1 SPECIFICATIONS

1.1 FREQUENCY

1.1.1 FREQUENCY RANGE

FOR SELECTIVE AND WIDE-BAND MEASUREMENTS ..... 10 kHz to 160 MHz

1.1.2 FREQUENCY DISPLAY ..... digital, 9-decade, with LCD

Resolution ..... 1 Hz

1.1.3 FREQUENCY TUNING

Digital with keyboard,
in frequency steps with direction keys, input of the step increment with keyboard,
quasi-continuously with handwheel over the complete frequency range, switchable between coarse and fine tuning

Smallest frequency step, digital ..... 1 Hz
continuous, fine ..... 1 Hz
coarse ..... 100 Hz

1.1.4 AUTOMATIC FREQUENCY SEQUENCES

1.1.4.1 Frequency Search

over the whole frequency range with stop by signal detector and automatic fine tuning to the detected signal with AFC, search speed matched to the bandwidth:

Bandwidth	3.1 kHz	1.74 kHz	400 Hz	25 Hz
Search speed	1 MHz/s	250 kHz/s	20 kHz/s	200 Hz/s

1.1.4.2 Auto Step

Automatic stepping of the tuned frequency in increments between preset frequency limits.

Increments and frequency limits entered by keyboard,
Stepping speed adjustable ..... 0.1; 0.3; 1; ...; 300 s

1.1.4.3 Tracking

Automatic switching of the tuned frequency between preset frequency limits by a frequency instrument as soon as the level indication disappears, input of the increment and frequency limits by the keyboard.

1.1.4.4 Sweep Frequency Operation

Sweep limits are set with the keyboard by entering either the start and stop frequency or the center frequency and the deviation.
Sweep sequence: periodic (triangular) or single sweep
Sweep duration adjustable ..... 0.1; 0.3; 1 ...; 300 s

Additional facility ..... manual sweep and continuous search with optimum search speed as specified in section 1.1.4.1

1.1.5 AUTOMATIC FREQUENCY CONTROL (AFC)

The capture range corresponds to the nominal bandwidth of the selected bandwidth filter as specified in section 1.4.1 (switched off in the case of 48 kHz). The locking range corresponds to the frequency range specified in section 1.1.1.

1.1.6 ERROR LIMITS OF THE TUNED FREQUENCY ..... $\pm 1 \cdot 10^{-7}$

The above error limits are valid for the rated ranges of operation of influence quantities listed in section 1.9, including aging in the first year.

1.2 LEVEL

1.2.1 MEASURED PARAMETERS

Absolute level
as power level (dBm), refered to 1 mW or
as voltage level (dB), refer to 0.7746 V

Differential level (dB) between an absolute level and a stored reference level. Any absolute level can be stored as a reference level by depressing a pushbutton.

Reduced level (dBm0 or dB0)

1.2.2 RESULT INDICATION, RESOLUTION, RANGE SELECTION

1.2.2.1 Result Indication[1], switchable ..... digital or analog

Digital display ..... LCD with 5 digits and sign

Analog display ..... Analog meter with switchable ranges and digital display of the level value for 0 dB meter reading.

Ranges of the meter:

1 dB scale	-1.5	to +0.3 dB
20 dB scale	-20	to +2 dB
80 dB scale	-80	to +0 dB

1.2.2.2 Resolution

Selective mode, indication averaging on	0.01 dB
indication averaging off	0.1 dB
Wide-band mode	0.1 dB

Levels which cause wide variations of the indication, for example due to superimposed interference signals or to insufficient separation from the intrinsic noise, are displayed with a resolution of 0.1 dB, even if indication averaging is switched on.

1.2.2.3 Range Selection

For digital display: Automatic with overload checking of the wide-band section during selective measurements.

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[1] Noise signals such as the loading level of CF systems actually carrying traffic, thermal noise, or intermodulation noise result, due to the rectifier characteristic, in practically the same reading as a sinusoidal signal with the same RMS value. Crest factor: 12 dB.

For analog display: Single automatic cycle by depression of a push-button with overload checking of the wide-band section for selective measurement or manually with the range switch in 1 dB or 5 dB steps, depending on the selected range of the meter.

In addition to remote control (BN 853/02):
Adjustment of the measurement range in 1 dB steps, with the choise of the wide-band drive signal from 3 modes: low noise, normal, low distortion

Dynamic range in the selected range ..... ± 10 dB
(over- and underloading are indicated)
For very fast measurements, the short averaging feature permits a measurement to be made even when the receive section has not fully settled.

1.2.3 MEASURING RANGES

1.2.3.1 Absolute Level:

Input	Selective mode		Wide-band mode	
	dBm	dB	dBm	dB
Coax. 75 Ω	-130 to +20	-140 to +10	-50 to +20	-60 to +10

1.2.3.2 Reduced Level

According to the range of the absolute level specified in 1.2.3.1 for relative level (resolution 0.1 dB): ..... -99.9 to +20.0 dBr

1.2.4 AUTOMATIC LEVEL CALIBRATION

Automatic level calibration is carried out every two minutes and whenever a parameter change could cause an error in the level indication.

In selective mode, the frequency of the calibration signal tracks the tuning of the receiver; in wide-band mode, the calibration frequency is fixed at 10 MHz.

For measurements in which the measuring sequence could be disturbed by insertion of a calibration cycle, as during sweep frequency measurements, the automatic level calibration can be switched off.

When in external control, the SPM-16 can be calibrated as "single shot". (Auxiliary device BN 853/02).

1.2.5 BASIC INTERFERENCE

1.2.5.1 Intrinsic Noise Level (maximum value) when the measuring input is terminated by Z = 75 Ω:

Bandwidth	Intrinsic noise level/dBm (dB)		
25 Hz	-121 (-130)	-130 (-139)	
400 Hz	-109 (-118)	-126 (-135)	
1.74 kHz	-102 (-111)	-120 (-129)	
3.1 kHz	-100 (-109)	-118 (-127)	
48 kHz			-104 (-113)

10 kHz 50 kHz 300 kHz 160 MHz

1.2.5.2 Level of interference lines

Synchronous (tracking as receiver is tuned) ..... ≦ -130 dBm (-139 dB)
Tunable (not tracking as receiver is tuned) .....≦ -127 dBm (-136 dB)

1.2.6 FAST SIGNAL DETECTOR FOR RAPID SIGNAL IDENTIFICATION, ACTIVE ONLY WITH ANALOG DISPLAY

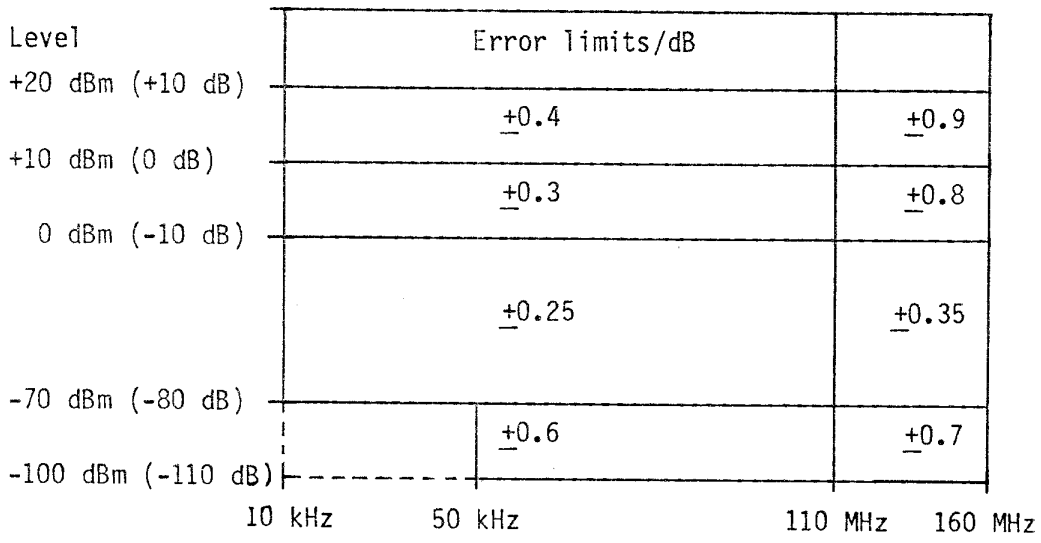
The threshold referred to 0-dB meter reading
on the 1 dB scale ..... approximately -1.2 dB
on the 20 dB scale ..... approximately -15 dB
on the 80 dB scale (for search only) ..... approximately -40 dB

1.2.7 ERRORS OF THE LEVEL INDICATION

Unless otherwise stated, the specified error limits are valid for the rated range of use shown in section 1.9, with automatic level calibration on, with the input supplied from a source with an internal impedance Z. Level errors caused by the reflection coefficient of the input impedance are thus included in the error limits.

1.2.7.1 Errors in Selective Mode

Error limits with digital display, or with analog indication with indication averaging (1-dB-scale) for bandwidths 25 Hz to 3.1 kHz under inclusion of the basic interference given in para. 1.2.5.



Additional errors to those values shown in the table:

with 48 kHz bandwidth (level ≧ -70 dBm/-80 dB) ..... ±0.5 dB

with an analog reading: 20 dB scale (-5 to +2 dB) ..... ±0.2 dB

80 dB scale ..... ±2 dB

For short averaging (only with auxiliary device BN 853/02) ... ±0.4 dB

For digital display with switched off indication averaging, the tabulated values raise by the rounding off error of the decreased resolution according to para. 1.2.2.2.

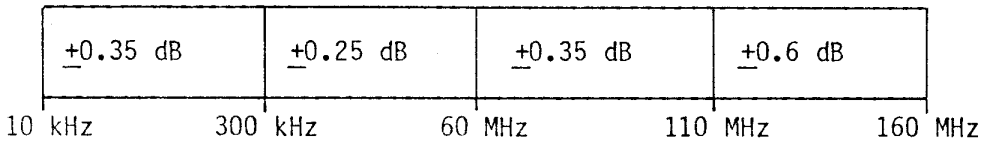
For attenuation measurements at the same frequency (level difference from two measurements, whereby the first measurement serves for the reference level), the tabulated values are also valid if the reference level is located in range -60 dBm to 0 dBm (-70 to -10 dB).

1.2.7.2 Variation of level reading with frequency, Selective Mode

Error limits

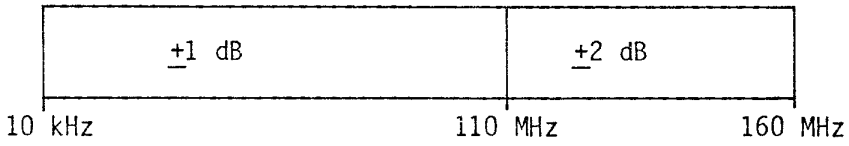
Referred to f = 10 MHz, in level range -60 to 0 dBm (-70 to -10 dB)

Automatic calibration, switched off



1.2.7.3 Error in Wideband Mode

Error limits with digital display



Error additional to tabulated values
with analog reading, 20 dB scale (-5 to +2 dB) ..... ±0.2 dB

1.3 PHASE JITTER

The weighting filter and the rectifier characteristic for measurement of phase jitter (peak-to-peak value) comply with CCITT recommendation 0.91.

For measurements with the test tone 1020 ± 10 Hz in the speech channel or in a CF channel, the receiver must be tuned to the center of the channel; otherwise, it is tuned to the test signal frequency.

1.3.1 MEASURING RANGE

Phase jitter is indicated digitally or on the analog meter
Indication range ..... 0.3 to 30°
Resolution of the digital display ..... Max. 0.1°

1.3.2 ERROR LIMITS OF THE INDICATION

at 150 Hz jitter frequency and signal level
≧ -60 dBm (-70 dB) ..... ±10 % ±0.5°
(The most favorable level range is automatically selected and an error is indicated if the signal level is too low).

1.4 SELECTIVITY AND HARMONIC RATIO

1.4.1 SELECTIVITY, SWITCHABLE: 25 Hz/400 Hz/1.74 kHz/3.1 kHz/48 kHz

Effective Noise Bandwidth					
Bandwidth	Attenuation value with separation from midfrequency of filter				
	±70 Hz	±250 Hz[1)]	±2 kHz[1)]	±5 kHz	±15 kHz
25 Hz	≧ 25 dB	≧ 60 dB			
400 Hz			≧ 55 dB	≧ 60 dB	≧ 70 dB
1.74 kHz			≧ 50 dB	≧ 54 dB	≧ 63 dB
3.1 kHz			≧ 45 dB	≧ 50 dB	≧ 60 dB
48 kHz[2)]	approx. 50 dB when separated by ±35 kHz				

1.4.2 IMAGE FREQUENCY REJECTION AND IF SUPPRESSION ..... ≧ 70 dB

Intermediate Frequencies at ..... 220 MHz, 40 MHz, 10 kHz

Image frequencies at ..... f_{in} + 440 MHz, f_{in} - 80 MHz, f_{in} + 20 kHz

1.4.3 DISTORTION PRODUCTS

for basic frequency level ≦ +10 dBm (0 dB) and digital measurement mode or analog with manual range selection and ≦ 40 dB sensitivity above the measuring range of the basic frequency level (authenticate with bandwidth 25 Hz).

1.4.3.1 Harmonic Distortion Products a_{K2} and a_{K3} for

Load in the frequency range ≧ 4 MHz ..... ≧ 65 dB

< 4 MHz ..... ≧ 60 dB

---

1) 10 dB lower values valid for frequencies > 110 MHz

2) The specified filter characteristics are achieved by sweeping the tuned frequency over a 48 kHz band and integrating the input signal spectrum which falls within this band.

1.4.3.2 Non-harmonic Distortion Products

for load in frequency range < 110 MHz ..... ≧ 75 dB
≧ 110 MHz ..... ≧ 55 dB

1.4.4 NOISE POWER RATIO NPR ..... approx. 45 dB

when loaded with a noise band signal of 4 to 60 MHz.
Wide-band level -25 to +10 dBm, measuring bandwidth 1.74 kHz and digital measurement mode.

1.5 MEASUREMENT PERIODS

The following specifications are guide line values, with which the measurement periods are sufficiently described for practical measurements.

1.5.1 LEVEL MEASUREMENTS WITH AUTORANGING, AUTOMATIC CALIBRATOR SWITCHED OFF

Bandwidth		25 Hz[1)]	400 Hz[1)]	1.74 kHz[1)]	3.1 kHz[1)]	Wideband
Averaging:	normal (OFF)	0.6 s	0.4 s	0.4 s	0.4 s	0.4 s
	long (ON)	1.8 s	1.5 s	1.5 s	1.5 s	0.4 s

1.5.2 LEVEL MEASUREMENT WITH ADJUSTMENT OF THE MEASURING RANGE AND THE WIDE-BAND DRIVE SIGNAL VIA AN IEC-BUS. (Auxiliary device BN 853/02).

Automatic calibration switched OFF:

Bandwidth		25 Hz	400 Hz	1.74 kHz	3.1 kHz	48 kHz
Averaging:	short[2)]	100 ms	20 ms	20 ms	20 ms	350 ms
	normal (OFF)	500 ms	150 ms	150 ms	150 ms	350 ms
	long (ON)	1.5 s	1.5 s	1.5 s	1.5 s	350 ms

1) The specified measurement periods are valid for levels with ≦40 dB separation from the signal loading level. With separation > 40 dB, the values are lengthened through the linearity check by 1 s + 300 ms/5 dB.

2) measured with not completely settled receive section (see para. 1.2.7.1)

1.5.3 LENGTHENING OF THE MEASUREMENT PERIODS WHEN AUTOMATIC CALIBRATOR IS SWITCHED ON:

(The bracketed values are for input level ≧ -10 dBm/dB)

Bandwidth	25 Hz	400 Hz/1.74 kHz/3.1 kHz	48 kHz	WIDEBAND
Averaging: normal (OFF)	1 s	100 ms	300 ms	600 ms
Averaging: long (ON)	1 s	600 ms	---	600 ms

1.5.4 PHASE JITTER MEASUREMENT: ..... 3 s

1.5.5 DATA TRANSFER, TRANSFER TIME PER CHARACTER ..... 1 ms

1.6 INPUT FOR MEASURING

Coaxial ..... System Versacon® 9
Input impedance ..... 75 Ω
Return loss ..... ≧ 30 dB
Tolerable input level (AC and DC components) ..... ≦ +25 dBm (16 dB)
Discrete spurious output signals

1.7 ADDITIONAL INPUTS AND OUTPUTS

1.7.1 INPUT FOR EXTERNAL STANDARD FREQUENCY

Input connector ..... Versacon® 9 conversion system
Frequencies ..... 1, 2, 5 or 10 MHz
Necessary level ..... -10 to +10 dBm
Input impedance ..... 75 Ω

1.7.2 OUTPUT FOR STANDARD FREQUENCY

Output connector ..... Versacon® 9 conversion system
Frequency ..... 10 MHz
Output level into 75 Ω load ..... 0 dBm +2/-4 dBm

1.7.3 INPUT FOR CONTROL FREQUENCY

For control of the Receive Section through the synthesizer

Input connector ..... Versacon® 9 conversion system, floating
Frequency range ..... 220 to 380 MHz
Level into 75 Ω load ..... (+3 ±2) dBm

1.7.4 IF OUTPUT

Output connector ..... Versacon® 9 conversion system

Output frequency when tuned to
center of band ..... 10 kHz
Output level proportional to meter reading,
Level for 0-dB indication into 600 Ω
load ..... -10 dB

1.7.5 Y-OUTPUT VOLTAGE (DC) ..... 3-pole CF connector

DC output voltage proportional to meter reading,
open circuit voltage for full scale deflection ..... +5 V
Output impedance ..... 5 kΩ

1.7.6 X-OUTPUT VOLTAGE (DC) ..... 3-pole CF connector

DC output voltage proportional to frequency
within the start and stop frequency limits,
Open circuit voltage: at start frequency ..... -2.5 V
at stop frequency ..... +2.5 V

Output impedance ..... 5 kΩ

1.7.7 DEMODULATOR OUTPUT ..... 3-pole CF socket

Built-in loudspeaker with adjustable volume.

Single sideband demodulation, switchable to upright or inverted
position, frequency position of converted channel
when tuned to center of channel ..... 0 to 4 kHz
Frequency response in the range 0.6 to
3.4 kHz, referred to 2 kHz ..... ±1 dB
Output level proportional to meter reading

Level for 0-dB-indication into 600 Ω
load ..... approx. 0 dB

Psophometrically weighted intrinsic noise at the demodulator output, for Transmission Level Point (TLP) settings in the range -50 to +10 dBr,
at f ≧ 100 kHz, ... -65 dBm

Intrinsic phase jitter (in accordance with CCITT recommendation 0.91) ..... ≦ 0.5°

1.7.8 DISPLAY UNIT CONNECTION SOCKET

for X, Y, and reference trace voltages. Control input for switching the meter for display of the reference trace voltage of the display unit. A TTL signal for control of the pen lift of an X-Y plotter is also available (series B and later).

1.7.9 INTERFACE BUS ⟨IEC 625⟩ (with auxiliary device BN 853/02)

for control of all SPM-16 functions through an external computer.

1.7.10 DIGITAL INTERFACE

for control of two additional units.

1.7.11 POWER SUPPLY CONNECTION FOR TEST PROBE TK-11 ..... short-circuit proof

with automatic compensation for pass-band attenuation of ..... 10 dB

1.7.12 TRACKING GENERATOR OUTPUT

Output connector ..... Versacon® 9 conversion system
for controlling the PSS-16 Send Section or
as fixed level output, level into Z = 75 Ω ..... -15 dBm

1.8 MEMORIES FOR FIXED FREQUENCIES AND SPM-16 SETTINGS

1.8.1 NUMBER OF FIXED FREQUENCIES
freely programmable[1)] 100
preprogrammed (Auxiliary device BN 874/00.01) 100

1) Maintenance of stored data in the case
of a.c. dropout ..... approx. 30 days

The fixed frequencies can be advanced automatically by one step per address step as described in sections 1.1.4.2 and 1.1.4.3.

1.8.2 NUMBER OF EQUIPMENT SETTINGS

freely programmable[1] 11
preprogrammed (auxiliary device BN 874/00.01) 40

1.9 POWER SUPPLIES AND AMBIENT CONDITIONS

All error limits specified in the preceeding specifications are applicable for the following rated ranges of use of the influence quantities, unless otherwise specified.

1.9.1 POWER SUPPLIES

A.C. line voltage range without switching,
rated range of use ..... 96 to 261 V

A.C. line frequency, rated range of use ..... 47.5 to 63 Hz
Current consumption I_{rms} ..... approx. 1.5 A
Power consumption ..... approx. 65 W
Protection class in accordance with
IEC 348 and VDE 0411 I

Warming up time ..... $\geq$ 15 min

1.9.2 OPERATING CLIMATE

Permissible ambient temperature
Nominal operating range ..... +5 to -40°C
Storage and transport range ..... -40 to +70°C
Radio frequency interference
suppression ..... in accordance with VFg. 526/1979 of the Federal German Post Office

1) Maintenance of stored data in the case
of a.c. dropout ..... approx. 30 days

1.10 DIMENSIONS, WEIGHT

Weight ..... approx. 22 kg

Overall dimensions without cover (w x h x d in mm):

Table-top unit ..... 477 x 244 x 432

19" chassis (DIN 41 494) ..... 443 x 220 x 377
(5 units)

19" conversion kit ..... BN 700/00.05

1.11 AUXILIARY DEVICES

1.11.1 EPROM, ORDER NO. BN 874/00.01

Storage of 100 fixed frequencies and menu of 40 instrument settings in a non-volatile memory, according to users own needs.
(Request Ordering Form No 5/798 a, b)

1.11.2 INTERFACE BUS ⟨IEC 625⟩ CARD BN 853/02

for control of all unit functions.

1.11.3 PRINTER INTERFACE, BN 905/02

Applicable in SPM-16 commencing with Series B, instead of ⟨IEC-625⟩ Interface. For the connection of a printer with a V.24/V.28 Interface with printout of measurement mode, measurement parameters, and measured results.

1.12 MEASURING ACCESSORIES

1.12.1 TEST PROBE TK-11, ACTIVE TEST PROBE (SERIES D...)

Frequency range ..... 2 kHz to 160 MHz

Input level

Maximum permissible AC voltage ..... 1 V or +10 dBm (+2 dB)

Maximum superimposed DC voltage ..... 50 V

Attenuation when terminated with $R_i = R_a = 75\ \Omega$ at 100 kHz and 20 °C ..... 10 dB $\pm$0.1 dB
(with automatic gain correction in SPM-16).

Affects of ambient temperature on attenuation
within the rated range of use ..... $\leqq$ 0.05 dB

Frequency response, referred to 100 kHz: up to 100 MHz ..... $\leqq$ 0.2 dB
up to 160 MHz approx. 0.2 dB

Input impedance: up to f = 25 MHz ..... approx. 50 kΩ || 3.5 pF[1)]
up to f = 100 MHz ..... approx. 5 kΩ || 3.5 pF[1)]
up to f = 160 MHz ..... approx. 2 kΩ || 3.5 pF[1)]

Intrinsic harmonic ratio for input levels $\leqq$ 0 dB ..... $a_{k2} \geqq 40$ dB, $a_{k3} \geqq 50$ dB
for input levels $\leqq$ -20 dB ..... $a_{k2} \geqq 60$ dB, $a_{k3} \geqq 70$ dB

Power supplies ..... from SPM-16

Permissible ambient temperature
Rated range of use ..... +5 to +40°C
Storage and transport range ..... -40 to +70°C

Standard accessories:
Connection to unit being tested ..... Test prod and ground clamp with prod
Receiver connection ..... Element of the Versacon® 9 Conversion system (pin contact)

Optional accessories:
Versacon® 9 adaptor: S 222
Elements of the Versacon® 9 conversion system

Weight ..... 150 g

Dimensions, in mm, with test prod ..... 11 dia. x 105

1.12.2 REFLECTION FACTOR MEASURING BRIDGE RFZ-14

Frequency range ..... 100 kHz to 100 MHz
Rated impedance ..... 75 Ω
Insertion loss with Z_x connection open ..... approx. 8 dB
Frequency response in the range 300 kHz to 60 MHz .... approx. ±0.5 dB
Reference impedance ..... Built-in

---

1) The capacitance is valid for TK-11 without conversion to Versacon® 9.

Error limits after calibration, with plug connector BNC, TNC or 1,6/10

300 kHz to 60 MHz ..... 0.007 $\pm$0.10 r^2

100 kHz to 100 MHz ..... 0.015 $\pm$0.13 r^2

Permissible input power ..... 0.5 W

Connections for transmitter and receiver ..... Universal socket Versacon® 9

Connections to unit being tested ..... Universal socket Versacon® 9

Optional connections ..... BNC; TNC; 1,6/5, 6; 2,5/6; 1,6/10

Weight ..... 200 g

Dimensions, w x h x d in mm, without connections ..... 54 x 33 x 27

1.12.3 ADAPTER FEDA-1 (75 Ω/50 Ω)

The data are valid for the adapter without connecting elements at an ambient temperature of 23°C $\pm$ 5°C.

Impedances 75 Ω/50Ω

Frequency range ..... 0 to 100 MHz

Attenuation ..... 6 dB

Error limits of attenuation ..... $\pm$ 0.1 dB

Reflection factor ..... $\leqq$ 0.01

Maximum load ..... $\leqq$ 1 W

Maximum permissible ambient temperature at rated load ..... 0 to +45°C

Storage temperature ..... -55°C to +60°C

Socket adapters

75 Ω side ..... 2, 5/6 (F) or 1, 6/10 (M/F) or BNC (M/F) or N-connector (M/F)

50 Ω side ..... BNC (M/F) or N-connector (M/F)

Weight ..... 50 g

Dimensions without adapters, l x d in mm ..... 47 x 16

Abbreviations: (M) = male connector; (F) = female connector.

1.12.4 REO-50/REO-56 MATCHING TRANSFORMER

Frequency range

REO-56 ..... 300 kHz to 60 MHz

REO-50 ..... 50 kHz to 14 MHz

Input

Loop-through of useful signal, characteristic impedance ..... 75 Ω

Outputs

Splitting the test signal for two test connectors,

output impedance ..... 75 Ω

Return loss

Return loss of loop (both measuring connectors loaded with 75 Ω):

REO-50 ..... 26 dB

REO-56 ..... 20 dB

Insertion loss of the through-loop (both measuring connectors loaded with 75 Ω): REO-50 ..... 0.25 ± 0.1 dB

REO-56 ..... $0.25^{+0.4}_{-0.1}$ dB

1.12.5 TWO-WAY SPLITTER REV-56

Frequency range ..... 6 kHz to 200 MHz

Input

Input impedance ..... 75 Ω

Outputs

Signal splitting to 2 test connectors, output impedance ..... 75 Ω

Loss with 75 Ω termination ..... 10 dB

Error limits of attenuation in ranges:

6 kHz to 100 MHz ..... $\pm$0.2 dB

100 MHz to 200 MHz (with Series B) ..... approx. $\pm$0.3 dB

Return loss in ranges:

6 kHz to 100 MHz ..... $\geq$ 30 dB

100 MHz to 200 MHz (with Series B) ..... $\geq$ 25 dB

1.13 ORDERING INFORMATION

Level meter SPM-16+	BN 874/01
Auxiliary device (at extra cost)	
EPROM, Storage of fixed frequencies and instrument settings in a non-valible memory[1)]	BN 874/00.01
Interface Bus Card ⟨IEC 625⟩ with adapter plug IEC 625/IEE 488 (S 834)	BN 853/02
Alternatively:	
Printer Interface V.24/V.28	BN 905/02
Measuring accessories (at extra cost)	
Test Probe TK-11 (with test prod)	BN 573/00
Versacon® 9 adapter	S 222
Reflection factor measuring bridge RFZ-14	BN 830/00.01
Test Point Selector MU-7	BN 590/00
IEC-Bus-Interface For MU-7	BN 590/00.01
Matching Transformer REU-56+	BN 839/00.01
REU-50+	BN 839/00.02
Two-way Splitter REV-56+	BN 839/00.03
Adapter FEDA-1 (75 Ω/50 Ω)	BN 319/00
Display unit SG-2 (screen size 85 mm x 120 mm)	BN 429/00
Display unit SG-3 (screen size 150 mm x 210 mm)	BN 593/00
Display unit inserts see	SG-2/SG-3
Printer Trend 800 RO 8	++
Connection cable for ⟨IEC 625⟩ interface bus	
120 cm long	K 343
200 cm long	K 344
19" conversion kit for SPM-16	BN 700/00.05
Front and rear covers for SPM-16 (1 set)	SD-5
Equipment case TPK-5	BN 626/11
Transport case TPG-65	BN 621/65

+) Equipped with the basic 75 Ω socket Versacon® 9 and with BNC element. Other elements must be specified when ordering the equipment - see data sheet for Versacon® 9.

1) The required fixed frequencies and equipment settings must be specified with ordering form No. 5/798 a, b.

++) See data sheet TREND 800 RO for ordering details and data.

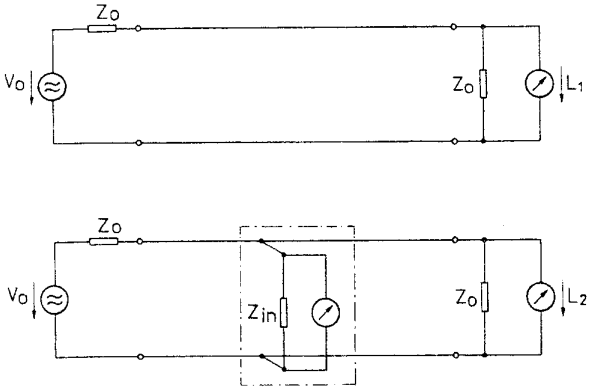
Return Loss

The effect introduced by the return loss of the receiver input or the generator output is included in the error specified for the level reading of a receiver or the output level of a generator.

Moreover, the specified error takes into account that a level meter is operated as "terminated" (input impedance = source impedance = Z_o). This is also valid for a level generator (output impedance = load impedance = Z_o).

Bridging Loss

A receiver operated in the "high impedance" (bridging) mode introduces a level error due to the finite input impedance. The error's maximum value when measured at a testpoint of source impedance Z/2 is expressed as a_B, the bridging loss.



The bridging loss is defined as follows:
Bridging loss $a_B = L_2 - L_1$

$$a_B = 20 \text{ lg} \left| 1 + \frac{1}{2} \frac{Z_o}{Z_{in}} \right|$$

Therefore, the bridging loss is the level difference caused by the high impedance level meter input bridging a system terminated with Z_o.

In every case, $Z_{in} \gg Z_o$, which results in:

$$a_B \leqq 4.3 \frac{Z_o}{Z_{in}} \quad [dB]$$

For that reason, the specified value of $a_{B,1}$ related to the value Z_1 (e.g. 600 Ohms) can be easily recalculated to yield the value of $a_{B,2}$ for the value Z_2 (e.g. 900 Ohms):

$$a_{B,2} = a_{B,1} \cdot \frac{Z_2}{Z_1}$$

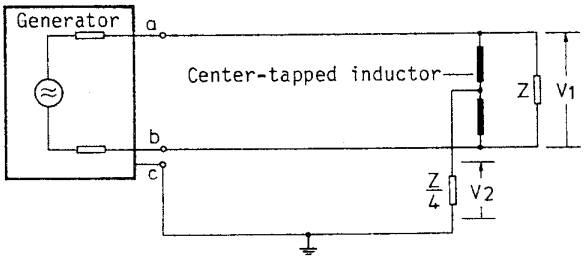
Impedance balance ratio

The specifications given for the input or output balance are provided by the methods defined in CCITT Recommendation O. 121.

This same Recommendation states that:
"The signal balance ratio is an overall measurement of the symmetry of a device and includes the influence of the impedance balance ratio as well as the influence of unwanted longitudinal voltages produced by a generator or the influence of the common-mode rejection ratio of a receiver."

To describe the degree of balance of a device (generator or receiver) under operational conditions in most cases it is sufficient to measure and specify the signal balance ratio only. Thus, the specifications in this Operating Mannual are provided by measurement of signal balance ratio. This is done through emplomet of an accurately center-tapped inductor with both of the tightly-coupled half windings being completely symmetrical. Each half represents Z/2.

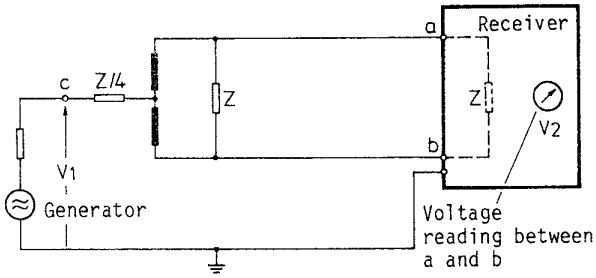
Measurement of Generator Signal Balance Ratio



Generator signal balance ratio is defined as:

$$a_B = 20 \log \left| \frac{V_1}{V_2} \right| \quad [dB]$$

Measurement of Receiver Signal Balance Ratio



Receiver signal balance ratio is defined as:

$$a_B = 20 \log \left| \frac{V_1}{V_2} \right| \quad [dB]$$

The dotted impedance, Z, is the input impedance of the device under test. If the input impedance is a high value, then this impedance must be externally connected in the parallel.