ROHDE&SCHWARZ

Manual

BASIC SOFTWARE FOR CONTROL OF SMFP2 WITH PUC SMFP2 - K1

Printed in Wes. Germany

R 42234 - 0

SOFTWARE COPYRIGHT

This software is the copyright of Rohde & Schwarz.
The Purchaser is authorized to use the software exclusively for his own purposes; he is not authorized to transfer this right to third parties. Copying of software for third parties, or making software or related manuals available to third parties for the purpose of making copies thereof is also prohibited.

Any breach of these conditions will render the Purchaser liable to a claim for compensation on the part of Rohde & Schwarz.

Table of Contents

Routines:

System data:

Instrument settings:

AF and DC measurements:

Transmitter measurements:

Receiver measurements:

Output:

Hints for the use of Software SMFP2-K1

1. Software Structure

The Basic Software SMFP2-K1 consists of a number of subroutines for controlling the Mobile Tester SMFP2, the Programmable Power Supply NGPU and the Printer PUD from the Process Controller PUC.

The following groups of routines are included:

- Initialization of IEC (GPIB) interface bus and instruments; entry of test-item data with storage in the PUC.
- Settings on the SMFP2 and NGPU.
- Measurements with the SMFP.
- Transmitter measurement routines.
- Receiver measurement routines.
- Routines for presenting instructions on the screen of the PPC, for visualizing adjustments and for generating output on the printer.

The basic software occupies program lines 8998 to 16500.

The user program will normally be written using lines 100 to 8900.

The basic software uses the following variables:

```
X, X(-)
Y, Y1...Y9, Y$, Y$(  )
R
Y1$...Y9$, YS$, YS%
YA, YB, YC, YD, YE, YF, YG, YH
Z(-), ZC, ZP
```

These variables should not be used in the user program. All other variables may be used as required. If arrays are to be used, these must be dimensioned in the user program.

2. Calling up the Individual Routines

Routines are called up in general using a three-part procedure:

→ Definition of parameters needed in the routine.

→ Jump to the corresponding part of the program.

→ Output of the result generated by the routine.

Example: Measurement of receiver sensitivity for 20-dB SINAD.

500	Y = 20	- Definition:	20 dB SINAD
510	R = 67 : GOSUB 9000	- Jump:	routine 67, jump to line 9000
520	PRINT Y	- Output on screen:	sensitivity in µV

Not all routines require this full procedure. Thus simple settings do not require an output instruction and measurements are usually possible without any prior parameter definition.

3. Preparation of the User Program

3.1 Initialization

The initialization routine (routine 1) should always be used at the start of a test program.

```
100  Y1$ = "SMFP2"
110  R = 1 : GOSUB 9000
```

3.2 Entry of Test-item Data

Routines 2 through 7 are used to store the essential data of the radio to be tested as variables in the PPC. Examples:

```
110  Y = 75.275
120  R = 2 : GOSUB 9000          } - Receive frequency

130  Y = 9800
140  R = 4 : GOSUB 9000          } - Upper/lower band spacing
 .
 .                                  etc.
 .
 .
190  Y = 4
200  R = 7 : GOSUB 9000          } - Maximum permissible deviation
```

3.3 Instrument Settings

This section covers settings on the power supply, basic modulation settings etc. By using the rear-panel control outputs of the SMFP it is also possible to set the radio under test to the correct mode, channel etc.

```
300  Y = 1
310  R = 18 : GOSUB 9000         } - CCITT filter on

320  Y = 4
330  R = 23 : GOSUB 9000         } - NGPU current limit

340  Y = 12.0
350  R = 24 : GOSUB 9000         } - NGPU voltage setting
```

3.4 Measurements

The SMFP2 is switched to the appropriate measuring mode before performing the measurement.

Attention should be paid to the conditions which must be fulfilled before certain test routines can be executed. These preconditions are described in detail in the routine definitions. Error-free operation of the routines can be ensured only if all stated conditions have been realised.

If an error occurs in a routine in the course of the program caused, for example, by an automatic search routine demanding an impossible parameter value or because the SMFP2 responds with a measurement other than that commanded, the error is signalled on the PUC screen. When a button is pressed on the PUC the program continues to run.

The error message states the number of the routine in which the error occurred and the number of the previously used routine.

Settings on the test item which are to be carried out manually can be displayed on the screen with routine 87.

When the setting is completed it is acknowledged using the keyboard on the PUC and the program continues.

```
400  Y$    = "SWITCH TO RECEIVE MODE"
410  R     = 87 : GOSUB 9000
420  R     = 62 : GOSUB 9000
430  Y     = 20
440  R     = 67 : GOSUB 9000
450  Z(1)  = Y
```

Instruction on screen

Receiver test

Sensitivity of receiver for 20 dB SINAD and storage in Z(1)

3.5 Output of Results

Test results can be output on the screen of the PUC or on the printer PUD. The normal PRINT instructions are used for output on the PUC screen.

A number of routines in the software SMFP2-K1 provide output on the printer PUD. Routine 89 produces a formatted line of print containing text and result. Routine 90 additionally performs a comparison of the measured result with previously stated tolerance limits.

In order to produce titles and other text on the printer use can be made of routine 88.

Output can be generated following each measurement or at the end of the complete test. In the latter case it will be necessary to store the results in the PUC for later use as illustrated in program line 450 above. Variable arrays must be dimensioned within the user program.

```
500  Y$ = "RECEIVER MEASUREMENTS":R=88:Y=2:GOSUB 9000
510  Y$ = "SENSITIVITY FOR 20 DB SINAD (MICROVOLT)"
520  Y  = Z(1)
530  R  = 89:GOSUB 9000
```

	Routine No.	Routine	Input parameter	Output parameter
System data	1	Start	SMFP2 - firmware version Y1$ = "SMFP" Y1$ = "SMFP2"	---
	2	RF frequency (= receive frequency)	Y in MHz	X(1) in MHz
	3	Channel spacing	Y = in MHz Y1 = channel number Y2 = in kHz	X(1) in MHz X(2) X(3) in kHz
	4	Upper band/lower band spacing	Y in MHz, positive for rec. freq. > transm. freq.	X(4) in MHz X(6) in MHz
	5	IF	Y = in MHz, positive for osc. freq. > input frequency	X(5) = in MHz
	6	Modulation AM, FM, φM	Y = 1, 2 or 3	X(7) = type of mod.
	7	Maximum permissible modulation	Y = modulation in %, kHz or rad	X(8) = mod.
Instrument settings	8	RF frequency setting (signal generator)	Y in MHz	---
	9	RF level setting (signal generator)	Y in µV	---
	10	RF generator output on/off	Y = 1 or Ø	---
	11	RF level (continuous variation ±0.1dB)	Y = +1 or -1	---
	12	Modulation setting (int.)	Y in %, kHz or rad	---
	13	Modulation setting (ext.)	Y in %, kHz or rad	---
	14	Internal modulation on/off	Y = 1 or Ø	---
	15	---		

	Routine No.	Routine	Input parameter	Output parameter
Instrument settings	16	AF frequency setting	Y in kHz	---
	17	AF output level setting	Y in mV	---
	18	CCITT filter on/off	Y = 1 or Ø	---
	19	Tone sequences to ZVEI, CCIR	Y$ = "Z" for ZVEI Y$ = "C" for CCIR	---
	20	Control lines on/off	Y1 = relay number Y = Ø or 1	---
	21	BCD lines	Y$ = 3-digit decimal number	---
	22	Channel setting (transceiver)	Y = channel number	X(1) Rx freq. X(2) channel no. X(3) Tx freq.
	23	Current limiting (NGPU)	Y = in A	---
	24	Voltage setting (NGPU)	Y = in V	---
	25	---	---	---
	26	---	---	---
AF and DC measurements	27	AF frequency (ext.)	YE = Ø for 1 Hz resol. YE = 1 for 0.1 Hz res. for adjustment: Y1 = min. Y2 = max. Y3 = 2	Y in Hz
	28	AF level (ext.)	for adjustment: Y1 = min. Y2 = max. Y3 = 2	Y in mV
	29	For internal use only		
	30	Distortion	YE = 1 for 300 Hz YE = 2 for 500 Hz YE = 3 for 1 kHz for adjustment: Y1 = min. Y2 = max. Y3 = 2	Y = k in %

	Routine No.	Routine	Input parameter	Output parameter
AF and DC measurements	31	RF voltage (via RF millivoltmeter)	YE = 1 for mV YE = 2 for dBm for adjustment: Y1 = min. Y2 = max. Y3 = 2	Y in mV or dBm
	32	AF frequency response	Y$ = test frequencies in kHz	Y9 = number of freq. Y(1)...Y(n) in dB X(21)...X(20+Y9) = test freq. in kHz
	33	Multitone sequence generation (setting evaluation facility)	Y$ = "...", code (up to 8 figures successively (YE = 1 (for acknowledge signal)	Y$ = "..." (with call acknowledge facility only)
	34	Multitone sequence decoding	---	Y$ = decoded tones
	35	DC voltage	for adjustment: Y1 = min. Y2 = max. Y3 = 2	Y in V
	36	DC current	for adjustment: Y1 = min. Y2 = max. Y3 = 2	Y in A
	37	NGPU current (using SMFP2 voltmeter)	---	Y in A
	38	---	---	---
	39	Universal adjustment	Y0 = nominal value Y1 = tolerance in % Y2 = test routine Y4 = setting routine Y5 = step size Y6 = start	Y = last value measured Y1 = last setting

	Routine No.	Routine	Input parameter	Output parameter
Transmitter measurements	40	Transmitter test	X(6) in MHz	---
	41	RF power	for adjustment: Y1 = min. Y2 = max. Y3 = 2	Y in W
	42	RF frequency offset	X(6) in MHz	Y in Hz
	43	Positive modulation	for adjustment: Y1 = min. Y2 = max. Y3 = 2	Y in %, kHz or rad
	44	Negative modulation	for adjustment: Y1 = min. Y2 = max. Y3 = 2	Y in %, kHz or rad
	45	---	---	---
	46	---	---	---
	47	Residual modulation	---	Y in %, kHz or rad
	48	Modulation sensitivity	YA = mod.freq. in kHz Y = nominal modulation in % of max. mod.	Y in mV
	49	Modulation frequency response (referred to 1 kHz)	Y$ = "test freq. in kHz"	Y(1)...Y(n) levels in dB Y9 = number of freq. X(21)...X(20+Y9) = test freq. in kHz
	50	---	---	---
	51	Modulation distortion	Y = % of max. modulation YE = 1 for 300 Hz YE = 2 for 500 Hz YE = 3 for 1 kHz	Y in %
	52	For internal use only	---	---
	53	S/N ratio	---	Y in dB

	Routine No.	Routine	Input parameter	Output parameter
Transmitter measurements	54	RF frequency (via FREQ. METER or HF-RF input)	YE = 1 FREQ. METER YE = 2 HF-RF	Y in MHz
	55	Demodulated frequency	for adjustment: Y1 = min. Y2 = max. Y3 = 2 YE = 0 resolution 1 Hz YE = 1 resolution 0.1 Hz	Y in Hz
	56	Beat frequency (via FREQ. METER or HF-RF input)	YØ = comp. freq. in MHz YE = 1 FREQ. METER YE = 2 HF-RF	Y in Hz with polarity sign
	57	---	---	---
	58	Adjacent-channel power ratio	Y = +1 upper channel Y = -1 lower channel	Y in dB
	59	Adjacent-channel power	Y = +1 upper channel Y = -1 lower channel	Y in µW
	60	---	---	---
	61	---	---	---
Receiver measurements	62	Receiver test	X(1) = in MHz	---
	63	---	---	---
	64	S/N ratio (at 1 kHz)	Y = % of max. modulation	Y in dB
	65	SINAD measurement (at 1 kHz)	Y = % of max. modulation	Y in dB
	66	Sensitivity for given S/N ratio	Y = S/N in dB	Y in µV
	67	Sensitivity for given SINAD	Y = SINAD in dB YE= Ø threshold 2 dB YE= 1 threshold 1 dB	Y in µV
	68	Quieting sensitivity	---	Y in µV
	69	6-dB bandwidth + centre-frequency offset	X(1) = channel freq.	Y = in kHz Y1 = centre freq. offset in kHz

	Routine No.	Routine	Input parameter	Output parameter
Receiver measurements	70	---	---	---
	71	Modulation acceptance bandwidth	---	Y = in kHz
	72	Upper and lower squelch thresholds and hysteresis	---	Y(1) = lower threshold in µV Y(2) = upper threshold in µV Y = in dB
	73	---	---	---
	74	---	---	---
	75	---	---	---
	76	AF frequency response (at 1 kHz)	Y$ = test frequencies in kHz	Y9 = number of freq. Y(1)...Y(n)=levels in dB X(21)...X(20+Y9) = test freq. in kHz
	77	Duplexer test	---	Y = in dB
	78	Image frequency rejection	---	Y in dB
Output	79	---	---	---
	80	---	---	---
	81	---	---	---
	82	---	---	---
	83	---	---	---
	84	---	---	---
	85	---	---	---

	Routine No.	Routine	Input parameter	Output parameter
Output	86	Adjustment with analog indication	Y = measured value Y1 = min. Y2 = max. Y$ = "text"	Y3 = 1 continue Y3 = Ø stop
	87	Text (instruction on screen)	Y$ = "text"	---
	88	Text (on printer)	Y = Ø (normal) Y = 1 (underlined) Y = 2 (expanded) Y$ = "text"	---
	89	Printer output	Y$ = "text" Y = measured value	---
	90	Printer output with nominal/actual comparison	Y = measured value Y1 = min. Y2 = max. Y$ = "text"	---
	91	Screen output with nominal/actual comparison	Y = measured value Y1 = min. Y2 = max. Y$ = "text"	---
	92	Frequency-response	Y9 = number of freq. X(21)...X(20+n) = test freq. in kHz Y(1)...Y(n) = levels in dB	---
	93	Hard copy	---	---
	94	---	---	---
	95	---	---	---
	96	---	---	---
	97	---	---	---
	98	---	---	---
	99	---	---	---
	100	Error signal (int.)	---	---

Start routine

Routine No. 1

Function

Produces a defined initial condition.
Should be used at the start of every test program.

Dimensions arrays X ( ) for input data and
Y ( ) for test results.

Includes definition of IEC-bus addresses and message delimiter declaration.

For distinguishing the different measurement capabilities of SMFP and SMFP2, the type of instrument with which the software is used is assigned to variable Y1$. If this variable is not defined prior to calling up a routine SMFP will be used automatically.

Variables

INPUT Y1$ = "SMFP2" when using SMFP2
Y1$ = "SMFP" when using SMFP

OUTPUT none

Preconditions none

Routines used none

RF frequency

Routine No. 2

Function

Stores the receiver frequency.
Value is used later during receiver test or for transmitter-frequency offset measurement.

Routine should be used for single-channel radios and for each channel of units with various different channel frequencies. A separate routine is provided for multi-channel equipment (R3).

Variables

INPUT Y = RF frequency in MHz

OUTPUT X (1) = RF frequency

Preconditions

none

Routines used

none

Channel spacing

Routine No. 3

Function

Stores the entered values of receiver frequency, channel number and channel spacing. Values are used later for multi-channel measurements.

Variables

INPUT Y = receive frequency of channel Y1 in MHz
Y1 = channel number (frequency Y)
Y2 = channel spacing in kHz (positive for frequency increasing with increasing channel number, negative for frequency decreasing with increasing channel number)

OUTPUT X (1) = RF frequency
X (2) = channel number
X (3) = channel spacing

Preconditions

none

Routines used

none

Upper-band/lower-band spacing

Routine No. 4

Function — Stores the upper-band/lower-band spacing for duplex equipment.

Variables

INPUT Y = upper-band/lower-band spacing in MHz:
positive for rec. freq. > trans. freq.
negative for rec. freq. < trans. freq.
For simplex equipment the routine can be omitted.

X (4) is then set to 0 in the initialization routine.

OUTPUT X (4) = band spacing in MHz

X (6) = X (1) - X (4)
calculated nominal value of trans. frequency.

Preconditions — RF frequency R2

Routines used — none

Intermediate frequency

Routine No. 5

Function — Stores the intermediate frequency of the receiver section. Value is used later for measuring image-frequency rejection. Need not be used if image-frequency measurements are not to be carried out.

Variables — INPUT Y = IF in MHz
positive for LO freq. > input freq.
negative for LO freq. < input freq.

OUTPUT X (5) = IF in MHz

Preconditions — none

Routines used — none

Type of modulation

Routine No. 6

Function: Stores the type of modulation and sets the SMFP2 accordingly.

Variables:

		INTERNAL MODULATION	EXTERNAL MODULATION	
INPUT Y	= type of mod.	AM	FM	Y = 1
		FM	φM	Y = 2
		φM	AM	Y = 3

OUTPUT X (7) = type of mod.

Preconditions: none

Routines used: R100 (error signal)

Maximum permissible modulation

Routine No. 7

Function

Stores the maximum permissible modulation. Value is used later for settings and adjustments and as reference value for the calculation of spurious modulation ratios.

Variables:

INPUT Y = maximum permissible modulation in accordance with type of mod.:
for AM in %
for FM in kHz
for φM in rad
(permissible range 0 to 100)

OUTPUT X (8) = maximum permissible modulation

Preconditions

none

Routines used

R100 (error signal)

RF frequency setting on signal generator

Routine No. 8

Function — Sets the signal generator of the SMFP2 to the given frequency.

Variables — INPUT Y = frequency in MHZ
(permissible range 0.4 to 1040)

OUTPUT none

Preconditions — none

Routines used — R100 (error signal)

RF level setting on signal generator

Routine No. 9

Function

Level setting in µV.

Coarse setting using step attenuator;
interpolation (< 2 dB) using electronic fine variation.

Variables

INPUT Y = RF level in µV
(permissible range 0.032 to 1000000)

OUTPUT none

Preconditions

none

Routines used

R100 (error signal)

RF generator output on/off

Routine No. 10

Function — Switches the RF output of the signal generator on or off without affecting the frequency, level setting or modulation.

Variables — INPUT Y = Ø off
= 1 on

OUTPUT none

Preconditions — none

Routines used — R100 (error signal)

RF level (continuous variation)

Routine No. 11

Function

Continuous variation of RF level using the electronic attenuator.

The RF level must first be set to an initial value using routine 9. Starting from this value it is possible to increase the attenuation by up to 10 dB without causing an interruption of the RF signal.

If variation is continued beyond this range the coarse step attenuator will switch, causing a brief interruption of the RF signal.

Each time the routine is executed the level is changed by the smallest possible step of 0.1 dB. Larger steps are produced by repeating the routine.

Variables

INPUT Y = 1 Increase level by 0.1 dB
= -1 Decrease level by 0.1 dB

OUTPUT none

Preconditions

Coarse level setting R9

Routines used

R100 (error signal)

Modulation setting, int.

Routine No. 12

Function

Setting the modulation of the RF signal generator.
In accordance with the selected type of modulation
the setting will be in % (AM), kHz (FM) or rad (φM).

Variables

INPUT Y = modulation in %, kHz or rad

Range: 0.1 to 100 for AM, FM
0.1 to 12 for φM

OUTPUT none

Preconditions

Type of modulation R6

Routines used

R100 (error signal)

Modulation setting, ext.

Routine No. 13

Function

Setting the external modulation of the RF signal generator. In accordance with the selected type of modulation, the setting will be in % (AM), kHz (FM) or rad (φM).

An external modulation signal amplitude of precisely 1 V_{rms} is assumed.

Setting the type of modulation (ext.). See R6.

Variables

INPUT Y = modulation in %, kHz or rad
Range: 0.1 to 100 for AM, FM
0.1 to 12 for φM

OUTPUT none

Preconditions

Type of modulation R6
Application of external modulation signal

Routines used

R100 (error signal)

Modulation, int. ON/OFF

Routine No. 14

Function — Switches the internal modulation on and off without changing the set AF frequency or modulation.

Variables — INPUT Y = Ø off
= 1 on

OUTPUT none

Preconditions — none

Routines used — none

AF frequency setting

Routine No. 16

Function — Setting and switchover of AF generator frequency so that this AF signal is present only at the AF output socket.

Variables — INPUT Y = AF frequency in kHz
(permissible range 0.009 to 25 kHz)

OUTPUT none

Preconditions — none

Routines used — R100 (error signal)

AF output level setting

Routine No. 17

Function — Setting of the level of the AF generator output signal at the AF output socket.

Variables — INPUT Y = AF output level in mV
(permissible range 0 to 4995 mV)

OUTPUT none

Preconditions — none

Routines used — R100 (error signal)

CCITT filter on/off

Routine No. 18

Function

Switches the CCITT weighting filter on or off.

When the filter is on both measurements on externally applied signals and measurements on internally demodulated signals are passed through the weighting filter.

Variables

INPUT Y = 1 filter on
= Ø filter off

OUTPUT none

Preconditions

none

Routines used

R100 (error signal)

Tone sequences to ZVEI, CCIR

Routine No. 19

Function

Generation and decoding of 5-tone sequences to ZVEI or CCIR.

The defined tone sequence is generated or decoded in routines 33 and 34.

Variables

INPUT Y$ = "Z" ZVEI
"C" CCIR

OUTPUT none

Precondition

none

Routines used

R100 (error signal)

Control lines on/off

Routine No. 20

Function

Controls the relay matrix built into the SMFP2. The relays may be used for controlling the radio being tested or for switching test signals.
Relay 1 cannot be switched with this routine.
Relay 1 is closed by calling up R40 (transmitter test) and opened by calling up R62 (receiver test).

The relay contacts are brought out at the control sockets BU401 and BU402 on the rear panel. Contact occupancy:

Relais	1	2	3	4	5	6	7	8	9
Contacts	14+15	1+2	3+4	5+6	7+8	9+10	11+12	13+15	14+15
Socket	BU401	BU402							

Contact 15 of BU402 is common to relays 8 and 9

Variables

INPUT Y1 = number of relay
(permissible range see table above)

Y = Ø contacts open
= 1 contacts closed

OUTPUT none

Preconditions none

Routines used R100 (error signal)

BCD lines

Routine No. 21

Function

The data contained in the string Y$ are brought out at the pins of socket BU401 on the rear of the SMFP2.
Pin allocation:

	Hundreds				Tens				Units			
Contact Socket BU401	9	10	11	12	5	6	7	8	1	2	3	4
	MSB			LSB	MSB			LSB	MSB			LSB

Four bit hexadecimal bytes (decimal 10 to 15) can also be produced by using the appropriate ASCII characters (:; < = > ?)

Variables

INPUT Y$ = decimal value to be generated
(always enter 3 characters)
permissible characters 0 to 9 and : ; < = > ?

OUTPUT none

Preconditions

none

Routines used

R100 (error signal)

Channel setting on transceiver

Routine No. 22

Function

Receive and transmit frequencies are calculated from the channel number entered. These are then stored in X (1) and X (6).

The channel number is output on the BCD lines of socket BU401 (occupancy see routine no. 21).

Variables

INPUT Y = channel number
(permissible range 0...999)

OUTPUT X (1) = receive frequency in MHz
X (2) = channel number
X (6) = transmit frequency

Precondition

channel spacing R3

Routines used

R4 Upper-band/lower-band spacing
R21 BCD lines

Setting of current limiting on NGPU

Routine No. 23

Function

Setting the current limiting on the NGPU 70/10.
If the NGPU 70/20 is used the value entered in the routine should be exactly one half of the current limit required.
(E.g. Y = 2 produces a current limit of 4 A)

Variables

INPUT Y = maximum current in A
(permissible range 0.001 to 9.99)

OUTPUT none

Preconditions

none

Routines used

R100 (error signal)

Setting of voltage on NGPU

Routine No. 24

Function: Setting the output voltage of the programmable power supply NGPU.

Variables: INPUT Y = voltage in V
(permissible range 0.1 to 70 V)

OUTPUT none

Preconditions: none

Routines used: R100 (error signal)

AF frequency measurement (external signal)

Routine No. 27

Function

Measures the frequency of a signal applied at the AF input socket.
For adjustments, the measurement can be displayed in analog form on the screen by setting Y3 = 2.
See routine 86.

Variables

INPUT YE = Ø resolution of measured value 1 Hz
1 resolution of measured value .1 Hz

Optional for adjustment

Y3 = 2
Y1 = lower limit in Hz
Y2 = upper limit in Hz

OUTPUT Y = frequency in Hz

Preconditions

Selection of firmware version (SMFP/SMFP2) R1

Routines used

R100 (error signal)

AF level measurement (external signal)

Routine No. 28

Function

Measures the voltage of a signal applied at the AF input socket.

For adjustments, the measurement can be displayed in analog form on the screen by setting Y3 = 2.
See routine 86.

Variables

INPUT optional for adjustment

	Y3	= 2
	Y1	= lower limit
	Y2	= upper limit
OUTPUT	Y	= level in mV

Preconditions

none

Routines used

R100 (error signal)

Distortion measurement

Routine No. 30

Function

Measures the harmonic distortion of a 300-Hz, 500-Hz or 1-kHz signal applied at the AF input.

For adjustments, the measurement can be displayed in analog form on the screen by setting Y3 = 2.
See routine 86.

Variables

INPUT YE = 1 for 300 Hz
YE = 2 for 500 Hz
YE = 3 for 1 kHz

Optional for adjustment

Y3 = 2
Y1 = lower limit
Y2 = upper limit

OUTPUT Y = distortion in %

Preconditions

AF frequency setting (externally or with R16)

Selection of firmware version (SMFP/SMFP2) R1.

Routines used

R100 (error signal)

RF voltage measurement (via RF millivoltmeter)

Routine No. 31

Function

Measures the RF voltage with the RF millivoltmeter option.

For adjustments, the measurement can be displayed in analog form on the screen by setting Y3 = 2.
See routine 86.

Variables

INPUT YE = 1 value in mV
2 value in dBm

optional for adjustment:

Y3 = 2
Y1 = lower limit
Y2 = upper limit

OUTPUT Y = value in mV or dBm

Preconditions

Selection of firmware version (SMFP/SMFP2) R1.

Routines used

R100 (error signal)

AF frequency response

Routine No. 32

Function

→ AF frequencies contained in string and separated by commas are allocated to distinct variables.

→ Set 1 kHz modulation frequency and measure reference value.

→ Measure at test frequencies and compute frequency-response values in dB.

→ Reset frequency to 1 kHz.

Variables

INPUT Y$ = string containing input data separated by commas

OUTPUT Y9 = number of data elements

Y (0) = AF level at 1 kHz (reference) in mV

X (21)
.
.
.
X (20 + Y9)
} test frequencies in kHz

Y (1)
.
.
.
Y (Y9)
} frequency response values in dB ordered as in input string Y$

Preconditions

AF output level setting R17

Routines used

R16 AF frequency setting

R28 AF level measurement

Multitone sequence generation

Routine No. 33

Function

Generates up to 8 tones to CCIR or ZVEI which are available at the MOD. GEN. output or which modulate the AF output signal.

The tone-sequence decoder is reset prior to the tone output.

Selection of CCIR or ZVEI in R19.
Level setting in R17, modulation setting in R42.

For radio sets with call acknowledge facility, setting YE = 1 causes the acknowledge signal to be detected and decoded.

Variables

INPUT Y$ = "--------"
(up to 8 figures from 0 to 9, successively without separator)

YE = 1 for acknowledge signal

OUTPUT Y$ = "----" acknowledge signal (with call acknowledge facility only)

Preconditions

Tone sequence to ZVEI/CCIR R19,
AF output level setting R17 or modulation setting R12
RF level setting R9, R66, R67, R68
Continuous tone R16
(frequency = Ø, suppresses the continuous tone).

Routines used

R100 (error signal)
R40 Transmitter test
R16 AF frequency setting
R8 RF frequency setting on signal generator
R41 RF power of transmitter
R62 Receiver test
R14 Modulation, int. ON/OFF
R10 RF generator output on/off
R28 AF level measurement

Multitone sequence decoding

Routine No. 34

Function

Decodes 5-tone sequences to ZVEI or CCIR.

The tone sequence is applied either to the external AF-AC input or derived from a demodulated transmitter signal. First carry out R33 (with Y$ = " ") to clear the decoder store.

Variables

INPUT none

OUTPUT Y$ = ordinal numbers of decoded tones (hexadecimal Ø to 9, A,B,C,D,E,F)

Preconditions

Tone sequence to ZVEI/CCIR R19

Decoding of demodulated signal:
Transmitter modulation R43, R44.

Decoding of AF-AC signal:
AF level measurement (ext.) R28
(level > 100 mV)

Resetting the decoder by output of a sound sequence R33

Routines used

R100 (error signal)

DC voltage measurement

Routine No. 35

Function

Measurement of the DC voltage applied at the DC test sockets. If the voltage is applied with the wrong polarity the result will be Ø.

For adjustments, the measurement can be displayed in analog form on the screen by setting Y3 = 2.

See routine 86.

Variables

INPUT optional for adjustment

Y3 = 2
Y1 = lower limit
Y2 = upper limit

OUTPUT Y = DC voltage in V

Preconditions

none

Routines used

R100 (error signal)

DC current measurement

Routine No. 36

Function

Measurement of the DC current flowing between one of the pairs of test sockets. If the polarity is wrong the result will be Ø.

For adjustments, the measurement can be displayed in analog form on the screen by setting Y3 = 2.

See routine 86.

Variables

INPUT optional for adjustment

Y3 = 2
Y1 = lower limit
Y2 = upper limit

OUTPUT Y = current in A

Preconditions

none

Routines used

R100 (error signal)

NGPU current measurement using sensing resistor and SMFP voltmeter

Routine No. 37

Function

Measurement of the current drawn from the NGPU by measuring the voltage drop across the sensing resistor in the NGPU using the DC voltmeter of the SMFP2.

100 mV is produced at the maximum current in each range of the current limiting. (If the NGPU 70/20 is used the result must be further multiplied by 2).

Variables

INPUT none

OUTPUT Y = DC current in A

Preconditions

none

Routines used

R35 DC voltage measurement

Universal adjustment routine

Routine No. 39

Function

One routine is used for measurements and another for setting. The set parameter is varied automatically until the measurement reaches the nominal value within the given tolerance.

The direction of variation is determined automatically by the routine. The initial step size should be chosen to produce a change in the measured result by a factor of 2.

If the required adjustment cannot be made, the routine stops and outputs the measured value reached or the set parameter.

Variables

INPUT	Y0	=	nominal value
	Y1	=	tolerance in %
	Y2	=	number of measurement routine
	Y4	=	number of setting routine
	Y5	=	initial step size
	Y6	=	initial value for setting routine
OUTPUT	Y	=	measured value at end of adjustment
	Y1	=	last value of setting parameter

Preconditions

none

Routines used

Routines specified with Y4 and Y5

Transmitter test

Routine No. 40

Function

Switches the SMFP2 to the transmitter test mode. Transceiver is switched to transmit by closing the control relay no. 1 (contacts 14 and 15 of socket BU401).

Variables

INPUT X (6) = nominal transmitter frequency in MHz

OUTPUT none

Preconditions

Receiver frequency R2 or R3

Band spacing R4 if required

Routines used

R12 Modulation setting

R20 Relay control

RF power of transmitter

Routine No. 41

Function — Measurement of RF transmitter power

Variables — INPUT optional for adjustment

Y3 = 2
Y1 = lower limit
Y2 = upper limit

OUTPUT Y = measured power in W

Preconditions — none

Routines used — R100 (error signal)

RF frequency offset of transmitter

Routine No. 42

Function	Measurement of transmitter frequency and calculation of the offset from the nominal frequency X (6).
Variables	INPUT X (6) = transmitter nominal frequency OUTPUT Y = frequency offset in Hz
Preconditions	Receiver frequency R2 or R3 Band spacing R4 if required
Routines used	R100 (error signal)

Positive modulation of transmitter

Routine No. 43

Function

Measurement of the positive modulation in %, kHz or rad.
Switches off SMFP2 generator modulation.

Variables

INPUT optional for adjustment

Y3 = 2
Y1 = lower limit
Y2 = upper limit

OUTPUT Y = modulation in %, kHz or rad positive values

Preconditions

Type of modulation R6
Transmitter modulation R16 + R17
Transmitter test R40

Routines used

R100 (error signal)

Negative modulation of transmitter

Routine No. 44

Function

Measurement of the negative modulation in %, kHz or rad.

Switches off SMFP2 generator modulation.

Variables

INPUT optional for adjustment

Y3 = 2
Y1 = lower limit
Y2 = upper limit

OUTPUT Y = modulation in %, kHz or rad. negative values

Preconditions

Type of modulation R6

Transmitter modulation R16 + R17

Transmitter test R40

Routines used

R100 (error signal)

Residual modulation

Routine No. 47

Function

→ Switch off AF signal

→ Measure modulation

Variables

INPUT none

OUTPUT Y = residual modulation in %, kHz or rad

Preconditions

Transmitter test R40

Type of modulation R6

Routines used

R17 AF output level setting

R43 Positive modulation

Modulation sensitivity of transmitter

Routine No. 48

Function

→ Sets modulation generator

→ Measures modulation and automatically sets AF generator level until the given modulation is reached within 5%.

The modulation is to be specified as % of maximum permissible modulation.

Variables

INPUT YA = modulation generator frequency in kHz

Y = test modulation as % of max. perm. mod.

OUTPUT Y = AF generator voltage in mV for the given test modulation

Preconditions

Transmitter test R40

Type of modulation R6

Maximum permissible modulation R7

Routines used

R16 Modulation frequency

R17 AF output level setting

R43 Positive modulation

Modulation frequency response of transmitter

Routine No. 49

Function

→ Stores the test frequencies as separate variables.

→ Sets 20% of max. perm. modulation at 1 kHz.

→ Measures modulation at the test frequencies.

→ Calculates difference from value at 1 kHz in dB.

→ Sets 20% of max. perm. mod. at 1 kHz.

Variables

INPUT Y$ = list of test frequencies separated by commas

OUTPUT Y9 = number of test frequencies

Y (0) = modulation at 1 kHz (reference value)

Y (1) … Y (9) } levels in dB relative to value of modulation at 1 kHz, ordered as in input string Y$

X (21) … X (20+Y9) } Test frequencies in kHz

Preconditions

Type of modulation R6

Max. perm. modulation R7

Transmitter test R40

Routines used

R43 Positive modulation

R48 Modulation sensitivity

R16 AF frequency setting

Modulation distortion of transmitter

Routine No. 51

Function

→ Sets AF generator frequency

→ Sets modulation to % of max. perm. mod.

→ Measures harmonic distortion.

Variables

INPUT YE = 1 for 300 Hz
2 for 500 Hz
3 for 1 kHz

Y = % of max. perm. mod.

OUTPUT Y = distortion in %

Preconditions

Type of modulation R6
Max. perm. modulation R7
SMFP/SMFP2 firmware level R1

Routines used

R16 AF frequency setting
R17 AF level setting
R43 Positive modulation
R30 Distortion measurement

Transmitter S/N ratio

Routine No. 53

Function

The AF output signal (modulation generator) is switched on and off, the modulation being measured in both cases. The ratio of the two modulation measurements is computed.

Variables

INPUT none

OUTPUT Y = S/N in dB

Preconditions

Transmitter test R40
Modulation sensitivity R48
or AF frequency and level setting R16 + R17
or AF level setting R17.

Routines used

R100 (error signal)

RF frequency

Routine No. 54

Function

Measurement of frequency either via HF-RF input/output or FREQ. METER input

Variables

INPUT YE = 1 measurement via FREQ. METER input
YE = 2 measurement via HF-RF input/output

OUTPUT Y = frequency in MHz

Preconditions

none

Routines used

R100 (error signal)

Measurement of demodulated frequency

Routine No. 55

Function

Measurement of frequency of demodulated transmitter signal present at RF input.

For adjustment procedures, the measured value can be displayed directly as an analog value on the screen by setting Y3 = 2.
See routine 86.

Variables

INPUT optional for adjustment

Y3 = 2
Y1 = lower limit
Y2 = upper limit
YE = 1 resolution 0.1 Hz
YE = Ø resolution 1 Hz

OUTPUT Y = frequency in Hz

Preconditions

none

Routines used

R100 (error signal)

Beat frequency

Routine No. 56

Function

Measurement of beat frequency between signal applied to FREQ. METER or HF-RF input and the comparison frequency given by the variable YØ.

The maximum allowable difference between the frequency of YØ and the frequency of signal at selected input is 20 kHz.

Variables

INPUT	YE = 1	measurement via FREQ. METER input
	YE = 2	measurement via HF-RF input
	YØ =	comparison frequency in MHz
OUTPUT	Y =	beat frequency in Hz
		positive for test freq. > comparison freq.
		negative for test freq. < comparison freq.

Preconditions

none

Routines used

R54	Frequency measurement
R8	RF generator setting

Adjacent-channel power ratio

Routine No. 58

a) for SMFP

Function

→ Checking for upper or lower adjacent channel

→ Checking for permissible channel spacing

→ Setting test modulation
f_{mod} = 1.25 kHz 20 dB overmodulation

→ Storing channel spacing

→ Measuring adjacent-channel power ratio

→ Setting nominal channel frequency on signal generator

→ Resetting test modulation f_{mod} = 1 kHz without overmodulation.

Variables

INPUT	Y = (+)1	upper adjacent channel
	Y = -1	lower adjacent channel
OUTPUT	Y =	power ratio in dB

Preconditions

Transmitter frequency R2 or R4
Channel spacing R3
Max. permissible modulation R7
Selection of firmware version (SMFP/SMFP2) R1

Routines used

R48 Modulation sensitivity
R17 AF generator level
R16 AF generator frequency
R40 Basic setting for transmitter measurement

b) for SMFP2

Function

→ Checking for upper or lower adjacent channel

→ Setting test modulation .
f_{mod} = 1.25 kHz, 20 dB overmodulation
(only with channel spacing 10; 12.5; 20; 25 kHz)

→ Storing channel spacing

→ Setting nominal channel frequency on signal generator

→ Measuring adjacent-channel power ratio

→ Resetting test modulation
f_{mod} = 1 kHz without overmodulation.
(only with channel spacing 10; 12.5; 20; 25 kHz)

Variables

INPUT Y = (+)1 upper adjacent channel
Y = - 1 lower adjacent channel

YE = Ø Adjacent-channel power ratio measured at 4 kHz IF bandwidth

YE = 1 Adjacent-channel power ratio measured at 8 kHz IF bandwidth

OUTPUT Y = power ratio in dB

Preconditions

Transmitter frequency R2 or R4
Channel spacing R3
Max. permissible modulation R7
Selection of firmware version (SMFP/SMFP2) R1

Routines used

R48	Modulation sensitivity
R17	AF generator level
R16	AF generator frequency
R40	Basic setting for transmitter measurement

Adjacent-channel power

Routine No. 59

a) for SMFP

Function

→ Checking for upper or lower adjacent channel

→ Checking for permissible channel spacing

→ Setting test modulation
f_{mod} = 1.25 kHz, 20 dB overmodulation

→ Storing channel spacing

→ Setting nominal channel frequency on signal generator

→ Measuring adjacent-channel power

→ Resetting test modulation f_{mod} = 1 kHz
without overmodulation.

Variables

INPUT Y = (+)1 upper adjacent channel
- 1 lower adjacent channel

OUTPUT Y = power in µW

Preconditions

Transmitter frequency R2 or R4
Channel spacing R3
Max. permissible modulation R7
Selection of firmware version (SMFP/SMFP2) R1.

Routines used

R48 Modulation sensitivity
R17 AF generator level
R16 AF generator frequency
R40 Basic setting of transmitter measurement

b) for SMFP2

Function

→ Checking for upper or lower adjacent channel

→ Setting test modulation
f_{mod} = 1.25 kHz, 20 dB overmodulation
(only with channel spacing 10; 12.5; 20; 25 kHz)

→ Storing channel spacing

→ Setting nominal channel frequency on signal generator

→ Measuring adjacent-channel power

→ Resetting test modulation
f_{mod} = 1 kHz without overmodulation
(only with channel spacing 10; 12.5; 20; 25 kHz)

Variables

INPUT Y = (+)1 upper adjacent channel
- 1 lower adjacent channel

YE = Ø Adjacent-channel power measured at 4 kHz IF bandwidth

YE = 1 Adjacent-channel power measured at 8 kHz IF bandwidth

OUTPUT Y = power in µW

Preconditions

Transmitter frequency R2 or R4
Channel spacing R3
Max. permissible modulation R7
Selection of firmware version (SMFP/SMFP2) R1

Routines used

R48 Modulation sensitivity
R17 AF generator level
R16 AF generator frequency
R40 Basic setting of transmitter measurement

Receiver test

Routine No. 62

Function

→ Switches the SMFP2 to receiver test mode.

→ Switches transceiver transmitter off by opening control relay no. 1 (contacts 14 and 15 of socket BU401).

→ Sets SMFP2 to receive frequency of transceiver.

Variables

INPUT X (1) = receiver frequency

OUTPUT none

Preconditions

Receive frequency R2

Routines used

R20 Control lines on/off

R8 RF generator frequency

S/N-ratio measurement, 1 kHz

Routine No. 64

Function

→ Sets sig. gen. to % of max. perm. modulation

→ Sets AF generator to 1 kHz

→ First AF level measurement, switches modulation off

→ Second AF level measurement, calculates S/N ratio in dB

Variables

INPUT Y = % of max. perm. modulation

OUTPUT Y = S/N ratio in dB

Preconditions

RF frequency setting R62 or R8

RF level setting R9

Max. perm. modulation R7

Type of modulation R6

Routines used

R12 Modulation setting

R16 AF frequency setting

R28 AF level measurement

SINAD measurement, 1 kHz

Routine No. 65

Function

→ Sets sig. gen. to % of max. perm. mod.

→ Sets AF generator to 1 kHz

→ Measures SINAD

Variables

INPUT Y = % of max. perm. mod.

OUTPUT Y = SINAD in dB

Preconditions

RF frequency setting R8 or R62

RF level setting R9

Max. perm. modulation R7

Type of modulation R6

Routines used

R12 Modulation setting

R16 AF frequency setting

R100 (error signal)

Receiver sensitivity for given S/N ratio

Routine No. 66

Function

→ Sets RF level to 1 µV

→ Measures S/N at 1 kHz with 60% of max. perm. mod. and compares with nominal value

→ Corrects RF level setting and measures S/N until correct nominal value has been reached.

Variables

INPUT Y = nominal value of S/N ratio in dB

OUTPUT Y = sensitivity in µV

Preconditions

RF frequency setting R8 or R62

Type of modulation R6

Max. perm. modulation R7

Routines used

R9 RF level setting

R64 S/N ratio measurement

Receiver sensitivity for given SINAD

Routine No. 67

Function

→ Sets RF level to 1 µV

→ Measures SINAD at 1 kHz with ~~60%~~ Y1 of max. perm. mod. and compares with nominal value.

→ Corrects RF level setting and measures SINAD until nominal value has been reached.

Variables

INPUT Y = nominal value of SINAD in dB
Y1 = % of max. modulation
YE = Ø threshold at 2 dB
1 threshold at 1 dB

OUTPUT Y = sensitivity in µV

Preconditions

RF frequency setting R62 or R8
Type of modulation R6
Max. perm. modulation R7

Routines used

R9 RF level setting
R65 SINAD measurement

Quieting sensitivity

Routine No. 68

Function

→ RF off

→ Measure AF level

→ Apply unmodulated RF signal and increase RF level until AF level has dropped by 20 dB.

Variables

INPUT none

OUTPUT Y = 20 dB noise quieting sensitivity

Preconditions

RF frequency setting R62 or R8

Routines used

R10 RF generator on/off

R28 AF level measurement

R9 RF generator level setting

Receiver 6-dB bandiwdth and centre-frequency offset

Routine No. 69

Function

→ RF off, modulation off

→ Measures AF noise level

→ Switches on RF and increases level until noise falls by 10 dB (quieting).

→ Increases RF level by further 6 dB and varies RF frequency to obtain same AF level again.

→ Calculates bandwidth and offset from nominal channel frequency.

→ Resets RF frequency to nominal channel frequency.

Variables

INPUT	X (1)	= channel frequency
OUTPUT	Y	= bandwidth in kHz
	Y1	= centre-frequency offset in kHz

Preconditions

Receive frequency R2

Routines used

R10	RF generator output on/off
R28	AF level measurement
R9	RF level setting
R8	RF frequency setting

Modulation acceptance bandwidth

Routine No. 71

(to EIA)

Function

→ Set modulation to 60% of max. permissible mod. at 1 kHz

→ Adjust RF level for 12 dB SINAD

→ Raise RF level by 6 dB

→ Increase deviation until SINAD returns to 12 dB
(Measurement only possible with FM modulation).

Variables

INPUT none

OUTPUT Y = deviation in kHz

Preconditions

RF frequency setting R8 or R62
Type of modulation R6 (only FM possible)
Maximum permissible modulation R7

Routines used

R67 Receiver sensitivity for given SINAD
R9 RF level setting
R65 SINAD measurement

Squelch upper and lower thresholds and hysteresis

Routine No. 72

Function

→ Sets low RF level and increases in coarse steps until squelch responds.

→ Continuously reduces RF level until squelch closes again. (Level = Y1)

→ Continuously raises RF level until squelch reopens (Level = Y2).

→ Compute hysteresis in dB.

Variables

INPUT none

OUTPUT Y1 = lower squelch threshold in µV
Y2 = upper squelch threshold in µV
Y = squelch hysteresis in dB

Preconditions

RF frequency setting R62 or R8
Modulation setting R12

Routines used

R9 RF level setting
R28 AF level measurement

Receiver AF frequency response

Routine No. 76

Function

- → Stores test frequencies separately
- → Measures AF output voltage at 1 kHz and at 20% of max. perm. modulation.
- → Measures AF output voltage at test frequencies.
- → Calculates difference from value at 1 kHz in dB.
- → Sets AF frequency to 1 kHz.

Variables

INPUT Y$ = "test frequencies in kHz separated by commas"

OUTPUT Y9 = number of test frequencies

Y (Ø) = AF level at 1 kHz (reference)

X (21) … X (20 + Y9) } test frequencies in kHz

Y (1) … Y (Y9) } levels in dB relative to value at 1 kHz in same order as test frequencies

Preconditions

RF frequency setting R62 or R8

Type of modulation R6

Max. perm. modulation R7

Routines used

R9 RF level setting

R28 AF level measurement

Duplexer test

Routine No. 77

Function

→ Measures sensitivity for 12 dB SINAD

→ Switches transmitter on (close relay no. 1)

→ Measures sensitivity again for 12 dB SINAD

→ Computes change in sensitivity in dB

→ Switches off transmitter (open relay no. 1)

Variables

INPUT none

OUTPUT Y = change of receiver sensitivity in dB when transmitter in operation

Preconditions

RF generator frequency	R62 or R8
Type of modulation	R6
Max. perm. mod.	R7

Routines used

Sensitivity for given SINAD	R67
RF frequency setting	R8
Transmitter test	R40

Image frequency rejection

Routine No. 78

Function

→ Measure in-channel 12 dB SINAD sensitivity

→ Set RF generator to image frequency

→ Repeat sensitivity measurement

→ Compute rejection ratio in dB

→ Reset RF frequency to channel frequency

Variables

INPUT none

OUTPUT Y = difference between sensitivities in channel and at image frequency in dB

Preconditions

RF frequency setting	R62 or R8
Enter IF	R5
Type of mod.	R6
Max. perm. mod.	R7
Enter receiver frequency	R2

Routines used

Sensitivity for given SINAD	R67
RF generator frequency	R8

Adjustment with analog indication

Routine No. 86

Function

Displays adjustment procedure on PUC screen.

An arrow indicates the position of the measured value relative to the given limits. The values of the current measurement and the limits are also shown digitally. Pressing any key on the PUC keyboard sets a variable which indicates whether the adjustment should be continued or stopped.

(This routine can also be used directly with various test routines. Before the routine is called set Y3 = 2, which makes it unnecessary to interrogate Y3 in the program.)

Variables

INPUT Y = measured value
Y1 = lower limit
Y2 = upper limit
Y$ = text instruction (max. 39 characters)

OUTPUT Y3 = 1 when adjustment is to be continued
= Ø when adjustment is to be stopped

Preconditions

none

Routines used

none

Text instruction on screen

Routine No. 87

Function

Produces text on the screen of the PUC as an instruction to the operator. Text flashes at intervals of 0.5 s.

The routine can be stopped by pressing any key, which also causes the text to be cleared from the screen.

Variables

INPUT Y$ = text (max. 39 characters)

OUTPUT none

Preconditions

none

Routines used

none

Text output on printer (PUD)

Routine No. 88

Function

The routine addresses the printer for the output of text such as titles on the printer. Various character types can be selected.

Variables

INPUT	Y	= 0	normal text
	Y	= 1	normal text underlined
	Y	= 2	expanded text
	Y	= 3	new line with no text in Y$
	Y$	= "Text"	max. 72 characters normal
			max. 36 characters expanded

Preconditions

none

Routines used

R100 (error signal)

Printer output (PUD)

Routine No. 89

Function

The printer is addressed and the text printed.
The text appears at the lefthand margin and
the measured value in a column to the right of this.

Variables

INPUT Y = measured value
Y$ = text (max. 48 characters)

OUTPUT none

Preconditions

none

Routines used

none

Printer output with nominal/actual comparison (PUD)

Routine No. 90

Function

The measured value is compared with a nominal value (upper and lower limits). Text and measured value are then printed. If the measured value lies outside the tolerance limits the measured value is printed one column further to the right and marked with an asterisk.

Variables

INPUT Y = value to be printed
Y1 = lower limit
Y2 = upper limit
Y$ = text and physical unit to be printed (max. 48 characters)

OUTPUT none

Preconditions

none

Routines used

R89 Printer output

Screen output with nominal/actual comparison

Routine No. 91

Function

The measured value is compared with a nominal value (upper/lower limits). Text and measured value are then output on screen. If the measured value lies outside the tolerance limits it is marked with an asterisk.

Variables

INPUT
- Y = measured value to be output
- Y1 = lower limit
- Y2 = upper limit
- Y$ = text and physical unit to be output (max. 26 characters)

OUTPUT none

Preconditions

none

Routines used

none

Frequency-response diagram

Routine No. 92

Function

The routine produces a graphic representation of an AF frequency response measurement on the screen. The X-axis covers 0.1 to 10 kHz logarithmic. The Y-axis is scaled automatically. It shows the dB variation from the value at 1 kHz.

Variables

INPUT Y9 = number of test frequencies

X (21) ... X (20 + Y9) } test frequencies in kHz

Y (1) ... Y (Y9) } values to be displayed in dB relative to value at 1 kHz

OUTPUT none

Preconditions

Frequency-response measurement R32, R49 or R76. These routines automatically supply the input data for the graphical display.

Routines used

none

Hard copy

Routine No. 93

Function

The routine produces a copy of the screen display on the printer PUD connected at the parallel interface. The printer is switched to no-space mode for the output and returned to normal mode after the output.

Variables

INPUT none

OUTPUT none

Preconditions

none

Routines used

none

Error signal

Routine No. 100

Function

Program jumps to this routine when an error is recognized in one of the measurement routines.

The number and function of the routine in which the error has been found is indicated. The program can be stopped using the STOP key or continued by pressing any other key.

Variables

INPUT Y = number of routine in which error has been found

OUTPUT none

Preconditions

none

Routines used

none