

EMC Test Report

Project Number: 4049639

Report Number: 4049639EMC01

Revision Level: 0

Client: Continental Automotive Systems, Inc.

Equipment Under Test: Wireless Modem Module

Model: CUW

FCC ID: LHJ-CUW

FCC Rule Parts: Part 24E

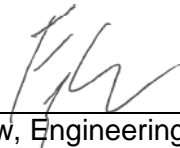
Industry Canada: RSS-GEN, Issue 4

RSS-133, Issue 6

Report issued on: 09 November 2016


Test Result: Compliant

Tested by:



Fendy Liauw, Engineering Technician

Reviewed by:



Jeremy Pickens, Senior EMC Engineer

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

Reference Sections		Test Description	Test Limit	Test Condition	Test Result
FCC	IC				
2.1046	RSS-GEN (6.12)	Conducted Output Power	N/A	Conducted	Pass
24.232(d)	RSS-133 (6.4)	Peak-to-Average Ratio	<13 dB		Pass
2.1049 24.238(a)	RSS-GEN (6.6) RSS-133 (2.3)	Occupied Bandwidth	N/A		Reported
2.1051 24.238(a)	RSS-133 (6.5.1)	Band Edge / Conducted Spurious Emissions	$< 43 + 10\log_{10}(P_{[Watts]})$ at band edge and for all out of band emissions		Pass
2.1055 24.238(a)	RSS-GEN (6.11) RSS-133 (6.3)	Frequency Stability	<2.5 ppm		Pass
24.232(c)	RSS-133 (6.4)	Effective Isotropic Radiated Power	< 1 Watts max EIRP	Radiated	Pass
2.1053 24.238(a)	RSS-GEN (6.13) RSS-133 (6.5.1)	Radiated Spurious Emissions	$< 43 + 10\log_{10}(P_{[Watts]})$ at band edge and for all out of band emissions		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: CUW
Serial Number: Not Labeled

FCC ID: LHJ- CUW

IMEI Number: 352599076105365

Rated Voltage: 10.2 – 13.8 Vdc
Test Voltage: 12 Vdc,
Tx Frequency Range: 1850 - 1910 MHz (WCDMA Band II)

FCC Classification: PCS Licensed Transmitter PCB
Type: Pre Production

Sample Received Date: 26 September 2016
Dates of testing: 20 October – 09 November 2016

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 RSS-GEN (6.12)	Compliant

3.2 Test Method

The EUT was directly connected to a Radio Communication Tester (CMW 500) and a radio link was established. The output power of the EUT was set to maximum value by using the maximum power setting on the CMW. The output power was measured using the CMW internal measurement functions.

3.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.2 °C

Relative Humidity: 52.4%

Atmospheric Pressure: 97.9 kPa

3.4 Test Equipment

Test Date: 20-Oct-2016

Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	19-Jan-2018
RF CABLE	141	HUBER & SUHNER	B095585	26-Jul-2017

- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 is on a 2 year calibration cycle.

3.5 Test Data - WCDMA Band II

Max Power: 22.55 dBm / 0.180W

Band	Uplink Channel	UL Frequency (MHz)	Subtest	Modulation	Measured Power (dBm)	Cable Loss (dB)	Conducted Power (dBm)
Band 2	9262	1852.4	Subtest1	QPSK	21.78	0.53	22.31
Band 2	9400	1880	Subtest1	QPSK	21.76	0.53	22.29
Band 2	9538	1907.6	Subtest1	QPSK	21.51	0.53	22.04
Band 2	9262	1852.4	Subtest2	QPSK	21.69	0.53	22.22
Band 2	9400	1880	Subtest2	QPSK	21.8	0.53	22.33
Band 2	9538	1907.6	Subtest2	QPSK	21.59	0.53	22.12
Band 2	9262	1852.4	Subtest3	QPSK	21.17	0.53	21.7
Band 2	9400	1880	Subtest3	QPSK	21.24	0.53	21.77
Band 2	9538	1907.6	Subtest3	QPSK	20.98	0.53	21.51
Band 2	9262	1852.4	Subtest4	QPSK	21.13	0.53	21.66
Band 2	9400	1880	Subtest4	QPSK	21.12	0.53	21.65
Band 2	9538	1907.6	Subtest4	QPSK	20.98	0.53	21.51
Band 2	9262	1852.4	Subtest1	QPSK	21.78	0.53	22.31
Band 2	9262	1852.4	Subtest1	16QAM	21.71	0.53	22.24
Band 2	9400	1880	Subtest1	QPSK	21.76	0.53	22.29
Band 2	9400	1880	Subtest1	16QAM	21.74	0.53	22.27
Band 2	9538	1907.6	Subtest1	QPSK	21.51	0.53	22.04
Band 2	9538	1907.6	Subtest1	16QAM	21.5	0.53	22.03
Band 2	9262	1852.4	Subtest2	QPSK	21.69	0.53	22.22
Band 2	9262	1852.4	Subtest2	16QAM	21.81	0.53	22.34
Band 2	9400	1880	Subtest2	QPSK	21.8	0.53	22.33
Band 2	9400	1880	Subtest2	16QAM	21.8	0.53	22.33
Band 2	9538	1907.6	Subtest2	QPSK	21.59	0.53	22.12
Band 2	9538	1907.6	Subtest2	16QAM	21.57	0.53	22.1
Band 2	9262	1852.4	Subtest3	QPSK	21.17	0.53	21.7
Band 2	9262	1852.4	Subtest3	16QAM	21.15	0.53	21.68
Band 2	9400	1880	Subtest3	QPSK	21.24	0.53	21.77
Band 2	9400	1880	Subtest3	16QAM	21.22	0.53	21.75
Band 2	9538	1907.6	Subtest3	QPSK	20.98	0.53	21.51
Band 2	9538	1907.6	Subtest3	16QAM	21.08	0.53	21.61
Band 2	9262	1852.4	Subtest4	QPSK	21.13	0.53	21.66
Band 2	9262	1852.4	Subtest4	16QAM	21.16	0.53	21.69
Band 2	9400	1880	Subtest4	QPSK	21.12	0.53	21.65
Band 2	9400	1880	Subtest4	16QAM	21.25	0.53	21.78
Band 2	9538	1907.6	Subtest4	QPSK	20.98	0.53	21.51
Band 2	9538	1907.6	Subtest4	16QAM	21.08	0.53	21.61
Band 2	9262	1852.4	Subtest1	QPSK	21.02	0.53	21.55
Band 2	9400	1880	Subtest1	QPSK	21.08	0.53	21.61
Band 2	9538	1907.6	Subtest1	QPSK	21.43	0.53	21.96
Band 2	9262	1852.4	Subtest2	QPSK	20.5	0.53	21.03
Band 2	9400	1880	Subtest2	QPSK	20.11	0.53	20.64
Band 2	9538	1907.6	Subtest2	QPSK	20.26	0.53	20.79
Band 2	9262	1852.4	Subtest3	QPSK	20.67	0.53	21.2
Band 2	9400	1880	Subtest3	QPSK	20.24	0.53	20.77
Band 2	9538	1907.6	Subtest3	QPSK	20.41	0.53	20.94
Band 2	9262	1852.4	Subtest4	QPSK	20.62	0.53	21.15
Band 2	9400	1880	Subtest4	QPSK	20.83	0.53	21.36
Band 2	9538	1907.6	Subtest4	QPSK	20.43	0.53	20.96
Band 2	9262	1852.4	Subtest5	QPSK	21.5	0.53	22.03
Band 2	9400	1880	Subtest5	QPSK	22.02	0.53	22.55
Band 2	9538	1907.6	Subtest5	QPSK	21.3	0.53	21.83

4 Peak to Average Ratio

4.1 Test Result

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

4.2 Test Method

KDB document 971168 D01 Power Meas License Digital Systems v02r02 was used to determine peak-to-average ratio. For the measurements, Clause 5.7.1 was used which defined the measurement method using the CCDF function of the spectrum analyzer. Measurements were recorded at the mid channels at the highest power.

4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.5 °C

Relative Humidity: 36.3%

Atmospheric Pressure: 98.7 kPa

4.4 Test Equipment

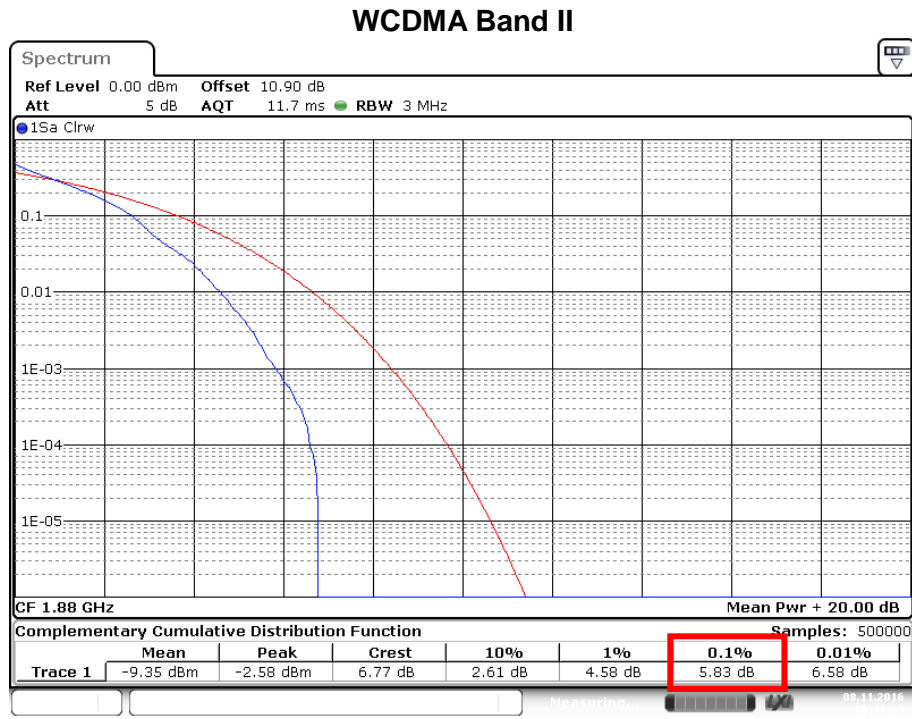
Test Date: 7-Nov-2016

Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	19-Jan-2018
RF CABLE	1134	GORE	B094785	26-Jul-2017
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101743	28-Jul-2017
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017

- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 and FSV are a 2 year calibration cycle

4.5 Test Data



Date: 8.NOV.2016 06:41:09

5 Occupied Bandwidth

5.1 Test Result

Test Description	Basic Standards	Test Result
Occupied Bandwidth	2.1049 24.238(a) RSS-GEN(6.6) RSS-133 (2.3)	Reported

5.2 Test Method

KDB document 971168 D01 Power Meas License Digital Systems v02r02, Clause 4 was used to determine the occupied measurement.

The 99% measurement function of the spectrum analyzer was used.

The measurement was conducted at the center channel of each band.

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.5 °C

Relative Humidity: 36.3%

Atmospheric Pressure: 98.7 kPa

5.4 Test Equipment

Test Date: 7-Nov-2016

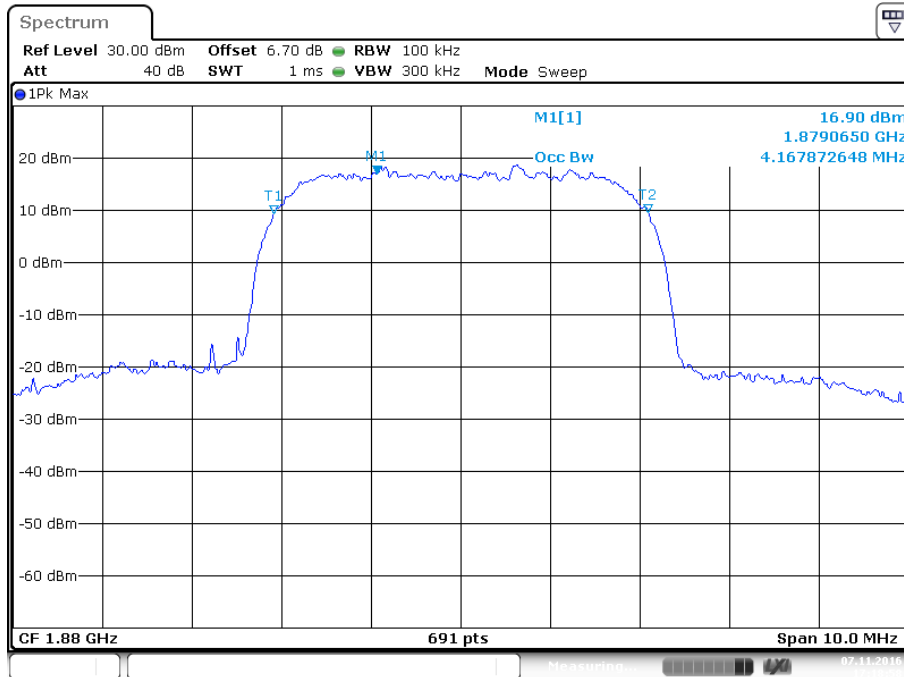
Tester: JOP

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	19-Jan-2018
RF CABLE	1134	GORE	B094785	26-Jul-2017
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101743	28-Jul-2017
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017

- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 and FSV are a 2 year calibration cycle

5.5 Test Data

WCDMA – Band II CH 9400 - 99% Bandwidth



Date: 7.NOV.2016 17:18:58

6 Band Edge and Conducted Spurious Emissions

6.1 Test Result

Test Description	Basic Standards	Test Result
Conducted spurious emissions and Band Edge	2.1051 24.238(a) RSS-133 (6.5.1)	Pass

6.2 Test Method

KDB document 971168 D01 Power Meas License Digital Systems v02r02, Clause 6 was used to measure spurious emissions at the antenna terminals.

6.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.5 °C

Relative Humidity: 36.3%

Atmospheric Pressure: 98.7 kPa

6.4 Test Equipment

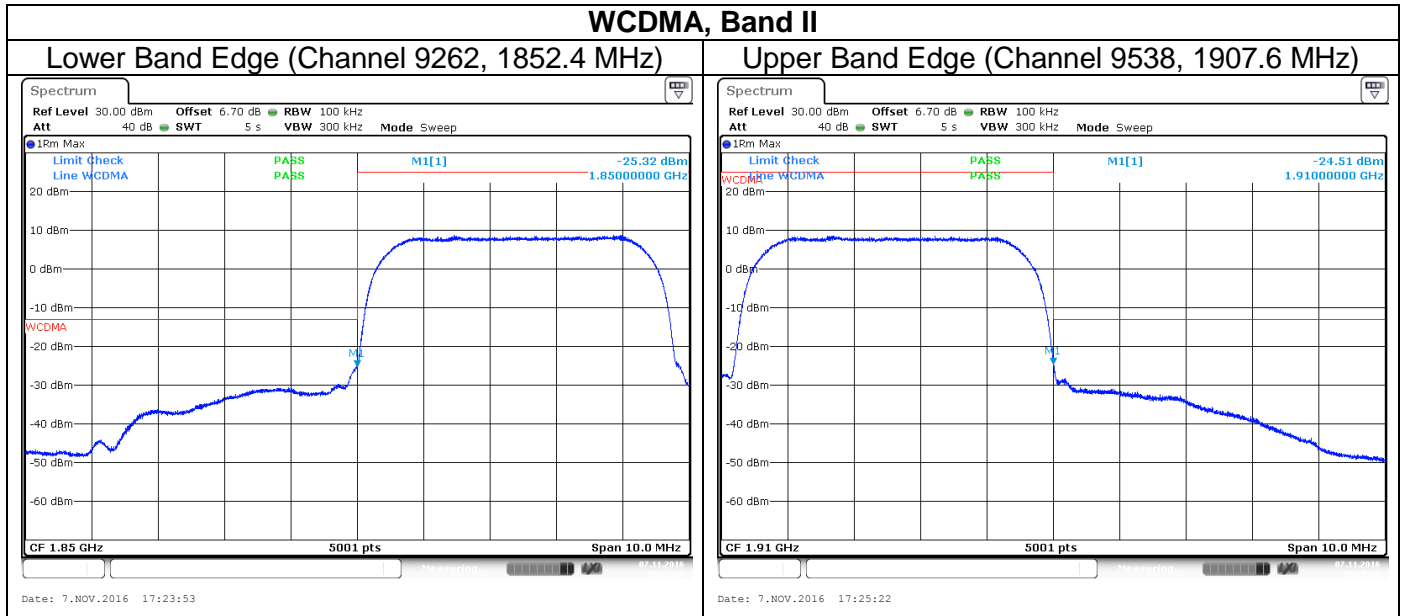
Test Date: 7-Nov-2016

Tester: JOP

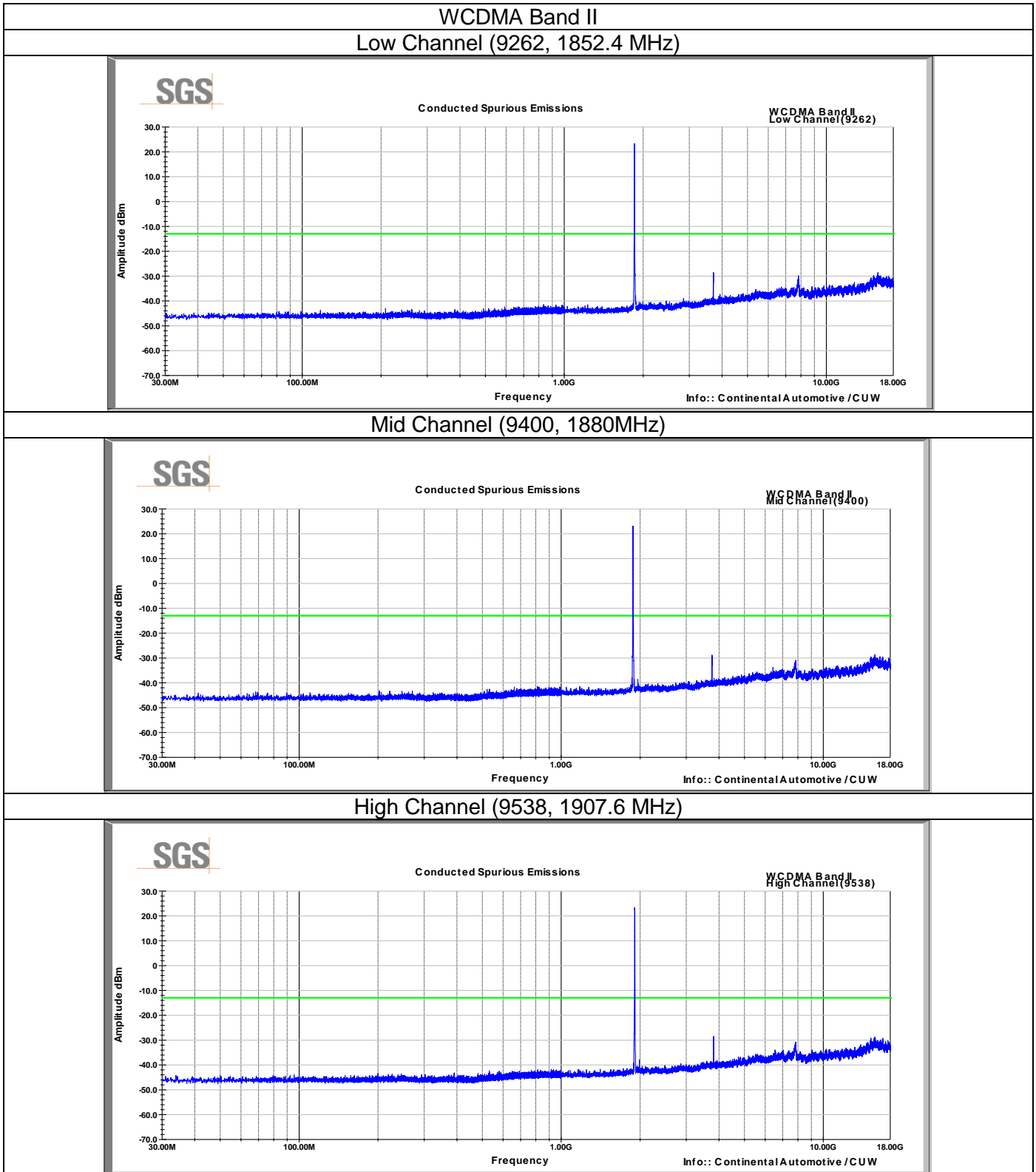
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	19-Jan-2018
RF CABLE	1134	GORE	B094785	26-Jul-2017
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101743	28-Jul-2017
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	8-Oct-2017

- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW-500 and FSV are a 2 year calibration cycle

6.5 Test Data - Band Edge



6.6 Test Data - Conducted Spurious Emissions



7 Effective Radiated Power

7.1.1 Test Result

Test Description	Basic Standards	Test Result
Effective Isotropic Radiated Power	24.232(c) RSS-133 (6.4)	Pass

7.1.2 Test Method

Because the CUW is provided with a coaxial port but no antenna, ERP/EIRP measurements were taken by applying the maximum output power including tolerances. A max antenna gain of 6dBi was declared by the manufacturer.

7.2 Test Site

SGS EMC Laboratory, Suwanee, GA

7.3 Test Equipment

None

7.4 Test Data

Band of Operation		Conducted Power w/tolerance dBm	Antenna Gain	Cable Loss	Average EIRP		Distance (R) cm	Power Density EIRP _{Avg} /(4πR ²) mW	FCC mW/cm ²	% of Limit	Verdict
Type	MHz				dBm	mW					
WCDMA Band II	1850-1910	25.0	6.0	1.0	30.0	1000	20	0.199	1.00	20%	Pass

8 Radiated Spurious Emissions

8.1 Test Result

Test Description	Basic Standards		Test Result
Radiated Spurious Emissions	2.1053 24.238(a) 27.53(c)(2) 27.53(h) ANSI/TIA-603-D-2010	RSS-GEN (6.13) RSS-130 (4.6) RSS-132 (5.5) RSS-133 (6.5.1) RSS-139 (6.5.1)	Pass

8.2 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 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 performed at the low, middle, and high channels.

8.3 Test Site

SGS 3m Chamber, Suwanee, GA (validated to ANS C63.4: 2014 below and above 1GHz)

Environmental Conditions

Temperature: 23.30 °C
Relative Humidity: 45.4 %
Atmospheric Pressure: 98.37 kPa

8.4 Test Equipment

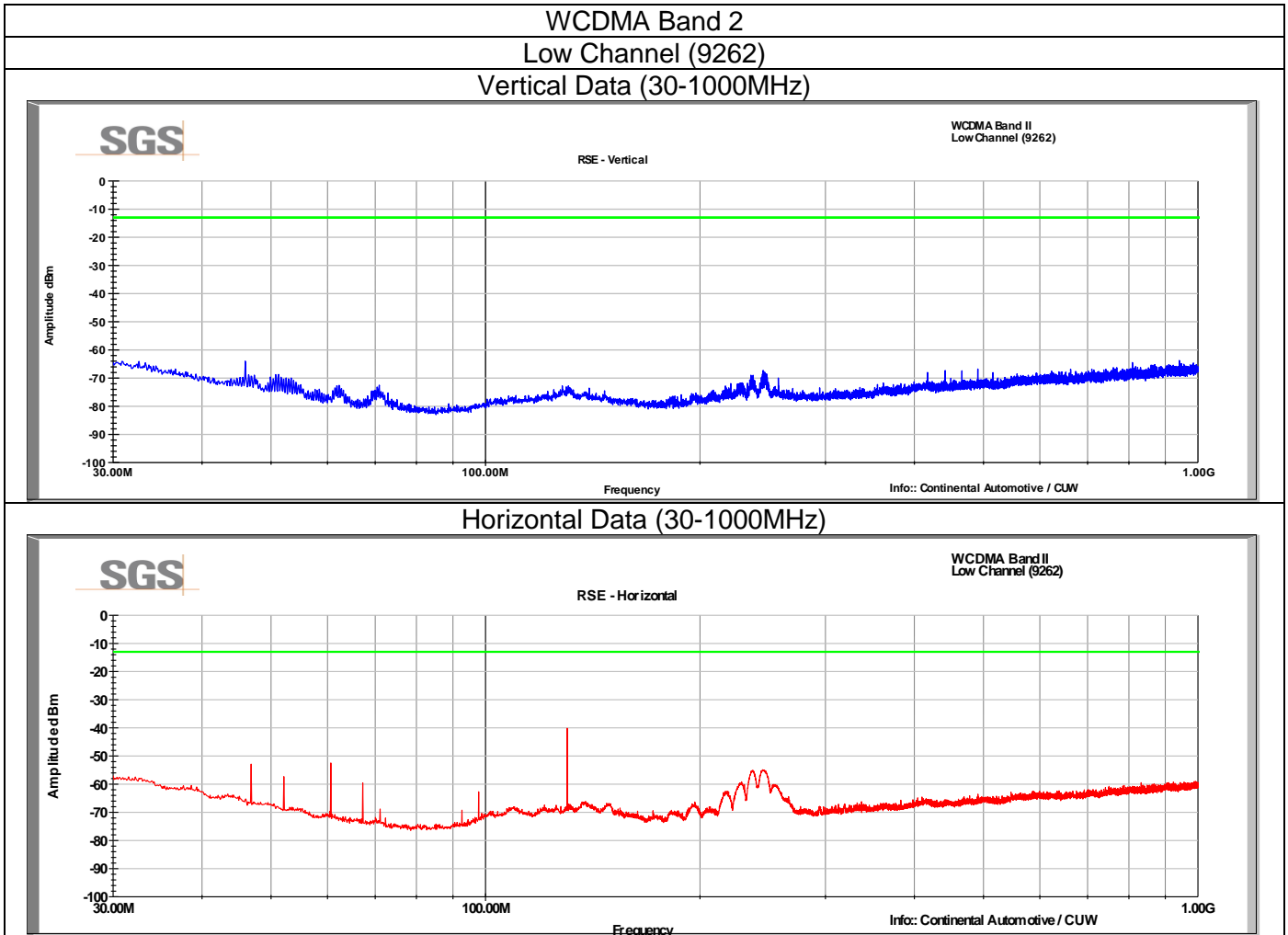
Test Date: 28-Oct-2016

Tester: FL

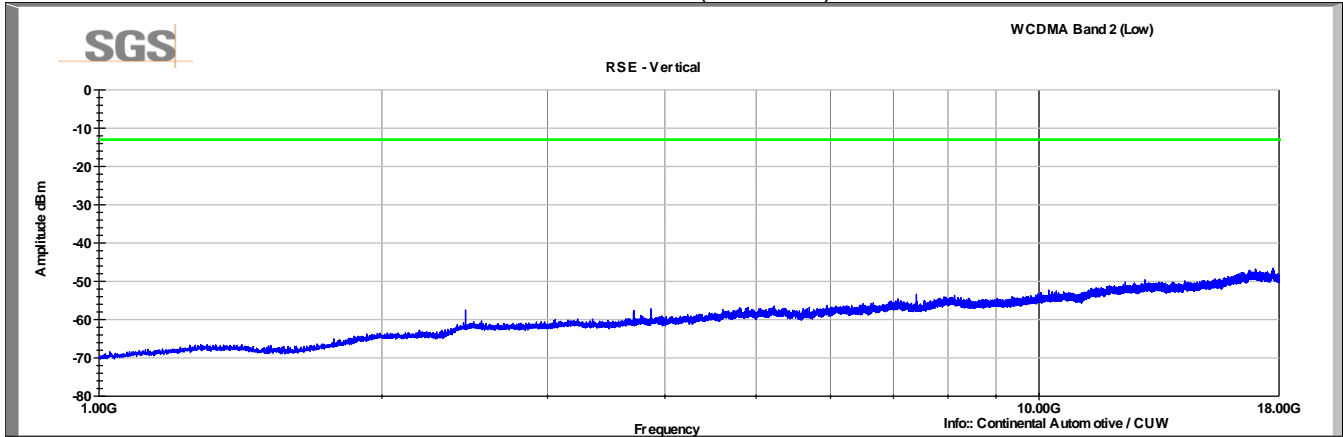
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	CBL 6143A	TESEQ	B085931	1-Dec-2016
RF CABLE	SF106	HUBER & SUHNER	B079716	27-Jul-2017
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B085757	3-Nov-2016
RF CABLE	SF106	HUBER & SUHNER	B079713	27-Jul-2017
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	B079629	20-Jun-2017
RF CABLE	SF106	HUBER & SUHNER	B079712	27-Jul-2017
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	16-Feb-2017
RF CABLE	SF106	HUBER & SUHNER	B085892	27-Jul-2017
DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079699	26-Apr-2017
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	4-Aug-2017
FILTER, BAND REJECT	BRC50720	MICRO-TRONICS	B079784	28-Jul-2017
FILTER, HIGH PASS	HPM50110	MICRO-TRONICS	B079792	28-Jul-2017
RF CABLE	SF102	HUBER & SUHNER	B079822	27-Jul-2017
RF CABLE	SF102	HUBER & SUHNER	B079824	27-Jul-2017
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	29-Jul-2017

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

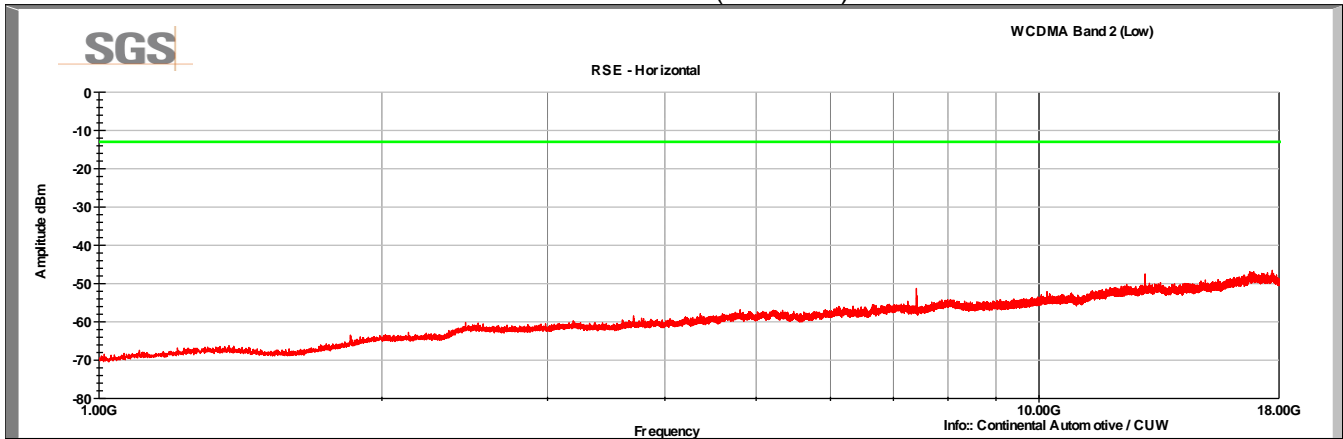
8.5 Test Data



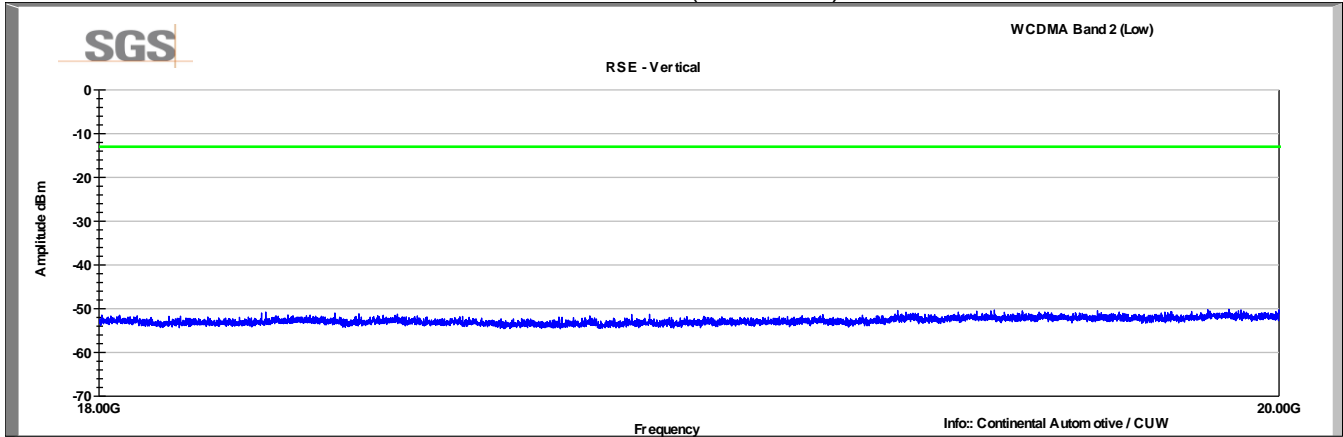
WCDMA Band 2
 Low Channel (9262)
 Vertical Data (1-18GHz)



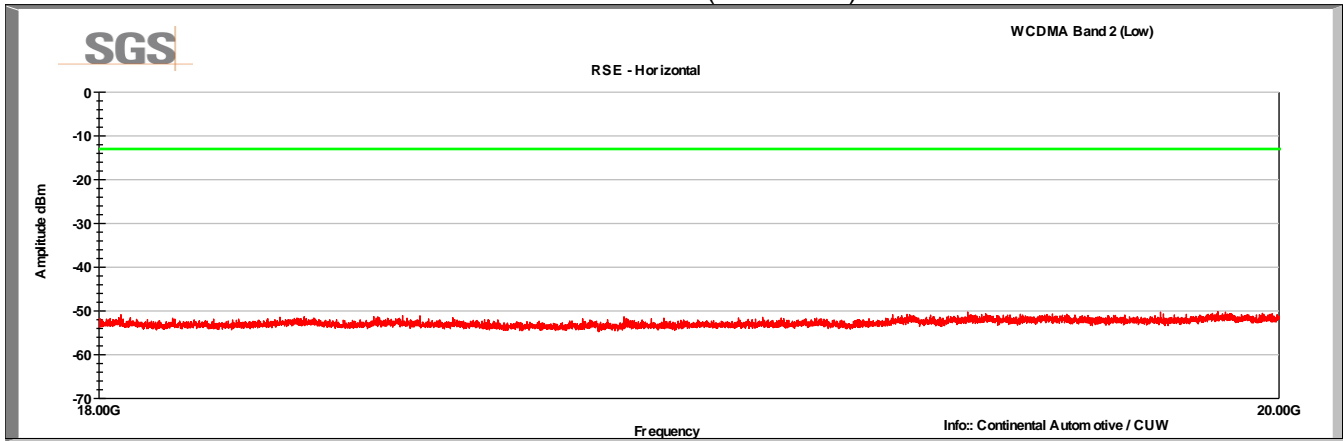
Horizontal Data (1-18GHz)



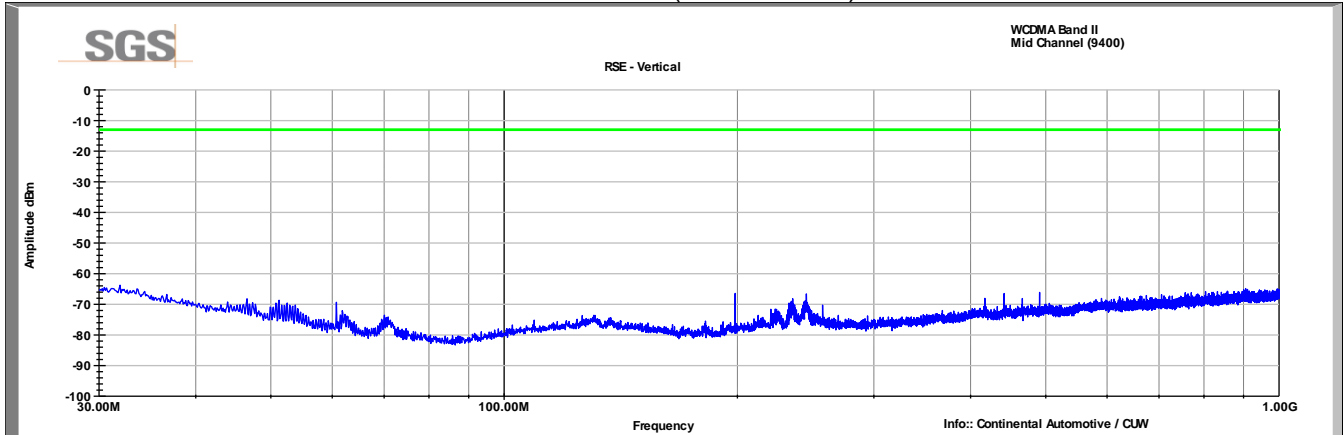
WCDMA Band 2
Low Channel (9262)
Vertical Data (18-20GHz)



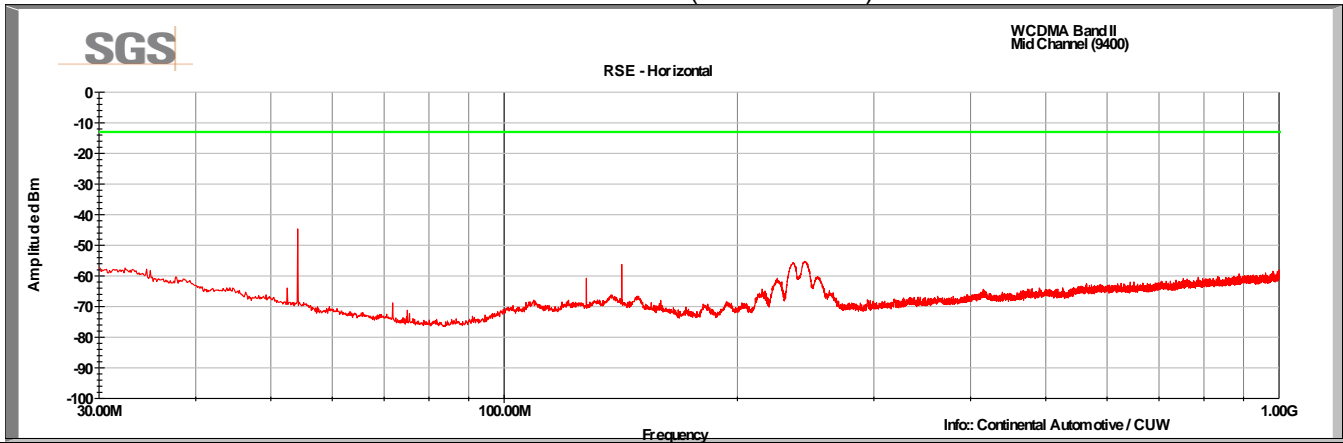
Horizontal Data (18-20GHz)



WCDMA Band 2
Mid Channel (9400)
Vertical Data (30-1000MHz)



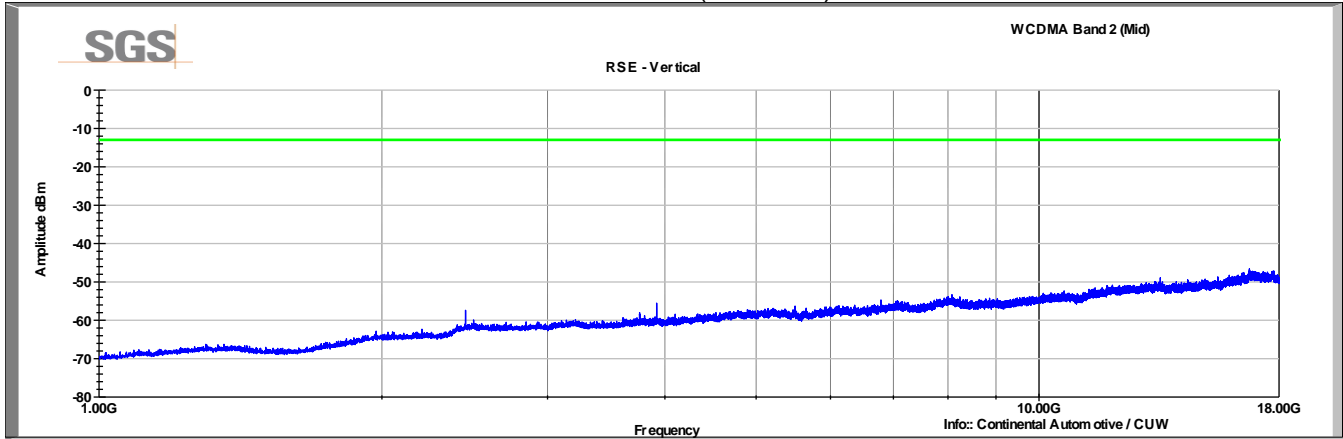
Horizontal Data (30-1000MHz)



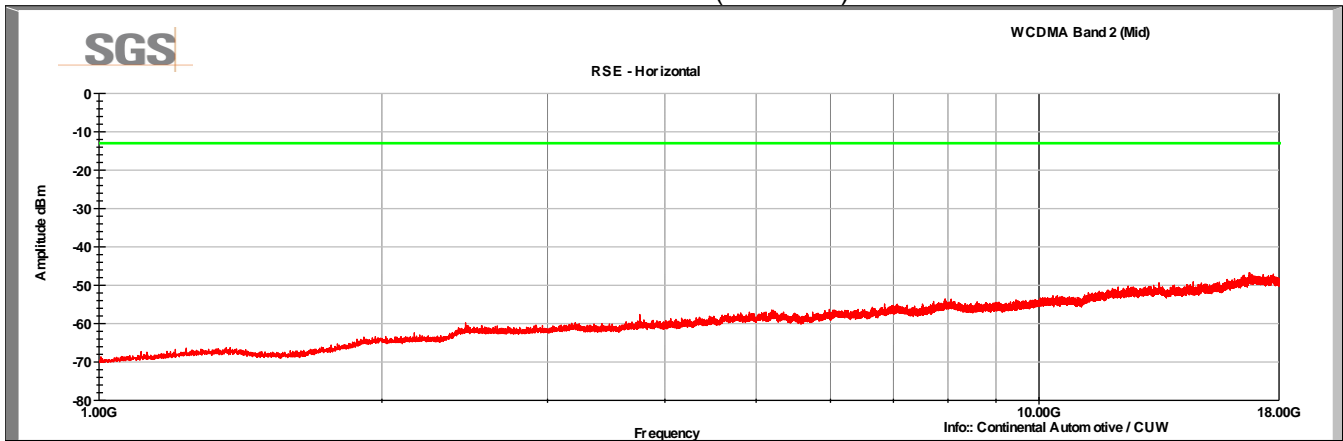
WCDMA Band 2

Mid Channel (9400)

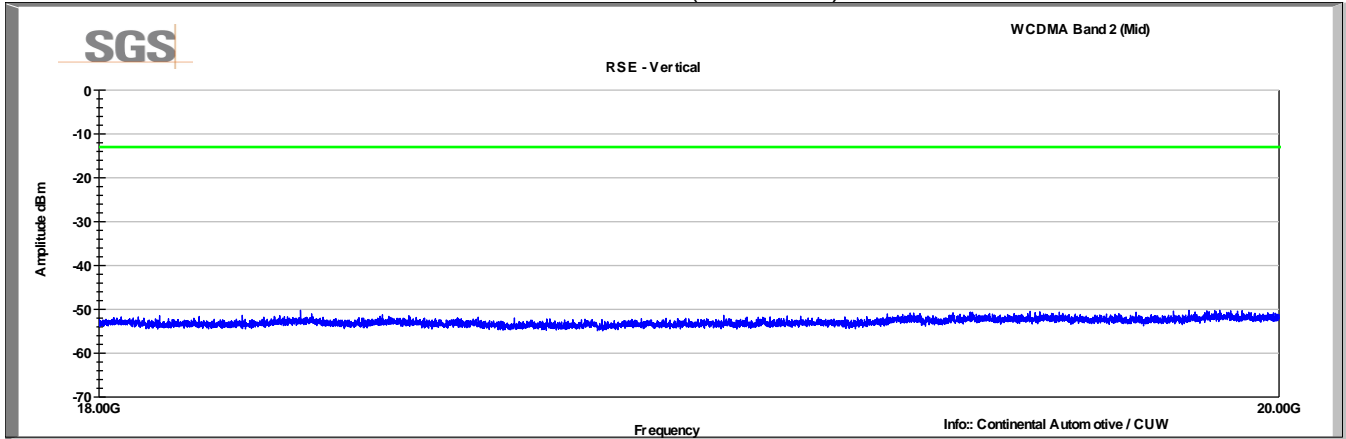
Vertical Data (1-18GHz)



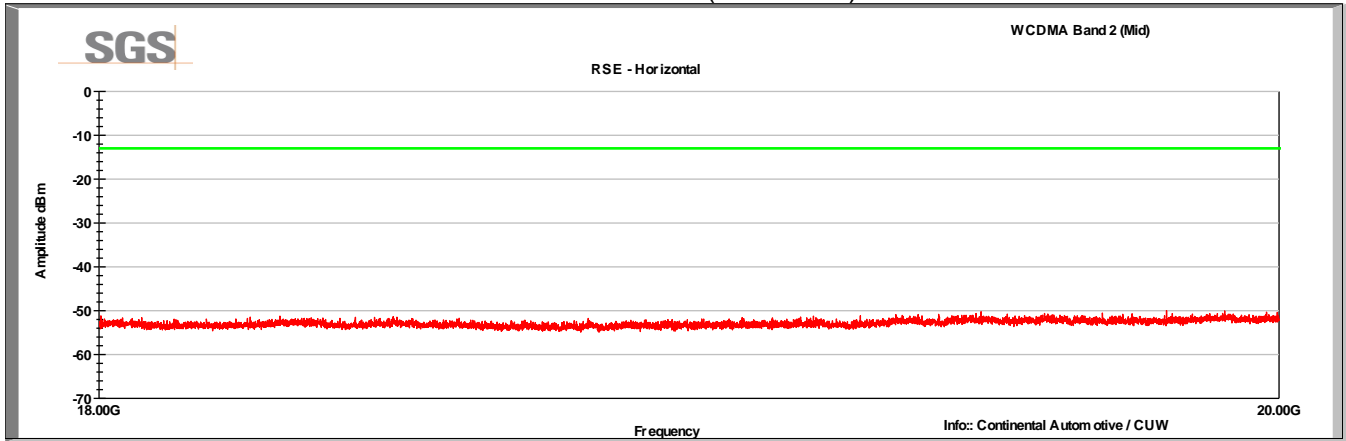
Horizontal Data (1-18GHz)



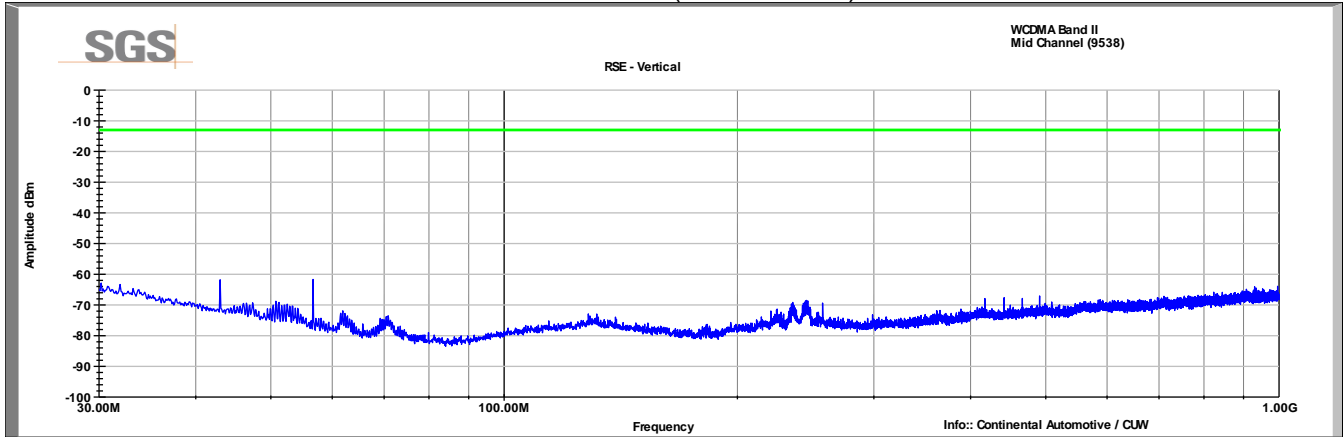
WCDMA Band 2
Mid Channel (9400)
Vertical Data (18-20GHz)



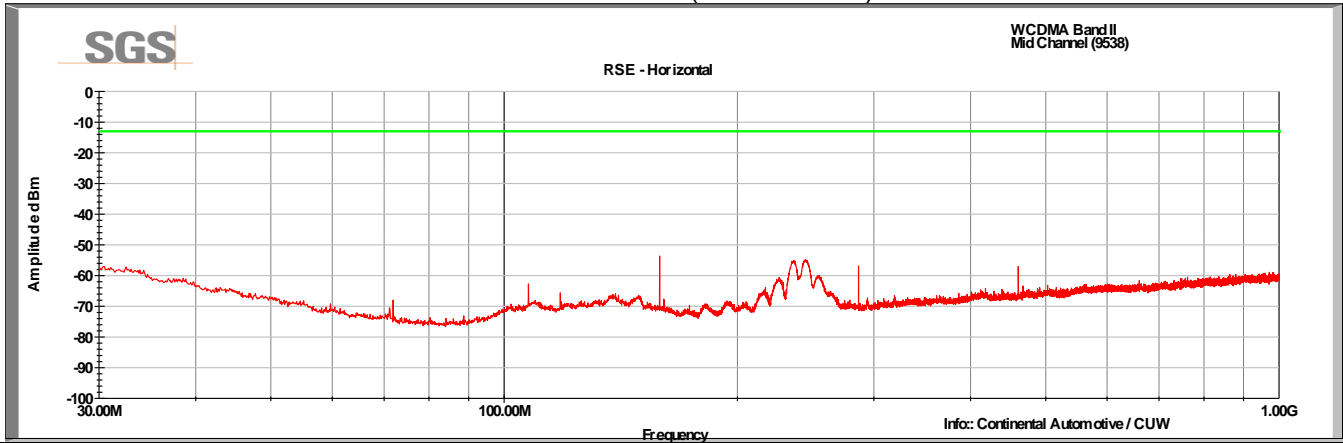
Horizontal Data (18-20GHz)



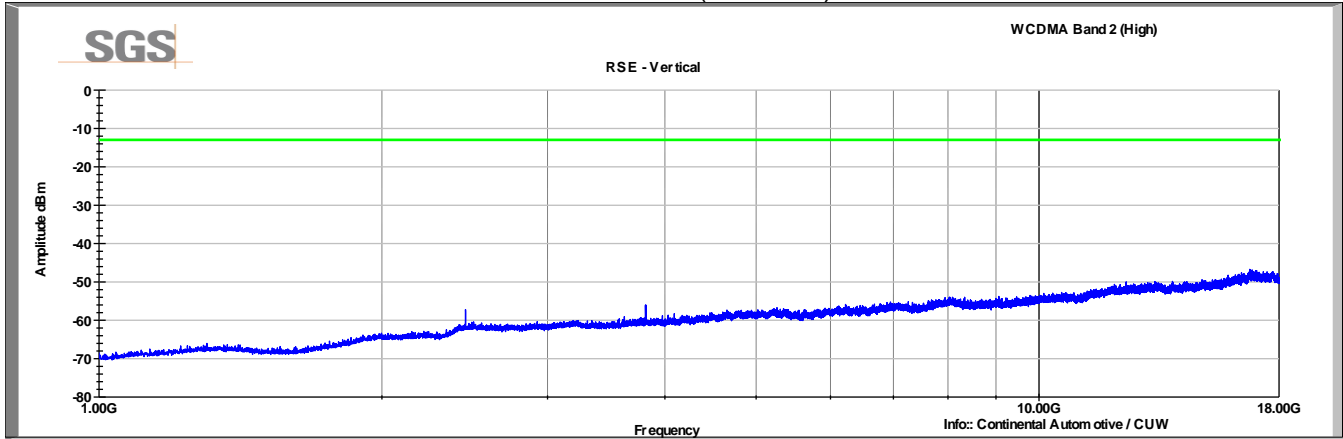
WCDMA Band 2
High Channel (9538)
Vertical Data (30-1000MHz)



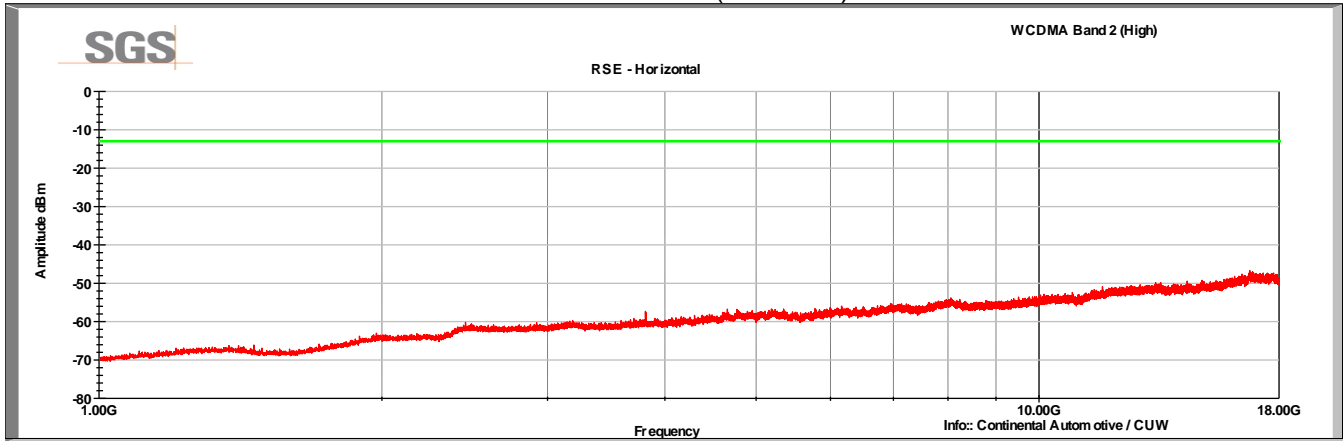
Horizontal Data (30-1000MHz)



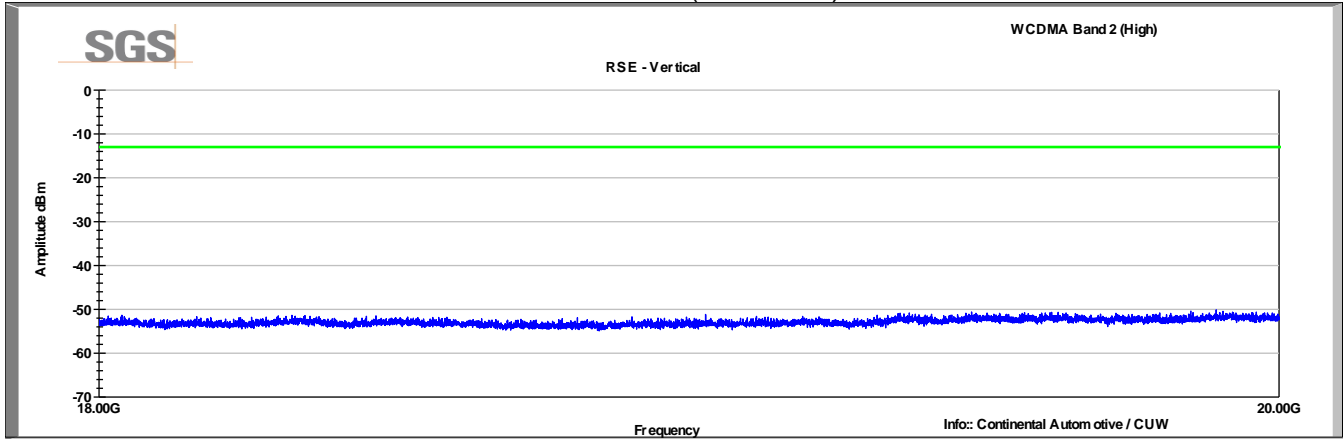
WCDMA Band 2
High Channel (9538)
Vertical Data (1-18GHz)



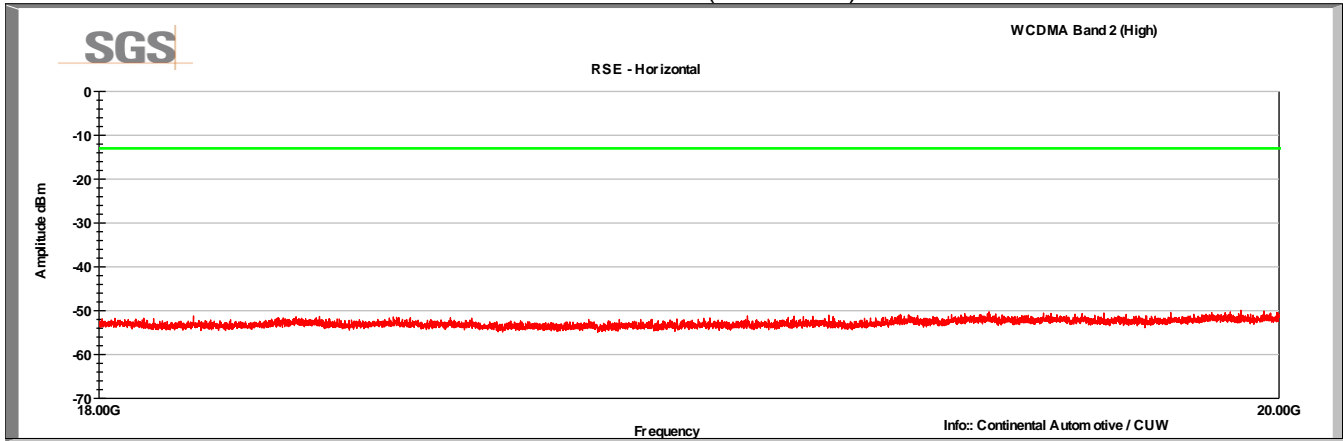
Horizontal Data (1-18GHz)



WCDMA Band 2
High Channel (9538)
Vertical Data (18-20GHz)



Horizontal Data (18-20GHz)



9 Frequency Stability

9.1 Test Result

Test Description	Basic Standards	Test Result
Frequency Stability	2.1055 24.238(a) RSS-GEN (6.11) RSS-133 (6.3)	Compliant

9.2 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 the middle channel of Band 2.

9.3 Test Site

SGS EMC Laboratory, Suwanee, GA

9.4 Test Equipment

Test Date: 9-Nov-2016

Tester: JOP

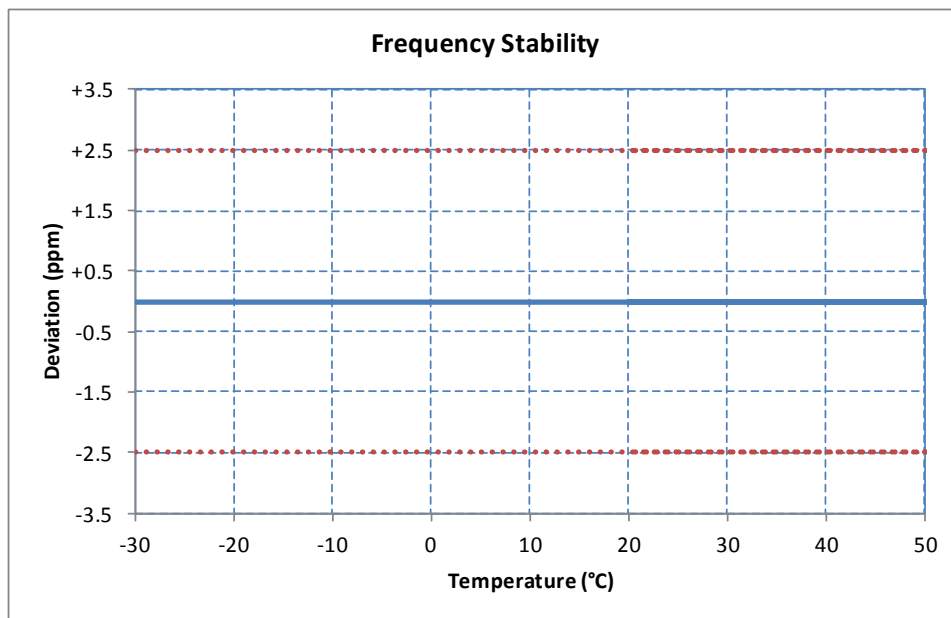
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	19-Jan-2018
ENVIRONMENTAL TEST CHAMBER	T2RC	TENNEY ENVIRONMENTAL	B094877	CNR
HANDHELD MULTIMETER	87V	FLUKE	B079676	29-Jul-2017

- 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

Band 2, Channel 6400

Voltage %	Power V _{DC}	Temp °C	Frequency Hz	Freq Dev Hz	Freq Dev ppm	Deviation %
100%	12.00	+20 (Ref)	1,879,999,995	-5	-0.00	-0.000000
100%	12.00	-30	1,879,999,999	-1	-0.00	-0.000000
100%	12.00	-20	1,879,999,993	-7	-0.00	-0.000000
100%	12.00	-10	1,879,999,992	-8	-0.00	-0.000000
100%	12.00	0	1,879,999,993	-7	-0.00	-0.000000
100%	12.00	+10	1,879,999,992	-8	-0.00	-0.000000
100%	12.00	+20	1,879,999,995	-5	-0.00	-0.000000
100%	12.00	+30	1,879,999,992	-8	-0.00	-0.000000
100%	12.00	+40	1,879,999,993	-7	-0.00	-0.000000
100%	12.00	+50	1,879,999,993	-7	-0.00	-0.000000
100%	12.00	+55	1,879,999,992	-9	-0.00	-0.000000
115%	13.80	+20	1,879,999,991	-9	-0.00	-0.000000
85%	10.20	+20	1,879,999,992	-8	-0.00	-0.000000



10 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	09 November 2016