

EMC Test Report

Project Number: 3562408

Report Number: 3562408EMC02

Revision Level: 1

Client: Continental

Equipment Under Test: Wireless Modem Module

Model: CASAN

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

Industry Canada: RSS-132, Issue 3: 2013, RSS-133 Issue 6: 2013,

Report issued on: 03 October 2014

Test Result: Compliant

Tested by:



Jeremy O. Pickens, Senior EMC Engineer

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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Table of Contents

1	SUMMARY OF TEST RESULTS.....	4
1.1	MODIFICATIONS REQUIRED TO COMPLIANCE	4
2	GENERAL INFORMATION.....	5
2.1	CLIENT INFORMATION	5
2.2	TEST LABORATORY	5
2.3	GENERAL INFORMATION OF EUT	5
2.4	OPERATING MODES AND CONDITIONS	5
3	RF OUTPUT POWER.....	6
3.1	TEST RESULT.....	6
3.2	TEST METHOD.....	6
3.3	TEST SITE	7
3.4	TEST EQUIPMENT	7
3.5	TEST DATA.....	7
4	OCCUPIED BANDWIDTH	8
4.1	TEST RESULT.....	8
4.2	TEST METHOD.....	8
4.3	TEST SITE	8
4.4	TEST EQUIPMENT	8
4.5	TEST DATA.....	9
5	BAND EDGE AND CONDUCTED SPURIOUS EMISSIONS.....	11
5.1	TEST RESULT.....	11
5.2	TEST METHOD.....	11
5.3	TEST SITE	11
5.4	TEST EQUIPMENT	11
5.5	TEST DATA.....	12
5.6	CONDUCTED SPURIOUS EMISSIONS PLOT	13
6	EFFECTIVE RADIATED POWER.....	15
6.2	TEST SITE	15
6.3	TEST EQUIPMENT	15
6.4	TEST DATA.....	15
7	RADIATED SPURIOUS EMISSIONS.....	16
7.1	TEST RESULT.....	16
7.2	TEST METHOD.....	16
7.3	TEST EQUIPMENT	16
7.4	TEST DATA.....	18
7.5	PLOTS	18
8	FREQUENCY STABILITY	33
8.1	TEST RESULT.....	33
8.2	TEST METHOD.....	33
8.3	TEST SITE	33
8.4	TEST EQUIPMENT	33
8.5	TEST DATA.....	34
9	PEAK TO AVERAGE RATIO	36
9.1	TEST RESULT.....	36



9.2 TEST METHOD..... 36

9.3 TEST SITE 36

9.4 TEST EQUIPMENT 36

9.5 TEST DATA..... 37

10 REVISION HISTORY 38

1 Summary of Test Results

Reference Sections	Test Description	Test Limit	Test Condition	Test Result
Transmit Mode Testing				
2.1046	Conducted Output Power	N/A	Conducted	Reported
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		Reported
2.1051 22.917(a) 24.238(a)	Band Edge / Conducted Spurious Emissions	$< 43 + 10\log_{10}(P_{\text{Watts}})$ 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	$< 43 + 10\log_{10}(P_{\text{Watts}})$ 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: Continental Automotive System, Inc..
Address: 21440 West Lake Cook Road
City, State, Zip, Country: Deer Park, IL 60010, 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

Type of Product: Wireless Modem Module
Model Number: CASAN
FCC ID: LHJ-CASAN
S/N: Z00J09NM
IMEI Number: 004401810082251

Rated Voltage: 10.2 - 13.8 Vdc,
Test Voltage: 12 Vdc
Tx Frequency Range: 824.7– 848.31 MHz (CDMA 850)
1851.25– 1908.75 MHz (CDMA 1900)
FCC Classification: PCS Licensed Transmitter PCB
Type: Pre Production

Sample Received Date: 24 July 2014
Dates of testing: 25 Aug - 05 Sept 2014

2.4 Operating Modes and Conditions

The EUT was exercised by connecting a CMW communications tester to the device. The CMW was used to control signaling and channel during testing.

3 RF Output Power

3.1 Test Result

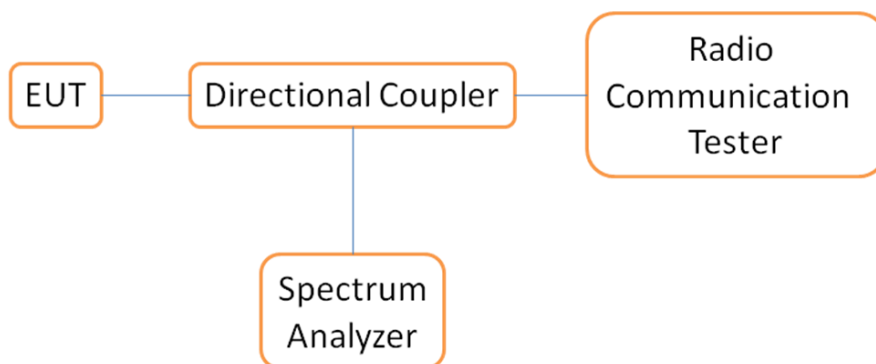
Test Description	Basic Standards	Test Result
RF Output Power	FCC Part 2.1046	Reported

3.2 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 CMW500 was used to measure the output power.

All R.C. and S.O. configurations were investigated with the worst case being reported.

The measurements were conducted at the low, middle, and high channels in RC3/SO55.



3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.5 °C
Relative Humidity: 53 %
Atmospheric Pressure: 98.07 kPa

3.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
CMW500 WIDEBAND RADIO COMMUNICATIONS TESTER	CMW500	ROHDE & SCHWARZ	B085757	29-Oct-2014
MULTIFLEX COAXIAL CABLE	141	HUBER&SUHNER	B095590	6-Aug-2015

- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 is on a 3 year calibration cycle.

3.5 Test Data

Mode	Band / CH / Freq.	Measured Power, dBm
CDMA	BC0 / CH1013 / 824.7 MHz	23.76
CDMA	BC0 / CH384 / 836.52 MHz	23.61
CDMA	BC0 / CH777 / 848.31 MHz	23.53
CDMA	BC1 / CH25 / 1851.25 MHz	23.78
CDMA	BC1 / CH600 / 1880 MHz	23.56
CDMA	BC1 / CH1175 / 1908.75 MHz	23.44

4 Occupied Bandwidth

4.1 Test Result

Test Description	Basic Standards	Test Result
Occupied Bandwidth	FCC Part 2.1049 FCC Part 22.917(a) FCC Part 24.238(a)	Reported

4.2 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 was measured using spectrum analyzer's occupied bandwidth measurement. RBW was set to 30 kHz on spectrum analyzer.

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

4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.2 °C

Relative Humidity: 44.2 %

Atmospheric Pressure: 98.15 kPa

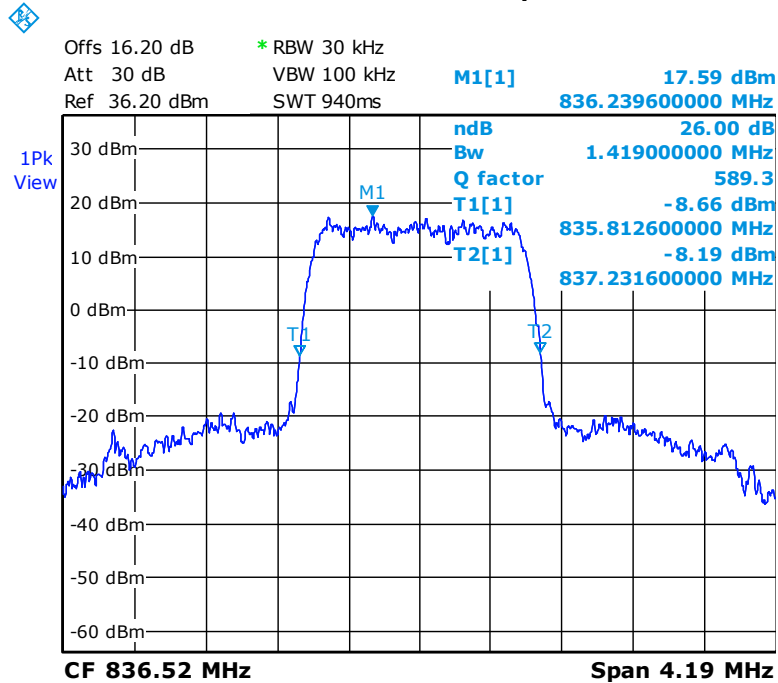
4.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
NETWORK ANALYZER	ZVL	ROHDE & SCHWARZ	B079799	27-Sep-2014
CMW500 WIDEBAND RADIO COMMUNICATIONS TESTER	CMW500	ROHDE & SCHWARZ	B085757	29-Oct-2014
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101743	8-Aug-2015
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079824	6-Aug-2015

- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 is on a 3 year calibration cycle.

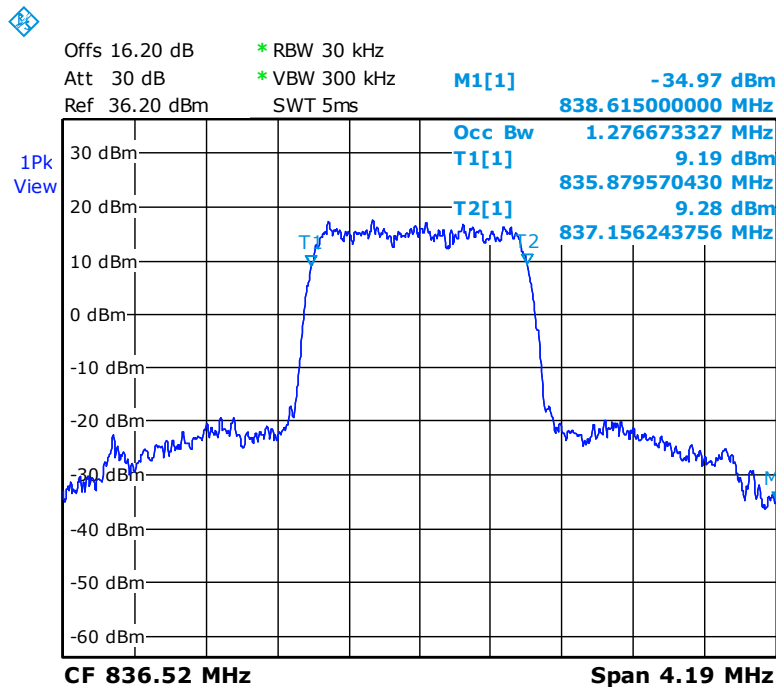
4.5 Test Data

CDMA – BC 0 CH 384 - 26dB Occupied Bandwidth



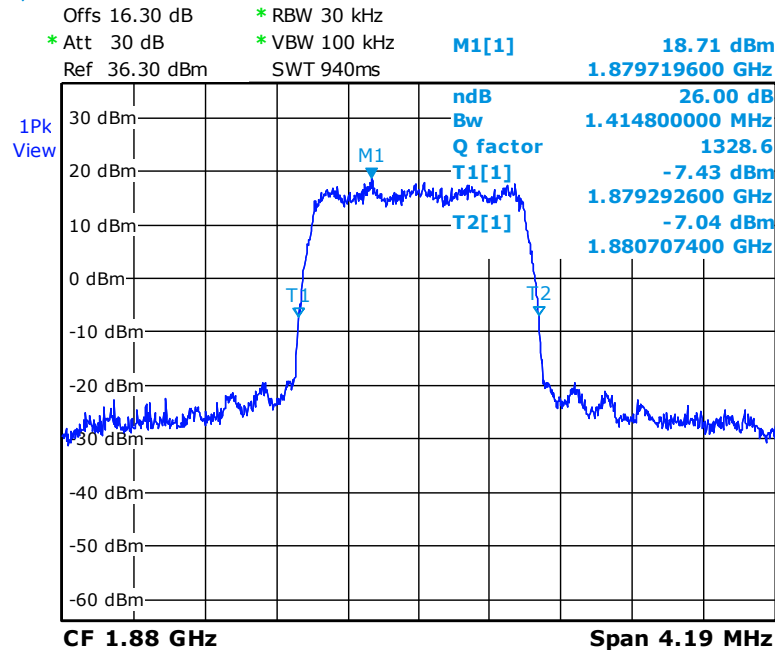
Date: 26.AUG.2014 18:10:37

CDMA – BC 0 CH 384 - 99% Bandwidth



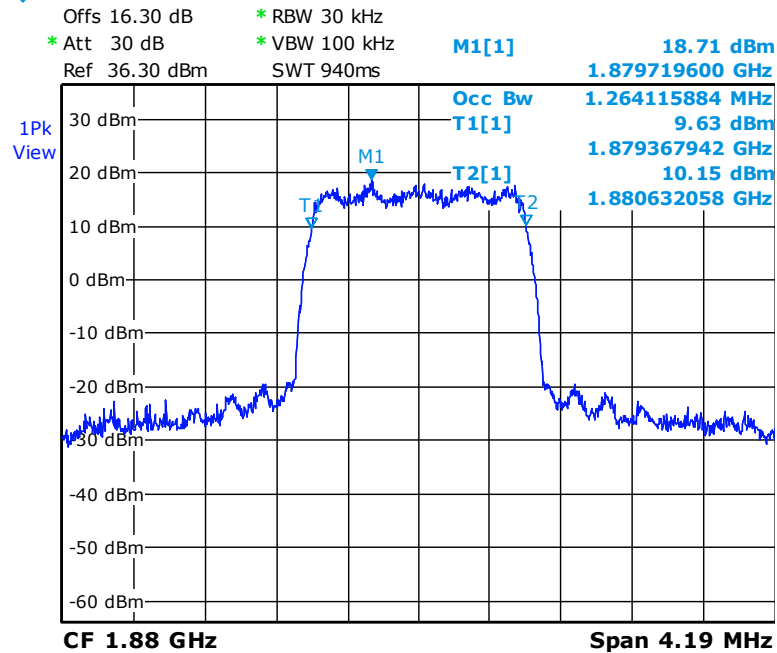
Date: 26.AUG.2014 18:12:42

CDMA BC 1 CH 600 26dB Occupied Bandwidth



Date: 26.AUG.2014 18:33:45

CDMA BC 1 CH 600 99% Bandwidth



Date: 26.AUG.2014 18:33:07

5 Band Edge and Conducted Spurious Emissions

5.1 Test Result

Test Description	Basic Standards	Test Result
Conducted spurious emissions and Band Edge	2.1051 22.917(a) 24.238(a)	Pass

5.2 Test Method

The levels of the carrier and the various conducted spurious and harmonics frequencies were measured by means of a calibrated spectrum analyzer. The emissions spectrum emanating from the EUT transmit antenna port were scanned from the lowest frequency generated in the equipment up to a frequency including its 10th 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 was 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.

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.2 °C

Relative Humidity: 44.2 %

Atmospheric Pressure: 98.15 kPa

5.4 Test Equipment

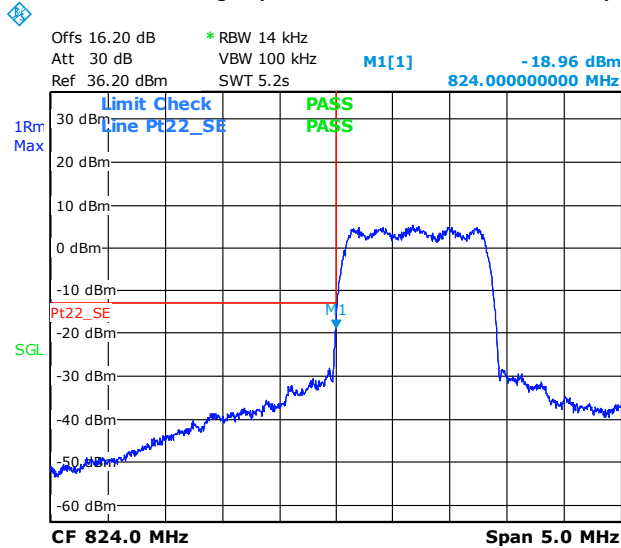
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
NETWORK ANALYZER	ZVL	ROHDE & SCHWARZ	B079799	27-Sep-2014
CMW500 WIDEBAND RADIO COMMUNICATIONS TESTER	CMW500	ROHDE & SCHWARZ	B085757	29-Oct-2014
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101743	8-Aug-2015
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079824	6-Aug-2015

- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 is on a 3 year calibration cycle.

5.5 Test Data

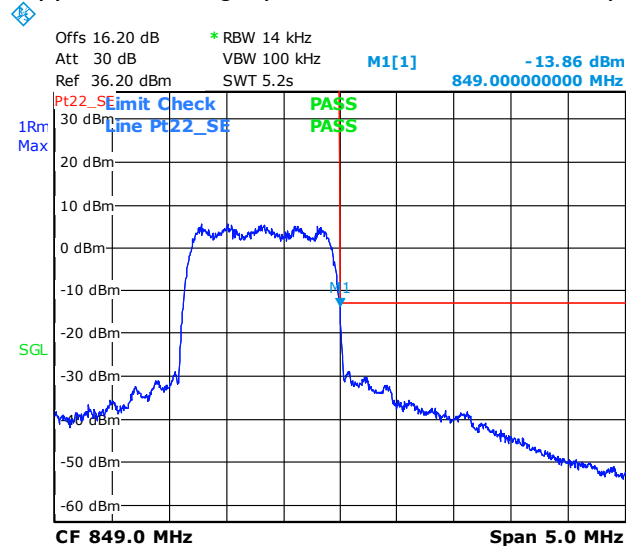
CDMA, BC 0

Lower Band Edge (Channel 1013, 824.7 MHz)



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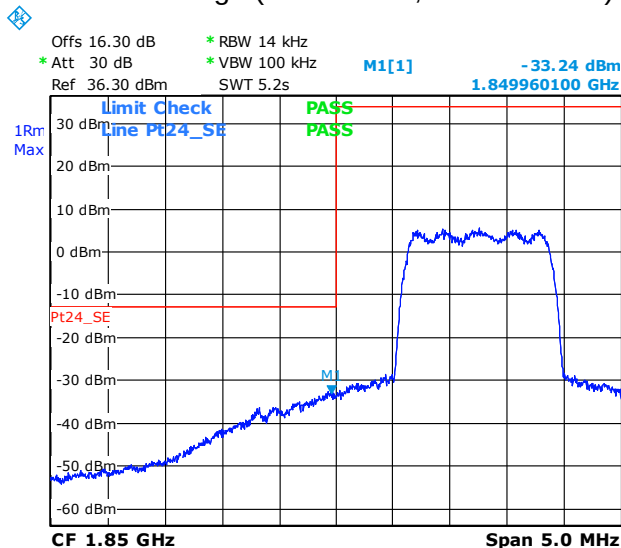
Upper Band Edge (Channel 777, 847.06 MHz)



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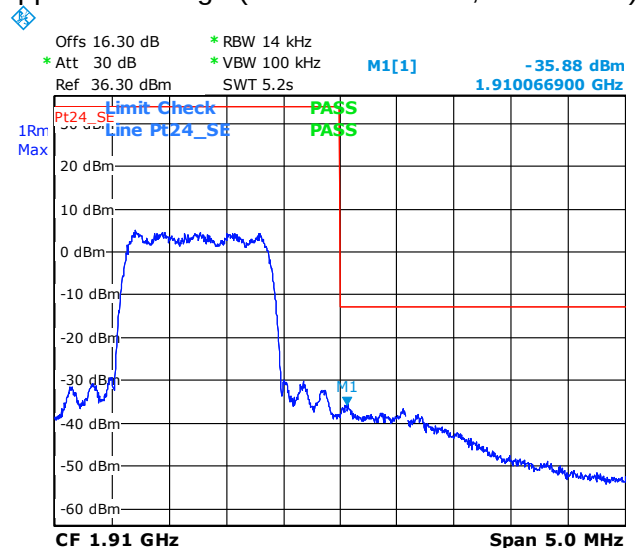
CDMA, BC 1

Lower Band Edge (Channel 25, 1851.25 MHz)



Date: 26.AUG.2014 18:27:51

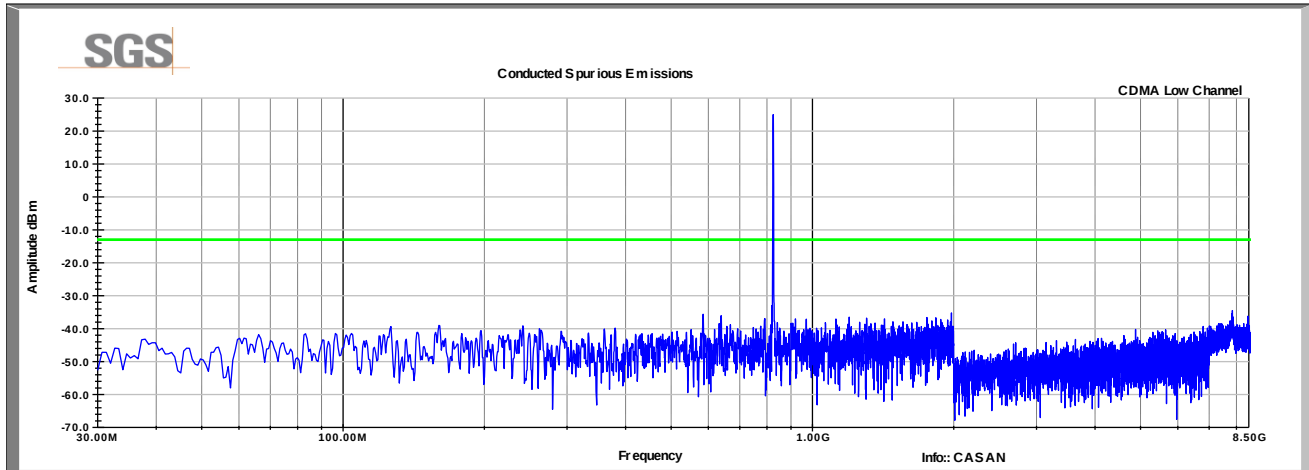
Upper Band Edge (Channel 1908.75, 848.8 MHz)



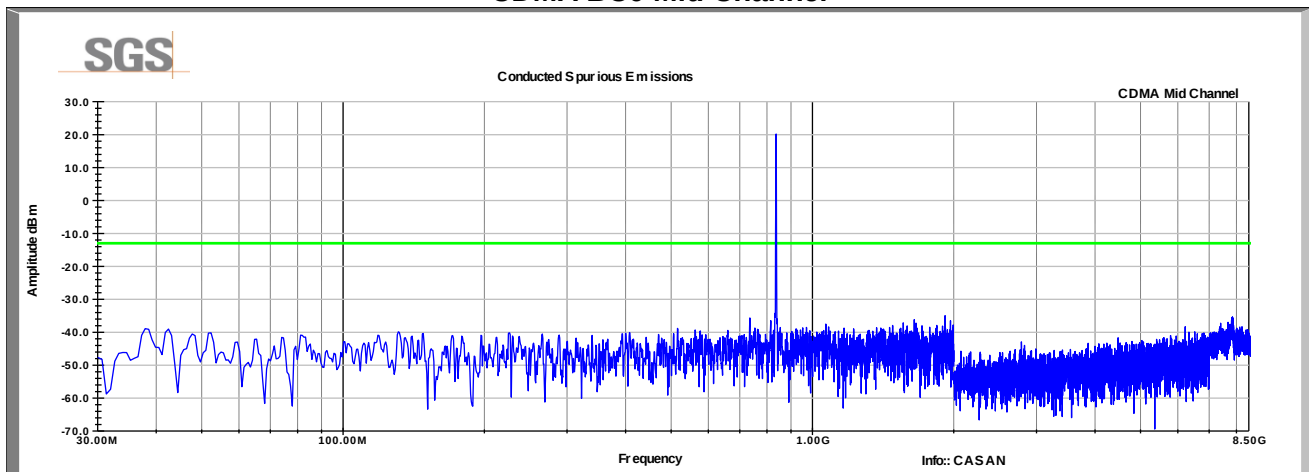
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5.6 Conducted Spurious Emissions Plot

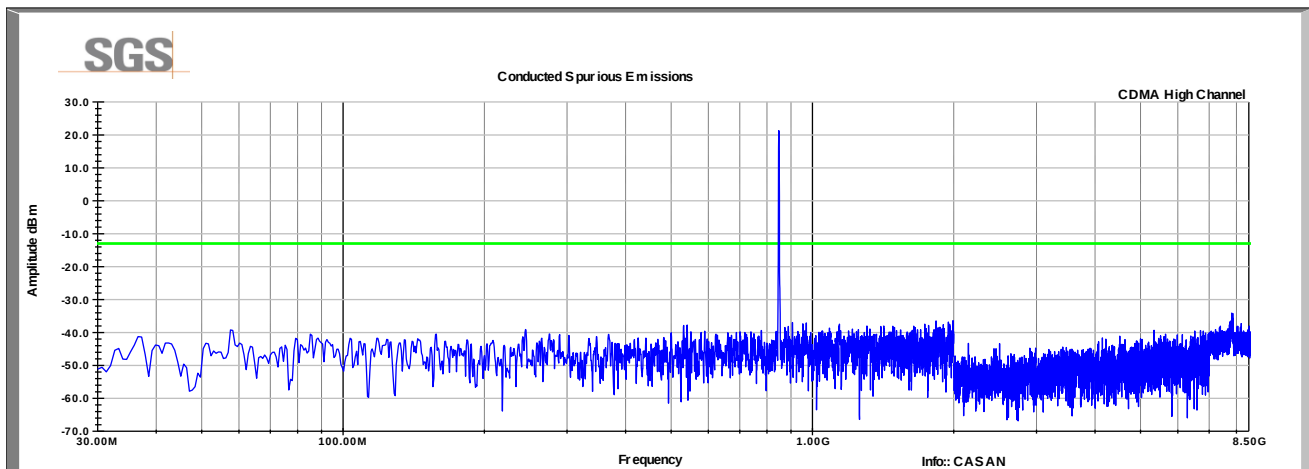
CDMA BC0 Low Channel



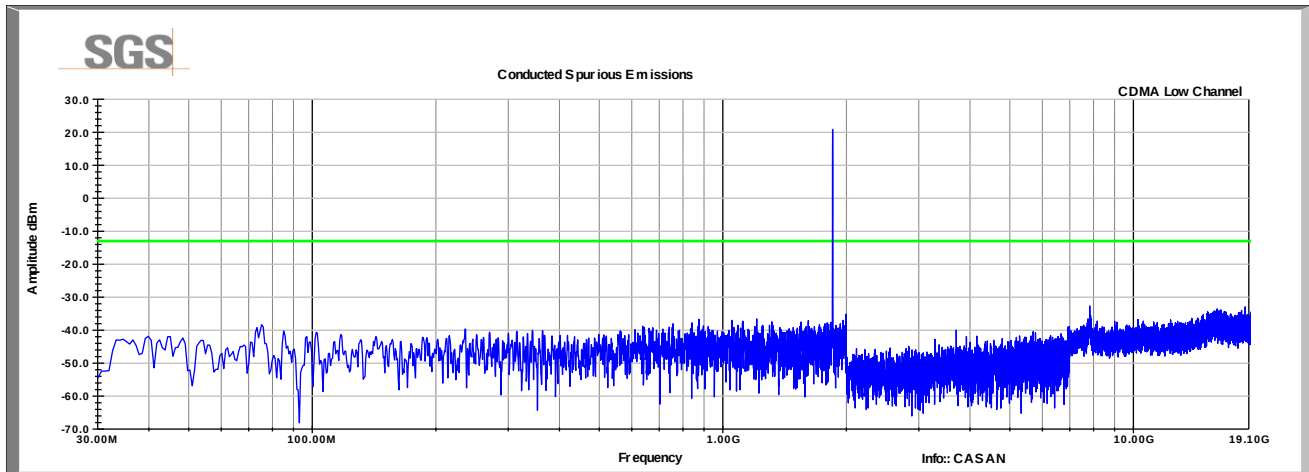
CDMA BC0 Mid Channel



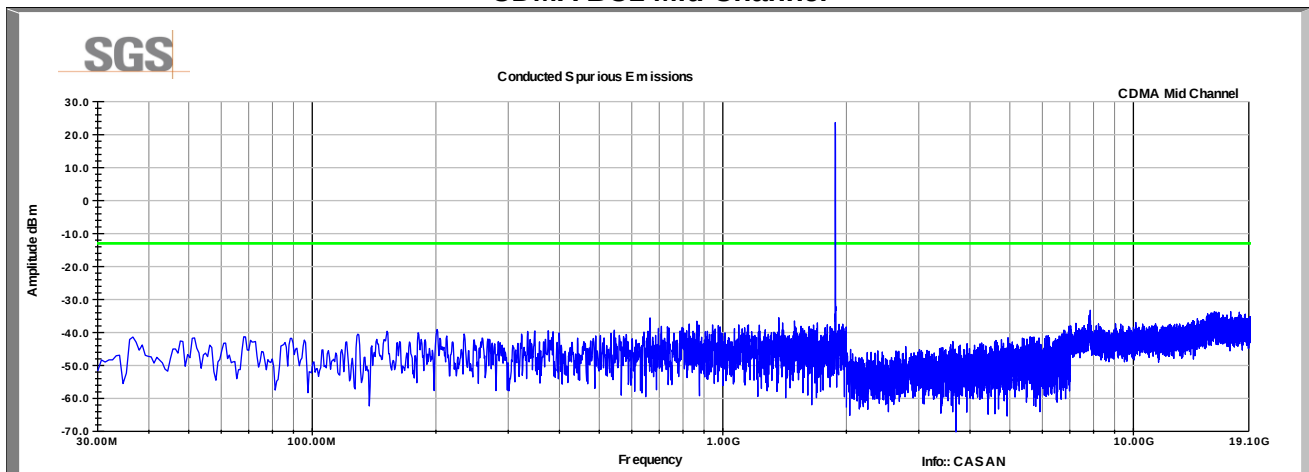
CDMA BC0 High Channel



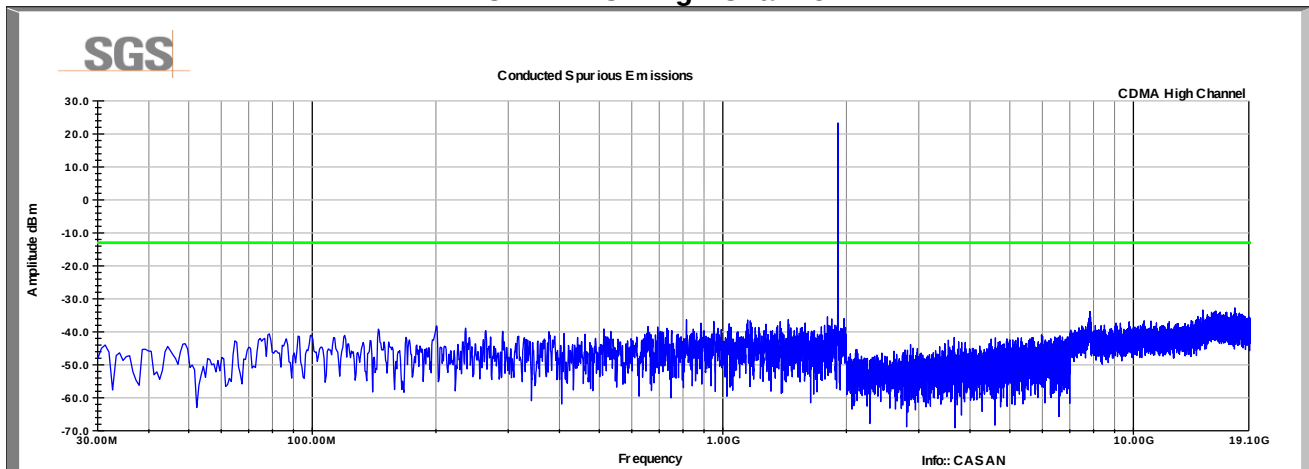
CDMA BC1 Low Channel



CDMA BC1 Mid Channel



CDMA BC1 High Channel



6 Effective Radiated Power

6.1.1 Test Result

Test Description	Basic Standards	Test Result
Effective Radiated Power	FCC Part 22.913(a)(2) RSS-132 5.4	Pass
Effective Isotropic Radiated Power	24.232(c) RSS-133 6.4	Pass

6.1.2 Test Method

Because the CASAN device is provided with a coaxial port but no antenna, ERP/EIRP measurements were taken by measuring the conducted output power and defining the maximum gain antenna that may be used while maintaining compliance with the applicable limits.

6.2 Test Site

SGS EMC Laboratory, Suwanee, GA

6.3 Test Equipment

None

6.4 Test Data

Mode	Band / CH / Freq.	Max Power, dBm	Antenna Gain dBd/dBi	Cable Loss, dB	ERP/EIRP	ERP/EIRP		Result	
					Limit, dBm	Limit, dBm			
					FCC	FCC	IC	FCC	IC
CDMA	BC0 / CH1013 / 824.7 MHz	26	6	1	31	38.5	40.6	PASS	PASS
CDMA	BC0 / CH384 / 836.52 MHz	26	6	1	31	38.5	40.6	PASS	PASS
CDMA	BC0 / CH777 / 848.31 MHz	26	6	1	31	38.5	40.6	PASS	PASS
CDMA	BC1 / CH25 / 1851.25 MHz	26	6	1	31	33	33	PASS	PASS
CDMA	BC1 / CH600 / 1880 MHz	26	6	1	31	33	33	PASS	PASS
CDMA	BC1 / CH1175 / 1908.75 MHz	26	6	1	31	33	33	PASS	PASS

Note: Antenna gain was determined from maximum gain while still meeting the RF exposure requirements for simultaneous transmissions.

7 Radiated Spurious Emissions

7.1 Test Result

Test Description	Basic Standards	Test Result
Radiated Spurious Emissions	FCC Part 2.1053 FCC Part 22.917(a) FCC Part 24.238(a) RSS-132 5.5 RSS-133 6.5 ANSI/TIA-603-C-2004	Pass

7.2 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 10th 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 measurements were conducted at the low, middle, and high channels in RC3/SO55 which was determined to be the worst case operating mode.

7.3 Test Equipment

Test Start Date: 28-Aug-2014

Test End Date: 5-Sep-2014

Tester: FL / JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	28-Jul-2015
BILOG ANTENNA	CBL 6143A	TESEQ	B085931	29-Oct-2014
DRG HORN (MEDIUM)	3117	ETS-LINDGREN	B079691	24-Jun-2015
DRG HORN (SMALL)	3116B	ETS-LINDGREN	B079695	13-Mar-2015
PREAMPLIFIER-ANTENNA SYS	TS-PR18	ROHDE & SCHWARZ	B094463	13-Feb-2015
FIXED GAIN AMPLIFIER	NSP1840-HG	MITEQ	B087572	31-Oct-2014
17 FT N TYPE COAX CABLE	HS 84133232	HUBER&SUHNER	B079661	4-Aug-2015
RF CABLE - 12000MM (10KHZ - 18GHZ)	SF106	HUBER&SUHNER	B079714	4-Aug-2015
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079822	6-Aug-2015
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079823	6-Aug-2015

- Unless otherwise noted, equipment is on a 1 year calibration cycle.

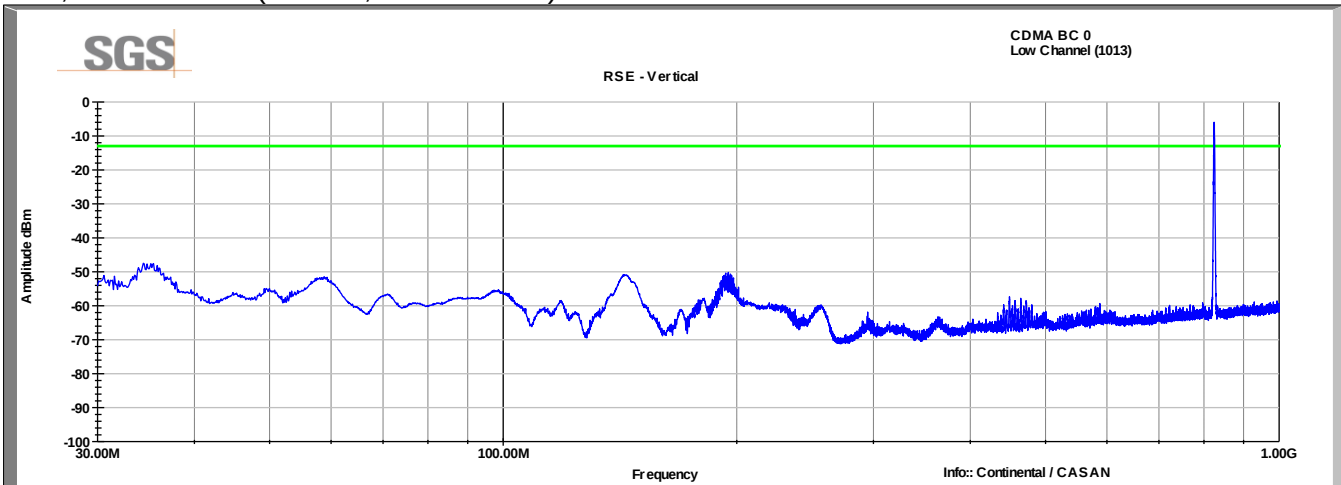
7.4 Test Data

Test Date(s): 28 August - 05 September 2014

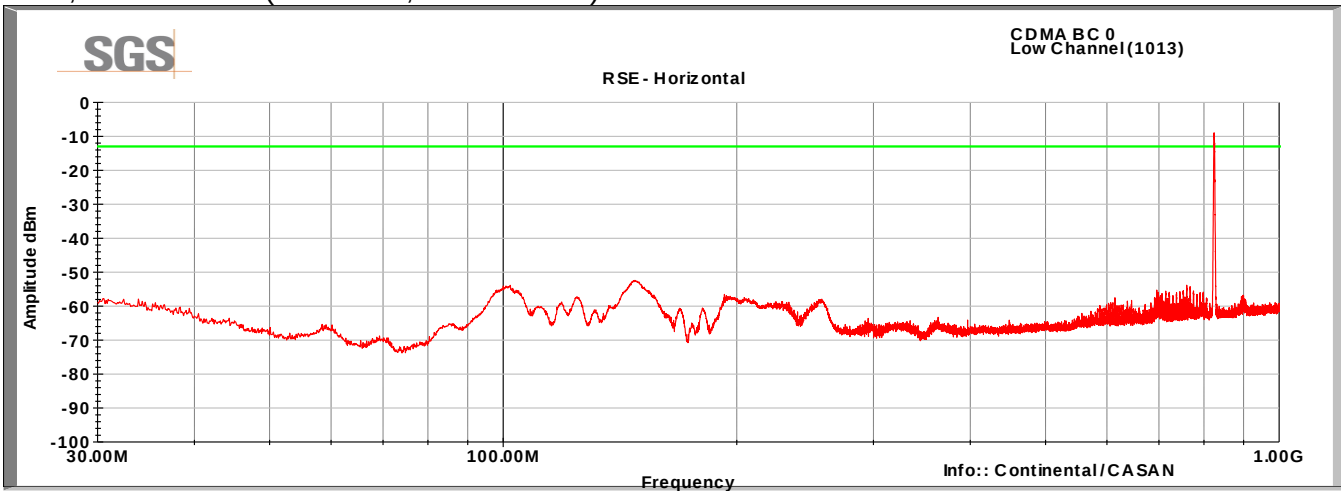
There were no spurious emissions within 20 dB of the limit.

7.5 Plots

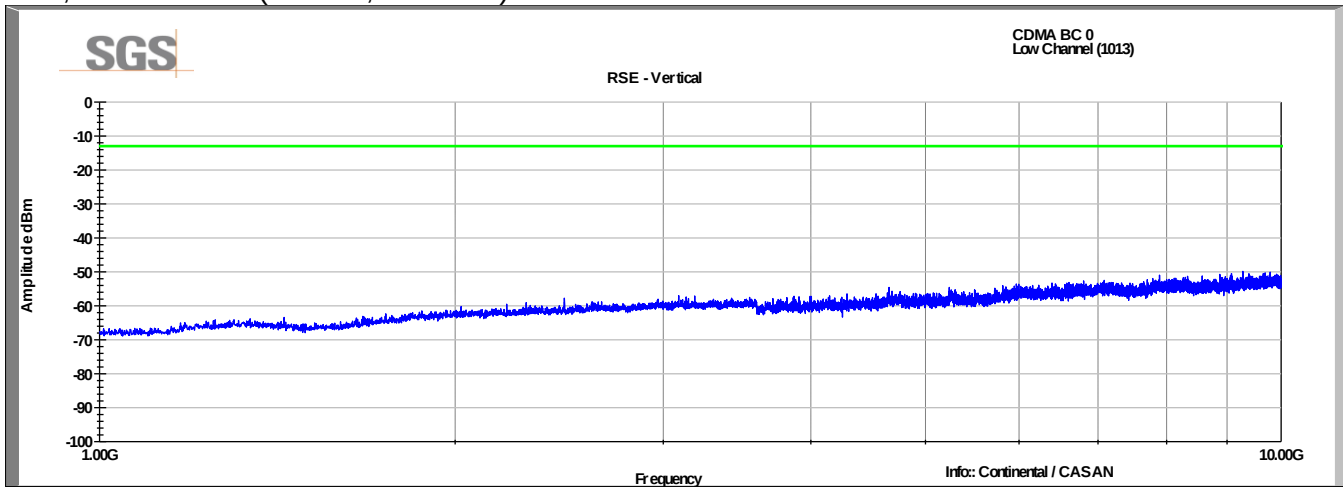
BC0, Low Channel (Vertical, 30-1000MHz)



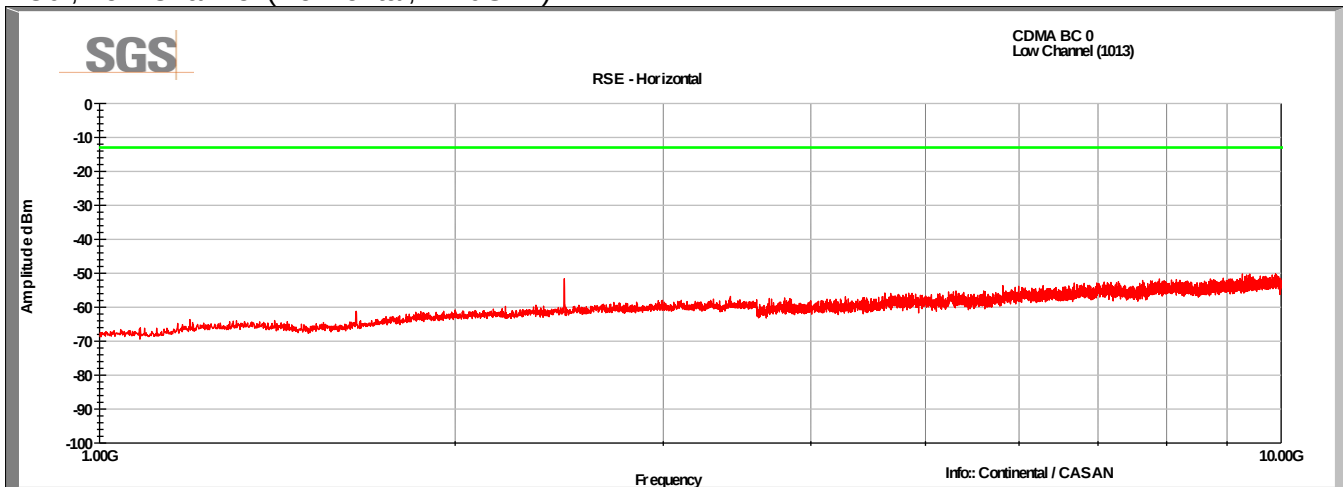
BC0 , Low Channel (Horizontal, 30-1000MHz)



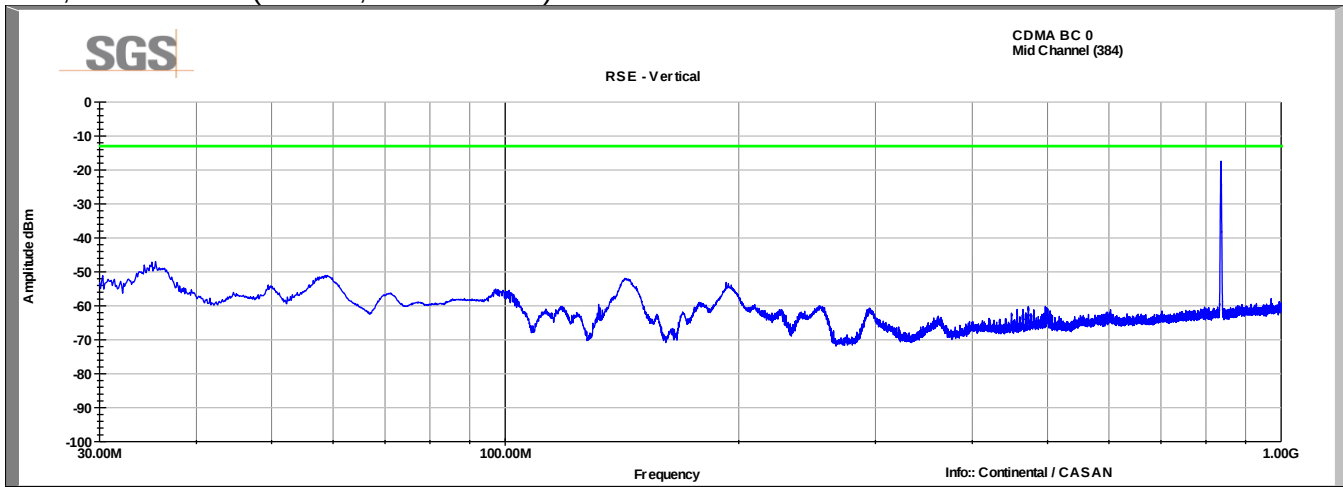
BC0, Low Channel (Vertical, 1-10GHz)



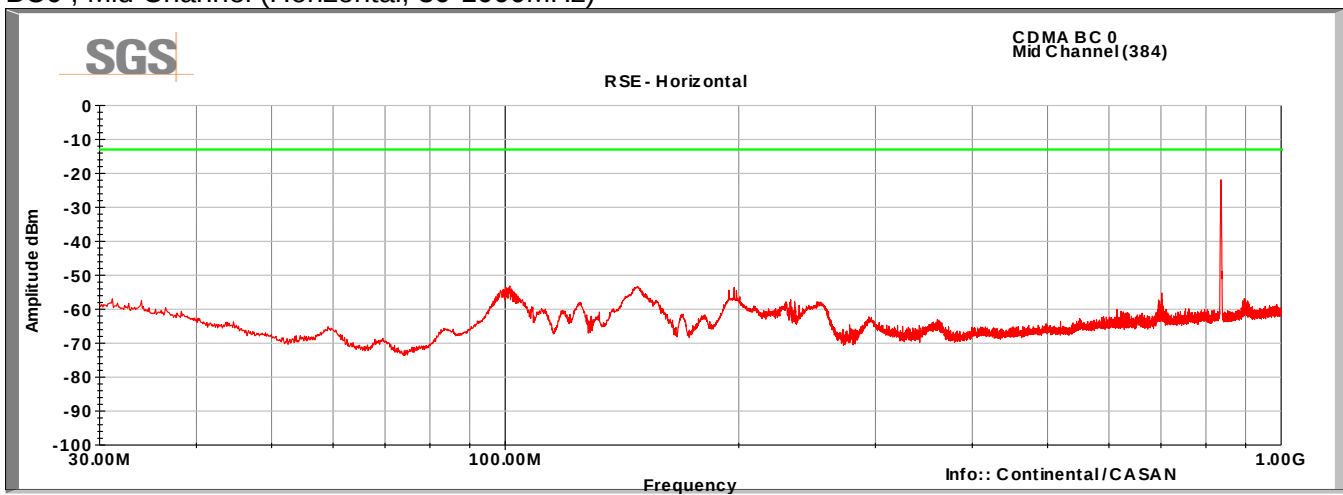
BC0 , Low Channel (Horizontal, 1-10GHz)



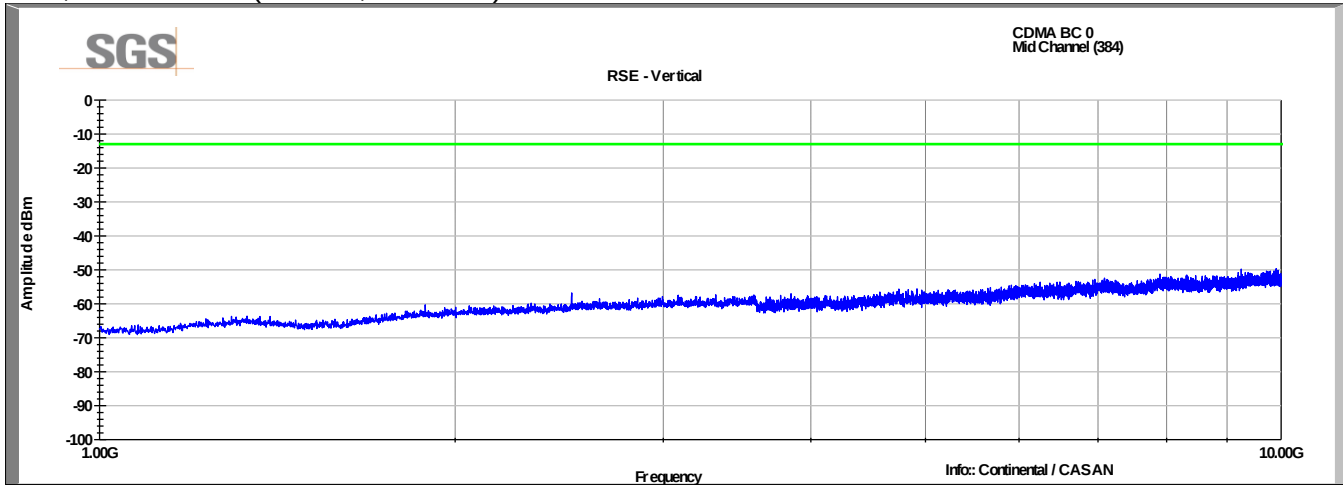
BC0, Mid Channel (Vertical, 30-1000MHz)



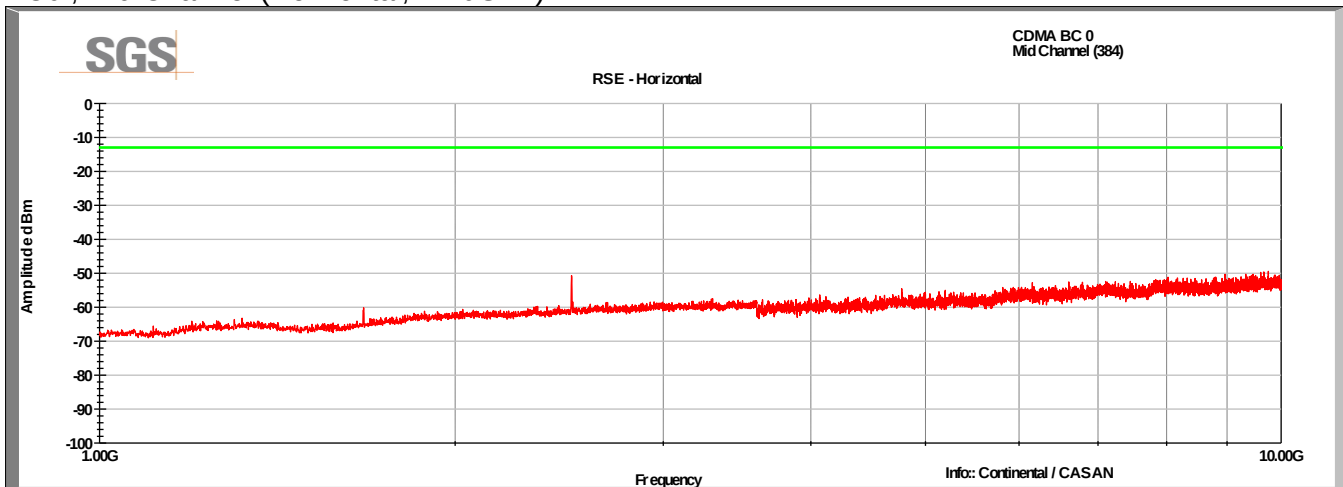
BC0, Mid Channel (Horizontal, 30-1000MHz)



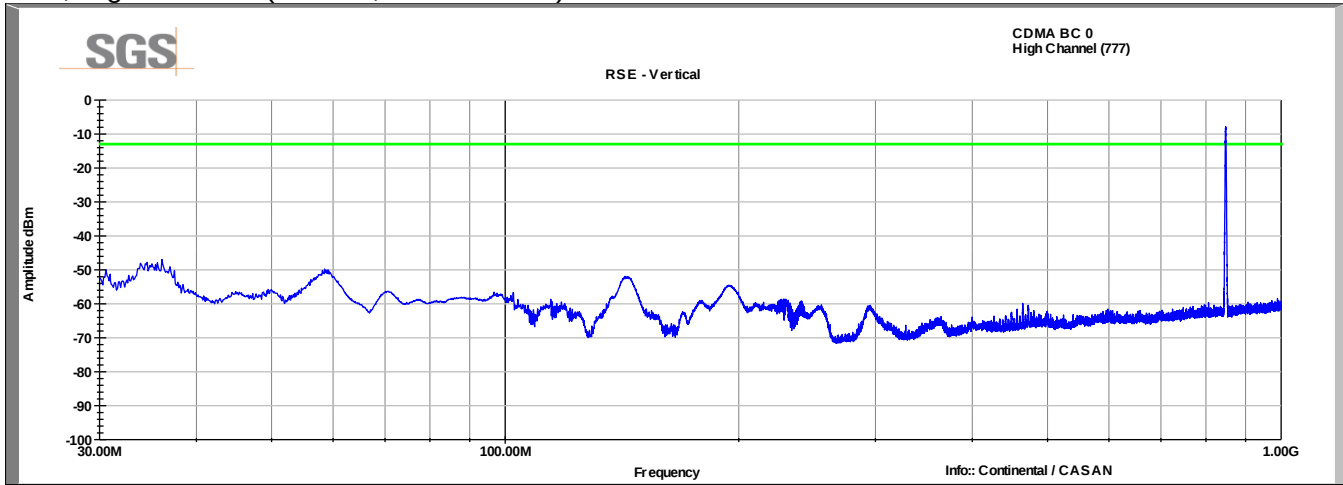
BC0, Mid Channel (Vertical, 1-10GHz)



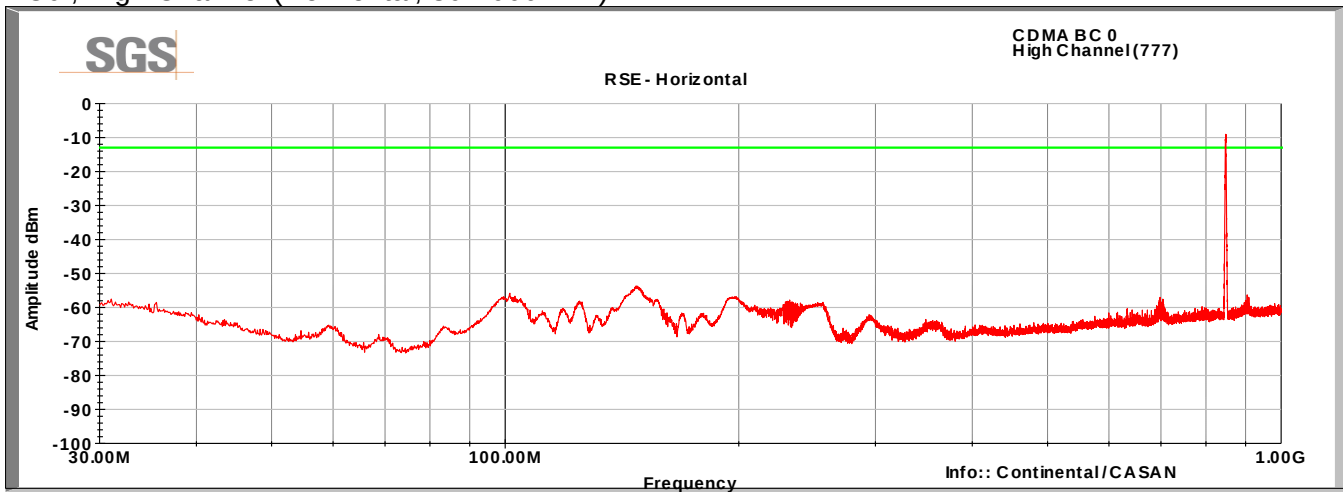
BC0 , Mid Channel (Horizontal, 1-10GHz)



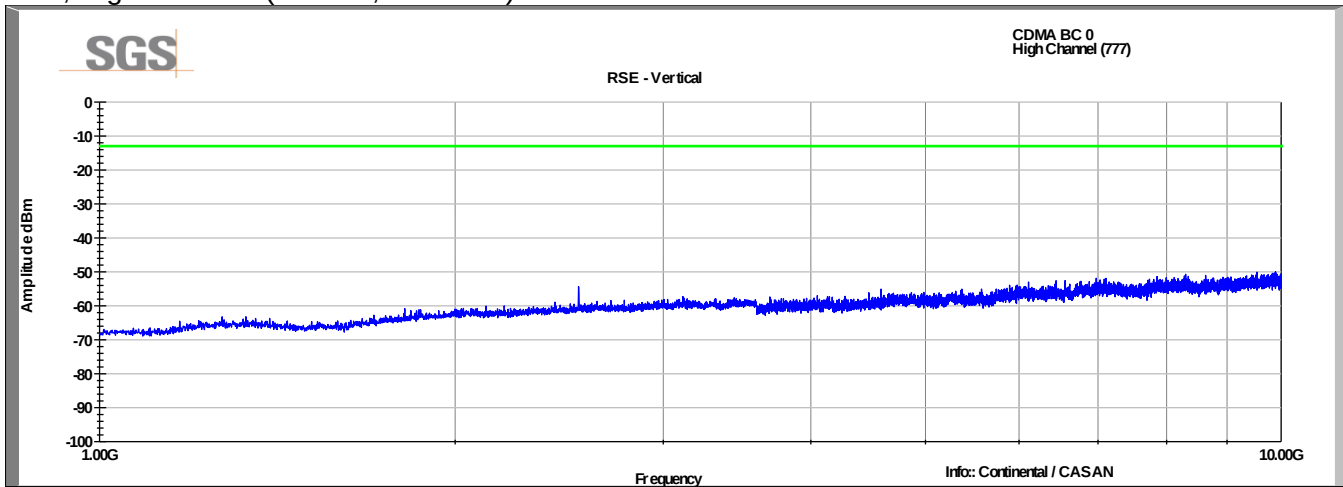
BC0, High Channel (Vertical, 30-1000MHz)



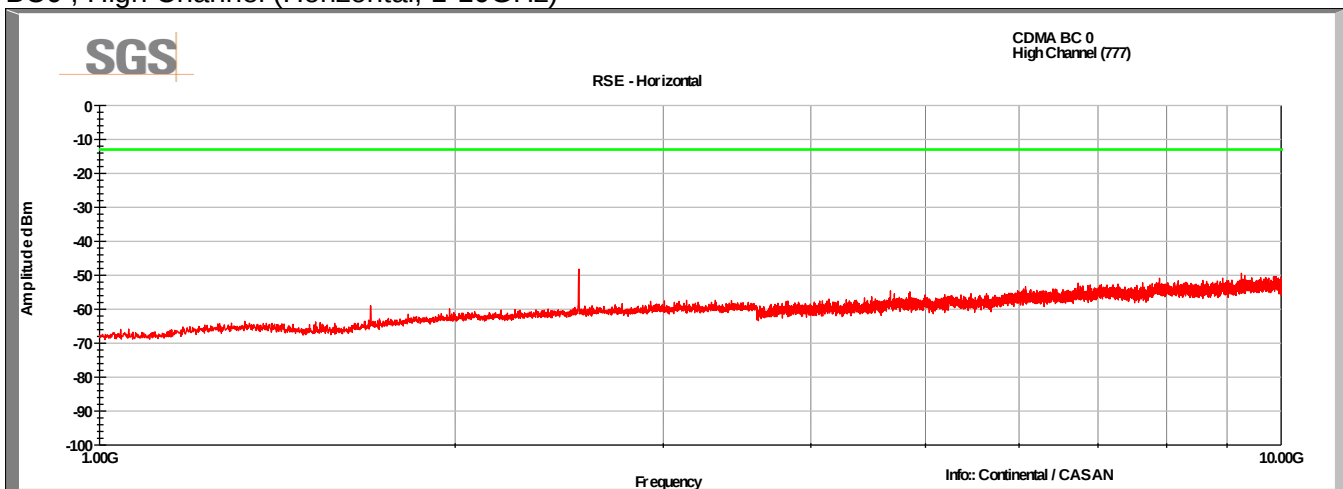
BC0, High Channel (Horizontal, 30-1000MHz)



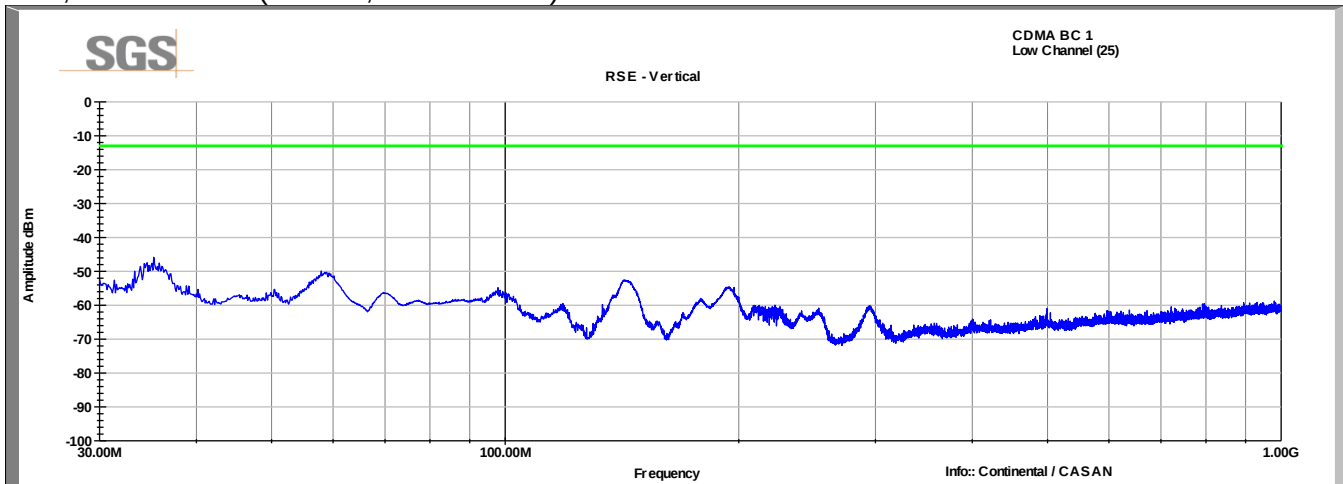
BC0, High Channel (Vertical, 1-10GHz)



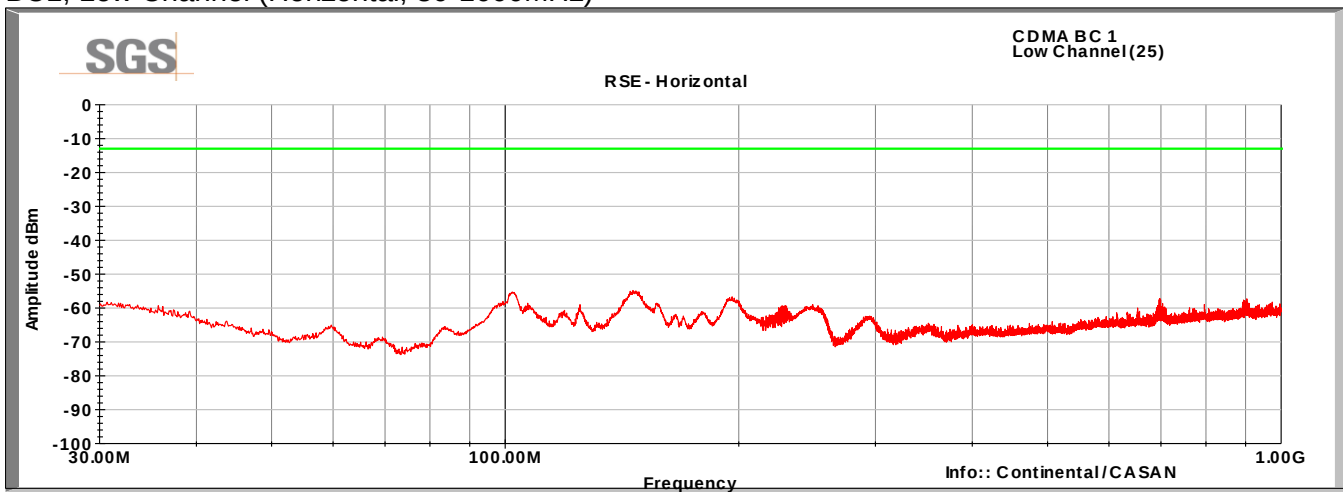
BC0 , High Channel (Horizontal, 1-10GHz)



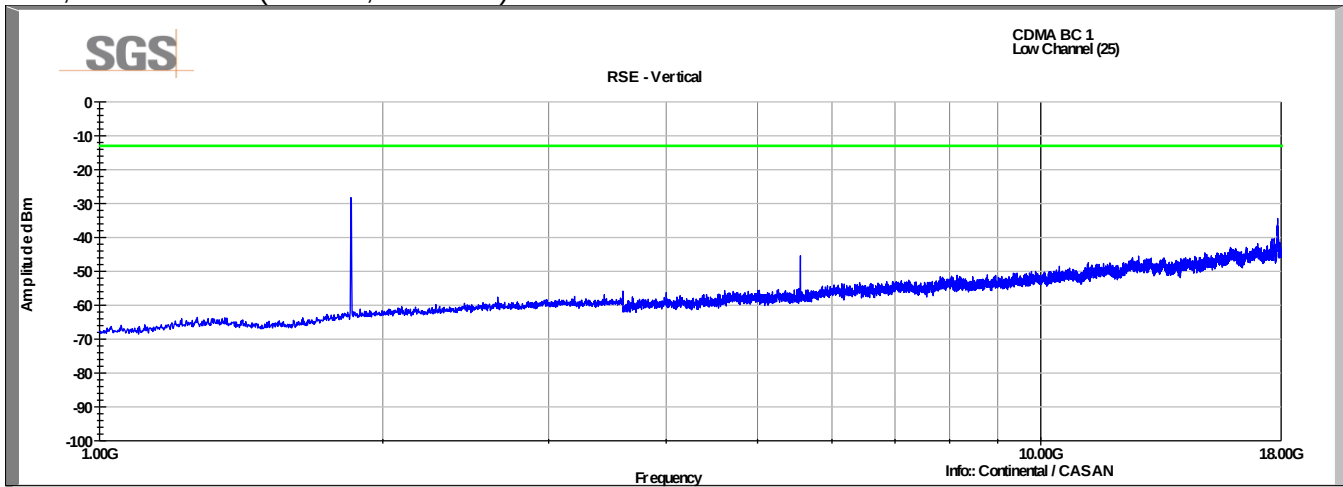
BC1, Low Channel (Vertical, 30-1000MHz)



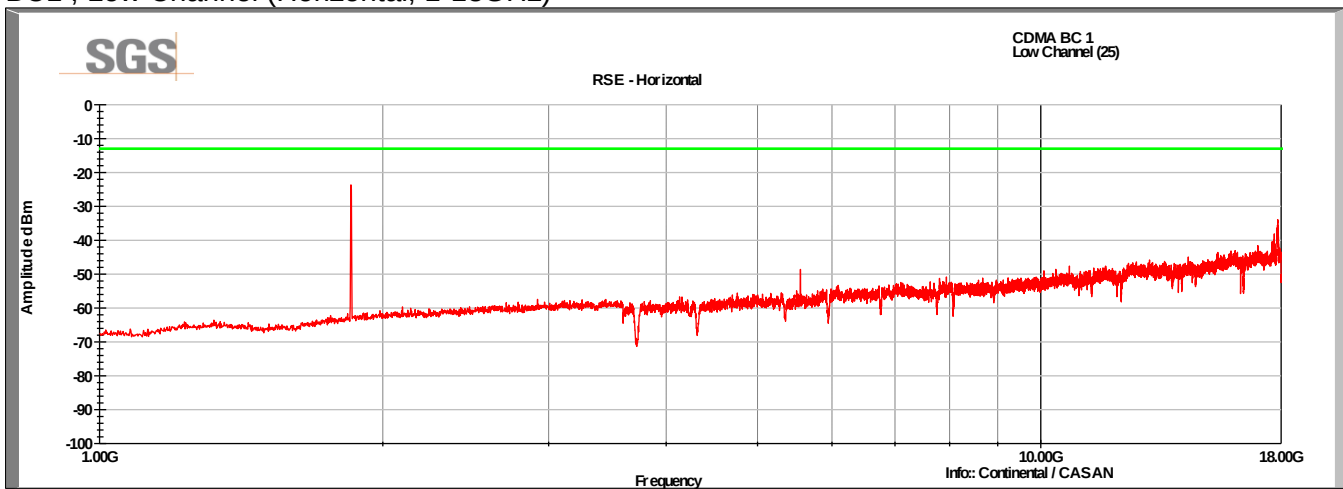
BC1, Low Channel (Horizontal, 30-1000MHz)



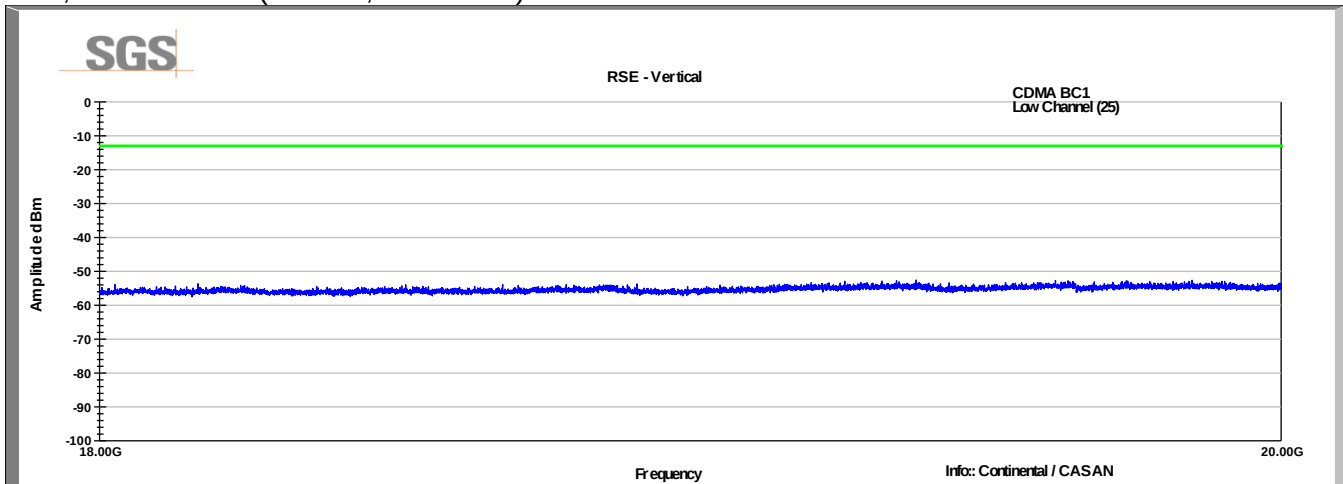
BC1, Low Channel (Vertical, 1-18GHz)



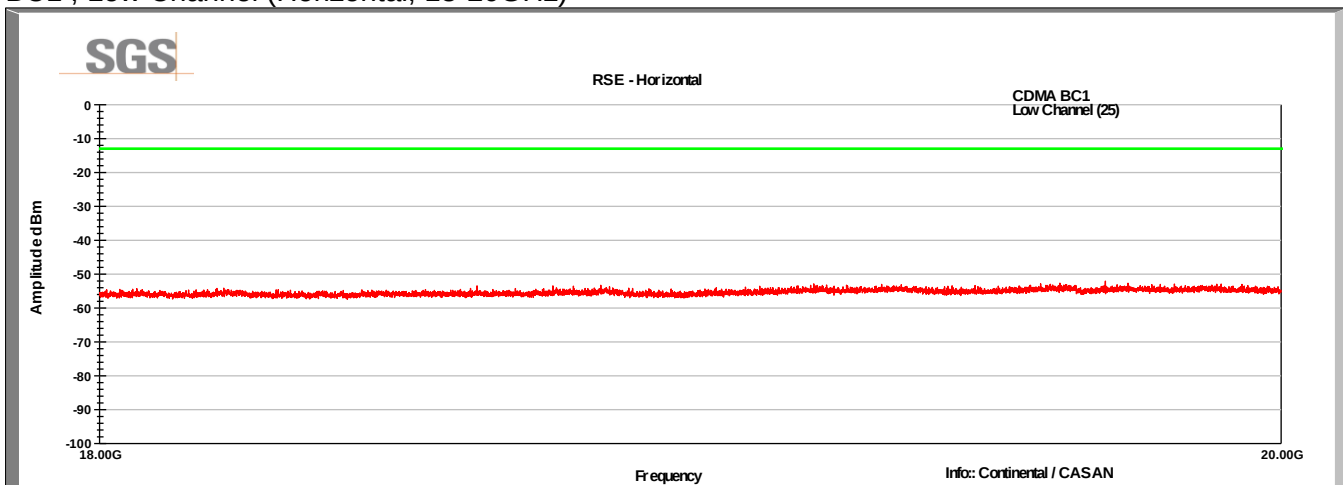
BC1 , Low Channel (Horizontal, 1-18GHz)



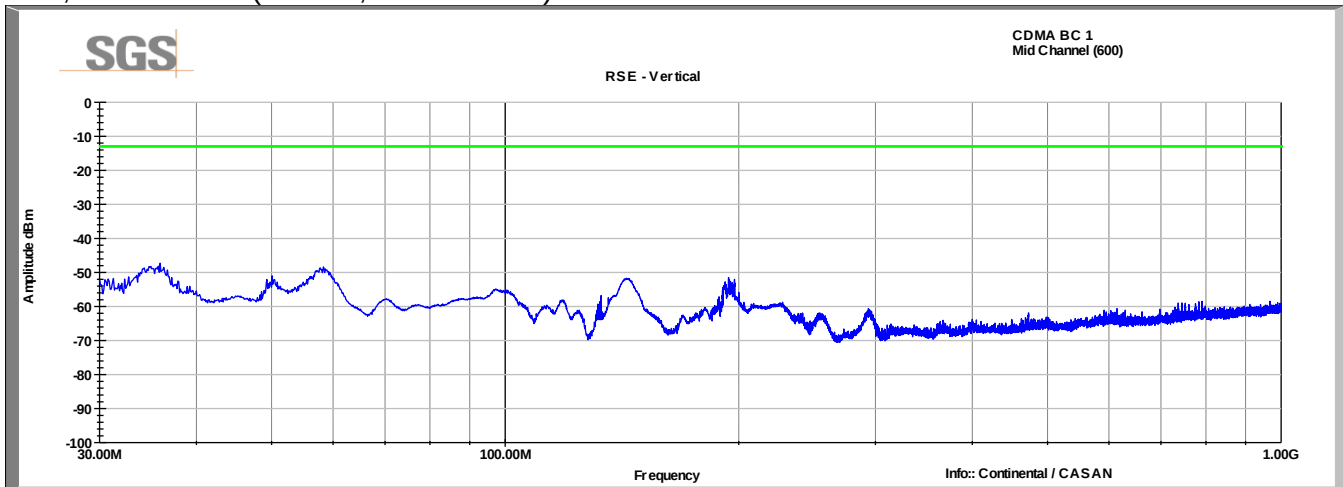
BC1, Low Channel (Vertical, 18-20GHz)



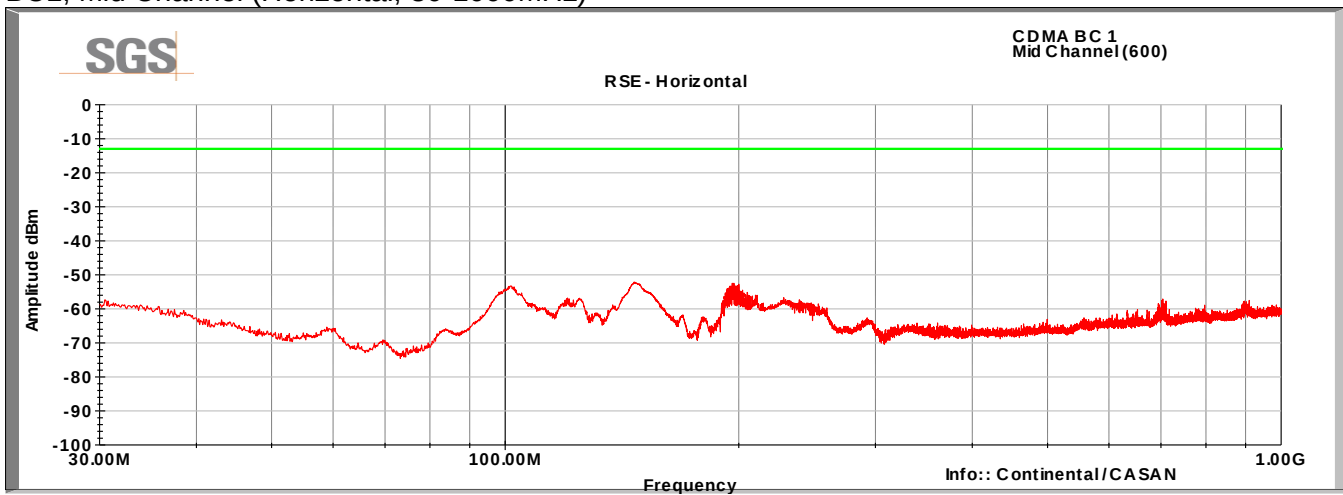
BC1 , Low Channel (Horizontal, 18-20GHz)



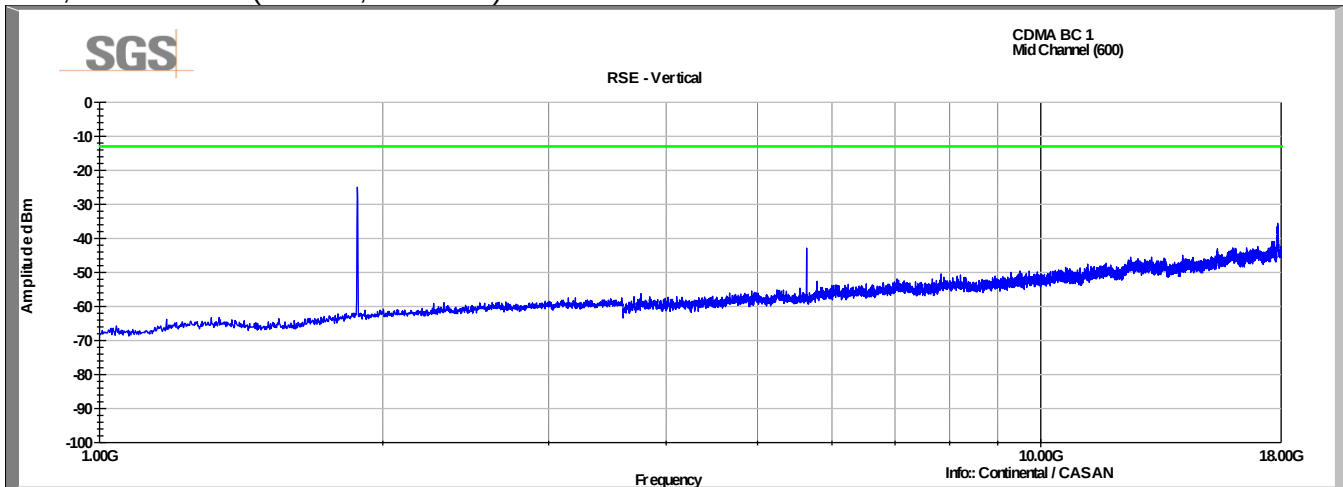
BC1, Mid Channel (Vertical, 30-1000MHz)



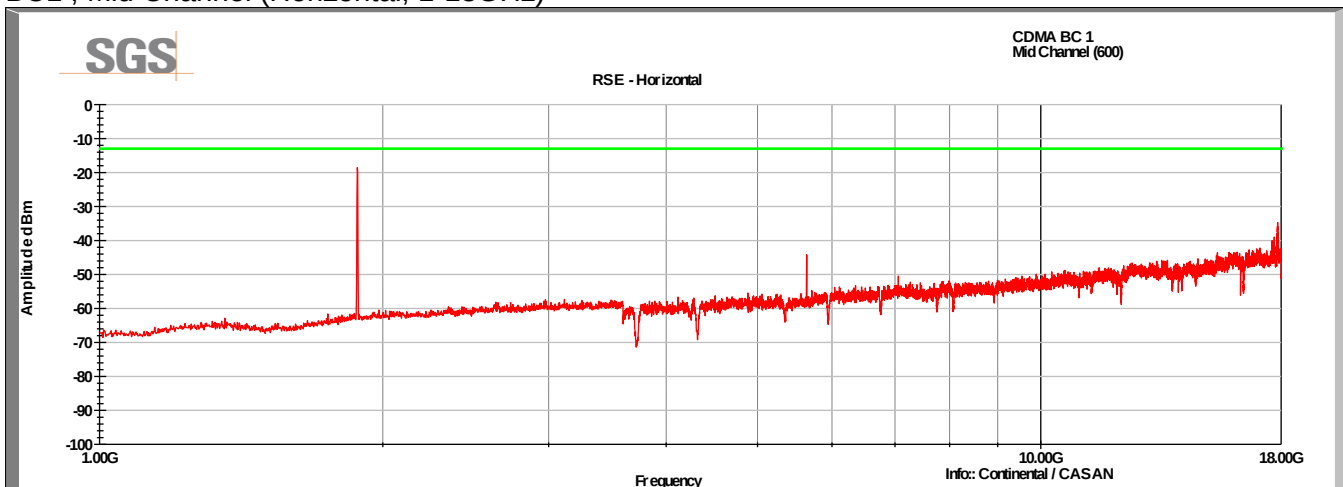
BC1, Mid Channel (Horizontal, 30-1000MHz)



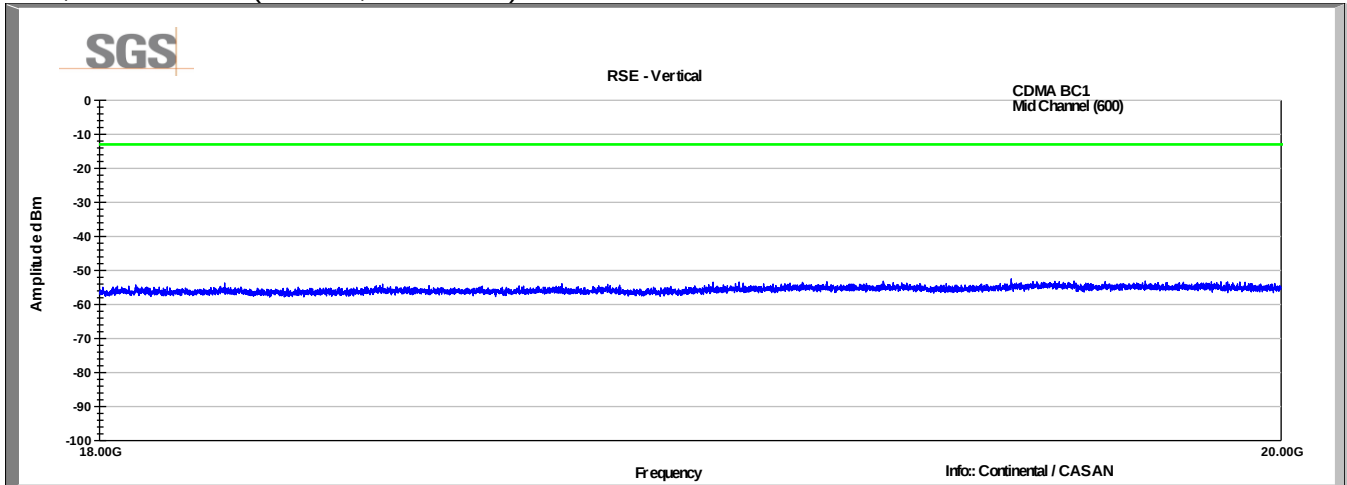
BC1, Mid Channel (Vertical, 1-18GHz)



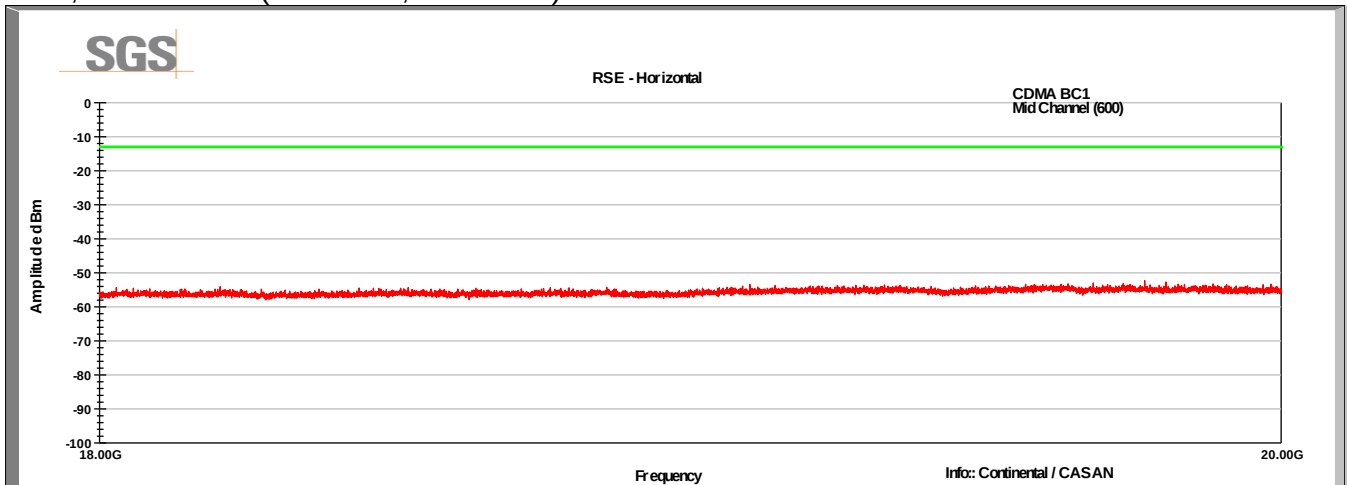
BC1, Mid Channel (Horizontal, 1-18GHz)



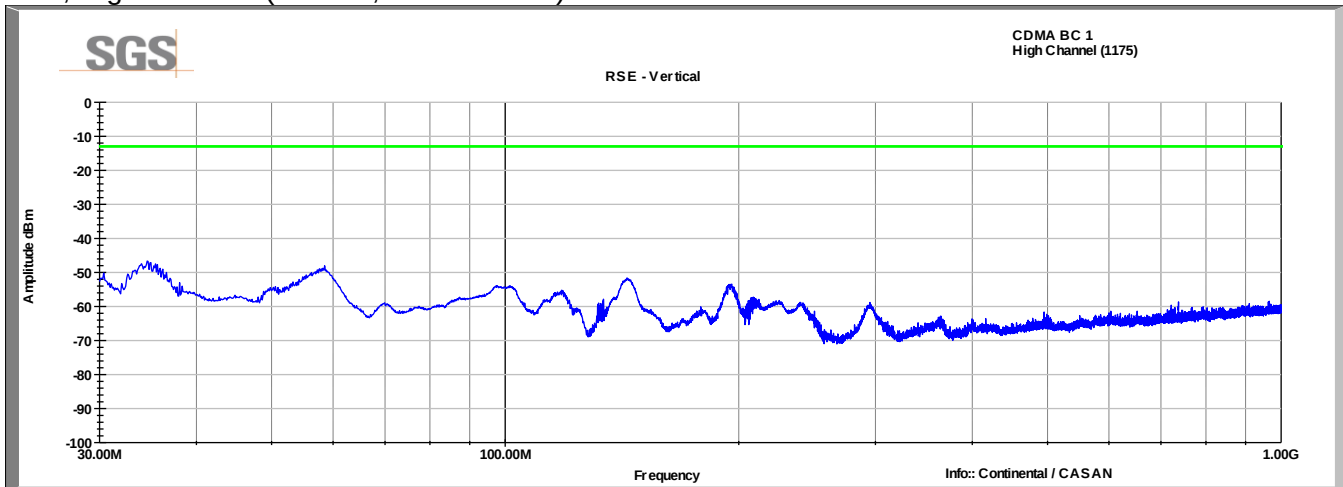
BC1, Mid Channel (Vertical, 18-20GHz)



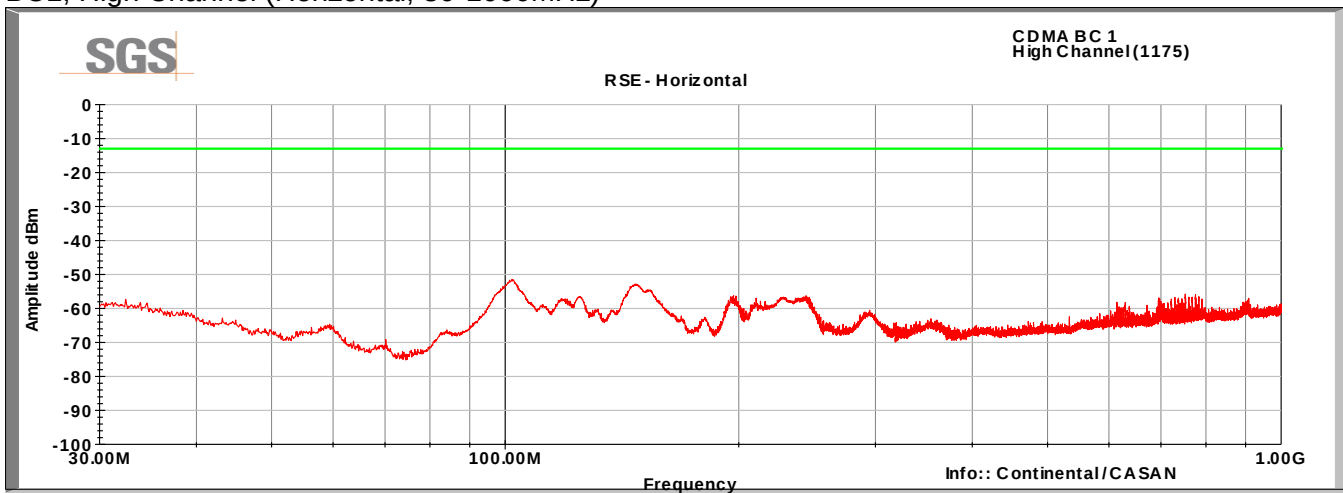
BC1, Mid Channel (Horizontal, 18-20GHz)



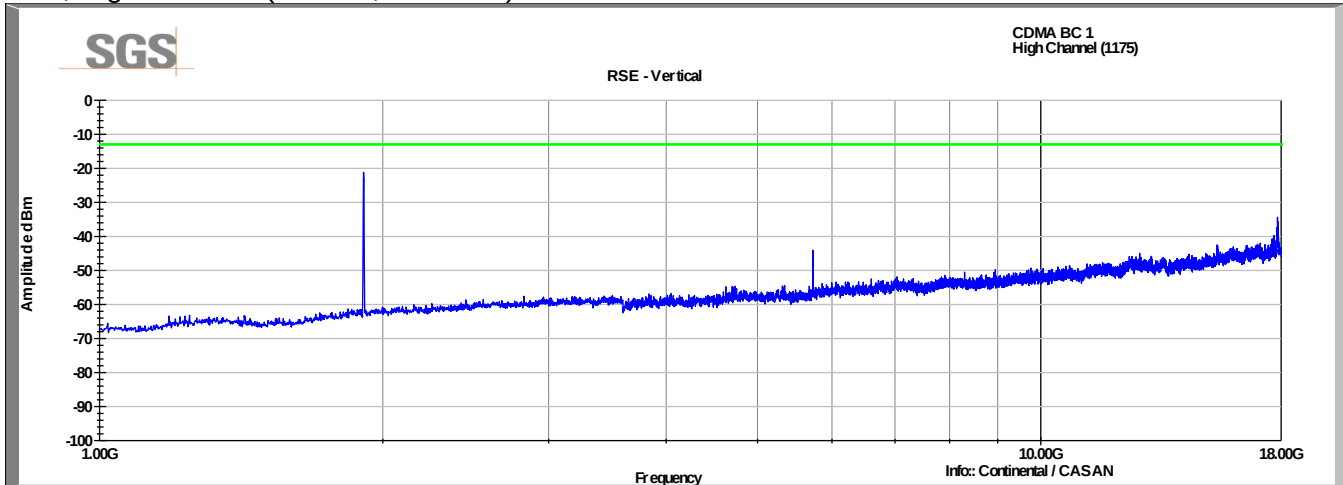
BC1, High Channel (Vertical, 30-1000MHz)



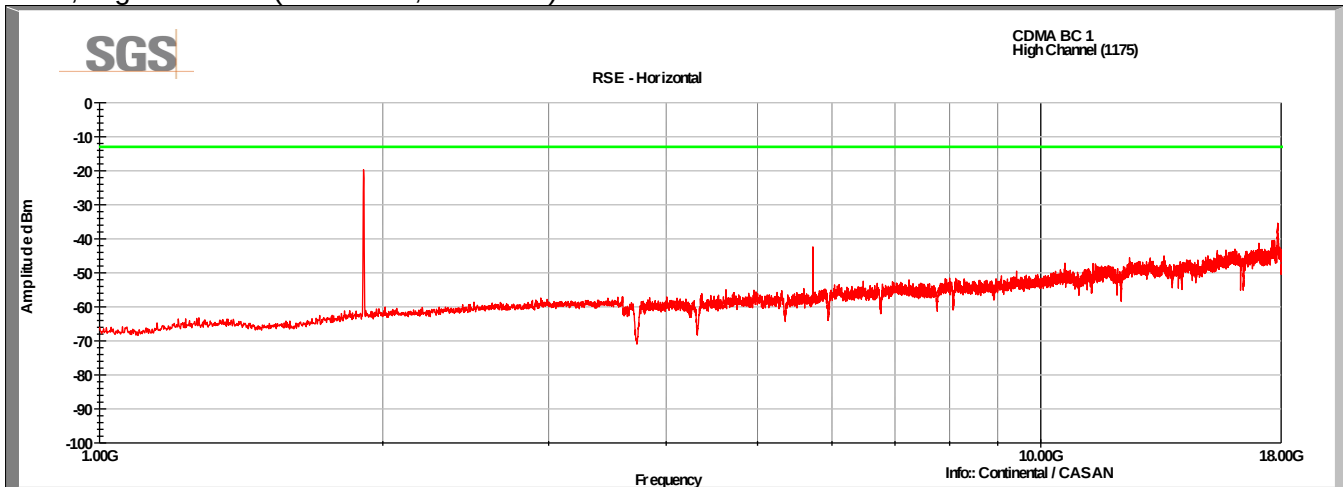
BC1, High Channel (Horizontal, 30-1000MHz)



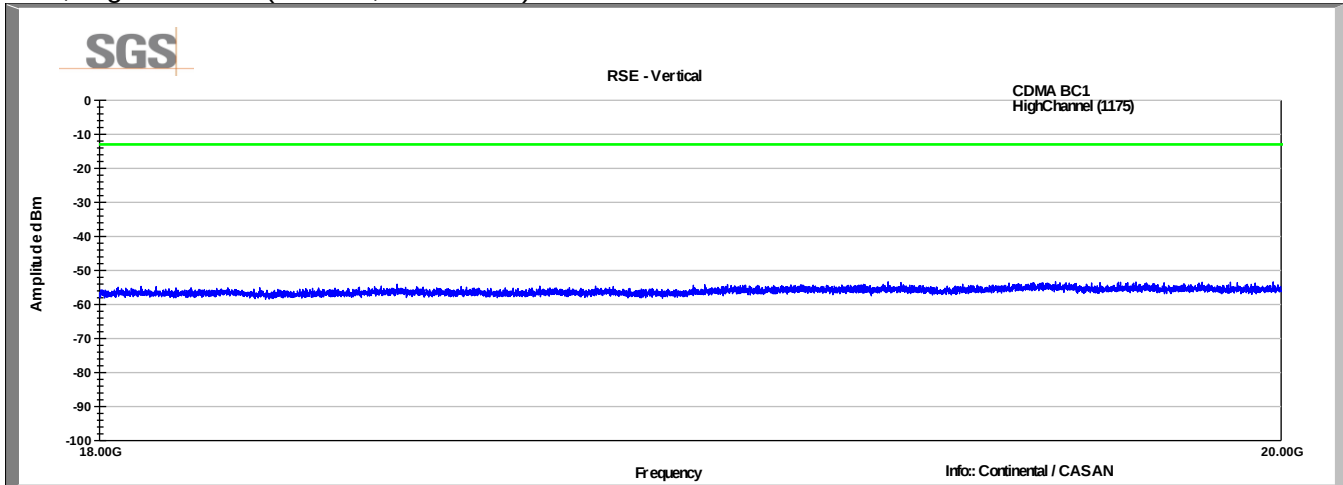
BC1, High Channel (Vertical, 1-18GHz)



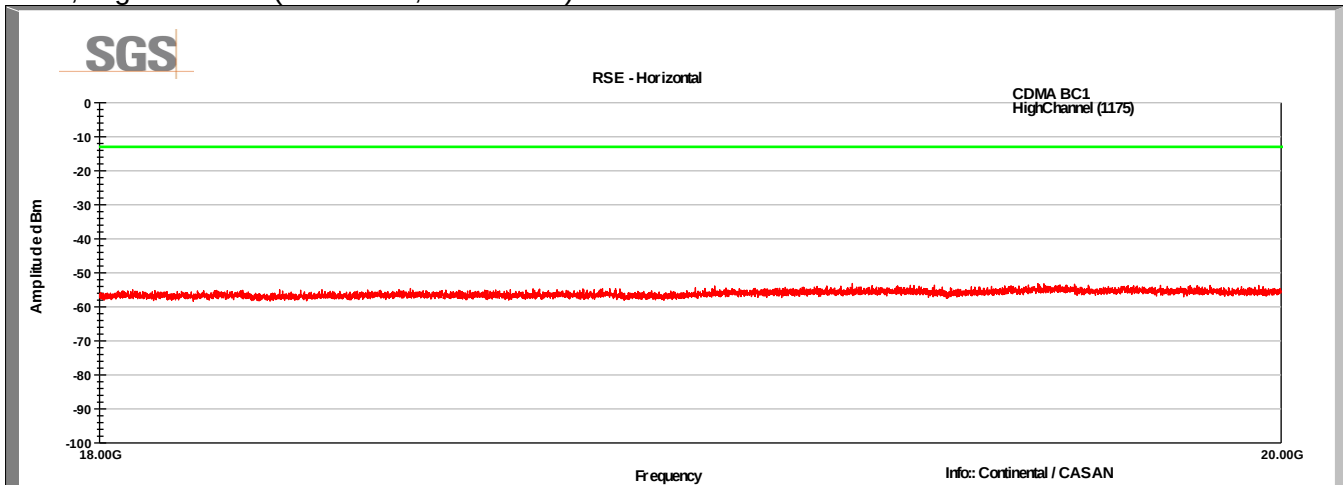
BC1 , High Channel (Horizontal, 1-18GHz)



BC1, High Channel (Vertical, 18-20GHz)



BC1, High Channel (Horizontal, 18-20GHz)



8 Frequency Stability

8.1 Test Result

Test Description	Basic Standards	Test Result
Frequency Stability	FCC Part 2.1055 FCC Part 22.917(a) FCC Part 24.238(a) RSS-132 5.3 RSS-132 6.3	Pass

8.2 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. The EUT was tested at BC0 channel 283 and BC1 channel 150.

8.3 Test Site

SGS EMC Laboratory, Suwanee, GA

8.4 Test Equipment

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
CMW500 WIDEBAND RADIO COMMUNICATIONS TESTER	CMW500	ROHDE & SCHWARZ	B085757	29-Oct-2014
ENVIRONMENTAL CHAMBER	SM-16-8200	THERMOTRON	B079728	5-Aug-2015

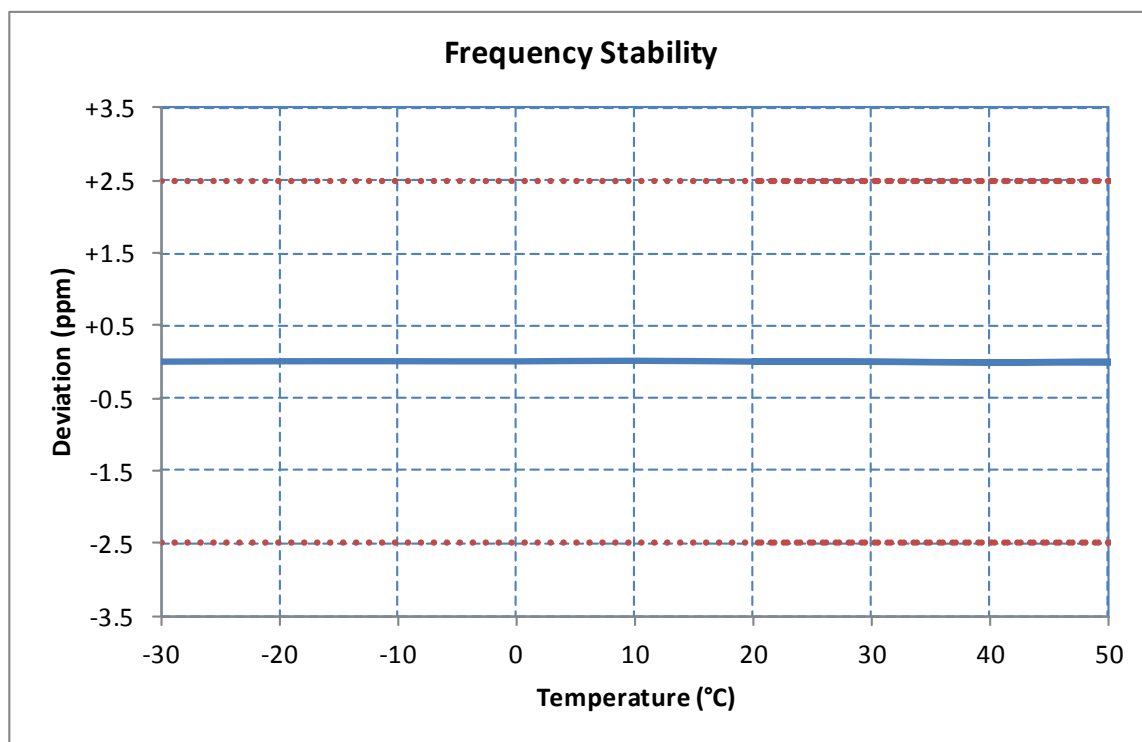
- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 is on a 3 year calibration cycle.

8.5 Test Data

Test Date: 06 Sept 2013

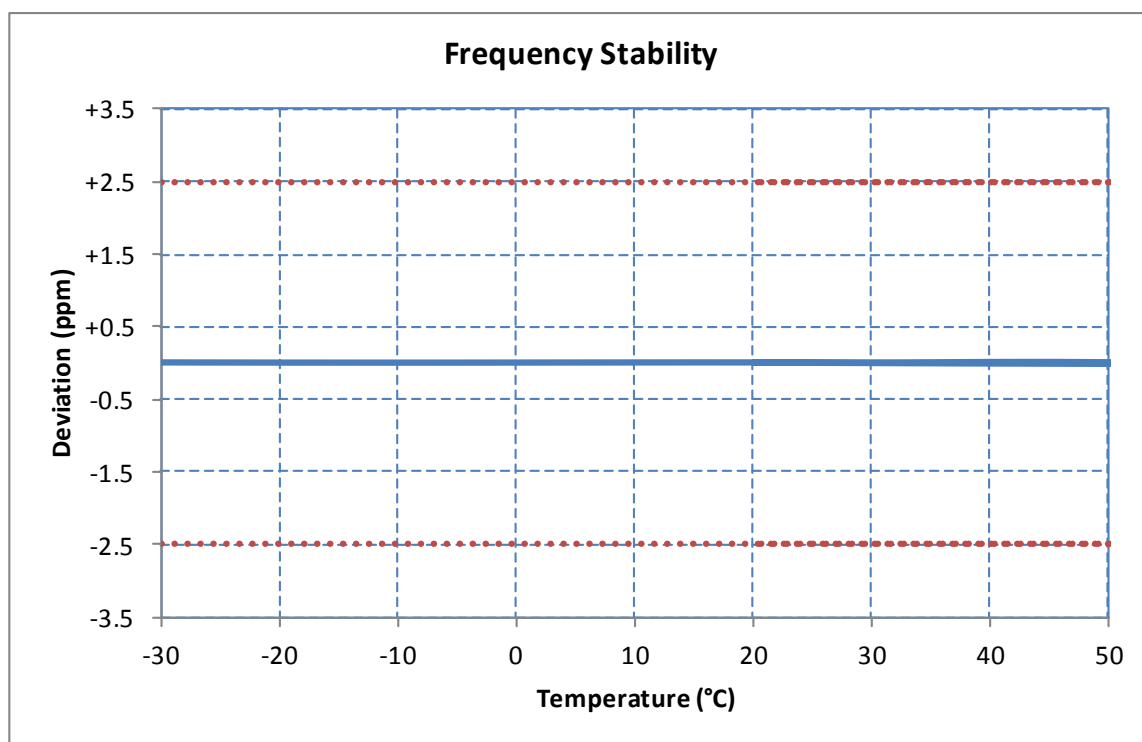
CDMA, Band BC0, Channel 283 (833.49MHz)

Voltage %	Power V _{DC}	Temp °C	Frequency Hz	Freq Dev Hz	Freq Dev ppm	Deviation %
100%	12.00	+20 (Ref)	833,490,000	0	+0.00	+0.000000
100%	12.00	-30	833,490,003	3	+0.00	+0.000000
100%	12.00	-20	833,490,004	4	+0.01	+0.000001
100%	12.00	-10	833,490,004	4	+0.01	+0.000001
100%	12.00	0	833,490,004	4	+0.00	+0.000000
100%	12.00	+10	833,490,006	6	+0.01	+0.000001
100%	12.00	+20	833,490,003	3	+0.00	+0.000000
100%	12.00	+30	833,490,003	3	+0.00	+0.000000
100%	12.00	+40	833,489,999	-1	-0.00	-0.000000
100%	12.00	+50	833,490,003	3	+0.00	+0.000000
100%	12.00	+55	833,489,997	-3	-0.00	-0.000000
100%	13.80	+20	833,490,004	4	+0.00	+0.000000
100%	10.20	+20	833,490,004	4	+0.01	+0.000001



CDMA Band BC1, Channel 150 (1857.5MHz)

Voltage %	Power V_{DC}	Temp °C	Frequency Hz	Freq Dev Hz	Freq Dev ppm	Deviation %
100%	12.00	+20 (Ref)	1,857,500,000	+0	+0.00	+0.000000
100%	12.00	-30	1,857,500,007	+7	+0.00	+0.000000
100%	12.00	-20	1,857,500,005	+5	+0.00	+0.000000
100%	12.00	-10	1,857,500,004	+4	+0.00	+0.000000
100%	12.00	0	1,857,500,005	+5	+0.00	+0.000000
100%	12.00	+10	1,857,500,007	+7	+0.00	+0.000000
100%	12.00	+20	1,857,500,007	+7	+0.00	+0.000000
100%	12.00	+30	1,857,500,005	+5	+0.00	+0.000000
100%	12.00	+40	1,857,500,012	+12	+0.01	+0.000001
100%	12.00	+50	1,857,500,009	+9	+0.00	+0.000000
100%	12.00	+55	1,857,499,989	-12	-0.01	-0.000001
100%	13.80	+20	1,857,500,005	+5	+0.00	+0.000000
100%	10.20	+20	1,857,500,005	+5	+0.00	+0.000000



9 Peak to Average Ratio

9.1 Test Result

Test Description	Basic Standards	Test Result
Peak to Average Ratio	FCC Part 24.232(d) RSS-132 5.4 RSS-133 6.4	Pass

9.2 Test Method

KDB document 971168 D01 Power Meas License Digital Systems v02r01 was used to determine peak-to-average ratio. For the CDMA measurement, Clause 5.7.1 was used which defined the measurement method using the CCDF function of the spectrum analyzer.

9.3 Test Site

SGS EMC Laboratory, Suwanee, GA

9.4 Test Equipment

Test Date: 27 Aug 2014

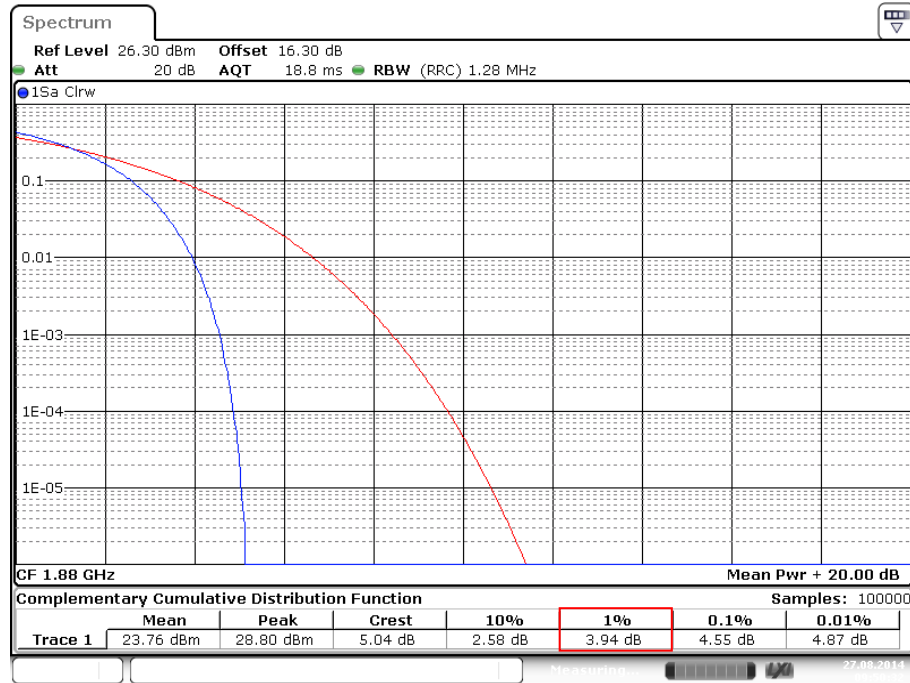
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
CMW500 WIDEBAND RADIO COMMUNICATIONS TESTER	CMW500	ROHDE & SCHWARZ	B085757	29-Oct-2014
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	28-Aug-2015
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101743	8-Aug-2015
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079822	6-Aug-2015
COAXIAL CABLE	SUCOFLEX 102	HUBER&SUHNER	B079824	6-Aug-2015

- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 is on a 3 year calibration cycle.

9.5 Test Data

Test Date: 27 Aug 2014

CDMA BC1



Date: 27.AUG.2014 09:50:32

10 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	09 Sept 2014
1	- ANSI/TIA-603-C-2004 reference added to page 16 - Added 3-year calibration cycle info for the CMW-500 to pages 7, 8, 11, 33, 36	03 October 2014