TEST REPORT

No. I14N01495-2G

for

ZTE CORPORATION

4G Wireless Router

Model Name: MF253M

FCC ID: SRQ-MF253M

with

Hardware Version: MF253M.H01

Software Version: EN_VIVO_BR_MF253MV1.0.0B05

Issued Date: 2014-12-30

Test Laboratory:

FCC 2.948 Listed: No.342690

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:

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I14N01495-2G	Rev.0	1st edition	2014-12-30

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1. Test Laboratory

1.1. Testing Location

Company Name:	CTTL ShenZhen, Telecommunication Technology Labs
Address:	No. 12 Building, Shangsha Innovation and Technology Park, Futian District
Postal Code:	518048
Telephone:	+86(0)755-33322000
Fax:	+86(0)755-33322001

1.2. Testing Environment

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

1.3. Project data

Testing Start Date:	2014-12-15
Testing End Date:	2014-12-30

1.4. Signature

Huang Qiuqin

(Prepared this test report)

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(Reviewed this test report)

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(Approved this test report)

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2. Client Information

2.1. Applicant Information

Company Name:	ZTE CORPORATION
Address /Post:	ZTE Plaza, Keji Road South, Shenzhen, China
City:	ShenZhen
Postal Code:	518057
Country:	China
Telephone:	+86 18616587757

2.2. Manufacturer Information

Company Name:	ZTE CORPORATION
Address /Post:	ZTE Plaza, Keji Road South, Shenzhen, China
City:	ShenZhen
Postal Code:	518057
Country:	China
Telephone:	+86 18616587757

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

3.1. About EUT

Description	4G Wireless Router
Model Name	MF253M
Marketing Name	ZTE
FCC ID	SRQ-MF253M
Frequency	GSM850; PCS1900; WCDMA Band II; WCDMA Band V
Extreme vol. Limits	3.2VDC to 3.6VDC (nominal: 3.3VDC)
Extreme temp. Tolerance	-30°C to +50°C

3.2. Internal Identification of EUT used during the test

EUT ID*	SN or IMEI	HW Version	SW Version
N01	/	MF253M.H01	EN_VIVO_BR_MF253MV1.0.0B05

*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
AE1	Travel charger	/

AE1

Model	STC-A2O120150C55-A
Manufacturer	Ruide Electronical Industrial Co., Ltd

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

3.4. EUT set-ups

EUT set-up No.	Combination of EUT and AE	Remarks
Set.1	EUT1+ AE1	Charging mode

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4. Reference Documents

4.1. Reference Documents for testing

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

Reference	Title	Version
ANSI/TIA-603-D	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2010
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	2003
KDB971168 D01	Procedures for Compliance Measurement of the Fundamental Emission Power of Licensed Wideband (> 1 MHz) Digital Transmission Systems	2011
FCC Part 24	PERSONAL COMMUNICATIONS SERVICES	10-1-13 Edition
FCC Part 22	PUBLIC MOBILE SERVICES	10-1-13 Edition
FCC Part 15, Subpart B	Radio frequency devices	10-1-2013 Edition
FCC Part 2	Frequency Allocations and Radio Treaty Matters; General Rules and Regulations	10-1-2010 Edition

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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 ℃, Max. = 30 ℃
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 ℃, Max. = 35 ℃
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 ℃, Max. = 30 ℃
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 ℃, Max. = 30 ℃
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

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6. SUMMARY OF TEST RESULTS

Abbreviations used in this clause:	
P	Pass
NA	Not applicable
F	Fail

Items	List	Clause in FCC rules	Verdict
1	Output Power	22.913(a)/24.232(b)	P
2	Emission Limit	2.1051/22.917/24.238	P
3	Conducted Emission	15.107/15.207	P
4	Frequency Stability	2.1055/24.235	P
5	Occupied Bandwidth	2.1049(h)(i)	P
6	Emission Bandwidth	22.917(b)/24.238(b)	P
7	Band Edge Compliance	22.917(b)/24.238(b)	P
8	Conducted Spurious Emission	2.1057/22.917/24.238	P
9	PEAK-TO-AVERAGE POWER RATIO	KDB971168	P

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7. Test Equipments Utilized

NO.	Description	TYPE	SERIES NUMBER	MANUFACTURE	CAL DUE DATE
1	Test Receiver	ESCI	100701	R&S	2015.07.30
2	Test Receiver	ESCI	100702	R&S	2015.07.30
3	Test Receiver	FSP40	100378	R&S	2015.12.19
4	BiLog Antenna	VULB9163	9163 329	Schwarzbeck	2017.01.20
5	Horn Antenna	3117	00066577	ETS-Lindgren	2016.04.01
6	Universal Radio Communication Tester	CMU200	114544	R&S	2015.12.25
7	DC Power Source	ZUP60-14	6MY-847Z13-000 2	TDK-Lambda	2015.03.09
8	LISN	ESH2-Z5	100196	R&S	2016.01.13
9	Horn Antenna	3160-09	ETS-Lindgren	00118383	2015.09.05
10	Universal Radio Communication Tester	CMU200	Rohde&Schwarz	114828	2016.01.03
11	Spectrum Analyzer	FSU	Rohde&Schwarz	200679	2016.01.03
12	Temperature Chamber	SH-241	ESPEC	92007516	2015.02.20
13	DC Power Supply	U3606A	Agilent Technologies	MY50450012	2015.11.11
14	RF Switch Matrix	OSP130	Rohde&Schwarz	100259	2016.01.03
15	Vector Signal Generator	SMU200A	Rohde&Schwarz	104072	2016.01.03
16	MXG Analog Signal Generator	N5183A	Agilent Technologies	MY50140012	2016.01.03

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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

Measurement result

GPRS（GMSK，1Slot）

Frequency(MHz)	Power Step	Output power(dBm)
824.2	3	32.97
836.6	3	32.87
848.8	3	32.84

EGPRS（8PSK，1Slot）

Frequency(MHz)	Power Step	Output power(dBm)
824.2	6	27.30
836.6	6	27.36
848.8	6	27.59

PCS1900

Measurement result

GPRS（GMSK，1Slot）

Frequency(MHz)	Power Step	Output power(dBm)
1850.2	3	30.02
1880.0	3	29.64

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1909.8	3	29.46

EGPRS（8PSK，1Slot）

Frequency(MHz)	Power Step	Output power(dBm)
1850.2	5	27.02
1880.0	5	27.15
1909.8	5	26.91

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A.1.3 Radiated

A.1.3.1 Description

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

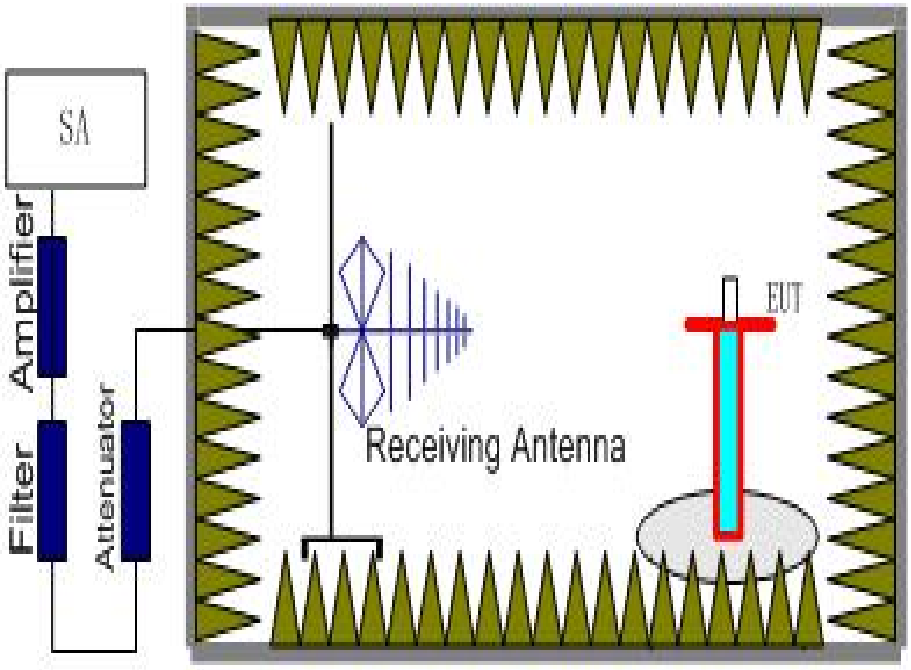
Rule Part 24.232(b) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage."

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-603D-2010 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.

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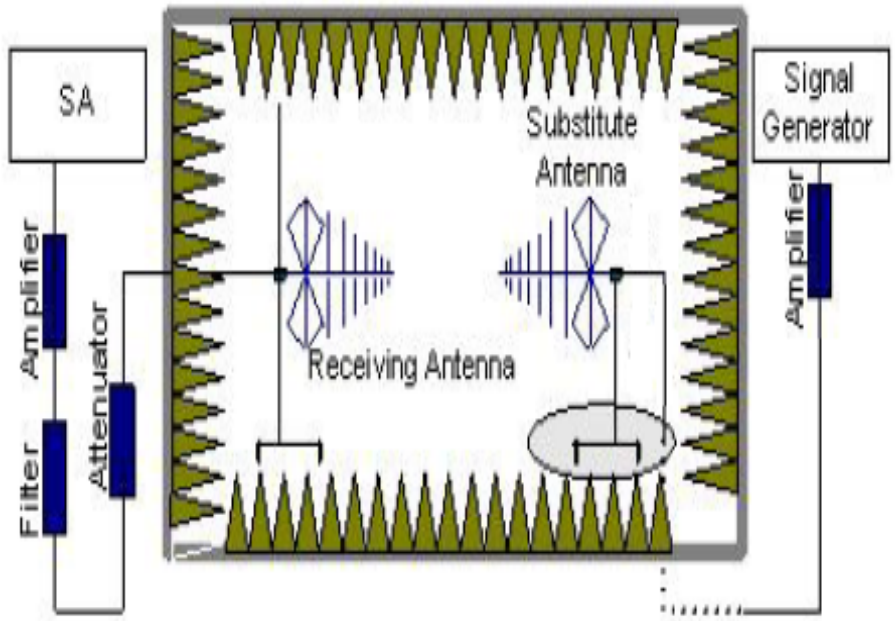

In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern 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:
   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 -2.15dBi.

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GSM 850-ERP

Limits

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

Measurement result

GPRS

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)	P_{Ag}(dB)	G_a Antenna Gain(dB)	Correction (dB)	ERP(dBm)	Polarization
824.20	6.41	2.07	-36.20	8.22	2.15	30.17	V
836.60	7.52	2.08	-36.00	8.22	2.15	31.07	V
848.80	8.19	2.09	-35.90	8.21	2.15	31.64	V

EGPRS

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)	P_{Ag}(dB)	G_a Antenna Gain(dB)	Correction (dB)	ERP(dBm)	Polarization
824.20	6.40	2.07	-36.20	8.22	2.15	30.16	V
836.60	7.61	2.08	-36.00	8.22	2.15	31.16	V
848.80	8.26	2.09	-35.90	8.21	2.15	31.71	V

Note: the result contains vertical part and Horizontal part

ANALYZER SETTINGS: RBW = VBW = 3MHz

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PCS1900-EIRP

Limits

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

Measurement result

GPRS

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)	P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Polarization
1850.20	4.99	3.13	-35.80	7.81	29.85	H
1880.00	4.85	3.15	-35.60	7.80	29.50	H
1909.80	4.47	3.18	-35.40	7.77	28.92	H

EGPRS

Frequency(MHz)	P_{Mea}(dBm)	P_{cl}(dB)	P_{Ag}(dB)	G_a Antenna Gain(dB)	EIRP(dBm)	Polarization
1850.20	4.32	3.13	-35.80	7.81	29.18	H
1880.00	4.61	3.15	-35.60	7.80	29.26	H
1909.80	4.50	3.18	-35.40	7.77	28.95	H

Note: the result contains vertical part and Horizontal part

ANALYZER SETTINGS: RBW = VBW = 3MHz

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A.2 EMISSION LIMIT

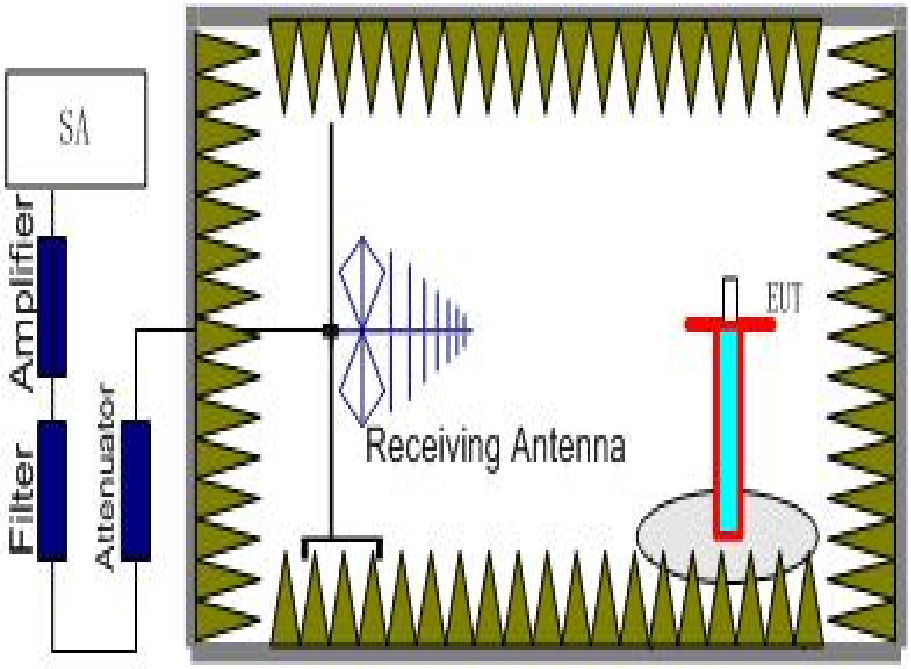
A.2.1 Measurement Method

The measurement procedures in TIA-603D-2010 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.

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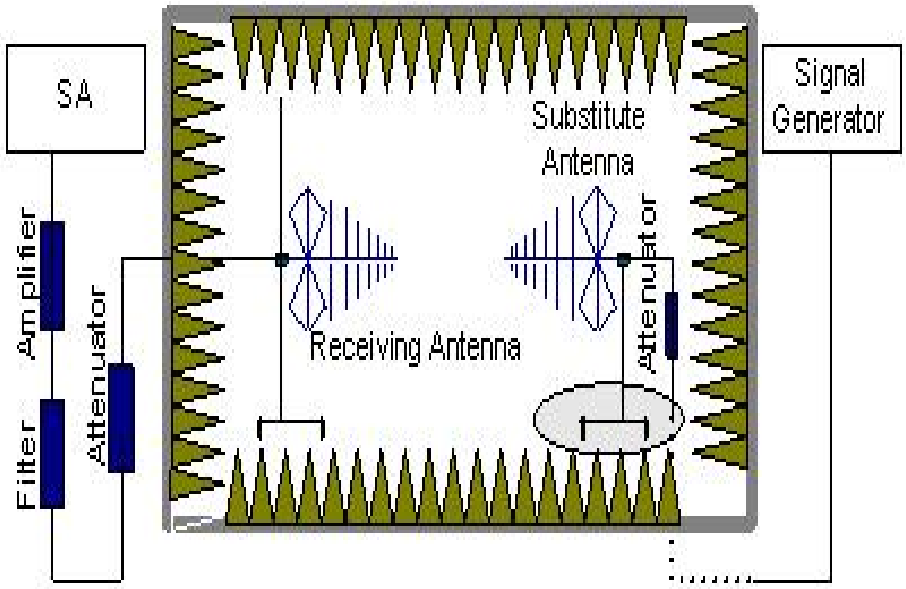

In the chamber, a substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern 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.
   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:
   Power(EIRP)=P_{Mea} - P_{pl} - G_a
5. Use the power meter to measure the result of power in substitute antenna. Record the result of power meter(P_{pm}).
   The measurement results are obtained as described below:
   Power(EIRP)= P_{pm} - G_a
6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dBi.

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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.

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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

Note: the result contains vertical part and Horizontal part

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Channel 128/824.2MHz

Frequency(MHz)	P_{pm}(dBm)	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit （dBm）	Polarization
8632	-56.05	-12.3	2.15	-45.9	-13.00	V
9211.5	-55.85	-12.4	2.15	-45.6	-13.00	V
9385	-55.45	-12.4	2.15	-45.2	-13.00	V
9416.5	-55.75	-12.3	2.15	-45.6	-13.00	V
9856	-56.35	-12.3	2.15	-46.2	-13.00	V
9953.5	-55.75	-12.3	2.15	-45.6	-13.00	V

Channel 190/836.6MHz

Frequency(MHz)	Ppm(dBm)	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit （dBm）	Polarization
9260	-51.05	-11.1	2.15	-42.1	-13.00	V
9330.875	-51.15	-12.4	2.15	-40.9	-13.00	H
9430.5	-51.75	-12.4	2.15	-41.5	-13.00	V
9739.25	-52.35	-12.3	2.15	-42.2	-13.00	V
9872.375	-52.25	-12.3	2.15	-42.1	-13.00	H
9960.125	-51.75	-12.3	2.15	-41.6	-13.00	V

Channel 251/848.8MHz

Frequency(MHz)	P_{pm}(dBm)	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit （dBm）	Polarization
9118.875	-52.75	-12.4	2.15	-42.5	-13.00	H
9268.125	-51.15	-12.4	2.15	-40.9	-13.00	V
9357.375	-51.85	-12.4	2.15	-41.6	-13.00	V
9730.5	-52.45	-12.3	2.15	-42.3	-13.00	V
9837.875	-52.55	-12.3	2.15	-42.4	-13.00	H
9903	-51.75	-12.3	2.15	-41.6	-13.00	H

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Channel 512/1850.2MHz

Frequency(MHz)	P_{pm}(dBm)	Antenna Gain	Peak EIRP(dBm)	Limit （dBm）	Polarization
18619.25	-48.20	-13.7	-34.5	-13.00	V
18831	-49.40	-15	-34.4	-13.00	V
19065.5	-50.00	-15.3	-34.7	-13.00	V
19275.5	-49.60	-15.3	-34.3	-13.00	H
19637.75	-50.00	-15.3	-34.7	-13.00	H
19982.5	-49.90	-15.3	-34.6	-13.00	V

Channel 661/1880.0MHz

Frequency(MHz)	Ppm(dBm)	Antenna Gain	Peak EIRP(dBm)	Limit （dBm）	Polarization
18720.75	-49.00	-15	-34	-13.00	V
18836.25	-49.50	-15	-34.5	-13.00	V
19151.25	-49.80	-15.3	-34.5	-13.00	V
19608	-49.80	-15.3	-34.5	-13.00	V
19655.25	-48.80	-15.3	-33.5	-13.00	V
19839	-49.60	-15.3	-34.3	-13.00	V

Channel 810/1909.8MHz

Frequency(MHz)	Ppm(dBm)	Antenna Gain	Peak EIRP(dBm)	Limit （dBm）	Polarization
18295.5	-47.70	-13.7	-34	-13.00	H
18790.75	-49.70	-15	-34.7	-13.00	V
18904.5	-49.30	-15	-34.3	-13.00	V
19293	-49.10	-15	-34.1	-13.00	H
19637.75	-49.90	-15.3	-34.6	-13.00	V
19996.5	-49.60	-15.3	-34.3	-13.00	V

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A.3 CONDUCTED EMISSION

The measurement procedure in ANSI C63.4-2003 is used. Conducted Emission is measured with travel charger.

A.3.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi -Peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50
* Decreases with logarithm of the frequency		

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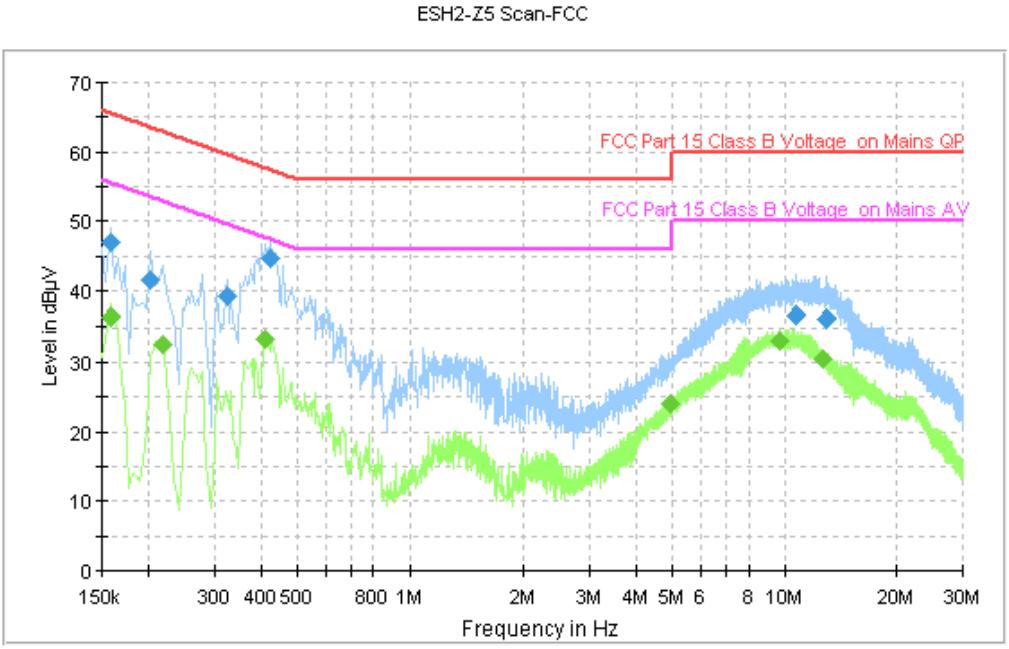
A.3.2 Measurement result

GSM850MHz



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	47.1	FLO	L1	10.0	18.5	65.6
0.202000	41.5	FLO	N	10.1	22.0	63.5
0.326000	39.2	FLO	N	10.0	20.3	59.6
0.426000	44.8	FLO	N	10.1	12.6	57.3
10.782000	36.7	FLO	L1	10.3	23.3	60.0
12.934000	36.3	FLO	L1	10.4	23.7	60.0

Final Measurement Detector 2

Frequency (MHz)	Average (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.158000	36.5	FLO	L1	10.0	19.0	55.6
0.218000	32.5	FLO	N	10.0	20.4	52.9
0.410000	33.4	FLO	N	10.1	14.3	47.6
4.954000	24.1	FLO	L1	10.2	21.9	46.0
9.710000	33.0	FLO	L1	10.3	17.0	50.0
12.602000	30.5	FLO	L1	10.4	19.5	50.0

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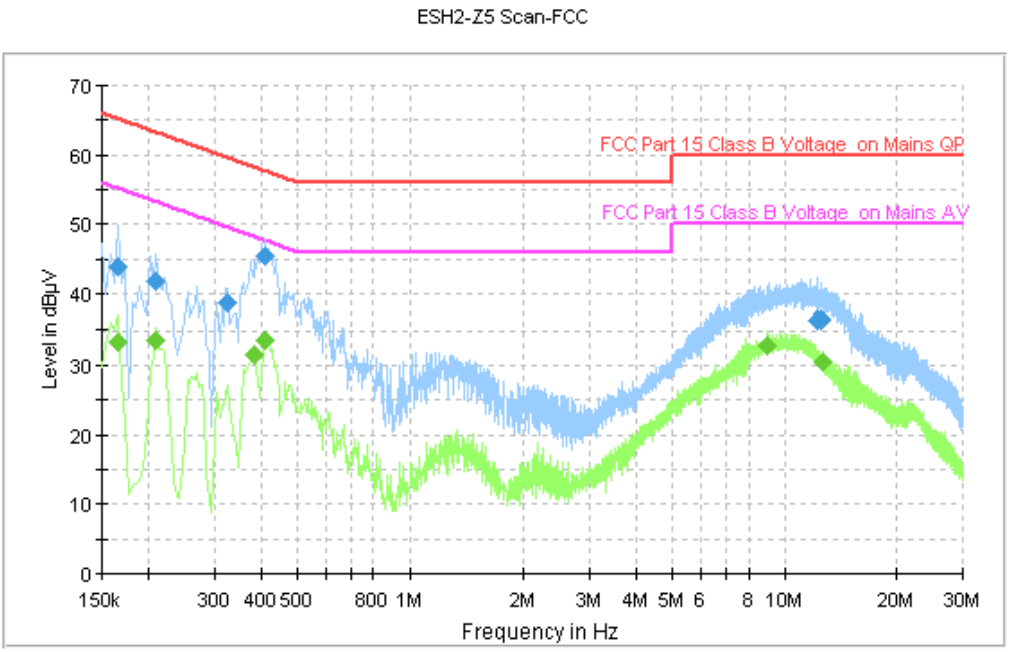
PCS1900MHz



Final Measurement Detector 1

Frequency (MHz)	QuasiPeak (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166000	43.8	FLO	L1	10.0	21.3	65.2
0.210000	42.0	FLO	N	10.1	21.3	63.2
0.326000	38.8	FLO	N	10.0	20.7	59.6
0.410000	45.6	FLO	N	10.1	12.1	57.6
12.186000	36.4	FLO	N	10.4	23.6	60.0
12.458000	36.4	FLO	N	10.4	23.6	60.0

Final Measurement Detector 2

Frequency (MHz)	Average (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.166000	33.2	FLO	L1	10.0	22.0	55.2
0.210000	33.5	FLO	N	10.1	19.7	53.2
0.386000	31.5	FLO	N	10.0	16.6	48.1
0.410000	33.5	FLO	N	10.1	14.2	47.6
8.946000	32.7	FLO	L1	10.3	17.3	50.0
12.610000	30.5	FLO	N	10.5	19.5	50.0

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A.4 FREQUENCY STABILITY

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℃.
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℃ increments from -30℃ to +50℃. 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℃.
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℃ to -30℃. 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℃ during the measurement procedure.

A.4.2 Measurement Limit

A.4.2.1 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.4.2.2 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

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nominal value for other than hand carried battery equipment.

A.4.3 Measurement results

GSM 850

Frequency Error vs Voltage

Voltage(V)	Frequency error(Hz)	Frequency error(ppm)
3.2	8	0.010
3.3	6	0.007
3.6	8	0.010

Frequency Error vs Temperature

temperature(℃)	Frequency error(Hz)	Frequency error(ppm)
-30	10	0.012
-20	9	0.011
-10	7	0.008
0	10	0.012
10	5	0.006
20	5	0.006
30	6	0.007
40	8	0.010
50	11	0.013

PCS 1900

Frequency Error vs Voltage

Voltage(V)	Frequency error(Hz)	Frequency error(ppm)
3.2	8	0.004
3.3	6	0.003
3.6	12	0.006

Frequency Error vs Temperature

temperature(℃)	Frequency error(Hz)	Frequency error(ppm)
-30	14	0.007
-20	11	0.006
-10	8	0.004
0	6	0.003
10	6	0.003
20	7	0.004
30	8	0.004
40	10	0.005
50	12	0.006

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A.5 OCCUPIED BANDWIDTH

A.5.1 Occupied Bandwidth Results

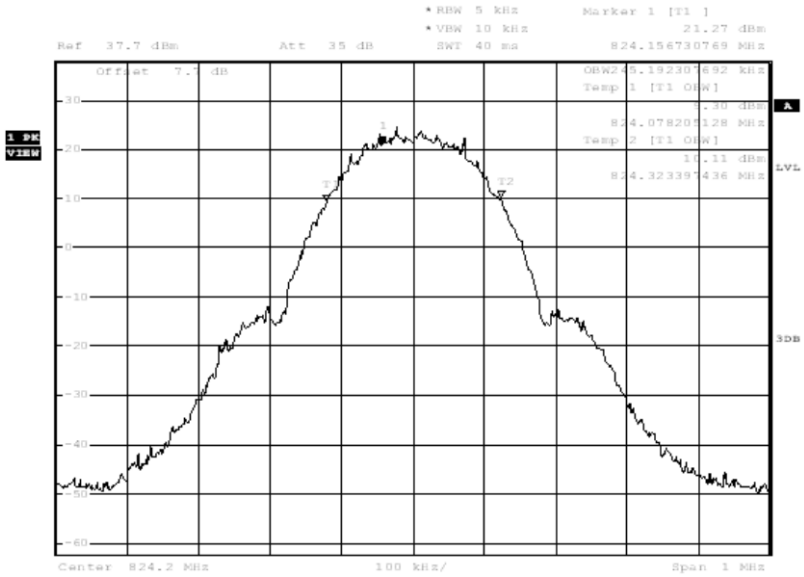
Similar to conducted emissions; occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of PCS1900 band and GSM850 band. Spectrum analyzer plots are included on the following pages.

GPRS 850

Frequency(MHz)	Occupied Bandwidth (kHz)
824.2	245.19
836.6	246.79
848.8	245.19

GPRS 850

Channel 128-Occupied Bandwidth



Date: 15.DEC.2014 18:13:07

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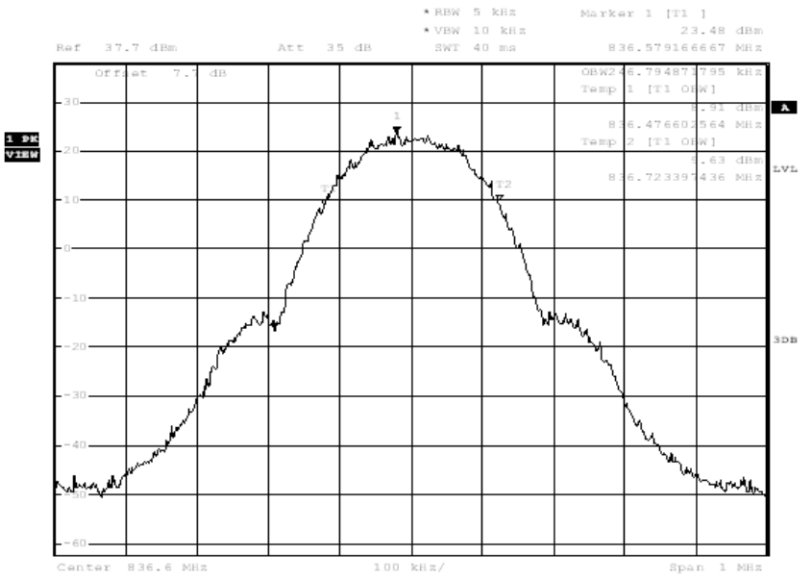
Channel 190-Occupied Bandwidth



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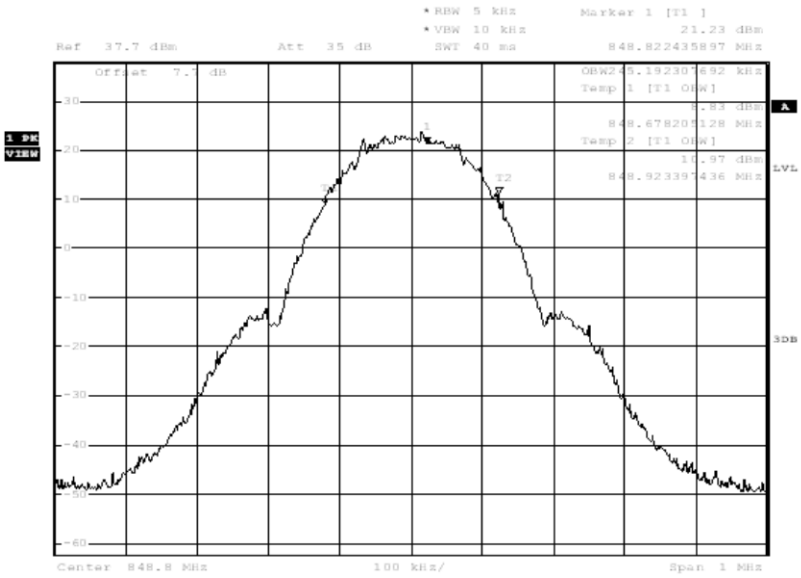
Channel 251-Occupied Bandwidth



Date: 15.DEC.2014 18:15:28

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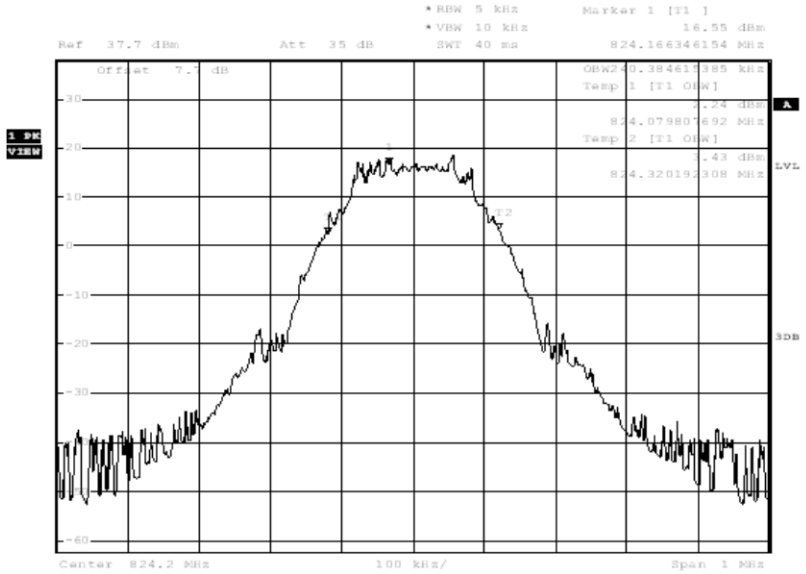
EGPRS 850

Frequency(MHz)	Occupied Bandwidth (kHz)
824.2	240.38
836.6	241.99
848.8	240.38

EGPRS 850

Channel 128-Occupied Bandwidth



Date: 15.DEC.2014 18:49:04

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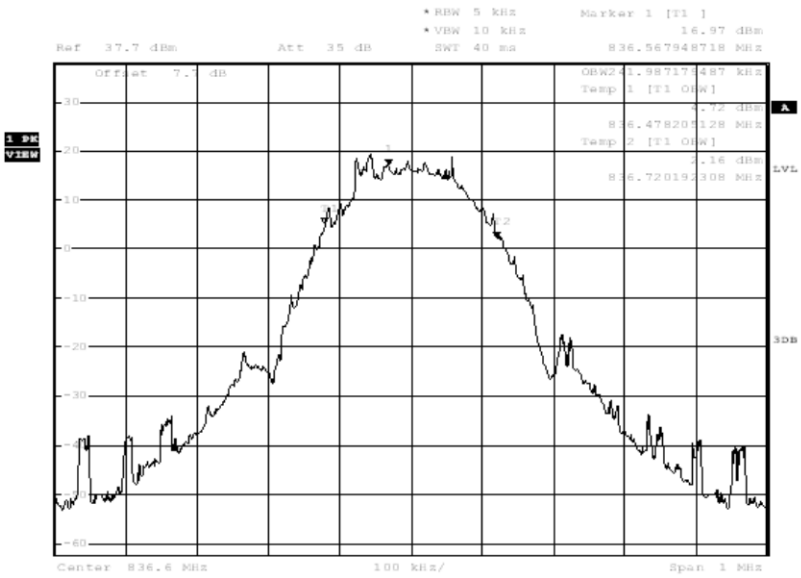
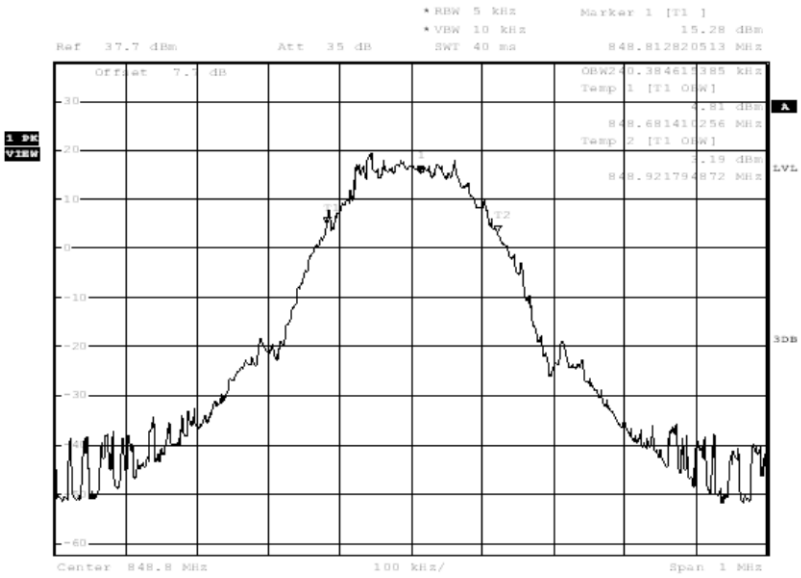
Channel 190-Occupied Bandwidth



Date: 15.DEC.2014 18:50:15

Channel 251-Occupied Bandwidth



Date: 15.DEC.2014 18:51:25

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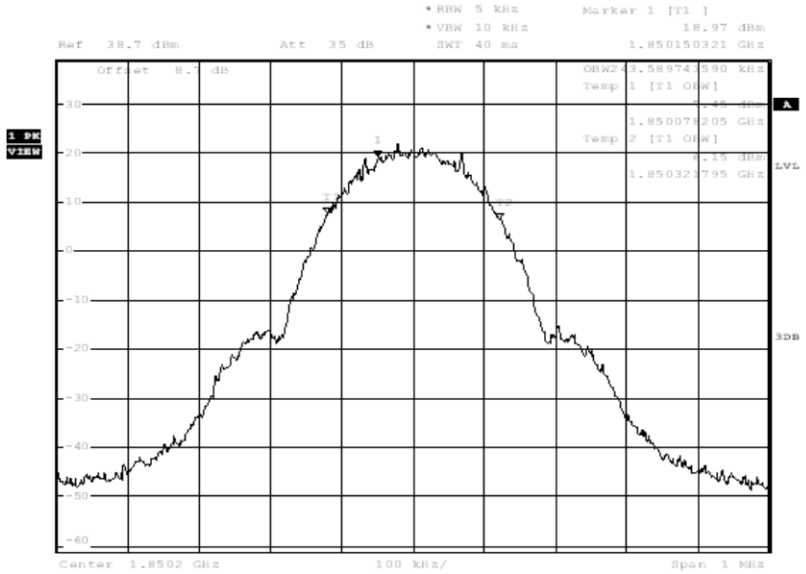
GPRS 1900

Frequency(MHz)	Occupied Bandwidth (kHz)
1850.2	243.19
1880.0	243.19
1909.8	245.19

GPRS 1900

Channel 512-Occupied Bandwidth



Date: 15.DEC.2014 19:05:17

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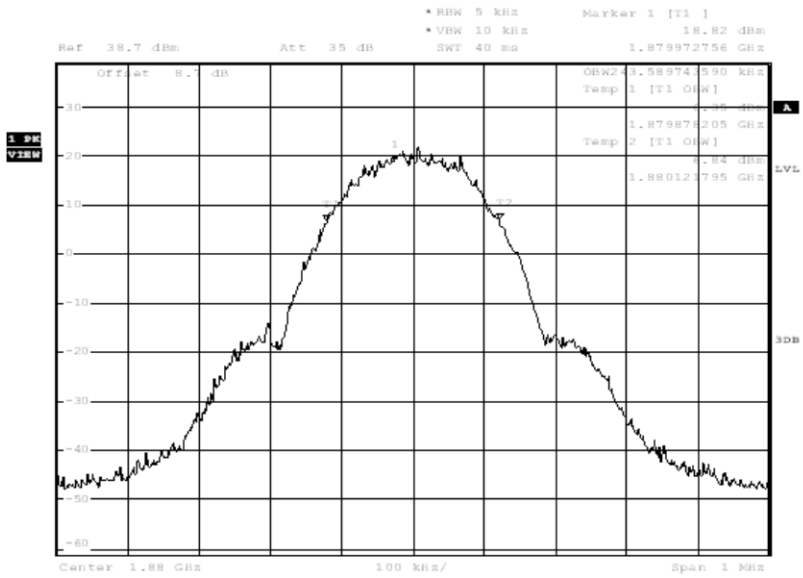
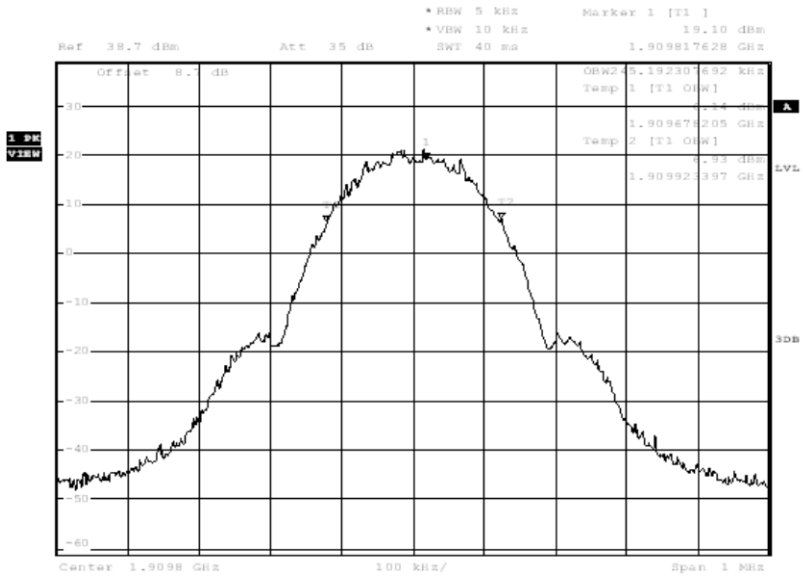
Channel 661-Occupied Bandwidth



Date: 15.DEC.2014 19:06:27

Channel 810-Occupied Bandwidth



Date: 15.DEC.2014 19:07:38

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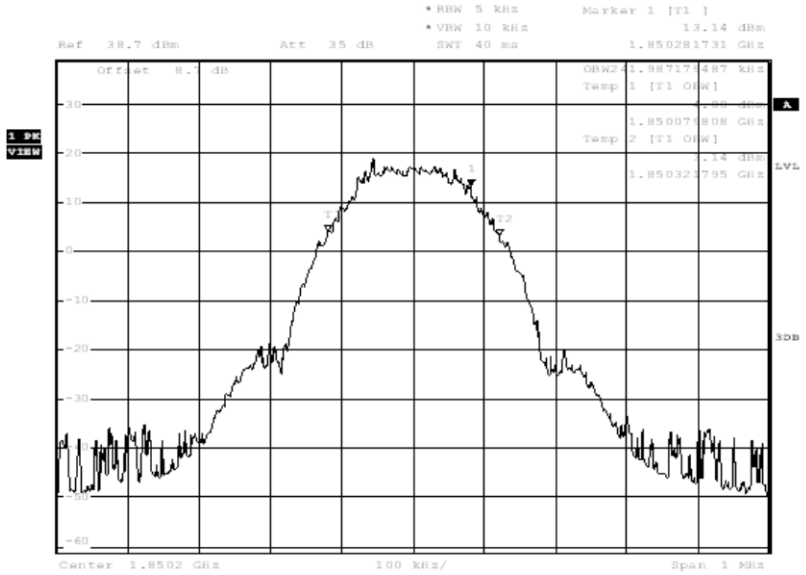
EGPRS 1900

Frequency(MHz)	Occupied Bandwidth (kHz)
1850.2	241.99
1880.0	243.59
1909.8	243.59

Channel 512-Occupied Bandwidth



Date: 15.DEC.2014 19:22:02

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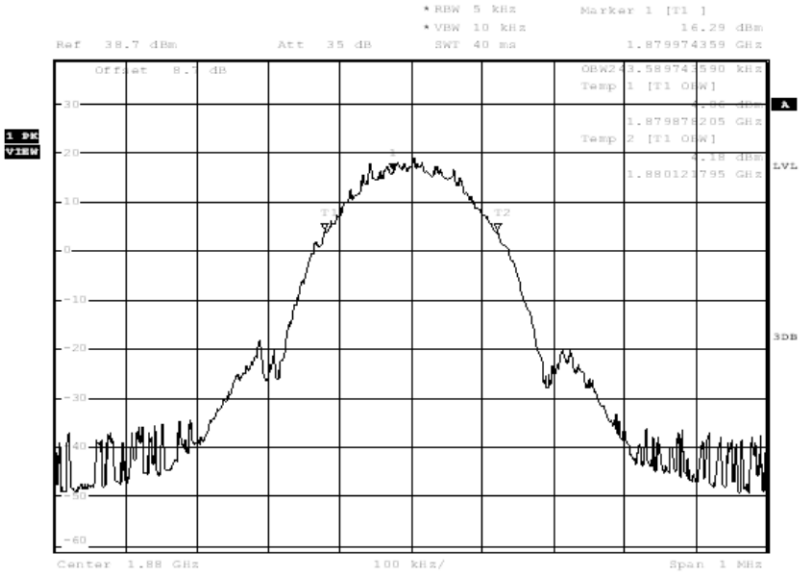
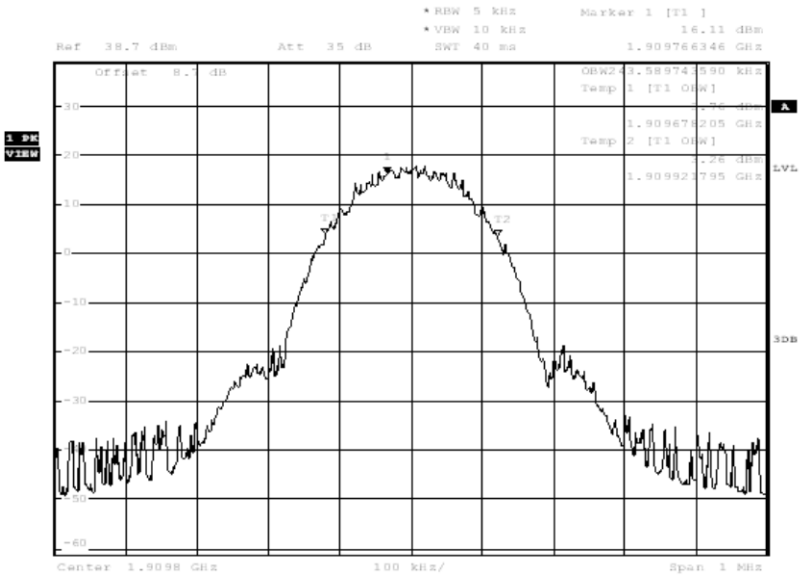
Channel 661-Occupied Bandwidth



Date: 15.DEC.2014 19:34:14

Channel 810-Occupied Bandwidth



Date: 15.DEC.2014 19:35:25

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A.6 EMISSION BANDWIDTH

A.6.1Emission Bandwidth Results

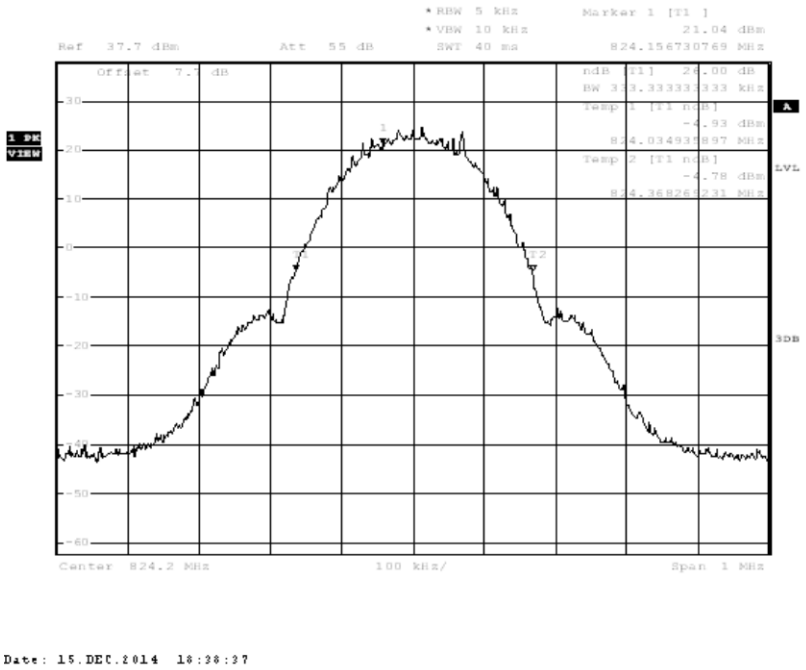
Similar to conducted emissions; Emission bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of PCS1900 band and GSM850 band. Table below lists the measured -26dBc BW. Spectrum analyzer plots are included on the following pages.

GPRS 850(-26dBc)

Frequency(MHz)	Occupied Bandwidth (–26dBc BW)(kHz)
824.2	333.33
836.6	325.32
848.8	328.53

GPRS 850

Channel 128-Occupied Bandwidth (-26dBc BW)



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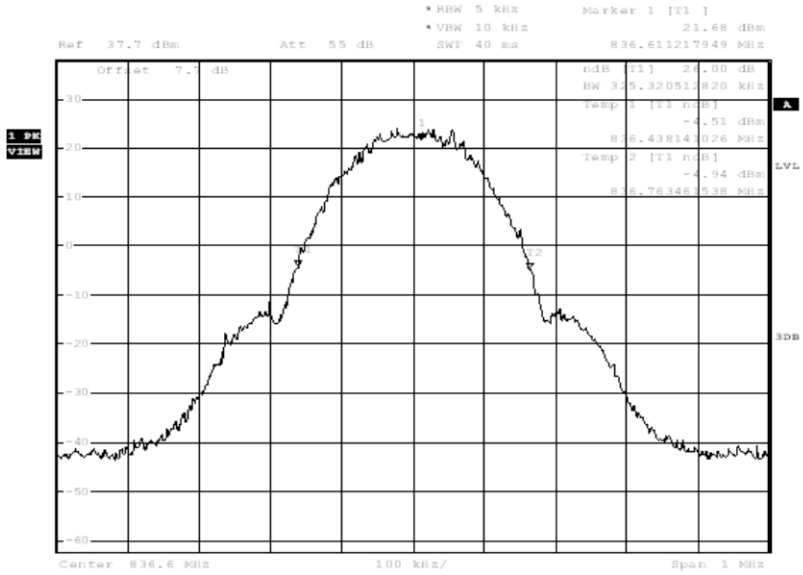
Channel 190-Occupied Bandwidth (-26dBc BW)



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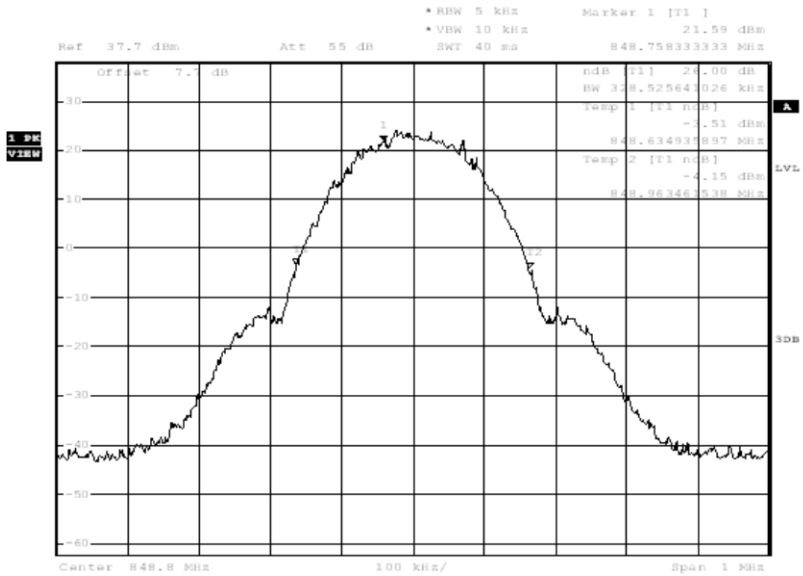
Channel 251-Occupied Bandwidth (-26dBc BW)



Date: 15.DEC.2014 18:41:03

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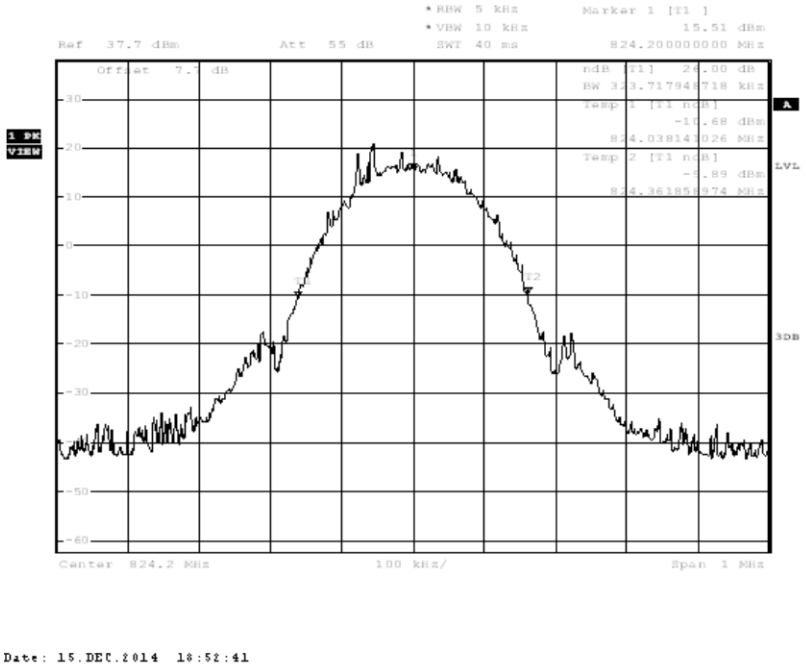
EGPRS 850(-26dBc)

Frequency(MHz)	Occupied Bandwidth (–26dBc BW)(kHz)
824.2	323.72
836.6	322.12
848.8	325.32

EGPRS 850

Channel 128-Occupied Bandwidth (-26dBc BW)



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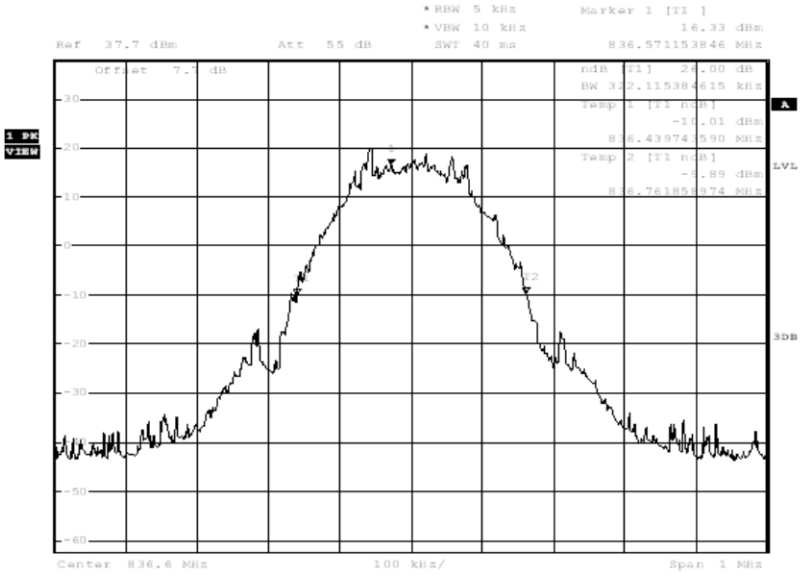
Channel 190-Occupied Bandwidth (-26dBc BW)



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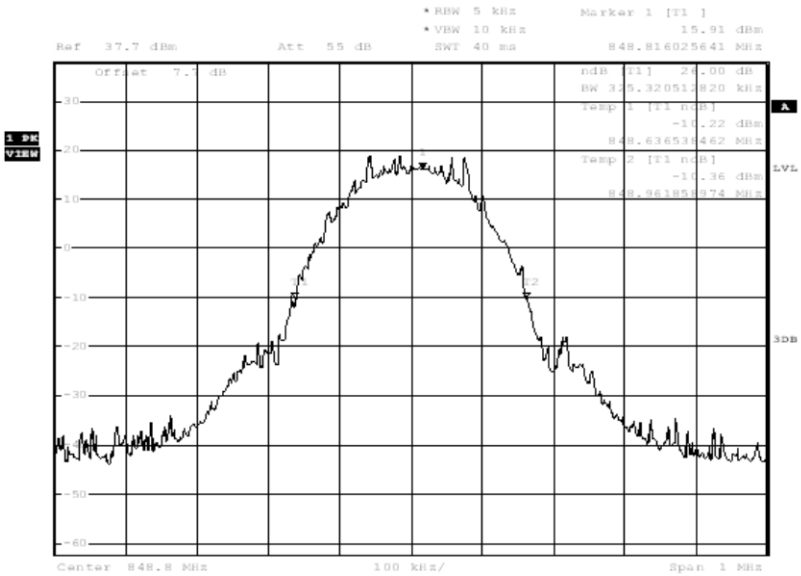
Channel 251-Occupied Bandwidth (-26dBc BW)



Date: 15.DEC.2014 18:55:08

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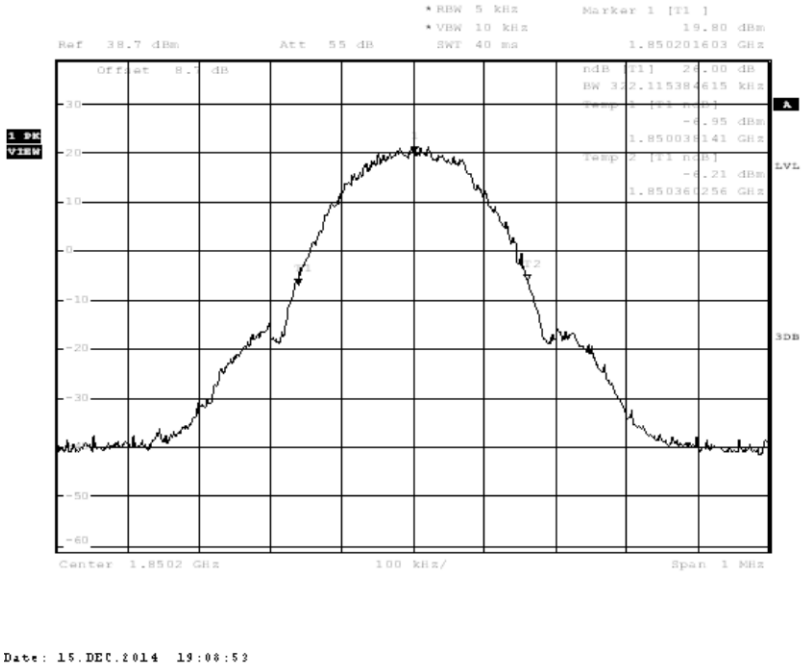
GPRS 1900(-26dBc)

Frequency(MHz)	Occupied Bandwidth (–26dBc BW)(kHz)
1850.2	322.12
1880.0	325.32
1909.8	330.13

GPRS 1900

Channel 512-Occupied Bandwidth (-26dBc BW)



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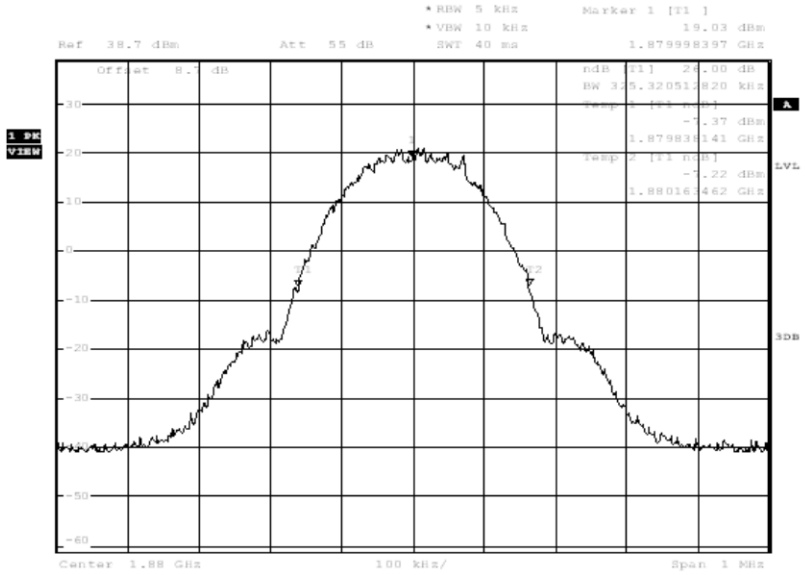
Channel 661-Occupied Bandwidth (-26dBc BW)



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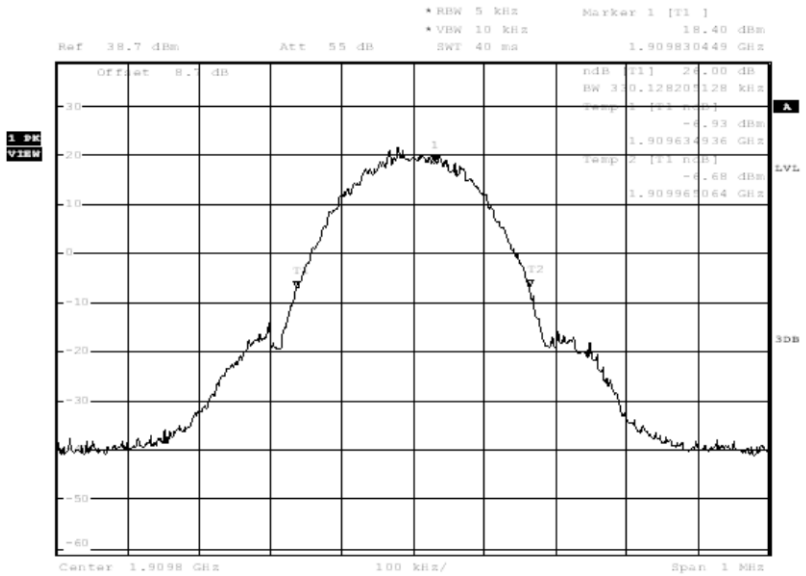
Channel 810-Occupied Bandwidth (-26dBc BW)



Date: 15.DEC.2014 19:11:19

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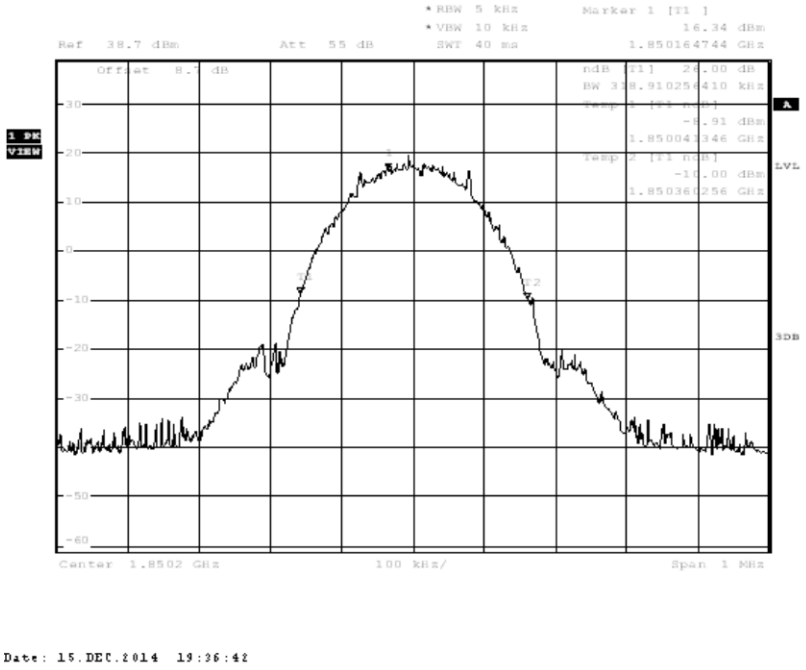
EGPRS 1900(-26dBc)

Frequency(MHz)	Occupied Bandwidth (–26dBc BW)(kHz)
1850.2	318.91
1880.0	320.51
1909.8	320.51

EGPRS 1900

Channel 512-Occupied Bandwidth (-26dBc BW)



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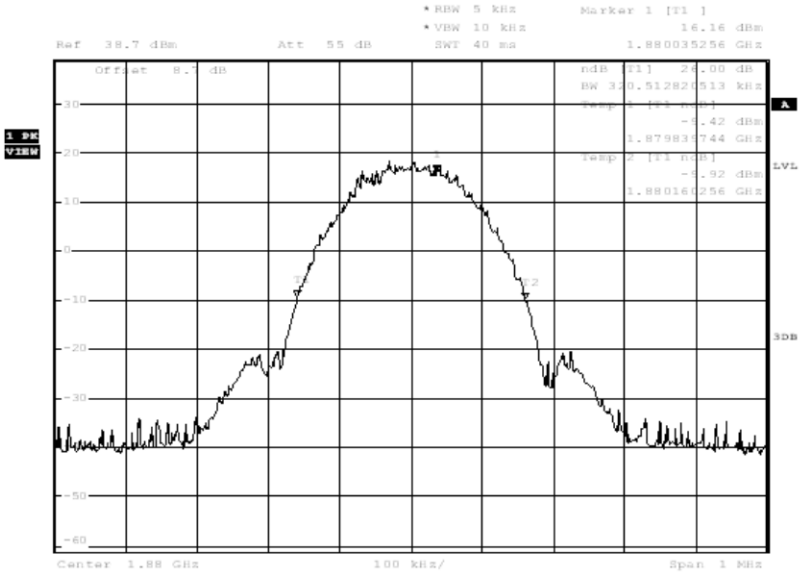
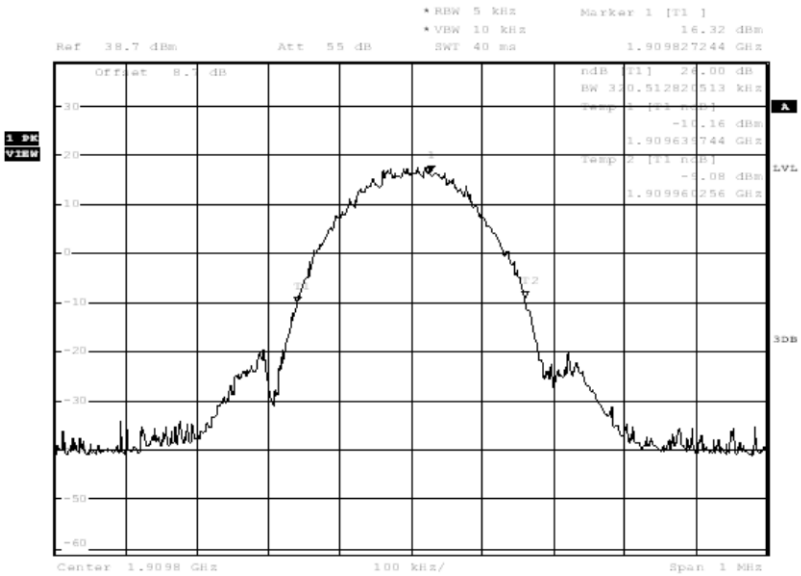
Channel 661-Occupied Bandwidth (-26dBc BW)



Date: 15.DEC.2014 19:37:55

Channel 810-Occupied Bandwidth (-26dBc BW)



Date: 15.DEC.2014 19:39:07

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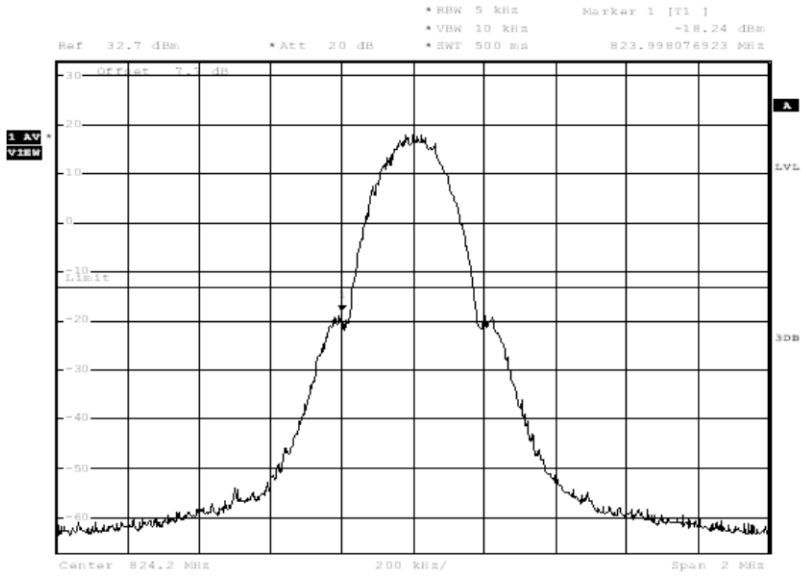
A.7 BAND EDGE COMPLIANCE

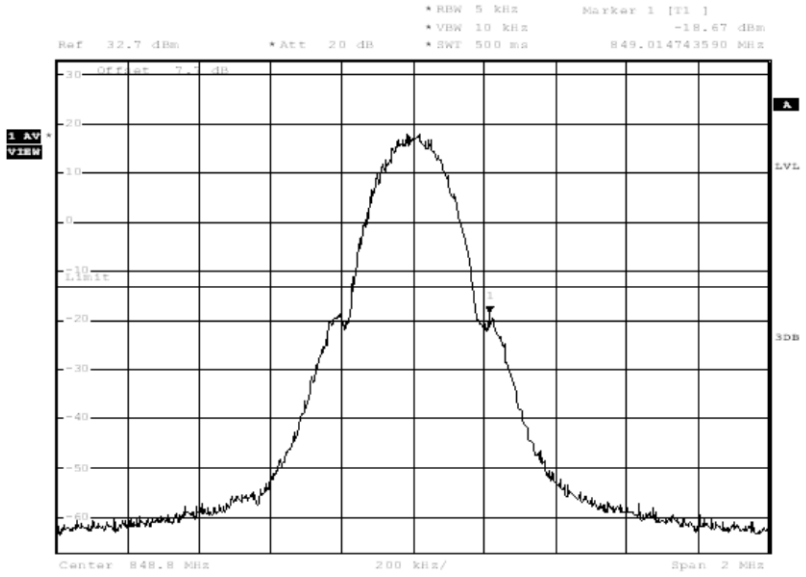
GPRS 850

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



Date: 15.DEC.2014 18:21:00

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



Date: 15.DEC.2014 18:22:48

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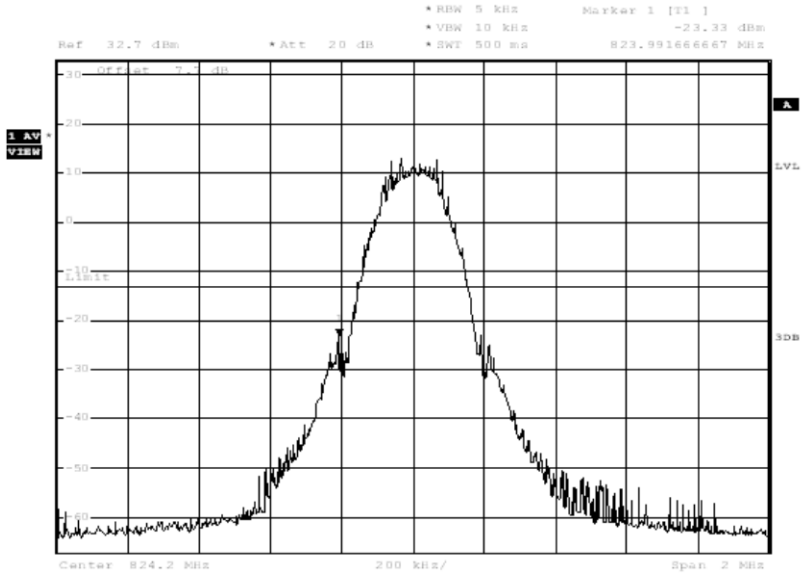
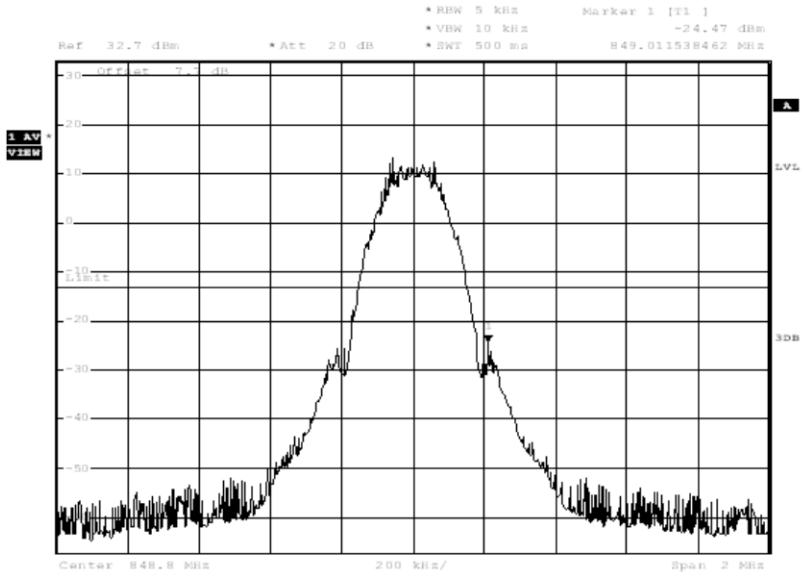
EGPRS 850

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



Date: 15.DEC.2014 18:56:58

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



Date: 15.DEC.2014 18:58:46

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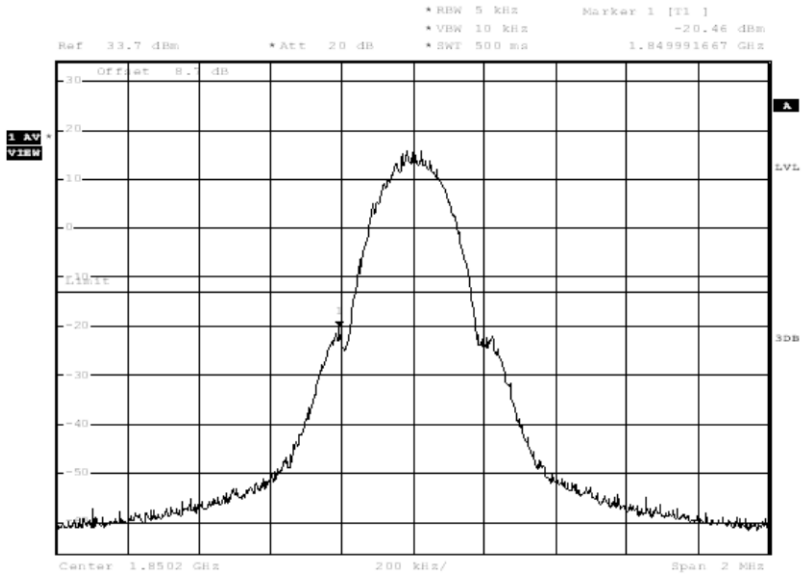
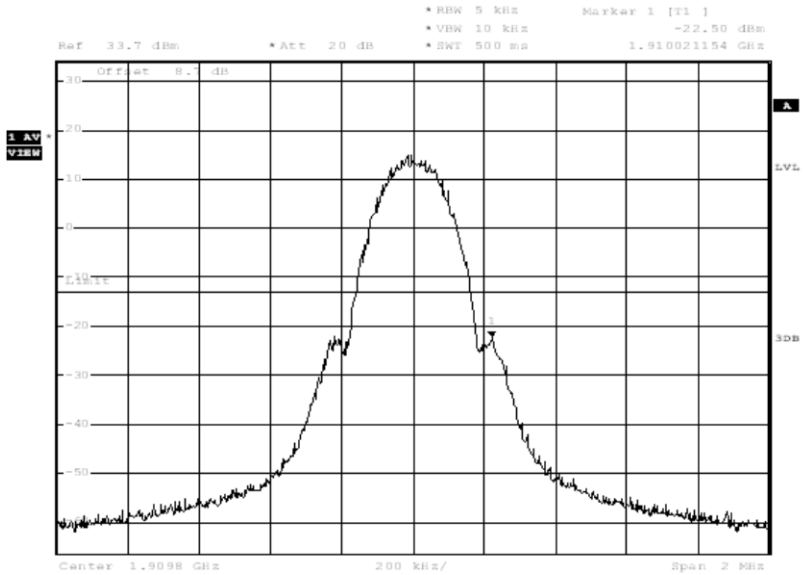
GPRS 1900

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



Date: 15.DEC.2014 19:13:10

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



Date: 15.DEC.2014 19:14:57

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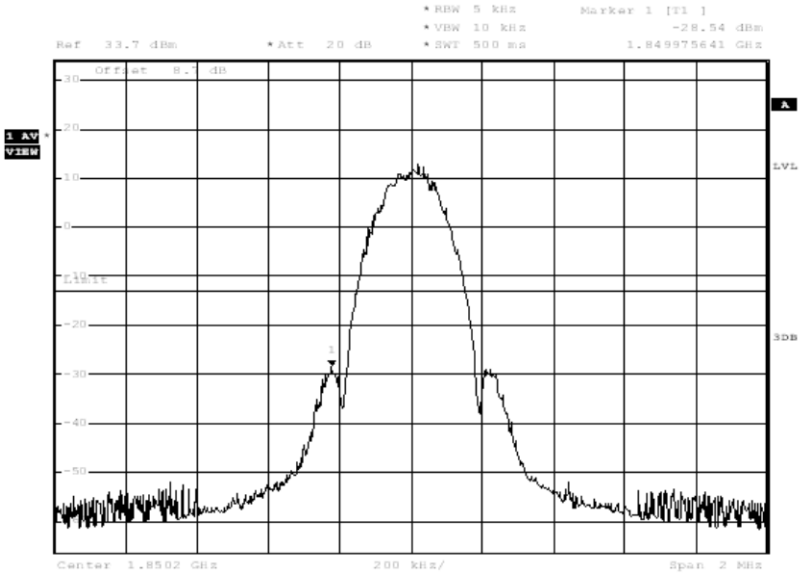
EGPRS 1900

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



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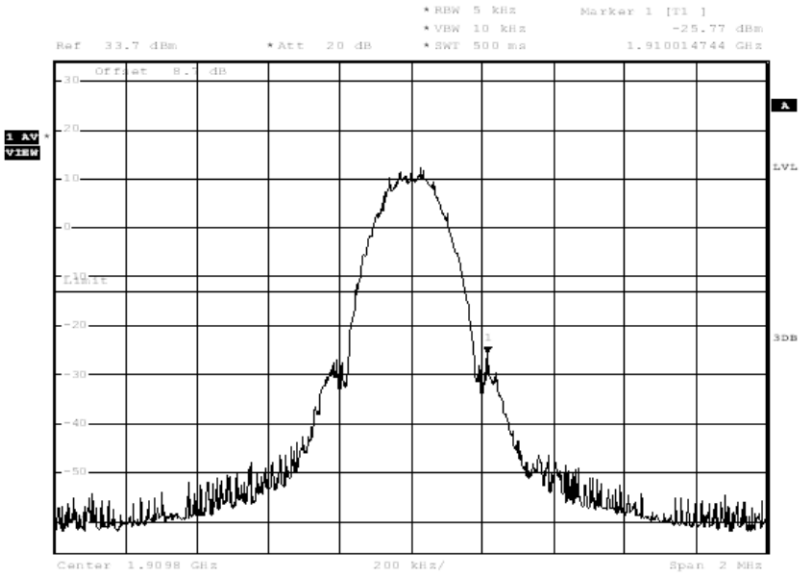
HIGH BAND EDGE BLOCK-C (PCS-1900) –Channel 810



Date: 15.DEC.2014 19:42:46

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A.8 CONDUCTED SPURIOUS EMISSION

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 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. 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.

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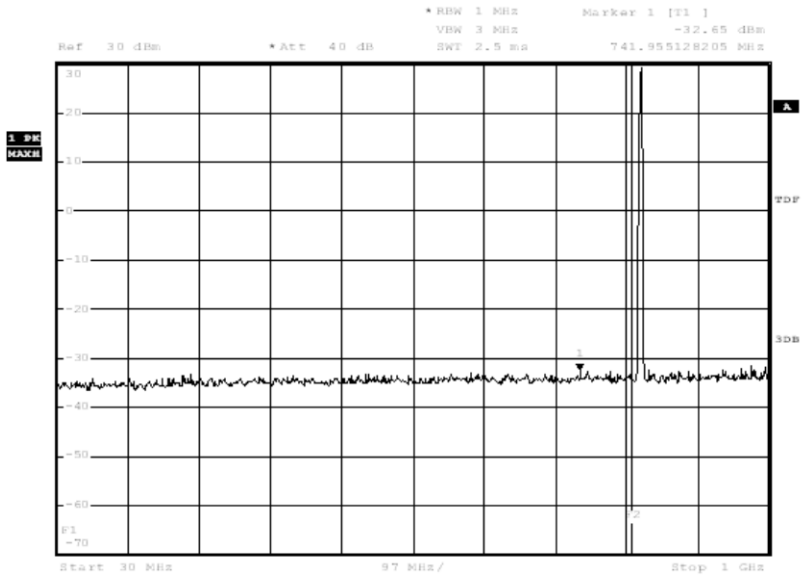
A. 8.3 Measurement result

GSM850

A.8.3.1 Channel 128: 30MHz – 1GHz

Spurious emission limit –13dBm.

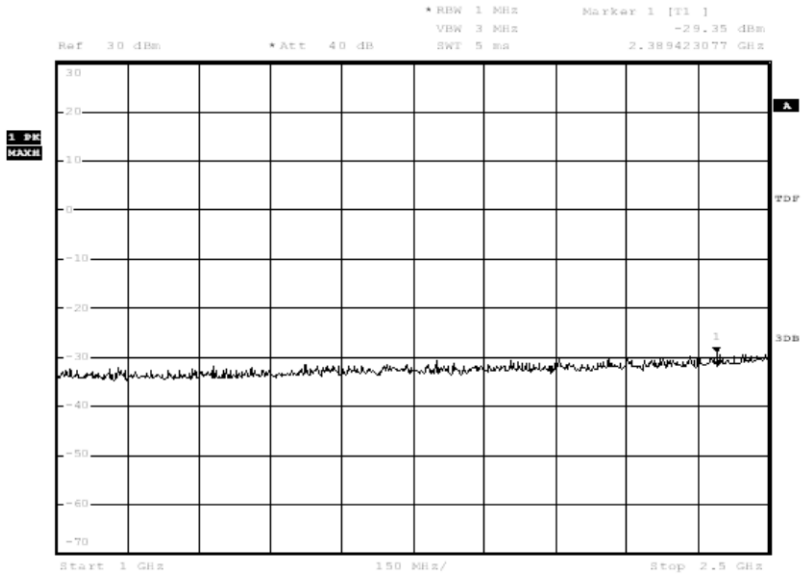
NOTE: peak above the limit line is the carrier frequency.



Date: 15.DEC.2014 18:23:10

A.8.3.2 Channel 128: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



Date: 15.DEC.2014 18:23:28

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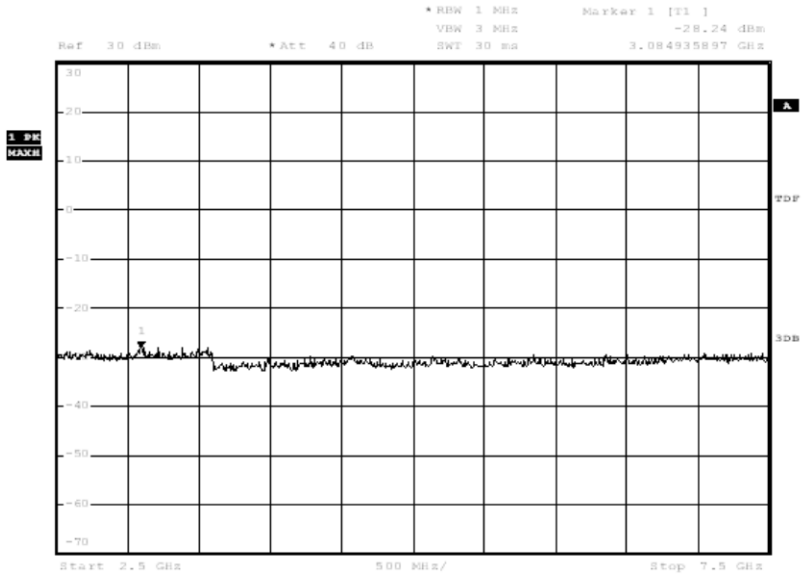
A.8.3.3 Channel 128: 2.5GHz – 7.5GHz

Spurious emission limit –13dBm.



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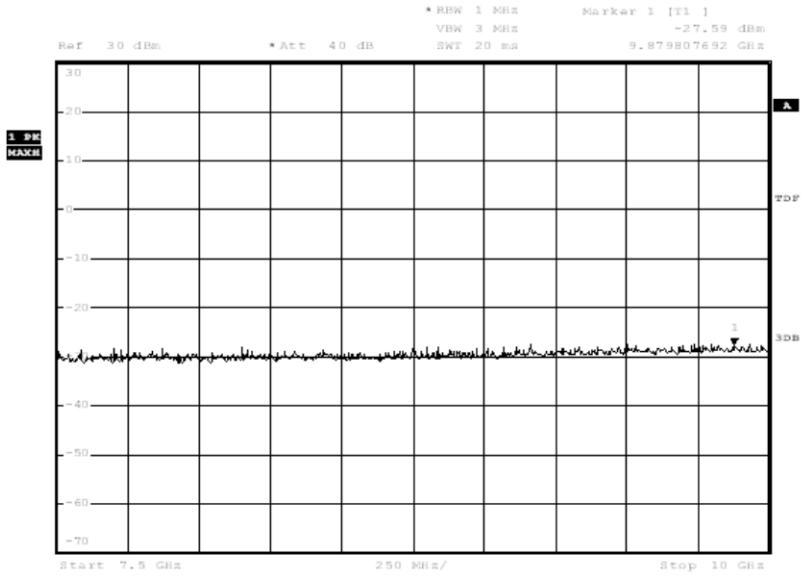
A.8.3.4 Channel 128: 7.5GHz –10GHz

Spurious emission limit –13dBm.



Date: 15.DEC.2014 18:24:03

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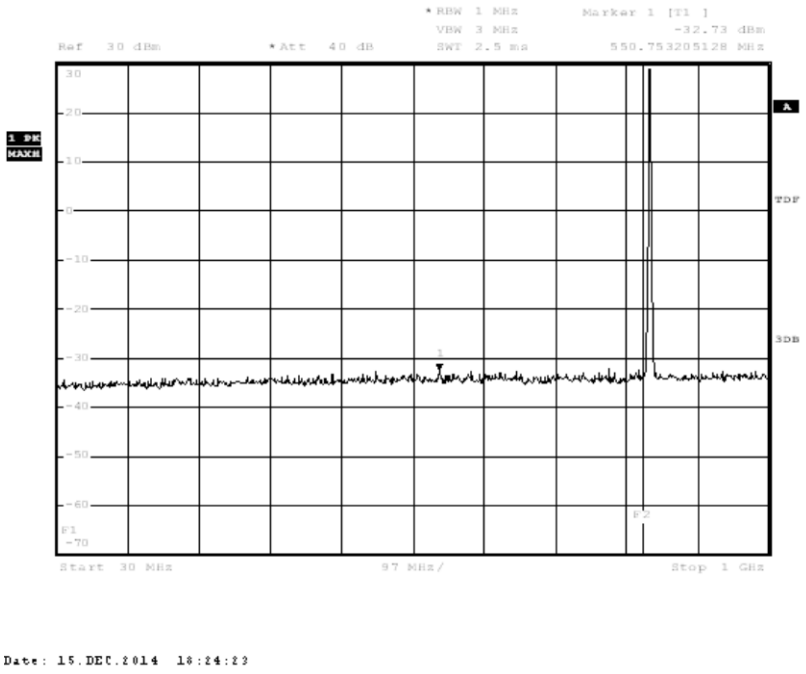
A.8.3.5 Channel 190: 30MHz – 1GHz

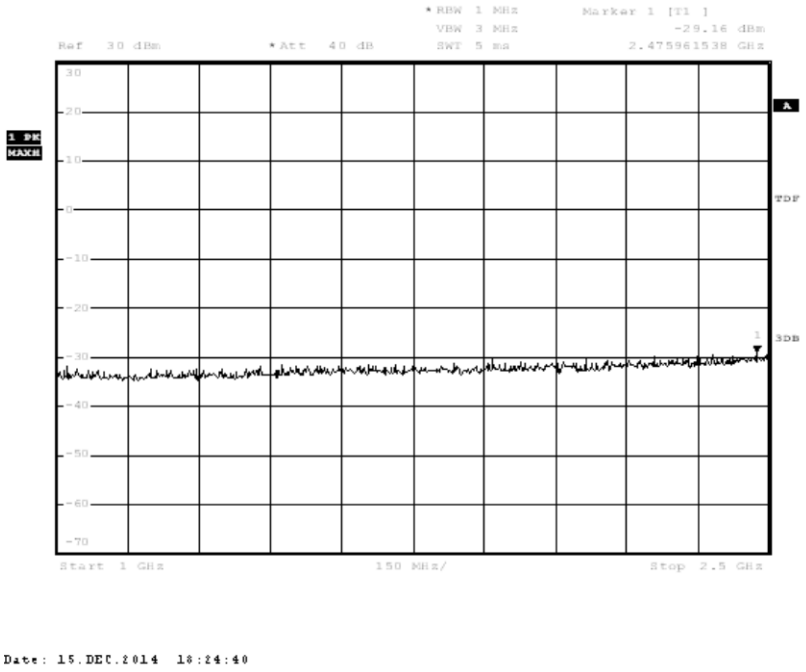
Spurious emission limit –13dBm

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



A.8.3.6 Channel 190: 1GHz –2.5GHz

Spurious emission limit –13dBm



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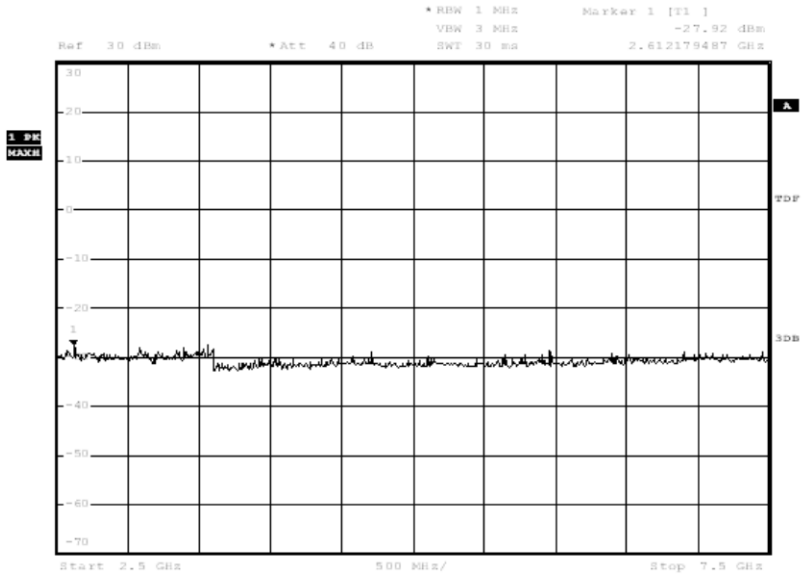
A.8.3.7 Channel 190: 2.5GHz –7.5GHz

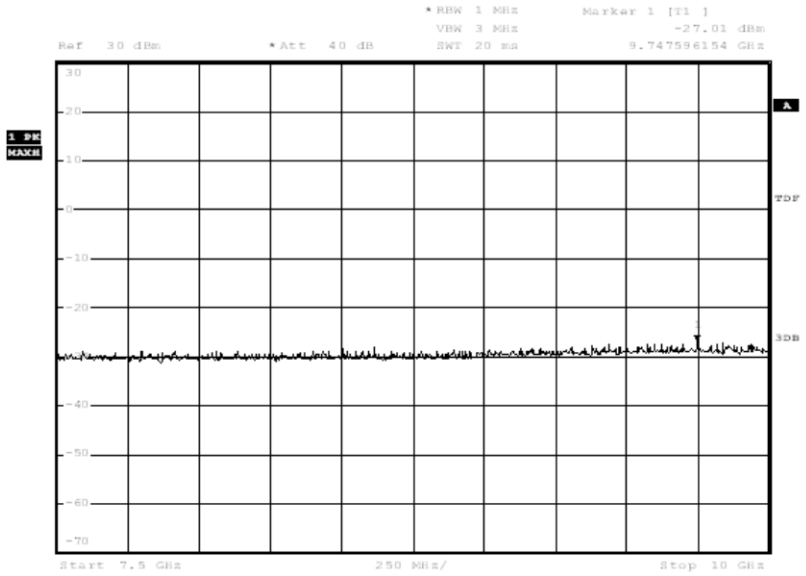
Spurious emission limit –13dBm



Date: 15.DEC.2014 18:24:58

A.8.3.8 Channel 190: 7.5GHz –10GHz

Spurious emission limit –13dBm



Date: 15.DEC.2014 18:25:15

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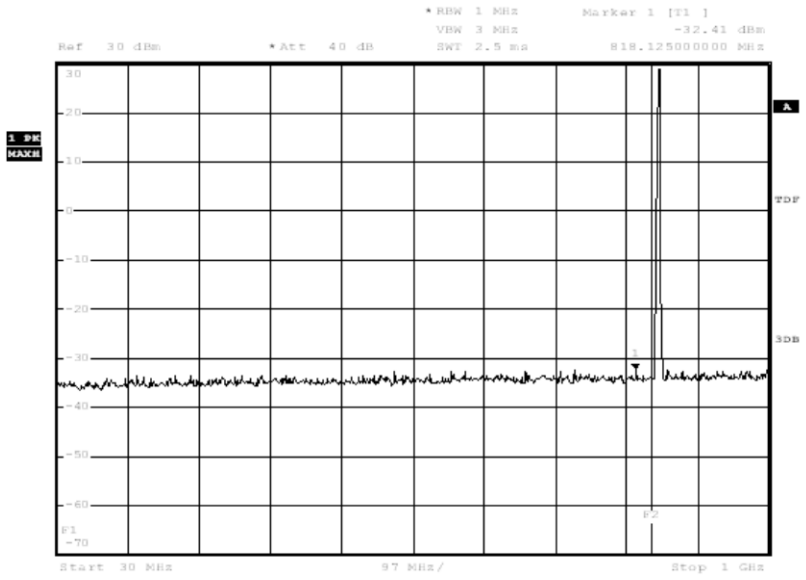
A.8.3.9 Channel 251: 30MHz – 1GHz

Spurious emission limit –13dBm.

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



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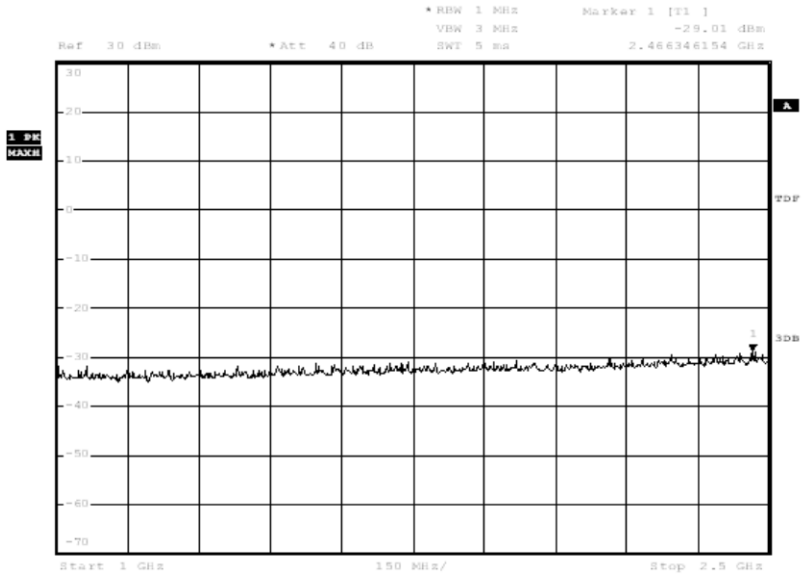
A.8.3.10 Channel 251: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



Date: 15.DEC.2014 18:25:53

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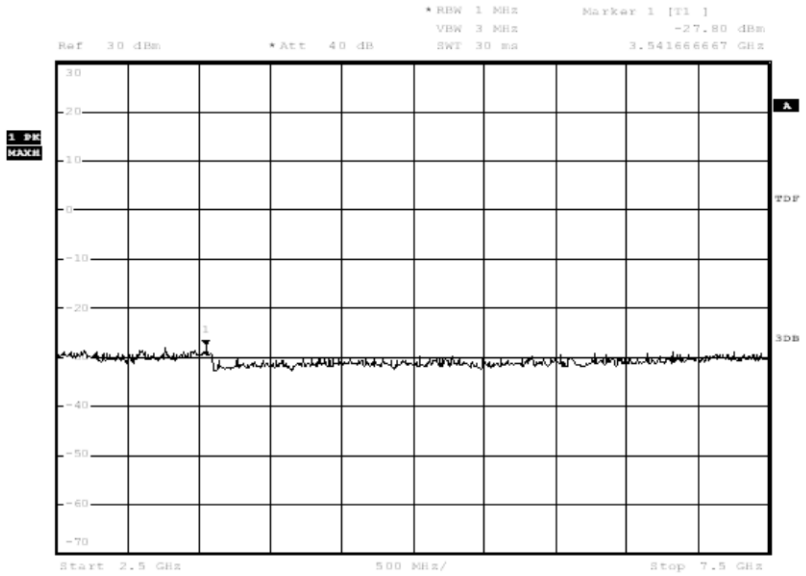
A.8.3.11 Channel 251:2.5GHz – 7.5GHz

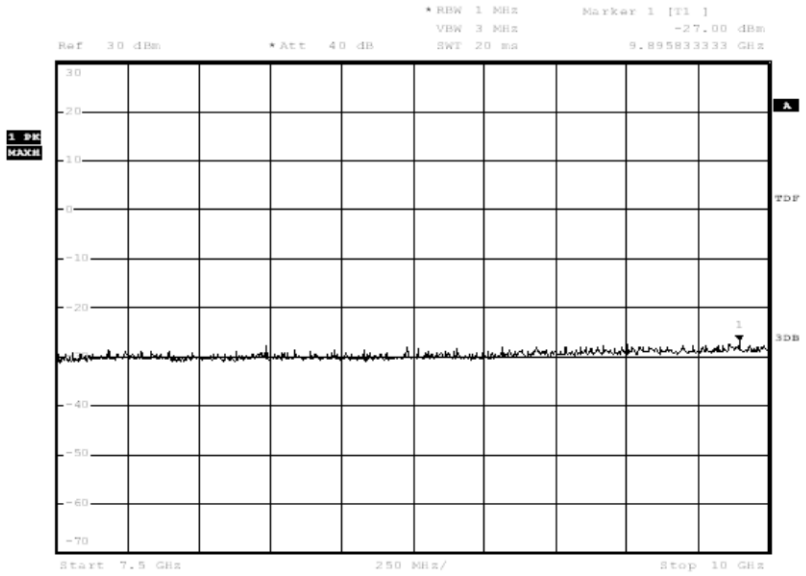
Spurious emission limit –13dBm.



Date: 15.DEC.2014 18:26:10

A.8.3.12 Channel 251: 7.5GHz – 10GHz

Spurious emission limit –13dBm.



Date: 15.DEC.2014 18:26:28

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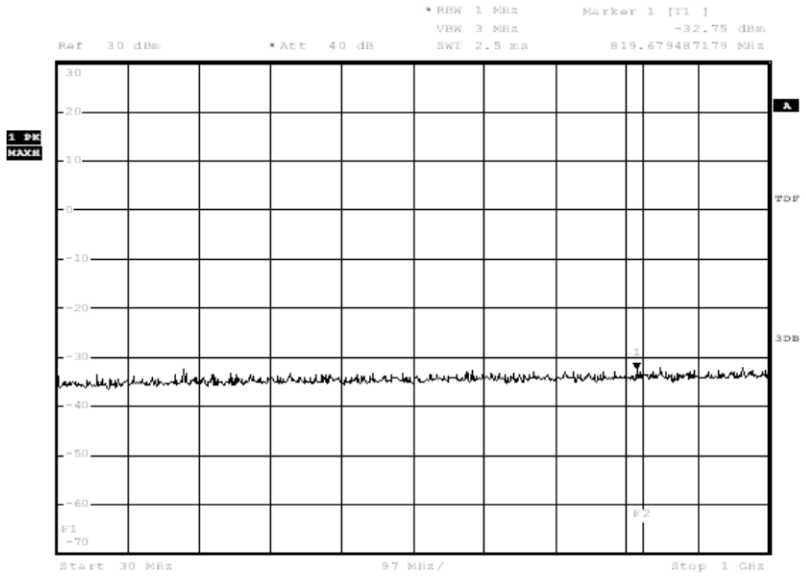
A.8.3.13 Idle mode: 30MHz – 1GHz

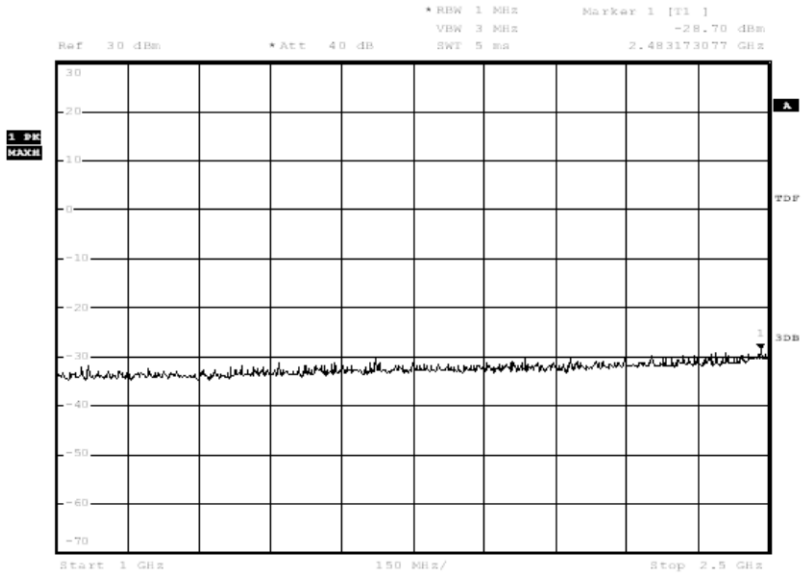
Spurious emission limit –13dBm.



Date: 15.DEC.2014 18:28:20

A.8.3.14 Idle mode: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



Date: 15.DEC.2014 18:28:28

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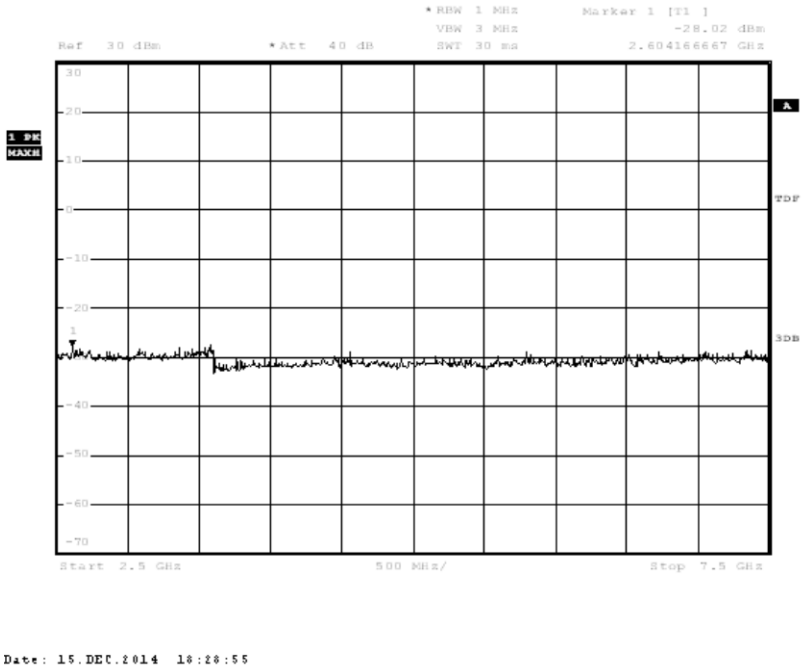
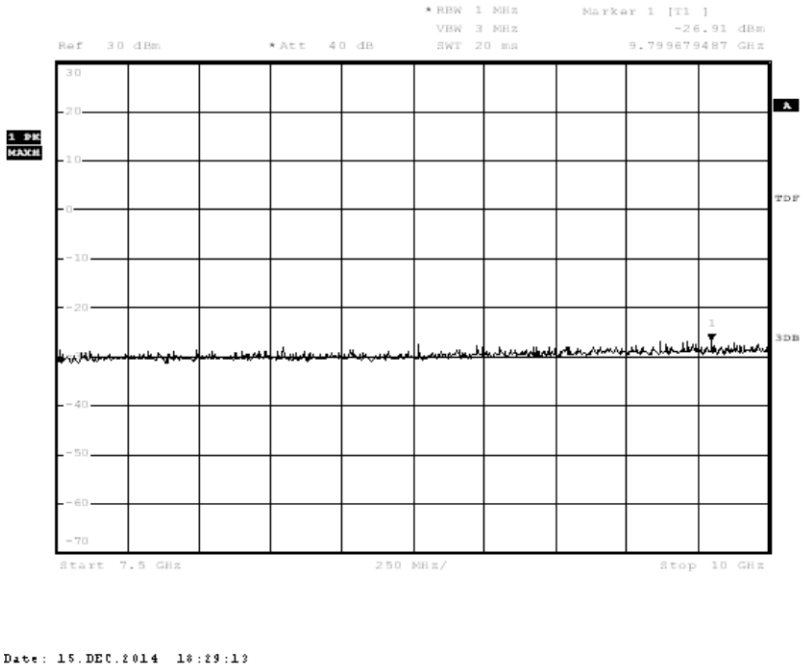
A.8.3.15 Idle mode: 2.5GHz – 7.5GHz

Spurious emission limit –13dBm.



A.8.3.16 Idle mode: 7.5GHz – 10GHz

Spurious emission limit –13dBm.



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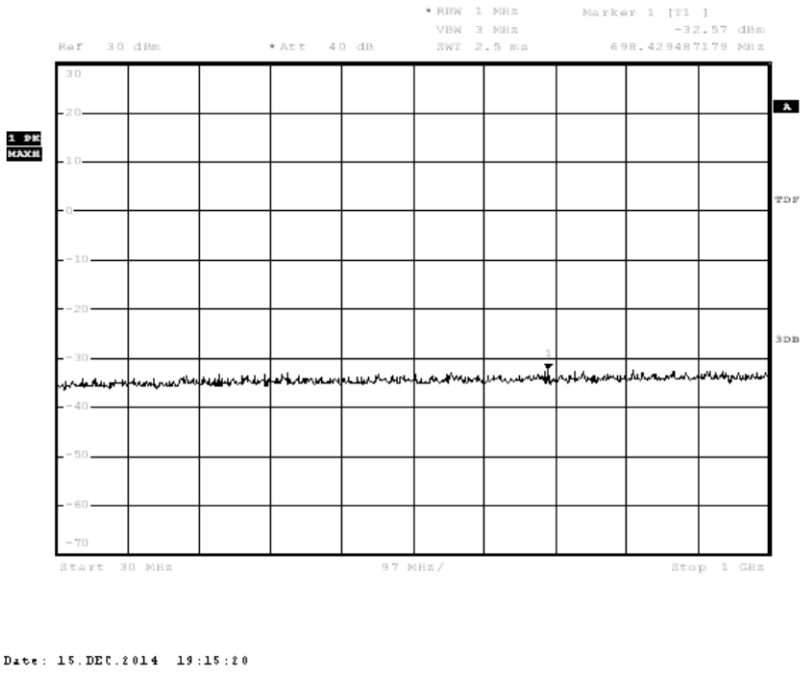
PCS1900

A.8.3.17 Channel 512: 30MHz – 1GHz

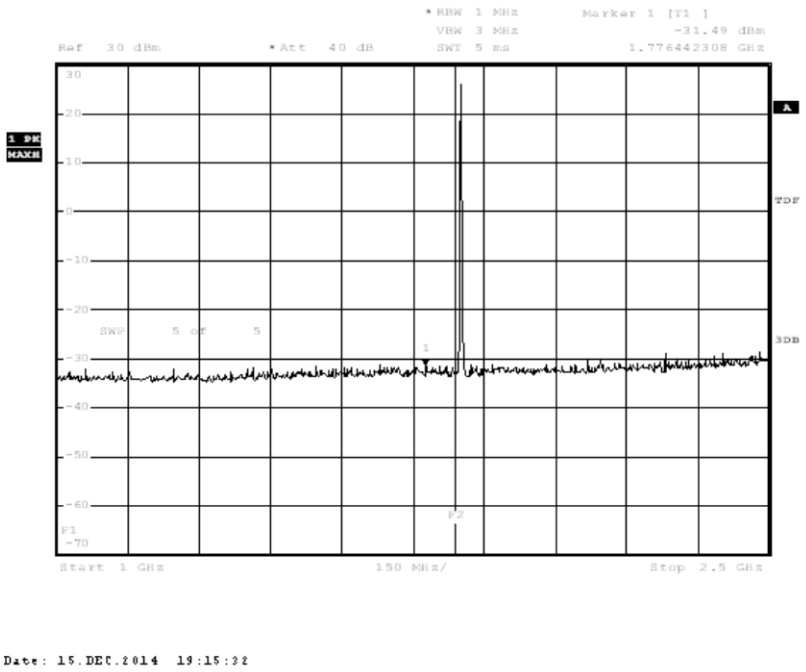
Spurious emission limit –13dBm.



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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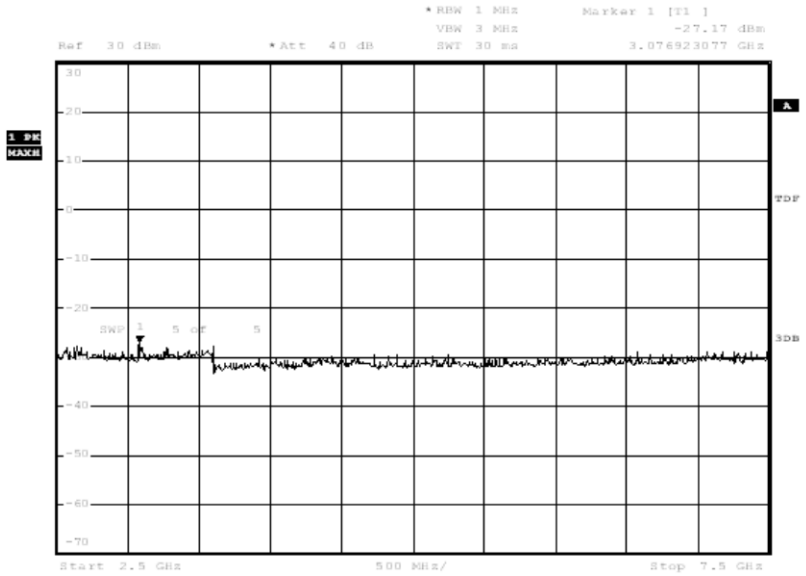
A.8.3.19 Channel 512: 2.5GHz – 7.5GHz

Spurious emission limit –13dBm.



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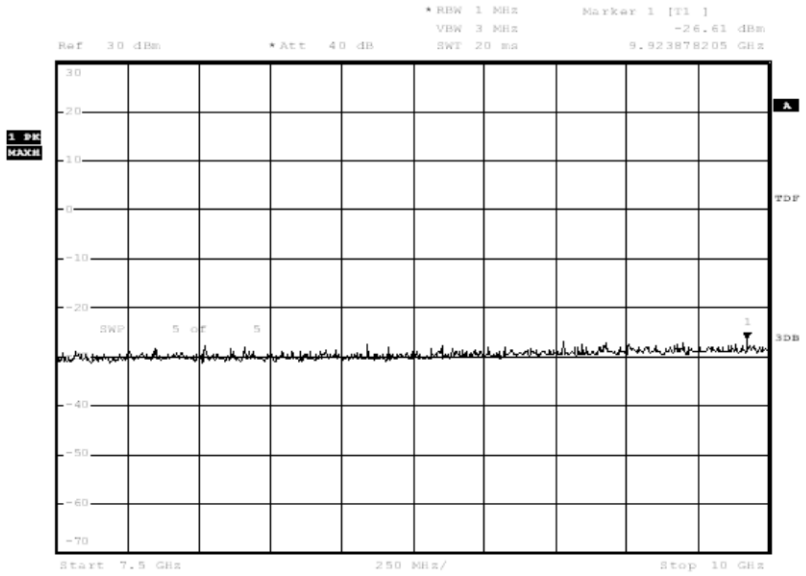
A.8.3.20 Channel 512: 7.5GHz –10GHz

Spurious emission limit –13dBm.



Date: 15.DEC.2014 19:16:08

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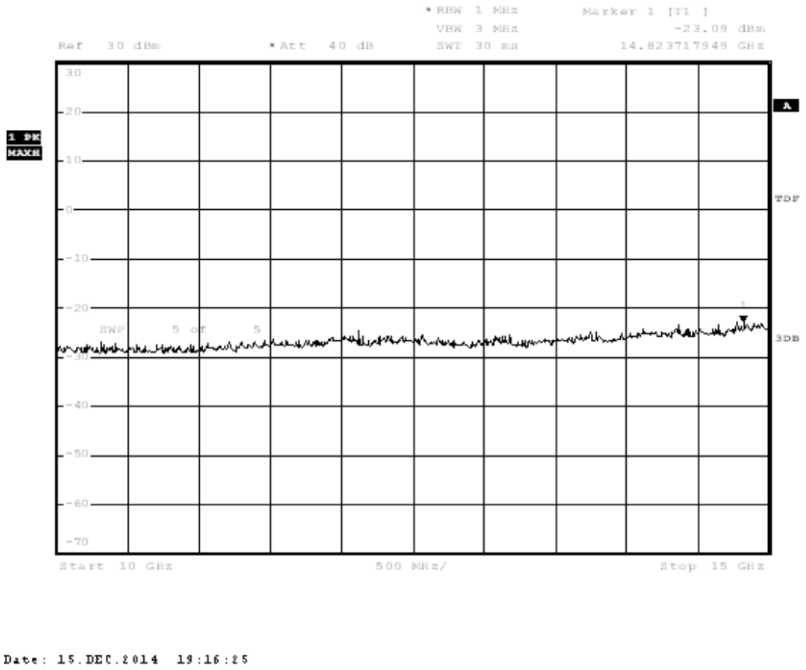
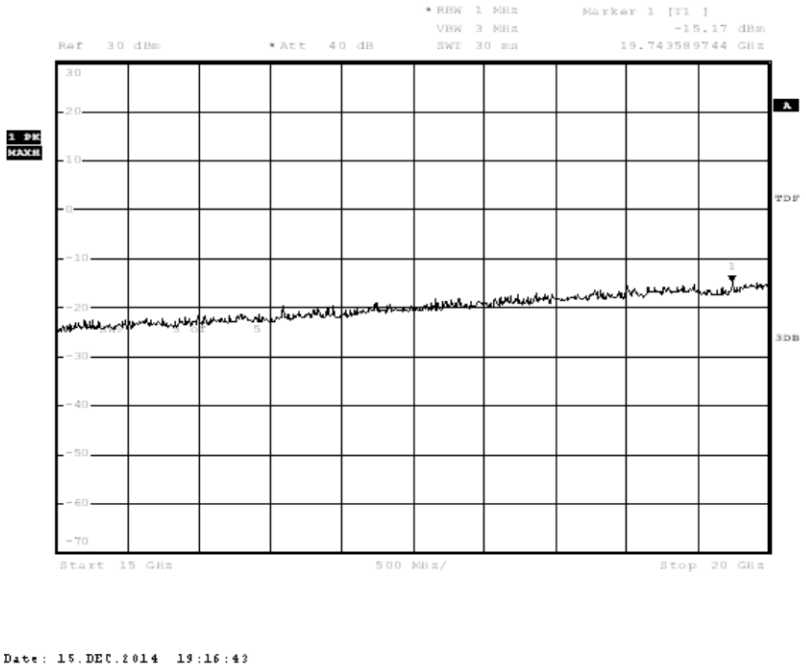
A.8.3.21 Channel 512: 10GHz –15GHz

Spurious emission limit –13dBm.



A.8.3.22 Channel 512: 15GHz –20GHz

Spurious emission limit –13dBm.



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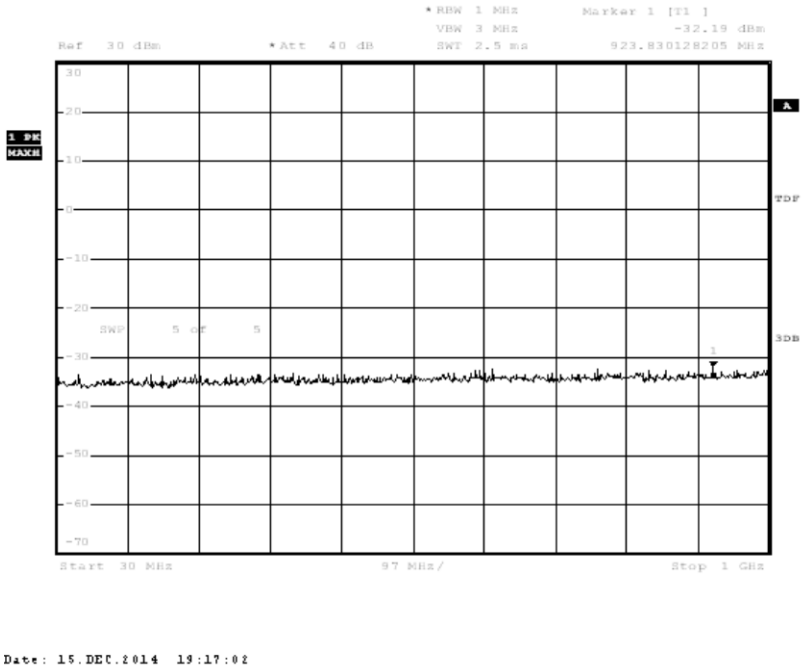
A.8.3.23 Channel 661: 30MHz – 1GHz

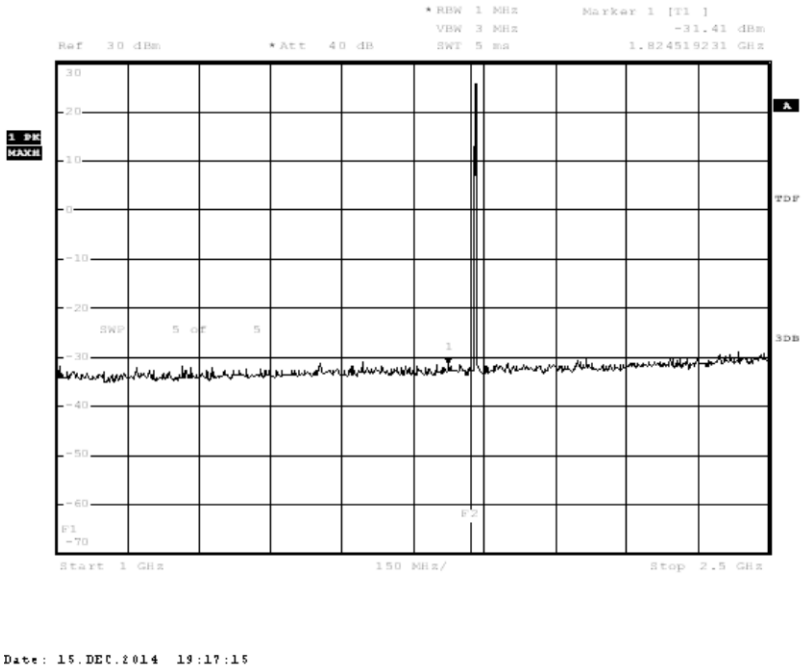
Spurious emission limit –13dBm



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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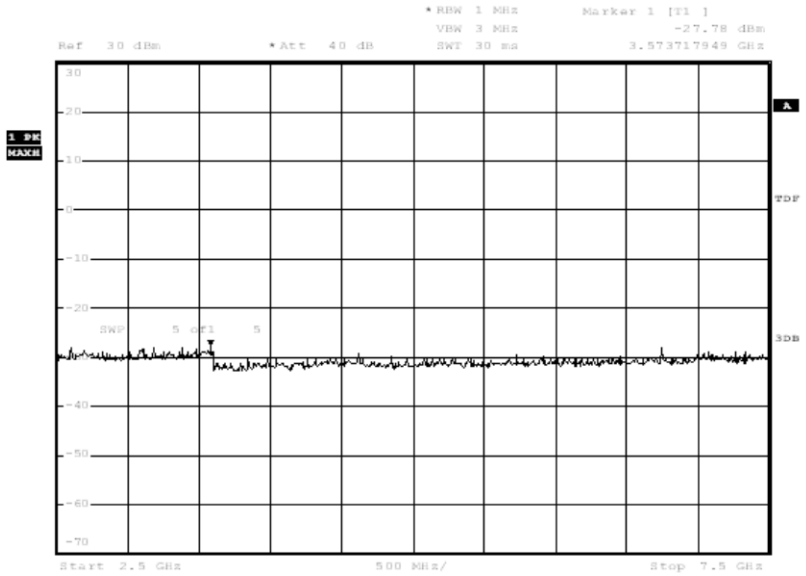
A.8.3.25 Channel 661: 2.5GHz –7.5GHz

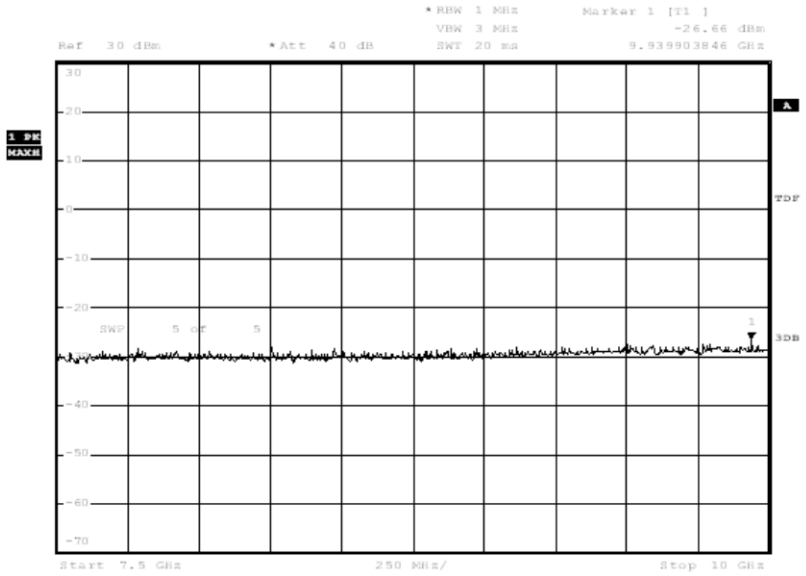
Spurious emission limit –13dBm



Date: 15.DEC.2014 19:17:33

A.8.3.26 Channel 661: 7.5GHz –10GHz

Spurious emission limit –13dBm



Date: 15.DEC.2014 19:17:50

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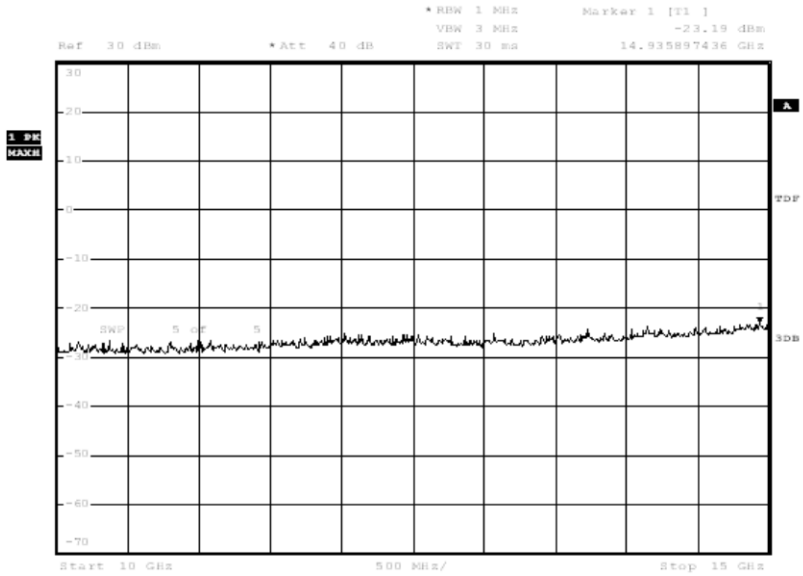
A.8.3.27 Channel 661: 10GHz –15GHz

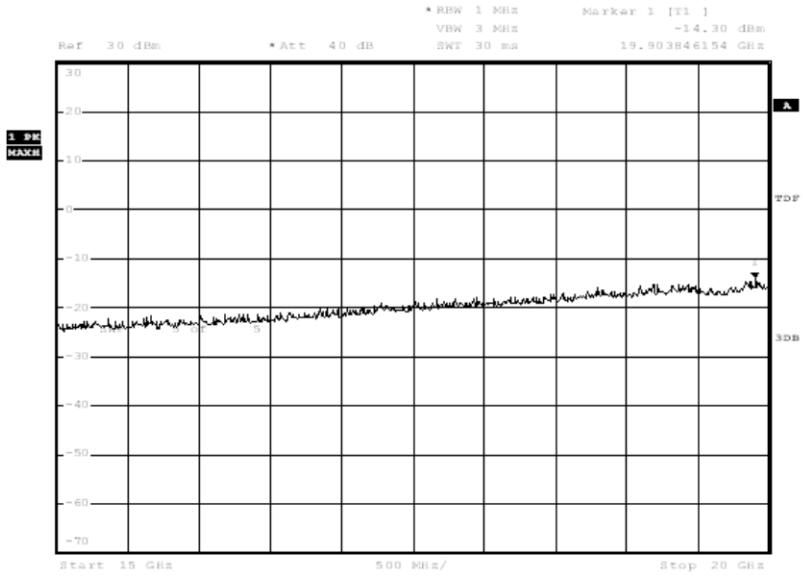
Spurious emission limit –13dBm.



Date: 15.DEC.2014 19:18:08

A.8.3.28 Channel 661: 15GHz –20GHz

Spurious emission limit –13dBm.



Date: 15.DEC.2014 19:18:26

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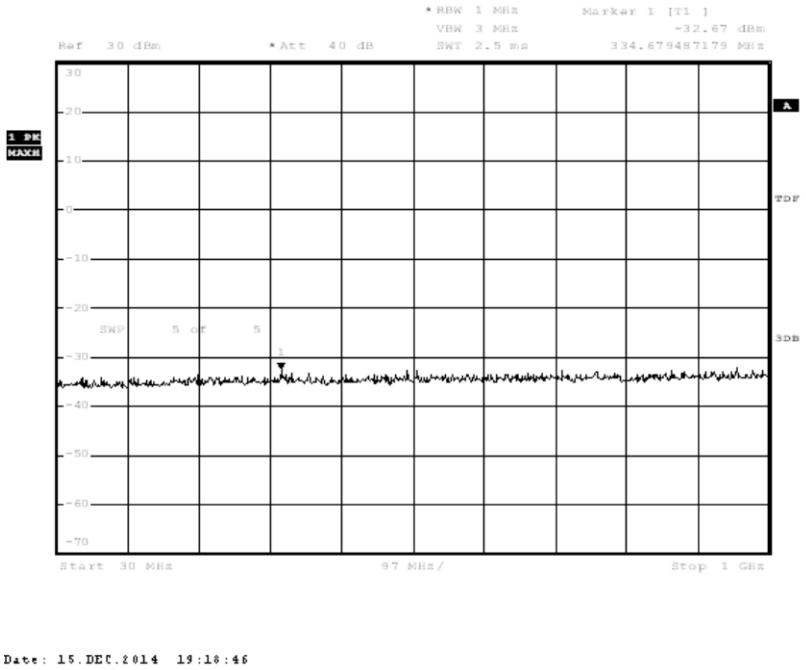
A.8.3.29 Channel 810: 30MHz – 1GHz

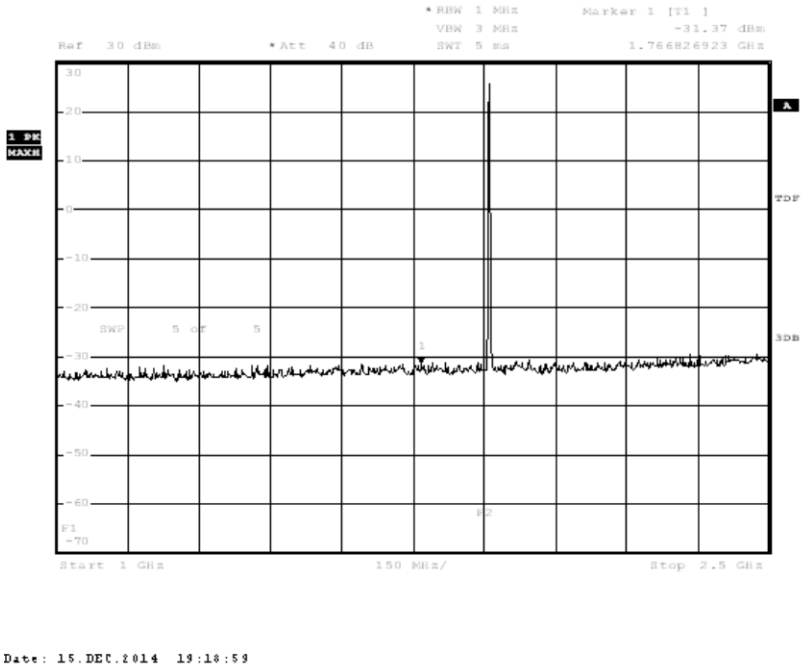
Spurious emission limit –13dBm.



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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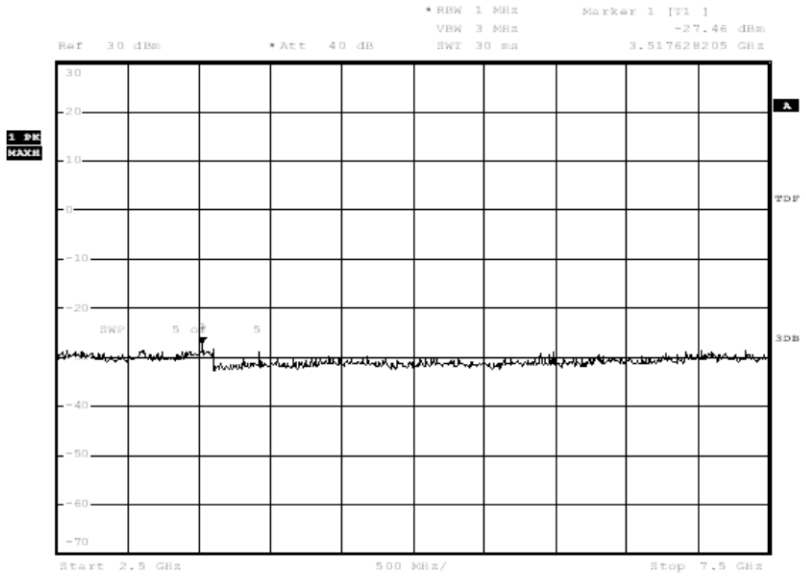
A.8.3.31 Channel 810:2.5GHz – 7.5GHz

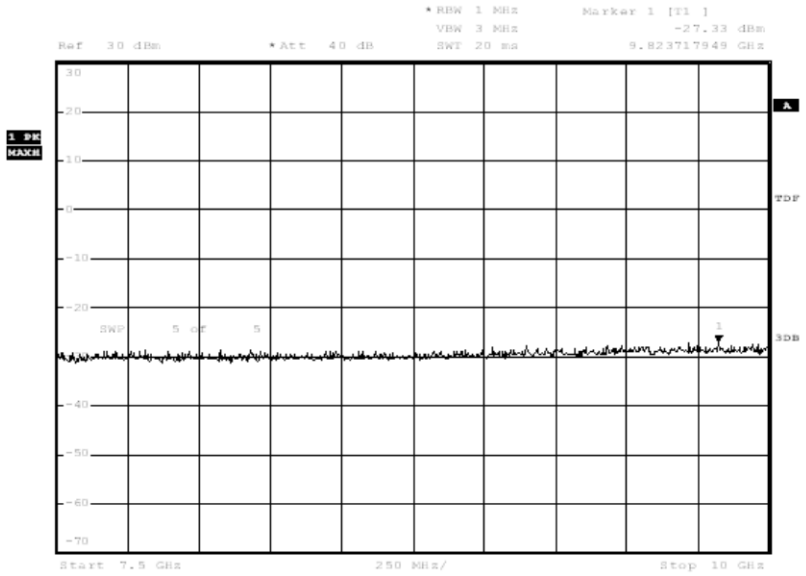
Spurious emission limit –13dBm.



Date: 15.DEC.2014 19:19:16

A.8.3.32 Channel 810: 7.5GHz – 10GHz

Spurious emission limit –13dBm.



Date: 15.DEC.2014 19:19:24

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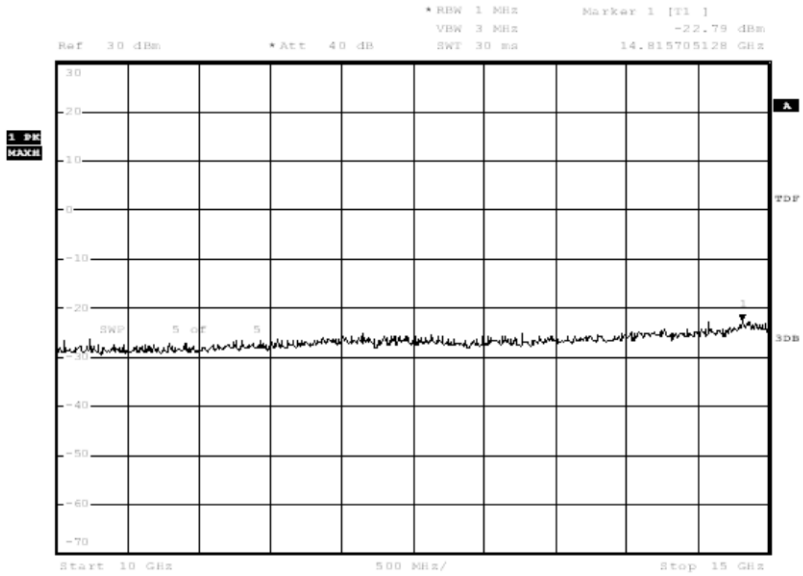
A.8.3.33 Channel 810: 10GHz –15GHz

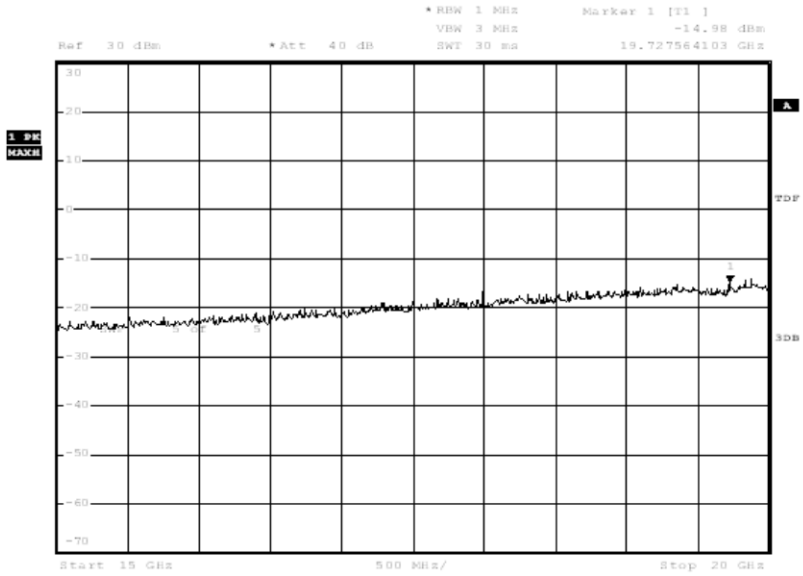
Spurious emission limit –13dBm.



Date: 15.DEC.2014 19:19:52

A.8.3.34 Channel 810: 15GHz –20GHz

Spurious emission limit –13dBm.



Date: 15.DEC.2014 19:20:09

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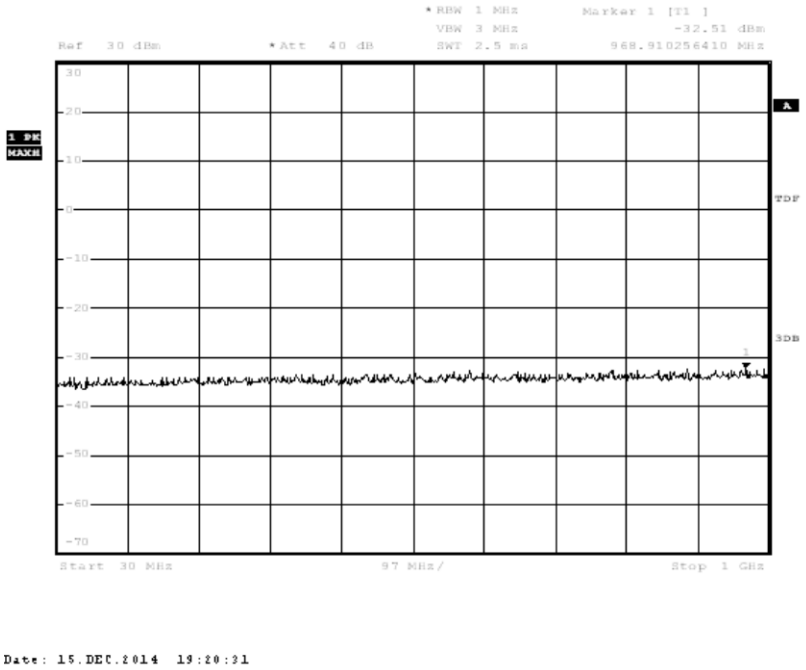
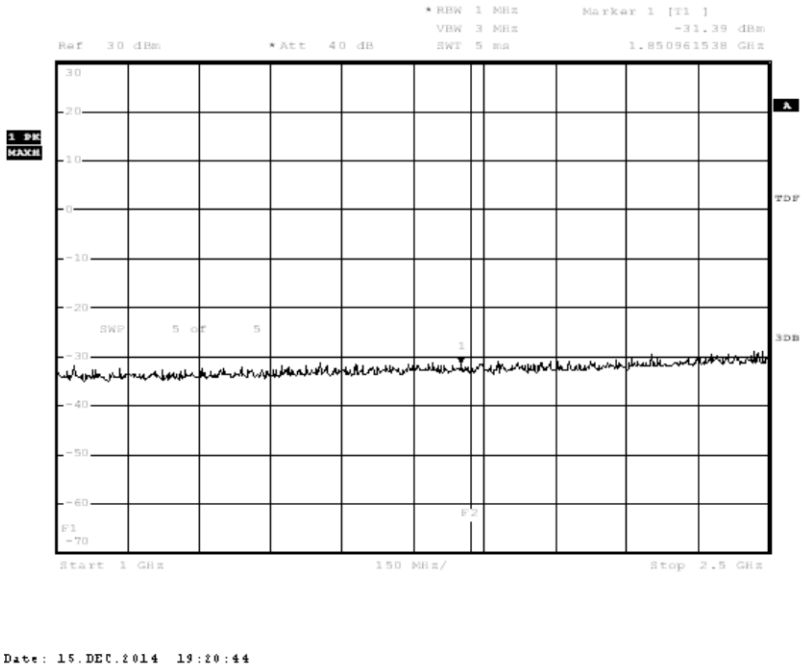
A.8.3.35 Idle mode: 30MHz – 1GHz

Spurious emission limit –13dBm.



A.8.3.36 Idle mode: 1GHz – 2.5GHz

Spurious emission limit –13dBm.



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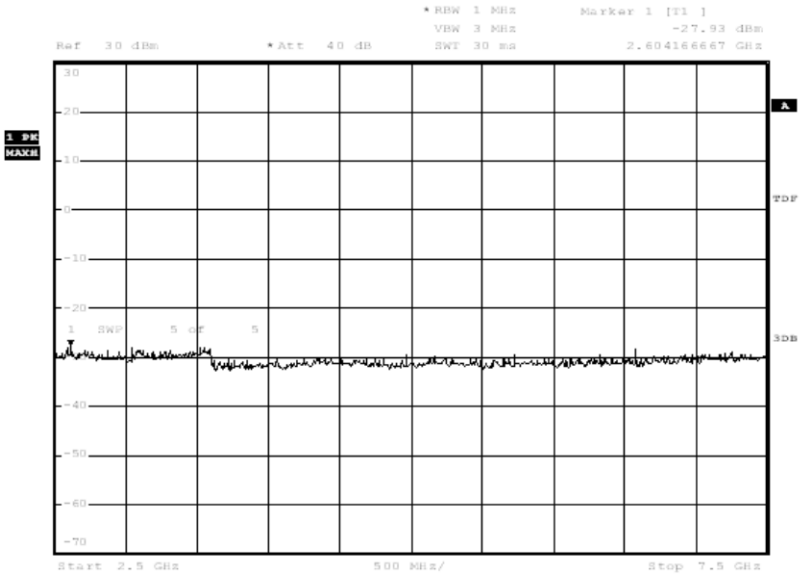
A.8.3.37 Idle mode: 2.5GHz – 7.5GHz

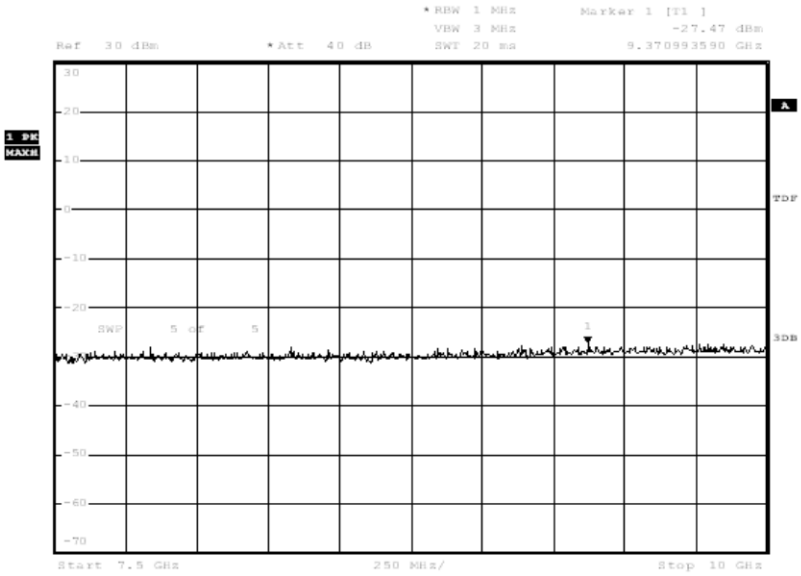
Spurious emission limit –13dBm.



Date: 15.DEC.2014 19:21:02

A.8.3.38 Idle mode: 7.5GHz – 10GHz

Spurious emission limit –13dBm.



Date: 15.DEC.2014 19:21:20

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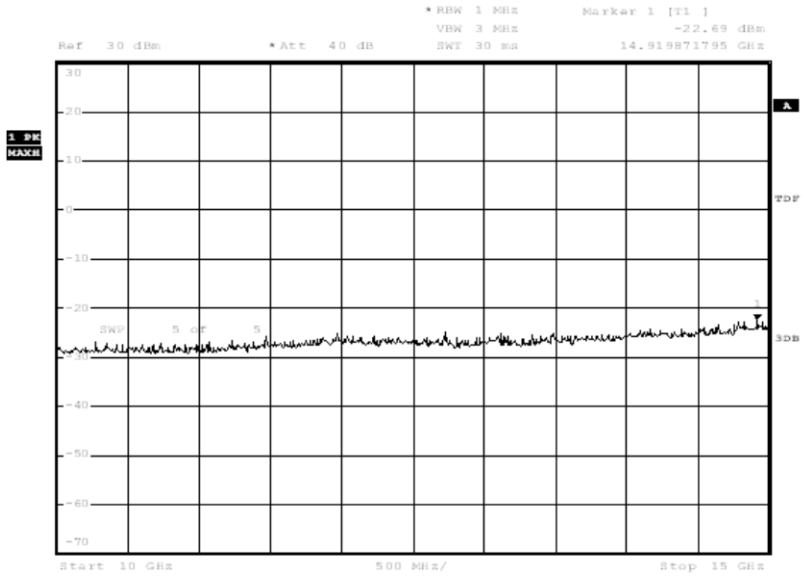
A.8.3.39 Idle mode: 10GHz –15GHz

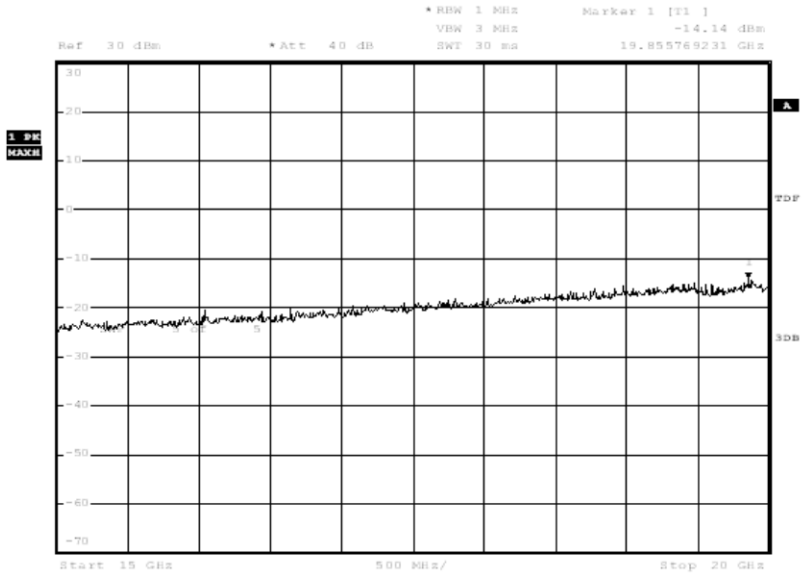
Spurious emission limit –13dBm.



Date: 15.DEC.2014 19:21:37

A.8.3.40 IDLE mode: 15GHz –20GHz

Spurious emission limit –13dBm.



Date: 15.DEC.2014 19:21:55

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A.9 PEAK-TO-AVERAGE POWER RATIO

A.9.1 Measurement description

According to KDB971168, the transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

The parameter of spectrum analyzer: RBW = 10MHz, detector = sample, No. of sample = 500,000

A.9.2 Measurement results

Frequency Error vs Temperature

	Frequency(MHz)	PAPR(dB)
GPRS850	836.60	7.36
EGPRS850	836.60	7.48
GPRS1900	1880.00	7.44
EGPRS1900	1880.00	7.53

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

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