



# TEST REPORT

No. I15N01121-GSM

for

**TCL Communication Ltd.**

**GSM Quad band &UMTS Dual band mobile phone**

**Model Name: 2045X**

**FCC ID: 2ACCJB038**

with

**Hardware Version: PIO**

**Software Version: V1.0**

**Issued Date: 2015-10-20**

**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 CTTL.

**Test Laboratory:**

**FCC 2.948 Listed: No. 342690**

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## **REPORT HISTORY**

<b>Report Number</b>	<b>Revision</b>	<b>Description</b>	<b>Issue Date</b>
I15N01121	Rev.0	1st edition	2015-10-20

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## 1. Test Laboratory

### 1.1. Testing Location

Company Name: CTTL ShenZhen, Telecommunication Technology Labs, Academy of  
Telecommunication Research, MIIT  
Address: TCL International E city No. 1001 Zhongshanyuan Road,  
Nanshan District, Shenzhen, Guangdong, China  
Postal Code: 518048  
Telephone: +86(755)33322000  
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### 1.2. Testing Environment

Normal Temperature: 15-35℃  
Relative Humidity: 20-75%

### 1.3. Project data

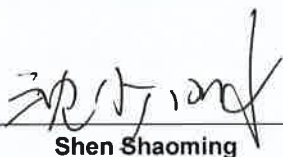
Testing Start Date: 2014-11-24  
Testing End Date: 2014-12-04

### 1.4. Signature



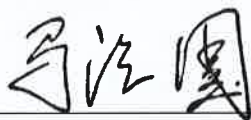
Lai Minghua

(Prepared this test report)



Shen Shaoming

(Reviewed this test report)



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Deputy Director of the laboratory

(Approved this test report)



## **2. Client Information**

### **2.1. Applicant Information**

Company Name: TCL Communication Ltd.  
Address /Post: 5F, E building, No. 232, Liang Jing Road, ZhangJiang High-Tech  
Park, Pudong Area, Shanghai, 201203, P.R. China  
Contact Person: Tiffany.Tang  
Contact Email: xiu.tang@tcl.com  
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### **2.2. Manufacturer Information**

Company Name: TCL Communication Ltd.  
Address /Post: 5F, E building, No. 232, Liang Jing Road, ZhangJiang High-Tech  
Park, Pudong Area, Shanghai, 201203, P.R. China  
Contact Person: Tiffany.Tang  
Contact Email: xiu.tang@tcl.com  
Telephone: 0086-021-51798260  
Fax: 0086-021-61460600

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

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

Description	GSM Quad band &UMTS Dual band mobile phone
Model Name	2045X
FCC ID	2ACCJB038
Antenna	Integrated
Output power	30.46dBm maximum ERP measured for GSM850
Extreme vol. Limits	3.5VDC to 4.2VDC (nominal: 3.8VDC)
Extreme temp. Tolerance	-30°C to +50°C

Note: a.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.  
b.The EUT is a variant model of 2045M. All of the result is coming from the initial model.

#### **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>
S01	/	PIO	V1.0

\*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	Travel charger
AE3	USB Cable

##### **AE1**

Model	CAB3120000C1
Manufacturer	BYD
Capacitance	850mAh
Nominal voltage	3.8V

##### **AE2**

Model	CBA3007AG0C1
Manufacturer	BYD
Length of cable	95cm

##### **AE3**

Model	CDA0000029C3
Manufacturer	JiaYiKang
Length of cable	95cm

\*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 GSM Dual band &UMTS Dual band mobile phone with integrated antenna. Manual and specifications of the EUT were provided to fulfil the test. Samples undergoing test were selected by the Client.

## 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 24	PERSONAL COMMUNICATIONS SERVICES	10-1-14 Edition
FCC Part 22	PUBLIC MOBILE SERVICES	10-1-14 Edition
ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2004
ANSI C63.4	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	2009
KDB 971168 D01	Measurement Guidance for Certification of Licensed Digital Transmitters	v02r02



## 5. LABORATORY ENVIRONMENT

**Semi-anechoic chamber** (11.20 meters×6.10meters×5.60meters) 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	> 2MΩ
Ground system resistance	< 0.5 Ω
Normalised site attenuation (NSA)	< ±3.5 dB, 3 m distance, from 30 to 1000 MHz
Uniformity of field strength	Between 0 and 6 dB, from 80 to 3000 MHz

**Control room** 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	> 2MΩ
Ground system resistance	< 0.5 Ω

**Conducted chamber** 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	> 2MΩ
Ground system resistance	< 0.5 Ω

**Fully-anechoic chamber** (11.20 meters×6.10 meters×6.60 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	> 2MΩ
Ground system resistance	< 0.5 Ω
Voltage Standing Wave Ratio (VSWR)	≤ 6 dB, from 1 to 6 GHz, 3 m distance

## 6. SUMMARY OF TEST RESULTS

Items	List	Clause in FCC rules	Verdict
1	Output Power	22.913(a)/24.232(c)	P
2	Emission Limit	2.1051/22.917/24.238	P
3	Frequency Stability	2.1055/24.235	P
4	Occupied Bandwidth	2.1049(h)(i)	P
5	Emission Bandwidth	22.917(b)/24.238(b)	P
6	Band Edge Compliance	22.917(b)/24.238(b)	P
7	Conducted Spurious Emission	2.1057/22.917/24.238	P

**7. Test Equipments Utilized**

NO.	Description	TYPE	SERIES NUMBER	MANUFACTURE	CAL DUE DATE
1	Test Receiver	ESCI	100701	R&S	2016.08.10
2	BiLog Antenna	VULB9163	9163 329	Schwarzbeck	2017.01.20
3	Horn Antenna	3117	00066577	ETS-Lindgren	2016.04.01
4	Universal Radio Communication Tester	CMU200	114544	R&S	2016.09.10
5	Universal Radio Communication Tester	CMW500	152499	R&S	2016.07.23
6	Spectrum Analyser	FSP40	100378	R&S	2015.12.19
7	Universal Radio Communication Tester	CMU200	114828	R&S	2016.01.03
8	Spectrum Analyzer	FSU	200679	R&S	2016.01.03
9	Temperature Chamber	SH-241	92007516	ESPECs	2016.01.08
10	DC Power Supply	U3606A	MY50450012	Agilent Technologies	2015.11.11
11	RF Switch Matrix	OSP130	100259	R&S	2016.01.03
12	Vector Signal Generator	SMU200A	104072	R&S	2016.01.03
13	MXG Analog Signal Generator	N5183A	MY50140012	Agilent Technologies	2016.01.03

## **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. This result contains output power and EIRP measurements for the EUT. 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. The power was measured with Rhode & Schwarz Spectrum Analyzer FSU (peak). These measurements were done at 3 frequencies, 1850.2 MHz, 1880.0MHz and 1909.8MHz for PCS1900 band; 824.2MHz, 836.6MHz and 848.8MHz for GSM850 band. (bottom, middle and top of operational frequency range).

##### **A.1.2.2 Test Condition**

RBW	VBW	Sweep Time	Span
1MHz	1MHz	300ms	10MHz

#### **GSM850**

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

#### **GSM850**

##### **Measurement result**

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

Frequency(MHz)	Power Step	Output power(dBm)
824.2	5	32.59
836.6	5	32.62
848.8	5	32.62

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

Frequency(MHz)	Power Step	Output power(dBm)
824.2	3	32.59
836.6	3	32.62
848.8	3	32.62

**PCS1900**

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

**PCS1900**

**Measurement result**

**GSM (GMSK)**

Frequency(MHz)	Power Step	Output power(dBm)
1850.2	0	29.40
1880.0	0	29.03
1909.8	0	28.76

**GPRS (GMSK, 1Slot)**

Frequency(MHz)	Power Step	Output power(dBm)
1850.2	3	29.40
1880.0	3	29.03
1909.8	3	28.76

### A.1.3 Radiated

#### A.1.3.1 Description

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

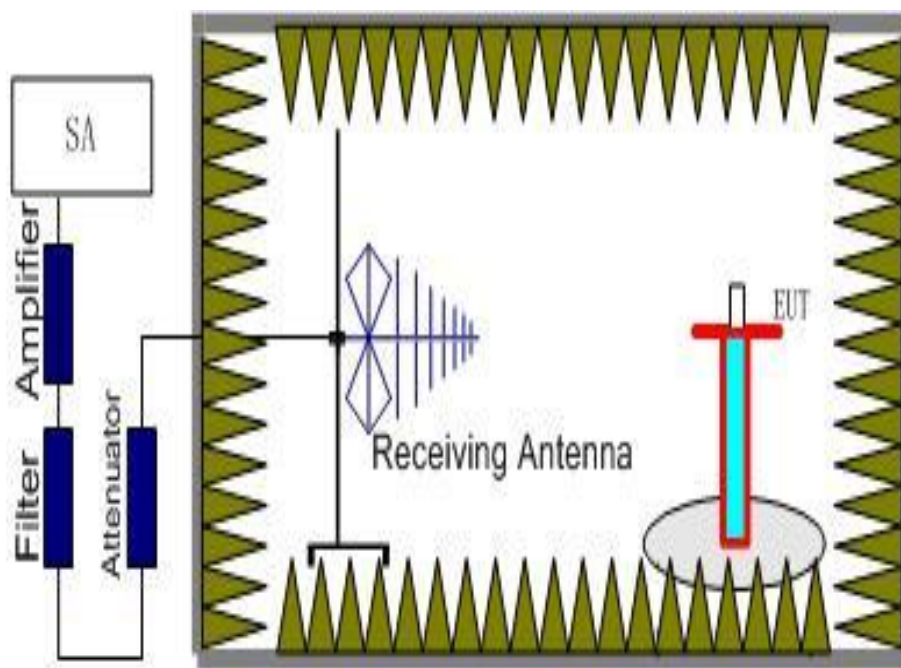
Rule Part 24.232(b) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage."

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

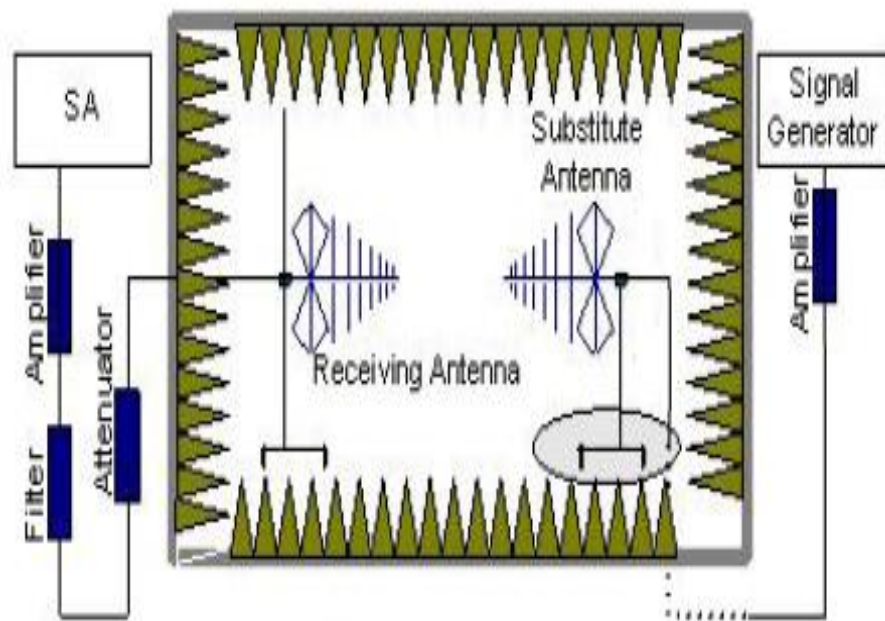
#### A.1.3.2 Method of Measurement

The measurements procedures in TIA-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, 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 22.913(a)**

**Limits**

	Power Step	Burst Peak ERP (dBm)
GSM	5	≤38.45dBm (7W)
GPRS	3	≤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)	Polarization
824.20	5.07	2.07	-36.20	8.22	2.15	28.83	V
836.60	6.35	2.08	-36.00	8.22	2.15	29.90	V
848.80	7.01	2.09	-35.90	8.21	2.15	30.46	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)	Correction (dB)	ERP(dBm)	Polarization
824.20	4.30	2.07	-36.20	8.22	2.15	28.06	V
836.60	5.36	2.08	-36.00	8.22	2.15	28.91	V
848.80	5.06	2.09	-35.90	8.21	2.15	28.51	V

Frequency: 836.60MHz

Peak ERP(dBm)=P<sub>Mea</sub>(7.01dBm)-P<sub>cl</sub>(2.09dB)-P<sub>Ag</sub>(-35.90dB)-G<sub>a</sub>(8.21dB)-2.15dB=30.46dBm

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



**PCS1900-EIRP 24.232(b)**

**Limits**

	Power Step	Burst Peak EIRP (dBm)
GSM	0	≤33dBm (2W)
GPRS	3	≤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)	Polarization
1850.20	1.77	3.13	-35.80	7.81	26.63	H
1880.00	1.57	3.15	-35.60	7.80	26.22	H
1909.80	1.24	3.18	-35.40	7.77	25.69	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)	EIRP(dBm)	Polarization
1850.20	1.65	3.13	-35.80	7.81	26.51	H
1880.00	1.26	3.15	-35.60	7.80	25.91	H
1909.80	1.22	3.18	-35.40	7.77	25.67	H

Frequency: 1909.80MHz

Peak EIRP(dBm)= P<sub>Mea</sub>(1.77dBm) - P<sub>cl</sub>(3.13dB) - P<sub>Ag</sub>(-35.80dB) - G<sub>a</sub>(7.81dB)=26.63dBm

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

## **A.2 EMISSION LIMIT**

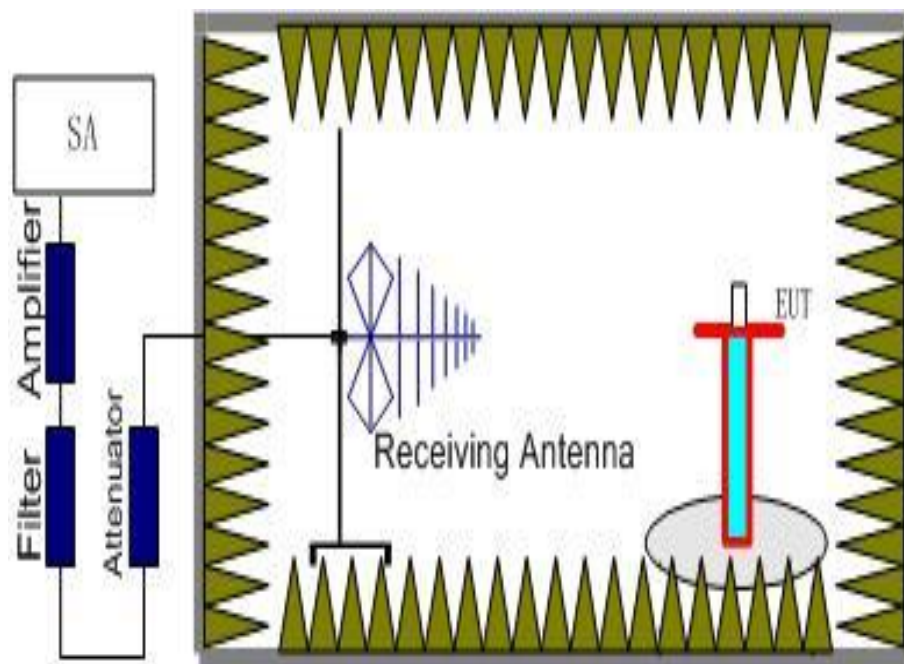
### **A.2.1 Measurement Method**

The measurement procedures in TIA-603C-2004 are used.

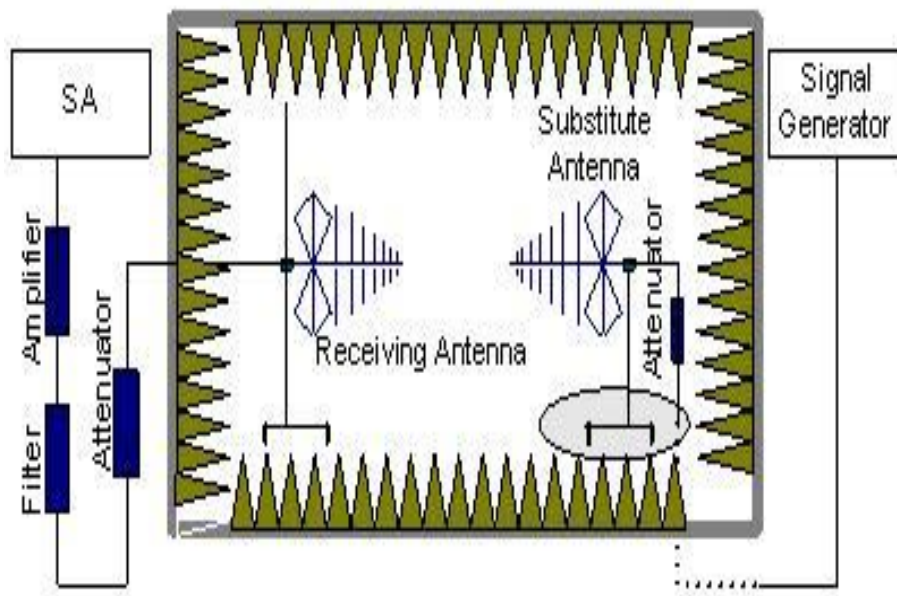
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier that can be as high as 1910 MHz. The resolution bandwidth is set as outlined in Part 24.238 and Part 22.917. The spectrum is scanned with the mobile station 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 (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, and adjusts 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 PCS1900 (1850.2 MHz, 1880 MHz and 1909.8 MHz) and GSM850 (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 and 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>pm</sub> (dBm)	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
7012.5	-57.95	-12.4	2.15	-47.7	-13.00	V
7467.5	-57.95	-12.4	2.15	-47.7	-13.00	V
7494	-57.95	-12.4	2.15	-47.7	-13.00	V
8381.5	-57.55	-12.3	2.15	-47.4	-13.00	V
9415.5	-57.25	-12.3	2.15	-47.1	-13.00	H
9432.5	-57.75	-12.3	2.15	-47.6	-13.00	V

**GSM Mode Channel 190/836.6MHz**

Frequency(MHz)	P <sub>pm</sub> (dBm)	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
3346.5	-48.25	-6.6	2.15	-43.8	-13.00	V
7294	-57.45	-12.4	2.15	-47.2	-13.00	H
7528.5	-57.45	-12.4	2.15	-47.2	-13.00	V
8351.5	-57.15	-12.3	2.15	-47	-13.00	V
8873	-57.05	-12.3	2.15	-46.9	-13.00	H
9389	-56.35	-12.3	2.15	-46.2	-13.00	V

**GSM Mode Channel 251/848.8MHz**

Frequency(MHz)	P <sub>pm</sub> (dBm)	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Polarization
7294.5	-57.65	-12.4	2.15	-47.4	-13.00	H
7639.5	-56.55	-12.4	2.15	-46.3	-13.00	H
8843.5	-57.65	-12.3	2.15	-47.5	-13.00	V
9296.5	-57.25	-12.3	2.15	-47.1	-13.00	V
9393	-56.75	-12.3	2.15	-46.6	-13.00	V
9447	-57.55	-12.3	2.15	-47.4	-13.00	V

**GSM Mode Channel 512/1850.2MHz**

Frequency(MHz)	P <sub>pm</sub> (dBm)	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Polarization
18727.75	-50.70	-15	-35.7	-13.00	H
18948.25	-50.70	-15	-35.7	-13.00	H
19153	-50.50	-15.3	-35.2	-13.00	V
19382.25	-51.20	-15.3	-35.9	-13.00	V
19790	-50.70	-15.3	-35.4	-13.00	H
19956.25	-50.70	-15.3	-35.4	-13.00	H

**GSM Mode Channel 661/1880.0MHz**

Frequency(MHz)	Ppm(dBm)	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Polarization
18593	-50.50	-15	-35.5	-13.00	H
18839.75	-50.70	-15	-35.7	-13.00	H
18986.75	-50.30	-15	-35.3	-13.00	H
19622	-50.80	-15.3	-35.5	-13.00	H
19791.75	-50.50	-15.3	-35.2	-13.00	V
19968.5	-49.90	-15.3	-34.6	-13.00	H

**GSM Mode Channel 810/1909.8MHz**

Frequency(MHz)	Ppm(dBm)	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Polarization
18920.25	-50.70	-15	-35.7	-13.00	V
19135.5	-51.50	-15.3	-36.2	-13.00	V
19284.25	-51.60	-15.3	-36.3	-13.00	H
19508.25	-51.40	-15.3	-36.1	-13.00	V
19700.75	-51.10	-15.3	-35.8	-13.00	H
19982.5	-51.40	-15.3	-36.1	-13.00	H

### **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 -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 and 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 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 +50°C to -30°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 3.5VDC and 4.2VDC, with a nominal voltage of 3.8VDC. 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)
3.5	6	0.007
3.8	4	0.005
4.2	8	0.010

##### Frequency Error vs Temperature

temperature(°C)	Frequency error(Hz)	Frequency error(ppm)
-30	9	0.011
-20	8	0.010
-10	8	0.010
0	7	0.008
10	5	0.006
20	4	0.005
30	6	0.007
40	7	0.008
50	5	0.006

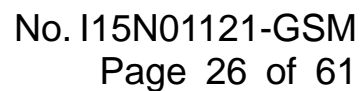
#### PCS 1900

##### Frequency Error vs Voltage

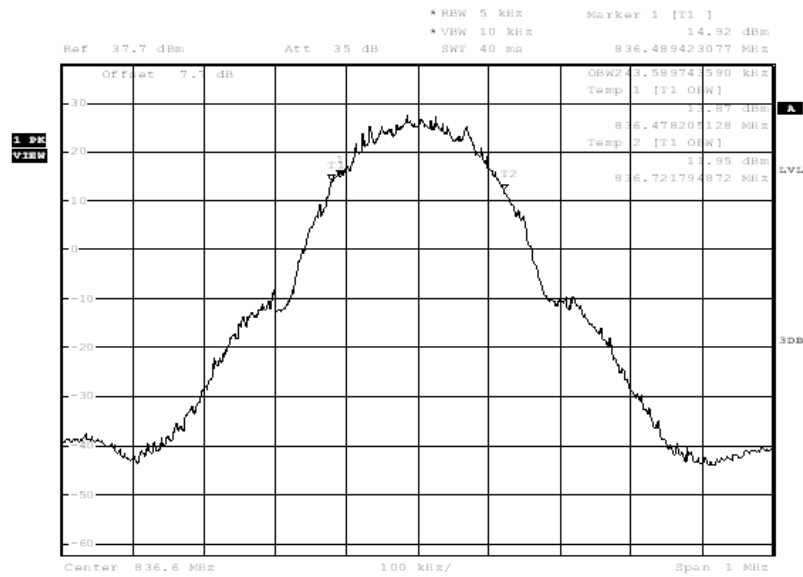
Voltage(V)	Frequency error(Hz)	Frequency error(ppm)
3.5	7	0.004
3.8	6	0.003
4.2	9	0.005

##### Frequency Error vs Temperature

temperature(°C)	Frequency error(Hz)	Frequency error(ppm)
-30	10	0.005
-20	10	0.005
-10	7	0.004
0	8	0.004
10	6	0.003
20	7	0.004
30	5	0.003
40	6	0.003
50	9	0.005

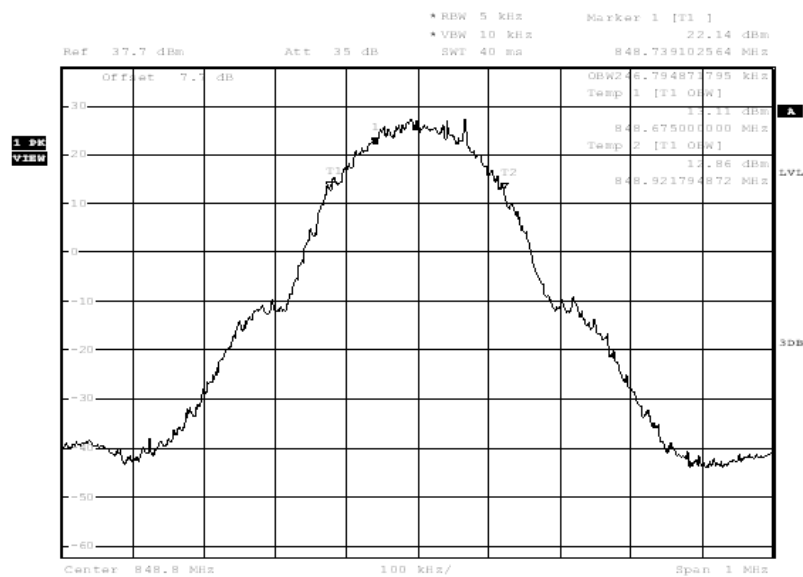


### Channel 190-Occupied Bandwidth



Date: 24.NOV.2014 18:02:14

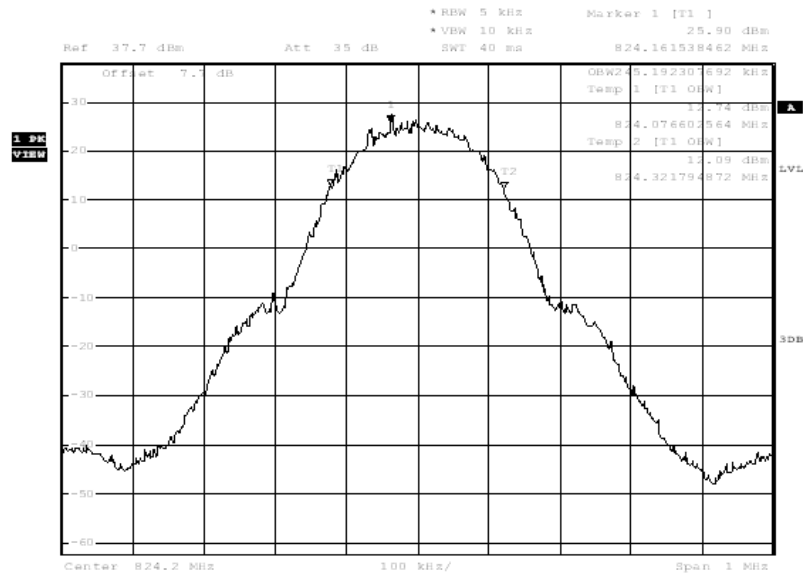
### Channel 251-Occupied Bandwidth



Date: 24.NOV.2014 18:03:25

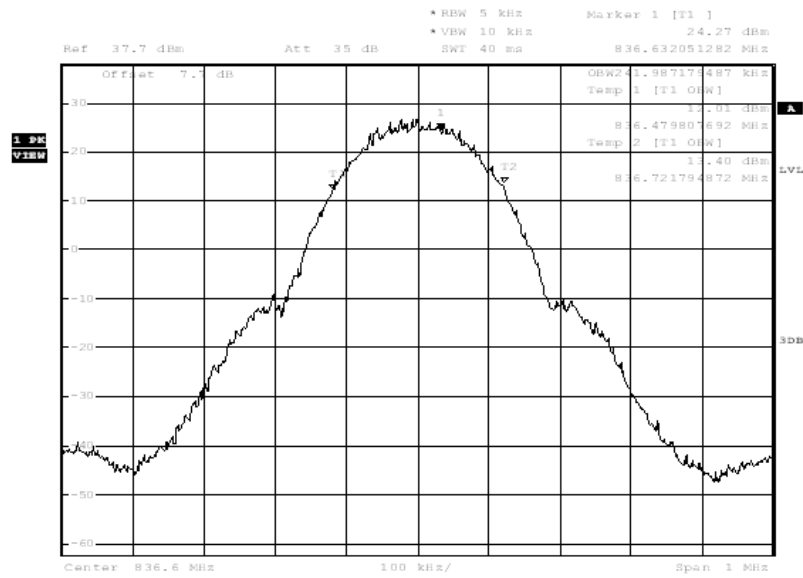
## GPRS 850

### Channel 128-Occupied Bandwidth



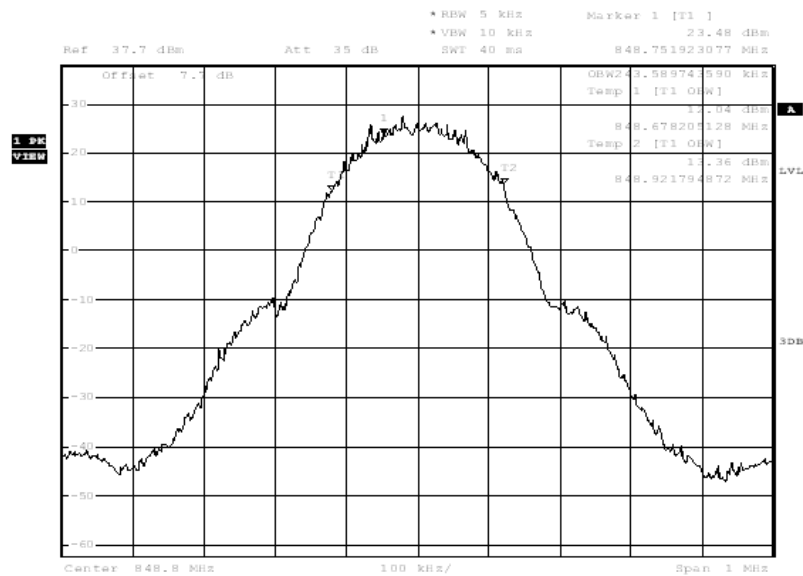
Date: 24.NOV.2014 18:22:39

### Channel 190-Occupied Bandwidth



Date: 24.NOV.2014 18:23:50

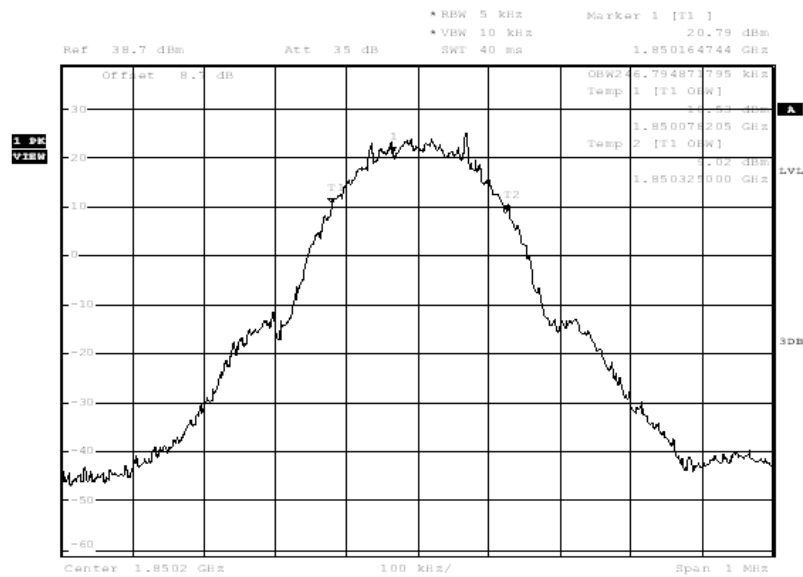
### Channel 251-Occupied Bandwidth



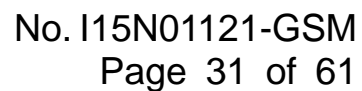
Date: 24.NOV.2014 18:25:01



**PCS 1900**  
**Channel 512-Occupied Bandwidth**



Date: 24.NOV.2014 18:38:26



\*RBW 5 kHz  
 \*VBW 10 kHz  
 \*SWT 40 ms

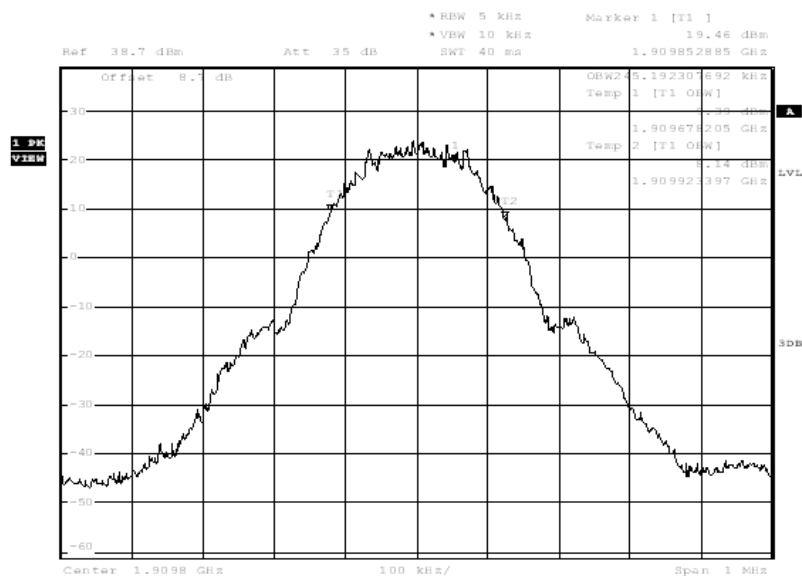
Marker 1 [T1 1]  
 24.34 dBm  
 1.880065705 GHz

Ref 38.7 dBm  
 Att 35 dB

Offset 8.0 dB  
 Temp 1 [T1 OFF] 1.95 dBm  
 Temp 2 [T2 OFF] 1.879876603 GHz  
 Temp 3 [T3 OFF] 1.78 dBm  
 Temp 4 [T4 OFF] 1.880123795 GHz

Center 1.88 GHz  
 Span 1 MHz  
 100 kHz/

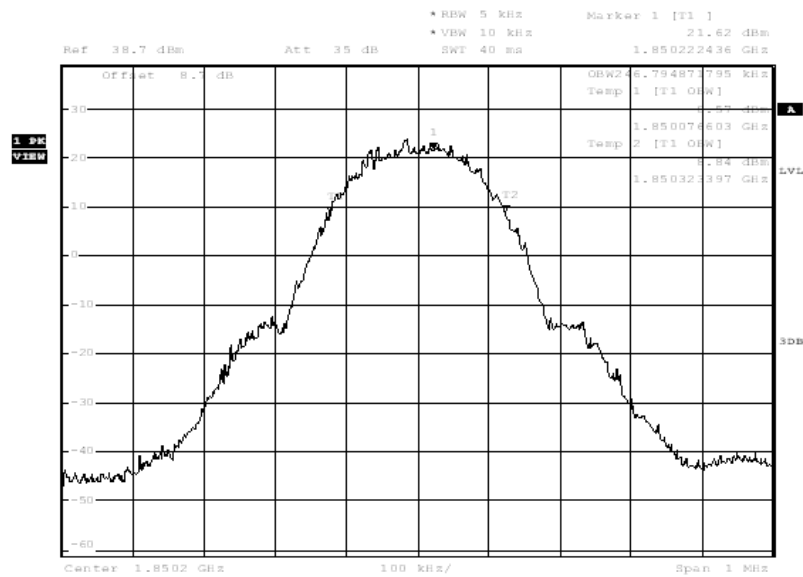
### Channel 810-Occupied Bandwidth



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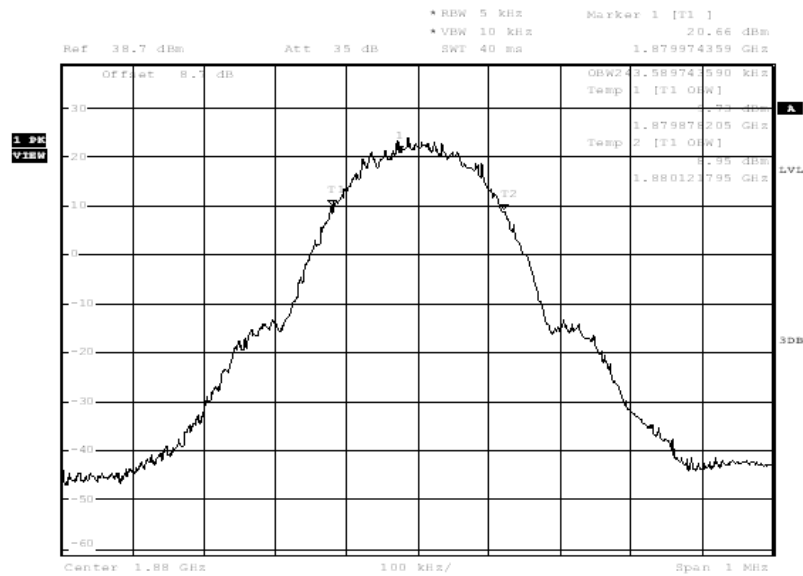
## GPRS 1900 Channel 512-Occupied Bandwidth



Date: 24.NOV.2014 19:00:57

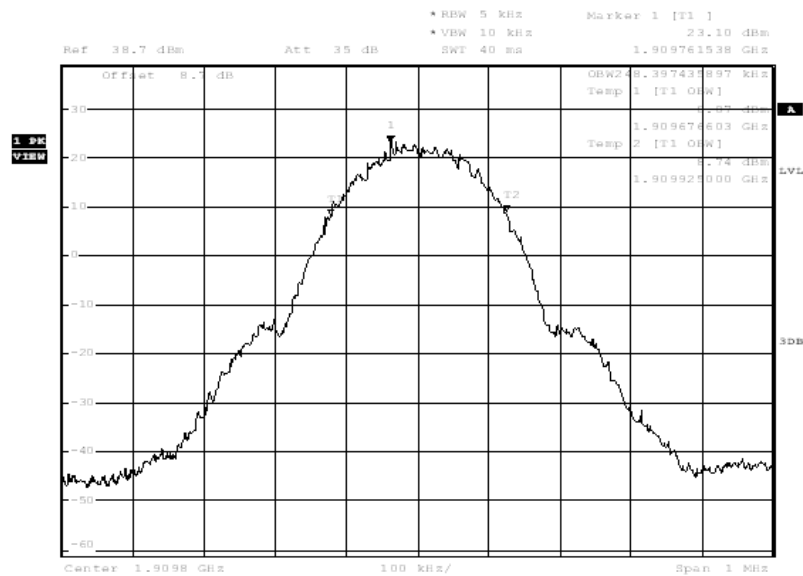


### Channel 661-Occupied Bandwidth



Date: 24.NOV.2014 19:02:08

### Channel 810-Occupied Bandwidth



Date: 24.NOV.2014 19:03:18

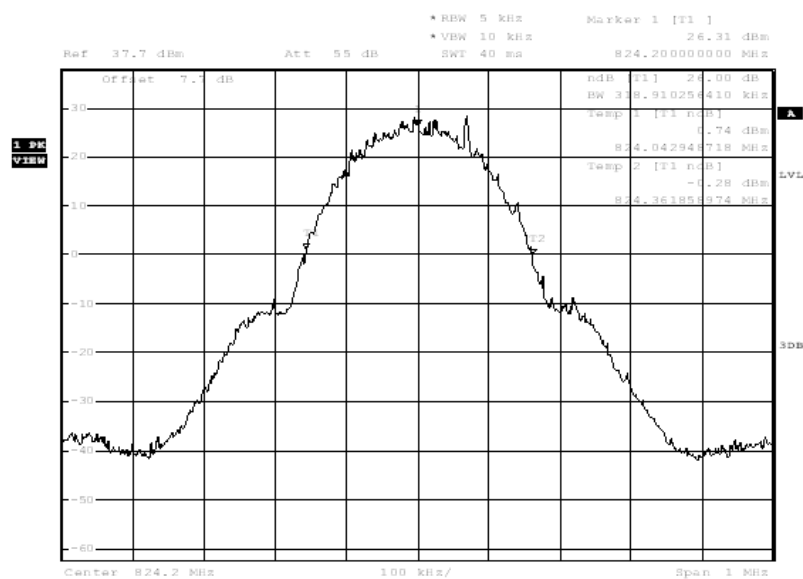
## A.5 EMISSION BANDWIDTH

### A.5.1 Emission Bandwidth Results

Similar to conducted emissions; 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 PCS1900 band and GSM850 band. Table below lists the measured -26dBc BW. Spectrum analyzer plots are included on the following pages.

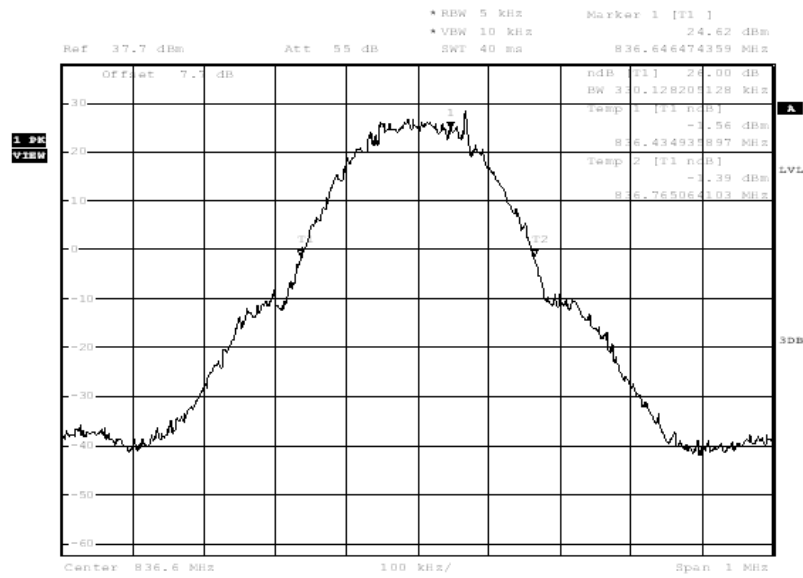
#### GSM 850

##### Channel 128-Occupied Bandwidth (-26dBc BW)



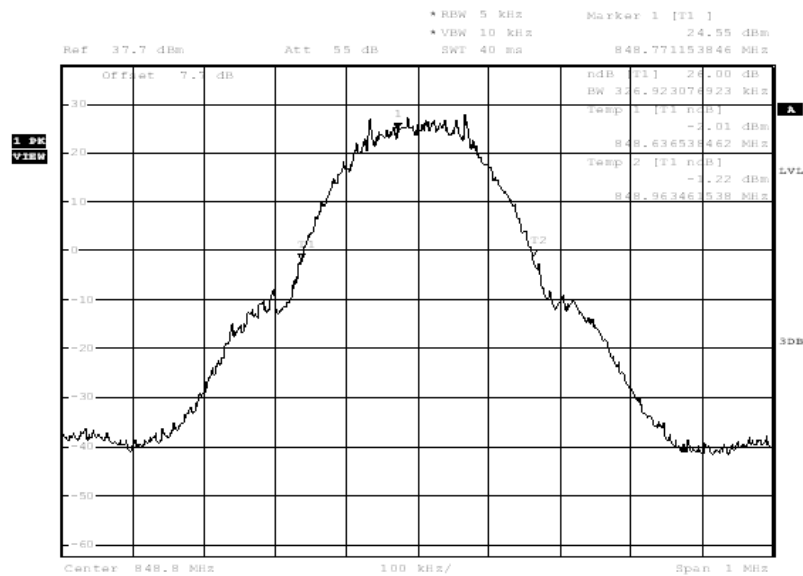
Date: 24.NOV.2014 18:04:40

### Channel 190-Occupied Bandwidth (-26dBc BW)



Date: 24.NOV.2014 18:05:53

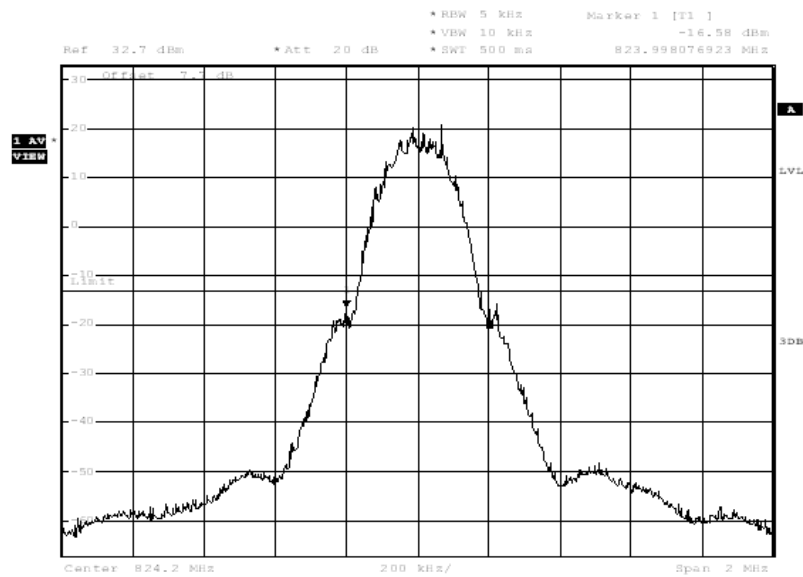
### Channel 251-Occupied Bandwidth (-26dBc BW)



Date: 24.NOV.2014 18:07:06

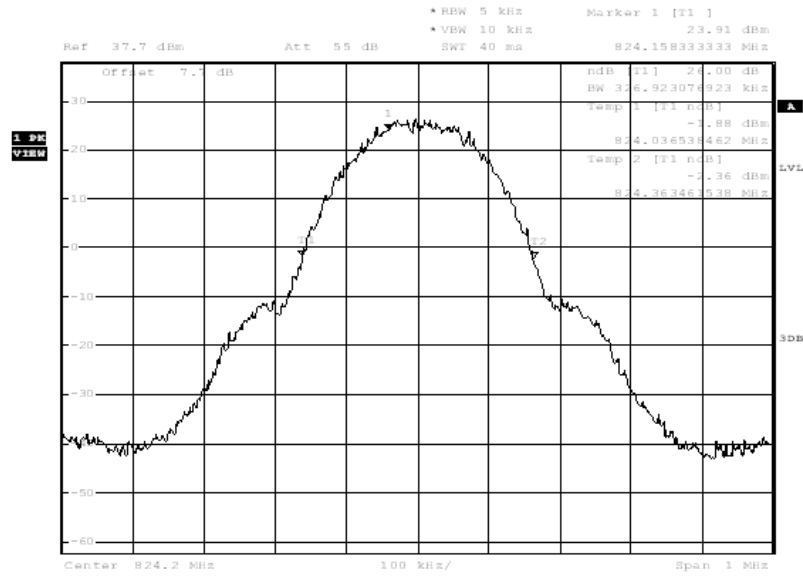
## GPRS 850

### Channel 128-Occupied Bandwidth (-26dBc BW)



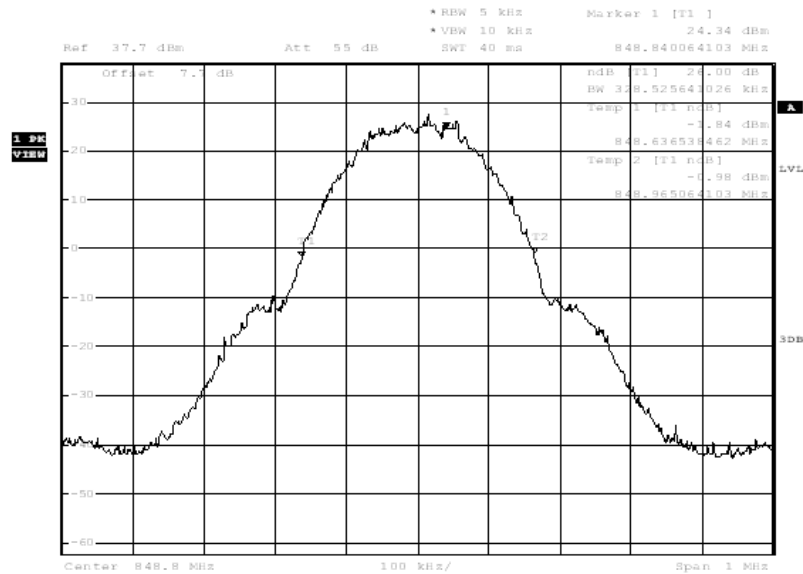
Date: 24.NOV.2014 18:08:56

### Channel 190-Occupied Bandwidth (-26dBc BW)



Date: 24.NOV.2014 18:26:16

### Channel 251-Occupied Bandwidth (-26dBc BW)

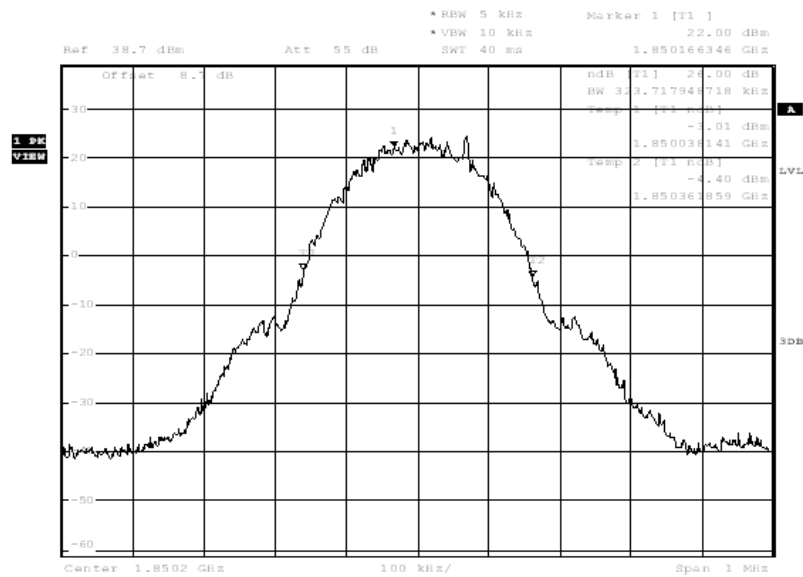


Date: 24.NOV.2014 18:28:42



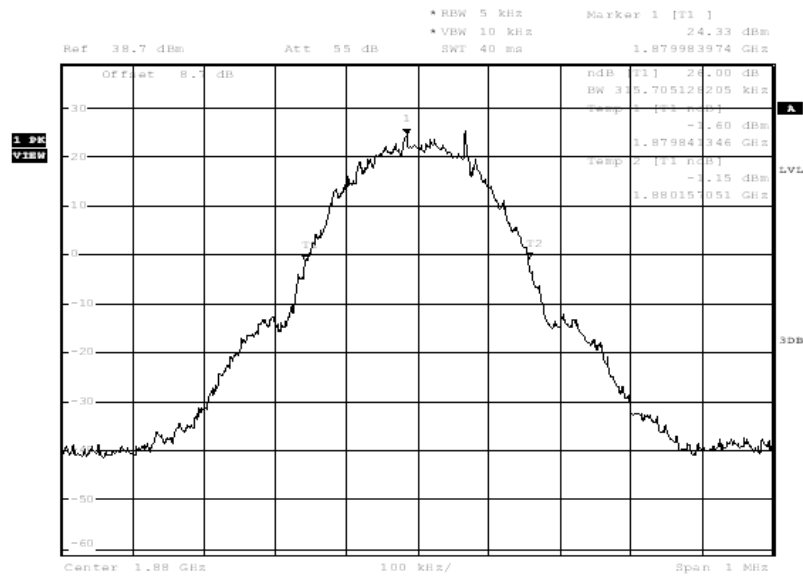
## PCS 1900

### Channel 512-Occupied Bandwidth (-26dBc BW)



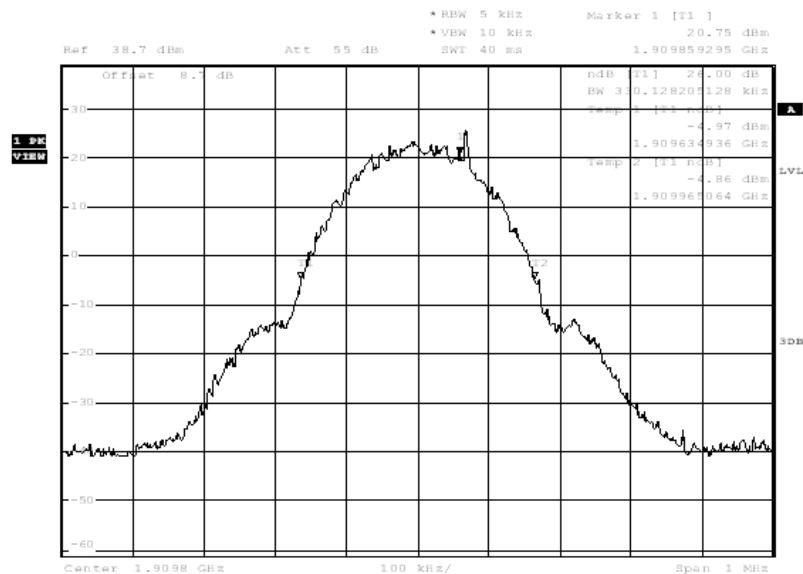
Date: 24.NOV.2014 18:42:03

### Channel 661-Occupied Bandwidth (-26dBc BW)



Date: 24.NOV.2014 18:42:16

### Channel 810-Occupied Bandwidth (-26dBc BW)

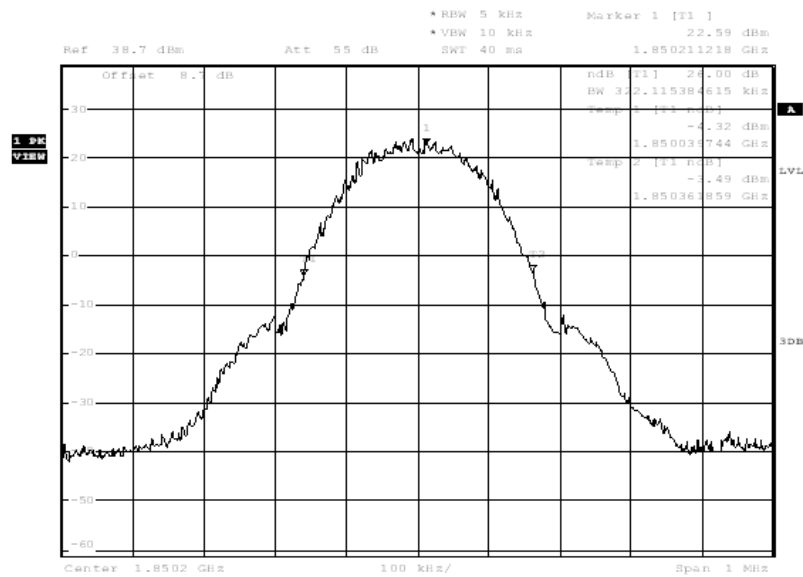


Date: 24.NOV.2014 18:44:29



## GPRS 1900

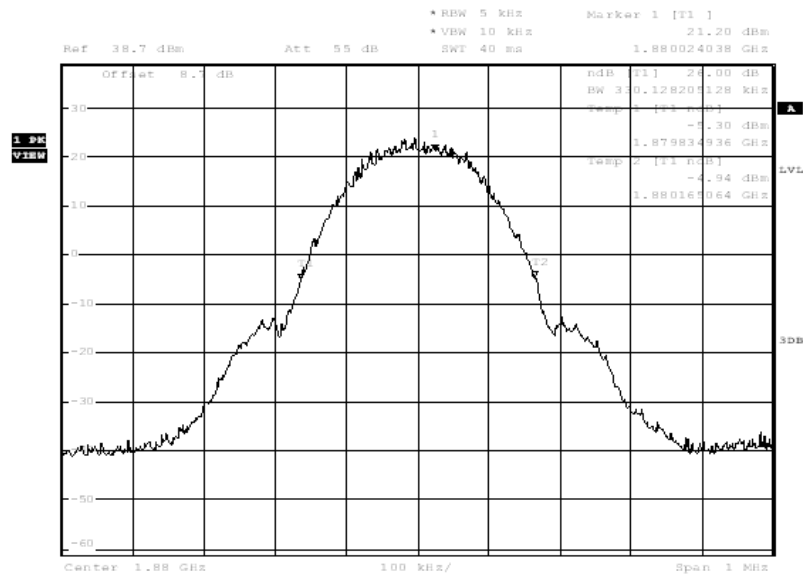
### Channel 512-Occupied Bandwidth (-26dBc BW)



Date: 24.NOV.2014 19:04:34

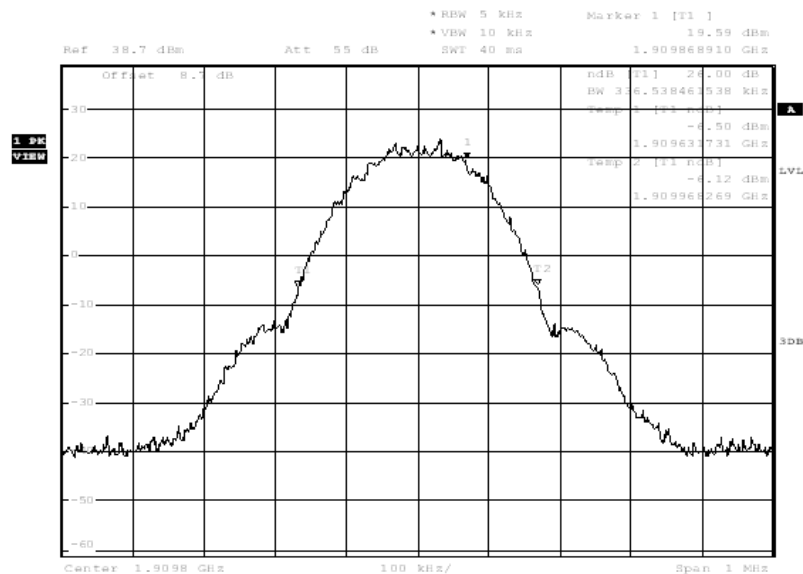


### Channel 661-Occupied Bandwidth (-26dBc BW)



Date: 24.NOV.2014 19:05:47

### Channel 810-Occupied Bandwidth (-26dBc BW)

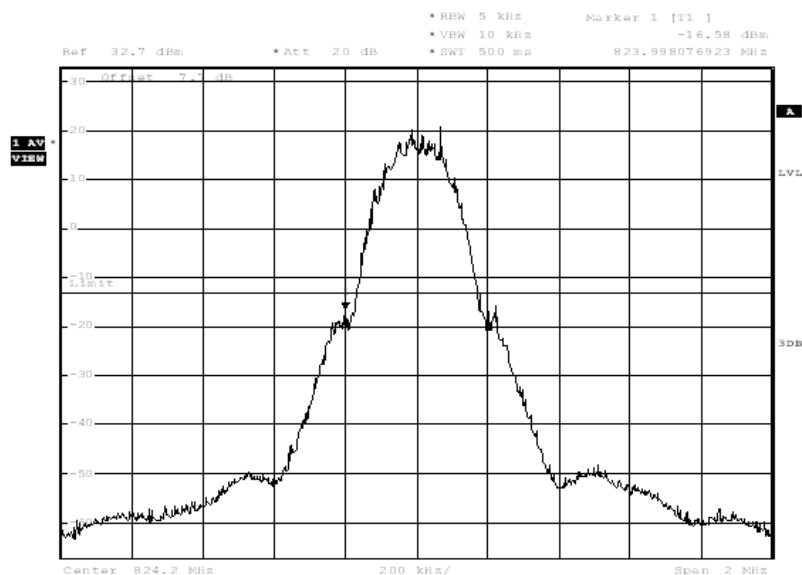


Date: 24.NOV.2014 19:07:00

## A.6 BAND EDGE COMPLIANCE

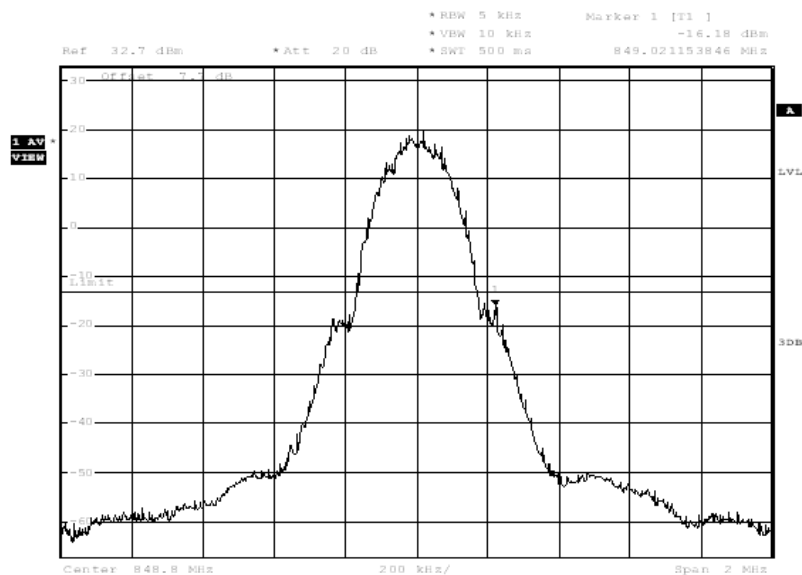
### GSM 850

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



Date: 24.NOV.2014 18:08:56

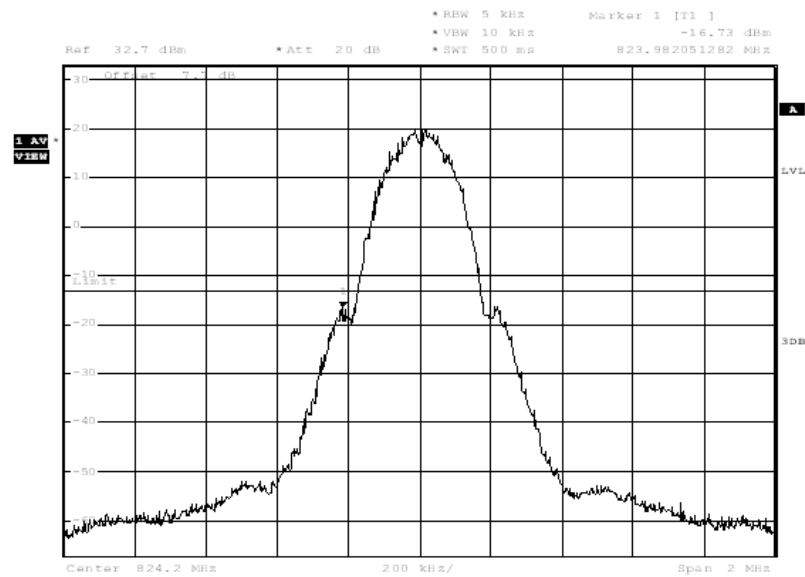
#### HIGH BAND EDGE BLOCK-C (GSM850) –Channel 251



Date: 24.NOV.2014 18:10:44

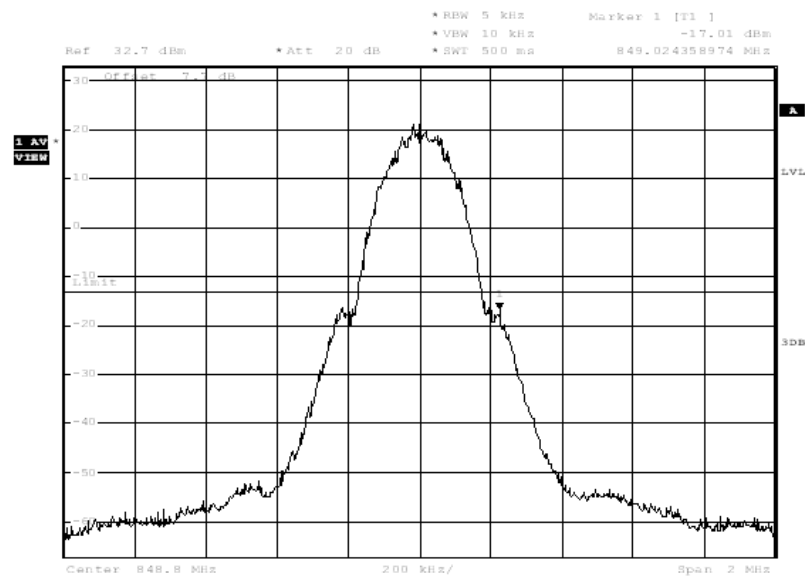
## GPRS 850

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



Date: 24.NOV.2014 18:30:32

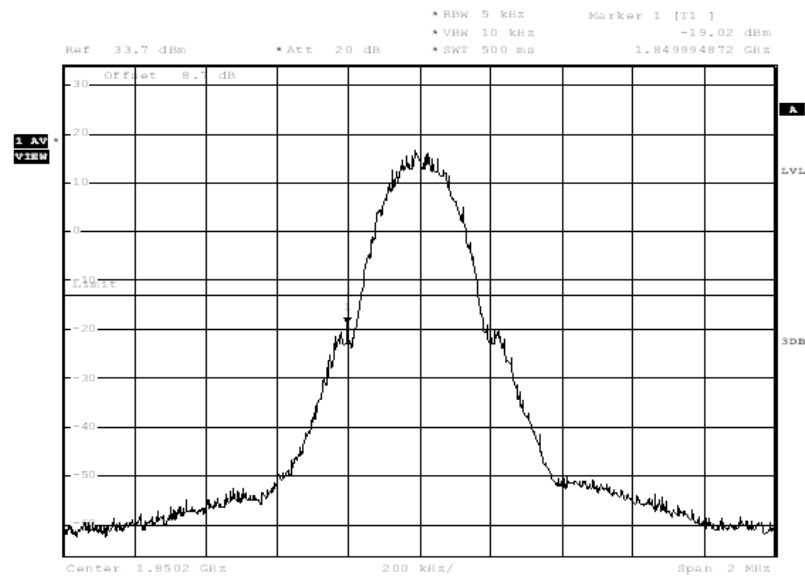
### HIGH BAND EDGE BLOCK-C (GSM850) -Channel 251



Date: 24.NOV.2014 18:32:20

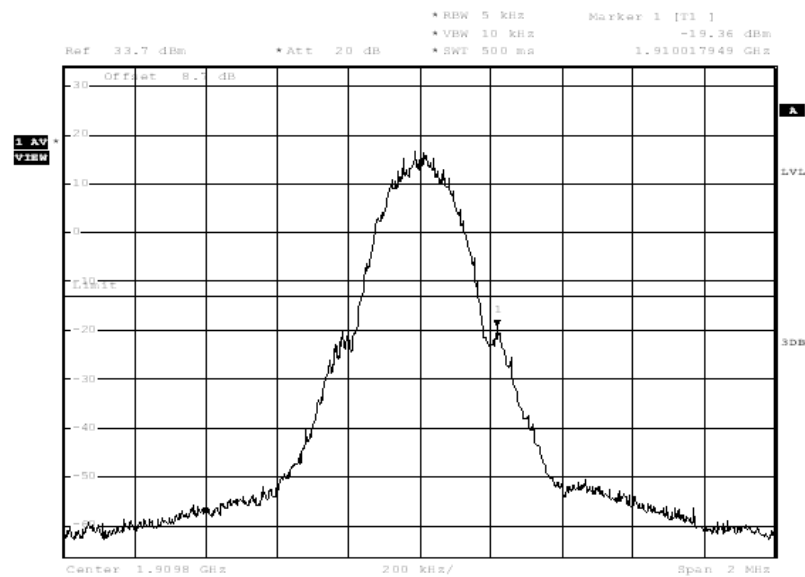
## PCS 1900

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



Date: 24.NOV.2014 18:46:19

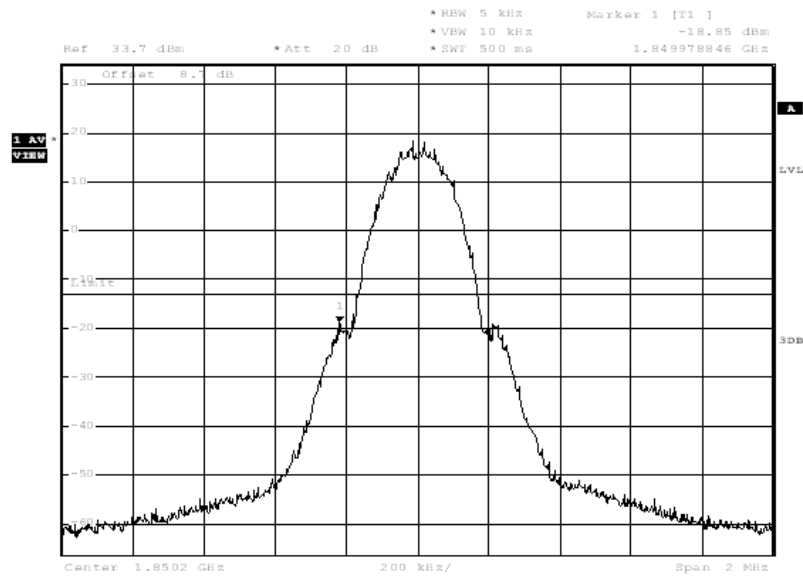
### HIGH BAND EDGE BLOCK-C (PCS-1900) -Channel 810



Date: 24.NOV.2014 18:46:07

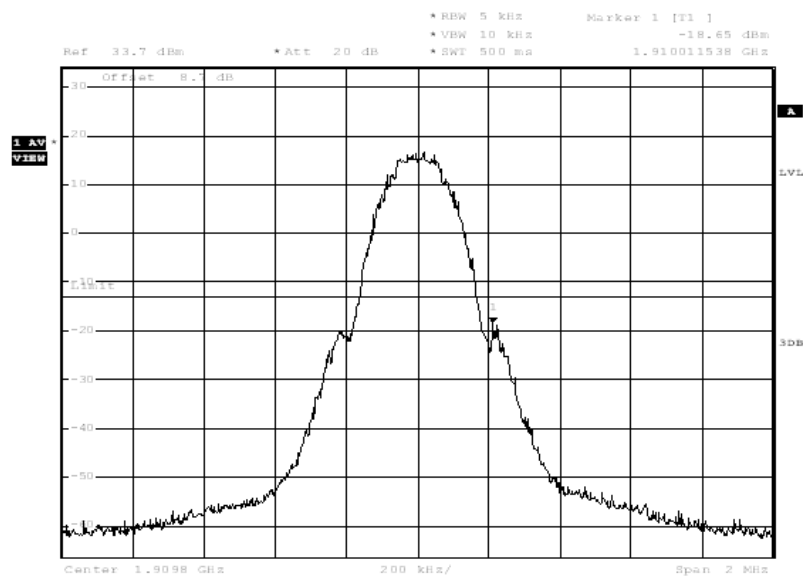
## GPRS 1900

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



Date: 24.NOV.2014 19:08:50

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



Date: 24.NOV.2014 19:10:38

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

### **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 equipment of PCS1900 band, this equates to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz. For GSM850, data taken from 30 MHz to 10 GHz.
2. The sweep time is set automatically by instrument itself. That should be the optimal sweep time for the span and the RBW. If the sweep time is too short, that is sweep is too fast, the sweep result is not accurate; If the sweep time is too long, that is sweep is too low, some frequency components may be lost. The instrument will give a optimal sweep time according the selected span and RBW.
3. The procedure to get the conducted spurious emission is as follows:  
The trace mode is set to MaxHold to get the highest signal at each frequency;  
Wait 25 seconds;  
Get the result.
4. 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. 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.

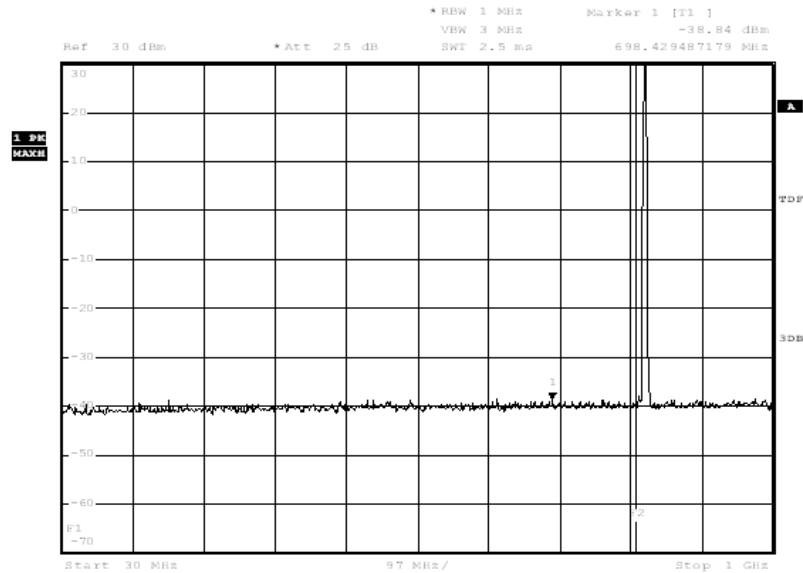
### A. 7.3 Measurement result

#### GSM850

#### Channel 128: 30MHz – 1GHz

Spurious emission limit –13dBm.

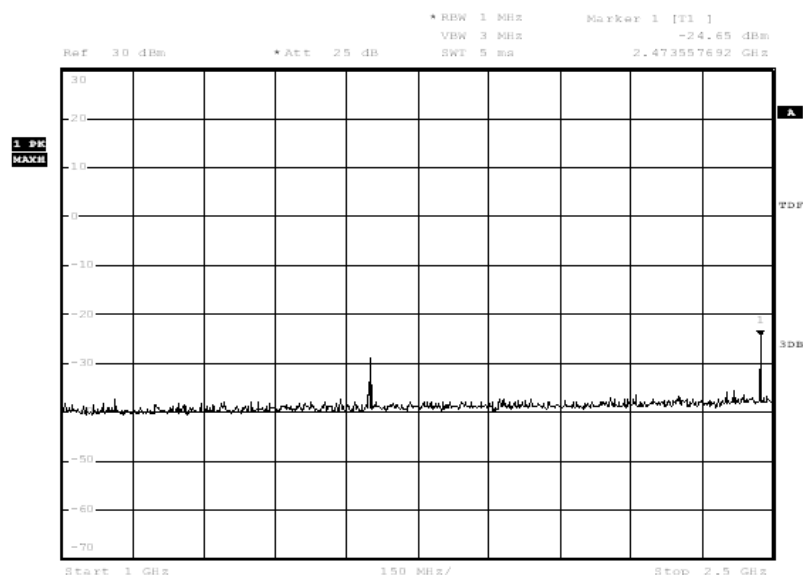
**NOTE:** peak above the limit line is the carrier frequency.



Date: 24.NOV.2014 18:11:06

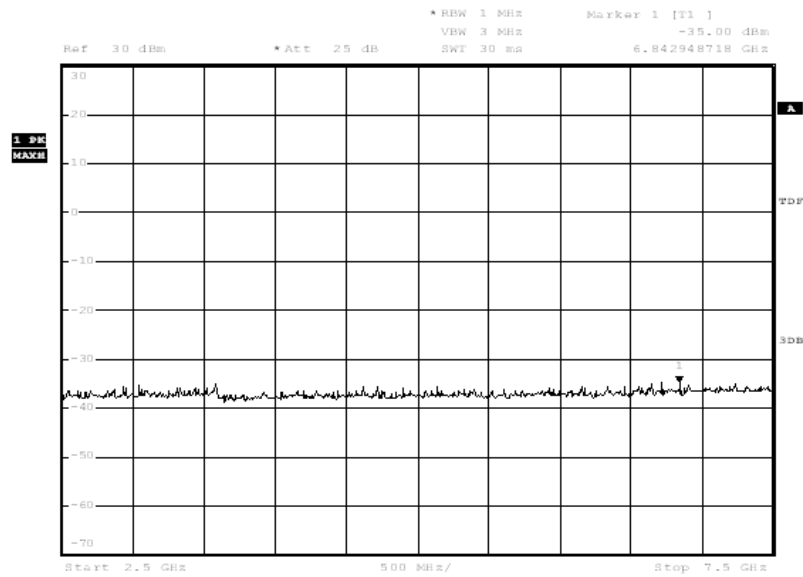
#### Channel 128: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



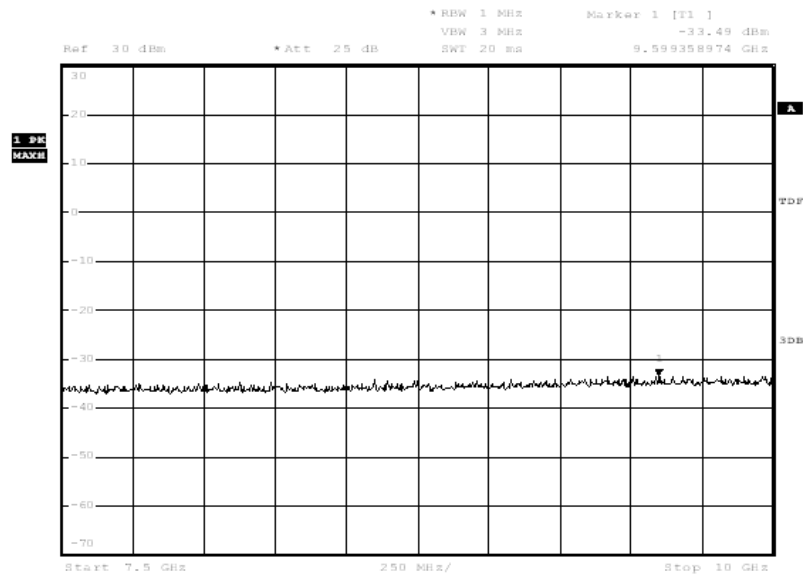
Date: 24.NOV.2014 18:11:24

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



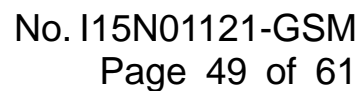
Date: 24.NOV.2014 18:11:41

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



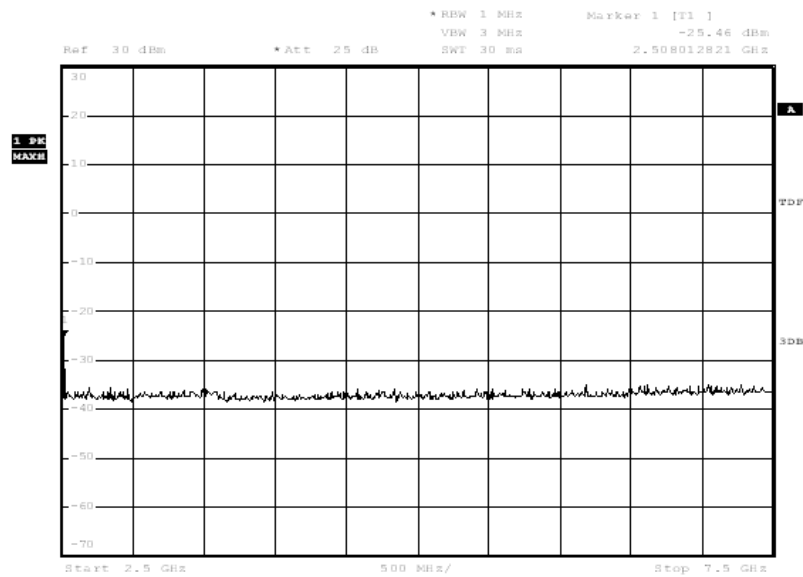
Date: 24.NOV.2014 18:11:59





### Channel 190: 2.5GHz –7.5GHz

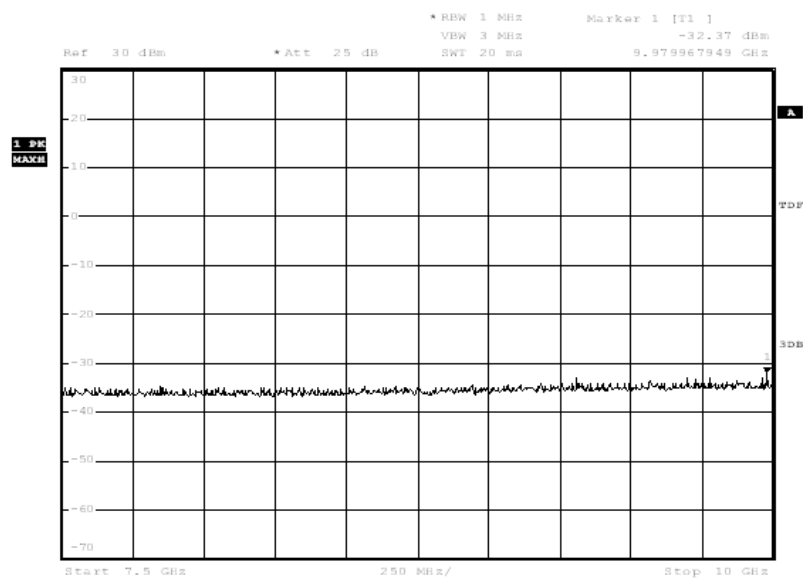
Spurious emission limit –13dBm



Date: 24.NOV.2014 18:12:54

### Channel 190: 7.5GHz –10GHz

Spurious emission limit –13dBm

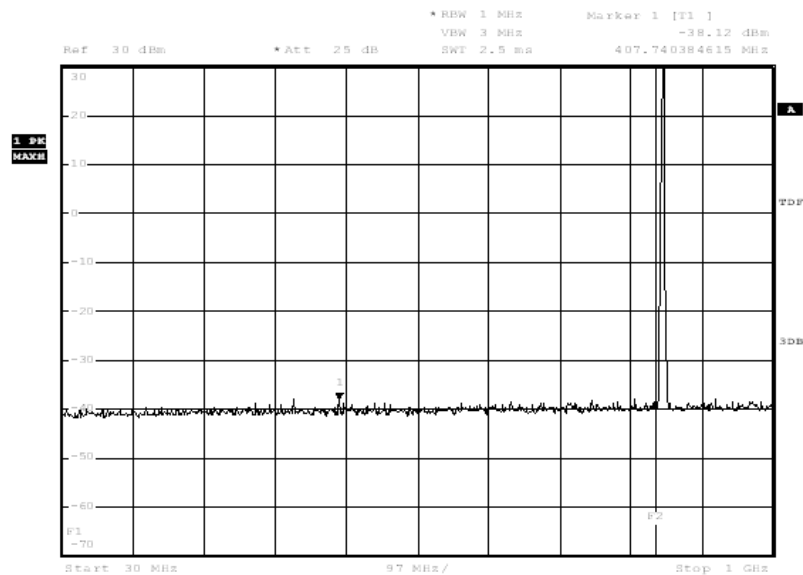


Date: 24.NOV.2014 18:13:12

### Channel 251: 30MHz – 1GHz

Spurious emission limit –13dBm.

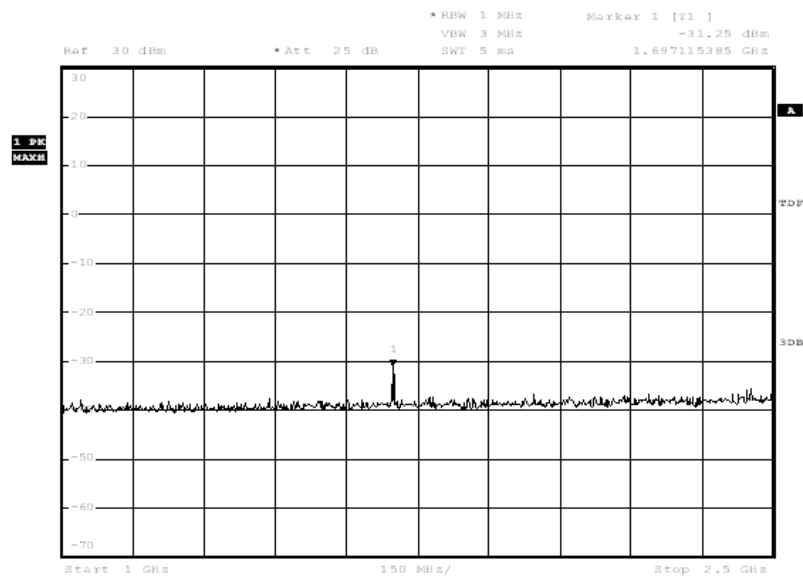
**NOTE:** peak above the limit line is the carrier frequency.



Date: 24.NOV.2014 18:13:32

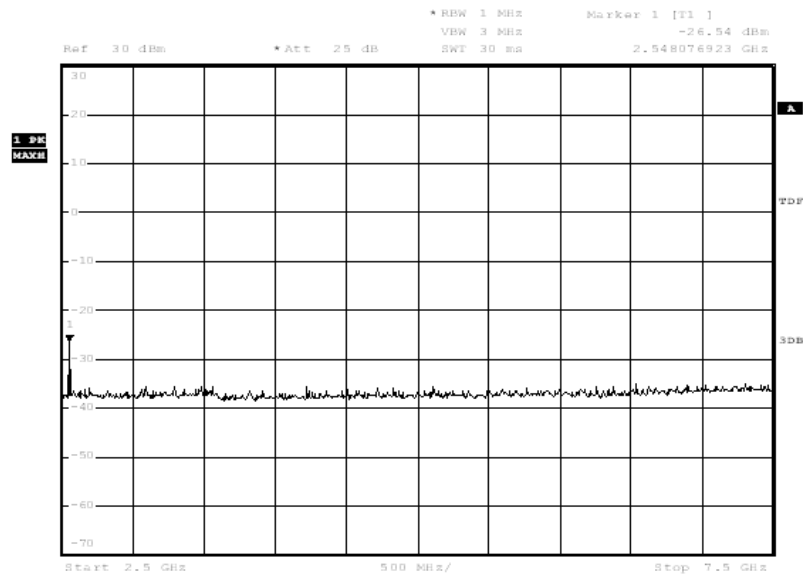
### Channel 251: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



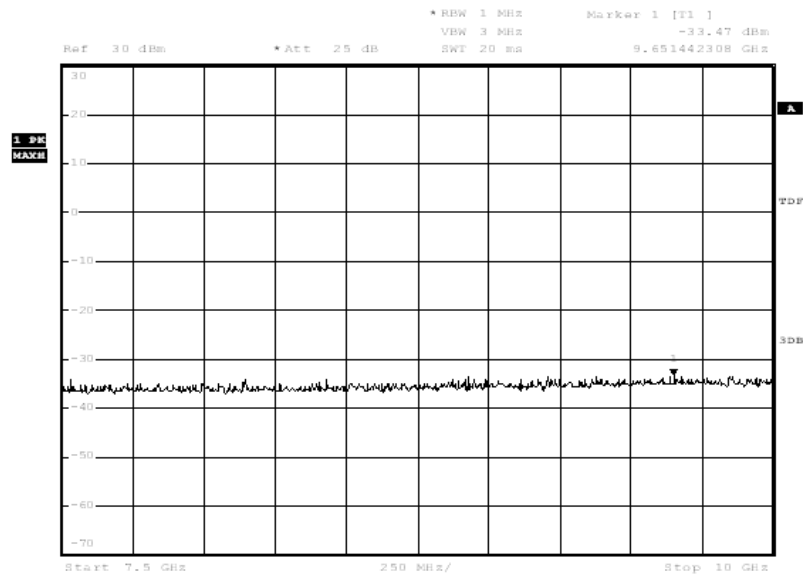
Date: 24.NOV.2014 18:13:50

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



Date: 24.NOV.2014 18:14:07

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

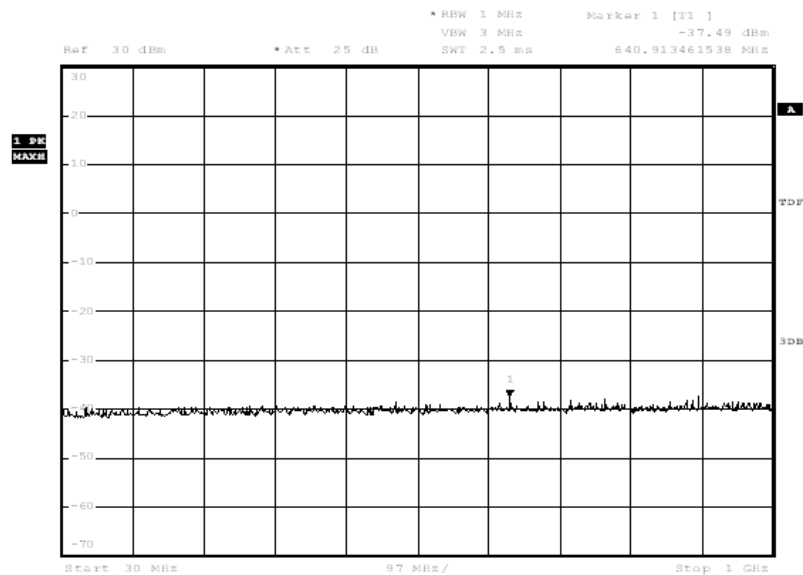


Date: 24.NOV.2014 18:14:25

### PCS1900

#### Channel 512: 30MHz – 1GHz

Spurious emission limit –13dBm.

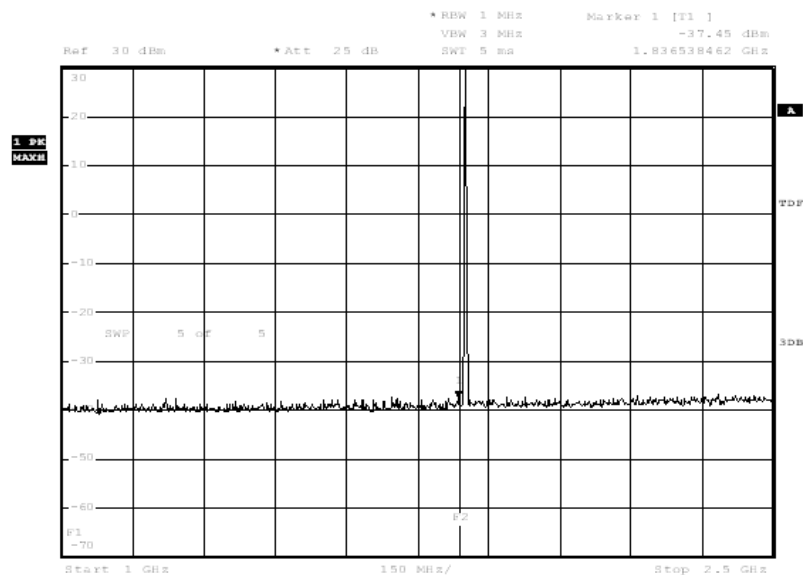


Date: 24.NOV.2014 18:48:28

#### Channel 512: 1GHz – 2.5GHz

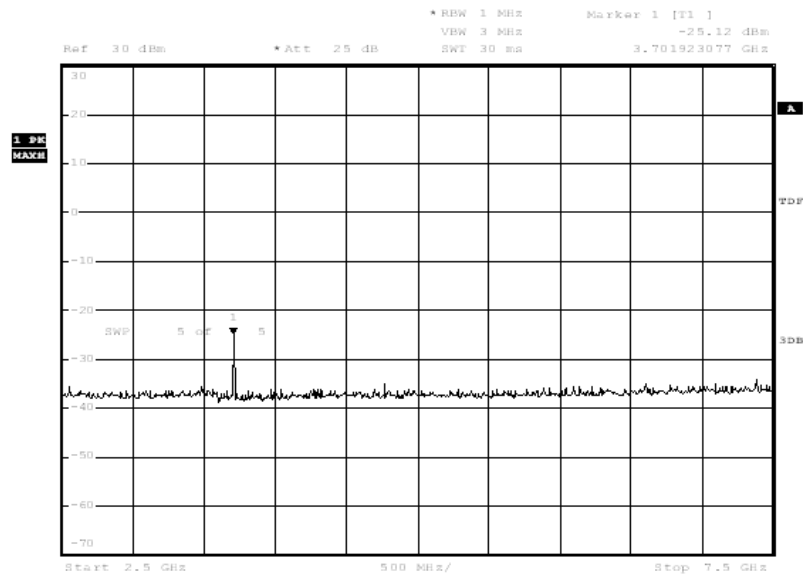
Spurious emission limit –13dBm.

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



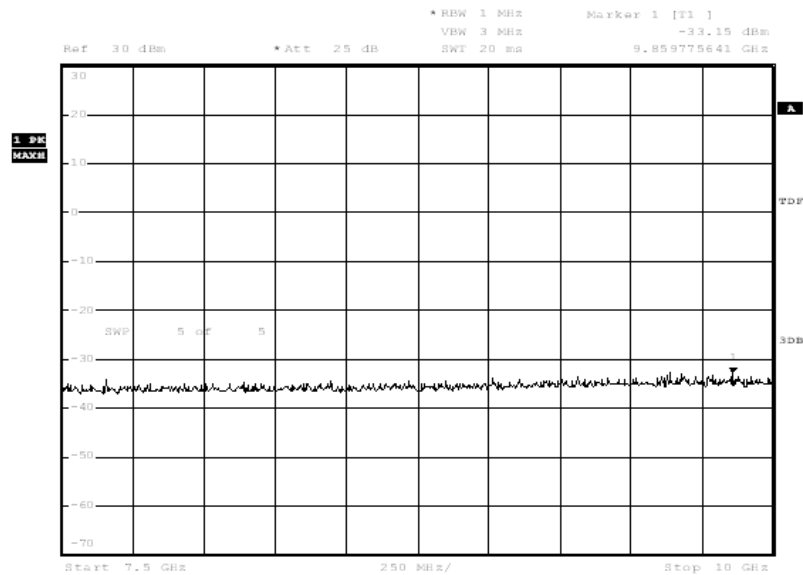
Date: 24.NOV.2014 18:48:41

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



Date: 24.NOV.2014 18:48:59

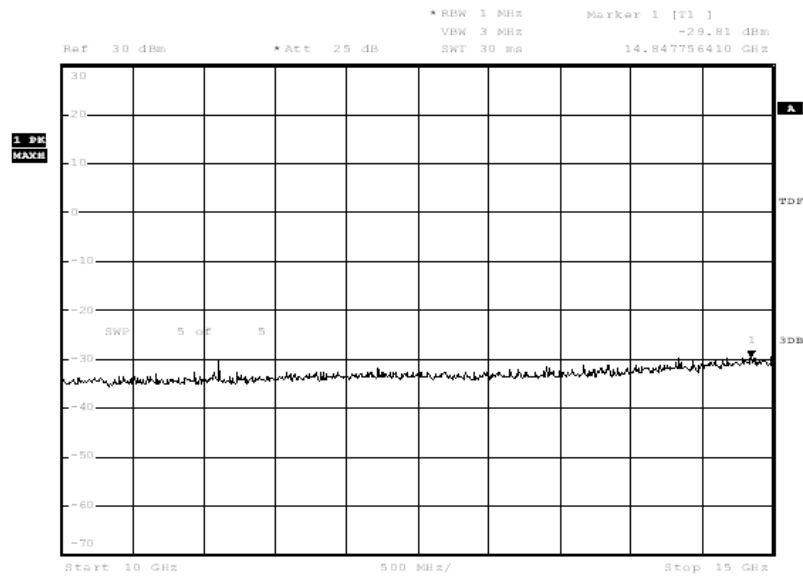
**Channel 512: 7.5GHz –10GHz**  
Spurious emission limit –13dBm.



Date: 24.NOV.2014 18:49:17

### Channel 512: 10GHz –15GHz

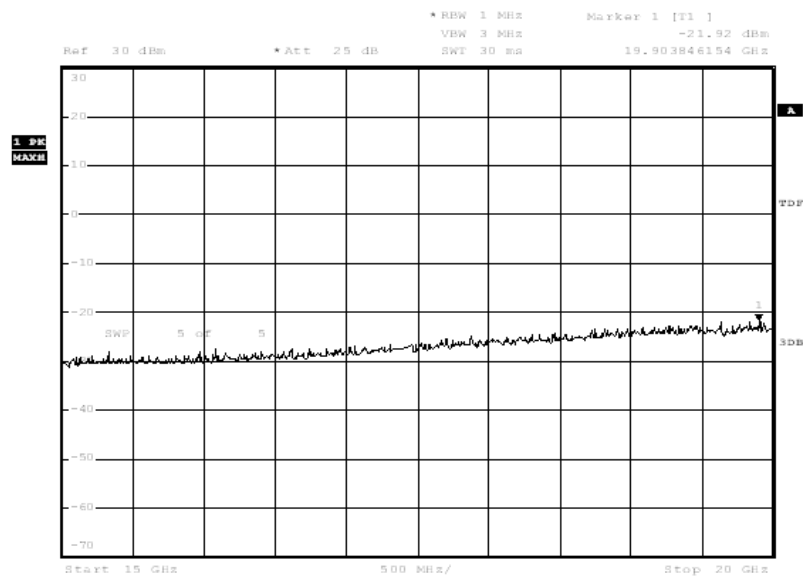
Spurious emission limit –13dBm.



Date: 24.NOV.2014 18:49:34

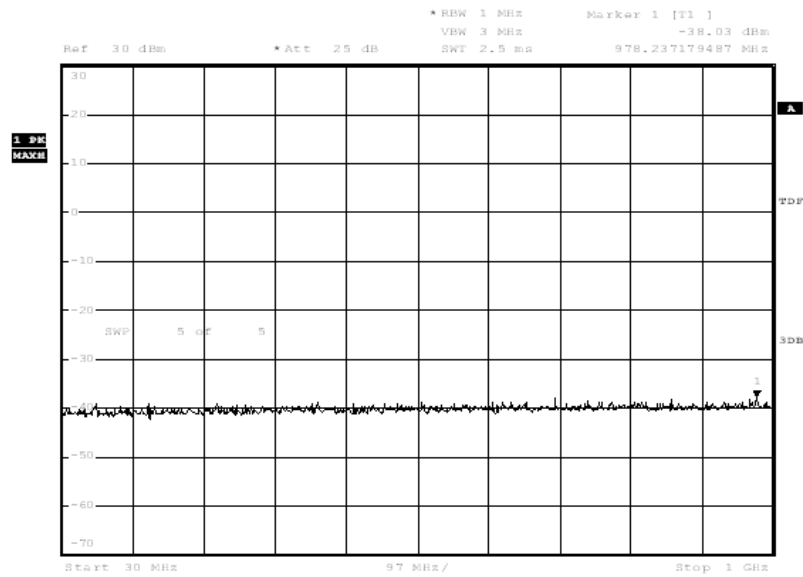
### Channel 512: 15GHz –20GHz

Spurious emission limit –13dBm.



Date: 24.NOV.2014 18:49:52

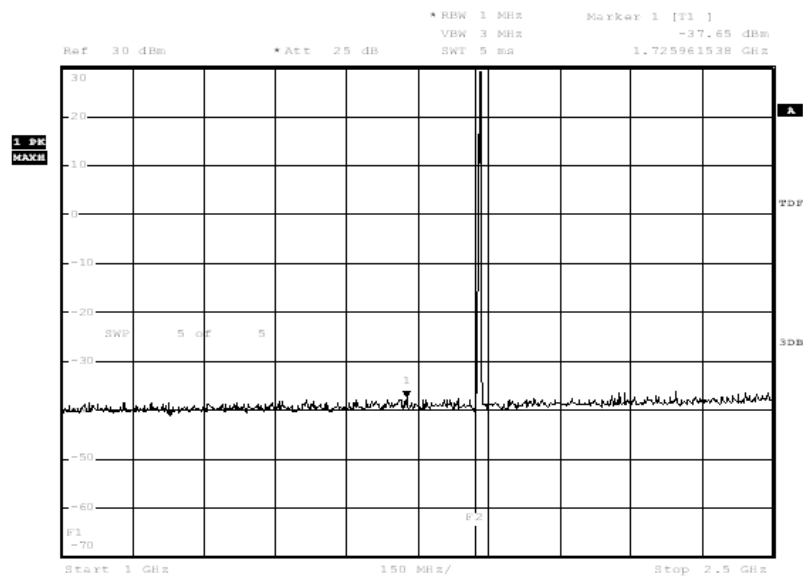
**Channel 661: 30MHz – 1GHz**  
Spurious emission limit –13dBm



Date: 24.NOV.2014 18:50:12

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

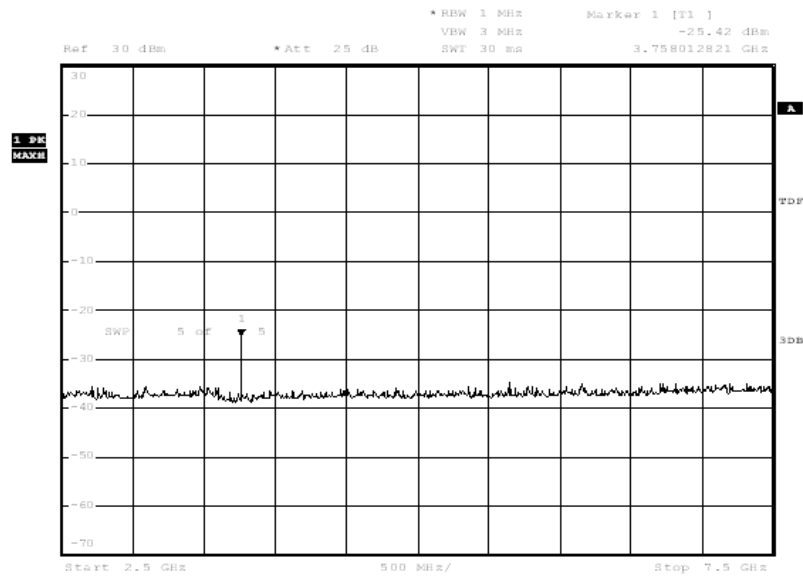
**NOTE: peak above the limit line is the carrier frequency.**



Date: 24.NOV.2014 18:50:25

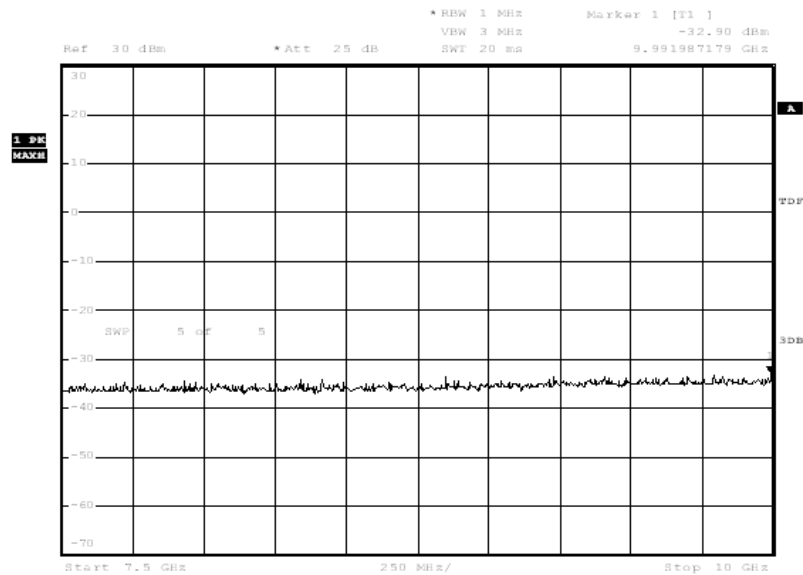


**Channel 661: 2.5GHz –7.5GHz**  
Spurious emission limit –13dBm



Date: 24.NOV.2014 18:50:42

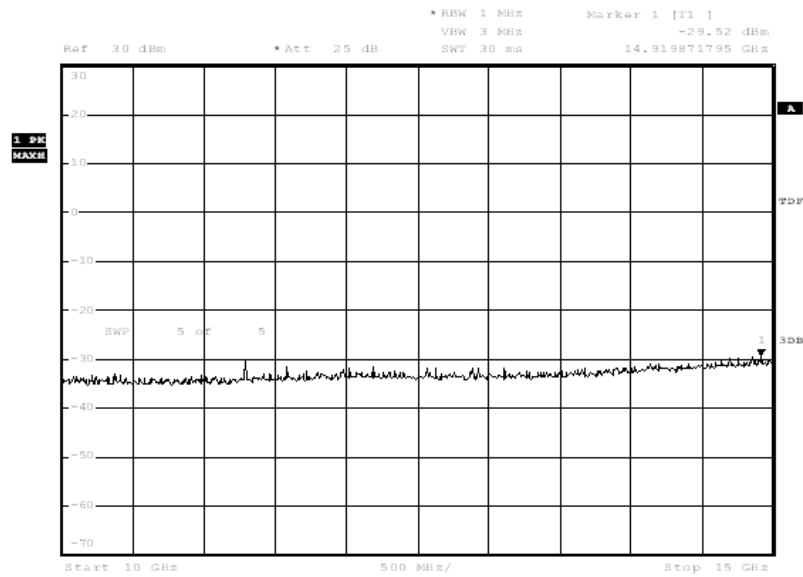
**Channel 661: 7.5GHz –10GHz**  
Spurious emission limit –13dBm



Date: 24.NOV.2014 18:51:00

### Channel 661: 10GHz –15GHz

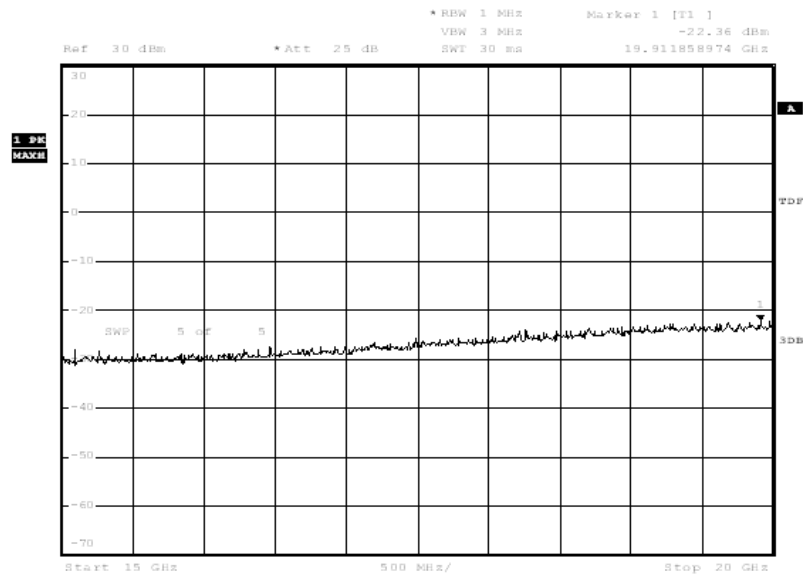
Spurious emission limit –13dBm.



Date: 24.NOV.2014 18:51:17

### Channel 661: 15GHz –20GHz

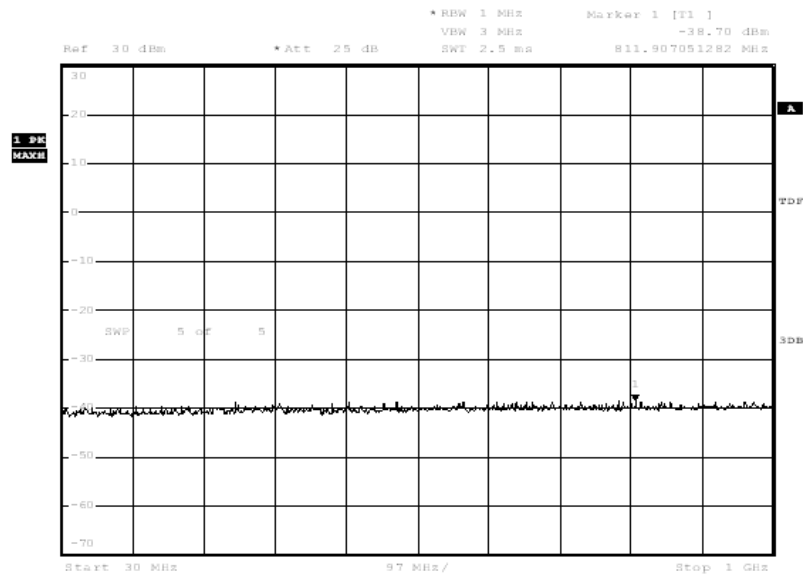
Spurious emission limit –13dBm.



Date: 24.NOV.2014 18:51:35

### Channel 810: 30MHz – 1GHz

Spurious emission limit –13dBm.

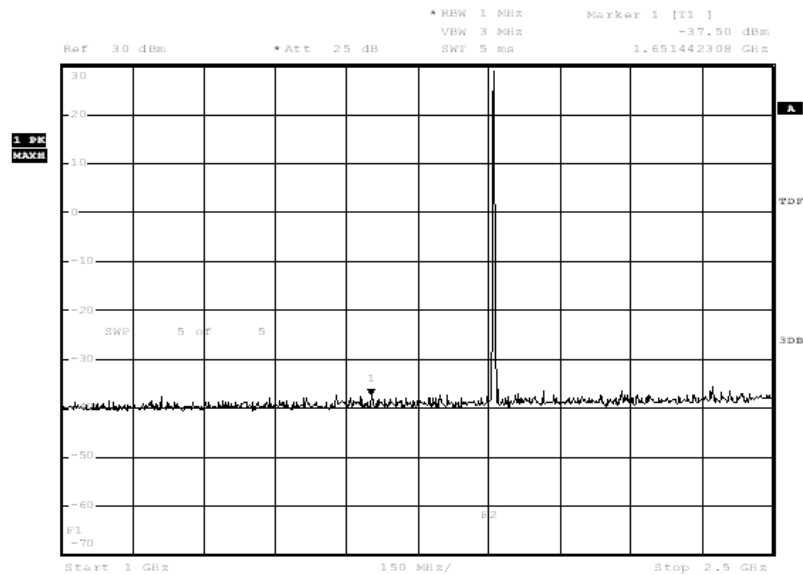


Date: 24.NOV.2014 18:51:55

### Channel 810: 1GHz – 2.5GHz

Spurious emission limit –13dBm.

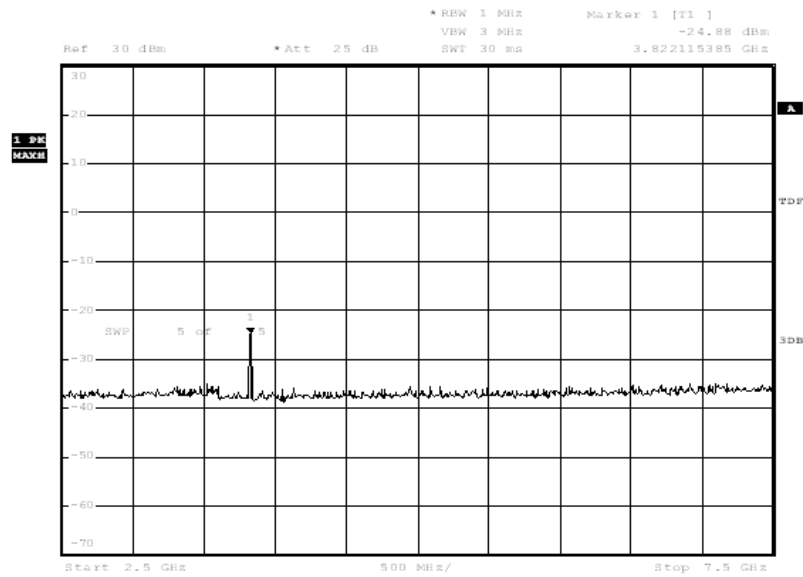
**NOTE:** peak above the limit line is the carrier frequency.



Date: 24.NOV.2014 18:52:08

### Channel 810: 2.5GHz – 7.5GHz

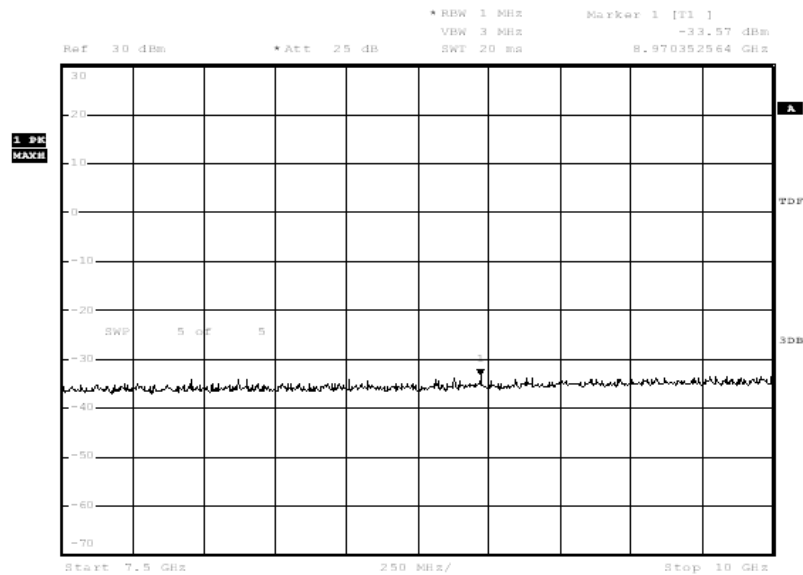
Spurious emission limit –13dBm.



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### Channel 810: 7.5GHz – 10GHz

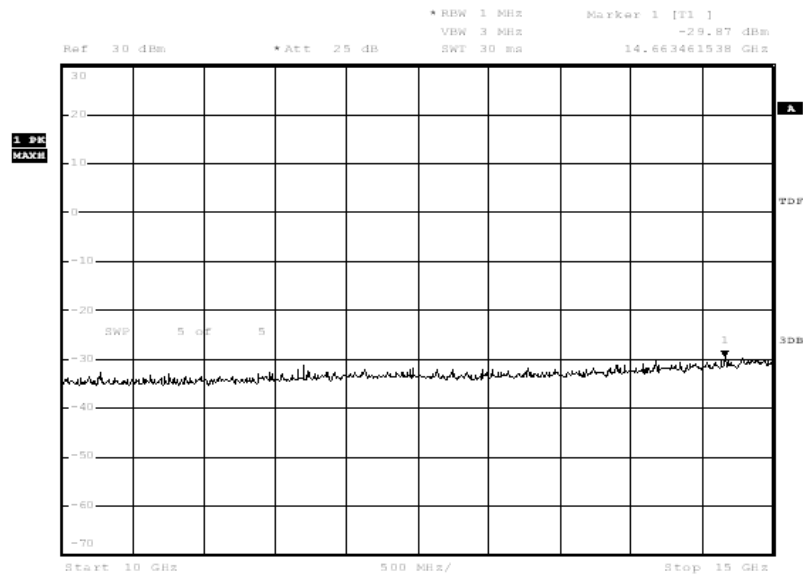
Spurious emission limit –13dBm.



Date: 24.NOV.2014 18:52:42

### Channel 810: 10GHz –15GHz

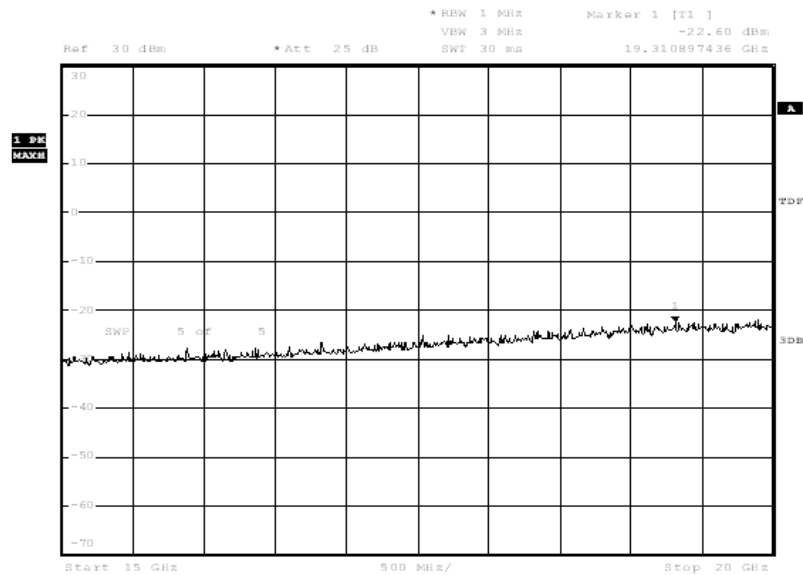
Spurious emission limit –13dBm.



Date: 24.NOV.2014 18:53:01

### Channel 810: 15GHz –20GHz

Spurious emission limit –13dBm.



Date: 24.NOV.2014 18:53:18

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