

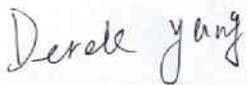
FCC TEST REPORT

Application No: ZR/2020/60015
Applicant: LG Electronics USA, Inc.
Address of Applicant: 111 Sylvan Avenue, North Building Englewood Cliffs, NJ 07632
Manufacturer: Huaqin Telecom Technology Co.,Ltd.
Address of Manufacturer: No.1 Building, No.9 Building, No.399,Keyuan Road,Zhangjiang Hi-tech Park,Shanghai,P.R.China
EUT Description: Mobile handset
Model No.: LM-K420HMW, LM-K420HM
Trade Mark: LG
FCC ID: ZNFK420HMW
Standards: 47 CFR FCC Part 2, Subpart J
 47 CFR Part 15, Subpart C
Test Method: KDB558074 D01 15.247 Meas Guidance v05r02
 ANSI C63.10 (2013)
Date of Receipt: 2020/6/22
Date of Test: 2020/7/22 to 2020/7/29
Date of Issue: 2020/8/12

Test Result:	PASS *
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* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Derek Yang

Wireless Laboratory Manager

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Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2020/8/12		Original

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Test Summary

Test Item	Test Requirement	Test method	Test Result	Result
AC Power Line Conducted Emission	15.207	ANSI C63.10 2013	Clause 4.2	PASS
Conducted Output Power	15.247 (b)(3)	ANSI C63.10 2013	Clause 4.3	PASS
DTS (6 dB) Bandwidth & 99% Occupied Bandwidth	15.247 (a)(2)	ANSI C63.10 2013	Clause 4.4	PASS
Power Spectral Density	15.247 (e)	ANSI C63.10 2013	Clause 4.5	PASS
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10 2013	Clause 4.6	PASS
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10 2013	Clause 4.7	PASS
Radiated Spurious Emissions	15.205/15.209	ANSI C63.10 2013	Clause 4.8	PASS
Restricted bands around fundamental frequency (Radiated Emission)	15.205/15.209	ANSI C63.10 2013	Clause 4.9	PASS

Checked By

David Chen

David Chen
Reviewer

Test By

Daniel Wang

Daniel Wang
Project Engineer

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邮编 710086 sgs.china@sgs.com



1 General Information

1.1 Client Information

Applicant:	LG Electronics USA, Inc.
Address of Applicant:	111 Sylvan Avenue, North Building Englewood Cliffs, NJ 07632
Manufacturer:	Huaqin Telecom Technology Co.,Ltd.
Address of Manufacturer:	No.1 Building, No.9 Building, No.399,Keyuan Road,Zhangjiang Hi-tech Park,Shanghai,P.R.China

1.2 Test Location

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Xi'an Branch
Address:	Single floor D, building 1, Kanghong orange square science and technology park, No.137 keyuan 3rd road, fengdong new town, Xi 'an city, Shaanxi China
Post code:	710000
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1.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

A2LA (Certificate No. 4854.01)

SGS-CSTC STANDARDS TECHNICAL SERVICES CO., LTD. XI'AN BRANCH is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4854.01.

Test Site No.:	SGS Xi'an Site No.		FCC Designation No.
	CO01-XA	03CH01-XA	CN1271

1.4 General Description of EUT

EUT Description::	Mobile handset
Model No.:	LM-K420HMW, LM-K420HM
Trade Mark:	LG
Operation Frequency:	2400MHz~2483.5MHz $f_c = 2402 \text{ MHz} + N * 2 \text{ MHz}$, where: - f_c = "Operating Frequency" in MHz, - N = "Channel Number" with the range from 0 to 39.
Bluetooth Version:	Bluetooth V5.0 LE
Modulation Type:	GFSK
Number of Channel:	40
Sample Type:	<input checked="" type="checkbox"/> Portable Device, <input type="checkbox"/> Module
Antenna Type:	<input type="checkbox"/> External, <input checked="" type="checkbox"/> Integrated
Antenna Gain:	-3.8dBi
Power Supply	<input type="checkbox"/> AC/DC Adapter; <input checked="" type="checkbox"/> Battery; <input type="checkbox"/> PoE.; <input type="checkbox"/> Other:

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Operation Frequency of each channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	10	2422MHz	20	2442MHz	30	2462MHz
1	2404MHz	11	2424MHz	21	2444MHz	31	2464MHz
2	2406MHz	12	2426MHz	22	2446MHz	32	2466MHz
3	2408MHz	13	2428MHz	23	2448MHz	33	2468MHz
4	2410MHz	14	2430MHz	24	2450MHz	34	2470MHz
5	2412MHz	15	2432MHz	25	2452MHz	35	2472MHz
6	2414MHz	16	2434MHz	26	2454MHz	36	2474MHz
7	2416MHz	17	2436MHz	27	2456MHz	37	2476MHz
8	2418MHz	18	2438MHz	28	2458MHz	38	2478MHz
9	2420MHz	19	2440MHz	29	2460MHz	39	2480MHz

Remark:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel (CH0)	2402MHz
The middle channel (CH19)	2440MHz
The highest channel (CH39)	2480MHz

1.5 Test Environment

Operating Environment	
Temperature:	25.0 °C
Humidity:	50 % RH
Atmospheric Pressure:	101.32 KPa

1.6 Description of Support Units

The EUT has been tested independent unit.

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2 Test results and Measurement Data

2.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
<p>15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>15.247(b) (4) requirement: The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p>	
<p>The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -3.8dBi.</p>	

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2.2 AC Power Line Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	150kHz to 30MHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
	* Decreases with the logarithm of the frequency.		
Test Procedure:	<p>1) The mains terminal disturbance voltage test was conducted in a shielded room.</p> <p>2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.</p> <p>3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane.</p> <p>4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.</p> <p>5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.</p>		

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<p>Test Setup:</p>	
<p>Test Mode:</p>	<p>Transmitting with GFSK modulation. Charge +Transmitting mode.</p>
<p>Instruments Used:</p>	<p>Refer to section 5.10 for details.</p>
<p>Test Results:</p>	<p>Pass</p>

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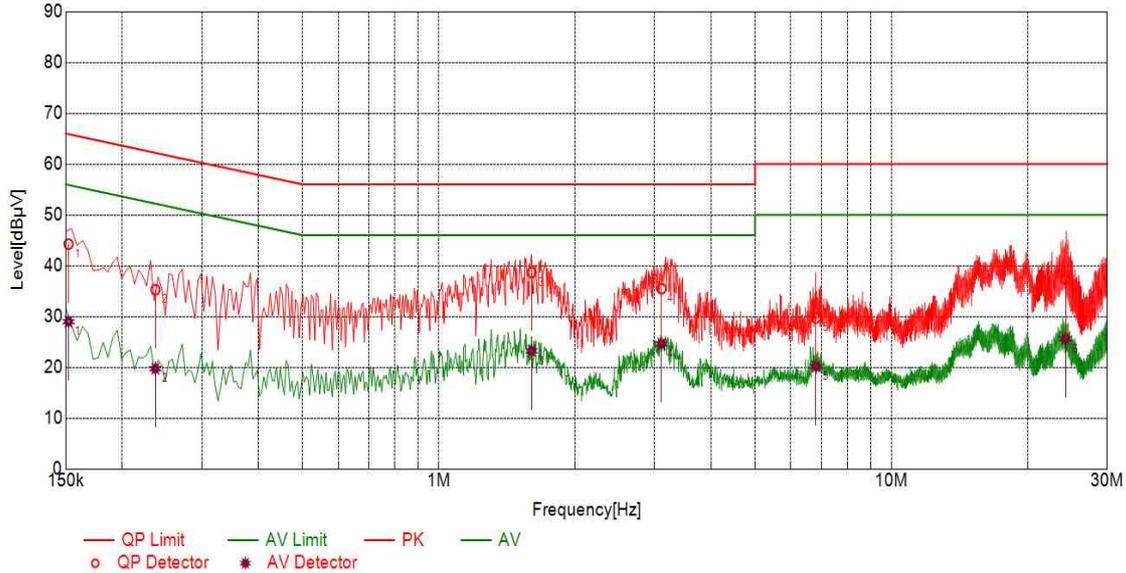


Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live line:



Test Graph

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type
1	0.1522	10.10	44.25	65.88	21.63	28.98	55.88	26.90	L
2	0.2368	10.10	35.28	62.21	26.93	19.73	52.21	32.48	L
3	1.6044	10.10	38.66	56.00	17.34	23.25	46.00	22.75	L
4	3.1069	10.10	35.49	56.00	20.51	24.63	46.00	21.37	L
5	6.8174	10.10	29.73	60.00	30.27	20.16	50.00	29.84	L
6	24.2437	10.11	37.30	60.00	22.70	25.62	50.00	24.38	L

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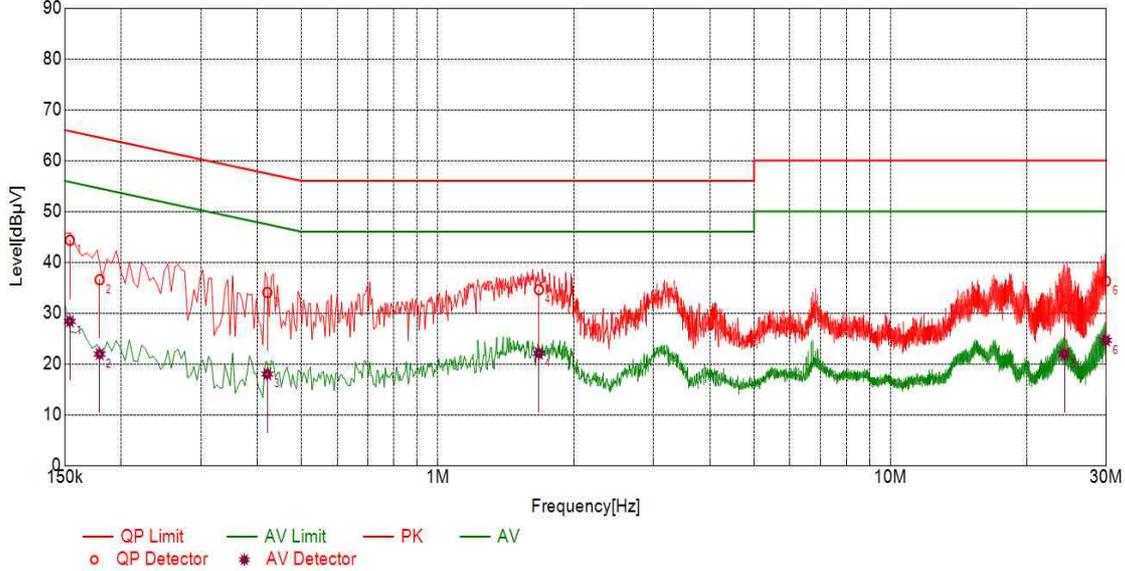
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Neutral line:



Test Graph

Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type
1	0.1540	10.10	44.33	65.78	21.45	28.36	55.78	27.42	N
2	0.1792	10.10	36.56	64.52	27.96	21.93	54.52	32.59	N
3	0.4204	10.10	34.05	57.44	23.39	17.99	47.44	29.45	N
4	1.6738	10.10	34.62	56.00	21.38	22.11	46.00	23.89	N
5	24.2460	10.11	31.11	60.00	28.89	21.93	50.00	28.07	N
6	29.9318	10.11	36.30	60.00	23.70	24.65	50.00	25.35	N

Remarks:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level = Receiver Reading + LISN Factor + Cable Loss.

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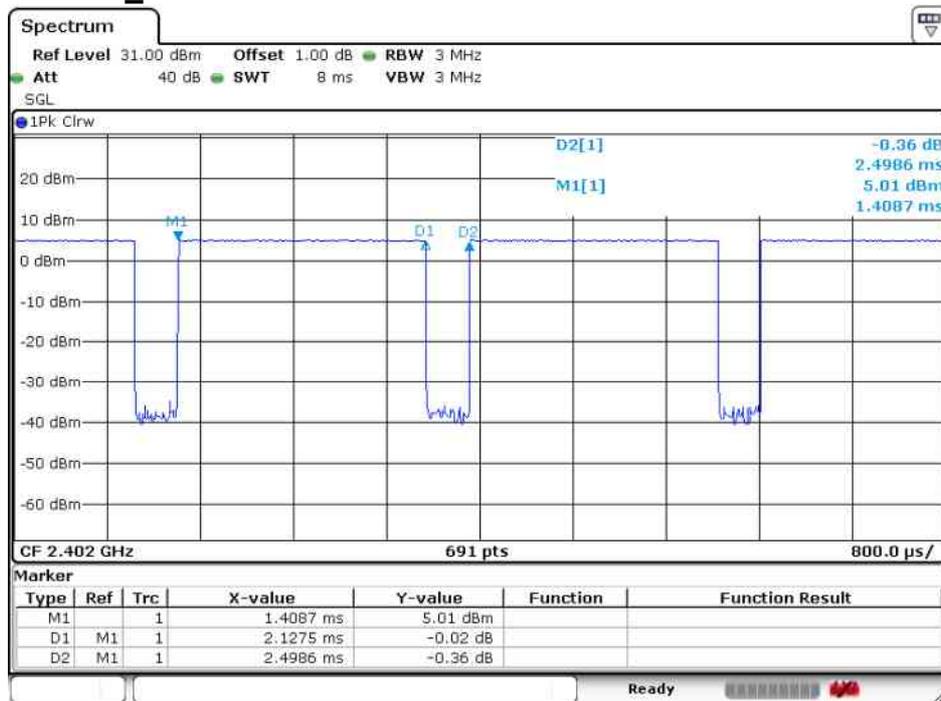
2.3 Duty Cycle

2.3.1 Test Results

Test Mode	TX Freq. [MHz]	Duty cycle [%]
BLE_1M	CH0,CH19,CH39	85.15
BLE_2M	CH0,CH19,CH39	56.70

2.3.1 Test Plots

2.3.1.1 BLE_1M



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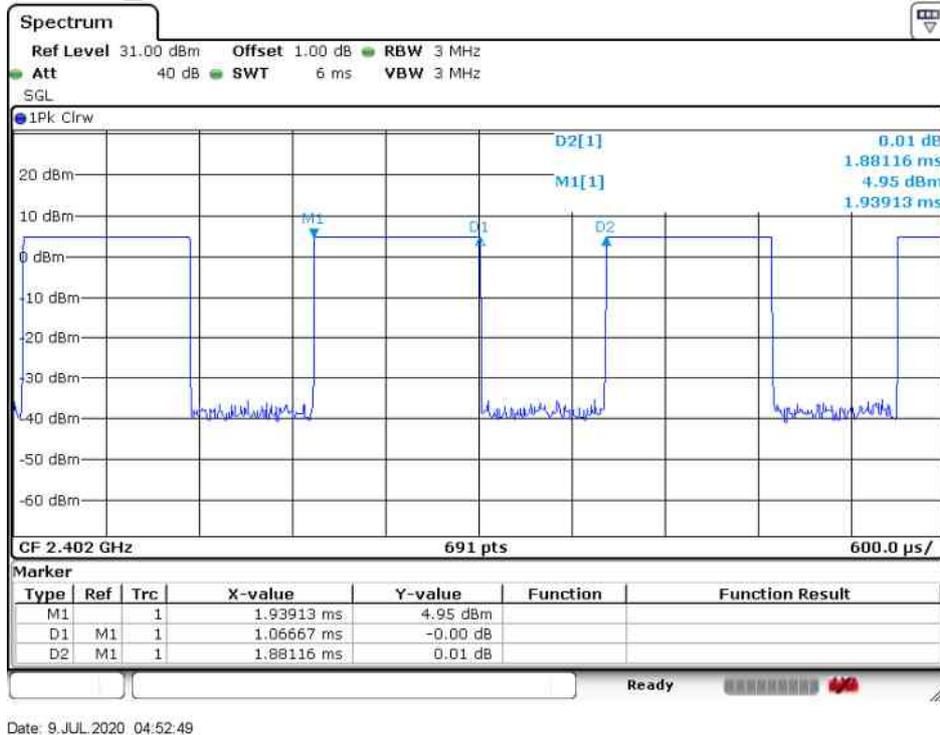
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2.3.1.2

BLE_2M



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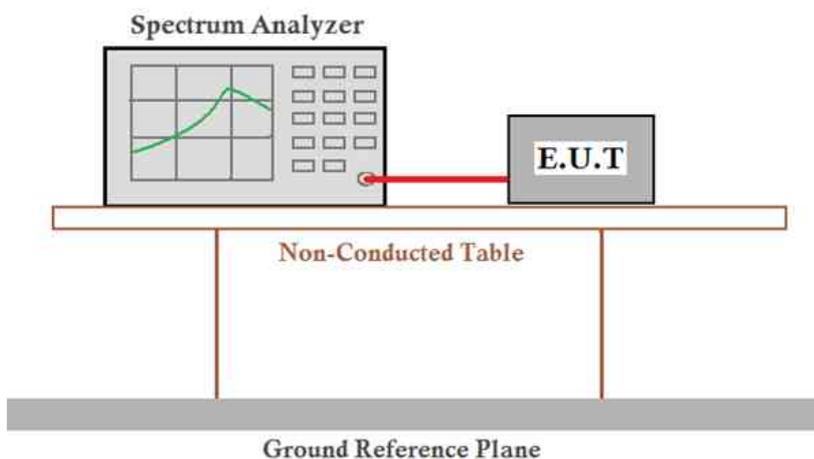
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2.4 Conducted Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(3)
Test Method:	ANSI C63.10 :2013 Section 11.9.1.1
Test Setup:	
Limit:	30dBm
Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

2.4.1 Test Results

Measurement Data of Peak Power :

GFSK mode_1M			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	5.05	30.00	Pass
Middle	6.28	30.00	Pass
Highest	5.38	30.00	Pass
GFSK mode_2M			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	5.07	30.00	Pass
Middle	6.28	30.00	Pass
Highest	5.43	30.00	Pass

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2.4.2 Test plots:

2.4.2.1 GFSK_Lowest Channel_1M



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2.4.2.2 GFSK_Middle Channel_1M



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2.4.2.3 GFSK_Highest Channel_1M



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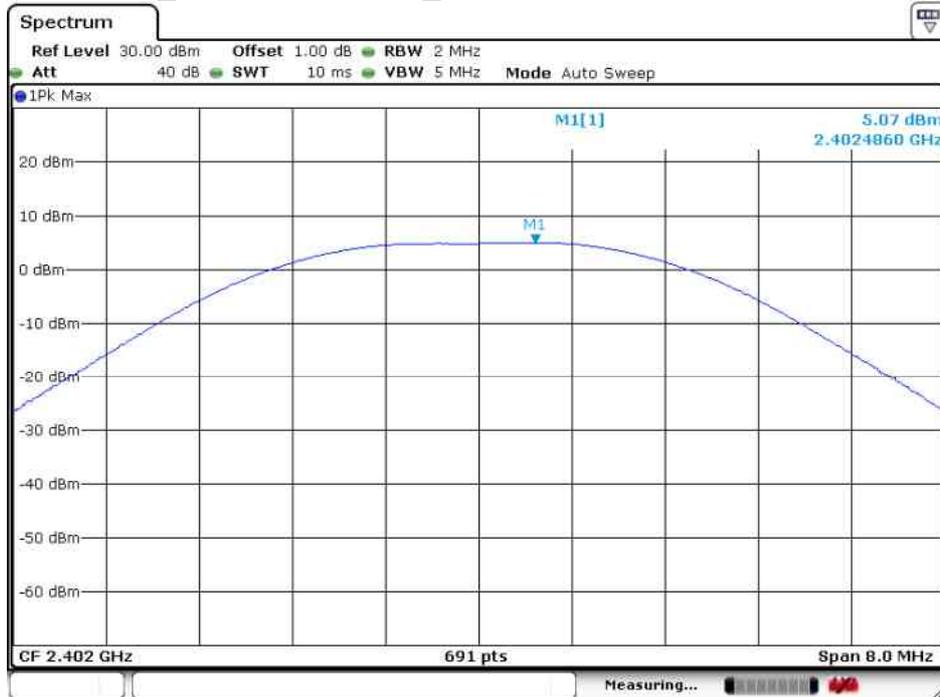
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2.4.2.4 GFSK_Lowest Channel_2M



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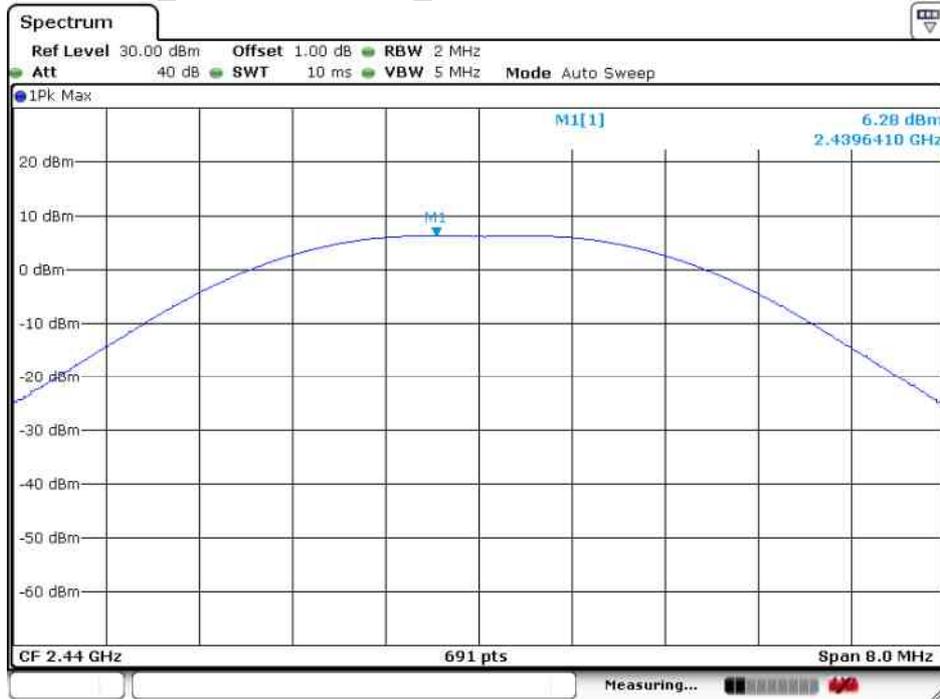
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2.4.2.5 GFSK_Middle Channel_2M



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2.4.2.6 GFSK_Highest Channel_2M



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2.5 DTS (6 dB) Bandwidth & 99% Occupied Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10: 2013 Section 11.8 Option 2
Test Setup:	
Limit:	≥ 500 kHz
Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

2.5.1 Test Results

Mode	Test Channel	99% Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
GFSK_1M	Lowest	1.03	0.67	≥500	Pass
	Middle	1.03	0.67	≥500	Pass
	Highest	1.03	0.67	≥500	Pass
Mode	Test Channel	99% Occupied Bandwidth (MHz)	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
GFSK_2M	Lowest	2.08	1.17	≥500	Pass
	Middle	2.08	1.17	≥500	Pass
	Highest	2.08	1.18	≥500	Pass

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2.5.2 Test plots

2.5.2.1 GFSK_Lowest Channel_1M



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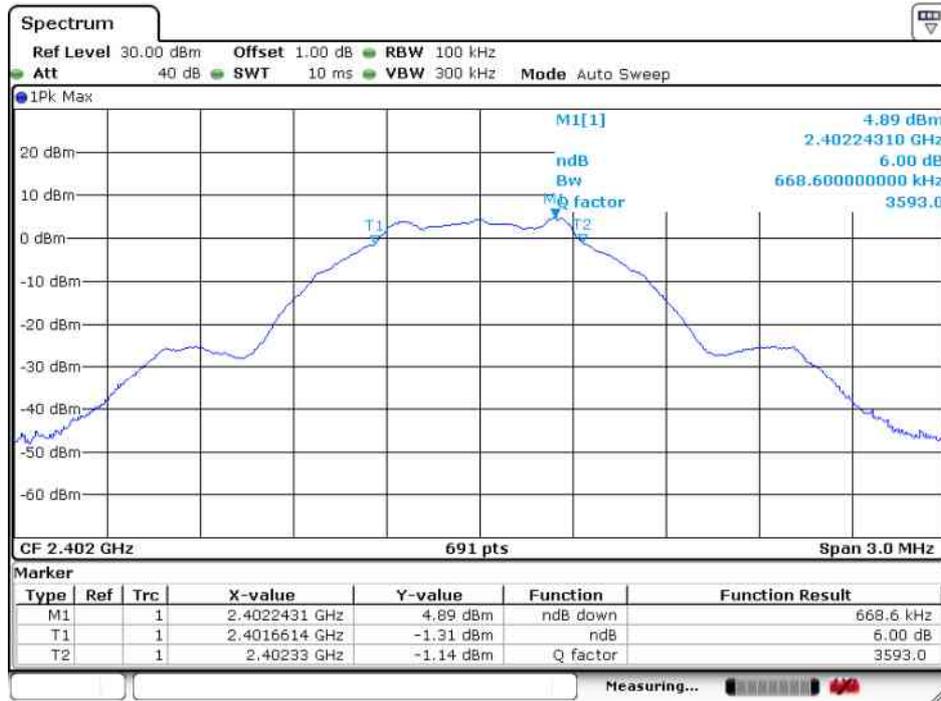
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2.5.2.2 GFSK_Middle Channel_1M



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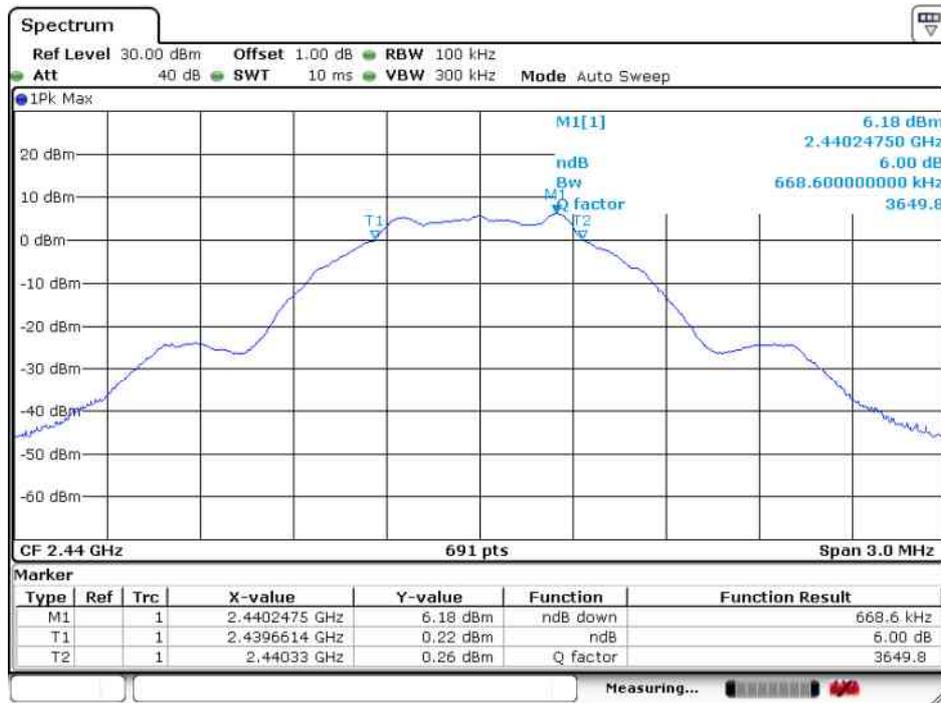
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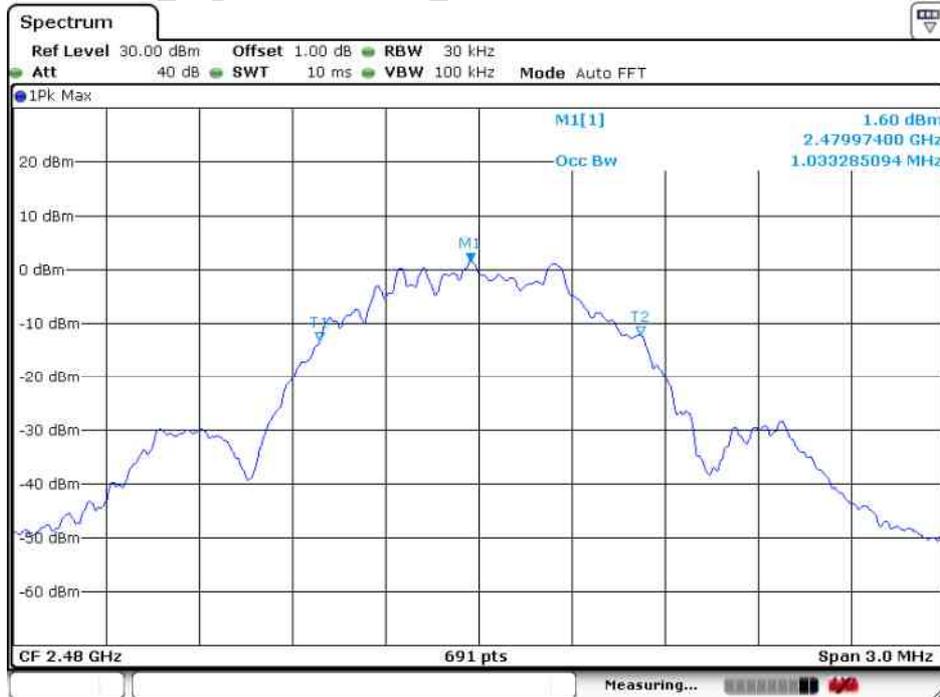
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2.5.2.3 GFSK_Highest Channel_1M



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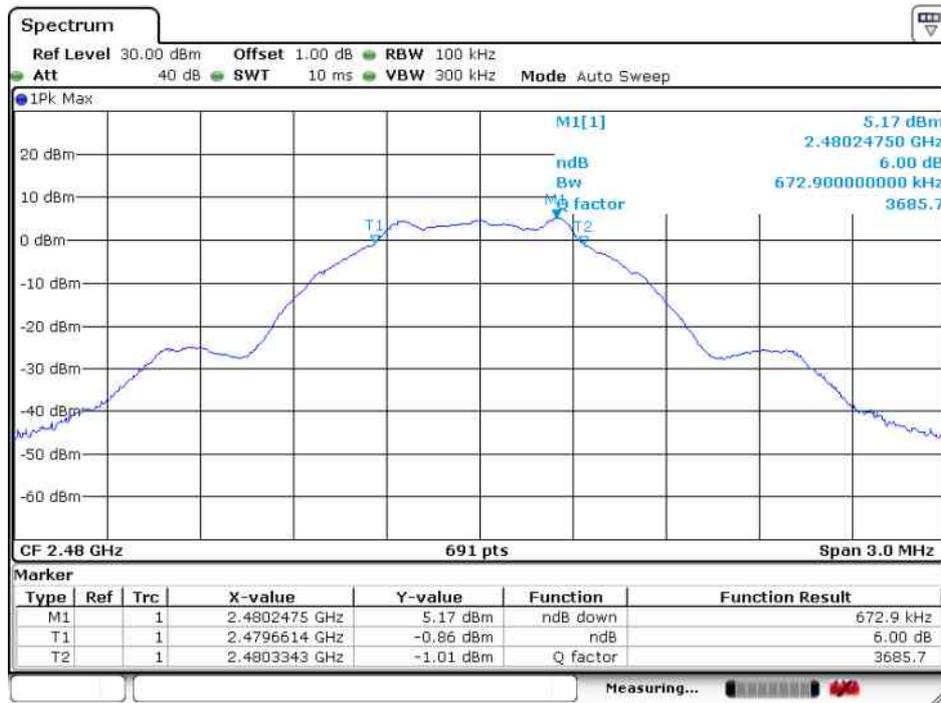
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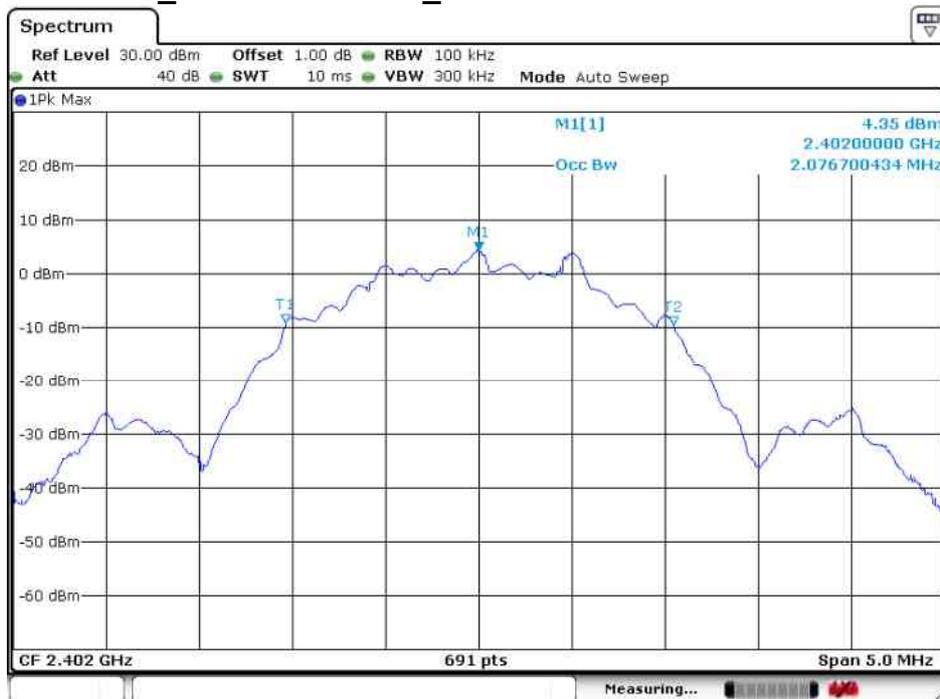
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2.5.2.4 GFSK_Lowest Channel_2M



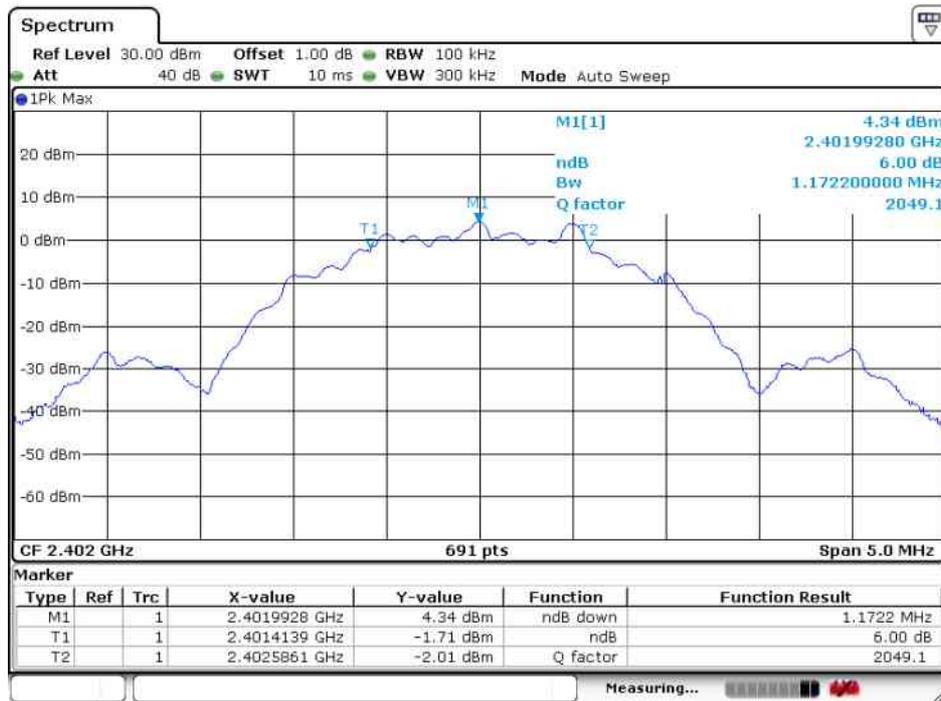
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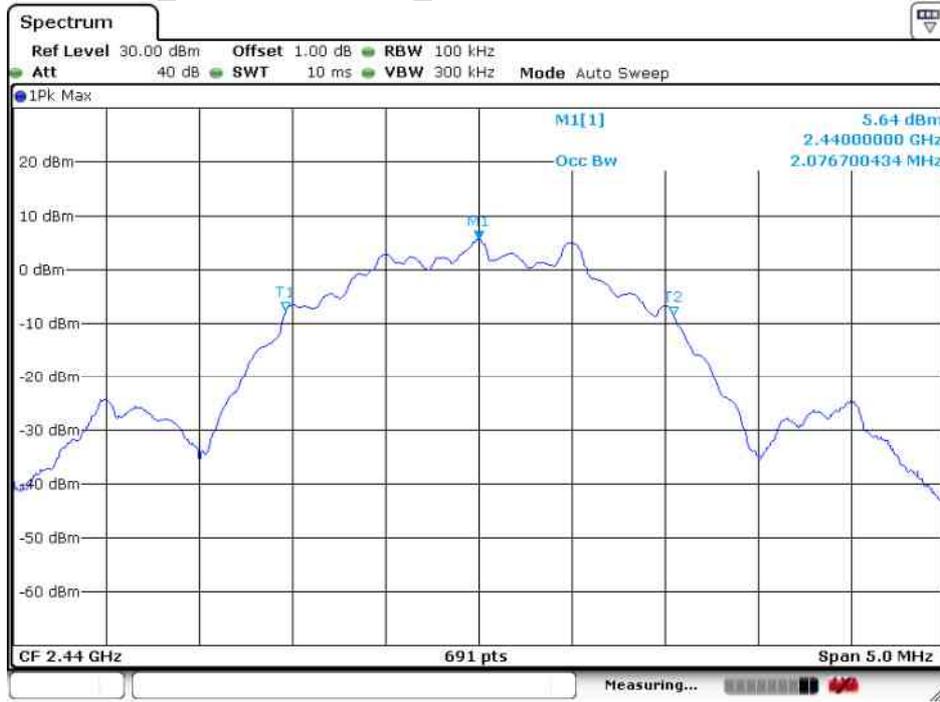
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2.5.2.5

GFSK_Middle Channel_2M



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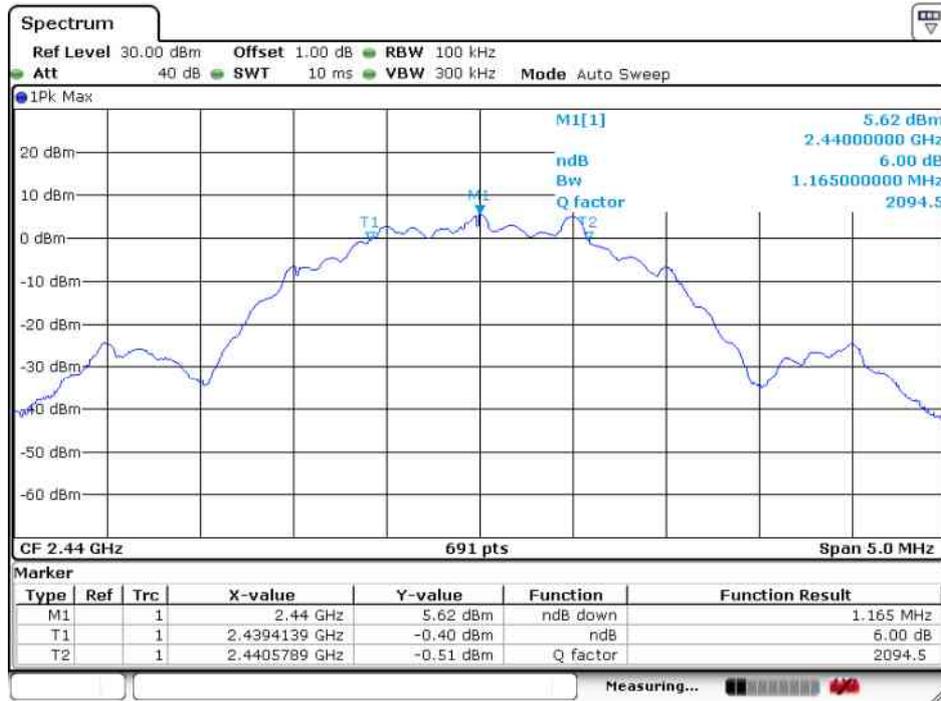
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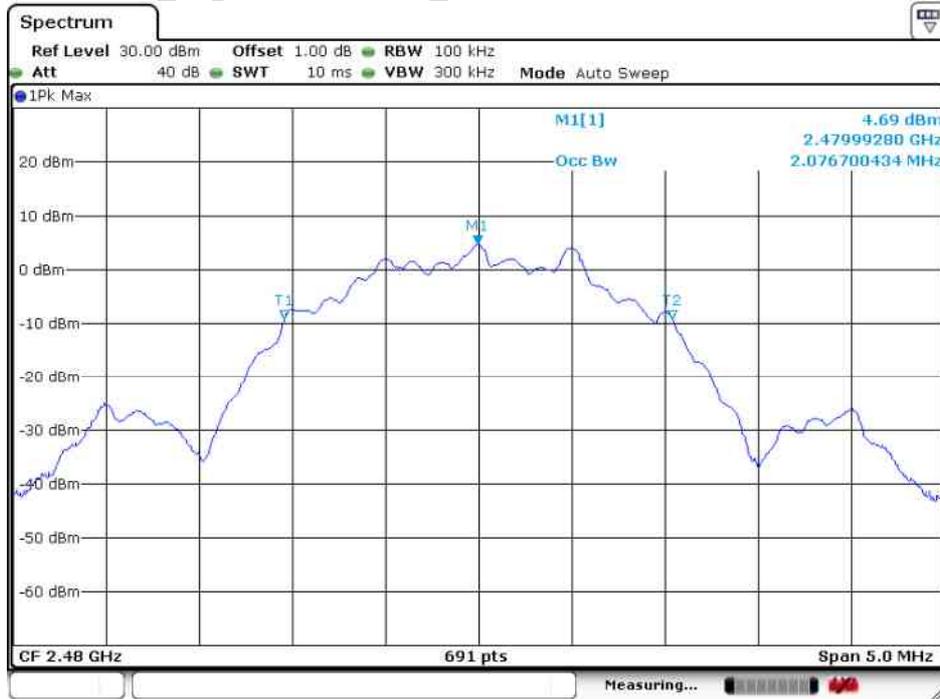
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2.5.2.6 GFSK_Highest Channel_2M



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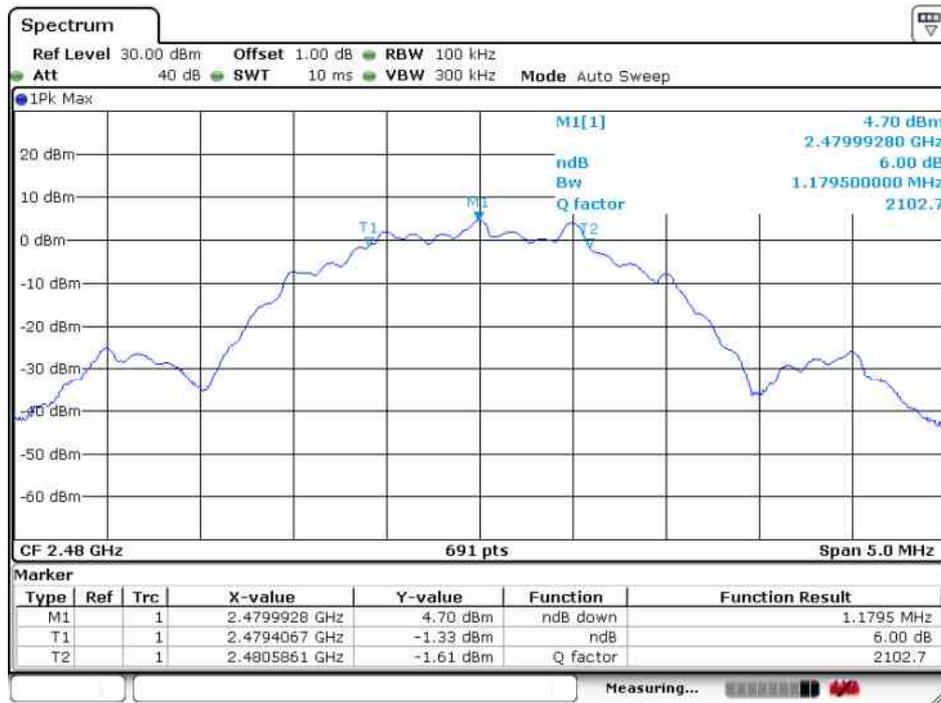
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2.6 Power Spectral Density

Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10 :2013 Section 11.10.2
Test Setup:	<p>The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Limit:	≤8.00dBm/3kHz
Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

2.6.1 Test Results

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
GFSK_1M	Lowest	-11.58	≤8.00	Pass
	Middle	-10.27	≤8.00	Pass
	Highest	-11.24	≤8.00	Pass
Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
GFSK_2M	Lowest	-13.85	≤8.00	Pass
	Middle	-12.53	≤8.00	Pass
	Highest	-13.47	≤8.00	Pass

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2.6.2 Test plots

2.6.2.1 GFSK_Lowest Channel_1M



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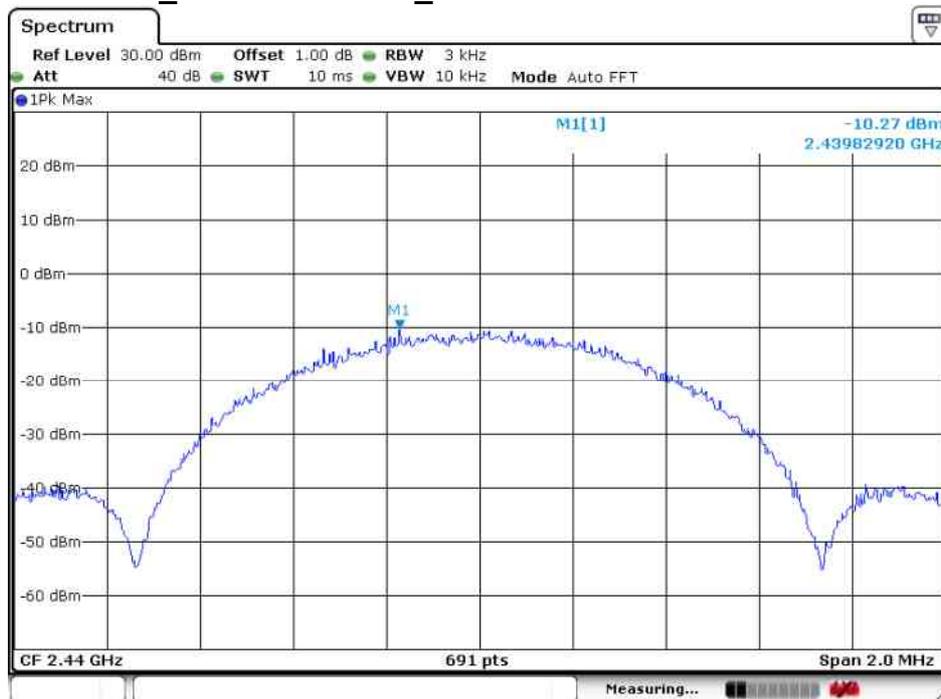
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2.6.2.2 GFSK_Middle Channel_1M



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2.6.2.3 GFSK_Highest Channel_1M



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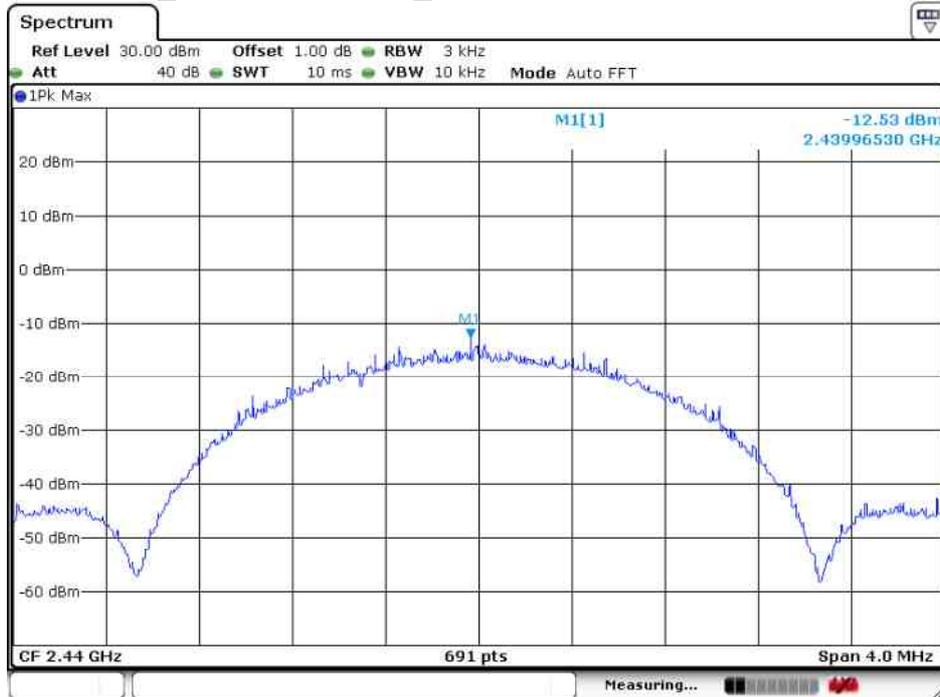
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2.6.2.5 GFSK_Middle Channel_2M



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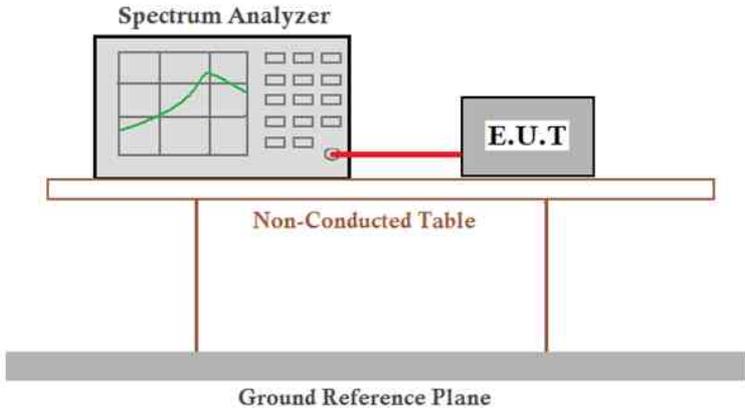
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2.7 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.13
Test Setup:	
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

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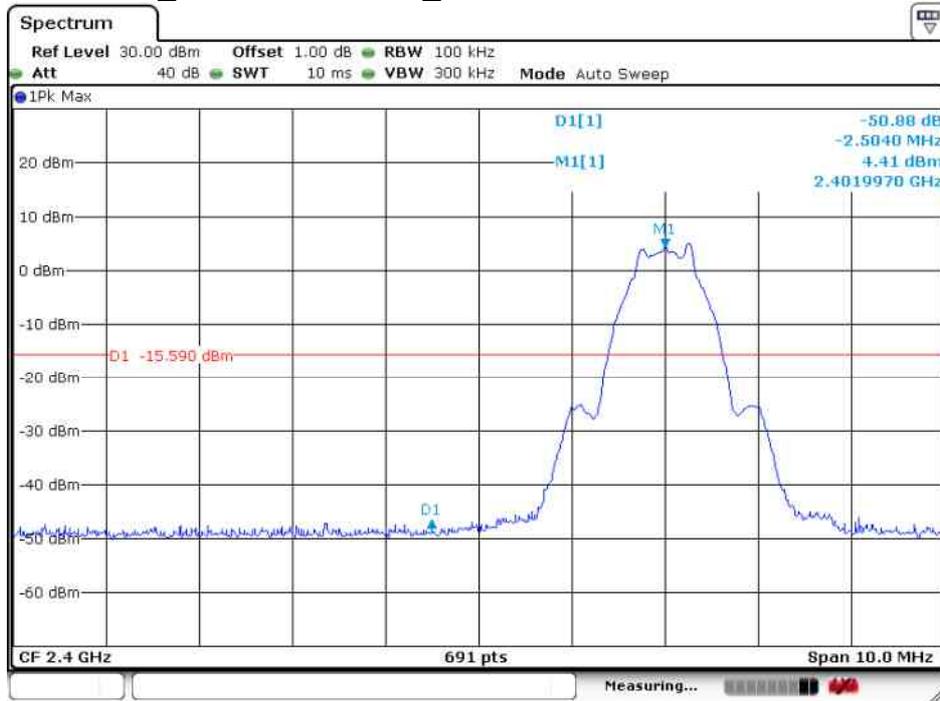
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2.7.1 Test plots

2.7.1.1 GFSK_Lowest Channel_1M



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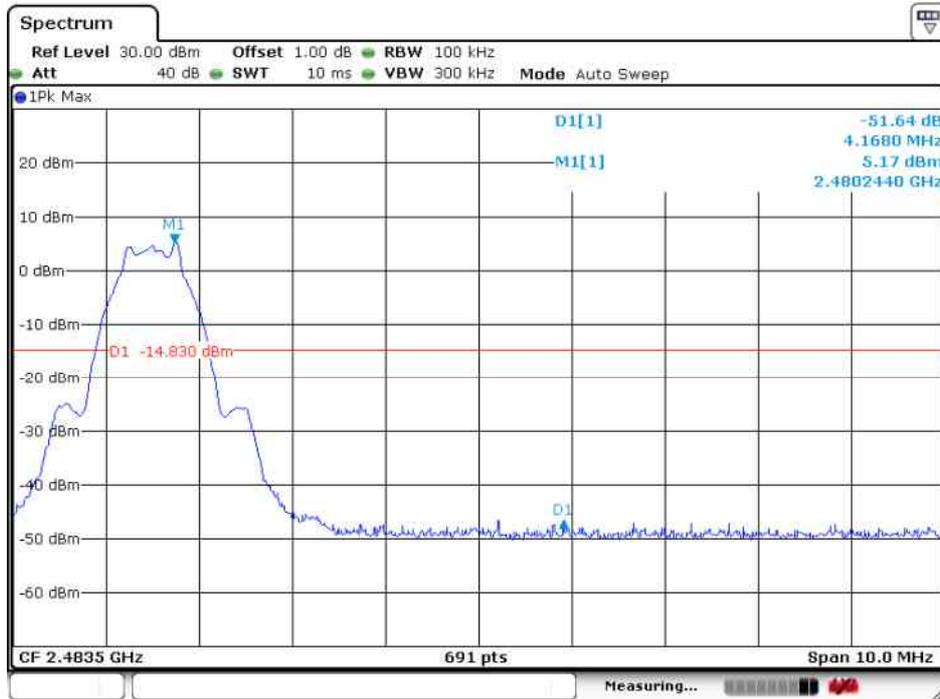
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2.7.1.2 GFSK_Highest Channel_1M



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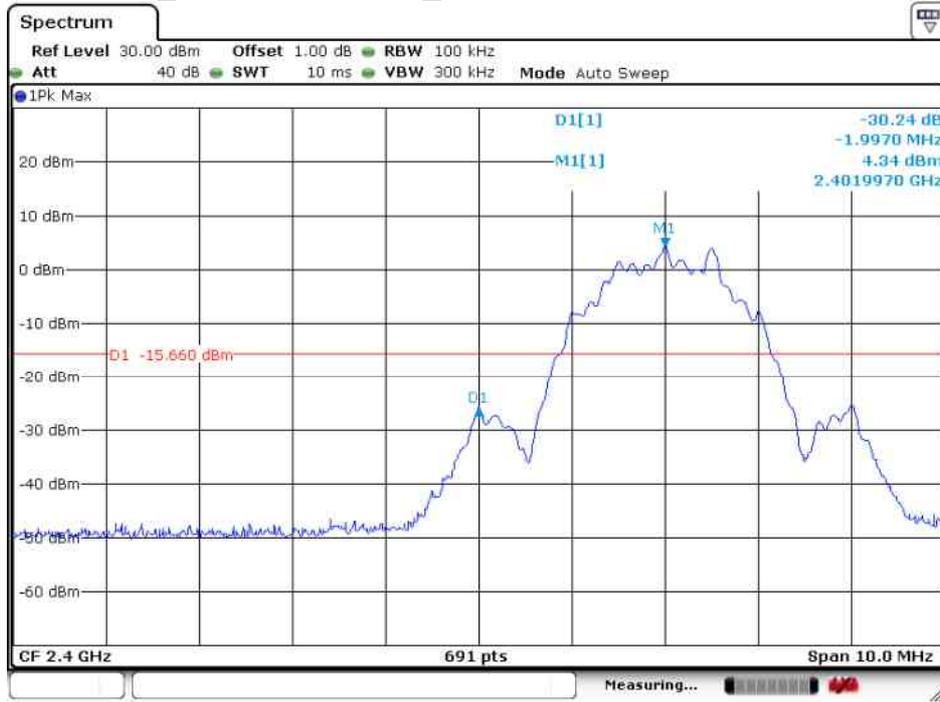
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2.7.1.3

GFSK_Lowest Channel_2M



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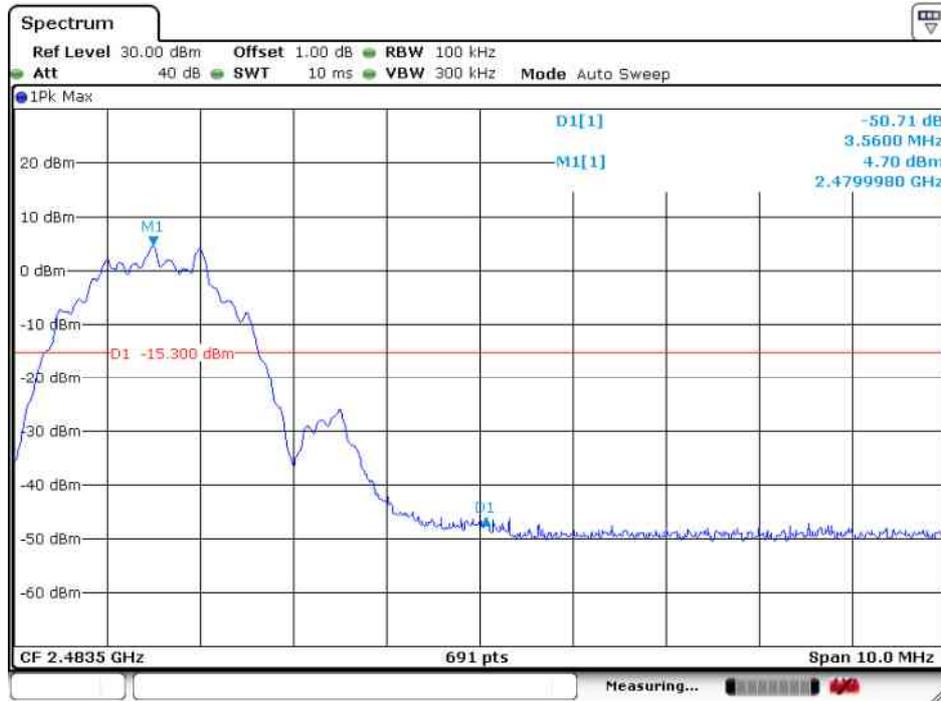
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2.7.1.4 GFSK_Highest Channel_2M



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2.8 Spurious RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.11
Test Setup:	
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

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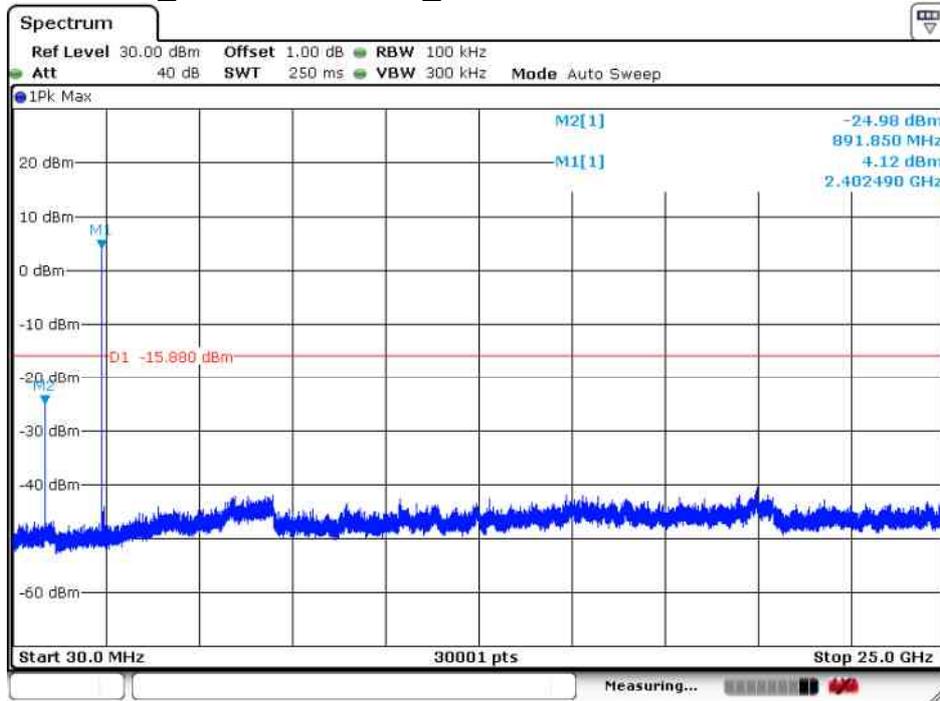
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2.8.1 Test plots:

2.8.1.1 GFSK_Lowest Channel_1M



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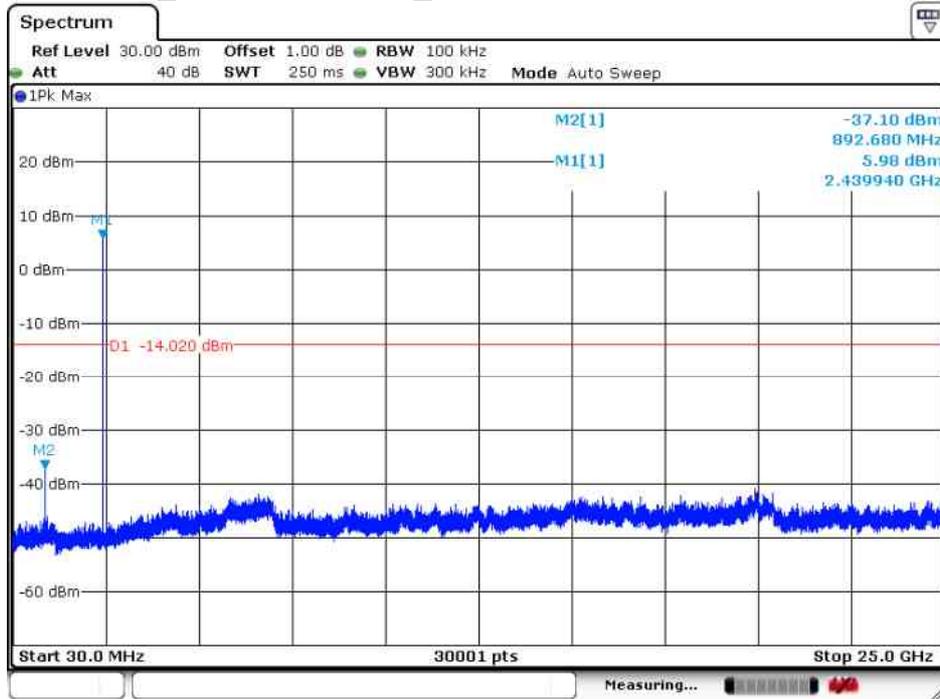
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2.8.1.2 GFSK_Middle Channel_1M



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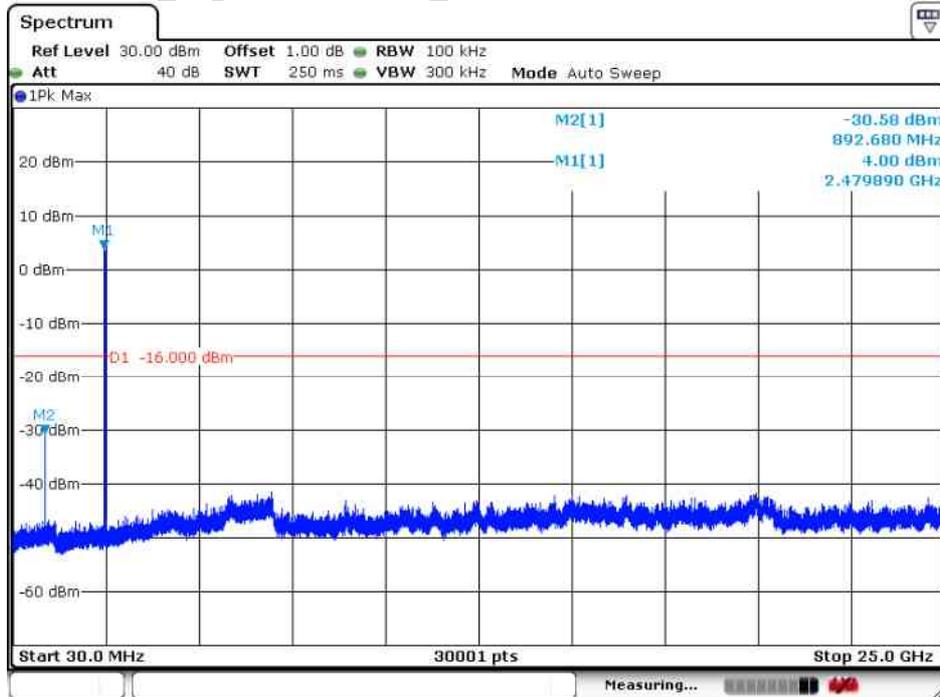
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2.8.1.3 GFSK_Highest Channel_1M



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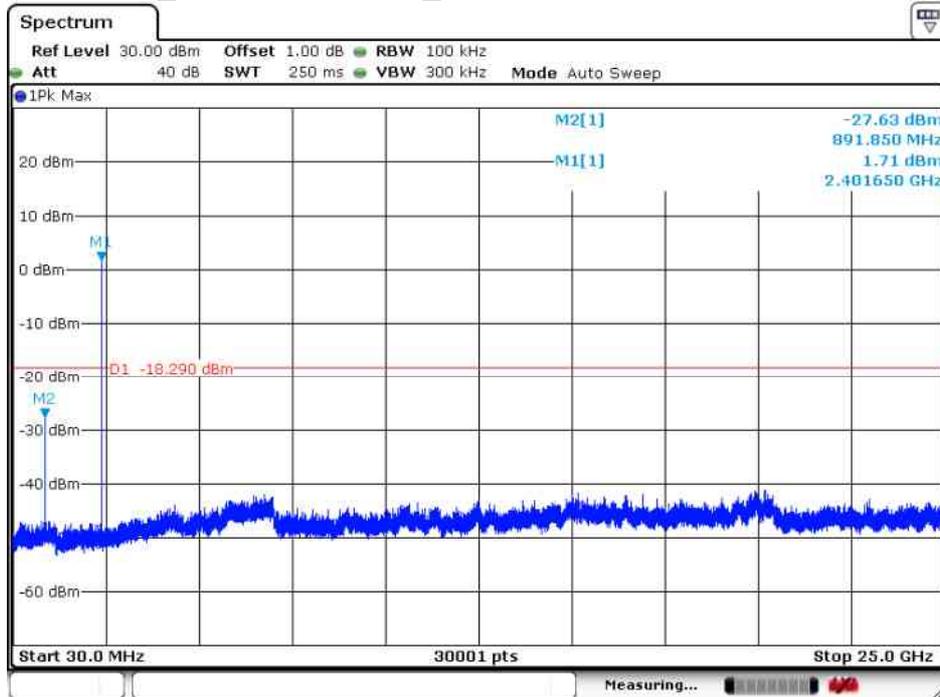
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2.8.1.4 GFSK_Lowest Channel_2M



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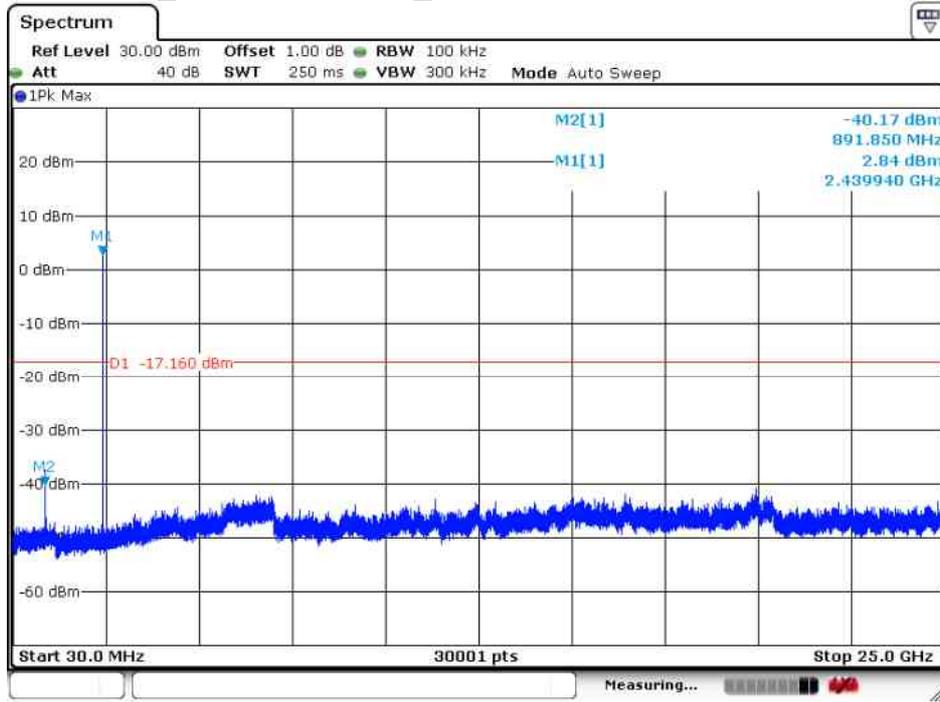
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2.8.1.5 GFSK_Middle Channel_2M



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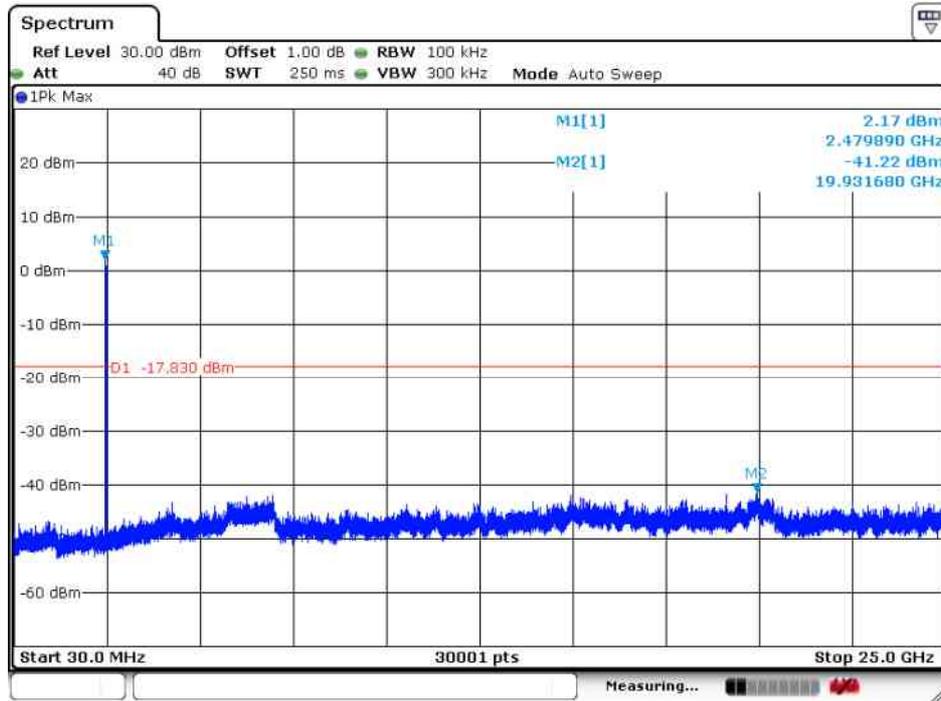
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2.8.1.6 GFSK_Highest Channel_2M



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Remark:

Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz was very low, and the above harmonics were the highest point could be found when testing, The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

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2.9 Radiated Spurious Emission

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10 :2013 Section 11.12				
Test Site:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
Peak		1MHz	10Hz	Average	
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
Remark: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.					

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Test Setup:

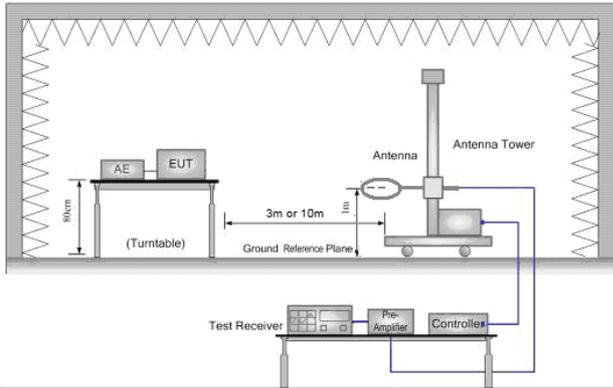


Figure 1. Below 30MHz

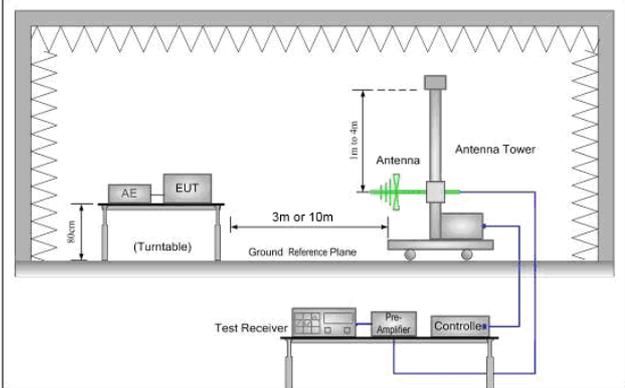


Figure 2. 30MHz to 1GHz

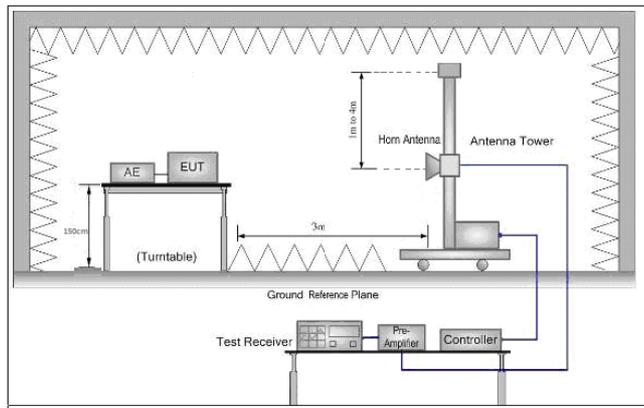


Figure 3. Above 1 GHz

Test Procedure:

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for

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	<p>the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.</p> <p>f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</p> <p>h. Test the EUT in the lowest channel (2402MHz),the middle channel (2440MHz),the Highest channel (2480MHz)</p> <p>i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.</p> <p>j. Repeat above procedures until all frequencies measured was complete.</p>
Exploratory Test Mode:	Transmitting with GFSK modulation. Charge + Transmitting mode.
Final Test Mode:	Transmitting with GFSK modulation. Pretest the EUT at Charge + Transmitting mode, For below 1GHz part, through pre-scan, the worst case is the lowest channel.Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

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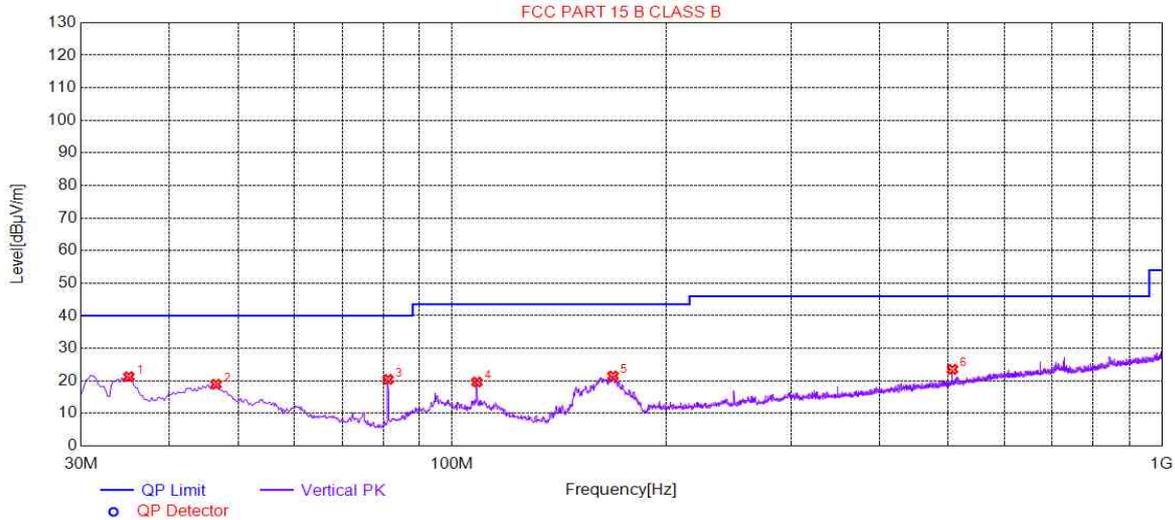
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2.9.1 Radiated Emission below 1GHz

2.9.1.1 Charge + Transmitting, Vertical



Suspected List

NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	35.0450	21.29	-29.95	40.00	18.71	100	359	Vertical
2	46.4933	18.97	-30.41	40.00	21.03	100	341	Vertical
3	81.2262	20.45	-35.85	40.00	19.55	100	37	Vertical
4	108.391	19.66	-32.00	43.50	23.84	100	90	Vertical
5	168.543	21.50	-34.13	43.50	22.00	100	14	Vertical
6	506.947	23.54	-23.14	46.00	22.46	100	25	Vertical

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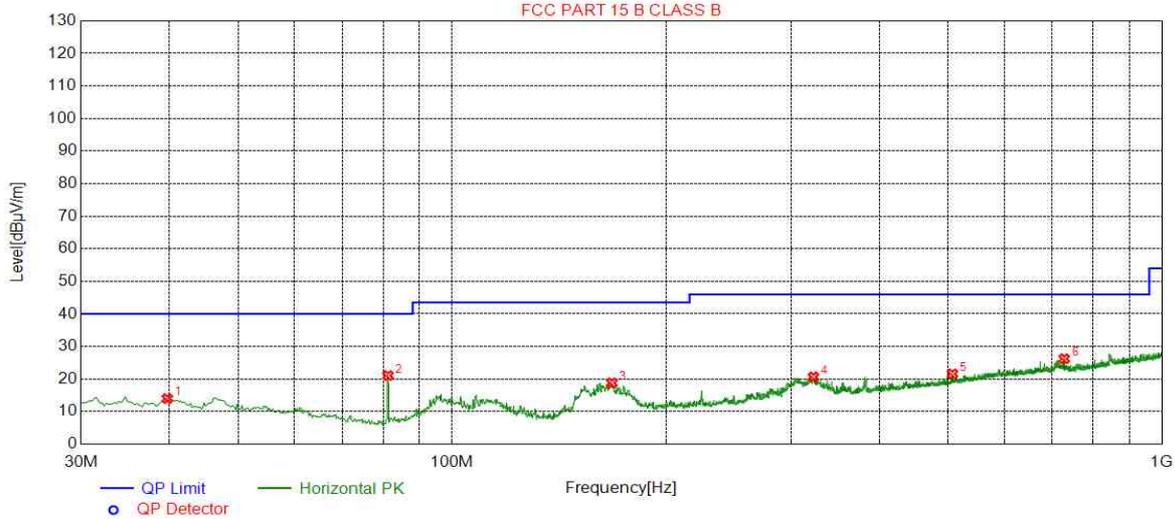
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2.9.1.2 Charge + Transmitting, Horizontal



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	39.7019	14.00	-28.44	40.00	26.00	100	286	Horizontal
2	81.2262	21.07	-35.85	40.00	18.93	200	48	Horizontal
3	167.961	18.81	-34.16	43.50	24.69	200	110	Horizontal
4	322.998	20.65	-27.61	46.00	25.35	100	81	Horizontal
5	506.947	21.59	-23.14	46.00	24.41	100	113	Horizontal
6	728.539	26.24	-18.84	46.00	19.76	100	272	Horizontal

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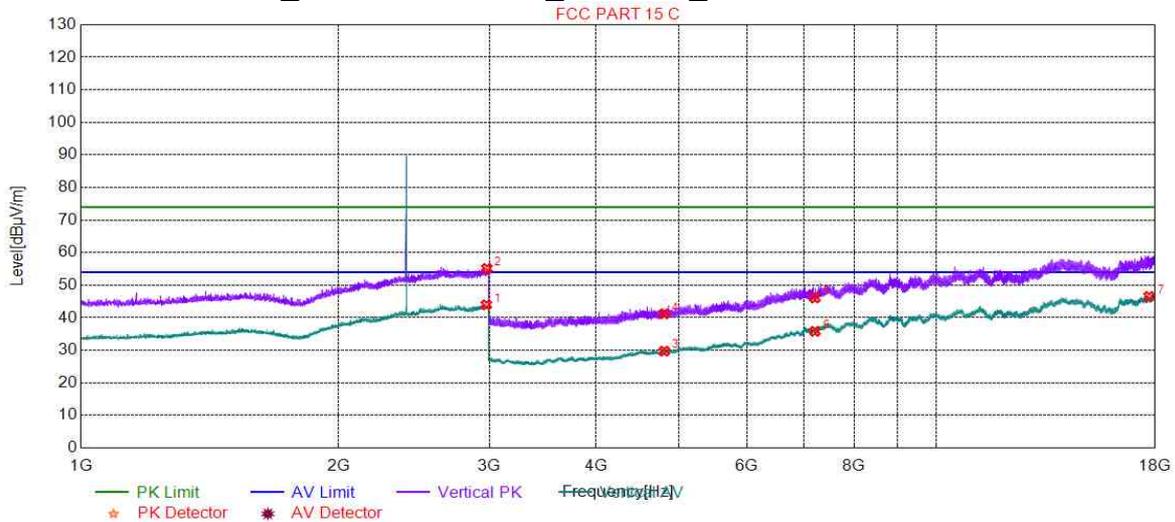
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2.9.2 Transmitter Emission above 1GHz

2.9.2.1 GFSK _Lowest Channel_ Vertical_1M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2976.49	43.97	9.56	54.00	10.03	150	132	Vertical
2	2980.99	55.14	9.54	74.00	18.86	150	176	Vertical
3	4804.00	29.76	-18.30	54.00	24.24	150	258	Vertical
4	4804.00	41.21	-18.30	74.00	32.79	150	258	Vertical
5	7206.00	46.09	-10.09	74.00	27.91	150	179	Vertical
6	7206.00	35.81	-10.09	54.00	18.19	150	129	Vertical
7	17703.5	46.55	1.29	54.00	7.45	150	340	Vertical

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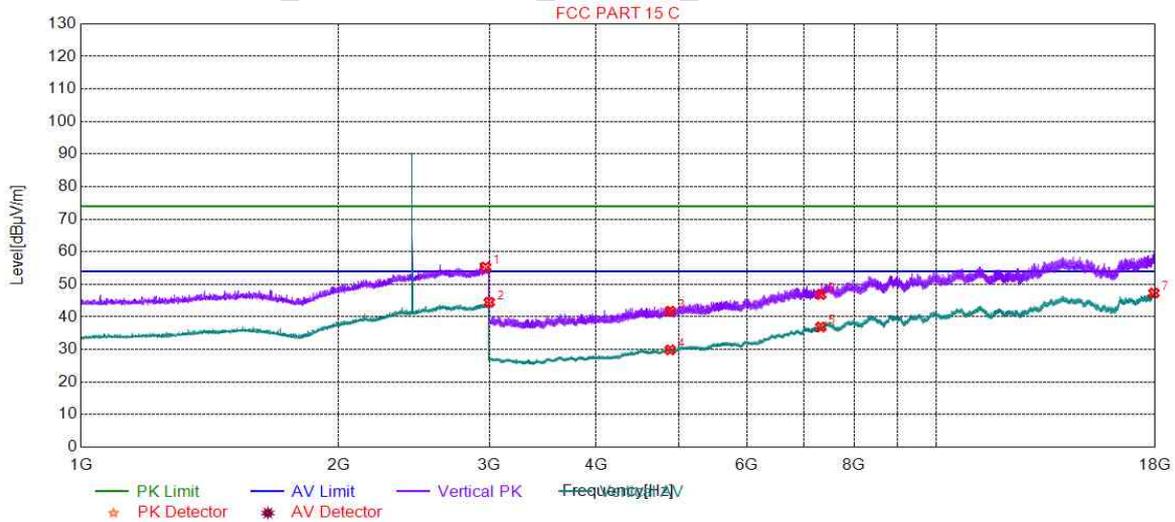
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2.9.2.2 GFSK _Middle Channel_ Vertical_1M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2970.49	55.31	9.59	74.00	18.69	150	200	Vertical
2	2999.49	44.52	9.45	54.00	9.48	150	180	Vertical
3	4880.00	41.76	-17.97	74.00	32.24	150	217	Vertical
4	4880.00	29.88	-17.97	54.00	24.12	150	217	Vertical
5	7320.00	36.92	-9.72	54.00	17.08	150	232	Vertical
6	7320.00	46.86	-9.72	74.00	27.14	150	173	Vertical
7	17933.4	47.33	0.70	54.00	6.67	150	232	Vertical

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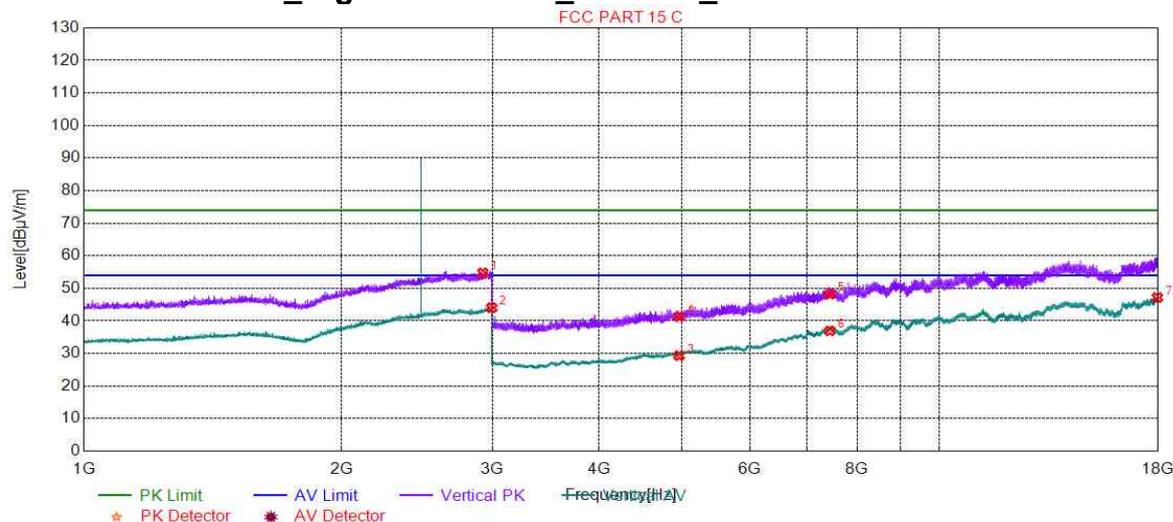
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2.9.2.3 GFSK _Highest Channel_ Vertical_1M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2924.48	54.77	9.40	74.00	19.23	150	109	Vertical
2	2995.99	44.07	9.47	54.00	9.93	150	189	Vertical
3	4960.00	29.34	-17.47	54.00	24.66	150	117	Vertical
4	4960.00	41.33	-17.47	74.00	32.67	150	242	Vertical
5	7440.00	48.23	-9.35	74.00	25.77	150	287	Vertical
6	7440.00	36.94	-9.35	54.00	17.06	150	337	Vertical
7	17957.0	47.17	0.71	54.00	6.83	150	25	Vertical

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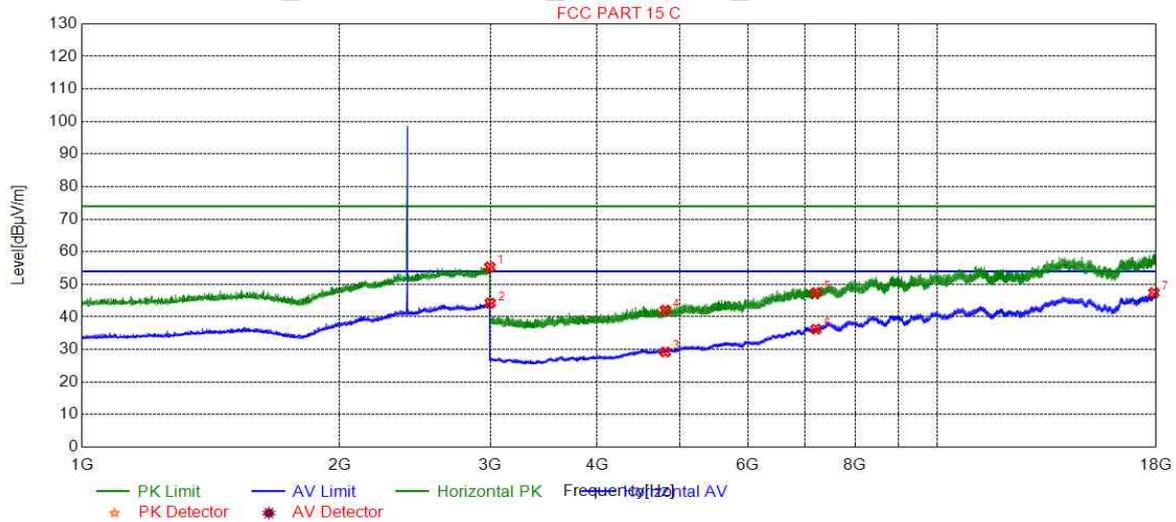
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2.9.2.4 GFSK _Lowest Channel_ Horizontal_1M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2996.49	55.33	9.47	74.00	18.67	150	177	Horizontal
2	2999.49	44.25	9.45	54.00	9.75	150	310	Horizontal
3	4804.00	29.23	-18.30	54.00	24.77	150	167	Horizontal
4	4804.00	42.09	-18.30	74.00	31.91	150	344	Horizontal
5	7206.00	47.47	-10.09	74.00	26.53	150	273	Horizontal
6	7206.00	36.24	-10.09	54.00	17.76	150	110	Horizontal
7	17886.1	47.45	0.51	54.00	6.55	150	159	Horizontal

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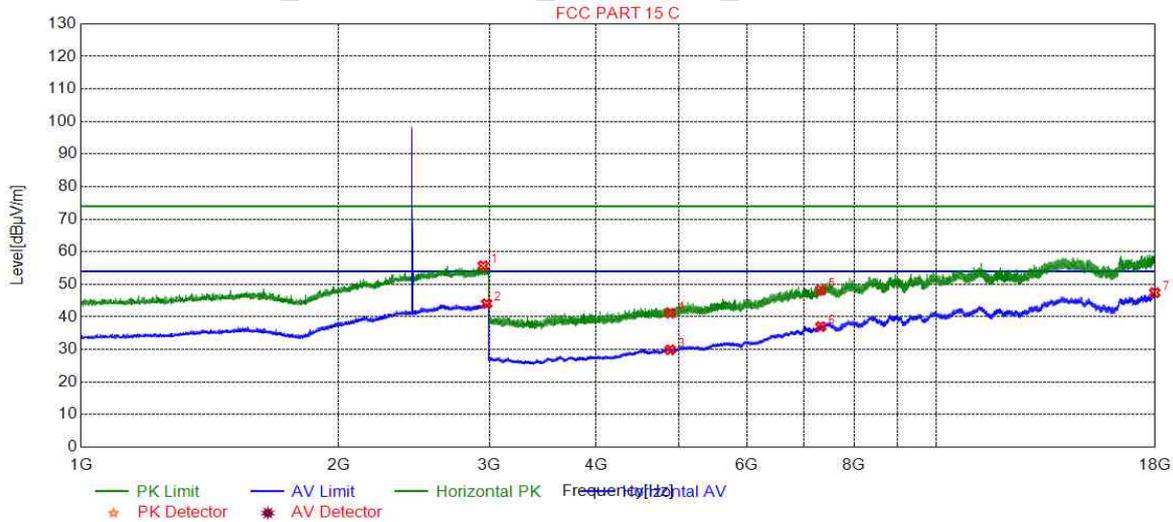
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2.9.2.5 GFSK_Middle Channel_Horizontal_1M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2950.48	55.73	9.68	74.00	18.27	150	73	Horizontal
2	2979.49	44.10	9.54	54.00	9.90	150	206	Horizontal
3	4880.00	29.89	-17.97	54.00	24.11	150	360	Horizontal
4	4880.00	41.17	-17.97	74.00	32.83	150	360	Horizontal
5	7320.00	48.24	-9.72	74.00	25.76	150	106	Horizontal
6	7320.00	37.01	-9.72	54.00	16.99	150	268	Horizontal
7	17976.8	47.43	0.71	54.00	6.57	150	327	Horizontal

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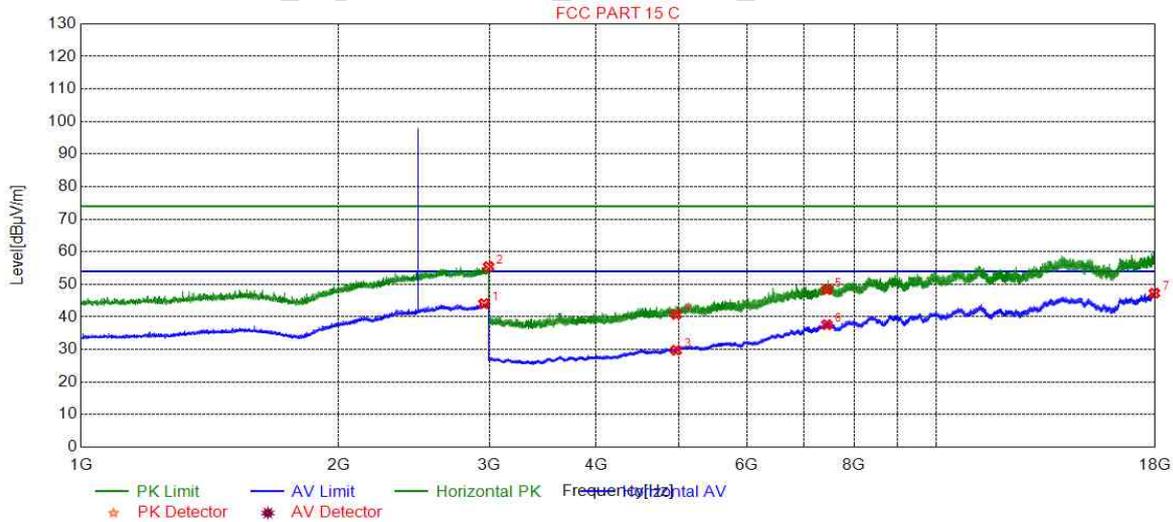
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2.9.2.6 GFSK_Highest Channel_Horizontal_1M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2956.98	44.09	9.65	54.00	9.91	150	27	Horizontal
2	2994.49	55.44	9.48	74.00	18.56	150	75	Horizontal
3	4960.00	29.76	-17.47	54.00	24.24	150	95	Horizontal
4	4960.00	40.80	-17.47	74.00	33.20	150	95	Horizontal
5	7440.00	48.37	-9.35	74.00	25.63	150	108	Horizontal
6	7440.00	37.62	-9.35	54.00	16.38	150	275	Horizontal
7	17954.8	47.28	0.71	54.00	6.72	150	56	Horizontal

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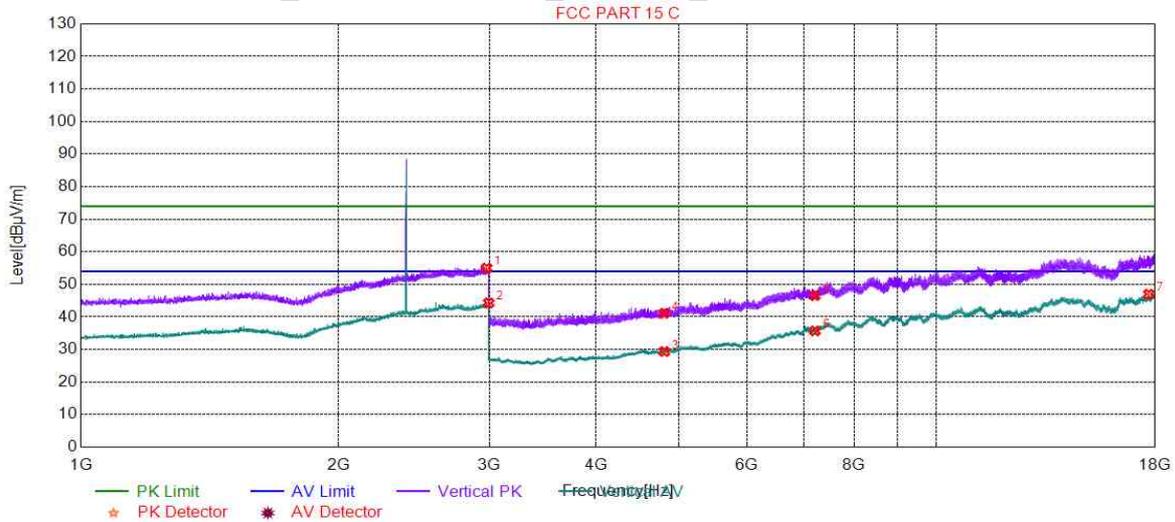
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2.9.2.7 GFSK _Lowest Channel_ Vertical_2M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2979.49	55.01	9.54	74.00	18.99	150	318	Vertical
2	2995.99	44.29	9.47	54.00	9.71	150	5	Vertical
3	4804.00	29.37	-18.30	54.00	24.63	150	217	Vertical
4	4804.00	41.11	-18.30	74.00	32.89	150	156	Vertical
5	7206.00	46.54	-10.09	74.00	27.46	150	183	Vertical
6	7206.00	35.71	-10.09	54.00	18.29	150	20	Vertical
7	17691.9	46.99	1.36	54.00	7.01	150	334	Vertical

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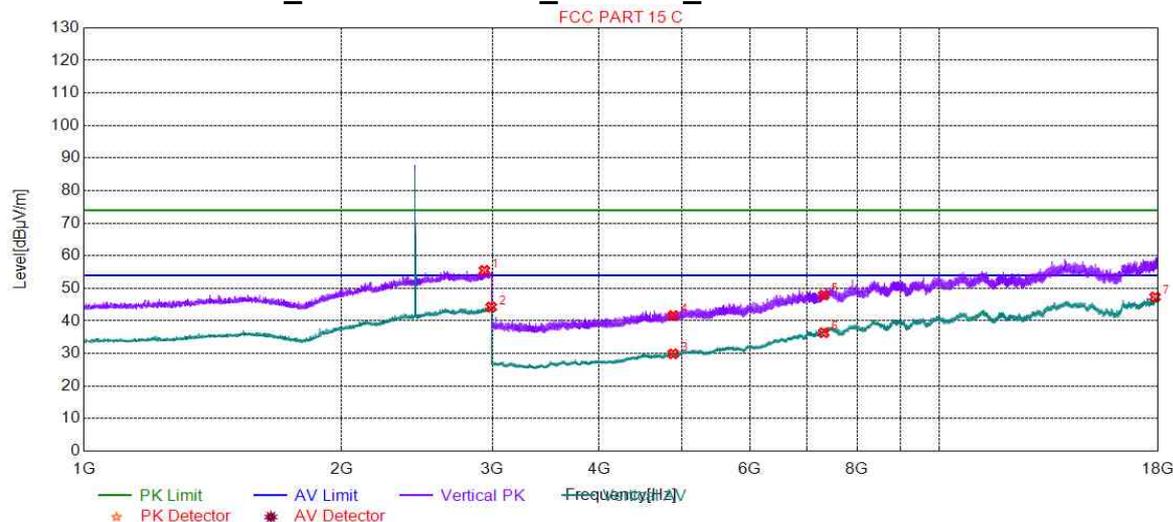
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2.9.2.8 GFSK _Middle Channel_ Vertical_2M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2936.98	55.52	9.54	74.00	18.48	150	334	Vertical
2	2991.49	44.27	9.49	54.00	9.73	150	158	Vertical
3	4880.00	29.89	-17.97	54.00	24.11	150	291	Vertical
4	4880.00	41.62	-17.97	74.00	32.38	150	140	Vertical
5	7320.00	47.90	-9.72	74.00	26.10	150	4	Vertical
6	7320.00	36.37	-9.72	54.00	17.63	150	107	Vertical
7	17843.2	47.34	-0.06	54.00	6.66	150	168	Vertical

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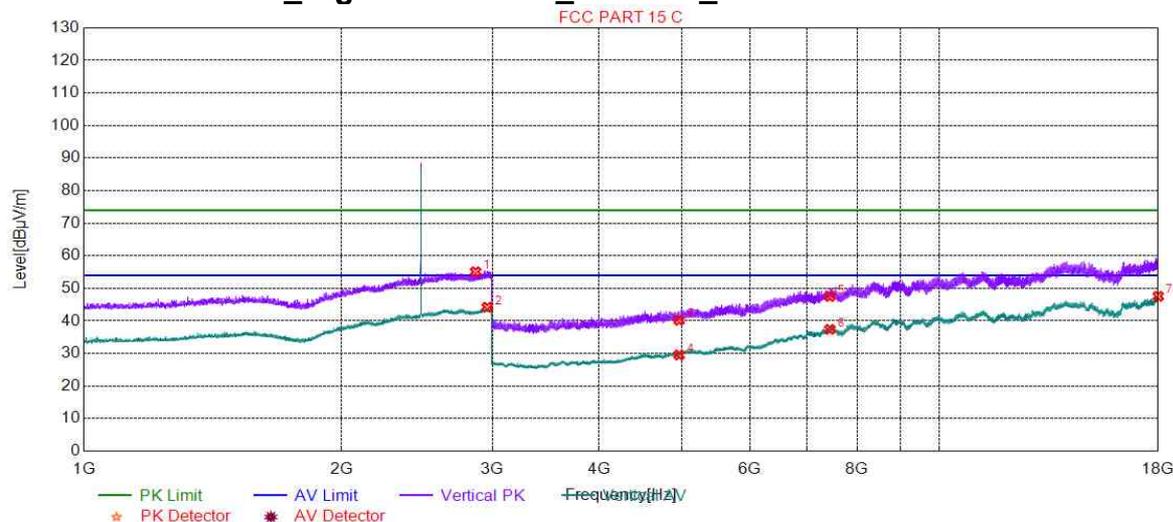
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2.9.2.9 GFSK _Highest Channel_ Vertical_2M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2868.46	55.11	9.20	74.00	18.89	150	338	Vertical
2	2960.49	44.22	9.63	54.00	9.78	150	0	Vertical
3	4960.00	40.19	-17.47	74.00	33.81	150	93	Vertical
4	4960.00	29.53	-17.47	54.00	24.47	150	18	Vertical
5	7440.00	47.52	-9.35	74.00	26.48	150	339	Vertical
6	7440.00	37.42	-9.35	54.00	16.58	150	230	Vertical
7	17998.3	47.57	0.72	54.00	6.43	150	67	Vertical

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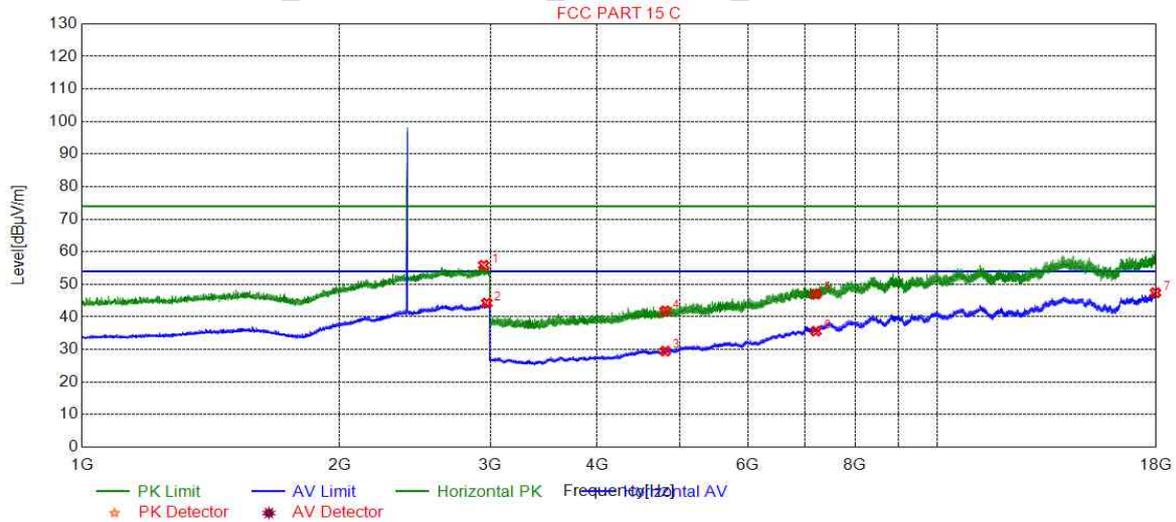
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2.9.2.10 GFSK _Lowest Channel_ Horizontal_2M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2947.98	55.87	9.66	74.00	18.13	150	20	Horizontal
2	2972.49	44.27	9.58	54.00	9.73	150	88	Horizontal
3	4804.00	29.49	-18.30	54.00	24.51	150	227	Horizontal
4	4804.00	41.87	-18.30	74.00	32.13	150	90	Horizontal
5	7206.00	46.98	-10.09	74.00	27.02	150	40	Horizontal
6	7206.00	35.64	-10.09	54.00	18.36	150	240	Horizontal
7	17960.3	47.42	0.71	54.00	6.58	150	190	Horizontal

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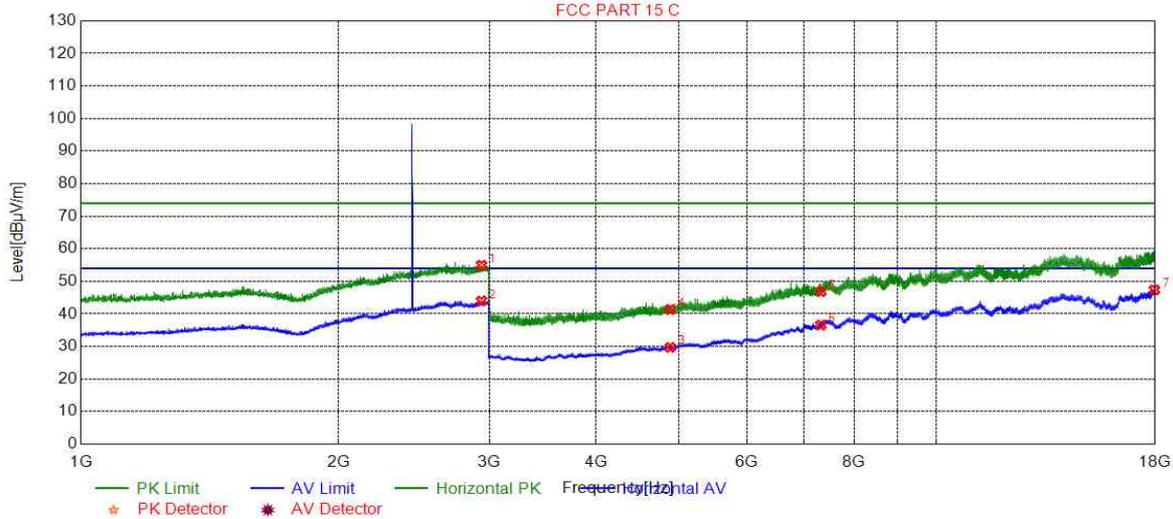
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2.9.2.11 GFSK_Middle Channel_Horizontal_2M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2937.48	54.98	9.54	74.00	19.02	150	98	Horizontal
2	2937.98	43.99	9.55	54.00	10.01	150	360	Horizontal
3	4880.00	29.72	-17.97	54.00	24.28	150	202	Horizontal
4	4880.00	41.35	-17.97	74.00	32.65	150	18	Horizontal
5	7320.00	46.83	-9.72	74.00	27.17	150	77	Horizontal
6	7320.00	36.57	-9.72	54.00	17.43	150	230	Horizontal
7	17963.1	47.37	0.71	54.00	6.63	150	332	Horizontal

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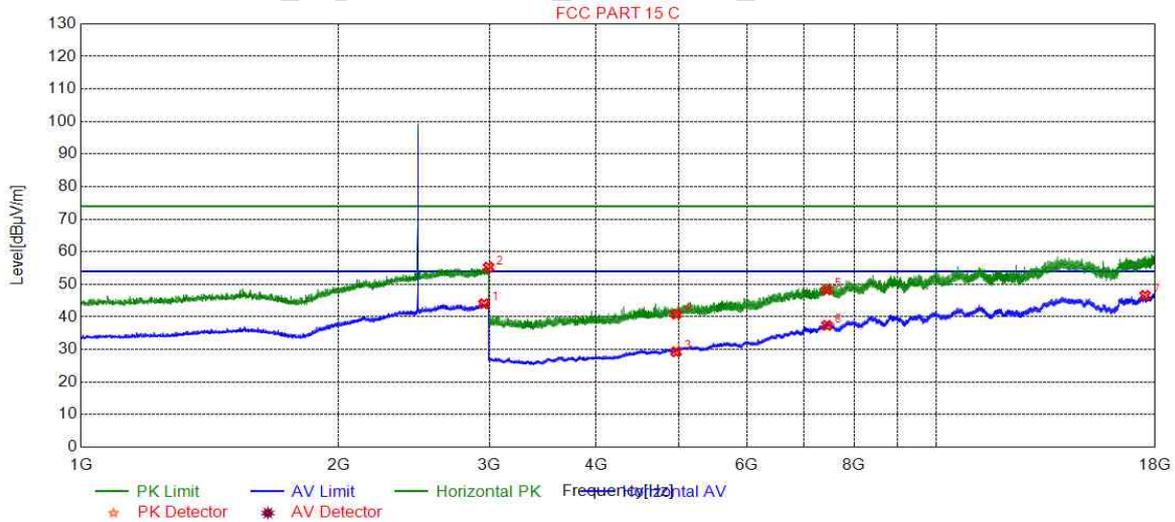
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2.9.2.12 GFSK _Highest Channel_ Horizontal_2M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2957.48	44.05	9.65	54.00	9.95	150	335	Horizontal
2	2994.49	55.29	9.48	74.00	18.71	150	272	Horizontal
3	4960.00	29.27	-17.47	54.00	24.73	150	357	Horizontal
4	4960.00	40.87	-17.47	74.00	33.13	150	241	Horizontal
5	7440.00	48.28	-9.35	74.00	25.72	150	43	Horizontal
6	7440.00	37.40	-9.35	54.00	16.60	150	151	Horizontal
7	17515.9	46.59	0.98	54.00	7.41	150	0	Horizontal

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

$$\text{Final Test Level} = \text{Receiver Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Preamplifier Factor}$$

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- 2) Scan from 9kHz to 25GHz, the disturbance between 9KHz to 30MHz was very low, and the above harmonics were the highest point could be found when testing, The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 3) As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.
- 4) All Modes have been tested, but only the worst case data displayed in this report.

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2.10 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10: 2013 Section 11.12		
Test Site:	Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)		
Limit:	Frequency	Limit (dBuV/m @3m)	Remark
	30MHz-88MHz	40.0	Quasi-peak Value
	88MHz-216MHz	43.5	Quasi-peak Value
	216MHz-960MHz	46.0	Quasi-peak Value
	960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz		54.0	Average Value
		74.0	Peak Value
Test Setup:			

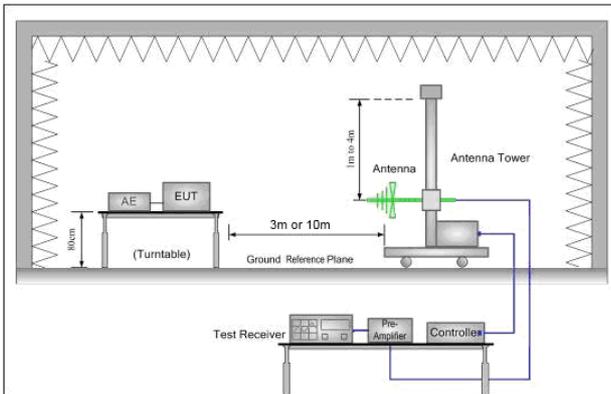


Figure 1. 30MHz to 1GHz

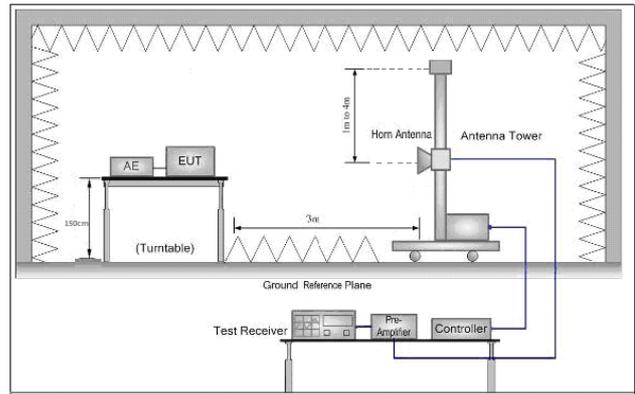


Figure 2. Above 1 GHz

Test Procedure:	<ol style="list-style-type: none"> For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
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	<p>g. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel</p> <p>h. Test the EUT in the lowest channel, the Highest channel</p> <p>i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.</p> <p>j. Repeat above procedures until all frequencies measured was complete.</p>
Exploratory Test Mode:	Transmitting with GFSK modulation. Charge + Transmitting mode.
Final Test Mode:	Transmitting with GFSK modulation. Pretest the EUT at Charge + Transmitting mode. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

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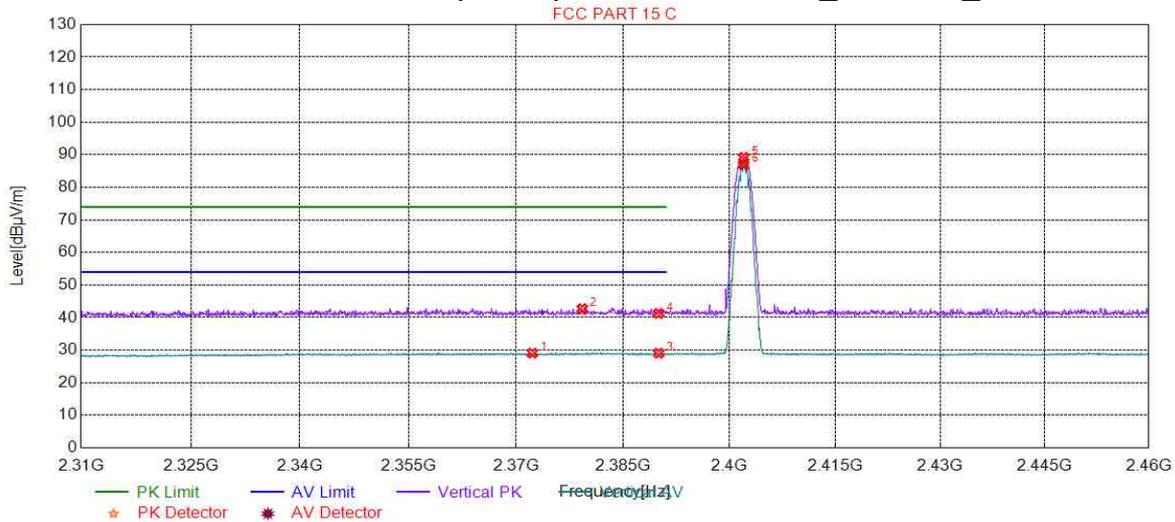
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2.10.1 Test plots

2.10.1.1 Worst Case Mode(GFSK) Lowest Channel_ Vertical_1M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2372.28	29.10	7.79	54.00	24.90	150	52	Vertical
2	2379.25	42.73	7.78	74.00	31.27	150	313	Vertical
3	2390.00	29.07	7.77	54.00	24.93	150	346	Vertical
4	2390.00	41.26	7.77	74.00	32.74	150	302	Vertical
5	2402.00	89.19	7.77	0.00	-89.19	150	334	Vertical
6	2402.00	86.94	7.77	0.00	-86.94	150	186	Vertical

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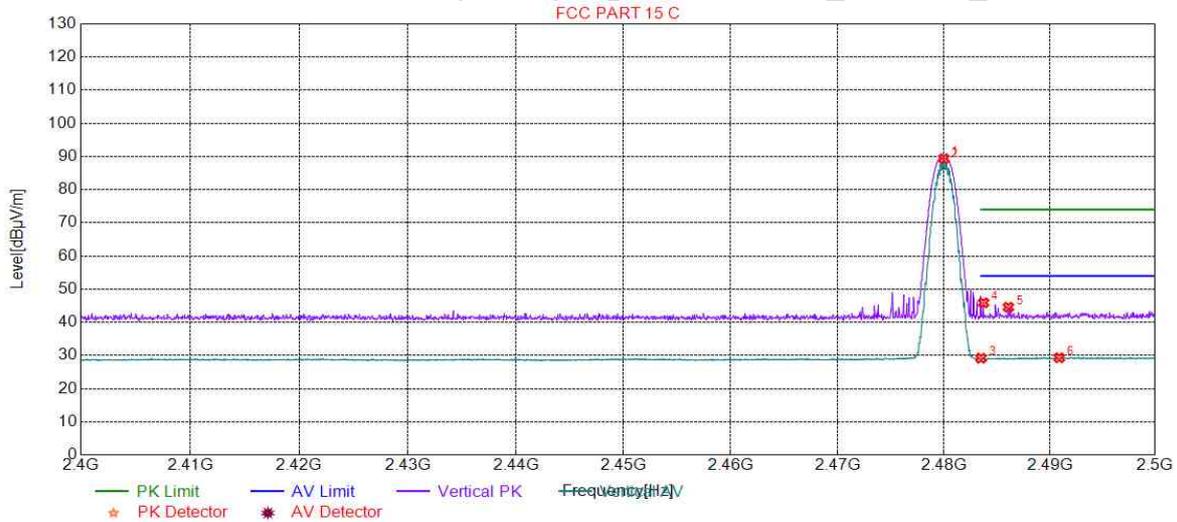
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2.10.1.2 Worst Case Mode(GFSK) Highest Channel_ Vertical_1M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2480.00	89.37	8.01	0.00	-89.37	150	181	Vertical
2	2480.00	88.93	8.01	0.00	-88.93	150	181	Vertical
3	2483.50	29.20	8.01	54.00	24.80	150	181	Vertical
4	2483.74	45.90	8.01	74.00	28.10	150	340	Vertical
5	2486.09	44.59	8.01	74.00	29.41	150	296	Vertical
6	2490.89	29.35	8.02	54.00	24.65	150	257	Vertical

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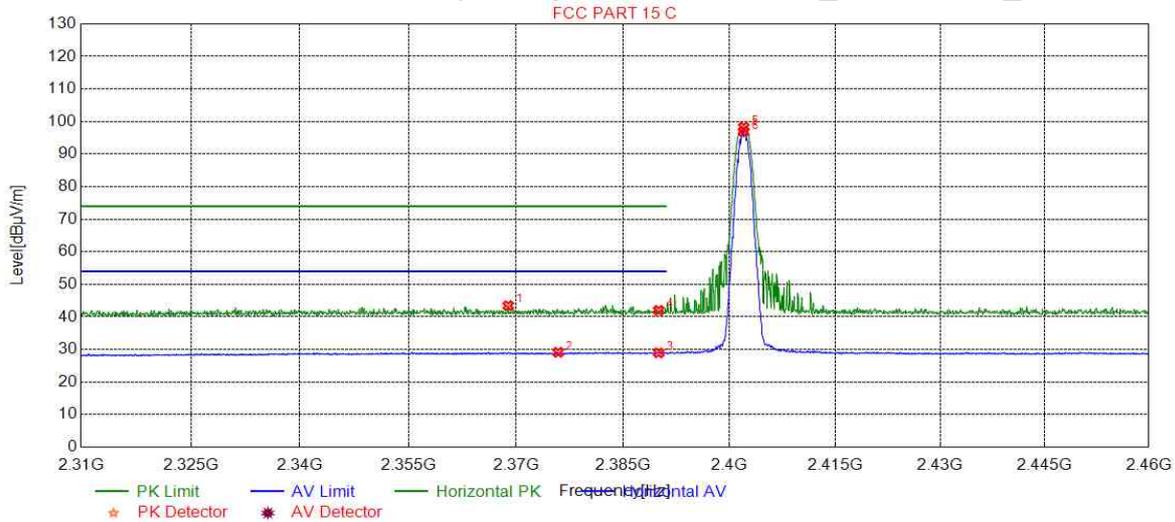
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2.10.1.3 Worst Case Mode(GFSK) Lowest Channel_ Horizontal_1M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2368.90	43.46	7.79	74.00	30.54	150	232	Horizontal
2	2375.88	29.12	7.78	54.00	24.88	150	15	Horizontal
3	2390.00	28.95	7.77	54.00	25.05	150	210	Horizontal
4	2390.00	42.01	7.77	74.00	31.99	150	160	Horizontal
5	2402.00	98.29	7.77	0.00	-98.29	150	226	Horizontal
6	2402.00	96.91	7.77	0.00	-96.91	150	226	Horizontal

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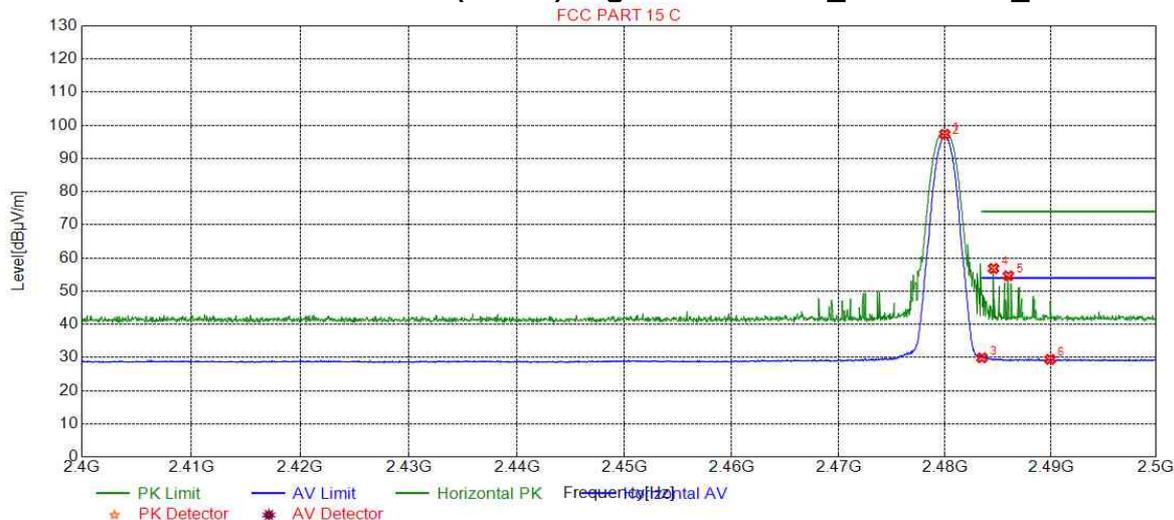
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2.10.1.4 Worst Case Mode(GFSK) Highest Channel_ Horizontal_1M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2480.00	97.31	8.01	0.00	-97.31	150	226	Horizontal
2	2480.00	96.41	8.01	0.00	-96.41	150	215	Horizontal
3	2483.50	29.94	8.01	54.00	24.06	150	232	Horizontal
4	2484.59	56.86	8.01	74.00	17.14	150	198	Horizontal
5	2485.99	54.65	8.01	74.00	19.35	150	198	Horizontal
6	2489.94	29.45	8.02	54.00	24.55	150	137	Horizontal

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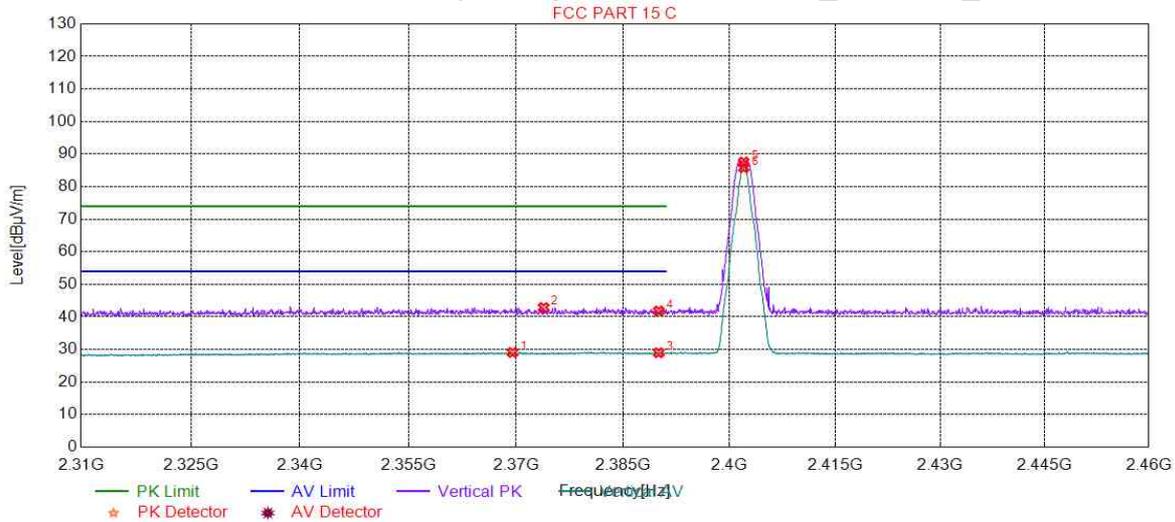
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2.10.1.5 Worst Case Mode(GFSK) Lowest Channel_ Vertical_2M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2369.50	29.08	7.79	54.00	24.92	150	281	Vertical
2	2373.85	42.90	7.79	74.00	31.10	150	281	Vertical
3	2390.00	29.00	7.77	54.00	25.00	150	172	Vertical
4	2390.00	41.84	7.77	74.00	32.16	150	281	Vertical
5	2402.00	87.56	7.77	0.00	-87.56	150	197	Vertical
6	2402.00	85.84	7.77	0.00	-85.84	150	98	Vertical

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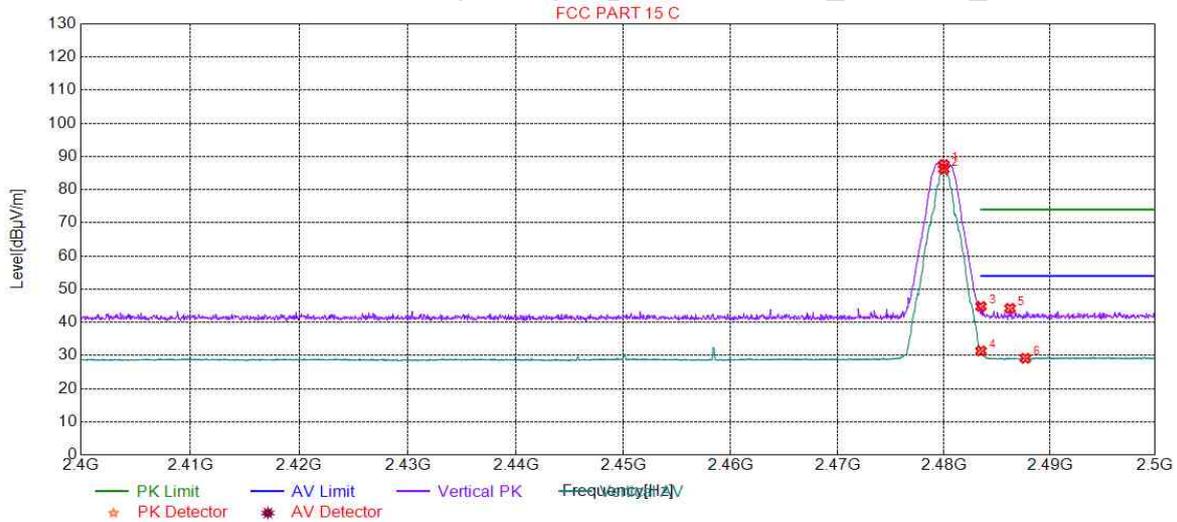
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2.10.1.6 Worst Case Mode(GFSK) Highest Channel_ Vertical_2M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2480.00	87.57	8.01	0.00	-87.57	150	3	Vertical
2	2480.00	86.25	8.01	0.00	-86.25	150	3	Vertical
3	2483.50	44.79	8.01	74.00	29.21	150	33	Vertical
4	2483.50	31.39	8.01	54.00	22.61	150	3	Vertical
5	2486.24	44.24	8.01	74.00	29.76	150	97	Vertical
6	2487.69	29.18	8.02	54.00	24.82	150	251	Vertical

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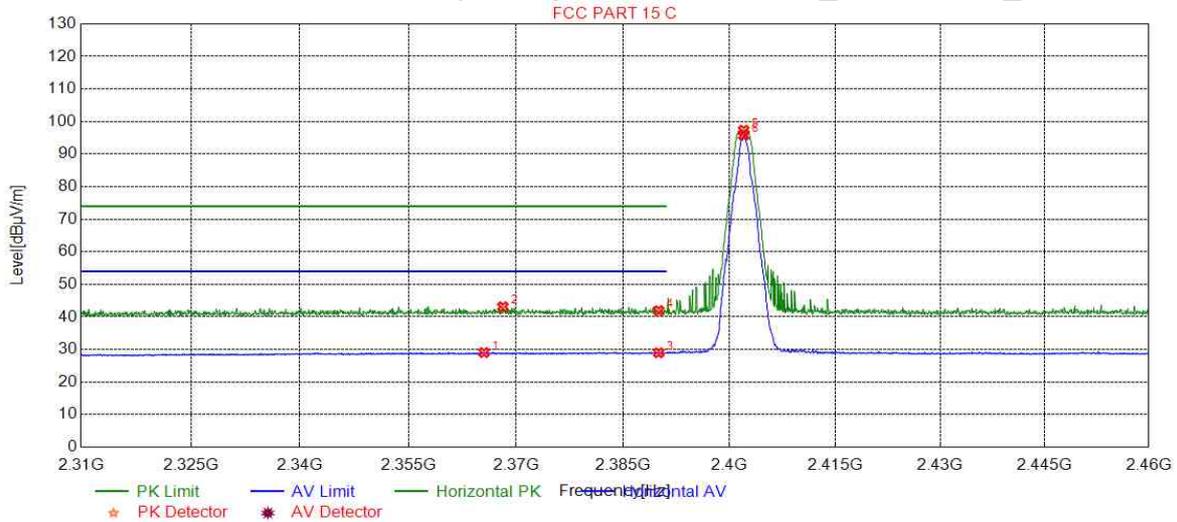
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2.10.1.7 Worst Case Mode(GFSK) Lowest Channel_ Horizontal_2M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2365.52	29.05	7.79	54.00	24.95	150	222	Horizontal
2	2368.15	43.14	7.79	74.00	30.86	150	222	Horizontal
3	2390.00	28.97	7.77	54.00	25.03	150	228	Horizontal
4	2390.00	41.94	7.77	74.00	32.06	150	340	Horizontal
5	2402.00	97.35	7.77	0.00	-97.35	150	228	Horizontal
6	2402.00	95.76	7.77	0.00	-95.76	150	228	Horizontal

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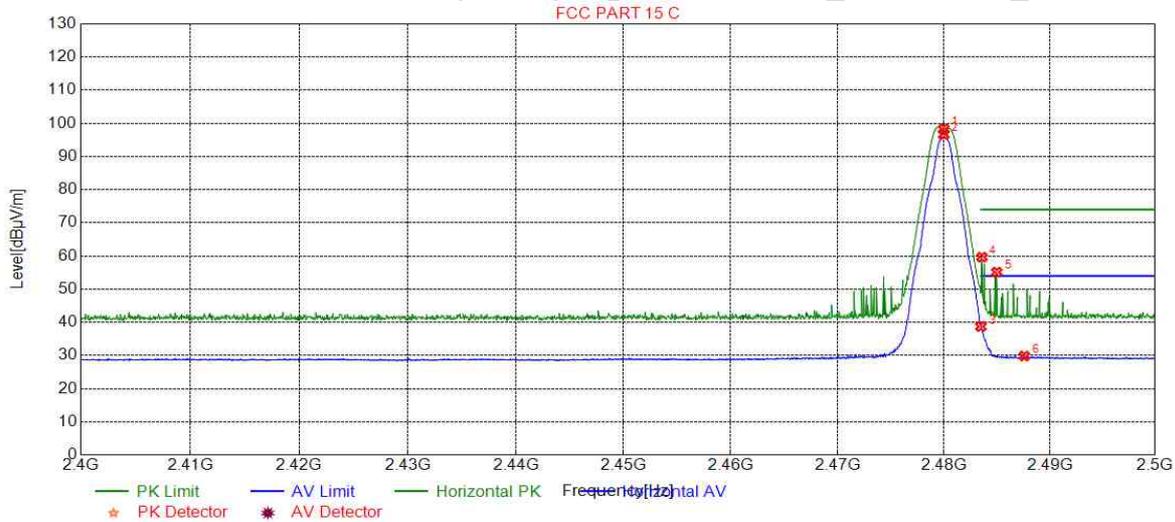
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2.10.1.8 Worst Case Mode(GFSK) Highest Channel_ Horizontal_2M



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2480.00	98.36	8.01	0.00	-98.36	150	233	Horizontal
2	2480.00	96.65	8.01	0.00	-96.65	150	233	Horizontal
3	2483.50	38.75	8.01	54.00	15.25	150	233	Horizontal
4	2483.59	59.67	8.01	74.00	14.33	150	360	Horizontal
5	2484.99	55.17	8.01	74.00	18.83	150	360	Horizontal
6	2487.59	29.85	8.02	54.00	24.15	150	233	Horizontal

Remark:

The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

$$\text{Final Test Level} = \text{Receiver Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Preamplifier Factor}$$

All Modes have been tested, but only the worst case data displayed in this report.

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3 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	±0.75dB
2	Duty cycle	± 0.37%
3	Occupied Bandwidth	± 0.2%
4	RF power density, conducted	±2.84dB
5	Spurious emissions, conducted	±0.75dB
6	Radiated Spurious emission test	±4.8dB (30MHz-1GHz)
		±5.2dB (1GHz-6GHz)
		±5.5dB (6GHz-18GHz)
		±5.02dB (18GHz-40GHz)
7	Conduct emission test	±3.4 dB (9KHz- 30MHz)

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4 Equipment List

BT&WIFI Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
MXA signal analyzer	Agilent	N9020A	XAW01-06-07	2020-04-16	2021-04-15
MXG vector signal Generator	Agilent	N5182B	XAW01-07-16	2020-04-16	2021-04-15
MXG vector signal Generator	Agilent	N5181A	XAW01-07-17	2020-04-16	2021-04-15
Measurement Software	Tonscend	JS1120-3	XAW02-13-02	NCR	NCR
RF control unit	Tonscend	JS0806-2	XAW03-37-01	NCR	NCR
Temperature and humidity meter	MingGao	TH101B	XAW01-01-02	2019-11-28	2020-11-28
temperature chamber	Votsch	VT4002	XAW01-18-01	2020-06-28	2021-06-28
power supply	Agilent	66311B	XAW01-17-01	2020-06-20	2021-06-20
RE in Chamber					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Semi-Anechoic Chamber	Brilliant-emc	966	XAW03-35-01	NCR	NCR
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2020-04-02	2021-04-02
Radio communication analyzer	ROHDE&SCHWARZ	CMW 500	XAW01-03-02	2020-04-02	2021-04-02
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2019-09-07	2020-09-06
Receiving antenna	Rosenberger	VULB 9163	XAW01-09-01	2019-10-13	2021-10-12
Receiving antenna	Rosenberger	BBHA 9120D	XAW01-09-02	2019-10-13	2021-10-12
Receiving antenna	Rosenberger	BBHA 9170	XAW01-09-03	2019-10-13	2021-10-12
Directional antenna rack controller	Max-Full	MF-7802BS	XAW03-03-01	NCR	NCR
High-speed antenna rack controller	Max-Full	MF-7802	XAW03-04-01	NCR	NCR
Filter bank	Tonscend	JS0806-F	XAW03-05-01	NCR	NCR
Filter bank	Tonscend	JS0806s	XAW03-05-02	NCR	NCR
Amplifier	Tonscend	TAP00903040	XAW01-41-01	2019-11-18	2020-11-18
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2019-11-18	2020-11-18
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2019-12-03	2020-12-03
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2019-11-18	2020-11-18
5G UXM	Keysight	E7515B	XAW01-04-01	2019-09-04	2020-09-03
Temperature and humidity meter	MingGao	TH101B	XAW01-01-01	2019-11-28	2020-11-28
Measurement Software	Tonscend	TS+ RSE&RE	XAW02-05-01	NCR	NCR
Measurement Software	Tonscend	TS+ CE	XAW02-05-02	NCR	NCR

5 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for ZR/2020/60015.

The End

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