# Spectrum Report (WCDMA)

| | |
|---|---|
| **Applicant:** | Spireon Inc |
| **Address of Applicant:** | 9724 Kingston Pike,Suite 800 Knoxville,TN37922, United States |
| **Manufacturer:** | Kayamatics Limited |
| **Address of Manufacturer:** | Room 1206, Trend Center, 29 Cheung Lee Street, Chai Wan, Hong Kong |
| **Equipment Under Test (EUT)** | |
| Product Name: | Wireless Communication Device |
| Model No.: | JG-LS, JG-L |
| Marketing Name: | JG-L 001 |
| **FCC ID:** | O9YJL01 |
| **IC:** | 22952-JL01 |
| **Applicable standards:** | FCC CFR Title 47 Part 2 |
| | FCC CFR Title 47 Part22 Subpart H |
| | FCC CFR Title 47 Part24 Subpart E |
| | FCC CFR Title 47 Part 27 |
| | RSS-132 Issue 3, January 2013 |
| | RSS-133 Issue 6, January 2013 |
| | RSS-139 Issue 3, July 2015 |
| | RSS-Gen Issue 5, April 2018 |
| **Date of sample receipt:** | September 10, 2018 |
| **Date of Test:** | September 11-27, 2018 |
| **Date of report issued:** | September 28, 2018 |
| **Test Result :** | PASS * |

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

**Robinson Lo**
**Laboratory Manager**

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

# 1 Version

| Version No. | Date | Description |
|---|---|---|
| *00* | *September 28, 2018* | *Original* |
| | | |
| | | |
| | | |
| | | |

| | | | |
|---|---|---|---|
| ***Prepared By:*** | Tiger. Chen | ***Date:*** | *September 28, 2018* |
| | ***Project Engineer*** | | |
| ***Check By:*** | Robinson Lo | ***Date:*** | *September 28, 2018* |
| | ***Reviewer*** | | |

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# 3 Test Summary

| Test Item | Section in CFR 47 | Result |
|---|---|---|
| RF Exposure (SAR) | Part 1.1307<br>Part 2.1093 | Pass*<br>(Please refer to MPE Report) |
| RF Output Power | Part 2.1046<br>Part 22.913 (a)(2)<br>Part 24.232 (c)<br>Part 27.50(c)(10)/(d)(4) | Pass |
| Peak-to-Average Ratio | FCC part24.232(d)<br>FCC Part 27.50 | Pass |
| Modulation Characteristics | Part 2.1047 | Pass |
| 99% & -26 dB Occupied Bandwidth | Part 2.1049<br>Part 22.917<br>Part 24.238<br>Part 27.53(h)/(g) | Pass |
| Spurious Emissions at Antenna Terminal | Part 2.1051<br>Part 22.917 (a)<br>Part 24.238 (a)<br>Part 27.53(h)/(g) | Pass |
| Field Strength of Spurious Radiation | Part 2.1053<br>Part 22.917 (a)<br>Part 24.238 (a)<br>Part 27.53(h)/(g) | Pass |
| Out of band emission, Band Edge | Part 22.917 (a)<br>Part 24.238 (a)<br>Part 27.53(h)/(g) | Pass |
| Frequency stability vs. temperature | Part 2.1055(a)(1)(b) | Pass |
| Frequency stability vs. voltage | Part 2.1055(d)(1)(2) | Pass |

*Pass: The EUT complies with the essential requirements in the standard.*

| Test Item | Section in RSS | Result |
|---|---|---|
| RF Exposure (SAR) | RSS-102 | Pass*<br>(Please refer to MPE Report) |
| Frequency Plan | RSS-132 Clause 5.1<br>RSS-133 Clause 6.1<br>RSS-139 Clause 6.1 | Pass |
| Types of Modulation | RSS-132 Clause 5.2<br>RSS-133 Clause 6.2<br>RSS-139 Clause 6.2 | Pass |
| Occupied Bandwidth | RSS-Gen Clause 6.6 | Pass |
| Frequency Stability | RSS-132 Clause 5.3<br>RSS-133 Clause 6.3<br>RSS-139 Clause 6.4 | Pass |
| Transmitter Output Power and Equivalent Isotropically Radiated Power | RSS-132 Clause 5.4<br>RSS-133 Clause 6.4<br>RSS-139 Clause 6.5 | Pass |
| Peak-to-Average Power Ratio | RSS-132 Clause 5.4<br>RSS-133 Clause 6.4<br>RSS-139 Clause 6.5 | Pass |
| Transmitter Unwanted Emissions | RSS-132 Clause 5.5<br>RSS-133 Clause 6.5<br>RSS-139 Clause 6.6 | Pass |
| Field strength of spurious radiation measurement | RSS-Gen Clause 6.13 | Pass |

*Pass: The EUT complies with the essential requirements in the standard.*

## 3.1 Measurement Uncertainty

| Test Item | Frequency Range | Measurement Uncertainty | Notes |
|---|---|---|---|
| Radiated Emission | 9kHz ~ 30MHz | ± 4.34dB | (1) |
| Radiated Emission | 30MHz ~ 1000MHz | ± 4.24dB | (1) |
| Radiated Emission | 1GHz ~ 26.5GHz | ± 4.68dB | (1) |
| Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%. | | | |

# 4 General Information

## 4.1 General Description of EUT

| | |
|---|---|
| Product Name: | Wireless Communication Device |
| Model No.: | JG-LS, JG-L |
| Test model: | JG-LS |
| Remark: difference details of this two model, please refer to the difference description | |
| S/N: | XK2009000415 |
| Tested Sample(s) ID: | GTS201809000106-01 |
| Hardware Version: | P1.1.0 |
| Software Version: | 1.0.1 |
| Support Networks: | WCDMA |
| Support Bands: | WCDMA Band II, Band V, Band IV |
| TX Frequency: | WCDMA Band II: 1852.40MHz -1907.60MHz<br>WCDMA Band IV: 1712.40MHz -1752.60MHz<br>WCDMA Band V: 826.40MHz -846.60MHz |
| Modulation type: | WCDMA Band II/V/IV: QPSK |
| Antenna type: | Integral antenna |
| Antenna gain: | Band II: 1.9dBi<br>Band IV: 2.2dBi<br>Band V: 1.7dBi(declared by manufacturer) |
| Power supply: | DC 12V or<br>DC 7.4V 4400mAh/32.56Wh Li-ion Rechargeable Battery |

**Operation Frequency List:**

| WCDMA Band V | | WCDMA Band II | | WCDMA Band IV | |
|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 4132 | 826.40 | 9262 | 1852.40 | 1312 | 1712.40 |
| 4133 | 826.60 | 9263 | 1852.60 | 1313 | 1712.60 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 4181 | 836.20 | 9399 | 1879.80 | 1411 | 1732.20 |
| 4182 | 836.40 | 9400 | 1880.00 | 1412 | 1732.40 |
| 4183 | 836.60 | 9401 | 1880.20 | 1413 | 1732.60 |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| 4232 | 846.40 | 9537 | 1907.40 | 1512 | 1752.40 |
| 4233 | 846.60 | 9538 | 1907.60 | 1513 | 1752.60 |

Regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

**Final test channel:**

| WCDMA Band V | | WCDMA Band II | | WCDMA Band IV | |
|---|---|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 4132 | 826.40 | 9262 | 1852.40 | 1312 | 1712.40 |
| 4183 | 836.60 | 9400 | 1880.00 | 1412 | 1732.40 |
| 4233 | 846.60 | 9538 | 1907.60 | 1513 | 1752.60 |

## 4.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is filing to comply with Section Part 22 subpart H and Part 24 subpart E of the FCC CFR 47 Rules.
This submittal(s) (test report) is filing to comply with RSS-132, RSS-133, RSS-139, RSS-Gen of the IC Rules.

## 4.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures document on TIA/EIA 603 and ANSI C63.4, FCC CFR 47.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057, 27.50, 27.53

## 4.4 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

● **FCC —Registration No.: 381383**

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 381383, January 08, 2018.

● **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, August 15, 2016.

## 4.5 Test Location

| All tests were performed at: |
|---|
| Global United Technology Services Co., Ltd.<br>Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China<br>Tel: 0755-27798480<br>Fax: 0755-27798960 |

# 5 Test Instruments list

| Radiated Emission: | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | 3m Semi- Anechoic Chamber | ZhongYu Electron | 9.2(L)*6.2(W)* 6.4(H) | GTS250 | July. 03 2015 | July. 02 2020 |
| 2 | Control Room | ZhongYu Electron | 6.2(L)*2.5(W)* 2.4(H) | GTS251 | N/A | N/A |
| 3 | EMI Test Receiver | Rohde & Schwarz | ESU26 | GTS203 | June. 27 2018 | June. 26 2019 |
| 4 | BiConiLog Antenna | SCHWARZBECK MESS-ELEKTRONIK | VULB9163 | GTS214 | June. 27 2018 | June. 26 2019 |
| 5 | Double -ridged waveguide horn | SCHWARZBECK MESS-ELEKTRONIK | BBHA 9120 D | GTS208 | June. 27 2018 | June. 26 2019 |
| 6 | Horn Antenna | ETS-LINDGREN | 3160 | GTS217 | June. 27 2018 | June. 26 2019 |
| 7 | EMI Test Software | AUDIX | E3 | N/A | N/A | N/A |
| 8 | Coaxial Cable | GTS | N/A | GTS213 | June. 27 2018 | June. 26 2019 |
| 9 | Coaxial Cable | GTS | N/A | GTS211 | June. 27 2018 | June. 26 2019 |
| 10 | Coaxial cable | GTS | N/A | GTS210 | June. 27 2018 | June. 26 2019 |
| 11 | Coaxial Cable | GTS | N/A | GTS212 | June. 27 2018 | June. 26 2019 |
| 12 | Amplifier(100kHz-3GHz) | HP | 8347A | GTS204 | June. 27 2018 | June. 26 2019 |
| 13 | Amplifier(2GHz-20GHz) | HP | 84722A | GTS206 | June. 27 2018 | June. 26 2019 |
| 14 | Amplifier (18-26GHz) | Rohde & Schwarz | AFS33-18002 650-30-8P-44 | GTS218 | June. 27 2018 | June. 26 2019 |
| 15 | Band filter | Amindeon | 82346 | GTS219 | June. 27 2018 | June. 26 2019 |
| 16 | Power Meter | Anritsu | ML2495A | GTS540 | June. 27 2018 | June. 26 2019 |
| 17 | Power Sensor | Anritsu | MA2411B | GTS541 | June. 27 2018 | June. 26 2019 |
| 18 | Wideband Radio Communication Tester | Rohde & Schwarz | CMW500 | GTS575 | June. 27 2018 | June. 26 2019 |
| 19 | Splitter | Agilent | 11636B | GTS237 | June. 27 2018 | June. 26 2019 |
| 20 | Loop Antenna | ZHINAN | ZN30900A | GTS534 | June. 27 2018 | June. 26 2019 |

| General used equipment: | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Equipment** | **Manufacturer** | **Model No.** | **Inventory No.** | **Cal.Date (mm-dd-yy)** | **Cal.Due date (mm-dd-yy)** |
| 1 | Humidity/ Temperature Indicator | KTJ | TA328 | GTS243 | June. 27 2018 | June. 26 2019 |
| 2 | Barometer | ChangChun | DYM3 | GTS255 | June. 27 2018 | June. 26 2019 |

# 6 System test configuration

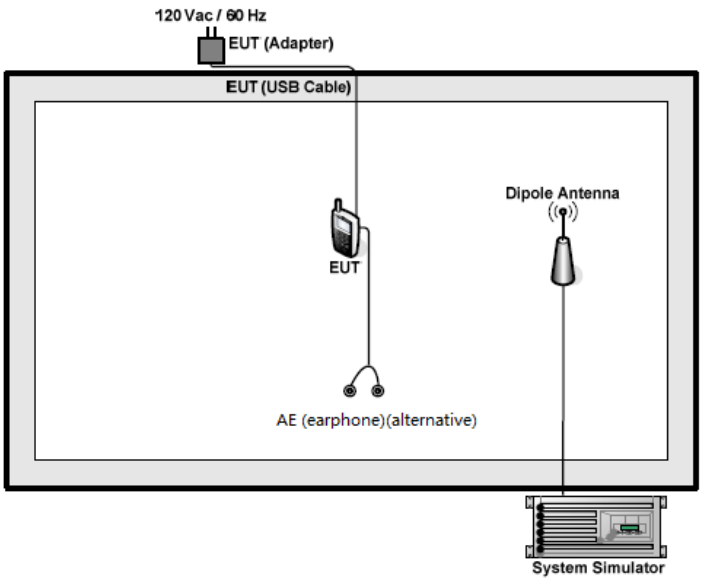
## 6.1 Test mode

During all testing, EUT is in link mode with base station emulator at maximum power level. The spurious emission measurements were carried out in semi-anechoic chamber with 3-meter test range, and EUT is rotated on three test planes to find out the worst emission.

| Test modes | | |
|---|---|---|
| **Band** | Radiated | Conducted |
| **WCDMA II** | ■ RMC 12.2Kbps link | ■ RMC 12.2Kbps link |
| **WCDMA Band V** | ■ RMC 12.2Kbps link | ■ RMC 12.2Kbps link |
| **WCDMA Band IV** | ■ RMC 12.2Kbps link | ■ RMC 12.2Kbps link |

Note: The maximum power levels is RMC12.2Kbps mode for WCDMA Band V, Band IV and Band II. Only these modes were used for all tests.

## 6.2 Configuration of Tested System



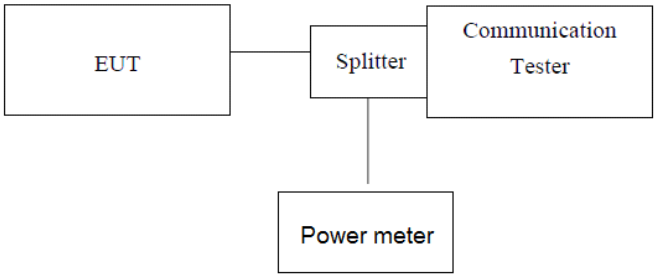
## 6.3 Frequency Plan

| Frequency Plan for band 824MHz ~ 849MHz | | | | |
|---|---|---|---|---|
| **Frequency Plan (MHz)** | **824-835** | **835-845** | **845-846.5** | **846.5-849** |
| **Product Supported plan (Yes or No)** | Y | Y | Y | Y |

| Frequency Plan for band 1850MHz ~ 1915MHz | | | |
|---|---|---|---|
| **Block** | **Total Spectrum** | **Lower Sub-band** | **Product Supported plan (Yes or No)** |
| Block A | 30 MHz | 1850-1865 MHz | Y |
| Block D* | 10 MHz | 1865-1870 MHz | Y |
| Block B1 | 10 MHz | 1870-1875 MHz | Y |
| Block B2* | 10 MHz | 1875-1880 MHz | Y |
| Block B3* | 10 MHz | 1880-1885 MHz | Y |
| Block E* | 10 MHz | 1885-1890 MHz | Y |
| Block F | 10 MHz | 1890-1895 MHz | Y |
| Block C1* | 10 MHz | 1895-1900 MHz | Y |
| Block C2* | 10 MHz | 1900-1905 MHz | Y |
| Block C3* | 10 MHz | 1905-1910 MHz | Y |
| Block G | 10 MHz | 1910-1915 MHz | N |
| Note: * The usage of these blocks in certain geographic areas is under policies listed in SRSP-510 sections 3.1.3, 3.1.4, 3.1.5 and 3.1.15. | | | |

| Frequency Plan for band 1710MHz ~ 1755MHz | | | |
|---|---|---|---|
| **Block** | **Total Spectrum** | **Lower Sub-band** | **Product Supported plan (Yes or No)** |
| Block A | 20 MHz | 1710-1720 MHz | Y |
| Block B | 20 MHz | 1720-1730 MHz | Y |
| Block C | 10 MHz | 1730-1735 MHz | Y |
| Block D | 10 MHz | 1735-1740 MHz | Y |
| Block E | 10 MHz | 1740-1745 MHz | Y |
| Block F | 20 MHz | 1745-1755 MHz | Y |
| Block G | 10 MHz | 1755-1760 MHz | N |
| Block H | 10 MHz | 1760-1765 MHz | N |
| Block I | 10 MHz | 1765-1775 MHz | N |
| Block J1 | 10 MHz | 1770-1775 MHz | N |
| Block J2 | 10 MHz | 1775-1780 MHz | N |

## 6.4 Conducted Average Output Power

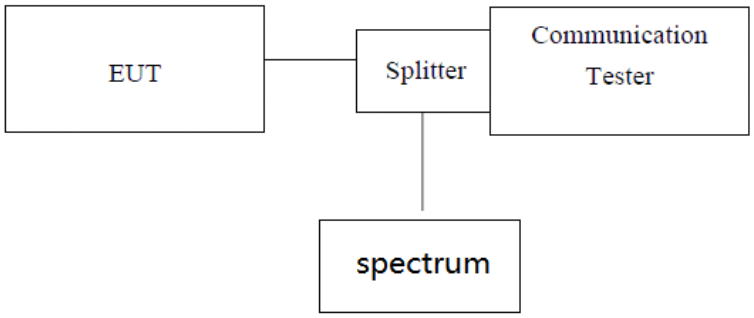
| | |
|---|---|
| Test Requirement for FCC: | FCC part22.913(a) and FCC part24.232(b) and FCC part 27.50 |
| Test Requirement for IC | RSS-132 Clause 5.4, RSS-133 Clause 6.4, ,RSS-139 Clause 6.5 |
| Limit for FCC: | WCDMA Band V: 7W<br>WCDMA Band II: 2W<br>WCDMA Band IV: 1W |
| Limit for IC: | WCDMA Band V: 11.5W<br>WCDMA Band II: 2W<br>WCDMA Band IV: 1W |
| Test setup: |  <br>*Note: Measurement setup for testing on Antenna connector* |
| Test Procedure: | 1. The transmitter output port was connected to base station.<br>2. The RF output of EUT was connected to the power meter by RF cable and attenuator, the path loss was compensated to the results for each measurement.<br>3. Set EUT at maximum power through base station.<br>4. Select lowest, middle, and highest channels for each band and different modulation.<br>5. Measure the maximum burst average power. |
| Test Instruments: | Refer to section 5.0 for details |
| Test mode: | Refer to section 6.1 for details |
| Test results: | Pass |

**Measurement Data**

| Conducted Power (dBm) | | | | | | |
|---|---|---|---|---|---|---|
| Band | WCDMA Band II | | | WCDMA Band V | | |
| Channel | 9262 | 9400 | 9538 | 4132 | 4183 | 4233 |
| Frequency | 1852.4 | 1880.0 | 1907.6 | 826.4 | 836.6 | 846.6 |
| RMC 12.2Kbps | 22.11 | 22.15 | 22.80 | 22.12 | 22.20 | 22.13 |
| HSDPA Subtest-1 | 21.02 | 21.89 | 21.23 | 21.09 | 21.11 | 21.04 |
| HSDPA Subtest-2 | 21.52 | 21.59 | 21.31 | 21.30 | 21.42 | 21.41 |
| HSDPA Subtest-3 | 21.48 | 21.52 | 21.38 | 21.28 | 21.30 | 21.38 |
| HSDPA Subtest-4 | 21.38 | 21.27 | 21.20 | 21.27 | 21.28 | 21.25 |
| HSUPA Subtest-1 | 21.01 | 21.00 | 21.17 | 21.32 | 21.49 | 21.41 |
| HSUPA Subtest-2 | 21.19 | 21.25 | 21.13 | 21.24 | 21.40 | 21.27 |
| HSUPA Subtest-3 | 21.20 | 21.23 | 21.09 | 21.21 | 21.27 | 21.22 |
| HSUPA Subtest-4 | 21.15 | 21.11 | 21.13 | 21.24 | 21.29 | 21.18 |
| HSUPA Subtest-5 | 21.21 | 21.27 | 21.22 | 21.16 | 21.28 | 21.13 |
| AMR | 21.89 | 21.97 | 21.82 | 21.93 | 21.99 | 21.80 |

| Conducted Power (dBm) | | | |
|---|---|---|---|
| Band | WCDMA Band IV | | |
| Channel | 1312 | 1412 | 1513 |
| Frequency | 1712.4 | 1732.4 | 1752.6 |
| RMC 12.2Kbps | 21.67 | 21.31 | 21.07 |
| HSDPA Subtest-1 | 20.61 | 21.01 | 20.27 |
| HSDPA Subtest-2 | 20.20 | 20.43 | 20.10 |
| HSDPA Subtest-3 | 22.09 | 20.26 | 20.05 |
| HSDPA Subtest-4 | 20.37 | 20.11 | 20.54 |
| HSUPA Subtest-1 | 20.11 | 20.21 | 20.13 |
| HSUPA Subtest-2 | 20.48 | 20.17 | 20.04 |
| HSUPA Subtest-3 | 20.30 | 20.23 | 20.46 |
| HSUPA Subtest-4 | 20.41 | 20.02 | 20.11 |
| HSUPA Subtest-5 | 20.12 | 20.39 | 20.32 |
| AMR | 20.41 | 20.53 | 20.69 |

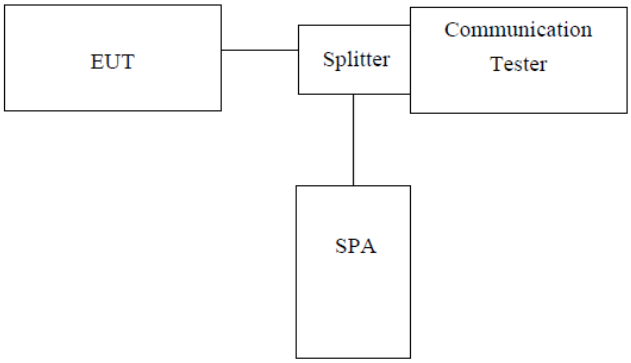
## 6.5 Peak-to-Average Ratio

| | |
|---|---|
| Test Requirement for FCC: | FCC part24.232(d) and FCC part 27.50 |
| Test Requirement for IC: | RSS-132 Clause 5.4, RSS-133 Clause 6.4, RSS-139 Clause 6.5 |
| Limit: | 13db |
| Test setup: |  <br>*Note: Measurement setup for testing on Antenna connector* |
| Test Procedure: | 1. The transmitter output port was connected to base station.<br>2. The RF output of EUT was connected to the power meter by RF cable and attenuator, the path loss was compensated to the results for each measurement.<br>3. Set EUT at maximum power through base station.<br>4. Select lowest, middle, and highest channels for each band and different modulation.<br>5. Measure the maximum burst average power.<br>6. Record the maximum peak-to-average ratio value. |
| Test Instruments: | Refer to section 5.0 for details |
| Test mode: | Refer to section 6.1 for details |
| Test results: | Pass |

**Measurement data:**

| Cellullar band | Frequency(MHz) | PAPR(dB) | Limit | Verdict |
|---|---|---|---|---|
| WCMDA BAND V | 826.4 | 4.21 | 13 | Compliant |
| | 836.6 | 3.24 | 13 | Compliant |
| | 846.6 | 3.22 | 13 | Compliant |
| WCDMA BAND II | 1852.4 | 3.19 | 13 | Compliant |
| | 1880.0 | 3.11 | 13 | Compliant |
| | 1907.6 | 3.48 | 13 | Compliant |
| WCDMA BAND IV | 1712.4 | 3.92 | 13 | Compliant |
| | 1732.4 | 2.98 | 13 | Compliant |
| | 1752.6 | 3.60 | 13 | Compliant |

## 6.6 Occupy Bandwidth

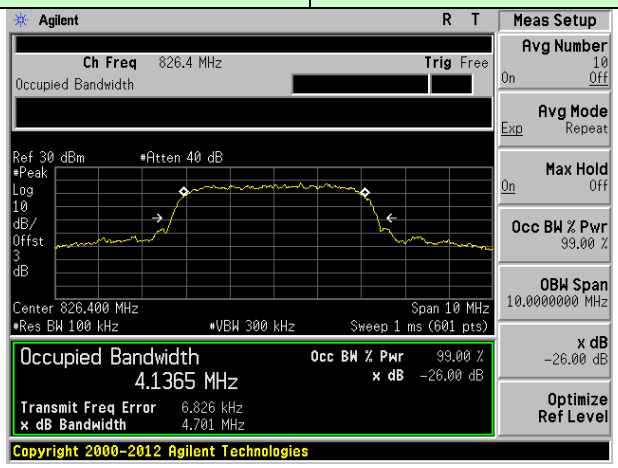
| | |
|---|---|
| Test Requirement for FCC: | FCC part22.913(a) and FCC part24.232(b) and FCC part 27.53 |
| Test Requirement for IC: | RSS-Gen Clause 6.6 |
| Test setup: |  <br>*Note: Measurement setup for testing on Antenna connector* |
| Test Procedure: | 1. The EUT's output RF connector was connected with a short cable to the spectrum analyzer<br>2. RBW was set to about 1% of emission BW, VBW= 3 times RBW.<br>3. -26dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace. |
| Test Instruments: | Refer to section 5.0 for details |
| Test mode: | Refer to section 6.1 for details |
| Test results: | Pass |

**Measurement Data**

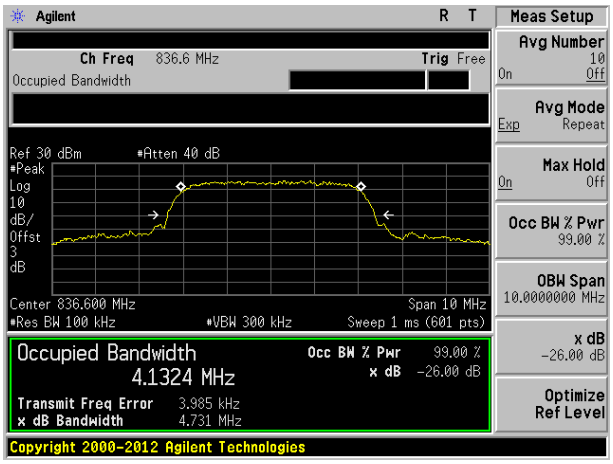
| EUT Mode | Channel | Frequency (MHz) | 99% Occupy bandwidth (KHz) | -26dB bandwidth (KHz) |
|---|---|---|---|---|
| WCDMA Band V (RMC 12.2Kbps link) | 4132 | 826.40 | 4136.5 | 4701.00 |
| | 4183 | 836.60 | 4132.4 | 4731.00 |
| | 4233 | 846.60 | 4137.6 | 4715.00 |
| WCDMA Band II (RMC 12.2Kbps link) | 9262 | 1852.40 | 4153.9 | 4764.00 |
| | 9400 | 1880.00 | 4131.0 | 4756.00 |
| | 9538 | 1907.60 | 4117.0 | 4710.00 |
| WCDMA Band IV (RMC 12.2Kbps link) | 1312 | 1852.40 | 4169.0 | 4750.00 |
| | 1412 | 1880.00 | 4147.1 | 4779.00 |
| | 1513 | 1907.60 | 4123.7 | 4740.00 |

Test plot as follows:

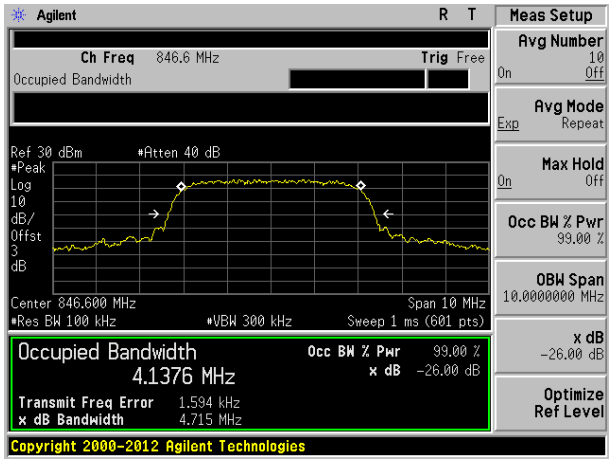
| Test band: | WCDMA Band V (RMC 12.2Kbps link) |
|---|---|




Lowest channel

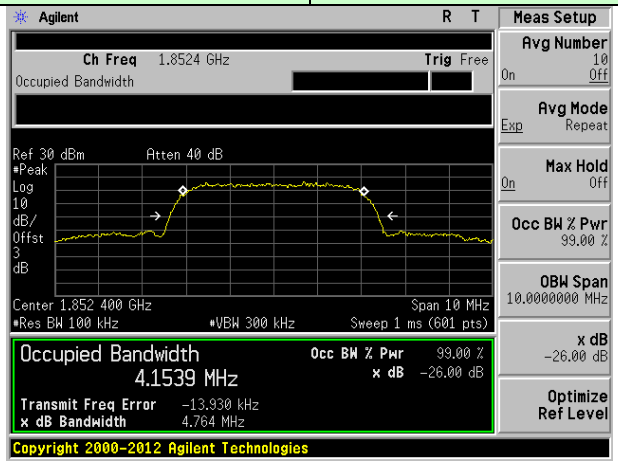



Middle channel

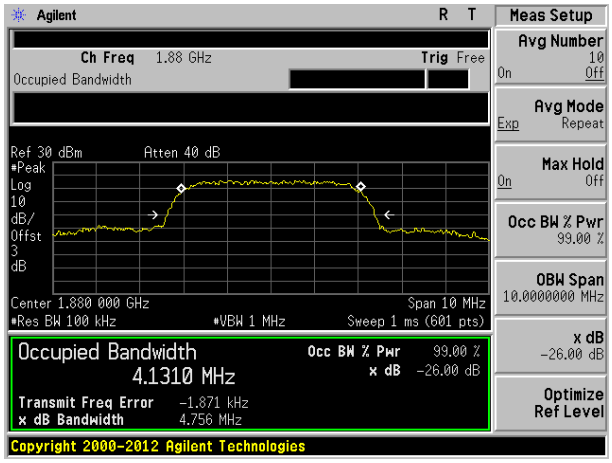



Highest channel

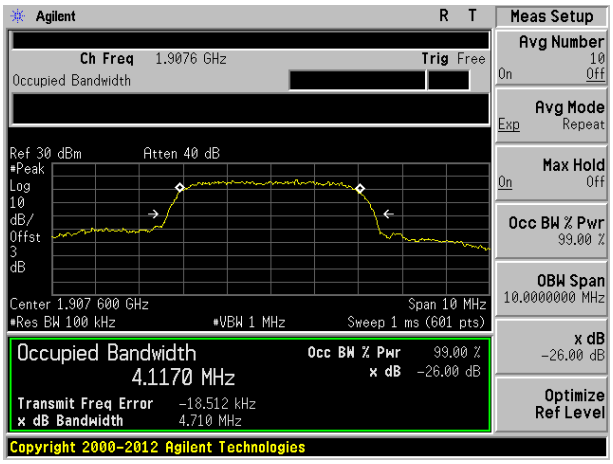
| Test band: | WCDMA Band II (RMC 12.2Kbps link) |
|---|---|




Lowest channel

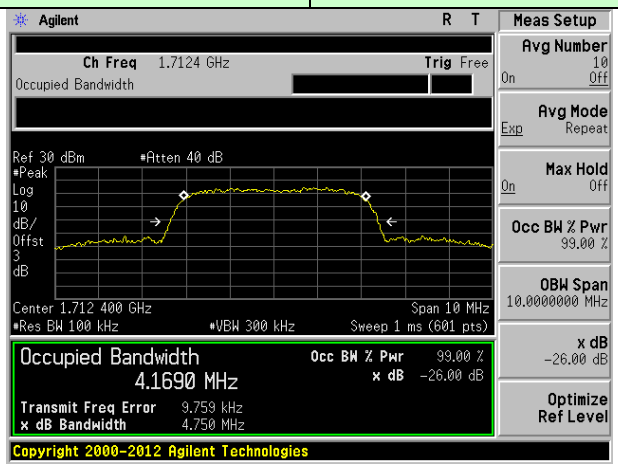



Middle channel

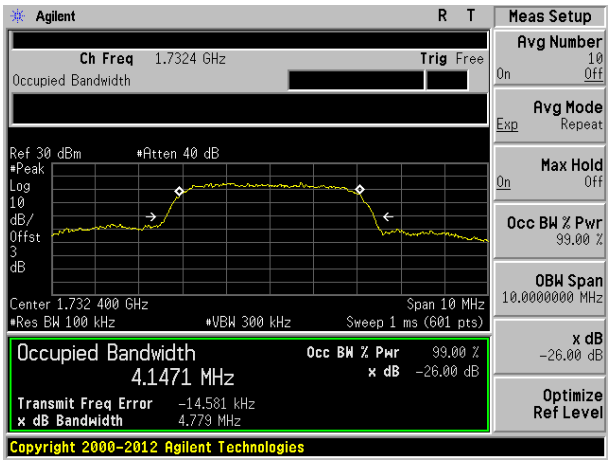



Highest channel

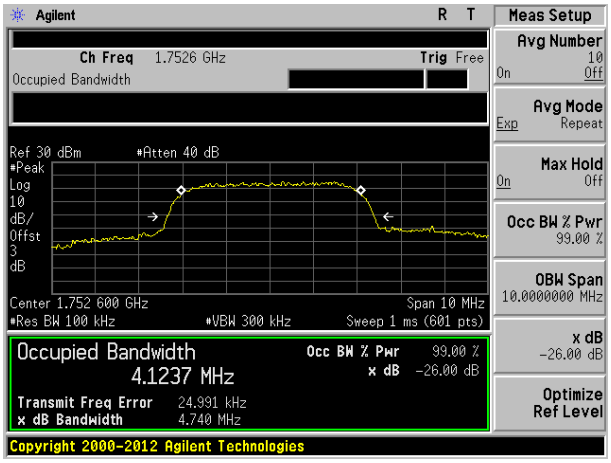
| Test band: | WCDMA Band IV (RMC 12.2Kbps link) |
|---|---|




Lowest channel




Middle channel

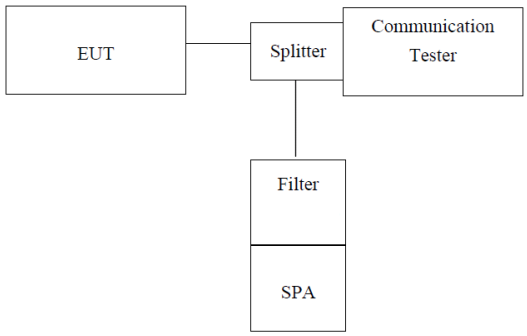



Highest channel

## 6.7 MODULATION CHARACTERISTIC

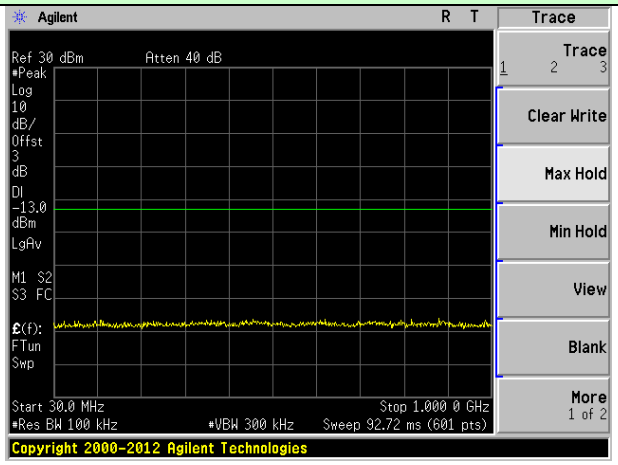
According to FCC § 2.1047(d), Part 22H & 24E there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

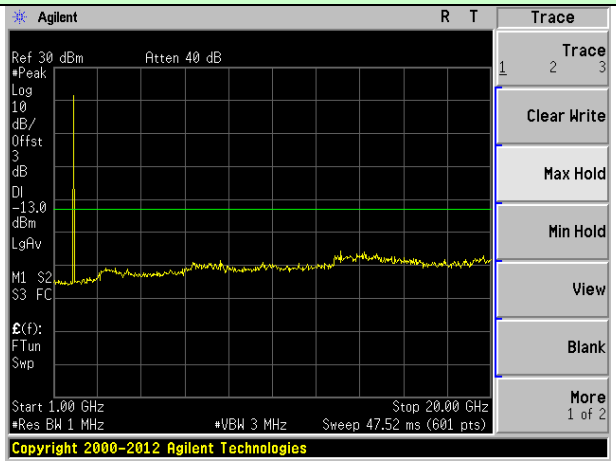
## 6.8 Out of band emission at antenna terminals

| | |
|---|---|
| Test Requirement for FCC: | FCC part22.917(a) and FCC part24.238(a) and FCC part 27.53 |
| Test Requirement for IC: | RSS-132 Clause 5.5, RSS-133 Clause 6.5, RSS-139 Clause 6.6 |
| Limit: | -13dBm |
| Test setup: |  <br>*Note: Measurement setup for testing on Antenna connector* |
| Test Procedure: | 1 The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.<br>2 The resolution bandwidth of the spectrum analyzer was set at 1MHz, sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.<br>3 For the out of band: Set the RBW, VBW = 1MHz, Start=30MHz, Stop= 10th harmonic.<br>4 Band Edge Requirements: In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the out of band Emissions. |
| Test Instruments: | Refer to section 5.0 for details |
| Test mode: | Refer to section 6.1 for details |
| Test results: | Pass |

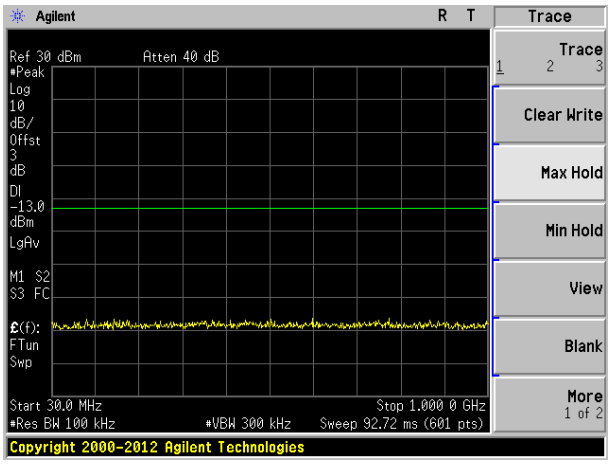
Test plot as follows:

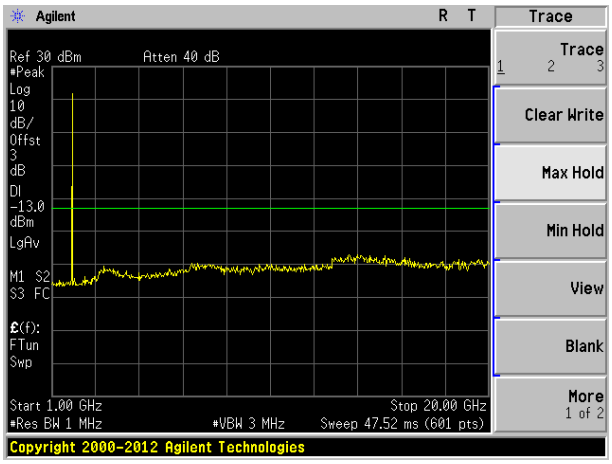
| Test Mode: Traffic mode | WCDMA Band II (RMC 12.2Kbps link) |
|---|---|



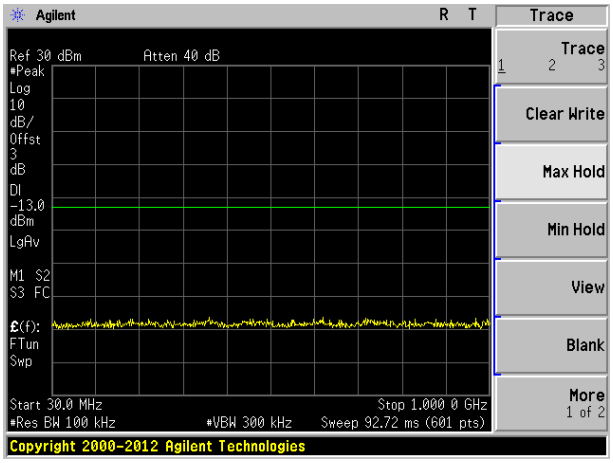



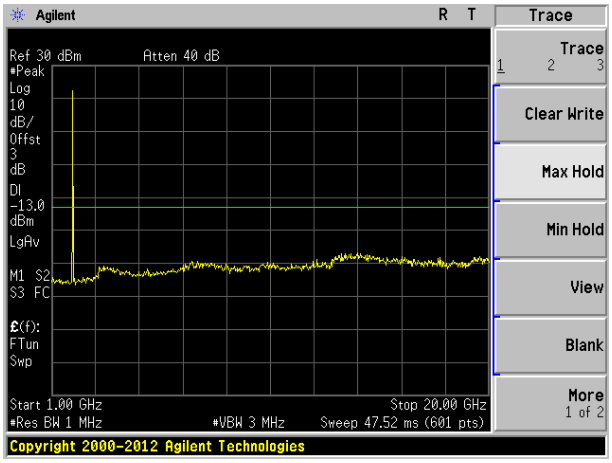

Lowest channel



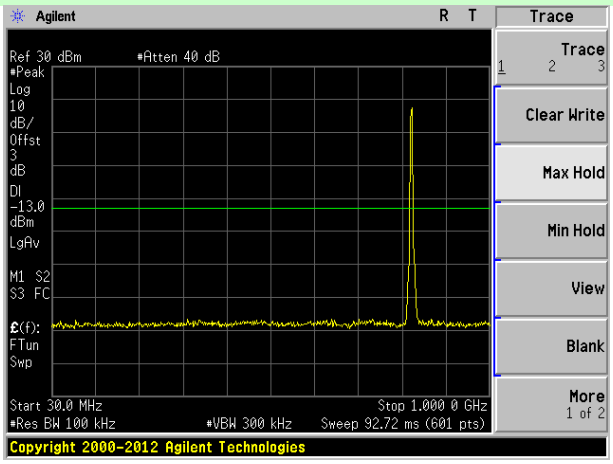

Middle channel

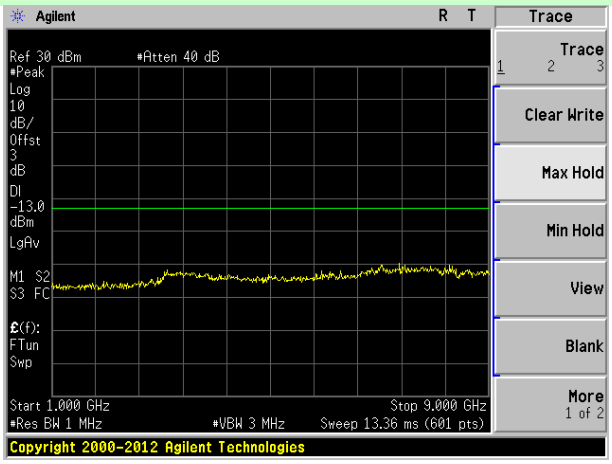


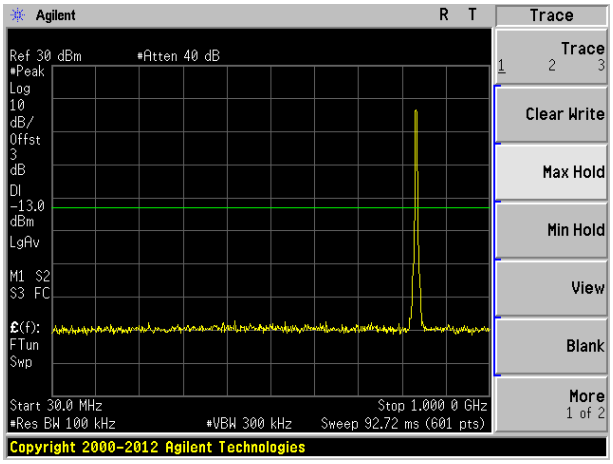

Highest channel

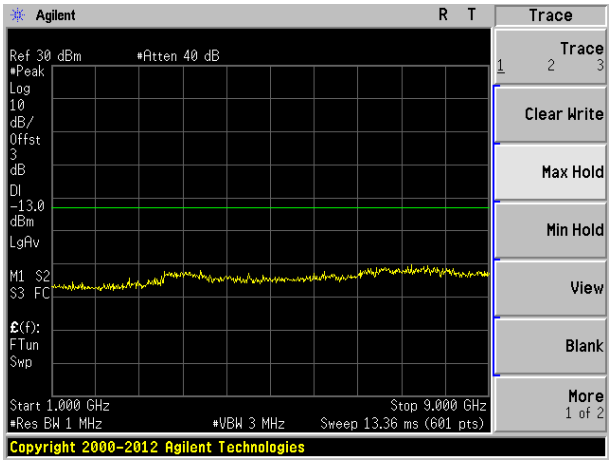
| Test Mode: Traffic mode | WCDMA Band V (RMC 12.2Kbps link) |
|---|---|



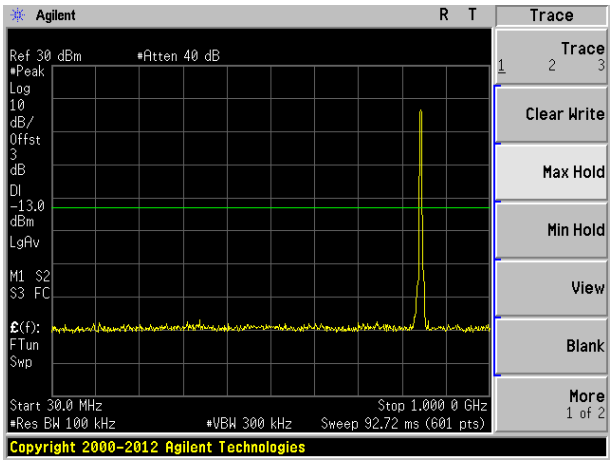



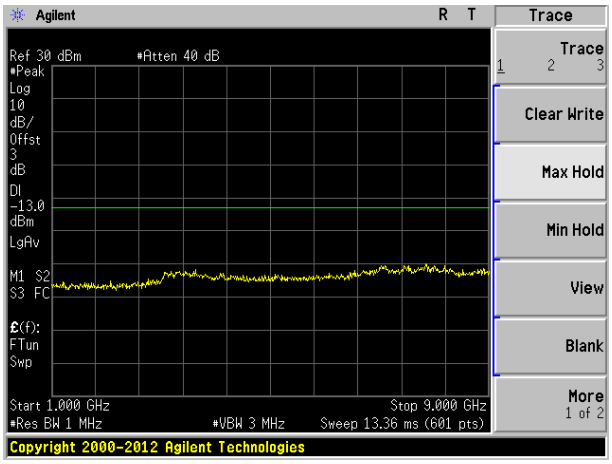

Lowest channel



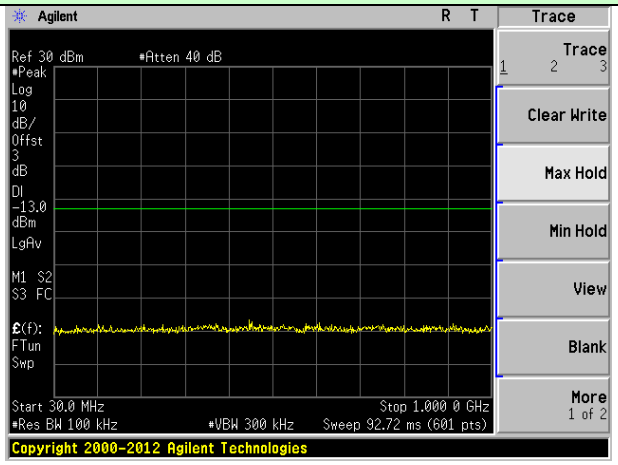

Middle channel

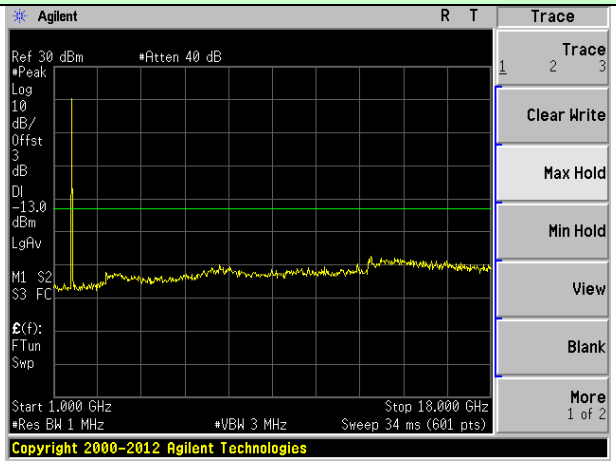


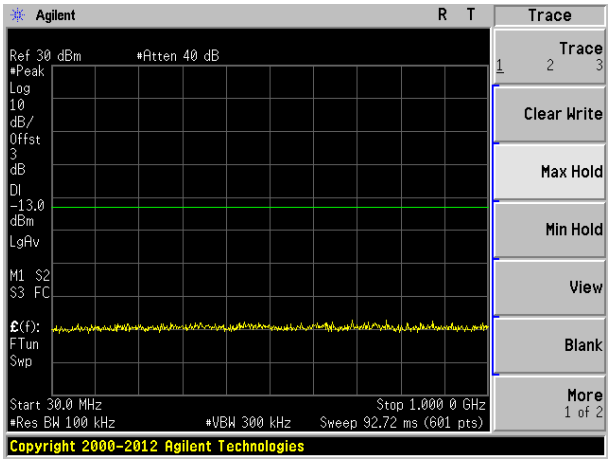

Highest channel

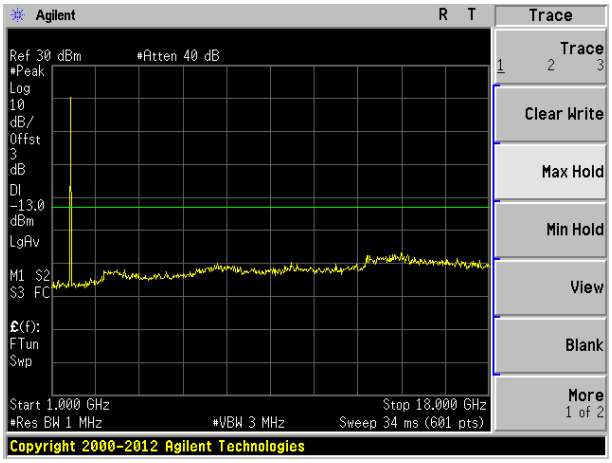
| Test Mode: Traffic mode | WCDMA Band IV (RMC 12.2Kbps link) |
|---|---|



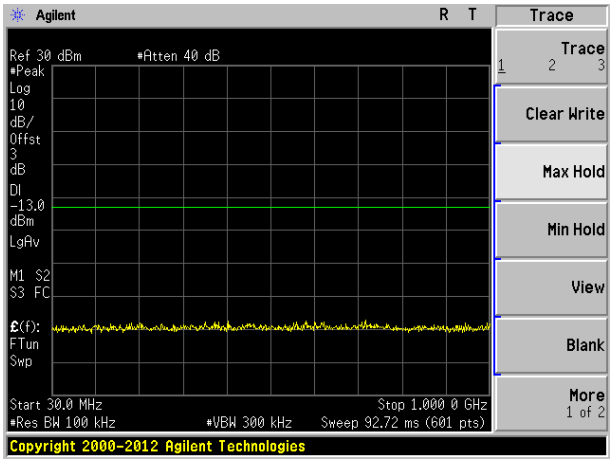



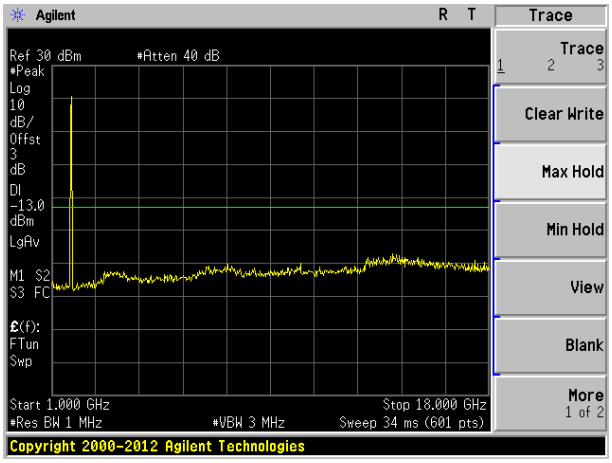

Lowest channel




Middle channel

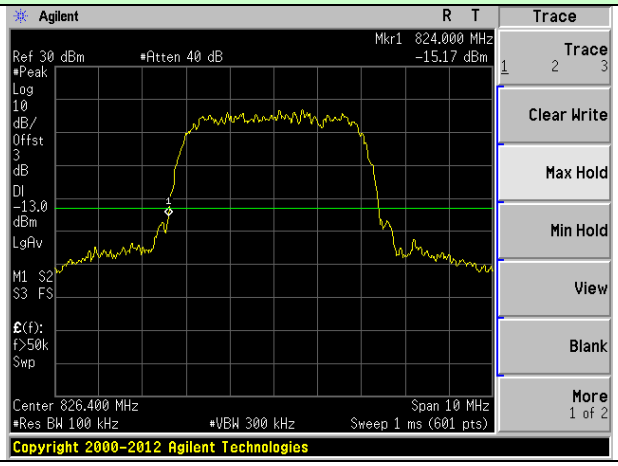


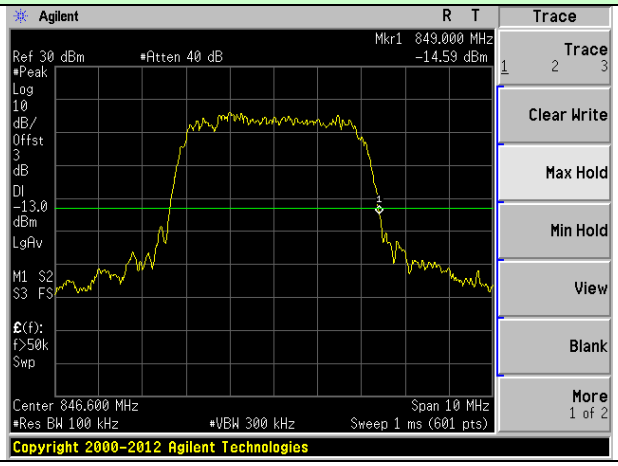




Highest channel

Band Edge:

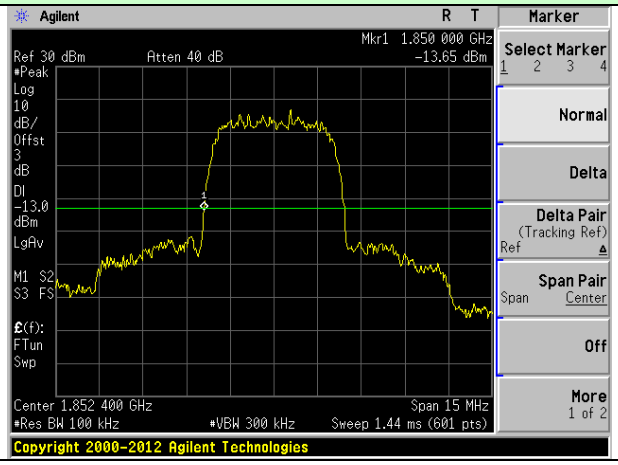
| Test Mode: Traffic mode | WCDMA Band V (RMC 12.2Kbps link) |
|---|---|

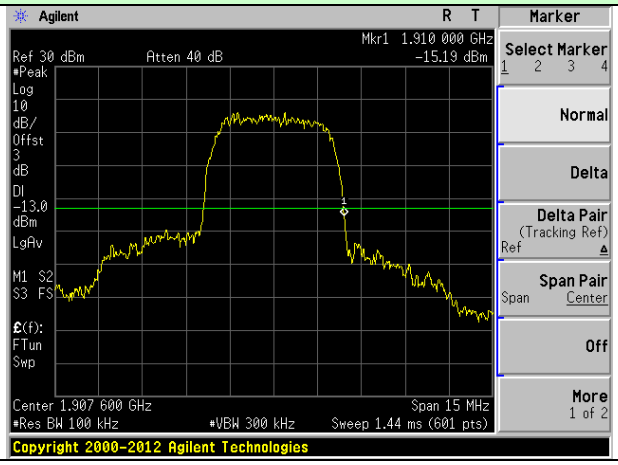



Lowest channel | Highest channel

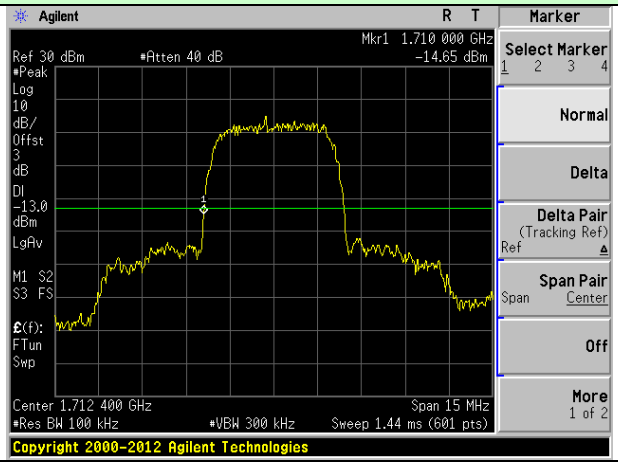
| Test Mode: Traffic mode | WCDMA Band II (RMC 12.2Kbps link) |
|---|---|

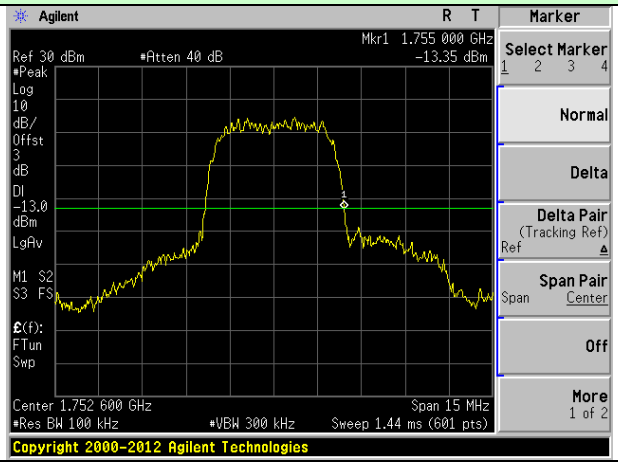



Lowest channel | Highest channel

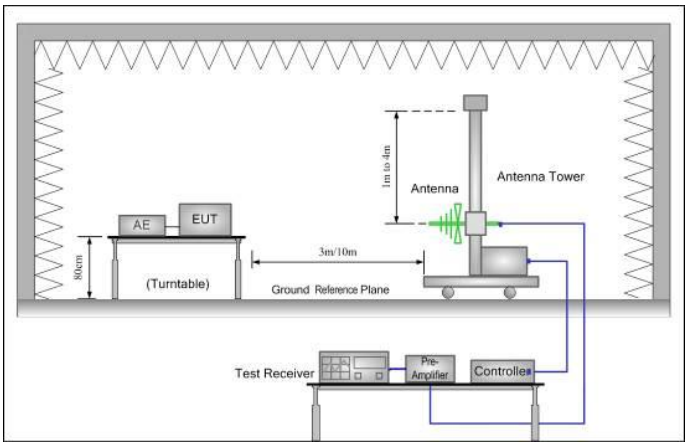
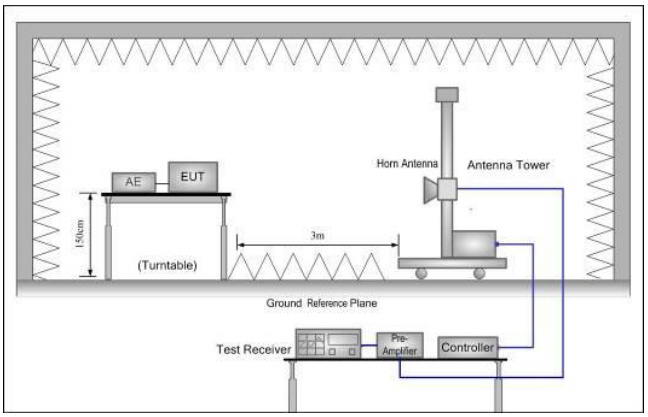
| Test Mode: Traffic mode | WCDMA Band IV (RMC 12.2Kbps link) |
|---|---|

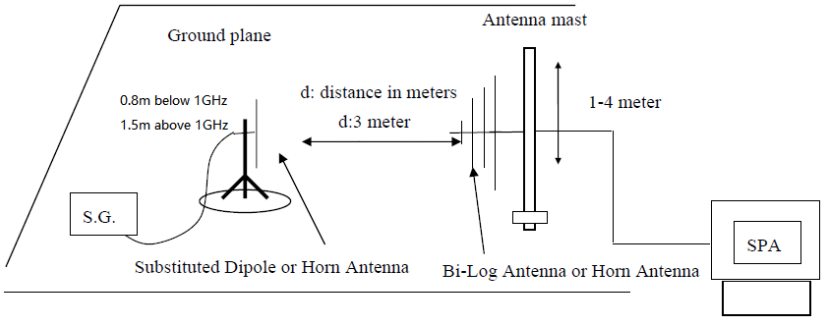



Lowest channel | Highest channel

## 6.9 ERP, EIRP Measurement

| | |
|---|---|
| Test Requirement for FCC: | FCC part22.913(a) and FCC part24.232(b) and FCC part 27.50 |
| Test Requirement for IC: | RSS-132 Clause 5.4, RSS-133 Clause 6.4, RSS-139 Clause 6.5 |
| Limit for FCC: | WCDMA Band V: 7W<br>WCDMA Band II: 2W<br>WCDMA Band IV: 1W |
| Limit for IC | WCDMA Band V: 11.5W<br>WCDMA Band II: 2W<br>WCDMA Band IV: 1W |
| Test setup: | Below 1GHz<br>  <br><br>Above 1GHz<br>  <br><br>Substituted method: |




| | | | | | | |
|---|---|---|---|---|---|---|
| Test Procedure: | 1. The EUT was placed on an non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer.<br>2. During the measurement, the EUT was communication with the station. The highest emission was recorded with the rotation of the turntable and the lowering of the test antenna from 4m to 1m. The reading was recorded and the field strength (E in dBuV/m) was calculated.<br>3. ERP in frequency band 824.2 –848.80.8MHz were measured using a substitution method. The EUT was replaced by dipole antenna connected, the S.G. output was recorded and ERP was calculated asfollows:<br>ERP = S.G. output (dBm) + Antenna Gain (dBd) – Cable Loss (dB)<br>4. EIRP in frequency band 1850.2 –1909.8MHz were measured using a substitution method. The EUT was replaced by or horn antenna connected, the S.G. output was recorded and EIRP was calculated as follows:<br>EIRP = S.G. output (dBm) + Antenna Gain (dBi) – Cable Loss (dB) | | | | | |
| Test environment: | Temp.: | 25 °C | Humid.: | 52% | Press.: | 1 012mbar |
| Test Instruments: | Refer to section 5.0 for details | | | | | |
| Test mode: | Refer to section 6.1 for details | | | | | |
| Test results: | Pass | | | | | |

Measurement Data

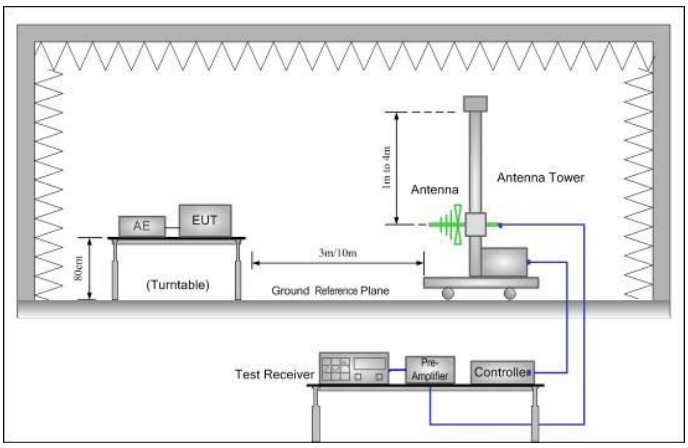
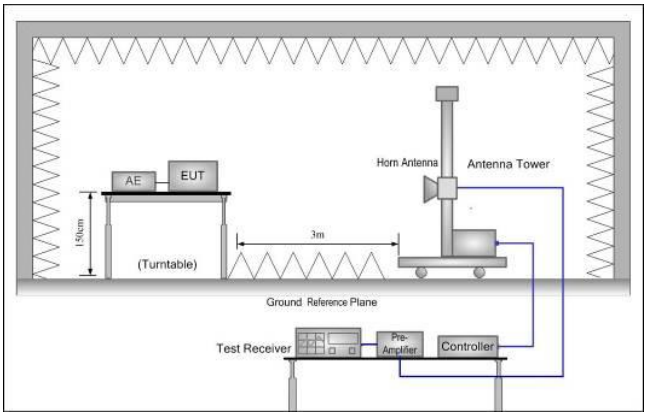
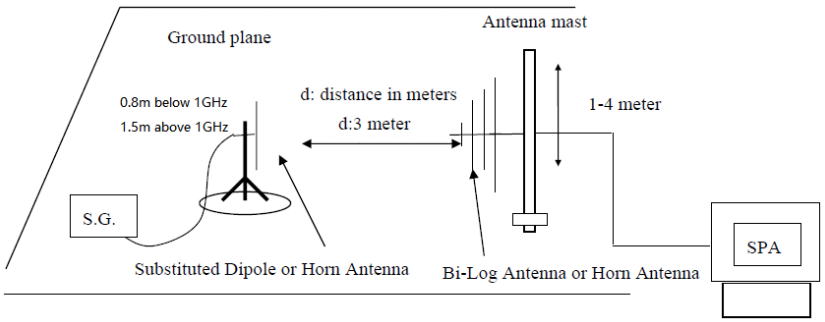
**The maximum value has been record and the tighter limits apply:**

| EUT mode | Channel | Modulation | Polarization | SGP [dBm] | Substitution Gain[dBi] | Cable loss[dB] | EIRP (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|---|---|
| WCDMA Band 2 | Lowest | QPSK | H | 21.48 | -1.93 | 1.13 | 20.68 | 33.00 | Pass |
| | Middle | QPSK | H | 22.08 | -1.93 | 1.22 | 21.37 | 33.00 | Pass |
| | Highest | QPSK | H | 22.34 | -1.93 | 1.34 | 21.75 | 33.00 | Pass |

| EUT mode | Channel | Modulation | Polarization | SGP [dBm] | Substitution Gain[dBi] | Cable loss[dB] | EIRP (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|---|---|
| WCDMA Band 4 | Lowest | QPSK | H | 22.23 | -2.74 | 1.71 | 21.2 | 30.00 | Pass |
| | Middle | QPSK | H | 21.99 | -2.74 | 1.73 | 20.98 | 30.00 | Pass |
| | Highest | QPSK | H | 22.17 | -2.74 | 1.81 | 21.24 | 30.00 | Pass |

| EUT mode | Channel | Modulation | Polarization | SGP [dBm] | Substitution Gain[dBi] | Cable loss[dB] | ERP (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|---|---|---|
| WCDMA Band 5 | Lowest | QPSK | H | 22.14 | -2.08 | 1.55 | 21.61 | 38.45 | Pass |
| | Middle | QPSK | H | 21.89 | -2.08 | 1.6 | 21.41 | 38.45 | Pass |
| | Highest | QPSK | H | 21.66 | -2.08 | 1.65 | 21.23 | 38.45 | Pass |

## 6.10 Field strength of spurious radiation measurement

| | |
|---|---|
| Test Requirement for FCC: | FCC part22.917(a) and FCC part24.238(a) and FCC part 27.53 |
| Test Requirement for IC: | RSS-GEN Clause 6.13 |
| Limit: | -13dBm |
| Test setup: | Below 1GHz<br>  <br><br>Above 1GHz<br>  <br><br>Substituted method:<br>  <br> |

| | | | | | | |
|---|---|---|---|---|---|---|
| Test Procedure: | 1. The EUT was placed on an non-conductive turntable using a non-conductive support. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and EMI spectrum analyzer.<br>2. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.<br>3. The frequency range up to tenth harmonic was investigated for each of three fundamental frequency (low, middle and high channels). Once spurious emission was identified, the power of the emission was determined using the substitution method.<br>4. The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and the spurious emissions frequency.<br>ERP / EIRP = S.G. output (dBm) + Antenna Gain(dB/dBi) – Cable Loss (dB) | | | | | |
| Test environment: | Temp.: | 25 °C | Humid.: | 52% | Press.: | 1 012mbar |
| Test Instruments: | Refer to section 5.0 for details | | | | | |
| Test mode: | Refer to section 6.1 for details | | | | | |
| Test results: | Pass | | | | | |

Measurement Data

| Test mode: | WCDMA Band V | | Test channel: | Lowest |
|---|---|---|---|---|
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 1652.80 | Vertical | -43.49 | -13.00 | Pass |
| 2479.20 | V | -44.27 | | |
| 3305.60 | V | -43.05 | | |
| 4132.00 | V | -42.60 | | |
| 4958.40 | V | -42.33 | | |
| 1652.80 | Horizontal | -44.36 | -13.00 | Pass |
| 2479.20 | H | -42.11 | | |
| 3305.60 | H | -47.56 | | |
| 4132.00 | H | -45.24 | | |
| 4958.40 | H | -43.65 | | |
| **Test mode:** | **WCDMA Band V** | | **Test channel:** | **Middle** |
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 1672.80 | Vertical | -43.69 | -13.00 | Pass |
| 2509.20 | V | -41.03 | | |
| 3345.60 | V | -43.69 | | |
| 4182.00 | V | -46.17 | | |
| 5018.40 | V | -44.05 | | |
| 1672.80 | Horizontal | -41.20 | -13.00 | Pass |
| 2509.20 | H | -43.15 | | |
| 3345.60 | H | -47.87 | | |
| 4182.00 | H | -44.31 | | |
| 5018.40 | H | -45.22 | | |
| **Test mode:** | **WCDMA Band V** | | **Test channel:** | **Highest** |
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 1693.20 | Vertical | -43.32 | -13.00 | Pass |
| 2539.80 | V | -42.79 | | |
| 3386.40 | V | -42.44 | | |
| 4233.00 | V | -45.35 | | |
| 5079.60 | V | -43.64 | | |
| 1693.20 | Horizontal | -40.72 | -13.00 | Pass |
| 2539.80 | H | -43.17 | | |
| 3386.40 | H | -44.58 | | |
| 4233.00 | H | -45.80 | | |
| 5079.60 | H | -43.65 | | |

Remark :

1. The emission behaviour belongs to narrowband spurious emission.
2. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

| Test mode: | WCDMA Band II | | Test channel: | Lowest |
|---|---|---|---|---|
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 3704.80 | Vertical | -43.09 | -13.00 | Pass |
| 5557.20 | V | -42.16 | | |
| 7409.60 | V | -44.69 | | |
| 9262.00 | V | -47.14 | | |
| 11114.40 | V | -44.08 | | |
| 3704.80 | Horizontal | -44.98 | -13.00 | Pass |
| 5557.20 | H | -49.32 | | |
| 7409.60 | H | -41.07 | | |
| 9262.00 | H | -44.12 | | |
| 11114.40 | H | -43.11 | | |
| **Test mode:** | **WCDMA Band II** | | **Test channel:** | **Middle** |
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 3760.00 | Vertical | -44.79 | -13.00 | Pass |
| 5640.00 | V | -42.70 | | |
| 7520.00 | V | -45.10 | | |
| 9400.00 | V | -47.43 | | |
| 11280.00 | V | -43.47 | | |
| 3760.00 | Horizontal | -45.38 | -13.00 | Pass |
| 5640.00 | H | -49.50 | | |
| 7520.00 | H | -41.16 | | |
| 9400.00 | H | -44.05 | | |
| 11280.00 | H | -43.44 | | |
| **Test mode:** | **WCDMA Band II** | | **Test channel:** | **Highest** |
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 3815.20 | Vertical | -46.00 | -13.00 | Pass |
| 5722.80 | V | -41.72 | | |
| 7630.40 | V | -43.95 | | |
| 9538.00 | V | -46.12 | | |
| 11445.60 | V | -42.17 | | |
| 3815.20 | Horizontal | -44.21 | -13.00 | Pass |
| 5722.80 | H | -48.05 | | |
| 7630.40 | H | -49.59 | | |
| 9538.00 | H | -42.29 | | |
| 11445.60 | H | -45.08 | | |

Remark :

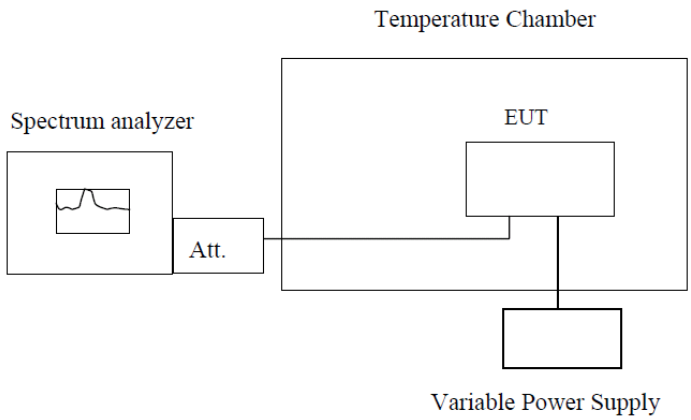
1. The emission behaviour belongs to narrowband spurious emission.
2. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

| Test mode: | WCDMA Band IV | | Test channel: | Lowest |
|---|---|---|---|---|
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 3424.80 | Vertical | -41.90 | -13.00 | Pass |
| 5137.20 | V | -42.69 | | |
| 6849.60 | V | -41.22 | | |
| 8562.00 | V | -42.48 | | |
| 10274.40 | V | -43.48 | | |
| 3424.80 | Horizontal | -41.26 | -13.00 | Pass |
| 5137.20 | H | -43.04 | | |
| 6849.60 | H | -44.07 | | |
| 8562.00 | H | -47.12 | | |
| 10274.40 | H | -44.77 | | |
| **Test mode:** | **WCDMA Band IV** | | **Test channel:** | **Middle** |
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 3464.80 | Vertical | -43.01 | -13.00 | Pass |
| 5197.20 | V | -41.20 | | |
| 6929.60 | V | -42.86 | | |
| 8662.00 | V | -46.98 | | |
| 10394.40 | V | -43.19 | | |
| 3464.80 | Horizontal | -42.33 | -13.00 | Pass |
| 5197.20 | H | -43.29 | | |
| 6929.60 | H | -45.61 | | |
| 8662.00 | H | -48.78 | | |
| 10394.40 | H | -42.33 | | |
| **Test mode:** | **WCDMA Band IV** | | **Test channel:** | **Highest** |
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 3505.20 | Vertical | -42.11 | -13.00 | Pass |
| 5257.80 | V | -41.60 | | |
| 7010.40 | V | -40.73 | | |
| 8763.00 | V | -41.82 | | |
| 10515.60 | V | -42.67 | | |
| 3505.20 | Horizontal | -43.02 | -13.00 | Pass |
| 5257.80 | H | -46.94 | | |
| 7010.40 | H | -41.10 | | |
| 8763.00 | H | -42.18 | | |
| 10515.60 | H | -41.01 | | |

Remark :

1. The emission behaviour belongs to narrowband spurious emission.
2. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

## 6.11 Frequency stability V.S. Temperature measurement

| | |
|---|---|
| Test Requirement for FCC: | FCC Part2.1055(a)(1)(b) |
| Test Requirement for IC: | RSS-132 Clause 5.3, RSS-133 Clause 6.3, RSS-139 Clause 6.4 |
| Limit: | 2.5ppm |
| Test setup: |  <br>**Note :** Measurement setup for testing on Antenna connector |
| Test procedure: | 1. The equipment under test was connected to an external DC power supply and input rated voltage.<br>2. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators.<br>3. The EUT was placed inside the temperature chamber.<br>4. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25°C operating frequency as reference frequency.<br>5. Turn EUT off and set the chamber temperature to –20°C. After the temperature stabilized for approximately 30 minutes recorded the frequency.<br>6. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached. |
| Test Instruments: | Refer to section 5.0 for details |
| Test mode: | Refer to section 6.1 for details |
| Test results: | Pass |

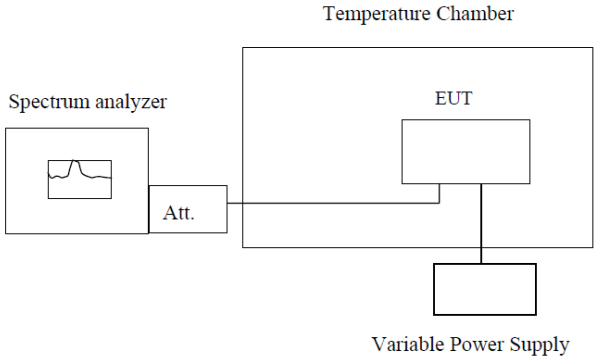
Measurement Data

| Reference Frequency: WCDMA Band V Middle channel=4183 channel=836.6MHz | | | | | |
|---|---|---|---|---|---|
| Power supplied (Vdc) | Temperature (°C) | Frequency error | | Limit (ppm) | Result |
| | | Hz | ppm | | |
| 12.0 | -30 | 96 | 0.1145 | 2.5 | Pass |
| | -20 | 109 | 0.1298 | | |
| | -10 | 92 | 0.1095 | | |
| | 0 | 75 | 0.0891 | | |
| | 10 | 87 | 0.1044 | | |
| | 20 | 75 | 0.0891 | | |
| | 30 | 126 | 0.1501 | | |
| | 40 | 113 | 0.1349 | | |
| | 50 | 109 | 0.1298 | | |

| Reference Frequency: WCDMA Band II Middle channel=9400 channel=1880.0MHz | | | | | |
|---|---|---|---|---|---|
| Power supplied (Vdc) | Temperature (°C) | Frequency error | | Limit (ppm) | Result |
| | | Hz | ppm | | |
| 12.0 | -30 | 22 | 0.0258 | 2.5 | Pass |
| | -20 | 24 | 0.0290 | | |
| | -10 | 20 | 0.0242 | | |
| | 0 | 18 | 0.0211 | | |
| | 10 | 19 | 0.0227 | | |
| | 20 | 16 | 0.0195 | | |
| | 30 | 31 | 0.0370 | | |
| | 40 | 26 | 0.0306 | | |
| | 50 | 24 | 0.0290 | | |

| Reference Frequency: WCDMA Band IV Middle channel=1412 channel=1732.4MHz | | | | | |
|---|---|---|---|---|---|
| Power supplied (Vdc) | Temperature (°C) | Frequency error | | Limit (ppm) | Result |
| | | Hz | ppm | | |
| 12.0 | -30 | 49 | 0.0583 | 2.5 | Pass |
| | -20 | 56 | 0.0670 | | |
| | -10 | 47 | 0.0565 | | |
| | 0 | 41 | 0.0494 | | |
| | 10 | 46 | 0.0550 | | |
| | 20 | 40 | 0.0482 | | |
| | 30 | 67 | 0.0799 | | |
| | 40 | 58 | 0.0699 | | |
| | 50 | 55 | 0.0663 | | |

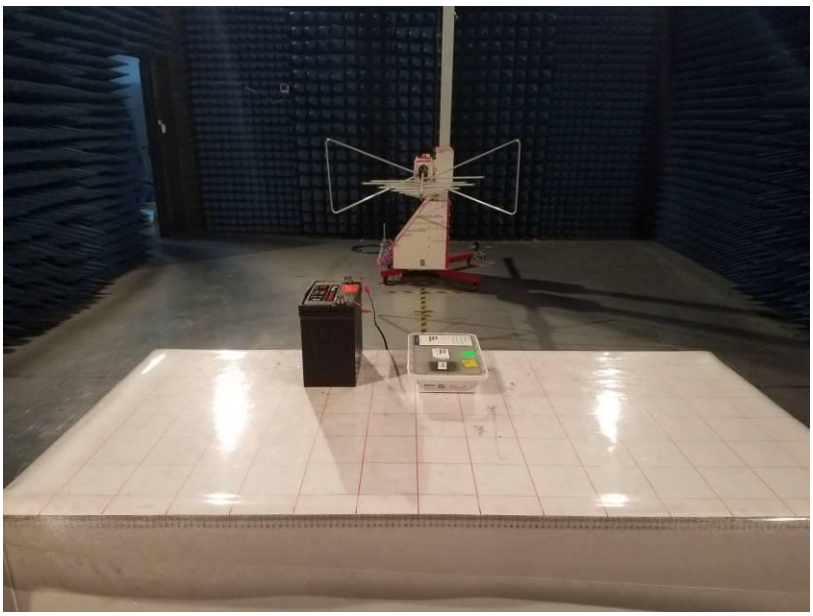
## 6.12 Frequency stability V.S. Voltage measurement

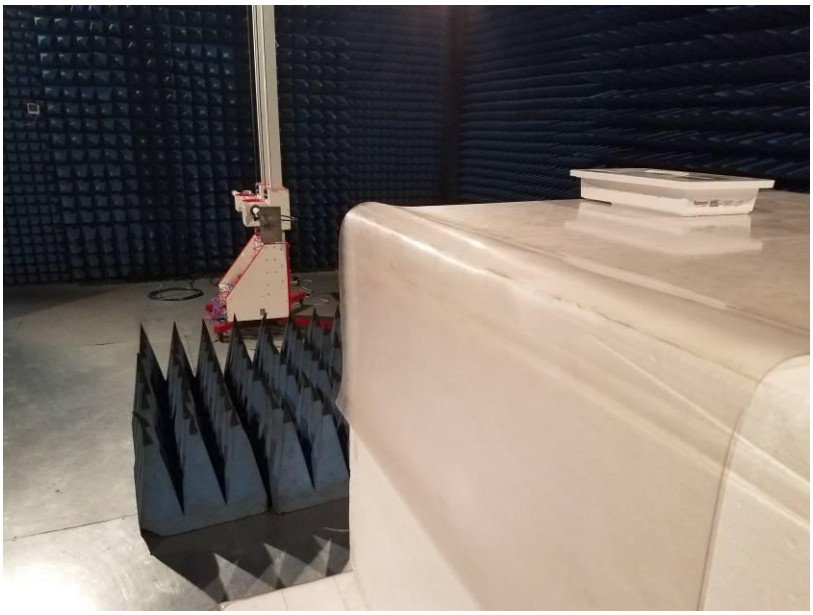
| | |
|---|---|
| Test Requirement for FCC: | FCC Part2.1055(d)(1)(2) |
| Test Requirement for IC: | RSS-132 Clause 5.3, RSS-133 Clause 6.3, RSS-139 Clause 6.4 |
| Limit: | 2.5ppm |
| Test setup: |  <br>**Note :** Measurement setup for testing on Antenna connector |
| Test procedure: | 1. Set chamber temperature to 25°C. Use a variable DC power source to power the EUT and set the voltage to rated voltage.<br>2. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.<br>3. Reduce the input voltage to specified extreme voltage variation (+/- 15%) and endpoint, record the maximum frequency change. |
| Test Instruments: | Refer to section 5.0 for details |
| Test mode: | Refer to section 6.1 for details |
| Test results: | Pass |

Measurement Data

| Reference Frequency: WCDMA Band V Middle channel=4183 channel=836.6MHz | | | | | |
|---|---|---|---|---|---|
| Temperature (°C) | Power supplied (Vdc) | Frequency error | | Limit (ppm) | Result |
| | | Hz | ppm | | |
| 25 | 14.0 | 74 | 0.0890 | 2.5 | Pass |
| | 12.0 | 86 | 0.1025 | | |
| | 10.0 | 97 | 0.1161 | | |
| Reference Frequency: WCDMA Band II Middle channel=940 channel=1880.0MHz | | | | | |
| Temperature (°C) | Power supplied (Vdc) | Frequency error | | Limit (ppm) | Result |
| | | Hz | ppm | | |
| 25 | 14.0 | 116 | 0.1381 | 2.5 | Pass |
| | 12.0 | 83 | 0.0991 | | |
| | 10.0 | 94 | 0.1121 | | |
| Reference Frequency: WCDMA Band IV Middle channel=1412 channel=1732.4MHz | | | | | |
| Temperature (°C) | Power supplied (Vdc) | Frequency error | | Limit (ppm) | Result |
| | | Hz | ppm | | |
| 25 | 14.0 | 111 | 0.1328 | 2.5 | Pass |
| | 12.0 | 127 | 0.1519 | | |
| | 10.0 | 143 | 0.1704 | | |

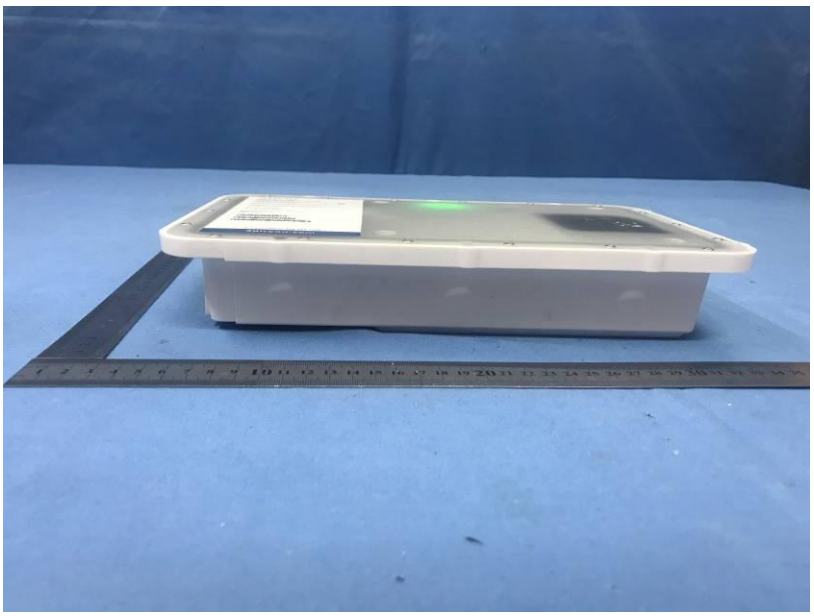
# 7 Test Setup Photo

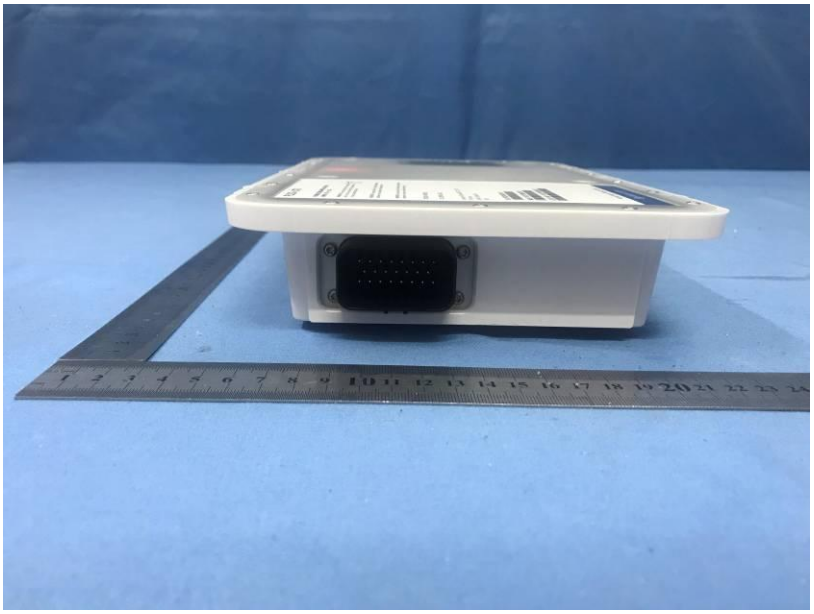


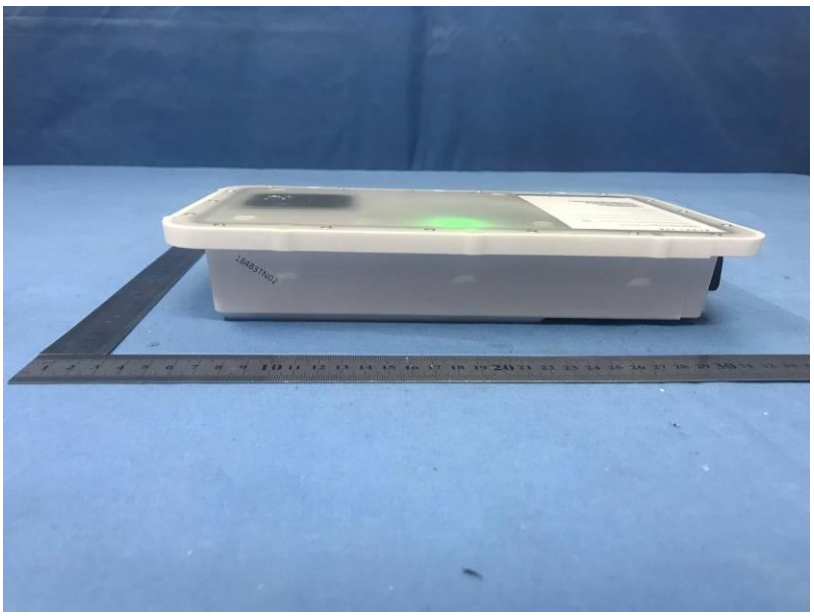


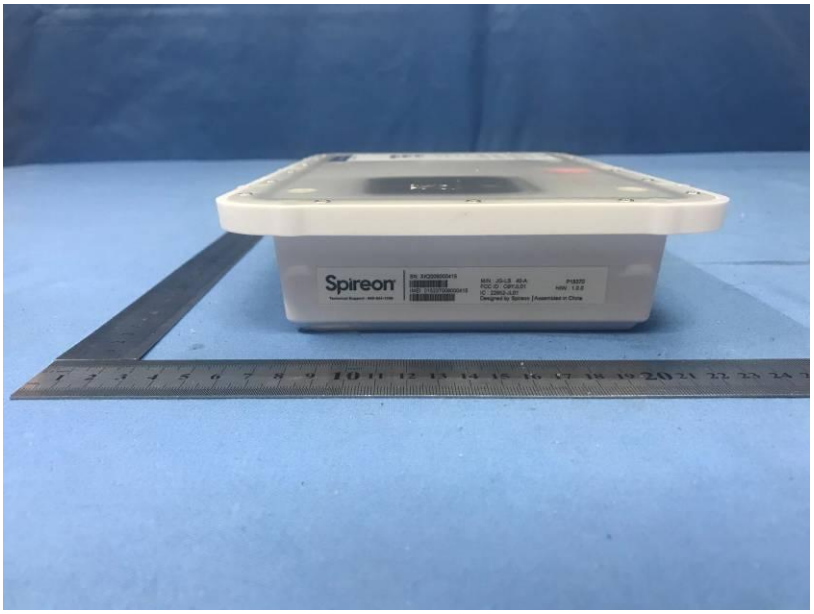
# 8 EUT Constructional Details

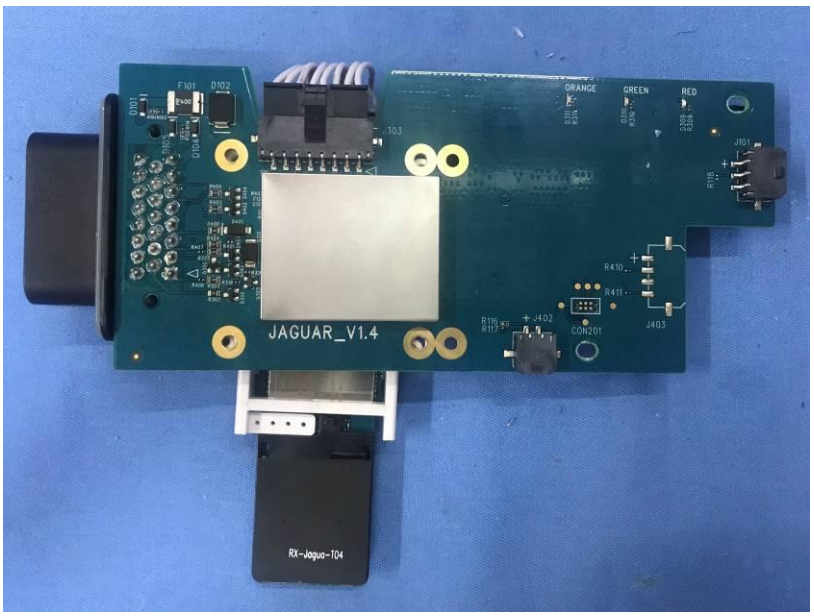
JG-LS:

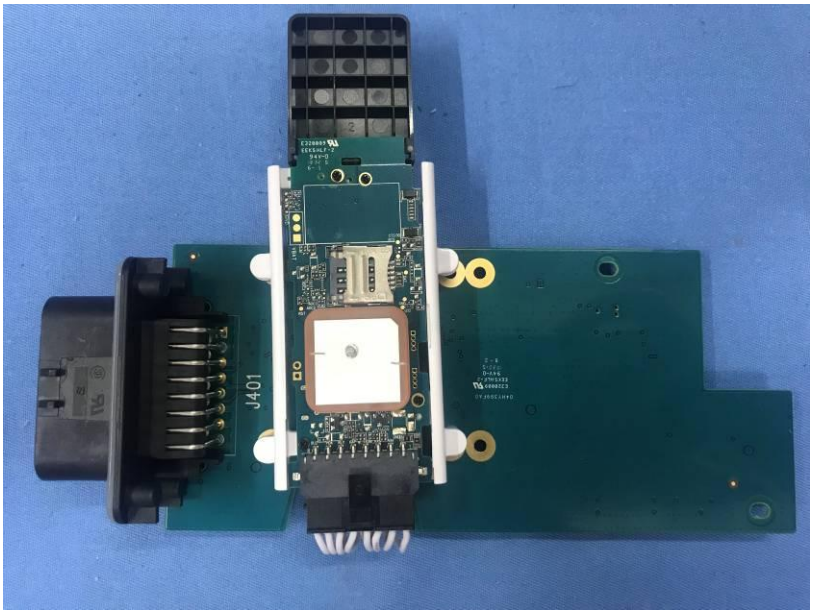







Spireon


ORANGE
GREEN
RED
JAGUAR_V1.4
RX-Jagua-T04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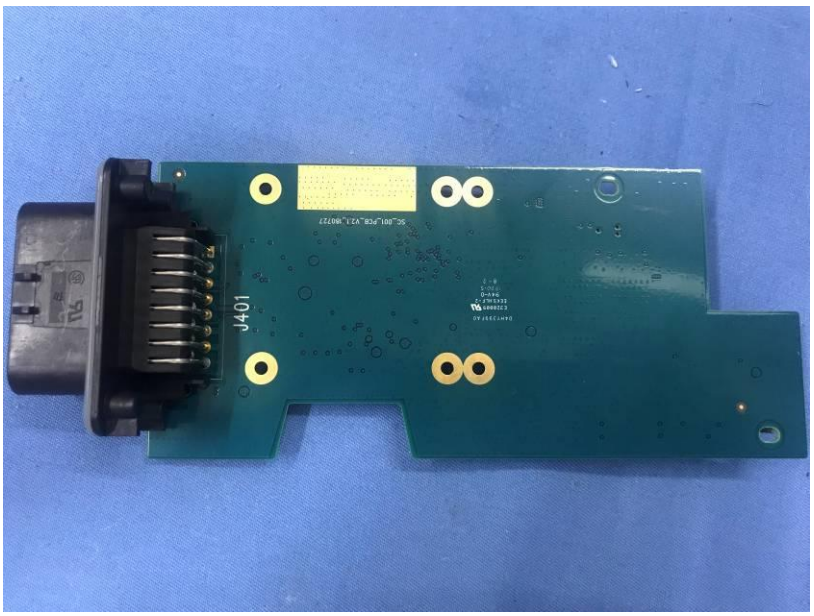
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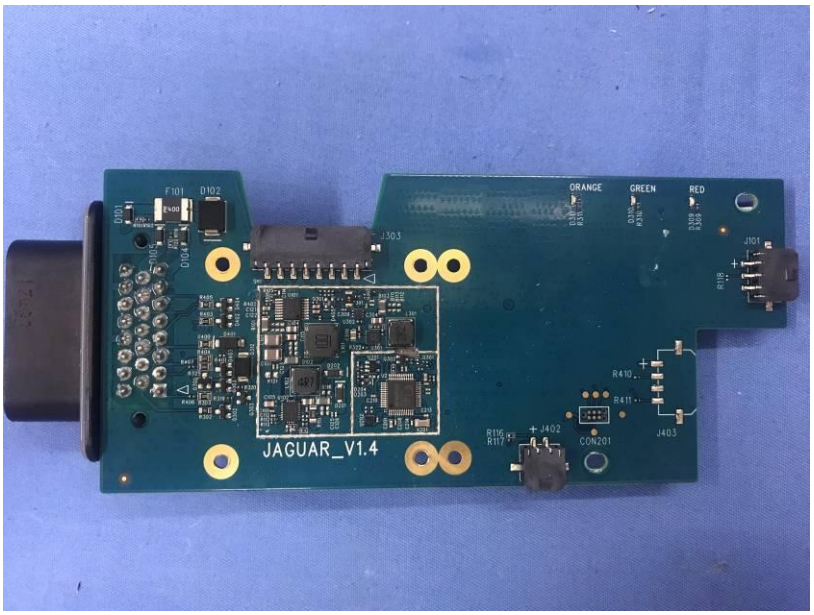
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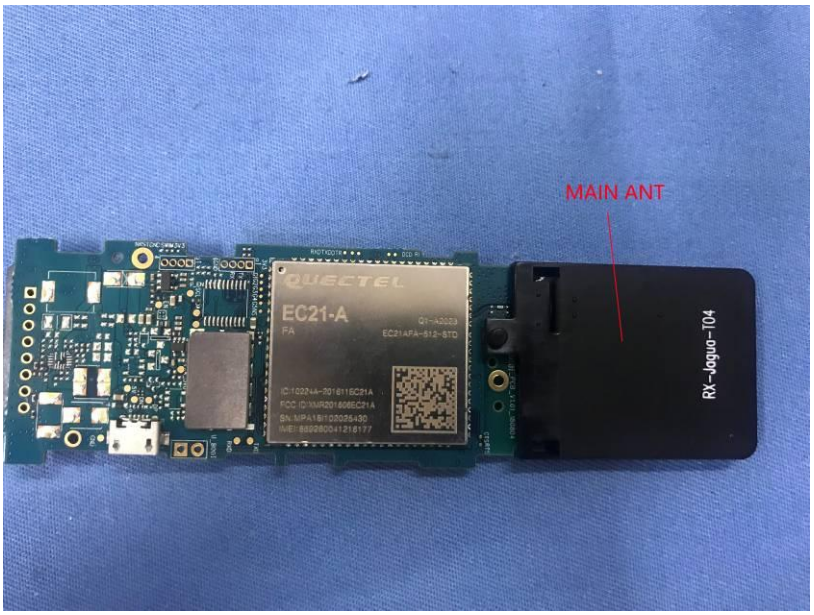
D101
ORANGE
GREEN
RED
J303
J101
R410
R411
J402
J403
CON201
JAGUAR_V1.4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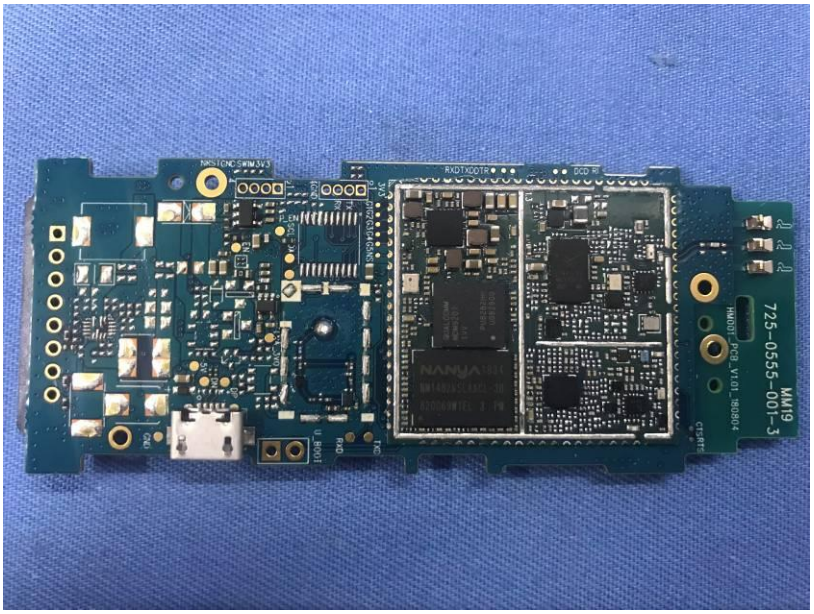
QUECTEL
EC21-A
RX-Joguo-T04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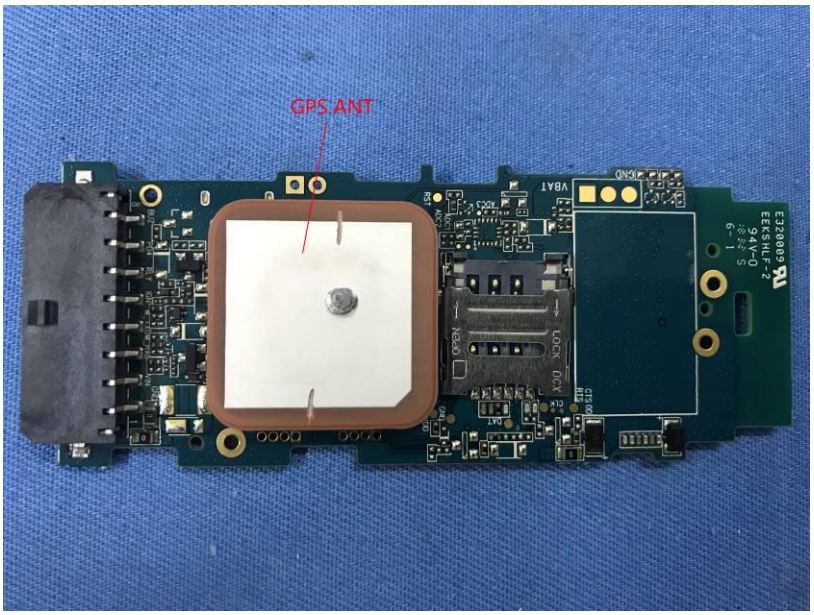
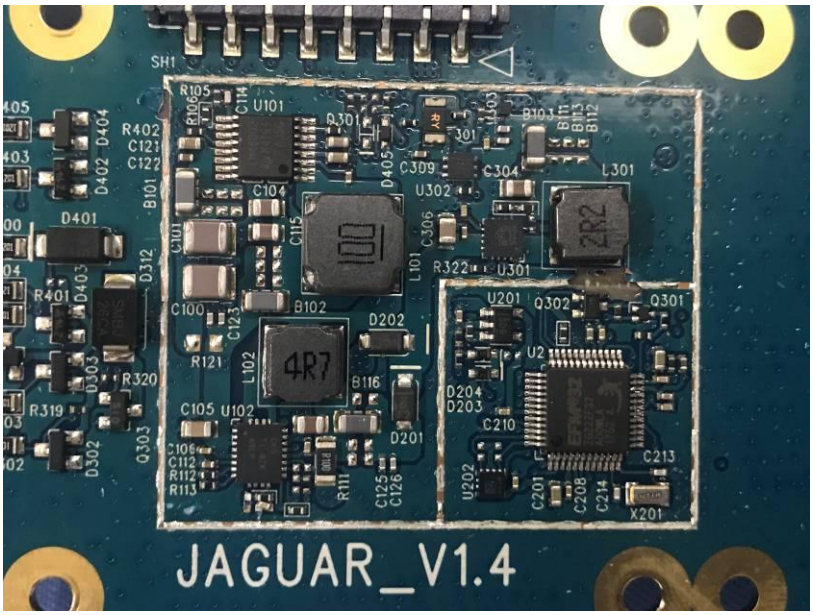
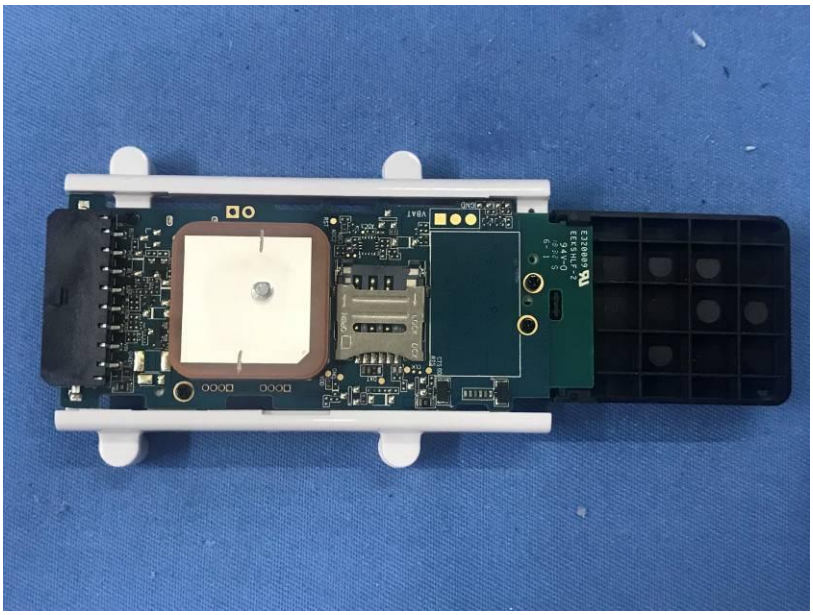

GPS ANT

Expocell Part#:LIP-2S2PLx18650LT-PTMol43
Voltage : 7.4V
Capacity : 4400mAh/32.56Wh
Battery : Li-ion Rechargeable Battery
CAUTION:
• May explode if disposed of in fire
• Use specified charger only
• Do not short circuit
Made in China
27S-EGR
JG44B


JAGUAR_V1.4



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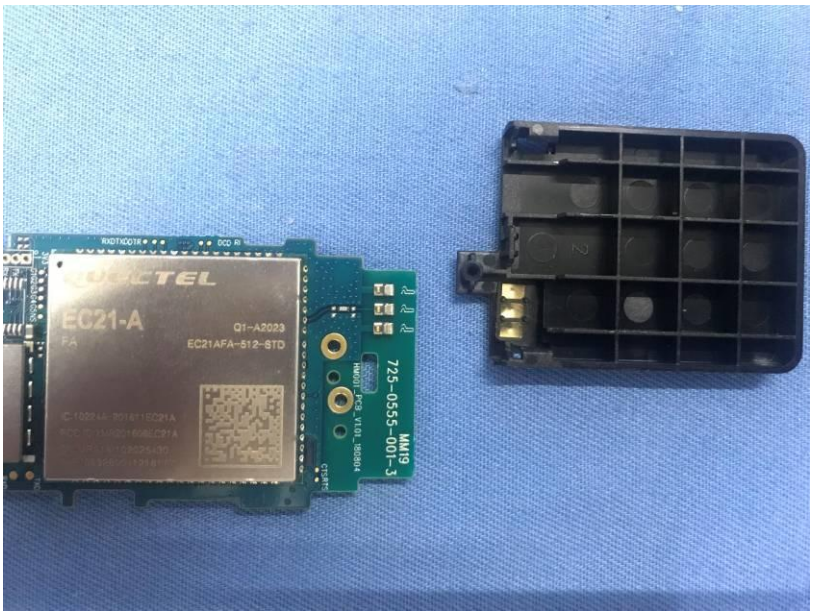
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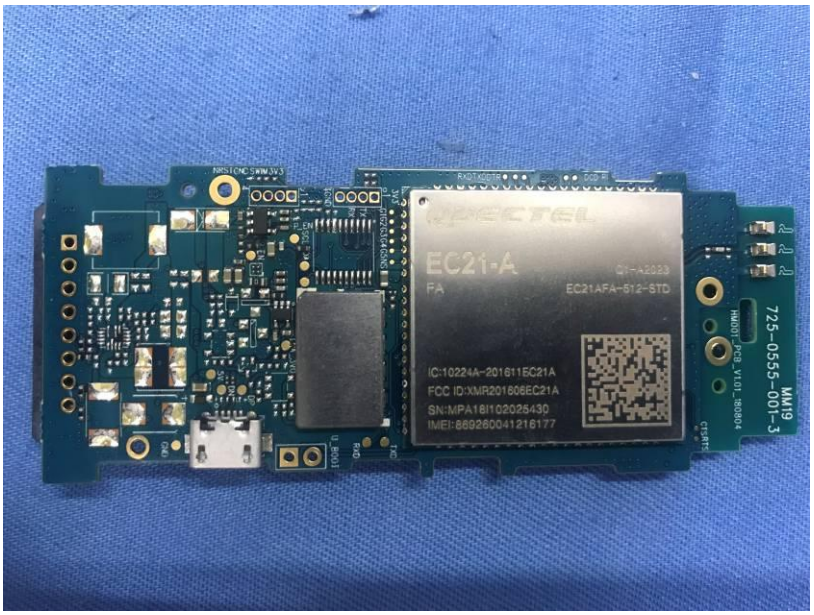
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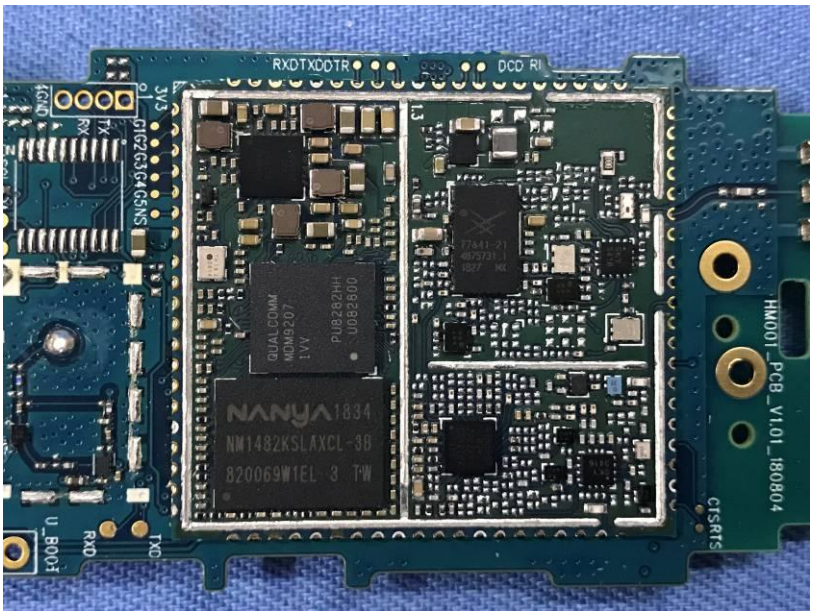
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G1G2G3G4G5NS
QUALCOMM
MDM9207
1VV
PU8282NH
U082600
NANYA 1834
NM1482KSLAXCL-38
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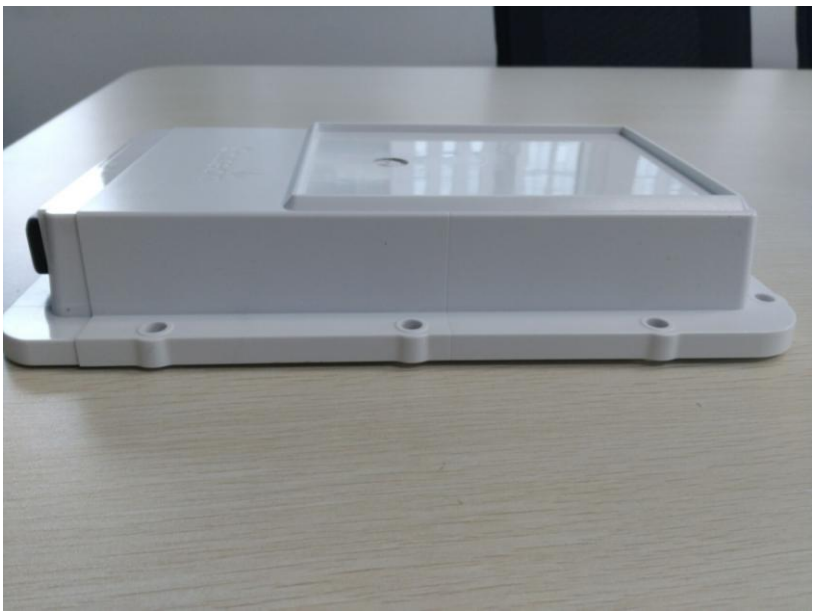
HM001_PCB_V1.01_180804
CTSRTS
U_BOOT
RXD
TXD

JG-L:



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