

EMC Test Report

Project Number: 4323472

Report Number: 4323472EMC01 **Revision Level:** 1

Client: Continental Automotive Systems, Inc.

Equipment Under Test: Wireless Modem Module

Model: BL28EU-001

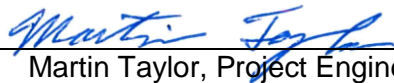
FCC ID: LHJ-BL28EU001

FCC Rule Parts: Part 2, Part 27

Report issued on: 12 October 2018

Test Result: Compliant

Tested by:



Martin Taylor, Project Engineer

Reviewed by:



David Schramm, Operations 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

Reference Sections FCC Rule Part	Test Description	Test Condition	Test Result
2.1046	Conducted Output Power	Conducted	Reported
	Peak-to-Average Ratio		Pass
2.1049 27.53(m)(6)	Occupied Bandwidth Emission Bandwidth		Reported
2.1051 27.53(m)(4)	Band Edge / Conducted Spurious Emissions (CSE)		Pass
27.50(h)(2)	Effective Isotropic Radiated Power	Radiated	Pass
2.1053 27.53(m)(4)	Radiated Spurious Emissions (RSE)		Pass
2.1055 27.54	Frequency Stability	Conducted	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: BL28EU-001
Serial Number: ADN171019008053
FCC ID: LHJ- BL28EU001

IMEI Number: 352375090008053

Rated Voltage: 10.2 – 13.8 Vdc
Test Voltage: 12 Vdc, 10.2 Vdc, 13.8 Vdc

Tx Frequency Range: 2500 – 2570 MHz (LTE Band 7)

FCC Classification: PCS Licensed Transmitter PCB
Type: Pre-Production

Sample Received Date: 13 June 2018
Dates of testing: 10 July – 27 August 2018

2.4 Operating Modes and Conditions

The EUT was exercised by connecting a CMW 500 Radio Communication 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 2.1046	Reported

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: 22.9 – 23.3 °C
 Relative Humidity: 47.1 – 51.5 %
 Atmospheric Pressure: 97.5 – 97.8 kPa

3.4 Test Equipment

Test End Date: 17-Jul-2018

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF CABLE	141	HUBER & SUHNER	B095588	25-Jul-2019
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

- 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 - LTE Band 7

Max Power: 23.23dBm / 0.210W

UpLink Channel	UL Frequency (MHz)	BW (MHz)	Modulation	# RB	Position	Measured Power (dBm)	Cable Loss (dB)	Conducted Power (dBm)
20775	2502.5	5	QPSK	1	(RB_Pos:0)	22.59	0.64	23.23
20775	2502.5	5	QPSK	1	(RB_Pos:24)	22.55	0.64	23.19
20775	2502.5	5	QPSK	12	(RB_Pos:0)	21.66	0.64	22.30
20775	2502.5	5	QPSK	12	(RB_Pos:13)	21.71	0.64	22.35
20775	2502.5	5	QPSK	25	(RB_Pos:0)	21.67	0.64	22.31
21100	2535	5	QPSK	1	(RB_Pos:0)	22.43	0.64	23.07
21100	2535	5	QPSK	1	(RB_Pos:24)	22.48	0.64	23.12
21100	2535	5	QPSK	12	(RB_Pos:0)	21.69	0.64	22.33
21100	2535	5	QPSK	12	(RB_Pos:13)	21.67	0.64	22.31
21100	2535	5	QPSK	25	(RB_Pos:0)	21.61	0.64	22.25
21425	2567.5	5	QPSK	1	(RB_Pos:0)	22.55	0.64	23.19
21425	2567.5	5	QPSK	1	(RB_Pos:24)	22.44	0.64	23.08
21425	2567.5	5	QPSK	12	(RB_Pos:0)	21.70	0.64	22.34
21425	2567.5	5	QPSK	12	(RB_Pos:13)	21.60	0.64	22.24
21425	2567.5	5	QPSK	25	(RB_Pos:0)	21.74	0.64	22.38
20800	2505	10	QPSK	1	(RB_Pos:0)	22.46	0.64	23.10
20800	2505	10	QPSK	1	(RB_Pos:49)	22.39	0.64	23.03
20800	2505	10	QPSK	25	(RB_Pos:0)	21.74	0.64	22.38
20800	2505	10	QPSK	25	(RB_Pos:25)	21.77	0.64	22.41
20800	2505	10	QPSK	50	(RB_Pos:0)	21.71	0.64	22.35
21100	2535	10	QPSK	1	(RB_Pos:0)	22.43	0.64	23.07
21100	2535	10	QPSK	1	(RB_Pos:49)	22.53	0.64	23.17
21100	2535	10	QPSK	25	(RB_Pos:0)	21.73	0.64	22.37
21100	2535	10	QPSK	25	(RB_Pos:25)	21.74	0.64	22.38
21100	2535	10	QPSK	50	(RB_Pos:0)	21.66	0.64	22.30
21400	2565	10	QPSK	1	(RB_Pos:0)	22.57	0.64	23.21
21400	2565	10	QPSK	1	(RB_Pos:49)	22.49	0.64	23.13
21400	2565	10	QPSK	25	(RB_Pos:0)	21.82	0.64	22.46
21400	2565	10	QPSK	25	(RB_Pos:25)	21.73	0.64	22.37
21400	2565	10	QPSK	50	(RB_Pos:0)	21.82	0.64	22.46
20825	2507.5	15	QPSK	1	(RB_Pos:0)	22.58	0.64	23.22
20825	2507.5	15	QPSK	1	(RB_Pos:74)	22.58	0.64	23.22
20825	2507.5	15	QPSK	36	(RB_Pos:0)	21.79	0.64	22.43
20825	2507.5	15	QPSK	36	(RB_Pos:39)	21.69	0.64	22.33
20825	2507.5	15	QPSK	75	(RB_Pos:0)	21.73	0.64	22.37
21100	2535	15	QPSK	1	(RB_Pos:0)	22.37	0.64	23.01
21100	2535	15	QPSK	1	(RB_Pos:74)	22.38	0.64	23.02
21100	2535	15	QPSK	36	(RB_Pos:0)	21.76	0.64	22.40
21100	2535	15	QPSK	36	(RB_Pos:39)	21.64	0.64	22.28
21100	2535	15	QPSK	75	(RB_Pos:0)	21.66	0.64	22.30
21375	2562.5	15	QPSK	1	(RB_Pos:0)	22.59	0.64	23.23
21375	2562.5	15	QPSK	1	(RB_Pos:74)	22.35	0.64	22.99
21375	2562.5	15	QPSK	36	(RB_Pos:0)	21.89	0.64	22.53
21375	2562.5	15	QPSK	36	(RB_Pos:39)	21.73	0.64	22.37
21375	2562.5	15	QPSK	75	(RB_Pos:0)	21.74	0.64	22.38
20850	2510	20	QPSK	1	(RB_Pos:0)	22.39	0.64	23.03
20850	2510	20	QPSK	1	(RB_Pos:99)	22.29	0.64	22.93
20850	2510	20	QPSK	50	(RB_Pos:0)	21.76	0.64	22.40
20850	2510	20	QPSK	50	(RB_Pos:50)	21.67	0.64	22.31
20850	2510	20	QPSK	100	(RB_Pos:0)	21.70	0.64	22.34
21100	2535	20	QPSK	1	(RB_Pos:0)	22.50	0.64	23.14
21100	2535	20	QPSK	1	(RB_Pos:99)	22.49	0.64	23.13
21100	2535	20	QPSK	50	(RB_Pos:0)	21.73	0.64	22.37
21100	2535	20	QPSK	50	(RB_Pos:50)	21.64	0.64	22.28
21100	2535	20	QPSK	100	(RB_Pos:0)	21.66	0.64	22.30
21350	2560	20	QPSK	1	(RB_Pos:0)	22.44	0.64	23.08
21350	2560	20	QPSK	1	(RB_Pos:99)	22.39	0.64	23.03
21350	2560	20	QPSK	50	(RB_Pos:0)	21.72	0.64	22.36
21350	2560	20	QPSK	50	(RB_Pos:50)	21.73	0.64	22.37
21350	2560	20	QPSK	100	(RB_Pos:0)	21.71	0.64	22.35

UpLink Channel	UL Frequency (MHz)	BW (MHz)	Modulation	# RB	Position	Measured Power (dBm)	Cable Loss (dB)	Conducted Power (dBm)
20775	2502.5	5	16-QAM	1	(RB_Pos:0)	21.59	0.64	22.23
20775	2502.5	5	16-QAM	1	(RB_Pos:24)	21.69	0.64	22.33
20775	2502.5	5	16-QAM	12	(RB_Pos:0)	20.86	0.64	21.50
20775	2502.5	5	16-QAM	12	(RB_Pos:13)	20.85	0.64	21.49
20775	2502.5	5	16-QAM	25	(RB_Pos:0)	20.93	0.64	21.57
21100	2535	5	16-QAM	1	(RB_Pos:24)	21.57	0.64	22.21
21100	2535	5	16-QAM	1	(RB_Pos:24)	21.66	0.64	22.30
21100	2535	5	16-QAM	12	(RB_Pos:0)	20.75	0.64	21.39
21100	2535	5	16-QAM	12	(RB_Pos:13)	20.79	0.64	21.43
21100	2535	5	16-QAM	25	(RB_Pos:0)	20.76	0.64	21.40
21425	2567.5	5	16-QAM	1	(RB_Pos:0)	21.44	0.64	22.08
21425	2567.5	5	16-QAM	1	(RB_Pos:24)	21.40	0.64	22.04
21425	2567.5	5	16-QAM	12	(RB_Pos:0)	20.86	0.64	21.50
21425	2567.5	5	16-QAM	12	(RB_Pos:13)	20.74	0.64	21.38
21425	2567.5	5	16-QAM	25	(RB_Pos:0)	20.78	0.64	21.42
20800	2505	10	16-QAM	1	(RB_Pos:0)	21.60	0.64	22.24
20800	2505	10	16-QAM	1	(RB_Pos:49)	21.43	0.64	22.07
20800	2505	10	16-QAM	25	(RB_Pos:0)	20.95	0.64	21.59
20800	2505	10	16-QAM	25	(RB_Pos:25)	20.82	0.64	21.46
20800	2505	10	16-QAM	50	(RB_Pos:0)	20.88	0.64	21.52
21100	2535	10	16-QAM	1	(RB_Pos:0)	21.56	0.64	22.20
21100	2535	10	16-QAM	1	(RB_Pos:49)	21.68	0.64	22.32
21100	2535	10	16-QAM	25	(RB_Pos:0)	20.81	0.64	21.45
21100	2535	10	16-QAM	25	(RB_Pos:25)	20.85	0.64	21.49
21100	2535	10	16-QAM	50	(RB_Pos:0)	20.78	0.64	21.42
21400	2565	10	16-QAM	1	(RB_Pos:0)	21.69	0.64	22.33
21400	2565	10	16-QAM	1	(RB_Pos:49)	21.58	0.64	22.22
21400	2565	10	16-QAM	25	(RB_Pos:0)	20.94	0.64	21.58
21400	2565	10	16-QAM	25	(RB_Pos:25)	20.88	0.64	21.52
21400	2565	10	16-QAM	50	(RB_Pos:0)	20.96	0.64	21.60
20825	2507.5	15	16-QAM	1	(RB_Pos:0)	21.74	0.64	22.38
20825	2507.5	15	16-QAM	1	(RB_Pos:74)	21.70	0.64	22.34
20825	2507.5	15	16-QAM	36	(RB_Pos:0)	20.93	0.64	21.57
20825	2507.5	15	16-QAM	36	(RB_Pos:39)	20.81	0.64	21.45
20825	2507.5	15	16-QAM	75	(RB_Pos:0)	20.89	0.64	21.53
21100	2535	15	16-QAM	1	(RB_Pos:0)	21.68	0.64	22.32
21100	2535	15	16-QAM	1	(RB_Pos:74)	21.53	0.64	22.17
21100	2535	15	16-QAM	36	(RB_Pos:0)	20.80	0.64	21.44
21100	2535	15	16-QAM	36	(RB_Pos:39)	20.84	0.64	21.48
21100	2535	15	16-QAM	75	(RB_Pos:0)	20.84	0.64	21.48
21375	2562.5	15	16-QAM	1	(RB_Pos:0)	21.81	0.64	22.45
21375	2562.5	15	16-QAM	1	(RB_Pos:74)	21.72	0.64	22.36
21375	2562.5	15	16-QAM	36	(RB_Pos:0)	20.92	0.64	21.56
21375	2562.5	15	16-QAM	36	(RB_Pos:39)	20.85	0.64	21.49
21375	2562.5	15	16-QAM	75	(RB_Pos:0)	20.89	0.64	21.53
20850	2510	20	16-QAM	1	(RB_Pos:0)	21.68	0.64	22.32
20850	2510	20	16-QAM	1	(RB_Pos:99)	21.44	0.64	22.08
20850	2510	20	16-QAM	50	(RB_Pos:0)	20.89	0.64	21.53
20850	2510	20	16-QAM	50	(RB_Pos:50)	20.73	0.64	21.37
20850	2510	20	16-QAM	100	(RB_Pos:0)	20.88	0.64	21.52
21100	2535	20	16-QAM	1	(RB_Pos:0)	21.77	0.64	22.41
21100	2535	20	16-QAM	1	(RB_Pos:99)	21.67	0.64	22.31
21100	2535	20	16-QAM	50	(RB_Pos:0)	20.83	0.64	21.47
21100	2535	20	16-QAM	50	(RB_Pos:50)	20.75	0.64	21.39
21100	2535	20	16-QAM	100	(RB_Pos:0)	20.84	0.64	21.48
21350	2560	20	16-QAM	1	(RB_Pos:0)	21.76	0.64	22.40
21350	2560	20	16-QAM	1	(RB_Pos:99)	21.63	0.64	22.27
21350	2560	20	16-QAM	50	(RB_Pos:0)	20.83	0.64	21.47
21350	2560	20	16-QAM	50	(RB_Pos:50)	20.85	0.64	21.49
21350	2560	20	16-QAM	100	(RB_Pos:0)	20.93	0.64	21.57

4 Peak to Average Ratio

4.1 Test Result

Test Description	Basic Standards	Test Result
Peak to Average Ratio		Pass

4.2 Test Method

KDB document 971168 D01 Power Meas License Digital Systems v03r01 was used to determine the peak-to-average power ratio. Clause 5.7.2 references ANSI C63.26-2015 Subclause 5.2.3.4 which defines the measurement method using the CCDF function of the spectrum analyzer. Measurements were recorded at the middle channel of the band and the worst-case settings were determined to be the narrowest defined cell BW with full RB's and 16-QAM modulation.

4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.1 °C
 Relative Humidity: 48.1 %
 Atmospheric Pressure: 97.9 kPa

4.4 Test Equipment

Test End Date: 12-Jul-2018

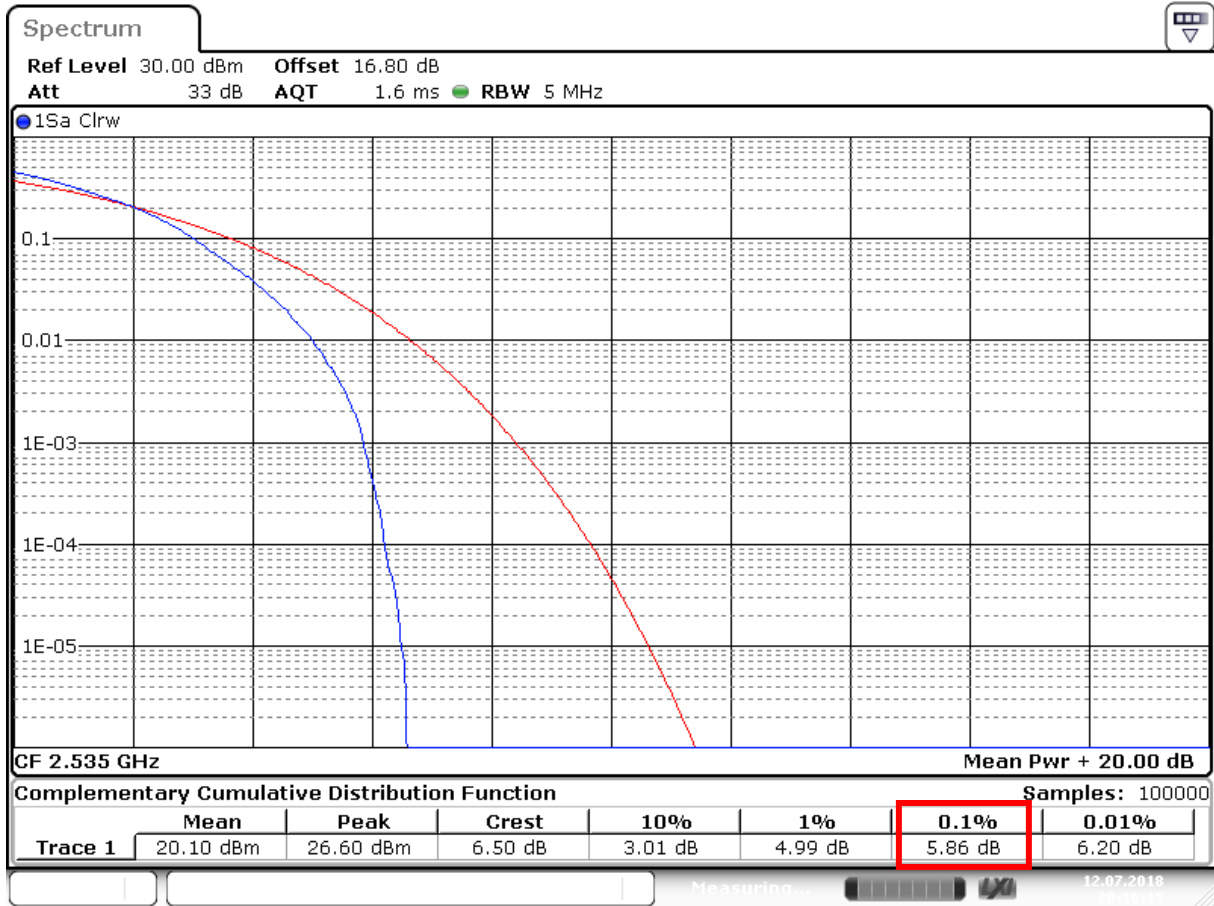
Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	1608522I	24-Jul-2018
RF CABLE	1134	GORE	B094785	26-Jul-2018
RF CABLE	141	HUBER & SUHNER	B095588	26-Jul-2018
ATTENUATOR, 10DB	BW-S10W2	MINI-CIRCUITS	15032	CNR
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101743	27-Jul-2018
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

- 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 7



Date: 12 JUL 2018 20:16:15

5 Bandwidth

5.1 Test Result

Test Description	Basic Standards	Test Result
Occupied Bandwidth / Emission Bandwidth	FCC 2.1049 FCC 27.53(m)(6)	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 of a given emission.

The emission 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 span of the analyzer was set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth was set to between 1% and 5% of the occupied bandwidth. The video bandwidth was set to 3 times the resolution bandwidth. Video averaging is not permitted. The 99% occupied bandwidth was measured using the spectrum analyzer's occupied bandwidth measurement function. The 26dB emission bandwidth was measured manually using the corresponding power level reported earlier in this report as the reference level.

A radio link was established between the EUT and the 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 measurement was conducted at the middle channel of the band and at all available channel bandwidths. The emission bandwidth measurement was conducted at low, middle and high channels and at all available channel bandwidths. All available resource blocks were used for maximum bandwidth.

5.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.4 °C

Relative Humidity: 52.0 %

Atmospheric Pressure: 98.5 kPa

5.4 Test Equipment

Test End Date: 24-Aug-2018

Tester: MT

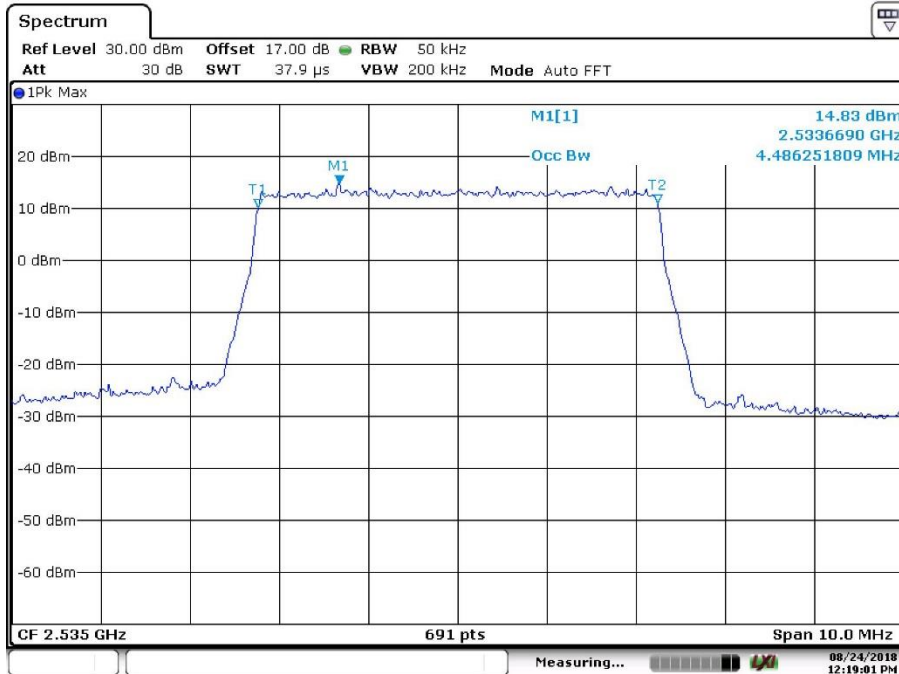
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	1-Nov-2019
RF CABLE	1134	GORE	B094785	25-Jul-2019
RF CABLE	141	HUBER & SUHNER	B095588	25-Jul-2019
ATTENUATOR, 10DB	BW-S10W2	MINI-CIRCUITS	15032	CNR
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101743	25-Jul-2019
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

- Unless otherwise noted, equipment is on a 1-year calibration cycle.
- Based on manufacturer's specifications, the FSV30 & CMW 500 are on a 2-year calibration cycle.

5.5 Test Data – Occupied Bandwidth (99%)

LTE Band 7

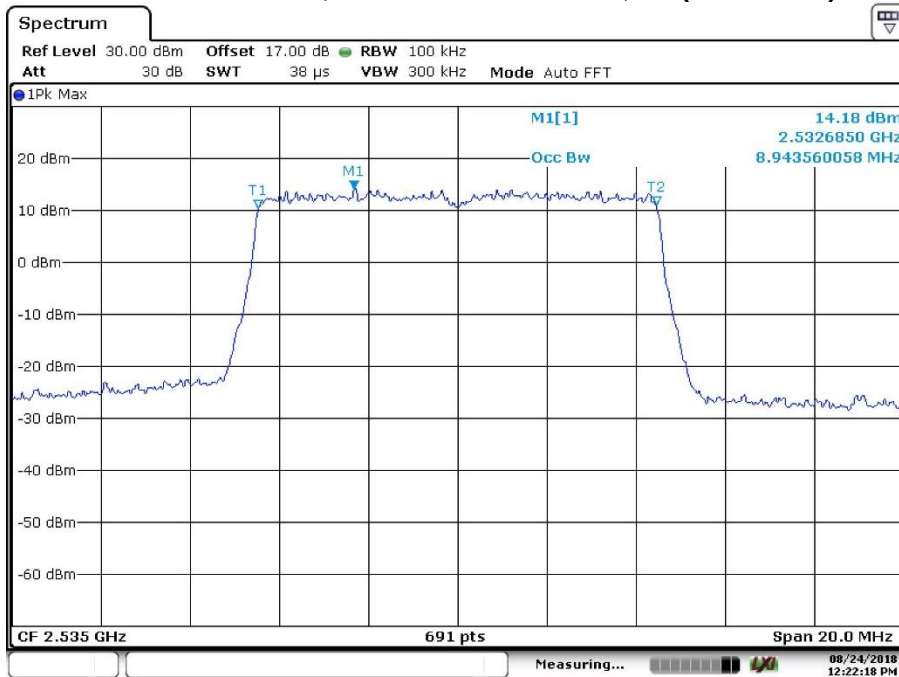
Occupied Bandwidth @ULCH: 21100; BW: 5.0 MHz;
 ULPower: 23dBm; UL_MOD_RB: QPSK, 25 (RB_Pos:0)



Date: 24.AUG.2018 12:19:02

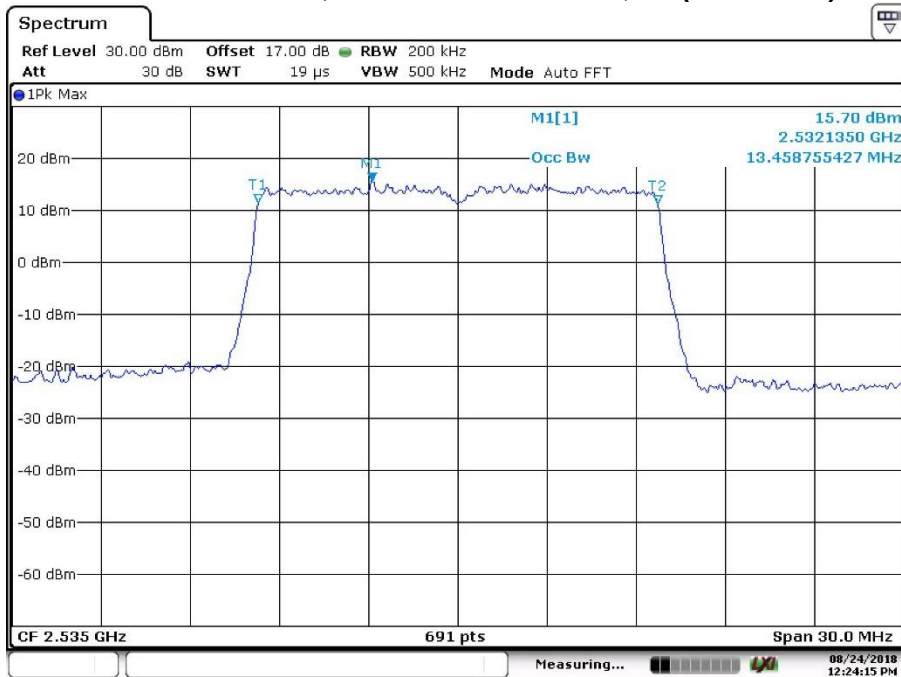
LTE Band 7

Occupied Bandwidth @ULCH: 21100; BW: 10 MHz;
 ULPower: 23dBm; UL_MOD_RB: QPSK, 50 (RB_Pos:0)



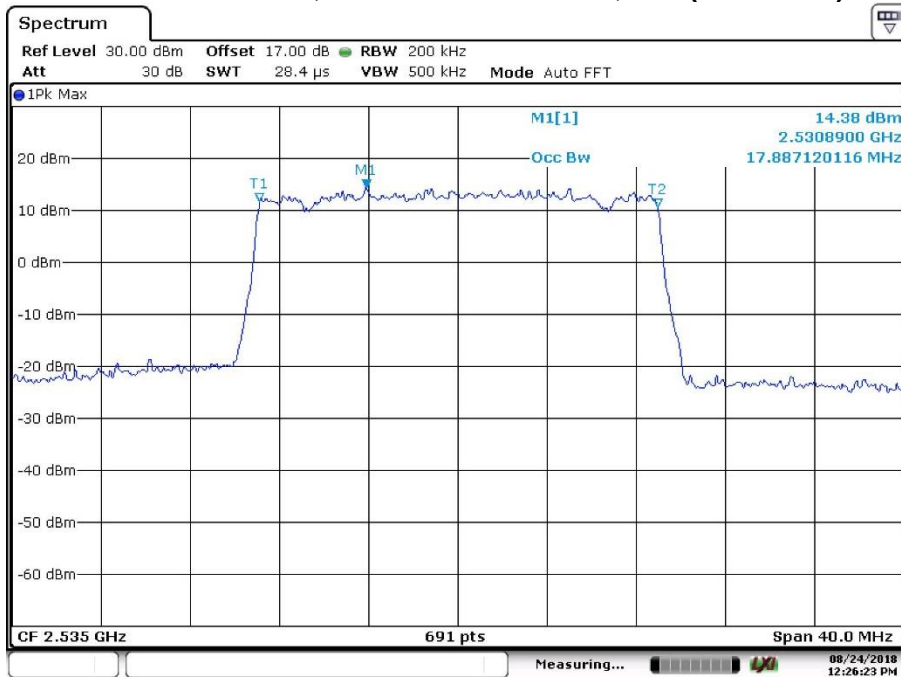
Date: 24.AUG.2018 12:22:18

LTE Band 7
Occupied Bandwidth @ULCH: 21100; BW: 15 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 75 (RB_Pos:0)



Date: 24.AUG.2018 12:24:15

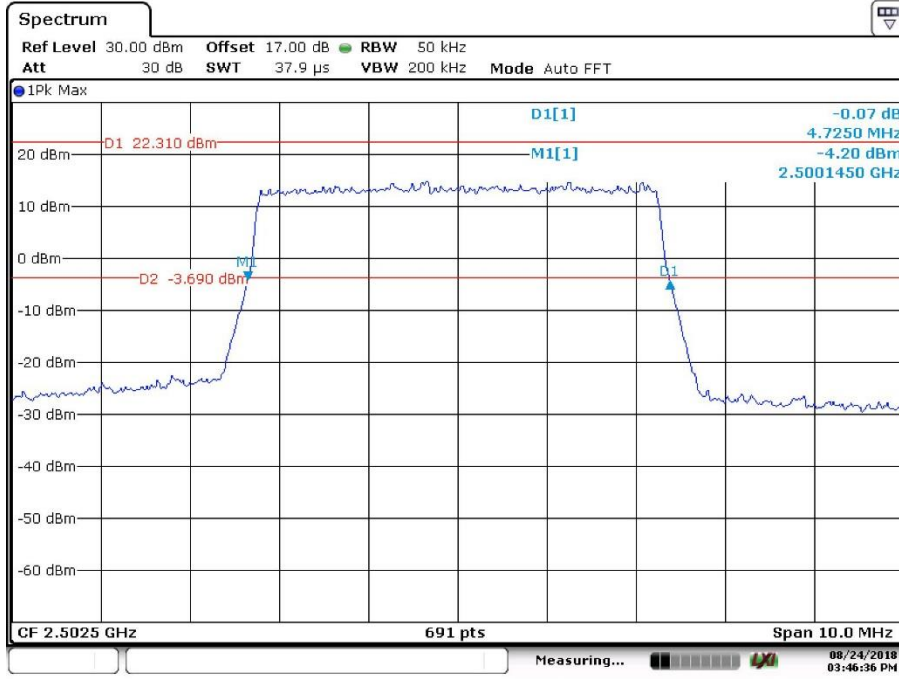
LTE Band 7
Occupied Bandwidth @ULCH: 21100; BW: 20 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 100 (RB_Pos:0)



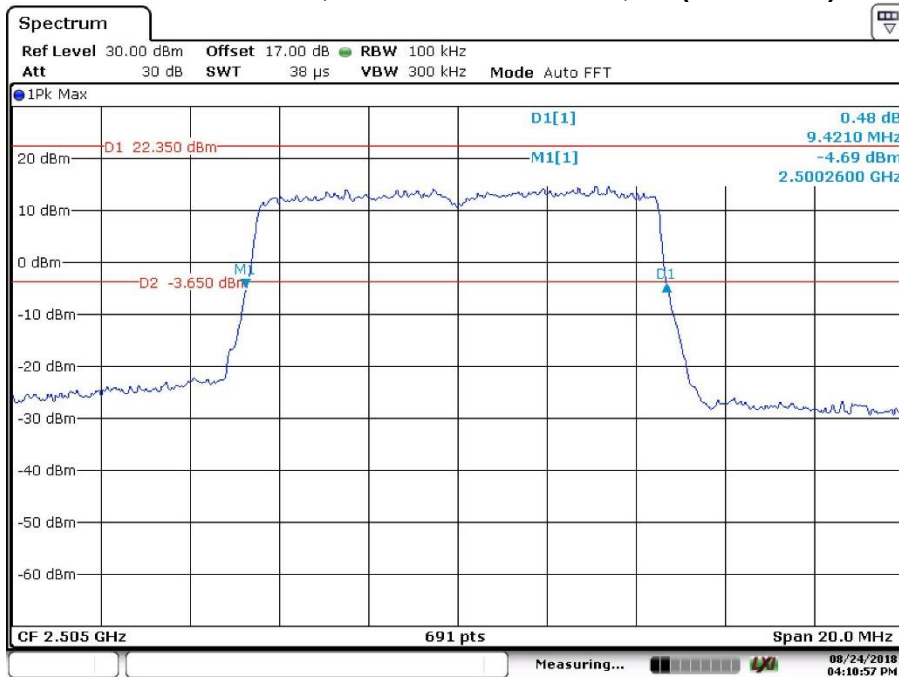
Date: 24.AUG.2018 12:26:23

5.6 Test Data – Emission Bandwidth (26dB)

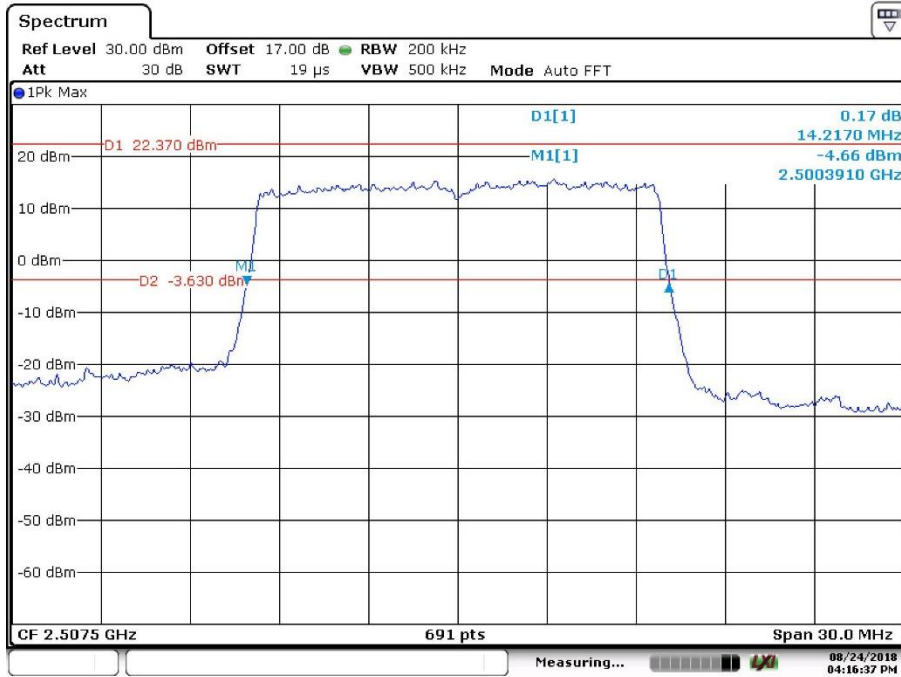
LTE Band 7 – Low Channel
Occupied Bandwidth @ULCH: 20775; BW: 5.0 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 25 (RB_Pos:0)



LTE Band 7 – Low Channel
Occupied Bandwidth @ULCH: 20800; BW: 10 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 50 (RB_Pos:0)

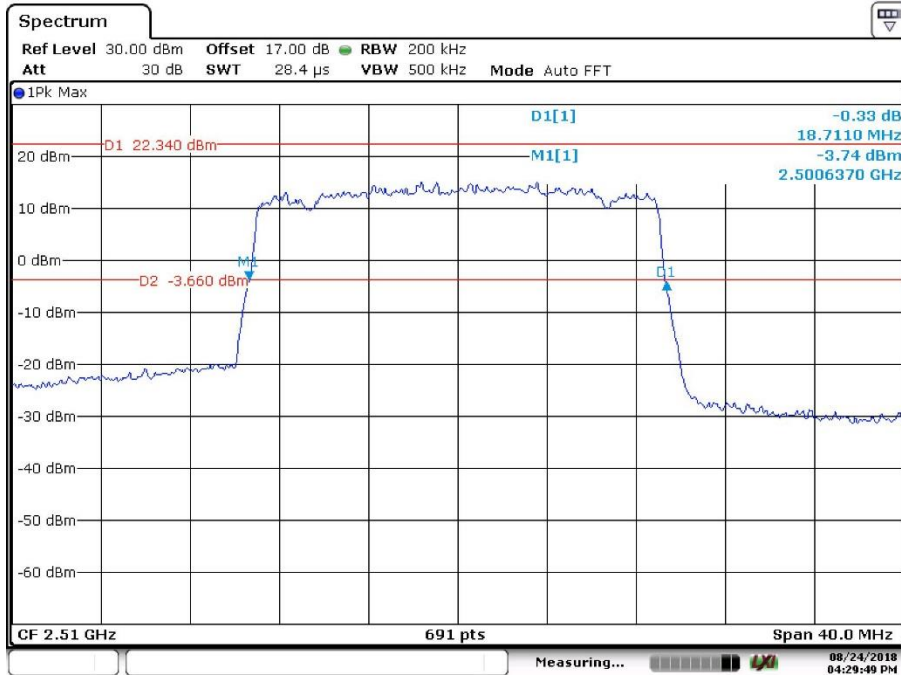


LTE Band 7 – Low Channel
Occupied Bandwidth @ULCH: 20825; BW: 15 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 75 (RB_Pos:0)



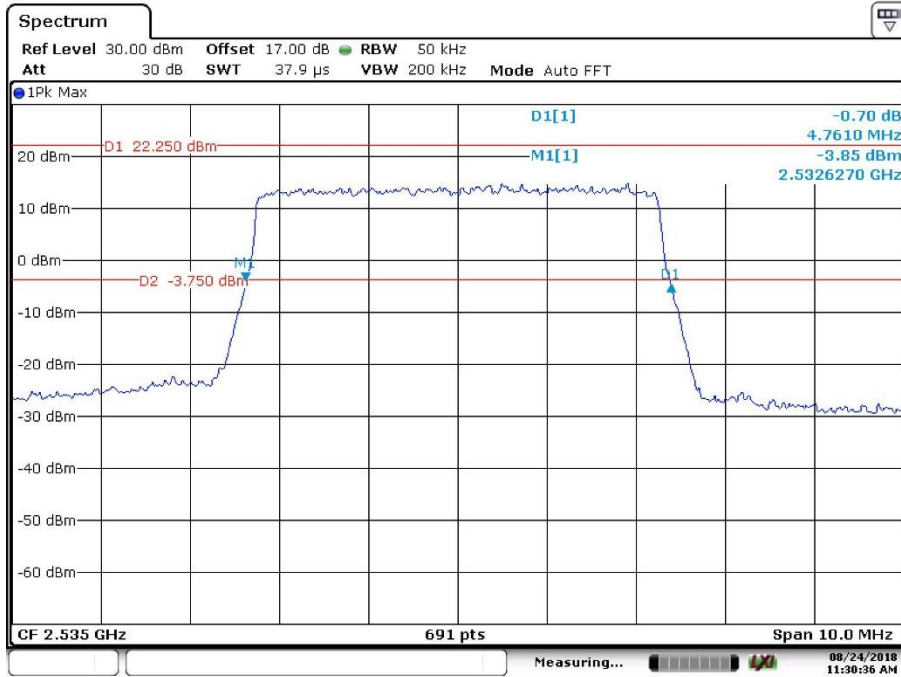
Date: 24.AUG.2018 16:16:37

LTE Band 7 – Low Channel
Occupied Bandwidth @ULCH: 20850; BW: 20 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 100 (RB_Pos:0)



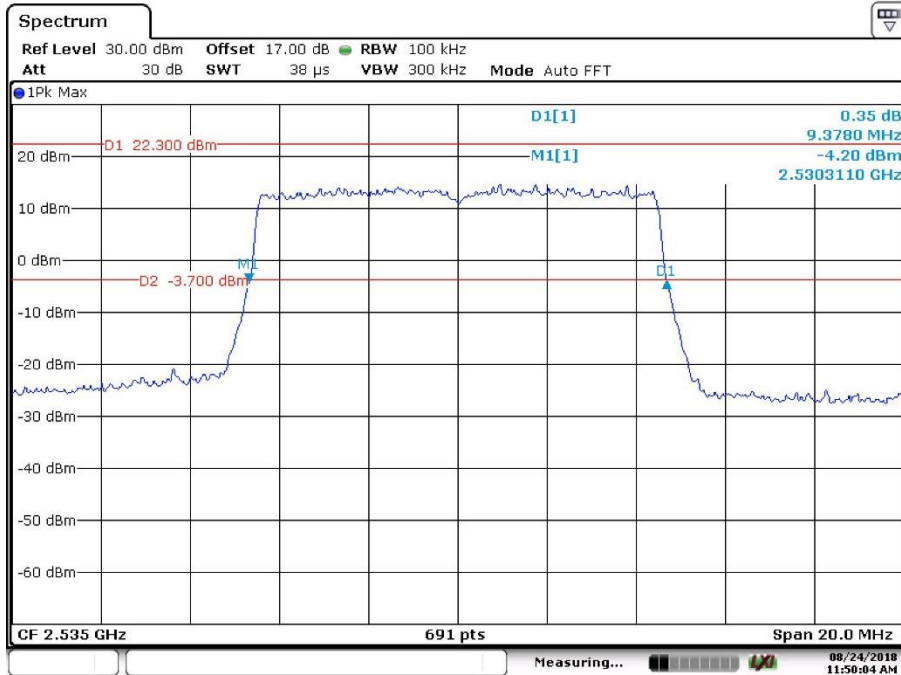
Date: 24.AUG.2018 16:29:49

LTE Band 7 – Mid Channel
Occupied Bandwidth @ULCH: 21100; BW: 5.0 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 25 (RB_Pos:0)



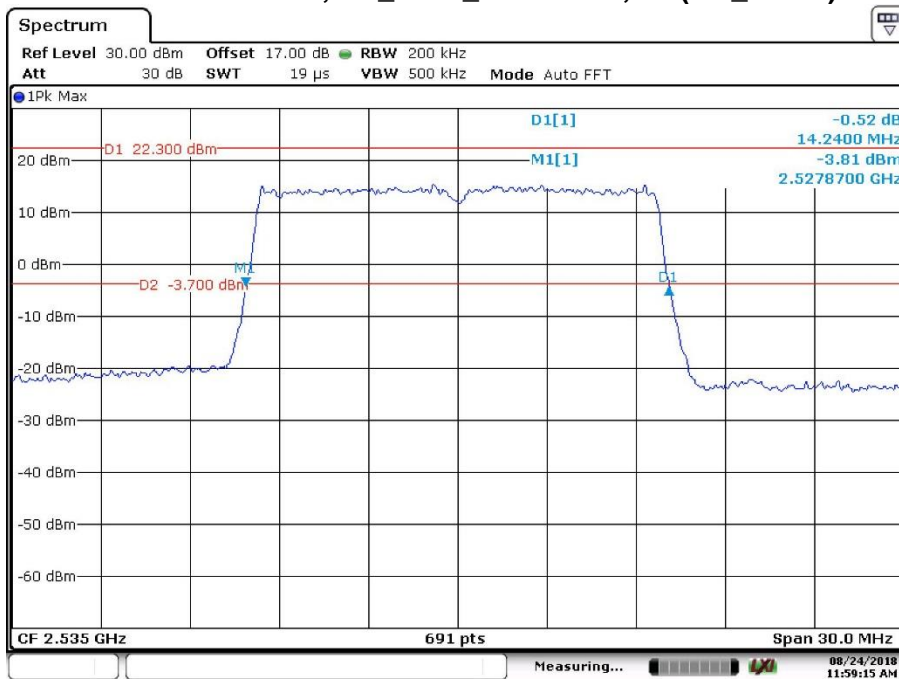
Date: 24.AUG.2018 11:30:36

LTE Band 7 – Mid Channel
Occupied Bandwidth @ULCH: 21100; BW: 10 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 50 (RB_Pos:0)



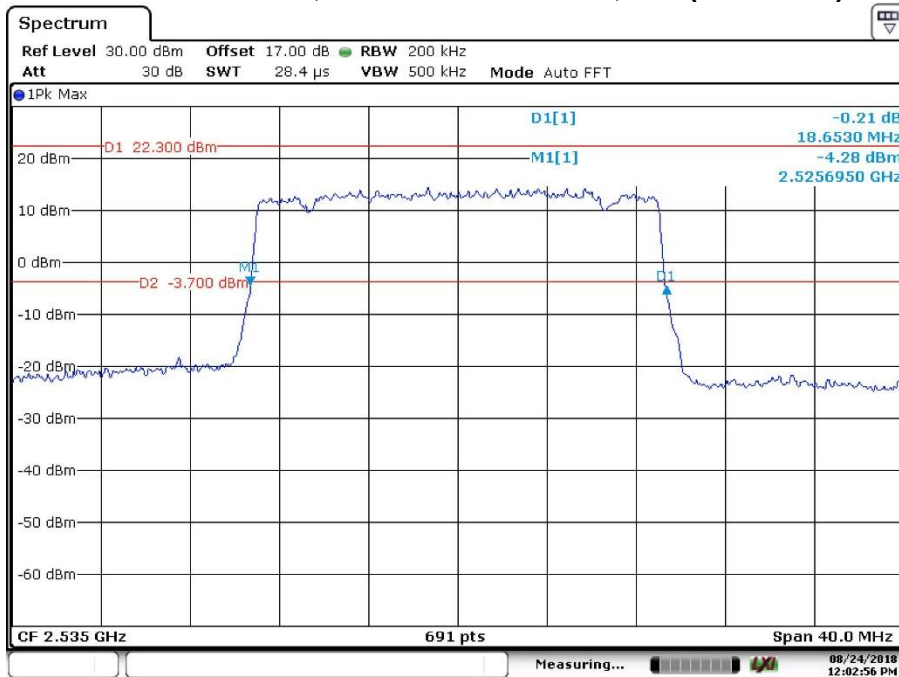
Date: 24.AUG.2018 11:50:04

LTE Band 7 – Mid Channel
Occupied Bandwidth @ULCH: 21100; BW: 15 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 75 (RB_Pos:0)



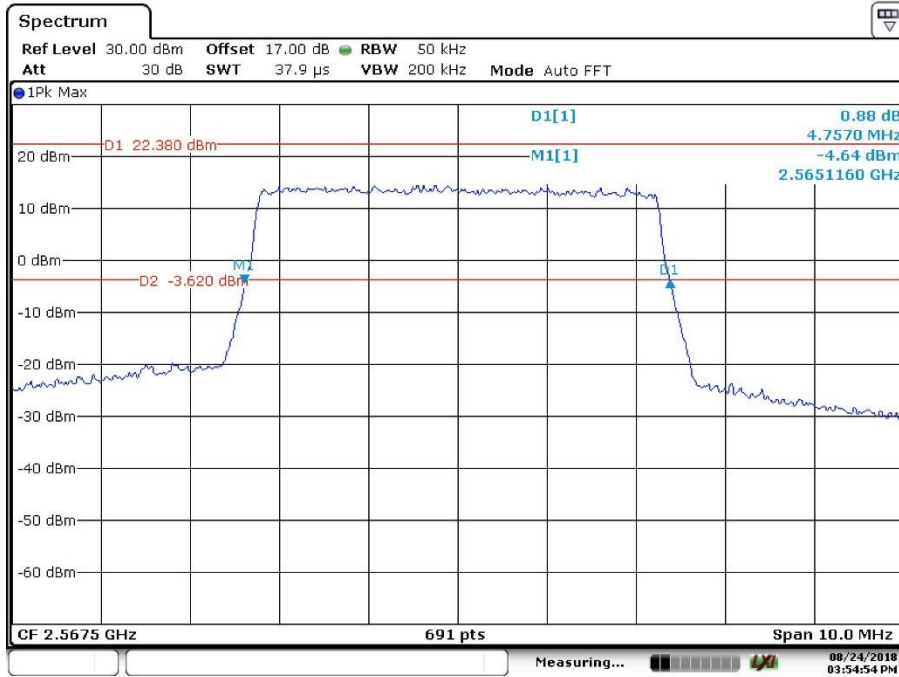
Date: 24.AUG.2018 11:59:15

LTE Band 7 – Mid Channel
Occupied Bandwidth @ULCH: 21100; BW: 20 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 100 (RB_Pos:0)



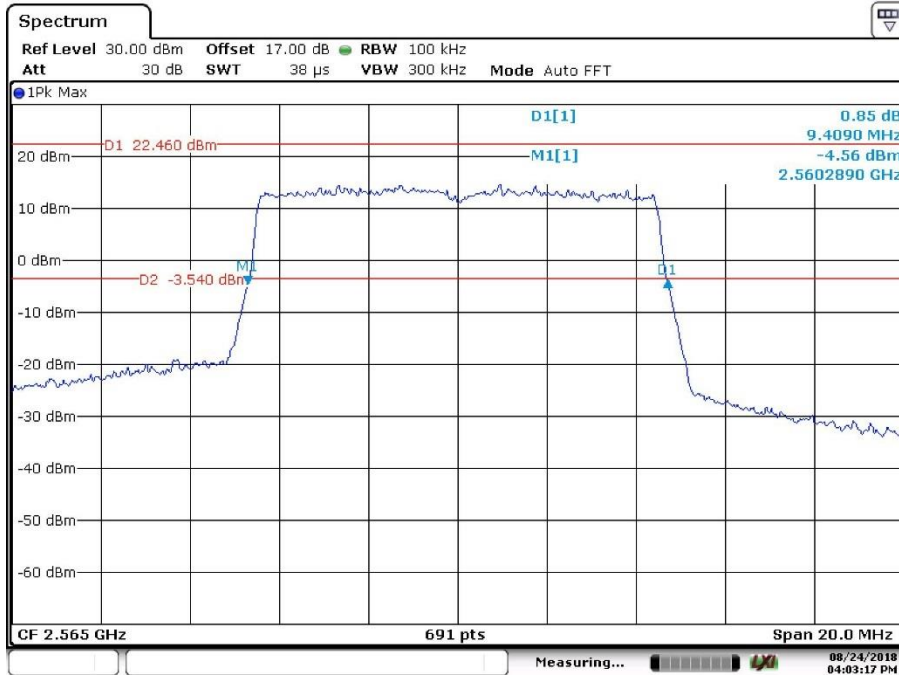
Date: 24.AUG.2018 12:02:56

LTE Band 7 – High Channel
Occupied Bandwidth @ULCH: 21425; BW: 5.0 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 25 (RB_Pos:0)



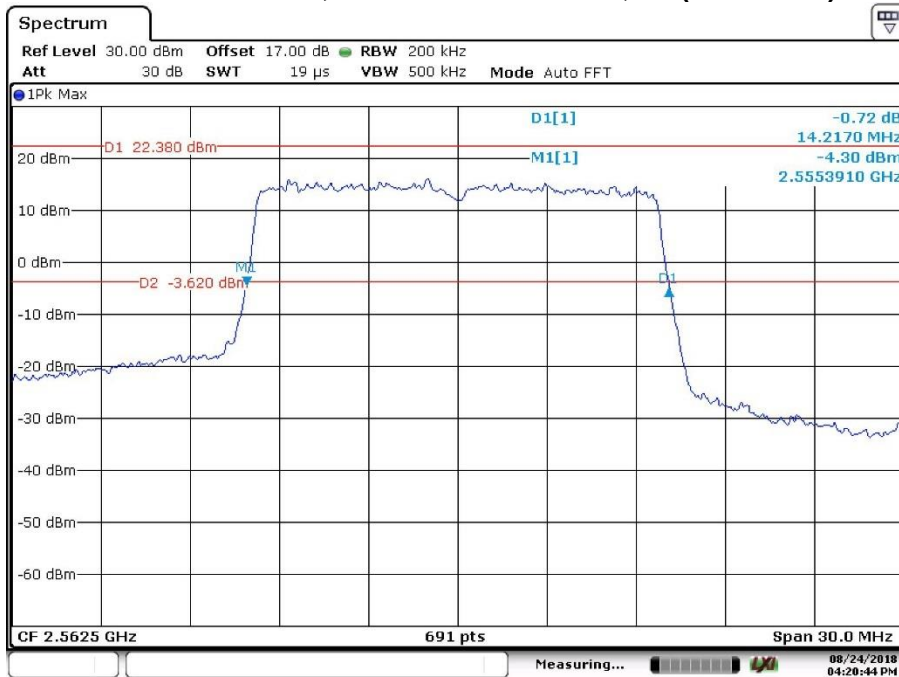
Date: 24.AUG.2018 15:54:53

LTE Band 7 – High Channel
Occupied Bandwidth @ULCH: 21400; BW: 10 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 50 (RB_Pos:0)



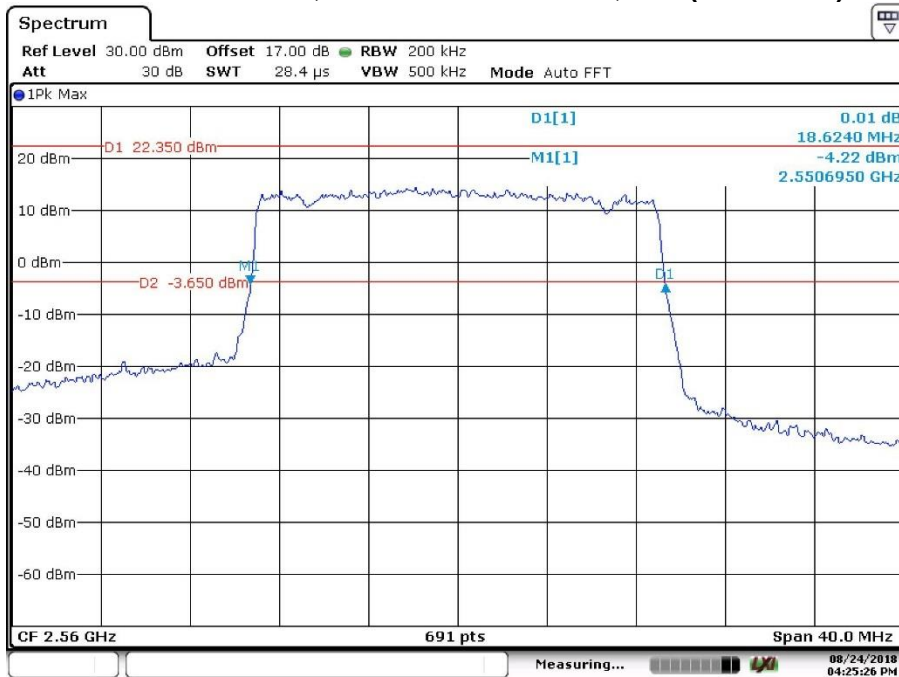
Date: 24.AUG.2018 16:03:17

LTE Band 7 – High Channel
Occupied Bandwidth @ULCH: 21375; BW: 15 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 75 (RB_Pos:0)



Date: 24.AUG.2018 16:20:44

LTE Band 7 – High Channel
Occupied Bandwidth @ULCH: 21350; BW: 20 MHz;
ULPower: 23dBm; UL_MOD_RB: QPSK, 100 (RB_Pos:0)



Date: 24.AUG.2018 16:25:25

6 Band Edge and Conducted Spurious Emissions

6.1 Test Result

Test Description	Basic Standards	Test Result
Band Edge and Conducted Spurious Emissions	FCC 2.1051 FCC 27.53(m)(4)	Pass

6.2 Test Method

The conducted power at the EUT antenna port of the band edge (out-of-band) and spurious band emissions are measured by means of a calibrated spectrum analyzer. The spectrum is investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. The power of any emissions outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) measured in watts by at least $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth. In addition, the attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. The emission 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 available bandwidth was measured at the lowest and highest channels in the band.

6.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.4 °C
 Relative Humidity: 51.3 %
 Atmospheric Pressure: 98.3 kPa

6.4 Test Equipment

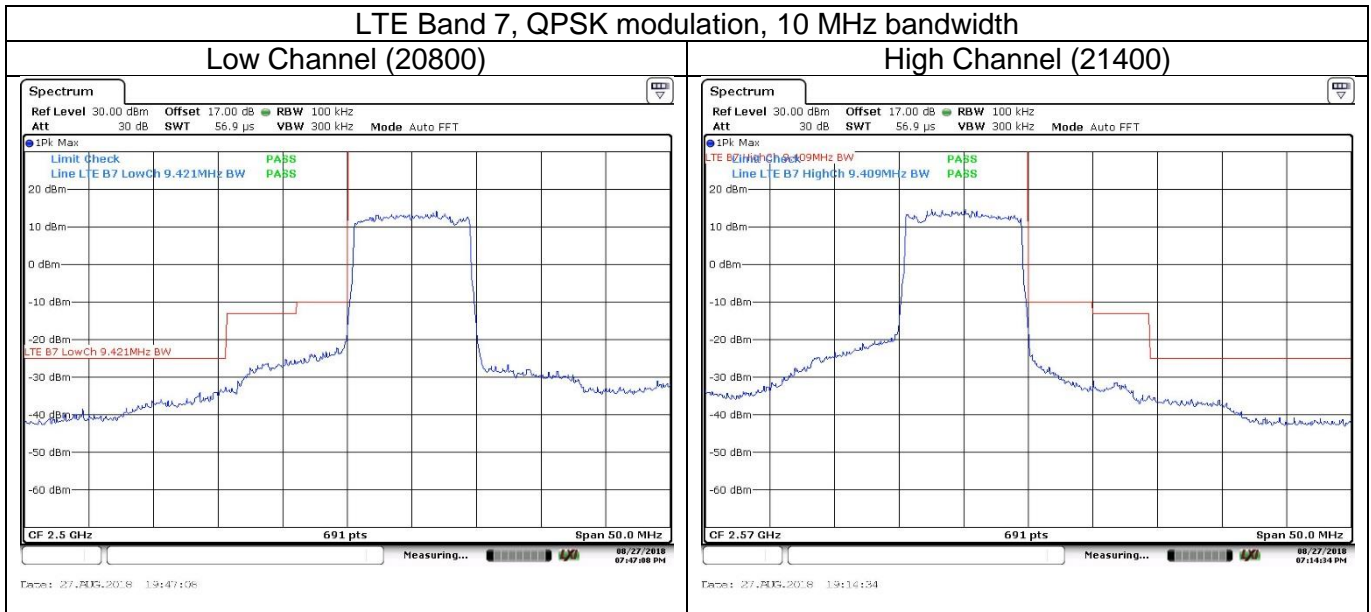
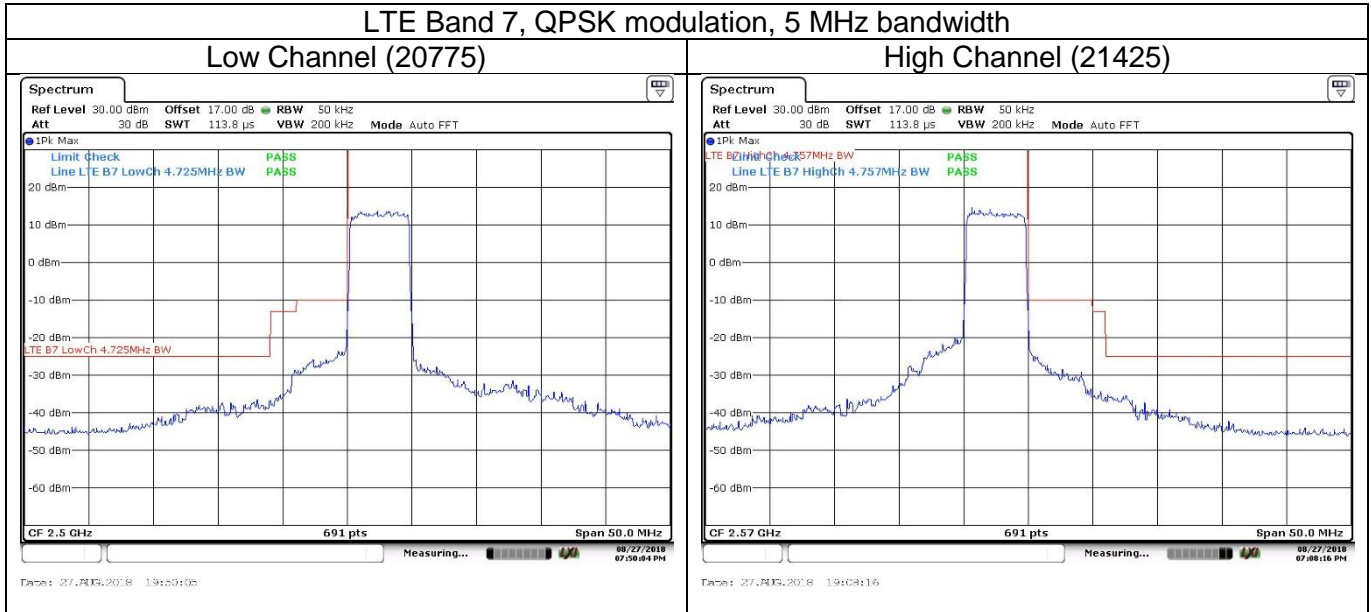
Test End Date: 27-Aug-2018

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER	FSV30	ROHDE & SCHWARZ	B085749	1-Nov-2019
RF CABLE	1134	GORE	B094785	25-Jul-2019
RF CABLE	141	HUBER & SUHNER	B095588	25-Jul-2019
ATTENUATOR, 10DB	BW-S10W2	MINI-CIRCUITS	15032	CNR
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101743	25-Jul-2019
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

- Unless otherwise noted, equipment is on a 1-year calibration cycle.
- Based on manufacturer's specifications, the FSV30 & CMW 500 are on a 2-year calibration cycle.

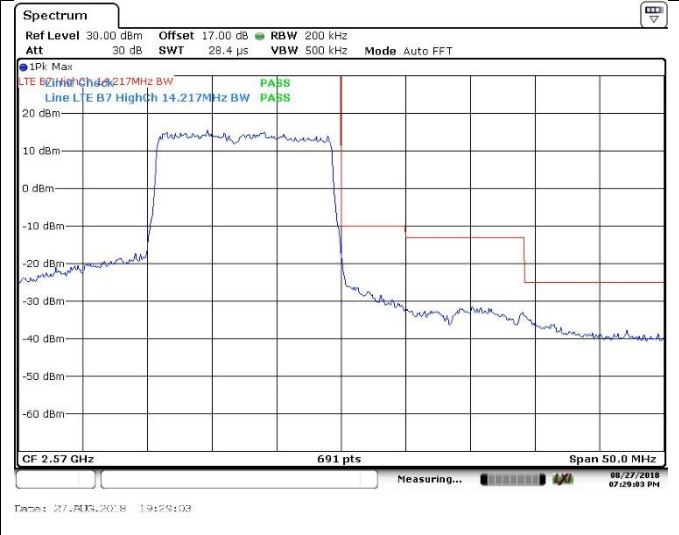
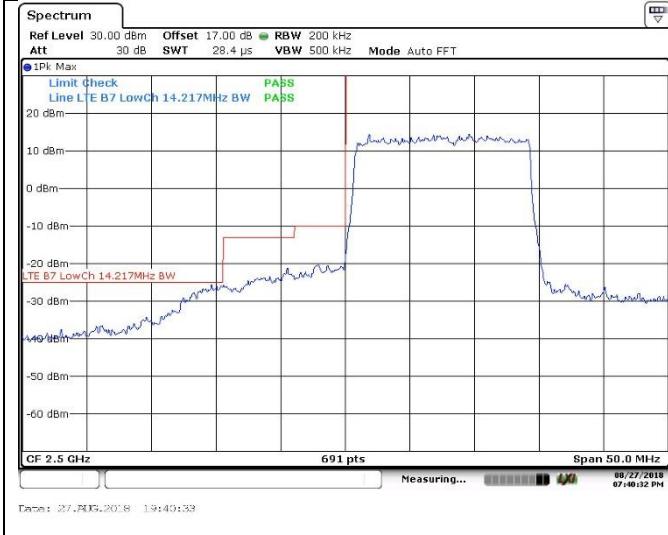
6.5 Test Data - Band Edge



LTE Band 7, QPSK modulation, 15 MHz bandwidth

Low Channel (20825)

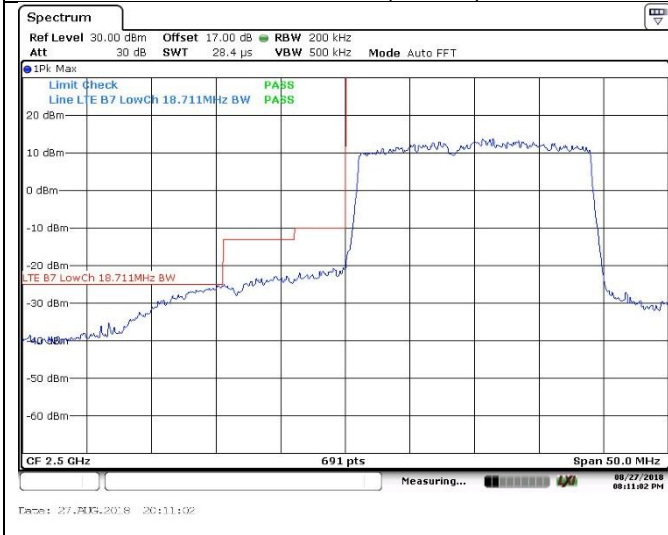
High Channel (21375)



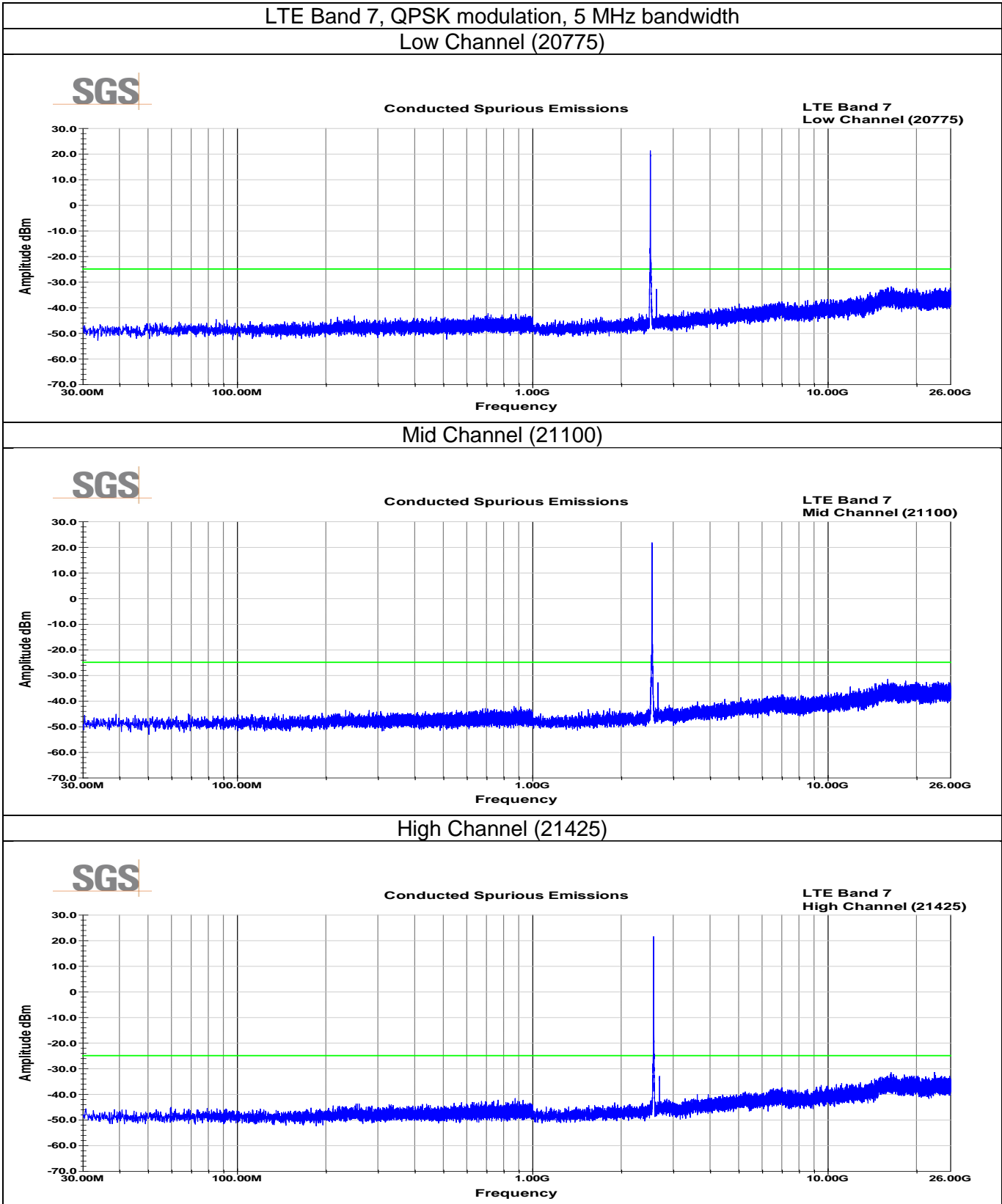
LTE Band 7, QPSK modulation, 20 MHz bandwidth

Low Channel (20850)

High Channel (21350)



6.6 Test Data - Conducted Spurious Emissions



7 Effective Radiated Power

7.1 Test Result

Test Description	Basic Standards	Test Result
Effective Isotropic Radiated Power	FCC 27.50(h)(2)	Pass

7.2 Test Method

Because the EUT 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.

7.3 Test Site

SGS EMC Laboratory, Suwanee, GA

7.4 Test Equipment

None

7.5 Test Data

Band of Operation		Conducted Power w/tolerance dBm	Antenna Gain	Cable Loss	Average EIRP		FCC EIRP Limit W	% of Limit	Verdict
Type	MHz				dBm	W			
LTE Band 7	2500-2570	25.0	8.0	0.0	33.0	1.995	2.0	100%	Pass

Note: Antenna gain was determined from maximum gain while still meeting the ERP/EIRP limits and the RF exposure requirements at 20cm.

8 Radiated Spurious Emissions

8.1 Test Result

Test Description	Basic Standards	Test Result
Radiated Spurious Emissions	FCC 2.1053 FCC 27.53(m)(4) ANSI/TIA-603-D-2010	Pass

8.2 Test Method

The radiated power emanating from the EUT of the band edge (out-of-band) and spurious band emissions are measured by means of a calibrated spectrum analyzer. The spectrum is investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. The power of any emissions outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) measured in watts by at least $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth. In addition, the attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. The emission 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 ANSI C63.4: 2014 below and above 1GHz)

Environmental Conditions

Temperature: 23.8 – 24.3 °C
 Relative Humidity: 47.2 – 53.5 %
 Atmospheric Pressure: 97.5 – 98.2 kPa

8.4 Test Equipment

30-1000MHz

Test End Date: 25-Jul-2018

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079689	16-Oct-2018
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	23-Jul-2019
RF CABLE	NFS-290-78.7-NFS	FLORIDA RF LABS	B095019	24-Jul-2019
RF CABLE	SF106	HUBER & SUHNER	B079659	23-Jul-2019
RF CABLE	SUCOFLEX 100	HUBER & SUHNER	B108523	24-Jul-2019
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	27-Jul-2019
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	25-Jul-2018
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

1-18GHz

Test End Date: 7-Aug-2018

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079699	2-Jul-2019
RF CABLE	NMS-290-236.2-NMS	FLORIDA RF LABS	B095020	23-Jul-2019
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Jul-2019
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	15003	27-Jul-2019
EMI TEST RECEIVER	ESW44	ROHDE & SCHWARZ	1206247	28-Feb-2019
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

18-26GHz

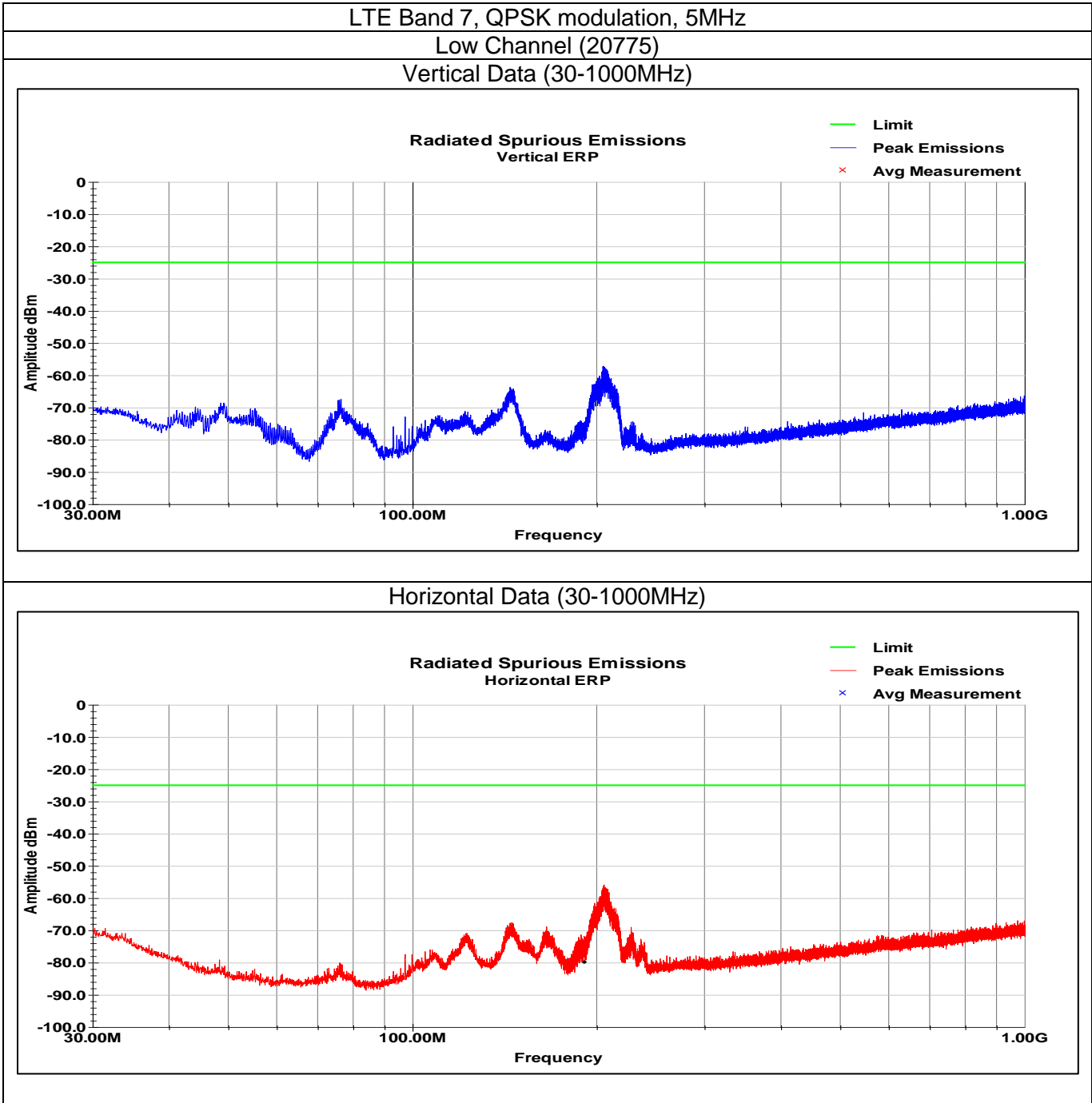
Test End Date: 7-Aug-2018

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, HORN (SMALL)	LB-180400-20-C-KF	A-INFO	15007	30-Mar-2019
RF CABLE	SF102	HUBER & SUHNER	B079822	25-Jul-2019
RF CABLE	SF102	HUBER & SUHNER	B079823	25-Jul-2019
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	27-Jul-2019
EMI TEST RECEIVER	ESW44	ROHDE & SCHWARZ	1206247	28-Feb-2019
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

- 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.

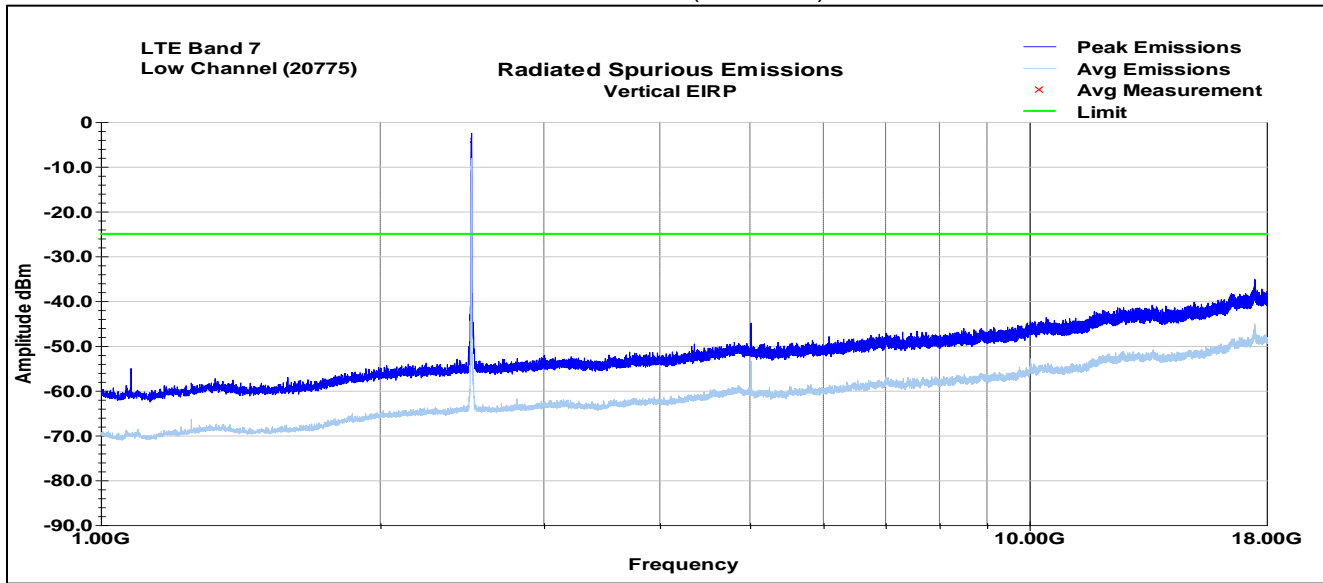
8.5 Test Data



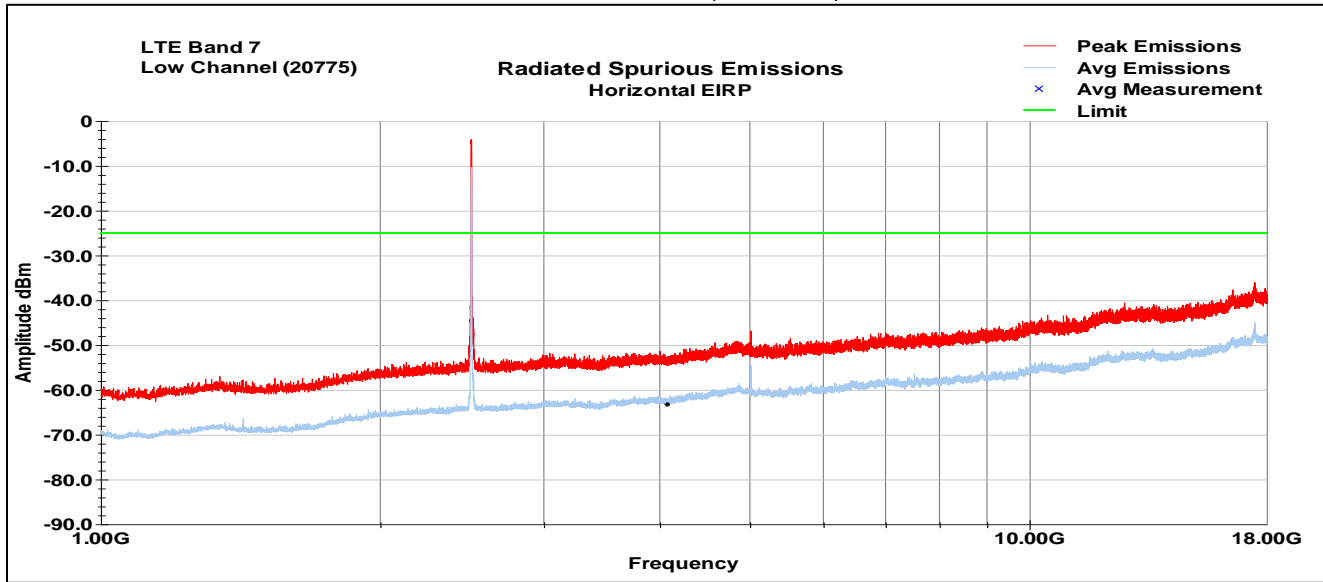
LTE Band 7, QPSK modulation, 5MHz

Low Channel (20775)

Vertical Data (1-18GHz)



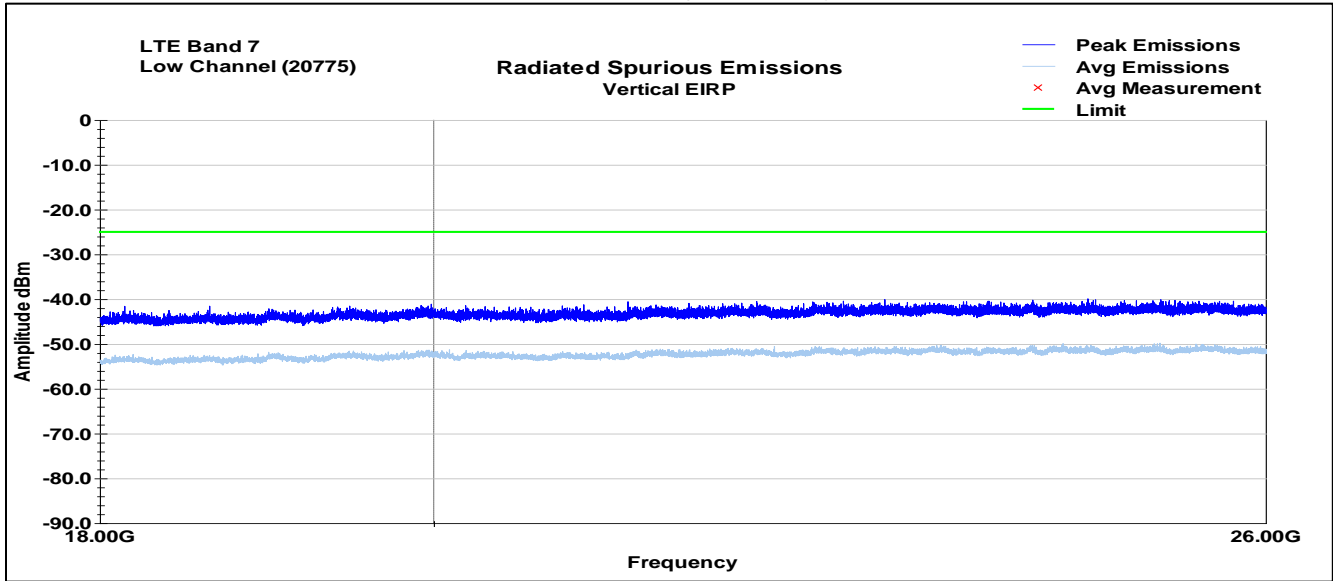
Horizontal Data (1-18GHz)



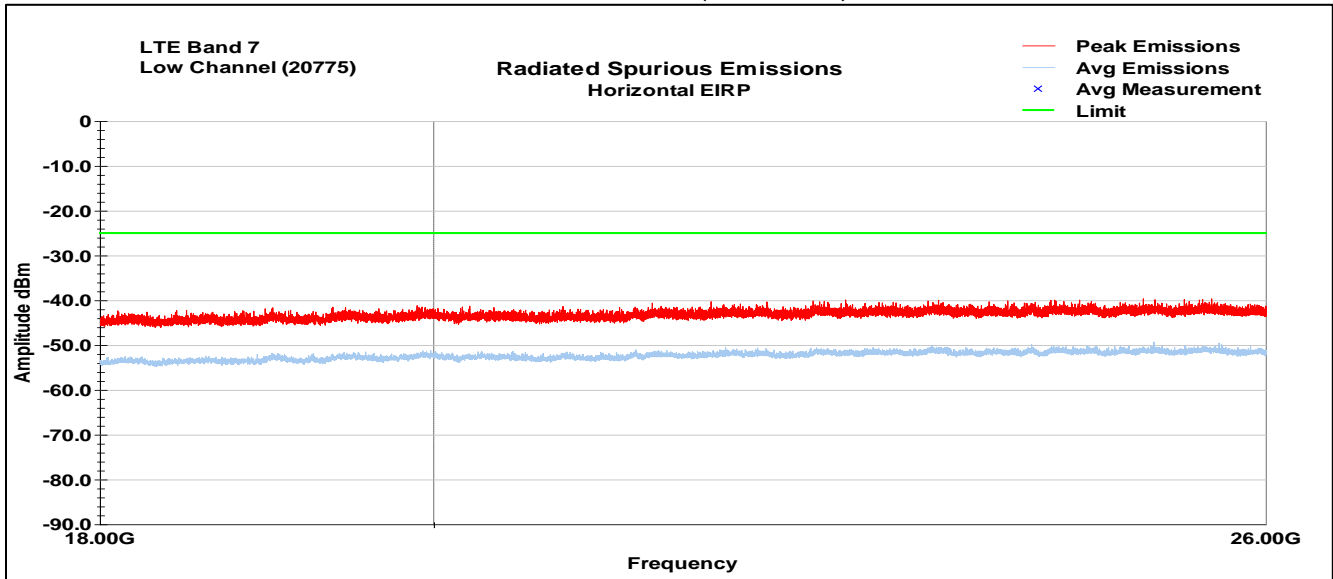
LTE Band 7, QPSK modulation, 5MHz

Low Channel (20775)

Vertical Data (18-26GHz)



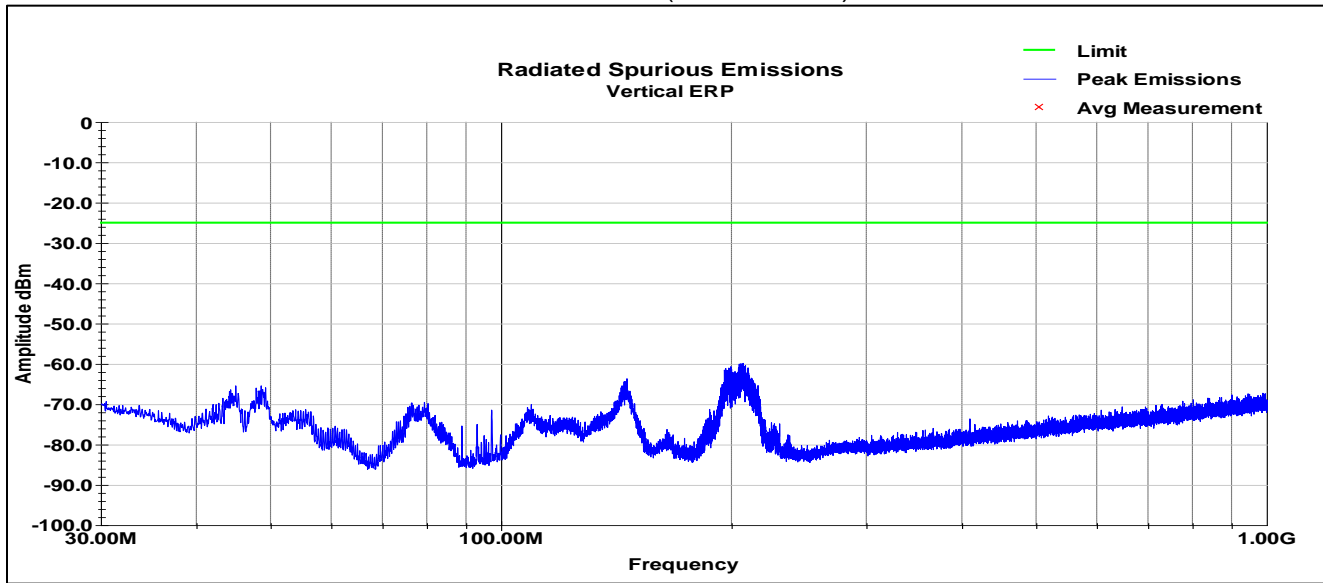
Horizontal Data (18-26GHz)



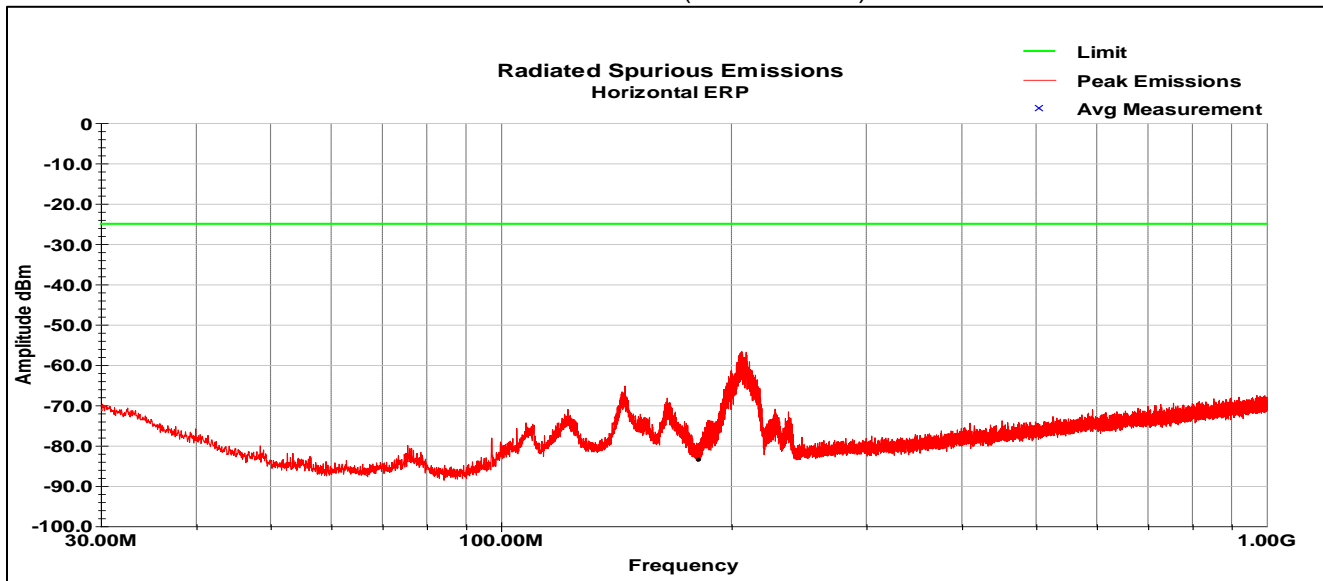
LTE Band 7, QPSK modulation, 5MHz

Mid Channel (21100)

Vertical Data (30-1000MHz)



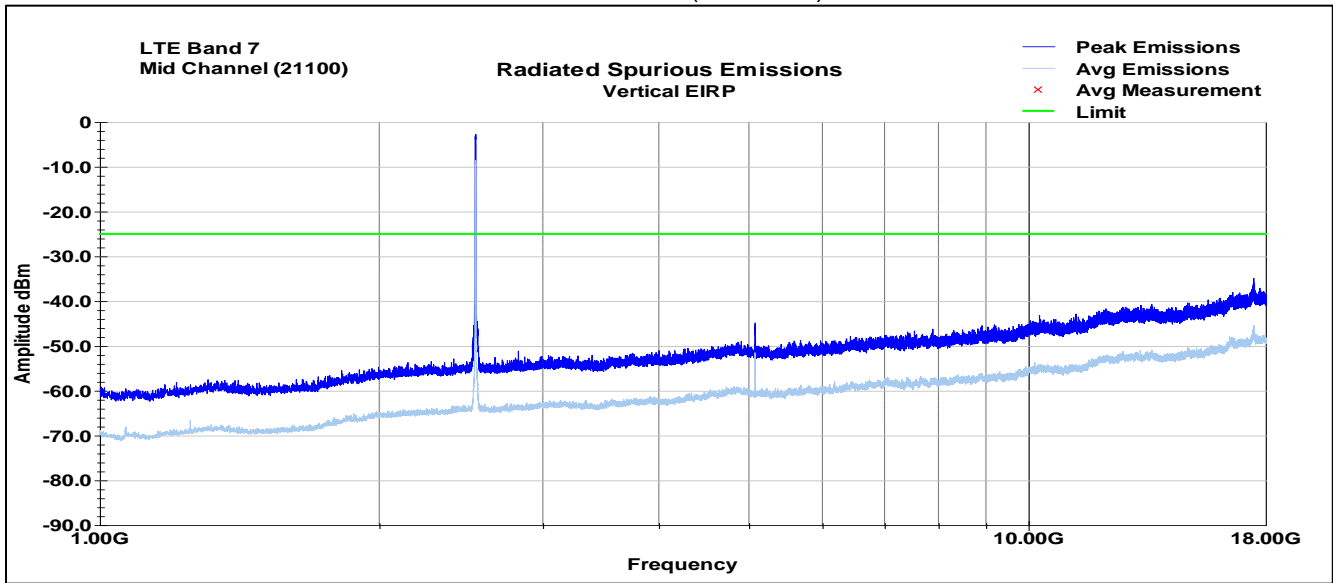
Horizontal Data (30-1000MHz)



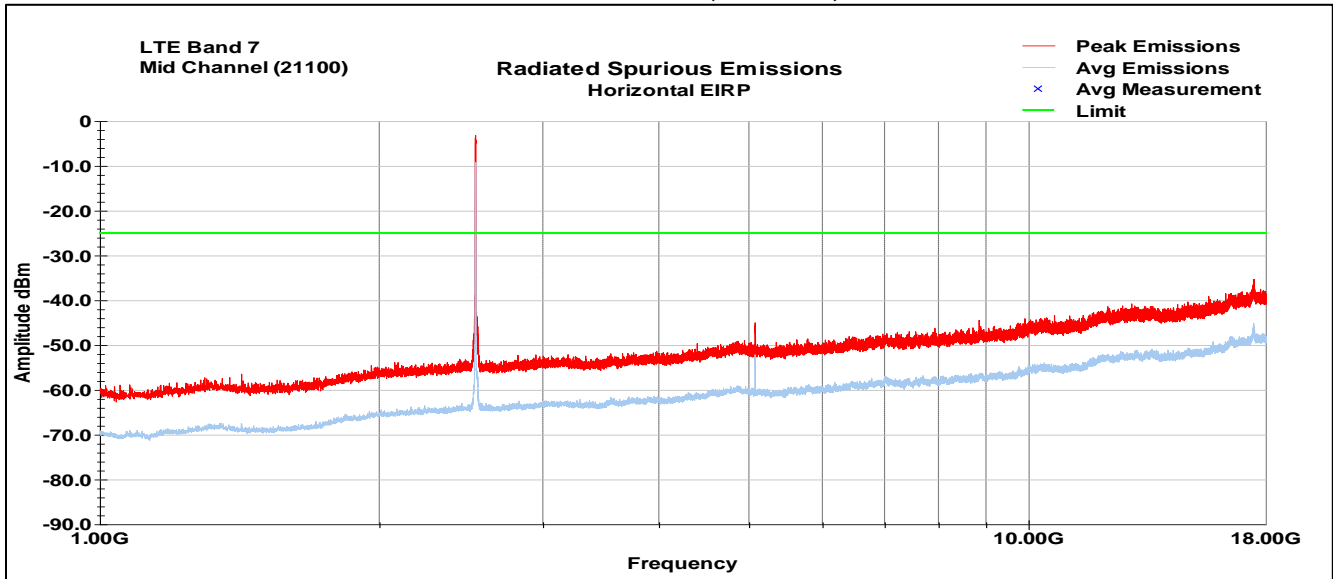
LTE Band 7, QPSK modulation, 5MHz

Mid Channel (21100)

Vertical Data (1-18GHz)



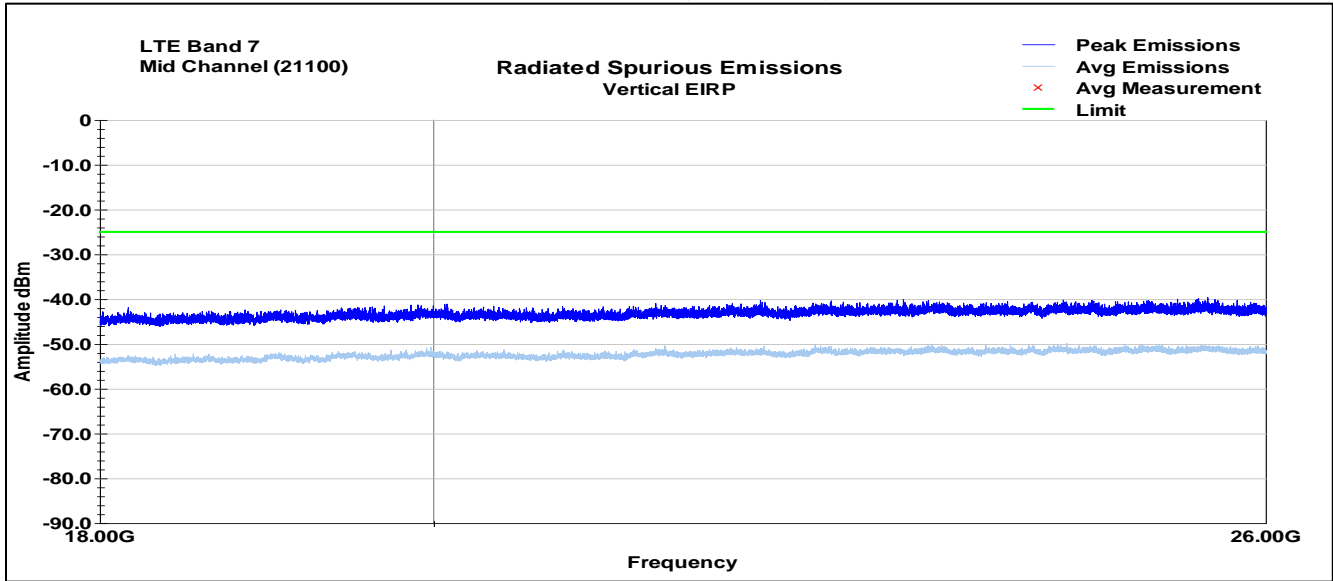
Horizontal Data (1-18GHz)



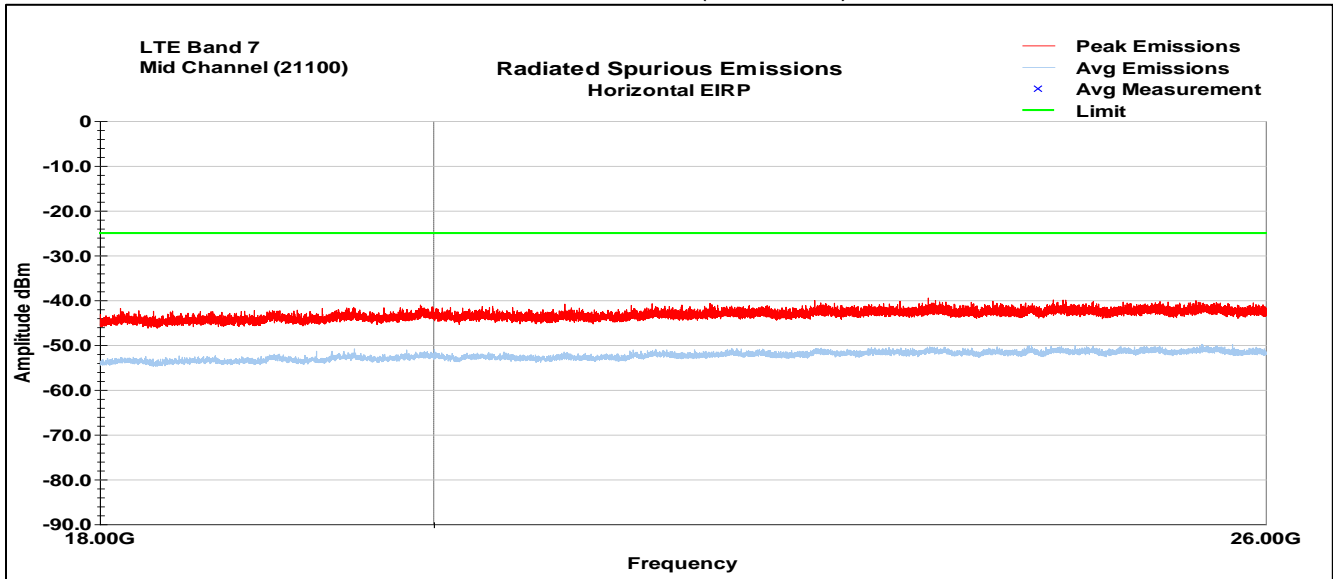
LTE Band 7, QPSK modulation, 5MHz

Mid Channel (21100)

Vertical Data (18-26GHz)



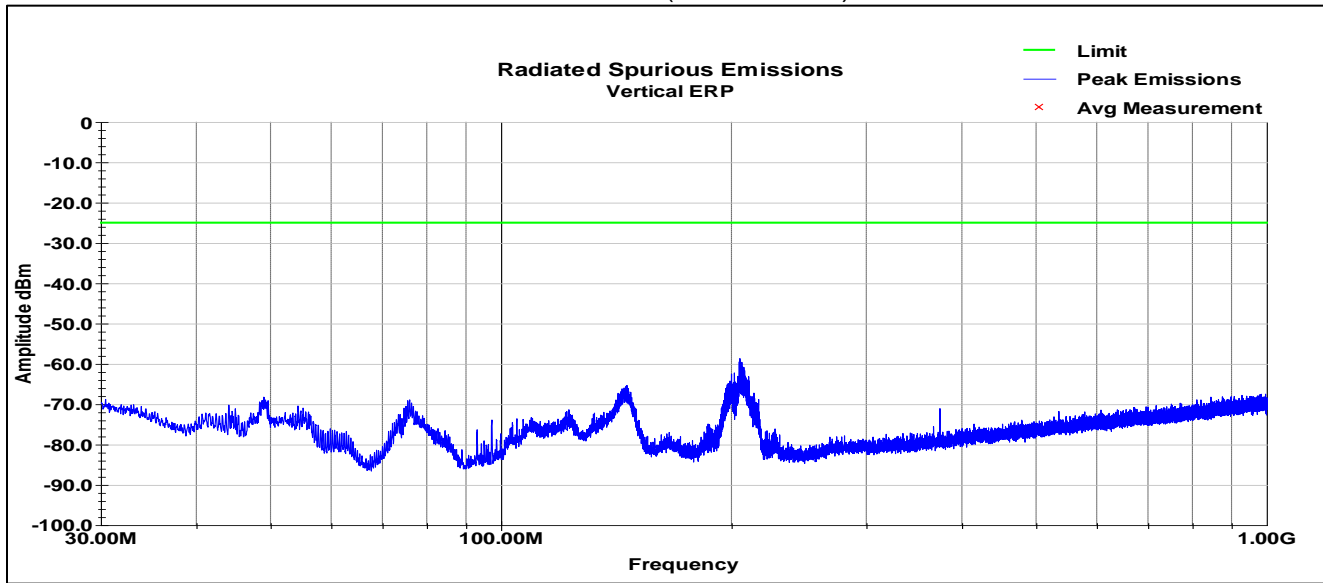
Horizontal Data (18-26GHz)



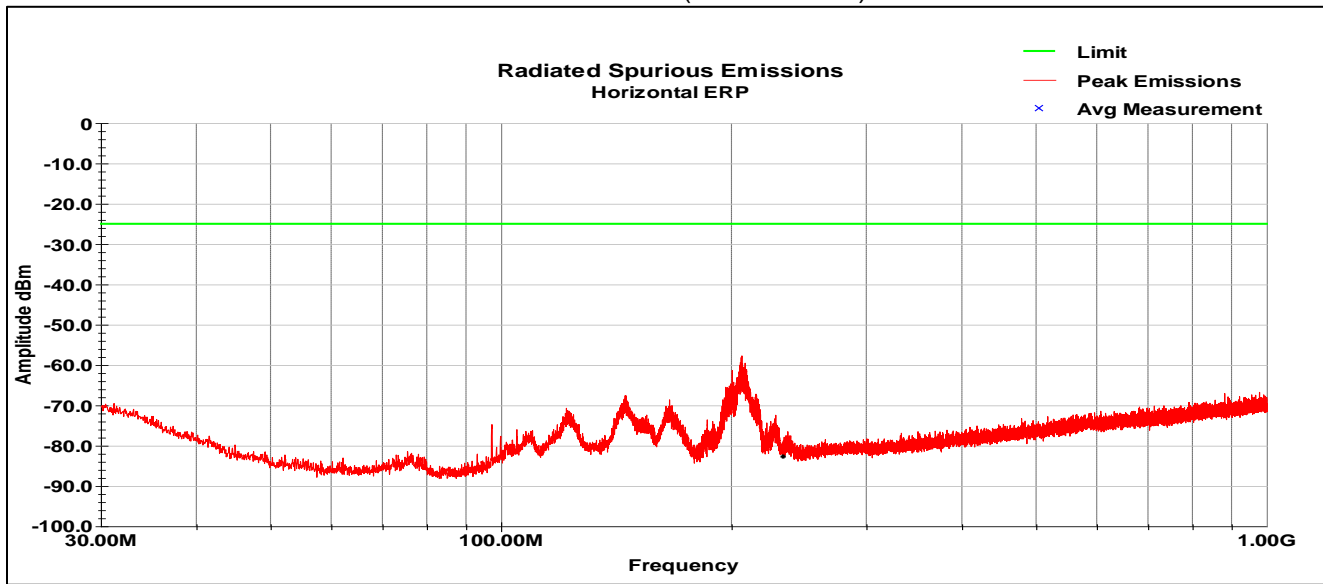
LTE Band 7, QPSK modulation, 5MHz

High Channel (21425)

Vertical Data (30-1000MHz)



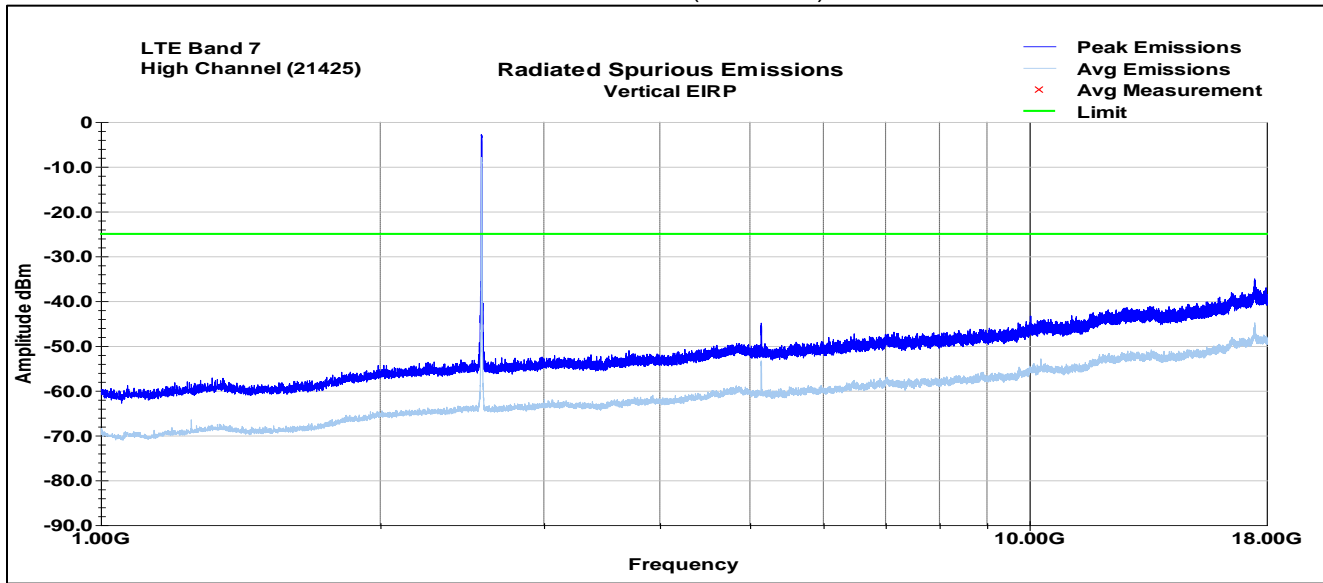
Horizontal Data (30-1000MHz)



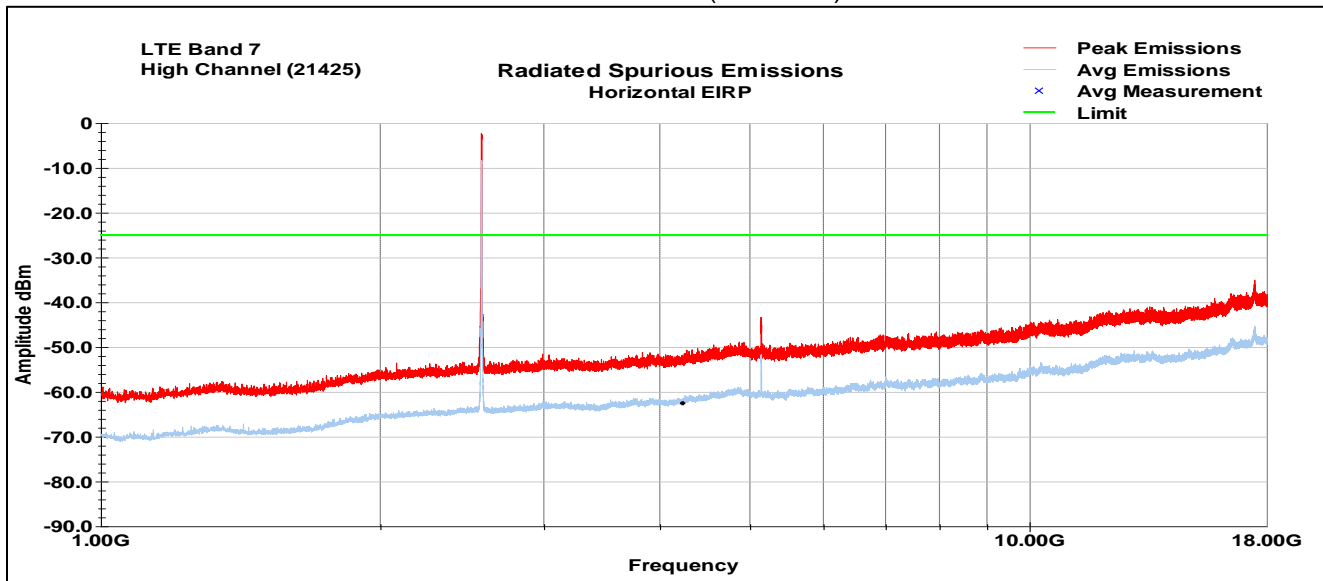
LTE Band 7, QPSK modulation, 5MHz

High Channel (21425)

Vertical Data (1-18GHz)



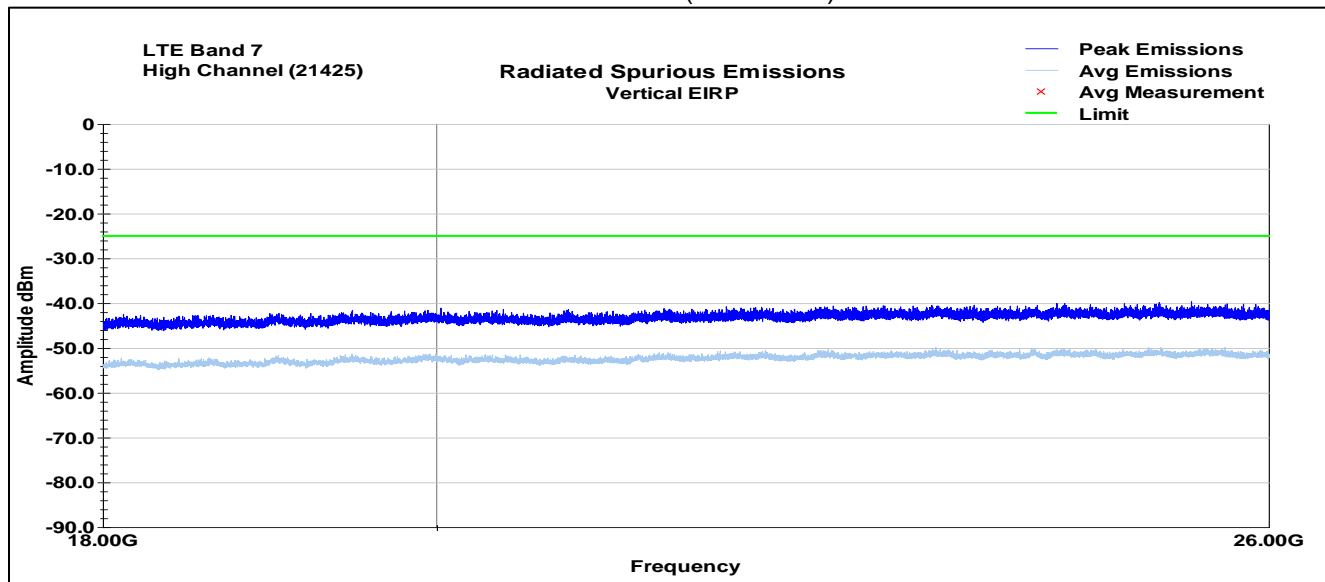
Horizontal Data (1-18GHz)



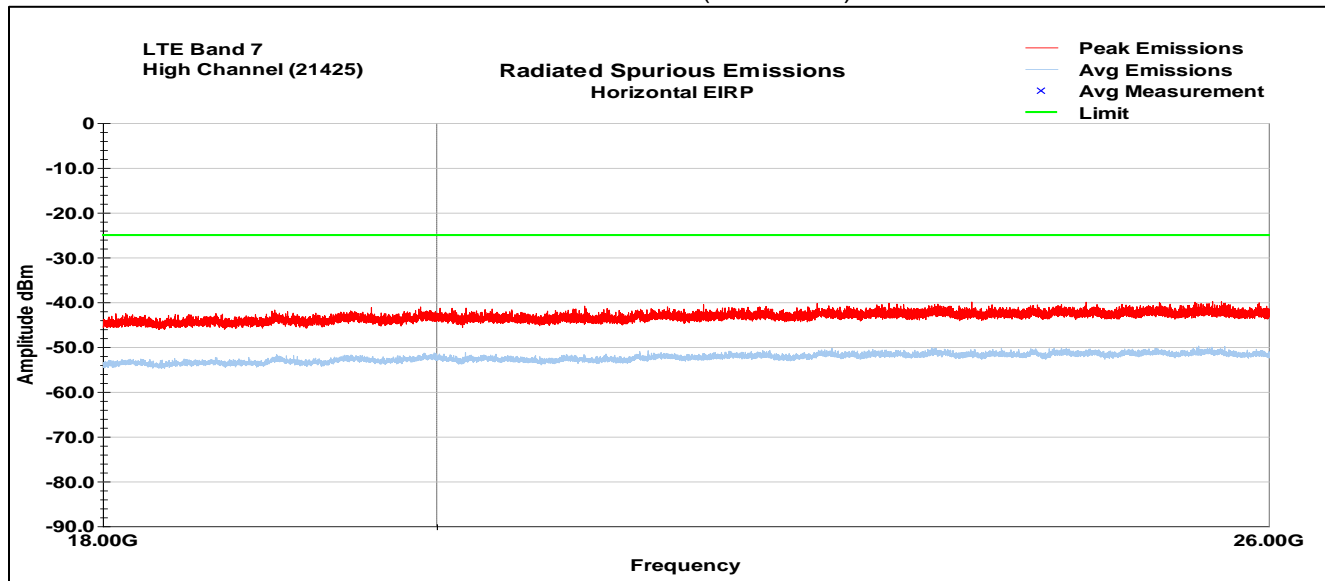
LTE Band 7, QPSK modulation, 5MHz

High Channel (21425)

Vertical Data (18-26GHz)



Horizontal Data (18-26GHz)



9 Frequency Stability

9.1 Test Result

Test Description	Basic Standards	Test Result
Frequency Stability	FCC 2.1055 FCC 27.54	Pass

9.2 Test Method

The EUT was placed inside the Environmental Chamber and was allowed to stabilize to set temperature for a minimum of thirty minutes before any measurements were made. The EUT antenna port was connected to the CMW 500 and the frequency was measured using the CMW internal measurement functions. The EUT was tested at the middle channel of the band.

9.3 Test Site

SGS EMC Laboratory, Suwanee, GA

9.4 Test Equipment

Test End Date: 14-Aug-2018

Tester: MT

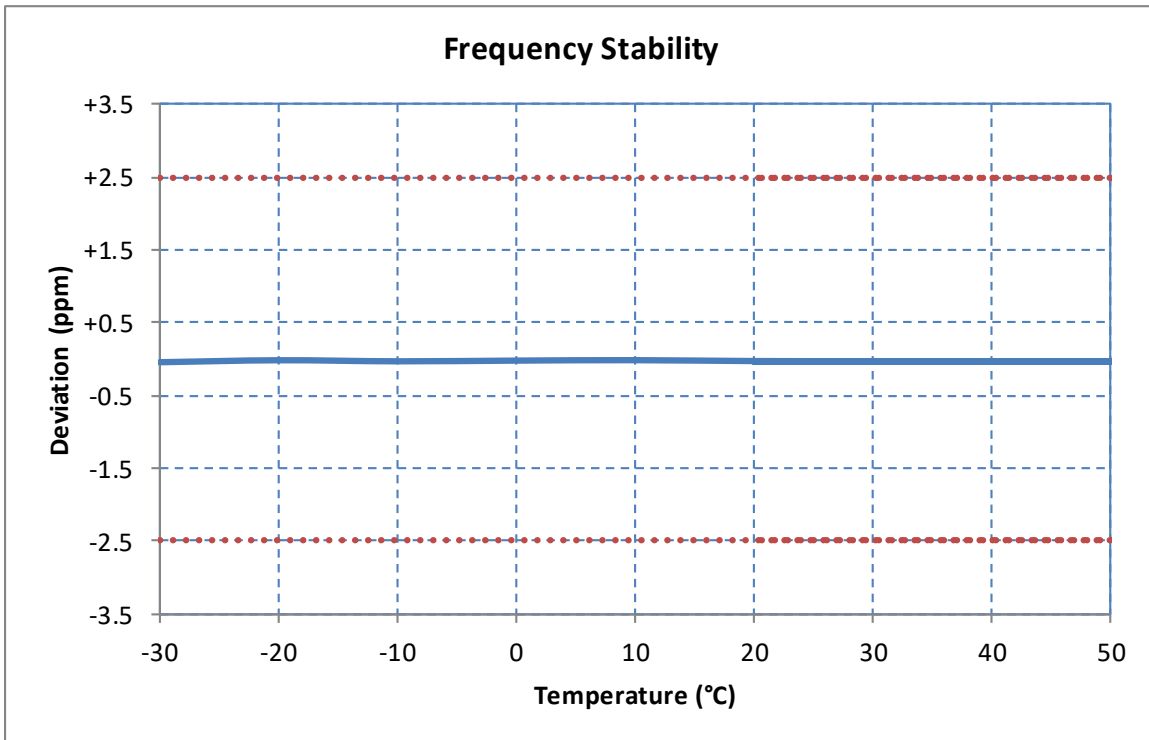
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020
ENVIRONMENTAL TEST CHAMBER	T2RC	TENNEY ENVIRONMENTAL	B094877	CNR
MULTIMETER	87V	FLUKE	B079677	27-Jul-2019

- 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 7, Channel 21100

Voltage %	Power V _{DC}	Temp °C	Frequency Hz	Freq Dev Hz	Freq Dev ppm	Deviation %
100%	12.00	+20 (Ref)	2,534,999,997	-3	-0.00	-0.000000
100%	12.00	-30	2,534,999,996	-4	-0.00	-0.000000
100%	12.00	-20	2,534,999,998	-2	-0.00	-0.000000
100%	12.00	-10	2,534,999,997	-3	-0.00	-0.000000
100%	12.00	0	2,534,999,998	-2	-0.00	-0.000000
100%	12.00	+10	2,534,999,998	-2	-0.00	-0.000000
100%	12.00	+20	2,534,999,997	-3	-0.00	-0.000000
100%	12.00	+30	2,534,999,997	-3	-0.00	-0.000000
100%	12.00	+40	2,534,999,997	-3	-0.00	-0.000000
100%	12.00	+50	2,534,999,997	-4	-0.00	-0.000000
100%	12.00	+55	2,534,999,997	-3	-0.00	-0.000000
115%	13.80	+20	2,534,999,996	-4	-0.00	-0.000000
85%	10.20	+20	2,534,999,997	-3	-0.00	-0.000000



10 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	28 August 2018
1	Changed maximum antenna gain from 12 to 8 dBi to meet EIRP limit in section 7.5	12 October 2018