



RF TEST REPORT

Report No.: SET2016-18249

Product: LTE Ufi

FCC ID: SRQ-R218

Model No.: R218

Applicant: ZTE Corporation

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

Dates of Testing: 10/10/2016 — 10/17/2016

Issued by: CCIC-SET

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

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Test Report

Product.....: LTE Ufi

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

Test Standards.....: 47 CFR FCC Part 2: Frequency Allocations and Radio Treaty
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.....:

Candy Liu

2016.10.18

Candy Liu, Test Engineer

Reviewed by.....:

Zhu Qi

2016.10.18

Zhu Qi, Senior Engineer

Approved by.....:

Wu Li'an

2016.10.18

Wu Li'an, Manager

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| Change History | | |
|----------------|------------|-------------------|
| Issue | Date | Reason for change |
| 1.0 | 2016.10.18 | First edition |
| | | |
| | | |

1. GENERAL INFORMATION

1.1 EUT Description

| | |
|---------------------------------|--|
| EUT Type | LTE Ufi |
| Hardware Version | Ver.B(T2) |
| Software Version | BD_R218V2.1 |
| EUT supports Radios application | GPRS/EDGE/WCDMA/HSPA/LTE WLAN2.4GHz 802.11b/g/n (HT20/40) |
| Multi Slot Class | GPRS: Multi slot Class12, EGPRS: Multi slot Class12 |
| Frequency Range | GSM 850MHz: Tx: 824.2 - 848.8MHz (at intervals of 200kHz); Rx: 869.2 - 893.8MHz (at intervals of 200kHz) GSM 1900MHz: Tx: 1850.2 - 1909.8MHz (at intervals of 200kHz); Rx: 1930.2 - 1989.8MHz (at intervals of 200kHz) WCDMA 850MHz Tx: 826.4 - 846.6MHz (at intervals of 200kHz); Rx: 871.4 - 891.6MHz (at intervals of 200kHz) WCDMA 1900MHz Tx: 1852.4 - 1907.6MHz (at intervals of 200kHz); Rx: 1932.4 - 1987.6MHz (at intervals of 200kHz) |
| Maximum Output Power to Antenna | GPRS 850: 31.98dBm GPRS 1900: 29.42dBm EDGE 850: 26.59dBm EDGE 1900: 25.14dBm WCDMA 850: 21.96dBm WCDMA 1900: 21.79dBm |
| Type of Modulation | GPRS:GMSK EDGE:GMSK / 8PSK WCDMA: QPSK(Uplink) HSDPA:QPSK(Downlink) HSUPA:QPSK(Uplink) |
| Antenna Type | Internal Antenna |

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

| System | Type of Modulation | Emission Designator | Frequency Tolerance (ppm) | Maximum ERP/EIRP(W) |
|----------------------------|--------------------|---------------------|---------------------------|---------------------|
| GRPS 850 | GMSK | 248KGXW | 0.03 | 1.517 |
| GRPS 1900 | GMSK | 246KGXW | 0.03 | 0.891 |
| EDGE 850 | 8PSK | 246KG7W | 0.03 | 0.433 |
| EDGE 1900 | 8PSK | 240KG7W | 0.03 | 0.299 |
| WCDMA 850 RMC 12.2Kbps | QPSK | 4M13F9W | 0.03 | 0.214 |
| WCDMA 1900 RMC 12.2Kbps | QPSK | 4M13F9W | 0.03 | 0.183 |

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 |
|-----|----------------------------------|-------------------------------------|---------------------------------------|--------|
| | FCC | | | |
| 1 | 2.1046 | Conducted Output Power | Reporting Only | PASS |
| 2 | 24.232(d) | Peak to Average Radio | <13dBm | PASS |
| 3 | 2.1049 22.917(b) 24.238(b) | Occupied Bandwidth | Reporting Only | PASS |
| 4 | 2.1055 22.355 24.235 | Frequency Stability | $\leq \pm 2.5\text{ppm}$ | PASS |
| 5 | 2.1051 22.917 24.238 | Conducted Out of Band Emissions | $< 43 + 10\log_{10}(P[\text{Watts}])$ | PASS |
| 6 | 2.1051 22.917 24.238 | Band Edge | $< 43 + 10\log_{10}(P[\text{Watts}])$ | PASS |
| 7 | 22.913 | Effective Radiated Power | <7Watts | PASS |
| | 24.232 | Equivalent Isotropic Radiated Power | <2Watts | PASS |
| 8 | 2.1053 22.917 24.238 | Radiated Spurious Emissions | $< 43 + 10\log_{10}(P[\text{Watts}])$ | PASS |

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 and WCDMA Band V.
2. 30 MHz to 20000 MHz for GSM1900 and WCDMA Band II.

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 |
| GSM 850 | GPRS Link | GPRS Link |
| | EDGE Link | EDGE Link |
| GSM 1900 | GPRS Link | GPRS Link |
| | EDGE Link | EDGE Link |
| WCDMA Band V | RMC 12.2Kbps Link | RMC 12.2Kbps Link |
| WCDMA Band II | RMC 12.2Kbps Link | RMC 12.2Kbps 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,

RMC 12.2Kbps mode for WCDMA band V,

RMC 12.2Kbps mode for WCDMA band II, only these modes were used for all tests.

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:

$$\begin{aligned}\text{Offset (dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 7 + 10 = 17 \text{ (dB)}\end{aligned}$$

1.6 Facilities and Accreditations

1.6.1 Test Facilities

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories

(identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories, Date of Registration: February 28, 2015. Valid time is until February 27, 2018.

FCC-Registration No.: 317478

Shenzhen Huatongwei International Inspection 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 317478, Renewal date Jul. 18, 2014, valid time is until Jul. 18, 2017

1.6.2 Test Environment Conditions

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

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

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.

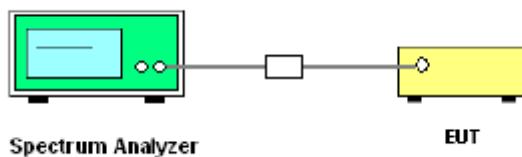
2.1.2 Measuring Instruments

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



2.1.5 Test Results of Conducted Output Power

1. Test Verdict:

| Band | Channel | Frequency (MHz) | Measured Output Power dBm | Verdict |
|--------------|---------|-----------------|---------------------------|---------|
| GPRS 850MHz | 128 | 824.2 | 31.96 | PASS |
| | 190 | 836.6 | 31.98 | PASS |
| | 251 | 848.8 | 31.81 | PASS |
| GPRS 1900MHz | 512 | 1850.2 | 29.31 | PASS |
| | 661 | 1880.0 | 29.08 | PASS |
| | 810 | 1909.8 | 29.42 | PASS |
| EDGE 850MHz | 128 | 824.2 | 26.59 | PASS |
| | 190 | 836.6 | 26.48 | PASS |
| | 251 | 848.8 | 26.51 | PASS |
| EDGE 1900MHz | 512 | 1850.2 | 25.14 | PASS |
| | 661 | 1880.0 | 25.15 | PASS |
| | 810 | 1909.8 | 25.11 | PASS |

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

2. WCDMA Model Test Verdict:

| Item | band | WCDMA 1900 | | | WCDMA 850 | | |
|-------|--------------|------------|--------------|-------|-----------|-------|--------------|
| | Frequency | 9262 | 9400 | 9538 | 4132 | 4183 | 4233 |
| | Subtest | dBm | | | dBm | | |
| WCDMA | RMC 12.2Kbps | 21.90 | 21.96 | 21.89 | 21.84 | 21.71 | 21.79 |
| HSDPA | 1 | 21.15 | 20.91 | 20.88 | 20.88 | 20.73 | 20.76 |
| | 2 | 21.14 | 20.87 | 20.81 | 20.79 | 20.83 | 20.77 |
| | 3 | 20.72 | 20.57 | 20.54 | 20.38 | 20.31 | 20.35 |
| | 4 | 20.57 | 20.52 | 20.45 | 20.28 | 20.25 | 20.21 |
| HSUPA | 1 | 20.29 | 20.23 | 20.27 | 20.61 | 20.59 | 20.57 |
| | 2 | 19.79 | 19.81 | 19.84 | 20.04 | 20.09 | 20.07 |
| | 3 | 18.91 | 18.85 | 18.88 | 19.65 | 19.57 | 19.61 |
| | 4 | 19.66 | 19.63 | 19.69 | 20.14 | 20.18 | 20.12 |
| | 5 | 20.47 | 20.31 | 20.32 | 20.69 | 20.48 | 21.00 |

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.

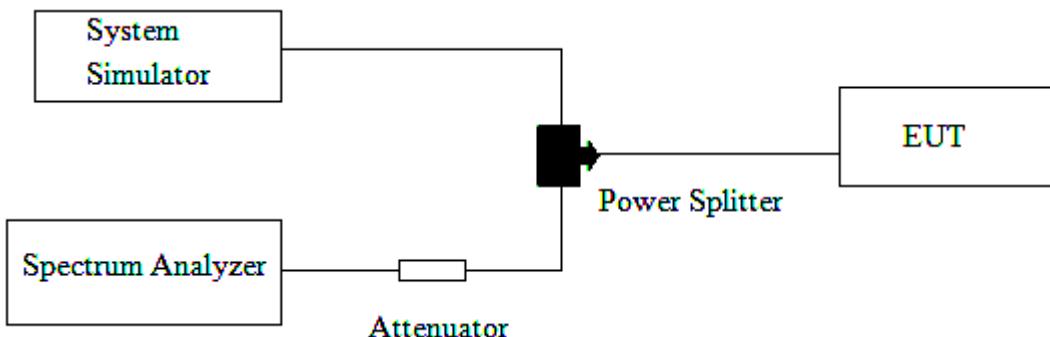
2.2.2 Measuring Instruments

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.

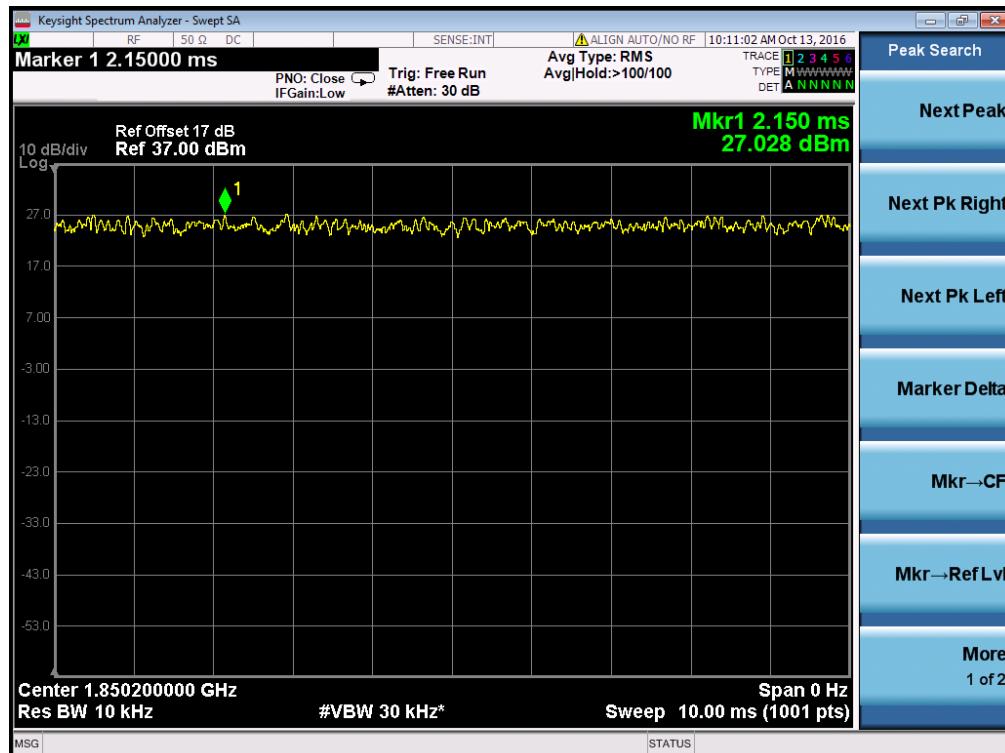
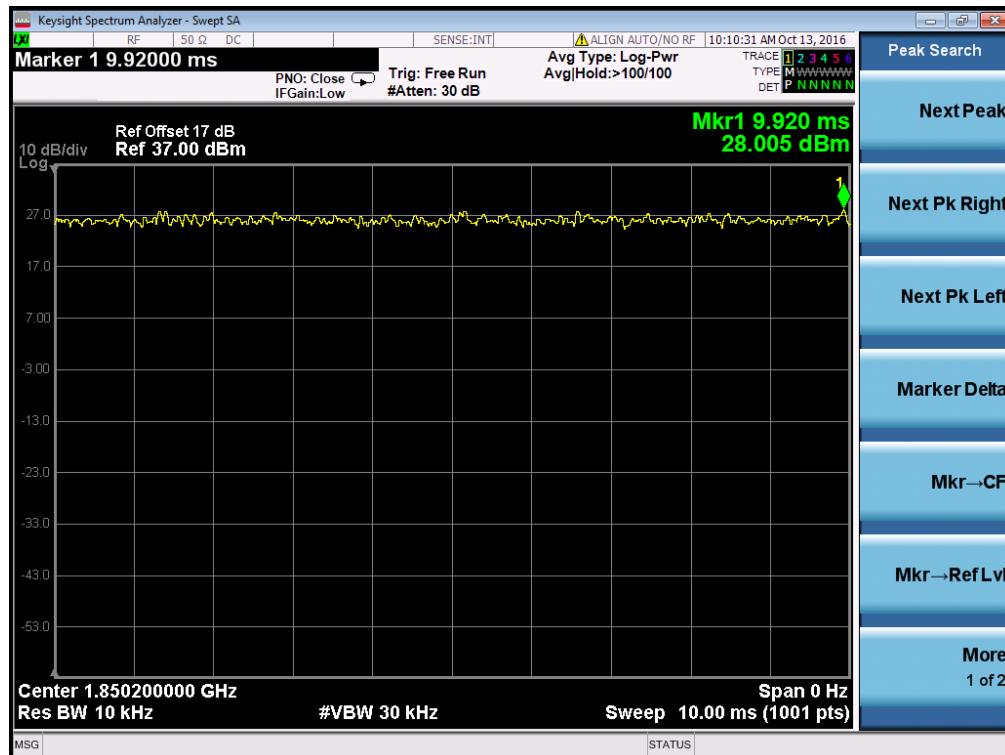
2.2.4 Test Setup



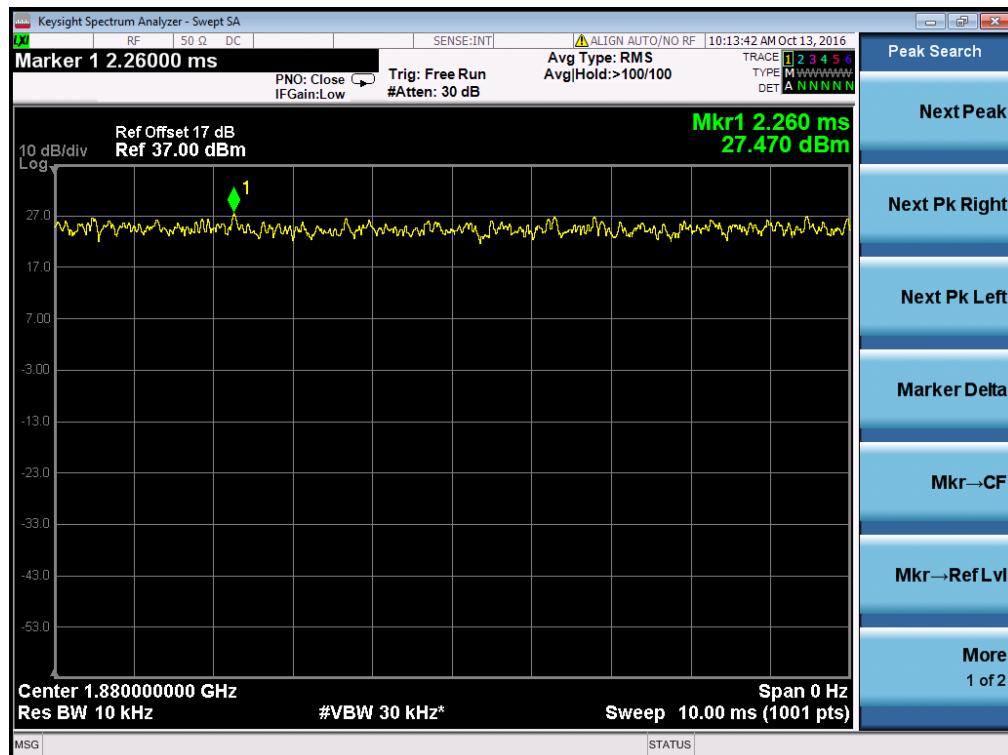
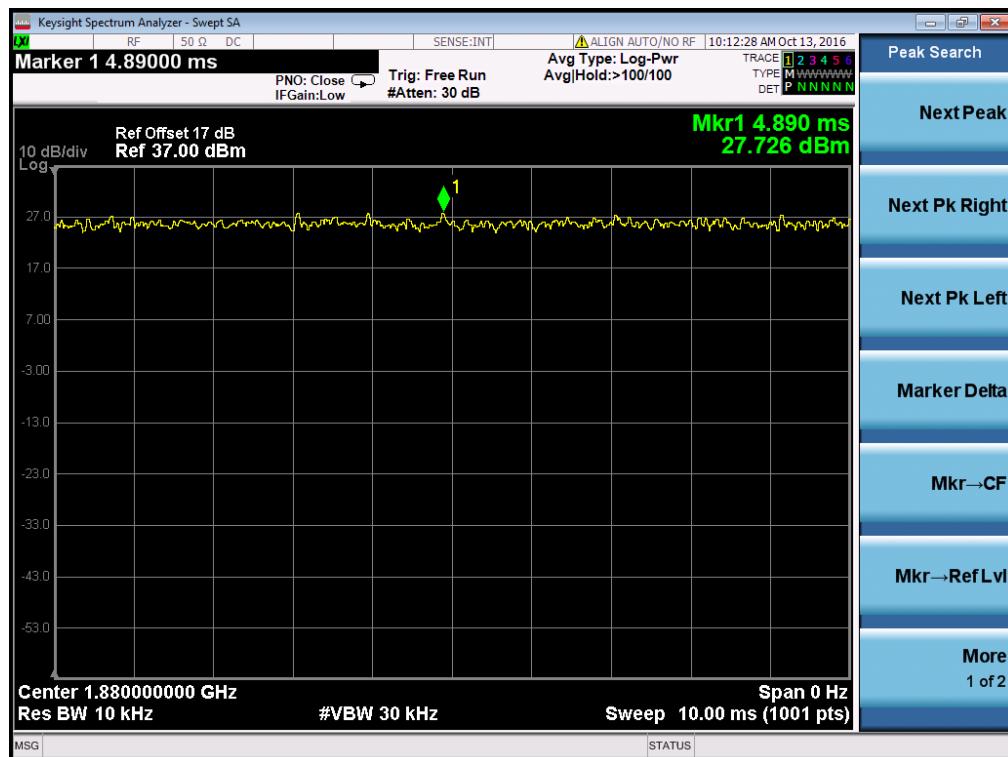
2.2.5 Test Results of Peak-to-Average Ratio

| Band | Channel | Frequency (MHz) | Peak to Average radio | | Limit dB | Verdict |
|------------------|---------|--------------------|-----------------------|---------------|-------------|---------|
| | | | dB | Refer to Plot | | |
| GPRS 1900MHz | 512 | 1850.2 | 0.977 | Plot A1 to A3 | 13 | PASS |
| | 661 | 1880.0 | 0.256 | | | PASS |
| | 810 | 1909.8 | 1.124 | | | PASS |
| EDGE 1900MHz | 512 | 1850.2 | 0.013 | Plot B1 to B3 | 13 | PASS |
| | 661 | 1880.0 | 0.021 | | | PASS |
| | 810 | 1909.8 | 0.033 | | | PASS |
| WCDMA 1900MHz | 9262 | 1852.4 | 5.97 | Plot C1 to C3 | 13 | PASS |
| | 9400 | 1880.0 | 5.96 | | | PASS |
| | 9538 | 1907.6 | 5.98 | | | PASS |

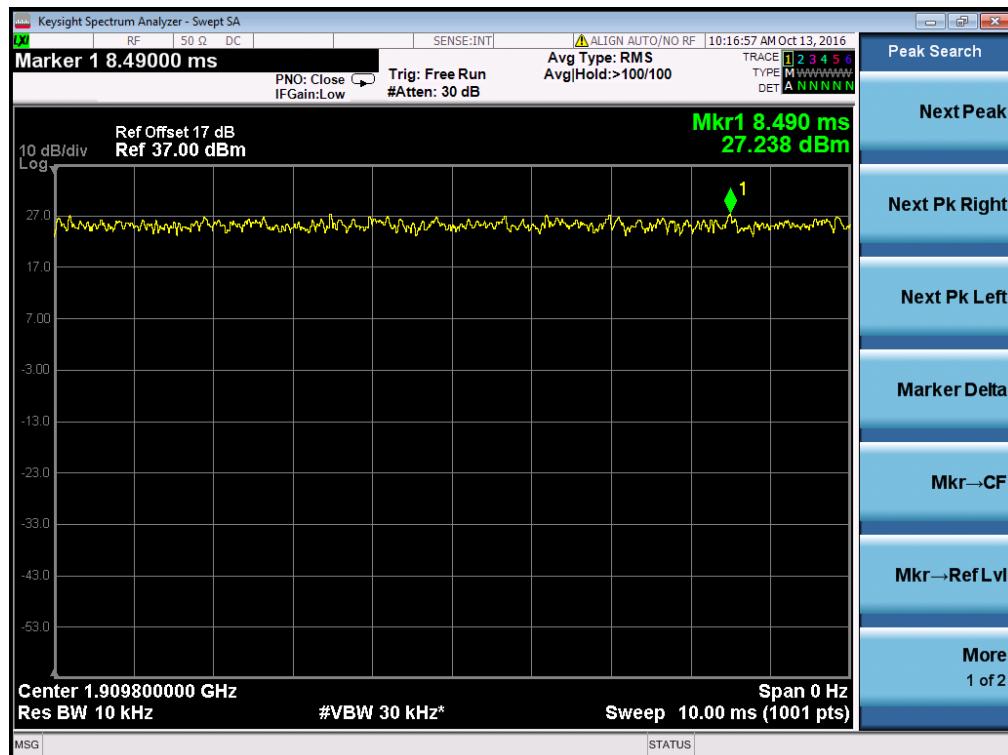
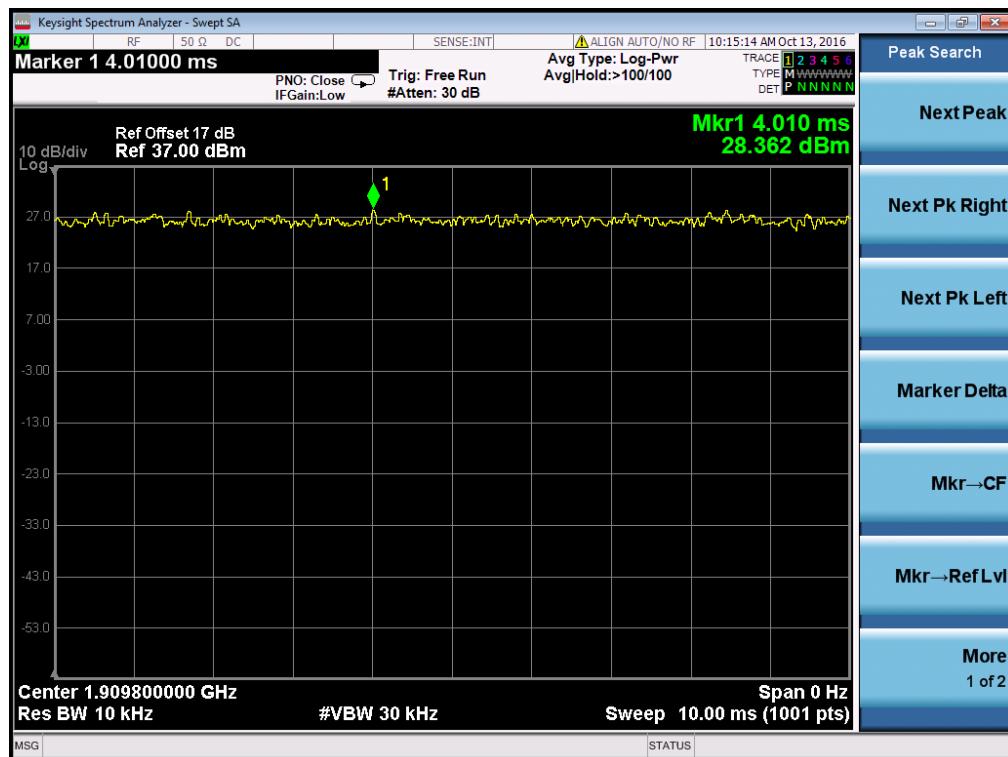
Test Results (Plots) of Peak-to-Average Ratio



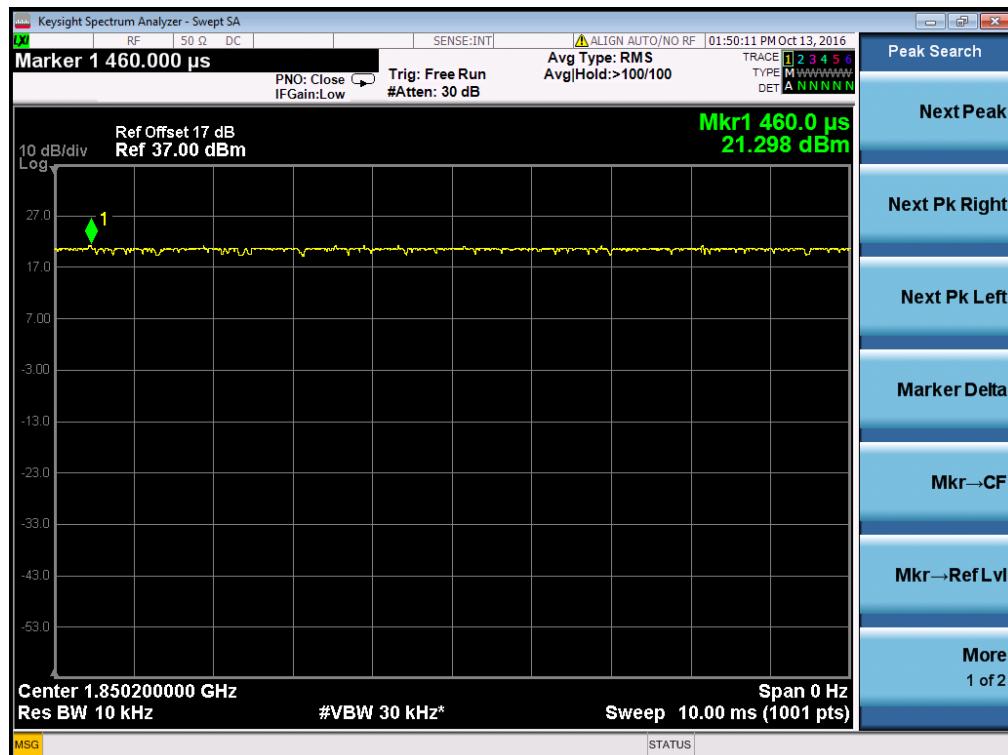
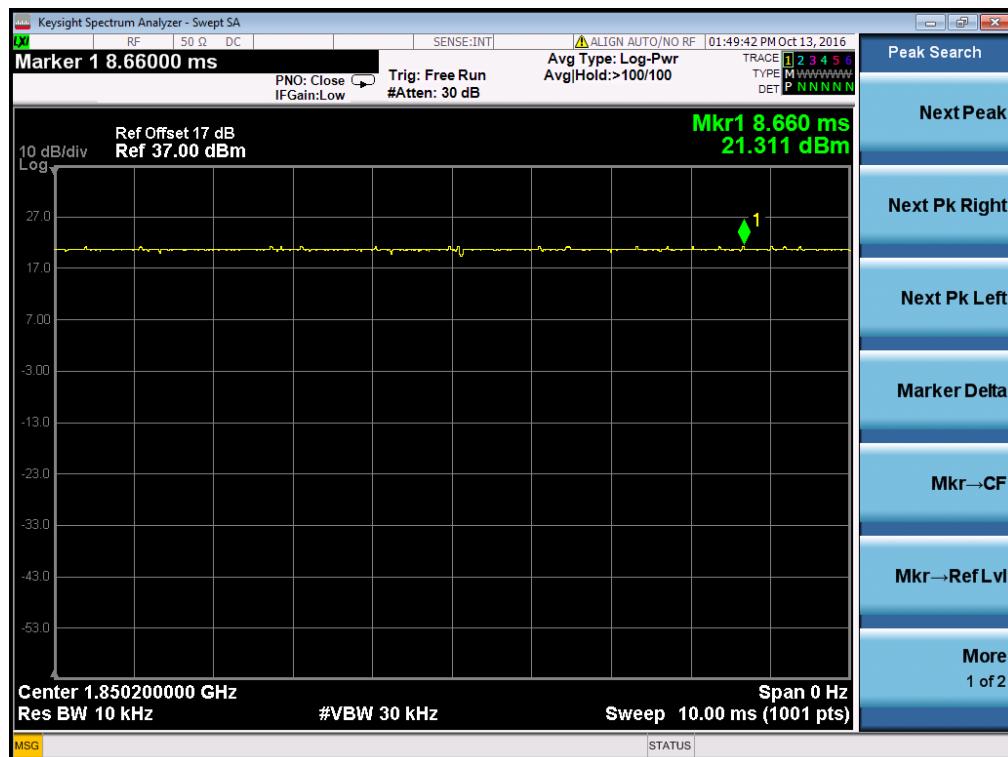
(Plot A1: GPRS 1900 MHz Channel = 512)



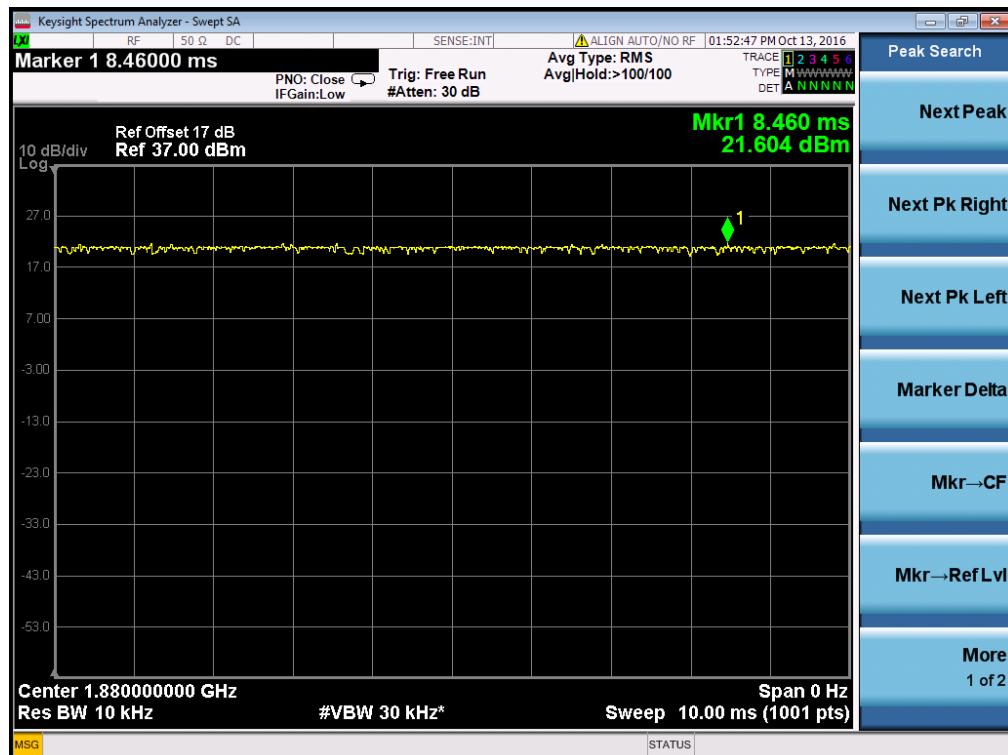
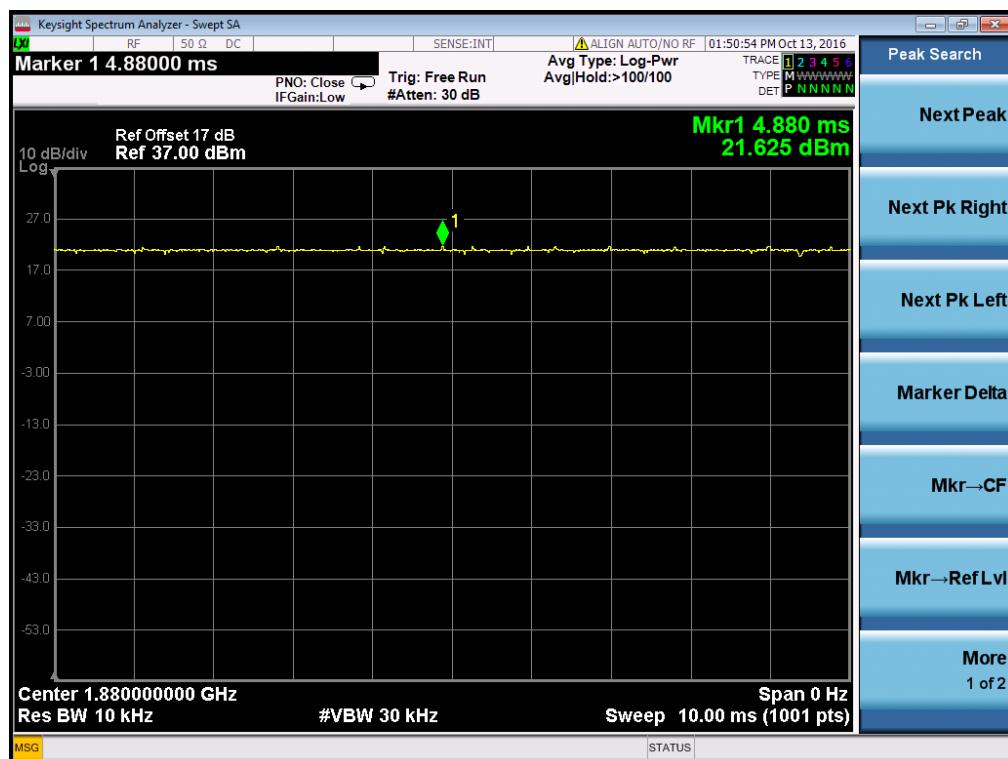
(Plot A2: GPRS 1900 MHz Channel = 661)



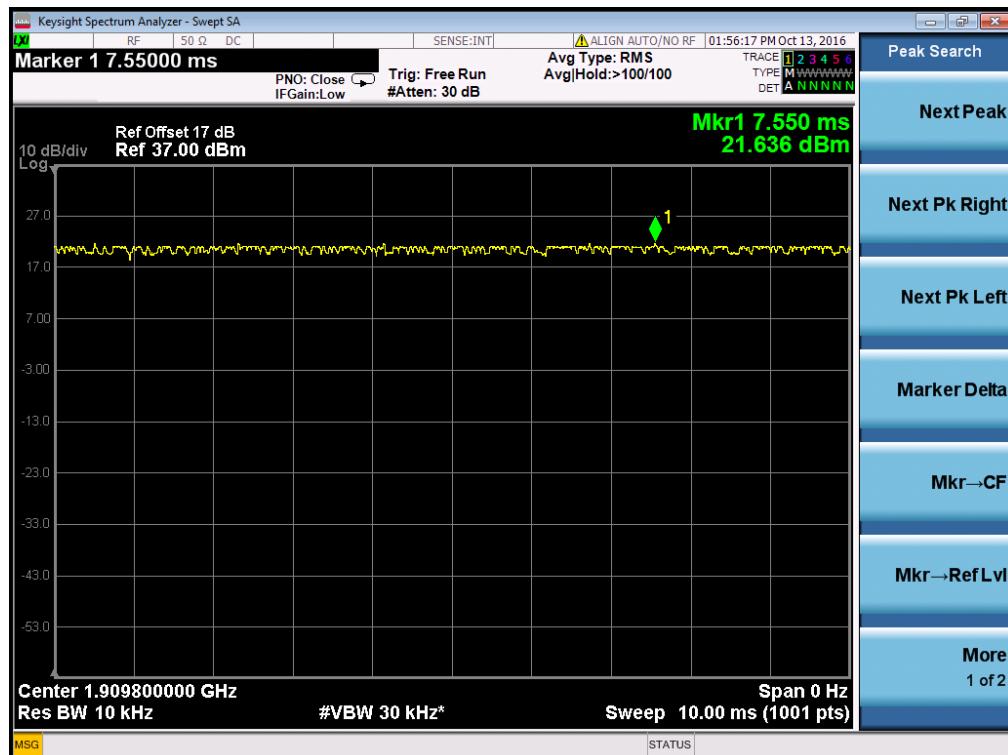
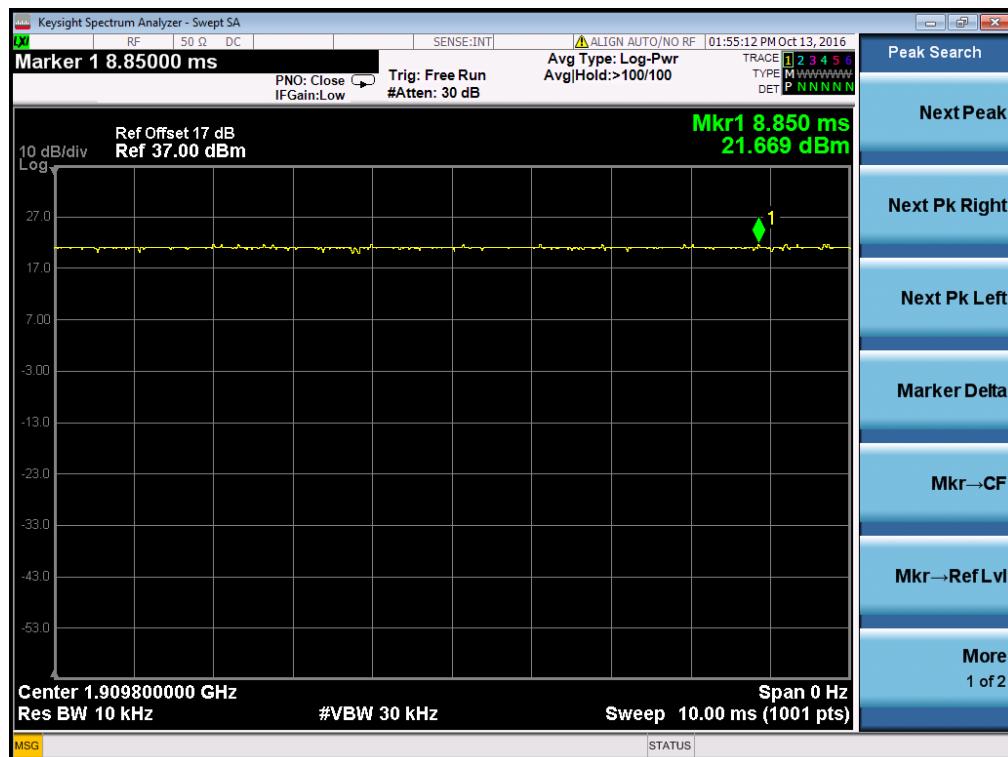
(Plot A3: GPRS 1900MHz Channel = 810)



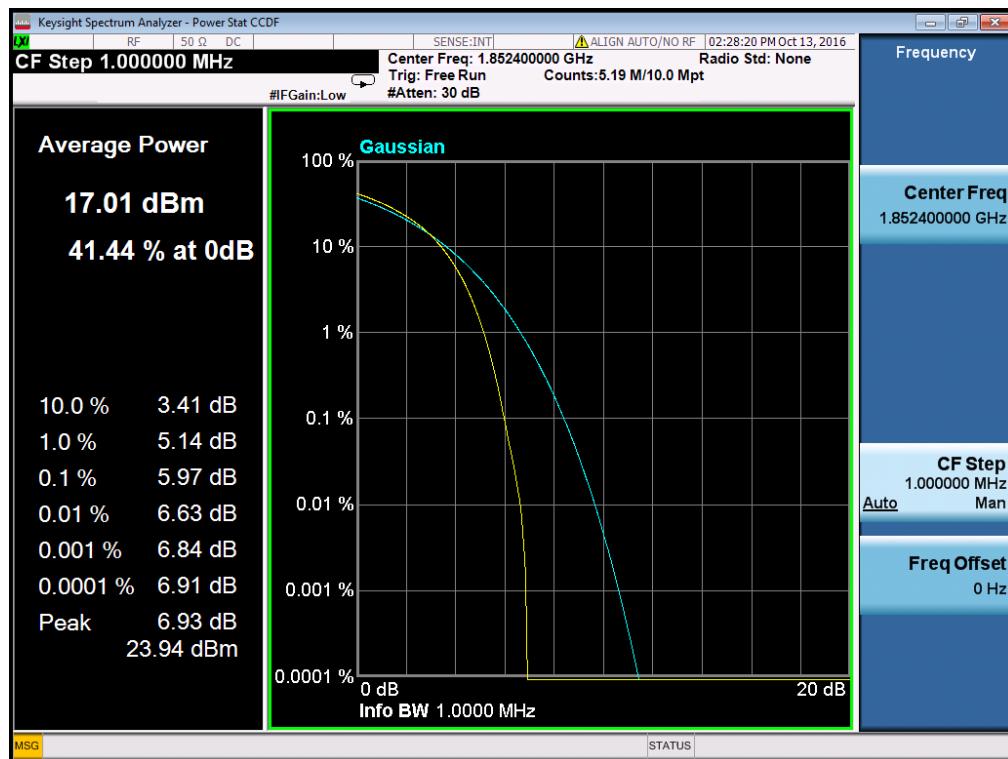
(Plot B1: EDGE 1900 MHz Channel = 512)



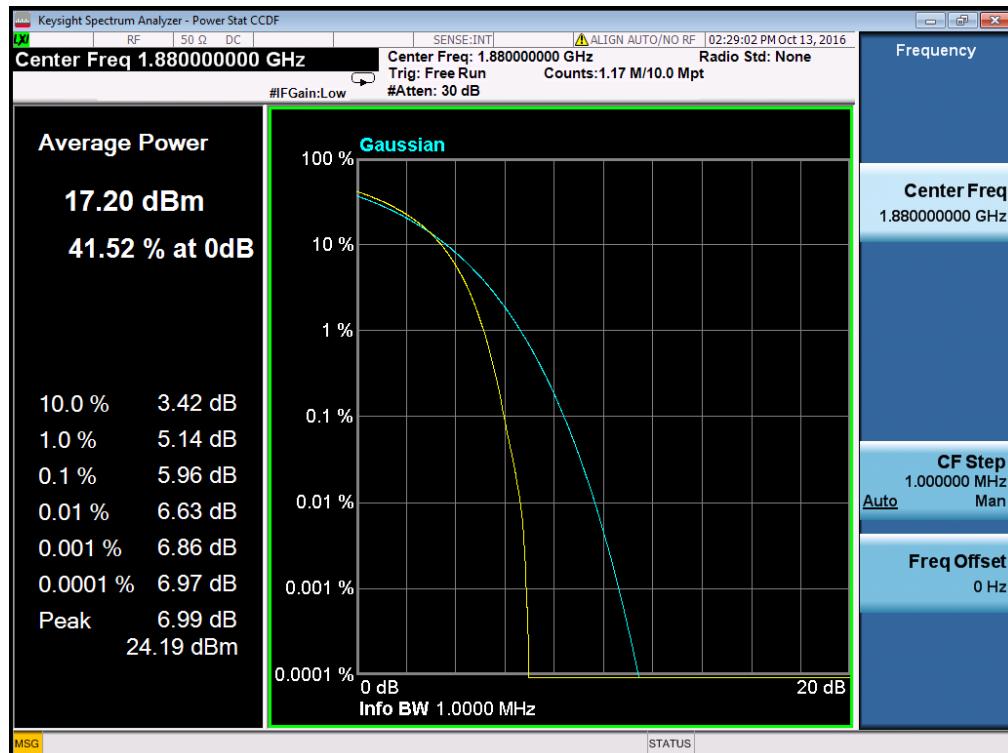
(Plot B2: EDGE 1900 MHz Channel = 661)



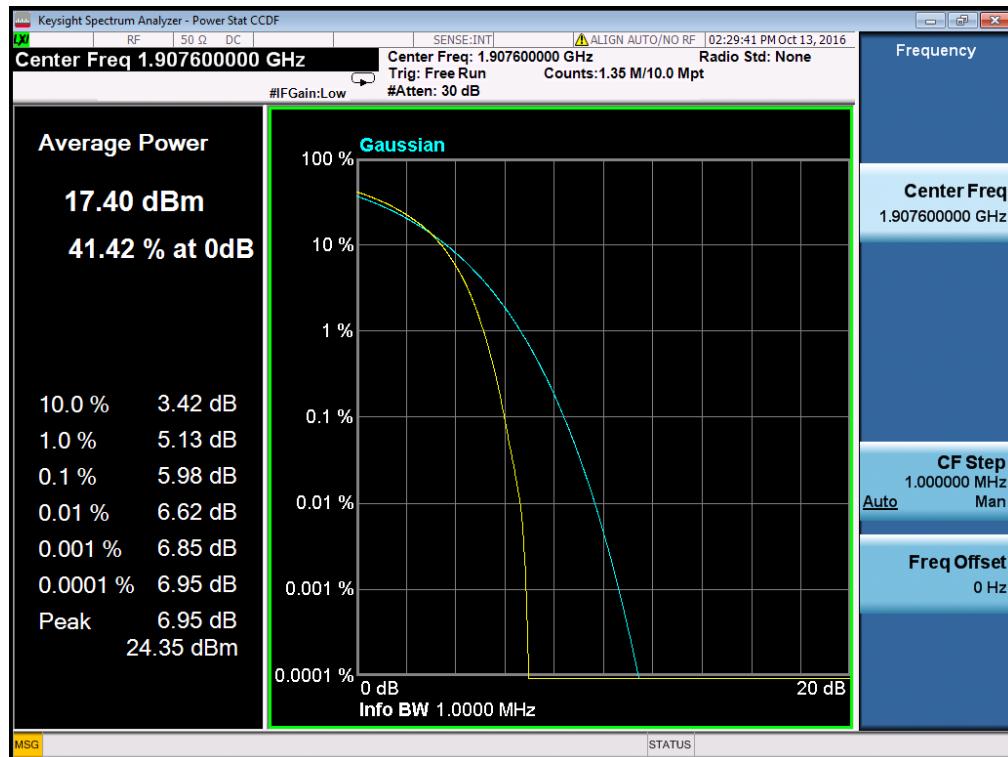
(Plot B3: EDGE 1900MHz Channel = 810)



(Plot C1: WCDMA 1900MHz Channel = 9262)



(Plot C2: WCDMA 1900MHz Channel = 9400)



(Plot C3: WCDMA 1900MHz Channel = 9538)

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

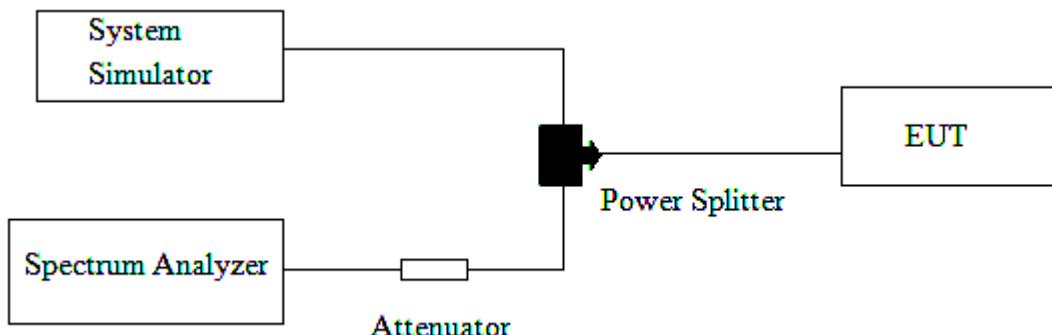
1. The testing follows FCC KDB 971168 D01v02r02 Section 4.2.
2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
3. The RF output of the EUT was connected to the spectrum analyzer by RF cable and attenuator.

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.

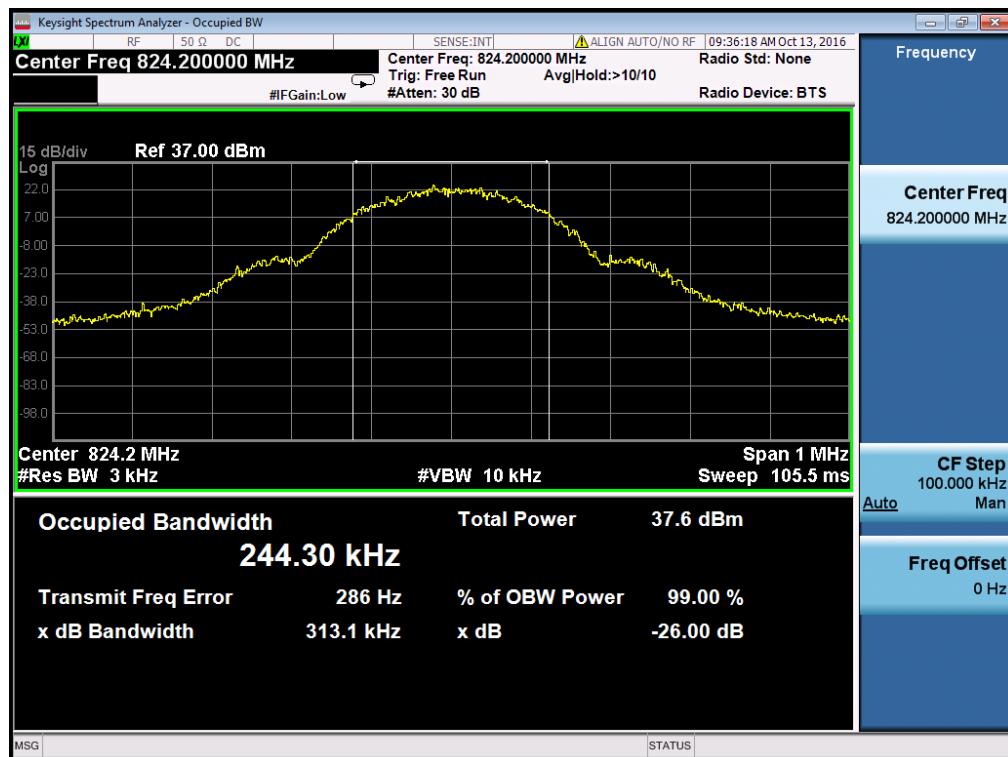
2.3.4 Test Setup



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

| Band | Channel | Frequency (MHz) | 26dB bandwidth | 99% Occupied Bandwidth | Refer to Plot |
|---------------|---------|-----------------|----------------|------------------------|---------------|
| GPRS 850MHz | 128 | 824.2 | 313 kHz | 244 kHz | Plot A1 |
| | 190 | 836.6 | 315 kHz | 244 kHz | Plot A2 |
| | 251 | 848.8 | 319 kHz | 248 kHz | Plot A3 |
| GPRS 1900MHz | 512 | 1850.2 | 312 kHz | 244 kHz | Plot B1 |
| | 661 | 1880.0 | 312 kHz | 246 kHz | Plot B2 |
| | 810 | 1909.8 | 312 kHz | 246 kHz | Plot B3 |
| EDGE 850MHz | 128 | 824.2 | 307 kHz | 243 kHz | Plot C1 |
| | 190 | 836.6 | 304 kHz | 246 kHz | Plot C2 |
| | 251 | 848.8 | 308 kHz | 242 kHz | Plot C3 |
| EDGE 1900MHz | 512 | 1850.2 | 317 kHz | 240 kHz | Plot D1 |
| | 661 | 1880.0 | 316 kHz | 240 kHz | Plot D2 |
| | 810 | 1909.8 | 317 kHz | 240 kHz | Plot D3 |
| WCDMA 850MHz | 4132 | 826.4 | 4.69 MHz | 4.12 MHz | Plot E1 |
| | 4183 | 836.6 | 4.68 MHz | 4.13 MHz | Plot E2 |
| | 4233 | 846.6 | 4.68 MHz | 4.13 MHz | Plot E3 |
| WCDMA 1900MHz | 9262 | 1852.4 | 4.74 MHz | 4.13 MHz | Plot F1 |
| | 9400 | 1880 | 4.73 MHz | 4.13 MHz | Plot F2 |
| | 9538 | 1907.6 | 4.73 MHz | 4.13 MHz | Plot F3 |

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



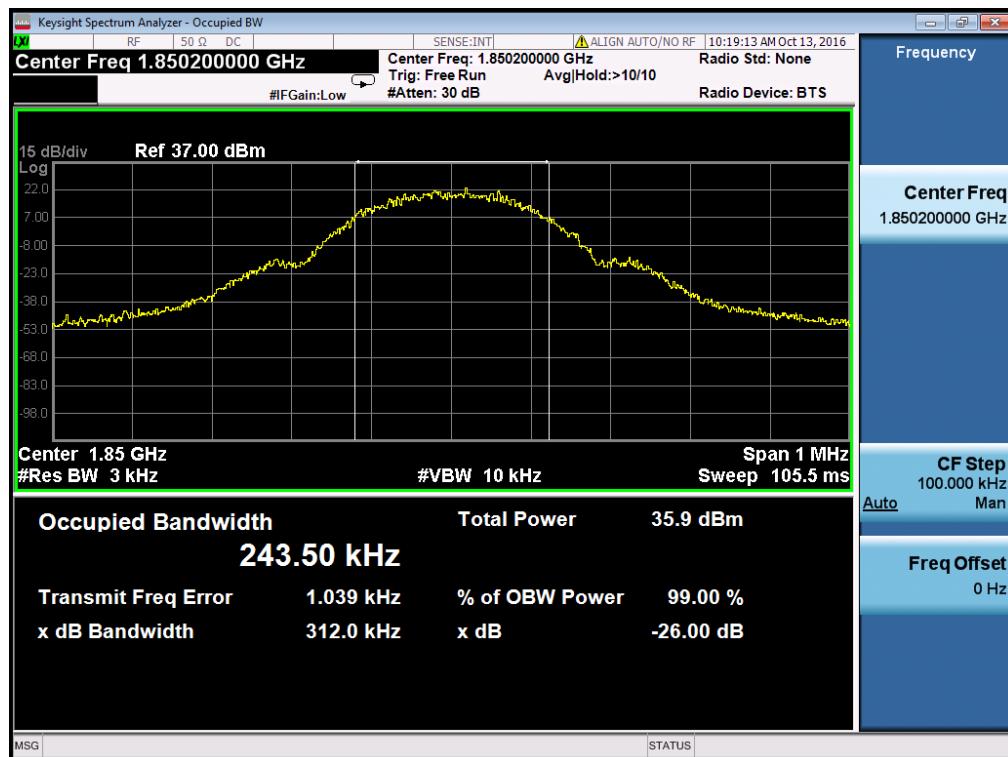
(Plot A1: GSM 850MHz Channel = 128 Occupied bandwidth)



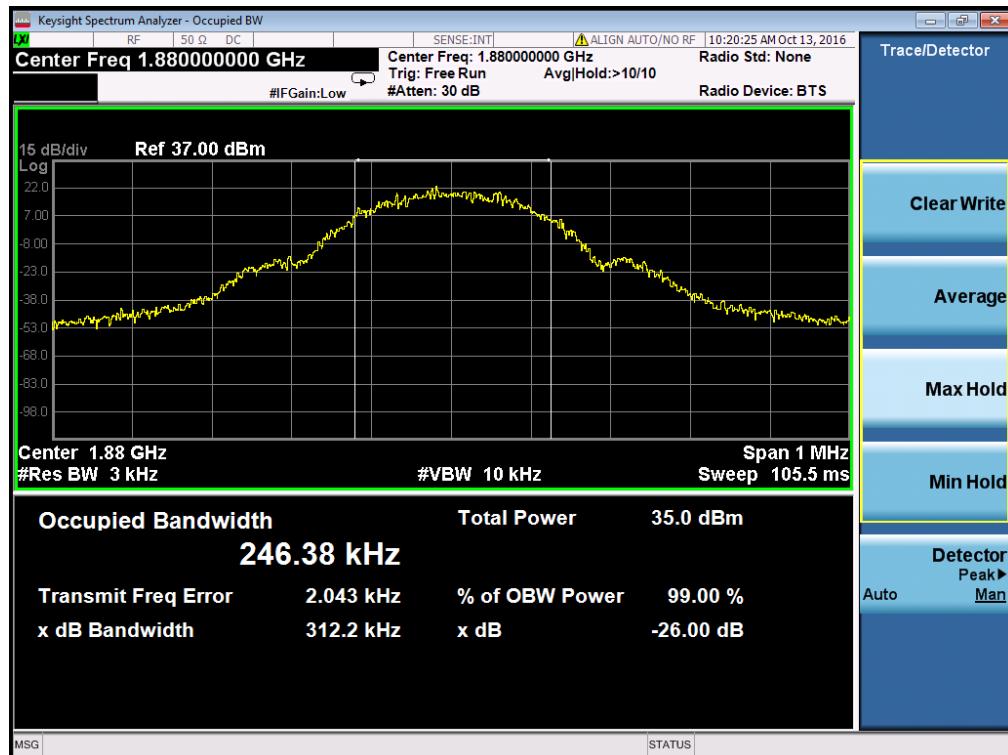
(Plot A2: GSM 850MHz Channel = 190 Occupied bandwidth)



(Plot A3: GSM 850MHz Channel = 251 Occupied bandwidth)



(Plot B1: GSM 1900MHz Channel = 512 Occupied bandwidth)



(Plot B2: GSM 1900MHz Channel = 661 Occupied bandwidth)



(Plot B3: GSM 1900MHz Channel = 810 Occupied bandwidth)



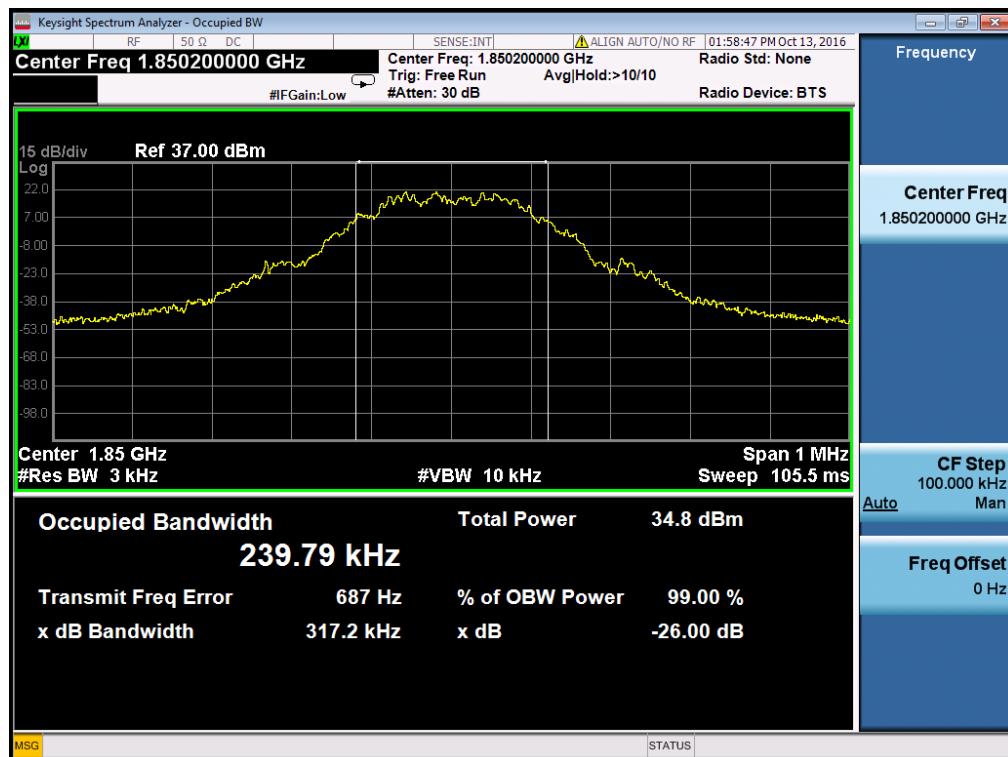
(Plot C1: EDGE 850MHz Channel = 128 Occupied bandwidth)



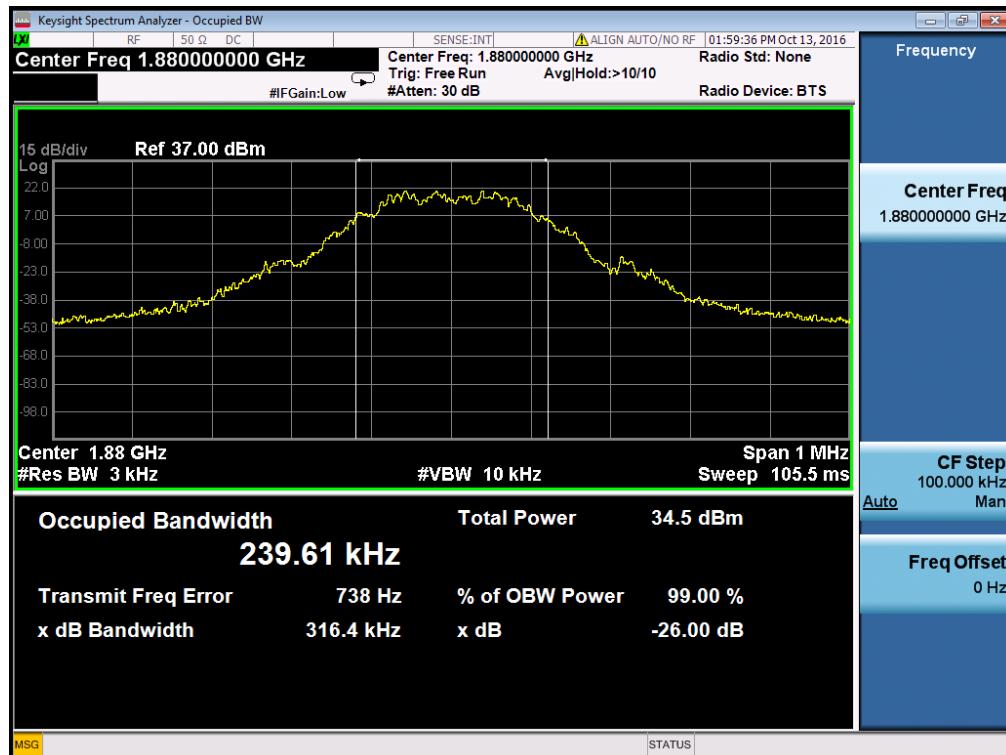
(Plot C2: EDGE 850MHz Channel = 190 Occupied bandwidth)



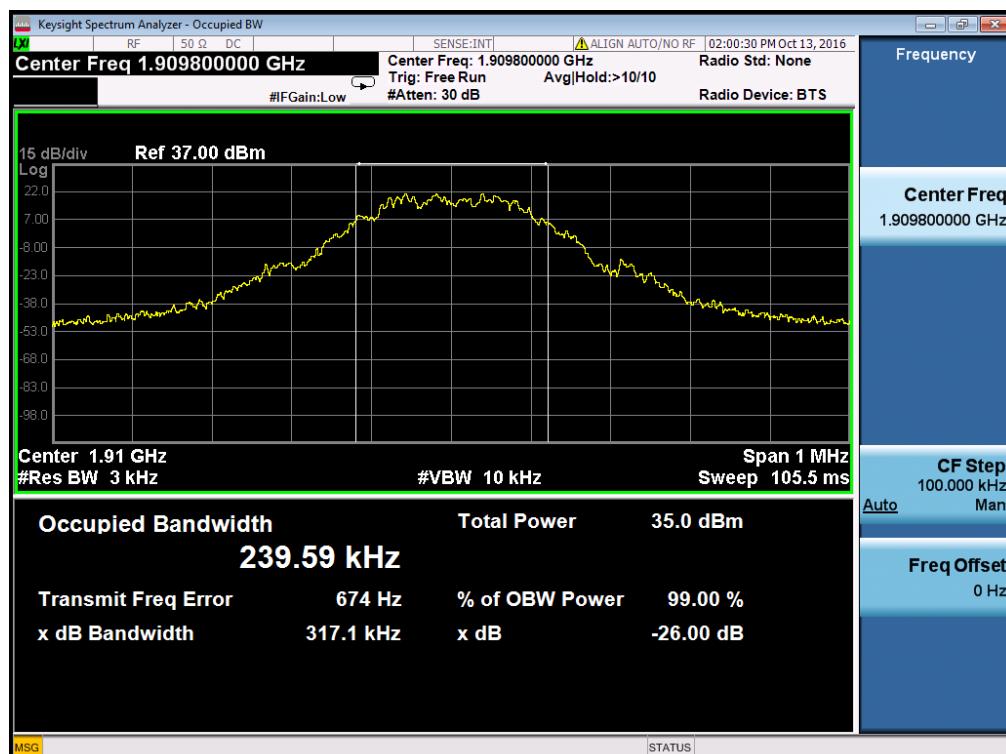
(Plot C3: EDGE 850MHz Channel = 251 Occupied bandwidth)



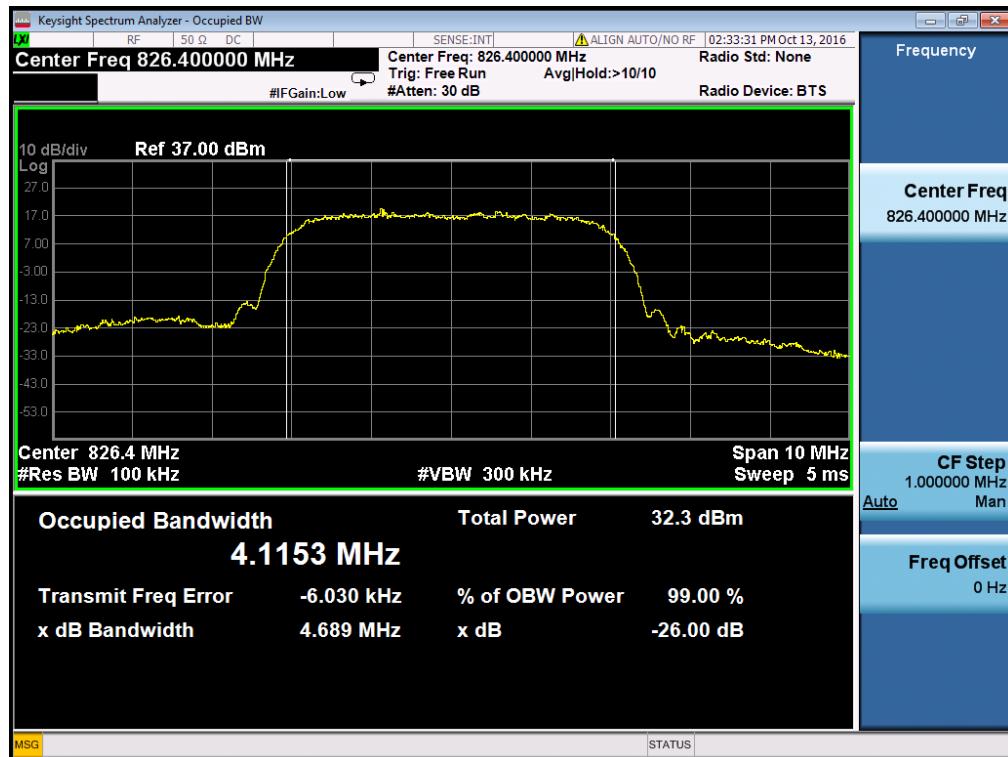
(Plot D1: EDGE 1900MHz Channel = 512 Occupied bandwidth)



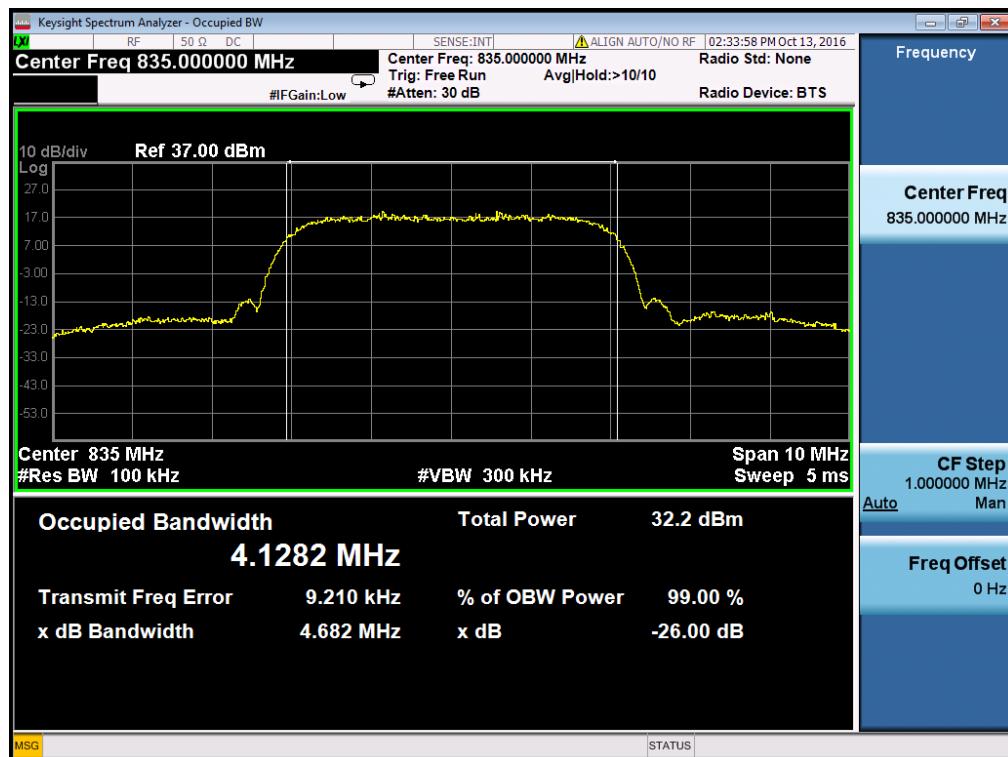
(Plot D2: EDGE 1900MHz Channel = 661 Occupied bandwidth)



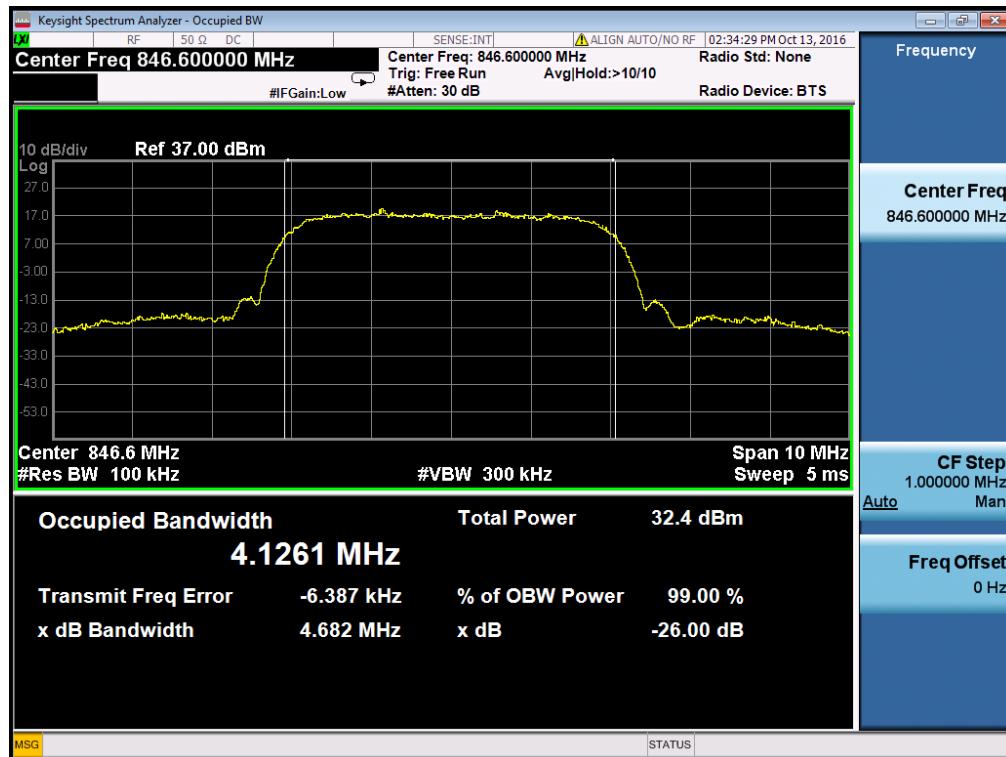
(Plot D3: EDGE 1900MHz Channel = 810 Occupied bandwidth)



(Plot E1: WCDMA 850MHz Channel = 4132 Occupied bandwidth)



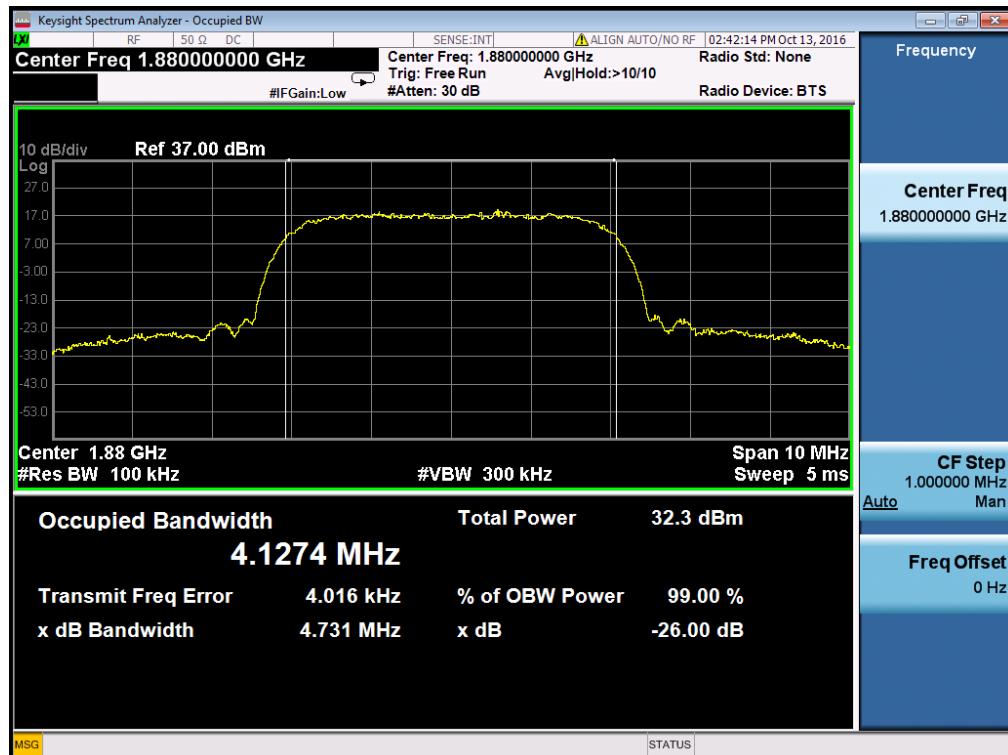
(Plot E2: WCDMA 850MHz Channel = 4183 Occupied bandwidth)



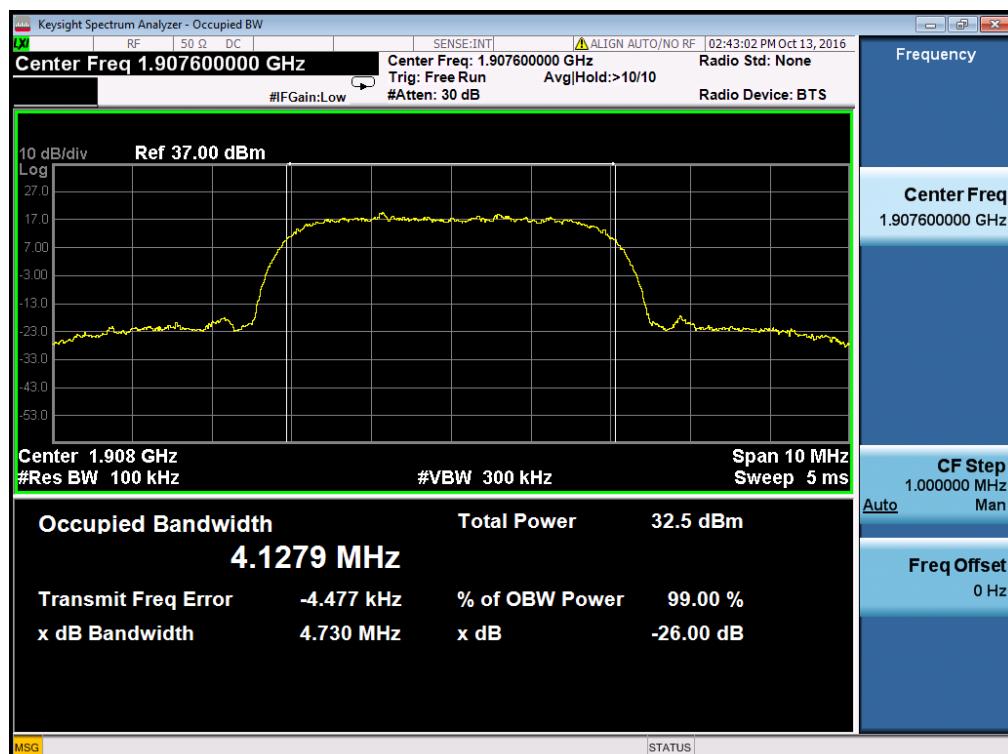
(Plot E3: WCDMA 850MHz Channel = 4233 Occupied bandwidth)



(Plot F1: WCDMA 1900MHz Channel = 9262 Occupied bandwidth)



(Plot F2: WCDMA 1900MHz Channel = 9400 Occupied bandwidth)



(Plot F3: WCDMA 1900MHz Channel = 9538 Occupied bandwidth)

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 $\pm 0.00025\%$ ($\pm 2.5\text{ppm}$) of the center frequency.

2.4.2 Measuring Instruments

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

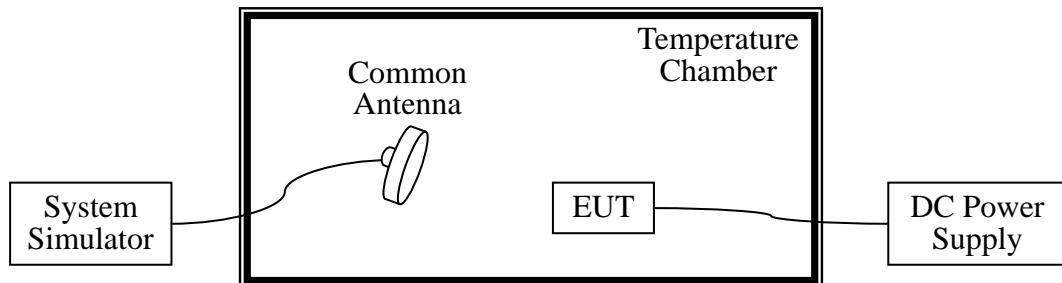
2.4.3 Test Procedures for Temperature Variation

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 $25\pm 5^\circ\text{C}$ 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.

2.4.5 Test Setup



2.4.6 Test Results of Frequency Stability

1. GSM 850MHz Band

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

| Power (VDC) | Temperature (°C) | GPRS | | EDGE | | Result |
|----------------|---------------------|--------------------|--------------------|--------------------|--------------------|--------|
| | | Freq. Dev. (Hz) | Deviation (ppm) | Freq. Dev. (Hz) | Deviation (ppm) | |
| 3.7 | -30 | 19 | 0.02 | 10 | 0.01 | PASS |
| | -20 | 22 | 0.02 | 23 | 0.02 | |
| | -10 | 28 | 0.03 | 18 | 0.02 | |
| | 0 | 12 | 0.01 | 9 | 0.01 | |
| | +10 | 10 | 0.01 | 28 | 0.03 | |
| | +20 | 21 | 0.02 | 22 | 0.02 | |
| | +30 | 18 | 0.02 | 11 | 0.01 | |
| | +40 | 27 | 0.03 | 27 | 0.03 | |
| | +50 | 9 | 0.01 | 13 | 0.01 | |
| | 4.2 | 12 | 0.01 | 29 | 0.03 | |
| 3.5 | +25 | 29 | 0.03 | 20 | 0.02 | |

2. GSM 1900MHz Band

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

| Power (VDC) | Temperature (°C) | GPRS | | EDGE | | Result |
|----------------|---------------------|--------------------|--------------------|--------------------|--------------------|--------|
| | | Freq. Dev. (Hz) | Deviation (ppm) | Freq. Dev. (Hz) | Deviation (ppm) | |
| 3.7 | -30 | 24 | 0.01 | 39 | 0.02 | PASS |
| | -20 | 45 | 0.02 | 21 | 0.01 | |
| | -10 | 22 | 0.01 | 42 | 0.02 | |
| | 0 | 59 | 0.03 | 55 | 0.03 | |
| | +10 | 41 | 0.02 | 44 | 0.02 | |
| | +20 | 24 | 0.01 | 27 | 0.01 | |
| | +30 | 48 | 0.02 | 58 | 0.03 | |
| | +40 | 61 | 0.03 | 26 | 0.01 | |
| | +50 | 28 | 0.01 | 57 | 0.03 | |
| 4.2 | +25 | 57 | 0.03 | 41 | 0.02 | |
| 3.5 | +25 | 55 | 0.03 | 59 | 0.03 | |

3. WCDMA 850MHz Band

| | | | |
|-------------|--------------|------------|----------|
| Band: | WCDMA Band V | Channel: | 4183 |
| Limit(ppm): | 2.5 | Frequency: | 836.6MHz |

| Power (VDC) | Temperature (°C) | RMC 12.2Kbps | | Result |
|----------------|---------------------|--------------------|--------------------|--------|
| | | Freq. Dev. (Hz) | Deviation (ppm) | |
| 3.7 | -30 | 7 | 0.01 | PASS |
| | -20 | 18 | 0.02 | |
| | -10 | 25 | 0.03 | |
| | 0 | 14 | 0.02 | |
| | +10 | 8 | 0.01 | |
| | +20 | 10 | 0.01 | |
| | +30 | 19 | 0.02 | |
| | +40 | 13 | 0.01 | |
| | +50 | 28 | 0.03 | |
| 4.2 | +25 | 19 | 0.02 | |
| 3.5 | +25 | 26 | 0.03 | |

4. WCDMA 1900MHz Band

| | | | |
|-------------|---------------|------------|-----------|
| Band: | WCDMA Band II | Channel: | 9400 |
| Limit(ppm): | 2.5 | Frequency: | 1880.0MHz |

| Power (VDC) | Temperature (°C) | RMC 12.2Kbps | | Result |
|----------------|---------------------|--------------------|--------------------|--------|
| | | Freq. Dev. (Hz) | Deviation (ppm) | |
| 3.7 | -30 | 58 | 0.03 | PASS |
| | -20 | 34 | 0.02 | |
| | -10 | 23 | 0.01 | |
| | 0 | 16 | 0.01 | |
| | +10 | 41 | 0.02 | |
| | +20 | 24 | 0.01 | |
| | +30 | 61 | 0.03 | |
| | +40 | 35 | 0.02 | |
| | +50 | 14 | 0.01 | |
| 4.2 | +25 | 55 | 0.03 | |
| 3.5 | +25 | 31 | 0.02 | |

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.

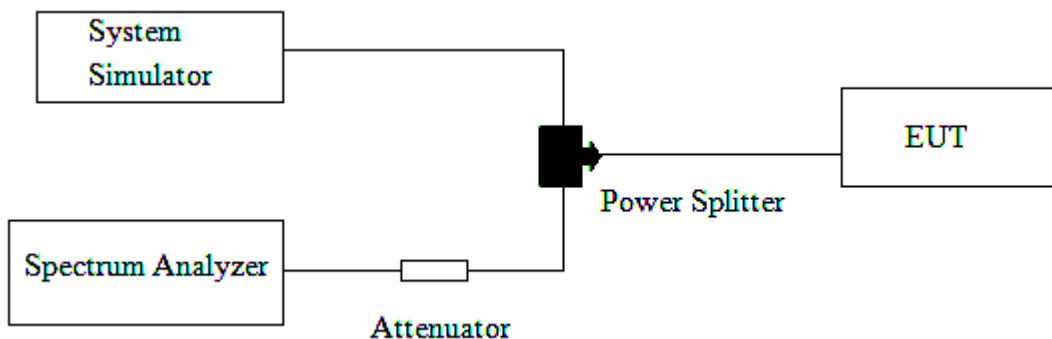
2.5.2 Measuring Instruments

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

2.5.3 Test Procedures

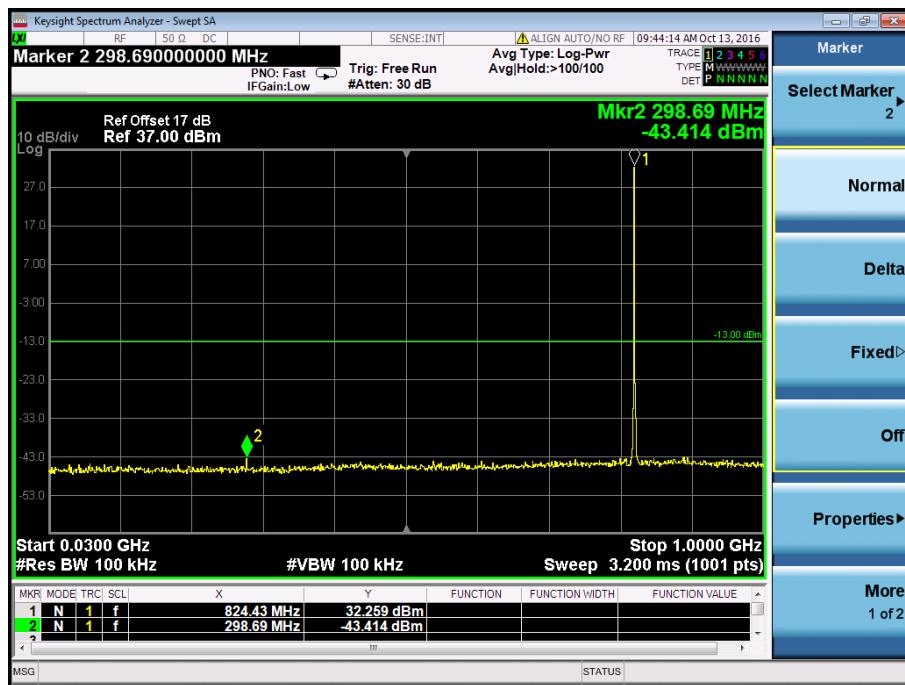
1. The testing follows FCC KDB 971168 D01v02r02 Section 6.0.
2. The EUT was connected to the spectrum analyzer and system simulator via a power divider.
3. The RF output of EUT was connected to the spectrum analyzer by an RF cable and attenuator. The path loss was compensated to the results for each 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 $43 + 10\log(P)$ dB below the transmitter power P(Watts)
$$= P(W) - [43 + 10\log(P)] \text{ (dB)}$$
$$= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$$
$$= -13 \text{ dBm.}$$
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.

2.5.4 Test Setup

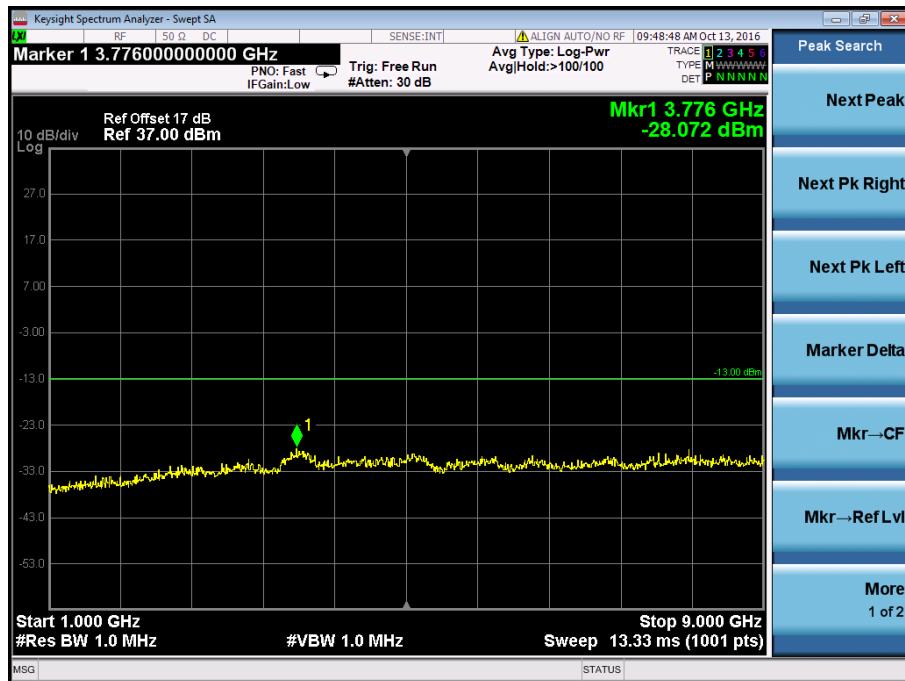


2.5.5 Test Result (Plots) of Conducted Spurious Emission

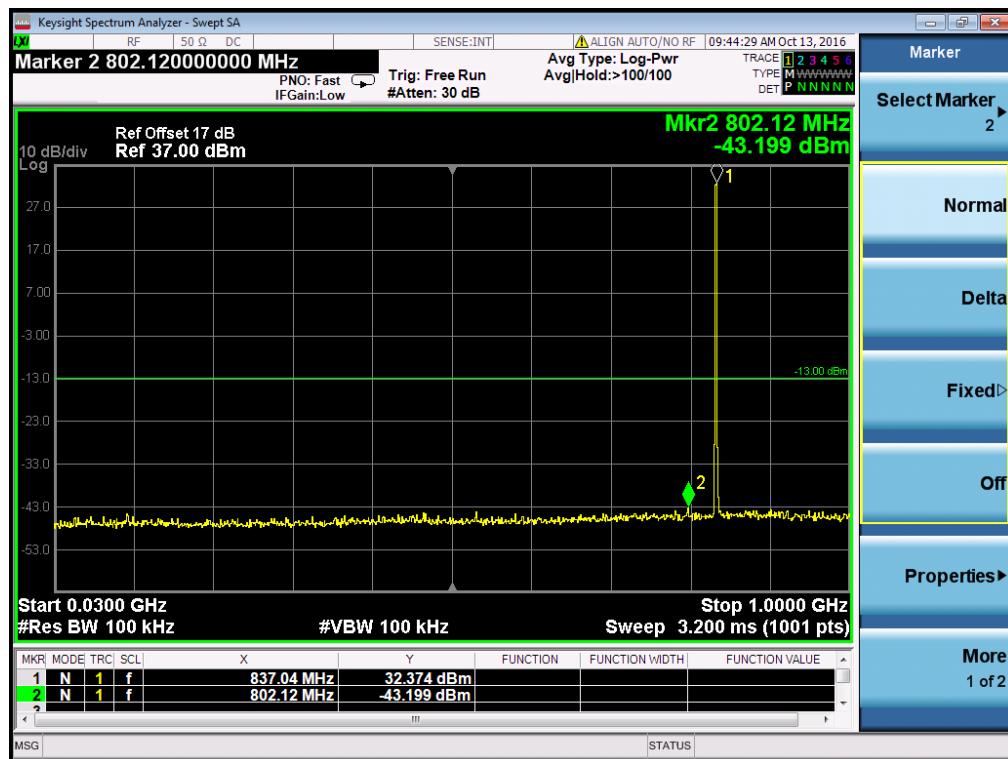
Note: For 9 KHz to 30MHz: the amplitude of spurious emissions is attenuated by more than 20dB below the permissible value, so we not provide the test result here.



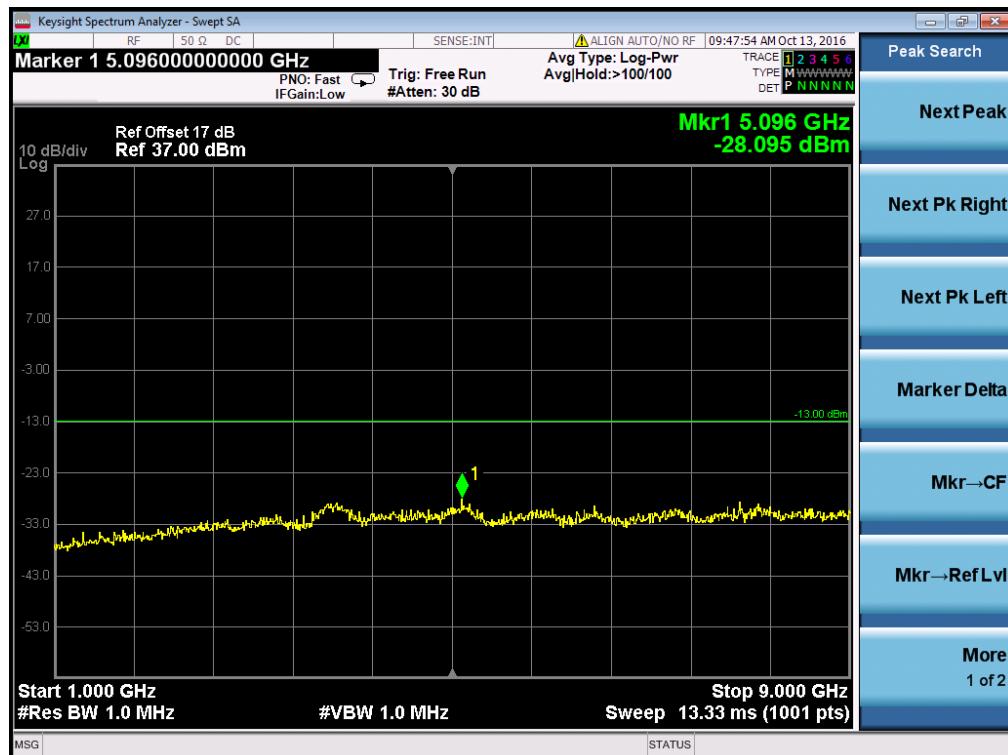
GSM 850MHz Channel = 128, 30MHz to 1GHz



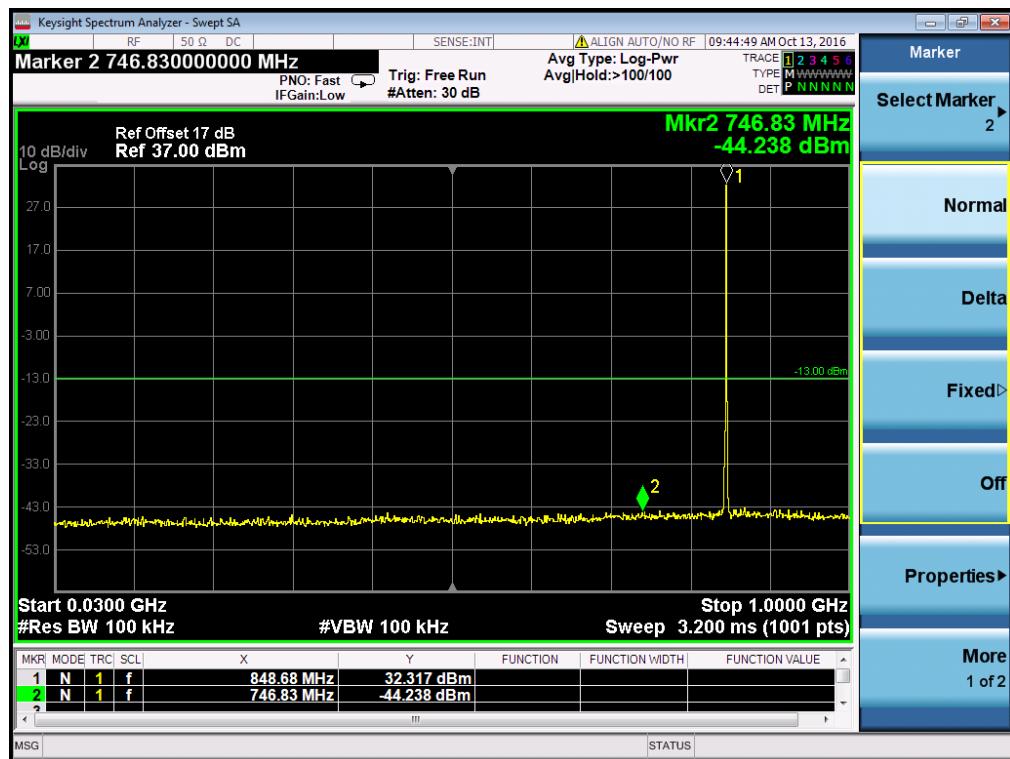
GSM 850MHz Channel = 128, 1GHz to 9GHz



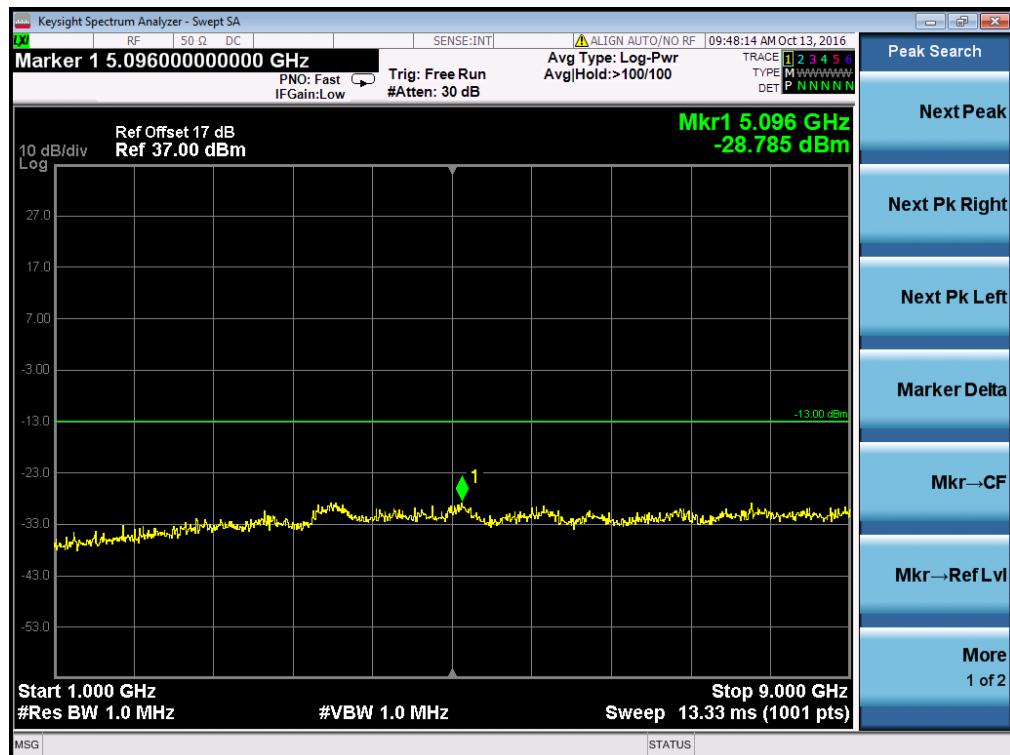
GSM 850MHz Channel = 190, 30MHz to 1GHz



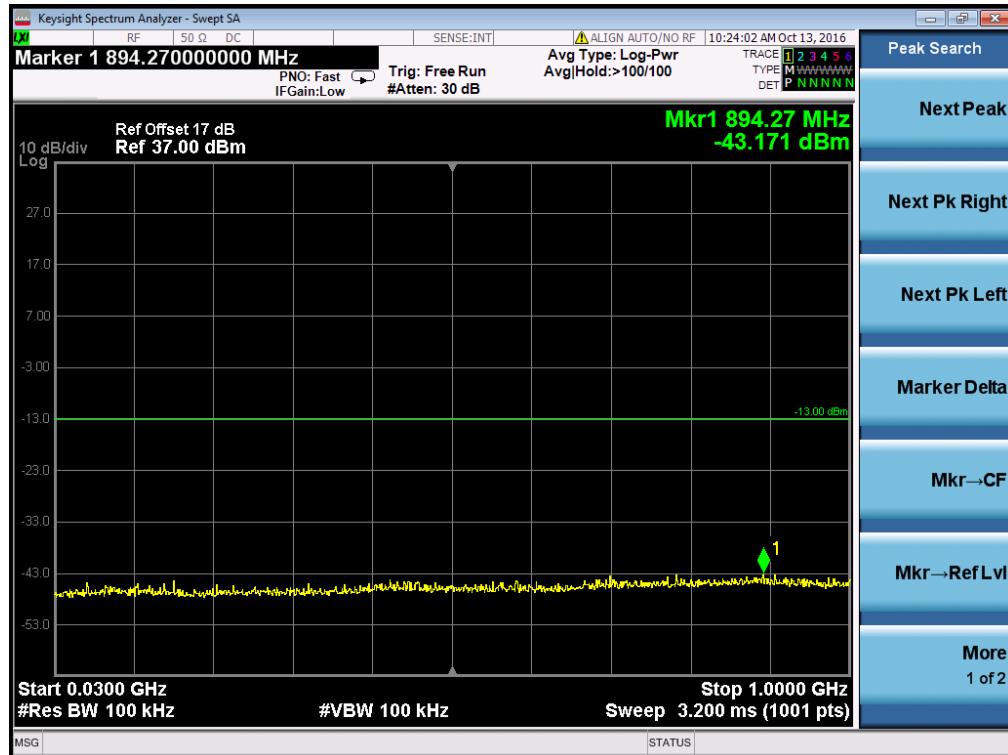
GSM 850MHz Channel = 190, 1GHz to 9GHz



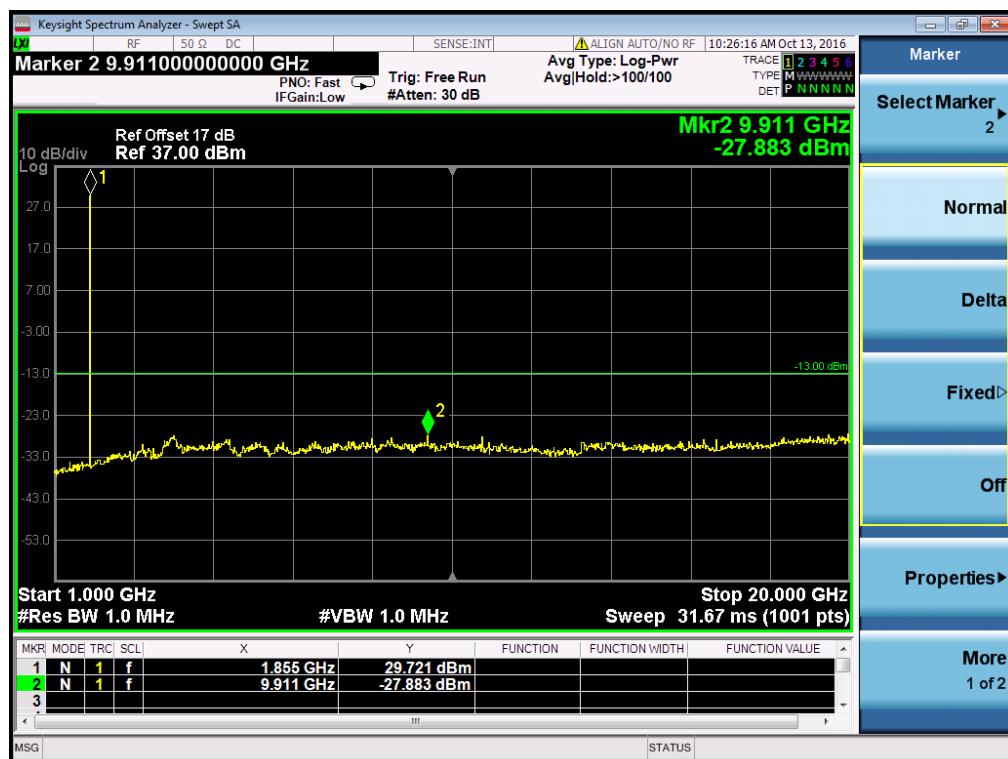
GSM 850MHz Channel = 251, 30MHz to 1GHz



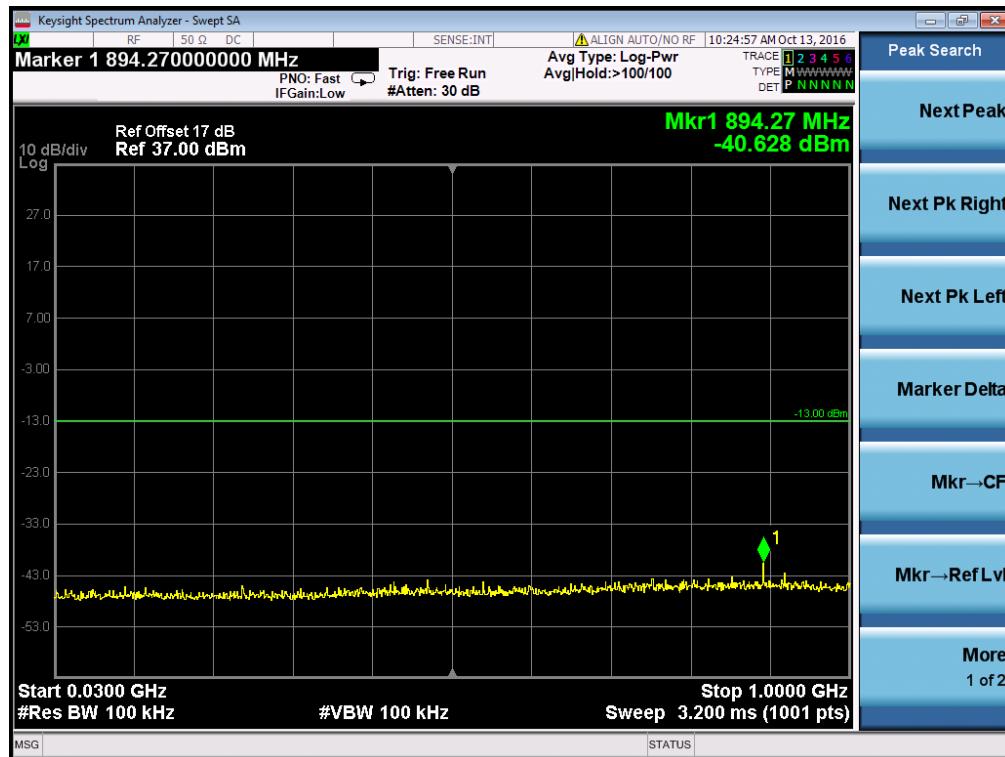
GSM 850MHz Channel = 251, 1GHz to 9GHz



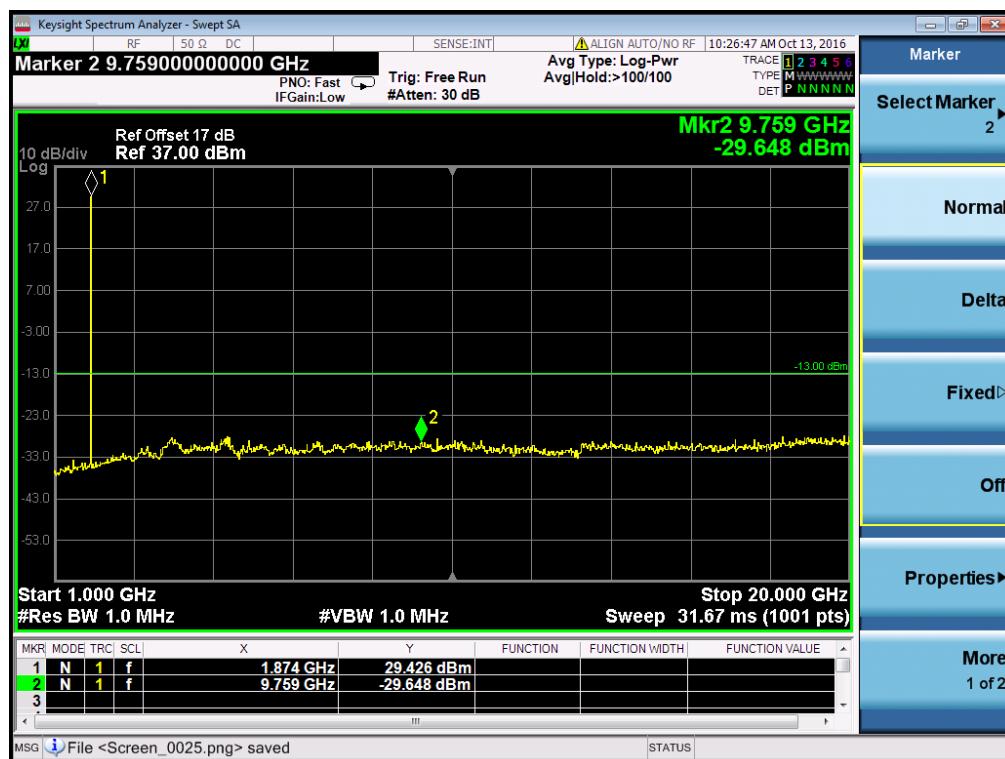
GSM 1900MHz Channel = 512, 30MHz to 1GHz



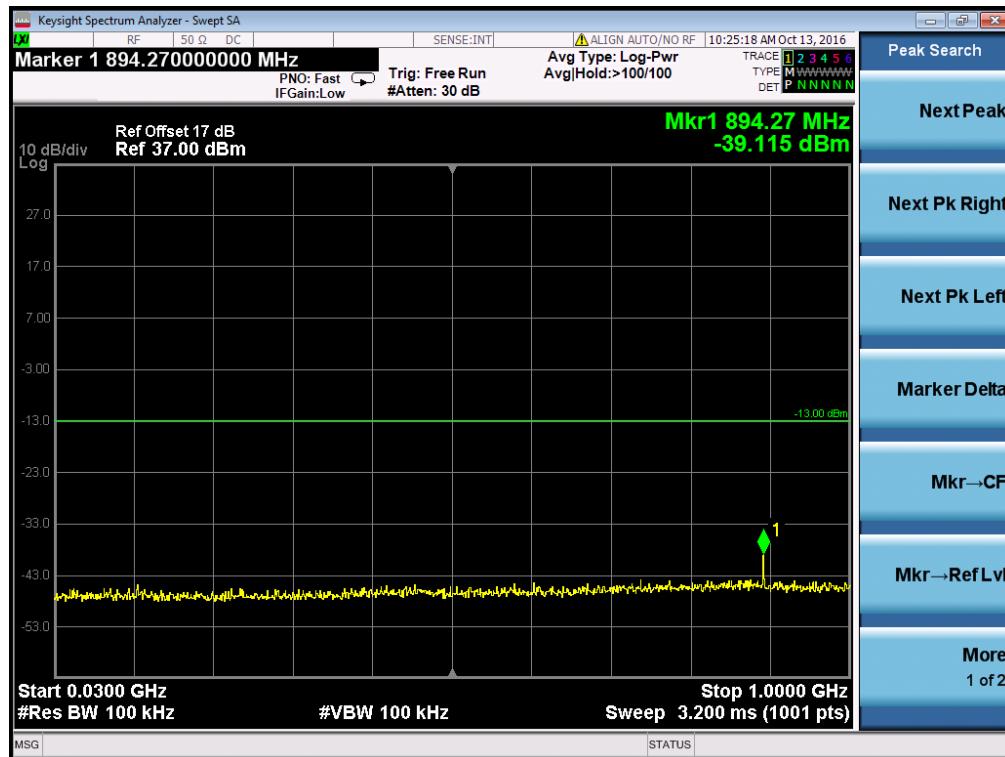
GSM 1900MHz Channel = 512, 1GHz to 20GHz



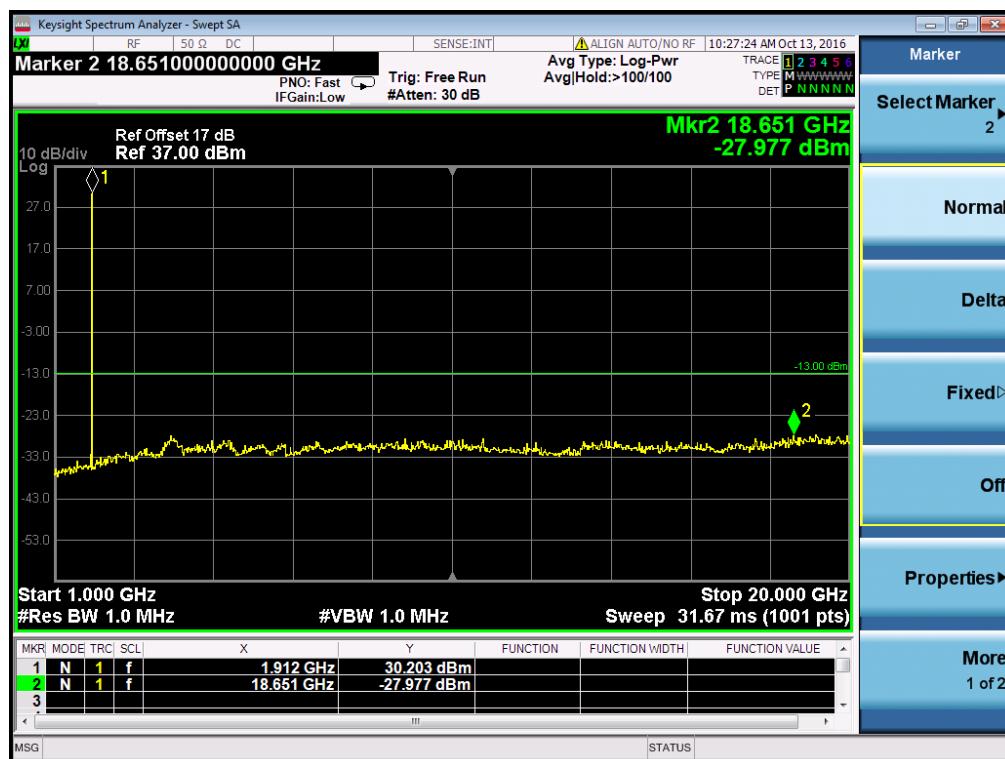
GSM 1900MHz Channel = 661, 30MHz to 1GHz



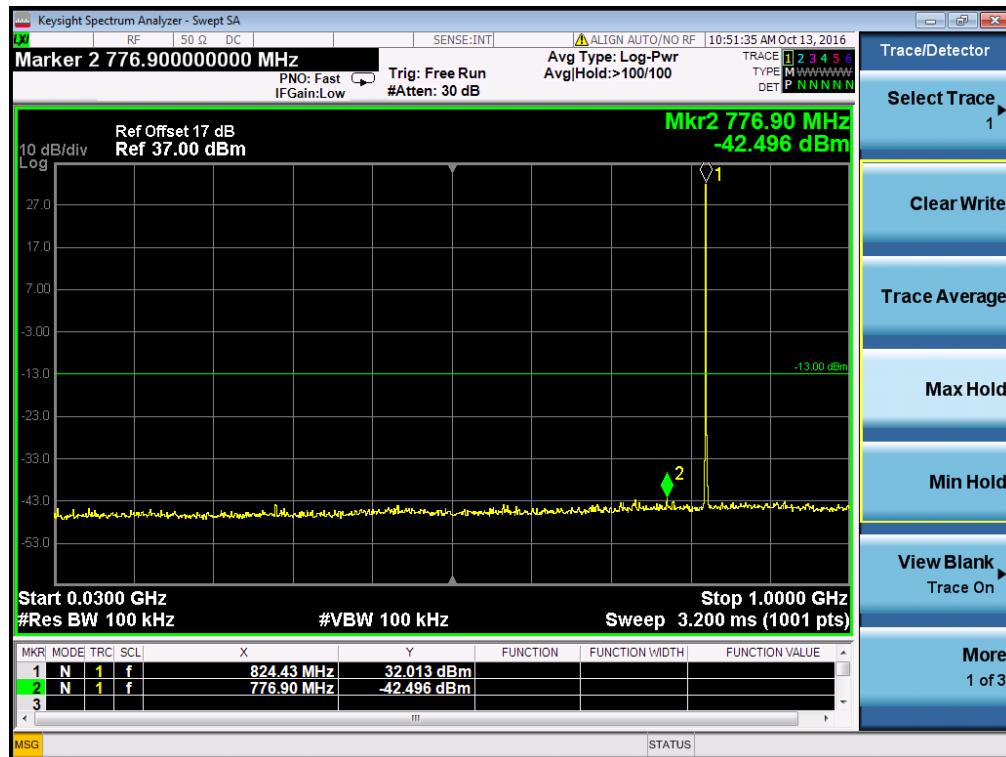
GSM 1900MHz Channel = 661, 1GHz to 20GHz



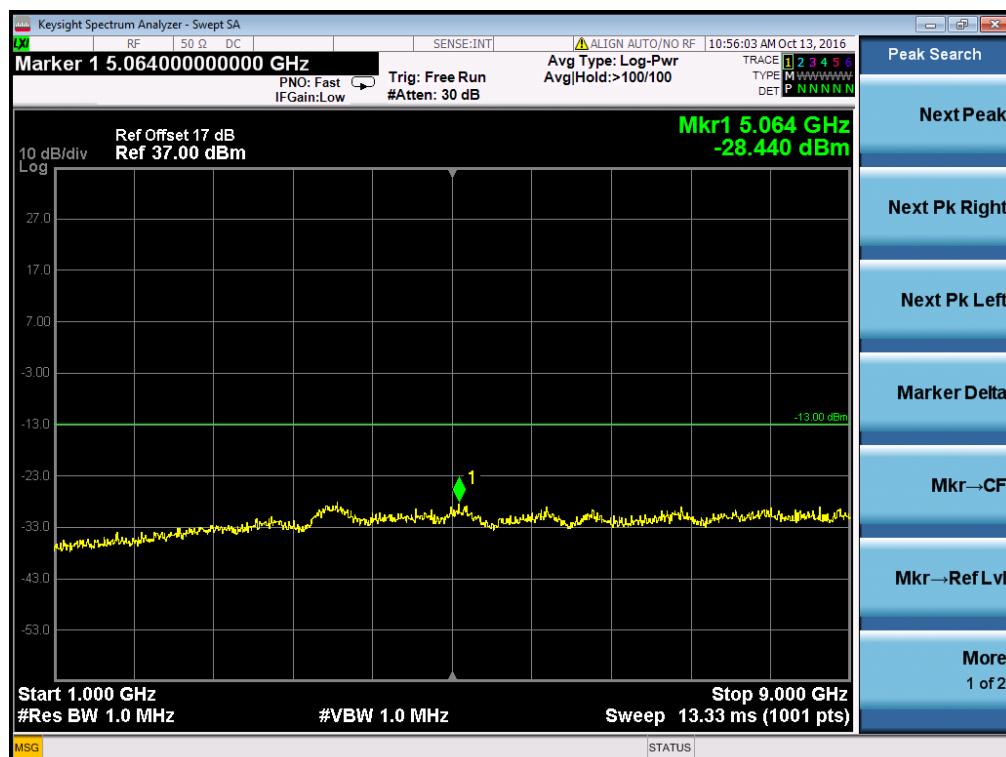
GSM 1900MHz Channel = 810, 30MHz to 1GHz



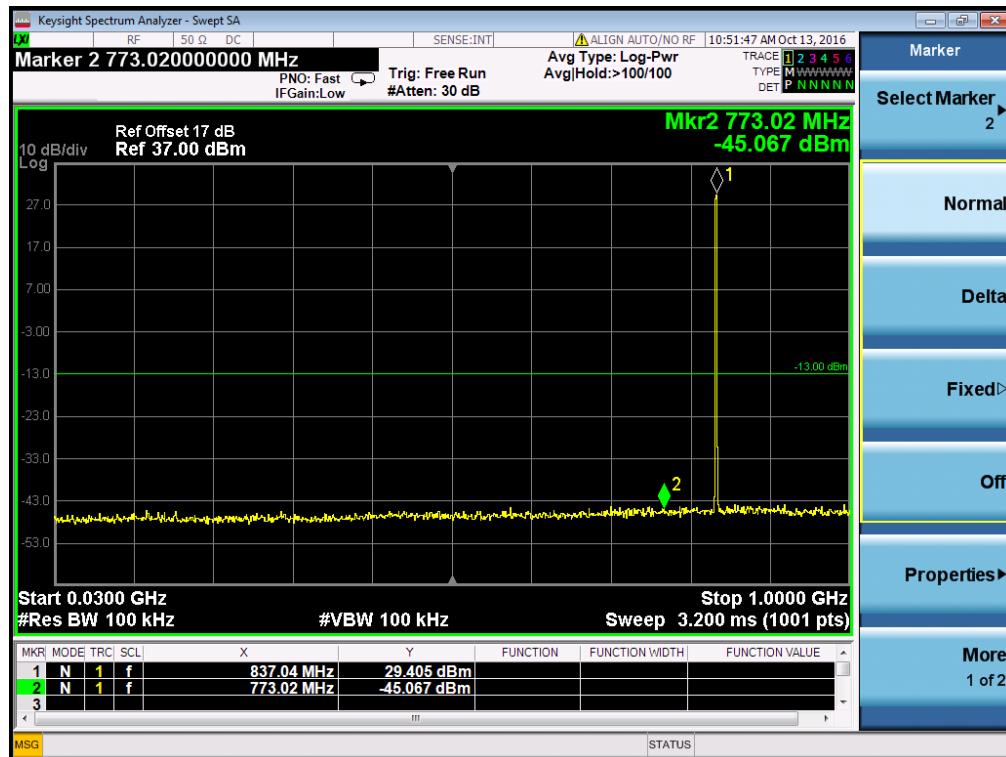
GSM 1900MHz Channel = 810, 1GHz to 20GHz



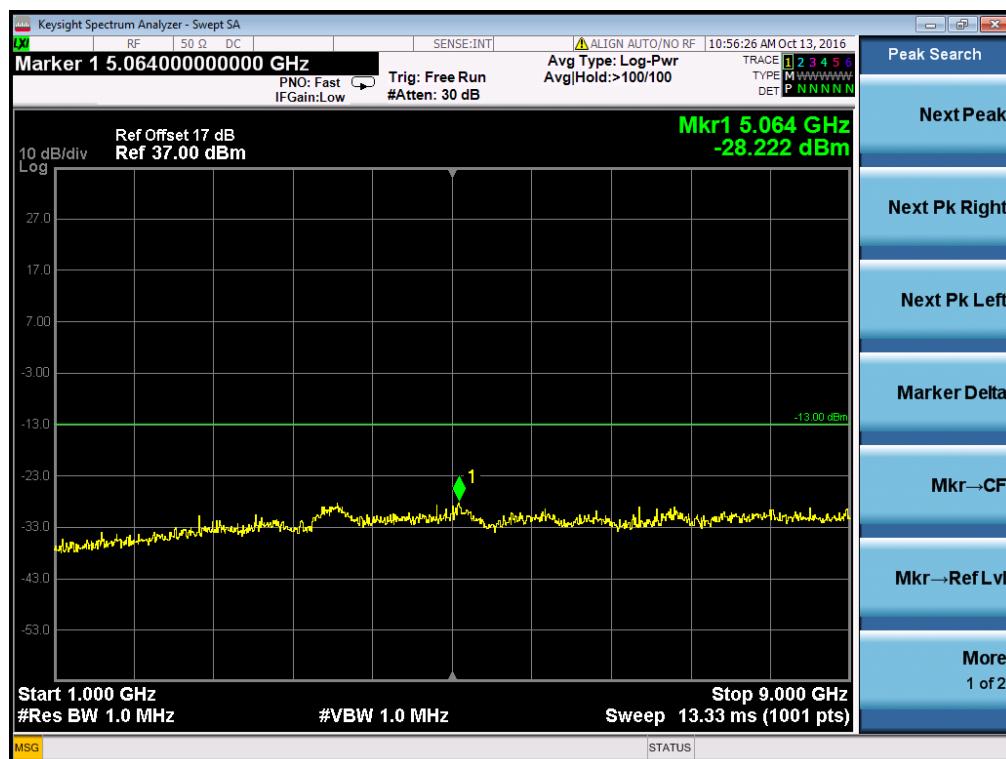
EDGE 850MHz Channel = 128, 30MHz to 1GHz



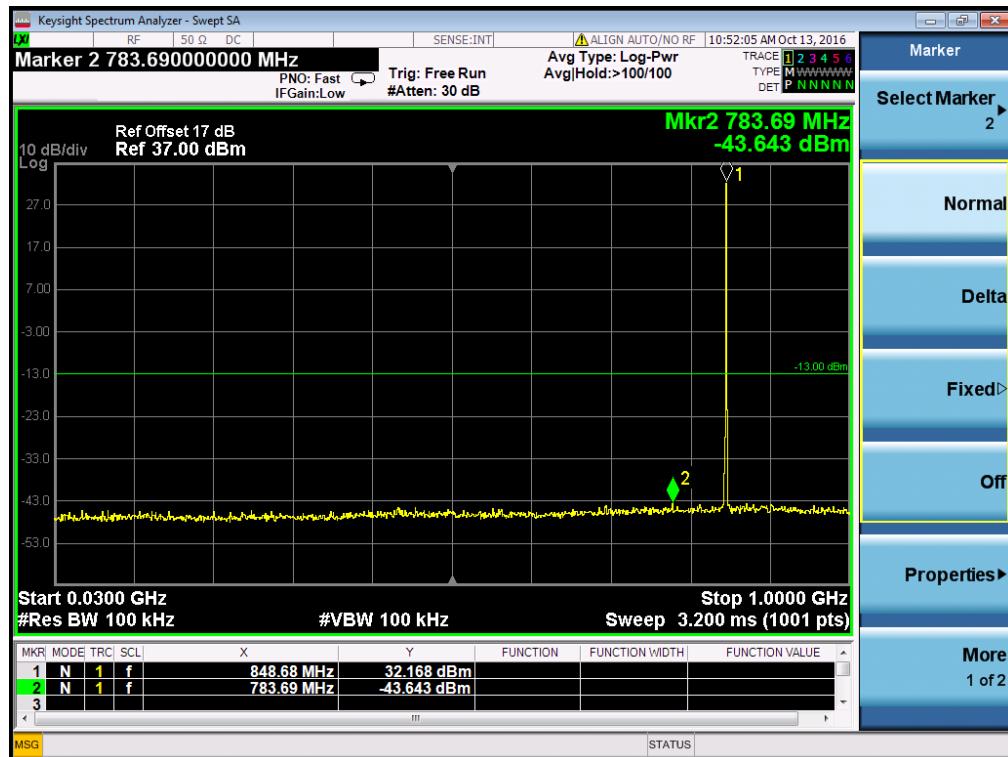
EDGE 850MHz Channel = 128, 1GHz to 9GHz



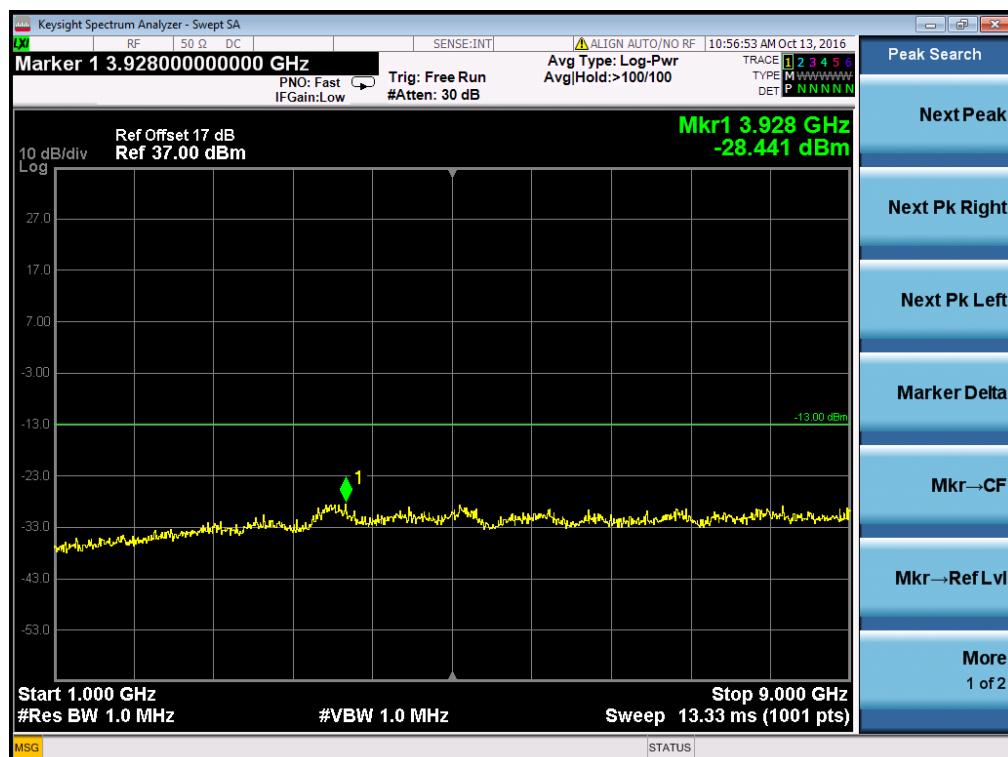
EDGE 850MHz Channel = 190, 30MHz to 1GHz



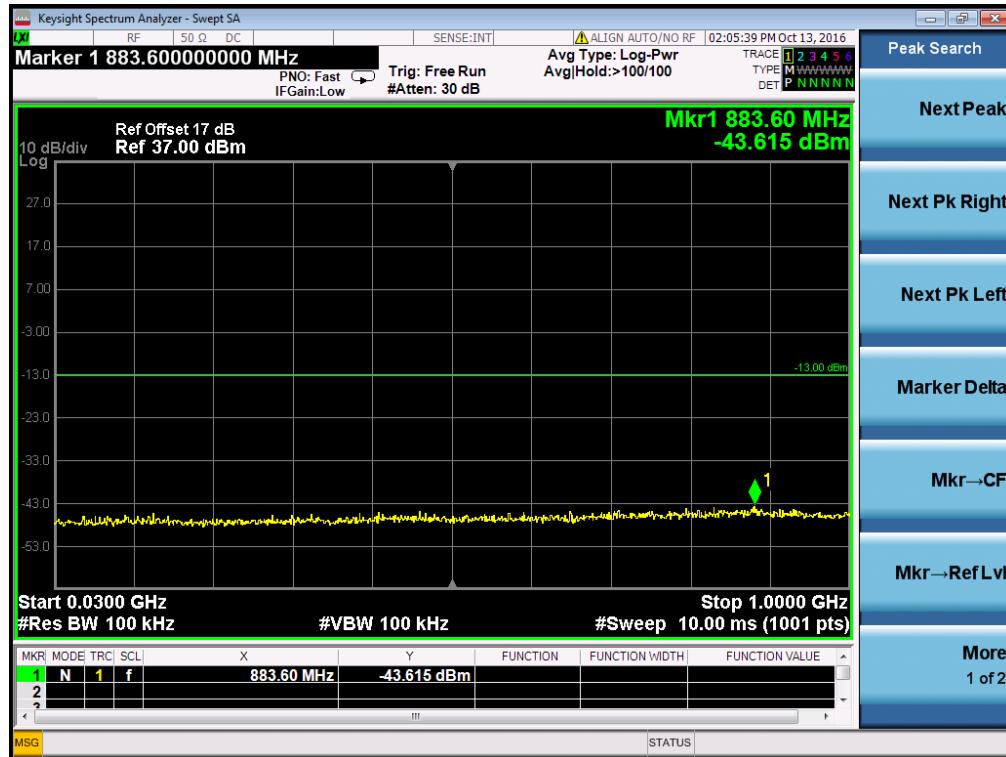
EDGE 850MHz Channel = 190, 1GHz to 9GHz



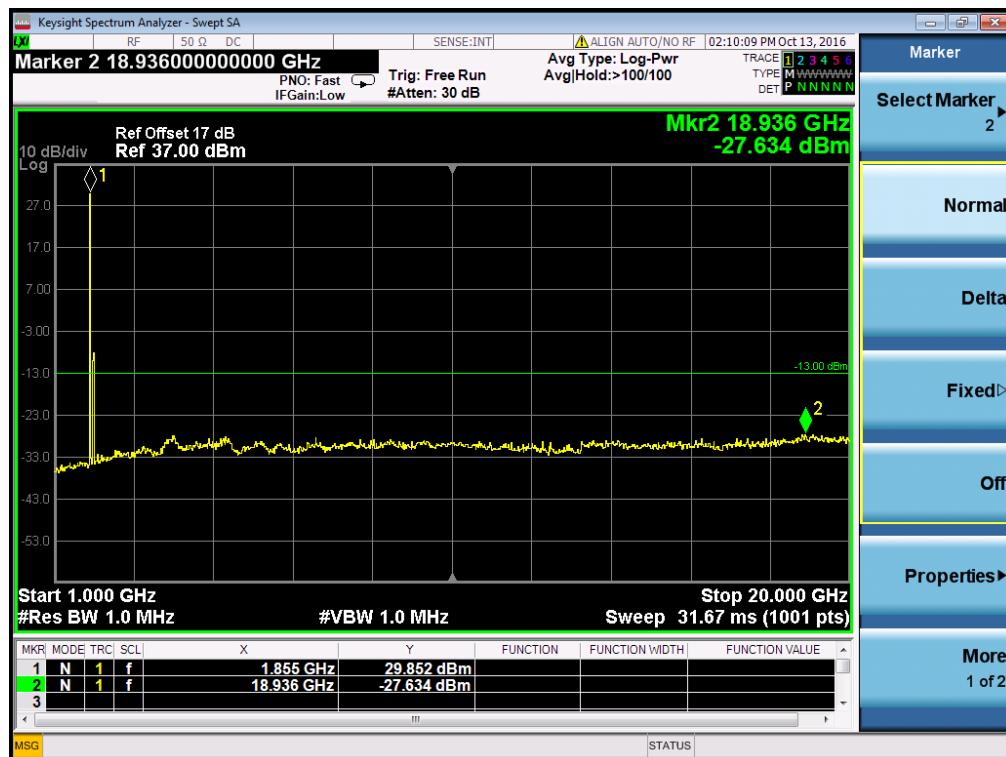
EDGE 850MHz Channel = 251, 30MHz to 1GHz



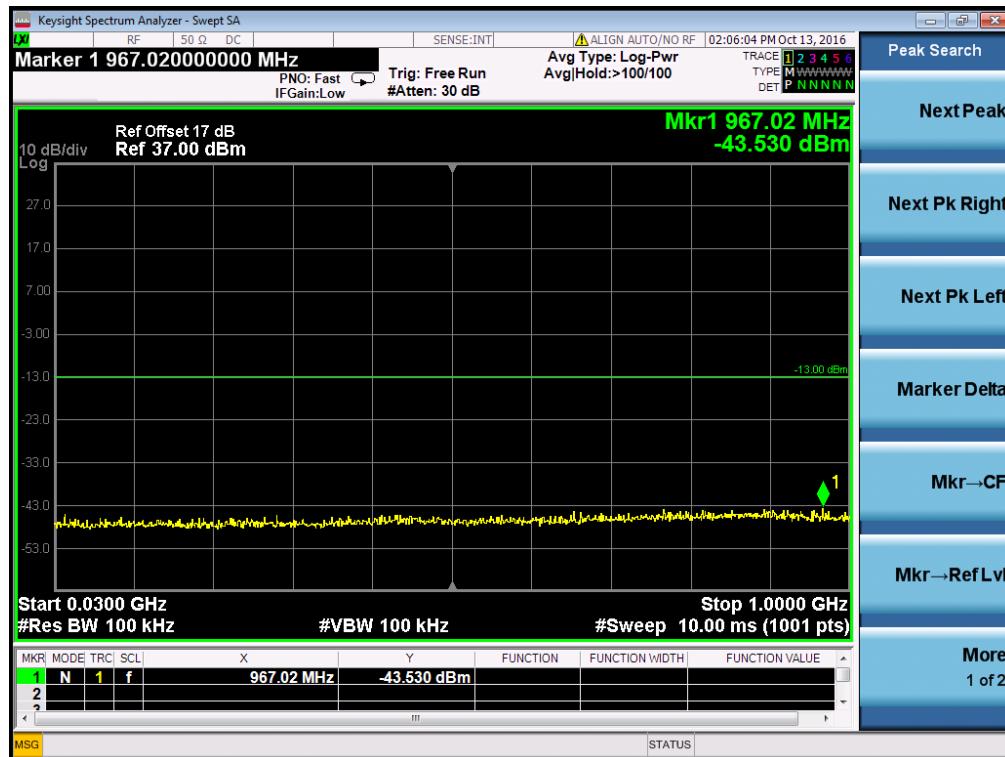
EDGE 850MHz Channel = 251, 1GHz to 9GHz



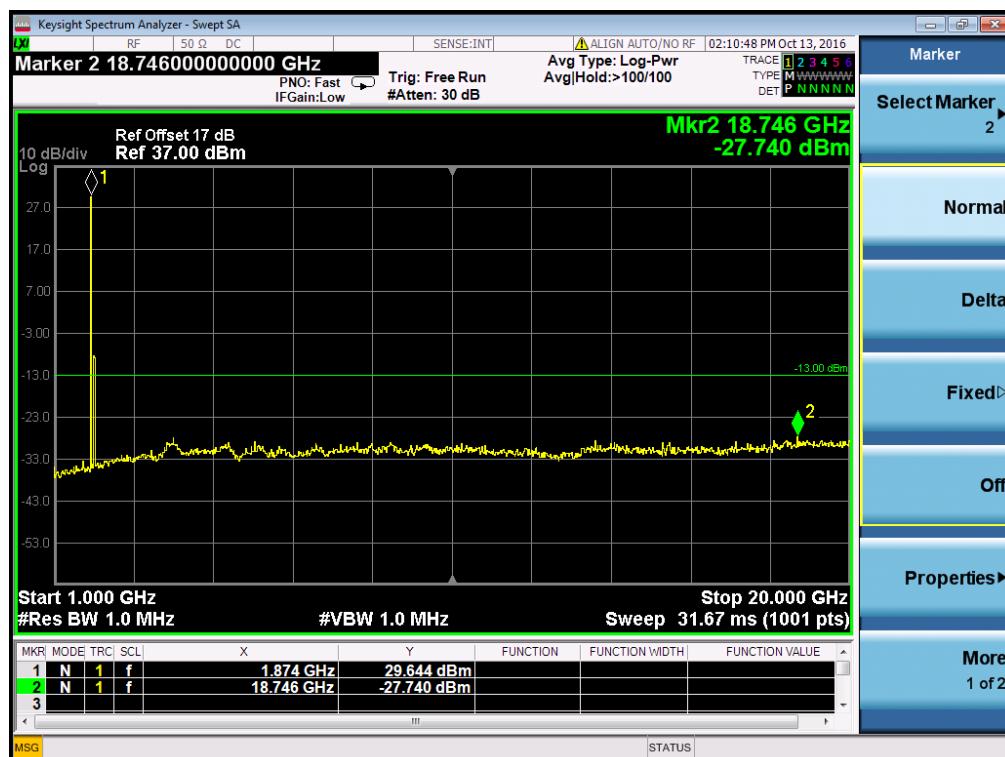
EDGE 1900MHz Channel = 512, 30MHz to 1GHz



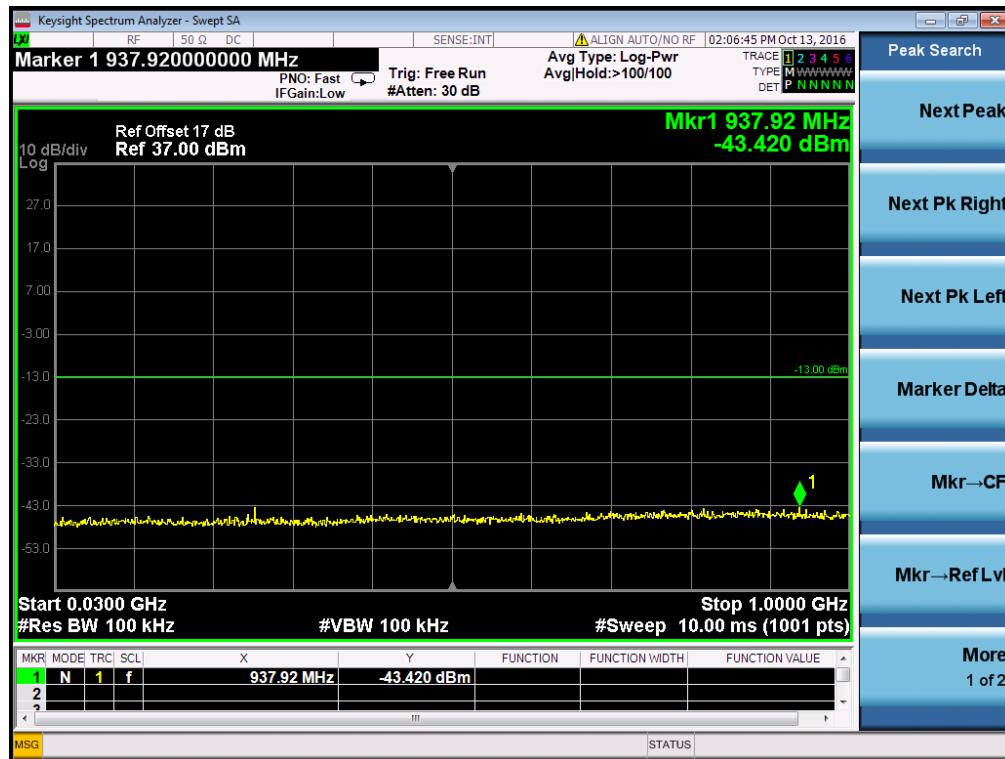
EDGE 1900MHz Channel = 512, 1GHz to 20GHz



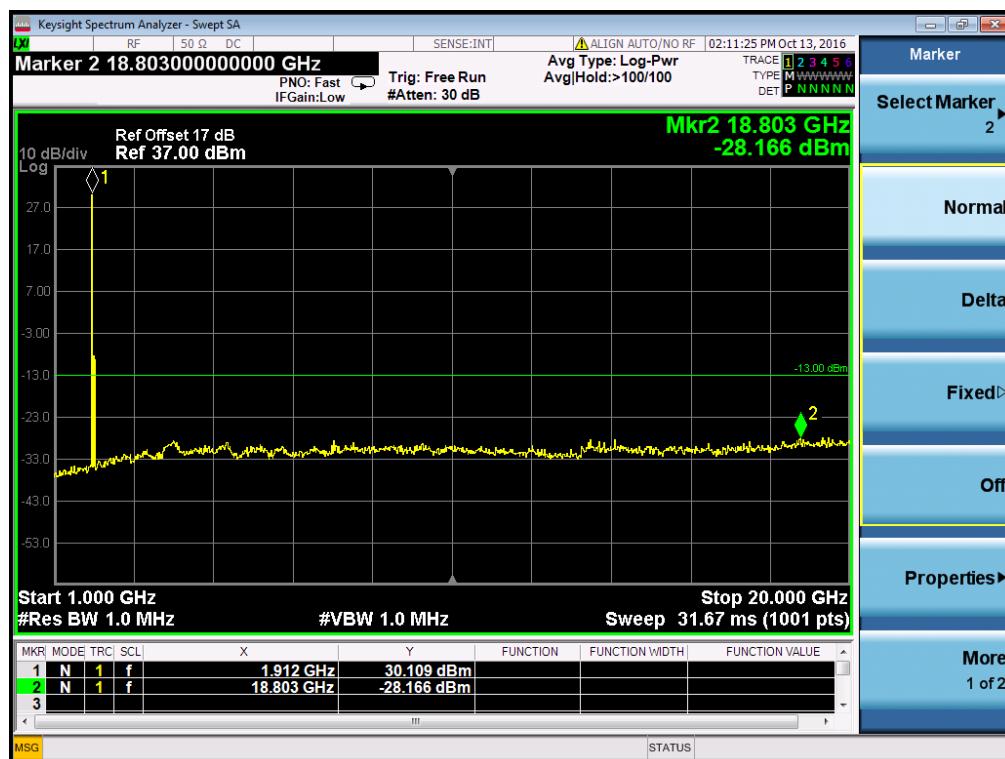
EDGE 1900MHz Channel = 661, 30MHz to 1GHz



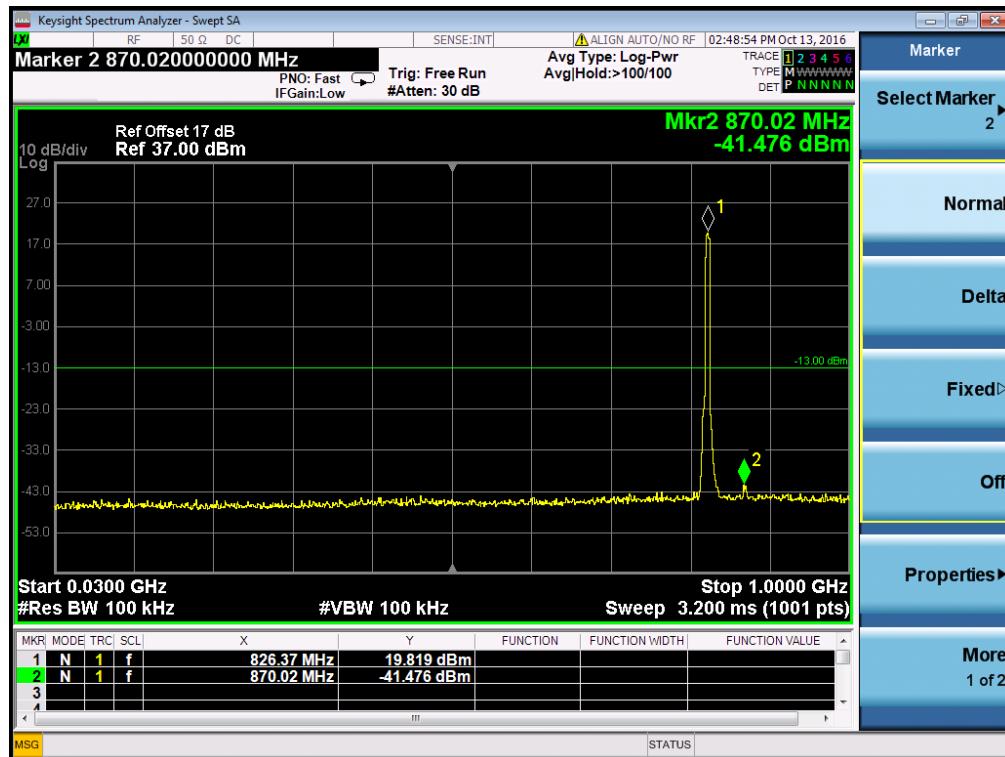
EDGE 1900MHz Channel = 661, 1GHz to 20GHz



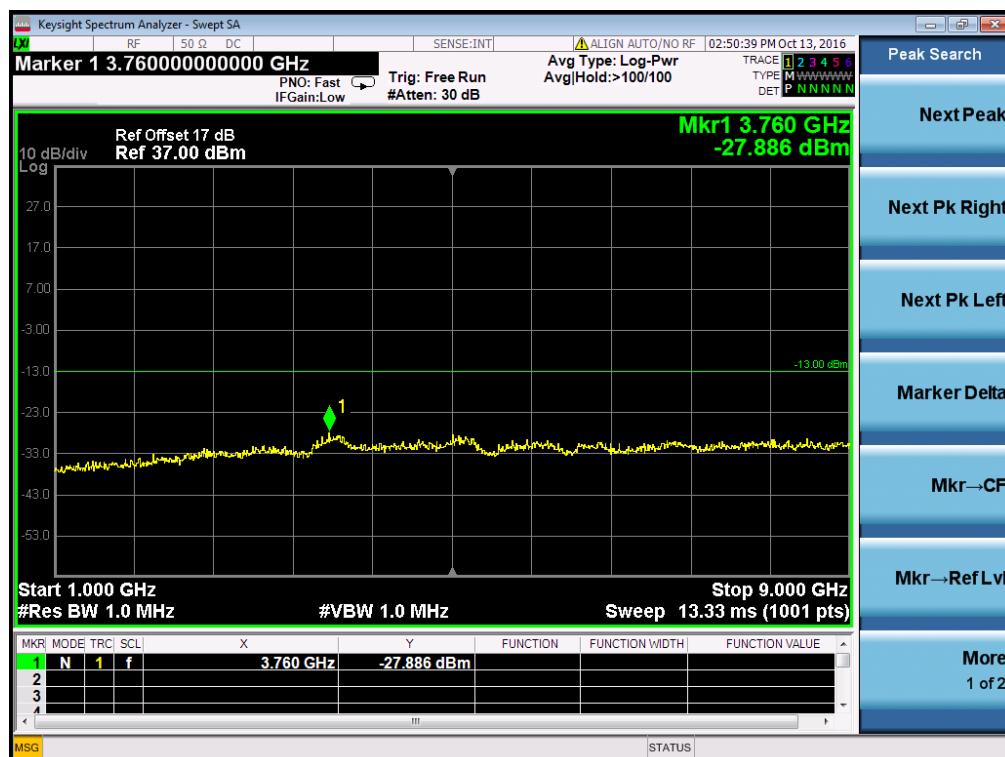
EDGE 1900MHz Channel = 810, 30MHz to 1GHz



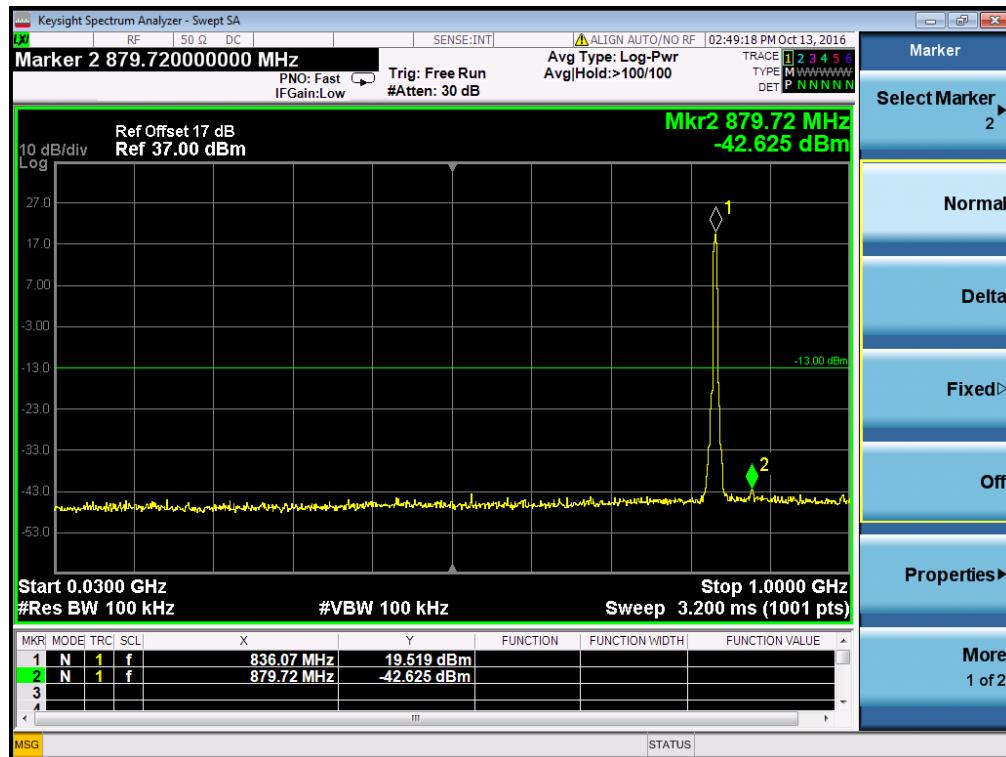
EDGE 1900MHz Channel = 810, 1GHz to 20GHz



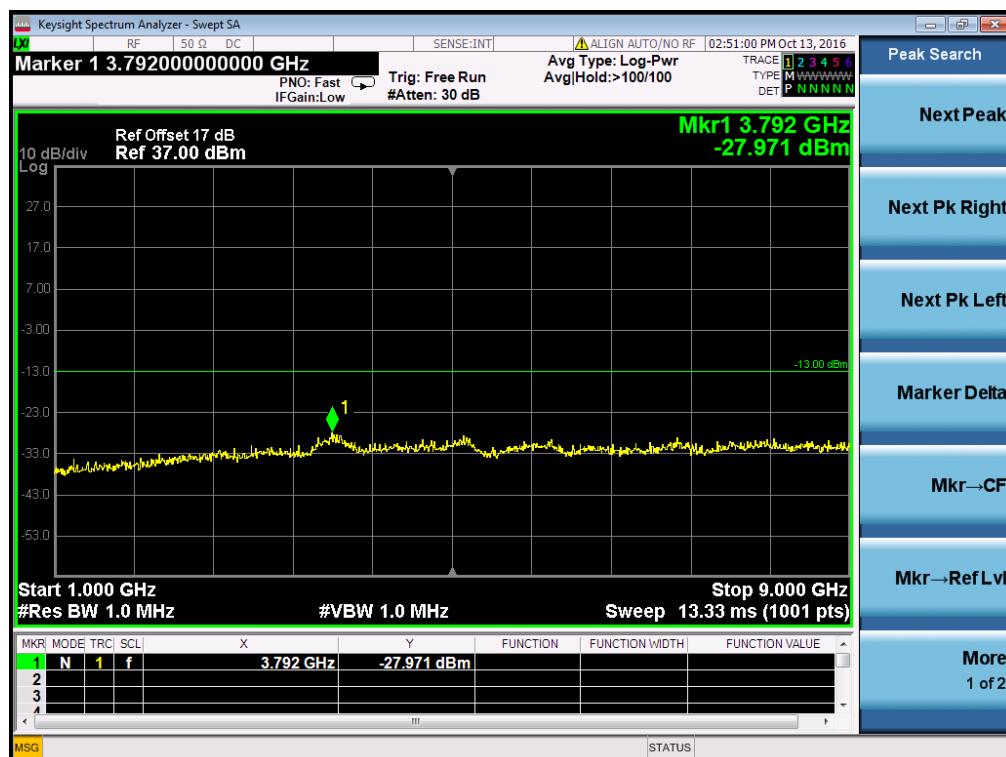
WCDMA850MHz Channel = 4132, 30MHz to 1GHz



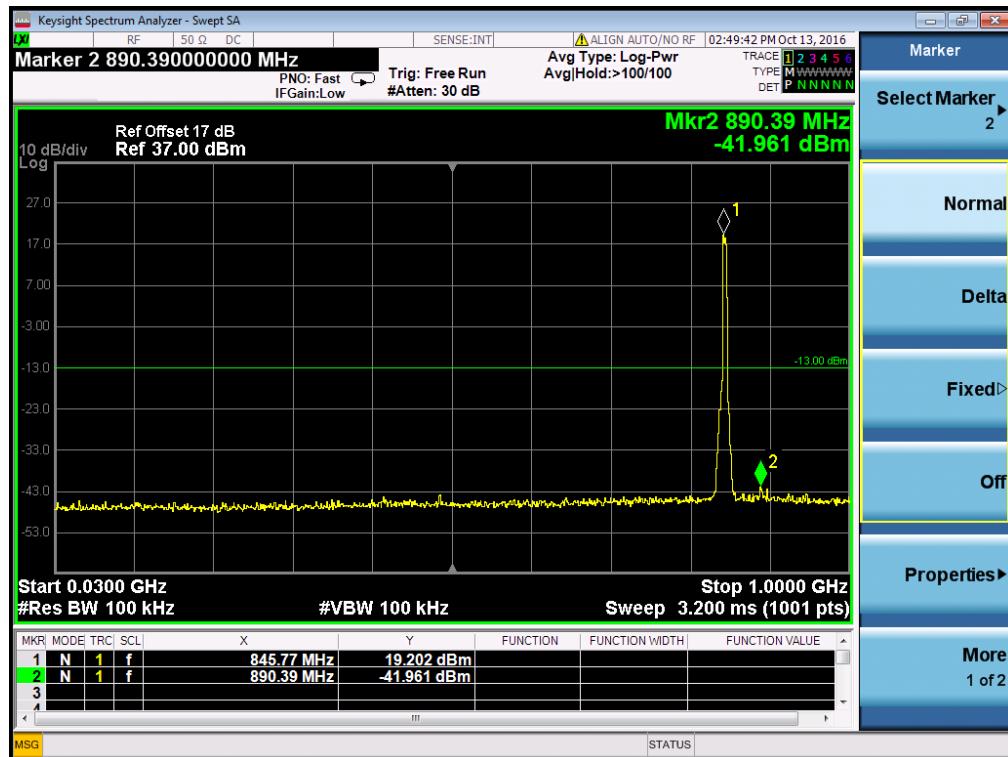
WCDMA850MHz Channel = 4132, 1GHz to 9GHz



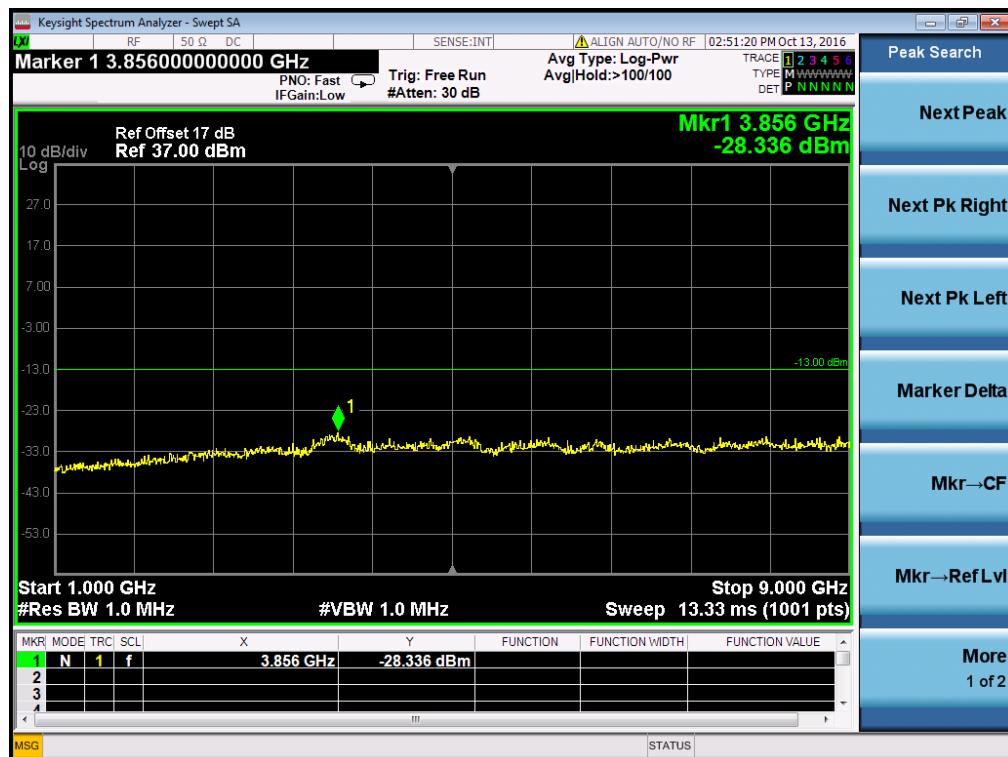
WCDMA850MHz Channel = 4183, 30MHz to 1GHz



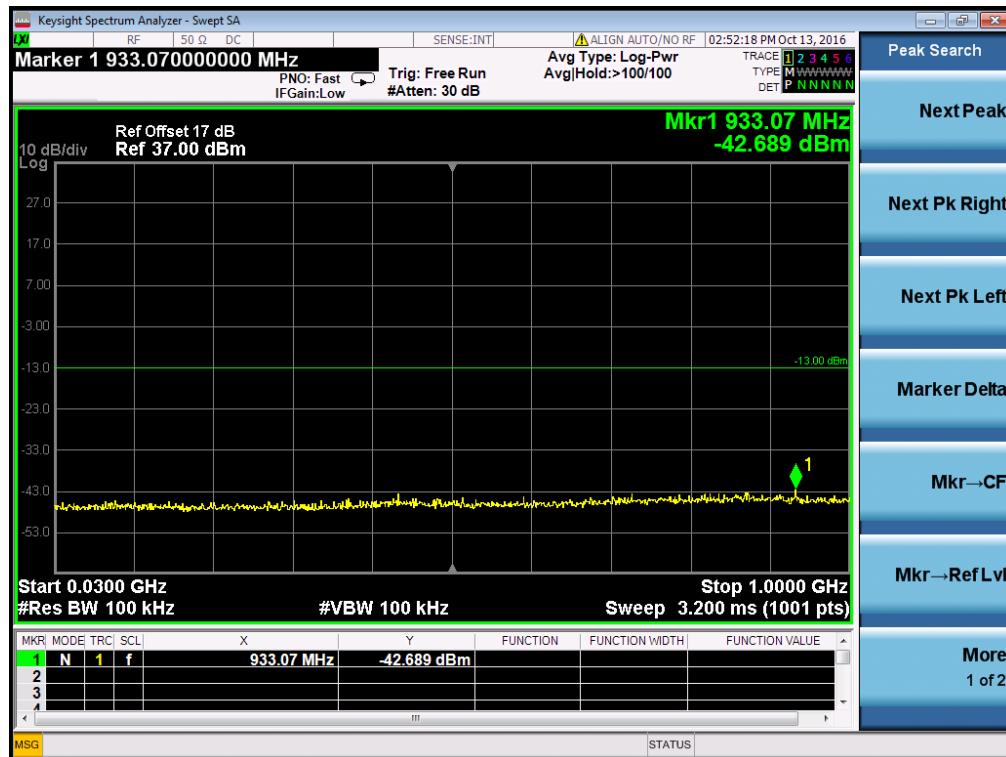
WCDMA850MHz Channel = 4183, 1GHz to 9GHz



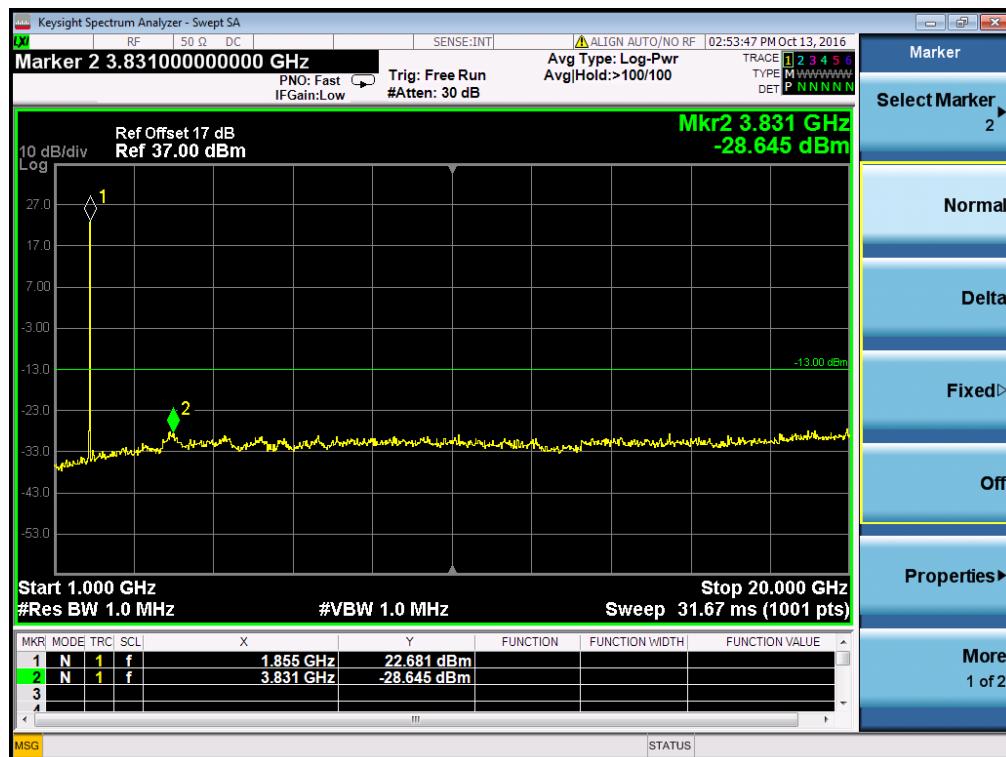
WCDMA850MHz Channel = 4233, 30MHz to 1GHz



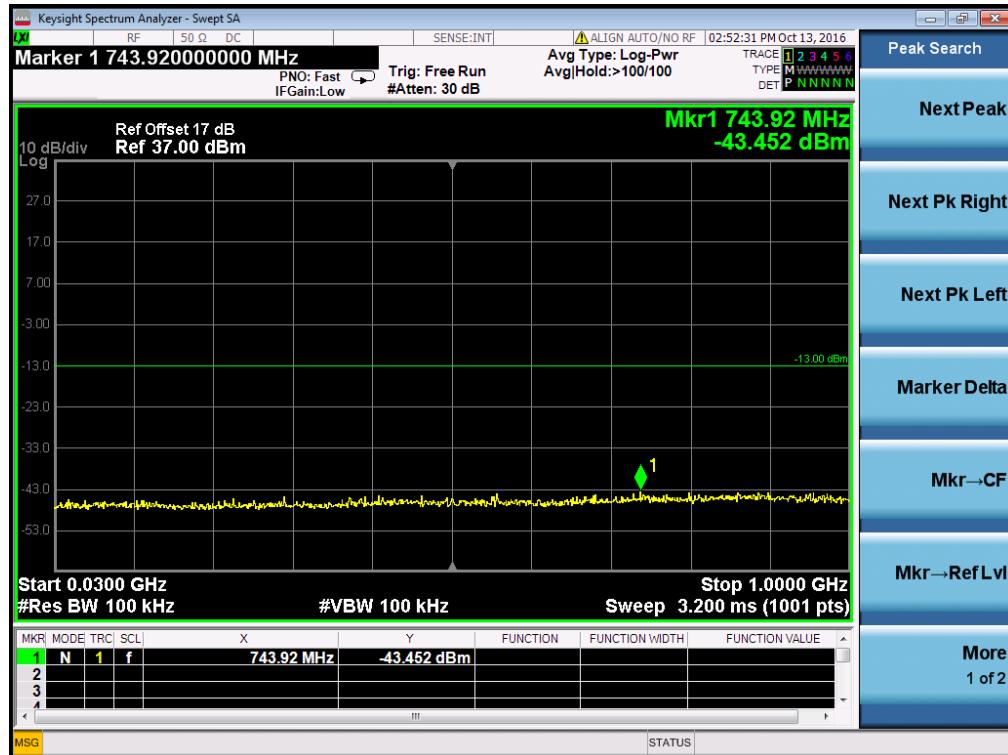
WCDMA850MHz Channel = 4233, 1GHz to 9GHz



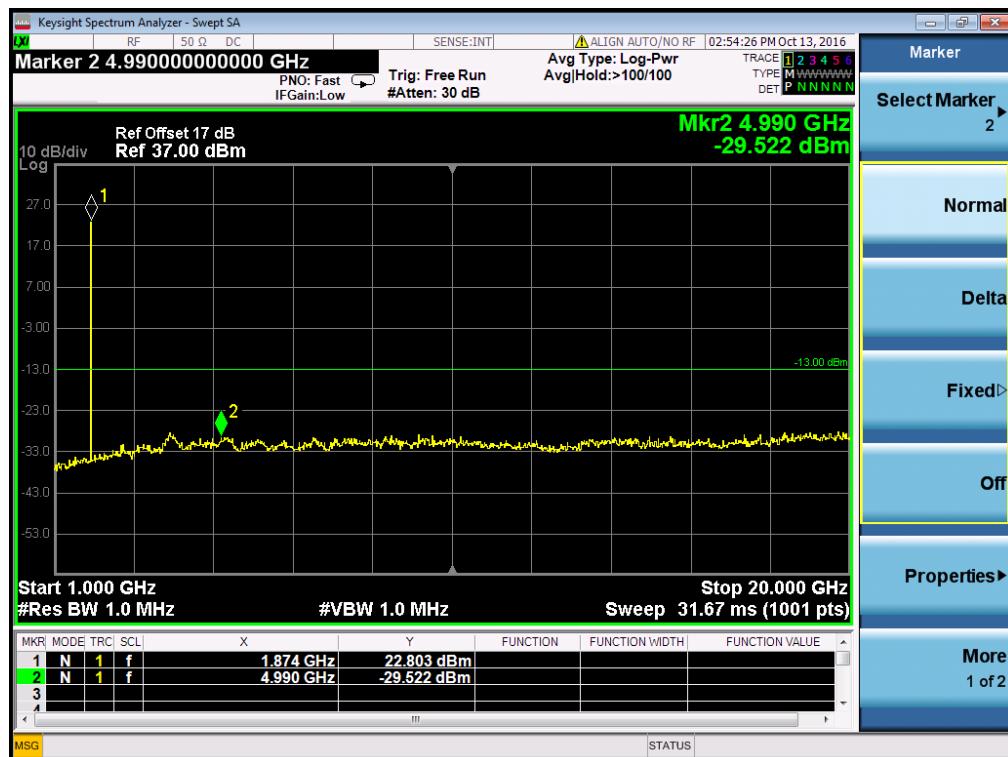
WCDMA1900MHz Channel = 9262, 30MHz to 1GHz



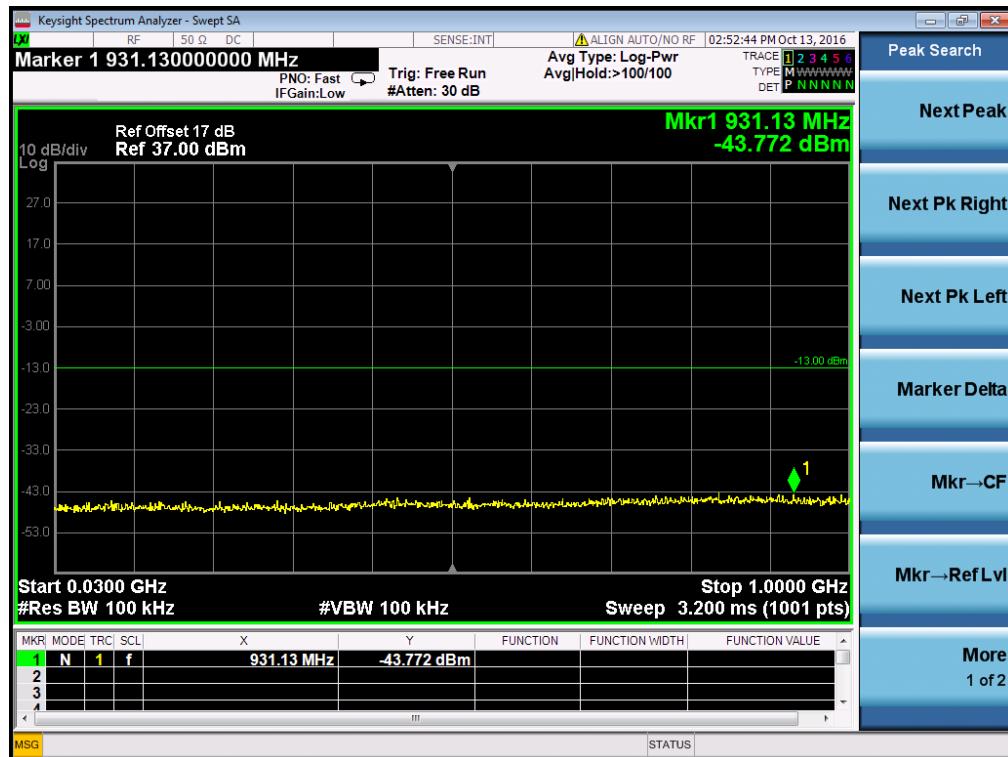
WCDMA1900MHz Channel = 9262, 1GHz to 20GHz



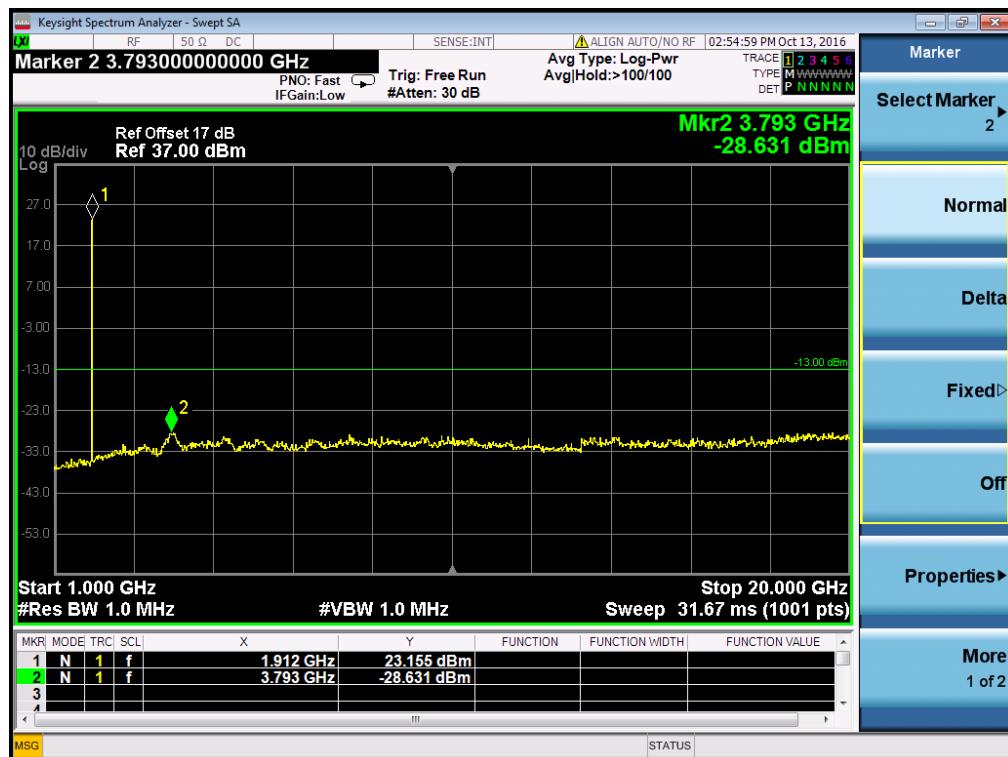
WCDMA1900MHz Channel = 9400, 30MHz to 1GHz



WCDMA1900MHz Channel = 9400, 1GHz to 20GHz



WCDMA1900MHz Channel = 9538, 30MHz to 1GHz



WCDMA1900MHz Channel = 9538 1GHz to 20GHz

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.

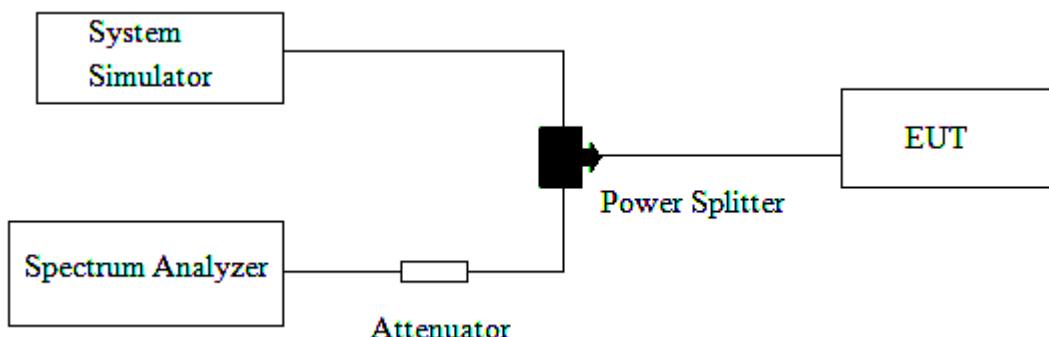
2.6.2 Measuring Instruments

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)
 $= -13$ dBm.

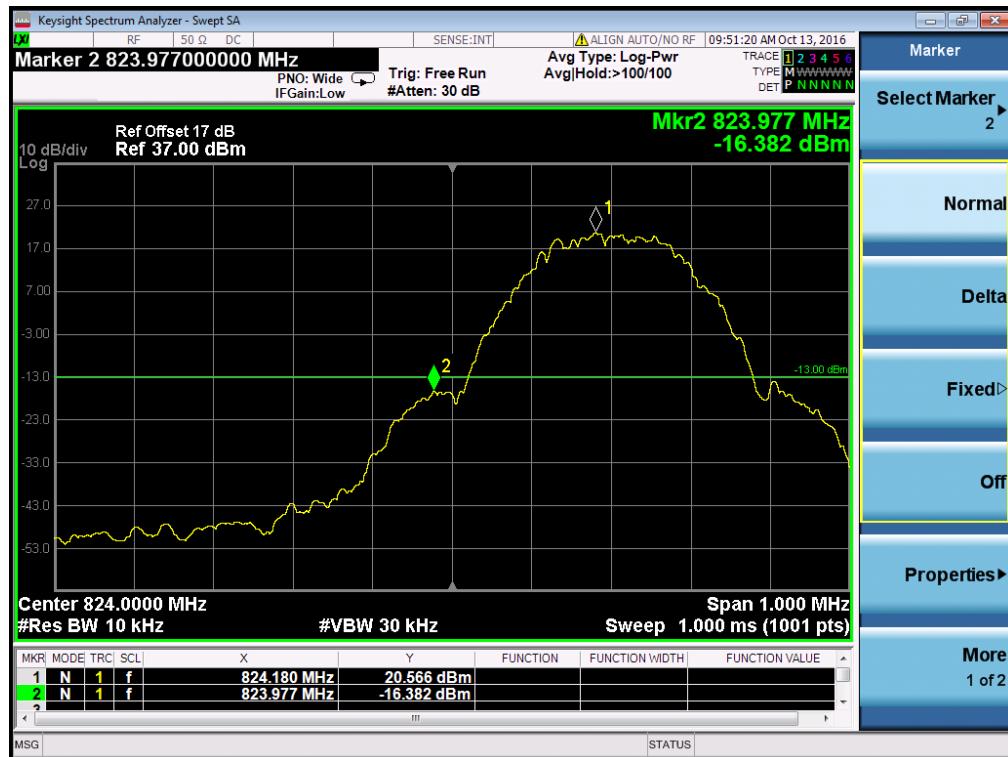
2.6.4 Test Setup



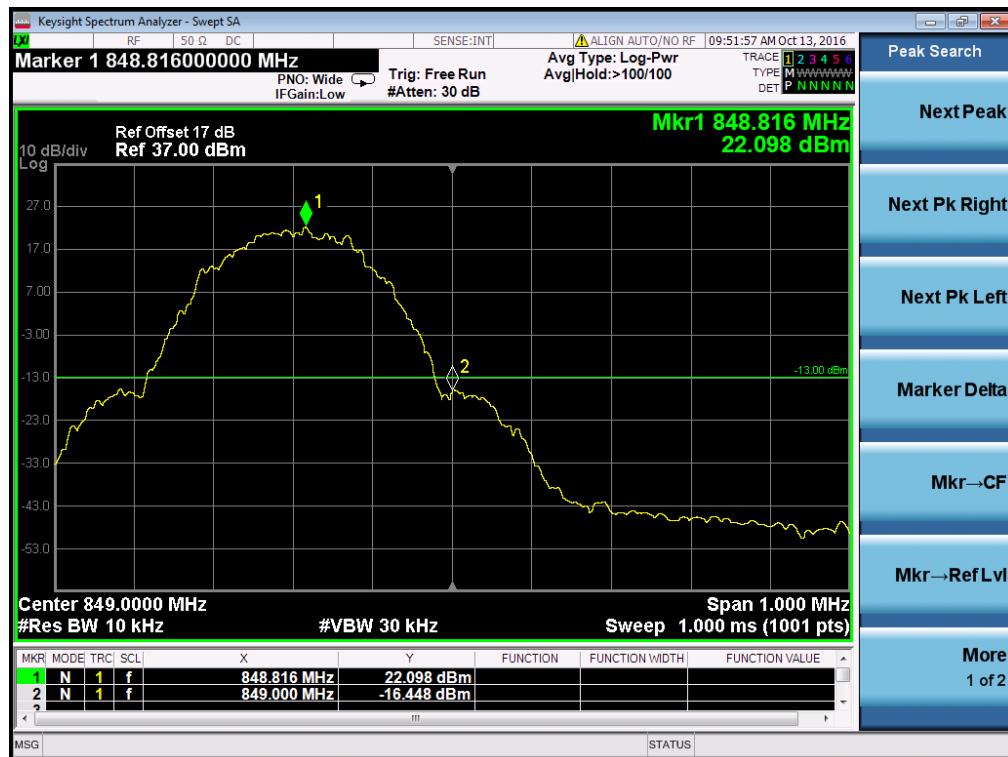
2.6.5 Test Result of Conducted Band Edge

| Band | Channel | Frequency (MHz) | Measured Max. Band Edge Emission (dBm) | Refer to Plot | Limit (dBm) | Verdict |
|------------------|---------|-----------------|--|---------------|-------------|---------|
| GPRS 850MHz | 128 | 824.2 | -16.38 | Plot A | -13 | PASS |
| | 251 | 848.8 | -16.45 | Plot B | | PASS |
| GPRS 1900MHz | 512 | 1850.2 | -15.30 | Plot C | -13 | PASS |
| | 810 | 1909.8 | -16.32 | Plot D | | PASS |
| EDGE 850MHz | 128 | 824.2 | -14.53 | Plot E | -13 | PASS |
| | 251 | 848.8 | -15.14 | Plot F | | PASS |
| EDGE 1900MHz | 512 | 1850.2 | -14.75 | Plot G | -13 | PASS |
| | 810 | 1909.8 | -16.66 | Plot H | | PASS |
| WCDMA 850MHz | 4132 | 826.4 | -14.55 | Plot I | -13 | PASS |
| | 4233 | 846.6 | -14.11 | Plot J | | PASS |
| WCDMA 1900MHz | 9262 | 1852.4 | -16.41 | Plot K | -13 | PASS |
| | 9538 | 1907.6 | -15.86 | Plot L | | PASS |

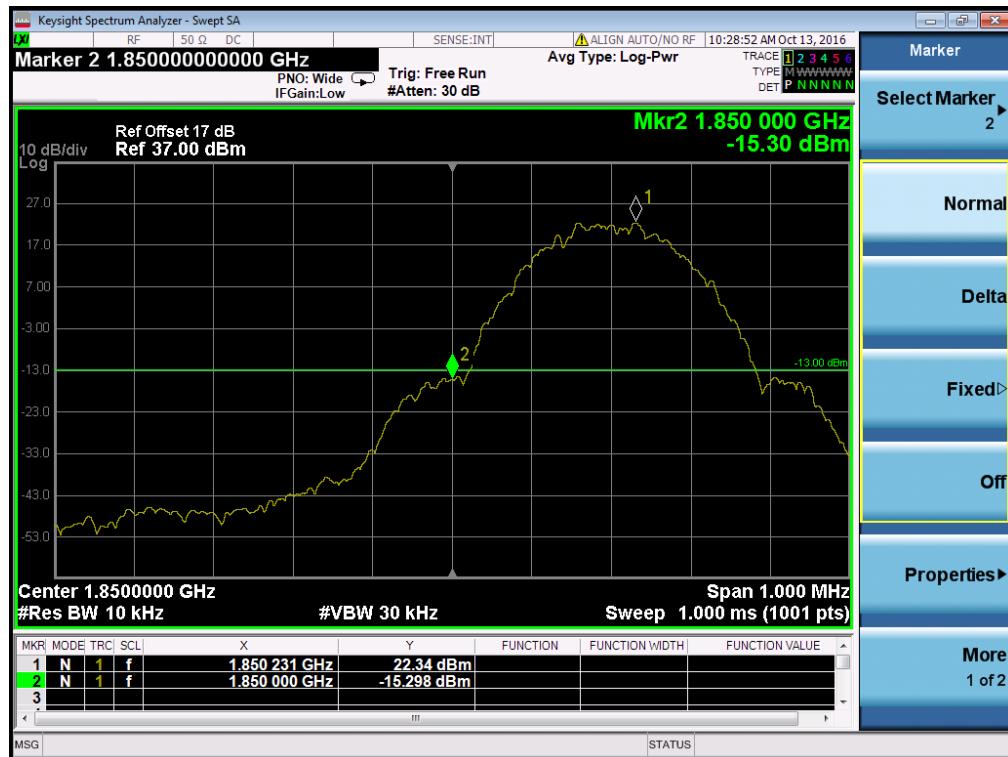
2.6.6 Test Result (Plots) of Conducted Band Edge



(Plot A: GPRS 850 Channel = 128)



(Plot B: GPRS 850 Channel = 251)



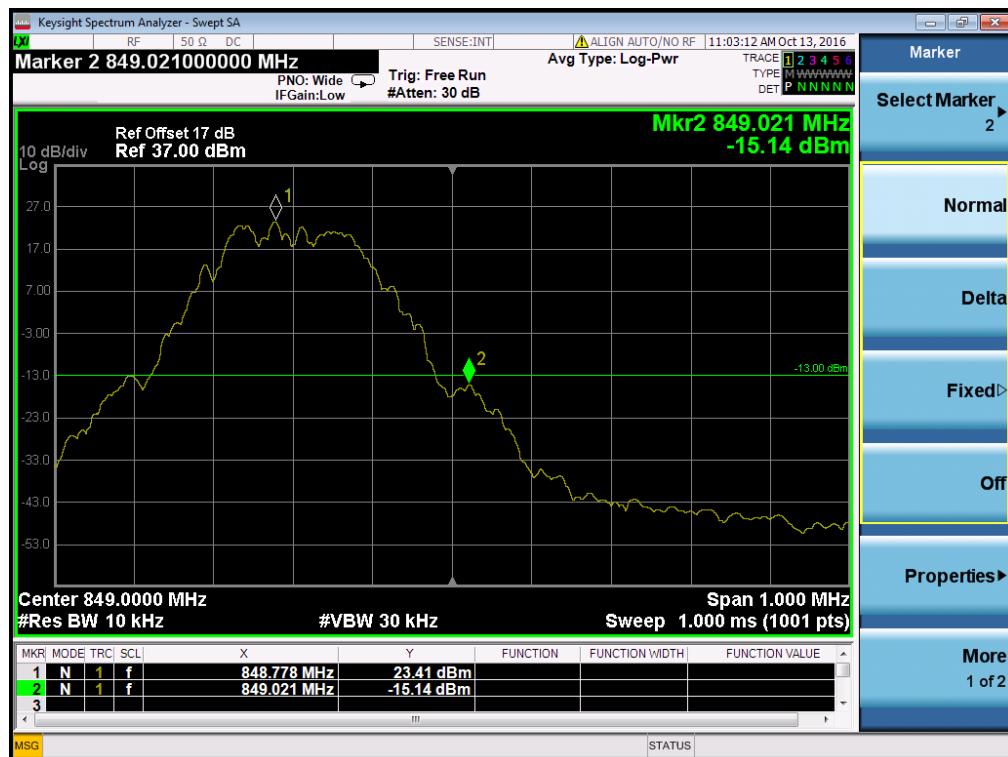
(Plot C: GPRS 1900 Channel = 512)



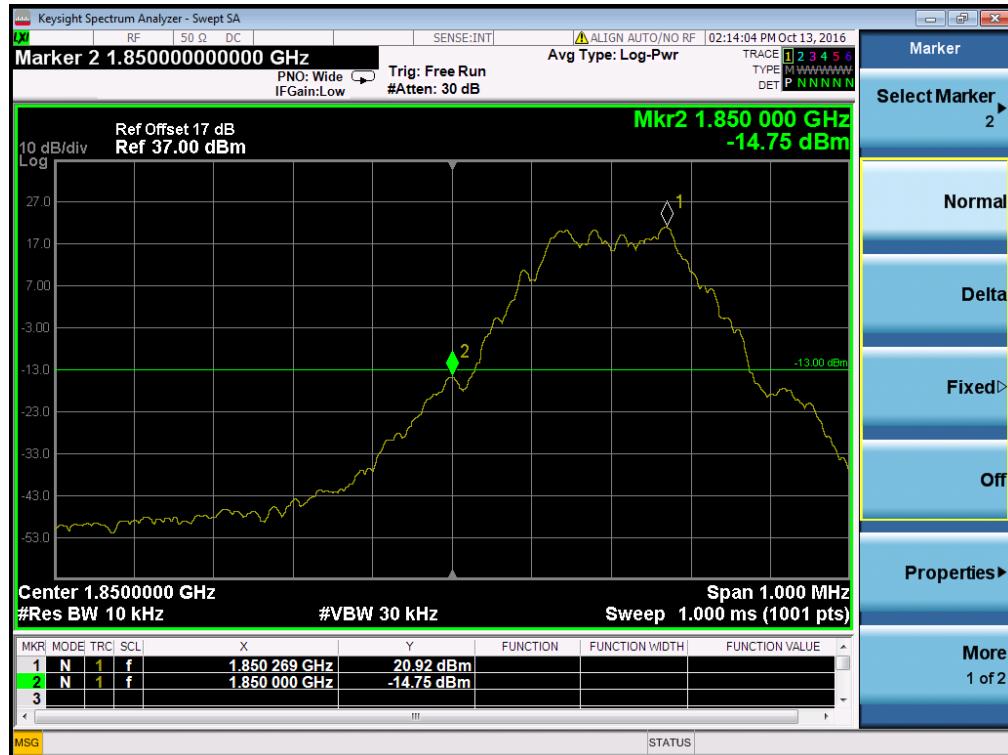
(Plot D: GPRS 1900 Channel = 810)



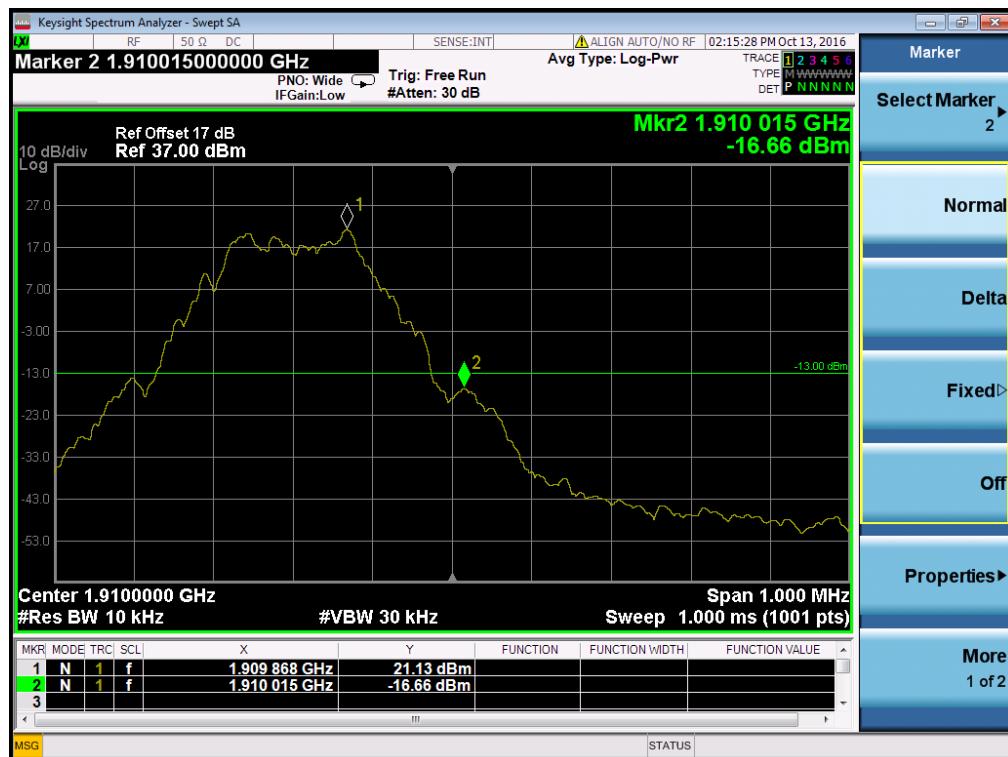
(Plot E: EDGE 850 Channel = 128)



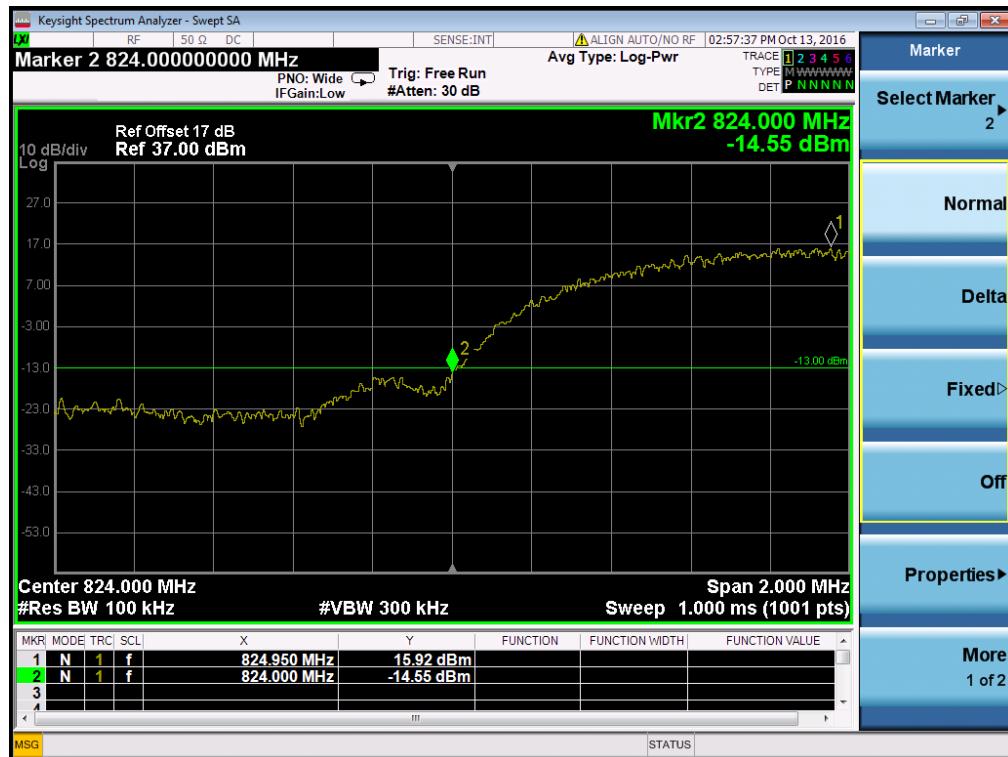
(Plot F: EDGE 850 Channel = 251)



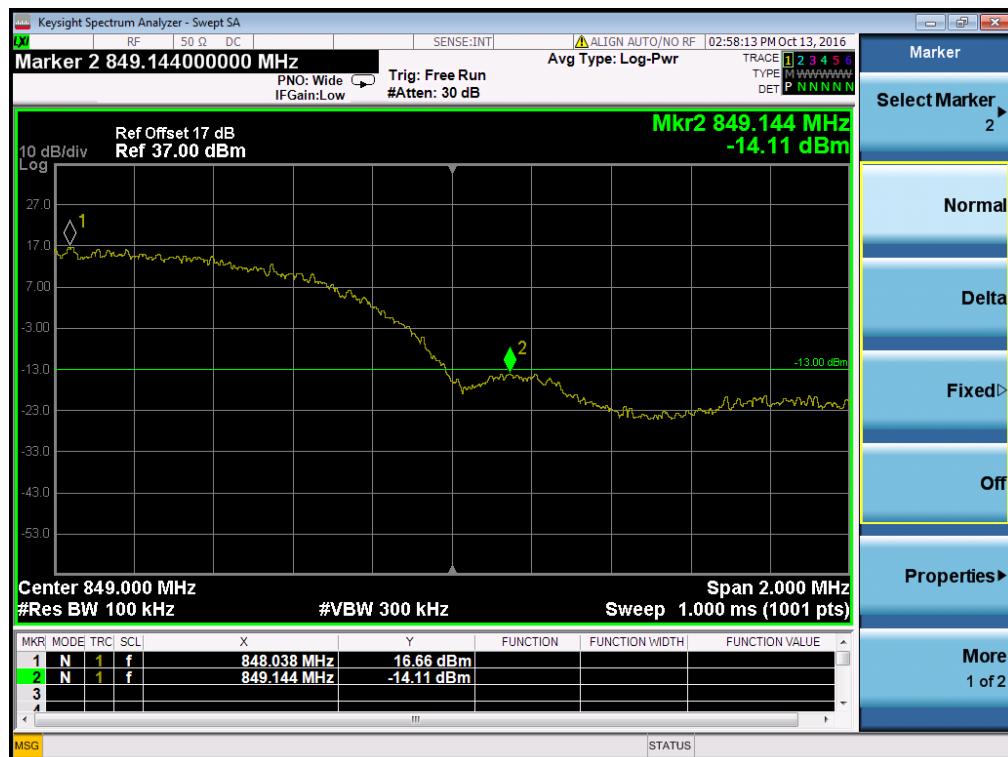
(Plot G: EDGE 1900 Channel = 512)



(Plot H: EDGE 1900 Channel = 810)



(Plot I: WCDMA 850 Channel = 4132)



(Plot J: WCDMA 850 Channel = 4233)



(Plot K: WCDMA 1900 Channel = 9262)



(Plot L: WCDMA 1900 Channel = 9538)

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 testing follows FCC KDB 971168 D01v02r02 Section 5.2.1. (for CDMA/WCDMA), Section 5.2.2.2 (for GSM/GPRS/EDGE) and ANSI / TIA-603-D-2010 Section 2.2.17.
2. The EUT was placed on a turntable 0.8 meters high in a fully anechoic chamber.
3. The EUT was placed 3 meters from the receiving antenna, which was mounted on the antenna tower.
4. GSM operating modes: Set RBW= 1MHz, VBW= 3MHz, RMS detector over burst; UMTS operating modes: Set RBW= 100 kHz, VBW= 300 kHz, RMS detector over frame, and use channel power option with bandwidth=5MHz, per KDB 971168 D01 v02r02.
5. The table was rotated 360 degrees to determine the position of the highest radiated power.
6. The height of the receiving antenna is adjusted to look for the maximum ERP/EIRP.
7. Taking the record of maximum ERP/EIRP.
8. A dipole antenna was substituted in place of the EUT and was driven by a signal generator.

9. The conducted power at the terminal of the dipole antenna is measured.
10. Repeat step 3 to step 5 to get the maximum ERP/EIRP of the substitution antenna.
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.

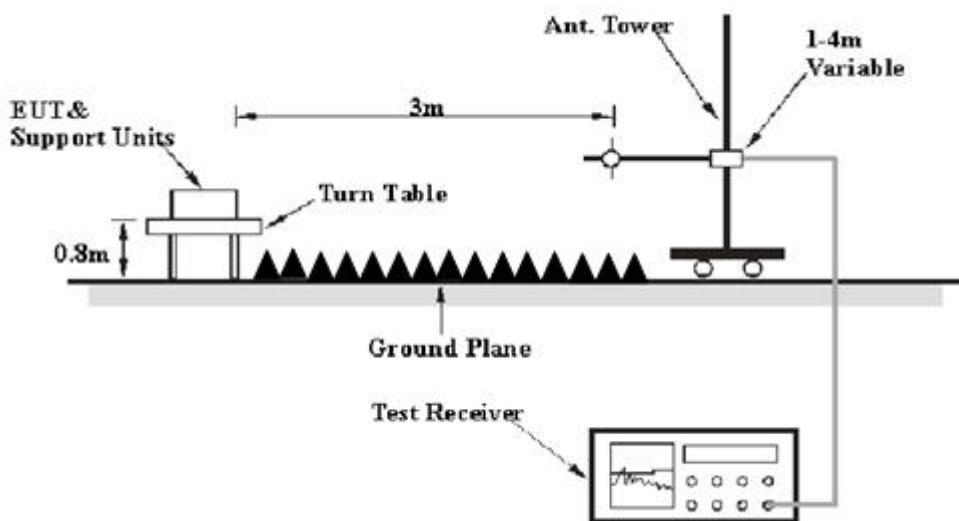
$$Et = Rt + AF \quad Es = Rs + AF$$

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



2.7.5 Test Result of Transmitter Radiated Power

Test Notes:

1. This device employs GMSK technology with 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 | 31.79 | 38.5 | PASS |
| | | | | H | 31.74 | | PASS |
| | 190 | 836.60 | 5 | V | 31.71 | | PASS |
| | | | | H | 31.76 | | PASS |
| | 251 | 848.80 | 5 | V | 31.81 | | PASS |
| | | | | H | 31.78 | | |

| Band | Channel | Frequency (MHz) | PCL | Antenna Pol (H/V) | Measured EIRP dBm | Limit dBm | Verdict |
|--------------|---------|-----------------|-----|-------------------|-------------------|-----------|---------|
| GPRS 1900MHz | 512 | 1850.2 | 0 | V | 29.18 | 33 | PASS |
| | | | | H | 29.45 | | PASS |
| | 661 | 1880.0 | 0 | V | 29.50 | | PASS |
| | | | | H | 29.42 | | PASS |
| | 810 | 1909.8 | 0 | V | 29.44 | | PASS |
| | | | | H | 29.47 | | |

| Band | Channel | Frequency (MHz) | PCL | Antenna Pol (H/V) | Measured ERP dBm | Limit dBm | Verdict |
|----------------|---------|-----------------|-----|-------------------|------------------|-----------|---------|
| EDGE 850MHz | 128 | 824.20 | 5 | V | 26.24 | 38.5 | PASS |
| | | | | H | 26.28 | | PASS |
| | 190 | 836.60 | 5 | V | 26.32 | | PASS |
| | | | | H | 26.35 | | PASS |
| | 251 | 848.80 | 5 | V | 26.37 | | PASS |
| | | | | H | 26.31 | | |

| Band | Channel | Frequency (MHz) | PCL | Antenna Pol (H/V) | Measured EIRP dBm | Limit dBm | Verdict |
|-----------------|---------|-----------------|-----|-------------------|-------------------|-----------|---------|
| EDGE 1900MHz | 512 | 1850.2 | 0 | V | 24.72 | 33 | PASS |
| | | | | H | 24.66 | | PASS |
| | 661 | 1880.0 | 0 | V | 24.71 | | PASS |
| | | | | H | 24.68 | | PASS |
| | 810 | 1909.8 | 0 | V | 24.75 | | PASS |
| | | | | H | 24.72 | | |

| Band | Channel | Frequency (MHz) | Antenna Pol (H/V) | Measured ERP dBm | Limit dBm | Verdict |
|-----------------|---------|-----------------|-------------------|------------------|-----------|---------|
| WCDMA 850MHz | 4132 | 826.4 | V | 23.25 | 38.5 | PASS |
| | | | H | 23.21 | | PASS |
| | 4175 | 835 | V | 23.30 | | PASS |
| | | | H | 23.22 | | PASS |
| | 4233 | 846.6 | V | 23.27 | | PASS |
| | | | H | 23.25 | | |

| Band | Channel | Frequency (MHz) | Antenna Pol (H/V) | Measured EIRP dBm | Limit dBm | Verdict |
|------------------|---------|-----------------|-------------------|-------------------|-----------|---------|
| WCDMA 1900MHz | 9262 | 1852.4 | V | 22.54 | 33 | PASS |
| | | | H | 22.58 | | PASS |
| | 9400 | 1880 | V | 22.61 | | PASS |
| | | | H | 22.63 | | PASS |
| | 9538 | 1907.6 | V | 22.57 | | PASS |
| | | | H | 22.49 | | |

2.8 Radiated Spurious Emissions

2.8.1 Requirement

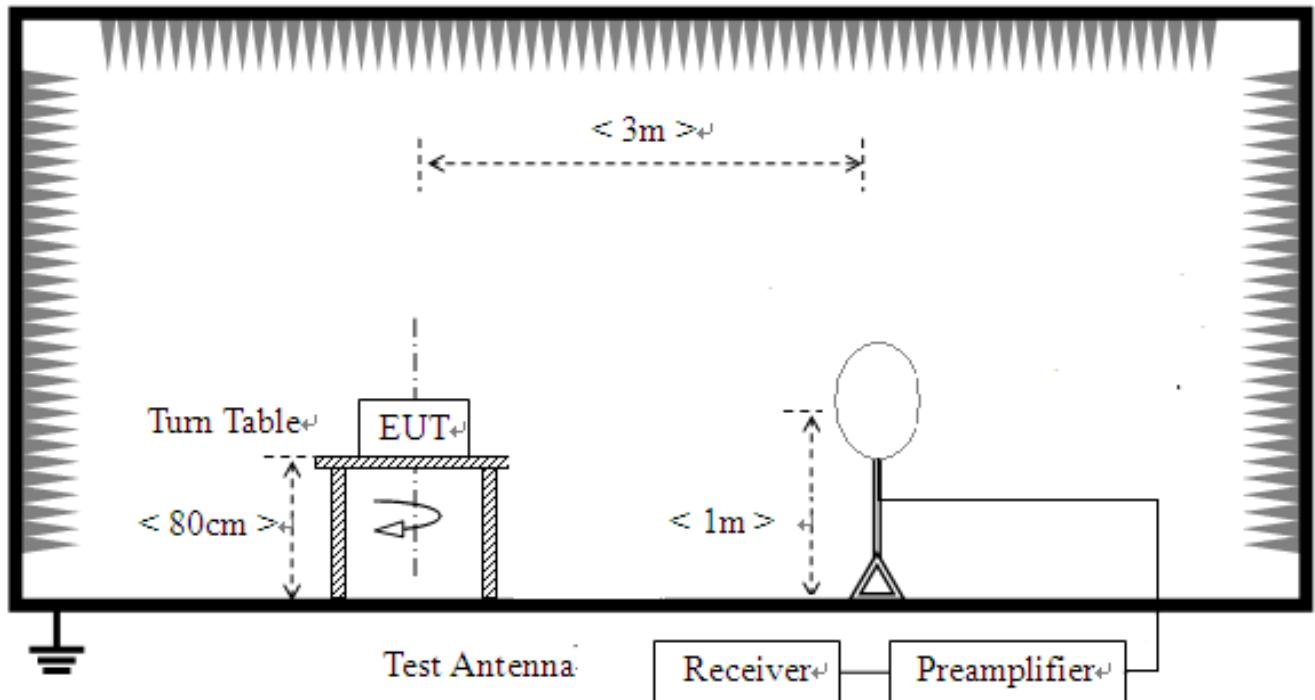
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB. The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

2.8.2 Measuring Instruments

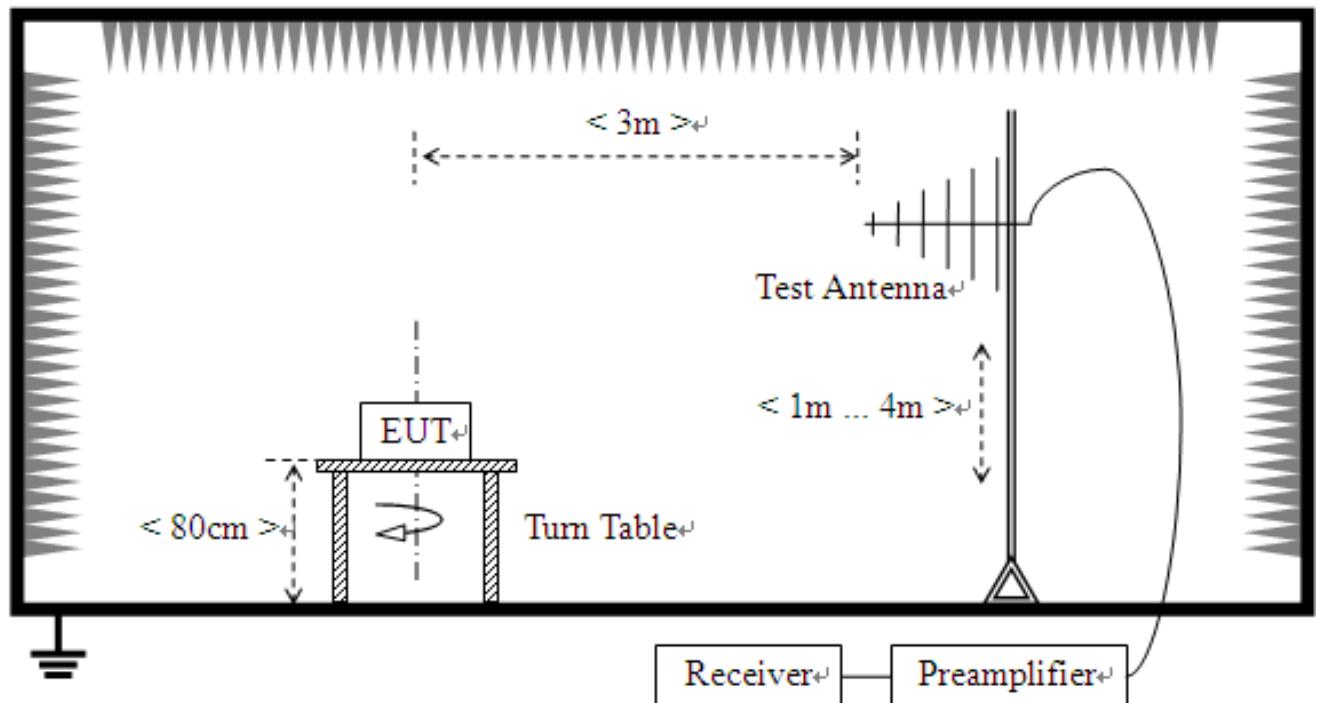
The measuring equipment is listed in the section 3 of this test report.

2.8.3 Test Setup

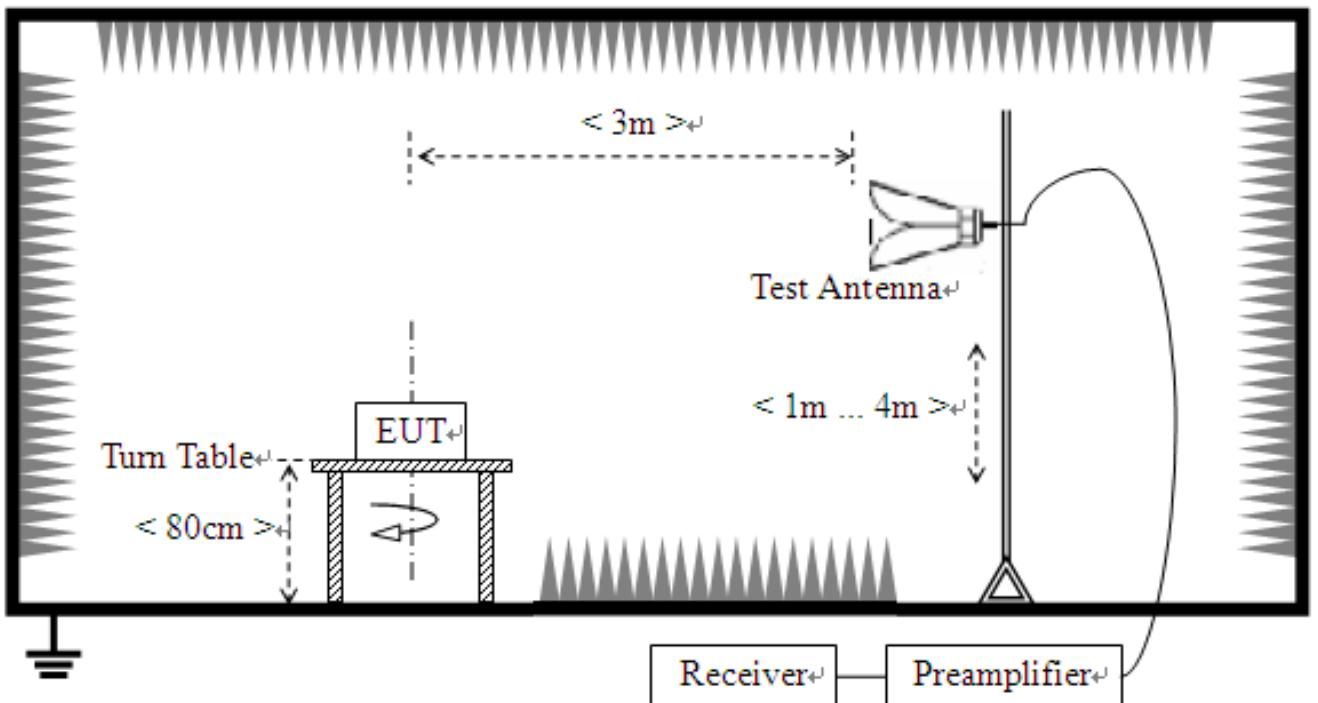
For radiated emissions from 9 kHz to 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



2.8.4 Test Procedures

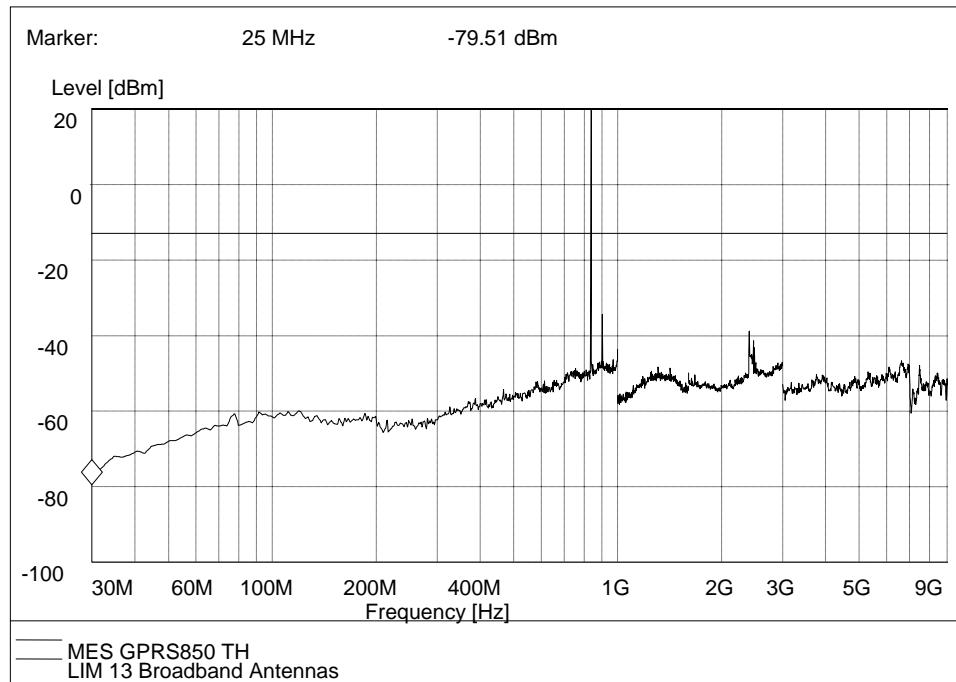
1. The testing follows FCC KDB 971168 D01v02r02 Section 5.8 and ANSI / TIA-603-D-2010 Section 2.2.12.
2. The EUT was placed on a rotatable wooden table 0.8 meters above the ground.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
5. The height of the receiving antenna is varied between one meter and four meters to search for the maximum spurious emission for both horizontal and vertical polarizations.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking record of maximum spurious emission.
7. A horn antenna 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 7 to step 8 for another polarization.
11. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
12. The limit line is derived from $43 + 10\log(P)$ dB below the transmitter power P(Watts)
$$= P(W) - [43 + 10\log(P)] \text{ (dB)}$$
$$= [30 + 10\log(P)] \text{ (dBm)} - [43 + 10\log(P)] \text{ (dB)}$$
$$= -13 \text{ dBm.}$$
13. This device employs GMSK technology with GSM and GPRS capabilities. All configurations were investigated and the worst case emissions were found in GSM mode.
14. 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.
15. This unit was tested with its standard battery.
16. 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.
17. 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.

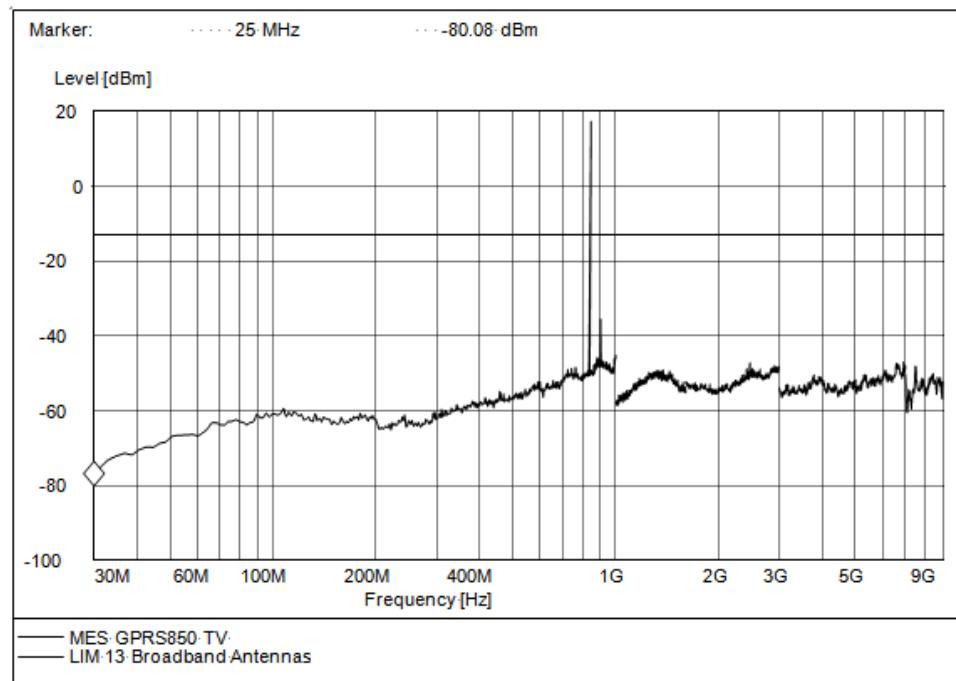
18. For 9KHz to 30MHz: the amplitude of spurious emissions are attenuated by more than 20dB below the permissible value has no need to be reported.

2.8.5 Test Results of Radiated Spurious Emissions

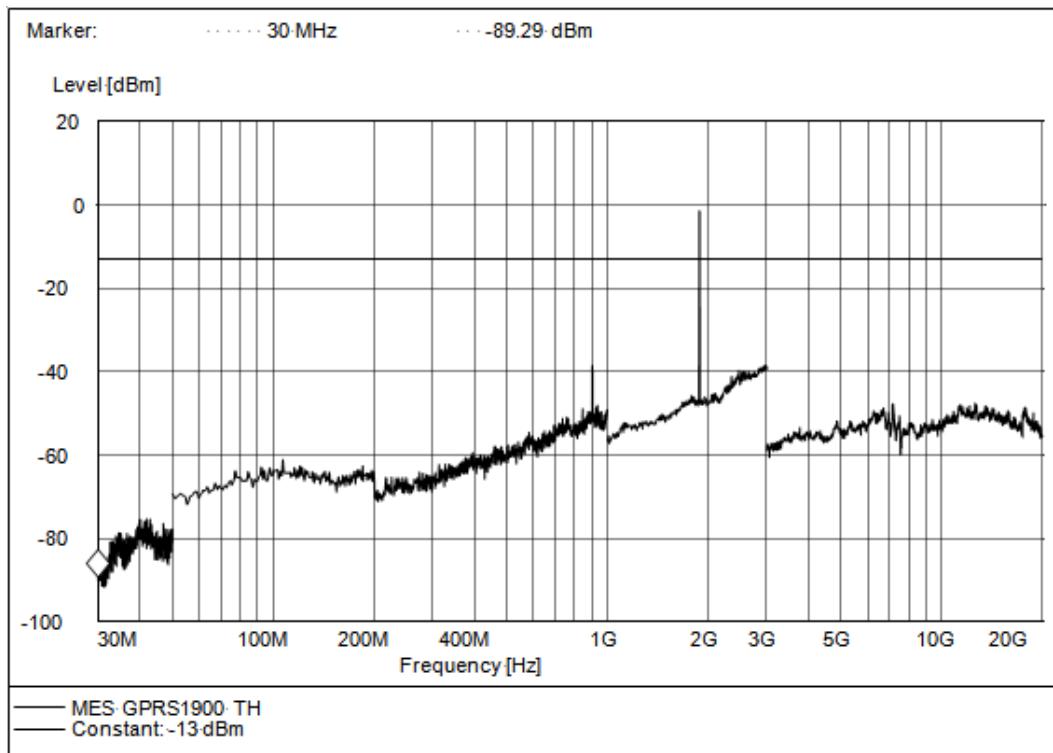
Note: For 9 KHz to 30MHz: the amplitude of spurious emissions is attenuated by more than 20dB below the permissible value, so we not provide the test result here.



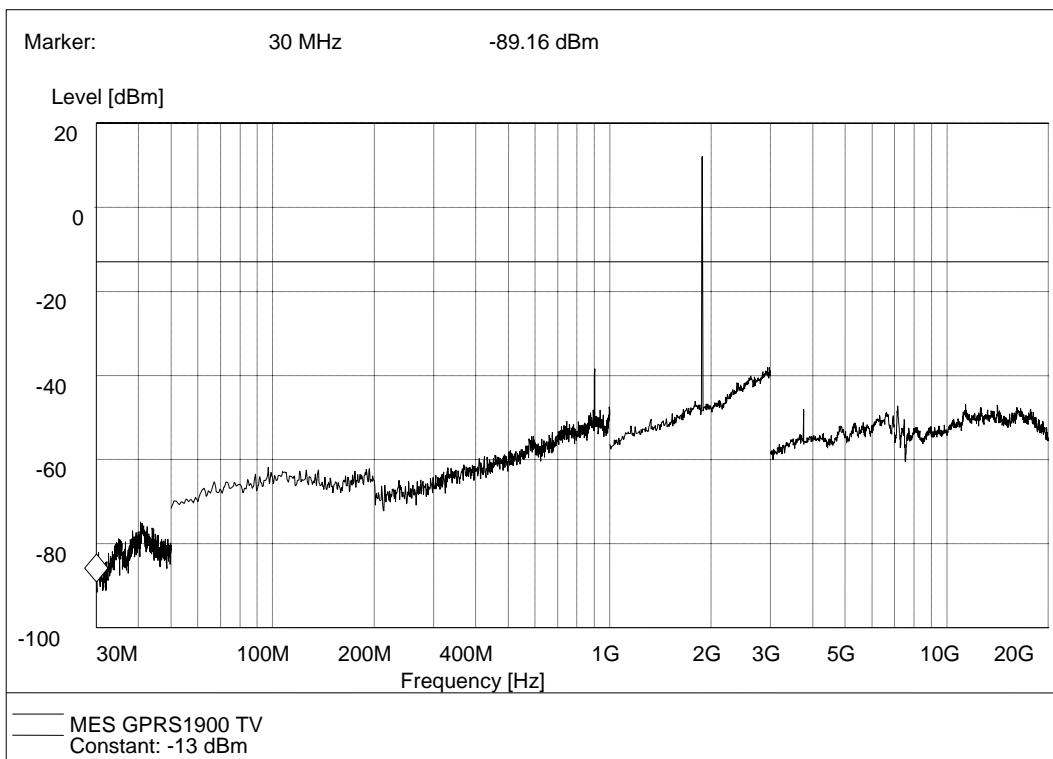
GPRS 850MHz, Test Antenna Horizontal



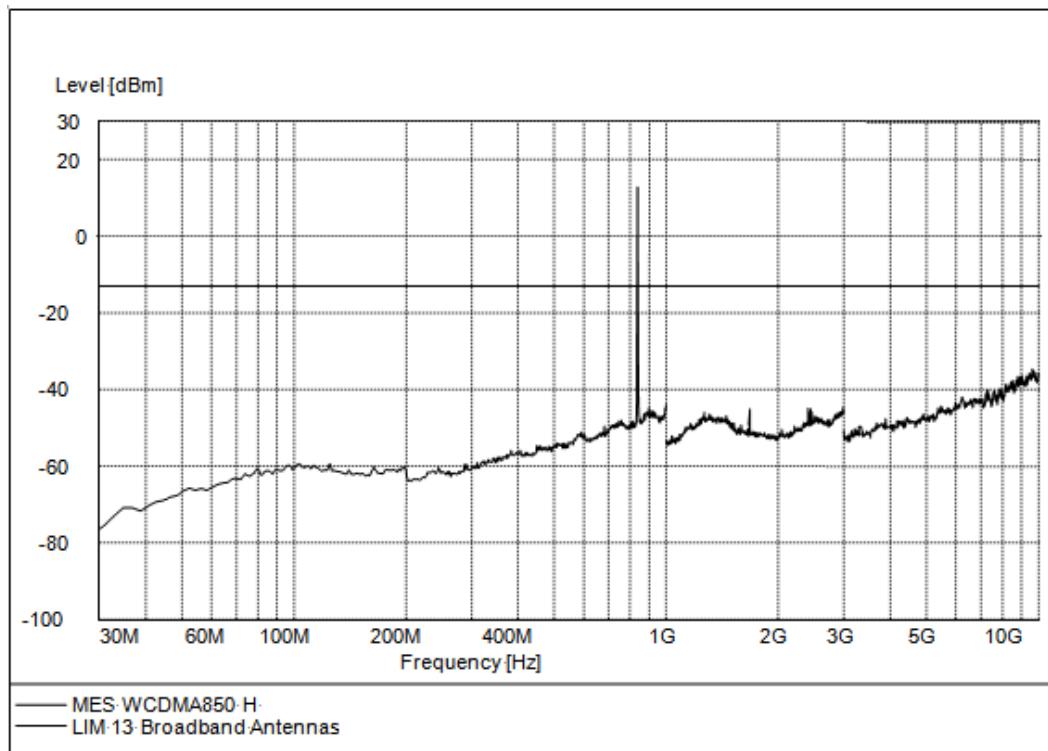
GPRS 850MHz, Test Antenna Vertical



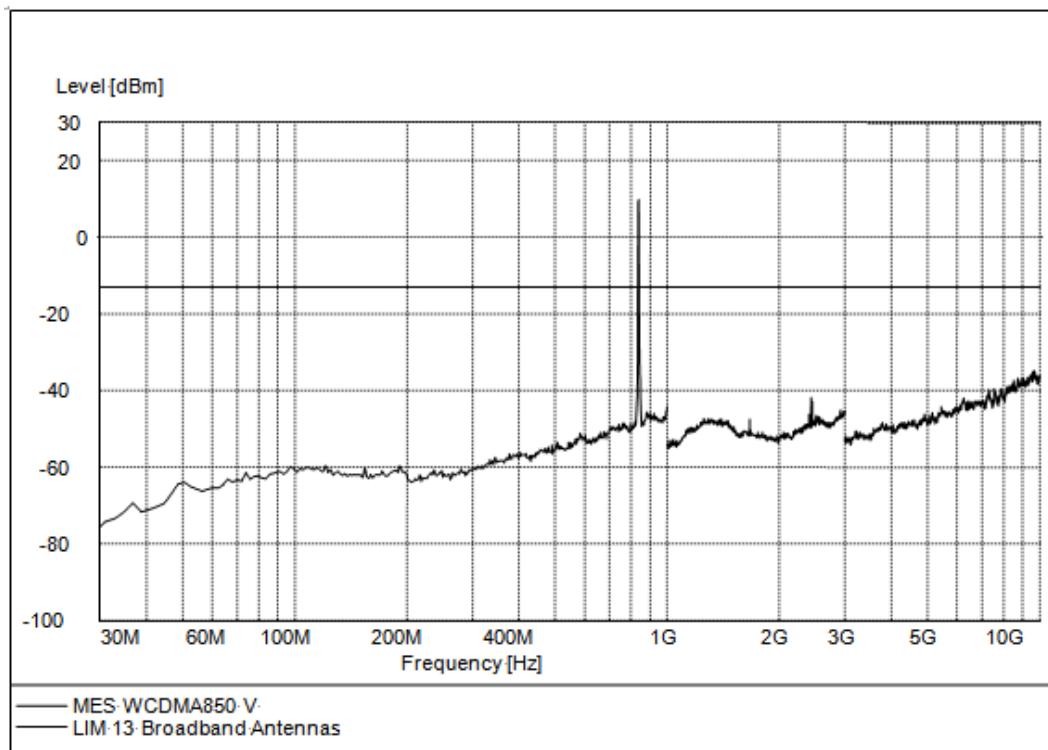
GPRS 1900MHz, Test Antenna Horizontal



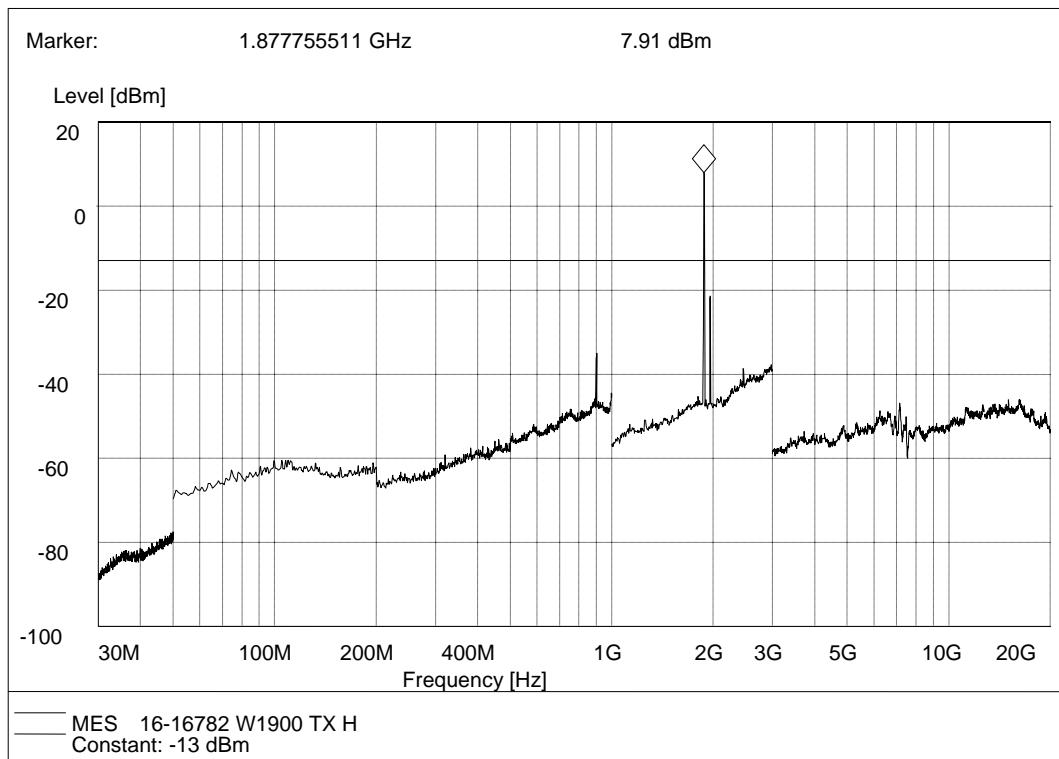
GPRS 1900MHz, Test Antenna Vertical



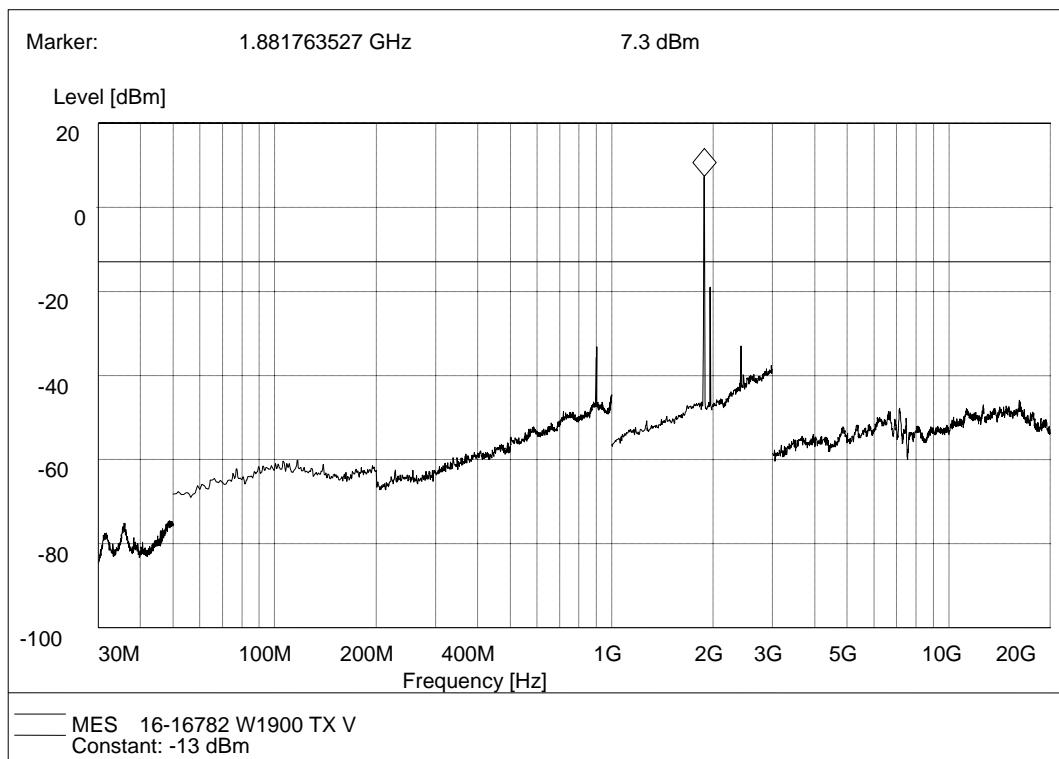
WCDMA 850MHz, Test Antenna Horizontal



WCDMA 850MHz, Test Antenna Vertical



WCDMA 1900MHz, Test Antenna Horizontal



WCDMA 1900MHz, Test Antenna Vertical

3. LIST OF MEASURING EQUIPMENT

| Item | Test Equipment | Manufacturer | Model No. | Serial No. | Last Cal. |
|------|-------------------------|-------------------|-----------|--------------|------------|
| 1 | EMI TEST RECEIVER | Rohde&Schwarz | ESI 26 | 100009 | 2015/11/02 |
| 2 | RF TEST PANEL | Rohde&Schwarz | TS / RSP | 335015/ 0017 | N/A |
| 3 | EMI TEST SOFTWARE | Rohde&Schwarz | ESK1 | N/A | N/A |
| 4 | Ultra-Broadband Antenna | ShwarzBeck | VULB9163 | 538 | 2015/11/08 |
| 5 | Ultra-Broadband Antenna | ShwarzBeck | VULB9163 | 539 | 2015/11/08 |
| 6 | HORN ANTENNA | ShwarzBeck | 9120D | 1011 | 2015/11/08 |
| 7 | HORN ANTENNA | ShwarzBeck | 9120D | 1012 | 2015/11/08 |
| 8 | Loop Antenna | Rohde&Schwarz | HZ-9 | 838622\013 | 2015/11/08 |
| 9 | HORN ANTENNA | Rohde&Schwarz | HF906 | 10068 | 2015/11/02 |
| 10 | HORN ANTENNA | Rohde&Schwarz | HF906 | 10039 | 2015/11/02 |
| 11 | Pre-amplifier | ShwarzBeck | BBV 9743 | 9743-0022 | 2015/11/02 |
| 12 | Pre-amplifier | ShwarzBeck | BBV 9718 | BBV 9718 | 2015/11/02 |
| 13 | TURNTABLE | MATURO | TT2.0 | N/A | N/A |
| 14 | ANTENNA MAST | MATURO | TAM-4.0-P | N/A | N/A |
| 15 | EMI TEST SOFTWARE | Audix | E3 | N/A | N/A |
| 16 | Test cable | Siva Cables Italy | RG 58A/U | W14.02 | 2015/12/05 |
| 17 | Climate Chamber | ESPEC | EL-10KA | 05107008 | 2015/11/02 |
| 18 | Spectrum Analyzer | Kysight | N9030A | ATO-67098 | 2016/07/19 |
| 19 | Power Meter | Rohde&Schwarz | NRP2 | 1020.1809.02 | 2016.06.02 |
| 20 | Power Sensor | Rohde&Schwarz | NRP-Z81 | 823.3618.03 | 2016.06.02 |
| 21 | System Simulator | Rohde&Schwarz | CMU200 | 112012 | 2015/11/2 |
| 22 | System Simulator | R&S | CMW500 | 148888 | 2016.06.02 |

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 Emission | 9kHz~30MHz | 3.39dB |
| Radiated Emission | 30MHz~1000MHz | 4.24dB |
| | 1G~18GHz | 5.16dB |
| | 18G~40GHz | 5.54dB |

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

** END OF REPORT **