Agilent
ESA-E Series Spectrum Analyzers GSM with EDGE Measurement Personality

Technical Overview with Self-Guided Demonstration

Option BAH – GSM/GPRS
Option 252 – EDGE Upgrade to GSM/GPRS

Quickly and accurately test your next-gen transmitter in the lab, in the field, or on the manufacturing line with the EDGE upgrade to the GSM measurement personality on the ESA-E Series spectrum analyzer.

Key Features

- One-button automated GSM/GPRS/EDGE measurements
- Polar vector and constellation displays for GSM and EDGE
- Phase error, magnitude error and EVM vs. time plots to isolate error mechanisms
- Multi-slot measurement capability
- Cable fault location capability
- Automatic carrier frequency and band selection
- Built-in context sensitive help
- Specified performance after 5 minute warm-up time

Agilent Technologies

Test Your EDGE Enabled GSM and GPRS Transmitter Quickly, Easily and Accurately

With increased demand for wireless data services, like Internet connectivity and multimedia, service providers are beginning to widely deploy EDGE (Enhanced Data Rates for GSM Evolution). This enhances the popular GSM (Global System for Mobile Communications) cellular standard, by introducing a new modulation scheme that allows theoretically higher data rates in the same frequency spectrum. This solution is attractive to service providers because it allows them to provide value to customers without having to purchase additional licenses for 3G deployment.

The Agilent ESA-E Series offers mid-performance spectrum analysis up to 26.5GHz [1], combining powerful one-button measurements and the industry's most versatile feature set in a rugged, portable, affordable package. Expand the ESA to include GSM and EDGE measurement capability by ordering the EDGE upgrade (Option 252) to the GSM/GPRS measurement personality (Option BAH).

For R&D bench

For design purposes, the ESA provides a more affordable alternative to the PSA Series high performance spectrum analyzer. The PSA offers industry leading accuracy and dynamic range, with the ESA offering great value on a general-purpose spectrum analysis platform.

Manufacturing

For manufacturing needs, the E4406A, a vector signal analyzer is an affordable solution for the fastest throughput in high volume production applications. For bench repair in the rework loop, the ESA is a great general-purpose tool for in-depth trouble-shooting and fault diagnosis.

Field installation and maintenance

For installation and maintenance, the ESA provides one-button standards compliant measurements in a rugged portable package. With pass/fail functionality and best in class general-purpose spectrum analysis, the ESA will ensure that you meet your performance goals accurately, easily and quickly in the most demanding environmental conditions.

ESA E-Series spectrum analyzer

One-button measurements and the industry's most versatile feature set in a rugged, portable, affordable package.

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Figure 1. GSM and EDGE features.

1. 325 GHz with external mixing.

Demonstration Preparation

All demonstrations use the ESA-E Series and the ESG vector signal generator (E4438C). The keystrokes surrounded by [ ] indicate hard keys, while key names surrounded by {} indicate soft keys located on the right edge of the display.

To perform the following demonstrations, you will need:

Product type:	Model number:	Required options[1]:
ESA-E Series spectrum analyzer	E4402B/04B/05B/07B	Available via COM express analyzer configuration, B7D – DSP and fast ADC hardware, B7E[2] – RF communications HW, 1D5 – high stability frequency reference, 1D6 – time gating
ESG vector signal generator	E4438C	001 or 002 – baseband generator, 402 – TDMA personalities

Since EDGE is essentially spectrum and time-slot compatible with GSM, most of the same transmitter measurements are required – some differ only in terms of specified limits. Whenever a measurement is specific to either standard, it will be prefixed by the appropriate name.

Connect the hardware as follows:

1. Using a 50 Ω RF cable, connect the RF Output 50 Ω port on the ESG to the RF INPUT 50 Ω port on the ESA as shown in figure 2.
2. Using a second 50 Ω RF cable, connect the 10 MHz OUT on the ESG to the EXT REF IN[3] on the ESA-series spectrum analyzer.
3. Using a third short 50 Ω RF cable, connect the 10 MHz OUT jack on the digital demodulation board to the 10MHz REF IN on the RF deck.
4. Using a fourth 50 Ω RF cable, connect the EVENT 1 out from the ESG to the Gate Trig/Ext Trig Input of the ESA.

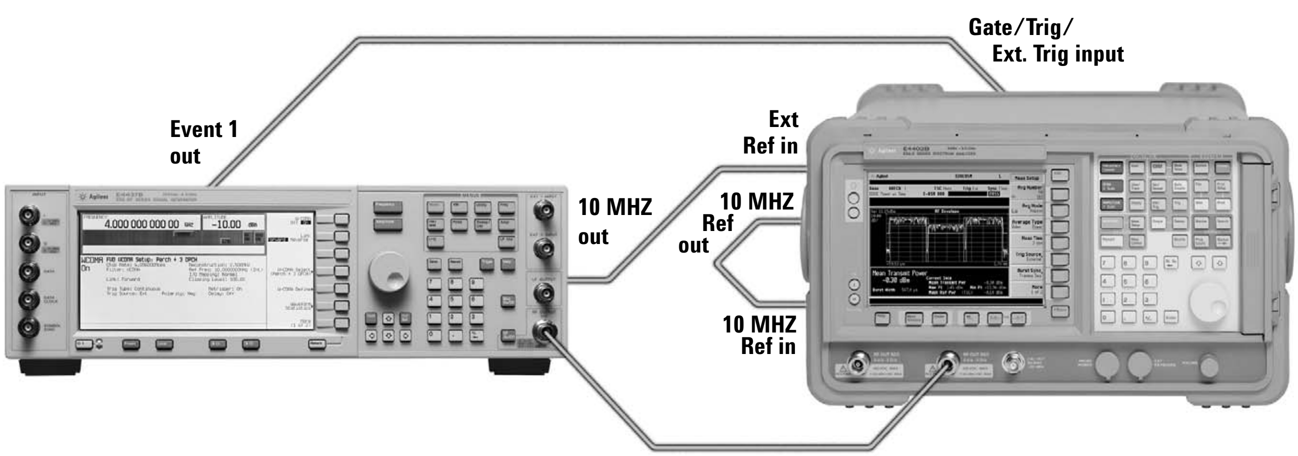


Figure 2. Connection diagram for GSM and EDGE measurements.

1. Please see page 13 for recommended configurations and measurement dependencies.
2. RF communications hardware (ID 117 or higher required for RF burst carrier triggering on EDGE signals). The ID number can be found by pressing [System] {Mode 1 of 3} {Show Hardware} on the ESA.
3. The ESA has the flexibility to use an internal frequency reference or an external one ranging from 1 to 30 MHz.

Switch to the GSM with EDGE measurement personality

Spectrum analyzers can make many different types of measurements. The GSM with EDGE measurement personality, one of many modes that the ESA-E Series can be operated in, makes a cost-effective way to expand the capability of an essential engineering tool.

Setup a GSM signal for analysis

The ESA has built-in frequency plans for all major GSM bands. You can manually setup a measurement or have the ESA locate the strongest GSM/EDGE signal to automatically set the RF channel frequency, absolute RF channel number (ARFCN) and band.

A cost-effective way to expand the capability of an essential engineering tool.

Monitor band or spectrum

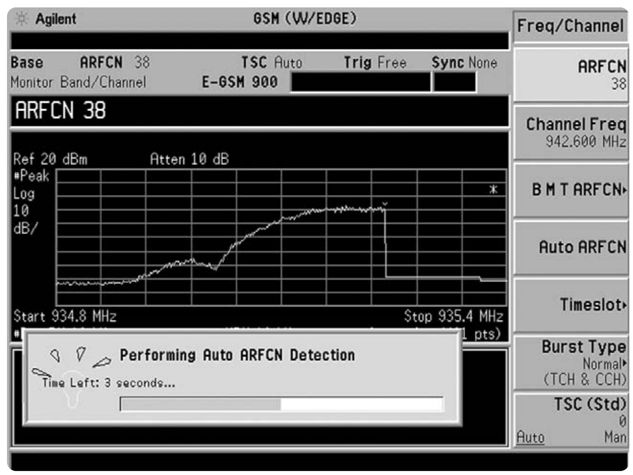
The performance of a transmitter is critical in a number of areas. In-channel performance refers to the link quality seen by a specific user. Out of channel measurements determine how much interference the user causes other GSM and EDGE users sharing a band. The default starting measurement, monitor band & monitor spectrum allows an engineer to quickly determine if there are any interfering signals within the transmission and reception bands or channels. The built-in AM and FM demodulation functionality on the ESA allows one to identify interfering signals that may be the result of AM/FM transmitters.

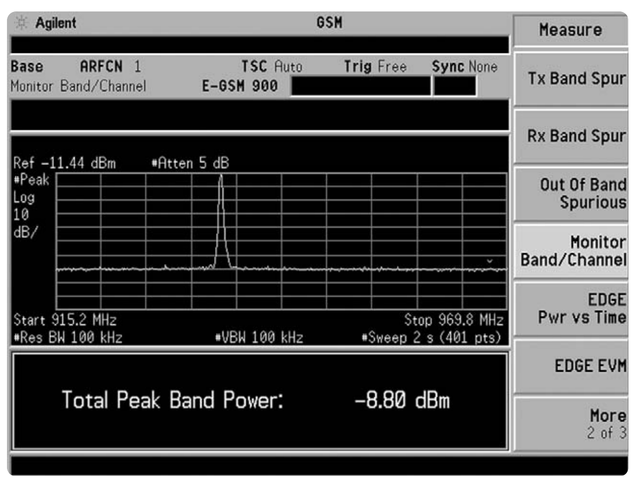
Instructions on ESA	Keystrokes
Switch to the GSM with EDGE measurement personality.	[Preset] [Mode] {GSM w/EDGE}

Instructions on ESG	Keystrokes
Generate a framed GSM.	[Preset] [Mode] {Real Time TDMA} {GSM} {Data Format: Pattern/Framed} {GSM Off/On}
Set the frequency band to *E-GSM for the downlink.*	[Frequency] {More (1 of 2)} {Freq Channels} {Freq Channels: Off/On} {Channel Band} {GSM/EDGE Bands} {E-GSM Base}
Set the amplitude to -10 dBm and turn the RF carrier on.	[Amplitude] [+/-] [10] {dBm} [RF On/Off]

Instructions on ESA	Keystrokes
Set the ESA to the extended GSM (E-GSM) mode.	[Mode Setup] {Radio} {E-GSM} {Device: BTS/MS}
Set the channel to ARFCN 1.	[FREQUENCY] {ARFCN} [1] [Enter]
Alternative approach for automatic band selection.	[Auto ARFCN]

Figure 3. Automatic carrier frequency and band selection to simplify measurements.





GMSK and EDGE power versus time

Output power is a fundamental transmitter characteristic and is linked directly to range. GSM and EDGE systems have to ensure that each link is maintained sufficiently with a minimum of power. This ensures that overall system interference is kept to a minimum and battery life is maximized. Additionally, in GSM and EDGE systems, transmitters must ramp their power up and down within a strictly defined time division multiple access structure, to prevent adjacent time-slot interference, loss of data at the beginning of the burst or unnecessary spectral splatter. Because of these considerations, standards specify that the envelope of a burst in the time domain fit a tightly prescribed mask.

The ESA has one-button measurements to allow measurement of the constant RF envelope of a GSM burst or the EDGE envelope, which exhibits amplitude modulation due to its modulation format. The applied masks are all standards compliant with pass/fail functionality for quick and easy verification of performance.

The measurement has flexible views with a:

- ‘Monitor mode’ which allows you to quickly visualize relative time-slot positioning
- ‘Rise and Fall’ view which allows you to analyze the performance of the burst modulator
- “On Burst” which allows you to focus on the modulated part of the burst to identify errors like amplitude droop due to amplifier thermal effects and modulation problems

All of these views can be zoomed for an even closer analysis.

Instructions on ESA	Keystrokes
Measure power versus time mask (Figure 4).	[MEASURE] {GMSK Pwr vs. Time}
View the rising and falling parts of the burst and then zoom on just the falling parts of the burst (Figure 5).	[View/Trace] {Rise and Fall} [Next Window] [Zoom]
View the ”on part” of the burst (Figure 6).	[View/Trace] {On Burst}

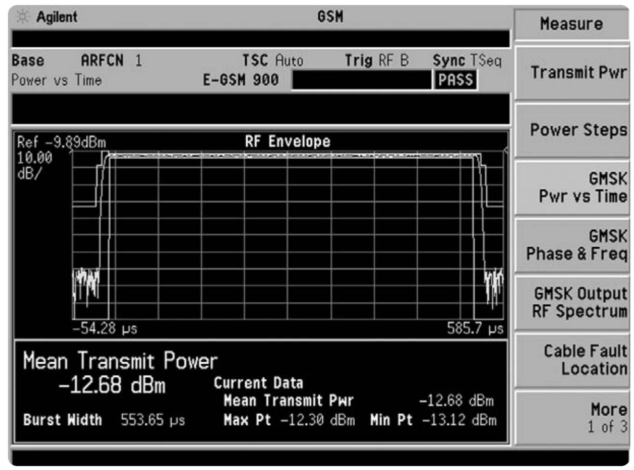


Figure 4. GMSK power versus time, Mask measurement with pass/fail functionality.

Figure 5.
Rise and Fall edge view in GMSK power vs. time measurement.

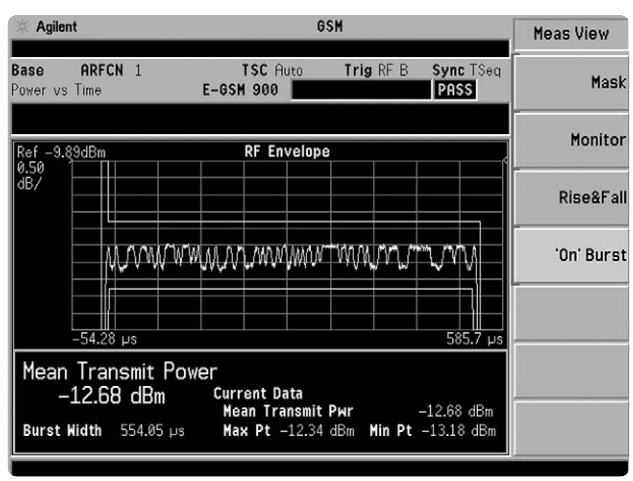


Figure 6.
On Burst view in GMSK power vs. time measurement.

Now make a multi-slot measurement on an EDGE signal

Conventional GSM mobiles use a single time-slot on the uplink and downlink. With the advent of GPRS and EDGE, multiple users are allowed to transmit on multiple time-slots at varying power levels. These time-slots need not be contiguous. Consequently, it has become necessary to be able to perform flexible multi-slot power vs. time measurement to analyze a whole frame.

The ESA has multiple triggering schemes for this measurement: default, RF burst triggering [1] for "off the air" operation, external triggering for when the device under test has an output trigger signal, and a frame trigger. The frame trigger is an internally generated trigger signal corresponding to the frame rate of GSM and EDGE.

Modulation quality

The major difference between GSM and EDGE is the modulation scheme used. GSM uses a GMSK modulation scheme, which is a constant amplitude scheme that transmits information in differential phase shifts. Here, a phase and frequency error will tell you a lot about the modulation accuracy of the transmitter. For EDGE, the modulation scheme is a 3pi/8 rotated, 8 PSK. This is a non-constant amplitude modulation scheme. Consequently a useful indication of modulation quality has to take into account the amplitude variations, as well as phase. The EDGE error vector magnitude (EVM) measurement is the modulation quality metric required. Modulation quality translates directly to voice quality and data rates. Good voice quality and higher data rates are a key differentiator that will increase subscription and promote retention of existing wireless customers. It is hence a metric that needs to be monitored carefully.

Instructions on ESG	Keystrokes
Generate a framed EDGE signal.	[Mode] {Real Time TDMA} {EDGE} {Data Format: Pattern/Framed} {EDGE Off/On}
Turn on a second time-slot at a lower level relative to the first.	{Configure Time-slots} {Time-slot #} [1] {Enter} {Time-slot Type} {Normal All} {Time-slot On} {Time-slot Ampl Delta} [Amplitude] {More 1 of 2} {Alternate Amplitude} {Alternate Ampl Delta} [+/] [10] {dB} {Alt Ampl On}
Turn on a third time-slot.	[Mode] {Real-time} {EDGE} {Configure Time-slots} {Time-slot #} [2] {Enter} {Time-slot On}

Instructions on ESA	Keystrokes
Make an EDGE power vs. time measurement.	[Meas] {More 1of 2} {EDGE Power vs. Time}
Set the ESA to external trigger.	[Meas Setup] {Trigger Source} {External}
Set the ESA to measure 3 time-slots.	[Meas Time] [3] {Slots}
Set the ESA if not selected to the mask view.	[View Trace] {Mask}
Improve time resolution by increasing number of trace points.	[Meas Set up] {More 1 of 2} {Advanced} {trace points} {6401 samples}

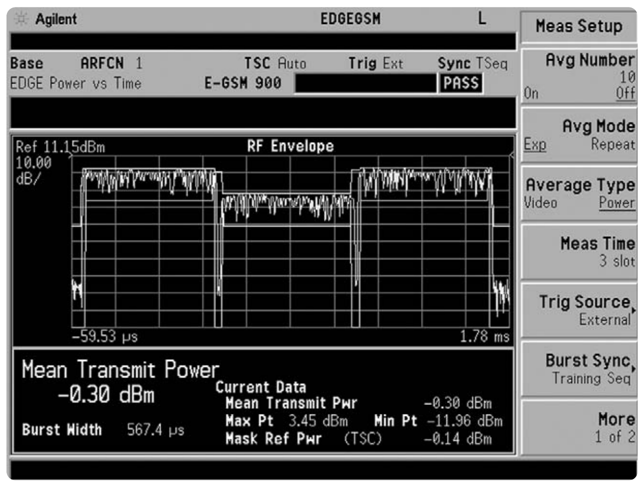


Figure 7. Multi-slot power vs. time on a frame with 3 active EDGE time-slots at differing amplitudes. Notice the larger peak to average ratio in the modulated part of the burst due to the non-constant amplitude modulation scheme.

1. RF communications hardware (ID 117 or higher required for RF burst carrier triggering on EDGE signals). The ID number can be found by pressing [System] {Mode 1 of 3} {Show Hardware} on the ESA.

EDGE EVM

The EDGE upgrade to the GSM/GPRS measurement personality allows measurements of EDGE EVM and all related metrics. This measurement provides an I/Q constellation diagram, error vector magnitude (EVM) in RMS and peak, as well as magnitude error versus time, phase error versus time, and EVM versus time in a quad-view display. These additional views are invaluable in design, allowing one to view modulation quality while troubleshooting a design and isolate sources of impairments.

User-editable pass/fail functionality exists allowing one to test modulation quality according to standards requirements or specific needs.

Easily identify sources of impairments with the quad view display.

When integrating a communications system, many signals (digital, baseband, IF, and RF) are present. The close proximity of the components is an invitation to cross-talk and can lead to unwanted signals in the signal output. This interfering signal is usually too small to be seen in the frequency domain, however, the EVM displays have the capability to easily highlight the presence of such interference. The interfering signal causes the amplitude or phase of the transmitted signal to be different each time the signal passes through the same state. *PM interference, for example causes a variation of the phase around the ideal symbol reference point.*

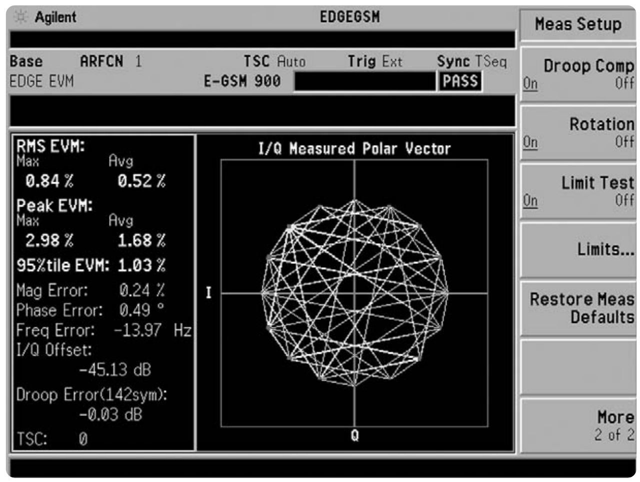
The measurement passes, but a poor modulation quality could mean that customers have to put up with a lower data rate service that has more redundancy in terms of error correction. A poor EVM dominated by a poor magnitude error would have pointed to problems in the amplifier, perhaps due to compression. One could use the power suite measurement to investigate this further.

Instructions on ESA	Keystrokes
Make an EDGE EVM measurement.	[Meas] {More 1of 2} {EDGE EVM}
Set the ESA to external trigger.	[Meas Setup] {Trigger Source} {External}

Table 1. Representative specifications for GSM and EDGE signal formats

	GSM	EDGE
Modulation	GMSK	3pi/8-rotating 8PSK
Bits/symbol	1	3
Data bits/burst	114	342
Symbol rate	270.833 kHz	270.8333 kHz
Amplitude modulation	No	Yes

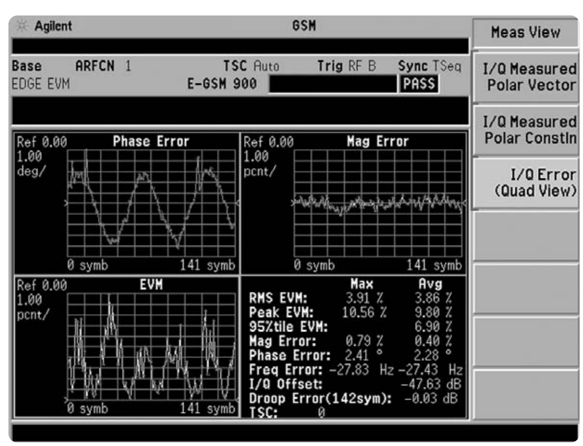
Figure 8.
Polar vector display in EDGE EVM measurement. A "real" EDGE signal has considerable inter-symbol interference (ISI), however, Agilent's proprietary ISI compensation algorithm provides both a clear constellation diagram and accurate EVM metrics.



Instructions on ESG	Keystrokes
Go to frequency and phase modulation menu and toggle to the phase modulation menu.	Press [FM/ΦM] {FM ΦM} The ΦM term should be highlighted
Set the frequency of the internally-generated phase modulating signal to 5 kHz. **And** Set the phase modulation deviation to approximately 3 degrees.	{ΦM Rate} [5] {kHz} {ΦM Dev} [3] {deg}
Turn on the phase modulation.	Press {ΦM Off On} The "On" should be highlighted

Instructions on ESA	Keystrokes
Change to the quad view display.	[View/Trace] {I/Q Error (Quad View)}

Figure 9.
Quad view display in EVM measurement shows that there is a regular phase modulating interfering signal that is degrading EVM.



GMSK phase and frequency error

Phase and frequency error are the equivalent modulation accuracy measurement for GSM systems. Like EVM, this metric can reveal a lot about a transmitter's performance. The GMSK modulation scheme used in GSM is more robust than the 3pi/8 rotated 8 PSK used in EDGE. Regardless, a poor phase error metric means a likely reduction in the ability of a receiver to correctly demodulate a signal. With degrading modulation quality, the range at which a cell phone can operate reduces. A poor frequency error could mean that a receiver will not be able to synchronously demodulate a signal or the transmitter could interfere with other users.

The ESA has a one-button phase and frequency error test, with a constellation display and phase error vs. time plot for further analysis.

Instructions on ESG	Keystrokes
Generate a framed GSM signal.	[Mode] {Real Time TDMA} {GSM} {Data Format: Pattern/Framed} {GSM Off/On}
Go to frequency and phase modulation menu and turn it off.	Press [FM/ΦM]
Turn off the phase modulation.	Press {ΦM Off On} The "Off" should be highlighted

Instructions on ESA	Keystrokes
Make a GMSK phase & freq error measurement.	[Meas] {GMSK Phase & Freq}
Change to the quad view display.	[View/Trace] {I/Q Error (Quad View)}
Change the polar vector display.	[View/Trace] {I/Q Measured Polar Vector}

Figure 10.
Quad view display in GMSK phase and frequency error measurement.

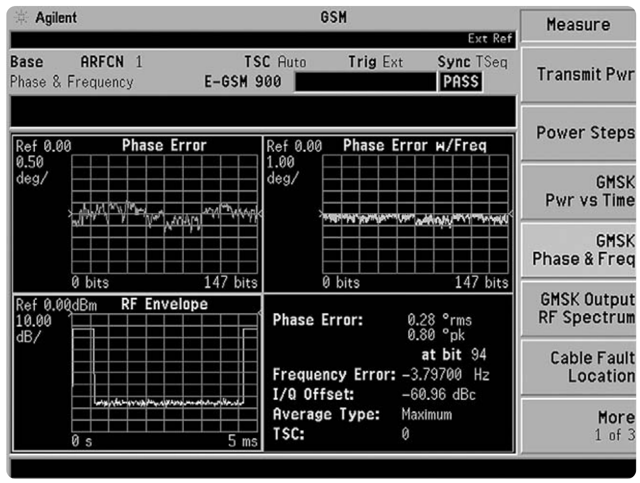
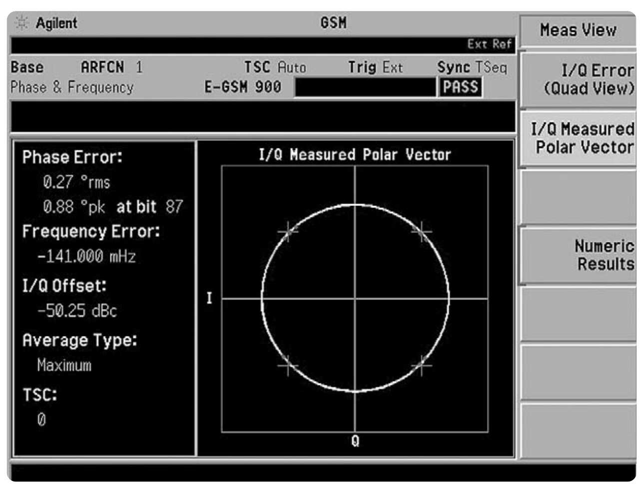


Figure 11.
Polar vector display of phase and frequency error with ESA.



GMSK and EDGE output RF spectrum (ORFS)

A key test of whether a transmitter is a good spectral citizen is the output RF spectrum measurement (ORFS). Modulation causes a carrier to spread spectrally, and this test ensures that this spreading does not interfere with other users on adjacent channels. This measurement is equivalent to the adjacent channel power measurement for CDMA systems with multiple channels being considered in this case.

During the power vs. time measurement, a burst that ramps up too fast will be evident, however, there will be no violation of a mask. The test that will quantitatively indicate the existence of a problem is the spectrum due to switching on the ORFS measurement. The ESA can also make an ORFS measurement due to modulation and wideband noise. There are three methods with different views on the ESA. The first is the multi-offset method, which measures multiple offsets as defined by the standard; the single offset mode, which can be regarded as an examine mode, where the power of the modulated signal at a single offset from the carrier frequency is calculated; then there is the swept mode.

In this case, a measurement is made in the frequency domain where the analyzer sweeps the range as opposed to stepping through the defined frequency offsets. For output RF spectrum due to modulation, the measurement uses time gated spectrum analysis with the gate turned on only for the desired portion of the burst. This way, the ORFS can be shown in an entirely graphical format.

Instructions on ESA	Keystrokes
Select the GMSK ORFS measurement.	[Measure] {GMSK Output RF Spectrum}
Change the measurement to single offset and examine the ORFS at a 250 kHz offset from carrier.	[Meas Setup] {Meas Method} {Single offset}
Change the measurement to the swept mode.	[Meas Setup] {Meas Method} {Swept}

Figure 12.
ORFS measurement due to modulation in multi-offset mode on ESA.

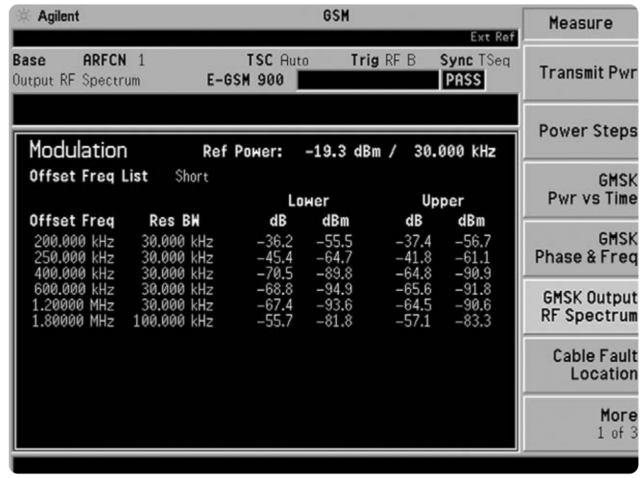


Figure 13.
ORFS measurement due to modulation in single offset or examine mode on ESA.

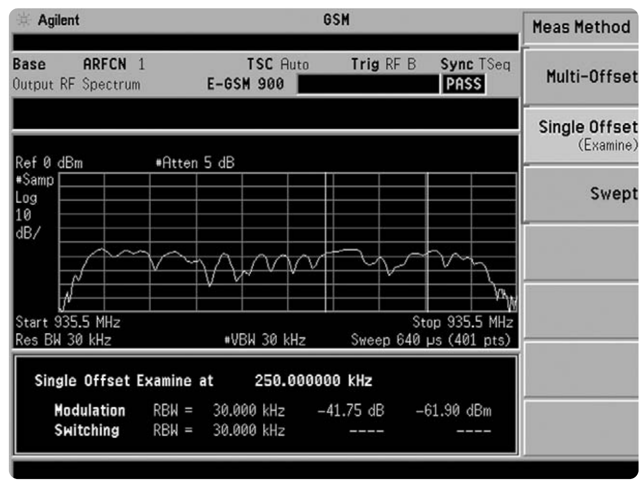
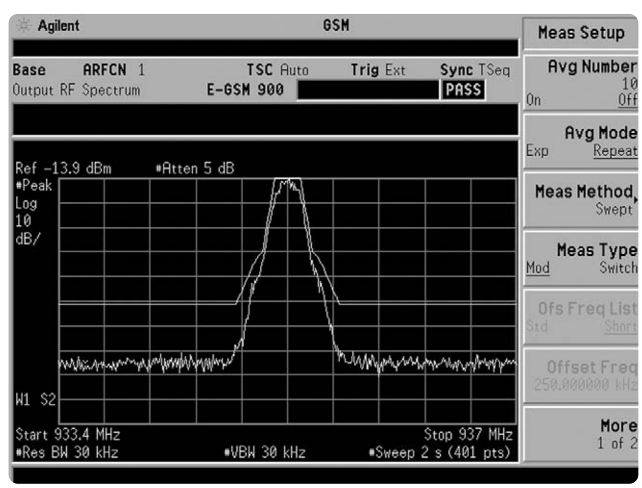


Figure 14.
ORFS measurement due to modulation in swept mode on ESA.



Cable fault location

For field service, antenna feed-line and cable faults are responsible for a large percentage of failures at a site. In many cases, service providers will benchmark SWR performance when the antenna network is first installed. Tests done at a later date can be compared to the benchmark results and degradation can be seen, if it exists. This allows the provider to spot a potential problem and fix it before it becomes a total failure for the sector or site. Once it is determined that SWR has degraded and there is a potential problem, a distance to fault measurement can be made to determine how far away the fault is.

The ESA has a built-in cable fault location personality that works with the tracking generator to help in cable fault detection. The personality has several industry standard cables built-in with their parameters like velocity factor and cable loss. These can also be customized by the user if they have cables with unique parameters.

Instructions on ESA	Keystrokes
Make a cable fault location measurement.	[Meas] {Cable Fault Location}
Select the right cable to make a measurement on an RG 58 cable.	[Meas Setup] {Cable Type} {Cable} [53] {Enter} {Select}
Set the range (start and stop distance) for the measurement to be made.	[Meas Setup] {More 1 of 2} {Stop Distance} [10] {meters}
Calibrate the measurement to remove any errors introduced by the cabling components of the test setup before making the measurement.	[Meas Setup] {Calibrate}
The analyzer should prompt you to connect a load (open or short).	{Continue}
The analyzer should prompt you to connect a DUT. Connect the cable now.	{Continue}
You can use a marker to identify the "distance to fault".	[Peak search]

Figure 15.
Built-in cable editor for cable fault personality has several industry standard cables to choose from.

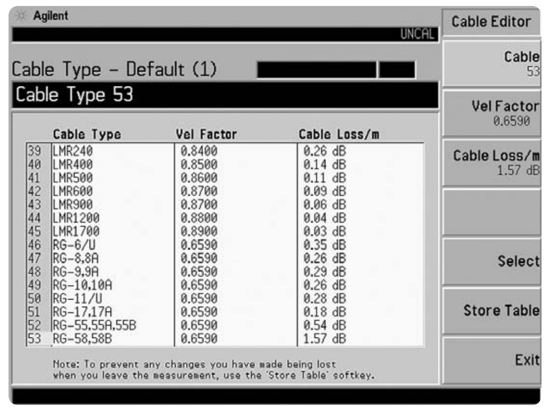


Figure 16.
Dialog boxes with detailed diagrams guide you through the calibration process.

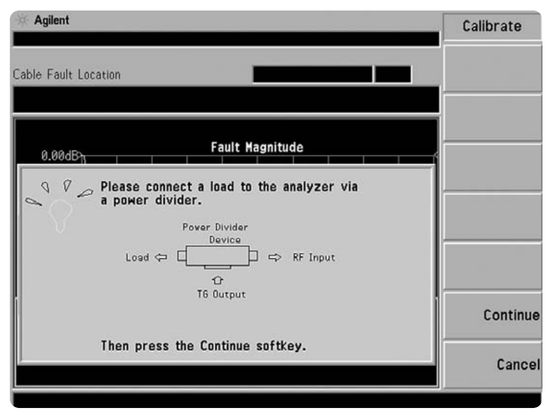
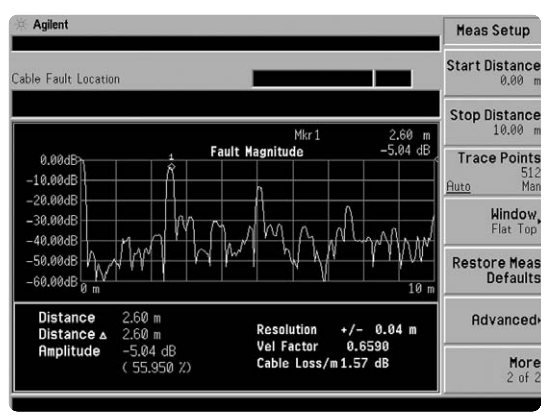


Figure 17.
The fault location personality allows you to easily locate the fault distance and the severity of the fault.



Key Features and Benefits of the ESA-E Series Spectrum Analyzer

Multi-functional ESA E-Series spectrum analyzer meets more than just your GSM, GPRS and EDGE test needs.

Easy to use – GSM, GPRS and EDGE measurements made simple

- One-button standards compliant GSM/GPRS and EDGE measurements
- Pass/fail functionality with limit testing
- Built-in help key for quick reference without manuals
- Band and channel specific monitor spectrum mode
- Automatic frequency tuning plans for all major standards
- Multiple triggering and synchronization modes
- AM/FM demodulation tune and listen for quick signal identification

With spectrum analysis – Maximize measurement capability and confidence

- Best in class ± 0.4 dB overall amplitude accuracy
- Best in class –133 dBc/Hz (1MHz) wide offset phase noise for great ORFS dynamic range
- Best in class 108 dB third order dynamic range
- 1 Hz digital resolution bandwidth that is up to 220 times faster than analog resolution bandwidths
- Continuous automatic background alignment to guarantee performance

Upgradeable – Ready for other applications

- Versatile card cage architecture for hardware expansion
- Instrument firmware and software upgrades available on the web
- Wide bandwidth digital demodulation platform
- Choose the performance you need, when you need it, and upgrade in the future

PC connected – Easy analysis of transmitter performance data

- Store measurement results in spreadsheet format using the built-in floppy disk drive or transfer data directly to your PC with IntuiLink software[1]
- BenchLink Web Remote software enables remote control of an ESA-E over the Internet
- Industry standard SCPI programmable instrument language for remote control
- GPIB (Option A4H), RS-232 (Option 1AX) interface available

Fast – Finish your job quicker

- Five minute warm-up time for full accuracy
- Forty-five measurement updates per second for higher probability of intercept and real-time response

Portable – Sophisticated measurement performance anywhere

- Rugged case, water resistant front panel
- Snap-on battery (E1779A) or 12 Vdc adapter (Option A5D)
- Carrying/operating/transit case (Option AYT/AYU/AXT)

1. For more information about IntuiLink software visit our web site at: **www.agilent.com/find/intuilink**

Ideal for R&D, manufacturing, installation, maintenance and depot repair.

R&D

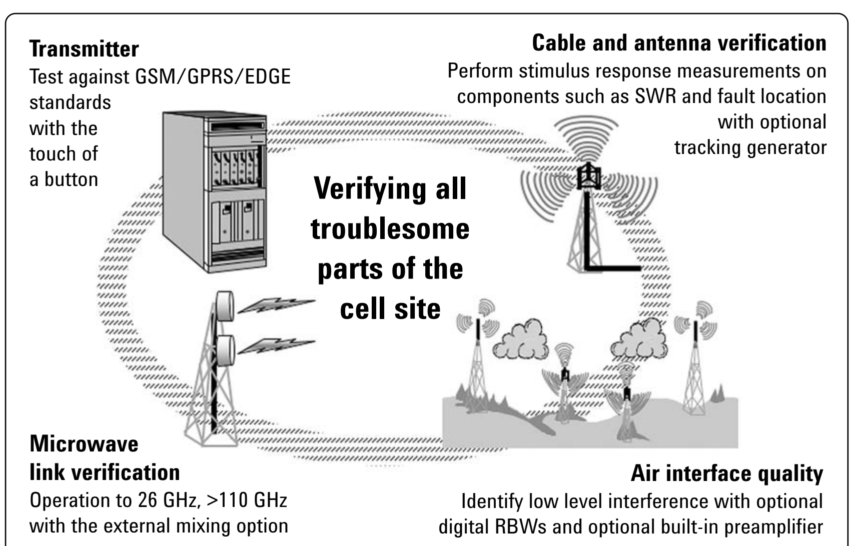
- Affordable spectrum and vector modulation analysis on every engineers bench
- Configurable measurement routines
- Unparalleled flexibility with ten measurement personalities to address any measurement need
- Spurious testing to 26.5 GHz and external mixing capability to 325 GHz

Manufacturing

- Complete measurement suite for cost effective alternative in production final test
- Flexible troubleshooting tool for engineering root cause analysis in production rework
- Built-in help with SCPI commands and SCPI debugging capabilities for easy programming reference

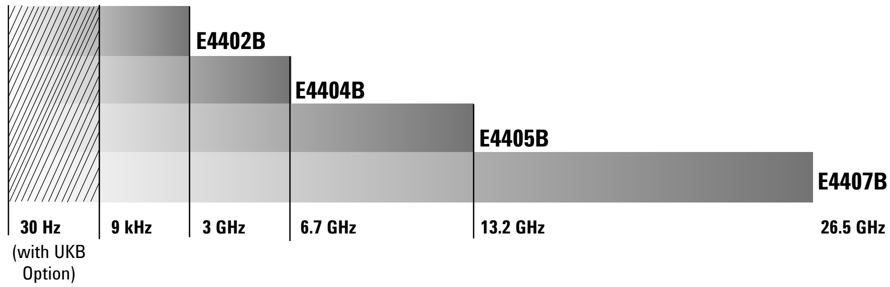
Field service

- Fast accurate whole cell site optimization
- Cable fault location capability
- One-button standards compliant go/no testing
- Rugged, portable tool for field repair
- All weather use



Ordering Information

First, choose your frequency range



Now, choose your option configuration

Use	Task	Recommended option configurations	GSM/GPRS/EDGE measurements
Transmission performance checks (full functionality)	• Verifies equipment specifications • Compliance to radio regulatory standards • Verifying modulation quality and network synchronization • Ensures the RF transmission parameters are optimal • Verifies the transmission and receive bands are free from interference • Proves the quality of RF cables and connections	**ESA-E Series spectrum analyzer plus options:** **BAH** - GSM/GPRS measurement personality **252** - EDGE upgrade to GSM measurement personality **1D6** - Time-gated spectrum analysis **1DS** - Preamplifier **1D5** - High stability frequency reference **1DR** - Narrow resolution bandwidths **B7D** - DSP and fast ADC **B7E**† - RF communications hardware **BAA** - FM demodulation **1DN** - 50 Ohm tracking generator	• Monitor channel/band • Channel tuning • Distance to fault (1DN required) • Spurious emissions • Power steps • Output RF spectrum • Power versus time • Transmit power • Phase and frequency error • Full suite of triggering options†
Cell site functionality checks (limited functionality)	• Ensures that the RF transmission parameters are optimal • Verifies the transmission and receive bands are free from interference • Proves the quality of RF cables and connections	**ESA-E** Series spectrum analyzer plus options **BAH** - GSM/GPRS measurement personality **1D6** - Time gated spectrum analysis **AYX** - Fast time domain sweep **1D5** - High stability frequency reference **1DS** - Preamplifier **1DR** - Narrow resolution bandwidths **1DN** - 50 Ohm tracking generator	• Monitor channel/band • Channel tuning • Distance to fault (1DN required) • Spurious emissions • Power steps • Output RF spectrum • Power versus time • Transmit power
Basic cell site quality checks (limited functionality)	• Proves the quality of RF cables and connections • Verifies the transmission and receive bands are free from interference	**ESA-E** series spectrum analyzer plus options **BAH** - GSM/GPRS measurement personality **1DS** - Preamplifier **1D5** - High stability frequency reference **1DR** - Narrow resolution bandwidths **1DN** - 50 Ohm tracking generator	• Monitor channel/band • Channel tuning • Distance to fault (1DN required) • Spurious emissions • Power steps

† RF communications hardware (ID 117 or higher required for RF burst carrier triggering on EDGE signals).
The ID number can be found by pressing [System] {Mode 1 of 3} {Show Hardware} on the ESA.

Specifications

GSM measurement personality (Option BAH) and EDGE upgrade to GSM measurement personality (Option 252)

The following specifications apply to the E4402B model only. For more detailed specifications on the E4404B, E4405B and E4407B, please see the ESA-E Series specifications guide.

Unless otherwise noted, all specifications are with RF input range auto, default GSM measurement settings, and in the in-band frequency range. Option 1D6 and Option B72 are required.

In band frequency ranges [1]

GSM 900, P-GSM bands	890 to 915 MHz, 935 to 960 MHz
GSM 900, E-GSM bands	880 to 915 MHz, 925 to 960 MHz
GSM 900, R-GSM bands	876 to 915 MHz, 921 to 960 MHz
DCS 1800 bands	1710 to 1785 MHz, 1805 to 1880 MHz
PCS 1900 bands	1850 to 1910 MHz, 1930 to 1990 MHz

Alternate frequency ranges [2]

GSM 450 bands	450.4 to 457.6 MHz, 460.4 to 467.6 MHz
GSM 480 bands	478.8 to 486 MHz, 488.8 to 496 MHz
GSM 850 bands	824 to 849 MHz, 869 to 894 MHz

Transmit power measurement (GSM and EDGE) (requires *Option B7D or AYX*). Range at RF Input 30 to -60 dBm

Absolute power accuracy for in-band signal (mean channel power at RF input) [3]	**0 to 55 °C**	**20 to 30 °C**
P-GSM, E-GSM, and R-GSM Bands		
30 to -20 dBm	±1.49 dB	± 0.99 dB, ± 0.44 dB, typical
-20 to -30 dBm	±1.23 dB	± 0.92 dB, ± 0.38 dB, typical
-30 to -40 dBm	± 1.22 dB	±0.97 dB, ± 0.39 dB, typical
-40 to -50 dBm	±1.35 dB	±1.16 dB, ± 0.57 dB, typical
-50 to -60 dBm	±1.46 dB	±1.29 dB, ± 0.70 dB, typical
DCS 1800 and PCS 1900 Bands		
30 to -20 dBm	±1.41 dB	±0.83 dB, ±0.31 dB, typical
-20 to -30 dBm	±1.08 dB	±0.75 dB, ±0.28 dB, typical
-30 to -40 dBm	±1.07 dB	±0.80 dB, ±0.29 dB, typical
-40 to -50 dBm	±1.20 dB	±0.99 dB, ±0.47 dB, typical
-50 to -60 dBm	±1.31 dB	±1.12 dB, ±0.60 dB, typical

Power versus time measurement (GSM and EDGE)
(requires Option B7D or AYX).

Carrier power range at RF Input Preamp on (Option 1DS)	30 to -23 dBm ; 30 to -55 dBm, nominal 30 to -40 dBm; 30 to -72 dBm, nominal
Time resolution accuracy	±1% of sweep time, nominal
Maximum record length	8 time slots
Burst to mask uncertainty *(requires Option B7D and B7E)* [4]	$\pm\left[0.1 + \frac{(ST/(TP-1))}{Tsym}\right]$ symbol Where ST = sweep time [5], TP = trace points, Tsym = 3.69 μs

Output RF spectrum measurement (GSM and EDGE)

Carrier power range at RF input	+30 to -4 dBm
Reference power accuracy	Transmitter power accuracy ± 0.13 dB
Relative accuracy [6]	
Due to modulation	
Offsets ≤ 1200 kHz	±0.83 dB
Offsets ≥ 1800 kHz	±0.96 dB
Due to switching	±1.63 dB

1. Frequency ranges over which all specifications apply.
2. Frequency ranges with tuning plans.
3. Plus any external attenuation, excluding mismatch error.
4. RF communications hardware (ID 117 or higher required for RF burst carrier triggering on EDGE signals). The ID number can be found by pressing [System] {Mode 1 of 3} {Show Hardware} on the ESA.
5. Sweep time value can be found on the key label in the advanced settings menu, with GSM w/EDGE personality software versions C.01.00 and later.
6. Does not include uncertainty due to noise.

Spectrum due to modulation displayed dynamic range [1]

Offset	100 kHz	200 kHz	250 kHz	400 kHz GSM	400 kHz EDGE	600 kHz	1.8 MHz	6 MHz
Standard (dB)	67.5	69.5	70.2	71.7	67 dB	72.9	69.5	70.3
Option 120 (dB)		71.9	73.3	76.3	67 dB	79.2	77.5	78.0

Spectrum due to switching displayed dynamic range [1]

Offset	400 kHz	600 kHz	1.2 MHz	1.8 MHz
Standard (dB)	62.5	63.6	65.1	65.4
Option 120 (dB)	67.1	69.6	72.5	72.7

Phase and frequency error measurement (GSM)
(requires Option 1D5, B7D, and B7E)

Carrier power range at RF input	30 to -23 dBm; 30 to -55 dBm, nominal
Preamp on (Option 1DS)	30 to -40 dBm, 30 to -72 dBm, nominal
Phase error	
Range	0 to 180°
Displayed resolution	0.01°
Accuracy (Averages ≥10)	
Peak	±2.1° ; ±1.5°, typical
RMS	±1.1°; ±0.6°, typical
Frequency error [2]	
Initial frequency error range	±100 kHz
Accuracy (Avg. Type = Mean, Averages ≥10)	±10 Hz; ±5 Hz, typical
I/Q offset range	-10 to -46 dBc
Burst sync time uncertainty	±0.1 bit

Error vector magnitude (EVM) measurement (EDGE)
(requires Option 1D5, B7D, and B7E) [3]

Carrier power range at RF Input	30 to -23 dBm; 30 to -55 dBm, nominal
Preamp on (Option 1DS)	30 to -40 dBm, 30 to -72 dBm, nominal
EVM	
Operating range	0 to 25% nominal
Floor (RMS)	0.8% (nominal)
Accuracy EVM range 1% to 10%	±0.75 % (nominal)
Frequency error [2]	
Accuracy	±5 Hz, nominal
I/Q origin offset	–20 to –45 dBc

1. Previously available GSM measurements options for ESA specified dynamic range for CW signals only. These specifications apply for GSM and EDGE signals.
2. Excludes frequency reference error.
3. RF communications hardware (ID 117 or higher required for RF burst carrier triggering on EDGE signals). The ID number can be found by pressing [System] {Mode 1 of 3} {Show Hardware} on the ESA.

Related Literature

Product literature

ESA-E Series Spectrum Analyzer,
Brochure,
literature number 5968-3278E

Select the Right Portable Spectrum Analyzer, Selection Guide,
literature number 5968-3413E

ESA-E Series Spectrum Analyzer,
Technical Specifications,
literature number 5968-3386E

ESA/EMC Spectrum Analyzer,
Configuration Guide,
literature number 5968-3412E

ESA Snap-On Battery Pack,
Product Overview,
literature number 5966-1851E

IntuiLink Software, Data Sheet,
literature number 5980-3115EN

Application notes

AN 1312: Understanding GDM Transmitter Measurements for Base Transceiver Stations and Mobile Stations,
literature number 5968-2320E

AN: 1361: Measuring EDGE Signals New and Modified,
literature number 5980-2508EN

Online

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