TEST REPORT

for

FCC Part 22 Subpart H / Part 24 Subpart E

of

E.U.T. ： Rugged Tablet PC
Model ： ALGIZ 10X
FCC ID： YY3-ALGIZ10X

for

APPLICANT : Handheld Group AB
ADDRESS : Kinnegatan 17, 53133, Lidköping, Sweden

Test Performed by

ELECTRONICS TESTING CENTER, TAIWAN
NO. 34. LIN 5. DINGFU, LINKOU DIST.,
NEW TAIPEI CITY, TAIWAN, 24442, R.O.C.
Tel:(02)26023052 Fax:(02)26010910
http://www.etc.org.tw ; e-mail : emc@etc.org.tw

Report Number : 13-03-RBF-025-01

TEST REPORT CERTIFICATION

Applicant	:	Handheld Group AB Kinnegatan 17, 53133, Lidköping, Sweden
Manufacture	:	WINMATE Communication INC. 9F, No.111-6, Shing-De Rd., San-Chung District, New Taipei City 241 Taiwan
Description of Device	:	
a) Type of EUT	:	Rugged Tablet PC
b) Trade Name	:	Handheld
c) Model No.	:	ALGIZ 10X
d) Power Supply	:	Switching Adapter I/P: 100-240VAC, 50-60Hz, 2.5A O/P: 12VDC, 6.6A
Regulation Applied	:	FCC 47 CFR, Part 22 Subpart H and Part 24 Subpart E

I HEREBY CERTIFY THAT:

The testing described in this report has been carried out to the best of our knowledge and ability, and our responsibility is limited to the exercise of reasonable care. This certification is not intended to believe the sellers from their legal and/or contractual obligations.

The compliance test is only certified for the test equipment and the results of the testing report relate only to the item tested. The compliance test of this report was conducted in accordance with the appropriate standards. It's not intention to assure the quality and performance of the product. This report shall not be reproduced except in full, without the approval of ETC. This report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.

Date Test Item Received	:	*Oct. 09, 2012*
Date Test Campaign Completed	:	*May 29, 2013*
Date of Issue	:	*Jun. 05 , 2013*

Test Engineer : 

(Vincent Chang, Engineer)

Approve & Authorized : 

S. S. Liou, Section Manager
EMC Dept. II of ELECTRONICS
TESTING CENTER, TAIWAN

Table of Contents Page

1 GENERAL INFORMATION

1.1 Product Description

a) Type of EUT	:	Rugged Tablet PC
b) Trade Name	:	Handheld
c) Model No.	:	ALGIZ 10X
d) Power Supply	:	Switching Adapter I/P: 100-240VAC, 50-60Hz, 2.5A O/P: 12VDC, 6.6A
e) Model Difference	:	N/A
f) Note	:	N/A

1.2 Characteristics of Device

The EUT is a rugged Tablet PC.
This device includes 2G/3G, Bluetooth and 2.4GHz WiFi function.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures document on chapter 13 of ANSI C63.4 and FCC CFR 47, 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055 and 2.1057.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the roof top of Building at NO. 34. LIN 5. DINGFU, LINKOU DIST., NEW TAIPEI CITY, TAIWAN, 24442, R.O.C.
This site has been fully described in a report submitted to your office, and accepted in a letter dated Jan. 11, 2011.
Open Area Test Site Industry Canada Number: 2949A-1.

1.5 Test Summary

FCC Part Section (s)	RSS Section (s)	Test Description	Test Limit	Test Condition	Test Result	Note
TRANSMITTER MODE (TX)						
2.1049, 22.917(a), 24.238 (a)	RSS-Gen (4.6.1) RSS-133 (2.3)	Occupied Bandwidth	N/A	CONDUCTED	PASS	
2.1051, 22.917(a) 24.238(a)	RSS-132 (4.5.1) RSS-133 (6.5.1)	Band Edge/Conducted Spurious Emissions	<43+ log10 (P[Watts]) at Band Edge and for all outband emissions		PASS	
24.232(d)	RSS-133	(6.4) Peak-Average Ratio	<13 dB		PASS	
2.1046	RSS-132 (4.4) RSS-133 (4.1)	Transmitter Conducted Output Power	N/A		PASS	
22.913(a)(2)	RSS-132 (4.4) [SRSP-503(5.1.3)]	Effective Radiated Power	<7 Watts max. ERP	RADIATED	PASS	
24.232(c)	RSS-133 (6.4) [SRSP-510(5.1.2)]	Equivalent Isotropic Radiated Power	<2 Watts max. EIRP		PASS	
2.1053, 22.917(a), 24.238(a)	RSS-132 (4.5.1) RSS-133 (6.5.1)	Undesirable Emissions	<43+log10 (P[Watts]) for all outband emissions		PASS	
2.1055,22.355,24.235	RSS-132 (4.3) RSS-133 (6.3)	Frequency Stability	<2.5 ppm		PASS	
RECEIVER MODE (RX) / DIGITAL EMISSIONS						
N/A	RSS-132 (4.6) RSS-133 (6.6)	Receiver Spurious Emissions Limits	<RSS-Gen Limits [Section 6; Table 1]	RADIATED	PASS	

2 SYSTEM TEST CONFIGURATION

2.1 Justification

For the purposes of this test report ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT during the test. The simulate equipment was used to control the RF channel under the hightest, middle and lowest frequency and transmit the maximun RF power.

2.2 Devices for Tested System

Device	Manufacture	Model / FCC ID	Cable Description
Rugged Tablet PC *	HANDHELD GROUP AB.	ALGIZ 10X/ YY3-ALGIZ10X	1.8m Unshielded AC Adapter
Earphone	KINYO	EM3000	0.8m Unshielded Earhpone Cable
Monitor	BenQ	FP547	1.8m Unshielded AC Power Cord 0.8m Shielded D-SUB data line
2.5”USB Disk	PHILIPS	100GB	0.3m Unshielded USB Line
2.5”USB Disk	Ministation 3.0	HD-PCTU3	0.3m Unshielded USB Line

Remark “*” means equipment under test.

2.2.1 Test Channel – Frequency comparison table for test:

GSM 850		PCS 1900	
Channel	Frequency (MHz)	Channel	Frequency (MHz)
128	824.2	512	1850.2
190	836.6	661	1880.0
251	848.8	810	1909.8

2.2.2 Power Control Level (CMU200)

GSM 850	5 (33 dBm)
PCS 1900	0 (30 dBm)

3 PEAK POWER MEASUREMENT

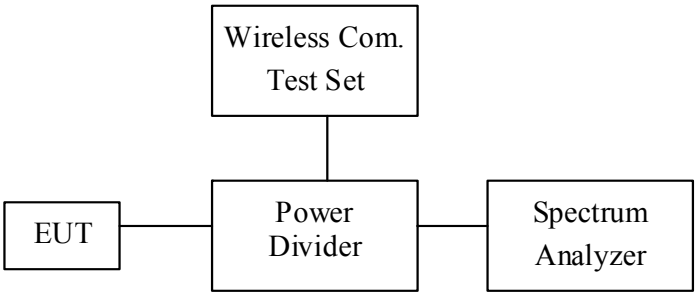
3.1 Applied Standard

According to FCC §2.1046.

3.2 Measurement Procedure

The setup of the EUT as shown in figure 1. The transmitter output was connected to a calibrated attenuator, the other end of which was connected to a Spectrum Analyzer. Transmitter output was read off the Spectrum Analyzer in dBm. The power output at the transmitter antenna port was determined by adding the value of the attenuator to the Spectrum Analyzer reading.

Figure 1: Peak power measurement configuration.



3.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	2013/09/20
Power Divider	SUHNER	4901.19.A	2013/08/12
Universal Digital Radiocommunication Tester	R&S	CMU200	2013/04/22

3.4 Test Result

Test Date : Oct. 23, 2012 Temperature : 25 °C Humidity : 65 %

(A) 850 band
Limits:

Power Control Level	Normal Peak Output Power	Tolerance (dB)
5	33dBm (2W)*	±2

Power measurements:

Test Mode	**Channel**	**Frequency (MHz)**	**Peak Power (dBm)**
GSM850 GPRS	128	824.2	31.59
	190	836.6	31.21
	251	848.8	31.32
GSM850 EDGE	128	824.2	31.61
	190	836.6	31.28
	251	848.8	31.35

(B) 1900 band
Limits:

Power Control Level	Normal Peak Output Power	Tolerance (dB)
0	30dBm (1W)*	±2

Power measurements:

Test Mode	**Channel**	**Frequency (MHz)**	**Peak Power (dBm)**
PCS1900 GPRS	512	1850.2	28.15
	661	1880.0	28.41
	810	1909.8	28.82
PCS1900 EDGE	512	1850.2	28.18
	661	1880.0	28.47
	810	1909.8	28.89

4. ERP & EIRP MEASUREMENT

43.1 Standard Applicable

According to FCC § 2.1046 and FCC § 22.913(b): The Effective Radiated Power (ERP) of mobile transmitters must not exceed 7 Watts. FCC §24.232(b): The equivalent Isotropic Radiated Power (EIRP) must not exceed 2 Watts.

4.2 Measurement Procedure

1. Setup the configuration per figure 2 and 3 for frequencies measured below and above 1 GHz respectively, adjusting the input voltage to produce the maximum power.
2. Adjust the analyzer for each frequency measured in chapter 6 on a 1 MHz frequency span and 1MHz resolution bandwidth.
3. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ° to 360 °, and record the highest value indicated on spectrum analyzer as reference value.
4. Repeat step 3 until all frequencies need to be measured were complete.
5. Repeat step 4 with search antenna in vertical polarized orientations.
6. Replace the EUT with a tuned dipole antenna (horn antenna for above 1 GHz) relative to each frequency in horizontally polarized orientation and as the same polarized orientation with search antenna. Connect the tuned dipole antenna to a standard signal generator (SG) via a low loss cable. Power on the SG and tune the right frequency in measuring as well as set SG at a appreciated output level. Rise and lower the search antenna to get the highest value on spectrum analyzer, and then hold this position. Adjust the SG output to get a identical value derived from step 3 on spectrum analyzer. Record this value for result calculated.
7. Repeat step 6 until all frequencies need to be measured was complete.
8. Repeat step 7 with both dipole antenna (horn antenna for above 1 GHz) and search antenna in vertical polarized orientations.

Figure 2: Frequencies measured below 1 GHz configuration

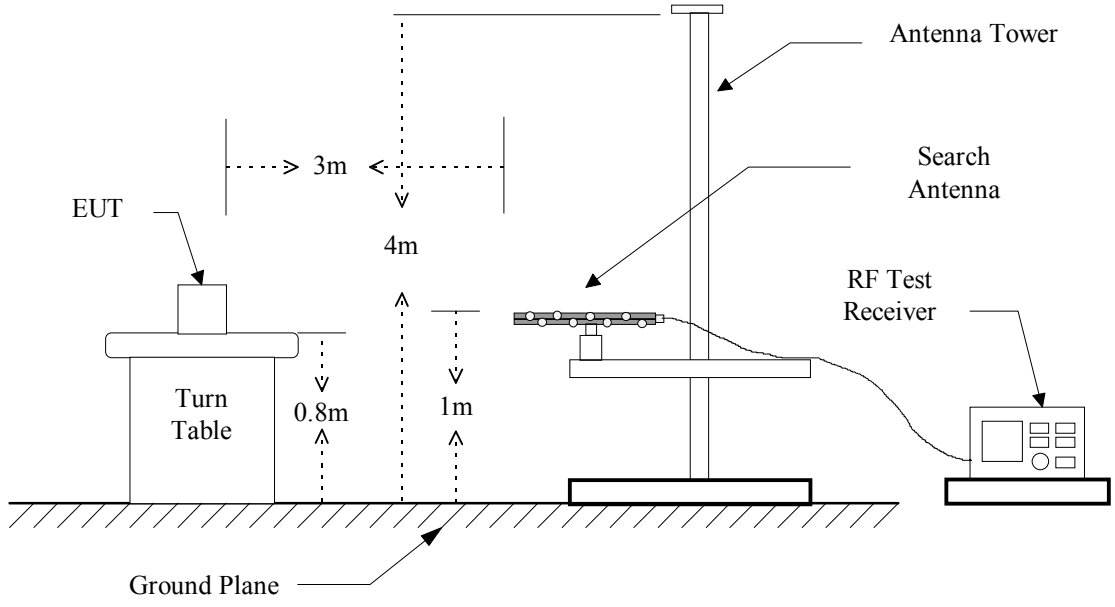
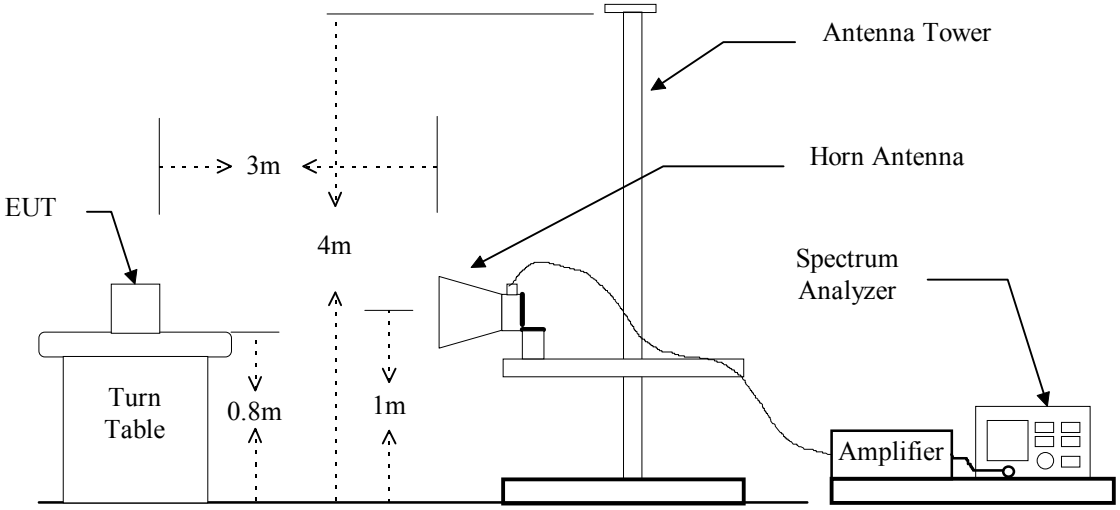


Figure 3: Frequencies measured above 1 GHz configuration



4.3 Test Result

Test Date : May 29, 2013 Temperature : 22 °C Humidity : 60 %

GSM 850 Band (ERP)/(GPRS)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Meter Reading (dB μ V/m)	SG Reading (dBm)	Cable Loss (dB)	Antenna Gain	Result ERP (dBm)	Limit (dBm)	Margin (dBm)
GSM850 GPRS	128	824.200	H	92.1	21.3	2.7	----	18.6	33	-14.4
	128	824.200	V	101.4	33.4	2.7	----	30.7	33	-2.3
	190	836.600	H	91.2	21.2	2.7	----	18.5	33	-14.5
	190	836.600	V	100.0	32.8	2.7	----	30.1	33	-2.9
	251	848.800	H	91.1	21.9	2.7	----	19.2	33	-13.8
	251	848.800	V	99.3	32.9	2.7	----	30.2	33	-2.8

Note: For measured frequency below 1GHz, a tuned dipole antenna is used.

GSM 850 Band (EDGE)/(GPRS)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Meter Reading (dB μ V/m)	SG Reading (dBm)	Cable Loss (dB)	Antenna Gain	Result ERP (dBm)	Limit (dBm)	Margin (dBm)
GSM850 EDGE	128	824.200	H	92.2	21.5	2.7	----	18.8	33	-14.2
	128	824.200	V	101.3	33.4	2.7	----	30.7	33	-2.3
	190	836.600	H	91.6	21.6	2.7	----	18.9	33	-14.1
	190	836.600	V	100.4	33.2	2.7	----	30.5	33	-2.5
	251	848.800	H	91.3	22.1	2.7	----	19.4	33	-13.6
	251	848.800	V	99.3	32.9	2.7	----	30.2	33	-2.8

Note: For measured frequency below 1GHz, a tuned dipole antenna is used.

Test Date : May 29, 2013 Temperature : 22 °C Humidity : 60 %

PCS 1900 Band (EIRP)/ GPRS

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Meter Reading (dB μ V/m)	SG Reading (dBm)	Cable Loss (dB)	Antenna Gain	Result EIRP (dBm)	Limit (dBm)	Margin (dBm)
PCS1900 GPRS	512	1850.200	H	118.1	9.3	1.6	7.7	15.4	30	-14.6
	512	1850.200	V	128.1	19.4	1.6	7.7	25.5	30	-4.5
	661	1880.000	H	118.3	9.6	1.7	7.7	15.6	30	-14.4
	661	1880.000	V	128.7	20.1	1.7	7.7	26.1	30	-3.9
	810	1909.800	H	118.8	10.2	1.7	7.7	16.2	30	-13.8
	810	1909.800	V	129.1	20.5	1.7	7.7	26.6	30	-3.4

PCS 1900 Band (EIRP)/ EDGE

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Meter Reading (dB μ V/m)	SG Reading (dBm)	Cable Loss (dB)	Antenna Gain	Result EIRP (dBm)	Limit (dBm)	Margin (dBm)
PCS1900 EDGE	512	1850.200	H	118.0	9.2	1.6	7.7	15.3	30	-14.7
	512	1850.200	V	128.2	19.5	1.6	7.7	25.6	30	-4.4
	661	1880.000	H	118.4	9.7	1.7	7.7	15.7	30	-14.3
	661	1880.000	V	128.9	20.3	1.7	7.7	26.3	30	-3.7
	810	1909.800	H	119.4	10.8	1.7	7.7	16.8	30	-13.2
	810	1909.800	V	130.2	21.7	1.7	7.7	27.7	30	-2.3

3.4 Result Calculation

Result calculation is as following:

ERP calculation:

Result = SG Reading - Cable Loss + Antenna Gain Corrected (if applicable)

Antenna Gain Corrected is used for antenna other than dipole to convert radiated power to ERP.

EIRP calculation:

Result = SG Reading - Cable Loss + Antenna Gain Corrected

Antenna Gain Corrected is the antenna gain (dBi) of the horn antenna for transmitting.

$$mW = \log^{-1}\left[\frac{Result(dBm)}{10}\right]$$

4.5 Test Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
EMI Test Receiver	Rohde & Schwarz	ESCI	2013/07/15
Spectrum Analyzer	Rohde & Schwarz	FSP40	2013/09/20
Dipole Antenna	Schwarzbeck	1166;1167	2014/09/07
Dipole Antenna	Schwarzbeck	897;898	2014/09/07
Log-periodic Antenna	EMCO	3146	2013/10/17
Amplifier	HP	8447D	2014/05/02
Horn Antenna	EMCO	3116	2013/11/23
Horn Antenna	EMCO	3115	2014/04/08
Signal generator	HP	83732B	2013/09/06

5 OCCUPIED BANDWIDTH MEASUREMENT

5.1 Standard Applicable

According to §FCC 2.1049.

5.2 Measurement Procedure

The setup of the EUT as shown in figure 1.The EUT's output RF connector was connected with a short cable to the spectrum analyzer, RBW was set to about but not less than 1% of emission BW, VBW is set to 3 times the RBW, -26dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth is the delta frequency between the two points where the display line intersects the signal trace.

5.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	2013/09/20
Power Divider	SUHNER	4901.19.A	2013/08/12
Universal Digital Radiocommunication Tester	R&S	CMU200	2013/04/22

5.4 Test Result

Test Date : Oct. 23, 2012 Temperature : 25 °C Humidity : 65 %

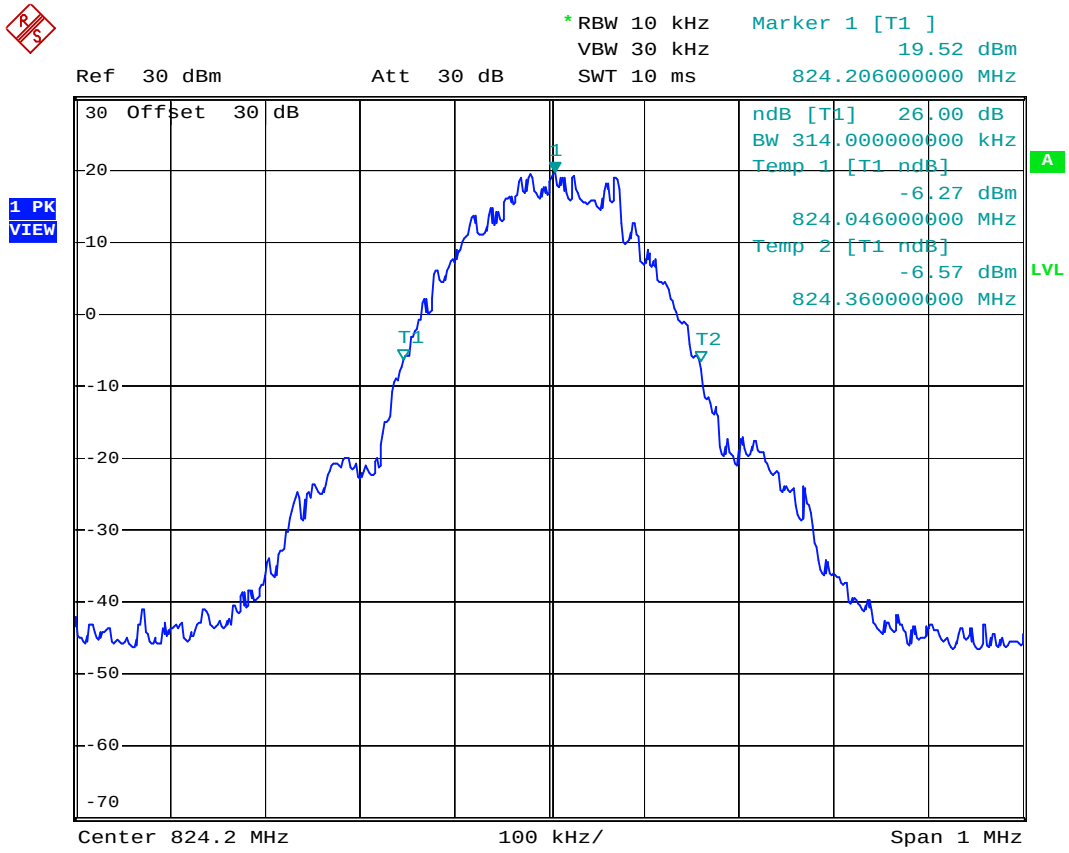
5.4.1 GSM 850 Band (GPRS)

Test Mode	Channel	Frequency (MHz)	Bandwidth (kHz)	Occupied Bandwidth (kHz)
GSM850 GPRS	128	824.2	314.00	240.00
	190	836.6	314.00	242.00
	251	848.8	312.00	244.00

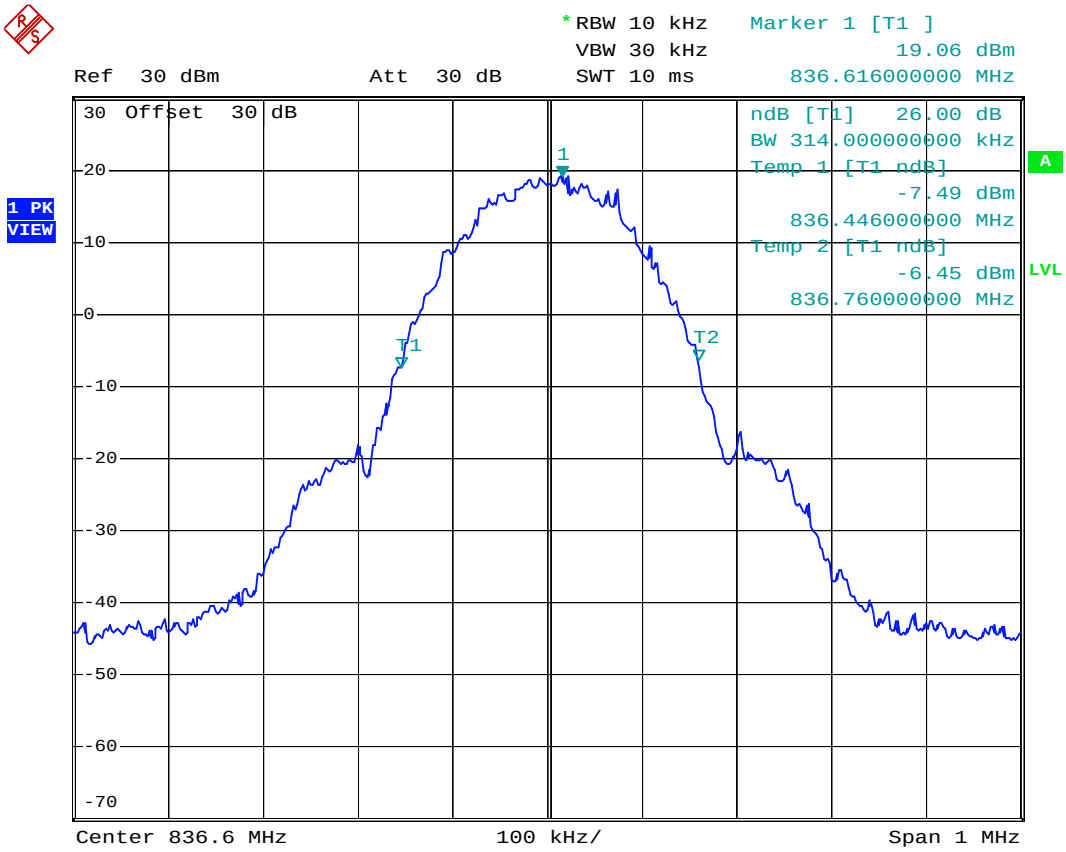
Note: Please refer to the following pages for chart

(A) Bandwidth (-26dB)

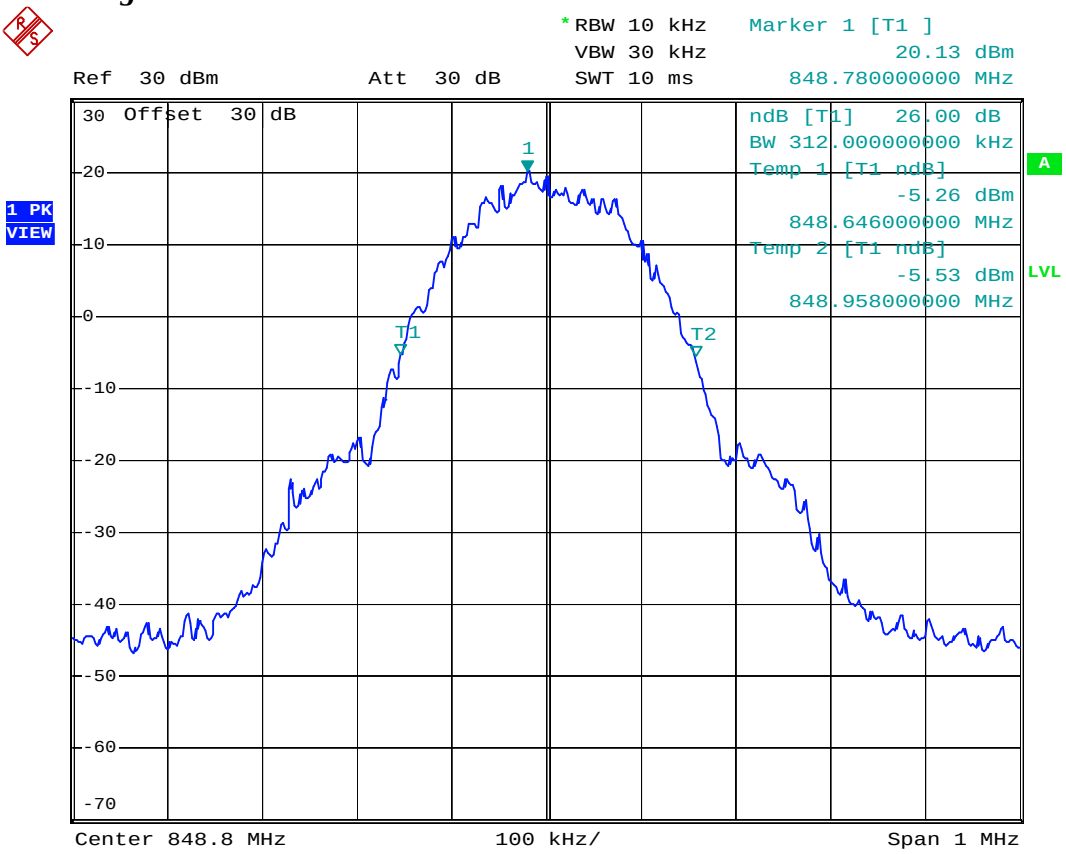
Channel Low



Channel Middle

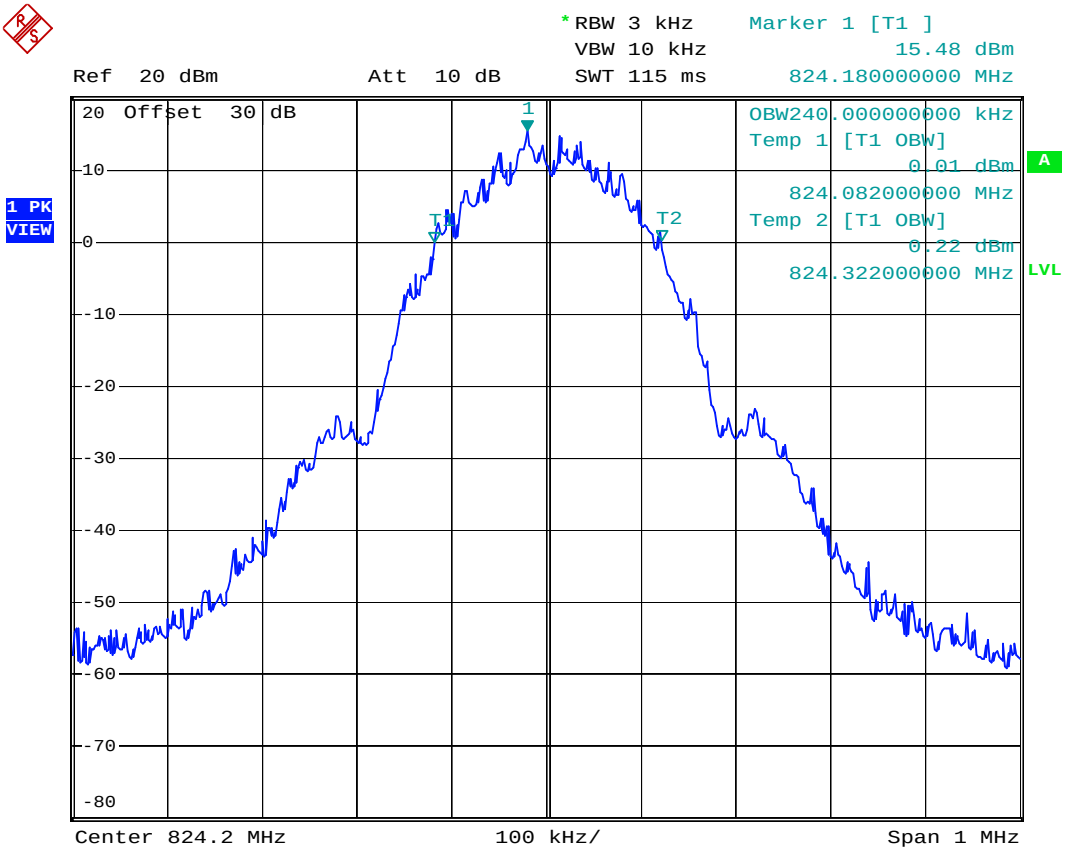


Channel High

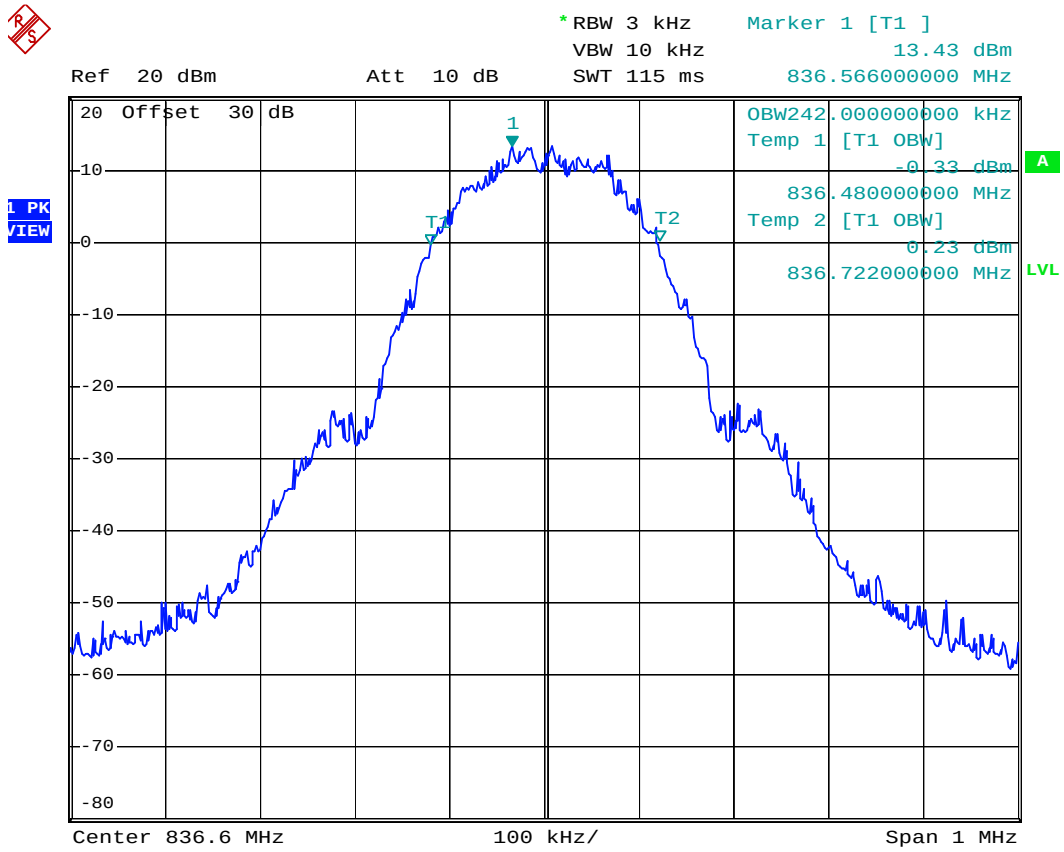


(B) Occupied bandwidth (99% bandwidth)

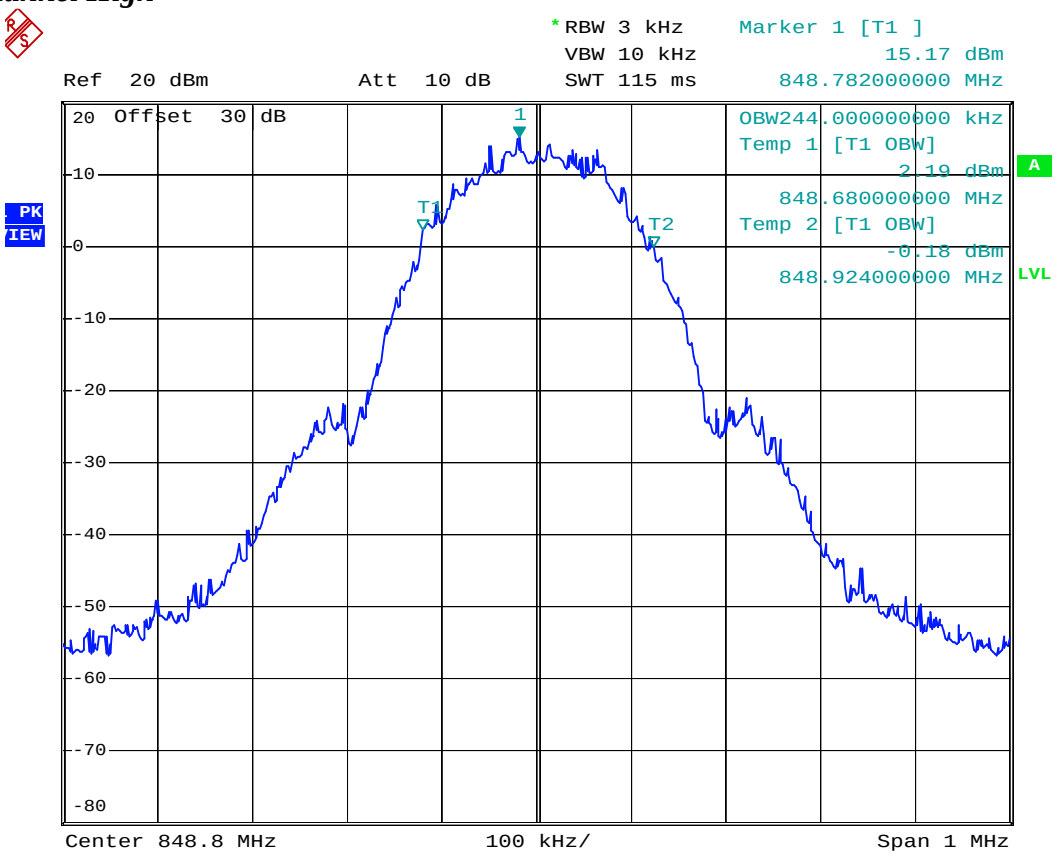
Channel Low



Channel Middle



Channel High



Test Date : Oct. 23, 2012 Temperature : 25 °C Humidity : 65 %

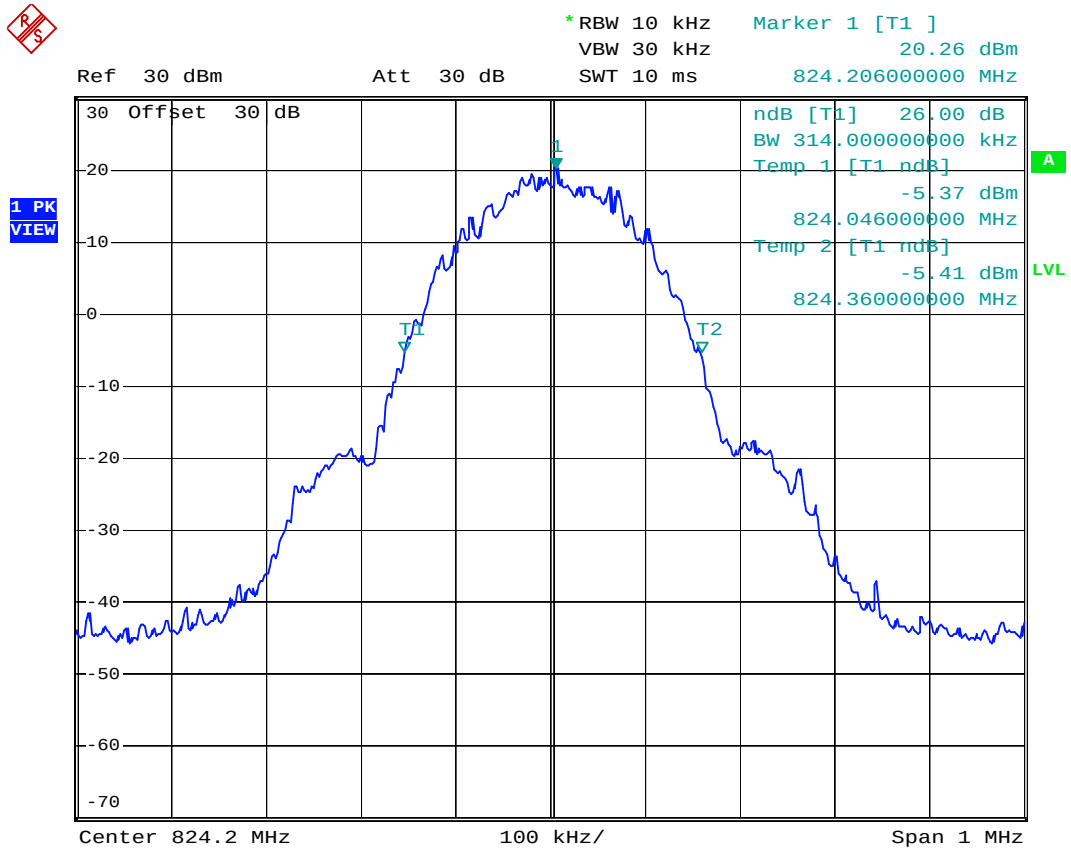
5.4.2 GSM 850 Band (EDGE)

Test Mode	Channel	Frequency (MHz)	Bandwidth (kHz)	Occupied Bandwidth (kHz)
GSM850 EDGE	128	824.2	314.00	242.00
	190	836.6	318.00	242.00
	251	848.8	314.00	248.00

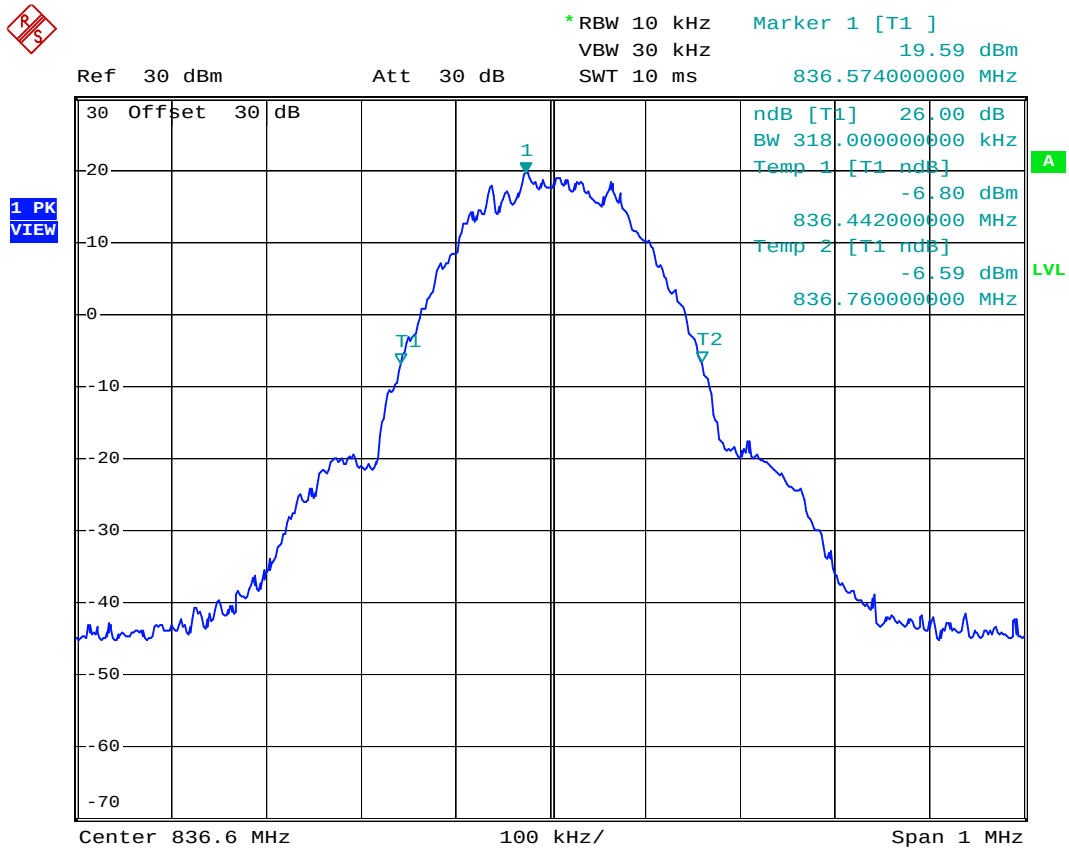
Note: Please refer to the following pages for chart

(A) Bandwidth (-26dB)

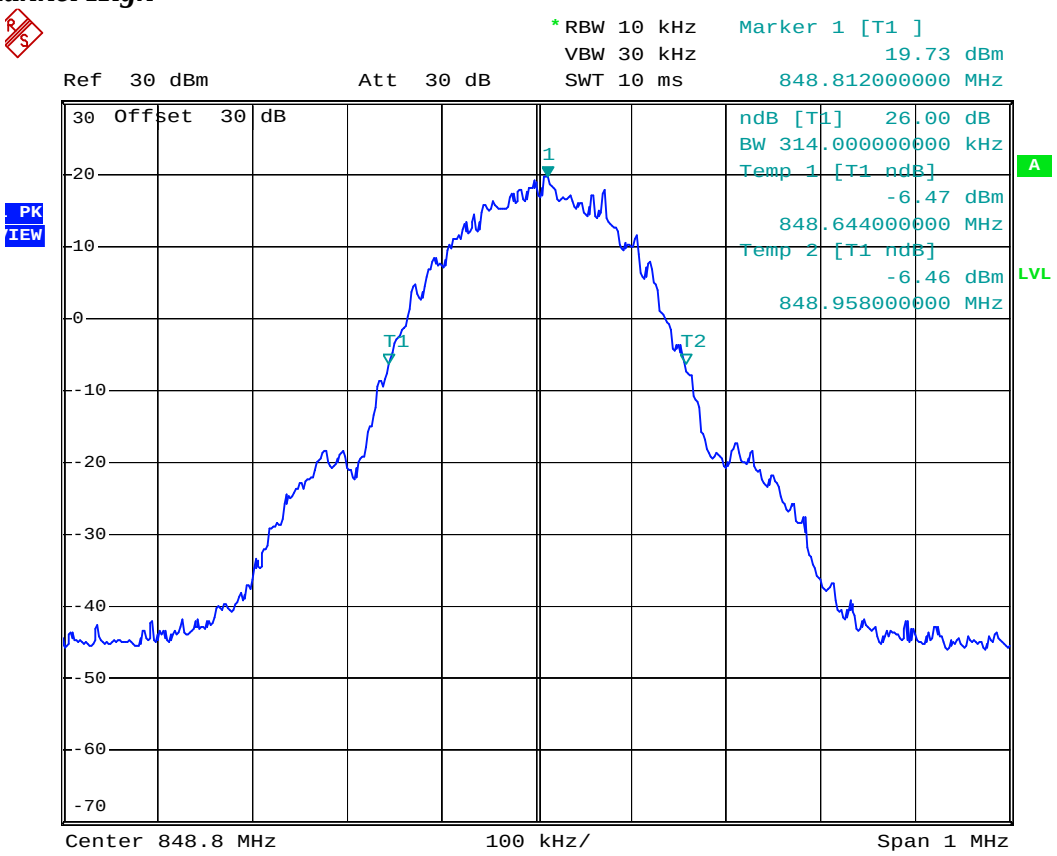
Channel Low



Channel Middle

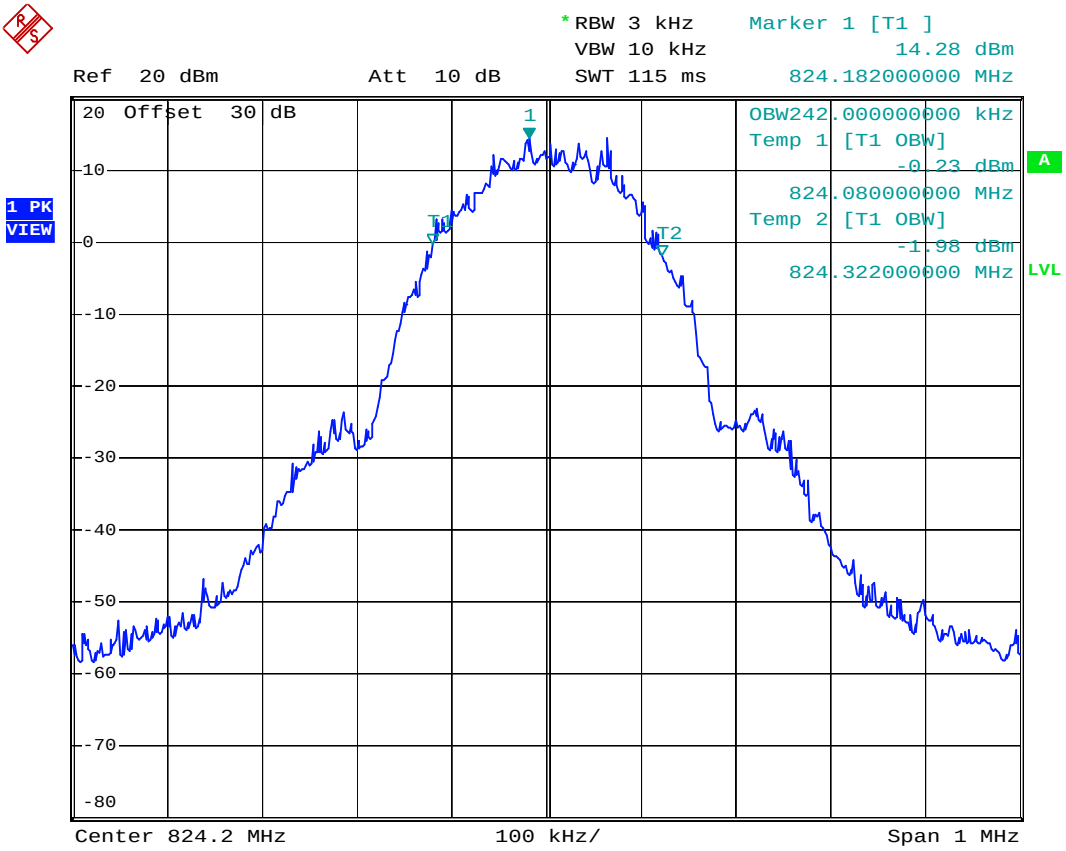


Channel High

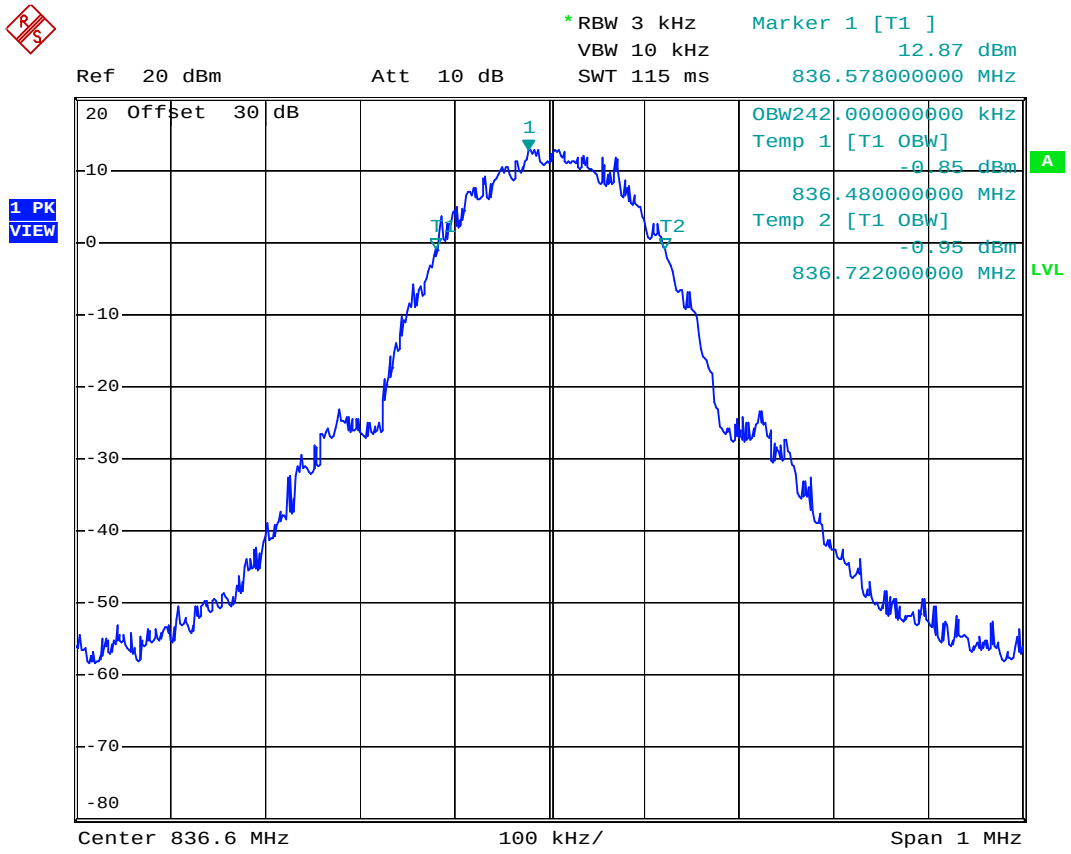


(B) Occupied bandwidth (99% bandwidth)

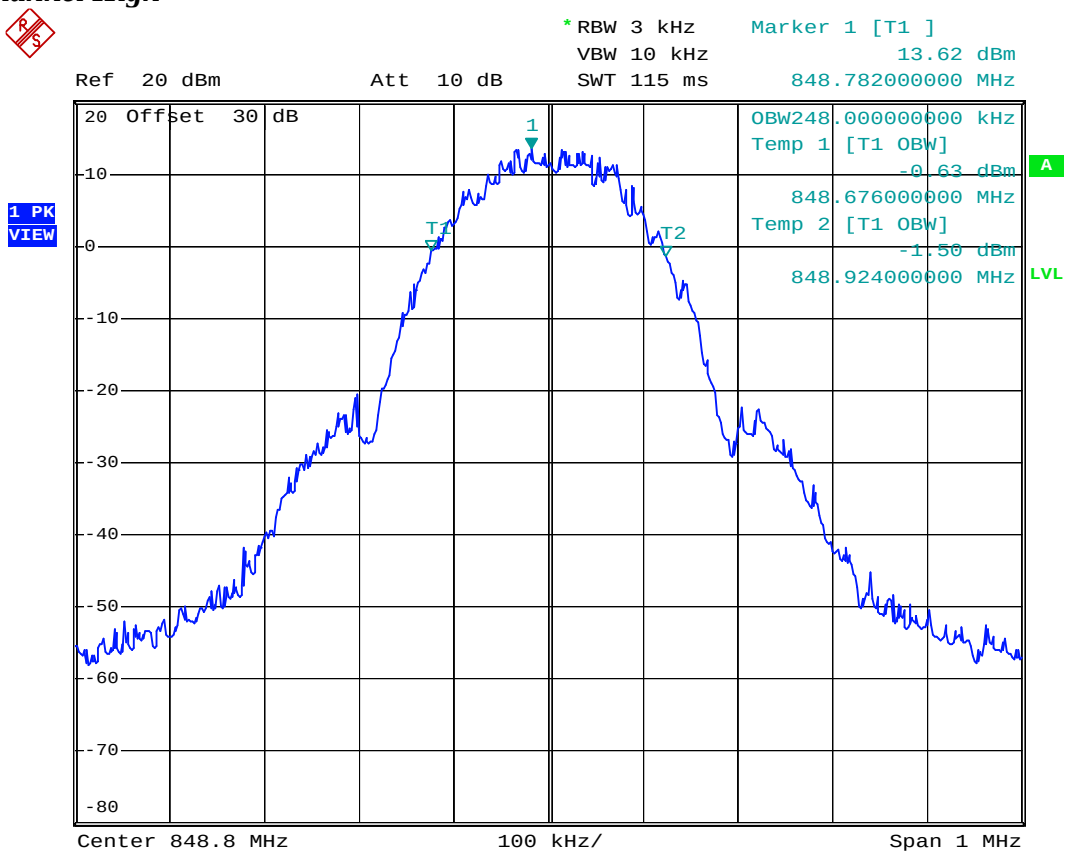
Channel Low



Channel Middle



Channel High



Test Date : Oct. 23, 2012 Temperature : 20 °C Humidity : 65 %

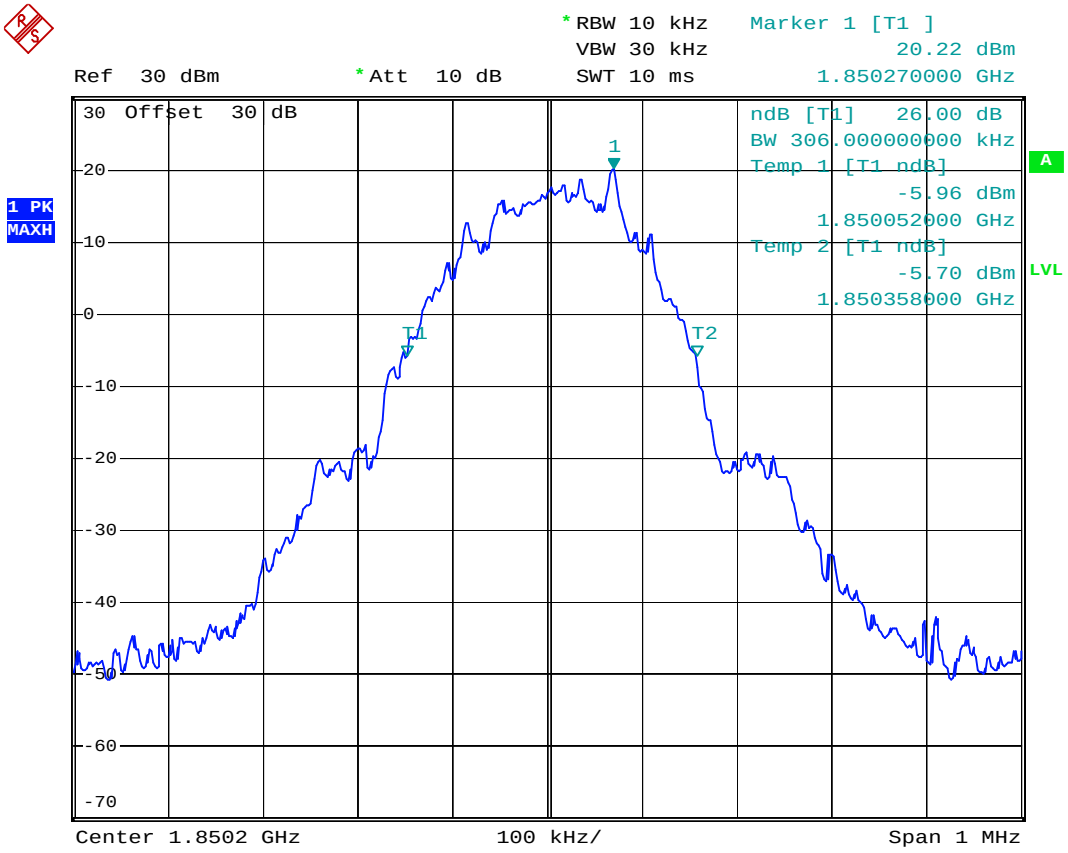
5.4.3 PCS1900 Band (GPRS)

Test Mode	Channel	Frequency (MHz)	Bandwidth (kHz)	Occupied Bandwidth (kHz)
PCS1900 GPRS	512	1850.2	306.00	240.00
	661	1880.0	310.00	240.00
	810	1909.8	310.00	240.00

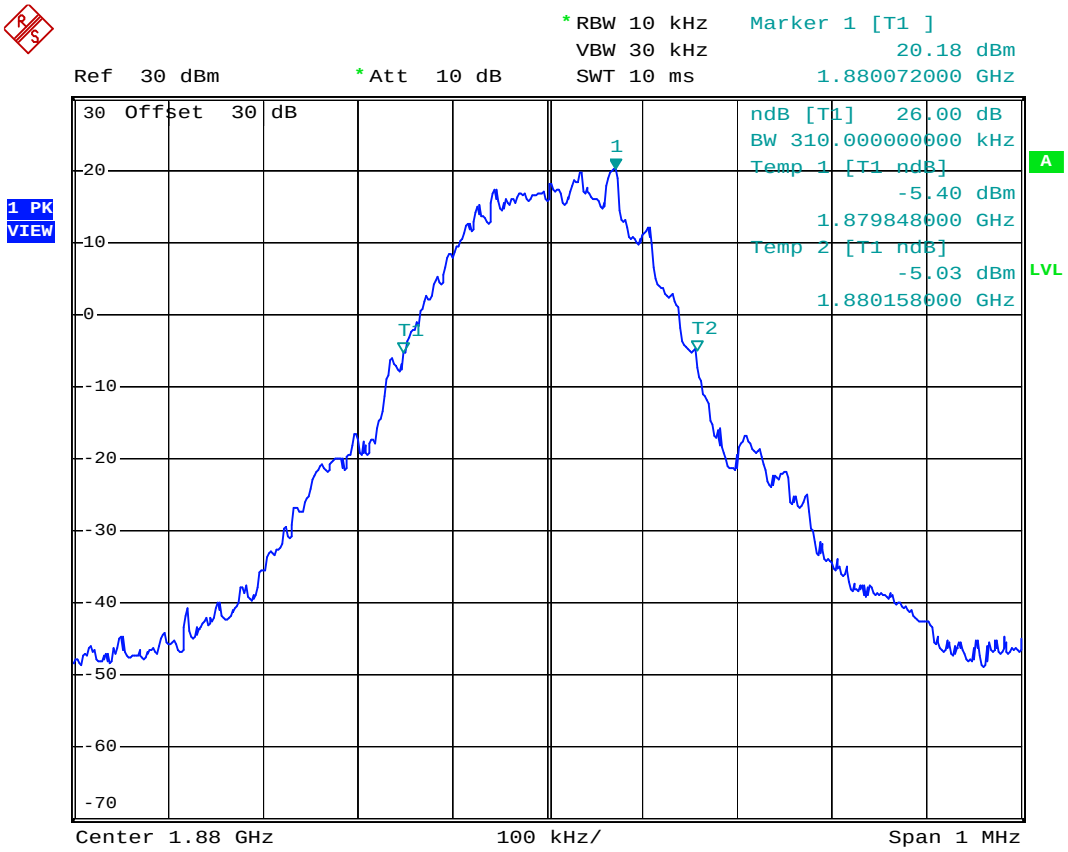
Note: Please refer to the following pages for chart

(A) Bandwidth (-26dB)

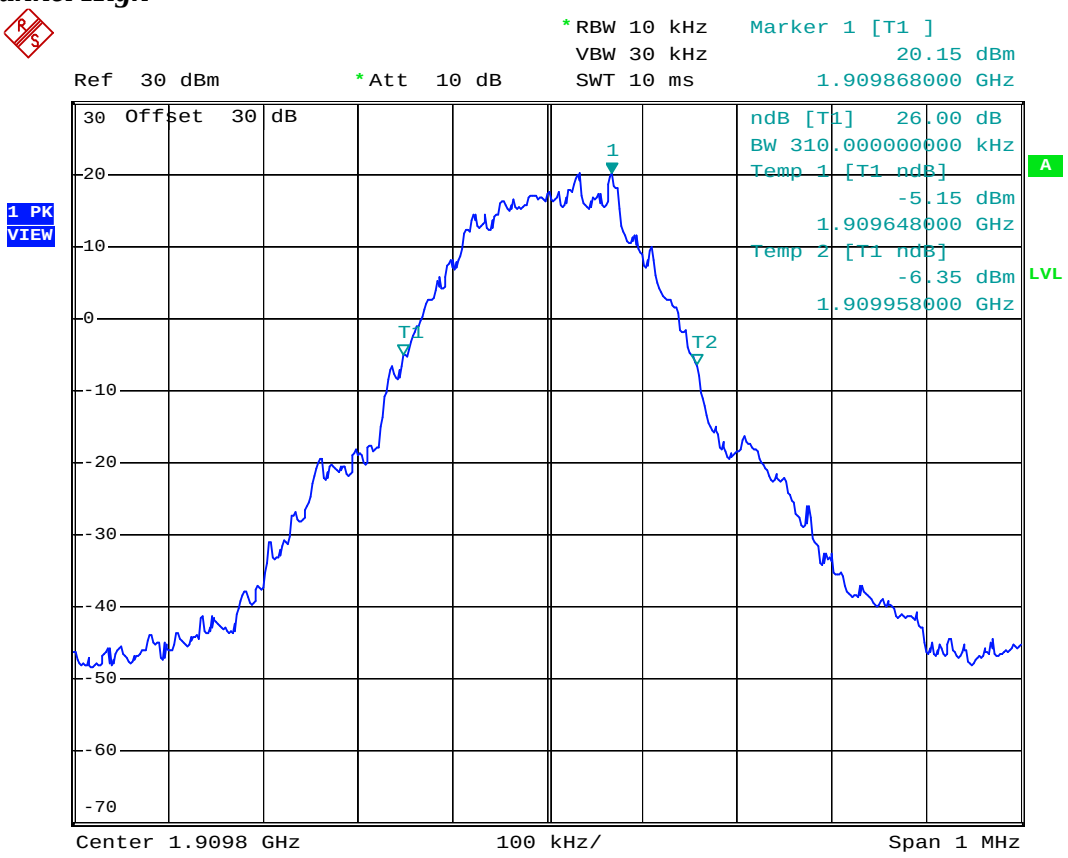
Channel Low



Channel Middle

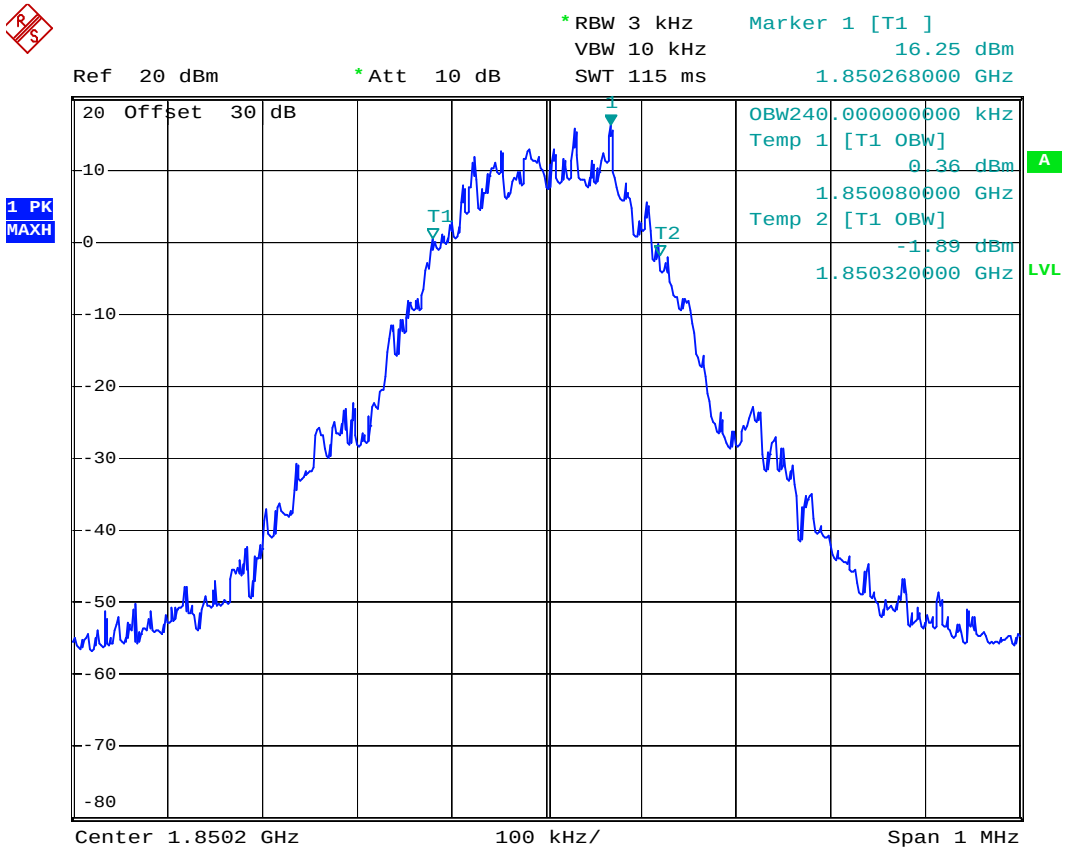


Channel High

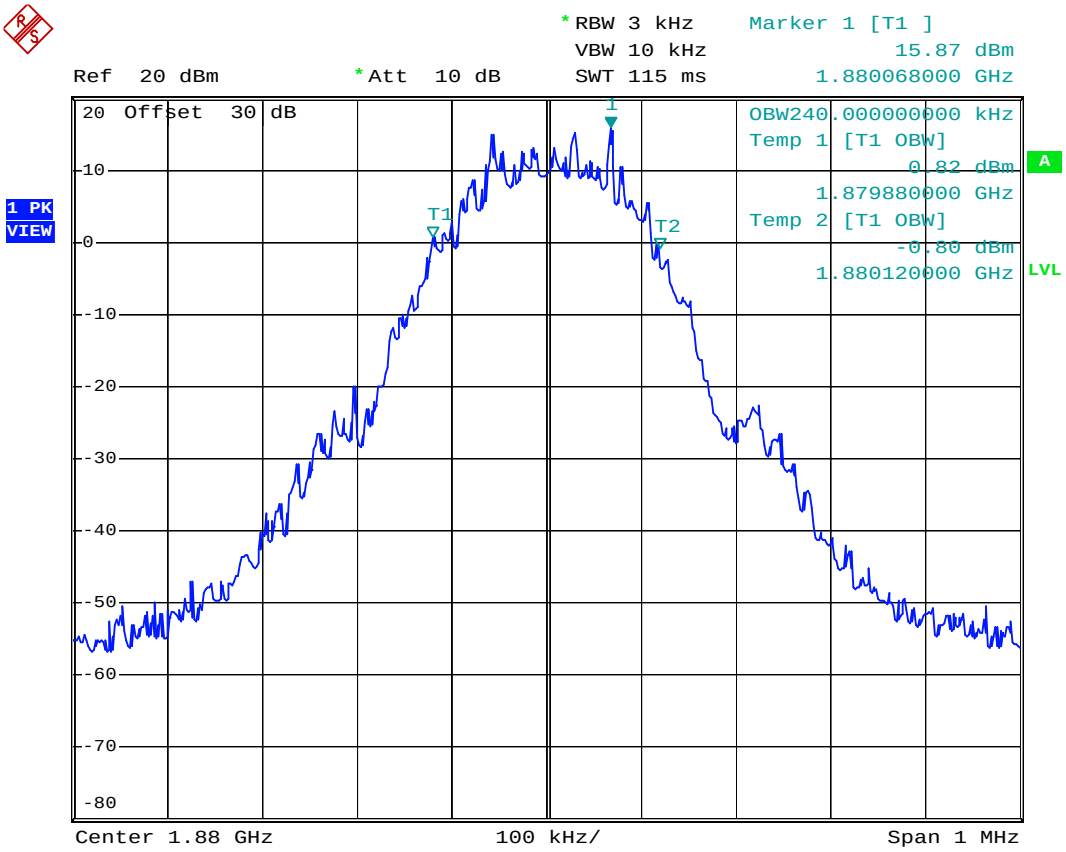


(B) Occupied bandwidth (99% bandwidth)

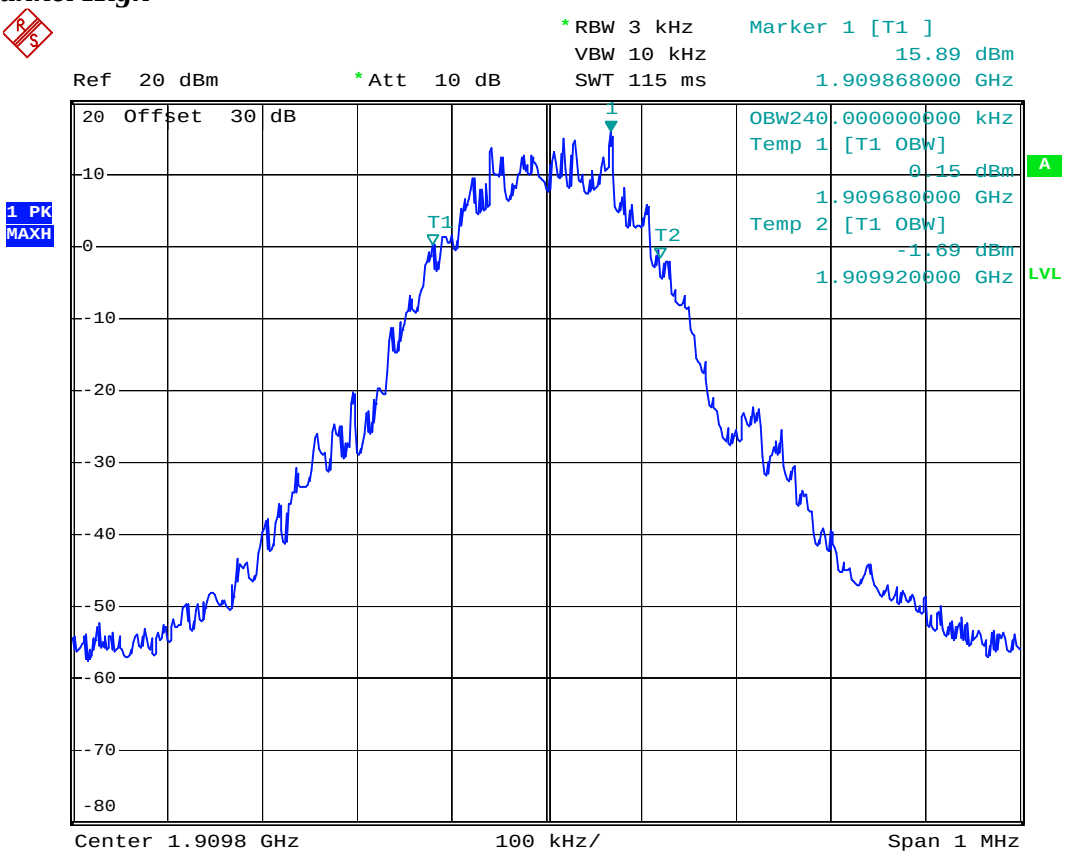
Channel Low



Channel Middle



Channel High



Test Date : Oct. 23, 2012 Temperature : 25 °C Humidity : 65 %

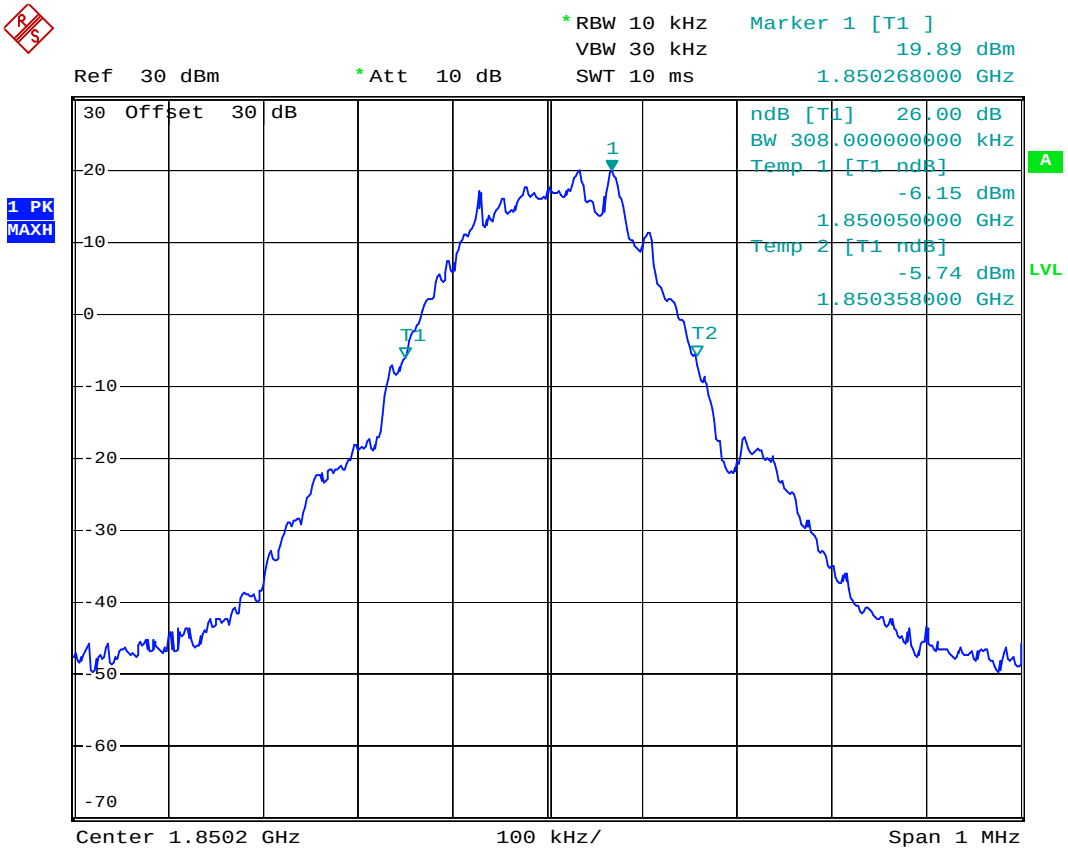
5.4.4 PCS1900 Band (EDGE)

Test Mode	Channel	Frequency (MHz)	Bandwidth (kHz)	Occupied Bandwidth (kHz)
PCS1900 EDGE	512	1850.2	308.00	240.00
	661	1880.0	306.00	238.00
	810	1909.8	314.00	240.00

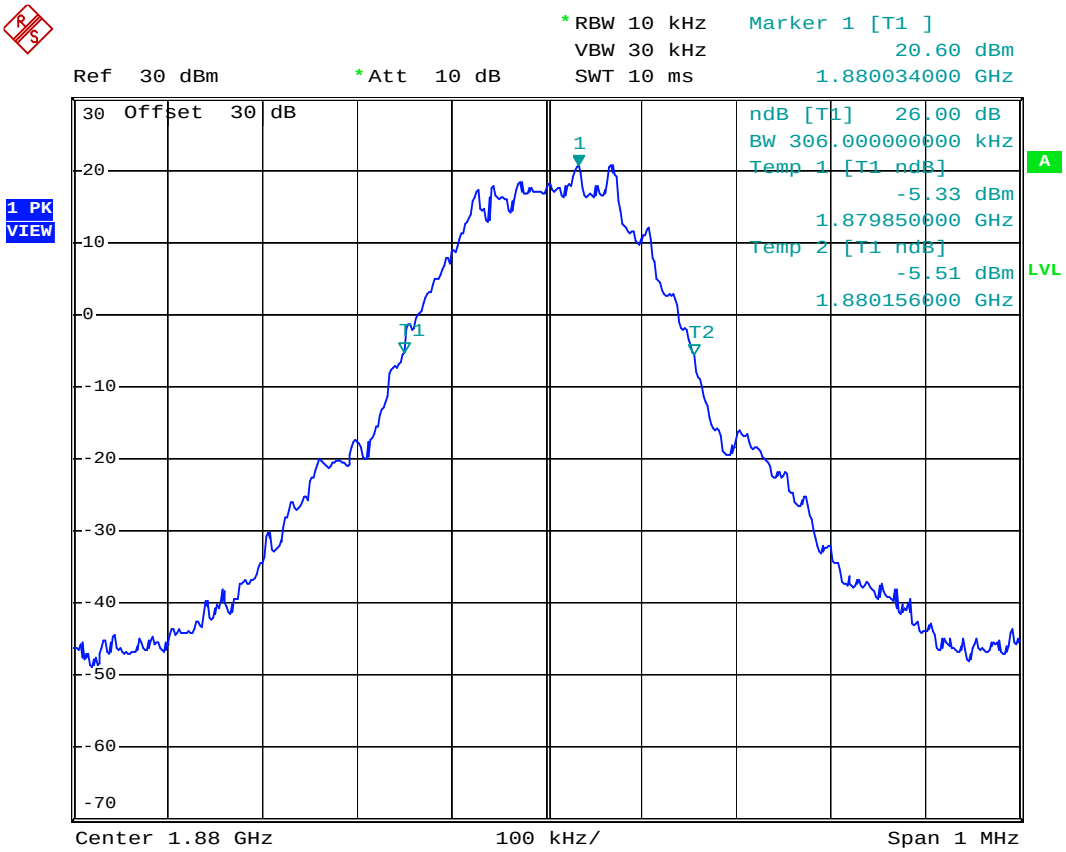
Note: Please refer to the following pages for chart

(A) Bandwidth (-26dB)

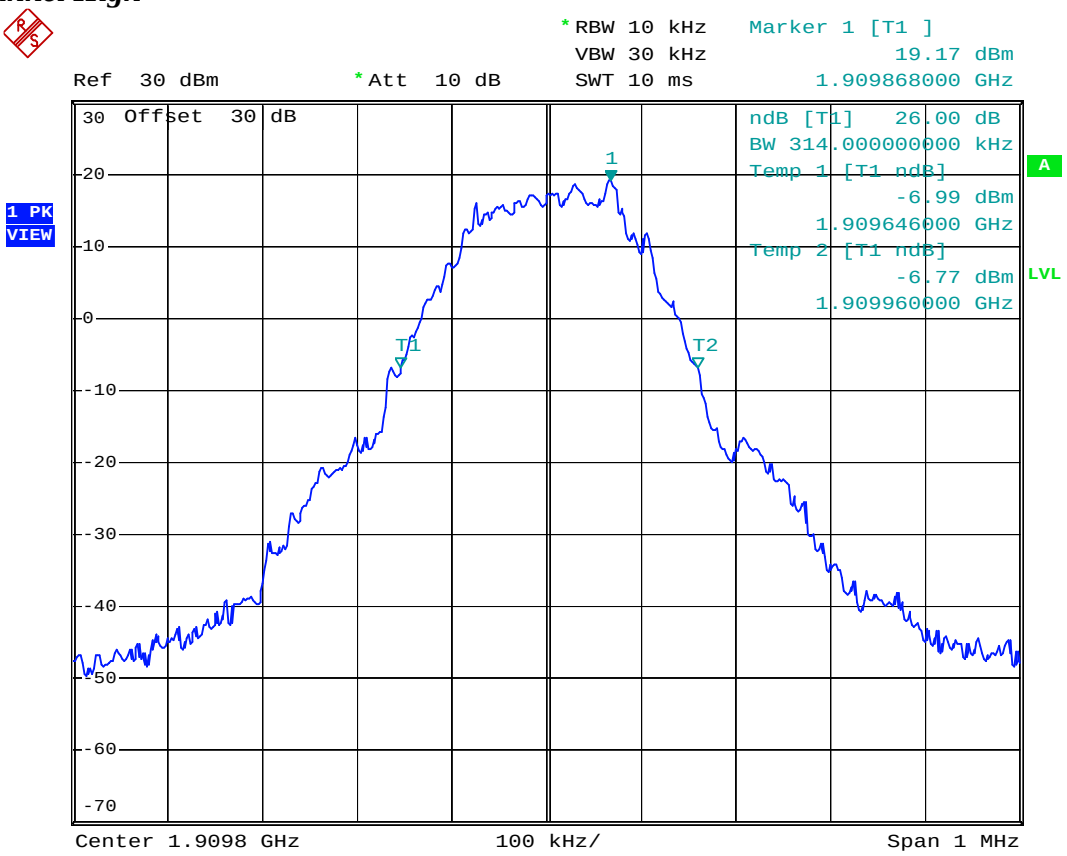
Channel Low



Channel Middle

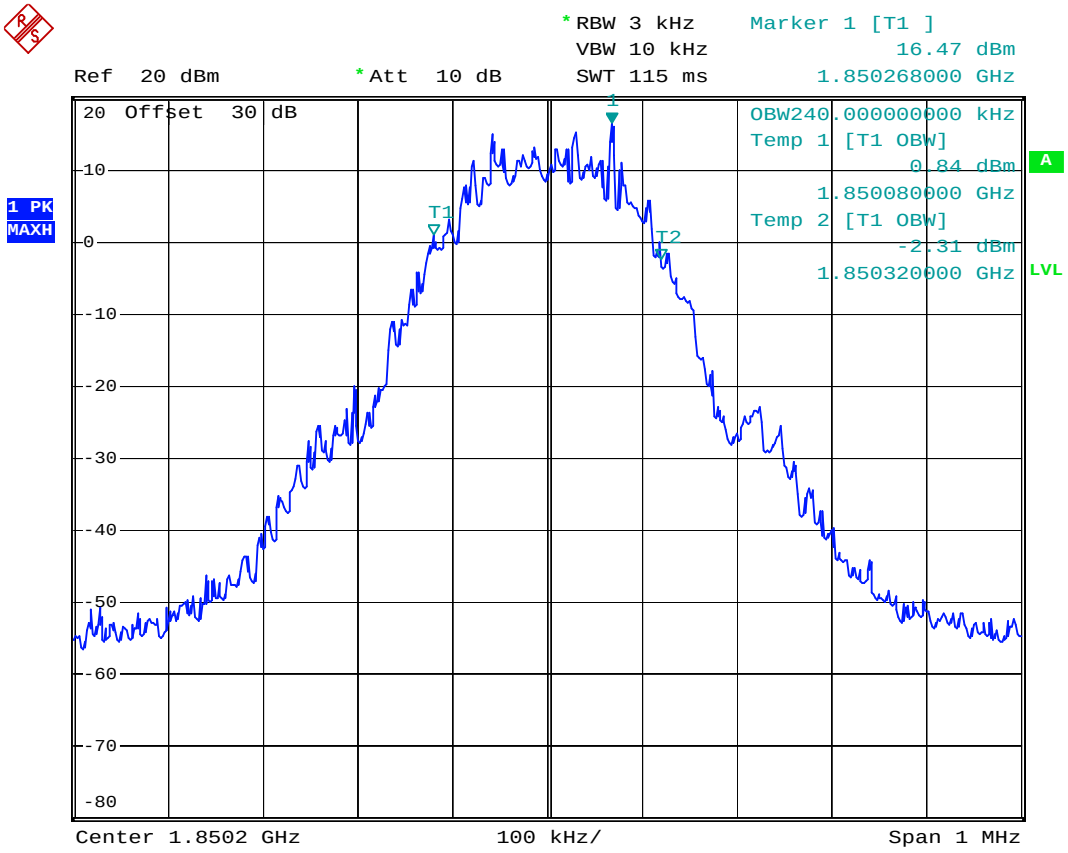


Channel High

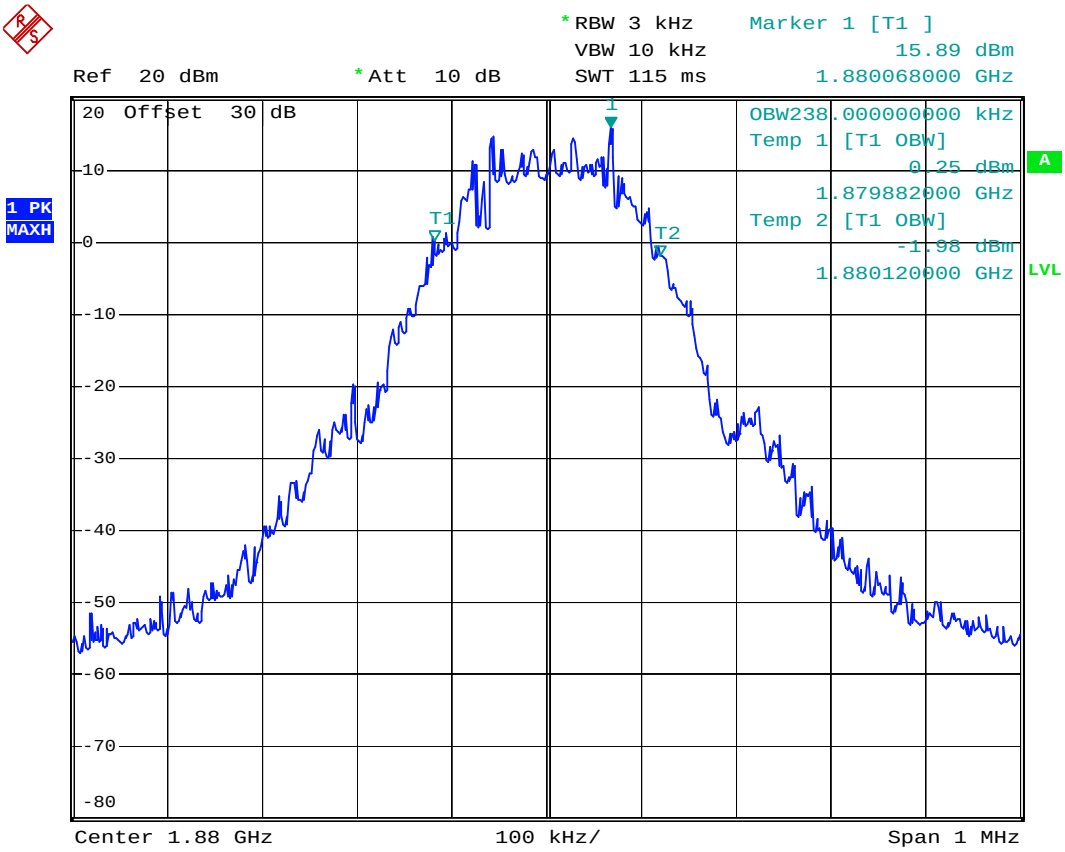


(B) Occupied bandwidth (99% bandwidth)

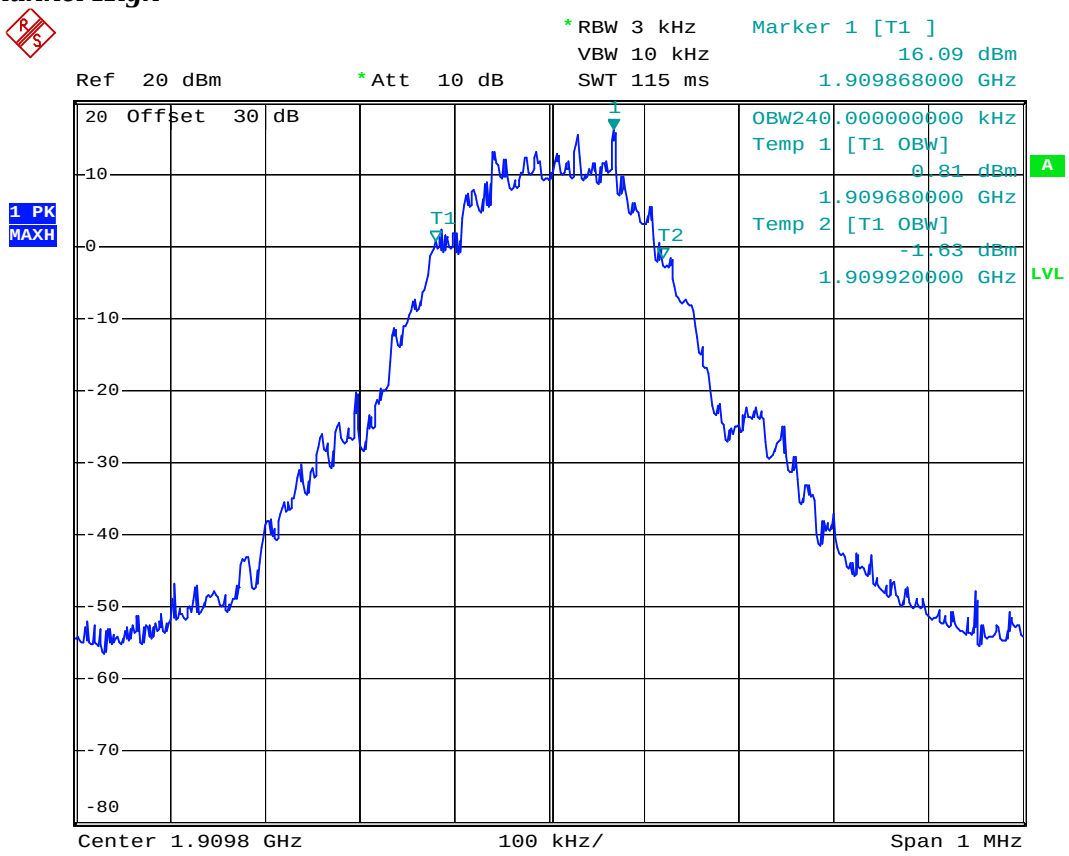
Channel Low



Channel Middle



Channel High



6 OUT OF BAND EMISSION AT ANTENNA TERMINALS

6.1 Standard Applicable

According to FCC §2.1051, FCC §22.917(f), FCC §24.238(a).

Out of Band Emissions: The mean power of emission must be attenuated below the mean power of the non-modulated carrier (P) on any frequency twice or more than twice the fundamental frequency by at lease 43 + 10 log P dB.

Mobile Emissions in Base Frequency Range: The mean power of any emissions appearing in the base station frequency range from cellular mobile transmitters operated must be attenuated to a level not exceed –80 dBm at the transmit antenna connector.

Band Edge Requirements: In the 1MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at lease 1% of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the Out of band Emission.

6.2 Measurement Procedure

The setup of the EUT as shown in figure 1.The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz, sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.

For the out of band: Set the RBW, VBW=1MHz, Start=30MHz, Stop= 10th harmonic. Limit = -13dBm

Band Edge Requirements (824 MHz and 849 MHz / 1850MHz and 1910MHz): In the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 1 percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the out of band emissions. Limit = -13dBm.

6.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	2013/09/20
Power Divider	SUHNER	4901.19.A	2013/08/12
Universal Digital Radiocommunication Tester	R&S	CMU200	2013/04/22

6.4 Measurement Data

Test Date : Oct. 23, 2012 Temperature : 25 °C Humidity : 65 %

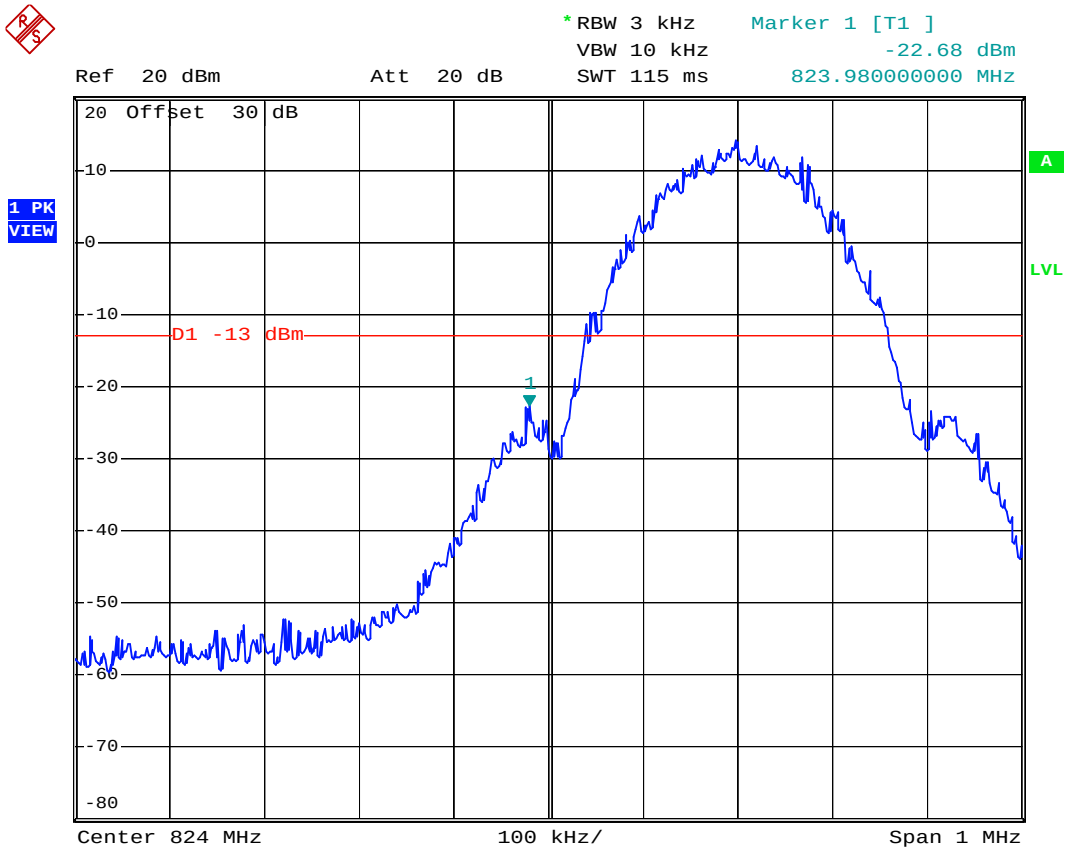
6.4.1 GSM850 Band (GPRS)

Test Mode	Channel	Frequency Range	Note	Chart
GSM850 GPRS	128	823MHz-825MHz	Lower Band Edge	Page 44
	251	848MHz-850MHz	Upper Band Edge	Page 45
	128	30MHz-10GHz	All Band Edge	Page 46
	190	30MHz-10GHz	All Band Edge	Page 47
	251	30MHz-10GHz	All Band Edge	Page 48

Note: Please refer to the following pages for chart

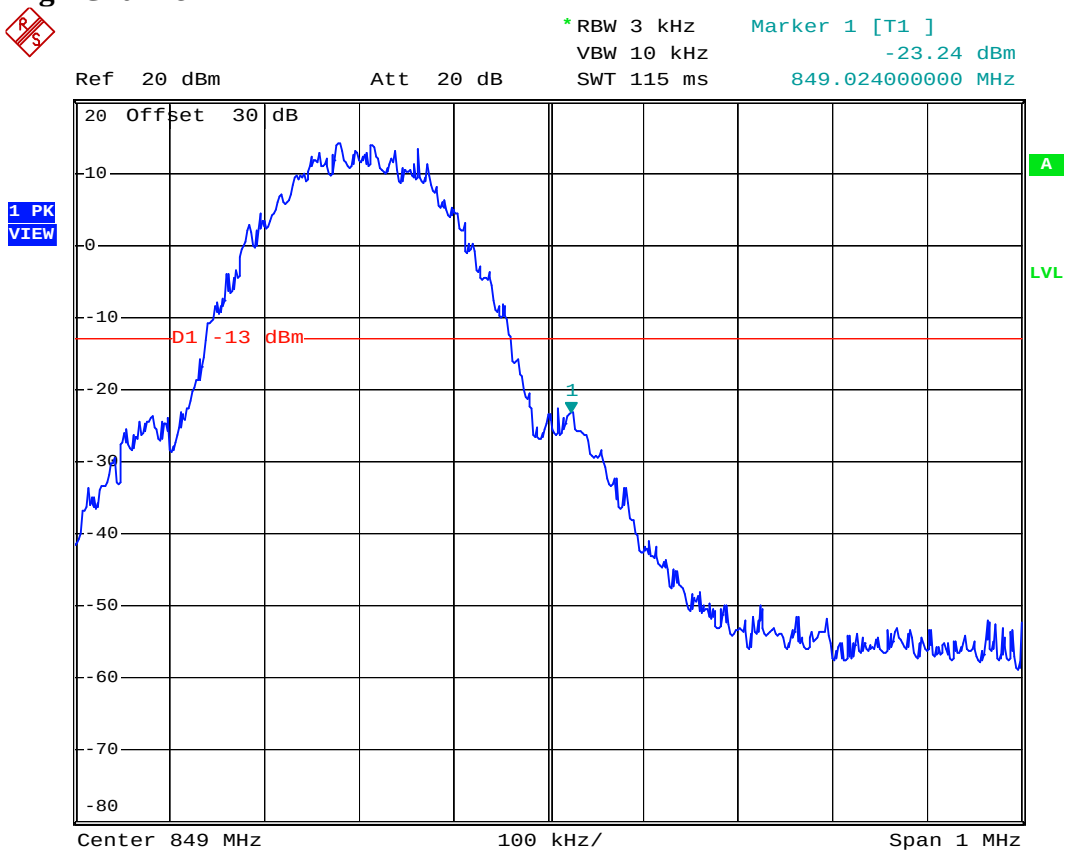
(A) Lower Band Edge

Low Channel



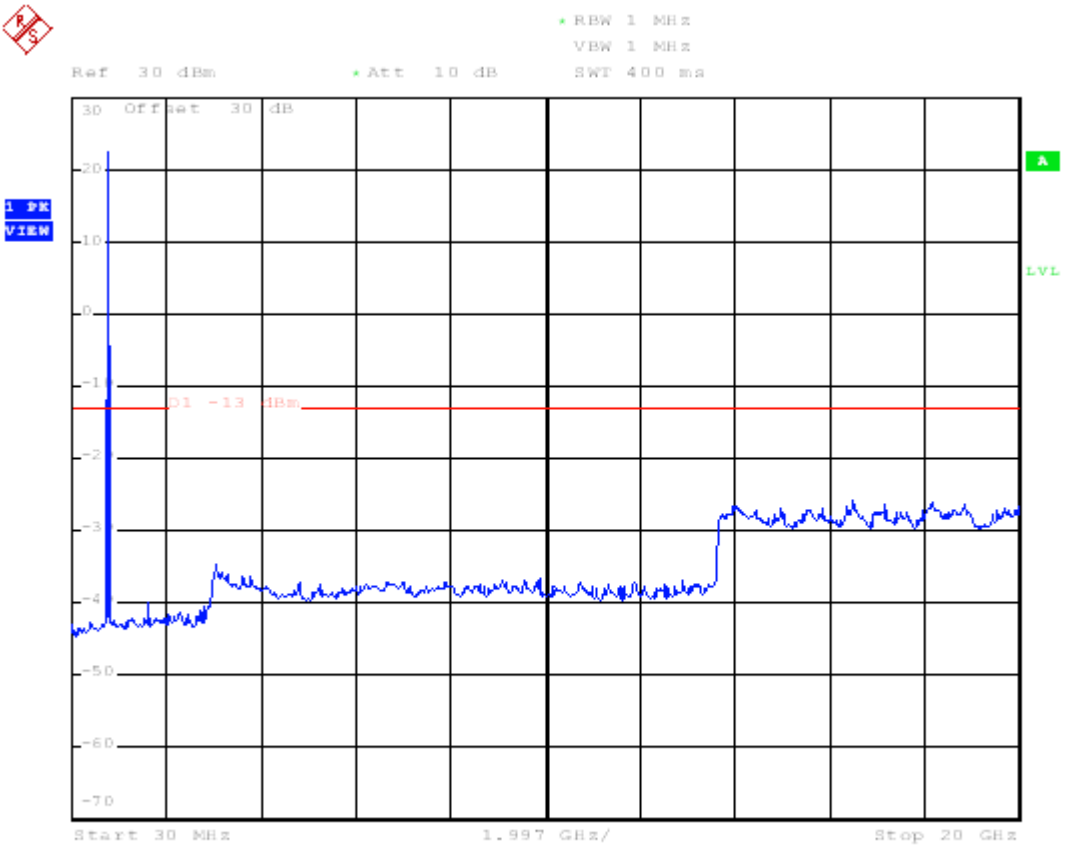
(B) Upper Band Edge

High Channel



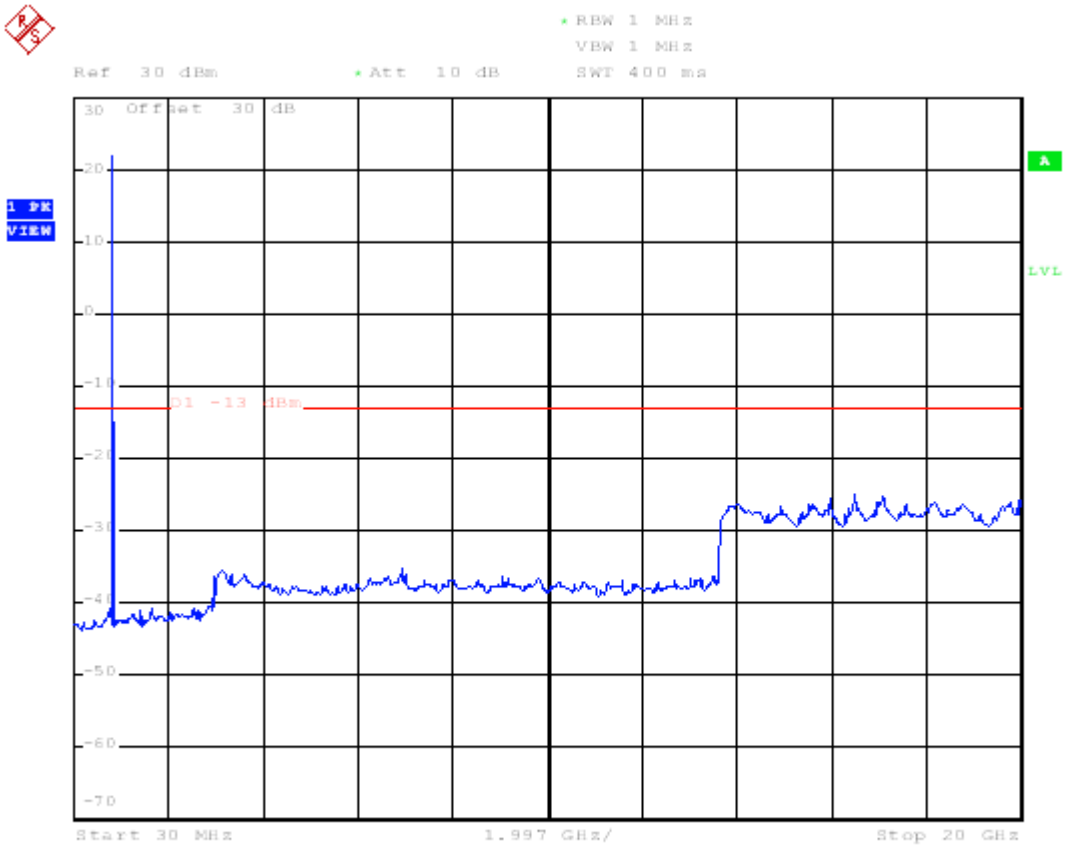
(C) All Band Edge

Low Channel



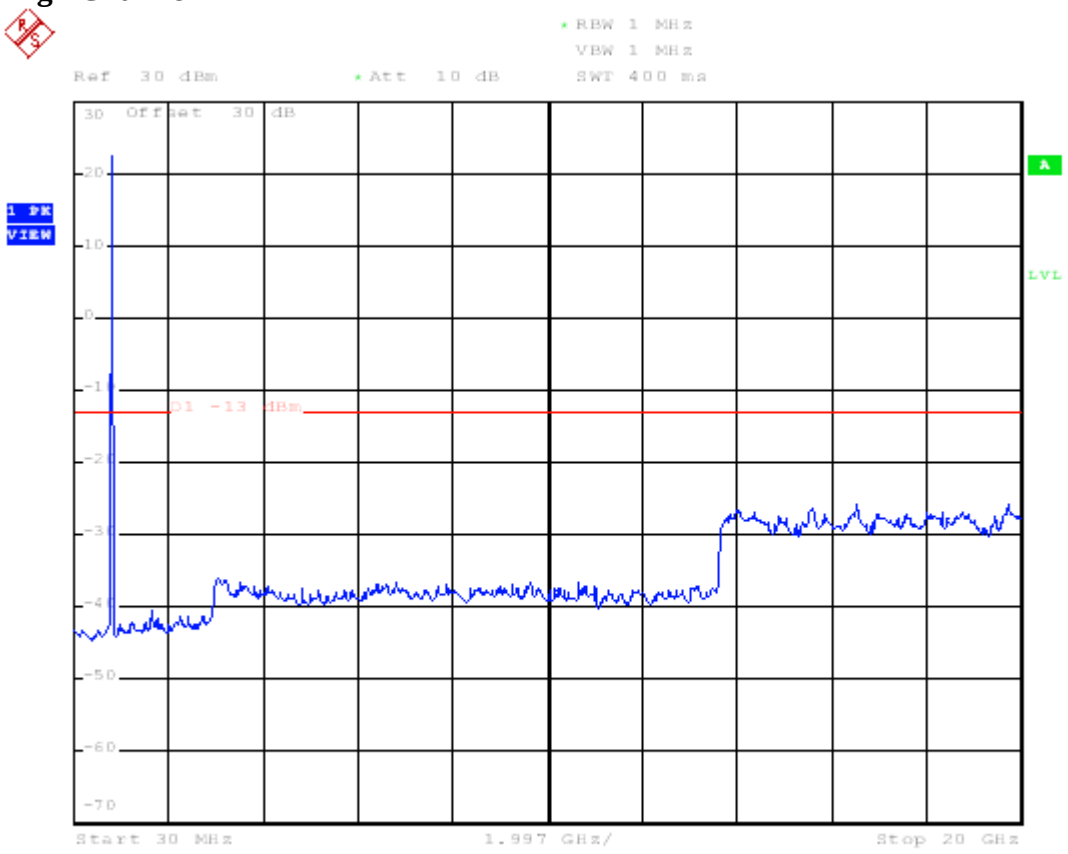
(D) All Band Edge

Middle Channel



(E) All Band Edge

High Channel



Test Date : Oct. 23, 2012 Temperature : 25 °C Humidity : 65 %

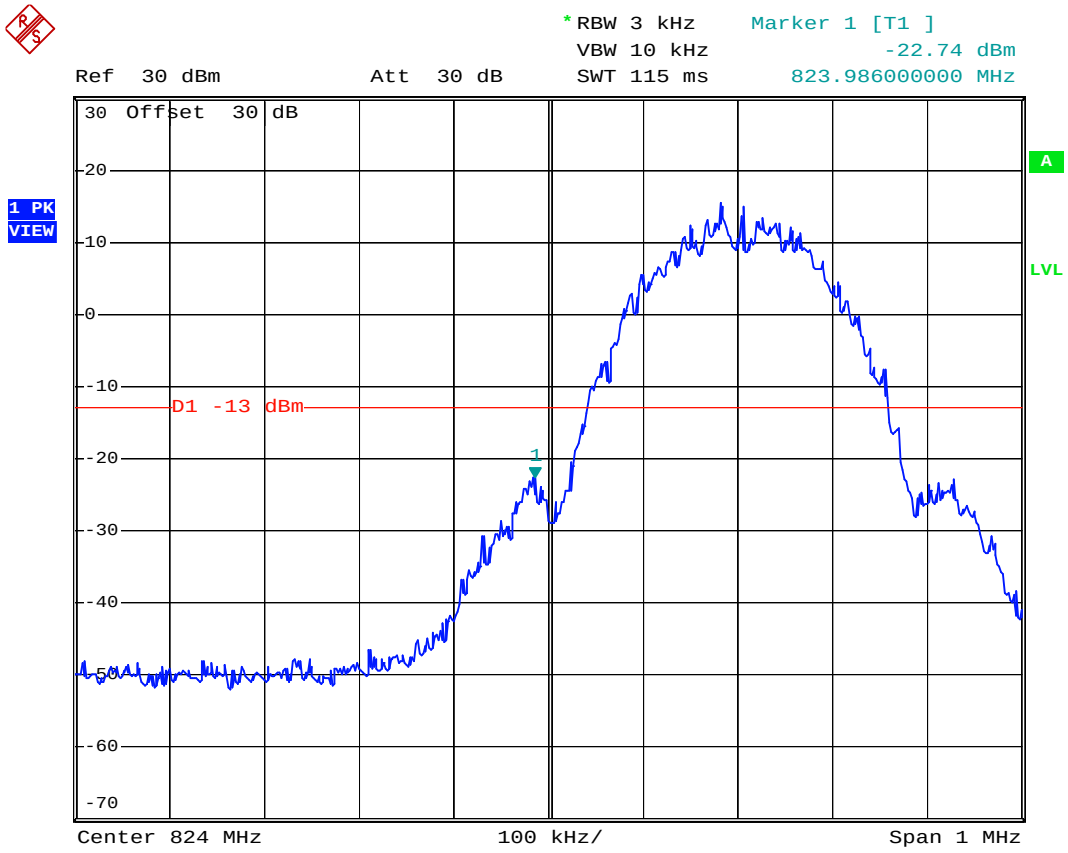
6.4.2 GSM850 Band (EDGE)

Test Mode	Channel	Frequency Range	Note	Chart
GSM850 EDGE	128	823MHz-825MHz	Lower Band Edge	Page 50
	251	848MHz-850MHz	Upper Band Edge	Page 51
	128	30MHz-10GHz	All Band Edge	Page 52
	190	30MHz-10GHz	All Band Edge	Page 53
	251	30MHz-10GHz	All Band Edge	Page 54

Note: Please refer to the following pages for chart

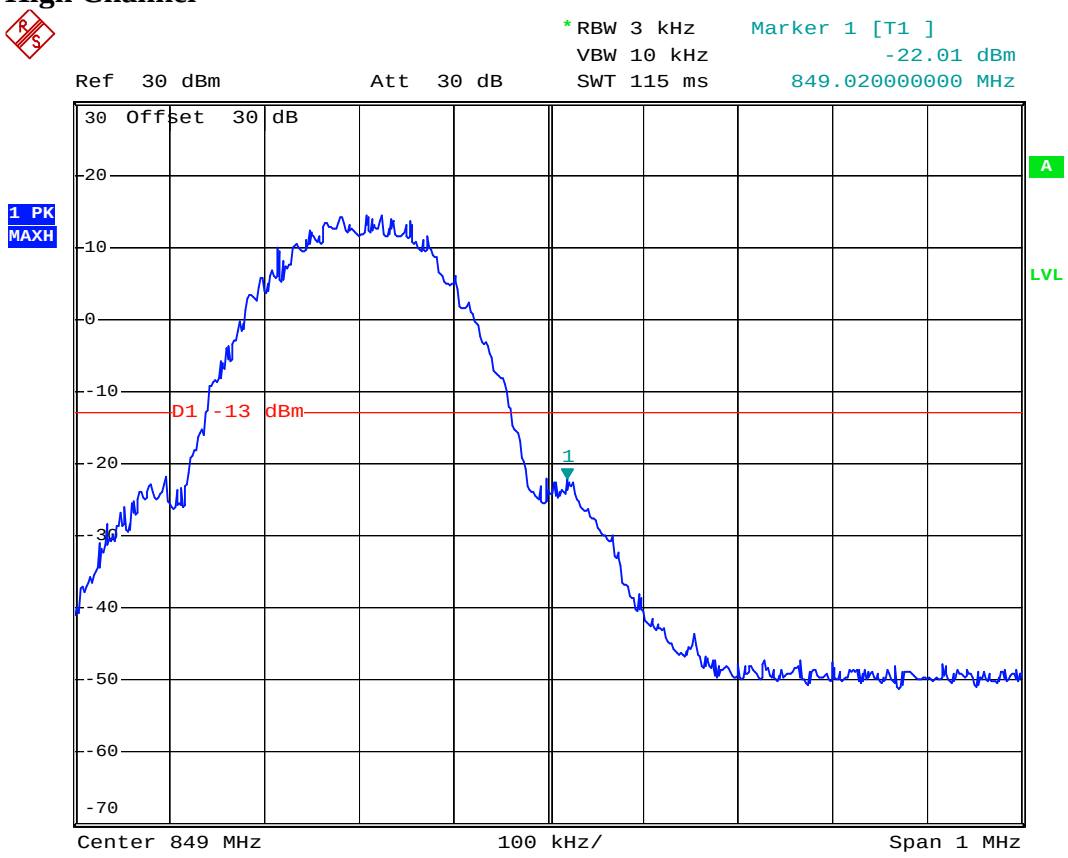
(A) Lower Band Edge

Low Channel



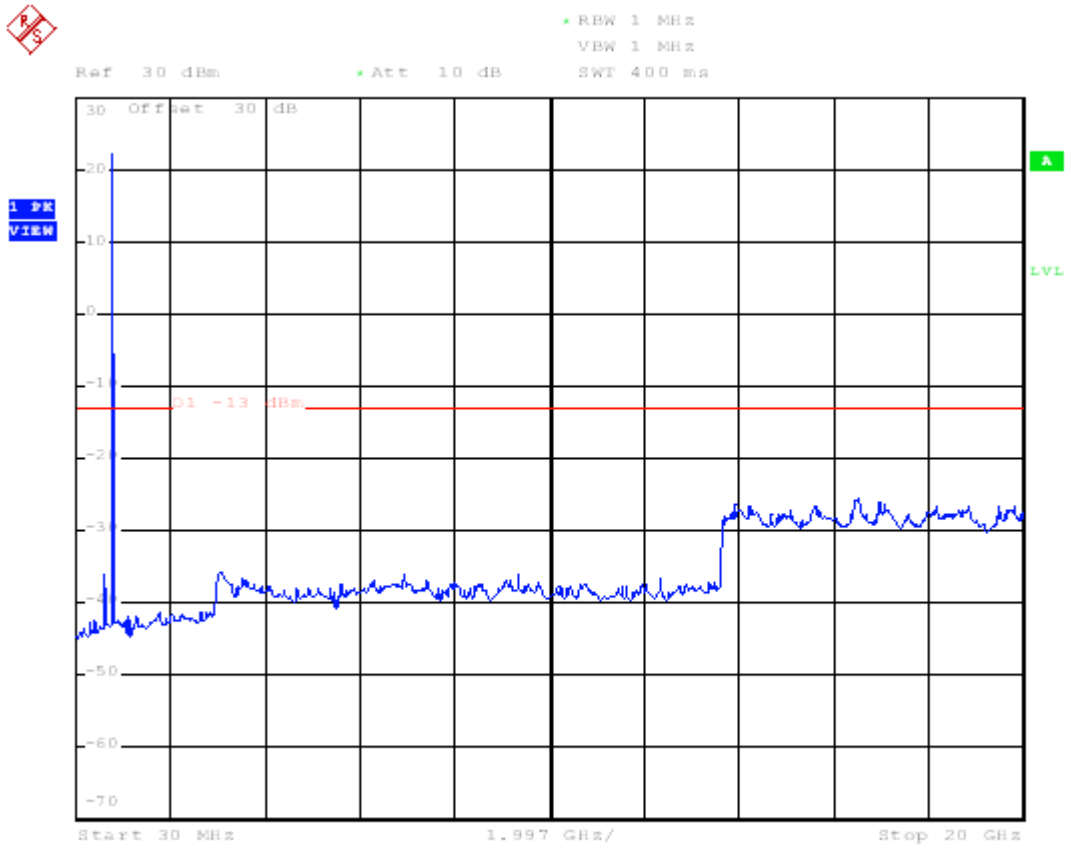
(B) Upper Band Edge

High Channel



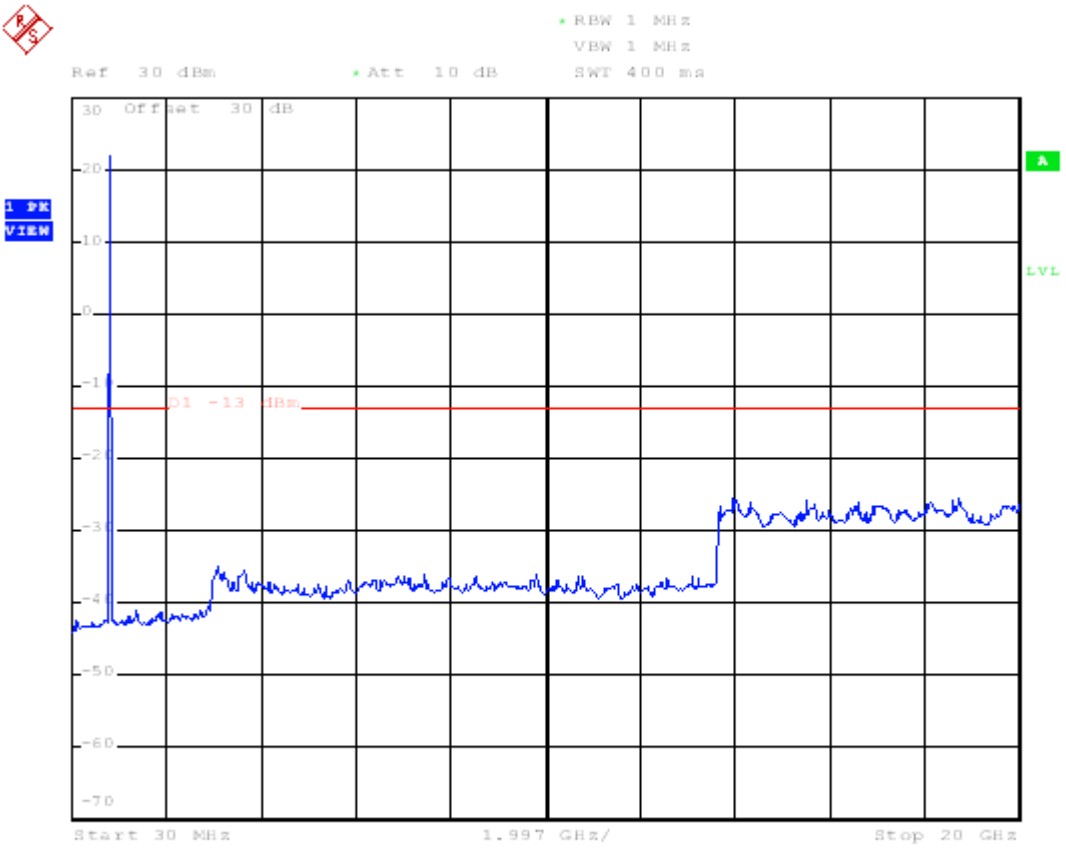
(C) All Band Edge

Low Channel



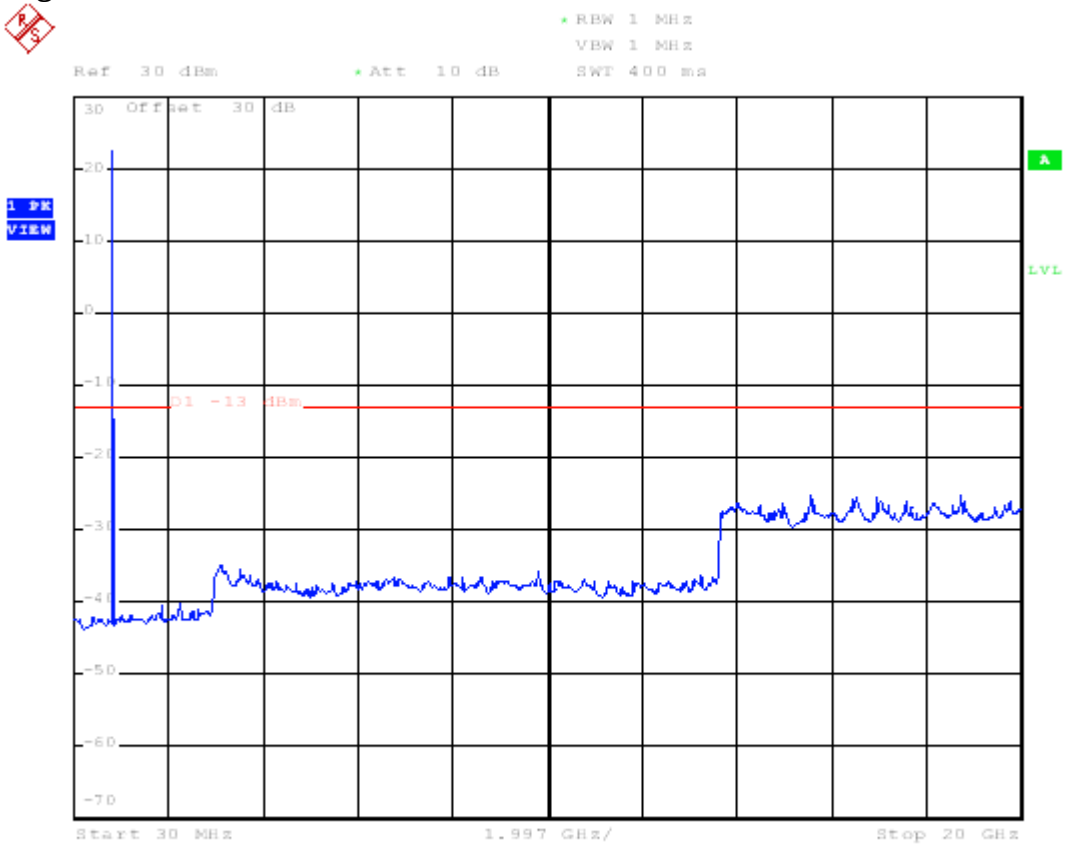
(D) All Band Edge

Middle Channel



(E) All Band Edge

High Channel



Test Date : Oct. 23, 2012 Temperature : 25 °C Humidity : 65 %

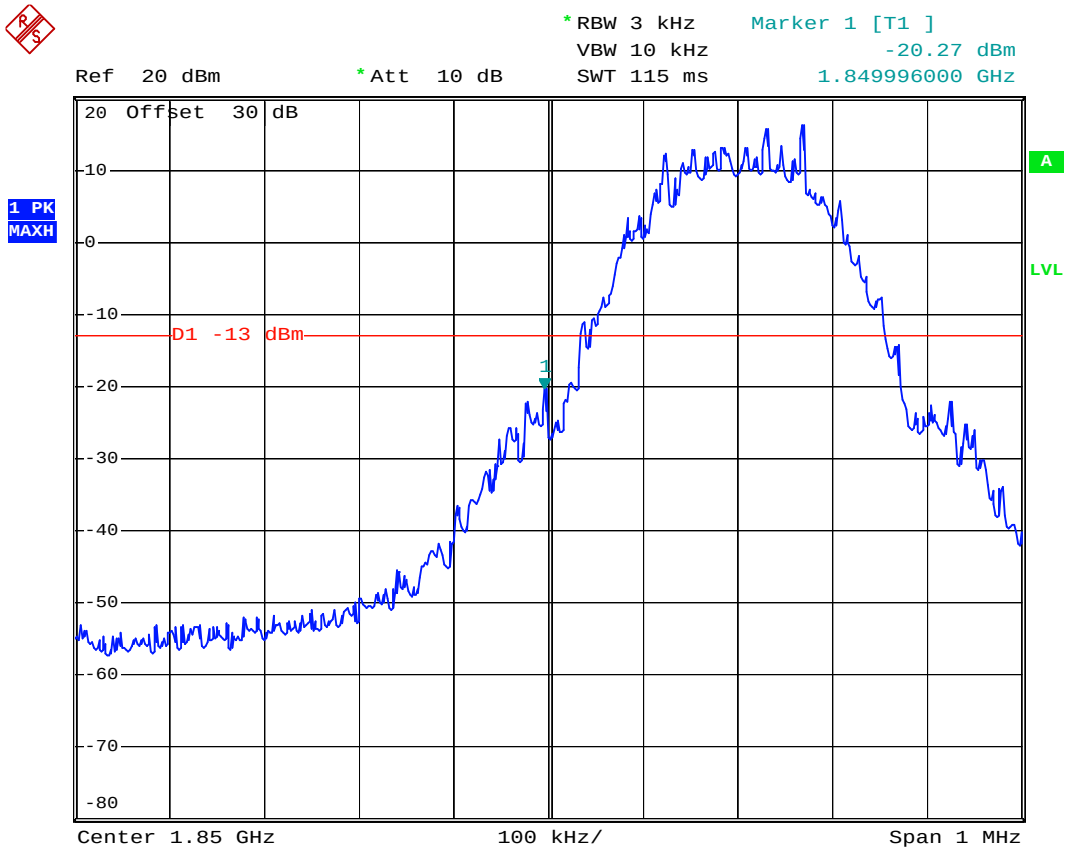
6.4.3 PCS1900 Band (GPRS)

Test Mode	Channel	Frequency Range	Note	Chart
PCS1900 GPRS	512	1849MHz-1851MHz	Lower Band Edge	Page 56
	810	1909MHz-1911MHz	Upper Band Edge	Page 57
	512	30MHz-20GHz	All Band Edge	Page 58
	661	30MHz-20GHz	All Band Edge	Page 59
	810	30MHz-20GHz	All Band Edge	Page 60

Note: Please refer to the following pages for chart

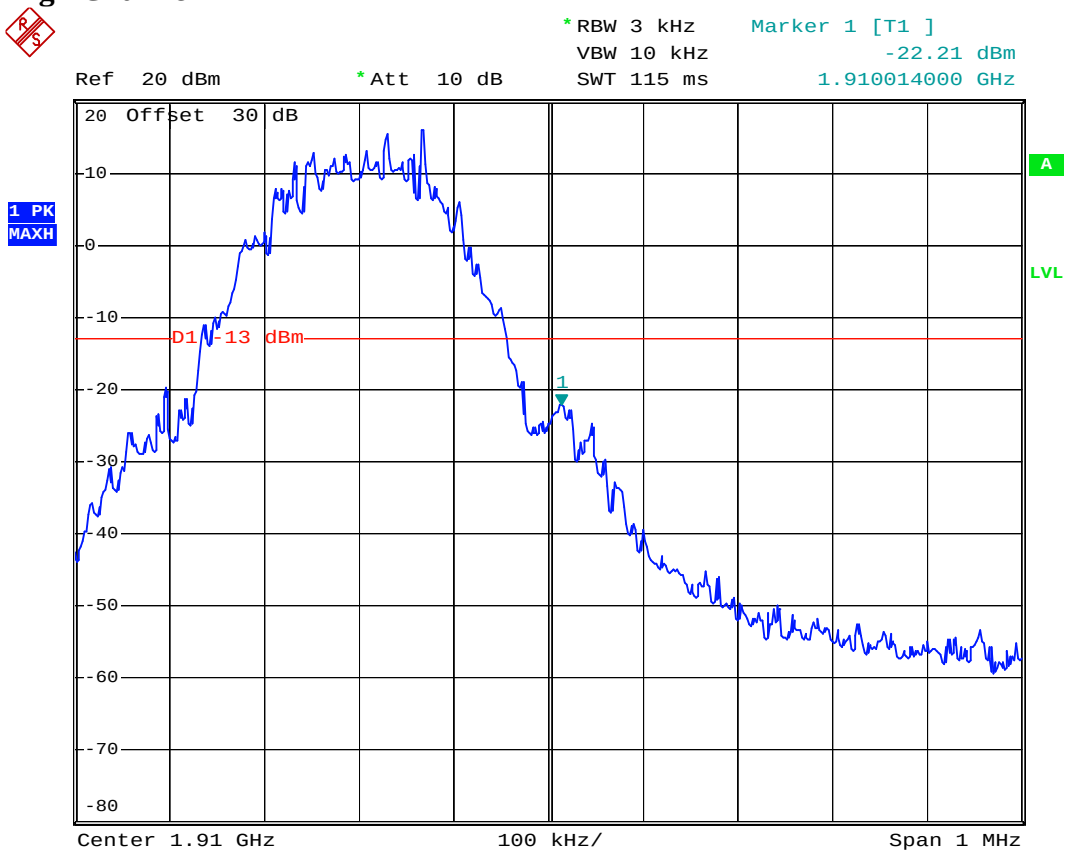
(A) Lower Band Edge

Low Channel



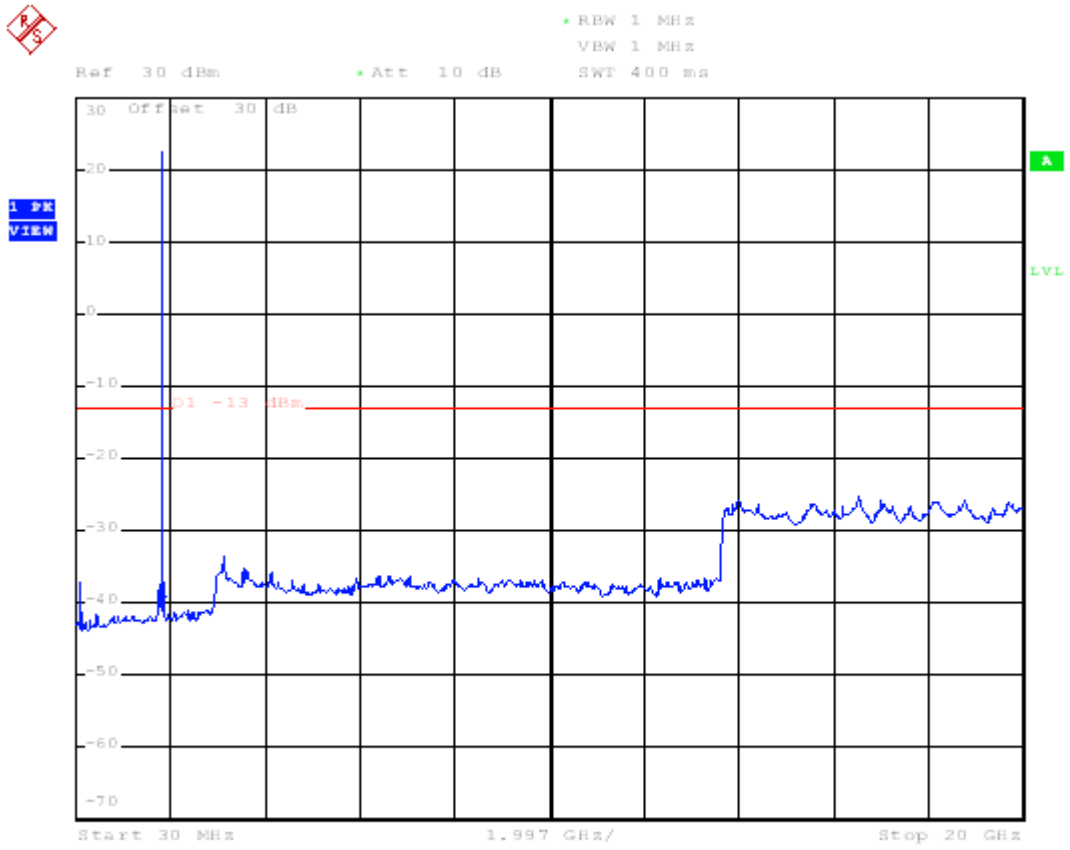
(B) Upper Band Edge

High Channel



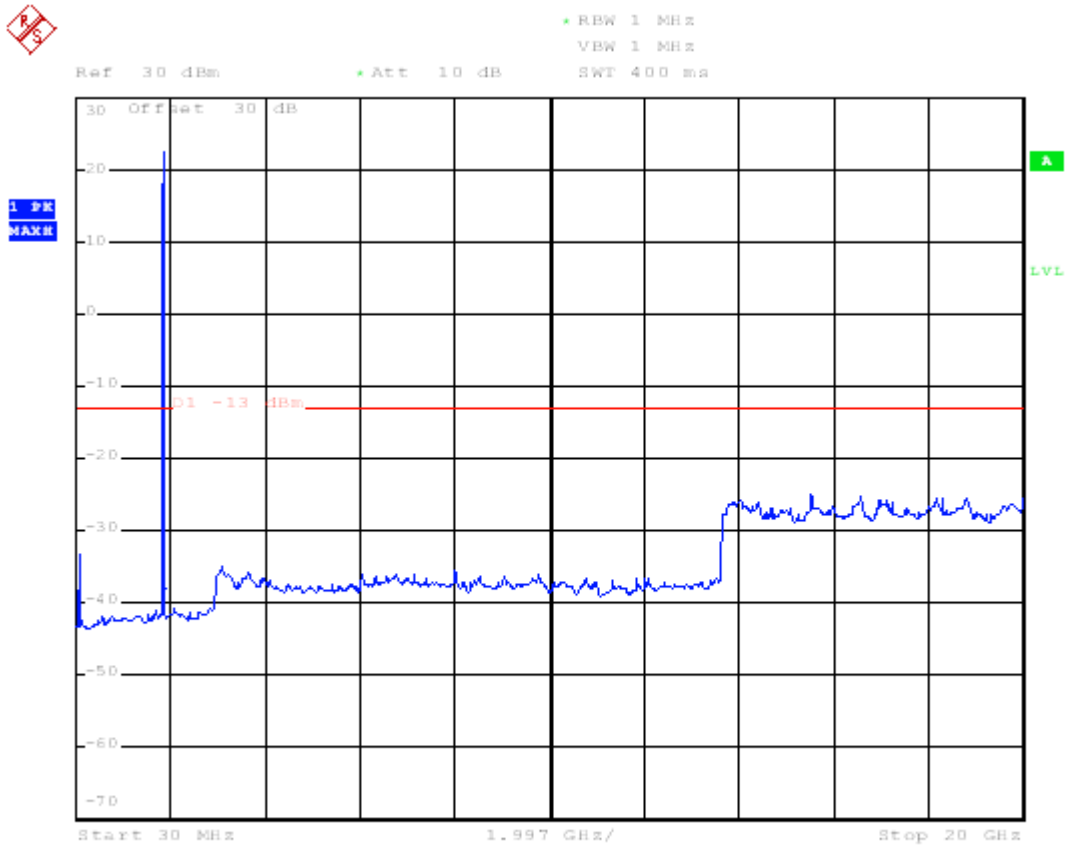
(C) All Band Edge

Low Channel



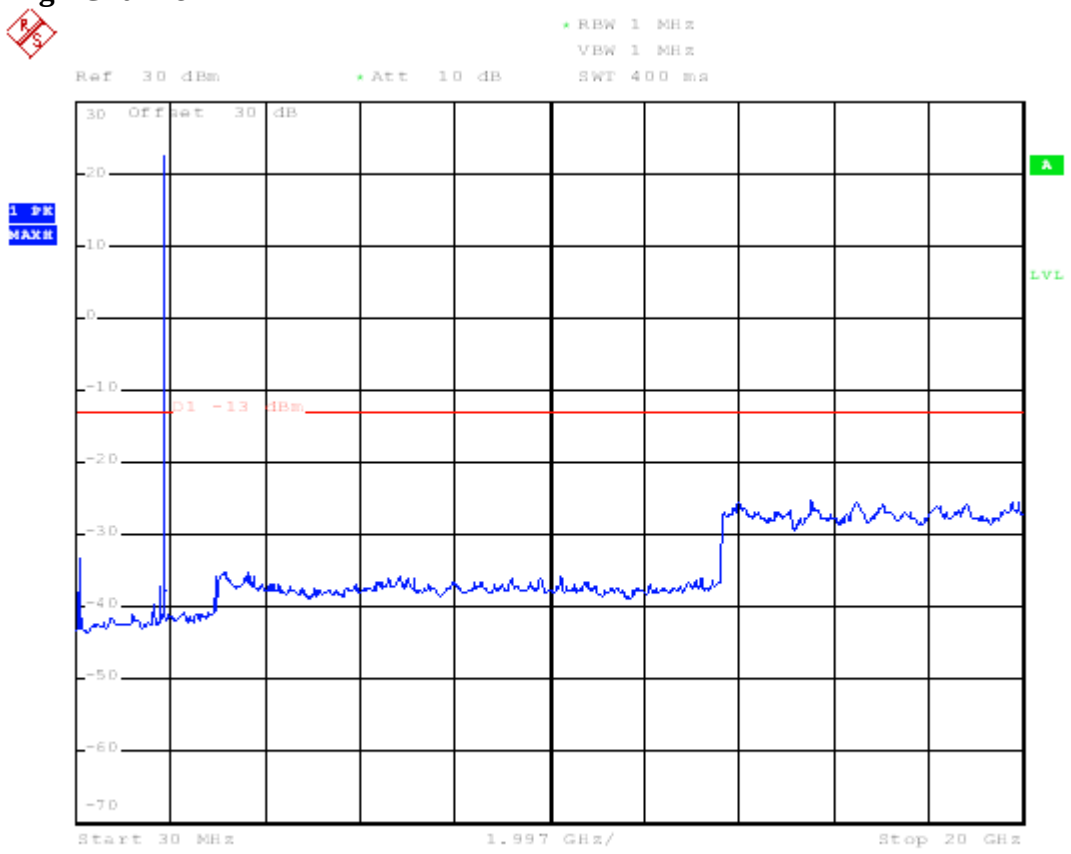
(D) All Band Edge

Middle Channel



(E) All Band Edge

High Channel



Test Date : Oct. 23, 2012 Temperature : 25 °C Humidity : 65 %

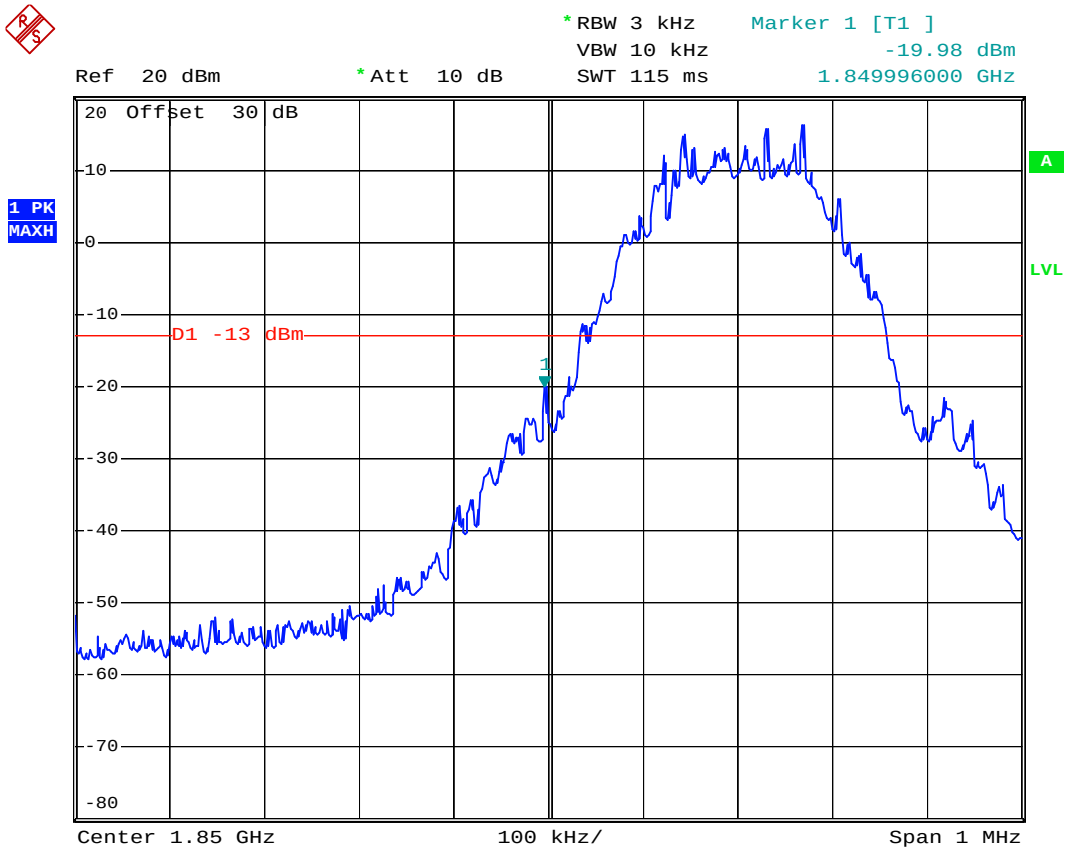
6.4.3 PCS1900 Band (EDGE)

Test Mode	Channel	Frequency Range	Note	Chart
PCS1900 EDGE	512	1849MHz-1851MHz	Lower Band Edge	Page 62
	810	1909MHz-1911MHz	Upper Band Edge	Page 63
	512	30MHz-20GHz	All Band Edge	Page 64
	661	30MHz-20GHz	All Band Edge	Page 65
	810	30MHz-20GHz	All Band Edge	Page 66

Note: Please refer to the following pages for chart

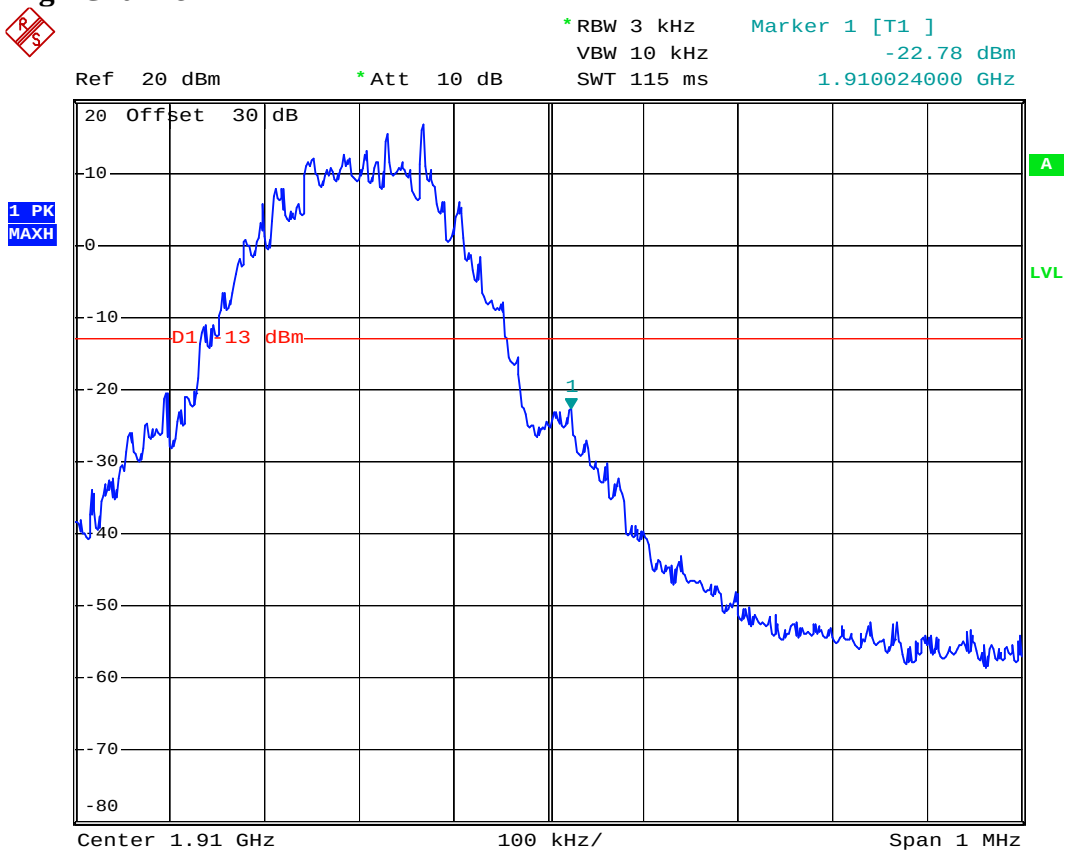
(A) Lower Band Edge

Low Channel



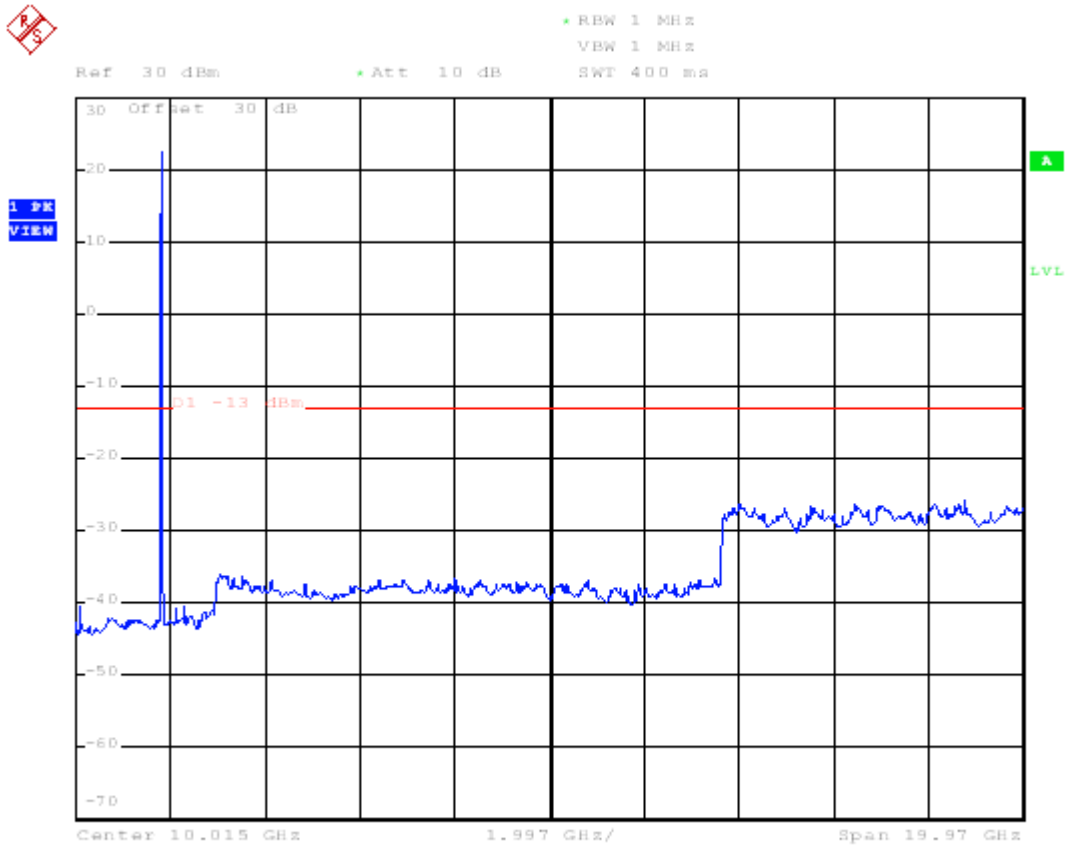
(B) Upper Band Edge

High Channel



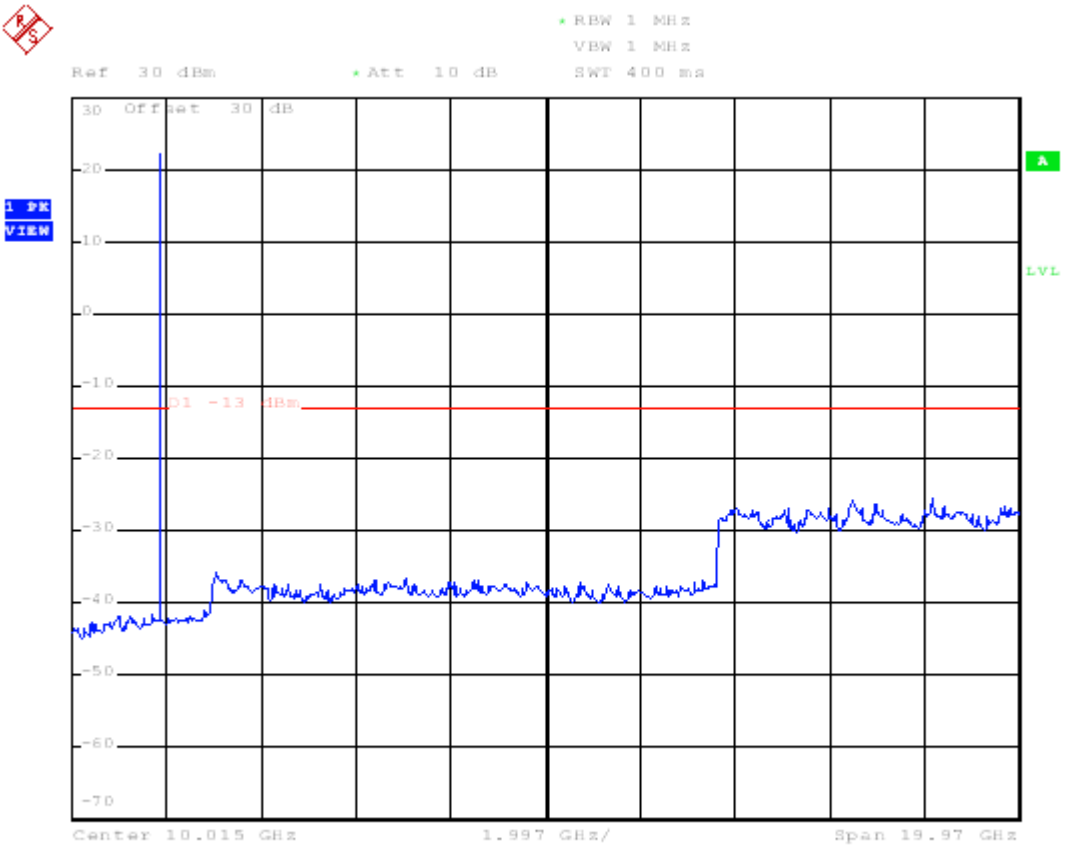
(C) All Band Edge

Low Channel



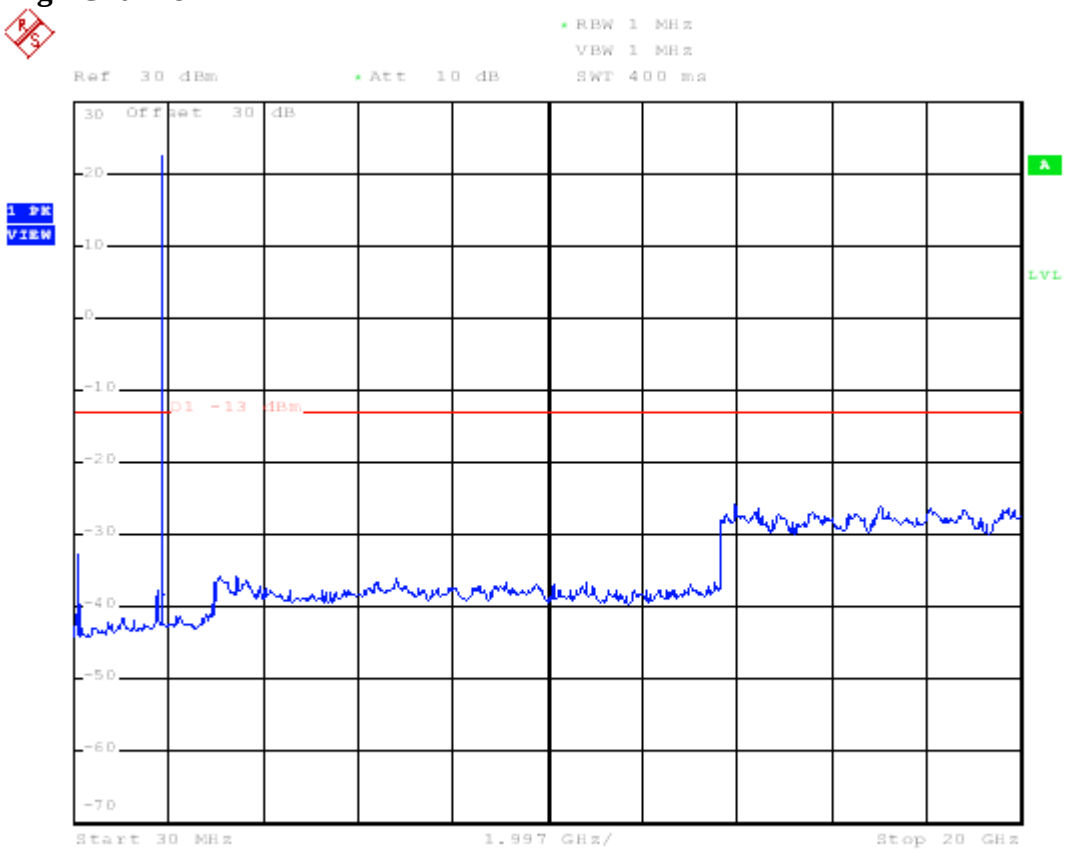
(D) All Band Edge

Middle Channel



(E) All Band Edge

High Channel



7 SPURIOUS RADIATION MEASUREMENT

7.1 Applicable Standard

According to FCC §2.1053

7.2 Measurement Procedure

The setup of the EUT as shown in figure 2 and figure 3.The EUT was placed on a non-conductive, the measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and the EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

The frequency range up to tenth harmonic was investigated for each of three fundamenta frequency (low, middle and high channels). Once spurious emission were identified, the power of the emission was determined using the substitution method.

The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and the spurious emissions frequency.

7.3 Measuring Instrument

Equipment	Manufacturer	Model No.	Next Cal. Due
EMI Test Receiver	Rohde & Schwarz	ESCI	2013/07/15
Spectrum Analyzer	Rohde & Schwarz	FSP40	2013/09/20
Dipole Antenna	Schwarzbeck	1166;1167	2014/09/07
Dipole Antenna	Schwarzbeck	897;898	2014/09/07
Log-periodic Antenna	EMCO	3146	2013/10/17
Amplifier	HP	8447D	2014/05/02
Horn Antenna	EMCO	3116	2013/11/23
Horn Antenna	EMCO	3115	2014/04/28
Signal generator	HP	83732B	2013/09/06

7.4 Test Result

7.4.1 GSM850 Band (GPRS)

Test Date : May 29, 2013 Temperature : 22 °C Humidity : 60 %

(A)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Result ERP (dBm)	Limit (dBm)
GSM850 GPRS	128	35.8200	H	-49.10	-13
		113.4200	V	-55.50	-13
		146.4000	H	-45.60	-13
		191.0200	V	-46.90	-13
		276.3800	H	-32.70	-13
		532.4600	V	-35.30	-13

(B)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Result ERP (dBm)	Limit (dBm)
GSM850 GPRS	190	47.4600	H	-40.70	-13
		80.4400	V	-45.00	-13
		243.4000	H	-40.10	-13
		288.0200	V	-34.00	-13
		332.6400	H	-32.90	-13
		532.4600	V	-31.10	-13

(C)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Result ERP (dBm)	Limit (dBm)
GSM850 GPRS	251	80.44	H	-60.20	-13
		146.4	V	-44.20	-13
		276.38	H	-32.30	-13
		332.64	V	-46.40	-13
		532.46	H	-34.70	-13
		654.68	V	-39.10	-13

7.4.2 GSM850 Band (EDGE)

Test Date : May 29, 2013 Temperature : 22 °C Humidity : 60 %

(A)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Result ERP (dBm)	Limit (dBm)
GSM850 EDGE	128	47.46	H	-44.10	-13
		82.54	V	-43.50	-13
		288.02	H	-38.90	-13
		332.64	V	-42.20	-13
		532.46	H	-35.00	-13
		600.36	V	-40.30	-13

(B)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Result ERP (dBm)	Limit (dBm)
GSM850 EDGE	190	146.4000	H	-44.00	-13
		196.8400	V	-44.60	-13
		280.2600	H	-32.10	-13
		330.7000	V	-45.30	-13
		532.4600	H	-33.30	-13
		662.4400	V	-38.40	-13

(C)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Result ERP (dBm)	Limit (dBm)
GSM850 EDGE	251	47.4600	H	-42.10	-13
		80.4400	V	-49.10	-13
		284.1400	H	-38.40	-13
		330.7000	V	-39.40	-13
		534.4000	H	-31.10	-13
		850.6200	V	-34.90	-13

7.4.3 PCS1900 Band (GPRS)

Test Date : May 29, 2013 Temperature : 22 °C Humidity : 60 %

(A)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Result ERP (dBm)	Limit (dBm)
PCS1900 GPRS	512	80.4400	H	-53.40	-13
		146.4000	V	-45.00	-13
		191.0200	H	-47.40	-13
		243.4000	V	-42.60	-13
		282.2000	H	-32.60	-13
		532.4600	V	-33.90	-13

(B)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Result ERP (dBm)	Limit (dBm)
PCS1900 GPRS	661	47.4600	H	-43.20	-13
		80.4400	V	-49.20	-13
		249.2200	H	-37.60	-13
		288.0200	V	-37.90	-13
		330.7000	H	-39.90	-13
		532.4600	V	-31.10	-13

(C)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Result ERP (dBm)	Limit (dBm)
PCS1900 GPRS	810	80.4400	H	-54.30	-13
		146.4000	V	-44.90	-13
		196.8400	H	-46.20	-13
		332.6400	V	-47.70	-13
		534.4000	H	-39.40	-13
		580.9600	V	-34.20	-13

7.4.4 PCS1900 Band (EDGE)

Test Date : May 29, 2013 Temperature : 22 °C Humidity : 60 %

(A)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Result ERP (dBm)	Limit (dBm)
PCS1900 EDGE	512	47.4600	H	-53.50	-13
		80.4400	V	-45.50	-13
		107.6000	H	-39.00	-13
		332.6400	V	-45.70	-13
		532.4600	H	-43.00	-13
		701.2400	V	-41.90	-13

(B)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Result ERP (dBm)	Limit (dBm)
PCS1900 EDGE	661	35.8200	H	-45.30	-13
		113.4200	V	-44.50	-13
		146.4000	H	-45.00	-13
		280.2600	V	-51.70	-13
		534.4000	H	-40.10	-13
		664.3800	V	-39.20	-13

(C)

Test Mode	Channel	Frequency (MHz)	Polarity (H/V)	Result ERP (dBm)	Limit (dBm)
PCS1900 EDGE	810	47.4600	H	-52.30	-13
		80.4400	V	-39.00	-13
		330.7000	H	-49.30	-13
		452.9200	V	-44.80	-13
		534.4000	H	-40.00	-13
		664.3800	V	-47.90	-13

7.5 Photos of Test Setup

8. FREQUENCY STABILITY MEASUREMENT

8.1 Provisions Applicable

According to FCC §2.1055, FCC §22.355, .FCC §24.235.

Frequency Tolerance: 2.5 ppm

8.2 Measurement Procedure

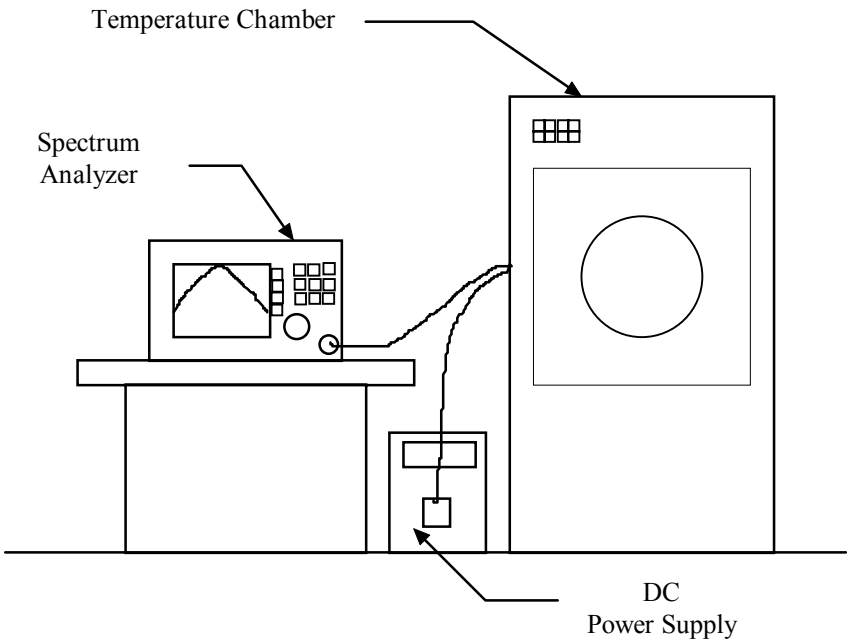
A) Frequency stability versus environmental temperature

1. Setup the configuration per figure 4 for frequencies measured at ambient temperature if it is within 15°C to 25°C. Otherwise, an environmental chamber set for a temperature of 20°C shall be used.
2. Turn on EUT and set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100 kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. Set the temperature of chamber to 50°C. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a 10°C decreased per stage until the lowest temperature -30°C is measured, record all measurement frequencies.

B) Frequency stability versus input voltage

1. Setup the configuration per figure 4 for frequencies measured at ambient temperature if it is within 15°C to 25°C. Otherwise, an environmental chamber set for a temperature of 20°C shall be used. Install new batteries in the EUT.
2. Set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100 kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. For non hand carried, battery operated device, supply the EUT primary voltage with 85 and 115 percent of the nominal value and record the frequency.

Figure 4: Frequency stability measurement configuration



8.3 Measurement Instrument

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Rohde & Schwarz	FSP40	2013/09/20
Power Divider	SUHNER	4901.19.A	2013/08/12
Universal Digital Radiocommunication Tester	R&S	CMU200	2013/04/22
Temperature Chamber	MALLIER	MCT-2X-M	2013/05/03

8.4 Measurement Data

A. GSM850 Band (GPRS)

A1. Frequency stability versus enviroment tempture

Reference Frequency : GSM850 Middle Channel 836.6 MHz			
Enviroment Tempture (℃)	Power Supplied (Vac)	Limit：0.00025% (2.5 ppm)	
		Frequency (MHz)	Delta (%)
50	120	836.6014	0.00016
40		836.6014	0.00017
30		836.6004	0.00005
20		836.6001	0.00002
10		836.5991	-0.00010
0		836.5989	-0.00013
-10		836.5989	-0.00014
-20		836.5989	-0.00013
-30		836.5984	-0.00019

A2. Frequency stability versus supplied voltage (85% - 115%)

Reference Frequency : GSM850 Middle Channel 836.6 MHz			
Enviroment Tempture (℃)	Power Supplied (Vac)	Limit：0.00025% (2.5 ppm)	
		Frequency (MHz)	Delta (%)
25	138	836.6013	0.00016
25	102	836.6012	0.00014

B. GSM850 Band (EDGE)

B1. Frequency stability versus enviroment tempture

Reference Frequency : GSM850 Middle Channel 836.6 MHz			
Enviroment Tempture (℃)	Power Supplied (Vac)	Limit：0.00025% (2.5 ppm)	
		Frequency (MHz)	Delta (%)
50	120	836.6006	0.00008
40		836.6005	0.00006
30		836.6003	0.00003
20		836.6000	0.00000
10		836.5996	-0.00004
0		836.5994	-0.00007
-10		836.5996	-0.00005
-20		836.5989	-0.00014
-30		836.5990	-0.00011

B2. Frequency stability versus supplied voltage (85% - 115%)

Reference Frequency : GSM850 Middle Channel 836.6 MHz			
Enviroment Tempture (℃)	Power Supplied (Vac)	Limit：0.00025% (2.5 ppm)	
		Frequency (MHz)	Delta (%)
25	138	836.5993	-0.00009
25	102	836.5991	-0.00011

C. PCS1900 Band (GPRS)

C1. Frequency stability versus enviroment tempture

Reference Frequency : PCS1900 Middle Channel 1880 MHz			
Enviroment Tempture (℃)	Power Supplied (Vac)	Limit：0.00025% (2.5 ppm)	
		Frequency (MHz)	Delta (%)
50	120	1880.0032	0.00017
40		1880.0025	0.00013
30		1880.0027	0.00014
20		1880.0006	0.00003
10		1879.9995	-0.00003
0		1879.9987	-0.00007
-10		1879.9974	-0.00014
-20		1879.9973	-0.00014
-30		1879.9966	-0.00018

C2. Frequency stability versus supplied voltage (85% - 115%)

Reference Frequency : PCS1900 Middle Channel 1880 MHz			
Enviroment Tempture (℃)	Power Supplied (Vac)	Limit：0.00025% (2.5 ppm)	
		Frequency (MHz)	Delta (%)
25	138	1879.9974	-0.00014
25	102	1879.9968	-0.00017

D. PCS1900 Band (EDGE)

D1. Frequency stability versus enviroment tempture

Reference Frequency : PCS1900 Middle Channel 1880 MHz			
Enviroment Tempture (℃)	Power Supplied (Vac)	Limit：0.00025% (2.5 ppm)	
		Frequency (MHz)	Delta (%)
50	120	1880.0031	0.00016
40		1880.0018	0.00010
30		1880.0004	0.00002
20		1879.9999	-0.00001
10		1879.9986	-0.00007
0		1879.9993	-0.00004
-10		1879.9982	-0.00009
-20		1879.9967	-0.00018
-30		1879.9971	-0.00016

D2. Frequency stability versus supplied voltage (85% - 115%)

Reference Frequency : PCS1900 Middle Channel 1880 MHz			
Enviroment Tempture (℃)	Power Supplied (Vac)	Limit：0.00025% (2.5 ppm)	
		Frequency (MHz)	Delta (%)
25	138	1879.9982	-0.00009
25	102	1879.9979	-0.00011

9 CONDUCTED EMISSION MEASUREMENT

9.1 Standard Applicable

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

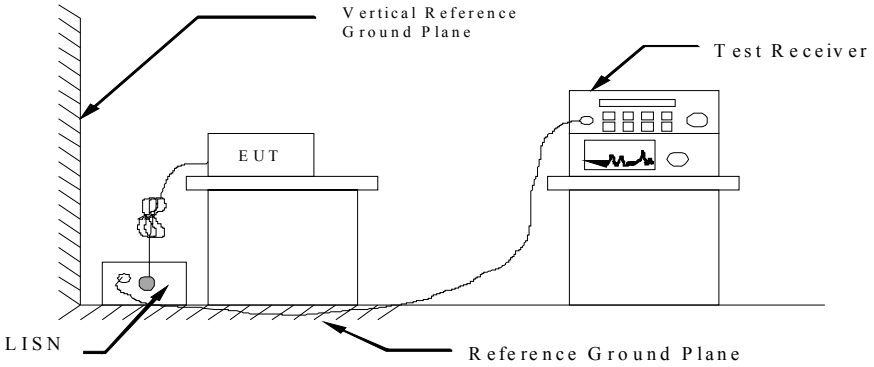
Frequency MHz	**Quasi Peak dB μV**	**Average dB μV**
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

* Decreases with the logarithm of the frequency

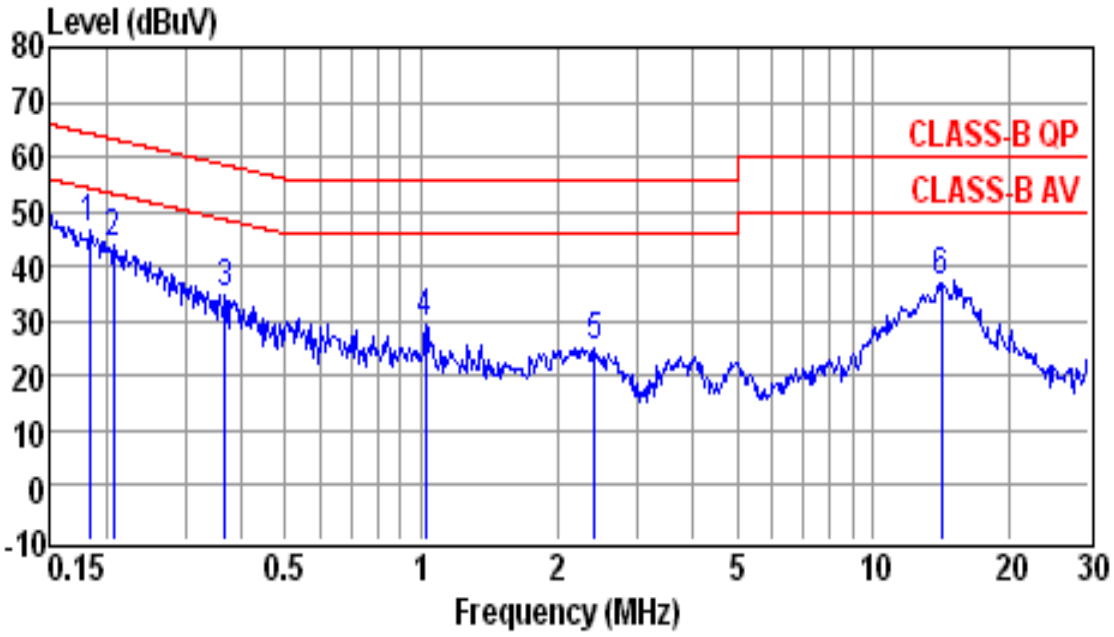
9.2 Measurement Procedure

1. Setup the configuration per figure 5.
2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
3. Record the 6 or 8 highest emissions relative to the limit.
4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then records the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
5. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.
6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 5: Conducted emissions measurement configuration



9.3 Conducted Emission Data

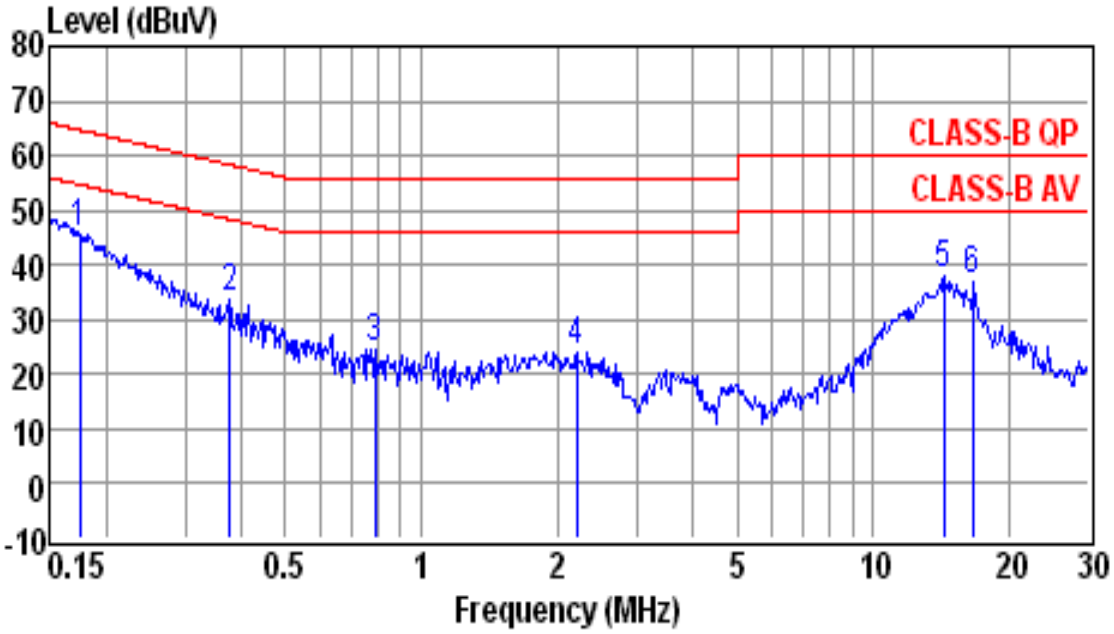


Site	: conducted #1	Date	: 05-29-2013
Condition	: CLASS-B QP	LISN	: NEUTRAL
Tem / Hum	: 25 ℃ / 65%		
Test Mode	: CHARGE & FULL SYSTEM & WIFI LINK MODE		
EUT	: Rugged Tablet PC		
Power Rating	: 100-240V (Adapter)		
Memo	:	Memo	:

Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
0.1844	36.2	10.3	46.5	64.3	-17.8	QP
0.2083	33.6	10.3	43.9	63.3	-19.4	QP
0.3673	24.5	10.3	34.8	58.6	-23.8	QP
1.0210	18.8	10.5	29.3	56.0	-26.7	QP
2.4220	14.3	10.5	24.8	56.0	-31.2	QP
14.2130	26.3	10.7	37.0	60.0	-23.0	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss



Site : conducted #1 Date : 05-29-2013
Condition : CLASS-B QP LISN : LINE
Tem / Hum : 25 ℃ / 65%
Test Mode : CHARGE & FULL SYSTEM & WIFI LINK MODE
EUT : Rugged Tablet PC
Power Rating : 100-240V (Adapter)
Memo : Memo :

Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
0.1749	35.3	10.3	45.6	64.7	-19.1	QP
0.3771	23.2	10.3	33.5	58.3	-24.8	QP
0.7876	14.1	10.3	24.4	56.0	-31.6	QP
2.2010	13.6	10.5	24.1	56.0	-31.9	QP
14.3640	27.1	10.8	37.9	60.0	-22.1	QP
16.6610	25.9	10.9	36.8	60.0	-23.2	QP

Note :
1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss

9.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

RESULT = READING + LISN FACTOR

Assume a receiver reading of 22.5 dB μ V is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dB μ V.

RESULT = 22.5 + 0.1 = 22.6 dB μ V
Level in μ V = Common Antilogarithm[(22.6 dB μ V)/20]
= 13.48 μ V

9.5 Conducted Measurement Equipment

The following test equipments are used during the conducted test.

Equipment	Manufacturer	Model No.	Next Cal. Due
EMI Test Receiver	Rohde & Schwarz	ESCI	2012/07/16
LISN	EMCO	3825/2	2012/11/02
LISN	Rohde & Schwarz	ESH2-Z5	2013/04/12

9.6 Photos of Conduction Measuring Setup