

# EMC Test Report

**Project Number:** 2733706

**Report Number:** 2733706EMC01

**Revision Level:** 1

**Client:** Sonim

**Equipment Under Test:** Cellular/PCS CDMA/EvDO Phone with Bluetooth

**Marketing Name:** Sonim XP Strike

**Model:** Sonim XP3410-A-R1 (C21F010AA)

**Hardware Version:** A

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

**Report issued on:** 27 September 2012

**Test Result:** Compliant

Tested by:

  
\_\_\_\_\_  
Fabian Nica, Engineering Technician

Reviewed by:

  
\_\_\_\_\_  
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)	Peak-to-Average Ratio	<13 dB		Pass
2.1049 22.917(b) 24.238(b)	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
24.232(c)	Effective Isotropic Radiated Power	< 2 Watts max EIRP		Pass
2.1053 22.917(a) 24.238(a)	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 24.235	Frequency Stability	<2.5 ppm		Conducted

### 1.1 Modifications Required to Compliance

None

## 2 General Information

### 2.1 Client Information

Name: Sonim Technologies, Inc.  
Address: 1825 S. Grant St., Suite 200  
City, State, Zip, Country: San Mateo, CA 94402, 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: Sonim XP Strike  
Model: Sonim XP3410-A-R1 (C21F010AA)  
Serial Number: A1000012926883, A1000012926880  
Build Version: B2.5  
Firmware Version: XP3410\_0200B00\_0150T  
Rated Voltage: 3.8 Vdc, internal battery  
Test Voltage: Fully charged 3.7 Vdc, internal battery  
Tx Frequency Range: 824.70 - 848.31 MHz (BC0, CDMA)  
1851.25 - 1908.75 MHz (BC1, CDMA)

Power Class: III  
Maximum RF Output: 0.141 W (21.5 dBm) ERP (BC0, CDMA)  
Power: 0.224 W (23.5 dBm) EIRP (BC1, CDMA)

Emissions Designator: 1M28F9W (BC0, CDMA)  
1M28F9W (BC1, CDMA)

Sample Received Date: July 20, 2012  
Dates of testing: July 20 to September 26, 2012

### 2.4 Operating Modes and Conditions

The EUT was programmed by the manufacturer to run continuously exercising all modes of operation.

### 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 (i.e. power control bits in “All Up” condition) on the Radio Communications Tester. The output power was measured by a spectrum analyzer with the use of a directional coupler.

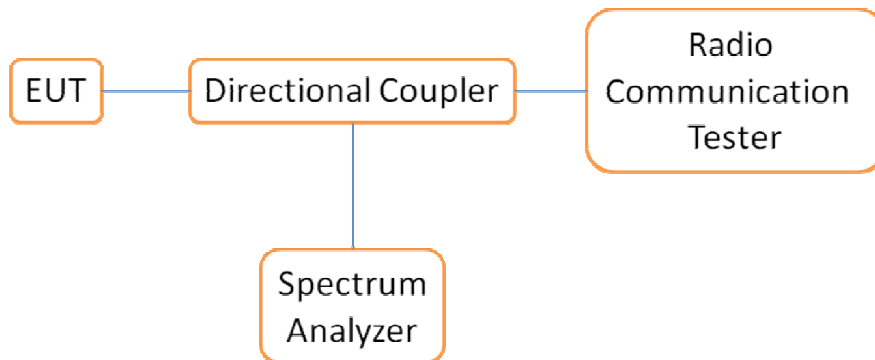
The power was measured using an RMS detector in accordance with KDB 971168.

Measured modes for CDMA: RC1/SO2, RC1/SO55, RC3/SO2, RC3/SO9, RC3/SO55

Measured modes for EvDO Rev 0: RTAP xx.x k, where xx.x ranges from 9.6 to 153.6.

Measured modes for EvDO Rev A: RETAP xx.x k, where xx.x ranges from 128 to 12288

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: 25.6 °C

Relative Humidity: 55.2 %

Atmospheric Pressure: 97.6 kPa

### 3.1.4 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.

**3.1.5 Test Data**

Center Frequency MHz	Channel No.	Test Mode	RF Power Output dBm (Average)
824.7	1013	RC1 / SO2	24.5
		RC1 / SO55	24.5
		RC3 / SO2	24.5
		RC3 / SO9	24.6
		RC3 / SO55	24.4
		RTAP 9.6k	24.6
		RTAP 76.8k	24.6
		RTAP 38.4k	24.7
		RTAP 19.2k	24.6
		RTAP 153.6k	24.6
		RETAP 128k	24.9
		RETAP 2048k	24.9
		RETAP 4096k	24.9
		RETAP 12288k	24.7
836.52	384	RC1 / SO2	24.7
		RC1 / SO55	24.5
		RC3 / SO2	24.5
		RC3 / SO9	24.7
		RC3 / SO55	24.5
		RTAP 9.6k	24.6
		RTAP 19.2k	24.6
		RTAP 38.4k	24.7
		RTAP 76.8k	24.6
		RTAP 153.6k	24.6
		RETAP 128k	24.9
		RETAP 2048k	24.9
		RETAP 4096k	24.9
		RETAP 12288k	24.9
848.31	777	RC1 / SO2	24.5
		RC1 / SO55	24.5
		RC3 / SO2	24.6
		RC3 / SO9	24.5
		RC3 / SO55	24.4
		RTAP 9.6k	24.5
		RTAP 19.2k	24.6
		RTAP 38.4k	24.6
		RTAP 76.8k	24.8
		RTAP 153.6k	24.6
		RETAP 128k	24.7
		RETAP 2048k	24.7
		RETAP 4096k	24.7
		RETAP 12288k	24.7

### 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 -

##### Occupied bandwidth – power bandwidth (99%) measurement procedure<sup>1</sup>

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 of the given emission.

The following procedure shall be used for measuring (99 %) power bandwidth<sup>2</sup>

- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts.
- b) The nominal IF filter bandwidth (3 dB RBW) shall be set to approximately 1% of the span, without being below 1%, and VBW should be approximately 3 × RBW or greater.
- c) Set the reference level of the instrument as required keeping the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation. In general, the peak of the spectral envelope must be more than 10 log (OBW / RBW) below the reference level.

*Steps a) through c) may require iteration to adjust within the specified range.*

- d) Video averaging is not permitted. For analog or narrowband digital modulation the detector shall be set to peak, trace mode set to max-hold. For digital wideband modulation (OBW > 1MHz) the detector shall be set to average power (RMS) detector, trace mode set to clear-write and a single sweep.
- e) Use the 99 % power bandwidth function of the spectrum analyzer (if available) and report the measured bandwidth.
- f) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display. The axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

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.

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 as pre-scans showed this to yield the worst case test results.

#### 3.2.3 Test Site

SGS EMC Laboratory, Suwanee, GA

<sup>1</sup> Measurement method to satisfy FCC CFR Title 47 §2.1049 and IC RSS-Gen

<sup>2</sup> See FCC KDB 971168 D01 Power Measurement – License Digital Systems v01



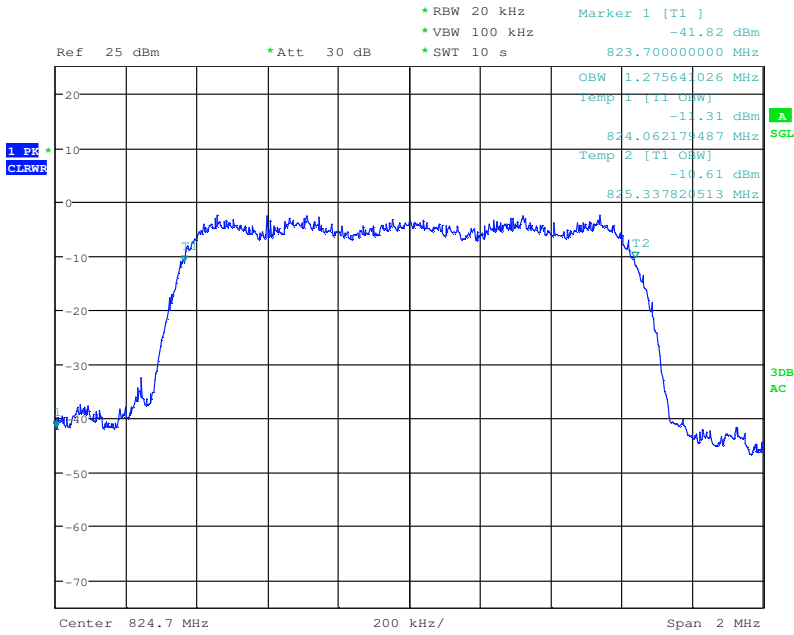
### 3.2.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU8	R & S	B085759	12 Jun 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.

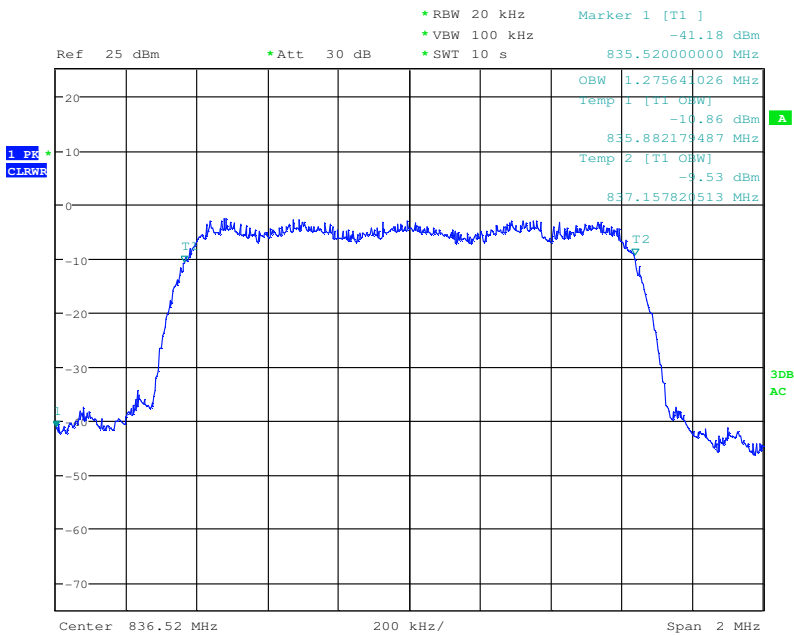
### 3.2.5 Test Data

#### CDMA



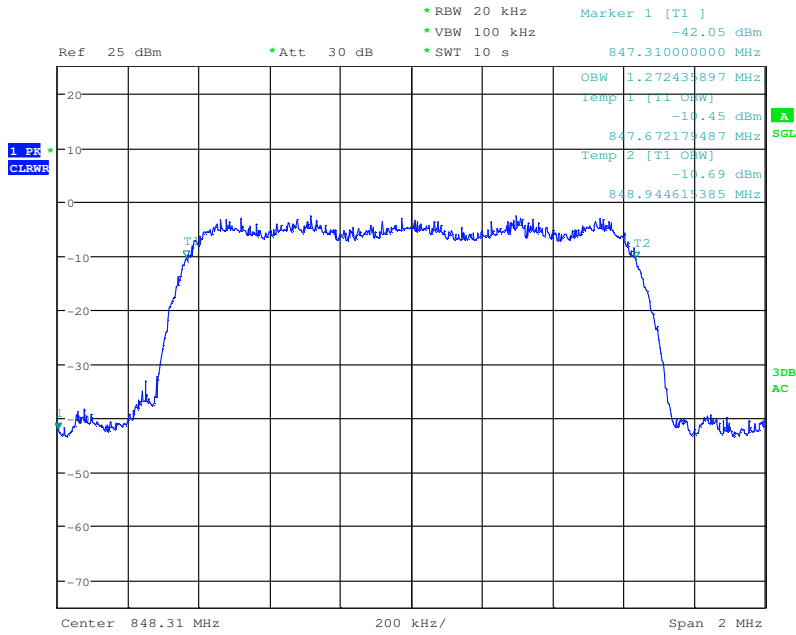
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#### CDMA



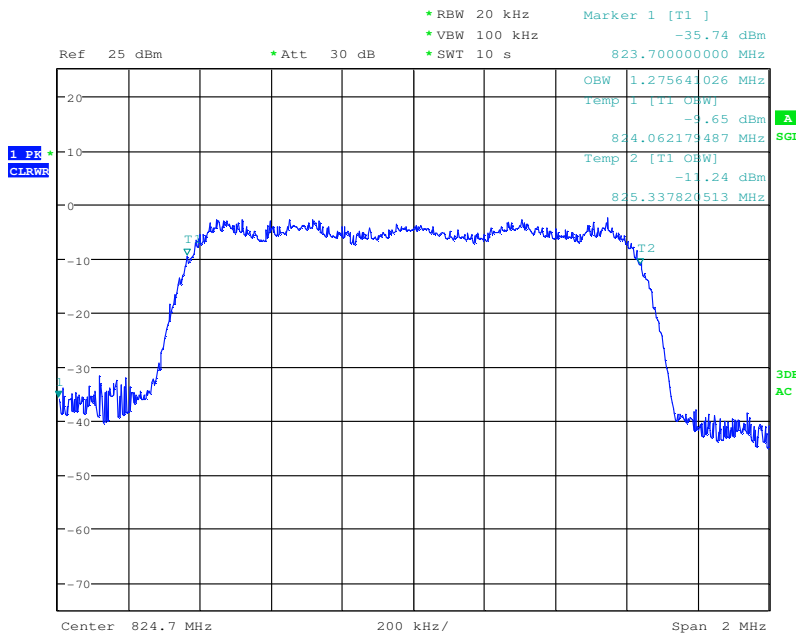
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## CDMA



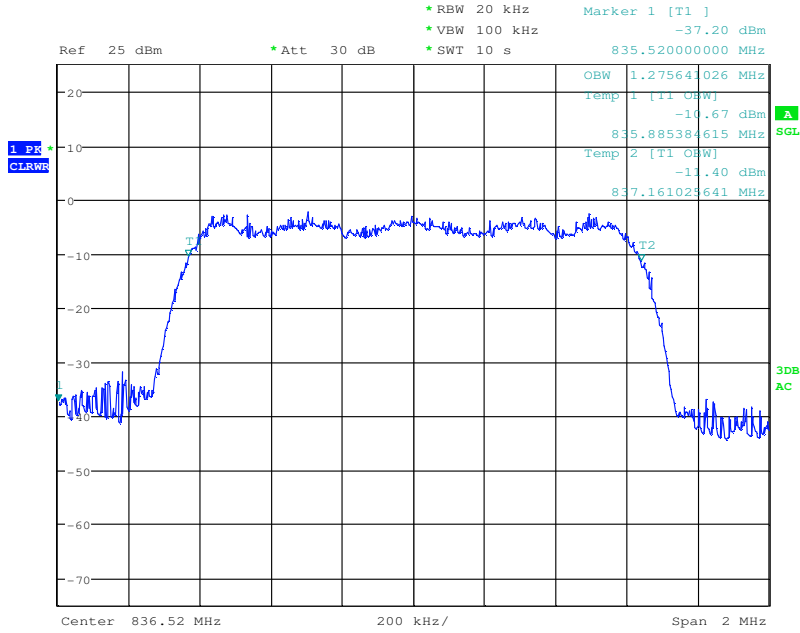
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## EvDO, Rev 0



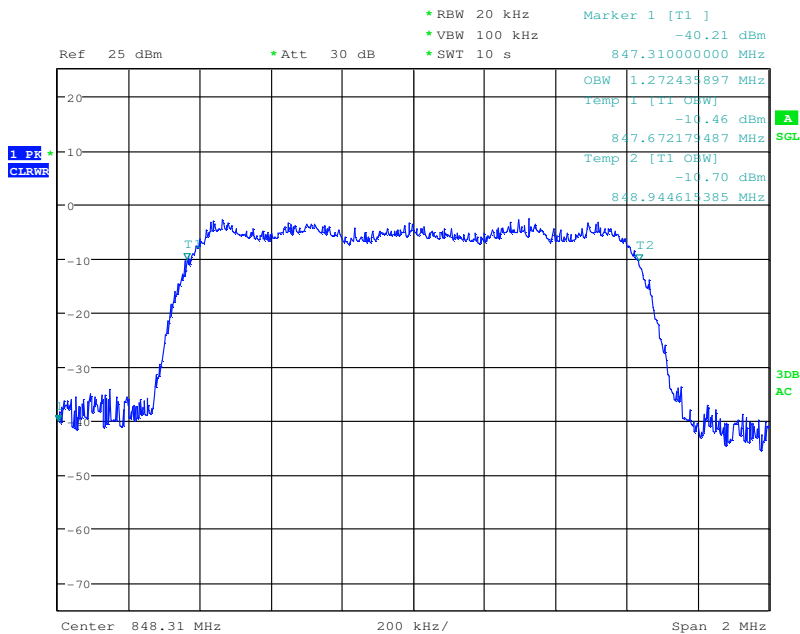
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## EvDO, Rev 0



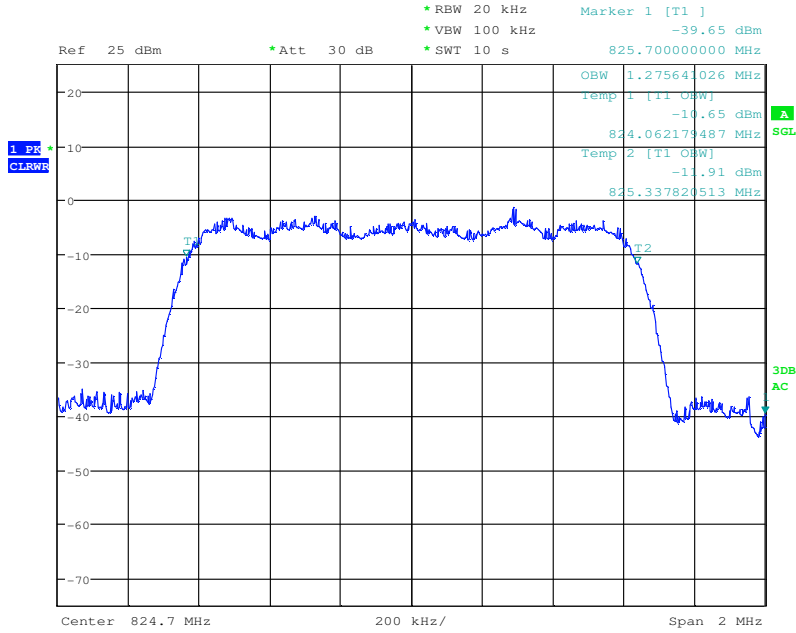
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## EvDO, Rev 0



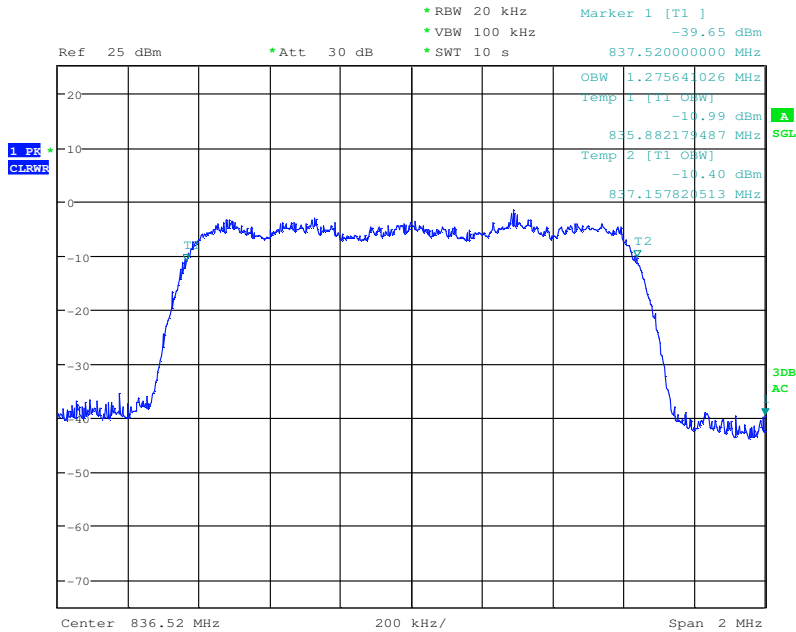
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## EvDO, Rev A



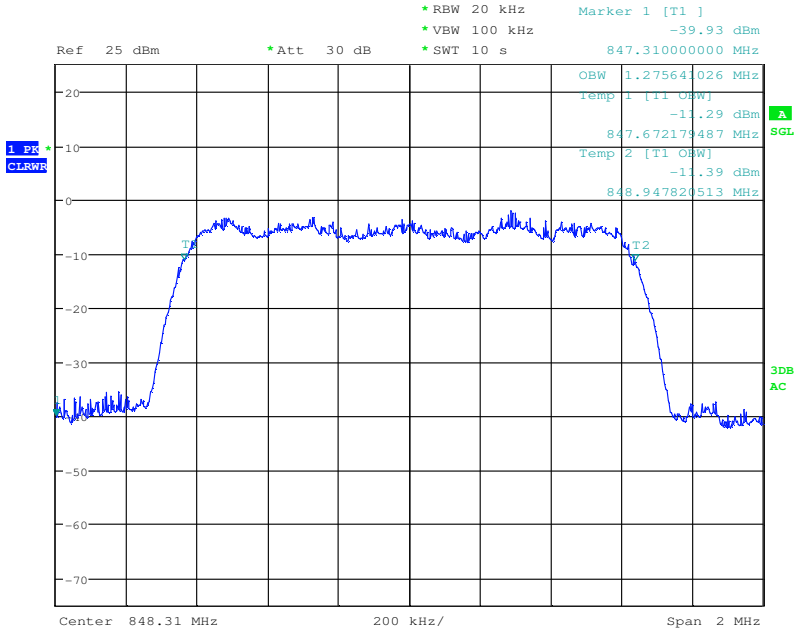
Date: 25.SEP.2012 19:51:49

## EvDO, Rev A



Date: 25.SEP.2012 19:50:57

## EvDO, Rev A



Date: 25.SEP.2012 19:50:17

### 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 100 kHz 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. KDB 971168 D01 Power Measurement – License Digital Systems v01 allows the use of the 99% bandwidth to be used as the emission bandwidth.

Scans from 30 MHz to 10 GHz were made using a resolution bandwidth of 1 MHz and a video bandwidth equal to or greater than 1 MHz. For any measurement within 20 dB of the limit, final compliance measurements are made using a resolution bandwidth of 100 kHz.

The measurement was conducted at the lowest channel 1013 and the highest channel 777 in RETAP 12288K test mode as pre-scans showed this to yield the worst case test results.

#### 3.3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

#### 3.3.4 Test Equipment

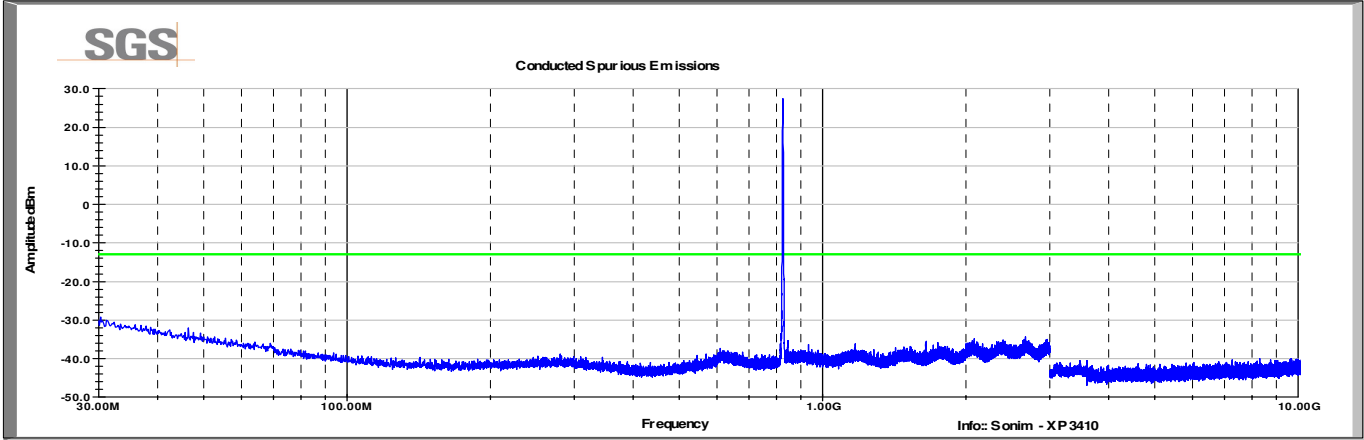
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	25 Aug 2012
Receiver	ESU8	R & S	B085759	12 Jun 2012
Radio Communications Tester	CMW-500	R & S	B085757	28 Sep 2012
Directional Coupler	11692D	Agilent / HP	B079666	14 OCT 2012
Directional Coupler	778D	Agilent / HP	B087456	14 Oct 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079656	12 Aug 2012
High Pass Filter	HPM50110	Microtronics	B003146	6 Aug 2013

Note: The calibration period equipment is 1 year.

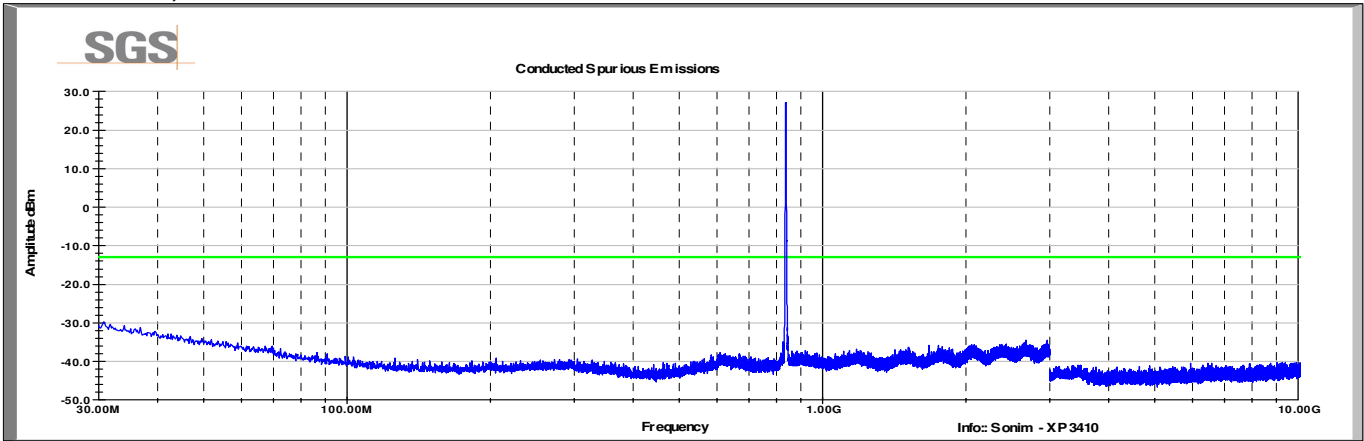
### 3.3.5 Test Data

Test Date: 2 Aug 2012

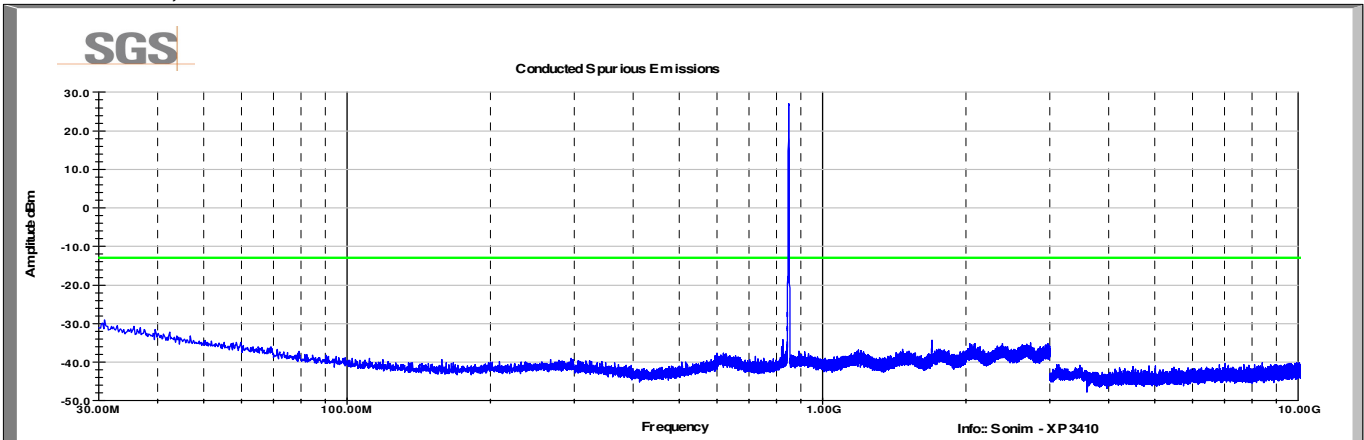
Channel 1013, 824.7 MHz



Channel 384, 836.52 MHz

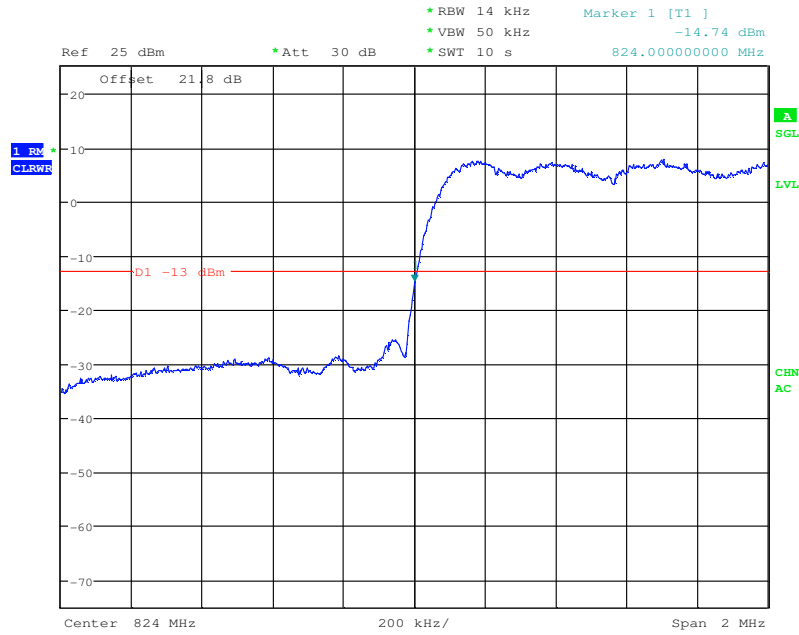


Channel 777, 848.31 MHz



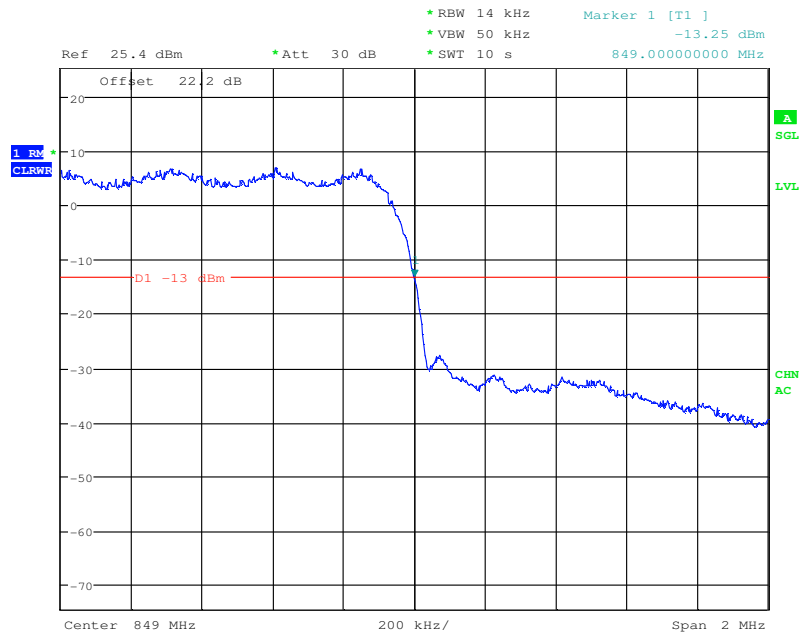


### Lower Band Edge



Date: 25.SEP.2012 20:53:22

### Upper Band Edge



Date: 25.SEP.2012 20:50:43

### 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 as pre-scans showed this to yield the worst case test results.

#### 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
Bilog Antenna	JB6	Sunol	B079690	24 Aug 2012
DRWG Antenna	3117	ETS-Lindgren	B079691	31 May 2013
DRWG Antenna	3117	ETS-Lindgren	B079699	21 Mar 2013
Receiver	ESU40	R&S	B079629	25 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079712	12 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079711	12 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B085888	26 Sep 2012
Radio Communications Tester	CMW-500	R&S	B085757	28 Sep 2012
Dipole Antenna	3121D-DB4	ETS-Lindgren	B085753	16 Mar 2012
Signal Generator	HMC-T2240	Hittite	B001212	CNR

Note: The calibration period equipment is 1 year.

Please note that the equipment used for testing was within its calibration cycle on the date of testing.

### 3.4.5 Test Data

Date tested: 8 August 2012

Frequency MHz	Mode	Measured Level dBm	Substitute Level dBm	Antenna Gain dBd	Pol H/V	ERP dBm	ERP Watts	Battery Type
824.70	BC0	-11.8	19.5	0.0	H	19.5	0.089	Standard
836.52	BC0	-10.0	21.5	0.0	H	21.5	0.141	Standard
848.31	BC0	-11.0	21.0	0.0	H	21.0	0.126	Standard

### 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 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. Prescan measurements were performed with the use of a spectrum analyzer employing a resolution bandwidth of 1 MHz or greater and a video bandwidth of 1 MHz or greater. Emissions within 20 dB of the limit were measured using the substitution method.

The EUT was placed on a non-conductive table 80cm above a flush mounted turntable with a measurement antenna was place 3 meters away

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 turntable was rotated from 0-360 degrees, the measurement antenna was raised from 1 to 4 meters in height in both vertical and horizontal polarizations, and the EUT was manipulated through each of its three orthogonal axes to capture the maximum reading on the spectrum analyzer.

Per the guidance of ANSI/TIA-603-C-2004, a half-wave dipole is then substituted in place of the EUT. For emissions above 1 GHz, a horn antenna is substituted in place of the EUT. The substitution antenna is driven by a signal generator with the level of the signal generator being used to obtain the same receive spectrum analyzer level previously recorded from the spurious emissions of the EUT. The power of the emission is calculated using the following formula:

$$P_{d[dBm]} = P_{g[dBm]} - \text{Cable Loss}_{[dB]} + \text{Antenna Gain}_{[dBd/dBi]}$$

Where Pd is the dipole equivalent power, Pg is the generator output to the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to  $P_{g[dBm]} - \text{Cable Loss}_{[dB]}$ .

The measurement was conducted at the middle channels, 384 in RC3/SO55 as pre-scans showed this to yield the worst case test results.

### 3.5.3 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
DRWG Antenna	3117	ETS-Lindgren	B079691	31 May 2013
DRWG Antenna	3117	ETS-Lindgren	B079699	21 Mar 2013
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079656	12 Aug 2012
Bilog Antenna	JB6	Sunol	B079689	24 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079712	12 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079711	12 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B085888	26 Sep 2012
Dipole Antenna	3121D	ETS-Lindgren	B085753	16 Mar 2012
Signal Generator	HMC-T2240	Hittite	B001212	CNR

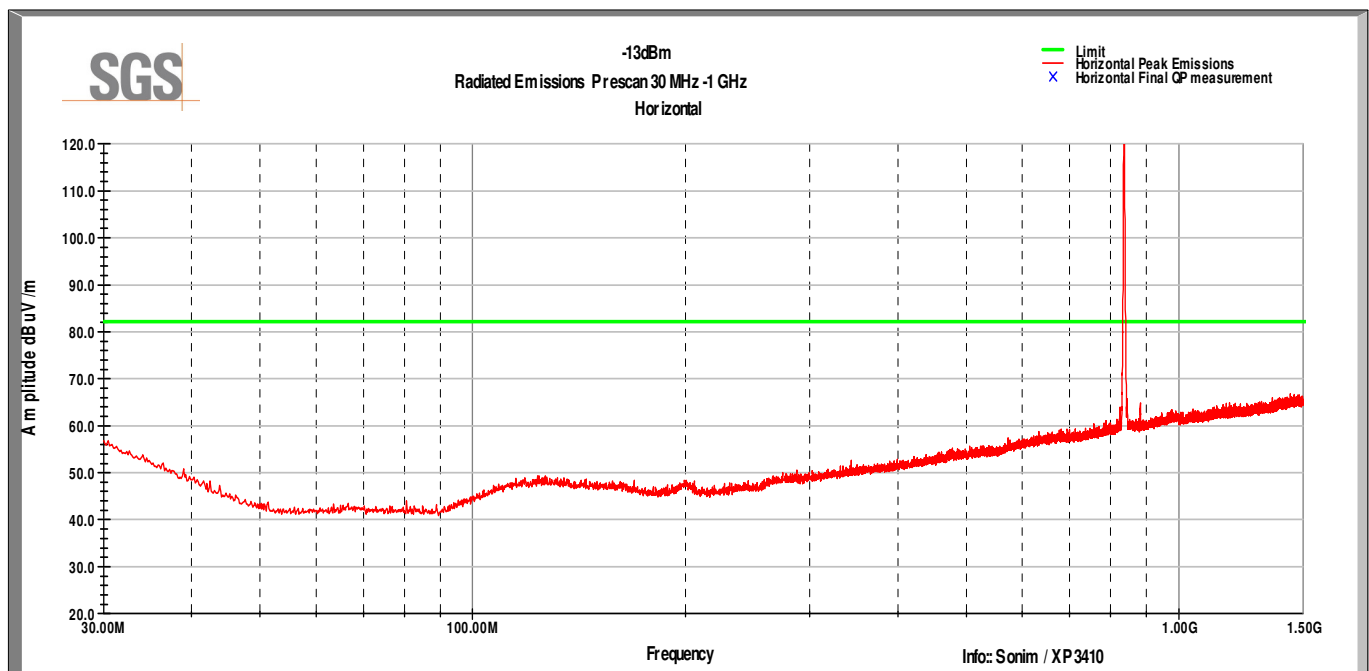
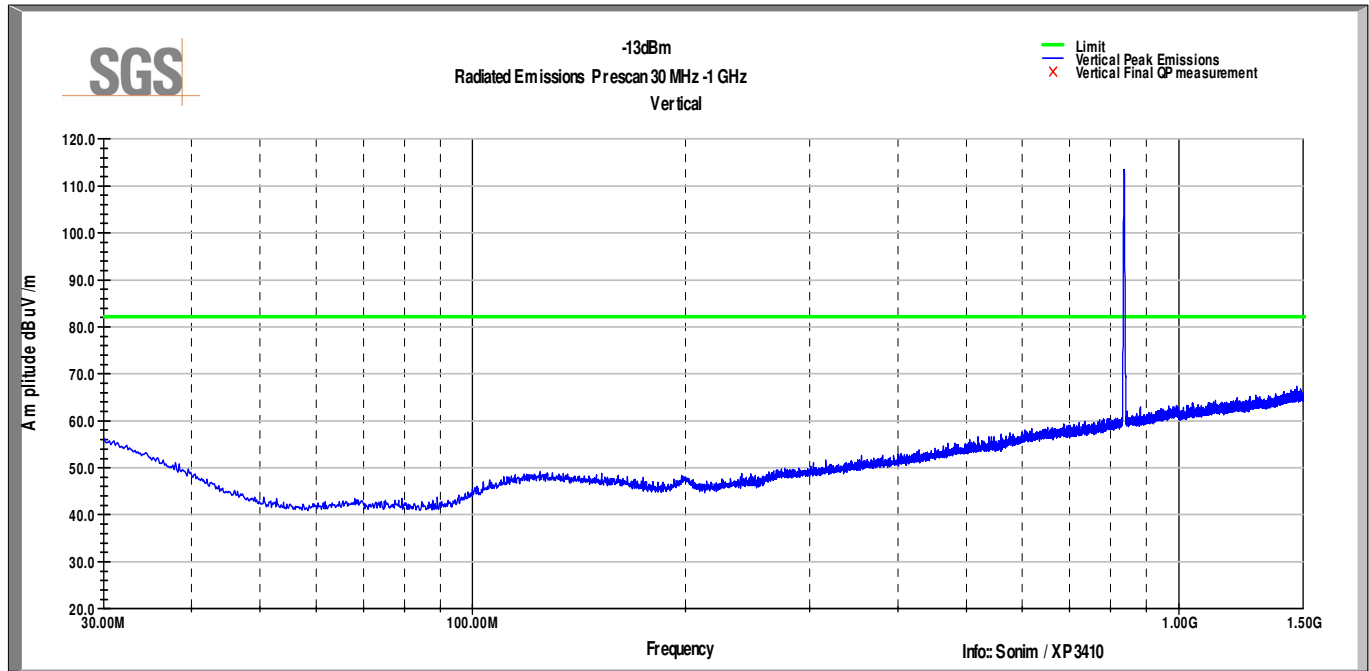
Note: The calibration period equipment is 1 year.

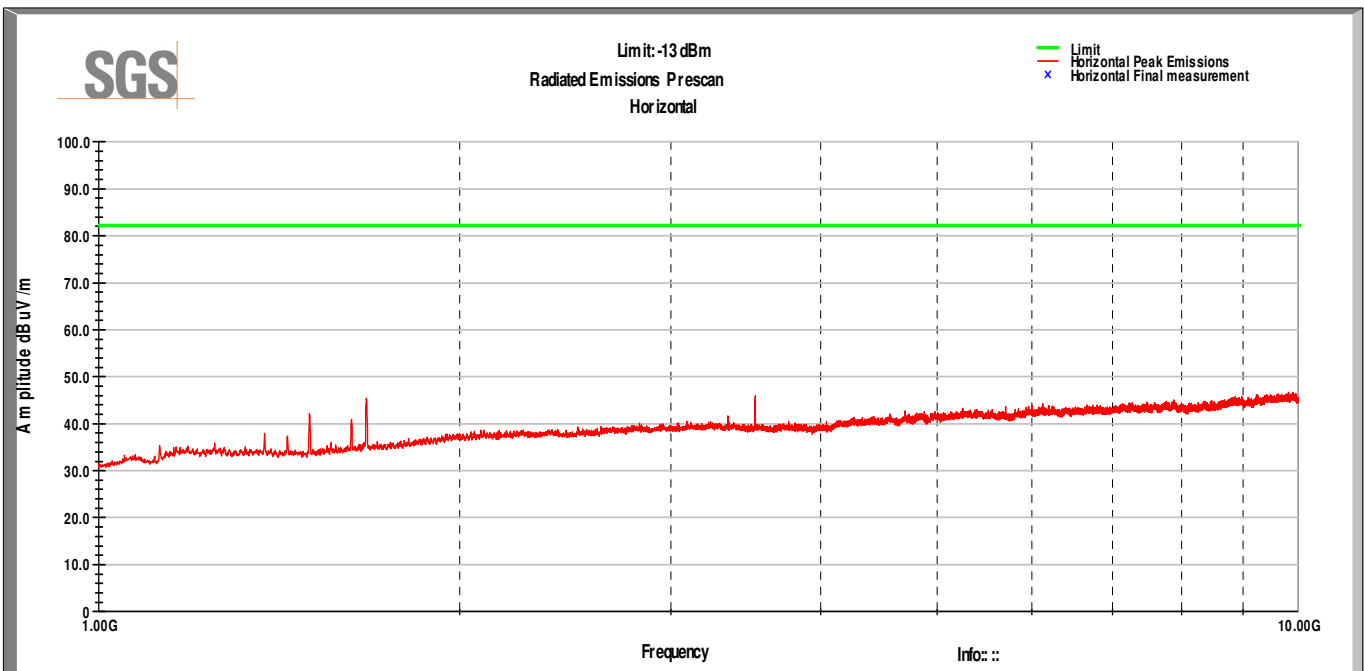
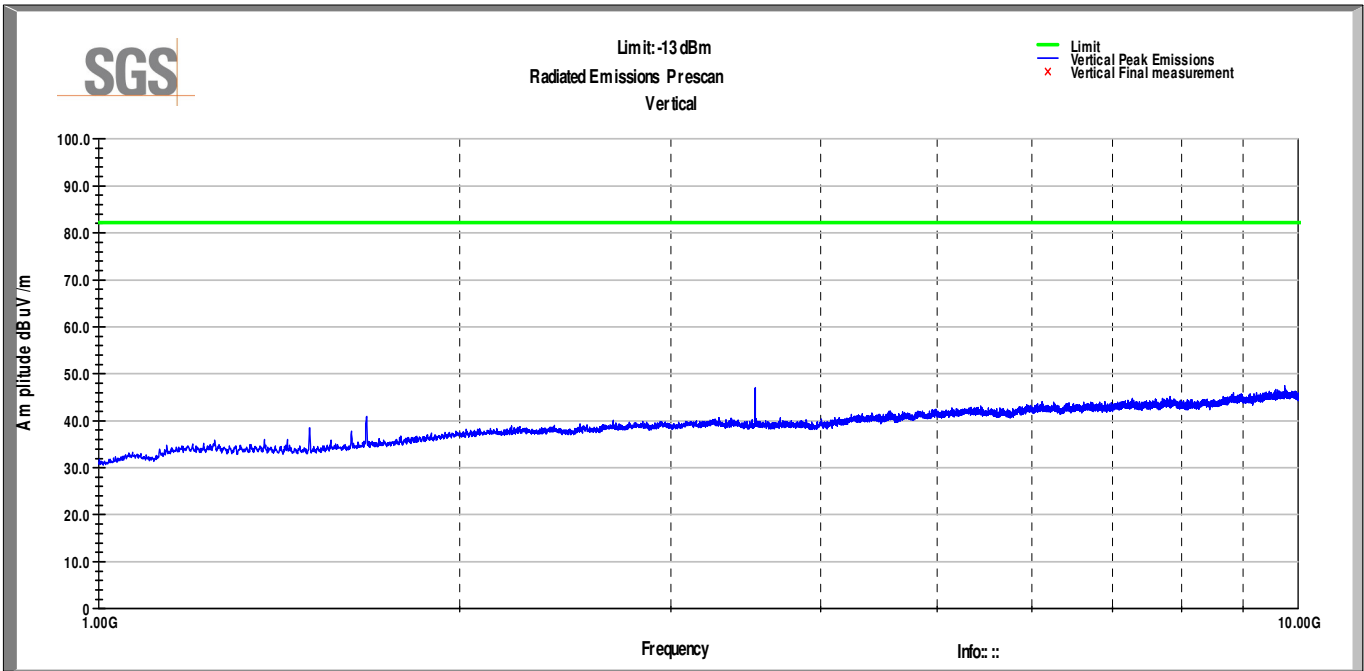
### 3.5.4 Test Data

Test Date: 7 Aug 2012

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

### 3.5.5 Plots





### 3.6 Frequency Stability

#### 3.6.1 Test Result

Test Description	Basic Standards	Test Result
Frequency Stability	2.1055	Pass

#### 3.6.2 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.

#### 3.6.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.6 °C

Relative Humidity: 56.8 %

Atmospheric Pressure: 97.4 kPa

#### 3.6.4 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

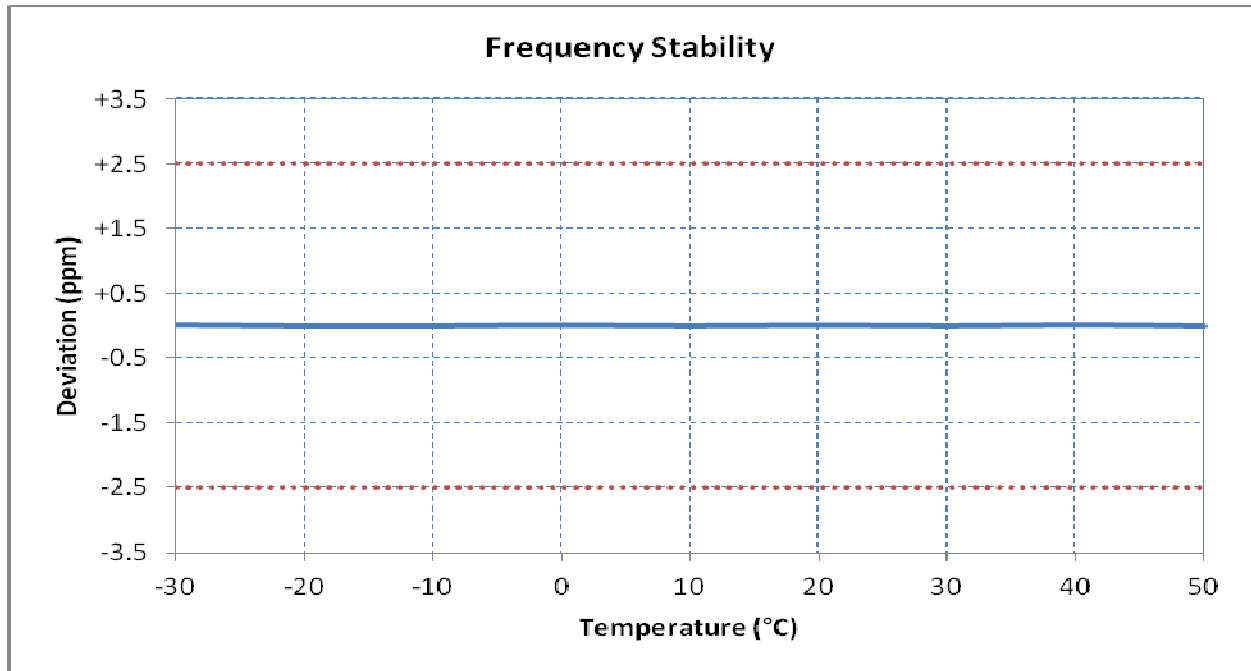
Note: The calibration period equipment is 1 year.



### 3.6.5 Test Data

Test Date: 10 Aug 2012

Voltage %	Power V <sub>DC</sub>	Temp °C	Frequency Hz	Freq Dev Hz	Freq Dev max Hz	Freq Dev ppm	Deviation %
100%	3.70	+20 (Ref)	823,100,000	+0	+11	+0.01	+0.000001
100%	3.70	-30	823,100,003	+3	-8	-0.01	-0.000001
100%	3.70	-20	823,099,998	-2	-5	-0.01	-0.000001
100%	3.70	-10	823,100,001	+1	+8	+0.01	+0.000001
100%	3.70	0	823,100,001	+1	+6	+0.01	+0.000001
100%	3.70	+10	823,100,000	-0	-7	-0.01	-0.000001
100%	3.70	+20	823,099,998	-2	-10	-0.01	-0.000001
100%	3.70	+30	823,100,000	+0	-8	-0.01	-0.000001
100%	3.70	+40	823,099,997	-3	-7	-0.01	-0.000001
100%	3.70	+50	823,100,001	+1	+6	+0.01	+0.000001
115%	4.23	+20	823,099,996	-4	-6	-0.01	-0.000001
Battery End	3.35	+20	823,100,000	+0	-7	-0.01	-0.000001



## 4 US PCS Band

### 4.1 RF Output Power

#### 4.1.1 Test Result

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

#### 4.1.2 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 (i.e. power control bits in “All Up” condition) on the Radio Communications Tester. The output power was measured by a spectrum analyzer with the use of a directional coupler.

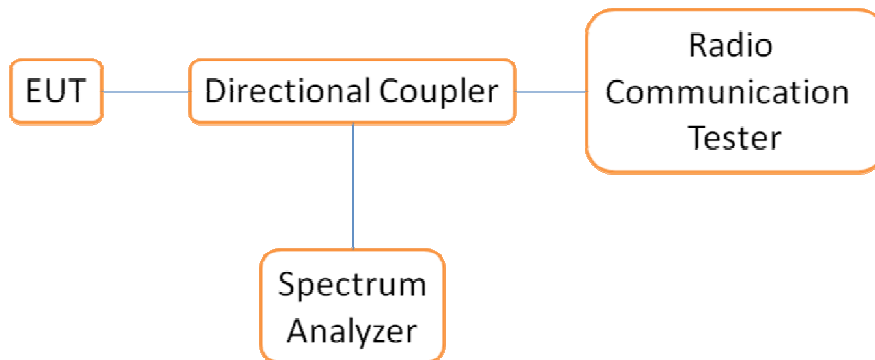
The power was measured using an RMS detector in accordance with KDB 971168.

Measured modes for CDMA: RC1/SO2, RC1/SO55, RC3/SO2, RC3/SO9, RC3/SO55

Measured modes for EvDO Rev 0: RTAP xx.x k, where xx.x ranges from 9.6 to 153.6

Measured modes for EvDO Rev A: RETAP xx.x k, where xx.x ranges from 128 to 12288

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).



#### 4.1.3 Test Site

SGS EMC Laboratory, Suwanee, GA

##### Environmental Conditions

Temperature: 25.6 °C

Relative Humidity: 55.2 %

Atmospheric Pressure: 97.6 kPa

#### 4.1.4 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.

**4.1.5 Test Data**

Center Frequency MHz	Channel No.	Test Mode	RF Power Output dBm (Average)
1851.25	25	RC1 / SO2	24.77
		RC1 / SO55	24.80
		RC3 / SO2	24.82
		RC3 / SO9	24.79
		RC3 / SO55	24.90
		RTAP 9.6k	24.21
		RTAP 19.2k	24.27
		RTAP 38.4k	24.39
		RTAP 76.8k	24.55
		RTAP 153.6k	24.46
		RETAP 128k	24.17
		RETAP 2048k	24.80
		RETAP 4096k	24.83
		RETAP 12288k	24.86
1880	600	RC1 / SO2	25.10
		RC1 / SO55	25.11
		RC3 / SO2	25.11
		RC3 / SO9	25.06
		RC3 / SO55	25.11
		RTAP 9.6k	24.82
		RTAP 19.2k	24.95
		RTAP 38.4k	25.12
		RTAP 76.8k	25.03
		RTAP 153.6k	25.10
		RETAP 128k	24.30
		RETAP 2048k	25.10
		RETAP 4096k	25.11
		RETAP 12288k	25.12
1908.75	1175	RC1 / SO2	24.88
		RC1 / SO55	24.85
		RC3 / SO2	24.91
		RC3 / SO9	24.88
		RC3 / SO55	24.91
		RTAP 9.6k	24.89
		RTAP 19.2k	24.93
		RTAP 38.4k	24.83
		RTAP 76.8k	24.92
		RTAP 153.6k	25.01
		RETAP 128k	24.26
		RETAP 2048k	24.91
		RETAP 4096k	24.92
		RETAP 12288k	24.93

## 4.2 Peak to Average Ratio

### 4.2.1 Test Result

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

### 4.2.2 Test Method

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

### 4.2.3 Test Site

SGS EMC Laboratory, Suwanee, GA

### 4.2.4 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.

#### 4.2.5 Test Data

Test Date: 2 Aug 2012

Center Frequency MHz	Channel No.	Test Mode	Peak-to-Average Ratio, dB
1851.25	25	RC1 / SO2	2.76
		RC1 / SO55	2.82
		RC3 / SO2	2.85
		RC3 / SO9	2.76
		RC3 / SO55	2.47
		RTAP 9.6k	3.43
		RTAP 19.2k	3.65
		RTAP 38.4k	3.53
		RTAP 76.8k	3.49
		RTAP 153.6k	3.56
		RETAP 128k	3.88
		RETAP 2048k	3.85
		RETAP 4096k	3.91
		RETAP 12288k	4.13
1880	600	RC1 / SO2	2.63
		RC1 / SO55	3.97
		RC3 / SO2	3.04
		RC3 / SO9	2.79
		RC3 / SO55	3.91
		RTAP 9.6k	4.10
		RTAP 19.2k	4.10
		RTAP 38.4k	4.04
		RTAP 76.8k	4.13
		RTAP 153.6k	4.23
		RETAP 128k	4.20
		RETAP 2048k	4.07
		RETAP 4096k	4.07
		RETAP 12288k	4.20
1908.75	1175	RC1 / SO2	3.69
		RC1 / SO55	4.10
		RC3 / SO2	3.75
		RC3 / SO9	4.13
		RC3 / SO55	3.72
		RTAP 9.6k	3.97
		RTAP 19.2k	3.72
		RTAP 38.4k	3.81
		RTAP 76.8k	3.65
		RTAP 153.6k	3.69
		RETAP 128k	4.29
		RETAP 2048k	4.23
		RETAP 4096k	4.07
		RETAP 12288k	4.13

### 4.3 Occupied Bandwidth

#### 4.3.1 Test Result

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

#### 4.3.2 Test Method

##### Occupied bandwidth – power bandwidth (99%) measurement procedure<sup>3</sup>

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 of the given emission.

The following procedure shall be used for measuring (99 %) power bandwidth<sup>4</sup>

- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts.
- b) The nominal IF filter bandwidth (3 dB RBW) shall be set to approximately 1% of the span, without being below 1%, and VBW should be approximately  $3 \times$  RBW or greater.
- c) Set the reference level of the instrument as required keeping the signal from exceeding the maximum spectrum analyzer input mixer level for linear operation. In general, the peak of the spectral envelope must be more than  $10 \log (OBW / RBW)$  below the reference level.

*Steps a) through c) may require iteration to adjust within the specified range.*

- d) Video averaging is not permitted. For analog or narrowband digital modulation the detector shall be set to peak, trace mode set to max-hold. For digital wideband modulation (OBW > 1MHz) the detector shall be set to average power (RMS) detector, trace mode set to clear-write and a single sweep.
- e) Use the 99 % power bandwidth function of the spectrum analyzer (if available) and report the measured bandwidth.
- f) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display. The axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

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.

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 as pre-scans showed this to yield the worst case test results.

<sup>3</sup> Measurement method to satisfy FCC CFR Title 47 §2.1049 and IC RSS-Gen

<sup>4</sup> See FCC KDB 971168 D01 Power Measurement – License Digital Systems v01

**4.3.3 Test Site**

SGS EMC Laboratory, Suwanee, GA

**4.3.4 Test Equipment**

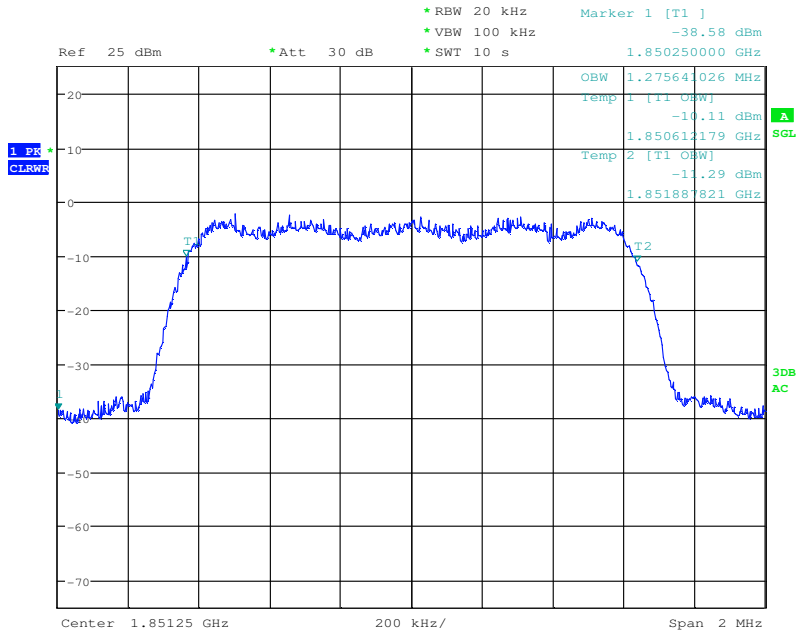
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	25 Aug 2012
Radio Communications Tester	CMW-500	R & S	B085757	28 Sep 2012
Directional Coupler	778D	Agilent / HP	B087456	14 Oct 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079656	12 Aug 2012

Note: The calibration period equipment is 1 year.



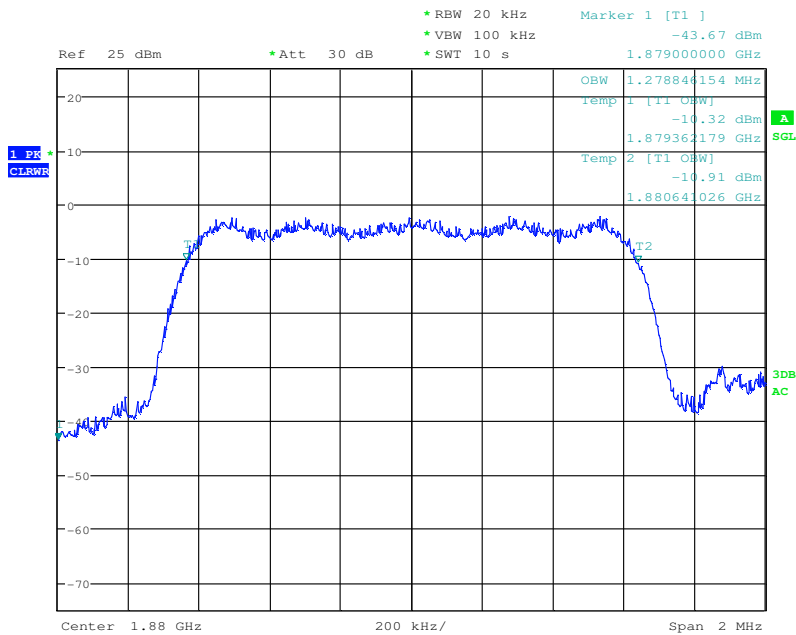
### 4.3.5 Test Data

#### CDMA



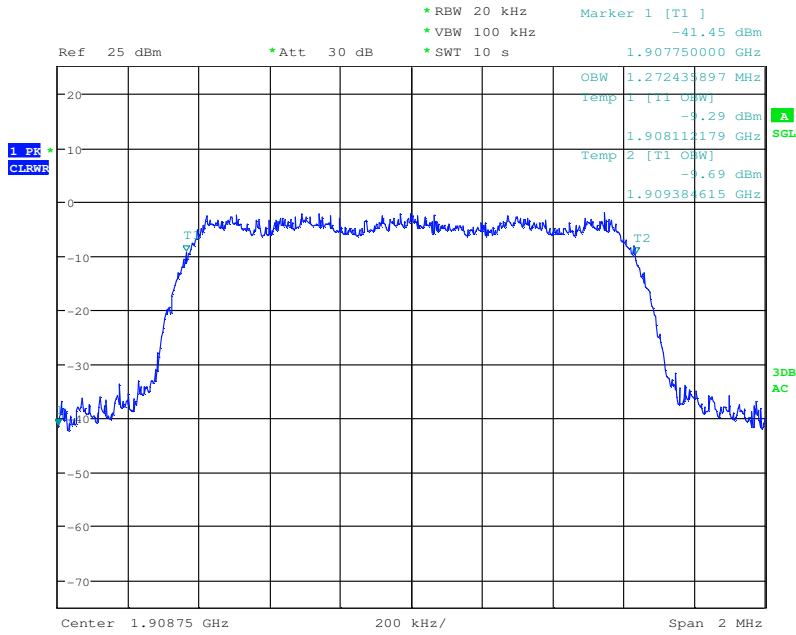
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#### CDMA



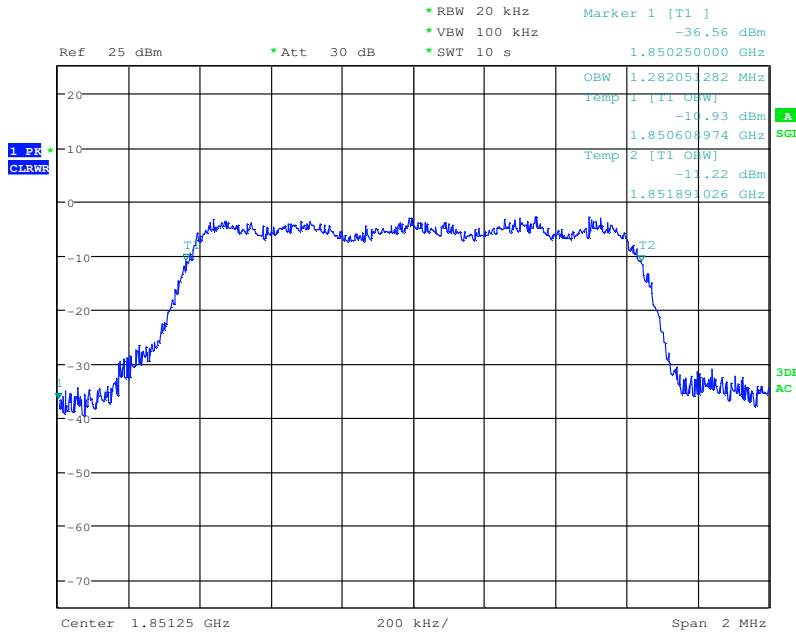
Date: 25.SEP.2012 20:19:31

## CDMA



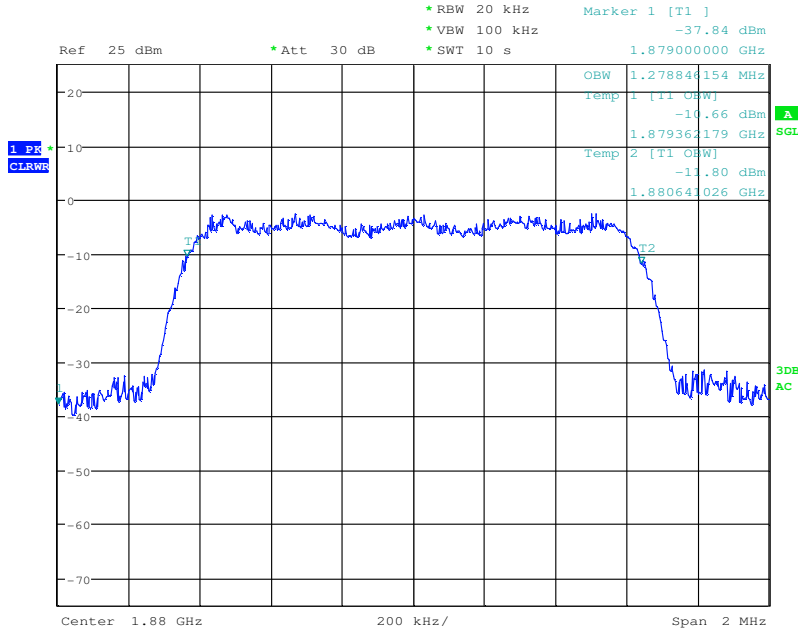
Date: 25.SEP.2012 20:20:08

## EVDO, Rev 0



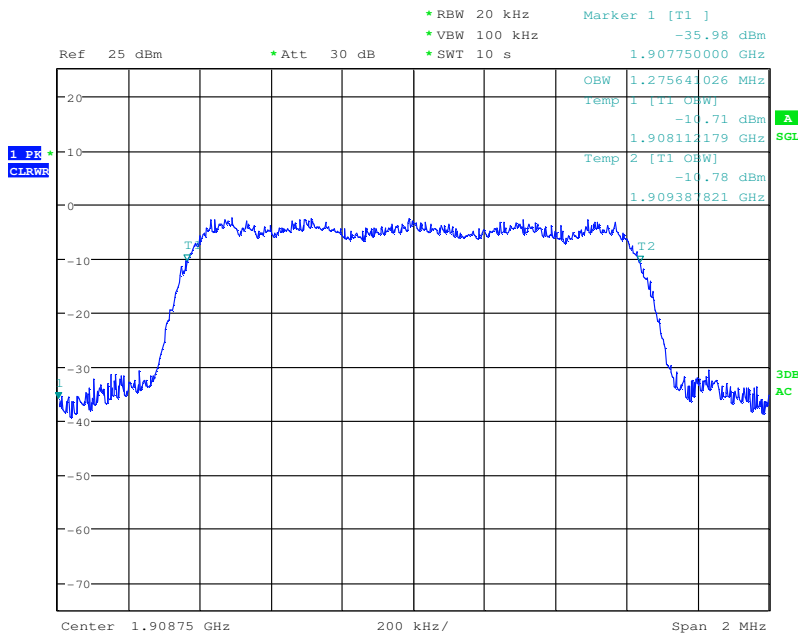
Date: 25.SEP.2012 20:07:19

## EvDO, Rev 0



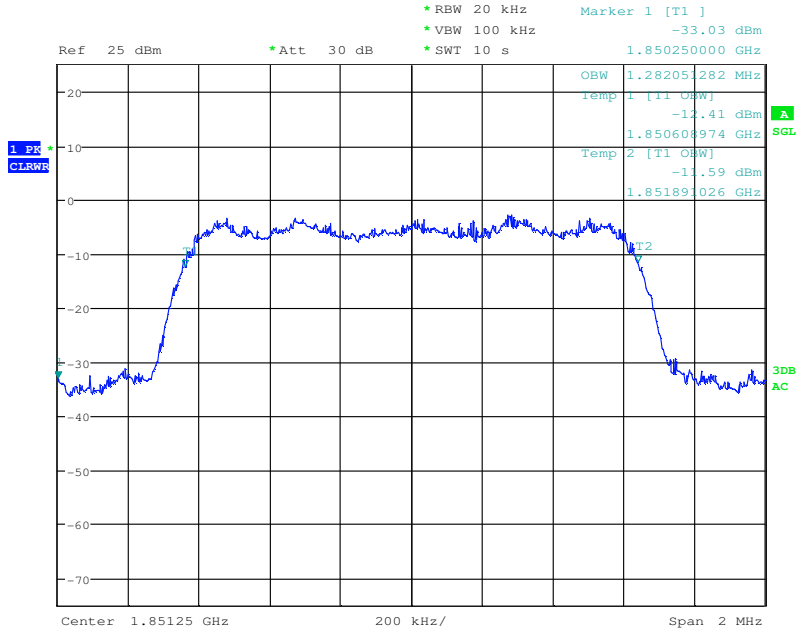
Date: 25.SEP.2012 20:08:01

## EvDO, Rev 0



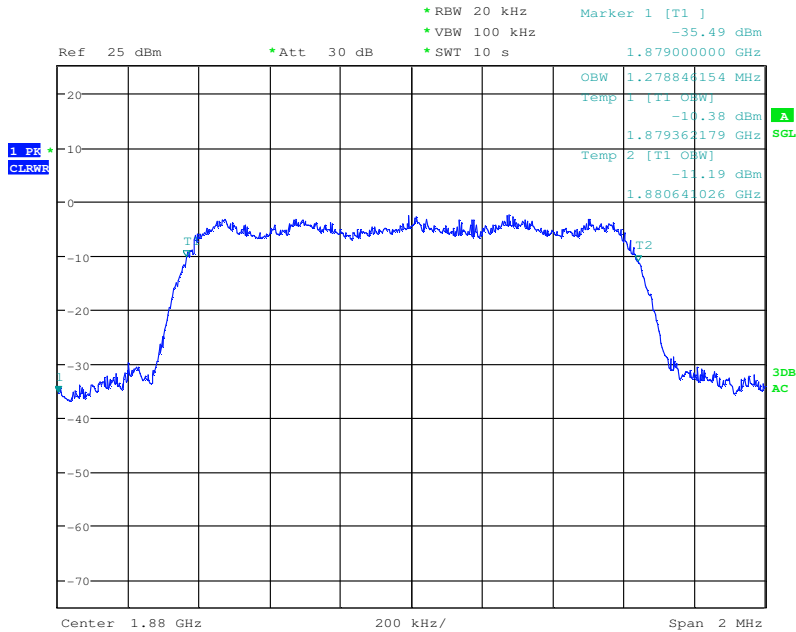
Date: 25.SEP.2012 20:08:51

## EvDO, Rev A



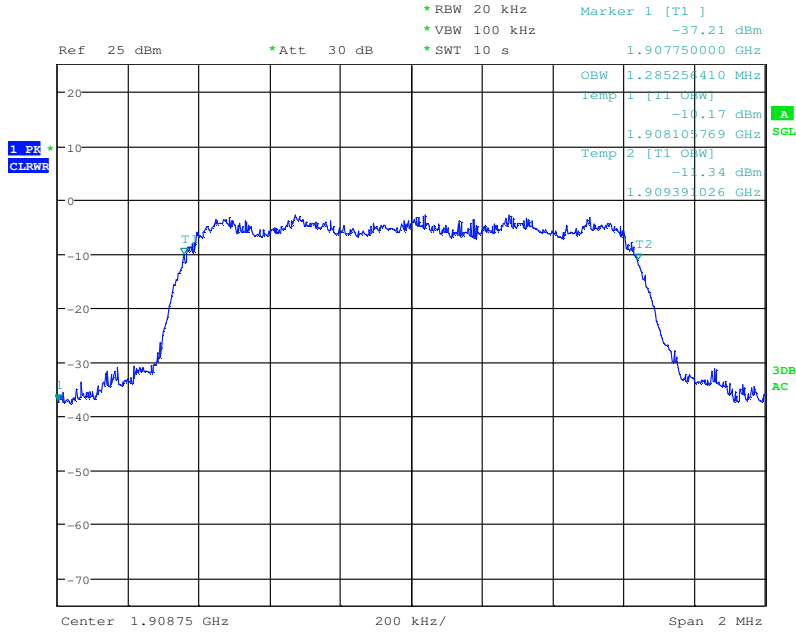
Date: 25.SEP.2012 19:53:30

## EvDO, Rev A



Date: 25.SEP.2012 19:54:17

## EvDO, Rev A



Date: 25.SEP.2012 19:55:08

## 4.4 Band Edge and Conducted Spurious Emissions

### 4.4.1 Test Result

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

### 4.4.2 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. KDB 971168 D01 Power Measurement – License Digital Systems v01 allows the use of the 99% bandwidth to be used as the emission bandwidth.

Scans from 30 MHz to 20 GHz were made using a resolution bandwidth of 1 MHz and a video bandwidth equal to or greater than 1 MHz.

The measurement was conducted at three channels: 25, 600 and 1175 (low, middle and high channels) in RETAP 12288K test mode as pre-scans showed this to yield the worst case test result.

### 4.4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

### 4.4.4 Test Equipment

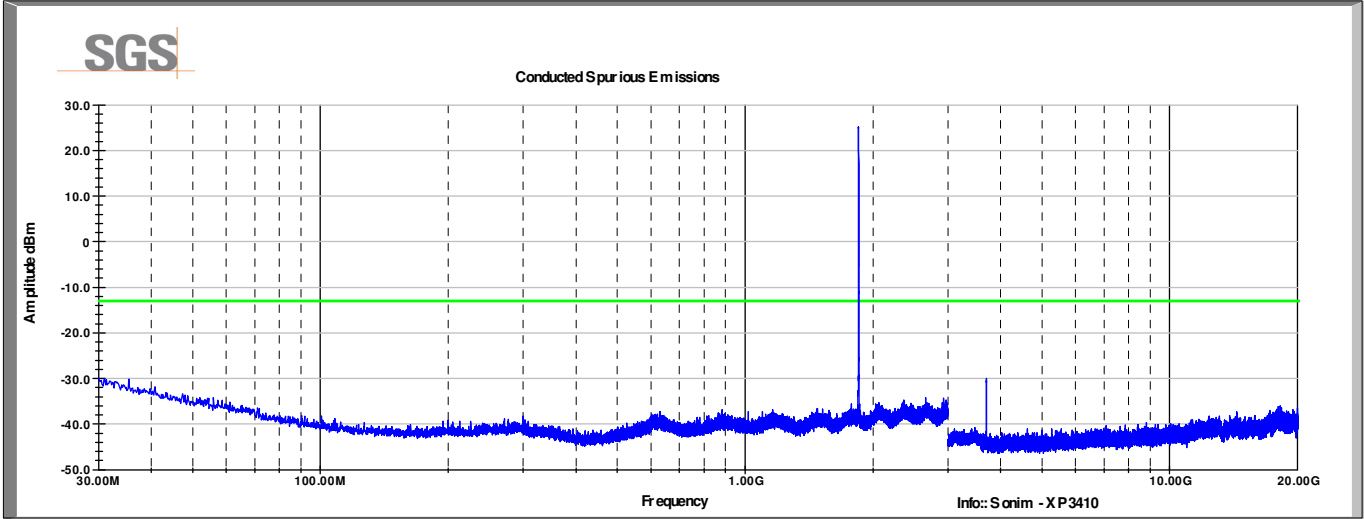
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Receiver	ESU40	R & S	B079629	25 Aug 2012
Radio Communications Tester	CMW-500	R & S	B085757	28 Sep 2012
Directional Coupler	11692D	Agilent / HP	B079666	14 OCT 2012
Directional Coupler	778D	Agilent / HP	B087456	14 Oct 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079656	12 Aug 2012

Note: The calibration period equipment is 1 year.

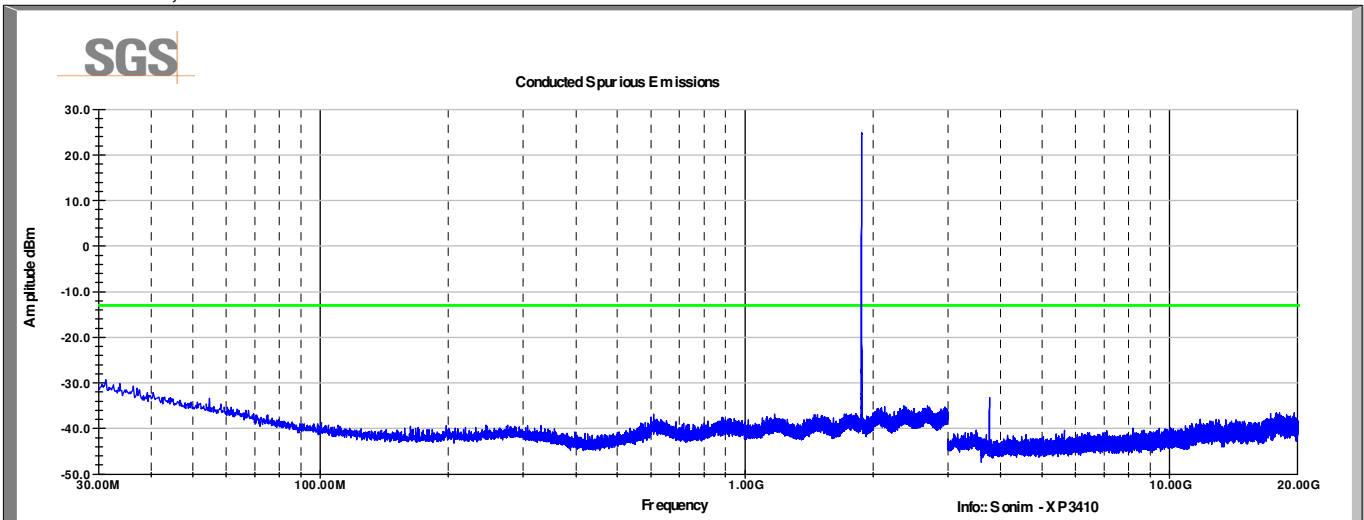
### 4.4.5 Test Data

Test Date: 2 Aug 2012

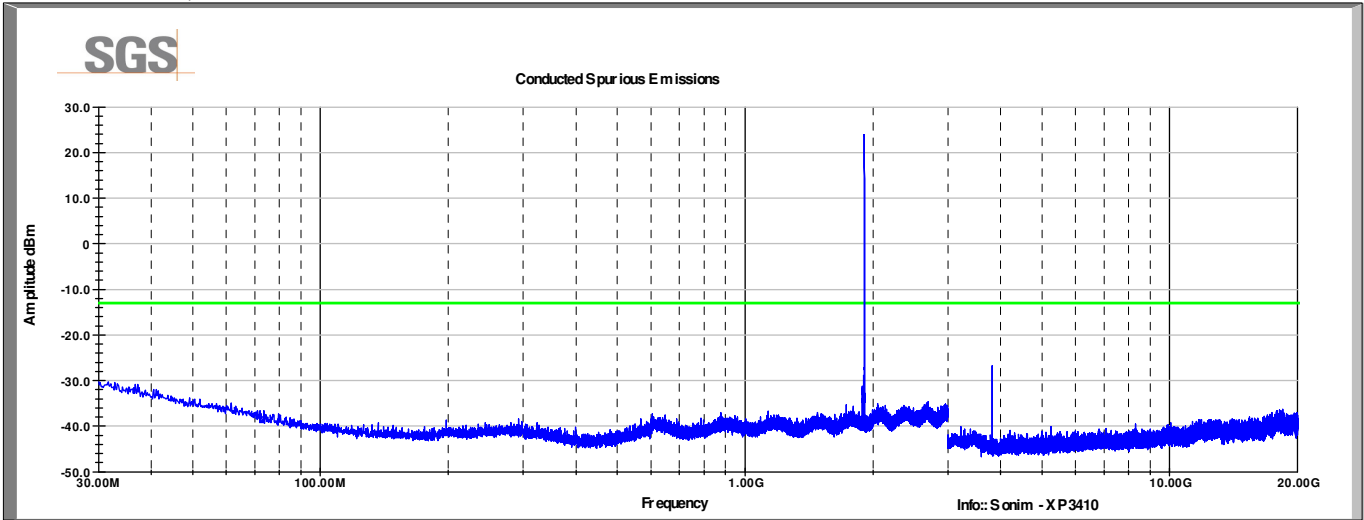
Channel 25, 1851.25 MHz



Channel 600, 1880 MHz

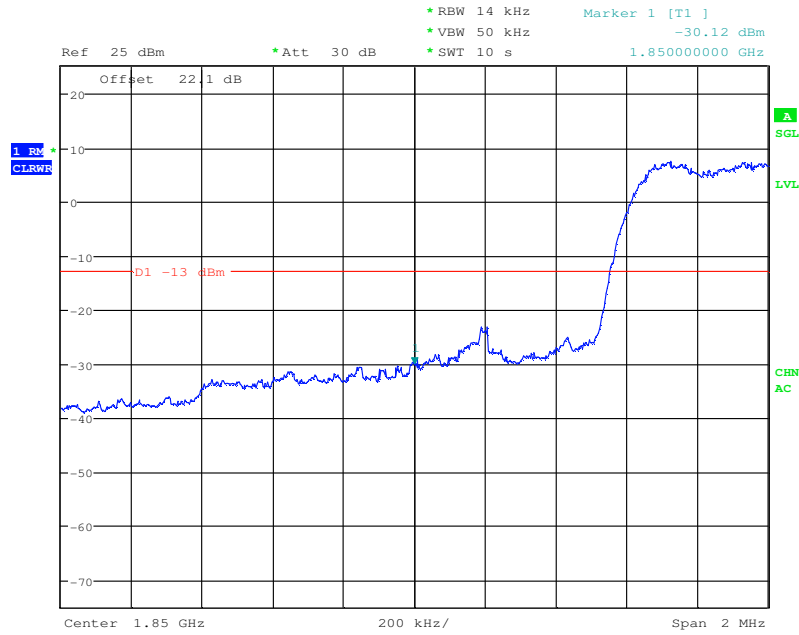


## Channel 1175, 1908.75 MHz



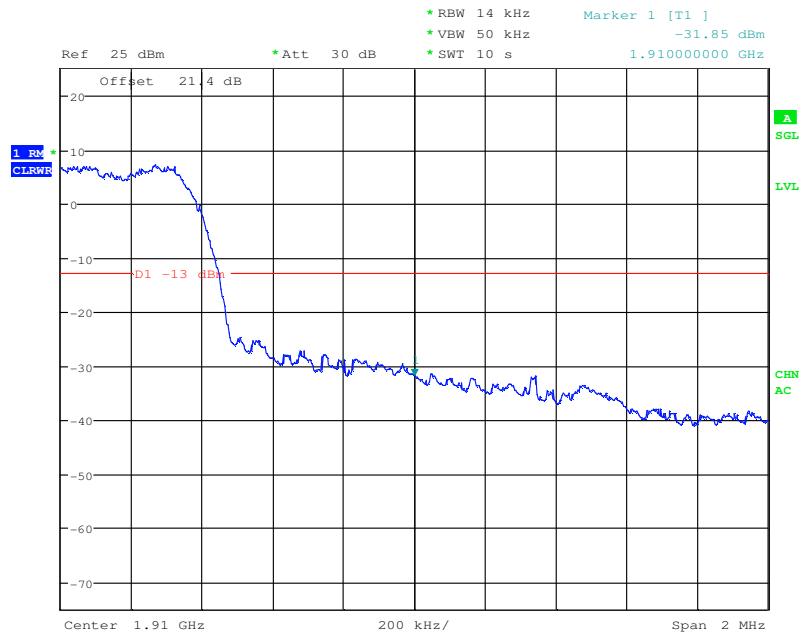


### Lower Band Edge



Date: 25.SEP.2012 20:57:34

### Upper Band Edge



Date: 25.SEP.2012 20:58:51

## 4.5 Effective Isotropic Radiated Power

### 4.5.1 Test Result

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

### 4.5.2 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.

### 4.5.3 Test Site

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

#### 4.5.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Bilog Antenna	JB6	Sunol	B079690	24 Aug 2012
DRWG Antenna	3117	ETS-Lindgren	B079691	31 May 2013
DRWG Antenna	3117	ETS-Lindgren	B079699	21 Mar 2013
Receiver	ESU40	R&S	B079629	25 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079712	12 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079711	12 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B085888	26 Sep 2012
Radio Communications Tester	CMW-500	R&S	B085757	28 Sep 2012
Dipole Antenna	3121D-DB4	ETS-Lindgren	B085753	16 Mar 2012
Signal Generator	HMC-T2240	Hittite	B001212	CNR

Note: The calibration period equipment is 1 year.

#### 4.5.5 Test Data

Test Date: 8 Aug 2012

Frequency MHz	Mode	Measured Level dBm	Substitute Level dBm	Antenna Gain dBi	Pol H/V	ERP dBm	ERP Watts	Battery Type
1851.25	BC1	-17.1	18.5	5.0	H	23.5	0.224	Standard
1880.00	BC1	-17.5	17.1	4.9	H	22.0	0.158	Standard
1908.75	BC1	-18.7	18.6	4.8	H	23.4	0.219	Standard

## 4.6 Radiated Spurious Emissions

### 4.6.1 Test Result

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

### 4.6.2 Test Method

The levels of the carrier and the various 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. Prescan measurements were performed with the use of a spectrum analyzer employing a resolution bandwidth of 1 MHz or greater and a video bandwidth of 1 MHz or greater. Emissions within 20 dB of the limit were measured using the substitution method.

The EUT was placed on a non-conductive table 80cm above a flush mounted turntable with a measurement antenna was place 3 meters away

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 turntable was rotated from 0-360 degrees, the measurement antenna was raised from 1 to 4 meters in height in both vertical and horizontal polarizations, and the EUT was manipulated through each of its three orthogonal axes to capture the maximum reading on the spectrum analyzer.

Per the guidance of ANSI/TIA-603-C-2004, a half-wave dipole is then substituted in place of the EUT. For emissions above 1 GHz, a horn antenna is substituted in place of the EUT. The substitution antenna is driven by a signal generator with the level of the signal generator being used to obtain the same receive spectrum analyzer level previously recorded from the spurious emissions of the EUT. The power of the emission is calculated using the following formula:

$$P_{d[dBm]} = P_{g[dBm]} - \text{Cable Loss}_{[dB]} + \text{Antenna Gain}_{[dBd/dBi]}$$

Where Pd is the dipole equivalent power, Pg is the generator output to the substitution antenna, and the antenna gain is the gain of the substitute antenna used relative to either a half-wave dipole (dBd) or an isotropic source (dBi). The substitute level is equal to  $P_{g[dBm]} - \text{Cable Loss}_{[dB]}$ .

The measurement was conducted at the middle channels, 600 in RC3/SO55 as pre-scans showed this to yield the worst case test results.

#### 4.6.3 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
DRWG Antenna	3117	ETS-Lindgren	B079691	31 May 2013
DRWG Antenna	3117	ETS-Lindgren	B079699	21 Mar 2013
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079656	12 Aug 2012
Bilog Antenna	JB6	Sunol	B079689	24 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079712	12 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B079711	12 Aug 2012
Coaxial Cable	Sucoflex 106	Huber+Suhner	B085888	26 Sep 2012
Dipole Antenna	3121D	ETS-Lindgren	B085753	16 Mar 2012
PCS Band Notch Filter	BRC50720	Microtronics	B003145	6 Aug 2013
High Pass Filter	HPM50110	Microtronics	B003146	6 Aug 2013
Signal Generator	HMC-T2240	Hittite	B001212	CNR

Note: The calibration period equipment is 1 year.

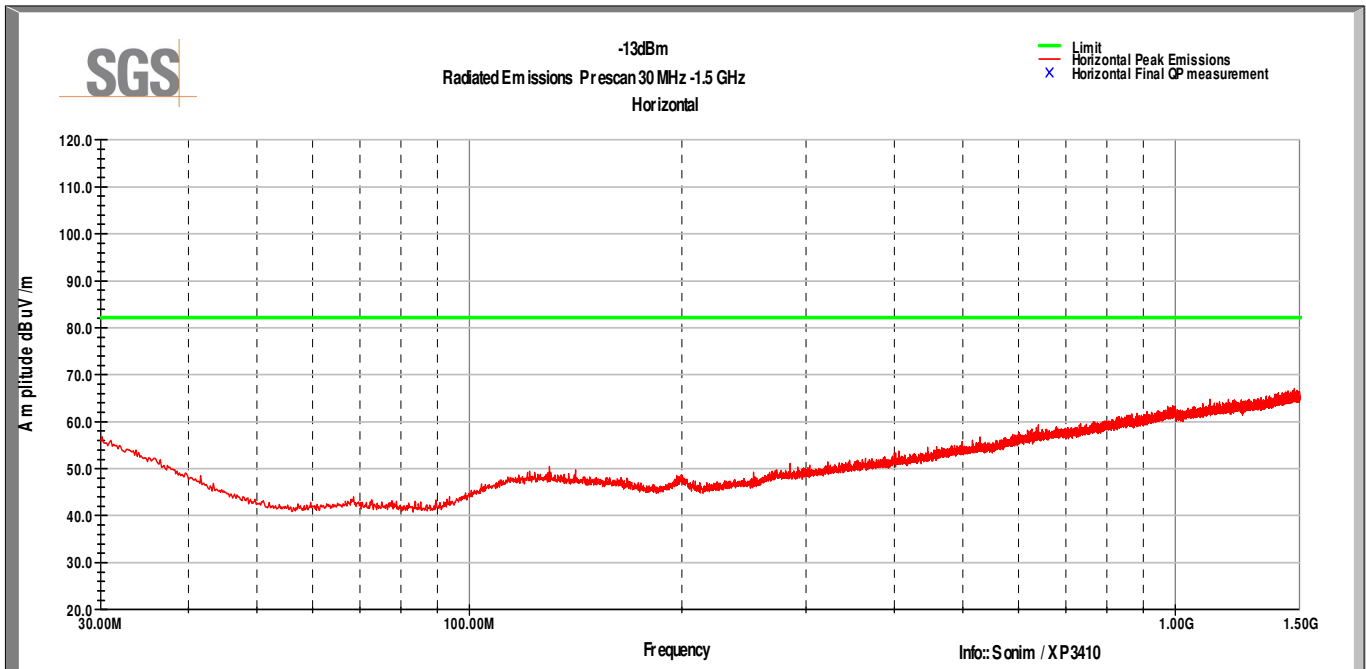
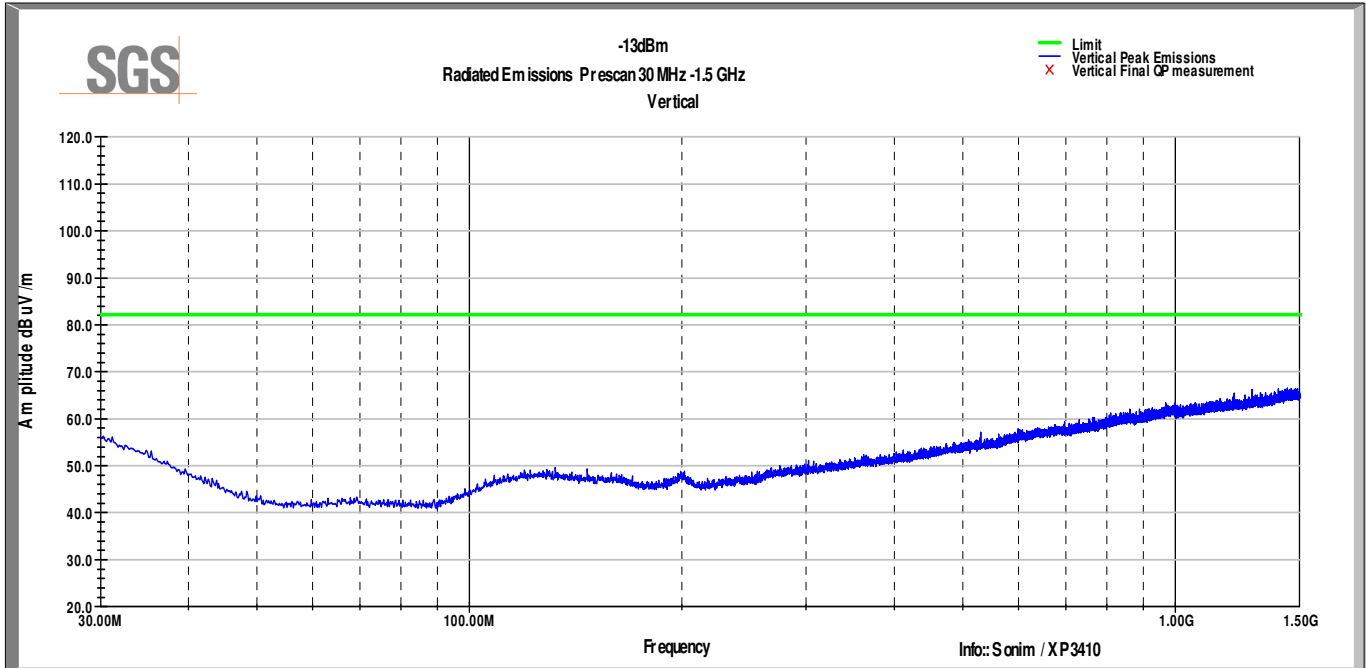
#### 4.6.4 Test Data

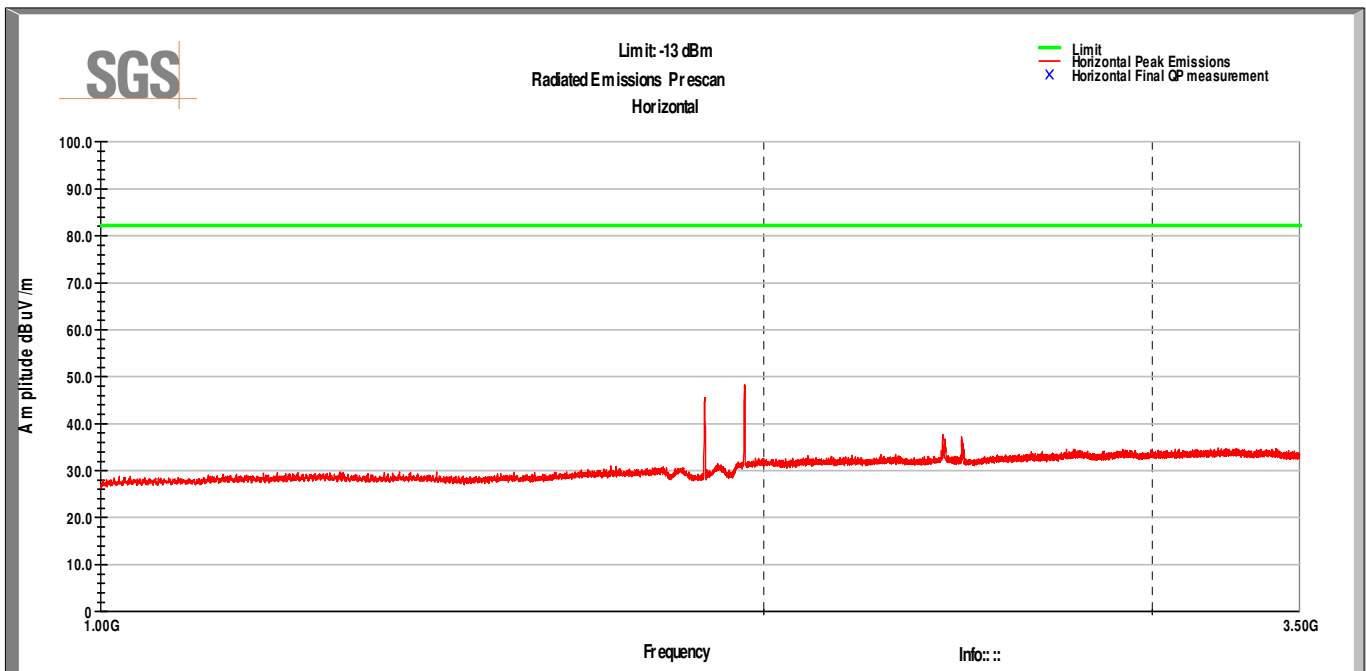
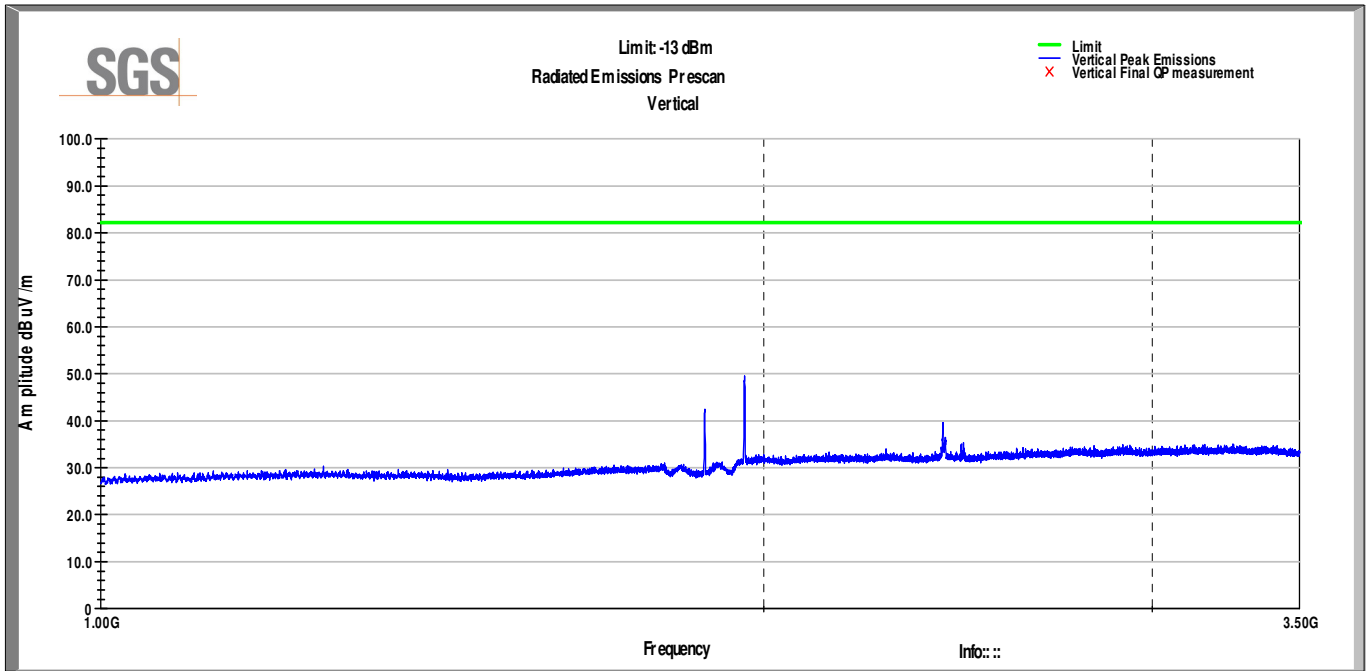
Test Date: 6 Aug 2012

Frequency MHz	Band, CH	Axis (F,S,U)	Polarity (V/H)	Raw Avg dBuV	SigGen dBm	Cable Loss dB	Ant Gain dBi	Net EIRP dBm	Limit dBm	Margin (dB)
3701.88	BC1, 25	F	H	73.2	-30.1	3.0	8.0	-25.1	-13.0	-12.1
	BC1, 600	F	No peaks within 20dB							
5725.44	BC1, 1175	F	V	65.8	-36.3	3.8	10.1	-30.0	-13.0	-17.0
3816.39	BC1, 1175	S	V	67.1	-34.3	3.1	8.0	-29.4	-13.0	-16.4
	BC1, 600	S	No peaks within 20dB							
3701.30	BC1, 25	S	V	67.9	-35.3	3.0	8.0	-30.3	-13.0	-17.3
3701.30	BC1, 25	U	H	67.9	-35.5	3.0	8.0	-30.5	-13.0	-17.5
	BC1, 600	U	No peaks within 20dB							
3815.15	BC1, 1175	U	V	68.0	-33.3	3.0	8.0	-28.3	-13.0	-15.3

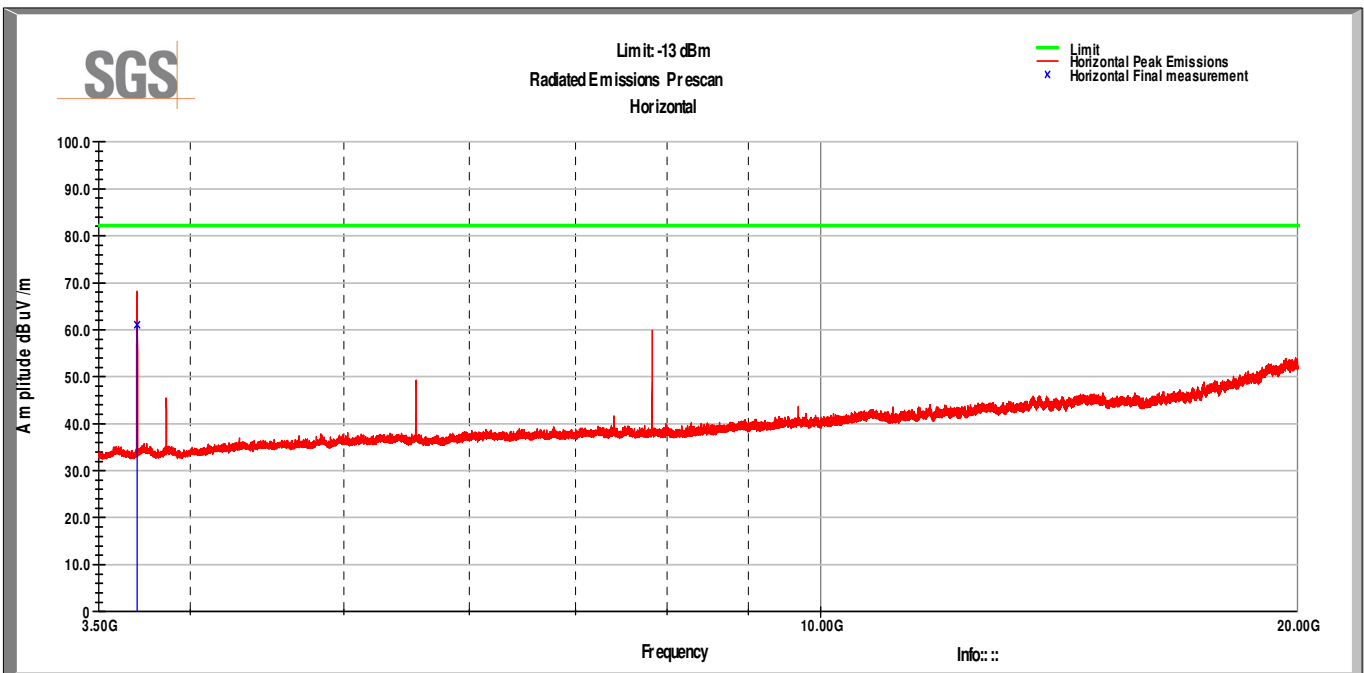
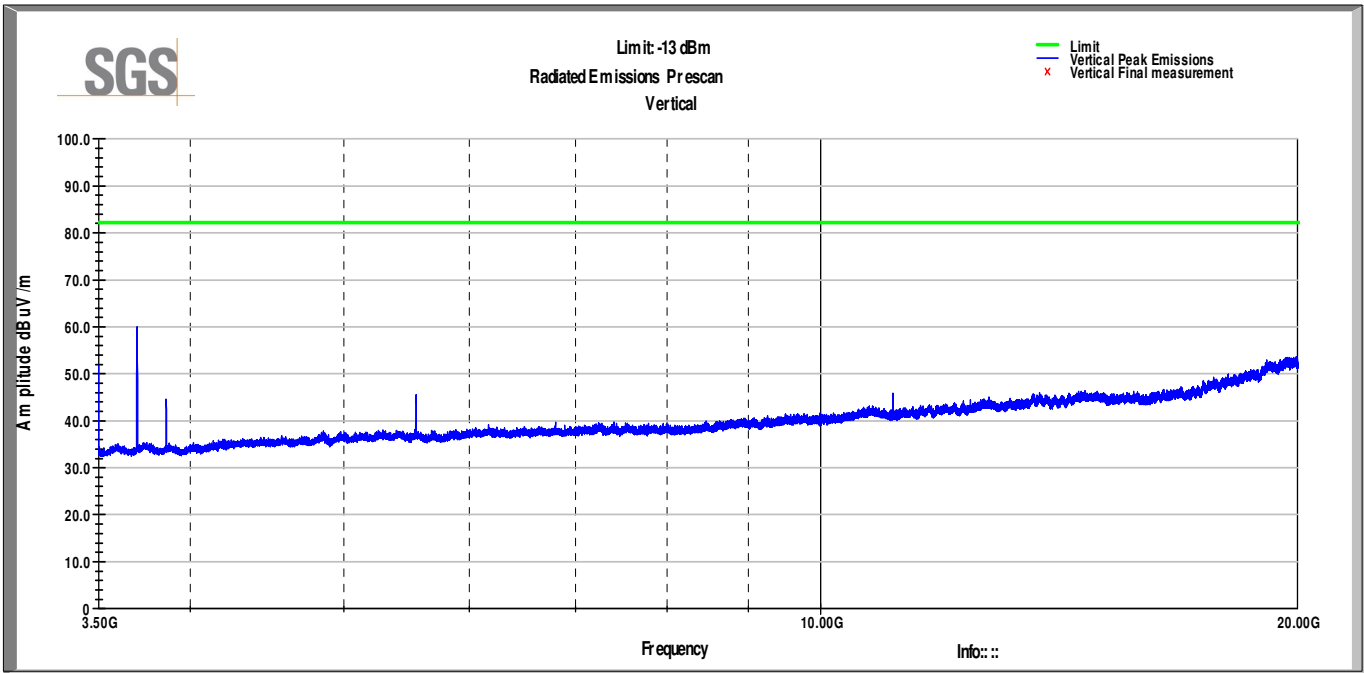
There were no other emissions within 20 dB of the limit.

### 4.6.5 Test Plots









## 4.7 Frequency Stability

### 4.7.1 Test Result

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

### 4.7.2 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.

### 4.7.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.6 °C

Relative Humidity: 56.8 %

Atmospheric Pressure: 97.4 kPa

### 4.7.4 Test Equipment

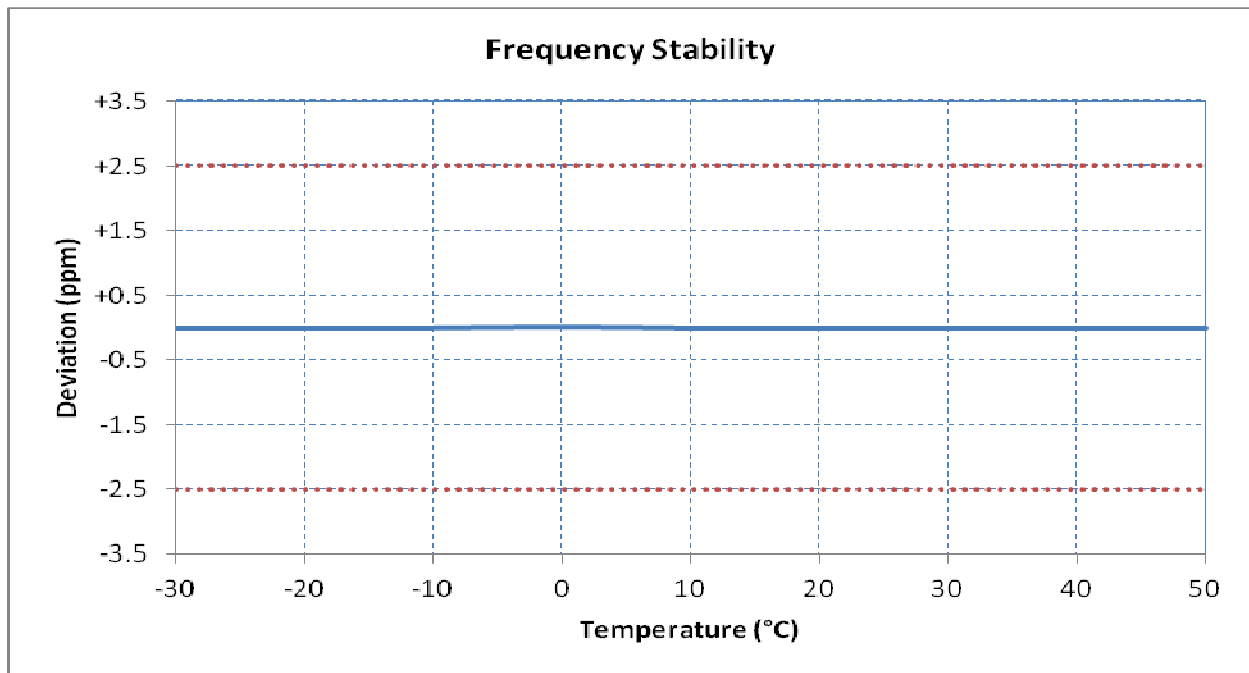
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
DC Power Supply	ZUP20-10	TDK-Lambda	B079774	14Nov2012
Wideband Radio Communications Tester	CMW500	Rohde & Schwarz	B085757	28Sep2012
Ultraflex Coaxial Cable	LMR-240	Time Microwave Systems	B092135	20July2013
Environmental Chamber	SM-16-8200	Thermotron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

Note: The calibration period equipment is 1 year.

### 4.7.5 Test Data

Test Date: 10 Aug 2012

Voltage %	Power V <sub>DC</sub>	Temp °C	Frequency Hz	Freq Dev Hz	Freq Dev max Hz	Freq Dev ppm	Deviation %
100%	3.70	+20 (Ref)	1,879,999,995	-5	-25	-0.01	-0.000001
100%	3.70	-30	1,879,999,997	-3	-16	-0.01	-0.000001
100%	3.70	-20	1,879,999,999	-1	-15	-0.01	-0.000001
100%	3.70	-10	1,880,000,002	+2	-12	-0.01	-0.000001
100%	3.70	0	1,880,000,002	+2	+8	+0.00	+0.000000
100%	3.70	+10	1,879,999,997	-3	-14	-0.01	-0.000001
100%	3.70	+20	1,879,999,997	-3	-19	-0.01	-0.000001
100%	3.70	+30	1,879,999,997	-3	-16	-0.01	-0.000001
100%	3.70	+40	1,879,999,996	-4	-18	-0.01	-0.000001
100%	3.70	+50	1,879,999,997	-3	-17	-0.01	-0.000001
115%	4.23	+20	1,879,999,996	-4	-18	-0.01	-0.000001
Battery End	3.35	+20	1,879,999,998	-2	-22	-0.01	-0.000001



## 5 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	28 Aug 2012
1	Revised per reviewer comments	27 Sep 2012