ADVANTEST

R3172/3182
Spectrum Analyzers

High Frequency Spectrum Analyzer for Microwave and Millimetric Wave Communications

R3172/3182

The R3172 and R3182 are low-cost portable spectrum analyzers capable of performing direct input measurements at a maximum frequency 26.5 and 40 GHz respectively. Adopting newly designed RF circuitry, both the R3172 and R3182 aim for improved basic performance with their 40 GHz direct input capability. Further, the R3172 and R3182 achieve "best-in-class" performance for average display noise levels of -104 dBm (at 26.5 GHz, RBW 1 kHz) and -106 dBm (at 40 GHz, RBW 1kHz) respectively, and SSB phase noise levels of -91 dBc/Hz (at 26.5 GHz, 20 kHz offset) and -85 dBc/Hz (at 40 GHz, 20 kHz offset) respectively.

Operating frequencies for radio communications have increasing tendency to shift to higher frequencies. Accordingly, the R3172 and R3182 have been developed as personal-use spectrum analyzers capable of use in a wide range of applications from development to manufacturing of high frequency modules, devices, etc.

Frequency range

R3172: 9 kHz to 26.5 GHz
R3182: 9 kHz to 40 GHz

Frequency span accuracy

Accuracy: ±1%

Best-In-Class Performance Noise Levels

-106 dBm/RBW 1 kHz @40 GHz
-104 dBm/RBW 1 kHz @26.5 GHz

Faster, more real-time analysis

Refresh rate: 20 traces/second (Typical)
50 µs high-speed zero span sweep (Option)

Applicable measurement functions

- Digital mobile communications measurement functions
  OBW, ACP, Spurious, Total/Channel/Average power,
  Default setup function for power measurement
- EMC measurement functions
  6 dB RBW: 9 kHz/120 kHz/1 MHz *(200 Hz optionally available)*
  Built-in QP detector
  Built-in antenna correction factor table
  AM/FM audio demodulation function
- Frequency counter function
  1 Hz resolution frequency counter
- Additional general-purpose measurement functions
  Accurate noise/Hz measurement function with PBW calibration
  %AM/%AM Video/FM frequency measurement
  Third-order measurement
  X dB down measurement
  Two different types of frequency channels

Easy-to-use standard functions

Auto-tuning, pass/fail testing, multiscreen,
multimarker, large character display,
trace computation function, TV trigger, and more

High-quality, large 6.5-inch TFT color LCD display

Depth 300 mm, space saving compact design

Standard option of I/O interface enables the automatic system construction at ease

GPIB, RS232 and printer interfaces, floppy disk drive

Available options

OPT.20 **High-stability frequency reference Option**
Stability : ±2 x 10^{-8}/day, ±1 x 10^{-7}/year

OPT.27 **Narrow-band resolution bandwidth Option**
30 Hz, 100 Hz, 300 Hz (3 dB bandwidth)
200 Hz (6 dB bandwidth)

OPT.29 **Time-domain high-speed sweep Option**
Maximum sweep time setting up to 50 µs

OPT.73 **Wide-range FM demodulation Option**
FM deviation up to 500 MHzp-p can be measured

OPT.74 **Tracking generator Option**
100 kHz to 3 GHz (Only for the R3172)

OPT.03 **Local signal output for external mixer (Only for the R3172)**
** The R3182 includes local signal output for external mixer as standard equipment.*

OPT.16 **External mixer** **26.5 to 40 GHz**

OPT.17 **External mixer** **40 to 60 GHz**

OPT.18 **External mixer** **50 to 75 GHz**

OPT.19 **External mixer** **75 to 110 GHz**

Option Table

	R3172	R3182
OPT.20	O	O
OPT.27	O	O
OPT.29	O	O
OPT.73	O	O
OPT.74	O	—
OPT.03	O	Included as standard
OPT.16	O	O
OPT.17	O	O
OPT.18	O	O
OPT.19	O	O

Note: The mark " O " means applicable option.

Panels Designed for Maximum Ease of Use

Soft menu setup

6.5-inch color LCD display

A large TFT color LCD offers maximum viewing comfort. Measurement results display in a separate window in a large-sized character font for optimal visual recognition. External display VGA output is supported as standard.

Local output of external mixer

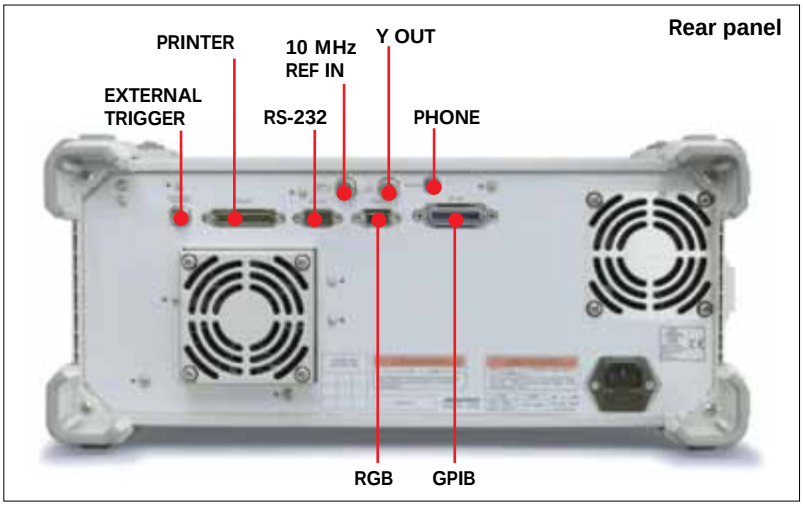
Various external mixers capable of measuring up to 110 GHz are provided as options. Since calibration data is provided with each mixer, absolute value level measurements are performed by simple operation.

R3182

RF input

By adopting a newly developed front end RF circuitry, wideband signals up to +30 dBm (1W) at 40 GHz can be directly entered into this analyzer. With a built-in preselector, measurements are performed without image signals.

Rear panel



Special-purpose function keys

Function keys dedicated to Auto-TUNE, Frequency counter, and Power measurement enable users to launch measurement in a single key touch operation.

CAL

Selects and executes automatic calibration of the instruments to ensure measurement data reliability.

EMC

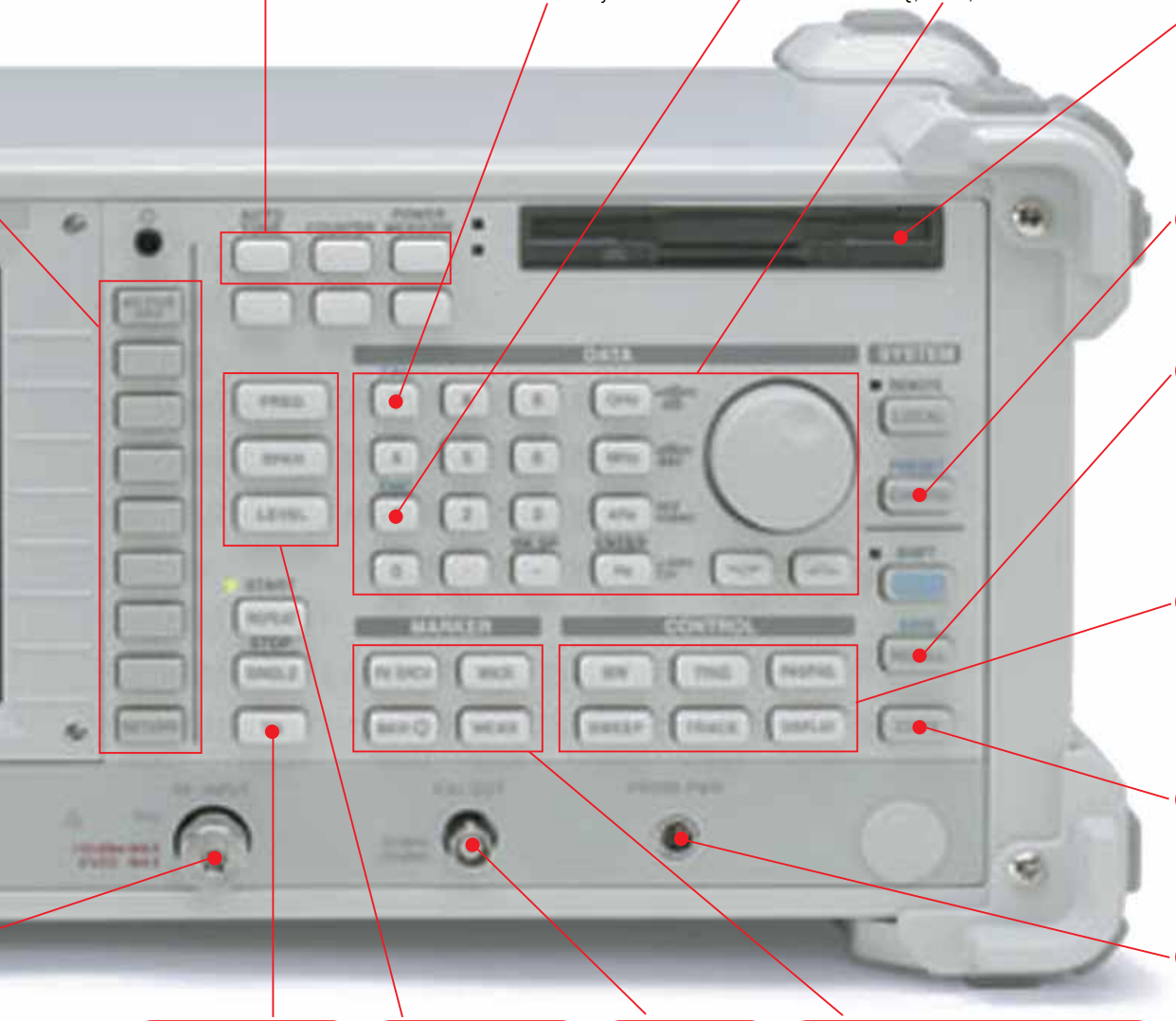
Program automatic correction and QP detection required for measuring EMI.

Data entry

Data entry keys arranged at the same level as the spectrum analyzer basic measurement functions, such as FREQ, SPAN, and LEVEL.

Floppy disk drive

Writes setup conditions and waveform data to a 3.5-inch floppy disk. Compatible with bitmap format and text data copying to a PC.



Config

Program a GPIB address, an RS232 interface, a printer and so on.

Save/Recall

Saves and recalls waveform data and measurement conditions. Archive location is selectable between internal memory and the standard floppy disk drive.

Controls

Setup measurement parameters, such as resolution bandwidth, sweep, and trigger, to address all measurement needs.

Copy

Copies images of onscreen data to an external printer or floppy disk drive.

Probe power

Used with accessories that require an external power supply, such as an FET probe. ±12 V, 4-pin connector.

TG function

An optional tracking generator measures the frequency response characteristics of filters and amplifiers. ** Only for the R3172*

Main functions

Set spectrum analyzer basic measurement functions, such as FREQ, SPAN, and LEVEL.

CAL out

Generates 30 MHz calibration signal.

Marker

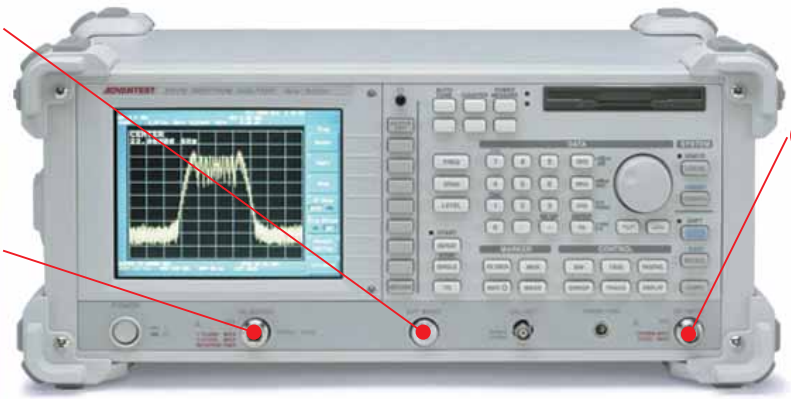
Provides a wide repertoire of marker functions, including a Δ marker and a search function. The MEAS key supports applicable functions, including Noise/Hz, %AM, Third-order, and X dB down measurement.

Local output of external mixer

Various external mixers capable of measuring up to 110 GHz are provided as options. Since calibration data is provided with each mixer, absolute value level measurements are performed by simple operation.

TG output (option 74)

An optional tracking generator (TG) is capable of generating a certain level signal synchronized with the frequency sweep of the spectrum analyzer, within the range from 100 kHz to 3 GHz.



R3172

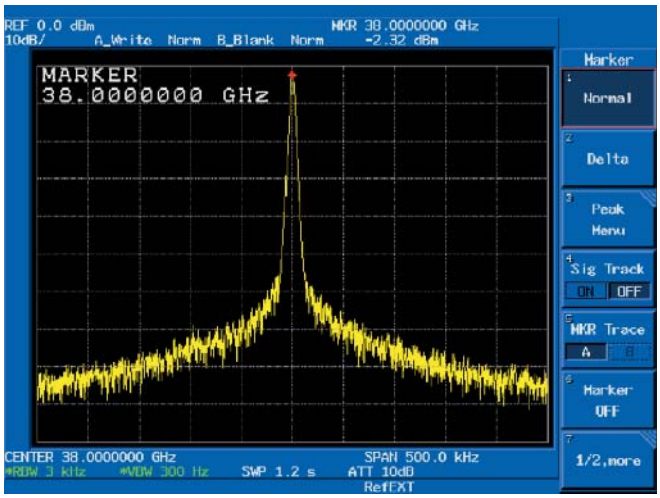
RF input

By adopting a newly developed front end RF circuitry, wideband signals up to +30 dBm (1W) at 26.5 GHz can be directly entered into this analyzer. With a built-in preselector, measurements are performed without image signals.

Enhanced Basic Performance Capable of Measuring Up to 110 GHz

Measurement of 40 GHz Input Through Coaxial Cable

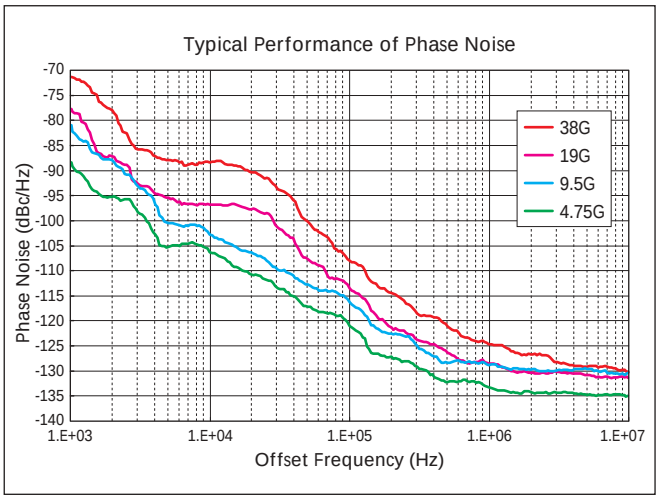
With a newly developed front end RF circuitry, from the RF input connector to the first IF conversion, wideband frequencies from 9 kHz to 26.5 (or 40 GHz) can be directly input. Because a preselector is built-in, which is synchronized with sweep frequency, the analyzer is capable of measuring wideband frequencies without image signals even for high-order mixing bands.



Example of 38 GHz measurement (for the R3182)

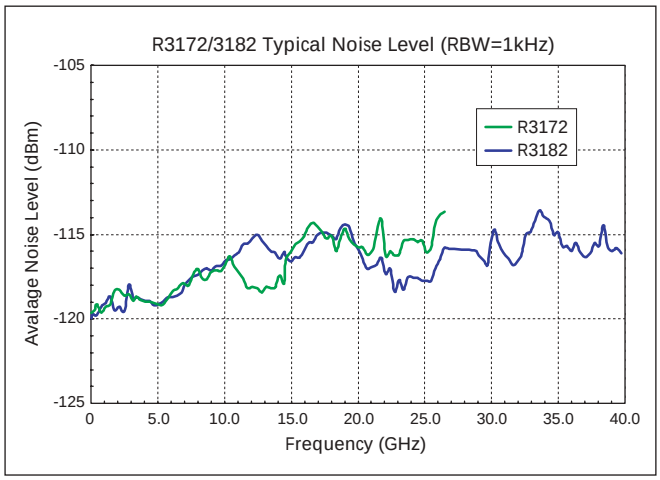
Outstanding Signal Purity

Phase noise characteristics of high frequency devices and modules are critical measurements, which affect the basic performance of communication units. The R3172 and R3182 enhance SSB phase noise characteristic measurements with full use of our newest technology, and by incorporating a synthesizer and RF circuit. These spectrum analyzers are suitable for evaluating high frequency devices and modules.



Analyzers Achieve Best-In-Class Input Sensitivity

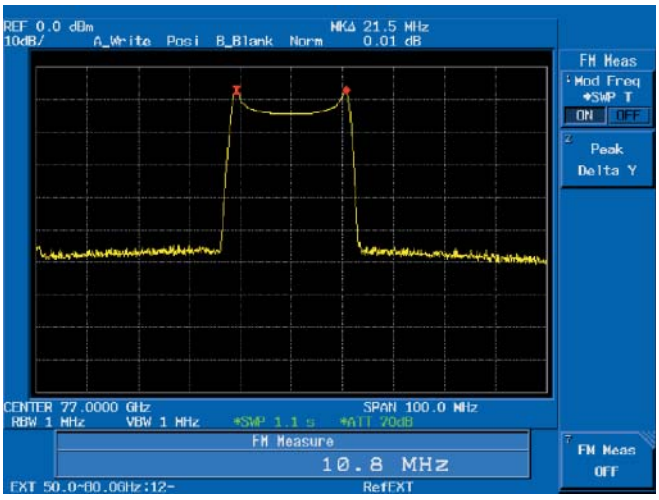
Since noise level increases as the measuring frequency increases, the measurable dynamic range is limited. However, the R3172 and R3182 each provide best-in-class performance noise level. Thereby, the comparative measurement range of harmonics and fundamental wave, or weak signals and fundamental signal can be ensured.



External Mixer Allows Maximum 110 GHz Measurement

Various external mixers are provided as options for analyzing high frequency signals over 40 GHz. Since calibration data is provided with each mixer on floppy disks, the R3172 and R3182 are capable of measuring the absolute values of high frequency signals by simply reading calibration data from the floppy disks.

OPT.16: 26.5 to 40 GHz
OPT.17: 40 to 60 GHz
OPT.18: 50 to 75 GHz
OPT.19: 75 to 110 GHz



Example of measurement with external mixers (measurement of FM modulation depth for 77 GHz)

Software Image Suppression (SIS) Function

When measuring signals with an external mixer, many image signals are displayed with true measured signals. The R3172 and R3182 are capable of suppressing these undesired images by software action. Thereby, measurement efficiency can be improved, since the previously complicated procedure to separate image signals, can now be performed simply.

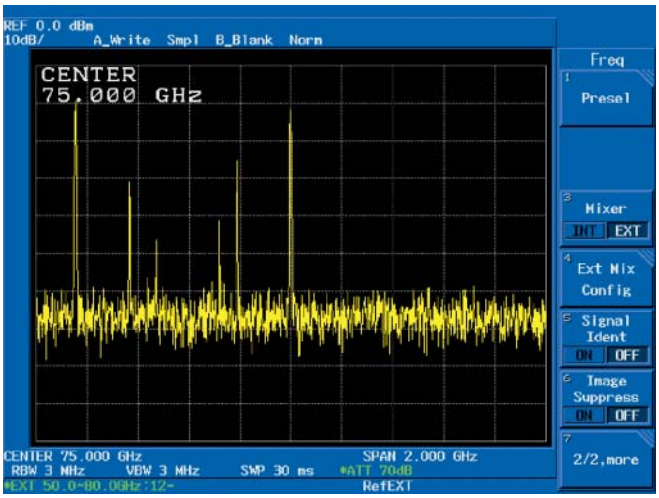


Image Suppression OFF

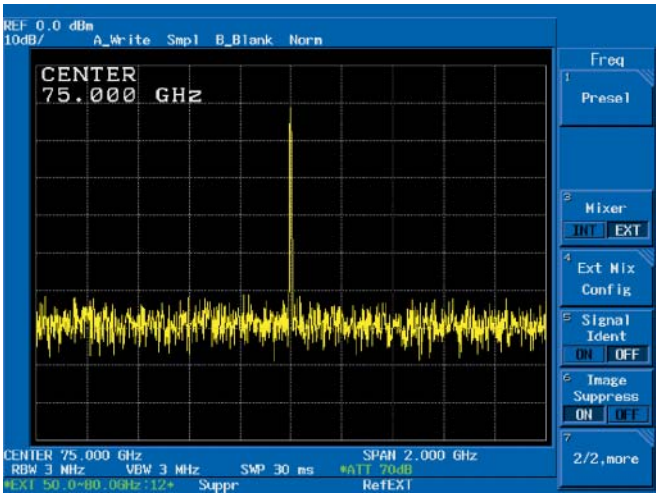


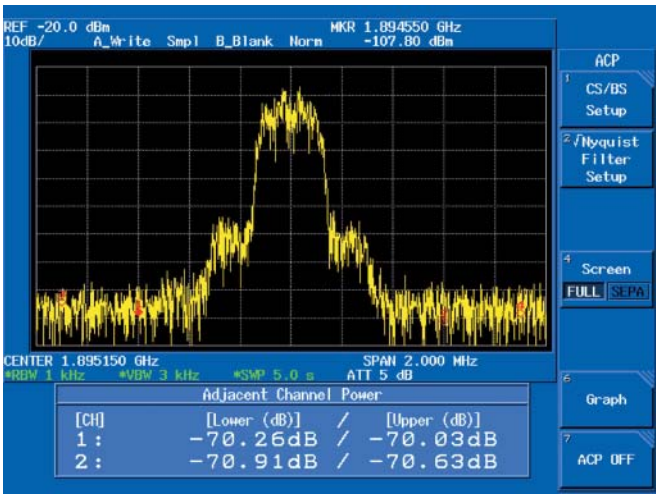
Image Suppression ON

Compact Design Reduces Weight and Saves Space

By adopting a newly designed housing, the R3172 and R3182 achieve compactness and weight reduction. With a size of approximately 424 (W) x 177 (H) x 300 (D) mm, the R3172 weighs approx.16 kg and the R3182 approx. 18 kg. Especially, the limited depth dimension allows full use of working space.

High-accuracy measurement

A newly developed synthesized local oscillator helps the instruments achieve frequency sweeps with a frequency span accuracy of ±1% or less. Keeping in pace with better frequency reading accuracy, the adjacent channel leakage power and occupied bandwidth measurement functions can now be measured with higher accuracy. In addition, an overall level accuracy of ±1.5 dB is guaranteed in frequency ranges of 100 kHz to 3 GHz .

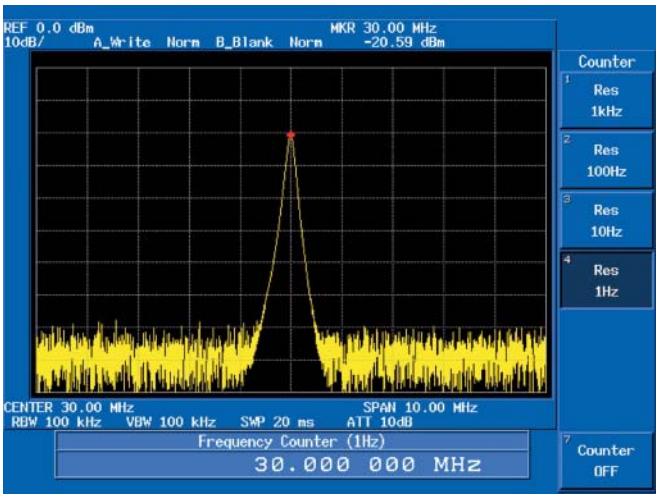


Example of ACP measurement

Single Key Touch Operations for Greater Ease of Operation

Frequency Counter

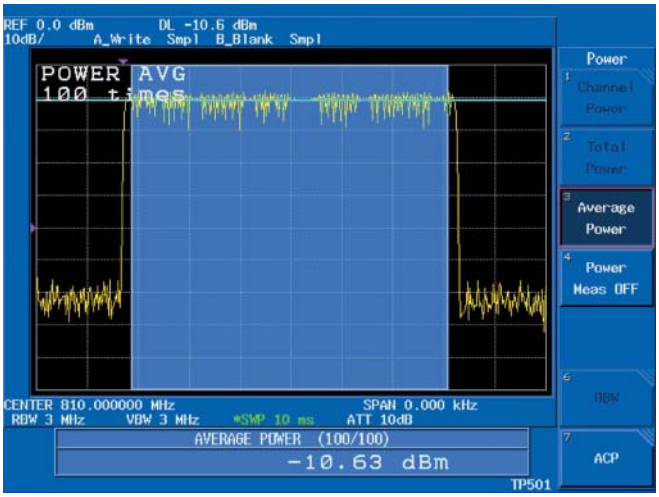
Positions the marker on the spectrum and lets the instruments measure the frequency with its built-in frequency counter to a resolution selectable from between 1 Hz and 1 kHz. This function is indispensable for measuring the frequencies of signals selected from a mix of signals, such as multicarrier signals.



Example of frequency counter

Power measurement

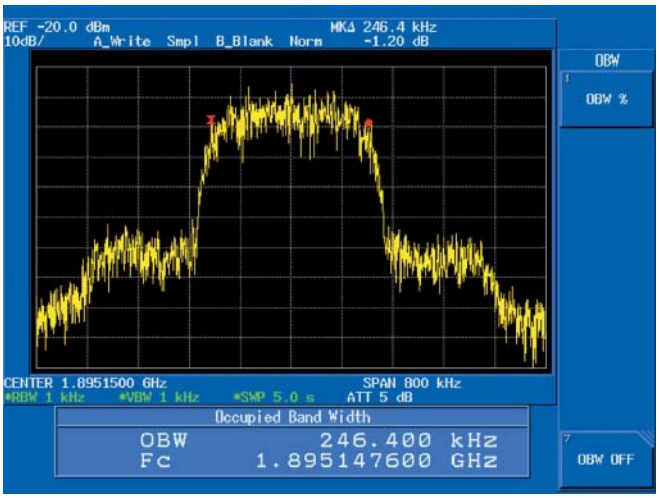
This function is useful for digital mobile communications measurement applications. Measurements made easy by this function include channel power measurement, which measures the power of signals diffused over a wide band, as in CDMA or OFDM, and average power measurement, which measures signals having large amplitude variations. These measurements are all windowprogrammed.



Example of average power measurement

Occupied bandwidth (OBW)

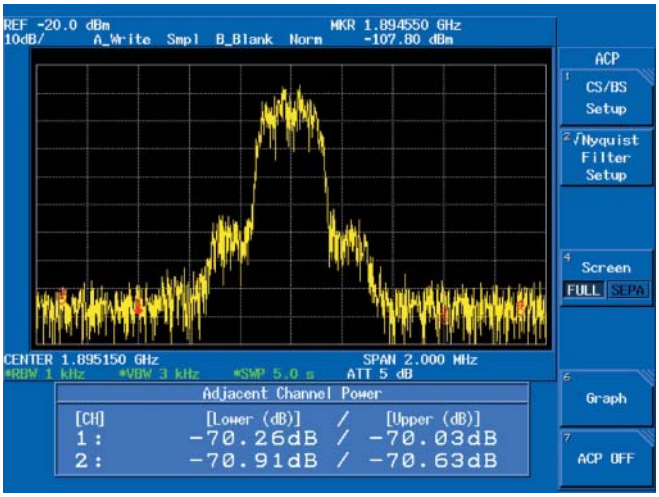
Calculates the bandwidth having a specified power ratio from measured spectrum data and displays the occupied bandwidth (OBW) and center frequency (FC). The ratio to total power can be set between 10 and 99.8%.



Example of OBW measurement

Adjacent channel leakage power (ACP)

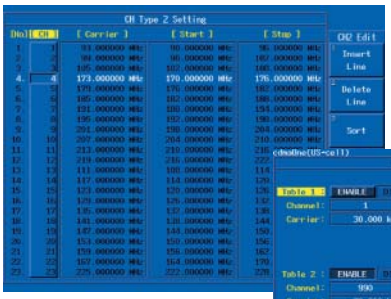
Allows you to measure the adjacent channel leakage power by simply programming the channel spacing and frequency bandwidth preset for a radio system. Up to five adjacent measurement points can be set.



Example of ACP measurement

Channel setting

A channel data can be registered for channel setting. Independent two types of tables for optimum setting according to mobile communication systems can make a simple operation.

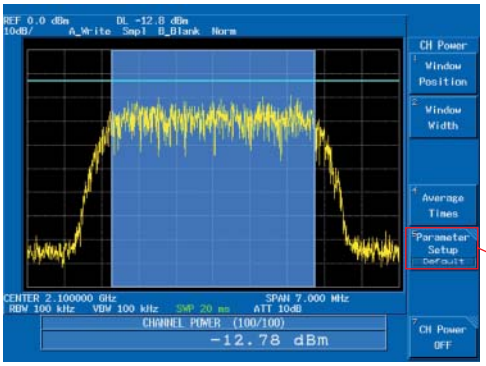


CH Type 1: for mobile communications
Channel type 1 is suitable to channel setup of fixed channel steps such as mobile communications.

CH Type 2: for TV and CATV
Channel type 2 is suitable to channel setup of irregular channel steps such as TV broadcasting and CATV.

One key measurement

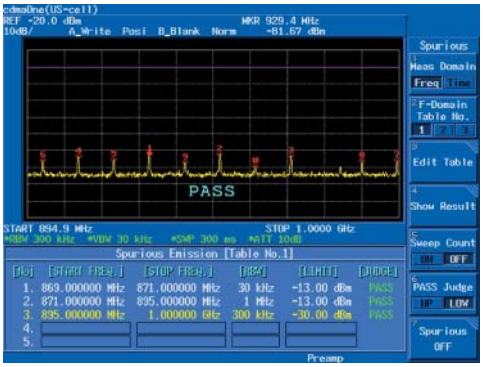
Different parameter setup can be registered for OBW/ACP/CH POWER/SPECTRUM MASK measurement, respectively. Pressing an each function key reproduces independent measurement parameter setup. These function can be measured without any parameter setup.



Default registering key

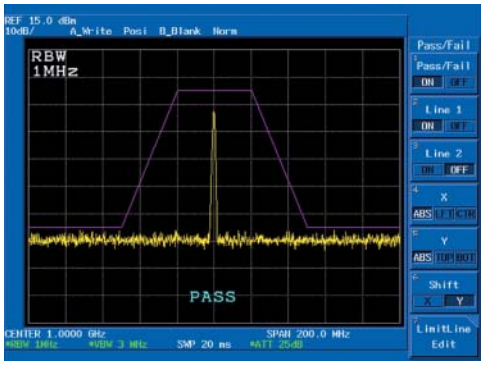
Spurious measurement function

Sweep frequency table up to 15 area can be made arbitrary, and set the limit line value in the area to measure the spurious emission automatically.This limit value can be used for lower limit, then perform as error detection function when the signal level does not exceed the specified value.



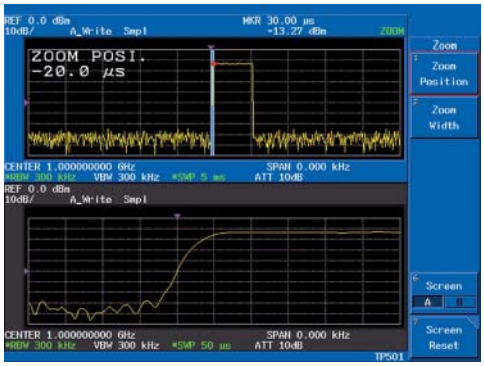
Pass/fail testing

Sets two limit lines onscreen, one as a high limit and the other as a low limit, for testing passes and failures. Limit lines can also be set on the timebase, allowing time template measurement. The limit line settings can be written to internal save memory or FD, so multiple pass/fail testing conditions can be recalled for testing.



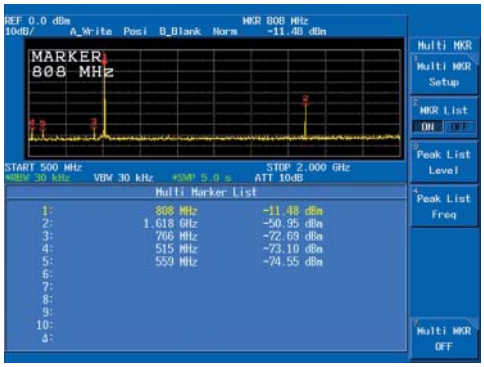
Multiscreen

The zoom function provides an A/B split screen display. Varied signal analysis tasks supported include F-F mode, in which different frequency spectrums are displayed, F-T mode, in which AM/FM modulation components are displayed, and T-T mode, which is convenient for producing partially magnified views in a time domain.



Multimarker

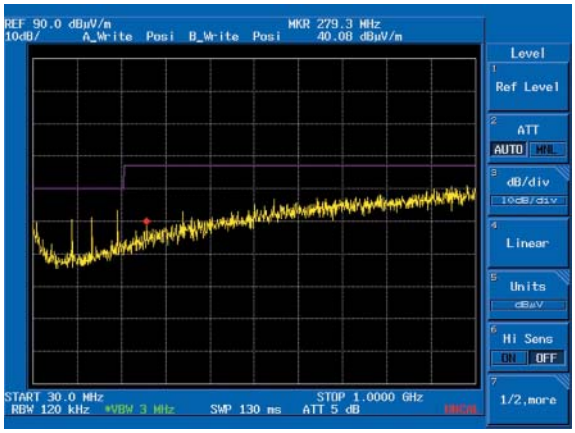
Up to 10 markers can be set in a single display screen. Each marker may be positioned at an optional frequency. In addition, the markers can be sorted and listed in level or frequency order after automatic peak detection.



EMC measurement

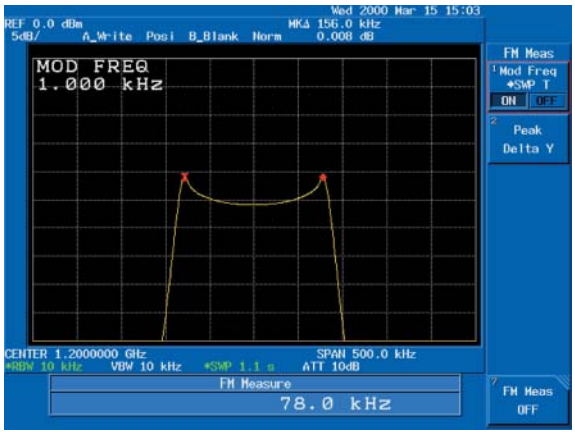
This function measures electromagnetic interferences arising from electronic equipment. The instruments come standard with 9 kHz, 120 kHz, and 1 MHz 6 dB bandwidth filters and a QP detector. A 200 Hz narrow-band filter can be added optionally. AM/FM demodulated audio is available from the rear-panel PHONE jack to identify disturbing broadcast waves. Correction coefficients for the antennas provided by us are built in the R3172/3182 so that the level reading can be calibrated for direct reading in dB µV/m by simply selecting the name of your antenna model. If an antenna not manufactured by us is used, a correction can be registered individually. For measuring weak noise lower than noise level of the spectrum analyzer, the built-in preamplifier* of R3172/3182 makes possible of sensitive measurements with calibrated level.

** Preamplifier is effective for inputting signals from 9 kHz to 3.3 GHz.*



Versatile measurement functions

MEAS key supports Noise/Hz measurements, %AM/%AM Video/FM measurements, Third-order measurement and XdB Down measurement. For Noise/Hz measurement, PBW calibration function makes for measurement with higher accuracy in power measurement by providing calibration resulted form conversion of resolution bandwidth (RBW) filter used by R3172/3182 into ideal filter.



FM measurement

FD-based data editing/management

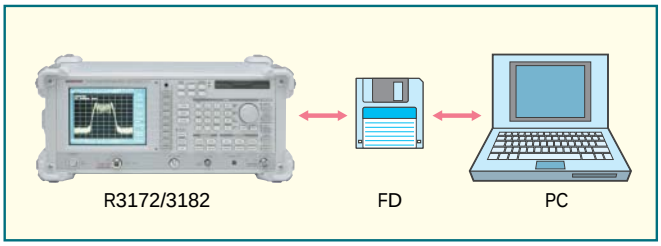
Measurement results can be written to internal save memory as trace data and can be recalled later together with the associated measurement conditions. Likewise, data saved to an FD can not only be recalled in the R3172/3182 but can also be accessed from a PC for reference.

SAVE Numeric data format

Trace data and measurement conditions can be loaded into a PC in numeric form, so that the data can be managed with applications, such as spreadsheets. Data thus loaded may be edited on the PC and then recalled in the R3172/3182.

COPY Bitmap format

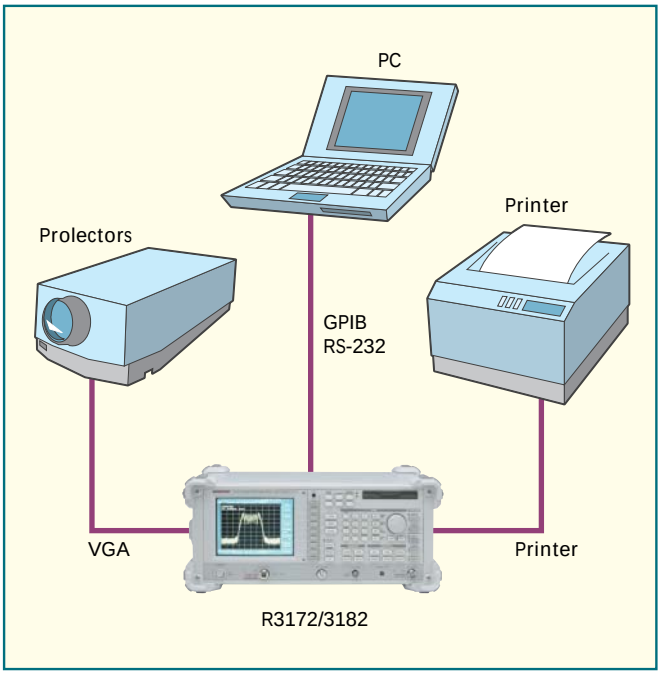
If the standard floppy disk drive is specified as external storage, bitmap files are created on the FD by simply pressing the panel COPY key. This allows intricate images of onscreen data to be handled in a PC for electronic filing and documentation purposes, without needing a further modification.



GPIB, RS-232 — Control and data transfer from an external controller

Printer — Compatible with ESC/P, ESC/P-R, and PCL

VGA — Display image output to monitors/projectors



Wide Choice of Options

OPT.03 Local Signal Output for External Mixer (only for the R3172)

The local signal output is supplied to the optional external mixer (OPT.16, 17, 18, or 19) of the R3172.

** The R3182 includes mixers as standard equipment.*

OPT.20 High-stability frequency reference

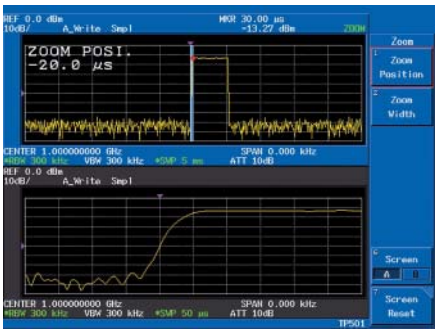
Crystal oscillator options with frequency stabilities of ±2 x 10^{-8}/day and ±1 x 10^{-7}/year are available for enhanced frequency reading accuracy and frequency counter accuracy.

OPT.27 Narrow-band resolution bandwidth

Since the analyzers provide signals of 30 Hz, 100 Hz, 300 Hz (3 dB bandwidth), and 200 Hz (6 dB bandwidth), as well as RBW 1 kHz (and 3 MHz as an option), the carrier wave separation and proximity noise measurements of a narrow band RF system can be measured.

OPT.29 Time-domain high-speed sweep

In time-domain high-speed sweeps, the sweep time can be set up to 50 µs, allowing TDMA waveform observation during digital mobile communications measurement and offering zoomed views of the leading and trailing regions of burst signals.



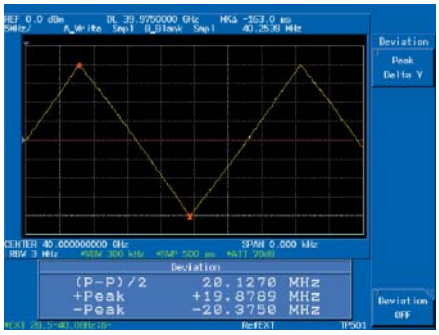
OPT.74 Tracking generator

The tracking generator generates signals synchronized with frequency sweeps by a spectrum analyzer in a frequency range of 100 kHz to 3 GHz, allowing the direct measurement of the frequency response characteristics of filters and amplifiers. A normalization feature is available with the tracking generator for cancelling frequency response characteristics in a single-touch operation to ease the evaluation of the characteristics of only the signals of interest. If return losses are measured using the SWR bridge, the impedance matching frequency characteristic of the signals of interest can be easily evaluated.

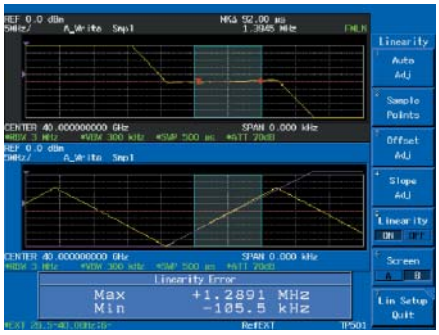
Return loss measurement

OPT.73 Wide-range FM demodulation

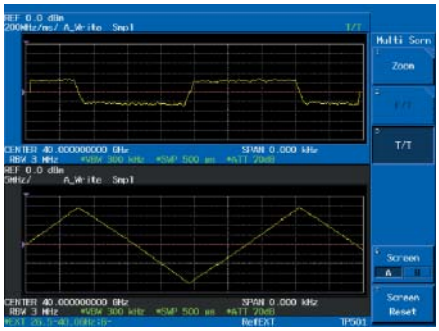
Devices such as a collision avoidance radar for preventing a collision between a car and another in front, which are installed in Intelligent Transport Systems (ITS), utilize an FM modulation in which the frequency deviation is very wide. The R3172/3182 can measure FM deviation widths up to 500 MHz (with an external mixer), whereas conventional measuring instruments can not measure these widths. At the same time, the R3172/3182 can measure modulation linearity and sensitivity. Further, since the R3172/3182 can perform a limit test during a PASS/FAIL evaluation at any given range. The function can improve the throughput of the tuning process of the production.



Example of measuring FM deviation

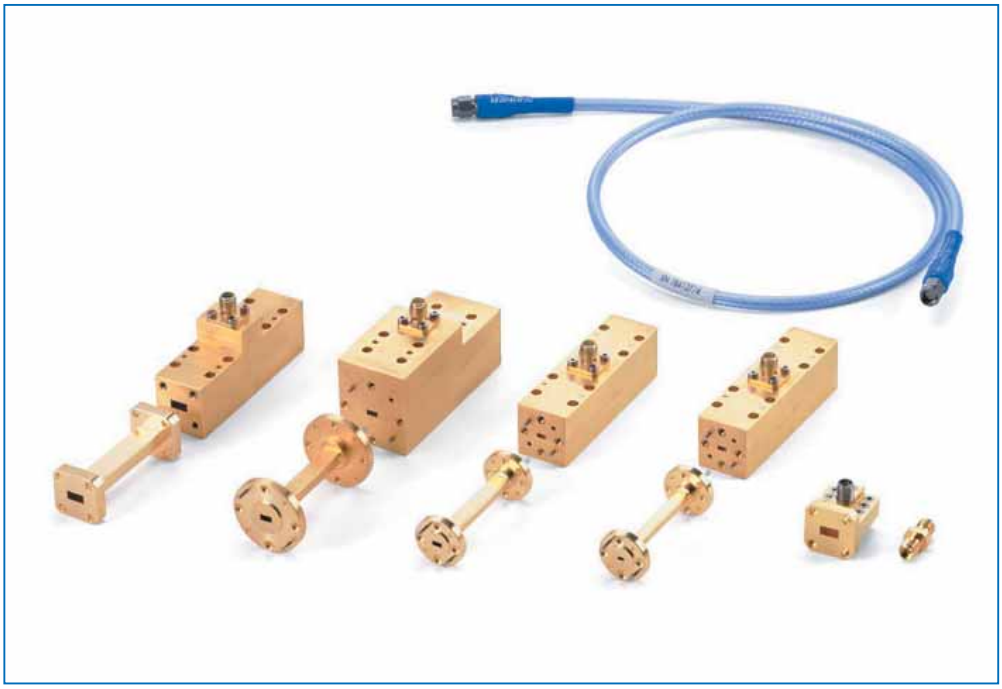


Example of measuring linearity

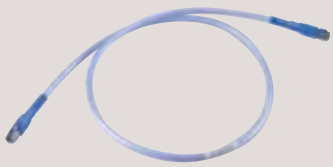


Example of measuring sensitivity

Enhanced Functions in Support of Applications



Waveforms of 26.5 to 110 GHz band can be measured with an external mixer. The following table lists the external mixers OPT.16 through OPT.19 with each appropriate measuring band. A compensation value is provided for the frequency responce of each external mixer. Further, various flanged wave-guides, and a coaxial wave-guide converter are available as listed. Measuring cables and conversion connectors, which are especially required for high-frequency measuring, are available as accessories as listed following the table.

Frequency band/ Wave-guide standard	External mixer	Wave-guide with flange	Coaxial wave-guide converter
26.5 to 40 GHz WR-28	 OPT.16	 ST28S-2.0	 410A599KF
40 to 60 GHz WR-19	 OPT.17	 ST19R-2.0	 **Cables with K connector for measuring** F102-11SK-0750 (0.75m) F102-11SK-1000 (1.0m) F102-11SK-1500 (1.5m) F102-11SK-2000 (2.0m)
50 to 75 GHz WR-15	 OPT.18	 ST15R-2.0	
75 to 110 GHz WR-10	 OPT.19	 ST10R-2.0	 **K through adapter** 5A-SFF40A **SMA through adapter** HRM-501

R3172 Specifications

Frequency

Frequency range:	9 kHz to 26.5 GHz	
Preamplifier OFF		Harmonic order (N)
band 0:	9 kHz to 3.3 GHz	1
band 1:	3.2 to 7.1 GHz	1
band 2:	7 to 14.7 GHz	2
band 3:	14.5 to 26.5 GHz	4
Preamplifier ON		
band 0:	9 kHz to 3.3 GHz	1

Frequency reading accuracy (Start, Stop, CF, Marker):	± (Reading of frequency x Frequency reference accuracy + Span x Span accuracy + RBW x 0.15 + 60 Hz)
Counter	
Resolution:	1 Hz to 1 kHz
Accuracy:	± (Marker frequency x Frequency reference accuracy + Residual FM + 1 LSD) (S/N ≥25 dB, span ≤200 MHz)
Frequency reference accuracy	
Stability:	$\pm 2 \times 10^{-6}$/year
Temperature stability:	$\pm 1 \times 10^{-5}$ (0 to +50°C)
Frequency span	
Range:	1 kHz to 26.5 GHz, 0 Hz (zero span)
Accuracy:	≤±1%
Residual FM	
Zero span:	≤ (60 Hzp-p x N) /100 ms
Noise sideband	
Frequency ≤2.6 GHz:	≤-100 dBc/Hz (at 10 kHz offset, RBW 300 Hz (OPT.27)) ≤-105 dBc/Hz (at 20 kHz offset)
Frequency >2.6 GHz:	≤ (-98 + 20 logN) dBc/Hz (at 10 kHz offset, RBW 300 Hz (OPT.27) ≤ (-103 + 20 logN) dBc/Hz (at 20 kHz offset)
Resolution bandwidth at 3 dB	
Range:	1 kHz to 3 MHz (1-3-10 sequence)
Accuracy:	±20% 1 kHz to 1 MHz ±25% 3 MHz
Selectivity (60 dB:3 dB):	<15 : 1
QP (6 dB) Range:	1 MHz, 120 kHz, 9 kHz (200 Hz (OPT.27))
Video bandwidth:	10 Hz to 3 MHz (1-3-10 sequence)

Amplitude range

Measuring range	+30 dBm to displayed average noise level
Maximum input level	(Input attenuator ≥10 dB)
Preamplifier OFF:	+30 dBm, 0 VDC max.
Preamplifier ON:	+13 dBm, 0 VDC max.
Indication range	
Log:	10 x 10 div, 10, 5, 2, 1 dB/div
Linear:	10% of reference level/div
Reference level range	
Preamplifier OFF:	(Input attenuator 0 to 70 dB)
Log:	-64 to +60 dBm (0.1 dB step)
Linear:	+141.1 µV to +223.6 V
Preamplifier ON:	(Input attenuator 0 to 30 dB)
Log:	-82 to +10 dBm (0.1 dB step)
Linear:	+17.76 µV to +707.1 mV
Input attenuator range:	0 to 70 dB (10 dB step)

Sweep

Sweep time:	10 ms to 1000 s (Sweep time under 20 ms can be set up at span 100 MHz or less)
Accuracy:	±2%
Trigger mode:	FREE RUN, LINE, VIDEO, EXT, TV
Sweep mode:	REPEAT, SINGLE

Dynamic range

Displayed average noise level:	RBW 1 kHz, VBW 10 Hz, input attenuator 0 dB, f ≥10 MHz
Preamplifier OFF	
10 MHz to 3.3 GHz (band 0):	-117 dBm + 2 f (GHz) dB*1
3.2 to 7.1 GHz (band 1):	-112 dBm*1
7 to 14.7 GHz (band 2):	-111 dBm*1
14.5 to 22 GHz (band 3):	-107 dBm*1
22 to 26.5 GHz (band 3):	-104 dBm*1
Preamplifier ON	
1 MHz to 3.3 GHz:	-132 dBm + 3 f (GHz) dB
1 dB gain compression	
Preamplifier OFF	
200 MHz to 3.3 GHz (band 0):	>0 dBm (mixer input level)
3.2 to 26.5 GHz (band 1 to 3):	>-5 dBm (mixer input level)
Preamplifier ON	(Input attenuator 0 to 30 dB)
200 MHz to 3.3 GHz (band 0):	>-25 dBm (RF input level)

Spurious response: preamplifier OFF
Second harmonic distortion:

Frequency range	Mixer level	Distortion level
100 to 800 MHz	-30 dBm	≤-70 dBc
≥800 MHz (band 0)	-30 dBm	≤-80 dBc
≥3.3 GHz	-10 dBm	≤-100 dBc

Third order intermodulation distortion:	≤-80 dBc (200 MHz to 3.3 GHz, band 0) ≤-70 dBc (3.2 to 26.5 GHz, band 1 to 3) (mixer input level -30 dBm, two signal difference >50 kHz)
Image/Multiple/ Out of band response:	<-70 dBc (10 MHz ≤ f ≤18 GHz) <-60 dBc (18 GHz < f ≤23 GHz) <-50 dBc (23 GHz < f ≤26.5 GHz)
Residual response:	(Input terminated 50 Ω , input attenuator 0 dB, f ≥1 MHz)
Preamplifier OFF:	≤-100 dBm (band 0) ≤-90 dBm (band 1 to 3)
Preamplifier ON:	≤-105 dBm (band 0)

**1: For a temperature range of 20 to 30°C. Add 2 dB for a temperature range of 0 to 50°C.*

Amplitude accuracy

Frequency response
(after calibration and preselector peak, attenuator 10 dB)
Preamplifier OFF

Frequency range	Relative		Absolute*2	
	20 to 30°C	0 to 50°C	20 to 30°C	0 to 50°C
100 kHz to 3 GHz	±0.5 dB	±1.0 dB	±0.6 dB	±1.0 dB
9 kHz to 3.3 GHz	±1.5 dB	±2.0 dB	±1.5 dB	±2.0 dB
3.3 to 7.1 GHz	±1.6 dB	±1.8 dB	±1.8 dB	±2.5 dB
7.1 to 14.7 GHz	±1.8 dB	±2.0 dB	±2.0 dB	±3.0 dB
14.7 to 26.5 GHz	±2.5 dB	±3.0 dB	±3.0 dB	±4.0 dB

Preamplifier ON

Frequency range	Relative		Absolute*2	
	20 to 30°C	0 to 50°C	20 to 30°C	0 to 50°C
100 kHz to 2.7 GHz	±1.0 dB	±1.0 dB	±1.0 dB	±1.0 dB
9 kHz to 3.3 GHz	±2.0 dB	±2.0 dB	±2.0 dB	±2.0 dB

Calibration signal level accuracy:	-20 dBm ±0.3 dB
IF gain error (after automatic calibration):	±0.5 dB
Scale indication accuracy (after automatic calibration)	
Log:	±1.5/90 dB, ±1.0/10 dB, ±0.2/1 dB
Liner:	±5% of reference level
Input ATT switching error:	≤±1.1/10 dB, 2 dB max. (9 kHz to 12 GHz) ≤±1.3/10 dB, 2.5 dB max. (12 to 18 GHz) ≤±1.8/10 dB, 3.5 dB max. (18 to 26.5GHz) in reference to an attenuation of 10dB at 30 MHz

**2: In reference to 30 MHz calibration signal.*

Resolution bandwidth switchinglevel error (after automatic calibration):	±0.5 dB
Total level accuracy Preamplifier OFF:	±1.5 dB (REF = -50 to 0 dBm, ATT = 10 dB, 2 dB/div, RBW = 300 kHz, f = 100 kHz to 3 GHz, after automatic calibration)

I/O

RF input	
Connector:	N connector (female) (changeable to SMA female)
Impedance:	50 Ω (nominal)
VSWR (at tuned frequency)	
Preamplifier OFF:	<1.5 : 1 (9 kHz to 3.3 GHz, band 0) (typical) <2 : 1 (3.2 to 26.5 GHz, band 1 to 3) (typical) with input ATT 10 to 70 dB
Preamplifier ON:	<2.5 : 1 (9 kHz to 3.3 GHz, band 0) (typical)
Probe power:	±12 V (nominal), 4-pin connector
Calibration output signal:	BNC female, 50 Ω (nominal) 30 MHz, -20 dBm
10MHz reference input:	BNC female, 500 Ω (nominal) -10 to +10 dBm
External trigger input:	BNC female
Y axis output:	BNC female Approx. 2 V in full scale (10 dB/div)
Phone output:	Small size monophonic female
GPIB interface:	IEEE-488 BUS connector
Serial interface:	D-Sub 9-pins
Printer interface:	D-Sub 25-pins, ESC/P, ESC/P-R, PCL
Video output:	VGA (15-pins, female)
Floppy disk:	3.5-inch, MS-DOS format

General specifications

Operating temperature:	0 to +50°C Relative humidity 85% or less (no condensation)
Storage temperature:	-20 to +60°C, Relative humidity 85% or less
Power source: 100 VAC: 200 VAC:	Automatic switching to 100 or 200 VAC 100 to 120 VAC, 50 to 60 Hz 220 to 240 VAC, 50 to 60 Hz
Power consumption:	<200 VA
Dimension:	Approx. 424 (W) x 177 (H) x 300 (D) mm (excluding feet and connectors)
Mass:	<16 kg (excluding options, cover, and accessories)

Options

OPT.16 to 20, 27, 29 or 73, please refer options for R3182 (page 16 to 17).

OPT.03 Local signal output for external mixer

Frequency range:	4.0 to 7.6 GHz
Output level:	>+8 dBm
Output impedance:	50 Ω (nominal)
Connector:	SMA female

OPT.74 Tracking generator

Frequency range:	100 kHz to 3 GHz
Output level range:	0 to -59.9 dBm
Output level accuracy:	±0.5 dB (30 MHz, -10 dBm, +20 to +30°C)
Output level flatness:	±1.0 dB (100 kHz to 1 GHz) ±1.5 dB (100 kHz to 3 GHz) (reference signal level: -10 dBm, frequency: 30 MHz)
Output level switching uncertainly:	±1.0 dB (100 kHz to 1 GHz, output level ≥-30 dBm) ±2.0 dB (100 kHz to 2.6 GHz) ±3.0 dB (100 kHz to 3 GHz) (reference level: -10 dBm)
Spurious output Harmonic: Non-harmonic:	 ≤-20 dBc (output level: -10 dBm) ≤-30 dBc (output level: -10 dBm)
TG leakage	≤-100 dBm (input ATT: 0dB)
Output impedance: VSWR:	50 Ω (nominal) ≤2 (output level ≤-10 dBm) (typical)
Maximum allowable input level:	+15 dBm ±10 VDC
Mass:	≤1 kg

R3182 Specifications

Frequency

Frequency range:	9 kHz to 40 GHz	
Preamplifier OFF		Harmonic order (N)
band 0:	9 kHz to 3.3 GHz	1
band 1:	3.2 to 7.1 GHz	1
band 2:	7 to 14.7 GHz	2
band 3:	14.5 to 27 GHz	4
band 4:	26.5 to 30 GHz	4
band 5:	29.5 to 40 GHz	8
Preamplifier ON		
band 0:	9 kHz to 3.3 GHz	1

Frequency reading accuracy (Start, Stop, CF, Marker):	± (Reading of frequency x Frequency reference accuracy + Span x Span accuracy + RBW x 0.15 + 60 Hz)
Counter	
Resolution:	1 Hz to 1 kHz
Accuracy:	± (Marker frequency x Frequency reference accuracy + Residual FM + 1 LSD) (S/N ≥25 dB, span ≤200 MHz)
Frequency reference accuracy	
Stability:	$\pm 2 \times 10^{-6}$/year
Temperature stability:	$\pm 1 \times 10^{-5}$ (0 to +50°C)
Frequency span	
Range:	1 kHz to 40 GHz, 0 Hz (zero span)
Accuracy:	≤±1%
Residual FM	
Zero span:	≤ (60 Hzp-p x N) /100 ms
Noise sideband	
Frequency ≤2.6 GHz:	≤-100 dBc/Hz (at 10 kHz offset, RBW 300 Hz (OPT.27)) ≤-105 dBc/Hz (at 20 kHz offset)
Frequency >2.6 GHz:	≤ (-98 + 20 logN) dBc/Hz (at 10 kHz offset, RBW 300 Hz (OPT.27)) ≤ (-103 + 20 logN) dBc/Hz (at 20 kHz offset)
Resolution bandwidth at 3 dB	
Range:	1 kHz to 3 MHz (1-3-10 sequence)
Accuracy:	±20% 1 kHz to 1 MHz ±25% 3 MHz
Selectivity (60 dB:3 dB):	<15 : 1
QP (6 dB) Range:	1 MHz, 120 kHz, 9 kHz
Video bandwidth:	10 Hz to 3 MHz (1-3-10 sequence)

Amplitude range

Measuring range	+30 dBm to displayed average noise level
Maximum input level	(Input attenuator ≥10 dB)
Preamplifier OFF:	+30 dBm, 0 VDC max.
Preamplifier ON:	+13 dBm, 0 VDC max.
Indication range	
Log:	10 x 10 div, 10, 5, 2, 1 dB/div
Linear:	10% of reference level/div
Reference level range	
Preamplifier OFF:	(Input attenuator 0 to 70 dB)
Log:	-64 to +60 dBm (0.1 dB step)
Linear:	+141.1 µV to +223.6 V
Preamplifier ON:	(Input attenuator 0 to 30 dB)
Log:	-82 to +10 dBm (0.1 dB step)
Linear:	+17.76 µV to +707.1 mV
Input attenuator range:	0 to 70 dB (10 dB step)

Sweep

Sweep time:	10 ms to 1000 s (Sweep time under 20 ms can be set up at span 100 MHz or less)
Accuracy:	±2%
Trigger mode:	FREE RUN, LINE, VIDEO, EXT, TV
Sweep mode:	REPEAT, SINGLE

Dynamic range

Displayed average noise level:	RBW 1 kHz, VBW 10 Hz, input attenuator 0 dB, f ≥10 MHz
Preamplifier OFF	
10 MHz to 3.3 GHz (band 0):	-117 dBm + 2 f (GHz) dB*1
3.2 to 7.1 GHz (band 1):	-114 dBm*1
7 to 14.7 GHz (band 2):	-112 dBm*1
14.5 to 27 GHz (band 3):	-110 dBm*1
26.5 to 30 GHz (band 4):	-107 dBm*1
29.5 to 40 GHz (band 5):	-106 dBm*1
Preamplifier ON	
1 MHz to 3.3 GHz:	-132 dBm + 3 f (GHz) dB
1 dB gain compression	
Preamplifier OFF	
200 MHz to 3.3 GHz (band 0):	>0 dBm (mixer input level)
3.2 to 40 GHz (band 1 to 5):	>-5 dBm (mixer input level)
Preamplifier ON	(Input attenuator 0 to 30 dB)
200 MHz to 3.3 GHz (band 0):	>-25 dBm (RF input level)

Spurious response: preamplifier OFF
Second harmonic distortion:

Frequency range	Mixer level	Distortion level
100 to 800 MHz	-30 dBm	≤-70 dBc
≥800 MHz (band 0)	-30 dBm	≤-80 dBc
≥3.3 GHz	-10 dBm	≤-95 dBc

Third order intermodulation distortion:	≤-80 dBc (200 MHz to 3.3 GHz, band 0) ≤-75 dBc (3.2 to 30 GHz, band 1 to 4) ≤-70 dBc (29.5 to 40 GHz, band 5) (mixer input level -30 dBm, two signal difference >50 kHz)
Image/Multiple/ Out of band response:	<-70 dBc (10 MHz ≤ f ≤18 GHz) <-65 dBc (18 GHz < f ≤26.5 GHz) <-60 dBc (26.5 GHz < f ≤34 GHz) <-50 dBc (34 GHz < f ≤40 GHz)
Residual response:	(Input terminated 50 Ω , input attenuator 0 dB, f ≥1 MHz)
Preamplifier OFF:	≤-100 dBm (band 0) ≤-90 dBm (band 1 to 5)
Preamplifier ON:	≤-105 dBm (band 0)

**1: For a temperature range of 20 to 30°C. Add 2 dB for a temperature range of 0 to 50°C.*

Amplitude accuracy

Frequency response
(after calibration and preselector peak, attenuator 10 dB)
Preamplifier OFF

Frequency range	Relative		Absolute*2	
	20 to 30°C	0 to 50°C	20 to 30°C	0 to 50°C
100 kHz to 3 GHz	±0.5 dB	±1.0 dB	±0.6 dB	±1.0 dB
9 kHz to 3.3 GHz	±1.5 dB	±2.0 dB	±1.5 dB	±2.0 dB
3.3 to 7.1 GHz	±1.6 dB	±1.8 dB	±1.8 dB	±2.5 dB
7.1 to 14.7 GHz	±1.8 dB	±2.0 dB	±2.0 dB	±3.0 dB
14.7 to 26.5 GHz	±2.5 dB	±3.0 dB	±3.0 dB	±4.0 dB
27 to 30 GHz	±3.0 dB	±3.5 dB	±3.5 dB	±4.5 dB
30 to 40 GHz	±3.5 dB	±4.0 dB	±4.0 dB	±5.0 dB

Preamplifier ON

Frequency range	Relative		Absolute*2	
	20 to 30°C	0 to 50°C	20 to 30°C	0 to 50°C
100 kHz to 2.7 GHz	±1.0 dB	±1.0 dB	±1.0 dB	±1.0 dB
9 kHz to 3.3 GHz	±2.0 dB	±2.0 dB	±2.0 dB	±2.0 dB

Calibration signal level accuracy:	-20 dBm ±0.3 dB
IF gain error (after automatic calibration):	±0.5 dB
Scale indication accuracy (after automatic calibration)	
Log:	±1.5/90 dB, ±1.0/10 dB, ±0.2/1 dB
Liner:	±5% of reference level

**2: In reference to 30 MHz calibration signal.*

Input ATT switching error:	≤±1.1/10 dB, 2 dB max. (9 kHz to 12 GHz) ≤±1.3/10 dB, 2.5 dB max. (12 to 18 GHz) ≤±1.8/10 dB, 3.5 dB max. (18 to 26.5GHz) ≤±2.2/10 dB, 4 dB max. (26.5 to 40GHz) in reference to an attenuation of 10dB at 30 MHz
Resolution bandwidth switchinglevel error (after automatic calibration):	±0.5 dB
Total level accuracy	
Preamplifier OFF:	±1.5 dB (REF = -50 to 0 dBm, ATT = 10 dB, 2 dB/div, RBW = 300 kHz, f = 100 kHz to 3 GHz, after automatic calibration)

I/O

RF input	
Connector:	K connector (male)
Impedance:	50 Ω (nominal)
VSWR (at tuned frequency)	
Preamplifier OFF:	<1.5 : 1 (9 kHz to 3.3 GHz, band 0) (typical) <2 : 1 (3.2 to 26.5 GHz, band 1 to 3) (typical) <2.2 : 1 (26.5 to 40 GHz, band 4, 5) (typical) with input ATT 10 to 70 dB
Preamplifier ON:	<2.5 : 1 (9 kHz to 3.3 GHz, band 0) (typical)
Probe power:	±12 V (nominal), 4-pin connector
Calibration output signal:	BNC female, 50 Ω (nominal) 30 MHz, -20 dBm
External mixer local output	
Connector:	SAM female
Impedance:	50 Ω (nominal)
Frequency range:	4.0 to 7.6 GHz
Output level:	>+8 dBm
10MHz reference input:	BNC female, 500 Ω (nominal) -10 to +10 dBm
External trigger input:	BNC female
Y axis output:	BNC female Approx. 2 V in full scale (10 dB/div)
Phone output:	Small size monophonic female
GPIB interface:	IEEE-488 BUS connector
Serial interface:	D-Sub 9-pins
Printer interface:	D-Sub 25-pins, ESC/P, ESC/P-R, PCL
Video output:	VGA (15-pins, female)
Floppy disk:	3.5-inch, MS-DOS format

General specifications

Operating temperature:	0 to +50°C Relative humidity 85% or less (no condensation)
Storage temperature:	-20 to +60°C, relative humidity 85% or less
Power source:	Automatic switching to 100 or 200 VAC
100 VAC:	100 to 120 VAC, 50 to 60 Hz
200 VAC:	220 to 240 VAC, 50 to 60 Hz
Power consumption:	<200 VA
Dimension:	Approx. 424 (W) x 177 (H) x 300 (D) mm (excluding feet and connectors)
Mass (without option):	<18 kg (excluding options, cover, and accessories)

Options

OPT.16 External mixer (26.5 to 40 GHz)

Frequency range:	26.5 to 40 GHz
Average noise level:	≤- 99 dBm (typical value at RBW 1 kHz, VBW 10 Hz)
Frequency response:	±5 dB (typical)
1 dB gain squeeze:	-1 dBm
Maximum input level:	+20 dBm (continuous wave (CW) power)

OPT.17 External mixer (40 to 60 GHz)

Frequency range:	40 to 60 GHz
Average noise level:	≤- 93 dBm (typical value at RBW 1 kHz, VBW 10 Hz)
Frequency response:	±5 dB (typical)
1 dB gain squeeze:	-1 dBm
Maximum input level:	+20 dBm (CW power)

OPT.18 External mixer (50 to 75 GHz)

Frequency range:	50 to 75 GHz
Average noise level:	≤- 90 dBm (typical value at RBW 1 kHz, VBW 10 Hz)
Frequency response:	±5 dB (typical)
1 dB gain squeeze:	-6 dBm
Maximum input level:	+20 dBm (CW power)

OPT.19 External mixer (75 to 110 GHz)

Frequency range:	75 to 110 GHz
Average noise level:	≤- 85 dBm (75 to 85 GHz) ≤- 80 dBm (85 to 110 GHz) (typical value at RBW 1 kHz, VBW 10 Hz)
Frequency response:	±5 dB (typical)
1 dB gain squeeze:	-6 dBm
Maximum input level:	+20 dBm (CW power)

OPT.20 High-stability frequency reference

Reference frequency source accuracy	
Stability:	±2 x 10^{-8}/day ±1 x 10^{-7}/year
Warm-up drift (nominal):	±5 x 10^{-8} (typical) (25°C, 10 minutes after tuning the power on)
Temperature drift:	±5 x 10^{-8} (0 to +40°C, with reference to +25°C)

OPT.27 Narrow-band resolution bandwidth

3-dB resolution bandwidth:	300 Hz, 100 Hz, 30Hz
Bandwidth accuracy:	±20%
6-dB resolution bandwidth:	200 Hz

OPT.29 Time-domain high-speed sweeps

Sweep time:	50 µs to 10 ms
Sweep time accuracy:	±1%
Trace detector:	Sample
Trace point:	501

OPT.73 Wide-range FM demodulation
Internal mixer mode

Measuring amplitude range:	**> -50 dBm + input attenuation value (at center frequency 1 GHz, RBW Wide, -20 dB or more than reference level)**
FM deviation	
Measuring range:	**2.5 MHz, 1 MHz, 500 kHz, 250 kHz, 100 kHz, 50 kHz, 25 kHz, 10 kHz**
Linearity error*:	**≤ (2 % of measuring range)**
Offset error*:	**≤ (4 % of measuring range + K + Readout of frequency x Frequency reference accuracy)**
	K; 8 kHz (measuring range 2.5 MHz to 250 kHz)
	2 kHz (measuring range 100 kHz to 10 kHz)
Demodulation frequency bandwidth (3 dB):	**≥300 kHz (nominal)**

External mixer mode (one of OPT.16, 17, 18 or 19 is required)

FM deviation	
Measuring range:	**500 MHz, 250 MHz, 100 MHz, 50 MHz, 25 MHz, 10 MHz, 5 MHz, 2.5 MHz, 1 MHz, 500 kHz, 250 kHz, 100 kHz, 50 kHz, 25 kHz, 10 kHz**
Linearity error*:	**≤ (2 % of measuring range)**
Offset error*:	**≤ (4 % of measuring range + K + Readout of frequency x Frequency reference accuracy)**
	K; 128 kHz (measuring range 500 MHz to 5 MHz)
	8 kHz (measuring range 2.5 MHz to 250 kMz)
	2 kHz (measuring range 100 kHz to 10 kMz)
Demodulation frequency bandwidth (3 dB):	**≥300 kHz (nominal)**

** These errors are values obtained by executing "FM Demod ALL CAL" software, after warming up the R3172/3182 and optional mixer for 30 minutes or more.*

Specifications may change without notification.

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