The Agilent Technologies E4406A vector signal analyzer (VSA) is a full-featured transmitter tester designed to meet the test needs of wireless equipment developers and manufacturers. For wireless base station, mobile transmitters and their components, the easy-to-use E4406A provides the best combination of speed and accuracy for a wide range of digital modulation analysis capability. And, with multiformat capability (W-CDMA, HSDPA/HSUPA, cdma2000, 1xEV-DV, 1xEV-DO, cdmaOne, EDGE, GSM, NADC, and PDC) the E4406A is the ideal, flexible choice for your production line.

Easily configure one-button measurements with the simple, straight-forward menu structure and view them on the large, high-resolution color display. With built-in, standards-compliant tests and state-of-the-art digital IF technology, engineers can be confident that test results are accurate. And, when combined with the Agilent ESG series of digital RF signal generators, the E4406A VSA provides a powerful, transmit-receive test solution for wireless-equipment manufacturers.
**Frequency**

**Frequency range**
- **RF input**: 7 to 314 MHz and 329 MHz to 4 GHz
- **Baseband IQ inputs**: 0 Hz to 5 MHz

**Frequency spans**
- **Baseband IQ inputs**: 5 Hz to 5 MHz (Baseband I or Q inputs)
- **Composite I/Q**: 10 Hz to 10 MHz

**Frequency setting resolution**
- 1 Hz

**Frequency reference**
- **Accuracy**: ±[(time since last adjustment x aging rate) + temperature stability + calibration accuracy]
- **Initial calibration accuracy**: ±5 x 10⁻⁸
- **Settability**: ±2 x 10⁻⁹
- **Aging rate**:
  - During any 24 hrs following 24-hr warm-up: ±5 x 10⁻¹₀ (nominal)
  - Per year: ±1 x 10⁻⁷ (nominal)
- **Temperature stability**: ±5 x 10⁻⁸ variation from frequency at +25 °C over the temperature range of 0 to +55 °C
- **Warm-up time**: 1 hour (nominal)

**Residual responses**

**RF input**
- 50 Ω input terminated, 0 dB input attenuation, +18 dB ADC gain
- 20 MHz to 2 GHz: ≤ −85 dBm
- 2 to 4 GHz: ≤ −80 dBm

**Baseband IQ inputs**
- 50 Ω input terminated
- 0 to 5 MHz: ≤ −90 dBm (typical)

**Noise Sidebands (RF Input)**

<table>
<thead>
<tr>
<th>Offset</th>
<th>Specifications</th>
<th>Supplemental</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Hz</td>
<td>≤ −85 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>1 kHz</td>
<td>≤ −92 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>10 kHz</td>
<td>≤ −102 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>100 kHz</td>
<td>≤ −131 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>600 kHz</td>
<td>≤ −138 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>1.2 MHz</td>
<td>≤ −141 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>6.0 MHz</td>
<td>≤ −145 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>10.0 MHz</td>
<td>≤ −145 dBc/Hz</td>
<td></td>
</tr>
</tbody>
</table>

**960 MHz**

<table>
<thead>
<tr>
<th>Offset</th>
<th>Specifications</th>
<th>Supplemental</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Hz</td>
<td>≤ −81 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>1 kHz</td>
<td>≤ −87 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>10 kHz</td>
<td>≤ −96 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>100 kHz</td>
<td>≤ −125 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>600 kHz</td>
<td>≤ −136 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>1.2 MHz</td>
<td>≤ −140 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>6.0 MHz</td>
<td>≤ −146 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>10.0 MHz</td>
<td>≤ −146 dBc/Hz</td>
<td></td>
</tr>
</tbody>
</table>

**1990 MHz**

<table>
<thead>
<tr>
<th>Offset</th>
<th>Specifications</th>
<th>Supplemental</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 Hz</td>
<td>≤ −75 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>1 kHz</td>
<td>≤ −82 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>10 kHz</td>
<td>≤ −86 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>100 kHz</td>
<td>≤ −118 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>600 kHz</td>
<td>≤ −132 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>1.2 MHz</td>
<td>≤ −137 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>6.0 MHz</td>
<td>≤ −141 dBc/Hz</td>
<td></td>
</tr>
<tr>
<td>10.0 MHz</td>
<td>≤ −141 dBc/Hz</td>
<td></td>
</tr>
</tbody>
</table>

**Noise Sidebands1 (Baseband IQ Inputs)**

<table>
<thead>
<tr>
<th>Offset</th>
<th>Specifications</th>
<th>Supplemental</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 kHz</td>
<td>≤ −120 dBc/Hz (typical)²</td>
<td></td>
</tr>
<tr>
<td>10 kHz</td>
<td>≤ −133 dBc/Hz (typical)²</td>
<td></td>
</tr>
<tr>
<td>100 kHz</td>
<td>≤ −134 dBc/Hz (typical)²</td>
<td></td>
</tr>
<tr>
<td>1.0 MHz</td>
<td>≤ −135 dBc/Hz (nominal)</td>
<td></td>
</tr>
<tr>
<td>5.0 MHz</td>
<td>≤ −135 dBc/Hz (nominal)</td>
<td></td>
</tr>
</tbody>
</table>

1. No DC offset applied
2. 100 percent of Option B7C baseband IQ assemblies are measured in the factory. More than 80 percent of these instruments exceed this typical specification.
Amplitude

The following amplitude specifications apply for all measurements unless otherwise noted within the measurement specification.

**RF input**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum measurement power</td>
<td>+30 dBm (1W)</td>
</tr>
<tr>
<td>Maximum safe DC voltage</td>
<td>±26 Vdc</td>
</tr>
<tr>
<td>Maximum safe input power</td>
<td>+35 dBm (3.16W)</td>
</tr>
</tbody>
</table>

**Baseband IQ inputs**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input ranges</td>
<td>–5 to +13 dBm in four ranges of 6 dB steps: –5 dBm, +1 dBm, +7 dBm, +13 dBm</td>
</tr>
<tr>
<td>Input impedance (50 Ω)</td>
<td>–6 dBV, 0 dB V</td>
</tr>
<tr>
<td>Maximum safe voltage</td>
<td>±5 V (DC + AC)</td>
</tr>
</tbody>
</table>

**Input attenuator**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RF input Range</td>
<td>0 to +40 dB</td>
</tr>
<tr>
<td>Step size</td>
<td>1 dB steps</td>
</tr>
<tr>
<td>Accuracy at 50 MHz</td>
<td>±0.3 dB relative to 10 dB attenuation</td>
</tr>
</tbody>
</table>

**First LO emission from RF input**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f_{\text{emission}} = \text{center frequency} ±321.4 MHz }</td>
<td>( \leq (–23 \text{ dBm} – \text{input frequency}) ) (nominal)</td>
</tr>
</tbody>
</table>

**Third-order intermodulation distortion (RF input)**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input power</td>
<td>( \leq +27 \text{ dBm} ), Pre-ADC Filter ON</td>
</tr>
</tbody>
</table>

**Absolute power measurement accuracy**

**RF input**

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>810 to 960 MHz</td>
<td>±0.60 dB (±0.4 dB, typical)</td>
</tr>
<tr>
<td>1710 to 2205 MHz</td>
<td>±0.60 dB (±0.4 dB, typical)</td>
</tr>
<tr>
<td>1428 to 1503 MHz</td>
<td>±0.60 dB (±0.5 dB, typical)</td>
</tr>
<tr>
<td>10 dB input attenuation +8 to –18 dBm</td>
<td>±0.75 dB</td>
</tr>
<tr>
<td>400 to 2205 MHz</td>
<td>±0.75 dB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Frequency Range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 to 1000 MHz</td>
<td>±1.0 dB</td>
</tr>
<tr>
<td>1000 to 2205 MHz</td>
<td>±1.3 dB</td>
</tr>
<tr>
<td>2205 to 4000 MHz</td>
<td>±1.8 dB</td>
</tr>
</tbody>
</table>

**Baseband IQ inputs**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input impedance (50 Ω)</td>
<td>±0.6 dB (typical)3</td>
</tr>
<tr>
<td>all ranges</td>
<td></td>
</tr>
<tr>
<td>Input impedance (600 Ω)</td>
<td>±2.0 dB (typical)3</td>
</tr>
<tr>
<td>all ranges</td>
<td></td>
</tr>
<tr>
<td>Input impedance (1 MΩ)</td>
<td>±0.7 dB (nominal)</td>
</tr>
<tr>
<td>all ranges</td>
<td></td>
</tr>
</tbody>
</table>

**Amplitude accuracy**

**RF input**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No averaging</td>
<td></td>
</tr>
<tr>
<td>–2 to –78 dBm</td>
<td>±0.25 dB (±0.15 dB, typical)</td>
</tr>
<tr>
<td>–78 to –88 dBm</td>
<td>±0.70 dB (±0.40 dB, typical)</td>
</tr>
<tr>
<td>–88 to –98 dBm</td>
<td>±1.20 dB (±0.80 dB, typical)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>With 10 averages</td>
<td></td>
</tr>
<tr>
<td>–78 to –88 dBm</td>
<td>±0.25 dB (nominal)</td>
</tr>
<tr>
<td>–88 to –98 dBm</td>
<td>±0.35 dB (nominal)</td>
</tr>
</tbody>
</table>

3. 100 percent of Option B7C baseband IQ assemblies are measured in the factory. More than 80 percent of these instruments exceed this typical specification.
Amplitude linearity
Baseband IQ inputs
0 to –35 dB below range ±0.17 dB (typical)\(^4\)
–35 to –55 dB below range ±1.0 dB (typical)\(^4\)

Displayed average noise level
RF input
Input terminated in 50 Ω, 0 dB attenuation, 1 kHz RBW, 10 kHz span, +18 dB ADC gain
7 to 20 MHz –103 dBm (–111 dBm, typical)
20 to 2000 MHz –106 dBm (–111 dBm, typical)
2000 to 2700 MHz –103 dBm (–108 dBm, typical)
2700 to 4000 MHz –98 dBm (–104 dBm, typical)

Baseband IQ inputs
Input terminated in 50 Ω, 1 kHz RBW, 1 kHz to 5 MHz
+13 dBm range –100 dBm, (typical)
+7 dBm range –105 dBm, (typical)
+1 dBm range –108 dBm, (typical)
–5 dBm range –110 dBm, (typical)

DC offset
Baseband IQ inputs
After auto-zero –55 dB below range, (typical)\(^4\)
Compensation for customer DC offset ≤ ±2.0 Vdc (typical)\(^4\)
Offset accuracy ±2.0% of range (nominal)

Channel match
Baseband IQ inputs
Amplitude match ±0.25 dB (typical)\(^4\)
0 to 5.0 MHz
Phase match ±2.0 degrees (typical)\(^4\)
0 to 5.0 MHz

Crosstalk
Baseband IQ inputs
Input impedance = 50 Ω < –60 dB (typical)\(^4\)
Input impedance = 600 Ω < –52 dB (typical)\(^4\)

Common mode rejection
Baseband IQ inputs
600 Ω balanced inputs
0 to 0.5 MHz < –50 dB (typical)\(^4\)
> 0.5 to 5.0 MHz < –35 dB (typical)\(^4\)

Measurements
Waveform measurement
Range at RF input
Maximum +30 dBm (1 W)
Minimum Displayed average noise level
Range at IQ input
Maximum (50 Ω input) +13 dBm (20 mW)
Maximum (600 Ω, 1 MΩ input) 1 V
Minimum Displayed average noise level
Sweep time range
RBW < 7.5 MHz 10 µs to 200 ms
RBW < 1 MHz 10 µs to 400 ms
RBW < 100 kHz 10 µs to 2 s
RBW < 10 kHz 10 µs to 20 s
Time record length 2 to > 900,000 points (nominal)
Resolution bandwidth
1, 1.5, 2, 3, 5, 7.5, 10 sequence, or arbitrary bandwidth (user-definable)
Gaussian filter 10 Hz to 8 MHz
Flat filter 10 Hz to 10 MHz
Averaging
Average number 1 to 10,000
Average mode Exponential, repeat
Average type Power average (RMS), log-power average (video), maximum, minimum
Displays
RF input Signal envelope, I/Q waveform, I/Q polar
Baseband IQ input Signal envelope, linear envelope, I/Q waveform, I and Q waveform, I/Q polar
Markers Normal, delta, band power

---

\(^4\) 100 percent of Option B7C baseband IQ assemblies are measured in the factory. More than 80 percent of these instruments exceed this typical specification.
<table>
<thead>
<tr>
<th><strong>Spectrum measurement</strong></th>
<th><strong>Trigger</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Range at RF input</strong></td>
<td><strong>Trigger sources</strong></td>
</tr>
<tr>
<td>Maximum</td>
<td>RF input</td>
</tr>
<tr>
<td>Minimum</td>
<td>Displayed average noise level</td>
</tr>
<tr>
<td><strong>Range at IQ input</strong></td>
<td>Baseband IQ inputs</td>
</tr>
<tr>
<td>Maximum (50 Ω input)</td>
<td>Free run (immediate), video (IF envelope), RF burst (wideband), frame timer, external front, external rear, line</td>
</tr>
<tr>
<td>Maximum (600 Ω, 1 MΩ input)</td>
<td>+13 dBm (20 mW)</td>
</tr>
<tr>
<td>Minimum</td>
<td>Displayed average noise level</td>
</tr>
<tr>
<td><strong>Span range</strong></td>
<td>Delay range</td>
</tr>
<tr>
<td>RF input</td>
<td>–500 to +500 ms</td>
</tr>
<tr>
<td>Composite I/Q input</td>
<td>Delay accuracy</td>
</tr>
<tr>
<td>Baseband I or Q only</td>
<td>±33 ns</td>
</tr>
<tr>
<td>inputs</td>
<td>Delay resolution</td>
</tr>
<tr>
<td></td>
<td>33 ns</td>
</tr>
<tr>
<td>Resolution BW range</td>
<td>Trigger slope</td>
</tr>
<tr>
<td>overall</td>
<td>Positive, negative</td>
</tr>
<tr>
<td></td>
<td>Holdoff range</td>
</tr>
<tr>
<td></td>
<td>0 to 500 ms</td>
</tr>
<tr>
<td></td>
<td>Holdoff resolution</td>
</tr>
<tr>
<td></td>
<td>1 µs</td>
</tr>
<tr>
<td><strong>Pre-FFT filter</strong></td>
<td><strong>RF burst trigger</strong></td>
</tr>
<tr>
<td>Type</td>
<td>Peak carrier power range</td>
</tr>
<tr>
<td></td>
<td>at RF input</td>
</tr>
<tr>
<td></td>
<td>+30 to –40 dBm</td>
</tr>
<tr>
<td><strong>FFT window</strong></td>
<td>Trigger level range</td>
</tr>
<tr>
<td>Flat top; (high amplitude accuracy); Uniform; Hanning; Hamming; Gaussian; Blackman; Blackman-Harris; Kaiser-Bessel 70, 90, 110</td>
<td>0 to –25 dB (relative to signal peak)</td>
</tr>
<tr>
<td></td>
<td>Bandwidth</td>
</tr>
<tr>
<td></td>
<td>&gt; 15 MHz (nominal)</td>
</tr>
<tr>
<td></td>
<td><strong>Video (IF envelope)</strong></td>
</tr>
<tr>
<td></td>
<td>Trigger range</td>
</tr>
<tr>
<td></td>
<td>+50 to –200 dBm</td>
</tr>
<tr>
<td><strong>Averaging</strong></td>
<td><strong>Displays</strong></td>
</tr>
<tr>
<td>Average number</td>
<td>RF input</td>
</tr>
<tr>
<td>1 to 10,000</td>
<td>Spectrum, linear spectrum, I/Q waveform, spectrum and I/Q waveform, I/Q polar, adjacent channel power, power stat CCDF</td>
</tr>
<tr>
<td>Average mode</td>
<td>Baseband IQ inputs</td>
</tr>
<tr>
<td>Exponential, repeat</td>
<td>Spectrum, linear spectrum, I/Q waveform, spectrum and I/Q waveform, I/Q polar, power stat CCDF</td>
</tr>
<tr>
<td>Average type</td>
<td>Markers</td>
</tr>
<tr>
<td>Power average (RMS), log-power average (video), maximum, minimum, voltage average</td>
<td>Normal, delta, band power, noise</td>
</tr>
<tr>
<td><strong>Displays</strong></td>
<td>Measurement resolution</td>
</tr>
<tr>
<td>RF input</td>
<td>Displayed</td>
</tr>
<tr>
<td></td>
<td>0.01 dB</td>
</tr>
<tr>
<td>Baseband IQ inputs</td>
<td>Remote query</td>
</tr>
<tr>
<td></td>
<td>0.001 dB</td>
</tr>
</tbody>
</table>
W-CDMA (Option E4406A-BAF)  
HSDPA/HSUPA (Option E4406A-210)

Channel power measurement
The channel power measurement measures the total RMS power in a user-specified bandwidth. The following specifications apply for the default bandwidth of 3.84 MHz for the 3GPP standard.

Minimum power at RF input: –70 dBm (nominal)
Absolute power accuracy: ±0.63 dB, 18 to 30 °C
Measurement floor: –73 dBm (nominal)

ACPR measurement (ACLR)
The adjacent channel power ratio (ACPR) measurement measures up to five pairs of offset channels and relates them to the carrier power. The measurement result is a ratio of the channel power to the power in each offset. The results can be displayed as a ratio to the total power in each bandwidth, or as a ratio of the power spectral density. Simulated spectrum analyzer mode is for those who are accustomed to spectrum analyzers.

Minimum power at RF input: –27 dBm (nominal)
ACPR accuracy: RRC weighted, 3.84 MHz noise bandwidth

Radio Offset frequency Specification
- MS (UE) 5 MHz: ±0.20 dB, at ACPR range of –30 to –36 dBc with optimum mixer level
- MS (UE) 10 MHz: ±0.30 dB, at ACPR range of –40 to –46 dBc with optimum mixer level
- BTS 5 MHz: ±0.93 dB, at ACPR range of –42 to –48 dBc with optimum mixer level
- BTS 10 MHz: ±0.82 dB, at ACPR range of –47 to –53 dBc with optimum mixer level
- BTS 5 MHz: ±0.39 dB, at –48 dBc non-coherent ACPR
Dynamic range: RRC weighted, 3.84 MHz noise bandwidth

ACPR measurement (ACLR) specification
- Code domain power: 25 to 35°C
  - 5 MHz: –68 dB (nominal)
  - 10 MHz: –72 dB (nominal)

Power statistics CCDF measurement
The complementary-cumulative distribution function (CCDF) traces provide you with how much time the waveform spends at or above a given power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

Minimum power at RF input: –40 dBm, average (nominal)
Histogram resolution: 0.01 dB

Code domain measurement
The code domain measurement provides a tremendous amount of information about the in-channel characteristics of the W-CDMA signal. Code domain power (CDP) view directly informs the user of the active channels with their individual channel powers. The CDP view also leads you to symbol rate analysis such as symbol rate EVM and symbol power versus time.

Code domain power: 25 to 35°C
95% confidence
- Minimum power at RF input: –70 dBm (nominal)
- Relative code domain accuracy: Using Test Model 1 with 32 DPCH signal
  - ±0.015 dB
  - ±0.08 dB
  - ±0.15 dB
- Symbol power vs. time
  - Minimum power at RF input: –45 dBm (nominal)
- Accuracy: Using Test Model 1 with 32 DPCH signal
  - ±0.10 dB
  - ±0.50 dB
- Symbol error vector magnitude
  - Minimum power at RF input: –45 dBm (nominal)
  - Accuracy: Using Test Model 1 with 32 DPCH signal
  - ± 1.0%

For more detail, please refer to the E4406A specifications that can be found at www.agilent.com/find/vsa

5. Nominals in using test model 5 with 8 HS-PDSCH.
**QPSK EVM measurement**

The QPSK EVM measurement measures the modulation quality of QPSK modulated signal. This measurement provides an IQ constellation diagram, error vector magnitude (EVM) in RMS and peak as well as magnitude error versus chip, phase error versus chip, and EVM versus chip.

**QPSK EVM**

**QPSK selected**

- Minimum power at RF input: –20 dBm (nominal)
- **EVM**
  - Operating range: 0 to 25% (nominal)
  - Floor: 1.5% (nominal)
  - Accuracy: ±1.0% (nominal) at EVM of 10%
- I/Q origin offset
  - Range: –10 to –50 dBC (nominal)
- Frequency error
  - Range: ±300 kHz (nominal)
  - Accuracy: ±10 Hz (nominal) + (transmitter frequency x frequency reference accuracy)

- **QPSK EVM**

**12.2k RMC selected**

- Minimum power at RF input: –20 dBm (nominal)
- **EVM**
  - Operating range: 0 to 20% (nominal)
  - Floor: 1.5% (nominal)
  - Accuracy: ±1.0% (nominal) at EVM of 10%
- I/Q origin offset
  - Range: –10 to –50 dBC (nominal)
- Frequency error
  - Range: ±20 kHz (nominal)
  - Accuracy: ±10 Hz (nominal) + (transmitter frequency x frequency reference accuracy)

**Modulation accuracy measurement (composite EVM)**

Composite EVM is a measure of the performance of a W-CDMA transmitter’s modulation circuitry. Composite EVM can be measured for a pilot channel along with other channel structures, i.e. multiple traffic channels.

**Minimum power**

- at RF input: –70 dBm (nominal)
- **Composite EVM**
  - Using Test Model 4
  - Range: 0 to 25%
  - Floor: 1.5%
  - Accuracy: ±1.0%
- **Peak code domain error**
  - Using Test Model 3 with 16 DPCH w/spreading code of 256
  - Accuracy: ±1.0 dB (nominal)
- **I/Q origin offset**
  - Range: –10 to –50 dBC (nominal)
- **Frequency error**
  - Specified for CPICH power ≥ –15 dBC
  - Range: ±500 Hz
  - Accuracy: ±2 Hz + (transmitter frequency x frequency reference accuracy)
- **Time offset**
  - Absolute frame offset accuracy: ±150 nsec
  - Relative frame offset accuracy: ±5.0 ns (nominal)
  - Relative offset accuracy: ±1.25 nsec (for STTD diff mode)

**Intermodulation distortion measurement**

The intermodulation distortion measurement determines the third order and fifth order intermodulation products caused by nonlinear devices in the transmitter. This measurement is made with two single tones or a single tone and a modulated W-CDMA signal. The results are displayed in relative power to the carrier in dBc or in absolute power in dBm.

**Minimum carrier power**

- at RF input: –20 dBm (nominal)

---

6. Nominals in using test model 5 with 8 HS-PDSCH.
**Power vs. time and power control measurement**

Absolute power measurement
Using 5 MHz resolution bandwidth

Accuracy
- 0 to –20 dBm: ±0.7 dB (nominal)
- –20 to –60 dBm: ±1.0 dB (nominal)

Relative power measurement

Accuracy
- Step range ± 1.5 dB: ±0.1 dB (nominal)
- Step range ± 3.0 dB: ±0.15 dB (nominal)
- Step range ± 4.5 dB: ±0.2 dB (nominal)
- Step range ± 26.0 dB: ±0.3 dB (nominal)

**Multicarrier power measurement**

This measurement is used for adjusting multicarrier power amplifiers to transmit well balanced multiple carriers. The measurement is similar to a combination of those for ACPR and intermodulation distortion product measurements giving in-channel and out-of-channel performance results. The results are displayed for the different frequency offsets either in relative power to the carrier in dBc or in absolute power in dBm.

Minimum carrier power: –15 dBm (nominal)

ACPR dynamic range, two carriers
- RRC weighted, 3.84 MHz noise bandwidth
- 5 MHz offset: –64 dB (nominal)
- 10 MHz offset: –68 dB (nominal)

ACPR accuracy, two carriers
- 5 MHz offset: ±0.70 dB (nominal)

**Spectrum emission mask measurement**

The spectrum emission mask measurement measures the in-channel and out-of-channel spurious emissions to provide useful figures of merit for spectral regrowth and emissions produced by components and circuit blocks. Up to five pairs of offsets/regions can be defined in which the user can specify the start and stop frequencies, resolution bandwidth, and the start and stop amplitudes of the mask.

Minimum power: –20 dBm (nominal)
at RF input

Dynamic range, relative
- 2.515 MHz offset: –77.9 dB (–82.8 dB, typical)
- 1980 MHz region: –72.2 dB (–77.2 dB, typical)

Sensitivity, absolute
- 2.515 MHz offset: –88.9 dB (–93.9 dB, typical)
- 1980 MHz region: –72.9 dB (–77.9 dB, typical)

Accuracy
- Display = Abs Peak Pwr: ±0.60 dB (±0.40 dB, typical)
- Display = Rel Peak Pwr: ±0.25 dB

**Occupied bandwidth measurement**

Occupied bandwidth (OBW) measurement measures the frequency bandwidth corresponding to 99 percent of the total transmitted power.

Minimum carrier power: –20 dBm (nominal)
at RF input

Frequency resolution: 100 Hz

Frequency accuracy: \(\frac{1.4\%}{\sqrt{N_{avg}}}\) (nominal)
Conformance with 3GPP TS 25.141 base station requirements for a manufacturing environment

<table>
<thead>
<tr>
<th>Sub-clause</th>
<th>Name</th>
<th>3GPP required test instrument tolerance</th>
<th>Instrument tolerance interval</th>
<th>Supplemental information</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.2.1</td>
<td>Maximum output power</td>
<td>±0.7 dB (95%)</td>
<td>±0.29 dB (95%)</td>
<td>±0.63 dB (100%)</td>
</tr>
<tr>
<td>6.2.2</td>
<td>CPICH power accuracy</td>
<td>±0.8 dB (95%)</td>
<td>±0.30 dB (95%)</td>
<td>–10 dB CDP</td>
</tr>
<tr>
<td>6.3.4</td>
<td>Frequency error</td>
<td>±12 Hz (95%)</td>
<td>±10 Hz (100%)</td>
<td>Freq ref locked</td>
</tr>
<tr>
<td>6.4.2</td>
<td>Power control steps</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-dB step</td>
<td>±0.1 dB (95%)</td>
<td>±0.03 dB (95%)</td>
<td>Test Model 2</td>
</tr>
<tr>
<td></td>
<td>0.5-dB step</td>
<td>±0.1 dB (95%)</td>
<td>±0.03 dB (95%)</td>
<td>Test Model 2</td>
</tr>
<tr>
<td></td>
<td>Ten 1-dB steps</td>
<td>±0.1 dB (95%)</td>
<td>±0.03 dB (95%)</td>
<td>Test Model 2</td>
</tr>
<tr>
<td></td>
<td>Ten 0.5-dB steps</td>
<td>±0.1 dB (95%)</td>
<td>±0.03 dB (95%)</td>
<td>Test Model 2</td>
</tr>
<tr>
<td>6.4.3</td>
<td>Power dynamic range</td>
<td>±1.1 dB (95%)</td>
<td>±0.50 dB (95%)</td>
<td></td>
</tr>
<tr>
<td>6.4.4</td>
<td>Total power dynamic range</td>
<td>±0.3 dB (95%)</td>
<td>±0.015 dB (95%)</td>
<td>Ref –35 dBm at mixer</td>
</tr>
<tr>
<td>6.5.1</td>
<td>Occupied bandwidth</td>
<td>±100 kHz (95%)</td>
<td>±38 kHz (95%)</td>
<td>10 averages</td>
</tr>
<tr>
<td>6.5.2.1</td>
<td>Spectrum emission mask</td>
<td>±1.5 dB (95%)</td>
<td>±0.59 dB (95%)</td>
<td>Absolute peak</td>
</tr>
<tr>
<td>6.5.2.2</td>
<td>ACLR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5 MHz offset</td>
<td>±0.8 dB (95%)</td>
<td>±0.34 dB (95%)</td>
<td>±0.93 dB (100%)</td>
</tr>
<tr>
<td></td>
<td>10 MHz offset</td>
<td>±0.8 dB (95%)</td>
<td>±0.40 dB (95%)</td>
<td>±0.82 dB (100%)</td>
</tr>
<tr>
<td>6.7.1</td>
<td>EVM</td>
<td>±2.5% (95%)</td>
<td>±1.0% (95%)</td>
<td>Range 15 to 20%</td>
</tr>
<tr>
<td>6.7.2</td>
<td>Peak code domain error</td>
<td>±1.0 dB (95%)</td>
<td>±1.0 dB (nominal)</td>
<td></td>
</tr>
</tbody>
</table>

Conditions
25 to 35 °C
Derived tolerances
95th percentile
100% limit tested
Calibration uncertainties included
cdma2000 (Option E4406A-B78)  
1xEV-DV (Option E4406A-214)

**Channel power measurement**

Range at RF input  
+30 to –80 dBm

Absolute power accuracy for in-band signal (excluding mismatch error), 18 °C to 30 °C

- +30 to –28 dBm at RF input  ±0.6 dB
- –28 to –50 dBm at RF input  ±0.8 dB
- –50 to –80 dBm at RF input  ±1.0 dB

**ACPR measurement**

Power range  
+30 to –20 dBm at RF input

Dynamic range (referenced to average power of carrier in 1.25 MHz BW)

<table>
<thead>
<tr>
<th>Offset frequency</th>
<th>Integ BW</th>
<th>Dynamic range</th>
</tr>
</thead>
<tbody>
<tr>
<td>750 kHz (BTS)</td>
<td>30 kHz</td>
<td>–82 dBc</td>
</tr>
<tr>
<td>885 kHz (MS)</td>
<td>30 kHz</td>
<td>–82 dBc</td>
</tr>
<tr>
<td>1.98 MHz</td>
<td>30 kHz</td>
<td>–85 dBc</td>
</tr>
</tbody>
</table>

Relative accuracy  ±0.9 dB

**Power statistics CCDF measurement**

Range at RF input

Maximum  
+30 dBm (average)  +40 dBm (peak)

Minimum  
–40 dBm (average)

**QPSK EVM measurement**

Range at RF input  
+30 to –20 dBm

EVM

Range  0 to 25% (nominal)

Floor  1.5% (nominal)

Accuracy  ±1.0% (nominal)

I/Q origin offset

Range  –10 to –50 dBc (nominal)

Frequency error

Range  ±500 Hz (nominal)

Accuracy  ±10 Hz (nominal) + (transmitter frequency x frequency reference accuracy)

**Code domain measurement**

**Code domain power**

Power range  
Mixer level (RF input power minus attenuation) is between –15 and –5 dBm

Accuracy  
QPSK modulated code signal

Relative range

- 0 to –10 dBc  ±0.015 dB
- –10 to –30 dBc  ±0.18 dB
- –30 to –40 dBc  ±0.51 dB

Symbol power vs. time  
QPSK modulated code signal

Range at RF input  
+30 to –40 dBm

Accuracy  ±0.3 dB (spread channel power is within 20 dB of total power; averaged power over a slot)

**Symbol error vector magnitude**

Range at RF input  
+30 to –20 dBm

Pilot time offset

(from even second signal to start PN sequence)

Range  –13.33 to +13.33 ms

Accuracy  ±250 ns

Resolution  10 ns

**Intermodulation distortion**

Range at RF input  
+30 to –20 dBm

Input intermodulation power range  
–20 to –65 dBc

Relative accuracy  ±1.5 dB

Resolution  0.01 dB display resolution

**Spectrum emission mask measurement**

Range at RF input  
+30 to –20 dBm

Spectrum emission  
≤ –136 dBc/Hz at 1 MHz offset

power range (nominal)

Relative accuracy  ±1.0 dB

Resolution  0.01 dB display resolution

**Occupied bandwidth measurement**

Range at RF input  
+30 to –20 dBm

Frequency

Resolution  1 kHz

Accuracy  ±3 kHz

---

7. Nominals for 8PSK/16QAM modulated code signal.
### Modulation accuracy measurement (composite rho)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range at RF input</td>
<td>+30 to –50 dBm</td>
</tr>
<tr>
<td>EVM</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>0 to 25%</td>
</tr>
<tr>
<td>Floor</td>
<td>2.0% or less</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01% display resolution</td>
</tr>
<tr>
<td>I/Q origin offset</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>–10 to –50 dBC</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.02 dB display resolution</td>
</tr>
<tr>
<td>Frequency error</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>±900 Hz</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±10 Hz + transmitter accuracy (nominal)</td>
</tr>
<tr>
<td>Resolution</td>
<td>±0.01 Hz display resolution</td>
</tr>
<tr>
<td>Pilot time offset</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>–13.33 to +13.33 ms</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±250 ns</td>
</tr>
<tr>
<td>Resolution</td>
<td>10 ns</td>
</tr>
<tr>
<td>Code domain timing</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>±200 ns</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±1.25 ns</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1 ns</td>
</tr>
<tr>
<td>Code domain phase</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>±200 mrad</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±10 mrad</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.1 mrad</td>
</tr>
</tbody>
</table>

### 1xEV-DO (Option E4406A-204)

#### Channel power measurement

1.23 MHz integration BW

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range at RF input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range at RF input</td>
<td>+30 dBm to –80 dBm</td>
</tr>
<tr>
<td>Absolute power accuracy</td>
<td>±0.6 dB</td>
</tr>
<tr>
<td>Range at RF input</td>
<td></td>
</tr>
<tr>
<td>Actual at RF input</td>
<td>±0.8 dB</td>
</tr>
<tr>
<td>Minimum</td>
<td>–40 dBm</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±1.0 dB</td>
</tr>
</tbody>
</table>

#### Power statistics CCDF measurement

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range at RF input</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>+30 dBm (average)</td>
</tr>
<tr>
<td>Minimum</td>
<td>–40 dBm (peak)</td>
</tr>
</tbody>
</table>

### Code domain measurement

For Pilot, 2 MAC channels, 16 channels of QPSK data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range at RF input (nominal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range at RF input</td>
<td>+30 to –50 dBm (nominal)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.3 dB (nominal, spread)</td>
</tr>
<tr>
<td>Channel power</td>
<td>channel power is within 20 dB</td>
</tr>
</tbody>
</table>

---

8. Nominal for 1xEV-DV signal.
**QPSK EVM measurement**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range at RF input</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVM</td>
<td>+30 to –20 dBm</td>
<td>+30 to –50 dBm</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>0 to 25% (nominal)</td>
<td>±1.0% at the range of 5% to 25%</td>
</tr>
<tr>
<td><strong>Floor</strong></td>
<td>1.5% (nominal)</td>
<td>±1.0% at the range of 5% to 25%</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±1.0% (nominal)</td>
<td>±1.0% at the range of 5% to 25%</td>
</tr>
<tr>
<td>I/Q origin offset range</td>
<td>–10 to –50 dBc</td>
<td>±1.5% (nominal)</td>
</tr>
<tr>
<td>Frequency error range</td>
<td>±500 Hz (nominal)</td>
<td>±10 Hz (nominal)</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±10 Hz (nominal)</td>
<td>±0.01 dB display resolution</td>
</tr>
<tr>
<td>Rho</td>
<td>0.9 to 1.0</td>
<td>±0.010 at 0.99751 Rho (5% EVM)</td>
</tr>
<tr>
<td><strong>Floor</strong></td>
<td>&gt; 0.99938 (0.99938 equals 2.5%EVM)</td>
<td>±0.0044 at 0.94118 Rho (25% EVM)</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±0.0010 at 0.99751 Rho (5% EVM)</td>
<td>±0.01 dB display resolution</td>
</tr>
<tr>
<td>Frequency error range</td>
<td>±400 Hz (nominal)</td>
<td>±10 Hz (nominal)</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±10 Hz (nominal)</td>
<td>±10 Hz (nominal)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01 Hz display resolution</td>
<td>±0.01 dB display resolution</td>
</tr>
<tr>
<td>I/Q origin offset range</td>
<td>–10 to –50 dBc</td>
<td>±1.0% (nominal)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.02 dB display resolution</td>
<td>±1.0% (nominal)</td>
</tr>
</tbody>
</table>

**Power vs. time**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range at RF input</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute power accuracy</td>
<td>+30 to –28 dBm</td>
<td>±0.6 dB (nominal)</td>
</tr>
<tr>
<td>at RF input</td>
<td>–28 to –50 dBm</td>
<td>±0.8 dB (nominal)</td>
</tr>
<tr>
<td>at RF input</td>
<td>–50 to –80 dBm</td>
<td>±1.0 dB (nominal)</td>
</tr>
</tbody>
</table>

**Modulation accuracy measurement (waveform quality)**

For Pilot, 2 MAC channels, 16 channels of QPSK data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range at RF input</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVM</td>
<td>+30 to –50 dBm</td>
<td>+30 to –50 dBm</td>
</tr>
<tr>
<td><strong>Range</strong></td>
<td>0 to 25% (nominal)</td>
<td>±1.5% (nominal)</td>
</tr>
<tr>
<td><strong>Floor</strong></td>
<td>2.5% or less (nominal)</td>
<td>±1.5% (nominal)</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±1.0% (nominal)</td>
<td>±1.0% (nominal)</td>
</tr>
<tr>
<td>Rho</td>
<td>0.9 to 1.0</td>
<td>±0.0010 at 0.99751 Rho (5% EVM)</td>
</tr>
<tr>
<td><strong>Floor</strong></td>
<td>&gt; 0.99938 (0.99938 equals 2.5%EVM)</td>
<td>±0.0044 at 0.94118 Rho (25% EVM)</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±0.0010 at 0.99751 Rho (5% EVM)</td>
<td>±0.01 dB display resolution</td>
</tr>
<tr>
<td>Frequency error range</td>
<td>±400 Hz (nominal)</td>
<td>±10 Hz (nominal)</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>±10 Hz (nominal)</td>
<td>±10 Hz (nominal)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01 Hz display resolution</td>
<td>±0.01 dB display resolution</td>
</tr>
<tr>
<td>I/Q origin offset range</td>
<td>–10 to –50 dBc</td>
<td>±1.0% (nominal)</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.02 dB display resolution</td>
<td>±1.0% (nominal)</td>
</tr>
</tbody>
</table>

**Intermodulation distortion**

Input signal must not be bursted

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range at RF input</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input intermodulation</td>
<td>+30 to –20 dBm</td>
<td>±3 dB (nominal)</td>
</tr>
<tr>
<td>Power range</td>
<td>–20 to –65 dBc</td>
<td>±1.5 dB</td>
</tr>
<tr>
<td>Relative accuracy</td>
<td>±0.01 dB display resolution</td>
<td>±1.0 dB</td>
</tr>
</tbody>
</table>

**Spurious emissions & ACP**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range at RF input</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectrum emission</td>
<td>+30 to –20 dBm</td>
<td>±1.0 dB</td>
</tr>
<tr>
<td>Power range</td>
<td>–136 dBc/Hz at 1 MHz offset (nominal)</td>
<td>±1.0 dB</td>
</tr>
<tr>
<td>Relative accuracy</td>
<td>±1.0 dB</td>
<td>±1.0 dB</td>
</tr>
<tr>
<td>Resolution</td>
<td>0.01 dB display resolution</td>
<td>±1.0 dB</td>
</tr>
</tbody>
</table>

**Occupied bandwidth measurement**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range at RF input</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>±3 kHz</td>
<td>±3 kHz at 1 kHz resolution bandwidth</td>
</tr>
</tbody>
</table>
**cdmaOne (Option E4406A-BAC)**

**Channel power measurement**

- **Range at RF input**: +30 to −80 dBm
- **Integration bandwidth range**: 1 kHz to 10 MHz (default is 1.23 MHz)
- **Absolute power accuracy for in-band signal (excluding mismatch error)**, 18 °C to 30 °C
- **RF input**
  - +30 to −28 dBm: ±0.6 dB (±0.4 dB, typical)
  - −28 to −50 dBm: ±0.8 dB (±0.7 dB, typical)
  - −50 to −80 dBm: ±1.0 dB (±0.9 dB, typical)
- **Relative power accuracy (same channel, different transmit power, input attenuator fixed)**, input level change
  - 0 to −76 dB: ±0.2 dB (±0.1 dB, typical)

**Code domain measurement (base station)**

- **Range at RF input**: +30 to −30 dBm
- **Measurement interval range**: 0.25 to 30 ms
- **Code domain power (measurement interval 1.25 ms)**
  - **Display dynamic range**: 50 dB
  - **Accuracy**: ±0.3 dB (Walsh channel power within 20 dB of total power)
  - **Resolution**: 0.01 dB
- **Other reported power parameters**
  - **Frequency error accuracy**: ±10 Hz (excludes frequency reference)
  - **Pilot time offset (from even second signal to start of PN sequence)**
    - **Range**: −13.33 to +13.33 ms
    - **Accuracy**: ±250 ns
    - **Resolution**: 10 ns
  - **Code domain timing (pilot to code-channel time tolerance)**
    - **Range**: ±200 ns
    - **Accuracy**: ±10 ns
    - **Resolution**: 0.1 ns
  - **Code domain phase (pilot to code-channel phase tolerance)**
    - **Range**: ±200 mrad
    - **Accuracy**: ±20 mrad
    - **Resolution**: 0.1 mrad
Modulation accuracy (rho) measurement

- Power range at RF input: +30 to –40 dBm
- Measurement interval range: 0.25 to 30 ms
- Rho (waveform quality) (usable range 0.5 to 1.0)
  - Range: 0.9 to 1.0
  - Accuracy: ±0.005
  - Resolution: 0.0001

Frequency error (frequency error excludes instrument time base error)
- Input frequency error range: ±900 Hz
- Accuracy: ±10 Hz + (transmitter frequency x frequency reference accuracy)
- Resolution: 0.1 Hz

Pilot time offset (from even second signal to start of PN sequence)
- Range: –13.33 to +13.33 ms
- Accuracy: ±250 ns
- Resolution: 10 ns

EVM
- Floor: 2.5% (1.8%, typical)
- Accuracy: ±0.5%
- Resolution: 0.1%

Carrier feedthrough
- Accuracy: ±2.0 dB
- Resolution: 0.1 dB

Magnitude error
- Accuracy: ±0.5%
- Resolution: ±0.01%

Phase error
- Accuracy: ±1.0 degrees
- Resolution: 0.1 degrees

Adjacent channel power ratio measurement

- Power range at RF input: +30 to –20 dBm
- Dynamic range (referenced to average power of carrier in 1.23 MHz BW)

<table>
<thead>
<tr>
<th>Offset frequency</th>
<th>Integ BW</th>
<th>Dynamic range</th>
</tr>
</thead>
<tbody>
<tr>
<td>750 kHz</td>
<td>30 kHz</td>
<td>–82 dBc</td>
</tr>
<tr>
<td>885 kHz</td>
<td>30 kHz</td>
<td>–82 dBc</td>
</tr>
<tr>
<td>1.25625 MHz</td>
<td>12.5 kHz</td>
<td>–86 dBc</td>
</tr>
<tr>
<td>1.98 MHz</td>
<td>30 kHz</td>
<td>–85 dBc</td>
</tr>
<tr>
<td>2.75 MHz</td>
<td>1 MHz</td>
<td>–56 dBc</td>
</tr>
</tbody>
</table>

Spurious close measurement (at transmitter maximum power)

- Carrier power range at RF input: +30 to –30 dBm
- Minimum spurious emission power sensitivity at RF input: –70 dBm (30 kHz RBW)
- Absolute accuracy for in-band signal: ±1.0 dB
- Relative accuracy: ±1.0 dB
- Resolution: 0.01 dB

Demod sync

- Even second input level and impedance same as external trigger
- PN offset range: 0 to 511 x 64 (chips)
- In-band frequency range
  - IS-95: 824 to 849 MHz
  - 869 to 894 MHz
  - J-STD-008: 1850 to 1910 MHz
  - 1930 to 1990 MHz
EDGE/GSM (Option E4406A-BAH)

GSMK Modulation

Power versus time measurement

Power versus time measures the average power during the “useful part” of the EDGE or GSM burst and verifies that the power ramp is within the EDGE or GSM mask. The specified EDGE or GSM masks for both base transceiver stations and mobile stations are provided. Power versus time also lets you view the rise, fall, and “useful part” of the burst. The timings are referenced to the transmitter from bit 13 to 14 of the training sequence (midamble).

Power vs. time and EDGE power vs. time

GMSK modulation (GSM)

3π/8 shifted 8PSK modulation (EDGE)

Measures mean transmitted RF carrier power during the useful part of the burst (GSM method) and the power vs. time ramping. 510 kHz RBW

Minimum carrier power –30 dBm (nominal)

at RF input for GSM and EDGE

Absolute power accuracy for in-band signal (excluding mismatch error)

18 to 30 °C; –0.11 ± 0.60 dB

(–0.11 ± 0.40 dB, typical)

0 to 55 °C; –0.11 ± 0.90 dB

Power ramp relative accuracy

Referenced to mean transmitted power

RF input range = Auto

+6 dB to noise

Mixer level ≤ -12 dBm

+6 dB to noise

Measurement floor –81 dBm + input attenuation (nominal)

Time resolution 200 ns

Burst to mask uncertainty ±0.2 bit (approx ±0.7 µs)

EDGE EVM measurement

The EDGE EVM measurement measures the modulation quality of the 3π/8 8PSK modulated signal providing you with IQ constellation diagram, error vector magnitude (EVM) in RMS and peak, 95 percentile, and I/Q origin offset.

EDGE EVM

(Error Vector Magnitude)

3π/8 shifted 8PSK modulation

Specifications based on 3GPP essential conformance requirements, and are based on 200 bursts

Carrie power range

at RF input

–45 dBm (nominal)

EVM

Range 0 to 25% (nominal)

Floor (RMS) 0.5%, (0.3%, typical)

Accuracy (RMS) ±0.5% (Power range at RF input from +27 to –12 dBm, EVM range 1% to 11%)

Frequency error ±1 Hz + (transmitter frequency x frequency reference accuracy)

I/Q origin offset range –20 to –45 dBc

Trigger to T0 time offset

Relative offset accuracy ±5.0 ns (nominal)

Output RF spectrum measurement

The output RF spectrum measurements determine the spectral energy emitted into the adjacent channels. The measurements are divided into two types: spectrum due to 3π/8 8PSK or GMSK modulation and noise, and spectrum due to switching transients (burst ramping). A single offset can be examined with a corresponding trace, or up to 15 offsets can be measured with a tabular data display.

Minimum carrier power –15 dBm (nominal)

at RF input

ORFS relative RF power uncertainty

Due to modulation

Offsets ≤ 1.2 MHz ±0.26 dB

Offsets ≥ 1.8 MHz ±0.36 dB

Due to switching ±0.27 dB (nominal)

ORFS absolute RF power accuracy 20 to 30 °C ±0.60 dB (±0.40 dB, typical)

Dynamic range

5-pole sync-tuned filters

Spectrum due to modulation

Methods: direct time and FFT

Offset frequency GSM EDGE

100 kHz 67.7 dB 67.7 dB

200 kHz 73.3 dB 73.3 dB

250 kHz 76.3 dB 76.3 dB

400 kHz 78.4 dB 77.9 dB

600 kHz 81.1 dB 80.2 dB

1.2 MHz 85.0 dB 83.3 dB

1.8 MHz 90.3 dB 82.4 dB

6.0 MHz 94.0 dB 85.3 dB

Spectrum due to switching

Offset frequency

400 kHz 68.7 dB (100%) 71.2 dB (95%)

600 kHz 71.0 dB (100%) 73.1 dB (95%)

1.2 MHz 74.1 dB (100%) 77.0 dB (95%)

1.8 MHz 78.4 dB (100%) 80.4 dB (95%)
**Transmit power measurement**

The transmit power measurement determines the average power for an RF signal burst at or above a user specified threshold value. The threshold value may be absolute, or relative to the peak value of the signal.

**Transmit power**

GMSK modulation (GSM)

- **Carrier power range at RF input**
  - +30dBm (1W) to -60 dBm
- **Absolute power accuracy**
  - +30 to -40dBm at RF input
  - (excluding mismatch error)
    - +18 to 30 °C: ±0.6 dB (±0.4 dB, typical)
    - 0 to +55 °C: ±0.9 dB
- **Relative power accuracy**
  - ±0.25dB (±0.1dB, typical)

**Phase and frequency error measurement**

Phase and frequency error measures the modulation quality of a GSM transmitter. Phase and frequency error can be displayed both numerically and or graphically. A binary representation of the demodulated data bits is also available.

**Phase and Frequency Error**

GMSK modulation (GSM)

- **Specifications based on 3GPP essential conformance requirements, and are based on 200 bursts.**
- **Carrier power range at RF Input**
  - +27 to -45 dBm (nominal)
- **Phase error**
  - **Floor (RMS)**: <0.5°
  - **Accuracy (RMS)**: ±0.5° (phase error range 1° to 15°)
- **Peak phase error**
  - **Floor**: <1.5°
  - **Accuracy**: ±2.0° (phase error range 3° to 25°)

**Frequency error**

- **Accuracy**: ±5 Hz + (transmitter frequency x frequency reference accuracy)

**I/Q offset**

- **Range**: -15 to -50 dBc (nominal)
- **Uncertainty**: ±0.1 bit (approx. ±0.4 μs)

**Trigger to T0 time offset**

- **Relative offset accuracy**: ±5.0 ns (nominal)

**Burst sync**

- **Source**: Training sequence, RF amplitude, external rear, none. Actual available choices dependent on measurement.
- **Training sequence code**: GSM defined 0 to 7 auto (search) or manual
- **Burst type**: Normal (TCH and CCH), Sync (SCH), Access (RACH)

**In-band frequency range**

- **Down band GSM**: 400 to 500 MHz
- **GSM 900, P-GSM**: 890 to 915 MHz
  - 935 to 960 MHz
- **GSM 900, E-GSM**: 880 to 915 MHz
  - 925 to 960 MHz
- **DCS 1800**: 1710 to 1785 MHz
  - 1805 to 1880 MHz
- **PCS1900**: 1850 to 1910 MHz
  - 1930 to 1990 MHz
- **GSM 450**: 450.4 to 457.6 MHz
  - 460.4 to 467.6 MHz
- **GSM480**: 478.8 to 486 MHz
  - 488.8 to 496 MHz
- **GSM850**: 824 to 849 MHz
  - 869 to 894 MHz
NADC/PDC (Option E4406A-BAE)

**ACPR measurement**
Carrier power range +27 to –20 dBm
at RF input
Dynamic range

**NADC mode**
Offset frequency (Integ BW)
30 kHz (32.8 kHz) –35 dB (nominal)
60 kHz (32.8 kHz) –65 dB
90 kHz (32.8 kHz) –70 dB

**PDC mode**
Offset frequency (Integ BW)
50 kHz (21.0 kHz) –55 dB
100 kHz (21.0 kHz) –70 dB

**Offset frequency (Integ BW)**

**Relative accuracy**
Resolution ±1.0 dB
Display resolution 0.01 dB

**EVM measurement**
EVM measurement measures the modulation quality of pi/4QPSK modulated signal providing you with IQ constellation diagram, error vector magnitude (EVM) in RMS and peak as well as each chip of magnitude error, phase error and EVM.

**Range at RF input**
Common in NADC and PDC

**EVM**
Range 0 to 25%
Floor 1.0%
Accuracy ±0.6%

**I/Q origin offset**
Range –10 to –50 dBc
Resolution 0.01 dB display resolution

**Carrier frequency error**
Frequency resolution 0.01 Hz display resolution

**OBW measurement (PDC only)**
Range at RF input +27 to –20 dBm
Frequency
Resolution 0.1 kHz
Accuracy +400 Hz, –100 Hz

**In-band frequency range (NADC)**
800 MHz band
Mobile transmit 824 to 849 MHz
Base station transmit 869 to 894 MHz

**PCS band**
Mobile transmit 1850 to 1910 MHz
Base station transmit 1930 to 1990 MHz

**In-band frequency range (PDC)**
800 MHz band #1 810 to 828 MHz
940 to 958 MHz
800 MHz band #2 870 to 885 MHz
925 to 940 MHz
800 MHz band #3 838 to 840 MHz
893 to 895 MHz
1500 MHz band 1477 to 1501 MHz
1429 to 1453 MHz

**General characteristics**

**Temperature range**
Operating 0 to +55 °C
Non-operating –40 to +71 °C

**EMI compatibility**
Conducted and radiated emission is in compliance with CISPR Pub. 11/1990 Group 1 Class A.

**Radiated immunity (RF input)**
When tested at 3 V/m according to IEC 801-3/1984, the displayed average noise level will be within specifications over the full immunity test frequency range of 27 to 500 MHz, except that at immunity test frequencies of 278.6 MHz ± selected resolution bandwidth and 321.4 MHz ± selected resolution bandwidth, the displayed average noise level may be up to –90 dBm. When the analyzer tuned frequency is identical to the immunity test signal frequency there may be signals of up to ±90 dBm displayed on the screen.
**Electrostatic**
In accordance with IEC 801-2/1991, an discharge air discharge of up to 8 kV, or a contact discharge of up to 4 kV, will not cause any change of instrument state or measurement data. However, discharges to center pins of front or rear panel connectors might cause damage to the associated circuitry.

**Power requirements**
- **Voltage, frequency**
  - 90 to 132 V rms, 47 to 440 Hz
  - 195 to 250 V rms, 47 to 66 Hz
- **Power consumption, ON** < 350 W
- **Power consumption, standby** < 20 W

**Weight**
- **Net** 19 kg (42 lb) (nominal)
- **Shipping** 39 kg (86 lb) (nominal)

**Dimensions**
- 177 mm H x 426 mm W x 432 mm D
  - (7.0 in H x 16.8 in W x 17 in D)

**Front panel**
- **RF input**
  - **Connector** Type N female
  - **Impedance** 50 Ω (nominal)
  - **VSWR**
    - 20 to 2205 MHz ≤ 1.4:1 (≤ 1.24:1, typical)
    - 2205 MHz to 4 GHz ≤ 1.6:1 (≤ 1.4:1, typical)
    - 50 MHz ≤ 1.4:1 (≤ 1.08:1, typical)
  - **Baseband I/Q inputs**
    - Balanced input impedance 600 Ω, 1 MΩ (nominal) (switchable)
    - Unbalanced input impedance 50 Ω, 1 MΩ (nominal) (switchable)
    - VSWR ≤ 1.4:1 (≤ 1.08:1, typical)
  - **Connectors**
    - 4 each I, Q, I–, and Q– BNC female

**Probe pwr**
- **Voltage/current** +15 Vdc, ±7% at 150 mA maximum
- −12.6 Vdc, ±10% at 150 mA maximum

**Rear panel**
- **10 MHz OUT**
  - **Connector** BNC female
  - **Impedance** 50 Ω (nominal)
  - **Output amplitude** ≥ 0 dBm (nominal)

**EXT REF IN**
- **Connector** BNC female
- **Impedance** 50 Ω (nominal)
- **Input amplitude range** −5 to +10 dBm (nominal)
- **Maximum DC level** ±28 Vdc
- **Frequency** 1 MHz to 30 MHz, selectable
- **Frequency lock range** ±5 x 10⁻⁶ of the specified external reference input frequency

**TRIGGER IN**
- **Connector** BNC female
- **Impedance** −10 kΩ (nominal)
- **Trigger level** −5 to +5 V

**TRIGGER 1 OUT and TRIGGER 2 OUT**
- **Connector** BNC female
- **Impedance** 50 kΩ (nominal)
- **Trigger level** 0 to +5 V (no load)

**MONITOR output**
- **Connector** VGA compatible, 15-pin mini D-SUB
- **Format** VGA (31.5 kHz horizontal, 60 Hz vertical sync rates, noninterlaced)
- **Resolution** 640 x 480

**PARALLEL interface**
- Allows printing to compatible printers

**GPIB interface**
- Allows communication with compatible devices

**LAN interface**
- Allows communication with 10baseT LAN

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*Note: Instrument noise sidebands and spurious responses might be affected by the quality of the external reference used.*
Agilent E4406A vector signal analyzer
product and application information

Agilent E4406A Vector Signal Analyzer, Brochure
Literature number 5968-7618E

PSA Series Spectrum Analyzers E4406A Vector Signal Analyzer Technical Overviews
• W-CDMA and HSDPA/HSUPA Measurement Personality
  Literature number 5988-2388EN
• cdma2000 and 1xEV-DV Measurement Personality
  Literature number 5988-3694EN
• 1xEV-DO Measurement Personality
  Literature number 5988-4828EN
• GSM with EDGE Measurement Personality
  Literature number 5988-2389EN

Select the Right Agilent Signal Analyzer for Your Needs, Selection Guide
Literature number 5968-3413E

Application notes

AN 1298 Digital Modulation in Communications Systems – An Introduction
Literature number 5965-7160E

AN 1311 Understanding CDMA Measurements for Base Stations and Their Components
Literature number 5968-0953E

AN 1312 Understanding GSM/EDGE Transmitter and Receiver Measurements for Base Transceiver Stations and their Components
Literature number 5968-2320E

AN 1313 Testing and Troubleshooting Digital RF Communications Transmitter Designs
Literature number 5968-3578E

AN 1314 Testing and Troubleshooting Digital RF Communications Receiver Designs
Literature number 5968-3579E

AN 1324 Understanding PDC and NADC Transmitter Measurements for Base Transceiver Stations and Mobile Stations, Literature number 5968-5537E

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