TECHNICAL SPECIFICATIONS

# LitePoint IQxstream-M™

LITEPOINT


IQxstream-M is a manufacturing-oriented, multi-device, physical layer communication system tester, tailored to calibrating and verifying performance in high volume production environments. Non-signaling physical layer testers offer 3x or better test throughput when compared against signaling based methodologies typical of R&D and conformance testing. IQxstream-M addresses all major wireless technologies and RF bands including cellular, wireless LAN (Wi-Fi), navigation, and other common wireless standards in support of the Smartphone, Tablet, Data-Card, Module, IoT, Small Cell base stations, and other mobile connectivity consumer devices.

IQxstream-M supports the following wireless technologies:

**Cellular**

- LTE / LTE-Advanced / LTE-Advance Pro
- LTE Cat 0 (Cat-M1) and LTE Cat-NB (NB-IoT)
- W-CDMA / HSPA / HSPA+
- GSM / EDGE
- CDMA2000 / 1xEV-DO
- TD-SCDMA

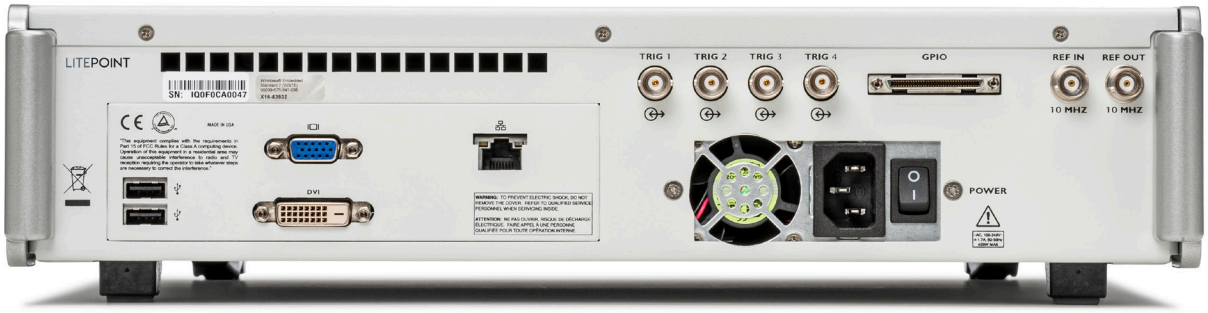
**Connectivity**

- 802.11a/b/g/n/j/p/af/ah
- Bluetooth 1.0, 2.x, 3.0, 4.x, 5
- Navigation: GPS, GLONASS
- ZigBee (802.15.4)
- DECT
- SISO and MIMO Antenna Configurations

## Port Descriptions


### Front Panel

| I/O | | Function | Type |
|---|---|---|---|
| Power Switch | | Power On/Off | Pushbutton Switch |
| Power Indicator | | LED Red – Powered Up, Standby<br>LED Green – Powered Up, Running | LED Indicator |
| USB (2) | | USB I/O | Type A |
| RF1 Bank 1, RF1 Bank 2 | ROUT11 | VSG / VSA Ports | BMA Male |
| RF2 Bank 1, RF2 Bank 2 | | VSG / VSA Ports | BMA Male |
| RF3 Bank 1, RF3 Bank 2 | | VSG / VSA Ports | BMA Male |
| RF4 Bank 1, RF4 Bank 2 | | VSG / VSA Ports | BMA Male |
| RF1 Bank 1, RF1 Bank 2 | ROUT12 | VSG / VSA Ports | BMA Male |
| RF2 Bank 1, RF2 Bank 2 | | VSG / VSA Ports | BMA Male |
| RF3 Bank 1, RF3 Bank 2 | | VSG / VSA Ports | BMA Male |
| RF4 Bank 1, RF4 Bank 2 | | VSG / VSA Ports | BMA Male |
| RF1 Bank 1, RF1 Bank 2 (optional) | ROUT13 | VSG / VSA Ports | BMA Male |
| RF2 Bank 1, RF2 Bank 2 (optional) | | VSG / VSA Ports | BMA Male |
| RF3 Bank 1, RF3 Bank 2 (optional) | | VSG / VSA Ports | BMA Male |
| RF4 Bank 1, RF4 Bank 2 (optional) | | VSG / VSA Ports | BMA Male |
| RF1 Bank 1, RF1 Bank 2 (optional) | ROUT14 | VSG / VSA Ports | BMA Male |
| RF2 Bank 1, RF2 Bank 2 (optional) | | VSG / VSA Ports | BMA Male |
| RF3 Bank 1, RF3 Bank 2 (optional) | | VSG / VSA Ports | BMA Male |
| RF4 Bank 1, RF4 Bank 2 (optional) | | VSG / VSA Ports | BMA Male |




Rear Panel
General I/O

| I/O | Function | Type |
|---|---|---|
| 10 MHz REF In | 10 MHz Reference In | BNC female |
| 10 MHz REF Out | 10 MHz Reference Out | BNC female |
| TRIG 1 | TTL Trigger Input / Output | BNC female |
| TRIG 2 | TTL Trigger Input / Output | BNC female |
| TRIG 3 | TTL Trigger Input / Output | BNC female |
| TRIG 4 | TTL Trigger Input / Output | BNC female |

Communication I/O

| I/O | Function | Type |
|---|---|---|
| VGA | Video Output | 15-Pin DSUB |
| DVI | Video Output | DVI-I |
| USB 1 | USB I/O – Keyboard | Type A |
| USB 2 | USB I/O – Mouse | Type A |
| LAN | 1000 Base-T LAN | RJ-45 |
| GPIO | General Purpose I/O | 50-Pin Connector |

## General Hardware Specifications

### Vector Signal Analyzer (VSA)

| Parameters | Ports | Value |
|---|---|---|
| RF Frequency Range | All Ports | 75 MHz to 6000 MHz |
| RF Maximum Input Power | | +36 dBm (peak envelope power)[1] |
| Effective Sample Rate | | 61.44 Msps |
| Capture Memory Depth | | 64 Msamples |
| Measurement Frequency Resolution | | 0.1 Hz |
| Input Impedance | | 50 Ω (nominal) |
| Power Measurement Accuracy[2, 3] | | < ± 1 dB (level > -40 dBm), 75 MHz to 300 MHz<br>< ± 0.4 dB (level > -40 dBm), 300 MHz to <3800 MHz<br>< ± 0.75 dB (level > -40 dBm), 3800 MHz to 6000 MHz |
| Power Measurement Repeatability | | < 0.1 dB (within 30 seconds of initial value), signal level > -40 dBm |
| Noise Figure | | <30 dB (at MIN attenuation), 300 MHz to <700 MHz<br><29 dB (at MIN attenuation), 700 MHz to <4000 MHz<br><40 dB (at MIN attenuation), 4000 MHz to 6000 MHz |
| Signal to Noise Ratio | | > 90 dB @ RBW = 1 kHz, input > -10 dBm, 400 MHz to <2000 MHz<br>> 80 dB @ RBW = 1 kHz, input > -10 dBm, 2000 MHz to 6000 MHz |
| VSWR (typical) | | < 1.6 : 1 (RL > 12.5 dB) 400 MHz to < 700 MHz<br>< 1.3 : 1 (RL > 18 dB) 700 MHz to < 2200 MHz<br>< 1.4 : 1 (RL > 16 dB) 2200 MHz to < 3400 MHz<br>< 1.8 : 1 (RL > 11 dB) 3400 MHz to 6000 MHz |
| Port Switching Time[4] | | < 50 µs (to within 0.1 dB) |
| Isolation | RF1 to RF4<br>Within a Bank of Ports | Port-to-Port, VSG Duplex Mode<br>> 55 dB (75 MHz to <2400 MHz)<br>> 40 dB (2400 MHz to 6000 MHz) |
| | | Port-to-Port, VSG Broadcast Mode<br>> 40 dB (75 MHz to <2500 MHz)<br>> 55 dB (2500 MHz to <4000 MHz)<br>> 45 dB (4000 MHz to 6000 MHz) |
| | RF1 – RF4, Between ROUT Modules | > 100 dB (75 MHz to 3800 MHz)<br>> 90 dB (> 3800 MHz) |

[1] Maximum peak envelope power at +36 dBm is specified for a GSM signal at 1/8th duty cycle
[2] Specifications valid when quality interface cables are used. Please contact LitePoint for recommended interface options
[3] For power levels above +30 dBm, add an additional +/- 0.1 dB of uncertainty
[4] When using hardware sequencing control

| Parameters | Ports | Value |
|---|---|---|
| Inherent Spurious Signals Floor (no input signal applied, RLEV = -10 dBm) | All Ports | < -73 dBm (<700 MHz)<br>< -83 dBm (700 MHz to <2700 MHz)<br>< -73 dBm (2700 MHz to 6000 MHz) |
| Input third order intercept point (IIP3) | | > +40 dBm (at MAX attenuation) |
| Non-harmonic Attenuation | | > 50 dB (Input level < +15 dBm) |
| Harmonic Attenuation | | > 40 dB (400 MHz to 6000 MHz)<br>> 10 dB (< 400 MHz) |
| Phase Noise | | < -108 dBc/Hz @ 900 MHz (250 kHz to 400 kHz offset)<br>< -102 dBc/Hz @ 1800 MHz (250 kHz to 400 kHz offset)<br>< -101 dBc/Hz @ 2400 MHz (250 kHz to 400 kHz offset)<br>< -93 dBc/Hz @ 5800 MHz (250 kHz to 400 kHz offset) |

Vector Signal Generator (VSG)

| Parameters | Ports | Value |
|---|---|---|
| RF Frequency Range | All RF Ports | 75 MHz to 6000 MHz |
| RF Output Power Range (Duplex) | | -15 dBm to -120 dBm (75 MHz to 3800 MHz) |
| | | -25 dBm to -120 dBm (> 3800 MHz to 6000 MHz) |
| RF Output Power Range (Broadcast) | | -12 dBm[1] to -120 dBm (400 MHz to 3000 MHz) |
| | | -50 dBm to -120 dBm (>3000 MHz to 6000 MHz) |
| Center Frequency Resolution | | 0.1 Hz |
| Power Level Resolution | | 0.1 dB |
| Power Level Settling Time[2] | | < 50 us to within 0.1 dB |
| Frequency Level Settling Time | | < 400 us to within 1 kHz |
| Output Power Accuracy (Duplex & VSG mode)[3] | | < ± 1 dB typical (level > -40 dBm), 75 MHz to <300 MHz<br>± 0.5 dB (levels ≥ -50 dBm), 300 MHz to <3800 MHz<br>± 0.75 dB (levels ≥ -50 dBm), 3800 MHz to 6000 MHz |
| | | ± 0.75 dB (-100 to < -50 dBm), 300 MHz to 3800 MHz<br>± 1 dB (-100 to < -50 dBm), 3800 MHz to 6000MHz |
| Broadcast Mode Output Power Uncertainty | RF1 – RF4, Within a Bank | ± 0.75 dB + VSG Power Accuracy<br>± 0.25 dB (typical) + VSG Power Accuracy<br>All ports in 50 ohms |
| Power Level Repeatability | All Ports | ± 0.1 dB (within 30 seconds of initial value) |
| VSWR (typical) | | < 1.6 : 1 (RL > 12.5 dB) 400 MHz to < 700 MHz<br>< 1.3 : 1 (RL > 18 dB) 700 MHz to < 2200 MHz<br>< 1.4 : 1 (RL > 16 dB) 2200 MHz to < 3400 MHz<br>< 1.8 : 1 (RL > 11 dB) 3400 MHz to 6000 MHz |

[1] -12 dBm enabled in firmware v1.9 and later
[2] When using hardware sequencing control
[3] Specifications valid when quality interface cables are used. Please contact LitePoint for recommended interface options.

| | | |
|---|---|---|
| Harmonic Attenuation | All Ports | < -40 dBc (output levels < -30 dBm), 350 MHz to 6000 MHz |
| Non-harmonic Attenuation | | < -32 dBc (output levels < -30 dBm), 400 MHz to 6000 MHz |
| Phase Noise | | < -108 dBc/Hz @ 900 MHz (250 kHz to 400 kHz offset)<br>< -102 dBc/Hz @ 1800 MHz (250 kHz to 400 kHz offset)<br>< -101 dBc/Hz @ 2400 MHz (250 kHz to 400 kHz offset)<br>< -93 dBc/Hz @ 5800 MHz (250 kHz to 400 kHz offset) |

### Timebase

| Parameters | Value |
|---|---|
| Oscillator Type | OCXO |
| Frequency | 10 MHz |
| Initial Accuracy (25°C, After 60 Minute Warm-Up) | < ± 0.04 ppm |
| Maximum Aging | < ± 0.1 ppm per year |
| Temperature Stability | < ± 0.05 ppm over 0°C to 50°C range, referenced to 25°C<br>< ± 0.01 ppm over 20°C to 35°C range |
| Warm-Up Time | 60 minutes |

## General Purpose RF

### Signal Generator

| Controls | Description | Setting Range |
|---|---|---|
| Frequency | Sets the VSG center frequency | See General HW Specifications |
| Output Power Level | Sets the VSG output power level | See General HW Specifications |

### Vector Signal Analyzer

| Controls | Description | Setting Range |
|---|---|---|
| Frequency | Sets the VSA center frequency | See General HW Specifications |
| Reference Level | Sets the VSA input power range | +36 dBm to -5 dBm |
| Resolution Bandwidth (RBW) | Sets the VSA resolution bandwidth | 1 Hz to 10 MHz |
| Sample Rate | Sets the VSA sample rate | See General HW Specifications |
| Capture Length | Sets the capture time | See General HW Specifications |
| Trigger Source | Sets the trigger input source | VSG11, VSG12, VSG13, VSG14, EXT1,2,3,4 |
| Trigger Level | Sets the RF trigger level | See General HW Specifications |
| Edge Level | Sets rising or falling edge trigger direction | |

### Graphic Display

| Controls | Description |
|---|---|
| Power in Band Table | Integrated power results (up to 10 results) |
| Spectrum (PSD) | Spectrum Display (Power vs. Frequency), Up to 30 MHz span |

## Factory Efficiency Module

The Factory Efficiency Module allows you to detect and repair test fixture wear and tear as well as improve test yield. These features are tailored specifically for issues that are common in the manufacturing environment.

| Measurement | Description |
|---|---|
| Fixture Health Check | Detects any signal integrity change between the tester and the end of the test fixture that could negatively impact RF measurements |
| DUT Sense | Detects that a DUT has been correctly placed in the test fixture by ensuring that the DUT antenna connection to the tester is of good quality |
| Return Loss | A magnitude measurement of the reflected signal as seen by the tester RF port |
| Fixture Health Check minimum detectable path change | 0.05 dB[1] |
| Fixture Health Check maximum external pathloss | 15 dB |
| Return Loss Magnitude Uncertainty[2] | <±1 dB, 450 MHz to 4000 MHz, RL > -12 dB |

[1] Relative to fixture reference measurement
[2] Trace filtering applied

## General and Environmental

| Parameters | Value |
|---|---|
| Dimensions | 14.5" W x 3.2" H x 20.5" D (368 mm x 82 mm x 521 mm) |
| Weight | 24 pounds (11 kg) |
| Power consumption | < 350 W |
| Average power consumption | < 180 W |
| Operating temperature | +10°C to +55°C (IEC EN60068-2-1, 2, 14) |
| Storage temperature | -20°C to +70°C (IEC EN60068-2-1, 2, 14) |
| Specification Validity Temperature[1] | 20°C to 35°C |
| Operating / storage humidity | 15% to 95% relative humidity, non-condensing (IEC EN60068-2-30) |
| EMC | EN61326-1 Class A, EN55011 |
| EMI (Immunity) | EN61000-4 |
| Safety | IEC 61010-1, EN61010-1, UL61010-1:2012 and CAN/CSA-C22.2 No. 61010-1-12 |
| Mechanical vibration | IEC 60068-2-6 for Sine Vibration and MIL-STD 810G for Random Vibration |
| Mechanical shock | ASTM D3332-99 |
| Recommended calibration cycle | 24 months |
| Warranty | 12 months hardware<br>12 months software updates |

[1] Specifications valid over temperature range after invoking temperature compensation function. For highest accuracy, recommend to enable temperature compensation if ambient temperature changes by more than 2° C. Temperature compensation is effective for frequencies: 400 MHz to 6000 MHz.

## Wireless Standards Support

IQxstream-M supports a wide variety of wireless standards and tests. As a software driven instrument, these capabilities will be updated from time to time to meet the needs of changing requirements. This includes the addition of new bands or enhancements to the standards.

At the time of this document's publication, IQxstream-M includes direct support for the standards based testing documented in the following tables. In addition to the tests noted, other measurements are often available that extend or provide additional information surrounding a specific test. For details of such additional support, please see the IQxstream-M user documentation.

IQxstream-M supports a continuous frequency range between 75 MHz and 6,000 MHz. Technology-specific frequency band support is detailed in the following section, but does not imply that frequency support is restricted only to the band listed.

Many standards specify tests under very specific test conditions. For example all standards contain a variety of power tests e.g. Max Power, Minimum Power, etc. IQxstream-M fundamentally measures power. If you can set the DUT to the particular state, IQxstream-M will measure its power, and additionally EVM, carrier frequency and a variety of generic measurements. Support for a specific test as described in the following pages does not impose any limitation on IQxstream-M capabilities. It only describes a minimum feature set included with the tester. IQxstream-M can do far more, and perhaps more importantly, can have specific capabilities added to it via software updates to meet application-specific needs.

## LTE Frequency Bands Supported

| Frequency Bands | Frequency Range (Generator) | Frequency Range (Analyzer) | Duplex Mode |
|---|---|---|---|
| 1 | 2110 MHz to 2170 MHz | 1920 MHz to 1980 MHz | FDD |
| 2 | 1930 MHz to 1990 MHz | 1850 MHz to 1910 MHz | FDD |
| 3 | 1805 MHz to 1880 MHz | 1710 MHz to 1785 MHz | FDD |
| 4 | 2110 MHz to 2155 MHz | 1710 MHz to 1755 MHz | FDD |
| 5 | 869 MHz to 894 MHz | 824 MHz to 849 MHz | FDD |
| 7 | 2620 MHz to 2690 MHz | 2500 MHz to 2570 MHz | FDD |
| 8 | 925 MHz to 960 MHz | 880 MHz to 915 MHz | FDD |
| 9 | 1845 MHz to 1880 MHz | 1750 MHz to 1785 MHz | FDD |
| 10 | 2110 MHz to 2170 MHz | 1710 MHz to 1770 MHz | FDD |
| 11 | 1476 MHz to 1496 MHz | 1428 MHz to 1448 MHz | FDD |
| 12 | 728 MHz to 746 MHz | 698 MHz to 716 MHz | FDD |
| 13 | 746 MHz to 756 MHz | 777 MHz to 787 MHz | FDD |
| 14 | 758 MHz to 768 MHz | 788 MHz to 798 MHz | FDD |
| 17 | 734 MHz to 746 MHz | 704 MHz to 716 MHz | FDD |
| 18 | 860 MHz to 875 MHz | 815 MHz to 830 MHz | FDD |
| 19 | 875 MHz to 890 MHz | 830 MHz to 845 MHz | FDD |
| 20 | 791 MHz to 821 MHz | 832 MHz to 862 MHz | FDD |

| Frequency Bands | Frequency Range (Generator) | Frequency Range (Analyzer) | Duplex Mode |
|---|---|---|---|
| 21 | 1495.9 MHz to 1510.9 MHz | 1447.9 MHz to 1462.9 MHz | FDD |
| 22 | 3510 MHz to 3590 MHz | 3410 MHz to 3490 MHz | FDD |
| 23 | 2180 MHz to 2200 MHz | 2000 MHz to 2020 MHz | FDD |
| 24 | 1525 MHz to 1559 MHz | 1626.5 MHz to 1660.5 MHz | FDD |
| 25 | 1930 MHz to 1995 MHz | 1850 MHz to 1915 MHz | FDD |
| 26 | 859 MHz to 894 MHz | 814 MHz to 849 MHz | FDD |
| 27 | 852 MHz to 869 MHz | 807 MHz to 824 MHz | FDD |
| 28 | 758 MHz to 803 MHz | 703 MHz to 748 MHz | FDD |
| 29 | 717 MHz to 728 MHz | Downlink Only | FDD |
| 30 | 2350 MHz to 2360 MHz | 2305 MHz to 2315 MHz | FDD |
| 31 | 462.5 MHz to 467.5 MHz | 452.5 MHz to 457.5 MHz | FDD |
| 33 | 1900 MHz to 1920 MHz | 1900 MHz to 1920 MHz | TDD |
| 34 | 2010 MHz to 2025 MHz | 2010 MHz to 2025 MHz | TDD |
| 35 | 1850 MHz to 1910 MHz | 1850 MHz to 1910 MHz | TDD |
| 36 | 1930 MHz to 1990 MHz | 1930 MHz to 1990 MHz | TDD |
| 37 | 1910 MHz to 1930 MHz | 1910 MHz to 1930 MHz | TDD |
| 38 | 2570 MHz to 2620 MHz | 2570 MHz to 2620 MHz | TDD |
| 39 | 1880 MHz to 1920 MHz | 1880 MHz to 1920 MHz | TDD |
| 40 | 2300 MHz to 2400 MHz | 2300 MHz to 2400 MHz | TDD |
| 41 | 2496 MHz to 2690 MHz | 2496 MHz to 2690 MHz | TDD |
| 42 | 3400 MHz to 3600 MHz | 3400 MHz to 3600 MHz | TDD |
| 43 | 3600 MHz to 3800 MHz | 3600 MHz to 3800 MHz | TDD |
| 44 | 703 MHz to 803 MHz | 703 MHz to 803 MHz | TDD |
| 45 | 1447 MHz to 1467 MHz | Downlink Only | TDD |
| 46 | 5150 MHz to 5925 MHz | Downlink Only | TDD |
| 47 | 5855 MHz to 5925 MHz | Downlink Only | TDD |
| 48 | 3550 MHz to 3700 MHz | Downlink Only | TDD |
| 49 | 3550 MHz to 3700 MHz | Downlink Only | TDD |
| 50 | 1432 MHz to 1517 MHz | Downlink Only | TDD |
| 51 | 1427 MHz to 1432 MHz | Downlink Only | TDD |
| 52 | 3300 MHz to 3400 MHz | Downlink Only | TDD |

| Frequency Bands | Frequency Range (Generator) | Frequency Range (Analyzer) | Duplex Mode |
|---|---|---|---|
| 65 | 2110 MHz to 2200 MHz | 1920 MHz to 2010 MHz | FDD |
| 66 | 2110 MHz to 2200 MHz | 1710 MHz to 1780 MHz | FDD |
| 68 | 753 MHz to 783 MHz | 698 MHz to 728 MHz | FDD |
| 70 | 1995 MHz to 2020 MHz | 1695 MHz to 1710 MHz | FDD |
| 71 | 617 MHz to 652 MHz | 663 MHz to 698 MHz | FDD |
| 72 | 461 MHz to 466 MHz | 451 MHz to 456 MHz | FDD |
| 73 | 460 MHz to 465 MHz | 450 MHz to 455 MHz | FDD |
| 74 | 1475 MHz to 1518 MHz | 1427 MHz to 1470 MHz | FDD |
| 85 | 728 MHz to 746 MHz | 698 MHz to 716 MHz | FDD |

## LTE Terminal Tests for UE Categories 1 through 12, Cat-0 (Cat-M1), and Cat-NB1 (NB-IoT)

| Standard Test | 3GPP TS 36.521-1 Reference Paragraph | Notes |
|---|---|---|
| Maximum output power | 6.2.2 | |
| Maximum power reduction | 6.2.3 | |
| Transmit on/off time mask | 6.3.4 | |
| Minimum output power | 6.3.2 | |
| Transmit off power | 6.3.3 | |
| Power control absolute | 6.3.5.1 | |
| Power control relative | 6.3.5.2 | |
| Frequency error | 6.5.1 | |
| Error vector magnitude | 6.5.2.1 | |
| EVM equalizer spectrum flatness | 6.5.2.4 | |
| Carrier leakage | 6.5.2.2 | |
| Occupied bandwidth | 6.6.1 | |
| In-band emissions for non-allocated RB | 6.5.2.3 | |
| ACLR | 6.6.2.3 | |
| Spectrum emission mask | 6.6.2.1 | |
| Spurious emissions | 6.6.3.1 | 75 MHz to 6 GHz |

| Standard Test | 3GPP TS 36.521-1 Reference Paragraph | Notes |
|---|---|---|
| Reference sensitivity | 7.3 | DUT support required |
| Maximum input level | 7.4 | DUT support required |
| RX level | | DUT support required. A common test as part of device calibration / verification. |

## LTE Small Cell Base Station Tests

| Standard Test | 3GPP TS 36.141 Reference Paragraph | Notes |
|---|---|---|
| Home BS output power | 6.2.1 | |
| Home BS output power for adjacent UTRA channel protection | 6.2.6 | |
| Home BS output power for adjacent E-UTRA channel protection | 6.2.7 | |
| Transmit off power | 6.4.1 | |
| Frequency error | 6.5.1 | |
| Error vector magnitude | 6.5.2 | |
| Occupied bandwidth | 6.6.1 | |
| ACLR | 6.6.2 | |
| Operating band unwanted emissions | 6.6.3 | |
| Transmitter spurious emissions | 6.6.4 | 75 MHz to 6000 MHz |
| Reference sensitivity | 7.2 | DUT support required |

## WCDMA/HSPA/HSPA+/Dual Carrier HSPA+ Frequency Bands

| Bands | Frequency Range (Analyzer) | Frequency Range (Generator) |
|---|---|---|
| I | 1920 - 1980 MHz | 2110 - 2170 MHz |
| II | 1850 - 1910 MHz | 1930 - 1990 MHz |
| III | 1710 - 1785 MHz | 1805 - 1880 MHz |
| IV | 1710 - 1755 MHz | 2110 - 2155 MHz |
| V | 824 - 849 MHz | 869 - 894 MHz |
| VI | 830 - 840 MHz | 875 - 885 MHz |
| VII | 2500 - 2570 MHz | 2620 - 2690 MHz |
| VIII | 880 - 915 MHz | 925 - 960 MHz |

| Measurement | | Performance |
|---|---|---|
| IX | 1749.9 - 1784.9 MHz | 1844.9 - 1879.9 MHz |
| X | 1710 - 1770 MHz | 2110 - 2170 MHz |
| XI | 1427.9 - 1447.9 MHz | 1475.9 - 1495.9 MHz |
| XII | 698 - 716 MHz | 728 - 746 MHz |
| XIII | 777 - 787 MHz | 746 - 756 MHz |
| XIV | 788 - 798 MHz | 758 - 768 MHz |

## WCDMA/HSPA/HSPA+/Dual Carrier HSPA+Terminal Tests

| Bands | Frequency Range (Analyzer) | Frequency Range (Generator) |
|---|---|---|
| Maximum output power | 5.2 | |
| Minimum output power | 5.4.3 | |
| Transmitter off power | 5.5.1 | |
| Inner loop power control | 5.4.2 | |
| Frequency error | 5.3 | |
| Error Vector Magnitude (EVM) | 5.13.1 | |
| Phase discontinuity | 5.13.3 | |
| I/Q mismatch | 5.13.1AAA | |
| Occupied BW | 5.8 | |
| Peak code domain error | 5.13.2 | |
| ACLR | 5.10 | |
| Spectrum Emission Mask (SEM) | 5.9 | |
| Spurious emissions | 5.11 | 75 MHz to 6 GHz |
| Reference sensitivity | 6.2, 6.2A | DUT support required |
| Maximum input level | 6.3, 6.3B | DUT support required |
| RX level | | DUT support required. A common test as part of device calibration / verification |
| RSCP | | DUT support required. A common test as part of device calibration / verification |

## WCDMA Small Cell Base Station Tests

| Standard Test | 3GPP TS 25.141 Reference Paragraph | Notes |
|---|---|---|
| Maximum output power | 6.2.1 | |
| Primary CPICH power accuracy | 6.2.2 | |
| Frequency error | 6.3.1 | |
| Occupied BW | 6.5.1 | |
| Spectrum Emission Mask (SEM) | 6.5.2.1 | |
| ACLR | 6.5.2.2 | |
| Error Vector Magnitude (EVM) | 6.7.1 | |
| Peak Code Domain Error (PCDE) | 6.7.2 | |
| Reference sensitivity | 7.2 | DUT support required |

## GSM/EDGE Frequency Bands Supported

| Frequency Bands | Frequency Range (Generator) | Frequency Range (Analyzer) |
|---|---|---|
| GSM 450 band | 460 MHz to 468 MHz | 450 MHz to 458 MHz |
| GSM 480 band | 488 MHz to 496 MHz | 478 MHz to 486 MHz |
| GSM 750 band | 747 MHz to 762 MHz | 777 MHz to 792 MHz |
| GSM 850 band | 869 MHz to 894 MHz | 824 MHz to 849 MHz |
| R-GSM 900 band | 921 MHz to 960 MHz | 876 MHz to 915 MHz |
| DCS 1800 band | 1805 MHz to 1880 MHz | 1710 MHz to 1785 MHz |
| GSM 1900 band | 1930 MHz to 1990 MHz | 1850 MHz to 1910 MHz |

## GSM/EDGE Tests

| Standard Test | 3GPP TS 51.010-1 Reference Paragraph | Notes |
|---|---|---|
| TX output power | 13.3, 13.17.3 | |
| Transmit burst timing | 13.3, 13.17.3 | |
| Frequency error | 13.1, 13.17.1 | |
| Phase error | 13.1, 13.17.1 | |
| Error Vector Magnitude (8-PSK) | 13.17.1 | |
| Origin offset suppression | 13.17.1 | I/Q Mismatch, I/Q Offset |
| Output RF spectrum due to modulation (M-ORFS) | 13.4, 13.17.4 | |
| Output RF spectrum due to switching (S-ORFS) | 13.4, 13.17.4 | |
| Reference sensitivity | 14.2 | DUT support required |
| Usable input level range | 14.3 | DUT support required |
| RX level | | DUT support required. A common test as part of device calibration / verification |

## TD-SCDMA Frequency Bands

| Frequency Bands | Frequency Range |
|---|---|
| 33 | 1900-1920 MHz |
| 34 | 2010-2025 MHz |
| 35 | 1850-1910 MHz |
| 36 | 1930-1990 MHz |
| 37 | 1910-1930 MHz |
| 38 | 2570-2620 MHz |
| 39 | 1880-1920 MHz |
| 40 | 2300-2400 MHz |

## TD-SCDMA Tests

| Standard Test | 3GPP TS 34.122 Reference Paragraph | Notes |
|---|---|---|
| Maximum output power | 5.2 | |
| Power time mask | 5.4.4 | |
| Transmitter off power | 5.4.4 | |
| Modulation accuracy | 5.7 | |
| Occupied bandwidth | 5.5.1 | |
| Spectrum emission mask | | |
| ACLR | 5.5.2 | |
| RX sensitivity | 6.2 | DUT support required |
| RX maximum input level | 6.3 | DUT support required |
| Throughput (single-ended) | 9.3 | DUT support required |

## cdma 2000 / 1xEV-DO Frequency Bands Supported

| Band Class | Frequency Range (Generator) | Frequency Range (Analyzer) |
|---|---|---|
| 0 | 860.025 MHz to 893.985 MHz | 815.025 MHz to 848.985 MHz |
| 1 | 1930.000 MHz to 1990.000 MHz | 1850.000 MHz to 1910.000 MHz |
| 2 | 917.0125 MHz to 959.9875 MHz | 872.0125 MHz to 914.9875 MHz |
| 3 | 1840.000 MHz to 1870.000 MHz | 887.0125 MHz to 924.9875 MHz |
| 4 | 421.675 MHz to 493.480 MHz | 1750.000 MHz to 1780.000 MHz |
| 5 | 421.675 MHz to 493.480 MHz | 411.675 MHz to 483.480 MHz |
| 6 | 2110.000 MHz to 2169.950 MHz | 1920.000 MHz to 1979.950 MHz |
| 7 | 746.000 MHz to 764.000 MHz | 776.000 MHz to 794.000 MHz |
| 8 | 1805.000 MHz to 1879.950 MHz | 1710.000 MHz to 1784.950 MHz |
| 9 | 925.000 MHz to 958.750 MHz | 880.000 MHz to 913.750 MHz |
| 10 | 851.000 MHz to 939.975 MHz | 806.000 MHz to 900.975 MHz |
| 11 | 421.675 MHz to 493.475 MHz | 411.675 MHz to 483.475 MHz |
| 12 | 915.0125 MHz to 920.9875 MHz | 870.0125 MHz to 875.9875 MHz |
| 13 | 2620.000 MHz to 2690.000 MHz | 2500.000 MHz to 2570.000 MHz |
| 14 | 1930.000 MHz to 1995.000 MHz | 1850.000 MHz to 1915.000 MHz |

| Measurement | Frequency Range (Generator) | Frequency Range (Analyzer) |
|---|---|---|
| 15 | 2110.000 MHz to 2155.000 MHz | 1710.000 MHz to 1755.000 MHz |
| 16 | 2624.000 MHz to 2690.000 MHz | 2502.000 MHz to 2568.000 MHz |
| 17 | 2624.000 MHz to 2690.000 MHz | |

## cdma2000 / 1xEV-DO Tests

| Standard Test | Reference Paragraph | | Notes |
|---|---|---|---|
| | C.S0011-C | C.S0033-B | |
| Maximum output power | 4.4.5 | 4.3.4 | |
| Frequency accuracy | 4.3.4 | 4.2.2 | |
| EVM | | | Available but not part of standards for cdma2000 |
| Rho(p) | 4.3.4 | 4.2.2 | |
| Code domain power | 4.3.5 | 4.3.8 | |
| ACLR | | | Available but not part of standards for cdma2000. Faster than the Conducted Spurious Emissions Test. |
| Receiver sensitivity | 3.5.1 | 3.3.1 | DUT support required |
| RX dynamic range | 3.5.1 | 3.3.1 | DUT support required |
| RX level | | | DUT support required. A common test as part of device calibration / verification. |

## Navigation / Positioning Waveforms

IQxstream-M provides support for the downlink signals for the major location technologies, such as GPS, GLONASS, COMPASS, and Galileo. VSG waveforms can be used by the DUT to validate navigation functionality.

## Wireless LAN (802.11 a/b/g/n/j/p) Measurement Specifications

| Controls | Description | Performance |
|---|---|---|
| EVM (2.4 GHz band) | EVM averaged over payload based on standard requirements | |
| EVM (5 GHz band) | EVM averaged over payload based on standard requirements | |
| Peak power | Peak power over all symbols (dBm) | VSA power accuracy:<br>± 0.4 dB (+20 to -35 dBm) |
| RMS power | All: average power of complete data capture (dBm) | |
| | No gap: average power over all symbols after removal of any gap between packets (dBm) | |
| Max avg power | Peak value of the amplitude as a moving average over 40 samples (dBm) | |
| I/Q amplitude error | I/Q amplitude imbalance (%) and approximate contribution to EVM (dB) | Residual VSA I/Q imbalance:<br>≤ 1% (+20 to -35 dBm)<br><br>Residual VSG I/Q imbalance:<br>≤ 1% (-5 to -70 dBm) |
| I/Q phase error | I/Q phase imbalance (degrees) and approximate contribution to EVM (dB) | Residual VSA I/Q imbalance:<br>≤ 0.5 degree (+20 to -35 dBm)<br><br>Residual VSG I/Q imbalance:<br>≤ 0.5 degree (-5 to -70 dBm) |
| Frequency error | Carrier frequency error (kHz) | (For 802.11n packet at 16 symbols, EVM better than -25 dB)<br>VSA measurement error:<br>≤ ± 0.2 ppm calibrated |
| RMS phase noise | Integrated phase noise (degrees) | VSA integrated phase noise:<br>< TBD degrees (100 Hz to 1 MHz) |
| PSD | Power spectral density (dBm/Hz) versus frequency offset center frequency ± 20 MHz | |
| Spectral mask | Transmit spectrum mask | Spectral mask view:<br>± 20 MHz |
| Spectral flatness | Reflects variation of signal energy as a function of OFDM subcarrier number 802.11a/g/p/n/j OFDM signals only | VSA flatness over ≤ 40 MHz Ch BW: 1 dB (MAX – MIN) |
| Sidelobe analysis (spectral mask, LO leakage) | Center peak and peaks of 1st and 2nd upper/lower sidelobes (dB) 802.11b/g DSSS signals only | |
| CCDF (complementary cumulative distribution function) | Probability of peak signal power being greater than a given power level versus peak-to-average power ratio (dB) | |

| | | |
|---|---|---|
| Power on / power down ramp | On: relative power level (% of average) versus time (802.11b/g CCK signals only)<br>Power-on time from 10% to 90%<br>Power-on time from 90% power level to start of packet<br>(Not provided for 802.11a/g/p/n/j) | |
| | Off: relative power level (% of average) versus time<br>(802.11b/g CCK signals only)<br>Power-off time from 90% to 10%<br>Power-off time from 90% power level to end of packet<br>(Not provided for 802.11a/g/p/n/j OFDM signals) | |
| Eye diagram | I and Q channels versus time<br>(802.11b/g DSSS signals only) | |
| PSDU data | Recovered binary data sequence, including the MAC header and Frame Check Sequence, if present | |
| Raw capture data | I and Q signals versus time | |
| General waveform analysis | DC offset, RMS level, minimum / maximum amplitude, peak-to-peak amplitude, RMS I- and Q-channel levels | |
| CW frequency analysis | Frequency of CW tone | |

## Bluetooth (1.0, 2.0, 2.1, 3.0) Measurement Specifications

| Controls | Description | Performance |
|---|---|---|
| TX output power | Transmit DUT output power (dBm) | VSA power accuracy:<br>± 0.4 dB (+20 to -35 dBm) |
| TX output spectrum | Transmit DUT power spectral density | |
| 20 dB bandwidth | Bandwidth between the ± 20 dB down points of the modulation waveform | VSA frequency accuracy:<br>≤ ± 0.2 ppm calibrated |
| In-band emissions (Adjacent channel) | Spurious emission measured at ± 5 MHz of DUT TX frequency only | VSA spurious:<br>< -50 dBc (50 kHz RBW) (CW) |
| Modulation characteristics | Average and peak frequency deviation (Hz) | (For EVM better than -25 dB)<br>VSA measurement error:<br>≤ ± 0.2 ppm calibrated |
| Carrier frequency tolerance | Carrier frequency offset (Hz) | |
| Carrier frequency drift | Carrier frequency change over the Bluetooth burst (Hz) | |
| Relative transmit power (EDR) | Average power of complete data capture (dBm) | VSA power accuracy:<br>± 0.4 dB (+20 to -35 dBm) |

| | | |
|---|---|---|
| Carrier frequency stability (EDR) | Frequency drift over the Bluetooth EDR burst duration (Hz) | |
| Receive sensitivity[1] | Receive sensitivity test using LitePoint or user-generated waveforms. Includes Dirty Packets. | VSG power accuracy:<br>± 0. 5 dB (+ 5 to -95 dBm) |
| Maximum input signal level | Assuming single-ended BER measurement | |
| RMS EVM (EDR) | RMS EVM for Bluetooth EDR | Residual VSA EVM:<br>≤ -35 dB (+20 to -25 dBm)<br><br>Residual VSG EVM:<br>≤ -35 dB (-5 to -70 dBm) |
| Peak EVM (EDR) | Peak EVM for Bluetooth EDR | |

## Bluetooth (4.0) Measurement Specifications

| Controls | Description | Performance |
|---|---|---|
| Output power at NOC[1] | | VSA power accuracy:<br>± 0.4 dB (+20 to -35 dBm) |
| Output power at EOC[1] | | |
| In-band emissions at NOC[1] | Spurious emission measured at ± 5 MHz of DUT TX frequency only | VSA spurious:<br>< -50 dBc (50 kHz RBW) (CW) |
| In-band emissions at EOC[1] | | |
| Modulation characteristics | Average and peak frequency deviation (Hz) | VSA frequency accuracy:<br>≤ ± 0.2 ppm calibrated |
| Carrier frequency offset and drift at NOC[1] | Carrier frequency offset (Hz) and change over the Bluetooth burst (Hz) | |
| Carrier frequency offset and drift at EOC[1] | | |
| Receiver sensitivity at NOC[1,2] | Receive sensitivity test using LitePoint or user-generated waveforms | VSA power accuracy:<br>± 0.4 dB (+20 to -35 dBm) |
| Receiver sensitivity at EOC[1,2] | | |
| C/I and receiver selectivity performance[3] | | VSA spurious:<br>< -50 dBc (50 kHz RBW) (CW) |
| Blocking performance[3] | | |
| Intermodulation performance | | |
| Maximum input signal level | Assuming single-ended BER measurement | VSG maximum output power:<br>-15 to -120 dBm CW |
| PER report integrity | Verifies the DUT PER report mechanism | |

Note 1: NOC and EOC tests are the same except for the operating conditions, which do not impact the test equipment requirements
Note 2: External signal source required for these measurements (not supplied by LitePoint)
Note 3: IQxstream-M provides the wanted signal only.

[1] IQxstream-M supports testing sensitivity with Dirty Packets

## Bluetooth 5 Measurement Specifications

Bluetooth 5 introduced a couple of new test requirements:

**Data Rate:** New requirements for testing with 2 Mbps, 1 Mbps, 500 kbps, 125 kbps signal

**Stable Modulation:** Optional requirement for device to support smaller variation in the frequency deviation during modulation (modulation index between 0.495-0.505). This enhancement gives device stable and better range coverage and thus competitive advantage

IQxstream-M is capable of testing for these new requirements

| Measurement | Description | Performance |
|---|---|---|
| In-band emissions | Spurious emission measured at ± 5 MHz of DUT TX frequency only. Tested at 1 Mbps, 2 Mbps | VSA spurious:<br>< -50 dBc (50 kHz RBW) (CW) |
| Modulation Characteristics | Average and peak frequency deviation (Hz). Tested at 1 Mbps, 2 Mbps, 125 kbps | VSA frequency accuracy:<br>≤ ± 0.2 ppm calibrated |
| Carrier Frequency offset and drift | Carrier frequency offset (Hz) and change over the Bluetooth burst (Hz). Tested at 1 Mbps, 2 Mbps, 125 kbps | |
| Stable Modulation Characteristics | Tested at 1 Mbps, 2 Mbps | VSA frequency accuracy:<br>≤ ± 0.2 ppm calibrated |
| Receiver Sensitivity | Receive sensitivity test using LitePoint or user-generated waveforms. Tested at 1 Mbps, 2 Mbps, 125 kbps | VSG power accuracy:<br>± 0.75 dB (-50 to -100 dBm) |
| Receiver Sensitivity – Stable Modulation Index | Tested at 1 Mbps, 2 Mbps, 500 kbps, 125 kbps | |
| Maximum Input signal level | Assuming single-ended BER measurement. Tested at 1 Mbps, 2 Mbps | VSG maximum output power:<br>-15 dBm |
| Maximum Input signal level – Stable Modulation Index | Tested at 1 Mbps, 2 Mbps | |
| C/I and Receiver Selectivity Performance | Tested at 1 Mbps, 2 Mbps, 500 kbps, 125 kbps | VSA spurious:<br>< -50 dBc (50 kHz RBW) (CW) |
| Blocking Performance | Tested at 1 Mbps, 2 Mbps | |
| Intermodulation Performance | Tested at 1 Mbps, 2 Mbps | |
| PER Report Integrity | Verifies the DUT PER report mechanism. Tested at 1 Mbps, 2 Mbps,500 kbps, 125 kbps | |

## ZigBee (802.15.4) Measurement Specifications

| Controls | Description | Performance |
|---|---|---|
| Output power | Transmit DUT output power (dBm) | VSA power accuracy:<br>± 0.4 dB (+20 to -35 dBm) |
| Power spectral density | Transmit DUT power spectral density | |
| Center Frequency Tolerance | Tx center frequency tolerance | VSA frequency accuracy:<br>≤ ± 0.2 ppm calibrated |
| EVM | Offset: compensate the I and Q offset in OQPSK<br>Normal: no compensation applied | |
| Other modulation quality measurements | LO leakage, clock error, phase error, symbol clock error | |
| CCDF (complementary cumulative distribution function) | Probability of peak signal power being greater than a given power level versus peak-to-average power ratio (dB) | |

## DECT (ETSI EN 300 176-1) Measurement Specifications

| Controls | Description | Performance |
|---|---|---|
| Power | Normal Transmit Power | VSA power accuracy:<br>± 0.4 dB (+20 to -35 dBm) |
| Power vs. time | Power time template | |
| Frequency offset | Frequency offset | VSA frequency accuracy:<br>≤ ± 0.2 ppm calibrated |
| Frequency drift | Frequency drift during packet transmission | |
| Frequency deviation | S field, B field, whole packet | |

## MIMO System Performance

| Controls | Performance |
|---|---|
| VSA capture trigger accuracy | ≤ ± 3.5 ns |
| VSA start trigger accuracy | ≤ ± 3.5 ns |

## General Purpose RF

Beyond the standards based testing IQxstream-M's Signal Generators and Vector Signal Analyzers provide you the ability to generate CW signals to a DUT and capture uplink signals for subsequent analysis. These tests can be performed over the full range of the tester's capabilities as defined in the General Specifications section.

When setting up the IQxstream for general purpose RF measurements the following controls are accessible.

| Vector Signal Generator | Vector Signal Analyzer | |
|---|---|---|
| Frequency | Frequency | Trigger source |
| Output power level | Reference level (capture range) | Trigger level |
| Sample rate | Resolution bandwidth | Edge level |
| Marker Source | Capture length | |
| Waveform | | |

Beyond the ability to capture a waveform and export it for further analysis, IQxstream-M has the ability to make some basic measurements and provide displays to the operator as shown in the following table.

| Test | Parameter | Notes |
|---|---|---|
| Power meter | Time domain filter bandwidth | Allow user selection of measurement windows from 10 kHz to 30 MHz |
| | Offset frequency | Allows power measurements to be offset within the capture band. This also supports multiple measurements from a single capture. |
| Power in band table | | Displays power by user specified windows (up to 10) within the 30 MHz capture |
| Spectrum | | Power vs. frequency for up to a 30 MHz capture |
| Power vs. Time | | Display power vs. time. Useful in analysis of signals that exhibit burst behavior. |

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CONTACT INFORMATION
180 Rose Orchard Way
San Jose, CA 95134
United States of America

+1.866.363.1911
+1.408.456.5000

LITEPOINT TECHNICAL SUPPORT
www.litepoint.com/support

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