

## S4-98A Spectrum Analyzer

- ◆ 100 Hz-39.6 GHz (standard equipment)  
100 Hz-178 GHz (to order)
- ◆ Synthesized LO (1 Hz step)
- ◆ High frequency resolution (up to 10 Hz)
- ◆ Preselector 1.7-22 GHz
- ◆ Built-in harmonic oscillator 0.1-22 GHz
- ◆ Exceeds S4-98A in sensitivity, frequency response, scale and level measurement accuracy



### DESCRIPTION

The series operation Spectrum Analyzer with a built-in microprocessor provides measurement automation and various service functions.

Designed to measure periodic signal spectrum parameters (frequencies and spectrum components).

The Analyzer is used to measure:

- complex CW spectrum parameters;
- repeated radio pulses spectrum parameters;
- modulated, spurious and out-of-band oscillation parameters;
- radiation band and out-of-band radiations;
- network parameters (non-linear distortion, transference and so on)

### SPECIFICATIONS

#### FREQUENCY

Frequency range 100 Hz-22 GHz (with internal mixers), 17.44-39.6 GHz (with external mixers supplied with the Instrument)

Frequency subranges: with internal mixers: 100 Hz-1.7 GHz (1), 1.7-5.7 GHz (1), 5.7-11.7 GHz (2), 11.7-17.7 GHz (3), 17.7-22 GHz (4); with external mixers: 17.44-25.95 GHz (4), 25.95-39.6 GHz (7)

Note. The number of N operating harmonic of the 1<sup>st</sup> local oscillator is shown in brackets

Frequency measurement error:

$\pm(kF + 0.1 F_s)$  for  $F_s \geq 50$  MHz,

$\pm(kF + 0.005 F_s + 10 \text{ Hz})$  for  $F_s \leq 20$  MHz,

$\pm(kF + 2 \text{ Hz})$  for  $F_s \leq 20$  MHz in "F fine" at signal level not less than 20 dB above intrinsic noise level and signal response in the upper side of the screen, where  $k = \pm 1 \cdot 10^{-7} f/\text{month}$ ,  $\pm 3 \cdot 10^{-7} f/\text{year}$ ,  $F_s$  – Frequency span

In external reference oscillator mode 5 or 10 MHz frequenced k is defined by the relative frequency error

Frequency span: 0; 500 Hz-20 GHz in 1, 2, 5 sequence: min value: 500 Hz (100 Hz-5.7 GHz), 1 kHz (5.7-11.7 GHz), 2 kHz (11.7-25.95 GHz), 5 kHz (25.95-39.6 GHz), max values: 1.7 GHz (100 Hz-1.7 GHz), 20 GHz (1.7-22 GHz), 5 GHz (17.44-25.95 GHz), 10 GHz (25.95-39.6 GHz)

Frequency difference measurement error:  $\pm 0.1 F_s$  for  $F_s \geq 50$  MHz,  $\pm 0.005 F_s$  for  $F_s \leq 20$  MHz

Resolution Bandwidth (BW) at -3 dB: 10 Hz-3 MHz in 1, 3, 10 sequence (may change independently or during frequency span setting in automatic mode)

Error:  $\pm 10\%$  ( $\pm 25\%$  for BW = 3 MHz) under normal conditions and  $\pm 20\%$  ( $\pm 30\%$  for BW = 3 MHz) under operating conditions

Bandwidth selectivity for -60/-3 dB not more than 12

Residual frequency deviation (double peak value) at non-synchronized 1<sup>st</sup> local oscillator not more than  $40 \cdot N$  kHz ( $F_s = 5$ -20 MHz)

Frequency setting stability after 1 h warm-up under normal conditions and constant operating mode not more than  $1.5 \cdot N$  MHz for 10 min at non-synchronized 1<sup>st</sup> local oscillator ( $F_s > 50$  MHz)

#### NOISE SIDEBANDS

Relative average noise level near carrier (0.01-5.7 GHz) not more than:

-75 dB/Hz (at offset from carrier 0.33; 1; 3 kHz),

-80 dB/Hz (at offset from carrier 10 kHz),

-85 dB/Hz (at offset from carrier 30 kHz)

Power line 50 Hz related sidebands at 100 Hz offset from carrier: not more than -45 dB in relation to carrier in 0.1-11.6 GHz

# POWER METER AND SPECTRUM ANALYZERS

## Spectrum Analyzers

### AMPLITUDE

Range: -134 - 20 dBm (up to +20 dBm with an external attenuator)

Scale: 10 div on CRT vertical axis with nominal value at upper horizontal screen line

Scales: LOG: 10 dB/div, 5 dB/div, 2 dB/div, 1 dB/div; LIN; SQUARE

#### Scale fidelity:

LOG (1 - 0.1 of scale)  
10 dB/div  $\pm 2$  ( $\pm 3^*$ ) dB under normal (operating) conditions  
5 dB/div  $\pm 2$  ( $\pm 2.5$ ) dB  
2 dB/div  $\pm 0.4$  ( $\pm 0.6$ ) dB  
1 dB/div  $\pm 0.2$  ( $\pm 0.3$ ) dB  
LIN, SQUARE (within 1-0.125 of scale value)  
 $\pm 2.0$  ( $\pm 3.0$ )% under normal (operating) conditions

Amplitude measurement accuracy:  $\pm 2$  dB (0.01-1.7 GHz),  $\pm 2.5$  dB (1.7-5.7 GHz),  $\pm 3$  dB (5.7-11.7 GHz),  $\pm 3$  dB (11.7-17.7 GHz) (under normal conditions with 10 dB attenuator at the instrument input at  $F_s \leq 100$  MHz from -10 dB/mW up to 20 dB above system noise level or spurious responses but not less than -100 dB/mW in AUTO mode after calibration and using PREC REAK function in the marker point above 1.7 GHz and LIN, SQUARE scales within 1-0.5 from the scale value. Under operating conditions the norm is exceeded by not more than 1.5 dB)

Frequency response:  $\pm 1$  dB (0.01-1.7 GHz),  $\pm 1.5$  dB (1.7-5.7 GHz),  $\pm 2$  dB (5.7-11.7 GHz),  $\pm 2$  dB (11.7-17.7 GHz) (under normal conditions with 10 dB input attenuator. Under operating conditions exceeds norm by not more than 1 dB).

Calibrator uncertainty at 100 MHz, 10 dBm:  $\pm 0.6$  (0.9) dB under normal (operating) conditions

Amplitude ratio measurement accuracy  $\pm 1$  dB (at one frequency in 0.01-39.6 GHz frequency range using LIN, SQUARE scales within 1-0.5 scale value -20 dB nominal level to 20 dB above system noise level or non-harmonic responses but not less than -90 dBm in automatic mode under normal conditions. Under operating conditions not more than  $\pm 1.5$  dB)

### DYNAMIC RANGE

Harmonic distortion: -40 dB (50 kHz-10 MHz, signal level  $P_c = -30$  dBm), -70 dB (0.01-1.7 GHz,  $P_c = -45$  dBm), -80 dB (1.7-11.7 GHz,  $P_c = -10$  dBm)

Third-order intermodulation:

-50 dB (1-10 MHz, signal levels  $P_{c1} = P_{c2} = P_c = -35$  dBm, detuning  $\Delta f = 100$  kHz, BW = 1 kHz);  
-70 dB (0.01-1.7 GHz,  $P_c = -30$  dBm,  $\Delta f = 100$  kHz, BW = 1 kHz);  
-70 dB (1.7-5.7 GHz,  $P_c = -25$  dBm,  $\Delta f = 1$  MHz, BW = 10 kHz);  
-60 dB (5.7-11.7 GHz,  $P_c = -20$  dBm,  $\Delta f = 3$  MHz, BW = 30 kHz);  
-60 dB (11.7-17.7 GHz,  $P_c = -10$  dBm,  $\Delta f = 10$  MHz, BW = 100 kHz);  
-40 dB (17.44-39.6 GHz,  $P_c = -25$  dBm,  $\Delta f = 10$  MHz, BW = 100 kHz);  
-90 dB (1.7-5.7 GHz,  $P_c = -10$  dBm,  $\Delta f = 100$  MHz)

#### Spurious response\*\* (at signal input):

-60 dB (0.01-1.7 GHz,  $P_c = -30$  dBm,  $\Delta f \geq 100$  kHz);  
-70 dB (1.7-5.7 GHz,  $P_c = -15$  dBm,  $\Delta f \geq 10$  MHz);  
-60 dB (5.7-11.7 GHz,  $P_c = -15$  dBm,  $\Delta f \geq 10$  MHz);  
-60 dB (11.7-17.7 GHz,  $P_c = -15$  dBm,  $\Delta f \geq 200$  MHz);  
-45 dB (17.7-22 GHz,  $P_c = -15$  dBm,  $\Delta f \geq 200$  MHz)

Image spurious: 50 dB (0.01-1.7 GHz), 70 dB (1.7-17.7 GHz), 50 dB (coax subrange 17.7-22 GHz)

#### Internal spurious (no signal at the instrument input):

-100 dBm (0.01-1.7 GHz)\*\*\*; -85 dBm (1.7-5.7 GHz);  
-80 dBm (5.7-11.7 GHz); -70 dBm (11.7-17.7 GHz);  
-65 dBm (17.7-22 GHz)

#### Displayed average noise level, dBm:

at BW = 10 Hz: -70 (100 Hz-10 kHz); -75 (10-100 kHz);  
-90 (0.1-1 MHz); -115 (1-10 MHz); -134 (0.01-1.7 GHz);  
-127 (1.7-5.7 GHz); -115 (5.7-11.7 GHz);  
at BW = 100 Hz: -100 (11.7-17.7 GHz);  
at BW = 100 kHz: -60 (17.7-22 GHz) (coax input);  
-65 (17.44-39.6 GHz) (with external mixers)

#### Notes:

\*  $\pm 4.0$  dB under high humidity conditions

\*\* Signal frequency is within operating subrange. In 0.01-1.7 GHz subrange it is permissible to have 3 interferences of more than -60 dB

\*\*\* It is permissible to have not more than 3 interferences of not more than -100 dBm in 0.01-1.7 GHz subrange

### SHIELDING EFFICIENCY

35dB (0.1-11.7GHz)

Microwave radiation:  $10^{-5}$  W/m<sup>2</sup> at 1 m from the instrument

### INPUTS

100 Hz-22 GHz coaxial 7/3.04 mm

Input impedance 50 Ohm; VSWR  $\leq 2$  (0.01-17.7 GHz with 10 dB external attenuator at the instrument input)

# POWER METER AND SPECTRUM ANALYZERS

## Spectrum Analyzers

Max signal:  
0.1 (100) mW with 10 (30) dB external attenuators at the Instrument input. Average limiting power 5 mW (without attenuator)

EXTERNAL MIXERS (supplied with the Instrument)

With external mixers: 17.44-25.95 GHz, WG input 11x5.5 mm, VSWR  $\leq$  4; 25.95-39.6 GHz – WG input 7.2x3.4 mm, VSWR  $\leq$  4

Max signal at external mixer input: 1 mW, average limiting power not destroying the mixer

### OUTPUT

0.1-22 GHz Calibrator

### SWEEP

Modes: continuous, single

Trigger modes: continuous, from power line, external

Time: 10 ms-2000 s

External trigger: TTL pulse of negative polarity with not less than 2  $\mu$ s duration

### GENERAL

Relative humidity: 95% at 30 °C

Warm-up time: 15 min

Continuous operation time: 16 h

Power: 220 $\pm$ 22 V, 50 $\pm$ 2.5 Hz; 220 $\pm$ 11 V, 400 $\pm$ 20 Hz

Power consumption: 450 V·A

Operating temperature range: 5...40 °C

Dimensions:

Microwave Unit: 493x215x586 mm

IF Unit: 493x175x586 mm

Weight: 53 kg