0,1W SMD	3513 999 80234	
R129	1k8 ±2% 0,1W SMD	3513 999 80227	
R130	47 ±2% 0,1W SMD	3513 999 80208	
R131	390 ±2% 0,1W SMD	3513 999 80219	
R132	1k ±2% 0,1W SMD	3513 999 80224	
R133	4k7 ±2% 0,1W SMD	3513 999 80232	
R134	100 ±2% 0,1W SMD	3513 999 80212	
R135	1k ±2% 0,1W SMD	3513 999 80224	
R136	10k ±2% 0,1W SMD	3513 999 80236	
R301	22 ±2% 0,1W SMD	3513 999 80204	
R302	100 ±2% 0,1W SMD	3513 999 80212	

Cct Ref	Description				Part No.	Remarks
Resistors (Cont'd)						
R303	2k2	±2%	0,1W	SMD	3513 999 80228	
R304	22k	±2%	0,1W	SMD	3513 999 80240	
R305,306	3k3	±2%	0,1W	SMD	3513 999 80230	
R307	1k8	±2%	0,1W	SMD	3513 999 80227	
R308	100	±2%	0,1W	SMD	3513 999 80212	
R309	100k	±2%	0,1W	SMD	3513 999 80248	
R310	27	±2%	0,1W	SMD	3513 999 80205	
R311	22	±2%	0,1W	SMD	3513 999 80204	
R312	82	±2%	0,1W	SMD	3513 999 80211	
R313	270	±2%	0,1W	SMD	3513 999 80217	
R314,315	3k9	±2%	0,1W	SMD	3513 999 80231	
R316	120	±2%	0,1W	SMD	3513 999 80213	
R317,318	68	±2%	0,1W	SMD	3513 999 80210	
R319	560	±2%	0,1W	SMD	3513 999 80221	
R320	22	±2%	0,1W	SMD	3513 999 80204	
R321	27	±2%	0,1W	SMD	3513 999 80205	
R322	82	±2%	0,1W	SMD	3513 999 80211	
R323	270	±2%	0,1W	SMD	3513 999 80217	
R324,325	3k9	±2%	0,1W	SMD	3513 999 80231	
R326	560	±2%	0,1W	SMD	3513 999 80221	
R327	330	±2%	0,1W	SMD	3513 999 80218	
R328	47	±2%	0,1W	SMD	3513 999 80208	
R329	18	±2%	0,1W	SMD	3513 999 80203	
R330	39k	±2%	0,1W	SMD	3513 999 80243	
R331,332	10k	±2%	0,1W	SMD	3513 999 80236	
R333	680k	±2%	0,1W	SMD	3513 999 80258	
R334	3k3	±2%	0,1W	SMD	3513 999 80230	
R335	22k	±2%	0,1W	SMD	3513 999 80240	
R336	6k8	±2%	0,1W	SMD	3513 999 80234	
R337,338	10k	±2%	0,1W	SMD	3513 999 80236	
R339	22k	±2%	0,1W	SMD	3513 999 80240	
R340	10k	±2%	0,1W	SMD	3513 999 80236	
R347	1k5	±2%	0,1W	SMD	3513 999 80226	
R348	10k	±2%	0,1W	SMD	3513 999 80236	
R357,358	10k	±2%	0,1W	SMD	3513 999 80236	
R360	10k	±2%	0,1W	SMD	3513 999 80236	
R361	12k	±2%	0,1W	SMD	3513 999 80237	
R363	100	±2%	0,1W	SMD	3513 999 80212	
R364-372	10k	±2%	0,1W	SMD	3513 999 80236	
R401	47	±2%	0,1W	SMD	3513 999 80208	
R402	56	±2%	0,1W	SMD	3513 999 80209	
R403	1k	±2%	0,1W	SMD	3513 999 80224	
R405	100	±2%	0,1W	SMD	3513 999 80212	
R404	2k7	±2%	0,1W	SMD	3513 999 80229	
R406,407	1k	±2%	0,1W	SMD	3513 999 80224	
R408	220	±2%	0,1W	SMD	3513 999 80216	
R409	10k	±2%	0,1W	SMD	3513 999 80236	
R410	3k9	±2%	0,1W	SMD	3513 999 80231	
R411	560	±2%	0,1W	SMD	3513 999 80221	
R412	1k	±2%	0,1W	SMD	3513 999 80224	
R413	8k2	±2%	0,1W	SMD	3513 999 80235	
R414-416	470	±2%	0,1W	SMD	3513 999 80220	
R417	2k2	±2%	0,1W	SMD	3513 999 80228	
R418	100	±2%	0,1W	SMD	3513 999 80212	
R419	22k	±2%	0,1W	SMD	3513 999 80240	
R420	47	±2%	0,1W	SMD	3513 999 80208	
R421,422	10k	±2%	0,1W	SMD	3513 999 80236	
R423	3k3	±2%	0,1W	SMD	3513 999 80230	
R427	470	±2%	0,1W	SMD	3513 999 80220	
R428	330	±2%	0,1W	SMD	3513 999 80218	
R429	680	±2%	0,1W	SMD	3513 999 80222	
R430	220	±2%	0,1W	SMD	3513 999 80216	
R431	1k	±2%	0,1W	SMD	3513 999 80224	
R433	1k	±2%	0,1W	SMD	3513 999 80224	
R434	820	±2%	0,1W	SMD	3513 999 80223	
R435	1k	±2%	0,1W	SMD	3513 999 80224	
R436	150	±2%	0,1W	SMD	3513 999 80214	
R437	22k	±2%	0,1W	SMD	3513 999 80240	
R438	100	±2%	0,1W	SMD	3513 999 80212	
R439	10k	±2%	0,1W	SMD	3513 999 80236	
R440	2k2	±2%	0,1W	SMD	3513 999 80228	
R441	100	±2%	0,1W	SMD	3513 999 80212	
R442	33	±2%	0,1W	SMD	3513 999 80206	
R443	10k	±2%	0,1W	SMD	3513 999 80236	
R444	5k6	±2%	0,1W	SMD	3513 999 80233	
R445	10k	±2%	0,1W	SMD	3513 999 80236	

Cct Ref	Description	Part No.	Remarks
Resistors (Cont'd)			
R446	220 ±2% 0,1W SMD	3513 999 80216	
R447	100 ±2% 0,1W SMD	3513 999 80212	
R448	82 ±2% 0,1W SMD	3513 999 80211	
R449	22 ±2% 0,1W SMD	3513 999 80204	
R450	220 ±2% 0,1W SMD	3513 999 80216	
R451,452	10k ±2% 0,1W SMD	3513 999 80236	
R453	33 ±2% 0,1W SMD	3513 999 80206	
R454	820 ±2% 0,1W SMD	3513 999 80223	
R455	39 ±2% 0,1W SMD	3513 999 80207	
R456,457	150 ±2% 0,1W SMD	3513 999 80214	
R458	5k6 ±2% 0,1W SMD	3513 999 80233	
R459	1k8 ±2% 0,1W SMD	3513 999 80227	
R460	270 ±2% 0,1W SMD	3513 999 80217	
R461	10k ±2% 0,1W SMD	3513 999 80236	
R462	33 ±2% 0,1W SMD	3513 999 80206	
R463	5k6 ±2% 0,1W SMD	3513 999 80233	
R464	150 ±2% 0,1W SMD	3513 999 80214	
R465	100 ±2% 0,1W SMD	3513 999 80212	
R466,467	22k ±2% 0,1W SMD	3513 999 80240	
R468	47k ±2% 0,1W SMD	3513 999 80244	
R469,470	10k ±2% 0,1W SMD	3513 999 80236	
R471	270k ±2% 0,1W SMD	3513 999 80253	
R472	6k8 ±2% 0,1W SMD	3513 999 80234	
R473	10k ±25% Pot Cermet	3513 999 95007	
R474	100k ±2% 0,1W SMD	3513 999 80248	
R478	5k6 ±2% 0,1W SMD	3513 999 80233	
R479	100 ±2% 0,1W SMD	3513 999 80212	
R480	47 ±2% 0,1W SMD	3513 999 80208	
R481	150 ±2% 0,1W SMD	3513 999 80214	
R485	220 ±2% 0,1W SMD	3513 999 80216	
R486	10k ±2% 0,1W SMD	3513 999 80236	
R487	470 ±2% 0,1W SMD	3513 999 80220	
R488	10k ±2% 0,1W SMD	3513 999 80236	
R489	47k ±2% 0,1W SMD	3513 999 80244	
R490	10k ±2% 0,1W SMD	3513 999 80236	
R501	1k ±2% 0,1W SMD	3513 999 80224	
R502	820k ±2% 0,1W SMD	3513 999 80259	
R503	680 ±2% 0,1W SMD	3513 999 80222	
R504	470k ±2% 0,1W SMD	3513 999 80256	
R505	100 ±2% 0,1W SMD	3513 999 80212	
R506	56k ±2% 0,1W SMD	3513 999 80245	
R507	Thermistor ptc 70°C	PL23137	
R508	4Ω7 ±5% 0,125W SMD	3513 999 80008	
R509	100k ±2% 0,1W SMD	3513 999 80248	
R510	100 ±2% 0,1W SMD	3513 999 80212	
R511	470 ±2% 0,1W SMD	3513 999 80220	
R512	15k ±2% 0,1W SMD	3513 999 80238	
R513	3k3 ±2% 0,1W SMD	3513 999 80230	
R514-516	10k ±2% 0,1W SMD	3513 999 80236	
R517	6k8 ±2% 0,1W SMD	3513 999 80234	
R518	1M ±2% 0,1W SMD	3513 999 80260	
R519	3k3 ±2% 0,1W SMD	3513 999 80230	
R520,521	100k ±2% 0,1W SMD	3513 999 80248	
R522	1k ±2% 0,1W SMD	3513 999 80224	
R523	3k9 ±2% 0,1W SMD	3513 999 80231	
R524	470 ±2% 0,1W SMD	3513 999 80220	
R525	390 ±2% 0,1W SMD	3513 999 80219	
R526	4k7 ±2% 0,1W SMD	3513 999 80232	
R527	100k ±2% 0,1W SMD	3513 999 80248	
R528	56k ±2% 0,1W SMD	3513 999 80245	
R529	39k ±2% 0,1W SMD	3513 999 80243	
R530	27k ±2% 0,1W SMD	3513 999 80241	
R531,532	4k7 ±2% 0,1W SMD	3513 999 80232	
R533	10k ±2% 0,1W SMD	3513 999 80236	
R534	47k ±2% 0,1W SMD	3513 999 80244	
R535	100k ±2% 0,1W SMD	3513 999 80248	
R536,537	2k2 ±2% 0,1W SMD	3513 999 80228	
R538,539	1k5 ±2% 0,1W SMD	3513 999 80226	
R540	220 ±2% 0,1W SMD	3513 999 80216	
R541,542	2k2 ±2% 0,1W SMD	3513 999 80228	
R543-545	4Ω7 ±5% 0,125W SMD	3513 999 80008	
R547	680k ±2% 0,1W SMD	3513 999 80258	
R601	10k ±2% 0,1W SMD	3513 999 80236	
R602	1k ±2% 0,1W SMD	3513 999 80224	
R603-606	10k ±2% 0,1W SMD	3513 999 80236	
R607	5k6 ±2% 0,1W SMD	3513 999 80233	

Cct Ref	Description				Part No.	Remarks
Resistors (Cont'd)						
R608	2k2	±2%	0,1W	SMD	3513 999 80228	
R609	1k	±2%	0,1W	SMD	3513 999 80224	
R610	10k	±2%	0,1W	SMD	3513 999 80236	
R612	22Ω	±5%	0,5W	carb	PM00009	
R613	4Ω7	±5%	0,125W	SMD	3513 999 80008	
R614	27	±2%	0,1W	SMD	3513 999 80205	
R615	10	±2%	0,1W	SMD	3513 999 80200	
R616	680	±2%	0,1W	SMD	3513 999 80222	
R617-619	33k	±2%	0,1W	SMD	3513 999 80242	
R620,621	10k	±2%	0,1W	SMD	3513 999 80236	
R622	10k	±25%	Pot Cermet		3513 999 95007	
R623	27k	±2%	0,1W	SMD	3513 999 80241	
R624	10k	±2%	0,1W	SMD	3513 999 80236	
R625	100k	±2%	0,1W	SMD	3513 999 80248	
R629	10k	±2%	0,1W	SMD	3513 999 80236	
R630	47	±2%	0,1W	SMD	3513 999 80208	
R631,632	2k7	±2%	0,1W	SMD	3513 999 80229	
R633	12k	±2%	0,1W	SMD	3513 999 80237	
R634	4k7	±2%	0,1W	SMD	3513 999 80232	
R635	15k	±2%	0,1W	SMD	3513 999 80238	
R636,637	10k	±2%	0,1W	SMD	3513 999 80236	
R638	15k	±2%	0,1W	SMD	3513 999 80238	
R639	1k	±2%	0,1W	SMD	3513 999 80224	
R640	2k7	±2%	0,1W	SMD	3513 999 80229	
R641	4k7	±2%	0,1W	SMD	3513 999 80232	
R642	10k	±2%	0,1W	SMD	3513 999 80236	
R643	6Ω8	±5%	0,25W	c film	PM01410	
R644	2k	±2%	0,1W	SMD	3513 999 80228	
R645	100	±2%	0,1W	SMD	3513 999 80212	
R646	220	±2%	0,1W	SMD	3513 999 80216	
R649	6Ω8	±5%	0,25W	c film	PM01410	
Capacitors						
C101	47n	±10%	50V	SMD	3513 999 55013	
C102	10	±10%	16V	SMD	3513 999 65067	
C103	47n	±10%	50V	SMD	3513 999 55013	
C104,105	1n	±10%	50V	SMD	3513 999 55459	
C106	180p	±5%		cer	3513 991 06056	
C107	0p8-10pf		variable		4313 326 10081	
C108	56p	±5%	50V	SMD	3513 999 55322	
C109	82p	±5%	50V	SMD	3513 999 55324	
C110	47n	±10%	50V	SMD	3513 999 55013	
C111,112	10	±20%	50V	elec	PS99436	
C113	100n	±10%	50V	SMD	3513 999 55498	
C114	47n	±10%	50V	SMD	3513 999 55013	
C115	10	±20%	50V	elec	PS99436	
C116	10n	±10%	50V	SMD	3513 999 55471	
C117	100n	±10%	50V	SMD	3513 999 55498	
C118,119	47n	±10%	50V	SMD	3513 999 55013	
C120	10	±20%	50V	elec	PS99436	
C121	47n	±10%	50V	SMD	3513 999 55013	
C122,123	100n	±10%	50V	SMD	3513 999 55498	
C124	47n	±10%	50V	SMD	3513 999 55013	
C125	1n	±10%	50V	SMD	3513 999 55459	
C126	10	±20%	50V	elec	PS99436	
C127,128	10n	±10%	50V	SMD	3513 999 55471	
C129	180p	±5%		cer	3513 991 06056	
C130	1n	±10%	50V	SMD	3513 999 55459	
C131	10p	±10%	50V	SMD	3513 999 55313	
C301	47	±20%	25V	elec	PS99423	
C302	47n	±10%	50V	SMD	3513 999 55013	
C303	1	±20%	100V	elec	PS99455	
C304	1n	±10%	50V	SMD	3513 999 55459	
C305	10	±20%	50V	elec	PS99436	
C306	1n	±10%	50V	SMD	3513 999 55459	
C307	47n	±10%	50V	SMD	3513 999 55013	
C309	10p	±10%	50V	SMD	3513 999 55313	
C310	4p7	±0p25	50V	SMD	3513 999 55309	
C311	1p	±0p25	50V	SMD	3513 999 55301	
C312,313	1n	±10%	50V	SMD	3513 999 55459	
C315,316	10p	±5%	50V	SMD	3513 999 55313	
C317	1p5	±0p25	50V	SMD	3513 999 55303	
C318-320	1n	±10%	50V	SMD	3513 999 55459	
C321	47n	±10%	50V	SMD	3513 999 55013	
C322	1p2	±0p25	50V	SMD	3513 999 55302	

Cct Ref	Description				Part No.	Remarks
Capacitors (cont'd)						
C323	1n	±10%	50V	SMD	3513 999 55459	
C324	10	±20%	50V	elec	PS99436	
C325	47n	±10%	50V	SMD	3513 999 55013	
C326-330	1n	±10%	50V	SMD	3513 999 55459	
C331	47n	±10%	50V	SMD	3513 999 55013	
C332	1n	±10%	50V	SMD	3513 999 55459	
C333	47n	±10%	50V	SMD	3513 999 55013	
C334	10	±20%	50V	elec	PS99436	
C335	1n	±10%	50V	SMD	3513 999 55459	
C336	1p2	±0p25	50V	SMD	3513 999 55302	
C337	2p2	±0p25	50V	SMD	3513 999 55305	
C338	1n	±10%	50V	SMD	3513 999 55459	
C348-350	1n	±10%	50V	SMD	3513 999 55459	
C351	47n	±10%	50V	SMD	3513 999 55013	
C352	10	±10%	16V	SMD	3513 999 65067	
C353	4p7	±0p25	50V	SMD	3513 999 55309	
C354	8p2	±0p5	50V	SMD	3513 999 55312	
C355	1n2	±10%	50V	SMD	3513 999 55460	
C356	1	±20%	100V	elec	PS99455	
C357	270n	±10%	50V	SMD	3513 999 55022	
C358	10n	±10%	50V	SMD	3513 999 55471	
C359	10	±10%	16V	SMD	3513 999 65067	
C360	47n	±10%	50V	SMD	3513 999 55013	
C361	10	±10%	16V	SMD	3513 999 65067	
C362	0p8-8pf		variable		2022 800 00218	
C364	270n	±10%	50V	SMD	3513 999 55022	
C365	1n	±10%	50V	SMD	3513 999 55459	
C366-368	100n	±10%	50V	SMD	3513 999 55498	
C369	1n	±10%	50V	SMD	3513 999 55459	
C370	15n	±10%	50V	SMD	3513 999 55472	
C371,372	10n	±10%	50V	SMD	3513 999 55471	
C373	270n	±10%	50V	SMD	3513 999 55022	
C374	10n	±10%	50V	SMD	3513 999 55471	
C376	100p	±5%	50V	SMD	3513 999 55325	
C377	10n	±10%	50V	SMD	3513 999 55471	
C378,379	47n	±10%	50V	SMD	3513 999 55013	
C380,381	270n	±10%	50V	SMD	3513 999 55022	
C401	33p	±5%	50V	SMD	3513 999 55319	
C402	33p	±5%	50V	SMD	3513 999 55319	
C403,404	120p	±5%	50V	SMD	3513 999 55326	
C406,407	100n	±10%	50V	SMD	3513 999 55498	
C408	1n	±10%	50V	SMD	3513 999 55459	
C409	100n	±10%	50V	SMD	3513 999 55498	
C410	10	±10%	16V	SMD	3513 999 65067	
C411	10	±20%	50V	elec	PS99436	
C412	47n	±10%	50V	SMD	3513 999 55013	
C413	100n	±10%	50V	SMD	3513 999 55498	
C414	10	±20%	50V	elec	PS99436	
C415	1	±20%	100V	elec	PS99455	
C416	180p	±5%	50V	SMD	3513 999 55328	
C417	10	±10%	16V	SMD	3513 999 65067	
C418	330p	±5%	50V	SMD	3513 999 55331	
C419	100n	±10%	50V	SMD	3513 999 55498	
C420	15p	±5%	50V	SMD	3513 999 55315	
C421	10	±20%	50V	elec	PS99436	
C425-427	1n2	±10%	50V	SMD	3513 999 55460	
C428	3p3	±0p25	50V	SMD	3513 999 55307	
C429	100n	±10%	50V	SMD	3513 999 55498	
C430	1n2	±10%	50V	SMD	3513 999 55460	
C431	100n	±10%	50V	SMD	3513 999 55498	
C432-434	10	±20%	50V	elec	PS99436	
C435	100n	±10%	50V	SMD	3513 999 55498	
C436,437	10	±20%	50V	elec	PS99436	
C438	100n	±10%	50V	SMD	3513 999 55498	
C439	10n	±10%	50V	SMD	3513 999 55471	
C440	10	±20%	50V	elec	PS99436	
C441	1n5	±10%	50V	SMD	3513 999 55461	
C442	330p	±5%	50V	SMD	3513 999 55331	
C443,444	8p2	±0p5	50V	SMD	3513 999 55312	
C445	4p7	±0p25	50V	SMD	3513 999 55309	
C446	2p2	±0p25	50V	SMD	3513 999 55305	
C447	1n	±10%	50V	SMD	3513 999 55459	
C448	1p	±0p25	50V	SMD	3513 999 55301	
C449	10	±20%	50V	elec	PS99436	
C450	47n	±10%	50V	SMD	3513 999 55013	
C451,452	1n	±10%	50V	SMD	3513 999 55459	

Cct Ref	Description				Part No.	Remarks
Capacitors (cont'd)						
C453,454	10	±20%	50V	elec	PS99436	
C455	1n	±10%	50V	SMD	3513 999 55459	
C456	8p2	±0p5	50V	SMD	3513 999 55312	
C457	1n	±10%	50V	SMD	3513 999 55459	
C458	1p8	±0p25	50V	SMD	3513 999 55304	
C459	10	±20%	50V	elec	PS99436	
C460-462	1n	±10%	50V	SMD	3513 999 55459	
C463	10p	±5%	50V	SMD	3513 999 55313	
C464	10	±20%	50V	elec	PS99436	
C465-467	1n	±10%	50V	SMD	3513 999 55459	
C469	2p2	±0p25	50V	SMD	3513 999 55305	
C471	10	±20%	50V	elec	PS99436	
C472	47n	±10%	50V	SMD	3513 999 55013	
C473	1n	±10%	50V	SMD	3513 999 55459	
C474	10	±20%	50V	elec	PS99436	
C475	47n	±10%	50V	SMD	3513 999 55013	
C476	1p8	±0p25	50V	SMD	3513 999 55304	
C477	1n	±10%	50V	SMD	3513 999 55459	
C478	3p3	±0p25	50V	SMD	3513 999 55307	
C479,480	1n	±10%	50V	SMD	3513 999 55459	
C481-483	100n	±10%	50V	SMD	3513 999 55498	
C484,485	10	±20%	50V	elec	PS99436	
C486	100n	±10%	50V	SMD	3513 999 55498	
C487	1n	±10%	50V	SMD	3513 999 55459	
C488	15n	±10%	50V	SMD	3513 999 55472	
C489	1n	±10%	50V	SMD	3513 999 55459	
C490	100p	±5%	50V	SMD	3513 999 55325	
C491	3n3	±10%	50V	SMD	3513 999 55465	
C492	100p	±5%	50V	SMD	3513 999 55325	
C493	22n	±10%	50V	SMD	3513 999 55010	
C494	10	±10%	16V	SMD	3513 999 65067	
C495	10	±20%	50V	elec	PS99436	
C497	1n	±10%	50V	SMD	3513 999 55459	
C498	2p2	±0p25	50V	SMD	3513 999 55305	
C499	1n	±10%	50V	SMD	3513 999 55459	
C501	100n	±10%	50V	SMD	3513 999 55498	
C502	10	±20%	50V	elec	PS99436	
C503,504	22	±20%	25V	elec	3513 991 00079	
C505	1	±20%	100V	elec	PS99455	
C506	100	±20%	25V	elec	3513 991 00081	
C507	100n	±10%	50V	SMD	3513 999 55498	
C508	1n	±10%	50V	SMD	3513 999 55459	
C509,510	270n	±10%	50V	SMD	3513 999 55022	
C511-534	100p	±5%	50V	SMD	3513 999 55325	
C535	100n	±10%	50V	SMD	3513 999 55498	
C536	10	±20%	50V	elec	PS99436	
C537	47p	±5%	50V	SMD	3513 999 55321	
C538	10	±10%	16V	SMD	3513 999 65067	
C539	47p	±5%	50V	SMD	3513 999 55321	
C540	22	±20%	100V	elec	PS99456	
C541,542	47p	±5%	50V	SMD	3513 999 55321	
C543	100p	±5%	50V	SMD	3513 999 55325	
C551-563	10n	±10%	50V	SMD	3513 999 55471	
C564-567	100n	±10%	50V	SMD	3513 999 55498	
C568,569	10n	±10%	50V	SMD	3513 999 55471	
C570	1n	±10%	50V	SMD	3513 999 55459	
C601	22p	±5%	50V	SMD	3513 999 55317	
C602	100n	±10%	50V	SMD	3513 999 55498	
C603	1n	±10%	50V	SMD	3513 999 55459	
C604	5p6	±0p5	50V	SMD	3513 999 55310	
C605	18p	±5%	50V	SMD	3513 999 55316	
C606,607	10p	±5%	50V	SMD	3513 999 55313	
C608	15p	±5%	50V	SMD	3513 999 55315	
C609	6p8	±0p5	50V	SMD	3513 999 55311	
C610	10p	±5%	50V	SMD	3513 999 55313	
C611	1n	±10%	50V	SMD	3513 999 55459	
C612	56p	±5%	50V	SMD	3513 999 55322	
C613	2p7	±0p25	50V	SMD	3513 999 55306	
C614	15p	±5%	50V	SMD	3513 999 55315	
C615	1n	±10%	50V	SMD	3513 999 55459	
C617	1	±20%	100V	elec	PS99455	
C618,619	100n	±10%	50V	SMD	3513 999 55498	
C620	220p	±5%	50V	SMD	3513 999 55329	
C621	10n	±10%	50V	SMD	3513 999 55471	
C622	10	±20%	50V	elec	PS99436	
C623	10p	±5%	50V	SMD	3513 999 55313	

Cct Ref	Description	Part No.	Remarks
Capacitors (Cont'd)			
C624	100n ±10% 50V SMD	3513 999 55498	
C625	1 ±20% 100V elec	PS99455	
C626	100n ±10% 50V SMD	3513 999 55498	
C627	47 ±20% 25V elec	PS99423	
C628	100n ±10% 50V SMD	3513 999 55498	
C629	1n ±10% 50V SMD	3513 999 55459	
C630	1 ±20% 100V elec	PS99455	
C631	10 ±20% 50V elec	PS99436	
C632	1n ±10% 50V SMD	3513 999 55459	
C633	100n ±10% 50V SMD	3513 999 55498	
C634	33p ±5% 50V SMD	3513 999 55319	
C635	5p6 ±0p5 50V SMD	3513 999 55310	
C636,637	3-10p variable SMD	3513 999 70001	
C638	1p ±0p25 50V SMD	3513 999 55301	
C639	4p7 ±0p25 50V SMD	3513 999 55309	
C640	2p2 ±0p25 50V SMD	3513 999 55305	
C641	5p6 ±0p5 50V SMD	3513 999 55310	
C642	2p2 ±0p25 50V SMD	3513 999 55305	
C643	4p7 ±0p25 50V SMD	3513 999 55309	
C644	2p2 ±0p25 50V SMD	3513 999 55305	
C645,646	100n ±10% 50V SMD	3513 999 55498	
C647	3-10p variable SMD	3513 999 70001	
C649	1n ±10% 50V SMD	3513 999 55459	
C650	470p ±5% cer	PN99886	
C651	10n ±10% 50V SMD	3513 999 55471	
C653	10p ±5% 50V SMD	3513 999 55313	
C654	1n ±10% 50V SMD	3513 999 55459	
C656,657	1n ±10% 50V SMD	3513 999 55459	
C4100	0p8-10pf variable	4313 326 10081	
C4101	1p ±0p25 50V SMD	3513 999 55301	
C4102	1n ±10% 50V SMD	3513 999 55459	
C4103	47n ±10% 50V SMD	3513 999 55013	
C4104	1n ±10% 50V SMD	3513 999 55459	
C4105	22n ±10% 50V SMD	3513 999 55010	
C4106	22n ±10% 50V SMD	3513 999 55010	
Inductors			
L101,102	Choke 100µh ±10%	3513 993 22553	
L301	Inductor 1µh ±20% SMD	3513 999 98089	
L302	Inductor 22nh ±20% SMD	3513 999 98079	
L303,304	Inductor 1µh ±20% SMD	3513 999 98089	
L305	Inductor 22nh ±20% SMD	3513 999 98079	
L306	Inductor 1µh ±20% SMD	3513 999 98089	
L307	Inductor 22nh ±20% SMD	3513 999 98079	
L308,309	Inductor 1µh ±20% SMD	3513 999 98089	
L313,314	Choke 100µh ±10%	3513 993 22553	
L315	Choke 0µ22 ±10%	3513 993 22546	
L401	Inductor 220nh ±20% SMD	3513 999 98086	
L402	Inductor 470nh ±20% SMD	3513 999 98087	
L403,404	Inductor 220nh ±20% SMD	3513 999 98086	
L405-407	Inductor 1000µh ±10% SMD	3513 999 98125	
L408-411	Inductor 1µh ±20% SMD	3513 999 98089	
L412	Inductor 22nh ±20% SMD	3513 999 98079	
L413	Inductor 1µh ±20% SMD	3513 999 98089	
L414	Inductor 22nh ±20% SMD	3513 999 98079	
L415-417	Choke 100µh ±10%	3513 993 22553	
L418	Inductor 22nh ±20% SMD	3513 999 98079	
L419	Inductor 1µh ±20% SMD	3513 999 98089	
L420	Choke 100µh ±10%	3513 993 22553	
L501	Bead 6-hole ferroxcube	4312 020 36700	
L502-513	Inductor 220nh ±20% SMD	3513 999 98086	
L514	Bead 6-hole ferroxcube	4312 020 36700	
L601	Choke assy toroidal	3513 509 00691	
L602	Inductor 220nh ±20% SMD	3513 999 98086	
L603	Inductor 1µh ±20% SMD	3513 999 98089	
L604	Coil air spaced	3513 509 00641	
L613	Coil	3513 509 00641	
L614	Coil	3513 509 01421	
Miscellaneous			
SK501	Skt 'D' type rt angle 15-way	FS42136	
SK601	Skt BNC type	FS43779	
Y101	Crystal 10Mhz	3513 900 60521	
	Bracket Antenna	3513 900 40151	

Cct Ref	Description	Part No.	Remarks
Miscellaneous (Cont'd)			
	Bush In(TO-220)	QA99024	1/IC502,503,603
	Cable Semi Rigid 55mm	AT70253	T11,T12
	Cover Screen	3513 901 10251	
	Hdr str male 2-pos'n	FC00837/02	
	Hdr str male 7-pos'n	FC00837/07	
	Heatsink plate	3513 901 30341	
	Heatsink plate assembly	3513 504 03991	
	Holder Crystal Oven	BT45165	
	Link Connector	FC99060	
	Nut st hex M2,5	QA11604/X	2/15-way plug; 1/IC502,503,603; 1/TR606
	Plug PCB mtd straight 2 x 7	FP99290	
	Retainer	BT48026	1/Xtal Oven
	Scr st pan pozi M2,5 x 6mm	QJ11945/X	1/IC502,503,603; 1/TR606
	Scr st pan pozi M2,5 x 8mm	QJ11946/X	1/Oven 2/15-way socket
	Scr st tap pozi No.4 x 4,5	QJ08227/X	8/VCO Covers
	Screen PA	3513 906 20131	
	Screen VCO	3513 906 20121	
	Skt Dil 28-way	FS99148	1/IC305
	Washer Compression	QA99040	1/TR606
	Washer Insulating TO-126	QA99016	1/TR502,606
	Washer Thermal TO-220	QA99111	1/IC502,503,603

TRANSMITTER POWER AMPLIFIER MODULE
AT04874/- 30W VERSION BANDS A9,BO (VHF)
AT04879/- 50W VERSION BANDS A9,BO (VHF)
AT04882/- 25W VERSION BANDS UO,T1,WM (UHF)
AT04883/- 50W VERSION BANDS EO (VHF)

INTRODUCTION

The transmitter power amplifier comprises two boards - an RF power amplifier and a PA control board.

The power amplifier accepts the nominal 1,25W input from the transmitter driver on VHF frequencies, or nominal 2,5W on UHF bands, producing the specified output power at the antenna. The control board provides power output regulation and also VSWR and thermal monitoring.

RF POWER AMPLIFIER

The low power RF input from the transmitter driver module is applied to a two-stage power amplifier TR1 and TR2, each transistor operating in class C. Automatic level control is provided by the switching regulator controlling the voltage supply line to:-

(i) TR1 and TR2 on 25W and 30W versions
(ii) TR1 on 50W versions.

TR2 on 50W versions is supplied with unregulated +24V from the PA Control PCB.

The RF power output from TR2 is fed via a harmonic filter to the antenna. LK1 may be removed from circuit to allow alignment of the antenna filter under workshop conditions. A stripline inductor (circuit reference L17 on VHF equipments) and power coupler D1, D2 provide forward and reverse power monitoring to the control board.

PA CONTROL BOARD AT28991/01

Power Level Control

The switching regulator circuit IC1, TR3, D6, uses the unregulated +24V DC input to provide a suitable supply voltage to power amplifier [O]TR1 and, on 25W and 30W versions, [O]TR2 at a level determined by the forward power feedback circuit. On 50W versions an unregulated +24V supply, is provided for [O]TR2. L3 acts as a flywheel coil to store energy which is drawn off by the power amplifier.

The Tx key input is used as the enable input to IC1 thus ensuring that the PA is shut down in the non-transmit condition.

At power-up the switching regulator is set to produce a nominal +15V supply to the PA. R37 provides current limiting to protect the regulator from short circuits.

A power coupler on L17 in the PA taps off the forward and reverse power to provide regulation of the RF output level and give VSWR indication and protection.

The forward power is detected by D1 and applied to the variable gain amplifier IC3(c). Gain is set by RV1 (POWER SET). The DC output from IC3(c) is compared to +5V in IC3(d) producing a DC level which is applied to IC1 pin 1. The switching regulator compares the level on pin 1 with the +2,5V reference on pin 2 and adjusts the supply voltage to the PA accordingly. The DC output from IC3(d) also provides an open collector monitor of forward power through TR7.

Reverse power detected by D2 is applied to IC3(b) to produce a DC output which is compared to +5V in IC3(a). The resulting output is passed to comparator IC3(d) to control the voltage supply line and hence RF power output as previously described. The output from IC3(a) is also used to provide an open collector output for VSWR alarm, via TR8.

An external VSWR detector may be connected directly to the reverse power line on SKC pin 9 whilst the output on pin 21 provides a metering point for forward power.

External control of comparator IC3(d) enables remote adjustment of the power output; a value of resistance, selected in the control module, connected between PLC pin 7 and OV reducing the transmitter power output.

Over-temperature Protection

Over-temperature protection within the module is provided by thermistor TH1 and dual comparator IC2(a) and IC2(b). At "normal" operating temperatures the potential from TH1 on IC2 pin 2 is greater than the bias on pins 3 and 5. The output from both comparators is "low" and the module functions as normal.

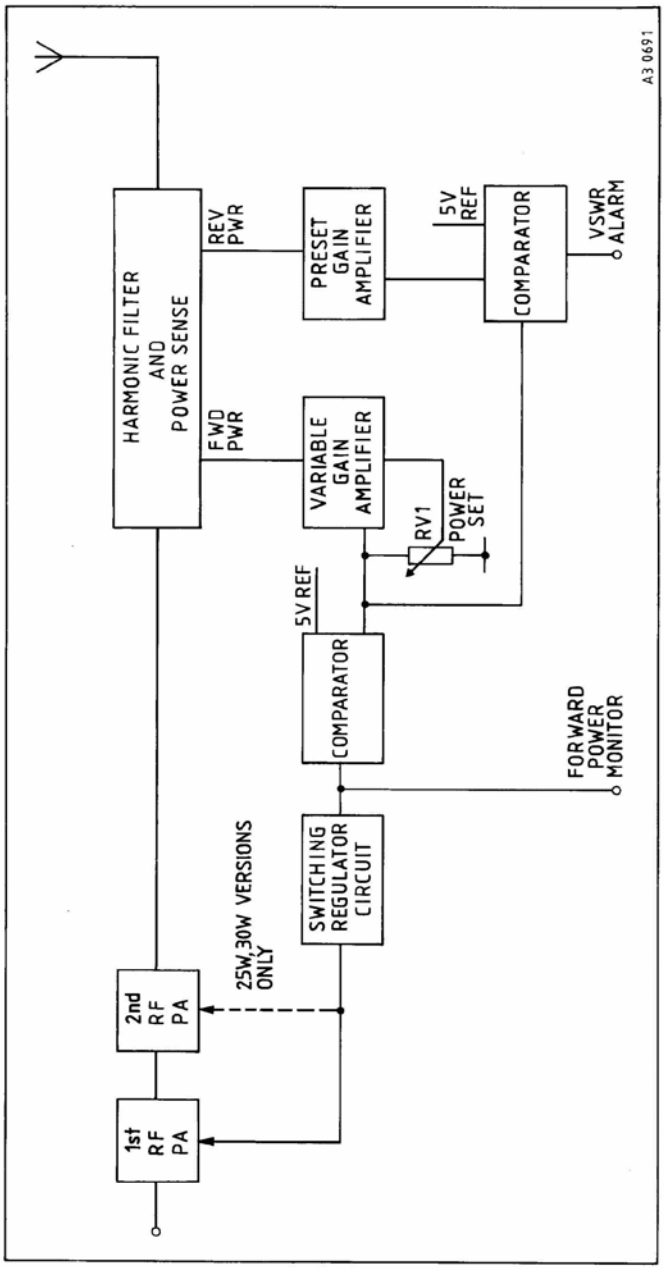
Should the temperature rise slightly above the nominal 80°C the potential from TH1 will fall as its resistance rises. The biasing arrangement is such that this potential will now be less than that on IC2 pin 3 but still greater than that at IC2 pin 5. The output from IC2(b) will remain "low" but the output from IC2(a) will go "high" causing TR5 and TR6 to conduct. TR5 provides an over-temperature alarm on SKC pin 17 and TR6 reduces the reference input on IC3(d) to a level such that the RF power output is reduced by 3dB (half-power), thus reducing the module dissipation.

A larger rise in heatsink temperature further decreases the potential from TH1, the bias level on IC2 pin 5 is now greater than the level on pin 6 and the output from IC2(b) goes "high". The enable line on IC1 pin 10 goes "high" and inhibits the switching regulator so providing total shutdown, and TR4 conducts providing a temperature shutdown alarm on SKC pin 4.

SPECIFICATION

Bands		
	ATO4874/02	A9 146-174MHz
	ATO4874/03	BO 132-156MHz
	ATO4879/02	A9 146-174MHz
	ATO4879/03	BO 132-156MHz
	ATO4882/05	TO 405-440MHz
	ATO4882/06	UO 440-470MHz
	ATO4882/07	WM 470-520MHz
	ATO4883/04	EO 66-88MHz
Output Impedance		50Ω nominal
Output Power		25W; adjustable down to 6W - O4882/-versions. 30W; adjustable down to 6W - ATO4874/-versions 50W; ATO4879/- and ATO4883/- versions.

Output Power Stability	Less than ±1dB variation over full range of voltage, temperature, switching bandwidth, and input power
Duty Cycle	100%
Input Impedance	50Ω nominal, VSWR less than 2:1
Input Power	1,25W ±1dB; 2,5W maximum without damage (VHF Bands) 2,0W ±1dB; 3W maximum without damage (UHF Bands)
Temperature Protection	3dB power reduction if heatsink temperature exceeds 85°C, total shutdown above 87°C
Supply Input	24V +20% -10% ; 3A maximum at 30W; 5A maximum at 50W.
Alarm Outputs (Open collector)	1) Supply Alarm (normally pulled low) 2) VSWR Alarm (pull low on alarm) indicates proportional shutdown operative 3) Temp Alarm 1 (pull low on alarm) indicates 3dB power reduction operative 4) Temp Alarm 2 (pull low on alarm) indicates complete shut-off



TX POWER AMPLIFIER AT04874/-, AT04879/-, AT04882/- and AT04883/-
BLOCK DIAGRAM

TEST PROCEDURE

Test Equipment required

Note: Refer to Part I, Table 3.1 for list of suitable types.

10* RF Signal Generator
15 Thruline Wattmeter
16 Spectrum Analyser
17* Return Loss Bridge
18 50Ω Load (includes sniffer)
20 "Break-out" connector 25 way
21* Input Test Lead (local manufacture)
Termaline Wattmeter

* Required only for optional Antenna Filter Alignment check

Preliminaries

1. Remove the cover plate from the power amplifier module. Disconnect the ribbon cable from the control board and remove the cover plate from the power amplifier board.

2. Ensure that LK1 and LK2 (where fitted) on AT28991/01 are as follows:- LK1 Open Circuit, LK2 Short Circuit.

Antenna Filter Alignment

Note: This check ensures that the input match of the antenna filter is maintained over the entire bandwidth of the equipment. It is factory set and should not normally require adjustment but may be carried out if any of the filter coils have been replaced or adjusted.

3. With the test equipment connected as shown in Fig.1 measure the 'return loss' of the 50Ω termaline load. This should be greater than 25dB.

4. On VHF equipments remove link LK1 from the power amplifier board and connect the input test lead and plug from the return loss bridge. Ensure that the clip on the test lead is connected to the filter screen. Connect the 50Ω load to the antenna socket SKB.
On UHF equipments remove the solder blob from LK1 and solder in test resistors RT1 and RT2; connect the test lead from the return loss bridge to the antenna socket SKB.

5. Sweep the RF signal generator output over the frequency range of the amplifier (see SPECIFICATION), check the return loss is greater than 20dB. If part of the sweep between these limits on VHF equipments shows a return loss of less than 20dB slight adjustment to the filter coils L14, L15 and L16 is required. DO NOT adjust L18.
If part of the sweep between these limits on UHF equipments shows a return loss of less than 20dB adjustment to the trimmer capacitors C43, C45 and C47 is required.

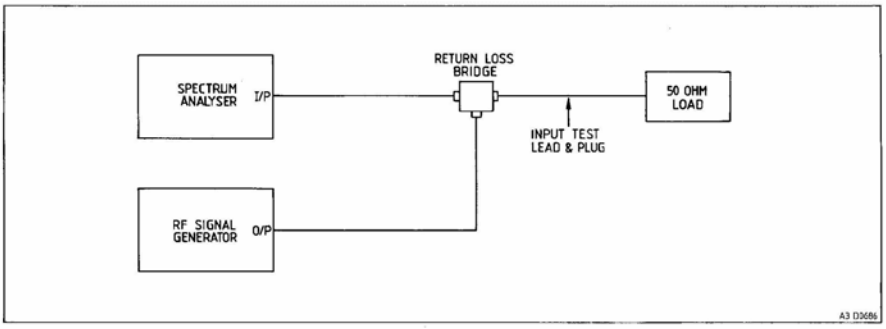


Fig.1 'Return Loss' Measurement

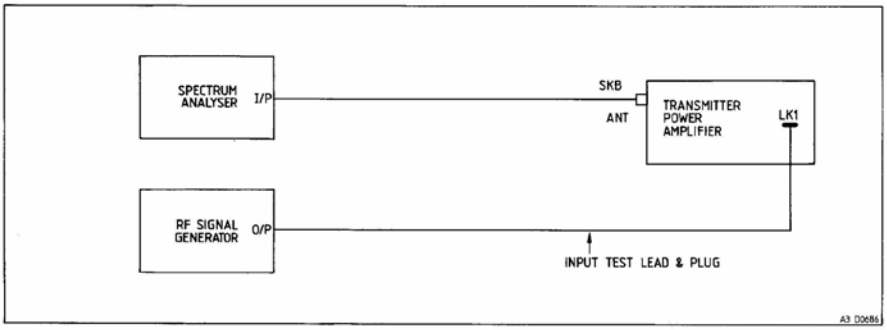


Fig.2 Antenna Filter Test Circuit - Direct Sweep

Note: *(i) Tuning is effected by either squeezing (to increase inductance) or parting (to reduce inductance) the turns of the coil. To assist coil tuning the use of a piece of ferrite or brass held near the coil will indicate whether more or less inductance, respectively, is required.*

(ii) It is normal for the return loss to deteriorate rapidly above the top frequency of the band covered by the equipment.

6. Connect the test equipment as shown in Fig.2 (for A,B and E Bands only) and sweep the filter directly. The attenuation at 136MHz (E Band), 246MHz (A and B Bands), should be greater than 55dB.

7. Remove the test equipment and refit LK1.

Amplifier Alignment

8. Connect the Termaline wattmeter to the antenna socket SKB and the spectrum analyser to the sniffer port (monitor output).

Note: *Connect the Thruline Wattmeter between the Signal Generator and the PA I/P SKA.*

9. Reconnect the ribbon cable to the control board (SKA/PLA) and connect the ribbon cable from the backplane to the module (SKC), via the "break-out" connector.

10. Check the following voltages on the control board:

+24V	on PLC pin 2	25V ±0,5V
+14V	on PLD pin 4	14V ±0,5V
+5V	on PLD pin 6	5V ±0,25V

11. Connect the engineer's handset to the control module front panel and set the manual function switch to TX ON. Select either the highest frequency customer channel, or the test channel corresponding to the highest frequency channel required.

12. Operate the EHS PTT switch, to key the transmitter.

13. Set the thruline wattmeter to 'reverse' and adjust the following capacitors on the PA board for minimum reverse power:-
C7 (on A and B Bands).
C4 and C48 (on T and U Bands);

14. Tune the following capacitors on the PA board for maximum power output:-
C14 and C24 on (A,B and E Bands)
C12, C25 and C26 (on T,U and W Bands)

15. Repeat steps 13 and 14. Check output power is greater than 30W (ATO4882/-); 35W (ATO4874/-); 60W (ATO4879/- and ATO4883/-)

16. Set RV1 (POWER SET) on the control board for an output of 25W (ATO4882/-); 30W (ATO4874/-); 50W (ATO4879/- and ATO4883/-)

17. Select the customer lowest frequency (or the test channel corresponding to the lowest frequency channel required) on the Tx driver. Check that the output power does not drop by more than 0,75dB below the level measured in step 16 above. Re-select the highest frequency channel.

18. Temporarily short circuit SKC pins 2 and 7 and check for a power output fall to 10-15W (ATO4882/-); 12-18W (ATO4874/-) or 20-30W (ATO4879/-) (ie Approximately 3dB down, half power)'.

19 Disconnect the RF load from the PA module output on SKB. Check the VSWR ALARM indicator LED3 on the Control Logic PCB is illuminated.

20. Disconnect and remove all items of test equipment and refit the covers to the module.

TX POWER AMPLIFIER

AT04874/02 A9 BAND 30W
AT04874/03 B0 BAND 30W
AT04879/02 A9 BAND 50W
AT04879/03 B0 BAND 50W

Cct. Ref	Description	Part No.	Remarks
	Feedthrough plate assembly	AT14803	
	PCB assy Tx PA control	AT28991/01	
	PCB assy Tx PA	AT28992/-	30W
	PCB assy Tx PA	AT29059/-	50W
	Housing & heatsink Tx PA	BT45146	30W
	Housing & heatsink Tx PA	BT45169	50W
	Lid assy Tx PA	AT29404	
SKA	Socket BNC str 50Ω	FS43808	RF I/P
SKB	Socket 50Ω N type	FS16081	RF O/P
	Lid unit	BT13802	
	Bushing shorty	FG02736	3/Tx PA lid
	Strap, earth	3513 904 40011	50W 1/TR2
	Label frequency align.	BT38238	
	Label, Beryllium oxide	CM01125	
	Label, unit	BT38209/01	Casting
	Nut st hex M3	QA11605/X	1/TR1,TR3,D6(PA control) 1/SKB, 2/f'thru assy - housing & heatsink
	Washer st M3	QA15005/X	1/TR1,TR3,D6(PA control), 1/SKB, 2/f'thru assy - housing & heatsink
	Bush insulating (TO-220)	QA99024	1/TR1,TR3,D6(PA control)
	Washer thermal	QA99111	50W 1/TR1,TR3,D6(PA control)
	Scr st tap pan M3 x 6mm	QJ11550/X1	2/front panel - housing & heatsink, 11/PA lid, 7/TX PA PCB - housing & heatsink, 4/TX PA Control PCB - housing & heatsink, 11/unit lid, 7/RF connectors
	Scr st tap pan M3 x 10mm	QJ11552/X1	1/Tx PA PCB - housing & heatsink
	Scr st tap pan M2,5 x 8mm	QJ11581/X1	50W 2/TR2
	Scr st pan pozi M3 x 16mm	QJ11905/X	1/TR1,TR3,D6(PA control), 1/SKB
	Scr st hex M3 x 12mm	QJ13255/X	2/f'thru assy - housing & heatsink

LID ASSEMBLY, TX PA AT29404

	Cable assy ribbon 26-way	AT70154	DC interconnecting
	Lid Tx PA	BT13808	
	Scr st pan pozi M2,5 x 8mm	QJ11946/B	2/SKC
	Nut st M2,5	QA11604/B	2/SKC

FRONT PANEL ASSEMBLY AT14820

	Panel, front	BT23741	
	Label, TX PA	BT38206/03	1/handle
	Label, Philips	BT38217/01	1/handle
	Fastener	BT17284	4/PA - shelf
	Handle	BT35950	
	Scr st tap pozi No4 x 8mm	QJ08241/X	3/handle

PCB ASSEMBLY TX PA CONTROL AT28991/01

Semiconductors & IC's

IC1	IC SG3524N	FU09729
IC2	IC Dual op amp 1458	FU99092
IC3	IC LM324	FU99115
TR1	Transistor BD947	FV99042
TR2	Transistor BSS64	FV99119/SM
TR3	Transistor RFP10N12	FV08879
TR4-9	Transistor BCW71	FV99100/SM
D1	Diode BAS16	3513 999 15003
D2	Diode BZX84C15	FV99018/SM
D3	Diode BZX84C8V2	FV99013/SM
D4,5	Diode BAS16	3513 999 15003
D6	Diode GP BYW29-150	FV99171
D7	Diode BAS16	3513 999 15003

Cct. Ref	Description				Part No.	Remarks
Resistors						
R1	39k	±5%	0,125W	SMD	3513 999 80055	
R2	1k8	±5%	0,125W	SMD	3513 999 80039	
R3	680	±5%	0,125W	SMD	3513 999 80034	
R4	390	±5%	0,125W	SMD	3513 999 80031	
R5	1k5	±5%	0,125W	SMD	3513 999 80038	
R6	100	±2%	0,5W	m oxide	PL99293	
R7	10k	±5%	0,125W	SMD	3513 999 80048	
R8-10	100k	±5%	0,125W	SMD	3513 999 80060	
R11	220	±5%	0,125W	SMD	3513 999 80028	
R12	4k7	±5%	0,125W	SMD	3513 999 80044	
R13	22k	±5%	0,125W	SMD	3513 999 80052	
R14	4k7	±5%	0,125W	SMD	3513 999 80044	
R15	1k8	±5%	0,125W	SMD	3513 999 80039	
R16	100k	±5%	0,125W	SMD	3513 999 80060	
R17	18k	±5%	0,125W	SMD	3513 999 80051	
R18	22k	±5%	0,125W	SMD	3513 999 80052	
R19-21	4k7	±5%	0,125W	SMD	3513 999 80044	
R22	3k9	±5%	0,125W	SMD	3513 999 80043	
R23	680	±5%	0,125W	SMD	3513 999 80034	
R24	1k8	±5%	0,125W	SMD	3513 999 80039	
R25	10k	±5%	0,125W	SMD	3513 999 80048	
R26	150	±5%	0,125W	SMD	3513 999 80026	
R27	1k	±5%	0,125W	SMD	3513 999 80036	
R28,29	27k	±5%	0,125W	SMD	3513 999 80053	
R30	47k	±5%	0,125W	SMD	3513 999 80056	
R31	4k7	±5%	0,125W	SMD	3513 999 80044	
R32	10	±5%	0,125W	SMD	3513 999 80012	
R33,34	18k	±5%	0,125W	SMD	3513 999 80051	
R35	22k	±5%	0,125W	SMD	3513 999 80052	
R36	27k	±5%	0,125W	SMD	3513 999 80053	
R37	30milli-ohm ±20%				PL41528	
R38,39	27k	±5%	0,125W	SMD	3513 999 80053	
R40,41	1k	±5%	0,125W	SMD	3513 999 80036	
R42	10k	±5%	0,125W	SMD	3513 999 80048	
R43,44	18k	±5%	0,125W	SMD	3513 999 80051	
R45,46	4k7	±5%	0,125W	SMD	3513 999 80044	
R47	27k	±5%	0,125W	SMD	3513 999 80053	
R48	10k	±5%	0,125W	SMD	3513 999 80048	
R49	1k	±5%	0,125W	SMD	3513 999 80036	
R50	100k	±5%	0,125W	SMD	3513 999 80060	
R51,52	10k	±5%	0,125W	SMD	3513 999 80048	
R53	100k	±5%	0,125W	SMD	3513 999 80060	
R54	10k	±5%	0,125W	SMD	3513 999 80048	
R55	47k	±5%	0,125W	SMD	3513 999 80056	
R56	4k7	±5%	0,125W	SMD	3513 999 80044	
R57	150	±5%	0,125W	SMD	3513 999 80026	
R58	220	±5%	0,125W	SMD	3513 999 80028	
RV1	10k	±20%	Pot,skel,lin		PL01478	
Capacitors						
C1	100n	±10%	50V	SMD	3513 999 55017	
C2-8	1n	±5%	50V	SMD	3513 999 55418	
C9	470	±20%	40V	elec	PS45812	
C10	1n	±5%	50V	SMD	3513 999 55418	
C11	100n	±10%	50V	SMD	3513 999 55017	
C12	470n	±5%		submin pes	PQ99538	
C13	1n	±5%	50V	SMD	3513 999 55418	
C14	100n	±10%	50V	SMD	3513 999 55017	
C15	100	±20%	63V	elec	PS38287	
C16	1n	±5%	50V	SMD	3513 999 55418	
C17	10n	±10%	50V	SMD	3513 999 55492	
C19	15n	±10%	50V	SMD	CN99116	
C20,21	1n	±5%	50V	SMD	3513 999 55418	
C22	100n	±10%	50V	SMD	3513 999 55017	
C23,24	1n	±5%	50V	SMD	3513 999 55418	
C25	10n	±10%	50V	SMD	3513 999 55492	
C26	100	±20%	63V	elec	PS38287	
C27	1n	±5%	50V	SMD	3513 999 55418	
C28	470	±20%	40V	elec	PS45812	
C29	100n	±10%	50V	SMD	3513 999 55017	
C30,31	1n	±5%	50V	SMD	3513 999 55418	
C32	270n	±10%	50V	SMD	3513 999 55022	
C33,34	100n	±10%	50V	SMD	3513 999 55017	
C35,36	470n	±5%		submin pes	PQ99538	
C37	470	±20%	40V	elect	PS45812	

Cct Ref	Description				Part No	Remarks
Capacitors (Cont'd)						
C38	10n	±5%		submin pes	PQ99532	
C39	100n	±10%	50V	SMD	3513 999 55017	
C40	1n	±5%	50V	SMD	3513 999 55418	
C41	470n	±5%		submin pes	PQ99538	
C42	470	±20%	40V	elect	PS45812	
C43	1n	±5%	50V	SMD	3513 999 55418	
C44,45	100n	±10%	50V	SMD	3513 999 55017	
C46	10n	±10%	50V	SMD	3513 999 55492	
C47	470n	±5%		submin pes	PQ99538	
C48	1n	±5%	50V	SMD	3513 999 55418	
C49	100n	±10%	50V	SMD	3513 999 55017	
C50	10n	±10%	50V	SMD	3513 999 55492	
C51	1n	±5%	50V	SMD	3513 999 55418	
C52	15n	±10%	50V	SMD	CN99116	
C53-61	1n	±5%	50V	SMD	3513 999 55418	
C62	270n	±10%	50V	SMD	3513 999 55022	
Inductors						
L1	Choke				AL21474	
L2	Choke assy				AT30092	
L3,4	Choke				AL21474	
Miscellaneous						
FS1	Fuse 5A quick acting				FF99018	
TH1	Thermistor PTC 70°C				PL23137	
	Fuseholder PCB mtg				FH99101	1/FS1
	Header, str, male 1 pos'n				3513 504 00121	1/TP -ve
PLB,C	Plug, PCB mtg, str 2 x 2				FP99172	
PLD	Plug, PCB mtg, str 2 x 3				FP99174	
PLA	Plug, PCB mtg, str 2 x 13				FP99186	

PCB ASSEMBLY TX PA
AT28992/02 A BAND 30W
AT28992/03 B BAND 30W

Semiconductors						
TR1	Transistor BLY87C 'BeO'				FV05647	
TR2	Transistor SD1274-3				FV42221	
D1,2	Diode schottky				FV09000	
Resistors						
R1	10	±5%	0,5W	carb	PM00001	
R2	100	±5%	0,5W	carb	PM00024	
R3	10	±5%	0,5W	carb	PM00001	/02
R3	303	±5%	0,25W	c film	PM01406	/03
R4	150	±5%	2,5W	m film	PL51219	
R5	68	±5%	0,25W	c film	PM01422	
R6	47k	±5%	0,25W	c film	PM01456	
Capacitors						
C1,2	1n	±5%		cer	PN99900	
C3	100n	±20%		cer	PN99927	
C4	18p	±5%	500V	NP0	PN10377	
C5	56p	±5%	500V	c disc	PN14335	
C6	100p	±5%	500V	SMD	3513 999 55663	
C7	16-90p			trimmer	PV06601	
C8	100	±20%	63V	elec	PS38287	
C9	100n	±5%		submin pes	PQ99535	
C10	56p	±5%	500V	c disc	PN14335	/02
C10	38p	±5%	500V	c disc	PN12307	/03
C11,12	1n	±5%		cer	PN99900	
C13	100n	±20%		cer	PN99927	
C14	16-90p			trimmer	PV06601	
C15	220p	±5%	200V	SMD	3513 999 55671	
C16	100	±20%	63V	elec	PS38287	
C17	10n	±5%		cer	PN99906	
C18	100n	±5%		submin pes	PQ99535	
C19,20	220p	±5%	200V	SMD	3513 999 55671	
C21	1n	±5%		cer	PN99900	
C22	100p	±5%	500V	SMD	3513 999 96053	
C23	1n	±5%		cer	PN99900	

Cct Ref	Description			Part No	Remarks
Capacitors (Cont'd)					
C24	16-90p		trimmer	PV06601	
C25	1n ±5%		cer	PN99900	
C26	100n ±20%		cer	PN99927	
C27-30	1n ±5%		cer	PN99900	
C31	12p ±5%	500V	cer	PN09382	
C32	4p ±0p25	500V	NP0	PN02410	
C33	470n ±5%		submin pes	PQ99538	
C34	10p ±0p5	500V	NP0	PN09344	
C35	12p ±5%	500V	cer	PN09382	
C36	5p ±0p25	500V	c disc	PN04306	
C37	12p ±5%	500V	cer	PN09382	
C38,39	15p ±5%	500V	c disc	PN10376	
C40-44	1n ±5%		cer	PN99900	
C45	12p ±5%	500V	cer	PN09382	
C46	1n ±5%		cer	PN99900	
C47	15p ±5%	500V	c disc	PN10376	
C48	5p ±0p25	500V	c disc	PN04306	
C49	100n ±5%		submin pes	PQ99535	
C51	470p ±5%	200V	SMD	3513 999 55679	
Inductors					
L1	Coil			AT30624/02	
L2	Loop(8mm)			AT31511/02	
L4	Coil			AT30624/01	
L5	Coil			AT30624/02	
L6	Choke assy			AT30092	
L7	Inductor			BT37703	
L8	Choke assy			AT31975/01	
L10	Coil			AT30624/01	
L11	Choke assy			AT30092	
L13	Loop(11mm)			AT31511/01	
L14	Coil			AT30624/02	
L15	Coil			AT31342/02	
L16	Coil			AT30624/03	
L18	Coil			AT30624/02	
Miscellaneous					
	Link connector			FC99060	
	Screen, TX PA filter			BT26410	
	Header, str, male, 4 pos'n			FC00837/04	

PCB ASSEMBLY PA
AT29059/02 A9 BAND 50W
AT29059/03 B0 BAND 50W

Semiconductors & IC's					
TR1	Transistor BLY87C "Be O"			FV05647	
TR2	Transistor SD1468-6 "Be O"			FV42231	
D1,2	Diode Schottky			FV09000	
Resistors					
R1	10 ±5%	0,5W	Carb.	PM00001	
R2	100 ±5%	0,5W	Carb.	PM00024	
R3	10 ±5%	0,5W	Carb.	PM00001	
R5	68 ±5%	0,25W	c film	PM01422	
R6	47k ±5%	0,25W	c film	PM01456	
Capacitors					
C1,2	1n ±5%		cer	PN99900	
C3	100n ±20%		cer	PN99927	
C4	18p ±5%	500V	C disc	PN10377	
C5	56p ±5%	500V	C disc	PN14335	
C6	150p ±5%	300V	SMD	3513 999 55667	
C7	16-90p		variable	PV06601	
C8	100 20%	63V	elec	PS38287	
C9	100n ±5%		pes	PQ99535	
C10	82p ±5%	500V	SMD	3513 999 55661	/02
C10	47p ±5%	500V	SMD	3513 999 55655	/03
C11,12	1n ±5%		cer	PN99900	

Cct Ref	Description			Part No	Remarks
Capacitors (Cont'd)					
C13	100n ±20%		cer	PN99927	
C14	16-90p		variable	PV06601	
C15	220p ±5%	200V	SMD	3513 999 55671	
C16	100 20%	63V	elec	PS38287	
C18	100n ±5%		pes	PQ99535	
C19,20	220p ±5%	200V	SMD	3513 999 55671	/02
C19,20	470p ±5%	200V	SMD	3513 999 55679	/03
C21	1n ±5%		cer	PN99900	
C22	82p ±5%	500V	SMD	3513 999 96065	/02
C22	100p ±5%	500V	SMD	3513 999 96053	/03
C23	1n ±5%		cer	PN99900	
C24	16-90p		variable	PV06601	
C25	1n ±5%		cer	PN99900	
C26	100n ±20%		cer	PN99927	
C27-30	1n ±5%		cer	PN99900	
C31	12p ±0p5	500V	cer	PN09382	
C32	4p ±0p25	500V		PN02410	
C33	470n ±5%		pes	PQ99538	
C34	10p ±0p5	500V	cer	PN09344	
C35	12p ±0p5	500V	cer	PN09382	
C36	5p ±0p25	500V	C disc	PN04306	
C37	12p ±0p5	500V	cer	PN09382	
C38,39	15p ±5%	500V	C disc	PN10376	
C40-44	1n ±5%		cer	PN99900	
C45	12p ±0p5	500V	cer	PN09382	
C46	1n ±5%		cer	PN99900	
C47	15p ±5%	500V	C disc	PN10376	
C48	5p ±0p25	500V	C disc	PN04306	
C49	100n ±5%		pes	PQ99535	
C50-52	470p ±5%	200V	SMD	3513 999 55679	
C53	22p ±5%	500V	SMD	3513 999 55647	
C54	100p ±5%	500V	SMD	3513 999 96053	/03
Inductors					
L1	Coil			AT30624/02	
L2	Loop (8mm high)			AT31511/02	
L4	Coil			AT30624/01	
L5	Coil			AT30624/02	
L6	Choke Assy			AT30092	
L7	Inductor			BT37703	
L8	Choke Assy			AT31975/01	
L10	Coil			AT30624/02	
L11	Choke Assy			AT30092	
L13	Loop (11mm high)			AT31511/01	
L14	Coil			AT30624/02	
L15	Coil			AT31342/02	
L16	Coil			AT30624/03	
L18	Coil			AT30624/02	
Miscellaneous					
	Screen Tx PA Filter			BT26410	
	Hder str male 4 pos'n			FC00837/04	
LK1	Link Connector			FC99060	
				TX POWER AMP MODULE	
				AT04882/05 T1 Band	
				AT04882/06 U0 Band	
				AT04882/07 WM Band	
	PCB Assembly Tx PA Control			AT28991/01	See Separate Headed List
	PCB Assembly Tx PA T1 Band			AT29078/05	/05 See Separate Headed List
	PCB Assembly Tx PA U0 Band			AT29078/06	/06 See Separate Headed List
	PCB Assembly Tx PA WM Band			AT29078/07	/07 See Separate Headed List
	Bush Insulating			QA99024	
	Bushing Shorty			FG02736	3/Tx PA Lid
	Feedthrough Plate Assembly			AT14803	
	Front Panel Assembly Tx PA			AT14820	
	Grommet			FG02736	2/Tx PA lid
	Housing & Heatsink Tx PA			BT45169	
L7	Inductor 15nh			3513 999 98078	/05,06
	Label Alignment Frequency			BT38238	1/Unit Lid
	Label Beryllium Oxide			CM01125	1/PA Lid
	Label Unit			BT38209/01	1/Casting
	Lid Assembly UHF Tx PA			AT29406	

Cct Ref	Description	Part No	Remarks
Miscellaneous (Cont'd)			
	Lid Unit	BT13802	
SKA	Socket BNC str 50Ω	FS43808	
SKB	Socket 50Ω N type	FS16081	
	Nut st hex M3	2522 401 64008	
	Scr st hex M3 x 12mm	QJ13255/X	
	Scr st pan pozi M3 x 16mm	QJ11905/X	
	Scr st tap pan M2,5 x 8mm	QJ11581/X1	2/TR2
	Scr st tap pan M3 x 10mm	QJ11552/X1	
	Scr st tap pan M3 x 6mm	QJ11550/X1	
	Wash st Form A M3	QA15005/X	
	Washer	3513 907 30031	2/TR1
	Washer Thermal TO-220	QA99111	
		PCB ASSEMBLY TX PA	
		AT29078/05 T1 Band	
		AT29078/06 U0 Band	
		AT29078/07 WM Band	
Semiconductors			
TR1	Transistor, SD1136	9337 447 50682	
TR2	Transistor, BLU30/12	9337 434 00112	
D1,2	Diode, BAT17	3513 999 15006	
D3	Diode, BYW54 GP	3513 990 10012	
Resistors			
R1,2	47 ±5% 0,125W SMD	3513 999 80020	
R3	10 ±5% 0,125W SMD	3513 999 80012	
R4,5	82 ±5% 0,125W SMD	3513 999 80023	
R6,7	22 ±2% 0,25W m film	3513 992 06207	/05,07
R6,7	10 ±2% 0,25W m film	PM99234	/06
R8	820 ±2% 0,25W m film	PM99280	
R9	1k ±2% 0,25W m film	PM99282	
R10	100k ±5% 0,125W SMD	3513 999 80060	
RT1,2	100 ±5% 0,125W SMD	3513 999 80024	
Capacitors			
C1	470p ±5% 200V Hi Q	3513 999 55679	
C2	100n ±10% 50V SMD	3513 999 55017	
C3	1n ±5% 50V SMD	3513 999 55418	
C4	2p-18p Var	PV99006	
C5	8p2 ±0p25 500V Hi Q	3513 999 55618	/05
C5	5p6 ±0p25 500V Hi Q	3513 999 55614	/06,07
C6	470p ±5% 200V Hi Q	3513 999 55679	
C7	39p ±5% 500V Hi Q	3513 999 55653	/05,06
C7	18p ±5% 500V Hi Q	3513 999 55645	/07
C9	39p ±5% 500V Hi Q	3513 999 55653	/07
C10	470p ±5% 200V Hi Q	3513 999 55679	
C11	18p ±5% 500V Hi Q	3513 999 55645	/05,06
C12	7p-50p Var	3513 999 70007	
C13	100n ±10% 50V SMD	3513 999 55017	
C14	100 ±20% 63V elec	PS38287	
C15	27p ±5% 500V Hi Q	3513 999 55649	/05
C15	33p ±5% 500V Hi Q	3513 999 55651	/06
C15	22p ±5% 500V Hi Q	3513 999 55647	/07
C16	27p ±5% 500V Hi Q	3513 999 55649	/05
C16	39p ±5% 500V Hi Q	3513 999 55653	/06
C16	27p ±5% 500V Hi Q	3513 999 55649	/07
C17	33p ±5% 500V Hi Q	3513 999 55651	/05,06
C17	22p ±5% 500V Hi Q	3513 999 55647	/07
C18	33p ±5% 500V Hi Q	3513 999 55651	/05,06
C18	27p ±5% 500V Hi Q	3513 999 55649	/07
C19	470p ±5% 200V Hi Q	3513 999 55679	/05,06,07
C20	22p ±5% 500V Hi Q	3513 999 55647	/05,06
C20	8p2 ±0p25 500V Hi Q	3513 999 55618	/07
C21	27p ±5% 500V Hi Q	3513 999 55649	/05
C21	22p ±5% 500V Hi Q	3513 999 55647	/06
C21	12p ±5% 500V Hi Q	3513 999 55641	/07
C22	100n ±10% 50V SMD	3513 999 55017	
C23	100 ±20% 63V elec	PS38287	
C24	8p2 ±0p25 500V Hi Q	3513 999 55618	/05
C24	5p6 ±0p25 500V Hi Q	3513 999 55614	/06,07
C25,26	2p-18p Var	PV99006	
C27,28	470p ±5% 200V Hi Q	3513 999 55679	

Cct Ref	Description		Part No	Remarks
Capacitors (Cont'd)				
C29,30	390p ±5% 50V	SMD	3513 999 55413	
C31	1n ±5% 50V	SMD	3513 999 55418	
C32	470p ±5% 200V	Hi Q	3513 999 55679	
C33	6p8 ±0p25 500V	Hi Q	3513 999 55616	/05,07
C33	8p2 ±0p25 500V	Hi Q	3513 999 55618	/06
C34	5p6 ±0p25 500V	Hi Q	3513 999 55614	/05,07
C34	6p8 ±0p25 500V	Hi Q	3513 999 55616	/06
C35-41	390p ±5% 50V	SMD	3513 999 55413	
C42	12p ±5% 500V	Hi Q	3513 999 55641	/05
C42	8p2 ±0p25 500V	Hi Q	3513 999 55618	/06,07
C43	1p4-5p5 Var		PV99004	
C44	27p ±5% 500V	Hi Q	3513 999 55649	/05
C44	22p ±5% 500V	Hi Q	3513 999 55647	/06
C44	18p ±5% 500V	Hi Q	3513 999 55645	/07
C45	1p4-5p5 Var		PV99004	
C46	12p ±5% 500V	Hi Q	3513 999 55641	/05
C46	8p2 ±0p25 500V	Hi Q	3513 999 55618	/06,07
C47	1p4-5p5 Var		PV99004	
C48	2p-18p Var		PV99006	
C49,50	100	elec	PS99449	
Inductors				
L1	Coil		3513 509 01301	
L2	Choke Assembly		3513 509 00221	
L3	Coil		3513 509 01301	
L4	Choke Assembly		3513 509 00221	
L5	Choke Assembly		AT30092	
L6	Coil		3513 509 01301	
L7	Choke Assembly		AT30092	
L8	Loop		3513 509 00661	/05
L8	Loop		3513 509 00671	/06
L8	Loop		3513 509 00681	/07
L9	Inductor 15nh		3513 999 98078	/05,06
L9	Inductor 8nh		3513 999 98050	/07
Miscellaneous				
	Pad Spacer		3513 905 10001	1/L2,4
	Screen Tx PA Filter		BT26410	
			TX POWER AMPLIFIER AT04883/04 EO BAND	
Miscellaneous				
	PCB Assembly Tx PA Control		AT28991/01	See Separate Headed List
	PCB Assembly Tx PA E Band 50W		AT29083/04	See Separate Headed List
SKA	Socket BNC straight 50Ω		FS43808	RF input
SKB	Socket 50Ω N type		FS16081	RF output
	Bush Ins(TO-220)		3513 990 16014	
	Bushing shorty		FG02736	3/Tx PA lid
	Feedthrough plate assembly		AT14803	
	Front Panel Assembly Tx PA		AT14820	See Separate Headed List
	Housing & heatsink Tx PA		BT45169	
	Label alignment frequency		BT38238	1/Unit Lid
	Label Beryllium Oxide		CM01125	1/PA Lid
	Label unit		3513 903 71211	1/Casting
	Lid assembly Tx PA		AT29404	
	Lid Unit		BT13802	
	Screening RF		FG00018	410mm/PA
	Sleeving natural PTFE		4313 324 30011	350mm/Feedthrough plate assy
	Strap earth		3513 904 40011	1/TR2
	Nut st hex m3		2522 401 64008	1/TR1; 1/TR3; 1/D6 Tx PA Control; 1/SKB; 2/Feedthrough plate assy - housing & heatsink
	Scr st hex M3 x 12mm		QJ13255/X	2/Feedthrough plate assy - housing & heatsink
	Scr st pan pozi M3 x 16mm		2522 178 20064	1/TR1; 1/TR3; 1/D6 Tx PA Control; 1/SKB
	Scr st tapt pan M2,5 x 8mm		QJ11581/X1	2/TR2
	Scr st tapt pan M3 x 10mm		QJ11552/X1	1/Tx PA PCB - housing & heatsink

Cct Ref	Description	Part No	Remarks
Miscellaneous (Cont'd)			
	Scr st tapt pan M3 x 6mm	QJ11550/X1	2/Front panel - housing & heatsink; 7/Tx PA PCB - housing & heatsink; 4/Tx Control PCB - housing & heatsink; 11/Tx PA lid; 11/Unit lid; 7/RF connectors
	Washer Thermal TO-220	3513 990 16254	1/TR1; 1/TR3; 1/D6 Tx PA Control
	Washer st form a M3	2522 600 89017	1/TR1; 1/TR3; 1/D6 Tx PA Control; 1/SKB; 2/Feedthrough plate assy - housing & heatsink

PCB ASSEMBLY TX PA E BAND 50W
AT29083/04

Semiconductors					
TR1	Transistor, BLY87C 'BeO'				9333 262 90112
TR2	Transistor, PT9783 'BeO'				FV41823
D1,2	Diode, Schottky				FV09000
Resistors					
R1	10	±5%	0,5W	carb	3513 992 00001
R2	100	±5%	0,5W	carb	PM00024
R3	10	±5%	0,5W	carb	3513 992 00001
R5	68	±5%	0,25W	c flm	PM01422
R6	47k	±5%	0,25W	c flm	PM01456
Capacitors					
C1,2	1n	±5%			PN99900
C3	100n	±20%			3513 991 06095
C4	56p	±5%	500V	c disc	PN14335
C5	68p	±5%	500V	c disc	2020 557 90408
C6	470p	±5%	200V	hi q	3513 999 55679
C8	100	±20%	63V	elec	PS38287
C9	100n	±5%	63V	pes	3513 991 08013
C10	47p	±5%	500V	c disc	2020 557 90407
C11,12	1n	±5%			PN99900
C13	100n	±20%			3513 991 06095
C14	90p-350p		variable	mica	4313 326 10191
C16	100	±20%	63V	elec	PS38287
C18	100n	±5%	63V	pes	3513 991 08013
C15	390p	±5%	200V	hi q	3513 999 55677
C19,20	470p	±5%	200V	hi q	3513 999 55679
C21	1n	±5%			PN99900
C22	220p	±5%	200V	hi q	3513 999 55671
C23	1n	±5%			PN99900
C24	16p-90p		variable	mica	PV06601
C25	1n	±5%			PN99900
C26	100n	±20%			3513 991 06095
C27-30	1n	±5%			PN99900
C31	33p	±5%	500V	c disc	PN12307
C32	18p	±5%	500V		PN10377
C33	470n	±5%		pes	3513 991 08016
C35	56p	±5%	500V	c disc	PN14335
C36	22p	±5%	500V	c disc	2020 557 90405
C37	8p	±0p5		c disc	2020 557 90404
C38	56p	±5%	500V	c disc	PN14335
C39	33p	±5%	500V	c disc	PN12307
C40-44	1n	±5%			PN99900
C45	22p	±5%	500V	c disc	2020 557 90405
C46	1n	±5%			PN99900
C47	22p	±5%	500V	c disc	2020 557 90405
C48	6p	±0p5	500V	c disc	2020 557 90403
C49	100n	±5%	63V	pes	3513 991 08013
C50-52	470p	±5%	200V	hi q	3513 999 55679
C55	100p	±5%	500V	hi q	3513 999 55663
C56	120p	±5%	300V	hi q	3513 999 55665
Inductors					
L1	Coil				AT30624/03
L2	Loop				AT31511/03
L4	Coil				AT31434/01
L5	Coil				AT30624/04
L6	Choke assembly				AT30092

Cct Ref	Description	Part No	Remarks
Inductors (Cont'd)			
L7	Inductor	3513 902 50161	
L8	Choke assembly	AT31975/01	
L10	Coil	AT30624/04	
L11	Choke assembly	AT30092	
L13-15	Coil	AT30624/03	
L16	Coil	AT30624/05	
L18	Coil	AT30624/04	
L19	Loop	AT31511/04	
Miscellaneous			
LK1	Link connector	FC99060	
	Header str male 4 pos'n	3513 504 00151	1/LK1
	Screen Tx PA filter	BT26410	

CONTROL MODULE
AT04872/-

INTRODUCTION

The basic control module provides an interface for local on-site control together with all the transmitter and receiver audio clipping, filtering and switching circuits. Both carrier and noise squelch detection circuits are included and also the audio filters and 2970 detectors necessary for simple (TX/RX only) 2 or 4 wire M80 series remote control.

In this form the module comprises three PCB assemblies:

(i) audio board

(ii) logic board

(iii) front panel

DETAILED DESCRIPTION

CONTROL AUDIO BOARD

The functions of the control audio board are divided as follows:

(i) Rx Audio - AF processing, squelch switching, Rx call generator data combining network and line amplifiers.

(ii) Tx Audio - AF processing, notch filter and tone detector, audio switching and line amplifier.

(iii) EHS Interface - Audio switching and mute control; monitor amp.

Rx Audio

Unprocessed audio from the receiver module is fed, via the backplane to the control logic board and then to the audio board on PLD pin 36. The signal is fed to an active high-pass filter IC47(a+b) and is then de-emphasised in IC39(b) and passed to the delay equaliser IC39(a). LK26 sets the de-emphasis response (A-B flat; B-C de-emphasised) and IC39(a) provides 'good' group delay equalisation.

The output from IC39(a) is fed two ways:

(i) To the T/T audio gate IC43(d) at a level set by RV5.

(ii) To the squelch controlled audio gate IC46(a). The squelch gate is enabled by a SQUELCH OPEN 'high' from the logic board on PLD pin 27, audio passes to IC39(c+d) an active low-pass filter. When the squelch control line is 'low' the gate is disabled and DC inhibits the audio line. The output from the filter is fed to the EHS audio line PLD pin 33 and the monitor amp IC35(d) and to the audio routeing gates IC44(b+c). The action of these two gates is controlled by inputs from the logic board:

   a. In the 'normal' mode of operation the MANUAL input, PLD pin 22, is 'high', this enables gate IC44(c) allowing audio to pass via the notch filter to the line drivers.

b. In the receiver mute condition the MUTE GATE input, PLD pin 21, is 'high', this enables gate IC44(b) and a DC level is applied to the audio line, thus inhibiting the AF path.

The notch filter IC34 is linked into circuit via LK27 and is used to remove any 2970Hz keytone frequency component present in the audio signal. The balanced line driver amplifiers IC38(a,b,c+d) provide an audio output to the 600Ω line at a level set by RV16. LK28 sets the output attention.

Rx Call

The Rx call generator IC29 produces a 2970Hz Rx call tone when commanded to do so by the logic switching input on PLD pin 35. The oscillator circuit XL1, IC27(d,e+f) produces a frequency of 29,7kHz which is applied to the CLK input of the generator. When the RX CALL line is 'high' the generator is enabled, IC29 divides the oscillator output by 10 and produces four outputs on Q1-Q4 which are summed across R184-R187 to produce a 2970Hz sine wave. RV15 sets the Rx call tone level and IC37(d) matches the generator output to the bandpass filter IC37(b) which 'cleans up' the sine wave output. Two other inputs are also applied to the matching stage - Tx audio from the 600Ω line, via LK24, when 4 wire intercom is used and data from the RCM at a level set by RV14.

The output from the filter IC37(b) is combined with the Rx audio and fed to the line drivers at a level set by RV16, then passed to the RX 600Ω line.

Tx Audio

The transmitter audio input to the control module may be carried on either a 2-wire or 4-wire line. On 4-wire schemes the audio inputs are on two separate pairs of wires, but for 2-wire applications both the Tx audio and Rx audio inputs are applied across the 'Rx 600Ω O/P' (PLB pins 4 and 22) and fed to the Tx 600Ω amplifier via the hybrid circuit IC37(c).

Tx audio routed via LK21 and LK20 is amplified by IC31(b) then fed, via the sensitivity control RV9, to the high-pass filter IC31(c). A two-stage notch filter IC33(a+b) removes the 2970Hz keytone component and IC35(c) provides group delay equalisation. Audio from the high-pass filter IC31(c) and the output from the 2nd stage notch filter is also routed to LK24, for use in 4-wire intercom applications. The 2970Hz tone extracted by the 1st stage of notch filtering is detected in IC36(c), passed through band-stop notch filter IC36(a+d) and fed via buffer IC36(b) to the 2970 DET line PLD pin 31.

Audio from IC35(c) is routed to the line audio gate IC43(b) which is enabled when the LINE input on PLD pin 13 is 'high'. IC35(b) is a variable gain amplifier controlled by compressor TR14 using the output from limiter IC41(a). Pre-emphasis is provided by IC35(a) whose response is set using LK15. TR8-TR9 prevent the limiter reaching the positive and negative rails and in addition the signal on TR8 collector is 'fed back' to operate the compressor TR14. Thus, the compressor only controls the variable gain amplifier once limiting is reached and is switched off 'out-of-limiting'.

During RCM operation TR15 is made to conduct by the DATA ENABLE input on PLD pin 17 going 'high' effectively grounding the feedBack path to the compressor.

The Tx audio path is inhibited when data from the RCM is present.

Audio from the limiting circuit is amplified by 1C41(b) with RV3 setting the peak deviation. IC32(a) combines the Tx audio signal with the CTCSS tone (via LK14) which may be either generated externally or on the logic board. The combined signal is applied to the low-pass filter which removes unwanted harmonics then fed, via LK19 to the high-pass filter IC32(c). LK19 is set according to the required channel spacing to select the appropriate value of resistor that will give the correct frequency response. LK19 linked 1A-1B gives high frequency roll-off for 12,5kHz spacing. The output on PLB pin 28 is applied, via the backplane, to the Tx driver module.

EHS Interface

Provision has been made for an engineer's handset (EHS) to be connected to the control module front panel. The control audio board houses the interface between the EHS and the Tx audio and Rx audio circuits.

Microphone audio across PLD pins 2 and 1 is amplified in IC31(d) with RV10 setting the sensitivity, then routed to the mic. audio gate IC44(a). A MIC ENABLE 'high' on PLD pin 12 enables the gate and mic. audio passes to the variable gain amplifier and pre-emphasis circuits.

Receiver audio from the output of the low-pass filter, IC39(d), is routed to the monitor amplifier IC35(d) and to the EHS earpiece, via PLD pin 33. The output from the monitor amplifier is applied, via the backplane to the monitor loudspeaker located on the PSU module. Audio to the EHS earpiece is routed via the control front panel.

In the transmit mode the Rx audio route to the EHS is inhibited through TR18 unless 'linecom' is selected on the front panel then the audio is routed through TR10 to the EHS.

CONTROL FRONT PANEL

The front panel of the control module houses the EHS socket, control switch and function indicators.

Engineers Handset

The engineers handset (EHS) is connected to the 7-pin DIN socket [0] SKE on the front panel and is used in conjunction with the function switch SA to provide various engineering facilities.

Connection of the handset is sensed by diodes D1 and D2. The MAKE or BREAK line is connected to COM (-ve) according to operation of the pressel.

Switch SA selects either the NORMAL mode or one of five facilities in the MANUAL mode.

NORMAL (SA position 1)

The EHS is non-functional irrespective of the operation of the pressel. The +14V line is connected via SA2 to the NOR gate IC1(a) and to IC1(b) pin 6. LED6 is held off via TR6 and the 'high' on the output of IC1(d) switches on TR5 to light LED7 (NORMAL). The MANUAL line PLA pin 20 is 'high' which provides a 'high' to the MANUAL and MIC ENABLE lines on the audio board, via the logic board.

MANUAL (SA positions 2-6)

Either the MAKE or BREAK line on PLC is connected to -ve as determined by the operation of the pressel. This -ve ('low') is detected by either D1 or D2 and applied to the NOR gate IC1(a) which produces a 'high' output fed via SA1 to the function control lines. IC1(d) provides an output 'low' which holds off LED7 (NORMAL) and inhibits the receiver path on the audio board. The detected 'low' also enables gate IC1(b) allowing the output from oscillator IC2(a) to switch TR6, thus causing LED6 (MANUAL) to flash.

MON. AUDIO on PLA pin 19 is applied to the buffer amplifier IC2(b) then fed to the EHS earpiece.

(i) LINECOM (SA position 2)
The 'high' on the LINECOM control line PLA pin 30 is routed via the logic board to produce a 'low' at the audio board PLD pin 20 which holds off TR10 thus preventing receive audio reaching the EHS earpiece.

(ii) BROADCAST (SA position 3)
The BROADCAST control line PLA pin 26 is connected directly to the +14V line. All audio paths are enabled as for 'normal' operation; use of the EHS enables communication 'over-the-air'.

(iii) SQ DEFEAT (SA position 4)
The 'high' on the SQ DEFEAT control line PLA pin 28 produces a 'high' from the logic board on PLA pin 23 which lights LED2 (SQUELCH), via TR1, and provides a 'high' to the audio board on PLD pin 27 to enable the squelch audio gate IC46(a).

This facility is used for receiver alignment; use of the EHS enables communication 'over-the-air'.

(iv) T/T (SA position 5)
The 'high' on the T/T control line PLA pin 29 produces a 'high' from the logic board on PLA pin 25 which lights LED4 (T/T), via TR3, and provides a 'high' to the audio board on PLD pin 18 to enable the T/T gate IC43(d). This facility is used for setting the talkthrough level; use of the EHS enables communication 'over-the-air'.

(v) TX ON (SA position 6)
The 'high' on the TX ON control line PLA pin 24 is applied to the logic board which produces the following outputs:

a. A 'high' on PLA pin 21 which lights LED3 (TX ON), via TR2.

b. A 'high' to the audio board on PLD pin 13 to enable the line gate IC43(b).

c. A 'low' to the audio board on PLD pin 29 to inhibit the mic enable gate IC44(a) thus preventing EHS mic audio reaching the transmitter.

This facility provides a continuous unmodulated carrier for transmitter alignment, operation of the pressel will provide modulation from the 600Ω line input enabling adjustment of the line sensitivity and CTCSS level.

Alarm Indication

In the alarm condition a 'low' is present on PLA pin 13 which enables gate IC1(c). TR4 is switched at a rate determined by oscillator circuit IC2(a) causing LED5 (ALARM) to flash.

CONTROL LOGIC BOARD

This board provides all the logic switching for the control module which determines the audio routeing, tone routeing, alarm switching and facility controls. Circuits are provided for carrier level and noise squelch control and a linkable interface enables connection of a remote control module.

Squelch Control

Noise Squelch - Rx noise from the receiver module on PLB pin 2 is applied to amplifier IC42(a) at a level set by RV2 (NOISE SQUELCH). The output is detected by IC40(a), D2(a), D2(b) and fed to low pass filter IC42(b) (which has a low roll-off characteristic) producing a DC level which is applied to schmitt trigger IC30(a). The schmitt trigger output is fed to NAND gate IC20(b) and is used to light LED8 (NOISE SQUELCH) via TR21.

Carrier Level Squelch - The carrier level input on PLB pin 20 is combined with the offset voltage from RV1 in DC amplifier IC30(b). Low pass filter IC30(c) and schmitt trigger IC30(d) operate in a similar manner to the noise squelch circuit to produce an output which is fed via LK6 to NAND gate IC20(b). LED10 indicates CARRIER SQUELCH. LK6 (NOISE SQ. ONLY) is normally linked A-B but may be left open circuit to allow operation from noise squelch only and enable the carrier squelch output to be linked via P24 to an open collector output for use as an external facility.

The third input to NAND gate IC20(b) is derived from the RX INHIBIT input (FAC8) and provided all three inputs are 'high' the resultant output from NAND gate IC16(a) is also 'high'. LK5 (SQUELCH RESPONSE) and D3, R65, C12 provide a time constant circuit which prevents 'chatter'.

The AND gate IC9(d) combines the carrier present 'high' from IC16(a) with a tone valid input from IC6(a) to produce a tone + carrier output which is routed through LK10 and available as an open collector output on TR4.

LK10 routes the 'tone + carrier' signal according to the squelch control function required.

(i)	Position 1 (SQ)	direct feed to AND gate (IC9(c)
(ii)	Position 2 (TT)	direct feed to RCM interface IC3 and via inverter IC25(d) to talkthrough enable gate IC8(d)
(iii)	Position 3	spare
(iv)	Position 4 (EXT, FAC)	external facility via RCM interface IC3

A 'high' on IC9(c) pin 8 enables the AND gate IC9(c) allowing the carrier present signal from IC16(a) to be fed to the squelch control gate. The carrier present input is also fed to the RCM interface and is available as an open collector output on TR3.

The squelch control gate IC21(a) also accepts three other inputs derived from the squelch defeat line, via IC12(a), and from the manual squelch defeat control on the front panel. When any of the inputs are 'high' the OR gate produces a logic 1, which is fed via IC11(a), to the SQUELCH OPEN line. The output from IC11(a) is controlled from IC15(d) whose inputs are derived from the RX INHIBIT line and the ON LINE DATA ENABLE line. A 'high' from IC15(d) enables gate IC11(a) producing a SQUELCH OPEN 'high' causing the squelch gate on the control audio board to open and the front panel squelch indicator to light

Rx Call

The Rx Call type is set by LK11 which may be linked to allow SQ DEFEAT to control RX CALL for compatibility with the 4000 series of equipments, or (as standard) RX CALL not controlled by SQ DEFEAT.

The AND gate IC10(d) is controlled by the output from IC15(d) (derived from the RX INHIBIT line) producing an Rx Call input to the audio board, via OR gate IC6(b). This signal also provides an Rx Call indication on the front panel, is fed to the RCM interface and is provided as an open collector output from TR5.

Manual Control

When the equipment is in the manual mode of operation a 'low' is applied to the MANUAL input on SKA pin 20 which is routed as follows.

Directly to:

(i) IC19(a) for MIC GATE control on PLD pin 12

(ii) the audio board on PLD pin 22 to disable IC44(c)*

and via R241 to:

(i) IC49(b) for MUTE GATE control on PLD pin 21

(ii) piptone gate IC22(b)

(iii) the DISABLE ASSORT gate IC5(a), the LINE DATA ENABLE gate IC5(b) and MAN ALARM generator TR2, via inverter IC26(c)

(iv) RCM interface, IC4

**Note: Resistor R309 on the audio board may be removed if the Rx audio line is required to be inhibited in the manual mode.*

Tx Key

The Tx Key input from the control equipment is applied on PLB pin 11. It is fed to the RCM interface link LK1 and combined with the 2970Hz detector input (from the audio board) in IC8(c). The output from this AND gate is passed to the audio board on PLD pin 30 (TX) and fed, via the inhibit gate IC14(c), to the Tx control gate IC21(b). The presence of a TX INHIBIT input, fed through IC14(a) and IC26(b), will pull this input low, via D11(b), and is also applied to the talkthrough gate IC19(b), via D11(a).

In addition to the Tx Key line the OR gate IC21(b) inputs are derived from the ALARM AIR DATA ENABLE line, via IC13(a), the manual TX ON input from the front panel and EHS control gate IC19(a). When any of these inputs are 'high' a logic output results, this is used to inhibit the receiver, via IC8(a), when LK8 is set for simplex operation and to provide a Tx Key input to the transmitter driver, power amplifier module and RCM. If LINECOM is selected the Tx Key line is inhibited in IC22(a).

Talkthrough (T/T)

Talkthrough may be initiated either by a backplane (active low) input on PLB pin 23 or by a tone input on SKA pin 3. The backplane input is fed directly to IC8(d) and tapped off to the RCM interface link LK1. The tone input is combined with the carrier in IC9(d) and routed, via LK10:2A-2B and inverter IC25(d), to IC8(d). If either input on IC8(d) is 'low' the output is also 'low' and providing the gate IC14(d) is enabled (i.e.: manual mode not selected) the output from IC8(d) is inverted and fed as a 'high' to IC6(c). If the manual mode is selected the talkthrough input is inhibited by IC14(d) and the input to IC6(c) is derived from the front panel switch (MAN T/T) input. For either condition a 'high' is fed to IC11(b). This AND gate is controlled by the output from IC23(a) such that if any input on pins 2-5 is 'high' a 'low' is produced which inhibits the talkthrough line. The output from IC11(b) provides the front panel T/T ON indication and is fed to AND gate IC10(c) which is in turn controlled by the carrier present output from IC9(d). IC19(b) produces a 'low' for the T/T hangtime circuit which 'holds' talkthrough during any fluctuations in audio level. A 'high' from IC16(c) is routed via IC6(d) and IC22(a) to providing Tx Key to the driver and power amplifier modules as previously described.

Alarms

The alarm inputs are applied via the backplane, the supply alarms are active 'high' all others being active 'low'. The TX, RX, VSWR and PA Temp alarm inputs have a direct feed to an alarm indicator. LK30 provides a means of overriding the supply alarm input to prevent an alarm condition each time a module is disconnected. All alarm inputs are 'paralleled' to the RCM interface.

Rx Alarm - The RX ALARM and RX SUPPLY ALARM (inverted in IC26(f)) are combined in IC24(c). Provision is made for an additional input on P20. The combined alarm output is routed via LK7 to AND gate IC24(b) and following inversion by IC26(a) may be used to disable the receiver, via LK9. With LK7 open circuit P19 may be linked to an open collector output to provide a separate external Rx alarm indication.

Power Alarm - NOR gate IC15(a) and AND gate IC8(b) each compare the forward power input from the TX PA with the Tx Key sense line. If only one input is present each gate produces an output 'high' which results in a 'low' from inverter IC25(b) causing LED6 (PA O/P ALARM) to light.

Tx Alarm - IC28(a) combines and inverts the PA SUPPLY ALARM, TX SUPPLY ALARM and an input from the power alarm circuit to produce a 'low' which is combined, in IC24(a), with the TX ALARM and VSWR ALARM (via D13) providing an output 'low' which is inverted by IC26(d) and applied to the latching circuit IC28(b+c).

The latching circuit provides for simple mains/standby configurations using an input on P17, with the output taken off P18 and indicated by LED2 (LATCH).

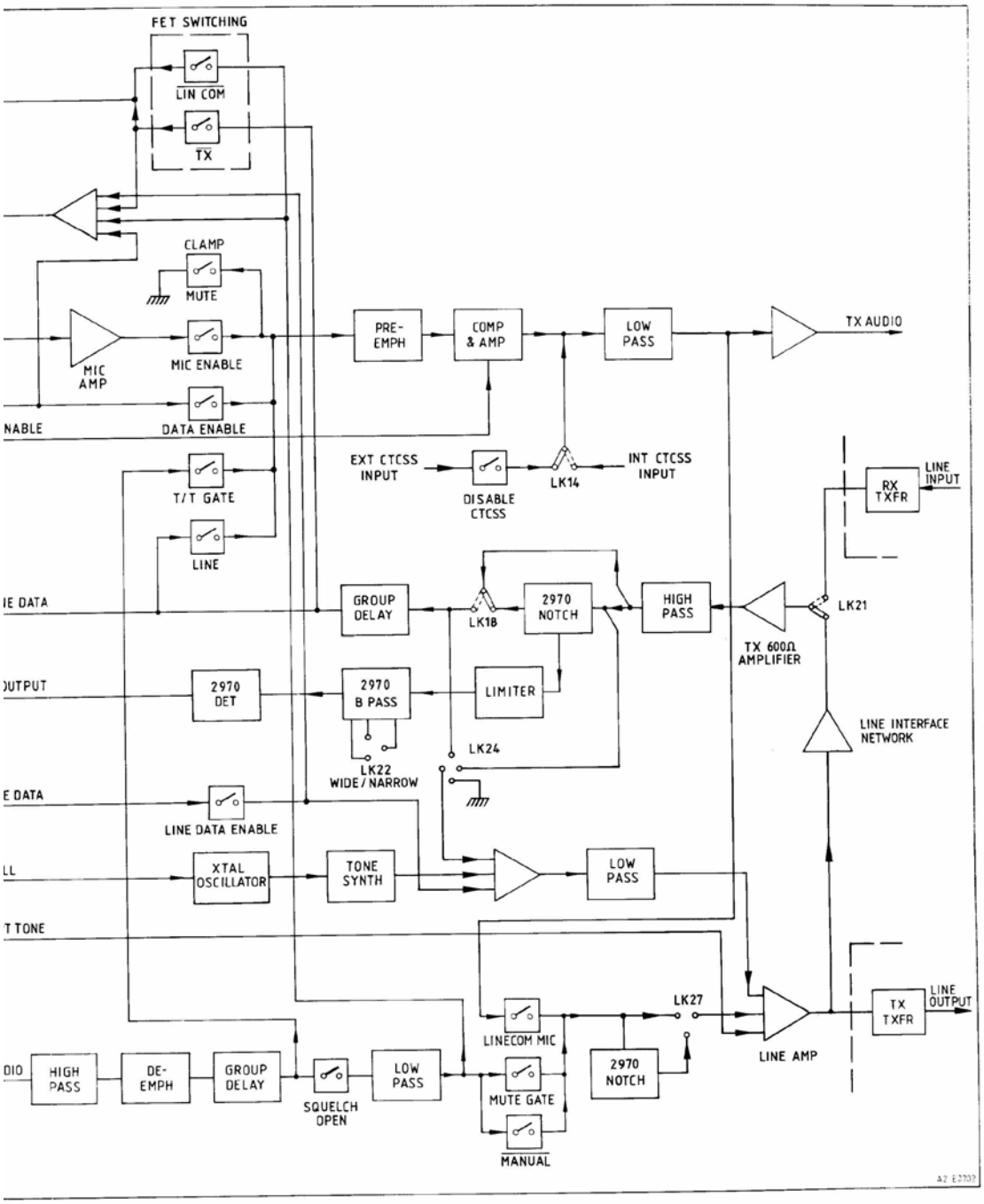
The output from the latching circuit is combined, in IC24(b), with the Rx alarm from IC24(c) and an external alarm input (indicated by LED7). The output from IC24(c) is in turn combined with the VSWR ALARM and PA TEMP ALARM in IC20(a) to provide a single alarm indication to the front panel, via IC16(d). The output from IC24(b) is also available from the open collector of TR6.

RCM Interface

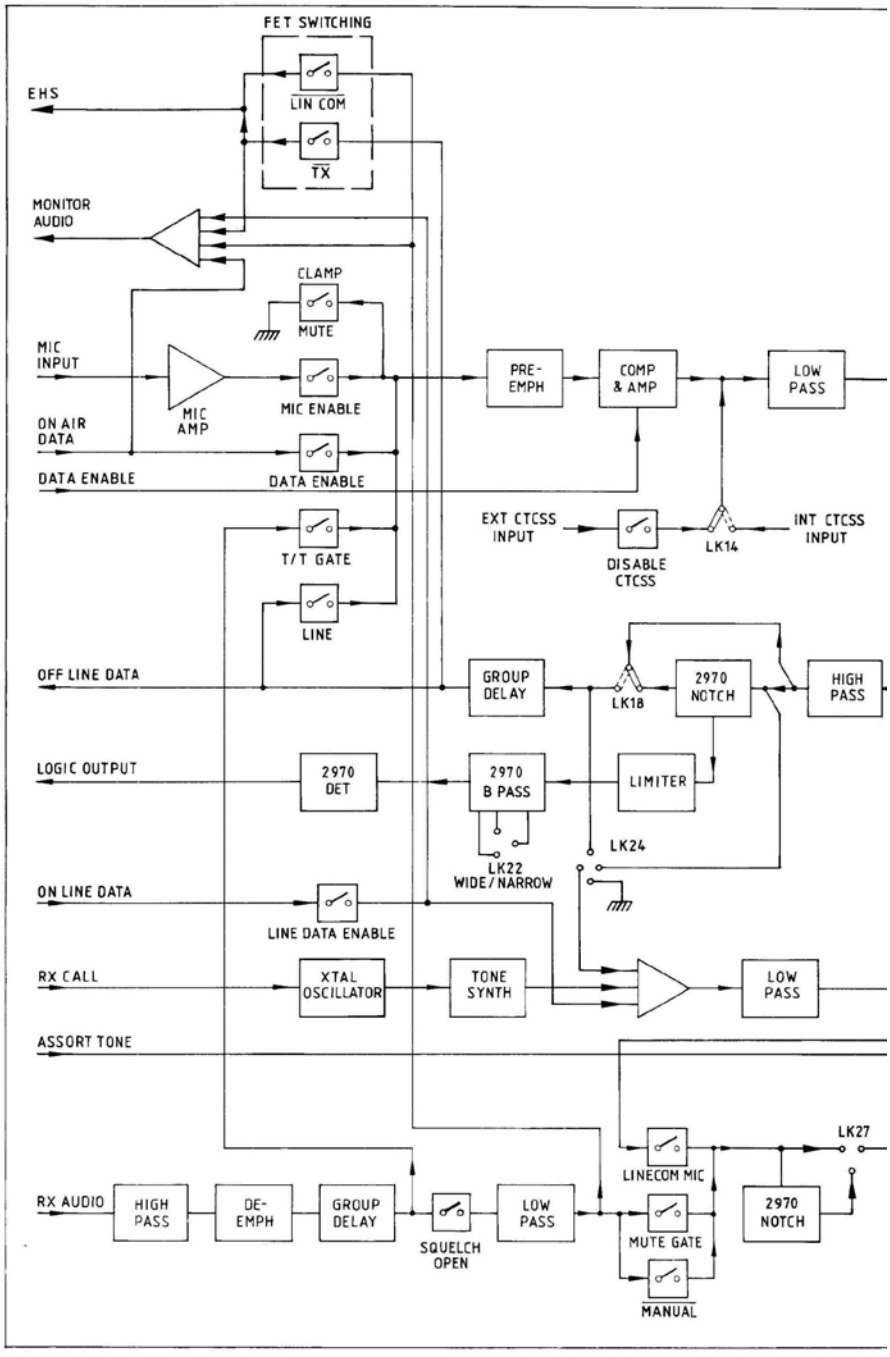
The RCM interface circuit provides for the connection of a basic (TX/RX only) M80 type control unit. LK1 provides linkable facilities with IC1-4 performing a serial-to-parallel data conversion.

IC7 (a+b) enables the carrier squelch to be adjusted (using RV1) or defeated from an RCM or (by linking P6/P5 and disconnecting D7) provide 3 set levels of squelch de-sensitisation.

Similarly, IC13 (c+d) provide control of the PA (from inputs on P7, P8) using gates IC45 (a, c + d). Three set levels of 3dB, 6dB and 10dB are available.



CONTROL MODULE AT04872/-
BLOCK DIAGRAM


FET SWITCHING
EHS
LIN COM
TX
MONITOR AUDIO
CLAMP
MUTE
MIC INPUT
MIC AMP
MIC ENABLE
ON AIR DATA
DATA ENABLE
DATA ENABLE
PRE-EMPH
COMP & AMP
LOW PASS
EXT CTCSS INPUT
DISABLE CTCSS
LK14
INT CTCSS INPUT
T/T GATE
LINE
OFF LINE DATA
GROUP DELAY
LK18
2970 NOTCH
HIGH PASS
LOGIC OUTPUT
2970 DET
2970 B PASS
LIMITER
LK24
LK22 WIDE/NARROW
ON LINE DATA
LINE DATA ENABLE
RX CALL
XTAL OSCILLATOR
TONE SYNTH
LOW PASS
ASSORT TONE
LK27
LINECOM MIC
RX AUDIO
HIGH PASS
DE-EMPH
GROUP DELAY
SQUELCH OPEN
LOW PASS
MUTE GATE
2970 NOTCH
MANUAL

SPECIFICATION

General

Supply input	18V ±0,5V at 0,5A maximum (without RCM but including options PCB)
Connectors	Interface to Backplane 37 way D plug Interface to RCM 16 way BERG header Interface to Option PCB 18 way BERG header Engineers Handset 7 way DIN socket
Indicators	Front Panel: Squelch TX ON Talkthrough Alarm Normal Manual Internal: TX Alarm RX Alarm PA Temp Alarm PA O/P Alarm VSWR Alarm Latched TX Alarm External Alarm 2970 Detector Noise Squelch Carrier Squelch

TX Audio Path

Audio Response	Base Station (12,5kHz) Rel 6dB/oct 300 - 3000 Hz +0,5 -2,8 dB Base Station (20/25kHz) Rel 6dB/oct 300 - 3000 Hz +0,5 -1,5 dB
Line I/P impedance	600Ω balanced
Line I/P sensitivity	4-wire -37 to 0dBm (for 60% deviation at 1kHz) adjustable 2-wire (remote) -16 to 0dBm (for 60% deviation at 1kHz) adjustable
EHS Mic I/P	600Ω approx
EHS Mic sensitivity	2mV (for 60% deviation at 1kHz)
TX Audio O/P impedance	100Ω approx
TX Audio O/P level	300mV/60% (12,5kHz) 480mV/60% (20kHz) 600mV/60% (25kHz)
S/N Ratio	Greater than 50dB rel to 60% deviation level
Distortion	Less than 0,5% (measured at 1kHz/60%)

RX Audio Path

Audio Response	Base Station (12,5/20/25kHz) Rel 6dB/oct 300 - 3000 Hz +0,5 -1,0 dB
Line O/P impedance	600Ω balanced, via external transformer
Line O/P level	4-wire -37 to +4dBm (for 60% deviation at 1kHz) adjustable 2-wire (remote) -16 to 0dBm (for 60% deviation at 1kHz) adjustable Note on 2-wire system, O/P level should be within 6dB of TX input level
RX Audio I/P impedance	3kΩ approx
RX Audio I/P level	300mV (for 60% deviation)
S/N Ratio	Greater than 50dB rel to 60% deviation level
Distortion	Less than 0,5% (measured at 1kHz/60% at +4dBm 600Ω O/P level)
Noise Squelch range	8 to 18dB SINAD adjustable (Normally preset to 10dB SINAD)
Carrier Squelch range	0,3 to 10μV adjustable

EXTERNAL CONTROL INTERFACE

The following control functions, with the exception of the 600Ω interface, are available at the facilities connector (37 way D type):

*Note: (i) Facilities marked * are secondary functions which require linking on the control module to bring them to the facility connector.*

(ii) The 600Ω interface can be brought to the facility connector by changing a link on the backplane PCB. For direct connection to British Telecom lines the Krone block must be used.

Control Inputs (pull 'low' to enable function):

(TX Facilities) -	TX Key Talkthrough Disable TT Disable CTCSS Tone PA Power Reduction (3dB) * PA Power Reduction (6dB) *
(RX Facilities) -	Squelch Defeat Tone Defeat (CTCSS) Disable RX Disable ASSORT ASSORT Override Carrier Squelch Defeat * (i.e. Noise Squelch only) Carrier Squelch Desensitisation * (6dB)

(General Facilities)	External Alarm input (to generate station alarm from ancillary Equipment) EHS Enable * (enables EHS in NORMAL mode) On Line Date Enable * Channel Control (7 lines common RX/TX - Synthesised only)

Logic Outputs (Open Collector pulling to -ve):

(TX Facilities) -	TX Alarm * (Normally combined with RX Alarm to give Station Alarm). Ext C/O relay (For driving relay connected to +24V only) Mod Monitor (Linkable alternative to analogue mod monitor)
(RX Facilities) -	RX Call Tone Controlled Facility Carrier Controlled Facility * RX Alarm *
(General Facilities) -	DC Standby Alarm Station Alarm (Combined RX/TX Alarm) Manual Alarm (Indicates use of EHS manual control) EHS Mic enabled *

Audio Inputs:

TX 600Ω input (balanced)
Ext CTCSS input * (unbalanced)

Audio Outputs:

RX 600Ω output (balanced)
RX unprocessed audio (unbalanced)
External loudspeaker

Analogue Outputs:

RX carrier level monitor
TX mod monitor
RF power monitor

INTERNAL MODULE INDICATIONS

Noise Squelch	Indicates that the noise squelch threshold has been exceeded.
Carrier Squelch	Indicates that the carrier squelch threshold has been exceeded.
2970 Detect	Indicates that a 2970Hz keytone has been detected.
PA Output Alarm	Indicates that the power control loop in the PA can no longer maintain the correct RF output power. Also indicates the presence of an RF output when the transmitter is not keyed. *Note: For the two stages of temperature shutdown in the PA, complete shutdown will generate a PA O/P alarm, whereas partial shutdown (3dB) will not.*

(General Facilities)	External Alarm input (to generate station alarm from ancillary Equipment) EHS Enable * (enables EHS in NORMAL mode) On Line Date Enable * Channel Control (7 lines common RX/TX - Synthesised only)

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Audio Inputs:

TX 600Ω input (balanced)
Ext CTCSS input * (unbalanced)

Audio Outputs:

RX 600Ω output (balanced)
RX unprocessed audio (unbalanced)
External loudspeaker

Analogue Outputs:

RX carrier level monitor
TX mod monitor
RF power monitor

INTERNAL MODULE INDICATIONS

Noise Squelch	Indicates that the noise squelch threshold has been exceeded.
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CONTROL MODULE

AT04872/01	Control System Code 12,13	Secondary Option 00
AT04872/05	Control System Code 12	Secondary Option 03,04
	Control System Code 13	Secondary Option 01-04
AT04872/06	Control System Code 21-24	Secondary Option 00
	Control System Code 31-34	Secondary Option 00
AT04872/07	Control System Code 21-24	Secondary Option 03,04
	Control System Code 31-34	Secondary Option 01-04
AT04872/08	Control System Code 11	Secondary Option 00
AT04872/09	Control System Code 11	Secondary Option 03,04

Cct. Ref	Description	Part No.	Remarks
	PCB assembly control logic	AT29023	
	PCB assembly control audio	AT29024/01	/01,05-07
	PCB assembly control audio	AT29024/05	/08,09
	PCB assembly front panel	AT28997/01	
	PCB assembly Voting/CTCSS	AT29061	/05,07,09
	M80 Signalling assembly	AT14920	/06,07
	Socket assembly 7-way DIN	AT14815	Engineers handset
	Knob printed	BJ30904/04	1/S1
	Spindle	BT07168	1/control knob-S1
	Circlip	QA01107	1/control knob
	Spire clip	QA04145	1/control knob
	Pillar hexagon	BT04463	4/audio screen-audio PCB
	Pillar 35mm long	BT04075	/05,07,09
	Pillar 7,1mm long	BT04074	/05,07,09
	Bushing shorty	FG02736	6/audio screen
	Scr st tap pozi No.6 x 6,4mm	QJ07703/B	4/plate assy mtg-bracket
	Scr st pan pozi M3 x 6mm	QJ11901/X	4/control PCB 4/logic PCB
	Scr st tap pozi No 4 x 8mm	QJ08241/X	/06,07
	Nut st M3	QA11605/X	4/audio screen-audio PCB

FRONT PANEL ASSEMBLY
AT14818

	Panel, front, printed	BJ30975	
	Fastener	BT17284	4/control module-shelf
	Handle	BT35950	
	Label Philips	BT38217/01	1/handle
	Label RCM	BT38206/02	1/handle
	Scr st tap pozi No.4 x 8mm	QJ08241/X	3/handle

PCB ASSEMBLY CONTROL LOGIC
AT29023

Semiconductors and IC's

IC1-4			Not Used
IC5-7	IC 4071B	FU99408/SM	
IC8-11	IC 4081B	FU99413/SM	
IC12-15	IC 4001B	FU99400/SM	
IC16	IC 4011B	3513 999 35002	
IC17	IC 4075B	FU99411/SM	
IC18,19	IC 4025B	FU99405/SM	
IC20	IC 4023B	FU99404/SM	
IC21	IC 4072B	FU99409/SM	
IC22	IC 4073B	FU99410/SM	
IC23	IC 4002B	FU99401/SM	
IC24	IC 4073B	FU99410/SM	
IC25	IC 4049B	FU99471/SM	
IC26	IC 4069UB	FU99472/SM	
IC27			Not Used
IC28	IC 4025B	FU99405/SM	
IC29			Not Used
IC30	IC Quad op amp LM348	3513 999 45003	
IC31-39			Not Used
IC40	IC Dual op amp 4558	FU99806/SM	
IC41			Not Used
IC42	IC Dual op amp 4558	FU99806/SM	
IC43,44			Not Used
IC45	IC 4066B	3513 999 35019	
IC46,47			Not Used
IC48	IC volt reg 317	FU99119	
IC49	IC 4001B	FU99400/SM	
TR1-6	Transistor BCX19	FV99102/SM	
TR7	Transistor BC337 GP	FV05896	
TR8-11			Not Used

Cct. Ref	Description			Part No.	Remarks
Semiconductors and IC's Cont'd					
TR12,13	Transistor BCX19			FV99102/SM	
TR14,15					Not Used
TR16	Transistor BCX19			FV99102/SM	
TR17,18					Not Used
TR19	Transistor BCX17			3513 999 00004	
TR20-22	Transistor BCX19			FV99102/SM	
D1	Diode GP 1N4148			FV05808	
D2,3	Diode BAV99 SMD			3513 999 15002	
D4-6					Not Used
D7	Diode GP 1N4148			FV05808	
D8	Diode BAV99 SMD			3513 999 15002	
D9,10					Not Used
D11	Diode BAV70 SMD			3513 999 15000	
D12					Not Used
D13	Diode GP 1N4148			FV05808	
D14					Not Used
D15	Diode BAV99			3513 999 15002	
Resistors					
R1	10k	±5%	0,125W SMD	3513 999 80048	
R2,3					Not Used
R4-10	10k	±5%	0,125W SMD	3513 999 80048	
R11	2k2	±5%	0,125W SMD	3513 999 80040	
R12-27	10k	±5%	0,125W SMD	3513 999 80048	
R28					Not Used
R29	1k	±5%	0,25W c film	PM01436	
R30	150k	±5%	0,25W c film	PM01462	
R31	10k	±2%	0,25W m film	PM99306	
R32	100k	±5%	0,125W SMD	3513 999 80060	
R33	100	±5%	0,125W SMD	3513 999 80024	
R34-36					Not Used
R37	10k	±5%	0,125W SMD	3513 999 80048	
R38	75k	±2%	0,25W m film	PM99327	
R39	150k	±2%	0,25W m film	PM99334	
R40					Not Used
R41	10k	±2%	0,25W m film	PM99306	
R42	15k	±2%	0,25W m film	PM99310	
R43,44	10k	±5%	0,125W SMD	3513 999 80048	
R45	10k	±2%	0,25W m film	PM99306	
R46	33k	±2%	0,25W m film	PM99318	
R47	33k	±2%	0,25W m film	PM99318	
R48	10k	±2%	0,25W m film	PM99306	
R49	16k	±2%	0,25W m film	PM99311	
R50	100k	±2%	0,25W m film	PM99330	
R51,52	10k	±5%	0,125W SMD	3513 999 80048	
R53	3k9	±2%	0,25W m film	PM99296	
R54	39k	±2%	0,25W m film	PM99320	
R55	2k2	±2%	0,25W m film	PM99290	
R56	82k	±2%	0,25W m film	PM99328	
R57	22k	±2%	0,25W m film	PM99314	
R58	47k	±2%	0,25W m film	PM99322	
R59-61	33k	±2%	0,25W m film	PM99318	
R62	27k	±2%	0,25W m film	PM99316	
R63	12k	±2%	0,25W m film	PM99308	
R64	2k2	±5%	0,125W SMD	3513 999 80040	
R65	100k	±2%	0,25W m film	PM99330	
R66	1k	±5%	0,125W SMD	3513 999 80036	
R67,68					Not Used
R69	10k	±2%	0,25W m film	PM99306	
R70	10k	±5%	0,125W SMD	3513 999 80048	
R71					Not Used
R72	10k	±5%	0,125W SMD	3513 999 80048	
R73	18k	±2%	0,25W m film	PM99312	
R74	4k7	±2%	0,25W m film	PM99298	
R75	8k2	±2%	0,25W m film	PM99304	
R76-83	10k	±5%	0,125W SMD	3513 999 80048	
R84-86					Not Used
R87	6k8	±5%	0,125W SMD	3513 999 80046	
R88-99					Not Used
R100	220	±5%	0,125W SMD	3513 999 80028	
R101	1k8	±5%	0,125W SMD	3513 999 80039	
R102-232					Not Used
R233,234	10k	±5%	0,125W SMD	3513 999 80048	
R235	100k	±5%	0,125W SMD	3513 999 80060	

Cct. Ref	Description				Part No.	Remarks
Resistors Cont'd						
R236	10k	±5%	0,125W	SMD	3513 999 80048	
R237-240						Not Used
R241-244	10k	±5%	0,125W	SMD	3513 999 80048	
R245-248						Not Used
R249	10k	±5%	0,125W	SMD	3513 999 80048	
R250-271						Not Used
R272-274	10k	±5%	0,125W	SMD	3513 999 80048	
R275,276						Not Used
R277	10k	±5%	0,125W	SMD	3513 999 80048	
R278	2k2	±5%	0,125W	SMD	3513 999 80040	
R279	10k	±5%	0,125W	SMD	3513 999 80048	
R280-283						Not Used
R284	2k2	±5%	0,125W	SMD	3513 999 80040	
R285	10k	±5%	0,125W	SMD	3513 999 80048	
R286	100k	±5%	0,125W	SMD	3513 999 80060	
R287	10k	±5%	0,125W	SMD	3513 999 80048	
R288	100k	±5%	0,125W	SMD	3513 999 80060	
R289-293						Not Used
R294-297	10k	±5%	0,125W	SMD	3513 999 80048	
R298,299	100k	±5%	0,125W	SMD	3513 999 80060	
R300-314						Not Used
R315	100k	±5%	0,125W	SMD	3513 999 80060	
R316	10k	±5%	0,125W	SMD	3513 999 80048	
R317	100k	±5%	0,125W	SMD	3513 999 80060	
R318						Not Used
R319-324	10k	±5%	0,125W	SMD	3513 999 80048	
R325-332						Not Used
R333	100k	±5%	0,125W	SMD	3513 999 80060	
R334	2k2	±5%	0,125W	SMD	3513 999 80040	
R335-337						Not Used
R338	10k	±5%	0,125W	SMD	3513 999 80048	
RN1	10k	±5%	9-pin SIL		RN99528	
RN2	2k2	±5%	9-pin SIL		RN99526	
RN3-6	10k	±5%	6-pin SIL		RN99368	
RV1	100k	±20%	Pot skel lin		PL99016	
RV2	10k	±20%	Pot skel lin		PL01478	
RV3						Not Used
RV4	1k	±20%	Pot cermet lin		PL99016	
Capacitors						
C1-4						Not Used
C5	56n	±10%	50V	SMD	3513 999 55014	
C6	12n	±10%	50V	SMD	CN99115	
C7	10	±20%	50V	elec	PS99436	
C8,9	56n	±10%	50V	SMD	3513 999 55014	
C10	12n	±10%	50V	SMD	CN99115	
C11	56n	±10%	50V	SMD	3513 999 55014	
C12	0µ22		50V	elec	PS99865	
C13,14	10	±20%	50V	elec	PS99436	
C15-20						Not Used
C21	100	±20%	25V	elec	PS99424	
C22,23	100n	±10%	50V	SMD	3513 999 55017	
C24-80						Not Used
C81	10n	±10%	50V	SMD	3513 999 55471	
C82-84	1n	±10%	50V	SMD	3513 999 55459	
C85-87	10n	±10%	50V	SMD	3513 999 55471	
C88	1n	±10%	50V	SMD	3513 999 55459	
C89-92	10n	±10%	50V	SMD	3513 999 55471	
C93	1n	±10%	50V	SMD	3513 999 55459	
C94,95	10n	±10%	50V	SMD	3513 999 55471	
C96						Not Used
C97-101	10n	±10%	50V	SMD	3513 999 55471	
C102	1n	±10%	50V	SMD	3513 999 55459	
C103-107	10n	±10%	50V	SMD	3513 999 55471	
C108	1n	±10%	50V	SMD	3513 999 55459	
C109-117	10n	±10%	50V	SMD	3513 999 55471	
C118						Not Used
C119-121	56n	±10%	50V	SMD	3513 999 55014	
C122-127						Not Used
C128	1	±20%	100V	elec	PS99455	
C129-133						Not Used
C134	100n	±10%	50V	SMD	3513 999 55017	
C135-136						Not Used
C137	10	±20%	50V	elec	PS99436	

Cct. Ref	Description				Part No.	Remarks
Capacitors Cont'd						
C138						Not Used
C139-141	56n	±10%	50V	SMD	3513 999 55014	
C142						Not Used
C143-150	33p	±5%	50V	SMD	3513 999 55319	
C151-204						Not Used
C205-207	56n	±10%	50V	SMD	3513 999 55014	
C208-210						Not Used
C211	1n	±10%	50V	SMD	3513 999 55459	
C212						Not Used
C213	1n	±10%	50V	SMD	3513 999 55459	
C214-218						Not Used
C219	1n	±10%	50V	SMD	3513 999 55459	
C220-223						Not Used
C224-226	1n	±10%	50V	SMD	3513 999 55459	

Miscellaneous

LED1-10	LED red	FV05860	
TP1-3	Header str male 1 pos'n	3513 504 00121	1/P1,2,5-11,14,15,19,20
	Header str male 2 pos'n	FC00837/02	1/P3&4,12&13,17&18,27&28
	Header str male 3 pos'n	FC00837/03	1/LK2,4-9,11,12,25,P21&22&23
	Header str male 15 pos'n	FC00837/15	LK1
	Plug, PCB mounted str 2 x 3	FP99174	LK30
	Plug, PCB mounted str 2 x 9	FP99176	LK3
	Plug, PCB mounted str 2 x 4	FP99196	LK10
	Plug, PCB mounted str 2 x 15	FP99296	LK1
PLB	Plug D type 37-way	FP99028	
PLC	Header less ears 16 pos'n	FP99221	
SKA	Conn. double row 2 x 17 pos,n	FC03608/17	Mates with PLA on front panel
SKD	Conn. female socket 40 pos'n	FS99191	
	Cable, 40-way ribbon IDC	FC99205	
	Connector PCB solder 40 pos'n	FP99155	
	Link connector	FC99060	
	Heatsink twisted vane	QA05850	1/IC48
	Nut st hex M3	QA11605/X	1/IC48 - heatsink, 2/PLB
	Washer st M3	QA15005/X	2/PLB
	Bush insulating (TO-220)	QA99024	2/IC48
	Washer thermal (TO-220)	QA99111	1/IC48
	Scr st pan pozi M3 x 8mm	QJ11902/X	2/PLB
	Scr st pan pozi M3 x 10mm	QJ11903/X	1/IC48 - heatsink

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Semiconductors and IC's

IC1-27			Not Used
IC27	IC 4069UB	FU99472/SM	
IC28			Not Used
IC29	IC 4018B	FU99442/SM	
IC30			Not Used
IC31-39	IC quad op amp LM348	3513 999 45003	
IC40			Not Used
IC41	IC dual op amp MC1458D	3513 999 45004	
IC42			Not Used
IC43,44	IC 4066B	3513 999 35019	
IC45			Not Used
IC46	IC 4053B	FU99483/SM	
IC47	IC dual op amp MC1458D	3513 999 45004	
TR1-7			Not Used
TR8	Transistor BCX17	3513 999 00004	
TR9	Transistor BCX19	FV99102/SM	
TR10	Transistor BSR58	FV99156/SM	
TR11	Transistor BCX19	FV99102/SM	
TR12,13			Not Used
TR14,15	Transistor BCX19	FV99102/SM	
TR16,17			Not Used
TR18	Transistor BCX19	FV99156/SM	
D1-3			Not Used
D4	Diode BAW56	FV99061/SM	
D5,6	Diode BAV99	3513 999 15002	
D7,8			Not Used
D9,10	Diode BAV99	3513 999 15002	

Cct. Ref	Description				Part No.	Remarks
Capacitors Cont'd						
C138						Not Used
C139-141	56n	±10%	50V	SMD	3513 999 55014	
C142						Not Used
C143-150	33p	±5%	50V	SMD	3513 999 55319	
C151-204						Not Used
C205-207	56n	±10%	50V	SMD	3513 999 55014	
C208-210						Not Used
C211	1n	±10%	50V	SMD	3513 999 55459	
C212						Not Used
C213	1n	±10%	50V	SMD	3513 999 55459	
C214-218						Not Used
C219	1n	±10%	50V	SMD	3513 999 55459	
C220-223						Not Used
C224-226	1n	±10%	50V	SMD	3513 999 55459	

Miscellaneous

LED1-10	LED red	FV05860	
TP1-3	Header str male 1 pos'n	3513 504 00121	1/P1,2,5-11,14,15,19,20
	Header str male 2 pos'n	FC00837/02	1/P3&4,12&13,17&18,27&28
	Header str male 3 pos'n	FC00837/03	1/LK2,4-9,11,12,25,P21&22&23
	Header str male 15 pos'n	FC00837/15	LK1
	Plug, PCB mounted str 2 x 3	FP99174	LK30
	Plug, PCB mounted str 2 x 9	FP99176	LK3
	Plug, PCB mounted str 2 x 4	FP99196	LK10
	Plug, PCB mounted str 2 x 15	FP99296	LK1
PLB	Plug D type 37-way	FP99028	
PLC	Header less ears 16 pos'n	FP99221	
SKA	Conn. double row 2 x 17 pos,n	FC03608/17	Mates with PLA on front panel
SKD	Conn. female socket 40 pos'n	FS99191	
	Cable, 40-way ribbon IDC	FC99205	
	Connector PCB solder 40 pos'n	FP99155	
	Link connector	FC99060	
	Heatsink twisted vane	QA05850	1/IC48
	Nut st hex M3	QA11605/X	1/IC48 - heatsink, 2/PLB
	Washer st M3	QA15005/X	2/PLB
	Bush insulating (TO-220)	QA99024	2/IC48
	Washer thermal (TO-220)	QA99111	1/IC48
	Scr st pan pozi M3 x 8mm	QJ11902/X	2/PLB
	Scr st pan pozi M3 x 10mm	QJ11903/X	1/IC48 - heatsink

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Semiconductors and IC's

IC1-27			Not Used
IC27	IC 4069UB	FU99472/SM	
IC28			Not Used
IC29	IC 4018B	FU99442/SM	
IC30			Not Used
IC31-39	IC quad op amp LM348	3513 999 45003	
IC40			Not Used
IC41	IC dual op amp MC1458D	3513 999 45004	
IC42			Not Used
IC43,44	IC 4066B	3513 999 35019	
IC45			Not Used
IC46	IC 4053B	FU99483/SM	
IC47	IC dual op amp MC1458D	3513 999 45004	
TR1-7			Not Used
TR8	Transistor BCX17	3513 999 00004	
TR9	Transistor BCX19	FV99102/SM	
TR10	Transistor BSR58	FV99156/SM	
TR11	Transistor BCX19	FV99102/SM	
TR12,13			Not Used
TR14,15	Transistor BCX19	FV99102/SM	
TR16,17			Not Used
TR18	Transistor BCX19	FV99156/SM	
D1-3			Not Used
D4	Diode BAW56	FV99061/SM	
D5,6	Diode BAV99	3513 999 15002	
D7,8			Not Used
D9,10	Diode BAV99	3513 999 15002	

Cct. Ref	Description				Part No.	Remarks
Resistors (Cont'd)						
R169,170	12k1	±1%	0,25W	m film	PL99099	/01
R171	10k	±1%	0,25W	m film	PL99098	/01
R172	8k66	±1%	0,25W	m film	PL45273	/01
R173	180	±5%	0,125W	SMD	3513 999 80027	
R174	2k7	±5%	0,125W	SMD	3513 999 80041	
R175	100	±5%	0,125W	SMD	3513 999 80024	
R176	27k	±5%	0,125W	SMD	3513 999 80053	
R177	18k	±2%	0,25W	m film	PM99312	/01
R178						Not Used
R179	47k	±5%	0,125W	SMD	3513 999 80056	
R180	8k2	±5%	0,125W	SMD	3513 999 80047	
R181	2k2	±5%	0,125W	SMD	3513 999 80040	
R182,183	22k	±5%	0,125W	SMD	3513 999 80052	
R184	127k	±1%	0,25W	m film	PL51200	/01
R185,186	90k9	±1%	0,25W	m film	PL45368	/01
R187	127k	±1%	0,25W	m film	PL51200	/01
R188	8k2	±5%	0,125W	SMD	3513 999 80047	
R189	120k	±5%	0,125W	SMD	3513 999 80061	
R190	10k	±5%	0,125W	SMD	3513 999 80048	
R191,192	27k	±5%	0,125W	SMD	3513 999 80053	
R193	10k	±5%	0,125W	SMD	3513 999 80048	
R194	33k	±5%	0,125W	SMD	3513 999 80054	
R195	39k	±5%	0,125W	SMD	3513 999 80055	
R196,197						Not Used
R198	18k	±5%	0,125W	SMD	3513 999 80051	
R199	10k	±5%	0,125W	SMD	3513 999 80048	
R200-203	10	±5%	0,125W	SMD	3513 999 80012	
R204	18k	±5%	0,125W	SMD	3513 999 80051	
R205	10k	±5%	0,125W	SMD	3513 999 80048	
R206	100	±5%	0,125W	SMD	3513 999 80024	
R207	27	±2%	0,25W	m film	PM99244	
R208	110	±2%	0,25W	m film	PM99259	
R209	470	±2%	0,25W	m film	PM99274	
R210	18k	±5%	0,125W	SMD	3513 999 80051	
R211	24k	±2%	0,25W	m film	PM99315	
R212						Not Used
R213	1k	±2%	0,25W	m film	PM99282	
R214	1k	±2%	0,25W	m film	PM99282	
R215	1k	±2%	0,25W	m film	PM99282	
R216						Not Used
R217	1	±5%	0,25W	c film	PM01400	
R218	1k5	±2%	0,25W	m film	PM99286	
R219	47k	±2%	0,25W	m film	PM99322	
R220	120k	±2%	0,25W	m film	PM99332	
R221	27k	±2%	0,25W	m film	PM99316	
R222	13k	±2%	0,25W	m film	PM99309	
R223	39k	±2%	0,25W	m film	PM99320	
R224	16k	±2%	0,25W	m film	PM99311	
R225	47k	±5%	0,125W	SMD	3513 999 80056	
R226	120k	±5%	0,125W	SMD	3513 999 80061	
R227,228	12k1	±1%	0,25W	m film	PL99099	/01
R229	10k	±1%	0,25W	m film	PL99098	/01
R230	8k66	±1%	0,25W	m film	PL45273	/01
R231	6k8	±5%	0,125W	SMD	3513 999 80046	
R232	1k5	±5%	0,125W	SMD	3513 999 80038	
R233-236						Not Used
R237	47k	±5%	0,125W	SMD	3513 999 80056	
R238-244						Not Used
R245	100	±5%	0,125W	SMD	3513 999 80024	
R246	10k	±5%	0,125W	SMD	3513 999 80048	
R247-254						Not Used
R255	10k	±5%	0,125W	SMD	3513 999 80048	
R256	100k	±5%	0,125W	SMD	3513 999 80060	
R257	2k2	±5%	0,125W	SMD	3513 999 80040	
R258						Not Used
R259	100	±5%	0,125W	SMD	3513 999 80024	
R607-264						Not Used
R265	15k	±2%	0,25W	m film	PM99310	
R267,268	10k	±5%	0,125W	SMD	3513 999 80048	
R269	47k	±5%	0,125W	SMD	3513 999 80056	
R270	100	±5%	0,125W	SMD	3513 999 80024	
R271	22k	±2%	0,25W	m film	PM99314	
R272-279						Not Used
R280	100k	±5%	0,125W	SMD	3513 999 80060	
R281	2k2	±5%	0,125W	SMD	3513 999 80040	

Cct. Ref	Description				Part No.	Remarks
Resistors Cont'd						
R282	100k	±5%	0,125W	SMD	3513 999 80060	
R283	1k	±5%	0,125W	SMD	3513 999 80036	
R283-300						Not Used
R301	47k	±5%	0,125W	SMD	3513 999 80056	
R302-308	10k	±5%	0,125W	SMD	3513 999 80048	
R309	1	±5%	0,25W	c film	PM01400	
R310	4k7	±5%	0,125W	SMD	3513 999 80044	
R311,312	10k	±5%	0,125W	SMD	3513 999 80048	
R313	47k	±5%	0,125W	SMD	3513 999 80056	
R314	10k	±5%	0,125W	SMD	3513 999 80048	
R315-324						Not Used
R325-327	10k	±5%	0,125W	SMD	3513 999 80048	
R328-331	100k	±5%	0,125W	SMD	3513 999 80060	
R332	10k	±5%	0,125W	SMD	3513 999 80048	
R333,334						Not Used
R335	91k	±2%	0,25W	m film	PM99329	
R336,337	2k2	±5%	0,125W	SMD	3513 999 80040	
RV1,2						Not Used
RV3	100k	±20%	Pot skel lin		PL99016	
RV5	4k7	±20%	Pot skel lin		PL01486	
RV6	50k	±20%	Pot cermet lin		PL99584	
RV7,8	2k	±20%	Pot encl lin		PL65802	/01
RV9	4k7	±20%	Pot skel lin		PL01486	
RV10	50k	±20%	Pot cermet lin		PL99584	
RV11	2k	±20%	Pot encl lin		PL65802	/01
RV12,13	10k	±20%	Pot skel lin		PL01478	
RV14	50k	±20%	Pot cermet lin		PL99584	
RV15	10k	±20%	Pot encl lin		PL99697	/01
RV16	100k	±20%	Pot skel lin		PL99016	
RV17	2k	±20%	Pot encl lin		PL65802	/01
RN8	100k	±5%	9-pin SIL		RN99531	
Capacitors						
C1-14						Not Used
C15-17	10	±20%	50V	elec	PS99436	
C18	1	±20%	100V	elec	PS99455	
C19,20	100	±20%	25V	elec	PS99424	
C21-23						Not Used
C24	2n2	±2,5%	100V	pp	PQ99617	
C25						Not Used
C26-29	10	±20%	50V	elec	PS99436	
C30	10n	±2,5%	63V	pp	PQ99621	
C31	680p	±2,5%	100V	pp	PQ99614	
C32	3n3	±2,5%	63V	pp	PQ99618	
C33	1n5	±2,5%	100V	pp	PQ99616	
C34	3n3	±10%	50V	SMD	CN99108	
C35	10	±20%	50V	elec	PS99436	
C36,37	1	±20%	100V	elec	PS99455	
C38,39						Not Used
C40	2n2	±5%		cer	PN99902	/01
C41	15n	±5%		cer	PN99907	
C42	2n2	±5%		cer	PN99902	/01
C43	15n	±5%		cer	PN99907	/01
C44,45	10n	±10%	50V	SMD	3513 999 55492	
C46,47						Not Used
C48	10n	±10%	50V	SMD	3513 999 55492	
C49	1	±20%	100V	elec	PS99455	
C50-53	10	±20%	50V	elec	PS99436	
C54	1	±20%	100V	elec	PS99455	
C55	15n	±5%		cer	PN99907	/01
C56	2n2	±5%		cer	PN99902	/01
C57	10	±20%	50V	elec	PS99436	/01
C58	10n	±5%		submin pes	PQ99532	
C59	22n	±10%	50V	SMD	3513 999 55496	
C60	56n	±10%	50V	SMD	3513 999 55014	
C61	2n2	±5%	50V	SMD	3513 999 55003	
C62	1n	±5%	50V	SMD	3513 999 55418	
163	56n	±10%	50V	SMD	3513 999 55014	
C64						Not Used
C65	10	±20%	50V	elec	PS99436	
C66	10n	±10%	50V	SMD	3513 999 55492	
C67	1	±20%	100V	elec	PS99455	
C68						Not Used

Cct. Ref	Description				Part No.	Remarks
Capacitors (Cont'd)						
C69	100n	±5%		submin pes	PQ99535	
C70,71	10n	±10%	50V	SMD	3513 999 55492	
C72	10n	±2,5%	63V	pp	PQ99621	
C73	470p	±5%	50V	SMD	3513 999 55414	
C74	3n3	±5%	50V	SMD	CN99154	
C75	1n8	±5%	50V	SMD	CN99058	
C76	100n	±10%	50V	SMD	3513 999 55017	
C77	15n	±5%		cer	PN99907	
C78	2n2	±5%		cer	PN99902	/01
C79	330p	±5%		cer	PN99884	/01
C80	100n	±10%	50V	SMD	3513 999 55017	
C81-117						Not Used
C118	47p	±5%	50V	SMD	CN99039	
C119-121						Not Used
C122	56n	±10%	50V	SMD	3513 999 55014	
C123	3n3	±20%		cer	PN99918	
C124	4µ7	±20%	63V	elec	PS99444	
C125	1n	±5%	50V	SMD	3513 999 55418	
C126	4µ7	±20%	63V	elec	PS99444	
C127	100n	±10%	50V	SMD	3513 999 55017	
C128						Not Used
C129	1	±20%	100V	elec	PS99455	
C130	680p	±5%		cer	PN99888	/01
C131,132						Not Used
C133	1n5	±2,5%	100V	pp	PQ99616	
C134-137						Not Used
C138	1	±20%	100V	elec	PS99455	
C139-150						Not Used
C151-153	33p	±5%	50V	SMD	3513 999 55319	
C154						Not Used
C155	1n	±10%	50V	SMD	3513 999 55459	
C156-159	33p	±5%	50V	SMD	3513 999 55319	
C160-163						Not Used
C164-171	33p	±5%	50V	SMD	3513 999 55319	
C172						Not Used
C173-176	33p	±5%	50V	SMD	3513 999 55319	
C177	1n	±10%	50V	SMD	3513 999 55459	
C178-185	33p	±5%	50V	SMD	3513 999 55319	
C186	1n	±10%	50V	SMD	3513 999 55459	
C187-194	33p	±5%	50V	SMD	3513 999 55319	
C195,196	1n	±10%	50V	SMD	3513 999 55459	
C197,198	33p	±5%	50V	SMD	3513 999 55319	
C199,200						Not Used
C201,202	33p	±5%	50V	SMD	3513 999 55319	
C203	1n	±10%	50V	SMD	3513 999 55459	
C227-229	56n	±10%	50V	SMD	3513 999 55014	
C230,231	33p	±5%	50V	SMD	3513 999 55319	
C232	470n	±10%	35V	tant SMD	CS99388	
Miscellaneous						
XL1	Crystal 29700Hz				FC06154	/01
	Link connector				FC99060	

FRONT PANEL PCB ASSEMBLY
AT28997/01

Semiconductors & IC's						
IC1	IC4001				FU99060	
IC2	IC Dual op amp 1458				FU99092	
TR1-6	Transistor BC547B				FV05891	
D1-4	Diode 1N4148				FV05808	
D5	Diode 8V2 ±5%				FV05970	
Resistors						
R1-3	100k	±5%	0,25W	c film	PM01460	
R4	10k	±5%	0,25W	c film	PM01448	
R5,6	100k	±5%	0,25W	c film	PM01460	
R7-15	10k	±5%	0,25W	c film	PM01448	
R16	220	±5%	0,25W	c film	PM01428	
R17-22	1k	±5%	0,25W	c film	PM01436	
R23,24	100k	±5%	0,25W	c film	PM01460	

Cct Ref	Description				Part No	Remarks
Resistors (Cont'd)						
R25	47k	±5%	0,25W	c film	PM01456	
R26	100k	±5%	0,25W	c film	PM01460	
R27	330	±5%	0,25W	c film	PM01430	
R28	100k	±5%	0,25W	c film	PM01460	
R29	4k7	±5%	0,25W	c film	PM01444	
Capacitors						
C1-3	4µ7	±20%	63V	elec	PS99444	
C4-7	100n	±20%		cer	PN99927	
C8,9	4µ7	±20%	63V	elec	PS99444	
C10	100n	±20%		cer	PN99927	
C11	4µ7	±20%	63V	elec	PS99444	
C12,13	33p	±5%		cer	PN99872	
C14-21						Not Used
C22	10n	±20%		cer	PN99921	
C23	1n	±20%		cer	PN99915	
C24	10n	±20%		cer	PN99921	
C25	1n	±20%		cer	PN99915	
C26,27	10n	±20%		cer	PN99921	
C28						Not Used
C29-37	10n	±20%		cer	PN99921	
C38	1n	±20%		cer	PN99915	
C39,40	10n	±20%		cer	PN99921	
C41	1n	±20%		cer	PN99915	
C42-48	10n	±20%		cer	PN99921	
C49-52	1n	±20%		cer	PN99915	
C53-59	10n	±20%		cer	PN99921	
Miscellaneous						
PLA	Plug PCB mtd Straight 2 x 17				FP99188	
PLB	Header, less ears 20 pos'n				FP99222	
PLC	Plug PCB mtd Straight 2 x 4				FP99196	
PLD	Plug PCB mtd Straight 2 x 2				FP99172	
LK1	Header straight male 3 pos'n				FC00837	
	Link connector				FC99060	1/LK1
SA	Switch 6 way 2 pole				FS07159/01	
LED2,4	LED Yellow				FV05930	1/Squelch, 1/T/T
LED3,5,6	LED Red				FV05858	1/Tx on, 1/Alarm, 1/Manual
LED7	LED Green				FV05931	1/Normal
	Spacer, LED 3,5mm x 4,76mm				QA05856	1/LED2-7

REMOTE CONTROL OPTION
AT14920

INTRODUCTION

The Remote Control Assembly may be fitted as an optional extra to the FR5000 series Base Stations. It enables the Base Station to be controlled by a M80 series Controller using AC signalling over a 2/4 wire 600Ω line.
The Remote Control Assembly is located in the Control Module where it is mounted on a PCB carrier plate, the assembly comprises a motherboard, which provides an interface with the Base Station, and a Facilities PCB. The AC signalling system uses a 2970Hz continuous tone to key the transmitter and a 112ms burst of FSK data which contains commands for activating the squelch defeat, line intercom and talkthrough facilities.

SUMMARY OF DATA

Line Connections

Type	2 or 4 wire
Line Specification	minimum specification to British Telecom schedule A line or equivalent.

Line audio

Audio Level	2 wire -18dBm 4 wire -14dBm
Frequency Response	300Hz to 3,4kHz±3dB relative to level at 1kHz, or as limited by British Telecom line.
Control Frequencies	2970Hz ±5Hz (key tone) 2295Hz ±5Hz (FSK low tone) 2505Hz ±5Hz (FSK high tone)
Key Tone Level	at least 18dB below peak speech line audio level and greater than -42dBm.
FSK Level	at least 8dB below peak speech line audio level and greater than -40dBm.

Control Functions

Transmission rate	300 baud
Preamble tone length	125ms±25ms
Start bit	logic 0
Stop bit	logic 1
Parity	odd
Bit time	36,6ms±3%
Inter word time	less than 15ms

INSTALLATION

Installation Items

Description	Part No	Remarks
Scr st tap pozi No4 x 8mm	QJ08241/X	2/M80 signalling assembly - Control Module

Note: Refer to Fig.1 throughout this installation procedure.

(1) Release the securing fasteners and withdraw the Control Module on its runners to gain access to the Control Logic PCB.

(2) Connect the lead assembly AT70246 to PLC on the Interface PCB and, routeing the leads around the back of the PCB carrier, pass the free end of the lead assembly through the top rearmost hole in the Control Plate.

(3) Taking care not to trap the lead assembly, hook the M80 signalling assembly mounting plate round the rear end of the control plate and secure the upper and lower lugs to the Control Unit front panel with the two screws provided.

> **CAUTION**
> **Before the following connections are made it is important to ensure LK2 of AT04872/- is set B-C, this is to prevent contention between the outputs of IC1, IC2 of AT04872/- and the RCM control outputs.**

(4) Referring to the STANDARD LINKING FUNCTIONS connect the free end of lead assembly AT70246 to P21 and the appropriate pins of LK1 on the Control Logic PCB to provide the functions required.

(5) Connect cable assembly AT70245 from PLB on the Interface assembly to PLC on the Control Logic PCB.

(6) Connect the 25-way ribbon cable from the backplane to the Interface assembly.

(7) Push the Control Module into the shelf assembly and tighten the securing fasteners.

STANDARD LINKING FUNCTIONS

Note:
(i) The following table defines the interconnection between the Interface PCB and the Base Station Control Module Logic PCB necessary to achieve a number of standard functions. Due to the flexible design of the Base Station it is impractical to produce a definitive list of all the potentially useful linking combinations that could be made.
(ii) Leads not used should be parked on the appropriate 'a' position of LK1 on Control Logic PCB AT29023.
(iii) The interconnecting leads are colour coded, using the resistor convention, with respect to the pin numbers on AT29074.

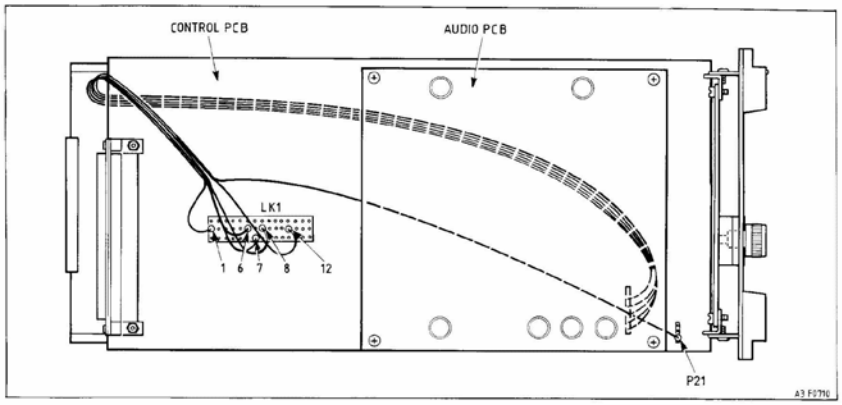


Fig. 2 Connections

Function	Interconnection		Remarks
	Interface PCB AT29074	Logic PCB AT29023	
Key Tone I/P to RCM	PLC pin 1 (Brown lead)	P21	Required when T/T function enabled and is fitted as standard. Used to prevent Line Fail T/T timeout when Tx is keyed.
Intercom enable Intercom disable	PLC pin 2 PLC pin 2 (Red lead)	LK1 pin 6b LK1 pin 6a	
Line data enable Supervisory tone signal enable Supervisory tone signal disable	PLC pin 3 PLC pin 3 (Orange lead)	LK1 pin 1b LK1 pin 1a	Enables supervisory tone to line, when deselected RV4 of AT28793 should be adjusted to set minimum audio from FSK tone generator.
Talkthrough enable Talkthrough disable	PLC pin 4 PLC pin 4 (Yellow lead)	LK1 pin 8b LK1 pin 8a	
Squelch defeat enable Squelch defeat disable	PLC pin 5 PLC pin 5 (Green lead)	LK1 pin 12b LK1 pin 12a	
Base Station Select required Base Station Select not required	PLC pin 6 PLC pin 6 (Blue lead)	LK1 pin 6c LK1 pin 7a	This function is exclusive with the channel change option. PLC pin 6 may also be used to connect M80 special function output to any control function on LK1 of AT04872/- e.g. disable CTCSS encode.

DETAILED DESCRIPTION

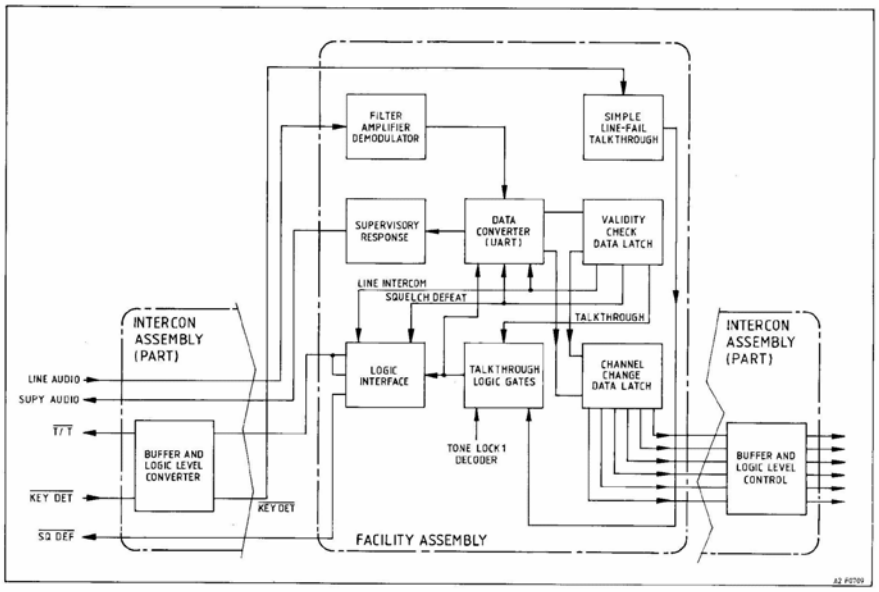


Fig. 3 Block Diagram

Summary

Interface PCB AT29074

The Interface PCB provides matching between the Facility PCB, Base Station and M80 Control Unit, also the 10V DC supply for the Facility PCB. An 18V DC input from the Base Station PSU is fed via PLA pin 15 to voltage regulator IC1, the output of which is the 10V DC supply for the Interface and Facility PCB's.

IC2, a Quad Comparator, acts as a buffer and logic level converter for the FSK DATA VALID, T/T, LINE I/C and KEY DETECT facilities. IC3, IC4 and IC5 control the Channel Change and Logic Function outputs as set by LK1, LK2 and LK3.

Links LK1 and LK2 control the logic inversion function of quad exclusive OR gates IC3 and IC4. LK1 enables the logic output of IC5 channel lines C1 to C6 to be inverted thereby allowing the channel change output to be linked via LK3 to provide base station site selection when channel change is not required. LK2 enables the logic output of IC5 'special function 4' and 'free function pin' lines to be inverted. Link LK3 provides access to the eight output signals from IC5 (six channel change, 'special function 4' and 'free function pin') via a current limiting resistor, R15, to a common connection at PLC pin 6 which may be used to drive a Base Station control module, this allows special functions e.g. 'RF power control' to be selected on the basis of channel selected.

Facilities PCB AT28793/04

The purpose of the Facilities PCB is to decode commands originating from the M80 series Controller. These commands are in the form of FSK bursts and the assembly converts them into logic outputs corresponding to the base station facility requested by each command.

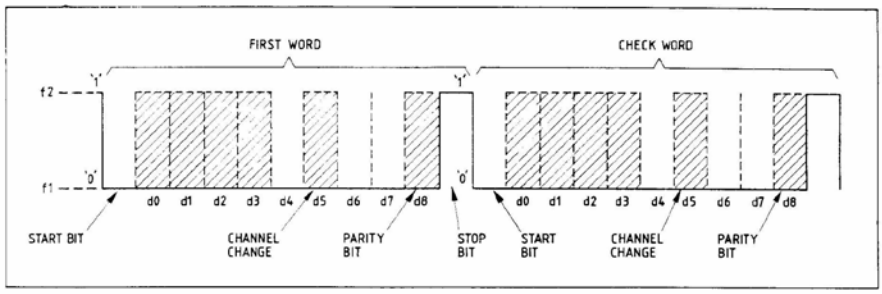


Fig. 4 M80 Signalling Format

Fig. 4 shows the format of an M80 FSK signalling burst. It consists of two eleven bit words, the second being a repeat of the first to provide extra security against noise and speech being decoded as FSK commands. Each word begins with a start bit, followed by the eight data bits, then a parity bit and finally a stop bit. The first four bits provide individual control for the base station facilities, provided the four most significant bits are 'low'. The sixth bit is used as a flag to indicate that the first four bits are to be interpreted as a channel change information, bits 4,5 and 7 being low.

Demodulation and Data Conversion

Line audio comes into the Facilities PCB on SKG pin 7 and is fed through a bandpass filter (IC1, IC2) and unity gain buffer amplifier IC3(b). After attenuation of the audio signal by R12 and R13, the FSK information present in the audio is fed into the demodulator IC4 and the demodulated output appears as a digital pulse train at pin 7. This output is gated with the lock output from IC4 pin 6 to provide a valid demodulated signal. NAND gate IC20(c) will then allow the data through to IC14, the Universal Asynchronous Receiver/Transmitter (UART), via IC8(c). Movement of data from IC20(c) is prevented by the OR gate IC8(c) while supervisory information is being sent.

The data is fed into IC14 on the 'Serial Data In' terminal, pin 20. IC14 converts this serial form data into parallel form by loading it into it's receiver holding register and then presenting the data outputs simultaneously on the receiver bus IC14 pins 5-12. When this has occurred, a logic 'high' appears on the Data Available Terminal pin 19 to flag the arrival of each word. Half a UART clock period later, IC15(b) applies a 'low' to IC14 pin 18 (Data Available Reset) resetting pin 19 to a 'low'. This enables IC14 to receive the next data pulse train from IC4.

Word Validation

IC15(a), IC16, IC18 and IC21 serve to check the validity of FSK information received by the Remote Control Module. A correct FSK signal burst should consist of two identical eight bit words. Each word is checked individually and then the lower nibble of the two are compared before their information is accepted. Referring to the receiver bus terminals of IC14, the frame error (FE) and parity error (PE) outputs indicate when the received word is the wrong length or when an odd number of bits have been corrupted in transmission.

For a correct data word, IC14 pins 5,6,8,13 and 14 of will be 'low'. When these outputs are accompanied by the data reset from IC15(b), there will be a pulsed 'high' output from the NOR gate IC21. This will be inverted to 'low' at the output of IC19(a). The result of this arrangement is that on arrival of the first data word, the output from IC15(a) pin 1 is switched to a 'low'. This 'low' together with the pulsed 'low' output from IC19(a) enables IC16(a) to latch the first four bits of the data word coming in from the D0-D3 terminals of IC14. On the arrival of the second data word, the pulsed 'high' output from IC21 will result in a reversal of the outputs from IC15(a) pins 1 and 2. In this state the latch IC16 will be disabled.

IC18 will then have the first data word from latch IC16 presented to it on pins 1,9,11 and 14 and the second data word, from IC14, presented on pins 2,7,10 and 15. Comparison of both words by IC18 will be enabled while there is a pulsed 'high' from IC21. If both words are the same, the outputs from IC18 pins 12 and 13 will be low and storing of the new information in the output latch IC17 will be enabled.

Facility Outputs

The valid data necessary for providing facility control in the base station appears as a 'high' on IC17 pins 4,5 and 6. Output pin 3 is a spare. Each output is then fed to the Interface PCB via a logic interface circuit comprising IC20(a),IC23 and TR1.

These outputs are routed as follows:-

(i) The talkthrough output from IC17 pin 6 is fed through OR gates IC7(a) and IC8(a), a 5V to 10V logic level converter IC23(d) and the NAND gate IC20(a). Gates IC8(a) and IC10(a) are to ensure that the mobile controlled talkthrough facility is only enabled when the Tone Lock Decoder is in receipt of the appropriate lock tone, i.e. when the receiver squelch is lifted. The talkthrough output is gated at IC7(a) with an output from the line-fail counter IC6. This allows IC6 to switch talkthrough on in the event of a line condition i.e. when the key tone is absent at SKG pin 9 of the Facilities PCB.

(ii) Squelch defeat output from pin 5 switches on TR1 and the collector current of this then operates the squelch defeat logic in the receiver. The squelch defeat control is also fed through logic level converter IC23(c) and gated with the talkthrough control at IC20(a). This ensures that the squelch defeat overrides the talkthrough.

(iii) The line intercom output from IC17 pin 4 is fed to IC23(b) which acts as a non-inverting buffer and logic level converter. This output is used in the Audio Assembly to inhibit keying of the transmitter.

Supervisory Function

IC9, IC12(a), IC13 and the associated logic gates provide a superivsory function by enabling a serial form data output from IC14, and from this producing a supervisory FSK tone burst.

To initiate this fuction, the current score of facility outputs from IC17 is transferred to the transmit bus, IC14 pins 26-29, via the select gate IC22. However, when the channel change facility occurs, IC22 will be switched to its opposite state, causing D0-D3 (pins 9-12) of the receive bus to be connected directly to D0-D3 of the transmit bus in IC14. D4, D6 and D7 of the transmit bus are strapped to logic 'low' and thus represent the check bits of the originally received word. D5 represents channel change and is also 'low', except when channel change is indicated in which case it will be 'high'.

When IC14 pin 23 is pulsed 'low', the data available on the transmit bus appears in serial form on the serial data output terminal, pin 25. This output is fed into IC9 on pin 9 where it is converted to FSK modulated data and is then routed to the Audio Assembly via SKG pin 6. The frequency of the FSK output is determined by externally connected timing resistors. Trimming potentiometers RV2 and RV3 provide a high and low frequency to the FSK output while RV4 sets the amplitude.

IC13 is a decade counter and controls the timing of FSK sends from IC9. On arrival of the first valid data word, the output of IC12(a) pin 2 will be clocked to a logic 'low' causing a reset to be applied to counter IC13 on pin 15. On arrival of the second valid word, the clocked output of IC12(a) changes its state to a logic high, and the reset is removed from IC13 allowing it to begin its count of 0-8. When IC13 reaches the count of 3 it will, by means of NAND gate IC10(a), cause a double negative-going pulse to be applied to IC14 pin 23. This results in a double send of the data word from IC14 pin 25, which is a facsimile of the originally received FSK signalling burst. The counter IC13 stops at 8 because of a reset 'high' from pin 8 to pin 13.

Channel Change

Referring to Fig.3 the binary coded channel change information is contained in the D0-D2 bits of the FSK data word. This is distinguished from facility information by the D5 bit which produces a logic 'high' on IC14 pin 7. Additionally, bits D4, D6 and D7 will produce a 'low' on pins 5,6 and 8 of IC14 and when these outputs are fed to IC25, they will be treated as valid channel change information. When this condition exists, and the output from IC18 pin 3 pulses 'high' then the output on IC25 pin 3 will also pulse 'high'. This enables the eight bit addressable latch IC24 to latch in the channel change information from IC14.

When a valid channel change word is received, the output at IC12(b) pin 13 will clock 'high'. Since this output is fed onto the transmit bus, IC14 pin 31, it will result in the supervisory signal correctly representing receipt of channel change information.

Line-Fail

The function of this is to provide an automatic switch to talkthrough if the line connection between the Remote Control Module and the M80 series Controller is broken. The counter of IC6 is reset whenever a valid data word is received and whenever keytone is detected. If neither of these events occur in a time period of 54 seconds, the counter will stop and IC6 pin 15 will go 'high'. Provided the link LK2 is in position B-D, this 'high' will be used to switch the Base Station to talkthrough.

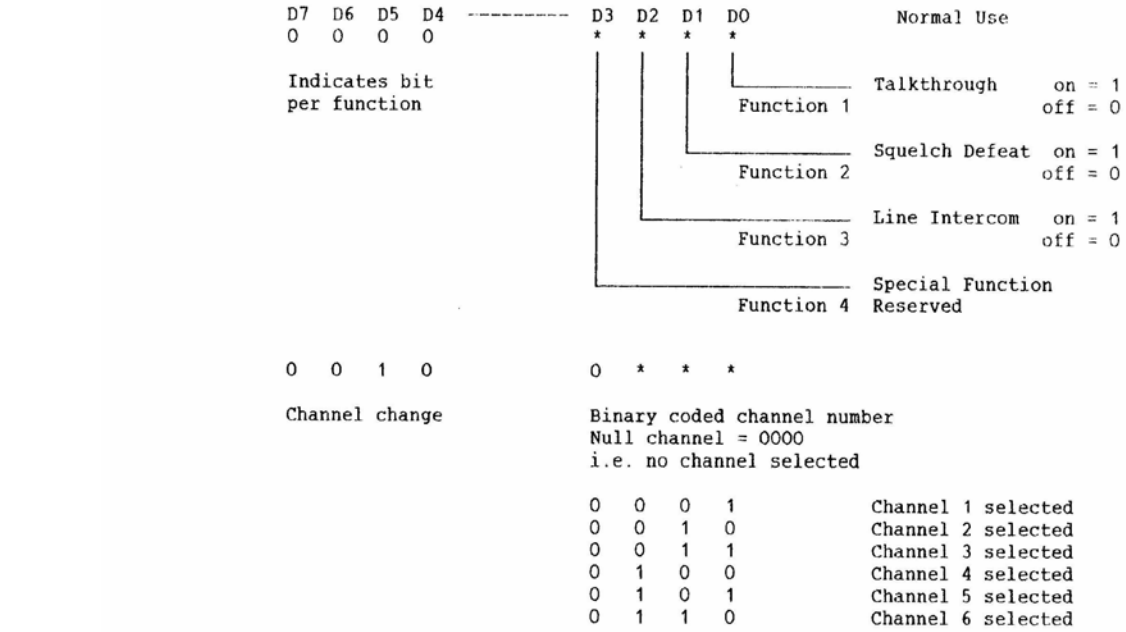
Two alternative link positions are provided, these are:-

(i) A-D to provided continuous talkthrough

(ii) C-D to inhibit line-Fail talkthrough

Data Codes

The following is a list of the remotely controlled facilities and the data codes used for selecting them.



SETTING UP AND ALIGNMENT PROCEDURE

Note: (i) Before carrying out the following procedure ensure that the base station transmitter and receiver are correctly aligned.
(ii) For the purpose of this procedure no links need be fitted to the Interface PCB AT29074

TEST EQUIPMENT

Note: Refer to Part I, Table 3.1 for suitable types.

10	RF Signal Generator	4	Digital Voltmeter
2	AF Generator	5	Oscilloscope
19	SINAD Meter	12	Frequency counter
22	50W, 50Ω Dummy Load	-	M80 Series Control Unit (wired for 2 or 4 wire line as required with facilities and channel change

TEST PROCEDURES

Linking Information

FACILITY ASSEMBLY AT28793/04

Link	Position	Function
LK1	A-B B-C	Engineering Tone On Supervisory On
LK2	B-D A-D C-D	Line Fail Talkthrough Permanent Talkthrough Inhibited Talkthrough

INTERFACE BOARD AT29074

Link	Position	Function
LK1	B-C A-B	Channel Change Logic Output Active Low Channel Change Logic Output Active High
LK2	B-C A-B	Logic Function Output Active Low Logic Function Output Active High
LK3	A B C D E F G H	Channel 1 Channel 2 Channel 3 Channel 4 Channel 5 Channel 6 Special Function Unused Open Collector Buffer

Note: (i) Set LK1 active low to select a channel, active high to select a base station.
(ii) Standard position for LK1, LK2 is B-C
(iii) Default standard for LK1, LK2 is low.

DC Supply Check

1. Switch off the base station and disconnect PLG/SKG interconnecting the RCM Facility PCB AT28793/04 and the Interface PCB AT29074.

2. Switch on the base station and check that the voltage between pin 2 of regulator IC1 and the negative plain of the Interconnecting PCB AT29074 is between 9,3 and 10,5V DC.

3. Switch off the base station and reconnect PLG/SKG.

FSK Output Level

1. Link RCM Facility PCB AT28793/04 as follows:-

   LK1 A-B Engineering Tone On
   LK2 C-D Inhibit Talkthrough

2. Ensure interconnections between Interface PCB AT29074 and Logic PCB AT29023 are as follows:-

   PLC pin 1 - P21 connected

   All other connections in the park position (pin 'a')

3. On the Logic PCB AT29023 connect a temporary shorting link between LK1 pin 1B and TP1 (ground), this opens the audio data path between the RCM Facility PCB AT28793/04 and line.

4. Connect the Audio Level Meter to SKU pins 1 and 3 (600Ω Rx) at the rear of the base station.

5. Switch on the base station.

6. Adjust RV4 on RCM Facility PCB AT28973/04 and RV14 on Control Audio PCB AT29024/01 for maximum output.

7. Adjust RV14 on Control Audio PCB AT29024/01 for an output to line of -10dBm.

8. Adjust RV4 on RCM Facility PCB AT28973/04 for an output to line of -14dBm (4 wire), -18dBm (2 wire).

9. Disconnect the Audio Level Meter from SKU pins 1 and 3, connect the Audio Frequency Counter to SKU pins 1 and 3.

Note: The controls detailed in the following procedures are factory preset; adjustments are normally only required if associated components are replaced.

10. Check tone output frequency is 2295Hz±5Hz, if necessary adjust RV3 on the RCM Facility PCB AT28793/04 to obtain this frequency.

11. Remove LK1 on the RCM Facility PCB AT28793/04.

12. Check tone output frequency is now 2505Hz±5Hz, if necessary adjust RV2 on the RCM Facility PCB AT28793/04 to obtain this frequency.

13. Refit LK1 on the RCM Facility PCB AT28793/04 in the B-C position.

14. Remove the temporary shorting link between LK1 pin 1b and TP1 on the Logic PCB AT29023, fitted at step 3.

15. Check that the FSK tone to line is muted.

16. If the Line Fail Talkthrough option is required fit LK2 B-D on the RCM Facility PCB AT28793/04.

FSK Receiver

1. Set the AF Signal Generator to -14dBm at 2,4kHz and connect to SKU pins 4 and 5 (Tx) on the rear of the base station.

2. Using the oscilloscope check that the peak voltage on TP1 of the RCM Facility PCB AT28793/04 is greater than 60mV.

3. Switch off the base station.

Functional Checks

1. Connect the M80 Series Control Unit to the 600Ω line socket SKU at the rear of the base station.

2. Connect the Thruline Wattmeter to the base station Tx Output.

3. Set the RF Signal Generator to 1mV at the frequency in use and connect to the base station Rx input.

4. Select the required Functions by removing the appropriate interconnecting leads between the Interface PCB AT29074 and the Logic PCB AT29023 from the 'park' position and connecting them to the enable position. Switch on the base station.

5. Carry out the applicable Functional Checks dependent on the linking and Options for which the base station is set up.

6. If any of the Functional checks fail, set up the FSK demodulator as follows:-
   (i) Using the oscilloscope, monitor IC20 pin 10 on the RCM Facility PCB AT28793/04
   (ii) Continually send Data Code 0000 0001 from the M80 Control Unit and adjust RV1 on the RCM Facility PCB AT28793/04 for a 1 to 1 mark space ratio for start bit and first data bit.

7. If Line Fail Talkthrough is enabled, disconnect the M80 Control Unit from the base station and check that the base station detects Line Fail within one minute and switches to Talkthrough.

Conclusion

1. Switch off base station and remove all test equipment.

2. Set links as required and reconnect all leads disconnected for the Test Procedure.

PARTS LIST

REMOTE CONTROL ASSEMBLY
AT14920

Cct Ref	Description	Part No.	Remarks
	PCB Assy RCM Facility	AT28793/04	
	PCB Assy Interface	AT29074	
	Cable assy ribbon	AT70246	To LK1, P21 Control PCB
	Cable assy ribbon	AT70247	To PLB Channel 1-6 Facilities
	Carrier Assy	AT14919	
	Pillar hexagon	BT04402	2/Carrier-Facilities PCB
	Pillar hexagon	BT04404	1/Carrier-Facilities PCB
	Scr st csk pozi M2,5 x 6mm	QJ11601/B	1/Post-carrier
	Scr st pan pozi M2,5 x 6mm	QJ11945/B	3/Facilities PCB-posts, 2/Posts-carrier
	Scr st pan pozi M3 x 6mm	QJ11901/X	4/Interface PCB-carrier

FACILITY PCB
AT28793/04

Semiconductors & IC's

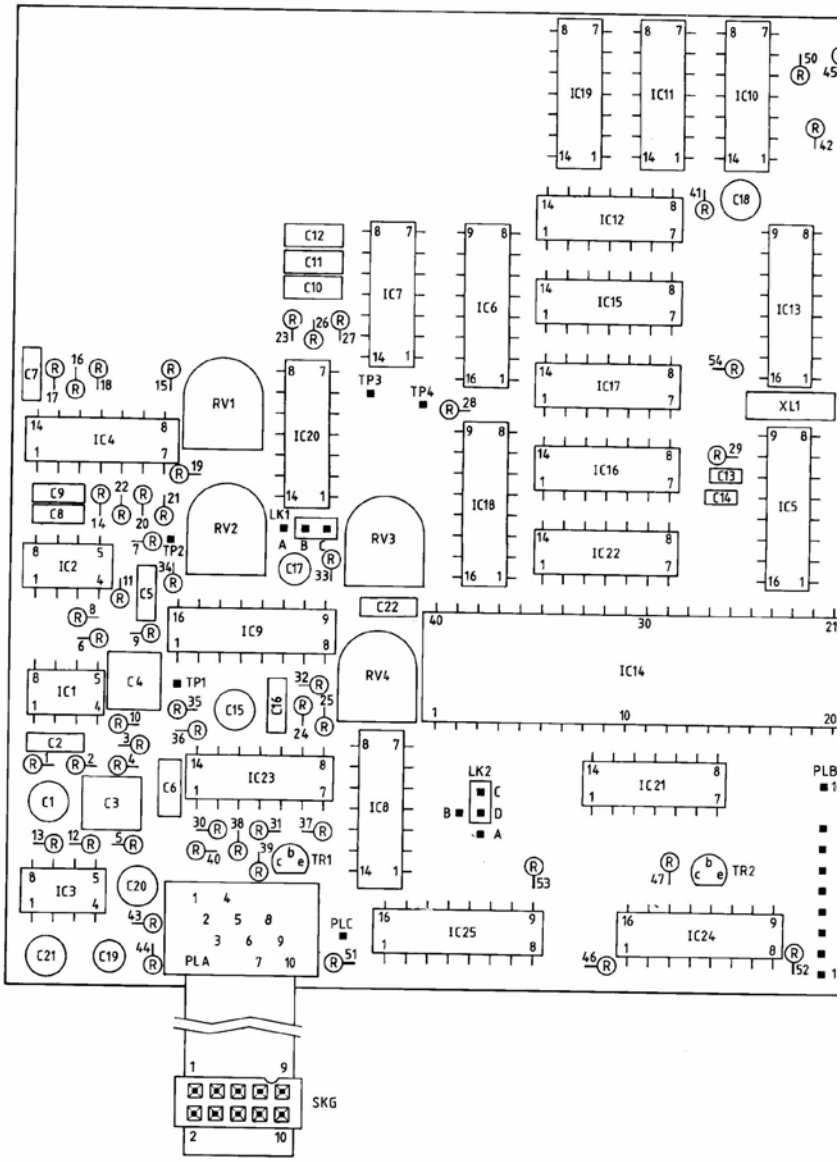
IC1-3	IC Dual Op Amp 1458	FU99092
IC4	IC FSK Demod/tone decoder	FU03751
IC5	IC 4060mos	FU99121
IC6	IC 4020mos	FU99067
IC7,8	IC 4071mos	FU99093
IC9	IC Mono function gen	FU03750
IC10	IC 4011mos	FU99062
IC11	IC 4081mos	FU99097
IC12	IC 4013mos	FU99064
IC13	IC 4017mos	FU99101
IC14	IC Uart	FU09159
IC15	IC 4027mos	FU99071
IC16,17	IC 4076mos	FU99140
IC18	IC Cos/mos Mag Comparator	FU09166
IC19	IC 4093mos	FU99103
IC20	IC 4023mos	FU99069
IC21	IC 4078mos	FU99130
IC22	IC 4019mos	FU99066
IC23	IC Quad comparator	FU99120
IC24	IC 4099	FU99136
IC25	IC 4585	FU99144
TR1,2	Transistor BC547b	FV05891

Resistors

R1	4k64	±1%	0,25W	m film	PL99094
R2-4	8k25	±1%	0,25W	m film	PL99097
R5	6k81	±1%	0,25W	m film	PL99096
R6	21k5	±1%	0,25W	m film	PL99102
R7-9	8k25	±1%	0,25W	m film	PL99097
R10	6k81	±1%	0,25W	m film	PL99096
R11	38k3	±1%	0,25W	m film	PL99105
R12	3k3	±5%	0,25W	c film	PM01442
R13	2k2	±5%	0,25W	c film	PM01440
R14	150k	±5%	0,25W	c film	PM01462
R15	82k5	±1%	0,25W	m film	PL99109
R16	1m	±1%	0,25W	m film	PL51210
R17,18	100k	±1%	0,25W	m film	PL99110
R19	560k	±5%	0,25W	c film	PM01469
R20-22	22k	±5%	0,25W	c film	PM01452
R23	100k	±5%	0,25W	c film	PM01460
R24-27	56k	±5%	0,25W	c film	PM01457
R28	100k	±5%	0,25W	c film	PM01460
R29	1m	±1%	0,25w	m film	PL51210
R30	10k	±5%	0,25W	c film	PM01448
R31	100k	±5%	0,25W	c film	PM01460
R32	52k3	±1%	0,25W	m film	PL45345
R33	59k	±1%	0,25W	m film	PL45350
R34	220	±5%	0,25W	c film	PM01428
R35,36	10k	±5%	0,25W	c film	PM01448
R37	39k	±5%	0,25W	c film	PM01455
R38-40	10k	±5%	0,25W	c film	PM01448
R41	100k	±5%	0,25W	c film	PM01460
R42	100	±5%	0,25W	c film	PM01424

Cct Ref	Description	Part No.	Remarks
Resistors (Cont'd)			
R43,44	10k ±5% 0,25W c film	PM01448	
R45	100k ±5% 0,25W c film	PM01460	
R46	10k ±5% 0,25W c film	PM01448	
R47	39k ±5% 0,25W c film	PM01455	
R48,49	Not Used		
R50	10k ±5% 0,25W c film	PM01448	
R51-54	100k ±5% 0,25W c film	PM01460	
RV1	47k ±20% Pot skel lin	PL01498	
RV2/3	10k ±20% Pot skel lin	PL01478	
RV4	47k ±20% Pot skel lin	PL01498	
Capacitors			
C1	10 ±20% 63V elec	PS99445	
C2	10n ±5% pes	PQ99532	
C3,4	10n ±2,5% 63V pp	PQ99621	
C5	10n ±5% pes	PQ99532	
C6	100n ±10% 63V pes	PQ99511	
C7	4n7 ±5% 25V cerm	PN99731	
C8-10	100n ±10% 63V pes	PQ99511	
C11,12	10n ±10% 63V pes	PQ99510	
C13	470p ±5% cer	PN99886	
C14	220p ±5% cer	PN99882	
C15	33 ±20% 16V elec	PS99409	
C16	6n8 ±5% 25V cer	PN99732	
C17	1 ±20% 50V elec	PS99869	
C18	10 ±20% 63V elec	PS99445	
C19	470n ±20% 50V elec	PS99867	
C20,21	33 ±20% 16V elec	PS99409	
Miscellaneous			
	Cable ribbon 10 x 28awg	FC99200	
	Con fem skt 10 pos'n	FS99185	
PLA	Con PCB solder 10 pos'n	FP99150	
	Link connector	FC99060	
XL1	Xtal, cer resonator 307khz	FC03199	
	INTERFACE PCB AT29074		
Semiconductors & IC's			
IC1	IC Volt reg 317	FU99119	
IC2	IC Quad comparator	FU99120	
IC3,4	IC 74HC86	3513 993 32027	
IC5	IC UDN2595A	FU99708	
TR1	Transistor BC337	FV05896	
D1	Diode GP BYW54	FV05892	
D2	Diode GP 1N4148	FV05808	
D3			Not Used
D4-7	Diode GP 1N4148	FV05808	
Resistors			
R1	215 ±1% 0,25W m film	PL99078	
R2	1k47 ±1% 0,25W m film	PL99088	
R3	100k ±2% 0,25W m film	PM99330	
R4,5	10k ±2% 0,25W m film	PM99306	
R6	1k ±2% 0,25W m film	PM99282	
R7-9	10k ±2% 0,25W m film	PM99306	
R10	100 ±5% 2,5W ww	PM01124	
R11-15	820 ±2% 0,25W m film	PM99280	
RN1	100k ±5% 9-pin sil	RN99531	
Capacitors			
C1	100n ±10% 63V pes	PQ99511	
C2,3	1 ±20% 50V elec	PS99869	
C4	100n ±10% 63V pes	PQ99511	
C5	10 ±20% 35V elec	PS99861	
C6	1n ±20% cer	PN99915	
C7-9	100n ±10% 63V pes	PQ99511	

Cct Ref	Description	Part No.	Remarks
Miscellaneous			
	Cable assy ribbon	AT70245	To PLC on Control PCB
	Connector PCB solder 16 pos'n	FP99151	
Pin 1	Header 1 pos'n	3513 504 00121	
	Header less ears 10 pos'n	FP99220	
LK1,2	Header str male 3 pos'n	FC00837/03	
PLC	Header str male 7 pos'n	FC00837/07	
	Header str male 10 pos'n	FC00837/10	
	Link connector	FC99060	
	Plug 25-way D-type angle	FP99027	
LK3	Plug PCB mtd 2 X 8	FP99182	
	Nut st hex M2,5	QA11604/B	2/25-way plug
	Nut st hex M3	QA11605/X	1/IC1
	Bush insulating (TO-220)	QA99024	1/IC1
	Washer thermal (TO-220)	QA99111	1/IC1
	Scr st pan pozi M3 x 6mm	QJ11901/X	1/IC1
	Scr st pan pozi M2,5 x 10mm	QJ11947/B	2/25-way plug


IC19
IC11
IC10
IC12
IC15
IC17
IC16
IC22
IC13
IC5
IC7
IC6
IC18
IC20
IC4
IC2
IC1
IC3
IC9
IC14
IC8
IC23
IC21
IC24
IC25
RV1
RV2
RV3
RV4
C12
C11
C10
C18
C7
C9
C8
C5
C22
C4
C15
C16
C2
C1
C3
C6
C20
C21
C19
C13
C14
XL1
LK1
LK2
TP1
TP2
TP3
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TR1
TR2
PLA
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PLC
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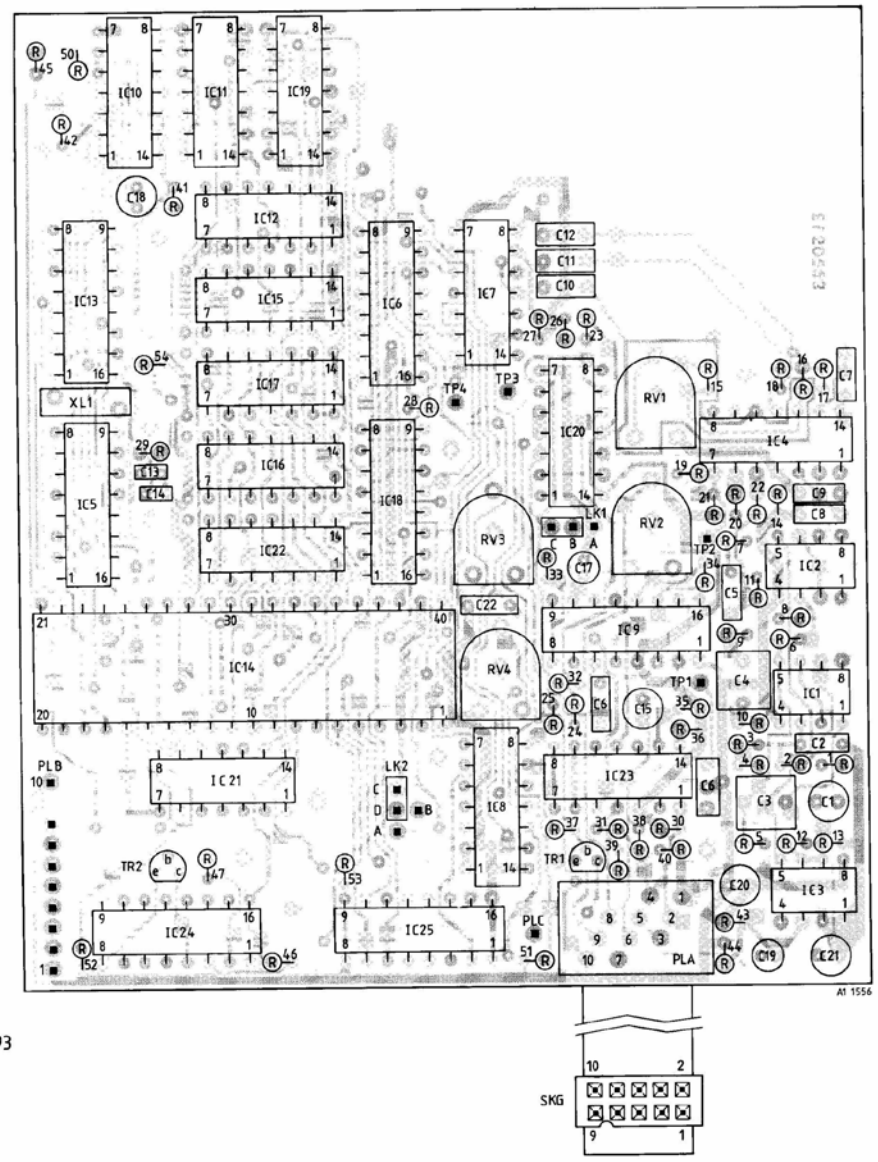


28793

FACILITY PCB AT28793/04
LAYOUT DIAGRAM

5000 SERIES CTCSS/VOTING/PIPTONE OPTIONS PCB

INTRODUCTION

The CTCSS/Voting/Piptone PCB is an option which may be fitted to the FR5000 series base stations. When fitted, it is located in the Control Module where it is mounted on the Control Logic PCB and electrically connected to the Front Panel PCB.

CTCSS

The CTCSS circuits provide sub-audio signalling facilities for FR5000 series base stations when used in CTCSS (Continuous Tone Controlled Squelch System) applications. In the receive mode, the decode facility is used to inhibit the audio path to the loudspeaker pending receipt of the correct tone. In the encode mode, activated by the press-to-transmit switch, the sub-audio tone is used to modulate the outgoing carrier.

Voting

The Voting circuits facilitate the automatic selection of the 'best' of a number of base station sites within range of a calling mobile. The Voting requirement is for the equipment to ensure that only intelligible signals are considered for selection purposes, and to automatically select the strongest signal. The basis for assessing the signal strength is receiver noise and carrier level as measured at the base station.

Piptone

Where a requirement exists to indicate that a channel is 'busy' provision is made to key the transmitter when the squelch opens to enable the transmission of a piptone. The piptone generator, when activated by a piptone enable input from the Control Logic PCB, provides a tone which is combined with the CTCSS tone and fed to the transmitter audio circuitry.

SUMMARY OF DATA

CTCSS

Signalling Format	Continuous sub-audio tone. Standard EIA CTCSS tones

CTCSS Encoder

Maximum No. of Tones	38
Tone Frequency Range	67,0Hz - 250,3Hz (Refer to Table 1 for specific frequencies)
Frequency Accuracy	Better than ±5% relative to nominal EIA frequency over the operating temperature range
Amplitude Stability	Less than ±1dB variation with frequency and temperature
Harmonic Distortion	Less than 5%
Risetime	Less than 50ms to 90% output level after removing inhibit

Reference Oscillator Frequency	1MHz	
Encode Level	15% Deviation	Nominal, adjustable between 8 and 16%

CTCSS Decoder

Frequency Accuracy	Better than 0,5%	
Selectivity	±0,5% minimum, ±3% maximum with a typical value of 1,7%	
Response Time	Less than 250ms	
Decode Sensitivity	0,2µV	

CTCSS Filter

Passband Gain	0dB ±0,5dB at 1kHz	
Passband Ripple	Less than ±0,5dB over the range 300Hz to 3kHz, relative to 1kHz	
Stopband Attenuation	Greater than 40dB over the range 67Hz to 250Hz	

Voting

Voting Frequencies (Hz)	2707 or No Tone - Squelch closed 2730 - Squelch open, no threshold exceeded 2791 - Threshold 1 exceeded 2852 - Threshold 2 exceeded 2913 - Threshold 3 exceeded 2972 - Threshold 4 exceeded	
Voting Frequency Tolerance	±1Hz	
Voting Level	-24dBm	Nominal, adjustable to suit customer requirements
Voting Threshold Levels	0,6µV 1,0µV 2,0µV 5,0µV	

Voting Filter

Passband gain	0dB ± 0,5dB at 1kHz
Passband ripple	Less than ±0,5dB over the range 300 - 2500Hz, relative to 1kHz
Standard attenuation	Greater than 30dB over the range 2,7kHz to 3kHz

Piptone

Piptone Frequency		950 - 1100Hz
Piptone Level		60% Deviation Nominal, adjustable to suit customer requirements
Piptone Repitition Rate	2 Seconds (approx.)	

INSTALLATION

Note: (i) Refer to Fig.1 throughout this installation procedure.
(ii) Before installation ensure that all Links and Switches are set for the functions and frequencies required.

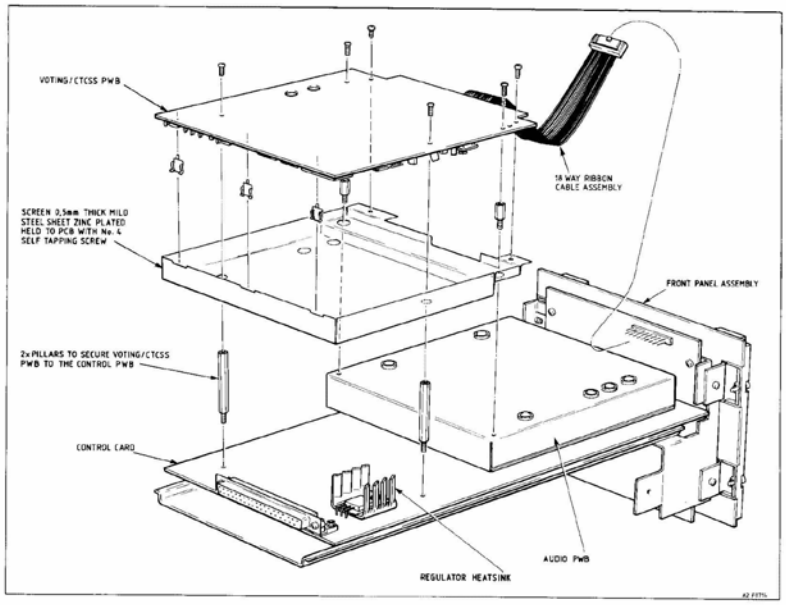


Fig.1 Installation

Installation Items

Description	Part No	Remarks
Pillar 7,1mm long	BT04074	2 off
Pillar 35mm long	BT04075	2 off

(1) Release the securing fasteners and withdraw the Control Module on its runners to gain access to the Control Logic PCB.

(2) Remove and retain the two M3 screws securing the Control Logic PCB to the plate assembly, fit the two 35mm hexagonal pillars provided in their place.

(3) Remove and retain the two rearmost M3 screws securing the screen assembly to the Control Audio PCB, fit the two 7,1mm hexagonal pillars provided in their place.

(4) Using the four screws retained at steps (2) and (3) secure the CTCSS/Voting/Piptone PCB to the four pillars.

(5) Connect the 20-way ribbon cable to PLB on the Control Module Front Panel PCB.

(6) Ensure all Links on the Control Logic and Options PCB's are correctly set for the options required.

(7) Relocate the Control Module in the shelf and lock the securing fasteners.

DETAILED DESCRIPTION

CTCSS

A separate IC, type FX365, is used for both the decode and encode functions. This permits duplex operation, with different decode and encode frequencies if necessary. The required 5 volt supply is provided by IC7(c).
A 1MHz clock frequency, generated by the oscillator in the decoder, IC15, and crystal XL1, is used to clock IC15 and, via pin 2, encoder IC16. Incoming Rx audio is applied to IC7(b), a low-pass filter with gain, which attenuates noise and speech signals above the tone signalling frequency range.
The signal level at the decoder input is preset at the factory and should not normally require adjustment, if however it becomes necessary to increase the decoder sensitivity or reduce 'falsing' RV3 may be adjusted. To increase decoder sensitivity turn RV3 clockwise (with PCB viewed from the non-component side), to reduce decoder 'falsing' turn RV3 anti-clockwise. When a tone is detected a 'low' output from IC15 pin 13 is fed to TR1, cutting it off, which produces a 'high' output to PLA pin 7. The 'low' output from IC15 pin 13 is also fed to TR2, cutting it off, which illuminates LED2, the Tone Valid indicator. The decode frequencies are set by DIL switch SA. The decoder can be overridden by linking LK10(b) D-E.

The CTCSS encoder is activated by the removal of the Disable CTCSS input at PLA pin 4 which connects to IC16 pin 17. The encoder output from IC16 pin 16 is fed via C33 to:-

(i) RV2, the set CTCSS LEVEL potentiometer, where it is combined with the output from the piptone generator and fed via summing amplifier IC7(d) to PLA pin 3

(ii) IC7(a) and its associated circuitry, illuminating LED3, the CTCSS TONE GENERATED indicator.

The encode frequencies are set by DIL switch SB.

Voting (ASSORT)

The output of Voting Encoder, IC14, is a sinewave, the frequency of which varies in steps between 2707Hz and 2972Hz according to the state of the squelch and the received signal strength.
With LK6 linked B-C no tone is produced when the squelch is closed, with LK6 linked A-B the lowest tone is produced when the squelch is closed. The next higher frequency corresponds to the squelch being open but no RF threshold level being exceeded.
Receiver noise at PLA pin 1 is fed via C27 and R43 to active rectifier, IC2(b) and associated components, which produces a DC level which corresponds to the receiver noise level. This DC is fed via IC8(a) to position C of links LK1-4.
A Carrier Level input at PLA pin 6 is fed via IC8(b) and associated circuitry to position A of links LK1-4.
The +14V DC at PLA pin 5 is applied across potential divider network R36,44, the input to IC2(a) being taken from their junction. IC2(a) output, a +7V DC reference is fed via R48 to potentiometers RV4-7 which set the four signal level thresholds. The comparators, IC9(a-d), can operate on either receiver noise DC or carrier level DC ,depending on the settings of LK1-4. Normally the lower two levels operate on receiver noise (links set B-C), and the two higher levels operate on carrier level (links set A-B).

The output from the comparators is fed to a series of OR gates IC12(b-d) which prevent invalid frequencies being generated if the thresholds are incorrectly set. Thus if any comparator operates before other comparators with a lower threshold level then the transmission gates associated with the lower levels are also opened.

Transmission gates IC13(a-d) are used to switch resistors R62-67 into the oscillator timing circuit as the thresholds are exceeded, thus increasing the tone frequency. The sinewave output from IC14 pin 2 is fed via R76, C40, R84 and TR4 to amplifier IC3(b) the gain of which is controlled by RV10, ASSORT LEVEL. IC3(b) output from pin 7 is fed via C42 to PLA pin 10 as ASSORT Tone. If the 'Disable ASSORT' input, PLA pin 16, is 'high' TR3 conducts, cutting off TR4 so that there is no voting tone output.
The voting encoder can be disabled by setting LK9 to B-C.

Piptone

A 'high' input on PLA pin 12 causes relaxation oscillator IC1(a) to apply a positive pulse to Wien Bridge oscillator IC1(b) approximately every 2 seconds producing a piptone. The output of IC1(a) is also fed via D1, R9 to LED1, PIPTONE indicator, causing it to flash at approximately 2 second intervals. The piptone, at a level set by RV1, PIPTONE LEVEL, is combined with the generated CTCSS tone in summing amplifier IC7(d) and then routed to the transmitter audio circuitry.
To enable the piptone level to be set, LK10(a) is linked A-B, causing the tone to be generated continuously.

Audio Filters

The receiver audio on PLA pin 9 is fed directly to a low-pass filter and, via Link 7 a high-pass filter. The low-pass filter comprising IC3(a), IC4(a,b), IC8(d), IC10(a-d) and their associated circuitry is used to remove speech frequencies within the frequency range of the voting tones, the notch frequencies being set by RV11-13. The high-pass filter comprising IC5(a,b), IC6(a,b), IC11(a-d) and their associated circuitry is used to remove CTCSS tones from the incoming Rx audio, and pass speech frequencies above 300Hz, the notch frequencies being set by RV14-16. Both filters are active seventh-order elliptic function filters and have a nominal unity gain in their respective passband. The low-pass filter is by-passed when LK7 is in the B-C position, the high-pass filter is by-passed when LK8 is in the B-C position. With both LK7 and LK8 in the A-B position both filters are in circuit. If filtered audio is required, LK25 on the Control Logic PCB must be linked B-C.

CTCSS Frequency Setting Up Procedure

Switch SA sets CTCSS encode frequency, switch SB sets CTCSS decode frequency. For Voting/Piptone Option both switches should be set to the 'No tone' position.

Nominal Frequency (Hz)	Switch Positions					
	1	2	3	4	5	6
67,0	0	0	0	0	0	0
71,9	0	0	0	0	0	1
74,4	1	0	0	0	0	0
77,0	0	0	0	0	1	1
79,7	0	1	0	0	0	0
82,5	1	0	0	0	0	1
85,4	1	1	0	0	0	0
88,5	1	0	0	0	1	1
91,5	0	0	1	0	0	0
94,8	0	1	0	0	0	1
97,4	1	0	1	0	0	0
100,0	0	1	0	0	1	1
103,5	1	1	0	0	0	1
107,2	1	1	0	0	1	1
110,9	0	0	1	0	0	1
114,8	0	0	1	0	1	1
118,8	1	0	1	0	0	1
123,0	1	0	1	0	1	1
127,3	0	1	1	0	0	1
131,8	0	1	1	0	1	1
136,5	1	1	1	0	0	1
141,3	1	1	1	0	1	1
146,2	0	0	0	1	0	1
151,4	0	0	0	1	1	1
156,7	1	0	0	1	0	1
162,2	1	0	0	1	1	1
167,9	0	1	0	1	0	1
173,8	0	1	0	1	1	1
179,9	1	1	0	1	0	1
186,2	1	1	0	1	1	1
192,8	0	0	1	1	0	1
203,5	0	0	1	1	1	1
210,7	1	0	1	1	0	1
218,1	1	0	1	1	1	1
225,7	0	1	1	1	0	1
233,6	0	1	1	1	1	1
241,8	1	1	1	1	0	1
250,3	1	1	1	1	1	1
No tone	1	1	1	1	0	0

0 = open, 1 = closed.

Table 1

TEST PROCEDURE

Test Equipment Required

Note: Refer to Part I, Table 3.1 for suitable types

10	RF Signal Generator	13	Modulation Meter
2	AF Generator	12	Frequency Counter
15	Thruline Wattmeter	4	Digital Voltmeter
19	SINAD Meter		

Note: (i) Before carrying out the following procedure ensure that the base station transmitter and receiver are correctly aligned
(ii) For the CTCSS modulating frequency use the customer's frequency if known, or, if not known, 100.0Hz

Linking Information

Functions

LK1-4	A-B	Carrier Level
	B-C	Noise Level
LK5	A-B	Squelch. (Always set A-B)
	B-C	Rx Call
LK6	A-B	Voting tone when squelch closed
	B-C	No voting tone when squelch closed
LK7	A-B	Low pass filter in circuit
	B-C	Low pass filter out of circuit
LK8	A-B	High pass filter in circuit
	B-C	High pass filter out of circuit
LK9	A-B	Assort voting tone on
	B-C	Assort voting tone off
LK10a	A-B	Pip tone on at all times (Engineering mode)
	B-C	Pip tone keyed (active high)
LK10b	D-E	CTCSS tone lock off
	E-F	CTCSS tone lock enabled

Option	Option Board Links										
	LK1	LK2	LK3	LK4	LK5	LK6	LK7	LK8	LK9	LK10a	LK10b
CTCSS/Voting/Pip	B-C	B-C	A-B	A-B	A-B	A-B	A-B	A-B	A-B	B-C	E-F
Voting/Pip	B-C	B-C	A-B	A-B	A-B	A-B	A-B	B-C	A-B	B-C	E-D
CTCSS/Pip	B-C	B-C	A-B	A-B	A-B	A-B	B-C	A-B	B-C	B-C	E-F
CTCSS Decode/Pip	B-C	B-C	A-B	A-B	A-B	A-B	B-C	A-B	B-C	B-C	E-F

Ensure LK25 on the Control Logic PCB is linked B-C.

CTCSS Decode

(1) Set Links 1-10 on the options PCB for the CTCSS Decode/Pip option

(2) Set the signal generator frequency to the channel in use, output level 1mV with no CTCSS modulation and connect to the receiver antenna. Check that the Squelch Indicator on the Control Module front panel is extinguished.

(3) Link LK10b E-D, check that the Squelch Indicator on the Control Module front panel is lit. Reset LK10b E-F.

(4) Modulate the signal generator with the CTCSS frequency in use at 15% deviation, check that LED2, TONE VALID, on the options PCB and the Squelch Indicator on the Control Module front panel are lit.

(5) Reduce the signal generator output level to 0,2µV, check that LED2, TONE VALID, on the options PCB remains lit. Reduce the signal generator output to 0µV, check that LED2, TONE VALID, on the options PCB is extinguished.

CTCSS Encode

(1) Set Links 1-10 on the Options PCB for the CTCSS/Pip option

(2) Connect the modulation meter, via the thruline wattmeter, to the transmitter antenna socket, key the transmitter with no external modulation applied and adjust RV2, CTCSS LEVEL on the options PCB to give 15% deviation.

(3) Set the AF generator to 600mV at 1kHz and connect to SKA pin 14 on the transmitter driver module, adjust RV3, DEVIATION, on the Control Audio PCB to give 100% deviation.

(4) Set the AF generator to each of the following modulating frequencies in turn, 300Hz, 700Hz, 1kHz, 2kHz and 3kHz and check that the Peak System Deviation (+ve and -ve) at each frequency does not exceed:-
±5kHz for 25kHz Channel Spacing Equipments.
±4kHz for 20kHz Channel Spacing Equipments.
±2,5kHz for 12,5kHz Channel Spacing Equipments.

Voting

(1) Set Links 1-10 on the Options PCB for the Voting/Pip option

(2) With no RF input to the receiver and the squelch closed check that the Voting tone frequency is 2707Hz ±1Hz, if necessary adjust RV9 on the options PCB to achieve this frequency.

(3) Using the voltmeter check that the line level at PLA pin 10 is -24dBm (49mV), if necessary adjust RV10 on the options PCB, ASSORT LEVEL, to achieve this figure.

(4) Set the RF signal generator frequency to that of the channel in use, modulated with 1kHz at 60% deviation and connect to the receiver antenna socket. With the RF signal generator output at 0µV check that the four threshold level LED's, LED4-7, on the options PCB are extinguished.

(5) Set RV4-7 on the options PCB fully counter-clockwise.

(6) Set the signal generator output level to 0,6µV, turn the RF off then on and slowly rotate RV4 until LED7, LEVEL 1, JUST illuminates; check that the frequency is 2971Hz ±7Hz.

(7) Set the signal generator output level to 1,0µV, turn the RF off then on and slowly rotate RV5 until LED6, LEVEL 2, JUST illuminates; check that the frequency is 2852Hz ±5Hz.

(8) Set the signal generator output level to 2,0µV, turn the RF off then on and slowly rotate RV6 until LED5, LEVEL 3, JUST illuminates; check that the frequency is 2913Hz ±2Hz.

(9) Set the signal generator output level to 5,0µV, turn the RF off then on and slowly rotate RV7 until LED4, LEVEL 4, JUST illuminates; check that the frequency is 2972Hz ±1Hz. If necessary adjust RV8 on the Options PCB to achieve this frequency.

(10) Disable voting by fitting a temporary link between LK3 pin 4B and -ve on the Control Logic PCB, set the signal generator output to 1mV, unmodulated, check that the rejection is greater than 40dB down. Remove the temporary link.

Receiver Audio Response

(1) Defeat CTCSS encoder by linking LK10(b) D-E; defeat Voting by linking LK9 B-C.

(2) Set the signal generator output to 1mV with 60% deviation and check the frequency response at the line output at the frequencies tabulated below:-

Option	250Hz		300Hz		1kHz	3kHz	
	Min(dB)	Max(dB)	Min(dB)	Max(dB)	0dB ref	Min(dB)	Max(dB)
CTCSS Decode	-60	-30	+7,5	+11,4	0dB ref	-12,5	-8,6
Voting	-	-	+7,5	+11,4	0dB ref	-80	-40
CTCSS Decode + Voting	-60	-30	+7,0	+11,9	0dB ref	-80	-40

Piptone

(1) Set links 1-10 on the Options Board for CTCSS/Voting/Pip. Link LK12 A-B on the Control Logic PCB. Link LK10a on the Options Board A-B.

(2) Defeat CTCSS Tone by fitting a temporary link between LK3 pin 5B and -ve on the Control Logic PCB; key transmitter with no external modulation applied and adjust RV1, PIPTONE LEVEL, for 60% deviation.

(3) Using the frequency counter, check that the Piptone frequency is between 950 - 1100Hz.

WARNING
During the following check the Transmitter will key when the squelch opens

(4) Link LK10a B-C. Set the signal generator to the frequency of the channel in use at an output of 1mV, check that the PIPTONE indicator, LED1 on the Options Board flashes

(5) Remove the temporary link between LK3 pin 5B and -ve on the Control Logic PCB, fitted at step (2)

CAUTION
The surface mount potentiometers RV11-16 are difficult to adjust due to the shallow slot for the adjusting tool, extra care is therefore needed.

Note: RV11-16 are preset at the factory and should only be adjusted if a filter has been repaired or the filter response does not meet specification, do not attempt adjustment before checking the filter response.

CTCSS Filter

(1) Ensure that RV14,15,16 are set to their mid position. Link LK7 B-C, LK8 A-B.

(2) Connect the AF generator to the Options PCB PLA pin 9 and the distortion analyser to the Options PCB PLA pin 8.

(3) Set the AF generator to 142,0Hz at 1V, using the set level function and maximum sensitivity on the distortion analyser, carefully adjust RV14 to obtain the greatest rejection (measured in dB).

(4) Set the AF generator to 252,4Hz at 1V, using the set level function and maximum sensitivity on the distortion analyser, carefully adjust RV15 to obtain the greatest rejection (measured in dB).

(5) Set the AF generator to 222,9Hz at 1V, using the set level function and maximum sensitivity on the distortion analyser, carefully adjust RV16 to obtain the greatest rejection (measured in dB).

(6) Set the AF generator to 1000Hz at 300mV, check that the distortion analyser, set to 'voltmeter', reads 300mV ±18mV. Using the distortion analyser set level function adjust the sensitivity vernier for a reading of 0dB.

(7) Set the AF generator in turn to the frequencies listed below and check that the reading on the distortion analyser is within the given limits.

Frequency (Hz)	Output Level (dB relative to 1000Hz)	
	Minimum	Maximum
67	-	-40
250	-	-40
300	-0,5	+0,5
1000	0	0
2000	-0,5	+0,5
3000	-0,5	+0,5

Voting Filter

(1) Ensure that RV11,12,13 are set to their mid position. Link LK7 A-B, LK8 B-C.

(2) Connect the AF generator to the Options PCB PLA pin 9 and the distortion analyser to the Options PCB PLA pin 8.

(3) Set the AF generator to 2851Hz at 1V, using the set level function and maximum sensitivity on the distortion analyser, carefully adjust RV11 to obtain the greatest rejection (measured in dB).

(4) Set the AF generator to 2698Hz at 1V, using the set level function and maximum sensitivity on the distortion analyser, carefully adjust RV12 to obtain the greatest rejection (measured in dB).

(5) Set the AF generator to 4150Hz at 1V, using the set level function and maximum sensitivity on the distortion analyser, carefully adjust RV13 to obtain the greatest rejection (measured in dB).

(6) Set the AF generator to 1000Hz at 300mV, check that the distortion analyser, set to 'voltmeter', reads 300mV ±18mV. Using the distortion analyser set level function adjust the sensitivity vernier for a reading of 0dB.

(7) Set the AF generator in turn to the frequencies listed below and check that the reading on the distortion analyser is within the given limits.

Frequency (Hz)	Output Level (dB relative to 1000Hz)	
	Minimum	Maximum
300	-0,5	+0,5
1000	0	0
2000	-0,5	+0,5
2500	-0,5	+0,5
2700	-	-30
3000	-	-30

VOTING/CTCSS PCB ASSEMBLY
AT29061

Cct Ref	Description	Part No	Remarks
Semiconductors & IC's			
IC1	IC Dual op amp MC1458D	3513 999 45004	
IC2	IC Dual op amp 4558	FU99806/SM	
IC3-6	IC Dual op amp MC1458D	3513 999 45004	
IC7	IC SMD LM348D	3513 999 45003	
IC8/9	IC SMD LM324 op amp	3513 999 45005	
IC10,11	IC SMD LM348D	3513 999 45003	
IC12	IC 4071B	FU99408/SM	
IC13	IC 4066B	3513 999 35019	
IC14	IC mono function gen	FU03750	
IC15,16	IC CTCSS encode/decode	FU99815/SM	
TR1-3	Transistor BCX19	FV99102/SM	
TR4	Transistor SMD BSR58	FV99156/SM	
D1	Diode Hyb Cct BAW56	3513 999 15001	
D2	Diode Hyb Cct BAV70	3513 999 15000	
D3	Diode Hyb Cct BAV99	3513 999 15002	
D4-7	Diode Hyb Cct BAS16	3513 999 15003	
Resistors			
R1,2	47k ±5% 0,125W SMD	3513 999 80056	
R3	36k ±2% 0,25W m film	PM99319	
R4	20k ±2% 0,25W m film	PM99313	
R5	47k ±5% 0,125W SMD	3513 999 80056	
R6	10k ±5% 0,125W SMD	3513 999 80048	
R7	100k ±5% 0,125W SMD	3513 999 80060	
R8	1k ±5% 0,125W SMD	3513 999 80036	
R9	1k5 ±5% 0,125W SMD	3513 999 80038	
R10	10k ±5% 0,125W SMD	3513 999 80048	
R11	3k3 ±5% 0,125W SMD	3513 999 80042	
R12	10k ±5% 0,125W SMD	3513 999 80048	
R13	3k3 ±5% 0,125W SMD	3513 999 80042	
R14	47k ±5% 0,125W SMD	3513 999 80056	
R15	22k ±5% 0,125W SMD	3513 999 80052	
R16	47k ±5% 0,125W SMD	3513 999 80056	
R17	10k ±5% 0,125W SMD	3513 999 80048	
R18	1M ±5% 0,125W SMD	3513 999 80072	
R19	56k ±5% 0,125W SMD	3513 999 80057	
R20	47k ±5% 0,125W SMD	3513 999 80056	
R21	22k ±5% 0,125W SMD	3513 999 80052	
R22-25	100k ±5% 0,125W SMD	3513 999 80060	
R26	820k ±5% 0,125W SMD	3513 999 80071	
R27	330k ±5% 0,125W SMD	3513 999 80066	
R28-31	4k7 ±5% 0,125W SMD	3513 999 80044	
R32	1k ±5% 0,125W SMD	3513 999 80036	
R33	47k ±5% 0,125W SMD	3513 999 80056	
R34	1k5 ±5% 0,125W SMD	3513 999 80038	
R35,36	10k ±5% 0,125W SMD	3513 999 80048	
R37	3k3 ±5% 0,125W SMD	3513 999 80042	
R38	68k ±5% 0,125W SMD	3513 999 80058	
R39	6k8 ±5% 0,125W SMD	3513 999 80046	
R40	47k ±5% 0,125W SMD	3513 999 80056	
R41	4k7 ±5% 0,125W SMD	3513 999 80044	
R42	68k ±5% 0,125W SMD	3513 999 80058	
R43	4k7 ±5% 0,125W SMD	3513 999 80044	
R44	10k ±5% 0,125W SMD	3513 999 80048	
R45	18k ±5% 0,125W SMD	3513 999 80051	
R46	10k ±5% 0,125W SMD	3513 999 80048	
R47	15k ±5% 0,125W SMD	3513 999 80050	
R48,49	1k5 ±5% 0,125W SMD	3513 999 80038	
R50	33k ±5% 0,125W SMD	3513 999 80054	
R51	180k ±5% 0,125W SMD	3513 999 80063	
R52	1k5 ±5% 0,125W SMD	3513 999 80038	
R53	15k ±5% 0,125W SMD	3513 999 80050	
R54	180k ±5% 0,125W SMD	3513 999 80063	
R55	1k5 ±5% 0,125W SMD	3513 999 80038	
R56	4k7 ±5% 0,125W SMD	3513 999 80044	
R57	180k ±5% 0,125W SMD	3513 999 80063	
R58	1k5 ±5% 0,125W SMD	3513 999 80038	
R59	4k7 ±5% 0,125W SMD	3513 999 80044	
R60	180k ±5% 0,125W SMD	3513 999 80063	
R61	1k5 ±5% 0,125W SMD	3513 999 80038	
R62	56k2 ±1% 0,25W m film	PM99107	

Cct Ref	Description				Part No	Remarks
Resistors (Cont'd)						
R63	2k15	±1%	0,25W	m film	PM99090	
R64	46k4	±1%	0,25W	m film	PM99106	
R65	2k15	±1%	0,25W	m film	PM99090	
R66	38k3	±1%	0,25W	m film	PM99105	
R67	31k6	±1%	0,25W	m film	PM99104	
R68,69	4k7	±5%	0,125W	SMD	3513 999 80044	
R70	22k	±5%	0,125W	SMD	3513 999 80052	
R71	27k	±2%	0,25W	m film	PM99316	
R72	6k81	±1%	0,25W	m film	PM99096	
R73	464	±1%	0,25W	m film	PM99082	
R74	26k1	±1%	0,25W	m film	PM99103	
R75	8k25	±1%	0,25W	m film	PM99097	
R76	4k7	±5%	0,125W	SMD	3513 999 80044	
R77	220	±5%	0,125W	SMD	3513 999 80028	
R78,79	10k	±1%	0,25W	m film	PM99098	
R80	47k	±5%	0,125W	SMD	3513 999 80056	
R81-83	10k	±5%	0,125W	SMD	3513 999 80048	
R84,85	22k	±5%	0,125W	SMD	3513 999 80052	
R86	10k	±5%	0,125W	SMD	3513 999 80048	
R87	1k5	±5%	0,125W	SMD	3513 999 80038	
R88	8k25	±1%	0,25W	m film	PM99097	
R89	12k1	±1%	0,25W	m film	PM99099	
R90	10k	±1%	0,25W	m film	PM99098	
R91	8k2	±2%	0,25W	m film	PM99304	
R92	20k	±2%	0,25W	m film	PM99313	
R93	10k	±1%	0,25W	m film	PM99098	
R94	17k8	±1%	0,25W	m film	PM99101	
R95	10k	±1%	0,25W	m film	PM99098	
R96	8k2	±2%	0,25W	m film	PM99304	
R97	24k	±2%	0,25W	m film	PM99315	
R98	10k	±1%	0,25W	m film	PM99098	
R99	3k16	±1%	0,25W	m film	PM99092	
R100	10k	±1%	0,25W	m film	PM99098	
R101	8k2	±2%	0,25W	m film	PM99304	
R102	10k	±1%	0,25W	m film	PM99098	
R103	4k64	±1%	0,25W	m film	PM99094	
R104	22k	±5%	0,125W	SMD	3513 999 80052	
R105	10k	±5%	0,125W	SMD	3513 999 80048	
R106,107	100k	±5%	0,125W	SMD	3513 999 80060	
R108	56k	±2%	0,25W	m film	PM99324	
R109	10k	±1%	0,25W	m film	PM99098	
R110	1k	±1%	0,25W	m film	PM99086	
R111	10k	±1%	0,25W	m film	PM99098	
R112	22k	±2%	0,25W	m film	PM99314	
R113	10k	±1%	0,25W	m film	PM99098	
R114	1k	±1%	0,25W	m film	PM99086	
R115	10k	±1%	0,25W	m film	PM99098	
R116	36k	±2%	0,25W	m film	PM99319	
R117	10k	±1%	0,25W	m film	PM99098	
R118	1k	±1%	0,25W	m film	PM99086	
R119	10k	±1%	0,25W	m film	PM99098	
R120	33k	±2%	0,25W	m film	PM99318	
R121	56k	±2%	0,25W	m film	PM99324	
R122	110k	±2%	0,25W	m film	PM99331	
R123,124	100k	±5%	0,125W	SMD	3513 999 80060	
R125	3k3	±5%	0,125W	SMD	3513 999 80042	
R126	1k5	±5%	0,125W	SMD	3513 999 80038	
R127	5k1	±2%	0,25W	m film	PM99299	
R128,129	1k	±5%	0,125W	SMD	3513 999 80036	
R130	10k	±5%	0,125W	SMD	3513 999 80048	
R131	100k	±5%	0,125W	SMD	3513 999 80060	
RV1,2	10k	±20%	Pot skel lin		PL01478	
RV3	2k2	±20%	Pot skel lin		PL99001	
RV4-7	47k	±20%	Pot skel lin		PL01498	
RV8,9	4k7	±20%	Pot skel lin		PL01486	
RV10	10k	±20%	Pot skel lin		PL01478	
RV11-13	5k	±25%	Pot lin		PL99560/SM	
RV14-16	10k	±25%	Pot		3513 999 95007	
Capacitors						
C1	22	±20%	25V	elec	PS99421	
C2,3	47p	±5%	50V	SMD	3513 999 55321	
C4,5	3n3	±5%	200V	SMD	CN99154	
C6	47p	±5%	50V	SMD	3513 999 55321	

Cct Ref	Description				Part No	Remarks
Capacitors (Cont'd)						
C7-9	10	±20%	16V	elec	PS99855	
C10	68p	±5%	50V	SMD	3513 999 55323	
C11	33p	±5%	50V	SMD	3513 999 55319	
C12,13	100n	±10%	200V	SMD	3513 999 55017	
C14						Not Used
C15	47p	±5%	50V	SMD	3513 999 55321	
C16	680p	±5%	50V	SMD	CN99053	
C17	33n	±5%		pes	PQ99539	
C18	10n	±5%		cer	PN99906	
C19,20	10	±20%	16V	elec	PS99855	
C21,22	47p	±5%	50V	SMD	3513 999 55321	
C23	100n	±20%	50V	pes	PQ99556	
C24	47p	±5%	50V	SMD	3513 999 55321	
C25	470n	±20%	50V	elec	PS99867	
C26	47p	±5%	50V	SMD	3513 999 55321	
C27	10n	±5%		cer	PN99906	
C28-31	47p	±5%	50V	SMD	3513 999 55321	
C32	1	±20%	100V	elec	PS99455	
C33	10	±20%	16V	elec	PS99855	
C34	47p	±5%	50V	SMD	3513 999 55321	
C35	10n	±10%	200V	SMD	3513 999 55492	
C36	10	±20%	16V	elec	PS99855	
C37	10n	±2%	200V	mica	PP25012	
C38	1	±20%	100V	elec	PS99455	
C39	10	±20%	16V	elec	PS99855	
C40	10n	±10%	200V	SMD	3513 999 55492	
C41	47p	±5%	50V	SMD	3513 999 55321	
C42,43	10	±20%	16V	elec	PS99855	
C44	100n	±10%	200V	SMD	3513 999 55017	
C45	47p	±5%	50V	SMD	3513 999 55321	
C46,47	6n8	±5%		cer	PN99905	
C48	47p	±5%	50V	SMD	3513 999 55321	
C49	6n8	±5%		cer	PN99905	
C50	47p	±5%	50V	SMD	3513 999 55321	
C51	6n8	±5%		cer	PN99905	
C52	47p	±5%	50V	SMD	3513 999 55321	
C53	6n8	±5%		cer	PN99905	
C54	47p	±5%	50V	SMD	3513 999 55321	
C55	6n8	±5%		cer	PN99905	
C56	47p	±5%	50V	SMD	3513 999 55321	
C57	6n8	±5%		cer	PN99905	
C58	47p	±5%	50V	SMD	3513 999 55321	
C59	6n8	±5%		cer	PN99905	
C60,61	47p	±5%	50V	SMD	3513 999 55321	
C62,63	100	±20%	25V	elec	PS99424	
C64	3n3	±2,5%	63V	pp	PQ99618	
C65	4n7	±2,5%	63V	pp	PQ99619	
C66	47n	±5%		pes	PQ99534	
C67,68	47p	±5%	50V	SMD	3513 999 55321	
C69	10n	±2,5%	63V	pp	PQ99621	
C70	6n8	±2,5%	63V	pp	PQ99620	
C71	10n	±2,5%	63V	pp	PQ99621	
C72,73	47p	±5%	50V	SMD	3513 999 55321	
C74	10n	±2,5%	63V	pp	PQ99621	
C75	560p	±5%	50V	SMD	CN99033	
C76	6n8	±2,5%	63V	pp	PQ99620	
C77	3n3	±2,5%	63V	pp	PQ99618	
C78	10n	±2,5%	63V	pp	PQ99621	
C79,80	47p	±5%	50V	SMD	3513 999 55321	
C81	10n	±2,5%	63V	pp	PQ99621	
C82	1n5	±5%	50V	SMD	3513 999 55420	
C83	10n	±2,5%	63V	pp	PQ99621	
C84	10	±20%	16V	elec	PS99855	
C85,86	47p	±5%	50V	SMD	3513 999 55321	
C87	1	±20%	100V	elec	PS99455	
C88	10n	±10%	200V	SMD	3513 999 55492	
C89-92	47p	±5%	50V	SMD	3513 999 55321	
C93-99	10	±20%	16V	elec	PS99855	
C100	3n3	±5%	200V	SMD	CN99154	
C101	2µ2	±20%	50V	elec	PS99871	

Cct Ref	Description	Part No	Remarks
Miscellaneous			
	Clip	QA04097	3/Screen
	Header straight male 1 pos'n	3513 504 00121	
	Header straight male 3 pos'n	FC00837/03	
	Holder LED	QA05846	1/LED1-7
	Lead Assembly	AT70237	
LED1-7	LED red	FV05860	
	Link connector	FC99060	
	Mount foam 25 x 12 x 1,5mm	FR05020	1/C37
	Plug PCB mtd rt angle 2 x 2	FP99173	
	Plug PCB mtd rt angle 2 x 4	FP99197	
	Plug PCB mtd straight 2 x 2	FP99172	
	Screen CTCSS/ASSORT	BT26415	
	Scr st tap pozi No4 x 6,5mm	QJ08227/X	2/Screen-PCB
	Switch min dil 8-way	FS99031	
	Tab mtg $\frac{1}{2}$" x $\frac{1}{2}$" x 1,5mm	FR05017	1/XL1
XL1	Xtal 1MHz holder QC4S	FC06165	
Installation Items			
	Pillar 7,5mm long	BT04074	
	Pillar 35mm long	BT04075	
	Scr st pan pozi M3 x 6mm	QJ11901/X	2/Control audio PCB, 2/Control logic 4/Voting CTCSS PCB-pillars

APPENDIX 1

F5000 SERIES METERING/CHANNEL FACILITIES PANEL

3513 508 00121 (Metering only)
3513 508 00131 (Metering and Channel Change - Old style Backplane)
3513 508 00141 (Metering and Channel Change - New style Backplane)

The Metering/Channel Facilities Panel is available as an option for use as a servicing aid for the F5000 series of equipment.

DESCRIPTION

The metering facility provides simple analogue metering of the functions available on the F5000 series of equipment (base stations and link). Except for the 600Ω signals, the functions are selected via the 'Metering' rotary switch. A test point function is available when the 'Metering' rotary switch is switched to the OFF/TP position.

Note: The 600Ω function may ONLY be used if the equipment is NOT connected to British Telecom lines.

The rotary 'Channel Change' switch enables local channel change on the FX5000 series of base stations. The selected channel is indicated by an LED. In the OFF/REMOTE position the Tx/Rx and RCM paths are connected via logic circuits and monitoring of the channel in use is displayed by the LEDs.

SPECIFICATION

Metering Functions

Switch Position	Meter Scale
OFF/TP	20V
+24V (Nom)	100V
+18V (1)	20V
+18V (2)	20V
Lock Volts (Used on FL5000 only)	10V
RF Power	10V
Deviation	10V
Carrier Level	10V
Injection (on FL5000, indicates C6 state on FX5000)	10V

Note: Tolerance on meter reading better than ±5%

Front Panel Sockets

Socket	Function
600 ohm LINE Rx	Connects to T1 on the equipment backplane.
600 ohm LINE Tx	Connects to T2 on the equipment backplane.

Channel Change

Six switchable channels as M80RCM (C0-C5)

Switch position	1	2	3	4	5	6
Binary channel	126	125	123	119	111	95

OPERATION

Metering

1 Ensure the Interface Panel is connected to the metering socket (SKX) on the backplane of the F5000 series equipment under test.

2 Referring to Fig.1 connect the Patch Cable Assembly between the Interface Panel and the Metering/Channel Facilities Panel.

3 Using the rotary 'Metering' switch, select the functions to be monitored; the switch position functions are as follows:-

Switch Position	Function
OFF/TP	Connects the Test Point on the front of the Metering/ Channel Facilities Panel to the meter (20V FSD)
+24V (Nom)	Measures the +24V unregulated supply from the PSU
+18V (1)	Measures the +18V No.1 supply from the PSU
+18V (2)	Measures the +18V No.2 supply from the PSU
Lock Volts	Used on the FL5000 only, measures the Lock Volts Monitor output from the Tx Module.
RF Power	Measures the RF Power Monitor output from the Tx (PA) Module
Deviation	Measures the Deviation Monitor output from the Tx
Carrier Level	Measures the Carrier Level Monitor output from the Receiver Module
Injection	(i) Used on the FL5000 to measure the Injection Monitor output from the Receiver Module (ii) Used on the FX5000 to indicate Channel line 6 state (C6).

4 The '600 ohm LINE' Rx and Tx sockets on the front of the Metering/Channel Facilities Panel provide direct access to the respective line transformers (T1 and T2) on the F5000 series equipment backplane.

Channel Change

1 Referring to Fig.1 connect the appropriate Channel Change Lead Assembly between the FX5000 backplane CHAN SW plug (PLX) and the Metering/Channel Facilities Panel.

2 Using the rotary 'Channel Change' switch select the required channel, the associated LED will illuminate indicating that the channel has been selected. In the 'Off/Remote' position of the switch the Tx/Rx is connected to the Remote Control Unit via logic circuits, the LED of the selected channel will illuminate.

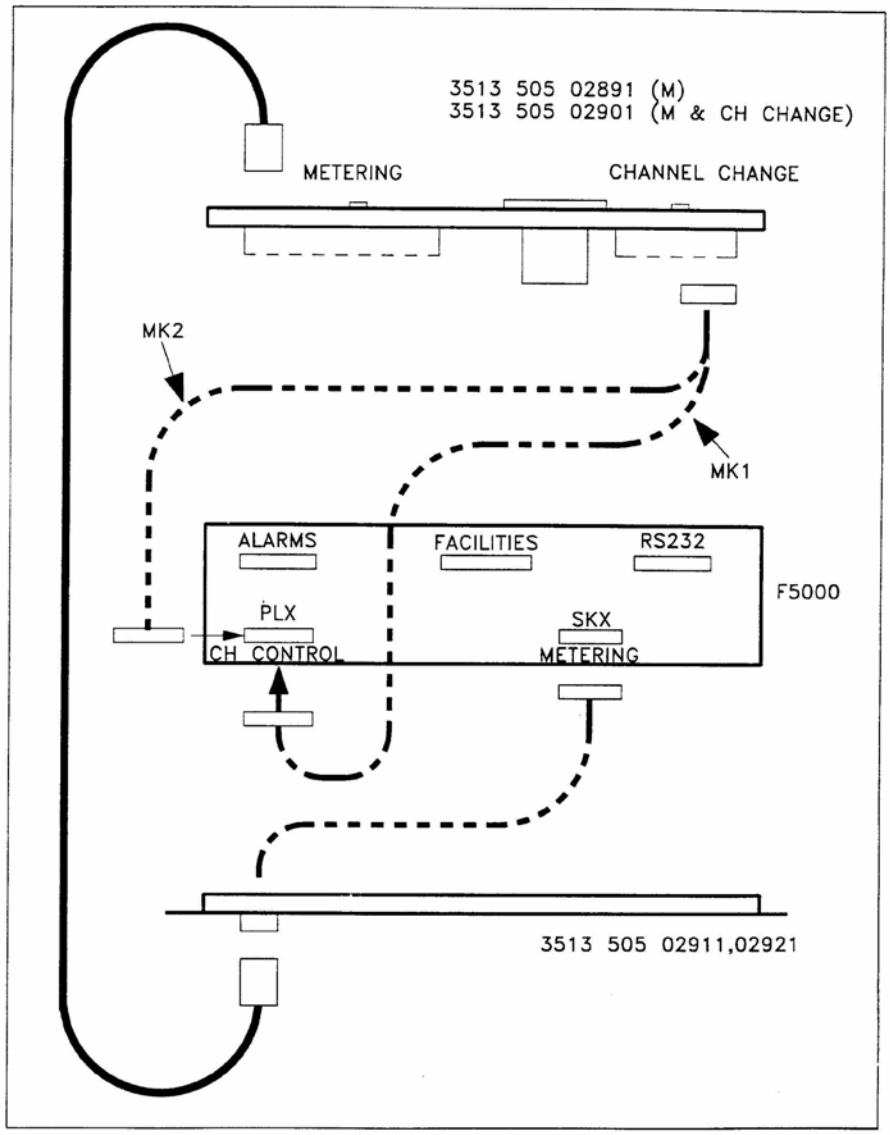


Fig.1 Interconnections

TEST PROCEDURE

Test Equipment Required

PSU	: 20V/1A
Digital Voltmeter	: Philips 2517X
Metering Test Jig	: See Fig 2
Channel Change Test Jig	: See Fig 3

Metering

1 Connect the Metering Test Jig to [1]PLA and switch [1]SW1 and SWA (on the Test Jig) to position 1. Set the PSU output to 10V ±0,1V.

2 Connect PLE on the Test Jig to [1]SKA (Tx A) and check Digital Voltmeter for a reading of 10V ±0,1V.

3 Repeat step 2 with PLE to [1]SKB (Tx B)

4 Repeat step 2 with PLE to [1]SKC (Rx A)

5. Repeat step 2 with PLE to [1]SKD (Rx B)

6 Connect PLE to [1]SKE (EXT TP) and check [1]M1 for a reading of 10V ±0,5V (FSD 20V)

7 Switch [1]SW1 and SWA (on the Test Jig) to position 2 and check [1]M1 for a reading of 10V ±0,5V (FSD 100V)

8 Switch [1]SW1 and SWA (on the Test Jig) to position 3 and check [1]M1 for a reading of 10V ±0,5V (FSD 20V)

9 Switch [1]SW1 and SWA (on the Test Jig) to position 4 and check [1]M1 for a reading of 10V ±0,5V (FSD 20V)

10 Switch [1]SW1 and SWA (on the Test Jig) to position 5 and check [1]M1 for a reading of 10V ±0,5V (FSD 10V)

11 Repeat step 10 for positions 6 to 9 of [1]SW1 and SWA (on the Test Jig)

12 Remove the test equipment.

Channel Change

1 Connect Channel Change Test Jig to [2]PLB and adjust the PSU for 18V. Check IC1 output is 5V ±0,25V.

2 Switch [2]SW1 and SWB (on the Channel Change Test Jig) to position 0; check all LED's are OFF. ([2]WLK1 not fitted*).

Note: * *If [2]WLK1 is fitted [2]LED1 will be illuminated when [2]SW1 is in position 0 and SWB (on the Channel Change Test Jig) will have no effect.*

3 Switch SWB on the Channel Change Test Jig through positions 1-7; check the Jig LEDs and [2]LED 1-6 are illuminated in sequence (only the Jig LED is illuminated on position 7.)

4 Switch [2]SW1 through positions 1-6; check [2]LEDs 1-6 and Jig LEDs 1-6 are illuminated in sequence and SWB on the Channel Change Test Jig has no effect.

5 Remove the test equipment.

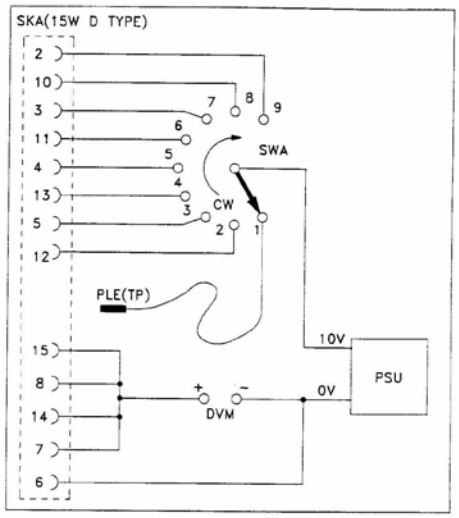


Fig.2 Metering Test Jig

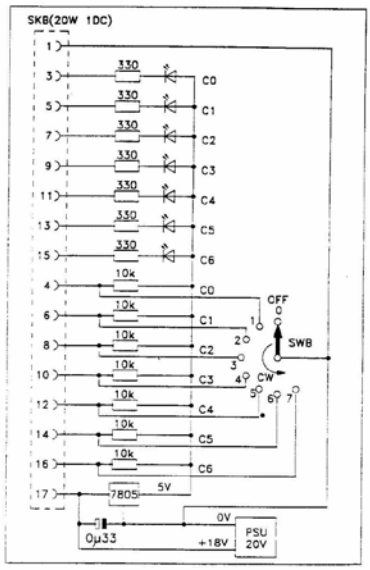


Fig.3 Channel Change Test Jig

PARTS LIST

METERING PANEL
9525 700 62004

Cct Ref	Description	Part No	Remarks
	Metering Panel	3513 508 00121	
	Metering Panel Assembly	3513 505 02891	
	Patch Cable Assembly	CT61127	

METERING/CHANNEL CHANGE PANEL (Old style Backplane)
9525 700 62005

	Metering/Channel Change Panel	3513 508 00131	Old style Backplane
	Metering/Ch Change Pnl Assembly	3513 505 02901	
	Lead Assembly Ch Change 26-Way	3513 509 50531	
	Patch Cable Assembly	CT61127	

METERING/CHANNEL CHANGE PANEL (New style Backplane)
9525 700 62006

	Metering/Channel Change Panel	3513 508 00141	New style Backplane
	Metering/Ch Change Pnl Assembly	3513 505 02901	
	Lead Assembly Ch Change 20-Way	3513 509 50521	
	Patch Cable Assembly	CT61127	

METERING PANEL ASSEMBLY
3513 505 02891

	PCB Assembly Metering	3513 500 01791	
M1	Meter	FM02192	
SKA-E	Socket 4mm black	FS17040	
	Circlip	QA01107	1/SW1
	Knob (Printed)	BJ30904/04	1/SW1
	Nut St Hex M3	2522 401 64008	2/PCB, 2/Blanking plate
	Panel Blank Ch Chg	3513 904 71881	1/Ch Change blanking
	Panel Metering Printed	4313 328 10141	
	Pillar Round M3	BT27210	2/Metering PCB
	Ring Compression	QA04145	1/SW1
	Scr st pan pozi M3 x 6mm	QJ11901/K1	2/Blanking Plate
	Screw Lock Assembly	FC15763	1/15W Plug
	Spindle	BT07168	1/SW1
	Wash st form A M3	2522 600 89017	2/Metering PCB

METERING/CHANNEL CHANGE PANEL ASSEMBLY
3513 500 02901

	PCB Assembly Channel Change	3513 500 01781	
	PCB Assembly Metering	3513 500 01791	
M1	Meter	FM02192	
SKA-E	Socket 4mm black	FS17040	
	Circlip	QA01107	1/SW1(M), 1/SW1 (Ch-Ch)
	Knob (Printed)	BJ30904/04	1/SW1(M), 1/SW1 (Ch-Ch)
	Nut st Hex M3	2522 401 64008	2/Metering PCB, 2/Ch Change PCB
	Panel Metering Printed	4313 328 10141	
	Pillar Round M3	BT27210	2/Metering PCB, 2/Ch Change PCB
	Ring Compression	QA04145	1/SW1(M), 1/SW1 (Ch-Ch)
	Screw Lock Assembly	FC15763	For 15W Plug
	Spindle	BT07168	1/SW1(M), 1/SW1 (Ch-Ch)
	Wash st form A M3	QA15005/X	2/Metering PCB 2/Ch Change PCB

PCB ASSEMBLY METERING
3513 500 01791

Resistors

R1	180k	±1%	0,25W	m. film	3513 992 07068
R2	18k	±1%	0,25W	m. film	3513 992 07049
R3	1M	±1%	0,25W	m. film	3513 992 07077
R4	180k	±1%	0,25W	m. film	3513 992 07068
R5	18k	±1%	0,25W	m. film	3513 992 07049
R6	180k	±1%	0,25W	m. film	3513 992 07068
R7	18k	±1%	0,25W	m. film	3513 992 07049
R8	82k	±1%	0,25W	m. film	3513 992 07065
R9	16k	±1%	0,25W	m. film	3513 992 07048
R10	82k	±1%	0,25W	m. film	3513 992 07065

Cct Ref	Description	Part No.	Remarks
Resistors (Cont'd)			
R11	16k ±1% 0,25W m. film	3513 992 07048	
R12	82k ±1% 0,25W m. film	3513 992 07065	
R13	16k ±1% 0,25W m. film	3513 992 07048	
R14	82k ±1% 0,25W m. film	3513 992 07065	
R15	16k ±1% 0,25W m. film	3513 992 07048	
R16	82k ±1% 0,25W m. film	3513 992 07065	
R17	16k ±1% 0,25W m. film	3513 992 07048	
Miscellaneous			
C1	Cap 1n ±5%	PN99900	
D1,2	Diode, 1N4148	9330 839 90113	
PLA	Plug 15-way D type	FP99031	
SW1	Switch 12-way	4313 324 50151	
	Adjustable stop	4313 324 50161	1/SW1
	Nut st Hex M3	2522 401 64008	2/Post
	Post	3513 904 91181	2/PLA - PCB

PCB ASSEMBLY CHANNEL CHANGE
3513 500 01781

IC1	IC 7805 Volt reg and fix	3513 993 34014	
IC2	IC 4050MOS	FU99090	
IC3	IC 74HCT541	FU98035	
LED1-6	LED Yellow MV5374C	3513 993 47001	
R1-6	Res 330Ω ±5% 0,25W c. film	PM01430	
R7	Res 10k ±5% 0,25W c. film	PM01448	
C1	Cap 330n ±5% pes submin	PQ99541	
C2	Cap 100n ±5% 63V min	3513 991 08013	
C3	Cap 1n ±5%	PN99900	
PLA	Header str less ears 26 pos'n	FP99223	
PLB	Header str less ears 20 pos'n	FP99222	
SW1	Switch 12-way	4313 324 50151	
	Adjustable stop	4313 324 50161	1/SW1
	Nut st Hex M3	2522 401 64008	1/IC1
	Scr st pan pozi M3 x 6mm	2522 178 20058	1/IC1
	Spacer LED 3,5mm x 4,76mm	QA05856	1/LED 1-6

INTERFACE PANEL WITH 600Ω
9525 700 62007

Interface Panel Assembly 600Ω	3513 505 02911	

INTERFACE PANEL LESS 600Ω
9525 700 62008

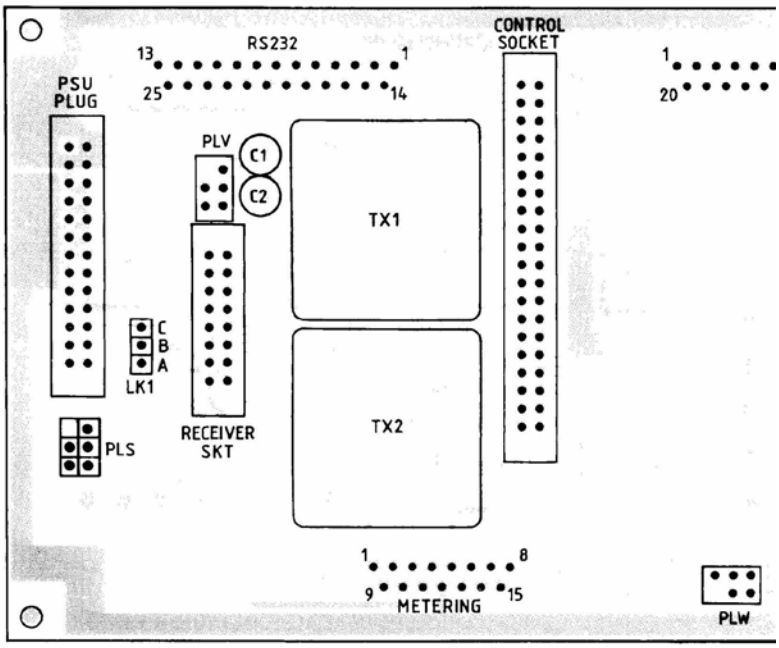
Interface Panel Assembly	3513 505 02921	

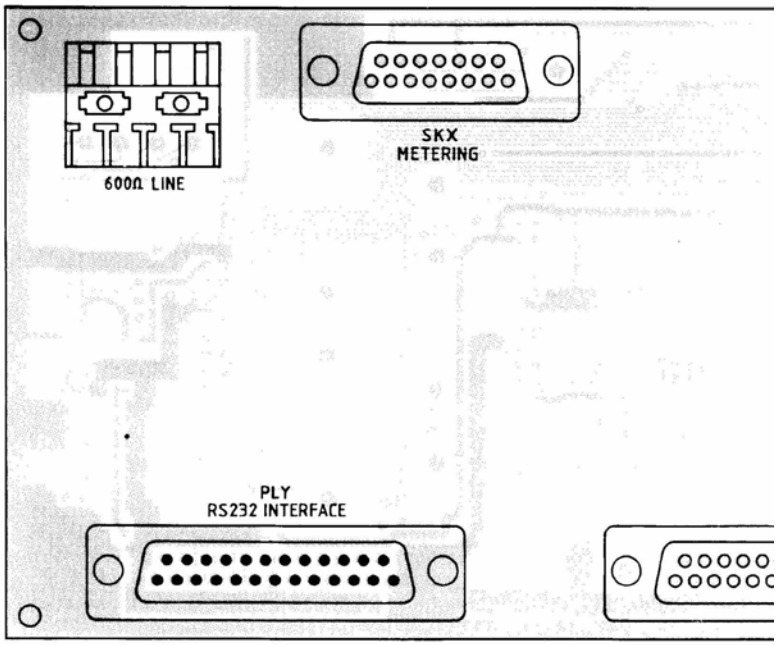
INTERFACE PANEL ASSEMBLY 600Ω
No 3513 505 02911

Clip P 3/16" diameter	QA00509	1/Cable Clamp
Cover Connector D type 15-way	FC15761	
Extension Lead Assembly 600Ω	3513 509 50511	
Panel Modified	4313 328 70091	
Scr st pan 4/40 UNC x 1/4" Zn	2513 084 03014	1/P clip
Screw Lock Assembly	FC15763	
Spacer tapped 4,40 UNC	BT27241	1/P Clip
Wash st form A M3	2522 600 89017	1/P Clip

INTERFACE PANEL ASSEMBLY
3513 505 02921

Clip P 3/16" diameter	QA00509	1/Cable Clamp
Cover Connector D type 15-way	FC15761	
Extension Lead Assembly	3513 509 50501	
Panel Modified	4313 328 70091	
Scr st pan 4/40 UNC x 1/4" Zn	2513 084 03014	1/P clip
Screw Lock Assembly	FC15763	
Spacer tapped 4,40 UNC	BT27241	1/P Clip
Wash st form A M3	2522 600 89017	1/P Clip


RS232
13
1
25
14
CONTROL
SOCKET
1
20
PSU
PLUG
PLV
C1
C2
TX1
C
B
A
LK1
RECEIVER
SKT
TX2
PLS
1
8
9
15
METERING
PLW


600Ω LINE
SKX
METERING
PLY
RS232 INTERFACE

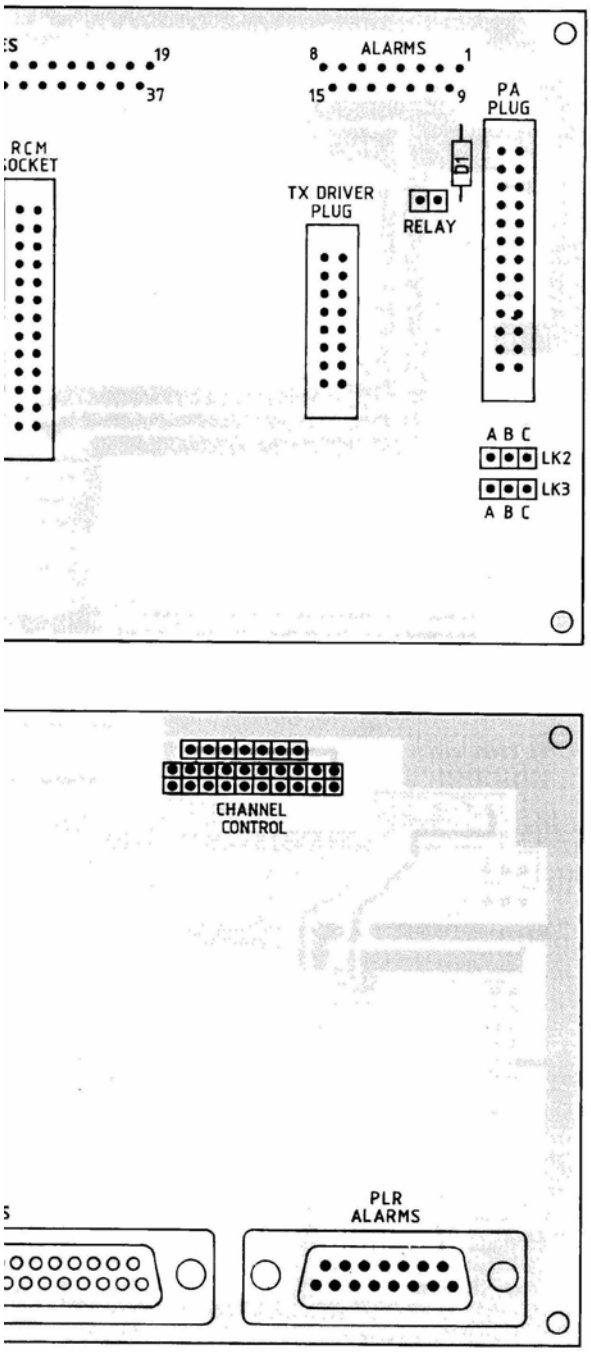


FIG.4.1 BACKPLANE LAYOUT DIAGRAM

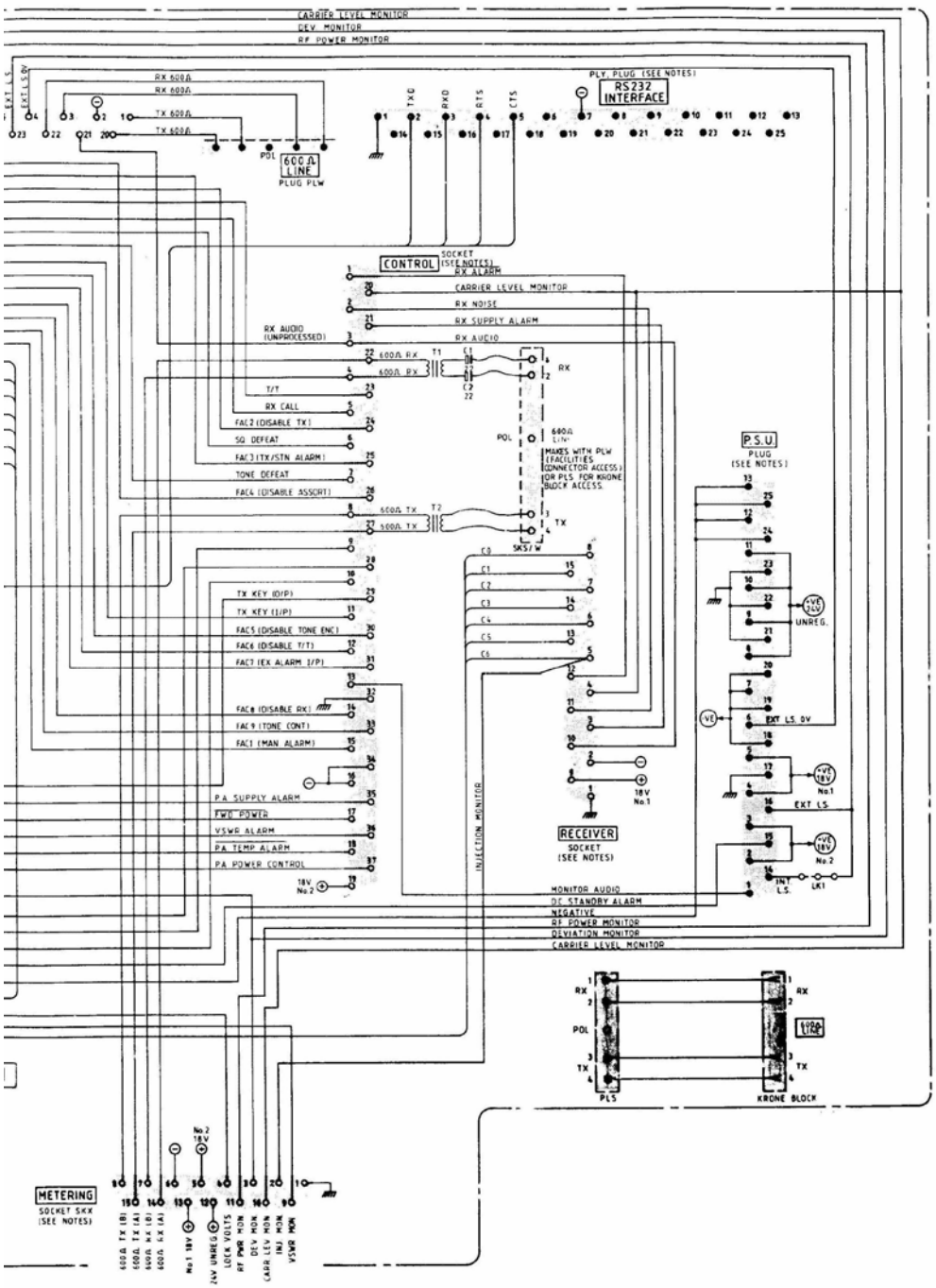


FIG.4.2 BACKPLANE INTERCONNECTIONS