



# TEST REPORT

No. I14Z47255-EMC01

for

**Sony Mobile Communications Inc.**

**GSM/WCDMA/LTE Mobile Phone**

**FCC ID: PY7PM-0808**

with

**Hardware Version: A**

**Software Version: 23.0.F.0.56**

**Issued Date: Aug. 07<sup>th</sup>, 2014**

**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of TMC Beijing.

**Test Laboratory:**

***DAkks accreditation (DIN EN ISO/IEC 17025): No. D-PL-12123-01-01***

***FCC 2.948 Listed: No.733176***

***IC O.A.T.S listed: No.6629A-1***

TMC Beijing, Telecommunication Metrology Center of Ministry of Industry and Information Technology

No. 52, Huayuan Bei Road, Haidian District, Beijing, P. R. China 100191.

Tel: +86(0) 10-62304633-2561, Fax: +86(0)10-62304633-2504 Email:welcome@emcite.com. [www.emcite.com](http://www.emcite.com)

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## **1. Test Laboratory**

### **1.1. Testing Location**

#### **Location A**

Company Name: TMC Beijing, Telecommunication Metrology Center of MIIT  
Address: No 52, Huayuan Bei Road, Haidian District, Beijing, P.R. China  
Postal Code: 100191

#### **Location B**

Company Name: TMC Beijing, Telecommunication Metrology Center of MIIT  
Address: Building Shouxian, No.51, Xueyuan Road, Haidian District, Beijing, China  
Postal Code: 100191

### **1.2. Testing Environment**

Normal Temperature: 15-35°C  
Relative Humidity: 20-75%  
Air pressure 980 - 1040 hPa

The climatic requirements above are general exclude the special requirements for dedicated test environments listed in section 5 and some specific test cases in other parts of this report.

### **1.3. Project data**

Receipt of Sample Jul. 08<sup>th</sup>, 2014  
Testing Start Date: Jul. 16<sup>th</sup>, 2014  
Testing End Date: Jul. 26<sup>th</sup>, 2014

### **1.4. Signature**



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Qu Pengfei  
(Prepared this test report)



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Sun Xiangqian  
(Reviewed this test report)



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Song Chongwen  
(Approved this test report)

## **2. Client Information**

### **2.1. Applicant Information**

Company Name: Sony Mobile Communications (China) Co. Ltd  
Address /Post: Sony Mobile R&D Center, No. 16, Guangshun South Street,  
Chaoyang District  
City: Beijing  
Postal Code: 100102  
Country: China  
Contact Person: Ma, Gang  
Telephone: +86-10-58656312  
Fax: +86-10-58659049

### **2.2. Manufacturer Information**

Company Name: Sony Mobile Communications Inc.  
Address /Post: 1-8-15 Konan, Minato-ku, Tokyo, 108-0075, Japan  
City: Tokyo  
Postal Code: 108-0075  
Country: Japan

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

#### 3.1. About EUT

|                         |                                                          |
|-------------------------|----------------------------------------------------------|
| Description             | GSM/WCDMA/LTE mobile phone                               |
| FCC ID                  | PY7PM-0808                                               |
| Antenna                 | Internal                                                 |
| Power supply            | Battery ( charged by travel adapter or vehicle charger ) |
| 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 Telecommunication Metrology Center of MIIT of People's Republic of China.

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

| EUT ID* | SN         | IMEI            | HW Version | SW Version  |
|---------|------------|-----------------|------------|-------------|
| EUT7    | CB5A1ZTFL3 | 004402452521127 | A          | 23.0.F.0.56 |
| EUT13   | CB5A1ZTFJ7 | 004402452421556 | A          | 23.0.F.0.56 |
| EUT11   | CB5A1ZTFRY | 004402452521432 | A          | 23.0.F.0.56 |
| #25139  | CB5A1ZTFL3 | 004402452521127 | A          | 23.0.F.0.56 |

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

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

| AE ID* | Description    | SN              | Revision |
|--------|----------------|-----------------|----------|
| AE1    | Travel Charger | /               | /        |
| AE3    | USB Cable      | 134912A21208328 | AP1.0    |
| #23086 | Travel Charger | 8512W32101941   | RTL      |
| #24925 | USB Cable      | 134912AC120616  | RTL      |

AE1, #23086

|                 |                              |
|-----------------|------------------------------|
| Commercial name | EP880                        |
| Type            | AC-0400-EU                   |
| Manufacturer    | SALCOMP                      |
| Length of cable | 100 cm (length of USB cable) |

AE3, #24925

|                 |             |
|-----------------|-------------|
| Commercial name | EC803       |
| Type            | AI-0404     |
| Manufacturer    | Sony Mobile |
| Length of cable | 100 cm      |

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

### **3.4. General Description**

The Equipment Under Test (EUT) is a model supporting GSM/UMTS/LTE with 2.4G/5G technologies.

It consists of normal options: USB cable and travel charger.

Manual and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the client.

### **3.5. EUT set-ups**

| EUT Set-up No. | Combination of EUT and AE | Remarks                            |
|----------------|---------------------------|------------------------------------|
| Set.8          | EUT7 + AE1 + AE3          | 1900MHz, Tests with travel charger |
| Set.9          | EUT7                      | 1900MHz, ERP/EIRP/RSE tests        |
| Set.10         | EUT13                     | 1900MHz, Conducted RF tests        |
| Set.11         | #25139+#23086+#24925      | 850MHz, Tests with travel charger  |
| Set.12         | #25139                    | 850MHz, ERP/EIRP/RSE tests         |
| Set.13         | AE11                      | 850MHz, Conducted RF tests         |

## 4. Reference Documents

### 4.1. Reference Documents for testing

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

| Reference      | Title                                                                                                                                      | Version            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------|
| FCC Part 15    | Radio frequency devices□                                                                                                                   | 10-1-13<br>Edition |
| FCC Part 22    | PUBLIC MOBILE SERVICES                                                                                                                     | 10-1-13<br>Edition |
| FCC Part 24    | PERSONAL COMMUNICATIONS SERVICES                                                                                                           | 10-1-13<br>Edition |
| ANSI/TIA-603-C | Land Mobile FM or PM Communications Equipment<br>Measurement and Performance Standards                                                     | 2004               |
| ANSI C63.4     | Methods of Measurement of Radio-Noise Emissions from<br>Low-Voltage Electrical and Electronic Equipment in the<br>Range of 9 kHz to 40 GHz | 2009               |

## 5. LABORATORY ENVIRONMENT

**Semi-anechoic chamber SAC-1** (23 meters×17meters×10meters) did not exceed following limits along the EMC testing:

|                                                 |                                                   |
|-------------------------------------------------|---------------------------------------------------|
| Temperature                                     | Min. = 15 °C, Max. = 35 °C                        |
| Relative humidity                               | Min. = 15 %, Max. = 75 %                          |
| Shielding effectiveness                         | 0.014MHz - 1MHz, >60dB;<br>1MHz - 1000MHz, >90dB. |
| Electrical insulation                           | > 2 MΩ                                            |
| Ground system resistance                        | < 4Ω                                              |
| Normalised site attenuation (NSA)               | < ± 4 dB, 3m/10m distance,<br>from 30 to 1000 MHz |
| 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           |

**Fully-anechoic chamber FAC-3** (9 meters×6.5 meters×4 meters) did not exceed following limits along the EMC testing:

|                                                 |                                                   |
|-------------------------------------------------|---------------------------------------------------|
| Temperature                                     | Min. = 15 °C, Max. = 35 °C                        |
| Relative humidity                               | Min. = 15 %, Max. = 75 %                          |
| Shielding effectiveness                         | 0.014MHz - 1MHz, >60dB;<br>1MHz - 1000MHz, >90dB. |
| Electrical insulation                           | > 2 MΩ                                            |
| Ground system resistance                        | < 4 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           |

**Shielded room** did not exceed following limits along the EMC testing:

|                          |                                                   |
|--------------------------|---------------------------------------------------|
| Temperature              | Min. = 15 °C, Max. = 35 °C                        |
| Relative humidity        | Min. = 20 %, Max. = 75 %                          |
| Shielding effectiveness  | 0.014MHz - 1MHz, >60dB;<br>1MHz - 1000MHz, >90dB. |
| Electrical insulation    | > 2 MΩ                                            |
| Ground system resistance | < 4 Ω                                             |

## 6. SUMMARY OF TEST RESULTS

### 6.1. Summary of test results

| Abbreviations used in this clause: |         |                                                                                                       |
|------------------------------------|---------|-------------------------------------------------------------------------------------------------------|
| Verdict Column                     | P       | Pass                                                                                                  |
|                                    | F       | Fail                                                                                                  |
|                                    | NA      | Not applicable                                                                                        |
|                                    | NM      | Not measured                                                                                          |
| Location Column                    | A/B/C/D | The test is performed in test location A, B, C or D which are described in section 1.1 of this report |

#### GSM 850

| Items | Test Name                   | Clause in FCC rules | Section in this report | Verdict | Test Location |
|-------|-----------------------------|---------------------|------------------------|---------|---------------|
| 1     | Output Power                | 22.913(a)           | A.1                    | P       | B             |
| 2     | Emission Limit              | 22.917, 2.1051      | A.2                    | P       | B             |
| 3     | Conducted Emission          | 15.107/207          | A.3                    | P       | A             |
| 4     | Frequency Stability         | 22.355, 2.1055      | A.4                    | P       | B             |
| 5     | Occupied Bandwidth          | 2.1049(h)(i)        | A.5                    | P       | B             |
| 6     | Emission Bandwidth          | 22.917(b)           | A.6                    | P       | B             |
| 7     | Band Edge Compliance        | 22.917(b)           | A.7                    | P       | B             |
| 8     | Conducted Spurious Emission | 22.917, 2.1057      | A.8                    | P       | B             |

#### PCS 1900

| Items | Test Name                   | Clause in FCC rules | Section in this report | Verdict | Test Location |
|-------|-----------------------------|---------------------|------------------------|---------|---------------|
| 1     | Output Power                | 24.232(c)           | A.1                    | P       | B             |
| 2     | Emission Limit              | 24.238, 2.1051      | A.2                    | P       | B             |
| 3     | Conducted Emission          | 15.107/207          | A.3                    | P       | A             |
| 4     | Frequency Stability         | 24.235, 2.1055      | A.4                    | P       | B             |
| 5     | Occupied Bandwidth          | 2.1049(h)(i)        | A.5                    | P       | B             |
| 6     | Emission Bandwidth          | 24.238(b)           | A.6                    | P       | B             |
| 7     | Band Edge Compliance        | 24.238(b)           | A.7                    | P       | B             |
| 8     | Conducted Spurious Emission | 24.238, 2.1057      | A.8                    | P       | B             |

### 6.2. Statements

The test cases listed in section 6.1 of this report for the EUT specified in section 3 were performed by TMC according to the standards or reference documents in section 4.1.

The EUT met all applicable requirements of the standards or reference documents in section 4.1. This report only deals with the GSM/GPRS/EGPRS functions among the features described in section 3.

## 7. Test Equipments Utilized

| NO. | NAME                                    | TYPE      | SERIES<br>NUMBER | PRODUCER     | CAL. DUE<br>DATE | CAL.<br>INTERVAL |
|-----|-----------------------------------------|-----------|------------------|--------------|------------------|------------------|
| 1.  | EMI Antenna                             | VULB 9163 | 9163-235         | Schwarzbeck  | 2014-09-28       | 3 Years          |
| 2.  | Test Receiver                           | ESCI      | 100344           | R&S          | 2015-03-03       | 1 Year           |
| 3.  | EMI Antenna                             | 3117      | 00119024         | ETS-Lindgren | 2016-01-20       | 3 Years          |
| 4.  | EMI Antenna                             | 9117      | 167              | Schwarzbeck  | 2015-07-06       |                  |
| 5.  | EMI Antenna                             | 3117      | 00058889         | ETS-Lindgren | 2014-12-20       | 3 Years          |
| 6.  | Signal Generator                        | N5183A    | MY49060052       | Agilent      | 2015-03-02       | 1 Year           |
| 7.  | Power Amplifier                         | 5S1G4     | 0341863          | AR           | /                | 1 Year           |
| 8.  | Universal Radio<br>Communication Tester | CMW500    | 143008           | R&S          | 2014-12-09       | 1 Year           |
| 9.  | Universal Radio<br>Communication Tester | CMW500    | 116588           | R&S          | 2014-10-27       | 1 Year           |
| 10. | Universal Radio<br>Communication Tester | E5515C    | MY48363198       | Agilent      | 2015-07-06       | 1 Year           |
| 11. | Spectrum Analyzer                       | E4440A    | MY48250642       | Agilent      | 2015-02-27       | 1 Year           |
| 12. | LISN                                    | ESH2-Z5   | 829991/012       | R&S          | 2015-04-14       | 1 Year           |
| 13. | Climatic chamber                        | SH-641    | 92014694         | ESPEC        | 2015-11-27       | 1 Year           |

## **ANNEX A: MEASUREMENT RESULTS**

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

#### **Reference**

FCC: CFR Part 22.913(a), 24.232(c).

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

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMU200) to ensure max power transmission and proper modulation.

This result contains peak output power and ERP/EIRP measurements for the EUT.

In all cases, output power is within the specified limits.

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

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

The EUT was set up for the max output power with pseudo random data modulation.

The power was measured with spectrum analyzer's peak detector.

These measurements were done at 3 frequencies (bottom, middle and top of operational frequency range) for each band: 1850.2 MHz, 1880.0MHz and 1909.8MHz for PCS1900 band; 824.2MHz, 836.6MHz and 848.8MHz for GSM850 band.

#### **GSM850**

##### **Limit**

|       | Power step | Nominal Peak output power (dBm) | Tolerance (dB) | Target (dBm) |
|-------|------------|---------------------------------|----------------|--------------|
| GSM   | 5          | 33dBm(2W)                       | ± 2            | 33±1         |
| GPRS  | 3          | 33dBm(2W)                       | ± 2            | 33±1         |
| EGPRS | 6          | 33dBm(2W)                       | ± 2            | 33±1         |

#### **Measurement result**

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

| Frequency(MHz) | Power Step | Peak output power(dBm) |
|----------------|------------|------------------------|
| 824.2          | 5          | <b>32.70</b>           |
| 836.6          | 5          | 32.56                  |
| 848.8          | 5          | 32.42                  |

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

| Frequency(MHz) | Power Step | Peak output power(dBm) |
|----------------|------------|------------------------|
| 824.2          | 3          | <b>32.80</b>           |
| 836.6          | 3          | 32.60                  |
| 848.8          | 3          | 32.50                  |

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

| Frequency(MHz) | Power Step | Peak output power(dBm) |
|----------------|------------|------------------------|
| 824.2          | 6          | <b>27.28</b>           |
| 836.6          | 6          | 26.84                  |
| 848.8          | 6          | 26.91                  |

Note: Expanded measurement uncertainty for GSM850 is  $U = 0.52$  dB,  $k = 2$ .

**PCS1900**
**Limit**

|       | Power step | Nominal Peak output power (dBm) | Tolerance (dB) | Target (dBm) |
|-------|------------|---------------------------------|----------------|--------------|
| GSM   | 0          | 30dBm(1W)                       | $\pm 2$        | $30 \pm 1$   |
| GPRS  | 3          | 30dBm(1W)                       | $\pm 2$        | $30 \pm 1$   |
| EGPRS | 5          | 30dBm(1W)                       | $\pm 2$        | $30 \pm 1$   |

**Measurement result**
**GSM (GMSK)**

| Frequency(MHz) | Power Step | Peak output power(dBm) |
|----------------|------------|------------------------|
| 1850.2         | 0          | 30.57                  |
| 1880.0         | 0          | 30.54                  |
| 1909.8         | 0          | <b>30.64</b>           |

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

| Frequency(MHz) | Power Step | Peak output power(dBm) |
|----------------|------------|------------------------|
| 1850.2         | 3          | 30.59                  |
| 1880.0         | 3          | 30.55                  |
| 1909.8         | 3          | <b>30.66</b>           |

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

| Frequency(MHz) | Power Step | Peak output power(dBm) |
|----------------|------------|------------------------|
| 1850.2         | 5          | <b>26.81</b>           |
| 1880.0         | 5          | 26.76                  |
| 1909.8         | 5          | 26.77                  |

Note: Expanded measurement uncertainty for PCS1900 is  $U = 0.83$  dB,  $k = 2$ .

### A.1.3 Radiated Power

#### A.1.3.1 Description

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

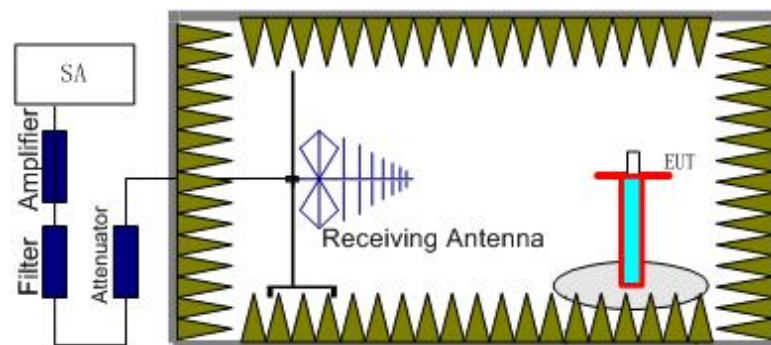
Rule Part 24.232(c) specifies "Mobile and portable stations are limited to 2 watts EIRP" and 24.232(e) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage."

Rule Part 22.913(a) specifies "Maximum ERP. The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts."

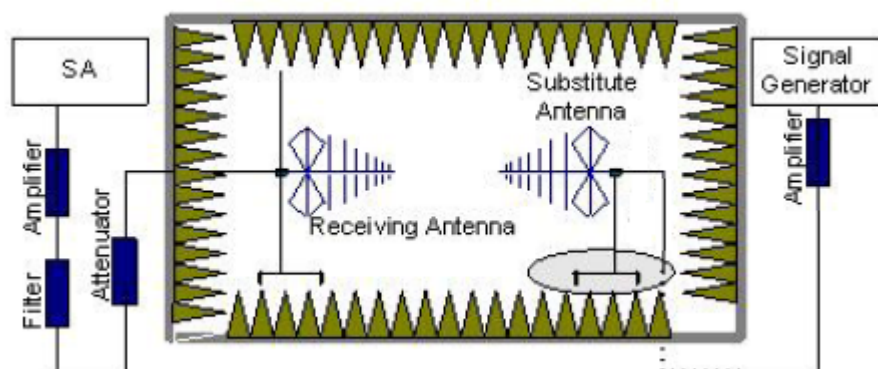
#### A.1.3.2 Method of Measurement

The measurements procedures in TIA-603C-2004 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, a 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. Adjust the level of the signal generator output until the value of the receiver reaches 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. An amplifier should be connected to the Signal Source output port. And the cable should be connected 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 (Unit: dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole,  $ERP = EIRP - 2.15$ .

For test layout photo, please refer to Pic.1 in Annex B.

#### GSM 850- ERP 22.913(a)

##### Limits

|       | Power Step | Burst Peak ERP (dBm)        |
|-------|------------|-----------------------------|
| GSM   | 5          | $\leq 38.45\text{dBm}$ (7W) |
| GPRS  | 3          | $\leq 38.45\text{dBm}$ (7W) |
| EGPRS | 6          | $\leq 38.45\text{dBm}$ (7W) |

##### Measurement result

##### GSM (GMSK)

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | $P_{Ag}$ (dB) | $G_a$ (dBi) | Correction (dB) | Peak ERP(dBm) | Polarization |
|-----------------|-----------------|---------------|---------------|-------------|-----------------|---------------|--------------|
| 824.20          | -18.47          | 2.07          | -53.00        | 0.84        | 2.15            | 29.47         | Horizontal   |
| 836.60          | -17.76          | 2.08          | -53.00        | 0.90        | 2.15            | 30.11         | Horizontal   |
| 848.80          | -17.89          | 2.09          | -53.00        | 0.95        | 2.15            | 29.92         | Horizontal   |

##### GPRS (GMSK)

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | $P_{Ag}$ (dB) | $G_a$ (dBi) | Correction (dB) | Peak ERP(dBm) | Polarization |
|-----------------|-----------------|---------------|---------------|-------------|-----------------|---------------|--------------|
| 824.20          | -18.51          | 2.07          | -53.00        | 0.84        | 2.15            | 29.43         | Horizontal   |
| 836.60          | -18.00          | 2.08          | -53.00        | 0.90        | 2.15            | 29.87         | Horizontal   |
| 848.80          | -18.16          | 2.09          | -53.00        | 0.95        | 2.15            | 29.65         | Horizontal   |

##### EGPRS (8PSK)

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | $P_{Ag}$ (dB) | $G_a$ (dBi) | Correction (dB) | Peak ERP(dBm) | Polarization |
|-----------------|-----------------|---------------|---------------|-------------|-----------------|---------------|--------------|
| 824.20          | -23.45          | 2.07          | -53.00        | 0.84        | 2.15            | 24.49         | Horizontal   |
| 836.60          | -22.64          | 2.08          | -53.00        | 0.90        | 2.15            | 25.23         | Horizontal   |
| 848.80          | -21.97          | 2.09          | -53.00        | 0.95        | 2.15            | 25.84         | Horizontal   |

Sample calculation: GSM, 836.60MHz

$$\begin{aligned} \text{Peak ERP(dBm)} &= P_{\text{Mea}}(-17.76\text{dBm}) - G_a(0.90\text{dBi}) - P_{\text{Ag}}(-53.00\text{ dB}) - P_{\text{cl}}(2.08\text{ dB}) - 2.15\text{ dB} \\ &= 30.11\text{ dBm} \end{aligned}$$

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

Note: Expanded measurement uncertainty for GSM850 is  $U = 0.96\text{dB}$ ,  $k = 2$ .

### PCS1900- EIRP 24.232(c)

#### Limits

|       | Power Step | Burst Peak EIRP (dBm)    |
|-------|------------|--------------------------|
| GSM   | 0          | $\leq 33\text{dBm}$ (2W) |
| GPRS  | 3          | $\leq 33\text{dBm}$ (2W) |
| EGPRS | 5          | $\leq 33\text{dBm}$ (2W) |

#### Measurement result

##### GSM (GMSK)

| Frequency (MHz) | $P_{\text{Mea}}$ (dBm) | $P_{\text{cl}}$ (dB) | $P_{\text{Ag}}$ (dB) | $G_a$ (dBi) | Peak EIRP(dBm) | Polarization |
|-----------------|------------------------|----------------------|----------------------|-------------|----------------|--------------|
| 1850.20         | -22.03                 | 3.19                 | -50.00               | -4.56       | 29.34          | Horizontal   |
| 1880.00         | -21.11                 | 3.11                 | -50.00               | -4.43       | 30.21          | Horizontal   |
| 1909.80         | -20.81                 | 3.18                 | -50.00               | -4.30       | <b>30.31</b>   | Horizontal   |

##### GPRS (GMSK)

| Frequency (MHz) | $P_{\text{Mea}}$ (dBm) | $P_{\text{cl}}$ (dB) | $P_{\text{Ag}}$ (dB) | $G_a$ (dBi) | Peak EIRP(dBm) | Polarization |
|-----------------|------------------------|----------------------|----------------------|-------------|----------------|--------------|
| 1850.20         | -21.98                 | 3.19                 | -50.00               | -4.56       | 29.39          | Horizontal   |
| 1880.00         | -21.09                 | 3.11                 | -50.00               | -4.43       | 30.23          | Horizontal   |
| 1909.80         | -21.84                 | 3.18                 | -50.00               | -4.30       | 29.28          | Horizontal   |

##### EGPRS (8PSK)

| Frequency (MHz) | $P_{\text{Mea}}$ (dBm) | $P_{\text{cl}}$ (dB) | $P_{\text{Ag}}$ (dB) | $G_a$ (dBi) | Peak EIRP(dBm) | Polarization |
|-----------------|------------------------|----------------------|----------------------|-------------|----------------|--------------|
| 1850.20         | -24.67                 | 3.19                 | -50.00               | -4.56       | 26.70          | Horizontal   |
| 1880.00         | -23.64                 | 3.11                 | -50.00               | -4.43       | 27.68          | Horizontal   |
| 1909.80         | -23.53                 | 3.18                 | -50.00               | -4.30       | 27.59          | Horizontal   |

Sample calculation: GSM, 1909.80MHz

$$\text{Peak EIRP(dBm)} = P_{\text{Mea}}(-20.81\text{dBm}) - G_a(-4.30\text{ dBi}) - P_{\text{Ag}}(-50.00\text{ dB}) - P_{\text{cl}}(3.18\text{ dB}) = 30.31\text{ dBm}$$

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

Note: Expanded measurement uncertainty for PCS1900 is  $U = 1.07\text{ dB}$ ,  $k = 2$ .

## A.2 EMISSION LIMIT

### Reference

FCC: CFR 2.1051, Part 22.917(a), 24.238(a).

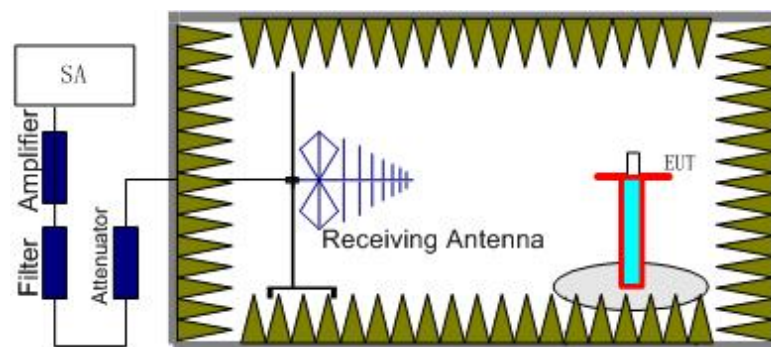
### A.2.1 Measurement Method

The measurements procedures in TIA-603C-2004 are used. This measurement is carried out in fully-anechoic chamber FAC-3.

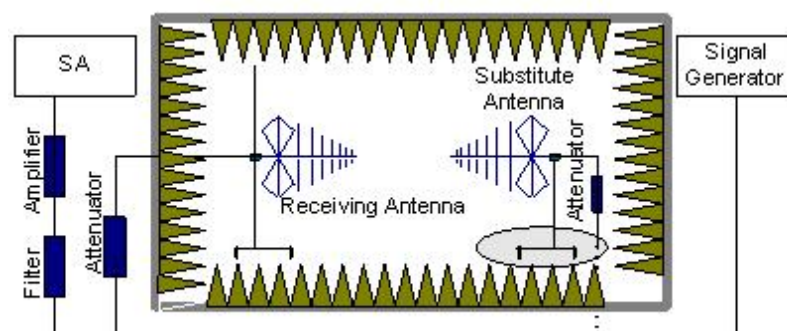
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. The resolution bandwidth is set 1MHz as outlined in Part 24.238. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the PCS1900 band, GSM850 band.

### 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 (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. Adjust the level of the signal generator output until the value of the receiver reaches 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.

An 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 (unit: dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole,  $ERP = EIRP - 2.15\text{dB}$ .

### A.2.2 Measurement Limit

Part 24.238 specifies 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 PCS band (1850.2 MHz, 1880 MHz and 1909.8 MHz), GSM850 band (824.2MHz, 836.6MHz and 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 GSM850 or PCS1900 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.

**GSM Mode Channel 128/824.2MHz**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Correction (dB) | Peak ERP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|-----------------|---------------|-------------|--------------|
| 1648.50         | -45.16                 | 2.91          | -5.45             | 2.15            | -44.77        | -13.00      | Horizontal   |
| 2472.50         | -40.42                 | 3.56          | -5.32             | 2.15            | -40.81        | -13.00      | Vertical     |
| 3294.87         | -53.68                 | 4.23          | -7.41             | 2.15            | -52.65        | -13.00      | Horizontal   |
| 4120.33         | -52.59                 | 4.68          | -8.57             | 2.15            | -50.85        | -13.00      | Horizontal   |
| 4946.42         | -51.41                 | 5.11          | -9.60             | 2.15            | -49.07        | -13.00      | Vertical     |
| 5768.19         | -49.01                 | 5.69          | -10.11            | 2.15            | -46.74        | -13.00      | Vertical     |

**GSM Mode Channel 190/836.6MHz**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Correction (dB) | Peak ERP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|-----------------|---------------|-------------|--------------|
| 1673.24         | -46.97                 | 2.97          | -5.34             | 2.15            | -46.75        | -13.00      | Horizontal   |
| 2509.71         | -41.30                 | 3.59          | -5.43             | 2.15            | -41.61        | -13.00      | Horizontal   |
| 3349.67         | -54.12                 | 4.24          | -7.54             | 2.15            | -52.97        | -13.00      | Horizontal   |
| 4184.91         | -52.45                 | 4.67          | -8.61             | 2.15            | -50.66        | -13.00      | Vertical     |
| 5016.26         | -50.95                 | 5.16          | -9.71             | 2.15            | -48.55        | -13.00      | Vertical     |
| 5860.50         | -49.47                 | 5.66          | -10.14            | 2.15            | -47.14        | -13.00      | Horizontal   |

**GSM Mode Channel 251/848.8MHz**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Correction (dB) | Peak ERP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|-----------------|---------------|-------------|--------------|
| 1697.51         | -47.83                 | 2.95          | -5.23             | 2.15            | -47.70        | -13.00      | Horizontal   |
| 2546.14         | -43.54                 | 3.63          | -5.52             | 2.15            | -43.80        | -13.00      | Horizontal   |
| 3400.07         | -53.55                 | 4.21          | -7.66             | 2.15            | -52.25        | -13.00      | Horizontal   |
| 4248.72         | -51.71                 | 4.79          | -8.65             | 2.15            | -50.00        | -13.00      | Vertical     |
| 5091.96         | -51.63                 | 5.20          | -9.76             | 2.15            | -49.22        | -13.00      | Horizontal   |
| 5938.08         | -49.03                 | 5.52          | -10.18            | 2.15            | -46.52        | -13.00      | Vertical     |

**GSM Mode Channel 512/1850.2MHz**

| Frequency<br>(MHz) | P <sub>Mea</sub><br>(dBm) | P <sub>pl</sub><br>(dB) | G <sub>a</sub><br>(dBi) | Peak EIRP<br>(dBm) | Limit<br>(dBm) | Polarity   |
|--------------------|---------------------------|-------------------------|-------------------------|--------------------|----------------|------------|
| 3700.34            | -58.60                    | 4.44                    | -8.14                   | -54.90             | -13.00         | Vertical   |
| 5550.90            | -58.55                    | 5.46                    | -10.02                  | -53.99             | -13.00         | Horizontal |
| 7429.52            | -60.63                    | 6.38                    | -11.36                  | -55.65             | -13.00         | Vertical   |
| 9316.98            | -60.03                    | 7.73                    | -12.60                  | -55.16             | -13.00         | Horizontal |
| 11183.42           | -55.33                    | 8.24                    | -12.40                  | -51.17             | -13.00         | Vertical   |
| 13048.34           | -56.84                    | 9.14                    | -13.35                  | -52.63             | -13.00         | Vertical   |

**GSM Mode Channel 661/1880.0MHz**

| Frequency<br>(MHz) | P <sub>Mea</sub><br>(dBm) | P <sub>pl</sub><br>(dB) | G <sub>a</sub><br>(dBi) | Peak EIRP<br>(dBm) | Limit<br>(dBm) | Polarity   |
|--------------------|---------------------------|-------------------------|-------------------------|--------------------|----------------|------------|
| 3760.23            | -57.51                    | 4.52                    | -8.21                   | -53.82             | -13.00         | Vertical   |
| 5611.81            | -61.83                    | 5.46                    | -10.04                  | -57.25             | -13.00         | Horizontal |
| 7539.73            | -62.09                    | 6.83                    | -11.44                  | -57.48             | -13.00         | Horizontal |
| 9465.22            | -57.96                    | 7.41                    | -12.60                  | -52.77             | -13.00         | Vertical   |
| 11245.71           | -57.09                    | 8.41                    | -12.40                  | -53.10             | -13.00         | Vertical   |
| 13138.04           | -53.89                    | 9.22                    | -13.44                  | -49.67             | -13.00         | Vertical   |

**GSM Mode Channel 810/1909.8MHz**

| Frequency<br>(MHz) | P <sub>Mea</sub><br>(dBm) | P <sub>pl</sub><br>(dB) | G <sub>a</sub><br>(dBi) | Peak EIRP<br>(dBm) | Limit<br>(dBm) | Polarity   |
|--------------------|---------------------------|-------------------------|-------------------------|--------------------|----------------|------------|
| 3868.02            | -61.62                    | 4.53                    | -8.34                   | -57.81             | -13.00         | Vertical   |
| 5778.84            | -61.77                    | 5.67                    | -10.11                  | -57.33             | -13.00         | Vertical   |
| 7654.29            | -59.19                    | 6.55                    | -11.55                  | -54.19             | -13.00         | Vertical   |
| 9582.80            | -59.08                    | 7.90                    | -12.57                  | -54.41             | -13.00         | Vertical   |
| 11396.95           | -56.43                    | 8.67                    | -12.40                  | -52.70             | -13.00         | Horizontal |
| 13214.77           | -53.37                    | 9.10                    | -13.51                  | -48.96             | -13.00         | Vertical   |

Note: Expanded measurement uncertainty for this test item is  $U = 4.2$  dB,  $k = 2$ .

### **A.3 CONDUCTED EMISSION**

#### **Reference**

FCC: CFR Part 15.107/207.

The measurement procedure in ANSI C63.4-2009 is used. Conducted Emission is measured with travel charger. The EUT is working under GSM 850/1900MHz traffic mode which is the worst case of conducted emission measurement.

For test layout photo, please refer to Pic.2 in Annex B.

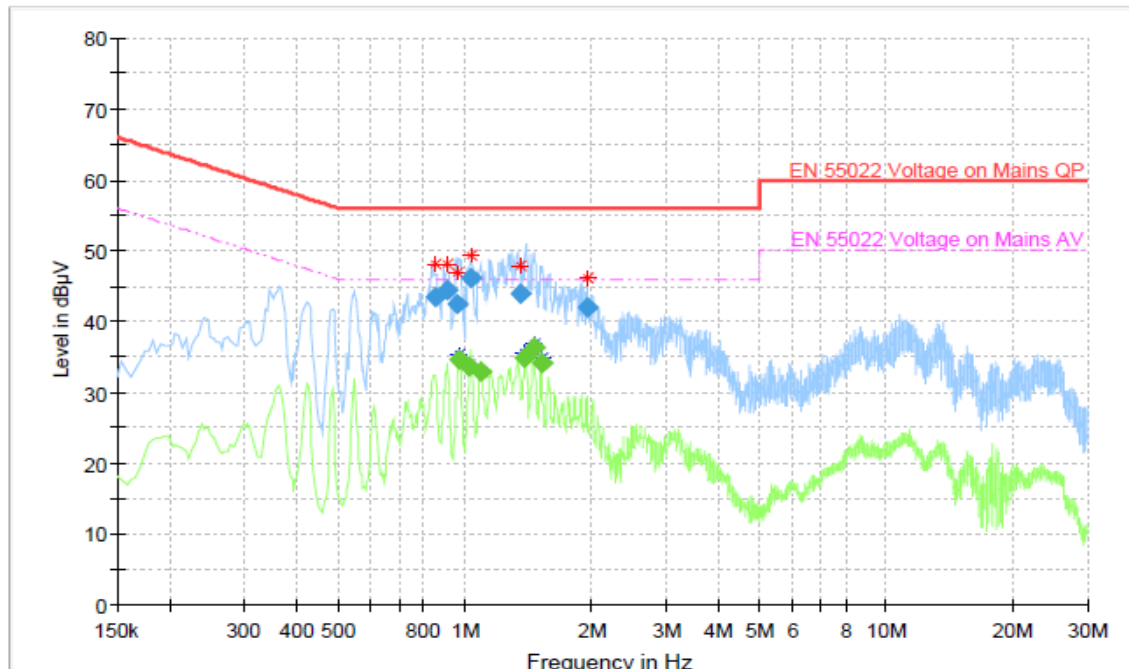
#### **A.3.1 Limit**

| Frequency of Emission<br>(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 logarithm of the frequency

#### **A.3.2 Measurement result**

##### **GSM 850MHz**



IF bandwidth 9 kHz

Note: The graphic result above is the maximum of the measurements for both phase line and neutral line.

 =PK value in pre-measurement

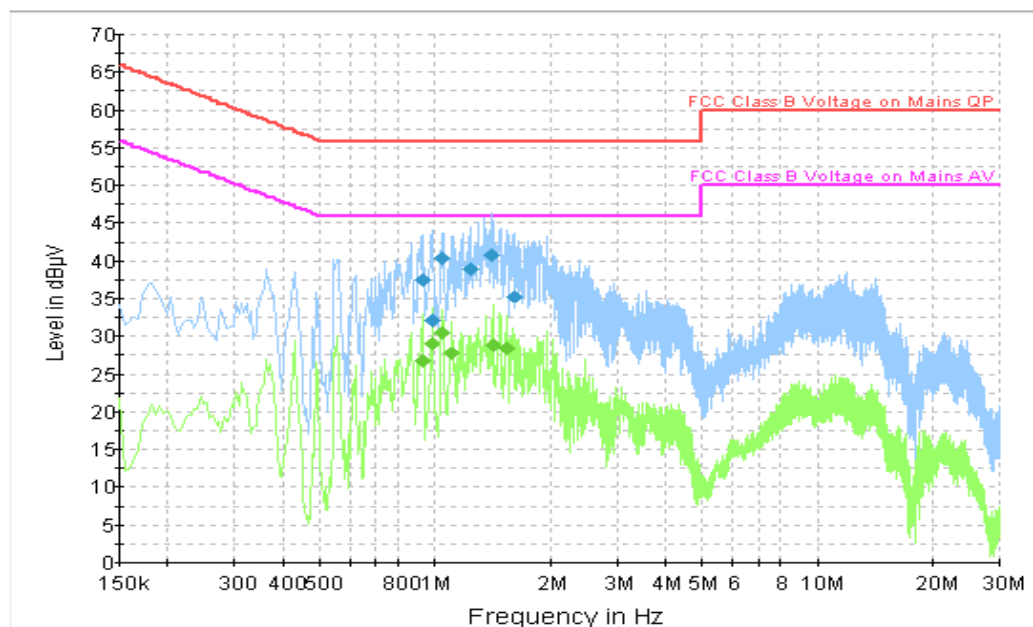
### Final Result 1

| Frequency (MHz) | QuasiPeak (dB $\mu$ V) | PE  | Line | Corr. (dB) | Margin (dB) | Limit (dB $\mu$ V) |
|-----------------|------------------------|-----|------|------------|-------------|--------------------|
| 0.853433        | 43.6                   | GND | L1   | 10.1       | 12.4        | 56.0               |
| 0.908519        | 44.4                   | GND | L1   | 10.1       | 11.6        | 56.0               |
| 0.962942        | 42.4                   | GND | L1   | 10.1       | 13.6        | 56.0               |
| 1.034394        | 46.2                   | GND | L1   | 10.1       | 9.8         | 56.0               |
| 1.349000        | 44.0                   | GND | L1   | 10.1       | 12.0        | 56.0               |
| 1.947837        | 41.9                   | GND | L1   | 10.1       | 14.1        | 56.0               |

### Final Result 2

| Frequency (MHz) | Average (dB $\mu$ V) | PE  | Line | Corr. (dB) | Margin (dB) | Limit (dB $\mu$ V) |
|-----------------|----------------------|-----|------|------------|-------------|--------------------|
| 0.967260        | 34.6                 | GND | L1   | 10.1       | 11.4        | 46.0               |
| 1.026538        | 33.7                 | GND | L1   | 10.1       | 12.3        | 46.0               |
| 1.087365        | 33.0                 | GND | L1   | 10.1       | 13.0        | 46.0               |
| 1.392413        | 35.0                 | GND | L1   | 10.1       | 11.0        | 46.0               |
| 1.458577        | 36.2                 | GND | L1   | 10.1       | 9.8         | 46.0               |
| 1.520740        | 34.2                 | GND | L1   | 10.1       | 11.8        | 46.0               |

### PCS 1900MHz



IF bandwidth 9 kHz

Note: The graphic result above is the maximum of the measurements for both phase line and neutral line.

**Final Result 1**

| Frequency<br>(MHz) | QuasiPeak<br>(dB $\mu$ V) | PE  | Line | Corr.<br>(dB) | Margin<br>(dB) | Limit<br>(dB $\mu$ V) |
|--------------------|---------------------------|-----|------|---------------|----------------|-----------------------|
| 0.924000           | 37.5                      | GND | L1   | 9.7           | 18.5           | 56.0                  |
| 0.991500           | 32.3                      | GND | L1   | 9.7           | 23.7           | 56.0                  |
| 1.041000           | 40.4                      | GND | L1   | 9.7           | 15.6           | 56.0                  |
| 1.239000           | 38.9                      | GND | L1   | 9.7           | 17.1           | 56.0                  |
| 1.405500           | 40.7                      | GND | L1   | 9.7           | 15.3           | 56.0                  |
| 1.612500           | 35.3                      | GND | L1   | 9.7           | 20.7           | 56.0                  |

**Final Result 2**

| Frequency<br>(MHz) | Average<br>(dB $\mu$ V) | PE  | Line | Corr.<br>(dB) | Margin<br>(dB) | Limit<br>(dB $\mu$ V) |
|--------------------|-------------------------|-----|------|---------------|----------------|-----------------------|
| 0.924000           | 26.7                    | GND | L1   | 9.7           | 19.3           | 46.0                  |
| 0.982500           | 29.0                    | GND | L1   | 9.7           | 17.0           | 46.0                  |
| 1.041000           | 30.5                    | GND | L1   | 9.7           | 15.5           | 46.0                  |
| 1.108500           | 27.7                    | GND | L1   | 9.7           | 18.3           | 46.0                  |
| 1.414500           | 28.8                    | GND | L1   | 9.7           | 17.2           | 46.0                  |
| 1.536000           | 28.4                    | GND | L1   | 9.7           | 17.6           | 46.0                  |

Note: The maximum value of expanded measurement uncertainty for this test item is  $U = 2.9$  dB,  $k=2$ .

## **A.4 FREQUENCY STABILITY**

### **Reference**

FCC: CFR Part 2.1055, 22.355, 24.235.

#### **A.4.1 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 -30°C.
3. With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on channel 661 for PCS 1900, channel 190 for 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 -30°C to +50°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 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 +50°C to -30°C. Allow at least 1.5 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.4.2 Measurement Limit**

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 4.2VDC, 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 from -5.4% to 10.8%. For the purposes of measuring frequency stability these voltage limits are to be used.

#### A.4.3 Measurement results

##### GSM 850

Room Temperature: 24 °C

##### Frequency Error vs Voltage

| Voltage(V) | Frequency error(Hz) | Frequency error(ppm) |
|------------|---------------------|----------------------|
| 4.2        | 10                  | 0.012                |
| 3.8        | 11                  | 0.013                |
| 3.6        | 8                   | 0.010                |

##### Frequency Error vs Temperature

| Temperature(°C) | Frequency error(Hz) | Frequency error(ppm) |
|-----------------|---------------------|----------------------|
| 50°             | 10                  | 0.012                |
| 40°             | 7                   | 0.008                |
| 30°             | 8                   | 0.010                |
| 20°             | 11                  | 0.013                |
| 10°             | 9                   | 0.011                |
| 0°              | 14                  | 0.017                |
| - 10°           | 12                  | 0.014                |
| - 20°           | 7                   | 0.008                |
| - 30°           | 10                  | 0.012                |

Expanded measurement uncertainty for this test item is 10 Hz,  $k=2$

**PCS 1900**
**Room Temperature: 24°C**
**Frequency Error vs Voltage**

| Voltage(V) | Frequency error(Hz) | Frequency error(ppm) |
|------------|---------------------|----------------------|
| 3.8        | 95                  | 0.051                |
| 4.2        | 55                  | 0.029                |
| 3.6        | 60                  | 0.032                |

**Frequency Error vs Temperature**

| Temperature(°C) | Frequency error(Hz) | Frequency error(ppm) |
|-----------------|---------------------|----------------------|
| 50°             | 55                  | 0.029                |
| 40°             | 149                 | 0.079                |
| 30°             | 122                 | 0.065                |
| 20°             | 60                  | 0.032                |
| 10°             | 57                  | 0.030                |
| 0°              | 62                  | 0.033                |
| - 10°           | 61                  | 0.033                |
| - 20°           | 55                  | 0.029                |
| - 30°           | 59                  | 0.031                |

Expanded measurement uncertainty for this test item is 10 Hz,  $k = 2$ .

## A.5 OCCUPIED BANDWIDTH

### Reference

FCC: CFR Part 2.1049(h)(i).

### A.5.1 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.

### Measurement Parameters:

RBW = 5 kHz, VBW = 20 kHz

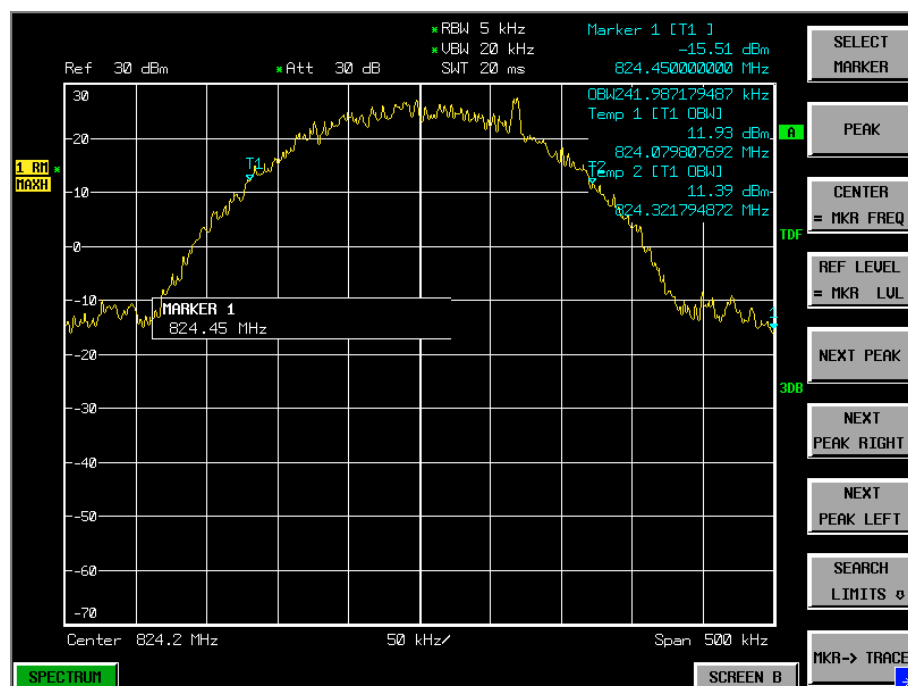
### GSM 850(99% BW) per FCC rules

| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |
|----------------|-----------------------------------|
| 824.2          | 241.987                           |
| 836.6          | 246.794                           |
| 848.8          | 242.788                           |

Expanded measurement uncertainty for this test item is 1.1 kHz,  $k=2$ .

### GSM 850

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



Ref 30 dBm Att 30 dB RBW 5 kHz VBW 20 kHz SWT 20 ms Marker 1 [T1] -13.07 dBm 836.350000000 MHz

OBW246.794871795 kHz Temp 1 [T1 OBW] 11.28 dBm T2 836.477403846 MHz Temp 2 [T1 OBW] 13.07 dBm 836.724198718 MHz

CENTER FREQUENCY 836.6 MHz

Center 836.6 MHz 50 kHz/ Span 500 kHz

SPECTRUM SCREEN B

CENTER CF- STEP SIZE START STOP FREQUENCY OFFSET SIGNAL TRACK SCREEN B

Ref 30 dBm \*Att 30 dB

\*RBW 5 kHz \*VBW 20 kHz \*SMT 20 ms

Marker 1 [T1 ] -16.76 dBm 848.55000000 MHz

OBW 242.788461538 kHz Temp 1 [T1: 0.000] 11.69 dBm 848.678205128 MHz Temp 2 [T1: 0.000] 9.60 dBm 848.920993590 MHz

1 RM MAXH

CENTER FREQUENCY 848.8 MHz

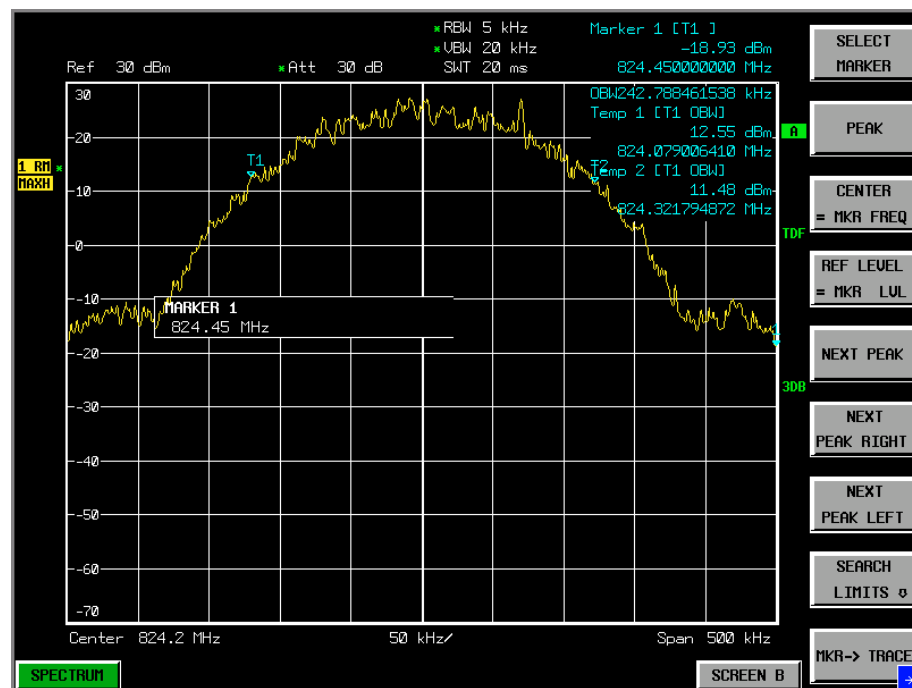
Center 848.8 MHz 50 kHz Span 500 kHz

SPECTRUM SCREEN B

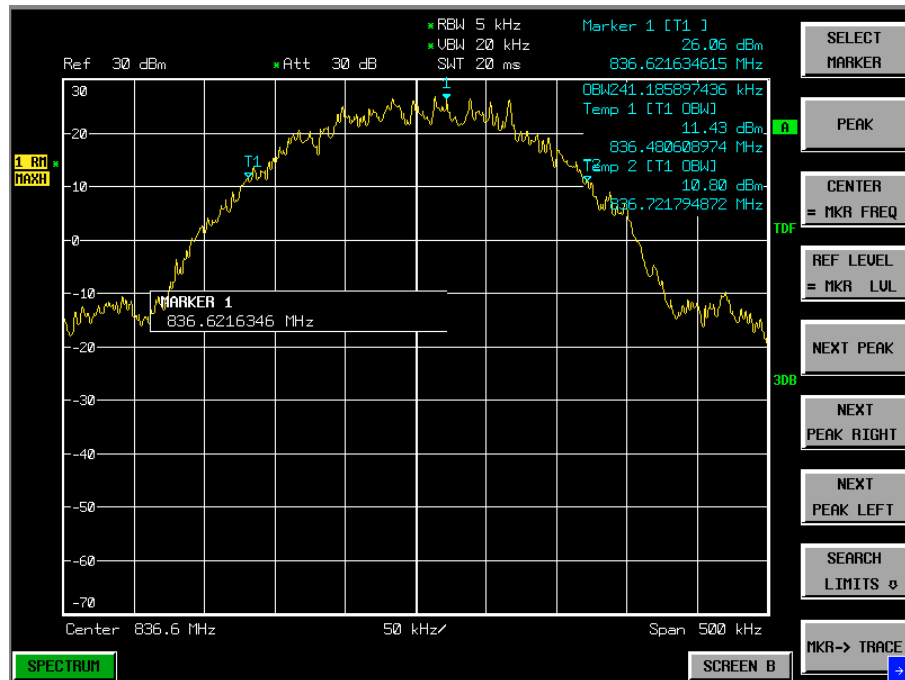
CENTER CF- STEPSIZE START STOP FREQUENCY OFFSET SIGNAL TRACK

| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |
|----------------|-----------------------------------|
| 824.2          | 242.788                           |
| 836.6          | 241.185                           |
| 848.8          | 245.192                           |

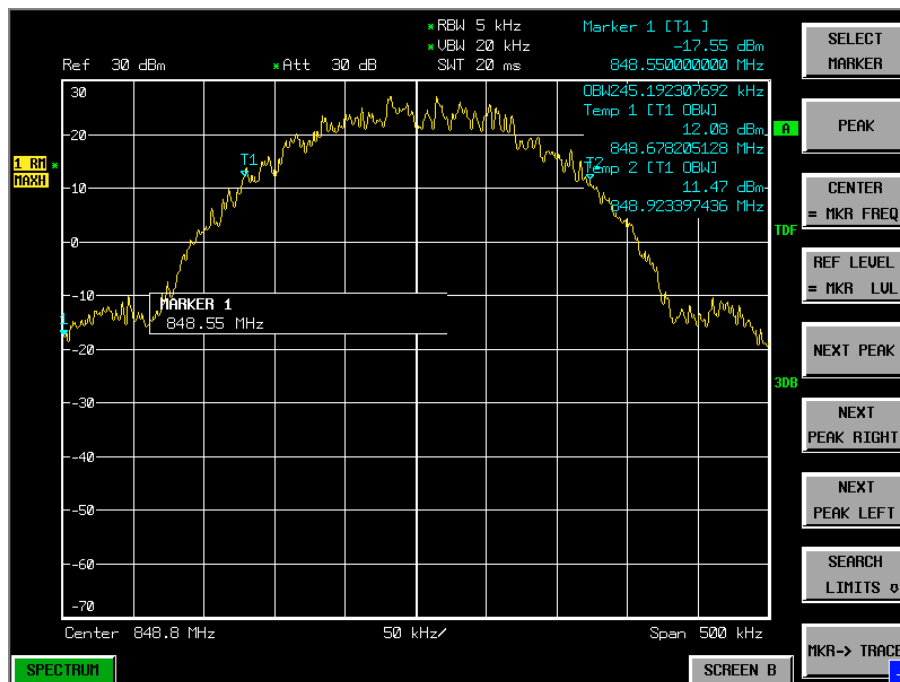
### Channel 128-Occupied Bandwidth (99% BW)



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



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



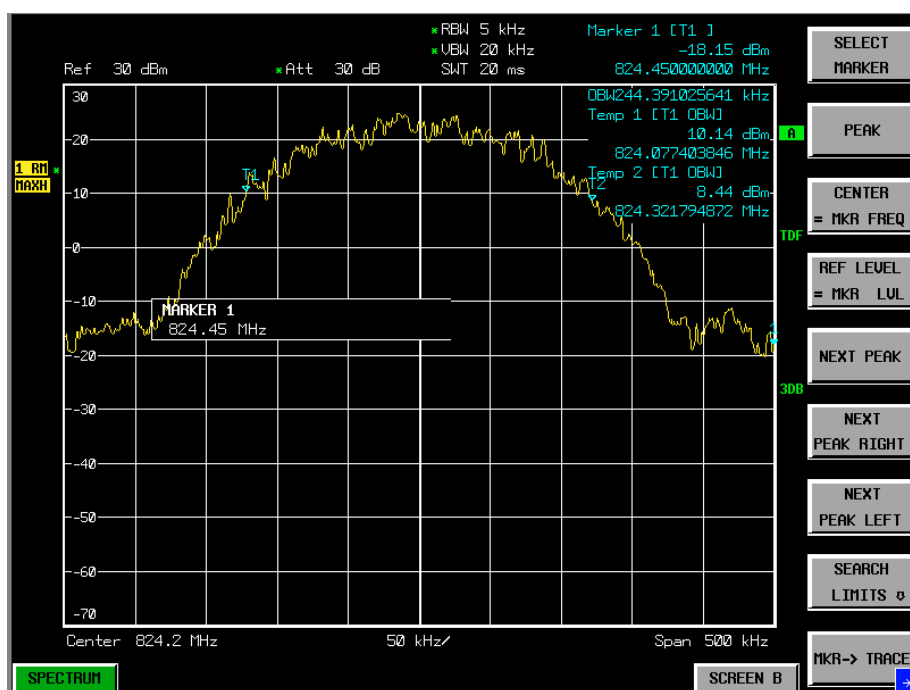
### EGPRS 850(99% BW) per FCC rules

| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |
|----------------|-----------------------------------|
| 824.2          | 244.391                           |
| 836.6          | 243.589                           |
| 848.8          | 245.192                           |

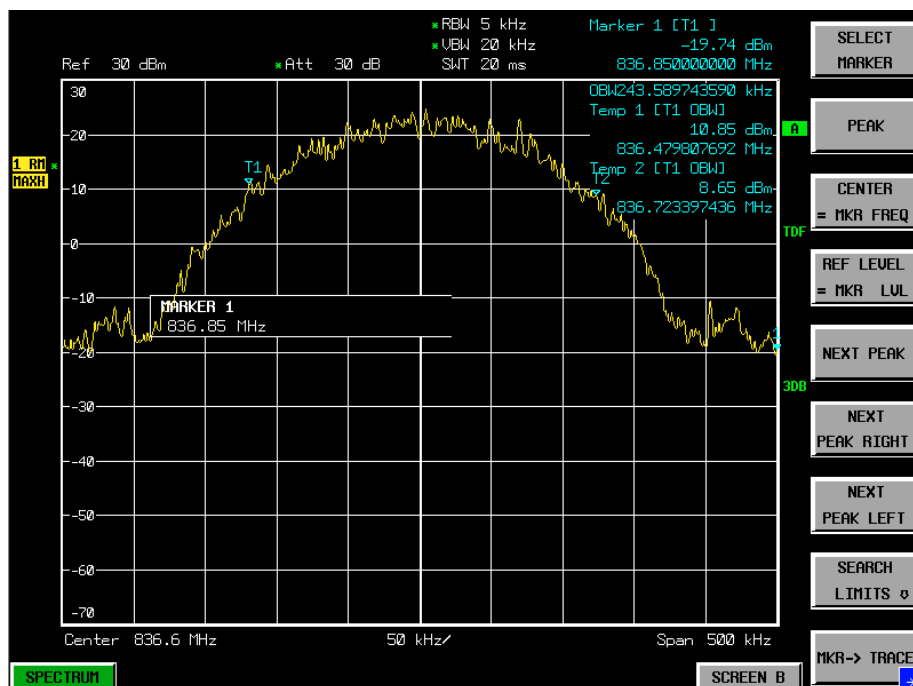
Expanded measurement uncertainty for this test item is 1.1 kHz,  $k=2$

### EGPRS 850

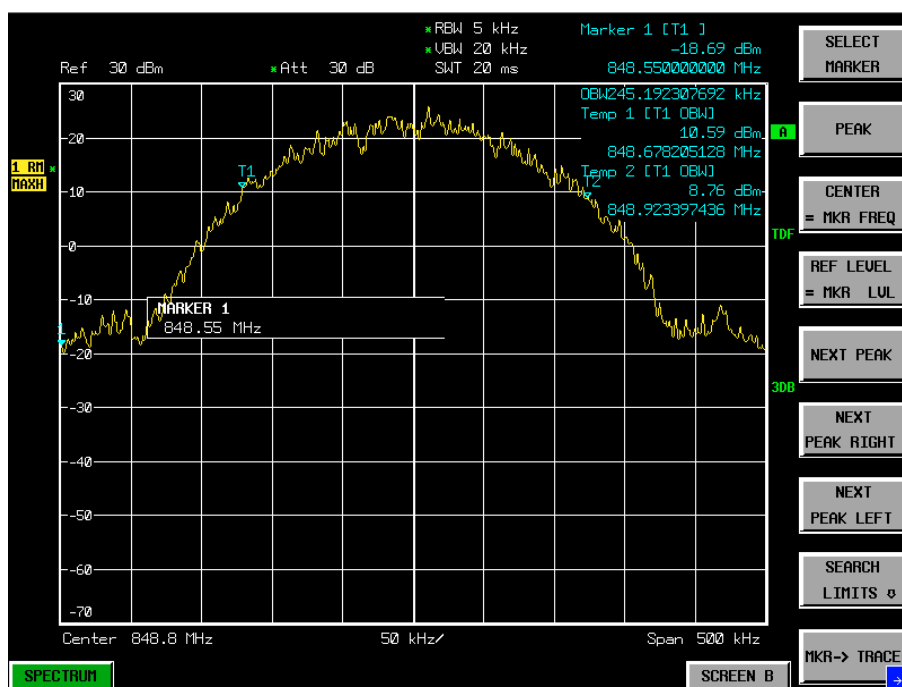
#### Channel 128-Occupied Bandwidth (99% BW)



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



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



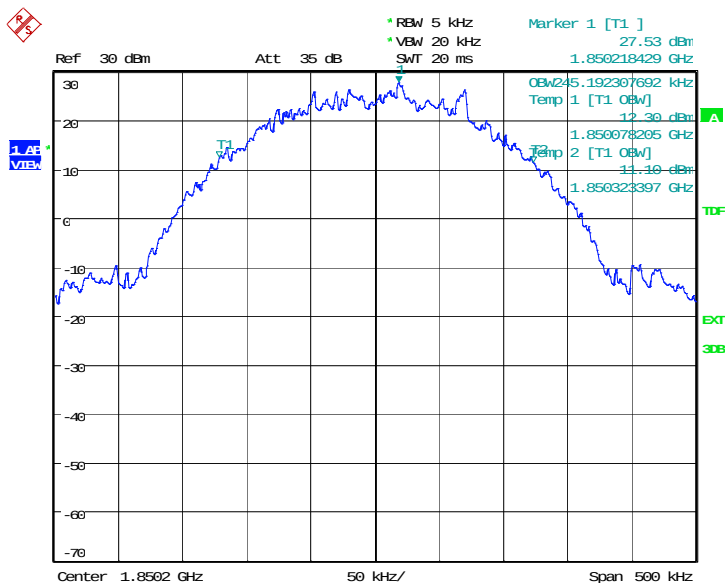
### PCS 1900(99% BW) per FCC rules

| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |
|----------------|-----------------------------------|
| 1850.2         | 245.192                           |
| 1880.0         | 244.391                           |
| 1909.8         | 245.994                           |

Expanded measurement uncertainty for this test item is 1.1 kHz,  $k=2$

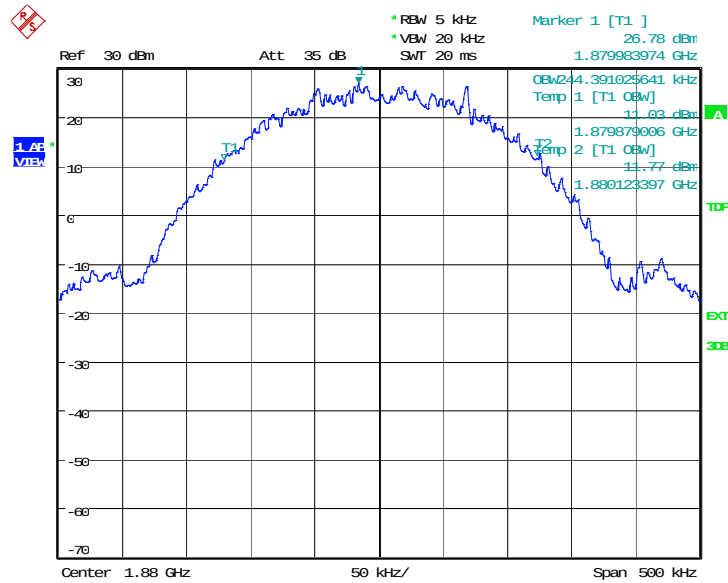
### PCS 1900

#### Channel 512-Occupied Bandwidth (99% BW)



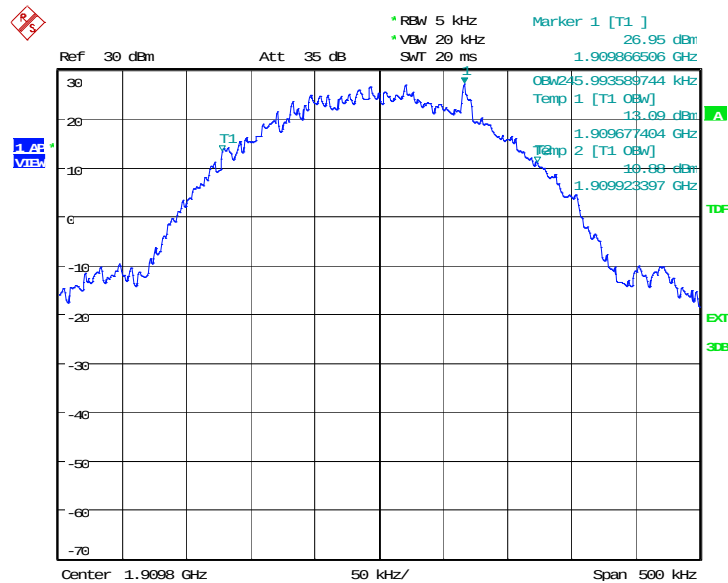
Date: 21.JUL.2014 09:29:43

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



Date: 21.JUL.2014 09:30:15

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



Date: 21.JUL.2014 09:30:47

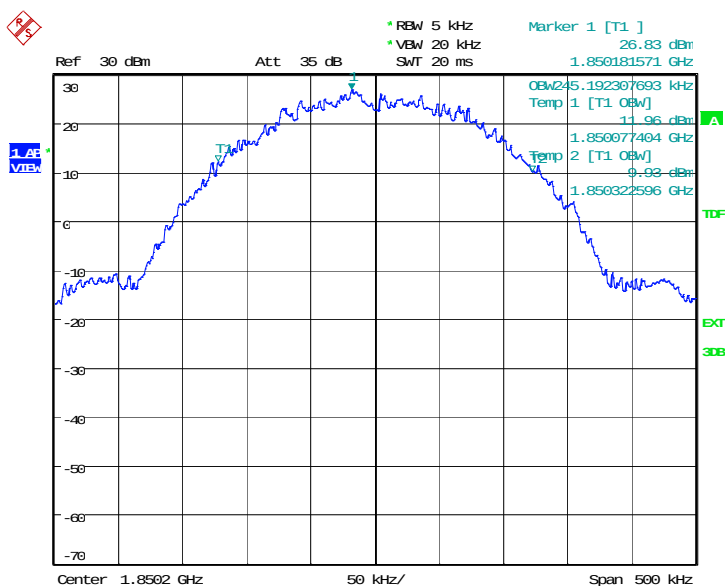
### GPRS 1900(99% BW) per FCC rules

| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |
|----------------|-----------------------------------|
| 1850.2         | 245.192                           |
| 1880.0         | 241.987                           |
| 1909.8         | 241.987                           |

Expanded measurement uncertainty for this test item is 1.1 kHz,  $k=2$

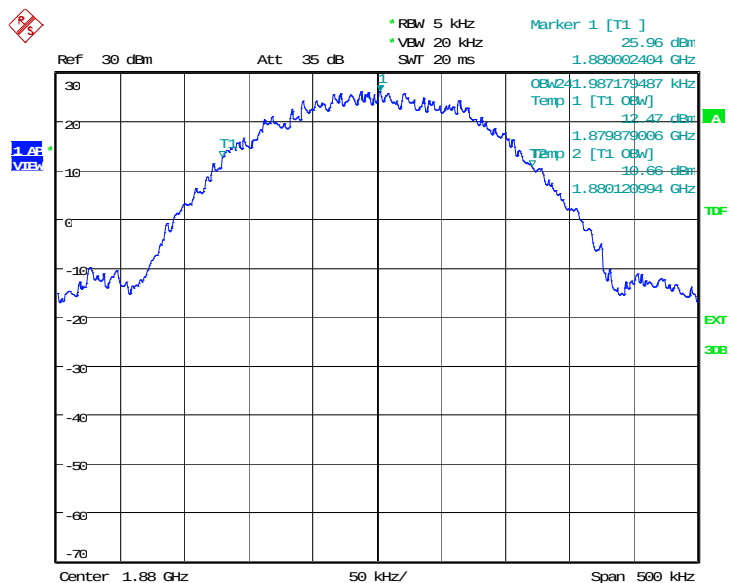
### GPRS 1900

#### Channel 512-Occupied Bandwidth 99% BW)



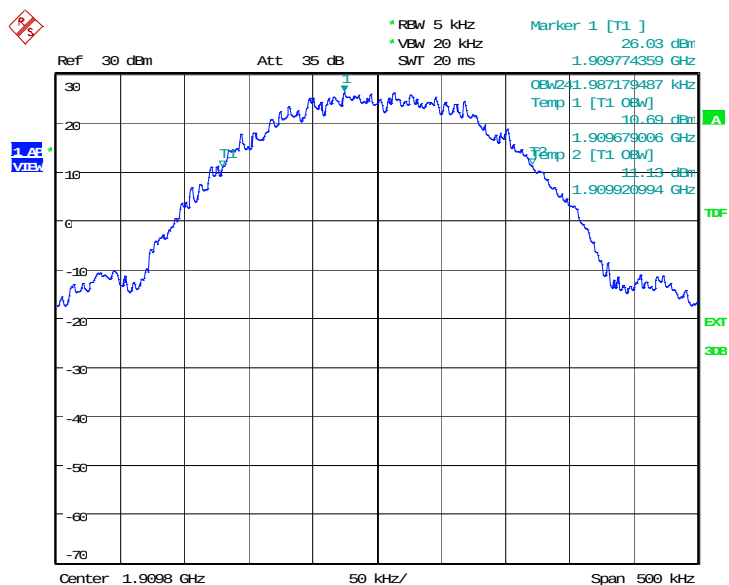
Date: 21.JUL.2014 08:58:40

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



Date: 21.JUL.2014 08:59:12

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



Date: 21.JUL.2014 08:59:45

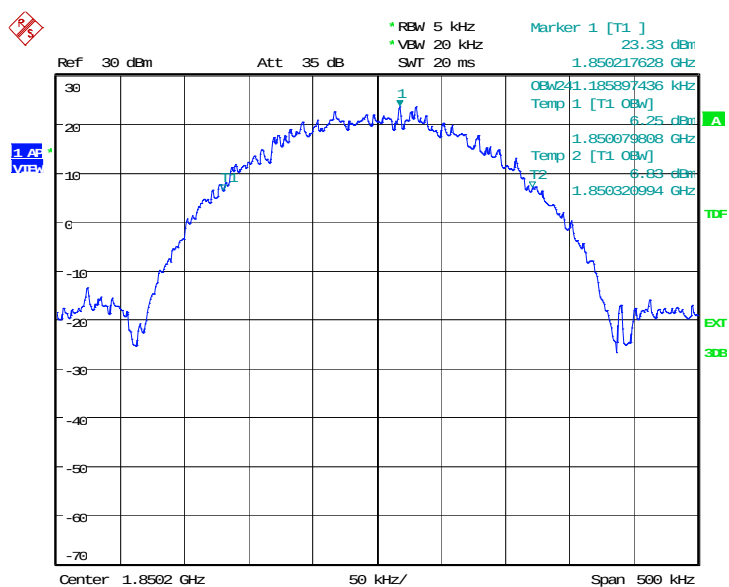
### EGPRS 1900(99% BW) per FCC rules

| Frequency(MHz) | Occupied Bandwidth (99% BW)( kHz) |
|----------------|-----------------------------------|
| 1850.2         | 241.186                           |
| 1880.0         | 242.788                           |
| 1909.8         | 245.994                           |

Expanded measurement uncertainty for this test item is 1.1 kHz,  $k=2$

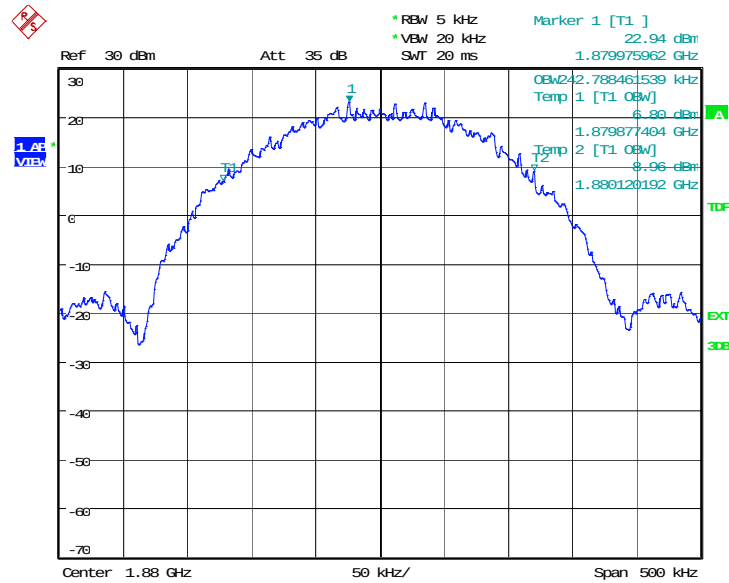
### EGPRS 1900

#### Channel 512-Occupied Bandwidth (99% BW)



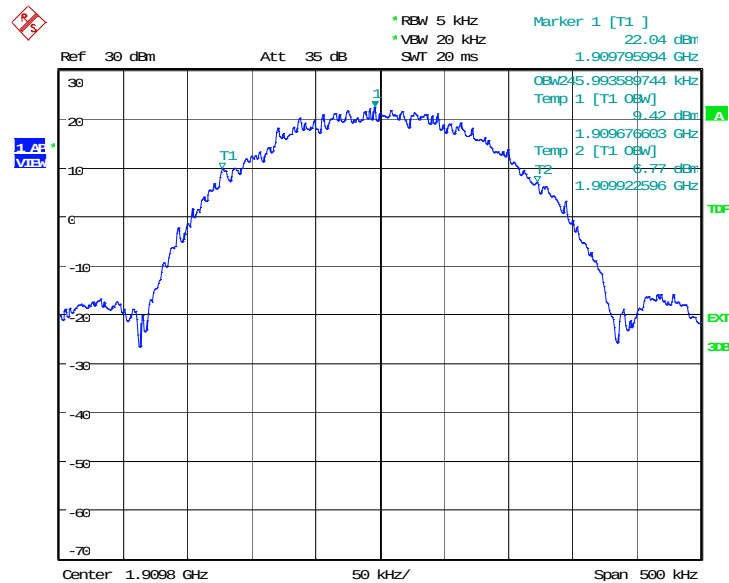
Date: 21.JUL.2014 09:17:38

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



Date: 21.JUL.2014 09:18:10

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



Date: 21.JUL.2014 09:18:42

## A.6 EMISSION BANDWIDTH

### Reference

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

### A.6.1 Emission Bandwidth Results

Emission 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 PCS1900 band and GSM850 band. Table below lists the measured 100% BW. Spectrum analyzer plots are included on the following pages.

#### Measurement Parameters:

RBW = 5 kHz, VBW = 20 kHz

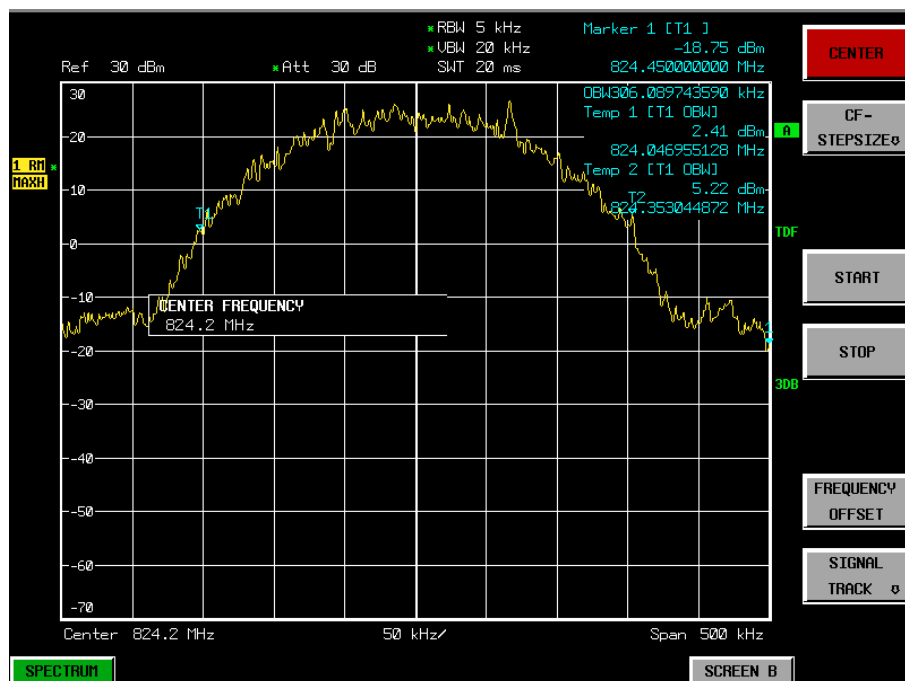
#### GSM 850(100% BW)

| Frequency(MHz) | Occupied Bandwidth (100% BW)( kHz) |
|----------------|------------------------------------|
| 824.2          | 306.089                            |
| 836.6          | 306.891                            |
| 848.8          | 306.089                            |

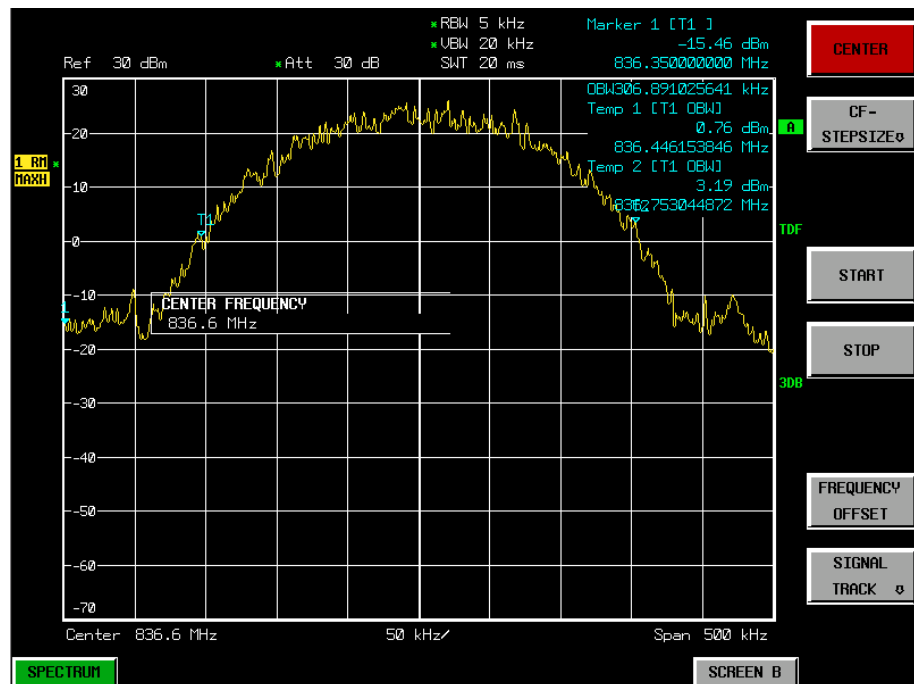
Expanded measurement uncertainty for this test item is 1.1 kHz, k=2

#### GSM 850

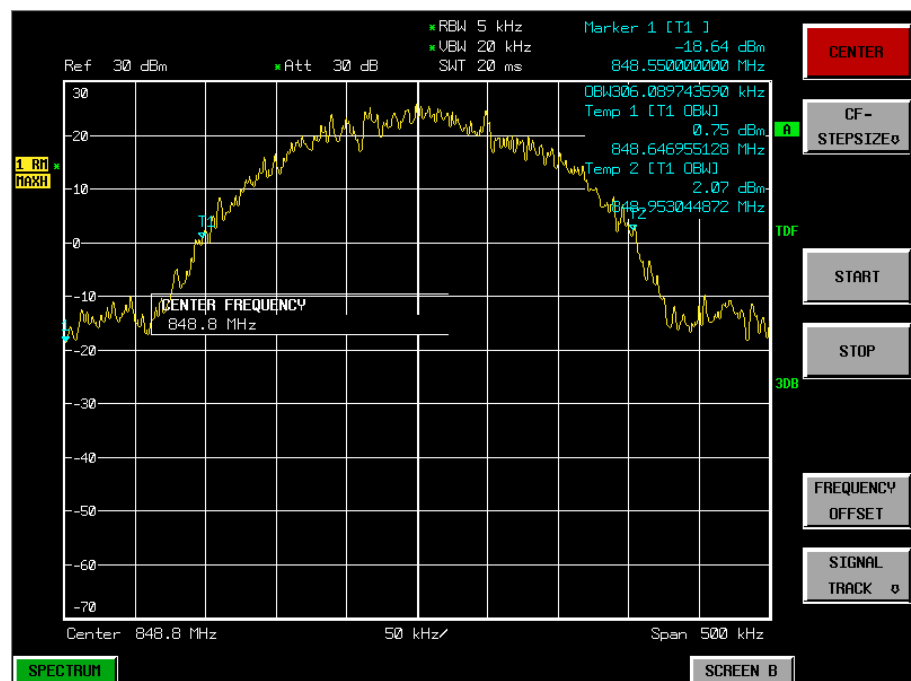
#### Channel 128-Occupied Bandwidth (100% BW)



### Channel 190-Occupied Bandwidth (100% BW)



### Channel 251-Occupied Bandwidth (100% BW)



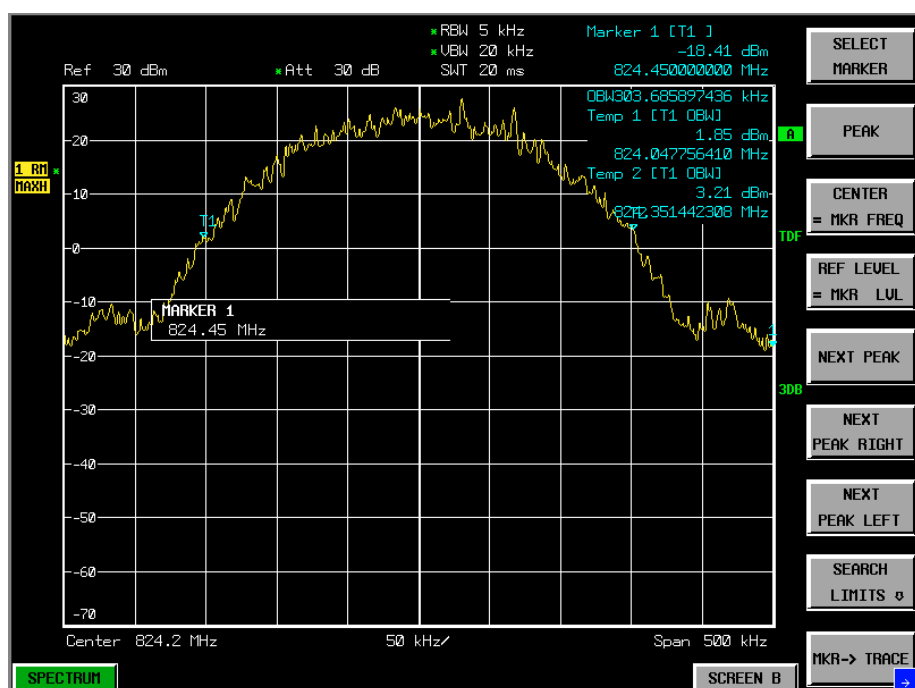
### GPRS 850(100% BW)

| Frequency(MHz) | Occupied Bandwidth (100% BW)( kHz) |
|----------------|------------------------------------|
| 824.2          | 303.685                            |
| 836.6          | 306.089                            |
| 848.8          | 305.288                            |

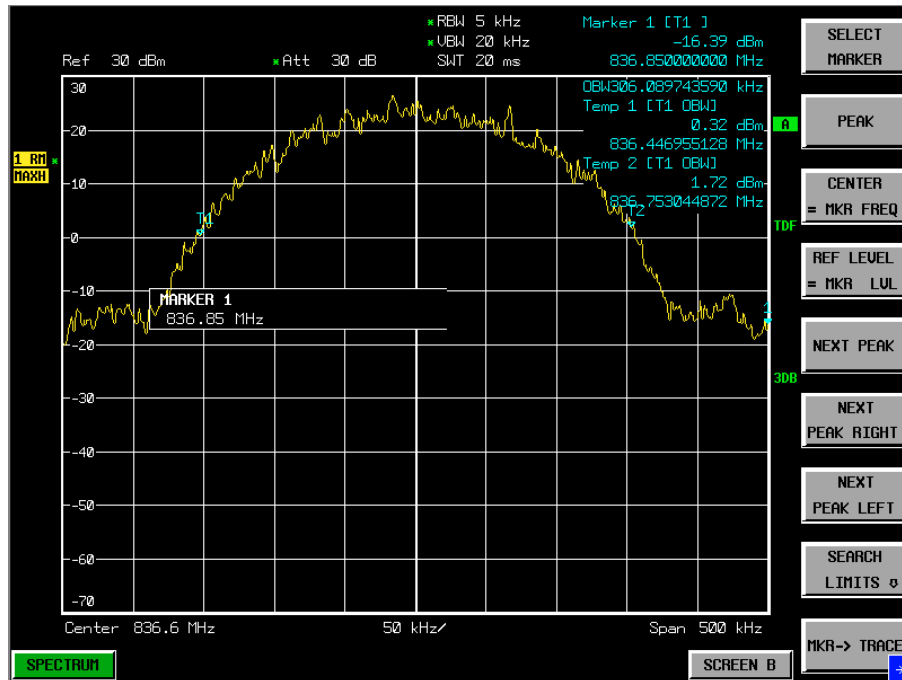
Expanded measurement uncertainty for this test item is 1.1 kHz, k=2

### GPRS 850

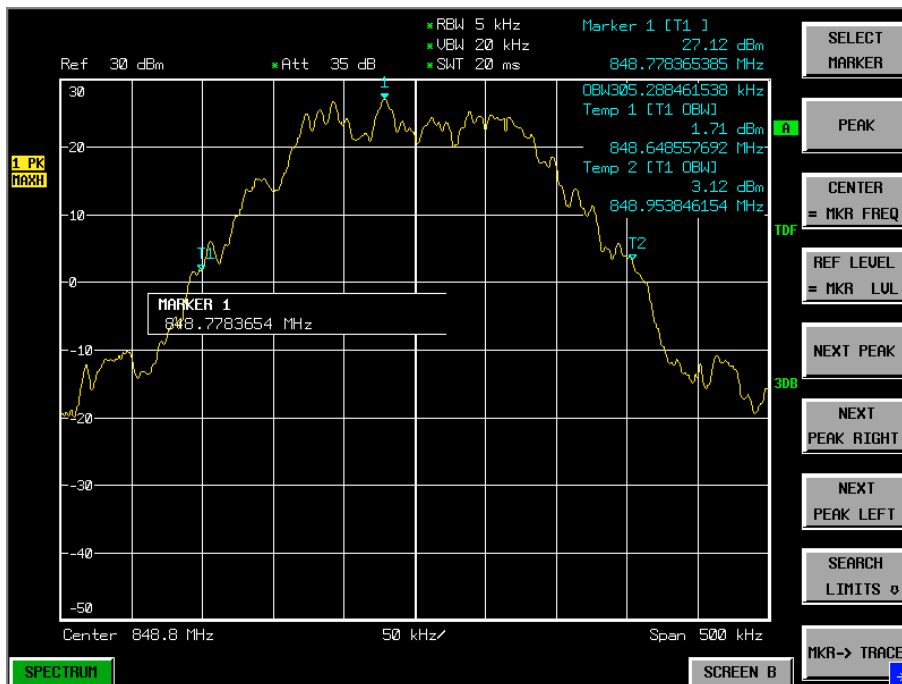
#### Channel 128-Occupied Bandwidth (100% BW)



### Channel 190-Occupied Bandwidth (100% BW)



### Channel 251-Occupied Bandwidth (100% BW)



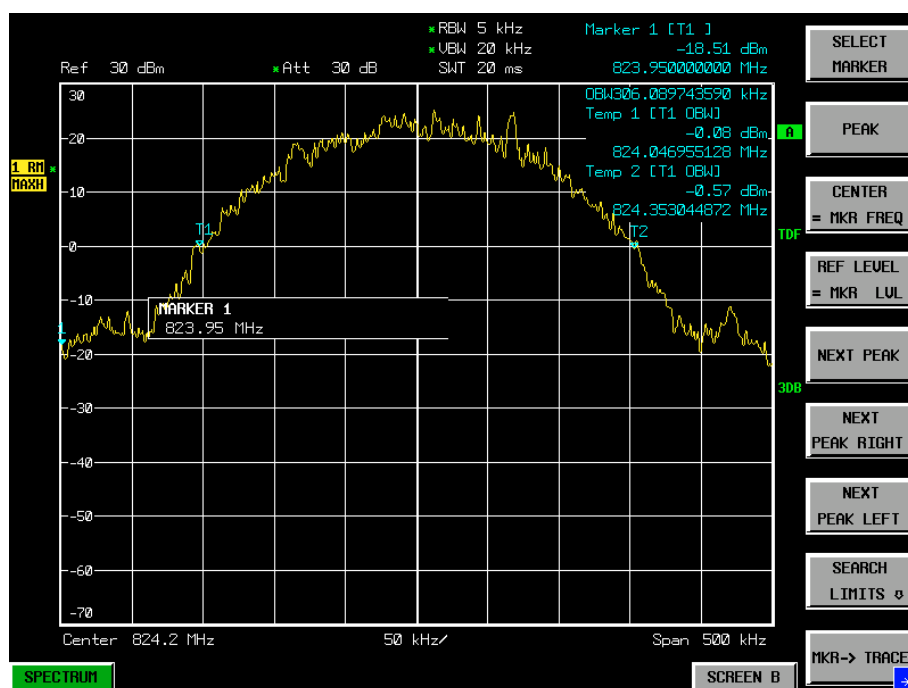
### EGPRS 850(100%)

| Frequency(MHz) | Occupied Bandwidth (100% BW)( kHz) |
|----------------|------------------------------------|
| 824.2          | 306.089                            |
| 836.6          | 304.487                            |
| 848.8          | 306.089                            |

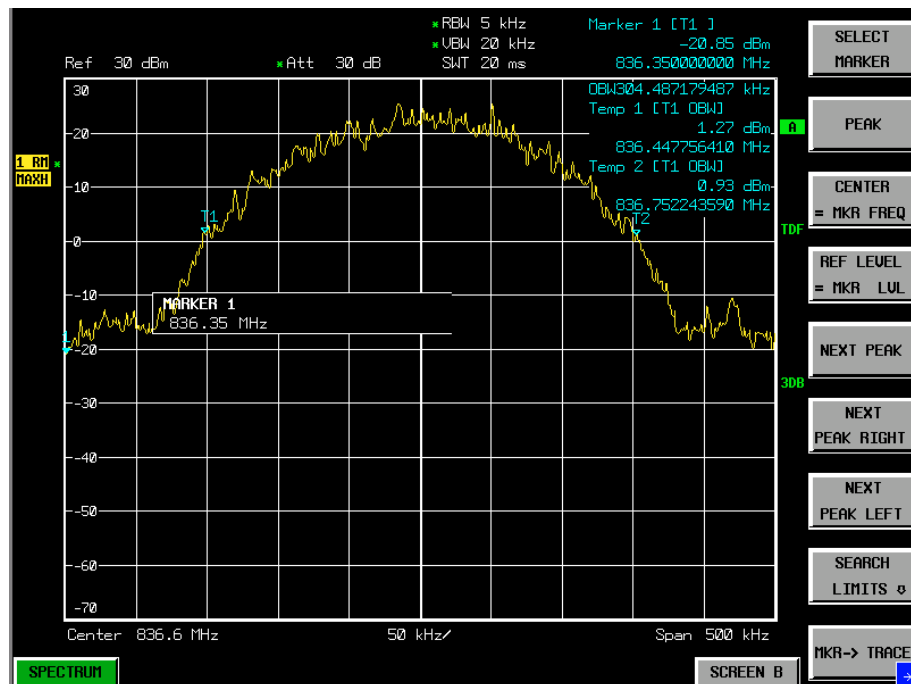
Expanded measurement uncertainty for this test item is 1.1 kHz, k=2

### EGPRS 850

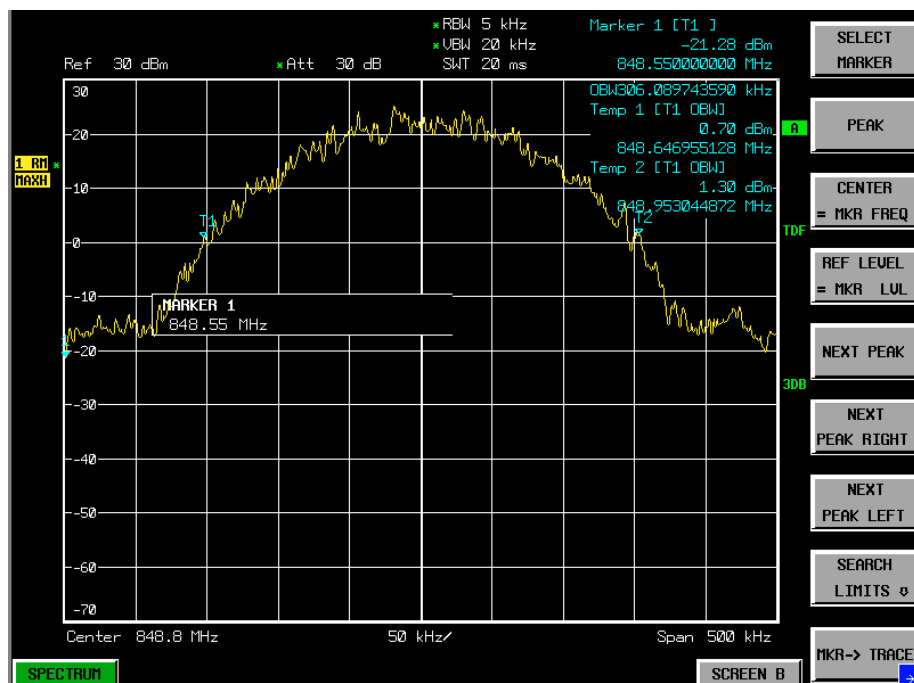
#### Channel 128-Occupied Bandwidth (100% BW)



### Channel 190-Occupied Bandwidth (100% BW)



### Channel 251-Occupied Bandwidth (100% BW)



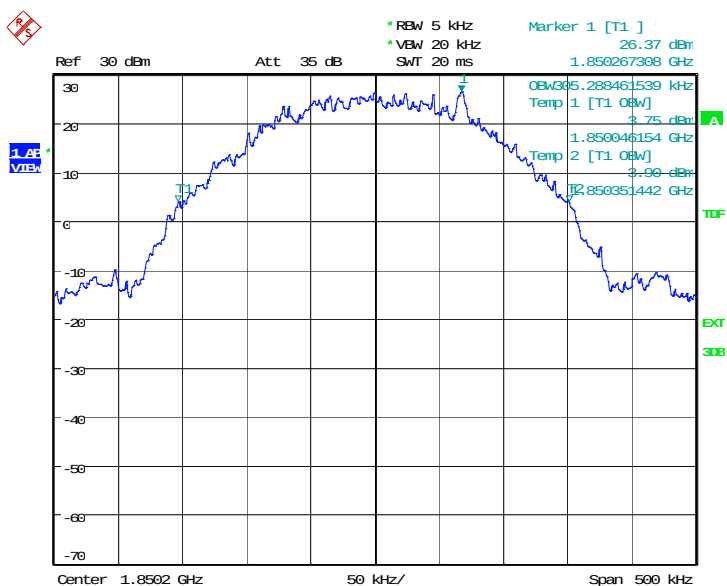
### PCS 1900(100% BW)

| Frequency(MHz) | Occupied Bandwidth (100% BW)( kHz) |
|----------------|------------------------------------|
| 1850.2         | 305.288                            |
| 1880.0         | 306.090                            |
| 1909.8         | 306.090                            |

Expanded measurement uncertainty for this test item is 1.1 kHz, k=2

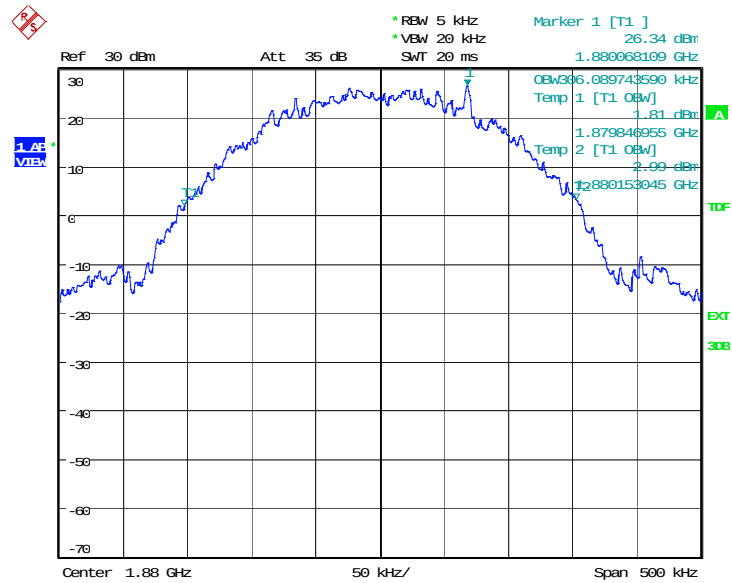
### PCS 1900

#### Channel 512-Occupied Bandwidth (100% BW)



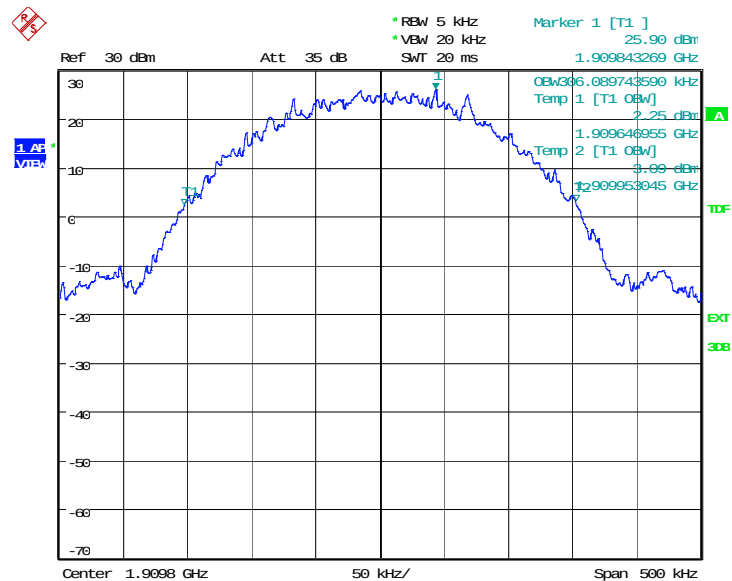
Date: 21.JUL.2014 09:31:21

### Channel 661-Occupied Bandwidth (100% BW)



Date: 21.JUL.2014 09:31:53

### Channel 810-Occupied Bandwidth (100% BW)



Date: 21.JUL.2014 09:32:25

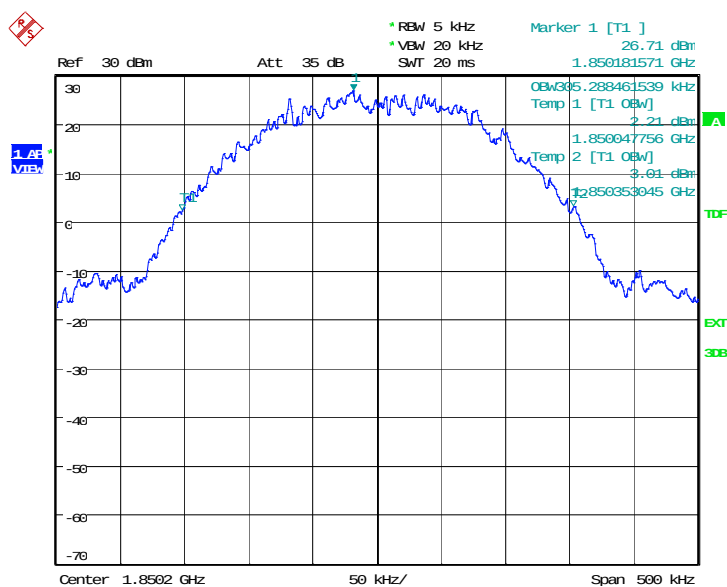
### GPRS 1900(100%)

| Frequency(MHz) | Occupied Bandwidth (100% BW)( kHz) |
|----------------|------------------------------------|
| 1850.2         | 305.288                            |
| 1880.0         | 305.288                            |
| 1909.8         | 305.288                            |

Expanded measurement uncertainty for this test item is 1.1 kHz,  $k=2$

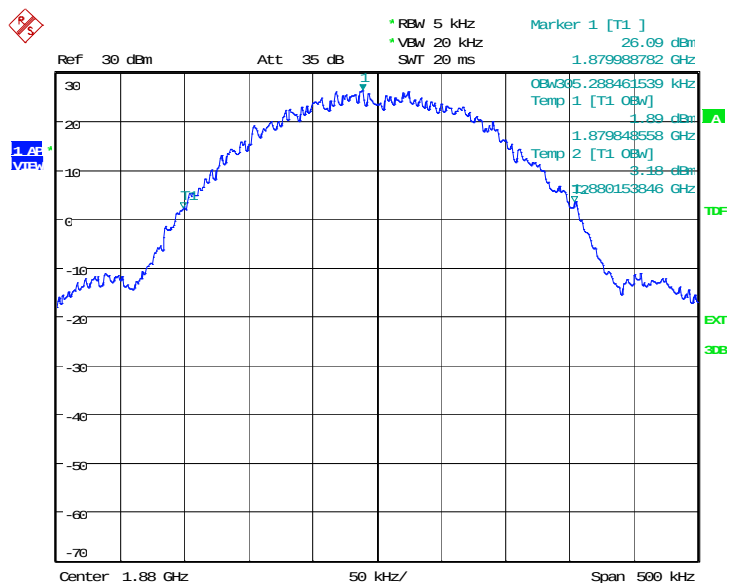
### GPRS 1900

#### Channel 512-Occupied Bandwidth (100% BW)



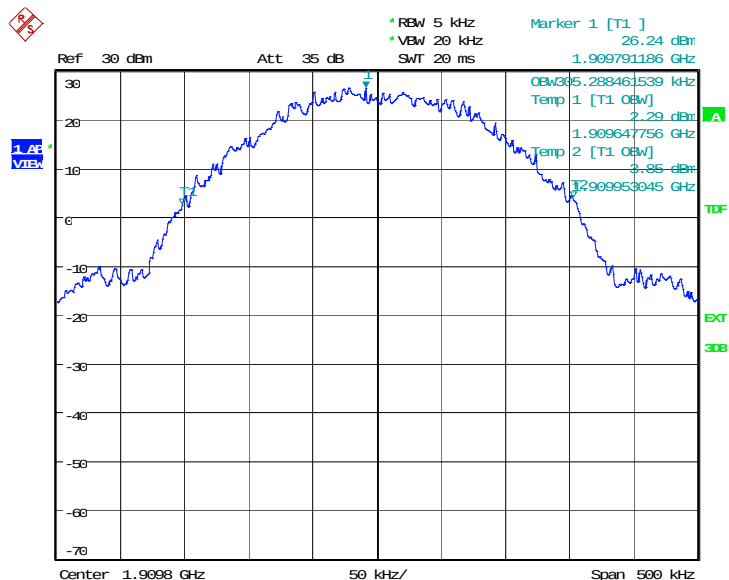
Date: 21.JUL.2014 09:00:18

### Channel 661-Occupied Bandwidth (100% BW)



Date: 21.JUL.2014 09:00:50

### Channel 810-Occupied Bandwidth (100% BW)



Date: 21.JUL.2014 09:01:22

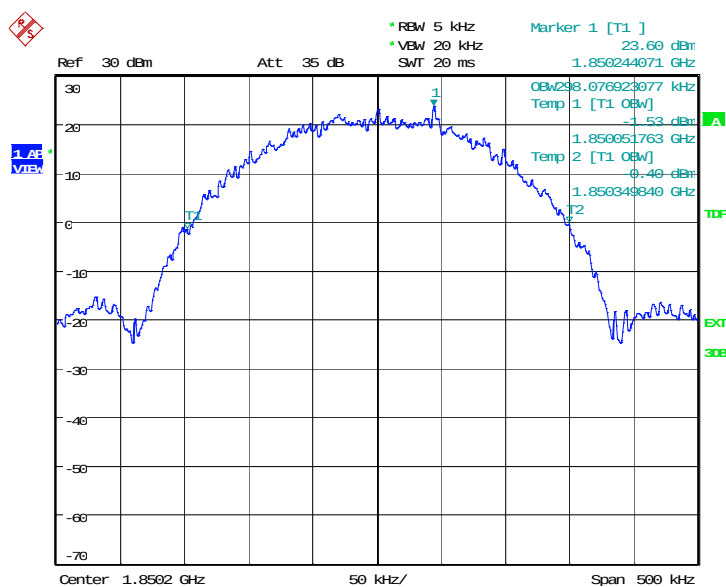
### EGPRS 1900(100% BW)

| Frequency(MHz) | Occupied Bandwidth (100% BW)( kHz) |
|----------------|------------------------------------|
| 1850.2         | 298.077                            |
| 1880.0         | 299.679                            |
| 1909.8         | 299.679                            |

Expanded measurement uncertainty for this test item is 1.1 kHz, k=2

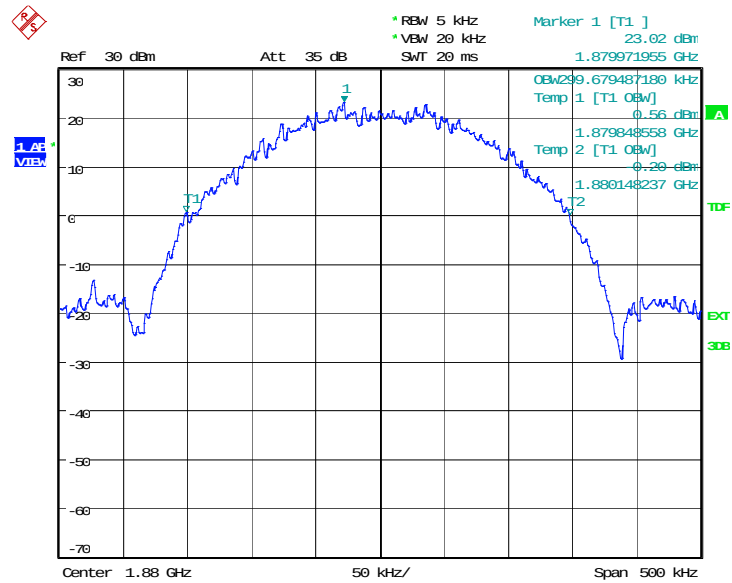
### EGPRS 1900

#### Channel 512-Occupied Bandwidth (100% BW)



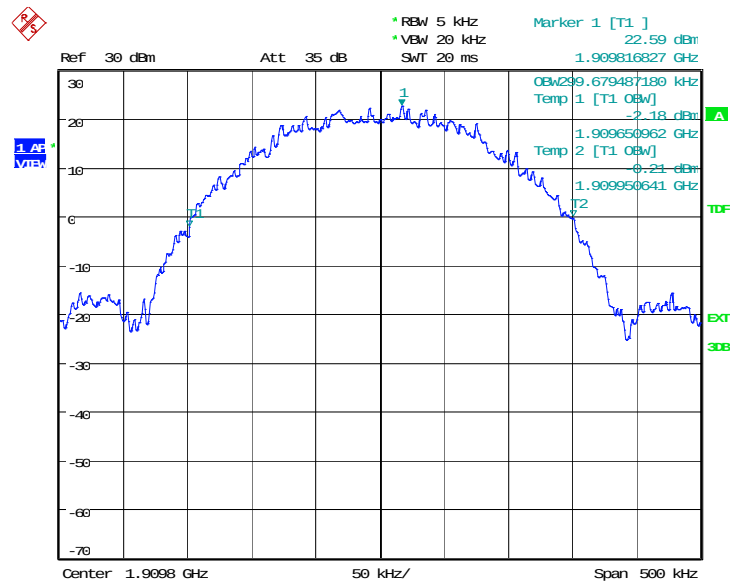
Date: 21.JUL.2014 09:19:16

### Channel 661-Occupied Bandwidth (100% BW)



Date: 21.JUL.2014 09:19:48

### Channel 810-Occupied Bandwidth (100% BW)



Date: 21.JUL.2014 09:20:20

## A.7 BAND EDGE COMPLIANCE

### Reference

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

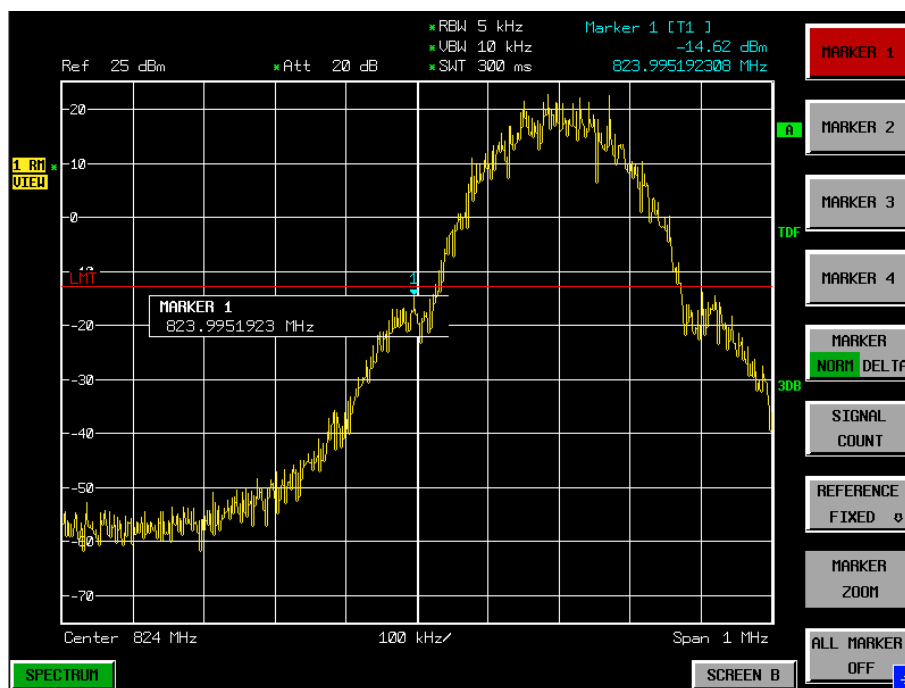
#### A.7.1 Measurement limit

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.

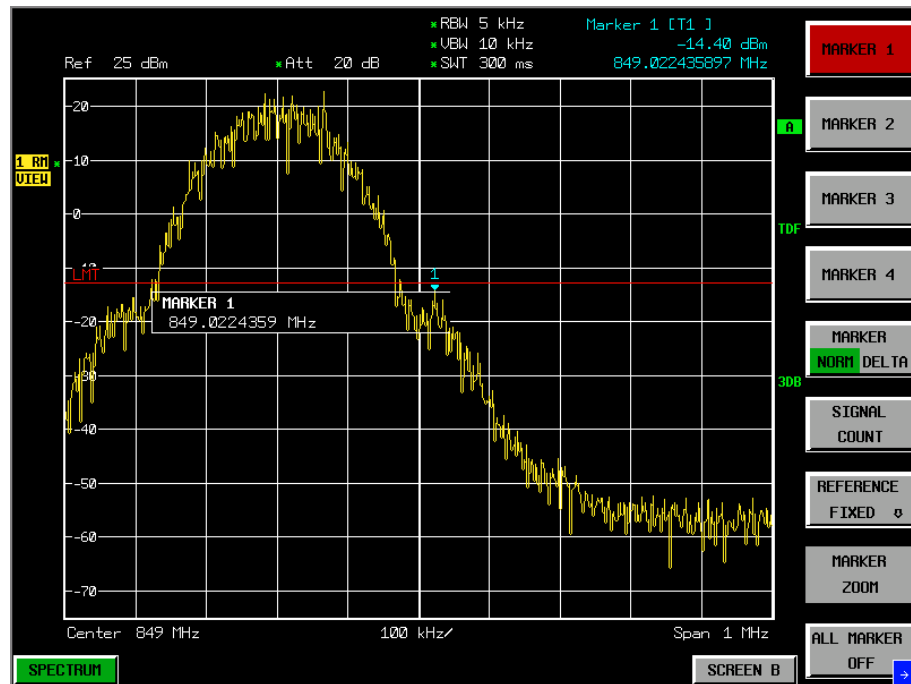
#### A.7.2 Measurement result

##### GSM 850

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

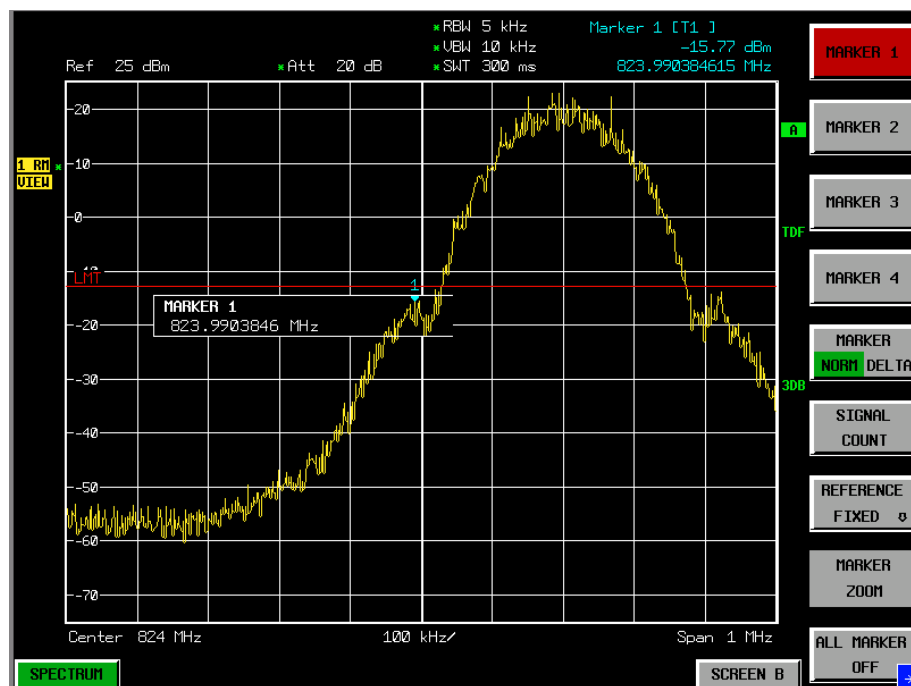


### HIGH BAND EDGE BLOCK-C (GSM850) –Channel 251

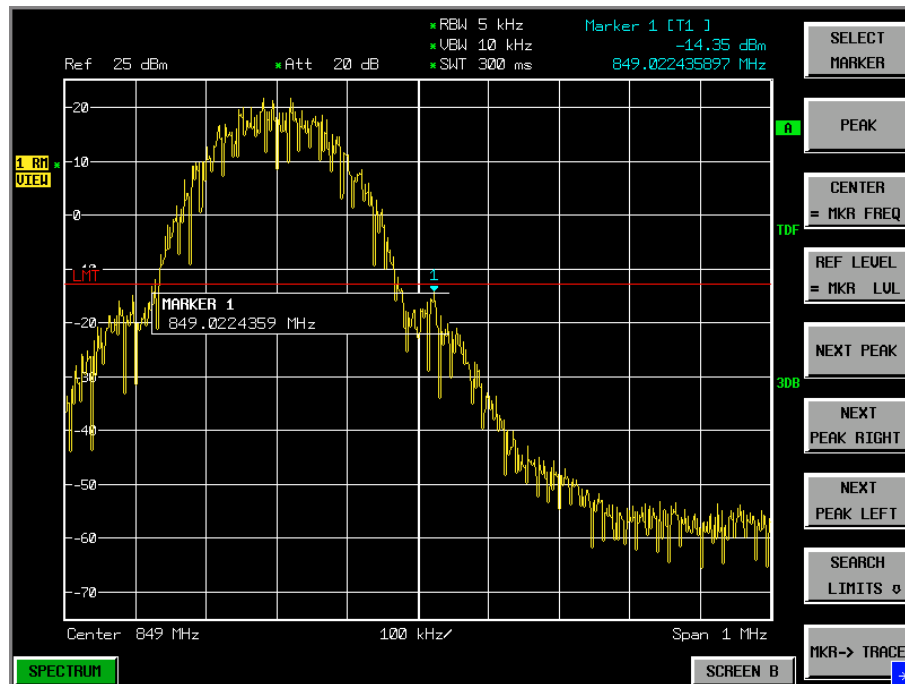


### GPRS 850

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

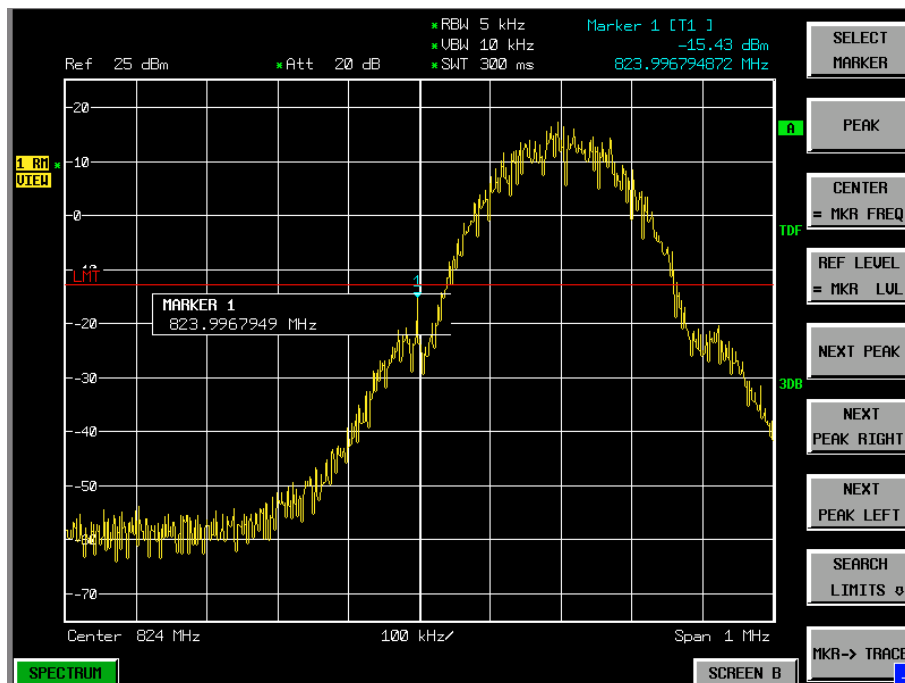


### HIGH BAND EDGE BLOCK-C (GSM850) –Channel 251

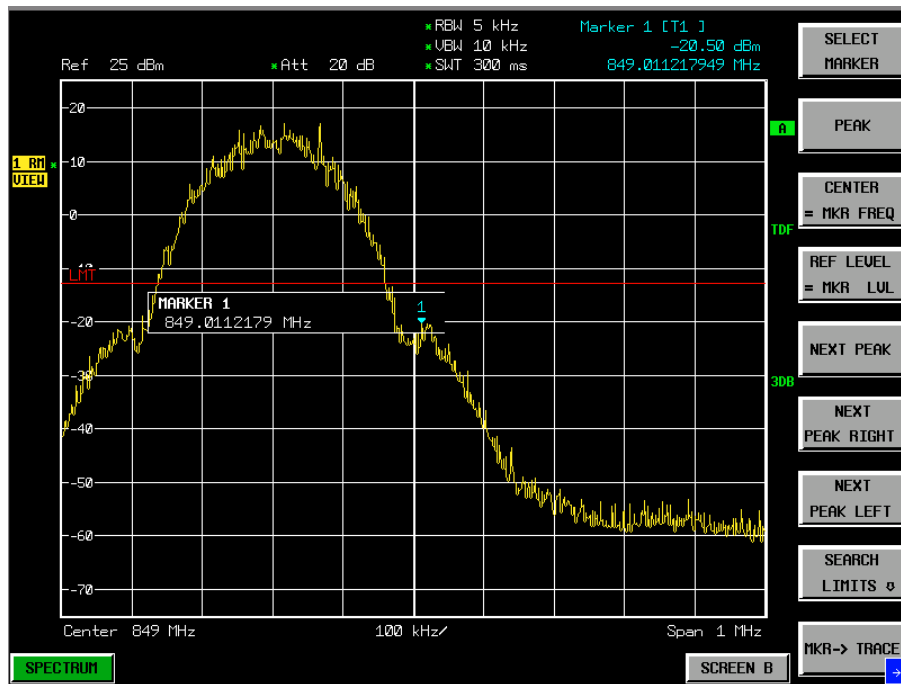


### EGPRS 850-8PSK

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

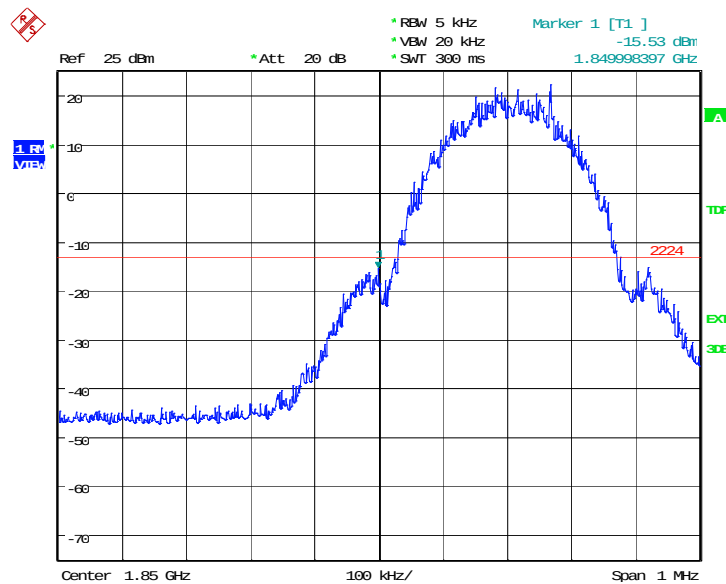


### HIGH BAND EDGE BLOCK-C (GSM850) –Channel 251

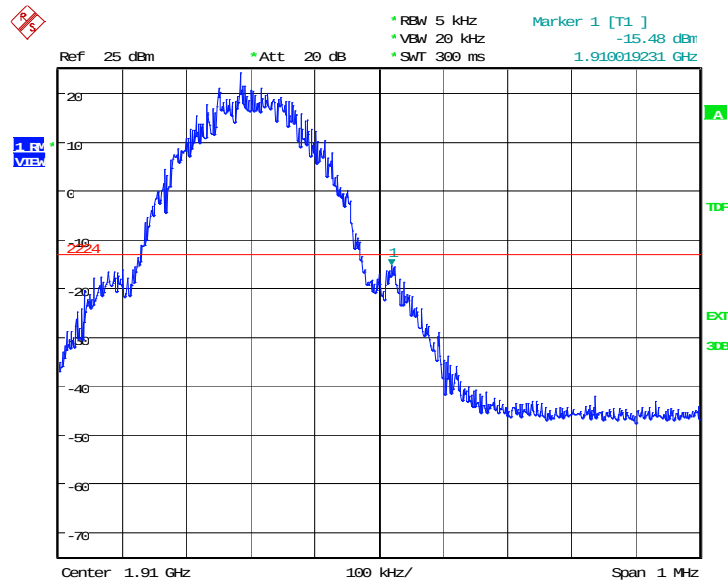


### PCS 1900

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



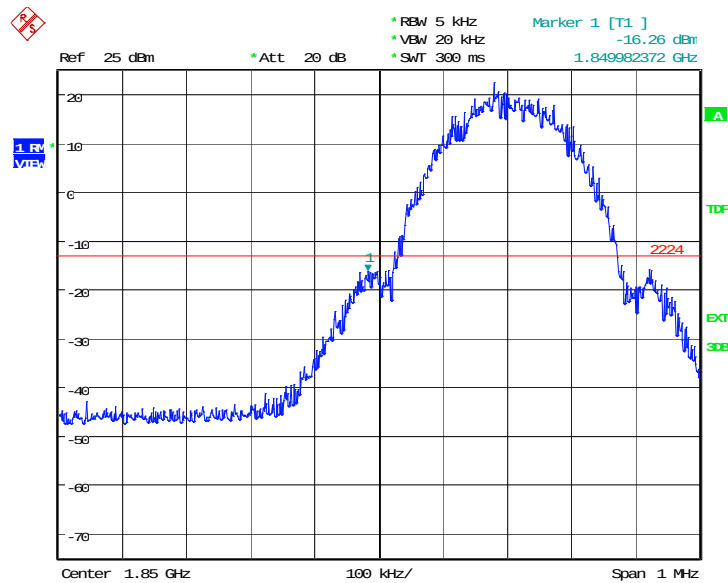
### HIGH BAND EDGE BLOCK-C (PCS-1900) –Channel 810



Date: 21.JUL.2014 09:32:53

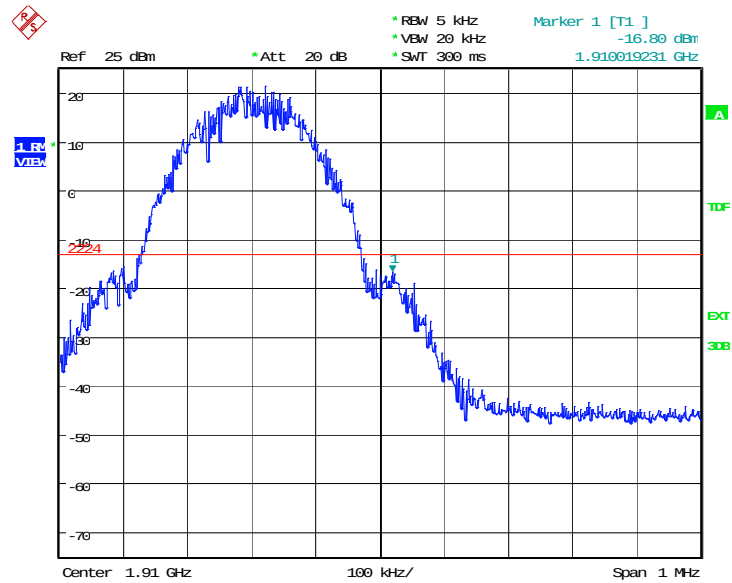
### GPRS 1900

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



Date: 21.JUL.2014 09:01:36

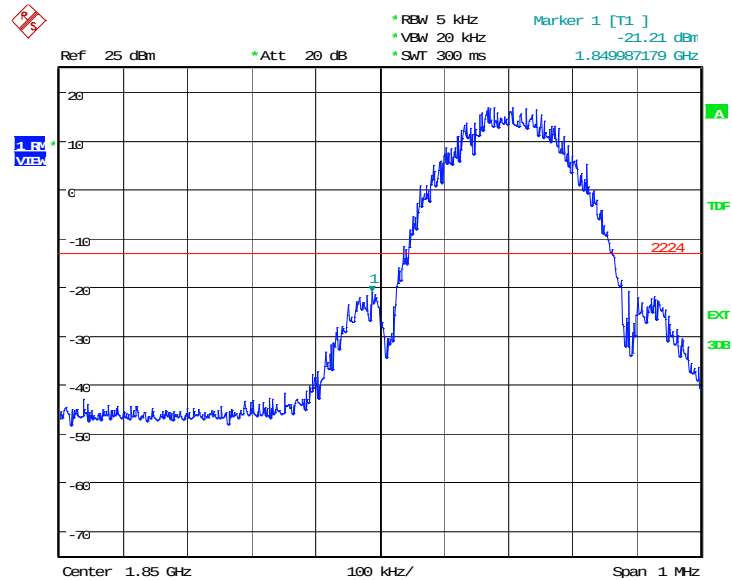
### HIGH BAND EDGE BLOCK-C (PCS-1900) –Channel 810



Date: 21.JUL.2014 09:01:50

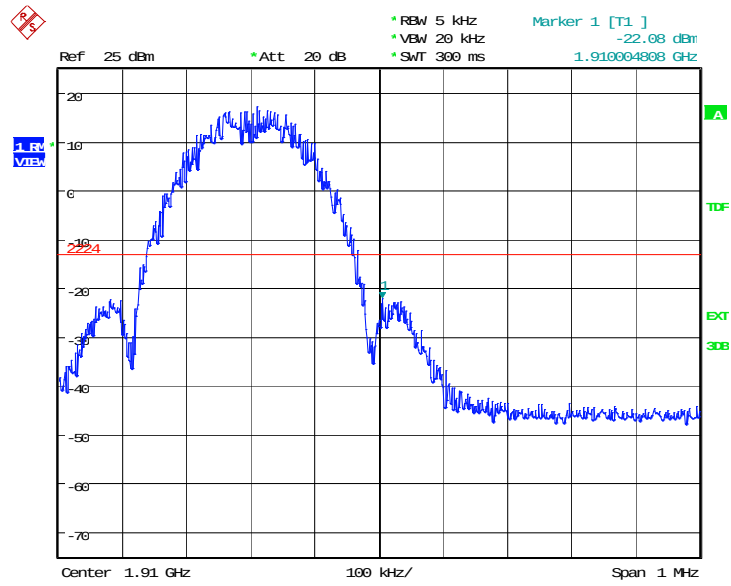
### EGPRS 1900-8PSK

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



Date: 21.JUL.2014 09:20:34

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



Date: 21.JUL.2014 09:20:48

## **A.8 CONDUCTED SPURIOUS EMISSION**

### **Reference**

FCC: CFR Part 2.1057, 22.917, 24.238.

### **A.8.1 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 equipment of PCS1900 band, this equates to a frequency range of 30 MHz to 19.1 GHz, data are taken from 30 MHz to 20 GHz. For GSM850, data are taken from 30 MHz to 10 GHz.
2. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

#### **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. 8.2 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.

**Measurement Uncertainty: 0.3dB**

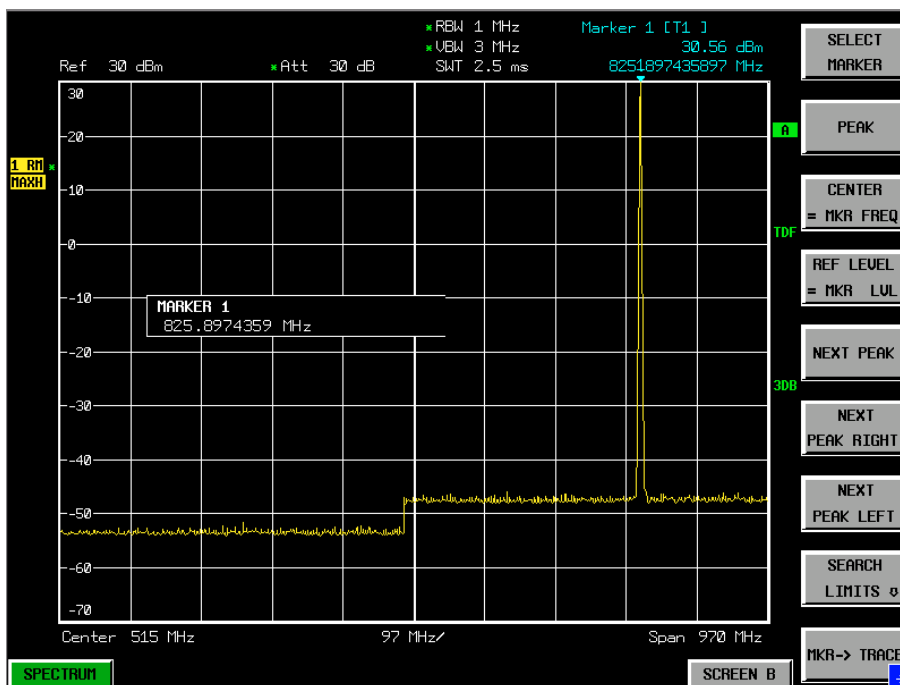
[illegible]

## GSM850

### A.8.3.1 Channel 128: 30MHz – 1GHz

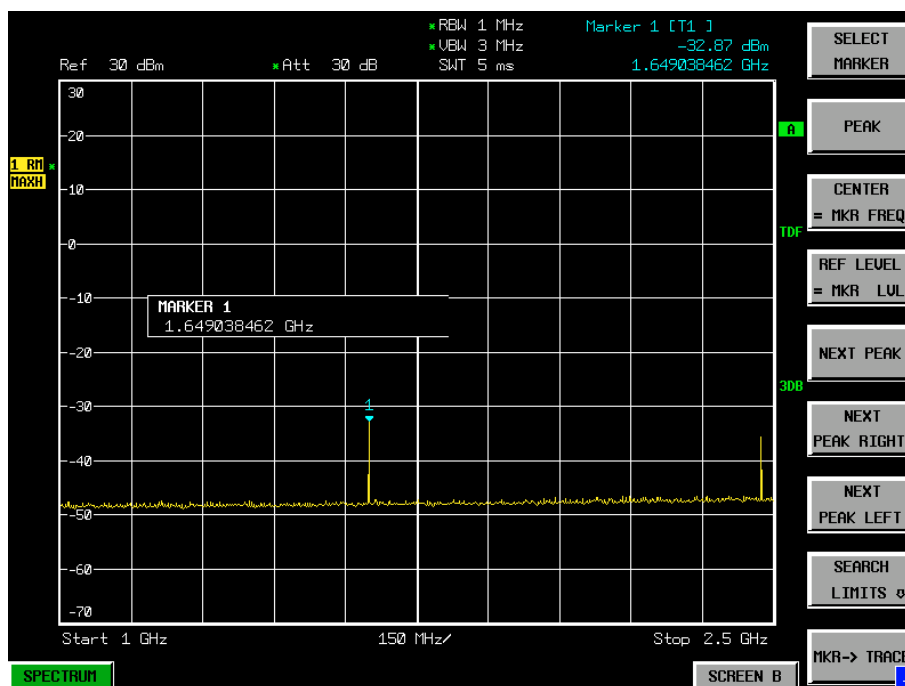
Spurious emission limit –13dBm.

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



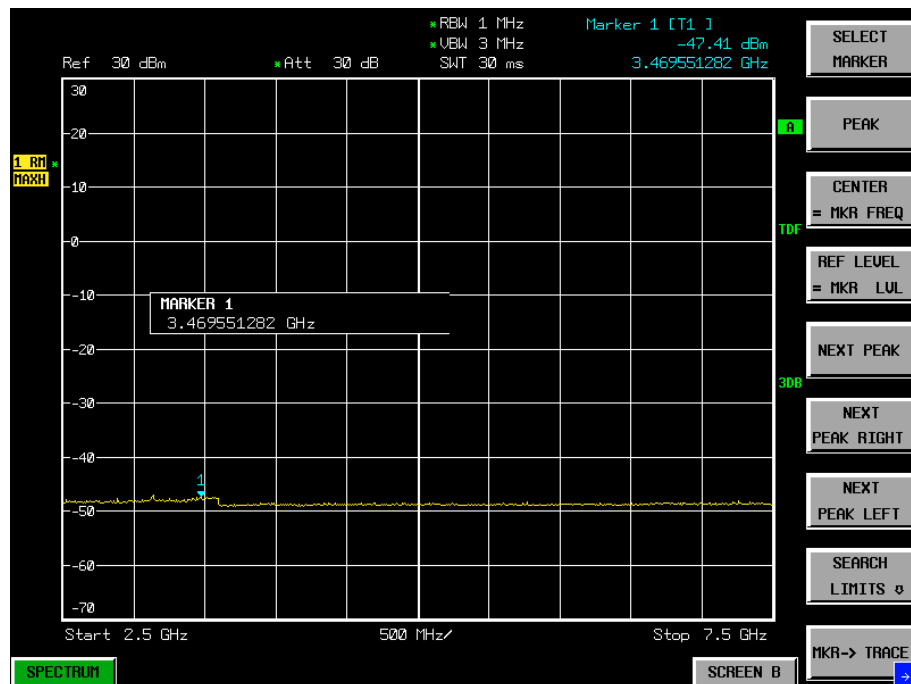
### A.8.3.2 Channel 128: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



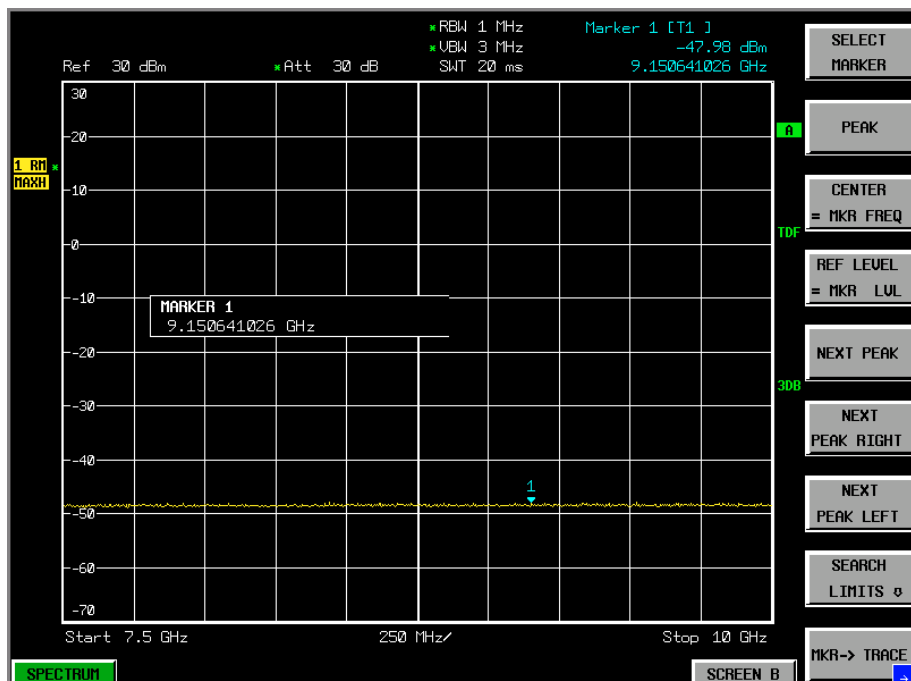
### A.8.3.3 Channel 128: 2.5GHz – 7.5GHz

Spurious emission limit –13dBm.



### A.8.3.4 Channel 128: 7.5GHz –10GHz

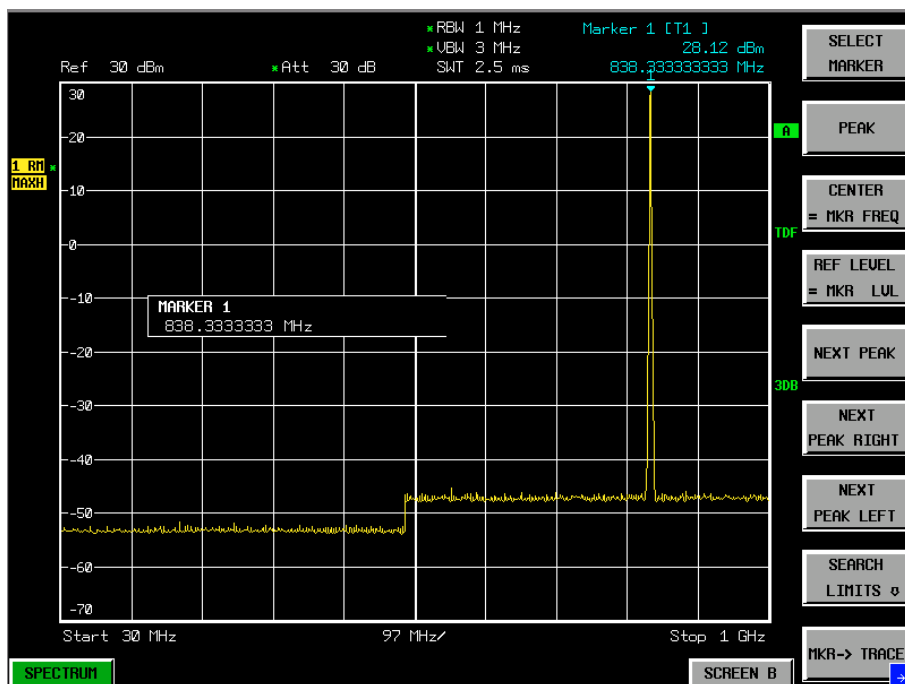
Spurious emission limit –13dBm.



### A.8.3.5 Channel 190: 30MHz – 1GHz

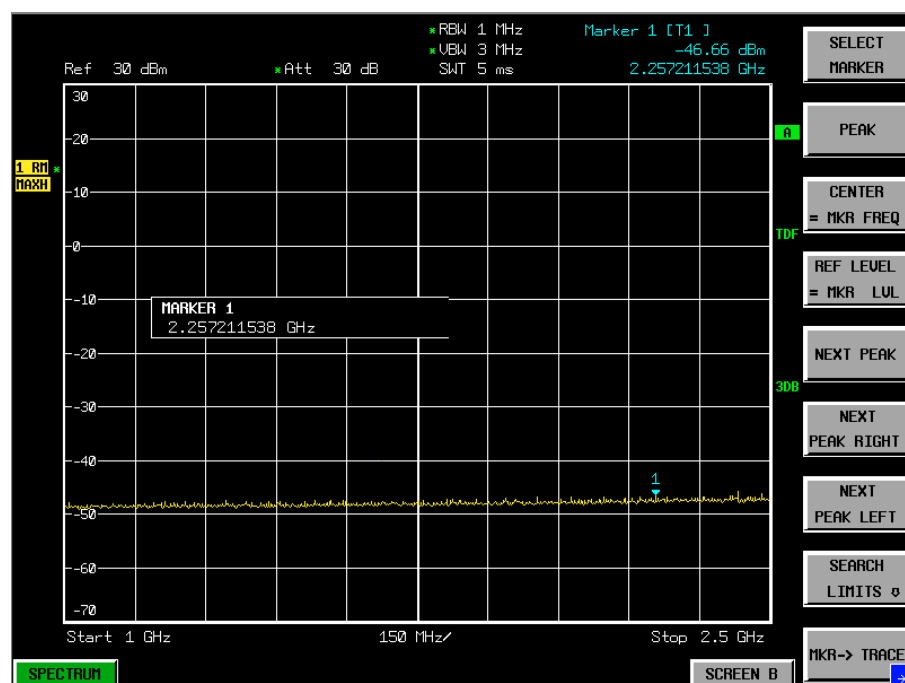
Spurious emission limit –13dBm

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



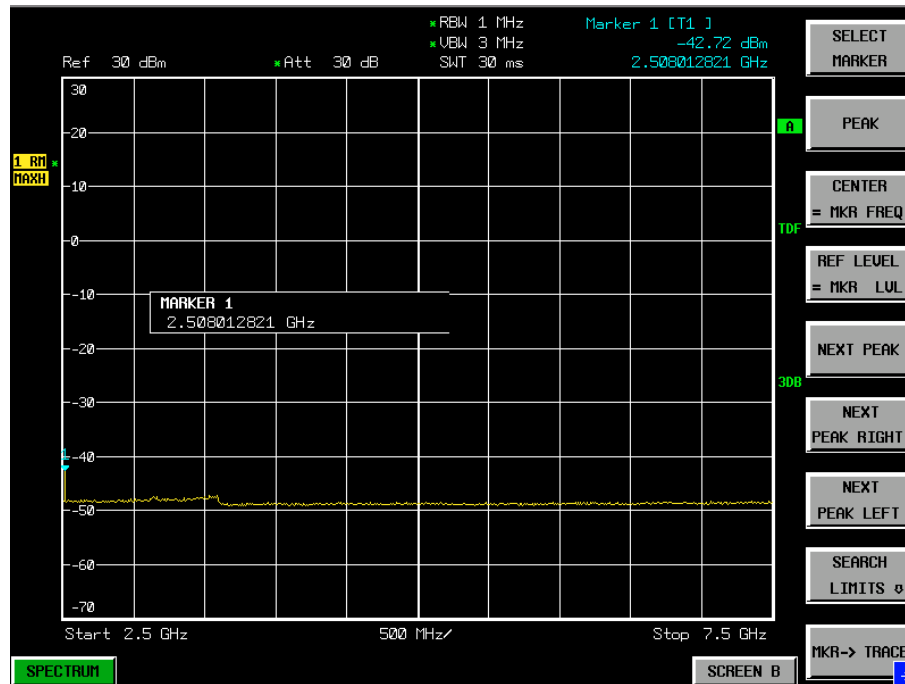
### A.8.3.6 Channel 190: 1GHz –2.5GHz

Spurious emission limit –13dBm



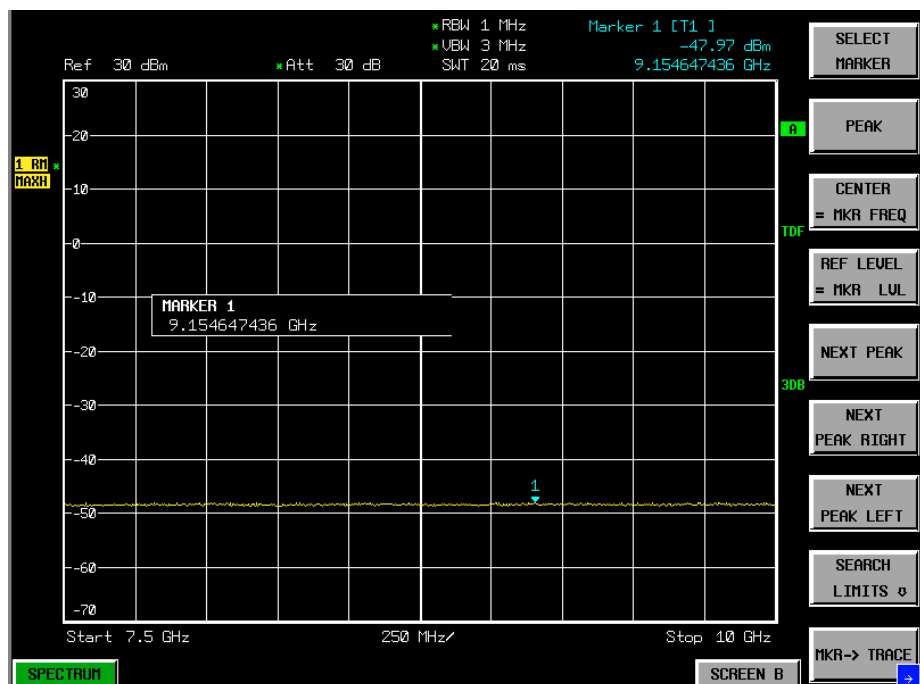
### A.8.3.7 Channel 190: 2.5GHz –7.5GHz

Spurious emission limit –13dBm



### A.8.3.8 Channel 190: 7.5GHz –10GHz

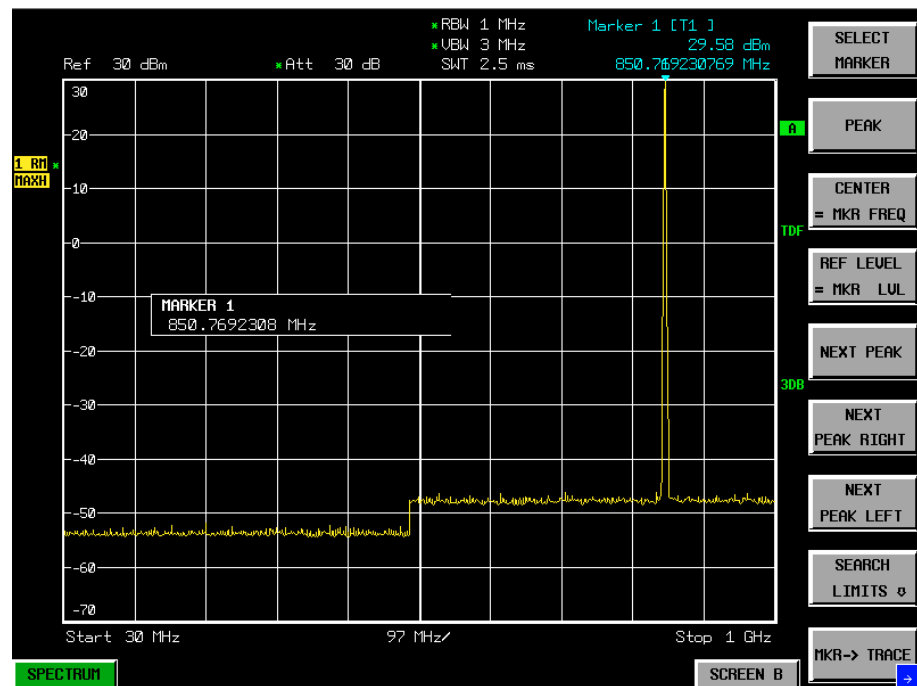
Spurious emission limit –13dBm



#### A.8.3.9 Channel 251: 30MHz – 1GHz

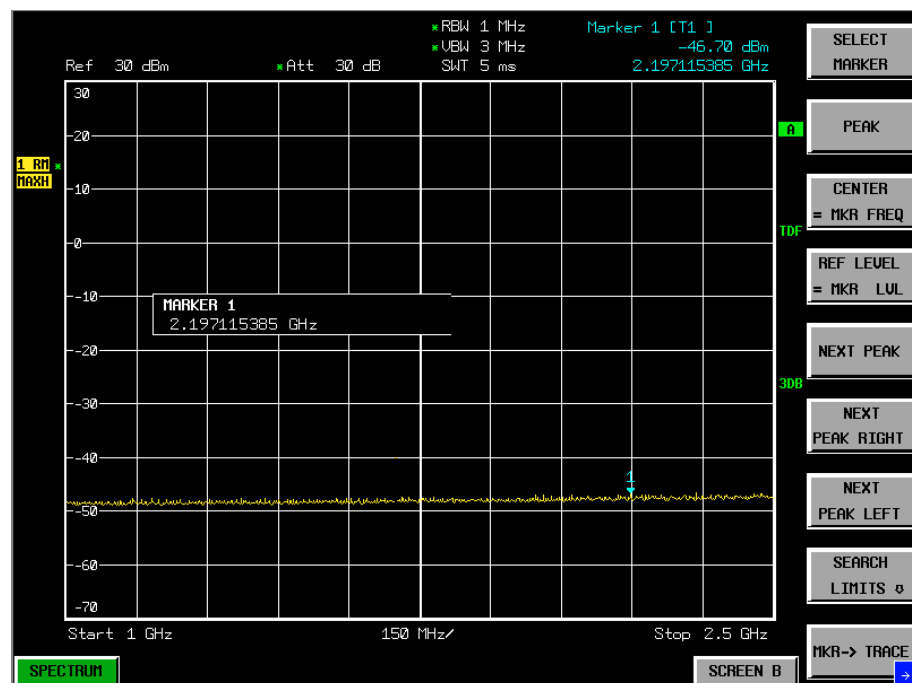
Spurious emission limit –13dBm.

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



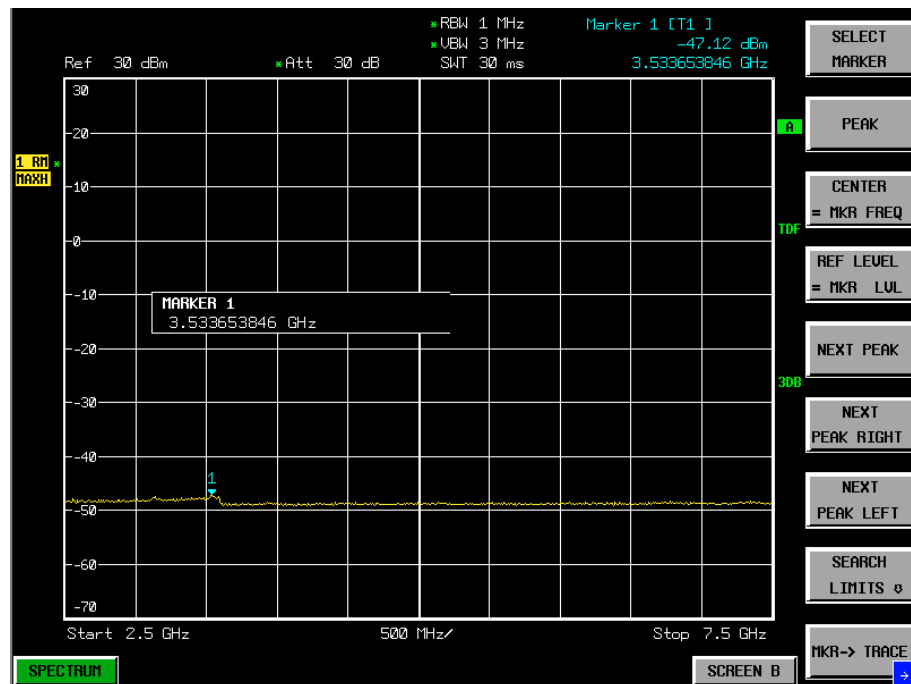
#### A.8.3.10 Channel 251: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



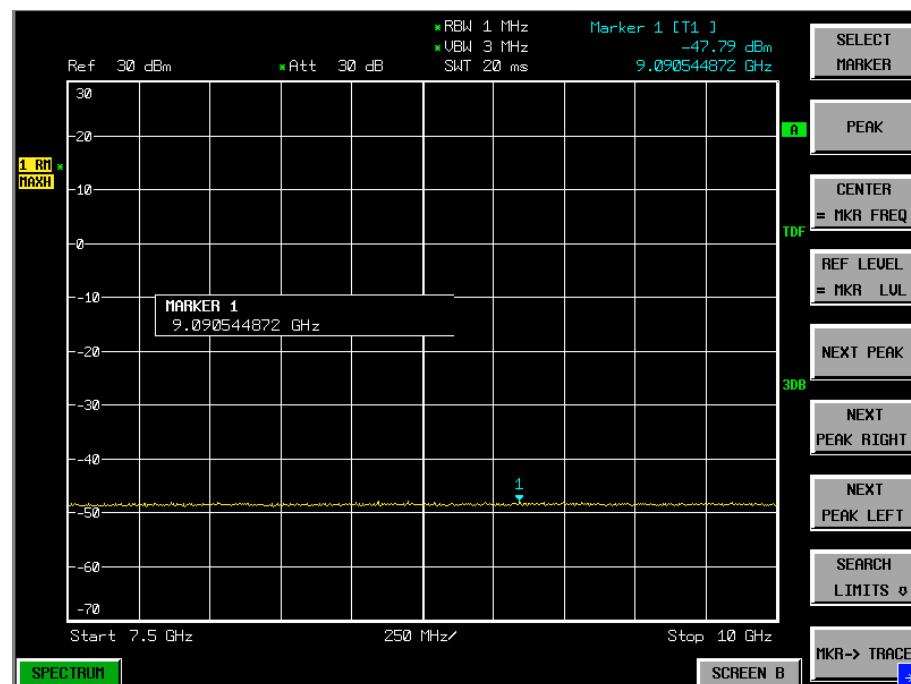
### A.8.3.11 Channel 251: 2.5GHz – 7.5GHz

Spurious emission limit –13dBm.



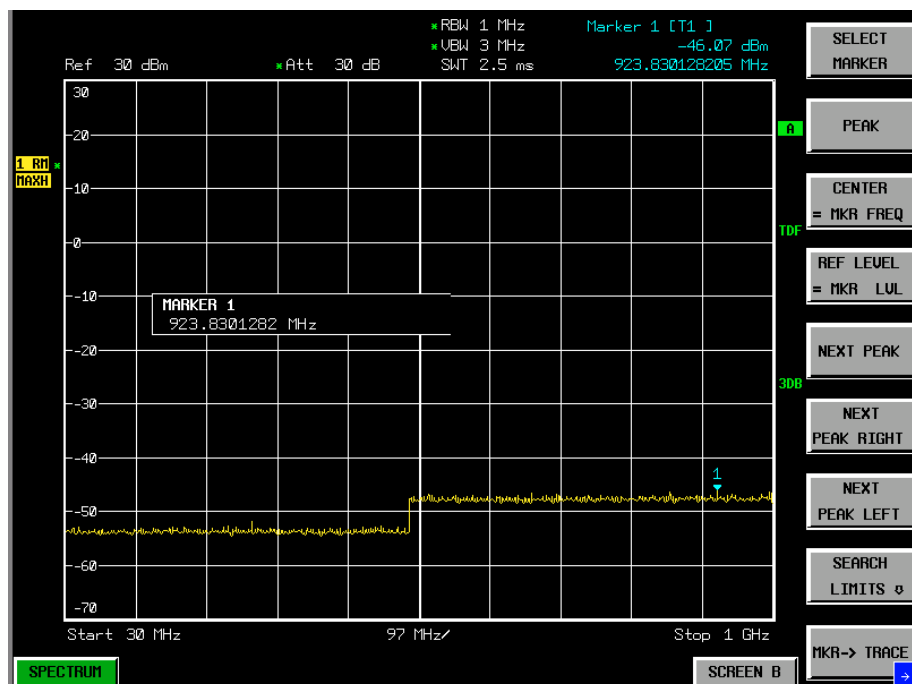
### A.8.3.12 Channel 251: 7.5GHz – 10GHz

Spurious emission limit –13dBm.



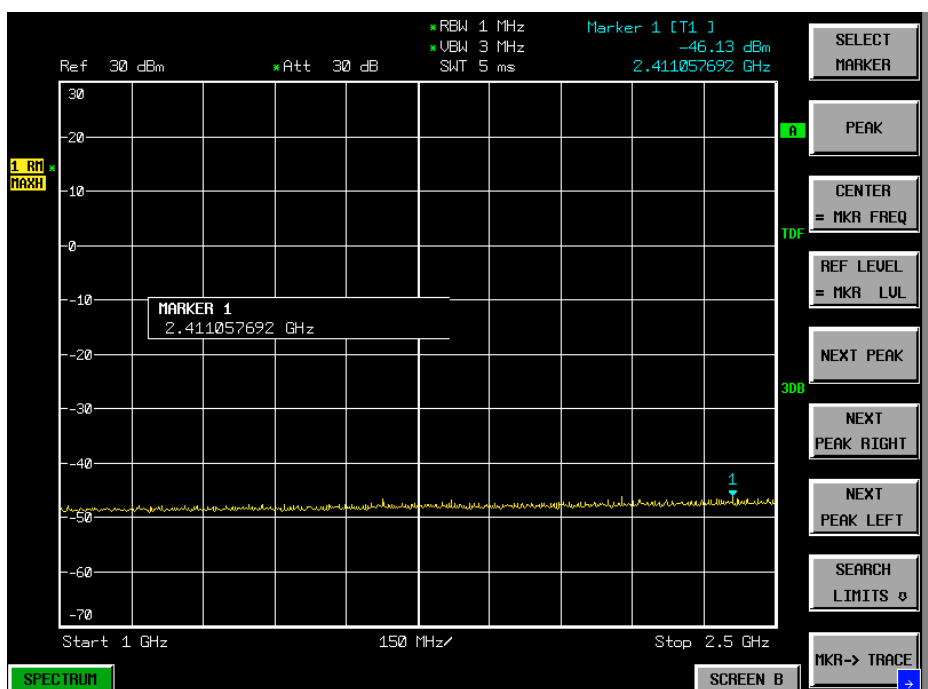
### A.8.3.13 Idle mode: 30MHz – 1GHz

Spurious emission limit –13dBm.



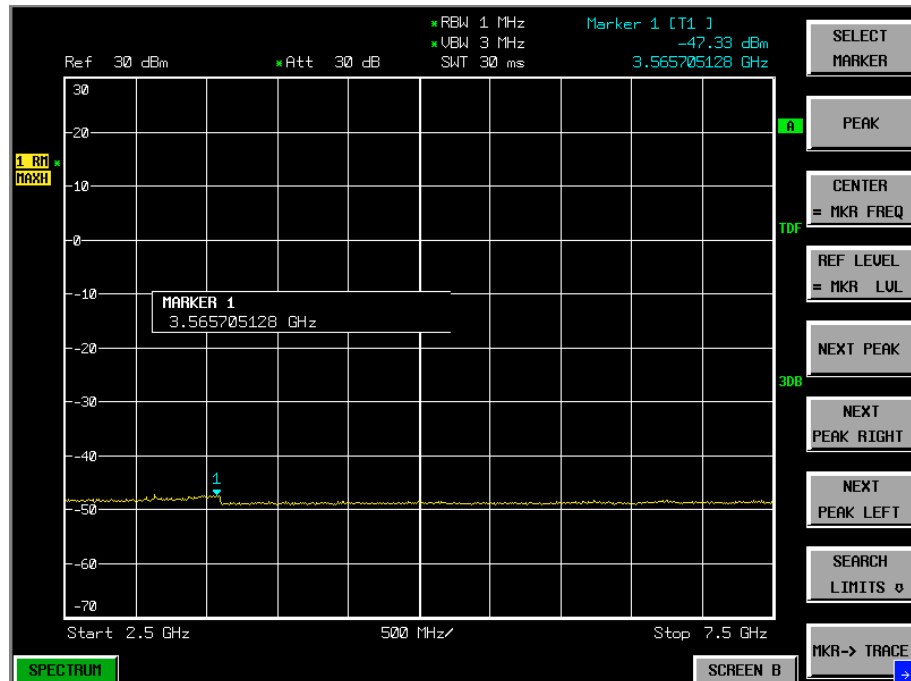
### A.8.3.14 Idle mode: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



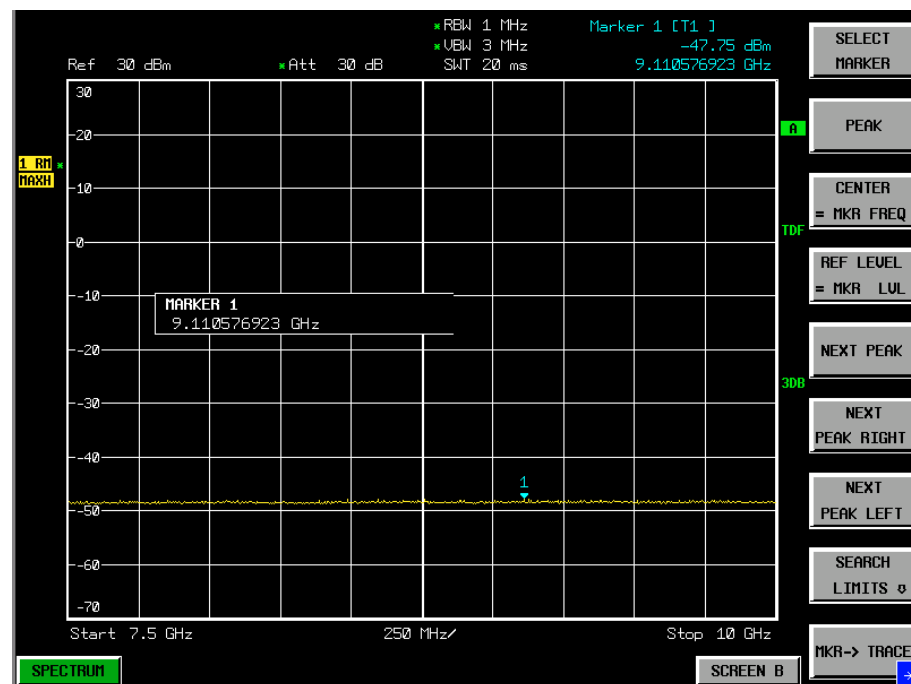
### A.8.3.15 Idle mode: 2.5GHz – 7.5GHz

Spurious emission limit –13dBm.



### A.8.3.16 Idle mode: 7.5GHz – 10GHz

Spurious emission limit –13dBm.



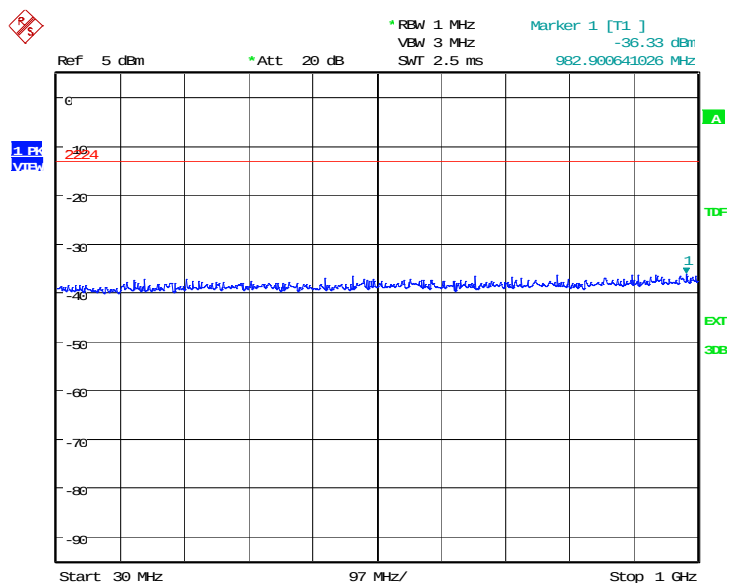
## PCS1900

[illegible]

## PCS1900

### A.8.3.17 Channel 512: 30MHz – 1GHz

Spurious emission limit –13dBm.

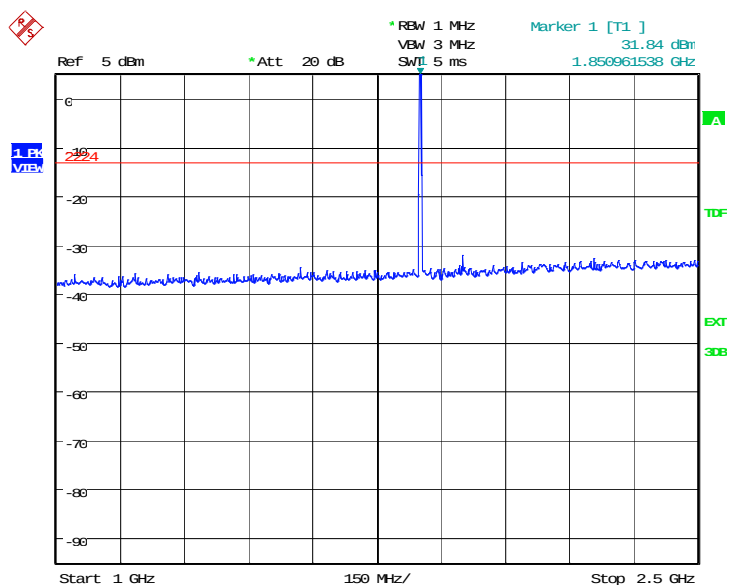


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### A.8.3.18 Channel 512: 1GHz – 2.5GHz

Spurious emission limit –13dBm.

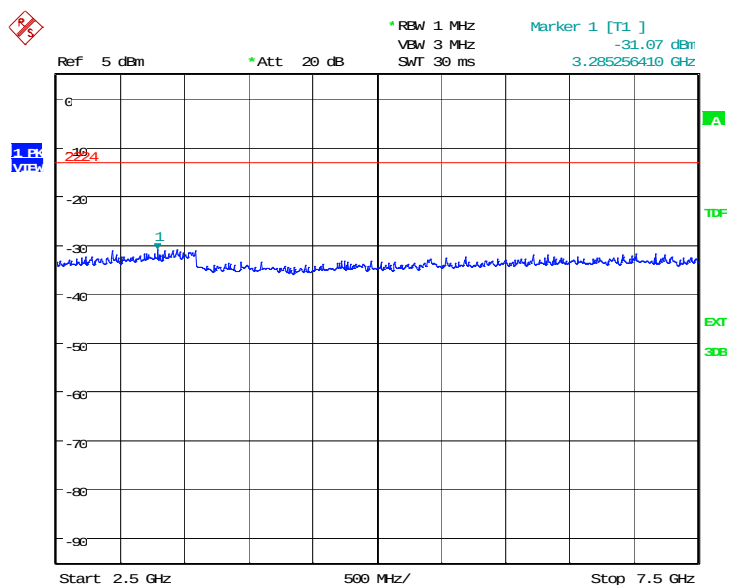
**NOTE: peak above the limit line is the carrier frequency.**



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### A.8.3.19 Channel 512: 2.5GHz – 7.5GHz

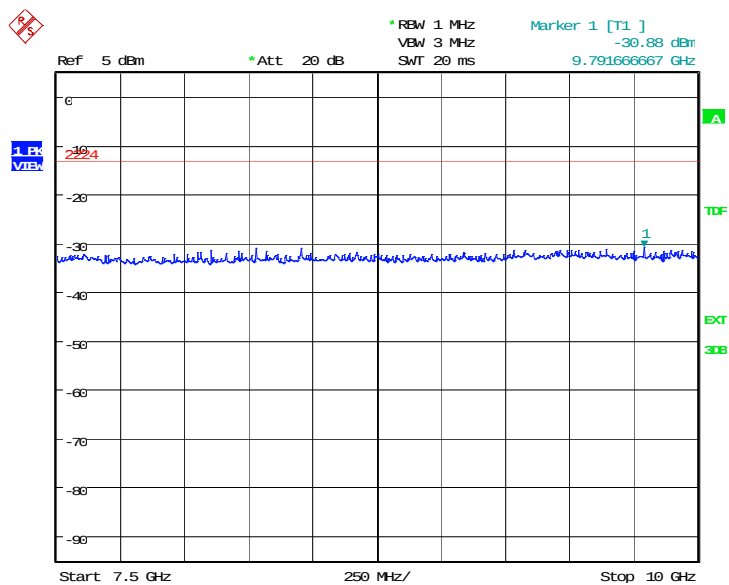
Spurious emission limit –13dBm.



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### A.8.3.20 Channel 512: 7.5GHz –10GHz

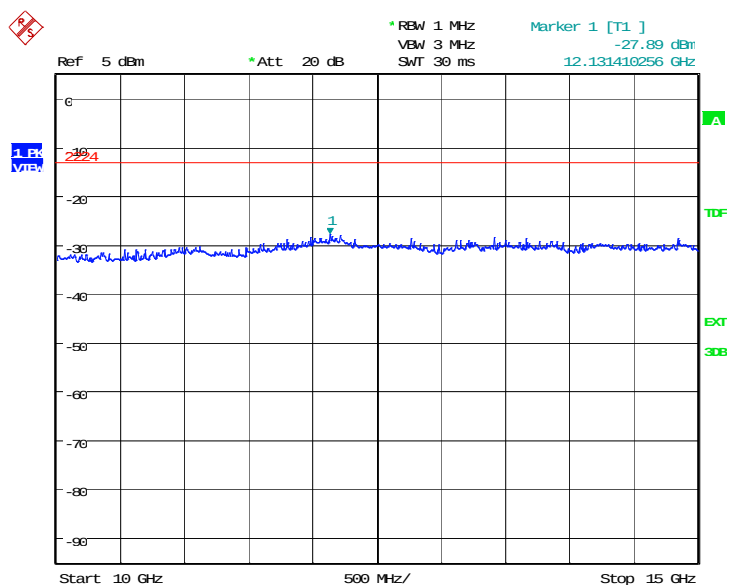
Spurious emission limit –13dBm.



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### A.8.3.21 Channel 512: 10GHz –15GHz

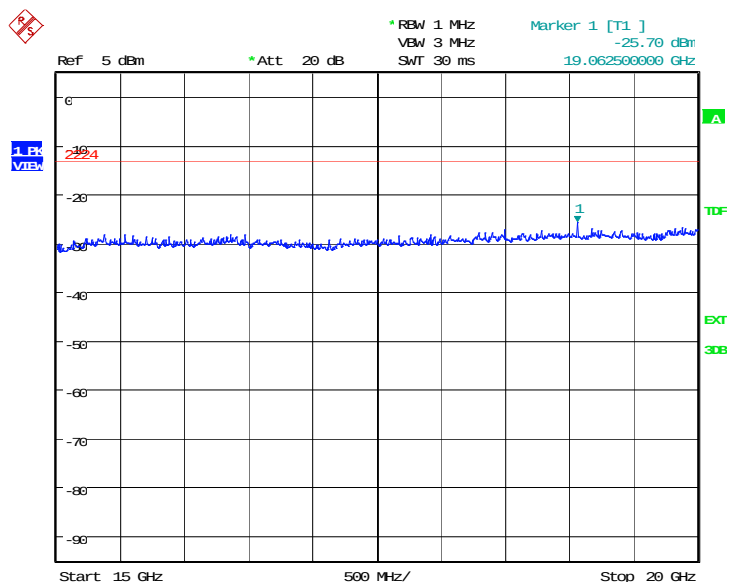
Spurious emission limit –13dBm.



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### A.8.3.22 Channel 512: 15GHz –20GHz

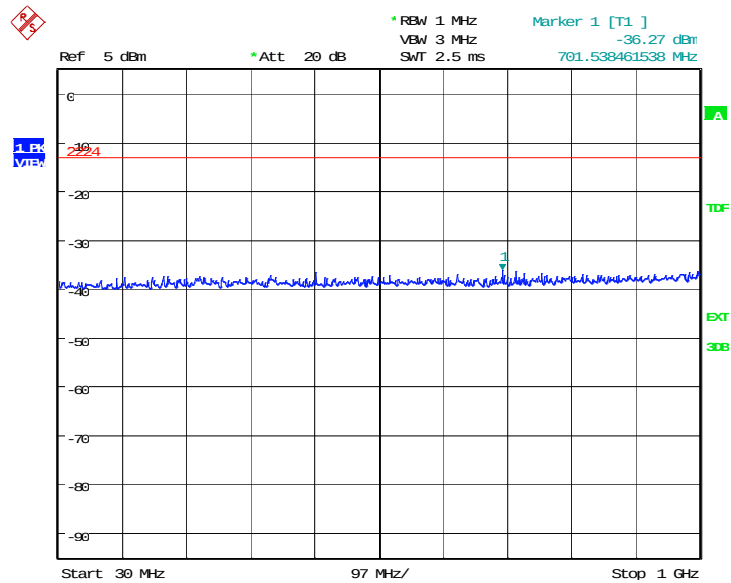
Spurious emission limit –13dBm.



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### A.8.3.23 Channel 661: 30MHz – 1GHz

Spurious emission limit –13dBm

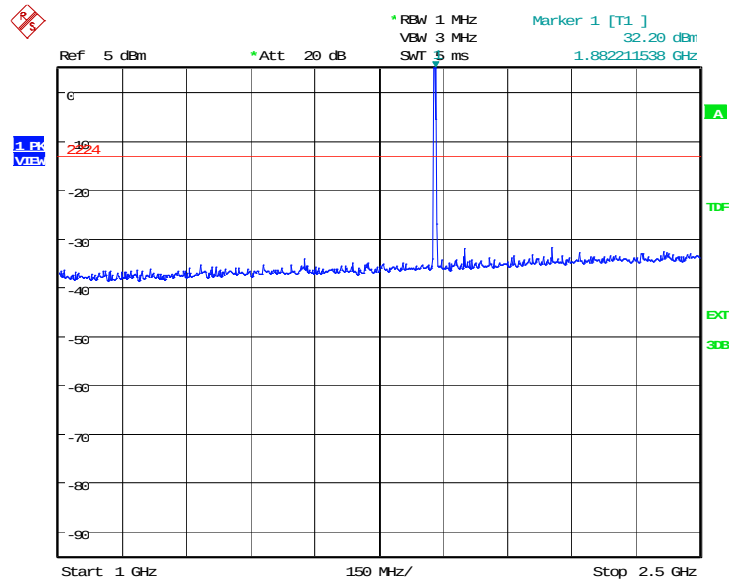


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### A.8.3.24 Channel 661: 1GHz – 2.5GHz

Spurious emission limit –13dBm

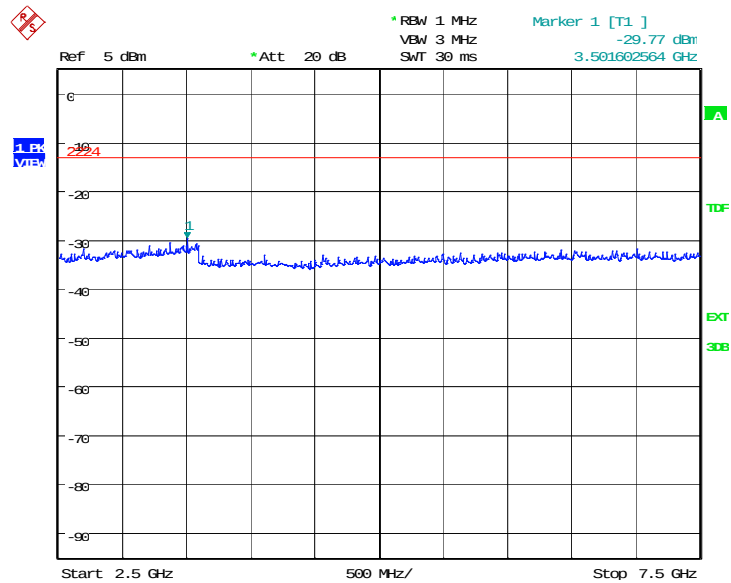
**NOTE: peak above the limit line is the carrier frequency.**



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### A.8.3.25 Channel 661: 2.5GHz –7.5GHz

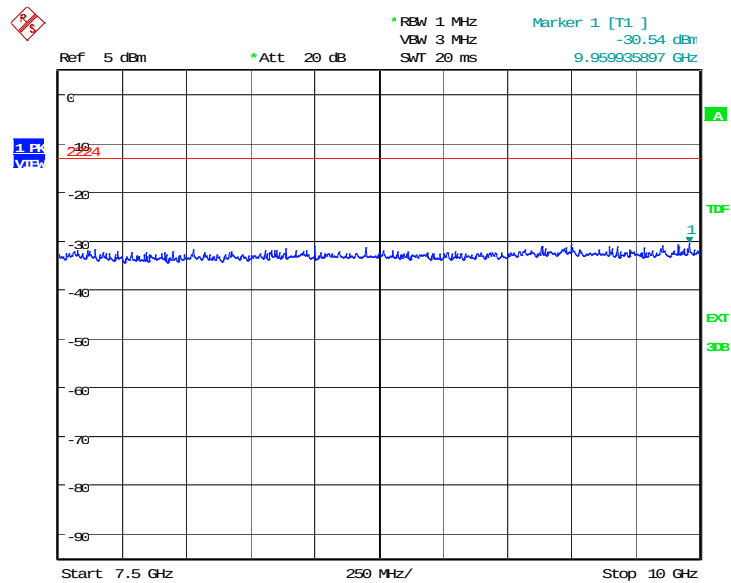
Spurious emission limit –13dBm



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### A.8.3.26 Channel 661: 7.5GHz –10GHz

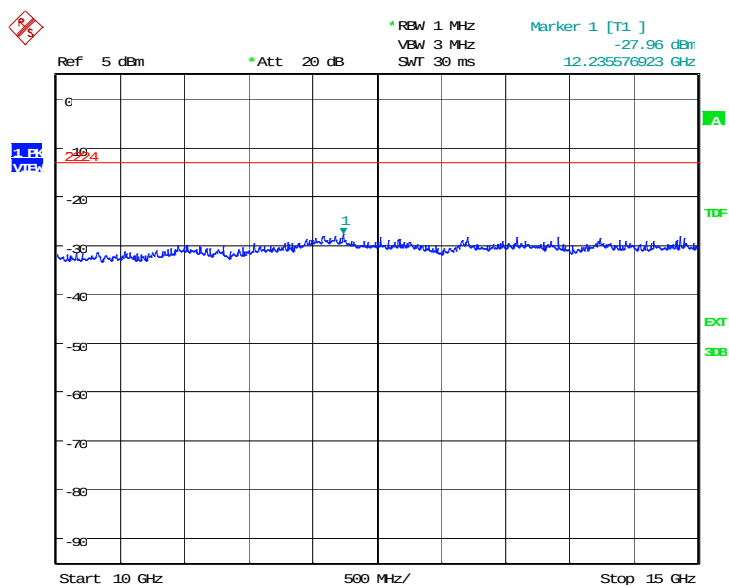
Spurious emission limit –13dBm



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### A.8.3.27 Channel 661: 10GHz –15GHz

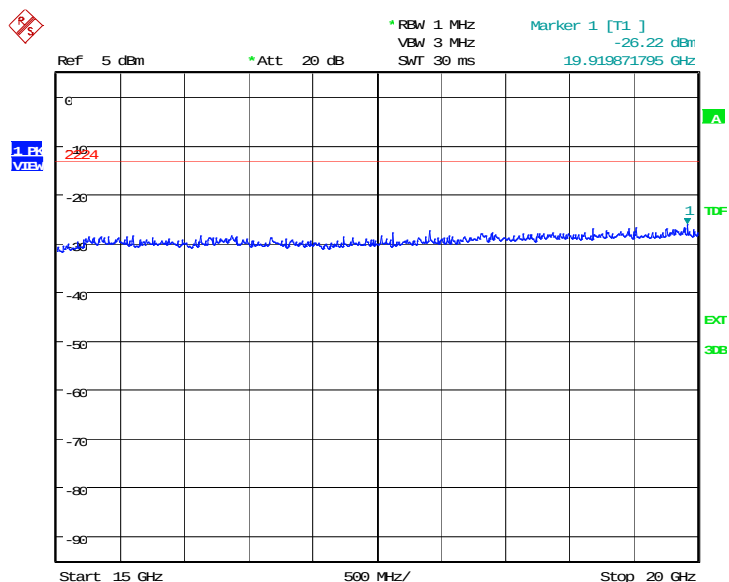
Spurious emission limit –13dBm.



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### A.8.3.28 Channel 661: 15GHz –20GHz

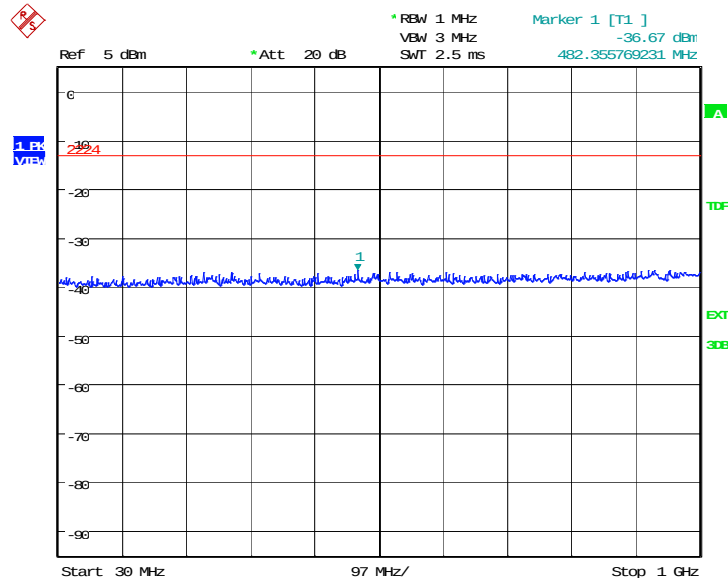
Spurious emission limit –13dBm.



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### A.8.3.29 Channel 810: 30MHz – 1GHz

Spurious emission limit –13dBm.

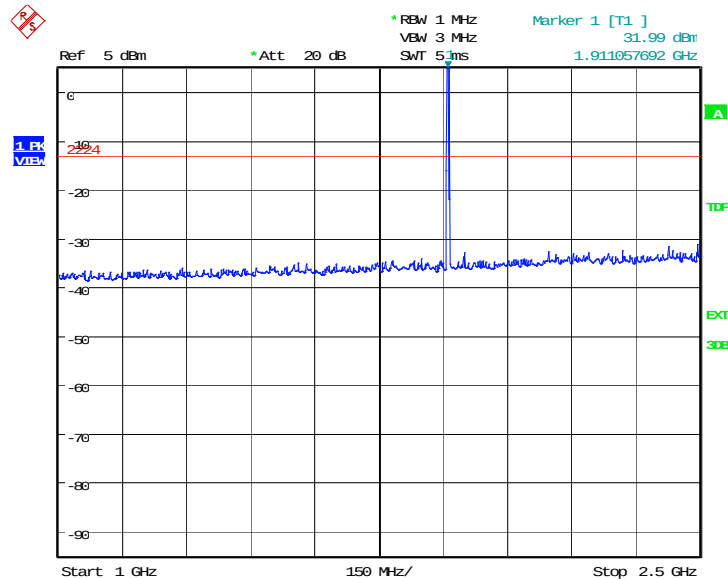


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### A.8.3.30 Channel 810: 1GHz – 2.5GHz

Spurious emission limit –13dBm.

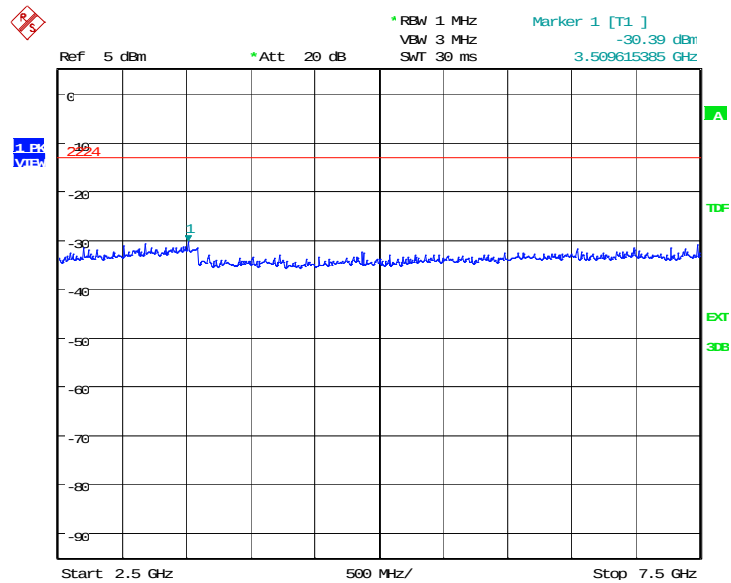
**NOTE:** peak above the limit line is the carrier frequency.



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### A.8.3.31 Channel 810: 2.5GHz – 7.5GHz

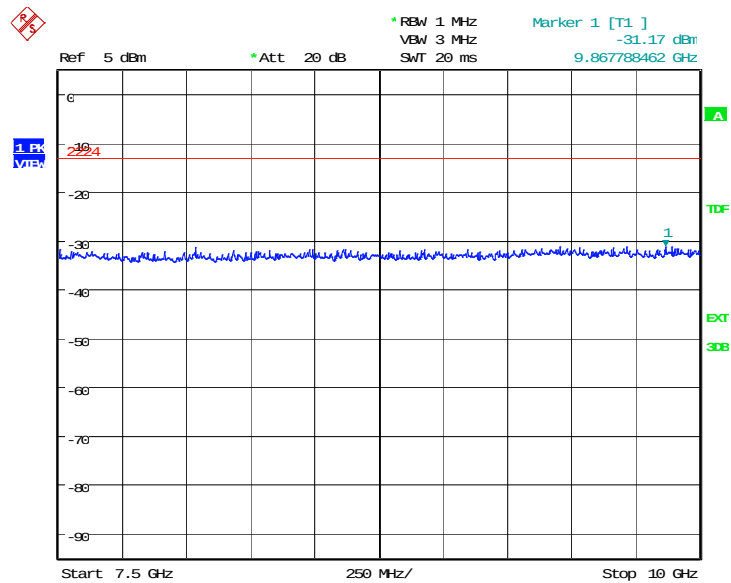
Spurious emission limit –13dBm.



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### A.8.3.32 Channel 810: 7.5GHz – 10GHz

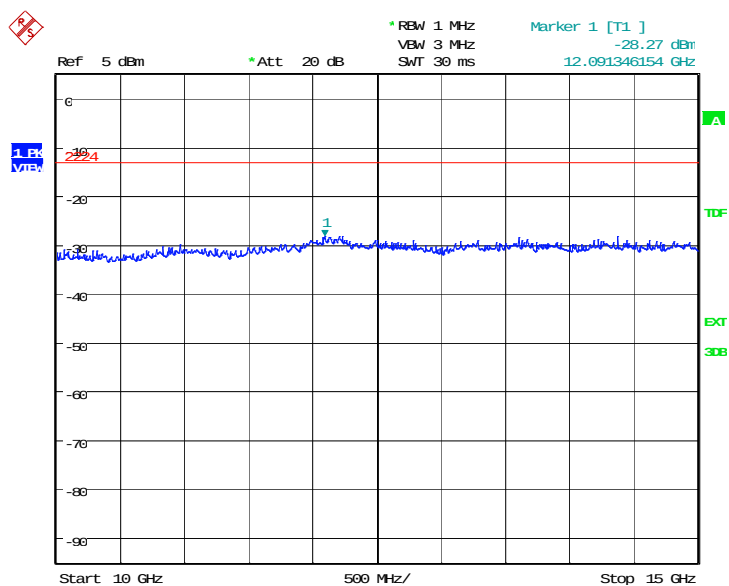
Spurious emission limit –13dBm.



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### A.8.3.33 Channel 810: 10GHz –15GHz

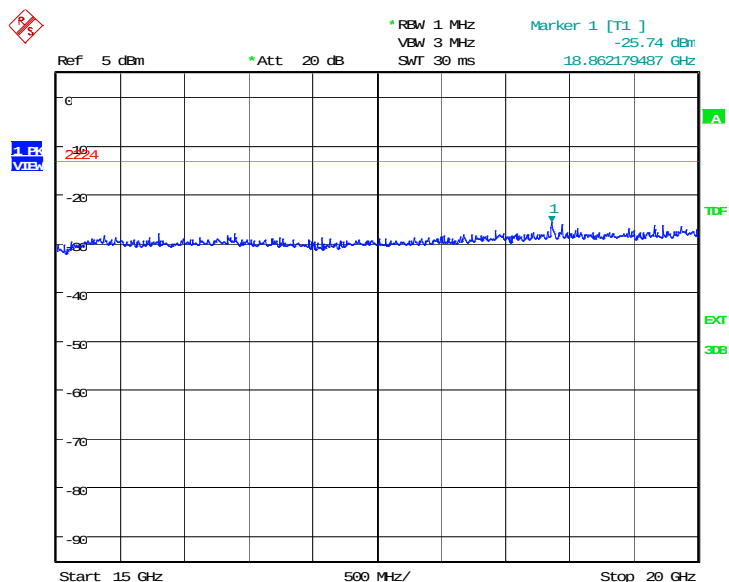
Spurious emission limit –13dBm.



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### A.8.3.34 Channel 810: 15GHz –20GHz

Spurious emission limit –13dBm.



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