



RF TEST REPORT

Report No.: SET2016-08990

Product: HSPA+ USB MODEM

FCC ID: SRQ-K4607-ZR

Model No.: K4607-Zr

Applicant: ZTE Corporation

Address: ZTE Plaza, Keji Road South, Shenzhen, China

Dates of Testing: 05/10/2016 — 06/20/2016

Issued by: CCIC-SET

Lab Location: Building 28/29, East of Shigu, Xili Industrial Zone, Xili Road, Nanshan

District, Shenzhen, Guangdong, China

This test report consists of 62 pages in total. It may be duplicated completely for legal use with the approval of the applicant. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product endorsement by CCIC-SET. The test results in the report only apply to the tested sample. The test report shall be invalid without all the signatures of testing engineers, reviewer and approver. Any objections must be raised to CCIC-SET within 15 days since the date when the report is received. It will not be taken into consideration beyond this limit.

CCIC-SET/T (00) Page 1 of 62





Test Report

Product...... HSPA+ USB MODEM

Brand Name..... ZTE

Trade Name..... ZTE

Applicant.....: ZTE Corporation

Applicant Address......: ZTE Plaza, Keji Road South, Shenzhen, China

Manufacturer...... ZTE Corporation

Manufacturer Address...: ZTE Plaza, Keji Road South, Shenzhen, China

Matters; General Rules and Regulations

47 CFR FCC Part 22(H): Cellular Radiotelephone Service

47 CFR FCC Part 24(E): Personal Communications Services

Test Result.....: PASS

Tested by....:

2016.06.21

Lu Lei, Test Engineer

Reviewed by....:

Zhu Qi

(ulei

2016.06.21

Zhu Qi, Senior Egineer

Wu Li'an, Manager

CCIC-SET/T (00) Page 2 of 62



Table of Contents

| 1. | GENERAL INFORMATION | 4 |
|-----|--|------------|
| 1.1 | EUT Description | 4 |
| 1.2 | Maximum ERP/EIRP Power, Frequency Tolerance, and Emission Designator | 5 |
| 1.3 | Test Standards and Results | 6 |
| 1.4 | Test Configuration of Equipment under Test | 7 |
| 1.5 | Measurement Results Explanation Example | 8 |
| 1.6 | Facilities and Accreditations | 8 |
| 2. | 47 CFR PART 2, PART 22H & 24E REQUIREMENTS | 9 |
| 2.1 | Conducted RF Output Power | 9 |
| 2.2 | Peak to Average Radio | 11 |
| 2.3 | 99% Occupied Bandwidth and 26dB Bandwidth Measurement | 19 |
| 2.4 | Frequency Stability | 27 |
| 2.5 | Conducted Out of Band Emissions | 30 |
| 2.6 | Band Edge | 4 4 |
| 2.7 | Transmitter Radiated Power (EIRP/ERP) | 50 |
| 2.8 | Radiated Spurious Emissions | 54 |
| 3. | LIST OF MEASURING EQUIPMENT | 61 |
| 4. | UNCERTAINTY OF EVALUATION | 62 |

| | Change History | | | | | | |
|------------------------------|----------------|---------------|--|--|--|--|--|
| Issue Date Reason for change | | | | | | | |
| 1.0 | 2016.06.21 | First edition | | | | | |
| | | | | | | | |
| | | | | | | | |



1. GENERAL INFORMATION

1.1 EUT Description

| EUT Type | HSPA+ USB MODEM | | |
|---------------------------------|---|--|--|
| Hardware Version | denA | | |
| Software Version | VDF_DE_MF730MV1.0.1B02 | | |
| EUT supports Radios application | GPRS/EDGE | | |
| Multi Slot Class | GPRS: Multi slot Class12, EGPRS: Multi slot Class12 | | |
| | 850MHz: | | |
| | Tx: 824.2 - 848.8MHz (at intervals of 200kHz); | | |
| Г | Rx: 869.2 - 893.8MHz (at intervals of 200kHz) | | |
| Frequency Range | 1900MHz: | | |
| | Tx: 1850.2 - 1909.8MHz (at intervals of 200kHz); | | |
| | Rx: 1930.2 - 1989.8MHz (at intervals of 200kHz) | | |
| | GPRS 850: 32.01dBm | | |
| Maximum Output Power to | GPRS 1900: 29.10dBm | | |
| Antenna | EDGE 850: 26.50dBm | | |
| | EDGE 1900: 24.86dBm | | |
| Type of Modulation | GPRS:GMSK | | |
| Type of Modulation | EDGE:GMSK / 8PSK | | |
| Antenna Type | Internal Antenna | | |

CCIC-SET/T (00) Page 4 of 62



1.2 Maximum ERP/EIRP Power, Frequency Tolerance, and Emission Designator

| System | Type of Modulation | Emission Designator | Frequency Tolerance (ppm) | Maximum ERP/EIRP(W) |
|-----------|--------------------|------------------------|---------------------------------|------------------------|
| GPRS 850 | GMSK | 246KGXW | 0.03 | 0.841 |
| GPRS 1900 | GMSK | 245KGXW | 0.03 | 0.566 |
| EDGE 850 | 8PSK | 252KG7W | 0.03 | 0.351 |
| EDGE 1900 | 8PSK | 248KG7W | 0.03 | 0.210 |

CCIC-SET/T (00) Page 5 of 62

Report No.: SET2016-08990



1.3 Test Standards and Results

- 1. 47 CFR Part 2, 22(H), 24(E)
- 2. ANSI / TIA / EIA-603-D-2010
- 3. FCC KDB 971168 D01 Power Meas. License Digital Systems v02r02

Remark:

- 1. All test items were verified and recorded according to the standards and without any deviation during the test.
- 2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

Test detailed items/section required by FCC rules and results are as below:

| No. | Section | Description | Limit | Result |
|-----|-----------------|--------------------------|-----------------------------------|--------|
| NO. | FCC | Description | Lillill | Result |
| 1 | 2.1046 | Conducted Output Power | Reporting Only | PASS |
| 2 | 24.232(d) | Peak to Average Radio | <13dBm | PASS |
| | 2.1049 | | | |
| 3 | 22.917(b) | Occupied Bandwidth | Reporting Only | PASS |
| | 24.238(b) | | | |
| | 2.1055 | | | |
| 4 | 22.355 | Frequency Stability | $\leq \pm 2.5$ ppm | PASS |
| | 24.235 | | | |
| | 2.1051 | Conducted Out of Band | Conducted Out of Band <43+10log10 | PASS |
| 5 | 22.917 | | Emissions (P[Watts]) | |
| | 24.238 | Ellissions | (P[waits]) | |
| | 2.1051 | | < 42 + 101o ≈10 | |
| 6 | 22.917 | Band Edge | Band Edge <43+10log10 | PASS |
| | 24.238 | | (P[Watts]) | |
| | 22.913 | Effective Radiated Power | <7Watts | PASS |
| 7 | 24.232 | Equivalent Isotropic | <2Watts | PASS |
| | 2 4. 232 | Radiated Power | ~2 wans | IASS |
| | 2.1053 | Radiated Spurious | < 43+10log10 | |
| 8 | 22.917 | Emissions | (P[Watts]) | PASS |
| | 24.238 | Emissions | (F[Walls]) | |

CCIC-SET/T (00) Page 6 of 62

Report No.: SET2016-08990



1.4 Test Configuration of Equipment under Test

Antenna port conducted and radiated test items were performed according to KDB 971168 D01 Power Meas. License Digital Systems v02r02 with maximum output power.

Radiated measurements were performed with rotating EUT in different three orthogonal test planes to find the maximum emission.

Radiated emissions were investigated as following frequency range:

- 1. 30 MHz to 9000 MHz for GSM850.
- 2. 30 MHz to 20000 MHz for GSM1900.

All modes and data rates and positions were investigated.

Test modes are chosen to be reported as the worst case configuration below:

| Test Modes | | | | | | |
|------------|--------------|---------------|--|--|--|--|
| Band | Radiated TCs | Conducted TCs | | | | |
| CCM 950 | GPRS Link | GPRS Link | | | | |
| GSM 850 | EDGE Link | EDGE Link | | | | |
| CCM 1000 | GPRS Link | GPRS Link | | | | |
| GSM 1900 | EDGE Link | EDGE Link | | | | |

Note: The maximum power levels are chosen to test as the worst case configuration as follows: GPRS mode for GMSK modulation,

EDGE multi-slot class 8 mode for 8PSK modulation, only these modes were used for all tests.

CCIC-SET/T (00) Page 7 of 62

Report No.: SET2016-08990



1.5 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 7dB and 10dB attenuator.

Example:

Offset (dB) = RF cable loss(dB) + attenuator factor(dB).
=
$$7 + 10 = 17$$
 (dB)

1.6 Facilities and Accreditations

1.6.1 Test Facilities

CNAS-Lab Code: L1659

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. CCIC is a third party testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659. A 12.8*6.8*6.4 (m) fully anechoic chamber was used for the radiated spurious emissions test.

FCC-Registration No.: 406086

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. 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 our files. Registration 406086, October 28, 2017.

IC-Registration No.: 11185A-1

CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on July. 15, 2013, valid time is until July. 15, 2016.

1.6.2 Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

| Temperature (°C): | 15℃-35℃ |
|-----------------------------|--------------|
| Relative Humidity (%): | 30% -60% |
| Atmospheric Pressure (kPa): | 86KPa-106KPa |

CCIC-SET/T (00) Page 8 of 62



2. 47 CFR PART 2, PART 22H & 24E REQUIREMENTS

2.1 Conducted RF Output Power

2.1.1 Definition

A system simulator was used to establish communication with the EUT. Its parameters were set to enforce EUT transmitting at the maximum power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

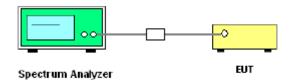
2.1.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.1.3 Test Procedures

- 1. The transmitter output port was connected to the system simulator.
- 2. Set EUT at maximum power through system simulator.
- 3. Select lowest, middle, and highest channels for each band and different modulation.
- 4. Measure and record the power level from the system simulator.

2.1.4 Test Setup



CCIC-SET/T (00) Page 9 of 62



2.1.5 Test Results of Conducted Output Power

1. GPRS and EDGE Model Test Verdict:

| Band | Channel | Frequency (MHz) | Measured Output Power dBm | Verdict |
|-----------------|---------|-----------------|---------------------------|---------|
| CDDC | 128 | 824.2 | 31.91 | PASS |
| GPRS | 190 | 836.6 | 32.01 | PASS |
| 850MHz | 251 | 848.8 | 31.86 | PASS |
| CDDC | 512 | 1850.2 | 28.96 | PASS |
| GPRS | 661 | 1880.0 | 29.04 | PASS |
| 1900MHz | 810 | 1909.8 | 29.10 | PASS |
| EDCE | 128 | 824.2 | 26.45 | PASS |
| EDGE 850MHz | 190 | 836.6 | 26.50 | PASS |
| 830MHZ | 251 | 848.8 | 26.46 | PASS |
| EDCE | 512 | 1850.2 | 24.65 | PASS |
| EDGE 1900MHz | 661 | 1880.0 | 24.74 | PASS |
| 1900MHZ | 810 | 1909.8 | 24.86 | PASS |

Note 1: For the GPRS and EDGE model, all the slots were tested and just the worst data was record in this report.

CCIC-SET/T (00) Page 10 of 62



2.2 Peak to Average Radio

2.2.1 Definition

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

2.2.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

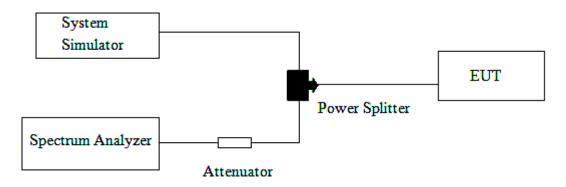
2.2.3 Test Procedures

- 1. The testing follows FCC KDB 971168 D01v02r02 Section 5.7.1.
- 2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
 - 3. For GSM/EGPRS operating modes:
 - a. Set EUT in maximum power output.
 - b. Set the RBW = 1MHz, VBW = 3MHz, Peak detector on spectrum analyzer for first trace.
- c. Set the RBW = 1MHz, VBW = 3MHz, RMS detector on spectrum analyzer for second trace.
- d. The wanted burst signal is triggered by spectrum analyzer, and measured respectively the peak level and Mean level without burst-off time, after system simulator has synchronized with the spectrum analyzer.
 - 4. For UMTS operating modes:
- a. Set the CCDF (Complementary Cumulative Distribution Function) option on the spectrum analyzer.
- b. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of $0.1\,\%$.
 - 5. Record the deviation as Peak to Average Ratio.

CCIC-SET/T (00) Page 11 of 62



2.2.4 Test Setup



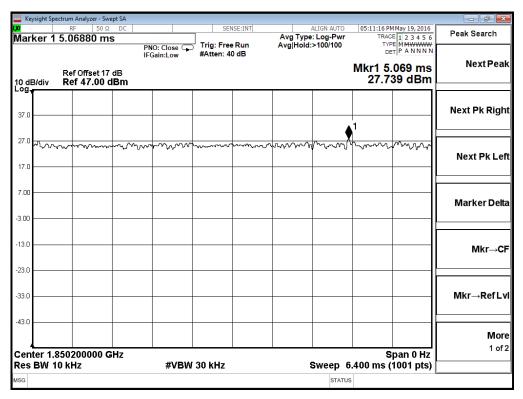
2.2.5 Test Results of Peak-to-Average Ratio

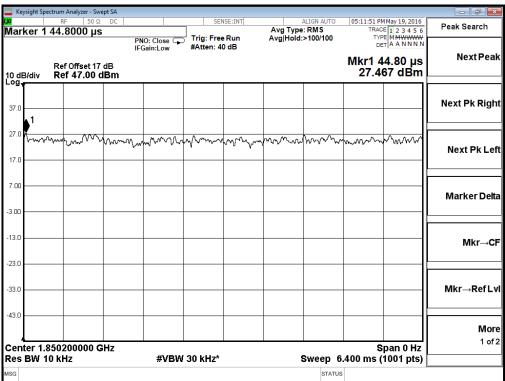
| Band | Channal | Frequency | Peak to A | Average radio | Limit | Verdict |
|-----------------|---------|-----------|-----------|---------------|-------|---------|
| Dallu | Channel | (MHz) | dB | Refer to Plot | dB | verdict |
| GPRS | 512 | 1850.2 | 0.272 | | | PASS |
| 1900MHz | 661 | 1880.0 | 0.436 | Plot A1 to A3 | 13 | PASS |
| 1900MHZ | 810 | 1909.8 | 0.687 | | | PASS |
| EDCE | 512 | 1850.2 | 0.152 | | | PASS |
| EDGE 1900MHz | 661 | 1880.0 | 0.466 | Plot B1 to B3 | 13 | PASS |
| 1900MHZ | 810 | 1909.8 | 0.432 | | | PASS |

CCIC-SET/T (00) Page 12 of 62



2.2.6 Test Results (Plots) of Peak-to-Average Ratio

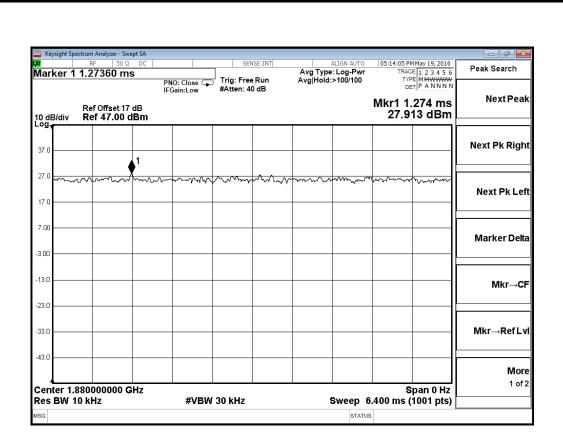


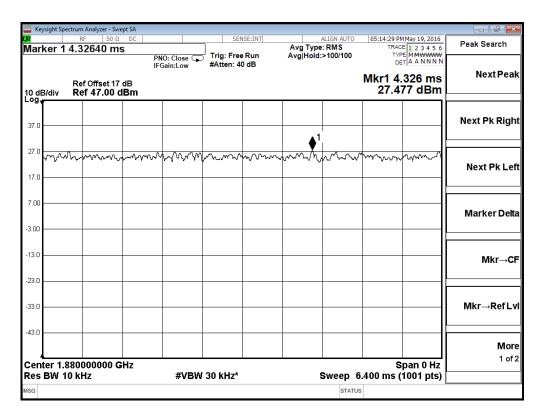


(Plot A1: GPRS 1900 MHz Channel = 512)

CCIC-SET/T (00) Page 13 of 62



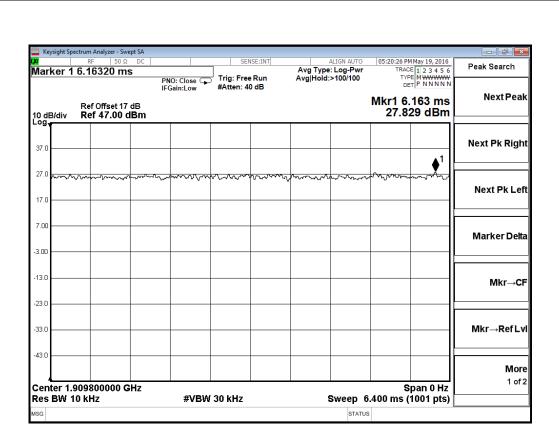


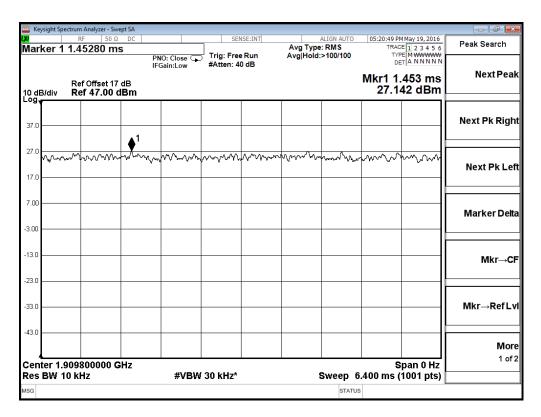


(Plot A2: GPRS 1900 MHz Channel = 661)

CCIC-SET/T (00) Page 14 of 62



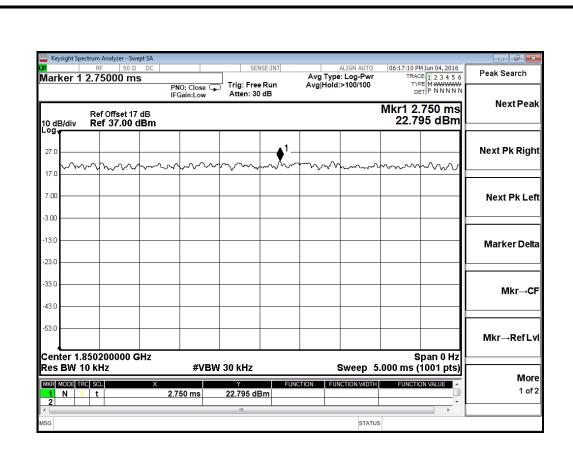


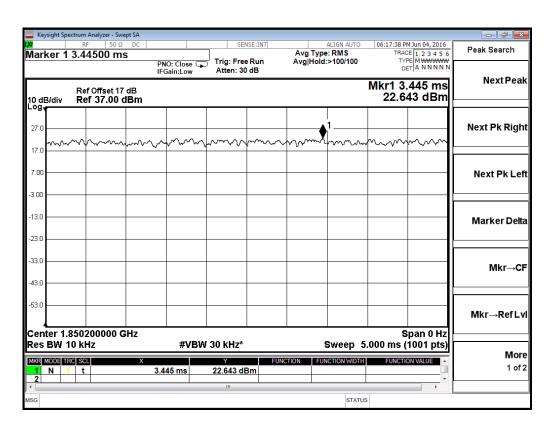


(Plot A3: GPRS 1900MHz Channel = 810)

CCIC-SET/T (00) Page 15 of 62



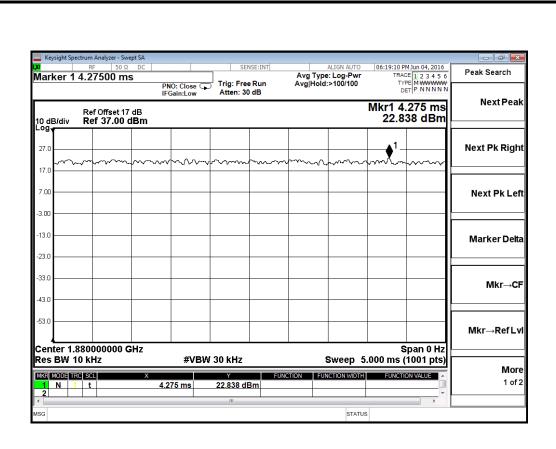


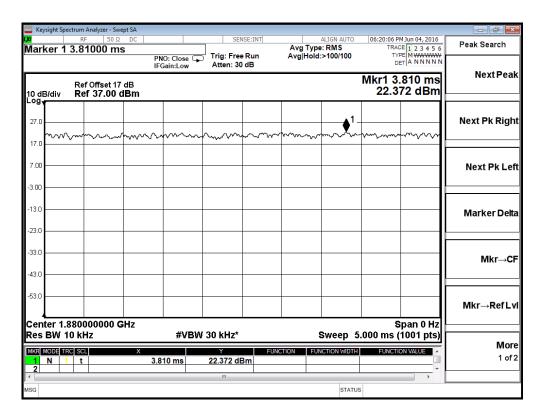


(Plot B1: EDGE 1900 MHz Channel = 512)

CCIC-SET/T (00) Page 16 of 62



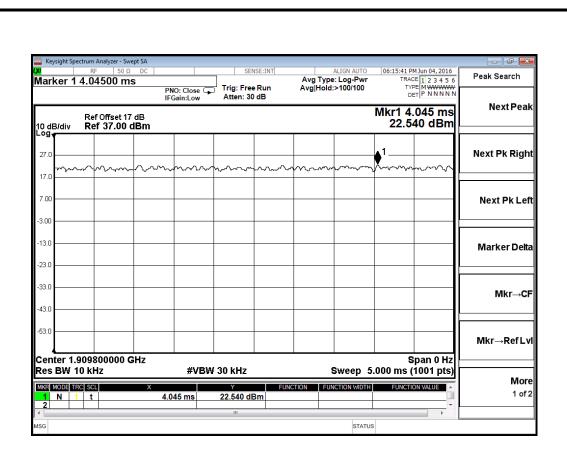


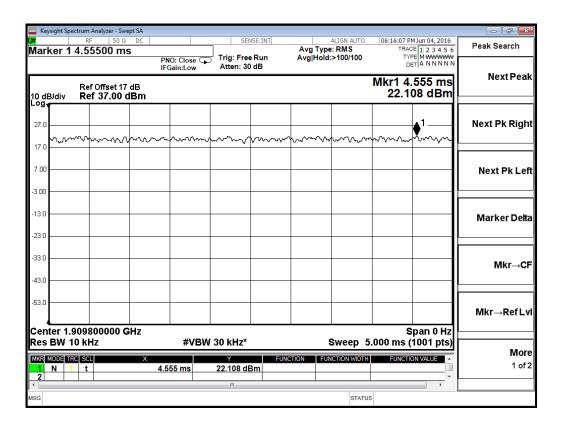


(Plot B2: EDGE 1900 MHz Channel = 661)

CCIC-SET/T (00) Page 17 of 62







(Plot B3: EDGE 1900MHz Channel = 810)

CCIC-SET/T (00) Page 18 of 62



2.3 99% Occupied Bandwidth and 26dB Bandwidth Measurement

2.3.1 Definition

The 99% occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The emission bandwidth is defined as the width of the signal between two points, located at the 2 sides of the carrier frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

2.3.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

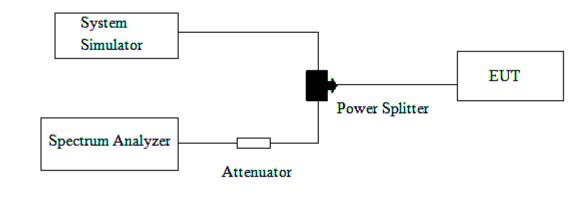
2.3.3 Test Procedures

- 1. The testing follows FCC KDB 971168 D01v02r02 Section 4.2.
- 2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
- 3. The RF output of the EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

- 4. The 99% occupied bandwidth were measured, set RBW= 1% of span, VBW= 3*RBW, sample detector, trace maximum hold.
- 5. The 26dB bandwidth were measured, set RBW= 1% of EBW, VBW= 3*RBW, peak detector, trace maximum hold.

2.3.4 Test Setup



CCIC-SET/T (00) Page 19 of 62



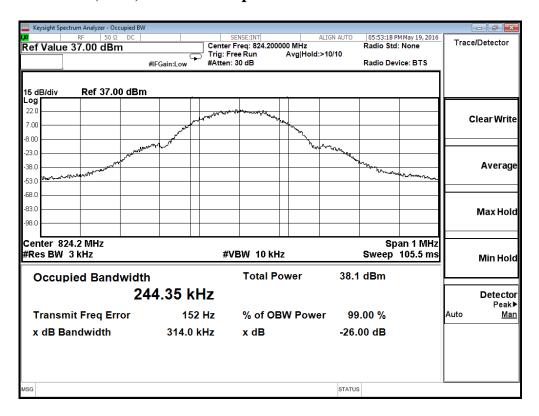
2.3.5 Test Results of 99% Occupied Bandwidth and 26dB Bandwidth

| Band | Channel | Frequency (MHz) | 26dB bandwidth | 99% Occupied Bandwidth | Refer to Plot |
|--------------|---------|-----------------|-------------------|------------------------|---------------|
| | 128 | 824.2 | 314 kHz | 244 kHz | Plot A1 |
| GPRS 850MHz | 190 | 836.6 | 316 kHz | 246 kHz | Plot A2 |
| | 251 | 848.8 | 314 kHz | 244 kHz | Plot A3 |
| | 512 | 1850.2 | 313 kHz | 245 kHz | Plot B1 |
| GPRS 1900MHz | 661 | 1880.0 | 315 kHz | 244 kHz | Plot B2 |
| | 810 | 1909.8 | 314 kHz | 245 kHz | Plot B3 |
| | 128 | 824.2 | 312 kHz | 243 kHz | Plot C1 |
| EDGE 850MHz | 190 | 836.6 | 301 kHz | 241 kHz | Plot C2 |
| | 251 | 848.8 | 316 kHz | 252 kHz | Plot C3 |
| | 512 | 1850.2 | 319 kHz | 244 kHz | Plot D1 |
| EDGE 1900MHz | 661 | 1880.0 | 313 kHz | 247 kHz | Plot D2 |
| | 810 | 1909.8 | 321 kHz | 248 kHz | Plot D3 |

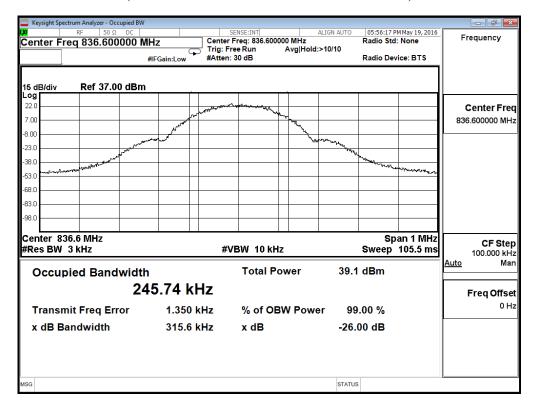
CCIC-SET/T (00) Page 20 of 62



2.3.6 Test Results (Plots) of 99% Occupied Bandwidth and 26dB Bandwidth



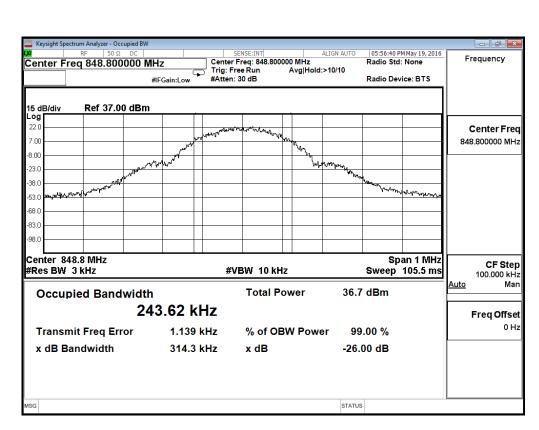
(Plot A1: GPRS 850MHz Channel = 128)



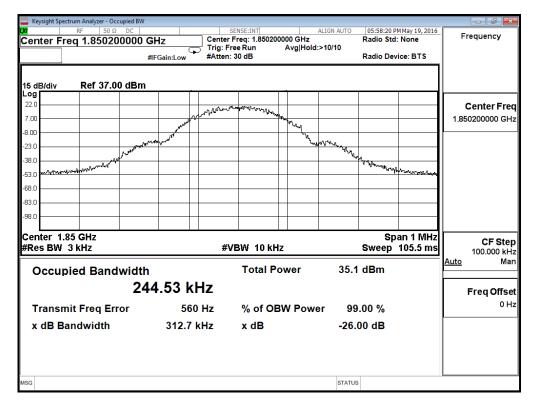
(Plot A2: GPRS 850MHz Channel = 190)

CCIC-SET/T (00) Page 21 of 62





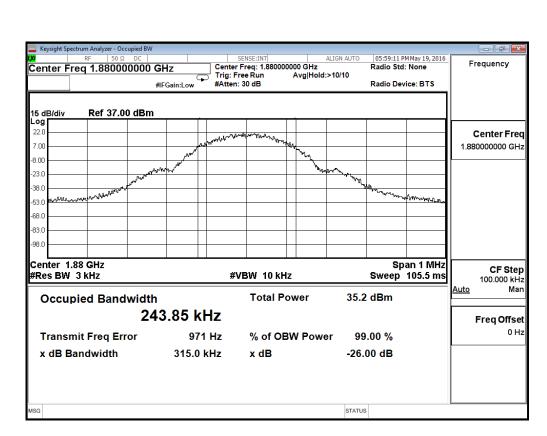
(Plot A3: GPRS 850MHz Channel = 251)



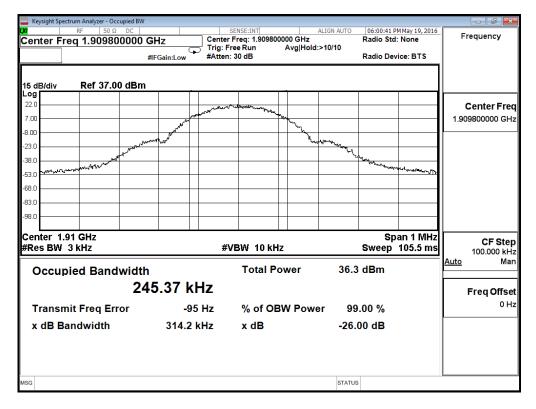
(Plot B1: GPRS 1900MHz Channel = 512)

CCIC-SET/T (00) Page 22 of 62





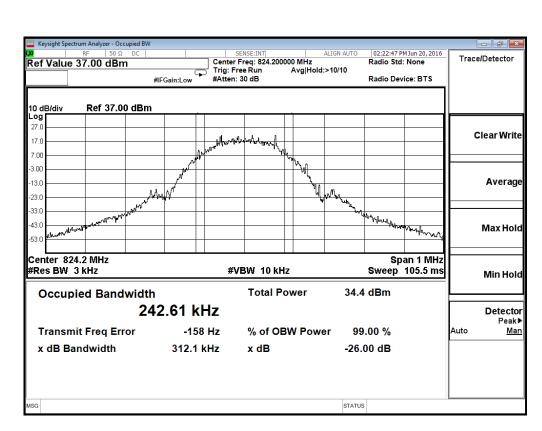
(Plot B2: GPRS 1900MHz Channel = 661)



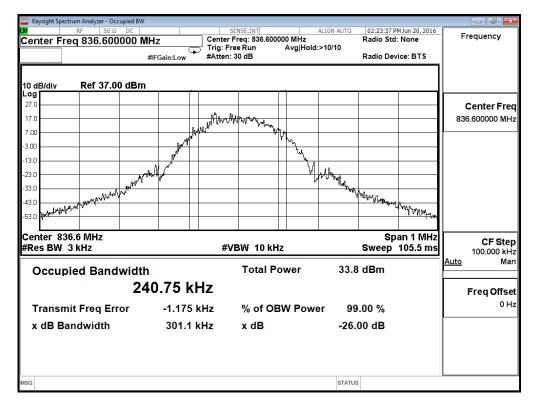
(Plot B3: GPRS 1900MHz Channel = 810)

CCIC-SET/T (00) Page 23 of 62





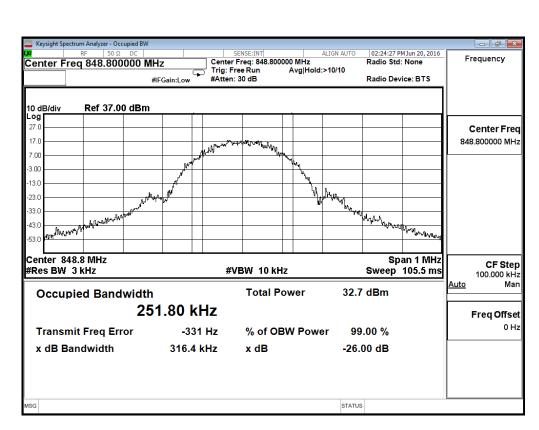
(Plot C1: EDGE 850MHz Channel = 128)



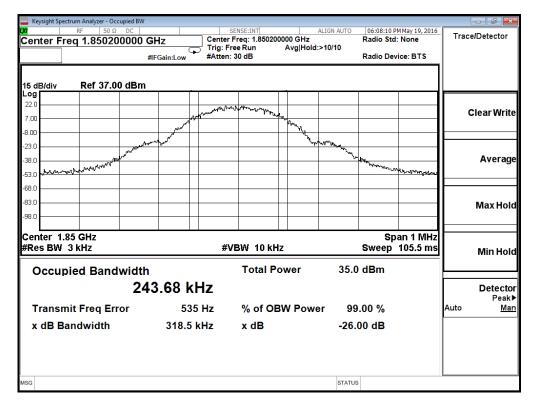
(Plot C2: EDGE 850MHz Channel = 190)

CCIC-SET/T (00) Page 24 of 62





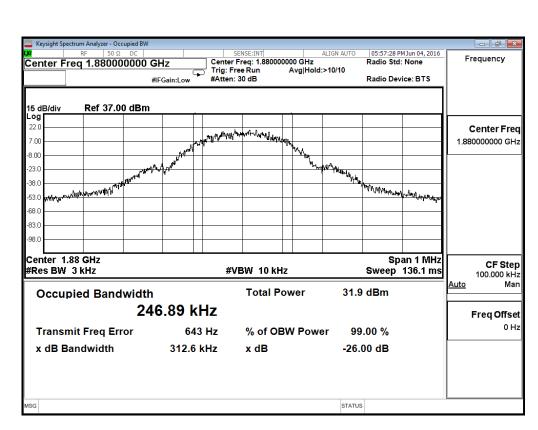
(Plot C3: EDGE 850MHz Channel = 251)



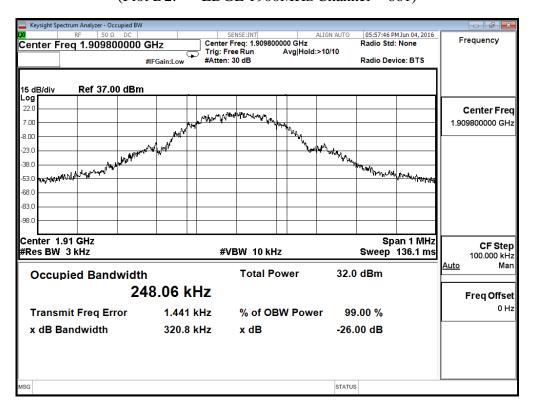
(Plot D1: EDGE 1900MHz Channel = 512)

CCIC-SET/T (00) Page 25 of 62





(Plot D2: EDGE 1900MHz Channel = 661)



(Plot D3: EDGE 1900MHz Channel = 810)

CCIC-SET/T (00) Page 26 of 62



2.4 Frequency Stability

2.4.1 Requirement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ (± 2.5 ppm) of the center frequency.

2.4.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.4.3 Test Procedures for Temperature Variation

- 1. The testing follows FCC KDB 971168 D01v02r02 Section 9.0.
- 2. The EUT was set up in the thermal chamber and connected with the system simulator.
- 3. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
- 4. With power OFF, the temperature was raised in 10°C steps up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

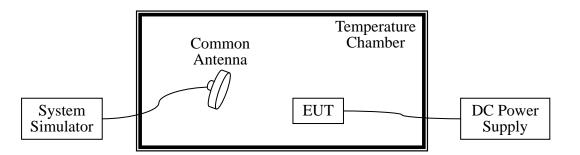
2.4.4 Test Procedures for Voltage Variation

- 1. The testing follows FCC KDB 971168 D01v02r02 Section 9.0.
- 2. The EUT was placed in a temperature chamber at 25±5° C and connected with the system simulator.
- 3. The power supply voltage to the EUT was varied from BEP to 115% of the nominal value measured at the input to the EUT.
- 4. The variation in frequency was measured for the worst case.

CCIC-SET/T (00) Page 27 of 62



2.4.5 Test Setup



2.4.6 Test Results of Frequency Stability

1. GPRS 850MHz Band

| Band: | GPRS 850 | Channel: | 190 |
|-------------|----------|------------|----------|
| Limit(ppm): | 2.5 | Frequency: | 836.6MHz |

| Power | Tomporeture | GP | RS | ED | GE | |
|-------|----------------------------------|-----------|------------|-----------|--------|-------------|
| (VDC) | Temperature Freq. Dev. Deviation | Deviation | Freq. Dev. | Deviation | Result | |
| (VDC) | (0) | (Hz) | (ppm) | (Hz) | (ppm) | Result PASS |
| | -30 | 17 | 0.02 | 11 | 0.01 | |
| | -20 | 10 | 0.01 | 19 | 0.02 | |
| | -10 | 25 | 0.03 | 17 | 0.02 | |
| | 0 | 15 | 0.02 | 13 | 0.01 | |
| 3.7 | +10 | 12 | 0.01 | 26 | 0.03 | |
| | +20 | 18 | 0.02 | 19 | 0.02 | PASS |
| | +30 | 17 | 0.02 | 12 | 0.01 | |
| | +40 | 25 | 0.03 | 25 | 0.03 | |
| | +50 | 8 | 0.01 | 10 | 0.01 | |
| 4.2 | +25 | 11 | 0.01 | 26 | 0.03 | |
| 3.5 | +25 | 26 | 0.03 | 19 | 0.02 | |

CCIC-SET/T (00) Page 28 of 62



2. GPRS 1900MHz Band

| Band: | GPRS 1900 | Channel: | 661 |
|-------------|-----------|------------|-----------|
| Limit(ppm): | 2.5 | Frequency: | 1880.0MHz |

| Power (VDC) | Temperature (°C) | GPRS | | EDGE | | |
|----------------|------------------|------------|-----------|------------|-----------|--------|
| | | Freq. Dev. | Deviation | Freq. Dev. | Deviation | Result |
| | | (Hz) | (ppm) | (Hz) | (ppm) | |
| 3.7 | -30 | 38 | 0.02 | 59 | 0.03 | PASS |
| | -20 | 47 | 0.02 | 22 | 0.01 | |
| | -10 | 26 | 0.01 | 45 | 0.02 | |
| | 0 | 57 | 0.03 | 23 | 0.01 | |
| | +10 | 44 | 0.02 | 45 | 0.02 | |
| | +20 | 22 | 0.01 | 25 | 0.01 | |
| | +30 | 41 | 0.02 | 46 | 0.02 | |
| | +40 | 56 | 0.03 | 24 | 0.01 | |
| | +50 | 25 | 0.01 | 58 | 0.03 | |
| 4.2 | +25 | 58 | 0.03 | 23 | 0.01 | |
| 3.5 | +25 | 22 | 0.01 | 57 | 0.03 | |

CCIC-SET/T (00) Page 29 of 62



2.5 Conducted Out of Band Emissions

2.5.1 Requirement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least $43 + 10 \log (P) dB$.

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its 10th harmonic.

2.5.2 Measuring Instruments

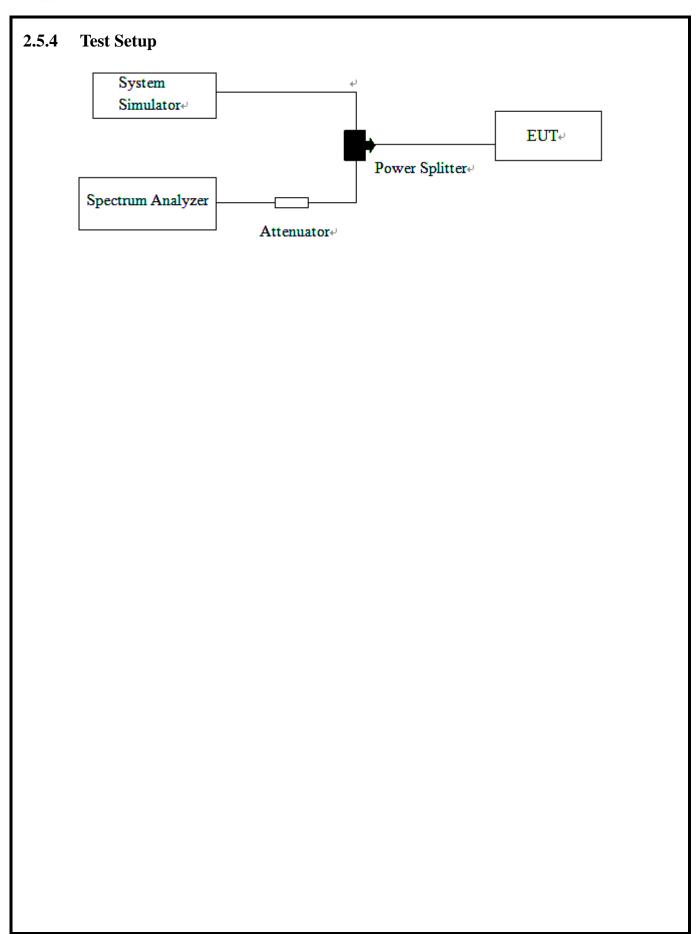
The measuring equipment is listed in the section 3 of this test report.

2.5.3 Test Procedures

- 1. The testing follows FCC KDB 971168 D01v02r02 Section 6.0.
- 2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
- 3. The RF output of EUT was connected to the spectrum analyzer by an RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 4. The middle channel for the highest RF power within the transmitting frequency was measured.
- 5. The conducted spurious emission for the whole frequency range was taken.
- 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
- 7. The limit line is derived from 43 + 10log(P) dB below the transmitter power P(Watts)
 - = P(W) [43 + 10log(P)] (dB)
 - $= [30 + 10\log(P)] (dBm) [43 + 10\log(P)] (dB)$
 - = -13dBm.
- 8. For 9KHz to 30MHz: the amplitude of spurious emissions are attenuated by more than 20dB below the permissible value has no need to be reported.

CCIC-SET/T (00) Page 30 of 62



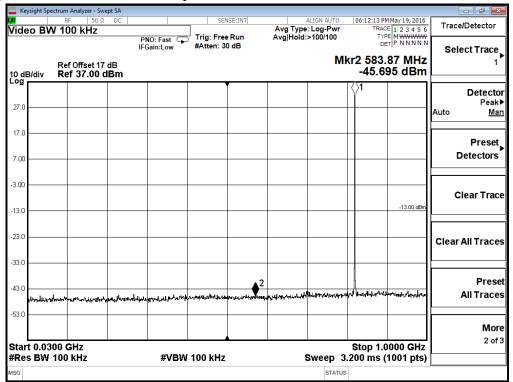


CCIC-SET/T (00) Page 31 of 62

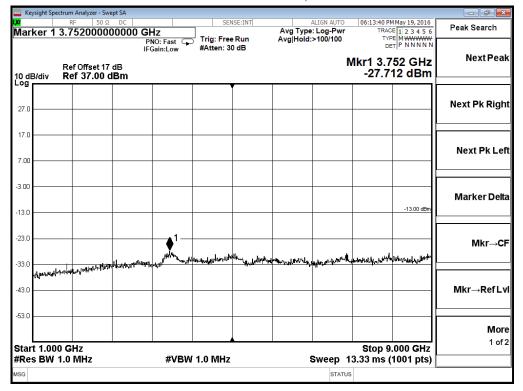


2.5.5 Test Result (Plots) of Conducted Spurious Emission

Note: For 9 KHz to 30MHz: the amplitude of spurious emissions is attenuated by more than 20dB below the permissible value, so we not provide the test result here.



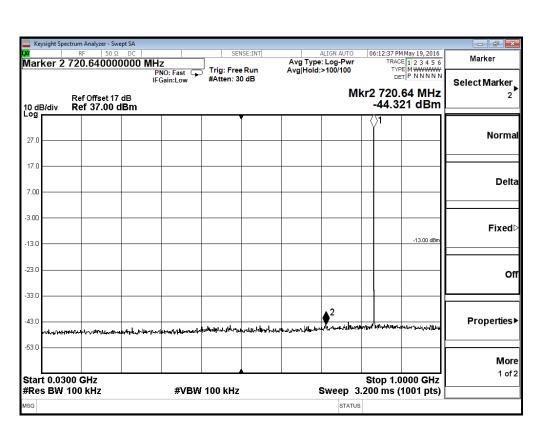
GPRS 850MHz Channel = 128, 30MHz to 1GHz



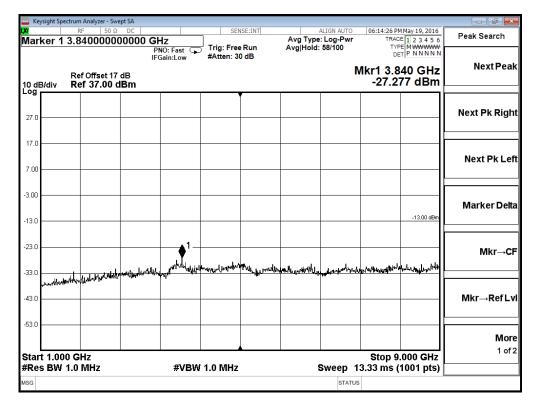
GPRS 850MHz Channel = 128, 1GHz to 9GHz

CCIC-SET/T (00) Page 32 of 62





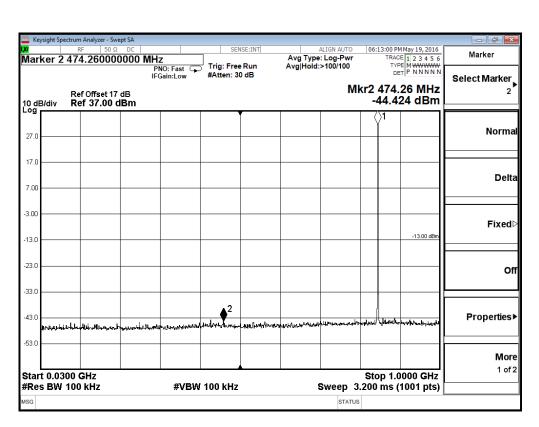
GPRS 850MHz Channel = 190, 30MHz to 1GHz



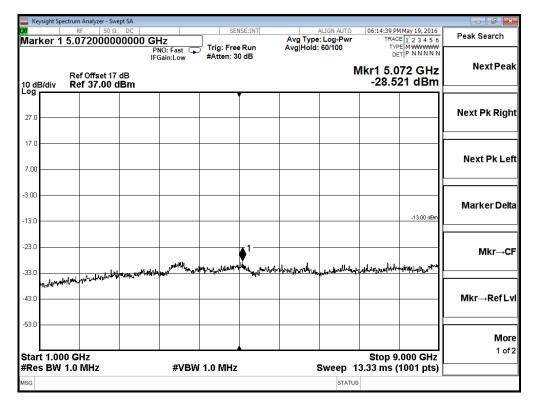
GPRS 850MHz Channel = 190, 1GHz to 9GHz

CCIC-SET/T (00) Page 33 of 62





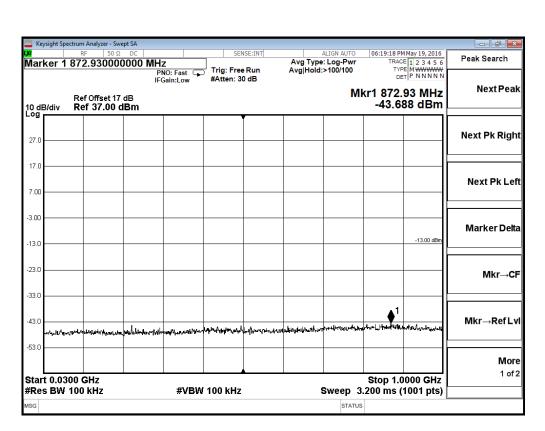
GPRS 850MHz Channel = 251, 30MHz to 1GHz



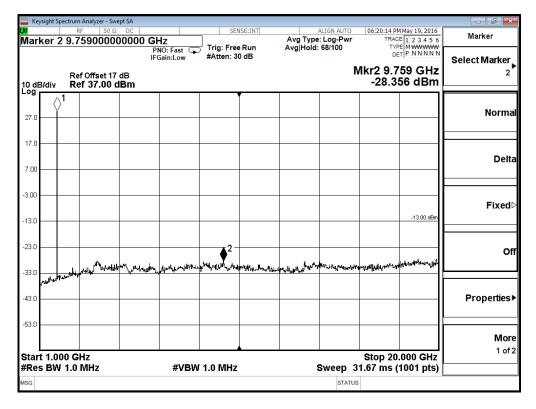
GPRS 850MHz Channel = 251, 1GHz to 9GHz

CCIC-SET/T (00) Page 34 of 62





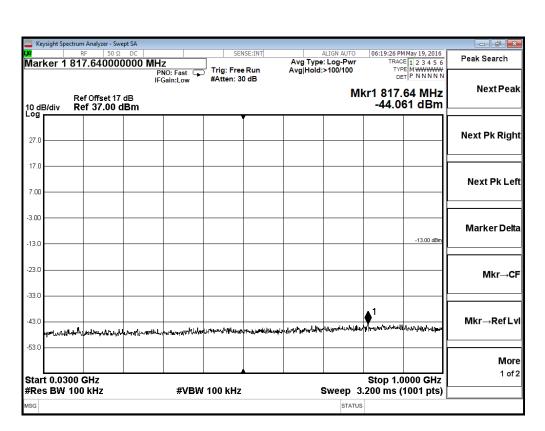
GPRS 1900MHz Channel = 512, 30MHz to 1GHz



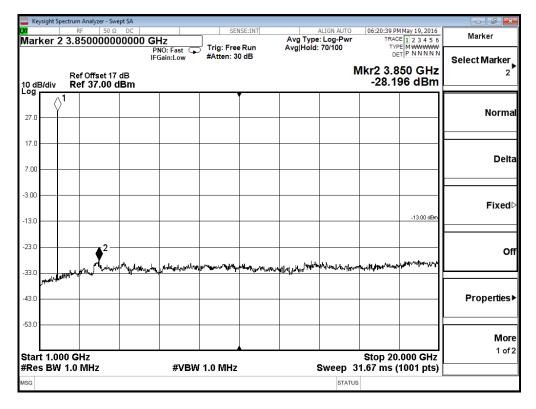
GPRS 1900MHz Channel = 512, 1GHz to 20GHz

CCIC-SET/T (00) Page 35 of 62





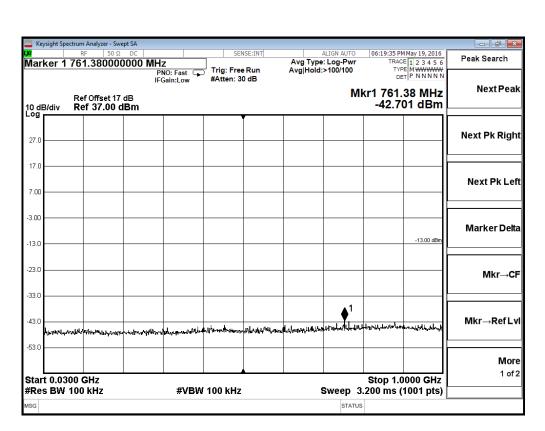
GPRS 1900MHz Channel = 661, 30MHz to 1GHz



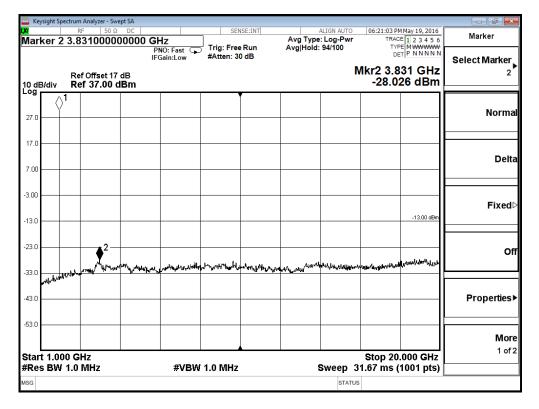
GPRS 1900MHz Channel = 661, 1GHz to 20GHz

CCIC-SET/T (00) Page 36 of 62





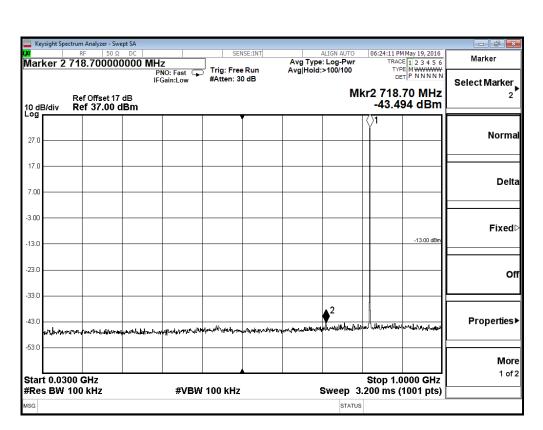
GPRS 1900MHz Channel = 810, 30MHz to 1GHz



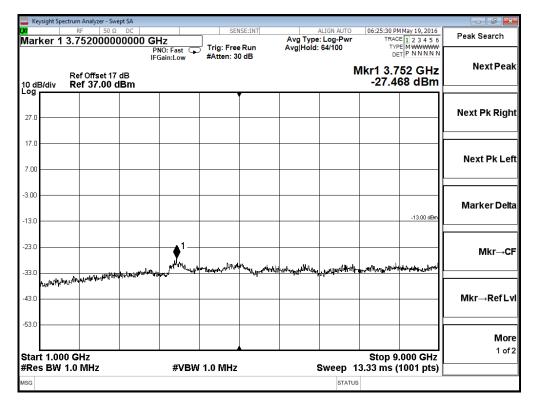
GPRS 1900MHz Channel = 810, 1GHz to 20GHz

CCIC-SET/T (00) Page 37 of 62





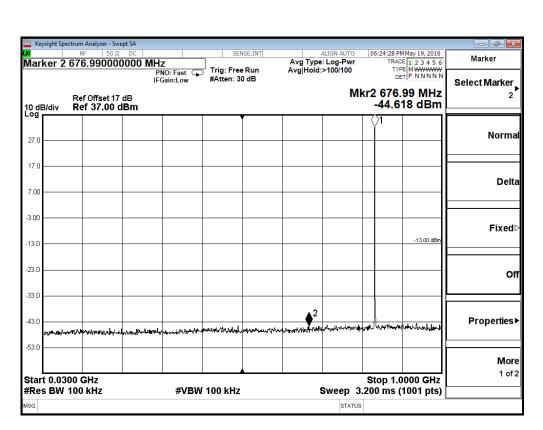
EDGE 850MHz Channel = 128, 30MHz to 1GHz



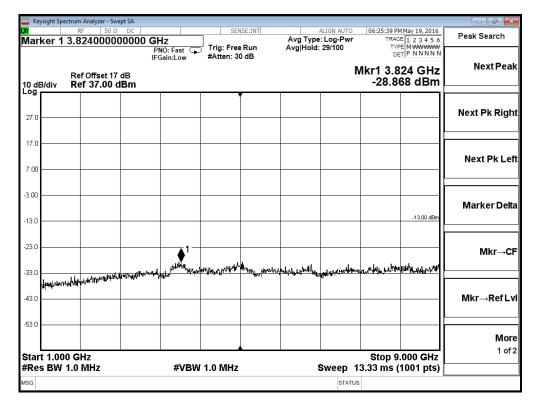
EDGE 850MHz Channel = 128, 1GHz to 9GHz

CCIC-SET/T (00) Page 38 of 62





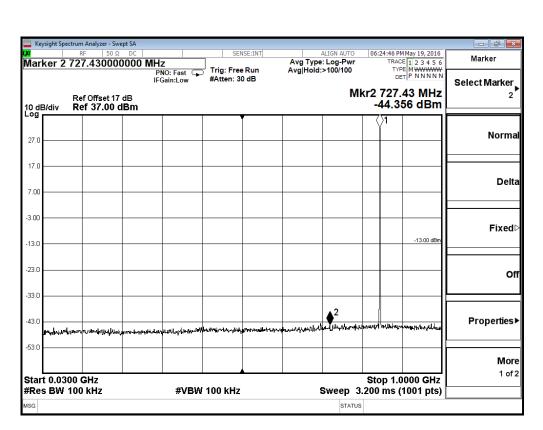
EDGE 850MHz Channel = 190, 30MHz to 1GHz



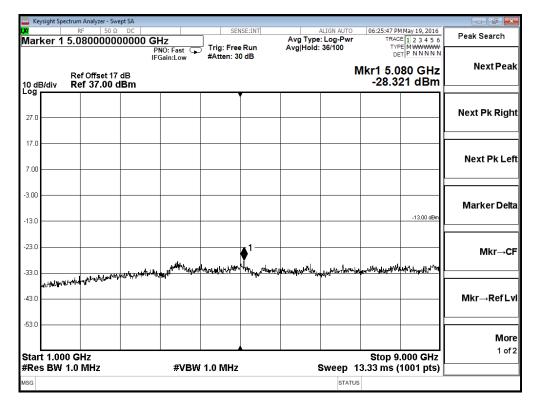
EDGE 850MHz Channel = 190, 1GHz to 9GHz

CCIC-SET/T (00) Page 39 of 62





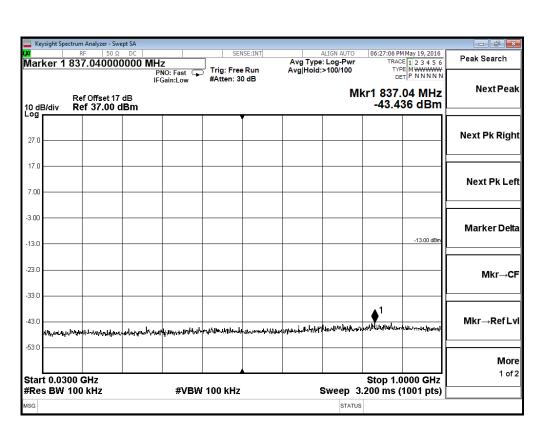
EDGE 850MHz Channel = 251, 30MHz to 1GHz



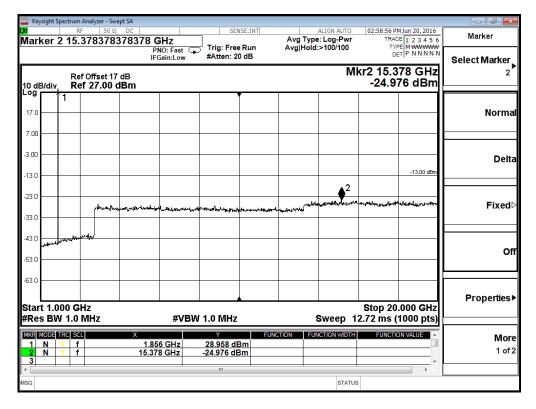
EDGE 850MHz Channel = 251, 1GHz to 9GHz

CCIC-SET/T (00) Page 40 of 62





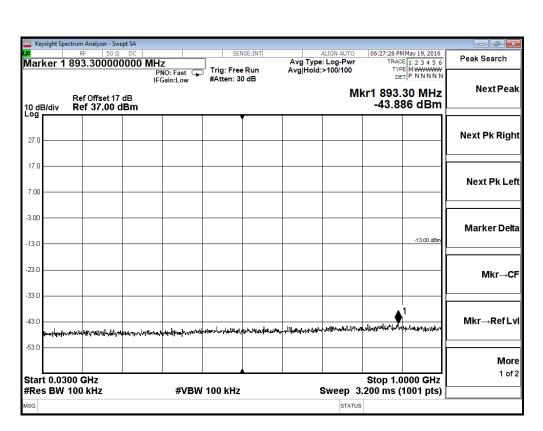
EDGE 1900MHz Channel = 512, 30MHz to 1GHz



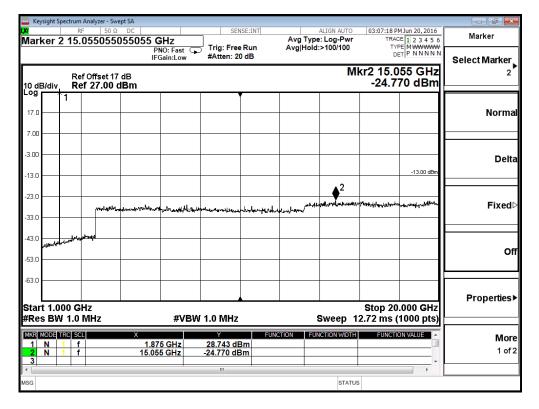
EDGE 1900MHz Channel = 512, 1GHz to 20GHz

CCIC-SET/T (00) Page 41 of 62





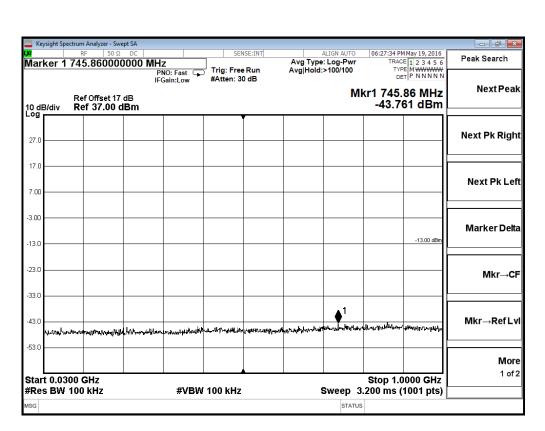
EDGE 1900MHz Channel = 661, 30MHz to 1GHz



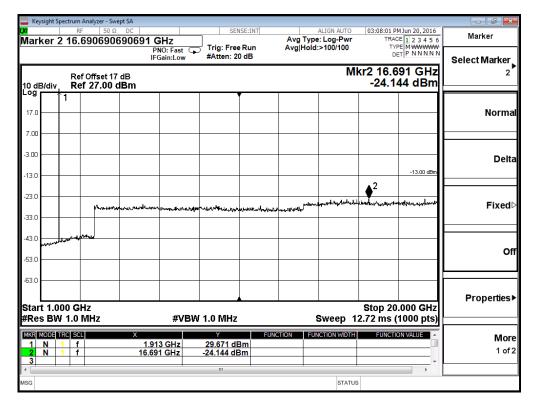
EDGE 1900MHz Channel = 661, 1GHz to 20GHz

CCIC-SET/T (00) Page 42 of 62





EDGE 1900MHz Channel = 810, 30MHz to 1GHz



EDGE 1900MHz Channel = 810, 1GHz to 20GHz

CCIC-SET/T (00) Page 43 of 62



2.6 Band Edge

2.6.1 Requirement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least $43 + 10 \log (P) dB$.

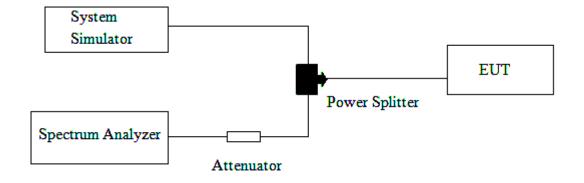
2.6.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.6.3 Test Procedures

- 1. The testing follows FCC KDB 971168 D01v02r02 Section 6.0.
- 2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
- 3. The RF output of EUT was connected to the spectrum analyzer by an RF cable and attenuator. The path loss was compensated to the results for each measurement.
- 4. The band edges of low and high channels for the highest RF powers were measured.
- 5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
- 6. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)
 - $= P(W) [43 + 10\log(P)] (dB)$
 - $= [30 + 10\log(P)] (dBm) [43 + 10\log(P)] (dB)$
 - = -13dBm.

2.6.4 Test Setup



CCIC-SET/T (00) Page 44 of 62



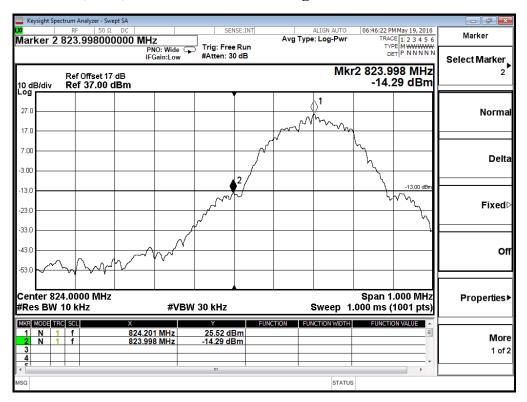
2.6.5 Test Result of Conducted Band Edge

| Band | Channel | Frequency (MHz) | Measured Max. Band Edge Emission (dBm) | Refer to Plot | Limit (dBm) | Verdict |
|---------|---------|-----------------|---|------------------|----------------|---------|
| GPRS | 128 | 824.2 | -14.29 | Plat A | -13 | PASS |
| 850MHz | 251 | 848.8 | -14.07 | Plot B | -13 | PASS |
| GPRS | 512 | 1850.2 | -14.86 | Plat C | -13 | PASS |
| 1900MHz | 810 | 1909.8 | -15.77 | Plot D | -13 | PASS |
| EDGE | 128 | 824.2 | -16.37 | Plat E | -13 | PASS |
| 850MHz | 251 | 848.8 | -17.31 | Plot F | -13 | PASS |
| EDGE | 512 | 1850.2 | -20.00 | Plat G | -13 | PASS |
| 1900MHz | 810 | 1909.8 | -17.26 | Plot H | -13 | PASS |

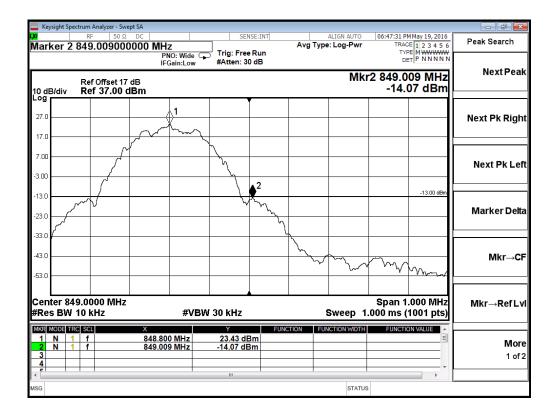
CCIC-SET/T (00) Page 45 of 62



2.6.6 Test Result (Plots) of Conducted Band Edge



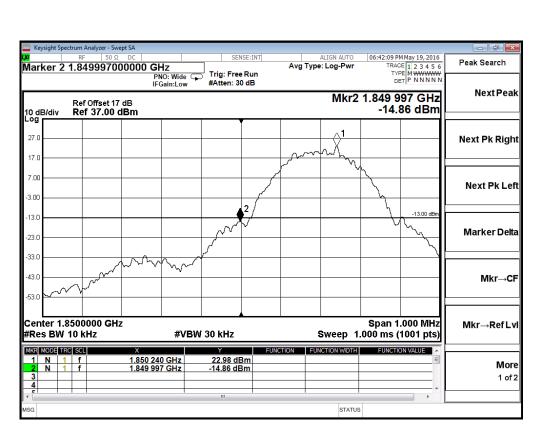
(Plot A: GPRS 850 Channel = 128)



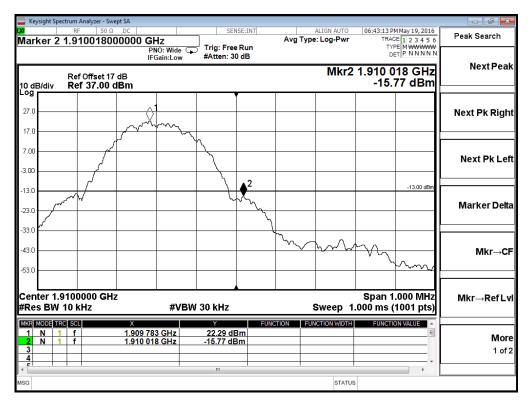
(Plot B: GPRS 850 Channel = 251)

CCIC-SET/T (00) Page 46 of 62





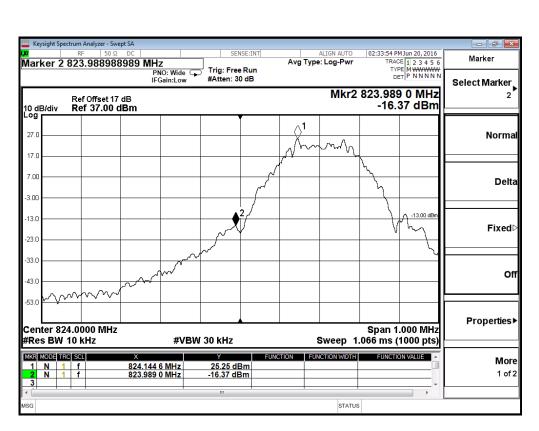
(Plot C: GPRS 1900 Channel = 512)



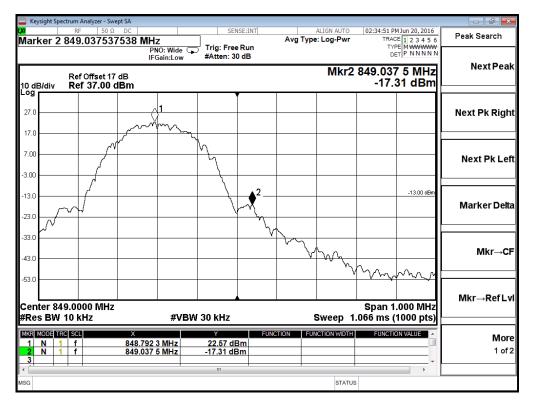
(Plot D: GPRS 1900 Channel = 810)

CCIC-SET/T (00) Page 47 of 62





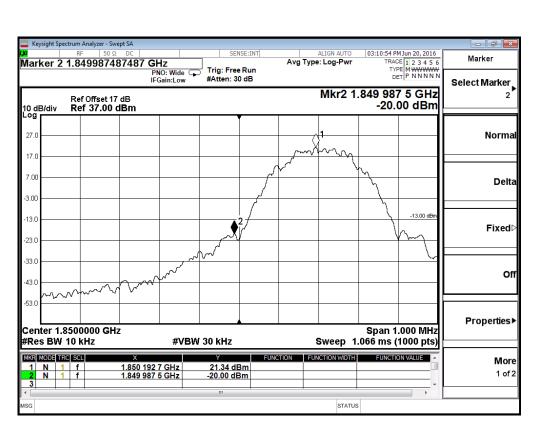
(Plot E: EDGE 850 Channel = 128)



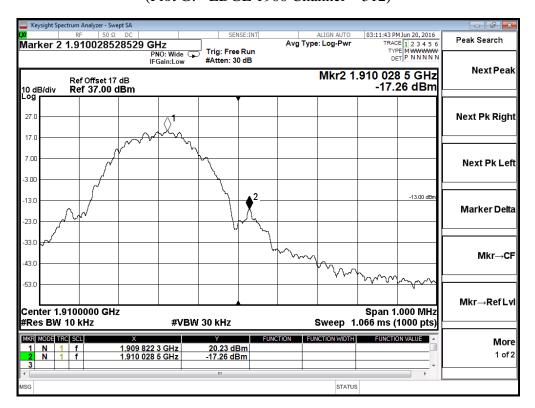
(Plot F: EDGE 850 Channel = 251)

CCIC-SET/T (00) Page 48 of 62





(Plot G: EDGE 1900 Channel = 512)



(Plot H: EDGE 1900 Channel = 810)

CCIC-SET/T (00) Page 49 of 62



2.7 Transmitter Radiated Power (EIRP/ERP)

2.7.1 Requirement

The substitution method, in ANSI / TIA / EIA-603-D-2010, was used for ERP/EIRP measurement, and the spectrum analyzer configuration follows KDB 971168 D01 Power Meas. License Digital Systems v02r02. The ERP of mobile transmitters must not exceed 7 Watts (Cellular Band) and the EIRP of mobile transmitters are limited to 2 Watts (PCS Band) and 1 Watts (AWS Band).

2.7.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.7.3 Test Procedures

- 1. The EUT was placed on a turntable with 1.5 meter height on a wooden turntable in a fully anechoic chamber.
- 2. The EUT was set at 3 meters from the receiving antenna, which was mounted on the antenna tower.
- 3. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and a spectrum analyzer which used a channel power option across EUT's signal bandwidth per section 4.0 of KDB 971168 D01v02r02.
- 4. The table was rotated 360 degrees and Both Horizontal & Vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.
- 5. The height of the receiving antenna is adjusted to look for the maximum value.
- 6. Taking the record of maximum value on spectrum analyzer.
- 7. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.
- 8. A Broadband antenna (for below 1GHz) and horn antenna (for above 1GHz) was substituted in place of the EUT and was driven by a signal generator.
- 9. The conducted power at the terminal of the antenna is measured.
- 10. Repeat step 3 to step 9 to get the maximum ERP/EIRP of the substitution antenna.

CCIC-SET/T (00) Page 50 of 62

Report No.: SET2016-08990



11.
$$ERP/EIRP = Ps + Et - Es + Gs = Ps + Rt - Rs + Gs$$

Ps (dBm): Input power to substitution antenna.

Gs (dBi or dBd): Substitution antenna Gain.

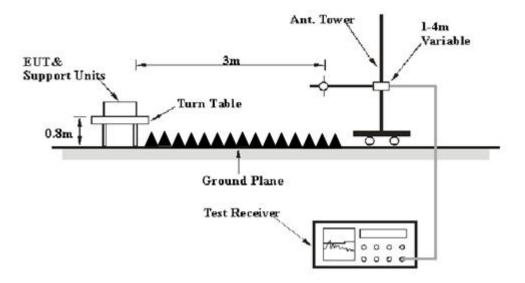
$$Et = Rt + AF$$
 $Es = Rs + AF$

AF (dB/m): Receive antenna factor

Rt: The highest received signal in spectrum analyzer for EUT.

Rs: The highest received signal in spectrum analyzer for substitution antenna.

2.7.4 Test Setup



CCIC-SET/T (00) Page 51 of 62

Report No.: SET2016-08990



2.7.5 Test Result of Transmitter Radiated Power

Test Notes:

- 1. This device employs GMSK technology with GSM and GPRS capabilities. All configurations were investigated and the worst case emissions were found in GSM mode.
- 2. This device employs UMTS technology with WCDMA (AMR/RMC), HSDPA, HSUPA capabilities. All configurations were investigated and the worst case UMTS emissions were found in RMC WCDMA mode at 12.2Kbps.
- 3. This unit was tested with its standard battery.
- 4. The worst case test configuration was found in the vertical positioning where the EUT is laying on its side. The data reported in the tables below were measured in this test setup.

| Band | Channel | Frequency (MHz) | PCL | Antenna Pol (H/V) | Measured ERP dBm | Limit dBm | Verdict |
|----------------|---------|-----------------|-----|----------------------|---------------------|--------------|---------|
| GPRS 850MHz | 128 | 824.20 | 5 | V | 29.21 | 38.5 | PASS |
| | 128 | | | Н | 29.18 | | |
| | 190 | 836.60 | 5 | V | 29.15 | | PASS |
| | | | | Н | 29.12 | | |
| | 251 | 848.80 | 5 | V | 29.25 | | PASS |
| | | | | Н | 29.19 | | |

| Band | Channel | Frequency (MHz) | PCL | Antenna Pol (H/V) | Measured EIRP dBm | Limit dBm | Verdict |
|---------------------|---------|-----------------|-----|-------------------|----------------------|--------------|---------|
| | | (1/11/2) | | V | 27.48 | <u>ubin</u> | |
| GPRS 1900MHz 661 | 512 | 1850.2 | 0 | v | | 33 | PASS |
| | | | | Н | 27.51 | | |
| | 661 | 661 1880.0 | 0 | V | 27.53 | | PASS |
| | 001 | | | Н | 27.44 | | |
| | 810 | 1909.8 | 0 | V | 27.48 | | PASS |
| | | | | Н | 27.49 | | |

CCIC-SET/T (00) Page 52 of 62





| Band | Channel | Frequency (MHz) | PCL | Antenna Pol (H/V) | Measured ERP dBm | Limit dBm | Verdict |
|----------------|---------|-----------------|-----|----------------------|---------------------|--------------|---------|
| EDGE 850MHz | 128 | 824.20 | 5 | V | 25.41 | 38.5 | PASS |
| | | | | Н | 25.46 | | |
| | 190 | 836.60 | 5 | V | 25.23 | | PASS |
| | | | | Н | 25.34 | | |
| | 251 | 848.80 | 5 | V | 25.45 | | PASS |
| | | | | Н | 25.37 | | |

| Band | Channel | Frequency (MHz) | PCL | Antenna Pol (H/V) | Measured EIRP dBm | Limit dBm | Verdict |
|-----------------|---------|-----------------|-----|----------------------|----------------------|--------------|---------|
| EDGE 1900MHz | 512 | 1850.2 | 0 | V | 23.22 | 33 | PASS |
| | | | | Н | 23.18 | | |
| | 661 | 1880.0 | 0 | V | 23.19 | | PASS |
| | | | | Н | 23.18 | | |
| | 810 | 1909.8 | 0 | V | 23.21 | | DACC |
| | | | | Н | 23.18 | | PASS |

CCIC-SET/T (00) Page 53 of 62



2.8 Radiated Spurious Emissions

2.8.1 Requirement

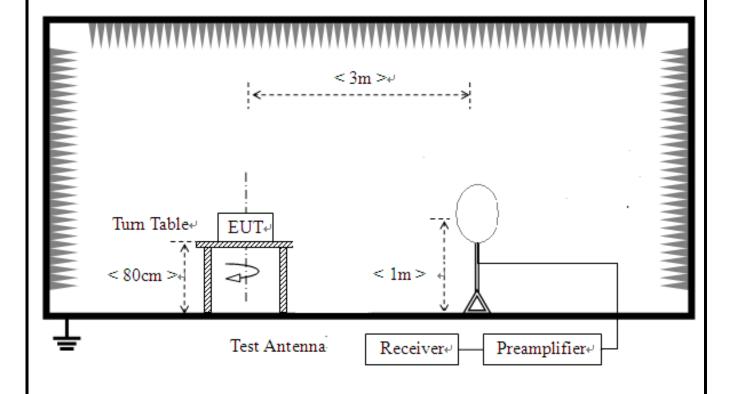
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P) dB$. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

2.8.2 Measuring Instruments

The measuring equipment is listed in the section 3 of this test report.

2.8.3 Test Setup

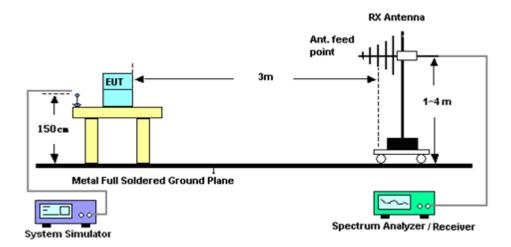
For radiated emissions from 9 kHz to 30MHz



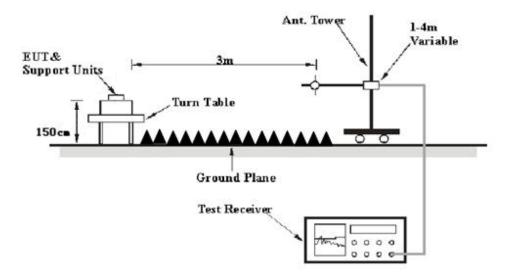
CCIC-SET/T (00) Page 54 of 62



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



2.8.4 Test Procedures

- 1. The EUT was placed on a rotatable wooden table with 1.5 meter above ground.
- 2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
- 3. The table was rotated 360 degrees and 3-orthogonal axis to determine the position of the highest spurious emission.

CCIC-SET/T (00) Page 55 of 62



- 4. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
- 5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record the maximum spurious emission.
- 6. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.
- 7. A Broadband antenna (for below 1GHz) and horn antenna (for above 1GHz) was substituted in place of the EUT and was driven by a signal generator.
- 8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
- 9. Taking the record of output power at antenna port.
- 10. Repeat step 3 to step 9 for another polarization.
- 11. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

The limit line is derived from $43 + 10\log(P)dB$ below the transmitter power P(Watts)

```
= P(W) - [43 + 10\log(P)] (dB)
```

 $= [30 + 10\log(P)] (dBm) - [43 + 10\log(P)] (dB)$

= -13dBm.

<For Band 7>

The limit line is derived from 55+ 10log(P)dB below the transmitter power P(Watts)

```
= P(W) - [55 + 10\log(P)] (dB)
```

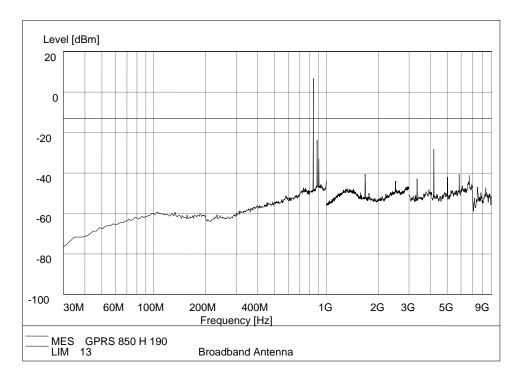
- $= [30 + 10\log(P)] (dBm) [55 + 10\log(P)] (dB)$
- = -25 dBm.
- 12. The spectrum is measured from 9 KHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. The worst case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
- 13. For 9KHz to 30MHz: the amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
- 14. All Spurious Emission tests were performed in X, Y, Z axis direction and low, middle, high channel. And only the worst axis test condition was recorded in this test report.

CCIC-SET/T (00) Page 56 of 62

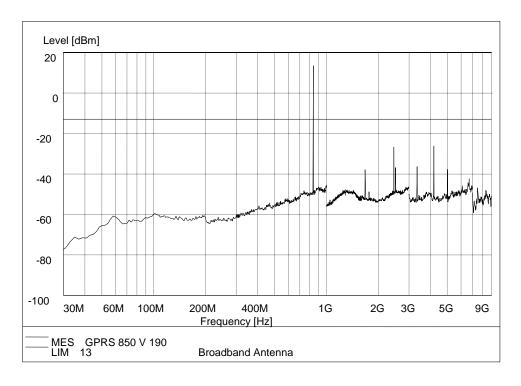


2.8.5 Test Results of Radiated Spurious Emissions

Note: For 9 KHz to 30MHz: the amplitude of spurious emissions is attenuated by more than 20dB below the permissible value, so we not provide the test result here.



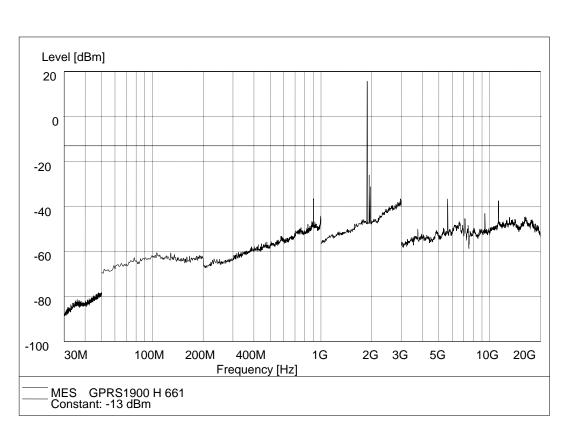
GPRS 850MHz, Test Antenna Horizontal



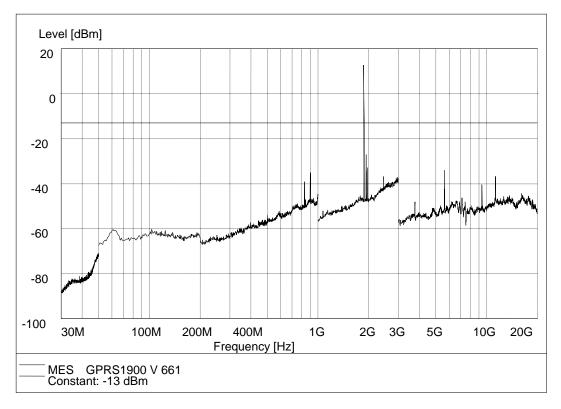
GPRS 850MHz, Test Antenna Vertical

CCIC-SET/T (00) Page 57 of 62





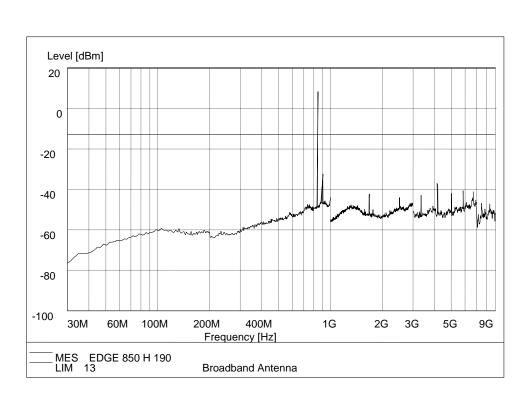
GPRS 1900MHz, Test Antenna Horizontal



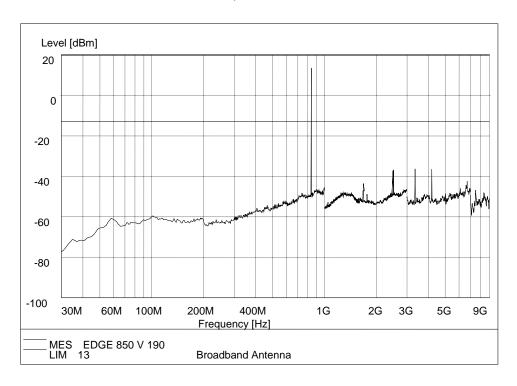
GPRS 1900MHz, Test Antenna Vertical

CCIC-SET/T (00) Page 58 of 62





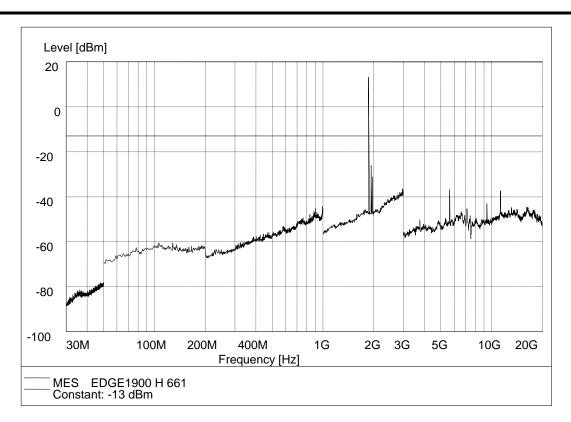
EDGE 850MHz, Test Antenna Horizontal



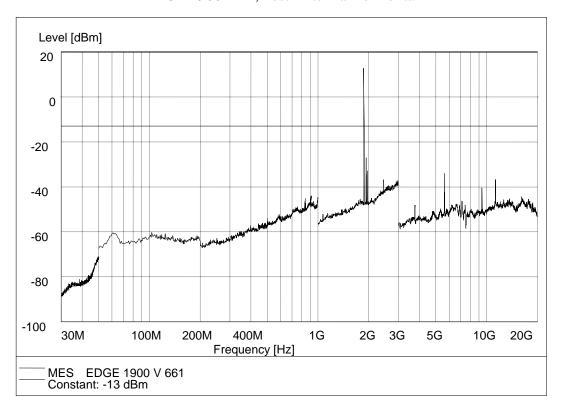
EDGE 850MHz, Test Antenna Vertical

CCIC-SET/T (00) Page 59 of 62





EDGE 1900MHz, Test Antenna Horizontal



EDGE 1900MHz, Test Antenna Vertical

CCIC-SET/T (00) Page 60 of 62



3. LIST OF MEASURING EQUIPMENT

| Description | Manufacturer | Model | Serial No. | Test Date | Due Date | Remark |
|--|-------------------|-----------------------------|---------------|------------|------------|-----------|
| EMI Test Receiver | R&S | ESIB26 | A0304218 | 2015.06.02 | 2016.06.01 | Radiation |
| Full-Anechoic Chamber | Albatross | 12.8m*6.8m*6. | A0412372 | 2015.06.02 | 2016.06.01 | Radiation |
| Loop Antenna | Schwarz beck | HFH2-Z2 | 100047 | 2015.06.02 | 2016.06.01 | Radiation |
| Bilog Antenna | Schwarzbeck | VULB 9163 | 9163-274 | 2015.06.02 | 2016.06.01 | Radiation |
| Broadband antenna (30MHz~1GHz) | R&S | HL562 | 101341 | 2015.06.02 | 2016.06.01 | Radiation |
| Broadband antenna (30MHz~1GHz) | R&S | HL562 | 101339 | 2015.06.02 | 2016.06.01 | Radiation |
| Double ridge horn antenna (1GHz~18GHz) | R&S | HF906 | 100150 | 2015.06.02 | 2016.06.01 | Radiation |
| Double ridge horn antenna (1GHz~18GHz) | R&S | HF906 | 100148 | 2015.06.02 | 2016.06.01 | Radiation |
| Horn antenna (18GHz~26.5GHz) | R&S | HM118 | 101286 | 2015.06.02 | 2016.06.01 | Radiation |
| Horn antenna (18GHz~26.5GHz) | R&S | HM118 | 101284 | 2015.06.02 | 2016.06.01 | Radiation |
| Amplifier 20M~3GHz | R&S | PAP-0203H | 22018 | 2015.06.02 | 2016.06.01 | Radiation |
| Ampilier 1G~18GHz | R&S | MITEQ AFS42-0010180 0 | 25-S-42 | 2015.06.02 | 2016.06.01 | Radiation |
| Ampilier 18G~40GHz | R&S | JS42-18002600- 28-5A | 12111.0980.00 | 2015.06.02 | 2016.06.01 | Radiation |
| Spectrum Analyzer | KEYSIGHT | N9030A | MY55410524 | 2016.05.05 | 2017.05.04 | Conducted |
| Power Meter | R&S | NRP2 | 1020.1809.02 | 2015.06.02 | 2016.06.01 | Conducted |
| Power Sensor | R&S | NRP-Z81 | 823.3618.03 | 2015.06.02 | 2016.06.01 | Conducted |
| LISN | ROHDE&SCH WARZ | ESH2-Z5 | A0304221 | 2015.06.02 | 2016.06.01 | Conducted |
| Test Receiver | R&S | ESCS30 | A0304260 | 2015.06.02 | 2016.06.01 | Conducted |
| Cable | SUNHNER | SUCOFLEX 100 | / | 2015.06.02 | 2016.06.01 | Radiation |
| Cable | SUNHNER | SUCOFLEX 104 | / | 2015.06.02 | 2016.06.01 | Radiation |

CCIC-SET/T (00) Page 61 of 62





4. UNCERTAINTY OF EVALUATION

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2

| Measurement | Frequency | Uncertainty | |
|---------------------|---------------|-------------|--|
| Conducted emissions | 9kHz~30MHz | 2.35dB | |
| | 9kHz~30MHz | 2.59dB | |
| Radiated emissions | 30MHz~1000MHz | 2.45dB | |
| Radiated effissions | 1G~18GHz | 2.21dB | |
| | 18G~40GHz | 1.96dB | |

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

** END OF REPORT **

CCIC-SET/T (00) Page 62 of 62