

# RF Test Report

## Class 2 Permissive Change

**Project Number:** 4297829

**Report Number:** 4297829EMC01      **Revision Level:** 1

**Client:** Continental Automotive Systems, Inc.

**Equipment Under Test:** Wireless Modem Module

**Model:** BL28NA-001

**FCC ID:** LHJ-BL28NA001

**IC ID:** 2807E-BL28NA001

**FCC Rule Parts:** Part 2, Part 24E, Part 27


**Industry Canada:** RSS-GEN, Issue 5; RSS-133, Issue 6; RSS-199, Issue 3

**Test Standard:** ANSI C63.26:2014

**Report issued on:** 17 October 2018

**Test Result:** Compliant

Tested by:

  
\_\_\_\_\_  
Brandon Osborn, Project Engineer

Reviewed by:

  
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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		Test Description	Test Condition	Test Result
FCC	IC			
2.1046 27.50(h)(2)	RSS-GEN (6.12)	Conducted Output Power	Conducted	Pass
2.1051 24.238(a) 27.53(m)(4)	RSS-133 (6.5.1) RSS-199 (4.5)(b)	Band Edge / Conducted Spurious Emissions		Pass
2.1053 24.238(a) 27.53(m)(4)	RSS-GEN (6.13) RSS-133 (6.5.1) RSS-199 (4.5)(b)	Radiated Spurious Emissions	Radiated	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: BL28NA-001  
Serial Number: ADN171020001760, ADN171020000184  
IMEI Number: 014831000001760, 014831000000184  
FCC ID: LHJ- BL28NA001  
IC ID: 2807E- BL28NA001

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

Tx Frequency Ranges: 1850 – 1910 MHz (LTE Band 2)  
1710 – 1755 MHz (LTE Band 4)  
824 – 849 MHz (LTE Band 5)  
2500 – 2570 MHz (LTE Band 7)  
699 – 716 MHz (LTE Band 12)  
777 – 787 MHz (LTE Band 13)

Tested bands for C2PC: 1850 – 1910 MHz (LTE Band 2)  
2500 – 2570 MHz (LTE Band 7)

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

Sample Received Date: 17 April 2018, 05 June 2018  
Dates of testing: 21 May to 29 June and 15-17 October 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 FCC 27.50(h)(2) RSS-GEN (6.12)	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: 23.3 °C  
 Relative Humidity: 53.0 %  
 Atmospheric Pressure: 98.3 kPa

#### 3.4 Test Equipment

Test End Date: 15-Oct-2018

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF CABLE (TS8997)	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 2

Max Power: 23.66 dBm / 0.232 W

UpLink Channel	UL Frequency (MHz)	BW (MHz)	Modulation	# RB	Position	Measured Power (dBm)	Cable Loss (dB)	Conducted Power (dBm)
18607	1850.7	1.4	QPSK	1	(RB_Pos:0)	22.97	0.53	23.50
18607	1850.7	1.4	QPSK	1	(RB_Pos:5)	22.69	0.53	23.22
18607	1850.7	1.4	QPSK	4	(RB_Pos:0)	22.68	0.53	23.21
18607	1850.7	1.4	QPSK	4	(RB_Pos:2)	22.68	0.53	23.21
18607	1850.7	1.4	QPSK	6	(RB_Pos:0)	21.73	0.53	22.26
18900	1880	1.4	QPSK	1	(RB_Pos:0)	23.05	0.54	23.59
18900	1880	1.4	QPSK	1	(RB_Pos:5)	22.91	0.54	23.45
18900	1880	1.4	QPSK	4	(RB_Pos:0)	23.06	0.54	23.60
18900	1880	1.4	QPSK	4	(RB_Pos:2)	23.12	0.54	23.66
18900	1880	1.4	QPSK	6	(RB_Pos:0)	22.08	0.54	22.62
19193	1909.3	1.4	QPSK	1	(RB_Pos:0)	22.80	0.54	23.34
19193	1909.3	1.4	QPSK	1	(RB_Pos:5)	22.77	0.54	23.31
19193	1909.3	1.4	QPSK	4	(RB_Pos:0)	22.88	0.54	23.42
19193	1909.3	1.4	QPSK	4	(RB_Pos:2)	23.05	0.54	23.59
19193	1909.3	1.4	QPSK	6	(RB_Pos:0)	21.91	0.54	22.45
18615	1851.5	3	QPSK	1	(RB_Pos:0)	22.47	0.53	23.00
18615	1851.5	3	QPSK	1	(RB_Pos:14)	22.54	0.53	23.07
18615	1851.5	3	QPSK	8	(RB_Pos:0)	21.80	0.53	22.33
18615	1851.5	3	QPSK	8	(RB_Pos:7)	21.68	0.53	22.21
18615	1851.5	3	QPSK	15	(RB_Pos:0)	21.69	0.53	22.22
18900	1880	3	QPSK	1	(RB_Pos:0)	23.04	0.54	23.58
18900	1880	3	QPSK	1	(RB_Pos:14)	22.79	0.54	23.33
18900	1880	3	QPSK	8	(RB_Pos:0)	22.16	0.54	22.70
18900	1880	3	QPSK	8	(RB_Pos:7)	22.14	0.54	22.68
18900	1880	3	QPSK	15	(RB_Pos:0)	22.04	0.54	22.58
19185	1908.5	3	QPSK	1	(RB_Pos:0)	22.83	0.54	23.37
19185	1908.5	3	QPSK	1	(RB_Pos:14)	22.80	0.54	23.34
19185	1908.5	3	QPSK	8	(RB_Pos:0)	21.97	0.54	22.51
19185	1908.5	3	QPSK	8	(RB_Pos:7)	21.92	0.54	22.46
19185	1908.5	3	QPSK	15	(RB_Pos:0)	21.96	0.54	22.50
18625	1852.5	5	QPSK	1	(RB_Pos:0)	22.42	0.53	22.95
18625	1852.5	5	QPSK	1	(RB_Pos:24)	22.45	0.53	22.98
18625	1852.5	5	QPSK	12	(RB_Pos:0)	21.66	0.53	22.19
18625	1852.5	5	QPSK	12	(RB_Pos:13)	21.63	0.53	22.16
18625	1852.5	5	QPSK	25	(RB_Pos:0)	21.64	0.53	22.17
18900	1880	5	QPSK	1	(RB_Pos:0)	22.79	0.54	23.33
18900	1880	5	QPSK	1	(RB_Pos:24)	22.87	0.54	23.41
18900	1880	5	QPSK	12	(RB_Pos:0)	22.07	0.54	22.61
18900	1880	5	QPSK	12	(RB_Pos:13)	22.07	0.54	22.61
18900	1880	5	QPSK	25	(RB_Pos:0)	22.05	0.54	22.59
19175	1907.5	5	QPSK	1	(RB_Pos:0)	22.94	0.54	23.48
19175	1907.5	5	QPSK	1	(RB_Pos:24)	22.80	0.54	23.34
19175	1907.5	5	QPSK	12	(RB_Pos:0)	21.94	0.54	22.48
19175	1907.5	5	QPSK	12	(RB_Pos:13)	21.84	0.54	22.38
19175	1907.5	5	QPSK	25	(RB_Pos:0)	21.88	0.54	22.42
18650	1855	10	QPSK	1	(RB_Pos:0)	22.55	0.53	23.08
18650	1855	10	QPSK	1	(RB_Pos:49)	22.84	0.53	23.37
18650	1855	10	QPSK	25	(RB_Pos:0)	21.82	0.53	22.35
18650	1855	10	QPSK	25	(RB_Pos:25)	21.81	0.53	22.34
18650	1855	10	QPSK	50	(RB_Pos:0)	21.81	0.53	22.34
18900	1880	10	QPSK	1	(RB_Pos:0)	23.06	0.54	23.60
18900	1880	10	QPSK	1	(RB_Pos:49)	23.02	0.54	23.56
18900	1880	10	QPSK	25	(RB_Pos:0)	21.99	0.54	22.53
18900	1880	10	QPSK	25	(RB_Pos:25)	22.09	0.54	22.63
18900	1880	10	QPSK	50	(RB_Pos:0)	22.10	0.54	22.64
19150	1905	10	QPSK	1	(RB_Pos:0)	22.98	0.54	23.52
19150	1905	10	QPSK	1	(RB_Pos:49)	22.89	0.54	23.43
19150	1905	10	QPSK	25	(RB_Pos:0)	22.05	0.54	22.59
19150	1905	10	QPSK	25	(RB_Pos:25)	21.89	0.54	22.43
19150	1905	10	QPSK	50	(RB_Pos:0)	21.93	0.54	22.47

UpLink Channel	UL Frequency (MHz)	BW (MHz)	Modulation	# RB	Position	Measured Power (dBm)	Cable Loss (dB)	Conducted Power (dBm)
18675	1857.5	15	QPSK	1	(RB_Pos:0)	22.59	0.53	23.12
18675	1857.5	15	QPSK	1	(RB_Pos:74)	22.69	0.53	23.22
18675	1857.5	15	QPSK	36	(RB_Pos:0)	21.77	0.53	22.30
18675	1857.5	15	QPSK	36	(RB_Pos:39)	21.85	0.53	22.38
18675	1857.5	15	QPSK	75	(RB_Pos:0)	21.83	0.53	22.36
18900	1880	15	QPSK	1	(RB_Pos:0)	22.91	0.54	23.45
18900	1880	15	QPSK	1	(RB_Pos:74)	22.90	0.54	23.44
18900	1880	15	QPSK	36	(RB_Pos:0)	22.08	0.54	22.62
18900	1880	15	QPSK	36	(RB_Pos:39)	22.03	0.54	22.57
18900	1880	15	QPSK	75	(RB_Pos:0)	22.11	0.54	22.65
19125	1902.5	15	QPSK	1	(RB_Pos:0)	23.07	0.54	23.61
19125	1902.5	15	QPSK	1	(RB_Pos:74)	22.79	0.54	23.33
19125	1902.5	15	QPSK	36	(RB_Pos:0)	22.10	0.54	22.64
19125	1902.5	15	QPSK	36	(RB_Pos:39)	21.88	0.54	22.42
19125	1902.5	15	QPSK	75	(RB_Pos:0)	21.95	0.54	22.49
18700	1860	20	QPSK	1	(RB_Pos:0)	22.44	0.53	22.97
18700	1860	20	QPSK	1	(RB_Pos:99)	22.74	0.53	23.27
18700	1860	20	QPSK	50	(RB_Pos:0)	21.81	0.53	22.34
18700	1860	20	QPSK	50	(RB_Pos:50)	21.89	0.53	22.42
18700	1860	20	QPSK	100	(RB_Pos:0)	21.85	0.53	22.38
18900	1880	20	QPSK	1	(RB_Pos:0)	22.88	0.54	23.42
18900	1880	20	QPSK	1	(RB_Pos:99)	22.93	0.54	23.47
18900	1880	20	QPSK	50	(RB_Pos:0)	22.14	0.54	22.68
18900	1880	20	QPSK	50	(RB_Pos:50)	22.11	0.54	22.65
18900	1880	20	QPSK	100	(RB_Pos:0)	22.13	0.54	22.67
19100	1900	20	QPSK	1	(RB_Pos:0)	22.89	0.54	23.43
19100	1900	20	QPSK	1	(RB_Pos:99)	22.75	0.54	23.29
19100	1900	20	QPSK	50	(RB_Pos:0)	22.21	0.54	22.75
19100	1900	20	QPSK	50	(RB_Pos:50)	22.01	0.54	22.55
19100	1900	20	QPSK	100	(RB_Pos:0)	22.11	0.54	22.65
18607	1850.7	1.4	16-QAM	1	(RB_Pos:0)	21.54	0.53	22.07
18607	1850.7	1.4	16-QAM	1	(RB_Pos:5)	21.55	0.53	22.08
18607	1850.7	1.4	16-QAM	4	(RB_Pos:0)	21.64	0.53	22.17
18607	1850.7	1.4	16-QAM	4	(RB_Pos:2)	21.61	0.53	22.14
18607	1850.7	1.4	16-QAM	6	(RB_Pos:0)	20.70	0.53	21.23
18900	1880	1.4	16-QAM	1	(RB_Pos:0)	22.26	0.54	22.80
18900	1880	1.4	16-QAM	1	(RB_Pos:5)	22.20	0.54	22.74
18900	1880	1.4	16-QAM	4	(RB_Pos:0)	22.13	0.54	22.67
18900	1880	1.4	16-QAM	4	(RB_Pos:2)	22.13	0.54	22.67
18900	1880	1.4	16-QAM	6	(RB_Pos:0)	21.11	0.54	21.65
19193	1909.3	1.4	16-QAM	1	(RB_Pos:0)	21.60	0.54	22.14
19193	1909.3	1.4	16-QAM	1	(RB_Pos:5)	21.55	0.54	22.09
19193	1909.3	1.4	16-QAM	4	(RB_Pos:0)	21.68	0.54	22.22
19193	1909.3	1.4	16-QAM	4	(RB_Pos:2)	21.71	0.54	22.25
19193	1909.3	1.4	16-QAM	6	(RB_Pos:0)	21.24	0.54	21.78
18615	1851.5	3	16-QAM	1	(RB_Pos:0)	21.48	0.53	22.01
18615	1851.5	3	16-QAM	1	(RB_Pos:14)	21.45	0.53	21.98
18615	1851.5	3	16-QAM	8	(RB_Pos:0)	20.92	0.53	21.45
18615	1851.5	3	16-QAM	8	(RB_Pos:7)	20.91	0.53	21.44
18615	1851.5	3	16-QAM	15	(RB_Pos:0)	20.59	0.53	21.12
18900	1880	3	16-QAM	1	(RB_Pos:0)	21.99	0.54	22.53
18900	1880	3	16-QAM	1	(RB_Pos:14)	21.95	0.54	22.49
18900	1880	3	16-QAM	8	(RB_Pos:0)	21.07	0.54	21.61
18900	1880	3	16-QAM	8	(RB_Pos:7)	21.17	0.54	21.71
18900	1880	3	16-QAM	15	(RB_Pos:0)	21.14	0.54	21.68
19185	1908.5	3	16-QAM	1	(RB_Pos:0)	21.85	0.54	22.39
19185	1908.5	3	16-QAM	1	(RB_Pos:14)	21.68	0.54	22.22
19185	1908.5	3	16-QAM	8	(RB_Pos:0)	20.89	0.54	21.43
19185	1908.5	3	16-QAM	8	(RB_Pos:7)	20.66	0.54	21.20
19185	1908.5	3	16-QAM	15	(RB_Pos:0)	20.74	0.54	21.28

UpLink Channel	UL Frequency (MHz)	BW (MHz)	Modulation	# RB	Position	Measured Power (dBm)	Cable Loss (dB)	Conducted Power (dBm)
18625	1852.5	5	16-QAM	1	(RB_Pos:0)	21.34	0.53	21.87
18625	1852.5	5	16-QAM	1	(RB_Pos:24)	21.35	0.53	21.88
18625	1852.5	5	16-QAM	12	(RB_Pos:0)	20.76	0.53	21.29
18625	1852.5	5	16-QAM	12	(RB_Pos:13)	20.74	0.53	21.27
18625	1852.5	5	16-QAM	25	(RB_Pos:0)	20.67	0.53	21.20
18900	1880	5	16-QAM	1	(RB_Pos:0)	21.47	0.54	22.01
18900	1880	5	16-QAM	1	(RB_Pos:24)	21.40	0.54	21.94
18900	1880	5	16-QAM	12	(RB_Pos:0)	20.85	0.54	21.39
18900	1880	5	16-QAM	12	(RB_Pos:13)	20.96	0.54	21.50
18900	1880	5	16-QAM	25	(RB_Pos:0)	21.04	0.54	21.58
19175	1907.5	5	16-QAM	1	(RB_Pos:0)	21.66	0.54	22.20
19175	1907.5	5	16-QAM	1	(RB_Pos:24)	21.62	0.54	22.16
19175	1907.5	5	16-QAM	12	(RB_Pos:0)	20.62	0.54	21.16
19175	1907.5	5	16-QAM	12	(RB_Pos:13)	20.46	0.54	21.00
19175	1907.5	5	16-QAM	25	(RB_Pos:0)	20.88	0.54	21.42
18650	1855	10	16-QAM	1	(RB_Pos:0)	21.25	0.53	21.78
18650	1855	10	16-QAM	1	(RB_Pos:49)	21.39	0.53	21.92
18650	1855	10	16-QAM	25	(RB_Pos:0)	20.74	0.53	21.27
18650	1855	10	16-QAM	25	(RB_Pos:25)	20.73	0.53	21.26
18650	1855	10	16-QAM	50	(RB_Pos:0)	20.73	0.53	21.26
18900	1880	10	16-QAM	1	(RB_Pos:0)	21.55	0.54	22.09
18900	1880	10	16-QAM	1	(RB_Pos:49)	21.37	0.54	21.91
18900	1880	10	16-QAM	25	(RB_Pos:0)	20.97	0.54	21.51
18900	1880	10	16-QAM	25	(RB_Pos:25)	20.89	0.54	21.43
18900	1880	10	16-QAM	50	(RB_Pos:0)	20.98	0.54	21.52
19150	1905	10	16-QAM	1	(RB_Pos:0)	22.13	0.54	22.67
19150	1905	10	16-QAM	1	(RB_Pos:49)	21.96	0.54	22.50
19150	1905	10	16-QAM	25	(RB_Pos:0)	21.43	0.54	21.97
19150	1905	10	16-QAM	25	(RB_Pos:25)	21.25	0.54	21.79
19150	1905	10	16-QAM	50	(RB_Pos:0)	20.96	0.54	21.50
18675	1857.5	15	16-QAM	1	(RB_Pos:0)	21.64	0.53	22.17
18675	1857.5	15	16-QAM	1	(RB_Pos:74)	21.37	0.53	21.90
18675	1857.5	15	16-QAM	36	(RB_Pos:0)	20.97	0.53	21.50
18675	1857.5	15	16-QAM	36	(RB_Pos:39)	21.03	0.53	21.56
18675	1857.5	15	16-QAM	75	(RB_Pos:0)	20.88	0.53	21.41
18900	1880	15	16-QAM	1	(RB_Pos:0)	21.79	0.54	22.33
18900	1880	15	16-QAM	1	(RB_Pos:74)	21.44	0.54	21.98
18900	1880	15	16-QAM	36	(RB_Pos:0)	21.08	0.54	21.62
18900	1880	15	16-QAM	36	(RB_Pos:39)	21.06	0.54	21.60
18900	1880	15	16-QAM	75	(RB_Pos:0)	21.00	0.54	21.54
19125	1902.5	15	16-QAM	1	(RB_Pos:0)	22.19	0.54	22.73
19125	1902.5	15	16-QAM	1	(RB_Pos:74)	21.70	0.54	22.24
19125	1902.5	15	16-QAM	36	(RB_Pos:0)	21.05	0.54	21.59
19125	1902.5	15	16-QAM	36	(RB_Pos:39)	20.84	0.54	21.38
19125	1902.5	15	16-QAM	75	(RB_Pos:0)	20.93	0.54	21.47
18700	1860	20	16-QAM	1	(RB_Pos:0)	21.17	0.53	21.70
18700	1860	20	16-QAM	1	(RB_Pos:99)	20.95	0.53	21.48
18700	1860	20	16-QAM	50	(RB_Pos:0)	20.71	0.53	21.24
18700	1860	20	16-QAM	50	(RB_Pos:50)	20.76	0.53	21.29
18700	1860	20	16-QAM	100	(RB_Pos:0)	20.81	0.53	21.34
18900	1880	20	16-QAM	1	(RB_Pos:0)	22.08	0.54	22.62
18900	1880	20	16-QAM	1	(RB_Pos:99)	22.11	0.54	22.65
18900	1880	20	16-QAM	50	(RB_Pos:0)	21.09	0.54	21.63
18900	1880	20	16-QAM	50	(RB_Pos:50)	21.07	0.54	21.61
18900	1880	20	16-QAM	100	(RB_Pos:0)	21.11	0.54	21.65
19100	1900	20	16-QAM	1	(RB_Pos:0)	22.02	0.54	22.56
19100	1900	20	16-QAM	1	(RB_Pos:99)	21.75	0.54	22.29
19100	1900	20	16-QAM	50	(RB_Pos:0)	21.13	0.54	21.67
19100	1900	20	16-QAM	50	(RB_Pos:50)	20.96	0.54	21.50
19100	1900	20	16-QAM	100	(RB_Pos:0)	21.11	0.54	21.65



### 3.6 Test Data - LTE Band 7

Max Power: 23.47 dBm / 0.222 W

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)	22.54	0.64	23.18
20775	2502.5	5	QPSK	1	(RB_Pos:24)	22.42	0.64	23.06
20775	2502.5	5	QPSK	12	(RB_Pos:0)	21.78	0.64	22.42
20775	2502.5	5	QPSK	12	(RB_Pos:13)	21.73	0.64	22.37
20775	2502.5	5	QPSK	25	(RB_Pos:0)	21.78	0.64	22.42
21100	2535	5	QPSK	1	(RB_Pos:0)	22.54	0.64	23.18
21100	2535	5	QPSK	1	(RB_Pos:24)	22.68	0.64	23.32
21100	2535	5	QPSK	12	(RB_Pos:0)	21.67	0.64	22.31
21100	2535	5	QPSK	12	(RB_Pos:13)	21.76	0.64	22.40
21100	2535	5	QPSK	25	(RB_Pos:0)	21.69	0.64	22.33
21425	2567.5	5	QPSK	1	(RB_Pos:0)	22.54	0.64	23.18
21425	2567.5	5	QPSK	1	(RB_Pos:24)	22.40	0.64	23.04
21425	2567.5	5	QPSK	12	(RB_Pos:0)	21.70	0.64	22.34
21425	2567.5	5	QPSK	12	(RB_Pos:13)	21.61	0.64	22.25
21425	2567.5	5	QPSK	25	(RB_Pos:0)	21.65	0.64	22.29
20800	2505	10	QPSK	1	(RB_Pos:0)	22.61	0.64	23.25
20800	2505	10	QPSK	1	(RB_Pos:49)	22.66	0.64	23.30
20800	2505	10	QPSK	25	(RB_Pos:0)	21.83	0.64	22.47
20800	2505	10	QPSK	25	(RB_Pos:25)	21.81	0.64	22.45
20800	2505	10	QPSK	50	(RB_Pos:0)	21.88	0.64	22.52
21100	2535	10	QPSK	1	(RB_Pos:0)	22.59	0.64	23.23
21100	2535	10	QPSK	1	(RB_Pos:49)	22.59	0.64	23.23
21100	2535	10	QPSK	25	(RB_Pos:0)	21.78	0.64	22.42
21100	2535	10	QPSK	25	(RB_Pos:25)	21.77	0.64	22.41
21100	2535	10	QPSK	50	(RB_Pos:0)	21.70	0.64	22.34
21400	2565	10	QPSK	1	(RB_Pos:0)	22.81	0.64	23.45
21400	2565	10	QPSK	1	(RB_Pos:49)	22.62	0.64	23.26
21400	2565	10	QPSK	25	(RB_Pos:0)	21.88	0.64	22.52
21400	2565	10	QPSK	25	(RB_Pos:25)	21.72	0.64	22.36
21400	2565	10	QPSK	50	(RB_Pos:0)	21.83	0.64	22.47
20825	2507.5	15	QPSK	1	(RB_Pos:0)	22.70	0.64	23.34
20825	2507.5	15	QPSK	1	(RB_Pos:74)	22.56	0.64	23.20
20825	2507.5	15	QPSK	36	(RB_Pos:0)	21.77	0.64	22.41
20825	2507.5	15	QPSK	36	(RB_Pos:39)	21.77	0.64	22.41
20825	2507.5	15	QPSK	75	(RB_Pos:0)	21.74	0.64	22.38
21100	2535	15	QPSK	1	(RB_Pos:0)	22.46	0.64	23.10
21100	2535	15	QPSK	1	(RB_Pos:74)	22.49	0.64	23.13
21100	2535	15	QPSK	36	(RB_Pos:0)	21.80	0.64	22.44
21100	2535	15	QPSK	36	(RB_Pos:39)	21.76	0.64	22.40
21100	2535	15	QPSK	75	(RB_Pos:0)	21.70	0.64	22.34
21375	2562.5	15	QPSK	1	(RB_Pos:0)	22.83	0.64	23.47
21375	2562.5	15	QPSK	1	(RB_Pos:74)	22.44	0.64	23.08
21375	2562.5	15	QPSK	36	(RB_Pos:0)	22.03	0.64	22.67
21375	2562.5	15	QPSK	36	(RB_Pos:39)	21.71	0.64	22.35
21375	2562.5	15	QPSK	75	(RB_Pos:0)	21.87	0.64	22.51
20850	2510	20	QPSK	1	(RB_Pos:0)	22.57	0.64	23.21
20850	2510	20	QPSK	1	(RB_Pos:99)	22.34	0.64	22.98
20850	2510	20	QPSK	50	(RB_Pos:0)	21.84	0.64	22.48
20850	2510	20	QPSK	50	(RB_Pos:50)	21.78	0.64	22.42
20850	2510	20	QPSK	100	(RB_Pos:0)	21.77	0.64	22.41
21100	2535	20	QPSK	1	(RB_Pos:0)	22.66	0.64	23.30
21100	2535	20	QPSK	1	(RB_Pos:99)	22.59	0.64	23.23
21100	2535	20	QPSK	50	(RB_Pos:0)	21.80	0.64	22.44
21100	2535	20	QPSK	50	(RB_Pos:50)	21.78	0.64	22.42
21100	2535	20	QPSK	100	(RB_Pos:0)	21.80	0.64	22.44
21350	2560	20	QPSK	1	(RB_Pos:0)	22.65	0.64	23.29
21350	2560	20	QPSK	1	(RB_Pos:99)	22.59	0.64	23.23
21350	2560	20	QPSK	50	(RB_Pos:0)	22.03	0.64	22.67
21350	2560	20	QPSK	50	(RB_Pos:50)	21.84	0.64	22.48
21350	2560	20	QPSK	100	(RB_Pos:0)	21.92	0.64	22.56

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)	21.29	0.64	21.93
20775	2502.5	5	16-QAM	1	(RB_Pos:24)	21.12	0.64	21.76
20775	2502.5	5	16-QAM	12	(RB_Pos:0)	21.01	0.64	21.65
20775	2502.5	5	16-QAM	12	(RB_Pos:13)	20.93	0.64	21.57
20775	2502.5	5	16-QAM	25	(RB_Pos:0)	20.82	0.64	21.46
21100	2535	5	16-QAM	1	(RB_Pos:0)	20.94	0.64	21.58
21100	2535	5	16-QAM	1	(RB_Pos:24)	20.82	0.64	21.46
21100	2535	5	16-QAM	12	(RB_Pos:0)	20.44	0.64	21.08
21100	2535	5	16-QAM	12	(RB_Pos:13)	20.51	0.64	21.15
21100	2535	5	16-QAM	25	(RB_Pos:0)	20.45	0.64	21.09
21425	2567.5	5	16-QAM	1	(RB_Pos:0)	21.18	0.64	21.82
21425	2567.5	5	16-QAM	1	(RB_Pos:24)	20.82	0.64	21.46
21425	2567.5	5	16-QAM	12	(RB_Pos:0)	20.39	0.64	21.03
21425	2567.5	5	16-QAM	12	(RB_Pos:13)	20.30	0.64	20.94
21425	2567.5	5	16-QAM	25	(RB_Pos:0)	20.57	0.64	21.21
20800	2505	10	16-QAM	1	(RB_Pos:0)	21.34	0.64	21.98
20800	2505	10	16-QAM	1	(RB_Pos:49)	21.48	0.64	22.12
20800	2505	10	16-QAM	25	(RB_Pos:0)	20.79	0.64	21.43
20800	2505	10	16-QAM	25	(RB_Pos:25)	20.81	0.64	21.45
20800	2505	10	16-QAM	50	(RB_Pos:0)	20.70	0.64	21.34
21100	2535	10	16-QAM	1	(RB_Pos:0)	21.43	0.64	22.07
21100	2535	10	16-QAM	1	(RB_Pos:49)	21.20	0.64	21.84
21100	2535	10	16-QAM	25	(RB_Pos:0)	20.77	0.64	21.41
21100	2535	10	16-QAM	25	(RB_Pos:25)	20.71	0.64	21.35
21100	2535	10	16-QAM	50	(RB_Pos:0)	20.62	0.64	21.26
21400	2565	10	16-QAM	1	(RB_Pos:0)	22.00	0.64	22.64
21400	2565	10	16-QAM	1	(RB_Pos:49)	21.79	0.64	22.43
21400	2565	10	16-QAM	25	(RB_Pos:0)	20.96	0.64	21.60
21400	2565	10	16-QAM	25	(RB_Pos:25)	20.80	0.64	21.44
21400	2565	10	16-QAM	50	(RB_Pos:0)	20.79	0.64	21.43
20825	2507.5	15	16-QAM	1	(RB_Pos:0)	21.63	0.64	22.27
20825	2507.5	15	16-QAM	1	(RB_Pos:74)	21.53	0.64	22.17
20825	2507.5	15	16-QAM	36	(RB_Pos:0)	20.77	0.64	21.41
20825	2507.5	15	16-QAM	36	(RB_Pos:39)	20.77	0.64	21.41
20825	2507.5	15	16-QAM	75	(RB_Pos:0)	20.69	0.64	21.33
21100	2535	15	16-QAM	1	(RB_Pos:0)	21.66	0.64	22.30
21100	2535	15	16-QAM	1	(RB_Pos:74)	21.65	0.64	22.29
21100	2535	15	16-QAM	36	(RB_Pos:0)	20.73	0.64	21.37
21100	2535	15	16-QAM	36	(RB_Pos:39)	20.78	0.64	21.42
21100	2535	15	16-QAM	75	(RB_Pos:0)	20.73	0.64	21.37
21375	2562.5	15	16-QAM	1	(RB_Pos:0)	21.95	0.64	22.59
21375	2562.5	15	16-QAM	1	(RB_Pos:74)	21.35	0.64	21.99
21375	2562.5	15	16-QAM	36	(RB_Pos:0)	21.01	0.64	21.65
21375	2562.5	15	16-QAM	36	(RB_Pos:39)	20.73	0.64	21.37
21375	2562.5	15	16-QAM	75	(RB_Pos:0)	20.90	0.64	21.54
20850	2510	20	16-QAM	1	(RB_Pos:0)	21.25	0.64	21.89
20850	2510	20	16-QAM	1	(RB_Pos:99)	20.88	0.64	21.52
20850	2510	20	16-QAM	50	(RB_Pos:0)	20.91	0.64	21.55
20850	2510	20	16-QAM	50	(RB_Pos:50)	20.77	0.64	21.41
20850	2510	20	16-QAM	100	(RB_Pos:0)	20.71	0.64	21.35
21100	2535	20	16-QAM	1	(RB_Pos:0)	21.89	0.64	22.53
21100	2535	20	16-QAM	1	(RB_Pos:99)	21.76	0.64	22.40
21100	2535	20	16-QAM	50	(RB_Pos:0)	20.79	0.64	21.43
21100	2535	20	16-QAM	50	(RB_Pos:50)	20.76	0.64	21.40
21100	2535	20	16-QAM	100	(RB_Pos:0)	20.80	0.64	21.44
21350	2560	20	16-QAM	1	(RB_Pos:0)	21.74	0.64	22.38
21350	2560	20	16-QAM	1	(RB_Pos:99)	21.32	0.64	21.96
21350	2560	20	16-QAM	50	(RB_Pos:0)	21.03	0.64	21.67
21350	2560	20	16-QAM	50	(RB_Pos:50)	20.70	0.64	21.34
21350	2560	20	16-QAM	100	(RB_Pos:0)	20.82	0.64	21.46

## 4 Band Edge and Conducted Spurious Emissions

### 4.1 Test Result

Test Description	Basic Standards	Test Result
Band Edge and Conducted Spurious Emissions	FCC 2.1051 FCC 24.238(a) FCC 27.53(m)(4) RSS-133 (6.5.1) RSS-199 (4.5)(b)	Pass

### 4.2 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  $43 + 10 \log (P)$  dB for all bands except for band 7. In the case of band 7, the emissions shall be attenuated 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, just for band 7, 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 investigated and the worst-case measurements are reported at the lowest and highest channels in each band.

### 4.3 Test Site

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions	Band Edge	Conducted Spurious Emissions
Temperature:	23.7 °C	23.4 °C
Relative Humidity:	50.3 %	50.5 %
Atmospheric Pressure:	98.5 kPa	98.2 kPa

#### 4.4 Test Equipment

##### Band Edge Tests

Test End Date: 17-Oct-2018

Tester: MT

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
SIGNAL ANALYZER (TS8997)	FSV30	ROHDE & SCHWARZ	B085749	1-Nov-2019
RF CABLE	1134	GORE	B094785	25-Jul-2019
RF CABLE (TS8997)	141	HUBER & SUHNER	B095588	25-Jul-2019
ATTENUATOR, 10DB	BW-S10W2	MINI-CIRCUITS	15032	CNR
POWER SPLITTER	ZFRSC-183-S+	MINI-CIRCUITS	B101741	25-Jul-2019
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	25-Jan-2020

##### Conducted Spurious Emissions Tests

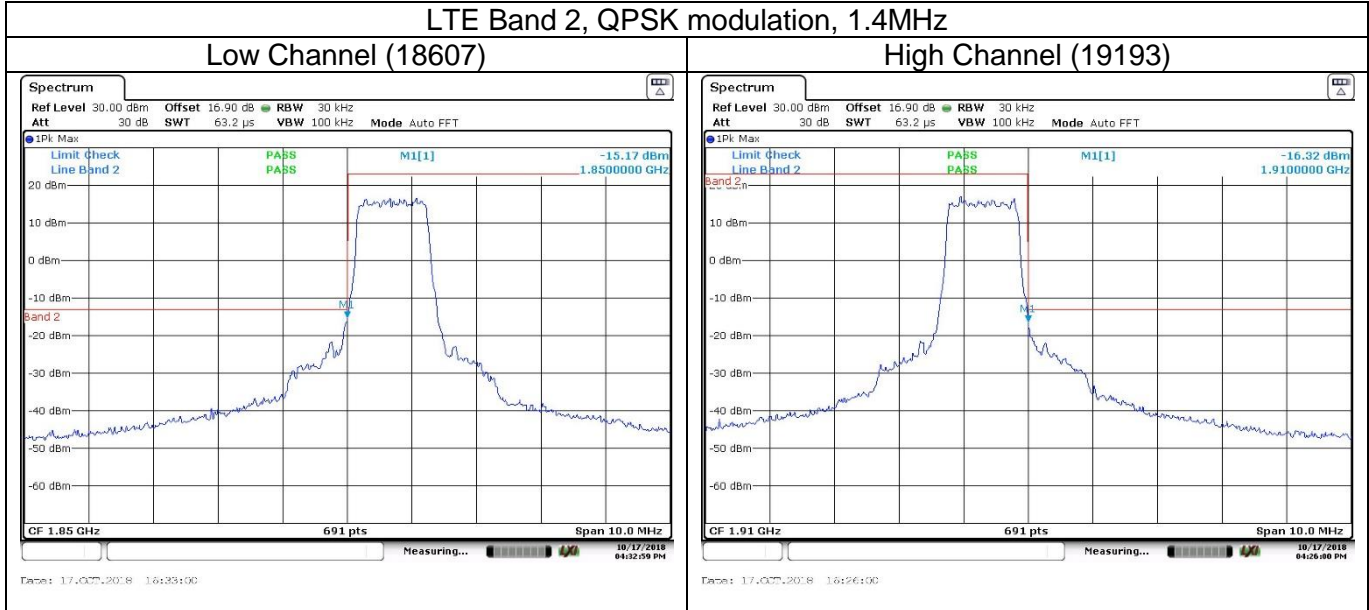
Test End Date: 22-May-2018

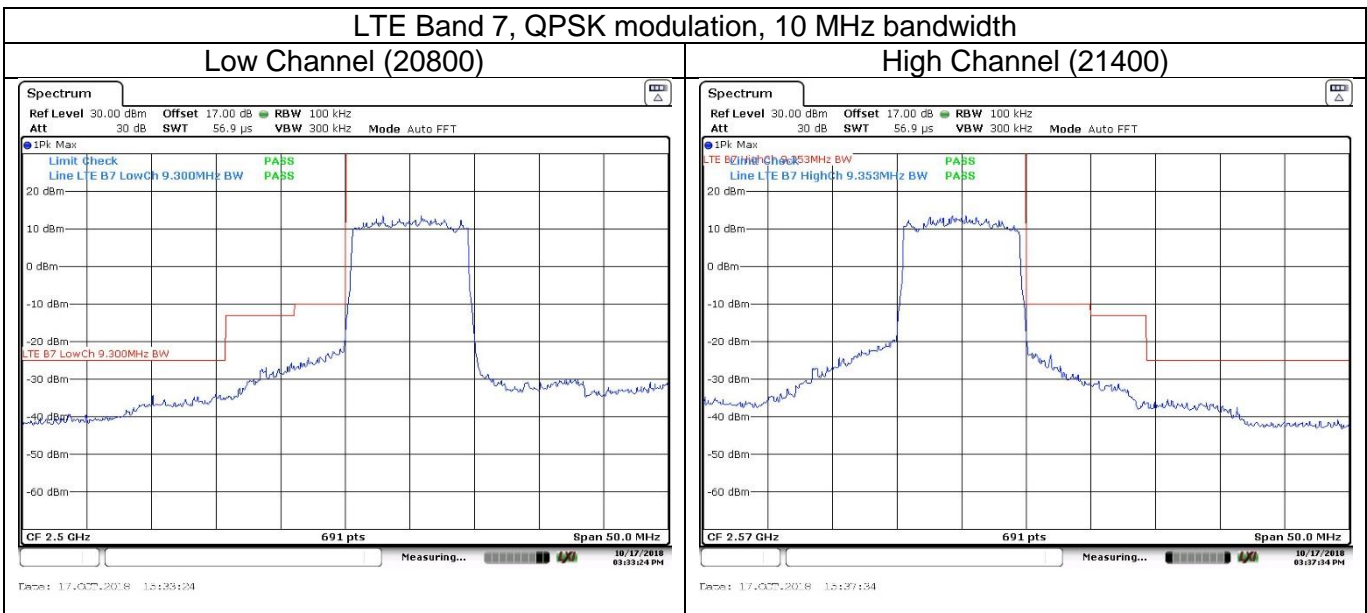
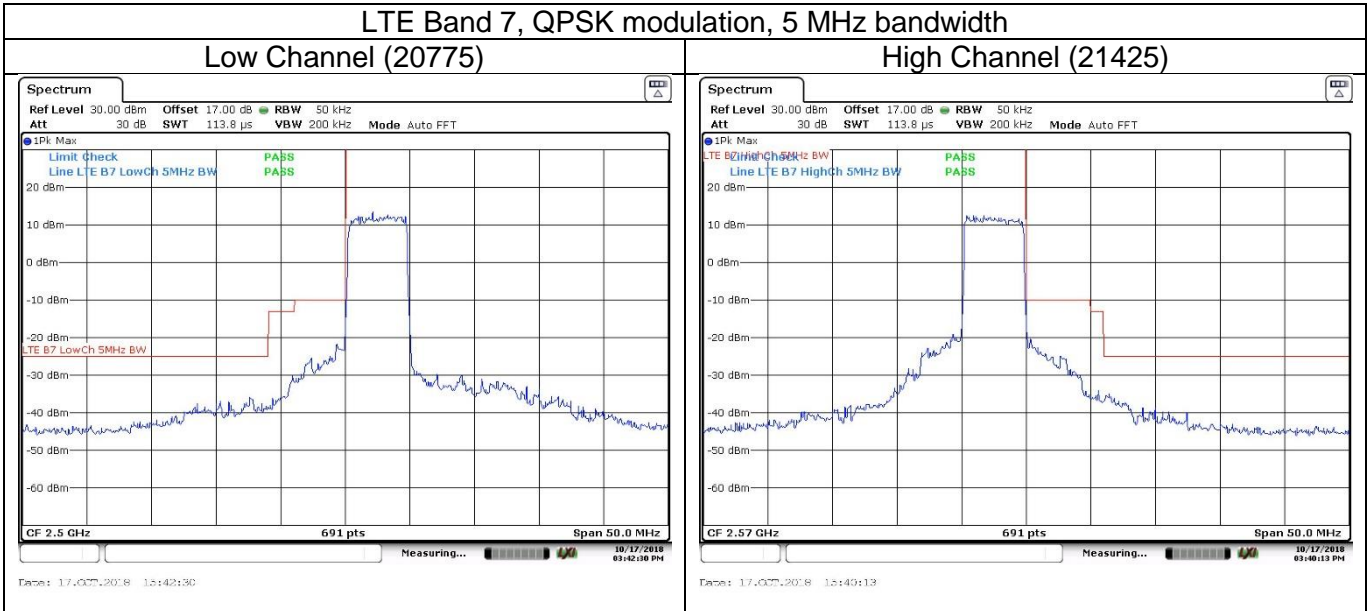
Tester: JL

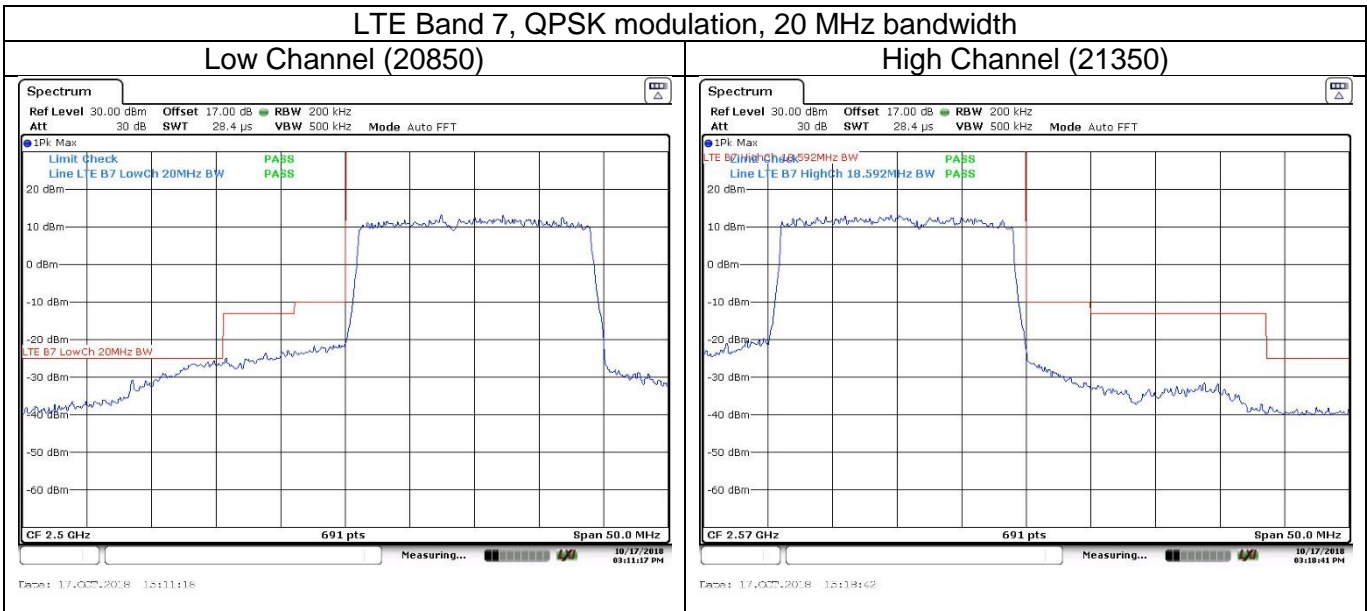
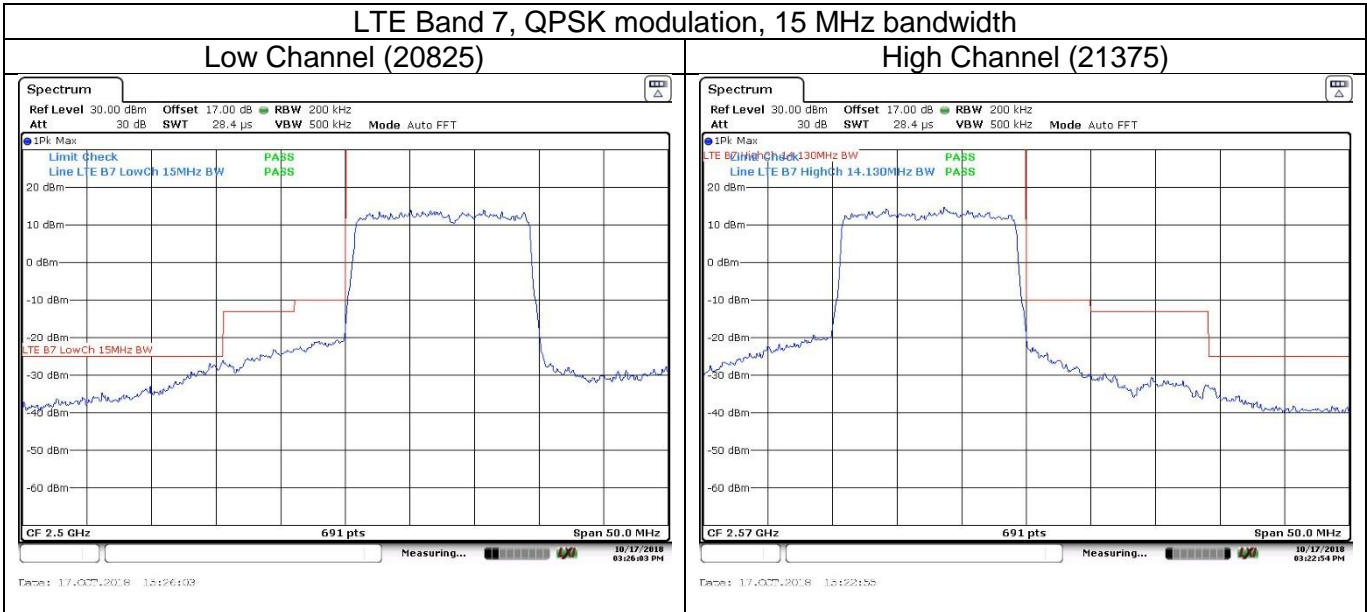
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
RF CABLE	SF102	HUBER & SUHNER	B079822	27-Jul-2018
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	13628	2-Oct-2018
WIDEBAND RADIO COMMUNICATION TESTER	CMW500	ROHDE & SCHWARZ	B094874	20-Jan-2020

- 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 - Band Edge

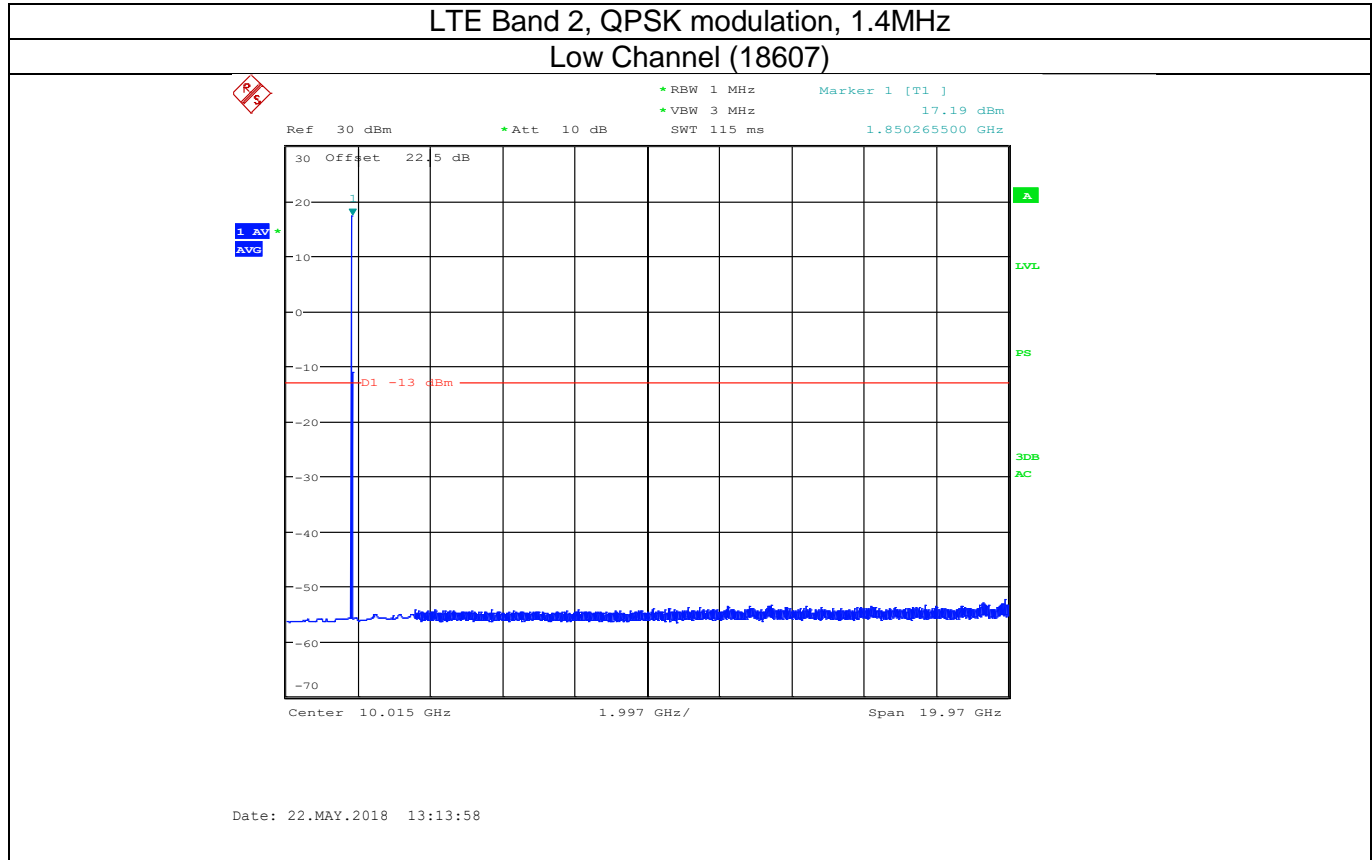






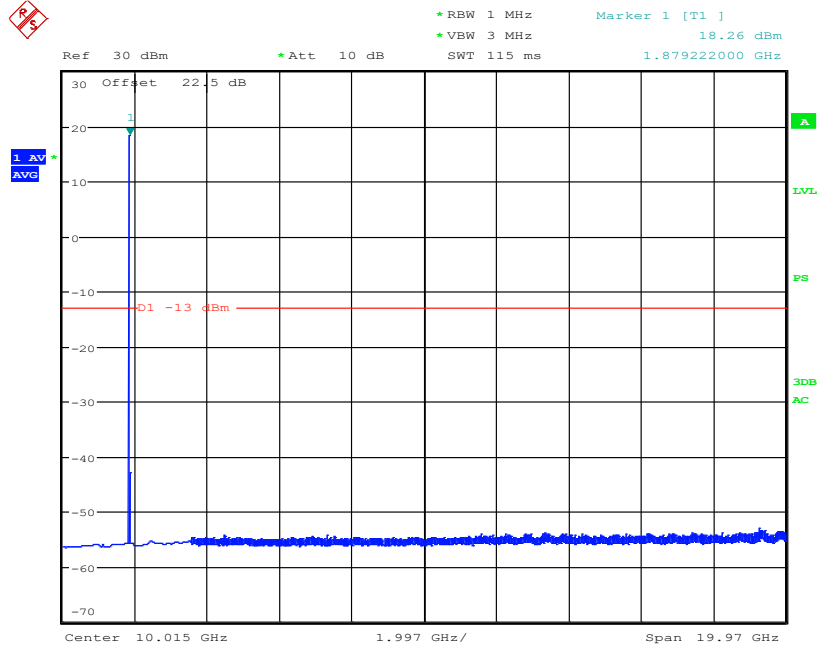
### 4.6 Test Data - Conducted Spurious Emissions

In the frequency range of 9 kHz to 1 GHz, there were no emissions within 20 dB of the limit.

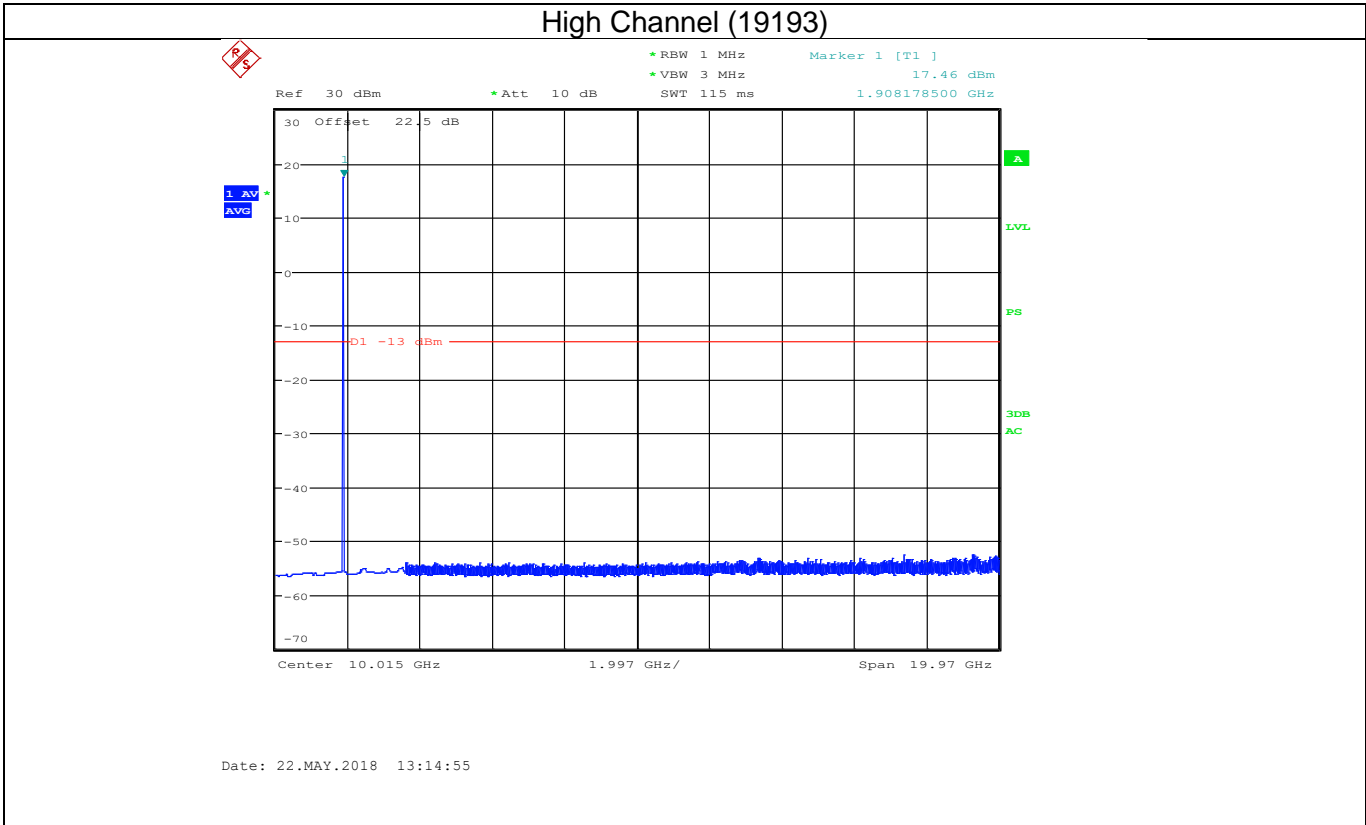




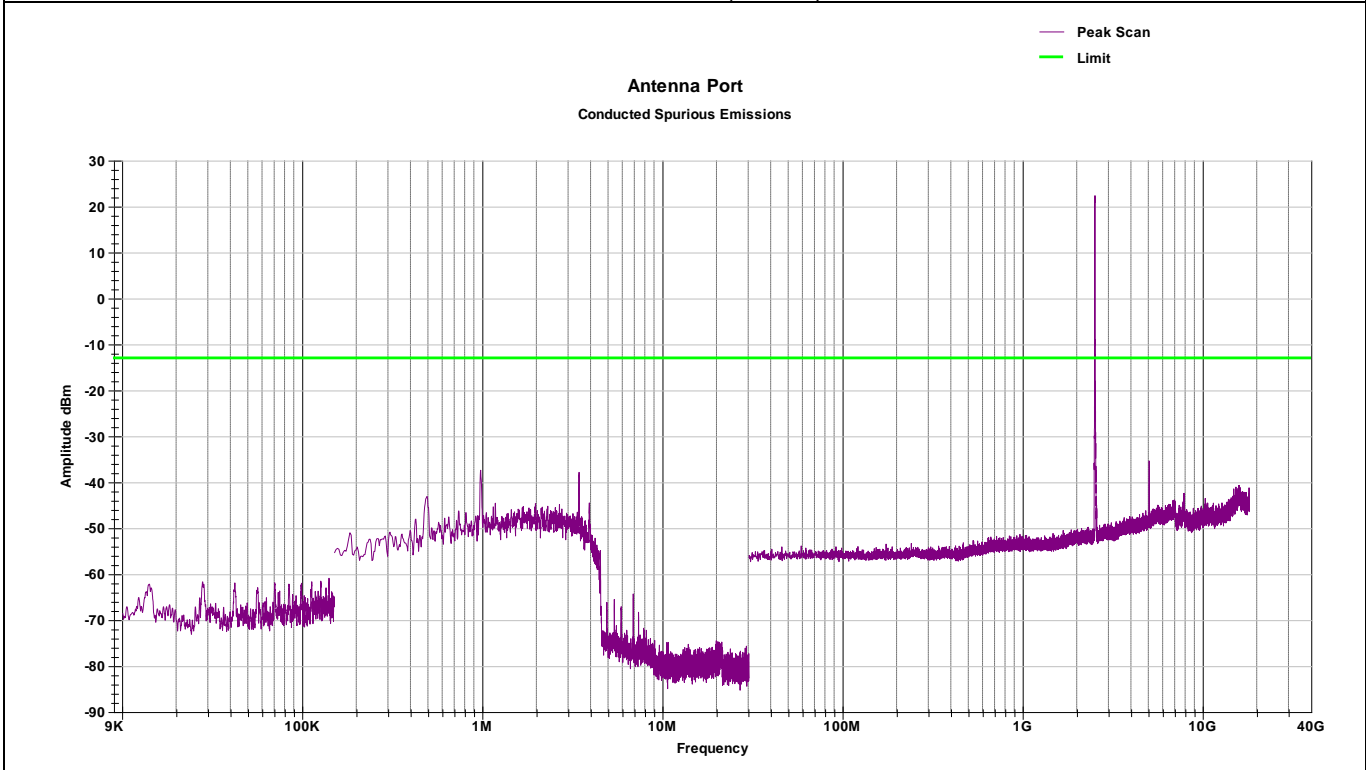
### Mid Channel (18900)

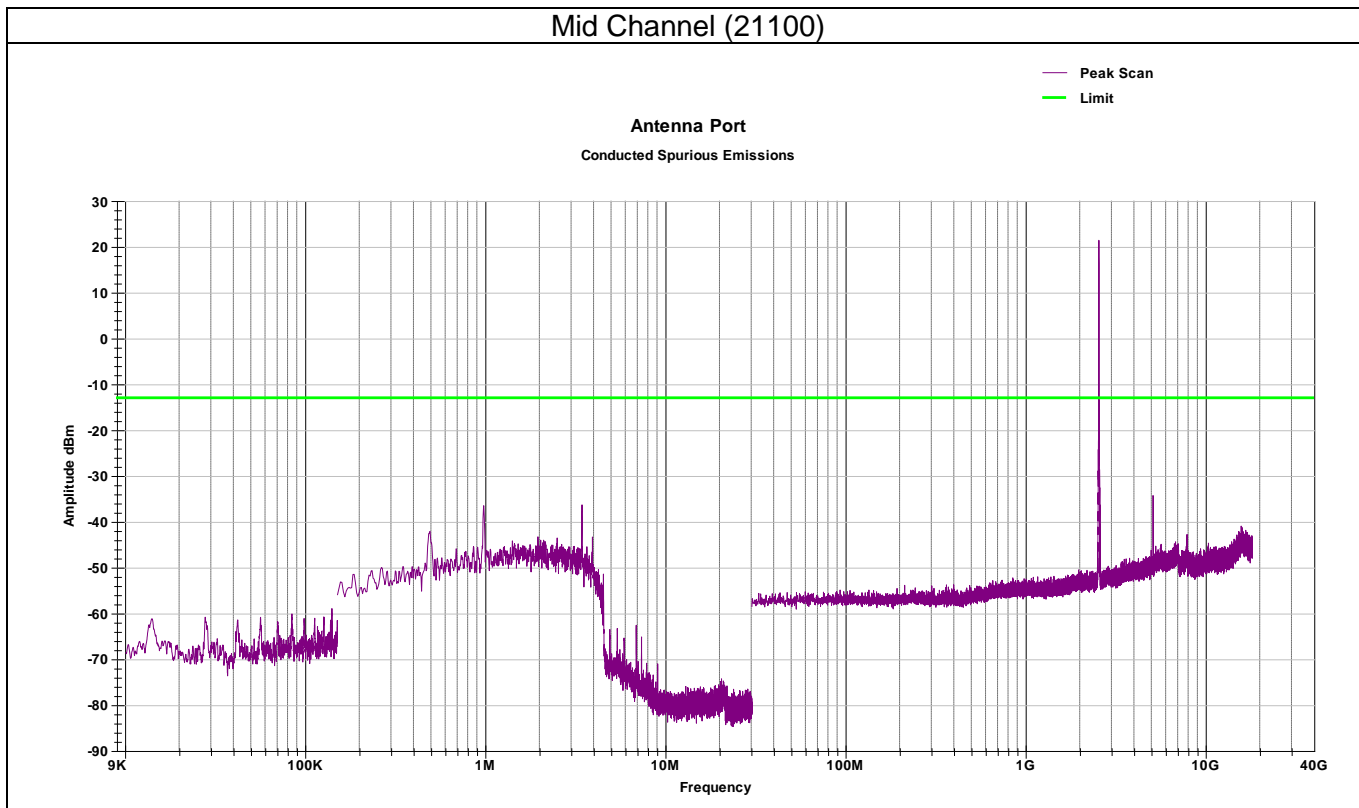


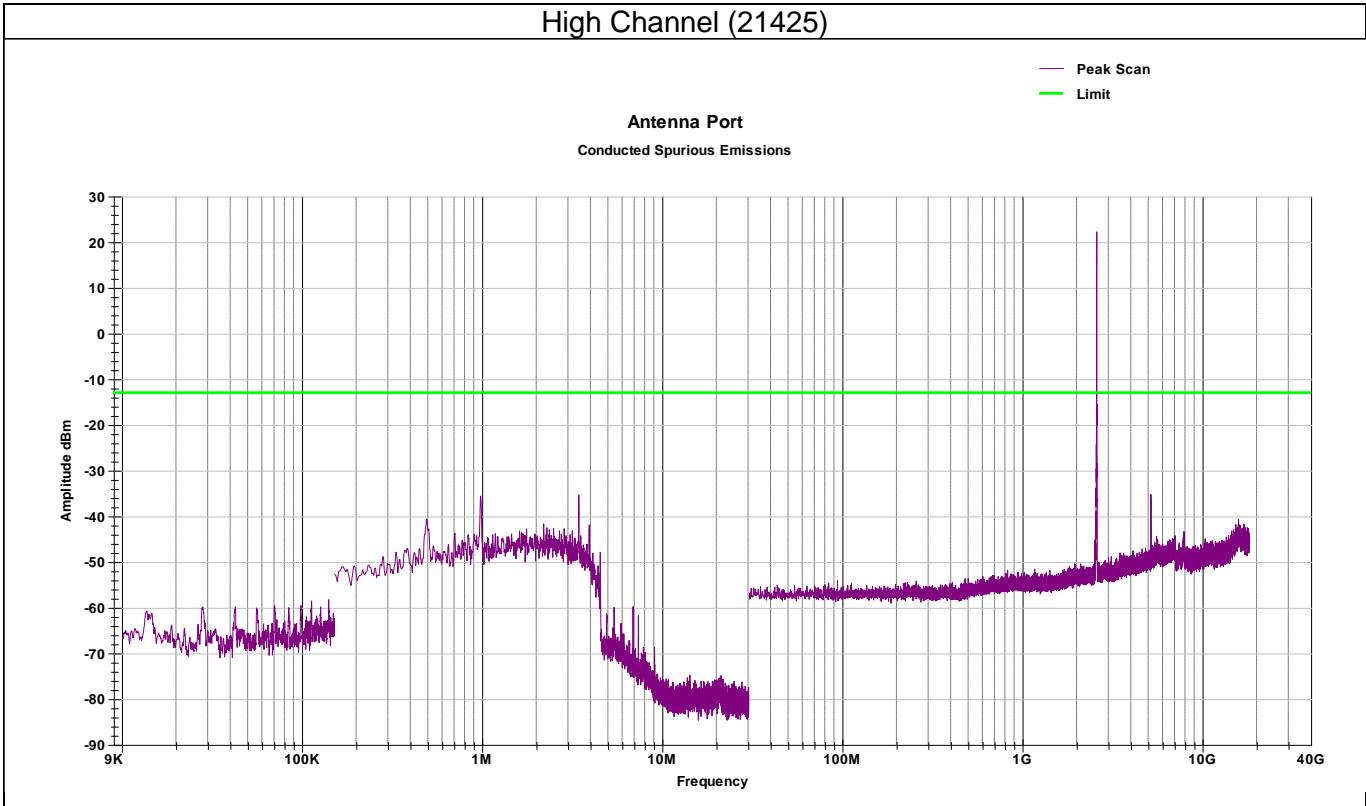
Date: 22.MAY.2018 13:14:33



LTE Band 7, QPSK modulation, 5MHz  
Low Channel (20755)







## 5 Radiated Spurious Emissions

### 5.1 Test Result

Test Description	Basic Standards		Test Result
Radiated Spurious Emissions	FCC 2.1053 FCC 24.238(a) FCC 27.53(m)(4)	RSS-GEN (6.13) RSS-133 (6.5.1) RSS-199 (4.5)(b)	Pass

### 5.2 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  $43 + 10 \log (P)$  dB for all bands except for band 7. In the case of band 7, the emissions shall be attenuated 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, just for band 7, 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.

### 5.3 Test Site

SGS 10m Chamber, Suwanee, GA (validated to ANS C63.4: 2014 below and above 1GHz)

#### Environmental Conditions

Temperature: 24.0 °C  
 Relative Humidity: 52.7 %  
 Atmospheric Pressure: 97.68 kPa

## 5.4 Test Equipment

Test End Date: 20-Jun-2018

Tester: BEO

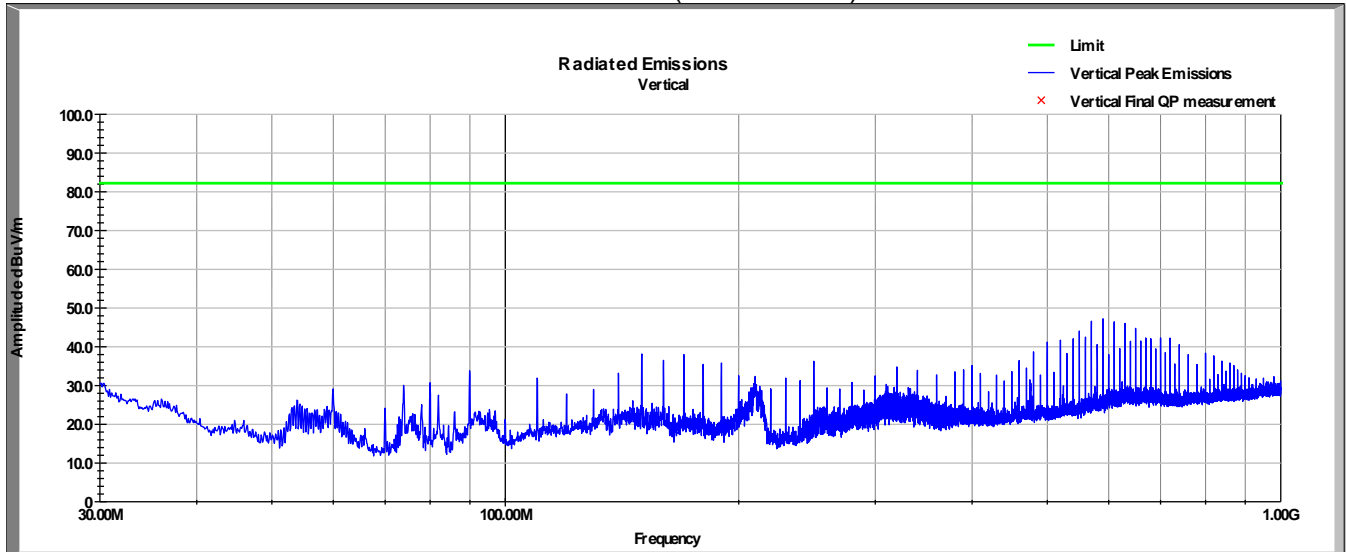
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
ANTENNA, BILOG	JB6	SUNOL	B079690	29-Nov-2018
ANTENNA, DRG HORN (MEDIUM)	3117	ETS LINDGREN	B079691	27-Jul-2018
ANTENNA, DRG HORN (SMALL)	3116B	ETS LINDGREN	B079695	27-Jul-2018
RF CABLE	SF106	HUBER & SUHNER	B079716	24-Jul-2018
RF CABLE	SF106	HUBER & SUHNER	B079713	24-Jul-2018
LOW NOISE AMPLIFIER	NSP1840-HG	MITEQ	B087572	28-Jul-2018
Attenuator, 6dB 5W	BW-N6W5+	MINI-CIRCUITS	18005	28-Feb-2019
RF CABLE	SF102	HUBER & SUHNER	B079824	26-Jul-2018
RF CABLE	SF102	HUBER & SUHNER	B079822	27-Jul-2018
RF CABLE	UC-N-MM-275	MAURY MICROWAVE	17015	25-Jul-2018
RF CABLE	104PE	HUBER & SUHNER	B079793	24-Jul-2018
LOW NOISE AMPLIFIER	TS-PR18	ROHDE & SCHWARZ	B094463	6-Mar-2019
EMI TEST RECEIVER	ESU40	ROHDE & SCHWARZ	13628	2-Oct-2018

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

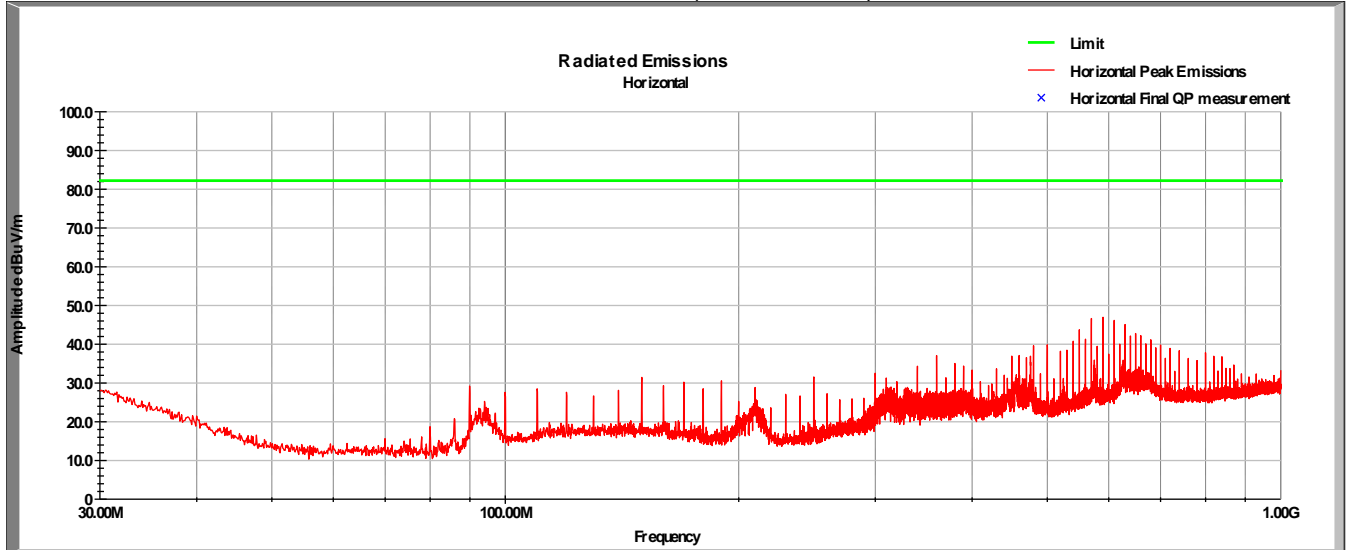
## 5.5 Test Data - LTE Band 2

### 5.5.1 Low Channel (18607), QPSK modulation, 1.4MHz

Vertical Data (30-1000MHz)

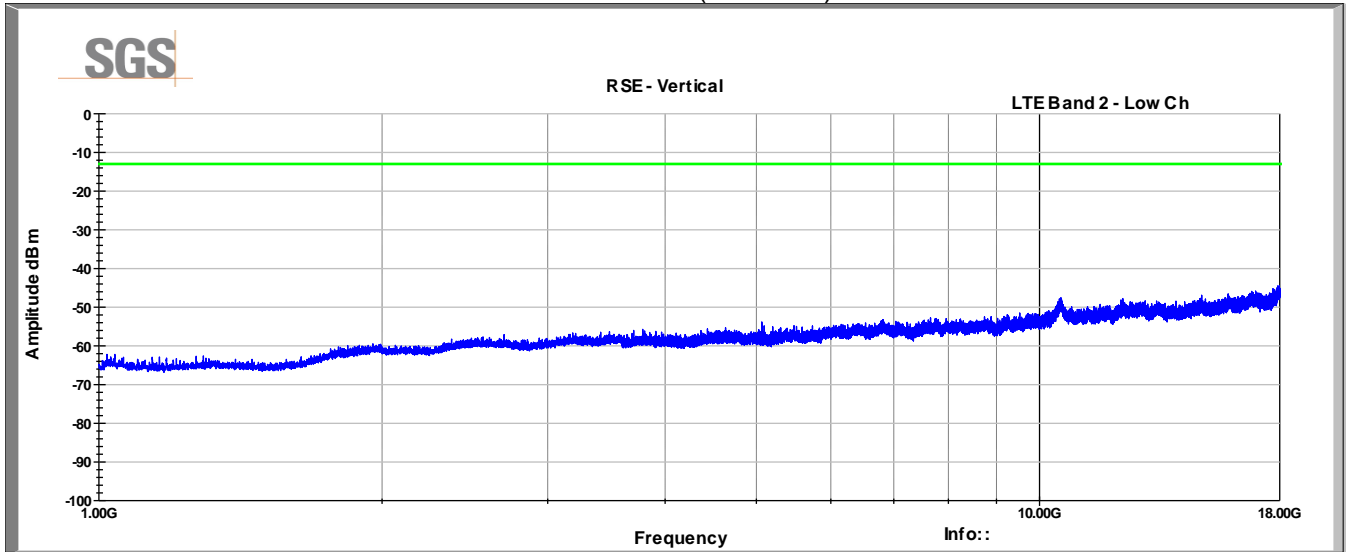


Horizontal Data (30-1000MHz)

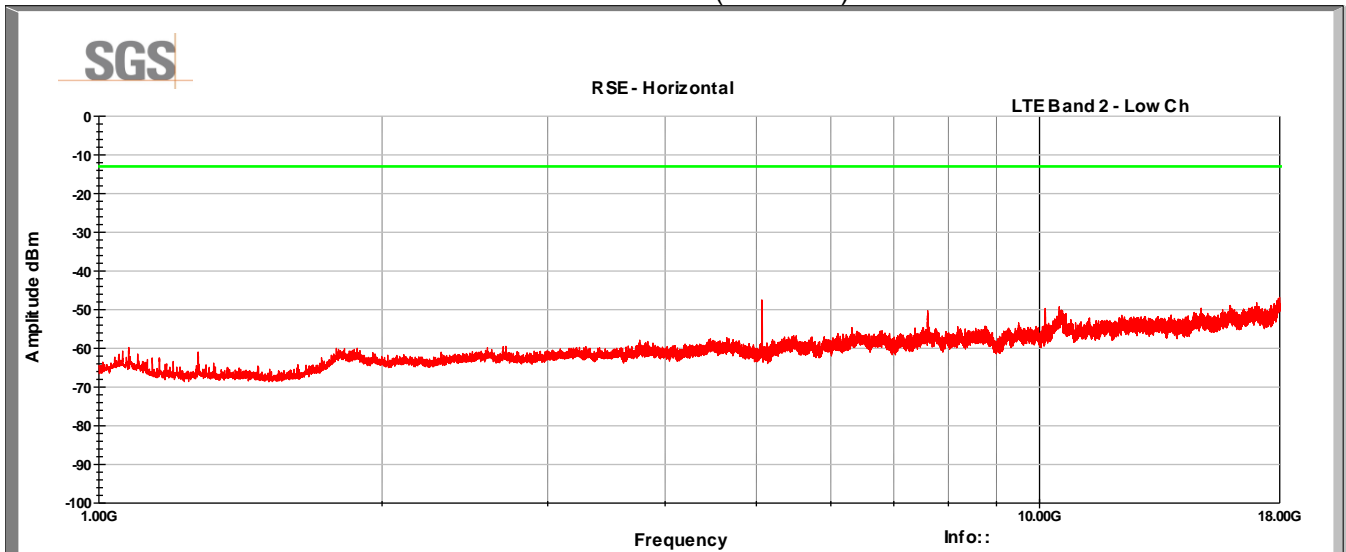




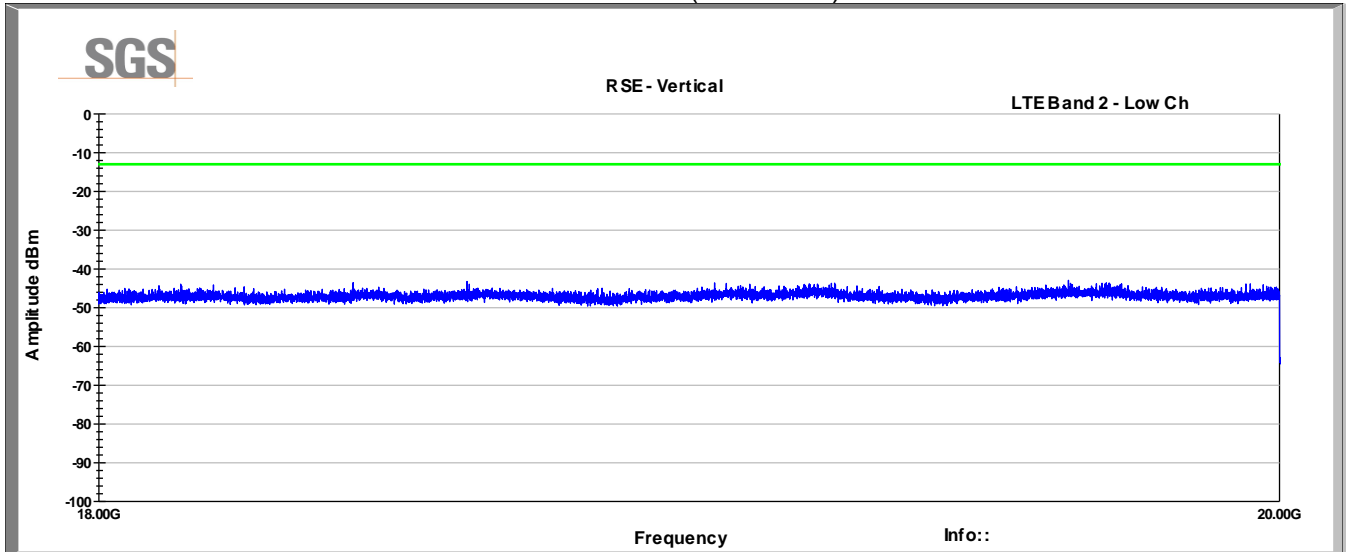
### Vertical Data (1-18GHz)



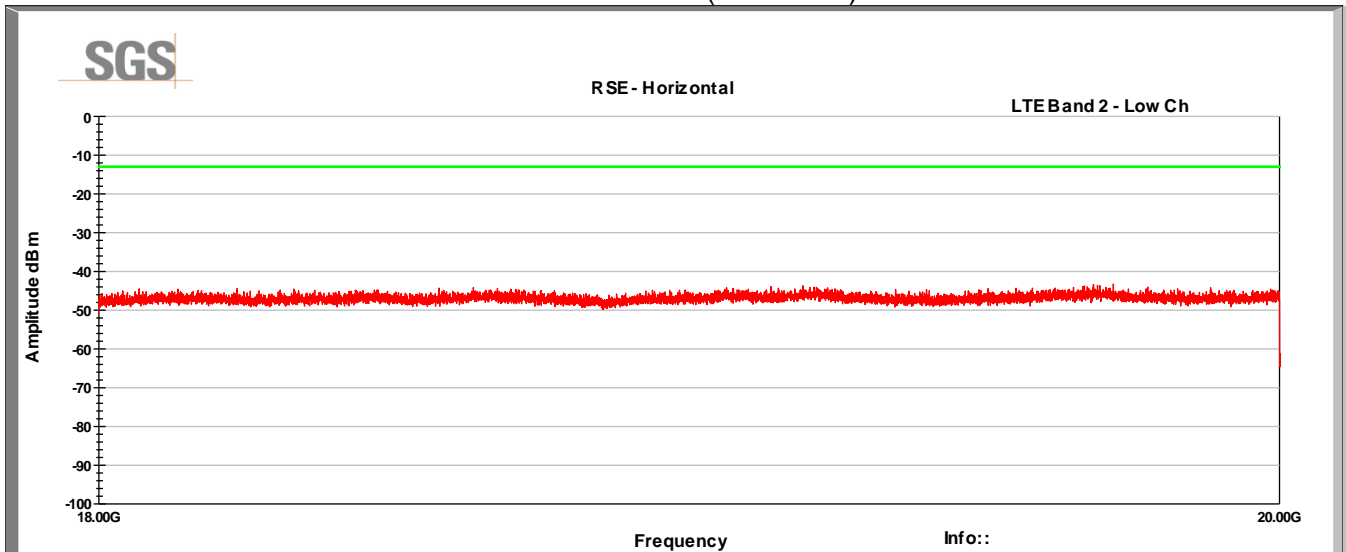
### Horizontal Data (1-18GHz)



### Vertical Data (18-20GHz)

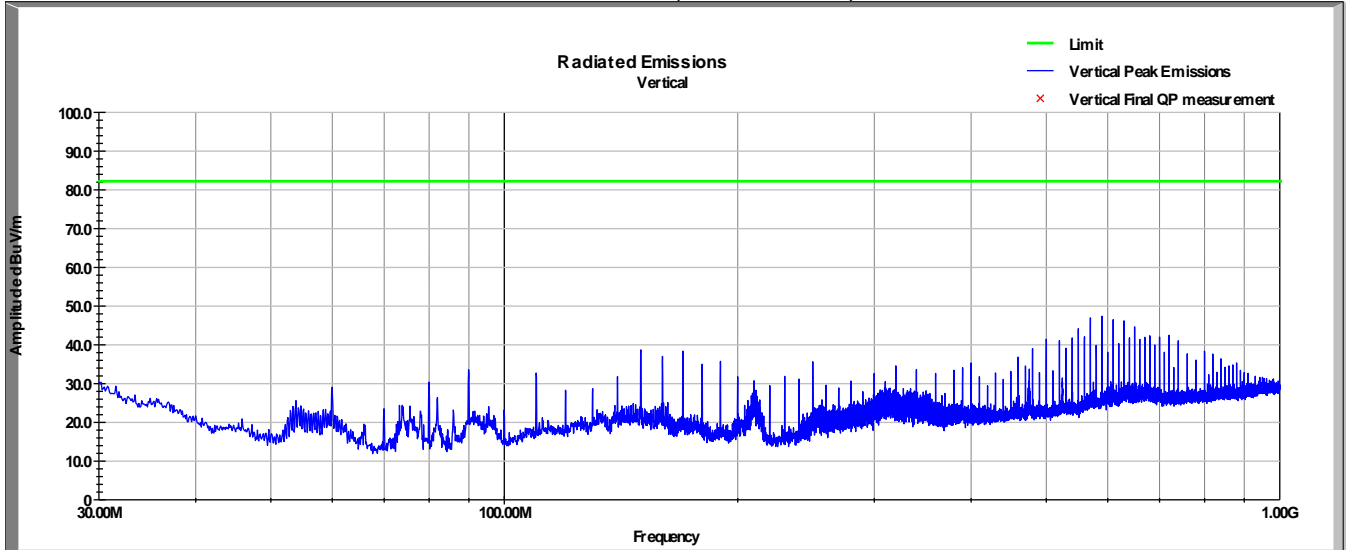


### Horizontal Data (18-20GHz)

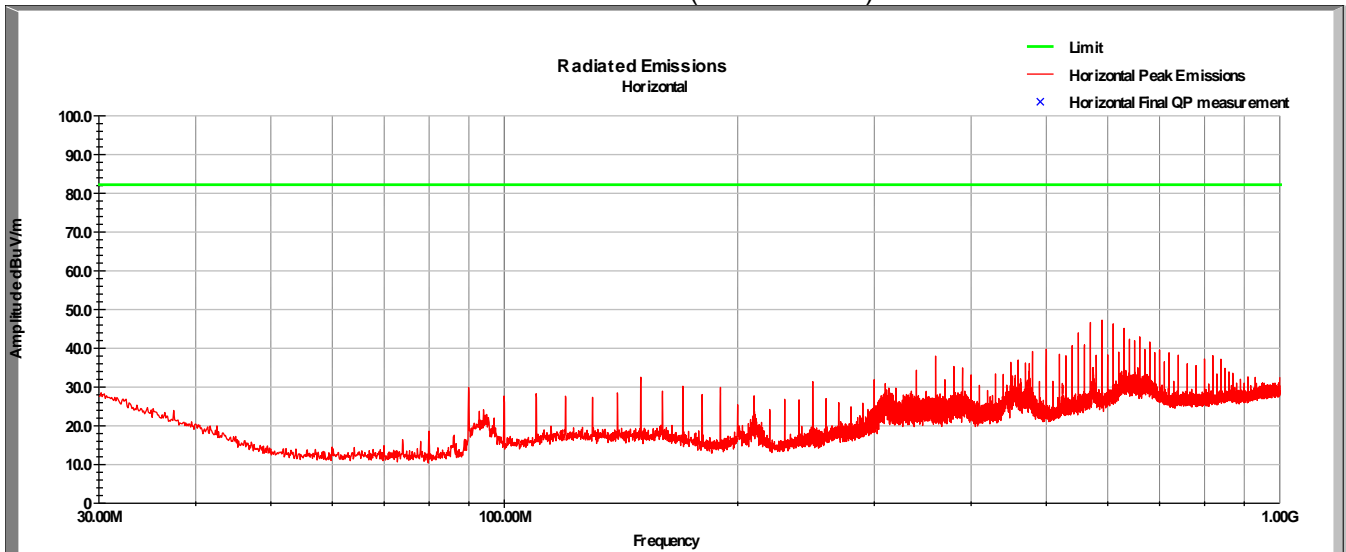


### 5.5.2 Mid Channel (18900), QPSK modulation, 1.4MHz

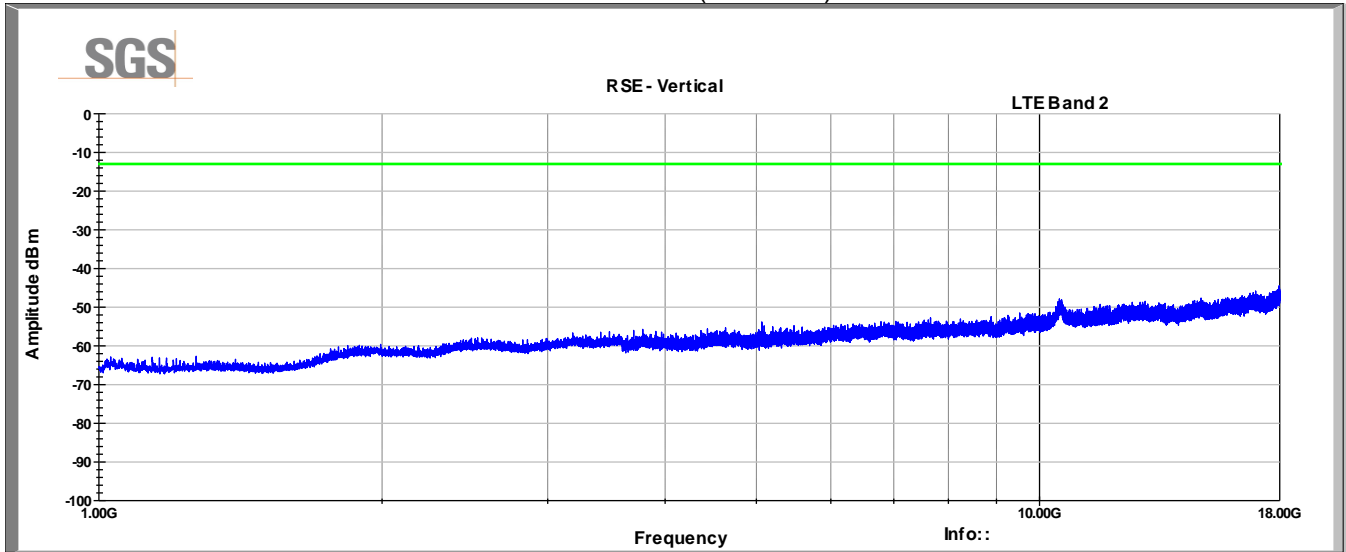
Vertical Data (30-1000MHz)



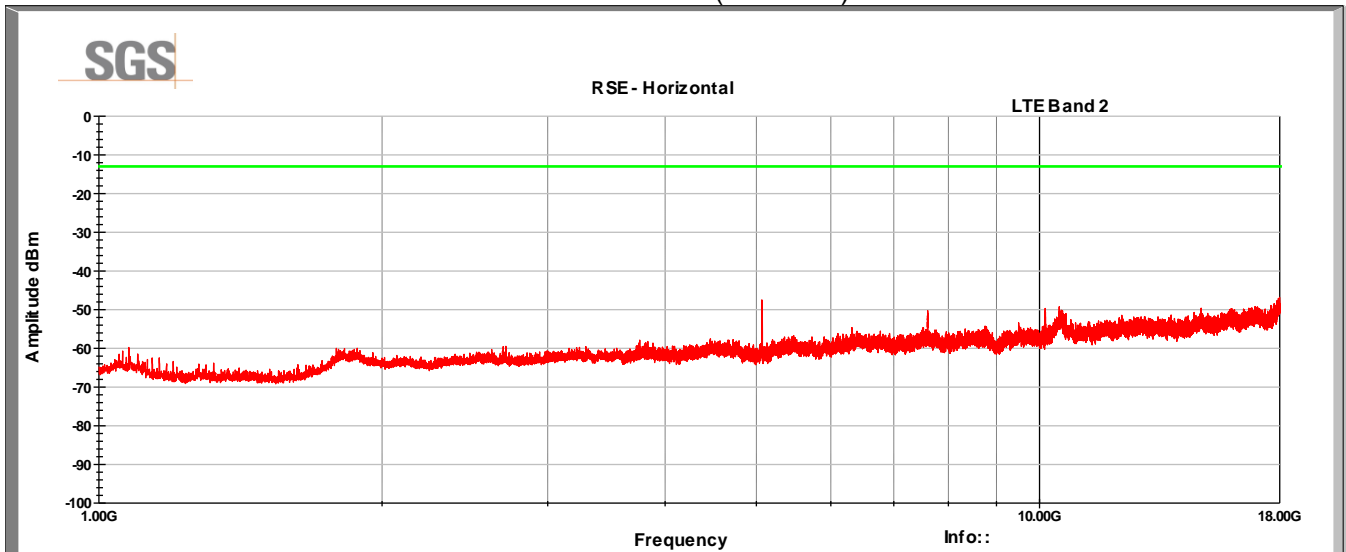
Horizontal Data (30-1000MHz)



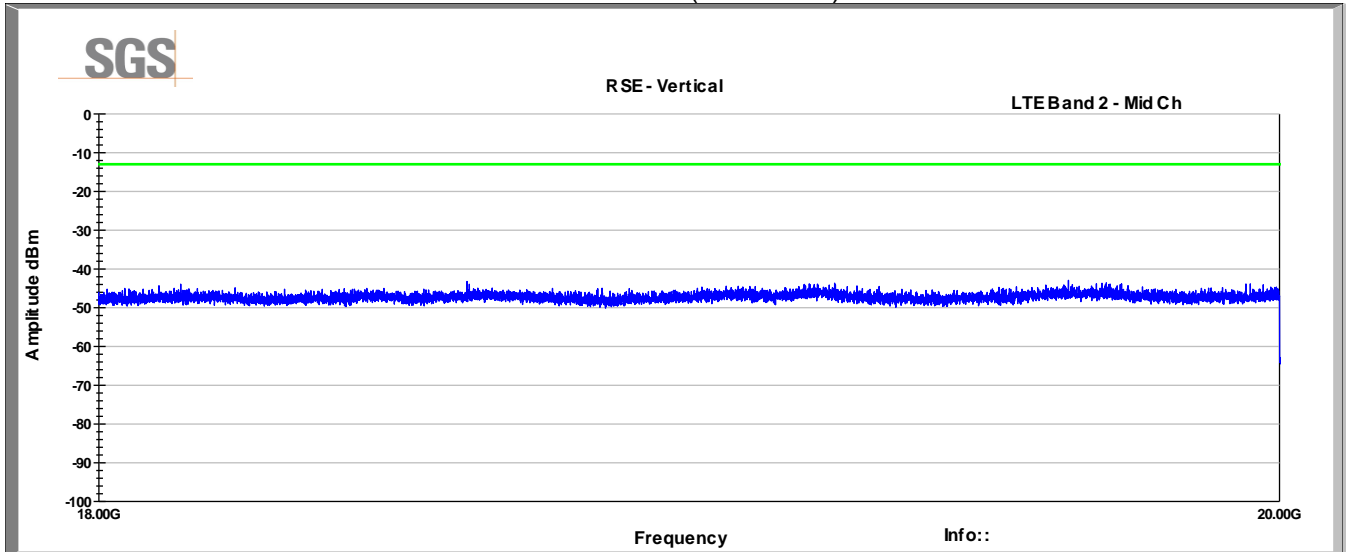
### Vertical Data (1-18GHz)



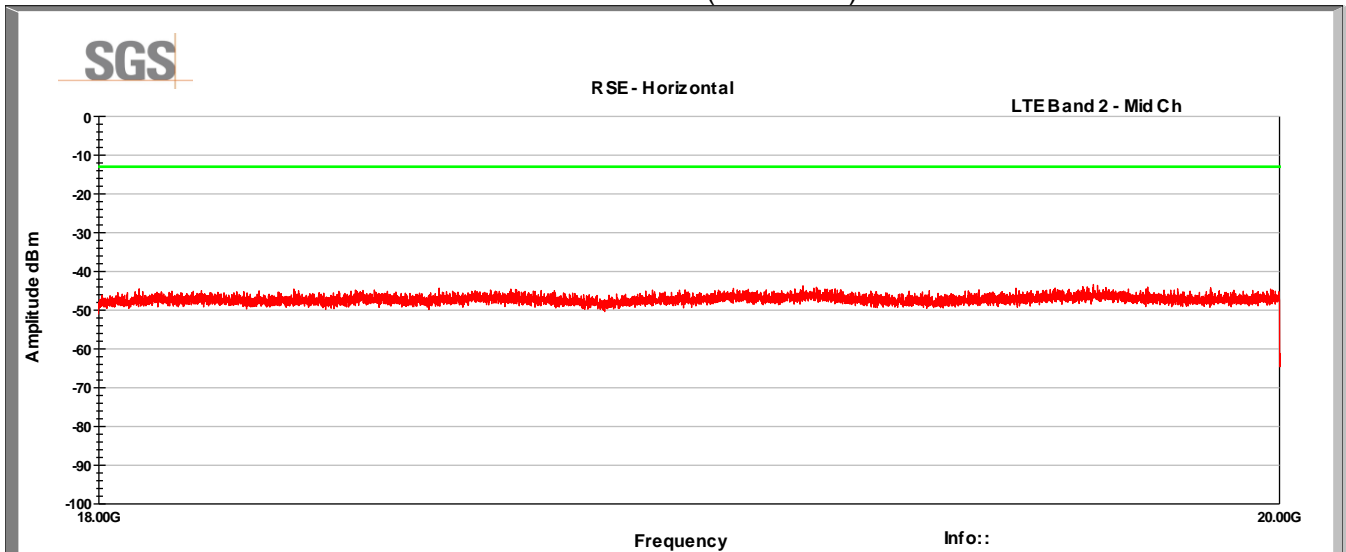
### Horizontal Data (1-18GHz)



### Vertical Data (18-20GHz)

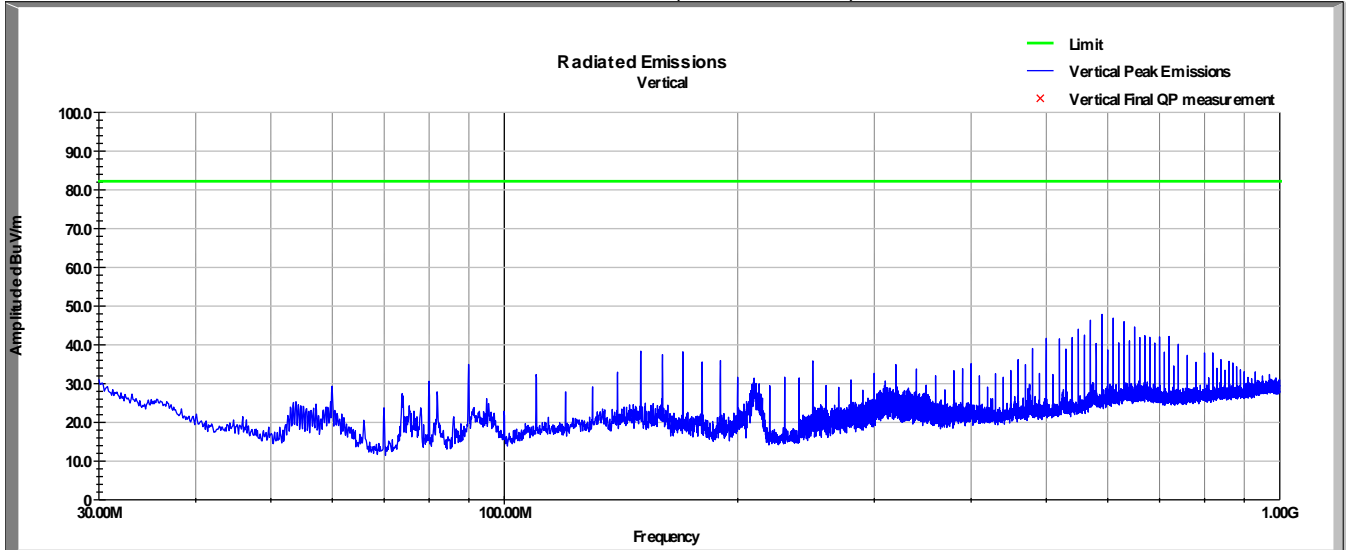


### Horizontal Data (18-20GHz)

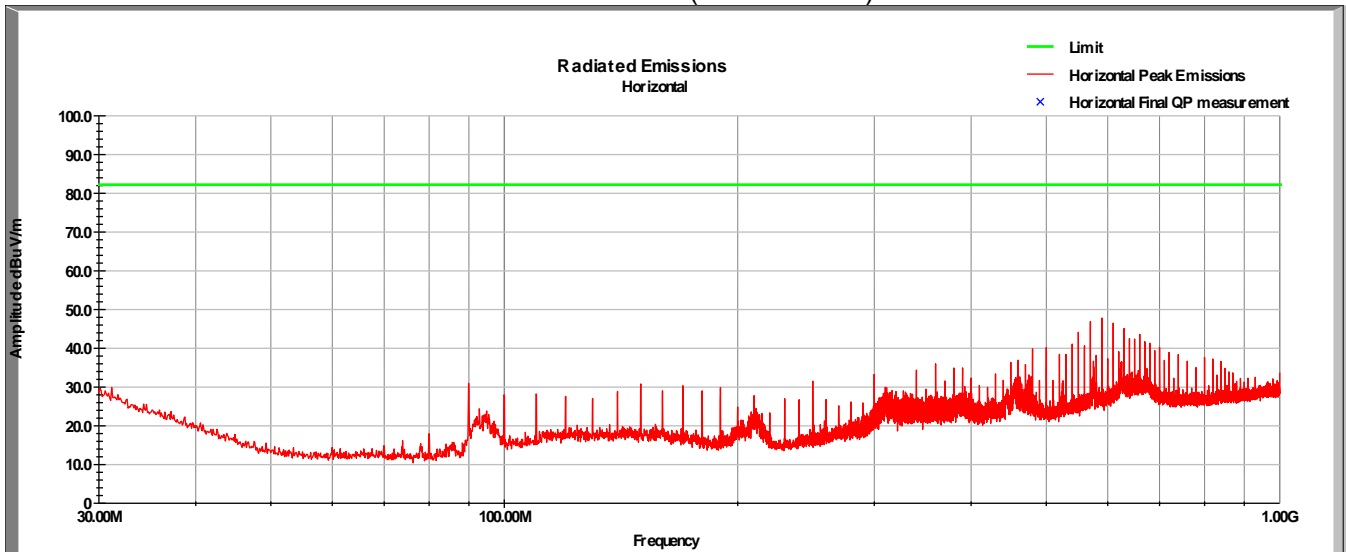


### 5.5.3 High Channel (19193), QPSK modulation, 1.4MHz

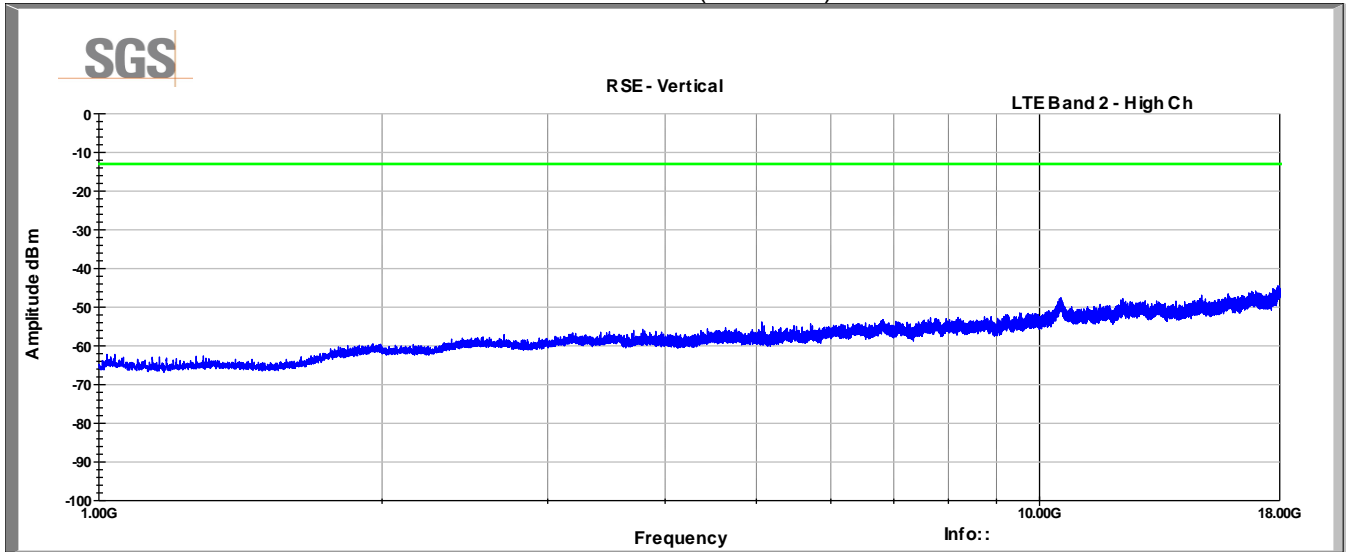
Vertical Data (30-1000MHz)



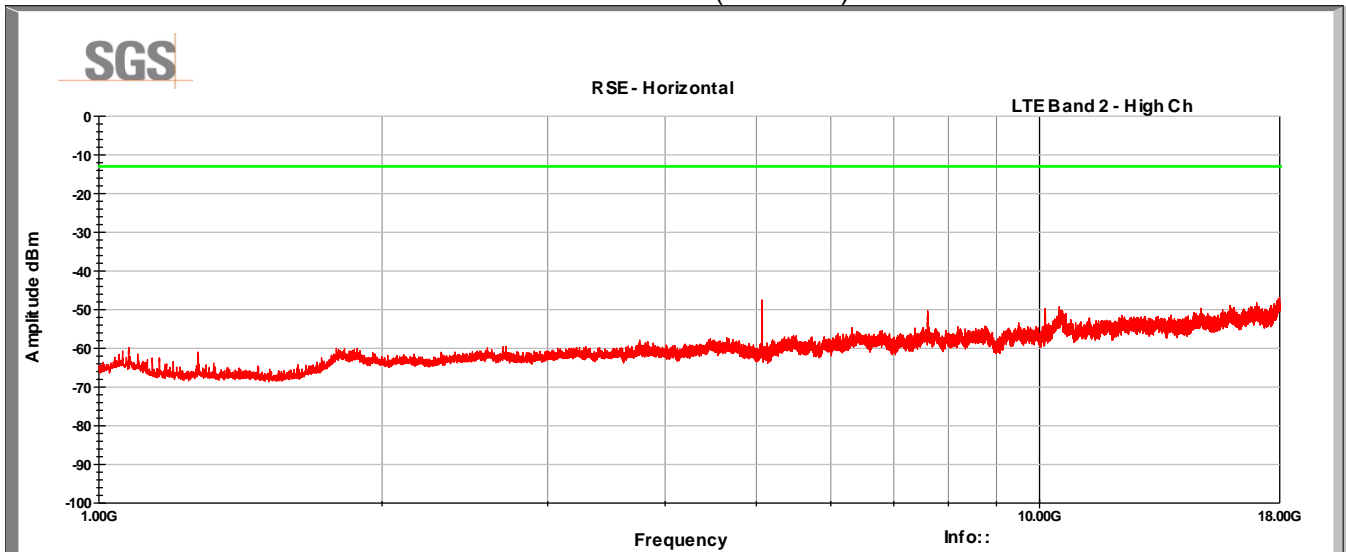
Horizontal Data (30-1000MHz)



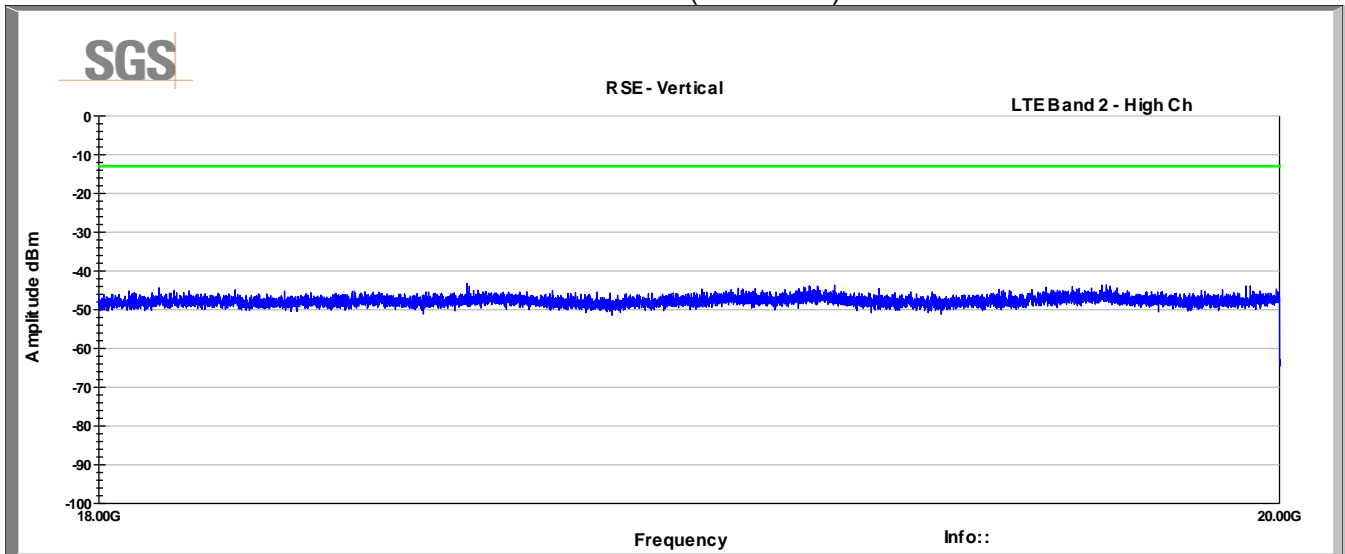
Vertical Data (1-18GHz)



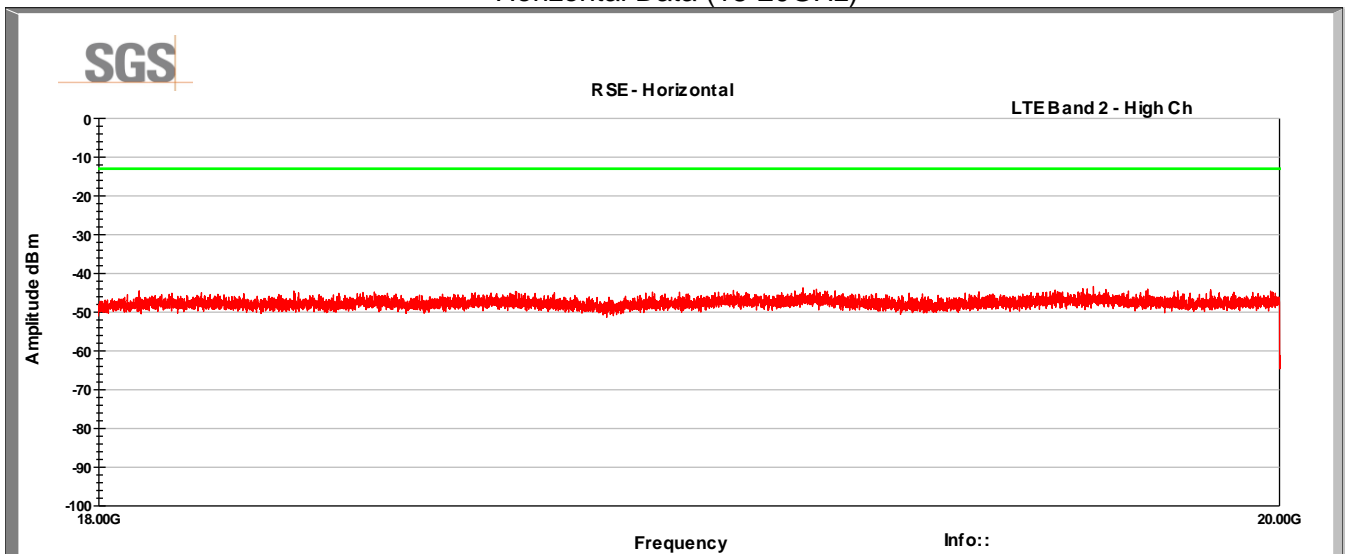
Horizontal Data (1-18GHz)



### Vertical Data (18-20GHz)



### Horizontal Data (18-20GHz)

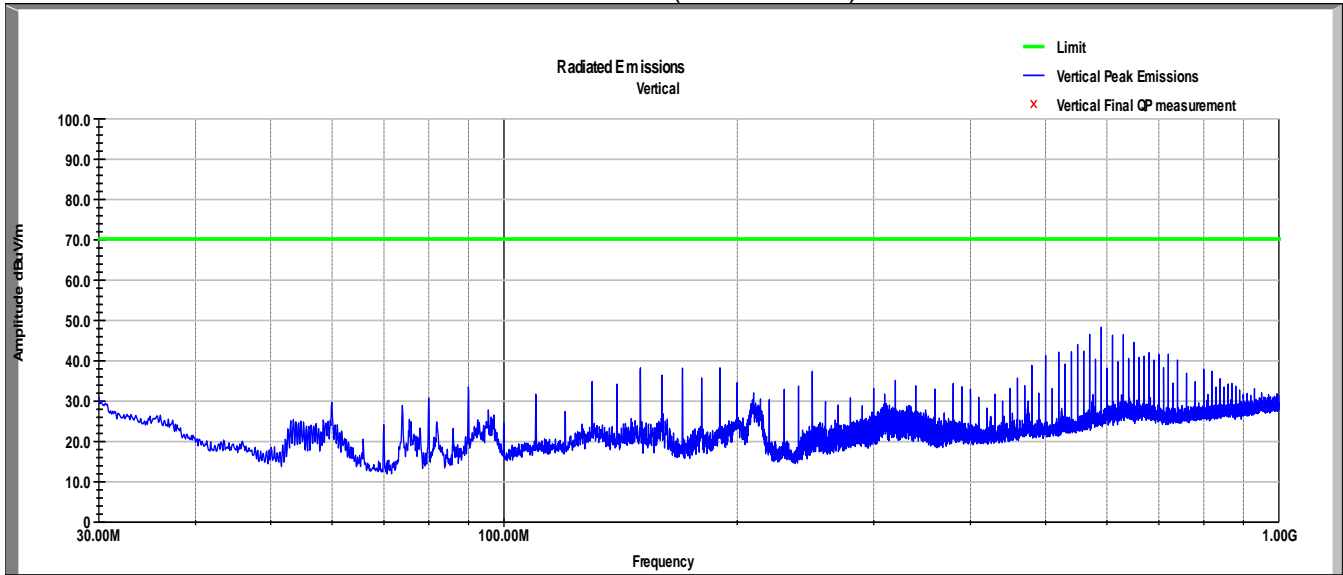




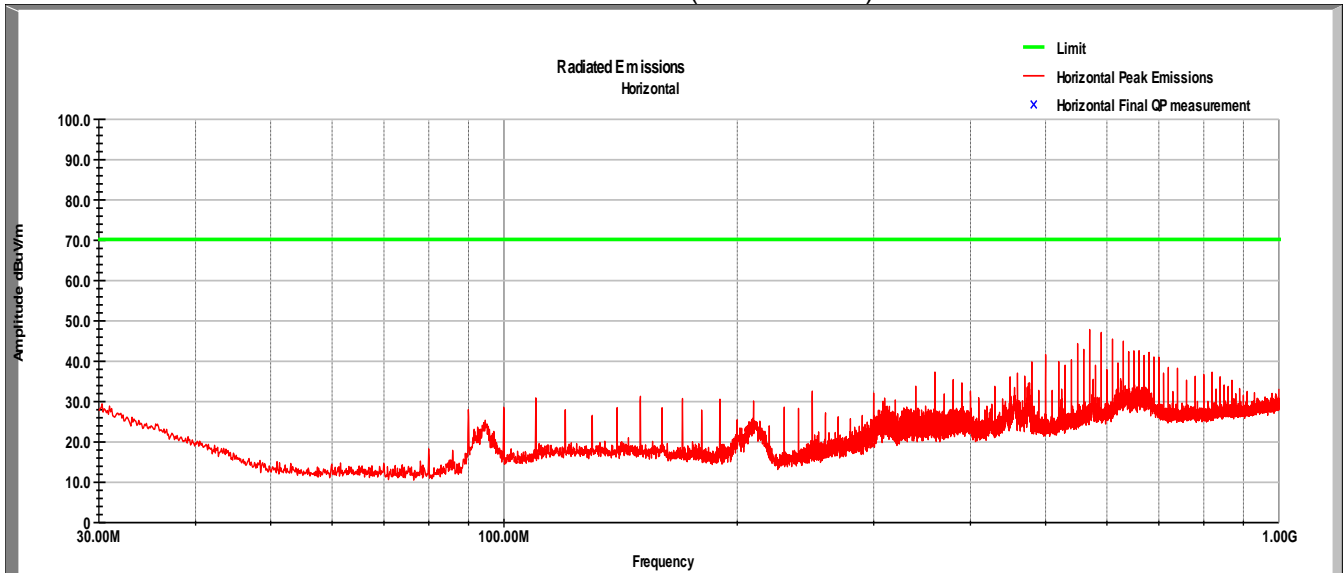
## 5.6 Test Data - LTE Band 7

### 5.6.1 Low Channel (20775), QPSK modulation, 5MHz

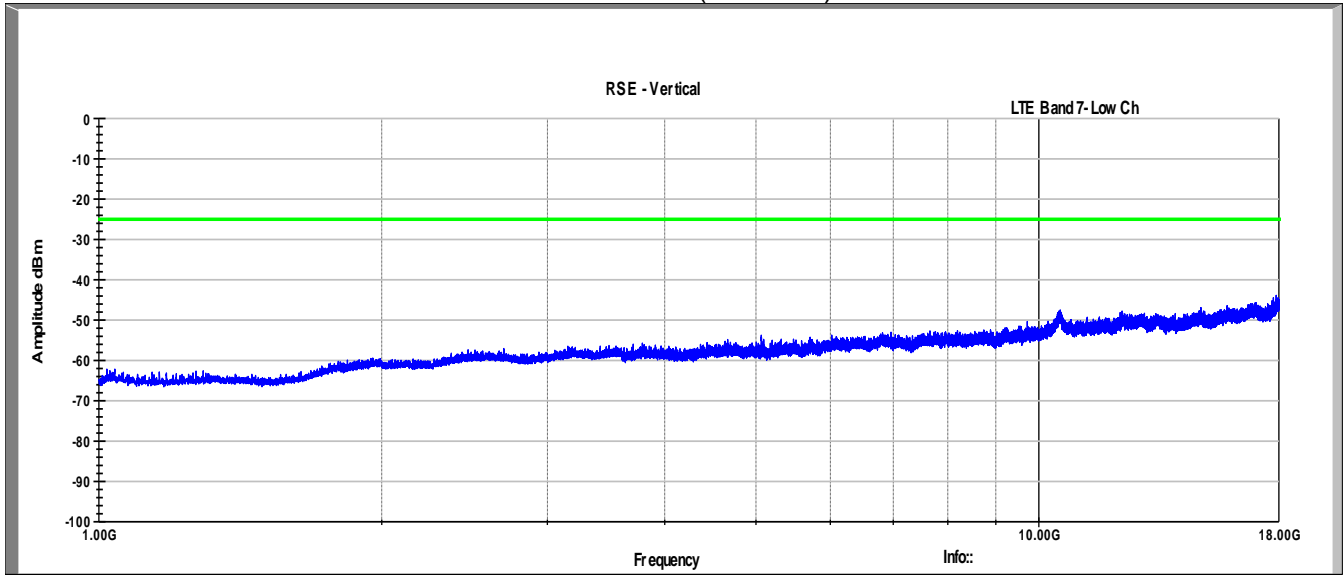
Vertical Data (30-1000MHz)



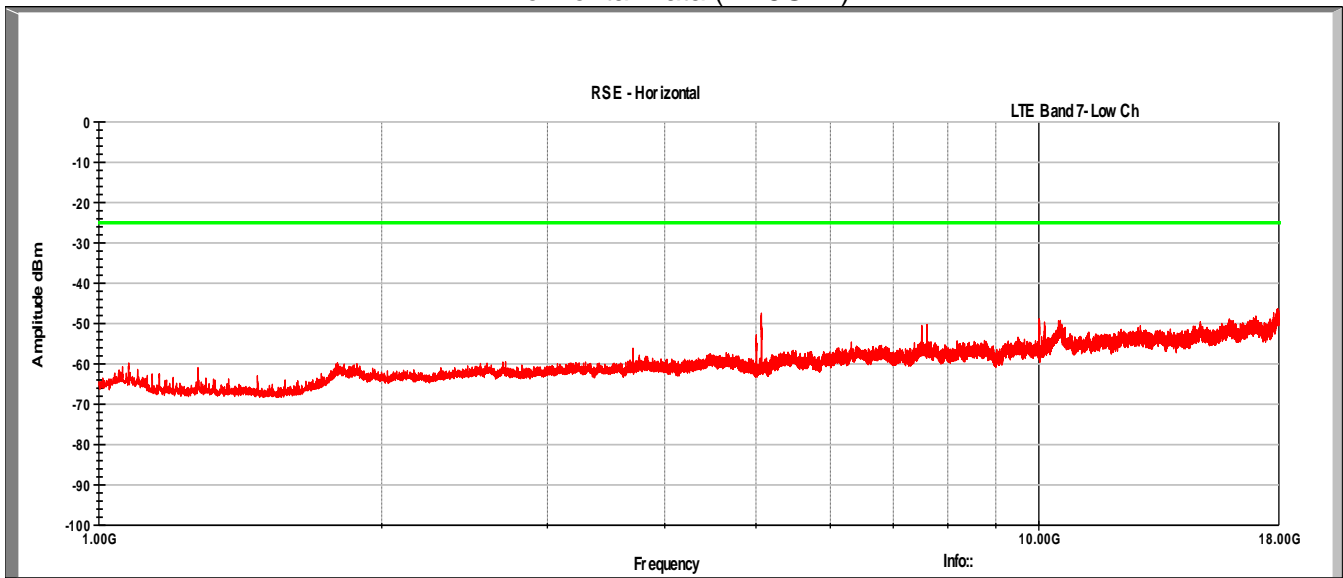
Horizontal Data (30-1000MHz)



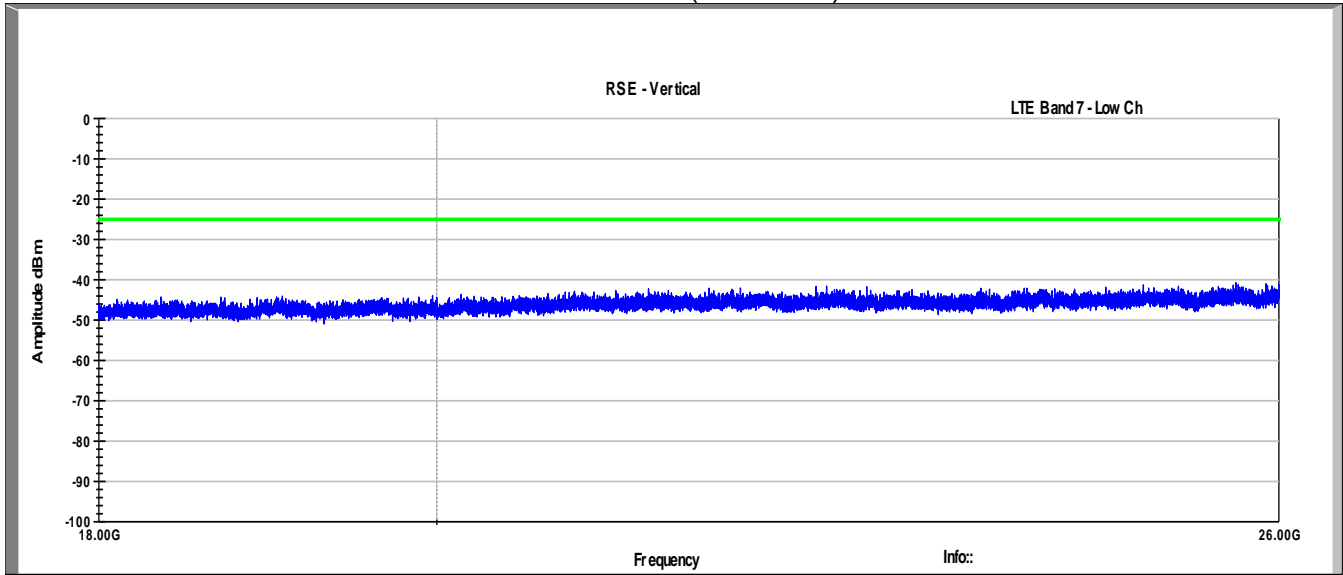
Vertical Data (1-18GHz)



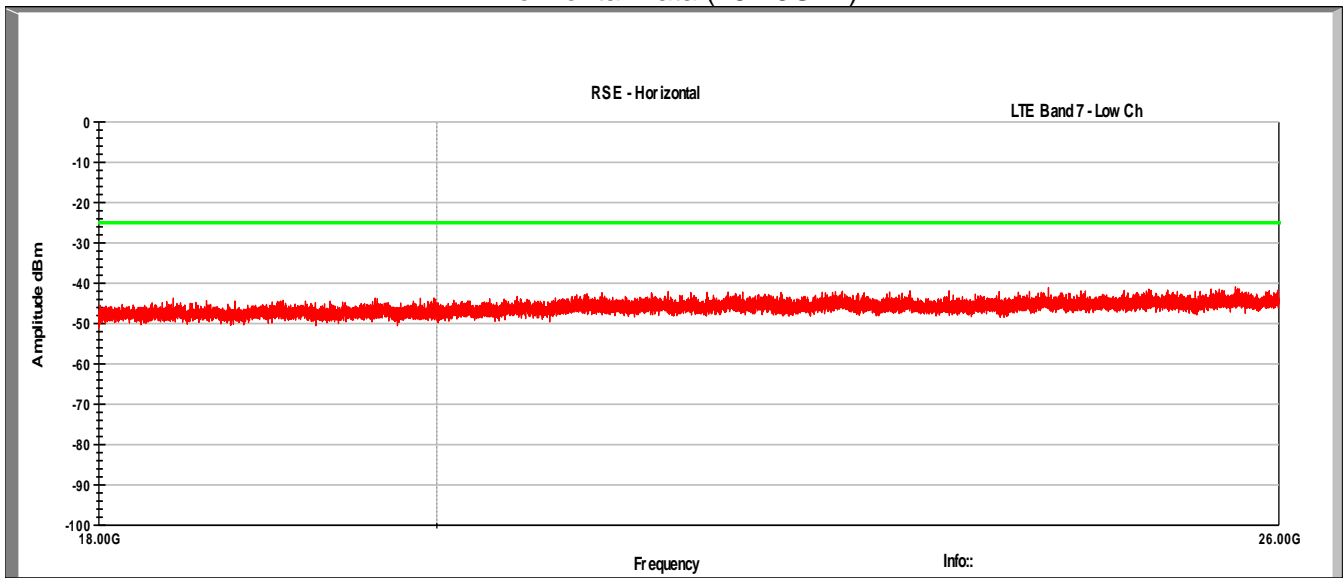
Horizontal Data (1-18GHz)



### Vertical Data (18-26GHz)

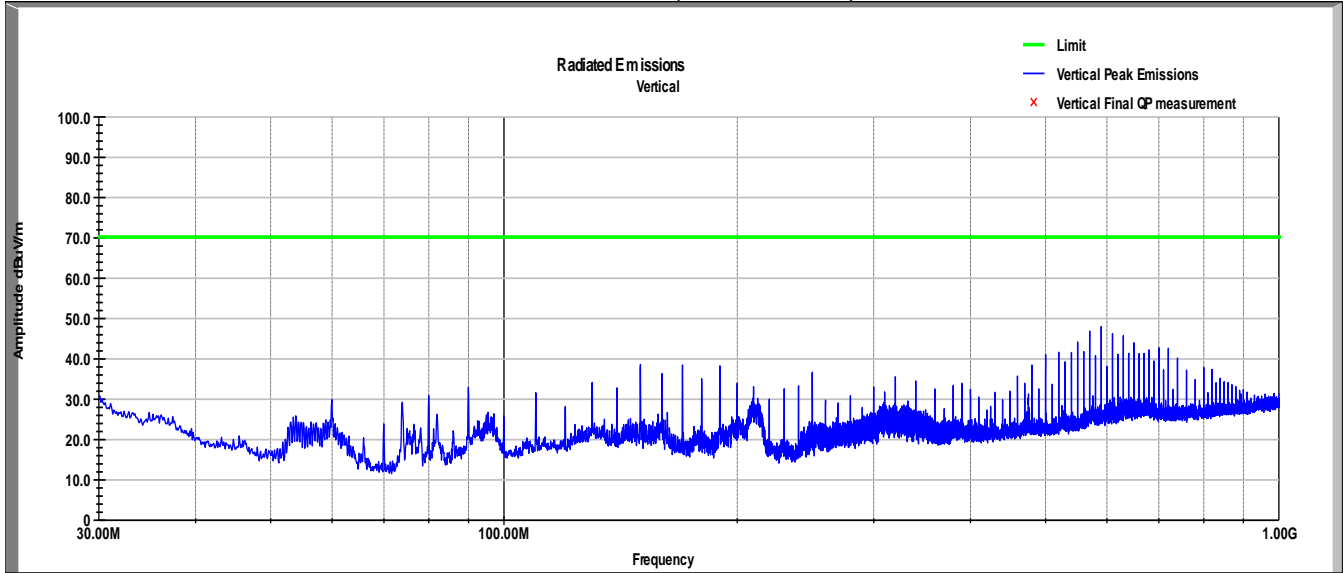


### Horizontal Data (18-26GHz)

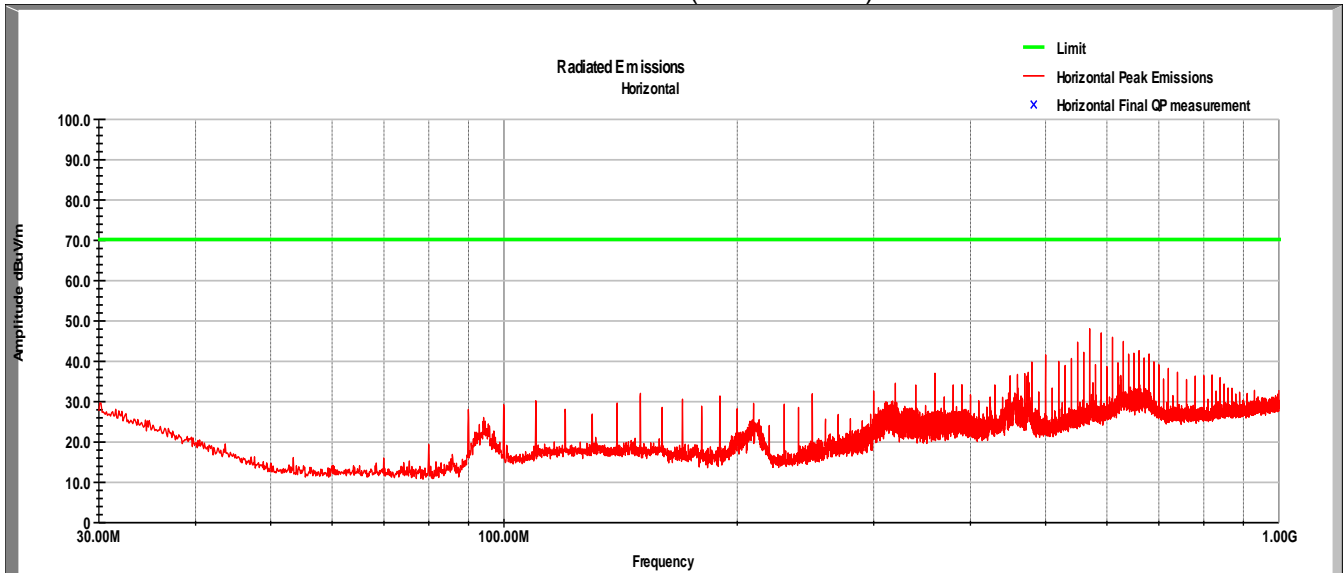


### 5.6.2 Mid Channel (21100), QPSK modulation, 5MHz

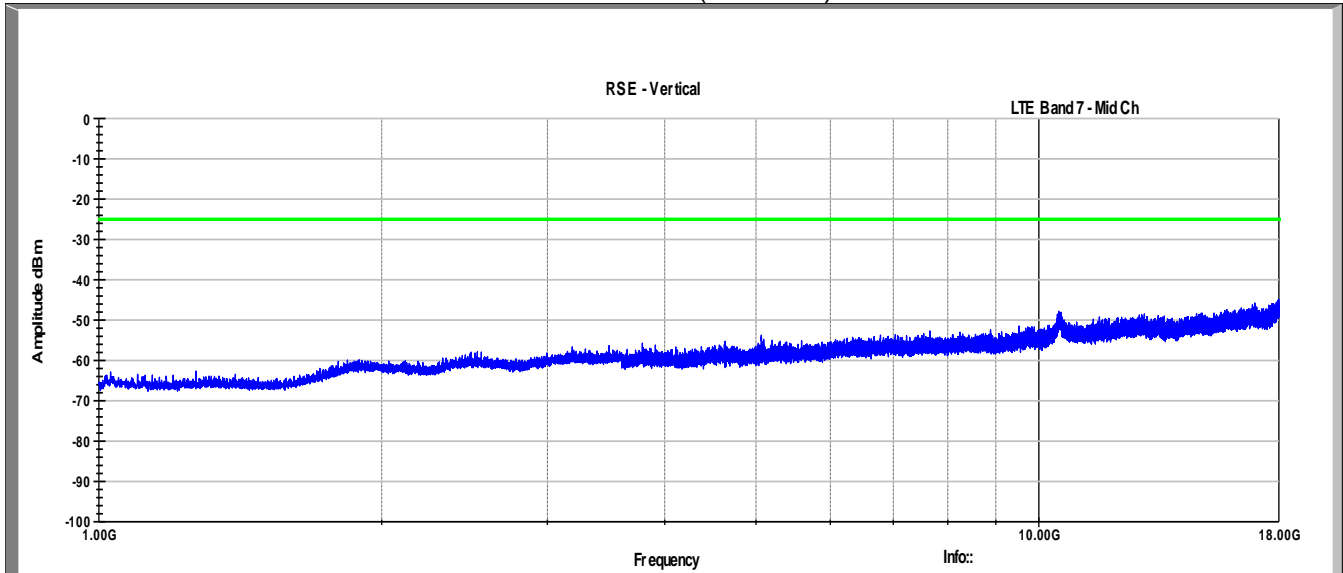
Vertical Data (30-1000MHz)



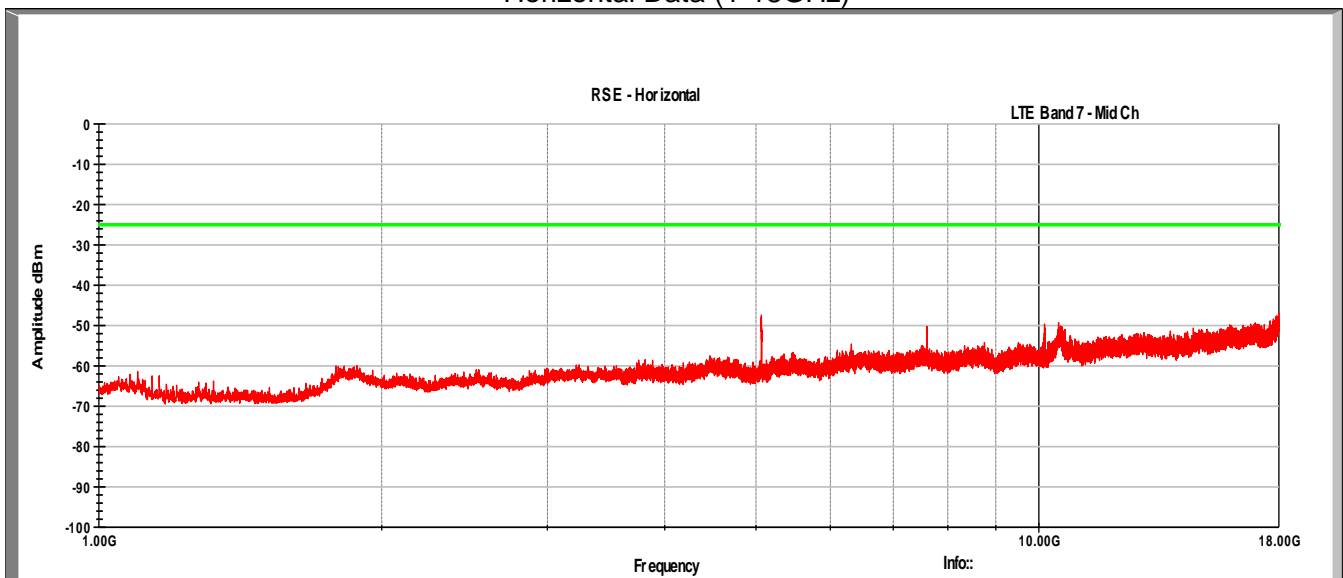
Horizontal Data (30-1000MHz)



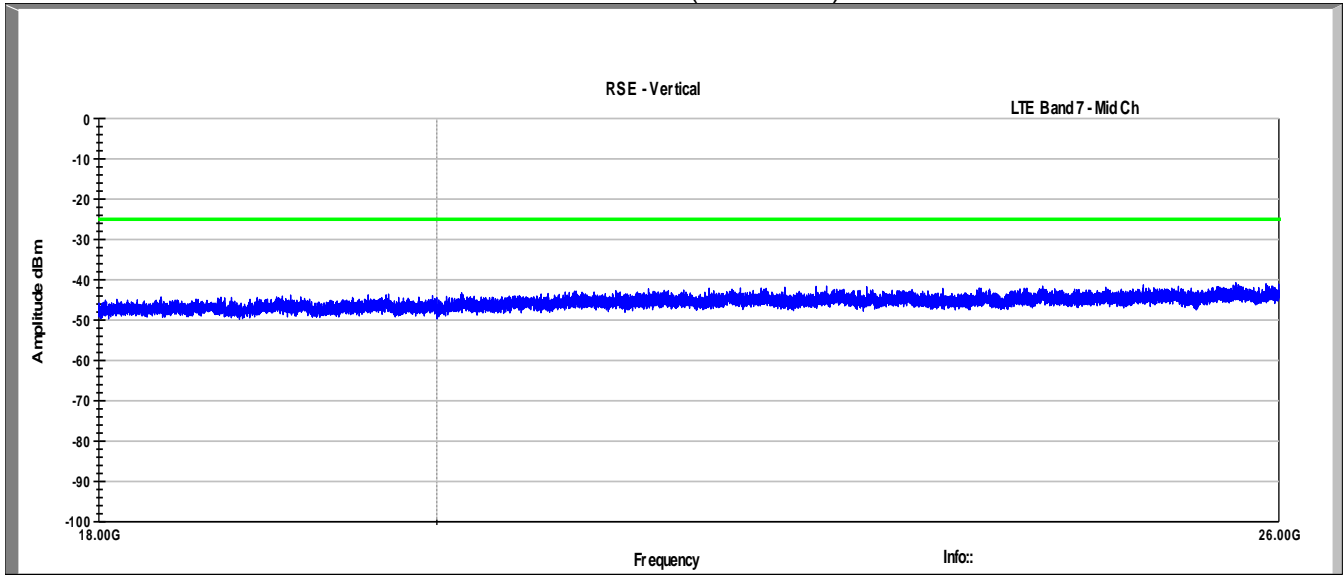
Vertical Data (1-18GHz)



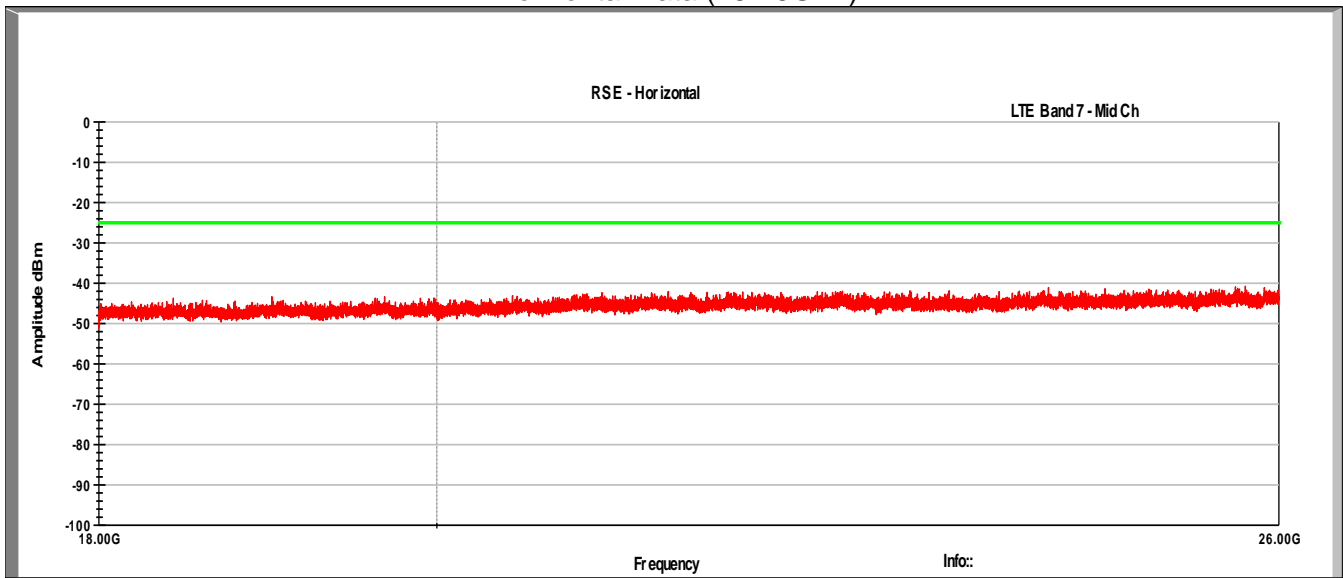
Horizontal Data (1-18GHz)



Vertical Data (18-26GHz)

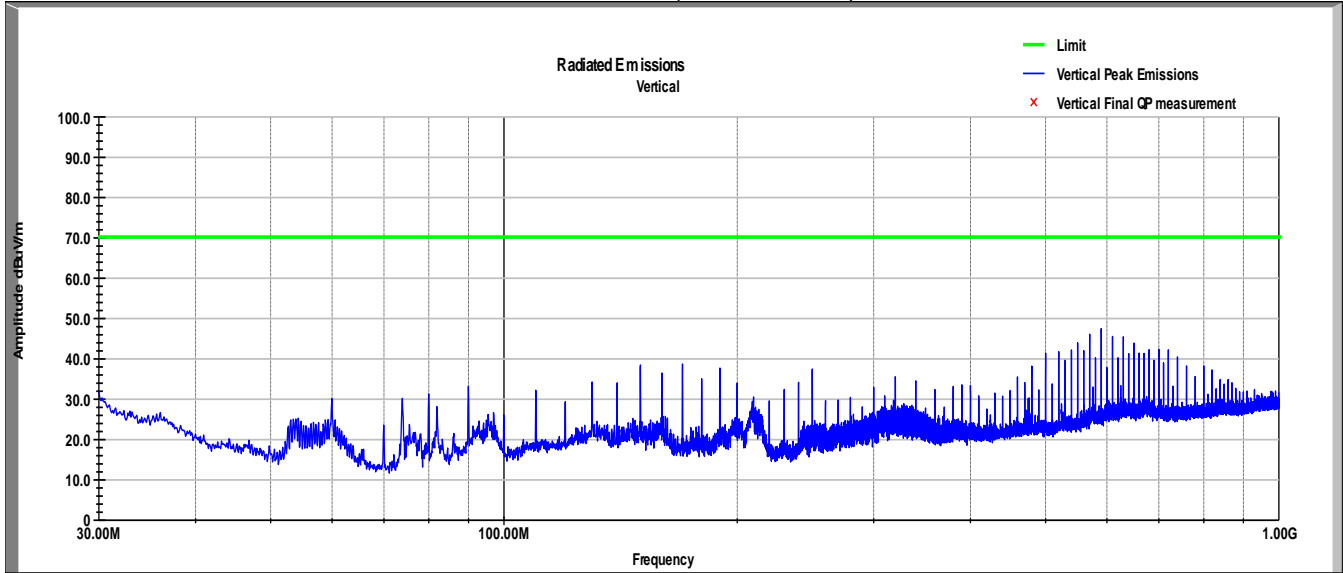


Horizontal Data (18-26GHz)

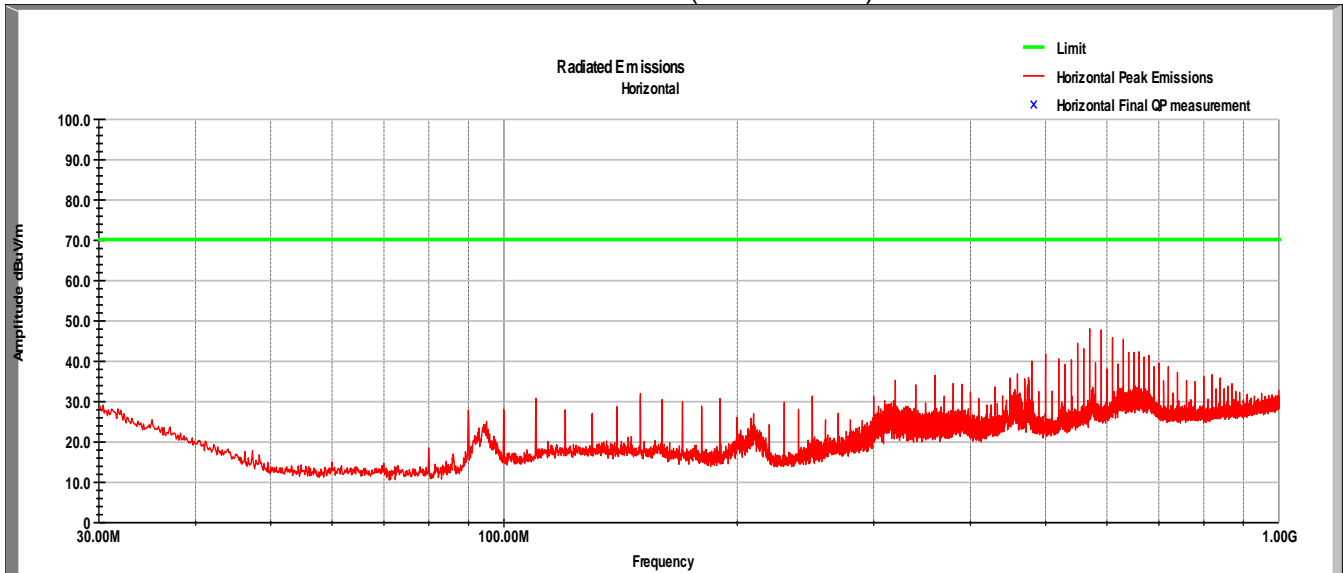


### 5.6.3 High Channel (21425), QPSK modulation, 5MHz

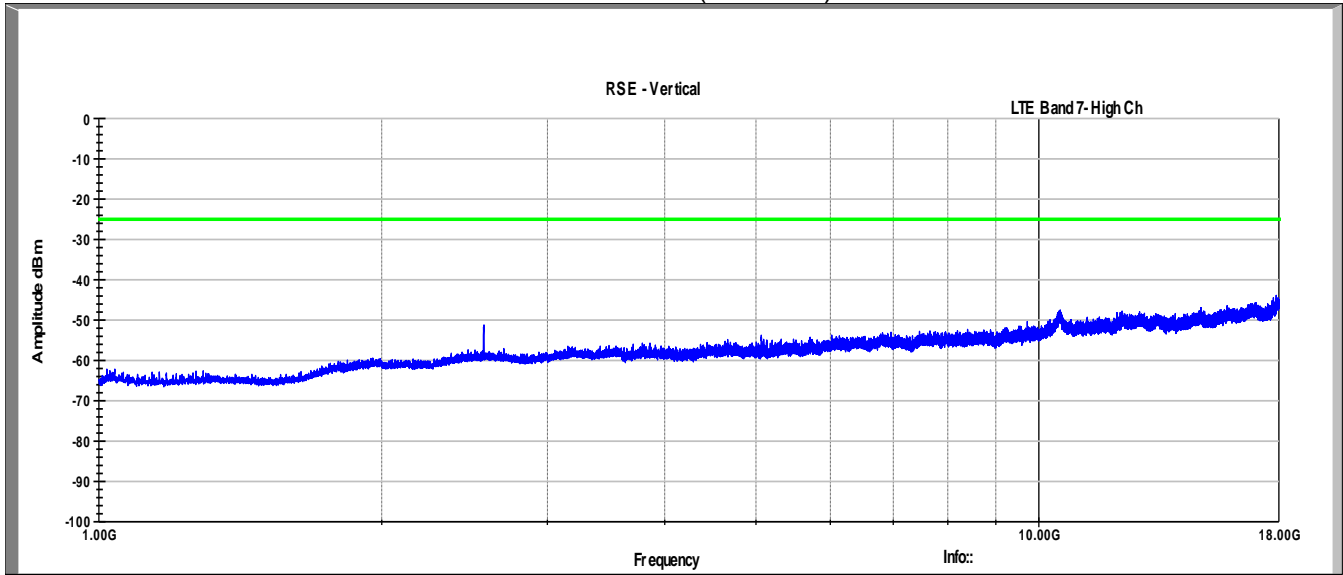
Vertical Data (30-1000MHz)



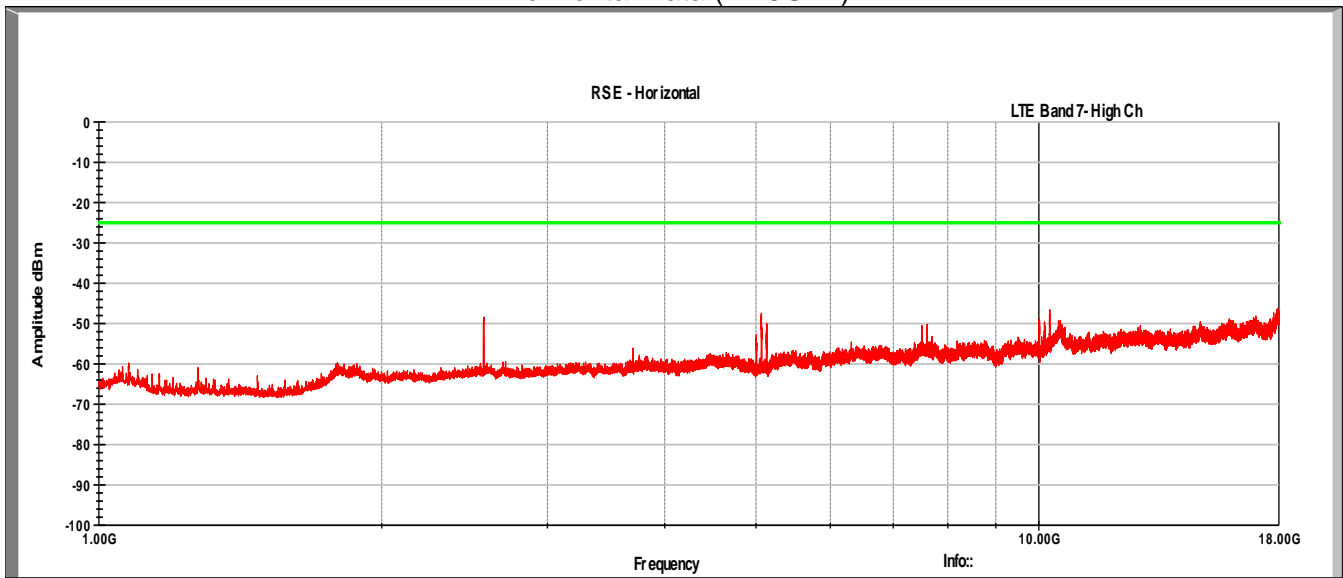
Horizontal Data (30-1000MHz)



### Vertical Data (1-18GHz)

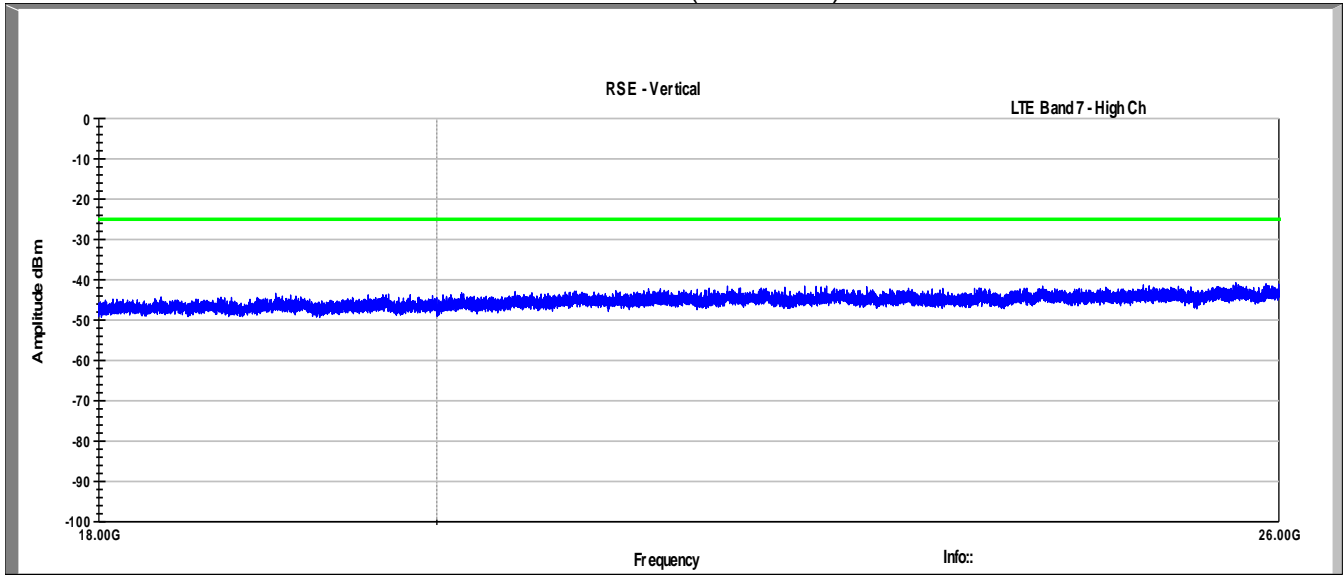


### Horizontal Data (1-18GHz)

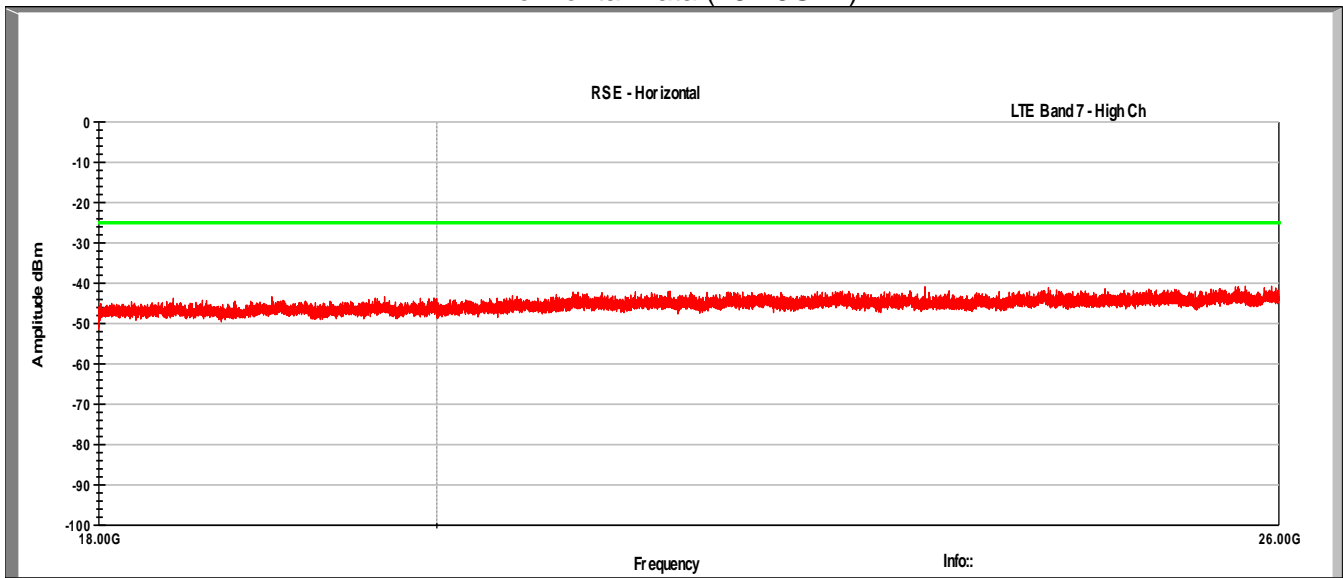




### Vertical Data (18-26GHz)



### Horizontal Data (18-26GHz)



## 6 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	30 June 2018
1	<ul style="list-style-type: none"> <li>- Added detailed RF Output Power data</li> <li>- Added Band Edge plots</li> <li>- Corrected emission limits for Band 7</li> <li>- Other minor additions, corrections and cleanup</li> </ul>	17 October 2018