ADVANTEST®

Cross Domain Analyzers

U3841/3851/3872

World's first* vector signal analysis realized by two-channel phase synchronization!

*: In a single measurement equipment in a frequency range of 43 GHz (as of May 2011)

The Cross Domain Analyzer™ Debut !

The Cross Domain Analyzer U3800 Series is a vector and spectrum-signal analyzer with built-in two-channel RF input function. This is the industry's first metrology tool that enables comparative measurement/analysis of the signals from two channels on the basis of their time, amplitude, phase, and frequency domains by simultaneous and synchronized measurement.

This Cross Domain Analyzer has the following features and functions:

- **Two-channel RF input and wide frequency range**
- **The best-in-class time domain analysis bandwidth of 40 MHz**
- **Vector operation that allows composition/decomposition**

U3800 Series allow the users to easily measure and analyze multiplexed/mixed/interfered signals so that complex signal analyses that are conventionally difficult to perform, such as multipath analysis, electromagnetic field decomposition, and inter-circuit interference, can be carried out.

U3800 Series consists of analyzers applicable to a wide variety of fields such as broadcasting, telecommunication, and EMC.

A new field of RF measurement—
Concept of Cross Domain

"We want to freely compare two RF signals in different analytical domains so that measurement and comparison of two signals that change with time, such as those in transient phenomena, modulating waves, and EMC noise can be achieved by means of a vector operation." In order to satisfy such requirements, we have developed a measurement equipment that can easily measure, compare, and analyze true momentary signals, which is difficult in the case of conventional measurement equipments, by equipping it with a two-channel phase-locked loop vector measurement function and operation function.

U3800 Series supporting 9 kHz to 43 GHz

3 GHz Cross Domain Analyzer

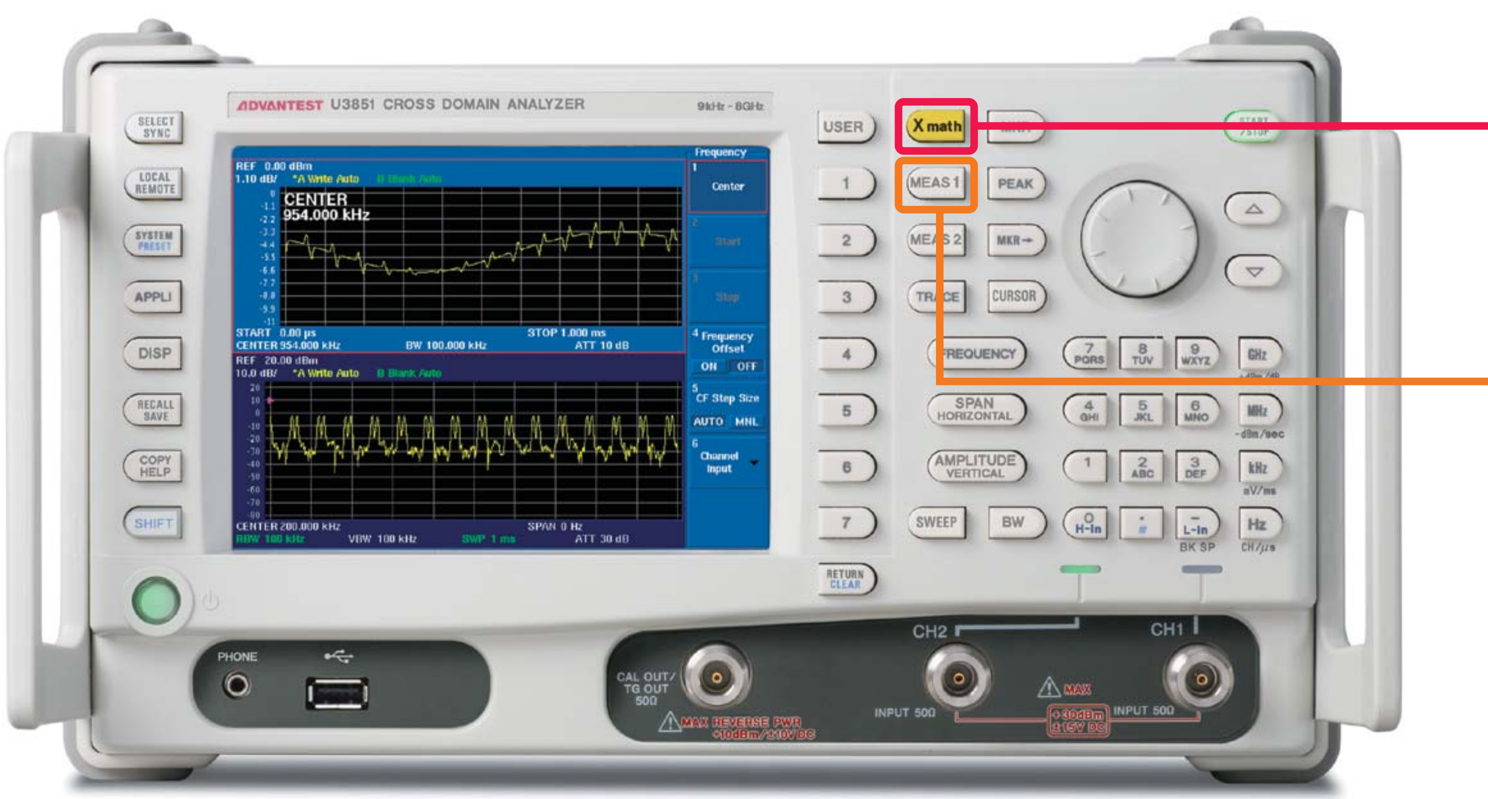
U3841 *Measurement frequency:* ***9 kHz to 3 GHz***

8 GHz Cross Domain Analyzer

U3851 *Measurement frequency:* ***9 kHz to 8 GHz***

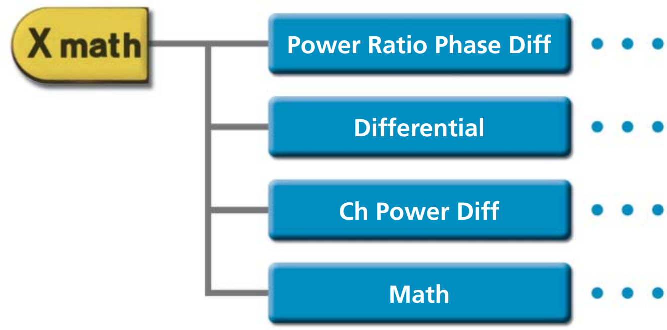
43 GHz Cross Domain Analyzer

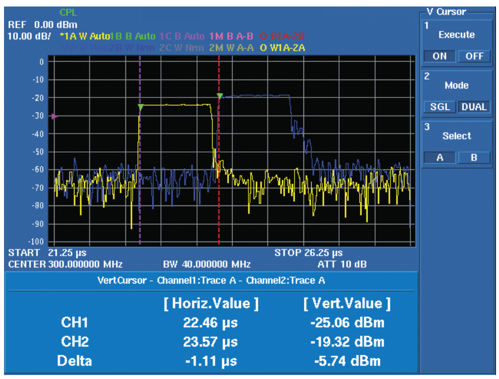
U3872 *Measurement frequency:* ***9 kHz to 43 GHz***



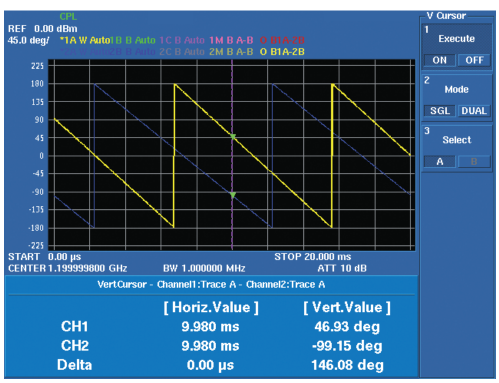
New Category Instrument

"X math function" allows vector operation of signals from two channels and facilitates comparative measurement by using an overlay function

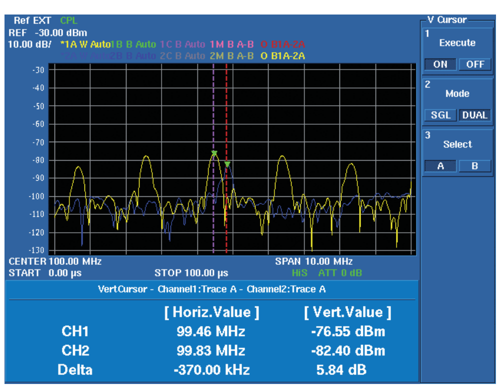




Overlay display: Power vs. time comparison of two signals



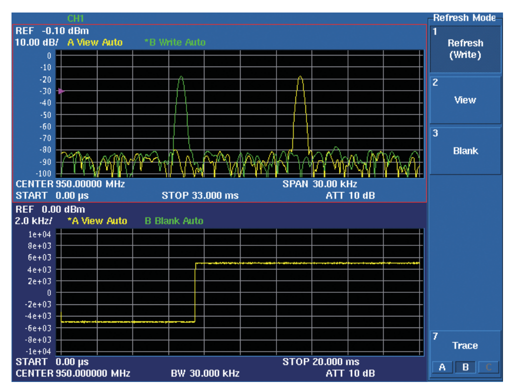
Overlay display: Phase vs. time comparison of two signals



Overlay display: FFT comparison of two signals

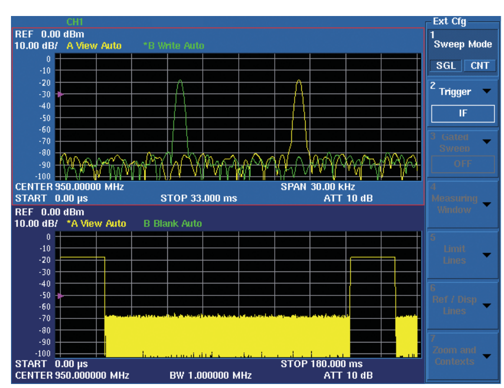
Basic time domain analysis function (maximum analysis bandwidth: 40 MHz)

Different analyses can be easily conducted, such as power vs. time, frequency vs. time, phase vs. time, time vs. I/Q, and FFT analysis, and displayed in any combination.



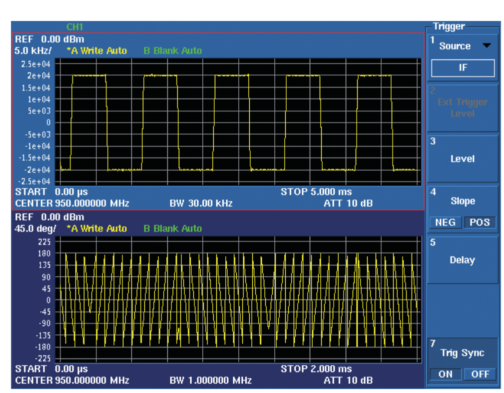
FFT analysis

Frequency vs. time analysis



FFT analysis

Power vs. time analysis



Frequency vs. time analysis

Phase vs. time analysis

Vector analysis

IQ waveform capture

Capture synchronization:	Trigger Synchronization, Phase Synchronization
Capture bandwidth (CBW):	100 Hz to 30 MHz, 1-3 steps, 40 MHz
Sampling rate:	500 Hz (CBW 100 Hz) to 65 MHz (CBW 40 MHz) (IQ pair data per sample)
Time resolution:	15.4 ns (CBW 40 MHz) to 2 ms (CBW 100 Hz)

Inter-channel balance:

Amplitude:	±2.0 dB
Phase:	±15 deg At 1 GHz (CBW 100 kHz/ms), with mixer input of -30 dBm, pre-amp off, CBW at center and after calibration.

Key performance of the U3800 Series

- World's first two-channel simultaneous/parallel measurement in the analysis bandwidth (maximum: 40 MHz)
- Vector comparison with high sensitivity and wide dynamic range (pre-amplifier equipped as standard)
- U3800 Series to support 9 kHz to 43 GHz of measurement frequencies
  3 GHz Cross Domain Analyzer U3841: 9 kHz to 3 GHz
  8 GHz Cross Domain Analyzer U3851: 9 kHz to 8 GHz
  43 GHz Cross Domain Analyzer U3872: 9 kHz to 43 GHz

U3841/3851 RF-part Specifications

Frequency

U3841:	9 kHz to 3 GHz
Pre-Amp:	10 MHz to 3 GHz
U3751:	9 kHz to 3.1 GHz (band 0), 3 GHz to 8 GHz (band 1)
Pre-Amp:	10 MHz to 8 GHz
Frequency reference stability	
Aging rate:	<±2 x 10^{-6}/year
Temperature stability:	<±2.5 x 10^{-6} (0 to 50°C)
Frequency span	
Range:	Zero span, 5 kHz to Full Freqency Sweep, 100 Hz to 40 MHz FFT, CBW step
Accuracy:	<±1%
Spectrum purity:	-85 dBc/Hz (offset 10 kHz, span ≤200 kHz)
Resolution bandwidth	
Range:	100 Hz to 3 MHz Frequency Sweep, 1-3 steps 1 Hz to 400 kHz FFT, CBW/100
Accuracy:	<±12%
Video bandwidth range:	10 Hz to 3 MHz (1-3 steps)

Sweep

Sweep time	
Setting range:	20 ms to 1000 s (spectrum mode) 50 µs to 1000 s (zero span)
Accuracy:	<±2%
Sweep mode:	Continuous, single, gated
Trigger source:	Free run, video, external, IF

Amplitude range

Measurement range:	Displayed average noise level to +30 dBm
Maximum safe input level:	Attenuator ≥10 dB
Pre-Amp OFF:	+30 dBm
Pre-Amp ON:	+13 dBm
U3841:	±50 VDC max.
U3851:	±15 VDC max.
Input attenuator range:	0 to 50 dB (10 dB steps)
Detection mode:	Normal, Positive peak, Negative peak, Sample, RMS, and Average

Amplitude accuracy

Calibration signal	
Frequency:	20 MHz
Level:	-20 dBm
Accuracy:	±0.3 dB
Level measurement accuracy:	After automatic calibration, image suppression OFF, pre-amp OFF, at temperature 20 to 30°C, input attenuator 10 dB, reference level 0 dBm, input signal level -10 dBm
U3841:	±1.0 dB (9 kHz to 3 GHz) ±0.8 dB (10 MHz to 3 GHz)
U3851:	±1.5 dB (9 kHz to 10 MHz) ±0.8 dB (10 MHz to 3.1 GHz) ±1.0 dB (3.1 GHz to 8 GHz)

Dynamic range

Displayed average noise level:	Frequency ≥10 MHz, reference level <-45 dBm, at RBW 100 Hz
U3841:	Frequency 10 MHz to 3 GHz
Pre-Amp OFF:	-123 dBm + 2f (GHz) dB (f < 2.5 GHz) -123 dBm + 2.5f (GHz) dB (f ≥ 2.5 GHz)
Pre-Amp ON:	-138 dBm + 3f (GHz) dB
U3851:	Frequency 10 MHz to 8 GHz
Pre-Amp OFF:	-123 dBm + 2f (GHz) dB (f ≤ 3.1 GHz, band 0) -122 dBm + 1.2f (GHz) dB (f ≥ 3 GHz, band 1)
Pre-Amp ON:	-138 dBm + 3f (GHz) dB (f ≤ 3.1 GHz, band 0) -139 dBm + 1.4f (GHz) dB (f ≥ 3 GHz, band 1)
1 dB gain compression	
U3841:	Frequency ≥20 MHz
Pre-Amp OFF:	>-5 dBm
Pre-Amp ON:	>-25 dBm
U3851:	Frequency ≥20 MHz
Pre-Amp OFF:	>-8 dBm
Pre-Amp ON:	>-25 dBm
Third order intermodulation distortion	
U3841:	<-60 dBc (Pre-Amp OFF, mixer input level -20 dBm, frequency >10 MHz, 2-signal separation >200 kHz)
U3851:	<-50 dBc (Pre-Amp OFF, mixer input level -20 dBm, frequency 10 MHz to 8 GHz, 2-signal separation >200 kHz)
Image/Multiple/Out-of-band response	
U3841:	<-60 dBc (Mixer input level -20 dBm)
U3851:	<-60 dBc (Mixer input level -30 dBm, Image suppression ON)
Residual response:	Frequency >10 MHz, pre-Amp OFF
U3841:	<-80 dBm
U3851:	<-80 dBm

RF input

Connector:	N-type female
Impedance:	50 Ω (nominal)
VSWR	
U3841:	<1.5 : 1
U3851:	<1.7 : 1 (10 MHz ≤ Frequency ≤ 3.0 GHz)
	<2.0 : 1 (Frequency >3.0 GHz)

Calibration signal output

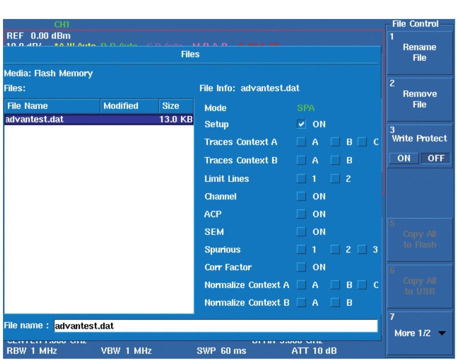
Connector:	N-type female
Impedance:	50 Ω (nominal)
Frequency:	20 MHz
Level:	-20 dBm

Front-panel interface

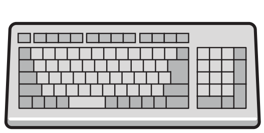
Audio output:	Small monophonic jack
USB:	USB 1.1

A USB interface that is useful for storing data and editing files.

Since the USB interface is provided at the front, USB accessories can be easily connected. This feature is very useful for organizing and storing data, and for editing files for the given measurement condition setting.



USB memory



Keyboard

Common Options

OPT.76 Tracking generator (50 Ω, 3 GHz)

Frequency range:	100 kHz to 3 GHz
Frequency offset	
Range:	0 to 1 GHz
Resolution:	1 kHz
Accuracy:	±300 Hz
Output level range:	-5 to -60 dBm (0.5 dB steps)
TG leakage:	≤-80 dBm (Input attenuator 0 dB)
Output impedance:	50 Ω (nominal)
Maximum allowable level:	+10 dBm, ±10 VDC

OPT.77 Tracking generator (50 Ω, 6 GHz)

Frequency range:	100 kHz to 6 GHz
Output level range:	-5 to -30 dBm (0.5 dB step)
TG leakage:	≤-80 dBm (Input attenuator 0 dB)
Output impedance:	50 Ω (nominal)
Maximum allowable level:	+10 dBm, ±10 VDC

OPT.20 High-stability frequency reference source

Aging rate:	$\pm 2 \times 10^{-8}$/day
	$\pm 1 \times 10^{-7}$/year
Warm-up drift:	$\pm 5 \times 10^{-8}$ (+25°C, 10 minutes after power-on)
Temperature stability:	$\pm 5 \times 10^{-8}$ (0 to +40°C, with reference to 25°C)

OPT.28 EMC filter

6 dB bandwidth:	200 Hz, 9 kHz, 120 kHz, 1 MHz
Bandwidth accuracy:	<±10%
Detection mode:	Normal, Positive peak, Negative peak, Sample, RMS, Average, and QP

U3872 RF-part Specifications

Frequency

Frequency range	
L-input	
Frequency range:	9 kHz to 8 GHz
Frequency band:	9 kHz to 3.1 GHz (band 0)
	3.0 GHz to 8.0 GHz (band 1)
Pre-Amp:	10 MHz to 8 GHz
H-input	
Frequency range:	10 MHz to 43 GHz
Frequency band:	10 MHz to 3.1 GHz (band 0, N = 1)
	3.0 to 8.0 GHz (band 1, N = 1)
	7.8 to 14.573 GHz (band 2, N = 2)
	14.4288 to 28.0 GHz (band 3, N = 4)
	27.8 to 43.0 GHz (band 4, N = 6)
Frequency reference stability	
Aging rate:	<±2 x 10^{-6}/year
Temperature stability:	<±2.5 x 10^{-6} (0 to 50°C)
Frequency span	
Range:	Zero span, 5 kHz to Full Freqency Sweep, 100 Hz to 40 MHz FFT, CBW step
Accuracy:	<±1%
Spectrum purity:	(-85 + 20 LogN) dBc/Hz, at offset 10 kHz, span ≤200 kHz
Resolution bandwidth	
Range:	100 Hz to 3 MHz Frequency Sweep, 1-3 steps
	1 Hz to 400 kHz FFT, CBW/100
Accuracy:	<±12%
Video bandwidth range:	10 Hz to 3 MHz (1-3 steps)

Sweep

Sweep time	
Setting range:	20 ms to 1000 s (spectrum mode)
	50 μs to 1000 s (zero span)
Accuracy:	<±2%
Sweep mode:	Continuous, single, gated
Trigger source:	Free run, video, external, IF

Amplitude range

Measurement range	
L-input:	Displayed average noise level to +30 dBm
H-input:	Displayed average noise level to +10 dBm
Maximum safe input level	
L-input	
Pre-Amp OFF:	+30 dBm (attenuator ≥10 dB)
Pre-Amp ON:	+13 dBm (attenuator 0 dB), ±15 VDC max.
H-input:	+10 dBm (attenuator 0 dB), ±25 VDC max.
Input attenuator range	
L-input:	0 to 50 dB (10 dB steps)
H-input:	0 to 30 dB (10 dB steps)
Detection mode:	Normal, Positive peak, Negative peak, Sample, RMS, and Average

Amplitude accuracy

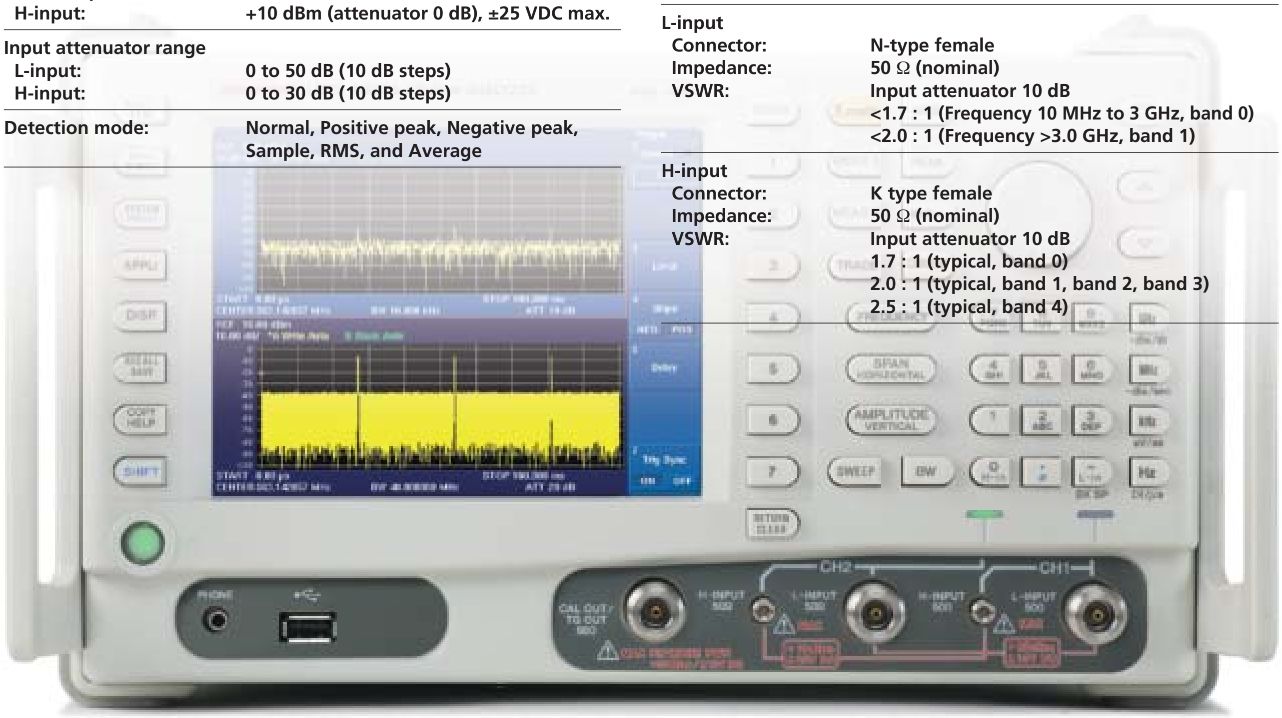
Calibration signal	
Frequency:	20 MHz
Level:	-20 dBm
Accuracy:	±0.3 dB
Level measurement accuracy:	After automatic calibration, image suppression OFF, pre-amp OFF, at temperature 20 to 30°C, input attenuator 10 dB, reference level 0 dBm, input signal level -10 dBm
L-input:	Band 0: ±0.8 dB (frequency: 10 MHz to 3.1 GHz)
	Band 1: ±1.0 dB (frequency: 3.1 to 8 GHz)
	±1.5 dB (frequency: 9 kHz to 10 MHz)
H-input:	Band 0: ±0.8 dB (frequency: 10 MHz to 3.1 GHz)
	Band 1: ±1.0 dB (frequency: 3.1 to 8 GHz)
	Band 2: ±3.0 dB (frequency: 7.8 to 14.573 GHz)
	Band 3: ±3.5 dB (frequency: 14.4288 to 28.0 GHz)
	Band 4: ±4.5 dB (frequency: 27.8 to 43 GHz)

Dynamic range

Displayed average noise level:	Frequency ≥10 MHz, reference level <-45 dBm, at RBW 100Hz
L-input	
Pre-Amp OFF:	Band 0: -123 dBm + 2f (GHz) dB
	Band 1: -122 dBm + 1.2f (GHz) dB
Pre-Amp ON:	Band 0: -138 dBm + 3f (GHz) dB
	Band 1: -139 dBm + 1.4f (GHz) dB
H-input:	Band 0: -121 dBm + 2f (GHz) dB
	Band 1: -120 dBm + 1.5f (GHz) dB
	Band 2: -111 dBm (typical: -118 dBm)
	Band 3: -109 dBm (typical: -117 dBm)
	Band 4: -105 dBm (typical: -112 dBm)
1 dB gain compression:	At frequency ≥10 MHz
Pre-Amp OFF:	>-8 dBm
Pre-Amp ON:	>-25 dBm
Third order intermodulation distortion:	-50 dBc (frequency >10 MHz, pre-amp OFF, mixer input level -20 dBm, 2-signal separation >1 MHz)
Image/Multiple/ Out-of-band response:	<-60 dBc (mixer input level -30 dBm, image suppression ON, span <5 GHz)
Residual response:	-80 dBm (frequency >10 MHz, pre-amp OFF)

RF inputs (CH1/2)

L-input	
Connector:	N-type female
Impedance:	50 Ω (nominal)
VSWR:	Input attenuator 10 dB
	<1.7 : 1 (Frequency 10 MHz to 3 GHz, band 0)
	<2.0 : 1 (Frequency >3.0 GHz, band 1)
H-input	
Connector:	K type female
Impedance:	50 Ω (nominal)
VSWR:	Input attenuator 10 dB
	1.7 : 1 (typical, band 0)
	2.0 : 1 (typical, band 1, band 2, band 3)
	2.5 : 1 (typical, band 4)



Rear-panel Interface Specifications

Frequency reference input	
Connector:	BNC female
Impedance:	50 Ω (nominal)
Frequency:	10 MHz
Level:	-2 to +16 dBm
Frequency reference output	
Connector:	BNC female
Impedance:	50 Ω (nominal)
Frequency:	10 MHz
Level:	>0 dBm
External trigger input	
Connector:	BNC female
Impedance:	10 kΩ (nominal), DC coupling
Level:	0 to +5 V
External trigger output	
Connector:	BNC female
Level:	+3.3 V (CMOS)
IF output:	IF output from CH1 only
Connector:	BNC female
Impedance:	50 Ω (nominal)
Frequency:	21.4 MHz, 97.5 MHz one of two frequencies, depending on resolution bandwidth, capture bandwidth and capture synchronization mode.
GPIB:	IEEE-488 bus connector
USB:	USB 1.1
Video output:	VGA (D-sub15 pin female)
LAN:	RJ45 type, 10/100 base-T

General Specifications

Operating environment range:	Ambient temperature: 0 to +50°C Humidity: RH 85% or less (no condensation)
Storage environment range:	-20 to +60°C, RH 85% or less
AC power input:	Automatic switching to 100 VAC or 220 VAC 100 VAC: 100-120 V, 50/60 Hz 200 VAC: 220-240 V, 50/60 Hz
Power consumption:	150 VA or less
Mass:	10 kg or less (excluding options)
External dimensions (W x H x D):	Approx. 308 x 175 x 339 mm (not including protruding parts) Approx. 337 x 190 x 437 mm (including the handle and feet)

Ordering Information

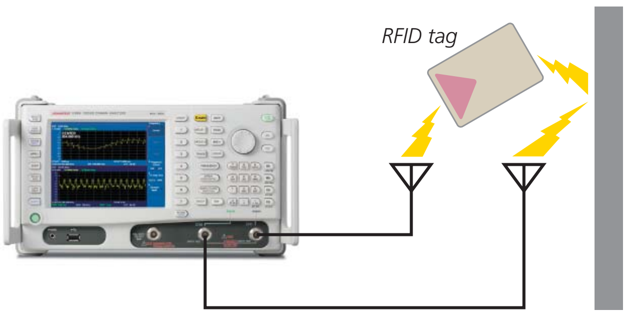
Main units	
3 GHz Cross domain analyzer:	U3841
8 GHz Cross domain analyzer:	U3851
43 GHz Cross domain analyzer:	U3872
Options	
High-stability frequency reference source:	OPT.20
EMC filter:	OPT.28
Tracking generator (3 GHz):	OPT.76
Tracking generator (6 GHz):	OPT.77

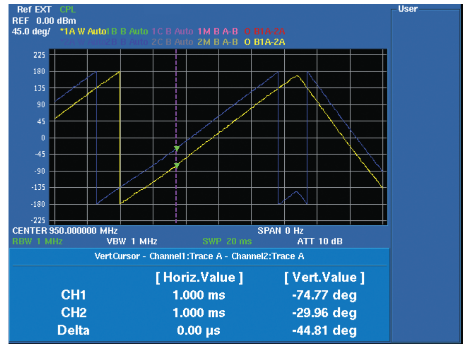
Please be sure to read the product manual thoroughly before using the products.
Specifications may change without notification.

Offering new solutions

RFID near-field multipath measurement

The near-field multipath components between RFIDs and the reader are measured by CH1 and CH2, respectively, and the time difference (phase difference) is analyzed.



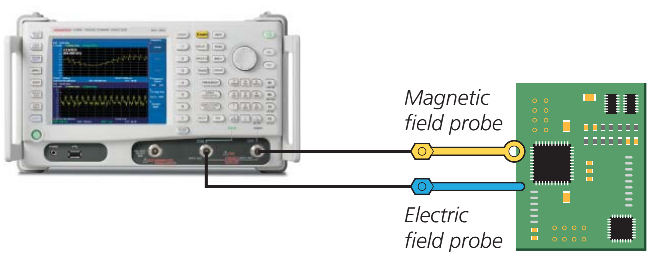


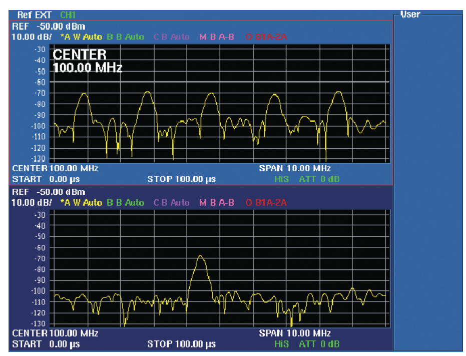
Measurement of phase difference (time difference) of 1/2 path

Example 1: RFID near-field multipath measurement

Measurement of electromagnetic field radiation from the electronic component surface

Connect the magnetic field probe to CH1 and the electric field probe to CH2 and measure the radiation from electronic and IC components in both the electric and magnetic field levels.





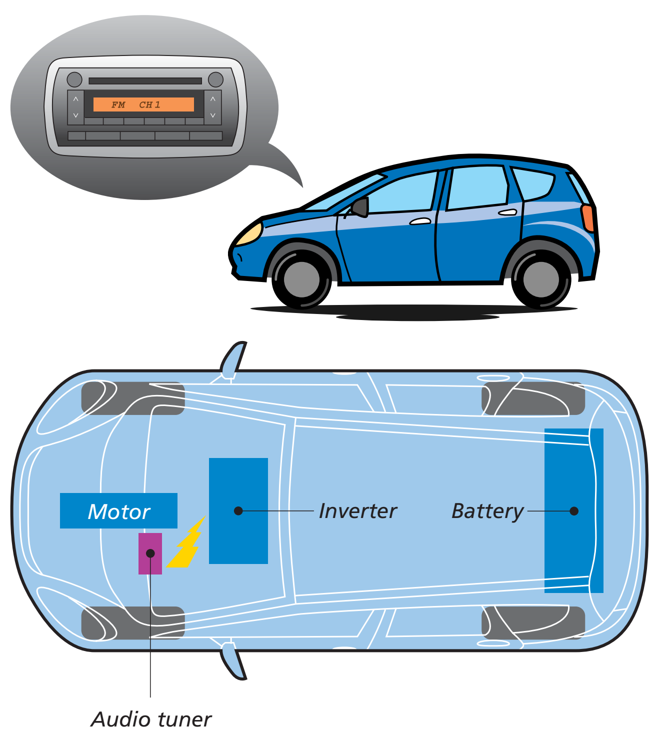
Magnetic field radiation from the electronic component surface

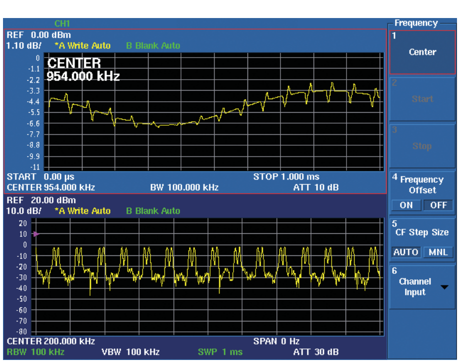
Electric field radiation from the electronic component surface

Example 2: Electromagnetic field radiation measurement from the electronic component surface

Analysis of interference to broadcast radio caused by inverters of EV vehicles

Inverters for electric vehicles operate with high-voltage switching, which affects the operation of electronic components in vehicles.For example, if the clock component etc., of the inverters are superimposed on the AM radio broadcast waves as noise for some reason, connect the RF input signal from AM radio broadcast waves to CH1 and the inverter clock signal to CH2 to measure how the clock noise is superimposed on the broadcast signals.





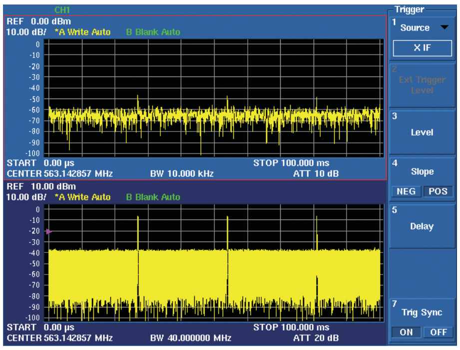
Inverter noise superimposed on broadcast waves

Inverter clock

Example 3: Analysis of interference to broadcast radio caused by inverters of EV vehicles

Module signal interference of mobile phones

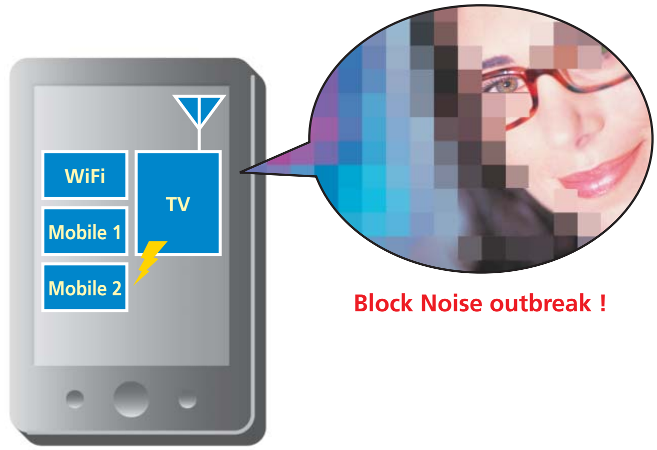
Mobile phones consist of many functional modules, and the signal interference among those modules may create some problems. For example, if block noise is seen on the TV screen of a mobile phone, connect the RF input signal of terrestrial digital tuner module to CH1 and the suspected module signal to CH2, to measure how the noise affects the signal. By setting CH2 as a trigger, the noise superimposed on the broadcast wave of CH1 can be measured.



Local signal inside the mobile phone superimposed on broadcast waves

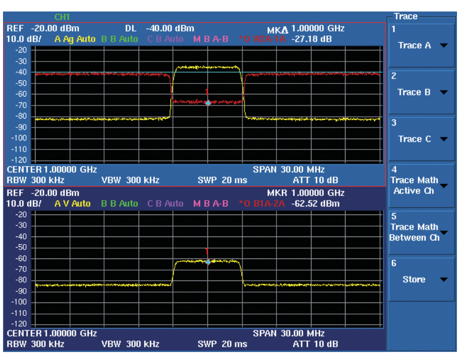
Local signal inside mobile phones

Example 4: Measurement of module signal interference of mobile phones



Measurement of cross-polarization discrimination (XPD) in satellite/microwave relay

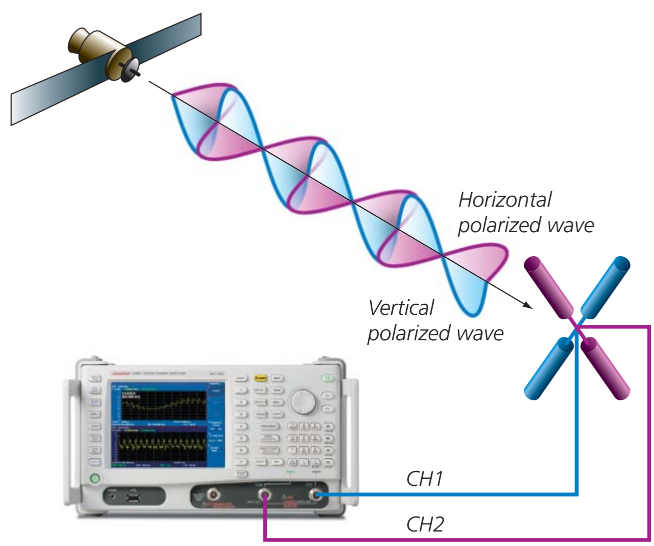
In satellite/microwave relay, vertical polarized waves and horizontal polarized waves are transmitted on the same frequency for efficient use of radio bandwidth. By the simultaneous measurement of vertical polarized waves and horizontal polarized waves input to CH1 and CH2, respectively, the quality of polarized multiplexed waves can be easily measured, including XPD.



Horizontal polarized wave signal and XPD (difference between the vertical and horizontal polarized waves)

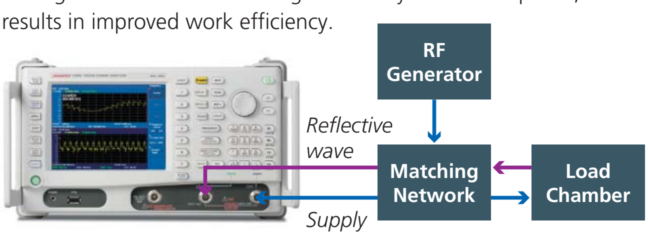
Vertical polarized wave signal

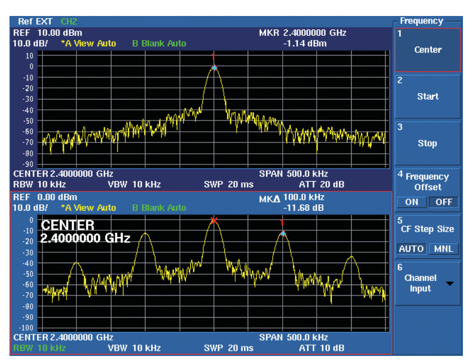
Example 5: Measurement of cross-polarization discrimination (XPD) in microwave communication



Matching measurement of plasma device etc., which use a high-frequency power source.

Plasma devices used for the production of semiconductors, solar panels, LCD panels, etc., are required to efficiently transmit RF power from a high-frequency power source to its plasma chamber through a matching network. Use of the Cross Domain Analyzer allows the monitoring of the phase/amplitude of the actual transmitted signal and the reflective signal with synchronized phase, which results in improved work efficiency.





Supply signal

Reflective wave

Example 6: Measurement of a 2.4-GHz high-frequency power source signal and reflective wave http://www.advantest.co.jp

ADVANTEST CORPORATION
Shin-Marunouchi Center Building, 1-6-2 Marunouchi, Chiyoda-ku, Tokyo 100-0005, Japan Phone: +81-3-3214-7500

 Printed in Japan Bulletin No.U3841/3851/3872-SI2E-222 Mar. '12 S