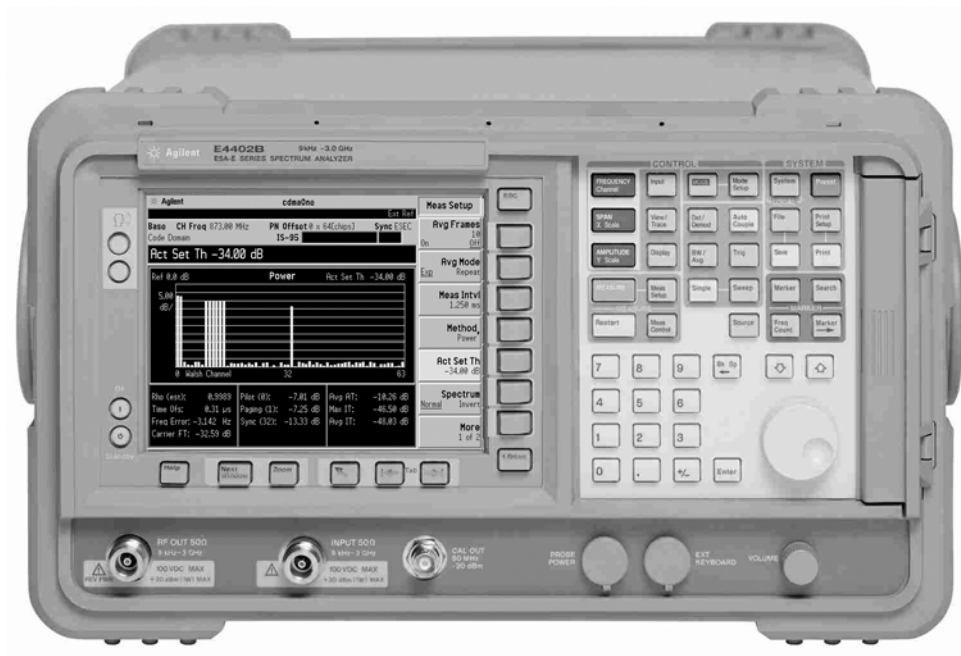


# Agilent ESA-E Series Spectrum Analyzers cdmaOne Measurement Solutions

## Technical Overview



Now the best-in-class spectrum analyzer has one-button cdmaOne measurements, including adjacent channel power ratio, modulation quality, and code domain digital demodulation.



Agilent Technologies

## Accurate and easy cell site optimization and troubleshooting

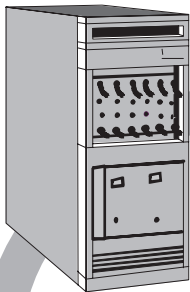
As a cellular network provider you are under increasing pressure to ensure optimal network performance. Interference free spectrum, combined with an optimized transmitter, means that the cellular system you maintain is performing at the peak of its operational capability.

The Agilent ESA-E series spectrum analyzers provide best-in-class general purpose spectrum analysis with built-in, one-button, standards compliant, cdmaOne measurement capability, including adjacent channel power ratio (ACPR), in a mid-priced portable rugged package. This provides enhanced capability to meet your performance goals accurately, easily, and quickly in the most demanding environmental conditions.

### Verifying all troublesome parts of the cell site

#### Transmitter tests

Test against cdmaOne standards with the touch of a button



#### General purpose spectrum analysis



#### Cable and antenna verification

Perform stimulus response measurements on components such as SWR and fault location with optional tracking generator



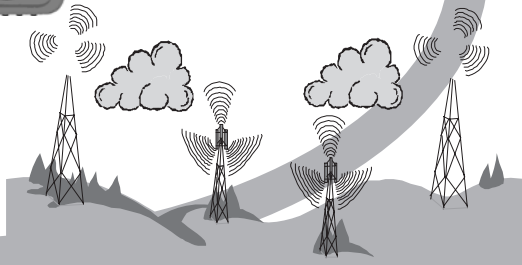
#### Microwave link verification

Operation to 26GHz, >110GHz with the external mixing option



#### Air interface quality

Identify low level interference with optional digital RBWs and optional built-in preamplifier



## Here's how it benefits you

### Accurate

#### Confidence in cell site performance

- ±0.6 dB absolute channel power accuracy
- ±10 Hz frequency accuracy
- ±0.0015 modulation quality (rho)

### Easy-to-use

#### Less training time needed

- One-button, standards compliant cdmaOne measurements with pass/fail messages for go/no-go testing, including adjacent channel power ratio (ACPR)
- Communications focused user interface
- Built-in help key for quick reference without manuals

### Portable

#### Sophisticated measurement performance anywhere

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

### Upgradeable

#### Ready for the next generation of cellular standards

- Versatile card-cage architecture
- Instrument firmware and software upgrades from the Web
- Wide bandwidth digital demodulation platform

### Flexible

#### Include just the options that you need now or in the future

- Multiple option configurations
- Spectrum analyzer mode or cdmaOne analyzer mode operation
- Choose just the frequency range that you need

### PC connected

#### Easy analysis of cell site transmitter performance data

- Store measurement results in spreadsheet format to disk using the built-in floppy disk drive or IntuiLink software<sup>1</sup>
- Industry standard SCPI 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
- 28 measurement updates per second for higher probability of intercept and real-time response
- Quick cdmaOne measurement set-up

### With spectrum analysis

#### Maximize measurement capability and confidence

- 108 dB<sup>2</sup> third order dynamic range to view low level distortion and intermodulation
- 1 Hz digital resolution band width up to 200 times faster than analog
- Continuous automatic background alignment that guarantees repeatability over varying temperatures

### Great for installation and maintenance plus more

### R&D

- Continuous, standards-compliant ACPR measurements for design verification
- Affordable spectrum and modulation analysis on every engineer's bench

### Manufacturing

- Spurious testing to 26.5 GHz
- Standards-compliant one-button ACPR measurement for fast product test throughput
- Flexible troubleshooting tool for production rework
- Engineering analysis of root cause

### Installation and maintenance

- Fast, accurate whole cell site optimization
- In any weather condition
- Minimal training time
- Complete spectrum analysis capability

1. For more information about IntuiLink software visit our Web site at: <http://www.agilent.com/find/IntuiLink>

2. Typical

## Here's the specific cdmaOne measurements

The cdmaOne measurement personality is software that resides in the ESA-E series spectrum analyzer that provides specialized features that perform measurements and calculations required to test the cdmaOne standard specifications at the press of a single button.

### Key measurements:

- Adjacent channel power ratio (ACPR)
- Channel power
- Modulation accuracy (rho)
- Code domain power
- Receive channel power
- In-band and out-of-band spurious measurements
- Harmonics
- Occupied bandwidth
- Monitor band/channel
- Distance to fault

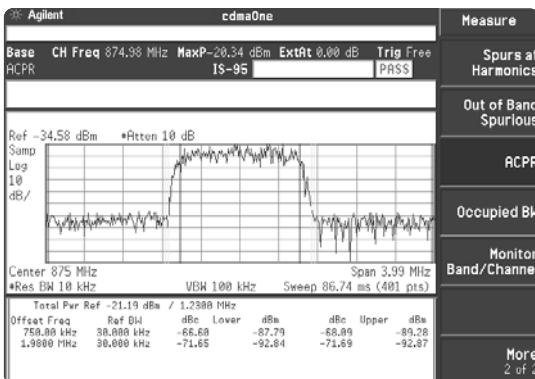


Figure 1. Adjacent channel power ratio measurement (ACPR) is one of the critical power measurements for the design and test of cdmaOne components and systems.

## Additional features

- Color enhanced pass/fail messages with editable limits
- Graphic displays that add key information to numerical results
- Automatic signal level detection and analyzer setup
- Standards based channel tuning and band selection
- External reference configuration and control
- Remote control measurements, parameters, and limits with SCPI programming language
- Storage of measurement results to floppy disk or directly to a PC with IntuiLink software

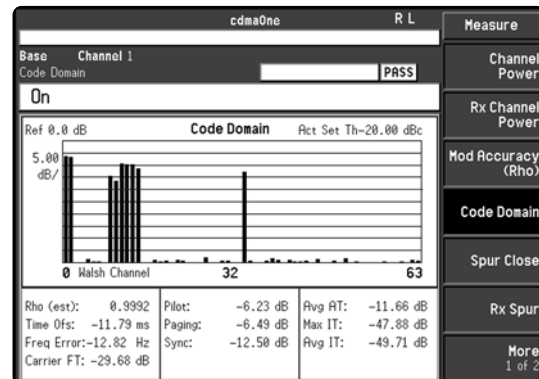


Figure 2. Code domain power provides insight into the modulation domain to verify that each Walsh channel is operating at its proper level. This measurement includes estimated rho, for on-air modulation quality.

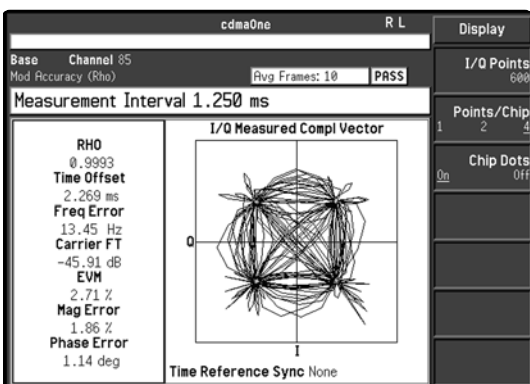


Figure 3. Waveform quality measurements uncover modulation problems.

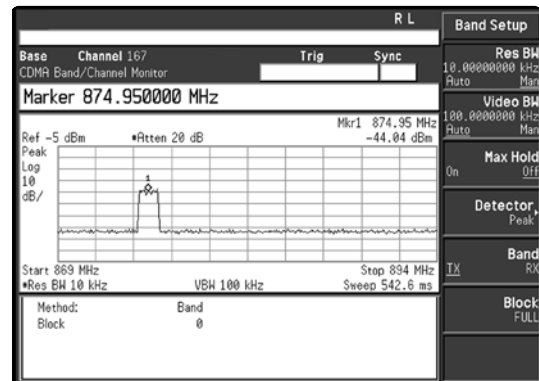
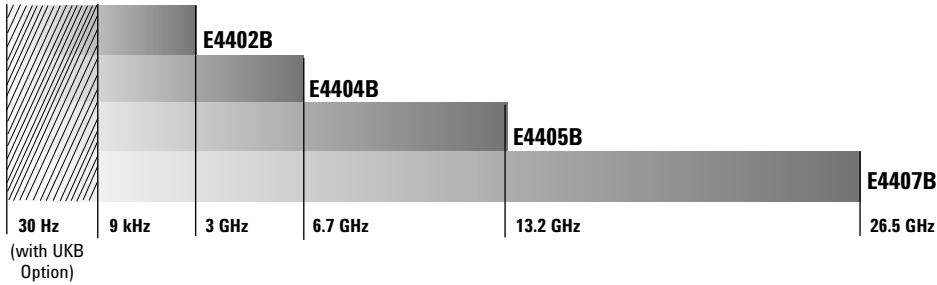


Figure 4. Identify interference signals using the monitor channel feature combined with the analyzer's wide dynamic range and sensitivity.

## Here's how you order it

### First, choose your frequency range



### ESA-E frequency ranges

## Now, choose your option configuration

Use	Task	Required option configurations	cdmaOne measurement
Transmission performance checks (full functionality)	<ul style="list-style-type: none"> <li>Verifies equipment specifications</li> <li>Complies with radio regulatory standards</li> <li>Verifies modulation quality and network synchronization</li> <li>Ensures the RF transmission parameters are optimal</li> <li>Verifies the transmission and receive bands are free from interference</li> <li>Proves the quality of RF cables and connections</li> </ul>	<p><b>ESA-E Series communications test analyzer (-COM) plus option:</b></p> <p>BAC cdmaOne measurement personality</p> <p><b>Alternative configuration via custom path:</b></p> <p>1D5 High stability frequency reference            B7D DSP and fast ADC            B7E RF communications hardware            BAA FM demodulation            BAC cdmaOne measurement personality</p> <p><b>Recommended options:</b></p> <p>1DR Narrow resolution bandwidths            1DS Preamplifier (default<sup>1</sup>)            1DN 50 Ohm tracking generator<sup>1</sup>            1D6 Time-gated spectrum analysis (default)</p>	<ul style="list-style-type: none"> <li>Channel power</li> <li>Modulation quality (rho)</li> <li>Code domain power</li> <li>Receive channel power</li> <li>Monitor channel/band</li> <li>In-band spurious</li> <li>Out-of-band spurious</li> <li>Harmonics</li> <li>Occupied bandwidth</li> <li>Distance to fault (1DN and 225 required)</li> </ul>
Cell site functionality checks (limited functionality)	<ul style="list-style-type: none"> <li>Ensures that the RF transmission parameters are optimal</li> <li>Verifies the transmission and receive bands are free from interference</li> <li>Proves the quality of RF cables and connections</li> </ul>	<p><b>ESA-E Series spectrum analyzer plus options<sup>1</sup></b></p> <p>BAC cdmaOne measurement personality            1D5 High stability frequency reference            AYX Fast time domain sweep</p> <p><b>Recommended options:</b></p> <p>1DS Preamplifier            1DR Narrow resolution bandwidths            1DN 50 Ohm tracking generator</p>	<ul style="list-style-type: none"> <li>Channel power</li> <li>Receive channel power</li> <li>Monitor channel/band</li> <li>In-band spurious</li> <li>Out-of-band spurious</li> <li>Harmonics</li> <li>Occupied bandwidth</li> <li>Distance to fault (1DN and 225 required)</li> </ul>

<sup>1</sup>. Option available only via the custom path.

# cdmaOne specifications

All specifications apply over 0 °C to +55 °C unless otherwise noted and are covered by the product warranty. The analyzer will meet its specifications when: it's within the one year calibration cycle, AUTO ALIGN [ALL] is selected, stored a minimum 2 hours within the operating temperature range, turned on for at least 5 minutes, Align Now RF has been run once every 24 hour period. **Italics** = characteristics, typical performance, or nominal values. For spectrum analyzer specifications, see ESA-E Series Technical Specifications, literature number 5968-3386E.

Table 1. Industry supported standards

Supported standards			Supported tuning plan
IS-95A	IS-97A	IS-98A	US Cellular, Korean Cellular
J-STD-008	J-STD-018	J-STD-019	US PCS, Korean PCS
ARIB STD-53			Japan Cellular
TIA/EIA-95B	TIA/EIA-97B	TIA/EIA-98B	US Cellular, US PCS
TIA/EIA-95C	TIA/EIA-97C	TIA/EIA-98C US	Cellular, US PCS

## General specifications

### Maximum safe input level

Total power must not exceed +30 dBm (1 W)

### Frequency reference

(with precision frequency reference, Option 1D5)

Aging  $\pm 1 \times 10^{-7}$ /year

Temperature stability  $\pm 5 \times 10^{-6}$

### External attenuation correction

-90 to +90 dB in 0.01 dB steps

### Frequency bands

cdmaOne cellular bands

824 to 870 MHz, 869 to 925 MHz

cdmaOne PCS bands

1715 to 1780 MHz, 1805 to 1870 MHz,  
1850 to 1910 MHz, 1930 to 1990 MHz

### Channel power<sup>1</sup>

#### Channel power range

+30 to -70 dBm

#### Absolute channel power accuracy<sup>2</sup>:

##### Cellular bands

E4402B	0°C to 55°C	20°C to 30°C
-5 to 30 dBm	$\pm 1.2$ dB	$\pm 0.9$ dB, 0.4 <i>typical</i>
-25 to -5 dBm	$\pm 1.1$ dB	$\pm 0.9$ dB, 0.4 <i>typical</i>
-45 to -25 dBm	$\pm 1.0$ dB	$\pm 0.7$ dB, 0.2 <i>typical</i>
-55 to -45 dBm	$\pm 1.0$ dB	$\pm 0.8$ dB, 0.3 <i>typical</i>
-70 to -55 dBm	$\pm 1.2$ dB	$\pm 0.8$ dB, 0.4 <i>typical</i>

##### E4404B,

##### E4405B, E4407B

0°C to 55°C	20°C to 30°C
-5 to 30 dBm	$\pm 1.1$ dB
-25 to -5 dBm	$\pm 1.1$ dB
-45 to -25 dBm	$\pm 1.0$ dB
-55 to -45 dBm	$\pm 1.0$ dB
-70 to -55 dBm	$\pm 1.3$ dB

##### PCS bands

E4402B	0°C to 55°C	20°C to 30°C
-5 to 30 dBm	$\pm 1.1$ dB	$\pm 0.8$ dB, 0.3 <i>typical</i>
-25 to -5 dBm	$\pm 1.0$ dB	$\pm 0.7$ dB, 0.2 <i>typical</i>
-45 to -25 dBm	$\pm 1.0$ dB	$\pm 0.7$ dB, 0.3 <i>typical</i>
-55 to -45 dBm	$\pm 1.0$ dB	$\pm 0.8$ dB, 0.3 <i>typical</i>
-70 to -55 dBm	$\pm 1.3$ dB	$\pm 0.9$ dB, 0.4 <i>typical</i>

### E4404B,

### E4405B, E4407B

0°C to 55°C	20°C to 30°C
-5 to 30 dBm	$\pm 1.3$ dB
-25 to -5 dBm	$\pm 1.1$ dB
-45 to -25 dBm	$\pm 1.1$ dB
-55 to -45 dBm	$\pm 1.1$ dB
-70 to -55 dBm	$\pm 1.4$ dB

### Adjacent channel power ratio (ACPR)

Carrier power range at RF input +30 dBm to -20 dBm

Dynamic range (referenced to the average power of the carrier in 1.23 MHz)

Offset frequency	Integration BW	Dynamic range
750 kHz	30 kHz	-70 dBc, characteristic
885 kHz	30 kHz	-73.5 dBc, characteristic
1.25625 MHz	12.5 kHz	-78 dBc, characteristic
1.98 MHz	30 kHz	-75.5 dBc, characteristic
2.75 MHz	1 MHz	-60.5 dBc, characteristic

Resolution: 0.01 dB

### Receive channel power<sup>1</sup>

#### Absolute power accuracy

##### Cellular bands

E4402B	0 to 30 dB	$\pm 1.1$ dB, $\pm 0.6$ typical
	-85 to 0 dB	$\pm 1.6$ dB, $\pm 0.63$ typical

##### E4404B, E4405B, E4407B

0 to 30 dB	$\pm 1.0$ dB, $\pm 0.6$ typical
-85 to 0 dB	$\pm 2.0$ dB, $\pm 1.3$ typical

### Code domain<sup>3</sup>

Range at RF input +30 dBm to -82 dBm, characteristic

Measurement interval range 0.5 ms to 26.67 ms

#### Code domain power

Display dynamic range 50 dB

Accuracy<sup>4</sup>  $\pm 0.2$  dB

Displayed resolution 0.01 dB

Frequency error range  $\pm 100$  kHz, typical

Accuracy<sup>5</sup>  $\pm 10$  Hz

1. Integrated 1.23 MHz bandwidth.  
2. For mean channel power at RF input, plus any external attenuation, excluding mismatch error.  
3. Requires Options 1DS, B7D, and B7E, measurement interval  $\geq 1.25$  ms.

4. Walsh channel power must be within 20 dB of total power.  
5. Excludes frequency reference error, measurement interval  $\geq 2.5$  ms.

## Code Domain specifications (continued)

<b>Estimated rho</b>	
Range	0.5 to 1.0
Accuracy <sup>1</sup> (0.9 to 1.0 range)	±0.02, characteristic
Displayed resolution	0.0001
<b>Pilot time offset<sup>2</sup></b>	
Range	–13.33 ms to +13.33 ms
Accuracy	±150 ns
Displayed resolution	four digits
<b>Code domain timing<sup>3</sup></b>	
Range	±200 ns
Accuracy	±7 ns typical
<b>Code domain phase<sup>3</sup></b>	
Range	±200 mrad
Accuracy	±15 mrad, ±10 mrad typical

### Other reported power parameters

Average active traffic, maximum inactive traffic,  
average inactive traffic

### Code domain displays

Power graph & metrics or power, timing & phase graphs

## Modulation accuracy (rho) measurement<sup>4</sup>

<b>Range at RF input</b>	+30 dBm to –70 dBm
<b>Preamp on (Option 1DS)</b>	+30 dBm to –87 dBm
<b>Measurement interval range</b>	0.15 ms to 26.67 ms
<b>Rho<sup>5</sup> (waveform quality)</b>	
Range	0.5 to 1.0, characteristic
Accuracy (0.9 to 1.0 range)	±0.0015 typical
Displayed resolution	0.0001
<b>Frequency error<sup>6</sup></b>	
Input frequency error range	±100 kHz
Accuracy	±10 Hz
<b>Pilot time offset<sup>2</sup></b>	
Range	–13.33 ms to +13.33 ms
Accuracy	±150 ns
Displayed resolution	four digits
<b>EVM</b>	
Floor	3.8%, <i>typical</i>
Accuracy <sup>7</sup>	±1.1%, <i>typical</i>
Displayed resolution	0.01%
<b>Carrier feedthrough</b>	
Accuracy <sup>7</sup>	±2.3 dB
Displayed resolution	0.01 dB
<b>Magnitude error</b>	
Accuracy <sup>7</sup>	±1.1%, <i>typical</i>
Displayed resolution	0.01%
<b>Phase error</b>	
Accuracy <sup>7</sup>	±0.65 degrees, <i>typical</i>
Displayed resolution	0.01 degrees

### Modulation accuracy displays

Numeric results or numeric results and IQ graph

## Occupied bandwidth

<b>Carrier power range</b>	+30 dBm to –45 dBm
<b>Frequency resolution</b>	1.88 kHz
<b>Frequency accuracy</b> (1.23 MHz channel bandwidth)	±15 kHz, <i>characteristic</i>
<b>Frequency resolution of delta frequency</b>	3.75 kHz
<b>Frequency accuracy of delta frequency</b>	± [35 kHz + (frequency reference error x carrier frequency)], <i>characteristic</i>

## Spur close (in-band spur)

### Carrier power range at RF input

+30 dBm to -12 dBm

### Dynamic range

Input power	55 dB
25 to 30 dBm	50 dB
20 to 25 dBm	46 dB
–12 to 20 dBm	

### Relative accuracy

±(2.7 dB + 0.01 x (dB from reference level))

## Transmitter spurious emissions (out-of-band)

Out-of-band spurious emissions are made with user-defined tables with 20 frequency ranges each (up to the top 10 spurs per range, maximum 100 spurs). Table parameters include frequency range, RBW, video BW, detector type, and amplitude test limits.

## Receiver spurious emissions (in IS-95 bands, 30 kHz RBW, 0 dB attenuation)

### Spurious emission power range

–20 dBm to –83 dBm	
With preamplifier on (Option 1DS)	–40 dBm to –101 dBm

1. With active set threshold set less than all active channels but greater than –20 dBc, 9 channels active.
2. From even second signal to start of PN sequence, measurement interval ≥ 1.25 ms.
3. Pilot to code-channel time tolerance, measurement interval ≥ 1.25 ms, IS-97A nominal power levels.
4. Requires options 1D5, B7D and B7E.
5. Measurement interval ≥ 1.25 ms.
6. Excludes frequency reference error, measurement interval ≥ 2.5 ms.
7. Does not include noise floor.

## Agilent ESA-E series spectrum analyzer product and application information

### Option ordering information

To add options to a product, use the following ordering scheme:

Model: E44xxB  
(xx = 02, 04, 05 or 07)

Model options: E44xxB-Option 1  
E44xxB-Option 2

### Additional related options and accessories

<b>Option A5D</b>	12 Vdc power cable
<b>Option AXT</b>	Hard transit case
<b>Option AYT</b>	Soft carrying/operating case
<b>Option AYZ</b>	External mixing
<b>Option UK9</b>	Front panel cover
<b>Option A4H</b>	GPIB and parallel printer interfaces
<b>Option IAX</b>	RS-232 and parallel printer interfaces
<b>Option ICP</b>	Rackmount handle kit with slides
<b>Option B7K</b>	Distance to fault accessory kit
<b>E1779A</b>	Battery pack
<b>11970/74</b>	Series harmonic mixers
<b>8498A</b>	(Option 030) High power attenuator
<b>IntuiLink software</b>	PC software included free

### Product literature

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

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

*ESA-E Series*, Data Sheet, literature number 5968-3386E

*ESA-E Series Self-Guided Demo*, Product Note, literature number 5968-3658E

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

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

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

### Application notes

*Understanding CDMA Measurement for Base Stations and Their Components*, literature number 5968-0953E

## Information Resources

For the latest product and support information, please visit our product Web pages:

[www.agilent.com/find/spectrumanalyzers](http://www.agilent.com/find/spectrumanalyzers)

[www.agilent.com/find/esa](http://www.agilent.com/find/esa)

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[www.agilent.com/find/assist](http://www.agilent.com/find/assist)

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