

#### ■ Measurement Domain Modes For Various Measurement Domains

Since digital spectrum analyzers have many measurement applications, there is a tendency for them to have many analysis functions and for their operations to become complicated. In order to free the user from such complicated operations, the R9211 Series has separate measurement domain modes according to the measurement application. The user can select the desired measurement mode without having to trouble with unused analysis functions or setting conditions. The sought-after results can be obtained easily by making only the software key settings necessary for the measurement.

#### • Waveform Measurement Mode

By using this mode, time domain signal analysis can be done more quickly than was possible previously. Further, an anti-aliasing filter can be turned on and off so that the series can be used as a 16-bit/ 256 kHz sampling oscilloscope. This is ideal for time domain transient phenomenon analysis of the sound of acoustic instruments, starting characteristics tests of engines or motors, waveform analysis of power on reset signals or differential linearity tests of D/A converters.

#### • Time/Frequency Analysis Mode

In evaluation of musical instruments' sound or hall reverberation characteristics, time variation analysis can be done which focuses on a specified spectrum. Further, analysis can be done of the time characteristics of spectrum variations in the wow and flutter component of VCRs or other equipment (frequency monitor function). The time characteristics of phase variations such as jitter can also be analyzed (phase monitor function).

#### • Spectrum Measurement Mode

Measurement is possible with a wide dynamic range of 90 dB (typ.) and high sensitivity of -140 dBV (typ., at a 2 kHz range). This is effective in harmonic distortion analysis and micro-level noise analysis.

#### • Frequency Response Function Measurement Mode

In this mode, frequency resolution can be varied from 25 to 800 lines. Also, since 2 power supply channels for acceleration sensors are built-in, direct measurements of transfer functions of structural components are possible by connection of a sensor with a built-in amp or an impulse hammer.

#### • Servo Analysis Mode (R9211B, R9211C)

The R9211 Series features a built-in summation amplifier for open loop characteristics evaluation, servo measurement with up to a 5 decade log sweep and a point servo measurement function with a frequency table of only specified frequencies.

#### ■ Features of each type

R9211E	<ul style="list-style-type: none"> <li>• 16 Bit Resolution, 90 dB (Typ.) Wide Dynamic Range</li> <li>• 10 mHz to 100 kHz Frequency Range</li> <li>• Maximum Input Sensitivity: -140 dBV (2 kHz Range, Typ.)</li> <li>• 12 kg Portable Type, 8 Inch CRT</li> <li>• Easy-to-Use Separate Measurement Domain Modes</li> </ul>
R9211A	<ul style="list-style-type: none"> <li>• Running Zoom Function With Minimum Span of 10 mHz</li> <li>• 15 Bit Resolution, 90 dB (Typ.) Wide Dynamic Range</li> <li>• 10 mHz to 100 kHz Frequency Range</li> <li>• Easy-to-Use Separate Measurement Domain Modes</li> <li>• 3.5 Inch Floppy Disk Drive Provided Standard</li> </ul>
R9211B	<ul style="list-style-type: none"> <li>• 130 dB Minimum Wide Dynamic Servo Analysis</li> <li>• 10 mHz to 100 kHz Frequency Range</li> <li>• High Speed Auto-Range Function, Frequency Resolution Variation Function (25 to 800 Lines), SSS Format High Speed Measurement</li> <li>• Built-in Addition Amplifier Ideal For Servo Analysis</li> </ul>
R9211C	<ul style="list-style-type: none"> <li>• Curve Fit Function, Frequency Response Function Synthesis Function</li> <li>• 130 dB Minimum Wide Dynamic Servo Analysis</li> <li>• High Speed Auto Range Function, Frequency Resolution Variation Function (25 to 800 Lines), SSS High Speed Measurement</li> </ul>

	Functions and Options													
	Curve fitting and synthesizer function	60-NO GO decisions by comparator function	Running zoom with 10 mHz resolution	SG with digital signal generation	SG with built-in summation amplifier	Power supply for acceleration sensor with built-in amp	SG with output up to ±15 V	Sign, multi-sign, swept sign, impulse, random or arbitrary waveform output	Difference input	Floppy disk drive	High speed thermal printer	CMOS memory (1 M words)	I/O + memory card	High speed calculation processor
R9211B				●	●	●	●	●	●	●	Opt.	Opt.	Opt.	
R9211C	●	●	●	●	●	●	●	●	●	●	Opt.	Opt.	●	●
R9211E						●			●	▲	Opt.	▲	▲	
R9211A			●			●			●	●	Opt.	Opt.	Opt.	Opt.

Note: Selection of only one possible of the items marked with ▲.

	Applications															
	Oscillation/structural components analysis	Acoustics/noise/sound analysis	Digital audio sound output evaluations	Device noise evaluations	Optical disk mechanical characteristics evaluations	Telephone line terminal equipment evaluations	A/D, D/A converter evaluations	Evaluations of servos in CD/DAT/video disk players	Digital servo evaluations	Digital amp/digital filter evaluations	1/1 and 1/3 octave analysis	High speed octave analysis	Analysis by frequency response function synthesis	Transient signal characteristics (indoor, in-car acoustic analysis)	Analog servo evaluations	130 dB wide dynamic range servo analysis
R9211B	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
R9211C	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
R9211E	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
R9211A	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

# Spectrum Analyzers

Choice of 4 Types, To Fit the Application

## R9211Series (Continued From Previous Page)

### Specifications

#### Input and Analysis Characteristics

**Number of input channels:** 2

**Input format:** Difference input format, signal ended format

**Input impedance:** Approx. 1 M $\Omega$ /100 pF (at signal ended)

**Input coupling:** AC, DC, GND

**A/D converter resolution:** 16 bits

**Frequency range:** 10 mHz to 100 kHz, 22 ranges in 1, 2, 5 steps

**Frequency accuracy:**  $\pm 50$  ppm of frequency range  $\pm$  measurement resolution (at  $+23^\circ\text{C} \pm 5^\circ\text{C}$ )

**Input filter:** Anti-aliasing filter (roll off characteristic -148 dB/oct.) is applied to each frequency range and automatically set. However, at ranges of 1 kHz and below, analog and digital filters are used together

**Common-mode rejection ratio (CMRR):**

50 dB min. (with DC coupling, at 50/60 Hz)

**Maximum difference input voltage:**  $\pm 200$  V

**Maximum in-phase input voltage:**  $\pm 200$  V

**Input range:** +30 to -60 dBV (variable in 1 dB steps)

**Voltage display** 44.7 V to 1.41 mV, rms display, 31.6 V to 1 mV

**Auto range:** Set at the optimum range stated above according to the input signal (5 dB steps)

**Maximum in-phase signal voltage:**

$\pm 14$  V (-60 to -6 dBV range)

$\pm 140$  V (-5 to +14 dBV range)

$\pm 200$  V (+15 to +30 dBV range)

**Maximum input sensitivity:** -125 dBV (approx. 0.56  $\mu\text{Vrms}$ ) (at -140 dBV, 2 kHz range)

**Dynamic range:** All dynamic ranges are those measured at full scale in spectrum mode, 0 to 90% of frequency range, sine wave input with -3 dB amplitude level, 32 averagings, rectangular wave weighting, filter on, 400-spectrum-line condition.

Also, 1/f noise is excluded. ( $23^\circ\text{C} \pm 5^\circ\text{C}$ )

85 dB min. (+30 to -30 dBV) (90 dB typ.)

80 dB min. (-31 to -40 dBV)

70 dB min. (-41 to -50 dBV)

60 dB min. (-51 to -60 dBV)

**Residual noise:** All residual noise values are those measured at full scale in spectrum mode, 32 averagings, rectangular wave weighting, filter on, 400-spectrum-line condition. Also, 1/f noise is excluded. However, at 0 to 90% of frequency range ( $23 \pm 5^\circ\text{C}$ )

-85 dB min. (+30 to -40 dBV)

-75 dB min. (-41 to -45 dBV)

-60 dB min. (-46 to -60 dBV)

**Amplitude linearity**  $\pm 0.2$  dB max.

(within -40 dB from full scale,  $+23 \pm 5^\circ\text{C}$ )

**Frequency flatness:**  $\pm 0.3$  dB max. (at  $23 \pm 5^\circ\text{C}$ )

At 0 to 90% of frequency range, AC coupled -3 dB point is approx. 0.2 Hz

**Amplitude accuracy:** Amplitude linearity + frequency flatness (at  $23 \pm 5^\circ\text{C}$ )

**Amplitude difference between channels:** In same sensitivity range, at 0 to 90% of frequency range (at  $23 \pm 5^\circ\text{C}$ )

R9211E/9211A	R9211B/9211C
Within $\pm 0.3$ dB	Within $\pm 0.1$ dB

**Phase difference between channels:** In same sensitivity range, at 0 to 90% of frequency range (at  $23 \pm 5^\circ\text{C}$ )

R9211E/9211A	R9211B/9211C
Within $\pm 3.0^\circ$	Within $\pm 1.0^\circ$

**Power supply for accelerometers:** Only AC input coupling, 4 mA source current, + side of channel A or B

Max. operating voltage +18 V, open circuit voltage 24 V max.

**Overload display:** LED

**Test signal:** At frequency ranges from 100 to 2 kHz,

amplitude level: approx. -4 dBV, frequency: sine wave, 8% of range

#### Trigger

**Trigger modes:** Free run mode, manual trigger mode, external trigger mode, input signal trigger mode, automatic repeat trigger mode

**Trigger source:** Input signal trigger through channel A or B signal; external signal trigger by EXT signal

**Trigger level:**

Input signal trigger; Set by number keys with a resolution of 1/256 of amplitude range

External signal trigger; TTL, rising or falling edge can be selected (rear panel BNC connector)

**Trigger slope:** +, -,  $\pm$  (input signal trigger)

**Trigger position:** -128 K to +1 M sample, with 1 channel measurement

-64 K to +1 M sample, with 2 channel measurement

#### Averaging

**Frequency domain averaging modes:** Addition (SUM), subtraction (SUB), exponential function moving average (EXP), peak value detection (PEAK)

**Time domain averaging modes:** Addition (SUM)

**Delay domain averaging modes:** Addition (SUM)

**Amplitude domain averaging modes:** Addition (SUM)

**Number of averagings:** 1 to 32767

**Overlapping:** 0%, 50%, 75%, MAX

**Start/stop control:** Start, stop, +1, continue (except for servo mode) (erasing done automatically during start)

#### Measurement Modes

- Waveform measurement mode
- Spectrum measurement mode
- Time/frequency analysis mode
- Frequency response function measurement mode
- Servo analysis mode (R9211B/C)

#### Waveform Measurement Mode

**Measurement functions:**

Time domain instantaneous data, time domain average data, auto-correlation function, cross-correlation function, probability density function, cumulative distribution function

**Amount of analysis data:** 64 to 8192 points (1 channel), 64 to 4096 points (2 channels)

**Amount of delay domain data:** 64 to 2048 points

**Averaging:** Time domain averaging

Delay domain averaging

Amplitude domain averaging

**Conversion function:** Engineering units

**Marker analysis functions:** Peak value, rise time, fall time, pulse width, root-mean-square value

**Calculation functions:** Differentiation, integration, smoothing, trend elimination, basic arithmetic, pre-envelope

**Display functions:** Time/amplitude, amplitude/probability density, orbit

#### Spectrum Measurement Mode

**Measurement functions:** Complex spectrum, power spectrum, cross-spectrum, time waveform

**Averaging:** Frequency domain averaging

**Amount of analysis data:** 64 to 8192 points (1 channel)  
64 to 4096 points (2 channels)

**Frequency resolution:**

**Linear** 25 to 3200 lines (1 channel)  
25 to 1600 lines (2 channels)

**Log** 3 decades max., 80 lines/decade

**Other** 1/3 octave, 1/1 octave

**Window functions:** Rectangular, Hanning, minimum, flat-pass, force/response

\* With log frequency resolution and octave resolution, window functions are Hanning, minimum or rectangular

**Weighting:** A, B, C weighting, C message weighting

**Conversion functions:** Engineering units

**Marker analysis functions:** Peak marker, next peak marker, band marker, harmonics marker, sideband marker, overall power, partial power, average power, dispersion

**Calculation functions:** Basic arithmetic, pre-envelope, filtered spectrum, power cepstrum,  $j\omega$ ,  $1/j\omega$ , smoothing

**Display functions:** Frequency/amplitude, frequency/phase, frequency/real number component, frequency/imaginary number component, Nyquist diagram

#### Time/Frequency Analysis Mode

**Basic measurement functions:** Time waveform, complex spectrum, power spectrum, cross-spectrum

**Time/frequency analysis mode:** Level monitor, phase monitor, frequency monitor

**Averaging:** Frequency domain averaging

**Frequency resolution:**

**Linear** 25 to 800 lines

**Log** 3 decades max., 80 lines/decade

**Other** 1/3 octave, 1/1 octave

**Window functions:** Rectangular, Hanning, minimum, flat-pass, force/response

\* With log frequency resolution and octave resolution, windows functions are Hanning, minimum or rectangular

**Weighting:** A, B, C weighting, C message weighting

**Conversion functions:** Engineering units

**Marker analysis functions:** Peak marker, next peak marker, band marker, harmonics marker, sideband marker, overall power, attenuation power, partial power, average power, dispersion

**Calculation functions:** Basic arithmetic, pre-envelope, filtered spectrum, power cepstrum,  $j\omega$ ,  $1/j\omega$ , smoothing, cumulative level monitor

**Display functions:** Frequency/real number component, frequency/imaginary number component, frequency/amplitude, frequency/phase, Nyquist diagram, time/level, time/phase, time/frequency

#### Frequency Response Function Measurement Mode

**Measurement functions:**

Frequency response function, group delay, coherence function, power spectrum, phase spectrum, impulse response function, time waveform

**Averaging:** Frequency domain averaging

**Amount of analysis data:** 64 to 2048 points

**Frequency resolution:**

Linear, 25 to 800 lines

**Window functions:** Rectangular, Hanning, minimum, flat-pass, force/response

**Weighting:** A, B, C weighting, C message weighting

**Conversion functions:** Engineering units

**Marker analysis functions:** Peak marker, next peak marker, band marker, harmonics marker, sideband marker, overall power, partial power, average power, dispersion, + peak marker, - peak marker, X dB marker, shape factor marker, ripple marker

**Calculation functions:** Basic arithmetic, unwrapped phase,  $j\omega$ ,  $1/j\omega$ , reciprocal, impulse response, equalize, phase correction, COP (coherent output power)

**Display functions:** Frequency/amplitude, frequency/phase, frequency/real number component, frequency/imaginary number component, frequency/delay, frequency/associativity function, Nyquist diagram, Cole-Cole diagram, Nichols diagram

#### Servo Analysis Mode (R9211B/9211C)

**Measurement functions:**

Frequency response function, group delay, coherence function, power spectrum, cross-spectrum, time waveform

**Sweep modes:** Linear sweep, log sweep

**Signal source for servo measurement:** Linear/log sign sweep signal, linear multi-sign sweep signal, log multi-sign signal

**Output impedance:** 1  $\Omega$  max.

**Maximum output voltage:**

$\pm 15$  V (when output impedance is 1  $\Omega$  or less)

**Maximum output current:**

100 mA (when output impedance is 1  $\Omega$  or less)

**DC offset:**  $\pm 10$  V (0.1 V resolution)

**Summation amplifier:** Can be turned on or off

**Number of averagings:** Fixed or automatic

**Signal source bandwidth:** Fixed or automatic

**Frequency table servo function:** Measurement can be done by grouping together output waveform, output voltage, DC offset, measurement frequency range and number of averagings (20 groups max.)

Linear f table

Log f table

**Frequency resolution:**

**Linear** 25 to 800 lines

**Log** 1 to 6 decades (25 to 200 lines/decade)

However, setting of up to only 5 decades is possible at 200 lines.

**Conversion functions:** Engineering units

# Spectrum Analyzers

## Choice of 4 Types To Fit the Application

### R9211Series (Continued From Previous Page)

**Marker analysis functions:** Peak marker, next peak marker, band marker, harmonics marker, sideband marker, overall power, partial power, average power, dispersion, + peak marker, - peak marker, X dB marker, shape factor marker, ripple marker, open loop Bode diagram marker, open loop gain marker

**Calculation functions:** Basic arithmetic, unwrapped phase,  $j\omega$ ,  $1/j\omega$ , reciprocal, impulse response, equalize, phase correction, COP (coherent output power), open/closed loop conversion

**Display functions:** Frequency/amplitude, frequency/phase, frequency/real number component, frequency/imaginary number component, frequency/group delay, frequency/associativity function, Nyquist diagram, Cole-Cole diagram, Nichols diagram

#### Curve Fitting Function

Up to 20 groups of range poles and zeroes are sampled from frequency response function data

**Weighting:** Auto weight, uniform weight, user weight

**Conversion function:** Sampled range poles and zeroes can be converted to range poles and residue or polynomials

#### Synthesis Function

Frequency response function, impulse response and step response can be synthesized from sampled range poles and zeroes or values of entered range poles and zeroes.

**Signal generator (R9211B/9211C)** Except for servo analysis mode

**Output waveform:** Sine wave (spot), swept sign, multi-sign, impulse, random, user selected waveform (max. memory size: 64 K words)

**Maximum output voltage:**  $\pm 15$  V (at 1  $\Omega$  max. output impedance)

**Maximum output current:** 100 mA (at 1  $\Omega$  max. output impedance)

**DC offset:**  $\pm 10$  V (0.1 V resolution)

**Output impedance:** 1  $\Omega$  max., 50  $\Omega$ , 600  $\Omega$

**Output modes:** Continuous, internal, external, external gate, manual

**Taper function:** 200 ms max.

**Summation amplifier:** Can be turned on or off

**Running zoom function:** (R9211A/9211C)

When the stop frequency is less than 10 kHz, the minimum span is 10 mHz. When the stop frequency is 10 kHz or more, zoom analysis can be done with a minimum span of 100 mHz.

**Comparator Function (R9211C)**

**Setting modes:** Table mode, reference mode

**Table mode:** Up to 20 groups of comparative sections can be set

**Reference mode:** Comparator can be done against a reference waveform

**Target waveform:** Comparator can be done against frequency domain data

**Comparator results:**

- PASS/FAIL displayed on screen
- Buzzer
- Output from rear by TTL O/C

#### Display Specifications and Functions

**Display functions:** 8-inch raster scan CRT

**Engineering units:** Marker readout values and vertical axis scaling can be displayed as freely specified physical quantities

**Scaling:** Linear/log scaling, scaling can be done independently for each channel

**Units:** Up to any 2 characters among those specified can be set

**Display modes:** 1, 2, 3 or 4 screen display

**Overlapping display mode:** Data in the same domain or analysis range can be displayed in overlapping format

**Lattice display:** Can be turned on or off

**3-D display:** Up to 50 lines of the desired display data can be displayed in 3-D

**Bar display:** Overall power, partial power, average power or power dispersion can be shown as a bar display at the right edge of the CRT screen

**Labels:** Up to 40 alphanumeric or special characters can be displayed and moved up and down

**List modes:**

**Single mode** 20 spectrum frequency values and level values in the display can be selected by cursor and listed in a digital display

**Harmonics mode** When the basic spectrum is set by entering the values, the level values are listed in a digital display, and THD (total harmonic distortion) and THP (total harmonic power) are calculated and displayed.

**Sideband mode** When carrier frequency and modulated signal frequency are set by entering the values, the upper waveband and lower waveband power up to the 10th degree is calculated and displayed

**Horizontal axis:** Linear, log

**Vertical axis:** Can be freely set by entering the values

**Calendar/clock function:** Calendar (year/month/day) and hour/minutes display

**Memory function:**

	R9211E	R9211A	R9211B	R9211C
Memory (128 K words)	Standard	Standard	Standard	-
I/O + memory (1 M words)	Option 11	Option 11	Option 11	Standard
CMOS memory (1 M words)	Option 10	Option 10	Option 10	Option 10

**Transient waveform data memory:** In time/frequency analysis mode

**Panel memory:** Remembers panel settings (battery backup, settings last about 1 month)

#### Input/Output Functions

**GPIB interface:** Provided as standard

**Plotter output:** Direct plotting can be done with any ADVANTEST plotter with a GPIB interface, or a plotter with HPGL function and GPIB cable

**External sampling clock input:** BNC type, TTL level

**External trigger input:** BNC type, TTL level

**Sampling clock output:** BNC type, TTL level

**Trigger output signal:** BNC type, TTL level

#### Floppy Disk Drive

R9211E	R9211A	R9211B	R9211C
Option 06	Standard	Standard	Standard

**Type:** 3.5 inch micro floppy disk

**Media:** 2DD/2HD (automatically identified)

**Capacity:** 720 K/1.2 M bytes (when formatted)

**Format:** Can be converted to MS-DOS format

**File format:** Data file, view file, table file

**Data file operations:** List, create, erase, search, copy

#### I/O + Memory Function

R9211E	R9211A	R9211B	R9211C
Option 11	Option 11	Option 11	Standard

**Memory capacity:** 1 M words (2 M bytes)

**Digital input:** Digital input can be done with the internal A/D converter, or an external digital signal (max. sampling rate 256 kHz)

**Data format:** 16 bit + EOC signal (offset binary)

**Digital output:** Internal A/D converter data is output  
Data format: 16 bit + channel identifier signal + strobe signal  
(offset binary)

**Comparator output:** (R9211C) Comparator function output is possible using O/C output

#### CMOS Memory Function

R9211E	R9211A	R9211B	R9211C
Option 10	Option 10	Option 10	Option 10

1 M words (2 M bytes) battery backup memory

#### Thermal Printer

R9211E	R9211A	R9211B	R9211C
Option 07	Option 07	Option 07	Option 07

Hard copy of CRT screen

**Printing method:** Thermal line/dot method

**Dot configuration:** 640 dots/line

**Paper used:** A09075

**Paper width:** 114 mm

#### High speed calculation processor functions

R9211E	R9211A	R9211B	R9211C
—	Option 12	—	Standard

High speed numerical calculations

#### Running Zoom Analysis Function (R9211A/9211C)

When the stop frequency is less than 10 kHz, the minimum span is 10 mHz. When the stop frequency is 10 kHz or more, zoom analysis can be done with a minimum span of 100 mHz.

#### General Specifications

**Operating conditions:** Temperature +5 to +35°C, RH 80% max.

**Storage conditions:** Temperature -20 to +60°C

**Power supply:** Specify at time of ordering

Option no.	Standard	32	42	44
Power voltage (V)	90 to 110	103 to 132	198 to 242	207 to 250

48 to 66 Hz

**Power consumption:** Standard

R9211E	R9211A	R9211B	R9211C
140 VA max.	160 VA max.	170 VA max.	190 VA max.

**External dimensions:** Approx. 330 (W) × 177 (H) × 450 (D) mm

**Mass:** Main unit

R9211E	R9211A	R9211B	R9211C
12 kg max.	14 kg max.	14 kg max.	16 kg max.

#### Accessories

**Power Cable:** A01402 (one)

**Input Cables:** MI-77 (two)

T-Type Connector

**Accessories (Sold Separately)**

<b>A02804</b>	Front Cover
<b>R16211</b>	Carrying Case
<b>R16055</b>	Transit Case
<b>A02034</b>	Panel Mount Set
<b>A02255</b>	Rack Mount Set (JIS standard)
<b>A02455</b>	Rack Mount Set (EIA standard)