# TEST Report

| | |
|---|---|
| **Applicant:** | OPTIKS SOLUTIONS, INC |
| **Address of Applicant:** | 15 CORPORATE PLACE SOUTH, SUITE 105, PISCATAWAY, New Jersey 08854, United States |
| **Manufacturer:** | OPTIKS SOLUTIONS, INC |
| **Address of Manufacturer:** | 15 CORPORATE PLACE SOUTH, SUITE 105, PISCATAWAY, New Jersey 08854, United States |

**Equipment Under Test (EUT)**

| | |
|---|---|
| Product Name: | Swittons IoT Edge-G |
| Model No.: | SWIT400CN |
| Trade mark: | Swittons |
| **FCC ID:** | 2AUJP-SWIT400CN |
| **Applicable standards:** | FCC CFR Title 47 Part 2 |
| | FCC CFR Title 47 Part 22 Subpart H |
| | FCC CFR Title 47 Part 24 Subpart E |
| **Date of sample receipt:** | September 17, 2019 |
| **Date of Test:** | September 18, 2019-October 08, 2019 |
| **Date of report issued:** | October 09, 2019 |
| **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* | *October 09, 2019* | *Original* |
| | | |
| | | |
| | | |
| | | |

***Prepared By:*** Bill. Yuan ***Date:*** *October 09, 2019*

***Project Engineer***

***Check By:*** ***Date:*** *October 09, 2019*

***Reviewer***

# 2 Contents

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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)<br>Part 24.232(c) | Pass |
| Peak-to-Average Ratio | Part 2.1046<br>Part 22.913(d)<br>Part 24.232(d) | Pass |
| Modulation Characteristics | Part 2.1047 | Pass |
| 99% Occupied Bandwidth & 26dB Bandwidth | Part 2.1049<br>Part 22.917(b)<br>Part 24.238(b) | Pass |
| Spurious Emissions at Antenna Terminal | Part 2.1051<br>Part 22.917<br>Part 24.238 | Pass |
| Field Strength of Spurious Radiation | Part 2.1053<br>Part 22.917<br>Part 24.238 | Pass |
| Out of band emission, Band Edge | Part 2.1051<br>Part 22.917<br>Part 24.238 | Pass |
| ERP and EIRP | Part 22.913(a)<br>Part 24.232(b) | Pass |
| Frequency stability vs. temperature | Part 2.1055(a)(1)(b)<br>Part 22.355<br>Part 24.235 | Pass |
| Frequency stability vs. voltage | Part 2.1055(d)(1)(2)<br>Part 22.355<br>Part 24.235 | Pass |

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

# 4 General Information

## 4.1 General Description of EUT

| | |
|---|---|
| Product Name: | Swittons IoT Edge-G |
| Model No.: | SWIT400CN |
| Test sample(s) ID: | GTS201909000109-1 |
| Sample(s) Status: | Engineer sample |
| Serial No.: | N/A |
| Hardware Version: | GSM-02-REV 1.1 |
| Software Version: | V1.0 |
| Support Networks: | GPRS |
| Support Bands: | GSM850, PCS1900 |
| TX Frequency: | GSM850: 824.20MHz-848.80MHz<br>PCS1900: 1850.20MHz-1909.80MHz |
| GPRS Class: | 10 |
| Release | R99 |
| Modulation type: | GMSK |
| Antenna type: | PCB antenna |
| Antenna gain: | GSM850: 0dBi<br>PCS1900: 0dBi |
| Power supply: | Adaptor<br>Model: EP19-050100WULA<br>Input: AC 100-240V, 50/60Hz, 200mA Max<br>Output: DC 5.0V, 1.0A<br>Or<br>Battery: DC 3.7V, 1400mAh, 4.81Wh |

**Operation Frequency List:**

| GSM 850 | | PCS1900 | |
|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 128 | 824.20 | 512 | 1850.20 |
| 129 | 824.40 | 513 | 1850.40 |
| ⋮ | ⋮ | ⋮ | ⋮ |
| 189 | 836.40 | 660 | 1879.80 |
| 190 | 836.60 | 661 | 1880.00 |
| 191 | 836.80 | 662 | 1880.20 |
| ⋮ | ⋮ | ⋮ | ⋮ |
| 250 | 848.60 | 809 | 1909.60 |
| 251 | 848.80 | 810 | 1909.80 |

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:**

| GSM 850 | | PCS1900 | |
|---|---|---|---|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 128 | 824.20 | 512 | 1850.20 |
| 190 | 836.60 | 661 | 1880.00 |
| 251 | 848.80 | 810 | 1909.80 |

## 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.

## 4.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures document on ANSI C63.26:2015 and FCC CFR 47.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057

## 4.4 Deviation from Standards

None.

## 4.5 Abnormalities from Standard Conditions

None.

## 4.6 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.

● **IC —Registration No.: 9079A**

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

● **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). LAB CODE:600179-0

## 4.7 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102

Tel: 0755-27798480

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. 26 2019 | June. 25 2020 |
| 4 | BiConiLog Antenna | SCHWARZBECK MESS-ELEKTRONIK | VULB9163 | GTS214 | June. 26 2019 | June. 25 2020 |
| 5 | Double -ridged waveguide horn | SCHWARZBECK MESS-ELEKTRONIK | BBHA 9120 D | GTS208 | June. 26 2019 | June. 25 2020 |
| 6 | Horn Antenna | ETS-LINDGREN | 3160 | GTS217 | June. 26 2019 | June. 25 2020 |
| 7 | EMI Test Software | AUDIX | E3 | N/A | N/A | N/A |
| 8 | Coaxial Cable | GTS | N/A | GTS213 | June. 26 2019 | June. 25 2020 |
| 9 | Coaxial Cable | GTS | N/A | GTS211 | June. 26 2019 | June. 25 2020 |
| 10 | Coaxial cable | GTS | N/A | GTS210 | June. 26 2019 | June. 25 2020 |
| 11 | Coaxial Cable | GTS | N/A | GTS212 | June. 26 2019 | June. 25 2020 |
| 12 | Amplifier(100kHz-3GHz) | HP | 8347A | GTS204 | June. 26 2019 | June. 25 2020 |
| 13 | Amplifier(2GHz-20GHz) | HP | 84722A | GTS206 | June. 26 2019 | June. 25 2020 |
| 14 | Amplifier (18-26GHz) | Rohde & Schwarz | AFS33-18002 650-30-8P-44 | GTS218 | June. 26 2019 | June. 25 2020 |
| 15 | Band filter | Amindeon | 82346 | GTS219 | June. 26 2019 | June. 25 2020 |
| 16 | Power Meter | Anritsu | ML2495A | GTS540 | June. 26 2019 | June. 25 2020 |
| 17 | Power Sensor | Anritsu | MA2411B | GTS541 | June. 26 2019 | June. 25 2020 |
| 18 | Wideband Radio Communication Tester | Rohde & Schwarz | CMW500 | GTS575 | June. 26 2019 | June. 25 2020 |
| 19 | Splitter | Agilent | 11636B | GTS237 | June. 26 2019 | June. 25 2020 |
| 20 | Loop Antenna | ZHINAN | ZN30900A | GTS534 | June. 26 2019 | June. 25 2020 |
| 21 | Breitband hornantenne | SCHWARZBECK | BBHA 9170 | GTS579 | Oct. 20 2018 | Oct. 19 2019 |
| 22 | Amplifier | TDK | PA-02-02 | GTS574 | Oct. 20 2018 | Oct. 19 2019 |
| 23 | Amplifier | TDK | PA-02-03 | GTS576 | Oct. 20 2018 | Oct. 19 2019 |
| 24 | PSA Series Spectrum Analyzer | Rohde & Schwarz | FSP | GTS578 | June. 26 2019 | June. 25 2020 |

| 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. 26 2019 | June. 25 2020 |
| 2 | Barometer | ChangChun | DYM3 | GTS255 | June. 26 2019 | June. 25 2020 |

# 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.

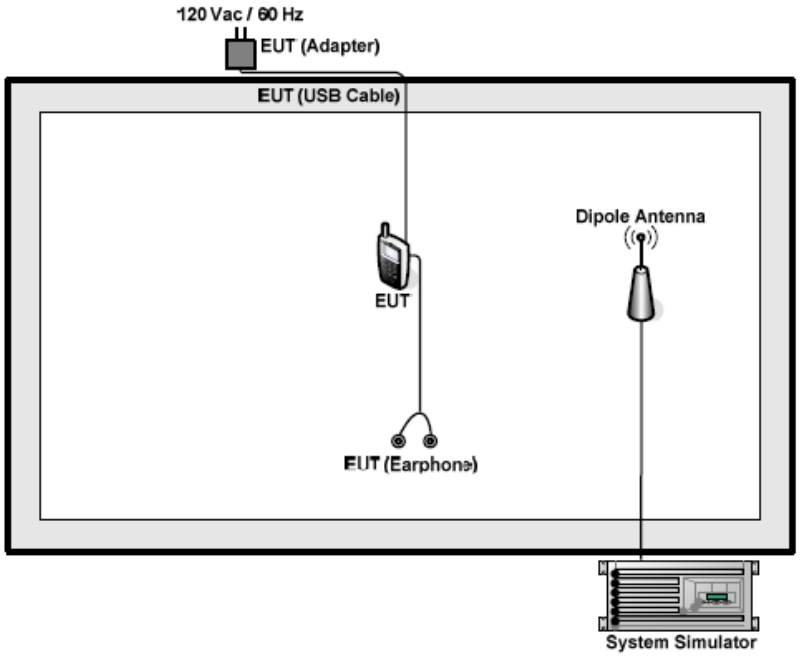
| **Test modes** | | |
|---|---|---|
| **Band** | Radiated | Conducted |
| **GSM 850** | ■ GPRS 1 link | ■ GPRS 1 link |
| **PCS 1900** | ■ GPRS 1 link | ■ GPRS 1 link |

Note: The maximum power levels are GPRS multi-slot class 10 mode for GMSK link. only these modes were used for all tests.

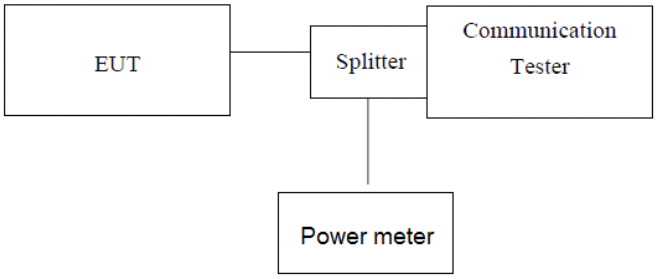
The conducted power tables are as follows:

| Conducted Power (dBm) | | | | | | |
|---|---|---|---|---|---|---|
| Band | GSM850 | | | PCS1900 | | |
| Channel | 128 | 190 | 251 | 512 | 661 | 810 |
| Frequency | 824.20 | 836.60 | 848.80 | 1850.20 | 1880.00 | 1909.80 |
| GPRS (GMSK, 1 TX slot) | 33.37 | 33.29 | 33.40 | 30.46 | 30.41 | 30.47 |
| GPRS (GMSK, 2 TX slot) | 33.16 | 33.11 | 33.09 | 29.87 | 29.84 | 29.82 |
| GPRS (GMSK, 3 TX slot) | 32.45 | 32.48 | 32.46 | 29.26 | 29.21 | 29.23 |
| GPRS (GMSK, 4 TX slot) | 31.68 | 31.73 | 31.79 | 28.45 | 28.62 | 28.59 |

## 6.2 Configuration of Tested System



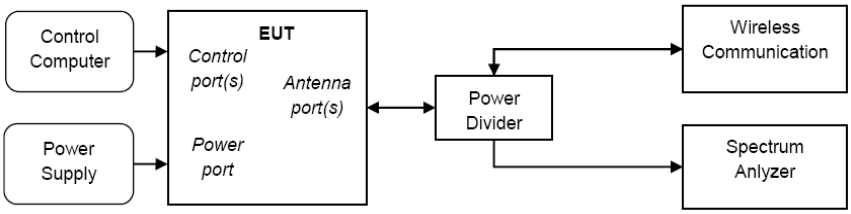
## 6.3 Conducted Peak Output Power

| | |
|---|---|
| Test Requirement: | FCC part 22.913(a) and FCC part 24.232(c) |
| Test Method: | FCC part2.1046 |
| Limit: | GSM850: 7W(38.45dBm)<br>PCS1900: 2W(33dBm) |
| 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 peak power. |
| 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) | PK power (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|
| GSM 850 (GPRS 1 link) | 128 | 824.20 | 33.37 | 38.45 | Pass |
| | 190 | 836.60 | 33.29 | | |
| | 251 | 848.80 | 33.40 | | |
| PCS 1900 (GPRS 1 link) | 512 | 1850.20 | 30.46 | 33.01 | Pass |
| | 661 | 1880.00 | 30.41 | | |
| | 810 | 1909.80 | 30.47 | | |

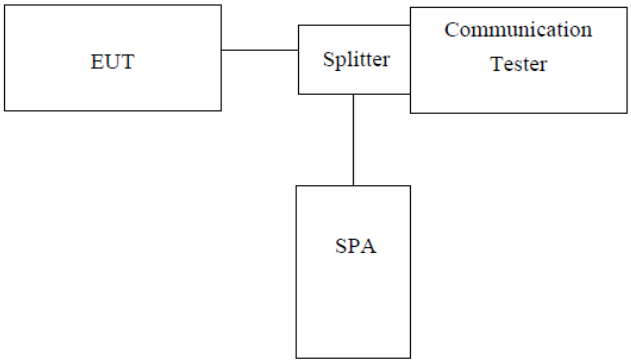
## 6.4 Peak-to-Average Ratio

| | |
|---|---|
| Test Requirement: | FCC Part 22.913(d) and FCC Part 24.232(d) |
| Test Method: | FCC part2.1046 |
| Limit: | 13db |
| Test setup: |  |
| Test Procedure: | A peak to average ratio measurement is performed at the conducted port of the EUT. For WCDMA signals, the spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level. For GSM signals, an average and a peak trace are used on a spectrum analyzer to determine the largest deviation between the average and the peak power of the EUT in a bandwidth greater than the emission bandwidth. The traces are generated with the spectrum analyzer set to zero span mode.<br><br>**Test Settings**<br>1. The signal analyzer's CCDF measurement profile enabled<br>2. Frequency= carrier center frequency<br>3. Measurement BW > EBW of signal<br>4. for continuous transmissions, set to 1ms<br>5. Record the maximum PAPR level associated with a probability of 0.1%. |
| Test Instruments: | Refer to section 5.0 for details |
| Test mode: | Refer to section 6.1 for details |
| Test results: | Pass |

**Measurement data**

| Test Band | Peak to Average Ratio ( dB ) | | | Limit ( dB ) | Result |
|---|---|---|---|---|---|
| | Low Ch. | Middle Ch. | High Ch. | | |
| GSM850 | 0.24 | 0.27 | 0.25 | 13 | PASS |
| PCS 1900 | 0.25 | 0.29 | 0.26 | 13 | PASS |

## 6.5 Occupy Bandwidth

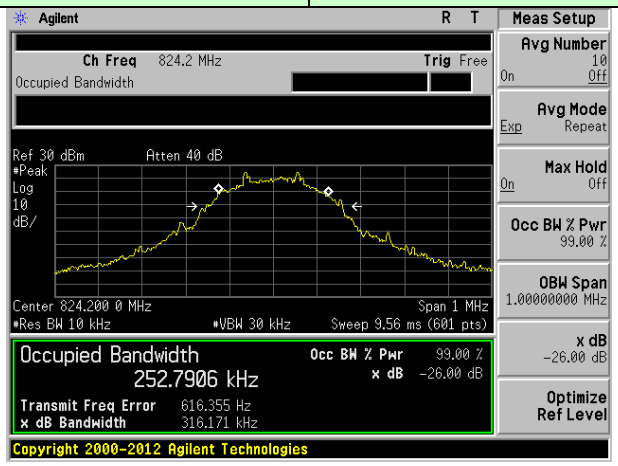
| | |
|---|---|
| Test Requirement: | FCC part 22.917(b) and FCC part 24.238(b) |
| Test Method: | FCC part2.1049 |
| Test setup: |  *Note: Measurement setup for testing on Antenna connector* |
| Test Procedure: | 1. The EUT's output RF connector was connected with a short cable to the spectrum analyzer<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

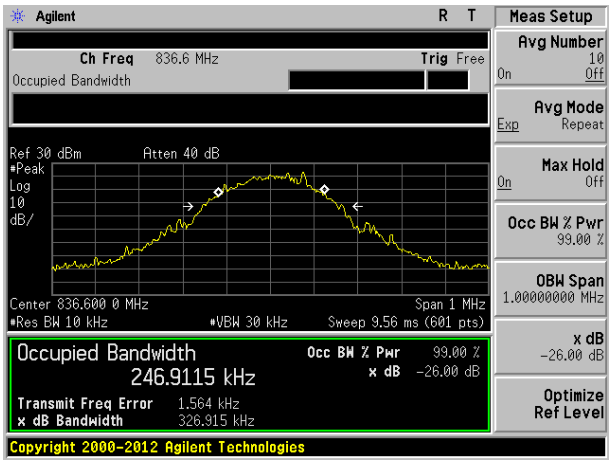
| EUT Mode | Channel | Frequency (MHz) | 99% Occupy bandwidth (KHz) | -26dB bandwidth (KHz) |
|---|---|---|---|---|
| GSM 850 (GPRS 1 link) | 128 | 824.20 | 252.7906 | 316.171 |
| | 190 | 836.60 | 246.9115 | 326.915 |
| | 251 | 848.80 | 241.0921 | 314.192 |
| PCS 1900 (GPRS 1 link) | 512 | 1850.20 | 250.2216 | 325.792 |
| | 661 | 1880.00 | 245.9260 | 316.488 |
| | 810 | 1909.80 | 242.3777 | 326.238 |

Test plot as follows:

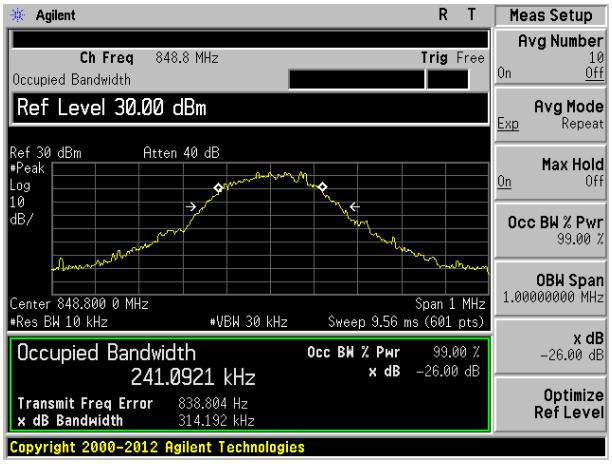
| Test band: | GSM 850 (GPRS 1 link) |
|---|---|




Lowest channel

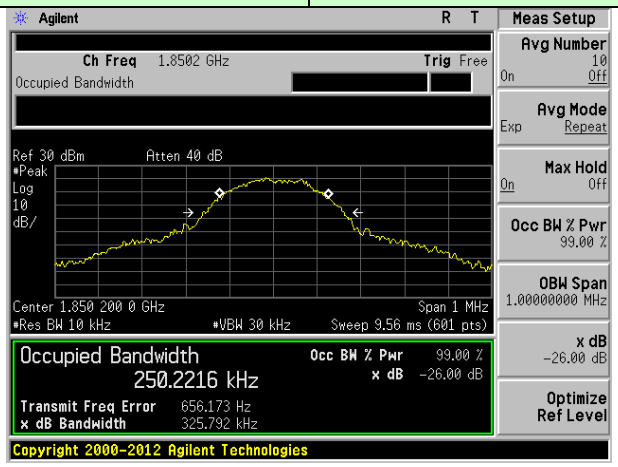



Middle channel

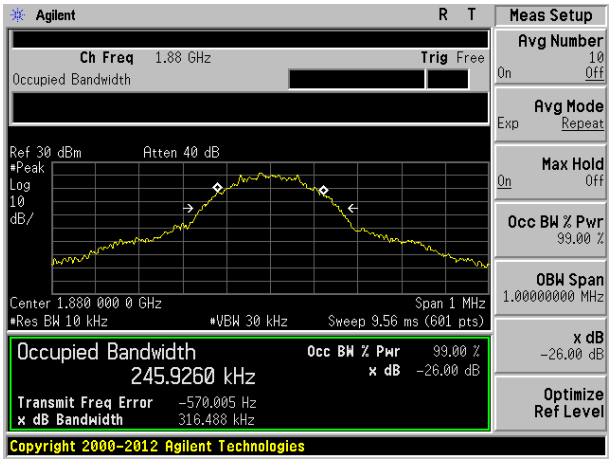



Highest channel

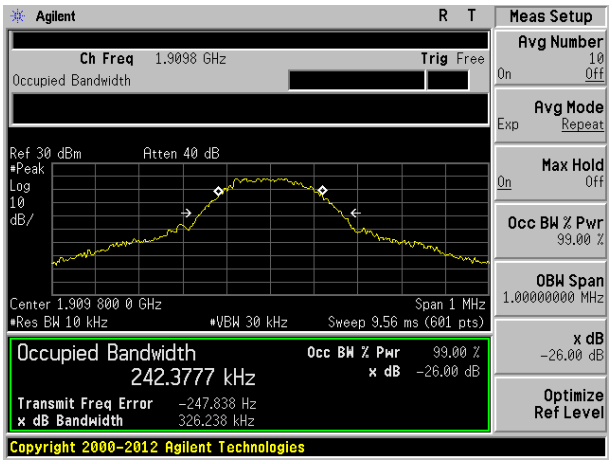
| Test band: | PCS 1900 (GPRS 1 link) |
|---|---|




Lowest channel




Middle channel

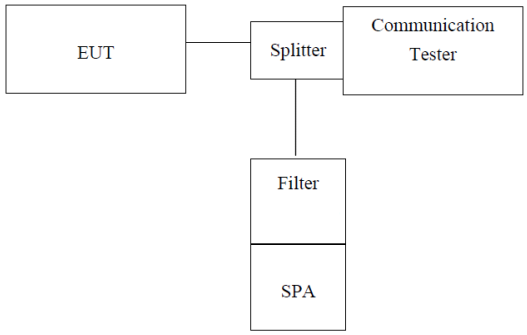



Highest channel

## 6.6 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.

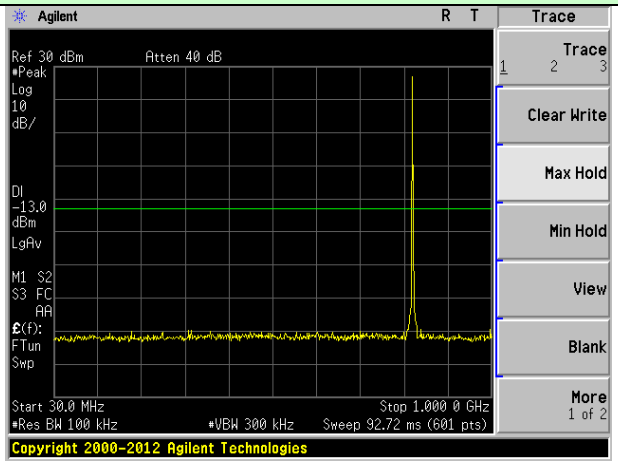
## 6.7 Out of band emission at antenna terminals

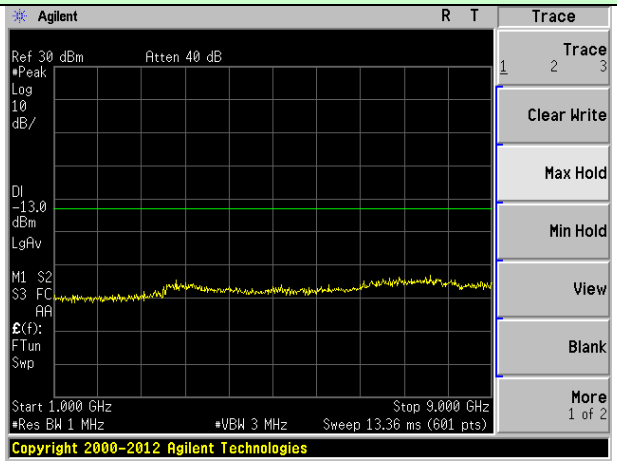
| | |
|---|---|
| Test Requirement: | FCC part 22.917 and FCC part 24.238 |
| Test Method: | FCC part2.1051 |
| Limit: | -13dBm |
| Test setup: |  *Note: Measurement setup for testing on Antenna connector* |
| Test Procedure: | 1 The RF output of the transceiver was connected to a spectrum analyzer through 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:

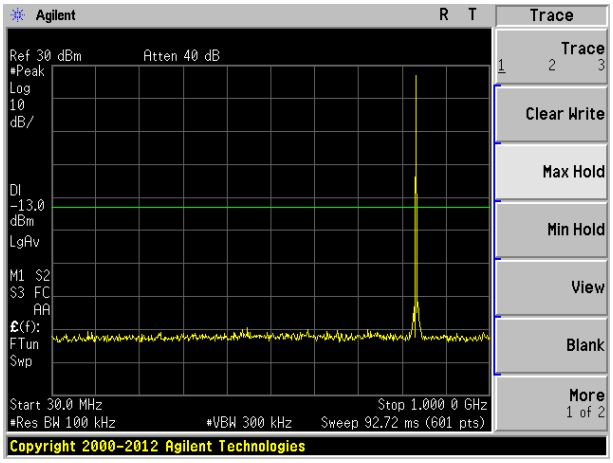
Note: During the conducted spurious emission test, a band filter was used. The information of the filter is reported at section 6.0 (refer to item 24, 25).

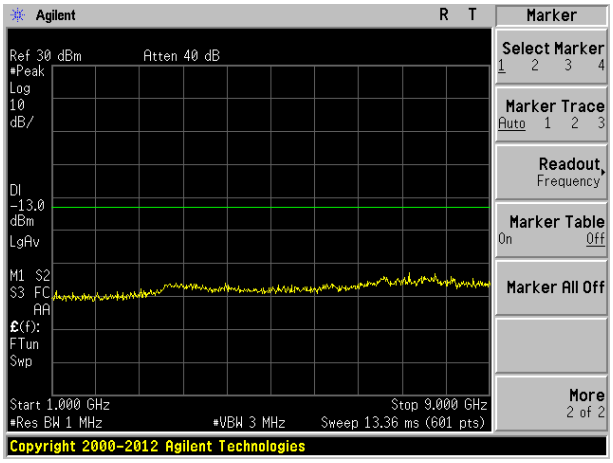
| Test Mode: Traffic mode | GSM 850 (GPRS 1 link) |
|---|---|



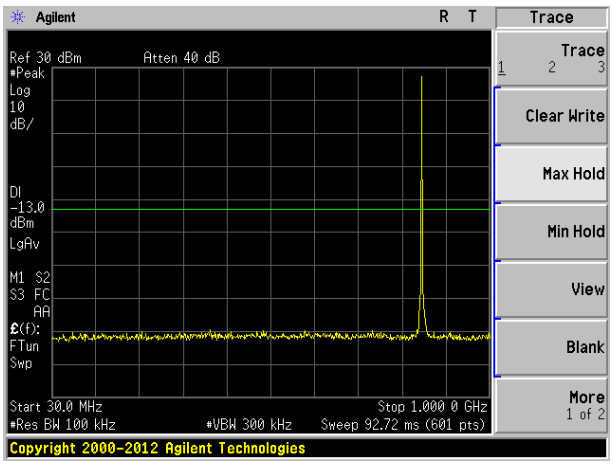



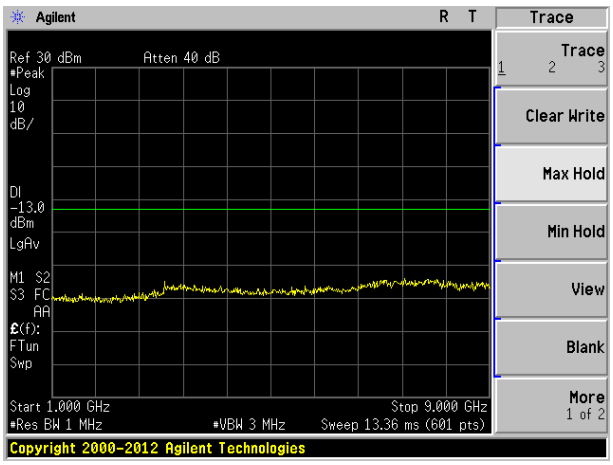

Lowest channel



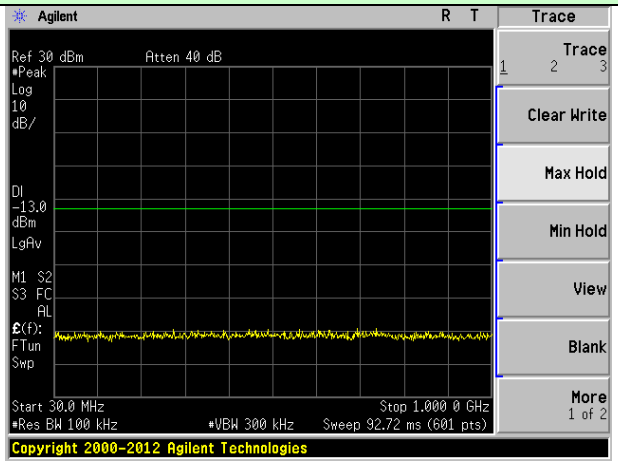

Middle channel

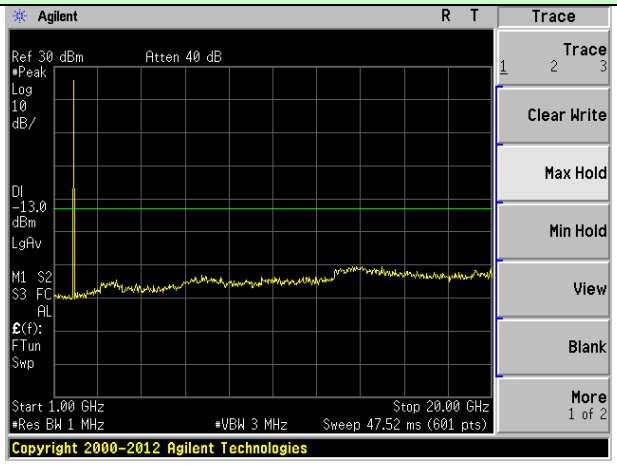


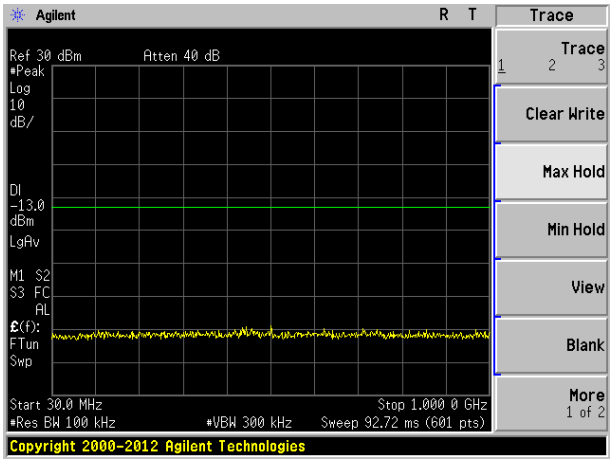

Highest channel

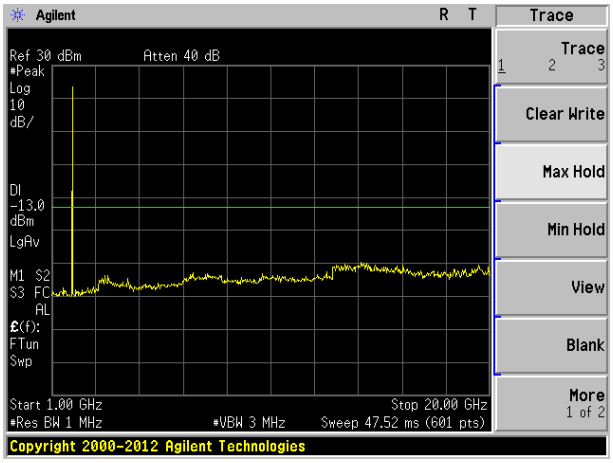
| Test Mode: Traffic mode | PCS1900 (GPRS 1 link) |
|---|---|



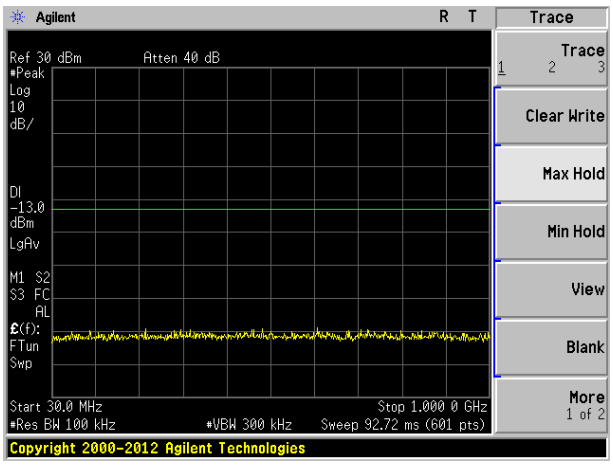



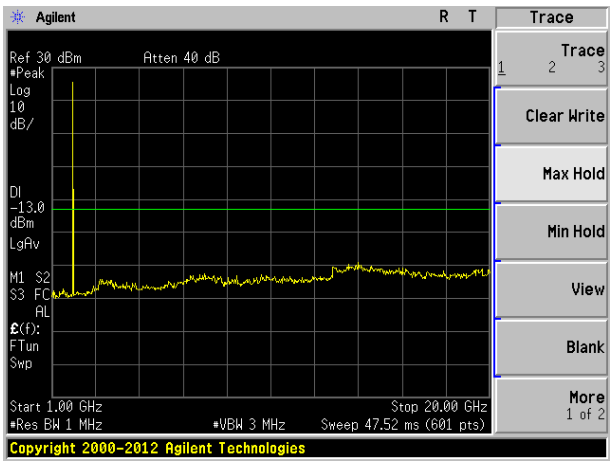

Lowest channel




Middle channel

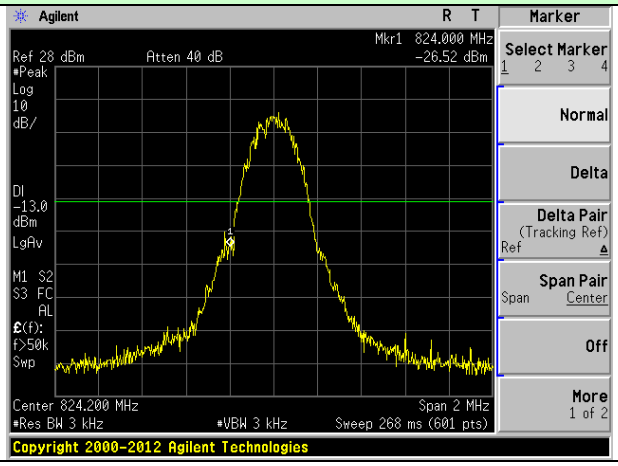


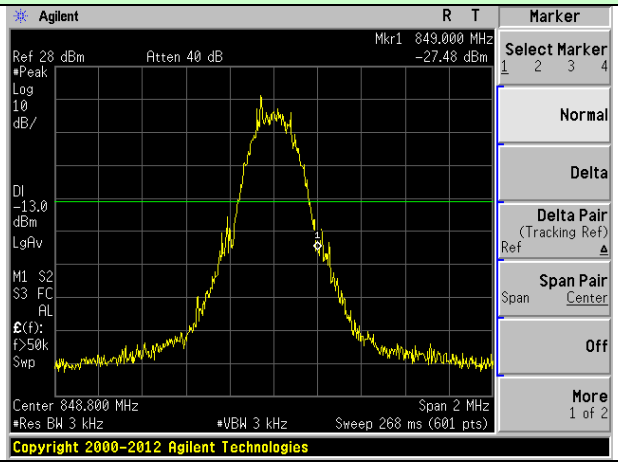

Highest channel

Band Edge:

| Test Mode: Traffic mode | GSM850 (GPRS 1 link) |
|---|---|

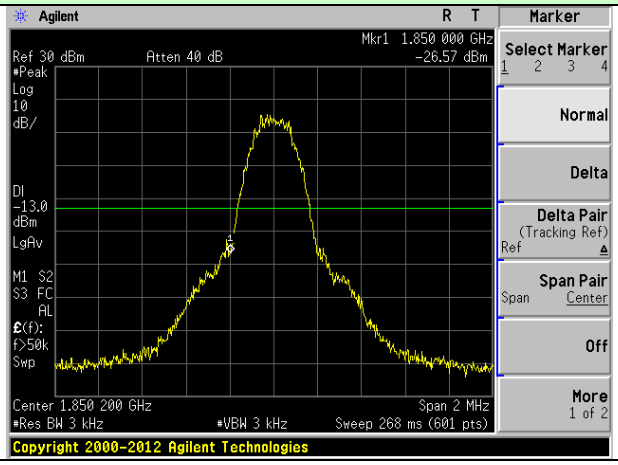



Lowest channel

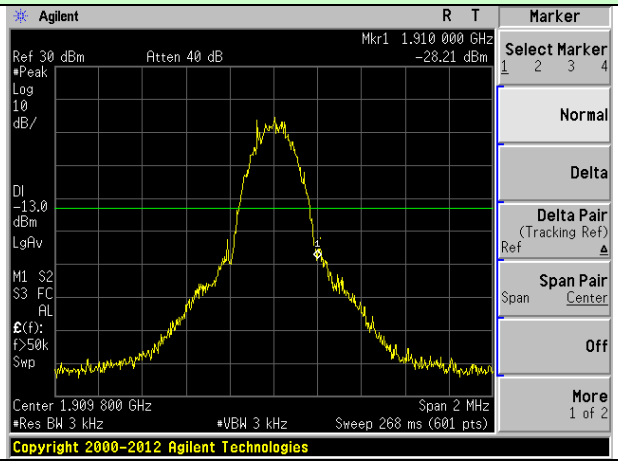



Highest channel

| Test Mode: Traffic mode | PCS1900 (GPRS 1 link) |
|---|---|

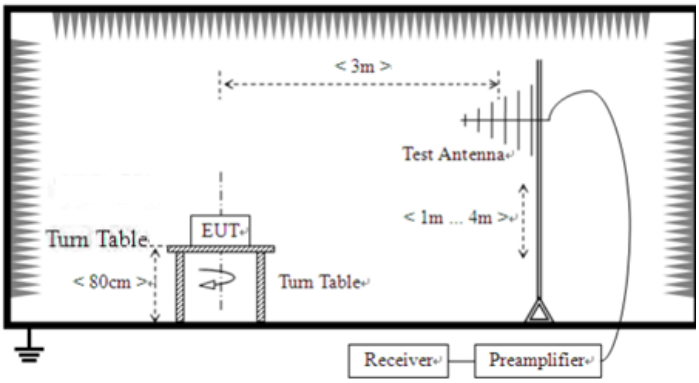
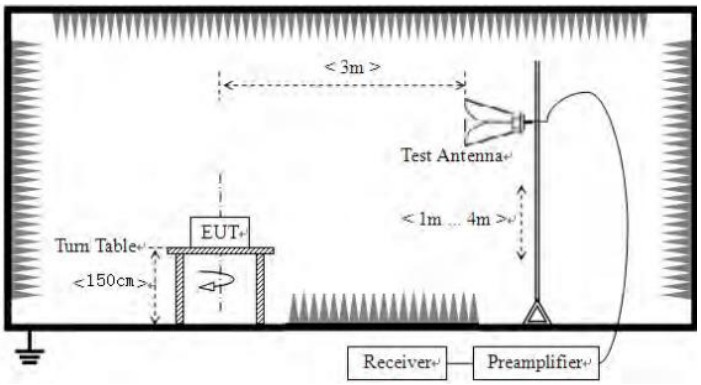
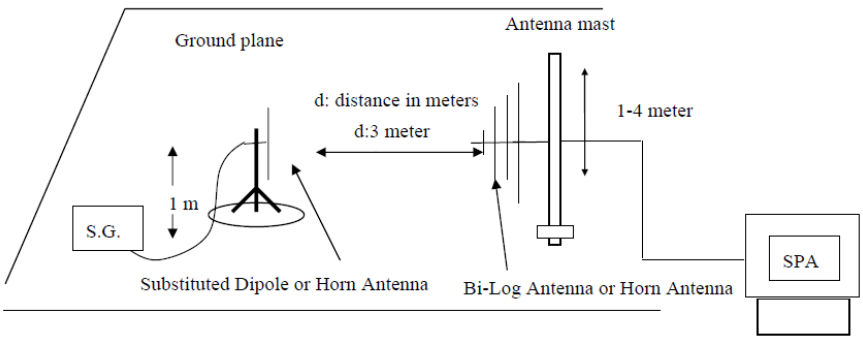



Lowest channel




Highest channel

## 6.8 ERP, EIRP Measurement

| | |
|---|---|
| Test Requirement: | FCC part22.913(a) and FCC part24.232(b) |
| Test Method: | FCC part 2.1046 and ANSI C63.26:2015 |
| Limit: | GSM850: 7W(38.45dBm) ERP<br>PCS1900: 2W(33dBm) EIRP |
| 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 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 Instruments: | Refer to section 5.0 for details |
| Test mode: | Refer to section 6.1 for details |
| Test results: | Pass |

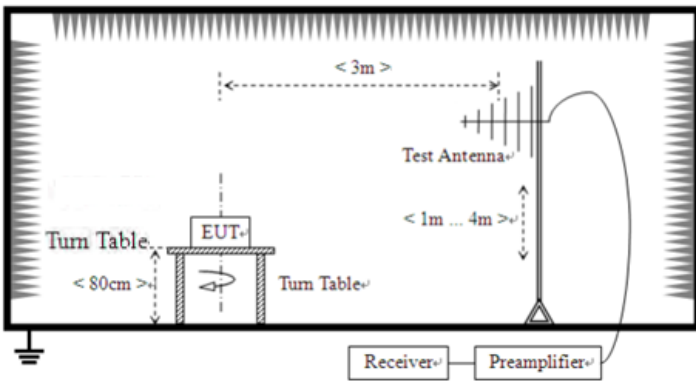
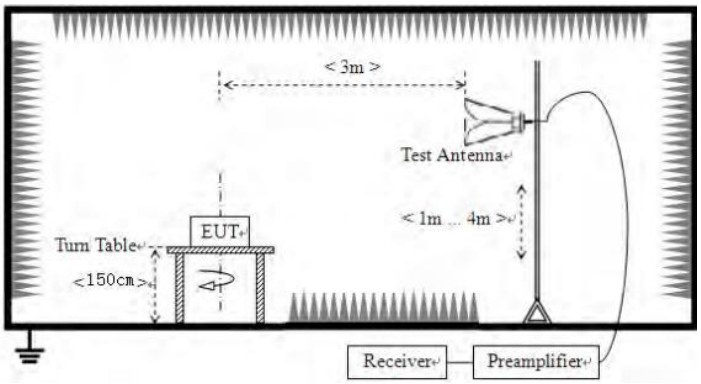
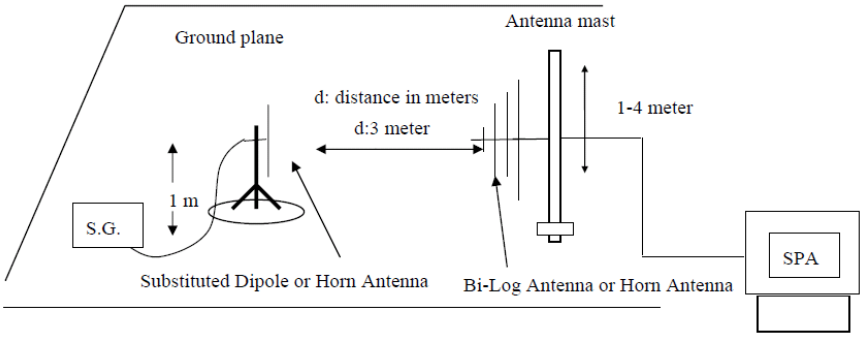
Measurement Data

Remark: All conditions have been considered and test, only the worst case report.

| EUT mode | Channel | EUT Pol. | Antenna Pol. | ERP(dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|
| GSM850 (GPRS 1 link) | Lowest | H | V | 32.87 | 38.45 | Pass |
| | | | H | 32.81 | | |
| | | E1 | V | 32.61 | | |
| | | | H | 31.96 | | |
| | | E2 | V | 32.40 | | |
| | | | H | 31.39 | | |
| | Middle | H | V | 32.46 | 38.45 | Pass |
| | | | H | 31.18 | | |
| | | E1 | V | 32.04 | | |
| | | | H | 31.94 | | |
| | | E2 | V | 32.29 | | |
| | | | H | 31.18 | | |
| | Highest | H | V | 32.51 | 38.45 | Pass |
| | | | H | 31.37 | | |
| | | E1 | V | 32.26 | | |
| | | | H | 31.14 | | |
| | | E2 | V | 32.76 | | |
| | | | H | 31.65 | | |

| EUT mode | Channel | EUT Pol. | Antenna Pol. | EIRP (dBm) | Limit (dBm) | Result |
|---|---|---|---|---|---|---|
| PCS1900 (GPRS 1 link) | Lowest | H | V | 29.83 | 33.01 | Pass |
| | | | H | 28.62 | | |
| | | E1 | V | 29.55 | | |
| | | | H | 28.44 | | |
| | | E2 | V | 29.21 | | |
| | | | H | 28.19 | | |
| | Middle | H | V | 29.68 | 33.01 | Pass |
| | | | H | 28.56 | | |
| | | E1 | V | 29.81 | | |
| | | | H | 28.96 | | |
| | | E2 | V | 28.91 | | |
| | | | H | 28.82 | | |
| | Highest | H | V | 29.63 | 33.01 | Pass |
| | | | H | 28.56 | | |
| | | E1 | V | 28.43 | | |
| | | | H | 28.75 | | |
| | | E2 | V | 29.39 | | |
| | | | H | 28.46 | | |

## 6.9 Field strength of spurious radiation measurement

| | |
|---|---|
| Test Requirement: | FCC part22.917 and FCC part24.238 |
| Test Method: | FCC part 2.1053 and ANSI C63.26:2015 |
| 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 Instruments: | Refer to section 5.0 for details |
| Test mode: | Refer to section 6.1 for details |
| Test results: | Pass |

Measurement Data

| Test mode: | GSM850 | | Test channel: | Lowest |
|---|---|---|---|---|
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 1648.40 | Vertical | -41.22 | -13.00 | Pass |
| 2472.60 | V | -44.08 | | |
| 3296.80 | V | -46.31 | | |
| 4121.00 | V | -49.46 | | |
| 4945.20 | V | --- | | |
| 1648.40 | Horizontal | -35.85 | -13.00 | Pass |
| 2472.60 | H | -38.45 | | |
| 3296.80 | H | -40.71 | | |
| 4121.00 | H | -42.36 | | |
| 4945.20 | H | --- | | |
| **Test mode:** | **GSM850** | | **Test channel:** | **Middle** |
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 1673.20 | Vertical | -37.03 | -13.00 | Pass |
| 2509.80 | V | -39.58 | | |
| 3346.40 | V | -41.29 | | |
| 4183.00 | V | -42.10 | | |
| 5019.60 | V | --- | | |
| 1673.20 | Horizontal | -41.38 | -13.00 | Pass |
| 2509.80 | H | -44.25 | | |
| 3346.40 | H | -45.34 | | |
| 4183.00 | H | -47.32 | | |
| 5019.60 | H | --- | | |
| **Test mode:** | **GSM850** | | **Test channel:** | **Highest** |
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 1697.60 | Vertical | -37.59 | -13.00 | Pass |
| 2546.40 | V | -39.20 | | |
| 3395.20 | V | -41.36 | | |
| 4244.00 | V | -43.08 | | |
| 5092.80 | V | --- | | |
| 1697.60 | Horizontal | -41.46 | -13.00 | Pass |
| 2546.40 | H | -44.28 | | |
| 3395.20 | H | -46.46 | | |
| 4244.00 | H | -48.25 | | |
| 5092.80 | H | --- | | |

Remarks：

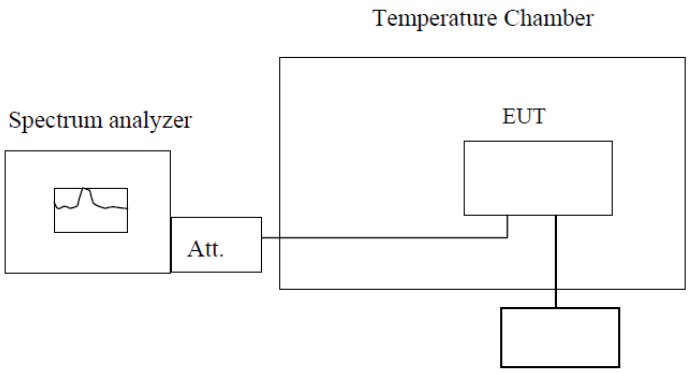
1. The emission behaviour belongs to narrowband spurious emission.
2. The emission levels of below 1 GHz are very lower than the limit and not show in test report.

| Test mode: | PCS1900 | | Test channel: | Lowest |
|---|---|---|---|---|
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 3700.40 | Vertical | -34.22 | -13.00 | Pass |
| 5550.60 | V | -37.14 | | |
| 7400.80 | V | -39.81 | | |
| 9251.00 | V | -41.21 | | |
| 11101.20 | V | --- | | |
| 3700.40 | Horizontal | -39.05 | -13.00 | Pass |
| 5550.60 | H | -42.14 | | |
| 7400.80 | H | -44.48 | | |
| 9251.00 | H | -46.75 | | |
| 11101.20 | H | --- | | |
| **Test mode:** | **PCS1900** | | **Test channel:** | **Middle** |
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 3760.00 | Vertical | -35.11 | -13.00 | Pass |
| 5640.00 | V | -38.28 | | |
| 7520.00 | V | -40.14 | | |
| 9400.00 | V | -42.65 | | |
| 11280.00 | V | --- | | |
| 3760.00 | Horizontal | -40.37 | -13.00 | Pass |
| 5640.00 | H | -43.18 | | |
| 7520.00 | H | -45.34 | | |
| 9400.00 | H | -47.25 | | |
| 11280.00 | H | --- | | |
| **Test mode:** | **PCS1900** | | **Test channel:** | **Highest** |
| Frequency (MHz) | Spurious Emission | | Limit (dBm) | Result |
| | Polarization | Level (dBm) | | |
| 3819.60 | Vertical | -33.55 | -13.00 | Pass |
| 5729.40 | V | -36.04 | | |
| 7639.20 | V | -38.13 | | |
| 9549.00 | V | -40.06 | | |
| 11458.80 | V | --- | | |
| 3819.60 | Horizontal | -38.31 | -13.00 | Pass |
| 5729.40 | H | -41.84 | | |
| 7639.20 | H | -43.30 | | |
| 9549.00 | H | -45.83 | | |
| 11458.80 | H | --- | | |

Remarks：

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.

## 6.10 Frequency stability V.S. Temperature measurement

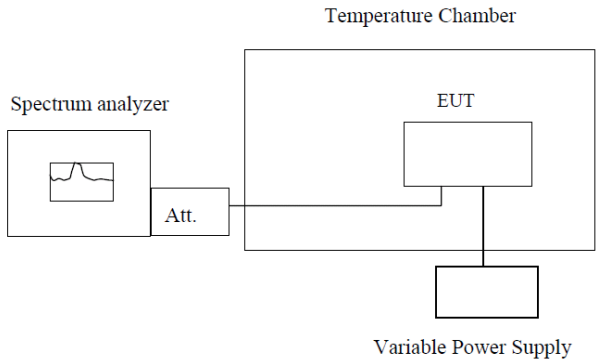
| | |
|---|---|
| Test Requirement: | FCC part 22.355 and FCC part 24.235 |
| Test Method: | FCC Part2.1055(a)(1)(b) |
| Limit: | 2.5ppm |
| Test setup: |  <br>**Note :** Measurement setup for testing on Antenna connector |
| Test procedure: | 1. The equipment under test was connected to an external 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: GSM850 (GPRS 1 link) Middle channel=190 channel=836.6MHz | | | | | |
|---|---|---|---|---|---|
| Power supplied (Vdc) | Temperature (°C) | Frequency error | | Limit (ppm) | Result |
| | | Hz | ppm | | |
| 3.70 | -30 | 21 | 0.0249 | 2.5 | Pass |
| | -20 | 23 | 0.0276 | | |
| | -10 | 25 | 0.0294 | | |
| | 0 | 20 | 0.0239 | | |
| | 10 | 23 | 0.0280 | | |
| | 20 | 20 | 0.0239 | | |
| | 30 | 34 | 0.0404 | | |
| | 40 | 24 | 0.0289 | | |
| | 50 | 23 | 0.0276 | | |

| Reference Frequency: PCS1900 (GPRS 1 link) Middle channel=661 channel=1880MHz | | | | | |
|---|---|---|---|---|---|
| Power supplied (Vdc) | Temperature (°C) | Frequency error | | | Result |
| | | Hz | ppm | | |
| 3.70 | -30 | 38 | 0.0203 | 2.5 | Pass |
| | -20 | 44 | 0.0236 | | |
| | -10 | 25 | 0.0294 | | |
| | 0 | 20 | 0.0239 | | |
| | 10 | 23 | 0.0280 | | |
| | 20 | 20 | 0.0239 | | |
| | 30 | 34 | 0.0404 | | |
| | 40 | 42 | 0.0223 | | |
| | 50 | 44 | 0.0236 | | |

## 6.11 Frequency stability V.S. Voltage measurement

| | |
|---|---|
| Test Requirement: | FCC part 22.355 and FCC part 24.235 |
| Test Method: | FCC Part2.1055(d)(1)(2) |
| 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: GSM850 (GPRS 1 link) Middle channel=190 channel=836.6MHz | | | | | |
|---|---|---|---|---|---|
| Temperature (°C) | Power supplied (Vdc) | Frequency error | | Limit (ppm) | Result |
| | | Hz | ppm | | |
| 25 | 4.255 | 27 | 0.0323 | 2.5 | Pass |
| | 3.70 | 31 | 0.0373 | | |
| | 3.145 | 35 | 0.0423 | | |
| Reference Frequency: PCS1900 (GPRS 1 link) Middle channel=661 channel=1880MHz | | | | | |
| Temperature (°C) | Power supplied (Vdc) | Frequency error | | Limit (ppm) | Result |
| | | Hz | ppm | | |
| 25 | 4.255 | 38 | 0.0453 | 2.5 | Pass |
| | 3.70 | 48 | 0.0573 | | |
| | 3.145 | 28 | 0.0333 | | |

# 7 Test Setup Photo

Reference to the **appendix I** for details.

# 8 EUT Constructional Details

Reference to the **appendix II** for details.

-----End------