



# RF TEST REPORT

**Report No.:** SET2014-12404

**Product:** OBD Telematics Dongle

**FCC ID:** 2ADKG-CW-601G

**Model No.:** CW-601GX0

**Applicant:** Shenzhen Chainway ITS Co., Ltd.

**Address:** R&D Building A 601, Tsinghua Information Harbor, Hi-Tech

Industrial Park North, Nanshan, Shenzhen, China

**Issued by:** CCIC-SET

**Lab Location:** Electronic Testing Building, Shahe Road, Xili, Nanshan District, Shenzhen China

**Tel:** 86 755 26627338      **Fax:** 86 755 26627238

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## Test Report

**Product:** OBD Telematics Dongle

**Brand Name:** CHAINWAY

**Trade Name:** CHAINWAY

**Applicant:** Shenzhen Chainway ITS Co., Ltd.

**Applicant Address:** R&D Building A 601, Tsinghua Information Harbor, Hi-Tech Industrial Park North, Nanshan, Shenzhen, China

**Manufacturer:** Shenzhen Chainway ITS Co., Ltd.

**Manufacturer Address:** R&D Building A 601, Tsinghua Information Harbor, Hi-Tech Industrial Park North, Nanshan, Shenzhen, China

**Test Standards:** 47 CFR Part 2(10-1-12 Edition) Frequency Allocations and Radio Treaty Matters; General Rules and Regulations  
47 CFR Part 22(10-1-12 Edition) Public Mobile Services  
47 CFR Part 24(10-1-12 Edition) Personal Communications Services

**Test Result:** PASS

**Tested by :**

2014.11.14

Haigang He, Test Engineer

**Reviewed by:**

2014.11.14

Shuangwen Zhang, Senior Engineer

**Approved by:**

2014.11.14

Wu Li'an, Manager

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| Change History |            |                   |
|----------------|------------|-------------------|
| Issue          | Date       | Reason for change |
| 1.0            | 2014-11-14 | First edition     |
|                |            |                   |
|                |            |                   |

## 1. GENERAL INFORMATION

### 1.1 EUT Description

EUT Type.....: OBD Telematics Dongle  
Serial No.....: GXG11140140418015038  
Hardware Version .....: OBD II \_V24  
Software Version .....: OBD\_WM\_1.7  
Frequency Range .....: GSM 850MHz:  
Tx: 824.20 - 848.80MHz (at intervals of 200kHz);  
Rx: 869.20 - 893.80MHz (at intervals of 200kHz)  
GSM 1900MHz:  
Tx: 1850.20 - 1909.80MHz (at intervals of 200kHz);  
Rx: 1930.20 - 1989.80MHz (at intervals of 200kHz)  
Modulation Type.....: GSM,GPRS Mode with GMSK Modulation  
Multislot Class.....: GPRS: Multislot Class12  
Antenna Type.....: FIFA Antenna  
Emission Designators .....: GSM 850:248KGXW,GSM 1900:244KGXW  
GPRS 850:248KGXW;GRPS 1900:248KGXW

*Note 1:* The transmitter (Tx) frequency arrangement of the Cellular 850MHz band used by the EUT can be represented with the formula  $F(nq)=824.2+0.2*(n-128)$ ,  $128 \leq n \leq 251$ ; the lowest, middle, highest channel numbers (ARFCHs) used and tested in this report are separately 128 (824.2MHz), 190 (836.6MHz) and 251 (848.8MHz).

*Note 2:* The transmitter (Tx) frequency arrangement of the PCS 1900MHz band used by the EUT can be represented with the formula  $F(n)=1850.2+0.2*(n-512)$ ,  $512 \leq n \leq 810$ ; the lowest, middle and highest channel numbers (ARFCHs) used and tested in this report are separately 512 (1850.2MHz), 661 (1880.0MHz) and 810 (1909.8MHz).

*Note 3:* For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer

## 1.2 Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 2, Part 22, Part 24 and part27 for the EUT FCC ID Certification:

| No. | Identity                            | Document Title  |
|-----|-------------------------------------|---|
| 1   | 47 CFR Part 2<br>(10-1-12 Edition)  | Frequency Allocations and Radio Treaty Matters; General Rules and Regulations |
| 2   | 47 CFR Part 22<br>(10-1-12 Edition) | Public Mobile Services  |
| 3   | 47 CFR Part 24<br>(10-1-12 Edition) | Personal Communications Services  |

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

| No. | Section                         | Description                           | Result |
|-----|---------------------------------|---------------------------------------|--------|
| 1   | 2.1046                          | Conducted RF Output Power             | PASS   |
| 2   | 2.1049,24.232(d)                | Peak to Average Radio                 | PASS   |
| 3   | 2.1049,22.917<br>24.238         | Occupied Bandwidth                    | PASS   |
| 4   | 2.1055,22.355<br>24.235         | Frequency Stability                   | PASS   |
| 5   | 2.1051,2.1057<br>22.917,24.238  | Conducted Out of Band Emissions       | PASS   |
| 6   | 2.1051,2.1057<br>22.917,24.238, | Band Edge                             | PASS   |
| 7   | 22.913,24.232                   | Transmitter Radiated Power (EIPR/ERP) | PASS   |
| 8   | 2.1053,2.1057<br>22.917,24.238  | Radiated Out of Band Emissions        | PASS   |

NOTE: Measurement method according to TIA/EIA 603.D-2010

## 1.3 Facilities and Accreditations

### 1.3.1 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, valid time is until October 28, 2017.

**1.3.2 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

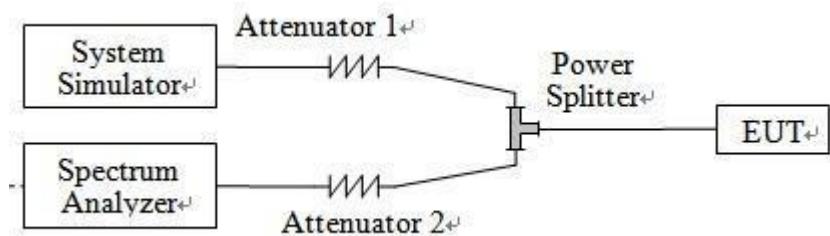
### 2.1 Conducted RF Output Power

#### 2.1.1 Requirement

According to FCC section 2.1046(a), for transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in FCC section 2.1033(c)(8).

#### 2.1.2 Test Description

##### 1. Test Setup:



The EUT, which is powered by the Battery, is coupled to the Spectrum Analyzer (SA) and the System Simulator (SS) with Attenuators through the Power Splitter; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. The EUT is commanded by the SS to operate at the maximum output power i.e. Power Control Level (PCL) = 5 and Power Class = 4. A call is established between the EUT and the SS.

##### 2. Equipments List:

| Description      | Manufacturer | Model  | Serial No.   | Cal.Date   | Cal.Due Date |
|------------------|--------------|--------|--------------|------------|--------------|
| System Simulator | Agilent      | E5515C | MY47510547   | 2014.06.11 | 2015.06.10   |
| Power Meter      | R&S          | NRV2   | 1020.1809.02 | 2014.06.08 | 2015.06.07   |
| Power Sensor     | R&S          | NRV-Z4 | 823.3618.03  | 2014.06.08 | 2015.06.07   |
| Attenuator 1     | MCE          | 10dB   | BN3693       | 2014.06.11 | 2015.06.10   |
| Attenuator 2     | Resent       | 3dB    | (n.a.)       | 2014.06.11 | 2015.06.10   |

#### 2.1.3 Test Results

Here the lowest, middle and highest channels are selected to perform testing to verify the conducted RF output power of the EUT.

## 1. GSM Model Test Verdict:

| Band         | Channel | Frequency (MHz) | Measured Output Power (dBm) | Verdict |
|--------------|---------|-----------------|-----------------------------|---------|
| GSM 850MHz   | 128     | 824.2           | 32.81                       | PASS    |
|              | 190     | 836.6           | 32.86                       | PASS    |
|              | 251     | 848.8           | 32.84                       | PASS    |
| GSM 1900MHz  | 512     | 1850.2          | 30.44                       | PASS    |
|              | 661     | 1880.0          | 30.57                       | PASS    |
|              | 810     | 1909.8          | 30.35                       | PASS    |
| GPRS 850MHz  | 128     | 824.2           | 32.19                       | PASS    |
|              | 190     | 836.6           | 32.36                       | PASS    |
|              | 251     | 848.8           | 32.20                       | PASS    |
| GPRS 1900MHz | 512     | 1850.2          | 29.85                       | PASS    |
|              | 661     | 1880.0          | 29.79                       | PASS    |
|              | 810     | 1909.8          | 30.01                       | PASS    |

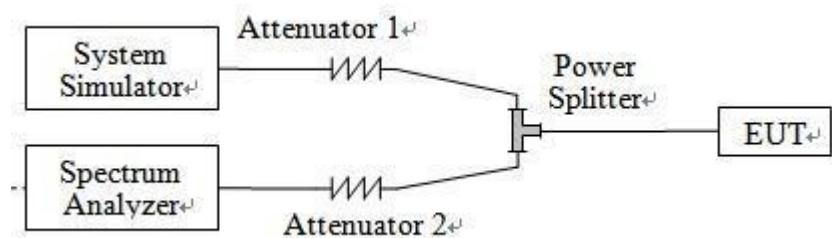
Note 1: For the GPRS model, all the slots were tested and just the worst data was record in this report.

## 2.2 Peak to Average Radio

### 2.2.1 Definition

According to FCC section 2.1049 and FCC 24.232(d), the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

### 2.2.2 Test Description



| Description       | Manufacturer | Model  | Serial No. | Cal. Date  | Cal. Due Date |
|-------------------|--------------|--------|------------|------------|---------------|
| System Simulator  | R&S          | CMW500 | 149333     | 2014.07.21 | 2015.07.20    |
| Spectrum Analyzer | R&S          | FSP40  | 100341     | 2014.07.07 | 2015.07.06    |
| Attenuator 1      | Resent       | 10dB   | (n.a.)     | 2014.06.11 | 2015.06.10    |
| Attenuator 2      | Resent       | 3dB    | (n.a.)     | 2014.06.11 | 2015.06.10    |

### 2.2.3 Test Verdict

Here the lowest, middle and highest channels are selected to perform testing to verify the peak-to-average ratio.

Test procedures:

A. For GSM operating mode:

- Set RBW=1MHz, VBW=3MHz, peak detector in spectrum analyzer.
- Set EUT in maximum output power, and triggered the burst signal.
- Measured respectively the peak level and mean level, and the deviation was recorded as Peak to Average radio.

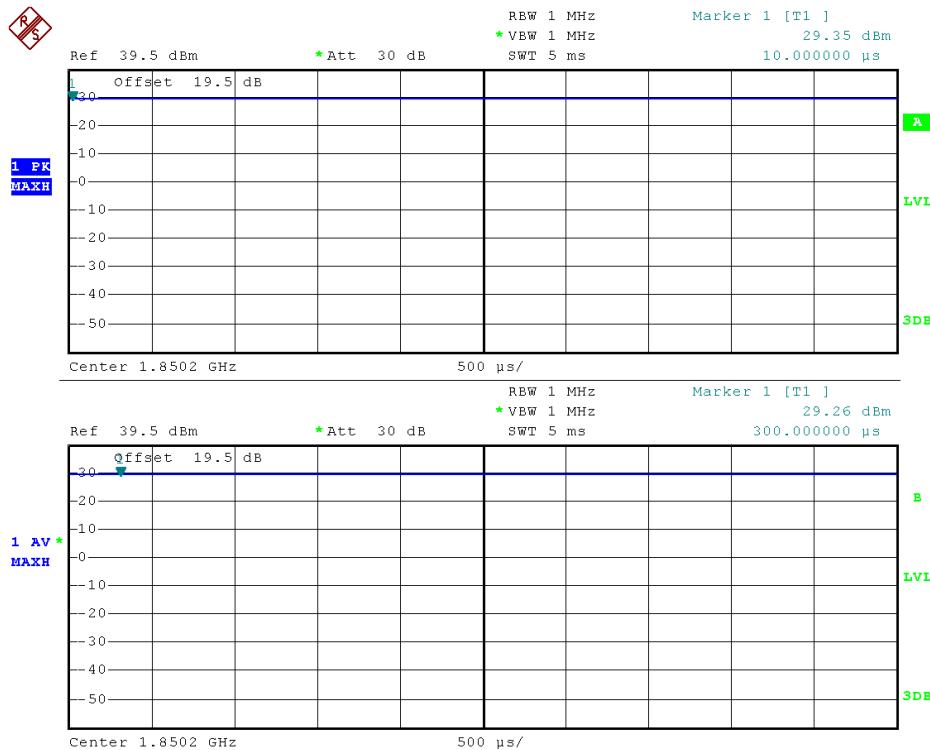
B. For UMTS operating mode:

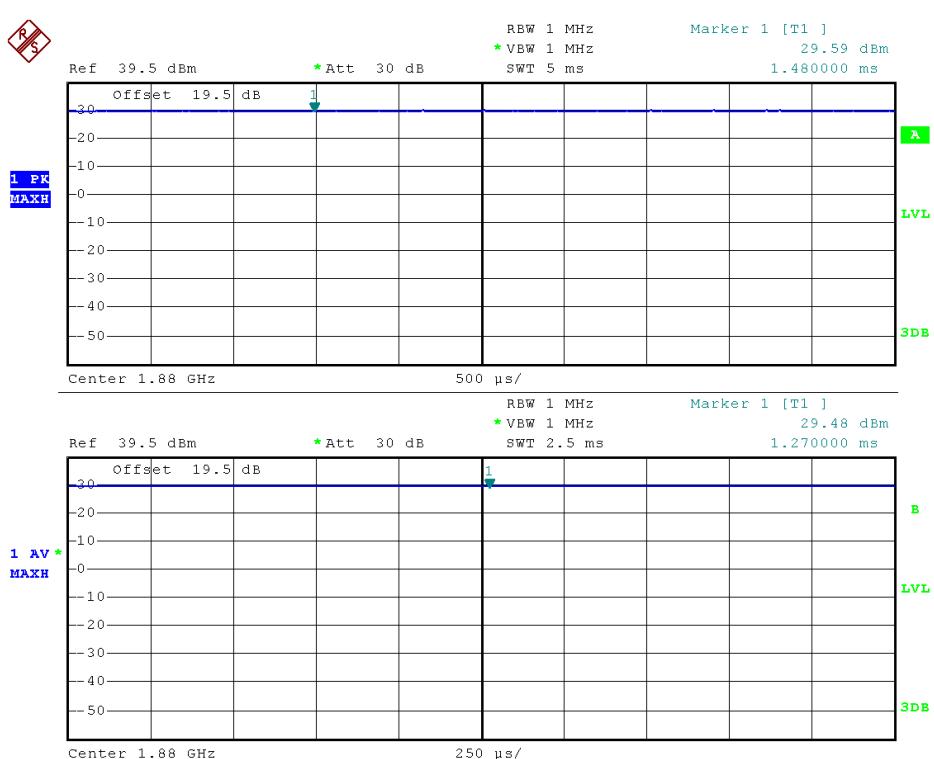
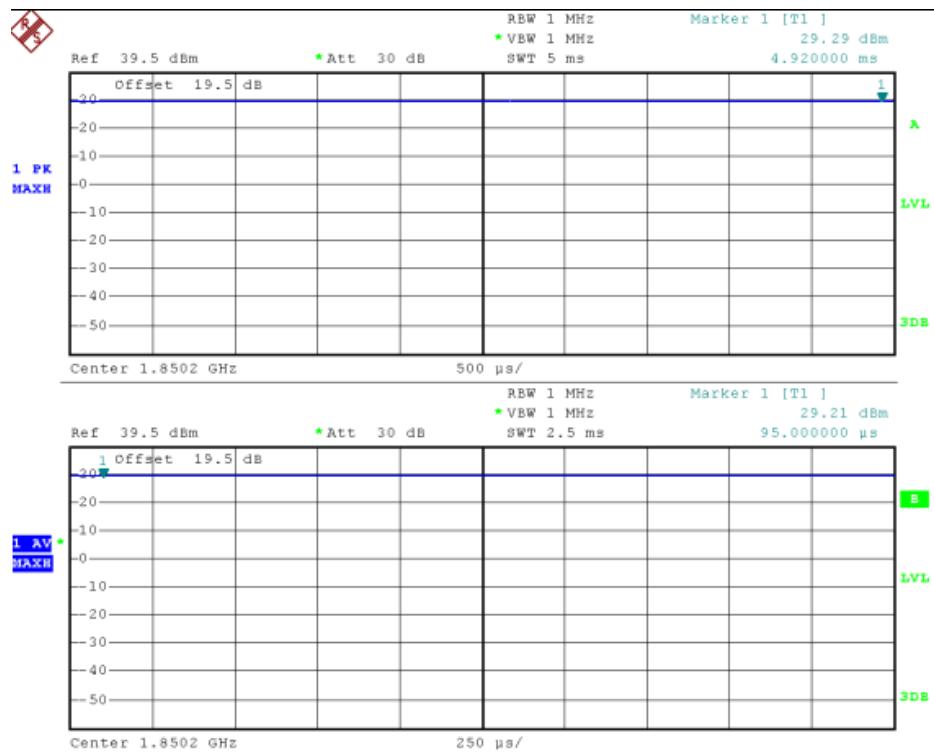
- Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
- The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1%.

### 1. Test Verdict:

| Band           | Channel | Frequency<br>(MHz) | Peak to Average radio |               | Limit<br>dBm | Verdict |
|----------------|---------|--------------------|-----------------------|---------------|--------------|---------|
|                |         |                    | dBm                   | Refer to Plot |              |         |
| GSM<br>1900MHz | 512     | 1850.2             | 0.09                  | Plot A1 to A3 | 13           | PASS    |
|                | 661     | 1880.0             | 0.08                  |               |              | PASS    |
|                | 810     | 1909.8             | 0.11                  |               |              | PASS    |

### 2. GSM Model Test Plots:





## 2.3 99% Occupied Bandwidth

### 2.3.1 Definition

According to FCC section 2.1049, the occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.

Occupied bandwidth is also known as the 99% emission bandwidth,

### 2.3.2 Test Description

See section 2.1.2 of this report.

### 2.3.3 Test Procedures

1. The testing follows FCC KDB 971168 v02r01 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 Verdict

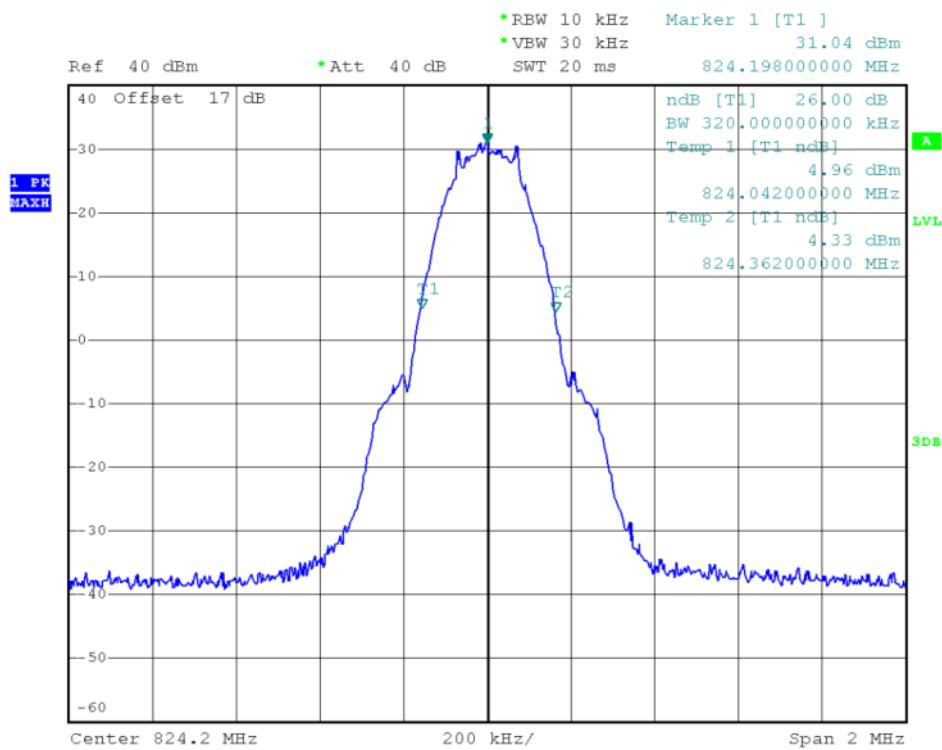
Here the lowest, middle and highest channels are selected to perform testing to verify the 99% occupied bandwidth.

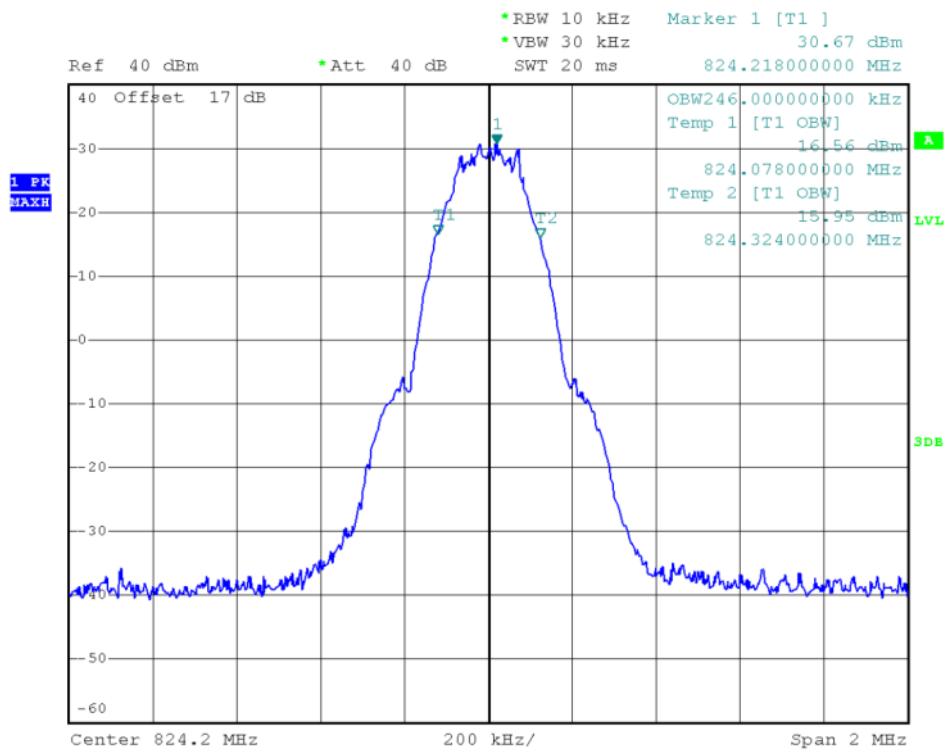
1. Test Verdict:

| Band        | Channel | Frequency (MHz) | 26dB bandwidth | 99% Occupied Bandwidth | Refer to Plot |
|-------------|---------|-----------------|----------------|------------------------|---------------|
| GSM 850MHz  | 128     | 824.2           | 320KHz         | 246KHz                 | Plot A1-A2    |
|             | 190     | 836.6           | 318KHz         | 246KHz                 | Plot A3-A4    |
|             | 251     | 848.8           | 320KHz         | 248KHz                 | Plot A5-A6    |
| GSM 1900MHz | 512     | 1850.2          | 318KHz         | 242KHz                 | Plot B1-B2    |
|             | 661     | 1880.0          | 318KHz         | 244KHz                 | Plot B3-B4    |

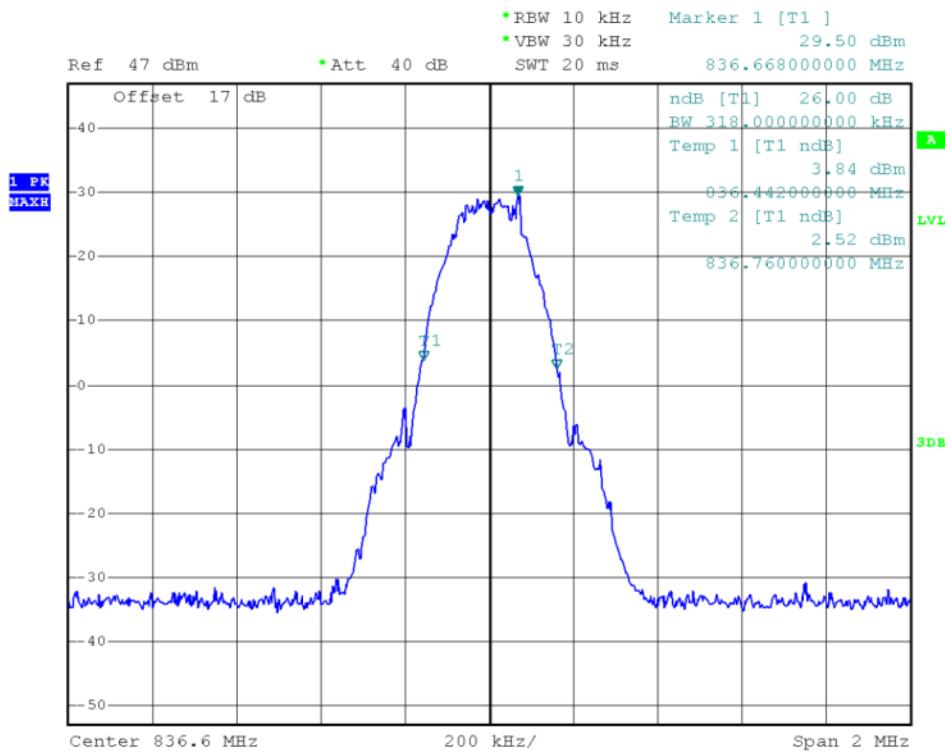
| Band         | Channel | Frequency (MHz) | 26dB bandwidth | 99% Occupied Bandwidth | Refer to Plot |
|--------------|---------|-----------------|----------------|------------------------|---------------|
| GPRS 850MHz  | 810     | 1909.8          | 314KHz         | 246KHz                 | Plot B5-B6    |
|              | 128     | 824.2           | 318KHz         | 244KHz                 | Plot C1-C2    |
|              | 190     | 836.6           | 312KHz         | 244KHz                 | Plot C3-C4    |
|              | 251     | 848.8           | 324KHz         | 248KHz                 | Plot C5-C6    |
| GPRS 1900MHz | 512     | 1850.2          | 318KHz         | 246KHz                 | Plot D1-D2    |
|              | 661     | 1880.0          | 318KHz         | 248KHz                 | Plot D3-D4    |
|              | 810     | 1909.8          | 320KHz         | 244KHz                 | Plot D5-D6    |

## 2. Test Plots:

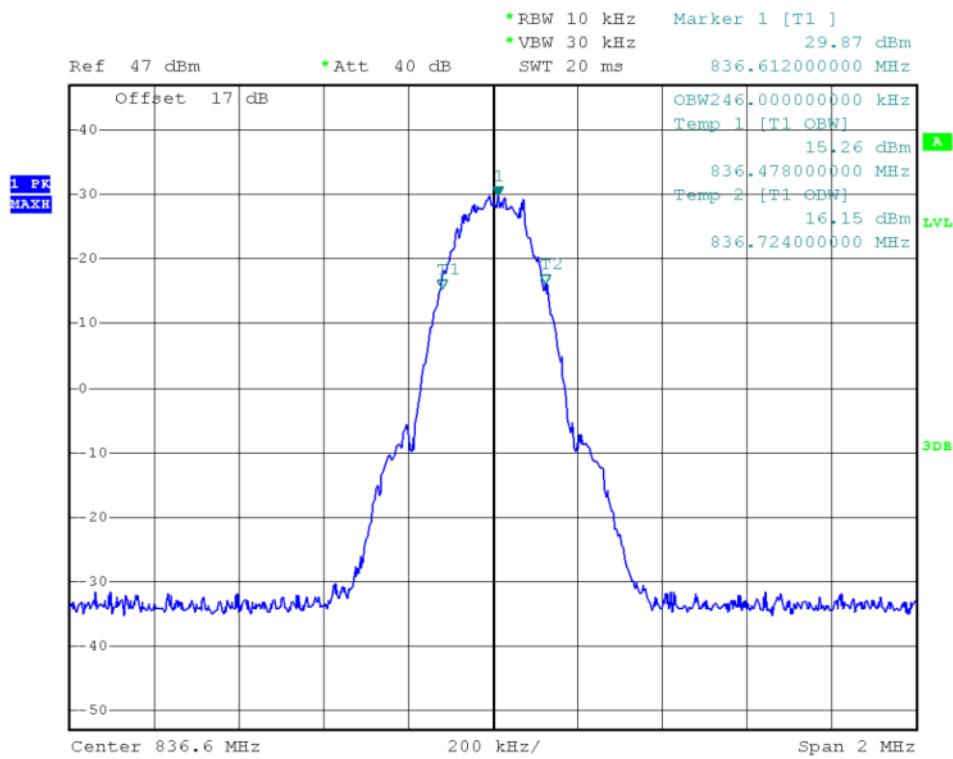




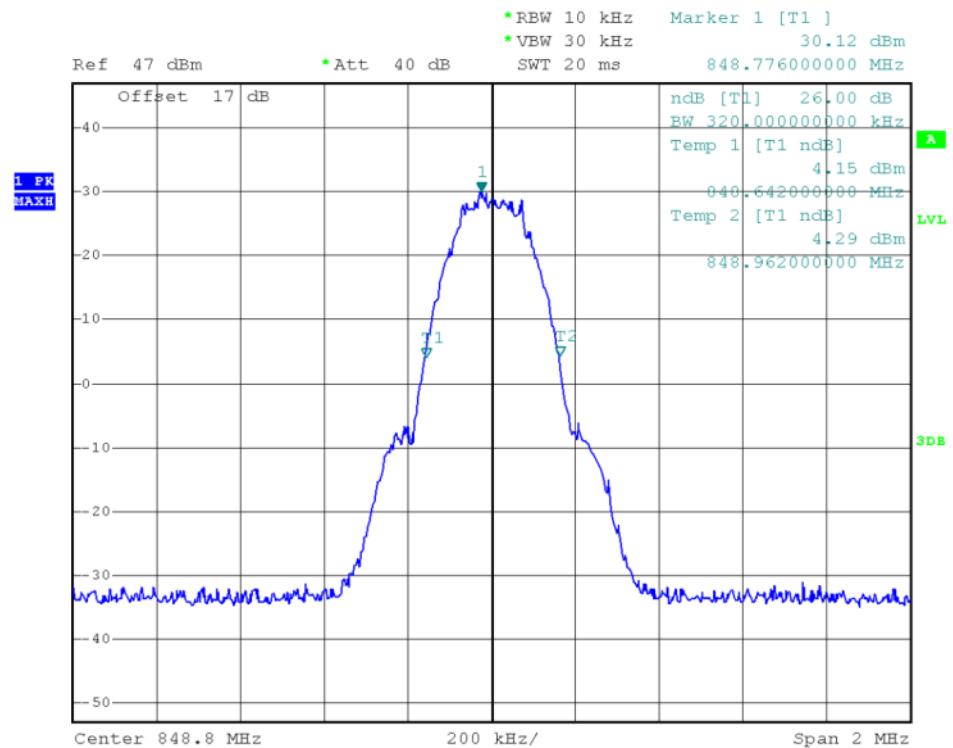
(Plot A2: GSM 850MHz Channel = 128)



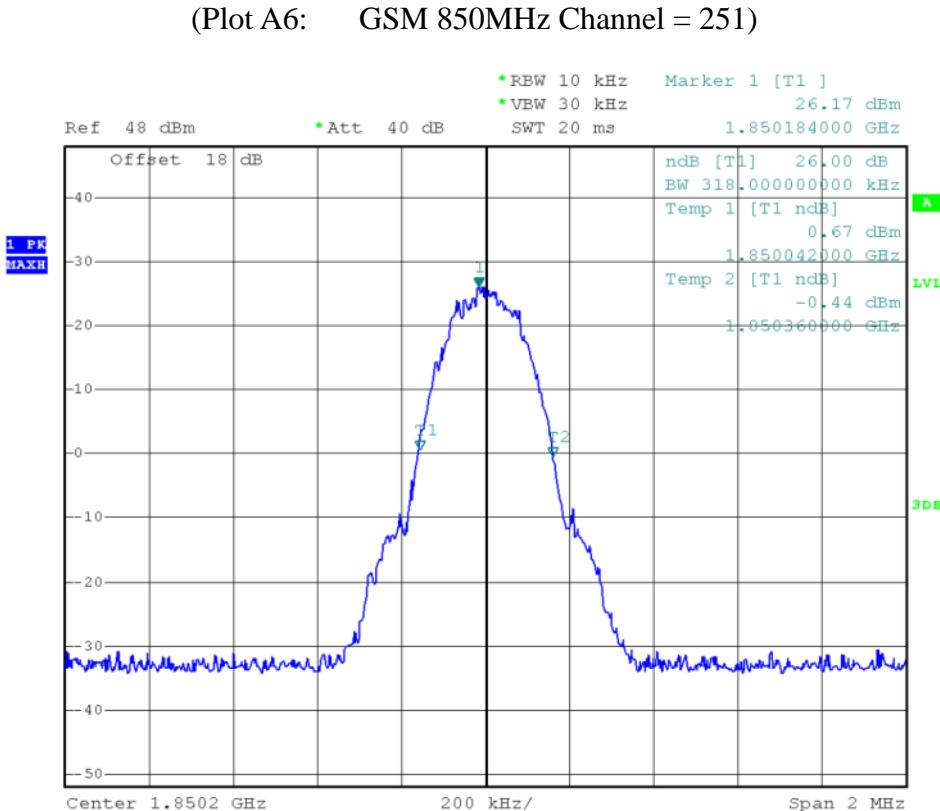
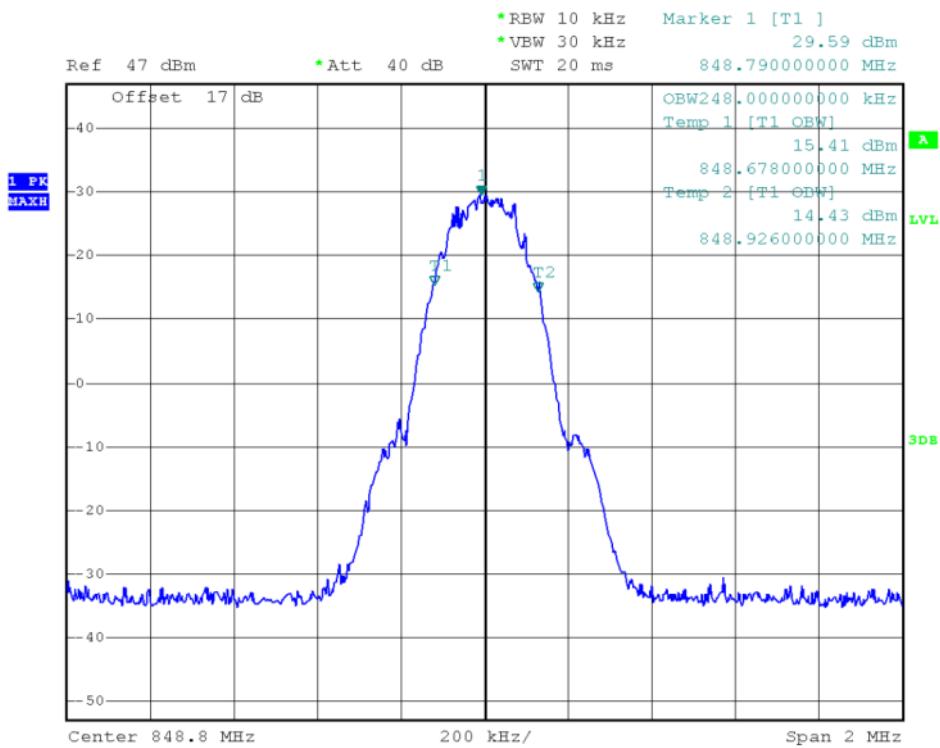
(Plot A3: GSM 850MHz Channel = 190)

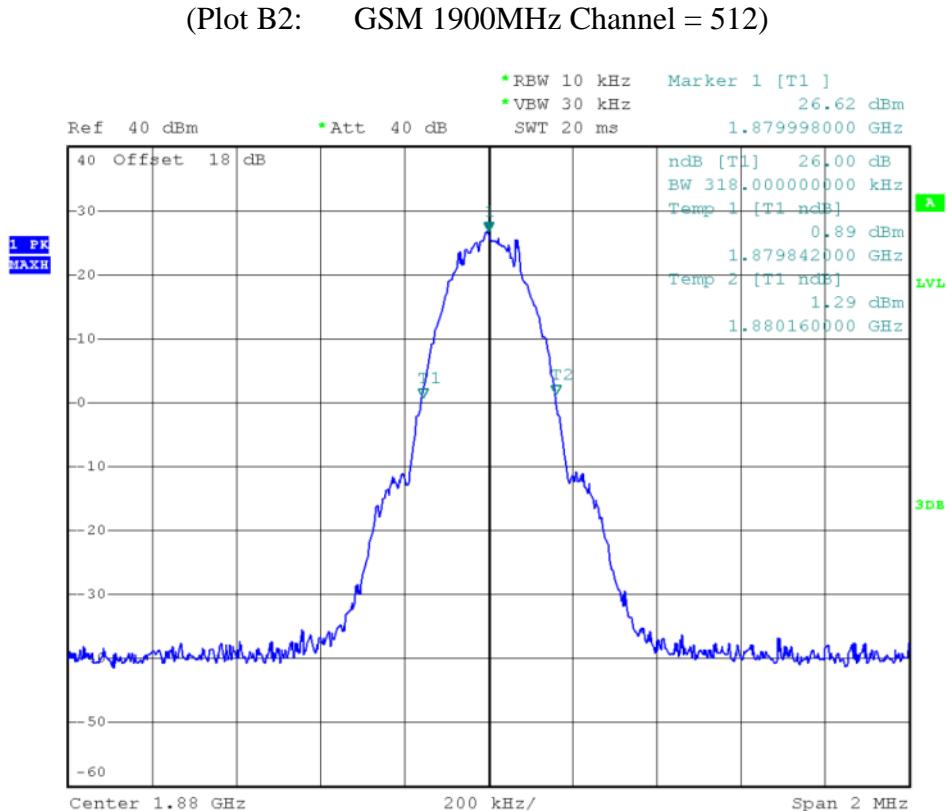
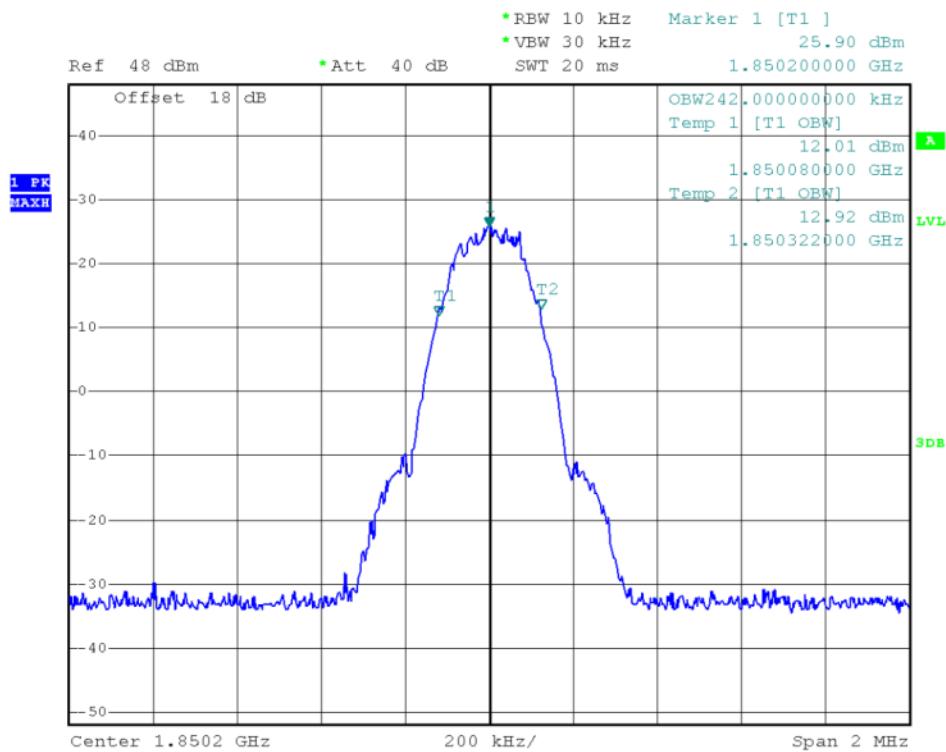


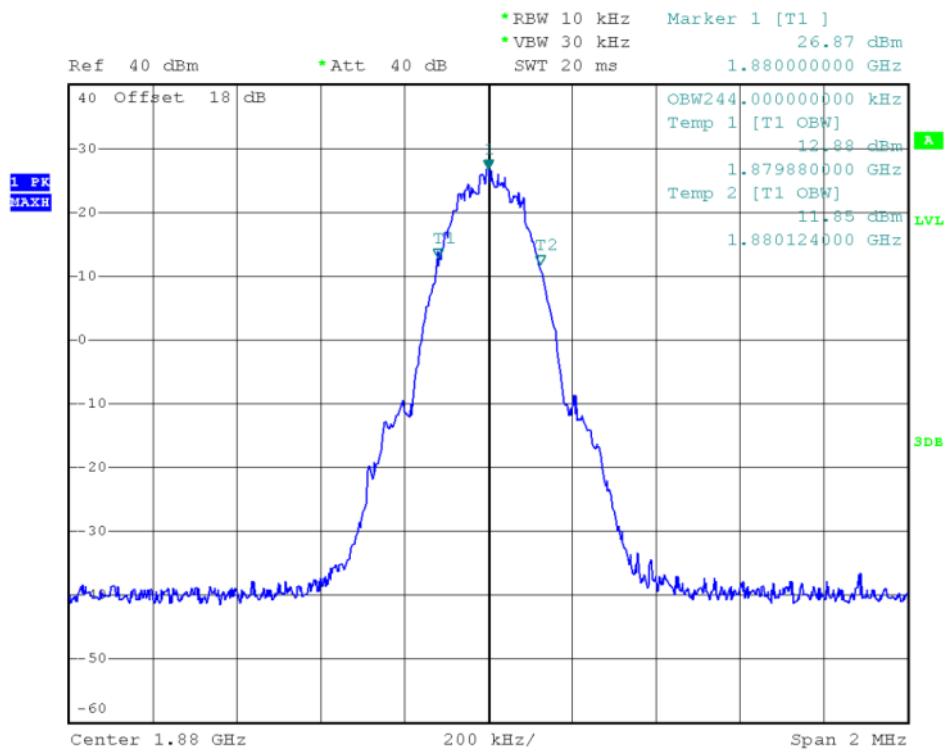
(Plot A4: GSM 850MHz Channel = 190)



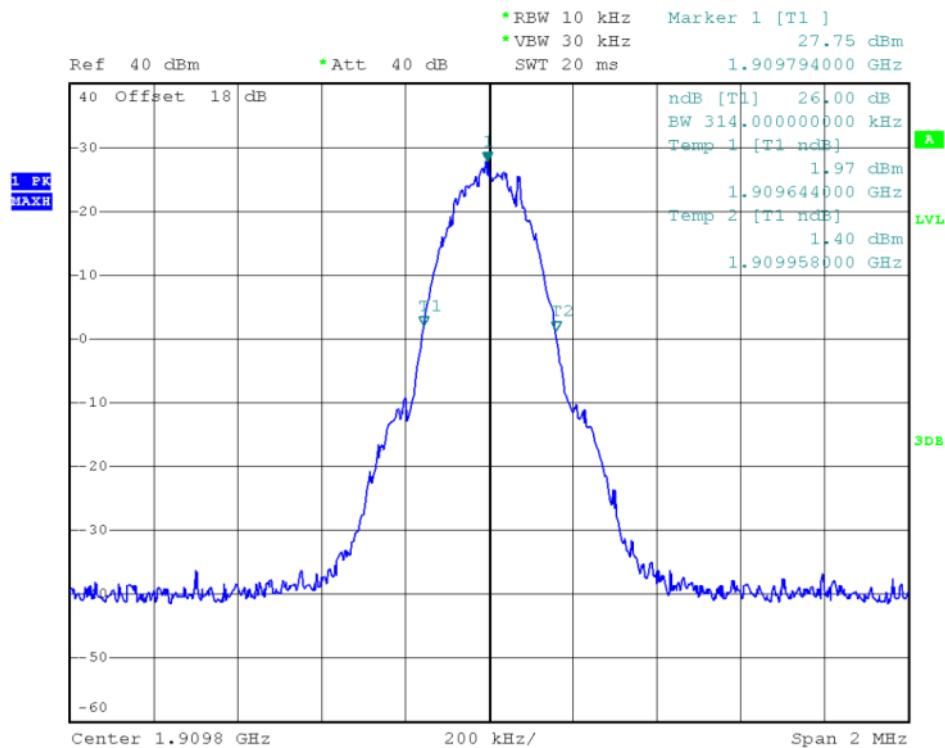
(Plot A5: GSM 850MHz Channel = 251)



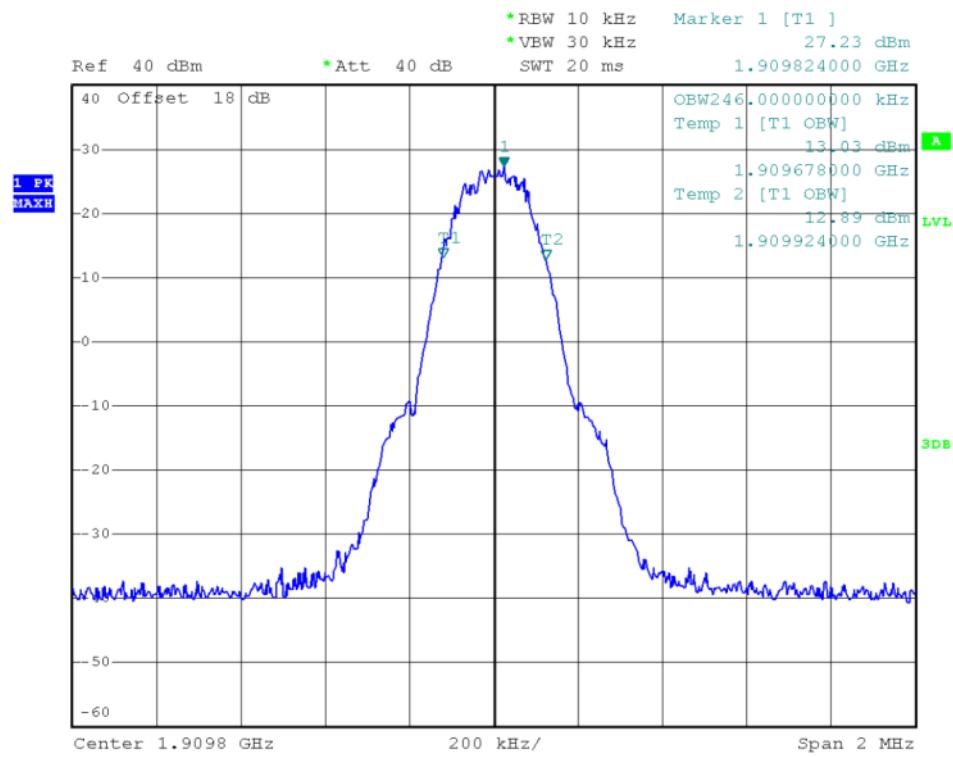




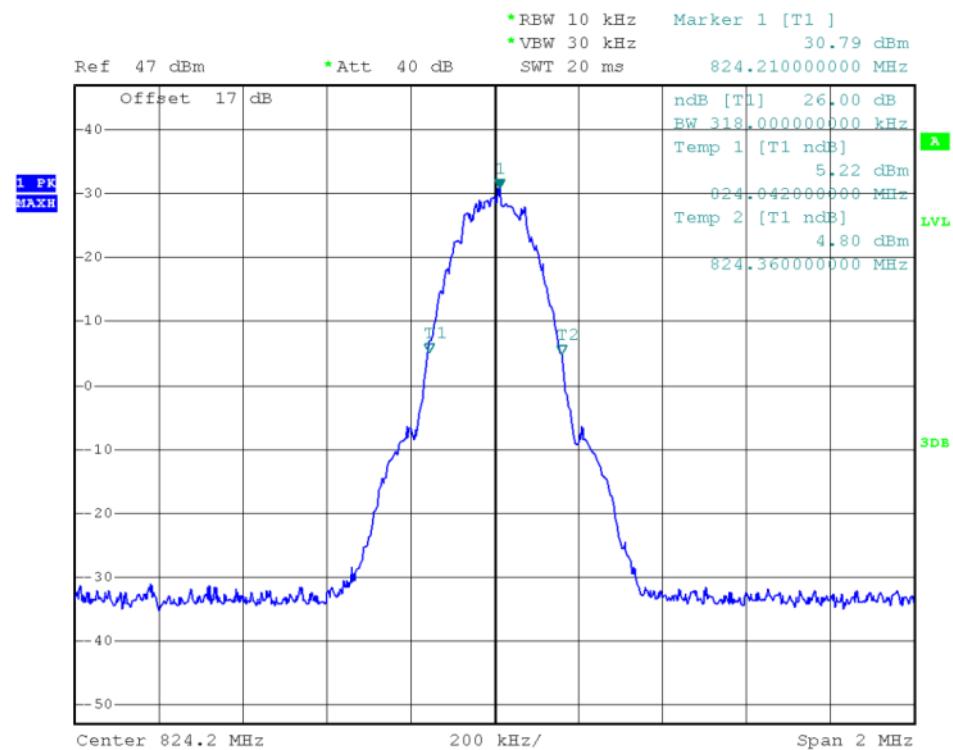
(Plot B4: GSM 1900MHz Channel = 661)



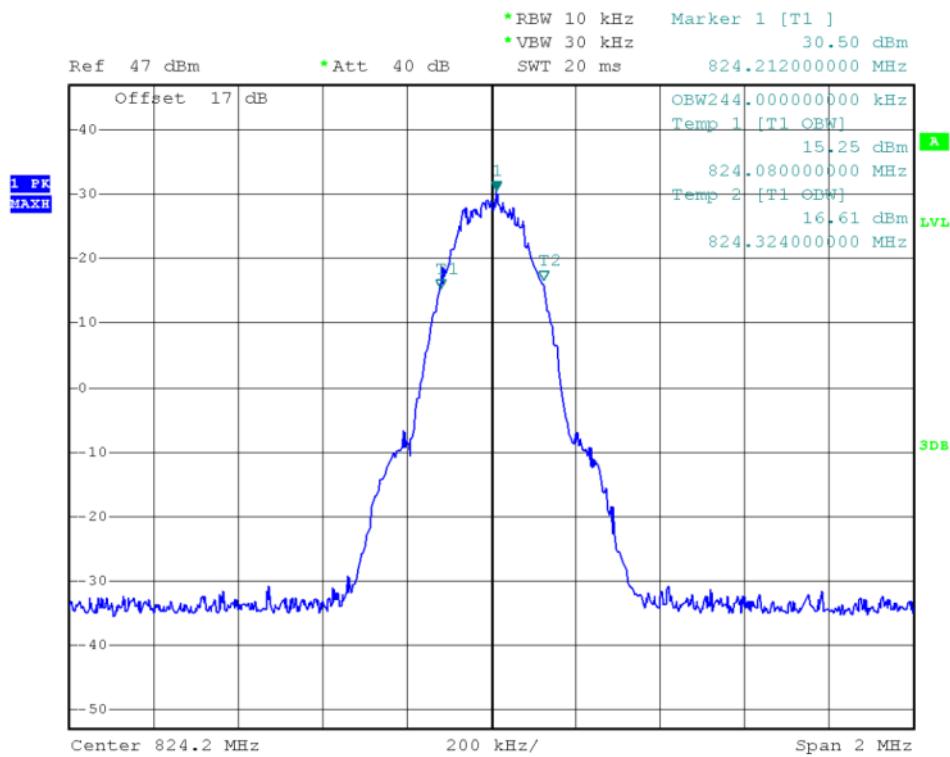
(Plot B5: GSM 1900MHz Channel = 810)



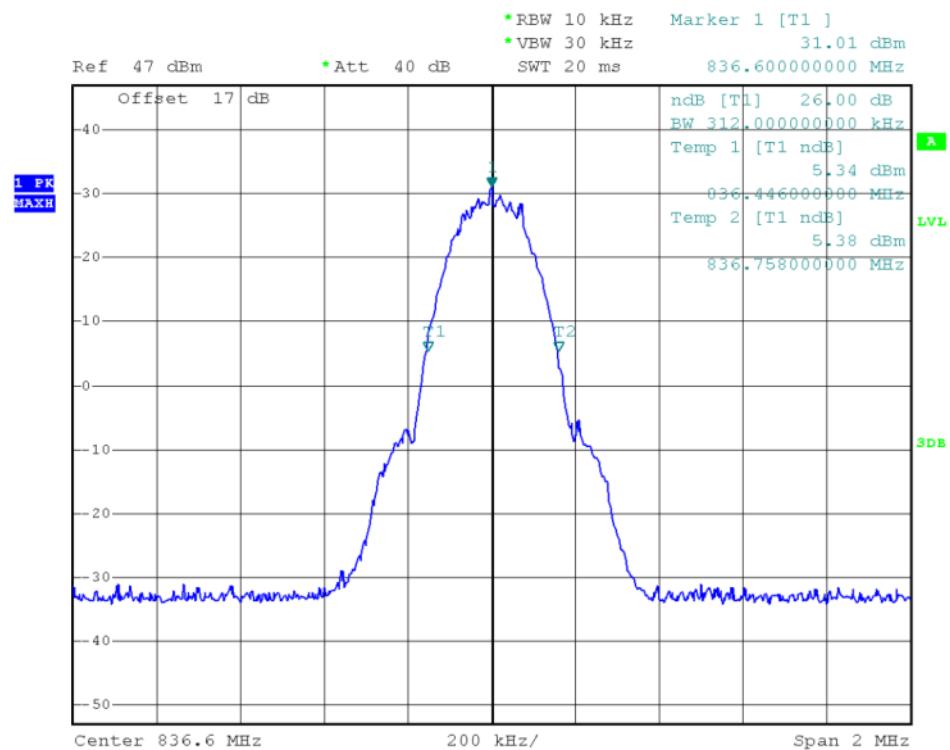
(Plot B6: GSM 1900MHz Channel = 810)



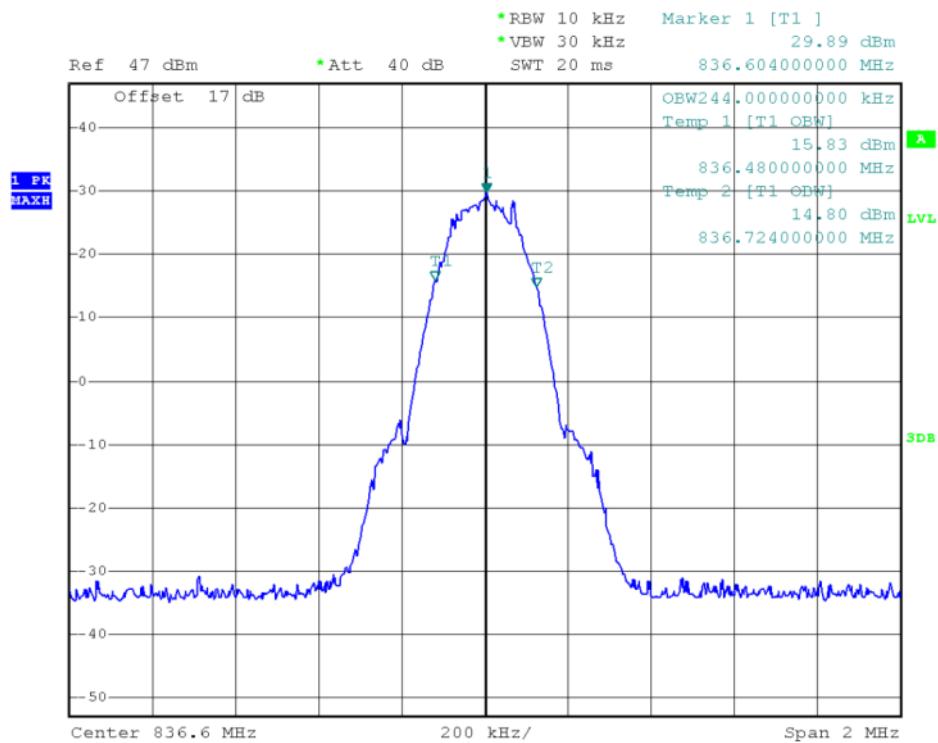
(Plot C1: GPRS 850MHz Channel = 128)



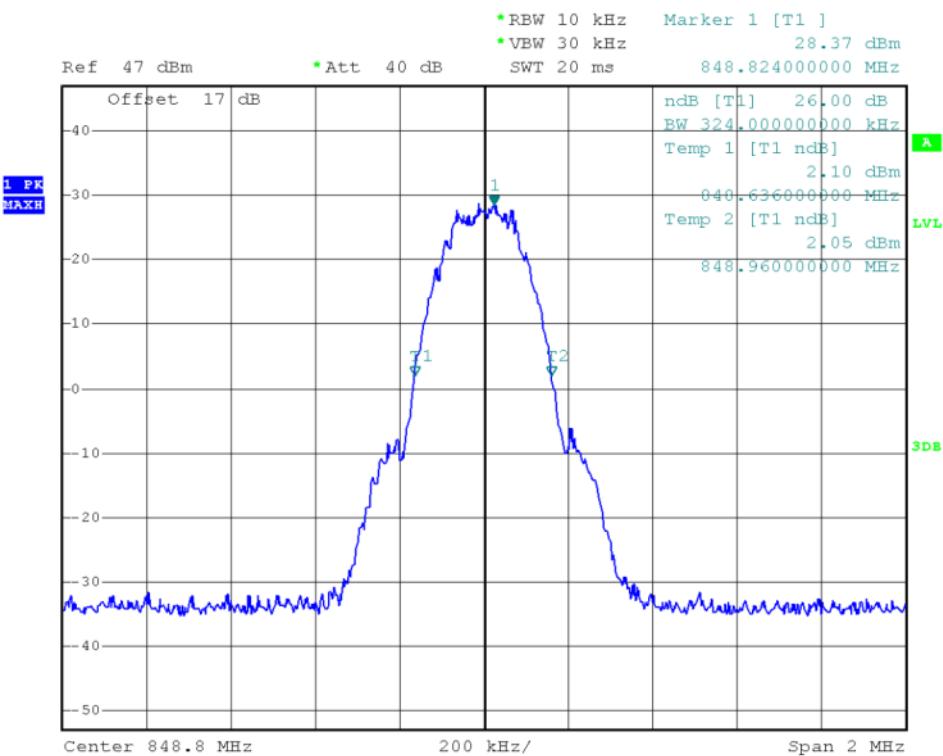
(Plot C2: GPRS 850MHz Channel = 128)



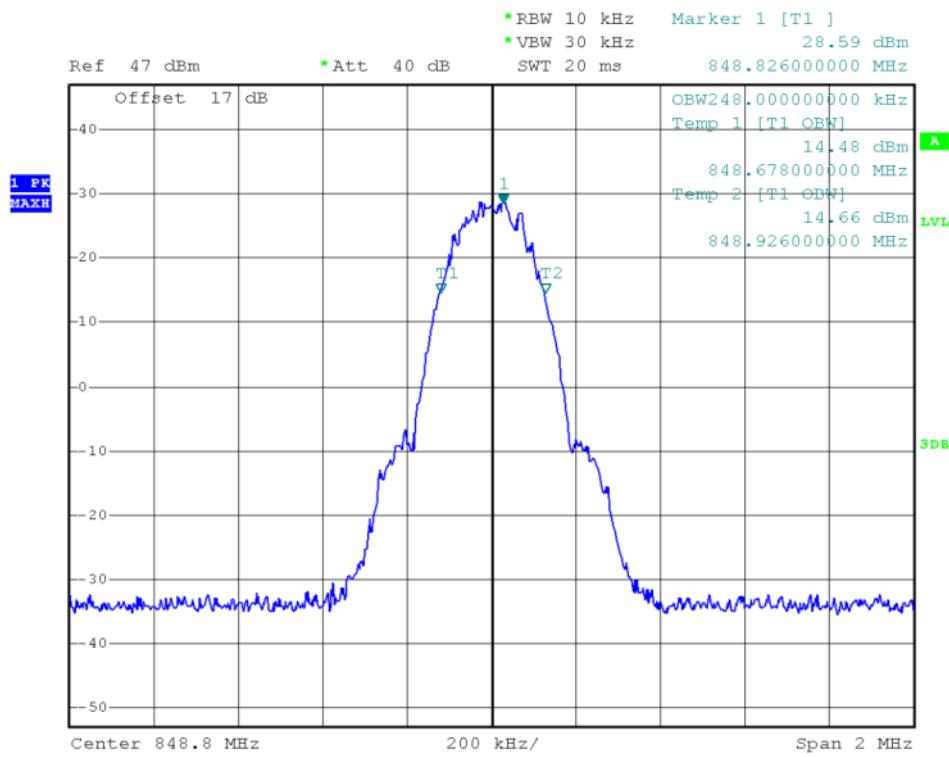
(Plot C3: GPRS 850MHz Channel = 190)



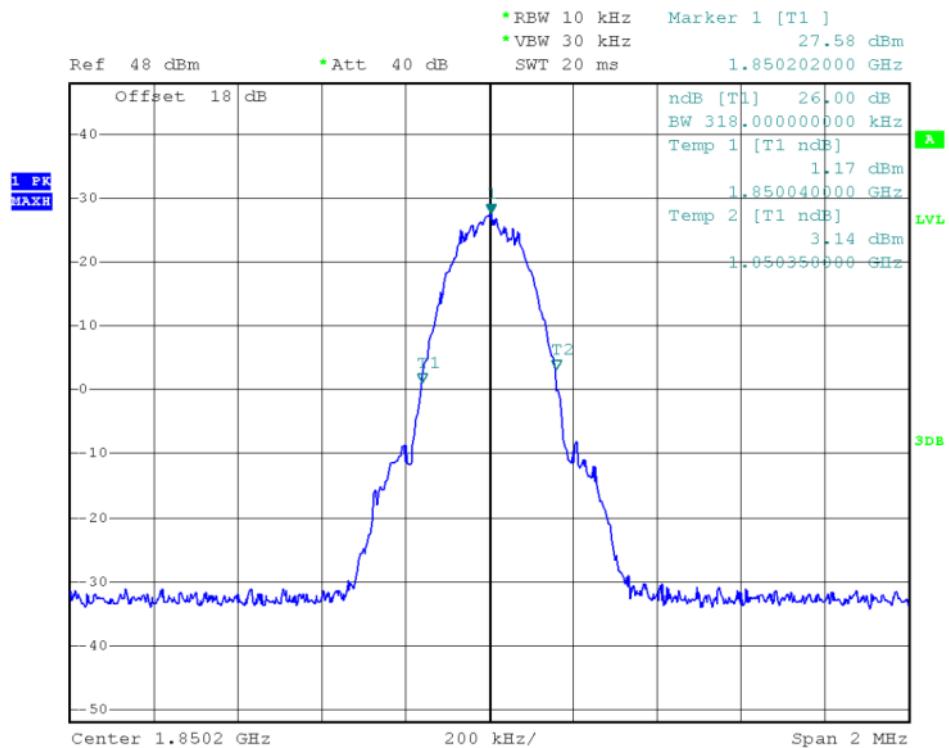
(Plot C4: GPRS 850MHz Channel = 190)



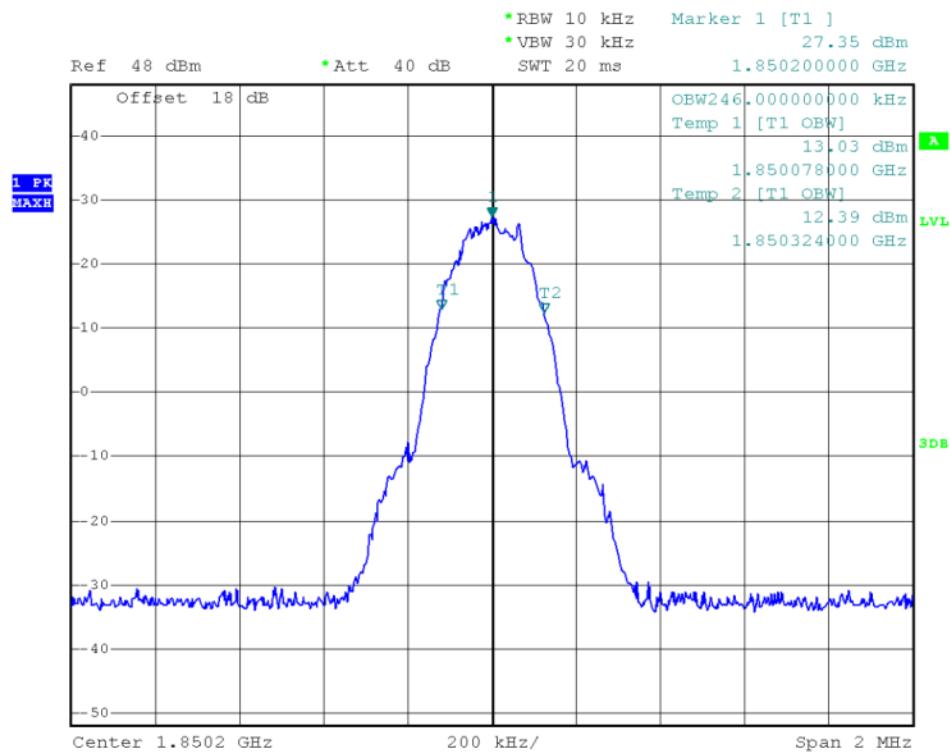
(Plot C5: GPRS850MHz Channel = 251)



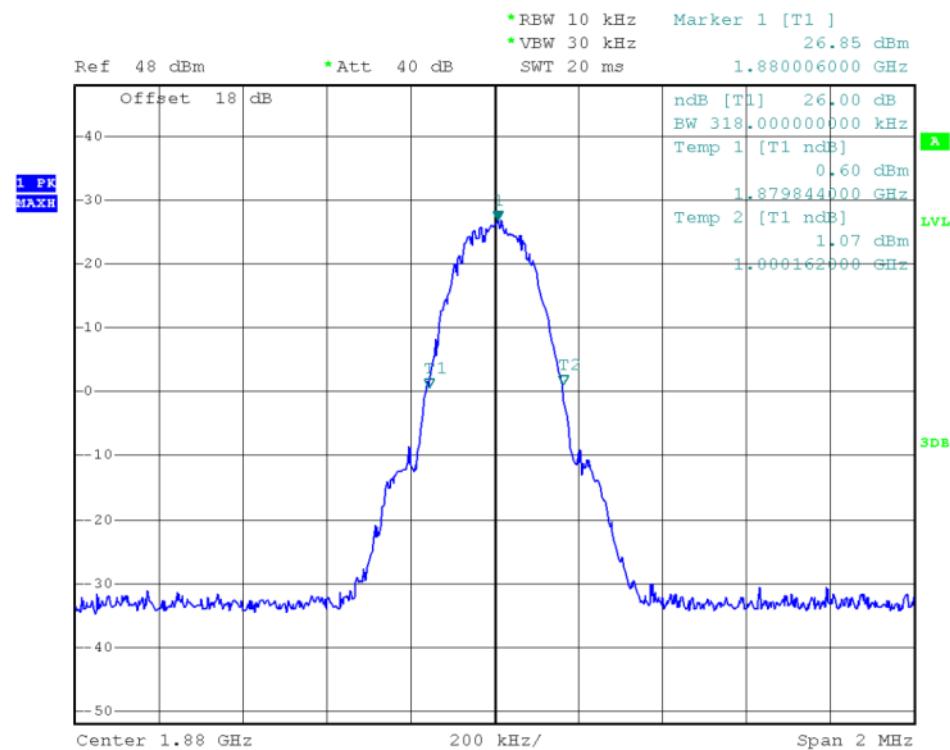
(Plot C6: GPRS850MHz Channel = 251)



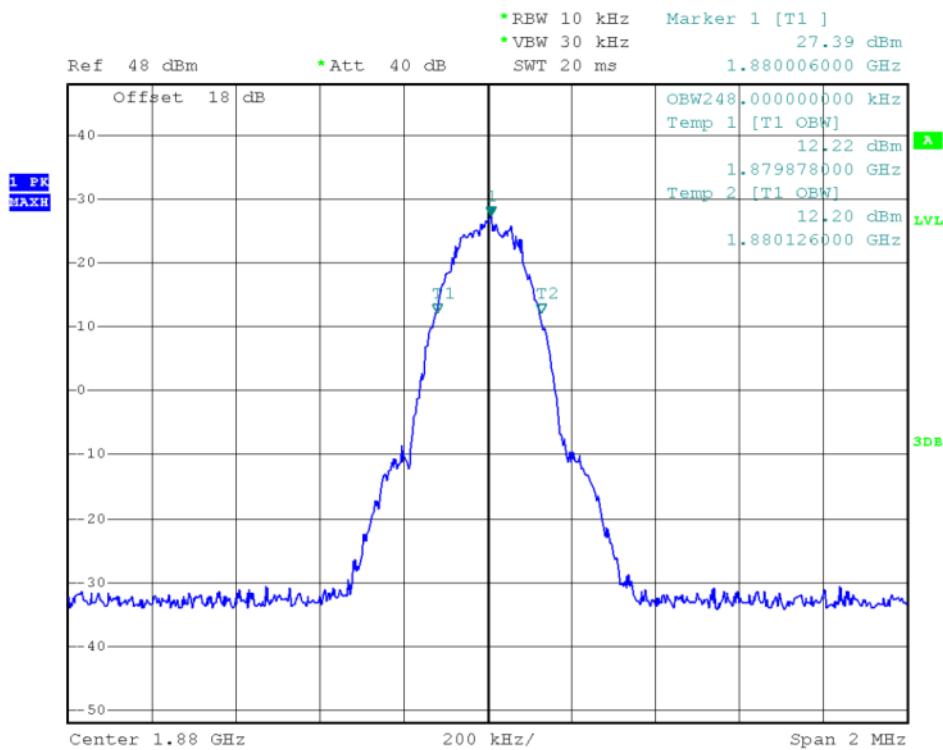
(Plot D1: GPRS 1900MHz Channel = 512)



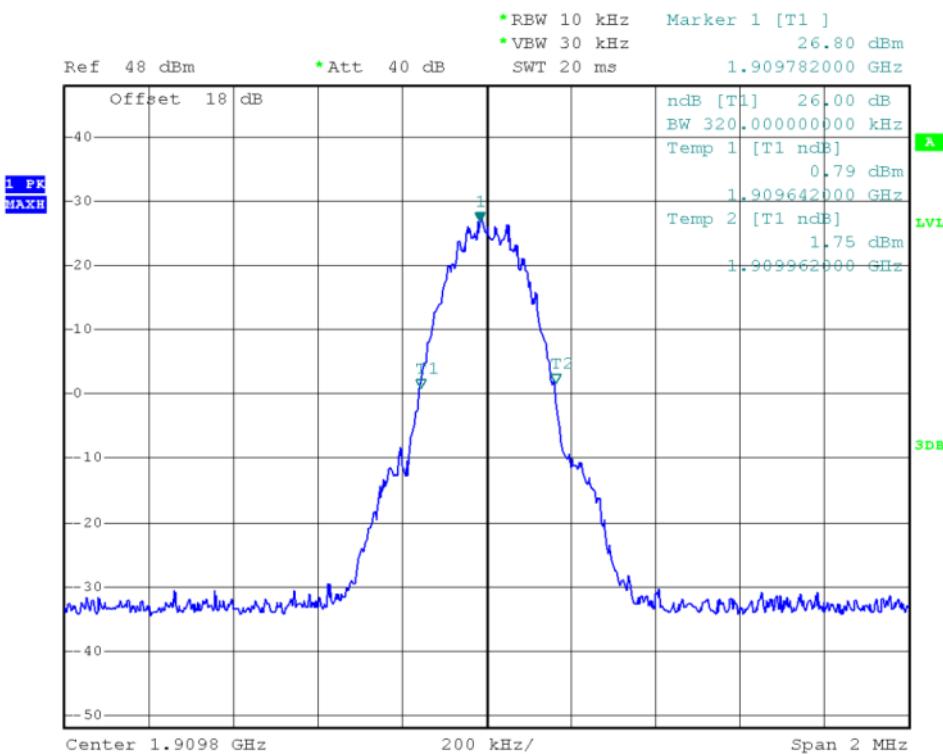
(Plot D2: GPRS 1900MHz Channel = 512)



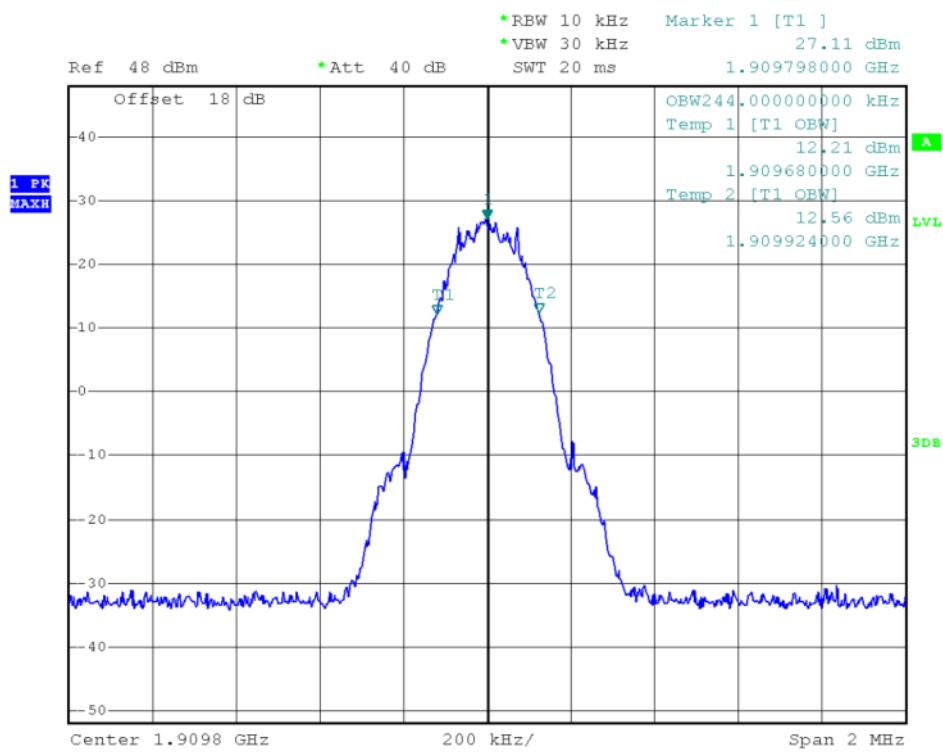
(Plot D3: GPRS 1900MHz Channel = 661)



(Plot D4: GPRS 1900MHz Channel = 661)



(Plot D5: GPRS 1900MHz Channel = 810)



(Plot D6: GPRS 1900MHz Channel = 810)

## 2.4 Frequency Stability

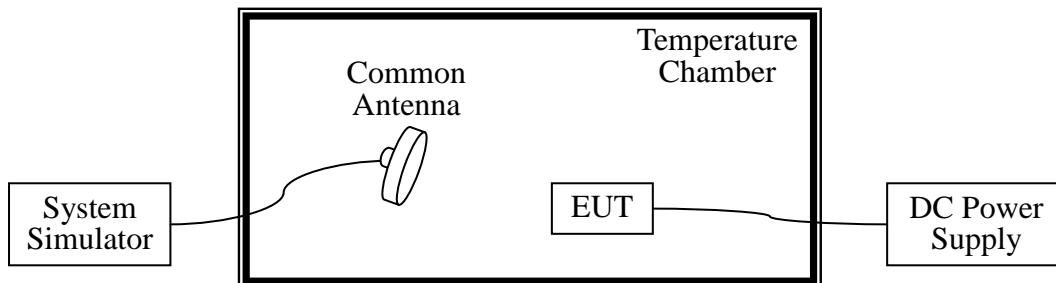
### 2.4.1 Requirement

According to FCC section 22.355 and FCC section 24.235, the frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. According to FCC section 2.1055, the test conditions are:

- The temperature is varied from -30 °C to +50 °C at intervals of not more than 10 °C.
- For hand carried battery powered equipment, the primary supply voltage is reduced to the battery operating end point which shall be specified by the manufacturer. The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided.

### 2.4.2 Test Description

#### 1. Test Setup:



The EUT, which is powered by the DC Power Supply directly, is located in the Temperature Chamber. The EUT is commanded by the System Simulator (SS) to operate at the maximum output power i.e. Power Control Level (PCL) = 5 and Power Class = 4. A call is established between the EUT and the SS via a Common Antenna.

#### 2. Equipments List:

| Description         | Manufacturer              | Model       | Serial No. | Cal. Data  | Cal. Due Data |
|---------------------|---------------------------|-------------|------------|------------|---------------|
| System Simulator    | Agilent                   | E5515C      | GB43130131 | 2014.06.11 | 2015.06.10    |
| DC Power Supply     | Good Will                 | GPS-3030D D | EF920938   | 2014.06.11 | 2015.06.10    |
| Temperature Chamber | YinHe Experimental Equip. | HL4003T     | (n.a.)     | 2014.06.11 | 2015.06.10    |

### 2.4.3 Test Verdict

The nominal, highest and lowest extreme voltages are separately 3.8VDC, 4.35VDC and 3.3VDC, which are specified by the applicant; the normal temperature here used is 25 °C. The frequency deviation limit of 850MHz band is  $\pm 2.5$ ppm, and 1900MHz is  $\pm 1$ ppm

#### 1. GSM 850MHz Band

| Test Conditions |                  | Frequency Deviation      |              |                          |              |                          |            | Verdict |  |
|-----------------|------------------|--------------------------|--------------|--------------------------|--------------|--------------------------|------------|---------|--|
| Power (VDC)     | Temperature (°C) | Channel = 128 (824.2MHz) |              | Channel = 190 (836.6MHz) |              | Channel = 251 (848.8MHz) |            |         |  |
|                 |                  | Hz                       | Limits       | Hz                       | Limits       | Hz                       | Limits     |         |  |
| 3.8             | -30              | 24.89                    | $\pm 2060.5$ | 20.32                    | $\pm 2091.5$ | 17.44                    | $\pm 2122$ | PASS    |  |
|                 | -20              | 38.66                    |              | 16.31                    |              | -11.07                   |            |         |  |
|                 | -10              | 41.47                    |              | -17.56                   |              | 15.22                    |            |         |  |
|                 | 0                | 13.21                    |              | 32.11                    |              | 7.05                     |            |         |  |
|                 | +10              | 10.35                    |              | -25.03                   |              | 3.02                     |            |         |  |
|                 | +20              | -12.03                   |              | -17.19                   |              | 10.52                    |            |         |  |
|                 | +30              | 21.03                    |              | 19.36                    |              | -13.21                   |            |         |  |
|                 | +40              | 25.80                    |              | 19.64                    |              | -2.11                    |            |         |  |
|                 | +50              | 27.93                    |              | 22.27                    |              | -12.99                   |            |         |  |
|                 | 4.35             | +25                      |              | 28.95                    |              | -51.58                   |            |         |  |
|                 | 3.3              | +25                      |              | 31.09                    |              | 16.11                    |            |         |  |

#### 2. GSM 1900MHz Band

| Test Conditions |                  | Frequency Deviation       |              |                           |              |                           |              | Verdict |  |
|-----------------|------------------|---------------------------|--------------|---------------------------|--------------|---------------------------|--------------|---------|--|
| Power (VDC)     | Temperature (°C) | Channel = 512 (1850.2MHz) |              | Channel = 661 (1880.0MHz) |              | Channel = 810 (1909.8MHz) |              |         |  |
|                 |                  | Hz                        | Limits       | Hz                        | Limits       | Hz                        | Limits       |         |  |
| 3.8             | -30              | -25.19                    | $\pm 1850.2$ | 11.24                     | $\pm 1880.0$ | -15.27                    | $\pm 1909.8$ | PASS    |  |
|                 | -20              | 19.00                     |              | -15.71                    |              | 19.32                     |              |         |  |
|                 | -10              | 38.22                     |              | -16.22                    |              | 25.31                     |              |         |  |
|                 | 0                | 25.23                     |              | 19.32                     |              | 30.26                     |              |         |  |
|                 | +10              | -1.45                     |              | 25.31                     |              | -29.21                    |              |         |  |
|                 | +20              | 6.94                      |              | 30.26                     |              | 19.33                     |              |         |  |
|                 | +30              | 21.13                     |              | -29.21                    |              | -19.27                    |              |         |  |
|                 | +40              | 41.23                     |              | 59.33                     |              | 26.29                     |              |         |  |
|                 | +50              | 30.96                     |              | -19.27                    |              | 18.97                     |              |         |  |
|                 | 4.35             | +25                       |              | 26.29                     |              | -16.28                    |              |         |  |
|                 | 3.3              | +25                       |              | 18.97                     |              | 19.32                     |              |         |  |

## 2.5 Conducted Out of Band Emissions

### 2.5.1 Requirement

According to FCC section 22.917(a) and FCC section 24.238(a), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB. This calculated to be -13dBm.

### 2.5.2 Test Description

See section 2.1.2 of this report.

### 2.5.3 Test Procedures

1. The testing follows FCC KDB 971168 v02r01 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)  
 $= P(W) - [43 + 10 \log(P)]$  (dB)  
 $= [30 + 10 \log(P)]$  (dBm) -  $[43 + 10 \log(P)]$  (dB)  
 $= -13$  dBm.

### 2.5.4 Test Result

The measurement frequency range is from 30MHz to the 10<sup>th</sup> harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the out of band emissions.

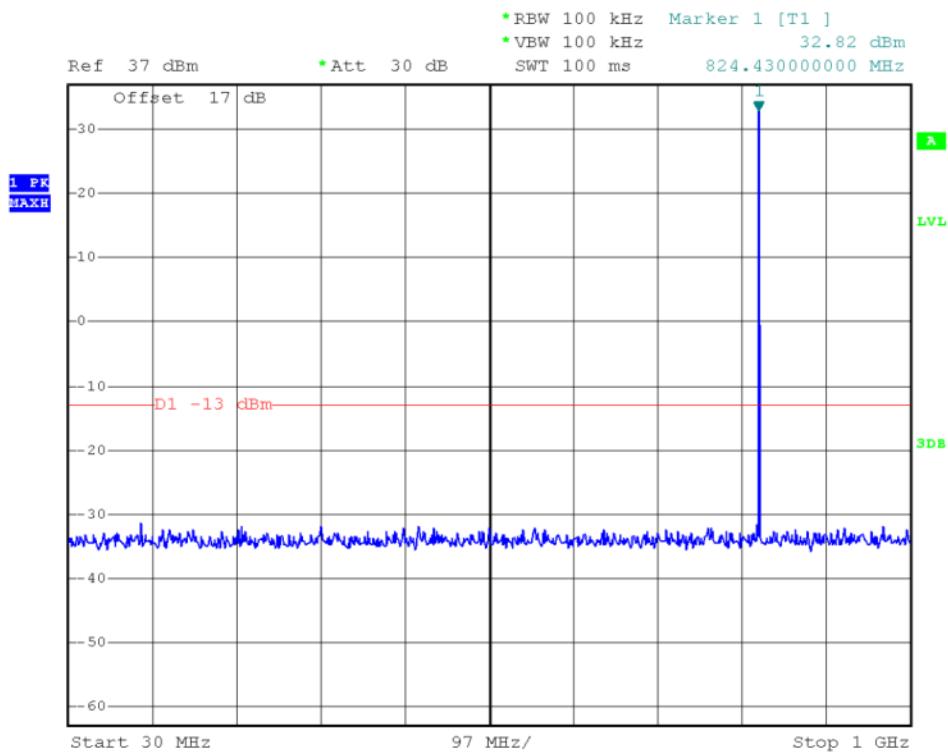
1. Test Verdict:

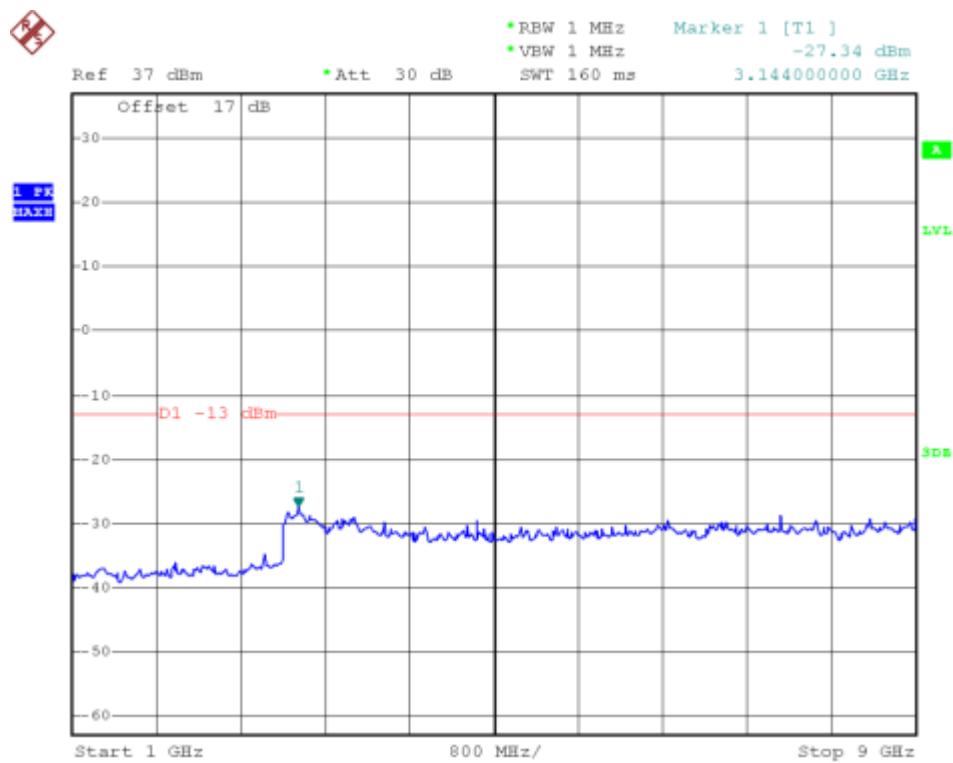
| Band          | Channel | Frequency (MHz) | Measured Max. Spurious Emission (dBm) | Refer to Plot | Limit (dBm) | Verdict |
|---------------|---------|-----------------|---------------------------------------|---------------|-------------|---------|
| GSM<br>850MHz | 128     | 824.2           | -27.34                                | Plot A1toA1.1 | -13         | PASS    |
|               | 190     | 836.6           | -27.11                                | Plot A2toA2.1 |             | PASS    |
|               | 251     | 848.8           | -27.42                                | Plot A3toA3.1 |             | PASS    |

| Band        | Channel | Frequency (MHz) | Measured Max. Spurious Emission (dBm) | Refer to Plot | Limit (dBm) | Verdict |
|-------------|---------|-----------------|---------------------------------------|---------------|-------------|---------|
| GSM 1900MHz | 512     | 1850.2          | -20.19                                | Plot B1toB1.1 | -13         | PASS    |
|             | 661     | 1880.0          | -19.65                                | Plot B2toB2.1 |             | PASS    |
|             | 810     | 1909.8          | -19.56                                | Plot B3toB3.1 |             | PASS    |

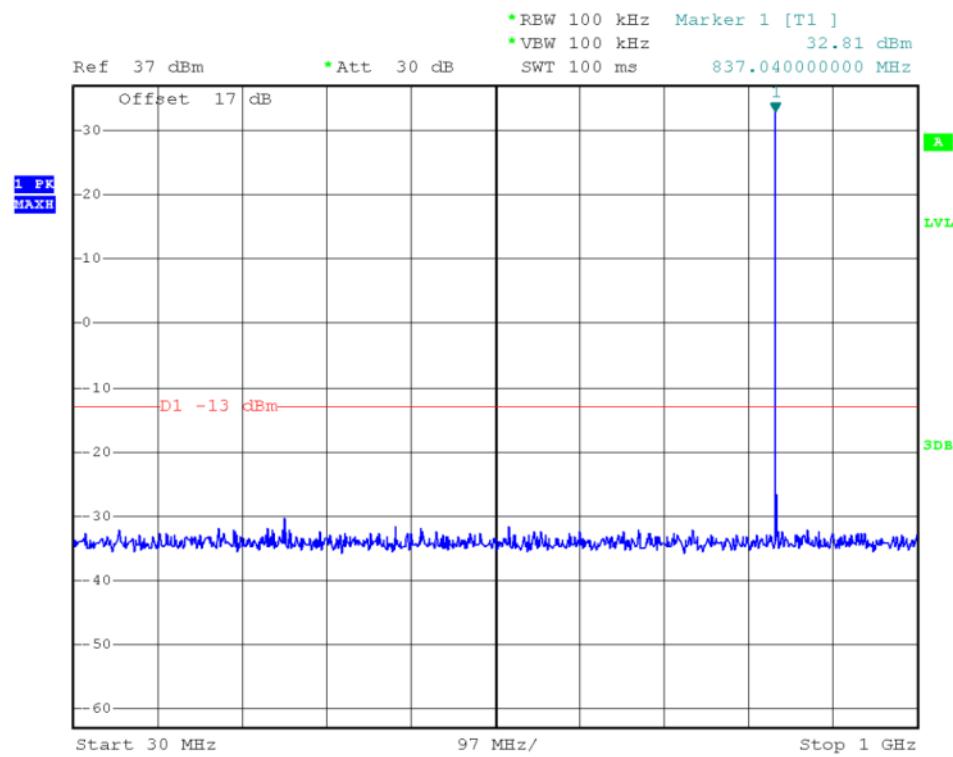
## 2. Test Plots for the Whole Measurement Frequency Range:

Note: the power of the EUT transmitting frequency should be ignored.

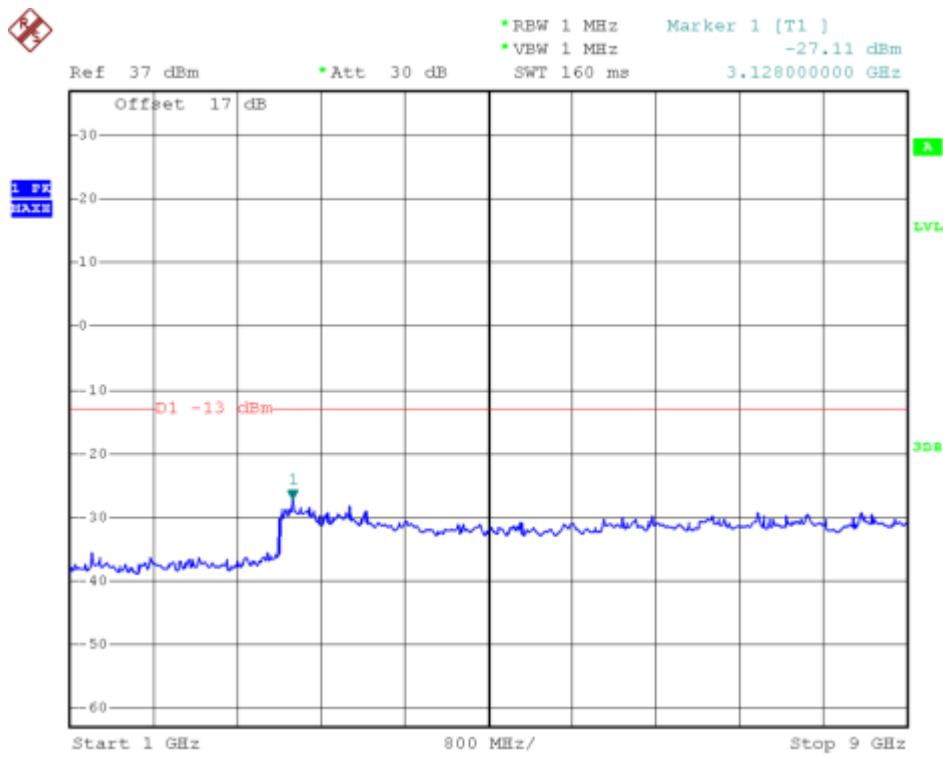




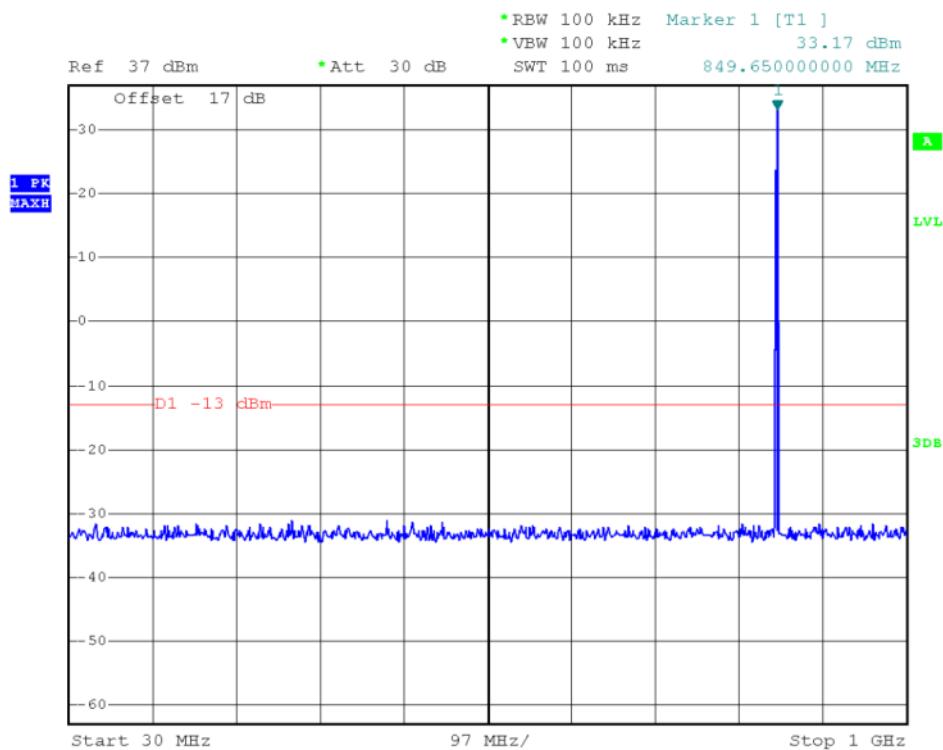
(Plot A1.1: GSM 850MHz Channel = 128, 1GHz to 9GHz)



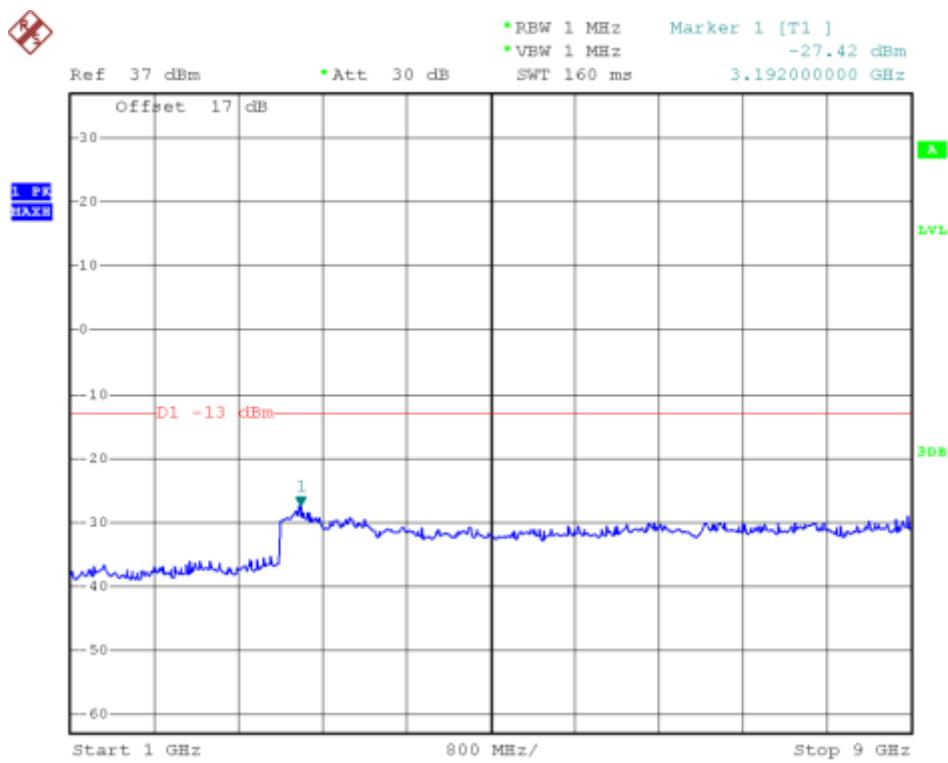
(Plot A2: GSM 850MHz Channel = 190, 30MHz to 1GHz)



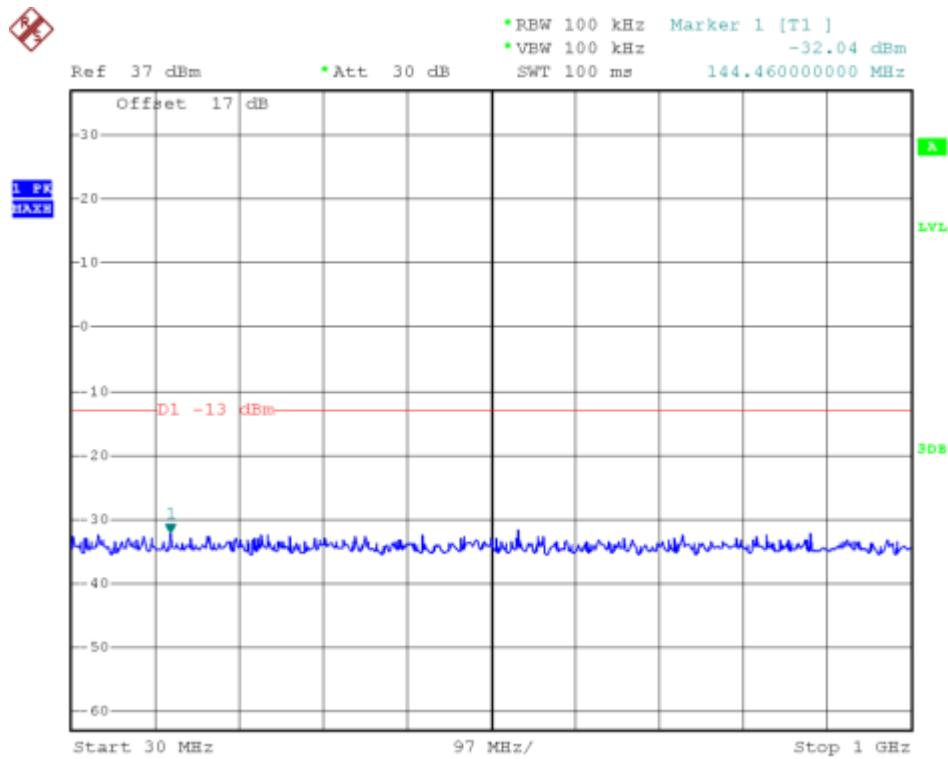
(Plot A2.1: GSM 850MHz Channel = 190, 1GHz to 9GHz)



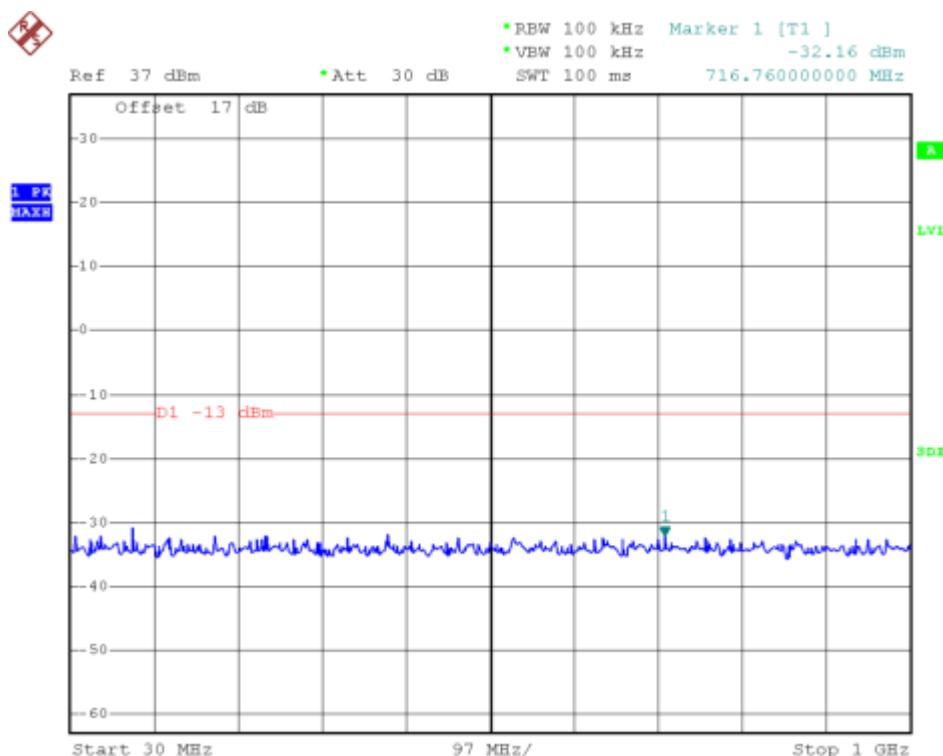
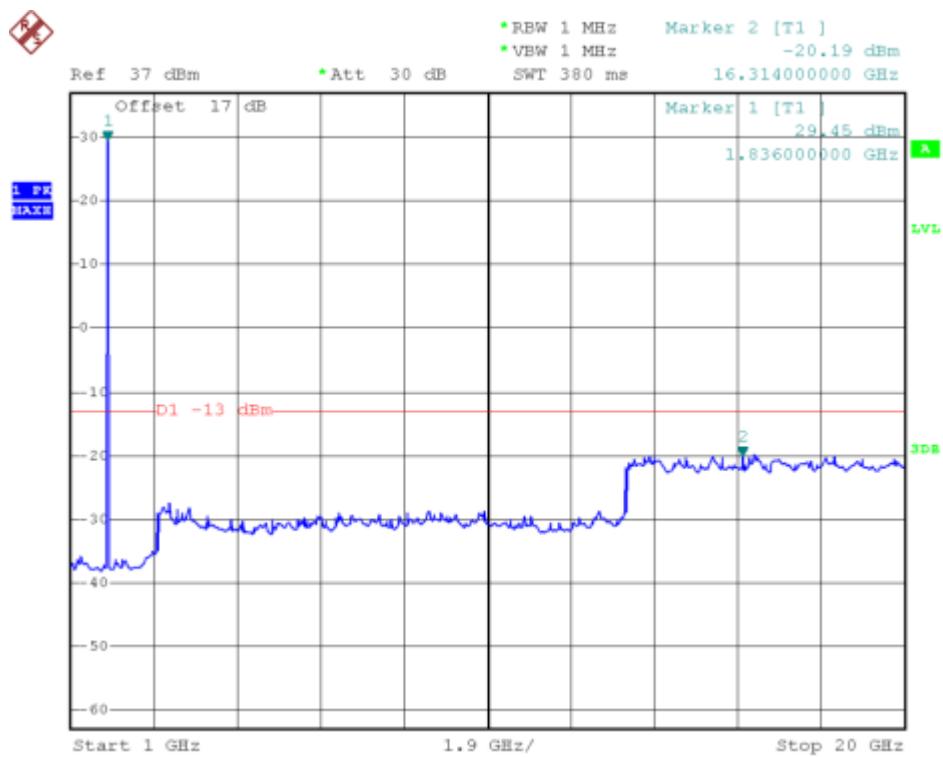
(Plot A3: GSM 850MHz Channel = 251, 30MHz to 1GHz)

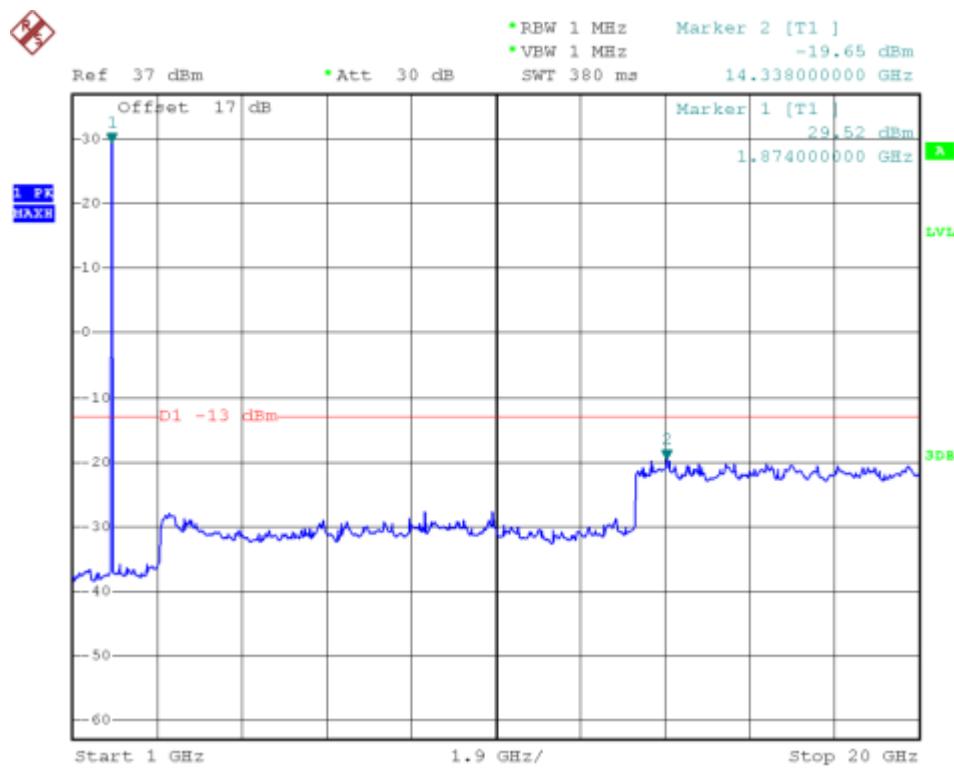


(Plot A3.1: GSM 850MHz Channel = 251, 1GHz to 9GHz)

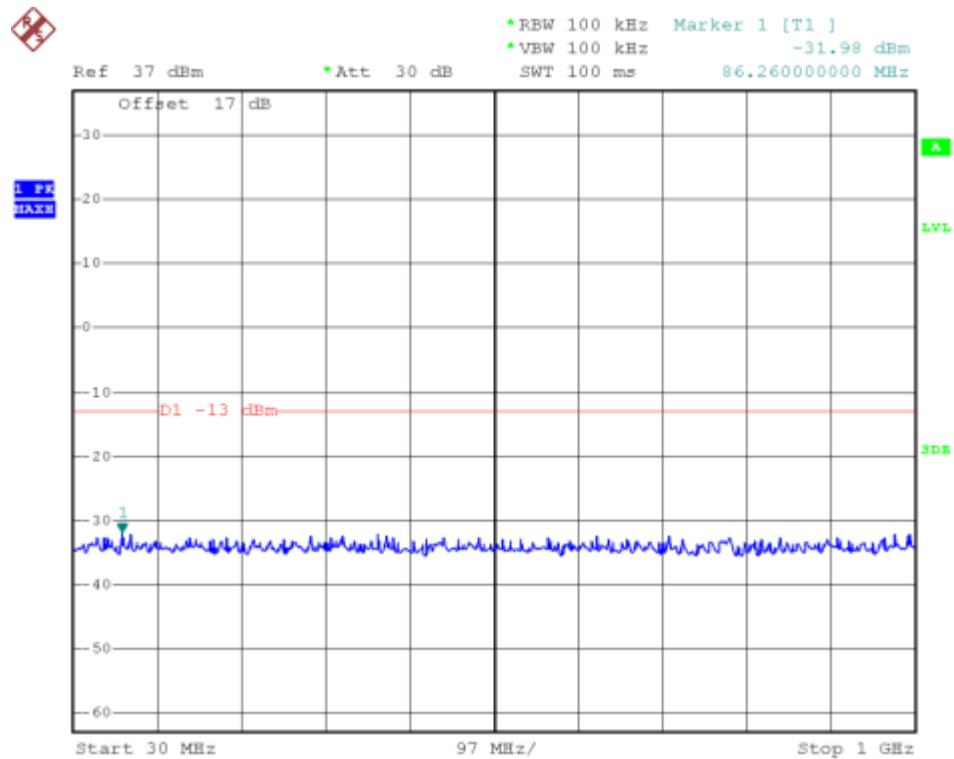


(Plot B1: GSM 1900MHz Channel = 512, 30MHz to 1GHz)

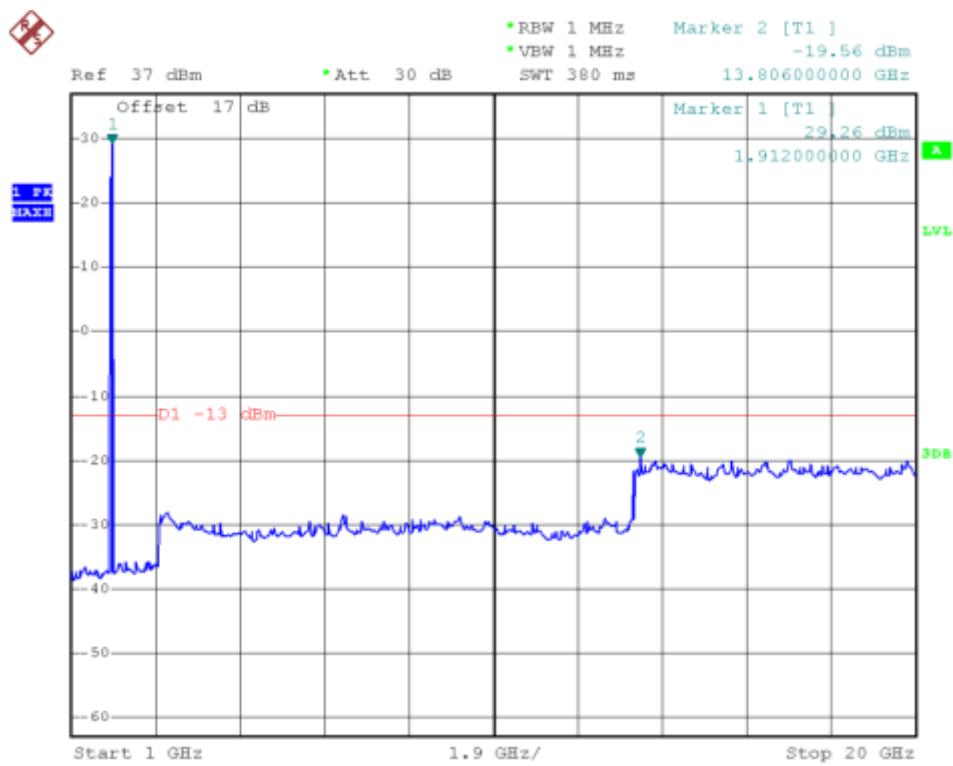




(Plot B2.1: GSM 1900MHz Channel = 661, 1GHz to 20GHz)



(Plot B3: GSM 1900MHz Channel = 810, 30MHz to 1GHz)



(Plot B3.1: GSM 1900MHz Channel = 810, 1GHz to 20GHz)

## 2.6 Band Edge

### 2.6.1 Requirement

According to FCC section 22.917(b) and FCC section 24.238(b), in the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth (26dB emission bandwidth) of the fundamental emission of the transmitter may be employed.

### 2.6.2 Test Description

See section 2.1.2 of this report.

### 2.6.3 Test Procedures

1. The testing follows FCC KDB 971168 v02r01 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.

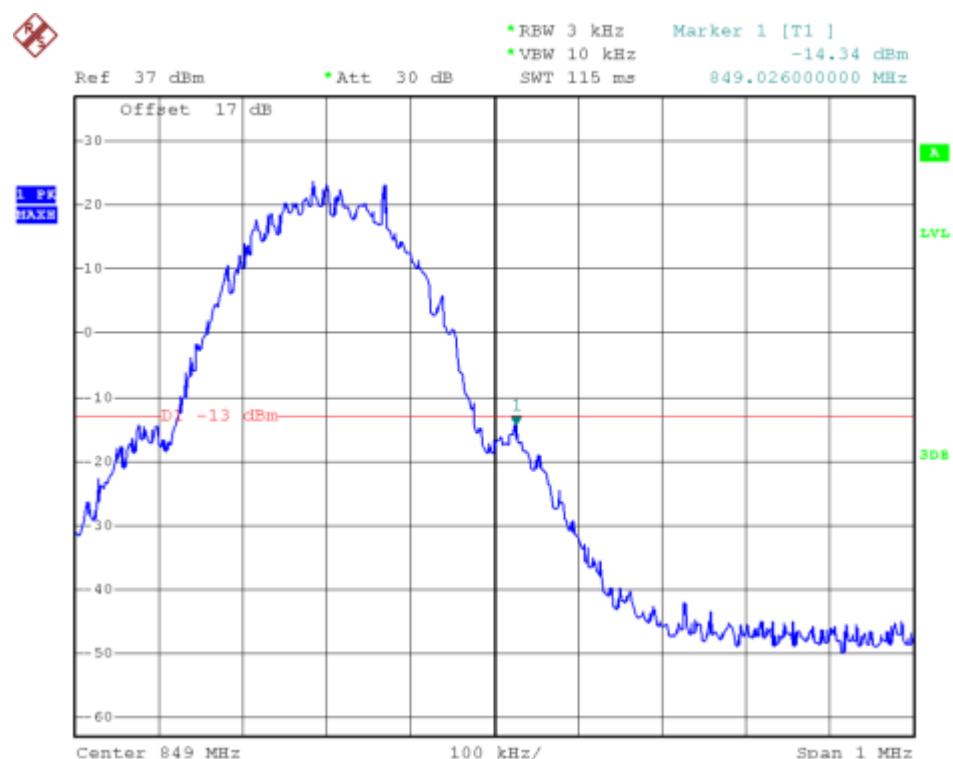
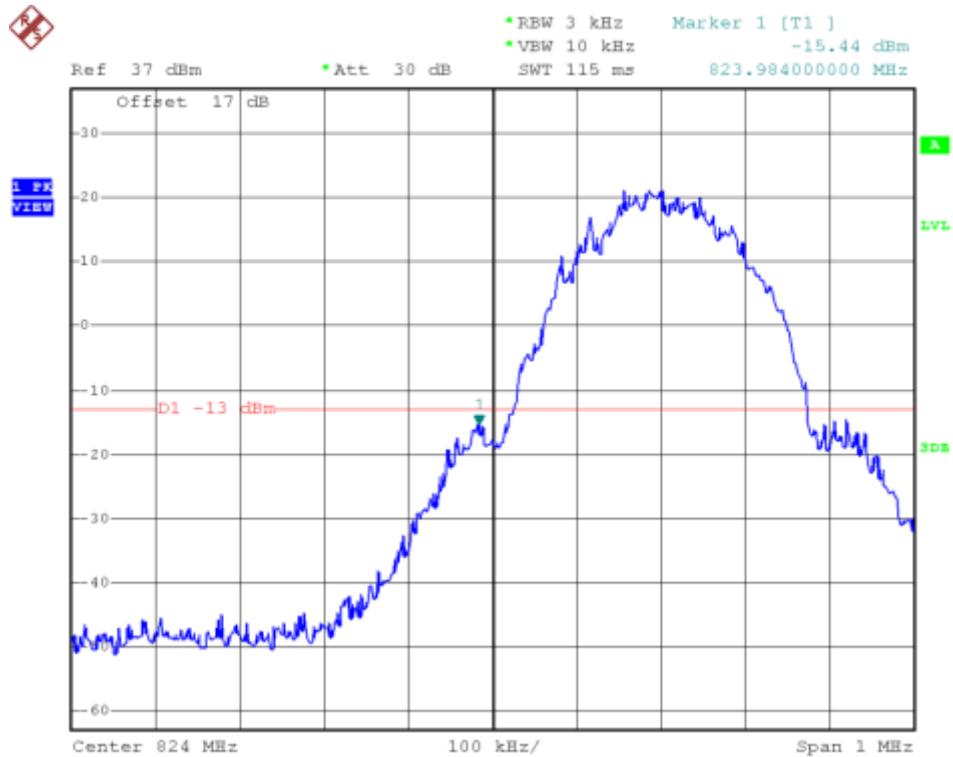
### 2.6.4 Test Result

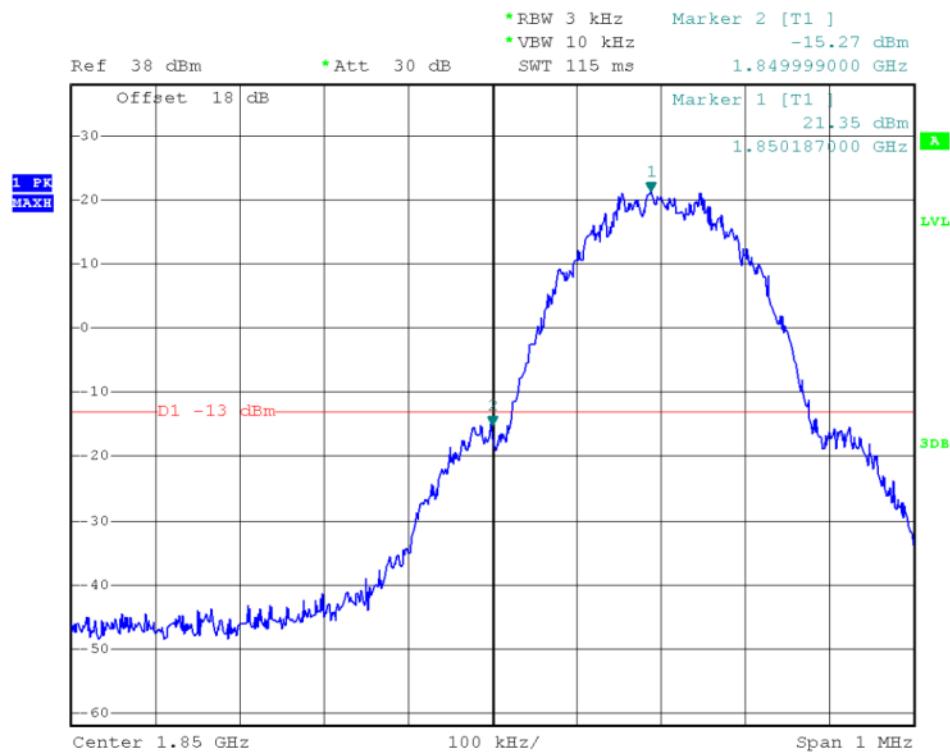
The lowest and highest channels are tested to verify the band edge emissions.

#### 1. Test Verdict:

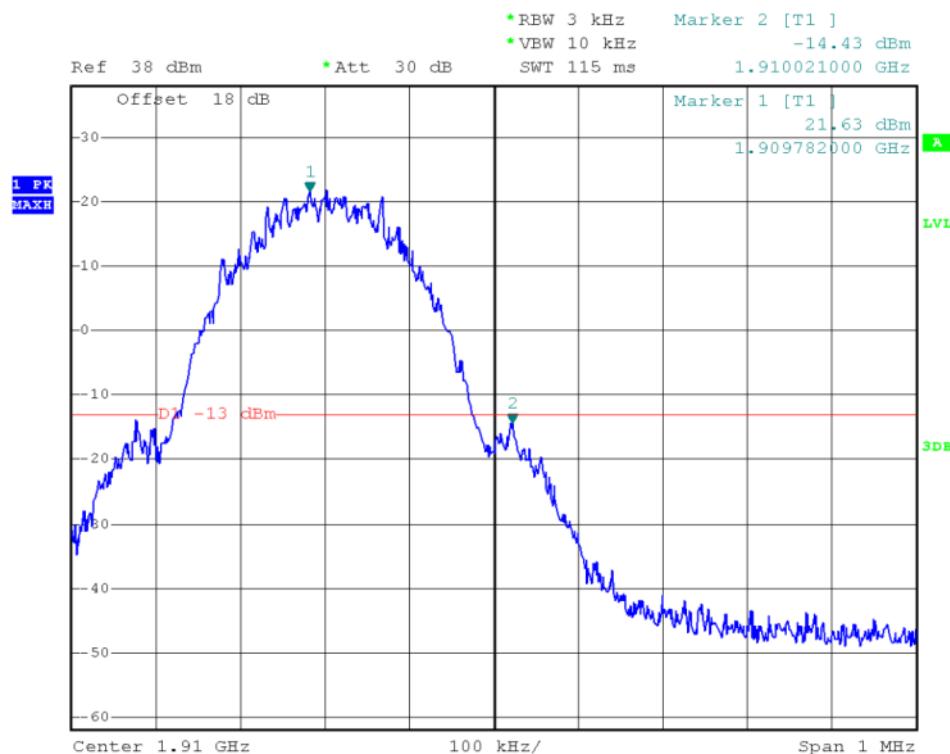
| Band           | Channel | Frequency (MHz) | Measured Max. Band Edge Emission (dBm) | Refer to Plot | Limit (dBm) | Verdict |
|----------------|---------|-----------------|--|---------------|-------------|---------|
| GSM<br>850MHz  | 128     | 824.2           | -15.44                                 | Plot A        | -13         | PASS    |
|                | 251     | 848.8           | -14.34                                 | Plot B        |             | PASS    |
| GSM<br>1900MHz | 512     | 1850.2          | -15.27                                 | Plot C        | -13         | PASS    |
|                | 810     | 1909.8          | -14.43                                 | Plot D        |             | PASS    |

## 2. Test Plots:





(Plot C: GSM 1900 Channel = 512)



(Plot D: GSM 1900 Channel = 810)

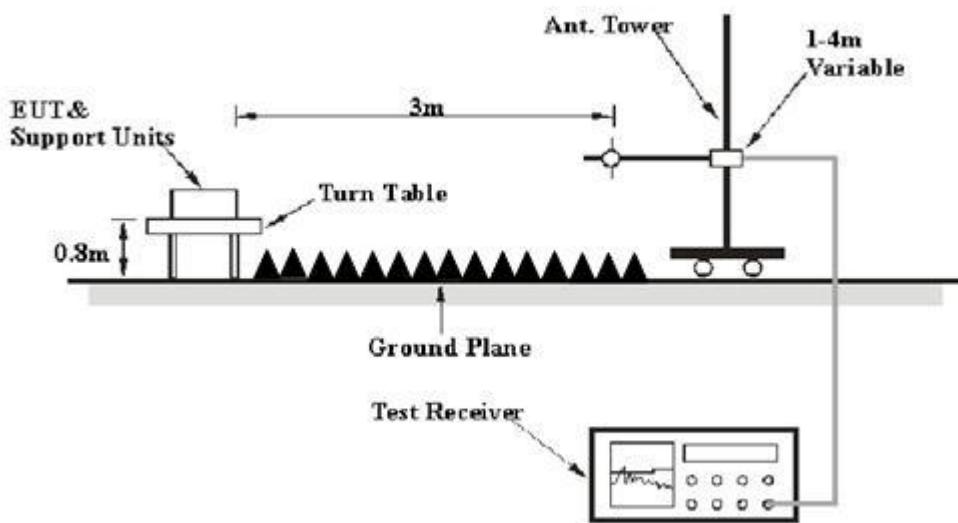
## 2.7 Transmitter Radiated Power (EIRP/ERP)

### 2.7.1 Requirement

According to FCC section 22.913, the Effective Radiated Power (ERP) of mobile transmitters and auxiliary test transmitters must not exceed 7Watts, and FCC section 24.232, the broadband PCS mobile station is limited to 2 Watts e.i.r.p. peak power.

### 2.7.2 Test Description

#### 1. Test Setup:



The EUT, which is powered by the DC 3.8V Power Supply directly, is located in a 3m Full-Anechoic Chamber; the cable loss, air loss and so on of the site as factors are pre-calibrated using the "Substitution" method, and calculated to correct the reading.

A call is established between the EUT and the SS via a Common Antenna. The EUT is commanded by the SS to operate at the maximum and minimum output power, and only the test result of the maximum output power was recorded.

#### 2. Equipments List:

| Description           | Manufacturer        | Model            | Serial No. | Cal. Date  | Cal. Due Date |
|-----------------------|---------------------|------------------|------------|------------|---------------|
| System Simulator      | R&S                 | CMW500           | 149333     | 2014.07.21 | 2015.07.20    |
| EMI Test Receiver     | R&S                 | ESIB26           | 100130     | 2014.07.07 | 2015.07.06    |
| Full-Anechoic Chamber | Albatross~ Projects | 12.8m*6.8m *6.4m | A0412372   | 2014.01.05 | 2015.01.04    |

|                                       |     |       |        |            |            |
|---------------------------------------|-----|-------|--------|------------|------------|
| Double ridge horn antenna(1GHz~18GHz) | R&S | HF906 | 100150 | 2014.06.11 | 2015.06.10 |
| Broadband antenna (30MHz~1GHz)        | R&S | HL562 | 101341 | 2014.06.11 | 2015.06.10 |

### 2.7.3 Test Procedures

1. The testing follows FCC KDB 971168 v02r01 Section 5.2.1. (for CDMA/WCDMA), Section 5.2.2.2 (for GSM/GPRS/EDGE) and ANSI / TIA-603-C-2004 Section 2.2.17.
2. The EUT was placed on a turntable 1.5 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.
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.

$Et = Rt + AF$        $Es = Rs + AF$

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 Result

Test Notes:

1. This unit was tested with its standard battery.
2. 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.

GSM Model Test Verdict:

| Band       | Channel | Frequency (MHz) | Antenna Pol (H/V) | PCL | Measured ERP dBm | Limit dBm | Verdict |
|------------|---------|-----------------|-------------------|-----|------------------|-----------|---------|
| GSM 850MHz | 128     | 824.20          | V                 | 5   | 33.23            | 38.5      | PASS    |
|            | 190     | 836.60          | V                 | 5   | 32.94            |           | PASS    |
|            | 251     | 848.80          | V                 | 5   | 33.14            |           | PASS    |

| Band       | Channel | Frequency (MHz) | Antenna Pol (H/V) | PCL | Measured ERP dBm | Limit dBm | Verdict |
|------------|---------|-----------------|-------------------|-----|------------------|-----------|---------|
| GSM 850MHz | 128     | 824.20          | H                 | 5   | 33.18            | 38.5      | PASS    |
|            | 190     | 836.60          | H                 | 5   | 32.87            |           | PASS    |
|            | 251     | 848.80          | H                 | 5   | 33.18            |           | PASS    |

| Band        | Channel | Frequency (MHz) | Antenna Pol (H/V) | PCL | Measured EIRP dBm | Limit dBm | Verdict |
|-------------|---------|-----------------|-------------------|-----|-------------------|-----------|---------|
| GSM 1900MHz | 512     | 1850.2          | V                 | 0   | 29.68             | 33        | PASS    |
|             | 661     | 1880.0          | V                 | 0   | 29.81             |           | PASS    |
|             | 810     | 1909.8          | V                 | 0   | 29.58             |           | PASS    |

| Band        | Channel | Frequency (MHz) | Antenna Pol (H/V) | PCL | Measured EIRP dBm | Limit dBm | Verdict |
|-------------|---------|-----------------|-------------------|-----|-------------------|-----------|---------|
| GSM 1900MHz | 512     | 1850.2          | H                 | 0   | 29.61             | 33        | PASS    |
|             | 661     | 1880.0          | H                 | 0   | 29.75             |           | PASS    |
|             | 810     | 1909.8          | H                 | 0   | 29.53             |           | PASS    |

## 2.8 Radiated Out of Band Emissions

### 2.8.1 Requirement

According to FCC section 22.917(a) and section 24.238(a), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43+10\log(P)$  dB. This calculated to be -13dBm.

### 2.8.2 Test Description

See section 2.7.2 of this report.

Equipment List:

| Description               | Manufacturer        | Model            | Serial No.   | Cal. Date  | Cal.Due Date |
|---------------------------|---------------------|------------------|--------------|------------|--------------|
| Spectrum Analyzer         | R&S                 | FSP40            | 1164.4391.40 | 2014.07.07 | 2015.07.06   |
| Power Meter               | R&S                 | NRV2             | 1020.1809.02 | 2014.06.08 | 2015.06.07   |
| Power Sensor              | R&S                 | NRV-Z4           | 823.3618.03  | 2014.06.08 | 2015.06.07   |
| Full-Anechoic Chamber     | Albatross~ Projects | 12.8m*6.8m *6.4m | A0412372     | 2014.01.05 | 2015.01.04   |
| Double ridge horn antenna | R&S                 | HF906            | A0304225     | 2014.06.11 | 2015.06.10   |
| Ultra-wideband antenna    | R&S                 | HL562            | A0304224     | 2014.06.11 | 2015.06.10   |
| Loop antenna              | R&S                 | HFH2-Z2          | A0304226     | 2014.06.11 | 2015.06.10   |

Note: when doing measurements above 1GHz, the EUT has been within the 3dB cone width of the horn antenna during horizontal antenna.

### 2.8.3 Test Result

Test Notes:

1. This device employs UMTS technology with WCDMA (AMR/RMC), HSDPA, HSUPA and HSPA+ capabilities. All configurations were investigated and the worst case UMTS emissions were found in RMC WCDMA mode at 12.2Kbps.
2. This unit was tested with its standard battery.
3. 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.

4. The spectrum is measured from 30MHz to the 10<sup>th</sup> 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.

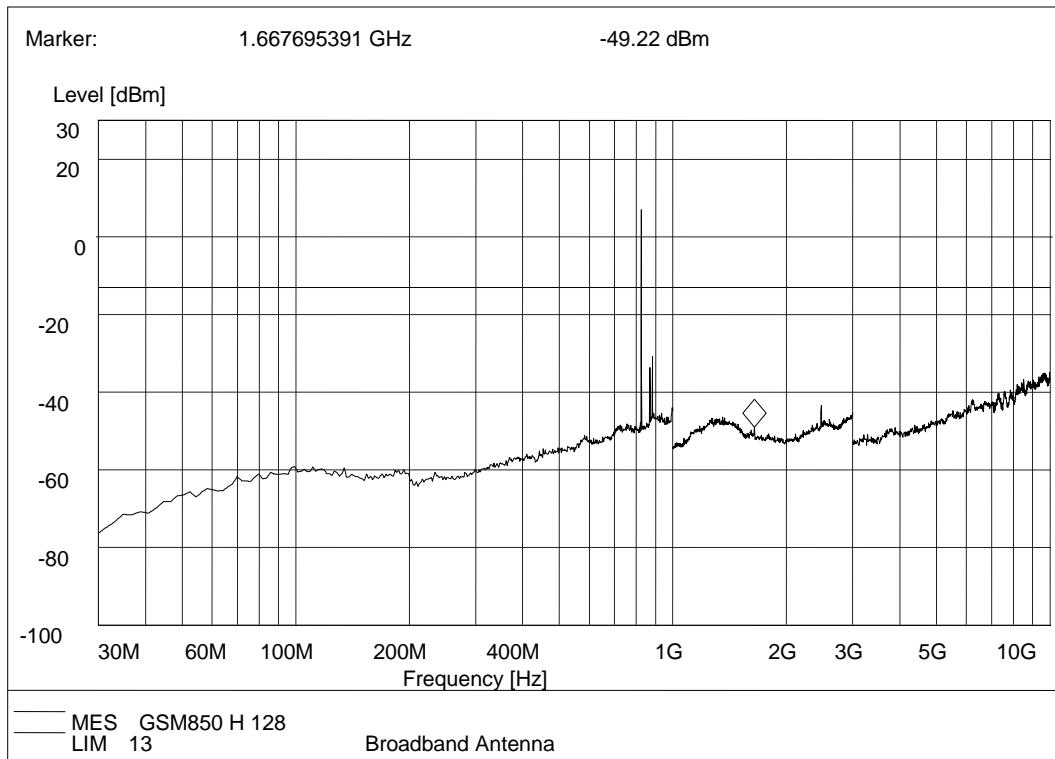
5. Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.

### 1. Test Verdict:

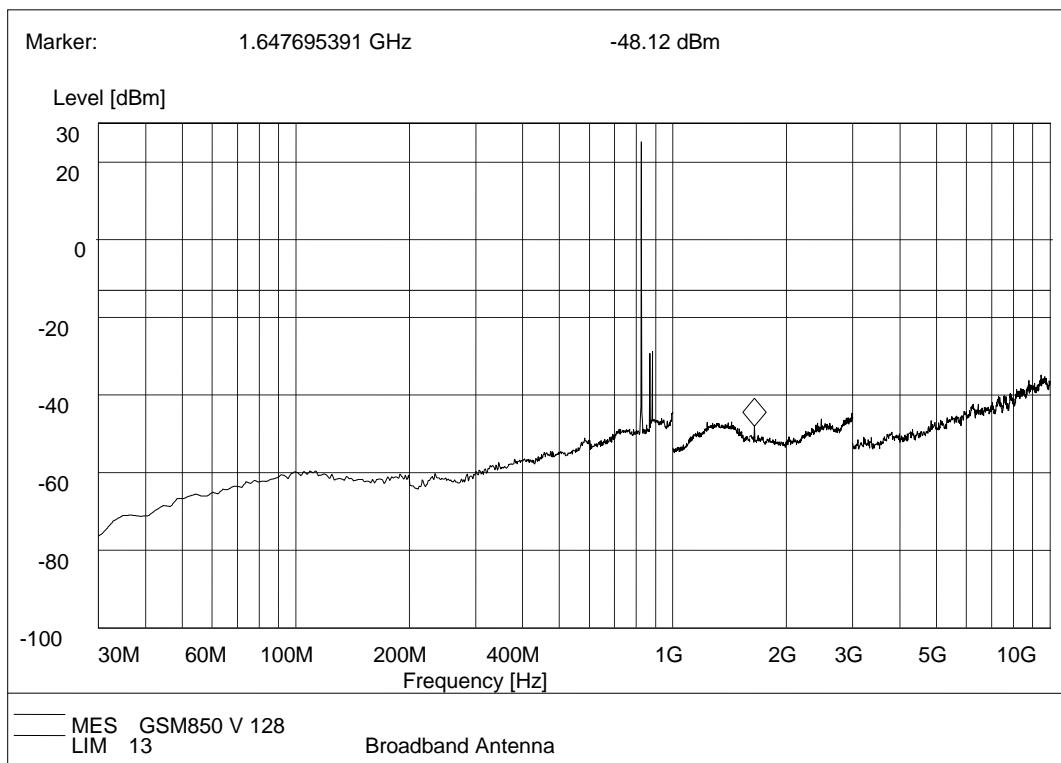
| Band           | Channel | Frequency<br>(MHz) | Measured Max. Spurious Emission<br>(dBm) |                          | Refer to Plot | Limit<br>(dBm) | Verdict |
|----------------|---------|--------------------|--|--------------------------|---------------|----------------|---------|
|                |         |                    | Test Antenna<br>Horizontal               | Test Antenna<br>Vertical |               |                |         |
| GSM<br>850MHz  | 128     | 824.2              | < -25                                    | < -25                    | Plot A.1/A.2  | -13            | PASS    |
|                | 190     | 836.6              | < -25                                    | < -25                    | Plot A.3/A.4  |                | PASS    |
|                | 251     | 848.8              | < -25                                    | < -25                    | Plot A.5/A.6  |                | PASS    |
| GSM<br>1900MHz | 512     | 1850.2             | < -25                                    | < -25                    | Plot B.1/B.2  | -13            | PASS    |
|                | 661     | 1880.0             | < -25                                    | < -25                    | Plot B.3/B.4  |                | PASS    |
|                | 810     | 1909.8             | < -25                                    | < -25                    | Plot B.5/B.6  |                | PASS    |

### 2. Test Plots for the Whole Measurement Frequency Range:

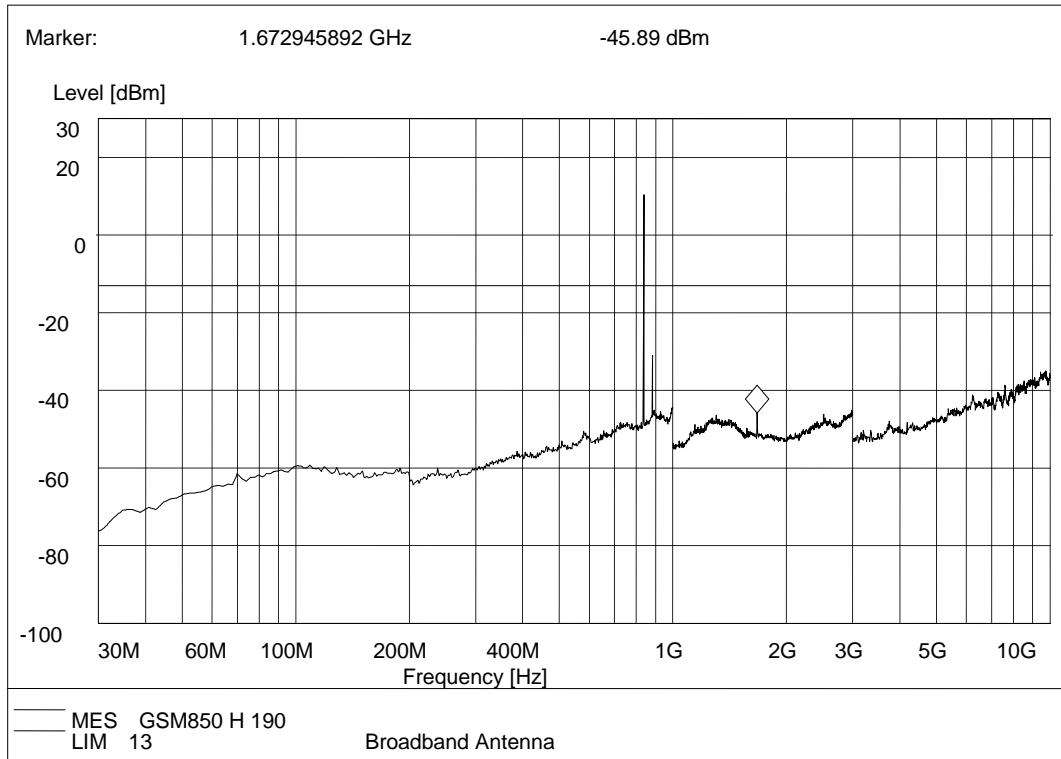
Note1: All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.



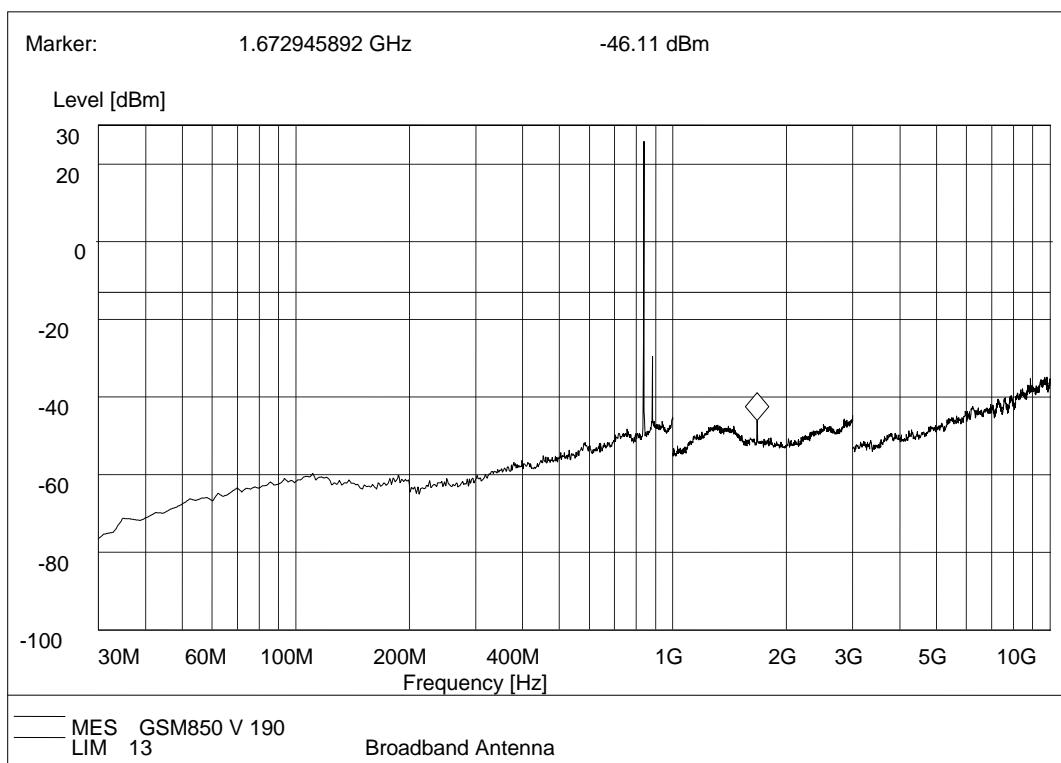
(Plot A.1: GSM 850MHz Channel = 128, Test Antenna Horizontal)



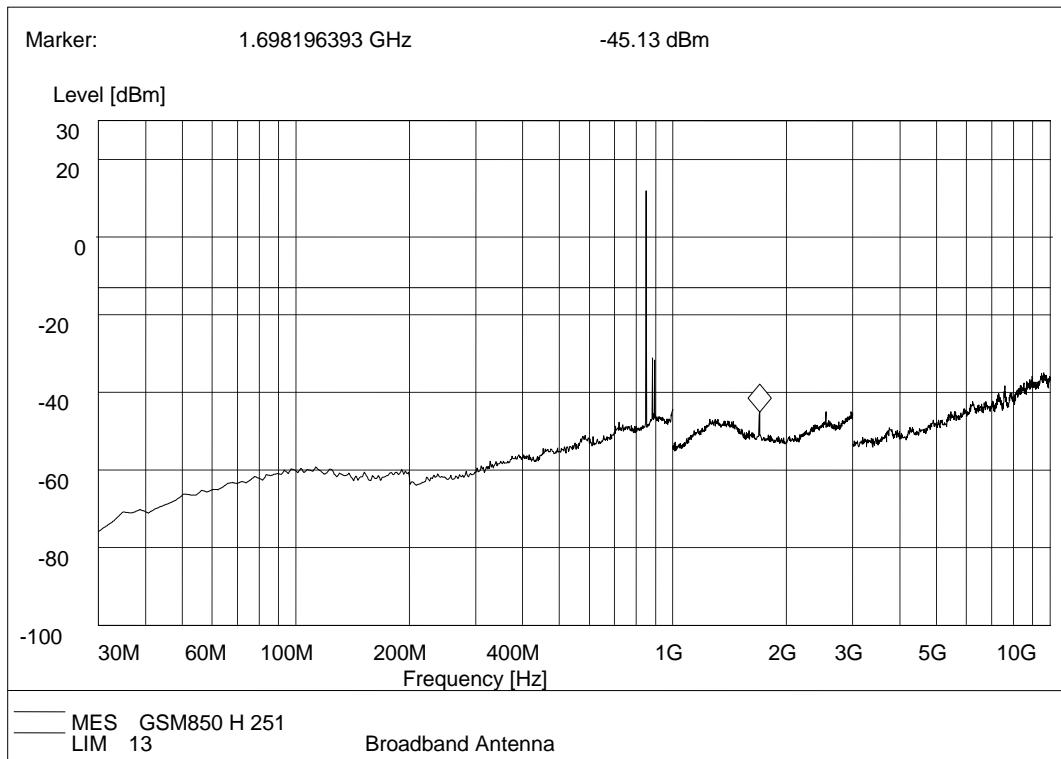
(Plot A.2: GSM 850MHz Channel = 128, Test Antenna Vertical)



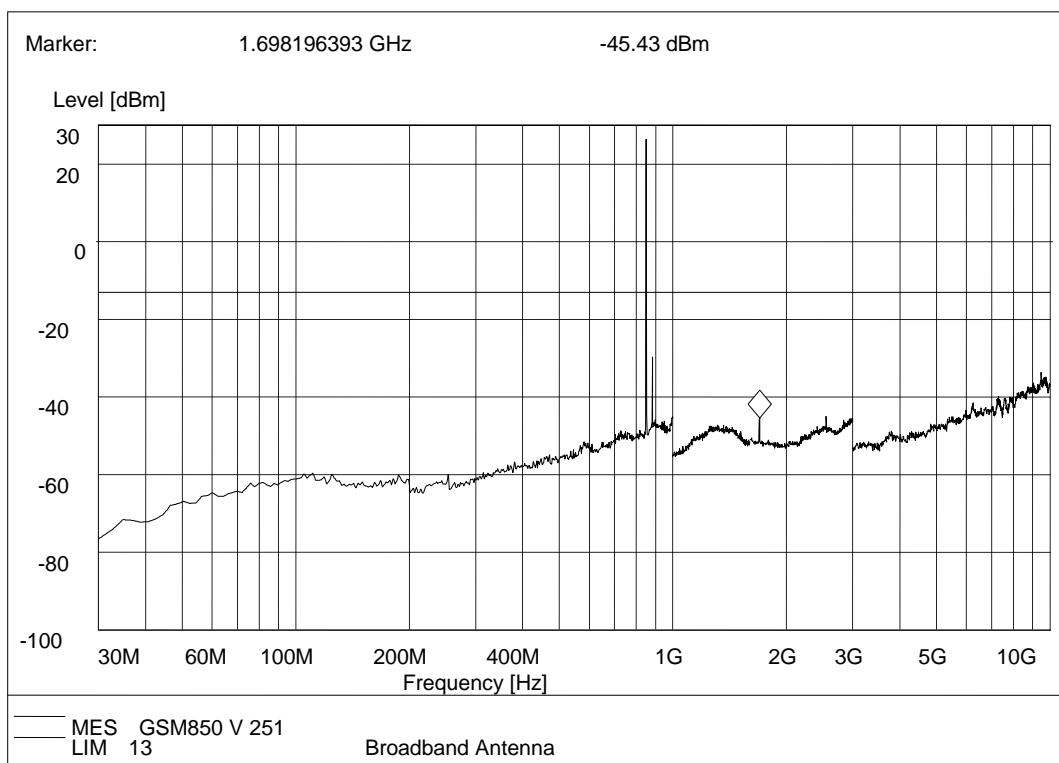
(Plot A.3: GSM 850MHz Channel = 190, Test Antenna Horizontal)



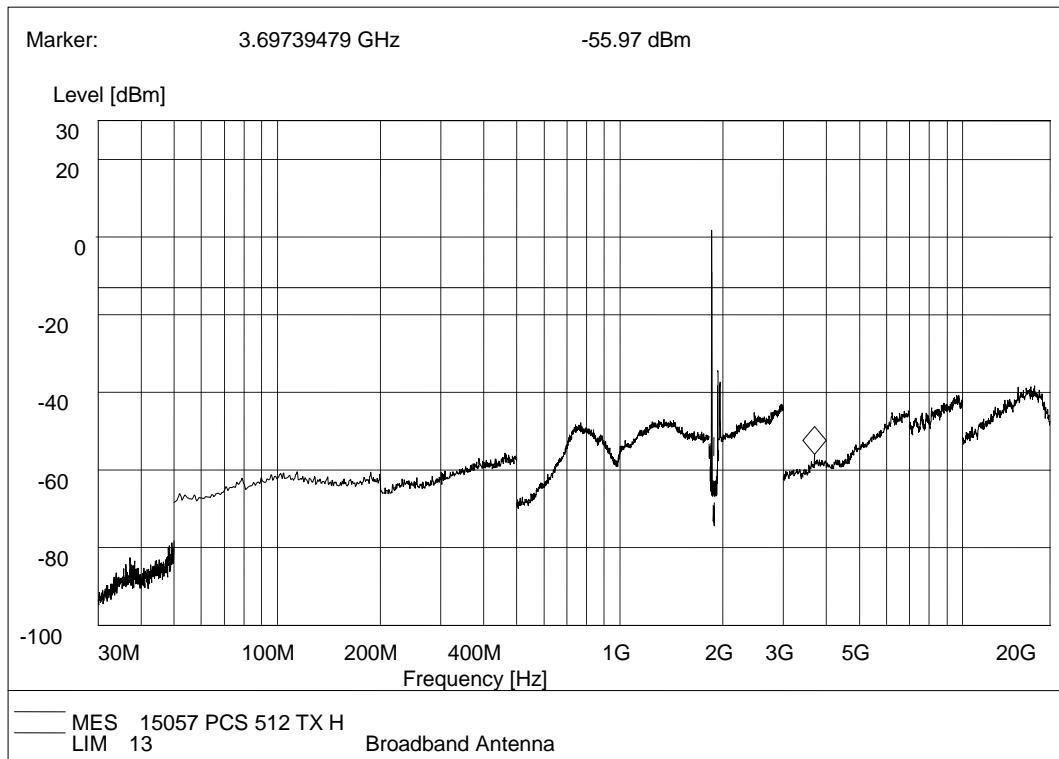
(Plot A.4: GSM 850MHz Channel = 190, Test Antenna Vertical)



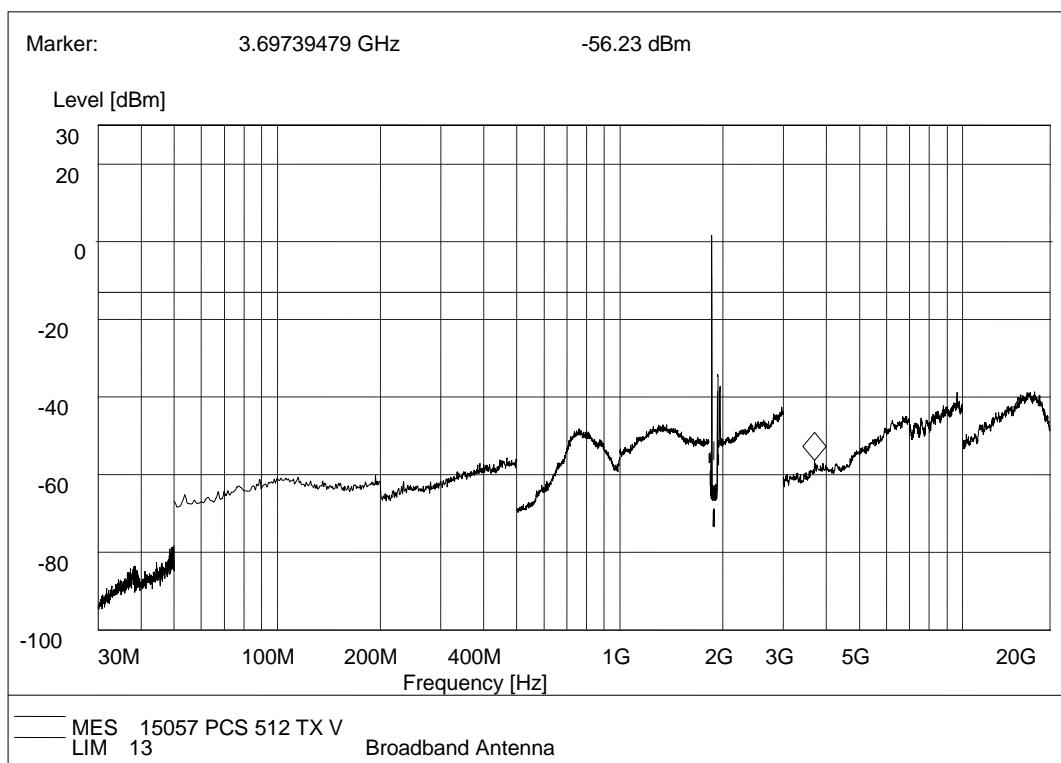
(Plot A.5: GSM 850MHz Channel = 251, Test Antenna Horizontal)



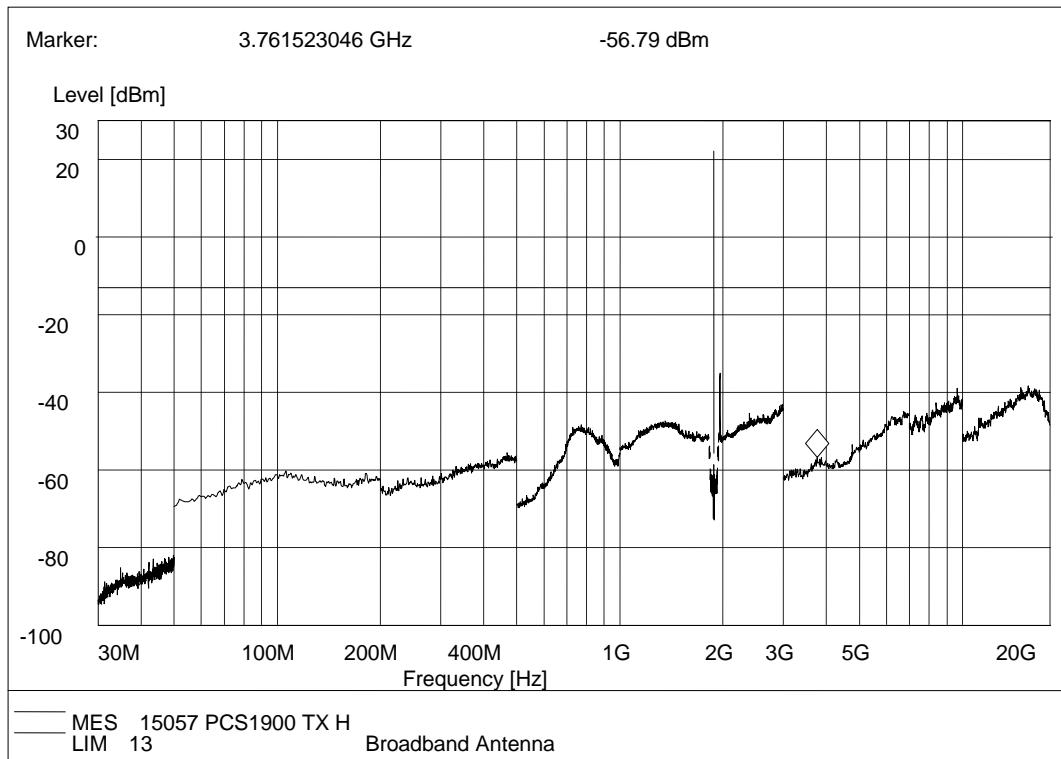
(Plot A.6: GSM 850MHz Channel = 251, Test Antenna Vertical)



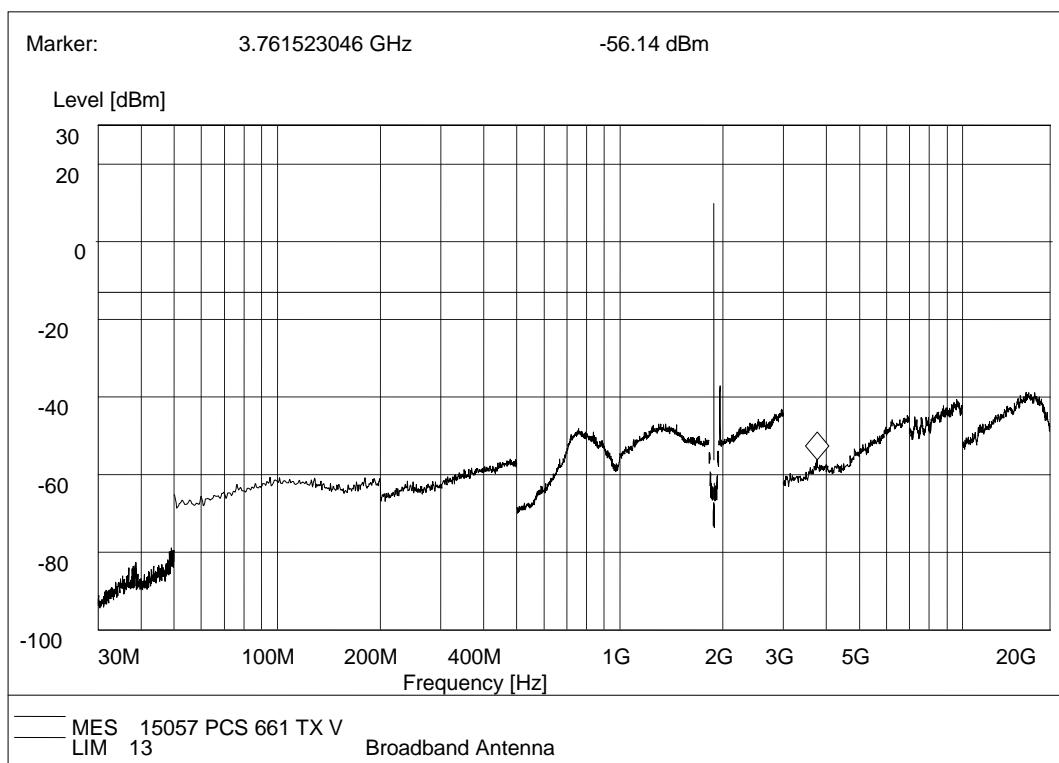
(Plot B.1: GSM 1900MHz Channel = 512, Test Antenna Horizontal)



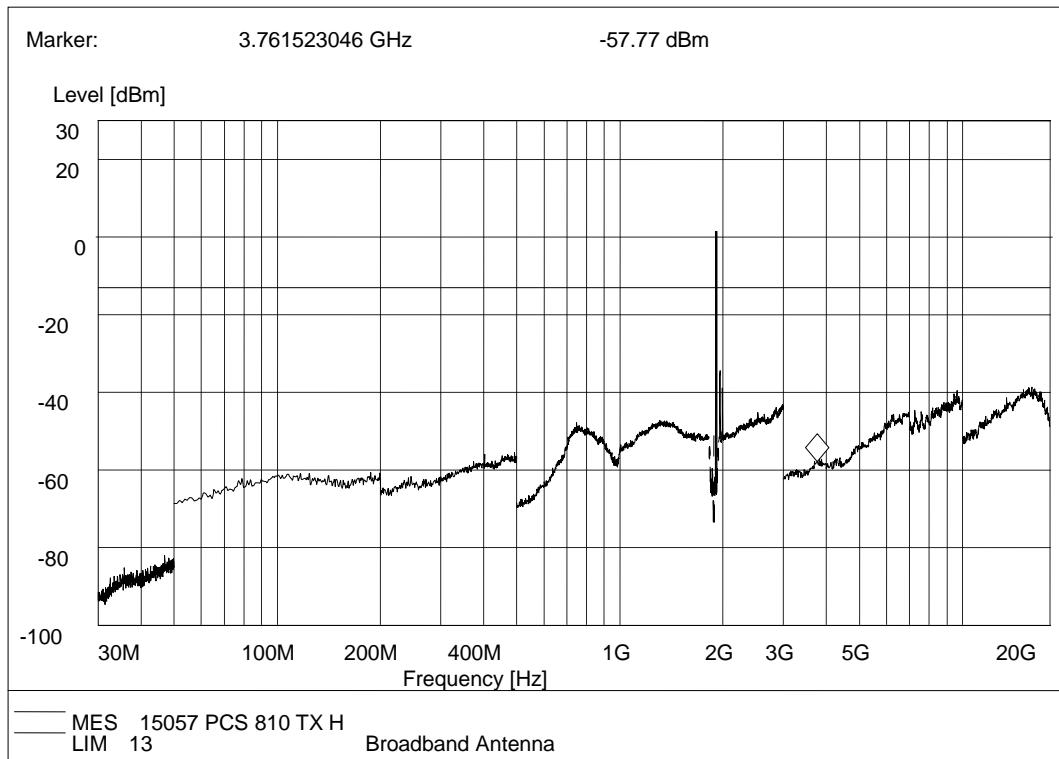
(Plot B.2: GSM 1900MHz Channel = 512, Test Antenna Vertical)



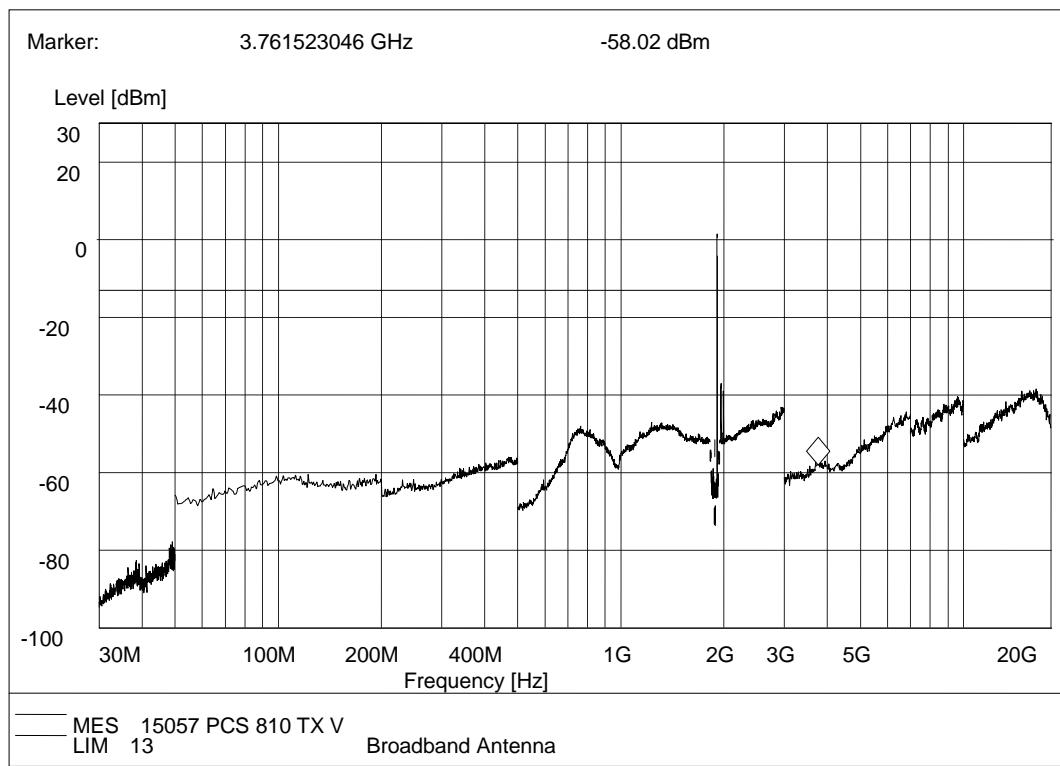
(Plot B.3: GSM 1900MHz Channel = 661, Test Antenna Horizontal)



(Plot B.4: GSM 1900MHz Channel = 661, Test Antenna Vertical)



(Plot B.5: GSM 1900MHz Channel = 810, Test Antenna Horizontal)



(PlotB.6: GSM 1900MHz Channel = 810, Test Antenna Vertical)

## Annex A Accreditation Certificate



**China National Accreditation Service for Conformity Assessment**

### **LABORATORY ACCREDITATION CERTIFICATE**

**(Registration No. CNAS L1659 )**

**CCIC Southern Electronic Product Testing (Shenzhen) Co., Ltd.**

Building 28/29, Shigudong, Xili Industrial Area, Xili Street,

Nanshan District, Shenzhen, Guangdong, China

*is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories(CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence of testing and calibration.*

*The scope of accreditation is detailed in the attached appendices bearing the same registration number as above. The appendices form an integral part of this certificate.*

Date of Issue: 2012-09-29

Date of Expiry: 2015-09-28

Date of Initial Accreditation: 1999-08-03

Date of Update: 2012-09-29



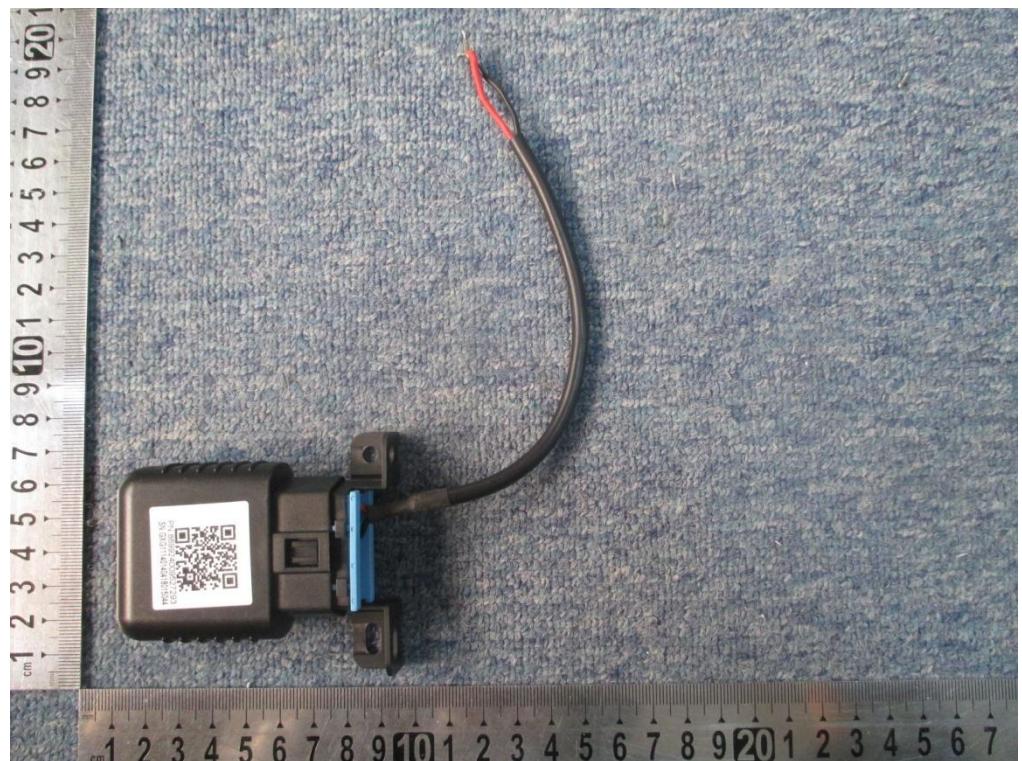
Signed on behalf of China National Accreditation Service  
for Conformity Assessment

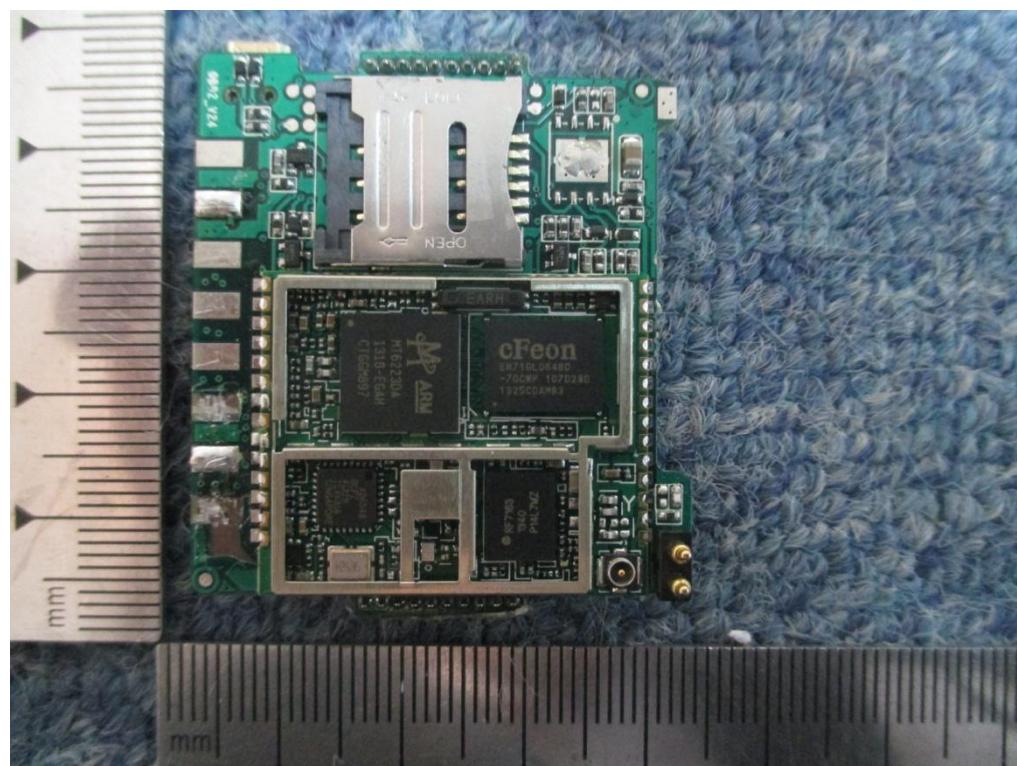
China National Accreditation Service for Conformity Assessment (CNAS) is authorized by Certification and Accreditation Administration of the People's Republic of China (CNCA) to operate the national accreditation scheme for conformity assessment. CNAS is the signatory to International Laboratory Accreditation Cooperation Multilateral Recognition Arrangement (ILAC-MRA) and Asia Pacific Laboratory Accreditation Cooperation Multilateral Recognition Arrangement (APLAC-MRA).

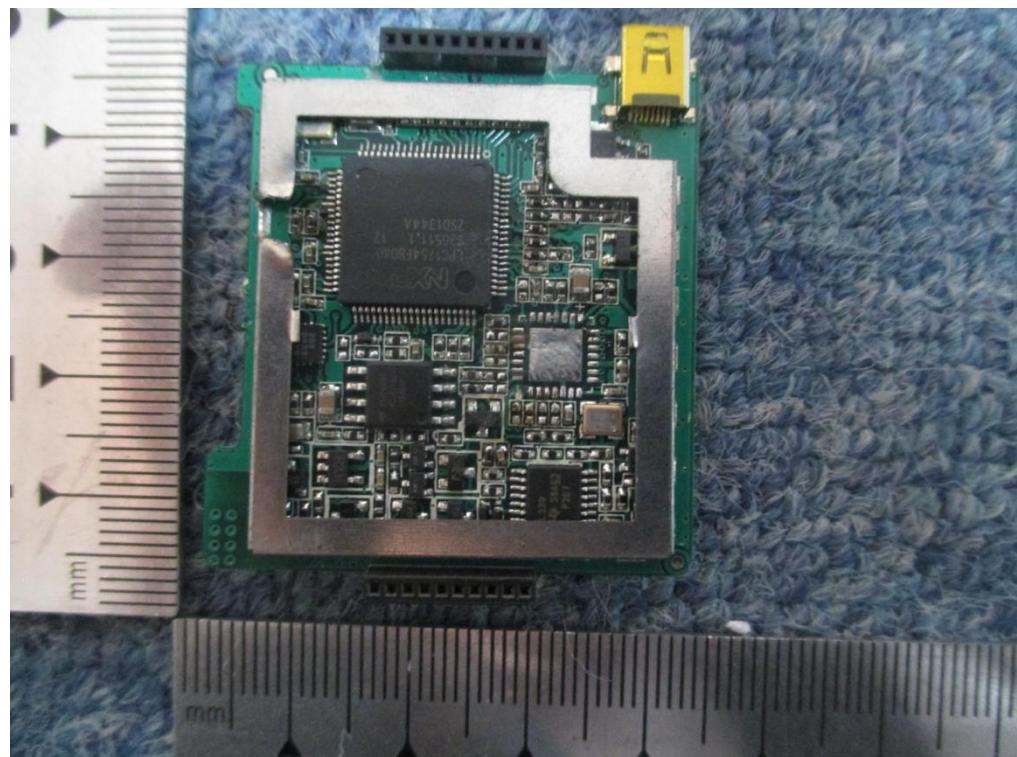
No.CNAS AL 2

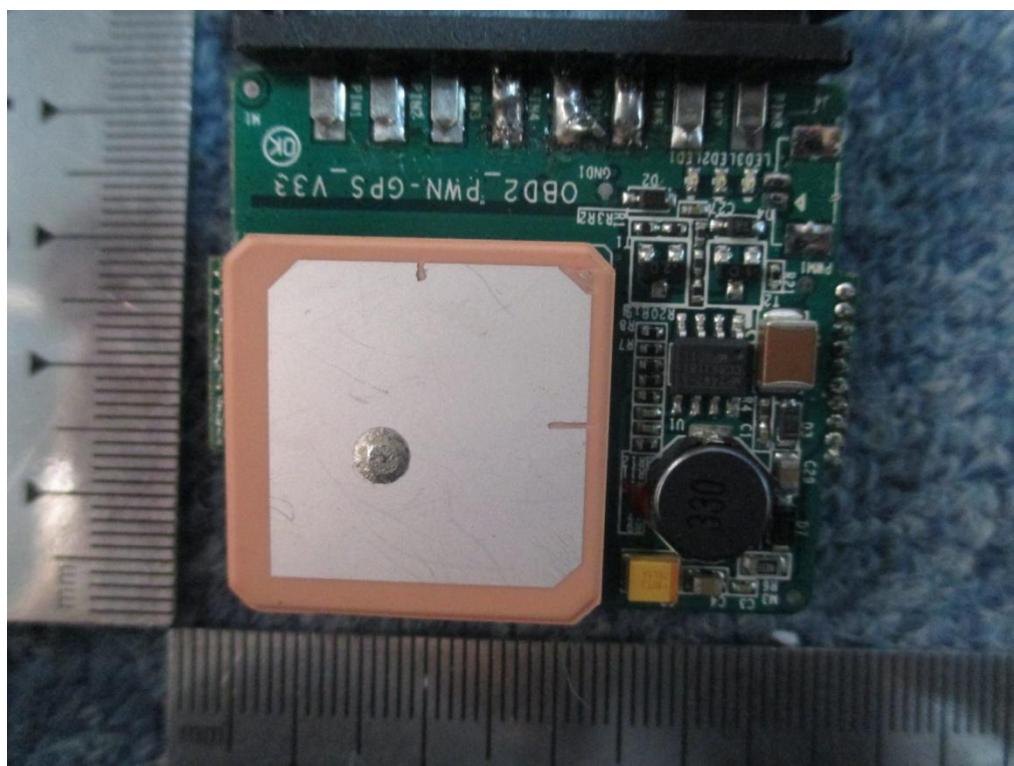
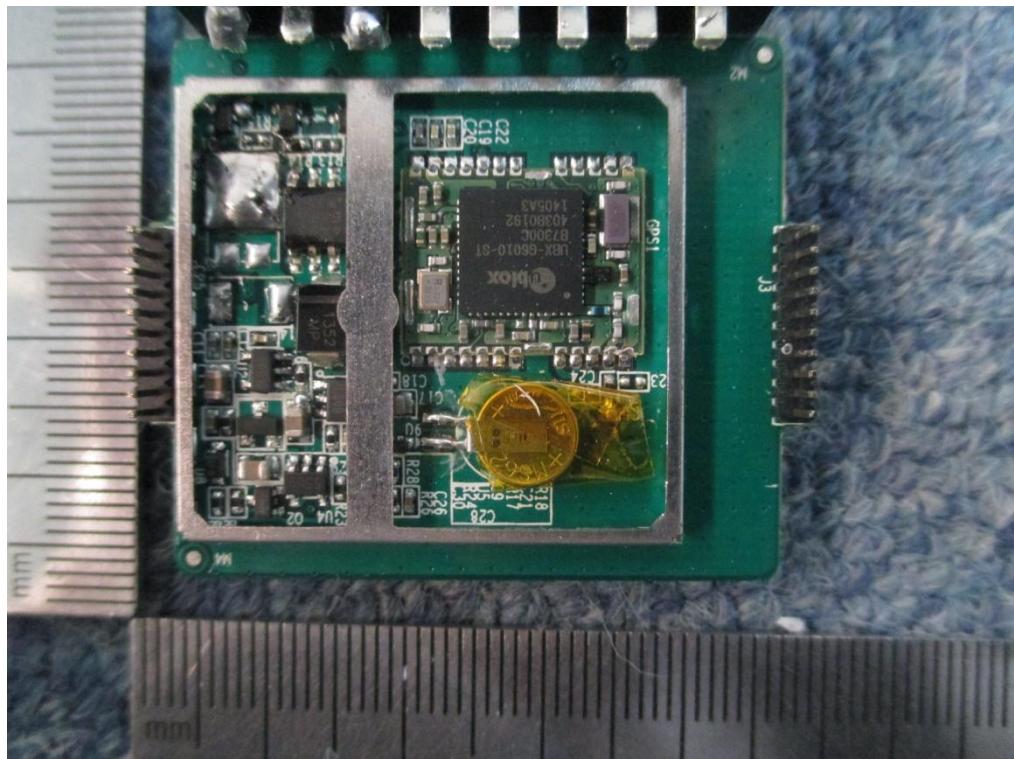
0005210

## Annex B PHOTOGRAFHS OF THE EUT







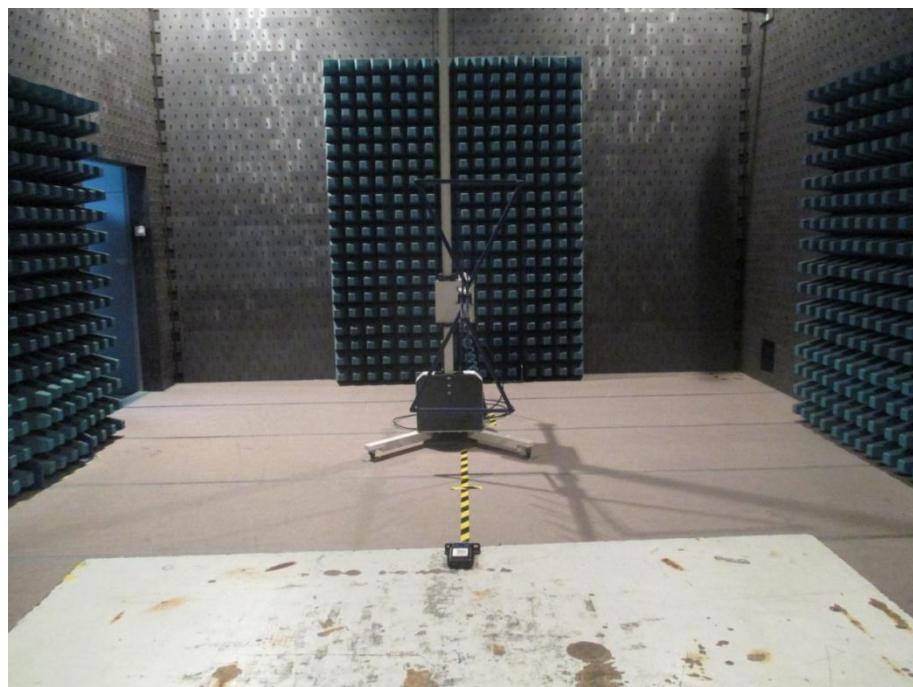


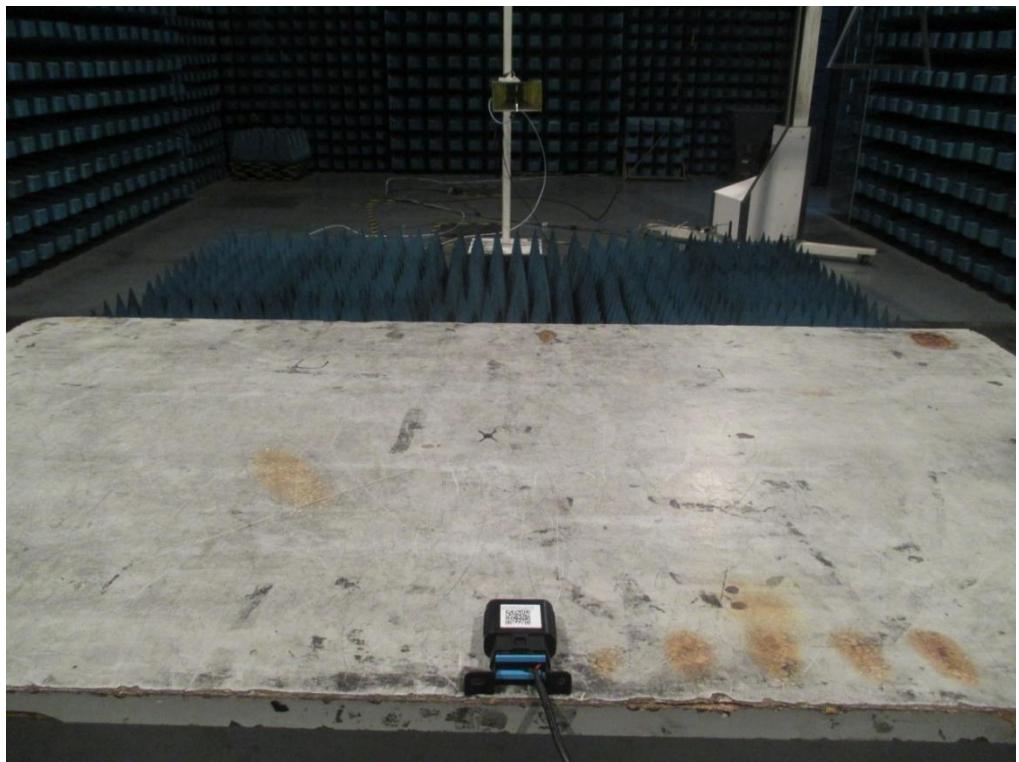
## Annex C PHOTOGRAHPS OF THE TEST SETUP

### 1. Conducted Measurement Setup



### 2. Radiated Measurement Setup





\*\* END OF REPORT \*\*