



# TEST REPORT

## No. I18Z60490-WMD01

for

**TCL Communication Ltd.**

**Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN**

**Model Name: LM-X410FC,LMX410FC,X410FC ;**

**LM-X410FO,LMX410FO,X410FO**

**FCC ID: ZNFX410FC**

with

**Hardware Version: Rev.1.0**

**Software Version: V09p**

**Issued Date: 2018-04-18**



**Note:**

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The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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## **REPORT HISTORY**

| <b>Report Number</b> | <b>Revision</b> | <b>Description</b> | <b>Issue Date</b> |
|----------------------|-----------------|--------------------|-------------------|
| I18Z60490-WMD01      | Rev.0           | 1st edition        | 2018-04-18        |



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### 1.1. Testing Location

Location 1: CTTL(huayuan North Road)

Address: No. 52, Huayuan North Road, Haidian District, Beijing,  
P. R. China 100191

Location 2: CTTL(Shouxiang)

Address: No. 51 Shouxiang Science Building, Xueyuan Road,  
Haidian District, Beijing, P. R. China 100191

### 1.2. Testing Environment

Normal Temperature: 15-35℃

Relative Humidity: 20-75%

### 1.3. Project data

Testing Start Date: 2018-03-11

Testing End Date: 2018-04-11

### 1.4. Signature



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Shen Yi

(Prepared this test report)



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Zhou Yu

(Reviewed this test report)



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Zhao Hui Lin

Deputy Director of the laboratory

(Approved this test report)



## **2. Client Information**

### **2.1. Applicant Information**

Company Name: LG Electronics MobileComm USA, Inc.  
Address /Post: 1000 Sylvan Avenue, Englewood Cliffs NJ 07632  
Contact: \  
Email: \  
Telephone: \

### **2.2. Manufacturer Information**

Company Name: LG Electronics Inc.  
Address /Post: LG Twin Tower 20, Yeouido-dong, Yeongdeungpo-gu Seoul, Korea  
150-721  
Contact: \  
Email: \  
Telephone: \



### **3. Equipment Under Test (EUT) and Ancillary Equipment (AE)**

#### **3.1. About EUT**

|                         |  |
|-------------------------|--|
| Description             | Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN  |
| Model Name              | LM-X410FC,LMX410FC,X410FC ;LM-X410FO,LMX410FO,X410FO |
|                         | O  |
| FCC ID                  | ZNFX410FC  |
| Antenna                 | Embedded   |
| Output power            | 30.29dBm maximum ERP measured for GSM850             |
| Extreme vol. Limits     | 3.6VDC to 4.2VDC (nominal: 3.8VDC)                   |
| Extreme temp. Tolerance | -10°C to +55°C                                       |

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of CTTL, Telecommunication Technology Labs, Academy of Telecommunication Research, MIIT

#### **3.2. Internal Identification of EUT used during the test**

| <b>EUT ID*</b> | <b>IMEI</b> | <b>HW Version</b> | <b>SW Version</b> | <b>Date of receipt</b> |
|----------------|-------------|-------------------|-------------------|------------------------|
| \              | \           | \                 | \                 | \                      |

\*EUT ID: is used to identify the test sample in the lab internally.

#### **3.3. Internal Identification of AE used during the test**

| <b>AE ID*</b> | <b>Description</b> |
|---------------|--------------------|
| AE1           | Battery            |
| AE2           | Battery            |
| AE3           | Charger            |

AE1

|              |  |
|--------------|--|
| Model        | EAC63778201                                  |
| Manufacturer | Shenzhen BYD Lithium Battery Company Limited |
| Capacitance  | 3000mAh                                      |

AE2

|              |             |
|--------------|-------------|
| Model        | EAC63638201 |
| Manufacturer | TOCAD       |
| Capacitance  | 3000mAh     |

AE3

|              |                             |
|--------------|-----------------------------|
| Model        | EAY62768908                 |
| Manufacturer | Sunlin Electronics Co.,Ltd. |

\*AE ID: is used to identify the test sample in the lab internally.

#### **3.4. Normal Accessory setting**

Fully charged battery was used during the test.



### **3.5. General Description**

The Equipment Under Test (EUT) is a model of Multi-band GSM/WCDMA/LTE phone with Bluetooth, WLAN with integrated antenna. Manual and specifications of the EUT were provided to fulfil the test.



## 4. Reference Documents

### 4.1. Reference Documents for testing

The following documents listed in this section are referred for testing.

| <b>Reference</b>        | <b>Title</b>   | <b>Version</b>     |
|-------------------------|--|--------------------|
| FCC Part 24             | PERSONAL COMMUNICATIONS SERVICES   | 10-1-17<br>Edition |
| FCC Part 22             | PUBLIC MOBILE SERVICES   | 10-1-17<br>Edition |
| ANSI/TIA-603-E          | Land Mobile FM or PM Communications Equipment<br>Measurement and Performance Standards               | 2016               |
| ANSI/TIA-102.CAAA<br>-E | DIGITAL C4FMCQPSK TRANSCEIVER MEASUREMENT<br>METHODS   | 2016               |
| ANSI C63.26             | American National Standard for Compliance Testing of<br>Transmitters Used in Licensed Radio Services | 2015               |
| KDB 971168 D01          | MEASUREMENT GUIDANCE FOR CERTIFICATION OF<br>LICENSED DIGITAL TRANSMITTERS                           | v03                |



## 5. LABORATORY ENVIRONMENT

**Control room / conducted chamber** did not exceed following limits along the EMC testing:

|                          |                            |
|--------------------------|----------------------------|
| Temperature              | Min. = 15 °C, Max. = 35 °C |
| Relative humidity        | Min. = 20 %, Max. = 80 %   |
| Shielding effectiveness  | > 110 dB                   |
| Electrical insulation    | > 2 MΩ                     |
| Ground system resistance | < 0.5 Ω                    |

**Fully-anechoic chamber 2** (8.6 meters X 6.1 meters X 3.85 meters) did not exceed following limits along the EMC testing:

|   |   |
|---|---|
| Temperature                                     | Min. = 15 °C, Max. = 30 °C              |
| Relative humidity                               | Min. = 35 %, Max. = 60 %                |
| Shielding effectiveness                         | > 110 dB                                |
| Electrical insulation                           | > 2 MΩ                                  |
| Ground system resistance                        | < 1 Ω                                   |
| Site voltage standing-wave ratio ( $S_{VSWR}$ ) | Between 0 and 6 dB, from 1GHz to 18GHz  |
| Uniformity of field strength                    | Between 0 and 6 dB, from 80 to 4000 MHz |

**Semi-anechoic chamber 2 / Fully-anechoic chamber 3** (10 meters X 6.7 meters X 6.15 meters) did not exceed following limits along the EMC testing:

|   |   |
|---|---|
| Temperature                                     | Min. = 15 °C, Max. = 30 °C              |
| Relative humidity                               | Min. = 35 %, Max. = 60 %                |
| Shielding effectiveness                         | > 100 dB                                |
| Electrical insulation                           | > 2 MΩ                                  |
| Ground system resistance                        | < 0.5 Ω                                 |
| Normalised site attenuation (NSA)               | < ±3.5 dB, 3 m distance                 |
| Site voltage standing-wave ratio ( $S_{VSWR}$ ) | Between 0 and 6 dB, from 1GHz to 18GHz  |
| Uniformity of field strength                    | Between 0 and 6 dB, from 80 to 3000 MHz |

## 6. SUMMARY OF TEST RESULTS

### GSM850

| Items | List                        | Clause in FCC rules | Verdict |
|-------|-----------------------------|---------------------|---------|
| 1     | Output Power                | 22.913(a)           | BR      |
| 2     | Emission Limit              | 2.1051/22.917       | BR      |
| 3     | Frequency Stability         | 2.1055              | BR      |
| 4     | Occupied Bandwidth          | 2.1049(h)(i)        | BR      |
| 5     | Emission Bandwidth          | 22.917(b)           | BR      |
| 6     | Band Edge Compliance        | 22.917(b)           | BR      |
| 7     | Conducted Spurious Emission | 2.1057/22.917       | BR      |

### PCS1900

| Items | List                        | Clause in FCC rules | Verdict |
|-------|-----------------------------|---------------------|---------|
| 1     | Output Power                | 24.232(c)           | BR      |
| 2     | Emission Limit              | 2.1051/24.238       | BR      |
| 3     | Frequency Stability         | 2.1055/24.235       | BR      |
| 4     | Occupied Bandwidth          | 2.1049(h)(i)        | BR      |
| 5     | Emission Bandwidth          | 24.238(b)           | BR      |
| 6     | Band Edge Compliance        | 24.238(b)           | BR      |
| 7     | Conducted Spurious Emission | 2.1057/24.238       | BR      |

Terms used in Verdict column

|    |   |
|----|---|
| P  | Pass, The EUT complies with the essential requirements in the standard.       |
| NP | Not Perform, The test was not performed by CTTL                               |
| NA | Not Applicable, The test was not applicable                                   |
| BR | Re-use test data from basic model report.                                     |
| F  | Fail, The EUT does not comply with the essential requirements in the standard |

### 6.1. Explanation of re-use of test data

The Equipment Under Test (EUT) model

LM-X410FC, LMX410FC, X410FC ; LM-X410FO, LMX410FO, X410FO (FCC ID: ZNFX410FC) is a variant product (FCC ID: ZNFX410HC) of LM-X410HC, LMX410HC, X410HC; LM-X410RC, LMX410RC, X410RC/ ZNFX410HC, according to the declaration of changes provided by the applicant and FCC KDB publication 178919 D01, all the test results are derived from test report No. I18Z60356-WMD01. For detail differences between two models please refer the Declaration of Changes document.

## 7. Test Equipments Utilized

| NO. | Description                          | TYPE     | series number | MANUFACTURE  | CAL DUE DATE | Calibration interval |
|-----|--------------------------------------|----------|---------------|--------------|--------------|----------------------|
| 1   | Test Receiver                        | ESU26    | 100235        | R&S          | 2019-03-31   | 1 year               |
| 2   | Test Receiver                        | ESU26    | 100376        | R&S          | 2018-04-27   | 1 year               |
| 3   | EMI Antenna                          | 3117     | 00058889      | ETS-Lindgren | 2020-05-27   | 3 year               |
| 4   | Universal Radio Communication Tester | CMU200   | 108646        | R&S          | 2019-01-05   | 1 year               |
| 5   | Universal Radio Communication Tester | CMW500   | 159082        | R&S          | 2019-01-05   | 1 year               |
| 6   | Spectrum Analyzer                    | FSU26    | 200030        | R&S          | 2018-06-10   | 1 year               |
| 7   | EMI Antenna                          | VULB9163 | 9163-235      | Schwarzbeck  | 2019-05-10   | 3 year               |
| 8   | Signal Generator                     | SMF100A  | 101295        | R&S          | 2018-12-23   | 1 year               |
| 9   | Climate chamber                      | SH-242   | 93008556      | ESPEC        | 2019-12-21   | 2 year               |
| 10  | Loop Antenna                         | HFH2-Z2  | 829324/007    | R&S          | 2018-12-14   | 3 year               |

## **ANNEX A: MEASUREMENT RESULTS**

### **A.1 OUTPUT POWER**

#### **A.1.1 Summary**

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMU-200) to ensure max power transmission and proper modulation. In all cases, output power is within the specified limits.

#### **A.1.2 Conducted**

##### **A.1.2.1 Method of Measurements**

The EUT was set up for the max output power with pseudo random data modulation. These measurements were done at 3 frequencies, 1850.2 MHz, 1880.0MHz and 1909.8MHz for PCS1900 band; 824.4MHz, 836.6MHz and 848.8MHz for GSM850 band. (bottom, middle and top of operational frequency range).

#### **GSM850**

|       | Power step | Nominal Peak output power (dBm) |
|-------|------------|---------------------------------|
| GSM   | 5          | 33dBm(2W)                       |
| GPRS  | 3          | 33dBm(2W)                       |
| EGPRS | 6          | 33dBm(2W)                       |

#### **Measurement result**

##### **GSM(GMSK)**

| Frequency(MHz) | Power Step | Output power(dBm) |
|----------------|------------|-------------------|
| 824.2          | 5          | 32.28             |
| 836.6          | 5          | 32.26             |
| 848.8          | 5          | 32.21             |

##### **GPRS(GMSK,1Slot)**

| Frequency(MHz) | Power Step | Output power(dBm) |
|----------------|------------|-------------------|
| 824.2          | 3          | 32.29             |
| 836.6          | 3          | 32.28             |
| 848.8          | 3          | 32.24             |

##### **EGPRS(8PSK,1Slot)**

| Frequency(MHz) | Power Step | Output power(dBm) |
|----------------|------------|-------------------|
| 824.2          | 6          | 26.50             |
| 836.6          | 6          | 26.62             |
| 848.8          | 6          | 26.54             |



**PCS1900**

|       | Power step | Nominal Peak output power (dBm) |
|-------|------------|---------------------------------|
| GSM   | 0          | 30dBm(1W)                       |
| GPRS  | 3          | 30dBm(1W)                       |
| EGPRS | 5          | 30dBm(1W)                       |

**Measurement result**

**GSM(GMSK)**

| Frequency(MHz) | Power Step | Output power(dBm) |
|----------------|------------|-------------------|
| 1850.2         | 0          | 29.19             |
| 1880.0         | 0          | 29.29             |
| 1909.8         | 0          | 29.34             |

**GPRS(GMSK,1Slot)**

| Frequency(MHz) | Power Step | Output power(dBm) |
|----------------|------------|-------------------|
| 1850.2         | 3          | 29.18             |
| 1880.0         | 3          | 29.28             |
| 1909.8         | 3          | 29.34             |

**EGPRS(8PSK,1Slot)**

| Frequency(MHz) | Power Step | Output power(dBm) |
|----------------|------------|-------------------|
| 1850.2         | 5          | 25.80             |
| 1880.0         | 5          | 25.68             |
| 1909.8         | 5          | 25.89             |

### A.1.3 Radiated

#### A.1.3.1 Description

This is the test for the maximum radiated power from the EUT.

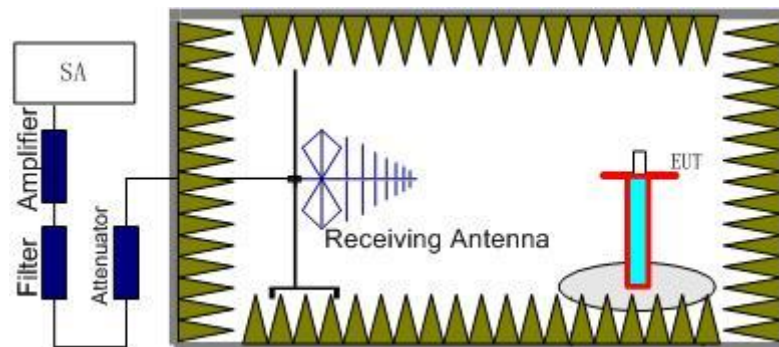
Rule Part 24.232(c) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage."

Rule Part 22.913(a) specifies "The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts."

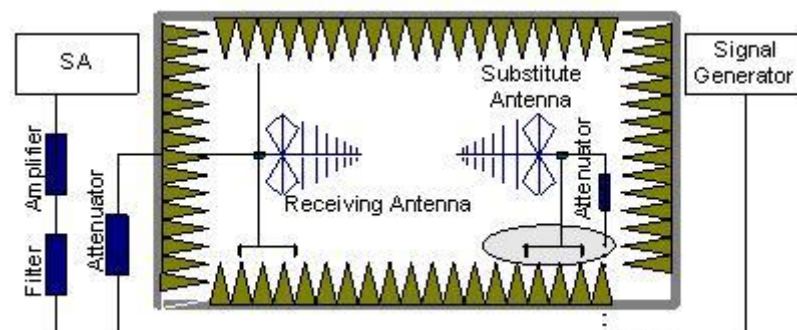
#### A.1.3.2 Method of Measurement

The measurements procedures in TIA-603E-2016 are used.

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere

with the radiation pattern of the antenna. A power ( $P_{Mea}$ ) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ ) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna.  
The cable loss ( $P_{cl}$ ), the Substitution Antenna Gain ( $G_a$ ) and the Amplifier Gain ( $P_{Ag}$ ) should be recorded after test.

The measurement results are obtained as described below:

$$\text{Power(EIRP)} = P_{Mea} - P_{Ag} - P_{cl} - G_a$$

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole,  $ERP = EIRP - 2.15\text{dBi}$ .



**GSM 850-ERP**

**Limits**

|       | Power Step | Burst Peak ERP (dBm) |
|-------|------------|----------------------|
| GSM   | 5          | ≤38.45dBm (7W)       |
| GPRS  | 3          | ≤38.45dBm (7W)       |
| EGPRS | 6          | ≤38.45dBm (7W)       |

**Measurement result**

**GSM**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | Correction (dB) | ERP(dBm) | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|-----------------|----------|------------|------------|--------------|
| 824.20         | -20.87                 | 2.26                 | 45.79                | 0.96                            | 2.15            | 30.29    | 38.45      | 8.16       | H            |
| 836.60         | -21.14                 | 2.26                 | 45.66                | 0.82                            | 2.15            | 29.75    | 38.45      | 8.70       | H            |
| 848.80         | -22.42                 | 2.28                 | 45.54                | 0.79                            | 2.15            | 28.34    | 38.45      | 10.11      | H            |

**GPRS**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | Correction (dB) | ERP(dBm) | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|-----------------|----------|------------|------------|--------------|
| 824.20         | -20.91                 | 2.26                 | 45.79                | 0.96                            | 2.15            | 30.25    | 38.45      | 8.20       | H            |
| 836.60         | -21.18                 | 2.26                 | 45.66                | 0.82                            | 2.15            | 29.71    | 38.45      | 8.74       | H            |
| 848.80         | -22.45                 | 2.28                 | 45.54                | 0.79                            | 2.15            | 28.31    | 38.45      | 10.14      | H            |

**EGPRS-8PSK**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | Correction (dB) | ERP(dBm) | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|-----------------|----------|------------|------------|--------------|
| 824.20         | -26.84                 | 2.26                 | 45.79                | 0.96                            | 2.15            | 24.32    | 38.45      | 14.13      | H            |
| 836.60         | -27.24                 | 2.26                 | 45.66                | 0.82                            | 2.15            | 23.65    | 38.45      | 14.80      | H            |
| 848.80         | -28.09                 | 2.28                 | 45.54                | 0.79                            | 2.15            | 22.67    | 38.45      | 15.78      | H            |

Frequency: 824.20MHz

Peak ERP(dBm)=P<sub>Mea</sub>(-20.87dBm)-P<sub>cl</sub>(-2.26dB)-P<sub>Ag</sub>(-45.79dB)-G<sub>a</sub>(-0.96dB)-2.15dB=30.29 dBm

**ANALYZER SETTINGS: RBW = VBW = 3MHz**





**PCS1900-EIRP**

**Limits**

|       | Power Step | Burst Peak EIRP (dBm) |
|-------|------------|-----------------------|
| GSM   | 0          | ≤33dBm (2W)           |
| GPRS  | 3          | ≤33dBm (2W)           |
| EGPRS | 5          | ≤33dBm (2W)           |

**Measurement result**

**GSM**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm) | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|-----------|------------|------------|--------------|
| 1850.20        | -21.74                 | 2.93                 | 43.75                | 4.87                            | 29.81     | 33.00      | 3.19       | V            |
| 1880.00        | -21.24                 | 2.85                 | 43.75                | 4.82                            | 30.18     | 33.00      | 2.82       | V            |
| 1909.80        | -21.17                 | 2.89                 | 43.77                | 4.76                            | 30.25     | 33.00      | 2.75       | V            |

**GPRS**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm) | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|-----------|------------|------------|--------------|
| 1850.20        | -21.77                 | 2.93                 | 43.75                | 4.87                            | 29.78     | 33.00      | 3.22       | V            |
| 1880.00        | -21.25                 | 2.85                 | 43.75                | 4.82                            | 30.17     | 33.00      | 2.83       | V            |
| 1909.80        | -21.22                 | 2.89                 | 43.77                | 4.76                            | 30.20     | 33.00      | 2.80       | V            |

**EGPRS-8PSK**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm) | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|-----------|------------|------------|--------------|
| 1850.20        | -25.09                 | 2.93                 | 43.75                | 4.87                            | 26.46     | 33.00      | 6.54       | V            |
| 1880.00        | -24.32                 | 2.85                 | 43.75                | 4.82                            | 27.10     | 33.00      | 5.90       | V            |
| 1909.80        | -24.20                 | 2.89                 | 43.77                | 4.76                            | 27.22     | 33.00      | 5.78       | V            |

Frequency: 1909.80MHz

Peak EIRP(dBm)= P<sub>Mea</sub>(-21.17dBm) - P<sub>cl</sub>(-2.89dB) - P<sub>Ag</sub>(-43.77dB) - G<sub>a</sub> (-4.76dB) = 30.25dBm

**ANALYZER SETTINGS: RBW = VBW = 3MHz**

## A.2 EMISSION LIMIT

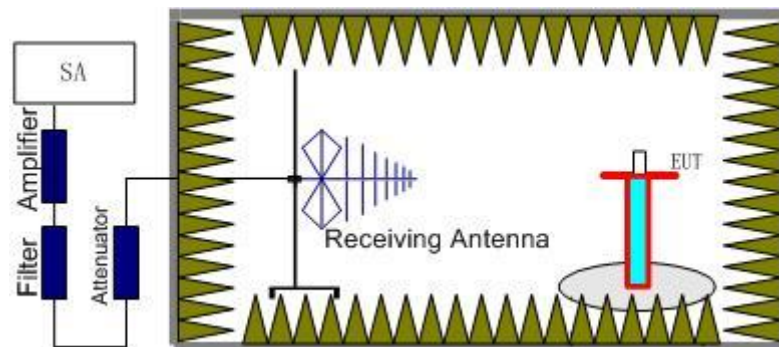
### A.2.1 Measurement Method

The measurement procedures in TIA-603E-2016 are used.

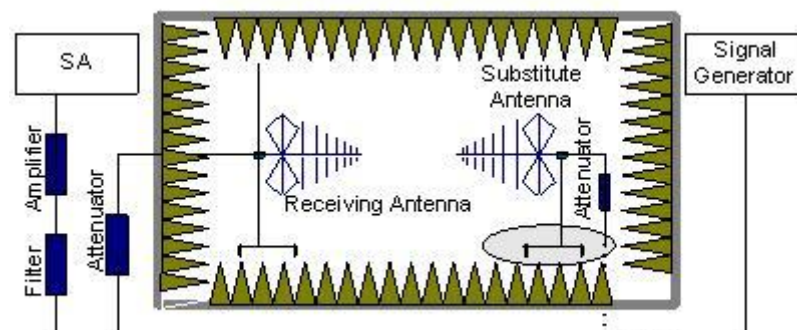
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. The resolution bandwidth is set as outlined in Part 24.238 and Part 22.917. The spectrum is scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of PCS1900 and GSM850.

#### **The procedure of radiated spurious emissions is as follows:**

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10th harmonic were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as ( $P_r$ ).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power ( $P_{Mea}$ ) is applied to the input of the

substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ ) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. The Path loss ( $P_{pl}$ ) between the Signal Source with the Substitution Antenna and the Substitution Antenna Gain ( $G_a$ ) should be recorded after test.

A amplifier should be connected in for the test.

The Path loss ( $P_{pl}$ ) is the summation of the cable loss and the gain of the amplifier.

The measurement results are obtained as described below:

$$\text{Power(EIRP)} = P_{Mea} - P_{pl} - G_a$$

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole,  $ERP = EIRP - 2.15\text{dBi}$ .



### **A.2.2 Measurement Limit**

Part 24.238 and Part 22.917 specify that 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.

The specification that emissions shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

### **A.2.3 Measurement Results**

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the PCS1900 band (1850.2 MHz, 1880 MHz and 1909.8 MHz) and GSM850 band (824.2MHz, 836.6MHz, 848.8MHz) . 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 PCS1900 ,GSM850 into any of the other blocks. 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.

**A.2.4 Measurement Results Table**

| Frequency   | Channel | Frequency Range | Result |
|-------------|---------|-----------------|--------|
| GSM 850MHz  | Low     | 30MHz-10GHz     | Pass   |
|             | Middle  | 30MHz-10GHz     | Pass   |
|             | High    | 30MHz-10GHz     | Pass   |
| GSM 1900MHz | Low     | 30MHz-20GHz     | Pass   |
|             | Middle  | 30MHz-20GHz     | Pass   |
|             | High    | 30MHz-20GHz     | Pass   |

**A.2.5 Sweep Table**

| Working Frequency | Subrange (GHz) | RBW    | VBW    | Sweep time (s) |
|-------------------|----------------|--------|--------|----------------|
| 850MHz            | 0.03~1         | 100KHz | 300KHz | 10             |
|                   | 1-2            | 1 MHz  | 3 MHz  | 2              |
|                   | 2~5            | 1 MHz  | 3 MHz  | 3              |
|                   | 5~8            | 1 MHz  | 3 MHz  | 3              |
|                   | 8~10           | 1 MHz  | 3 MHz  | 3              |
| 1900MHz           | 0.03~1         | 100KHz | 300KHz | 10             |
|                   | 1-2            | 1 MHz  | 3 MHz  | 2              |
|                   | 2~5            | 1 MHz  | 3 MHz  | 3              |
|                   | 5~8            | 1 MHz  | 3 MHz  | 3              |
|                   | 8~11           | 1 MHz  | 3 MHz  | 3              |
|                   | 11~14          | 1 MHz  | 3 MHz  | 3              |
|                   | 14~18          | 1 MHz  | 3 MHz  | 3              |
|                   | 18~20          | 1 MHz  | 3 MHz  | 2              |



**GSM Mode Channel 128/824.2MHz**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Correction (dB) | Peak ERP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|-----------------|---------------|-------------|------------|--------------|
| 1648.01        | -51.24                 | 3.56      | 5.23         | 2.15            | -51.72        | -13.00      | 38.70      | H            |
| 2472.00        | -41.59                 | 4.59      | 6.02         | 2.15            | -42.31        | -13.00      | 29.30      | H            |
| 3297.02        | -49.01                 | 5.29      | 7.71         | 2.15            | -48.74        | -13.00      | 35.70      | V            |
| 4127.02        | -49.94                 | 6.04      | 9.03         | 2.15            | -49.10        | -13.00      | 36.10      | H            |
| 4934.01        | -55.33                 | 6.72      | 9.83         | 2.15            | -54.37        | -13.00      | 41.40      | H            |
| 5761.01        | -54.31                 | 7.25      | 10.55        | 2.15            | -53.16        | -13.00      | 40.20      | H            |

**GSM Mode Channel 190/836.6MHz**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Correction (dB) | Peak ERP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|-----------------|---------------|-------------|------------|--------------|
| 1672.01        | -48.41                 | 3.58      | 5.19         | 2.15            | -48.95        | -13.00      | 36.00      | H            |
| 2510.00        | -43.01                 | 4.63      | 6.12         | 2.15            | -43.67        | -13.00      | 30.70      | H            |
| 3346.02        | -54.56                 | 5.31      | 7.83         | 2.15            | -54.19        | -13.00      | 41.20      | V            |
| 4187.02        | -49.71                 | 6.18      | 9.09         | 2.15            | -48.95        | -13.00      | 35.90      | H            |
| 5020.01        | -55.97                 | 6.57      | 9.93         | 2.15            | -54.76        | -13.00      | 41.80      | H            |
| 5854.01        | -54.69                 | 7.25      | 10.53        | 2.15            | -53.56        | -13.00      | 40.60      | V            |

**GSM Mode Channel 251/848.8MHz**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Correction (dB) | Peak ERP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|-----------------|---------------|-------------|------------|--------------|
| 1698.01        | -44.44                 | 3.60      | 5.14         | 2.15            | -45.05        | -13.00      | 32.00      | H            |
| 2546.00        | -41.33                 | 4.66      | 6.18         | 2.15            | -41.96        | -13.00      | 29.00      | H            |
| 3396.02        | -55.23                 | 5.36      | 7.95         | 2.15            | -54.79        | -13.00      | 41.80      | V            |
| 4248.02        | -51.90                 | 6.24      | 9.15         | 2.15            | -51.14        | -13.00      | 38.10      | H            |
| 5095.01        | -55.72                 | 6.76      | 10.03        | 2.15            | -54.60        | -13.00      | 41.60      | H            |
| 5945.01        | -53.26                 | 7.47      | 10.51        | 2.15            | -52.37        | -13.00      | 39.40      | H            |



**GSM Mode Channel 512/1850.2MHz**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3700.02        | -46.96                 | 6.43      | 8.48         | -44.91         | -13.00      | 31.91      | H            |
| 5556.02        | -48.45                 | 7.19      | 10.59        | -45.05         | -13.00      | 32.05      | V            |
| 7392.01        | -55.94                 | 8.12      | 12.07        | -51.99         | -13.00      | 38.99      | V            |
| 9253.01        | -54.54                 | 9.05      | 13.25        | -50.34         | -13.00      | 37.34      | H            |
| 11095.01       | -53.08                 | 9.85      | 13.18        | -49.75         | -13.00      | 36.75      | V            |
| 12947.01       | -50.12                 | 10.49     | 13.47        | -47.14         | -13.00      | 34.14      | H            |

**GSM Mode Channel 661/1880.0MHz**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3760.02        | -44.80                 | 6.26      | 8.56         | -42.50         | -13.00      | 29.50      | V            |
| 5645.02        | -51.74                 | 7.27      | 10.57        | -48.44         | -13.00      | 35.44      | V            |
| 7520.01        | -55.11                 | 8.31      | 12.22        | -51.20         | -13.00      | 38.20      | V            |
| 9412.01        | -55.01                 | 9.10      | 13.35        | -50.76         | -13.00      | 37.76      | V            |
| 11272.01       | -52.38                 | 9.83      | 13.15        | -49.06         | -13.00      | 36.06      | V            |
| 13155.01       | -48.43                 | 10.69     | 13.72        | -45.40         | -13.00      | 32.40      | H            |

**GSM Mode Channel 810/1909.8MHz**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3819.02        | -47.73                 | 6.08      | 8.65         | -45.16         | -13.00      | 32.16      | H            |
| 5733.02        | -50.85                 | 7.29      | 10.55        | -47.59         | -13.00      | 34.59      | V            |
| 7644.01        | -55.55                 | 8.17      | 12.32        | -51.40         | -13.00      | 38.40      | H            |
| 9557.01        | -54.79                 | 9.34      | 13.34        | -50.79         | -13.00      | 37.79      | H            |
| 11455.01       | -52.08                 | 9.93      | 13.11        | -48.90         | -13.00      | 35.90      | H            |
| 13370.01       | -48.95                 | 10.57     | 14.02        | -45.50         | -13.00      | 32.50      | V            |

### **A.3 FREQUENCY STABILITY**

#### **A.3.1 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 CMU200 DIGITAL RADIO COMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -10°C.
3. With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on mid channel of PCS 1900 and GSM850, 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 -10°C to +50°C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
5. Remeasure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments remeasuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, 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 CMU200 and in a simulated call on the centre channel, 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 -10°C to 50°C. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

#### **A.3.2 Measurement Limit**

##### **A.3.2.1 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, 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 3.6VDC and 4.4VDC, with a nominal voltage of 3.85VDC. 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 -10 % and +12.5 %. For the purposes of measuring frequency stability these voltage limits are to be used.

##### **A.3.2.2 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, 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 varying primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

### A.3.3 Measurement results

#### GSM 850

##### Frequency Error vs Voltage

| Voltage(V) | Frequency error(Hz) | Frequency error(ppm) |
|------------|---------------------|----------------------|
| 3.6        | 16                  | 0.019                |
| 3.8        | 18                  | 0.021                |
| 4.4        | 18                  | 0.021                |

##### Frequency Error vs Temperature

| temperature(°C) | Frequency error(Hz) | Frequency error(ppm) |
|-----------------|---------------------|----------------------|
| -10             | 14                  | 0.017                |
| 0               | 13                  | 0.015                |
| 10              | 14                  | 0.016                |
| 20              | 14                  | 0.017                |
| 30              | 15                  | 0.018                |
| 40              | 15                  | 0.017                |
| 50              | 14                  | 0.017                |

#### EGPRS 850 - 8PSK

##### Frequency Error vs Voltage

| Voltage(V) | Frequency error(Hz) | Frequency error(ppm) |
|------------|---------------------|----------------------|
| 3.6        | -49                 | 0.059                |
| 3.8        | -50                 | 0.060                |
| 4.4        | -52                 | 0.063                |

##### Frequency Error vs Temperature

| temperature(°C) | Frequency error(Hz) | Frequency error(ppm) |
|-----------------|---------------------|----------------------|
| -10             | -56                 | 0.067                |
| 0               | -52                 | 0.062                |
| 10              | -45                 | 0.054                |
| 20              | -49                 | 0.058                |
| 30              | -51                 | 0.061                |
| 40              | -52                 | 0.062                |
| 50              | -52                 | 0.062                |



**PCS 1900**

**Frequency Error vs Voltage**

| Voltage(V) | Frequency error(Hz) | Frequency error(ppm) |
|------------|---------------------|----------------------|
| 3.6        | 39                  | 0.021                |
| 3.8        | 34                  | 0.018                |
| 4.4        | 31                  | 0.016                |

**Frequency Error vs Temperature**

| temperature(°C) | Frequency error(Hz) | Frequency error(ppm) |
|-----------------|---------------------|----------------------|
| -10             | 39                  | 0.021                |
| 0               | 38                  | 0.020                |
| 10              | 46                  | 0.025                |
| 20              | 36                  | 0.019                |
| 30              | 37                  | 0.020                |
| 40              | 33                  | 0.018                |
| 50              | 35                  | 0.019                |

**EGPRS 1900 - 8PSK**

**Frequency Error vs Voltage**

| Voltage(V) | Frequency error(Hz) | Frequency error(ppm) |
|------------|---------------------|----------------------|
| 3.6        | -49                 | 0.026                |
| 3.8        | -51                 | 0.027                |
| 4.4        | -50                 | 0.026                |

**Frequency Error vs Temperature**

| temperature(°C) | Frequency error(Hz) | Frequency error(ppm) |
|-----------------|---------------------|----------------------|
| -10             | -55                 | 0.029                |
| 0               | -54                 | 0.029                |
| 10              | -62                 | 0.033                |
| 20              | -60                 | 0.032                |
| 30              | -44                 | 0.023                |
| 40              | -59                 | 0.031                |
| 50              | -51                 | 0.027                |



## **A.4 OCCUPIED BANDWIDTH**

### **Reference**

FCC: CFR Part 2.1049(h)(i)

### **A.4.1 Occupied Bandwidth Results**

Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the US Cellular/PCS frequency bands. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the following pages.

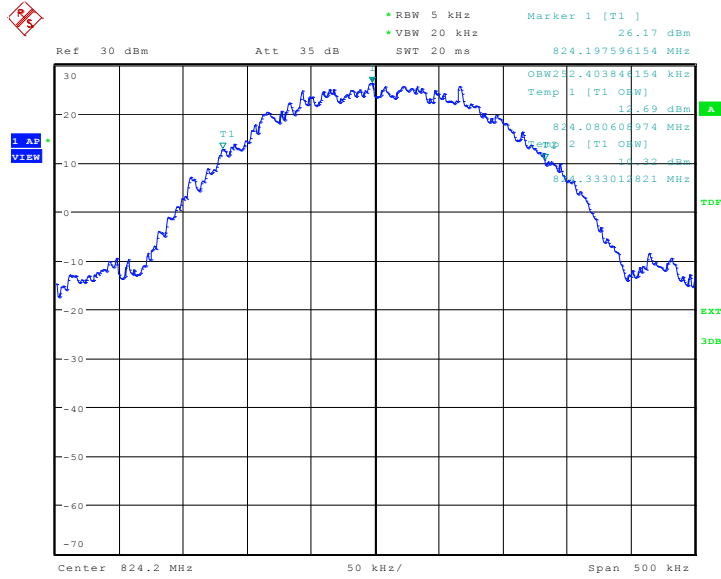
The measurement method is from KDB 971168:

- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the OBW).
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
- c) Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least  $10\log(\text{OBW} / \text{RBW})$  below the reference level.
- d) Set the detection mode to peak, and the trace mode to max hold.
- e) Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

### **GSM 850(99% BW)**

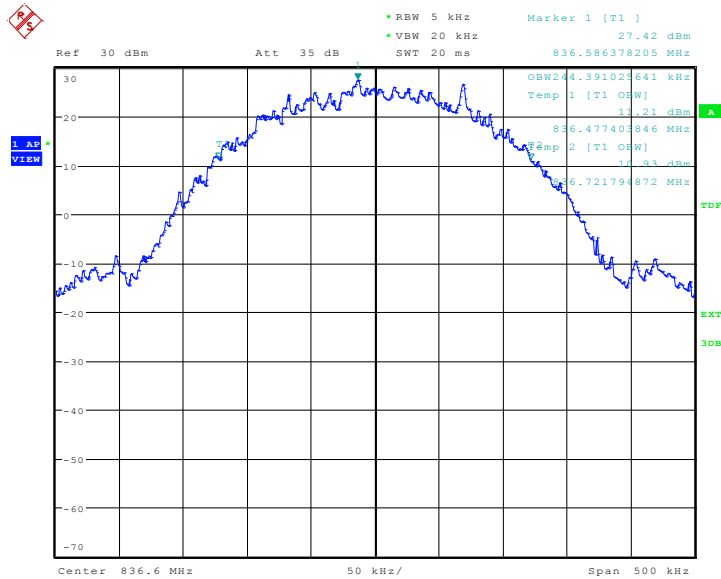
| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |
|----------------|-----------------------------------|
| 824.2          | 252.404                           |
| 836.6          | 244.391                           |
| 848.8          | 246.795                           |

**GSM 850**  
**Channel 128-Occupied Bandwidth (99% BW)**



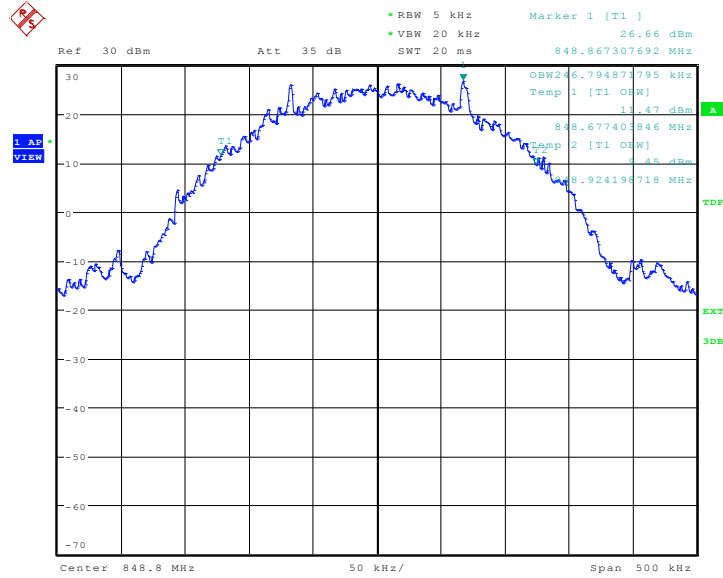
Date: 11.APR.2018 08:48:28

**Channel 190-Occupied Bandwidth (99% BW)**



Date: 11.APR.2018 08:49:00

### Channel 251-Occupied Bandwidth (99% BW)



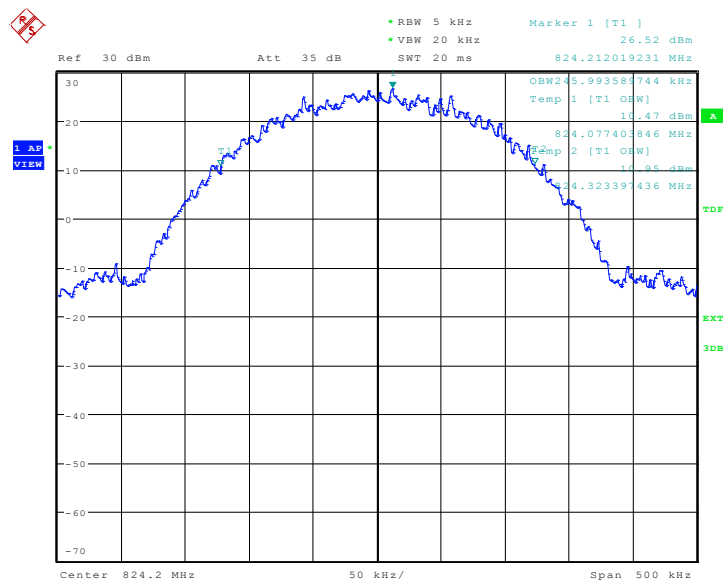
Date: 11.APR.2018 08:49:32

### GPRS 850(99% BW)

| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |
|----------------|-----------------------------------|
| 824.2          | 245.994                           |
| 836.6          | 245.994                           |
| 848.8          | 244.391                           |

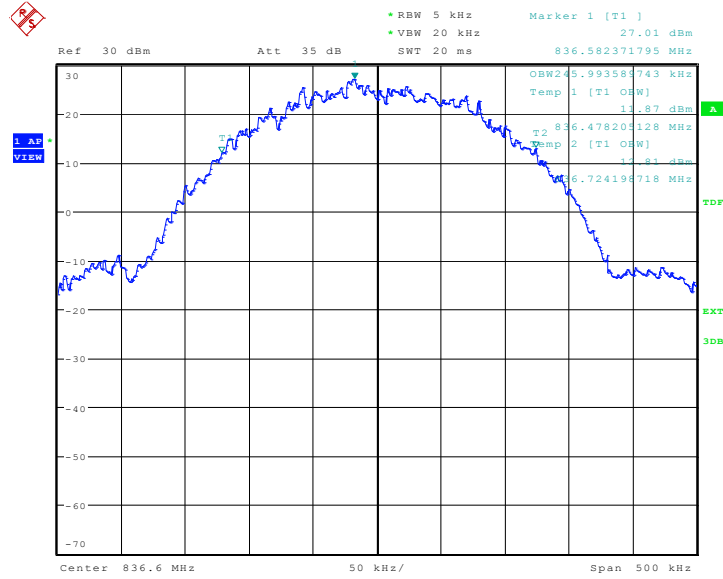
### GPRS 850

### Channel 128-Occupied Bandwidth (99% BW)



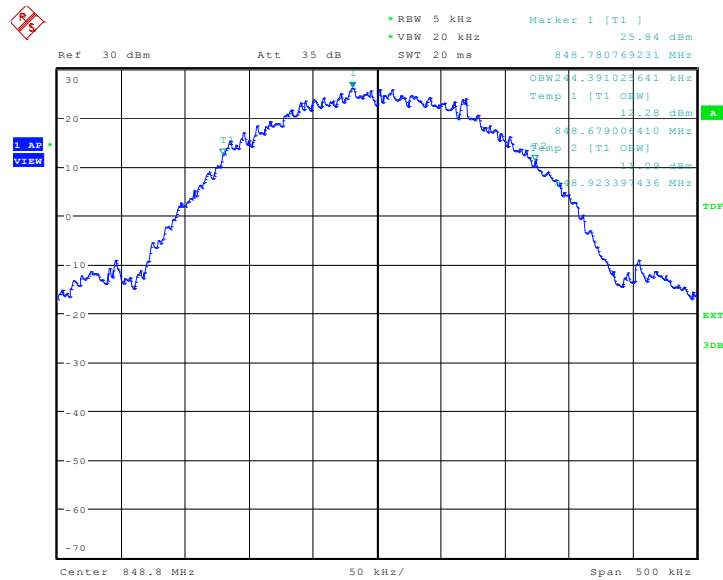
Date: 11.APR.2018 09:34:13

### Channel 190-Occupied Bandwidth (99% BW)



Date: 11.APR.2018 09:34:46

### Channel 251-Occupied Bandwidth (99% BW)



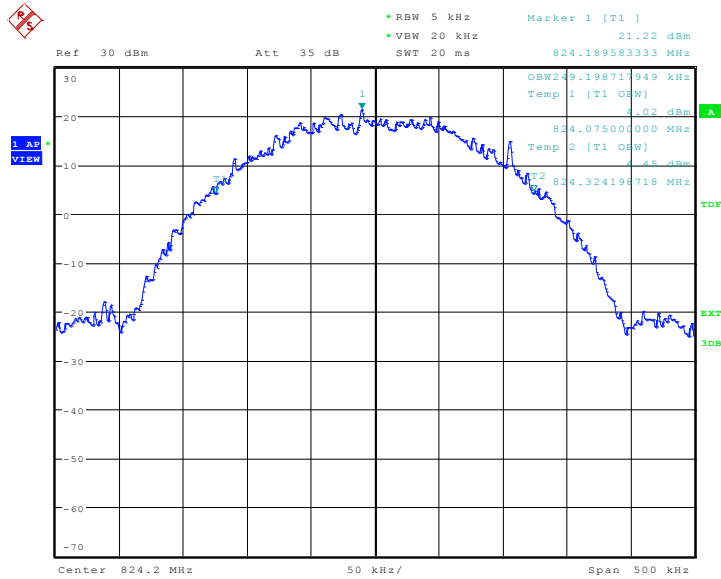
Date: 11.APR.2018 09:35:18

**EGPRS 850-8PSK(99% BW)**

| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |
|----------------|-----------------------------------|
| 824.2          | 249.199                           |
| 836.6          | 249.199                           |
| 848.8          | 250.000                           |

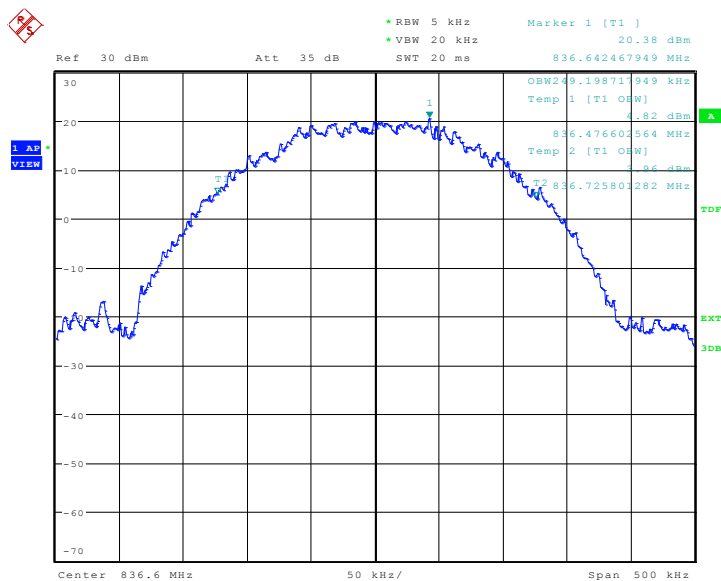
**EGPRS 850-8PSK**

**Channel 128-Occupied Bandwidth (99% BW)**



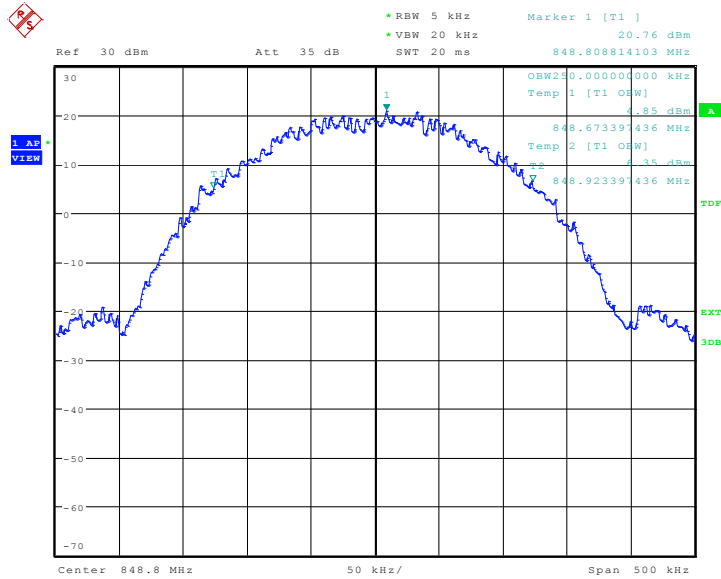
Date: 11.APR.2018 10:16:54

**Channel 190-Occupied Bandwidth (99% BW)**



Date: 11.APR.2018 10:17:26

**Channel 251-Occupied Bandwidth (99% BW)**



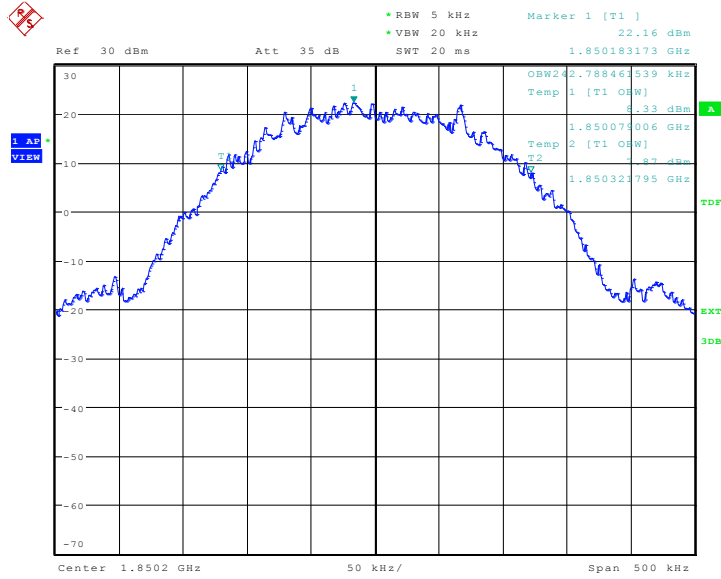
Date: 11.APR.2018 10:17:58

**PCS 1900(99% BW)**

| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |
|----------------|-----------------------------------|
| 1850.2         | 242.788                           |
| 1880.0         | 246.795                           |
| 1909.8         | 243.590                           |

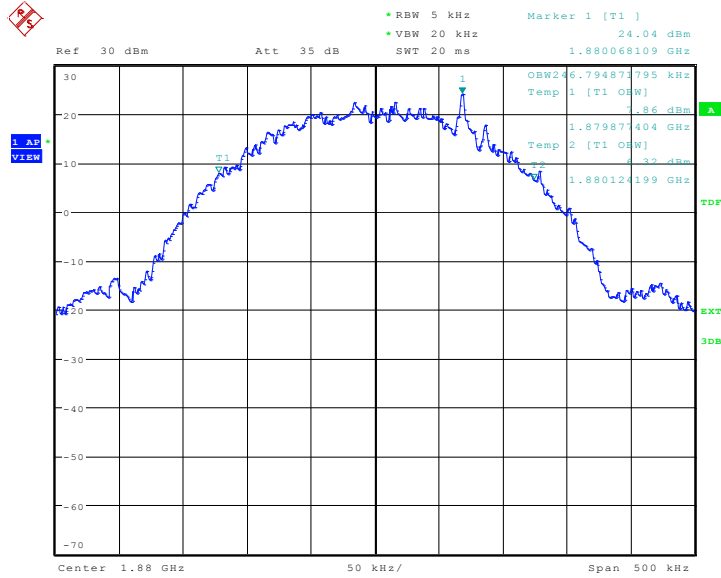


**PCS 1900**  
**Channel 512-Occupied Bandwidth (99% BW)**



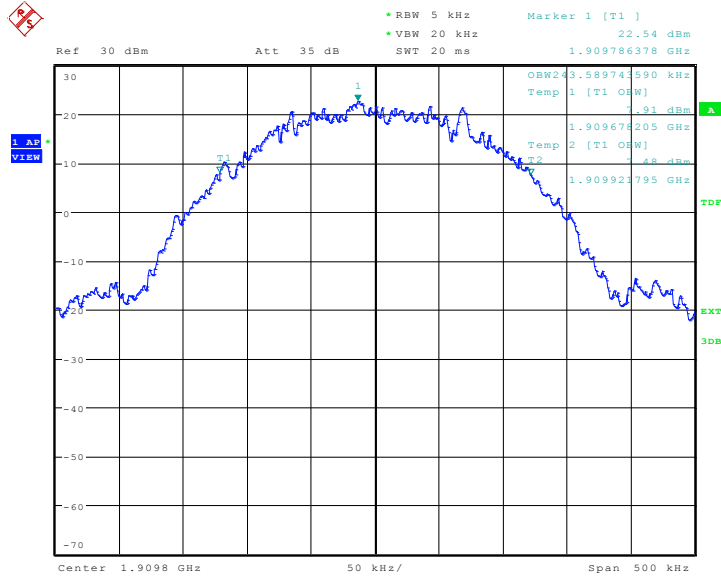
Date: 11.APR.2018 09:14:37

**Channel 661-Occupied Bandwidth (99% BW)**



Date: 11.APR.2018 09:15:09

**Channel 810-Occupied Bandwidth (99% BW)**

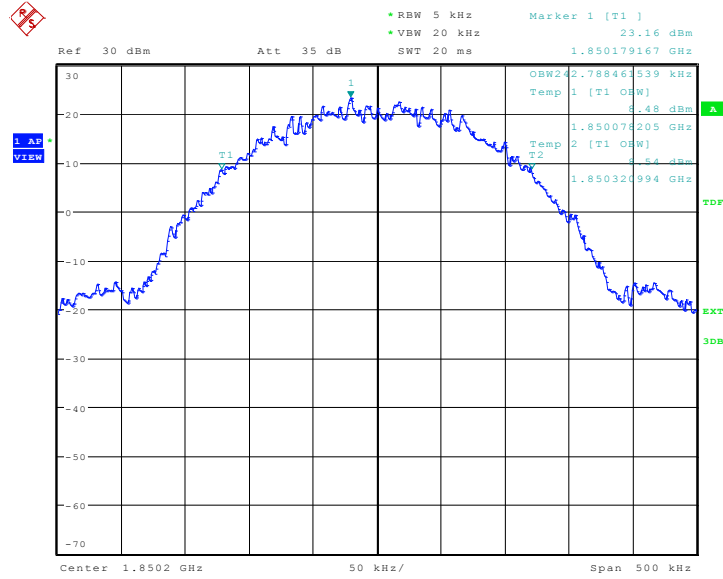


Date: 11.APR.2018 09:15:41

**GPRS 1900(99% BW)**

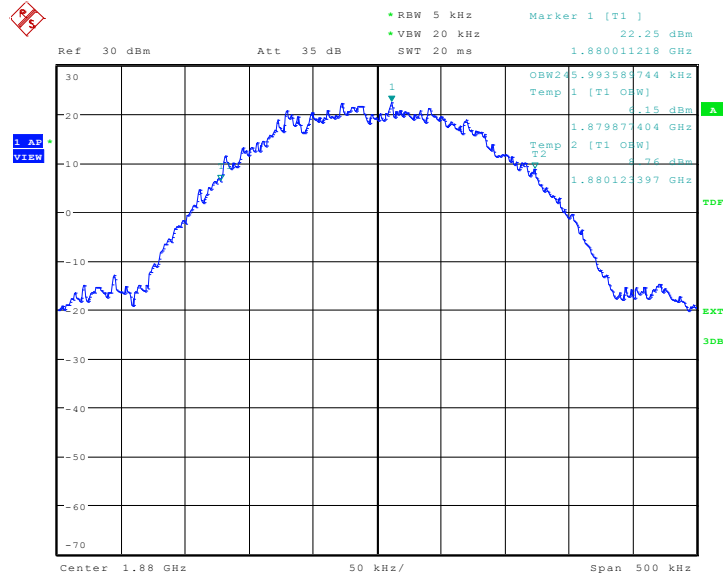
| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |
|----------------|-----------------------------------|
| 1850.2         | 242.788                           |
| 1880.0         | 245.994                           |
| 1909.8         | 243.590                           |

**GPRS 1900**  
**Channel 512-Occupied Bandwidth (99% BW)**



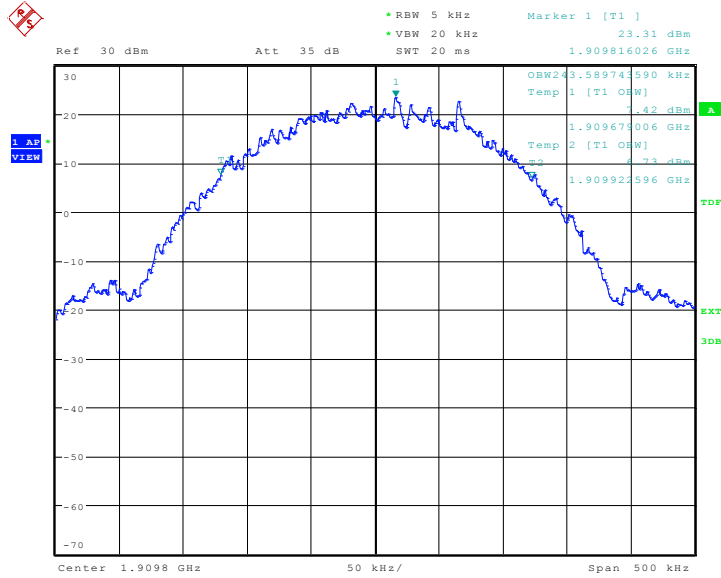
Date: 11.APR.2018 10:02:48

**Channel 661-Occupied Bandwidth (99% BW)**



Date: 11.APR.2018 10:03:20

**Channel 810-Occupied Bandwidth (99% BW)**



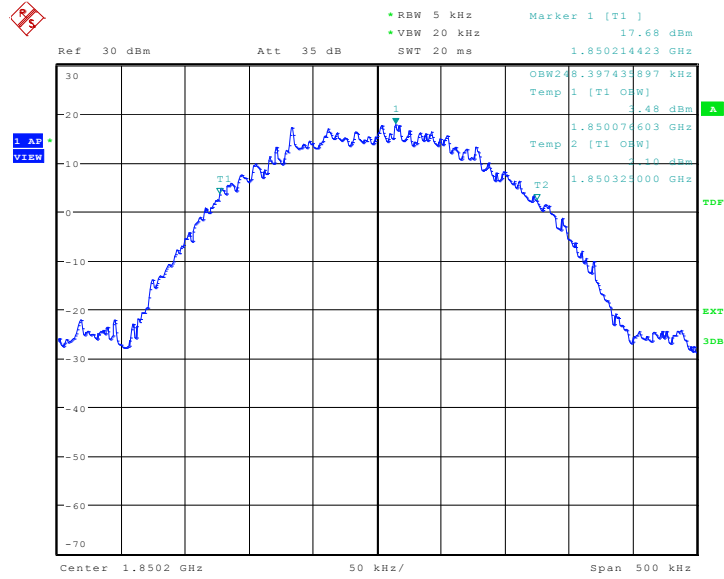
Date: 11.APR.2018 10:03:52

**EGPRS 1900-8PSK(99% BW)**

| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |
|----------------|-----------------------------------|
| 1850.2         | 248.397                           |
| 1880.0         | 250.000                           |
| 1909.8         | 252.404                           |

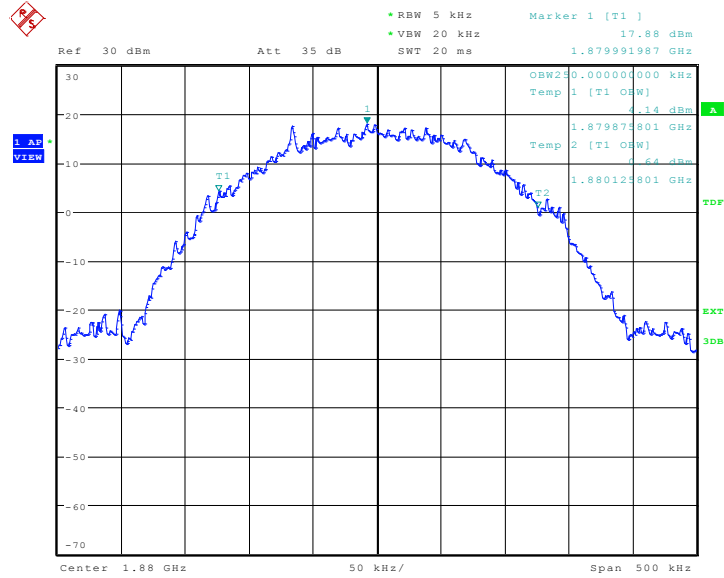


### EGPRS 1900-8PSK Channel 512-Occupied Bandwidth (99% BW)



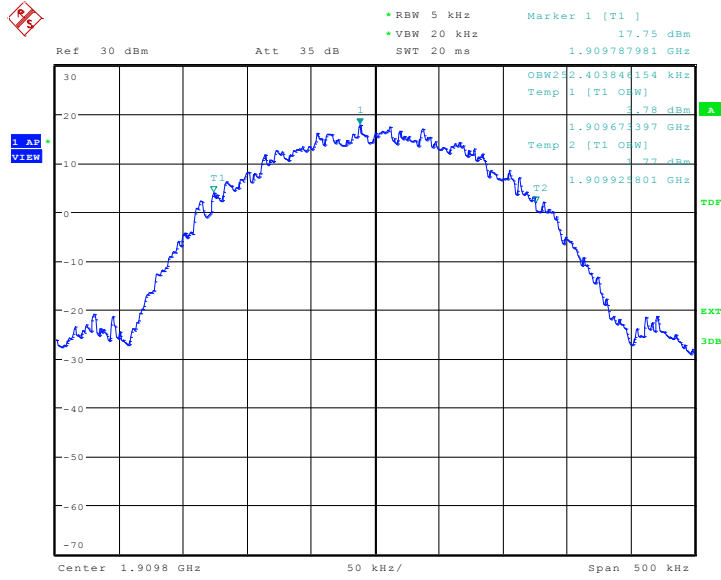
Date: 12.APR.2018 11:07:24

### Channel 661-Occupied Bandwidth (99% BW)



Date: 12.APR.2018 11:07:56

### Channel 810-Occupied Bandwidth (99% BW)



Date: 12.APR.2018 11:08:28

## A.5 EMISSION BANDWIDTH

### Reference

FCC: CFR Part 22.917(b), 24.238(a)

### A.5.1 Emission Bandwidth Results

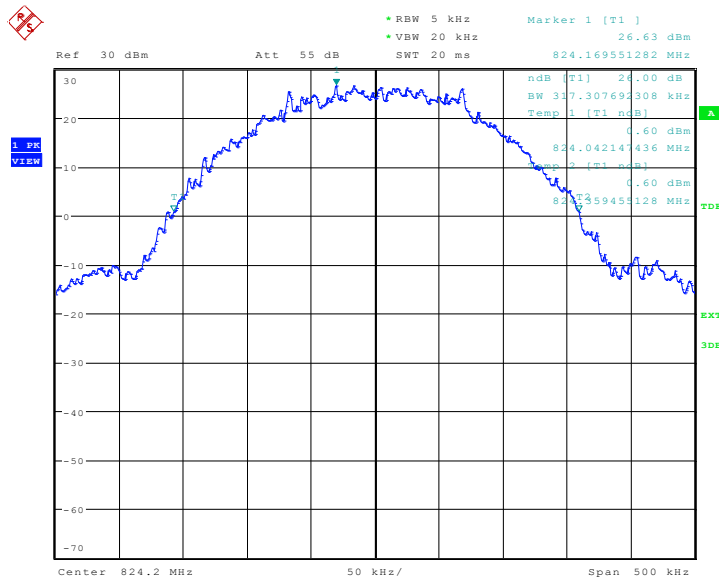
The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

#### GSM 850

| Frequency(MHz) | Emission Bandwidth ( kHz) |
|----------------|---------------------------|
| 824.2          | 317.31                    |
| 836.6          | 318.91                    |
| 848.8          | 314.10                    |

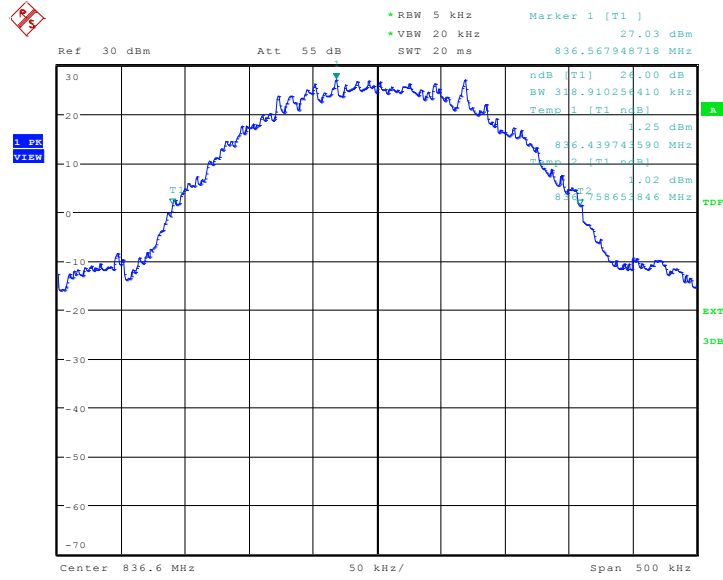
#### GSM 850

#### Channel 128-Emission Bandwidth



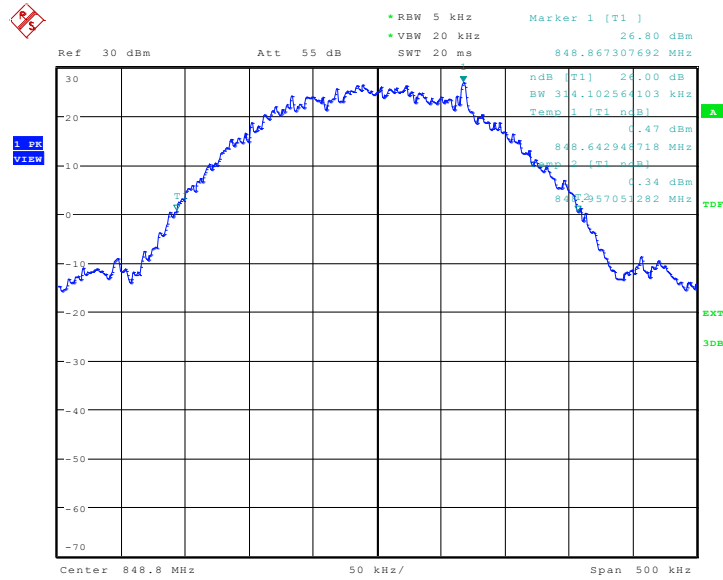
Date: 11.APR.2018 08:50:41

### Channel 190-Emission Bandwidth



Date: 11.APR.2018 08:51:49

### Channel 251-Emission Bandwidth



Date: 11.APR.2018 08:52:56

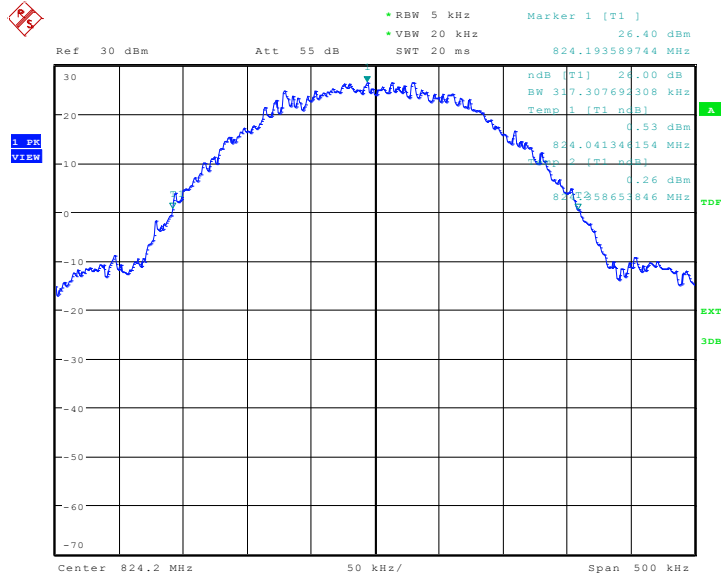


**GPRS 850**

| Frequency(MHz) | Emission Bandwidth ( kHz) |
|----------------|---------------------------|
| 824.2          | 317.31                    |
| 836.6          | 314.10                    |
| 848.8          | 318.91                    |

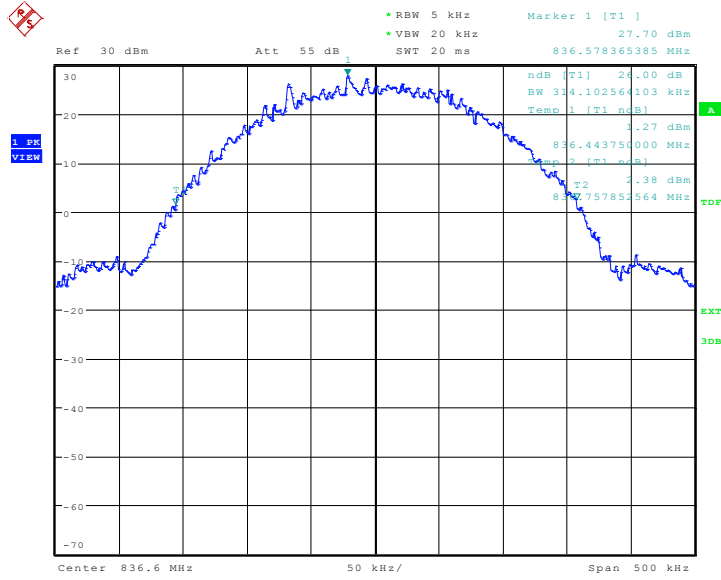
**GPRS 850**

**Channel 128-Emission Bandwidth**



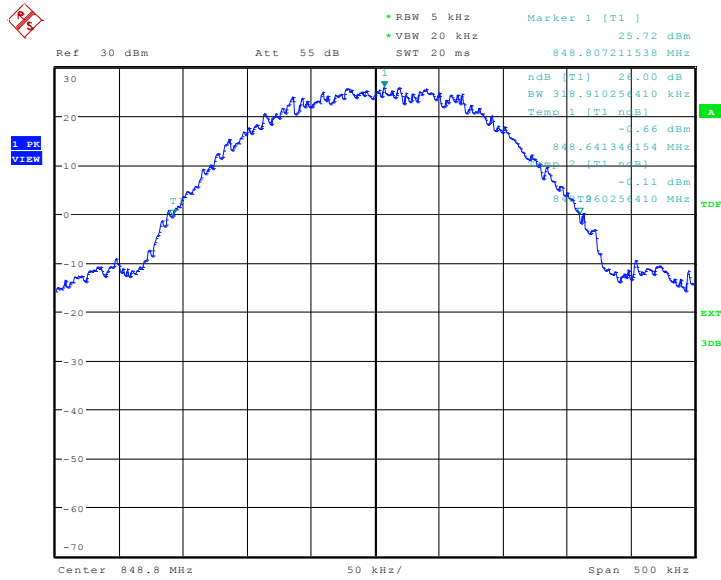
Date: 11.APR.2018 09:36:26

### Channel 190-Emission Bandwidth



Date: 11.APR.2018 09:37:33

### Channel 251-Emission Bandwidth



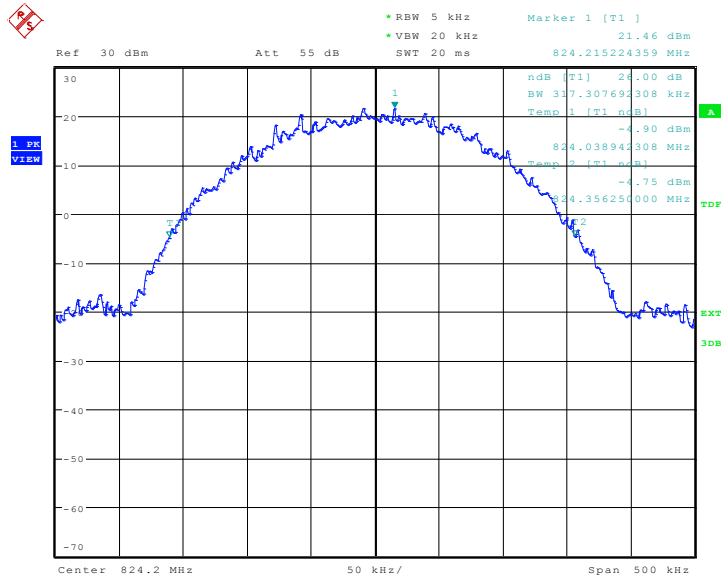
Date: 11.APR.2018 09:38:41

**EGPRS 850-8PSK**

| Frequency(MHz) | Emission Bandwidth ( kHz) |
|----------------|---------------------------|
| 824.2          | 317.31                    |
| 836.6          | 316.51                    |
| 848.8          | 317.31                    |

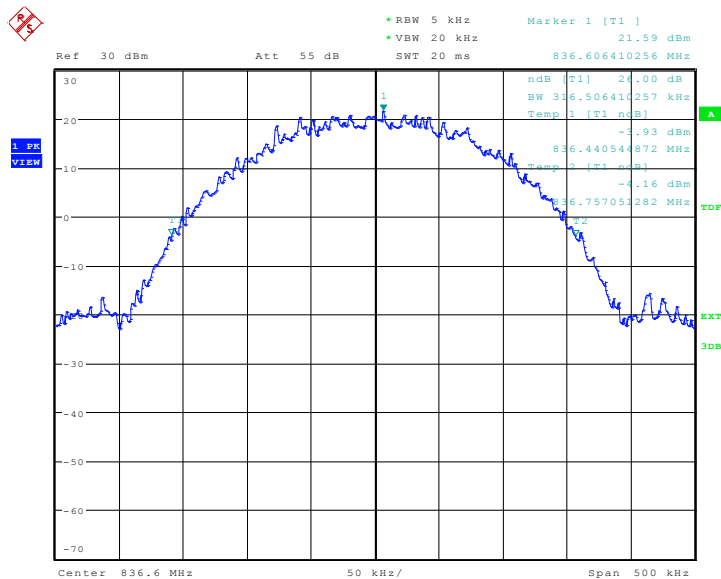
**EGPRS 850-8PSK**

**Channel 128-Emission Bandwidth**



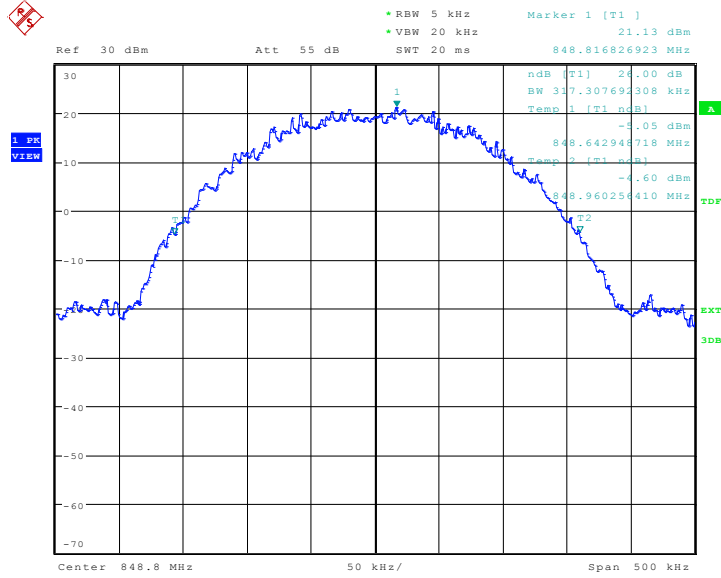
Date: 11.APR.2018 10:19:06

**Channel 190-Emission Bandwidth**



Date: 11.APR.2018 10:20:14

### Channel 251-Emission Bandwidth

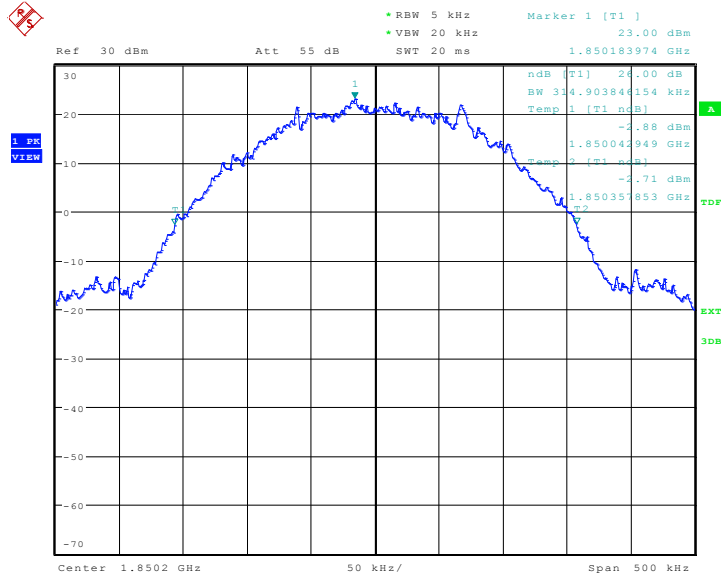


Date: 11.APR.2018 10:21:22

### PCS 1900

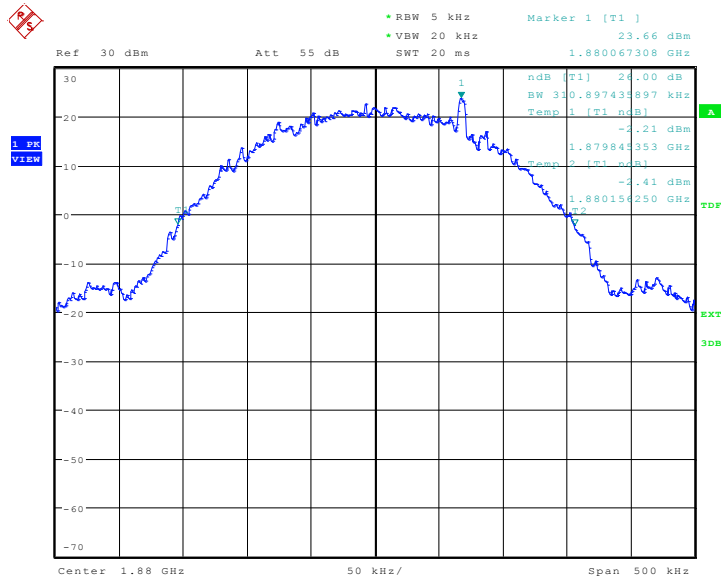
| Frequency(MHz) | Emission Bandwidth ( kHz) |
|----------------|---------------------------|
| 1850.2         | 314.90                    |
| 1880.0         | 310.90                    |
| 1909.8         | 312.50                    |

**PCS 1900**  
**Channel 512-Emission Bandwidth**



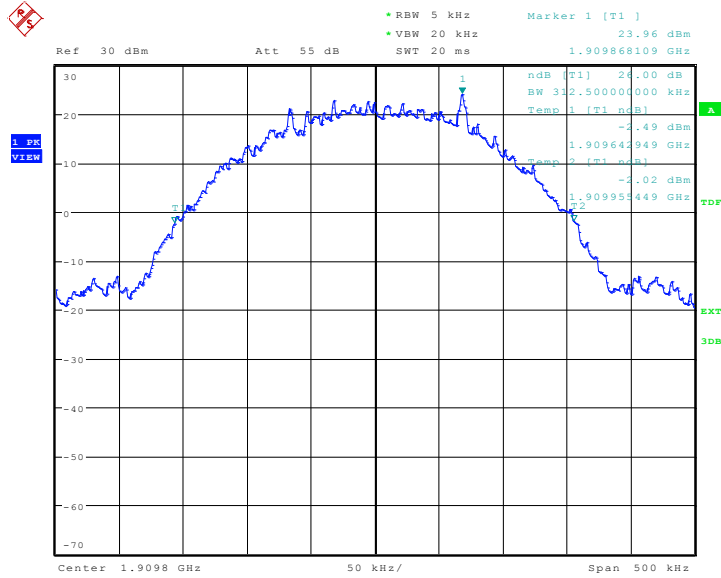
Date: 11.APR.2018 09:16:50

**Channel 661-Emission Bandwidth**



Date: 11.APR.2018 09:17:57

### Channel 810-Emission Bandwidth



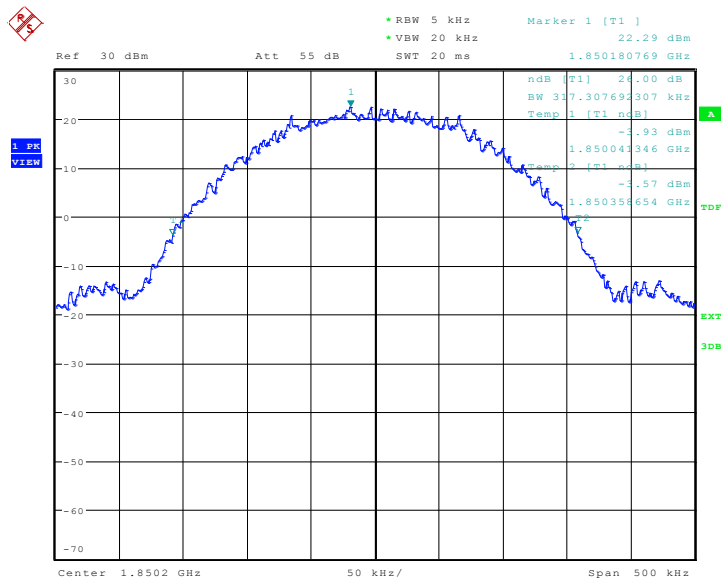
Date: 11.APR.2018 09:19:04

### GPRS 1900

| Frequency(MHz) | Emission Bandwidth ( kHz) |
|----------------|---------------------------|
| 1850.2         | 317.31                    |
| 1880.0         | 314.90                    |
| 1909.8         | 315.71                    |

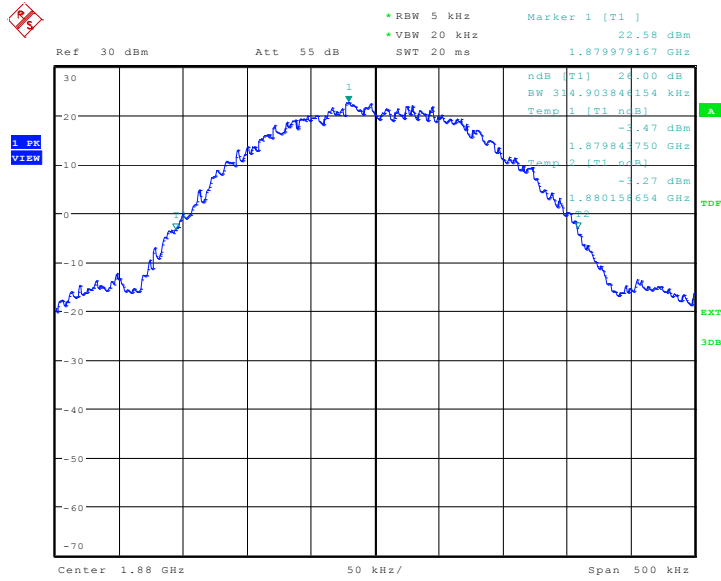
### GPRS 1900

#### Channel 512-Emission Bandwidth



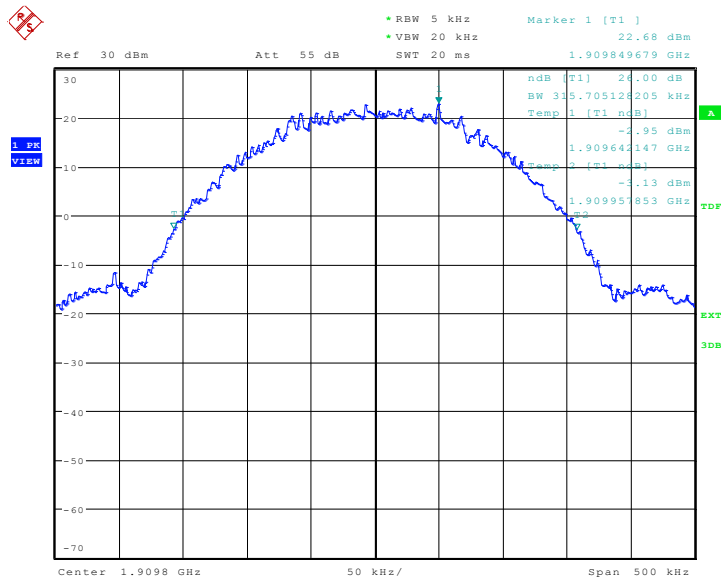
Date: 11.APR.2018 10:05:01

### Channel 661-Emission Bandwidth



Date: 11.APR.2018 10:06:08

### Channel 810-Emission Bandwidth



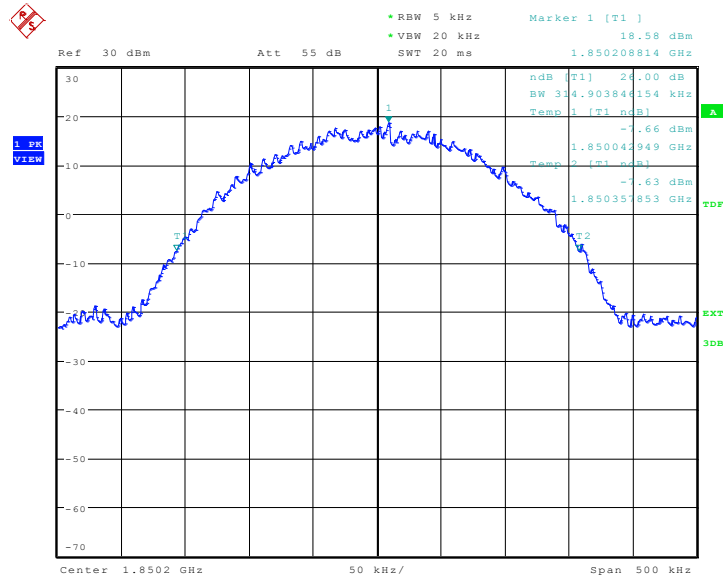
Date: 11.APR.2018 10:07:15

**EGPRS 1900-8PSK**

| Frequency(MHz) | Emission Bandwidth( kHz) |
|----------------|--------------------------|
| 1850.2         | 314.90                   |
| 1880.0         | 314.90                   |
| 1909.8         | 317.31                   |

**EGPRS 1900-8PSK**

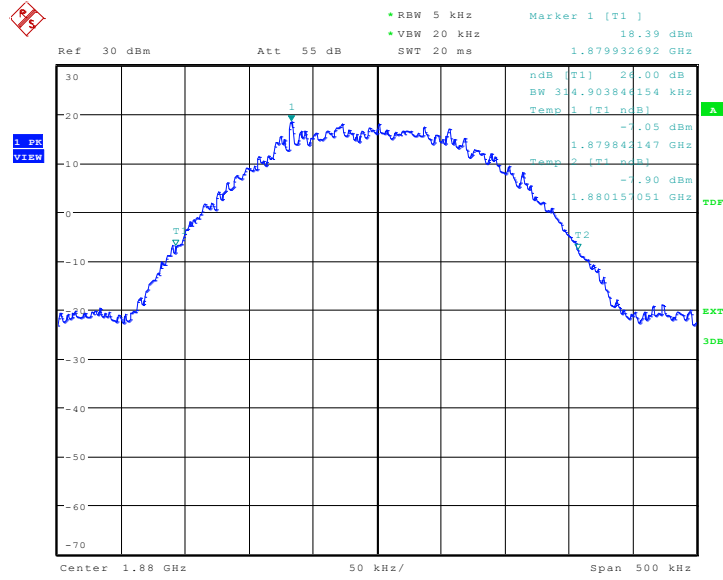
**Channel 512-Emission Bandwidth**



Date: 12.APR.2018 11:09:37

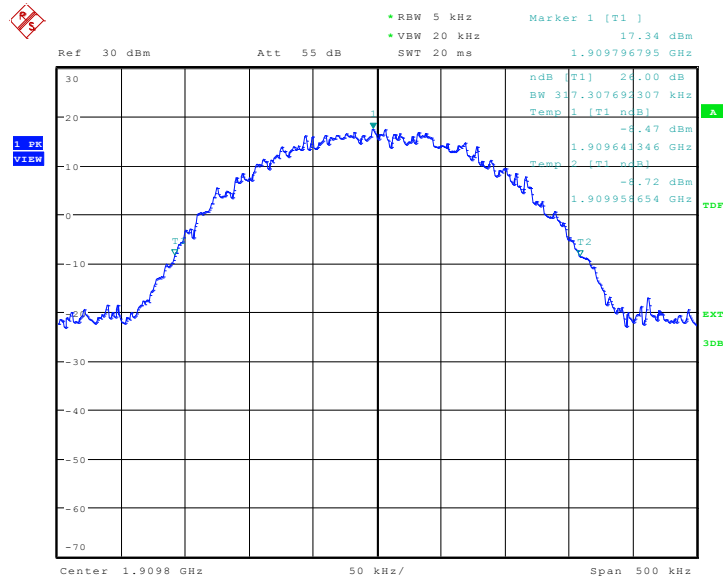


### Channel 661-Emission Bandwidth



Date: 12.APR.2018 11:10:44

### Channel 810-Emission Bandwidth



Date: 12.APR.2018 11:11:51

## A.6 BAND EDGE COMPLIANCE

### Reference

FCC: CFR Part 22.917(b), 24.238(a)

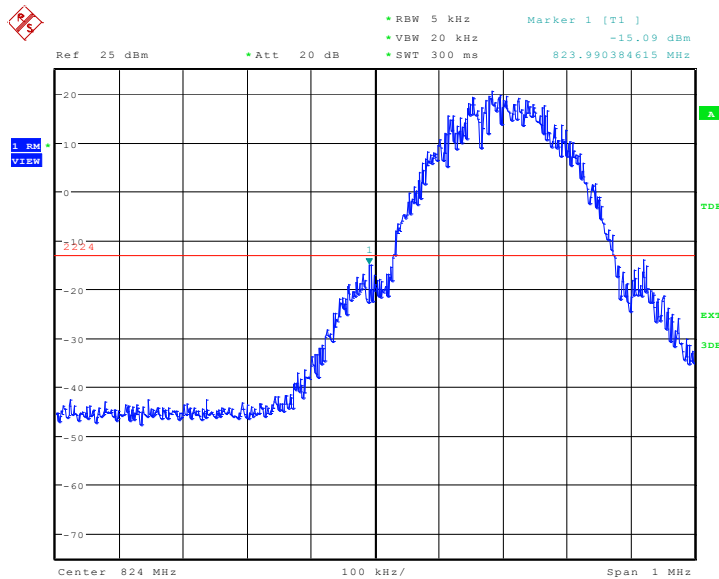
### Measurement limit

On any frequency outside frequency band of the US Cellular/PCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least  $43+10\log(P)$  dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

According to KDB 971168, a relaxation of the reference bandwidth is often provided for measurements within a specified frequency range at the edge of the authorized frequency block/band. This is often implemented by permitting the use of a narrower RBW (typically limited to a minimum RBW of 1% of the OBW) for measuring the out-of-band emissions without a requirement to integrate the result over the full reference bandwidth.

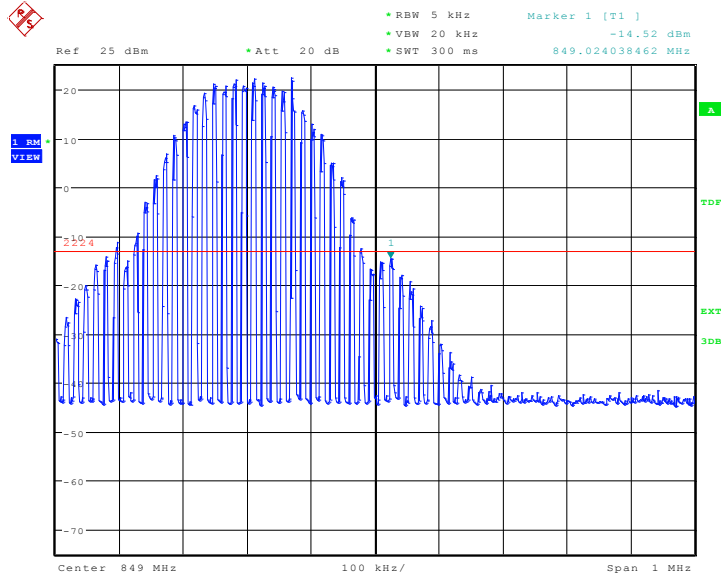
### GSM 850

#### LOW BAND EDGE BLOCK-A (GSM850)-Channel 128



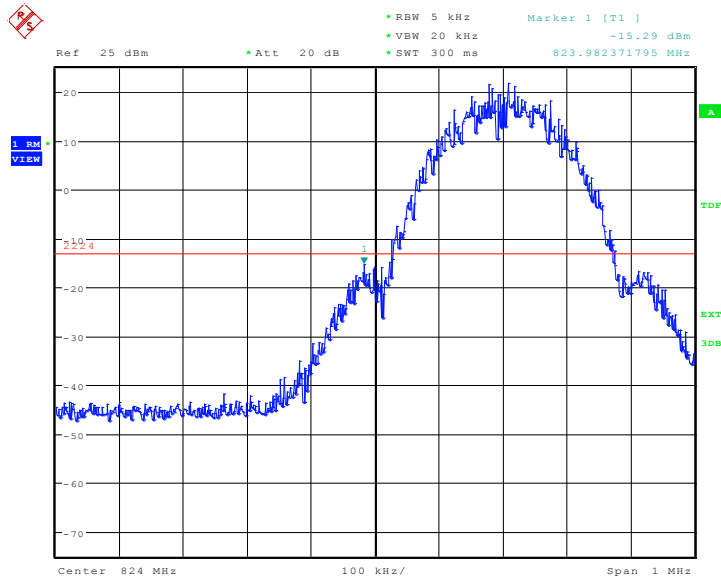
Date: 11.APR.2018 08:53:05

### HIGH BAND EDGE BLOCK-C (GSM850) –Channel 251



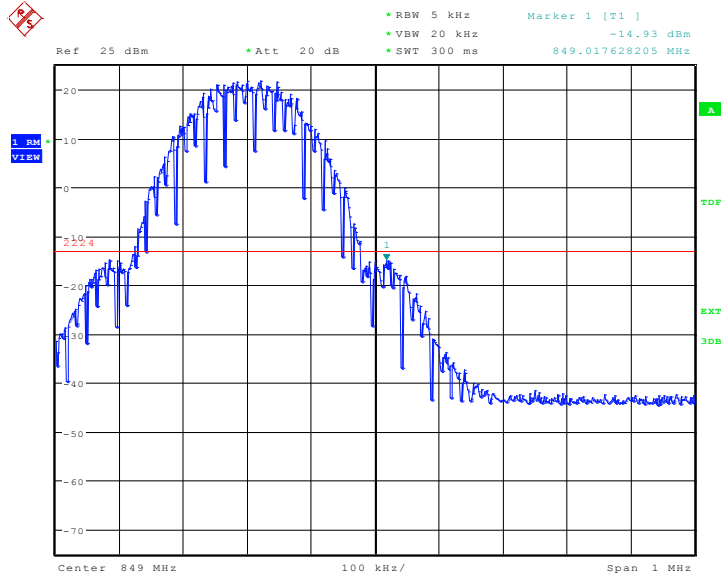
Date: 11.APR.2018 08:55:09

### GPRS 850 LOW BAND EDGE BLOCK-A (GSM850)-Channel 128



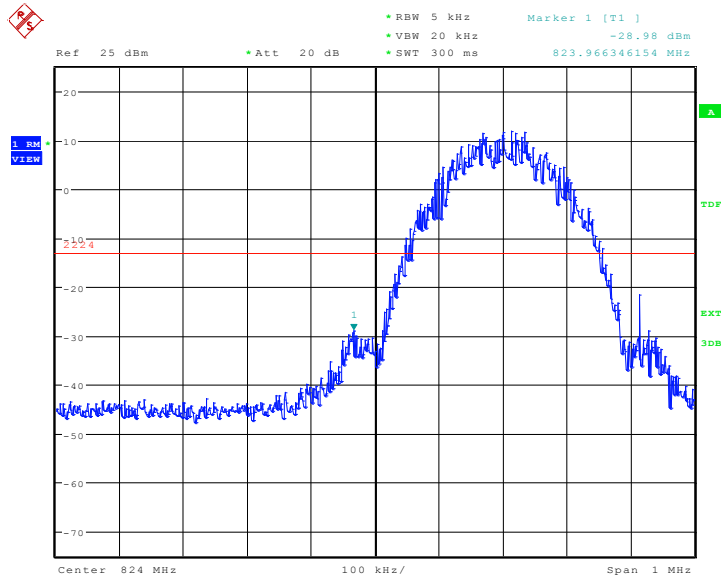
Date: 11.APR.2018 09:38:50

### HIGH BAND EDGE BLOCK-C (GSM850) –Channel 251



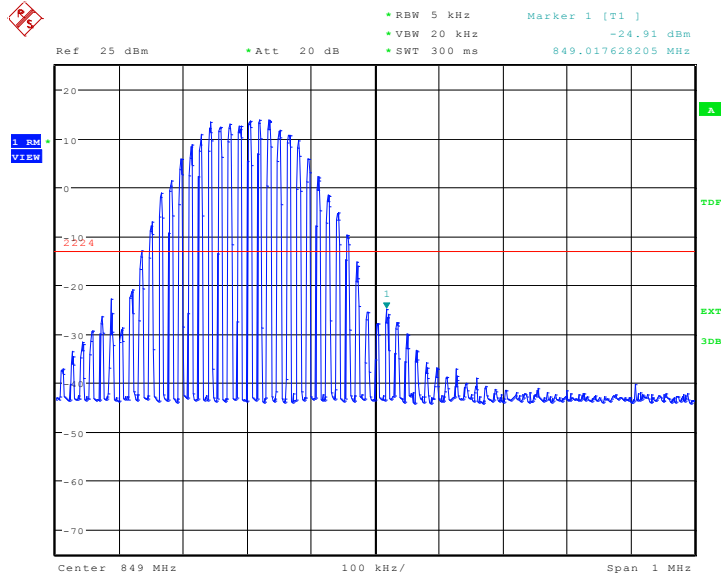
Date: 11.APR.2018 09:40:53

### EGPRS 850-8PSK LOW BAND EDGE BLOCK-A (GSM850)-Channel 128



Date: 12.APR.2018 10:58:04

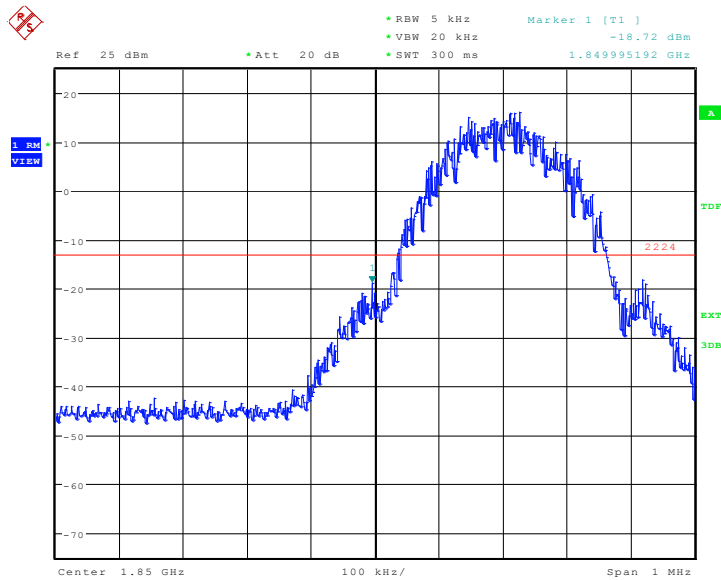
### HIGH BAND EDGE BLOCK-C (GSM850) –Channel 251



Date: 12.APR.2018 10:48:04

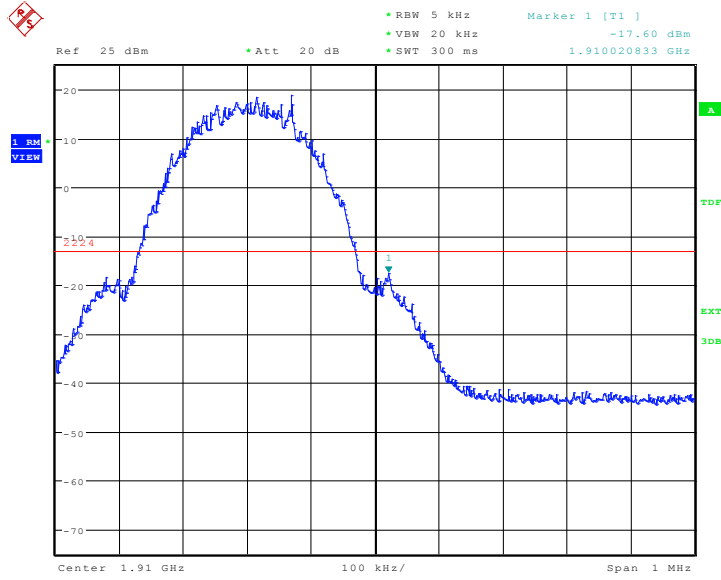
### PCS 1900

### LOW BAND EDGE BLOCK-A (PCS-1900)-Channel 512



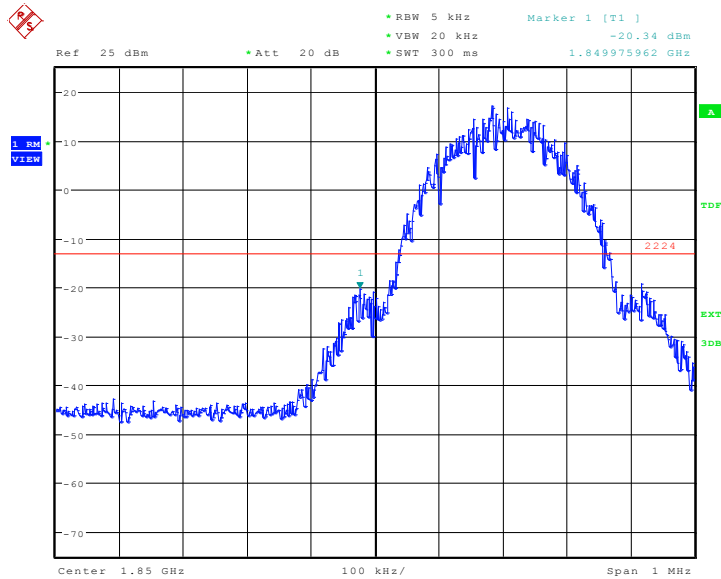
Date: 11.APR.2018 09:19:13

### HIGH BAND EDGE BLOCK-C (PCS-1900) –Channel 810



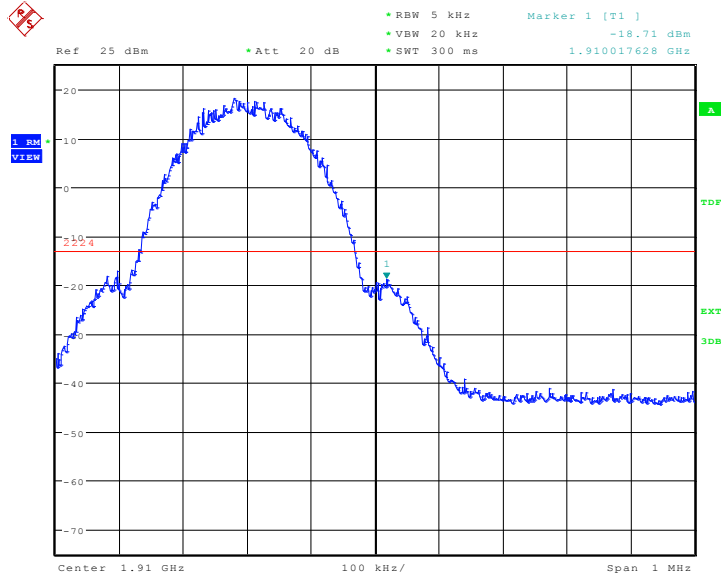
Date: 11.APR.2018 09:21:17

### GPRS 1900 LOW BAND EDGE BLOCK-A (PCS-1900)-Channel 512



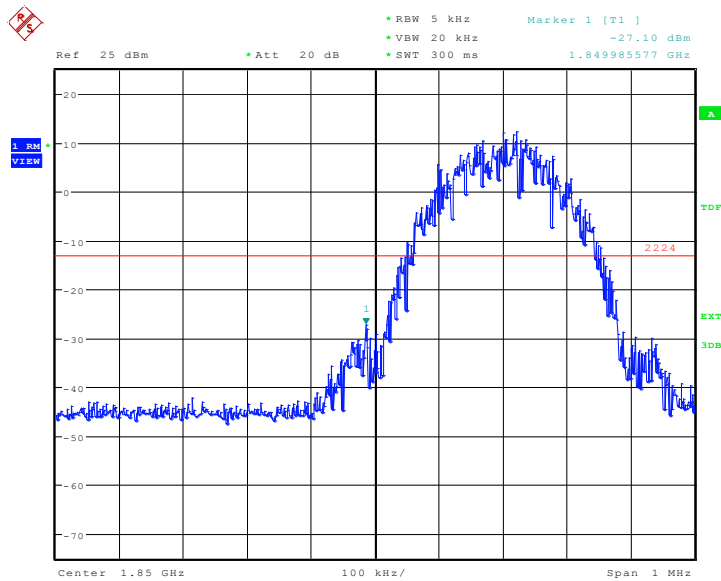
Date: 11.APR.2018 10:07:24

### HIGH BAND EDGE BLOCK-C (PCS-1900) –Channel 810



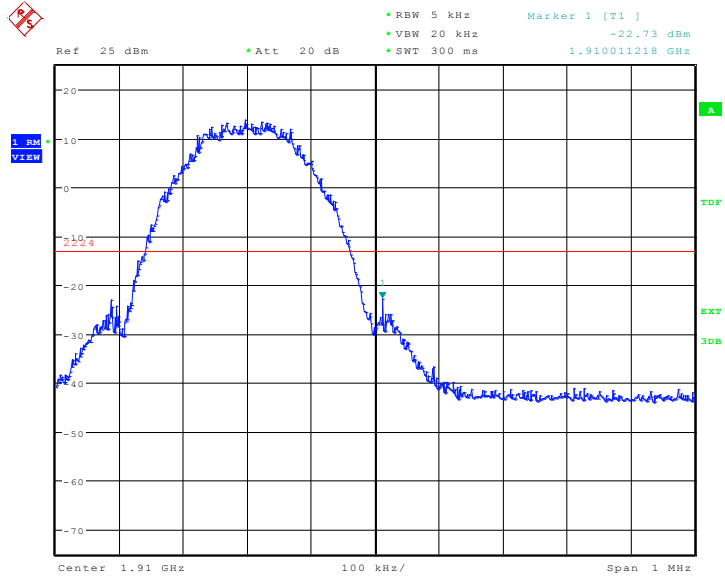
Date: 11.APR.2018 10:09:28

### EGPRS 1900-8PSK LOW BAND EDGE BLOCK-A (PCS-1900)-Channel 512



Date: 12.APR.2018 11:12:00

**HIGH BAND EDGE BLOCK-C (PCS-1900) –Channel 810**



Date: 12.APR.2018 11:17:04



## **A.7 CONDUCTED SPURIOUS EMISSION**

### **Reference**

FCC: CFR Part 2.1057, 22.917, 24.238.

### **A.7.1 Measurement Method**

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 25 GHz.
2. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.
3. According to KDB 971168, the applicable rule part specifies the reference bandwidth for measuring unwanted emission levels (typically, 100 kHz if the authorized frequency band/block is at or below 1 GHz and 1 MHz if the authorized frequency band/block is above 1 GHz)

### **GSM850 Transmitter**

| Channel | Frequency (MHz) |
|---------|-----------------|
| 128     | 824.2           |
| 190     | 836.6           |
| 251     | 848.8           |

### **PCS1900 Transmitter**

| Channel | Frequency (MHz) |
|---------|-----------------|
| 512     | 1850.2          |
| 661     | 1880.0          |
| 810     | 1909.8          |

### **A. 7.2 Measurement Limit**

Part 24.238 and Part 22.917 specify that 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.

The specification that emissions shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

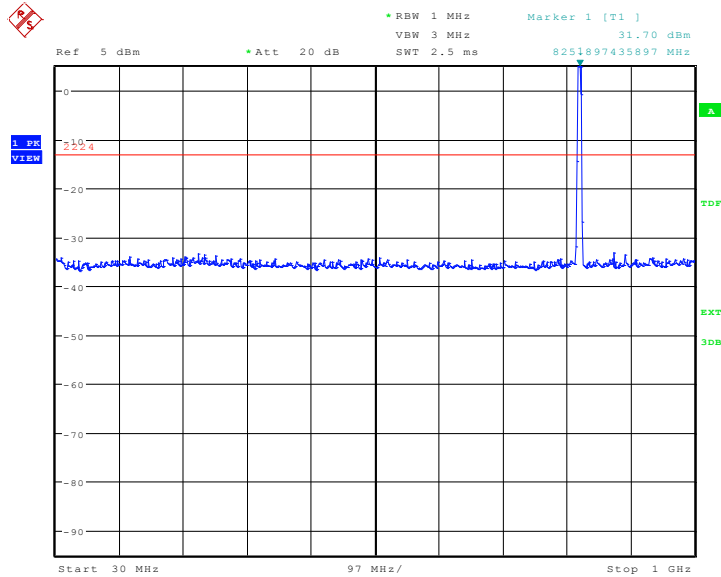
### A.7.3 Measurement result

#### GSM850

#### Channel 128: 30MHz – 1GHz

Spurious emission limit –13dBm.

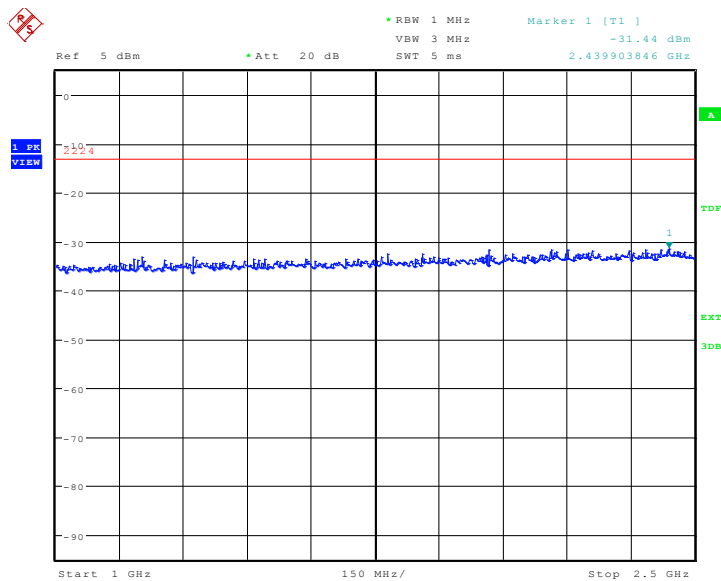
**NOTE: peak above the limit line is the carrier frequency.**



Date: 11.APR.2018 08:57:35

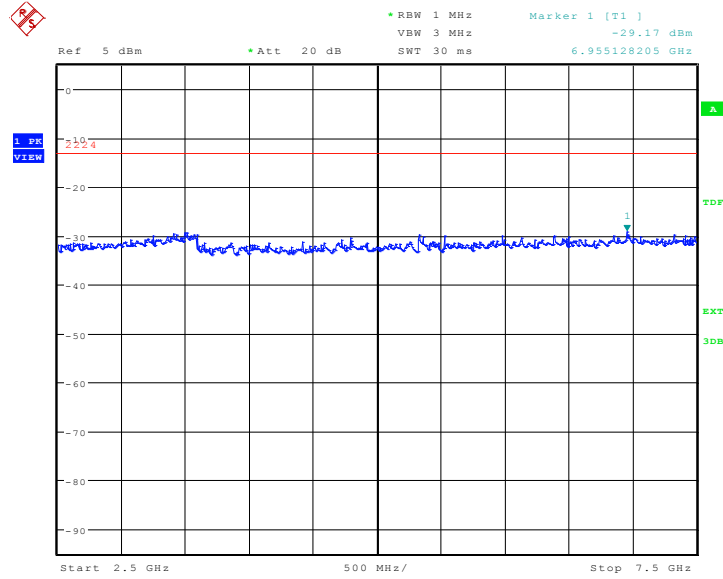
#### Channel 128: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



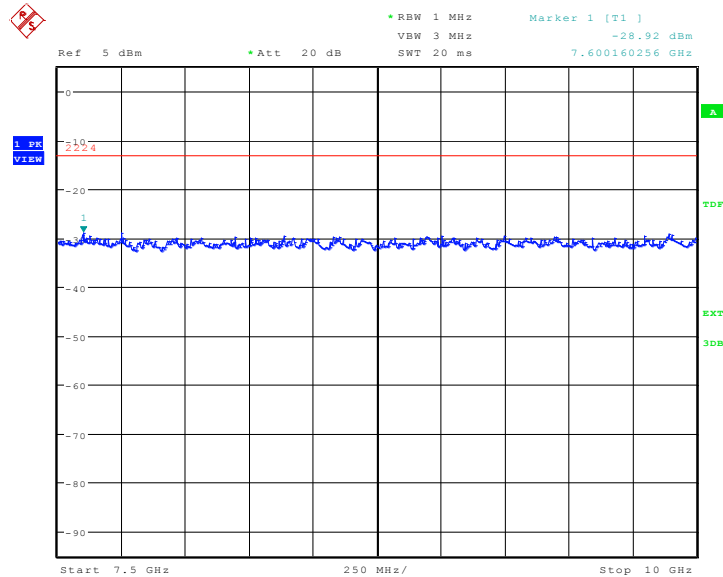
Date: 11.APR.2018 08:58:03

**Channel 128: 2.5GHz – 7.5GHz**  
Spurious emission limit –13dBm.



Date: 11.APR.2018 08:58:31

**Channel 128: 7.5GHz –10GHz**  
Spurious emission limit –13dBm.

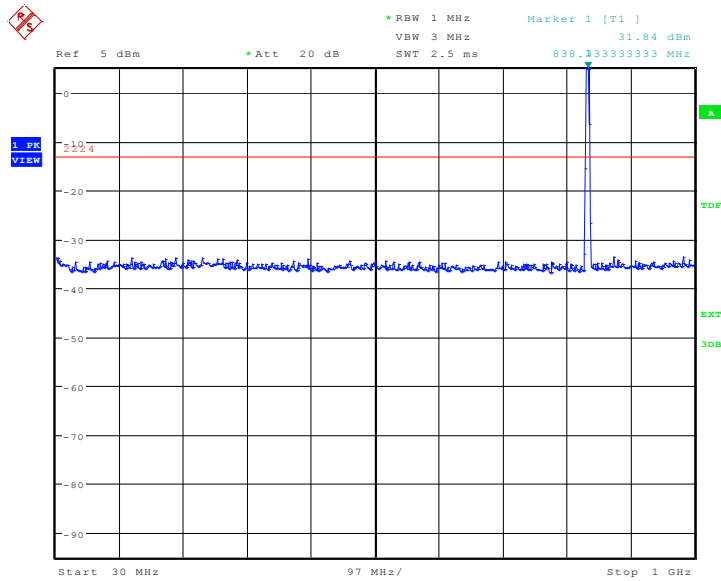


Date: 11.APR.2018 08:58:59

**Channel 190: 30MHz – 1GHz**

Spurious emission limit –13dBm

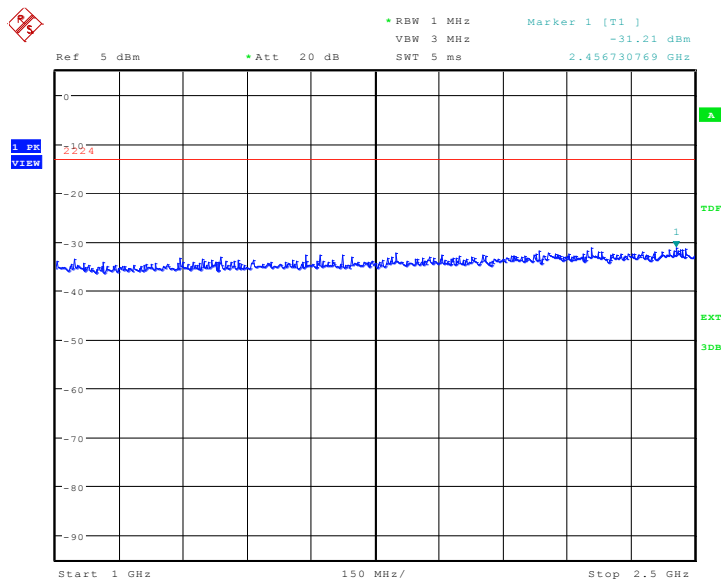
**NOTE: peak above the limit line is the carrier frequency.**



Date: 11.APR.2018 08:59:28

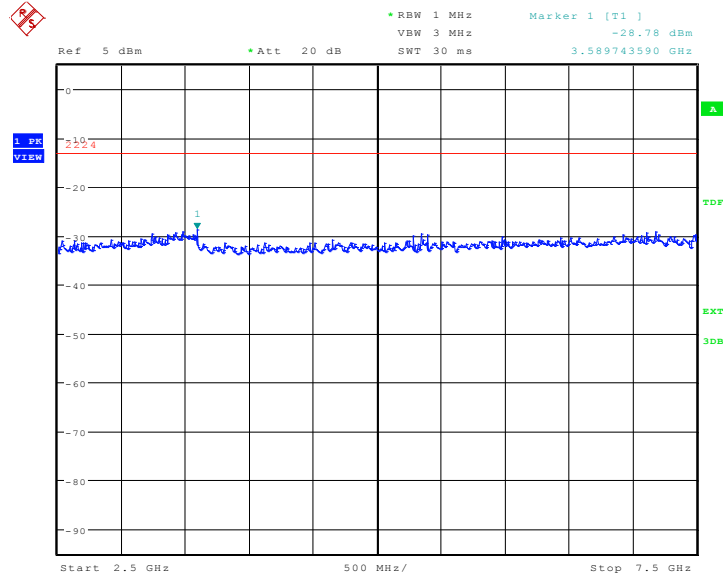
**Channel 190: 1GHz –2.5GHz**

Spurious emission limit –13dBm



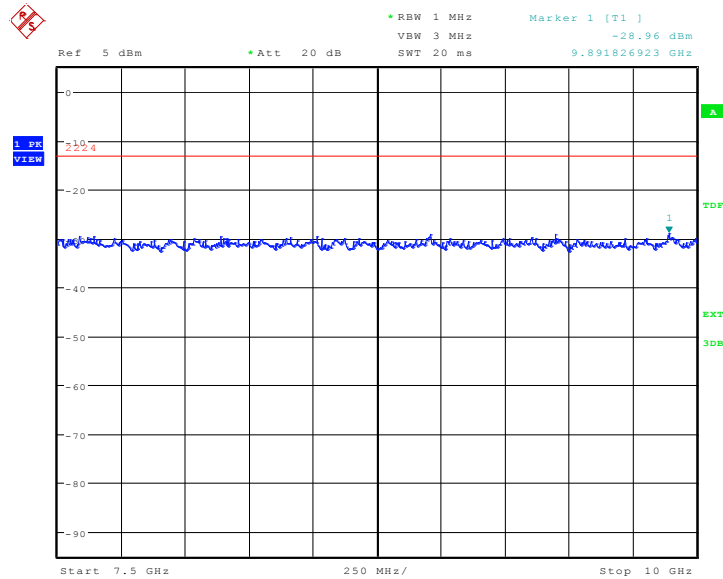
Date: 11.APR.2018 08:59:56

**Channel 190: 2.5GHz –7.5GHz**  
Spurious emission limit –13dBm



Date: 11.APR.2018 09:00:24

**Channel 190: 7.5GHz –10GHz**  
Spurious emission limit –13dBm

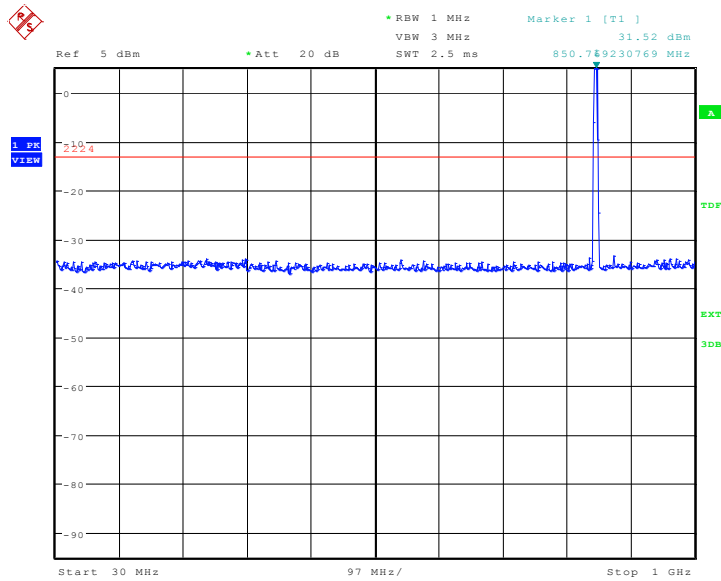


Date: 11.APR.2018 09:00:52

**Channel 251: 30MHz – 1GHz**

Spurious emission limit –13dBm.

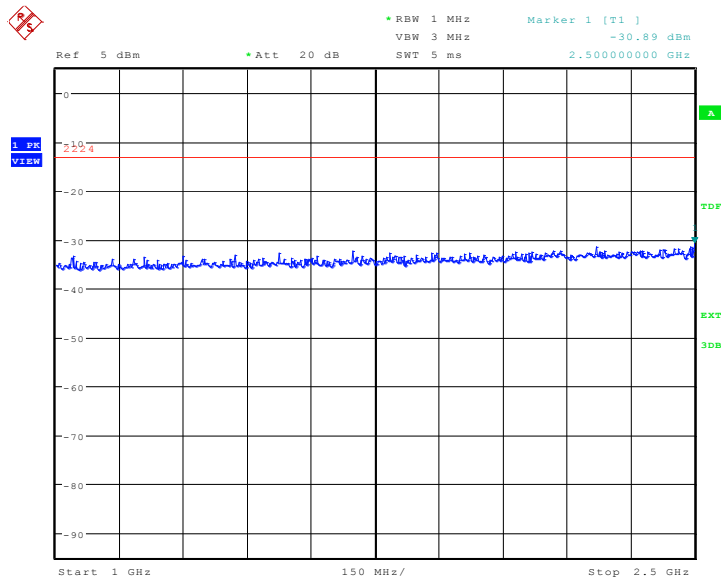
**NOTE: peak above the limit line is the carrier frequency.**



Date: 11.APR.2018 09:01:21

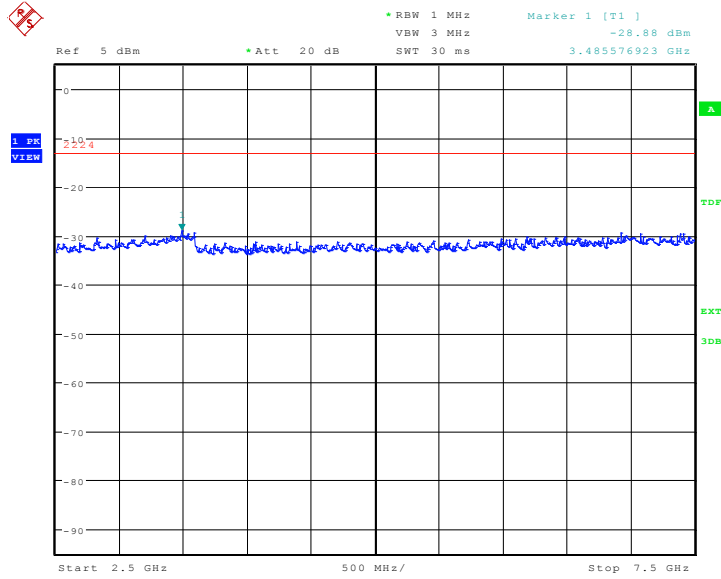
**Channel 251: 1GHz – 2.5GHz**

Spurious emission limit –13dBm.



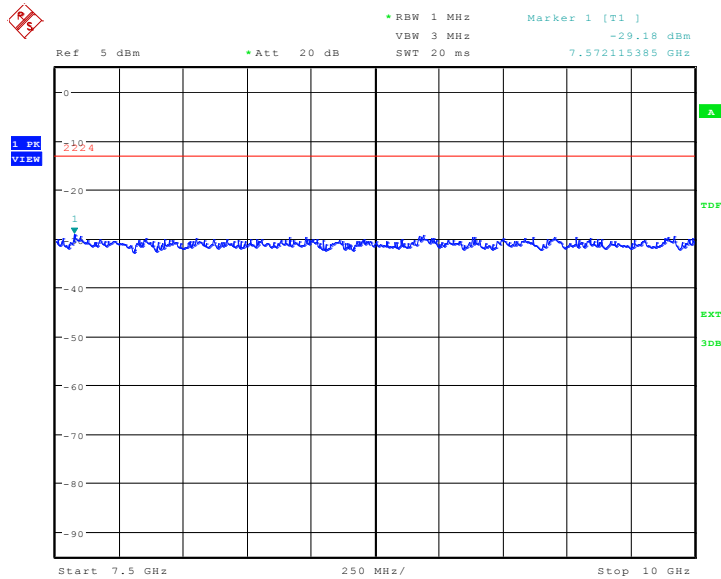
Date: 11.APR.2018 09:01:49

**Channel 251:2.5GHz – 7.5GHz**  
Spurious emission limit –13dBm.



Date: 11.APR.2018 09:02:17

**Channel 251: 7.5GHz – 10GHz**  
Spurious emission limit –13dBm.

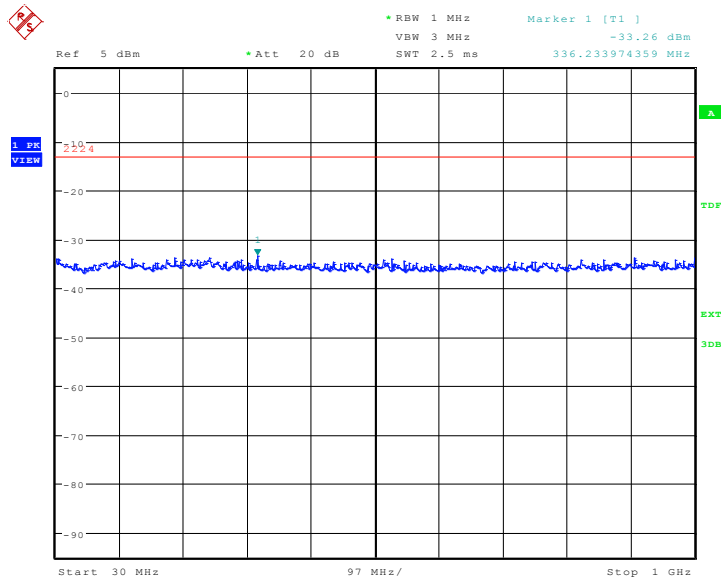


Date: 11.APR.2018 09:02:46

**PCS1900**

**Channel 512: 30MHz – 1GHz**

Spurious emission limit –13dBm.

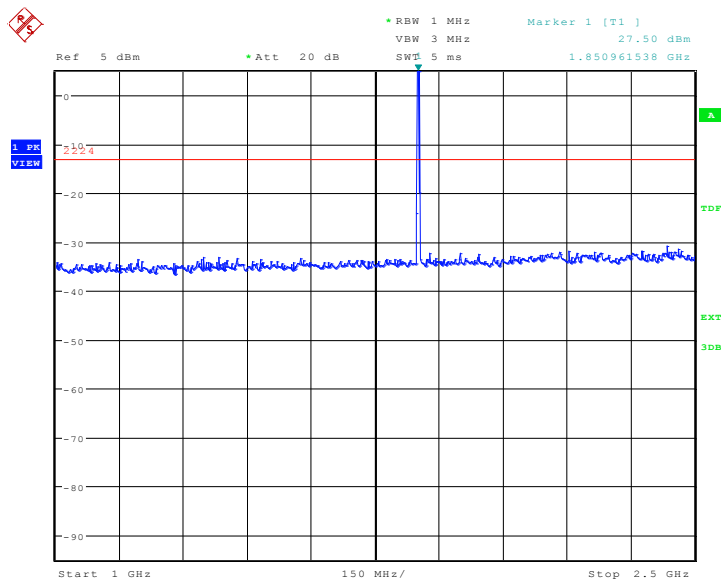


Date: 11.APR.2018 09:23:43

**Channel 512: 1GHz – 2.5GHz**

Spurious emission limit –13dBm.

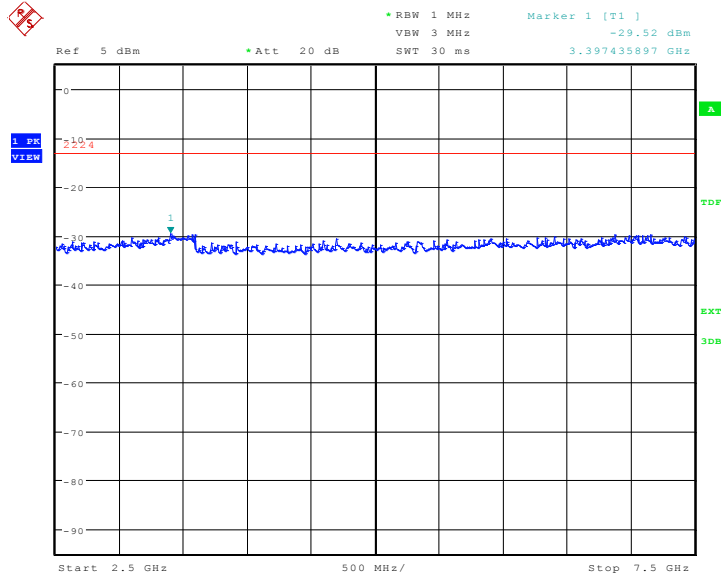
**NOTE: peak above the limit line is the carrier frequency.**



Date: 11.APR.2018 09:24:11

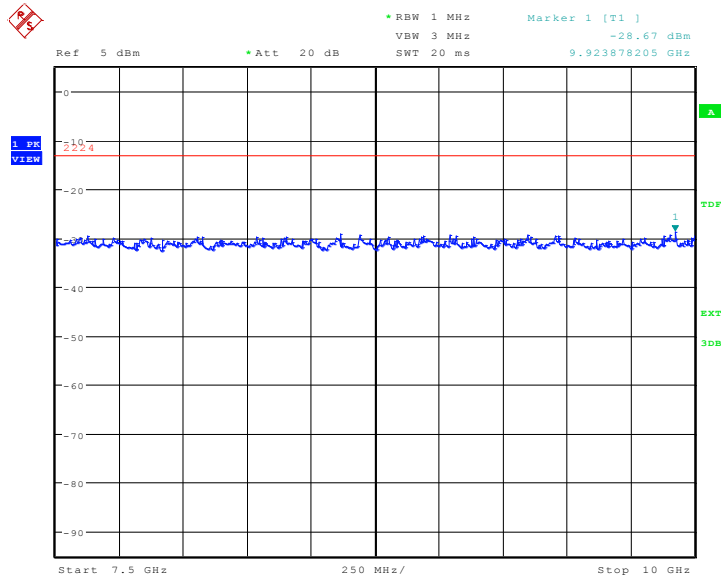


**Channel 512: 2.5GHz – 7.5GHz**  
Spurious emission limit –13dBm.



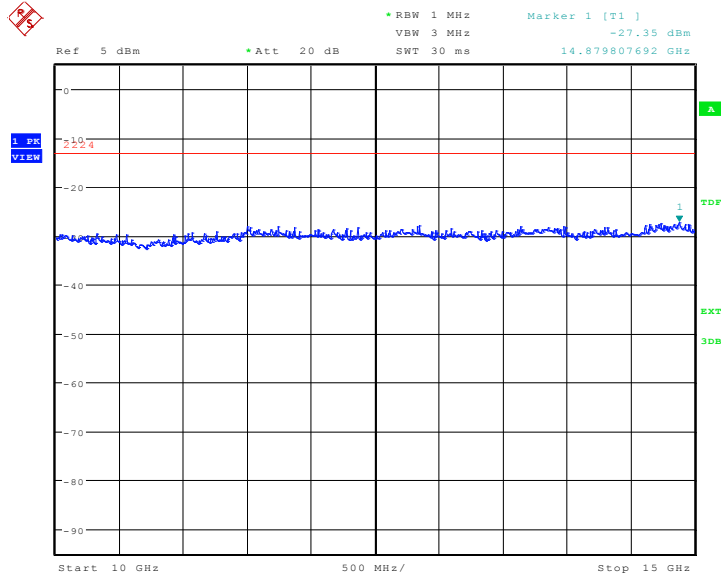
Date: 11.APR.2018 09:24:39

**Channel 512: 7.5GHz –10GHz**  
Spurious emission limit –13dBm.



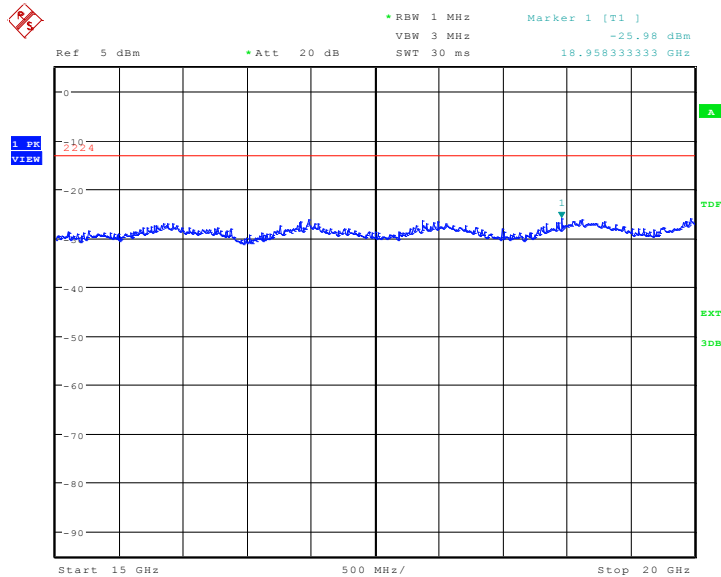
Date: 11.APR.2018 09:25:08

**Channel 512: 10GHz –15GHz**  
Spurious emission limit –13dBm.



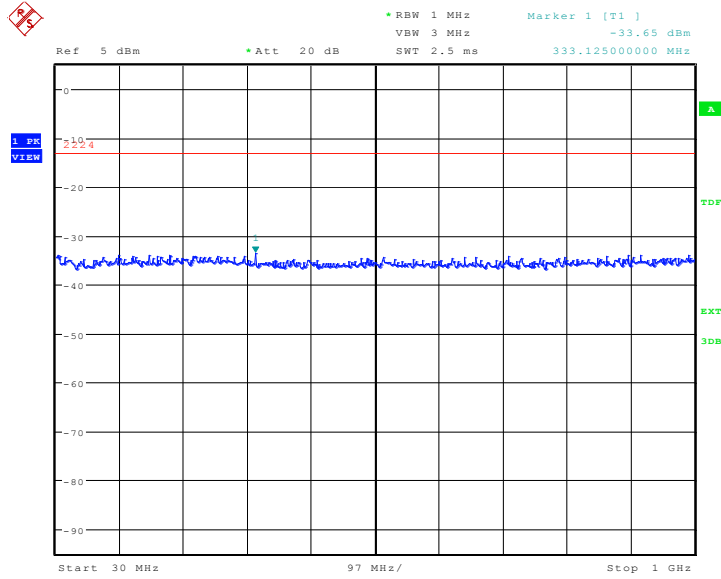
Date: 11.APR.2018 09:25:36

**Channel 512: 15GHz –20GHz**  
Spurious emission limit –13dBm.



Date: 11.APR.2018 09:26:04

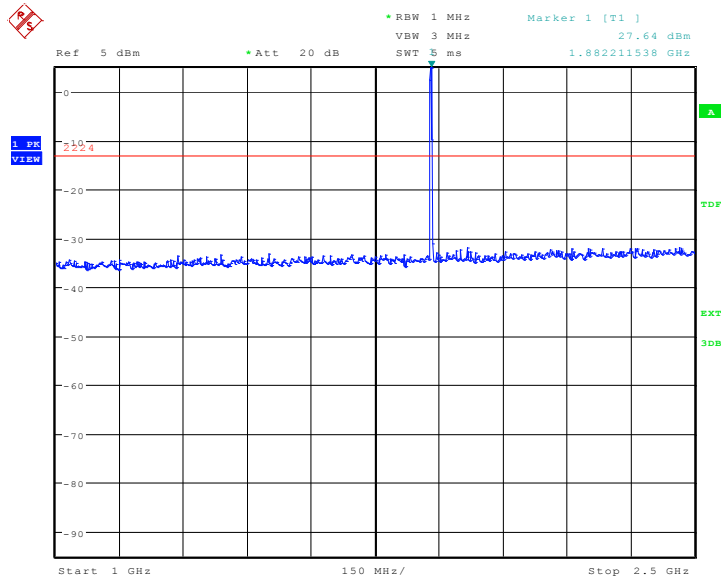
**Channel 661: 30MHz – 1GHz**  
Spurious emission limit –13dBm



Date: 11.APR.2018 09:26:33

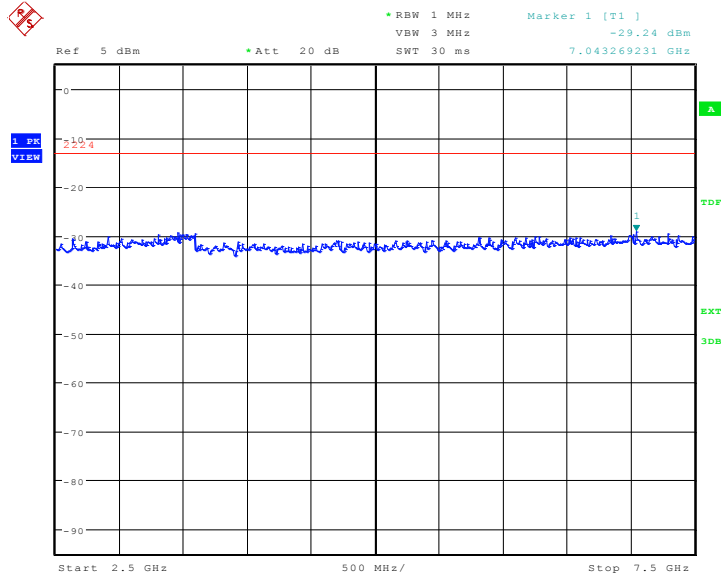
**Channel 661: 1GHz –2.5GHz**  
Spurious emission limit –13dBm

**NOTE: peak above the limit line is the carrier frequency.**



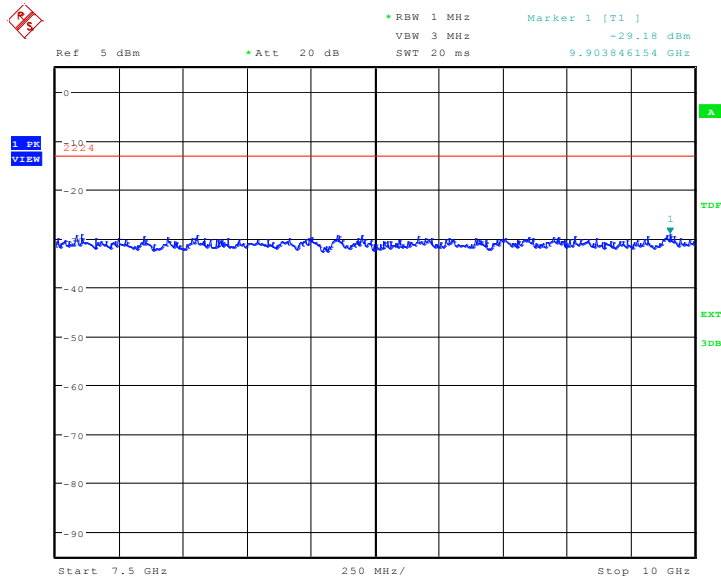
Date: 11.APR.2018 09:27:01

**Channel 661: 2.5GHz –7.5GHz**  
Spurious emission limit –13dBm



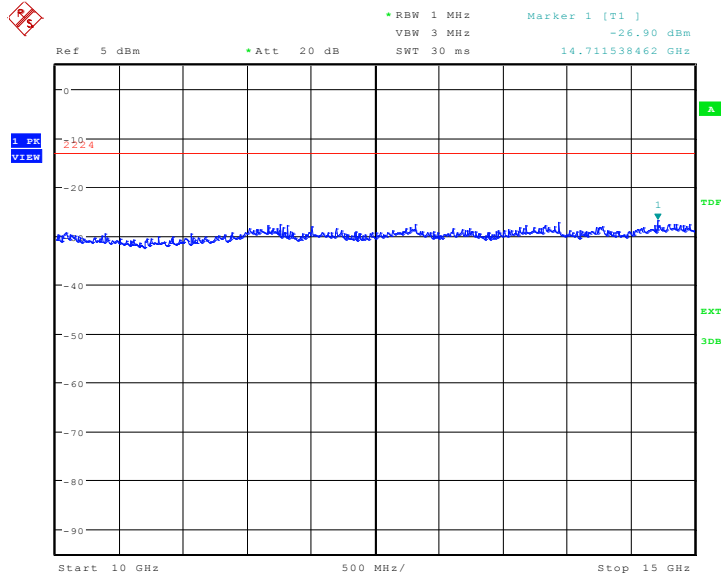
Date: 11.APR.2018 09:27:29

**Channel 661: 7.5GHz –10GHz**  
Spurious emission limit –13dBm



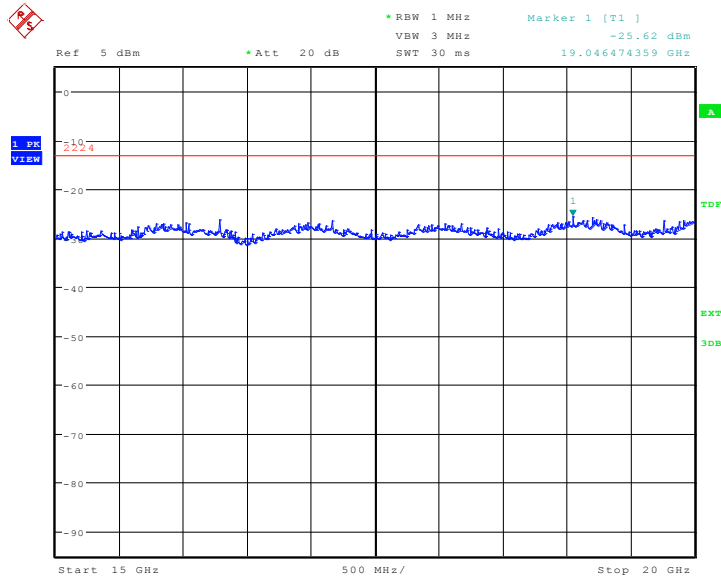
Date: 11.APR.2018 09:27:57

**Channel 661: 10GHz –15GHz**  
Spurious emission limit –13dBm.



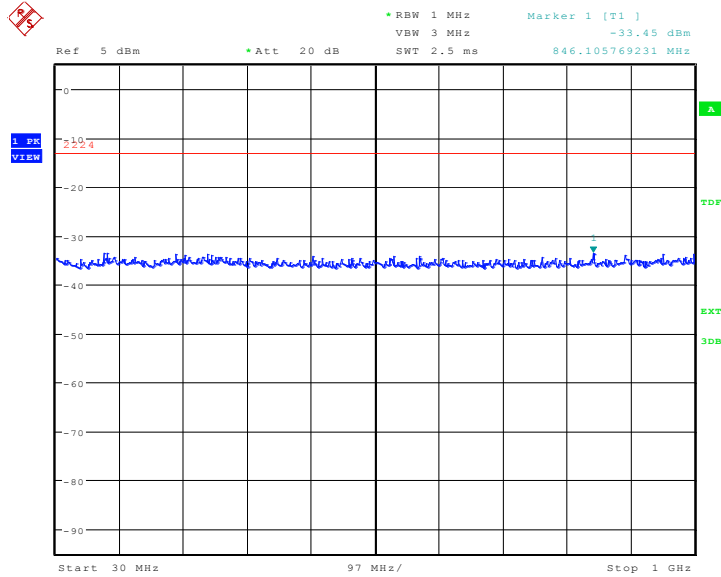
Date: 11.APR.2018 09:28:25

**Channel 661: 15GHz –20GHz**  
Spurious emission limit –13dBm.



Date: 11.APR.2018 09:28:53

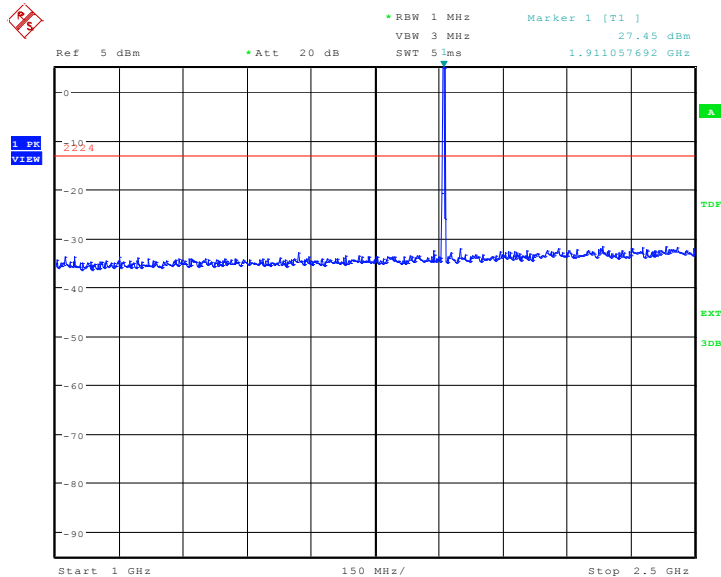
**Channel 810: 30MHz – 1GHz**  
Spurious emission limit –13dBm.



Date: 11.APR.2018 09:29:22

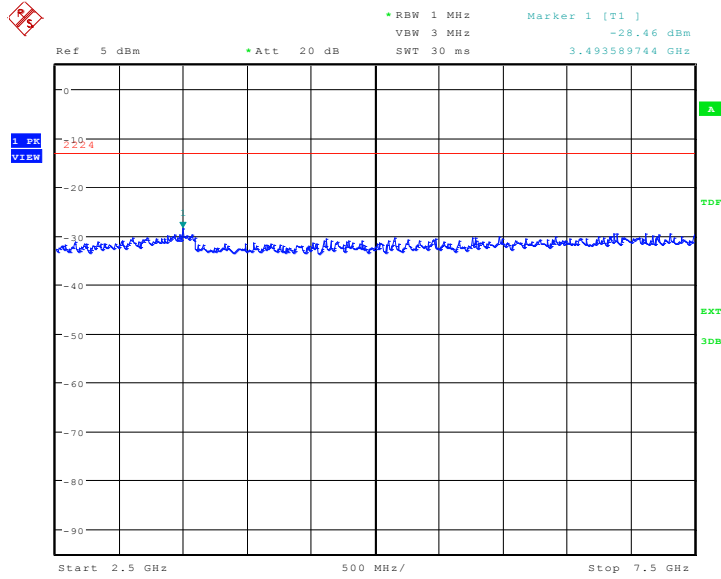
**Channel 810: 1GHz – 2.5GHz**  
Spurious emission limit –13dBm.

**NOTE: peak above the limit line is the carrier frequency.**



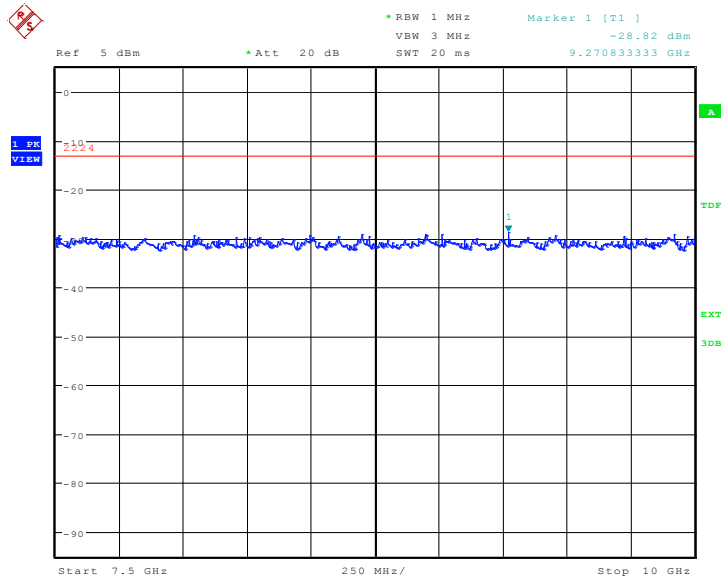
Date: 11.APR.2018 09:29:50

**Channel 810:2.5GHz – 7.5GHz**  
Spurious emission limit –13dBm.



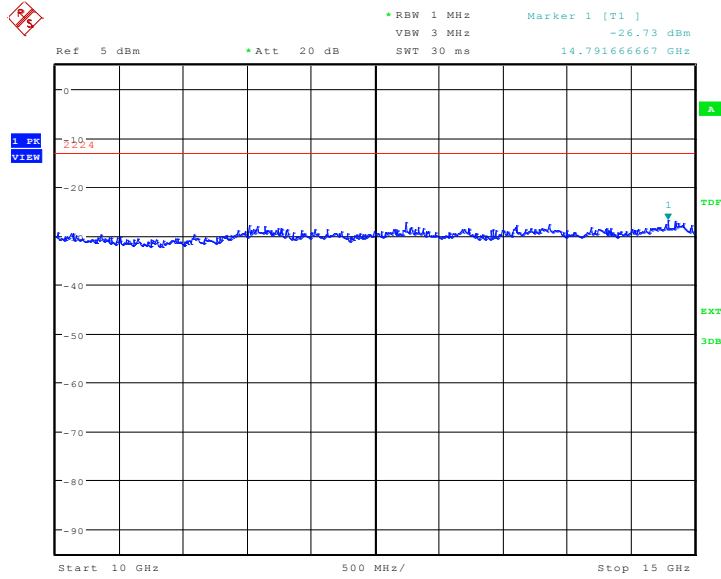
Date: 11.APR.2018 09:30:18

**Channel 810: 7.5GHz – 10GHz**  
Spurious emission limit –13dBm.



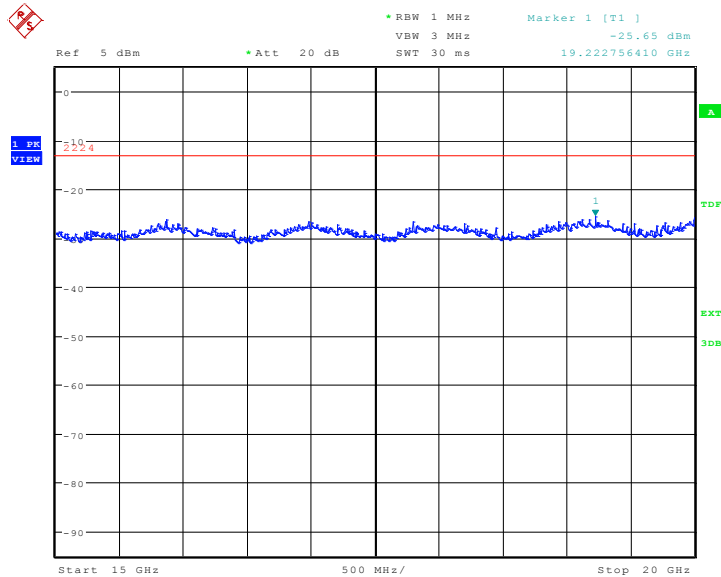
Date: 11.APR.2018 09:30:47

**Channel 810: 10GHz –15GHz**  
Spurious emission limit –13dBm.



Date: 11.APR.2018 09:31:15

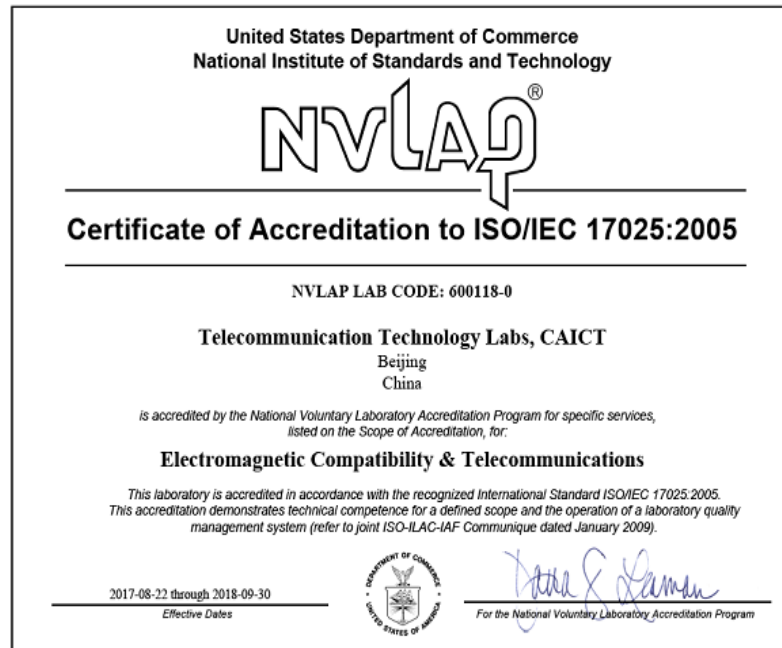
**Channel 810: 15GHz –20GHz**  
Spurious emission limit –13dBm.



Date: 11.APR.2018 09:31:43



**ANNEX B: Accreditation Certificate**



\*\*\*END OF REPORT\*\*\*