## TEK R3371A Spectrum Analyzer

**Features**

- Excellent Spectral Purity: -110dBc/Hz (10 kHz Away from Carrier)
- Resolution Bandwidth of 10 Hz to 3 MHz
- Built-in Frequency Counter with 1 Hz Resolution
- Audio Demodulation with Internal Speaker
- Portable System with a Large CRT Display
- High-speed 5 µs/div Sweep
- TDMA Signal Analysis
- Memory Card Function
- Multi-marker with up to Eight Points
- Extensive Built-in EMC Measurement Functions
- Conforms to MIL-T-28800 Standards
- Built-in Tracking Generator (R3365A and R3371A)

Applications

- Digital Mobile Radio Test
- Antenna and Base Station Test
- Radio Communications System Test
- Microwave Device Test

R3271A/R3371A Spectrum Analyzer

The R3271A/R3371A spectrum analyzer is designed to analyze pulse RF signals used for radar or to analyze the spectra of microwaves and quasi-millimeter waves used for satellite broadcasting, satellite communications, and mobile communication.

The R3271A/R3371A can measure the ultra-wide frequency range of 100 Hz to 26.5 GHz in one sweep operation. It can also perform the sweep continuously and repeatedly. A newly developed high-purity synthesizer enables a high signal purity of -110 dBc/Hz at 2.6 GHz and -108 dBc/Hz at 7.5 GHz (10 kHz offset).

The R3271A/R3371A spectrum analyzer is thus ideally suited for mobile radio communication, for which narrower signal bandwidths and digital transmission are being implemented. In the past, such high-performance equipment was used only for advanced research and development; however, this level of performance is now needed on a commercial level.

R3265A/R3365A Spectrum Analyzer

The R3265A/R3365A is a quasi-microwave spectrum analyzer designed to meet user needs and to ensure easy operations. The R3265A/R3365A incorporates a time domain function so it can be used for both digital and analog mobile communication. The R3265A/R3365A can measure a wide frequency range of 100 Hz to 8 GHz in one sweep over a wide dynamic range. Even at a frequency of 2.6 Hz, a newly developed high-purity synthesizer enables a high signal purity of -110 dBc/Hz (offset frequency of 10 kHz).

This unit performs especially well in measuring the spurious emission intensity of mobile communications equipment, occupied bandwidth, and signal leakage from adjacent channels. In the low-noise mode, the R3265A/R3365A has a high-input sensitivity of -145 dBm (1 MHz to 3.6 GHz), so it can easily measure faint signals.

In addition to its popular user-defined functions, the R3265A/R3365A incorporates a multi-marker function, as well as a function to list the frequency and level displayed by the multi-marker. A memory card function can save or recall measurement settings, measurement data, and user definitions. Using this function, the time needed for measurement and panel resetting operations can be significantly shortened.

Tracking Generator

The R3365A and R3371A are identical to the R3265A and R3271A respectively, except that the R3365A and R3371A include a built-in tracking generator to facilitate frequency response measurements and provide scalar network analyzer capability (with an external SWR bridge).

Burst Signal Analysis Functions

- Fast Digitized Sweep. The R3265A/R3365A, R3271A/R3371A use a high-speed digitizer to perform high-speed sweeps of 5 µs/div during zero span. This data can also be averaged. This function is ideally suited for monitoring the mean transmission power and duration of Time Division Multi-Access (TDMA) signals that are used in the Global System for Mobile Communication (GSM) systems in Europe and in the next-generation mobile telephone systems in Japan and the U.S.A. (e.g., digital mobile telephones). An arbitrary range can be expanded using the delayed sweep function.
- Gated Sweep Function. The burst signal (TDMA and video signals) analysis function, when combined with the high-speed sweep, can be used to monitor the transmission power in an arbitrary one-time slot of a TDMA signal or to analyze the noise in one horizontal line of a TV signal. Until now, the gated sweep function required an external gated sweep signal. The R3265A/R3271A standard configuration permits analysis of the spectrum of a burst signal without the need for an external gate or trigger signal.
- Delayed Sweep. Delayed sweep can be used to zoom in on detail in the time domain. The user can set a delay time following an internal or external trigger event.

Measurement of Occupied Frequency Bandwidths and Adjacent-Channel Leakage Power

By calculating from the measured spectrum data, the occupied frequency bandwidth of a radio transmission characteristic and the leakage power of an adjacent channel can be easily measured. The carrier frequency is also displayed when the occupied frequency bandwidth is measured. The leakage from an adjacent channel can be measured in a dynamic range of 70 dB (typical value) with high signal purity.

Internal Tracking Generator

The R3365A and R3371A include an internal tracking generator to dynamically measure the resonant characteristic of a high-Q element or the frequency response of a dielectric filter. In addition, the 120 dB dynamic-range display guarantees a 110 dB dynamic measurement range for frequency response measurement with the tracking generator. Therefore, even high stop-band attenuation can be measured.

Optical Modulation Spectrum Analyzer

Addition of the Q32605 Optical Receiver plug-in allows the R3265A/R3271A to function as an optical modulation spectrum analyzer.

Optical input sensitivity with the Q32605 is -160 dBm/Hz, frequency range of 6 MHz to 2.4 GHz, and a frequency flatness of ±1.8 dB.

The R3265A/R3271A/Q32605 can be used to measure RIN (Relative Intensity Noise) of optical analog transmission LDs and optical transmitters, modulatio

**Specifications**

Frequency Range - 100 Hz to 8 GHz, R3265A. 100 Hz to 26.5 GHz, R3271A.

Harmonic Mode (N), R3265A - =1.

Harmonic Mode (N), R3271A -

| Frequency Band | Harmonic Mode (N) |
|---|---|
| 100 Hz to 3.6 GHz | 1 |
| 3.5 to 7.5 GHz | 1 |
| 7.4 to 15.4 GHz | 2 |
| 15.2 to 23.3 GHz | 3 |
| 23 to 26.5 GHz | 4 |

Preselector - 3.5 GHz to 8 GHz (26.5 GHz for R3271A) using YIG-tuned preselector.

Frequency Readout Accuracy (Start, Stop, CF, Marker) - ±(freq. readout x freq. reference accuracy + span x span accuracy + 0.15 x res BW + 10 Hz).

Span Accuracy - Span >2 MHz: ±3%, Span </=2 MHz: ±5%.

Count Frequency Marker -
Resolution: 1 Hz to 1 kHz.
Count accuracy (S/N >25 dB): ±(marker freq. x freq. reference accuracy + 5 Hz x N + 1 LSD).
Delta marker count accuracy: (S/N >/=25 dB) ±(delta marker freq. x freq. reference accuracy + 10 Hz x N + 2 LSD).

Frequency Reference Accuracy -
R3265A: ±2 x $10^{-8}$/day, ±1 x $10^{-7}$/year,
±5 x $10^{-9}$/day with Option 21.
R3271A: ±2 x $10^{-8}$/day, ±1 x $10^{-7}$/year,
±5 x $10^{-9}$/day with Option 21.

Frequency Stability - Residual FM (zero span): <3 Hz x $N_{p-p}$/0.1 s. Drift (after 1 hour warmup): Span 50 kHz <span </=2 MHz, <2.5 kHz x sweep time (minute) x N. Span </=50 kHz, <60 Hz x sweep time (minute) x N.

Spectral Purity - Noise sidebands.

| Offset | f </=2.6 | f >/=2.6 |
|---|---|---|
| 1 kHz | <-100 dBc/Hz | </=(-95 + 20 logN) dBc/Hz |
| 10 kHz | <-110 dBc/Hz | </=(-108 + 20 logN) dBc/Hz |
| 20 kHz | <-110 dBc/Hz | </=(-108 + 20 logN) dBc/Hz |
| 100 kHz | <-114 dBc/Hz | </=(-110 + 20 logN) dBc/Hz |

Frequency Span

Linear Span - Range (zero span): 200 Hz to 8 GHz (R3265A), 200 Hz to 26.5 GHz (R3271A). Accuracy: ±3% (span >2 MHz), ±5% (span </=2 MHz).

Log Span -
Range: 1 kHz to 1 GHz 1, 2, 3 decades selected.
Accuracy: ±(10% + stop freq. x 0.1%).

Resolution Bandwidth (-3 dB) -
Range: 10 Hz to 3 MHz 1, 3, 10 sequence.
Accuracy: 100 Hz to 1 MHz: ±15%. 30 Hz to 3 MHz (25°C ±10°C): ±25%. 10 Hz to 100 Hz (digital IF): ±50%.
Selectivity (-60 dB/-3 dB): 100 Hz to 3 MHz: <15:1. 30 Hz: <20:1. 10 Hz to 100 Hz (digital IF): 5:1 (nominal).
Bandwidth (-6 dB): 200 Hz, 9 kHz, 120 kHz. Conformed to CISPR standard.

Video Bandwidth Range - 1 Hz to 3 MHz, 1, 3, 10 sequence.

Amplitude Related

Amplitude Range - +30 dBm to noise level.

Maximum Input - Average continuous power (Input attenuation >/=10 dB): +30 dBm (1 W). DC: 0V.

Display Range -
Scale calibration: 10x 10 division graticule. Log: 10, 5, 2, 1, 0.5, 0.2, 0.1 dB/div.
Linear: 10% of reference level/div.
QP log: 40 dB (5 dB/div).

Input Attenuator Range - 0 to 70 dB (10 dB step).

DYNAMIC RANGE

Maximum Dynamic Range -
1 dB Compression-to-noise level:
R3265A: 200 MHz to 3.6 GHz
135 dB - 1.55f (GHz).
R3271A: 10 MHz to 3.6 GHz
130 dB - 1.55f (GHz).
Second harmonic distortion:
R3265A: 100 MHz to 1.8 GHz 87 dB. 10 MHz to 3.6 GHz 82.5 dB. >3.5 GHz 112 dB.
R3271A: 10 MHz to 3.6 GHz 85 dB.
>3.5 GHz 110 dB.
Third order intermodulation:
R3265A: >200 MHz, 93 dB.
R3265A, R3271A: >10 MHz, 90 dB.

Displayed Average Noise Level (10 Hz RBW, 0 dB 1/p attenuation, 20x average) -
R3265A and R3271A: 1 kHz, -100 dBm.
10 kHz, -110 dBm. 100 kHz, -111 dBm.
1 MHz, -135 dBm.
R3265A: 10 MHz to 3.6 GHz) Normal mode, -140 + 1.55f (GHz) dBm. Low-noise Mode, -145 - 1.55f (GHz) dBm. 3.5 to 8 GHz) -135 dBm.
R3271A: 1 MHz to 3.6 GHz -135 + 1.55f (GHz) dBm. 3.5 to 7.5 GHz -130 dBm. 7.5 to 15.4 GHz -123 dBm. 15.2 to 23.3 GHz -116 dBm. 23 to 26.5 GHz -110 dBm.

Gain Compression (1 dB) -
R3265A: >10 MHz, -10 dBm (mixer level). >250 MHz, -5 dBm (mixer level).
R3271A: >10 MHz, 5 dBm (mixer level).

Second Harmonic Distortion -
R3265A: 100 MHz to 1.8 GHz <-70 dBc
(-30 dBm at mixer). 10 MHz to 1.8 GHz <-60 dBc (-30 dBm at mixer). >1.75 GHz <-100 dBc (-10 dBm at mixer).
R3271A: 10 MHz to 1.8 GHz <-70 dBc

(-30 dBm at mixer). >1.75 GHz <-100 dBc (10 dBm at mixer).

Third Order Distortion (30 dBm mixer level) -
R3265A: 200 MHz to 3.6 GHz <-70 dBc.
10 MHz to 3.6 GHz <-60 dBc). >3.5 GHz <-75 dBc.
R3271A: 10 MHz to 3.6 GHz <-70 dBc,
>3.5 GHz <-75 dBc.

Image Multiple, Out-of-band Response -
R3265A: 10 MHz to 8 GHz <-70 dBc.
R3271A: 10 MHz to 18 GHz <-70 dBc. 10 MHz to 23 GHz <-60 dBc. 10 MHz to 26.5 GHz <-50 dBc.

Residual Response (no signal at 1/p, attenuator 0 dB, 50 Ohm termination) -
1 MHz to 3.6 GHz <-100 dBm. 300 kHz to
8 GHz (26.5 GHz), <-90 dBm.

Amplitude Accuracy

Frequency Response - In band flatness
(10 dB input attenuation): 100 Hz to 3.6 GHz ±1.5 dB. 50 MHz to 2.6 GHz ±1.0 dB. 3.5 GHz to 7.5 GHz ±1.5 dB.
R3265A, 7.4 GHz to 8 GHz ±1.5 dB.
R3271A, 7.4 GHz to 15.4 GHz ±3.5 dB.
15.4 GHz to 23.3 GHz ±4.0 dB. 23 GHz to
26.5 GHz ±4.0 dB.

Additional Uncertainly Due to Band Switching - ±0.5 dB.

Frequency Response Referenced to CAL Signal - ±3 dB (R3265A), ±5 dB (R3271A).

Calibrator Accuracy - -10 dBm ±0.3 dB.

IF Gain Uncertainty (after automatic calibration) - 0 dBm to -50 dBm: ±0.5 dB. 0 dBm to -80 dBm: ±0.7 dB.

Scale Fidelity -
Log: ±0.2 dB/1 dB, ±1 dB/10 dB, ±1.5 dB/90 dB.
Linear: ±5% of reference level.
QP mode log: ±1.0 dB/30 dB, ±2 dB/40 dB, ±1.0 dB/40 dB (25°C ±10°C).

Input Attenuator Switching Accuracy (20 to 70 dB settings referenced to 10 dB) -
±1.1 dB/10 dB step, 2.0 dB max., 0 to 12.4 GHz.
±1.3 dB/10 dB step, 2.5 dB max., 12.4 GHz to 18 GHz.
±1.8 dB/10 dB step 3.5 dB max., 18 GHz to 26.5 GHz.

Resolution Bandwidth Switching Uncertainty (at reference BW, 300 kHz, after automatic calibration) -
100 Hz to 3 MHz: </=±0.3 dB. 30 Hz: </=±1 dB. 10 Hz to 100 Hz (digital IF): </=±1.5 dB.

Pulse Digitization Uncertainty (pulse response mode PRF >700/sweep time) Peak-to-Peak -
Log: RBW </=1 MHz, 1.2 dB; RBW </=3 MHz: 3 dB.
Linear: RBW </=1 MHz, 4% of reference level; RBW 3 MHz, 12% of reference level.

Sweep Related

Sweep Time -
SPAN = 0: 50 µs to 1000 s and manual sweep.
SPAN >/=200 Hz: 20 ms to 1000 s and manual sweep.
Accuracy: ±3%.

Sweep Trigger - Free run, line, single, video, TV-H, TV-V, external.

Demodulation -
Spectrum demodulation: Modulation type, AM and FM.
Audio output: Speaker and phone jack with volume control.
Marker pause time: 100 ms to 1000 s.

Delayed Sweep

Trigger Signal Source - External trigger signal (input from the external trigger input connector).
Trigger mode: VIDEO and TV-V.

Delay Time - 200 ns to 1.5 s with a resolution of 100 ns.

Delayed Sweep Time - 50 µs to 1000 s (resolution is the same as that set in the sweep time).

Gated Sweep

Trigger Signal Source - Frequency or time domain analysis: External trigger input (TTL), gate input (TTL), IF detection trigger (Trigger level variable, span </=7 MHz - frequency domain analysis - 1/p pulse >100 µs).

Gate Position - 300 ns to 100 ns with resolution of 100 ns.

Gate Width - 1 µs to 1.5 s with resolution of 100 ns.

TRACKING GENERATOR (R3365A/R3371A)

Frequency Range - 100 kHz to 3.6 GHz.

Output Level Range - -3 dBm to -30 dBm (0.1 dB steps).

Output Level Accuracy - ±0.5 dB (25 MHz, -10 dBm, 25°C, ±10°C).

Vernier Accuracy - ±0.5 dB (25 MHz, -10 dBm, 25°C, ±10°C).

Dynamic Range - 1 MHz to 3 GHz -110 dBm. 3 GHz to 3.6 GHz -100 dBm.

Power Sweep Range - 30 dB (in 0.1 dB steps).

Inputs/Outputs

External Memory Function - IC memory card.

RF Input -
Connector type: N type (adaptable to SMA type for R3271A).
Impedance: 50 Ohm (nominal).
VSWR (input attenuation >/=10 dB, at tuned frequency): </=3.6 GHz (nominal): <2.0:1 (R3265A), >3.6 GHz (nominal) <2.5:1 (R3271A).
LO emission level (average): <-80 dBm (nominal), 10 dB input attenuation, 0 to 26.5 GHz.

Video Output -
Connector: BNC female, rear panel.
Impedance (AC coupled): 75 Ohm (nominal).
Amplitude: Approx. 1 V p-p (composite video signal).

Probe Power -
Connector: 4-Pin, front panel.
Voltage: +15 V, -15 V.
Current: 150 mA max., each.

Demodulated Audio Output -
Connector: Subminiature monophonic jack, front panel.
Power output: 0.2 W, 8 Ohm (nominal).
Phone Output - Demodulated audio.
Connector: Subminiature monophonic jack, front panel.
Power output: 0.2 W, 8 Ohm (nominal).

GPIB Interface - Standard GPIB function enables remote operation and data input/output.
Connector: IEEE-488 bus connector. Direct plotter output: Supports HP7470A, HP7475A, HP7440A, and HP7550A, or other HPGL plotters.

Power Requirements

Operating Voltage - Automatically selects between 100 V AC and 220 V AC.
100 V AC: 90 V to 132 V.
220 V AC: 198 V to 250 V.

Power Consumption - Max. 400 VA.

Frequency -
100 V AC: 48 to 440 Hz.
200 V AC: 48 to 66 Hz.

General Specifications

Environmental -
Operating temperature: 0°C to +50°C.
non-operating temperature: -20°C to +60°C. Humidity: 85% RH.

Safety - This product has been safety tested by Advantest to IEC 348 specifications.

Physical Characteristics

| Dimensions*[1] | mm | in. |
|---|---|---|
| Height | 177 | 7 |
| Width | 353 | 13.9 |
| Depth | 450 | 17.7 |
| Weight | kg | lb. |
| Nominal | 22 | 48.5 |