1 SPECIFICATIONS

1.1 FREQUENCY

1.1.1 SELECTIVE AND WIDEBAND MEASUREMENT FREQUENCY RANGE

Version	BN 955/01	BN 955/02	Frequency range
Coaxial input	75 Ω	75 Ω	50 Hz[1)] to 10 MHz
Balanced input	124/150 Ω 600 Ω	124 Ω 135/600 Ω	6 kHz to 10 MHz 50 Hz[1)] to 620 kHz

1) Selective measurements below 2 kHz: 25 Hz bandwidth only.

1.1.2 FREQUENCY INDICATOR ..... 7 digit LED

Resolution ..... 1 Hz

1.1.3 FREQUENCY SETTING

Quasi-continuous across complete range, using manual control switchable between coarse and fine settings.

Smallest increment, fine ..... 1 Hz

coarse ..... 100 Hz

Additional frequency setting using variable step-width and automatic search-scan, halted by signal detection.

1.1.4 TUNING FREQUENCY ERROR LIMIT ..... $\pm 3 \times 10^{-6}$

This error limit is valid under the conditions laid out in section 1.7 for rated ranges of use of the influence quantities, and includes ageing for 1 year.

1.2 LEVEL

1.2.1 DISPLAY MODES

Absolute level

as power level (dBm), referred to 1 mW, or

as voltage level (dB), referred to 0.7746 V (BN 955/01 only)

as noise level (dBrnC)*) instead of voltage level indication with 955/00.23 option.

Level difference (dB) between absolute level and stored reference level.

*) 0 dBrnC ≙ -90 dBm

1.2.2 DISPLAY OF RESULTS

digital measuring mode ..... 5 digit LED
max. resolution ..... 0.01 dB
analog measuring mode ..... meter with switchable scale ranges and indication of 0 dB value on LED display
Scale ranges, 2 dB scale ..... -1 dB to +1 dB
20 dB scale ..... -20 dB to +2 dB
Setting of 0 dB value in 1 dB (2 dB scale) or
10 dB (20 dB scale) steps over the range ..... -120 dB to +20 dB or -110 dBm to +20 dBm

1.2.3 DISPLAY RANGES

(For BN 955/00 inputs, see 1.1.1)

Input	Selective measurement		Wideband measurement[1]	
	dBm	dB	dBm	dB
coax. 75 Ω	130 to +20	-140 to +20	-50 to +20	-60 to +20
bal. 124/150 Ω (135 Ω)	120 to +20	-130 to +20	-40 to +20	-50 to +20
bal. 600 Ω	-130 to +20		-50 to +20	

1) Lower limit 10 dB lower in analog mode.

1.2.4 LEVEL CALIBRATION

The level is automatically re-calibrated each time a parameter is changed which might cause an error in the level indicated. This facility is coupled with a check that the wideband section, when used for selective digital measurements, is not overdriven.
Can be switched out for continuous measurements (e.g. demodulation).
The calibration signal frequency tracks the receiver frequency in selective measurements; for wideband measurements it is fixed at 10 kHz.

1.2.5 FAST SIGNAL DETECTOR FOR RAPID SIGNAL RECOGNITION

only in conjunction with analog indication (20 dB scale)
response threshold referred to 0 dB meter reading ..... approx. -15 dB ($\leq$ 10 dB)

1.2.6 NOISE FLOOR

Intrinsic noise and discrete spurious signals, measured at highest sensitivity setting:

1.2.6.1 Coaxial input $Z_{in} = Z_0 = 75\ \Omega$

Bandwidth	Max. noise floor		
wideband	-75 dB/-65 dBm		
1.74 kHz[1] und 3.1 kHz	–		-125 dB/-115 dBm
25 Hz	-100 dB/-90 dBm	-115 dB/-105 dBm	-135 dB/-125 dBm
	50 Hz	200 Hz	3 kHz 10 MHz

1) 1.95 kHz with BN 955/00.23 option

1.2.6.2 Balanced input, $Z_{in} = Z_o$ = 124/150 Ω, 6 kHz to 10 MHz

(BN 955/02: Z_o = 124 Ω)

Bandwidth	Max. noise floor
wideband	-65 dB/-60 dBm
1.74 kHz[1] and 3.1 kHz	-115 dB/-110 dBm
25 Hz	-125 dB/-120 dBm

1.2.6.3 Balanced input, $Z_{in} = Z_o$ = 135/600 Ω

(BN 955/02: Z_o = 135/600 Ω)

Bandwidth	Max. noise floor		
wideband	-65 dB/dBm		
1.74 kHz1) and 3.1 kHz	—		-110 dB/dBm
25 Hz	-90 dB/dBm	-105 dB/dBm	-120 dB/dBm
	50 Hz	200 Hz 3 kHz	620 kHz

1.2.7 LEVEL INDICATOR ERROR LIMITS

Unless otherwise stated, the error limits are valid for the rated ranges of use for the influence quantities, as given in section 1.7, with automatic level calibration and when the instrument is fed from a source with output impedance $Z_{out} = Z_o$ and receiver input impedance $Z_{in} = Z_o$.

The error limits make allowance for the influence of the reflection coefficient on the input impedance Z_{in}.

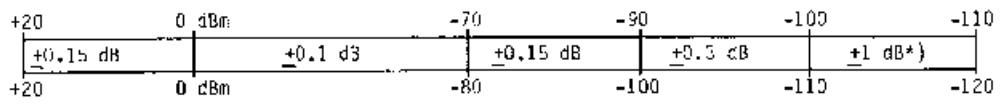
1.2.7.1 Selective measurement error limits

Indicator error limits for input level 0 dBm (0 dB) in digital or analog (2 dB scale) modes at f = 10 kHz (100 kHz at Z_o = 124/150 Ω) or Z_o = 124 Ω for BN 955/02):
Bandwidth 1.74 and 3.1 kHz (at 25 Hz extra error ±0.05 dB)

Input	Ambient temperature	
	+20 to +26°C	0 to +50°C
coaxial	±0.06 dB	±0.15 dB
balanced	±0.10 dB	±0.20 dB

Expansion of error limits given in 1.2.7.1 as a function of input level:

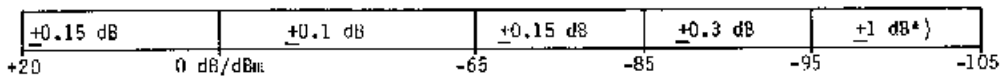
Z_o = 75 Ω, coaxial input



1) 1.95 kHz with BN 955/00.23 option

*) Error limit valid for 25 Hz bandwidth only.

Balanced input Z_0 = 124, (135), 150, 600 Ω



1.2.7.2 Frequency response of level indicator referred to f = 10 kHz

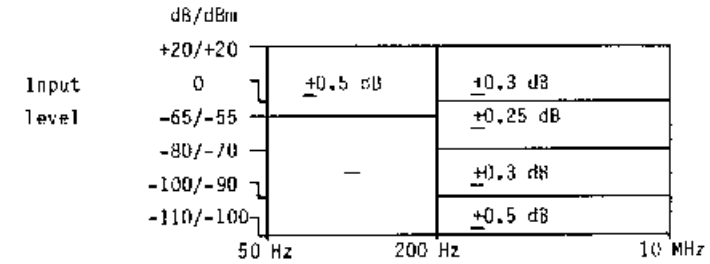
(100 kHz for Z_0 = 124/150 Ω or Z_0 = 124 Ω, BN 955/02), for input level ≥ 40 dB above noise floor (see 1.2.6), temperature range 20 to 26°C:

Input	BN 955/01	BN 955/02	Error limits/dB						
coaxial	75 Ω	75 Ω	±0.3	±0.08					
balanced	124/150 Ω	124 Ω	—			±0.4	±0.15		
balanced	600 Ω	135/600 Ω	±0.8	±0.25	±0.15		±0.25		–
			50 Hz	200 Hz	2 kHz	6 kHz	60 kHz	100 kHz	620 kHz	10 MHz

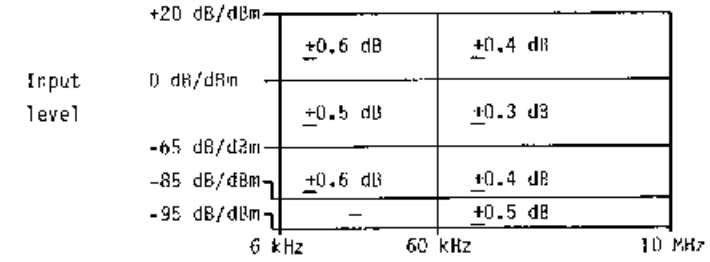
1.2.7.3 Total Error

within rated operating ranges (see Section 1.7), digital or analog (2 dB scale) mode, bandwidth 25 Hz to 3.1 kHz

Coaxial input, Z_0 = 75 Ω



Balanced input, Z_0 = 124 Ω and 150 Ω
(BN 955/02: Z_0 = 124 Ω)



*) Error limit valid for 25 Hz bandwidth only.

Balanced input, Z_0 = 600 Ω
(BN 955/02: Z = 135/600 Ω)

For analog (20 dB scale) mode, the tabulated values must be increased by
(-10 to +2 dB)..... ±0.3 dB

1.2.7.4 Wideband measurement error limits

Total errors within nominal ranges of use defined in 1.7:

Input	Impedance	Level range	Error limits
coaxial	75 Ω	-50 to +20 dB	± 0.6 dB
		-40 to +20 dBm	
		-60 to -50 dB	± 0.8 dB
		-50 to -40 dBm	
balanced	124/150 Ω (135 Ω)	-40 to +20 dB	± 0.7 dB
		-30 to +20 dBm	
		-50 to -40 dB	± 0.9 dB
		-40 to -30 dBm	
balanced	600 Ω	-40 to +20 dB/dBm	± 0.7 dB
		-50 to -40 dB/dBm	± 0.9 dB

1.3 SELECTIVITY AND HARMONIC RATIO

1.3.1 SELECTIVITY

Switchable to the nominal values: ..... 25 Hz; 1.74 kHz[1]; 3.1 kHz

Nominal value		25 Hz[2]	1.74 kHz[1]	3.1 kHz
Effective noise bandwidth (±10%)		---	1.74 kHz[1]	3.1 kHz
Δf from centre frequency for attenuation of	≤ 3 dB	± 7 Hz	±650 Hz	±1.5 kHz
	≥ 50 dB	± 80 Hz	---	---
	≥ 60 dB	± 250 Hz	±2 kHz	±2 kHz

1) 1.95 kHz with BN 955/00.23 option.

2) Valid in temperature range +5 to +40°C

1.3.2 IMAGE FREQUENCY AND IF SUPPRESSION ..... ≥ 70 dB

IF frequencies ..... 40 MHz and 10 kHz

1.3.3 HARMONIC RATIO a_{k2} and a_{k3}

for fundamental level ≤ 0 dBm (0 dB), automatic calibration, digital or analog (20 dB scale range with 40 dB increased sensitivity) referred to the measurement range for the fundamental level:

fundamental frequency ≥ 3 kHz ..... ≥ 80 dB

≥ 300 Hz (25 Hz bandwidth) ..... ≥ 70 dB

1.3.4 NOISE POWER RATIO (NPR)

when loaded with noise, bandwidth 12 kHz to 8160 kHz (1800 channels), Wideband level -25 to +10 dBm, noise slot anywhere in the band (B_{eff} ≥ 20 kHz), bandwidth 1.74 kHz (1.95 kHz), automatic calibration, digital mode ..... ≥ 54 dB

1.4 M E A S U R E M E N T I N P U T S

1.4.1 COAXIAL INPUT

suitable for all usual connectors ..... Versacon® 9 System

(BN 955/02: Female connector for WLCO 358 A male connector)

Frequency range ..... 50 Hz to 10 MHz

Input impedance, switchable to Z_0 ..... 75 Ω

or high impedance ..... ≥ 10 kΩ ‖60 pF

Return loss ..... ≥ 36 dB

Bridging loss[1], high input impedance

f = 200 Hz to 1 MHz ..... ≤ 0.05 dB

1.4.2 BALANCED INPUT ..... 3 pole CF connector

Input impedance, switchable to Z_0 ..... 124 Ω, 150 Ω

or high impedance ..... ≥ 100 kΩ ‖15 mH ‖25 pF

BN 955/02: Z_0 = 124 Ω,

female connector for ..... WLCO 378A/379A male connector

Frequency range ..... 6 kHz to 10 MHz

Return loss, f = 100 kHz ..... ≥ 40 dB

Bridging loss[1], high input impedance

f = 60 kHz to 1 MHz ..... ≤ 0.1 dB

f = 6 kHz to 60 kHz ..... ≤ 0.2 dB

Signal balance ratio, according to CCITT Rec. 0.121

f = 6 kHz to 1 MHz (10 MHz) ..... ≥ 40 dB (≥ 25 dB)

1) See "Remarks on Errors specified in this Operating Manual" at the end of chapter 1

Input impedance, switchable to Z_0 ..... 600 Ω
or high impedance ..... ≥ 100 kΩ ‖2.5 H ‖ 80 pF
BN 955/02: also Z_0 = 135 Ω,
135 Ω female connector for WECO 372A male connector.
600 Ω female connector for WECO 310 male connector.
Frequency range ..... 50 Hz to 620 kHz
Return loss, f = 10 kHz ..... ≥ 50 dB
Bridging loss[1], high input impedance
f = 200 Hz to 600 kHz ..... 0.15 dB
Signal balance ratio, according to CCITT Rec. O.121 ..... ≥ 40 dB

1.4.3 MAXIMUM PERMISSIBLE INPUT VOLTAGES (ALL INPUTS)

Overload limit when terminated with Z_0, V_{rms} ..... 10 V
D.C. input voltage, high impedance termination ..... 60 V
D.C. input voltage referred to ground, balanced inputs ..... 60 V

1.5 T R A C K I N G G E N E R A T O R

Option for BN 955/01 (PSE-15), built in to BN 955/02.

1.5.1 FREQUENCY RANGE

Tracking generator fitted to:	BN 955/01	BN 955/02	Frequency range
Coaxial output	75 Ω	75 Ω	50 Hz to 10 MHz
Balanced output	124/150 Ω	124 Ω	6 kHz to 10 MHz
	600 Ω	135/600 Ω	50 Hz to 620 kHz

Frequency setting, indication and error limits as for receive section, see section 1.1

1.5.2 SEND LEVEL

Signal shape ..... sinusoidal
Level indicator:
Digital indicator used for display of received level, can be switched to display send level.
Resolution ..... 0.1 dB

1) See "Remarks on Errors specified in this Operating Manual" at the end of chapter 1.

Send level range

Output	Impedance	Power level, referred to 1 mW	Voltage level referred to 0.7746 V
coaxial	$\mathcal{L}$ = 75 Ω	-55 to +12 dBm	-65 to +3 dB
balanced	Z = 124 Ω	-58 to +9.9 dBm	
	Z = 150 Ω [1]	-59 to +9 dBm	
balanced	Z = 135 Ω [2]	-58 to +9.5 dBm	
	Z = 600 Ω	-65 to +3 dBm	
	R_{out} D	-59 to +11 dBm	-59 to +11 dB

1) BN 955/01 only

2) BN 955/02 only

A level value between -75 and +50 dB/dBm which can be used as a reference value can be set using the level control if the tracking generator is switched off.

Send level setting ..... stepwise in 5 dB and 0.1 dB steps

1.5.3 SEND LEVEL ERROR LIMITS

The error limits given are valid within the rated ranges of use of the influence quantities as given in Section 1.7.

$Z_{in} = Z_{out} = Z_o$ or $Z_{in} = 0$, $Z_{out} = Z_o$

Output		Error limits (dB)				
coax.,	Z_o = 75 Ω	±0.6	±0.25			
bal.[1],	Z_o = 124/150 Ω	–	± 0.3	±0.4		
bal.[2],	$Z_{out} = Z_{in} = Z_o$	±0.6	±0.3	±0.4	–	
Z_o = 600 Ω	Z_{out} = 0				–	
	$Z_{out} = Z_o$	±0.6	±0.3	±0.6		
		50 Hz	200 Hz 6 kHz	100 kHz	620 kHz	10 MHz

1.5.4 MEASURING OUTPUTS

1.5.4.1 Coaxial output (a.c. voltage only)

Suitable for all usual connectors ..... Versacon® 9 System

(BN 955/02: female connector for WECO 358 A male connector)

Frequency range ..... 50 Hz to 10 MHz

Output impedance ..... 75 Ω

Return loss at f = 10 kHz ..... ≥ 50 dB

1) BN 955/02: Z_o = 124 Ω only

2) BN 955/02: Z_o = 0, 135, 600 Ω

1.5.4.2 Balanced output (floating) ..... 3 pole CF connector

BN 955/02: 124 Ω female connector for WECO 327 A/3/9 A male connector
135 Ω female connector for WECO 241 A male connector
600 Ω female connector for WECO 310 male connector

Output impedance ..... 124 Ω, 150(135) Ω, 600 Ω
and low impedance (Z = 600 Ω) ..... 15 Ω + jω 45 μH) ± 20%
Return loss at f = 100 kHz (10 kHz for Z_o = 600 Ω) ..... ≥ 36 dB
Signal balance ratio, according to CCITT Rec. 0.121 ..... ≥ 40 dB
Frequency range, Z_o = 124 Ω and 150 Ω (PSE-15 only with BN 955/01) ..... 6 kHz to 10 MHz
Z_o = 600 Ω (also 135 Ω for BN 955/02) ..... 50 Hz to 620 kHz
Max. a.c. or d.c. voltage referred to ground V_{rms} ..... 60 V

1.5.5 OUTPUT VOLTAGE SPECTRAL PURITY

With $Z_{in} = Z_{out} = Z_o$ or $Z_{in} = \infty$, $Z_{out} = Z_o$

Harmonic ratio a_{k2}, a_{k3}
for output level ≤ 0 dB/dBm:
Frequency range 50 Hz to 10 MHz ..... ≥ 40 dB

Non-harmonic spurious signals:
Frequency range 50 Hz to 10 MHz, signal to spurious signal ratio ..... ≥ 50 dB

Signal to noise ratio
referred to 1 Hz bandwidth, output level 0 dB/dBm, send frequency ≥ 10 kHz and
Δf from wanted signal ≥ 20 kHz ..... ≥ 110 dB
Intrinsic phase jitter (measured to CCITT Rec. 0.91)
for frequencies which are multiples of 5 Hz ..... ≤ 1.5°

1.6 ADDITIONAL INPUTS AND OUTPUTS

1.6.1 STANDARD FREQUENCY OUTPUT[1)]

Connector ..... BNC
Frequency ..... 10 MHz
Level into 75 Ω load ..... 0 dBm ± 3 dB

1.6.2 TUNING FREQUENCY OUTPUT[1)]

Connector ..... BNC
Frequency ..... 40 bis 50 MHz
Level into 75 Ω load ..... -6 dBm ± 3 dB

1.6.3 A.C. VOLTAGE OUTPUT, short circuit protected

Connector ..... BNC
Output level for 0 dB scale indication, $Z_{out} = Z_{in} = 75$ Ω ..... 0 dBm ± 1 dB
(valid for input levels ≥ -30 dBm for wideband measurements)
Output frequency, selective measurement ..... 10 kHz
wideband measurement ..... same as input frequency

1) For remote tuning of PS-15

1.6.4 D.C. VOLTAGE OUTPUT

F.s.d. open circuit voltage ..... +5 V ± 0.2 V
Output impedance ..... 5 kΩ ± 2%

1.6.5 DEMODULATOR

Built in loudspeaker with variable output volume, also with test output .... 3 pole CF connector (BN 955/02, female connector for WECO 310 male connector)
SSB demodulation, switchable between upper and lower sideband
Translated frequency range when tuned to channel carrier ..... 0 to 4 kHz

Frequency response, 0.3 to 3.4 kHz
referred to f = 1.85 kHz ..... +0.5/-3 dB
Output level proportional to meter reading
Output level for 0 dB scale reading (into 600 Ω load)..... 0 dBm ±0.5 dB
Intrinsic phase jitter (measured to CCITT Rec. 0.91)
for frequencies which are multiples of 5 Hz ..... ≤ 1.5°

1.6.6 REMOTE CONTROL INPUT (with Option BN 955/00.03 only)

Interface to DIN IEC 625 (IEEE 488 with adaptor S 834)
for remote control of all essential instrument functions.

Interface functions SH1, AH1, T6, L4, SR1, RL1, PP2, DC1, DT1, C0

Typical measurement times:

for changes in level (x = range already set) within	measurement time 1.74 or 3.1 kHz bandwidth	measurement time 25 Hz bandwidth
x ± 1 dB	2.0 s	2.3 s
x ± 10 dB	3.3 s	3.6 s
without preset range (program word "R002,")	4.6 s	4.8 s
increase due to cal. clock	1.9 s	2.3 s

Transfer time for setting data and results ..... approx. 1 ms/character

1.7 POWER SUPPLY AND AMBIENT CONDITIONS

Unless otherwise stated, the error limits given previously in the specifications are valid for the following rated ranges of use of the influence quantities, immediately following switch-on.

1.7.1 POWER SUPPLY

1.7.1.1 A.C. mains operation

Rated range of use	Set value	Voltage range
	110 V	96 to 121 V
	117 V	103 to 129 V
	127 V	112 to 141 V
	220 V	193 to 242 V
	227 V	199 to 250 V
	237 V	208 to 261 V

A.C. mains frequency ..... 47.5 to 63 Hz
Power consumption during measurement ..... approx. 38 VA
during charging ..... approx. 38 VA

1.7.1.2 Battery Operation

Using built-in rechargeable batteries (Option BAZ-15, BN 955/00.01)
Operating time ..... approx. 5 hours
Charge time ..... approx. 14 hours
Charge storage time (instrument off) ..... approx. 4 weeks
Battery type ..... 12 x KR 35/62

1.7.2 SAFETY CLASS

To IEC 348 and VDE 0411 ..... CLASS I

1.7.3 AMBIENT CONDITIONS

Operating temperature range ..... 0 to +50°C
Storage and transport range ..... -40 to +60°C
RFI/EMI suppression ..... to German Post Office regulation 526/1979
Warm up time ..... not required

1.8 D I M E N S I O N S A N D W E I G H T

Dimensions, in mm, without cover (w x h x d) ..... 317 x 175 x 342

Weight
SPM-15 without options ..... approx. 12.5 kg
PSE-15 Tracking Generator ..... approx. 0.7 kg
BAZ-15 Battery Pack ..... approx. 2.8 kg
<IEC 625> Interface board ..... approx. 1 kg
FTZ K numbers: SPM-15, BN 955/01 ..... 272 181 826-5
PSE-15, BN 955/00.02 ..... 272 918 104-5
BAZ-15, BN 955/00.01 ..... 191 090 156-0