



# FCC Test Report

**FOR:**

**Model Name:A1332  
Smart Cellular Telephone with Quad band GSM, UMTS I/II/V/VI/VIII,  
Bluetooth and WiFi 802.11 b,g,n**

**FCC ID: BCG-E2380B**

**47 CFR Part 2, 22, 24**

**TEST REPORT #: EMC\_APPLE\_057\_09001\_FCC22\_24\_BCG-E2380B\_Rev1  
DATE: 2010-06-04**



FCC listed:  
A2LA accredited

IC recognized #  
3462B-1

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Board of Directors: Dr. Harald Ansorge, Dr. Klaus Matkey, Hans Peter May

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# 1 Assessment

The following is in compliance with the applicable criteria specified in FCC rules Parts 2, 22 and 24 of Title 47 of the Code of Federal Regulations.

| Company    | Description   | Model # |
|------------|---|---------|
| Apple Inc. | Smart Cellular Telephone with Quad band GSM, UMTS I/II/V/VI/VIII, Bluetooth and WiFi 802.11 b,g,n | A1332   |

**Responsible for Testing Laboratory:**

| 2010-06-04 | Compliance | Heiko Strehlow<br>(Director) |           |
|------------|------------|------------------------------|-----------|
| Date       | Section    | Name                         | Signature |

**Responsible for the Report:**

| 2010-06-04 | Compliance | Sajay Jose<br>(EMC Engineer) |           |
|------------|------------|------------------------------|-----------|
| Date       | Section    | Name                         | Signature |

The test results of this test report relate exclusively to the test item specified in Section 3. CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM Inc USA.

## 2 Administrative Data

### 2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

|                                      |  |
|--------------------------------------|--|
| <b>Company Name:</b>                 | CETECOM Inc.   |
| <b>Department:</b>                   | Compliance   |
| <b>Address:</b>                      | 411 Dixon Landing Road<br>Milpitas, CA 95035<br>U.S.A. |
| <b>Telephone:</b>                    | +1 (408) 586 6200                                      |
| <b>Fax:</b>                          | +1 (408) 586 6299                                      |
| <b>Responsible Test Lab Manager:</b> | Heiko Strehlow   |
| <b>Responsible Project Leader:</b>   | Sajay Jose   |

### 2.2 Identification of the Client

|                          |                     |
|--------------------------|---------------------|
| <b>Applicant's Name:</b> | Apple Inc.          |
| <b>Street Address:</b>   | 1 Infinite Loop     |
| <b>City/Zip Code</b>     | Cupertino, CA 95014 |
| <b>Country</b>           | USA                 |
| <b>Contact Person:</b>   | Bob Steinfeld       |
| <b>Phone No.</b>         | 408-974-2618        |
| <b>e-mail:</b>           | steinfel@apple.com  |

### 2.3 Identification of the Manufacturer

|                               |               |
|-------------------------------|---------------|
| <b>Manufacturer's Name:</b>   | Same as above |
| <b>Manufacturers Address:</b> |               |
| <b>City/Zip Code</b>          |               |
| <b>Country</b>                |               |

### 3 Equipment under Test (EUT)

#### 3.1 Specification of the Equipment under Test

|                               |  |
|-------------------------------|--|
| <b>Marketing Name:</b>        | A1332  |
| <b>Model No:</b>              | A1332  |
| <b>Product Type:</b>          | Smart Cellular Telephone with Quad band GSM, UMTS I/II/V/VI/VIII, Bluetooth and WiFi 802.11 b/g/n.<br>Includes Ipod music, photo, GPS and application functions. |
| <b>Hardware Revision :</b>    | Rev C  |
| <b>Software Revision :</b>    | 01.50.01/8A224   |
| <b>FCC-ID:</b>                | BCG-E2380B   |
| <b>Frequency:</b>             | GSM 850: 824.2-848.8MHz; PCS 1900: 1850.2-1909.8MHz<br>FDD V: 826.4-846.6MHz; FDD II: 1852.4-1907.6MHz   |
| <b>Type(s) of Modulation:</b> | GMSK; 8-PSK; Dual BPSK   |
| <b>Number of channels:</b>    | GSM850: 125 and PCS 1900: 300<br>FDD II: 278/ FDD V: 103   |
| <b>Antenna Type:</b>          | Internal PIFA  |
| <b>Operating voltage:</b>     | Internal battery, 110V AC Adapter;<br>3.4V (Low)/ 4.2V (Nominal)/ 4.2V (Max)   |
| <b>Temperature Range:</b>     | 0°C to 35°C  |

### **3.2 Identification of the Equipment Under Test (EUT)**

| <b>EUT #</b> | <b>Serial Number/IMEI</b>         | <b>HW Version</b> | <b>SW Version</b> | <b>Notes</b>              |
|--------------|-----------------------------------|-------------------|-------------------|---------------------------|
| <b>1</b>     | 88012055FRZ/<br>00107200 288894 7 | Rev C             | 01.50.01/ 8A224   | Conducted testing sample. |
| <b>2</b>     | 880120A4FRX/<br>00107200 285569 8 | Rev C             | 01.50.01/ 8A224   | Radiated testing sample.  |

### **3.3 Identification of Accessory equipment**

| <b>AE #</b> | <b>Type</b>                | <b>Manufacturer</b> | <b>Model</b> | <b>Serial Number</b> |
|-------------|----------------------------|---------------------|--------------|----------------------|
| <b>1</b>    | 110V AC Adapter            | Flextronics         | A1265        | N/A                  |
| <b>2</b>    | Dummy Battery              | Apple Inc.          | N/A          | N/A                  |
| <b>3</b>    | External Antenna connector | Apple Inc.          | N/A          | N/A                  |

## **4 Subject of Investigation**

The objective of the measurements done by Cetecom Inc. was to measure the performance of the EUT as specified by requirements listed in the following test standards:

- 47 CFR Part 2: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission Frequency allocations and radio treaty matters; general rules and regulations.
- 47 CFR Part 22: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 22- Public mobile services
- 47 CFR Part 24: Title 47 of the Code of Federal Regulations: Chapter I-Federal Communications Commission subchapter B- common carrier services; Part 24- Personal communication services

This test report replaces the previously issued report #

“EMC\_APPLE\_057\_09001\_FCC22\_24\_BCG-E2380B” issued by Cetecom Inc. on May 30, 2010.



## 5 Measurements

### 5.1 RF Power Output

#### 5.1.1 References

FCC: CFR Part 2.1046, CFR Part 22.913, CFR Part 24.232

#### 5.1.2 FCC 2.1046 Measurements required: RF power output.

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 circuit elements as specified. The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

#### 5.1.3 Limits:

##### 5.1.3.1 FCC 22.913 (a) Effective radiated power limits.

The effective radiated power (ERP) of mobile transmitters must not exceed 7 Watts.

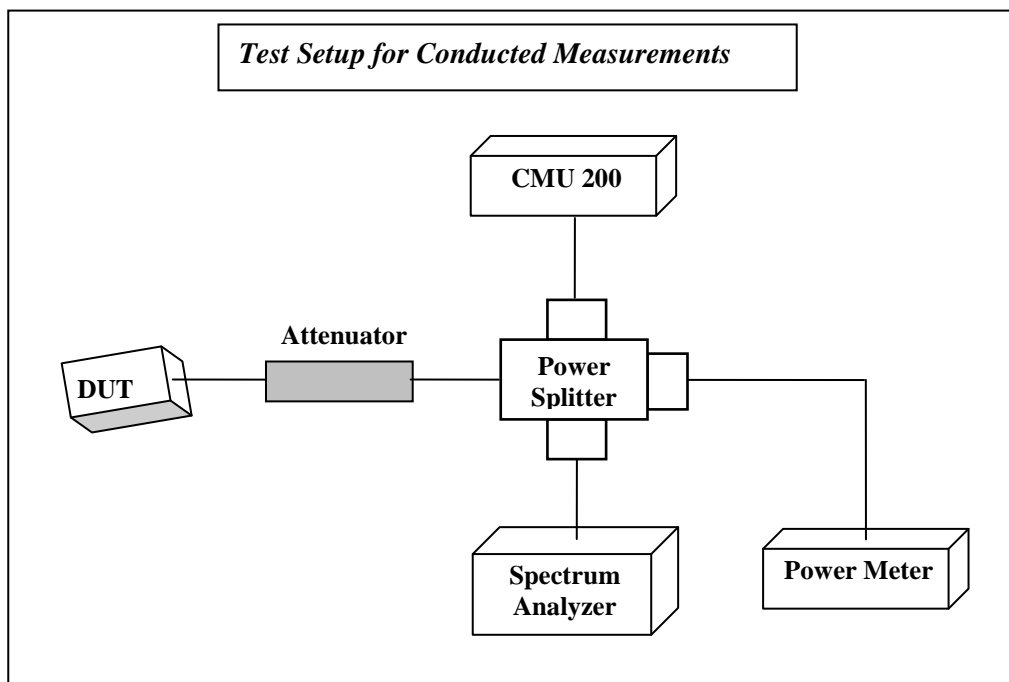
##### 5.1.3.2 FCC 24.232 (b)(c) Power limits.

(b) Mobile/portable stations are limited to 2 Watts effective isotropic radiated power (EIRP).

(c) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms equivalent voltage. The measurement results shall be properly adjusted for any limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement over the full bandwidth of the channel.

#### 5.1.4 Conducted Output Power Measurement procedure

Ref: TIA-603C 2004 2.2.1 Conducted Carrier Output Power Rating



1. Connect the equipment as shown in the above diagram. A Digital RadioCommunication Tester (DRT) is used to enable the EUT to transmit and to measure the output power.
2. Adjust the settings of the DRT to set the EUT to its maximum power at the required channel.
3. Record the output power level measured by the DRT.
4. Correct the measured level for all losses in the RF path.
5. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

**Spectrum Analyzer Settings:**

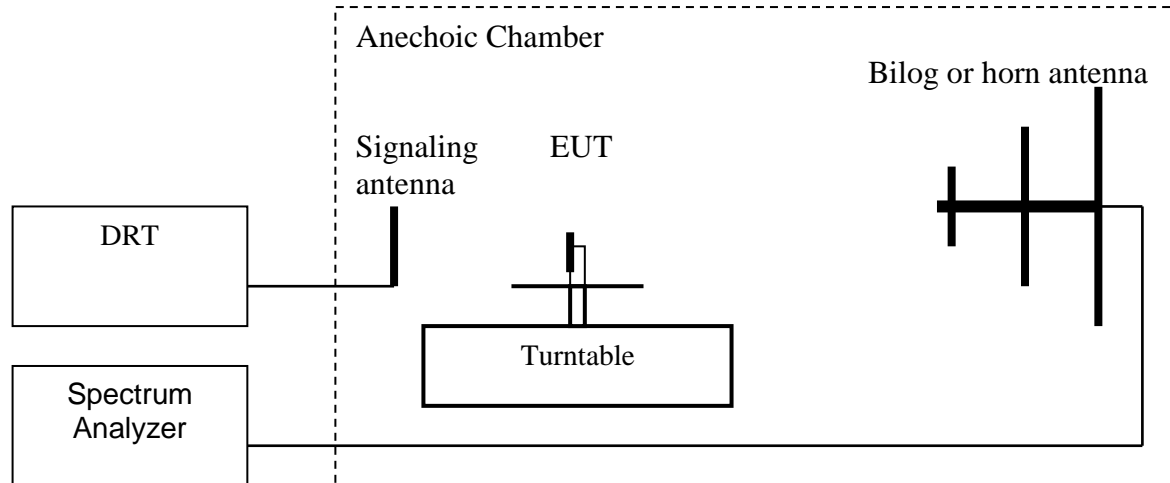
GSM: RBW=3MHz; Span=10MHz; Detector: Peak- Max Hold.

UMTS: RBW=5MHz; Span=10MHz; Detector: Peak- Max Hold.

Average measurements performed using RMS detector functionality on the Spectrum Analyzer.

### 5.1.5 Radiated Output Power Measurement procedure

Ref: TIA-603C 2004 -2.2.17.2 Effective Radiated Power (ERP) or Effective Isotropic Radiated Power (EIRP)



1. Connect the equipment as shown in the above diagram with the EUT's antenna in a vertical orientation.
2. Adjust the settings of the Digital RadioCommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to the channel frequency. Set the analyzer to measure peak hold with the required settings.
4. Rotate the EUT 360°. Record the peak level in dBm (**LVL**).
5. Replace the EUT with a vertically polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS**). **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the ERP using the following equation:  

$$\mathbf{ERP} \text{ (dBm)} = \mathbf{LVL} \text{ (dBm)} + \mathbf{LOSS} \text{ (dB)}$$
8. Determine the EIRP using the following equation:  

$$\mathbf{EIRP} \text{ (dBm)} = \mathbf{ERP} \text{ (dBm)} + 2.14 \text{ (dB)}$$
9. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

**Spectrum analyzer settings: RBW=VBW=3MHz**

(Note: Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4, 7 and 8 above are performed with test software.)

### 5.1.6 RF Power Output 850MHz band

**Limit: Nominal Peak Output Power < 38.45 dBm (7W)**

**Measurement Uncertainty (Conducted): ±0.5 dB**

**Measurement Uncertainty (Radiated): ±3.0 dB**

| <b>GSM 850: GMSK Mode</b>  |                             |                           |                                  |                       |
|----------------------------|-----------------------------|---------------------------|----------------------------------|-----------------------|
| <b>Frequency<br/>(MHz)</b> | <b>Conducted Power</b>      |                           |                                  | <b>Radiated Power</b> |
|                            | <b>Peak Power<br/>(dBm)</b> | <b>Av Power<br/>(dBm)</b> | <b>Peak-to-Av<br/>Ratio (dB)</b> | <b>ERP (dBm)</b>      |
| <b>824.2</b>               | 32.15                       | 31.98                     | 0.17                             | 28.5                  |
| <b>836.6</b>               | 32.15                       | 31.96                     | 0.19                             | 30.1                  |
| <b>848.8</b>               | 32.09                       | 31.83                     | 0.26                             | 29.8                  |

| <b>EGPRS 850: 8PSK Mode</b> |                             |                           |                                  |                       |
|-----------------------------|-----------------------------|---------------------------|----------------------------------|-----------------------|
| <b>Frequency<br/>(MHz)</b>  | <b>Conducted Power</b>      |                           |                                  | <b>Radiated Power</b> |
|                             | <b>Peak Power<br/>(dBm)</b> | <b>Av Power<br/>(dBm)</b> | <b>Peak-to-Av<br/>Ratio (dB)</b> | <b>ERP (dBm)</b>      |
| <b>824.2</b>                | 30.83                       | 27.0                      | 3.83                             | 27.4                  |
| <b>836.6</b>                | 30.85                       | 27.0                      | 3.85                             | 27.3                  |
| <b>848.8</b>                | 30.80                       | 27.0                      | 3.80                             | 27.3                  |

| <b>FDD V: UMTS Mode</b>    |                             |                           |                                  |                       |
|----------------------------|-----------------------------|---------------------------|----------------------------------|-----------------------|
| <b>Frequency<br/>(MHz)</b> | <b>Conducted Power</b>      |                           |                                  | <b>Radiated Power</b> |
|                            | <b>Peak Power<br/>(dBm)</b> | <b>Av Power<br/>(dBm)</b> | <b>Peak-to-Av<br/>Ratio (dB)</b> | <b>ERP (dBm)</b>      |
| <b>826.4</b>               | 25.37                       | 22.5                      | 2.87                             | 23.8                  |
| <b>836.6</b>               | 25.46                       | 22.8                      | 2.66                             | 25.0                  |
| <b>846.6</b>               | 25.42                       | 22.61                     | 2.81                             | 25.3                  |

### 5.1.7 RF Power Output 1900MHz band

**Limit: Nominal Peak Output Power < 33 dBm (2W)**

**PAR may not exceed 13dB**

**Measurement Uncertainty (Conducted): ±0.5 dB**

**Measurement Uncertainty (Radiated): ±3.0 dB**

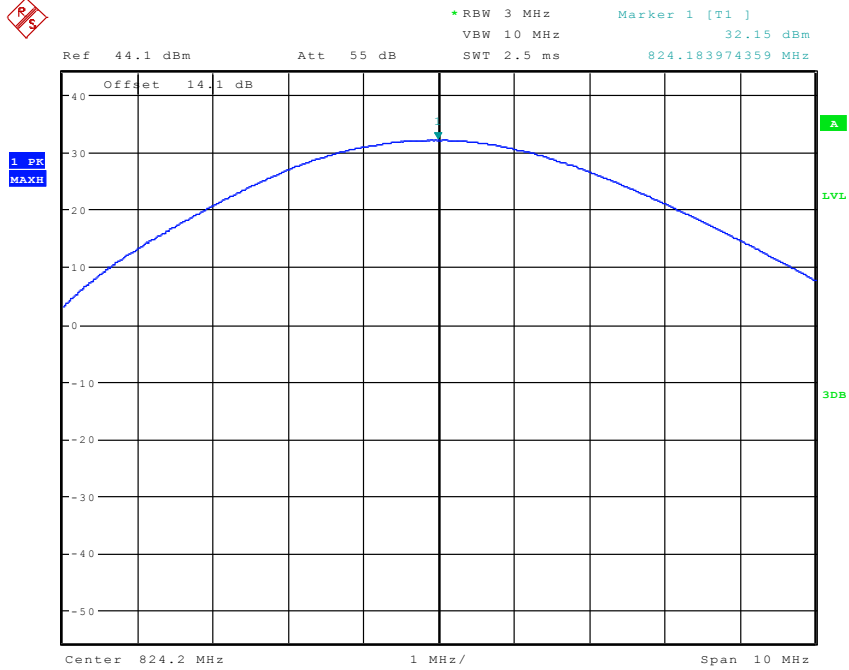
| <b>GSM 1900: GMSK Mode</b> |                         |                       |                              |                       |
|----------------------------|-------------------------|-----------------------|------------------------------|-----------------------|
| <b>Frequency (MHz)</b>     | <b>Conducted Power</b>  |                       |                              | <b>Radiated Power</b> |
|                            | <b>Peak Power (dBm)</b> | <b>Av Power (dBm)</b> | <b>Peak-to-Av Ratio (dB)</b> | <b>EIRP (dBm)</b>     |
| <b>1850.2</b>              | 29.85                   | 29.68                 | 0.17                         | 30.1                  |
| <b>1880.0</b>              | 29.82                   | 29.73                 | 0.09                         | 29.7                  |
| <b>1909.8</b>              | 29.71                   | 29.67                 | 0.04                         | 28.6                  |

| <b>EGPRS 1900: 8PSK Mode</b> |                         |                       |                              |                       |
|------------------------------|-------------------------|-----------------------|------------------------------|-----------------------|
| <b>Frequency (MHz)</b>       | <b>Conducted Power</b>  |                       |                              | <b>Radiated Power</b> |
|                              | <b>Peak Power (dBm)</b> | <b>Av Power (dBm)</b> | <b>Peak-to-Av Ratio (dB)</b> | <b>EIRP (dBm)</b>     |
| <b>1850.2</b>                | 28.26                   | 25.3                  | 2.96                         | 28.3                  |
| <b>1880.0</b>                | 28.28                   | 25.3                  | 2.98                         | 27.9                  |
| <b>1909.8</b>                | 28.18                   | 25.2                  | 2.98                         | 26.8                  |

| <b>FDD II: UMTS Mode</b> |                         |                       |                              |                       |
|--------------------------|-------------------------|-----------------------|------------------------------|-----------------------|
| <b>Frequency (MHz)</b>   | <b>Conducted Power</b>  |                       |                              | <b>Radiated Power</b> |
|                          | <b>Peak Power (dBm)</b> | <b>Av Power (dBm)</b> | <b>Peak-to-Av Ratio (dB)</b> | <b>EIRP (dBm)</b>     |
| <b>1852.4</b>            | 24.99                   | 22.62                 | 2.37                         | 26.0                  |
| <b>1880.0</b>            | 25.30                   | 22.71                 | 2.59                         | 25.3                  |
| <b>1907.6</b>            | 25.03                   | 22.92                 | 2.11                         | 24.7                  |

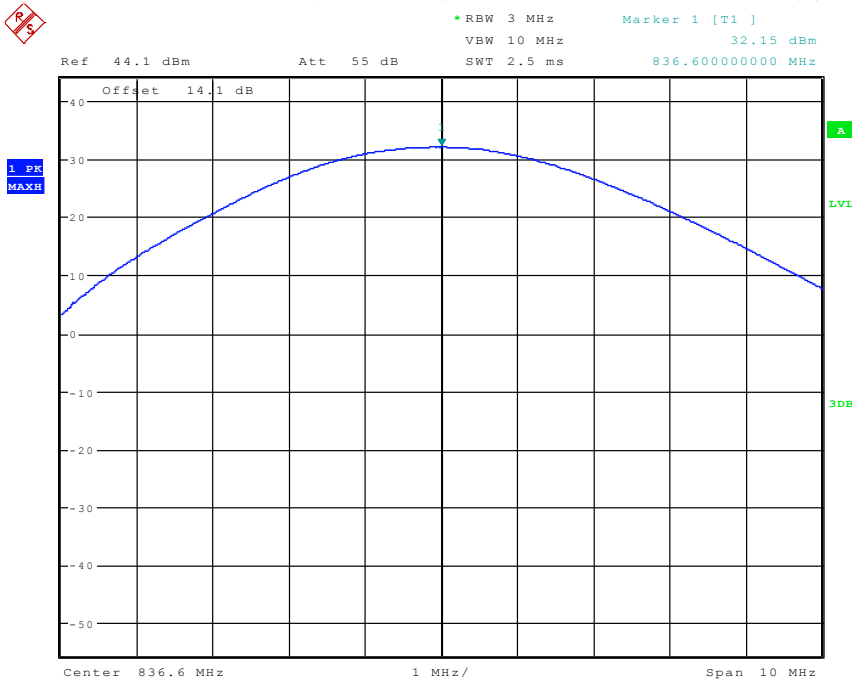
### 5.1.8 Results

#### CONDUCTED PEAK POWER (GSM 850) CHANNEL 128 §22.913(a)



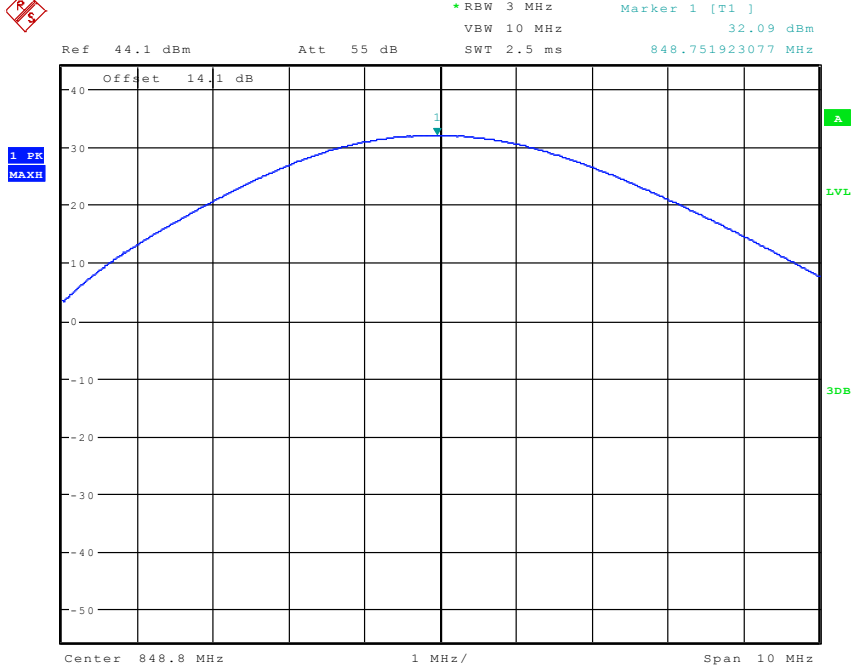
Date: 29.MAR.2010 11:00:42

#### CONDUCTED PEAK POWER (GSM 850) CHANNEL 190 §22.913(a)



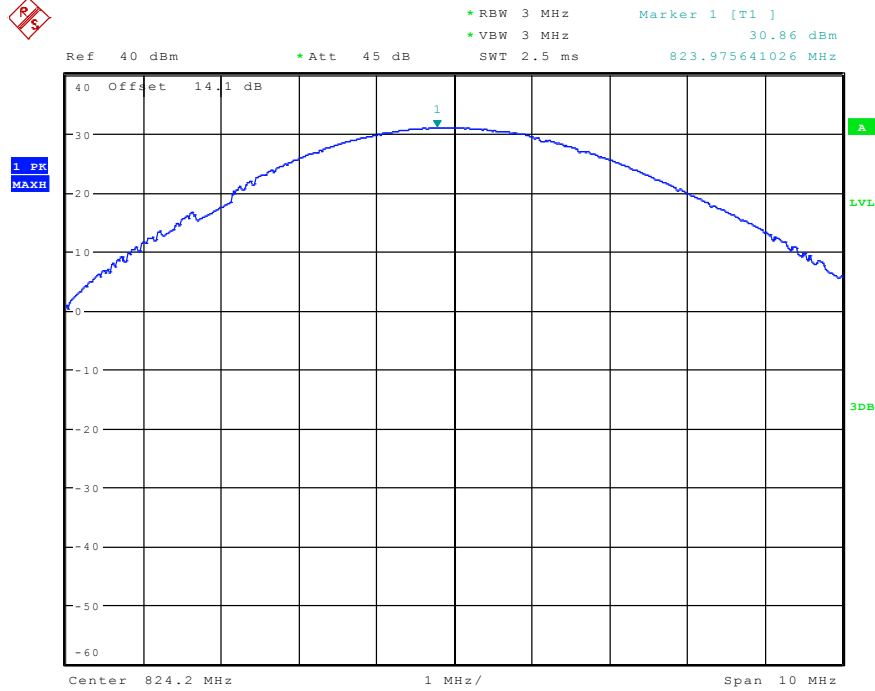
Date: 29.MAR.2010 10:58:54

### CONDUCTED PEAK POWER (GSM 850) CHANNEL 251 §22.913(a)



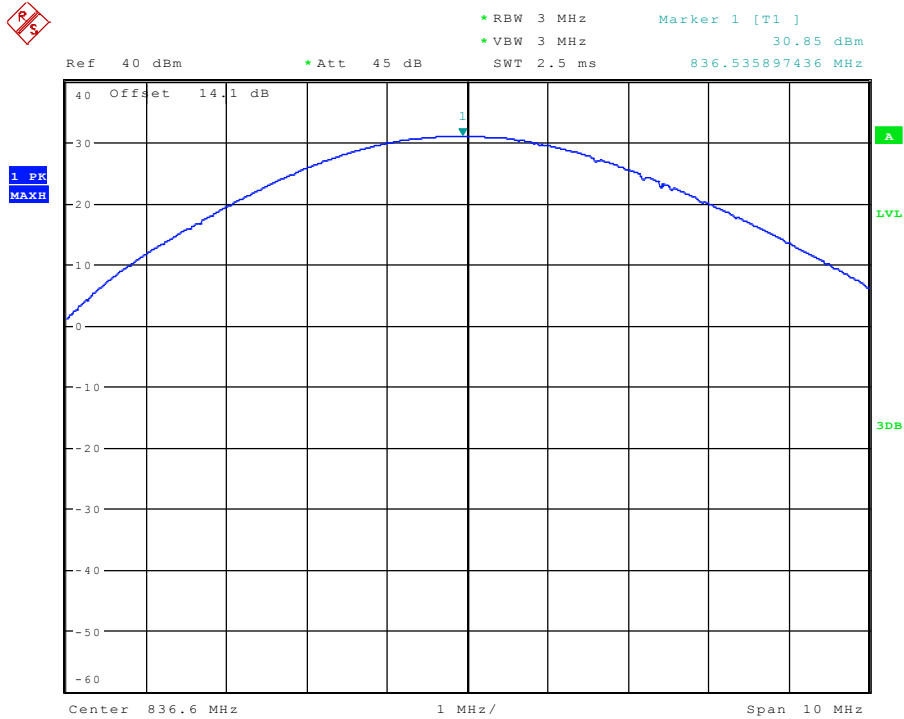
Date: 29.MAR.2010 11:01:33

### CONDUCTED PEAK POWER (EGPRS 850) CHANNEL 128 §22.913(a)



Date: 29.MAR.2010 13:43:47

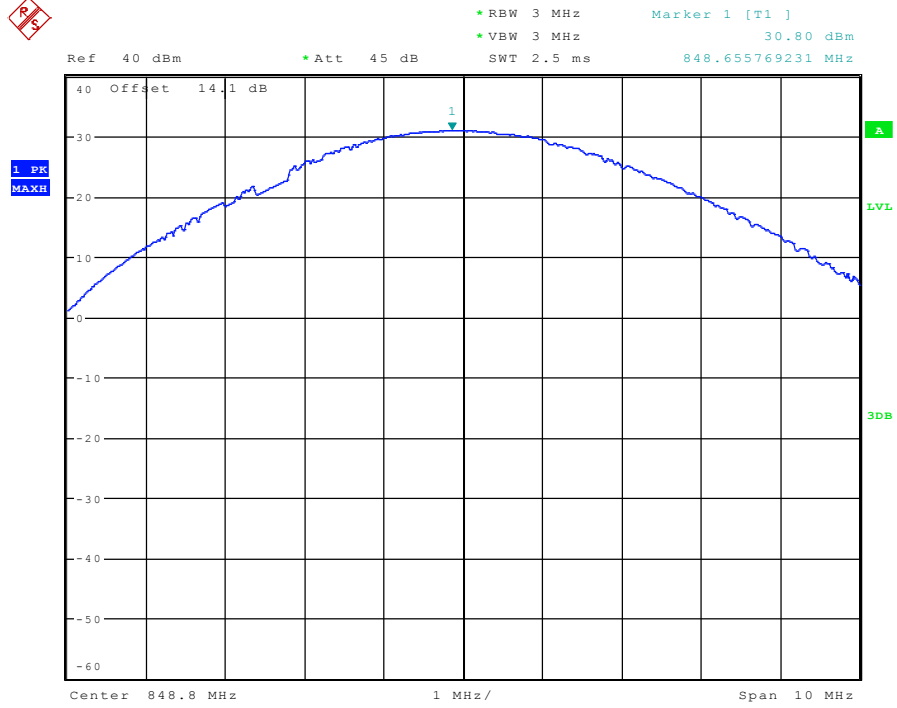
### CONDUCTED PEAK POWER (EGPRS 850) CHANNEL 190 §22.913(a)



Date: 29.MAR.2010 13:45:12

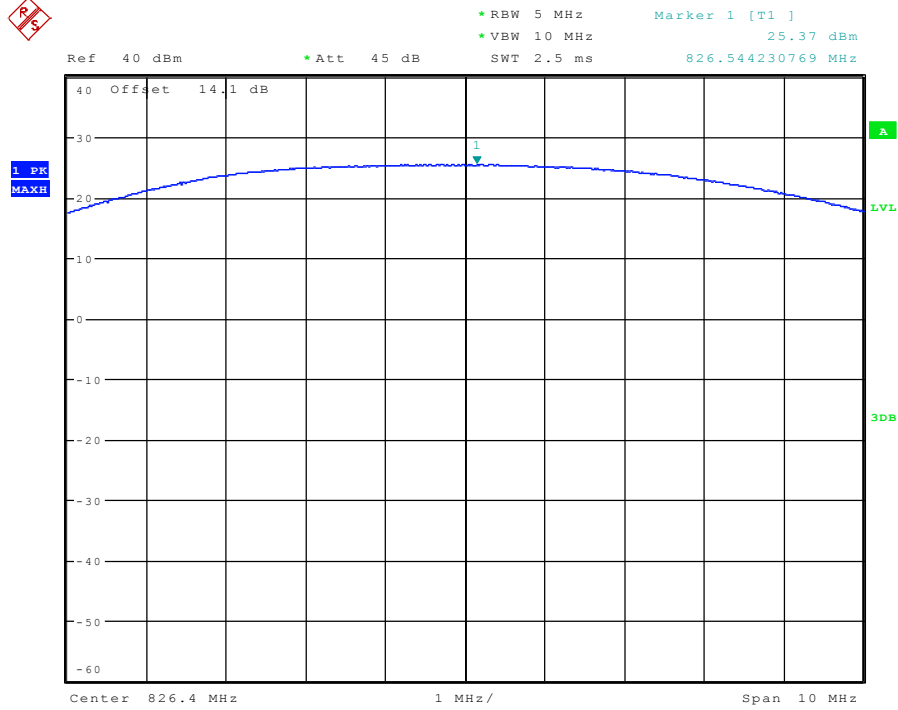


### CONDUCTED PEAK POWER (EGPRS 850) CHANNEL 251 §22.913(a)



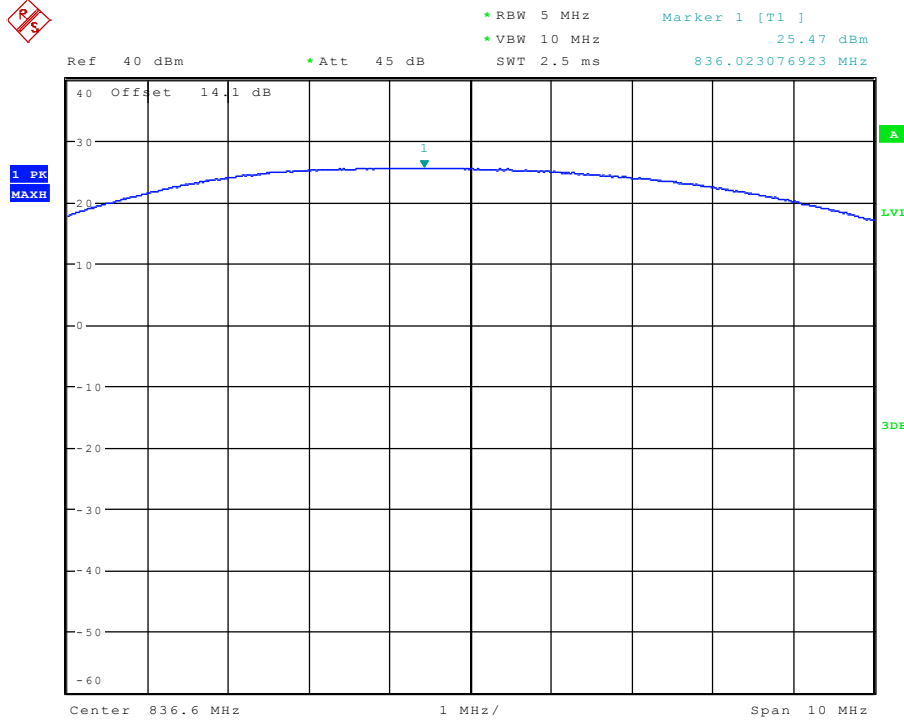
Date: 29.MAR.2010 13:46:16

### CONDUCTED PEAK POWER (UMTS FDD5) CHANNEL 4132 §22.913(a)



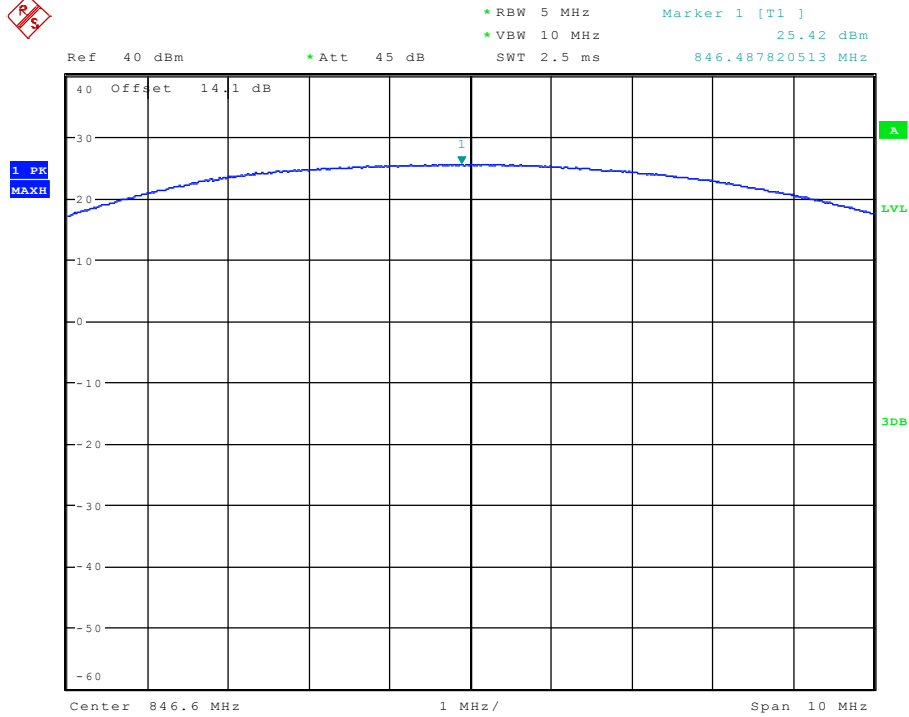
Date: 29.MAR.2010 16:12:20

### CONDUCTED PEAK POWER (UMTS FDD5) CHANNEL 4183 §22.913(a)



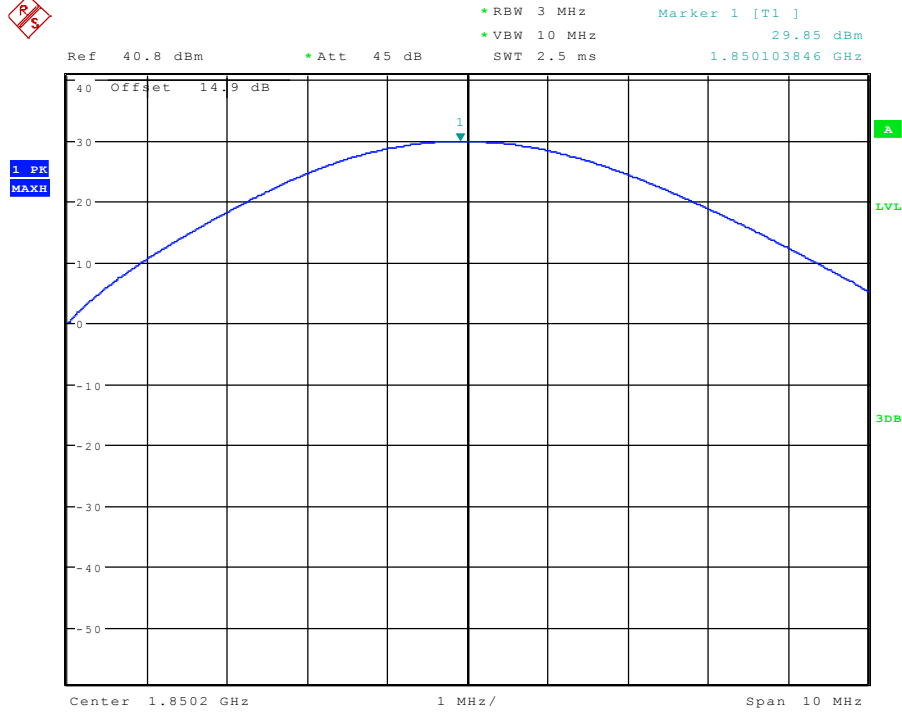
Date: 29.MAR.2010 16:13:13

### CONDUCTED PEAK POWER (UMTS FDD5) CHANNEL 4233 §22.913(a)



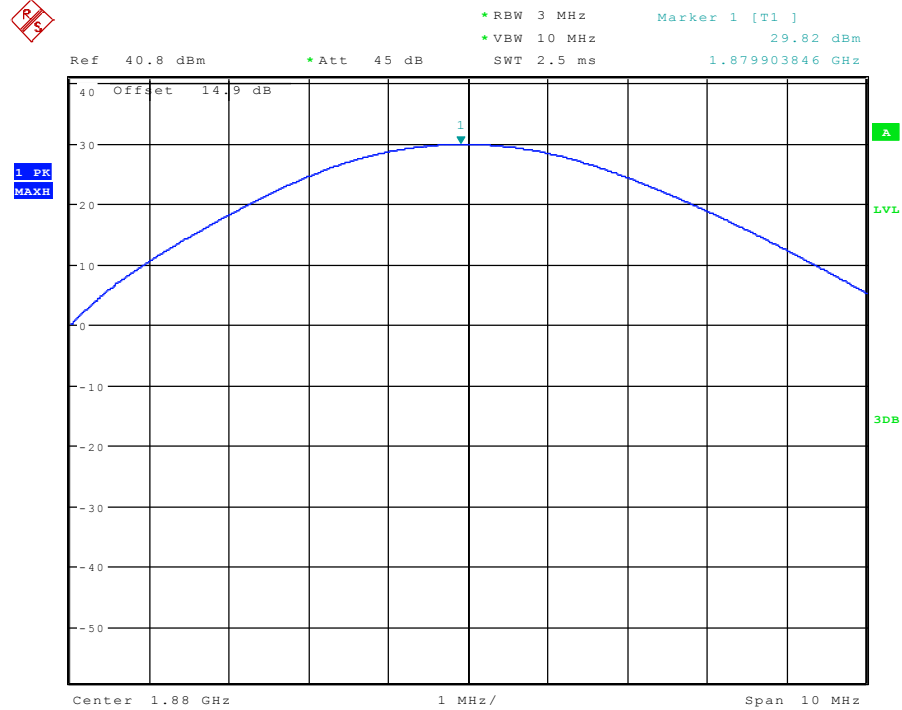
Date: 29.MAR.2010 16:13:55

### CONDUCTED PEAK POWER (PCS-1900) CHANNEL 512 §24.232(b)



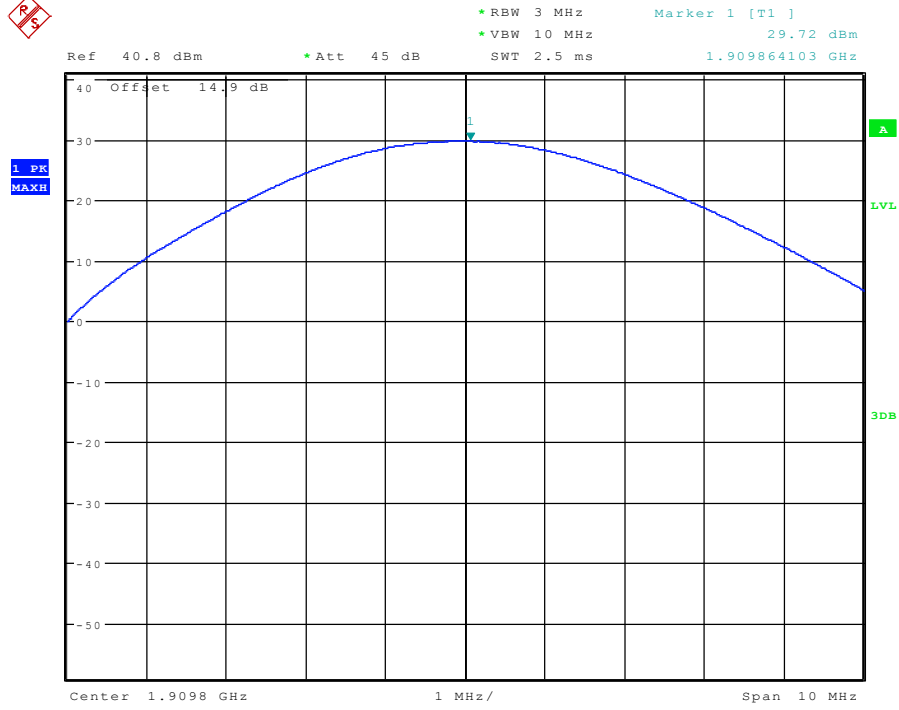
Date: 29.MAR.2010 14:38:32

### CONDUCTED PEAK POWER (PCS-1900) CHANNEL 661 §24.232(b)



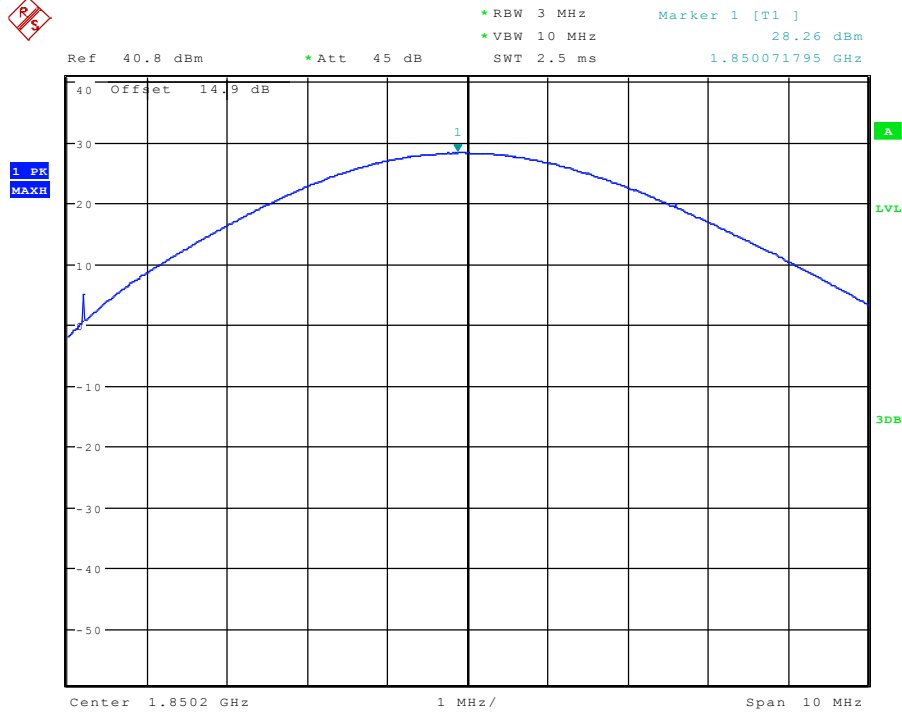
Date: 29.MAR.2010 14:39:05

### CONDUCTED PEAK POWER (PCS-1900) CHANNEL 810 §24.232(b)



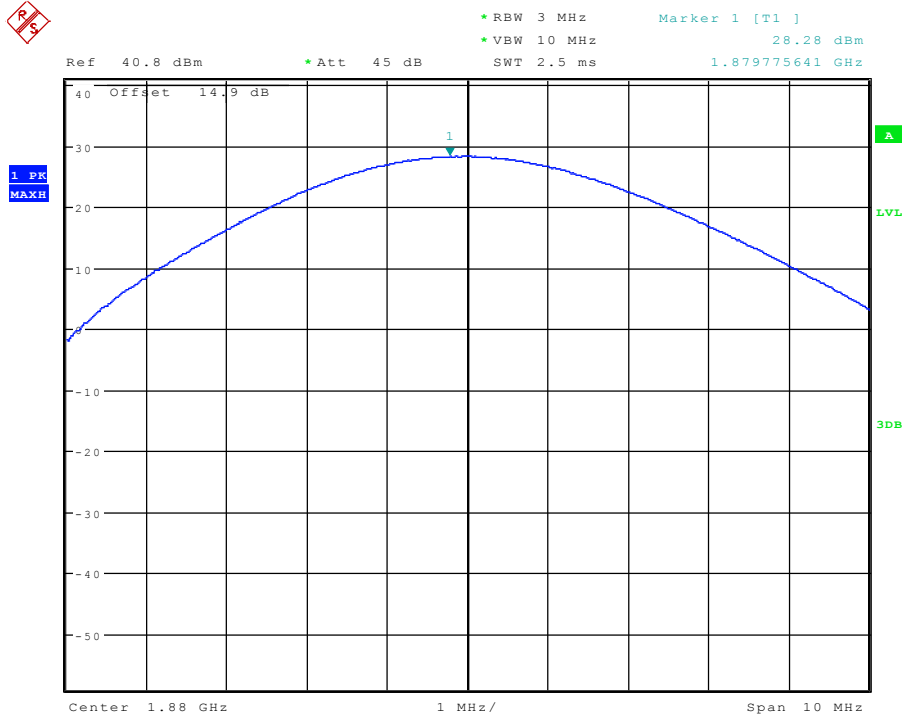
Date: 29.MAR.2010 14:39:39

### CONDUCTED PEAK POWER (EGPRS 1900) CHANNEL 512 §24.232(b)



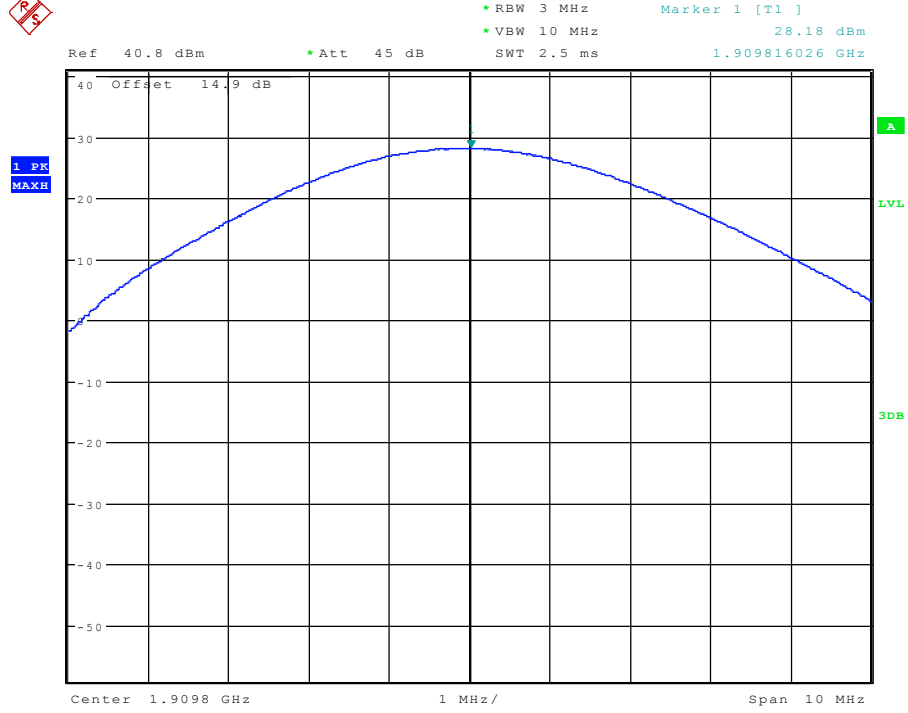
Date: 29.MAR.2010 14:49:08

### CONDUCTED PEAK POWER (EGPRS 1900) CHANNEL 661 §24.232(b)



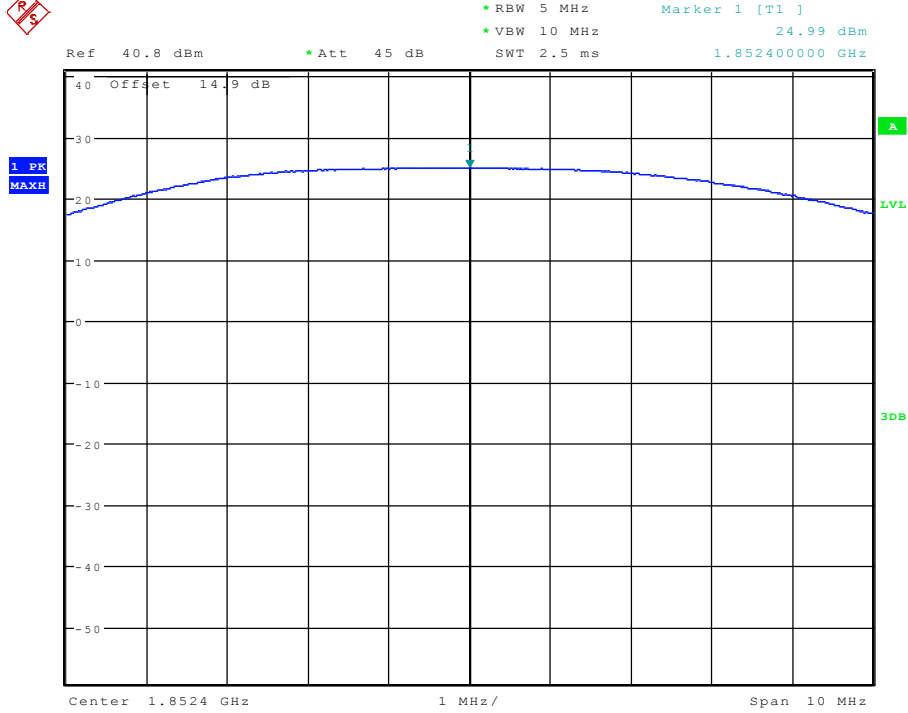
Date: 29.MAR.2010 14:49:43

### CONDUCTED PEAK POWER (EGPRS 1900) CHANNEL 810 §24.232(b)



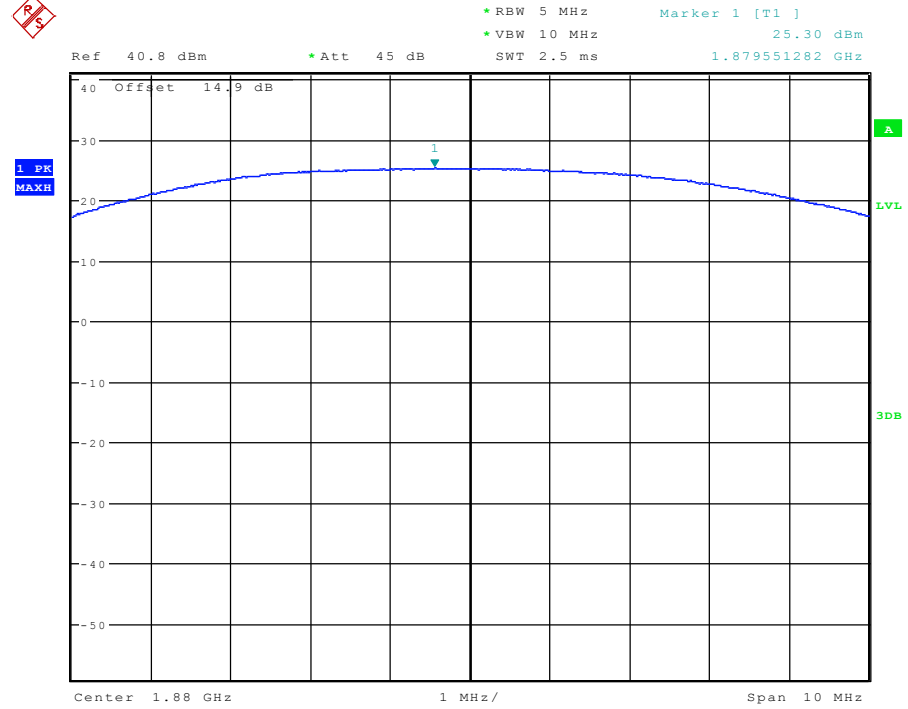
Date: 29.MAR.2010 14:50:26

### CONDUCTED PEAK POWER (UMTS FDD2) CHANNEL 9262 §24.232(b)



Date: 29.MAR.2010 15:27:31

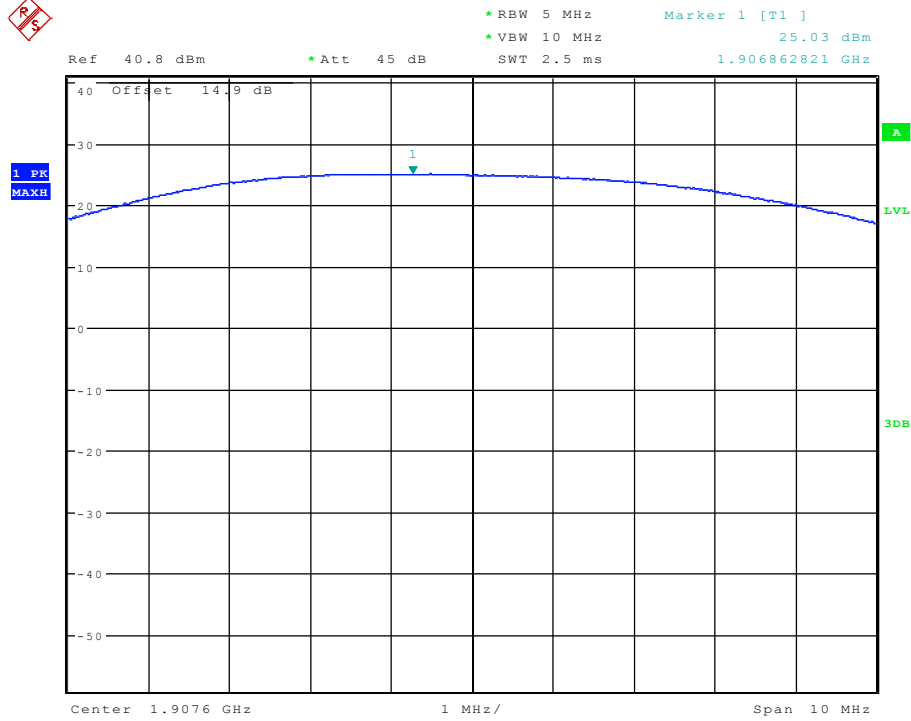
### CONDUCTED PEAK POWER (UMTS FDD2) CHANNEL 9400 §24.232(b)



Date: 29.MAR.2010 15:29:05

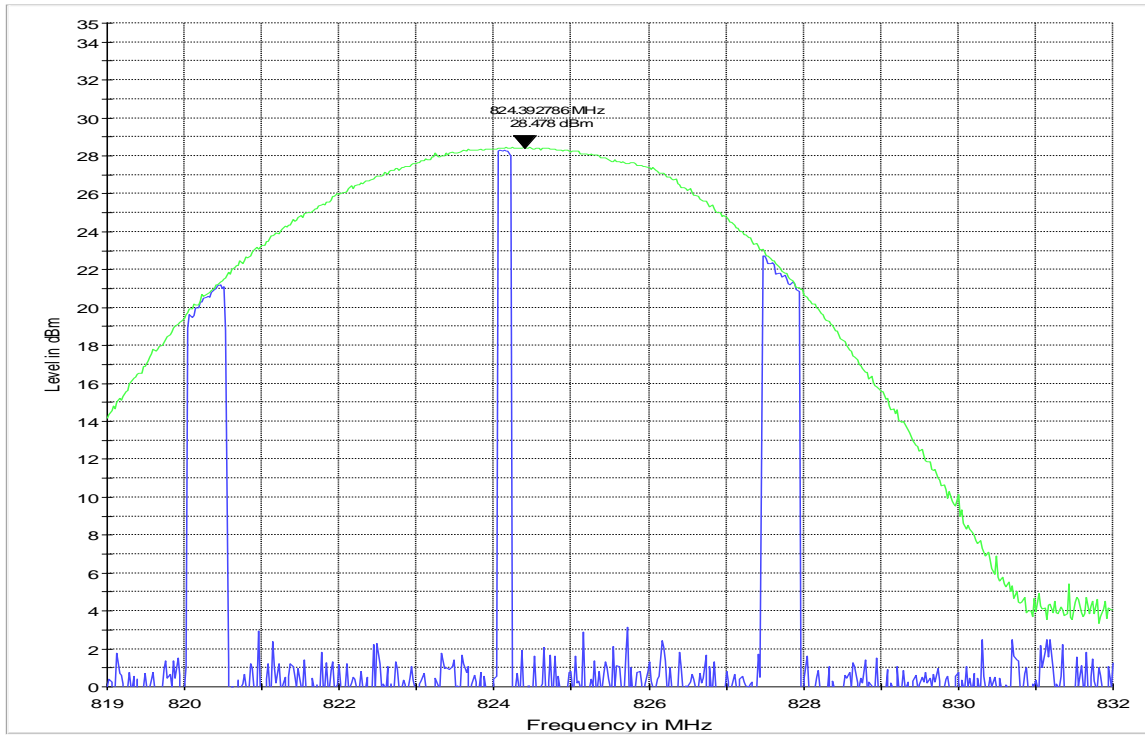


### CONDUCTED PEAK POWER (UMTS FDD2) CHANNEL 9538 §24.232(b)



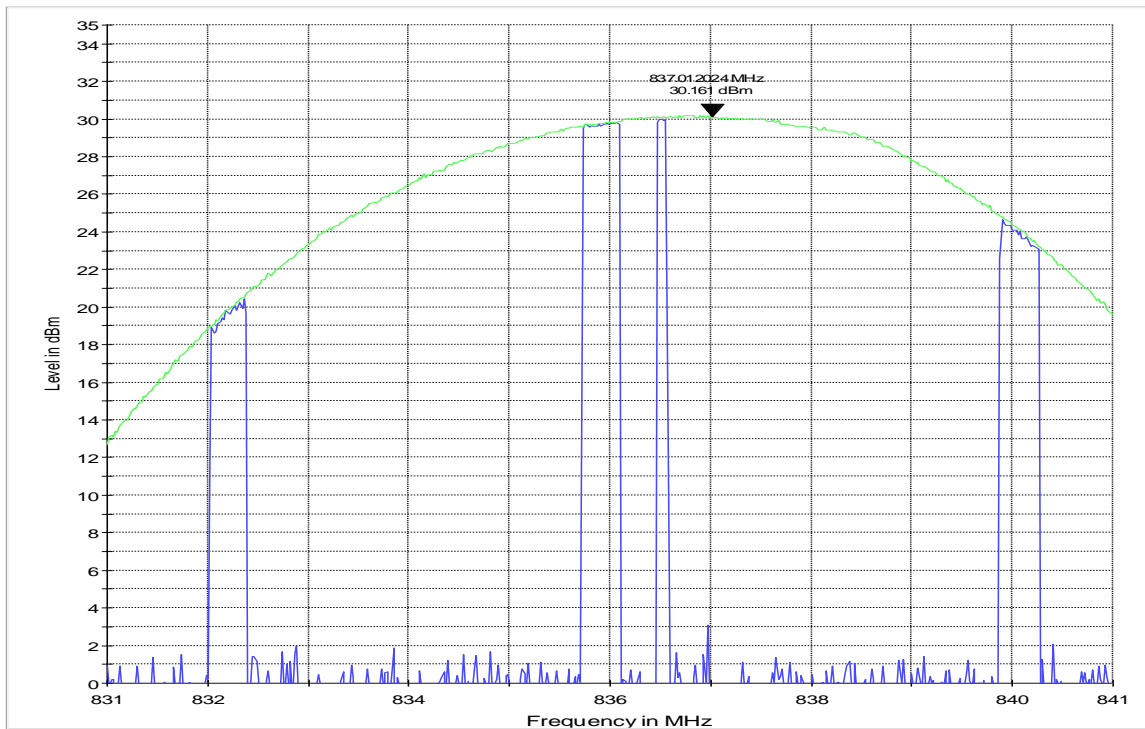
Date: 29.MAR.2010 15:29:46

### ERP (GSM 850) CHANNEL 128 §22.913(a)



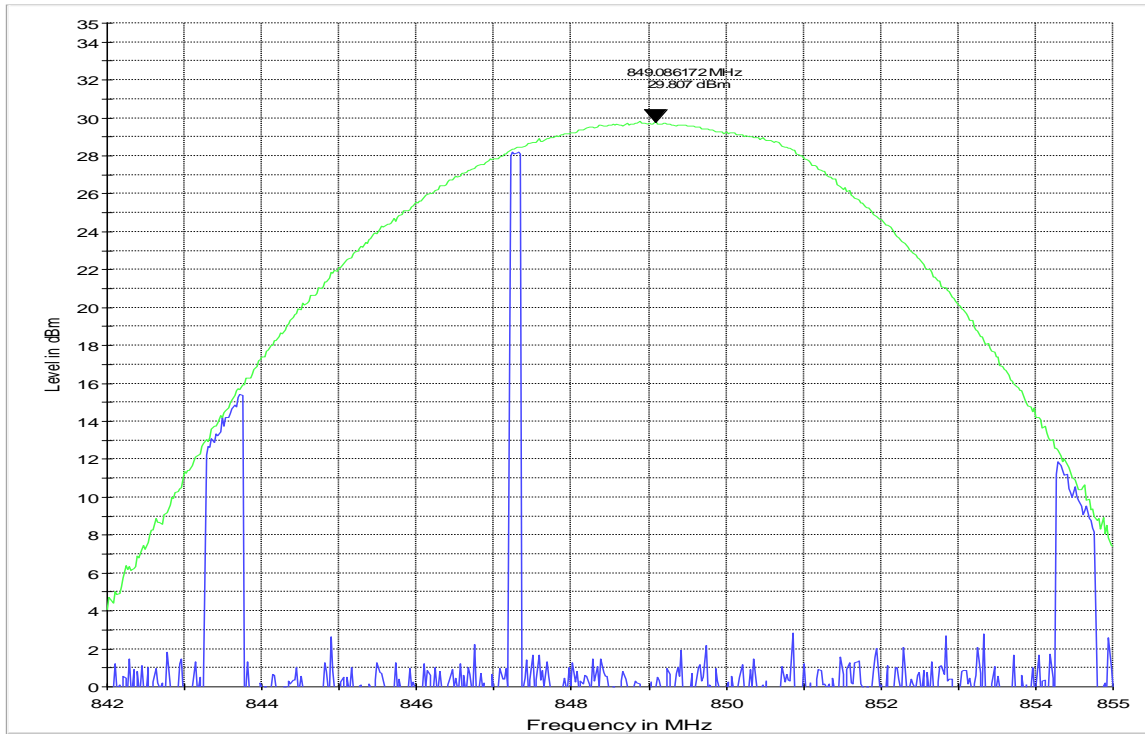
MaxPeak-ClearWrite      MaxPeak-MaxHold

### ERP (GSM 850) CHANNEL 190 §22.913(a)



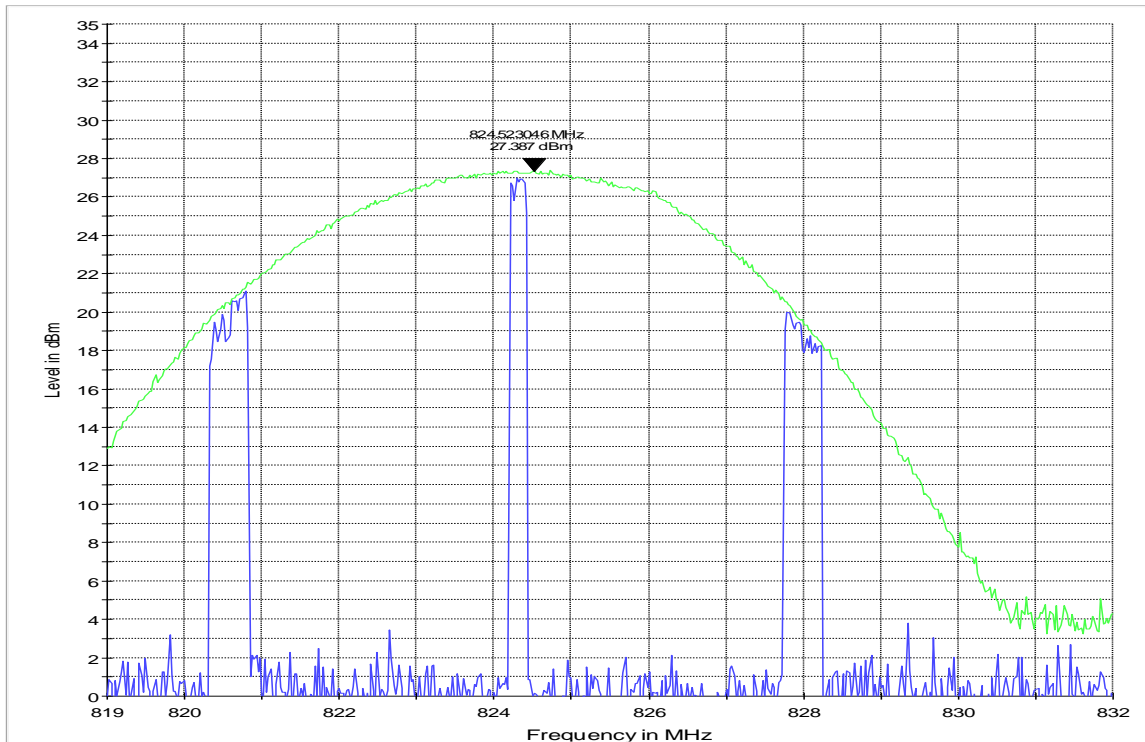
MaxPeak-ClearWrite      MaxPeak-MaxHold

### ERP (GSM 850) CHANNEL 251 §22.913(a)



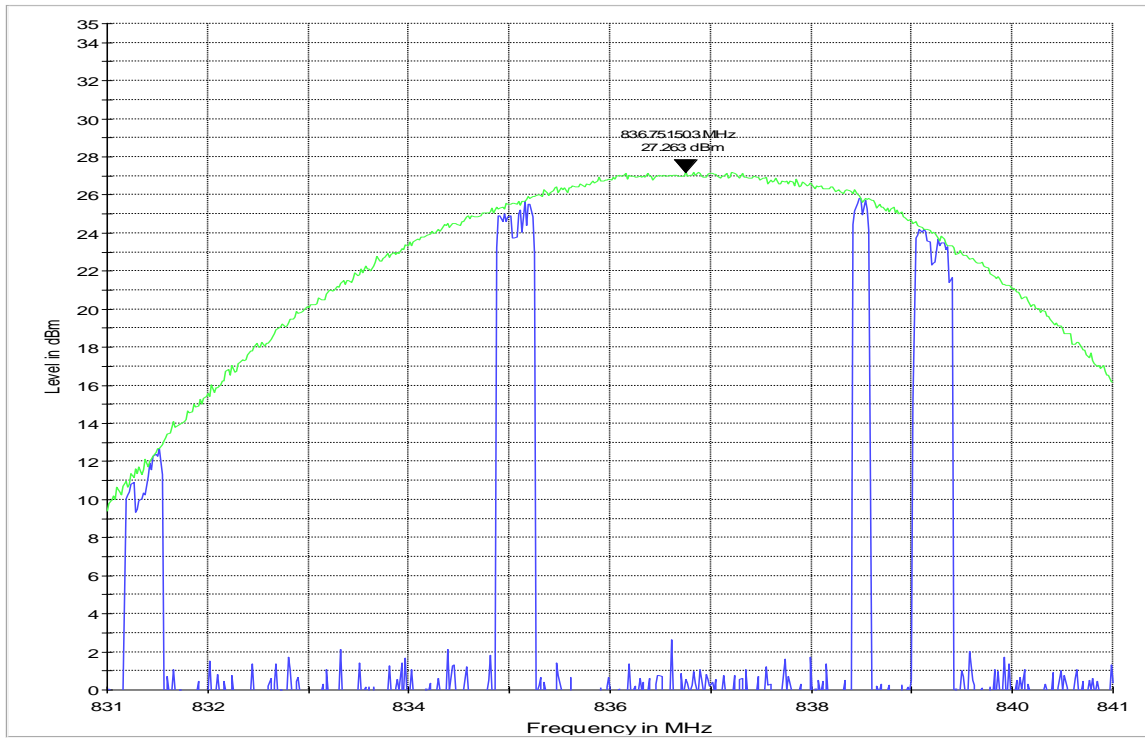
MaxPeak-ClearWrite      MaxPeak-MaxHold

### ERP (EGPRS 850) CHANNEL 128 §22.913(a)



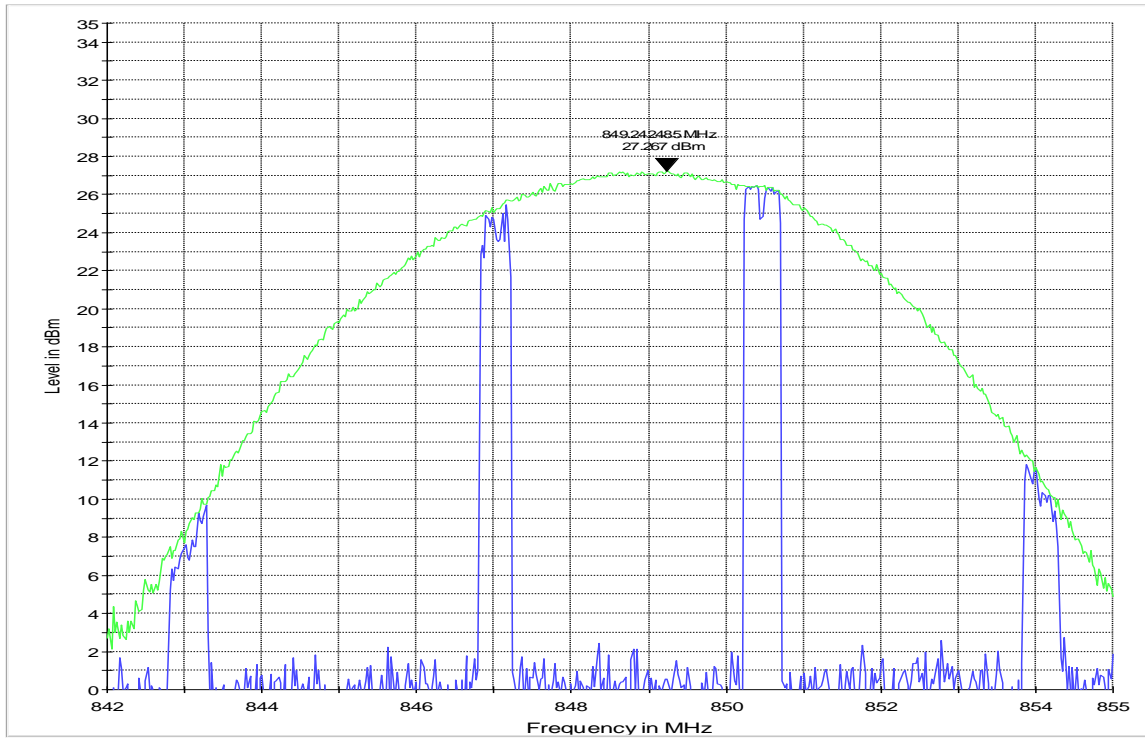
MaxPeak-ClearWrite      MaxPeak-MaxHold

**ERP (EGPRS 850) CHANNEL 190 §22.913(a)**



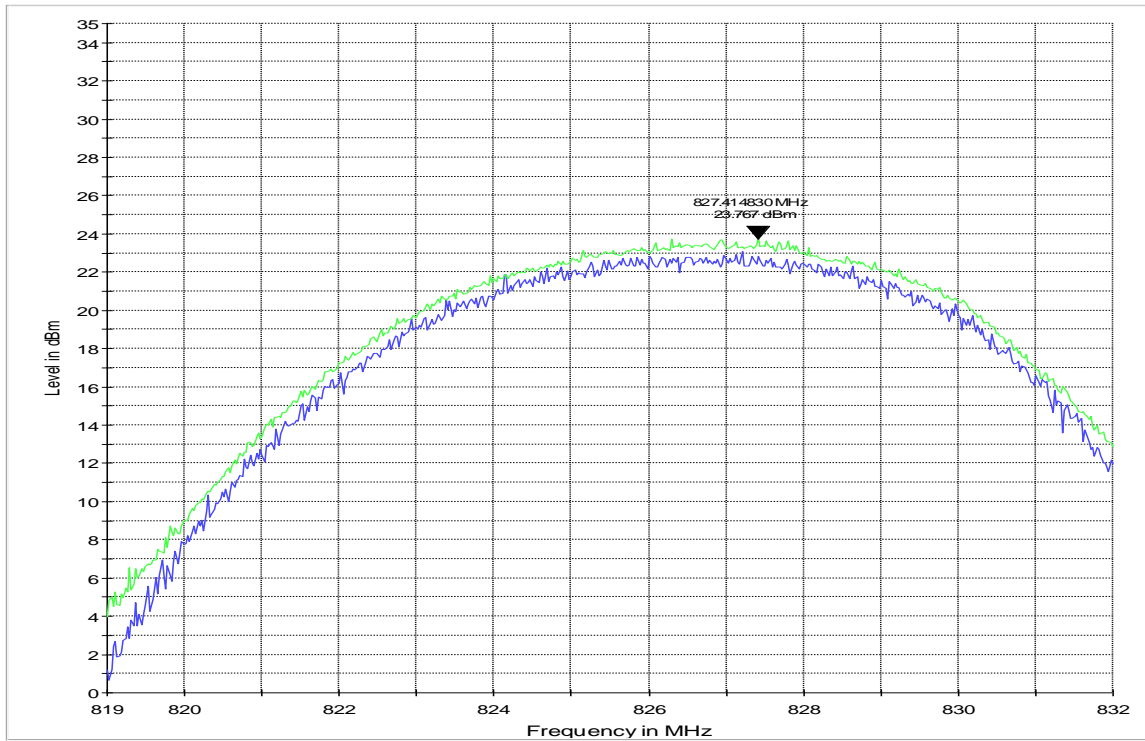
— MaxPeak-ClearWrite      — MaxPeak-MaxHold

**ERP (EGPRS 850) CHANNEL 251 §22.913(a)**



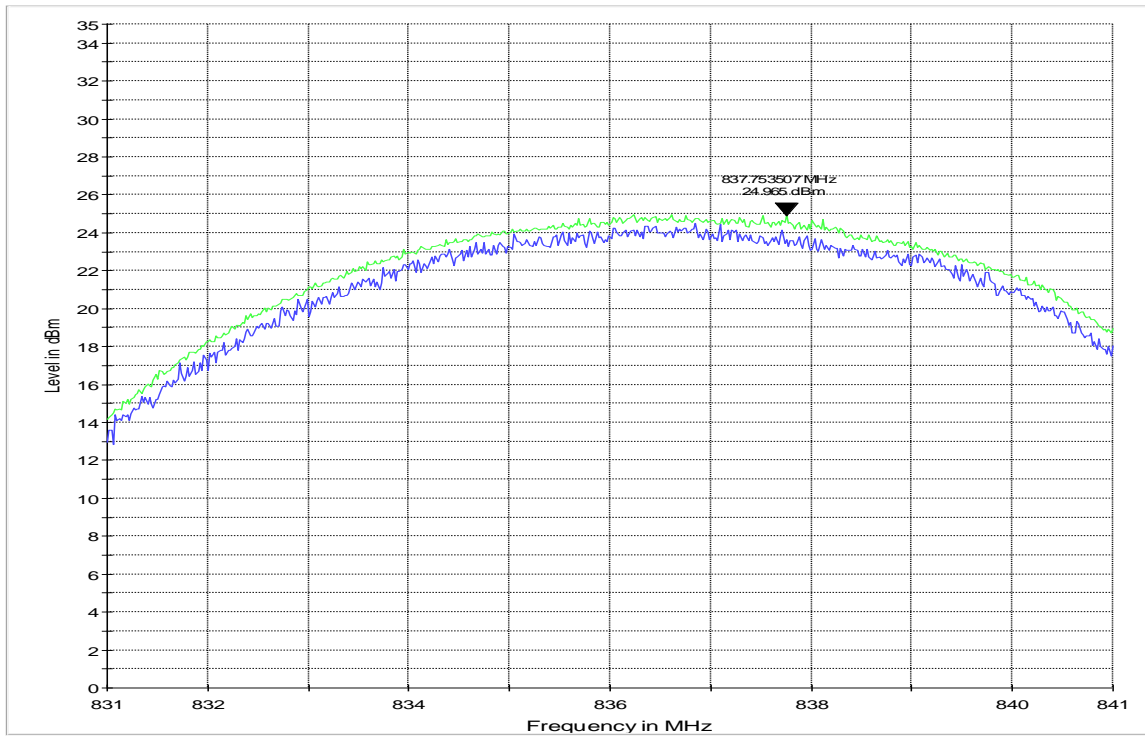
— MaxPeak-ClearWrite      — MaxPeak-MaxHold

### ERP (UMTS FDD5) CHANNEL 4132 §22.913(a)



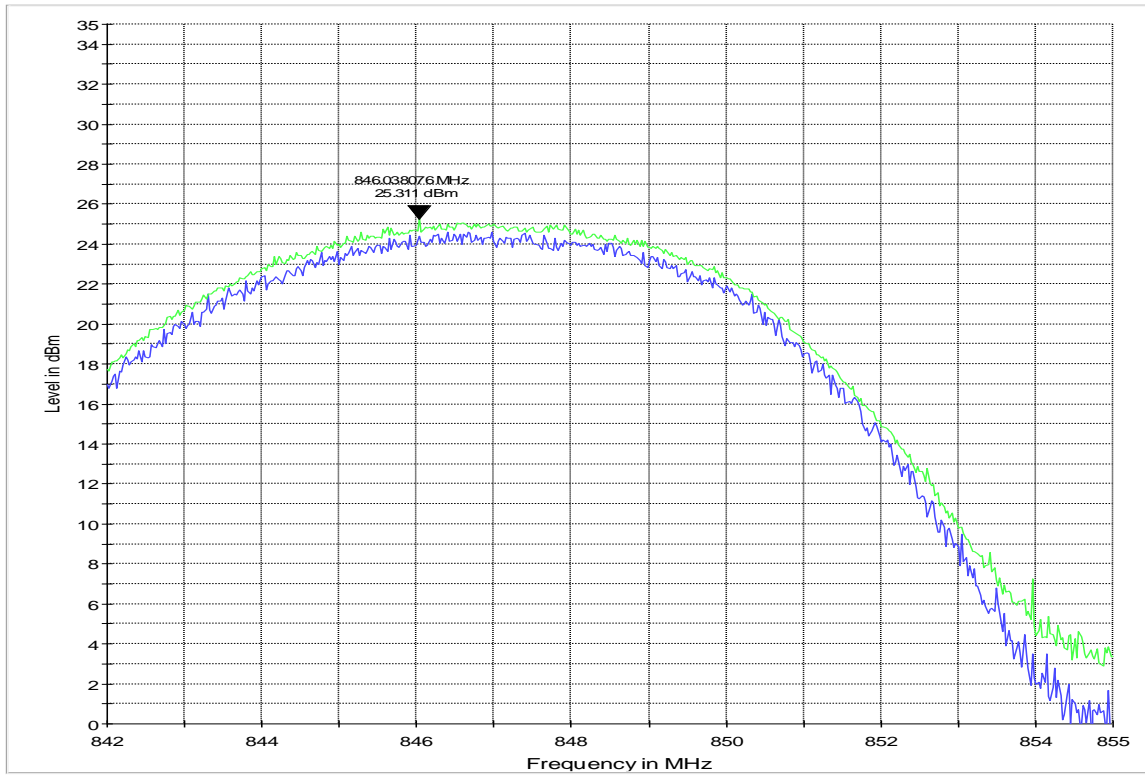
— MaxPeak-ClearWrite      — MaxPeak-MaxHold

### ERP (UMTS FDD5) CHANNEL 4183 §22.913(a)



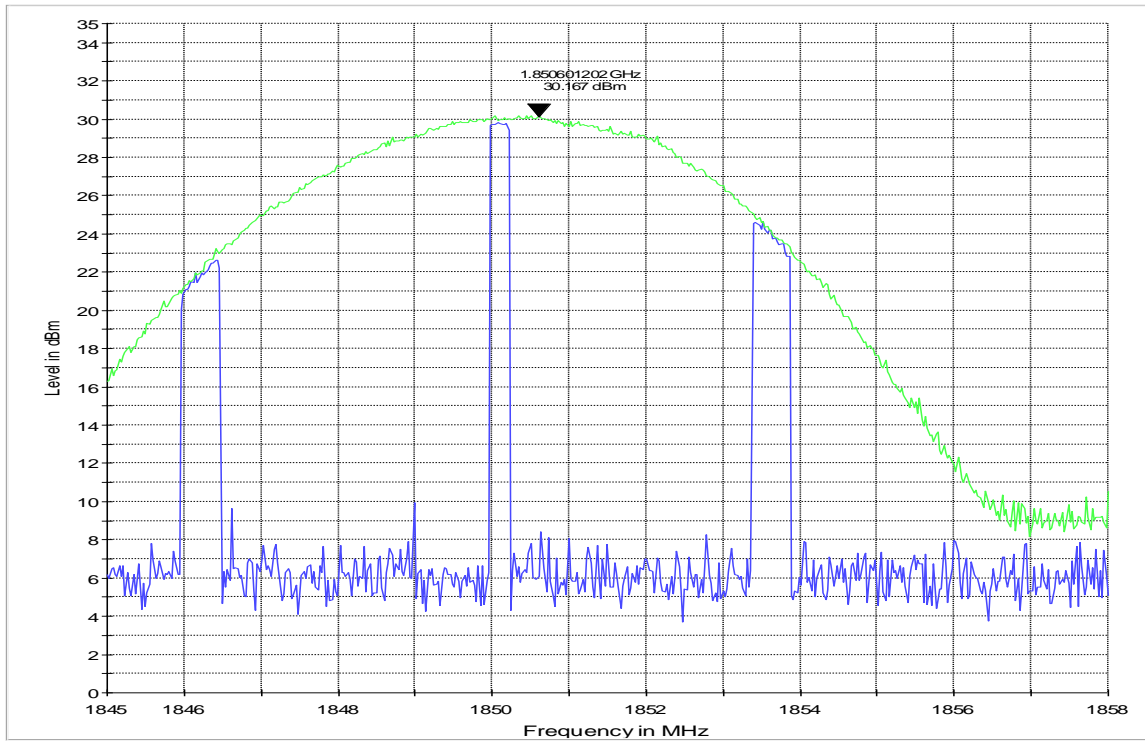
— MaxPeak-ClearWrite      — MaxPeak-MaxHold

ERP (UMTS FDD5) CHANNEL 4233 §22.913(a)



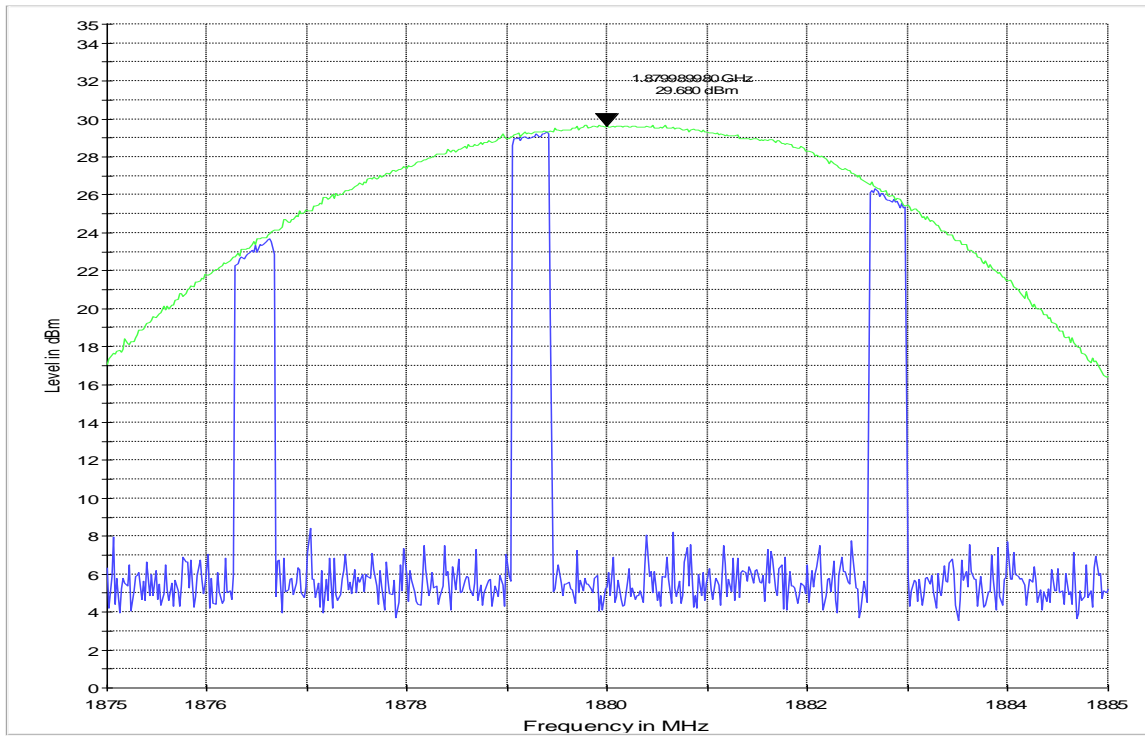
— Max Peak-ClearWrite      — Max Peak-MaxHold

### EIRP (PCS-1900) CHANNEL 512 §24.232(b)



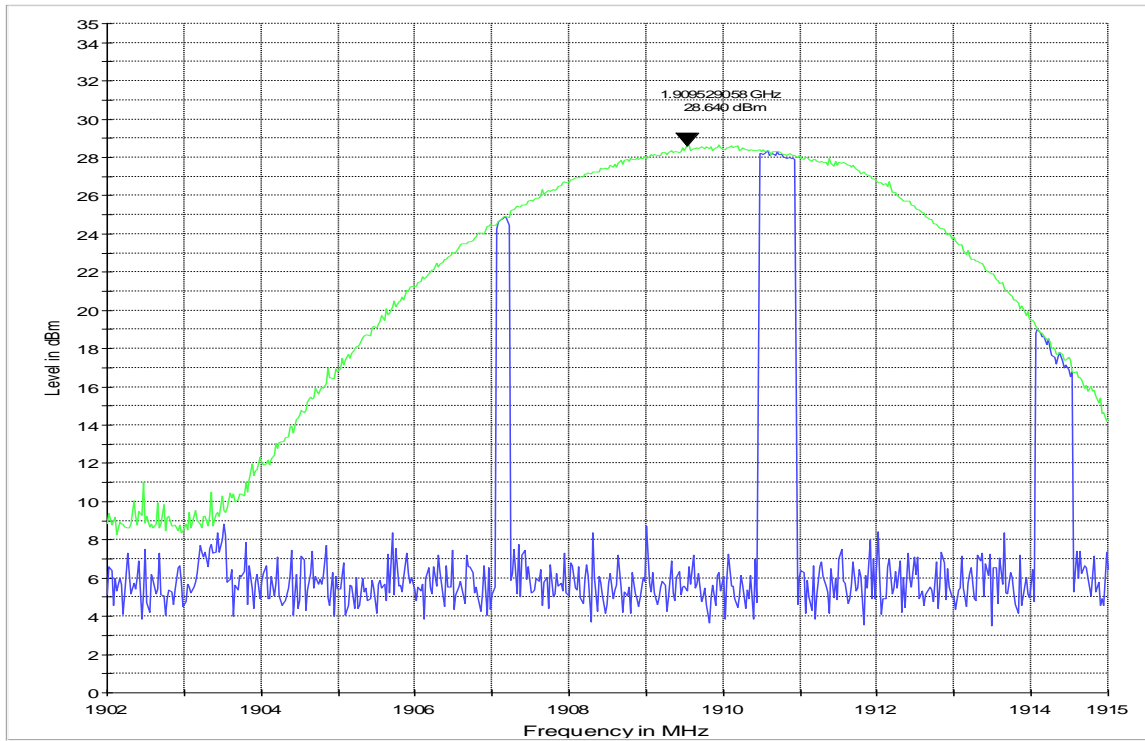
— MaxPeak-ClearWrite      — MaxPeak-MaxHold

### EIRP (PCS-1900) CHANNEL 661 §24.232(b)



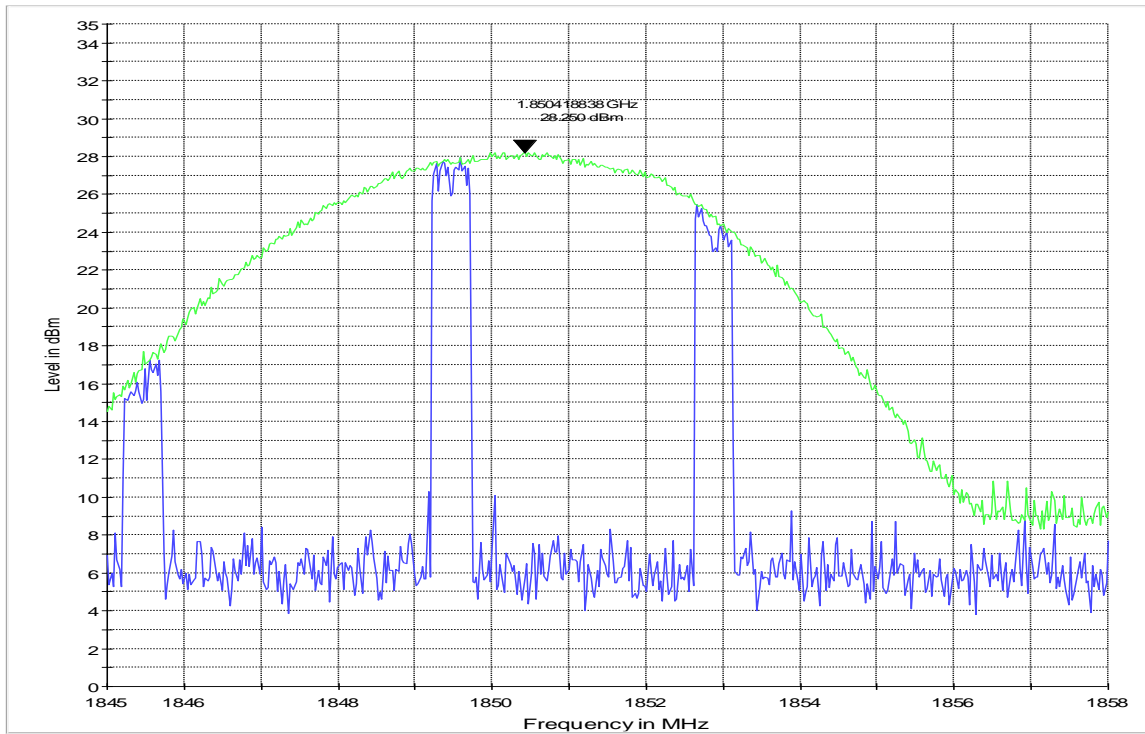
— MaxPeak-ClearWrite      — MaxPeak-MaxHold

### EIRP (PCS-1900) CHANNEL 810 §24.232(b)



— Max Peak-ClearWrite      — Max Peak-Max Hold

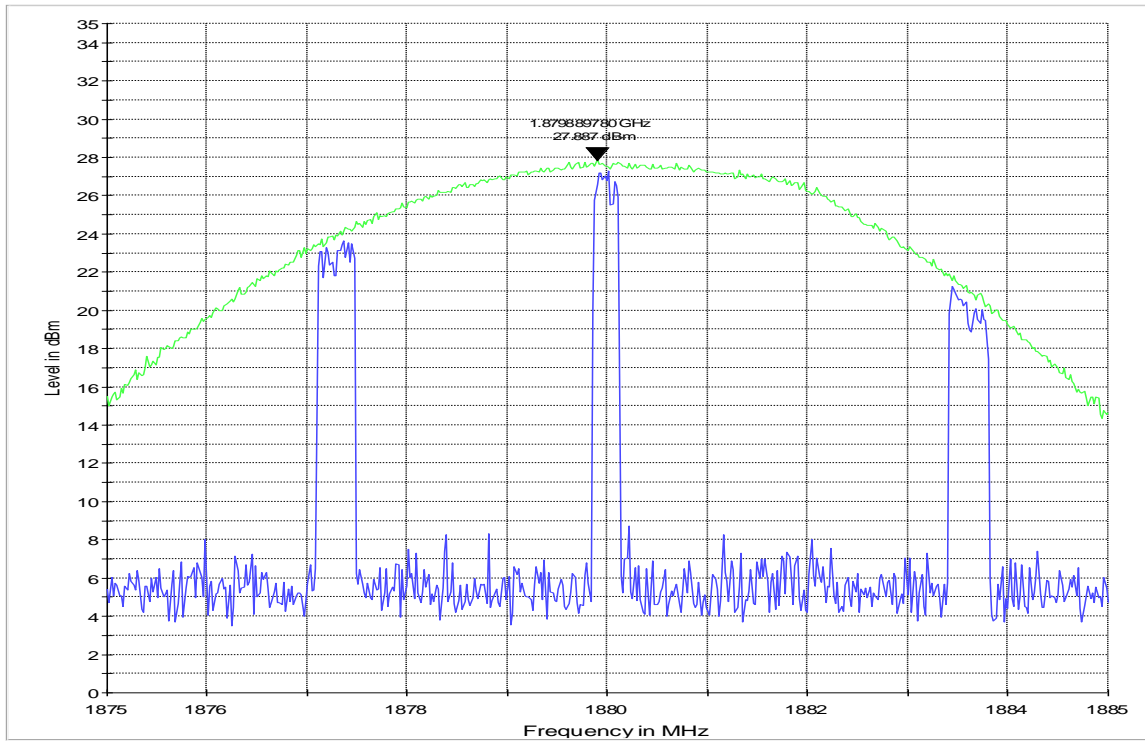
### EIRP (EGPRS 1900) CHANNEL 512 §24.232(b)



— Max Peak-ClearWrite      — Max Peak-Max Hold

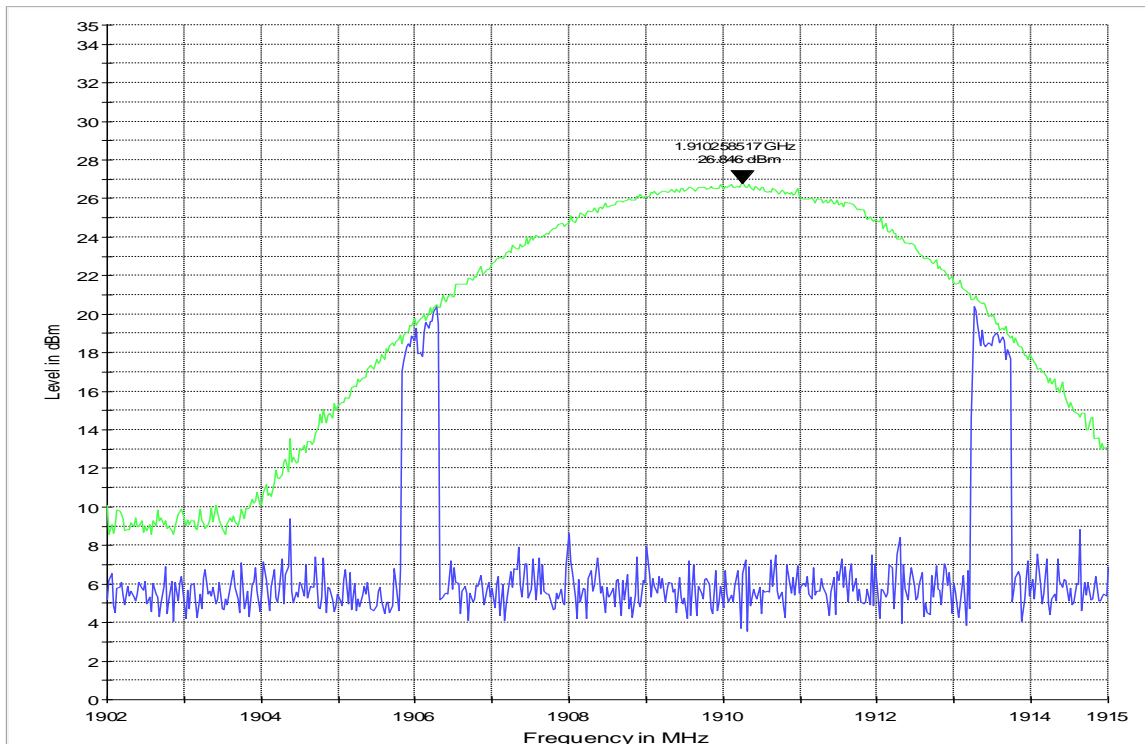


### EIRP (EGPRS 1900) CHANNEL 661 §24.232(b)



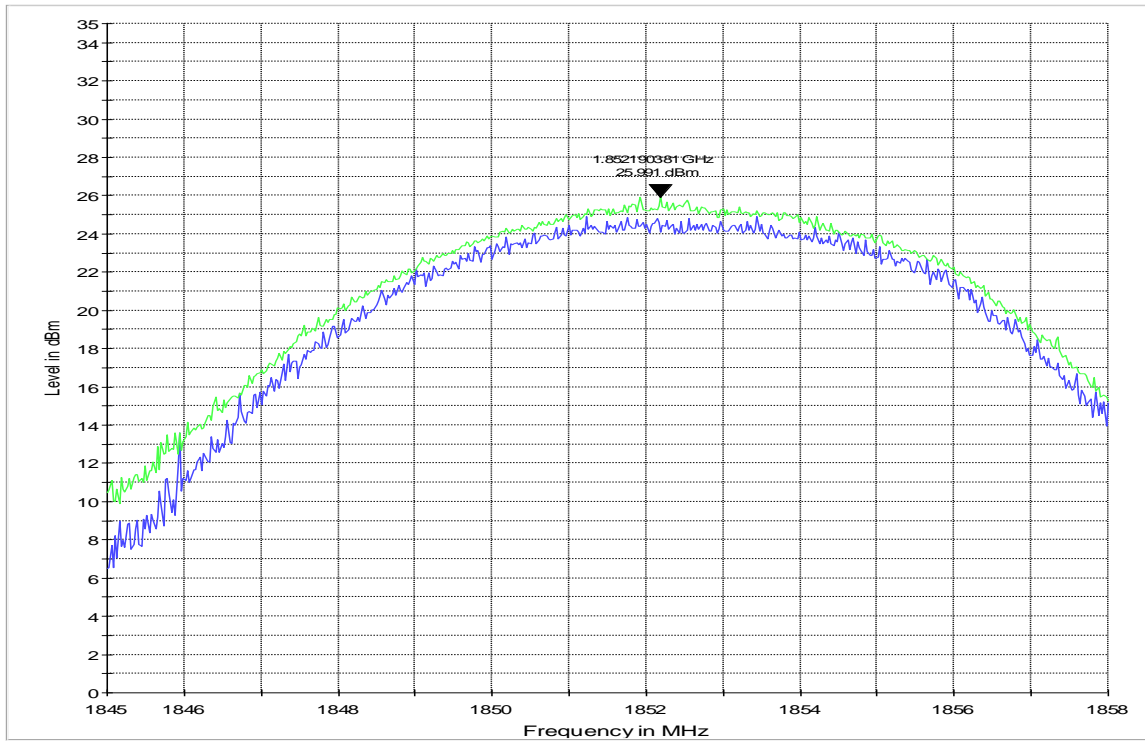
MaxPeak-ClearWrite      MaxPeak-MaxHold

### EIRP (EGPRS 1900) CHANNEL 810 §24.232(b)



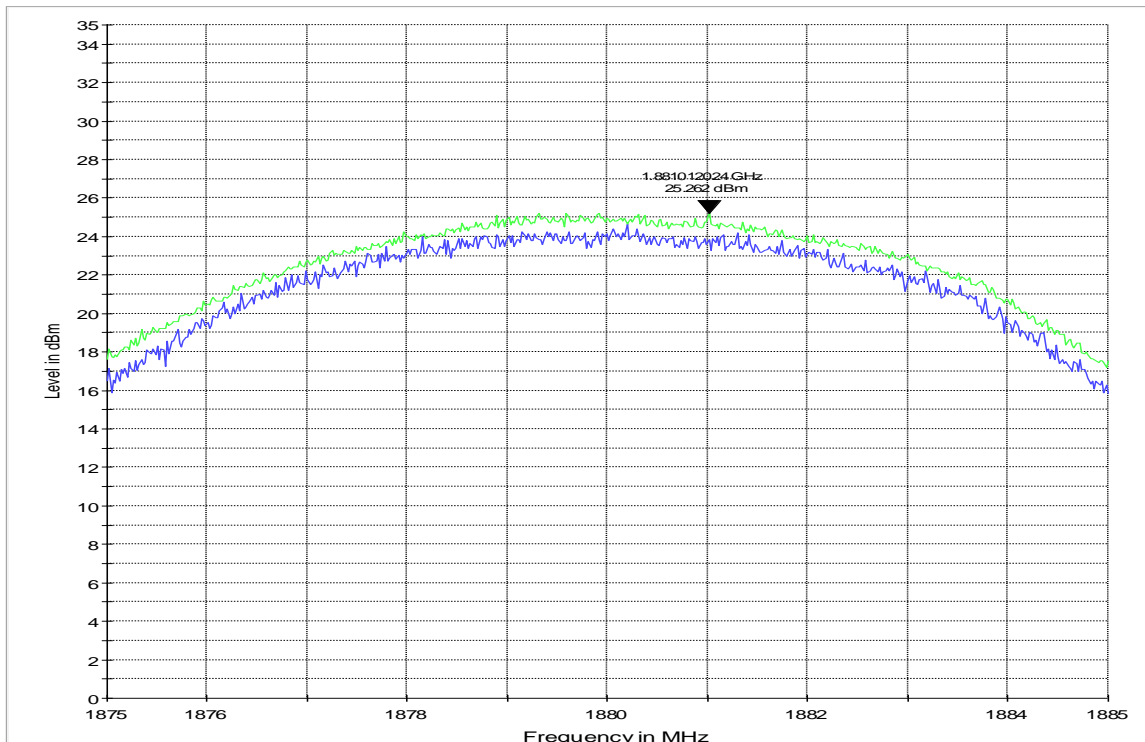
MaxPeak-ClearWrite      MaxPeak-MaxHold

### EIRP (UMTS FDD2) CHANNEL 9262 §24.232(b)



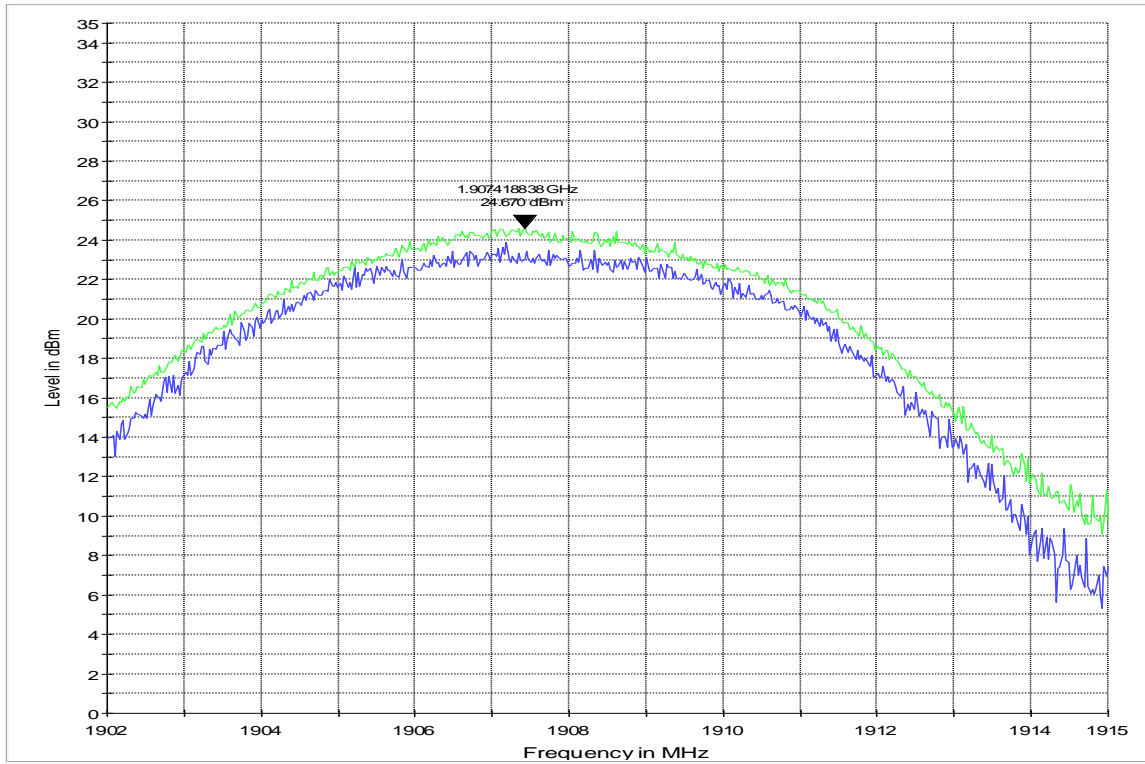
— Max Peak-ClearWrite      — Max Peak-Max Hold

### EIRP (UMTS FDD2) CHANNEL 9400 §24.232(b)



— Max Peak-ClearWrite      — Max Peak-Max Hold

**EIRP (UMTS FDD2) CHANNEL 9538 §24.232(b)**



— MaxPeak-ClearWrite      — MaxPeak-MaxHold

## 5.2 Occupied Bandwidth/Emission Bandwidth

### 5.2.1 References

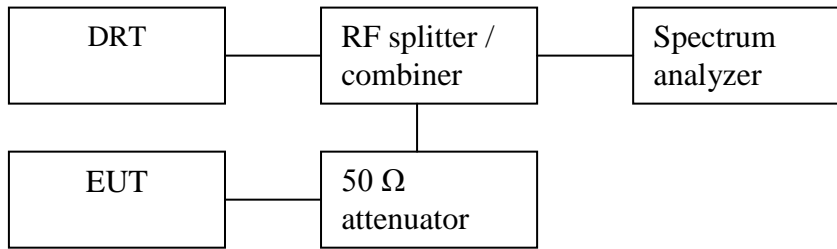
FCC: CFR Part 2.1049, CFR Part 22.917, CFR Part 24.238

### 5.2.2 FCC 2.1049 Measurements required: Occupied bandwidth

The occupied bandwidth, that 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 shall be measured under the following conditions as applicable.

(h) Transmitters employing digital modulation techniques-when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated.

### 5.2.3 Occupied / Emission bandwidth measurement procedure



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings of the Digital RadioCommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to measure the 99% (-20 dB) occupied bandwidth. Record the value.
4. Set the spectrum analyzer to measure the 99.5% (-26 dB) emission bandwidth. Record the value.
5. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

**Spectrum analyzer settings: Measurement bandwidth of at least 1% of the occupied bandwidth.**

GSM: RBW=3kHz; Span=1MHz; Detector: Peak- Max Hold.

UMTS: RBW=50kHz; Span=10MHz; Detector: Peak- Max Hold.

**5.2.4 Occupied/Emission Bandwidth- 850 MHz band**

| <b>GSM 850: GMSK Mode</b> |                                     |                               |
|---------------------------|-------------------------------------|-------------------------------|
| <b>Frequency (MHz)</b>    | <b>99% Occupied Bandwidth (kHz)</b> | <b>-26dBc Bandwidth (kHz)</b> |
| 824.2                     | 243.6                               | 314.1                         |
| 836.6                     | 243.6                               | 302.9                         |
| 848.8                     | 245.2                               | 317.3                         |

| <b>EGPRS 850: 8PSK Mode</b> |                                     |                               |
|-----------------------------|-------------------------------------|-------------------------------|
| <b>Frequency (MHz)</b>      | <b>99% Occupied Bandwidth (kHz)</b> | <b>-26dBc Bandwidth (kHz)</b> |
| 824.2                       | 245.2                               | 299.7                         |
| 836.6                       | 242.0                               | 309.3                         |
| 848.8                       | 246.8                               | 302.8                         |

| <b>FDD V: UMTS Mode</b> |                                     |                               |
|-------------------------|-------------------------------------|-------------------------------|
| <b>Frequency (MHz)</b>  | <b>99% Occupied Bandwidth (MHz)</b> | <b>-26dBc Bandwidth (MHz)</b> |
| 826.4                   | 4.07                                | 4.60                          |
| 836.6                   | 4.05                                | 4.56                          |
| 846.6                   | 4.07                                | 4.53                          |

**5.2.5 Occupied/Emission Bandwidth- 1900 MHz band**

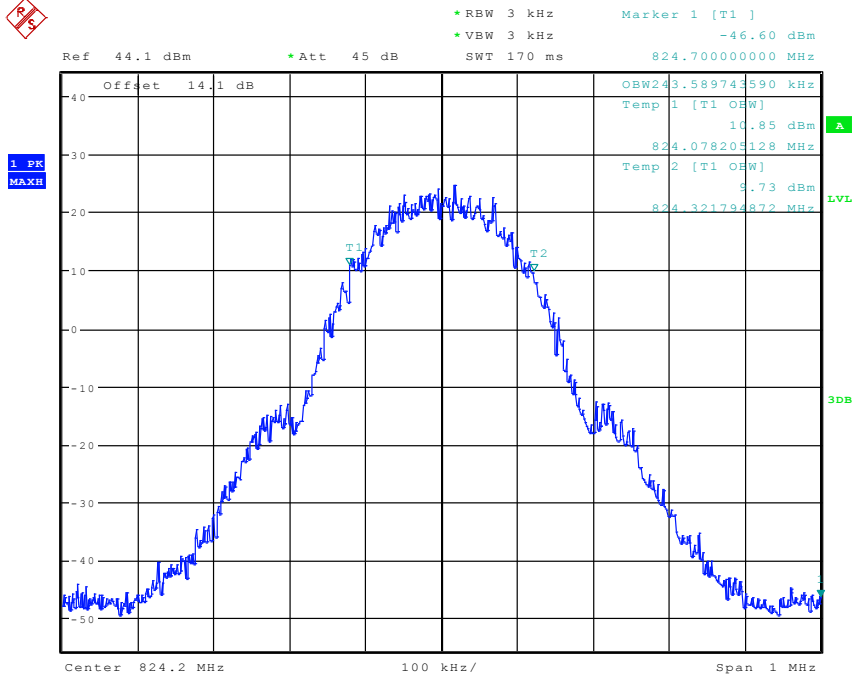
| <b>GSM 1900: GMSK Mode</b> |                                     |                               |
|----------------------------|-------------------------------------|-------------------------------|
| <b>Frequency (MHz)</b>     | <b>99% Occupied Bandwidth (kHz)</b> | <b>-26dBc Bandwidth (kHz)</b> |
| <b>1850.2</b>              | 243.6                               | 312.5                         |
| <b>1880.0</b>              | 243.6                               | 310.9                         |
| <b>1909.8</b>              | 242.0                               | 312.5                         |

| <b>EGPRS 1900: 8PSK Mode</b> |                                     |                               |
|------------------------------|-------------------------------------|-------------------------------|
| <b>Frequency (MHz)</b>       | <b>99% Occupied Bandwidth (kHz)</b> | <b>-26dBc Bandwidth (kHz)</b> |
| <b>1850.2</b>                | 246.8                               | 306.1                         |
| <b>1880.0</b>                | 246.8                               | 293.2                         |
| <b>1909.8</b>                | 243.6                               | 294.8                         |

| <b>FDD II: UMTS Mode</b> |                                     |                               |
|--------------------------|-------------------------------------|-------------------------------|
| <b>Frequency (MHz)</b>   | <b>99% Occupied Bandwidth (MHz)</b> | <b>-26dBc Bandwidth (MHz)</b> |
| <b>1852.4</b>            | 4.08                                | 4.60                          |
| <b>1880.0</b>            | 4.07                                | 4.60                          |
| <b>1907.6</b>            | 4.07                                | 4.61                          |

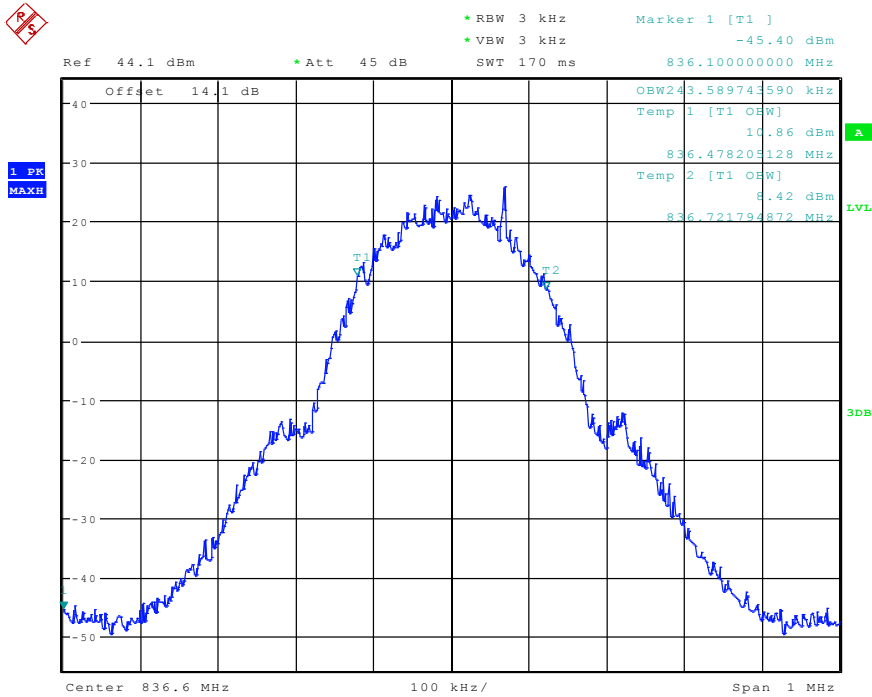
### 5.2.6 Results

#### Occupied band Width GSM850 MHz Channel 128 GSM



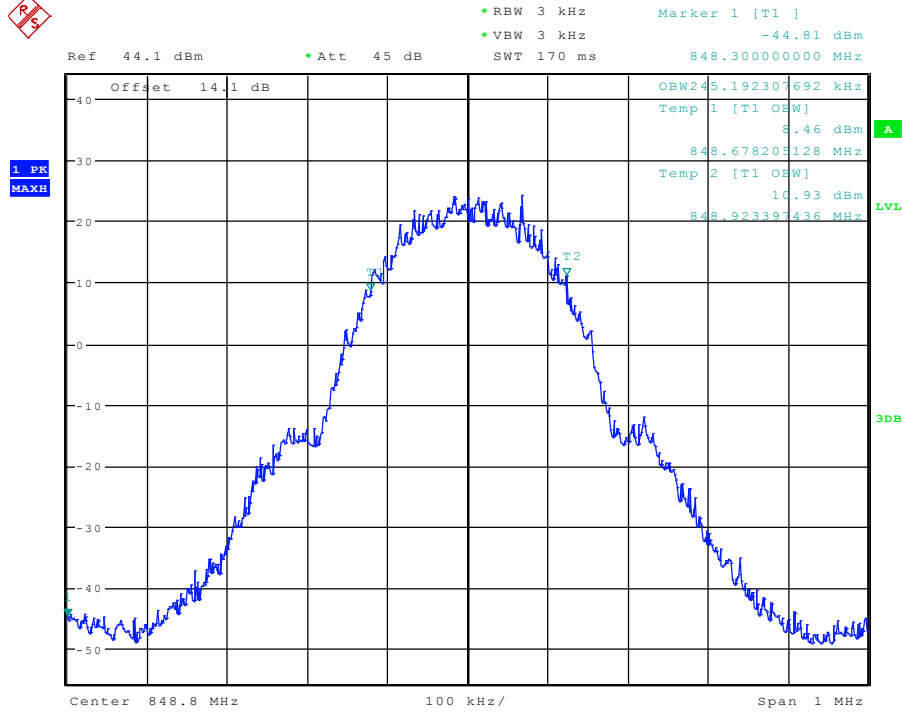
Date: 29.MAR.2010 11:44:10

#### Occupied band Width GSM850 MHz Channel 190 GSM



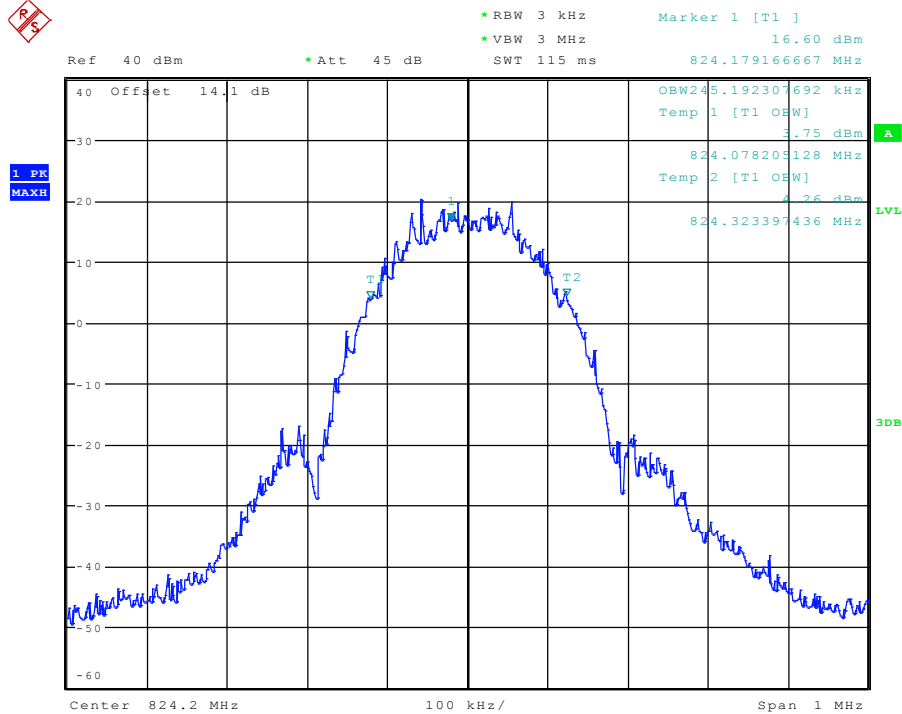
Date: 29.MAR.2010 11:45:15

### Occupied band Width GSM850 MHz Channel 251 GSM



Date: 29.MAR.2010 11:46:20

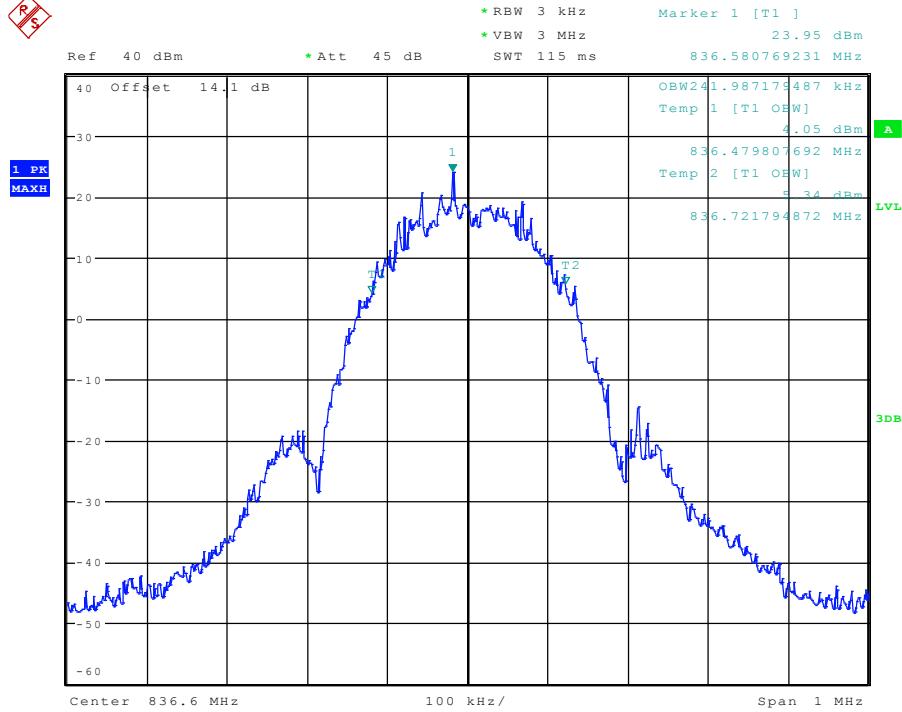
### Occupied band Width GSM850 MHz Channel 128 EGPRS



Date: 29.MAR.2010 13:54:59

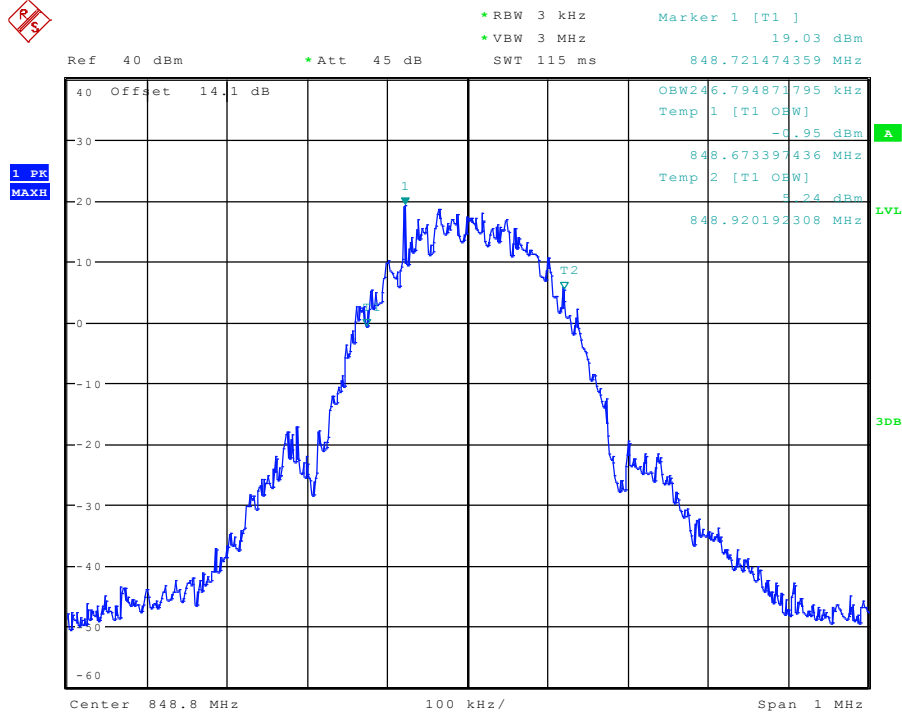


### Occupied band Width GSM850 MHz Channel 190 EGPRS



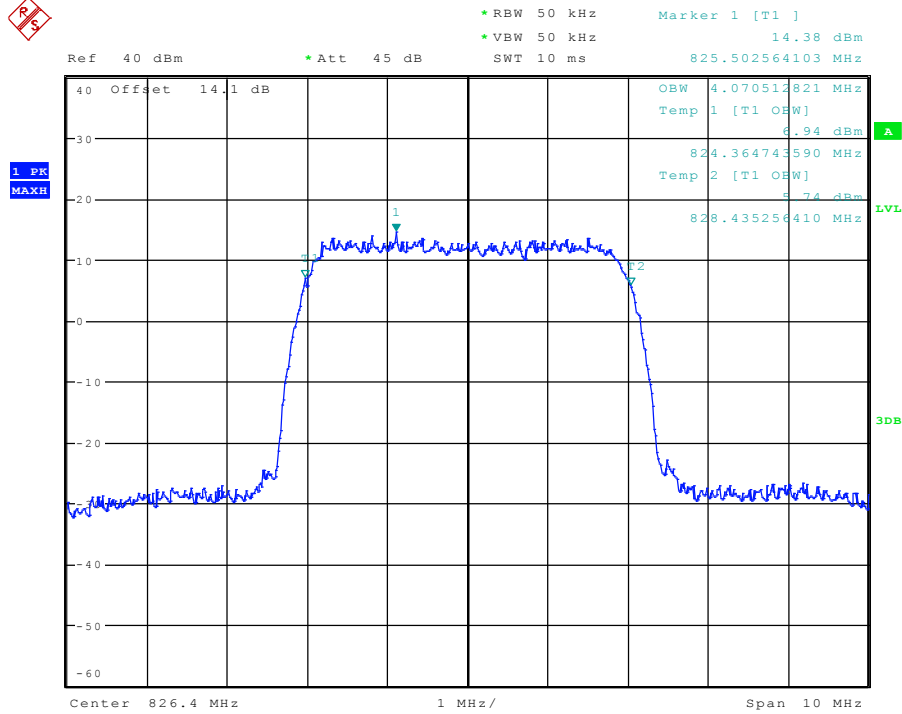
Date: 29.MAR.2010 13:56:33

### Occupied band Width GSM850 MHz Channel 251 EGPRS



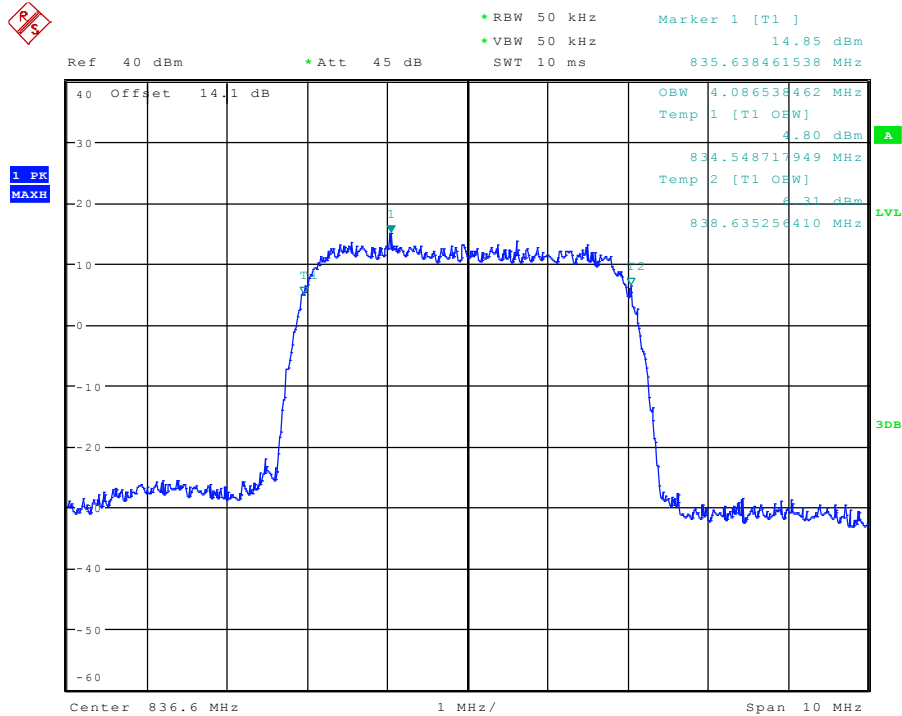
Date: 29.MAR.2010 14:01:22

### Occupied band Width UMTS FDD5 Channel 4132



Date: 29.MAR.2010 16:25:45

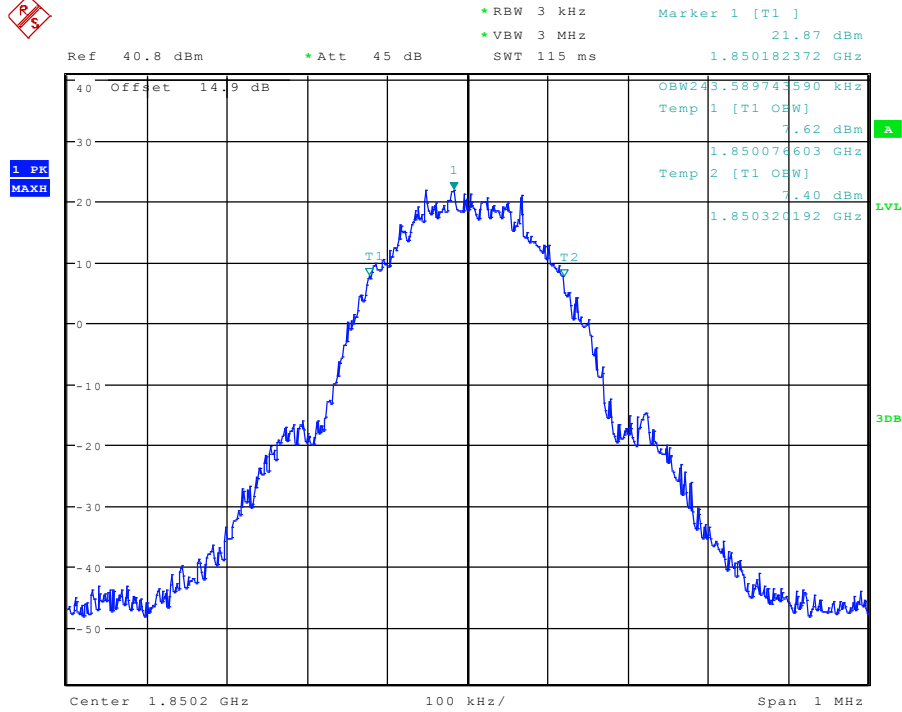
### Occupied band Width UMTS FDD5 Channel 4183



Date: 29.MAR.2010 16:25:14

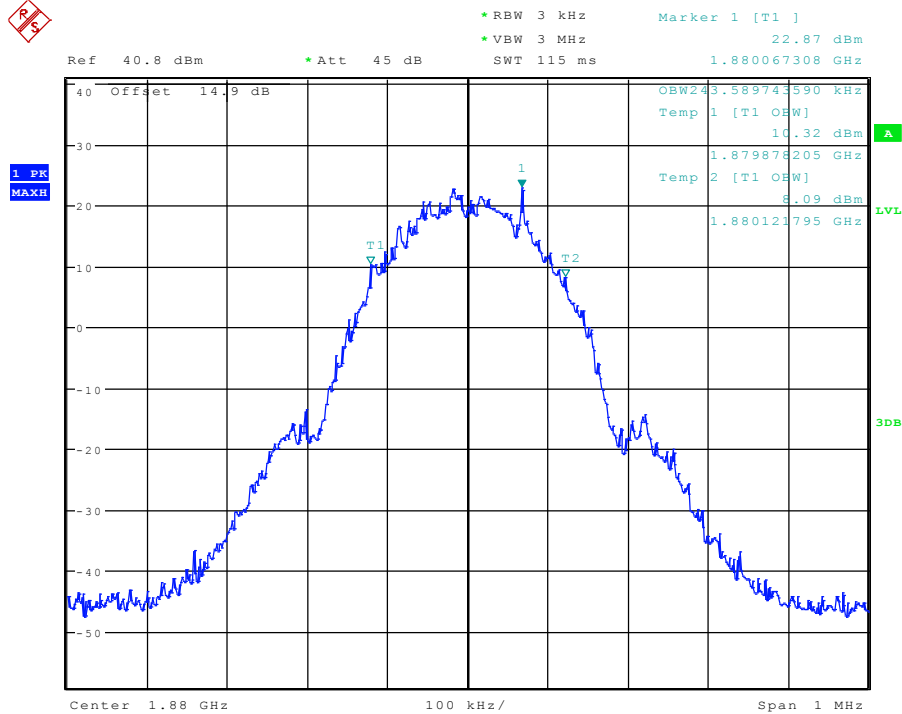


### Occupied band Width PCS1900 MHz Channel 512 GSM



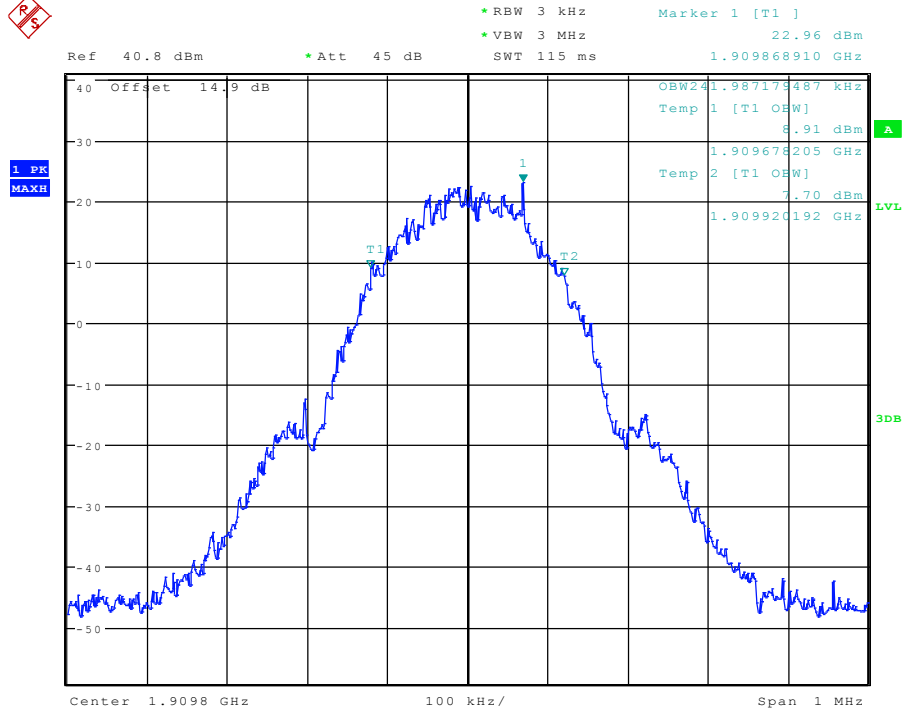
Date: 29.MAR.2010 14:57:01

### Occupied band Width PCS1900 MHz Channel 661 GSM



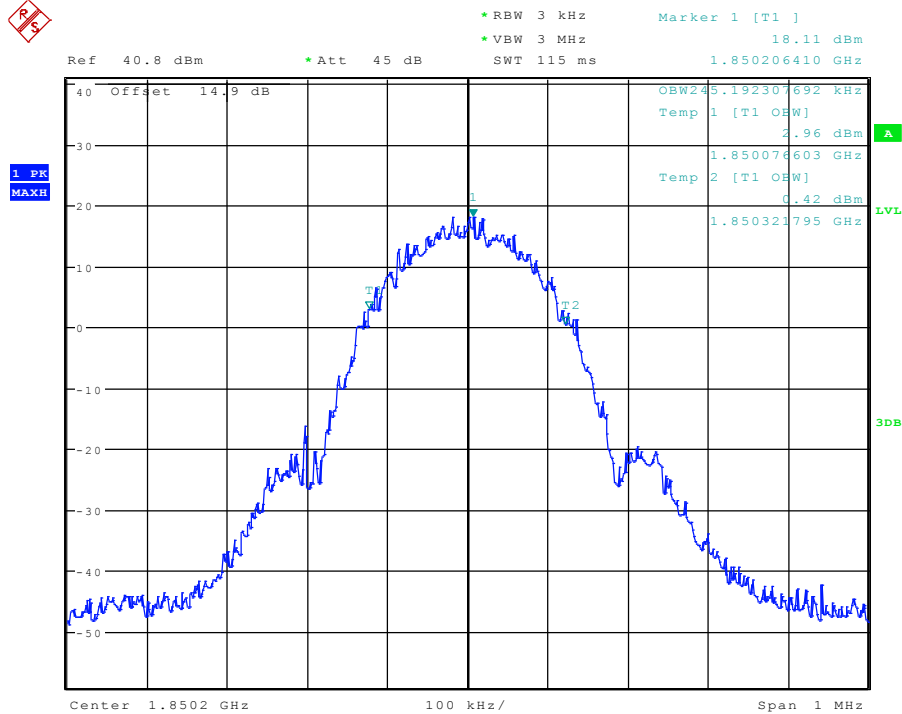
Date: 29.MAR.2010 14:58:04

### Occupied band Width PCS1900 MHz Channel 810 GSM



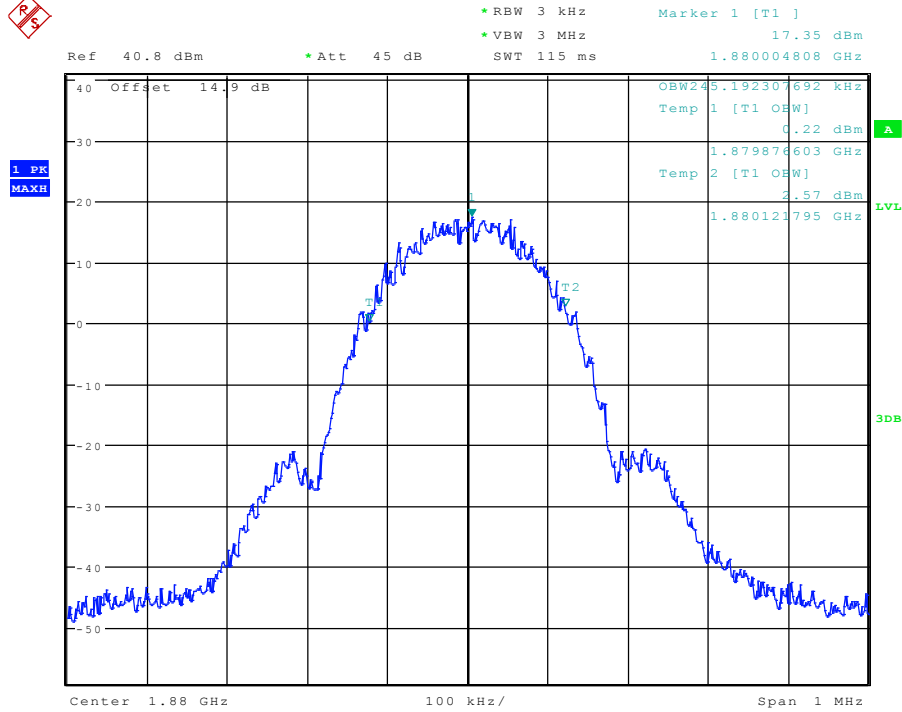
Date: 29.MAR.2010 14:58:50

### Occupied band Width PCS1900 MHz Channel 512 EGPRS



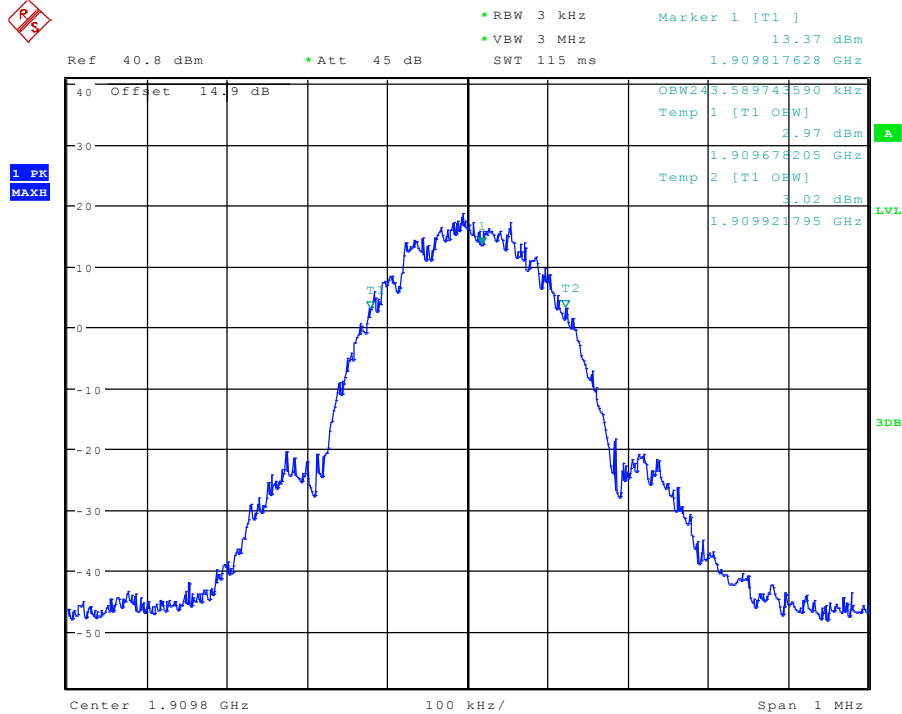
Date: 29.MAR.2010 15:06:31

### Occupied band Width PCS1900 MHz Channel 661 EGPRS



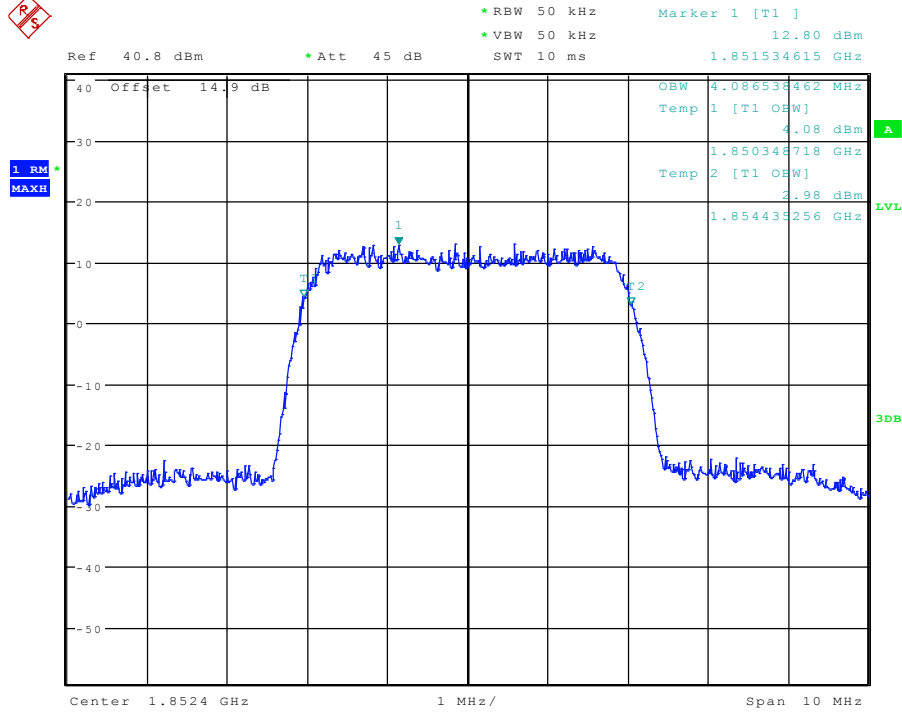
Date: 29.MAR.2010 15:05:51

### Occupied band Width PCS1900 MHz Channel 810 EGPRS



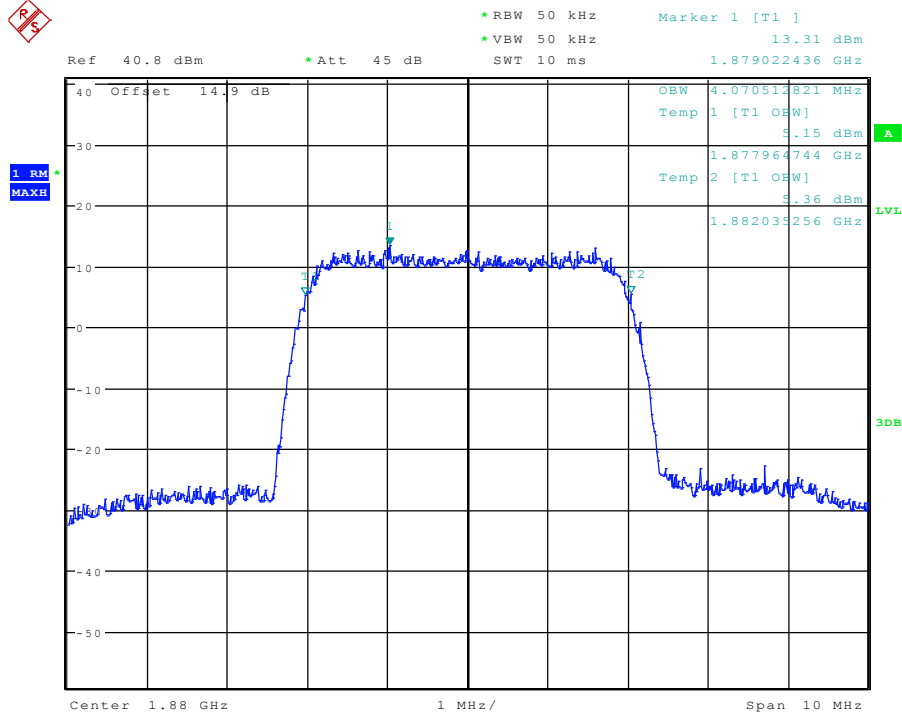
Date: 29.MAR.2010 15:05:14

### Occupied band Width UMTS FDD2 Channel 9262



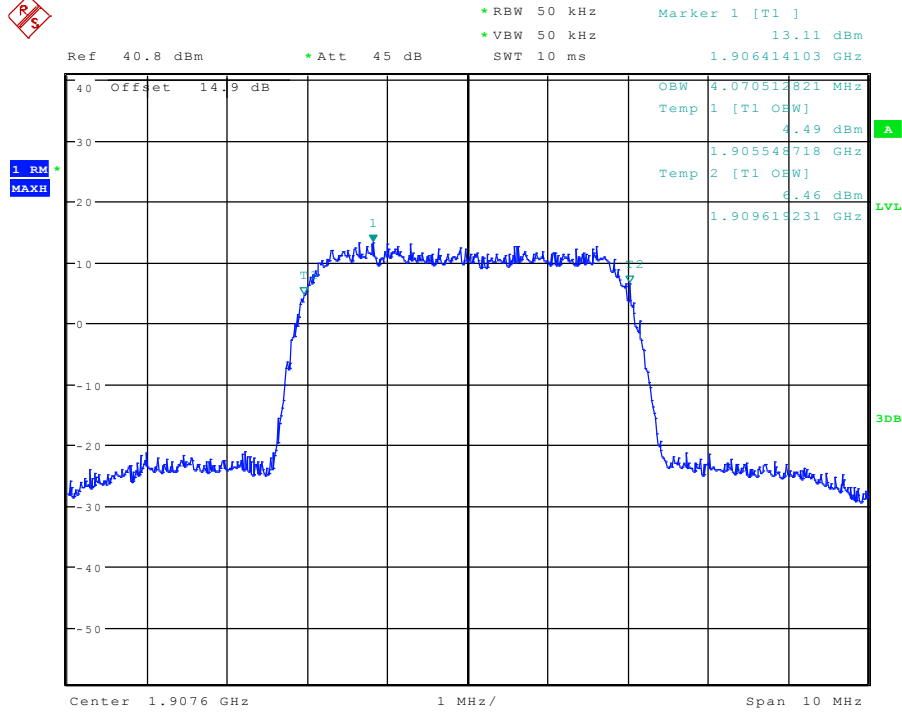
Date: 29.MAR.2010 15:33:20

### Occupied band Width UMTS FDD2 Channel 9400



Date: 29.MAR.2010 15:32:48

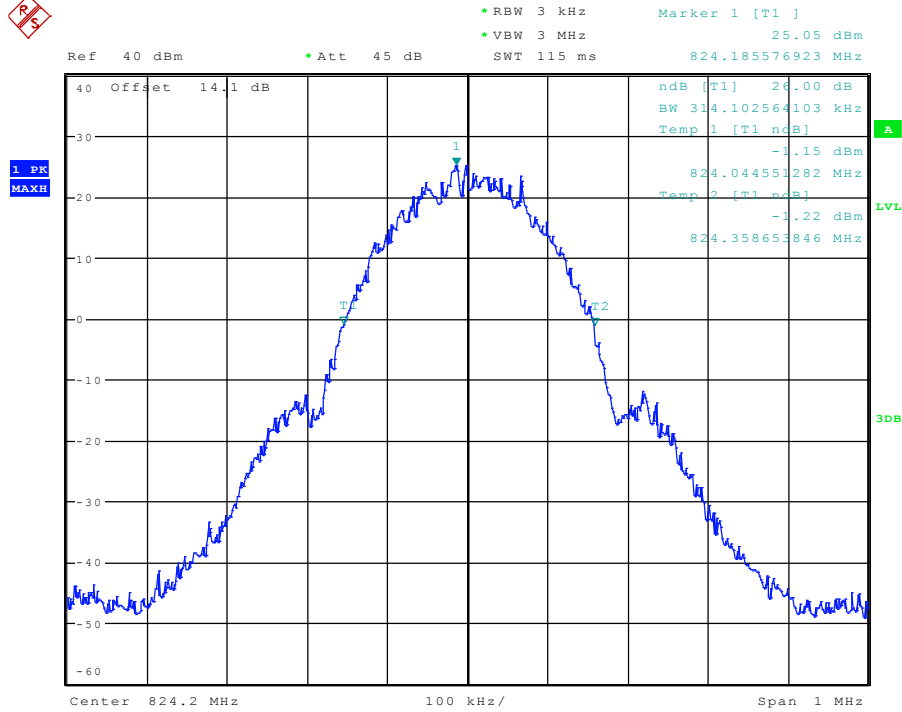
### Occupied band Width UMTS FDD2 Channel 9538



Date: 29.MAR.2010 15:32:09

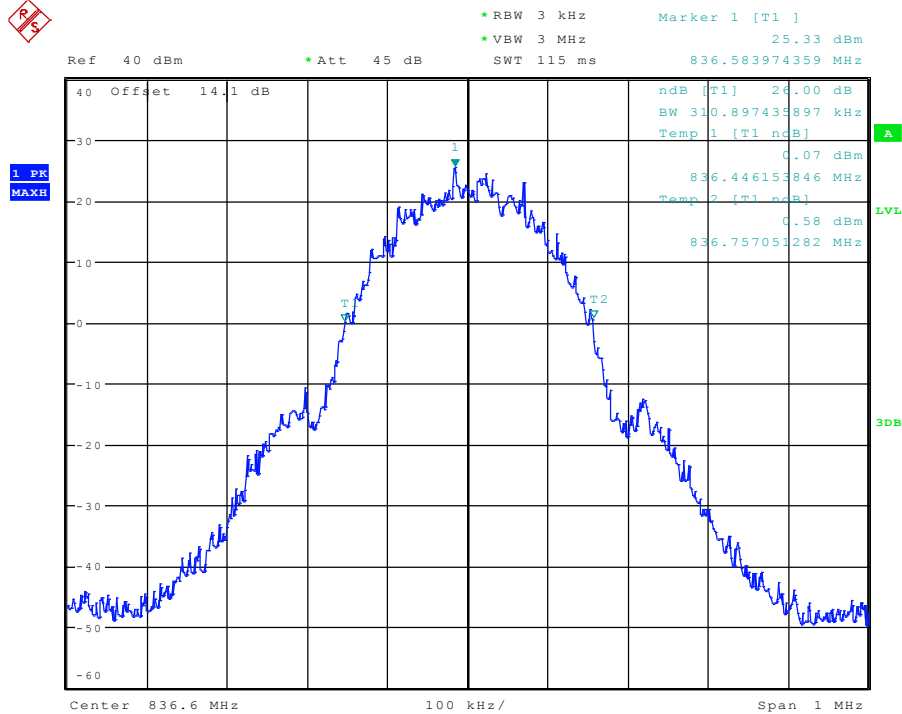


### Emission band Width GSM850 MHz Channel 128 GSM



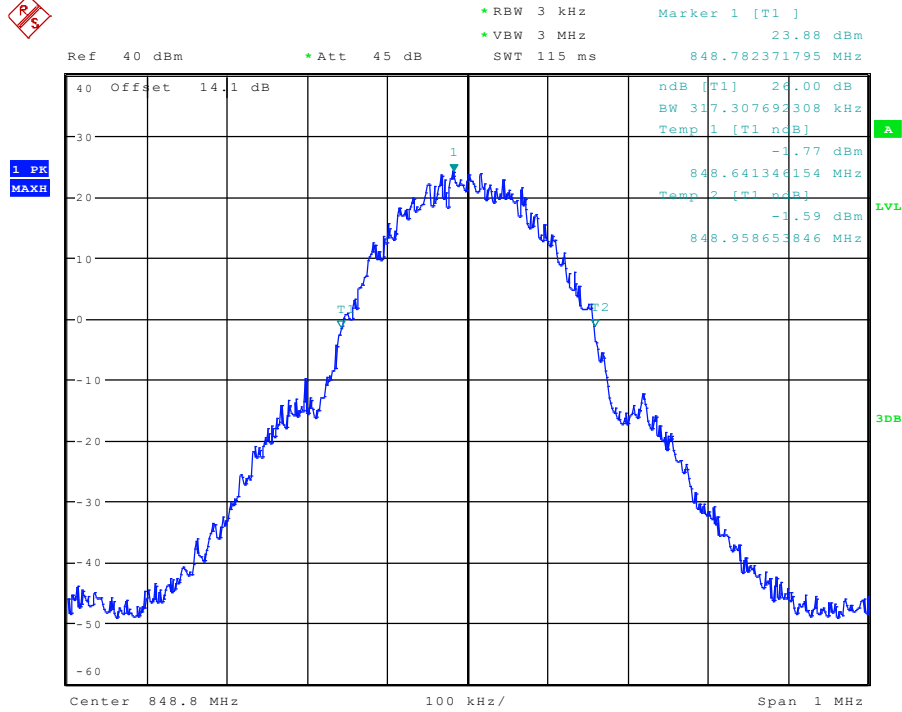
Date: 29.MAR.2010 14:08:53

### Emission band Width GSM850 MHz Channel 190 GSM



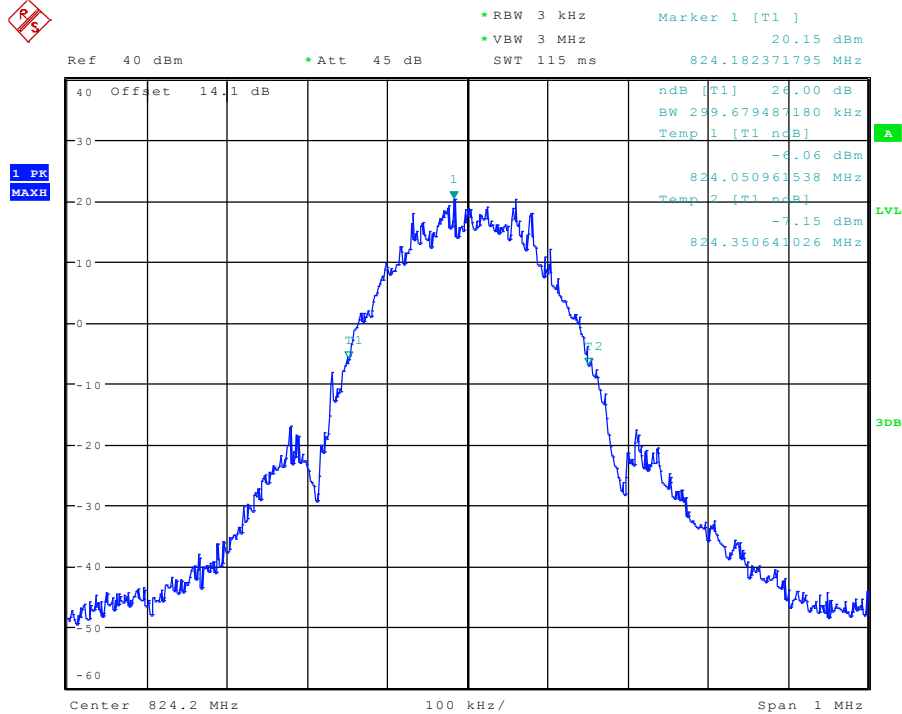
Date: 29.MAR.2010 14:09:34

### Emission band Width GSM850 MHz Channel 251 GSM



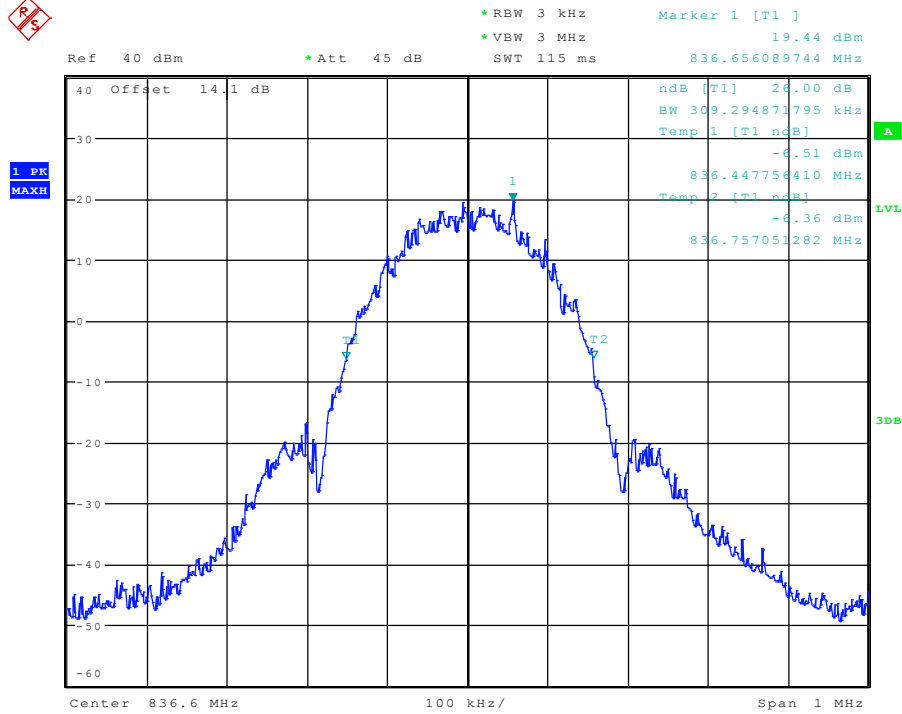
Date: 29.MAR.2010 14:10:24

### Emission band Width GSM850 MHz Channel 128 EGPRS



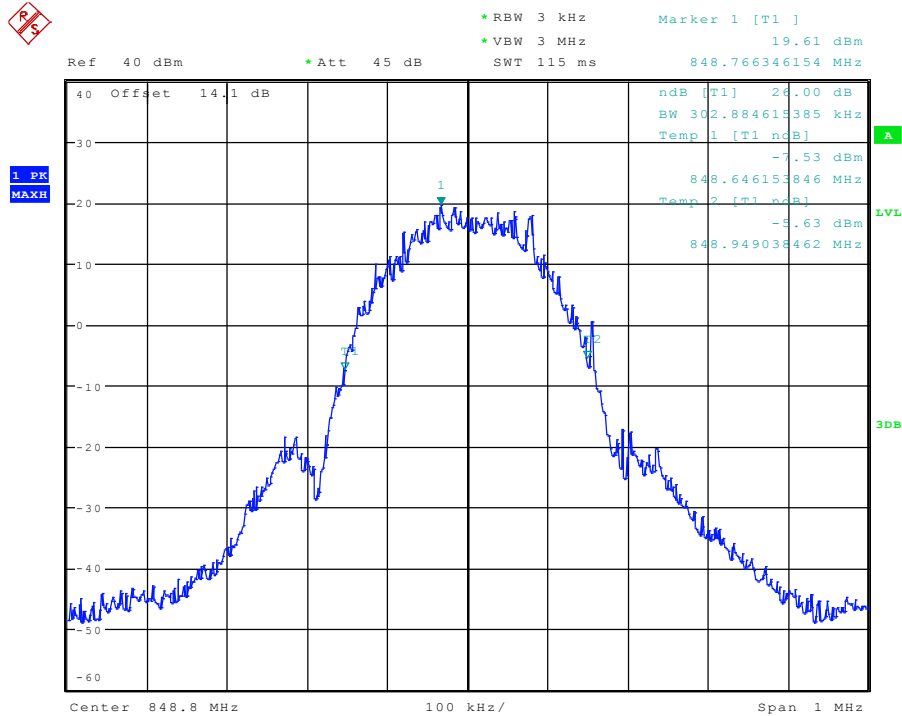
Date: 29.MAR.2010 14:06:59

### Emission band Width GSM850 MHz Channel 190 EGPRS



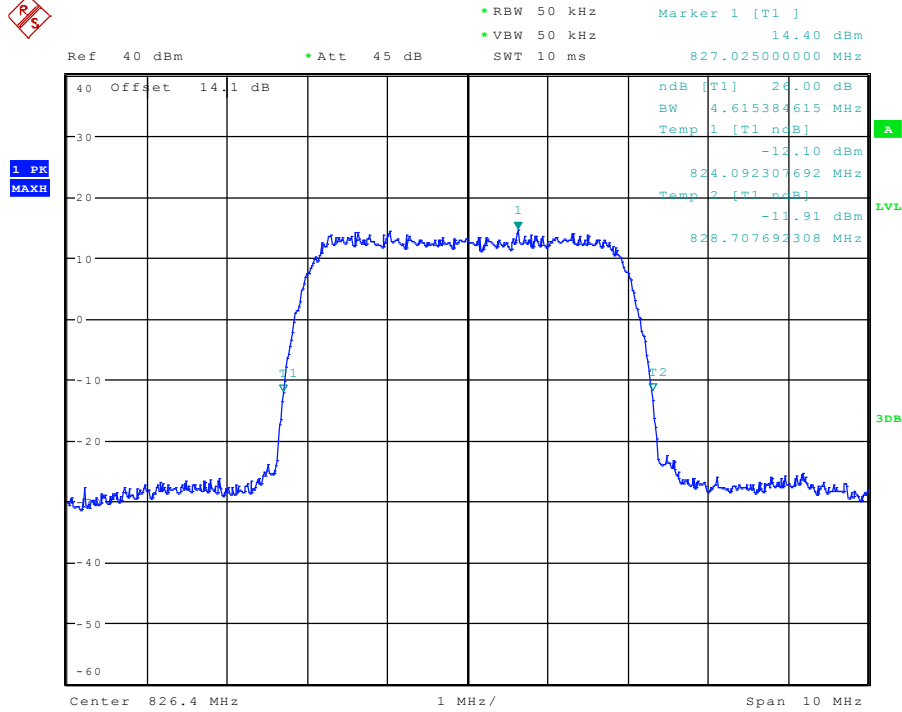
Date: 29.MAR.2010 14:06:05

### Emission band Width GSM850 MHz Channel 251 EGPRS



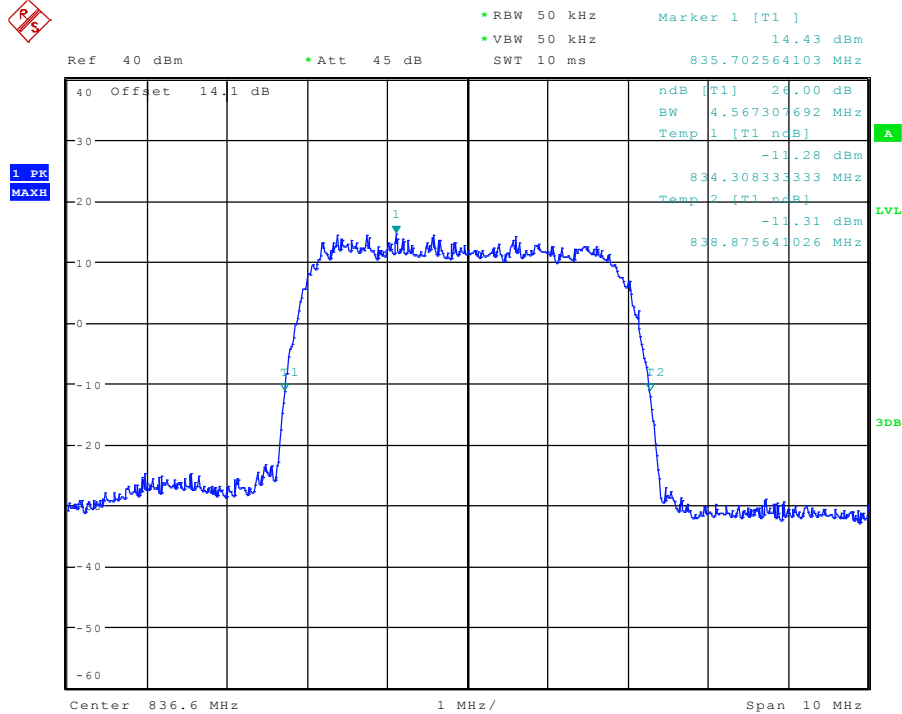
Date: 29.MAR.2010 14:04:54

### Emission band Width UMTS FDD5 Channel 4132



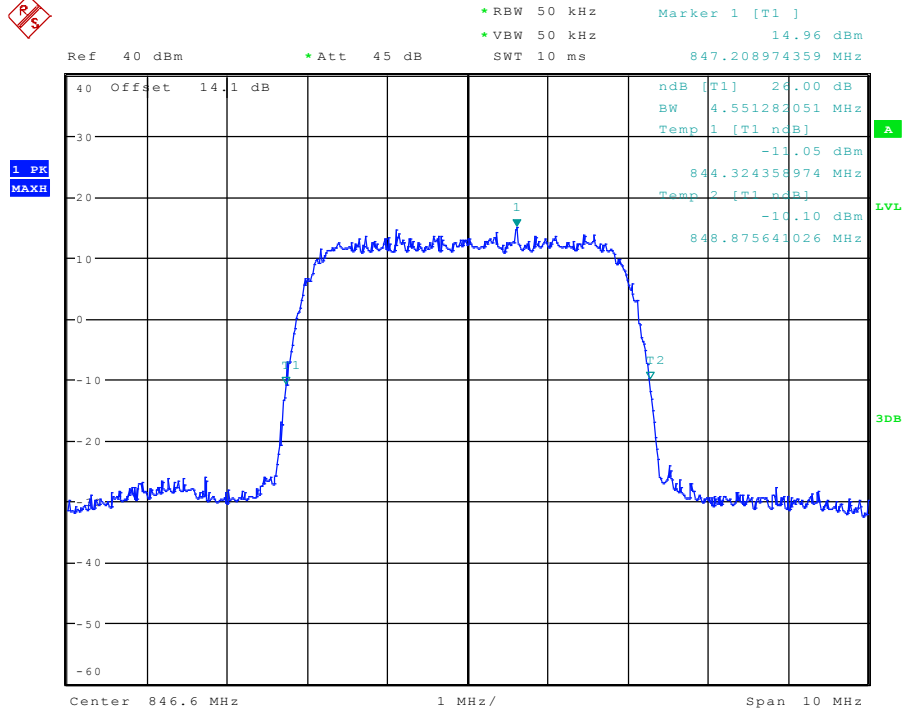
Date: 29.MAR.2010 16:26:32

### Emission band Width UMTS FDD5 Channel 4183



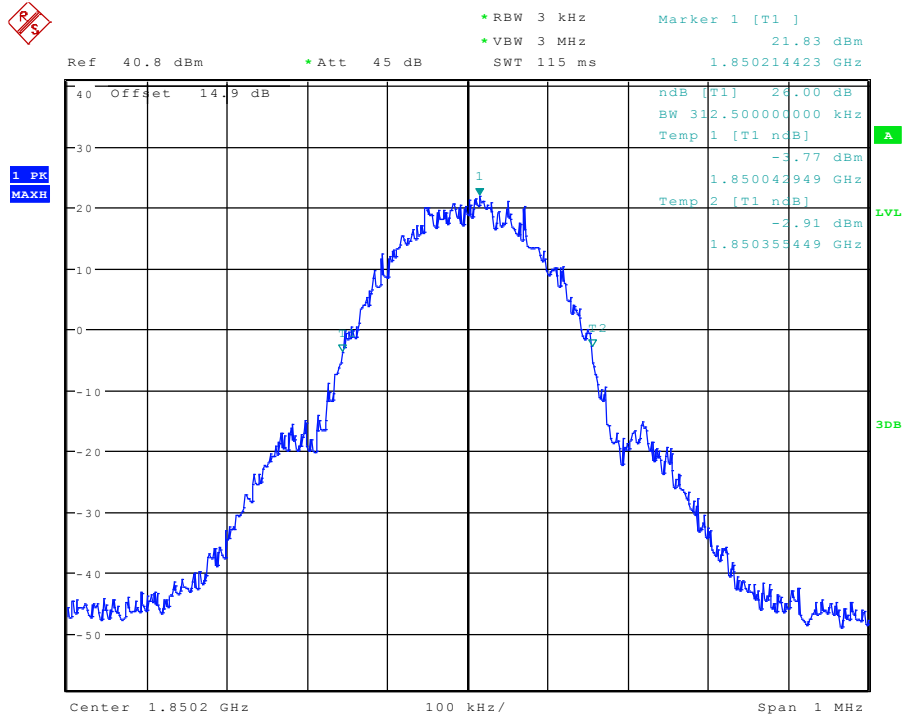
Date: 29.MAR.2010 16:27:05

### Emission band Width UMTS FDD5 Channel 4233



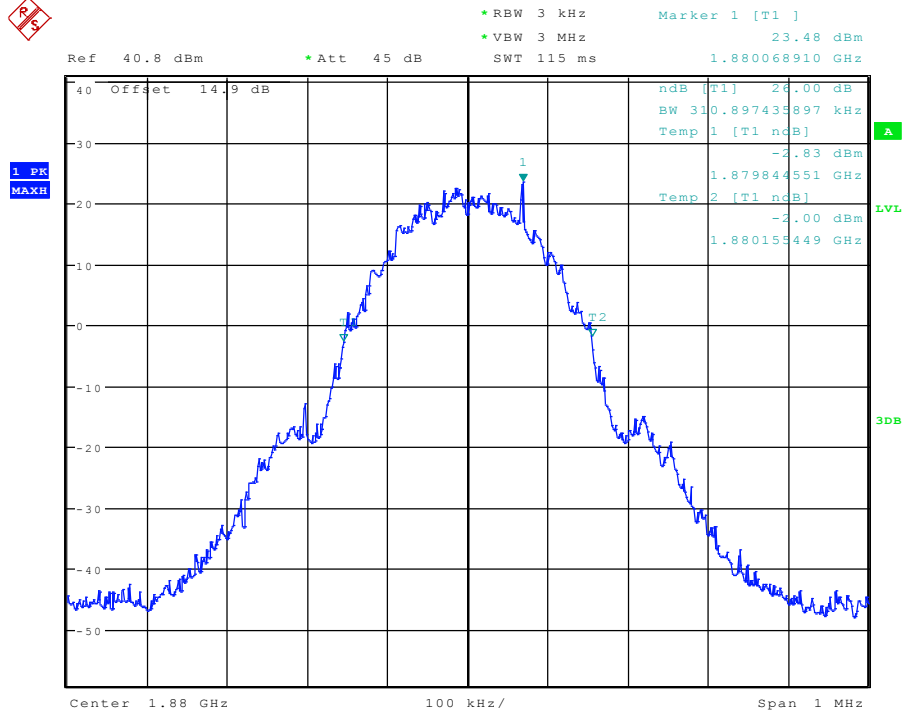
Date: 29.MAR.2010 16:27:37

### Emission band Width PCS1900 MHz Channel 512 GSM



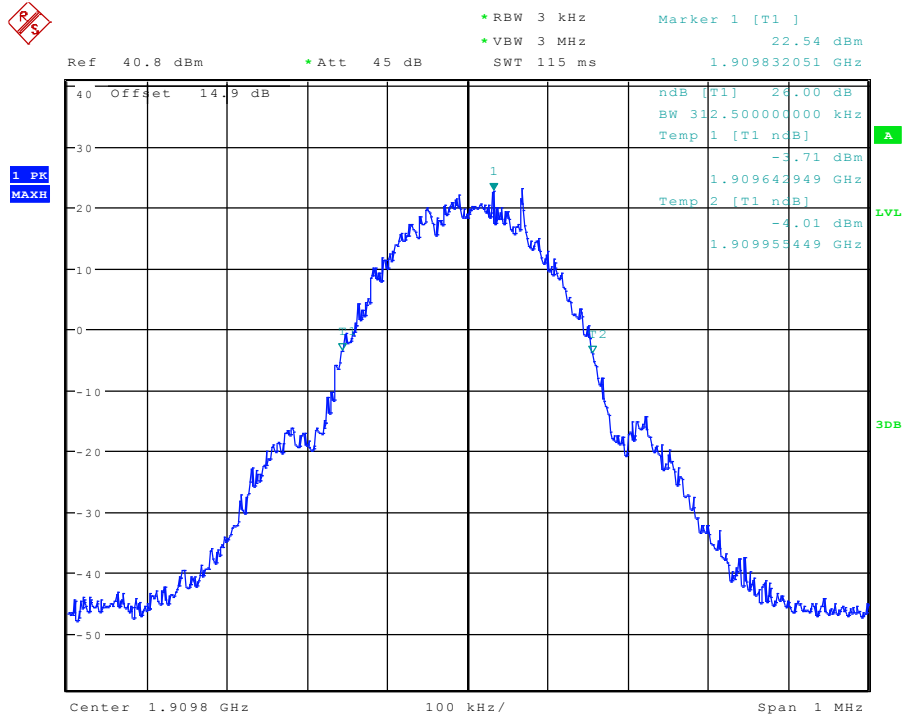
Date: 29.MAR.2010 15:01:33

### Emission band Width PCS1900 MHz Channel 661 GSM



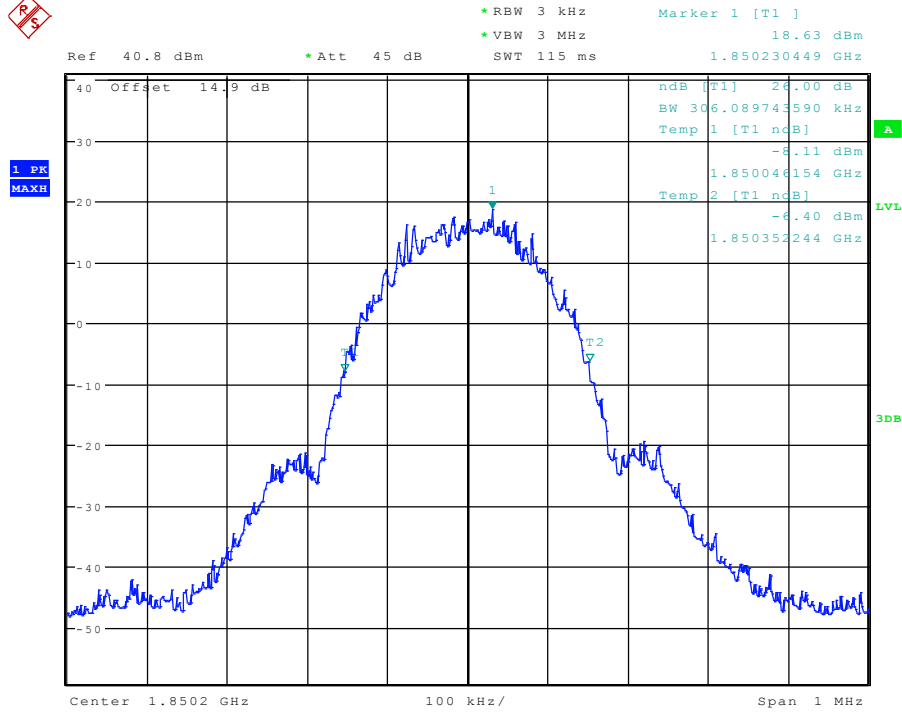
Date: 29.MAR.2010 15:00:53

### Emission band Width PCS1900 MHz Channel 810 GSM



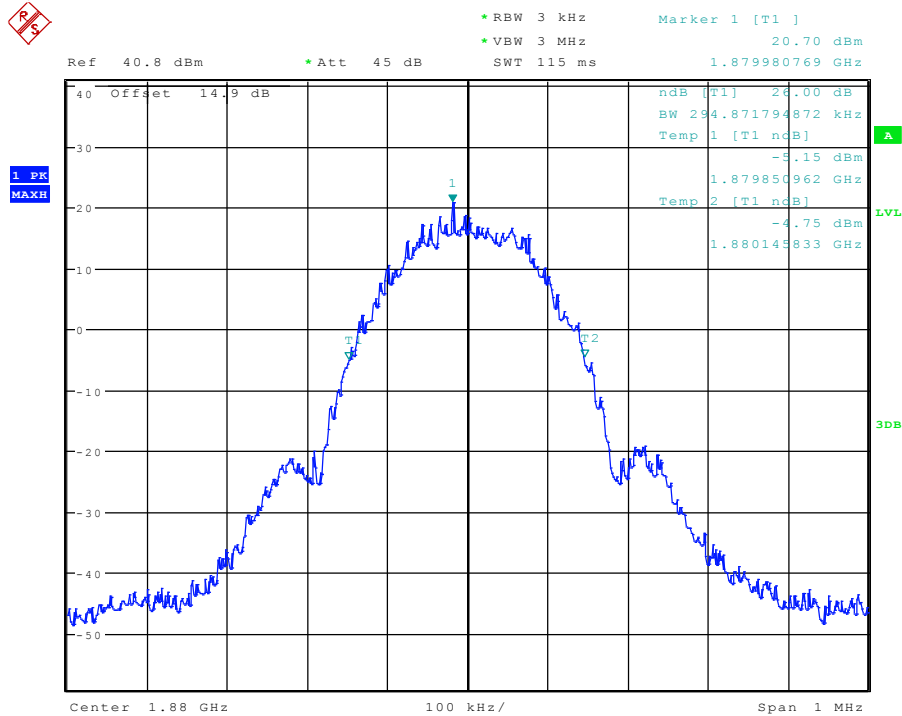
Date: 29.MAR.2010 14:59:49

### Emission band Width PCS1900 MHz Channel 512 EGPRS



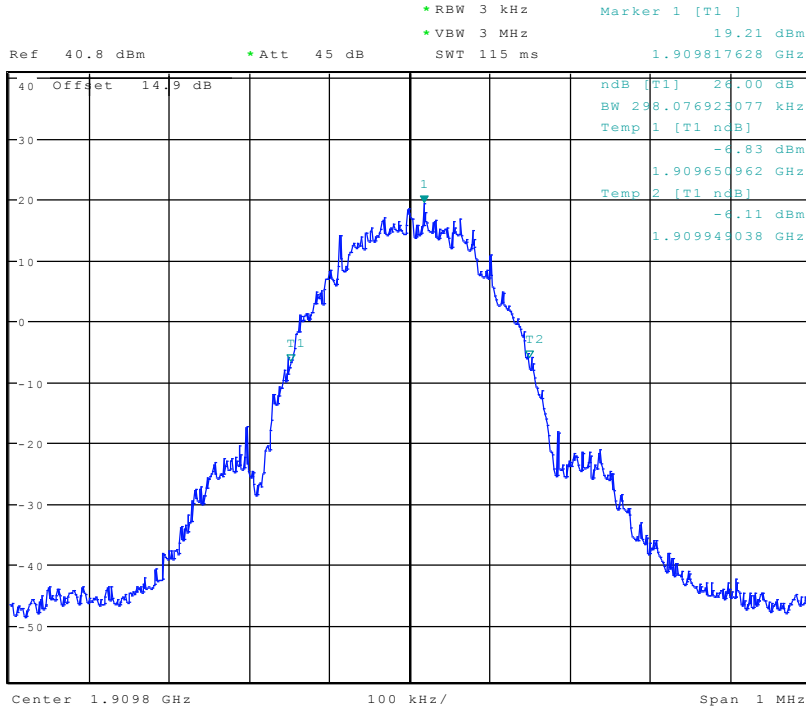
Date: 29.MAR.2010 15:02:55

### Emission band Width PCS1900 MHz Channel 661 EGPRS



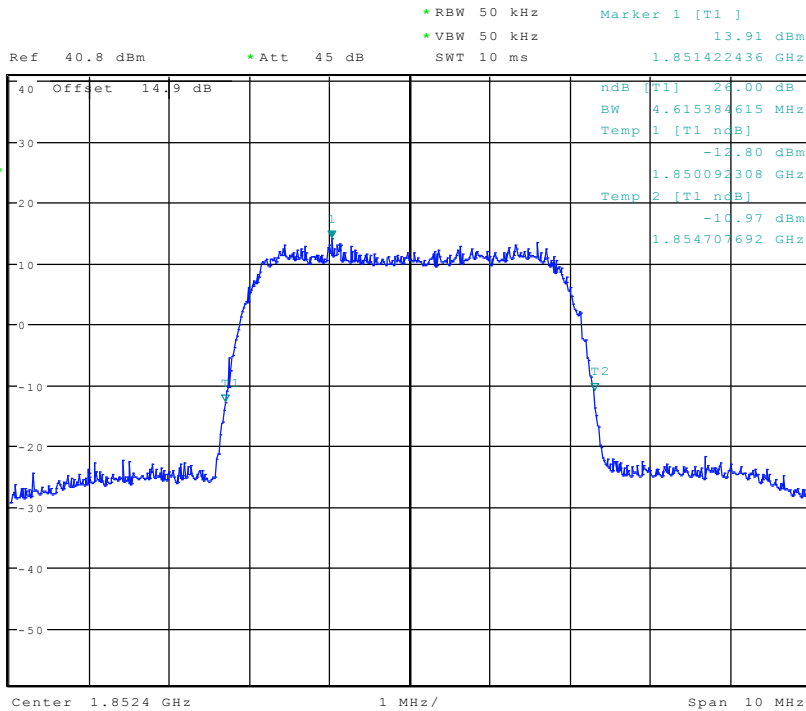
Date: 29.MAR.2010 15:03:57

### Emission band Width PCS1900 MHz Channel 810 EGPRS



Date: 29.MAR.2010 15:04:38

### Emission band Width UMTS FDD2 Channel 9262



Date: 29.MAR.2010 15:34:29





### **5.3 Frequency Stability**

#### **5.3.1 References**

FCC: CFR Part 2.1055, CFR Part 22.355, CFR Part 24.235

#### **5.3.2 Limits**

##### **For Hand carried battery powered equipment:**

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235/22.355 Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.4VDC and 4.2VDC, with a nominal voltage of 4.2VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance of -19% and 0%. For the purposes of measuring frequency stability these voltage limits are to be used.

##### **For equipment powered by primary supply voltage:**

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235/22.355 Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

For this EUT section 2.1055(d)(1) applies. This requires to vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

##### **Method of Measurement:**

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a "call mode". This is accomplished with the use of R&S CMU 200 Universal Radio Communication Tester.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30 C.
3. With the EUT, powered via nominal voltage, connected to the CMU 200 and in a simulated call on mid channel (190 for GSM 850 & 4183 for FDD5 & 661 for PCS1900 & 9400 for FDD2), measure the carrier frequency. These measurements should be made within 2 minutes of powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10 C increments from -30 C to +50 C. Allow at least 1 1/2 hours at each temperature, un-powered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Re-measure carrier frequency at low and high voltage. Pause at nominal voltage for 1 1/2 hours un-powered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50 C.
7. With the EUT, powered via nominal voltage, connected to the CMU 200 and in a simulated call on mid channel (190 for GSM 850 & 4183 for FDD5 & 661 for PCS1900 & 9400 for

FDD2), measure the carrier frequency. These measurements should be made within 2 minutes of powering up the EUT, to prevent significant self-warming.

8. Repeat the above measurements at 10 C increments from +50 C to -30 C. Allow at least 1 1/2 hours at each temperature, un-powered, before making measurements.

9. At all temperature levels hold the temperature to +/- 0.5 C during the measurement procedure.

**5.3.3 Test Results Frequency Stability (GSM-850): Channel 190 (836.6 MHz)**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (ppm) |
|-------------|----------------------|-----------------------|
| Low V: 3.4  | -3                   | -0.0036               |
| High V: 4.2 | -5                   | -0.0060               |

**§2.1055 (a)(1) AFC FREQ ERROR vs. TEMPERATURE**

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------|----------------------|-----------------------|
| -30              | 7                    | 0.0084                |
| -20              | 11                   | 0.0131                |
| -10              | 6                    | 0.0072                |
| 0                | 5                    | 0.0060                |
| +10              | -6                   | -0.0072               |
| +20              | 6                    | 0.0072                |
| +30              | 7                    | 0.0084                |
| +40              | -6                   | -0.0072               |
| +50              | -8                   | -0.0096               |

**§2.1055 (b)(2) Battery end point**

| Battery End Point (V DC) | Frequency Error (Hz) | Frequency Error (ppm) |
|--------------------------|----------------------|-----------------------|
| 3.2                      | 28                   | 0.0335                |

**5.3.4 Test Results Frequency Stability (GSM-1900): Channel 661 (1880.0 MHz)**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (ppm) |
|-------------|----------------------|-----------------------|
| Low V: 3.4  | -8                   | -0.0043               |
| High V: 4.2 | -16                  | -0.0085               |

**§2.1055 (a)(1) AFC FREQ ERROR vs. TEMPERATURE**

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------|----------------------|-----------------------|
| -30              | 25                   | 0.0133                |
| -20              | 17                   | 0.0090                |
| -10              | -15                  | -0.0080               |
| 0                | -17                  | -0.0090               |
| +10              | -12                  | -0.0064               |
| +20              | -17                  | -0.0090               |
| +30              | -15                  | -0.0080               |
| +40              | -21                  | -0.0112               |
| +50              | -18                  | -0.0096               |

**§2.1055 (b)(2) Battery end point**

| Battery End Point (V DC) | Frequency Error (Hz) | Frequency Error (ppm) |
|--------------------------|----------------------|-----------------------|
| 3.0                      | 67                   | 0.0356                |

**5.3.5 Test Results Frequency Stability (FDD V): Channel 4183 (836.6 MHz)**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (ppm) |
|-------------|----------------------|-----------------------|
| Low V: 3.4  | -11                  | -0.0131               |
| High V: 4.2 | -12                  | -0.0143               |

**§2.1055 (a)(1) AFC FREQ ERROR vs. TEMPERATURE**

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------|----------------------|-----------------------|
| -30              | -28                  | -0.0335               |
| -20              | -2                   | -0.0024               |
| -10              | 16                   | 0.0191                |
| 0                | -13                  | -0.0155               |
| +10              | -11                  | -0.0131               |
| +20              | -13                  | -0.0155               |
| +30              | -16                  | -0.0191               |
| +40              | -17                  | -0.0203               |
| +50              | -12                  | -0.0143               |

**§2.1055 (b)(2) Battery end point**

| Battery End Point<br>(V DC) | Frequency Error (Hz) | Frequency Error (ppm) |
|-----------------------------|----------------------|-----------------------|
| 3.1                         | 36                   | 0.0430                |

**5.3.6 Test Results Frequency Stability (FDD II): Channel 9400 (1880.0 MHz)**

| Voltage (V) | Frequency Error (Hz) | Frequency Error (ppm) |
|-------------|----------------------|-----------------------|
| Low V: 3.4  | 15                   | 0.0080                |
| High V: 4.2 | 24                   | 0.0128                |

**§2.1055 (a)(1) AFC FREQ ERROR vs. TEMPERATURE**

| Temperature (°C) | Frequency Error (Hz) | Frequency Error (ppm) |
|------------------|----------------------|-----------------------|
| -30              | 16                   | 0.0085                |
| -20              | 20                   | 0.0106                |
| -10              | 16                   | 0.0085                |
| 0                | 16                   | 0.0085                |
| +10              | -18                  | -0.0096               |
| +20              | 14                   | 0.0074                |
| +30              | 16                   | 0.0085                |
| +40              | -22                  | -0.0117               |
| +50              | 13                   | 0.0069                |

**§2.1055 (b)(2) Battery end point**

| Battery End Point (V DC) | Frequency Error (Hz) | Frequency Error (ppm) |
|--------------------------|----------------------|-----------------------|
| 3.2                      | 64                   | 0.0340                |

## **5.4 Conducted Spurious Emissions**

### **5.4.1 References**

FCC: CFR Part 2.1051, CFR Part 22.917, CFR Part 24.238

### **5.4.2 FCC 2.1051 Measurements required: Spurious emissions at antenna terminals.**

The radio frequency voltage or power generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in FCC 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

### **5.4.3 Limits**

(a) *Out of band emissions.* 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. For all power levels +30dBm to 0dBm, this becomes a constant specification of -13dBm.

#### **5.4.3.1 FCC 22.917 Emission limitations for cellular equipment.**

The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(b) *Measurement procedure.* Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz of 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

#### **5.4.3.2 FCC 24.238 Emission limitations for Broadband PCS equipment.**

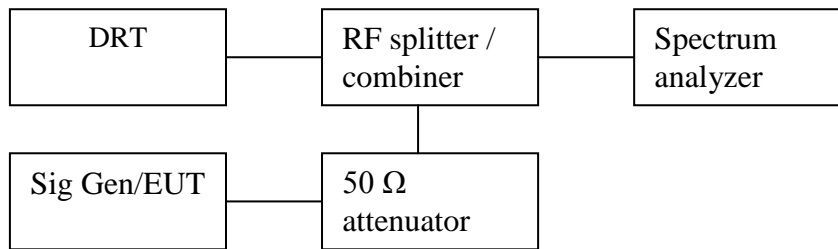
The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(b) *Measurement procedure.* Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz of 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.



#### **5.4.4 Measurement Procedure -Conducted Out of band Emissions**

**Ref: TIA-603C 2004 2.2.13 Unwanted Emissions: Conducted Spurious**



1. Connect the equipment as shown in the above diagram.
2. Set the spectrum analyzer to measure peak hold with the required settings.
3. Set the signal generator to a known output power and record the path loss in dB (**LOSS**) for frequencies up to the tenth harmonic of the EUT's carrier frequency. \ **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
4. Replace the signal generator with the EUT.
5. Adjust the settings of the Digital RadioCommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
6. Set the spectrum analyzer to measure peak hold with the required settings. Offset the spectrum analyzer reference level by the path loss measured above.
7. Measure and record all spurious emissions up to the tenth harmonic of the carrier frequency.
8. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.
9. If necessary steps 6 and 7 may be performed with the spectrum analyzer set to average detector.  
(**Note:** Step 3 above is performed prior to testing and **LOSS** is recorded by test software. Steps 2, 6, and 7 above are performed with test software.)

#### **Spectrum analyzer settings:**

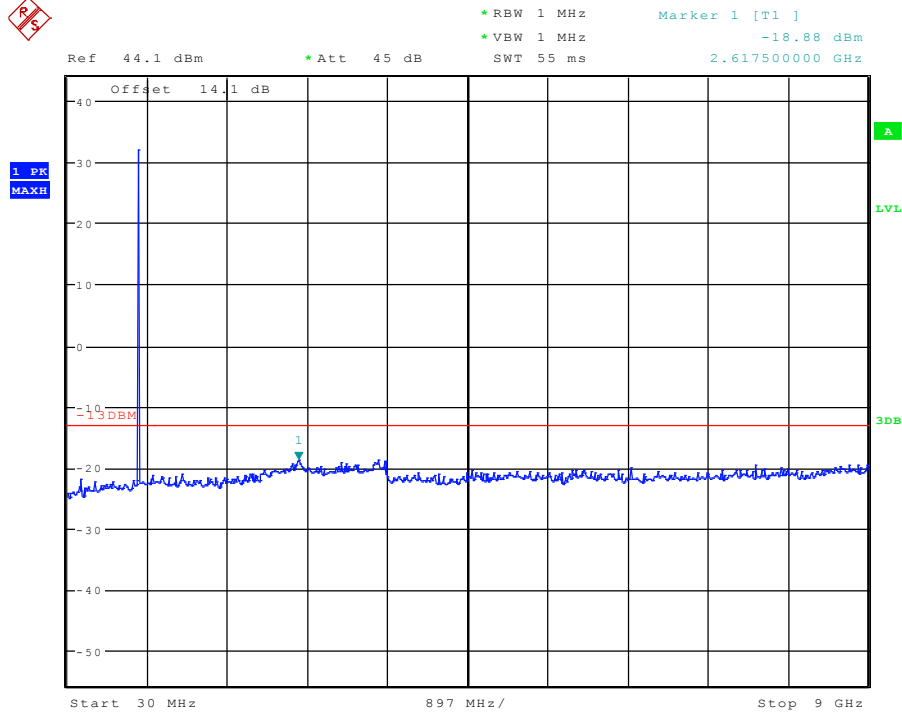
RBW/VBW=1MHz; Span=To cover 10<sup>th</sup> harmonic; Detector: Peak- Max Hold.

#### **5.4.5 Test Results- Conducted Out of band Emission**

No measurable spurious emissions noted. Emission above the limit in the plots is from EUT uplink.

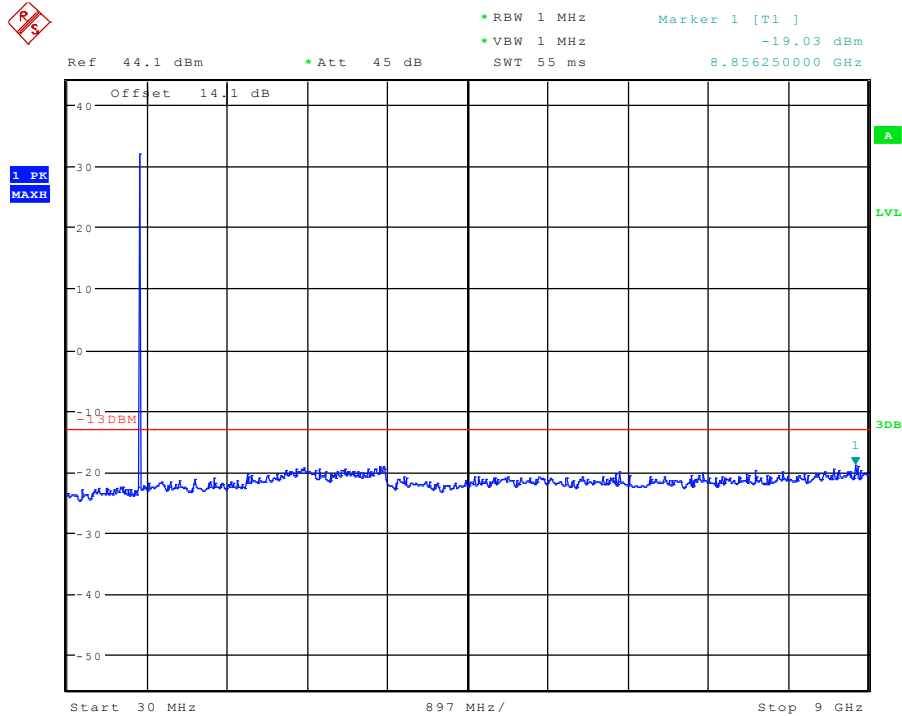
All measurement conducted in GSM and UMTS mode with highest power settings. Plots here show worse case emission for each channel under any modulation.

### Conducted Out of band Emission GSM850 channel 128:



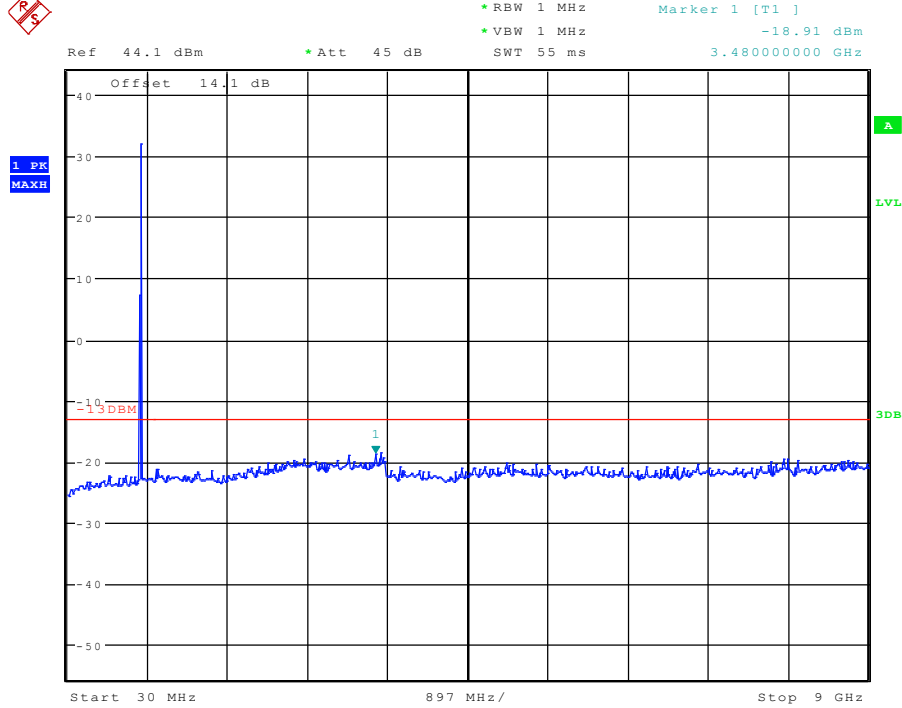
Date: 29.MAR.2010 11:11:34

### Conducted Out of band Emission GSM850 channel 190:



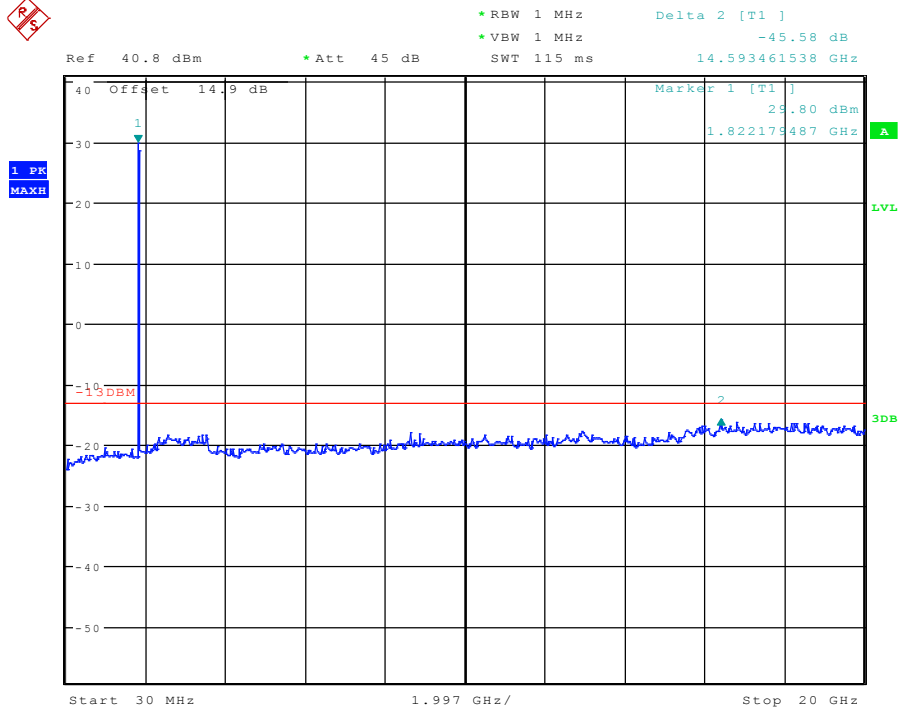
Date: 29.MAR.2010 11:12:49

### Conducted Out of band Emission GSM850 channel 251:



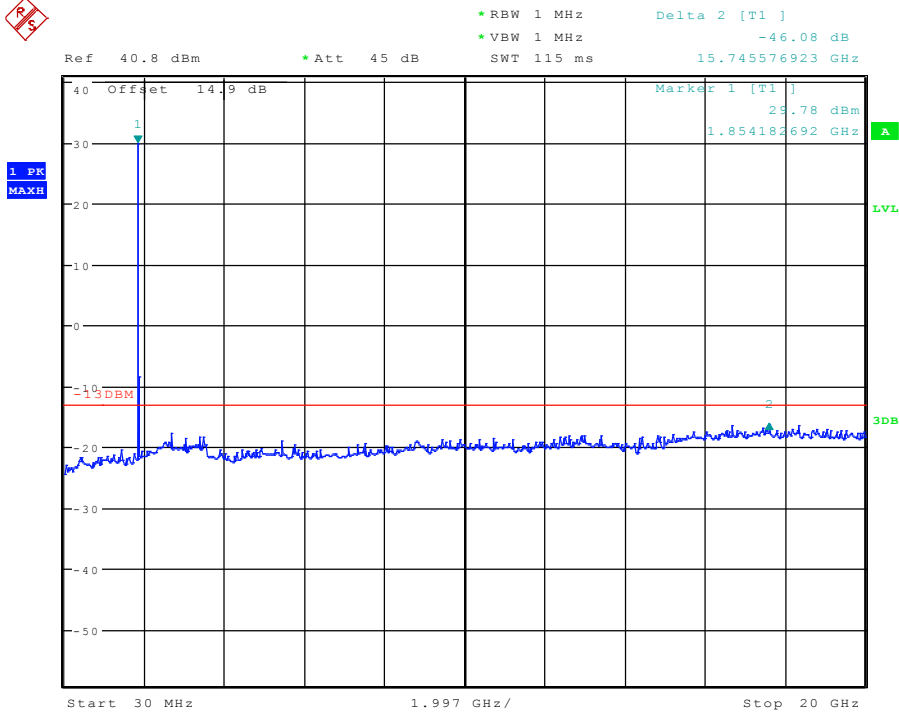
Date: 29.MAR.2010 11:13:37

### Conducted Out of band Emission GSM1900 channel 512:



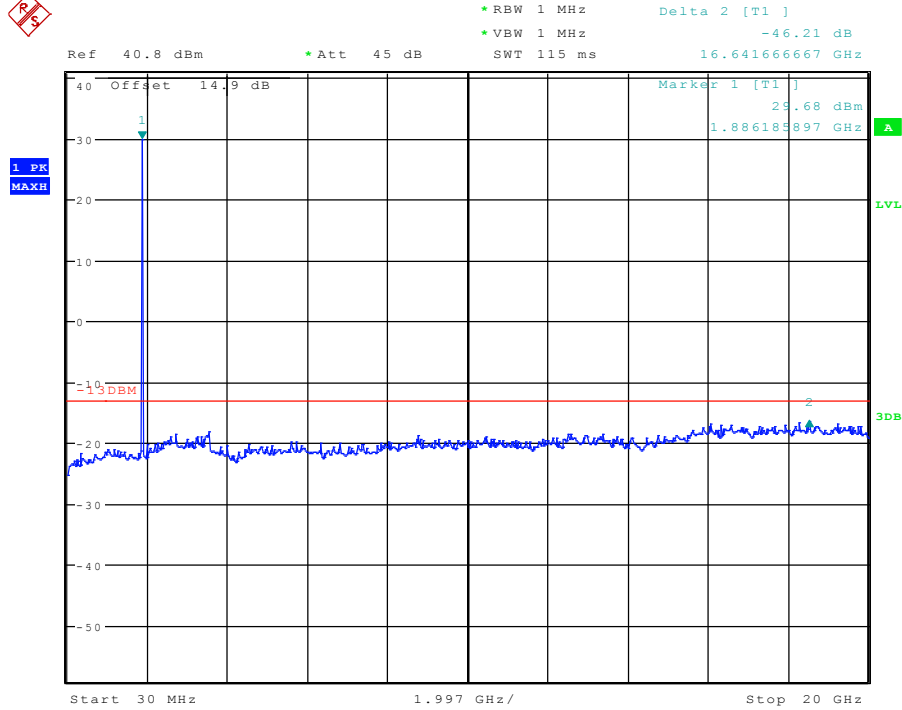
Date: 29.MAR.2010 14:53:14

### Conducted Out of band Emission GSM1900 channel 661:



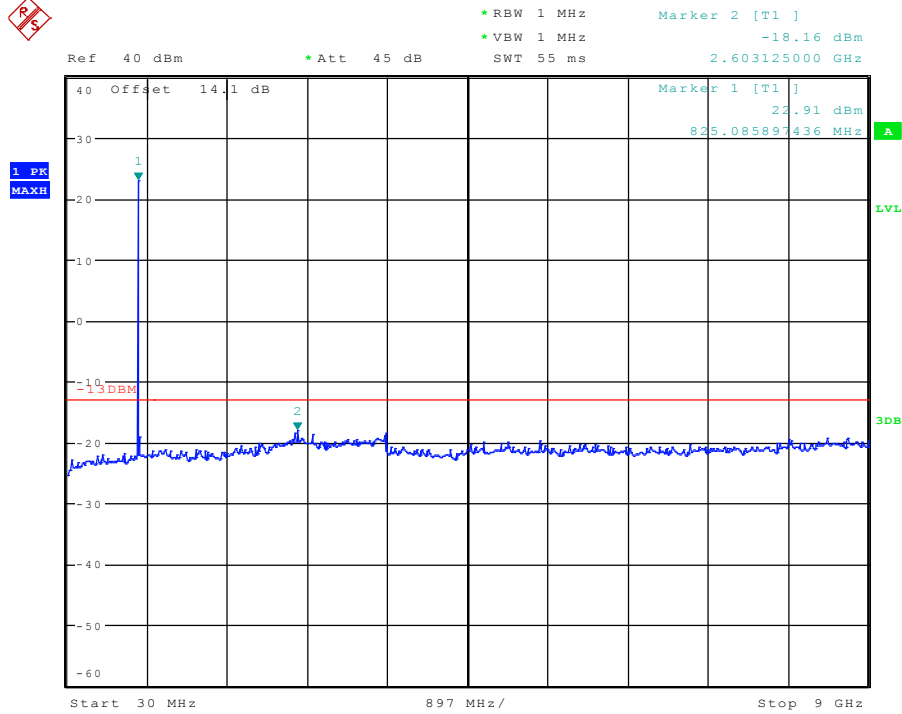
Date: 29.MAR.2010 14:54:19

### Conducted Out of band Emission GSM1900 channel 810:



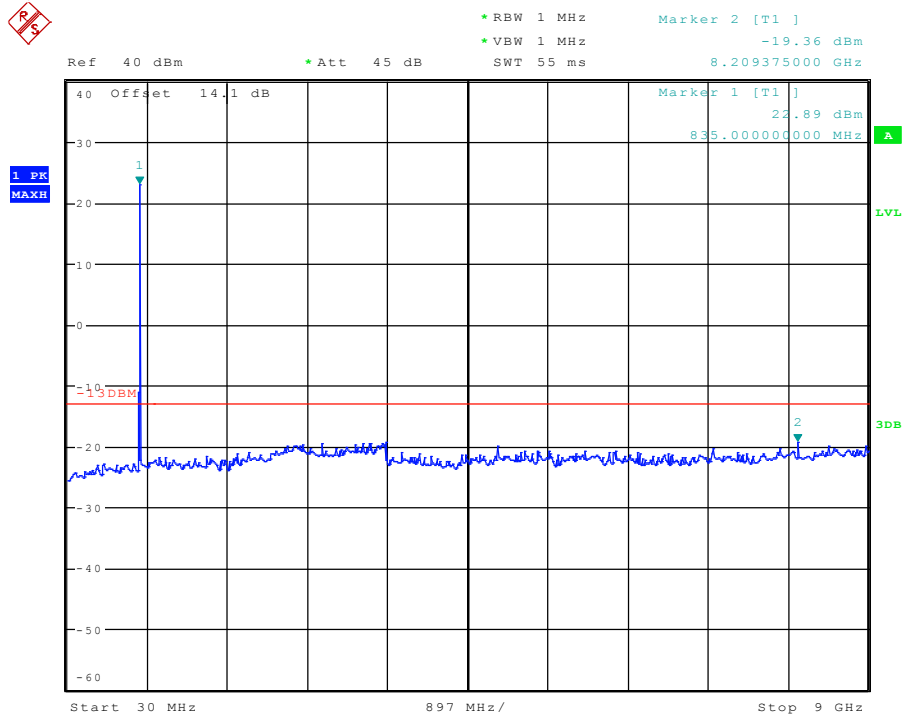
Date: 29.MAR.2010 14:55:08

### Conducted Out of band Emission UMTS FDD5 channel 4132:



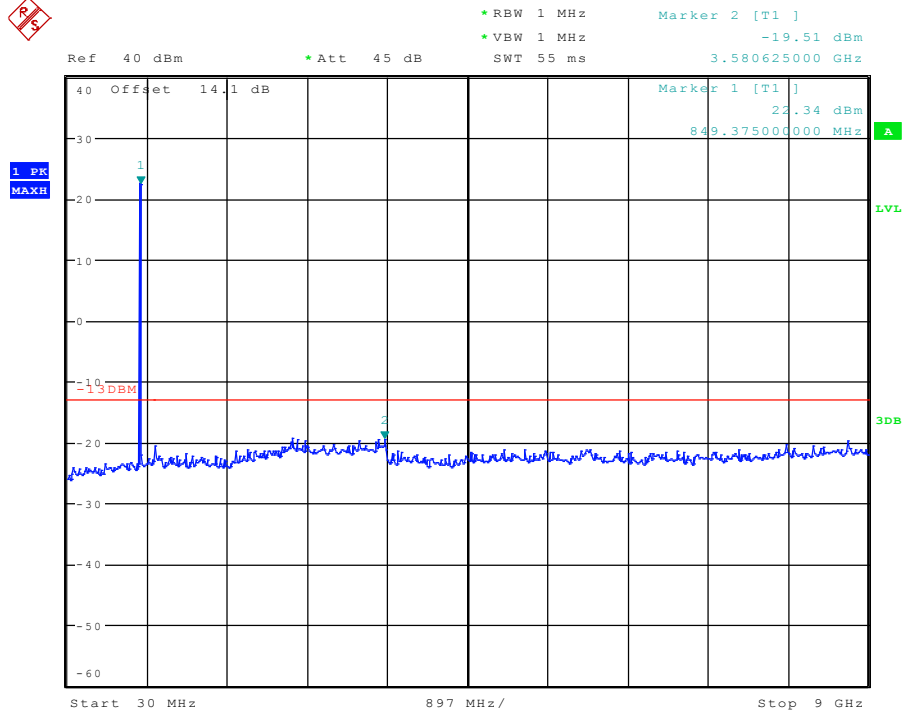
Date: 29.MAR.2010 16:19:44

### Conducted Out of band Emission UMTS FDD5 channel 4183:



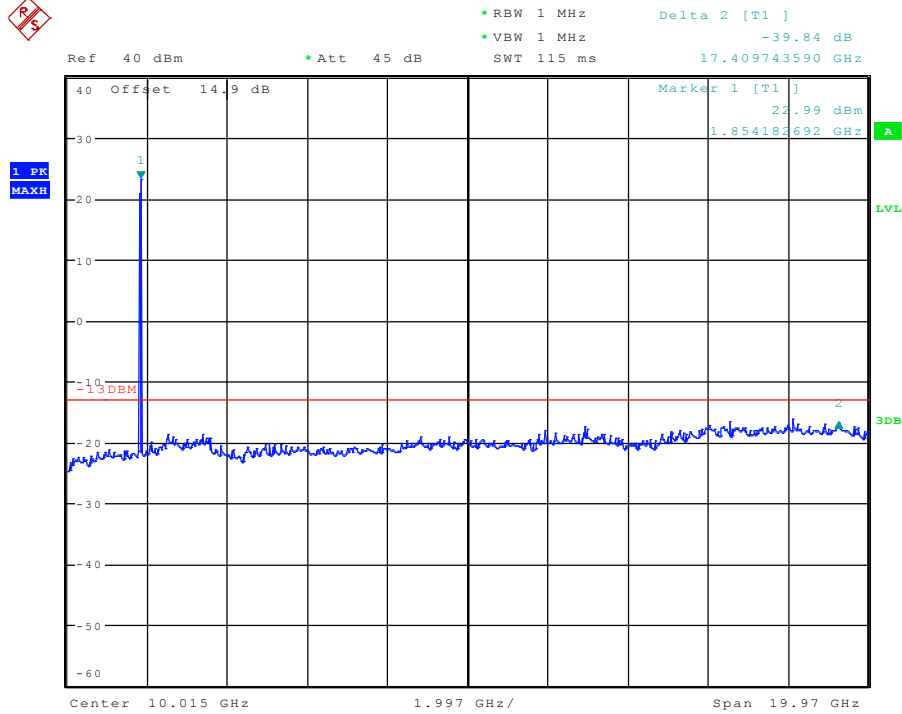
Date: 29.MAR.2010 16:20:32

### Conducted Out of band Emission UMTS FDD5 channel 4233:



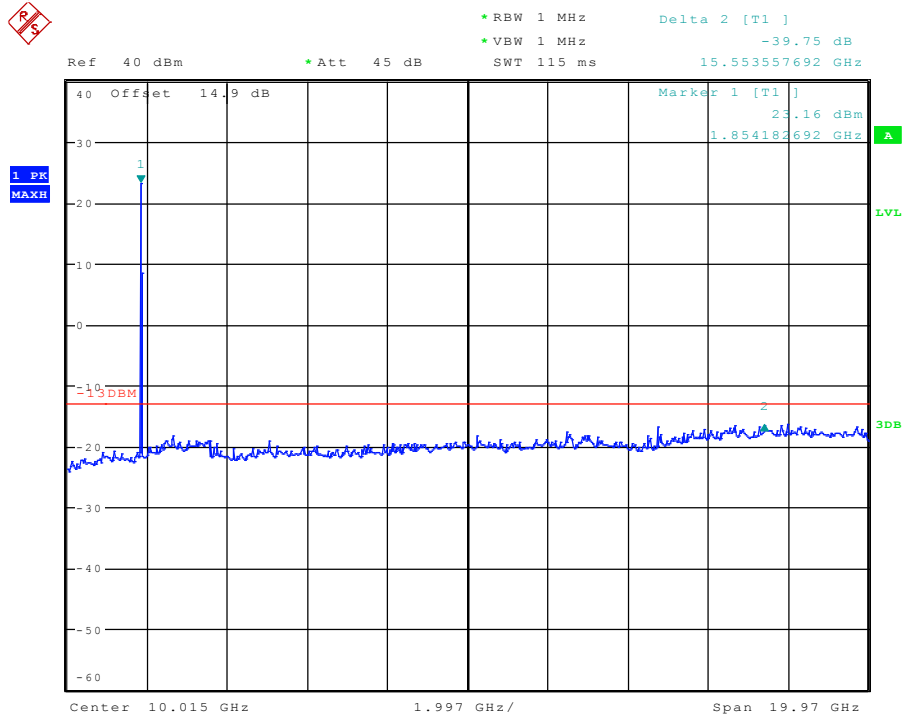
Date: 29.MAR.2010 16:21:37

**Conducted Out of band Emission UMTS FDD2 channel 9262:**



Date: 29.MAR.2010 15:48:04

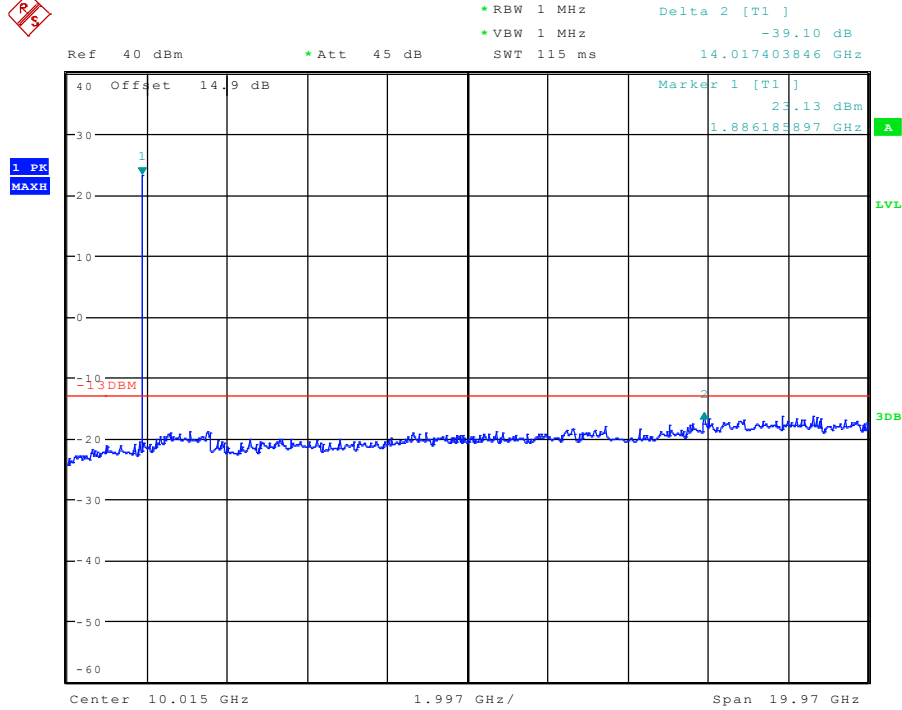
**Conducted Out of band Emission UMTS FDD2 channel 9400:**



Date: 29.MAR.2010 15:47:21



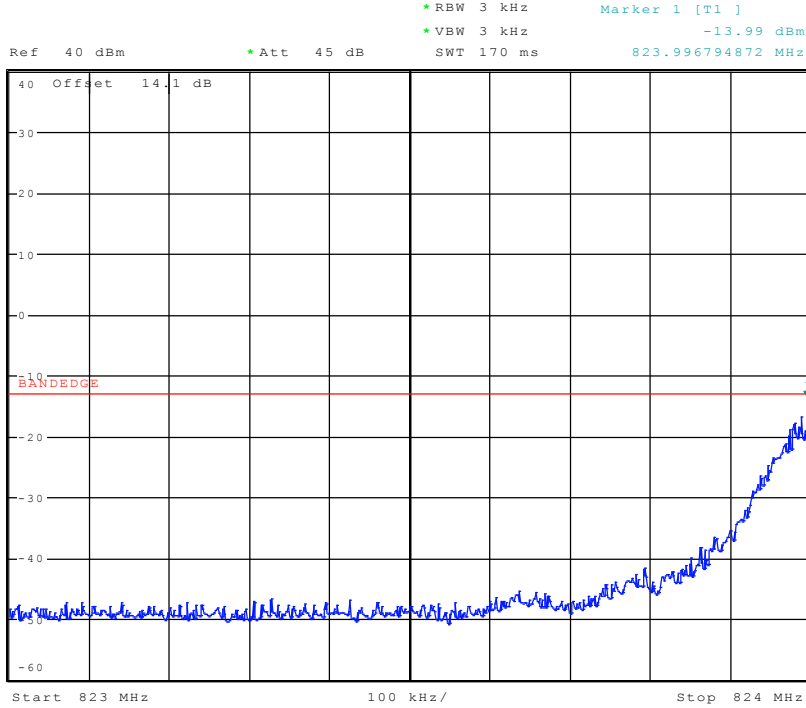
### Conducted Out of band Emission UMTS FDD2 channel 9538:



Date: 29.MAR.2010 15:44:31

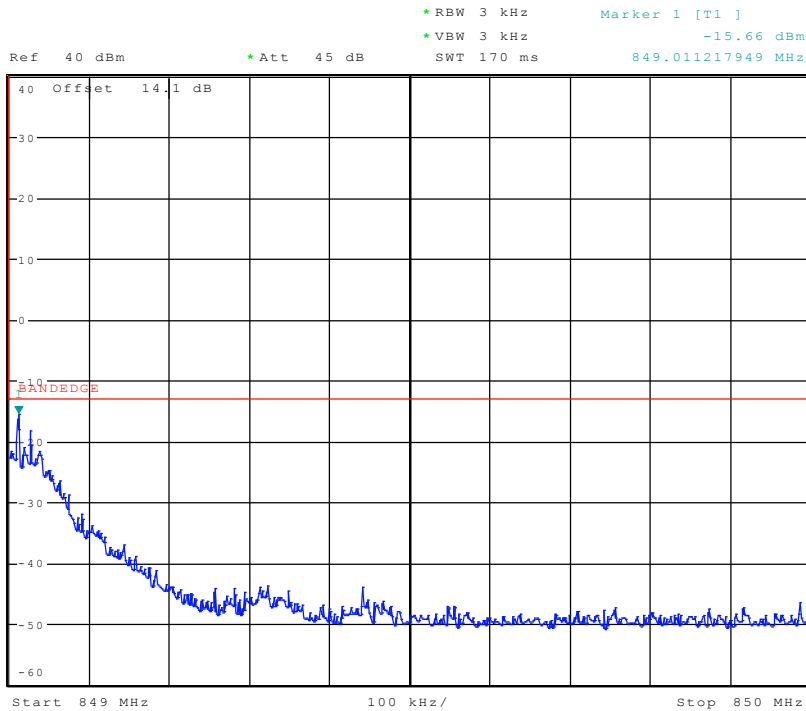


### Lower Band Edge GSM850 EGPRS



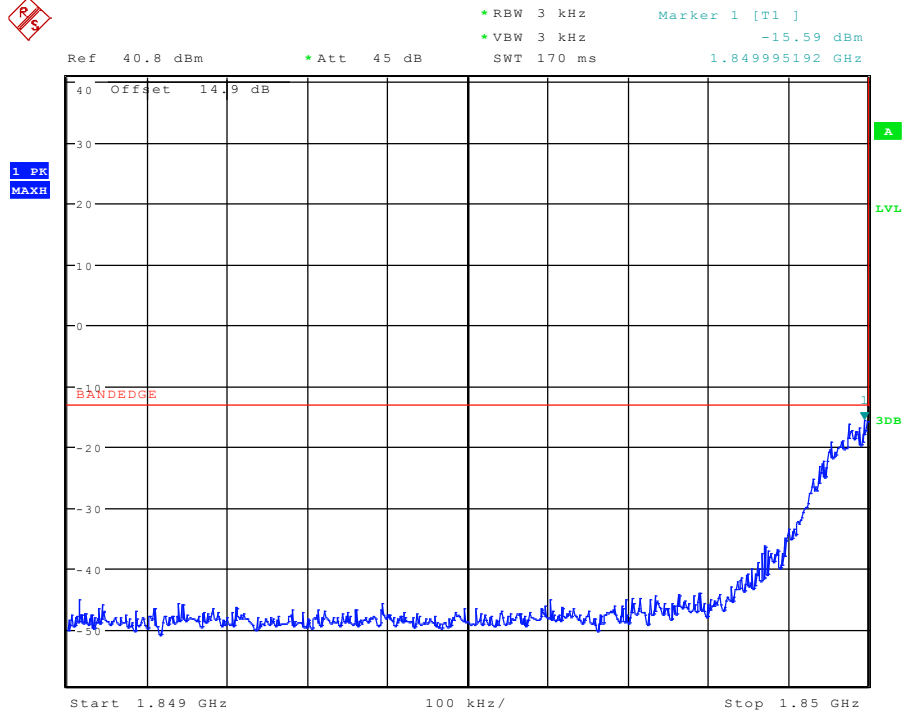
Date: 29.MAR.2010 14:16:39

### Upper Band Edge GSM850 EGPRS



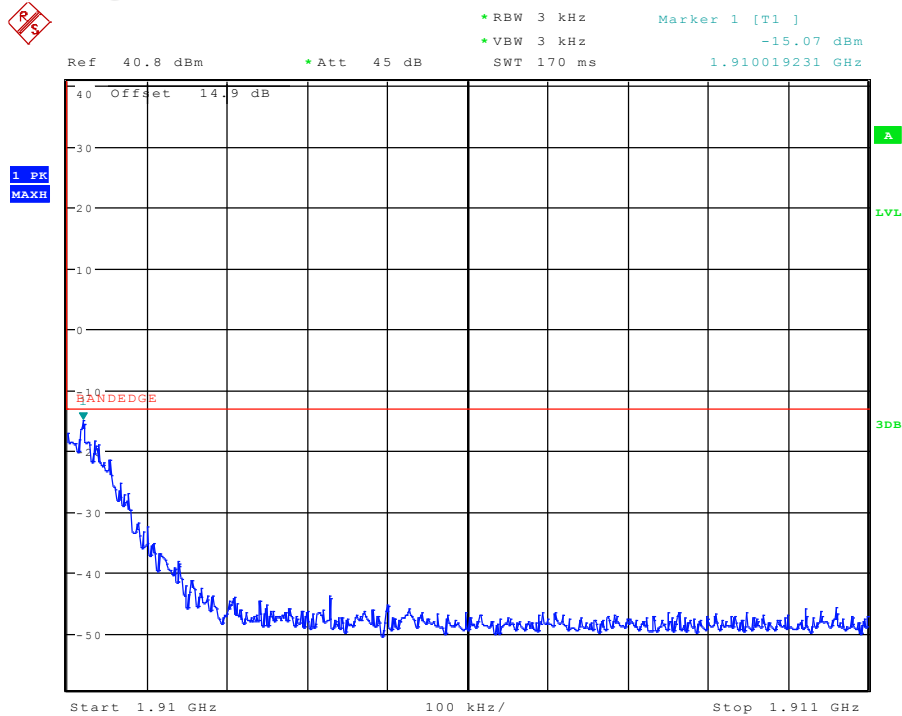
Date: 29.MAR.2010 14:14:55

### Lower Band Edge GSM1900 GSM



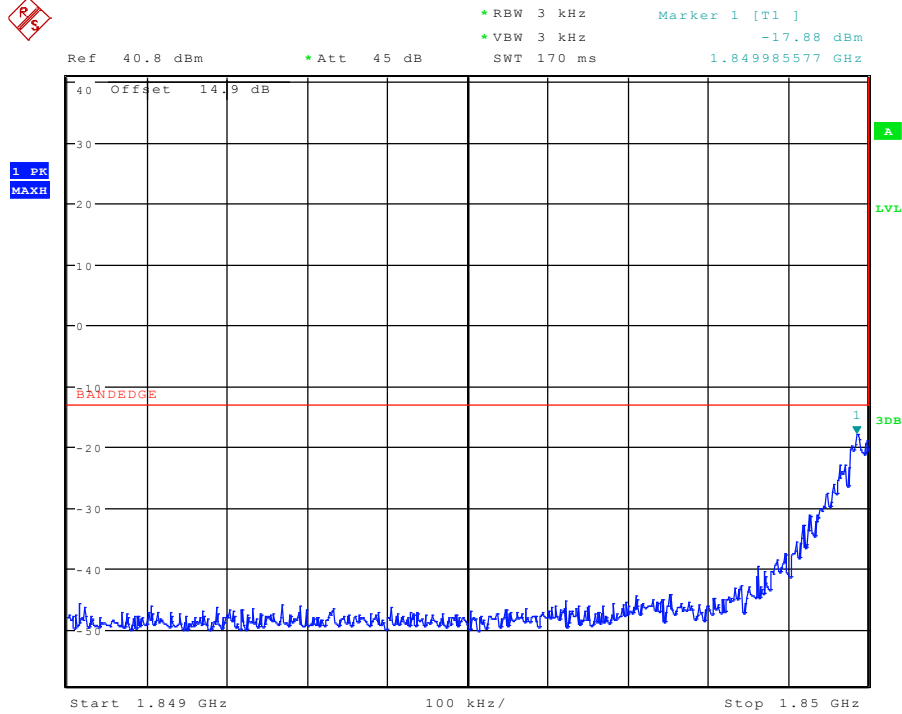
Date: 29.MAR.2010 15:10:58

### Upper Band Edge GSM1900 GSM



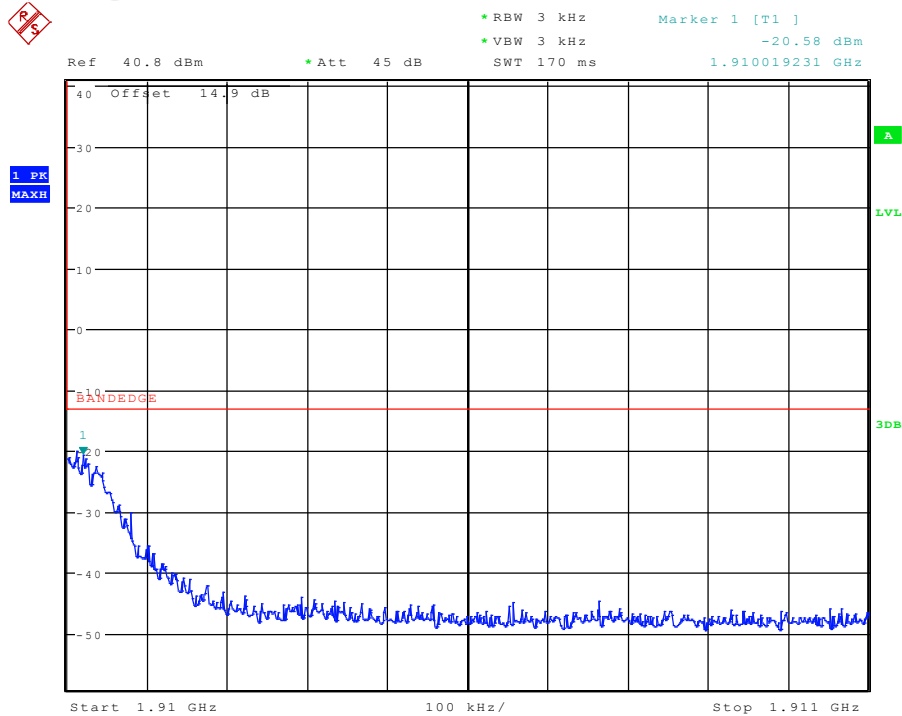
Date: 29.MAR.2010 15:11:48

### Lower Band Edge GSM1900 EGPRS



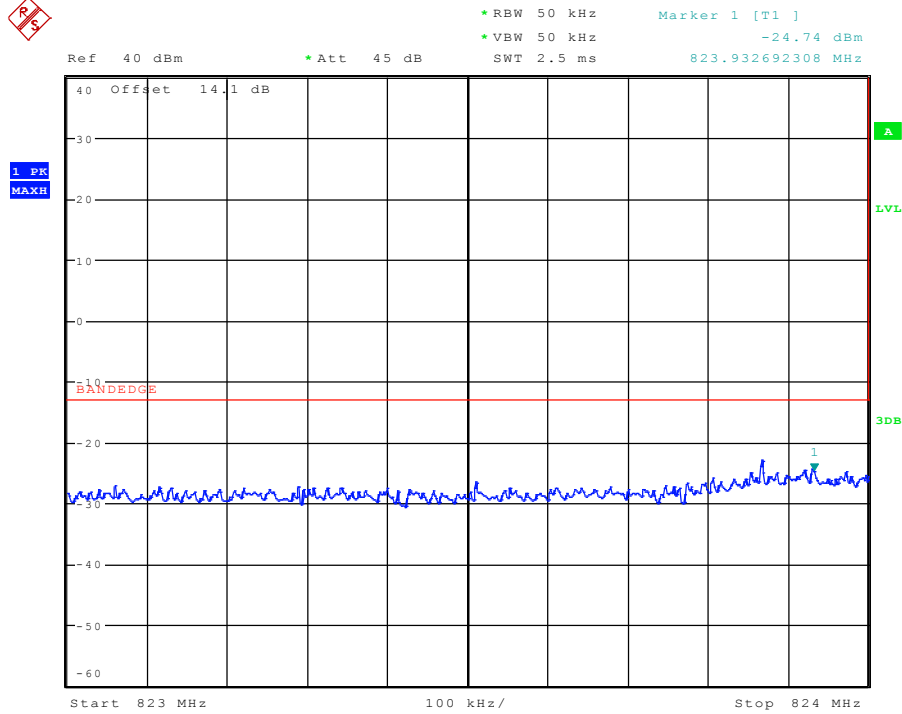
Date: 29.MAR.2010 15:09:34

### Upper Band Edge GSM1900 EGPRS



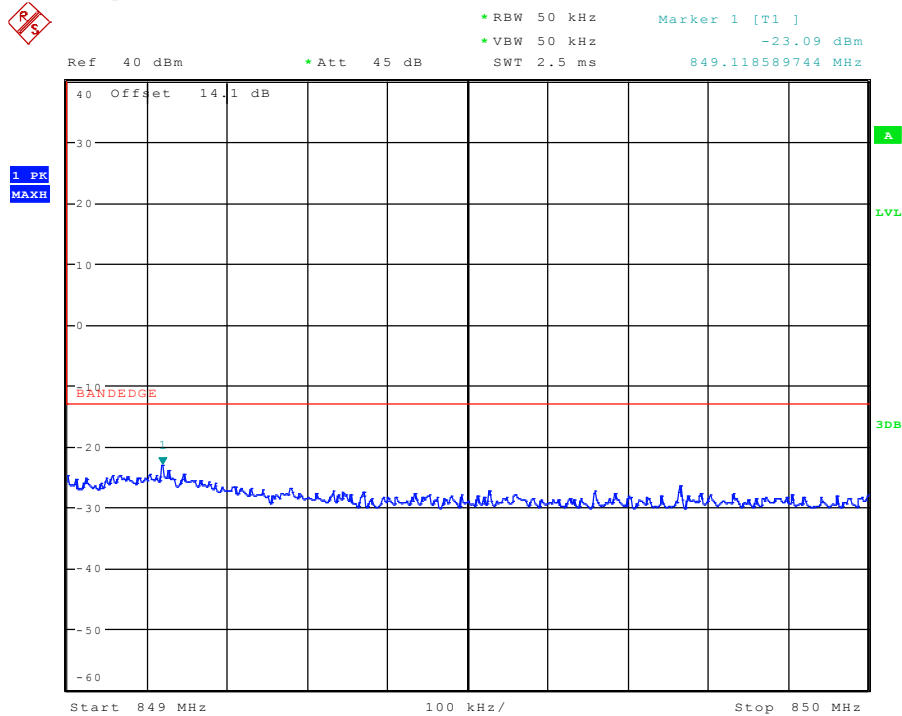
Date: 29.MAR.2010 15:08:48

### Lower Band Edge UMTS FDD5



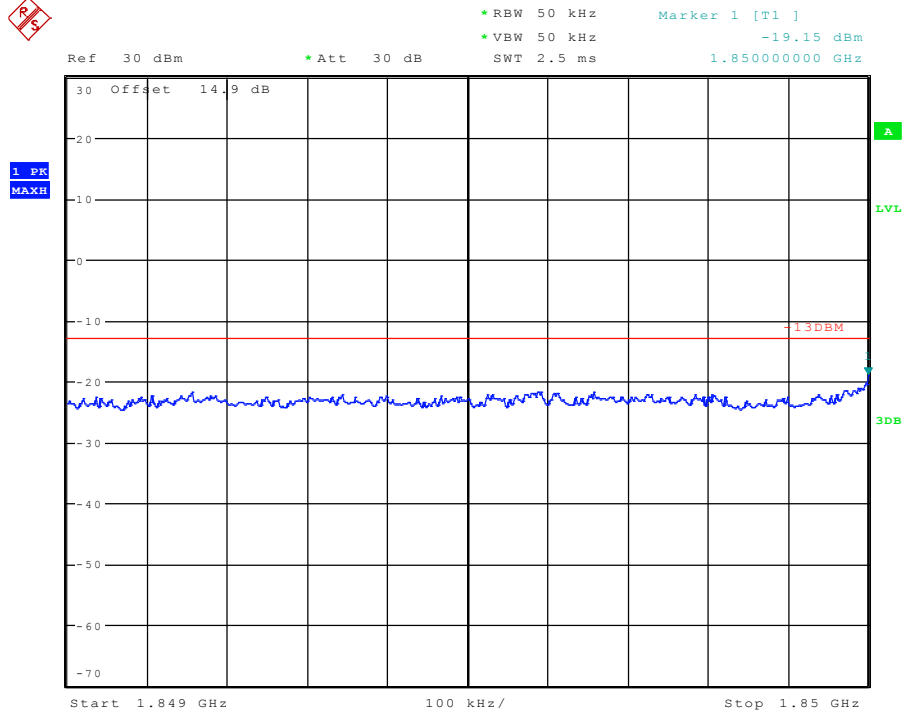
Date: 29.MAR.2010 16:30:52

### Upper Band Edge UMTS FDD5



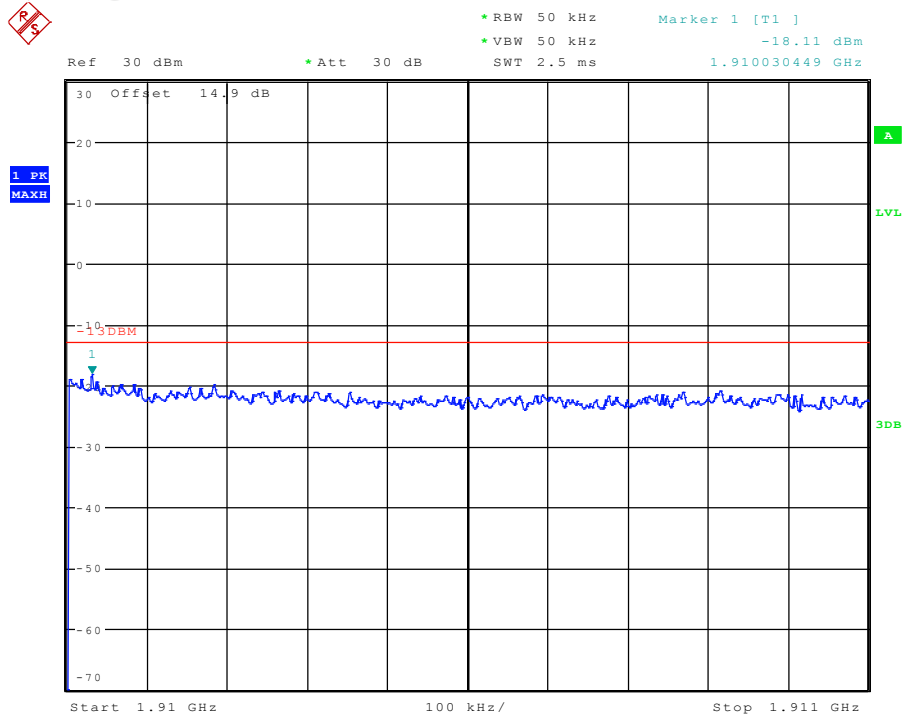
Date: 29.MAR.2010 16:30:00

### Lower Band Edge UMTS FDD2



Date: 29.MAR.2010 15:53:42

### Upper Band Edge UMTS FDD2



Date: 29.MAR.2010 15:55:00

## **5.5 Spurious Emissions Radiated**

### **5.5.1 References**

FCC: CFR Part 2.1053, CFR Part 22.917, CFR Part 24.238

### **5.5.2 FCC 2.1053 Measurements required: Field strength of spurious radiation.**

Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission.

### **5.5.3 Limits:**

(a) *Out of band emissions.* 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.

For all power levels +30dBm to 0dBm, this becomes a constant specification of -13dBm.

#### **5.5.3.1 FCC 22.917 Emission limitations for cellular equipment.**

The rules in this section govern the spectral characteristics of emissions in the Cellular Radiotelephone Service.

(b) *Measurement procedure.* Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz of 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

#### **5.5.3.2 FCC 24.238 Emission limitations for Broadband PCS equipment.**

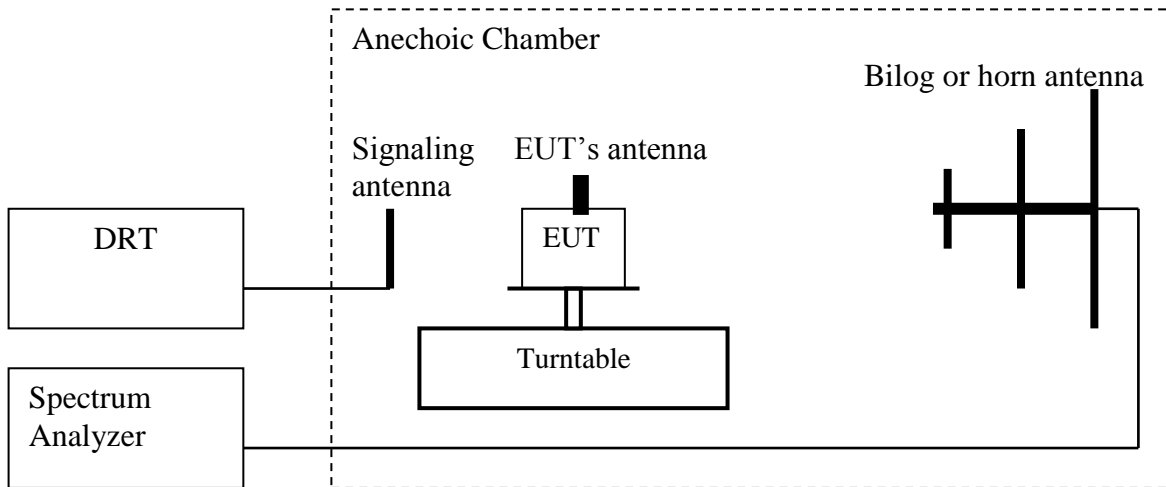
The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(b) *Measurement procedure.* Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz of 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.



#### 5.5.4 Radiated out of band measurement procedure:

Ref: TIA-603C 2004- 2.2.12 Unwanted emissions: Radiated Spurious



1. Connect the equipment as shown in the above diagram with the EUT's antenna in a horizontal orientation.
2. Adjust the settings of the Digital RadioCommunication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to measure peak hold with the required settings.
4. Place the measurement antenna in a horizontal orientation. Rotate the EUT 360°. Raise the measurement antenna up to 4 meters in 0.5 meters increments and rotate the EUT 360° at each height to maximize all emissions. Measure and record all spurious emissions (**LVL**) up to the tenth harmonic of the carrier frequency.
5. Replace the EUT with a horizontally polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS**). **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the level of spurious emissions using the following equation:  
**Spurious** (dBm) = **LVL** (dBm) + **LOSS** (dB):
8. Repeat steps 4, 5 and 6 with all antennas vertically polarized.
9. Determine the level of spurious emissions using the following equation:  
**Spurious** (dBm) = **LVL** (dBm) + **LOSS** (dB):
10. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.  
(**Note:** Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4 and 7 above are performed with test software.)

**Spectrum analyzer settings: RBW=VBW=1MHz**

**Measurement Survey:**

The site is constructed in accordance with ANSI C63.4 requirements and is recognized by the FCC to be in compliance for a 3m site. The spectrum is scanned from 30MHz to the 10<sup>th</sup> harmonic of the highest frequency generated by the EUT.

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the GSM-850 & PCS-1900 bands. It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the GSM-850 & PCS-1900 band into any of the other blocks respectively. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

Radiated emission measurements were made only with Circuit Switched mode GMSK modulation because this mode represents the worse case emission for all the modulations for GSM. All measurements are done in horizontal and vertical antenna polarization; and for three orientations of the EUT. The plots show the worst case where it is not indicated otherwise. Unless mentioned otherwise, the peaks in the plots are from the carrier frequency.

Radiated emissions measurements were made also with UMTS FDD mode.

**5.5.5 Radiated out of band emissions results on EUT- Transmit Mode:**

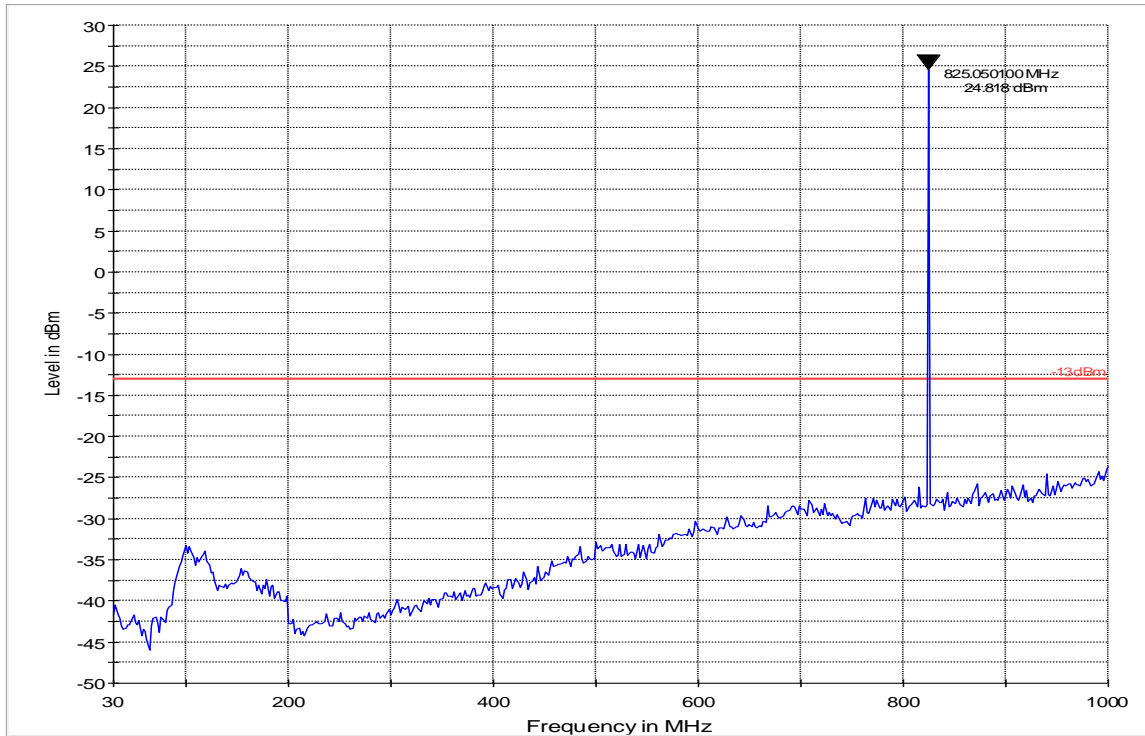
**5.5.5.1 Test Results Transmitter Spurious Emission GSM850:**

| Harmonic         | Tx ch-128<br>Freq.<br>(MHz) | Level<br>(dBm) | Tx ch-190<br>Freq.<br>(MHz) | Level<br>(dBm) | Tx ch-251<br>Freq.<br>(MHz) | Level<br>(dBm) |
|------------------|-----------------------------|----------------|-----------------------------|----------------|-----------------------------|----------------|
| 1                | 824.2                       | -              | 836.6                       | -              | 848.8                       | -              |
| 2                | 1648.4                      | NF             | 1673.2                      | NF             | 1697.6                      | NF             |
| 3                | 2472.6                      | -35            | 2509.8                      | NF             | 2546.4                      | -37            |
| 4                | 3296.8                      | NF             | 3346.4                      | NF             | 3395.2                      | NF             |
| 5                | 4121                        | NF             | 4183                        | NF             | 4244                        | NF             |
| 6                | 4945.2                      | NF             | 5019.6                      | NF             | 5092.8                      | NF             |
| 7                | 5769.4                      | NF             | 5856.2                      | NF             | 5941.6                      | NF             |
| 8                | 6593.6                      | NF             | 6692.8                      | NF             | 6790.4                      | NF             |
| 9                | 7417.8                      | NF             | 7529.4                      | NF             | 7639.2                      | NF             |
| 10               | 8242                        | NF             | 8366                        | NF             | 8488                        | NF             |
| NF = Noise Floor |                             |                |                             |                |                             |                |

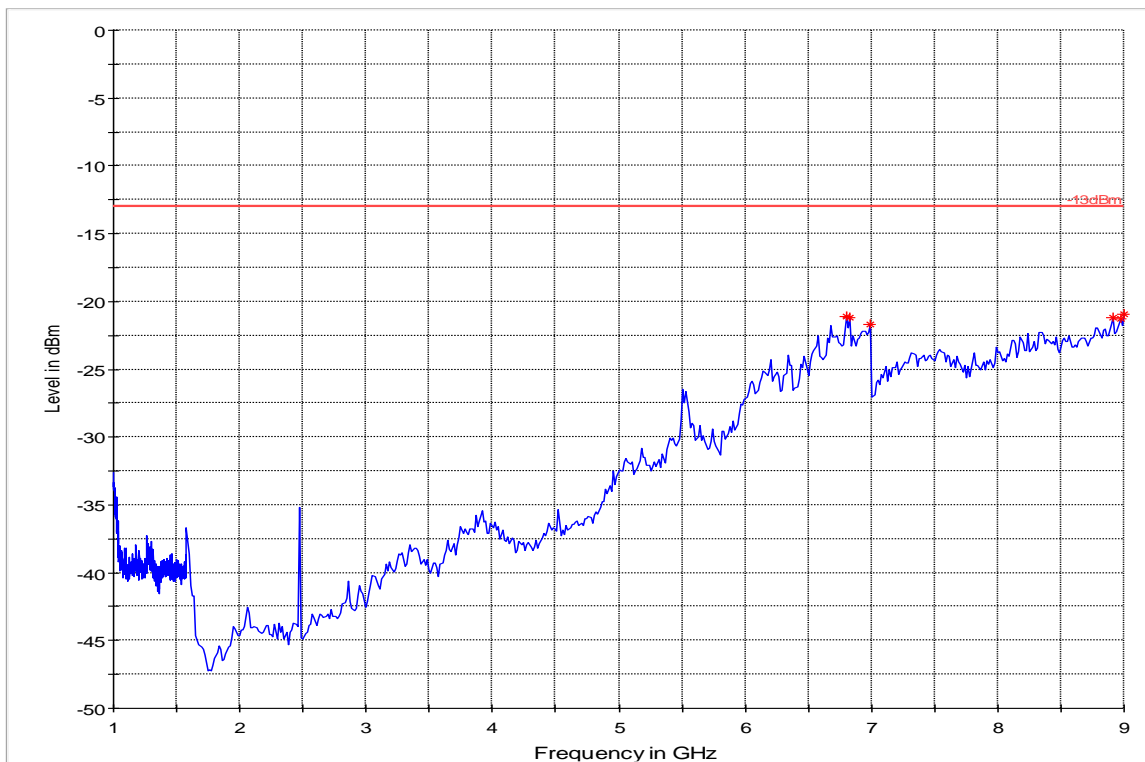
**Legend for the plots:**

-13dBm Limit Line      Preview Result 1

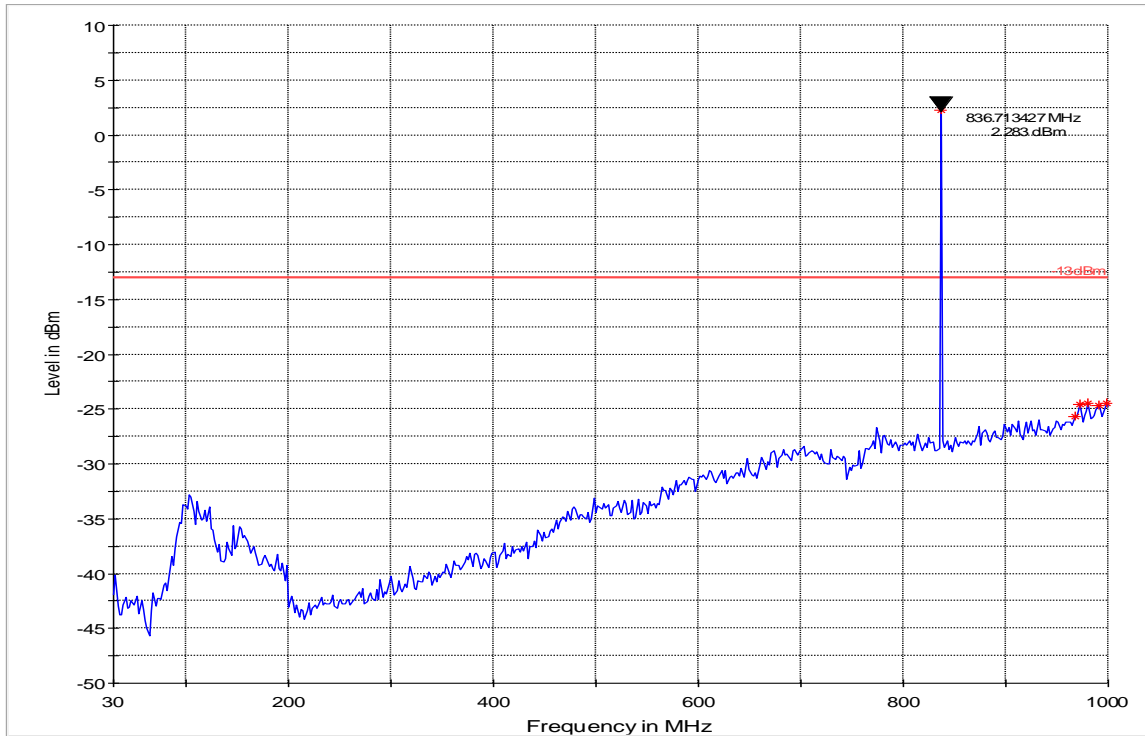
**Radiated Spurious Emissions (GSM-850) Tx: Low Channel**  
**Test results 30M-1GHz**



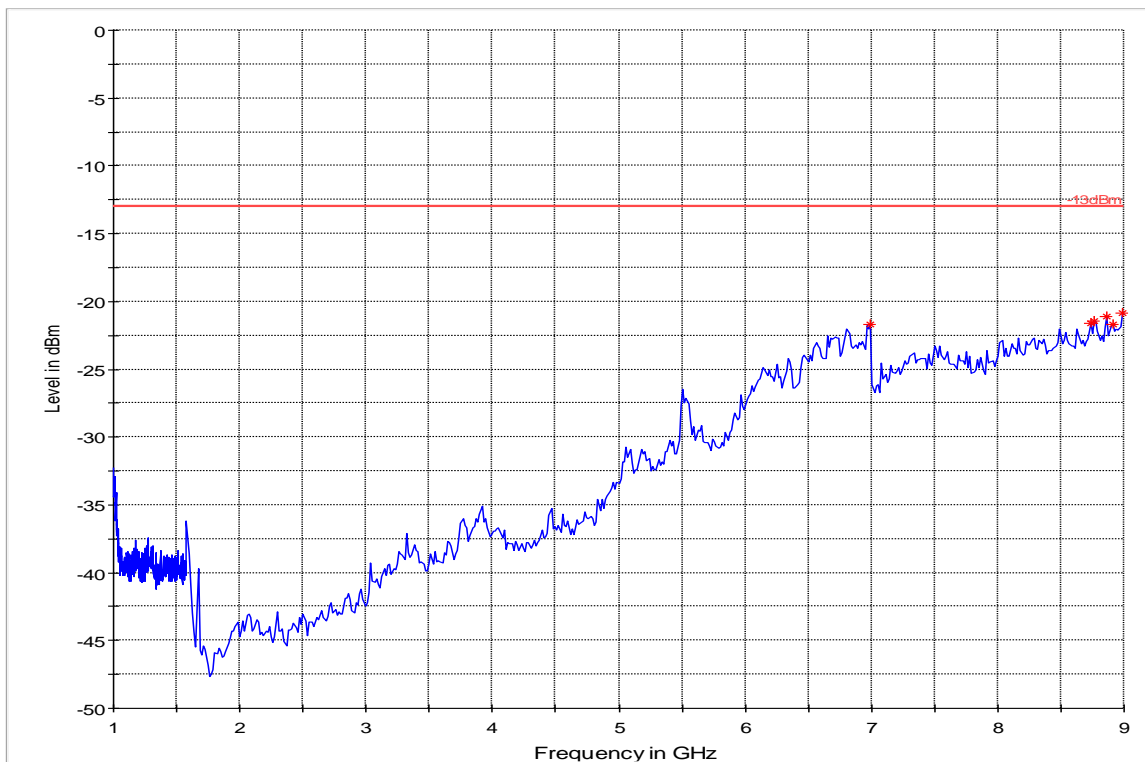
**Test results 1GHz-9GHz**



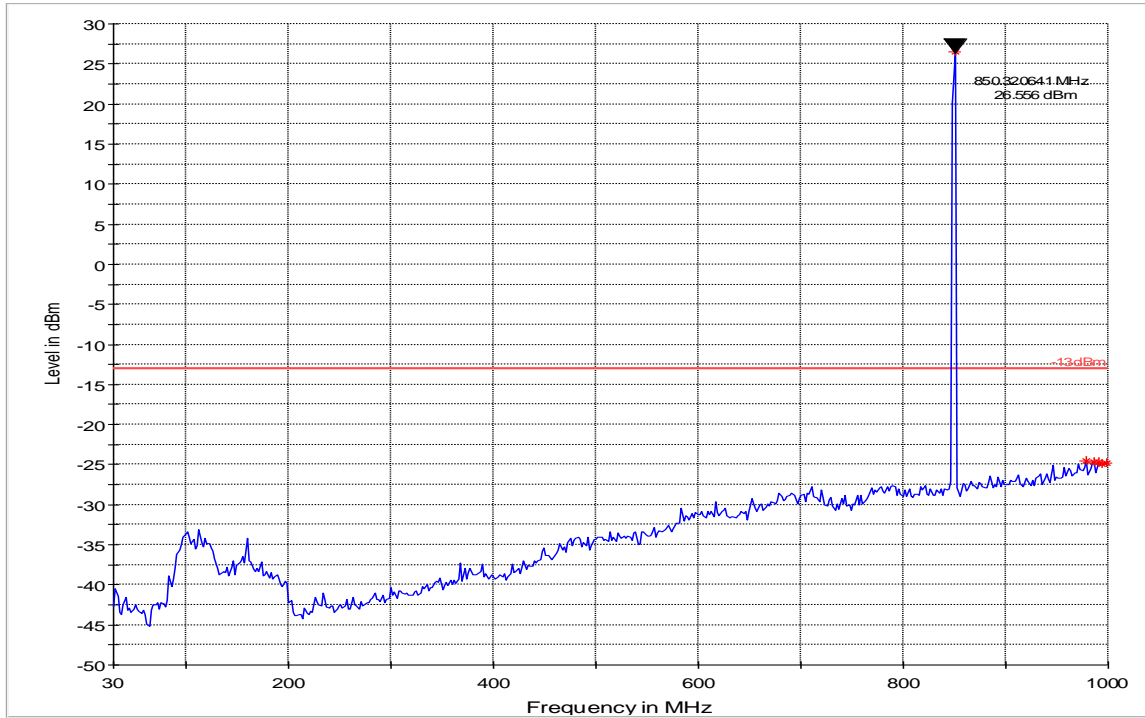
**Radiated Spurious Emissions (GSM-850) Tx: Mid Channel**  
**Test results 30M-1GHz**



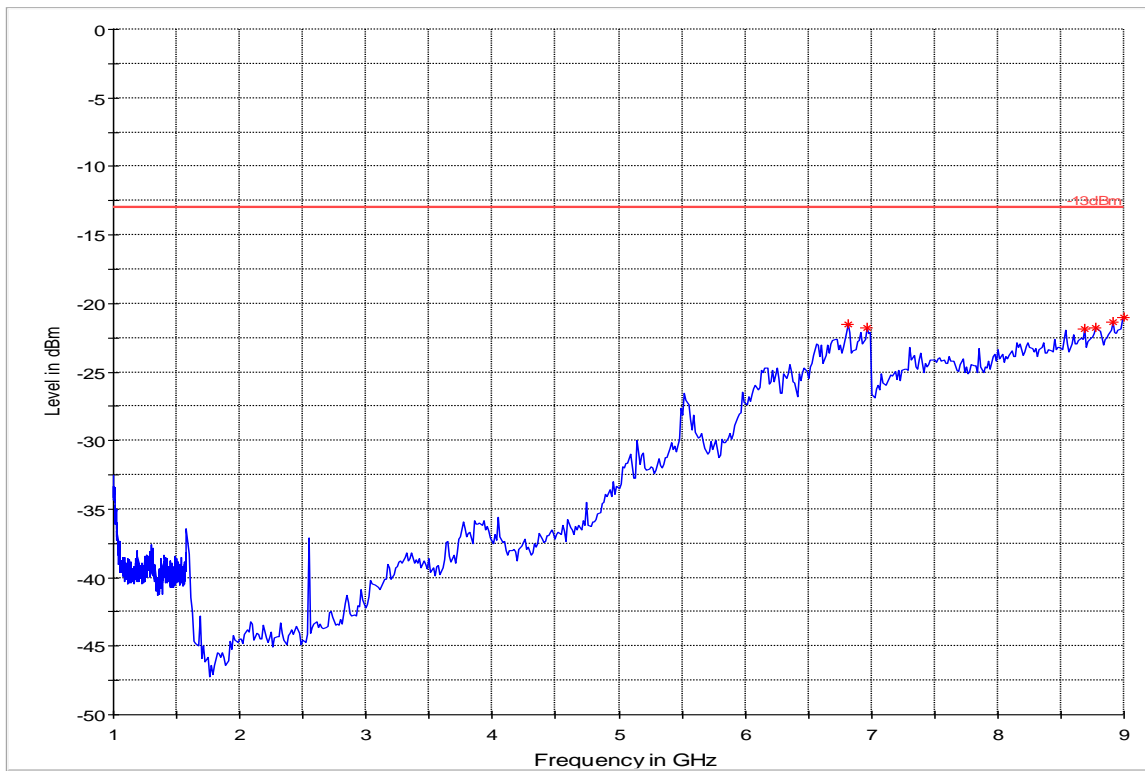
**Test results 1GHz-9GHz**



**Radiated Spurious Emissions (GSM-850) Tx: High Channel**  
**Test results 30M-1GHz**



**Test results 1GHz-9GHz**



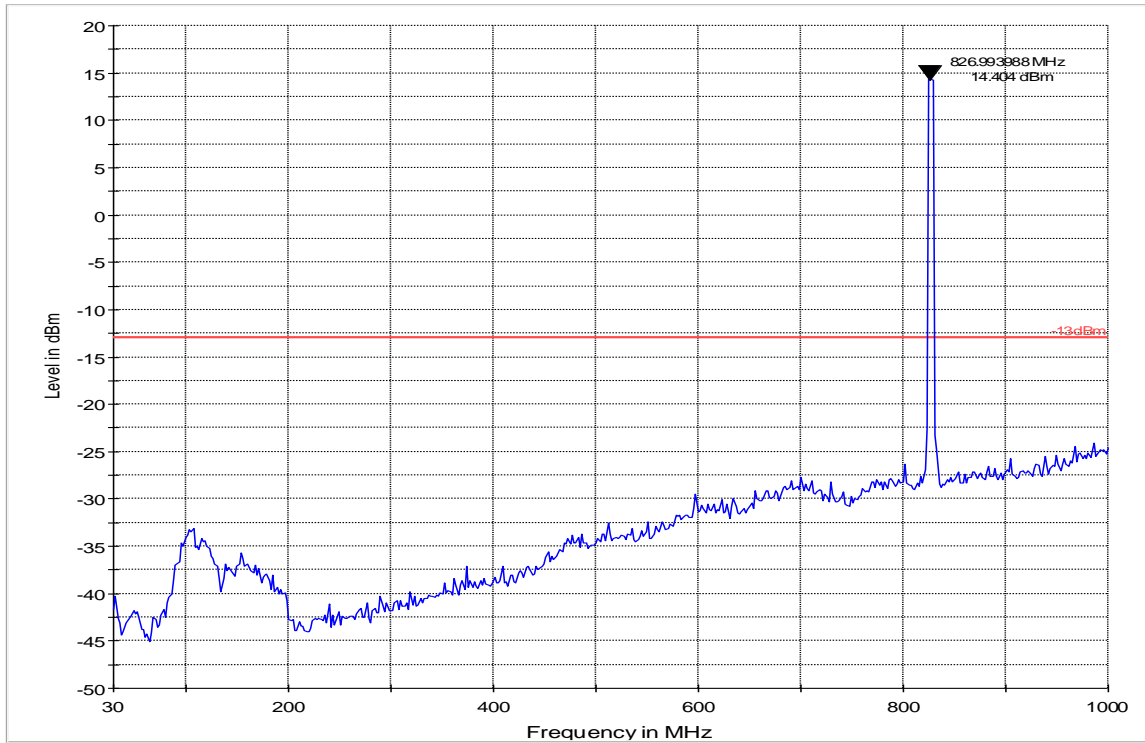
**5.5.5.2 Test Results Transmitter Spurious Emission UMTS FDDV**

| Harmonic        | Tx ch-4132<br>Freq.<br>(MHz) | Level<br>(dBm) | Tx ch-4183<br>Freq.<br>(MHz) | Level<br>(dBm) | Tx ch-4233<br>Freq.<br>(MHz) | Level<br>(dBm) |
|-----------------|------------------------------|----------------|------------------------------|----------------|------------------------------|----------------|
| 1               | 826.4                        | -              | 836.6                        | -              | 846.6                        | -              |
| 2               | 1652.8                       | NF             | 1673.2                       | NF             | 1693.2                       | NF             |
| 3               | 2479.2                       | NF             | 2509.8                       | NF             | 2539.8                       | NF             |
| 4               | 3305.6                       | NF             | 3346.4                       | NF             | 3386.4                       | NF             |
| 5               | 4132                         | NF             | 4183                         | NF             | 4233                         | NF             |
| 6               | 4958.4                       | NF             | 5019.6                       | NF             | 5079.6                       | NF             |
| 7               | 5784.8                       | NF             | 5856.2                       | NF             | 5926.2                       | NF             |
| 8               | 6611.2                       | NF             | 6692.8                       | NF             | 6772.8                       | NF             |
| 9               | 7437.6                       | NF             | 7529.4                       | NF             | 7619.4                       | NF             |
| 10              | 8264                         | NF             | 8366                         | NF             | 8466                         | NF             |
| NF= Noise Floor |                              |                |                              |                |                              |                |

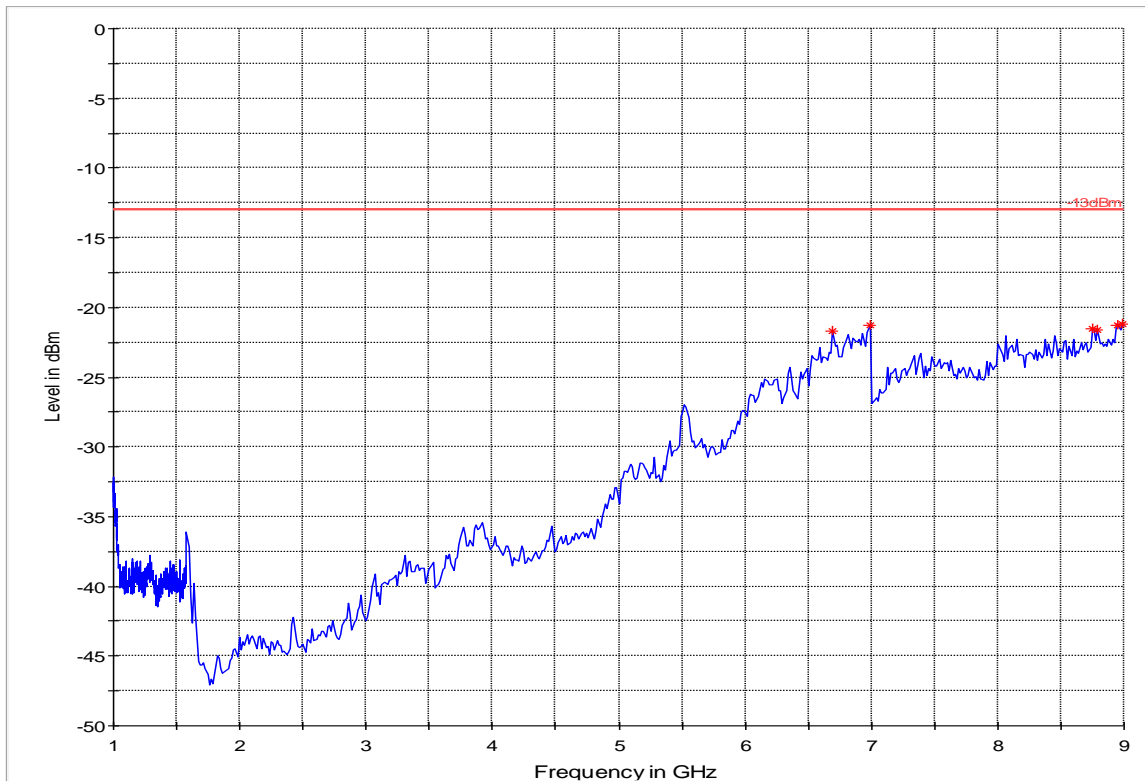
**Legend for the plots:**

 -13dBmLimitLine       PreviewResult1

**Radiated Spurious Emissions (UMTS Band 5) Tx: Low Channel**  
**Test results 30M-1GHz**

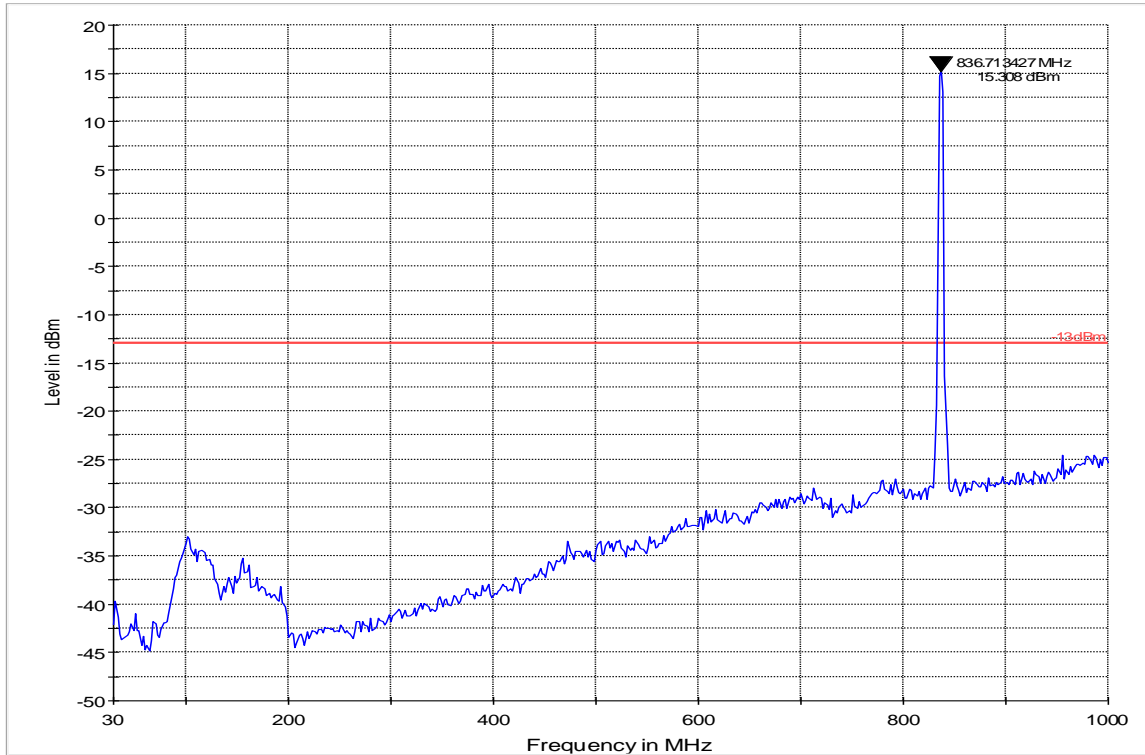


**Test results 1GHz-9GHz**

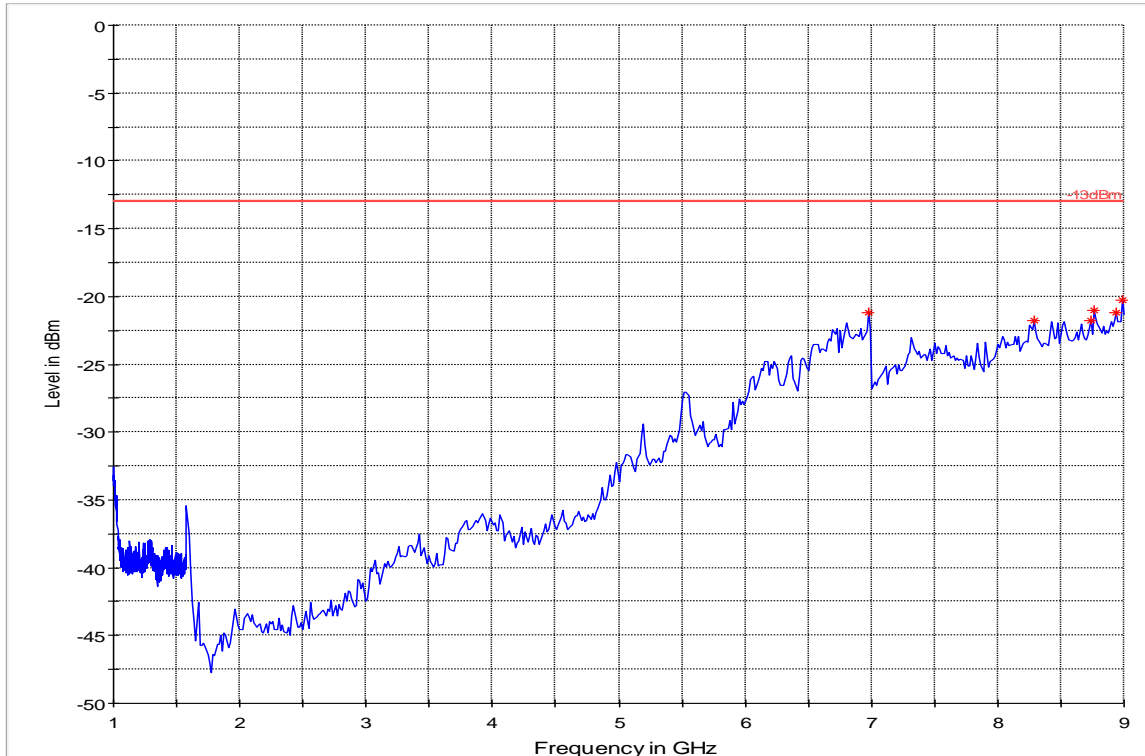




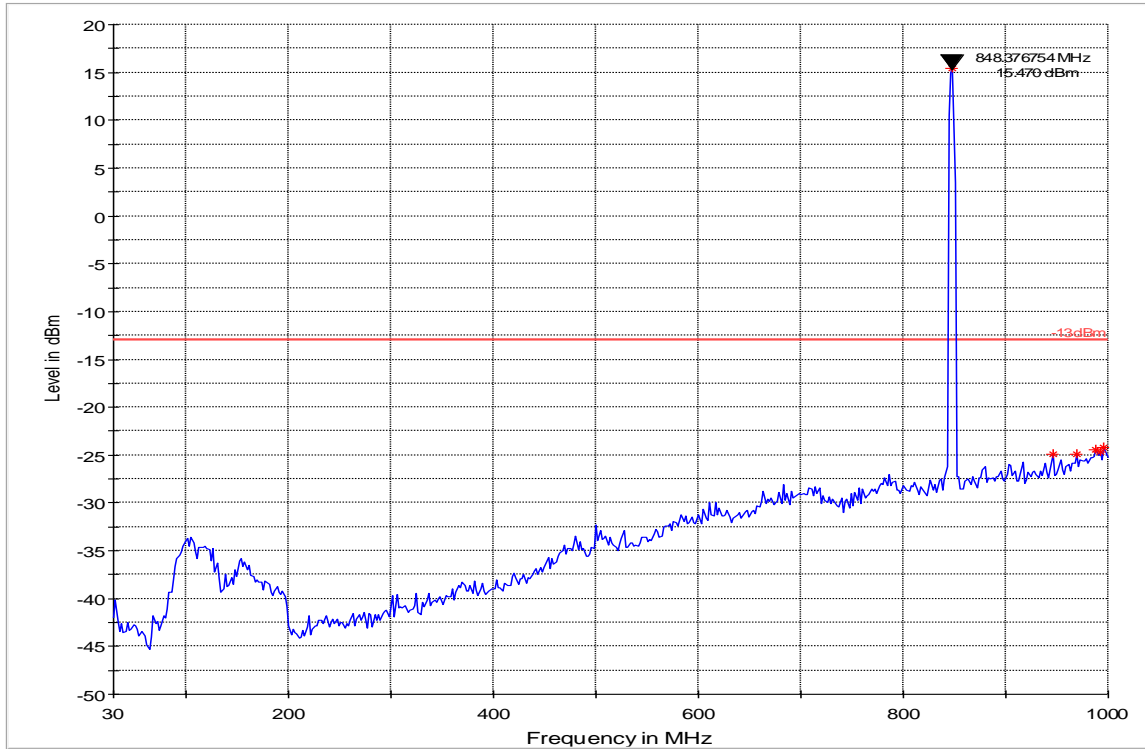
**Radiated Spurious Emissions (UMTS Band 5) Tx: Mid Channel**  
**Test results 30M-1GHz**



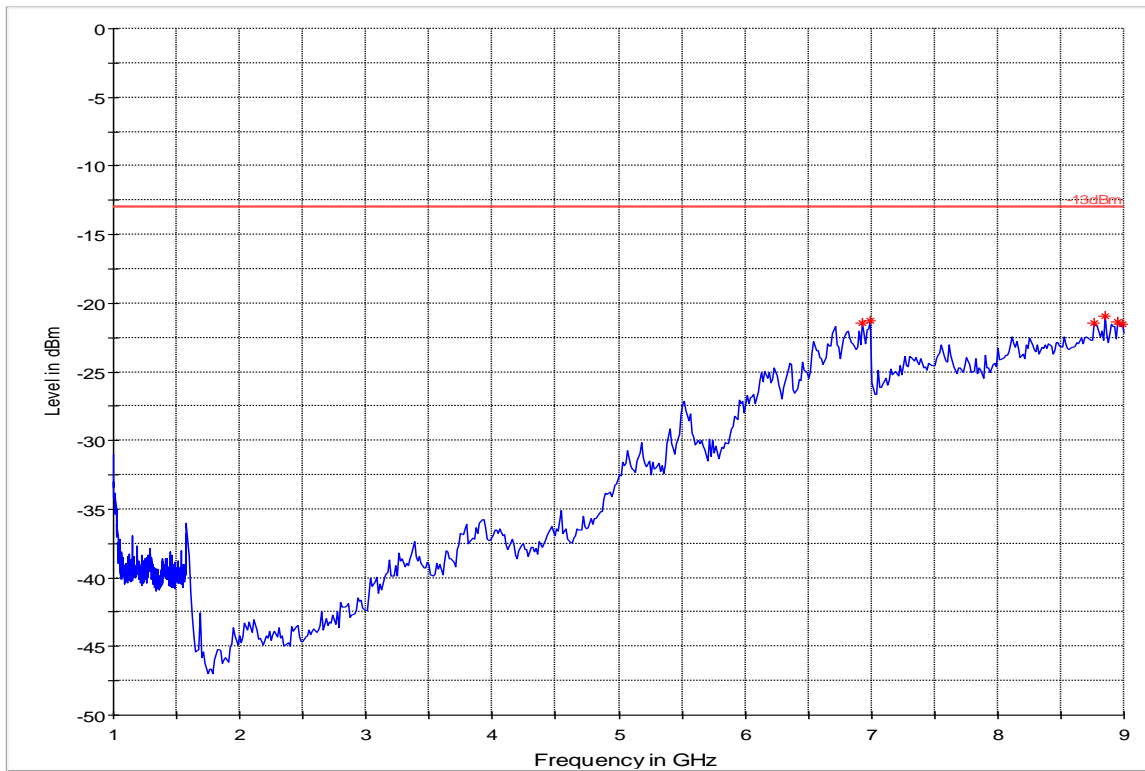
**Test results 1GHz-9GHz**



**Radiated Spurious Emissions (UMTS Band 5) Tx: High Channel**  
**Test results 30M-1GHz**



**Test results 1GHz-9GHz**



**5.5.5.3 Test Results Transmitter Spurious Emission PCS-1900:**

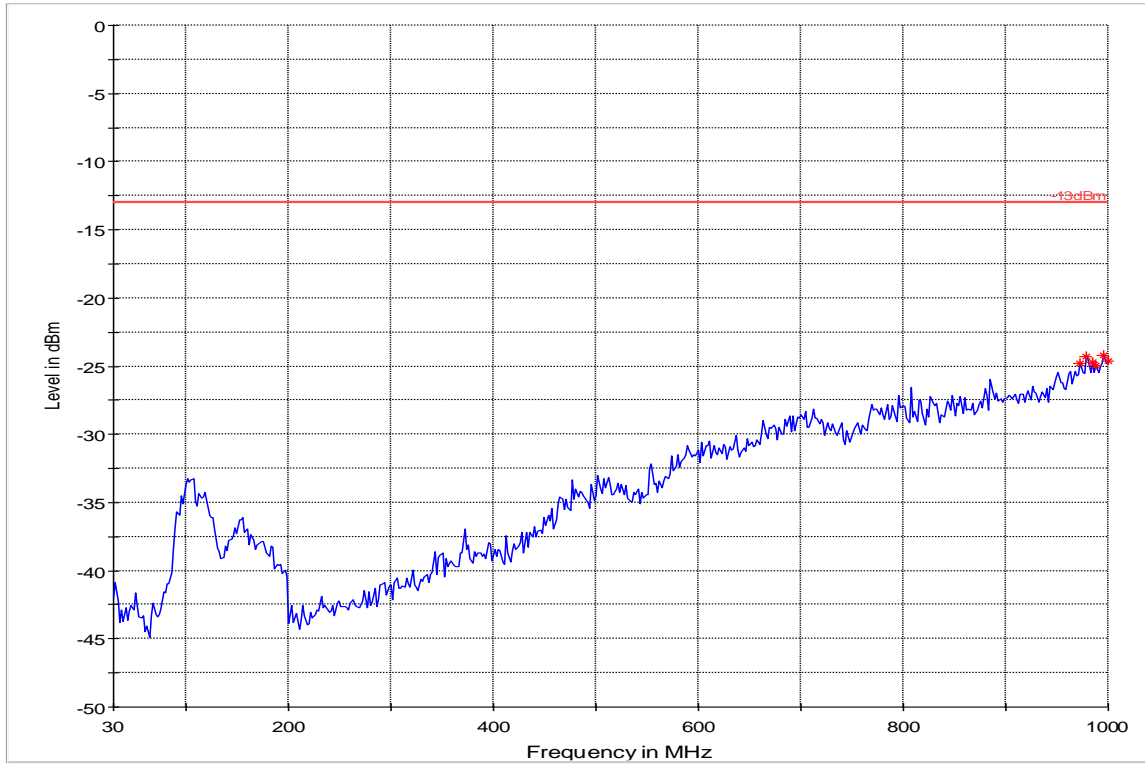
| Harmonic         | Tx ch-512 Freq.(MHz) | Level (dBm) | Tx ch-661 Freq. (MHz) | Level (dBm) | Tx ch-810 Freq. (MHz) | Level (dBm) |
|------------------|----------------------|-------------|-----------------------|-------------|-----------------------|-------------|
| 1                | 1850.2               | -           | 1880.0                | -           | 1909.8                | -           |
| 2                | 3700.4               | NF          | 3760                  | NF          | 3819.6                | NF          |
| 3                | 5550.6               | NF          | 5640                  | NF          | 5729.4                | NF          |
| 4                | 7400.8               | NF          | 7520                  | NF          | 7639.2                | NF          |
| 5                | 9251                 | NF          | 9400                  | NF          | 9549                  | NF          |
| 6                | 11101.2              | NF          | 11280                 | NF          | 11458.8               | NF          |
| 7                | 12951.4              | NF          | 13160                 | NF          | 13368.6               | NF          |
| 8                | 14801.6              | NF          | 15040                 | NF          | 15278.4               | NF          |
| 9                | 16651.8              | NF          | 16920                 | NF          | 17188.2               | NF          |
| 10               | 18502                | NF          | 18800                 | NF          | 19098                 | NF          |
| NF = Noise Floor |                      |             |                       |             |                       |             |

**Legend for the plots:**

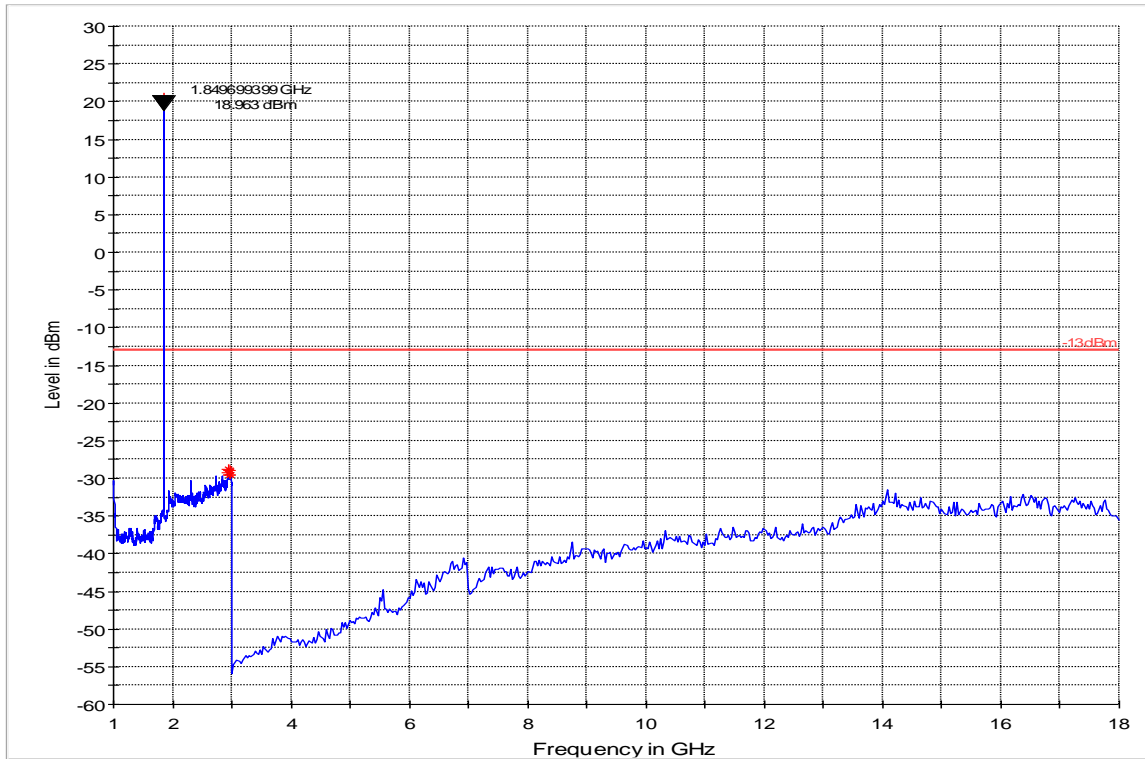
-13dBm Limit Line

Preview Result 1

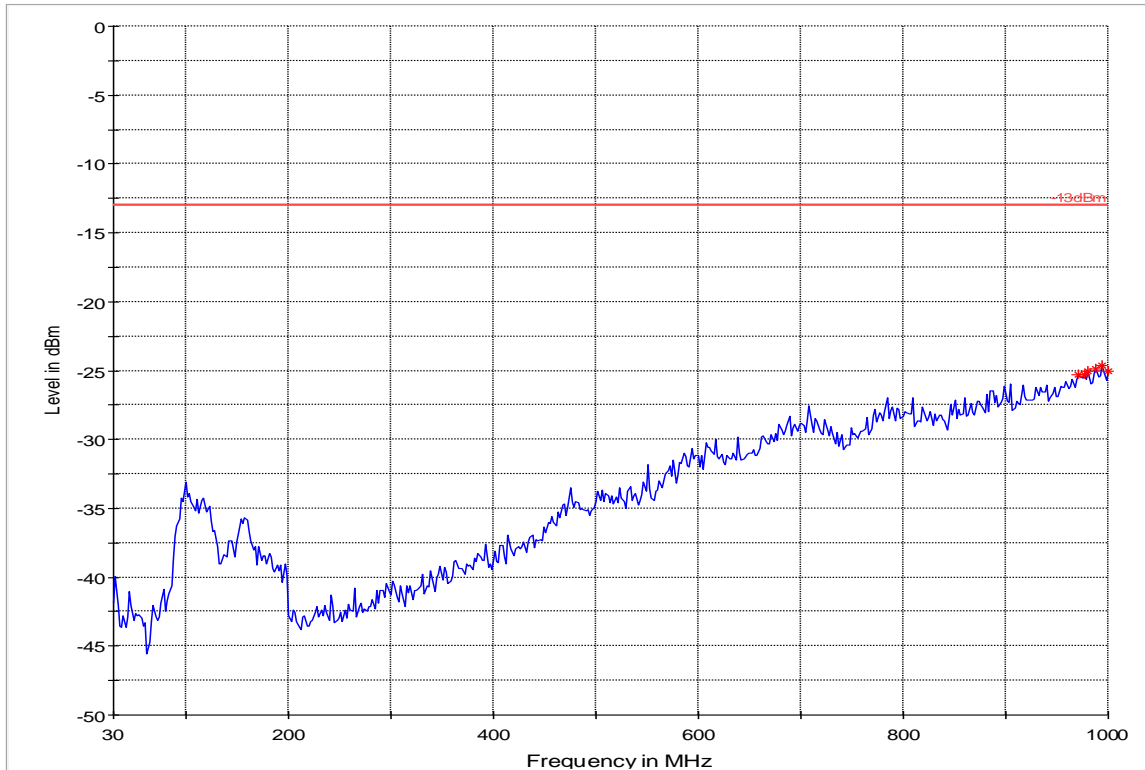
**Radiated Spurious Emissions (GSM-1900) Tx: Low Channel**  
**Test results 30M-1GHz**



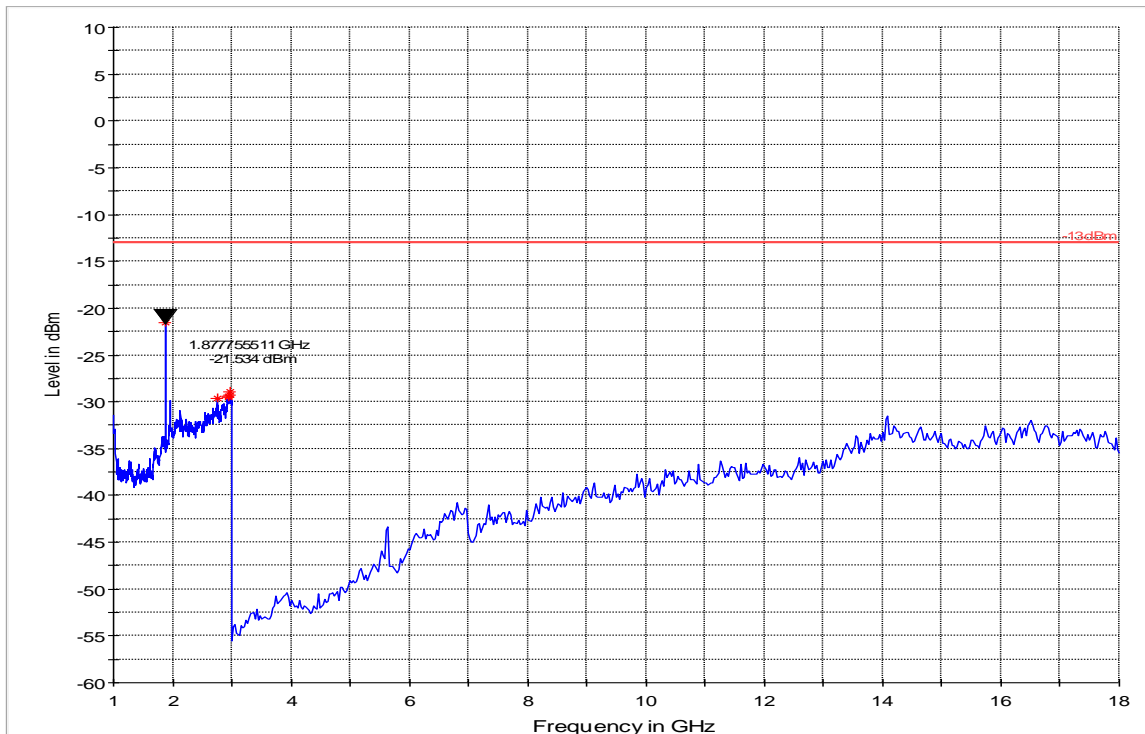
**Test results 1GHz-18GHz**



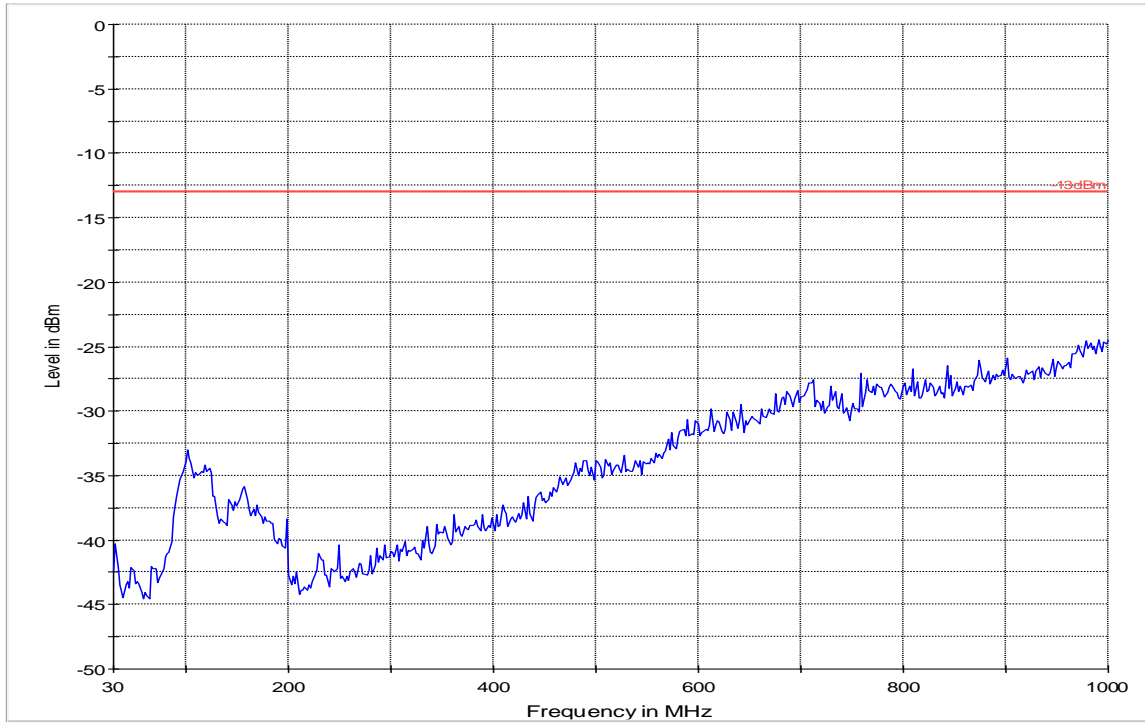
**Radiated Spurious Emissions (GSM-1900) Tx: Mid Channel**  
**Test results 30M-1GHz**



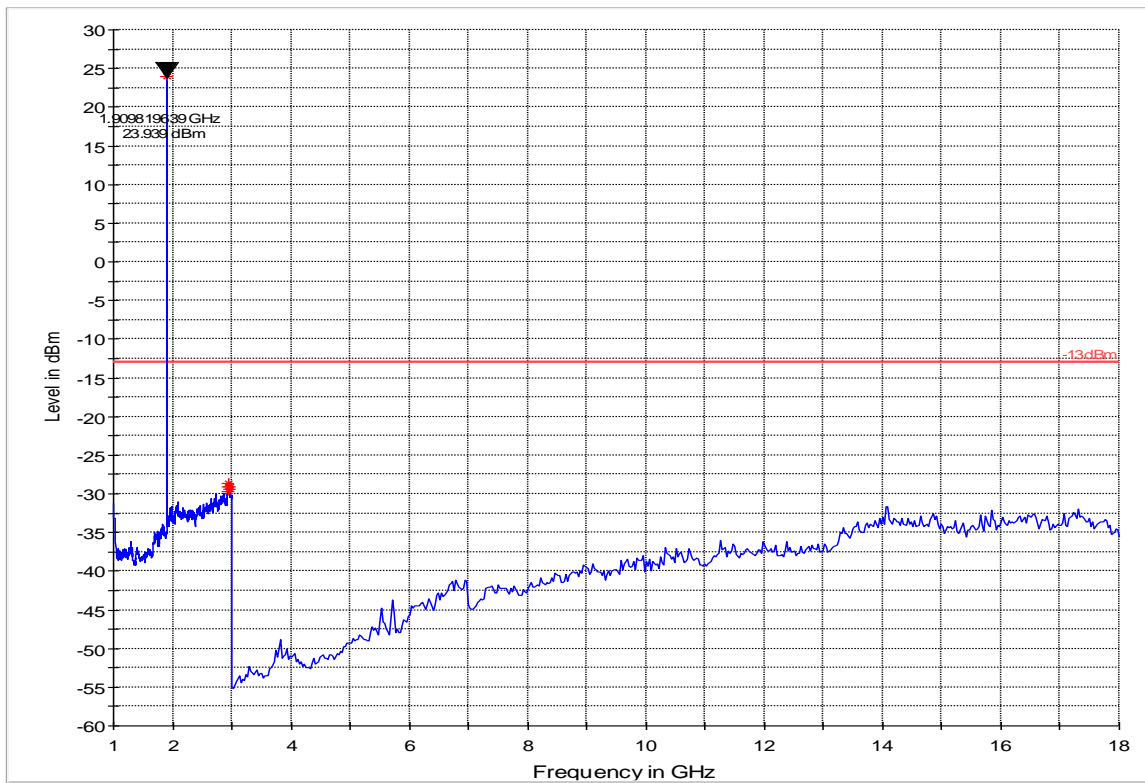
**Test results 1GHz-18GHz**



**Radiated Spurious Emissions (GSM-1900) Tx: High Channel**  
**Test results 30M-1GHz**

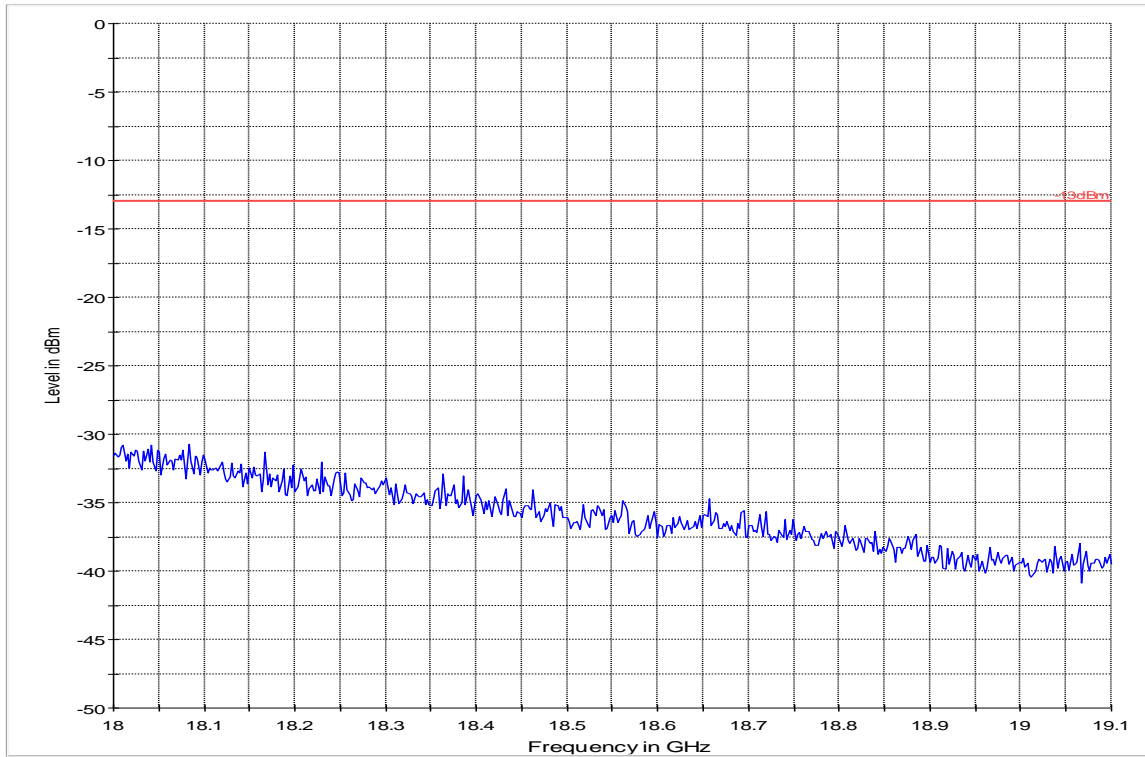


**Test results 1GHz-18GHz**



### Test results 18GHz-19.1GHz


Note: Worst case representation of all channels



**5.5.5.4 Test Results Transmitter Spurious Emission UMTS FDD2:**

| Harmonic        | Tx ch-9262<br>Freq. (MHz) | Level<br>(dBm) | Tx ch-9400<br>Freq.<br>(MHz) | Level<br>(dBm) | Tx ch-9538<br>Freq.<br>(MHz) | Level<br>(dBm) |
|-----------------|---------------------------|----------------|------------------------------|----------------|------------------------------|----------------|
| 1               | 1852.4                    | -              | 1880.0                       | -              | 1907.6                       | -              |
| 2               | 3704.8                    | NF             | 3760                         | NF             | 3815.2                       | NF             |
| 3               | 5557.2                    | NF             | 5640                         | NF             | 5722.8                       | NF             |
| 4               | 7409.6                    | NF             | 7520                         | NF             | 7630.4                       | NF             |
| 5               | 9262                      | NF             | 9400                         | NF             | 9538                         | NF             |
| 6               | 11114.4                   | NF             | 11280                        | NF             | 11445.6                      | NF             |
| 7               | 12966.8                   | NF             | 13160                        | NF             | 13353.2                      | NF             |
| 8               | 14819.2                   | NF             | 15040                        | NF             | 15260.8                      | NF             |
| 9               | 16671.6                   | NF             | 16920                        | NF             | 17168.4                      | NF             |
| 10              | 18524                     | NF             | 18800                        | NF             | 19076                        | NF             |
| NF= Noise Floor |                           |                |                              |                |                              |                |

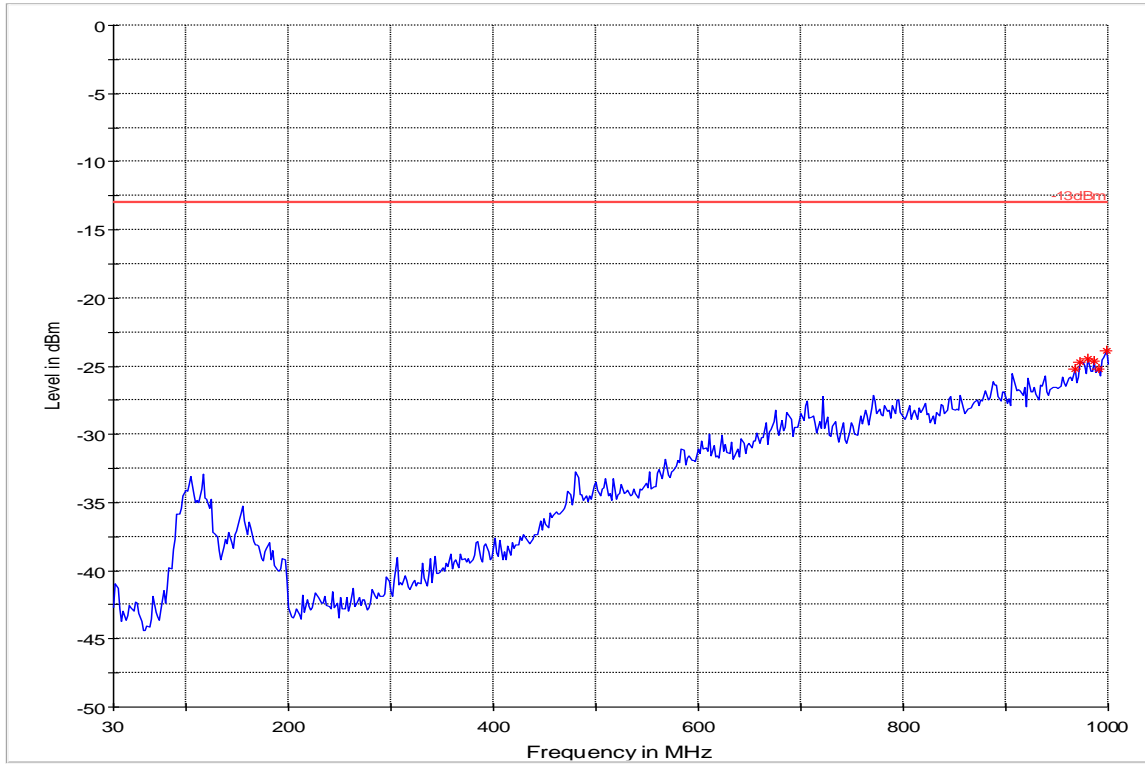
**Legend for the plots:**

 -13dBmLimitLine

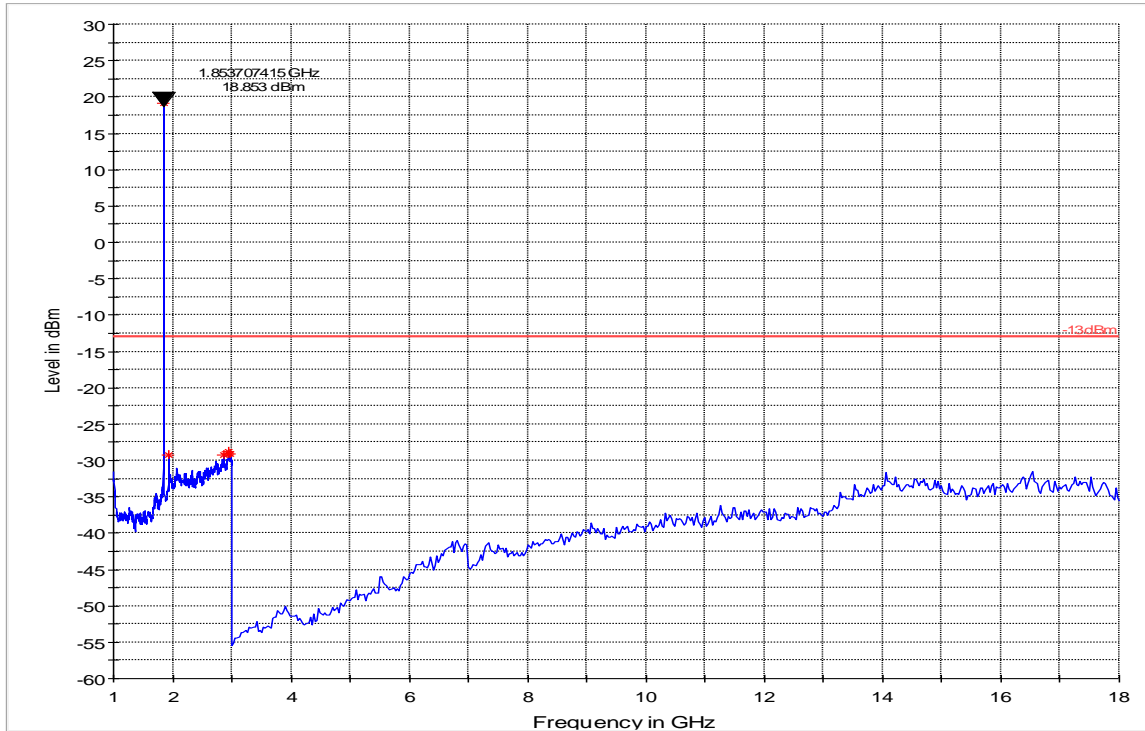
 PreviewResult1



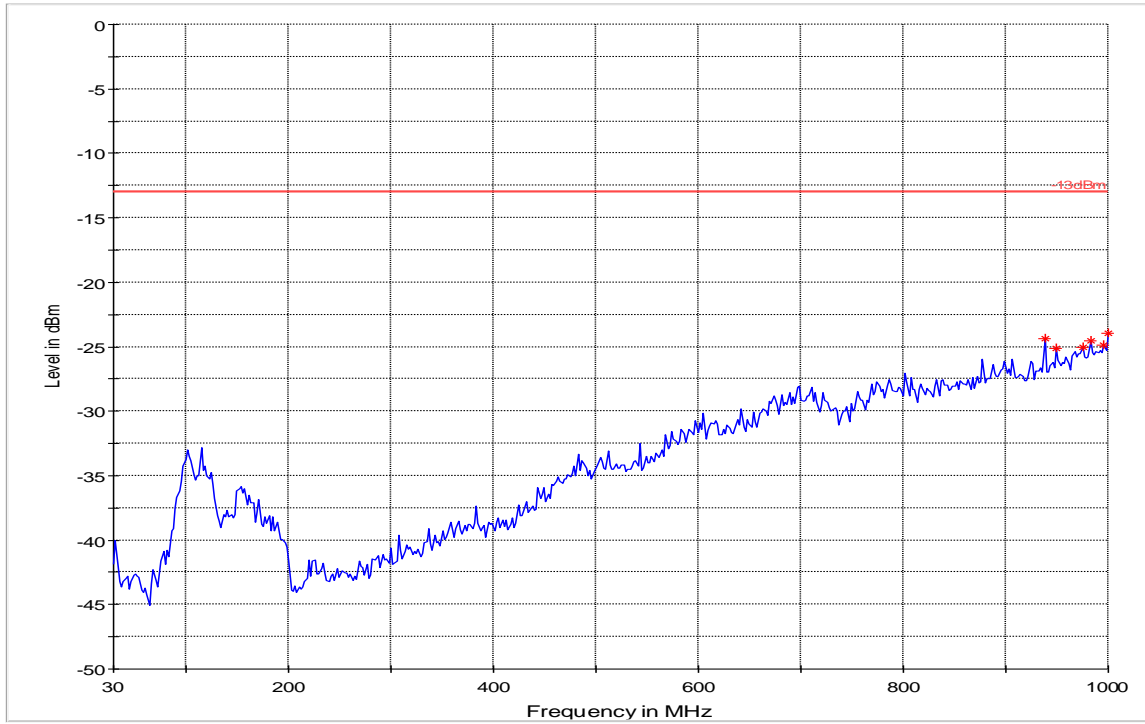
**Radiated Spurious Emissions (UMTS Band 2) Tx: Low Channel**  
**Test results 30M-1GHz**



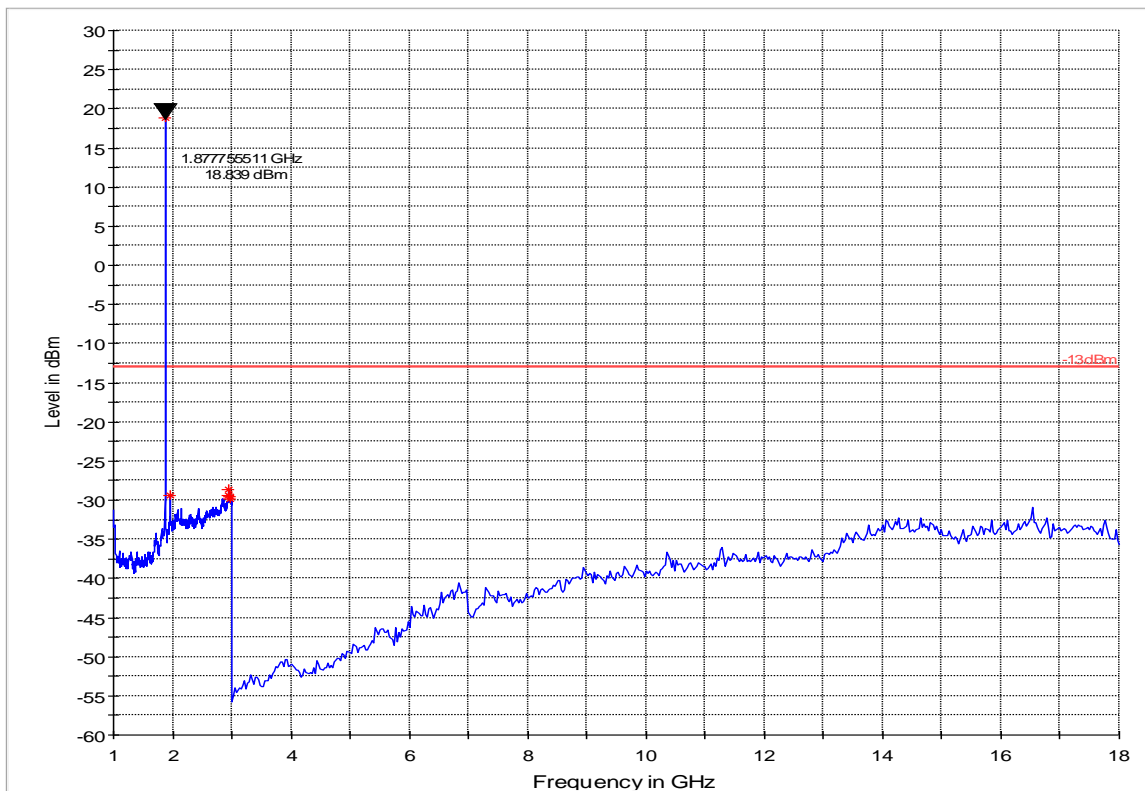
**Test results 1GHz-18GHz**



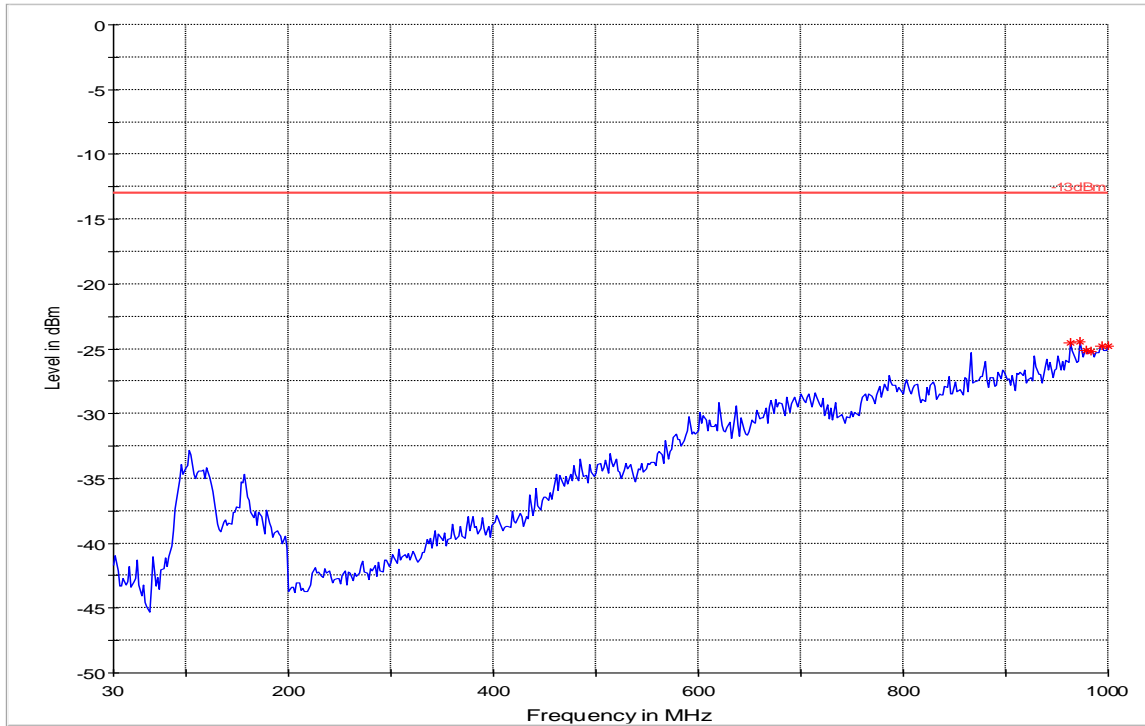
**Radiated Spurious Emissions (UMTS Band 2) Tx: Mid Channel**  
**Test results 30M-1GHz**



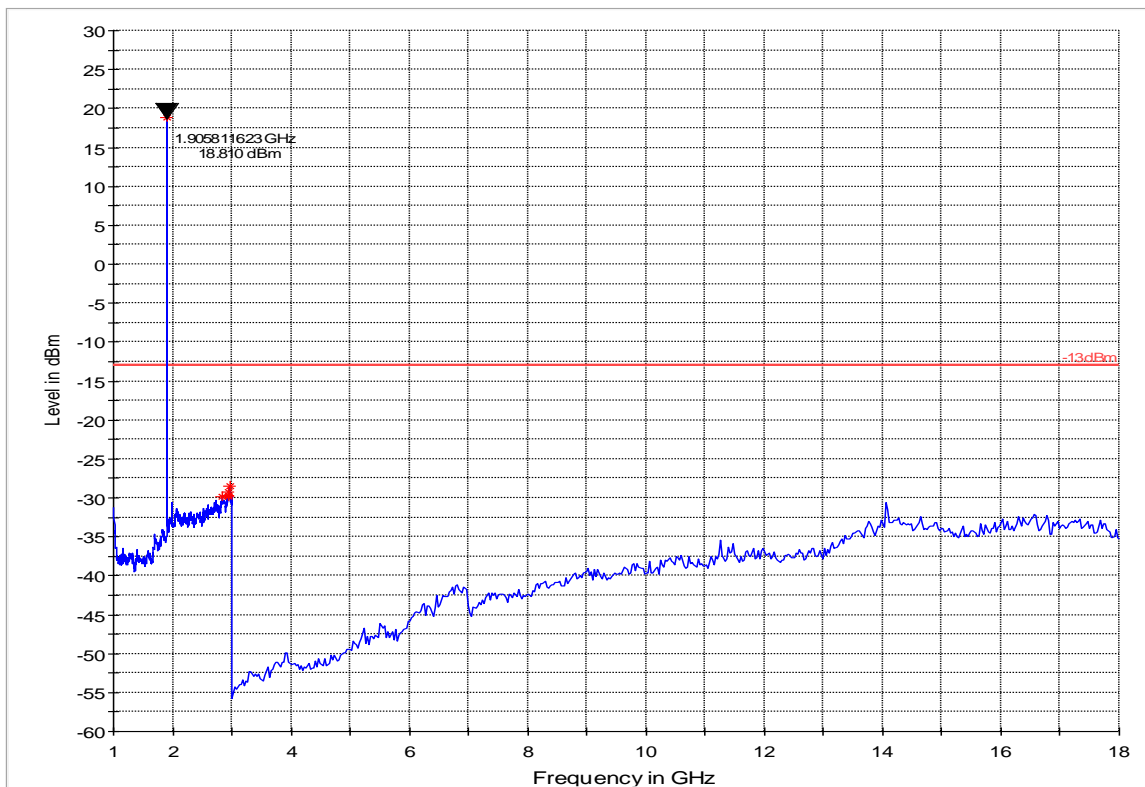
**Test results 1GHz-18GHz**



**Radiated Spurious Emissions (UMTS Band 2) Tx: High Channel**  
**Test results 30M-1GHz**

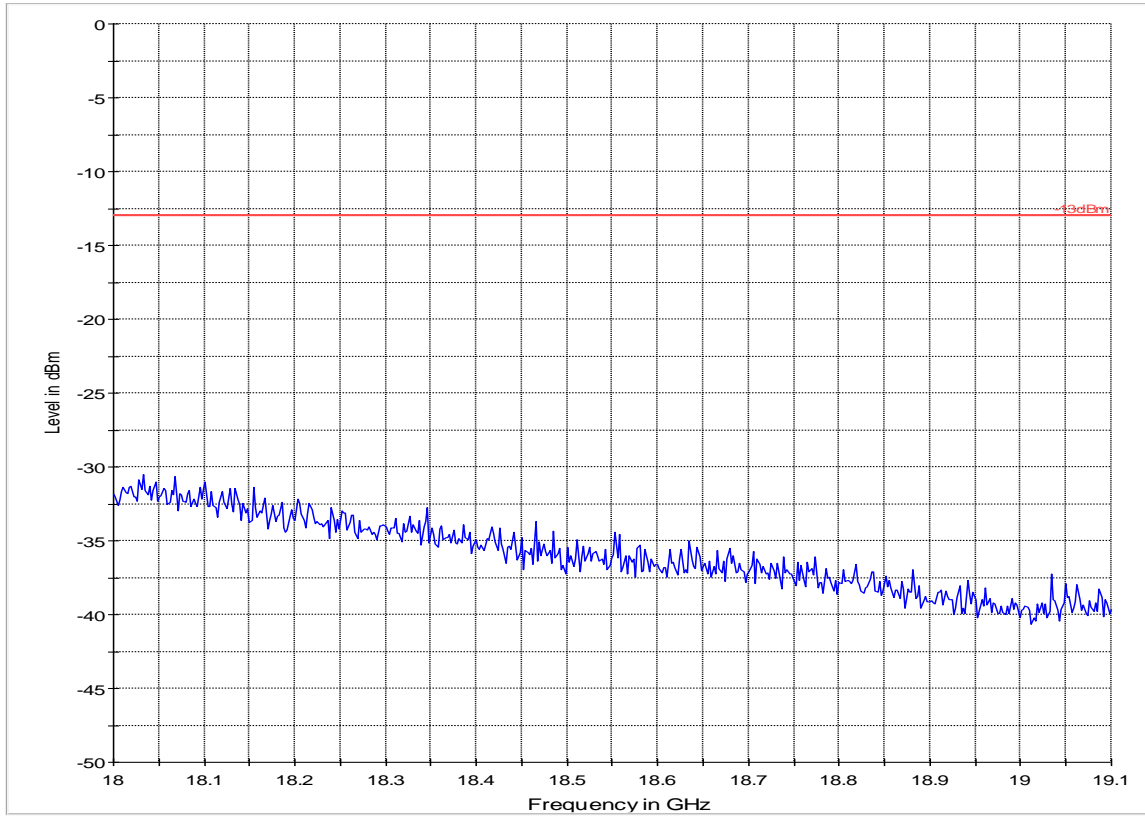


**Test results 1GHz-18GHz**



### Test results 18GHz-19.1GHz

Note: Worst case representation of all channels



**5.5.6 Radiated out of band emissions results on EUT- Receive Mode:**

**5.5.6.1 References**

FCC: CFR Part 15.109, 2.1053

**5.5.6.2 §15.109 Radiated emission limits- Unintentional Radiators:**

(a) Except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

| Frequency of emission (MHz) | Field strength ( $\mu\text{V/m}$ ) |
|-----------------------------|------------------------------------|
| 30–88                       | 100 (40dB $\mu\text{V/m}$ )        |
| 88–216                      | 150 (43.5 dB $\mu\text{V/m}$ )     |
| 216–960                     | 200 (46 dB $\mu\text{V/m}$ )       |
| Above 960                   | 500 (54 dB $\mu\text{V/m}$ )       |

(b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

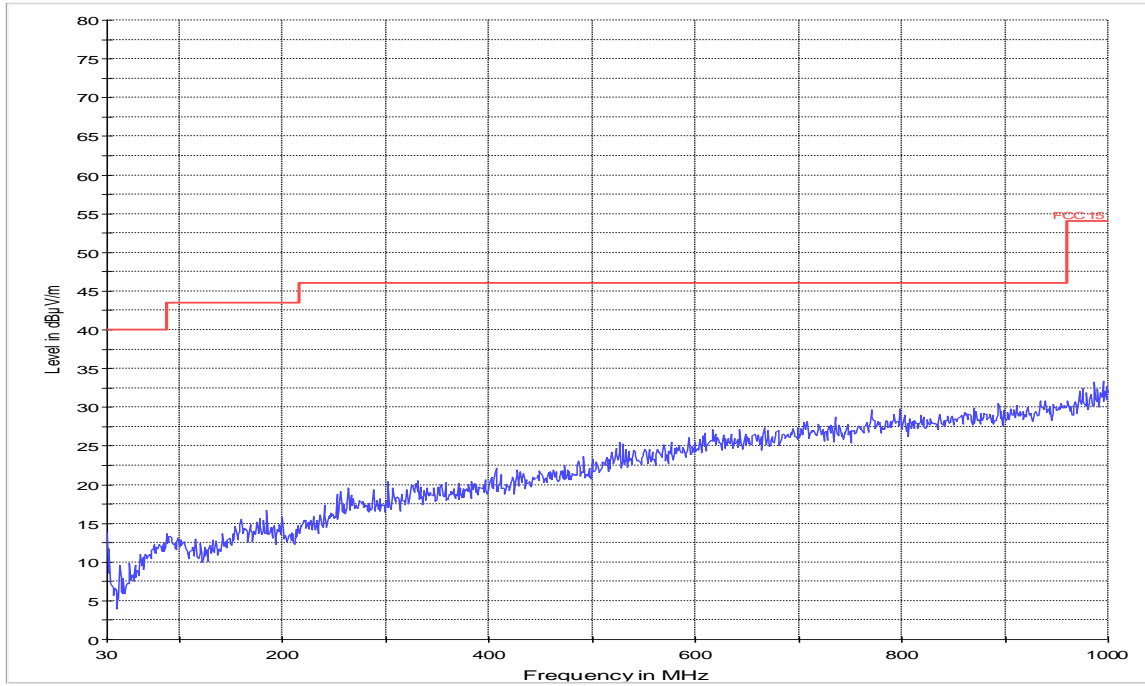
| Frequency of emission (MHz) | Field strength ( $\mu\text{V/m}$ ) |
|-----------------------------|------------------------------------|
| 30–88                       | 90                                 |
| 88–216                      | 150                                |
| 216–960                     | 210                                |
| Above 960                   | 300                                |

**5.5.6.3 Results**

No significant emissions measurable. Plots reported here represent the worse case emissions.

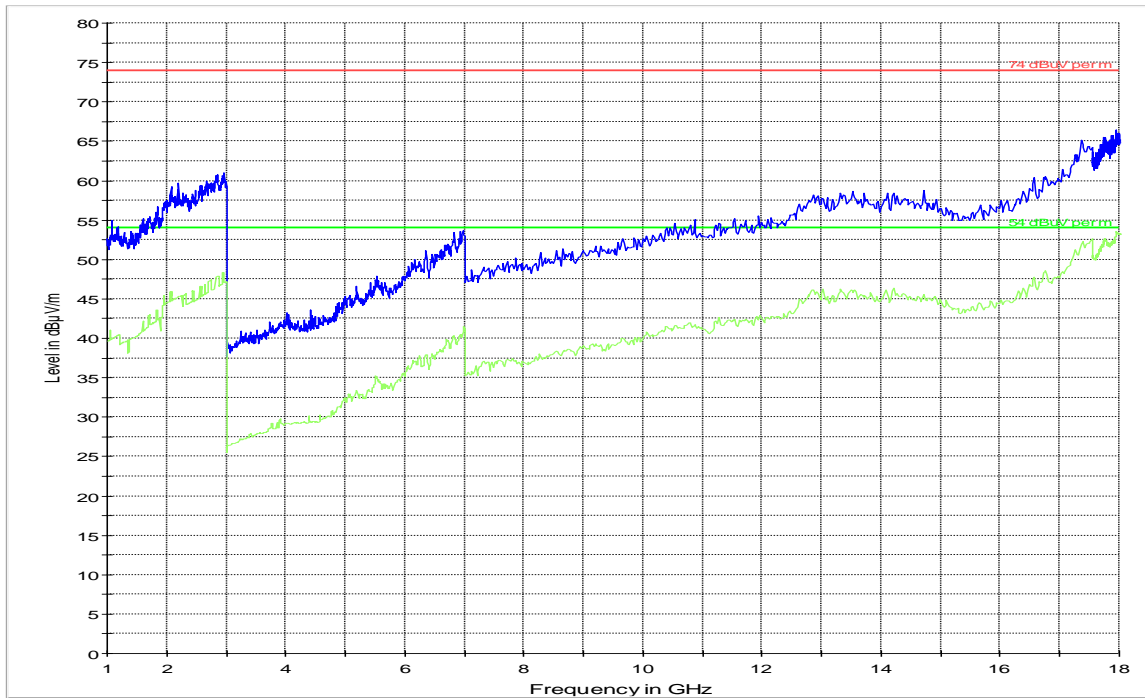
### 5.5.6.4 Test Results Receiver Spurious Emission

Receive Mode: 30MHz-1GHz



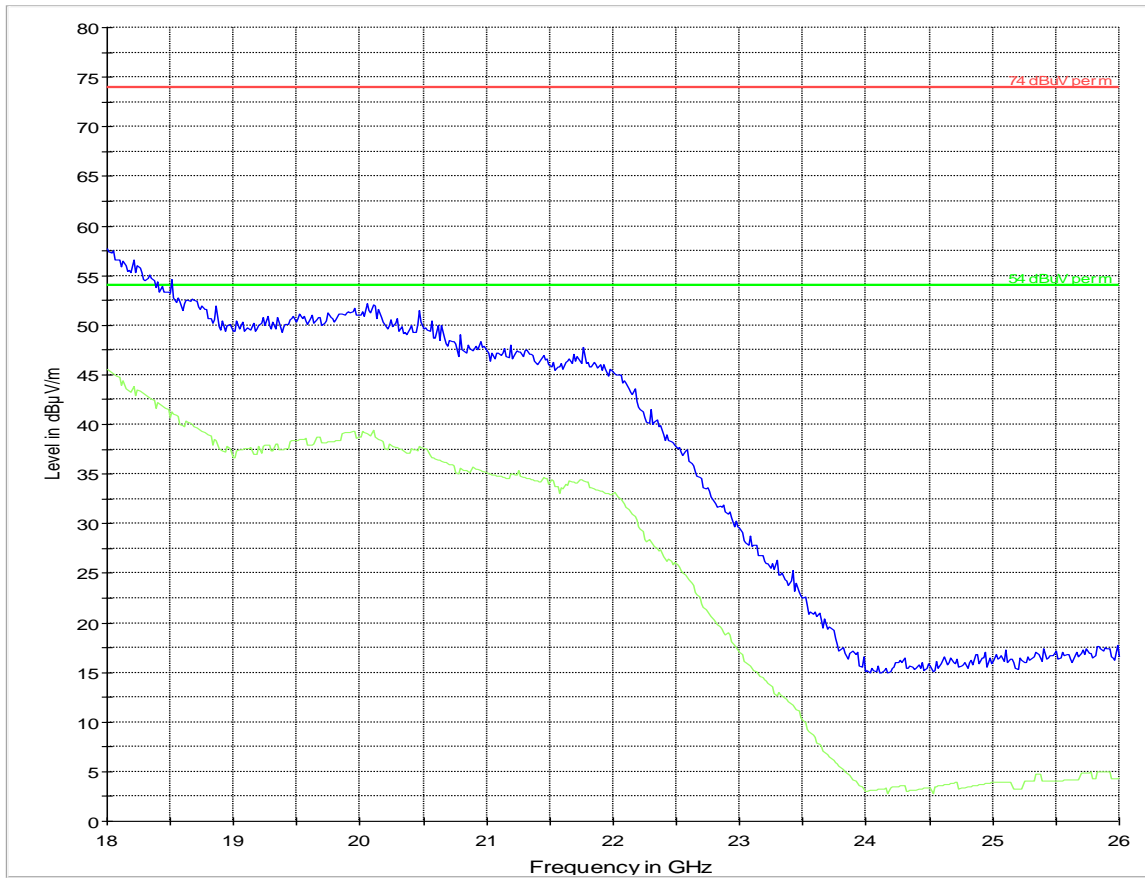
— FCC15LimitLine      — Preview Result 1

Receive Mode: 1GHz-18GHz



— 74 dBµV per m LimitLine      — 54 dBµV per m LimitLine  
— Preview Result 1      — Preview Result 2

### Receive Mode: 18GHz-26.0GHz



74 dBuV per m LimitLine  
54 dBuV per m LimitLine  
Preview Result 1  
Preview Result 2

**5.6 AC Power Line Conducted Emissions**

**5.6.1 §15.207 Conducted limits- Intentional Radiators:**

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency of emission (MHz) | Conducted limit (dBμV) |           |
|-----------------------------|------------------------|-----------|
|                             | Quasi-peak             | Average   |
| 0.15–0.5                    | 66 to 56*              | 56 to 46* |
| 0.5–5                       | 56                     | 46        |
| 5–30                        | 60                     | 50        |

\*Decreases with the logarithm of the frequency.

**Analyzer Settings: RBW = 10KHz; VBW = 10KHz**

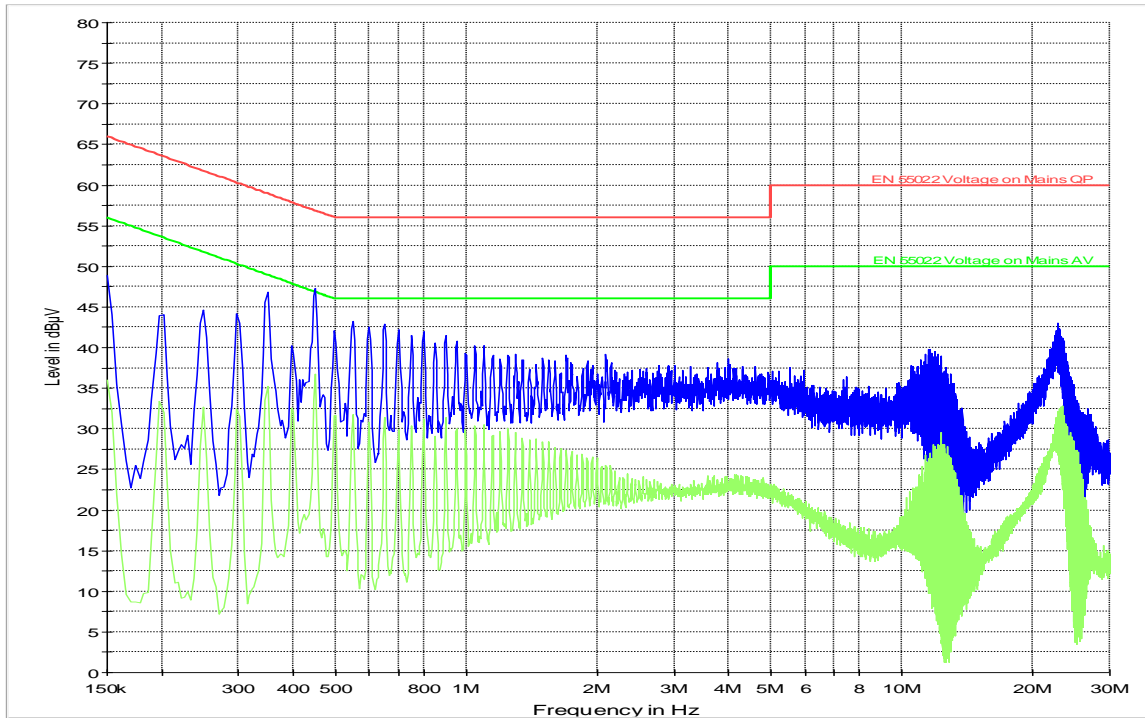
**5.6.2 Results**

Plots reported here represent the combined worst case emissions for Line and Neutral.



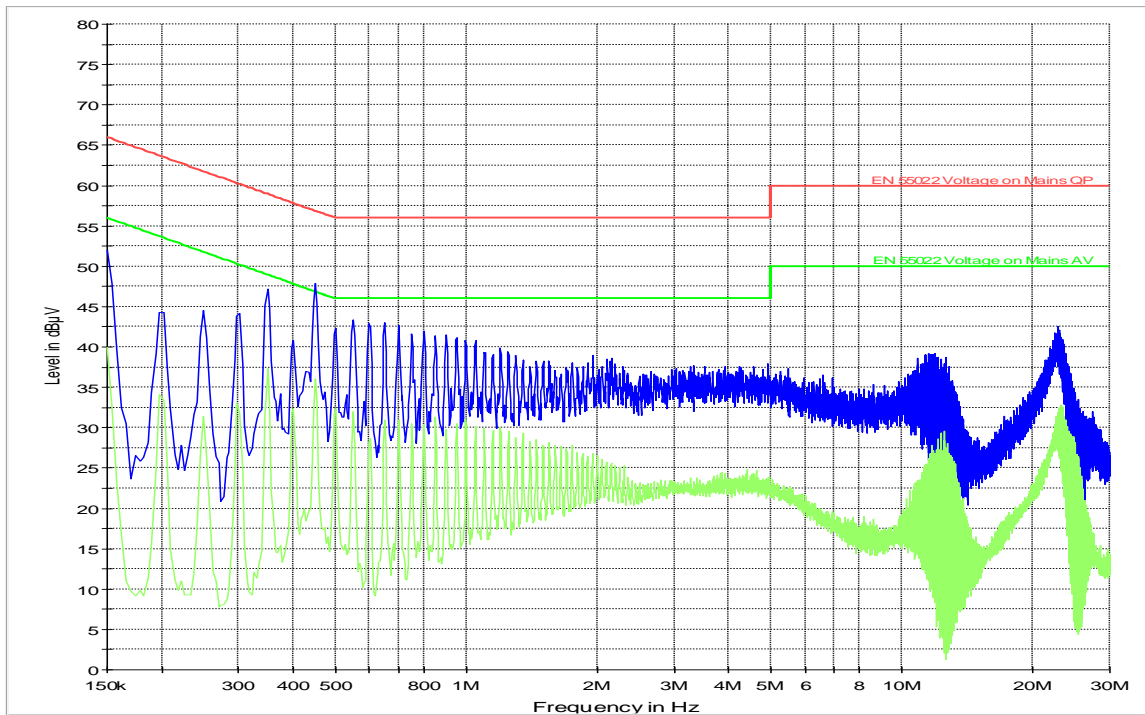
### 5.6.3 Test Results:

#### 850 TX Mode:



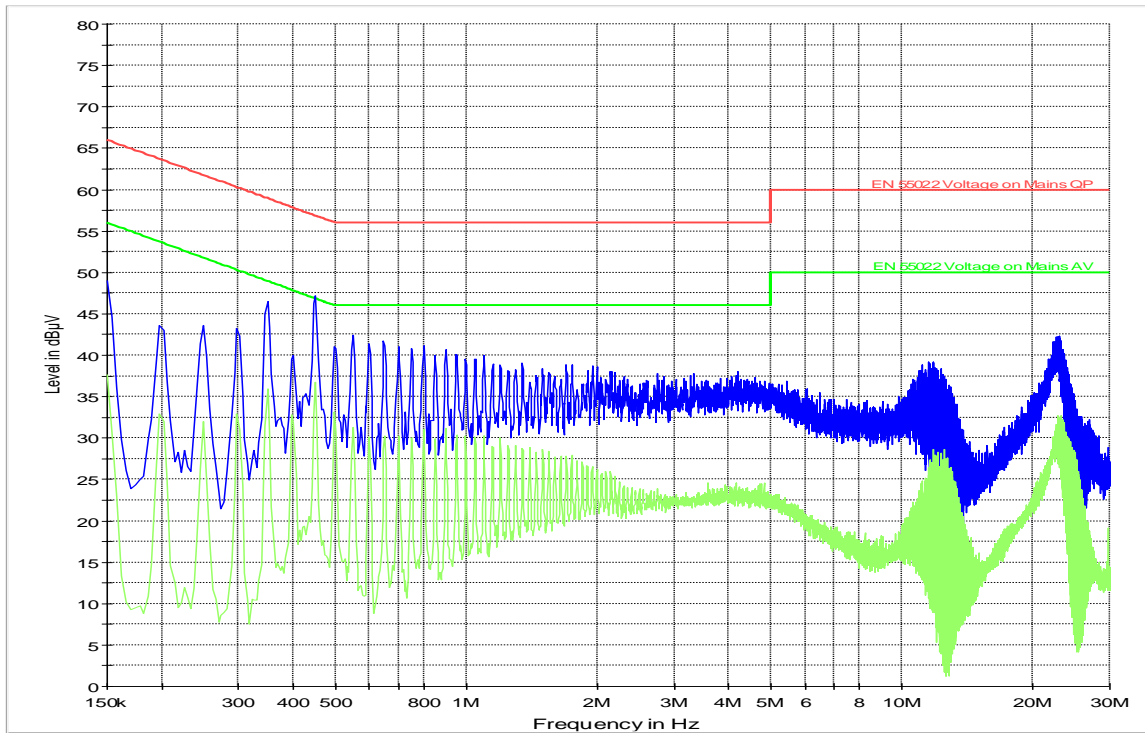
EN55022 Voltage on Mains CP/LineLine  
Preview Result 1  
EN55022 Voltage on Mains AV/LineLine  
Preview Result 2

#### 1900 TX Mode:



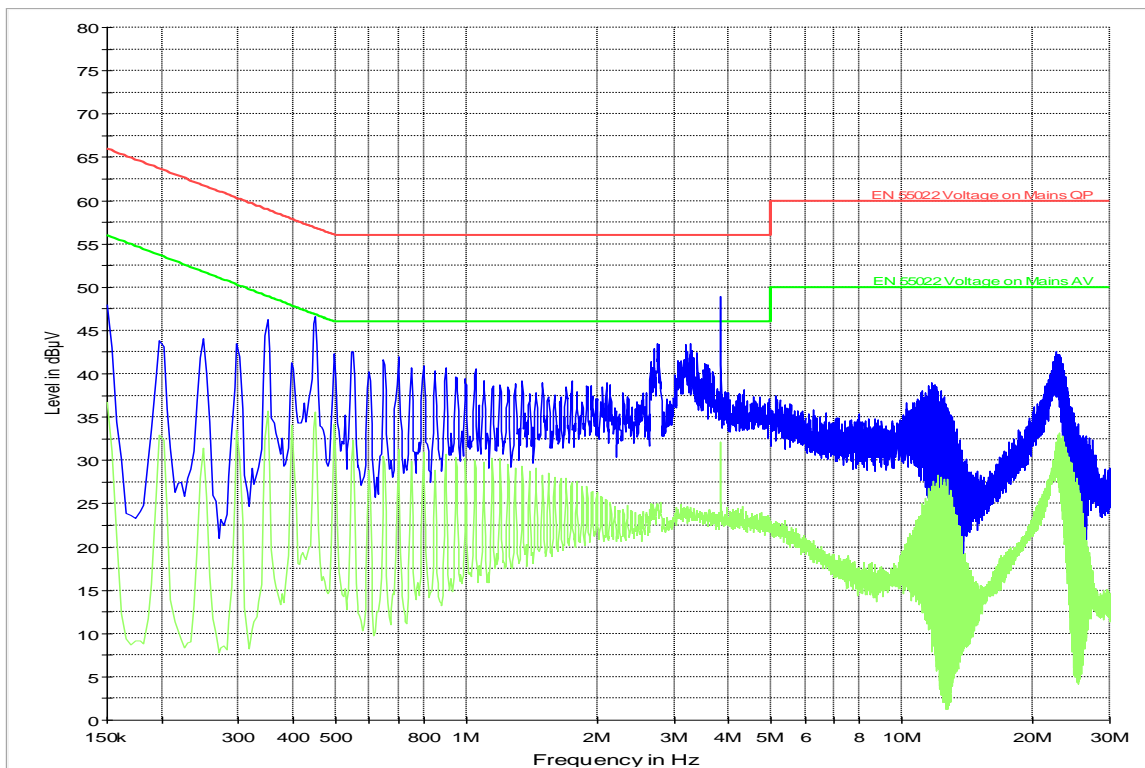
EN55022 Voltage on Mains CP/LineLine  
Preview Result 1  
EN55022 Voltage on Mains AV/LineLine  
Preview Result 2

**FDD II TX Mode:**



— EN 55022 Voltage on Mains CP Line  
— EN 55022 Voltage on Mains AV Line  
— Preview Result 1  
— Preview Result 2

**FDD V TX Mode:**



— EN 55022 Voltage on Mains CP Line  
— EN 55022 Voltage on Mains AV Line  
— Preview Result 1  
— Preview Result 2

## 6 Test Equipment And Ancillaries Used For Tests

| Instrument/Ancillary       | Model         | Manufacturer    | Serial No.  | Cal Date  | Cal Interval |
|----------------------------|---------------|-----------------|-------------|-----------|--------------|
| Radio Communication Tester | CMU 200       | Rohde & Schwarz | 101821      | May 2009  | 1 year       |
| Radio Communication Tester | CMU 200       | Rohde & Schwarz | 109879      | May 2009  | 1 year       |
| Radio Communication Tester | CMU 200       | Rohde & Schwarz | 110759      | May 2009  | 1 year       |
| Bluetooth Tester           | CBT           | Rohde & Schwarz | 100212      | May 2009  | 1 year       |
| EMI Receiver/Analyzer      | ESIB 40       | Rohde & Schwarz | 100107      | May 2009  | 1 year       |
| Spectrum Analyzer          | FSU           | Rohde & Schwarz | 200302      | Dec 2009  | 1 year       |
| Loop Antenna               | 6512          | EMCO            | 00049838    | July 2008 | 2 years      |
| Biconilog Antenna          | 3141          | EMCO            | 0005-1186   | June 2009 | 2 years      |
| Horn Antenna (1-18GHz)     | 3115          | ETS             | 00035111    | Jan 2009  | 3 years      |
| Horn Antenna (18-40GHz)    | 3116          | ETS             | 00070497    | Jan 2009  | 3 years      |
| Communication Antenna      | IBP5-900/1940 | Kathrein        | n/a         | n/a       | n/a          |
| High Pass Filter           | 5HC2700       | Trilithic Inc.  | 9926013     | n/a       | n/a          |
| High Pass Filter           | 4HC1600       | Trilithic Inc.  | 9922307     | n/a       | n/a          |
| 6GHz High Pass Filter      | HPM50106      | Microtronics    | 001         | n/a       | n/a          |
| Pre-Amplifier              | JS4-00102600  | Miteq           | 00616       | May 2009  | 1 year       |
| LISN                       | 50-25-2-08    | FCC             | 08014       | Apr 2009  | 1 year       |
| Power Smart Sensor         | R&S           | NRP-Z81         | 100161      | May 2009  | 1 Year       |
| Power Smart Sensor         | R&S           | NRP-Z22         | 100223      | May 2009  | 1 Year       |
| Upconverter                | PXI-5610      | NI              | E93740      | Aug 2008  | 2 years      |
| Waveform Generator         | PXI-5421      | NI              | E965F1      | Aug 2008  | 2 years      |
| 10dB attenuator            | ATT-0298-10   | MidwestMicrowav | n/a         | n/a       | n/a          |
| Power Splitter             | 11667B        | Hewlett Packard | 645348      | n/a       | n/a          |
| DC Power Supply            | E3610A        | Hewlett Packard | KR83021224  | n/a       | n/a          |
| DC Power Supply            | E3610A        | Hewlett Packard | KR83023316  | n/a       | n/a          |
| DC Power Supply            | 6632A         | Hewlett Packard | 3524A-12822 | n/a       | n/a          |
| DC Power Supply            | 6655A         | Hewlett Packard | 3403A-00487 | n/a       | n/a          |
| Multimeter                 | 179           | Fluke           | N/A         | Feb 2010  | 1 Year       |
| Temp Hum Logger            | TM320         | Dickson         | 03280063    | Feb 2010  | 1 Year       |
| Temp Hum Logger            | TM325         | Dickson         | 5285354     | Feb 2010  | 1 Year       |
| Climatic Chamber           | VT4004        | Votsch          | G1115       | May 2009  | 1 year       |

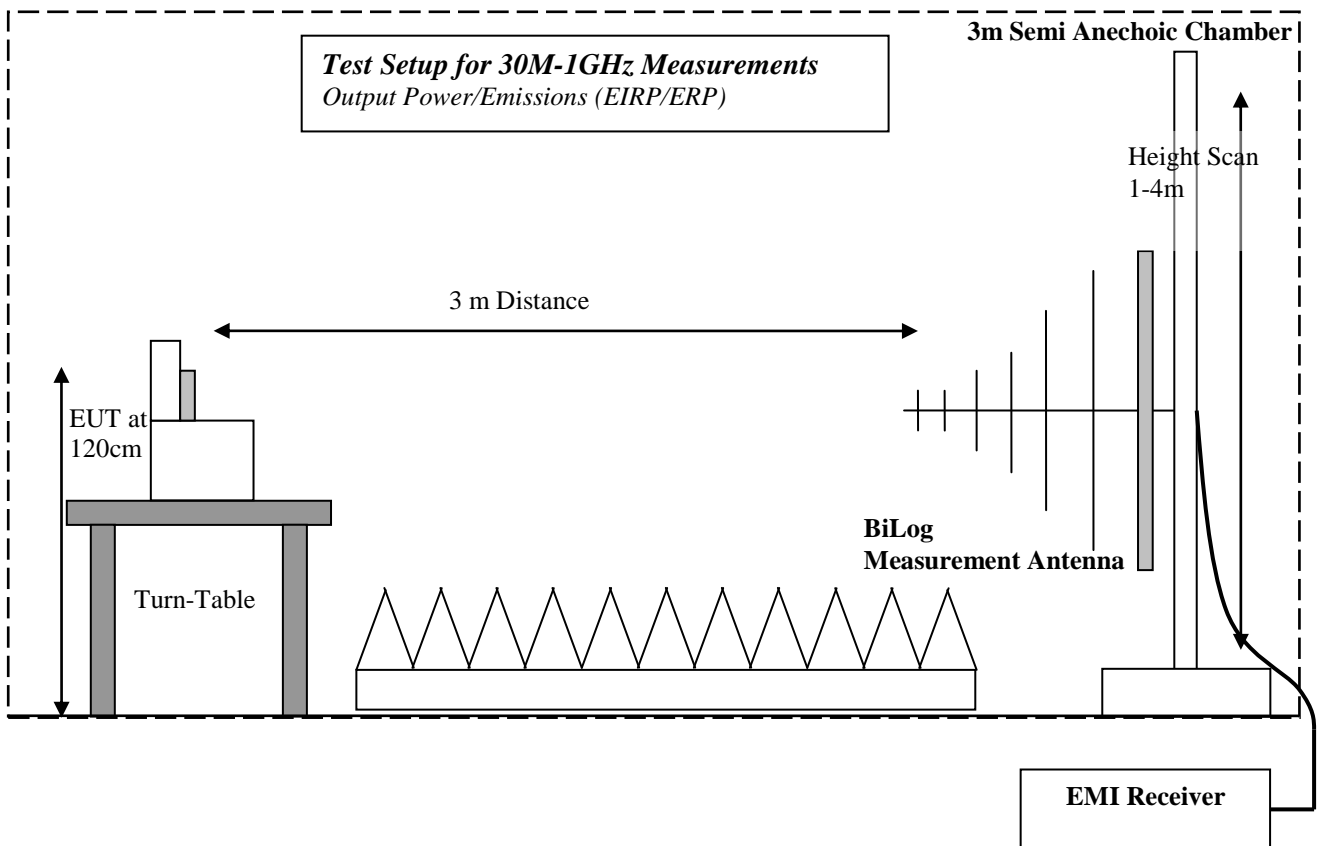
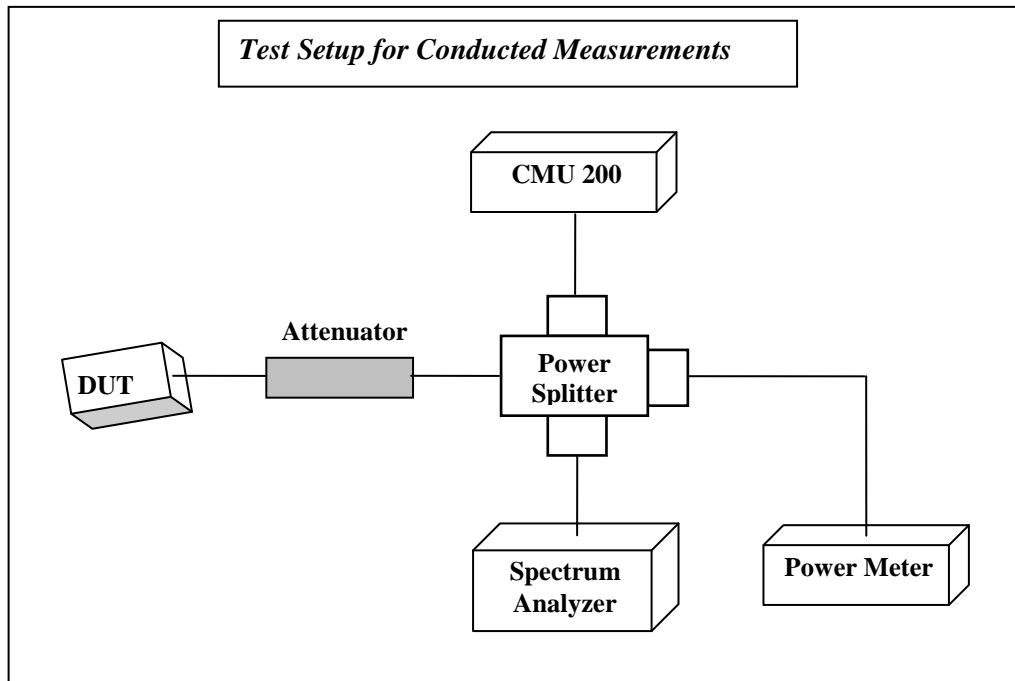
### Note:

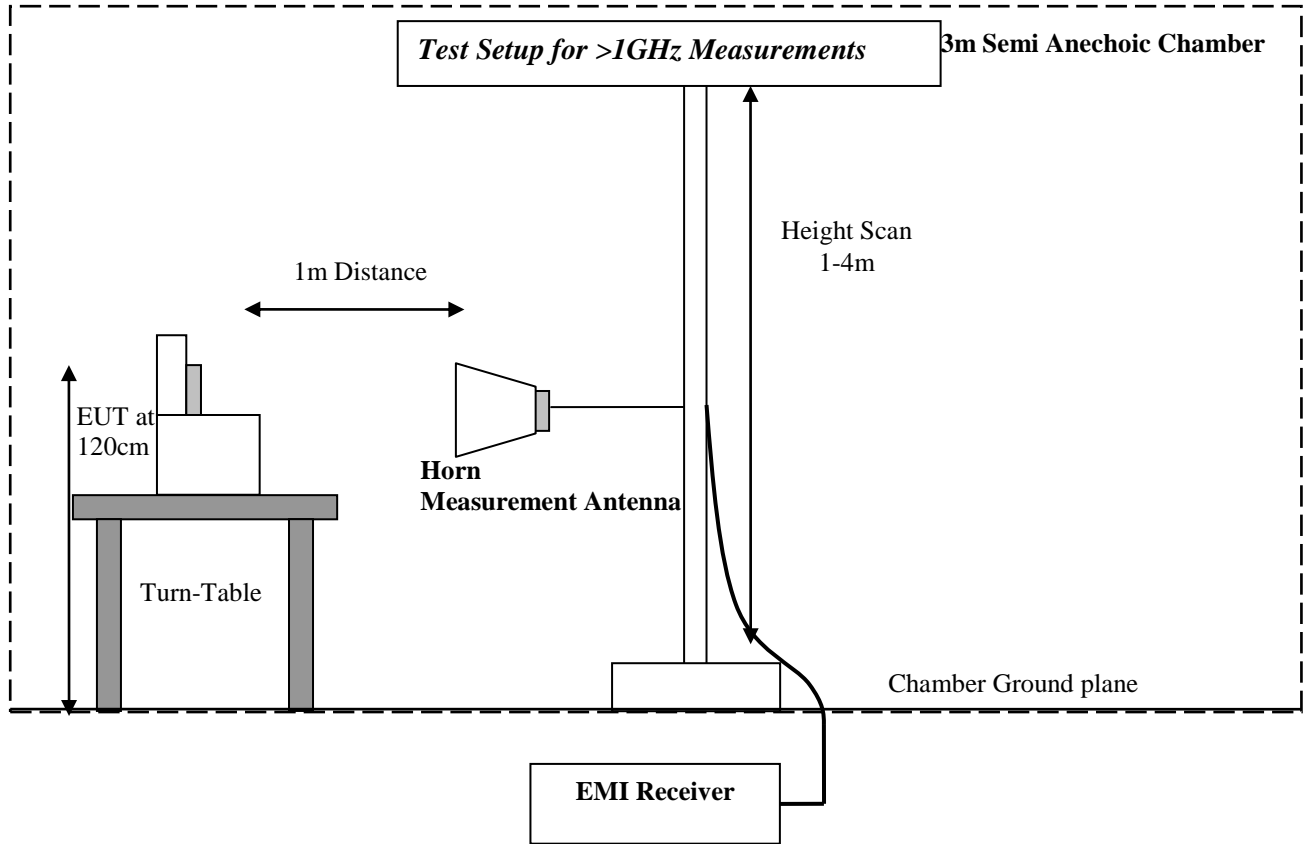
Equipment calibration is performed by an accredited calibration lab according to ISO 17025 requirements.

Calibration intervals are determined from manufacturer recommendation and/or lab discretion.

Cetecom Inc takes all measures to calibrate equipment before the due date; for instances when the equipment has to be used beyond the calibration due date, necessary steps are taken for calibration verification and documented until accredited calibration can be performed- to meet the Quality System requirements.

## 7 Block Diagrams





## **8 Revision History**

| <b>Date</b>       | <b>Report Name</b>                                  | <b>Changes to report</b>                          | <b>Report prepared by</b> |
|-------------------|---|---|---------------------------|
| <b>2010-05-30</b> | <b>EMC_APPLE_057_09001_FCC22_24_BCG-E2380B</b>      | <b>First Version</b>                              | <b>S Jose</b>             |
| <b>2010-06-04</b> | <b>EMC_APPLE_057_09001_FCC22_24_BCG-E2380B_Rev1</b> | <b>Added Avg measurement procedure- Sec 5.1.4</b> | <b>S Jose</b>             |