EMC Test Report

Project Number: **4238300**

Report Number: **4238300EMC01** **Revision Level:** **1**

Client: **Altair Semiconductor**

Equipment Under Test: **CAT-1 LTE Module**

Model: **ALT1210MOD-VZ-01**

FCC ID: **2AN5Z-001R1**

FCC Rule Parts: **Part 2, Part 27**

Report issued on: **20 December 2017**

Test Result: **Compliant**

Tested by: Martin Taylor, Project Engineer

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.

This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.

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 6
3.4 TEST EQUIPMENT 6
3.6 TEST DATA - LTE BAND 4 7
3.7 TEST DATA - LTE BAND 13 8

4 PEAK TO AVERAGE RATIO 9

4.1 TEST RESULT 9
4.2 TEST METHOD 9
4.3 TEST SITE 9
4.4 TEST EQUIPMENT 9
4.5 TEST DATA 10

5 OCCUPIED BANDWIDTH 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

6 BAND EDGE AND CONDUCTED SPURIOUS EMISSIONS 15

6.1 TEST RESULT 15
6.2 TEST METHOD 15
6.3 TEST SITE 15
6.4 TEST EQUIPMENT 15
6.5 TEST DATA - BAND EDGE 16
6.6 TEST DATA - CONDUCTED SPURIOUS EMISSIONS 17

7 EFFECTIVE RADIATED POWER 19

7.2 TEST SITE 19
7.3 TEST EQUIPMENT 19
7.4 TEST DATA 19

8 RADIATED SPURIOUS EMISSIONS 20

8.1 TEST RESULT 20
8.2 TEST METHOD 20
8.3 TEST SITE 20
8.4 TEST EQUIPMENT 21
8.5 TEST DATA 22

9 FREQUENCY STABILITY 37

9.1 TEST RESULT 37
9.2 TEST METHOD 37

9.3 TEST SITE 37
9.4 TEST EQUIPMENT 37
9.5 TEST DATA 38

1 Summary of Test Results

FCC Reference Sections	Test Description	Test Limit	Test Condition	Test Result
2.1046	Conducted Output Power	N/A	Conducted	Pass
27.50(d)(5)	Peak-to-Average Ratio	<13 dB		Pass
2.1049	Occupied Bandwidth	N/A		Reported
2.1051 27.53(c)(2) 27.53(h)	Band Edge / Conducted Spurious Emissions	< 43 +10log$_{10}$ ($P_{[Watts]}$) at band edge and for all out of band emissions		Pass
27.50(b)(10)	Effective Radiated Power	< 3 Watts max ERP		Pass
27.50(d)(4)	Effective Isotropic Radiated Power	< 1 Watts max EIRP		Pass
2.1053 27.53(c)(2) 27.53(h)	Radiated Spurious Emissions	< 43 +10log$_{10}$ ($P_{[Watts]}$) at band edge and for all out of band emissions		Pass
2.1055 27.5(b) 27.5(h) 27.54	Frequency Stability	<2.5 ppm		Pass

1.1 *Modifications Required to Compliance*

None

2 General Information

2.1 *Client Information*

Name:	Altair Semiconductor
Address:	6 Ha'harash st. P.O. Box 7158
City, State, Zip, Country:	Hod Hasharon 45240, Israel

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:	CAT-1 LTE Module
Model Number:	ALT1210MOD-VZ-01
Serial Number:	ALT1710110007041
FCC ID:	2AN5Z-001R1
IMSI Number:	001010123456063
Rated Voltage:	3.8 Vdc
Test Voltage:	3.8 Vdc
Tx Frequency Range:	1710 – 1755 MHz (LTE Band 4) 777 – 787MHz (LTE Band 13)
FCC Classification:	PCS Licensed Transmitter PCB
Type:	Pre-Production
Sample Received Date:	14 November 2017
Dates of testing:	28 November to 06 December 2017

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	Pass

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: 25.5 °C
Relative Humidity: 36.2%
Atmospheric Pressure: 98.5 kPa

3.4 *Test Equipment*

Test End Date: 29-Nov-2017 Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	19-Jan-2018
RF CABLE	141	HUBER & SUHNER	B095588	26-Jul-2018

- 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.

3.6 *Test Data - LTE Band 4*

Max Power: 23.13 dBm / 0.206W

UpLink Channel	UL Frequency (MHz)	BW (MHz)	# RB	Position	Measured Power (dBm)	Cable Loss (dB)	Conducted Power (dBm)
19975	1712.5	5	1	(RB_Pos:0)	22.43	0.51	22.94
19975	1712.5	5	1	(RB_Pos:24)	22.44	0.51	22.95
19975	1712.5	5	12	(RB_Pos:0)	20.99	0.51	21.50
19975	1712.5	5	12	(RB_Pos:13)	21.02	0.51	21.53
19975	1712.5	5	25	(RB_Pos:0)	21.04	0.51	21.55
20175	1732.5	5	1	(RB_Pos:0)	22.25	0.51	22.76
20175	1732.5	5	1	(RB_Pos:24)	22.37	0.51	22.88
20175	1732.5	5	12	(RB_Pos:0)	21.12	0.51	21.63
20175	1732.5	5	12	(RB_Pos:13)	21.11	0.51	21.62
20175	1732.5	5	25	(RB_Pos:0)	21.14	0.51	21.65
20375	1752.5	5	1	(RB_Pos:0)	22.14	0.51	22.65
20375	1752.5	5	1	(RB_Pos:24)	22.26	0.51	22.77
20375	1752.5	5	12	(RB_Pos:0)	21.05	0.51	21.56
20375	1752.5	5	12	(RB_Pos:13)	21.06	0.51	21.57
20375	1752.5	5	25	(RB_Pos:0)	21.03	0.51	21.54
20000	1715	10	1	(RB_Pos:0)	22.08	0.51	22.59
20000	1715	10	1	(RB_Pos:49)	22.22	0.51	22.73
20000	1715	10	25	(RB_Pos:0)	20.99	0.51	21.50
20000	1715	10	25	(RB_Pos:25)	21.12	0.51	21.63
20000	1715	10	50	(RB_Pos:0)	20.97	0.51	21.48
20175	1732.5	10	1	(RB_Pos:0)	22.06	0.51	22.57
20175	1732.5	10	1	(RB_Pos:49)	22.05	0.51	22.56
20175	1732.5	10	25	(RB_Pos:0)	21.14	0.51	21.65
20175	1732.5	10	25	(RB_Pos:25)	21.15	0.51	21.66
20175	1732.5	10	50	(RB_Pos:0)	21.07	0.51	21.58
20350	1750	10	1	(RB_Pos:0)	21.02	0.51	21.53
20350	1750	10	1	(RB_Pos:49)	22.39	0.51	22.90
20350	1750	10	25	(RB_Pos:0)	20.94	0.51	21.45
20350	1750	10	25	(RB_Pos:25)	20.99	0.51	21.50
20350	1750	10	50	(RB_Pos:0)	20.96	0.51	21.47
20025	1717.5	15	1	(RB_Pos:0)	22.09	0.51	22.60
20025	1717.5	15	1	(RB_Pos:74)	22.03	0.51	22.54
20025	1717.5	15	36	(RB_Pos:0)	21.18	0.51	21.69
20025	1717.5	15	36	(RB_Pos:39)	21.30	0.51	21.81
20025	1717.5	15	75	(RB_Pos:0)	21.38	0.51	21.89
20175	1732.5	15	1	(RB_Pos:0)	22.08	0.51	22.59
20175	1732.5	15	1	(RB_Pos:74)	22.18	0.51	22.69
20175	1732.5	15	36	(RB_Pos:0)	21.24	0.51	21.75
20175	1732.5	15	36	(RB_Pos:39)	21.20	0.51	21.71
20175	1732.5	15	75	(RB_Pos:0)	21.34	0.51	21.85
20325	1747.5	15	1	(RB_Pos:0)	21.73	0.51	22.24
20325	1747.5	15	1	(RB_Pos:74)	21.98	0.51	22.49
20325	1747.5	15	36	(RB_Pos:0)	21.20	0.51	21.71
20325	1747.5	15	36	(RB_Pos:39)	21.11	0.51	21.62
20325	1747.5	15	75	(RB_Pos:0)	21.24	0.51	21.75
20050	1720	20	1	(RB_Pos:0)	21.86	0.51	22.37
20050	1720	20	1	(RB_Pos:99)	21.95	0.51	22.46
20050	1720	20	50	(RB_Pos:0)	20.96	0.51	21.47
20050	1720	20	50	(RB_Pos:50)	21.06	0.51	21.57
20050	1720	20	100	(RB_Pos:0)	21.02	0.51	21.53
20175	1732.5	20	1	(RB_Pos:0)	22.27	0.51	22.78
20175	1732.5	20	1	(RB_Pos:99)	22.25	0.51	22.76
20175	1732.5	20	50	(RB_Pos:0)	21.11	0.51	21.62
20175	1732.5	20	50	(RB_Pos:50)	21.02	0.51	21.53
20175	1732.5	20	100	(RB_Pos:0)	21.11	0.51	21.62
20300	1745	20	1	(RB_Pos:0)	22.62	0.51	23.13
20300	1745	20	1	(RB_Pos:99)	22.47	0.51	22.98
20300	1745	20	50	(RB_Pos:0)	21.02	0.51	21.53
20300	1745	20	50	(RB_Pos:50)	20.92	0.51	21.43
20300	1745	20	100	(RB_Pos:0)	20.98	0.51	21.49

3.7 *Test Data - LTE Band 13*

Max Power: 23.3dBm / 0.214W

UpLink Channel	UL Frequency (MHz)	BW (MHz)	# RB	Position	Measured Power (dBm)	Cable Loss (dB)	Conducted Power (dBm)
23205	779.5	5	1	(RB_Pos:0)	22.66	0.34	23.00
23205	779.5	5	1	(RB_Pos:24)	22.71	0.34	23.05
23205	779.5	5	12	(RB_Pos:0)	21.64	0.34	21.98
23205	779.5	5	12	(RB_Pos:13)	21.64	0.34	21.98
23205	779.5	5	25	(RB_Pos:0)	21.49	0.34	21.83
23230	782	5	1	(RB_Pos:0)	22.84	0.34	23.18
23230	782	5	1	(RB_Pos:24)	22.85	0.34	23.19
23230	782	5	12	(RB_Pos:0)	21.66	0.34	22.00
23230	782	5	12	(RB_Pos:13)	21.46	0.34	21.80
23230	782	5	25	(RB_Pos:0)	21.47	0.34	21.81
23255	784.5	5	1	(RB_Pos:0)	22.80	0.34	23.14
23255	784.5	5	1	(RB_Pos:24)	22.96	0.34	23.30
23255	784.5	5	12	(RB_Pos:0)	21.45	0.34	21.79
23255	784.5	5	12	(RB_Pos:13)	21.56	0.34	21.90
23255	784.5	5	25	(RB_Pos:0)	21.47	0.34	21.81
23230	782	10	1	(RB_Pos:0)	22.74	0.34	23.08
23230	782	10	1	(RB_Pos:49)	22.81	0.34	23.15
23230	782	10	25	(RB_Pos:0)	21.57	0.34	21.91
23230	782	10	25	(RB_Pos:25)	21.47	0.34	21.81
23230	782	10	50	(RB_Pos:0)	21.53	0.34	21.87

4 Peak to Average Ratio

4.1 *Test Result*

Test Description	Basic Standards	Test Result
Peak to Average Ratio	27.50(d)(5)	Pass

4.2 *Test Method*

KDB document 971168 D01 Power Meas License Digital Systems v03 was used to determine peak-to-average ratio. For the LTE 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 and the worst-case setting was determined 5 MHz bandwidth and QPSK modulation.

4.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 25.3 °C
Relative Humidity: 41.9%
Atmospheric Pressure: 98.0 kPa

4.4 *Test Equipment*

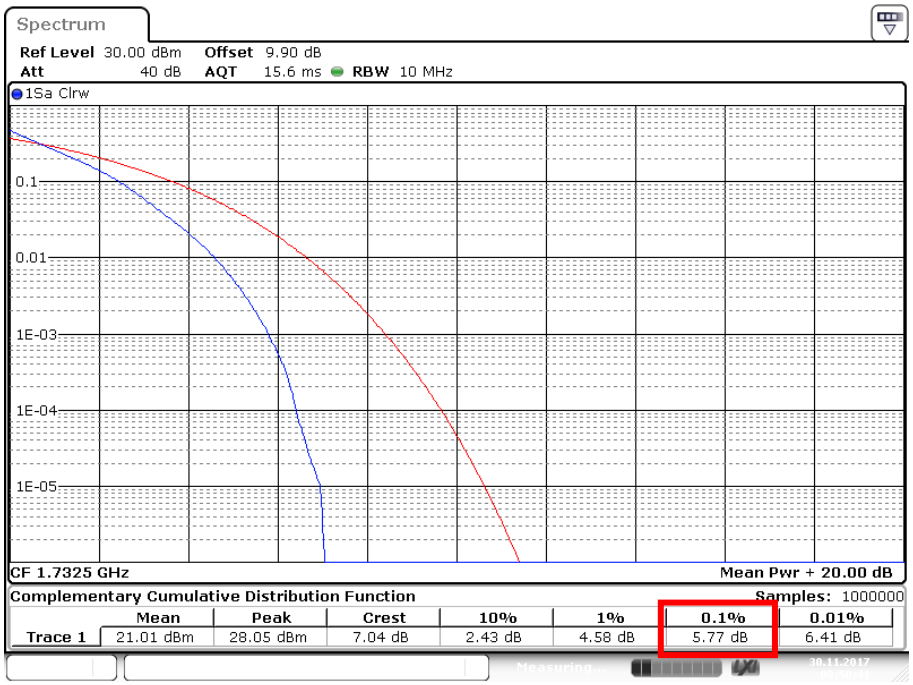
Test End Date: 30-Nov-2017 Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B085757	27-Oct-2018
POWER SPLITTER	ZFRSC-123-S+	MINI-CIRCUITS	B085748	27-Jul-2018
RF CABLE	SF102	HUBER & SUHNER	B079823	26-Jul-2018
RF CABLE	141	HUBER & SUHNER	B095588	26-Jul-2018
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	1608522I	24-Jul-2018

- 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.

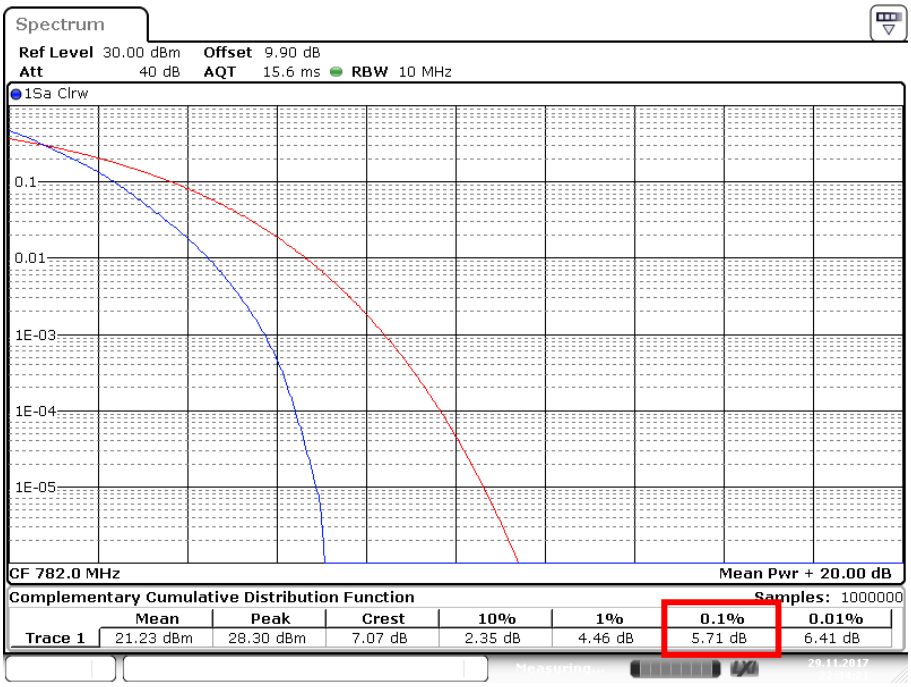
4.5 *Test Data*

LTE Band 4



Date: 30.NOV.2017 00:50:41

LTE Band 13



Date: 29.NOV.2017 22:34:21

5 Occupied Bandwidth

5.1 *Test Result*

Test Description	Basic Standards	Test Result
Occupied Bandwidth	2.1049	Reported

5.2 *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.

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.

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

The measurement was conducted at the center channel of each band. All resource blocks were explored. Worst-case results are reported.

5.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.3 °C
Relative Humidity: 37.1 %
Atmospheric Pressure: 98.7 kPa

5.4 *Test Equipment*

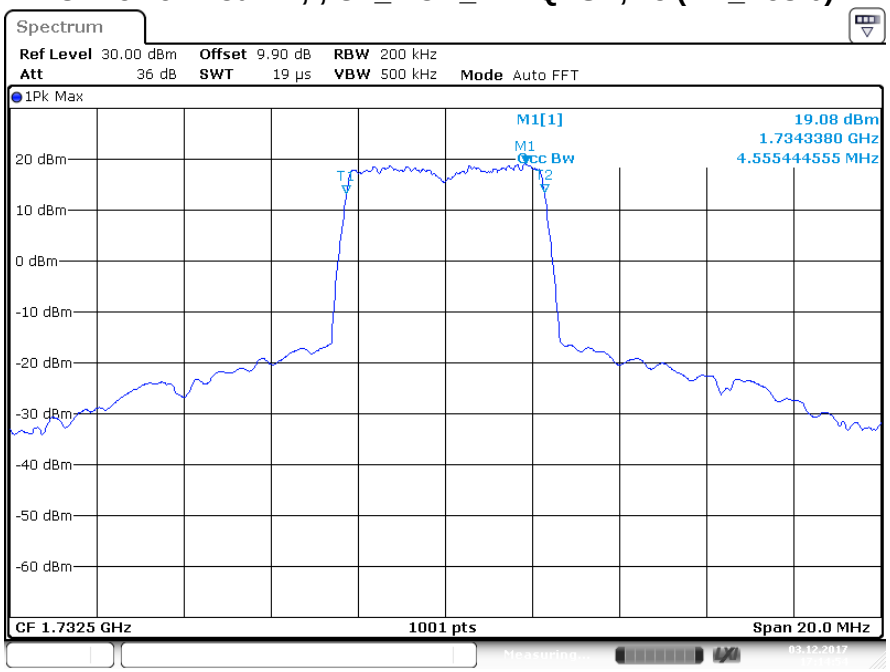
Test End Date: 4-Dec-2017 Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B085757	27-Oct-2018
POWER SPLITTER	ZFRSC-123-S+	MINI-CIRCUITS	B085748	27-Jul-2018
RF CABLE	SF102	HUBER & SUHNER	B079823	26-Jul-2018
RF CABLE	141	HUBER & SUHNER	B095588	26-Jul-2018
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	1608522I	24-Jul-2018

- 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.

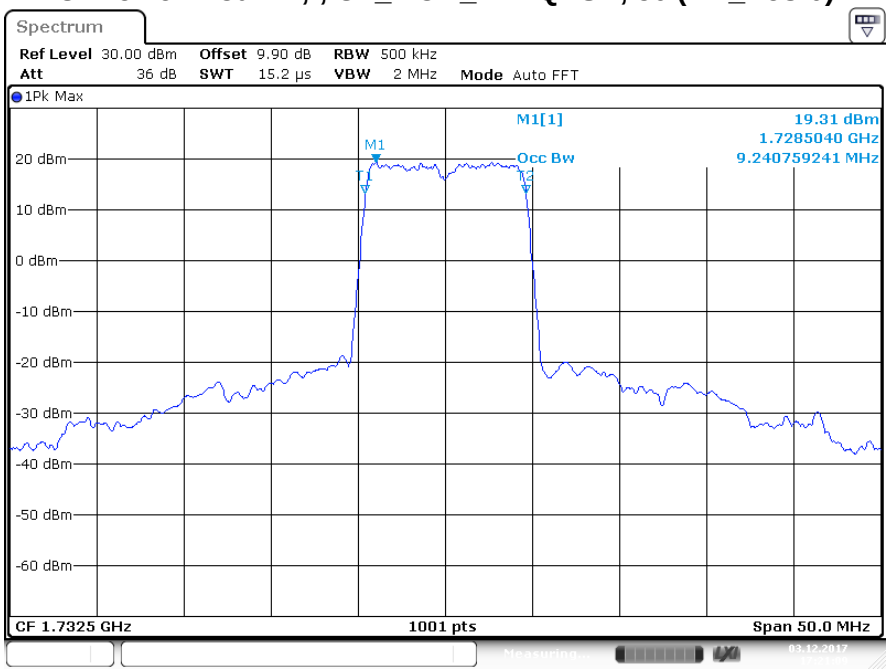
5.5 *Test Data*

LTE Band 4
Occupied Bandwidth: :@ULCH: 20175, BW: 5.0 MHz ,
ULPower: 23dBm; ; UL_MOD_RB: QPSK, 25 (RB_Pos:0)



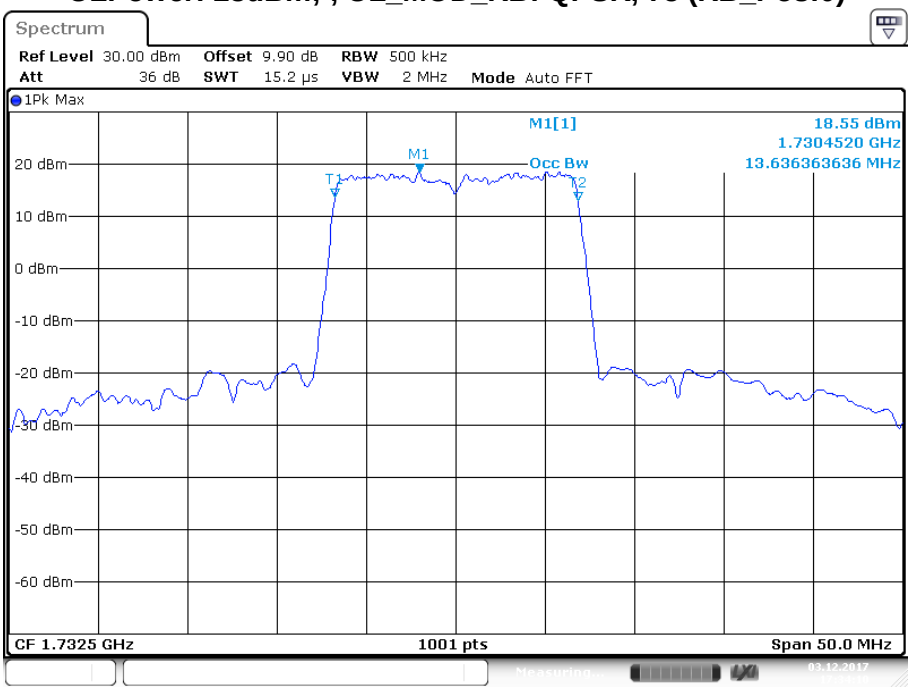
Date: 3.DEC.2017 17:14:54

LTE Band 4
Occupied Bandwidth: :@ULCH: 20175, BW: 10 MHz ,
ULPower: 23dBm; ; UL_MOD_RB: QPSK, 50 (RB_Pos:0)



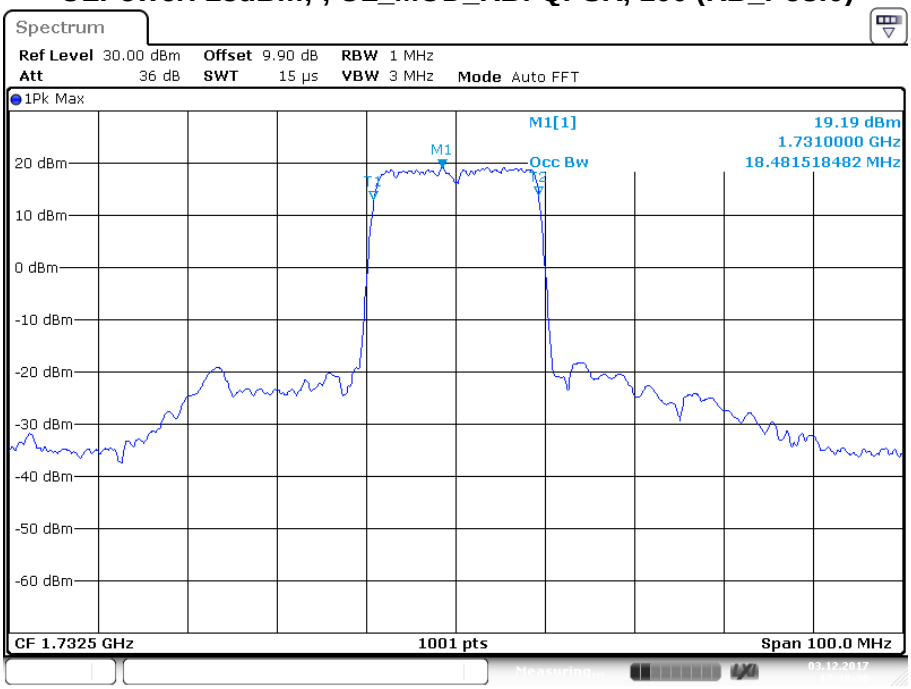
Date: 3.DEC.2017 17:21:10

LTE Band 4
Occupied Bandwidth: :@ULCH: 20175, BW: 15 MHz ,
ULPower: 23dBm; ; UL_MOD_RB: QPSK, 75 (RB_Pos:0)



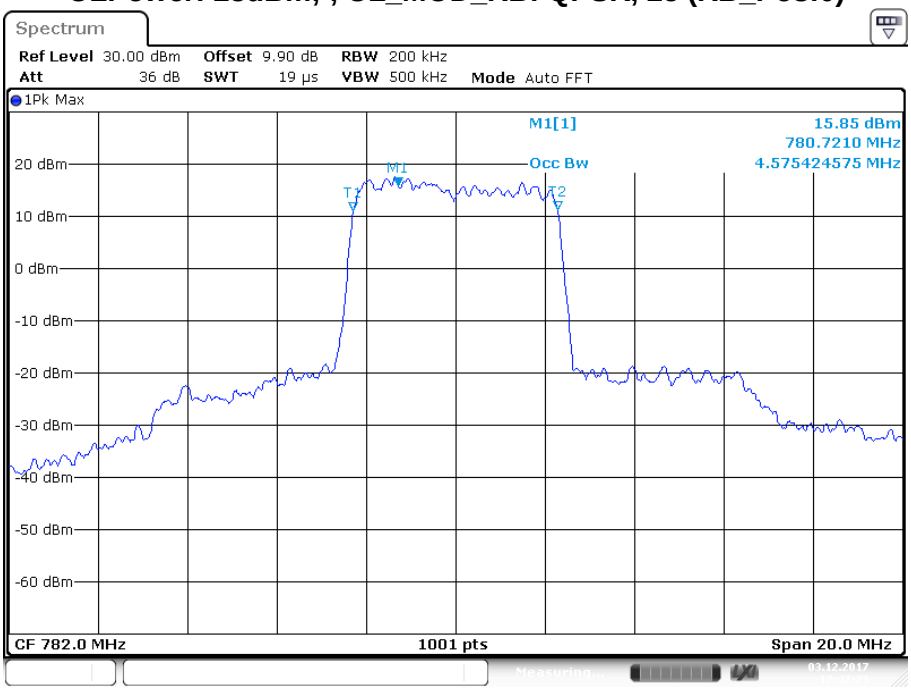
Date: 3.DEC.2017 17:34:10

LTE Band 4
Occupied Bandwidth: :@ULCH: 20175, BW: 20 MHz ,
ULPower: 23dBm; ; UL_MOD_RB: QPSK, 100 (RB_Pos:0)



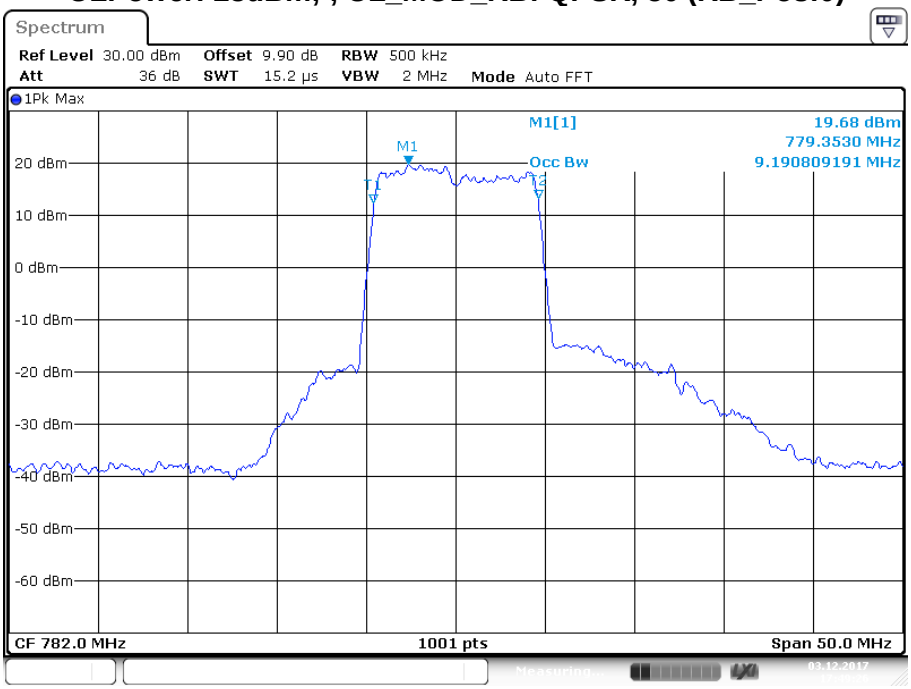
Date: 3.DEC.2017 17:38:30

LTE Band 13
Occupied Bandwidth: :@ULCH: 23230, BW: 5 MHz ,
ULPower: 23dBm; ; UL_MOD_RB: QPSK, 25 (RB_Pos:0)



Date: 3.DEC.2017 17:47:23

LTE Band 13
Occupied Bandwidth: :@ULCH: 23230, BW: 10 MHz ,
ULPower: 23dBm; ; UL_MOD_RB: QPSK, 50 (RB_Pos:0)



Date: 3.DEC.2017 17:49:26

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 27.53(c)(2) 27.53(h)	Pass

6.2 *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 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.

Every bandwidth was investigated for each LTE band, but only the worst-case is presented.

6.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	25.4 °C
Relative Humidity:	37.3 %
Atmospheric Pressure:	98.2 kPa

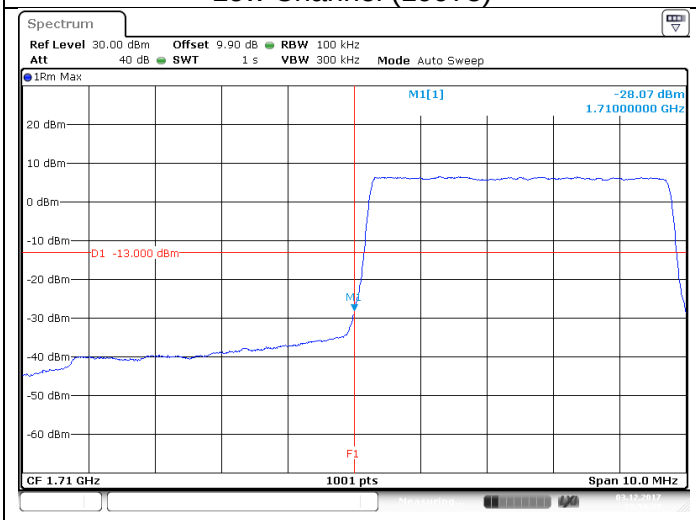
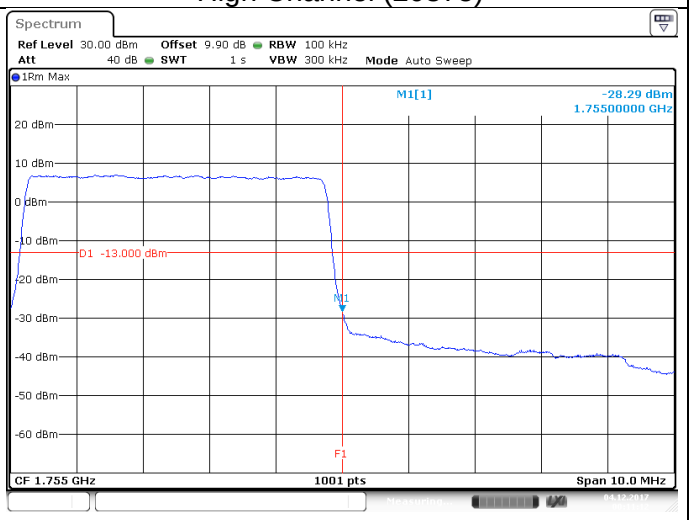
6.4 *Test Equipment*

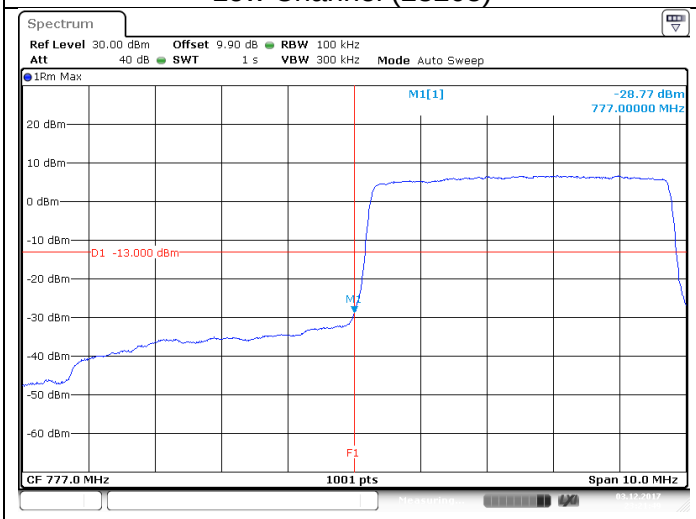
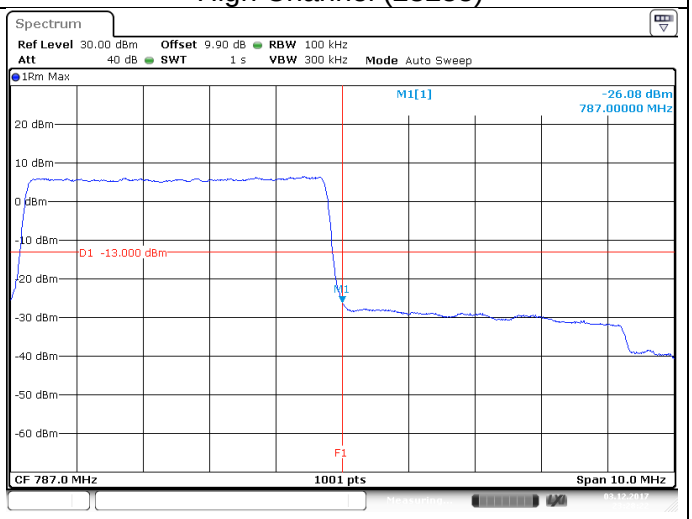
Test End Date: 5-Dec-2017 Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B085757	27-Oct-2018
POWER SPLITTER	ZFRSC-123-S+	MINI-CIRCUITS	B085748	27-Jul-2018
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101741	27-Jul-2018
RF CABLE	SF102	HUBER & SUHNER	B079823	26-Jul-2018
RF CABLE	141	HUBER & SUHNER	B095588	26-Jul-2018
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	1608522I	24-Jul-2018

- 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.

6.5 *Test Data - Band Edge*

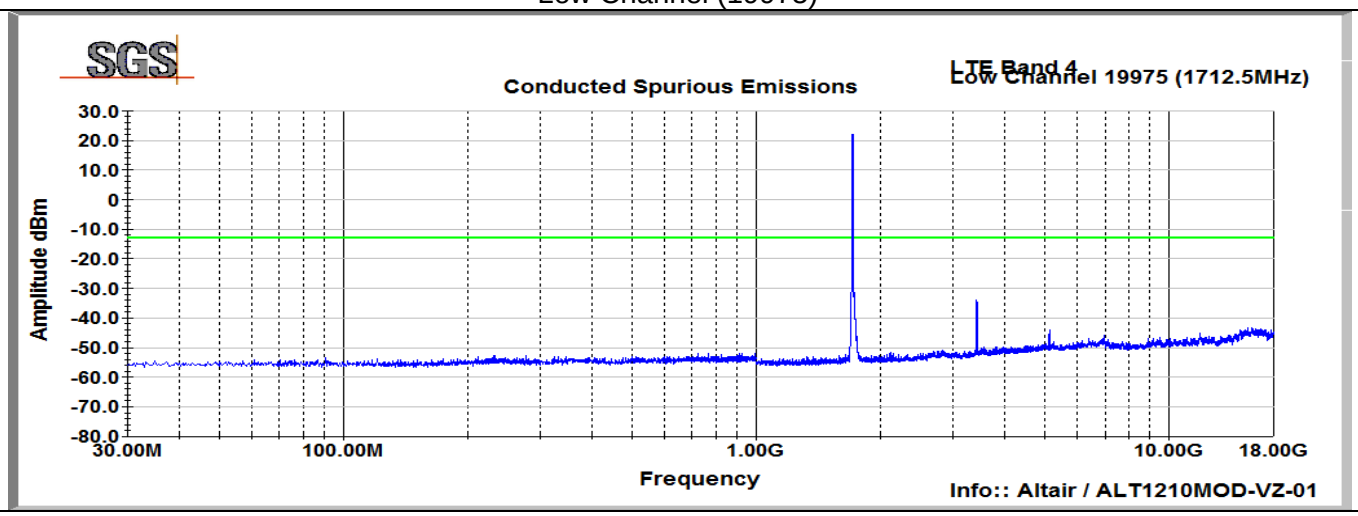
LTE Band 4, QPSK modulation, 5MHz	
Low Channel (19975)	High Channel (20375)
	

LTE Band13, QPSK modulation, 5MHz	
Low Channel (23205)	High Channel (23255)
	

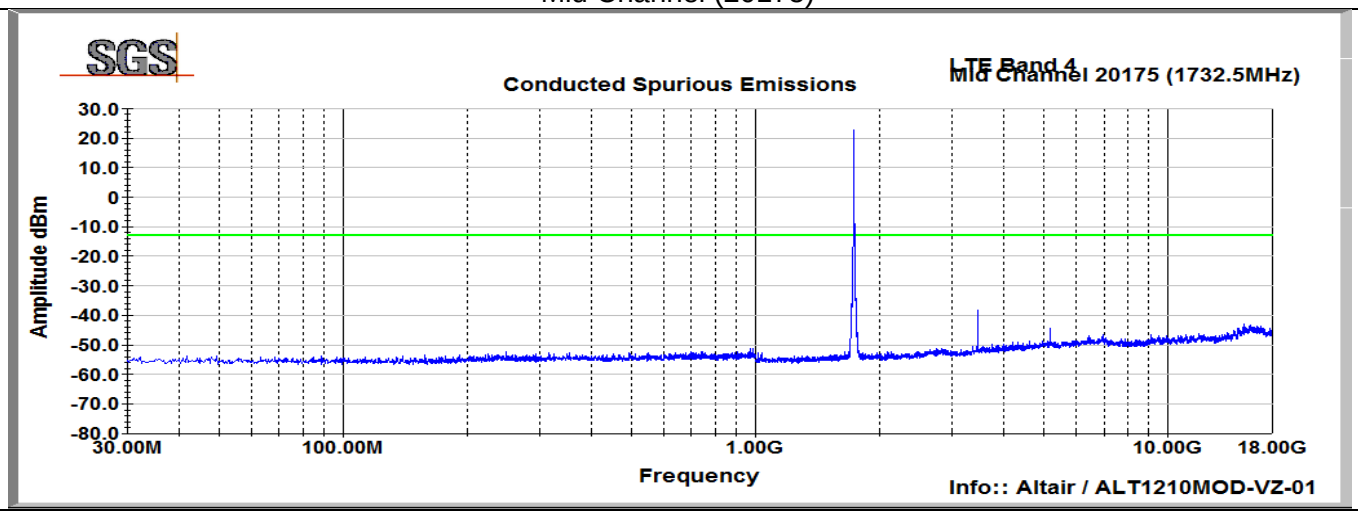
6.6 *Test Data - Conducted Spurious Emissions*

LTE Band 4, QPSK modulation, 5MHz

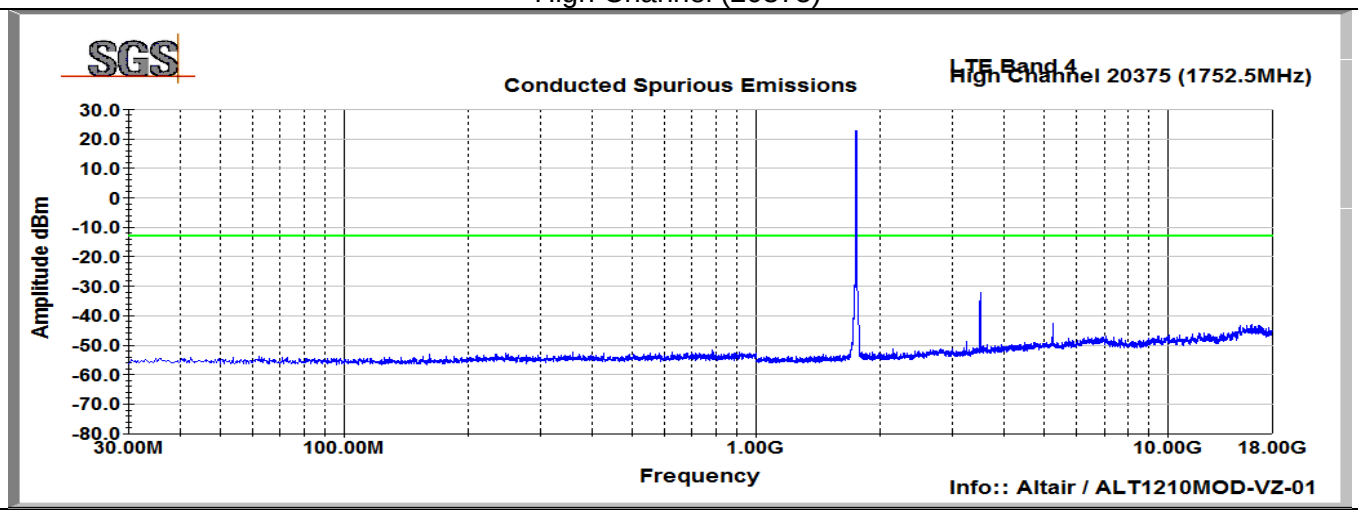
Low Channel (19975)



Mid Channel (20175)

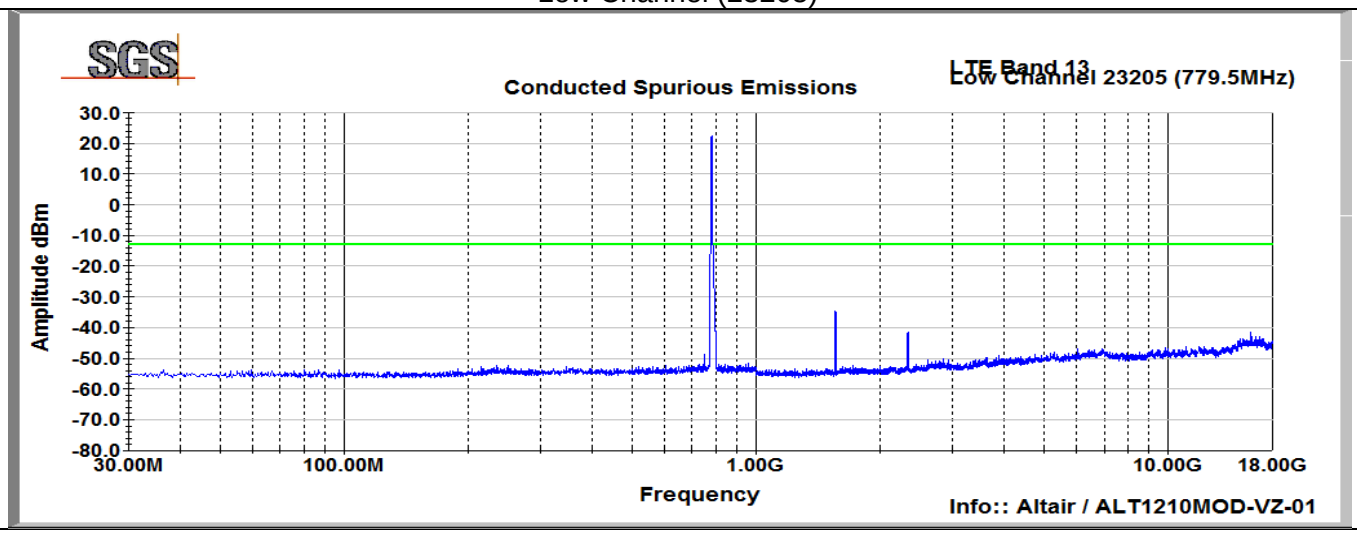


High Channel (20375)

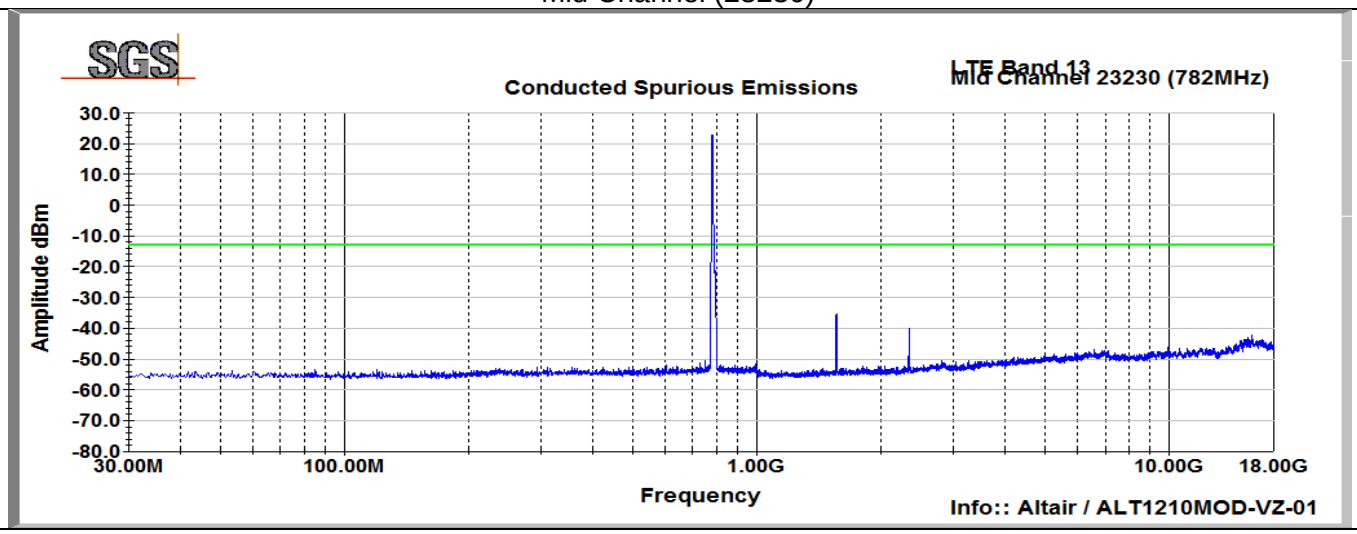


LTE Band 13, QPSK modulation, 5MHz

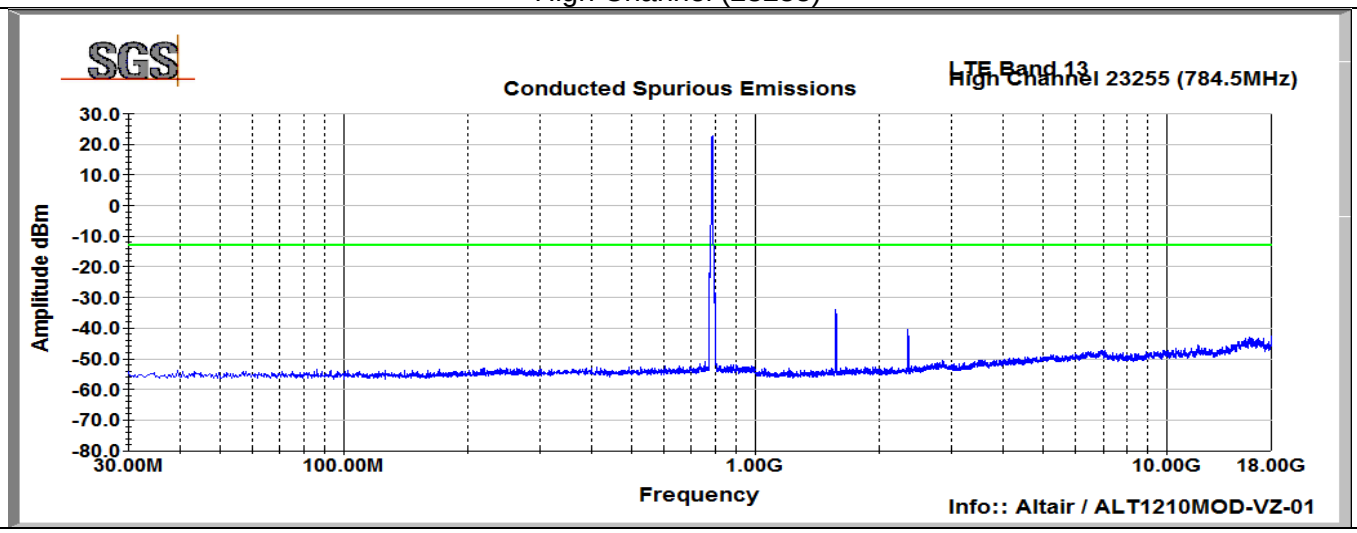
Low Channel (23205)



Mid Channel (23230)



High Channel (23255)



7 Effective Radiated Power

7.1.1 Test Result

Test Description	Basic Standards	Test Result
Effective Radiated Power	27.50(b)(10)	Pass
Effective Isotropic Radiated Power	27.50(d)(4)	Pass

7.1.2 Test Method

Because the ALT1210MOD-VZ-01 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.

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	Antenna Gain	Cable Loss	Average EIRP	
Type	MHz	dBm			dBm	mW
LTE Band 4	1710-1755	23.1	6.9	0.0	30.0	1000
LTE Band 13	777-787	23.3	11.4	0.0	34.7	2951

Note: Antenna gain was determined from maximum gain while still meeting the ERP/EIRP requirements for each band.

8 Radiated Spurious Emissions

8.1 *Test Result*

Test Description	Basic Standards	Test Result
Radiated Spurious Emissions	2.1053 27.53(c)(2) 27.53(h) ANSI/TIA-603-D-2010	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. During radiated spurious emissions, the antenna power was directly connected via coax to the CMW500.

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 ANSI C63.4: 2014 below and above 1GHz)

Environmental Conditions

Temperature:	24.5 °C
Relative Humidity:	27.5 %
Atmospheric Pressure:	98.7 kPa

8.4 *Test Equipment*

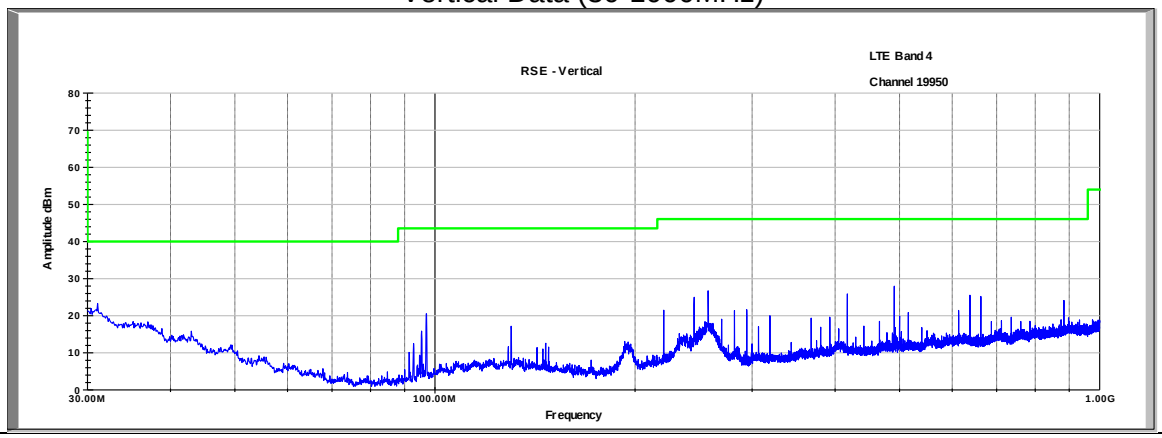
Test End Date: 1-Dec-2017 Tester: ASF

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	27-Jul-2018
RF CABLE	SF106	HUBER & SUHNER	B079712	24-Jul-2018
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B085757	27-Oct-2018
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	28-Jul-2018
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Jul-2018
ANTENNA, BILOG	CBL 6143A	TESEQ	B085931	6-Dec-2017
RF CABLE	SF106	HUBER & SUHNER	B079661	25-Jul-2018
RF CABLE	SF106	HUBER & SUHNER	B079713	24-Jul-2018
RF CABLE	UC-N-MM-78	MAURY MICROWAVE	17017	25-Jul-2018
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	22-Feb-2018
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	24-Jul-2018
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	25-Jul-2018

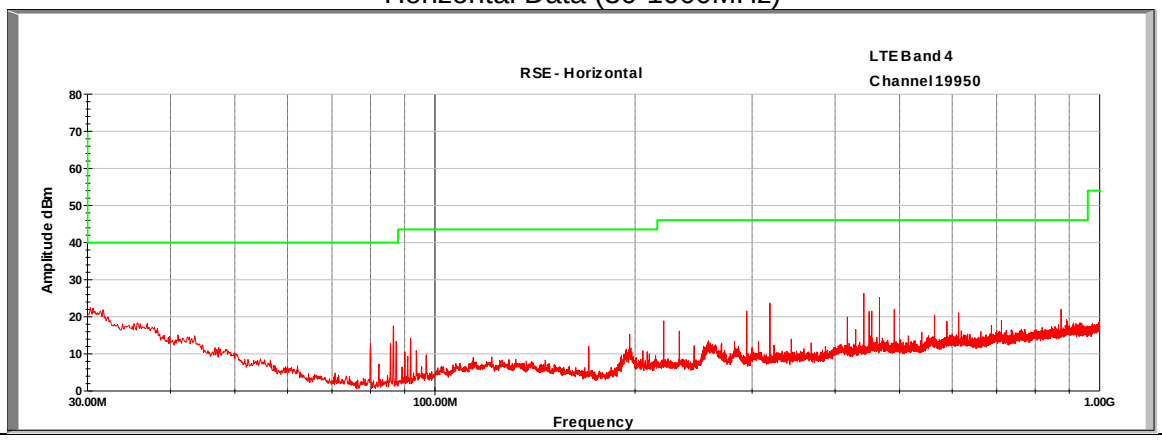
- Unless otherwise noted, equipment is on a 1 year calibration cycle.
- Based on manufacturer's specifications, the CMW 500 is on a 2 year calibration cycle.

8.5 *Test Data*

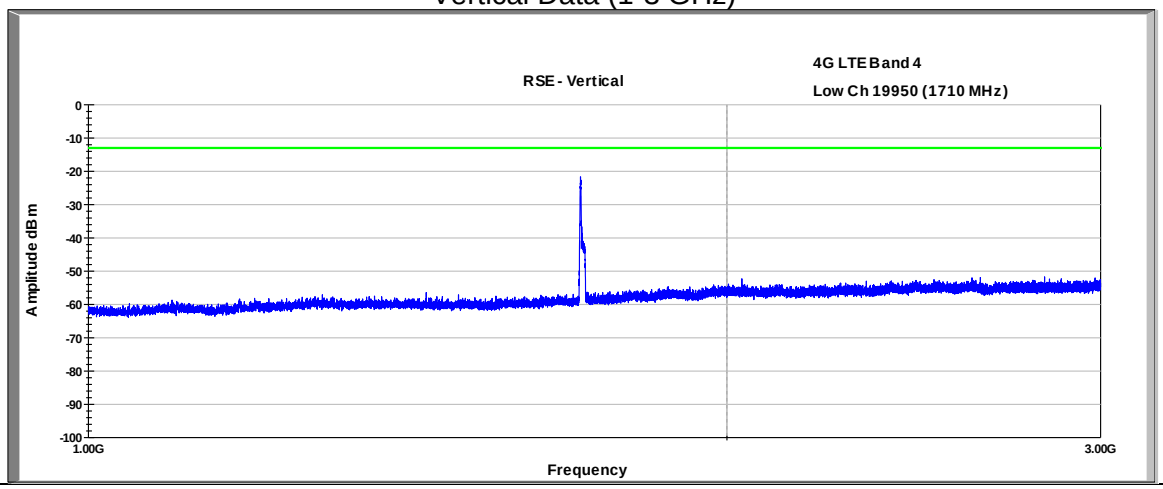
LTE Band 4, QPSK modulation, 10MHz
Low Channel (19950)
Vertical Data (30-1000MHz)



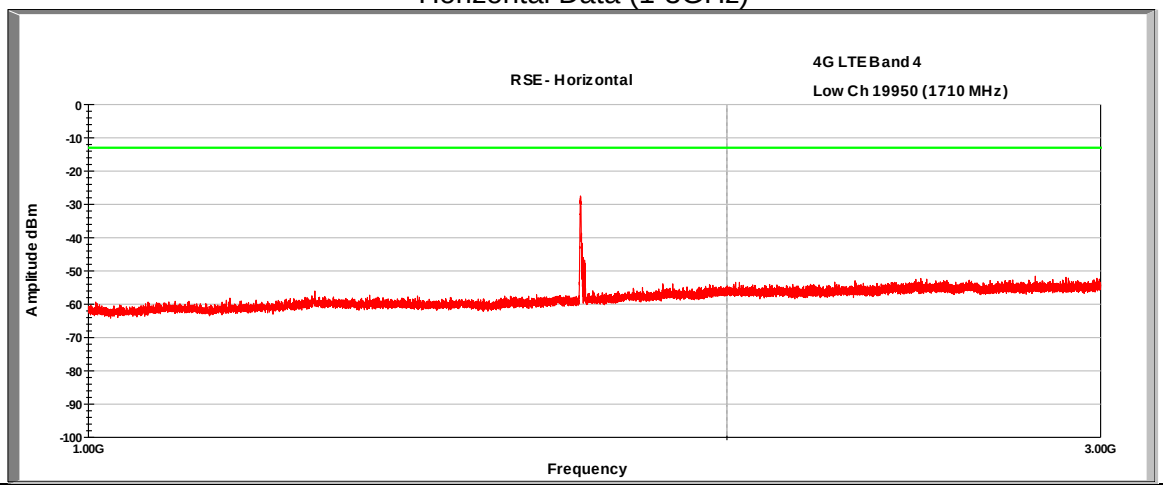
Horizontal Data (30-1000MHz)



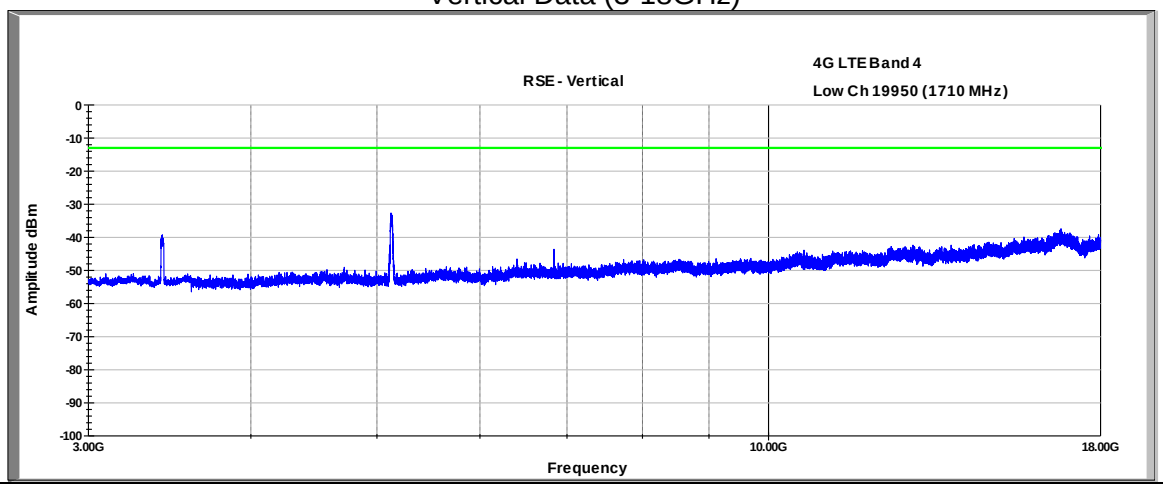
LTE Band 4, QPSK modulation, 10MHz
Low Channel (19950)
Vertical Data (1-3 GHz)



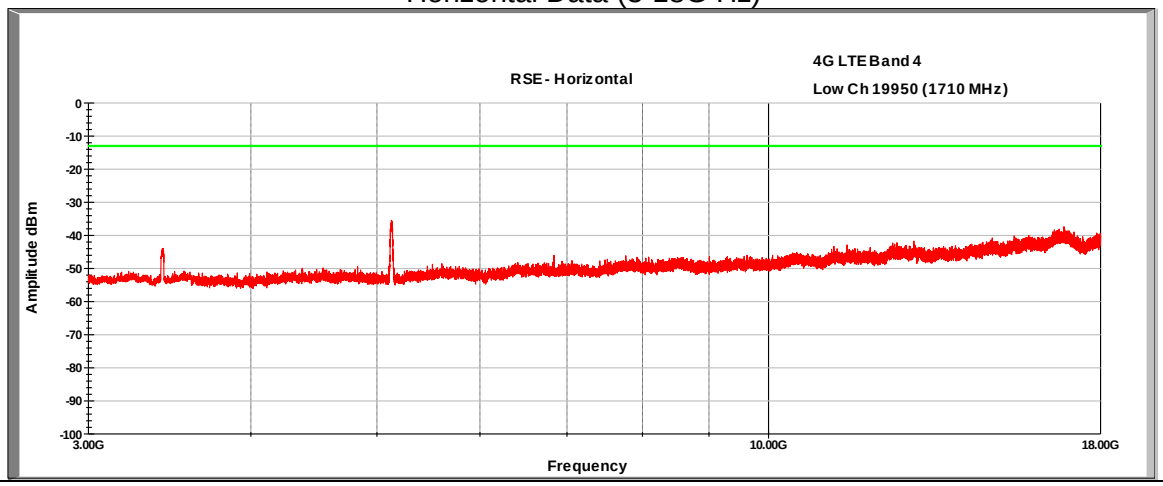
Horizontal Data (1-3GHz)



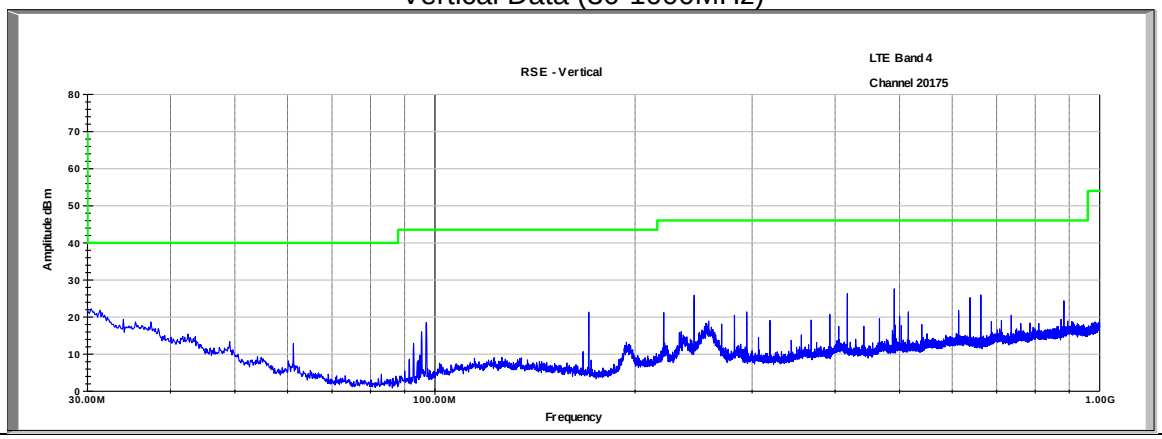
LTE Band 4, QPSK modulation, 10MHz
Low Channel (19950)
Vertical Data (3-18GHz)



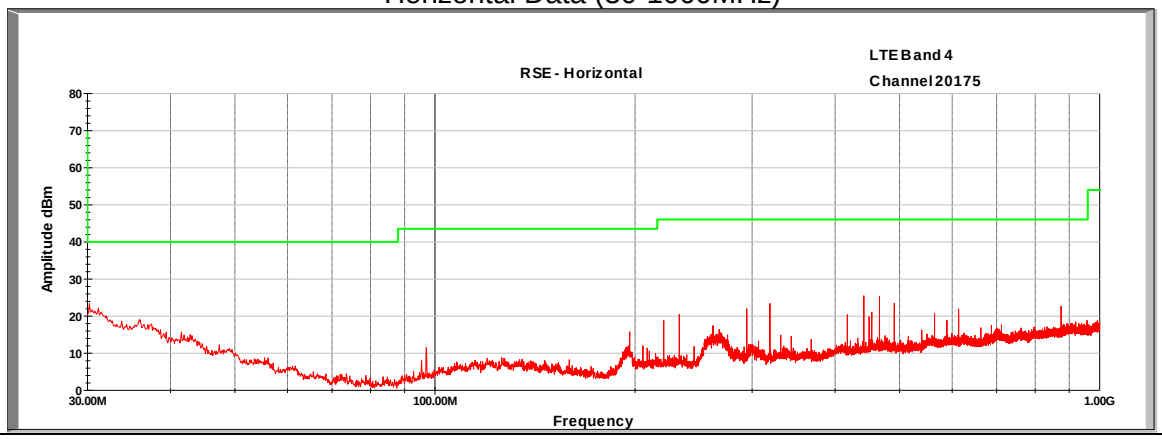
Horizontal Data (3-18G Hz)



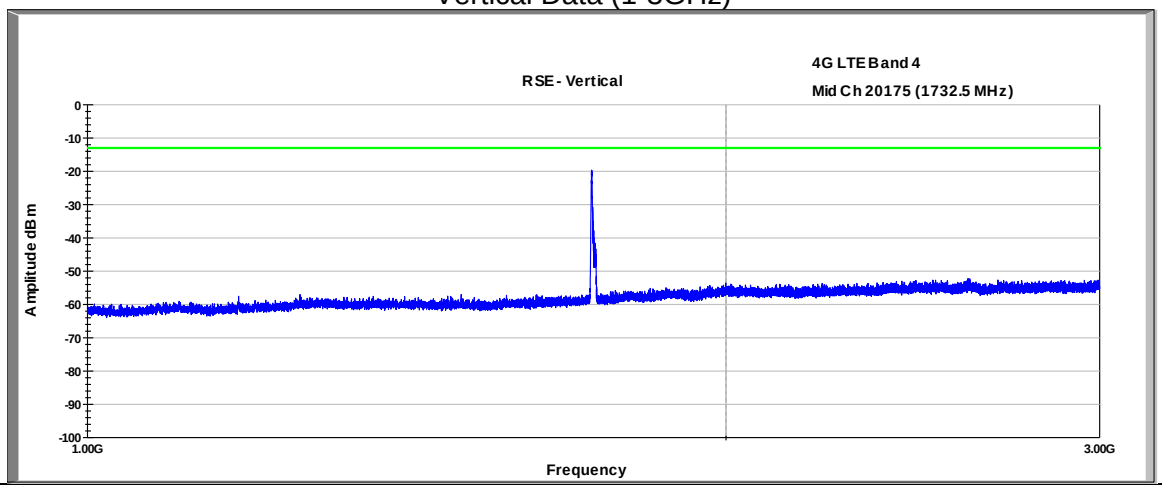
LTE Band 4, QPSK modulation, 10MHz
Mid Channel (20175)
Vertical Data (30-1000MHz)



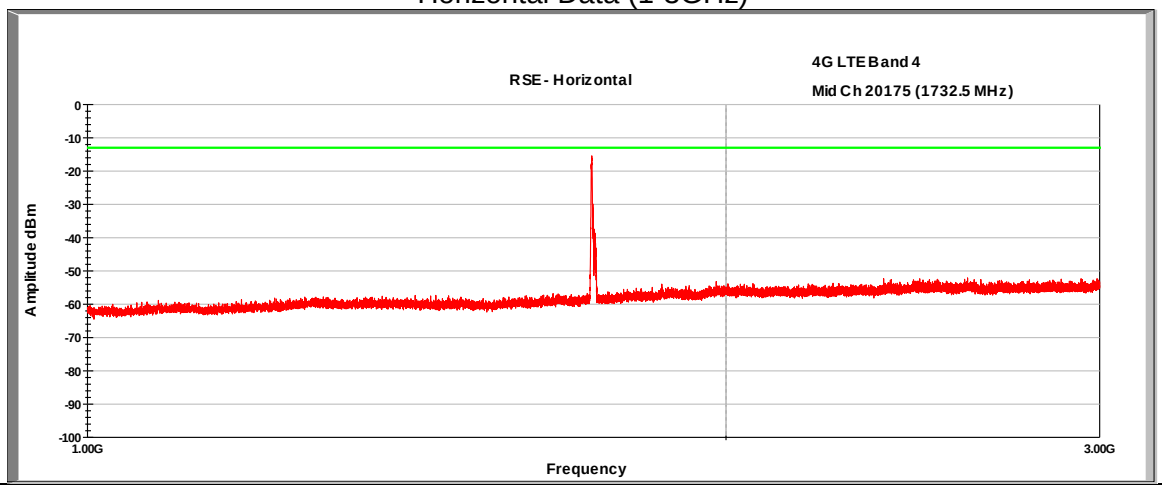
Horizontal Data (30-1000MHz)



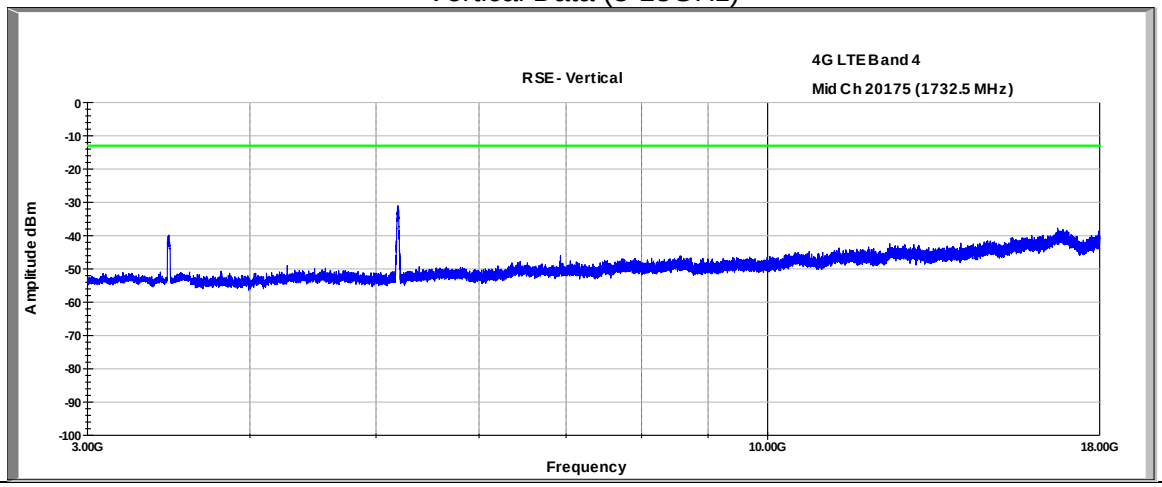
LTE Band 4, QPSK modulation, 10MHz
Mid Channel (20175)
Vertical Data (1-3GHz)



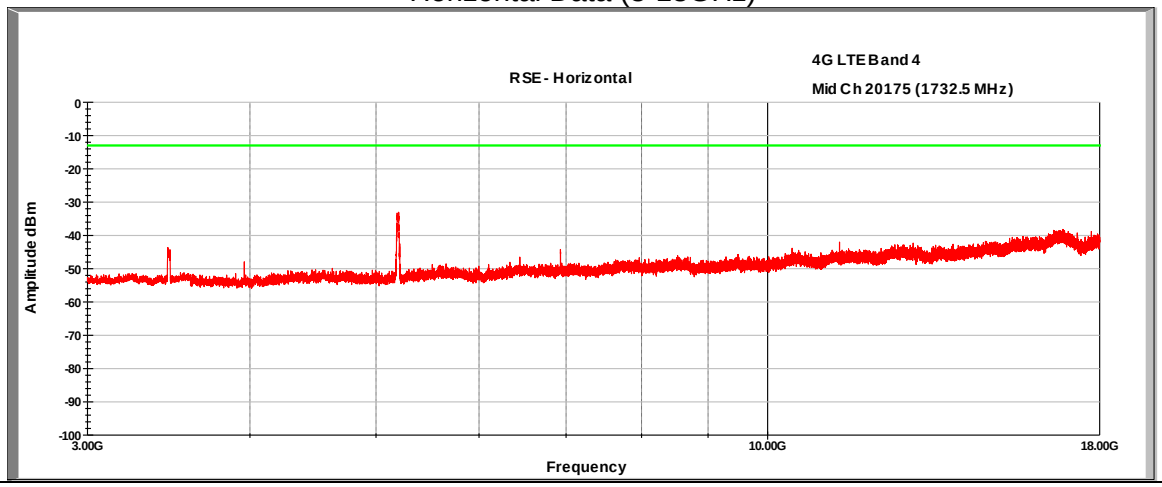
Horizontal Data (1-3GHz)



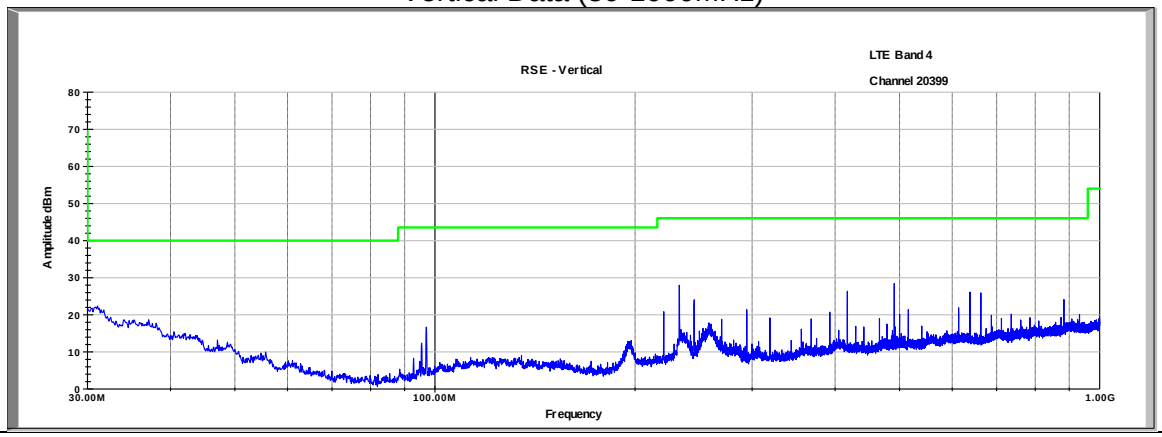
LTE Band 4, QPSK modulation, 10MHz
Mid Channel (20175)
Vertical Data (3-18GHz)



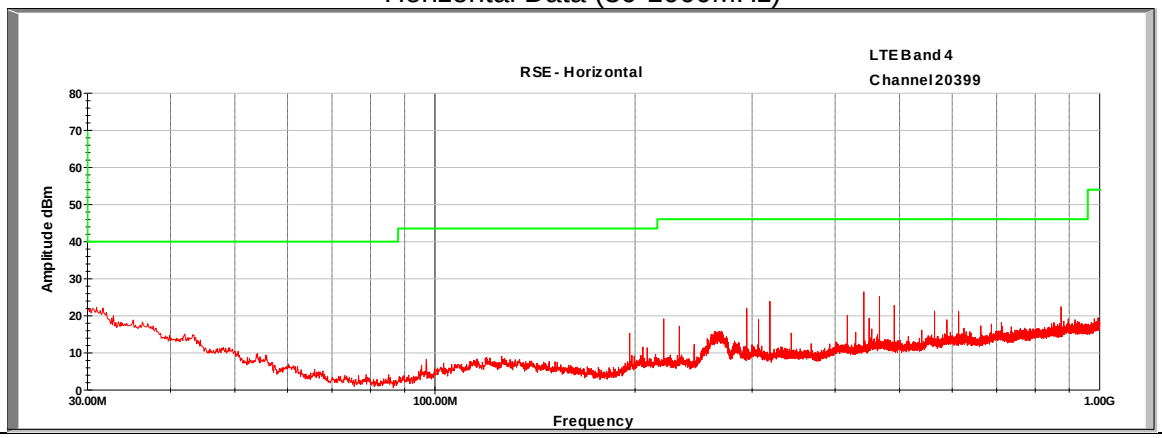
Horizontal Data (3-18GHz)



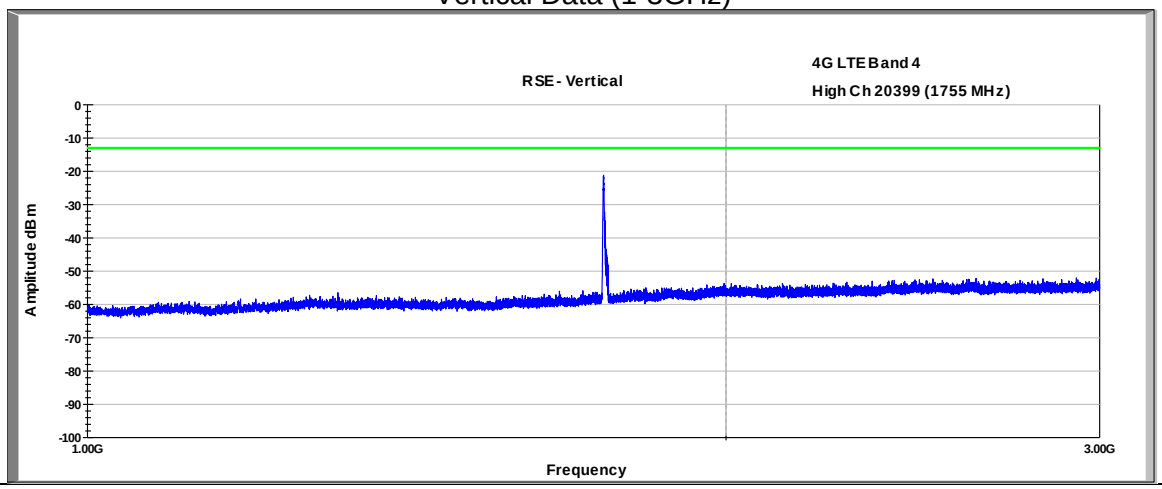
LTE Band 4, QPSK modulation, 10MHz
High Channel (20399)
Vertical Data (30-1000MHz)



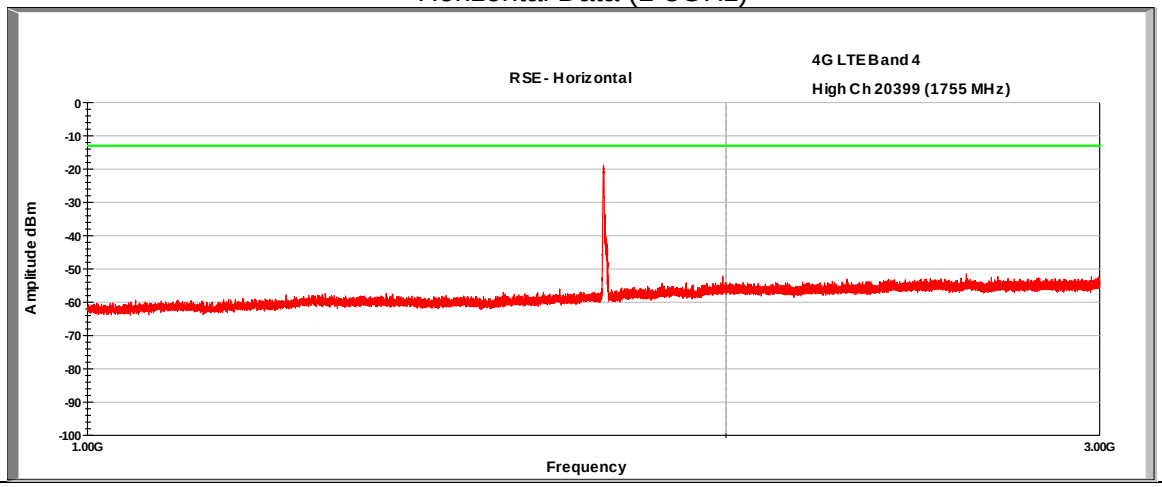
Horizontal Data (30-1000MHz)



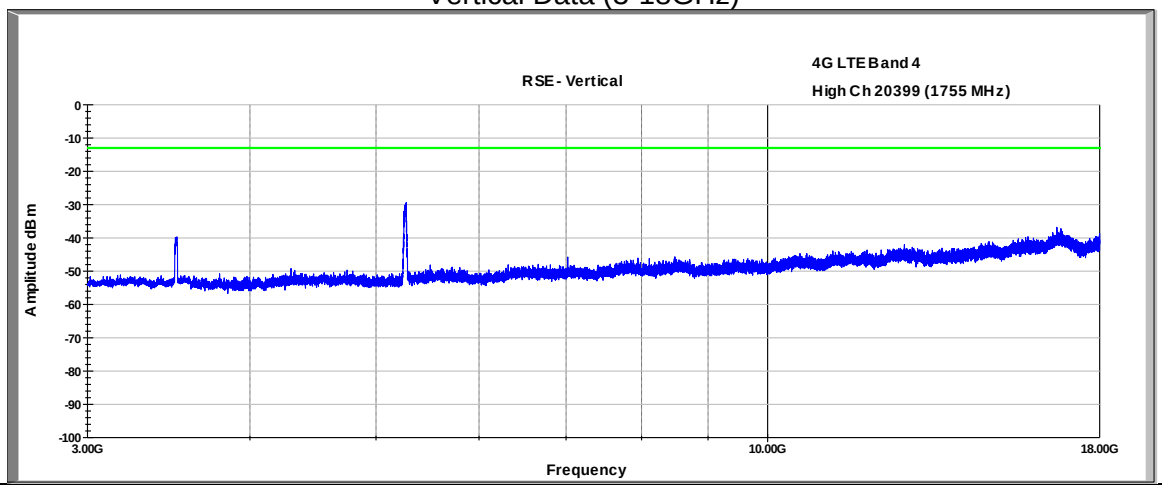
LTE Band 4, QPSK modulation, 10MHz
High Channel (20399)
Vertical Data (1-3GHz)



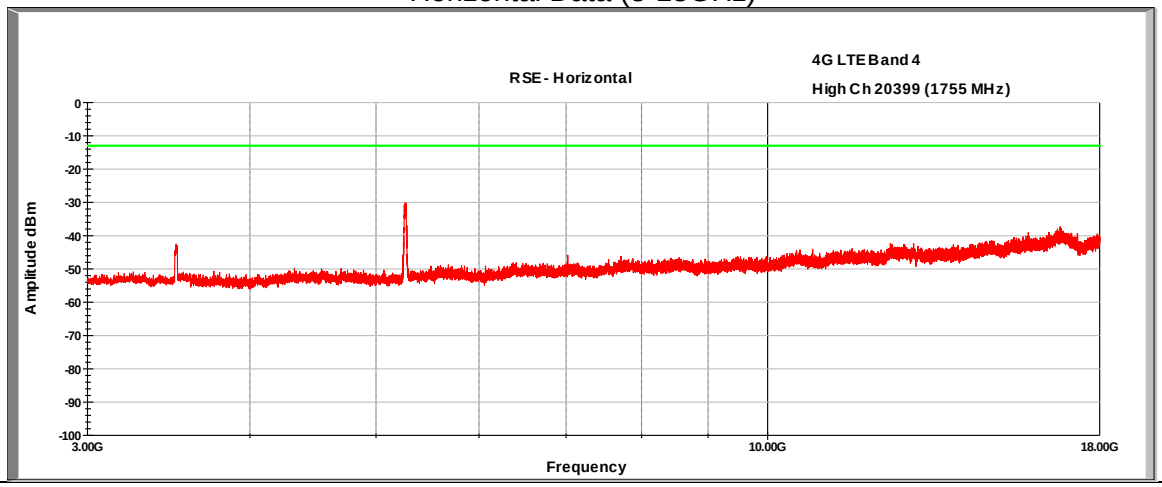
Horizontal Data (1-3GHz)



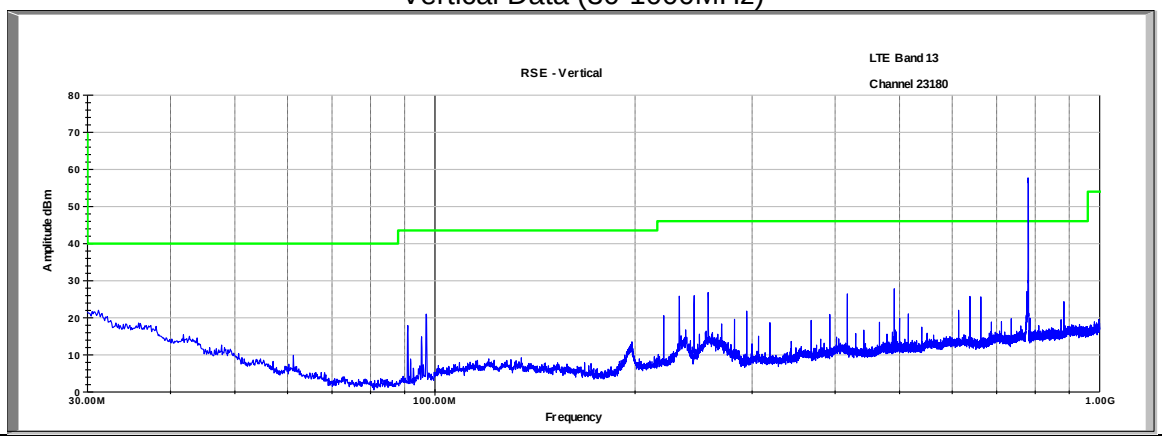
LTE Band 4, QPSK modulation, 10MHz
High Channel (20399)
Vertical Data (3-18GHz)



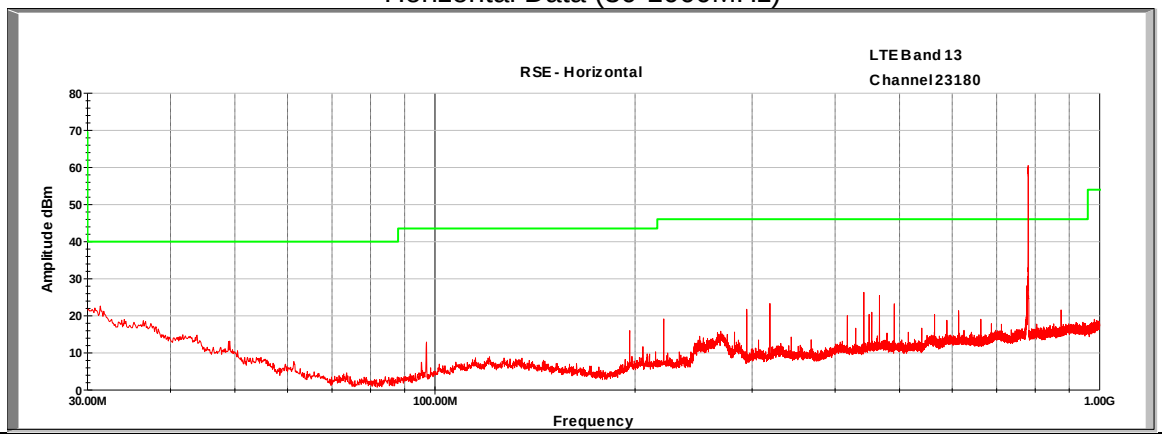
Horizontal Data (3-18GHz)



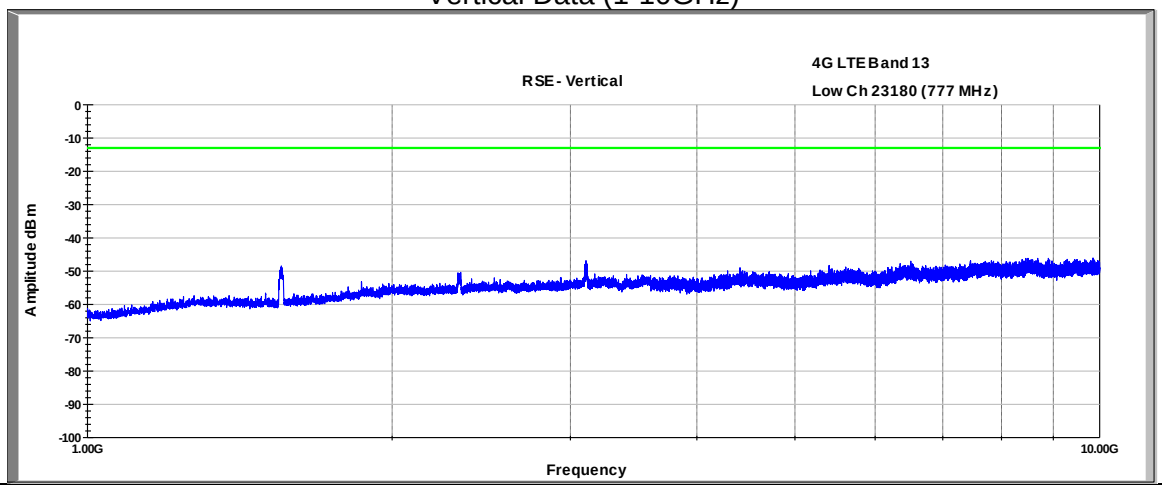
LTE Band 13, QPSK modulation, 5MHz
Low Channel (23180)
Vertical Data (30-1000MHz)



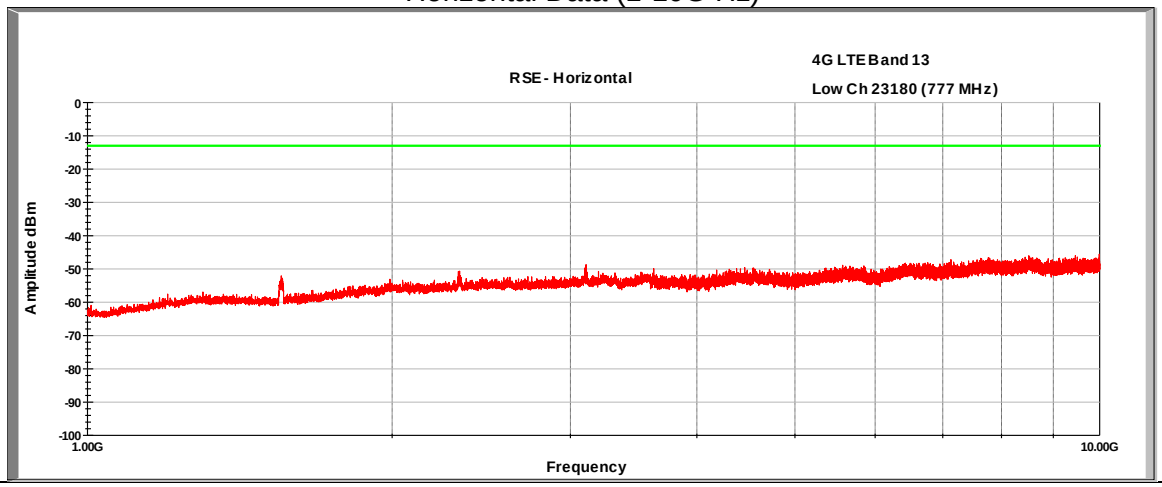
Horizontal Data (30-1000MHz)



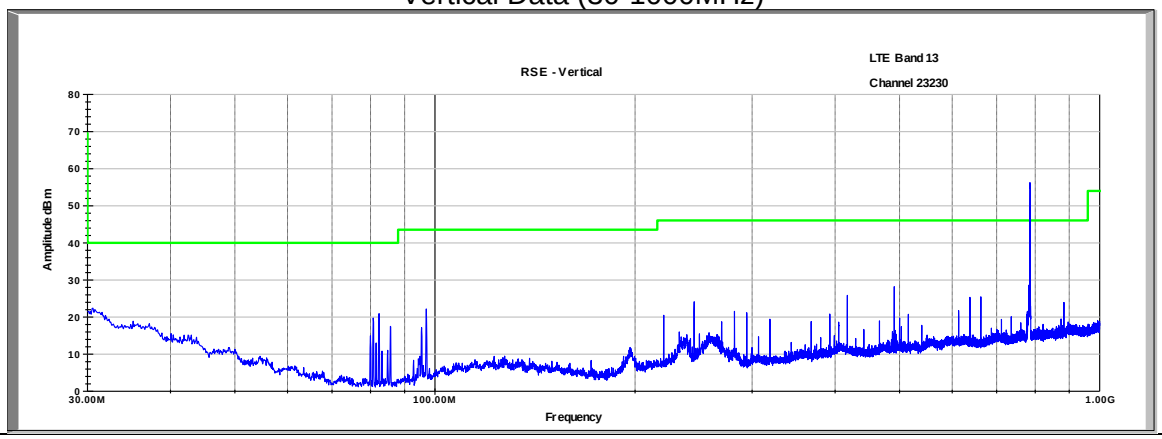
LTE Band 13, QPSK modulation, 5MHz
Low Channel (23180)
Vertical Data (1-10GHz)



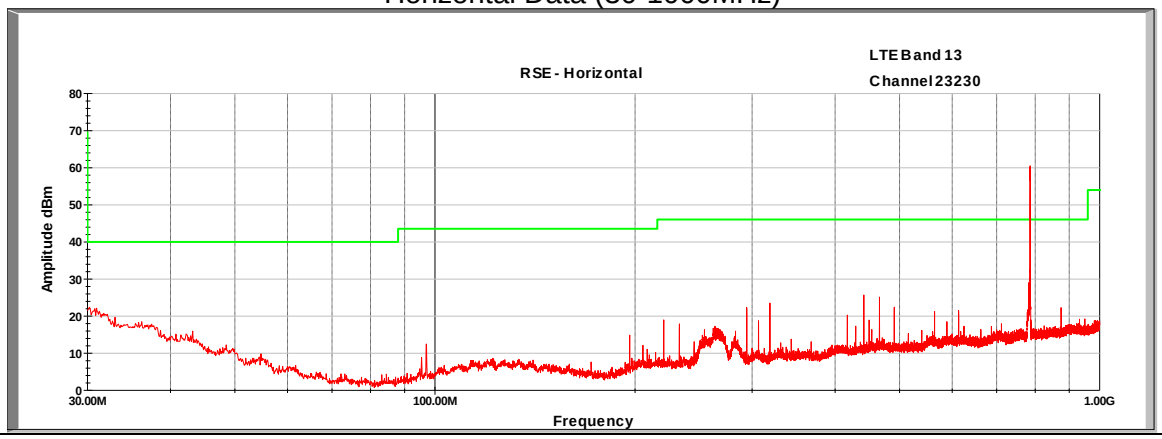
Horizontal Data (1-10G Hz)



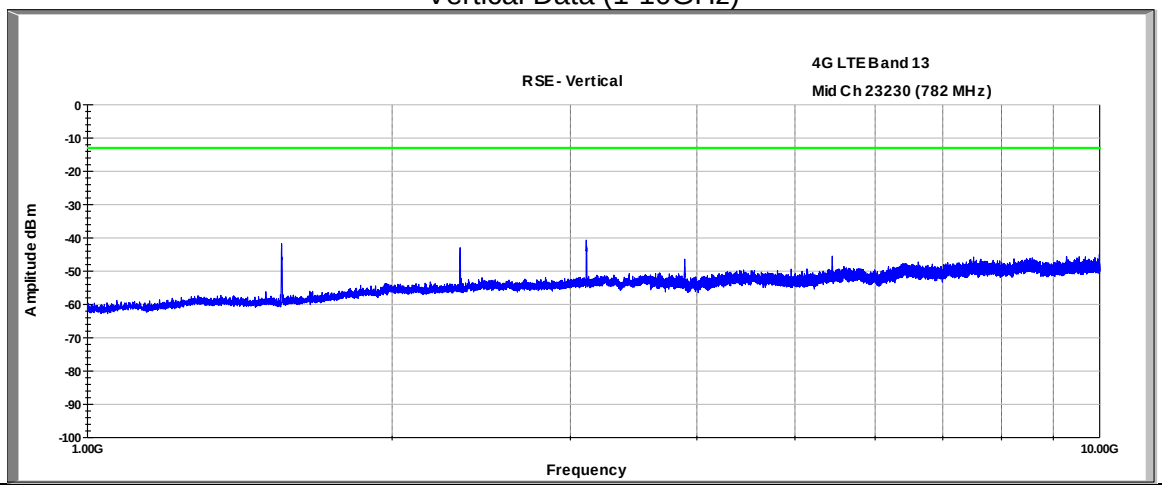
LTE Band 13, QPSK modulation, 5MHz
Mid Channel (23230)
Vertical Data (30-1000MHz)



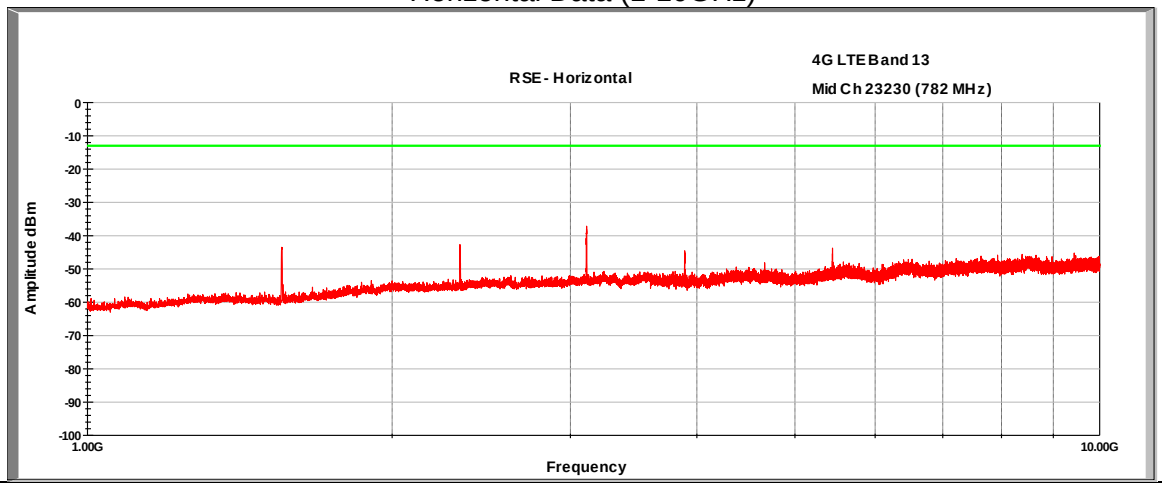
Horizontal Data (30-1000MHz)



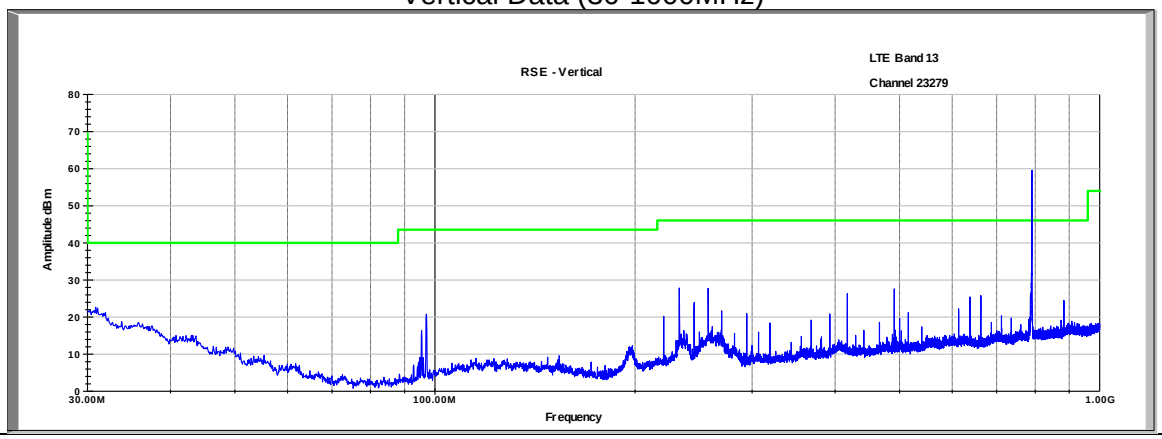
LTE Band 13, QPSK modulation, 5MHz
Mid Channel (23230)
Vertical Data (1-10GHz)



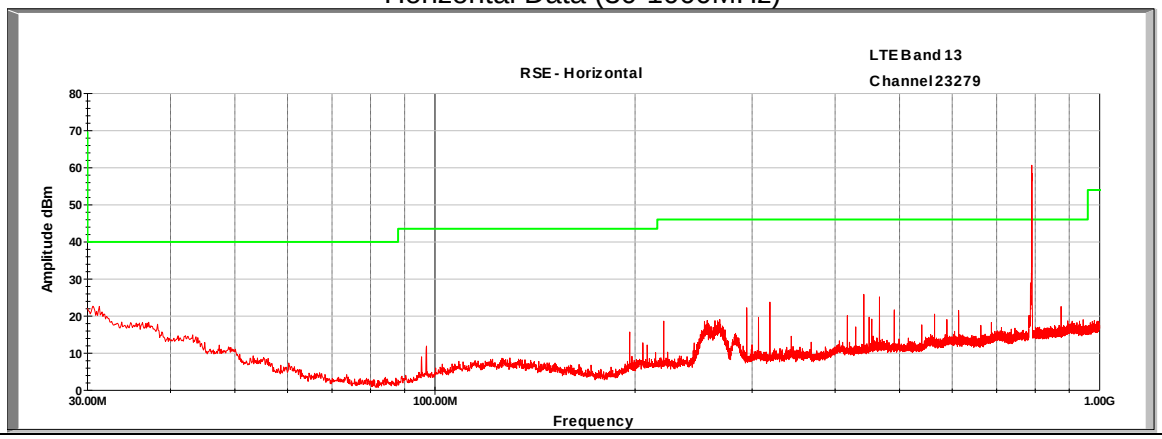
Horizontal Data (1-10GHz)



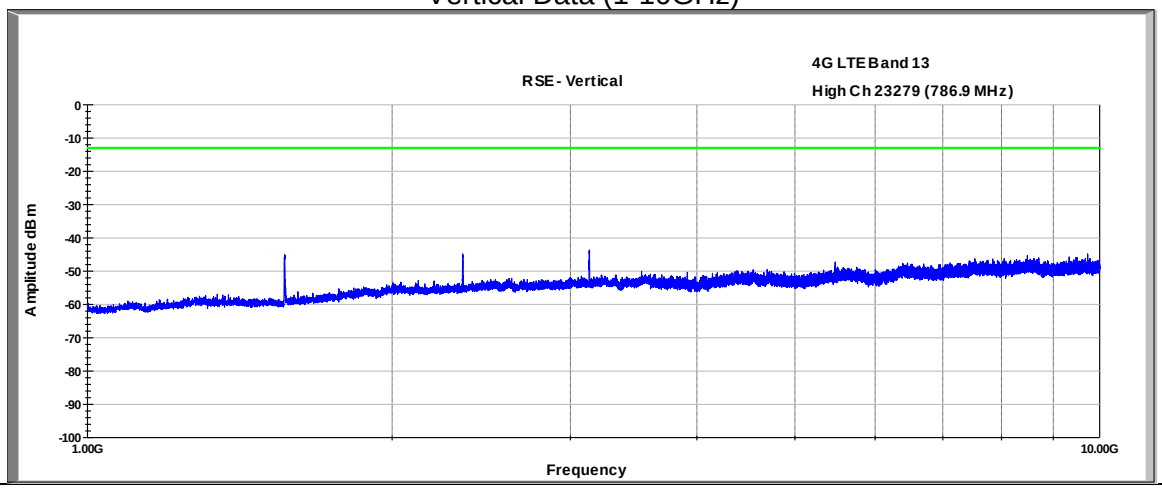
LTE Band 13, QPSK modulation, 5MHz
High Channel (23279)
Vertical Data (30-1000MHz)



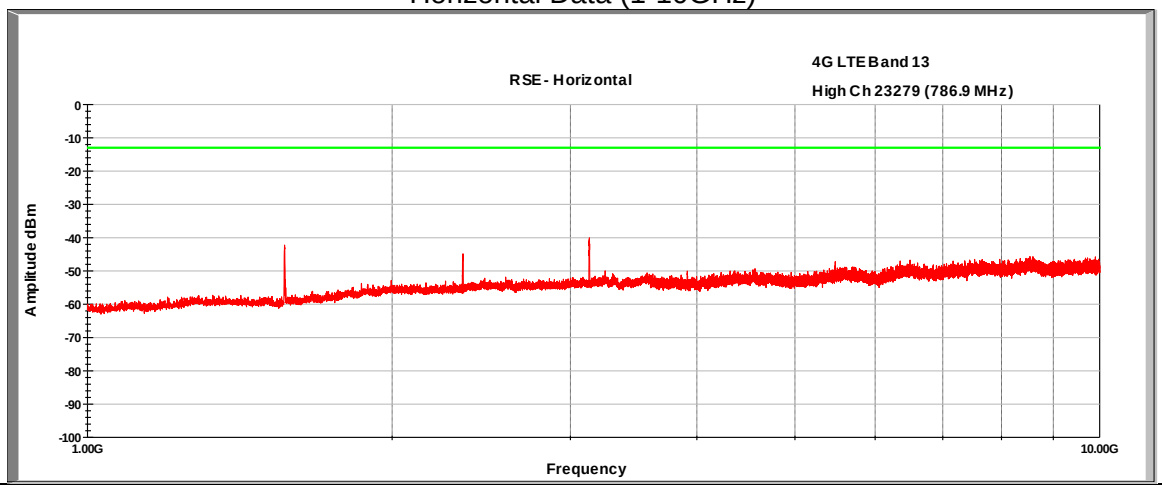
Horizontal Data (30-1000MHz)



LTE Band 13, QPSK modulation, 5MHz
High Channel (23279)
Vertical Data (1-10GHz)



Horizontal Data (1-10GHz)



9 Frequency Stability

9.1 *Test Result*

Test Description	Basic Standards	Test Result
Frequency Stability	2.1055 27.5(b) 27.5(h) 27.54	Pass

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 Bands 4 and 13.

9.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

9.4 *Test Equipment*

Test End Date: 6-Dec-2017 Tester: MT

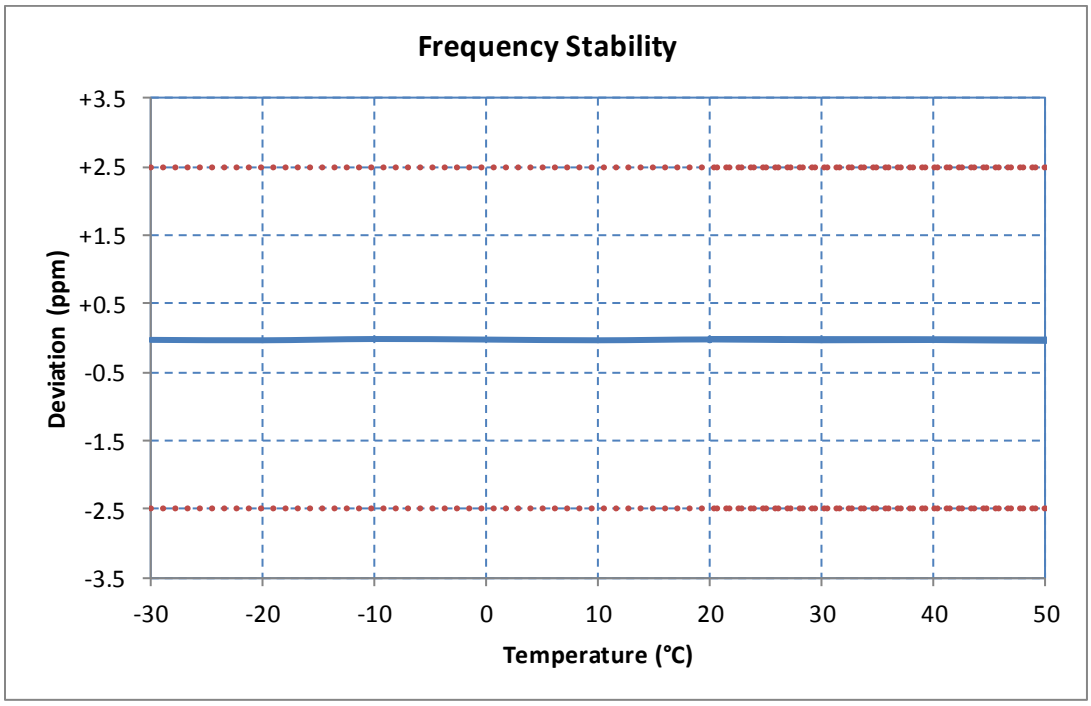
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	19-Jan-2018
RF CABLE	141	HUBER & SUHNER	B095590	26-Jul-2018
ENVIRONMENTAL TEST CHAMBER	T2RC	TENNEY ENVIRONMENTAL	B094877	CNR
MULTIMETER	87V	FLUKE	B079675	29-Jul-2018

- 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.

9.5 *Test Data*

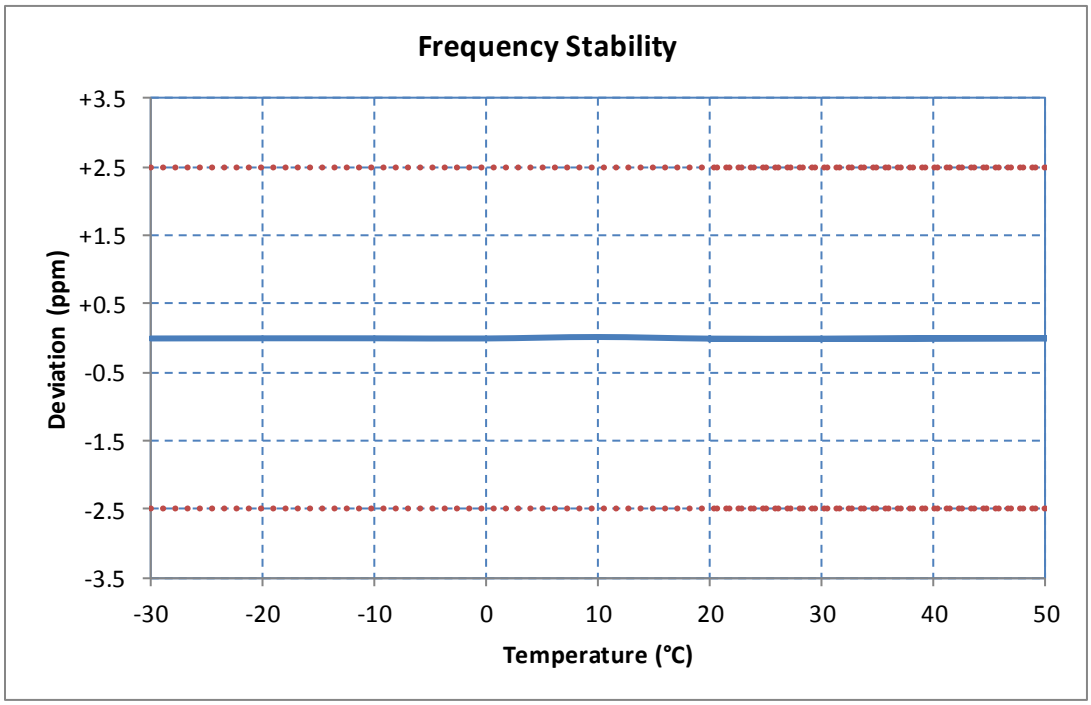
Band 4, Channel 20175

Voltage %	Power V_{DC}	Temp °C	Frequency Hz	Freq Dev	Freq Dev ppm	Deviation %
100%	3.80	+20 (Ref)	1,732,499,963	-37	-0.02	-0.000002
100%	3.80	-30	1,732,499,960	-40	-0.02	-0.000002
100%	3.80	-20	1,732,499,957	-43	-0.02	-0.000002
100%	3.80	-10	1,732,499,966	-34	-0.02	-0.000002
100%	3.80	0	1,732,499,962	-38	-0.02	-0.000002
100%	3.80	+10	1,732,499,957	-43	-0.02	-0.000002
100%	3.80	+20	1,732,499,963	-37	-0.02	-0.000002
100%	3.80	+30	1,732,499,957	-43	-0.02	-0.000002
100%	3.80	+40	1,732,499,959	-41	-0.02	-0.000002
100%	3.80	+50	1,732,499,953	-47	-0.03	-0.000003
100%	3.80	+55	1,732,499,961	-39	-0.02	-0.000002
115%	4.37	+20	1,732,499,966	-34	-0.02	-0.000002
85%	3.23	+20	1,732,499,957	-43	-0.02	-0.000002



Band 13, Channel 23230

Voltage %	Power V_{DC}	Temp °C	Frequency Hz	Freq Dev Hz	Freq Dev ppm	Deviation %
100%	3.80	+20 (Ref)	781,999,996	-4	-0.01	-0.000001
100%	3.80	-30	781,999,997	-3	-0.00	-0.000000
100%	3.80	-20	781,999,998	-2	-0.00	-0.000000
100%	3.80	-10	781,999,998	-2	-0.00	-0.000000
100%	3.80	0	781,999,997	-3	-0.00	-0.000000
100%	3.80	+10	782,000,006	+6	+0.01	+0.000001
100%	3.80	+20	781,999,996	-4	-0.01	-0.000001
100%	3.80	+30	781,999,994	-6	-0.01	-0.000001
100%	3.80	+40	781,999,997	-3	-0.00	-0.000000
100%	3.80	+50	781,999,997	-3	-0.00	-0.000000
100%	3.80	+55	782,000,000	+0	+0.00	+0.000000
115%	4.37	+20	781,999,994	-6	-0.01	-0.000001
85%	3.23	+20	781,999,998	-2	-0.00	-0.000000



Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	20 December 2017
1	Corrected Max Power in section 3.6	11 January 2018