

Specifications

Frequency

Frequency ranges

ESAI	20 Hz to 1.8 GHz
ESBI	20 Hz to 5 GHz
ESMI	20 Hz to 26.5 GHz, up to 110 GHz with external mixers

Frequency setting

Resolution	1 Hz
Error of frequency reference	$< 1 \times 10^{-7}$
Frequency scale	selectable: LIN/LOG

Frequency display

Error (with span >5 MHz, sweep time <100 ms)	$< 8 \times 10^{-3}$ x span
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Frequency span

Range	10 Hz to 2 / 5.2 / 26.5 GHz
Error	
Span 10 Hz to 5 MHz	$< 2 \times 10^{-3}$ x span
Span >5 MHz	$< 5 \times 10^{-3}$ x span

Frequency counter

Scan setting	< 1000 x resolution bandwidth
Resolution	0.1 Hz to 10 kHz
Error limit	$< \text{readout} \times 10^{-7} \pm 2$ x resolution

Spurious with discrete frequencies

n x mains frequency	>70 dBc
m x line frequency (29.4 kHz)	>80 dBc
100 kHz (span \leq 5 MHz)	>90 dBc
-10.7 MHz	>90 dBc
other for $\Delta f > 1$ MHz	>75 dBc

Internal spurious response

(input terminated with 50 Ω)	
f > 1 MHz	< -110 dBm (< -3 dB μ V)
ESBI and ESMI only: f < 1 MHz, f > 4.7 GHz, f = 1.585 GHz	< -95 dBm (< 12 dB μ V)
Oscillator feedthrough	typ. -25 dBm

Filters

RF preselector

Selectable filters (except YIG filter of ESMI), automatically switched

Filter	Passband frequencies from ... to		Filter type
	...	to	
Filter 1	DC	9 kHz	LP, fixed
Filter 2	9 kHz	150 kHz	BP, fixed
Filter 3	150 kHz	2 MHz	BP, fixed
Filter 4	2 MHz	10 MHz	BP, fixed
Filter 5	10 MHz	30 MHz	BP, fixed
Filter 6	30 MHz	50 MHz	BP, fixed
Filter 7	50 MHz	80 MHz	BP, fixed
Filter 8	80 MHz	110 MHz	BP, fixed
Filter 9	110 MHz	140 MHz	BP, fixed
Filter 10	140 MHz	260 MHz	BP, tuned
Filter 11	260 MHz	450 MHz	BP, tuned
Filter 12	450 MHz	700 MHz	BP, tuned
Filter 13	700 MHz	1 GHz	BP, tuned
Filter 14 (ESAI)	1 GHz	2 GHz	BP, fixed
Filter 14 (ESBI, ESMI)	1 GHz	1.9 GHz	BP, fixed
Filter 15 (ESBI)	1.9 GHz	5.2 GHz	BP, fixed
Filter 15 (ESMI)	1.9 GHz	5.0 GHz	BP, fixed
Filter 16 (ESMI)	4.9 GHz	26.5 GHz	YIG filter

The 6-dB bandwidth of the tunable bandpass filters is typ. <85 MHz, that of the YIG filter increases from typ. 50 MHz at 5 GHz to typ. 100 MHz at 26.5 GHz.

IF filters

Overview mode	
3-dB bandwidths	<10 Hz (typ. 6 Hz) to 3 MHz in 5% steps (except the range 30 to 80 kHz)

EMI receiver mode	
6-dB bandwidths	10 Hz*), 100 Hz, 200 Hz, 1 kHz, 9 kHz, 10 kHz, 100 kHz, 120 kHz, 1 MHz

Bandwidth factor	
-60 dB / -3 dB	<12
-80 dB / -3 dB	<20

Video filters

Bandwidth (-3 dB)	1st-order RC lowpass after IF rectifier
	1 Hz to 3 MHz in 1/3/10 steps

Amplitude

Maximum input level

DC voltage	
DC coupling	<0 V
AC coupling	<20 V
AC voltage (sinewave)	
RF attenuation 0 dB	<20 dBm (100 mW; 127 dB μ V)
RF attenuation \geq 10 dB	<30 dBm (1 W; 137 dB μ V)

Pulse spectral density with 0 dB RF attenuation,

RF preselector on	
f < 150 kHz	<130 dB μ V/MHz
f = 150 kHz to 1 GHz	<90 dB μ V/MHz
f \geq 1 GHz	<61 dB μ V/MHz
RF preselector off	<61 dB μ V/MHz

Maximum pulse voltage (RF attenuation \geq 10 dB)

Input 1	<150 V
Input 2	<50 V

Maximum pulse energy (t = 10 μ s), RF attenuation \geq 10 dB

Unit	ESAI, ESBI	ESMI
Input 1	<1 mWs (= 100 W for 10 μ s)	<10 mWs (= 1 kW for 10 μ s)
Input 2	<1 mWs (= 100 W for 10 μ s)	<1 mWs (= 100 W for 10 μ s)

Level compression

Pulse spectral density at 1-dB compression (RF attenuation 0 dB, RF preselector on, RF preamplifier off)

Frequency	1-dB compression for
<150 kHz	ESAI: >102 dB μ V/MHz ESBI/ESMI: >110 dB μ V/MHz
0.15 to 5 MHz	ESAI: >83 dB μ V/MHz ESBI/ESMI: >86 dB μ V/MHz
5 to 30 MHz	ESAI: >77 dB μ V/MHz ESBI/ESMI: >80 dB μ V/MHz
30 to 300 MHz	ESAI: >72 dB μ V/MHz ESBI/ESMI: >76 dB μ V/MHz
300 to 1000 MHz	ESAI: >72 dB μ V/MHz ESBI/ESMI: >75 dB μ V/MHz
>1000 MHz	ESAI/ESBI/ESMI: >50 dB μ V/MHz

*) ambient temperature 15 to 35 °C

Maximum inherent noise indication in CISPR bands

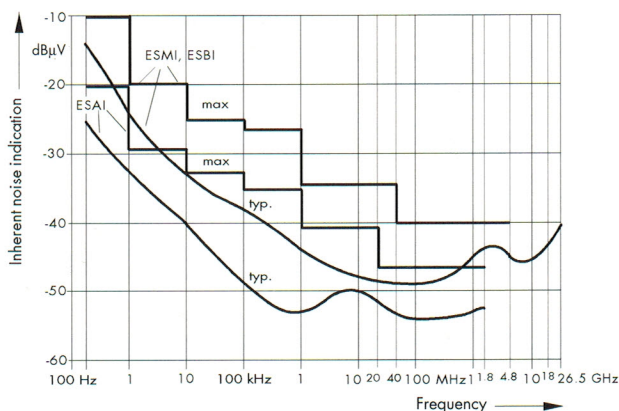
RF preamplifier off, RF attenuation 0 dB, discrete spuria excepted

Frequency range	CISPR band/ bandwidth	Unit	Indication (in dB μ V)		
			Average	Quasi-peak	Peak
9 to 150 kHz	A / 200 Hz	ESAI	-17	-15	-6
		ESBI/ESMI	-7	-5	+4
0.15 to 5 MHz	B / 9 kHz	ESAI	-3	0	+8
		ESBI/ESMI	0	+3	+11
5 to 30 MHz	B / 9 kHz	ESAI	-13	-10	-2
		ESBI/ESMI	-5	-2	+6
30 to 300 MHz	C / 120 kHz	ESAI	0	+4	+11
		ESBI/ESMI	+5	+9	+16
0.3 to 1 GHz	D / 120 kHz	ESAI	+5	+9	+16
		ESBI/ESMI	+8	+12	+19

In the frequency range from 20 Hz to 1 MHz, figures for the noise indication are valid in the temperature range 15 to 35 °C. Outside this temperature range, the specified values may vary by max. 10 dB. The guaranteed sensitivity value in the CISPR bands is improved by typ. 6.5 dB with the preamplifier on.

Inherent noise indication for all units with maximum sensitivity setting in the frequency range 20 to 200 Hz (bandwidth 10 Hz, video bandwidth 1 Hz, preamplifier off)

45 dB μ V



Inherent noise indication with maximum sensitivity setting (bandwidth 10 Hz, video bandwidth 1 Hz, preamplifier on, RF preselector bypassed)

Spectral sensitivity

Resolution bandwidth 1 MHz, f > 30 MHz, peak-value indication

Unit	Preamplifier	
	0 dB	10 dB
ESAI/ ESBI	<30 dB μ V/MHz	<21 dB μ V/MHz
ESMI (<18 GHz)	<32 dB μ V/MHz	<23 dB μ V/MHz

Level measurement error after internal calibration

(sum error in indication range and in temperature range 15 to 35 °C)
 ESAI (f = 9 kHz to 1 GHz) <1.5 dB
 ESBI (f = 9 kHz to 1 GHz) <1.5 dB; up to 5 GHz typ. max. 3 dB
 ESMI (f = 9 kHz to 1 GHz) <1.5 dB; up to 26.5 GHz typ. max. 4 dB

IF and image frequency rejection

IF rejection >100 dB, typ. >110 dB
 applies to all IF frequencies used except for:
 ESAI: 2221.4 MHz >75 dB, typ. 90 dB
 ESMI: 221.4 MHz >90 dB, typ. 110 dB

Image frequency rejection
 ESAI: f + 4.4428 GHz >90 dB, typ. 100 dB
 ESBI, ESMI: f + 10.8428 GHz >80 dB, typ. 90 dB
 ESAI, ESBI: f + 442.8 MHz >100 dB, typ. 115 dB
 ESMI: f + 442.8 MHz >85 dB, typ. 100 dB
 all units at f + 42.8 MHz >100 dB, typ. 115 dB
 all units at f + 8.388 MHz >100 dB, typ. 115 dB

Sweep

Sweep time	Span >0 Hz		Span =0 Hz (sampling rate: 1/8.9 μ s)	
	Step size	Error	Step size	Error
0.2 to 10 ms	-	-	1/2/4/8/10	<2%
20 ms to 2 s	20 ms	10 ⁻³	20 ms	10 ⁻³
2 to 20 s	200 ms	10 ⁻³	200 ms	10 ⁻³
20 to 1980 s	2 s	10 ⁻³	2 s	10 ⁻³

Trigger modes free run, line, video, external

Scalar network analysis

Tracking-generator frequencies and levels

Unit	Output frequency		Output level		
	min	max	min	max	Steps
ESAI	250 Hz	1.8 GHz	7 dB μ V	102 dB μ V	0.1 dB
ESBI	100 Hz	5 GHz	26 dB μ V	107 dB μ V	0.1 dB
ESMI	100 Hz	5 GHz	32 dB μ V	107 dB μ V	5 dB
ESMI + ESMI-B1	100 Hz	26.5 GHz	32 dB μ V	107 dB μ V	5 dB

Measurement ranges for gain and attenuation

Unit	Measurement range		Frequency offset
	Gain	Attenuation	
ESAI	130 dB	120 dB	not provided
ESBI	110 dB	110 dB	0 to \pm 1 GHz
ESMI (up to 5 GHz)	105 dB	110 dB	0 to \pm 1 GHz
ESMI + ESMI-B1	105 dB	5 to 18 GHz: 105 dB 18 to 26.5 GHz: 100 dB	not provided

Demodulation

Evaluation (modulation analysis)

Audiomonitoring

VDU

Monitor

Display mode

Number of display memories

Output to plotter/printer

Functions

AM and FM

measurement of modulation depth and frequency deviation
 built-in loudspeaker, headphones output

9" in-line colour CRT,

1024 x 512 pixels
 full display height or 2 x 1/2 display height (split screen)

4

HP-GL, pinwriter (24-pin), laser printer
 curve arithmetic (swap, subtract), comparison with tolerance curves, averaging, peak hold

Inputs and outputs

Front panel, RF section

Input 1 (all units)

DC coupling
AC coupling
VSWR with RF attenuation 0 dB
VSWR with RF attenuation ≥ 10 dB
Protection

BNC female, 50 Ω
20 Hz to 200 MHz
9 kHz to 200 MHz
<2
<1.2
fuse, surge arrester

Input 2 (DC coupling only)

ESAI

VSWR with RF attenuation 0 dB
VSWR with RF attenuation ≥ 10 dB

N female, 50 Ω
20 Hz to 1.8 GHz
<2 (f < 1 GHz)
<3 (f = 1 to 1.8 GHz)
<1.2 (f < 1 GHz)
<1.5 (f = 1 to 1.8 GHz)

ESBI

VSWR with RF attenuation 0 dB
VSWR with RF attenuation ≥ 10 dB

20 Hz to 5 GHz
<2 (f < 1 GHz)
<3 (f = 1 to 4.8 GHz)
<1.2 (f < 1 GHz)
<1.5 (f = 1 to 2.7 GHz)
<1.8 (f = 2.7 to 4.8 GHz)

ESMI

VSWR with RF attenuation 0 dB
VSWR with RF attenuation ≥ 10 dB

20 Hz to 26.5 GHz, 3.5-mm SMA female can be retrofitted
<2 (f < 1 GHz)
<3 (f = 1 to 4.8 GHz)
typ. <3 (f = 4.8 to 26.5 GHz)
<1.2 (f < 1 GHz)
<1.5 (f = 1 to 2.7 GHz)
<2.0 (f = 2.7 to 10 GHz)
<2.5 (f = 10 to 18 GHz)
typ. <3 (f = 18 to 26.5 GHz)
<2 (f = 4.8 to 18 GHz)
<2.5 (f = 18 to 26.5 GHz)

Selectable preamplifier

ESAI
ESBI
ESMI

100 Hz to 1.8 GHz, 10 dB and 20 dB
100 Hz to 5 GHz, 10 dB
100 Hz to 26.5 GHz, 10 dB

Input divider

ESAI, ESBI
ESMI

0 to 120 dB in steps of 2 dB
0 to 75 dB in steps of 5 dB

Calibration output

Calibration signal unpulsed
pulsed

BNC female, 50 Ω
100 MHz, 87 dB μ V
pulse area to CISPR 16-1, pulse repetition frequency 1 Hz to 1 kHz
12-contact Tuchel female
+10 V, -10 V, max. 100 mA each

Coding and supply connector

Supply voltages

Front panel, display section

Headphones output (PHONES)
Frequency range
EMF / source impedance
Keyboard connector

JK 34 jack
100 Hz to 15 kHz
 $V_{ppmax} = 10 \text{ V} / 30 \Omega$
JK 34 jack

Rear panel, RF section

IF OUTPUT 21.4 MHz
VSWR
Gain referred to level at input mixer = ref. level - RF attenuation
 ≤ -20 dBm (87 dB μ V)
 > -20 dBm (87 dB μ V)

BNC female, 50 Ω
 ≤ 2
8 dB \pm 2 dB
0 dB \pm 2 dB

Bandwidth (-6 dB)
10-MHz reference
Output level with internal reference ($Z_s = 50 \Omega$)
Input level with external reference ($Z_{in} = 500 \Omega$)
EXT ALC
Input voltage
SWEEP OUTPUT
Output voltage ($Z_L > 500 \Omega$)
START-SWEEP-STOP
Function

>10 MHz
BNC female
10 dBm + 3/-1 dB
0.1 to 1 V_{rms}
BNC female
0 to -1 V
BNC female
0 to 5 V
BNC female
positive TTL pulse (t = 1.4 μ s) occurring upon sweep start or stop

Rear panel, display section

IF OUTPUT (narrow) 21.4 MHz
VSWR
Level with reference level
EXT SWEEP TRG
VIDEO OUTPUT
EXTERNAL MONITOR

BNC female, 50 Ω
 ≤ 2
-15 dBm \pm 3 dB
BNC female
BNC female
BNC female for RED, GREEN, BLUE, COMP VIDEO; V SYNC; H SYNC
29.4 kHz
2 μ s
37-contact Cannon D female for PZ-11
25-contact Cannon D female
36-contact Amphenol female
25-contact Cannon D female
JK 34 jack
100 Hz to 15 kHz
10 V_{pp}
30 Ω
24-contact Amphenol female
AH1, SH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C1 to C4, C11

Line frequency
Sync pulses
EXT FLOPPY
RS-232-C
PARALLEL INTERFACE (Centronics)
USER PORT
PHONES
Frequency range (-3 dB)
EMF
Source impedance
IEC 625 bus (IEEE 488)
Functions

General data

Note

unless otherwise specified, all values applicable to continuous sweep with coupled functions in default coupling mode and calibrated; based on IEC 714 according to IEC 359, class I
0 to +55 $^{\circ}$ C
-40 to +70 $^{\circ}$ C
20 to 90% (without condensation) to EN 50081-1 and EN 50082-1 (EEC Directive); FCC DOC 20780: Part 15, Subpart 5
operating temperature attained after 1 h after cold start at $T_{amb} = 0$ to 55 $^{\circ}$ C

Ambient conditions
Rated temperature range
Storage temperature range
Max. relative humidity
EMC

Warmup period

Power supply

100/120/220/240 V \pm 10%,
45 to 66 Hz
500 VA

Power consumption
Dimensions (W x H x D), weight
ESAI and ESBI
ESMI
ESMI with ESMI-B1

435 mm x 413 mm x 590 mm, 64 kg
435 mm x 457 mm x 590 mm, 68 kg
435 mm x 457 mm x 590 mm, 72 kg

Certified Quality System
ISO 9001
REG. NO 1954-02