

# EMC Test Report

**Project Number:** 3044696

**Report Number:** 3044696EMC21

**Revision Level:** 1

**Client:** Intermec

**Equipment Under Test:** Mobile Computer with CDMA/EVDO/GSM/UMTS/BT/WiFi

**Marketing Name:** Catalina

**Model:** CN51 (1015CP01S)

**FCC Rule Parts:** Part 2, Part 22(H), Part 24(E)

**IC Standards:** RSS-132, Issue 3; RSS-133, Issue 6

**Report issued on:** 04 SEP 2013

**Test Result:** Compliant

Tested by:



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Brian Forster, EMC Engineer

Reviewed by:



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David Schramm, EMC Manager

**Remarks:**

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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# 1 Summary of Test Results

FCC Part Sections	Test Description	Test Limit	Test Condition	Test Result
<b>Transmit Mode Testing</b>				
2.1046	Conducted Output Power	N/A	Conducted	Pass
24.232(d) RSS-132 5.4 RSS-133 6.4	Peak-to-Average Ratio	<13 dB		Pass
2.1049 22.917(a) 24.238(a)	Occupied Bandwidth	N/A		Pass
2.1051 22.917(a) 24.238(a)	Band Edge / Conducted Spurious Emissions	< 43 +10log <sub>10</sub> (P <sub>[Watts]</sub> ) at band edge and for all out of band emissions		Pass
22.913(a)(2)	Effective Radiated Power	< 7 Watts max ERP	Radiated	Pass
RSS-132 5.4	Effective Radiated Power	< 11.5 Watts max ERP		Pass
24.232(c) RSS-133 6.4	Effective Isotropic Radiated Power	< 2 Watts max EIRP		Pass
2.1053 22.917(a) 24.238(a) RSS-132 5.5 RSS-133 6.5	Radiated Spurious Emissions	< 43 +10log <sub>10</sub> (P <sub>[Watts]</sub> ) at band edge and for all out of band emissions		Pass
2.1055 22.917(a) 24.238(a) RSS-132 5.3 RSS-132 6.3	Frequency Stability	<2.5 ppm		Pass

## 1.1 Modifications Required to Compliance

None

## 2 General Information

### 2.1 *Client Information*

Name: Intermec Technologies Corp.  
Address: 6001 36th Avenue W  
City, State, Zip, Country: Everett, WA 988203, USA

### 2.2 *Test Laboratory*

Name: SGS North America, Inc.  
Address: 620 Old Peachtree Road NW, Suite 100  
City, State, Zip, Country: Suwanee, GA 30024, USA

### 2.3 *General Information of EUT*

Marketing Name: Catalina  
Model: 1015CP01S  
Serial Number: 346X1200015 (conducted measurements)  
077X1200001 (radiated measurements)

Rated Voltage: 3.8 VDC, battery  
Test Voltage: Fully charged 3.8 Vdc, battery

Sample Received Date: 20 June 2013  
Dates of testing: 20 June - 31 Jul 2013

## 2.4 Operating Modes and Conditions

The EUT was exercised by connecting a CMW 500 Communications Tester to the device. The CMW was used to control signaling and power modes during testing.

Mode	FCC Rule Part	IC Reference	From Freq. MHz	To Freq. MHz	Emission Designation	Max. Power
Bluetooth	15C	RSS-210 Issue 8	2402	2480	1M45FXD	7.1 mW
WiFi	15C	RSS-210 Issue 8	2412	2462	17M3GXD	53.2 mW
GSM	22H	RSS-132 Issue 3	824.2	846.6	321KGXW	2089 mW
GSM	24E	RS-133 Issue 6	1850.2	1909.8	321KGXW	1072 mW
GSM - GPRS	22H	RSS-132 Issue 3	824.2	846.6	329KG7W	1959 mW
GSM - GPRS	24E	RS-133 Issue 6	1850.2	1909.8	319KG7W	1072 mW
GSM - EDGE	22H	RSS-132 Issue 3	824.2	846.6	321KG7W	2032 mW
GSM - EDGE	24E	RS-133 Issue 6	1850.2	1909.8	309KG7W	1072 mW
WCDMA	22H	RSS-132 Issue 3	826.4	846.6	4M64F9W	323.6 mW
WCDMA	24E	RS-133 Issue 6	1852.4	1907.6	4M64F9W	309.0 mW
CDMA	22H	RSS-132 Issue 3	824.7	848.31	1M41F9W	295.1 mW
CDMA	24E	RS-133 Issue 6	1851.25	1908.75	1M42F9W	295.1 mW

### 3 US Cellular Band

#### 3.1 RF Output Power

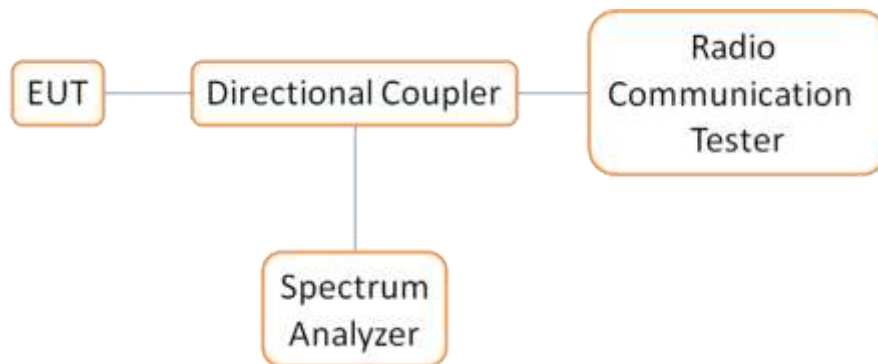
##### 3.1.1 Test Result

Test Description	Basic Standards	Test Result
RF Output Power	FCC Part 2.1046	Reported

##### 3.1.2 Test Method

A radio link was established between EUT and Radio Communication Tester. The output power of the EUT was set to maximum value by using the maximum power setting on the Radio Communications Tester. The output power was measured by a spectrum analyzer with the use of a directional coupler.

For CDMA Band 0, the measurement will be conducted at three channels: 1013, 384 and 777 (low, middle and high channels of US Cellular Band).



### 3.1.3 Test Site

SGS EMC Laboratory, Suwanee, GA

#### Environmental Conditions

Temperature: 22.2 °C  
 Relative Humidity: 47.6 %  
 Atmospheric Pressure: 100.9 kPa

### 3.1.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	24Sep2013
Radio Communications Tester	CMW-500	R & S	B085757	29 Oct 2013
Power splitter	ZFRSC-183-S+	Mini-Circuits	EA01	Verified Before Use
Attenuator	BW-S10W2+	Mini-Circuits	NA	Verified Before Use
Attenuator	BW-S10W2+	Mini-Circuits	NA	Verified Before Use
Signal Generator	HMC-T2240	Hittite	B0799813	Verified Before Use
Coaxial Cable	086-112SM+	Mini-Circuits	NA	Verified Before Use
Coaxial Cable	086-112SM+	Mini-Circuits	NA	Verified Before Use

Note: The calibration period equipment is 1 year.

### 3.1.5 Test Data

Mode	Band	Center Frequency (MHz)	Channel	Average Power (dBm)
CDMA	BC0	836.52	384	24.6
EVDO	BC0	836.52	384	24.7
GSM <sup>(1)</sup>	850	824.2	128	24.2
GSM <sup>(2)</sup>	850	824.2	128	33.2
WCDMA	Band V	837.5	837	25.1

1) Maximum Frame-Averaged Power

2) Maximum Burst-Averaged Power

## 3.2 Occupied Bandwidth

### 3.2.1 Test Result

Test Description	Basic Standards	Test Result
Occupied Bandwidth	FCC Part 2.1049	Reported

### 3.2.2 Test Method

The occupied bandwidth is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power by a given emission. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sample detector shall be used since a peak detector may produce a wider than actual bandwidth.

A radio link was established between EUT and Radio Communications Tester. The output power of the EUT was set to maximum value by using the maximum power setting on the Radio Communications Tester. The occupied bandwidth is measured using spectrum analyzer's occupied bandwidth measurement. RBW is set to 3 kHz on spectrum analyzer.

The bandwidth of 99% power can be read on spectrum analyzer.

The measurement was conducted at three channels: 1013, 384 and 777 (low, middle and high channels) in RETAP 12288K test mode.

### 3.2.3 Test Site

SGS EMC Laboratory, Suwanee, GA

### 3.2.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	25 Aug 2012
Radio Communications Tester	CMW-500	R & S	B085757	28 Sep 2012
Directional Coupler	778D	Agilent / HP	B087456	14 Oct 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079656	12 Aug 2012

Note: The calibration period equipment is 1 year.



### 3.2.5 Test Data

Mode	Frequency	BW (MHz)
CDMA	824.7	1.41
CDMA	836.52	1.41
CDMA	848.31	1.4
GSM	824.2	0.3214
GSM	848.8	0.3214
GPRS	824.2	0.3293
GPRS	848.8	0.3114
EGPRS	824.2	0.3154
EGPRS	848.8	0.3214
EGPRS2-A	824.2	0.3114
EGPRS2-A	848.8	0.3174
WCDMA	826.4	4.64
WCDMA	837.5	4.62
WCDMA	846.6	4.64

### 3.3 Band Edge and Conducted Spurious Emissions

#### 3.3.1 Test Result

Test Description	Basic Standards	Test Result
Conducted spurious emissions and Band Edge	2.1051 22.917(a)	Pass

#### 3.3.2 Test Method

The levels of the carrier and the various conducted spurious and harmonics frequencies are measured by means of a calibrated spectrum analyzer. The emissions spectrum emanating from the EUT transmit antenna port is scanned from the lowest frequency generated in the equipment up to a frequency including its 10<sup>th</sup> harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB. Compliance is based on the use of a spectrum analyzer employing a resolution bandwidth of 1 MHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of a least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emissions bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

#### 3.3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

#### 3.3.4 Test Equipment

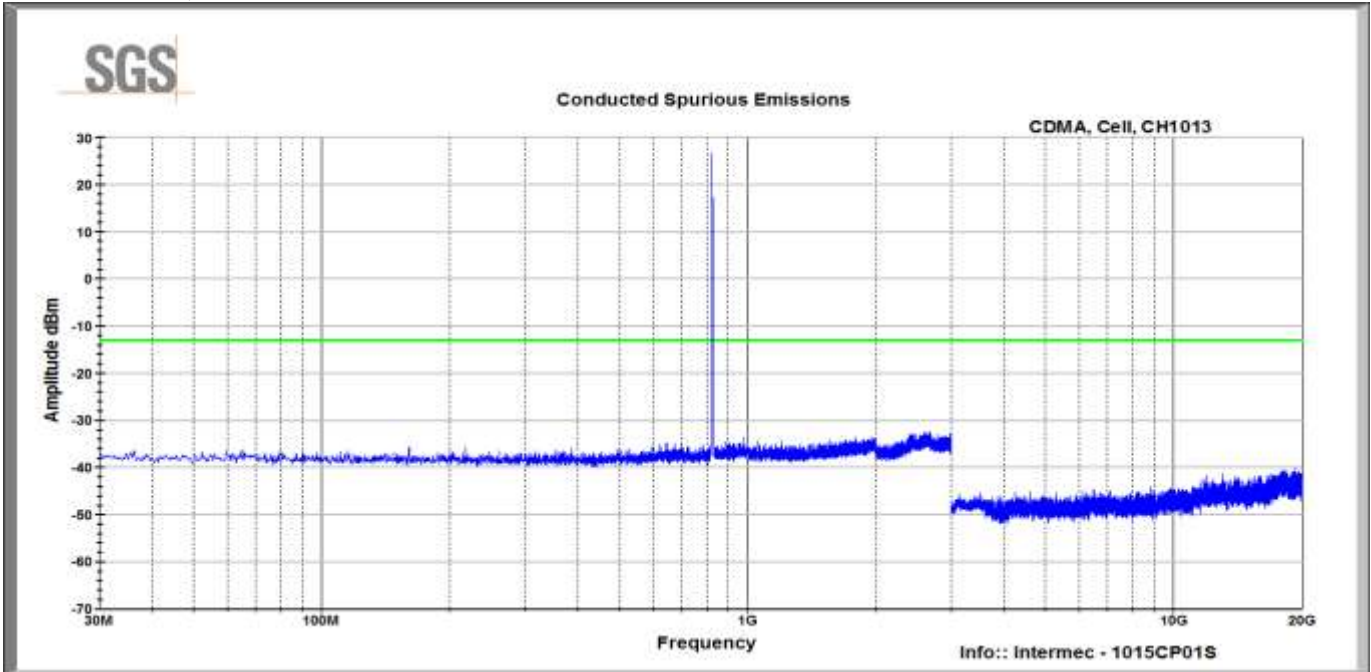
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	24Sep2013
Radio Communications Tester	CMW-500	R & S	B085757	29 Oct 2013
Power splitter	ZFRSC-183-S+	Mini-Circuits	EA01	Verified Before Use
Attenuator	BW-S10W2+	Mini-Circuits		Verified Before Use
Attenuator	BW-S10W2+	Mini-Circuits		Verified Before Use
Signal Generator	HMC-T2240	Hittite	B0799813	Verified Before Use
Coaxial Cable	086-112SM+	Mini-Circuits	NA	Verified Before Use
Coaxial Cable	086-112SM+	Mini-Circuits	NA	Verified Before Use

Note: The calibration period equipment is 1 year.

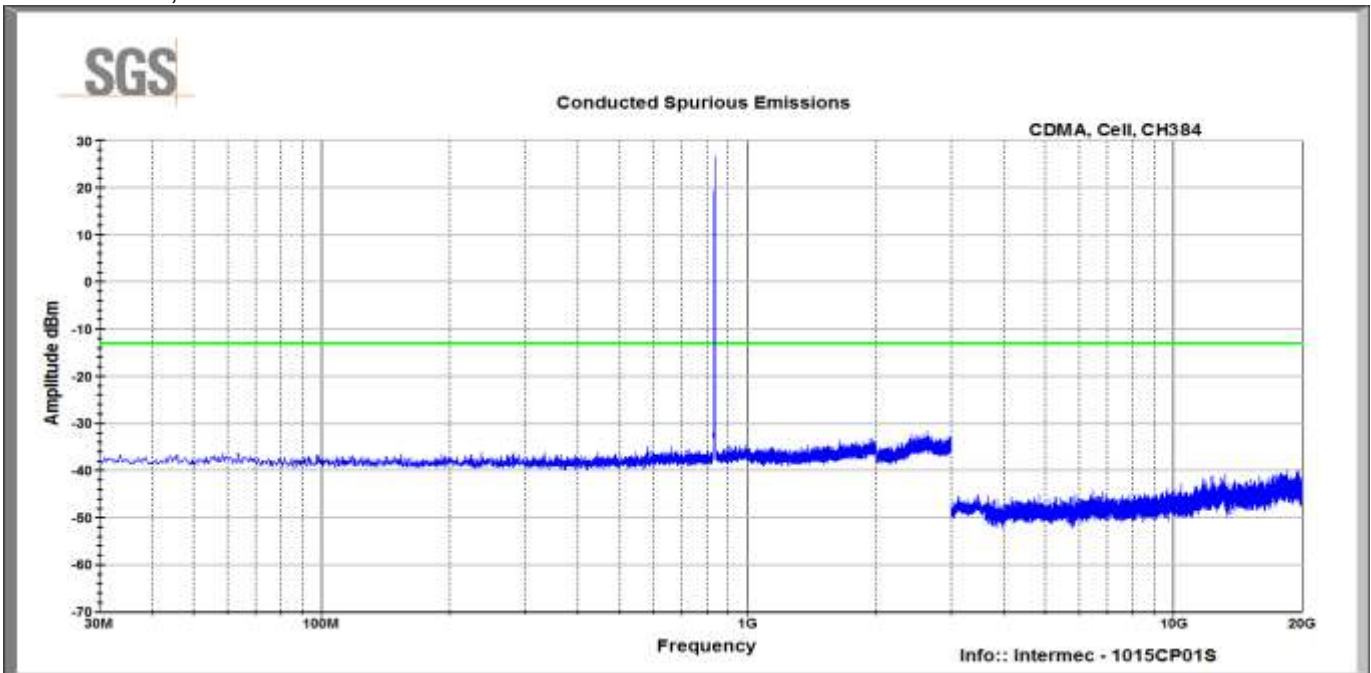
### 3.3.5 Test Data

Test Date: 2 Aug 2012

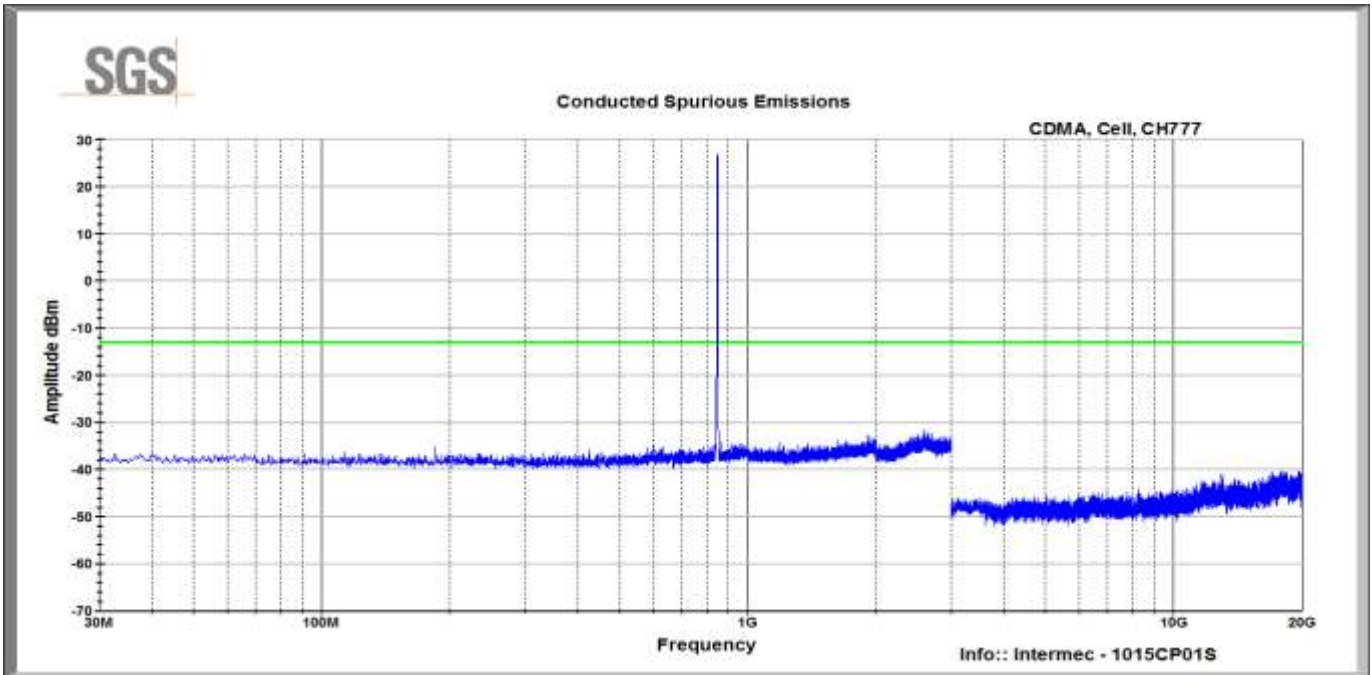
Channel 1013, 824.7 MHz



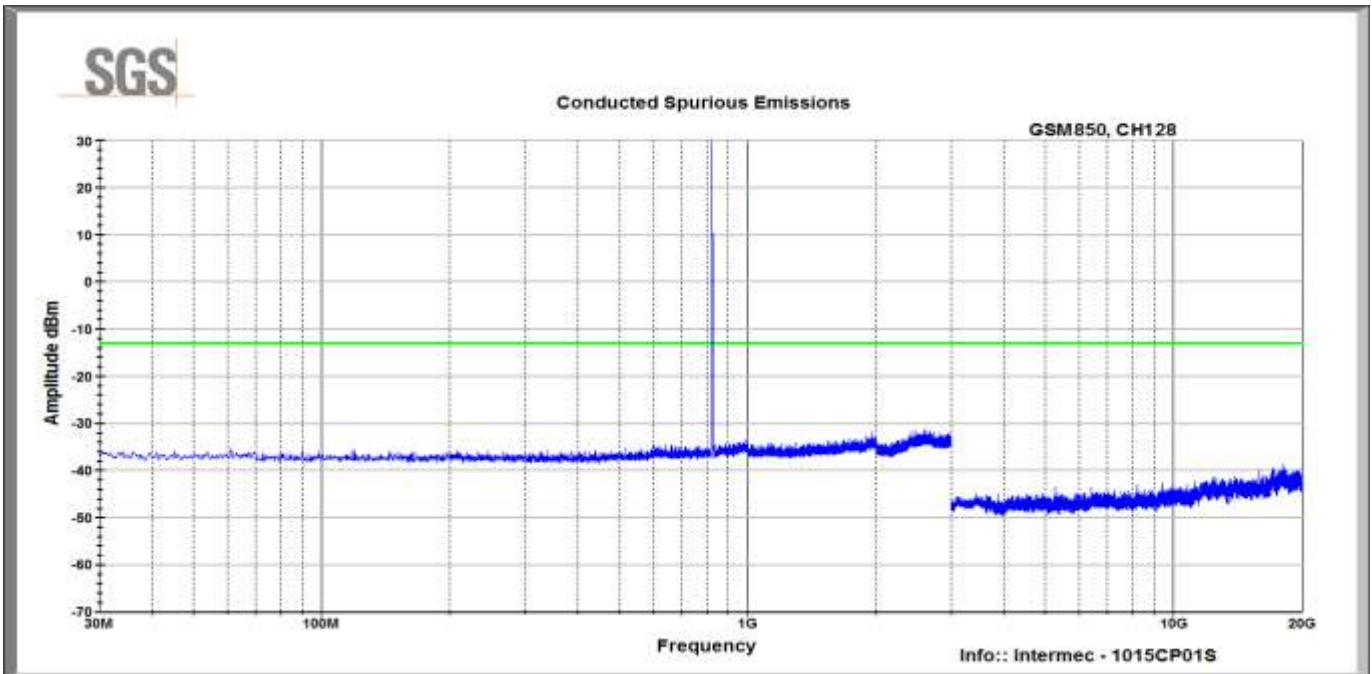
Channel 384, 836.52 MHz



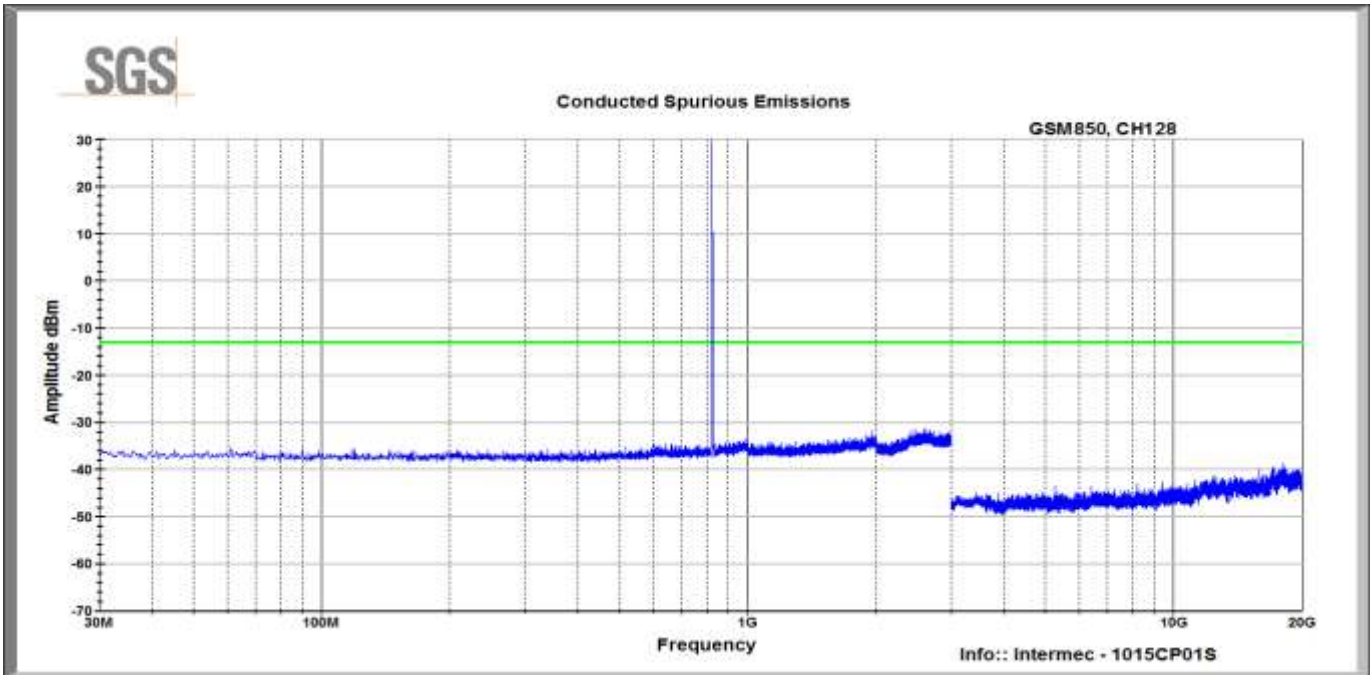
Channel 777, 848.31 MHz



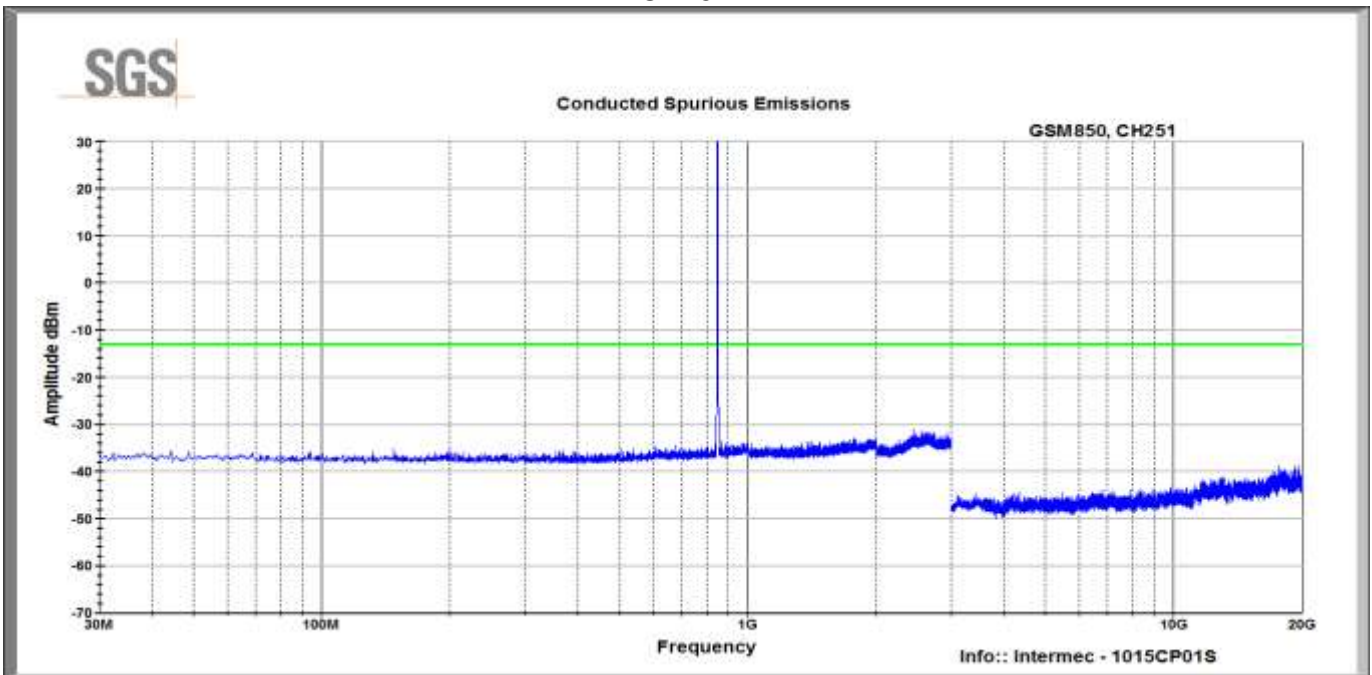
GSM  
Ch128



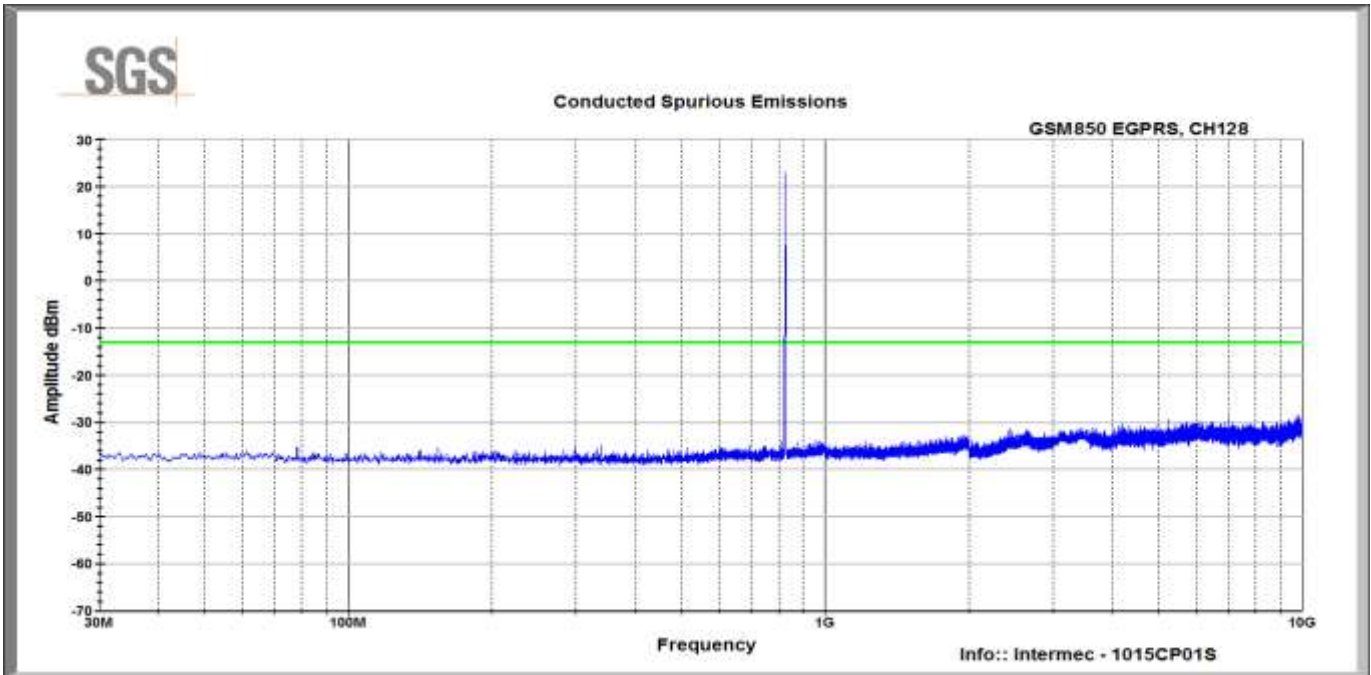
CH189



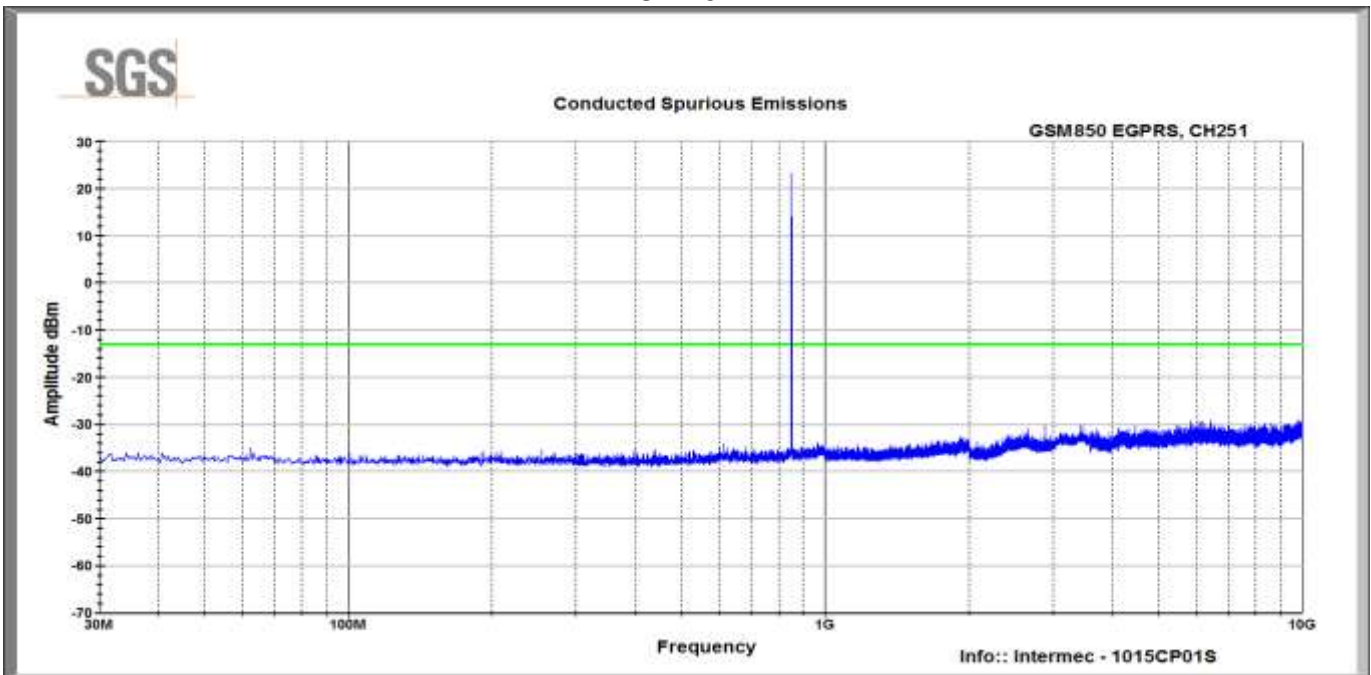
CH251



EGPRS  
CH128

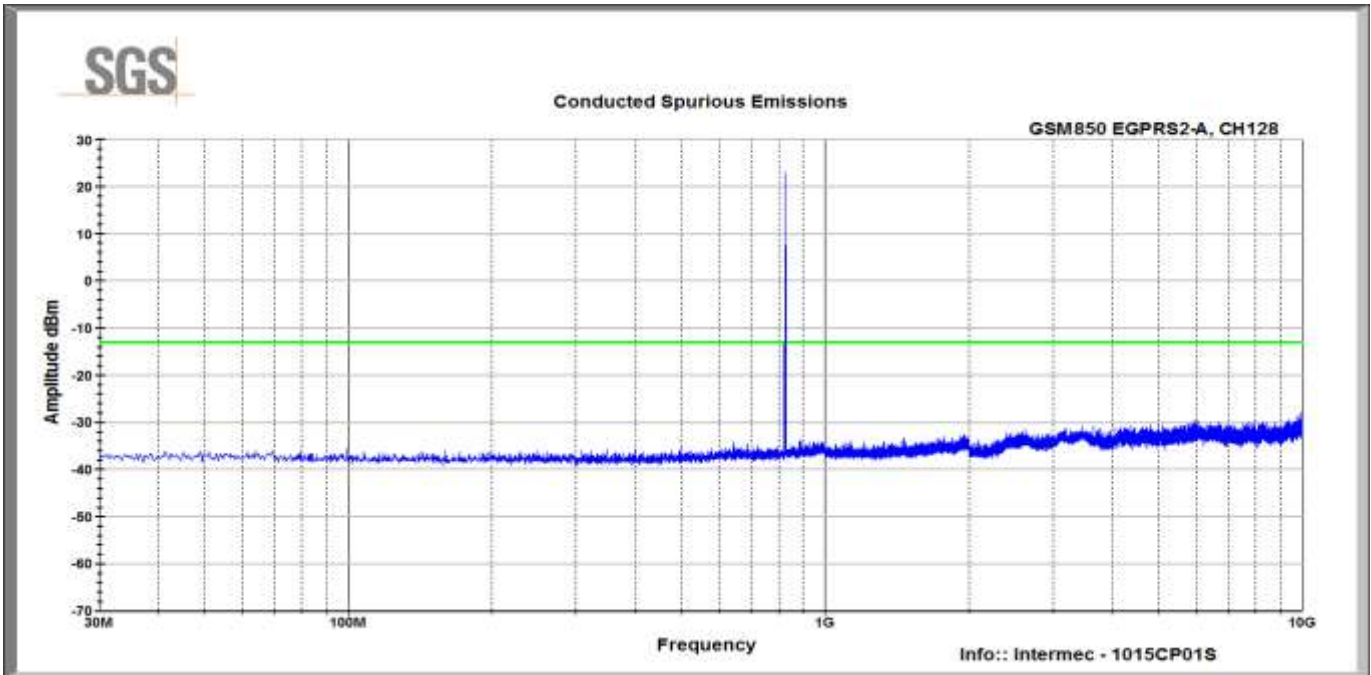


CH 251

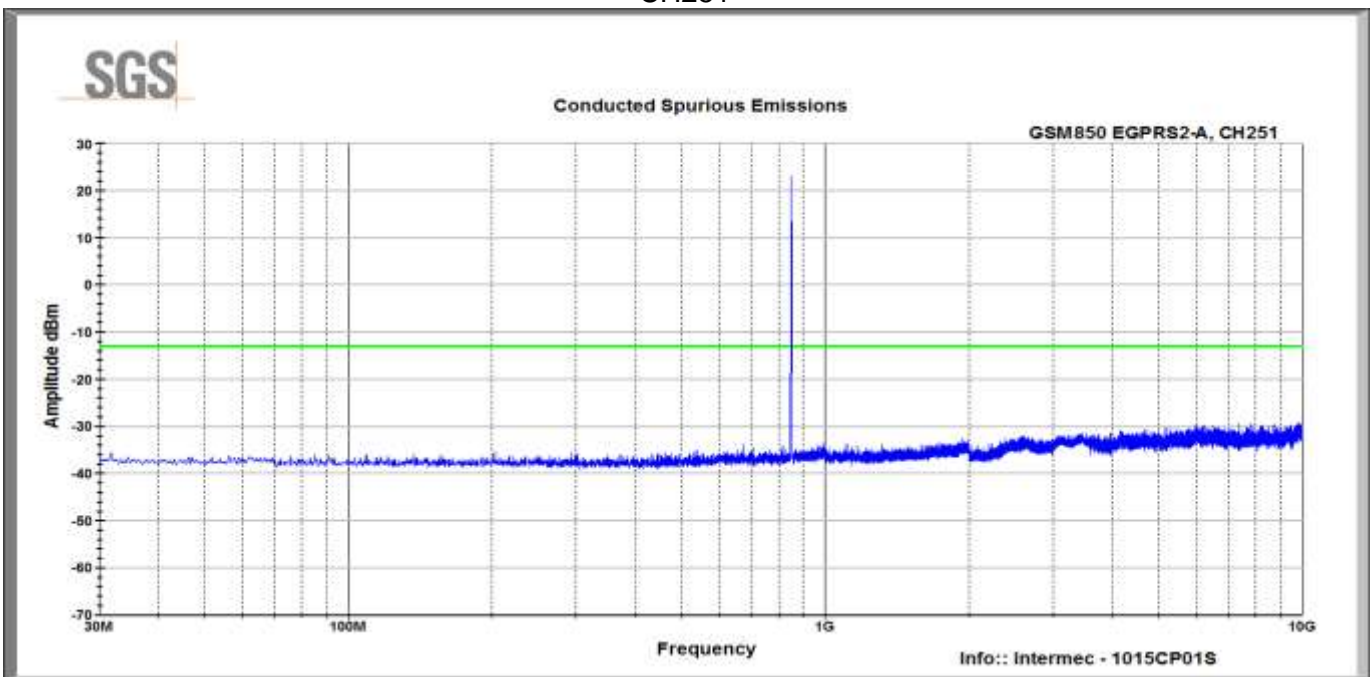


EGPRS2-A

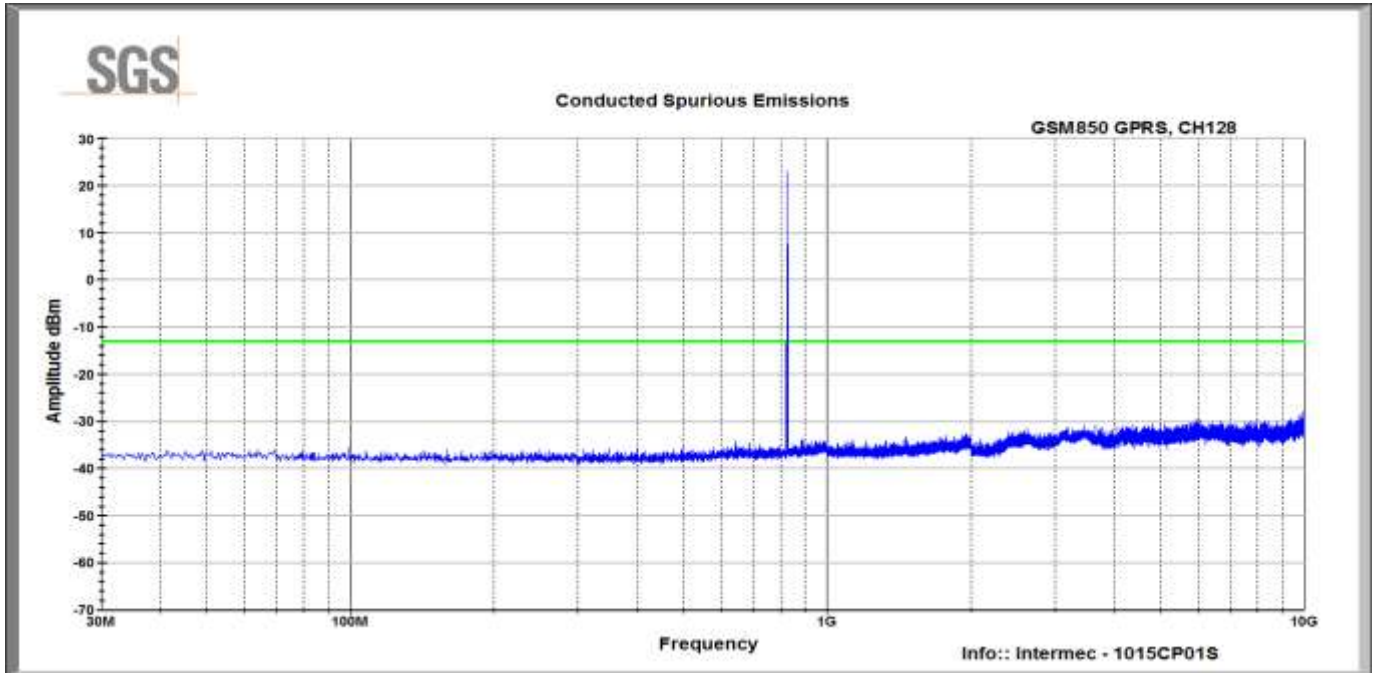
CH128



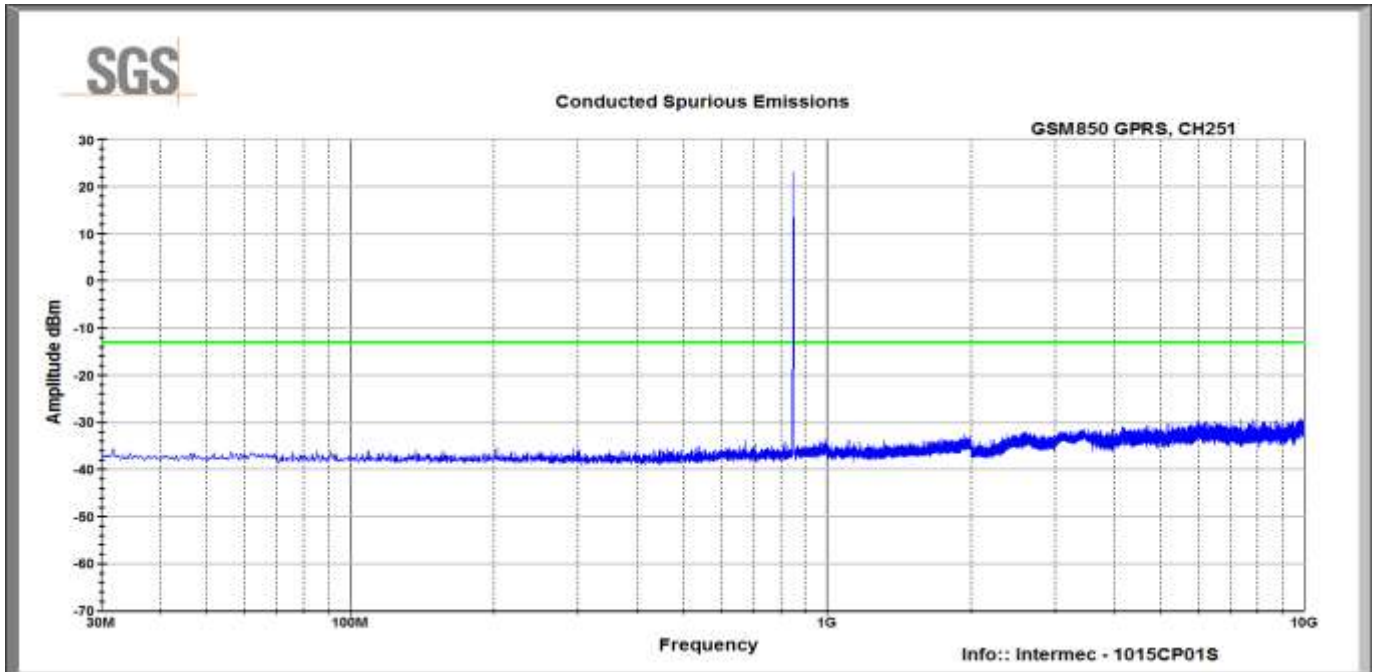
CH251



GPRS  
CH128

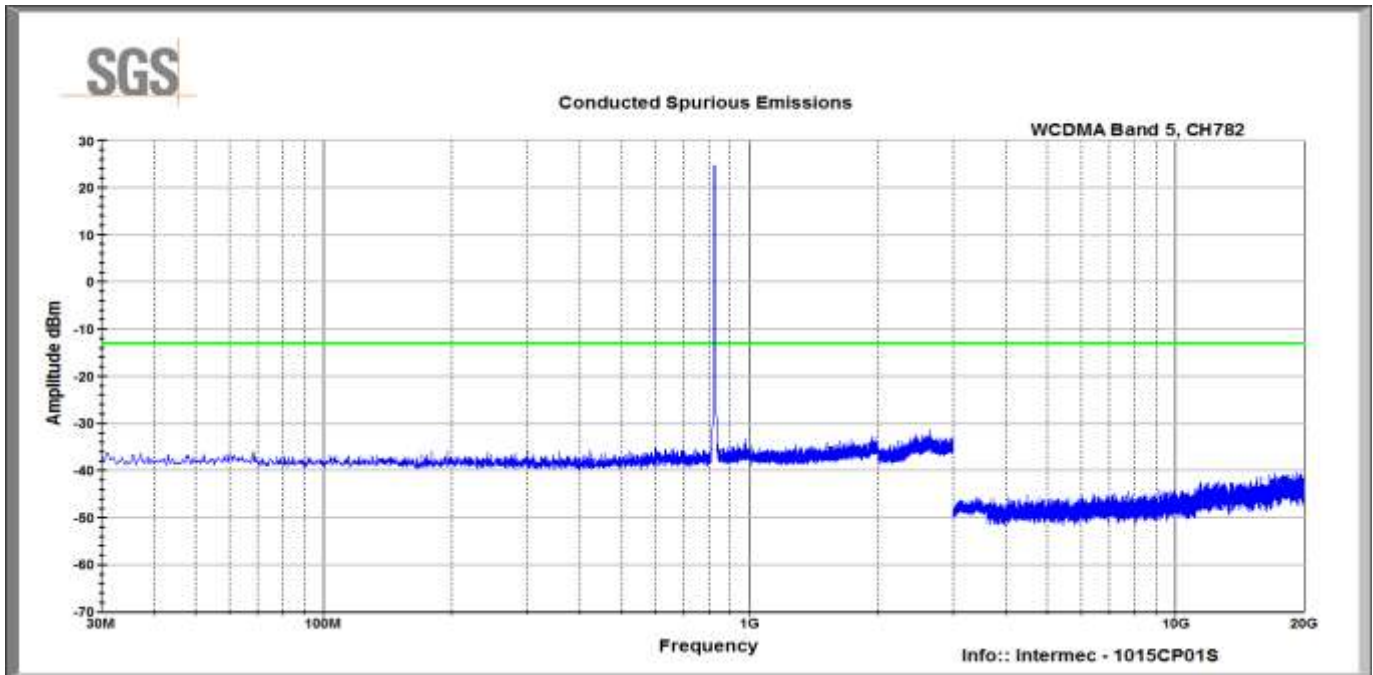


CH251

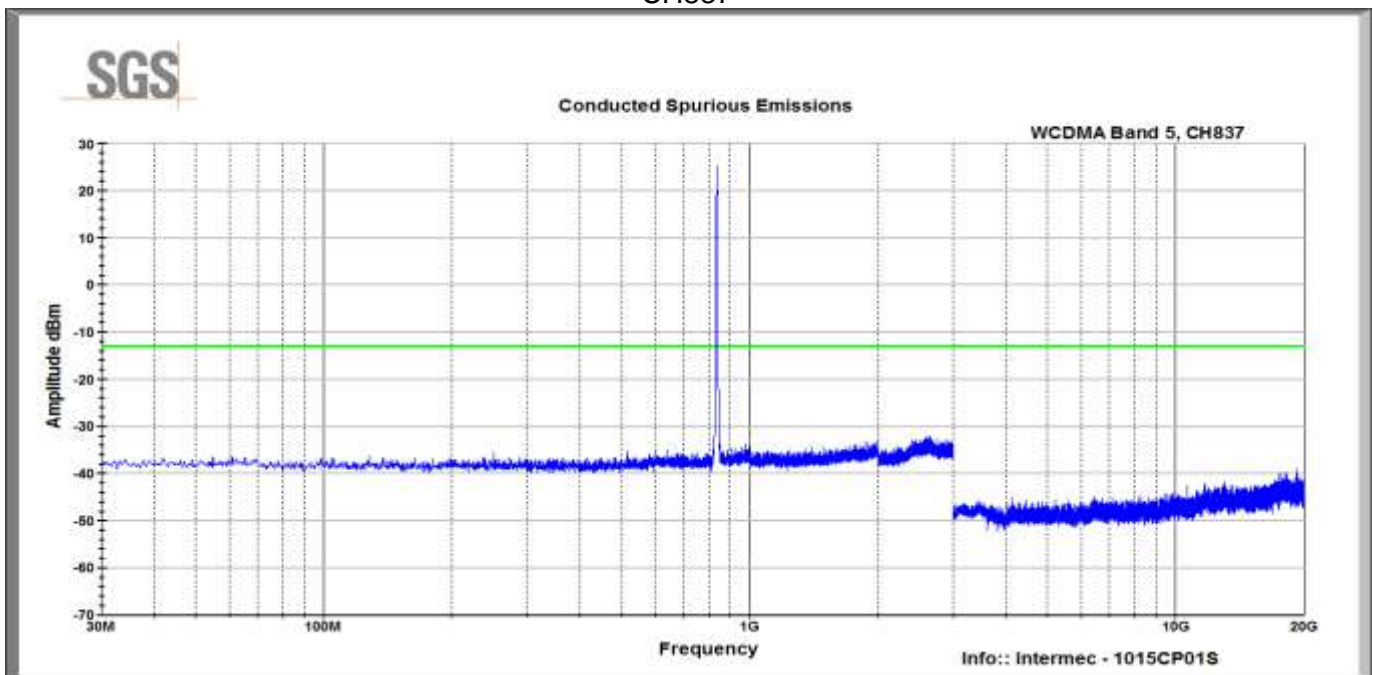




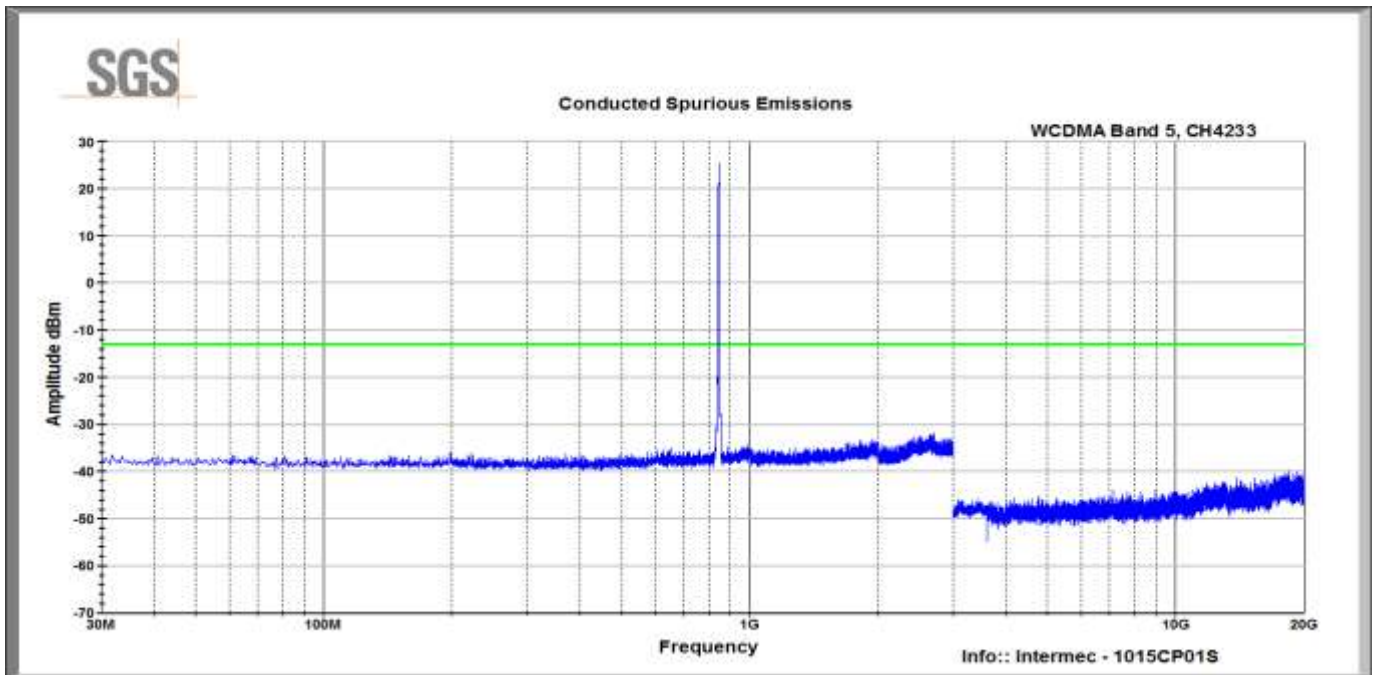
WCDMA  
BandV  
CH782



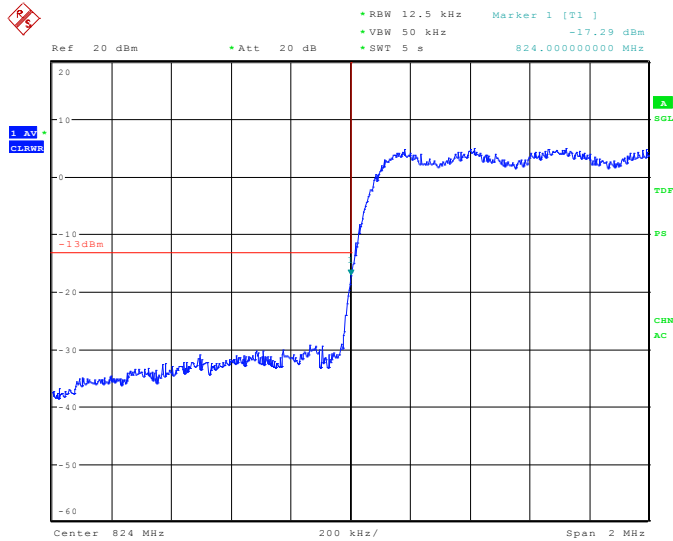
CH837



CH4233

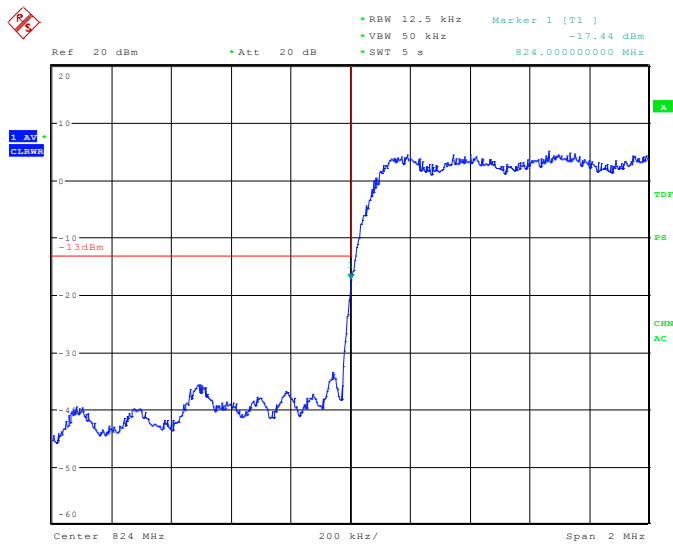


### Lower Band Edge EVDO BC0



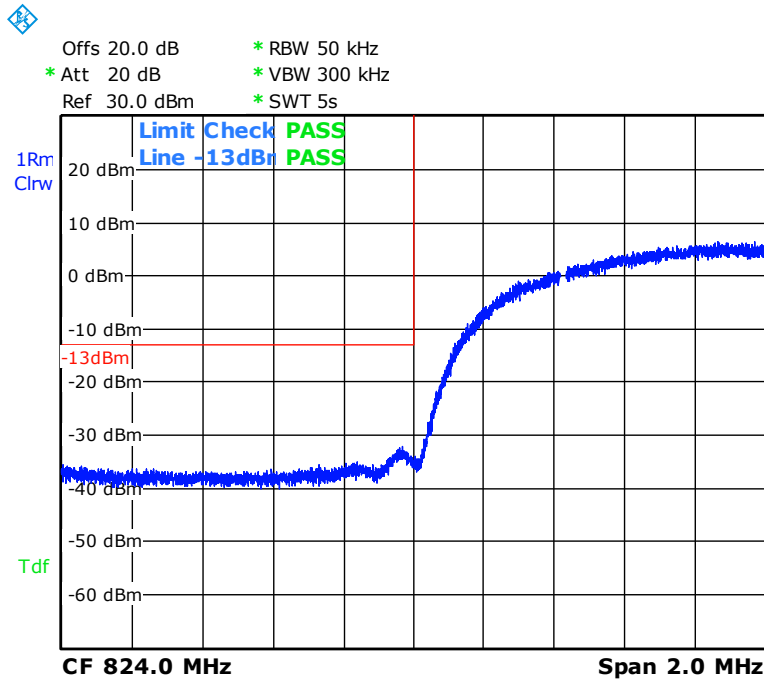
Date: 5.JUL.2013 10:05:46

### CDMA BC0



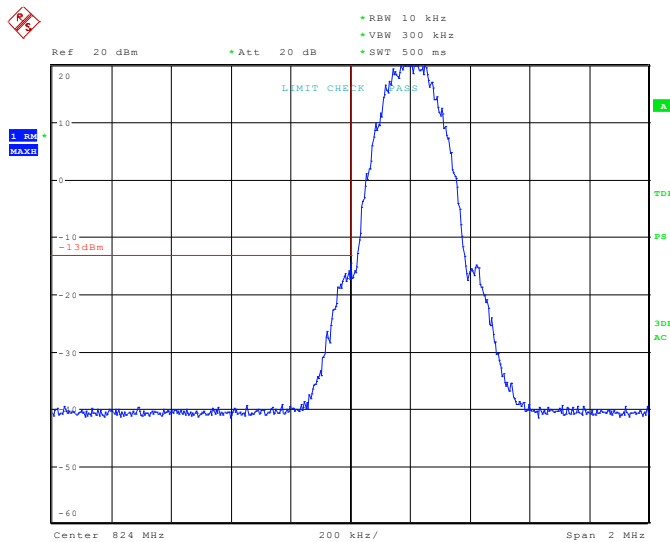
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### WCDMA Band 5



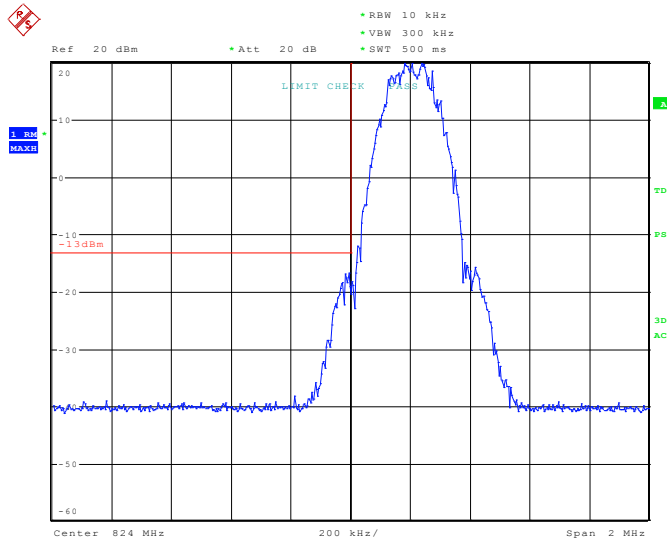
Date: 10.JUL.2013 19:24:26

### GSM Voice Band 5



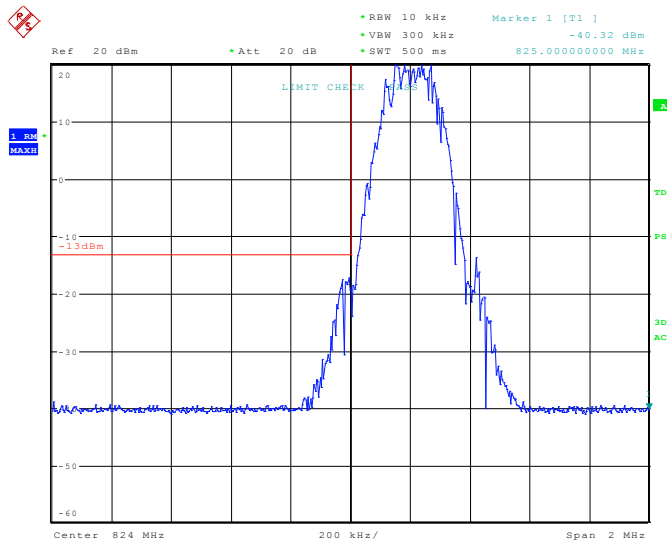
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### EGPRS2-A Band 5



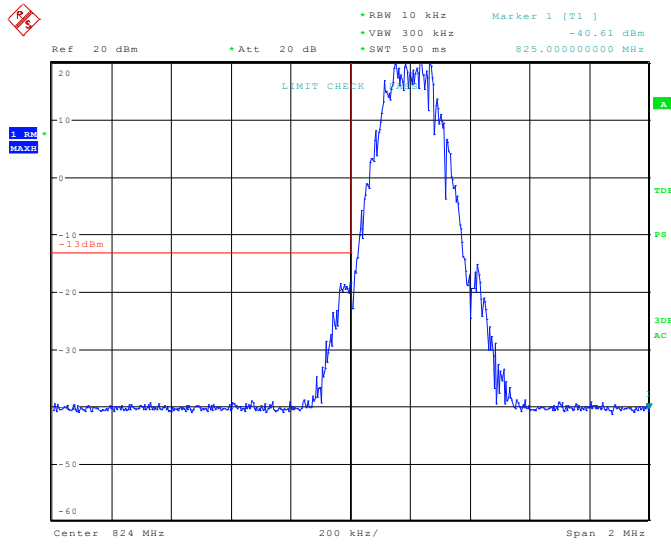
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### EGPRS Band 5



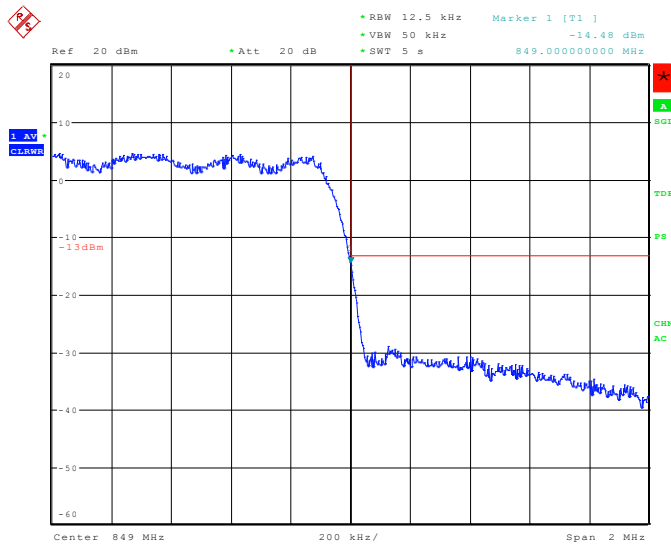
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### GPRS Band 5



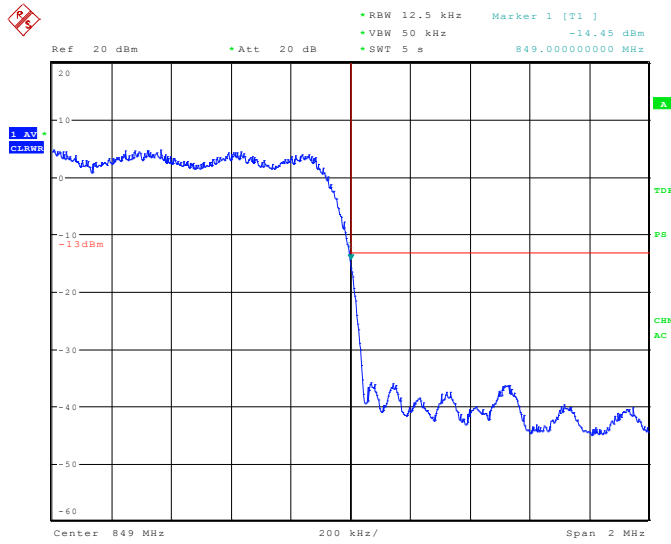
Date: 10.JUL.2013 23:58:22

### Upper Band Edge EVDO BC0



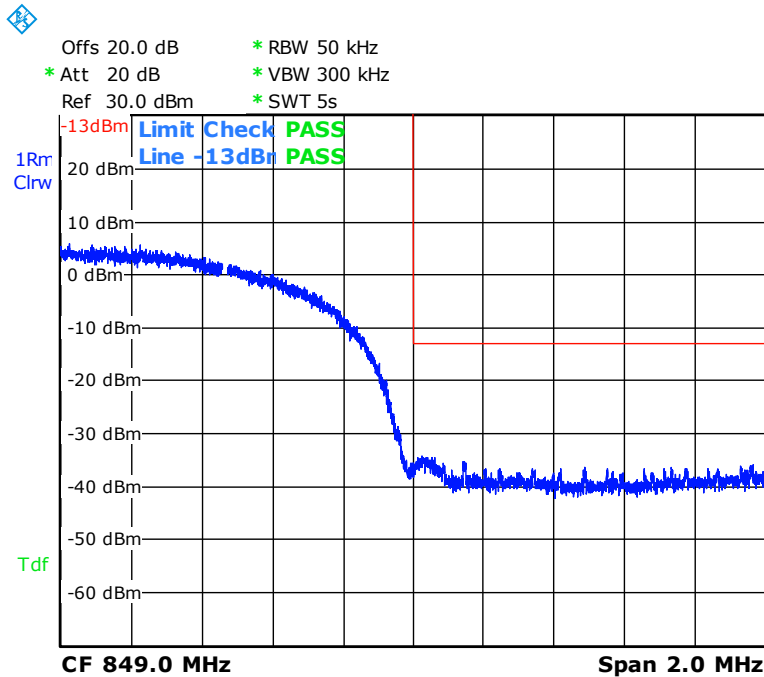
Date: 5.JUL.2013 09:51:47

### CDMA BC0



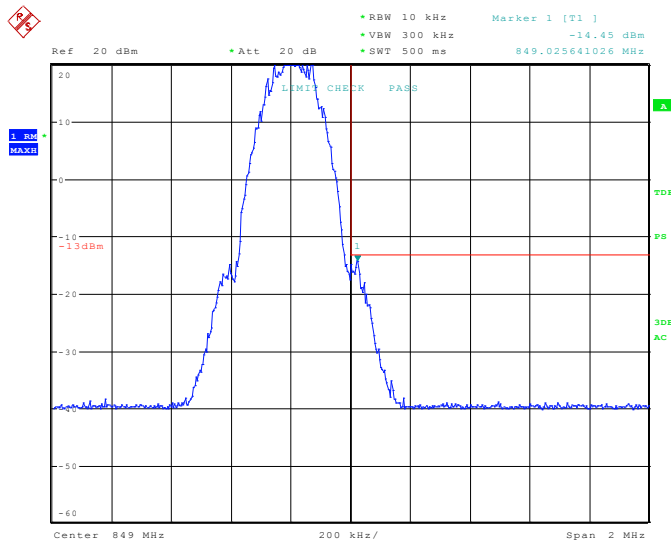
Date: 5.JUL.2013 10:37:14

### WCDMA Band 5



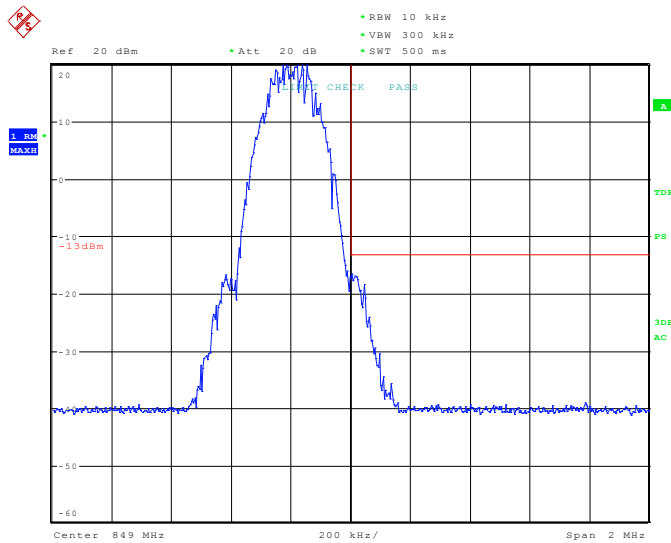
Date: 10.JUL.2013 19:25:06

### GSM Voice Band 5



Date: 11.JUL.2013 00:43:29

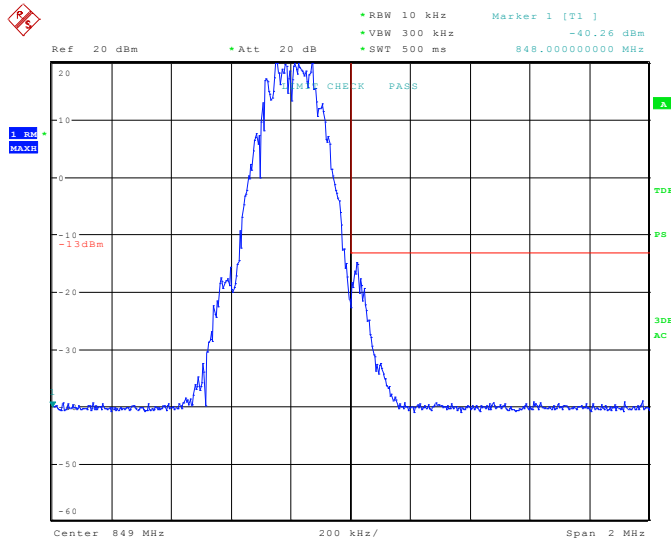
### EGPRS2-A



Date: 11.JUL.2013 00:51:16

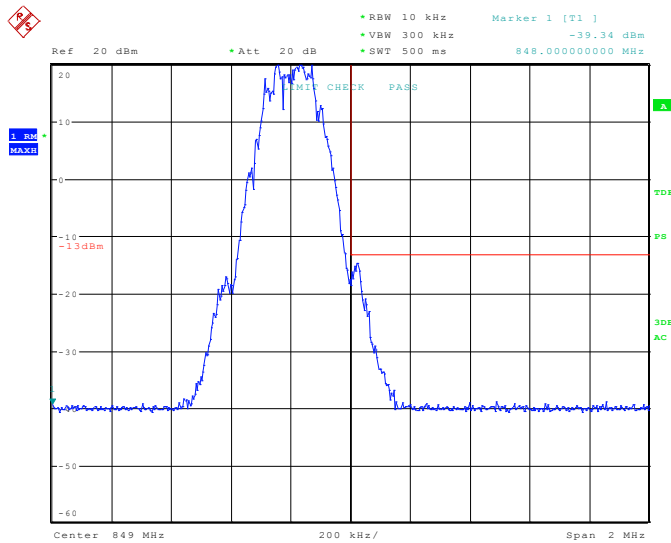
### EGPRS Band 5





Date: 11.JUL.2013 00:16:35

### GPRS Band 5



Date: 10.JUL.2013 23:56:31

### 3.4 **Effective Radiated Power**

#### 3.4.1 **Test Result**

Test Description	Basic Standards	Test Result
Effective Radiated Power	FCC Part 22.913	Pass

#### 3.4.2 **Test Method**

The measurements above 1 GHz are carried out in a fully anechoic chamber. Below 1 GHz, the measurements are carried out in semi-anechoic chamber. The EUT was placed on a 0.8 meter high non-conductive table at a 3 meters test distance from the test receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT. The height of receiving antenna is varied from 1 to 4 m to find the maximum power value. A radio link was established between EUT and Radio Communications Tester. The output power of the EUT was set to maximum value by using the maximum power setting on the Radio Communications Tester. A RMS detector is used and RBW is set to 3MHz. Then the antenna height and turn table rotation is adjusted till the maximum power value is founded on spectrum analyzer.

The EUT was positioned through each of its three orthogonal axes and the highest level was reported.

A dipole antenna (below 1 GHz) or double-ridged waveguide antenna (above 1 GHz) was substituted in place of the EUT. The substitution antenna will be driven by a signal generator. The receive antenna is varied to find the maximum response to the spectrum analyzer. Then the level of signal generator will be adjusted to achieve the same power value on the spectrum analyzer or receiver.

The ERP/EIRP of the EUT can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.

The measurement was conducted at three channels: 1013, 384 and 777 (low, middle and high channels) in RETAP 12288K test mode.

#### 3.4.3 **Test Site**

10m Semi-anechoic chamber, SGS EMC Laboratory, Suwanee, GA

### 3.4.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	24 SEP 2013
Bilog Antenna	JB6	Sunol	B079689	4 SEP 2013
Signal Generator	HMC T2240	Hittite	B079813	NCR
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079714	13 Aug 2013
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079659	13 Aug 2013
Radio Communications Tester	CMW-500	R&S	B085757	29 Oct 2013
Dipole	3121D-DB4	ETS-Lindgren	B085753	16 Mar 2015
Coaxial Cable	Sucoflex 102	Huber+Suhner	B079822	12 Dec 2013

Note: The calibration period equipment is 1 year.

### 3.4.5 Test Data

Mode	Band	Measured ERP dBm	Limit dBm	Result
CDMA	BC0	24.0	38.5	Pass
EVDO	BC0	23.7	38.5	Pass
GSM	GSM850	32.7	38.5	Pass
EDGE	GSM850	32.8	38.5	Pass
GPRS	GSM850	32.7	38.5	Pass
WCDMA	Band V	23.2	38.5	Pass
HSUPA	Band V	23.1	38.5	Pass

### 3.5 Radiated Spurious Emissions

#### 3.5.1 Test Result

Test Description	Basic Standards	Test Result
Radiated Spurious Emissions	FCC Part 2.1053 FCC Part 22.917(a)	Pass

#### 3.5.2 Test Method

The levels of the carrier and the various conducted spurious and harmonics frequencies are measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10<sup>th</sup> harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB. Compliance is based on the use of a spectrum analyzer employing a resolution bandwidth of 1 MHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of a least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emissions bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

The EUT was manipulated through each of its three orthogonal axes with the measurement oriented in both vertical and horizontal polarizations.

A radio link was established between EUT and Radio Communications Tester. The output power of the EUT was set to maximum value by using the maximum power setting on the Radio Communications Tester.

The measurement was conducted at the middle channels, in loopback(CDMA), circuit switched(GSM) or packet switched.

#### 3.5.3 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Bilog Antenna	JB6	Sunol	B079689	4 SEP 2013
DRWG Antenna	3117	ETS	B079691	10 Jun 2014
Receiver	ESU40	R & S	B079629	24 SEP 2013
Pre-Amplifier	TS-PR18	Rohde & Schwarz	B094463	12 Oct 2014
Filter	BRM50702	Micro-tronics	NA	Verified before use
Signal Generator	HMC T2240	Hittite	B079813	NCR
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079714	13 Aug 2013
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079659	13 Aug 2013
Radio Communications Tester	CMW-500	R&S	B085757	29 Oct 2013
Dipole Antenna	3121D	ETS-Lindgren	B085753	16 Mar 2012

Note: The calibration period equipment is 1 year.

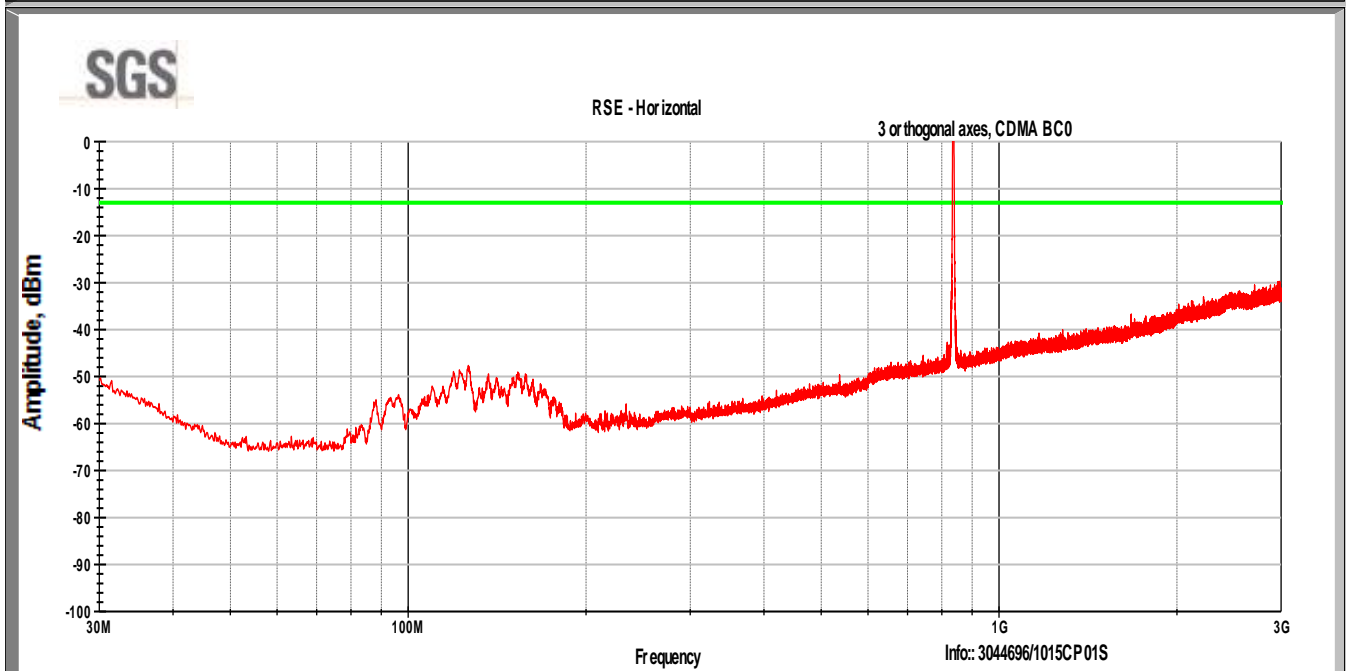
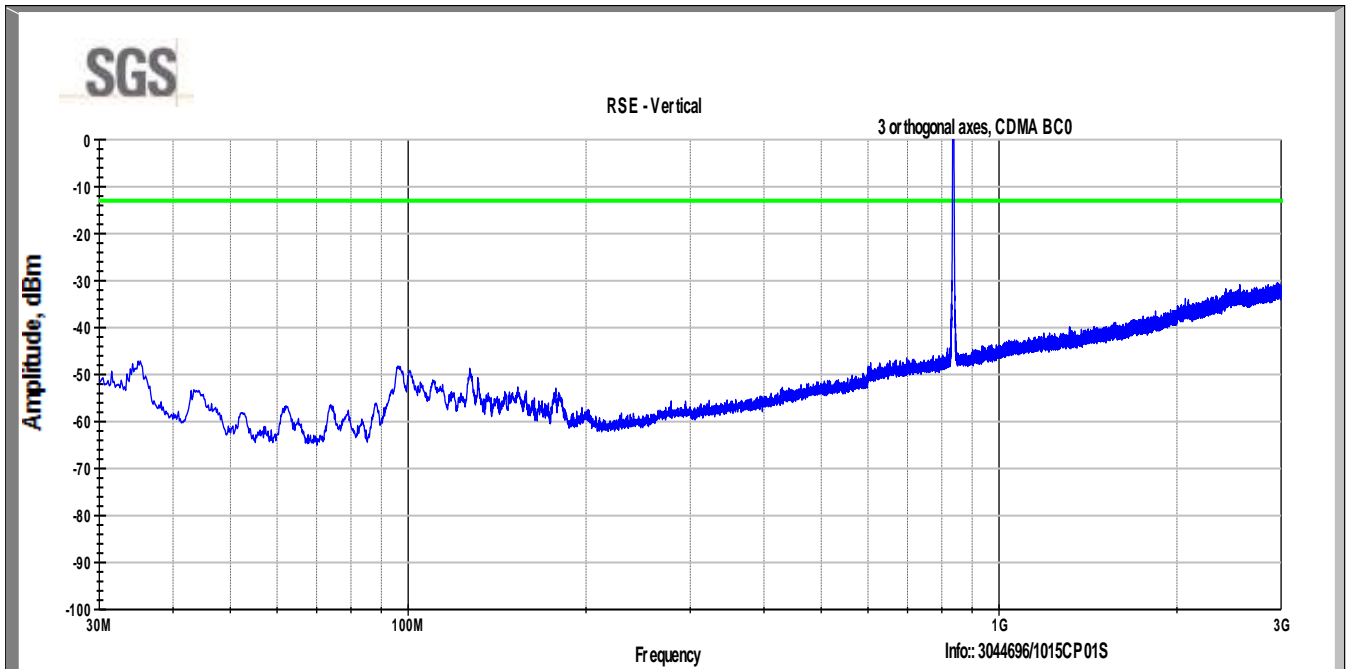
### 3.5.4 Test Data

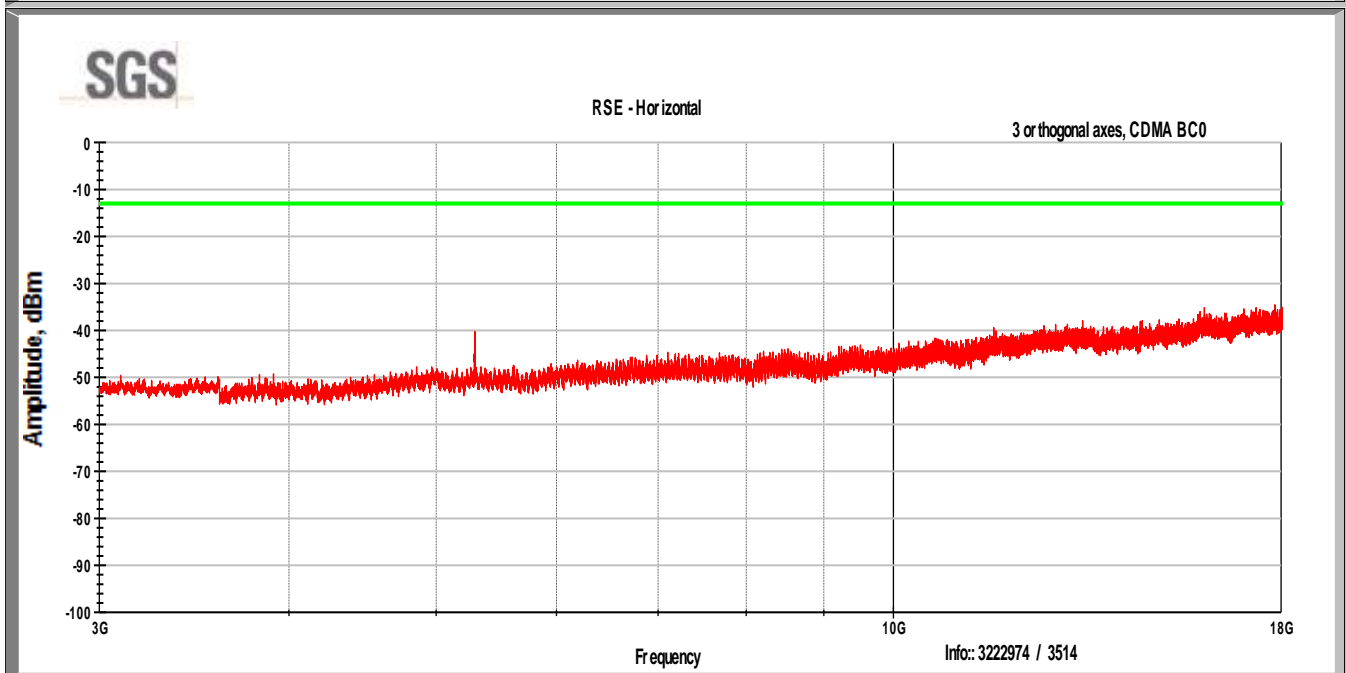
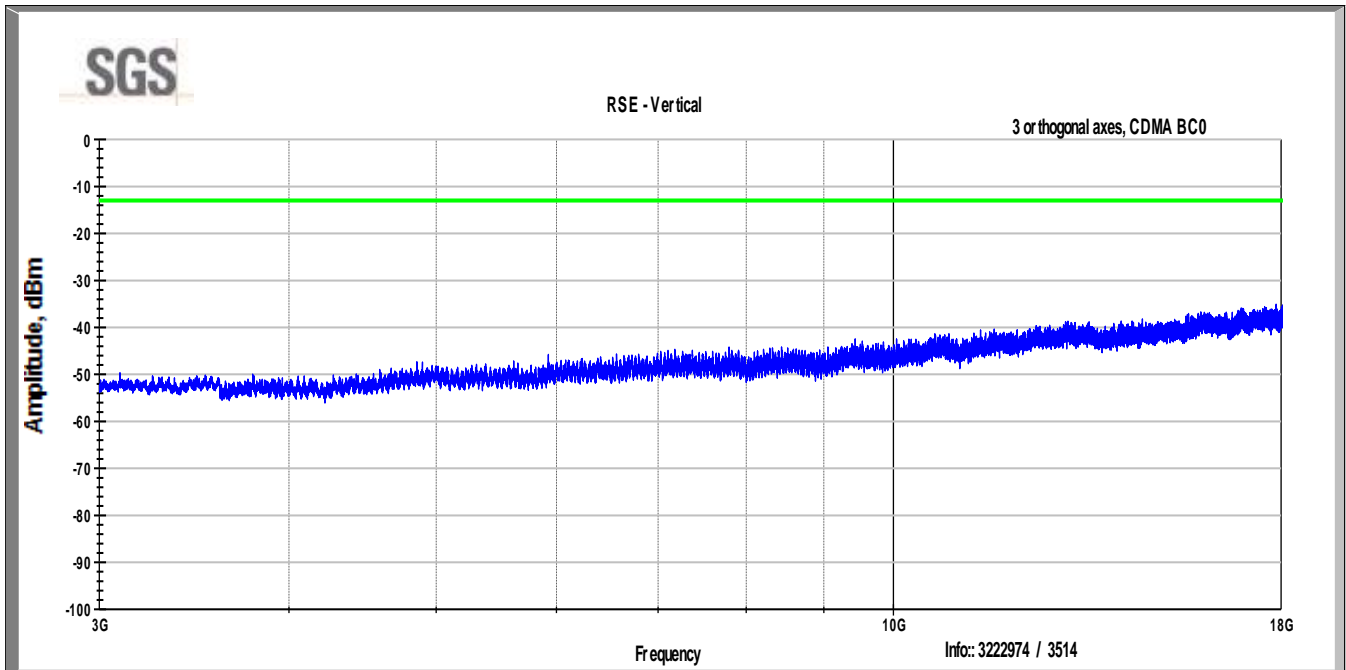
Test Date: 7 Aug 2012

There were no spurious emissions within 20 dB of the limit.

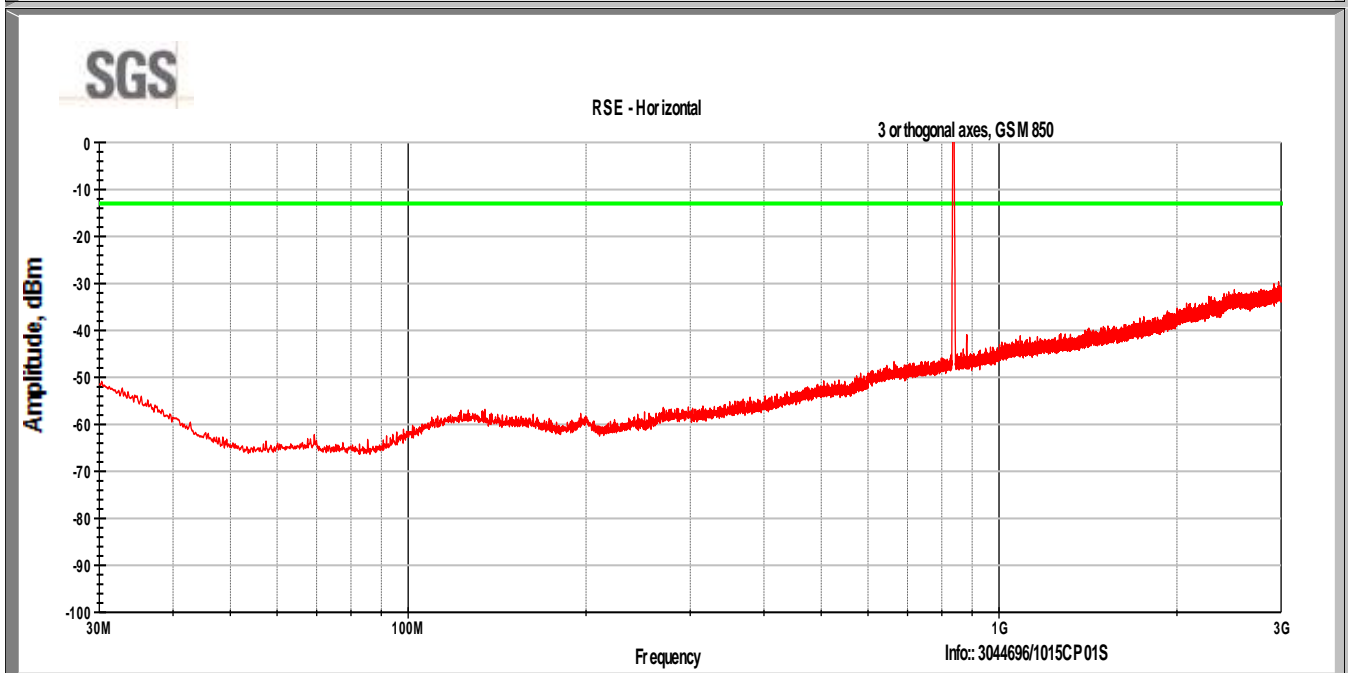
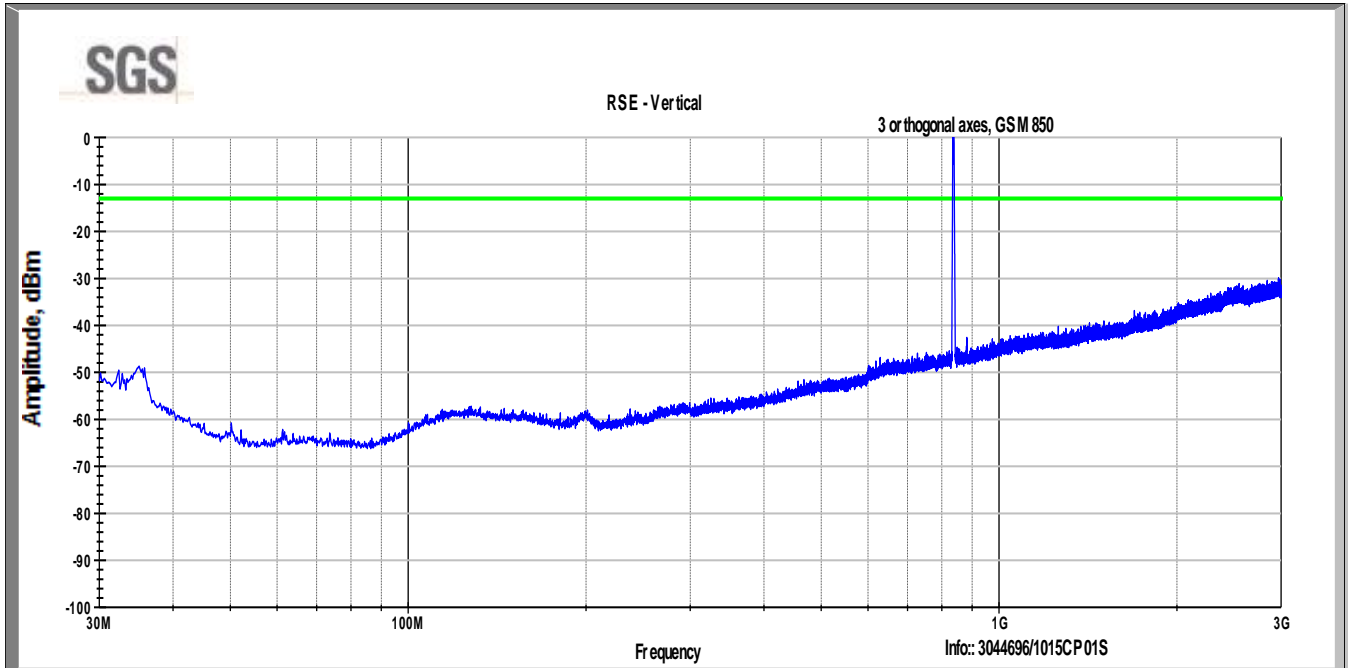
### 3.5.5 Plots

#### CDMA

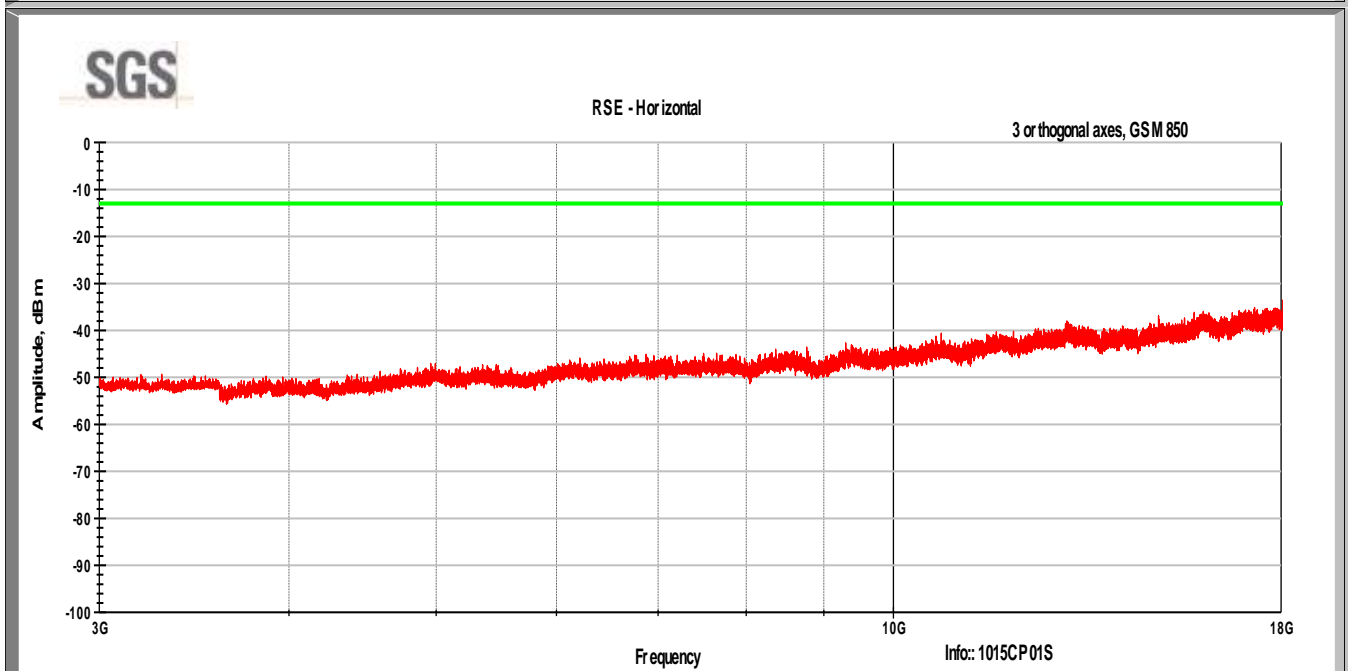
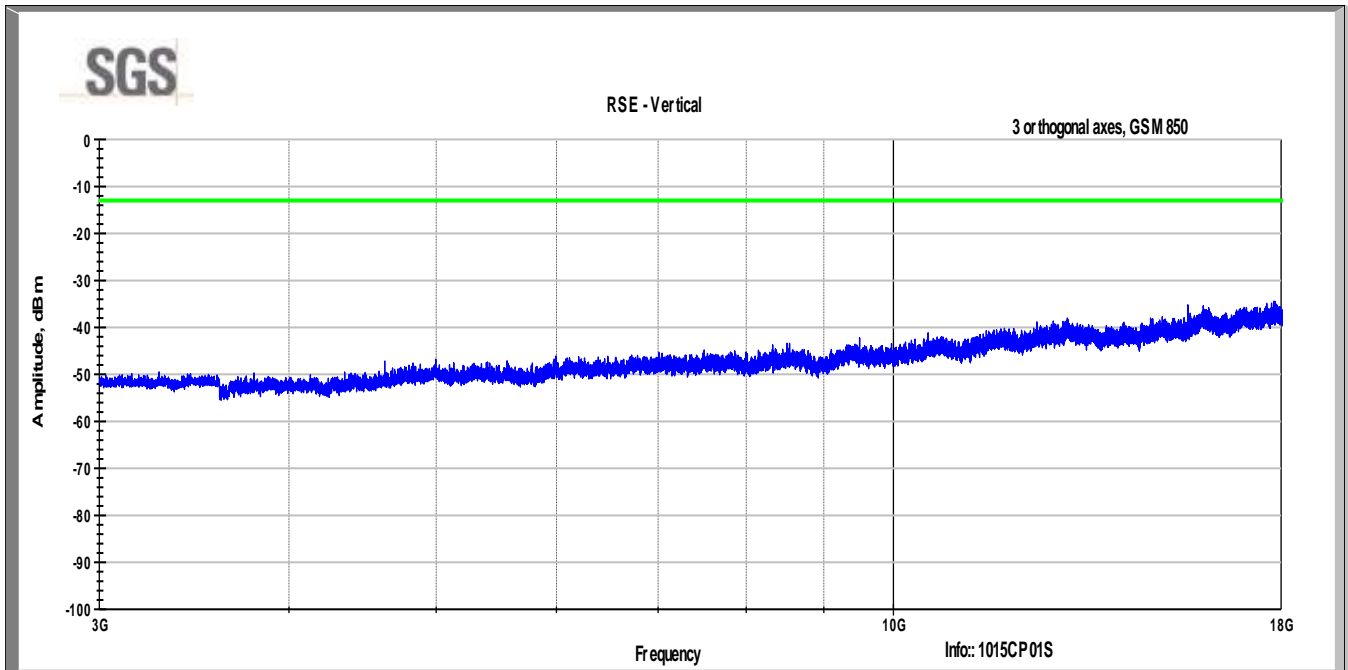




## GSM

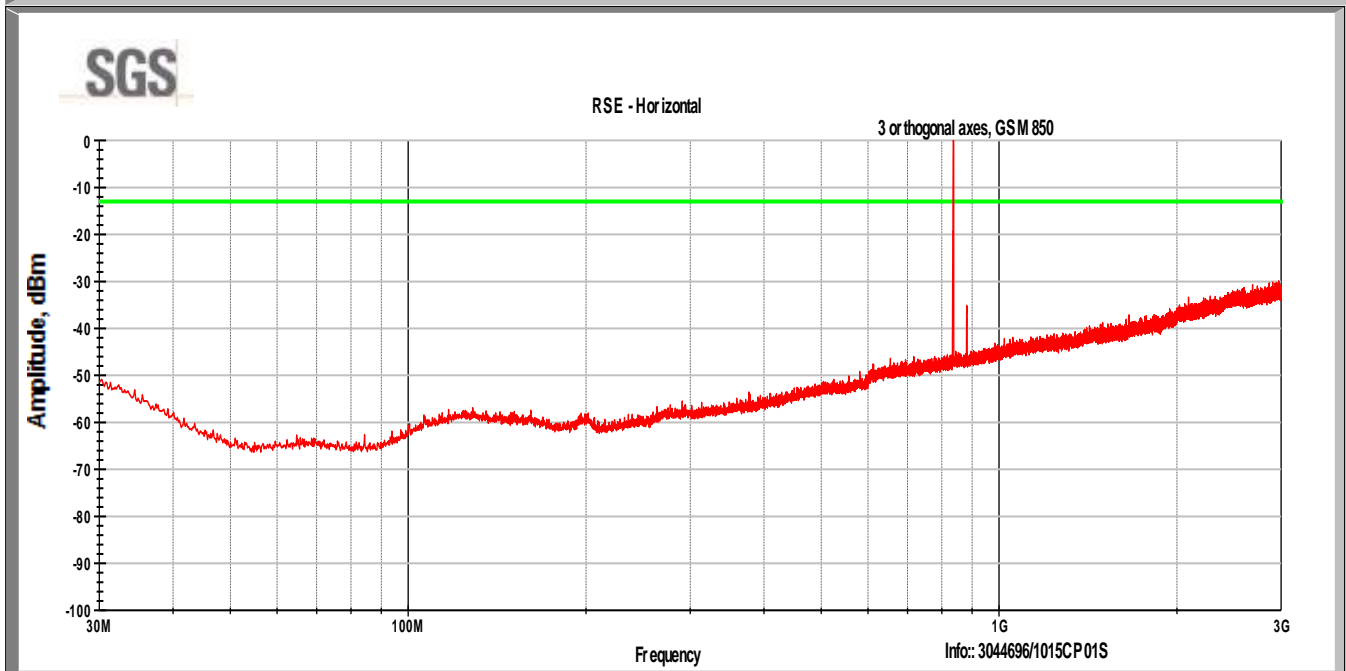
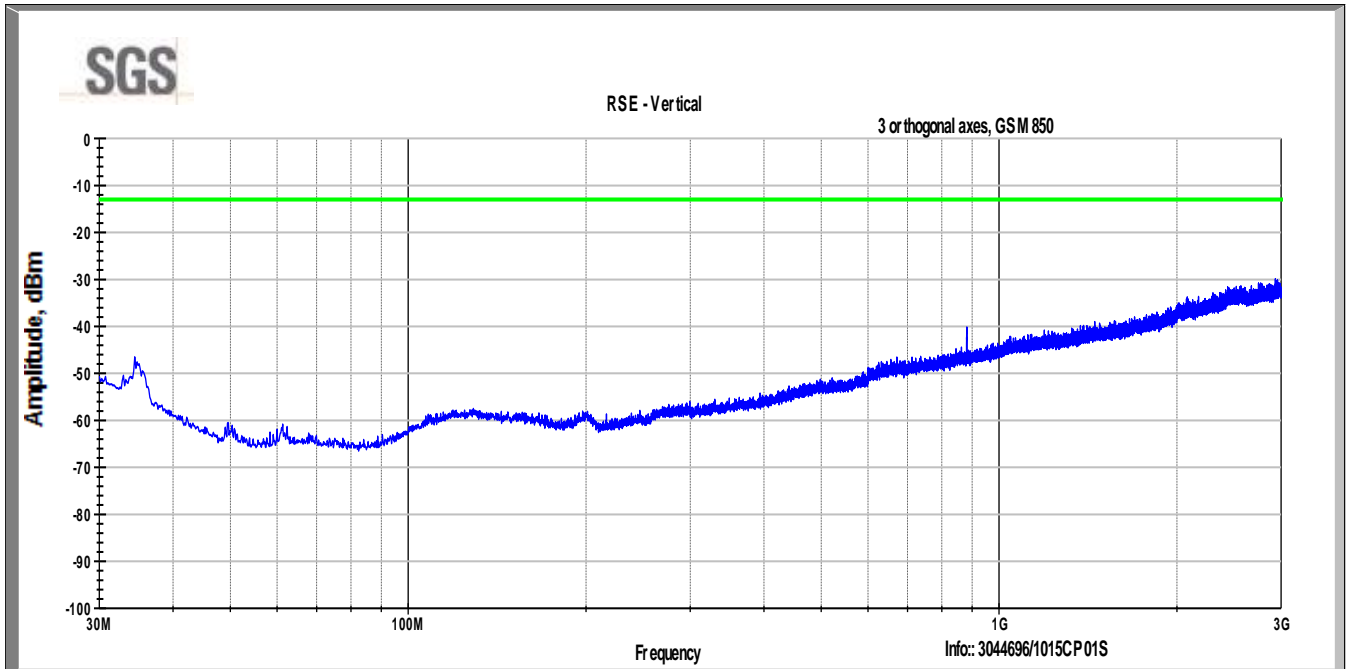


### GSM

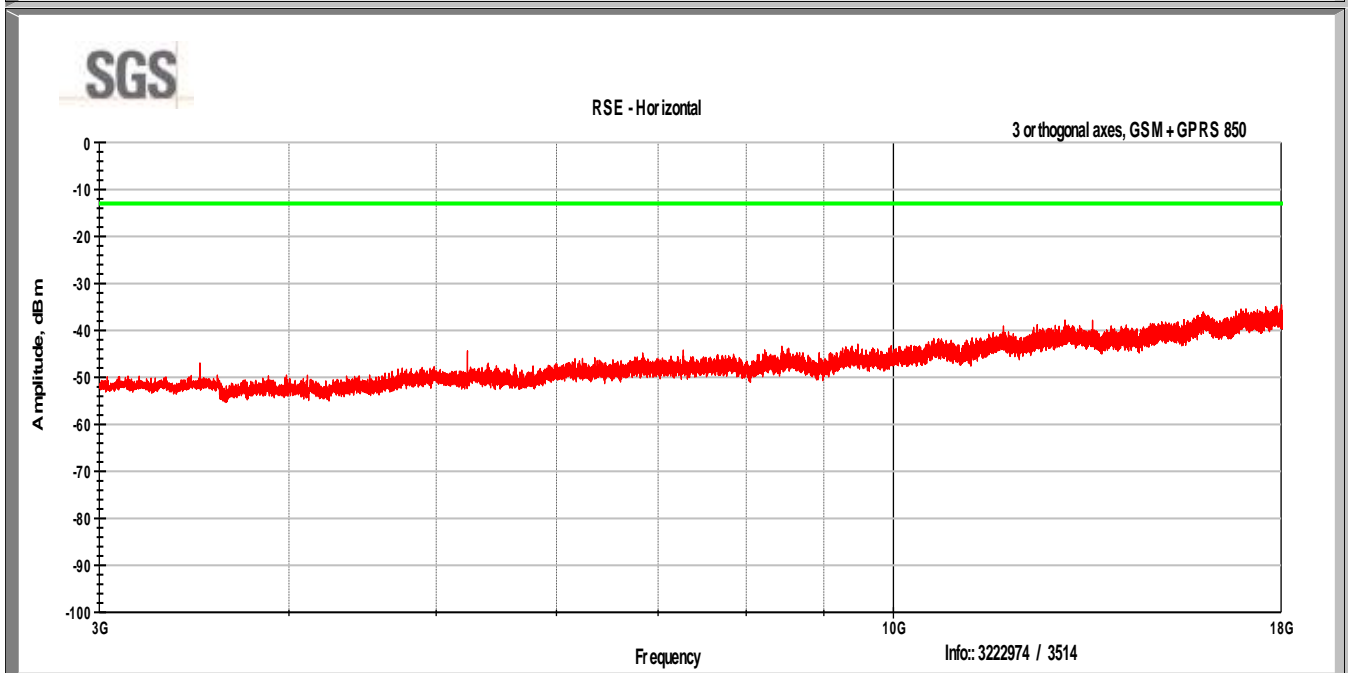
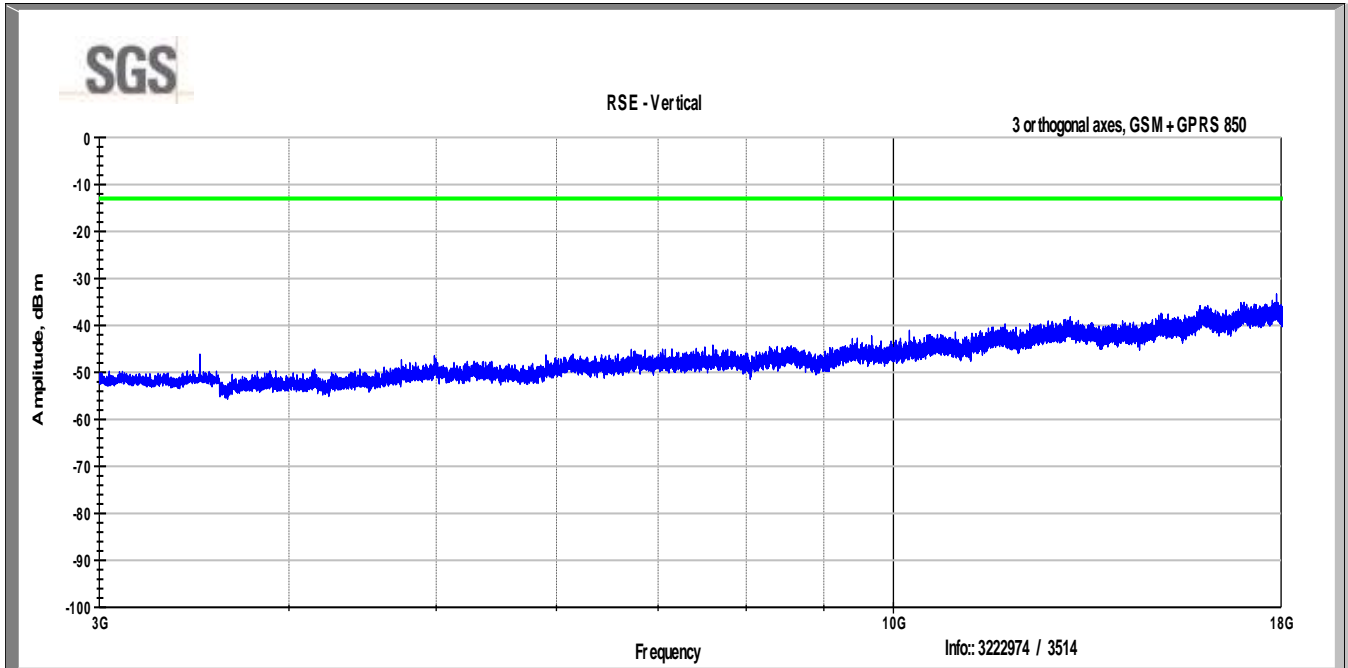




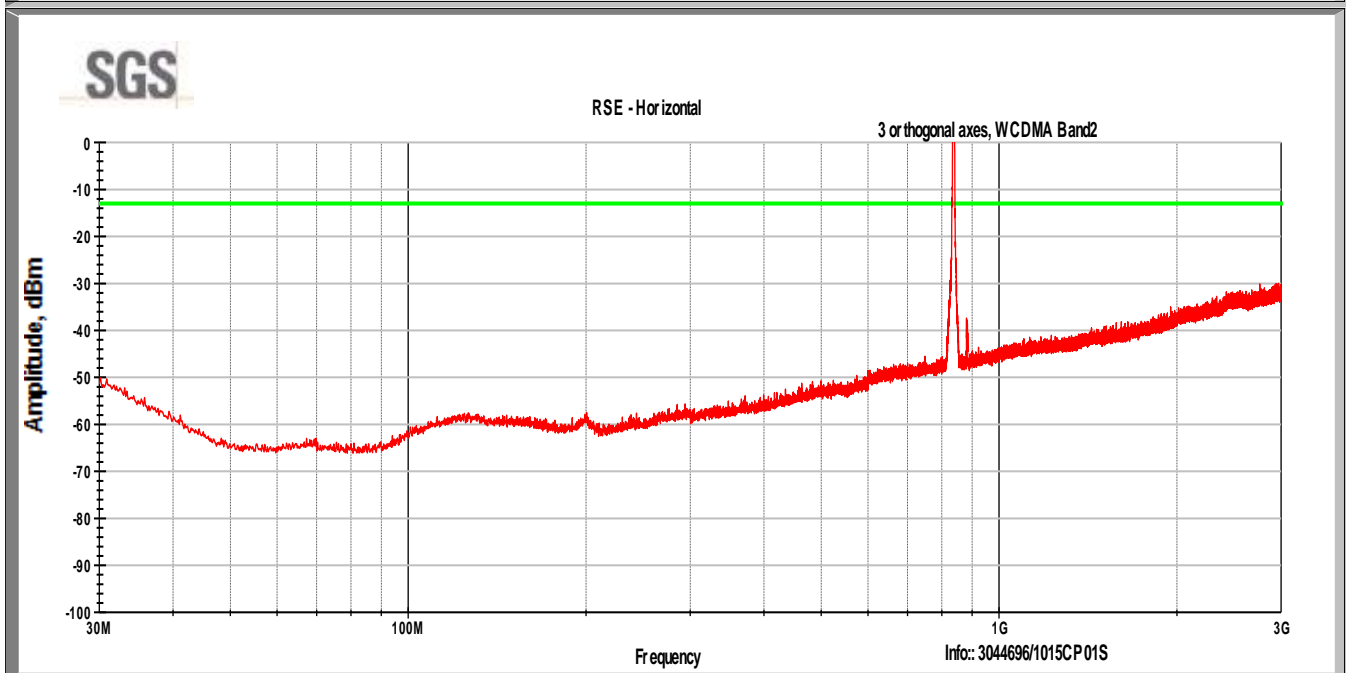
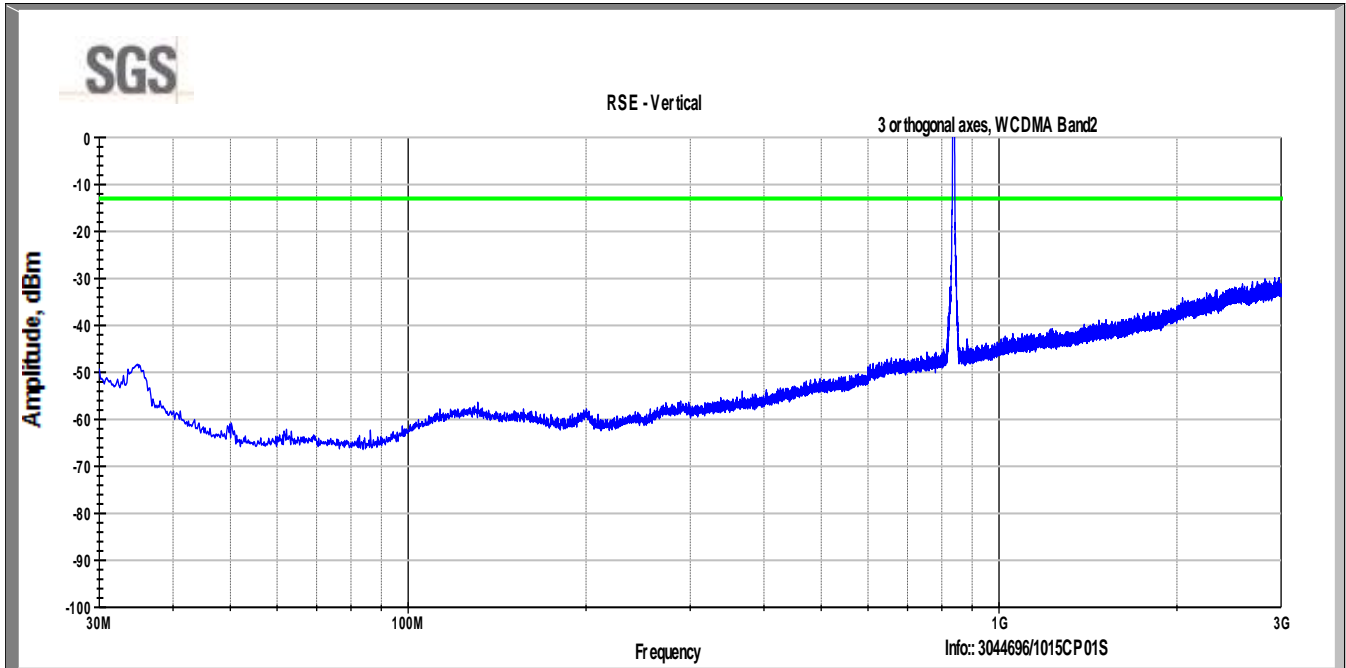
### GPRS



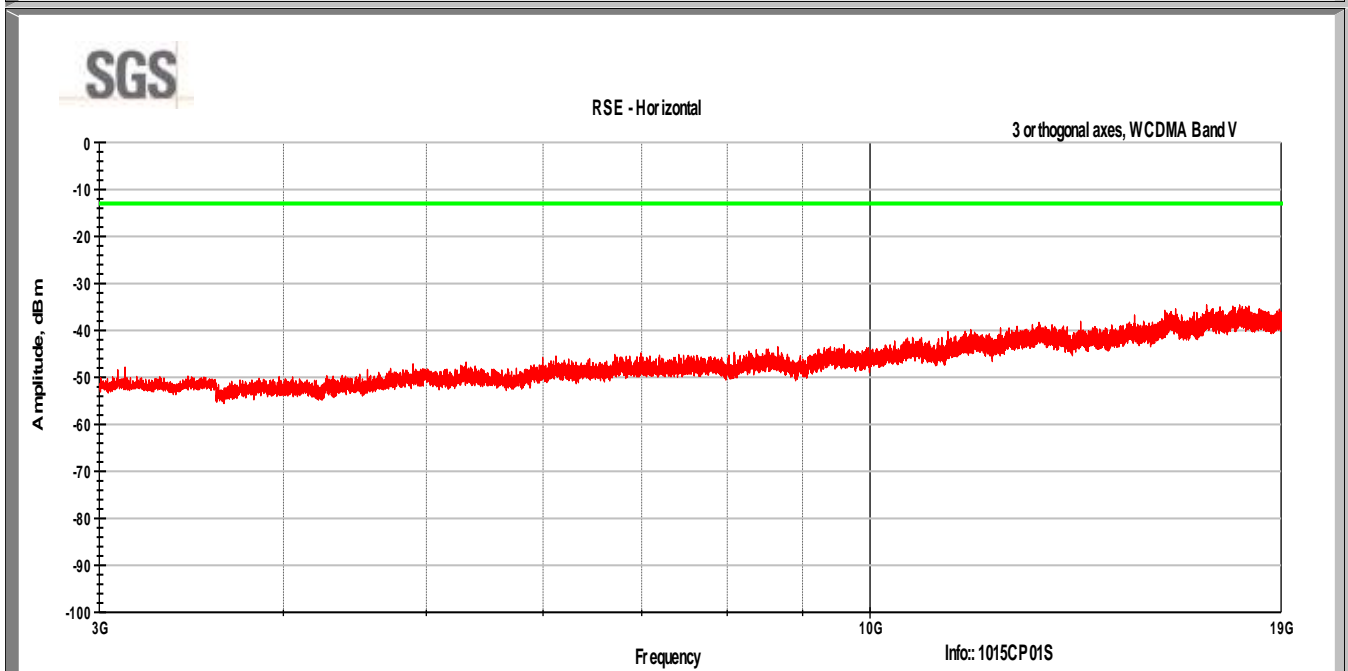
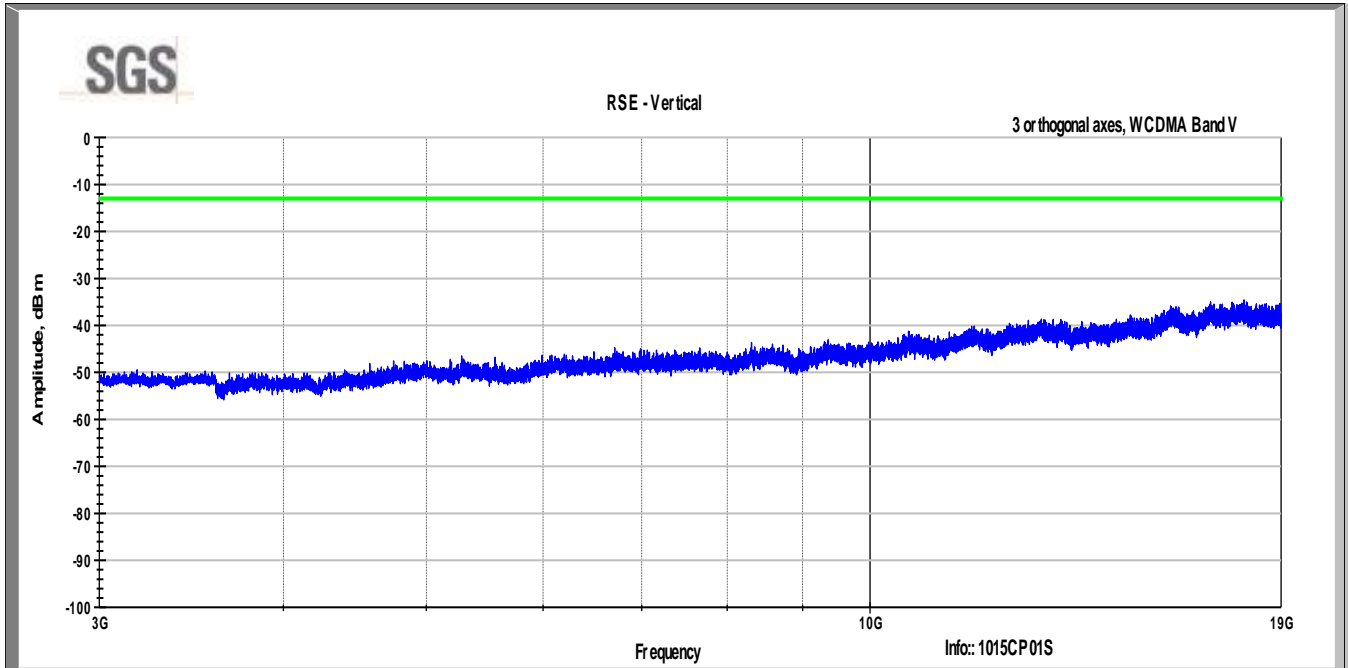
### GPRS



## WCDMA



### WCDMA



## 4 Frequency Stability

### 4.1.1 Test Result

Test Description	Basic Standards	Test Result
Frequency Stability	2.1055 22.917(a)	Pass

### 4.1.2 Test Method

The EUT was placed inside the Environmental Chamber and was left inside chamber to stabilize to set temperature for minimum of thirty minutes before any measurements were made. EUT was tested at BC10 channel 684, BC 1 channel 600, and BC0 channel 384.

### 4.1.3 Test Site

SGS EMC Laboratory, Suwanee, GA

#### Environmental Conditions

Temperature: 23.6 °C  
 Relative Humidity: 56.8 %  
 Atmospheric Pressure: 97.4 kPa

### 4.1.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
DC Power Supply	ZUP20-10	TDK-Lambda	B079774	14Nov2012
Wideband Radio Communications Tester	CMW500	Rohde & Schwarz	B085757	28Sep2012
Ultraflex Coaxial Cable	LMR-240	Time Microwave Systems	B092135	20July2013
Environmental Chamber	SM-16-8200	Thermotron	B079727	8 Aug2013

Note: The calibration period equipment is 1 year.

#### 4.1.5 Test Data

Test Date: 10 Aug 2012

##### CDMA

Voltage %	Power V <sub>DC</sub>	Temp °C	Frequency Hz	Freq Dev Av Hz	Freq Dev max Hz	Freq Dev ppm	Deviation %
100%	3.70	+20 (Ref)	836,520,000	+0	+3	+0.00	+0.000000
100%	3.70	-30	836,520,002	+2	+23	+0.03	+0.000003
100%	3.70	-20	836,520,004	+4	+22	+0.03	+0.000003
100%	3.70	-10	836,520,004	+4	+22	+0.03	+0.000003
100%	3.70	0	836,520,003	+3	+22	+0.03	+0.000003
100%	3.70	+10	836,520,002	+2	+20	+0.02	+0.000002
100%	3.70	+20	836,520,000	+0	+3	+0.00	+0.000000
100%	3.70	+30	836,520,000	+0	+18	+0.02	+0.000002
100%	3.70	+40	836,520,003	+3	+25	+0.03	+0.000003
100%	3.70	+50	836,520,002	+2	+6	+0.01	+0.000001
115%	4.26	+20	836,520,001	+1	+2	+0.00	+0.000000
Battery End	3.42	+20	836,520,001	+1	+5	+0.01	+0.000001

##### GSM 850

Voltage %	Power V <sub>DC</sub>	Temp °C	Frequency Hz	Freq Dev Av Hz	Freq Dev max Hz	Freq Dev ppm	Deviation %
100%	3.70	+20 (Ref)	836,400,007	+7	+14	+0.02	+0.000002
100%	3.70	-30	836,400,006	+6	+22	+0.03	+0.000003
100%	3.70	-20	836,400,003	+3	+21	+0.03	+0.000003
100%	3.70	-10	836,400,002	+2	+9	+0.01	+0.000001
100%	3.70	0	836,400,012	+12	+14	+0.02	+0.000002
100%	3.70	+10	836,400,002	+2	+7	+0.01	+0.000001
100%	3.70	+20	836,400,007	+7	+14	+0.02	+0.000002
100%	3.70	+30	836,400,011	+11	+16	+0.02	+0.000002
100%	3.70	+40	836,400,008	+8	+11	+0.01	+0.000001
100%	3.70	+50	836,400,016	+16	+18	+0.02	+0.000002
115%	4.26	+20	836,400,009	+9	+14	+0.02	+0.000002
Battery End	3.42	+20	836,400,012	+12	+14	+0.02	+0.000002

##### WCDMA

Voltage %	Power V <sub>DC</sub>	Temp °C	Frequency Hz	Freq Dev Av Hz	Freq Dev max Hz	Freq Dev ppm	Deviation %
100%	3.70	+20 (Ref)	826,400,004	+4	+19	+0.02	+0.000002
100%	3.70	-30	826,400,007	+7	+14	+0.02	+0.000002
100%	3.70	-20	826,400,006	+6	+15	+0.02	+0.000002
100%	3.70	-10	826,400,013	+13	+23	+0.03	+0.000003
100%	3.70	0	826,400,007	+7	+15	+0.02	+0.000002
100%	3.70	+10	826,400,004	+4	+14	+0.02	+0.000002
100%	3.70	+20	826,400,004	+4	+19	+0.02	+0.000002
100%	3.70	+30	826,400,001	+1	+21	+0.03	+0.000003
100%	3.70	+40	826,400,003	+3	+20	+0.02	+0.000002
100%	3.70	+50	826,400,003	+3	+16	+0.02	+0.000002
115%	4.26	+20	826,400,002	+2	+14	+0.02	+0.000002
Battery End	3.42	+20	826,400,002	+2	+51	+0.06	+0.000006

## 5 US PCS Band

### 5.1 RF Output Power

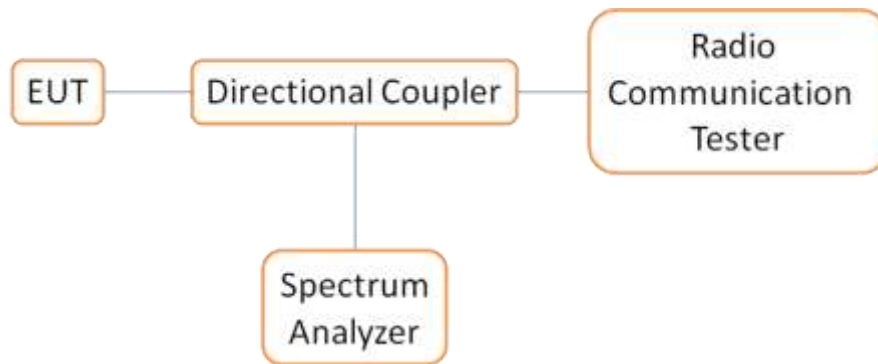
#### 5.1.1 Test Result

Test Description	Basic Standards	Test Result
RF Output Power	FCC Part 2.1046	Reported

#### 5.1.2 Test Method

A radio link was established between EUT and Radio Communication Tester. The output power of the EUT was set to maximum value by using the maximum power setting on the Radio Communications Tester. The output power was measured by a spectrum analyzer with the use of a directional coupler.

For CDMA Band 1, the measurement will be conducted at three channels: 25, 600, and 1175 (low, middle and high channels of the N American PCS Band).



### 5.1.3 Test Site

SGS EMC Laboratory, Suwanee, GA

#### Environmental Conditions

Temperature: 25.6 °C  
 Relative Humidity: 55.2 %  
 Atmospheric Pressure: 97.6 kPa

### 5.1.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	24Sep2013
Radio Communications Tester	CMW-500	R & S	B085757	29 Oct 2013
Power splitter	ZFRSC-183-S+	Mini-Circuits	EA01	Verified Before Use
Attenuator	BW-S10W2+	Mini-Circuits		Verified Before Use
Attenuator	BW-S10W2+	Mini-Circuits		Verified Before Use
Signal Generator	HMC-T2240	Hittite	B0799813	Verified Before Use
Coaxial Cable	086-112SM+	Mini-Circuits	NA	Verified Before Use
Coaxial Cable	086-112SM+	Mini-Circuits	NA	Verified Before Use

Note: The calibration period equipment is 1 year.

### 5.1.5 Test Data

Mode	Band	Center Frequency (MHz)	Channel	Average Power (dBm)
CDMA	BC1	1851.25	25	24.6
EVDO	BC1	1851.25	25	24.7
GSM <sup>(1)</sup>	1900	1909.8	810	21.3
GSM <sup>(2)</sup>	1900	1909.8	810	<b>30.3</b>
WCDMA	Band II	1882.5	162	24.9

1) Maximum Frame-Averaged Power

2) Maximum Burst-Averaged Power



## 5.2 Peak to Average Ratio

### 5.2.1 Test Result

Test Description	Basic Standards	Test Result
Peak to Average Ratio	FCC Part 24.232(d)	Pass

### 5.2.2 Test Method

Clause 6.0 of 971168 D01 Power Meas License Digital Systems v01 was used to determine peak-to-average ratio.

### 5.2.3 Test Site

SGS EMC Laboratory, Suwanee, GA

### 5.2.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	24Sep2013
Radio Communications Tester	CMW-500	R & S	B085757	29 Oct 2013
Power splitter	ZFRSC-183-S+	Mini-Circuits	EA01	Verified Before Use
Attenuator	BW-S10W2+	Mini-Circuits		Verified Before Use
Attenuator	BW-S10W2+	Mini-Circuits		Verified Before Use
Signal Generator	HMC-T2240	Hittite	B0799813	Verified Before Use
Coaxial Cable	086-112SM+	Mini-Circuits	NA	Verified Before Use
Coaxial Cable	086-112SM+	Mini-Circuits	NA	Verified Before Use

Note: The calibration period equipment is 1 year.

### 5.2.5 Test Data

Test Date: 1 Jul 2013

Mode	Band	Center Frequency (MHz)	Channel	Peak to Average ratio (dB)
CDMA	BC1	1880	600	3.0
EVDO	BC1	1880	600	<b>3.8</b>
GSM	1900	1880	661	0.5
WCDMA	Band II	1882.5	162	2.8

### 5.3 Occupied Bandwidth

#### 5.3.1 Test Result

Test Description	Basic Standards	Test Result
Occupied Bandwidth	FCC Part 2.1049 FCC Part 24.238(a)	Reported

#### 5.3.2 Test Method

The occupied bandwidth is the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power by a given emission. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sample detector shall be used since a peak detector may produce a wider than actual bandwidth.

A radio link was established between EUT and Radio Communications Tester. The output power of the EUT was set to maximum value by using the maximum power setting on the Radio Communications Tester. The occupied bandwidth is measured using spectrum analyzer's occupied bandwidth measurement. RBW is set to 3 kHz on spectrum analyzer.

The bandwidth of 99% power can be read on spectrum analyzer.

The measurement was conducted at three channels: 25, 600 and 1175 (low, middle and high channels) in RETAP 12288K test mode.

#### 5.3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

#### 5.3.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	24Sep2013
Radio Communications Tester	CMW-500	R & S	B085757	29 Oct 2013
Power splitter	ZFRSC-183-S+	Mini-Circuits	EA01	Verified Before Use
Attenuator	BW-S10W2+	Mini-Circuits		Verified Before Use
Attenuator	BW-S10W2+	Mini-Circuits		Verified Before Use
Signal Generator	HMC-T2240	Hittite	B0799813	Verified Before Use
Coaxial Cable	086-112SM+	Mini-Circuits	NA	Verified Before Use
Coaxial Cable	086-112SM+	Mini-Circuits	NA	Verified Before Use

Note: The calibration period equipment is 1 year.

### 5.3.5 Test Data

Mode	Frequency	BW (MHz)
CDMA	1851.25	1.42
CDMA	1880	1.42
CDMA	1908.75	1.42
GSM	1850.2	0.3214
GSM	1909.8	0.3154
GPRS	1850.2	0.3134
GPRS	1909.8	0.3194
EGPRS	1850.2	0.3154
EGPRS	1909.8	0.3094
EGPRS2-A	1850.2	0.3014
EGPRS2-A	1909.8	0.3094
WCDMA	1852.4	4.64
WCDMA	1880	4.64
WCDMA	1907.6	4.64

## 5.4 Band Edge and Conducted Spurious Emissions

### 5.4.1 Test Result

Test Description	Basic Standards	Test Result
Conducted spurious emissions and Band Edge	2.1051 24.238(a)	Pass

### 5.4.2 Test Method

The levels of the carrier and the various conducted spurious and harmonics frequencies are measured by means of a calibrated spectrum analyzer. The emissions spectrum emanating from the EUT transmit antenna port is scanned from the lowest frequency generated in the equipment up to a frequency including its 10<sup>th</sup> harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB. Compliance is based on the use of a spectrum analyzer employing a resolution bandwidth of 1 MHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of a least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emissions bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

### 5.4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

### 5.4.4 Test Equipment

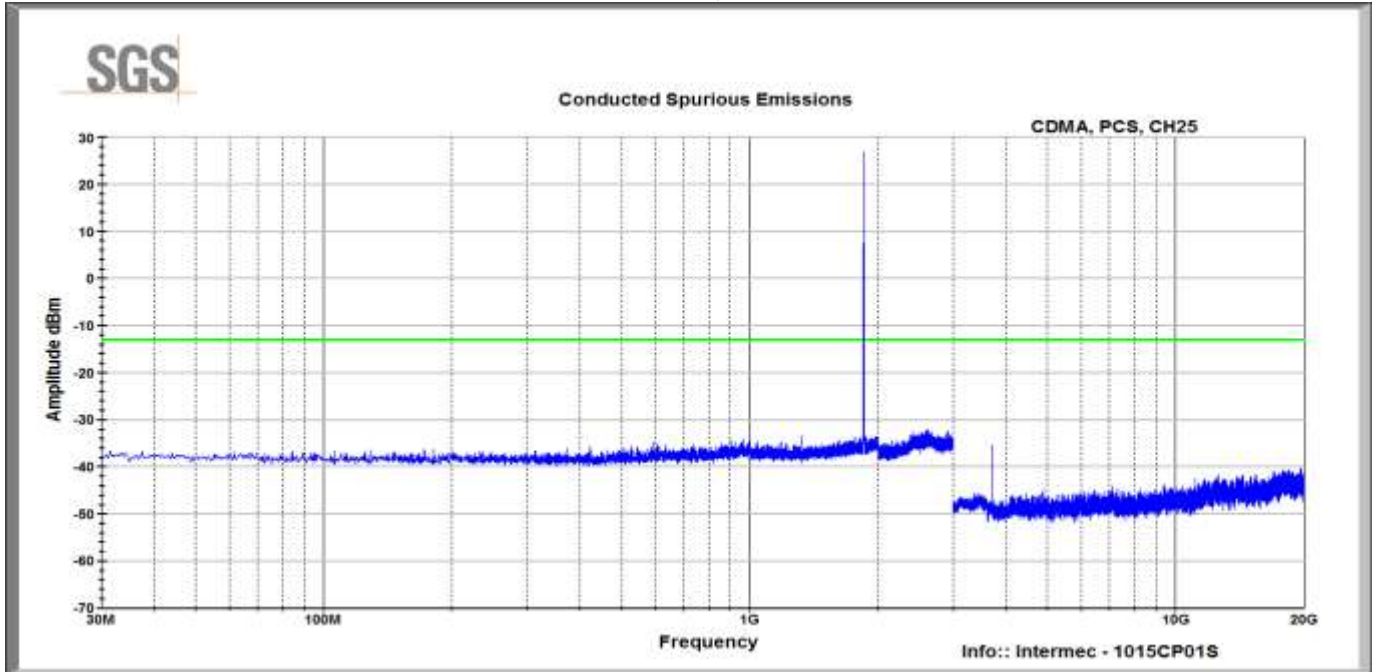
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	24Sep2013
Radio Communications Tester	CMW-500	R & S	B085757	29 Oct 2013
Power splitter	ZFRSC-183-S+	Mini-Circuits	EA01	Verified Before Use
Attenuator	BW-S10W2+	Mini-Circuits		Verified Before Use
Attenuator	BW-S10W2+	Mini-Circuits		Verified Before Use
Signal Generator	HMC-T2240	Hittite	B0799813	Verified Before Use
Coaxial Cable	086-112SM+	Mini-Circuits	NA	Verified Before Use
Coaxial Cable	086-112SM+	Mini-Circuits	NA	Verified Before Use

Note: The calibration period equipment is 1 year.

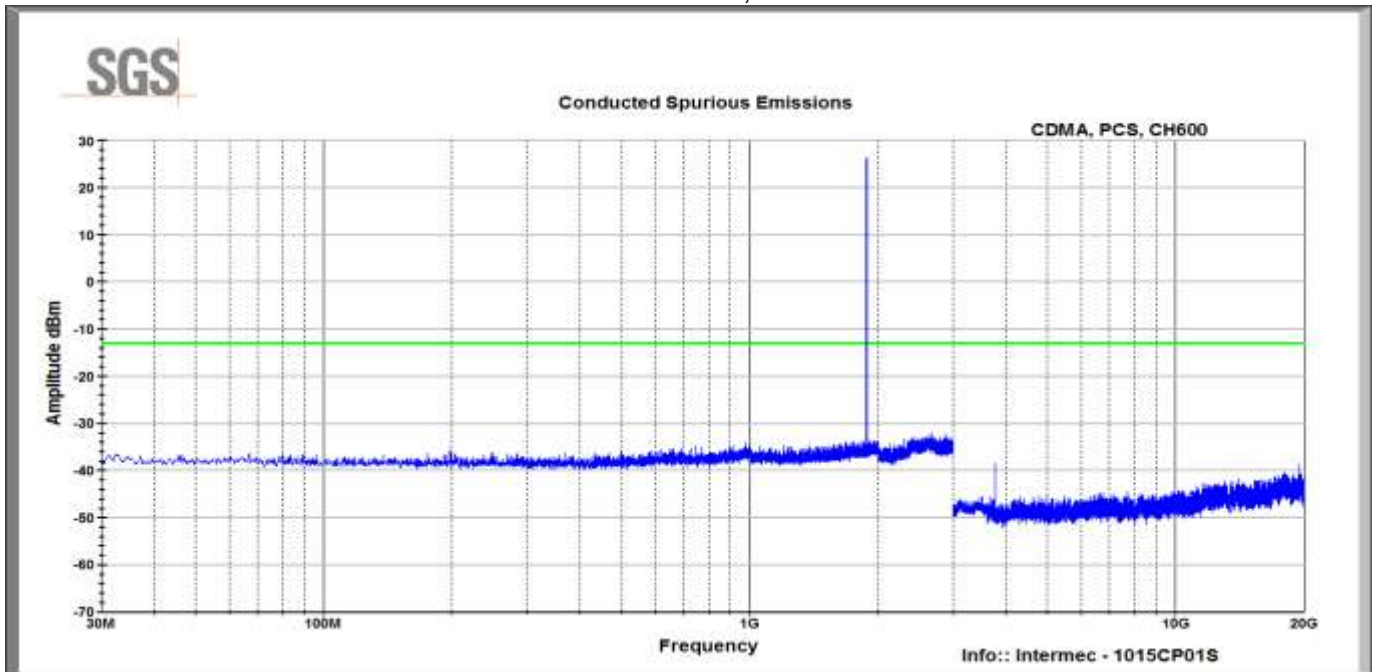
### 5.4.5 Test Data

Test Date: 2 Aug 2012

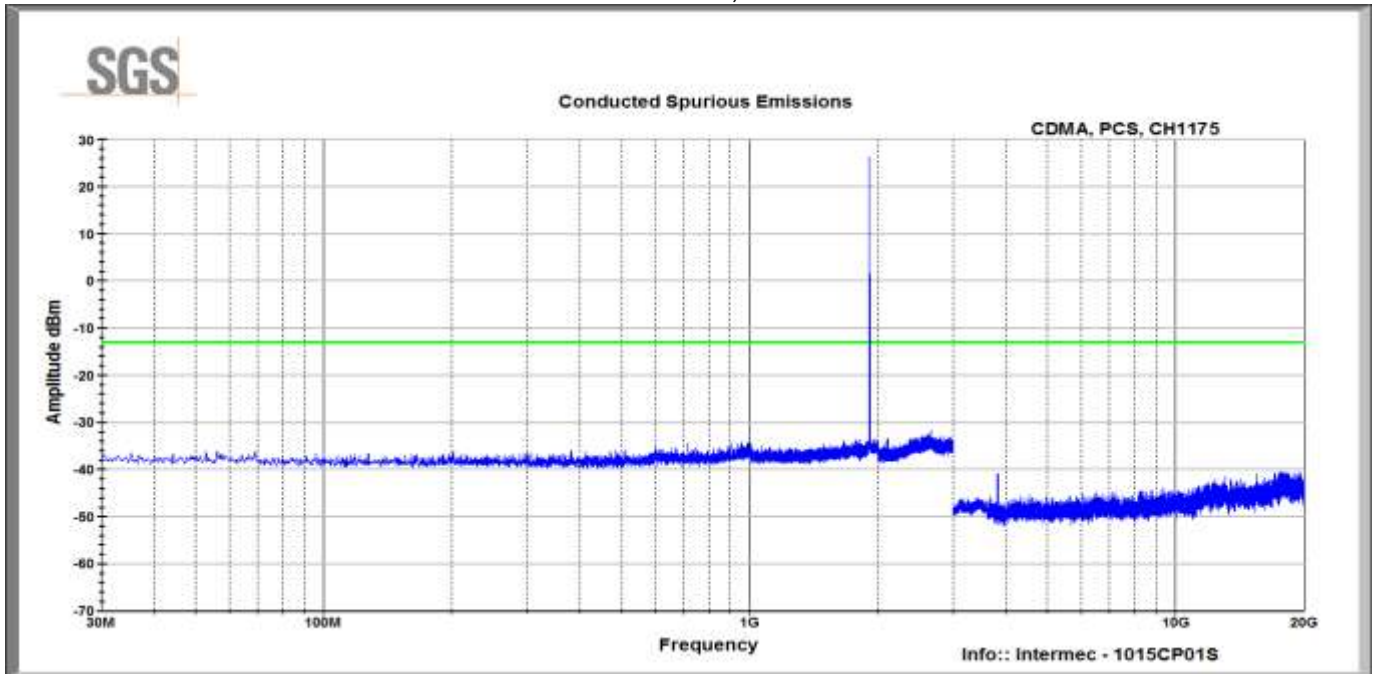
CDMA Channel 25, 1851.25 MHz



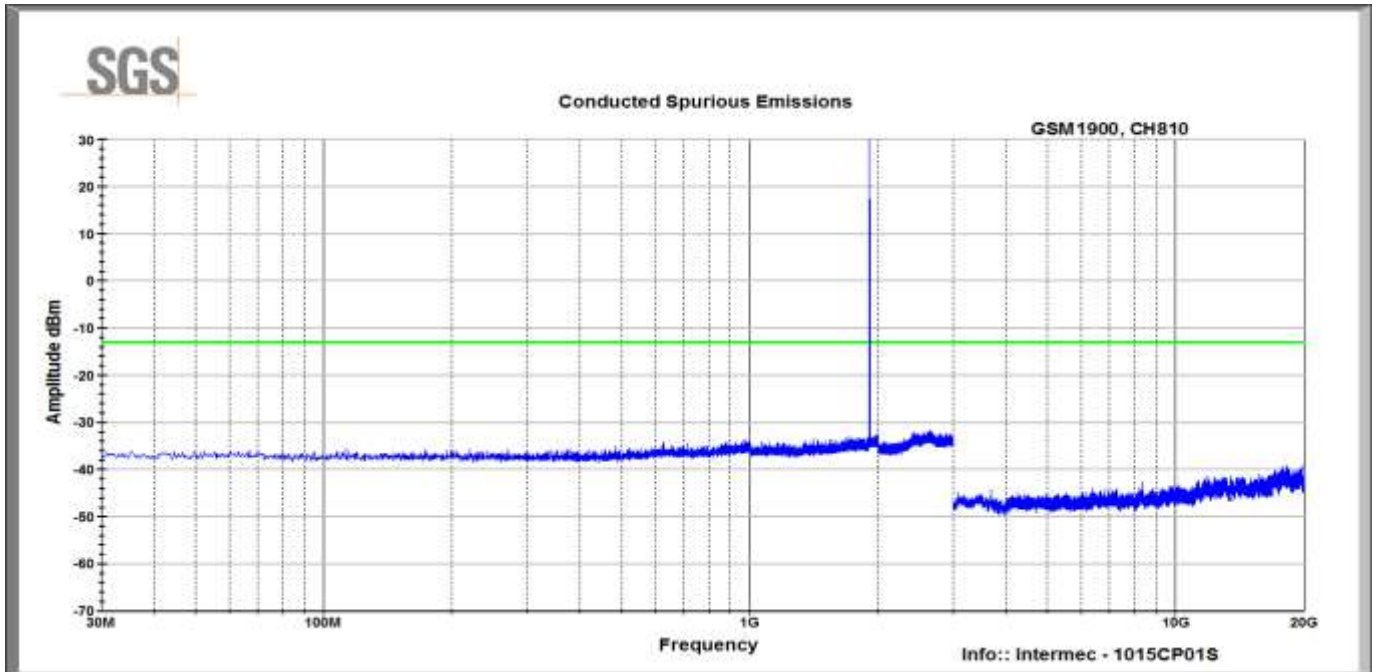
CDMA Channel 600, 1880 MHz



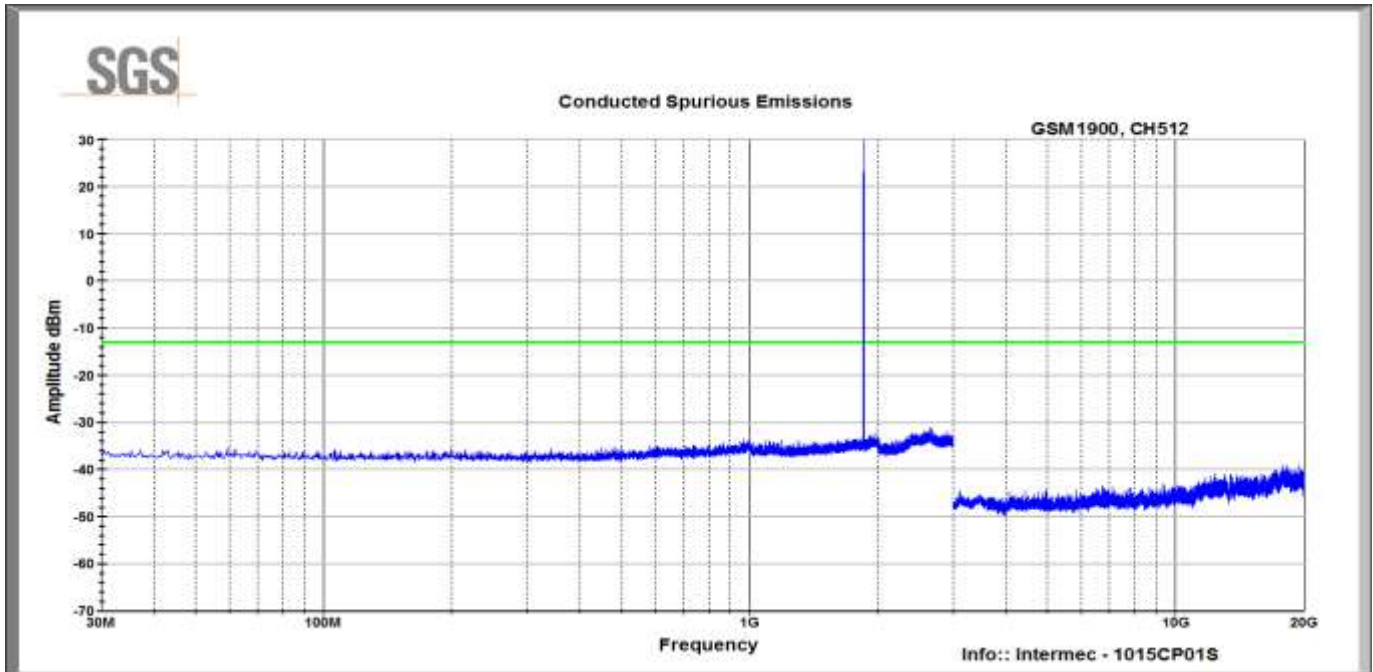
CDMA Channel 1175, 1908.75 MHz



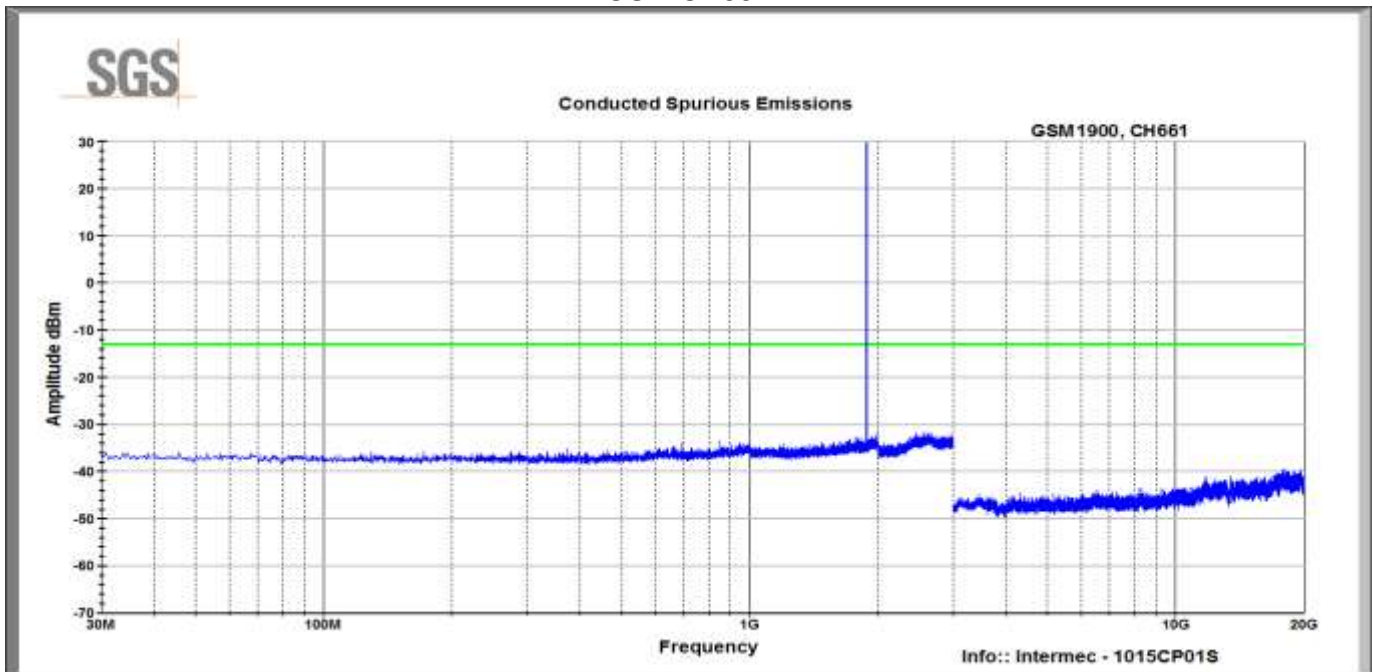
GSM CH810



### GSM CH512

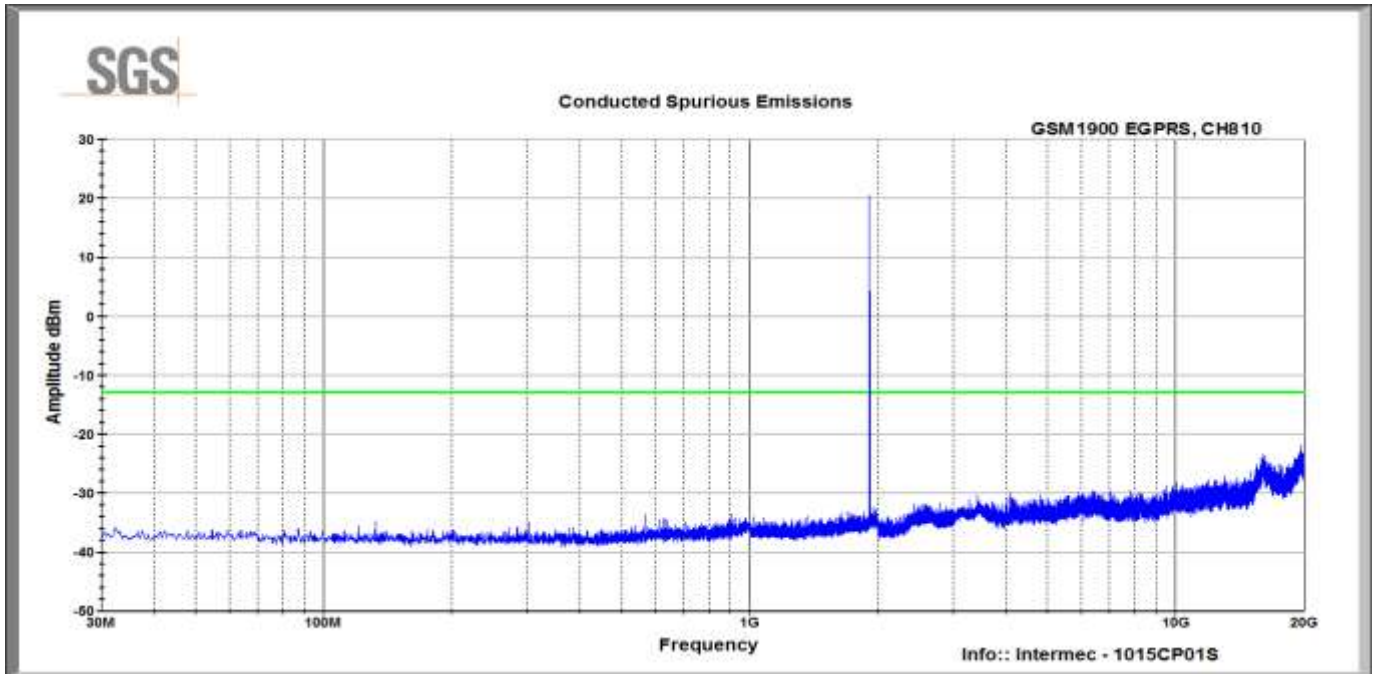


### GSM CH661

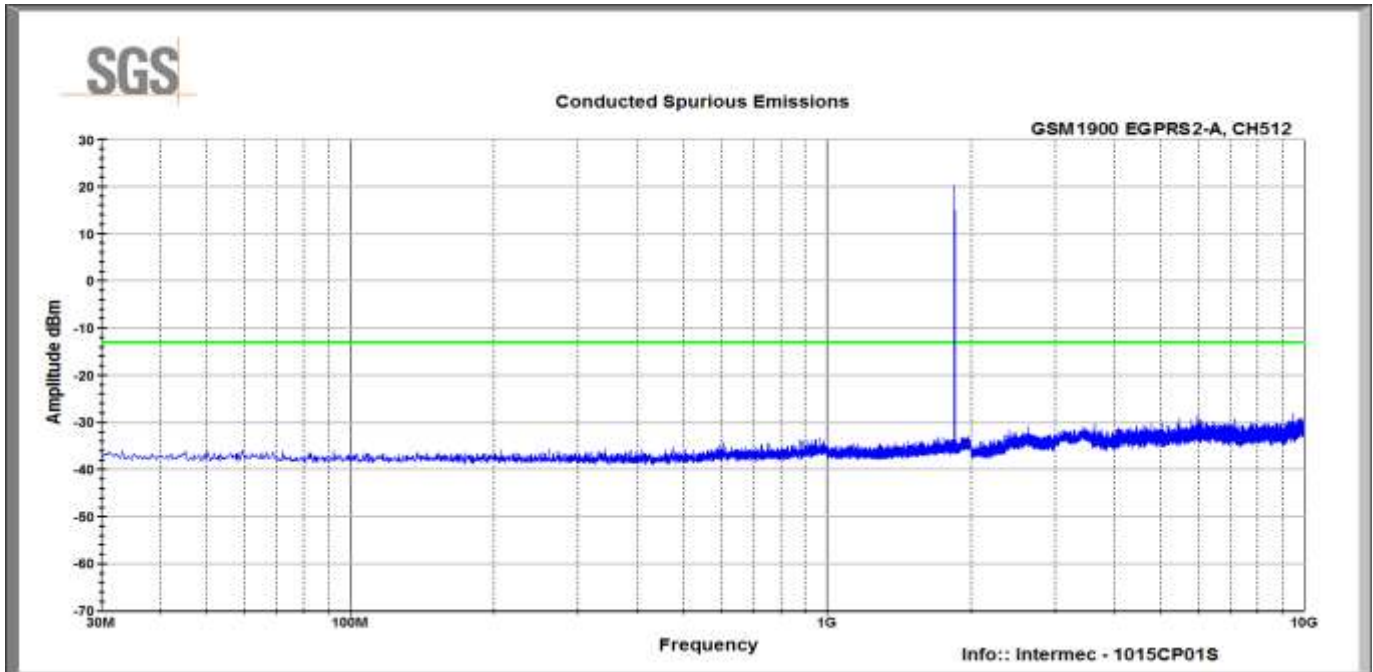




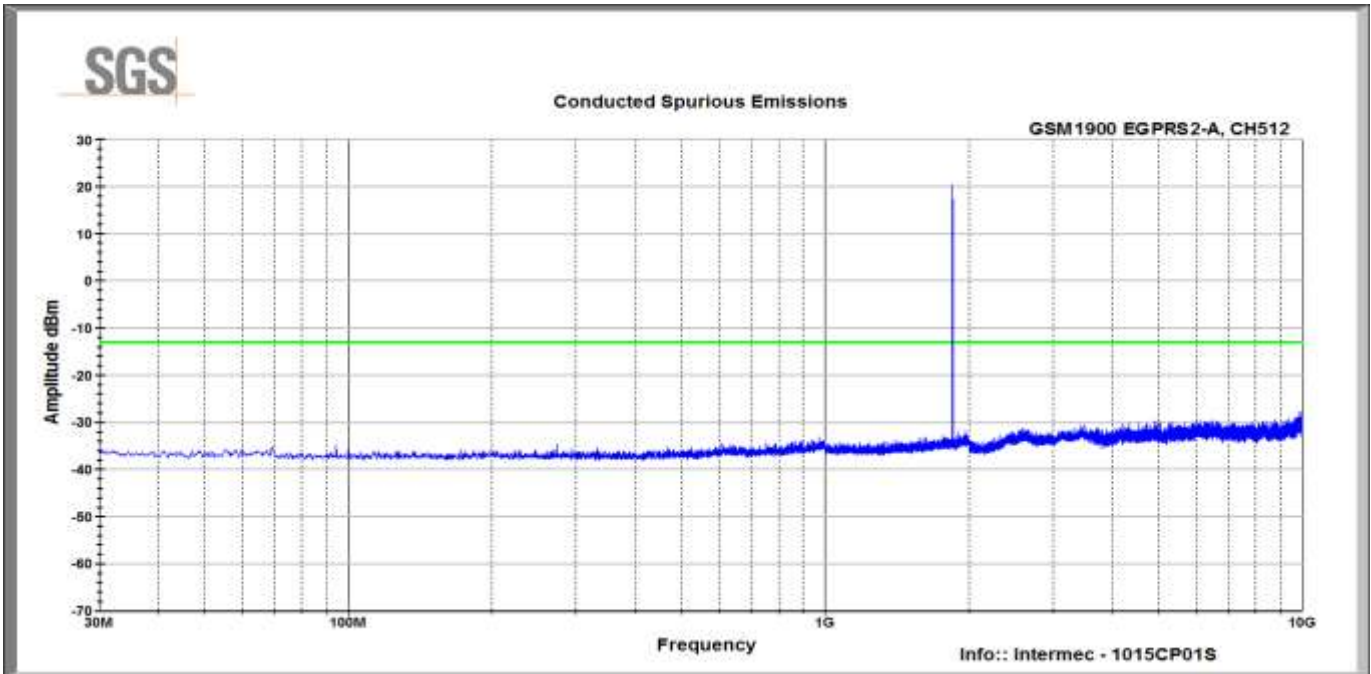
### EGPRS CH128



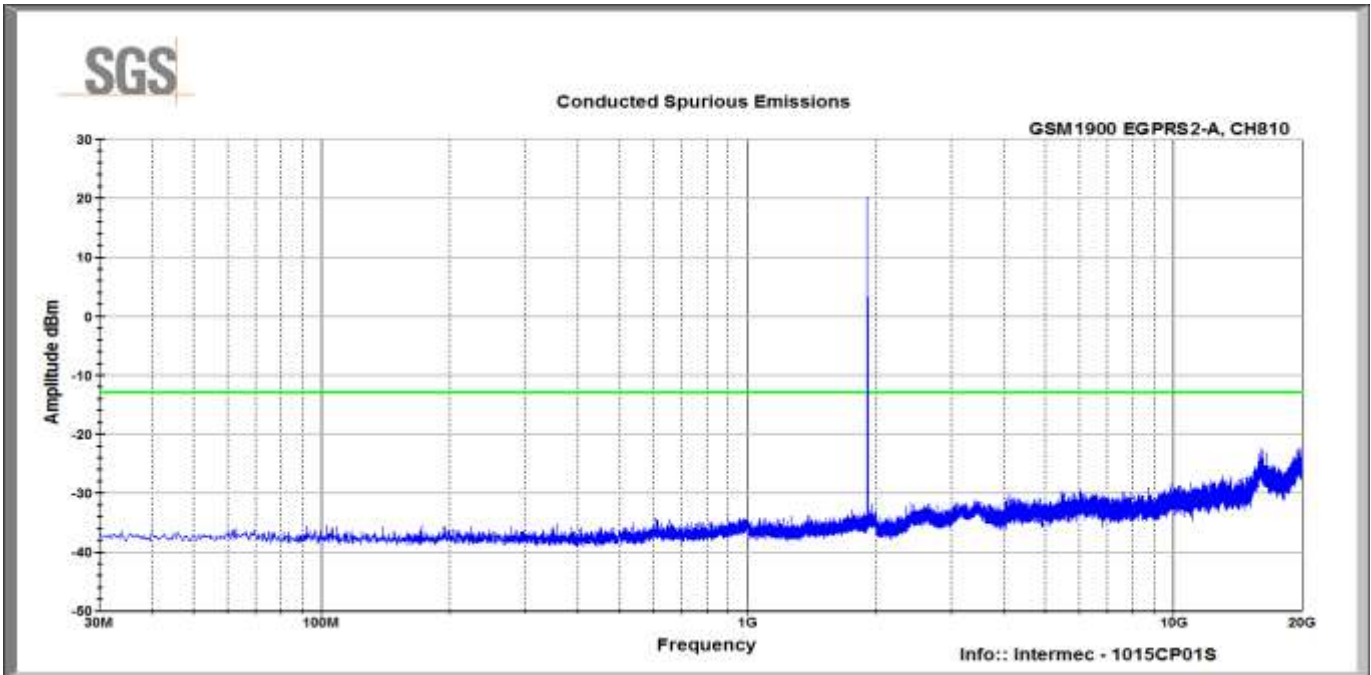
### EGPRS CH512



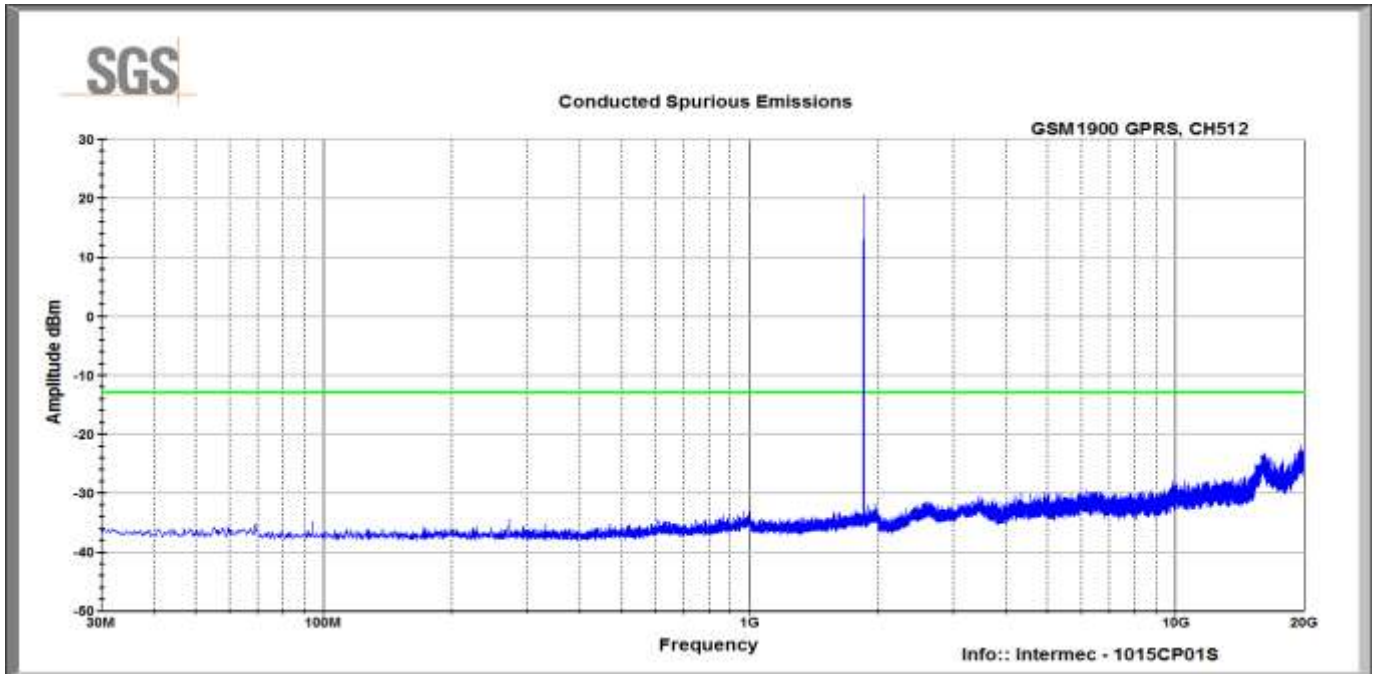
EGPRS2-A CH512



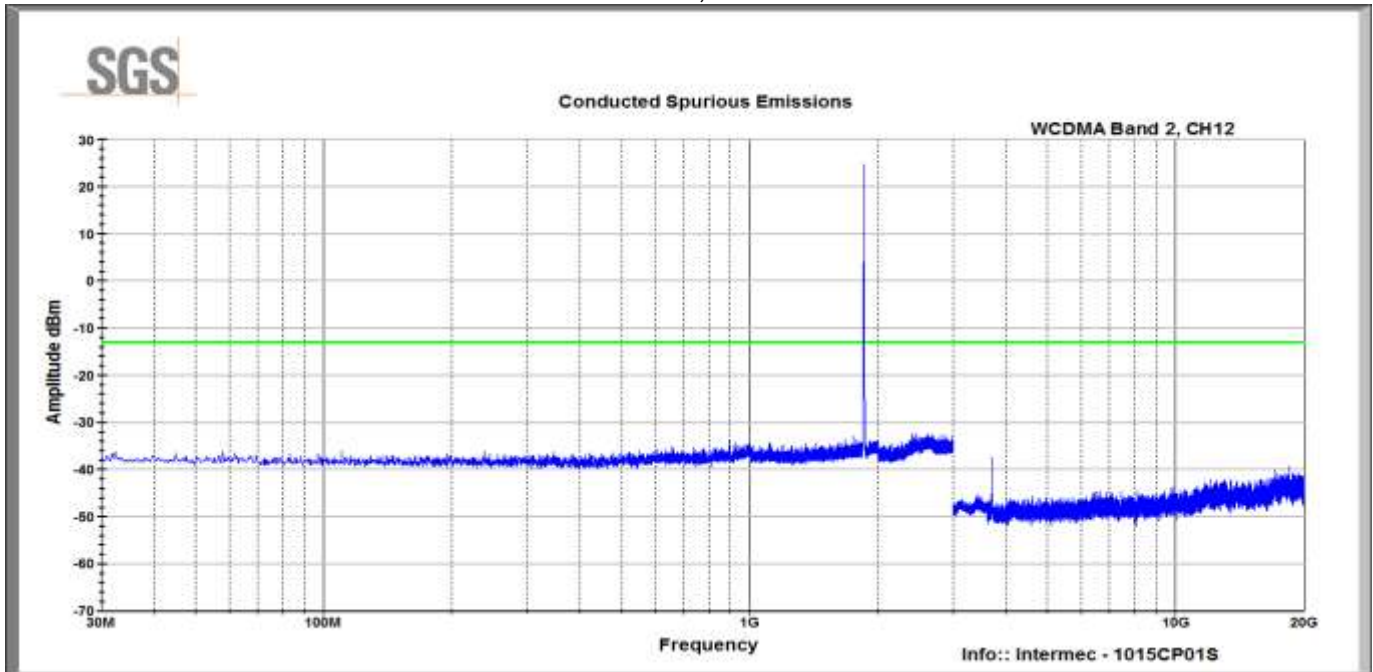
EGPRS2-A CH810



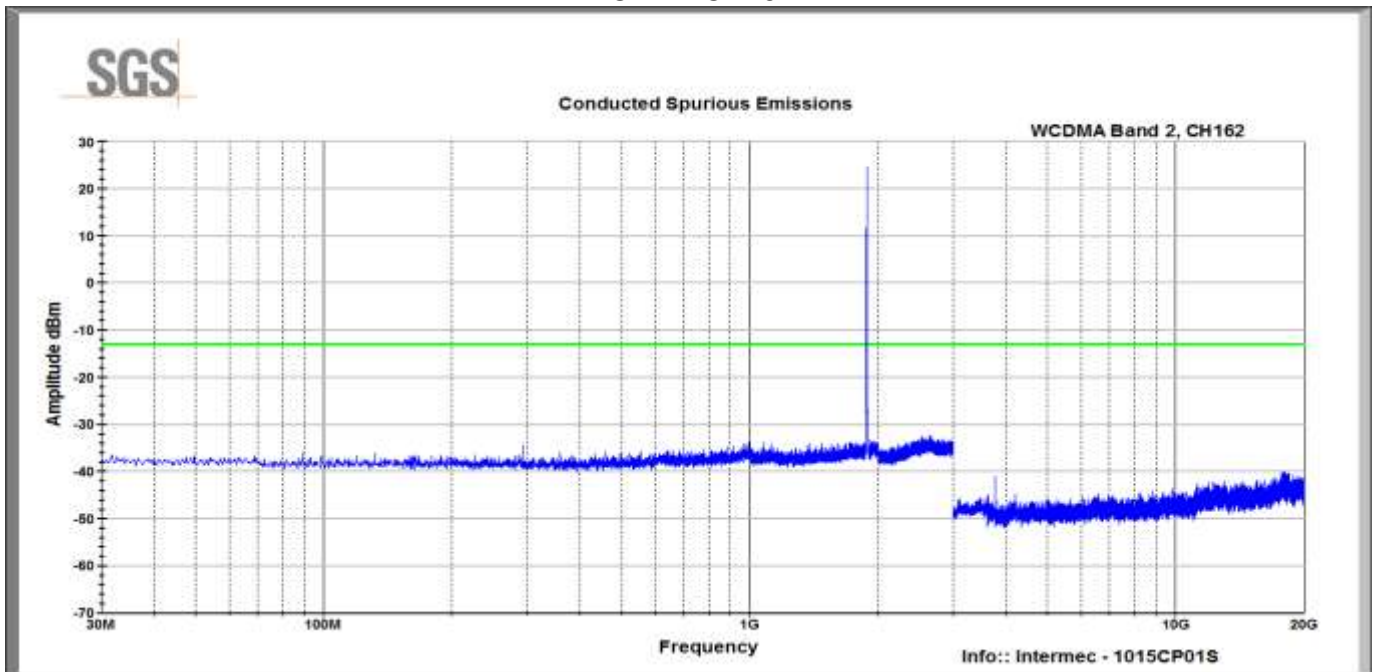
### GPRS CH512



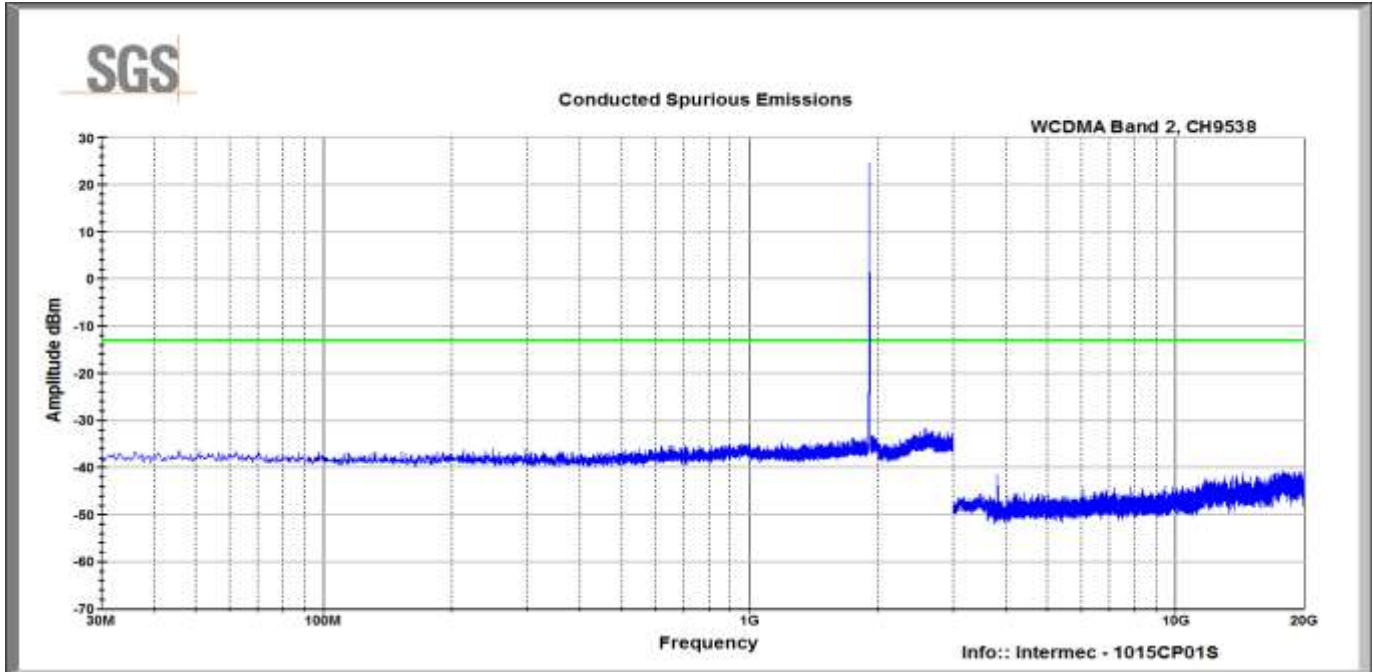
### WCDMA, CH12



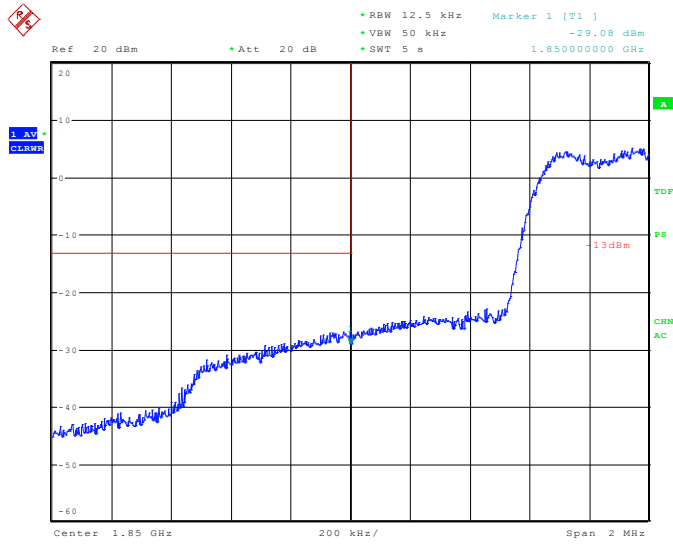
### WCDMA CH162



WCDMA CH9538

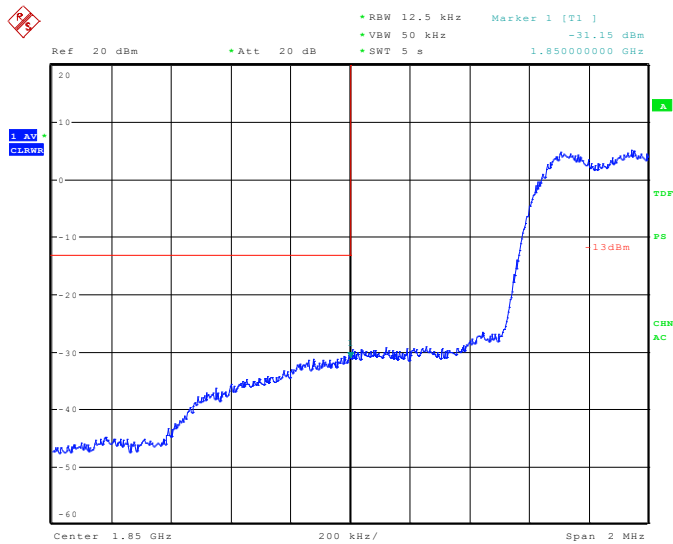


### Lower Band Edges EVDO BC1



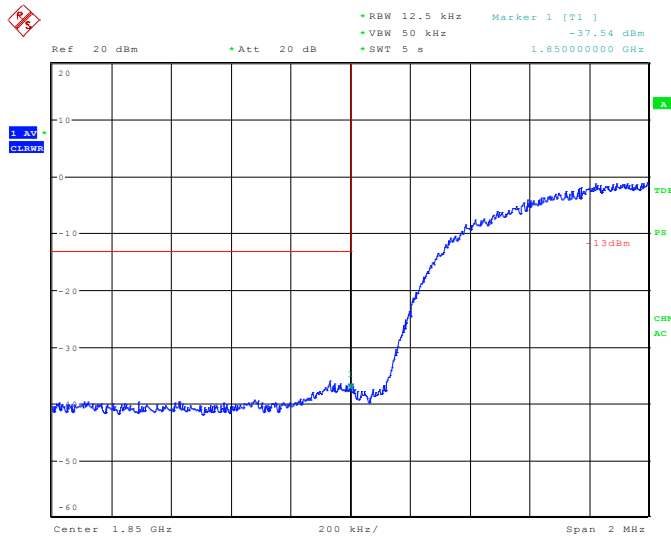
Date: 5.JUL.2013 10:09:42

### CDMA BC1



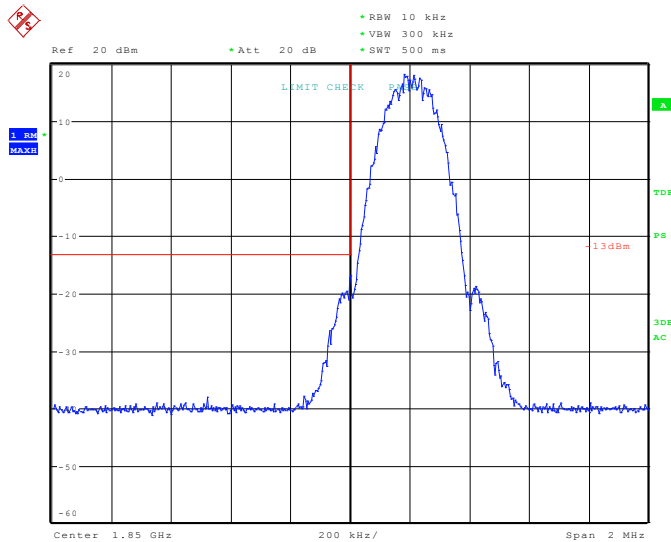
Date: 5.JUL.2013 10:39:27

### WCDMA Band 2



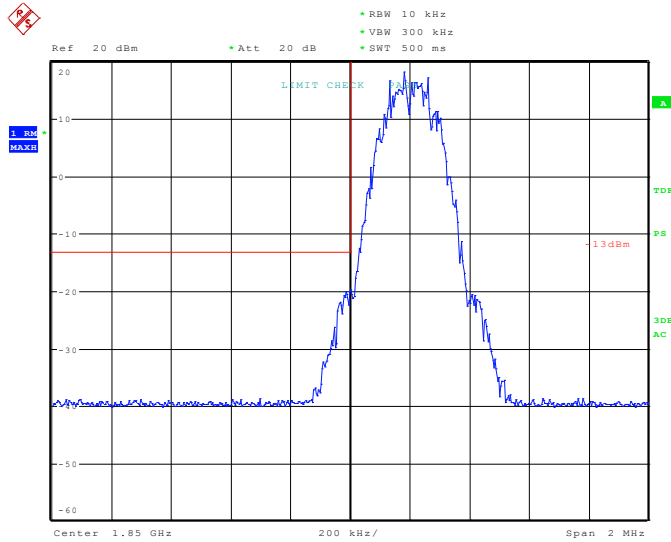
Date: 5.JUL.2013 10:51:00

### GSM Voice Band 2



Date: 11.JUL.2013 00:46:09

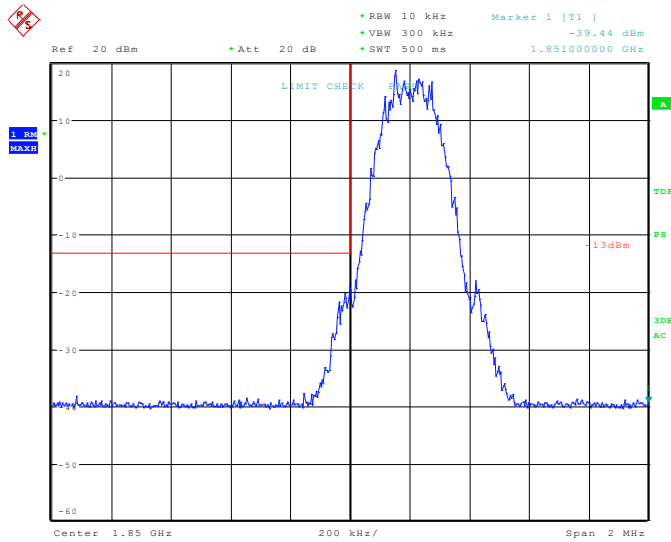
### EGPRS2-A Band 2



Date: 11.JUL.2013 00:54:27

### EGPRS

#### Band 2

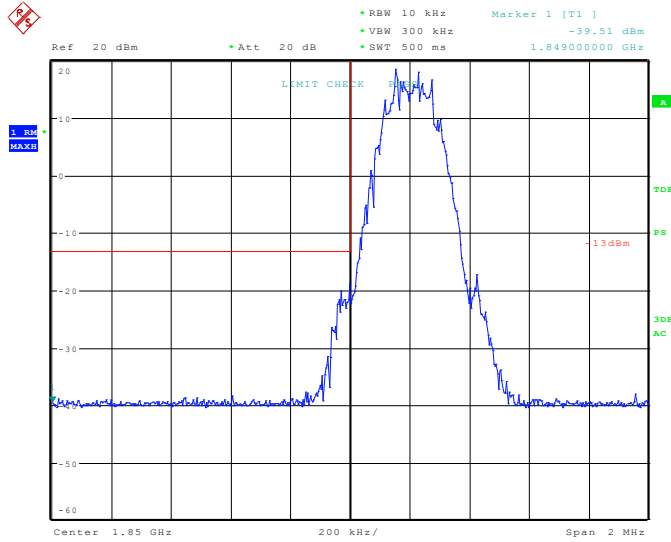


Date: 11.JUL.2013 00:12:26



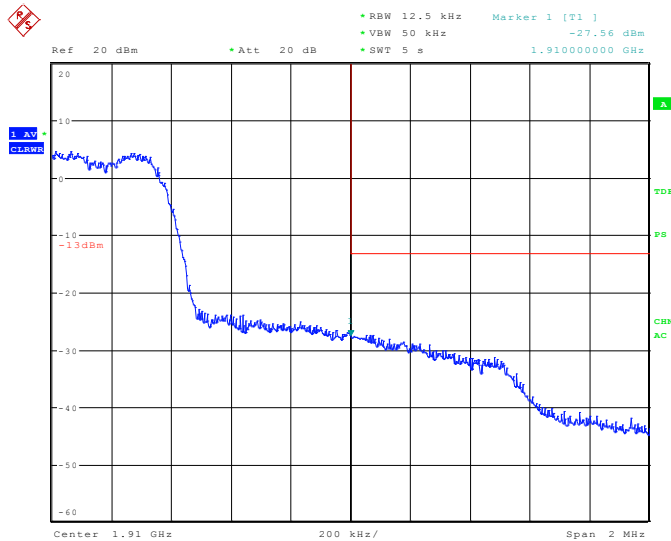
### GPRS

#### Band 2



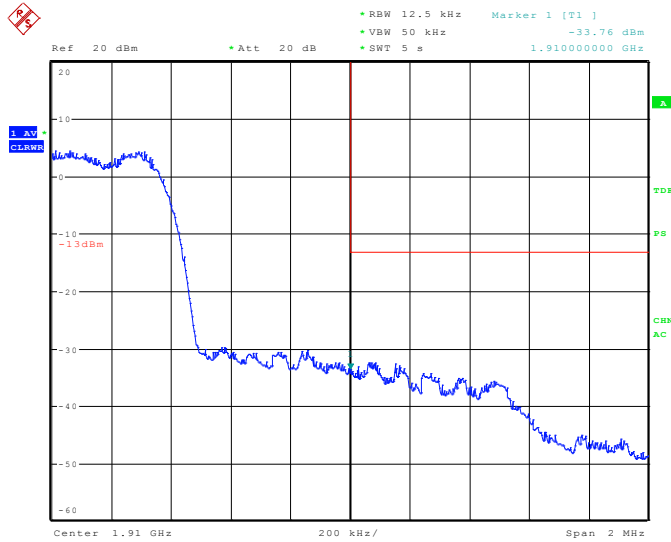
Date: 11.JUL.2013 00:00:43

### Upper Band Edges EVDO BC1



Date: 5.JUL.2013 10:17:56

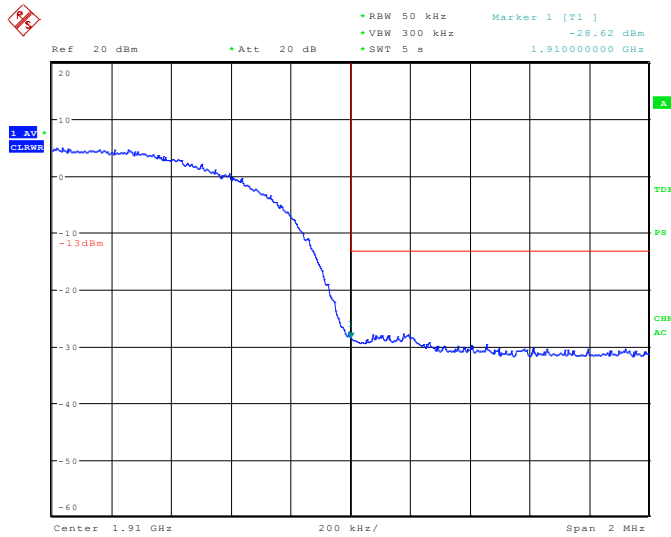
### CDMA BC1



Date: 5.JUL.2013 10:44:44

### WCDMA

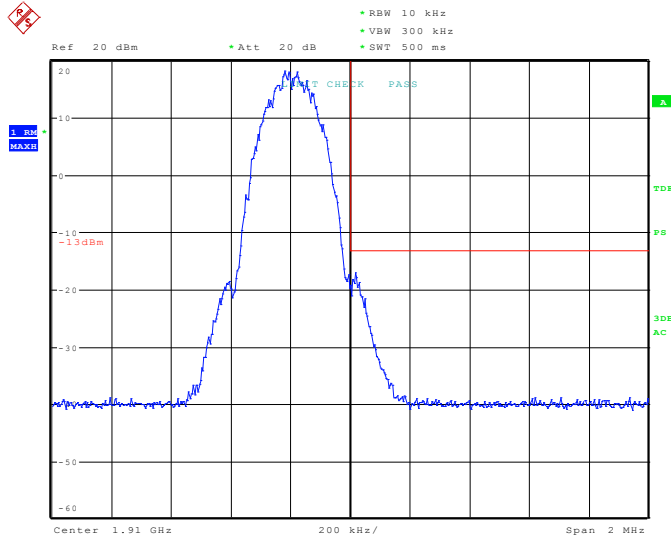
### Band 2



Date: 5.JUL.2013 10:56:33

### GSM Voice

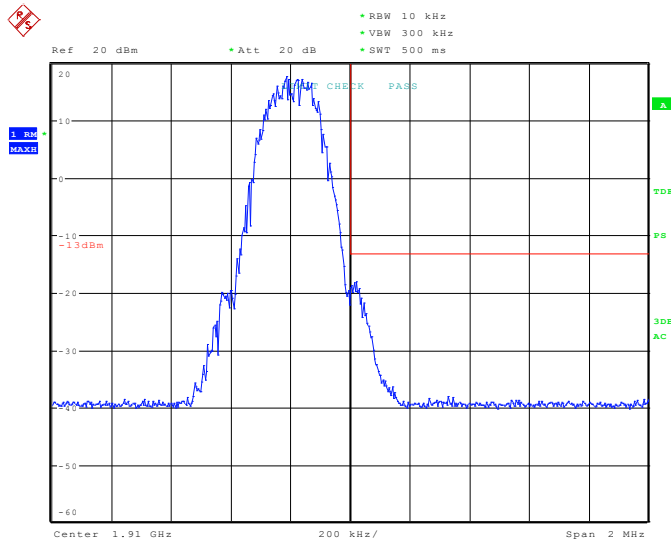
#### Band 2



Date: 11.JUL.2013 00:46:51

### EGPRS2-A

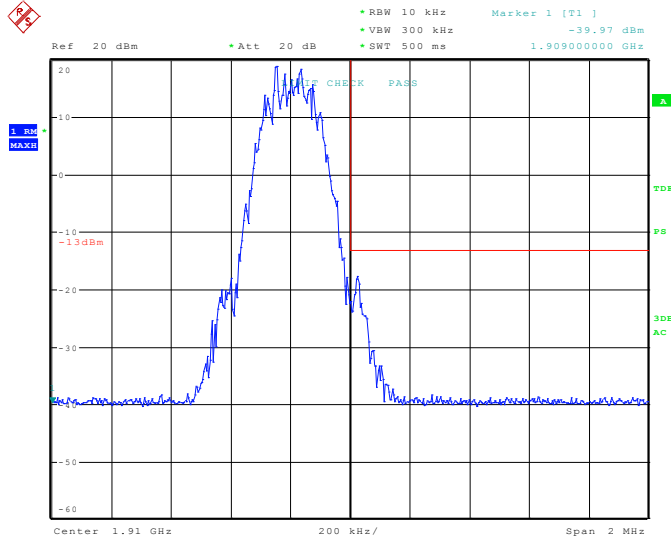
#### Band 2



Date: 11.JUL.2013 00:57:05

### EGPRS

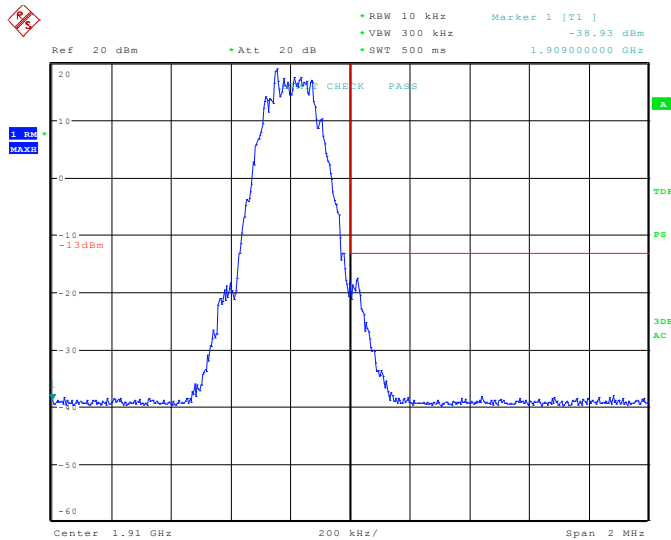
#### Band 2



Date: 11.JUL.2013 00:08:01

### GPRS

#### Band 2



Date: 11.JUL.2013 00:05:53

## 5.5 Effective Isotropic Radiated Power

### 5.5.1 Test Result

Test Description	Basic Standards	Test Result
Effective Radiated Power	FCC Part 24.232(c)	Pass

### 5.5.2 Test Method

The measurements above 1 GHz are carried out in a fully anechoic chamber. Below 1 GHz, the measurements are carried out in semi-anechoic chamber. The EUT was placed on a 0.8 meter high non-conductive table at a 3 meters test distance from the test receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT. The height of receiving antenna is varied from 1 to 4 m to find the maximum power value. A radio link was established between EUT and Radio Communications Tester. The output power of the EUT was set to maximum value by using the maximum power setting on the Radio Communications Tester. A RMS detector is used and RBW is set to 3MHz. Then the antenna height and turn table rotation is adjusted till the maximum power value is founded on spectrum analyzer.

The EUT was positioned through each of its three orthogonal axes and the highest level was reported.

A dipole antenna (below 1 GHz) or double-ridged waveguide antenna (above 1 GHz) was substituted in place of the EUT. The substitution antenna will be driven by a signal generator. The receive antenna is varied to find the maximum response to the spectrum analyzer. Then the level of signal generator will be adjusted to achieve the same power value on the spectrum analyzer or receiver.

The ERP/EIRP of the EUT can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.

The measurement was conducted at three channels: 25, 600 and 1175 (low, middle and high channels) in RETAP 12288K test mode.

### 5.5.3 Test Site

10m Semi-anechoic chamber, SGS EMC Laboratory, Suwanee, GA

### 5.5.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Date	Cal Due Date
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079691	10-Jun-13	10-Jun-14
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079699	25-Mar-13	25-Mar-14
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	24-Sep-12	24-Sep-13
RF CABLE - 7000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079712	20-Sep-12	20-Sep-13
RF CABLE - 7500MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079711	20-Sep-12	20-Sep-13
RF CABLE	SF106	HUBER&SUHNER	B085888	22-Oct-12	22-Oct-13
CMW500 WIDEBAND RADIO COMMUNICATIONS TESTER	CMW500	ROHDE & SCHWARZ	B085757	29-Oct-12	29-Oct-13
SIGNAL GENERATOR, 40 GHZ	000130	HITTITE	EA04	CNR	CNR

Note: The calibration period equipment is 1 year.

### 5.5.5 Test Data

Test Date: 2 Aug 2013

Mode	Band	Measured EIRP dBm	Limit dBm	Result
CDMA	BC1	24.1	33.0	PASS
EVDO	BC1	23.3	33.0	PASS
WCDMA	Band II	23.1	33.0	PASS
HSUPA	Band II	21.4	33.0	PASS

Test Date: 4 Sep 2013

Mode	Band	Measured EIRP dBm	Limit dBm	Result
GSM	1900	32.6	33.0	PASS
EDGE	1900	32.6	33.0	PASS
GPRS	1900	32.7	33.0	PASS

## 5.6 Radiated Spurious Emissions

### 5.6.1 Test Result

Test Description	Basic Standards	Test Result
Radiated Spurious Emissions	FCC Part 2.1053 FCC Part 22.917(a)	Pass

### 5.6.2 Test Method

The levels are measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its 10<sup>th</sup> harmonic. On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB. Compliance is based on the use of a spectrum analyzer employing a resolution bandwidth of 1 MHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of a least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emissions bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

The EUT was manipulated through each of its three orthogonal axes with the measurement oriented in both vertical and horizontal polarizations.

A PCS band notch filter or a high pass filter was used to protect the preamplifier from overload condition.

A radio link was established between EUT and Radio Communications Tester. The output power of the EUT was set to maximum value by using the maximum power setting on the Radio Communications Tester.

The measurement was conducted at the middle channels, 600 in RC3/SO55.

### 5.6.3 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Bilog Antenna	JB6	Sunol	B079689	4 SEP 2013
DRWG Antenna	3117	ETS	B079691	10 Jun 2014
Receiver	ESU40	R & S	B079629	24 SEP 2013
Pre-Amplifier	TS-PR18	Rohde & Schwarz	B094463	12 Oct 2014
Filter	BRM50702	Micro-tronics	NA	Verified before use
Signal Generator	HMC T2240	Hittite	B079813	NCR
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079714	13 Aug 2013
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079659	13 Aug 2013
Radio Communications Tester	CMW-500	R&S	B085757	29 Oct 2013

Note: The calibration period equipment is 1 year.



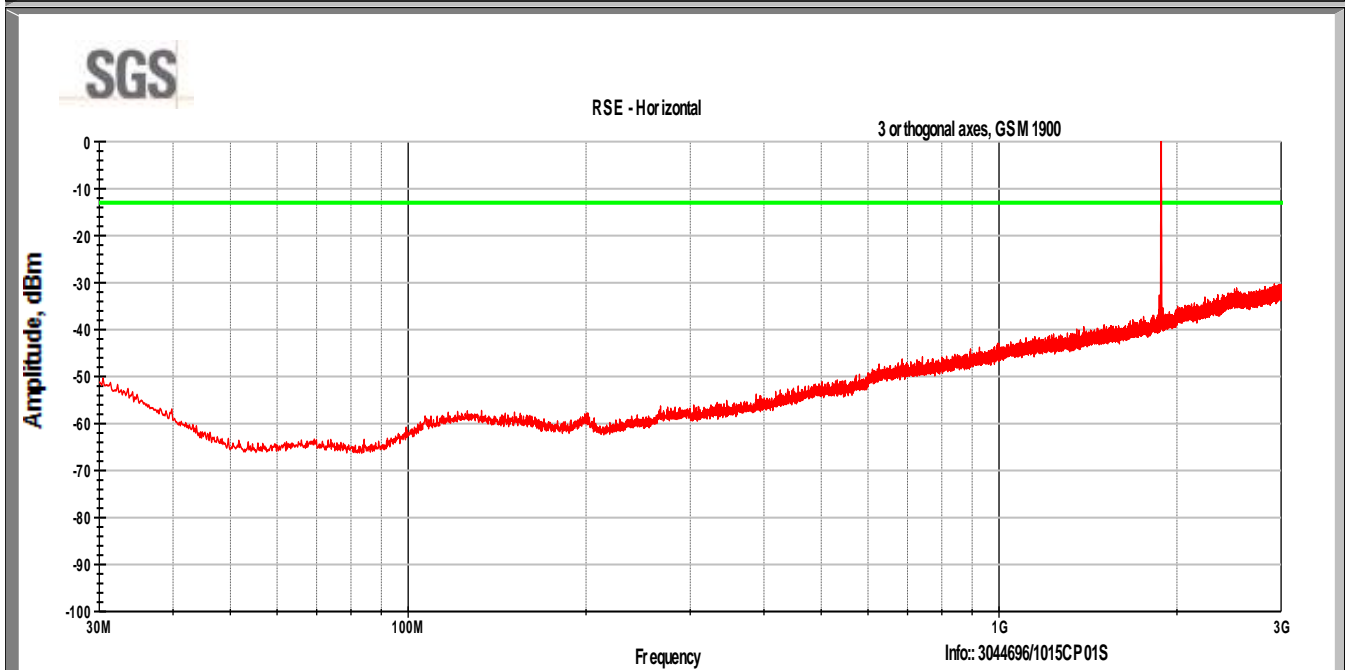
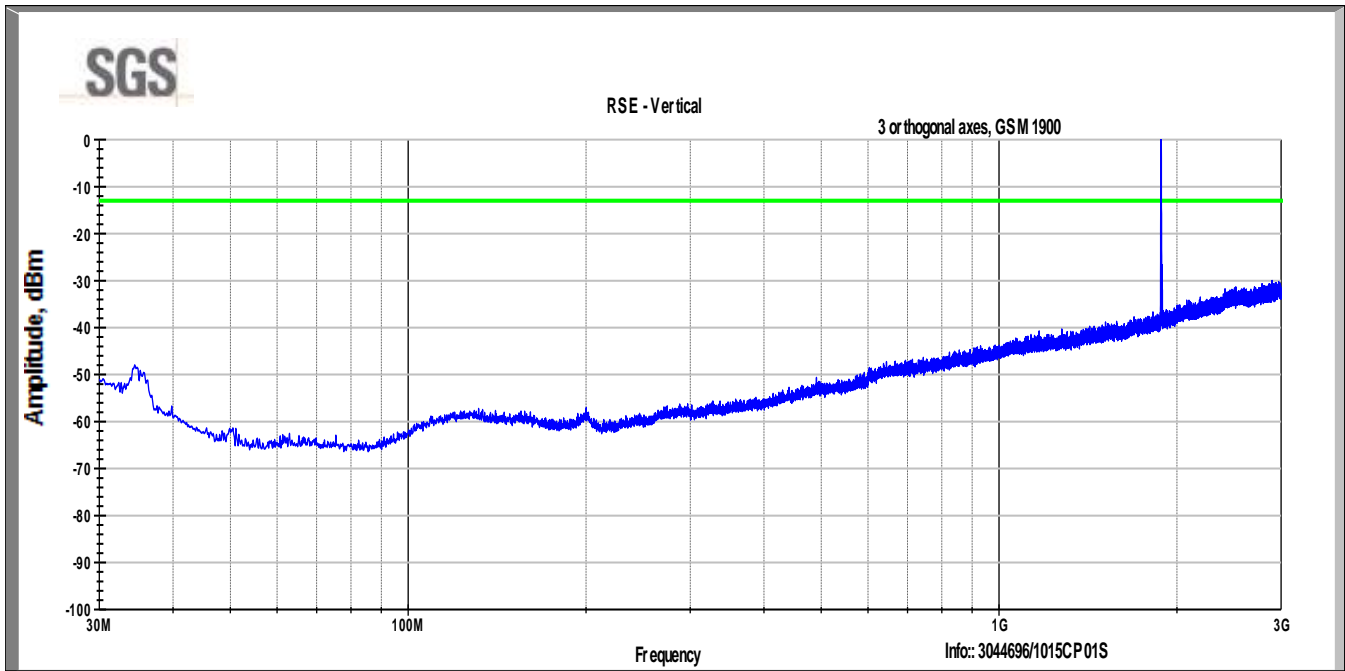
### 5.6.4 Test Data

Test Date: 6 Aug 2012

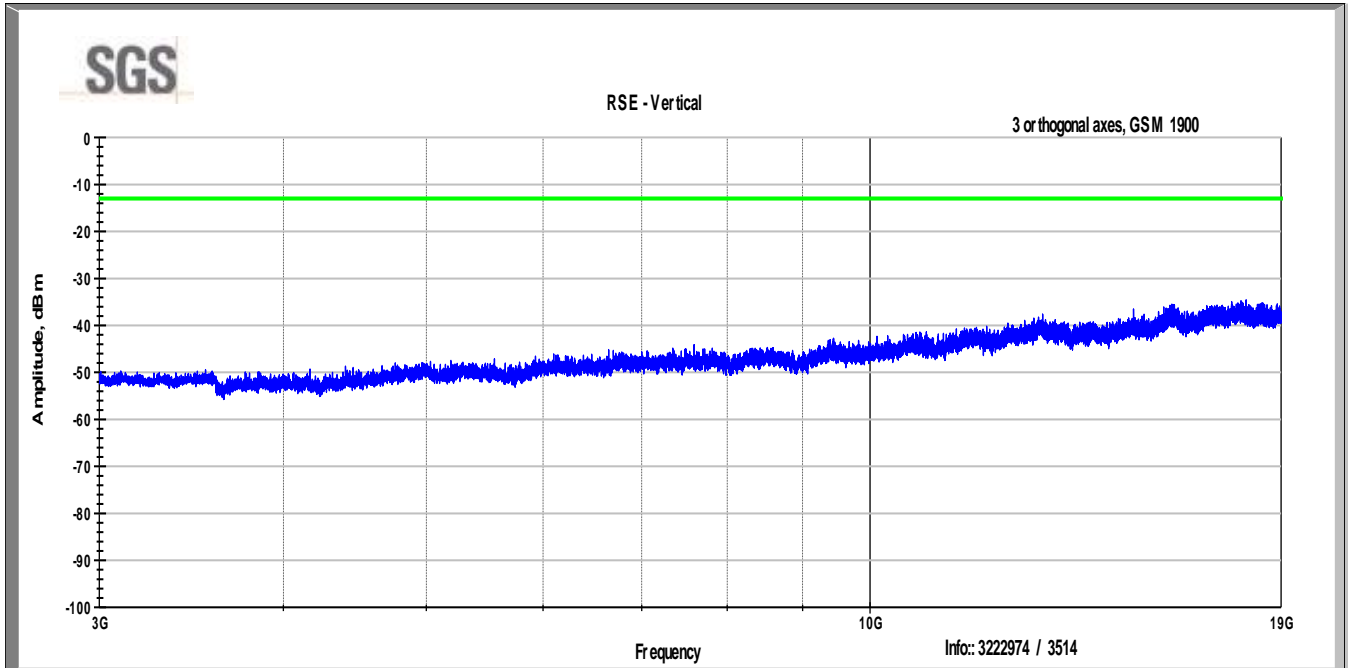
There were no emissions within 20 dB of the limit.

### 5.6.5 Test Plots

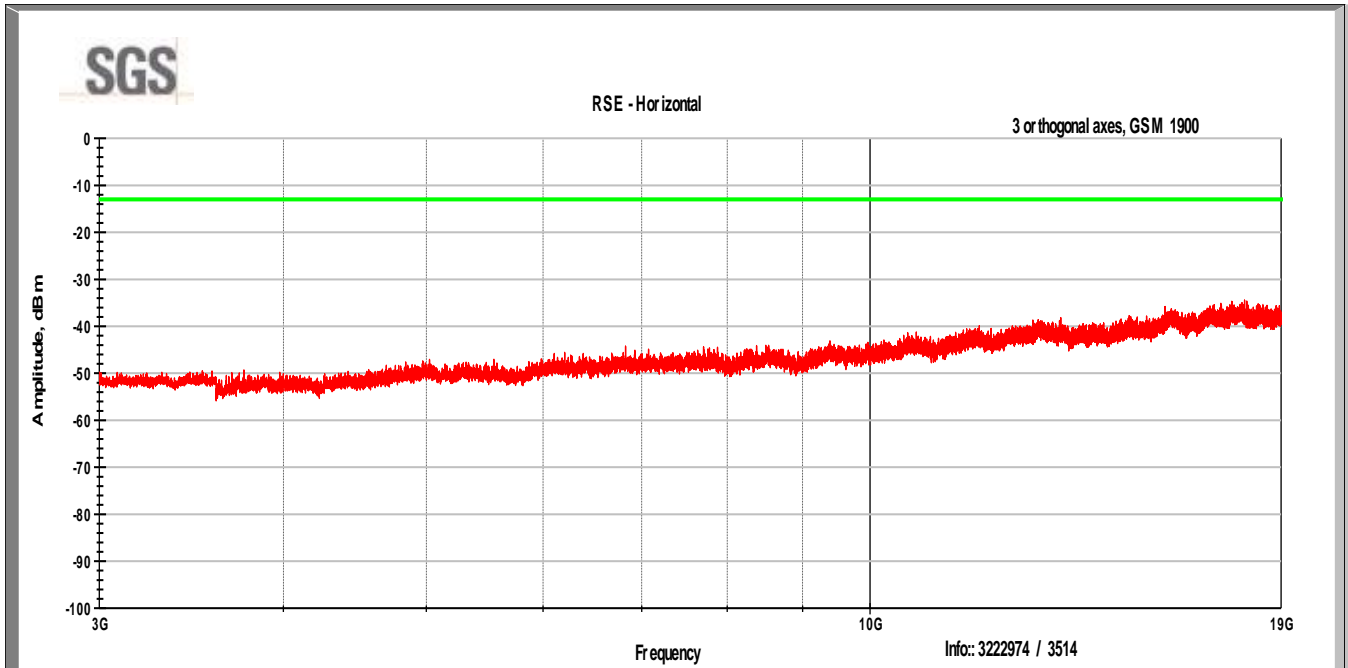
GSM 1900



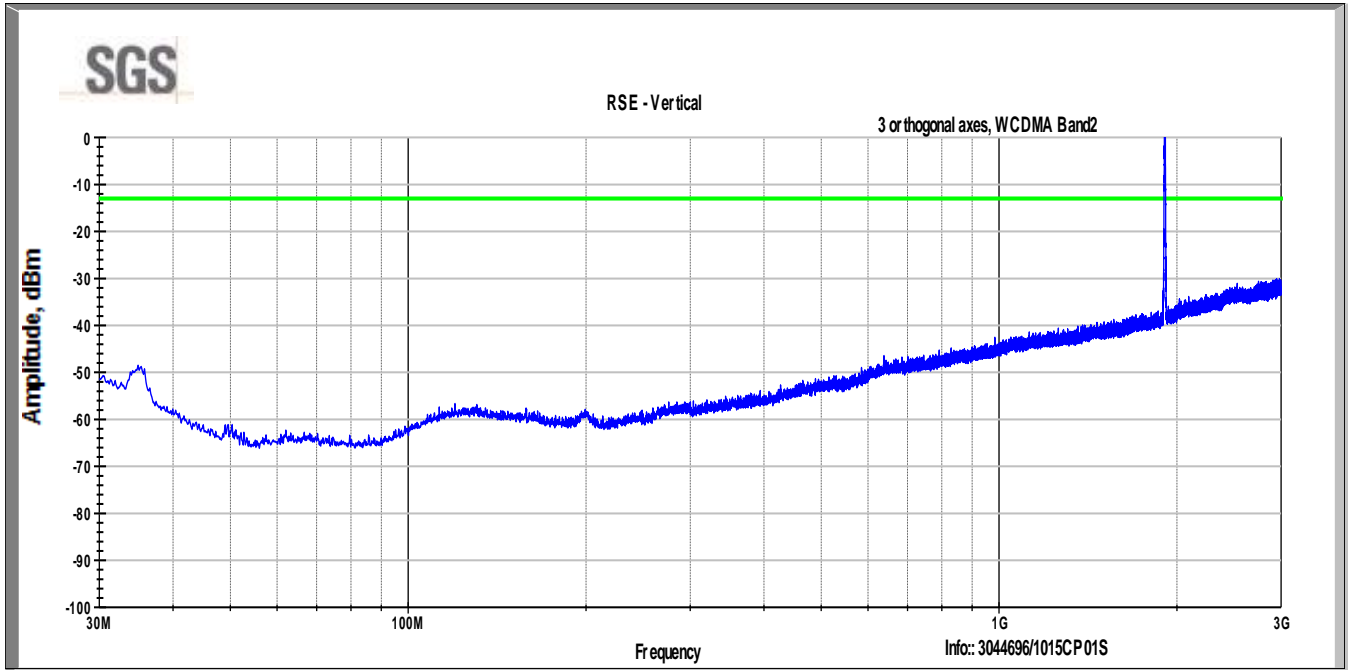
### GSM 1900



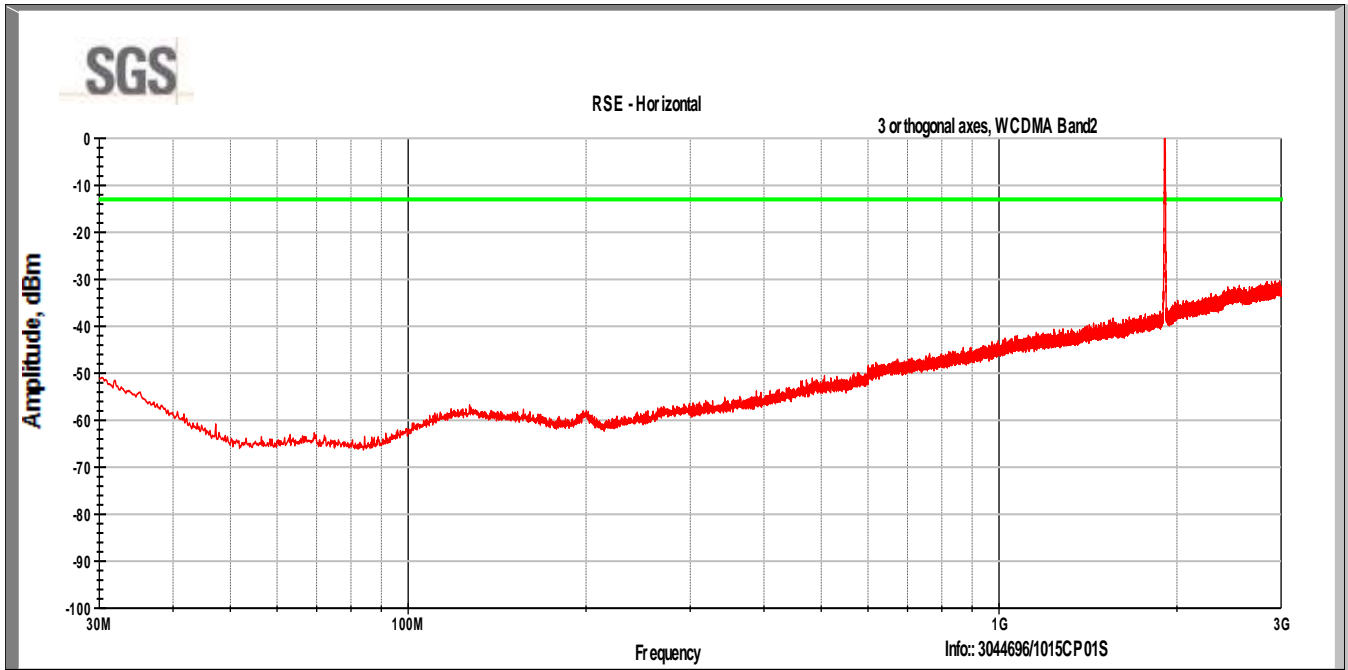
### GSM 1900



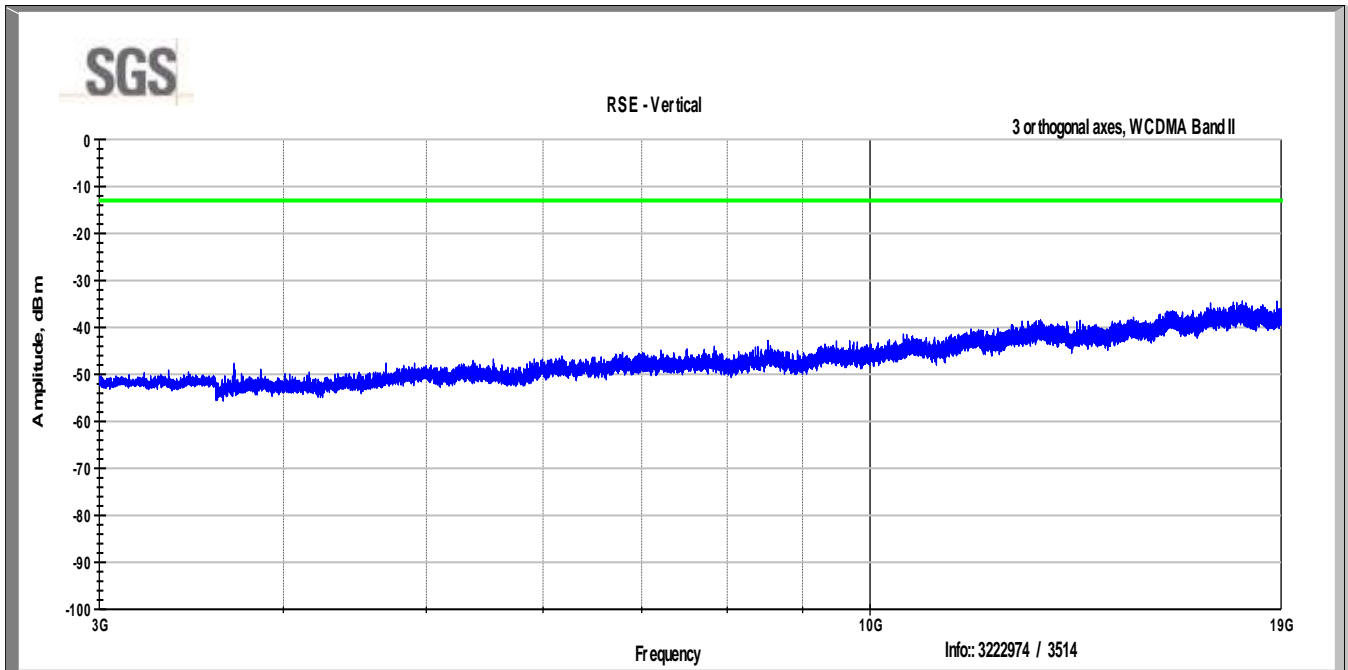
### WCDMA Band II



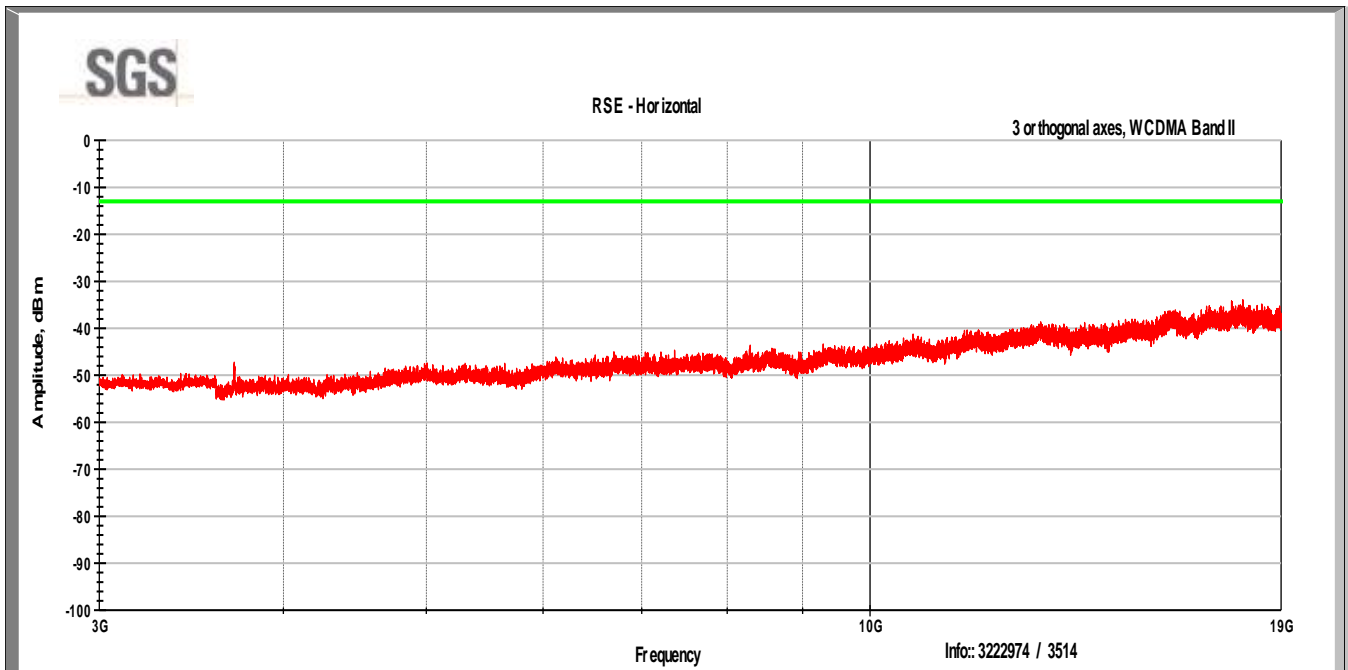
### WCDMA Band II



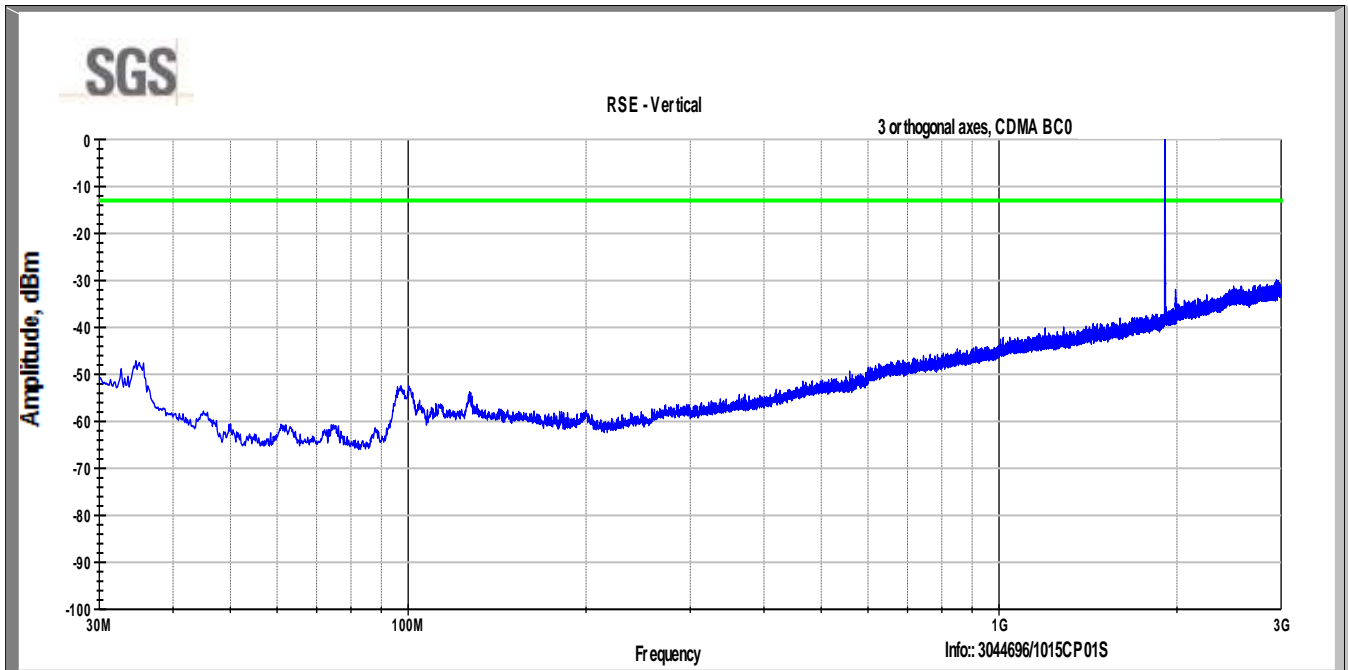
### WCDMA Band II



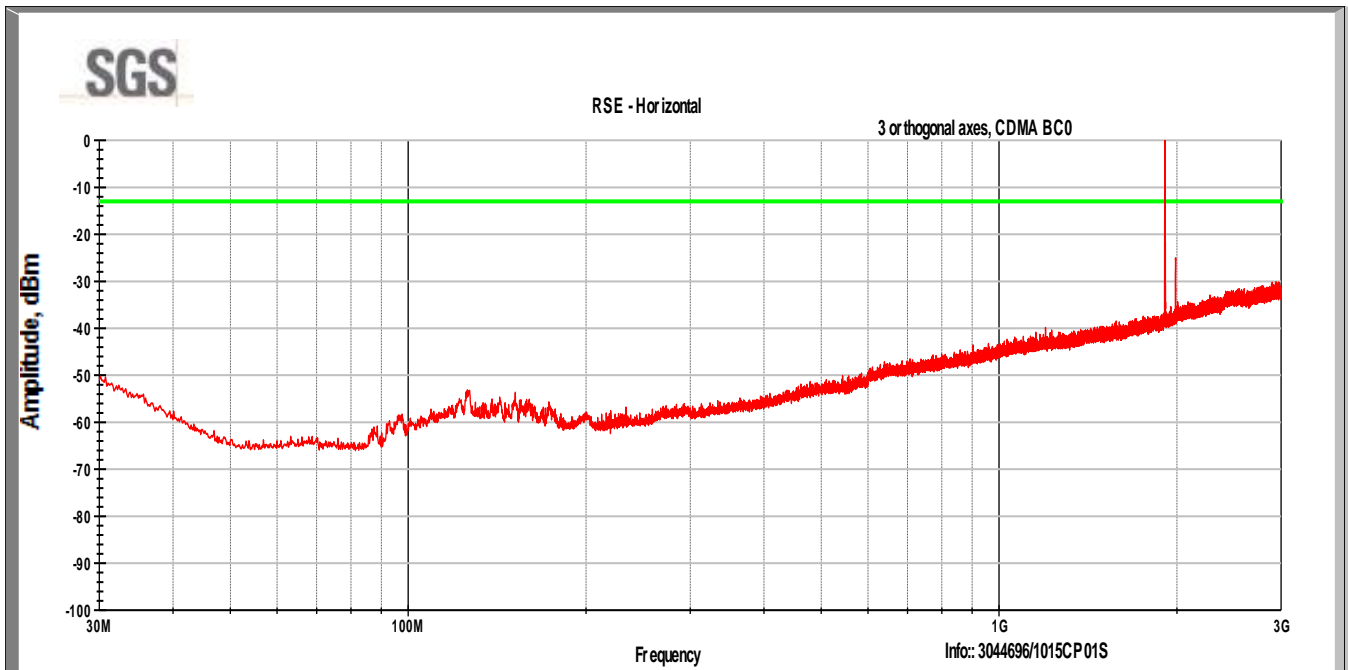
### WCDMA Band II



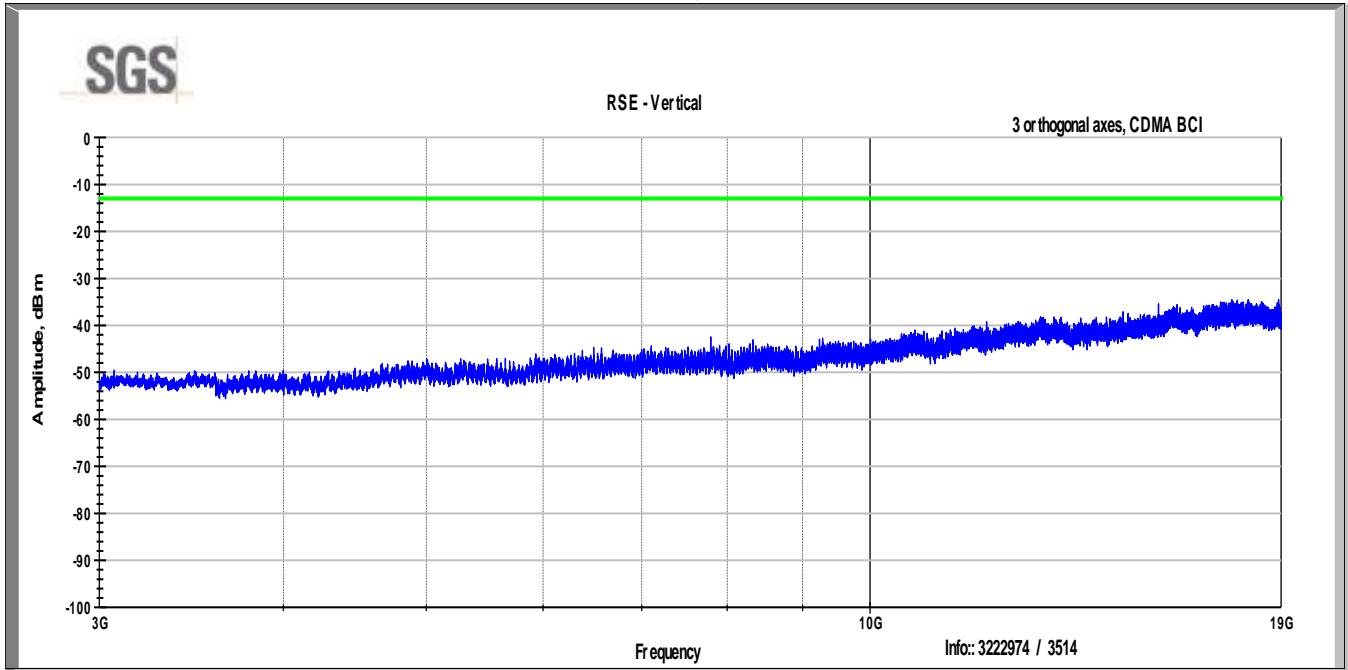
## CDMA BC1



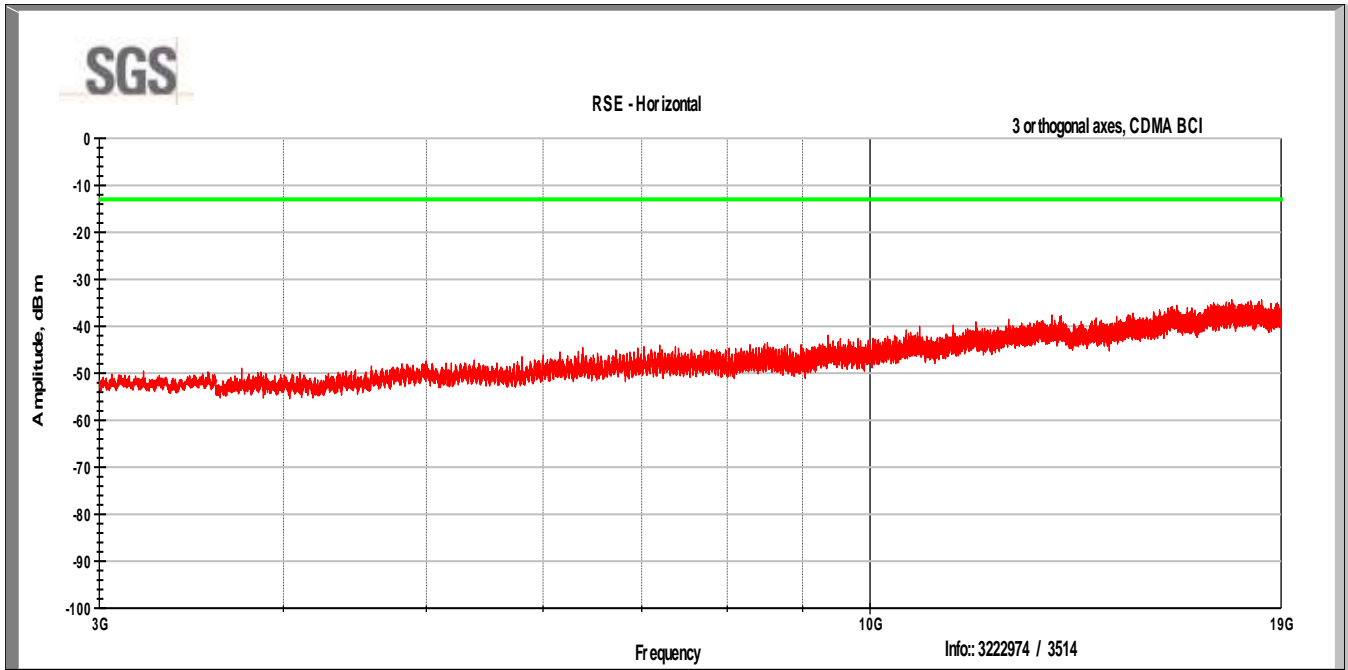
## CDMA BC1



### CDMA, B1



### CDMA B1



## 6 Frequency Stability

### 6.1.1 Test Result

Test Description	Basic Standards	Test Result
Frequency Stability	2.1055 24.238(a)	Pass

### 6.1.2 Test Method

The EUT was placed inside the Environmental Chamber and was left inside chamber to stabilize to set temperature for minimum of thirty minutes before any measurements were made. EUT was tested at BC10 channel 684, BC 1 channel 600, and BC0 channel 384.

### 6.1.3 Test Site

SGS EMC Laboratory, Suwanee, GA

#### Environmental Conditions

Temperature: 23.6 °C  
 Relative Humidity: 56.8 %  
 Atmospheric Pressure: 97.4 kPa

### 6.1.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
DC Power Supply	ZUP20-10	TDK-Lambda	B079774	14Nov2012
Wideband Radio Communications Tester	CMW500	Rohde & Schwarz	B085757	29OCT2013
Coaxial Cable	1302	Mini-circuits	NA	NCR
Environmental Chamber	SM-16-8200	Thermotron	B079727	8 Aug2013

Note: The calibration period equipment is 1 year.

### 6.1.5 Test Data

Test Date: 10 Aug 2012

#### CDMA

Voltage %	Power V <sub>DC</sub>	Temp °C	Frequency Hz	Freq Dev Av Hz	Freq Dev max Hz	Freq Dev ppm	Deviation %
100%	3.70	+20 (Ref)	1,867,000,002	+2	+7	+0.00	+0.000000
100%	3.70	-30	1,867,000,001	+1	+12	+0.01	+0.000001
100%	3.70	-20	1,867,000,001	+1	+12	+0.01	+0.000001
100%	3.70	-10	1,867,000,001	+1	+11	+0.01	+0.000001
100%	3.70	0	1,867,000,001	+1	+9	+0.00	+0.000000
100%	3.70	+10	1,867,000,001	+1	+10	+0.01	+0.000001
100%	3.70	+20	1,867,000,002	+2	+7	+0.00	+0.000000
100%	3.70	+30	1,867,000,001	+1	+15	+0.01	+0.000001
100%	3.70	+40	1,867,000,001	+1	+8	+0.00	+0.000000
100%	3.70	+50	1,867,000,002	+2	+9	+0.00	+0.000000
115%	4.26	+20	1,867,000,002	+2	+7	+0.00	+0.000000
Battery End	3.44	+20	1,867,000,003	+3	+8	+0.00	+0.000000

#### GSM 1900

Voltage %	Power V <sub>DC</sub>	Temp °C	Frequency Hz	Freq Dev Av Hz	Freq Dev max Hz	Freq Dev ppm	Deviation %
100%	3.70	+20 (Ref)	1,880,000,025	+25	+32	+0.02	+0.000002
100%	3.70	-30	1,880,000,038	+38	+46	+0.02	+0.000002
100%	3.70	-20	1,880,000,035	+35	+47	+0.03	+0.000003
100%	3.70	-10	1,880,000,038	+38	+42	+0.02	+0.000002
100%	3.70	0	1,880,000,045	+45	+51	+0.03	+0.000003
100%	3.70	+10	1,880,000,051	+51	+57	+0.03	+0.000003
100%	3.70	+20	1,880,000,025	+25	+32	+0.02	+0.000002
100%	3.70	+30	1,880,000,014	+14	+22	+0.01	+0.000001
100%	3.70	+40	1,880,000,013	+13	+19	+0.01	+0.000001
100%	3.70	+50	1,880,000,016	+16	+33	+0.02	+0.000002
115%	4.26	+20	1,880,000,016	+16	+26	+0.01	+0.000001
Battery End	3.42	+20	1,880,000,028	+28	+45	+0.02	+0.000002

#### WCDMA Band II

Voltage %	Power V <sub>DC</sub>	Temp °C	Frequency Hz	Freq Dev Av Hz	Freq Dev max Hz	Freq Dev ppm	Deviation %
100%	3.70	+20 (Ref)	1,852,400,006	+6	+28	+0.02	+0.000002
100%	3.70	-30	1,852,400,013	+13	+36	+0.02	+0.000002
100%	3.70	-20	1,852,400,006	+6	+17	+0.01	+0.000001
100%	3.70	-10	1,852,400,015	+15	+23	+0.01	+0.000001
100%	3.70	0	1,852,400,010	+10	+27	+0.01	+0.000001
100%	3.70	+10	1,852,400,009	+9	+30	+0.02	+0.000002
100%	3.70	+20	1,852,400,006	+6	+28	+0.02	+0.000002
100%	3.70	+30	1,852,400,002	+2	+27	+0.01	+0.000001
100%	3.70	+40	1,852,400,000	+0	+24	+0.01	+0.000001
100%	3.70	+50	1,852,400,015	+15	+29	+0.02	+0.000002
115%	4.26	+20	1,852,400,010	+10	+31	+0.02	+0.000002
Battery End	3.42	+20	1,852,400,006	+6	+16	+0.01	+0.000001



## 7 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	02AUG2013
1	Clarified GSM power measurements by including both Frame-averaged and Burst-averaged measurements (pages 7 and 40). Corrected EIRP measurements for GSM1900 to average (page 62)	4SEP2013