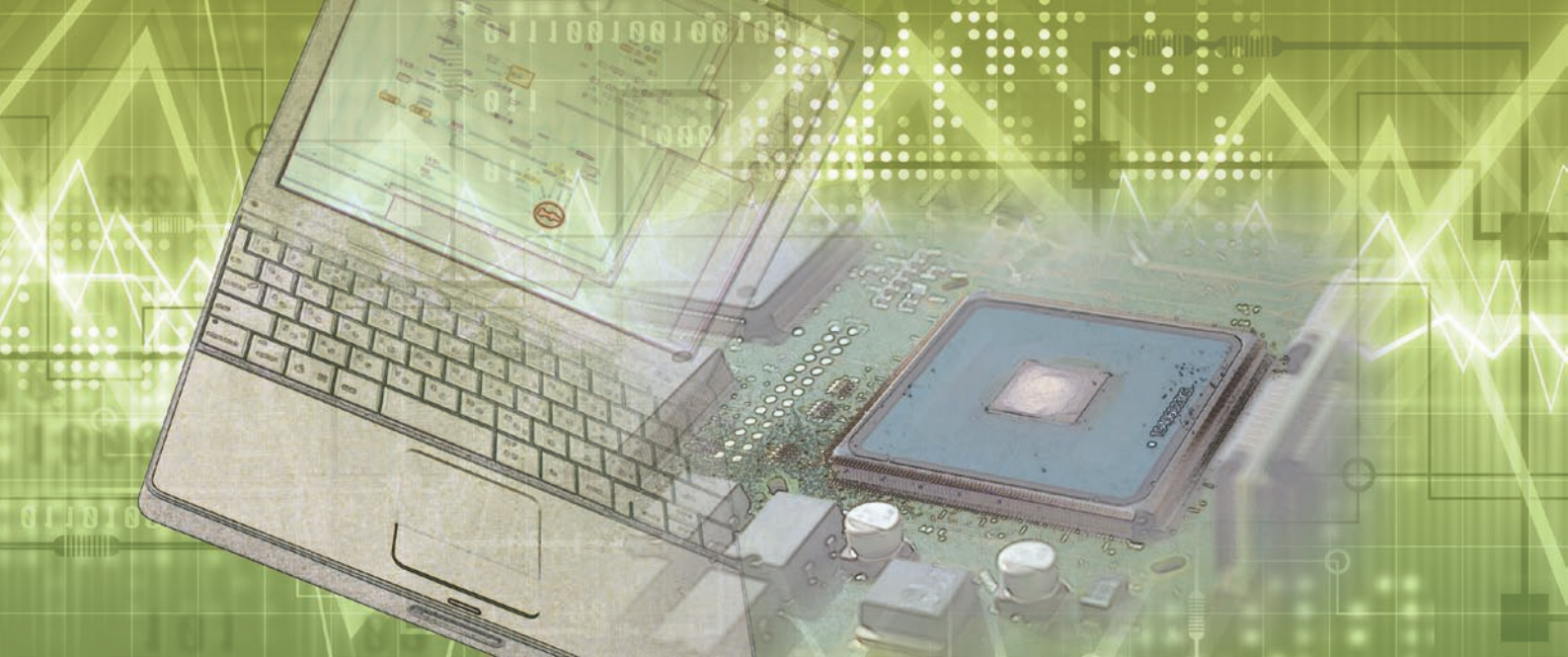


For MS2690A/MS2691A/MS2692A Signal Analyzer

# DigRF 3G RFIC Measurement Solution

- MS269xA-020 Vector Signal Generator
- MS269xA-040 Baseband Interface Unit
- MX269040A UMTS Measurement Software for RF DeviceTest
- MX269041A Digital I/F Control Software for DigRF2.5G/3G

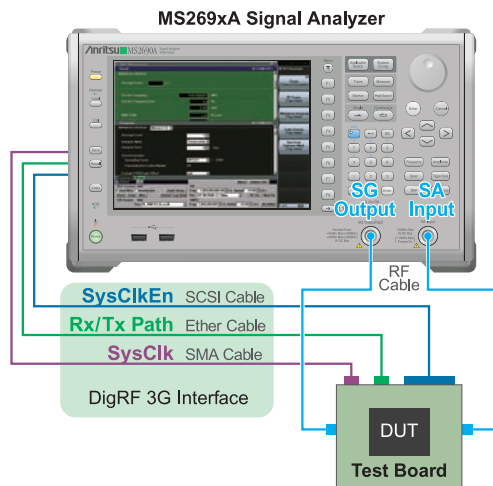




# One-Box Solution for Efficient RFIC Digital and RF Evaluation

The Next Generation of RFIC Testing is here today. The MS2690A/MS2691A/MS2692A Signal Analyzer can be configured as a One-Box Tester to support the evaluation of digital and RF functions of RFICs that support the DigRF v3.09 standard. By adding options to the Spectrum Analyzer, Signal Analyzer, and Digitizing functions of the MS2690A/MS2691A/MS2692A Signal Analyzer, a compact RFIC Tester can be created. Both setup time and RFIC analysis time can be reduced when the Signal Generator and the Baseband Interface Board are added to the main frame. Analysis software is available for all current 3GPP standards, including GSM, EDGE, W-CDMA, HSDPA, and HSUPA. The RFIC is controlled using List Files created by the Sequence Editor Software that is provided with the RFIC Test Options. List Files can be saved and used again and again. While tests are running, they can be interrupted to change parameters or issue commands on the fly.

## DigRF 3G RFIC Measurement Setup



## Outstanding Basic Performance

**Signal Analyzer**  
 Average Noise Level:  $-155$  dBm/Hz (2 GHz)  
 TOI:  $+22$  dBm  
 ACLR (W-CDMA):  $-78$  dBc (5 MHz)  
 General Level Accuracy:  $\pm 0.5$  dB (50 Hz to 6 GHz)

**Signal Generator**  
 Absolute Level Accuracy:  $\pm 0.5$  dB  
 Linearity:  $\pm 0.2$  dB (typ.)  
 ACLR (W-CDMA):  
 $\leq -64$  dBc (5 MHz offset)  
 $\leq -67$  dBc (10 MHz offset)

# DigRF 3G RFIC

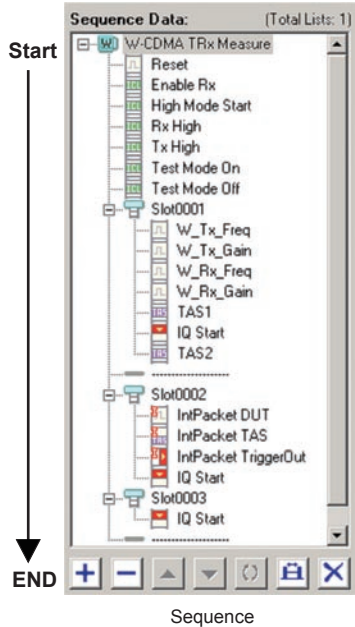
## MX269040A/MX269041A



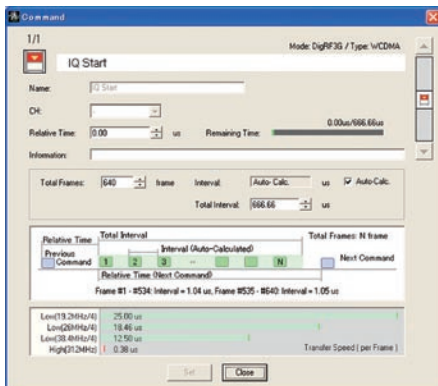


## Sequence Editor Function Simplifies RFIC Control

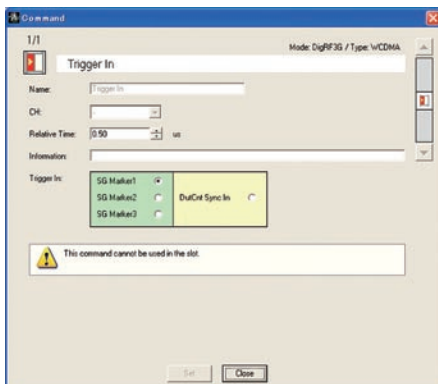
The Digital I/F Control Software for the MX269041A DigRF 2.5G/3G has a sequence editor function to simplify DigRF-supported RFIC control and measurement. The intuitive GUI simplifies use of DUT control commands, measurement timing, and addition, deletion and editing of triggers for controlling external equipment. This is especially useful for reducing the burden of creating test cases.



Sequence



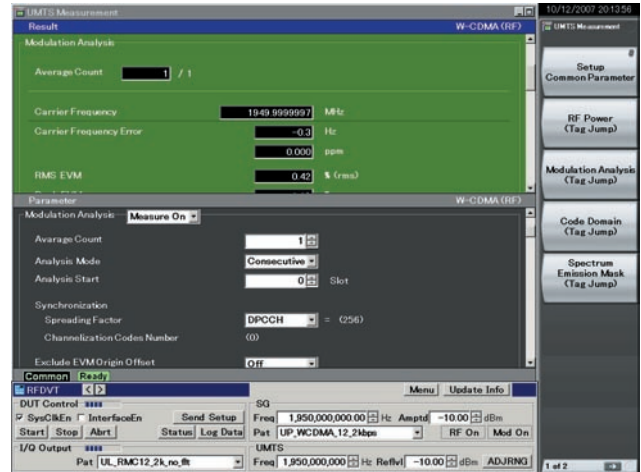
Command Editing



Trigger Editing

## Main Frame Software Provides a Single Screen for Test Setup and Results

Integrated software on the main frame allows signal analyzer, signal generator, and DigRF interface control with a single screen. Results of the testing are posted on the same screen. Imagine how efficient testing can be when results are displayed on the same screen that is used for setup.

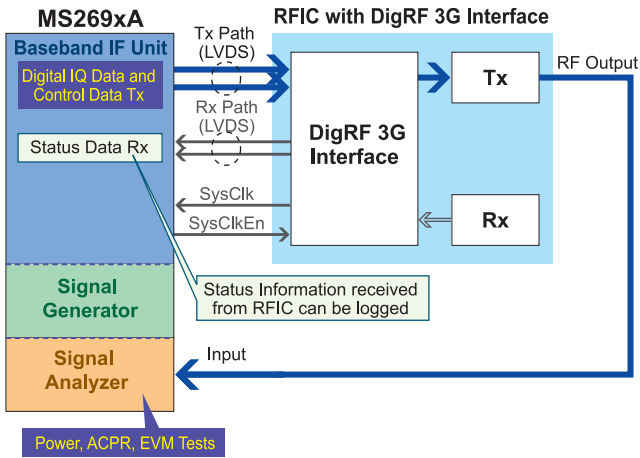


## RFIC Status Information Monitor

Logging data such as a status information (capture time, header and payload data) sent from RFIC to BBIC can be monitored/saved with 100-ns resolution. The frequency lock-up time and RSSI can be checked.

No.	Time Stamp [ms]	PS	LCT	CTS	#0	#4	#8	#12	#16	#20	#24	#28	#32
1	0.010	0	0010	1	0101	0101	0101	0101	0101	0101	0101	0101	0101
2	0.020	0	0010	1	1010	1010	1010	1010	1010	1010	1010	1010	1010
3	0.030	0	0010	1	1111	1111	1111	1111	1111	1111	1111	1111	1111
4	0.040	0	0010	1	0001	0001	0001	0001	0001	0001	0001	0001	0001
5	0.050	0	0010	1	0001	0001	0001	0001	0001	0001	0001	0001	0001
6	0.060	0	0010	1	0011	0011	0011	0011	0011	0011	0011	0011	0011
7	0.070	0	0010	1	0101	0101	0101	0101	0101	0101	0101	0101	0101
8	0.080	0	0010	1	1010	1010	1010	1010	1010	1010	1010	1010	1010
9	0.090	0	0010	1	1111	1111	1111	1111	1111	1111	1111	1111	1111
10	0.110	0	0010	1	0001	0001	0001	0001	0001	0001	0001	0001	0001
11	0.120	0	0010	1	0011	0011	0011	0011	0011	0011	0011	0011	0011
12	0.130	0	0010	1	0101	0101	0101	0101	0101	0101	0101	0101	0101
13	0.140	0	0010	1	1010	1010	1010	1010	1010	1010	1010	1010	1010
14	0.150	0	0010	1	1111	1111	1111	1111	1111	1111	1111	1111	1111
15	0.170	0	0010	1	0001	0001	0001	0001	0001	0001	0001	0001	0001
16	0.180	0	0010	1	0011	0011	0011	0011	0011	0011	0011	0011	0011
17	0.190	0	0010	1	0101	0101	0101	0101	0101	0101	0101	0101	0101
18	0.200	0	0010	1	1010	1010	1010	1010	1010	1010	1010	1010	1010

## RFIC Transmitter Tests



### W-CDMA and HSPA Transmitter Testing

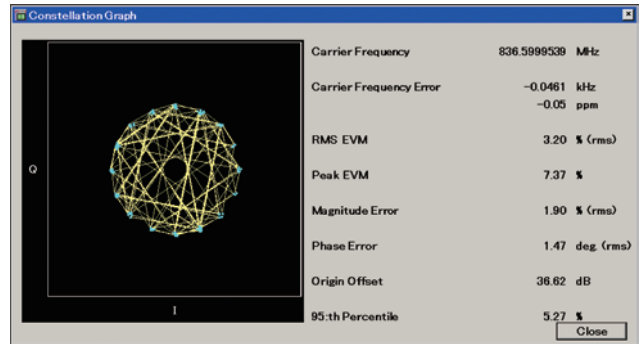
- Maximum Transmit Power
- Frequency Error
- Minimum Transmit Power
- Occupied Bandwidth
- Spectrum Emission Mask
- Adjacent Channel Power
- Spurious Emission
- EVM
- Peak Code Domain Error

### GSM and EDGE Transmitter Testing

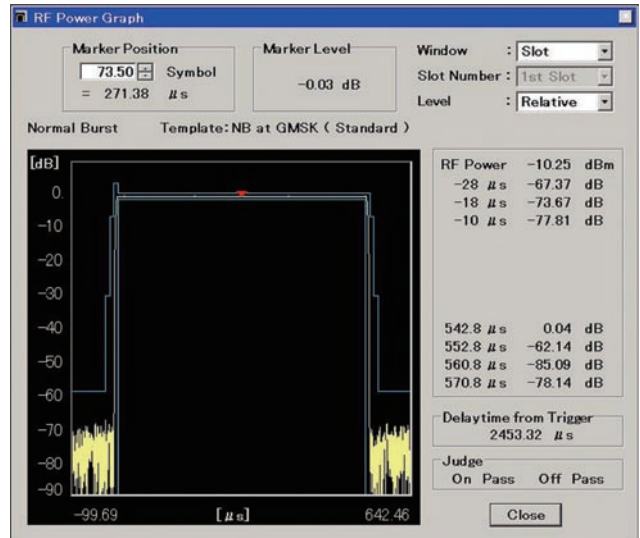
- Transmit Power
- Phase Error (Max. Peak/Max. RMS)
- EVM (EVM Peak/RMS 95%)
- Frequency Error
- Origin Offset
- Modulation Spectrum
- Switching Tangent
- Power/Time Mask
- Spurious Emissions

## GSM/EDGE Transmitter Testing

Various measurements, such as Constellation, Power vs. Time, and Output RF Spectrum, required for GSM/EDGE Tx tests can be performed easily.



Constellation



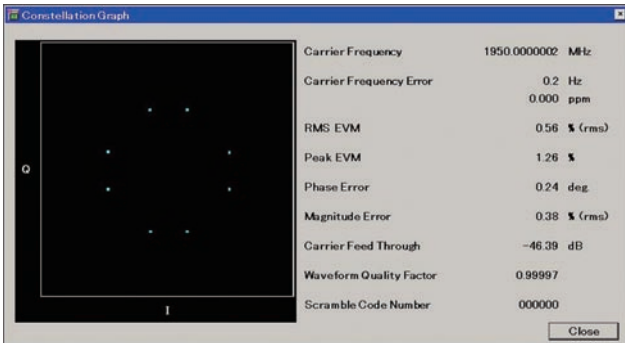
Power vs. Time



Output RF Spectrum

## W-CDMA/HSPA Transmitter Testing

Various measurements, such as Constellation, Code Domain, and Spectrum Emission Mask, required for W-CDMA/HSPA Tx tests can be performed easily.



Constellation

The Code Domain window displays a table with the following columns: No., CH, SF, Abs.(dBm), Rel.(dB), Err.(dB), and Rho. The data for the first channel is as follows:

No.	CH	SF	Abs.(dBm)	Rel.(dB)	Err.(dB)	Rho
1.	16	64	-11.53	-1.09	-67.26	0.77880
2.	---	---	---	---	---	---
3.	---	---	---	---	---	---
4.	---	---	---	---	---	---
5.	---	---	---	---	---	---
6.	---	---	---	---	---	---
7.	---	---	---	---	---	---
8.	---	---	---	---	---	---
9.	---	---	---	---	---	---
10.	---	---	---	---	---	---
11.	---	---	---	---	---	---
12.	---	---	---	---	---	---
13.	---	---	---	---	---	---
14.	---	---	---	---	---	---
15.	---	---	---	---	---	---
16.	---	---	---	---	---	---

Code Domain

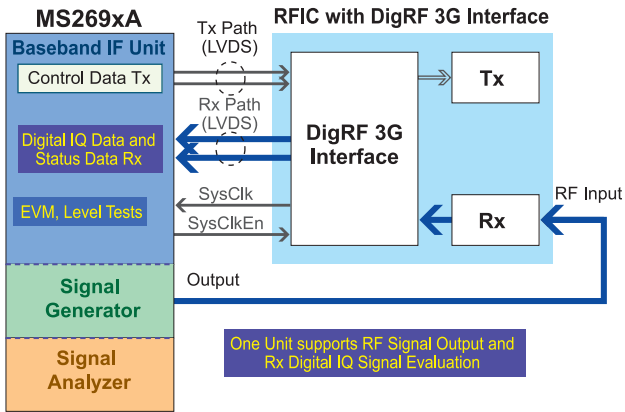
The Spectrum Emission Mask window displays a table with the following columns: Absolute (dBm), Relative (dB), Judge, and Mask. The data for various frequency bands is as follows:

Frequency Band	Absolute (dBm)	Relative (dB)	Judge	Mask
-12.5 to -8.5 MHz	-59.37	-59.29	Pass	-49.00 dB
-8.5 to -7.5 MHz	-59.77	-59.69	Pass	-39.00 dB
-7.5 to -6.5 MHz	-52.06	-51.98	Pass	-35.00 dB
-6.5 to -2.5 MHz	-61.32	-61.24	Pass	-35.00 dB
2.5 to 3.5 MHz	-55.41	-55.33	Pass	-35.00 dB
3.5 to 7.5 MHz	-55.41	-55.33	Pass	-35.00 dB
7.5 to 8.5 MHz	-58.91	-58.83	Pass	-39.00 dB
8.5 to 12.5 MHz	-58.15	-58.07	Pass	-49.00 dB

Spectrum Emission Mask



## RFIC Receiver Tests

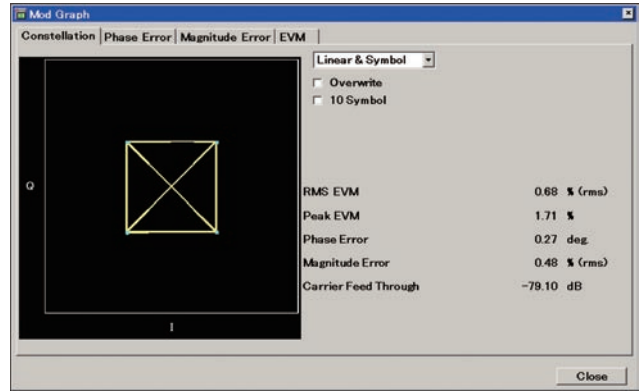


### GSM, EDGE, W-CDMA, and HSPA Receiver Testing

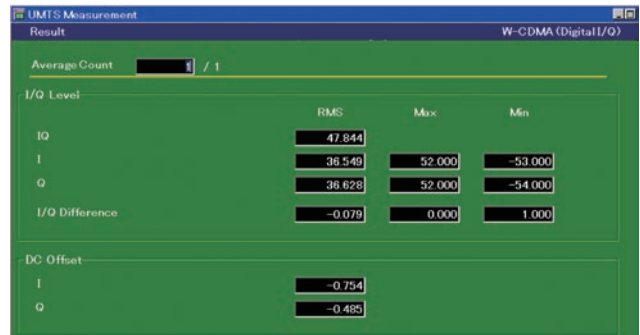
- I/Q Level
- RMS
- Peak
- Average
- $\sqrt{I^2 + Q^2}$
- EVM
- BER
- S/N
- Digital I/Q Data
- Time Domain Display
- Spectrum Display

## Digital IQ Signal EVM, S/N, and BER\* Measurements

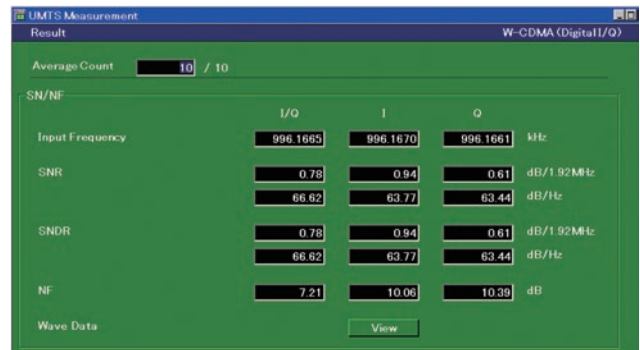
Various measurements required for RFIC Rx tests, such as EVM, IQ Level, S/N, and BER of digital IQ signals can be performed easily.



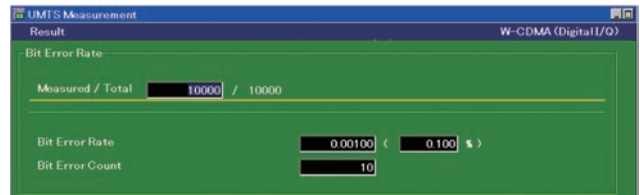
Constellation



I/Q Level



S/N

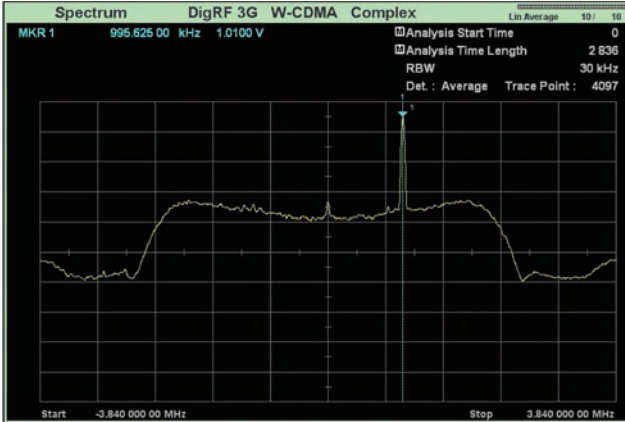


BER

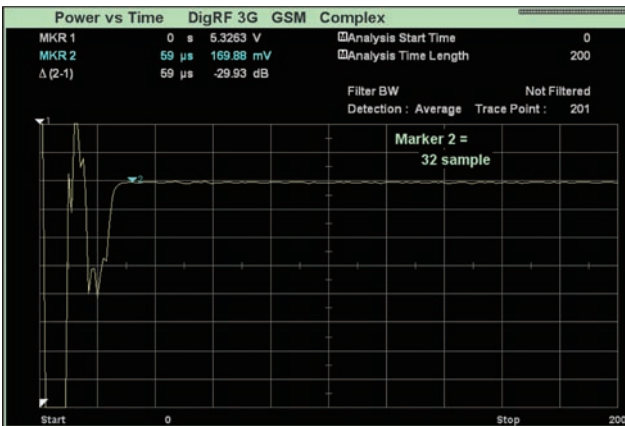
\*: Error-free BER measurements

## Monitoring Digital IQ Signal Transients

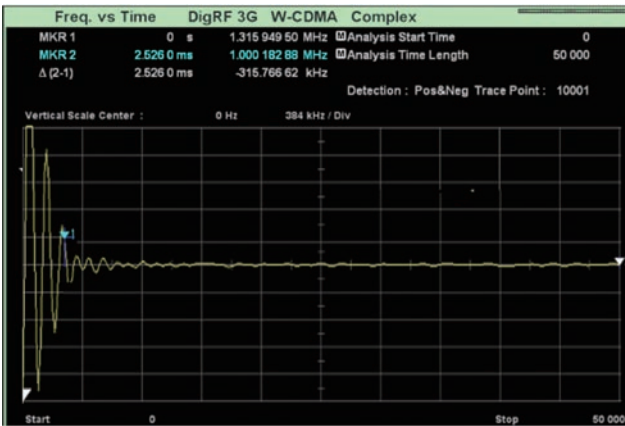
Spectrum, Power vs. Time, and Frequency vs. Time can be measured for digital IQ signals. The Presence of spurious, Rising power response, and Lock-up time at frequency switching can be observed.



Spectrum



Power vs. Time



Frequency vs. Time

## Specifications

### • W-CDMA/HSDPA/HSUPA Modulation Signal Analysis Function (Uplink)

At 18° to 28°C, after calibration and range adjustment

Modulation/Frequency Measurement	Measurement Frequency Range: 50 MHz to 3 GHz Measurement Level Range: -30 to +20 dBm (Average Power) Modulation Accuracy (Residual EVM): < 1% (rms)
Code Domain Analysis	Measurement Frequency Range: 50 MHz to 3 GHz Measurement Level Range: -30 to +20 dBm (Average Power) Code Domain Power Accuracy: For Signal not including Origin Offset ±0.1 dB (Code Power ≥ -10 dBc, Spreading Factor = 256) ±0.15 dB (Code Power ≥ -30 dBc, Spreading Factor = 256) Code Domain Error Residual Error: < -40 dB (Spreading Factor = 4) Accuracy: ±0.75 dB (Error for -40 dBc)
Amplitude Measurement	Measurement Frequency Range: 50 MHz to 3 GHz Measurement Level Range: -80 to +20 dBm (Average Power) Measurement Level Accuracy: ±0.8 dB (≥ -50 dBm)
Spectrum Emission Mask Measurement	Measurement Frequency Range: 50 MHz to 3 GHz Measurement Level Range: -10 to +20 dBm (Average Power) Measurement Range: -70 dB/30 kHz (≥ 2.515 MHz Offset)

Measurement Signal Conditions

- W-CDMA: RMC 12.2 kbps Signal (3GPP 34.121 C2.1)
- HSDPA: 3GPP 34.121 C10.1-compliant Continuous Wave Signal
- HSUPA: 3GPP 34.121 C11.1-compliant Continuous Wave Signal

### • GSM/EDGE Modulation Signal Analysis Function (Uplink)

At 18° to 28°C, after calibration and range adjustment

Modulation/Frequency Measurement	Measurement Frequency Range: 50 MHz to 3 GHz Measurement Level Range: -30 to +20 dBm (Average Power) Modulation Accuracy Residual EVM (EDGE): < 1% (rms) Residual Phase Error (GSM): < 0.5 deg (rms), < 2 deg (Peak)
Amplitude Measurement	Measurement Frequency Range: 50 MHz to 3 GHz Measurement Level Range: -50 to +20 dBm (Average Power) Measurement Level Accuracy: ±0.8 dB (≥ -50 dBm) Power Measurement at Carrier Off: On/Off ratio ≥ 65 dB (≥ -10 dBm) Results Display: RF Power, On/Off Ratio Text, Template (Pass/Fail) Multiple Slots: 4 Continuous Slots, Supports 8-PSK/GMSK Mixture Graph Display: Slot, Frame, Rising, Falling
Output RF Spectrum	Measurement Frequency Range: 50 MHz to 3 GHz Measurement Level Range: -10 to +20 dBm (At CW) Measurement Range Modulation: ≤ -60 dB (≥ ±250 kHz Offset) ≤ -73 dB (≥ ±400 kHz Offset) Switching Transients: ≤ -60 dB (≥ ±400 kHz Offset)



### • W-CDMA/HSDPA Digital I/Q Modulation Signal Analysis Function (Downlink)

I/Q Level Measurement	Measurement Range: -128.000 to +127.000 Results Display: Display Max. Level, Min. Level, RMS Level, $\sqrt{I^2 + Q^2}$
I/Q DC Offset	Measurement Range: -128.000 to +127.000 Results Display: I DC Offset, Q DC Offset
I/Q EVM	Modulation Methods: W-CDMA/HSDPA Results Display: EVM, Phase Error, Magnitude Error, Carrier Feed Through, Waveform Quality Factor, Scramble Code Number
I/Q Code Domain Analysis	Results Display: Code Domain Power, Code Domain Error
I/Q S/R	Results Display: Input Frequency, SNR, SNDR, NF, Spectrum
I/Q BER	Results Display: Bit Error Rate, Bit Error Count
Data Save	Choose save data from 10, 100, 1000, 10000, 50000 frames Trigger Signal Sync. and Digital I/Q Data Capture

Measurement Signal Conditions

- HSDPA is H-Set1 Continuous Signal

### • GSM/EDGE Digital I/Q Modulation Signal Analysis Function (Downlink)

I/Q Level Measurement	Measurement Range: -32,768,000 to +32,767,000 Results Display: Display Max. Level, Min. Level, RMS Level, $\sqrt{I^2 + Q^2}$
I/Q DC Offset	Measurement Range: -32,768,000 to +32,767,000 Results Display: I DC Offset, Q DC Offset
I/Q Phase Error, I/Q EVM	Results Display (GSM): Phase Error, Magnitude Error Results Display (EDGE): EVM, Magnitude Error, Phase Error, Origin Offset, 95th Percentile
I/Q S/R	Results Display: Input Frequency, SNR, SNDR, NF, Spectrum
I/Q BER	Results Display: Bit Error Rate, Bit Error Count
Data Save	Choose save data from 10, 100, 1000, 10000, 50000 frames Trigger Signal Sync. and Digital I/Q Data Capture

### • DigRF Interface Function

Tx Path/Rx Path Signal	Connector: RJ45 ANSI/TIA/EIA-644-A Compliant Tx Path: Supports Low Speed (SysClk/4), High Speed (312 Mbps) Rx Path: Supports Low Speed (SysClk/4), Medium Speed (SysClk), High Speed (312 Mbps)
SysClk Signal	Connector SMA (J) CMOS 3.3 V Single-end Signal Choose from 19.2, 26, or 38.4 MHz Input/Output Switching SysClk Output Signal Phase Noise Characteristics (typ., at 28°C) Offset 1 kHz: -123 dBc/Hz Offset 10 kHz: -133 dBc/Hz Offset 100 kHz: -138 dBc/Hz SysClk Output Signal Non-harmonic/Non-sub harmonic Spurious Level: $\leq -80$ dBc (Offset Frequency <100 kHz)
SysClkEn/InterfaceEn Signal	Connector: mini-SCSI 68 pin CMOS 3.3 V Single-end

### • Trigger Function

Trigger In/Out	Connector: D-sub 9 pin Trigger Out: TTL 5 V, Four Trigger Output Trigger In: TTL 5 V, One Trigger Input
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# Ordering Information

These products are software option for the MS2690A/MS2691A/MS2692A Signal Analyzer.

Please specify the model/order number, name and quantity when ordering.

The names listed in the chart below are Order Names. The actual name of the item may differ from the Order Name.

Model/Order No	Name
MS2690A MS2691A MS2692A	<b>– Main Frame –</b> Signal Analyzer (50 Hz to 6.0 GHz) Signal Analyzer (50 Hz to 13.5 GHz) Signal Analyzer (50 Hz to 26.5 GHz)
J0017F P0031A Z0541A J1408A	<b>– Standard Accessories –</b> Power Cord (2.6 m, 100 Vac, 3 core, gray) USB Memory (256 MB USB2.0 Flash Drive) USB Mouse SCSI-3 Mini Straight Cable (5 m) Install CD-ROM (Application Software, Operation Manual CD-ROM)
MS269xA-020 MS269xA-040	<b>– Hardware Options –</b> Vector Signal Generator Baseband Interface Unit
MX269040A MX269041A	<b>– Software Options –</b> UMTS Measurement Software for RF DeviceTest Digital I/F Control Software for DigRF2.5G/3G
Z1029A Z1029B J1417A J1406A J1407A J1408A W3130AE W3003AE W3004AE W3005AE W3006AE W3007AE W3008AE W3016AE W3028AE W3115AE W3116AE	<b>– Application Parts –</b> Signal Translator (for connecting main frame using three connector types: RJ45, SMA-J, SCSI) Signal Translator (for connecting main frame via J1417A I/O Box) I/O Box (integrates three connector IFs (RJ45, SMA-J, SCSI) into one RJ45 connector) SCSI-3 Mini Straight Cable (1 m) SCSI-3 Mini Straight Cable (3 m) SCSI-3 Mini Straight Cable (5 m) MS2690A/MS2691A/MS2692A-040 Baseband Interface Unit Operation Manual MX269040A Operation Manual (W-CDMA Operation) MX269040A Operation Manual (GSM/EDGE Operation) MX269040A Operation Manual (General Remote Control) MX269041A Operation Manual (BBIF Operation) MX269041A Operation Manual (BBIF Remote Control) MX269041A Operation Manual (IQ Pattern/DUT Control Producer) MX269041A Operation Manual (General Software for RF Device Test) Z1029A Signal Translator Operation Manual Z1029B Signal Translator Operation Manual J1417A I/O Box Operation Manual



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