

FCC TEST REPORT

Application No: ZR/2020/B0030
Applicant: Sony Mobile Communications, Inc.
Address of Applicant: 4-12-3 Higashi-shinagawa, Shinagawa-ku, Tokyo, 140-0002, Japan
Manufacturer: Sony Mobile Communications, Inc.
Address of Manufacturer: 4-12-3 Higashi-shinagawa, Shinagawa-ku, Tokyo, 140-0002, Japan
EUT Description: GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac, GPS and NFC
Trade Mark: Sony
FCC ID: PY7-10933K
Standards: 47 CFR FCC Part 2, Subpart J
 47 CFR Part 15, Subpart C
 KDB 558074 D01 DTS Meas Guidance v0502
Test Method
 ANSI C63.4(2014)
 ANSI C63.10 (2013)
Date of Receipt: 2020/11/19
Date of Test: 2020/11/19 to 2020/12/18
Date of Issue: 2021/7/4

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

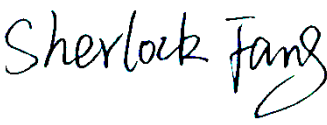



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1 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2020/12/20		Original
02		2021/5/15	Sherlock Fang	1.Add test site Information 2.Modify data conversion error of antenna height 3.Update equipment list

*This report supersedes our previous report ZR/2020/B0003003, issued on 2020-12-20, which is hereby deemed null and void.

Authorized for issue by:	
Prepared By	 _____ (Sherlock Fang) / Engineer
Checked By	 _____ (Jim Huang) / Reviewer



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2 Test Summary

Test Item	Test Requirement	Test Method	Test Result	Result	Test Lab*
AC Power Line Conducted Emission	15.207	ANSI C63.10 (2013)	Clause 4.3	PASS	B
Conducted Peak Output Power	15.247 (b)(1)	ANSI C63.10 (2013)	Clause 4.5	PASS	A
20dB Emission Bandwidth	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.6	PASS	A
Carrier Frequencies Separation	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.7	PASS	A
Hopping Channel Number	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.8	PASS	A
Dwell Time	15.247 (a)(1)	ANSI C63.10 (2013)	Clause 4.9	PASS	A
Band-edge for RF Conducted Emissions	15.247(d)	ANSI C63.10 (2013)	Clause 4.10	PASS	A
RF Conducted Spurious Emissions	15.247(d)	ANSI C63.10 (2013)	Clause 4.11	PASS	A
Radiated Spurious emissions	15.247(d); 15.205/15.209	ANSI C63.10 (2013)	Clause 4.12	PASS	B
Restricted bands around fundamental frequency (Radiated Emission)	15.247(d); 15.205/15.209	ANSI C63.10 (2013)	Clause 4.13	PASS	B

Remark: All test were performed by Lab A and B.

Parts of test items above were subcontracted to Lab B.

Lab A SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

Lab B SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD.



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3 General Information

3.1 Client Information

Applicant:	Sony Mobile Communications, Inc.
Address of Applicant:	4-12-3 Higashi-shinagawa, Shinagawa-ku, Tokyo, 140-0002, Japan
Manufacturer:	Sony Mobile Communications, Inc.
Address of Manufacturer:	4-12-3 Higashi-shinagawa, Shinagawa-ku, Tokyo, 140-0002, Japan

3.2 Test Location

Lab A:

Company:	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Address:	No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China
Post code:	518057
Test Engineer	Dee Zheng, Mike Hu

Lab B:

Company:	SGS-CSTC STANDARDS TECHNICAL SERVICES (XI 'AN) CO., LTD.
Address:	1/F, Unit D, Building 1, Kanghong Orange Technology Park, No.137, Keyuan 3rd Road, Fengdong New City, Xi'an, Shaanxi China
Post code:	710086
Test Engineer	Ben Huang, Lean Chen



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3.3 Test Facility

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

Lab A:

• A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

• VCCI

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

• FCC –Designation Number: CN1178

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1178. Test Firm Registration Number: 406779.

• Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.

Lab B:

A2LA (Certificate No. 4854.01)

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

FCC-Designation Number: CN1271.



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3.4 General Description of EUT

EUT Description:	GSM/WCDMA/LTE Phone with BT, DTS/UNII a/b/g/n/ac, GPS and NFC
Trade Mark:	Sony
S/N:	001265ADNVM2
Operation Frequency:	2402MHz~2480MHz $f_c = 2402 \text{ MHz} + N * 2 \text{ MHz}$, where: - f_c = "Operating Frequency" in MHz, - N = "Channel Number" with the range from 0 to 39.
Bluetooth Version:	Bluetooth V5.0
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:	-3.0dBi

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

3.5 Test Environment



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

3.6 Description of Support Units

The EUT has been tested independent unit.



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4 Test results and Measurement Data

4.1 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 -3.0dBi.</p>	



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4.2 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>



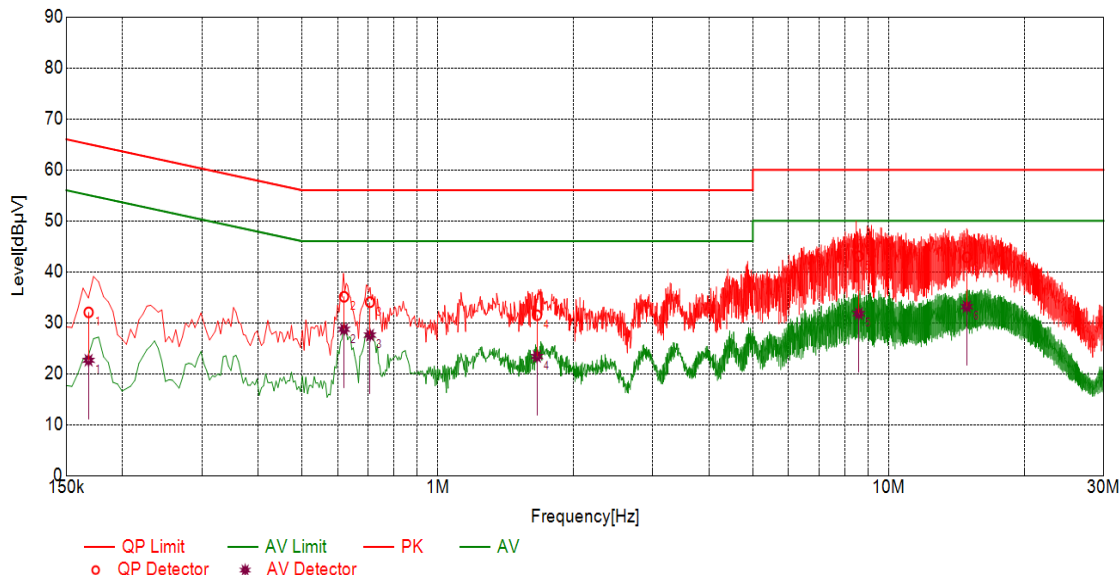
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Measurement Data

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:

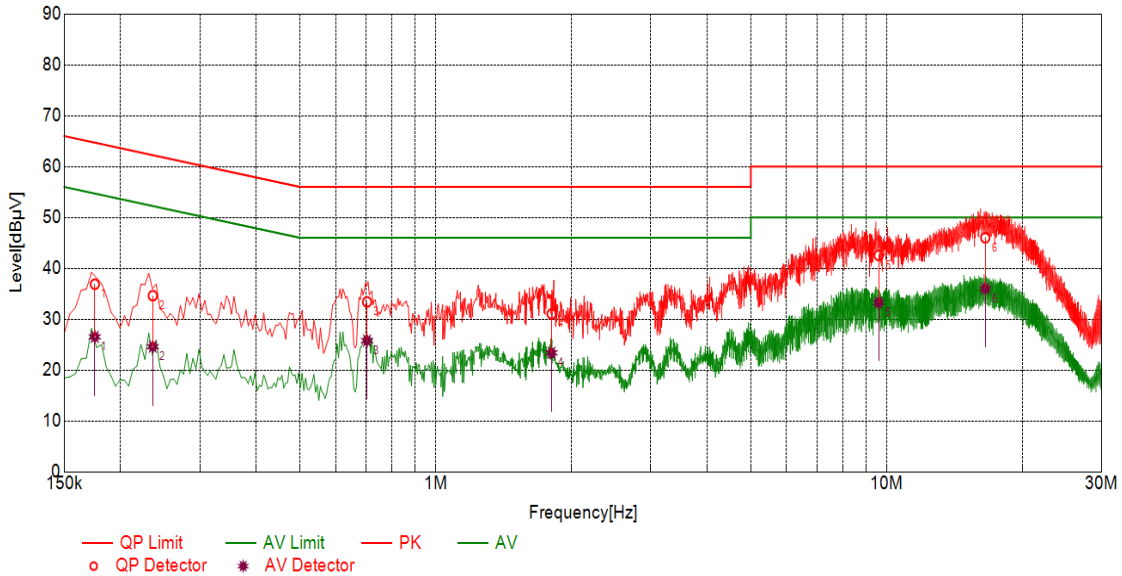


Final Data List									
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]	Type
1	0.1682	10.10	32.04	65.05	33.01	22.64	55.05	32.41	L
2	0.6199	10.10	35.10	56.00	20.90	28.71	46.00	17.29	L
3	0.7077	10.10	34.04	56.00	21.96	27.58	46.00	18.42	L
4	1.6602	10.10	31.48	56.00	24.52	23.38	46.00	22.62	L
5	8.5887	10.10	43.07	60.00	16.93	31.80	50.00	18.20	L
6	14.9100	10.11	42.85	60.00	17.15	33.16	50.00	16.84	L



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Neutral line:



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	0.1754	10.10	36.87	64.70	27.83	26.52	54.70	28.18	N
2	0.2358	10.10	34.63	62.24	27.61	24.60	52.24	27.64	N
3	0.7043	10.10	33.40	56.00	22.60	25.80	46.00	20.20	N
4	1.8067	10.10	31.03	56.00	24.97	23.39	46.00	22.61	N
5	9.6018	10.10	42.55	60.00	17.45	33.27	50.00	16.73	N
6	16.5513	10.11	46.01	60.00	13.99	36.01	50.00	13.99	N

Remarks:

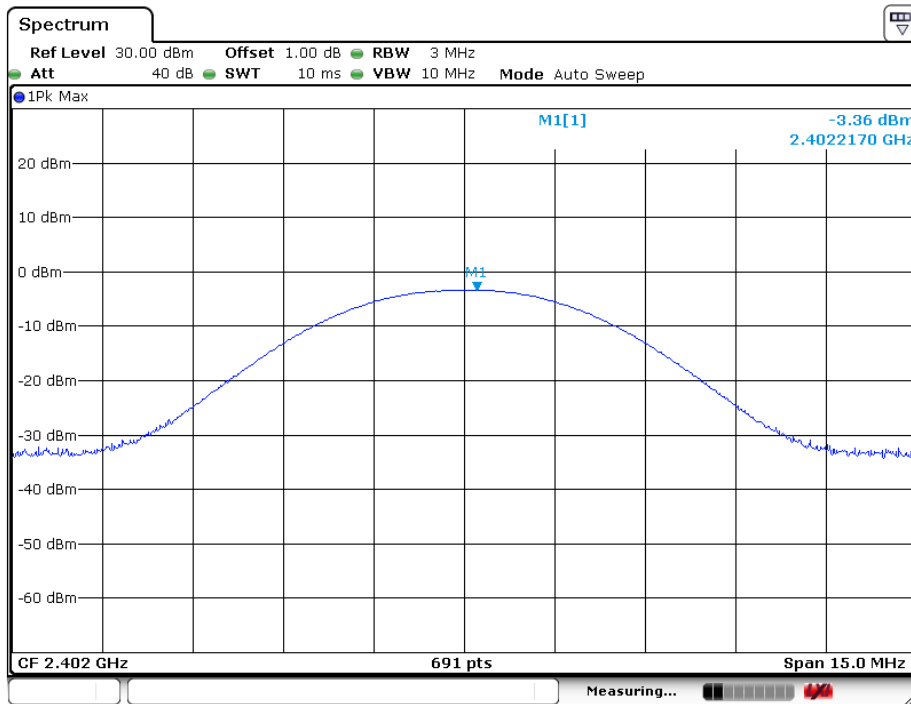
1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level = Receiver Reading + LISN Factor + Cable Loss.



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4.3.2 Test plots:

4.3.2.1 GFSK _1M_ Lowest Channel



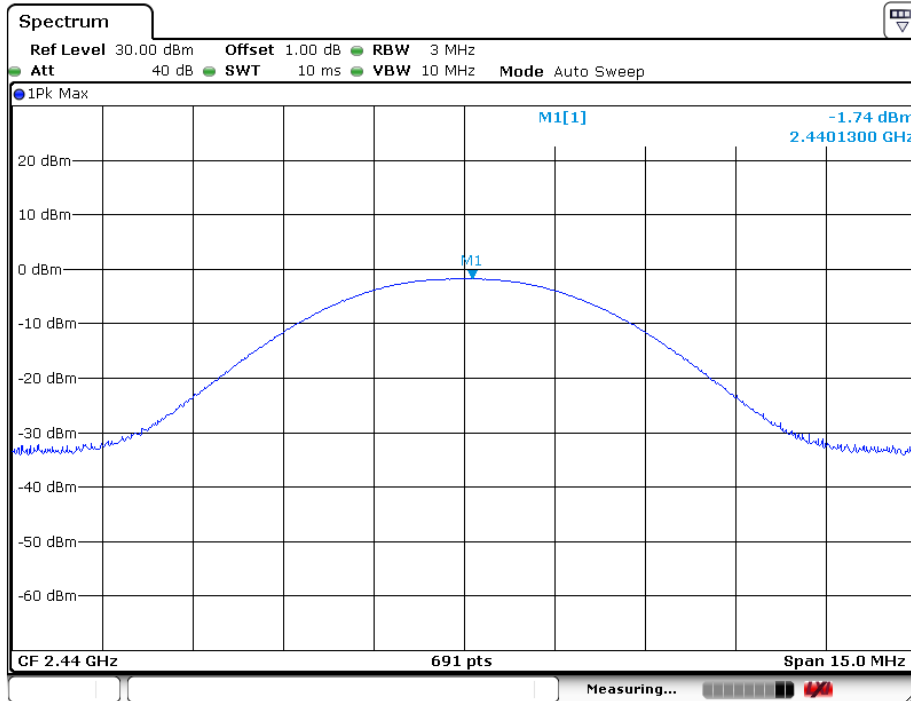
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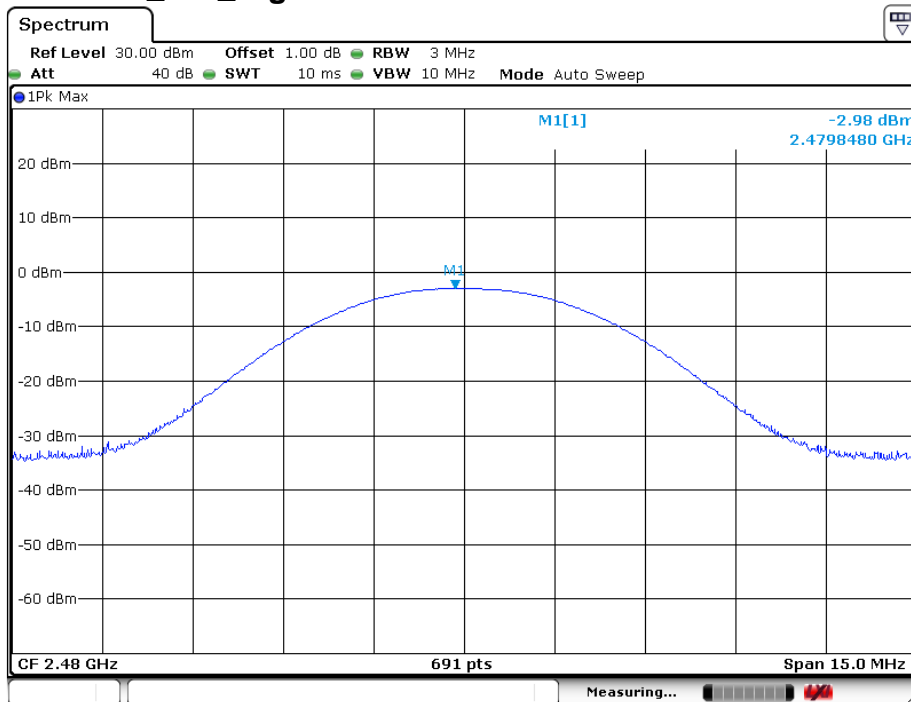
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4.3.2.2 GFSK _1M _Middle Channel



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4.3.2.3 GFSK _1M _Highest Channel



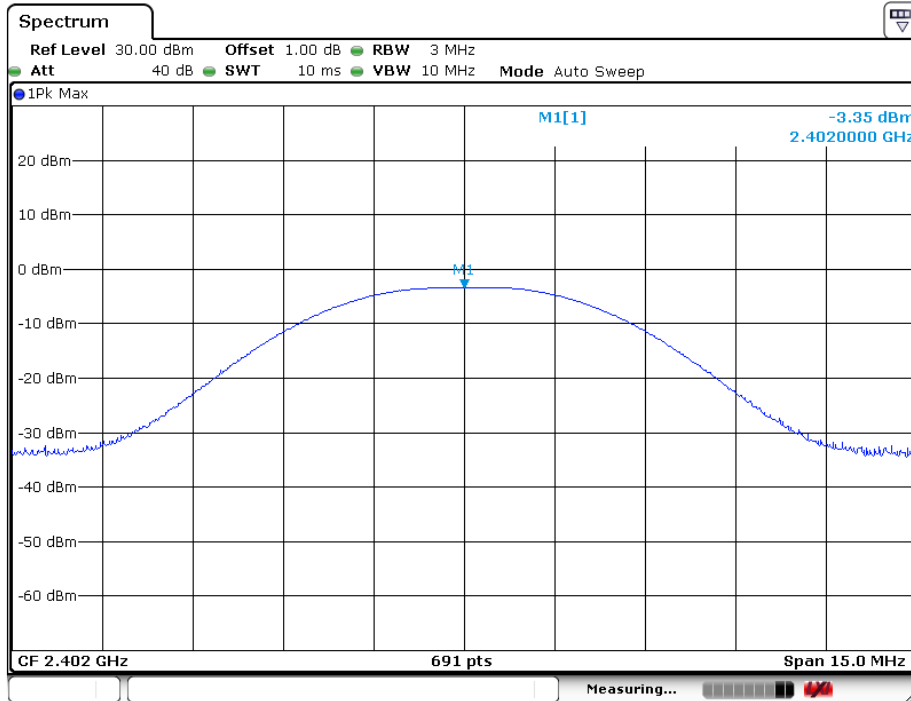
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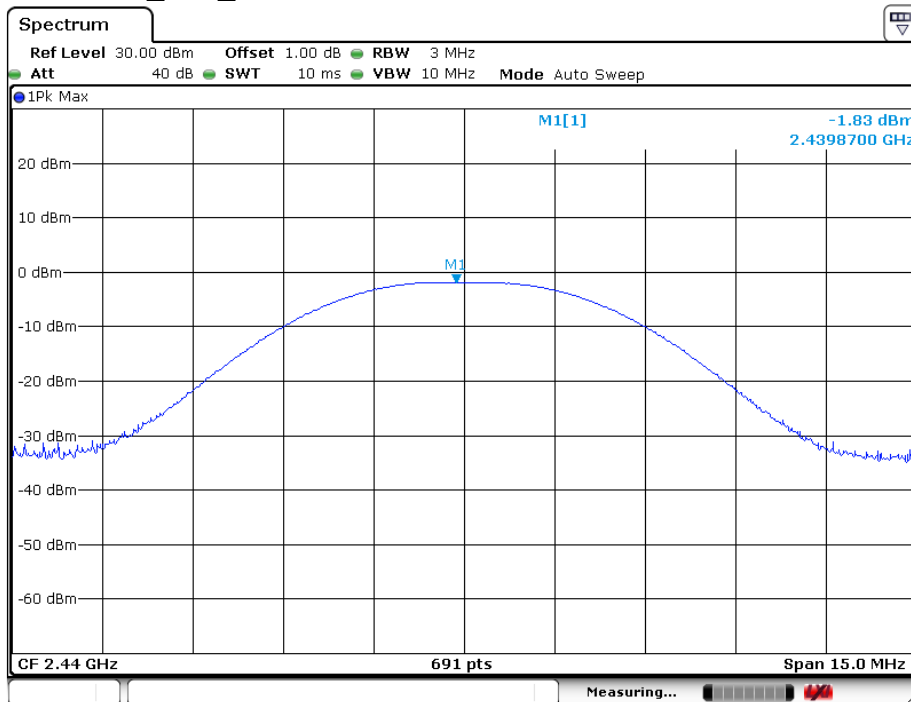
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4.3.2.4 GFSK_2M_Lowest Channel



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4.3.2.5 GFSK_2M_Middle Channel



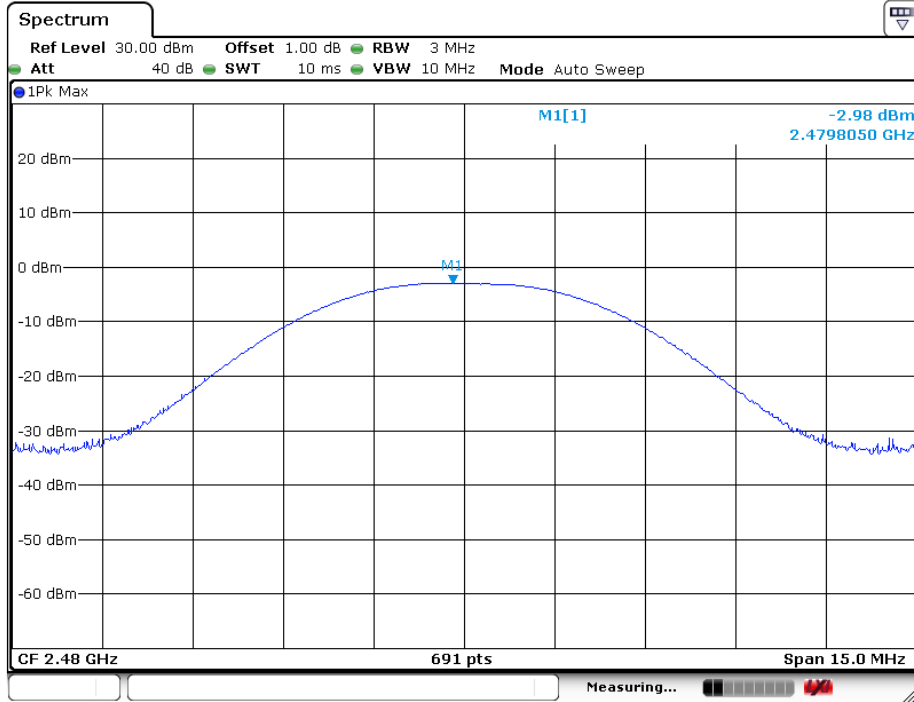
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4.3.2.6 GFSK _2M _Highest Channel



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4.4 DTS (6 dB) 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

4.4.1 Test Results

Mode	Test Channel	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
GFSK_1M	Lowest	0.68	≥500	Pass
	Middle	0.67	≥500	Pass
	Highest	0.68	≥500	Pass

Mode	Test Channel	6dB Emission Bandwidth (MHz)	Limit (kHz)	Result
GFSK_2M	Lowest	1.17	≥500	Pass
	Middle	1.23	≥500	Pass
	Highest	1.22	≥500	Pass

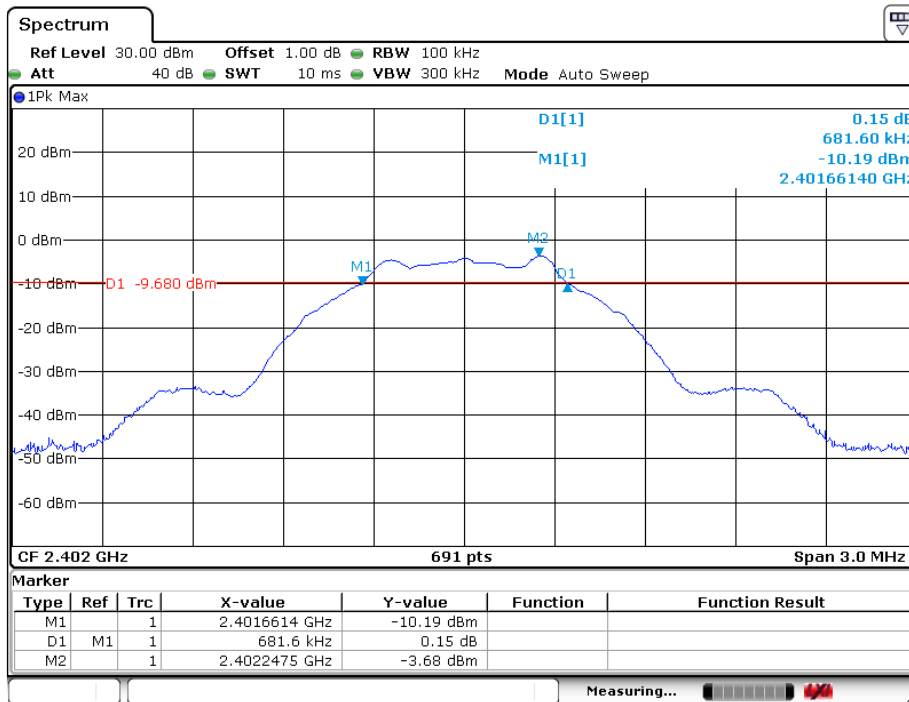


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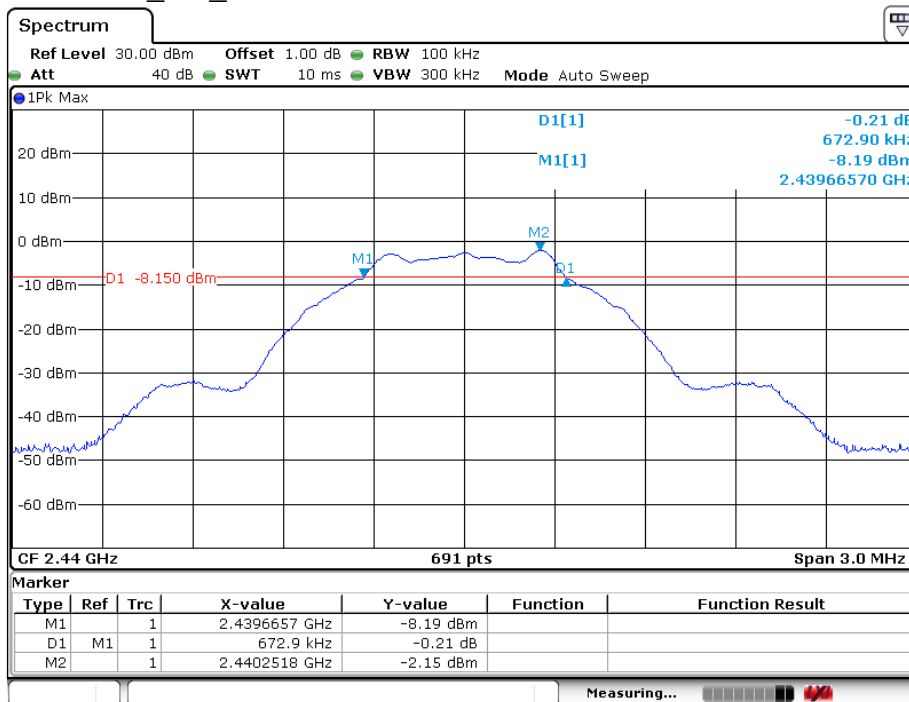
4.4.2 Test plots

4.4.2.1 GFSK_1M Lowest Channel



Date: 1.DEC.2020 14:14:40

4.4.2.2 GFSK_1M_Middle Channel

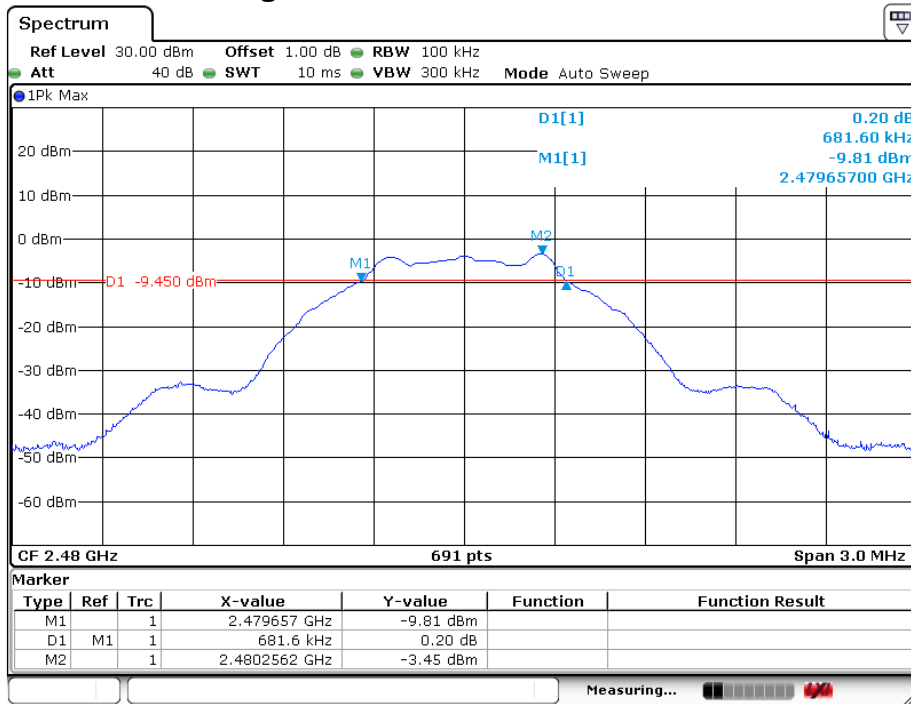


Date: 1.DEC.2020 14:15:17



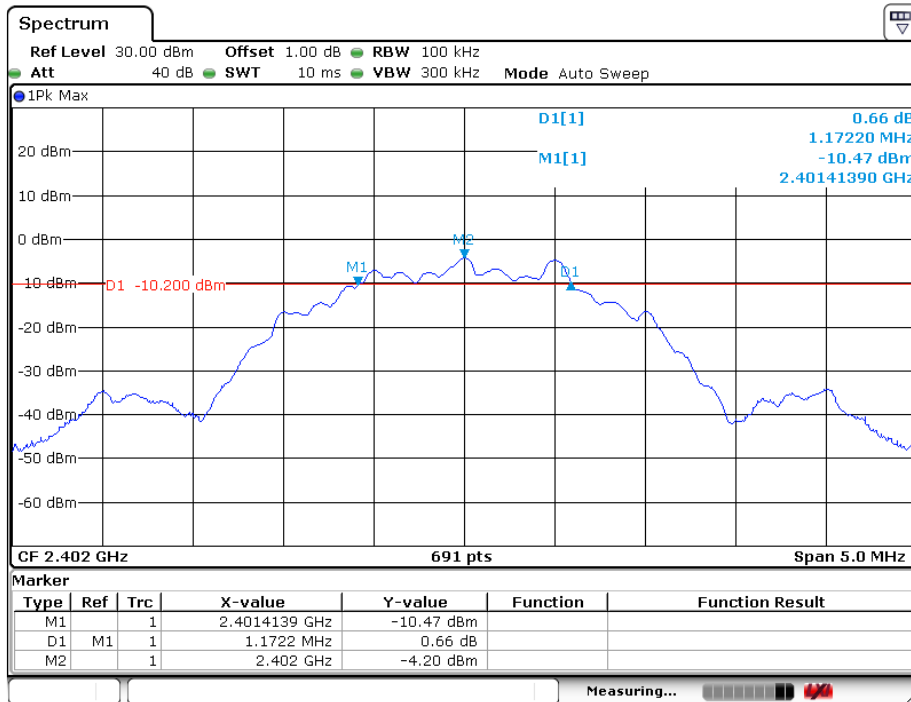
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4.4.2.3 GFSK_1M_Highest Channel



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4.4.2.4 GFSK_2M Lowest Channel

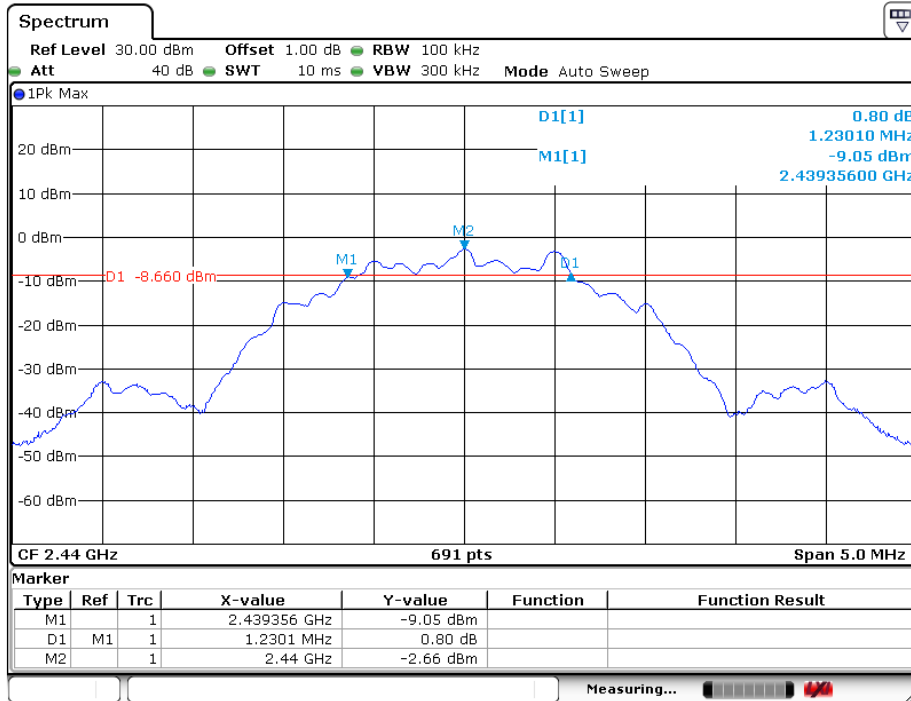


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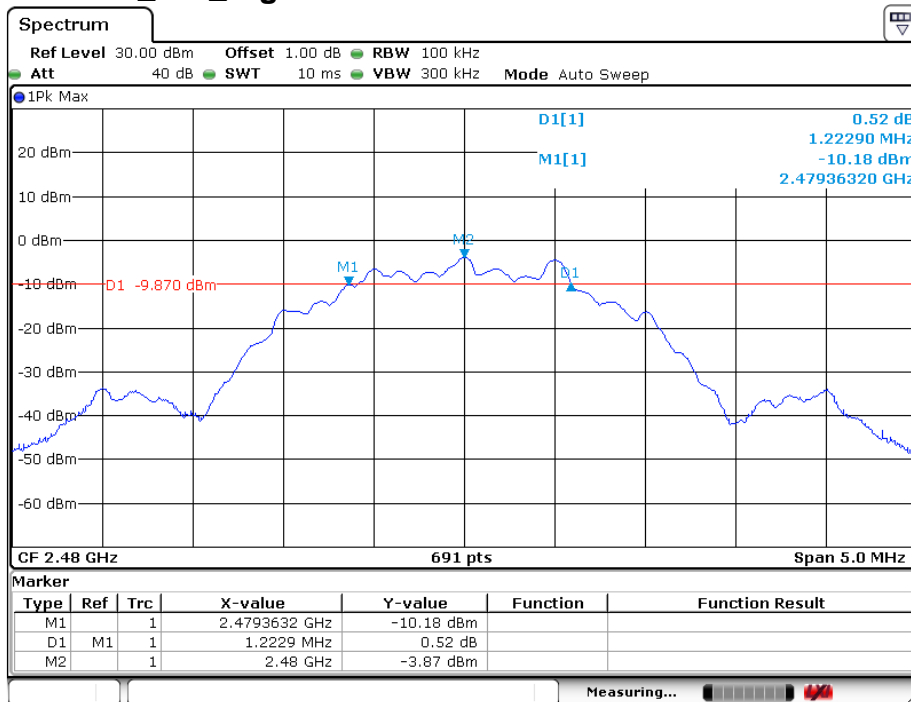
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4.4.2.5 GFSK 2M_Middle Channel



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4.4.2.6 GFSK 2M_Highest Channel



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4.5 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:	
Limit:	≤8.00dBm/3kHz
Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

4.5.1 Test Results

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
GFSK_1M	Lowest	-3.36	≤8.00	Pass
	Middle	-1.74	≤8.00	Pass
	Highest	-2.98	≤8.00	Pass

Mode	Test Channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
GFSK_2M	Lowest	-3.35	≤8.00	Pass
	Middle	-1.83	≤8.00	Pass
	Highest	-2.98	≤8.00	Pass

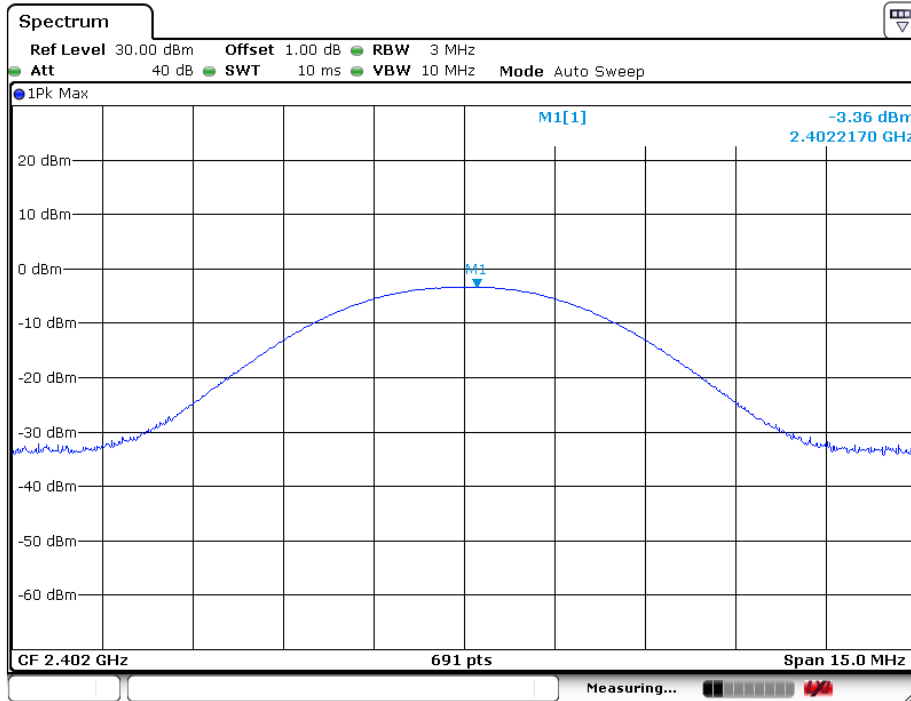


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4.5.2 Test plots

4.5.2.1 GFSK _1M_ Lowest Channel



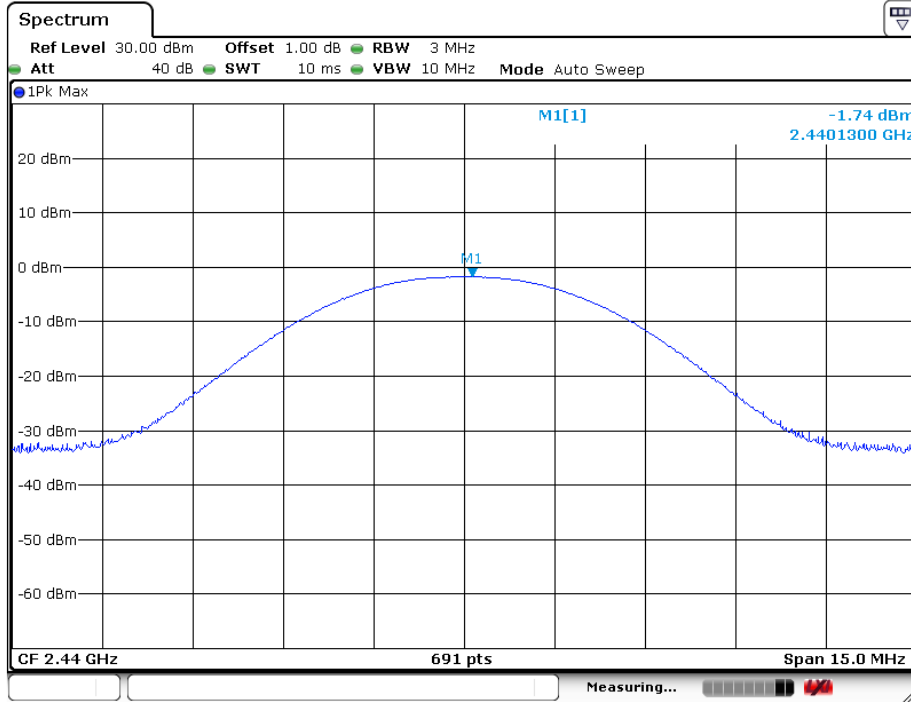
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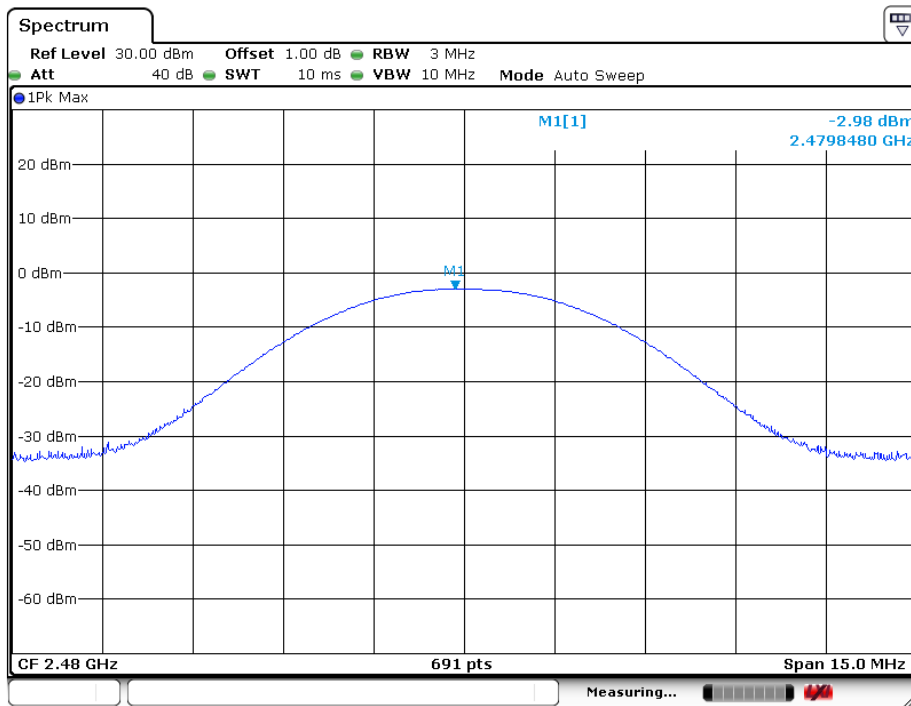
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4.5.2.2 GFSK _1M _Middle Channel



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4.5.2.3 GFSK _1M _Highest Channel



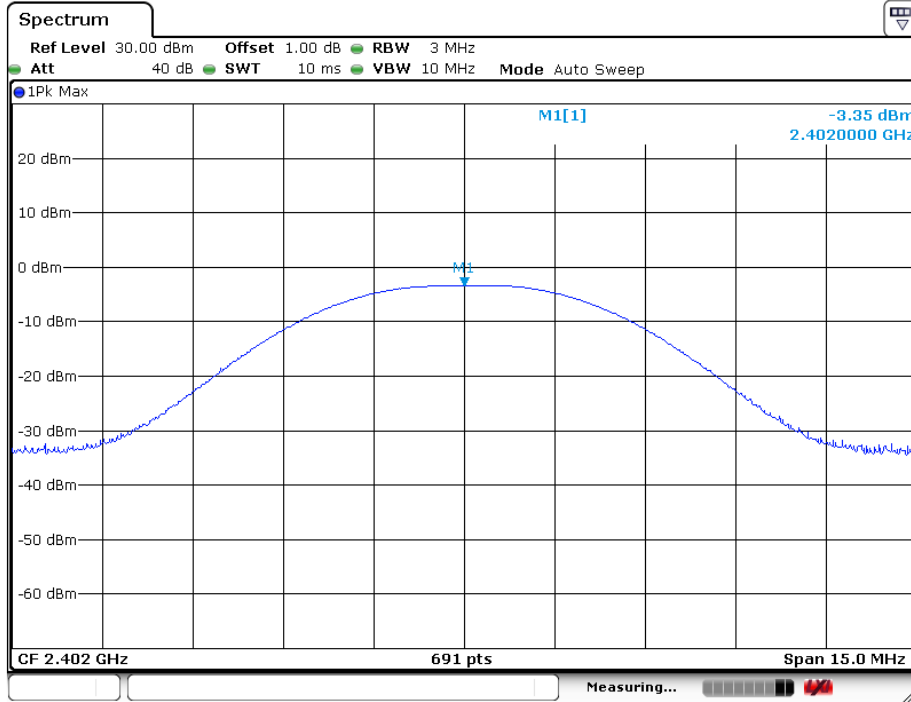
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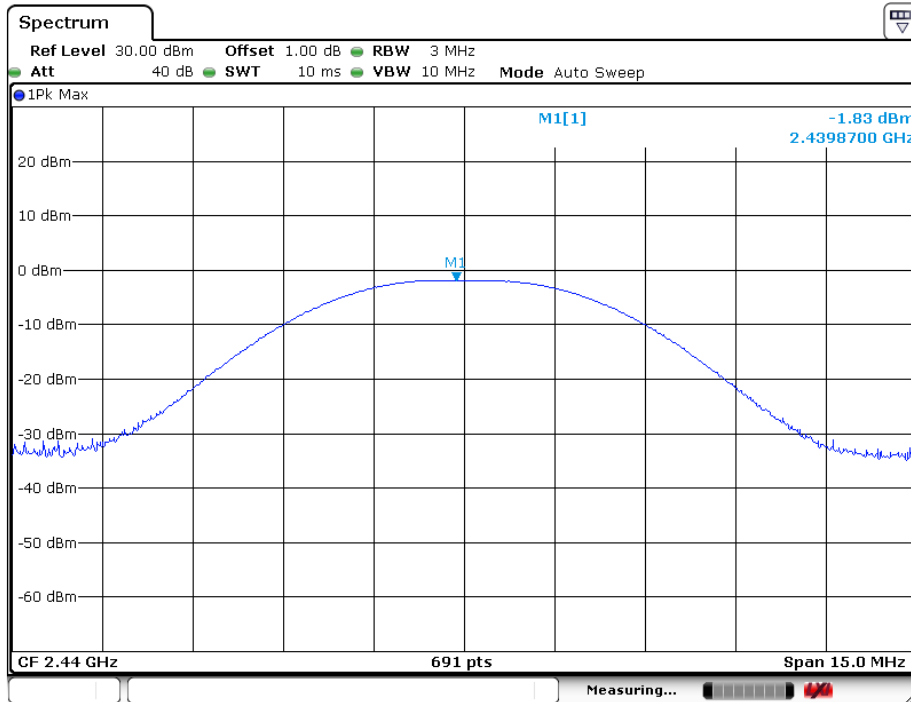
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4.5.2.4 GFSK_2M_Lowest Channel



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4.5.2.5 GFSK_2M_Middle Channel



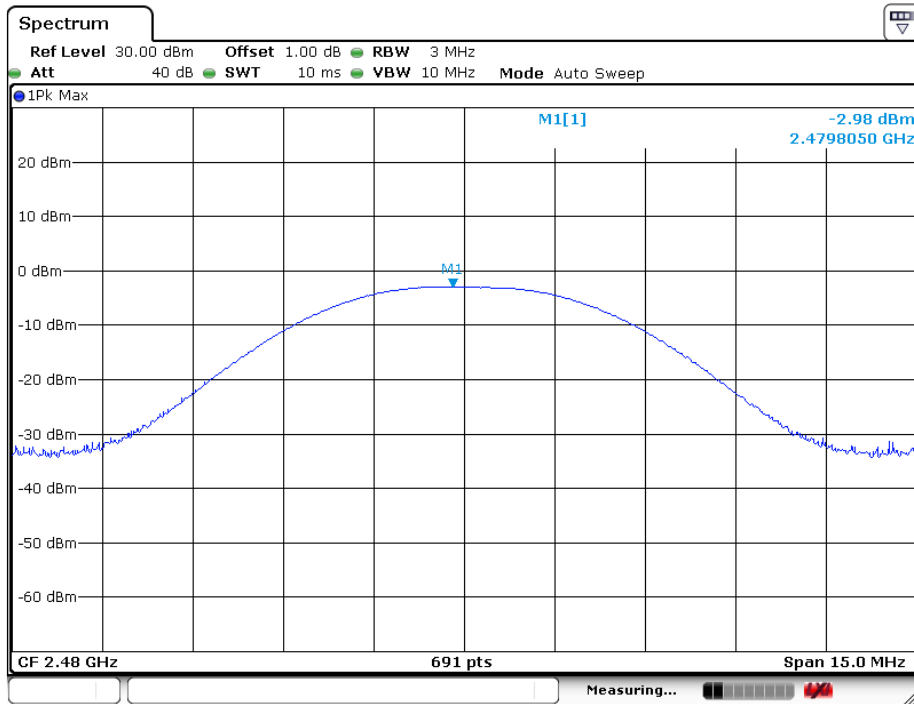
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4.5.2.6 GFSK _2M _Highest Channel



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4.6 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

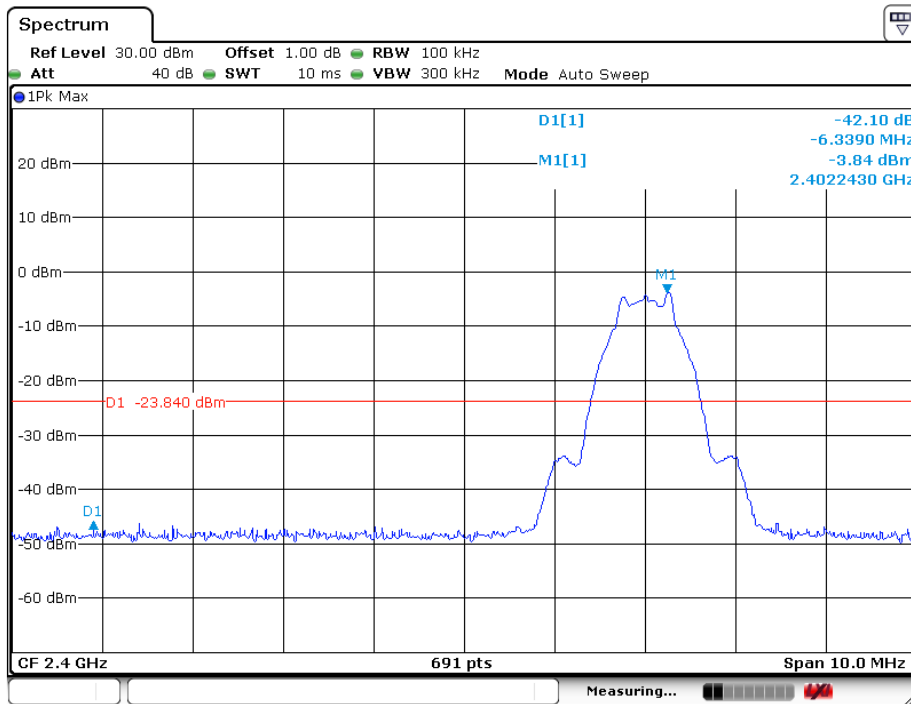


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4.6.1 Test plots

4.6.1.1 GFSK_1M_Lowest Channel



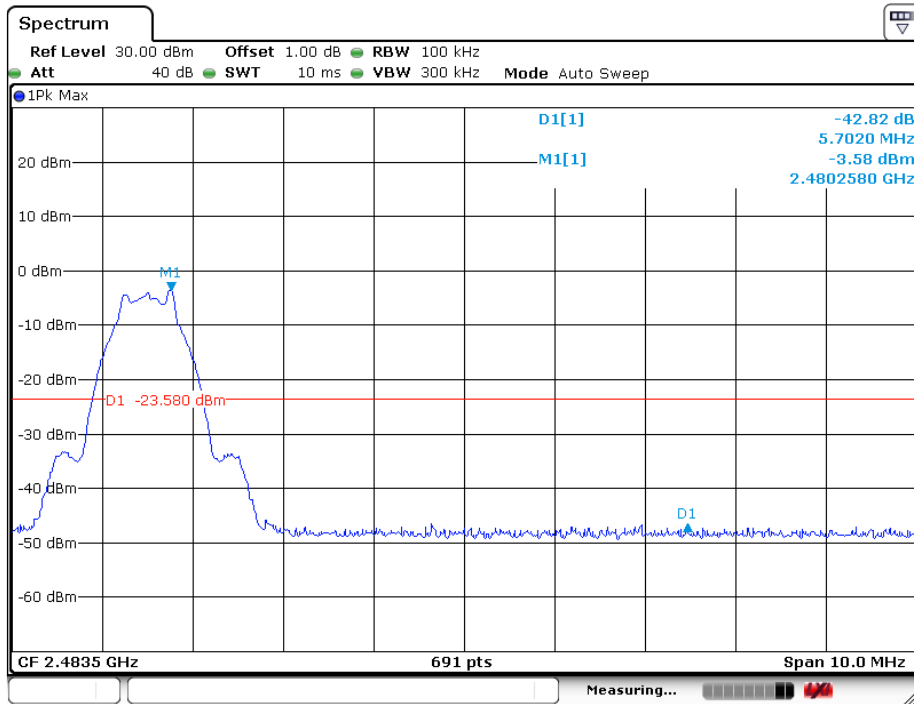
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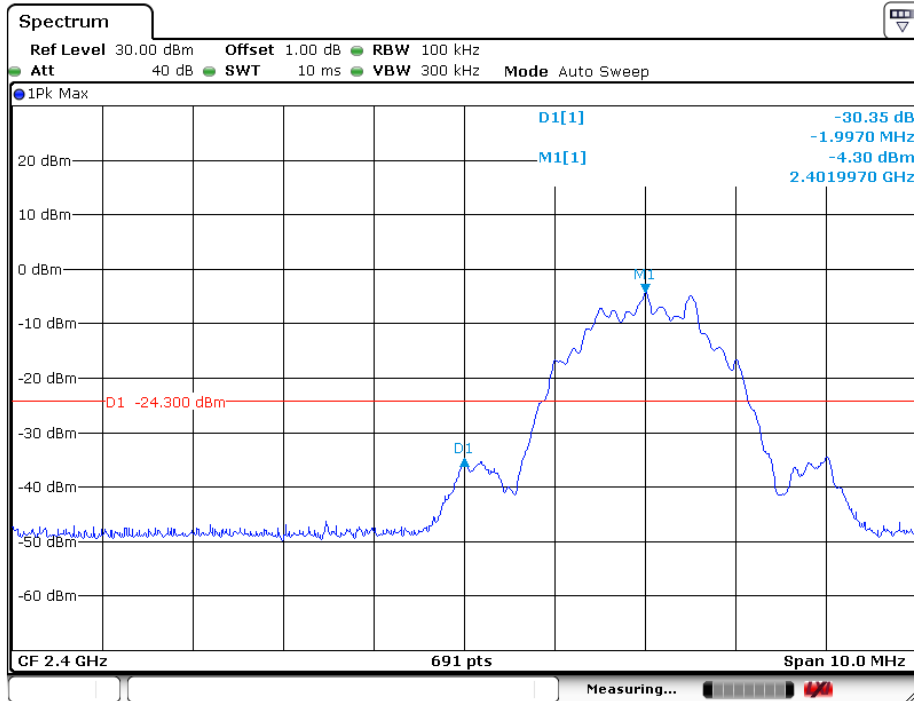
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4.6.1.2 GFSK_1M_Highest Channel



Date: 1.DEC.2020 14:30:17

4.6.1.3 GFSK_2M_Lowest Channel

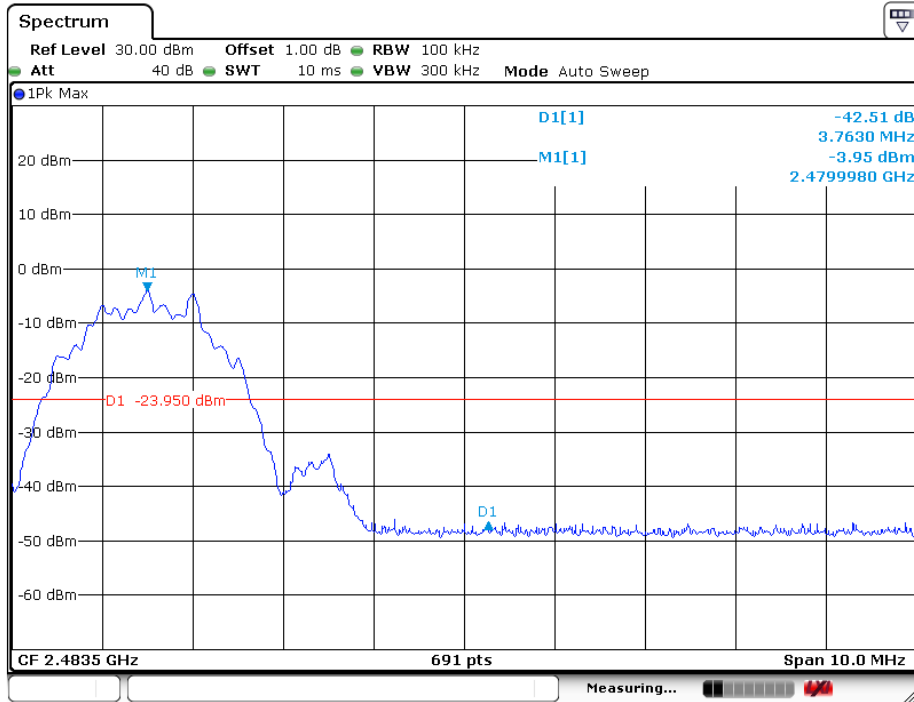


Date: 1.DEC.2020 14:31:56



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4.6.1.4 GFSK_2M _Highest Channel



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4.7 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

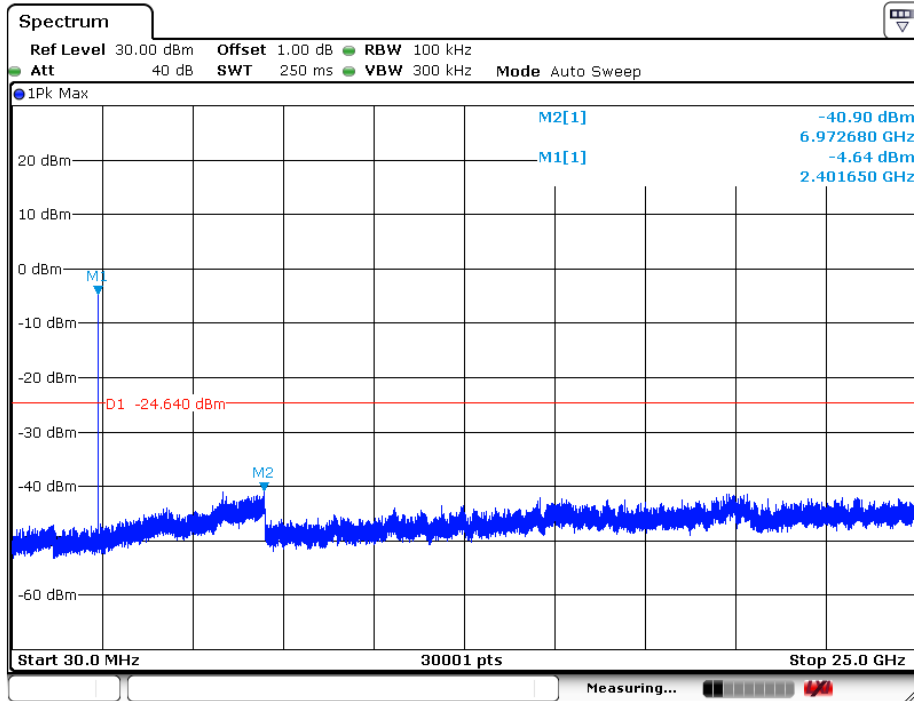


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4.7.1 Test plots:

4.7.1.1 GFSK_1M_Lowest Channel

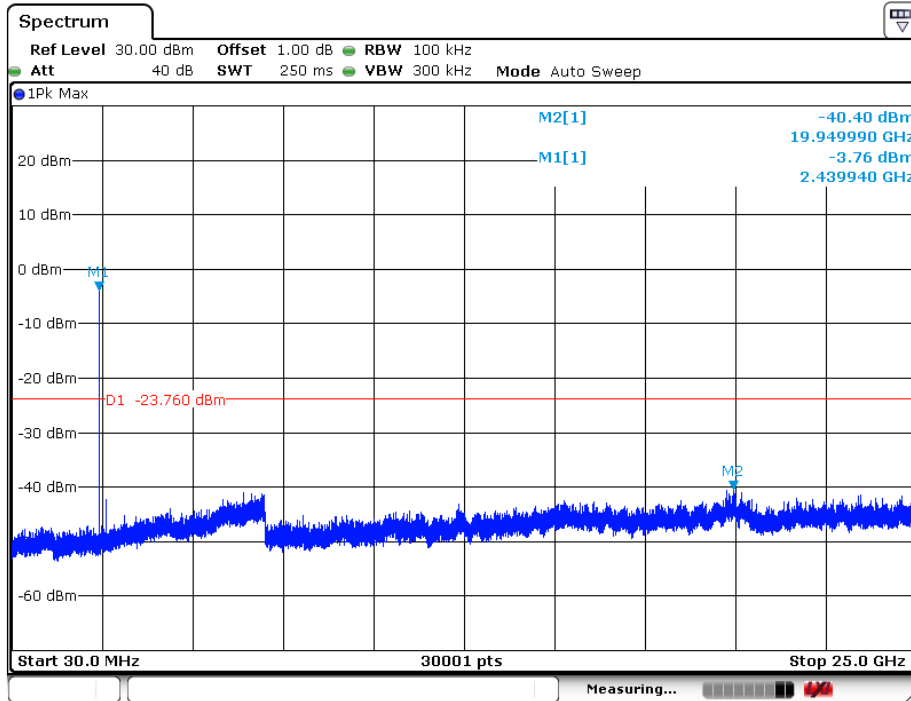


Date: 1.DEC.2020 14:42:30



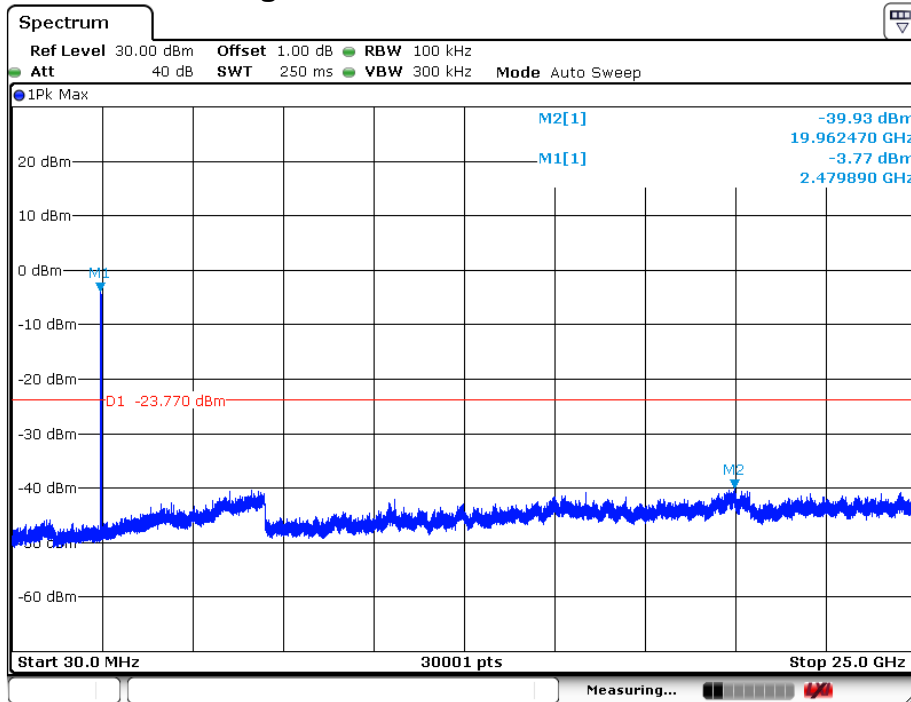
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4.7.1.2 GFSK_1M_Middle Channel



Date: 1.DEC.2020 14:41:54

4.7.1.3 GFSK_1M_Highest Channel

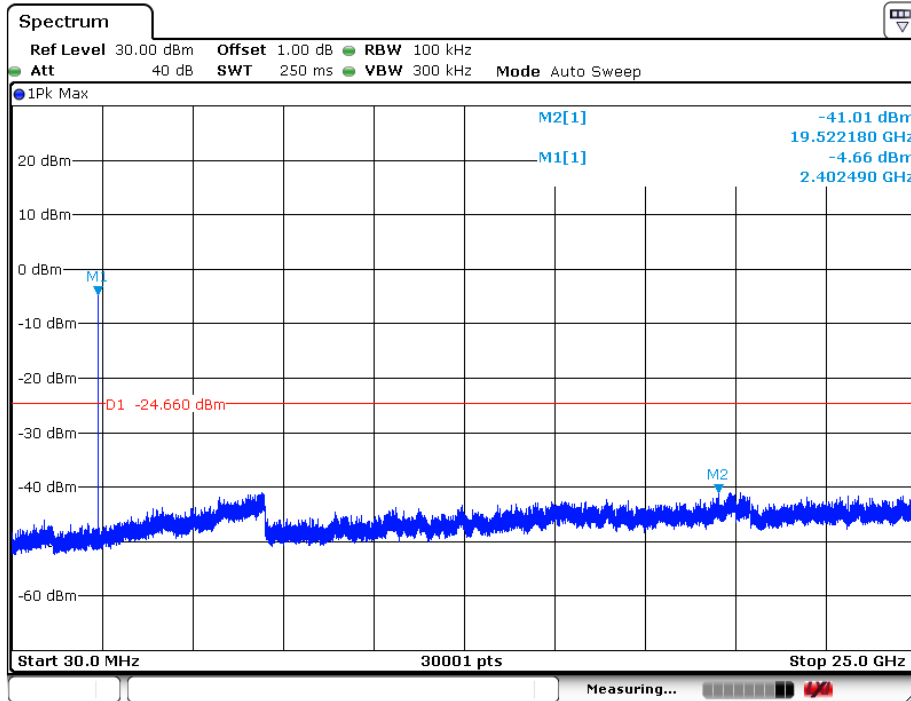


Date: 1.DEC.2020 14:41:13



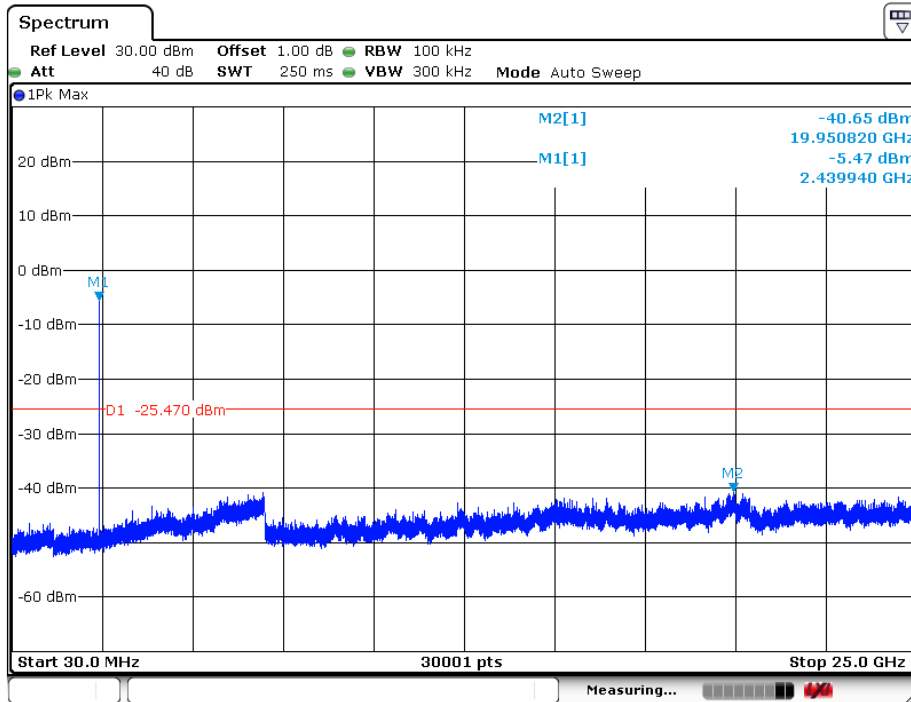
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4.7.1.4 GFSK 2M_Lowest Channel



Date: 1.DEC.2020 14:33:57

4.7.1.5 GFSK 2M_Middle Channel



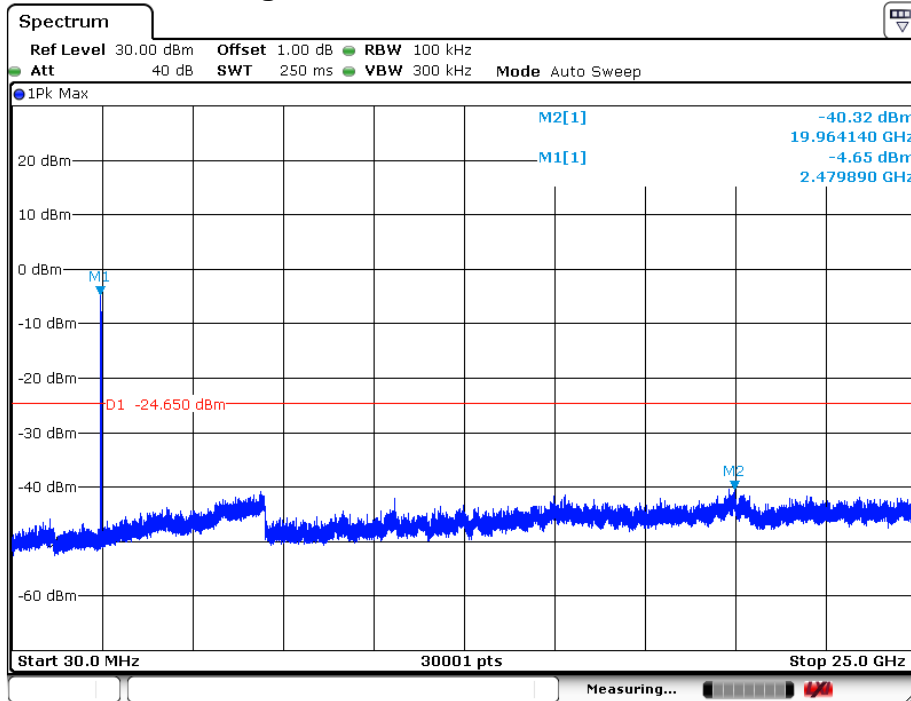
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4.7.1.6 GFSK_2M_Highest Channel



Date: 1.DEC.2020 14:35:59

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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4.8 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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<p>Test Setup:</p>			
	<p>Figure 1. Below 30MHz</p>	<p>Figure 2. 30MHz to 1GHz</p>	
	<p>Figure 3. Above 1 GHz</p>		
<p>Test Procedure:</p>	<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 (for 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. 		



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	<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

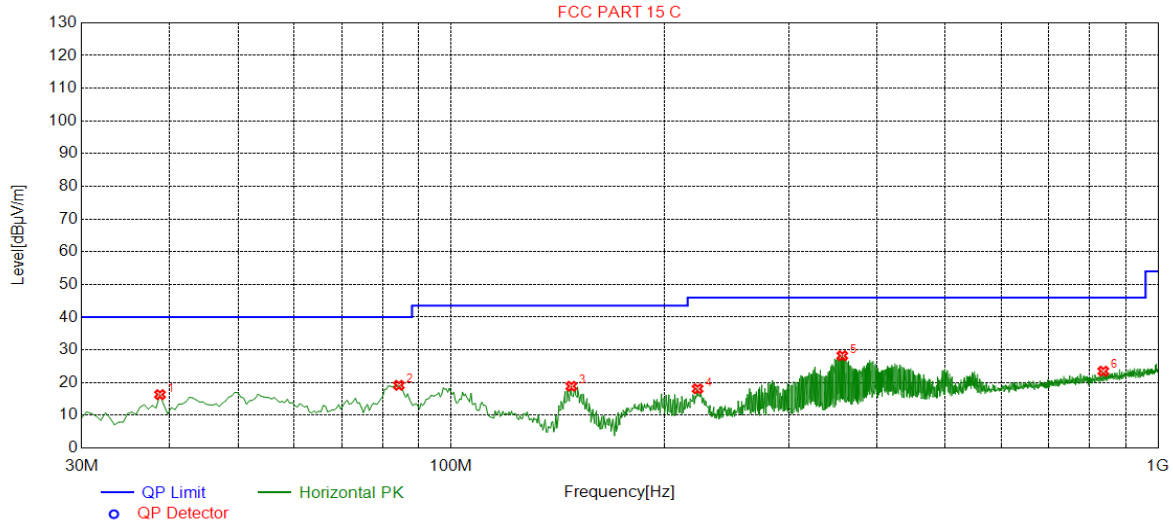


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4.8.1 Radiated Emission below 1GHz

4.8.1.1 Charge + Transmitting

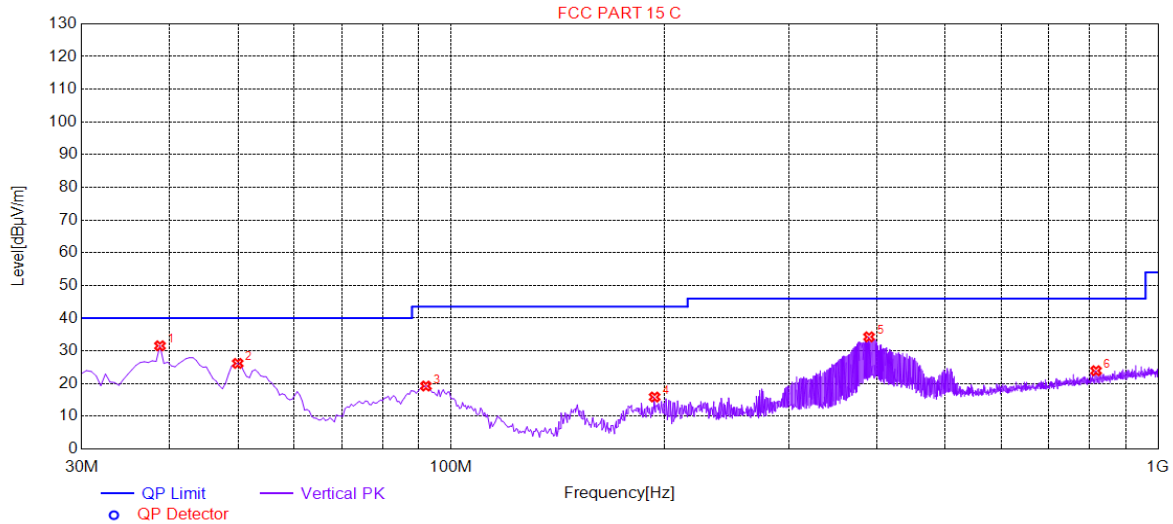


Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	38.7344	16.33	40.00	23.67	185	19	Horizontal
2	84.3472	19.18	40.00	20.82	279	255	Horizontal
3	147.9140	18.89	43.50	24.61	198	87	Horizontal
4	223.1266	18.11	46.00	27.89	246	202	Horizontal
5	357.5388	28.22	46.00	17.78	295	130	Horizontal
6	836.4732	23.49	46.00	22.51	242	316	Horizontal

Final Data List



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Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	38.7344	31.56	40.00	8.44	248	345	Vertical
2	49.8949	26.18	40.00	13.82	293	336	Vertical
3	92.1111	19.26	43.50	24.24	182	93	Vertical
4	194.0120	15.90	43.50	27.60	254	348	Vertical
5	390.0500	34.29	46.00	11.71	214	118	Vertical
6	817.0635	23.94	46.00	22.06	162	329	Vertical

Final Data List

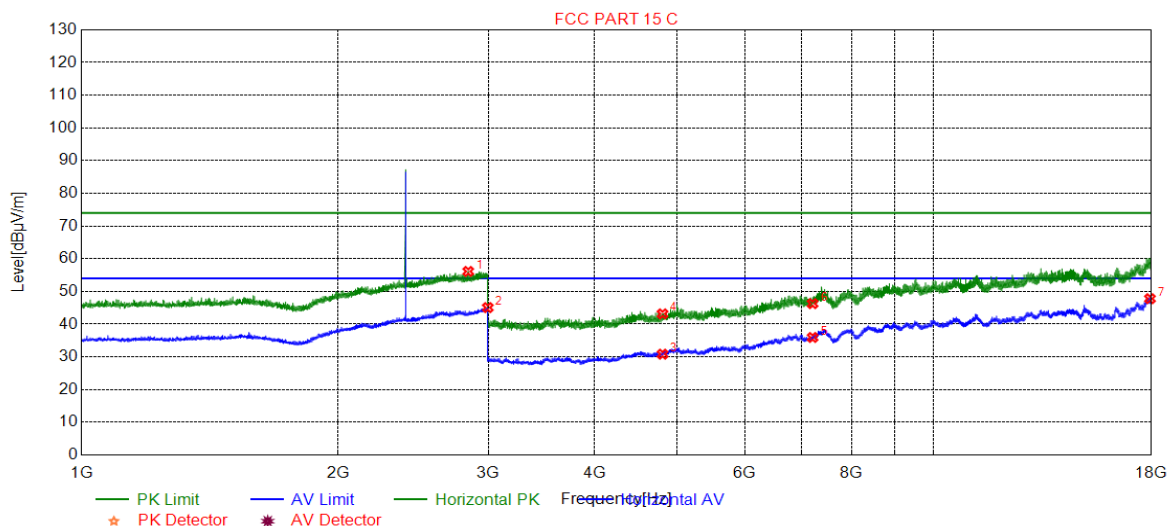


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4.8.2 Transmitter Emission above 1GHz

4.8.2.1 BLE_1M_Channel 0



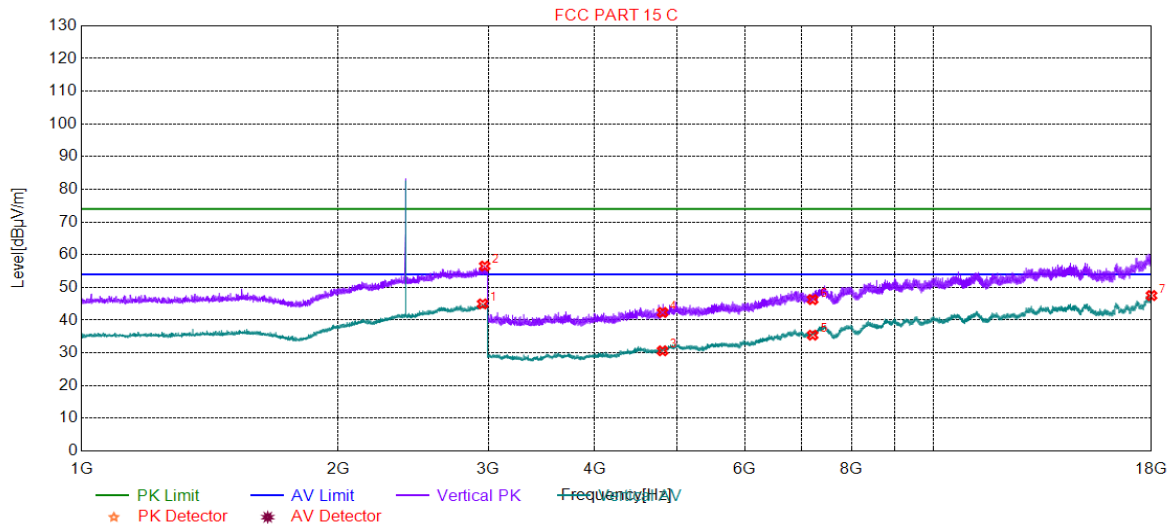
Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2842.460	56.14	74.00	17.86	226	88	Horizontal
2	2996.499	45.07	54.00	8.93	103	14	Horizontal
3	4804.000	30.83	54.00	23.17	185	329	Horizontal
4	4804.000	43.16	74.00	30.84	178	73	Horizontal
5	7206.000	35.95	54.00	18.05	178	38	Horizontal
6	7206.000	46.29	74.00	27.71	240	124	Horizontal
7	17925.74	47.80	54.00	6.20	238	55	Horizontal

Final Data List



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4.8.2.2 BLE_1M_Channel 0



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2954.988	44.99	54.00	9.01	290	153	Vertical
2	2971.492	56.55	74.00	17.45	218	132	Vertical
3	4804.000	30.64	54.00	23.36	278	202	Vertical
4	4804.000	42.37	74.00	31.63	150	219	Vertical
5	7206.000	35.43	54.00	18.57	206	287	Vertical
6	7206.000	46.30	74.00	27.70	269	31	Vertical
7	18000.00	47.54	54.00	6.46	170	236	Vertical

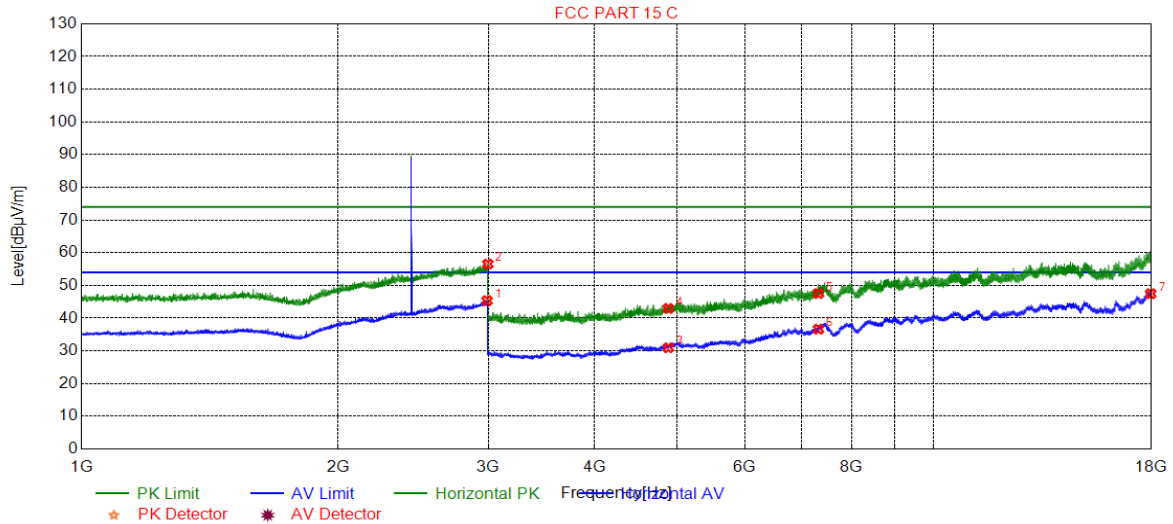
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4.8.2.3 BLE_1M_Channel 19



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2990.497	45.37	54.00	8.63	129	103	Horizontal
2	2996.999	56.55	74.00	17.45	238	332	Horizontal
3	4880.000	30.95	54.00	23.05	153	278	Horizontal
4	4880.000	43.00	74.00	31.00	235	312	Horizontal
5	7320.000	47.55	74.00	26.45	211	140	Horizontal
6	7320.000	36.65	54.00	17.35	232	192	Horizontal
7	17961.74	47.49	54.00	6.51	211	55	Horizontal

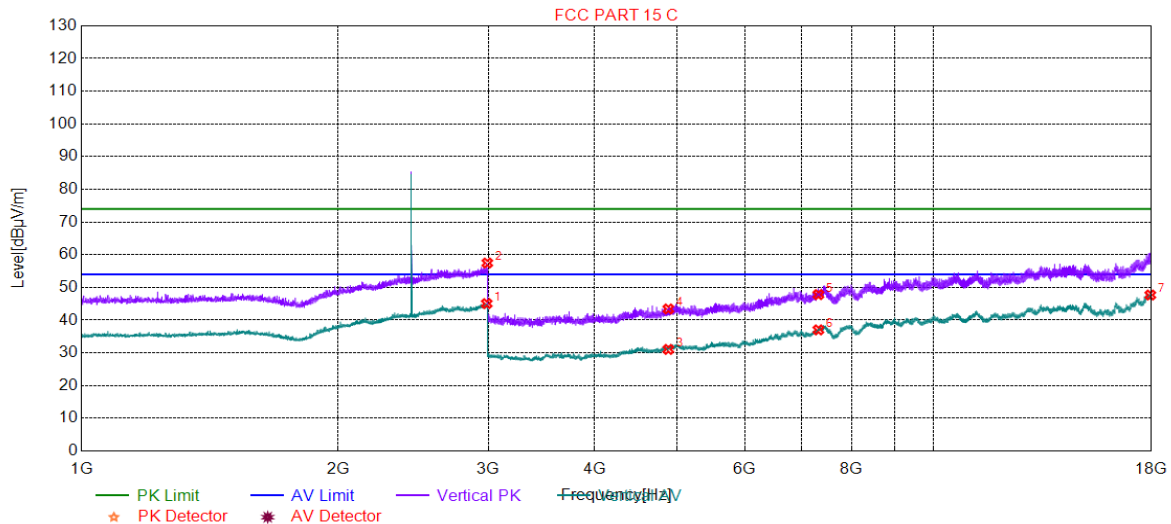
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4.8.2.4 BLE_1M_Channel 19



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2987.997	45.08	54.00	8.92	156	34	Vertical
2	2992.498	57.49	74.00	16.51	296	112	Vertical
3	4880.000	31.07	54.00	22.93	180	219	Vertical
4	4880.000	43.44	74.00	30.56	259	14	Vertical
5	7320.000	47.82	74.00	26.18	240	305	Vertical
6	7320.000	37.04	54.00	16.96	211	116	Vertical
7	17942.99	47.70	54.00	6.30	202	254	Vertical

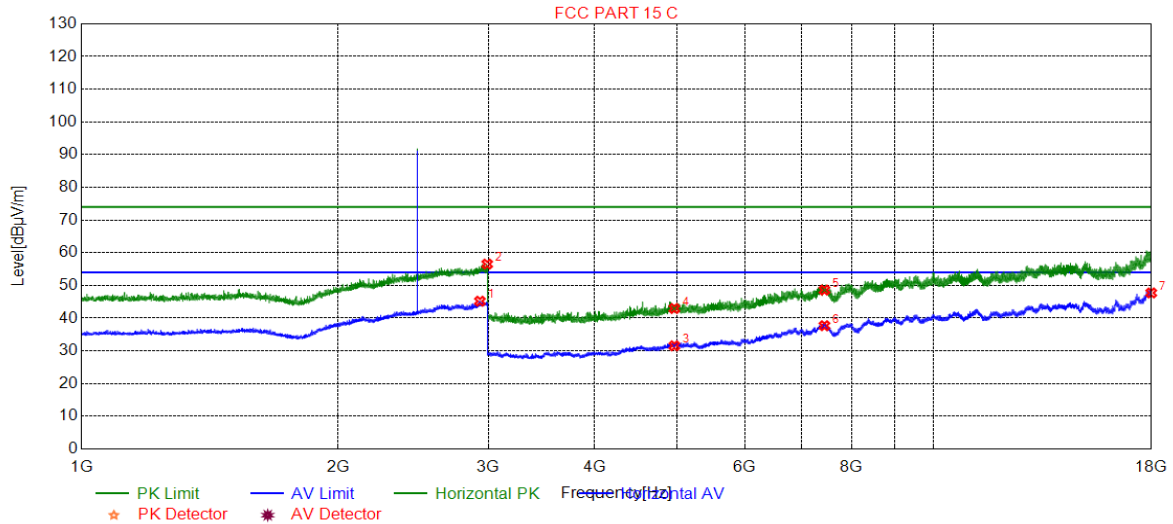
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4.8.2.5 BLE_1M_Channel 39



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2933.483	45.20	54.00	8.80	199	41	Horizontal
2	2991.998	56.55	74.00	17.45	169	315	Horizontal
3	4960.000	31.56	54.00	22.44	216	158	Horizontal
4	4960.000	42.97	74.00	31.03	114	278	Horizontal
5	7440.000	48.60	74.00	25.40	184	243	Horizontal
6	7440.000	37.70	54.00	16.30	113	158	Horizontal
7	17986.49	47.73	54.00	6.27	173	158	Horizontal

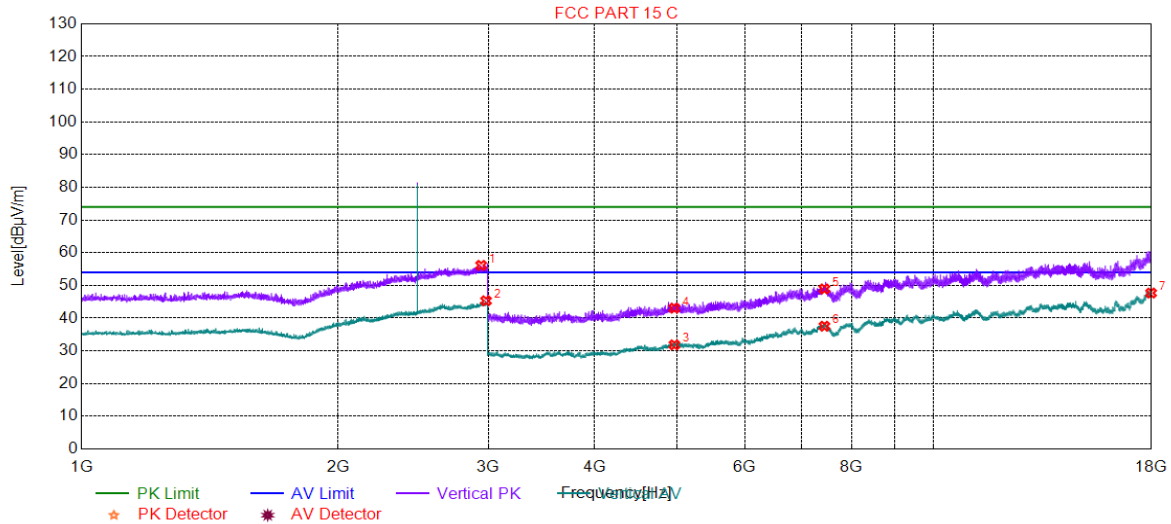
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4.8.2.6 BLE_1M_Channel 39



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2942.985	56.16	74.00	17.84	256	235	Vertical
2	2981.995	45.33	54.00	8.67	291	310	Vertical
3	4960.000	31.85	54.00	22.15	226	305	Vertical
4	4960.000	43.08	74.00	30.92	163	65	Vertical
5	7440.000	48.94	74.00	25.06	205	339	Vertical
6	7440.000	37.55	54.00	16.45	161	65	Vertical
7	17979.74	47.69	54.00	6.31	284	339	Vertical

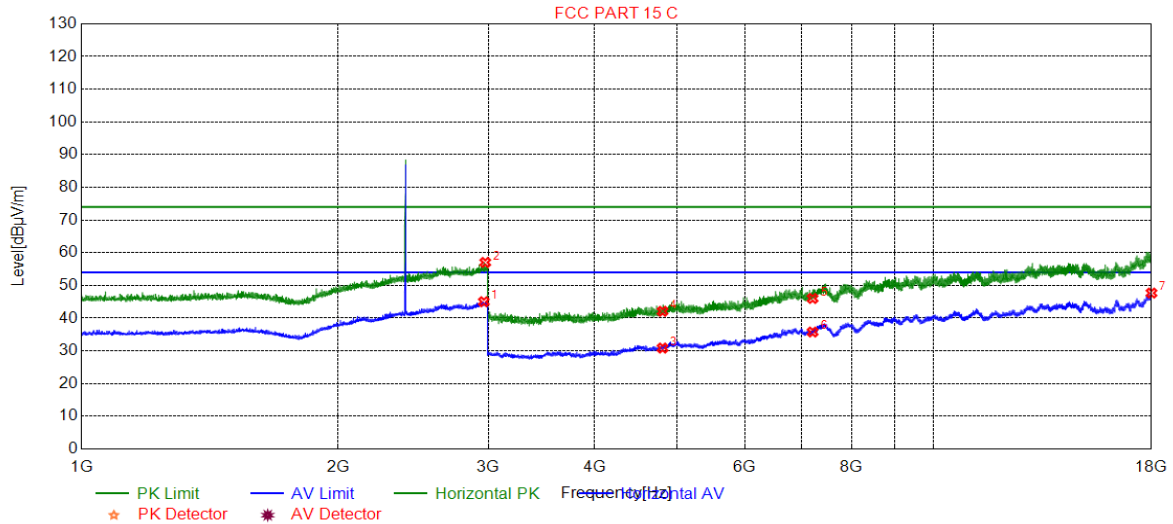
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4.8.2.7 BLE_2M_Channel 0



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2964.491	45.03	54.00	8.97	149	96	Horizontal
2	2975.994	57.05	74.00	16.95	146	304	Horizontal
3	4804.000	30.87	54.00	23.13	245	242	Horizontal
4	4804.000	42.11	74.00	31.89	127	154	Horizontal
5	7206.000	46.04	74.00	27.96	227	64	Horizontal
6	7206.000	35.77	54.00	18.23	145	276	Horizontal
7	18000.00	47.68	54.00	6.32	223	81	Horizontal

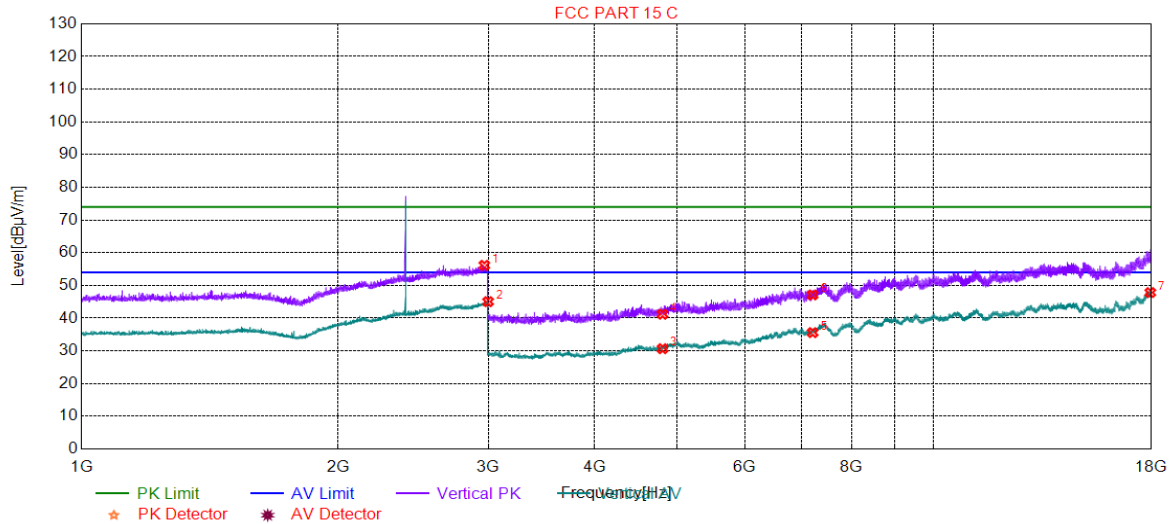
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4.8.2.8 BLE_2M_Channel 0



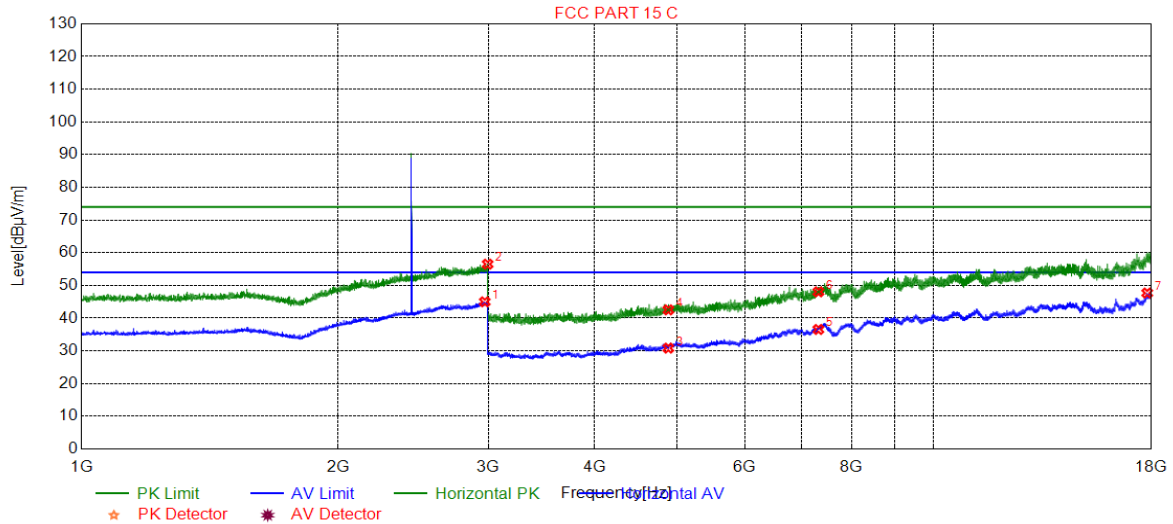
Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2968.492	56.18	74.00	17.82	209	194	Vertical
2	2998.999	45.05	54.00	8.95	157	82	Vertical
3	4804.000	30.68	54.00	23.32	268	14	Vertical
4	4804.000	41.21	74.00	32.79	235	222	Vertical
5	7206.000	35.59	54.00	18.41	289	14	Vertical
6	7206.000	47.12	74.00	26.88	163	68	Vertical
7	17941.49	47.84	54.00	6.16	273	324	Vertical

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4.8.2.9 BLE_2M_Channel 19



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2971.993	45.01	54.00	8.99	114	195	Horizontal
2	2995.498	56.53	74.00	17.47	178	252	Horizontal
3	4880.000	30.85	54.00	23.15	139	158	Horizontal
4	4880.000	42.54	74.00	31.46	173	124	Horizontal
5	7320.000	36.56	54.00	17.44	127	4	Horizontal
6	7320.000	48.06	74.00	25.94	184	175	Horizontal
7	17792.23	47.70	54.00	6.30	207	346	Horizontal

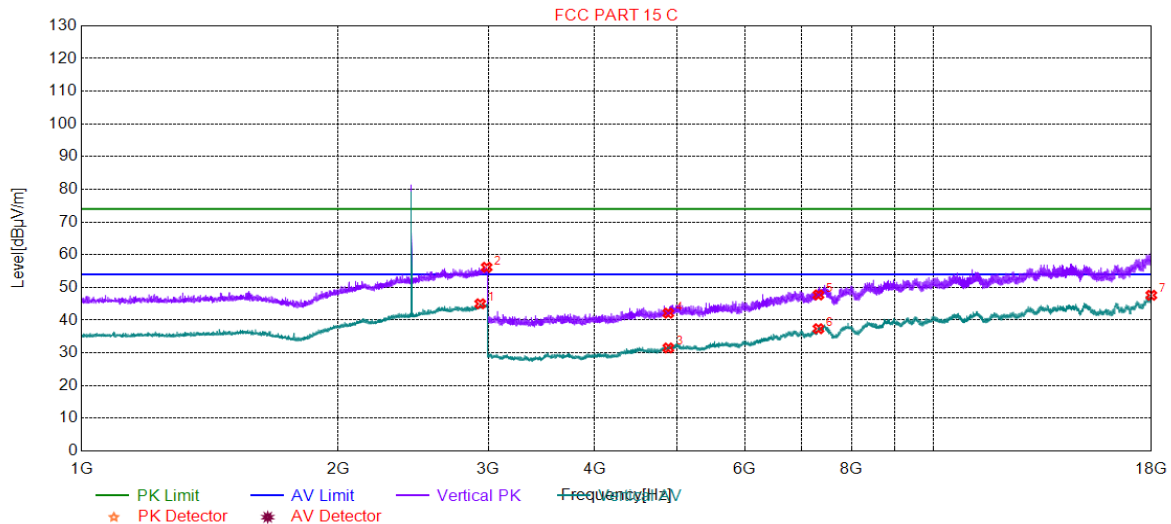
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4.8.2.10 BLE_2M_Channel 19



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2935.984	45.02	54.00	8.98	280	188	Vertical
2	2987.496	56.18	74.00	17.82	293	93	Vertical
3	4880.000	31.51	54.00	22.49	200	30	Vertical
4	4880.000	42.15	74.00	31.85	247	82	Vertical
5	7320.000	47.73	74.00	26.27	292	201	Vertical
6	7320.000	37.40	54.00	16.60	291	167	Vertical
7	17991.74	47.63	54.00	6.37	212	82	Vertical

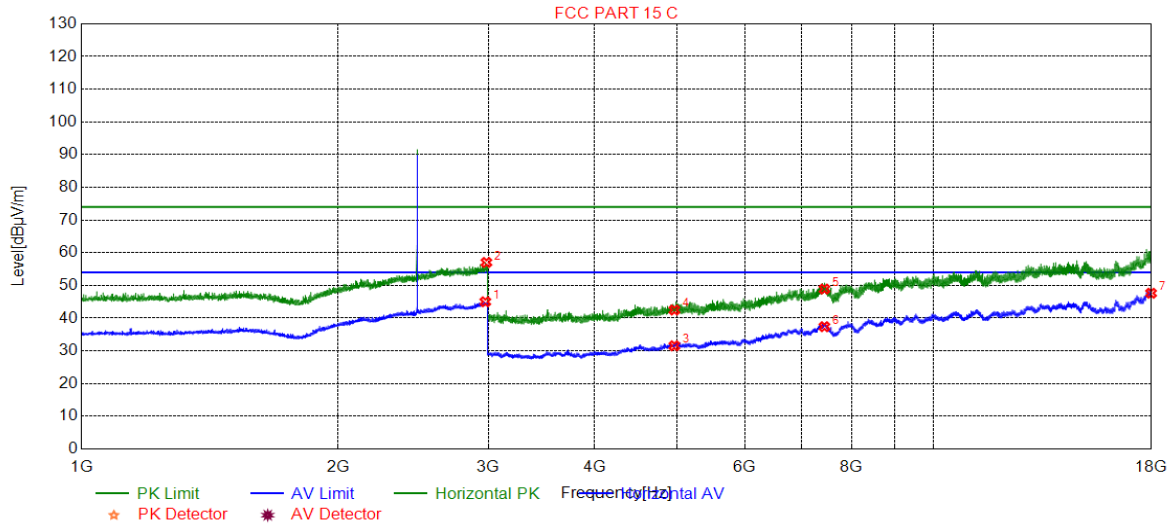
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4.8.2.11 BLE_2M_Channel 39



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2976.494	45.03	54.00	8.97	201	140	Horizontal
2	2985.496	57.04	74.00	16.96	239	341	Horizontal
3	4960.000	31.56	54.00	22.44	160	346	Horizontal
4	4960.000	42.51	74.00	31.49	141	208	Horizontal
5	7440.000	48.91	74.00	25.09	147	329	Horizontal
6	7440.000	37.40	54.00	16.60	182	260	Horizontal
7	17979.74	47.64	54.00	6.36	203	278	Horizontal

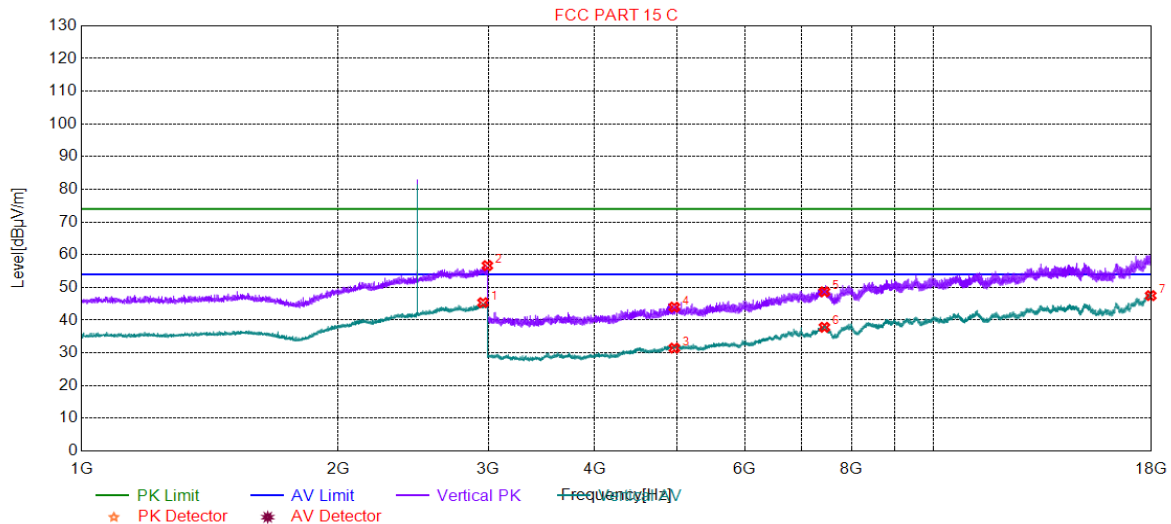
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4.8.2.12 BLE_2M_Channel 39



Suspected List							
NO.	Freq. [MHz]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2957.989	45.36	54.00	8.64	279	29	Vertical
2	2992.998	56.69	74.00	17.31	173	155	Vertical
3	4960.000	31.47	54.00	22.53	167	343	Vertical
4	4960.000	43.99	74.00	30.01	188	343	Vertical
5	7440.000	48.68	74.00	25.32	250	272	Vertical
6	7440.000	37.83	54.00	16.17	183	83	Vertical
7	17963.24	47.51	54.00	6.49	286	254	Vertical

Final Data List

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:
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
- 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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4.9 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:			

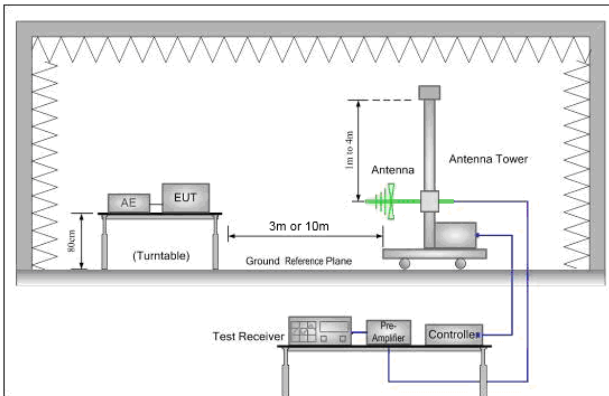


Figure 1. 30MHz to 1GHz

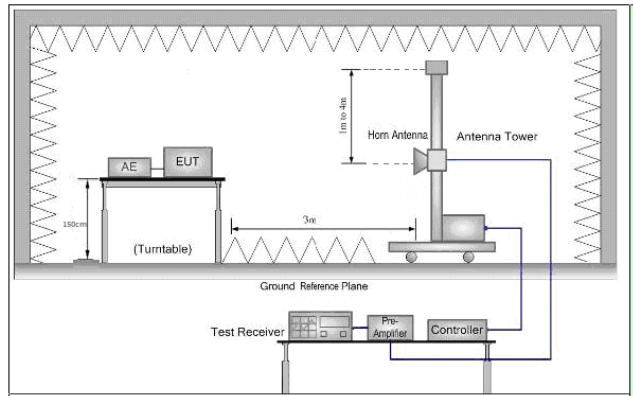


Figure 2. Above 1 GHz

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. 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
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	<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:	<p>Transmitting with GFSK modulation.</p> <p>Charge + Transmitting mode.</p>
Final Test Mode:	<p>Transmitting with GFSK modulation.</p> <p>Pretest the EUT at Charge + Transmitting mode.</p> <p>Only the worst case is recorded in the report.</p>
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

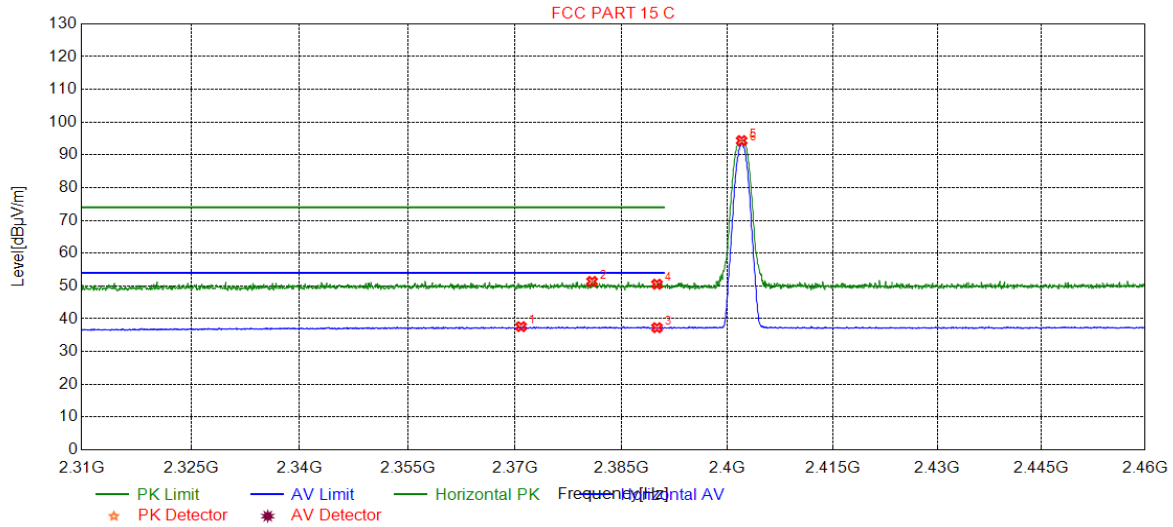


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4.9.1 Test plots

4.9.1.1 BLE_1M_Channel 0



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2370.85	37.61	7.79	54.00	16.39	111	340	Horizontal
2	2380.83	51.40	7.78	74.00	22.60	233	241	Horizontal
3	2390.00	37.28	7.77	54.00	16.72	202	166	Horizontal
4	2390.00	50.56	7.77	74.00	23.44	194	302	Horizontal
5	2402.00	94.38	7.77	0.00	-94.38	141	150	Horizontal
6	2402.00	93.41	7.77	0.00	-93.41	206	209	Horizontal

Final Data List

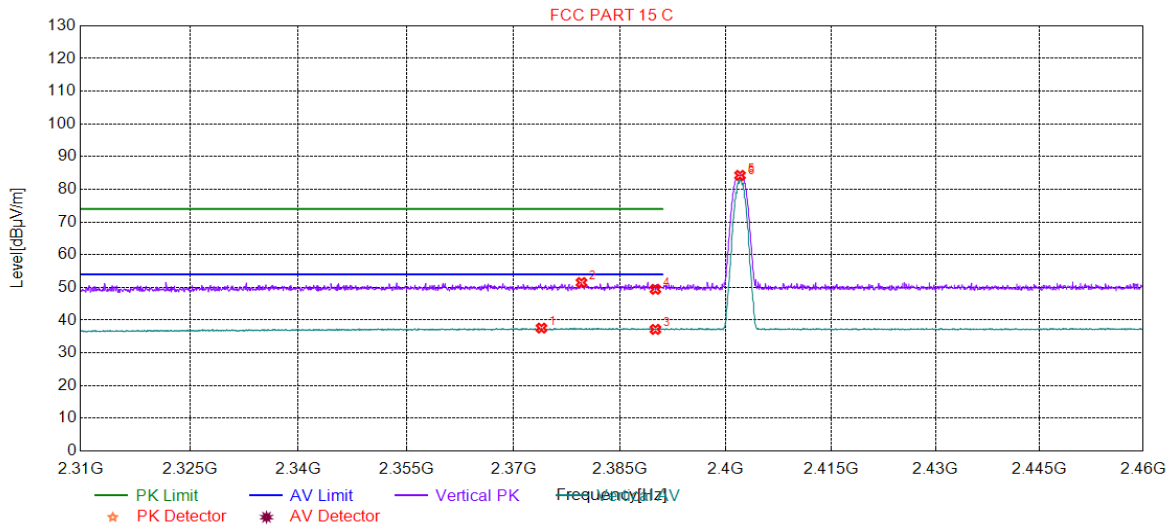


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4.9.1.2 BLE_1M_Channel 0



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2373.93	37.59	7.79	54.00	16.41	289	156	Vertical
2	2379.55	51.51	7.78	74.00	22.49	208	183	Vertical
3	2390.00	37.19	7.77	54.00	16.81	275	221	Vertical
4	2390.00	49.45	7.77	74.00	24.55	199	150	Vertical
5	2402.00	84.28	7.77	0.00	-84.28	215	303	Vertical
6	2402.00	83.59	7.77	0.00	-83.59	207	303	Vertical

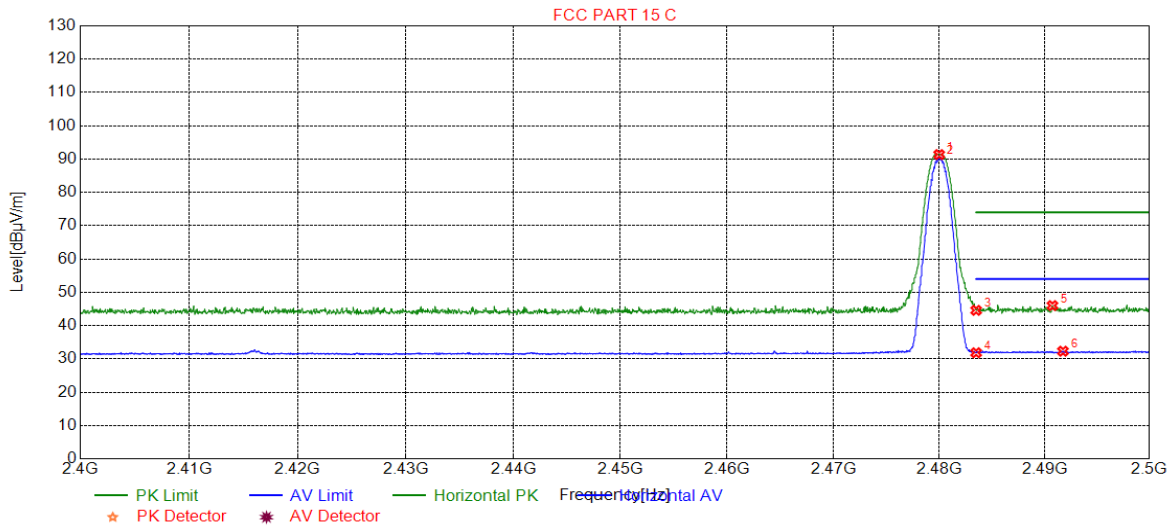
Final Data List



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4.9.1.3 BLE_1M_Channel 39



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2480.00	91.36	8.01	0.00	-91.36	110	207	Horizontal
2	2480.00	90.63	8.01	0.00	-90.63	185	207	Horizontal
3	2483.50	44.61	8.01	74.00	29.39	218	212	Horizontal
4	2483.50	31.88	8.01	54.00	22.12	161	90	Horizontal
5	2490.74	46.03	8.02	74.00	27.97	170	102	Horizontal
6	2491.74	32.34	8.02	54.00	21.66	104	179	Horizontal

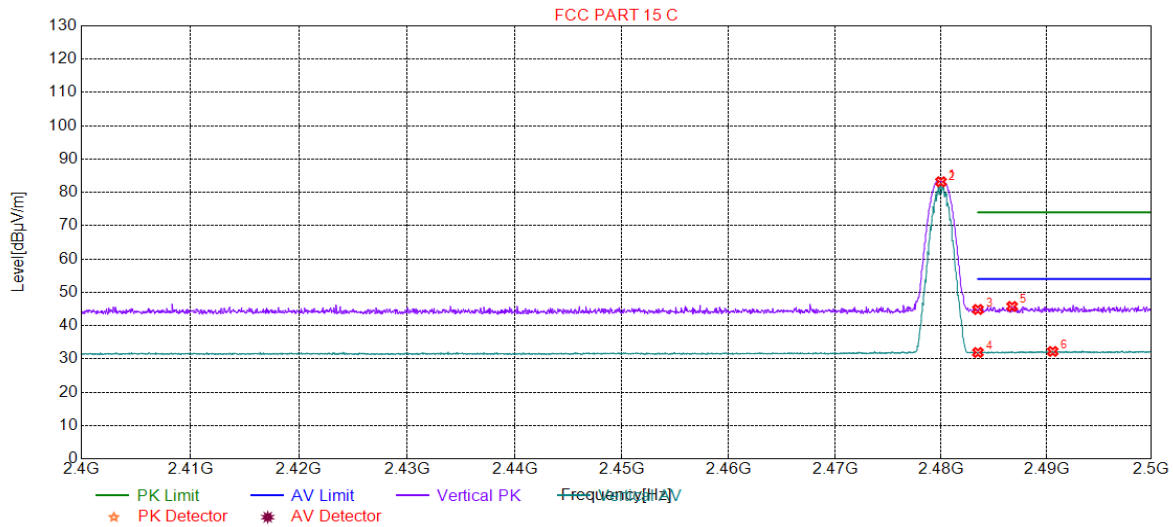
Final Data List



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4.9.1.4 BLE_1M_Channel 39



Suspected List								
NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	2480.00	83.20	8.01	0.00	-83.20	184	346	Vertical
2	2480.00	82.63	8.01	0.00	-82.63	206	346	Vertical
3	2483.50	44.86	8.01	74.00	29.14	277	100	Vertical
4	2483.50	31.96	8.01	54.00	22.04	168	302	Vertical
5	2486.74	45.78	8.01	74.00	28.22	238	265	Vertical
6	2490.59	32.27	8.02	54.00	21.73	271	346	Vertical

Final Data List

Remark:

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

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

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



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

Lab A:

No.	Item	Measurement Uncertainty
1	Total RF power, conducted	±0.75dB
2	RF power density, conducted	±2.84dB
3	Spurious emissions, conducted	±0.75dB
4	Temperature test	±1°C
5	Humidity test	±3%
6	DC and low frequency voltages	±0.5%

Lab B:

No.	Item	Measurement Uncertainty
1	Conduction Emission	± 3.0dB (150kHz to 30MHz)
2	Radiated Emission	± 4.8dB (Below 1GHz)
		± 4.8dB (1GHz to 6GHz)
		± 4.5dB (6GHz to 18GHz)
		± 5.02dB (Above 18GHz)



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6 Equipment List

RF conducted test					
Test Equipment	Manufacturer	Model No.	Inventory No	Cal. date	Cal.Duedate
				(yyyy-mm-dd)	(yyyy-mm-dd)
DC Power Supply	Agilent Technologie Inc	66311B	W009-09	2020/7/15	2021/7/15
Signal Analyzer	Rohde & Schwarz	FSV	W025-05	2020/1/3	2021/1/2
Coaxial Cable	SGS	N/A	SEM031-01	2020/6/12	2021/6/11
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Signal Generator	KEYSIGHT	N5173B	SEM006-05	2020/7/14	2021/7/14
Temperature Chamber	GIANT FORCE	ICT-150-40-CP AR	W027-03	2020/10/27	2021/10/27
Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2020/7/14	2021/7/14

CE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Shielding Room	Brilliant-emc	N/A	XAW03-35-01	2019-09-11	2022-09-10
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2020-09-11	2021-09-10
Artificial network	ROHDE&SCHWARZ	ENV216	XAW01-04-01	2020-08-04	2021-08-03
Temperature and humidity meter	MingGao	TH101B	XAW01-01-01	2020-11-06	2021-11-05
Measurement Software	Tonscend	TS+ CE V2.5	XAW02-05-02	NCR	NCR



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RSE Test System					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Semi-Anechoic Chamber	Brilliant-emc	N/A	XAW03-35-01	2019-09-11	2022-09-10
MXA signal analyzer	Keysight	N9020A	XAW01-06-01	2020-04-02	2021-04-01
Test receiver	ROHDE&SCHWARZ	ESR	XAW01-08-01	2020-09-11	2021-09-10
Receiving antenna (30MHz-3GHz)	Schwarzbeck	VULB 9163	XAW01-09-01	2019-10-13	2021-10-12
Receiving antenna (1GHz~18GHz)	Schwarzbeck	BBHA 9120D	XAW01-09-02	2019-10-13	2021-10-12
Receiving antenna (15GHz~40GHz)	Schwarzbeck	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	2020-10-26	2021-10-25
Amplifier	Tonscend	TAP01018048	XAW01-41-02	2020-10-26	2021-10-25
Amplifier	Tonscend	TAP18040048	XAW01-41-03	2020-10-27	2021-10-26
Amplifier	Shanghai Steed	YX28980930	XAW01-41-06	2020-10-26	2021-10-25
Temperature and humidity meter	MingGao	TH101B	XAW01-01-01	2020-11-06	2021-11-05
Measurement Software	Tonscend	TS+ RSE V3.0.0.2	XAW02-05-01	NCR	NCR



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7 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for ZR/2020/B0030.

The End



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