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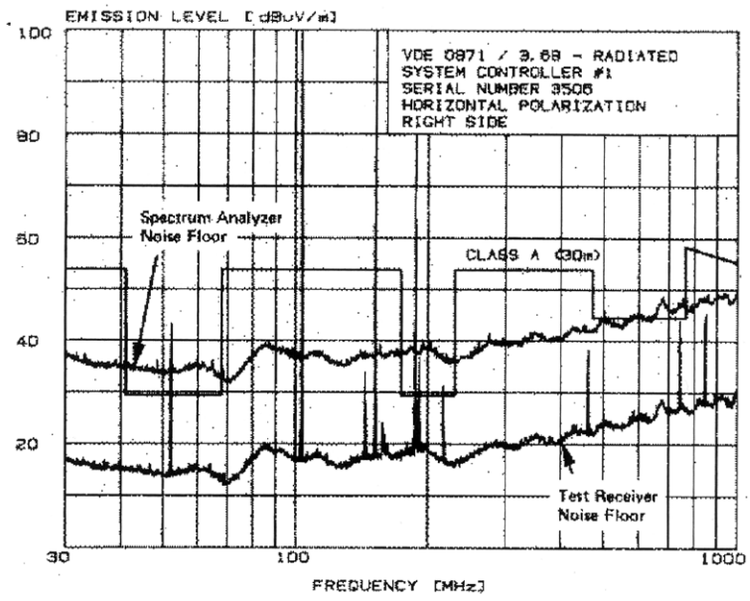
EMI Testing According to CSPR Publication 16 Recommendations

Combining the 85685A RF preselector with the 8566B or 8568B spectrum analyzer and the 85650A quasi-peak adapter produces an EMI receiver with the characteristics recommended in CISPR publication 16[1]. The RF preselector provides the measurement sensitivity and overload protection needed for FCC and VDE radiated emission testing at open sites. For commercial and MIL-STD conducted EMI tests, the low-frequency input tolerates large impulses and line impedance stabilization network (LISN) transients. A built-in calibrator ensures ±2.0 dB absolute-amplitude accuracy as required by the FCC and VDE. For measurement confidence, a linearity check tests for system overload and distortion.

The sample display shows results for VDE 0871 emission testing at an open site. To prevent overload from the high-level ambient signals, a spectrum analyzer needs input attenuation. This however, increases displayed noise, which can mask the low-level emissions. Using the RF preselector in this test eliminates the need for adding attenuation. The noise of the spectrum analyzer, as shown, exceeds the VDE limit, but the spectrum analyzer/test receiver noise is more than 10 dB below the lowest limit.

1. Comite International Special Des Perturbations Radio-Electriques (CISPR) publication 16 is the "CISPR specification for radio interference measuring apparatus and measurement methods."



Signal Monitoring in the Presence of High-Level Interference

The RF preselector gives the 8566B or the 8568B spectrum analyzer the sensitivity and selectivity of a receiver. The spectrum analyzer/test receiver measures signals within the preselector filter passband and rejects out-of-band interference by 40 dB. Even in the presence of interference with a total input power of +10 dBm, your test receiver can monitor signals down to -150 dBm.

The RF preselector improves signal reception for the broadband signal environment of a mobile test station. In the 150 – 170 MHz business band, the RF preselector reduces interference from radio and TV broadcast stations and from amateur radios. For the 800 – 900 MHz cellular radio band, the spectrum analyzer/test receiver makes field strength measurements on cellular base-station transmitters while rejecting interference from cellular mobile transmitters.

Transmitter Spurious Testing with Fast Wideband Measurements

Reduce transmitter-spurious test time by adding the RF preselector to your 8566B or 8568B spectrum analyzer. The preselector decreases input overload from the out-of-band carrier and thereby increases the range for measuring low-level signals. Compared to the spectrum analyzer alone, the spectrum analyzer/test receiver uses a wider resolution bandwidth for the same measurement range, resulting in a faster sweep time. For example, to measure spurious signals over a 1 GHz frequency range at –100 dB relative to the transmitter carrier, a spectrum analyzer by itself takes 3000 seconds, but when configured as a test receiver it requires only 3 seconds.

Specifications

Specifications describe the instrument's warranted performance over the temperature range of 0°C to +55°C unless otherwise noted. Typical values for the specified parameters represent probable but non-warranted performance. Nominal values provide useful but non-warranted information about functional performance.

Test Receiver

The following system specifications apply when the 85685A RF preselector (RFP) operates with the 8566B or 8568B spectrum analyzer (SA) and with or without the 85650A quasi-peak adapter (QPA). The test receiver system is fully GPIB programmable. Refer to the specific instrument data sheets for more detailed information.

Test receiver frequency	
Parameter	**Specification**
Frequency range RFP bypass[1]	20 Hz – 1.5 GHz with 8568B 20 Hz – 2.0 GHz with 8566B 20 Hz – 18 GHz (nominal) with 8568B
SA frequency resolution	1 Hz
SA frequency accuracy	±(tuned frequency x freq. reference error) Hz for SA zero span
SA frequency reference error	Settability[2] < 10^{-8}, Drift < 2 x 10^{-7}/year
SA Frequency selectivity[3] 3 dB resolution BW	10 Hz – 3 MHz in 1, 3, 10 sequence

Test receiver amplitude	
Parameter	**Specification**
Measurement range	-150 to +30 dBm (-43 to +137 dBµV) (nominal)
Gain compression (0 dB atten. for RFP and SA Inside RFP passband Outside RFP passband	 < 1 dB (nominal) for input ≤ -30 dBm < 1 dB (nominal) for input ≤ +10 dBm
Displayed average noise level (0 dB atten. for RFP and SA 10 Hz resolution BW)	< -132 dBm (-25 dBµV) for input 9 kHz – 1 MHz[4] < -150 dBm (-43 dBµV) for input 1 – 1500 MHz < -147 dBm (-40 dBµV) for input ≤ 2.0 GHz
Broadband signal sensitivity[5,6] (0 dB atten. for RFP and SA, 10 Hz resolution BW)	< 31 dBµV/MHz (nominal) for input < 1 MHz[4] < 13 dBµV/MHz (nominal) for input = 1 – 1500 MHz < 16 dBµV/MHz (nominal) for input ≤ 2.0 GHz
Second harmonic distortion (0 dB atten. for RFP and SA) For -35 dBm input signal: Within RFP passband Outside RFP passband	 < -55 dBc (nominal), Equiv. SOI = +20 dBm < -75 dBc (nominal), Equiv. SOI = +40 dBm
Third order intermodulation (0 dB atten. for RFP and SA) For two -35 dBm input signals: Within RFP passband Outside RFP passband	 < -40 dBc (nominal), Equiv. SOI = -15 dBm < -110 dBc (nominal), Equiv. SOI = +20 dBm
Residual responses (RFP input terminated, 0 dB atten. for RFP and SA	< -90 dB for input 2 kHz – 1 MHz < -112 dB for input ≥1 MHz < -120 dB (typical) for input ≥1 MHz
Amplitude accuracy[6] (+10° to + 30°C, 10 dB SA atten. 0 –20 dB RFP atten.) RFP bypass	±2.0 dB for input < 1.0 GHz ±3.0 dB for input ≥1.0 GHz **SA specification plus:** ± 0.5 dB (nominal) for input ≤ 2.0 GHz ± 1.0 dB (nominal) for input > 2.0 GHz

CISPR EMI Receiver

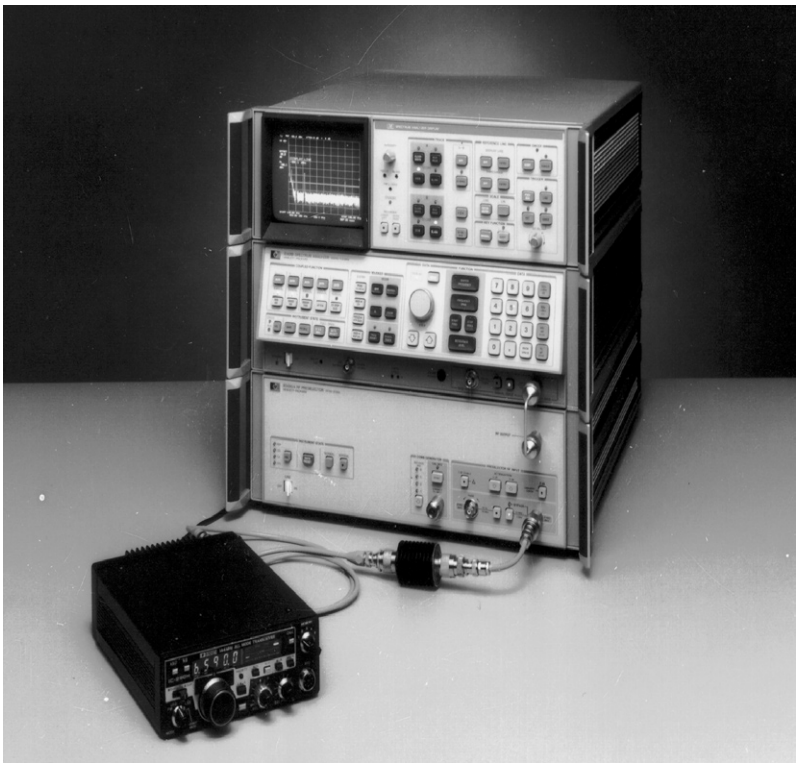
The following system specifications apply when the 85685A RF preselector (RFP) operates with the 8566B or 8568B spectrum analyzer (SA) and with the 85650A quasi-peak adapter (QPA). The EMI receiver system has the characteristics recommended in CISPR publication 16 and is fully GPIB programmable. Refer to the specific instrument data sheets for more information.

CISPR EMI receiver frequency	
Parameter	**Specification**
Frequency range	10 kHz – 1 GHz
SA frequency resolution	1 Hz
SA frequency accuracy	±(tuned frequency x freq. reference error) Hz
SA frequency reference error	Settability[2] < 10^{-8}, Drift < 2 x 10^{-7}/year
SA Frequency selectivity[9] CISPR 6 dB bandwidth (QPA)	200 Hz for input = 10 – 150 kHz (band A) 9 kHz for input = 150 kHz – 30 MHz (band B) 120 kHz for input = 300 – 1000 MHz (band C, D)

Make dedicated receiver measurements with a general-purpose spectrum analyzer

CISPR EMI Amplitude	
Parameter	**Specification**
Measurement range	+137 dBµV to noise floor (refer to amplitude sensitivity table)
Amplitude accuracy[8] (+10° to +30°C, 0 – 20 dB RFP atten.)	±2.0 dB for 10 dB SA atten. ± 2.5 dB for 0 dB SA atten.
Calibration[10]	Automatic calibration for absolute amplitude with comb generator (RFP)
Linearity check	3 dB input attenuator test for system overload and distortion (RFP)
Impulsive signal tolerance	Input #1 withstands LISN transients (RFP) Input #2 withstands CISPR calib. pulses (RFP)
Detection[9]	Peak and average (SA), quasi-peak (QPA)
Audio output	Speaker with volume control (QPA)

CISPR EMI Amplitude sensitivity			
EMI receiver		**Specification**	
Frequency band	Resolution bandwidth (6 dB)	Average noise[6] (RFP/SA atten. = 0 dB)	Quasi-peak noise (RFP/SA atten. = 0 dB)
10 – 150 kHz (band A)	200 Hz	-12 dBµV[4] -17 dBµV typical	-15 dBµV (nominal)
150 kHz – 1 MHz (band B)	9 kHz	+4 dBµV -1 dBµV typical	0 dBµV (nominal)
1 – 30 MHz (band B)	9 kHz	-13 dBµV -16 dBµV typical	-11 dBµV (nominal)
30 – 1000 MHz (band C, D)	120 kHz	-1 dBµV -6 dBµV typical	0 dBµV (nominal)



85685A RF Preselector

The following instrument specifications apply to the 85685A RF preselector (RFP).

85685A RF preselector input		
Parameter	**Specification**	
	Input #1	**Input #2**
Frequency range RFP bypass[1]	20 Hz – 50 MHz	20 MHz – 2 GHz DC – 18 GHz (nom.)
Connector type Fuse blow time	BNC, 50 Ω (nominal) < 0.1 sec for > + 35 dBm	Type N, 50 Ω (nom.) NA
Maximum safe input power Average power Impulsive signals ≥ 10 dB RFP atten. ≥ 20 dB RFP atten.	 +30 dBm (1 Watt) 100 Watts peak for a 10 µs pulse 2,000 Watts peak for a 10 µs pulse[11] (nom.)	 +30 dBm (1 Watt) NA
DC voltage	0 Volts	
Standing wave ratio (SWR)[12] 10 dB RFP atten. 0 dB RFP atten. RFP bypass	 < 1.5:1 < 1.5:1 (nominal) NA	 < 1.5:1 < 2.0:1 (nominal) < 1.5:1 (nominal)
Attenuator range Linearity check	0 – 50 dB in 10 dB steps (nominal) Add 3 dB (nominal)	
Filter characteristics Fixed filter BW (3 dB) Tracking filter BW (3 dB) Stopband attenuation	 BW range = 10 kHz• 1 MHz (nom.) for input < 2 MHz 10% (nom.) of tuned freq. for input = 2 – 55 MHz 5% (nom.) of tuned freq. for input = 55 – 500 MHz 20 MHz (nom.) for input = 500 – 2000 MHz > 40 dB (nominal)	
Preamplifier gain	20 dB (nominal) for 0 dB RFP atten.	

85685A RF preselector output	
Parameter	**Specification**
Comb generator Line spacing Line amplitude SWR	 100 kHz, 500 kHz, 1 MHz, 5 MHz (nominal) -40 to -60 dBm (nominal) < 1.5:1 (nominal)
GPIB interface* Private BUS Public BUS interface functions (public BUS)	Digital BUS and sweep control between RFP and SA IEEE 488-1978 BUS SH1, AH1, T6, L4, SR1, RL1, PPO, DC1, DT1, C0, E1

General	
Parameter	**Specification**
Temperature	0° to + 55°C operating -40° to +75°C storage
Warm-up time	30 minutes after cold start
Temp. equilibrium	2 hours after warm-up
EMI	Conducted and radiated interference is in compliance with MIL-STD 461A methods in CE03 and RE02, CISPR publication 11 (1975), and Messempfaenger-Postverfuegung 526/527/79 (Kennzeichnung Mit F-Nummer/Funkschutzzeichen).
Power requirements	100, 120, 220, or 240 V RMS +5%, -10%; 50 –400 Hz; 35 VA (nominal)
Weight	19 kg (42 lbs) net (nominal)
Size	133 mm (5.25") H x 425 mm (16.75") W x 508 mm (20.0") D (nominal)
Firmware compatibility for RFP operation with: 8566B, firmware data ≥ 5.5.85 8566B, firmware data < 5.5.85 8566A, any firmware date 8568B, firmware data ≥ 14.1.85 8568B, firmware data < 14.1.85 8568A, any firmware date	 Compatible 85685A Option 066 required 8566A + 01K retrofit kit required Compatible 85685A Option 068 required 8568A + 01K retrofit kit required

Product Information

85685A RF preselector

Option 010, Rack mount slide kit
Option 908, Rack flange kit without handles
Option 910, Extra manual
Option 913, Rack flange kit with handles

Firmware compatibility options (see compatibility specifications above)

85685A Option 066, Firmware upgrade kit* for 8566B
85685A Option 068, Firmware upgrade kit* for 8568B
8566A + 01K Retrofit kit
8568A + 01K Retrofit kit
8566B spectrum analyzer
8568B spectrum analyzer
85650A Quasi-peak adapter

Accessories

85864B EMI measurement software
Transit case, part number 1540-0663
EMI accessories[13]: Antennas, LISNs, current probes, and amplifiers

Footnotes:

1. The RFP bypass switch connects input #2 directly to the RF output.
2. Refer to spectrum analyzer test and adjustment manual for the correct frequency reference adjustment.
3. Refer to spectrum analyzer data sheet for filter BW accuracy and filter shape.
4. 17 dB higher with 8566B for frequency < 50 kHz.
5. Sensitivity is approximately equal to system peak noise level.
6. Peak noise is nominally 8 dB higher than average noise.
7. Measurement sensitivity is normalized to 1 MHz resolution BW.
8. Specifications apply after system calibration with the comb generator in the 85685A. Refer to 85685A operating manual for correct amplitude measurement technique.
9. The system meets CISPR publication 16 recommendations for resolution BW, detector time constant, and detector pulse response.
10. System calibration can be verified with an external CISPR standard pulse calibration generator.
11. Typical LISN transients.
12. SWR is measured at the tuned frequency of the spectrum analyzer.
13. Refer to the EMI measurement solutions guide (5954-2702) for more information.

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