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Report No.: SZEM150800538701  
Page: 1 of 57

## FCC REPORT

**Application No:** SZEM1508005387CR  
**Applicant:** IDT Technology Limited  
**Manufacturer:** IDT Technology Limited  
**Product Name:** Weather+BLE Connected Weather Station  
**Model No.(EUT):** BAR228  
**Add Model No.:** EM221  
**Trade Mark:** Oregon scientific  
**FCC ID:** NMTBAR228-01  
**Standards:** 47 CFR Part 15, Subpart C (2014)  
**Date of Receipt:** 2015-09-16  
**Date of Test:** 2015-09-17 to 2015-10-21  
**Date of Issue:** 2015-10-27

<b>Test Result:</b>	<b>PASS *</b>
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\* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Jack Zhang  
EMC Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

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## 2 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
00		2015-10-27		Original

Authorized for issue by:			
			2015-10-21
Tested By		(Robin Yu) /Project Engineer	Date
			2015-10-27
Prepared By		(Venus Wu) /Clerk	Date
			2015-10-27
Checked By		(Eric Fu) /Reviewer	Date

### 3 Test Summary

Test Item	Test Requirement	Test method	Result
<b>Antenna Requirement</b>	47 CFR Part 15, Subpart C Section 15.203/15.247 (c)	ANSI C63.10 2009	PASS
<b>AC Power Line Conducted Emission</b>	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10 2009	PASS
<b>Conducted Peak Output Power</b>	47 CFR Part 15, Subpart C Section 15.247 (b)(3)	ANSI C63.10 2009	PASS
<b>6dB Occupied Bandwidth</b>	47 CFR Part 15, Subpart C Section 15.247 (a)(2)	ANSI C63.10 2009	PASS
<b>Power Spectral Density</b>	47 CFR Part 15, Subpart C Section 15.247 (e)	ANSI C63.10 2009	PASS
<b>Band-edge for RF Conducted Emissions</b>	47 CFR Part 15, Subpart C Section 15.247(d)	ANSI C63.10 2009	PASS
<b>RF Conducted Spurious Emissions</b>	47 CFR Part 15, Subpart C Section 15.247(d)	ANSI C63.10 2009	PASS
<b>Radiated Spurious Emissions</b>	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 2009	PASS
<b>Restricted bands around fundamental frequency (Radiated Emission)</b>	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 2009	PASS

**Remark:**

Model No.: BAR228, EM221

Only the model BAR228 was tested, since the circuitry design, PCB layout, electrical components used, internal wiring and functions were identical for all above models. Only different on model BAR228 with function of bluetooth, temperature, humidity, weather forecast; and the model EM221 with function of bluetooth, temperature.

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## 5 General Information

### 5.1 Client Information

Applicant:	IDT Technology Limited
Address of Applicant:	Block C, 9/F, Kaiser Estate, Phase 1, 41 Man Yue Street, Hunghom, Kowloon, HongKong
Manufacturer:	IDT Technology Limited
Address of Manufacturer:	Chentian Industrial Estate,Xixiang,Bao An,ShenZhen.PRC

### 5.2 General Description of EUT

Product Name:	Weather+BLE Connected Weather Station
Model No.:	BAR228
Trade Mark:	Oregon scientific
Carrier Frequency:	BT
Bluetooth Version:	V4.0 Signal
Sample Type:	fixed production
Test Power Grade:	0dBm
Antenna Gain:	BT: 1.0dBi
Antenna Type:	Dipole
Battery:	3VDC (2X1.5V "AAA" Size Battery)
Tolerance Temperature:	-20~60°C

Operation Frequency each of 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

**Note:**

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

### **5.3 Test Environment**

<b>Operating Environment:</b>	
Temperature:	25.0 °C
Humidity:	53 % RH
Atmospheric Pressure:	1010mbar

### **5.4 Description of Support Units**

The EUT has been tested independent unit.

### **5.5 Test Location**

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch E&E Lab,  
No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Shenzhen, Guangdong, China.  
518057.

Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

## **5.6 Test Facility**

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

- CNAS (No. CNAS L2929)**

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- 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 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

- FCC – Registration No.: 556682**

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 556682.

- Industry Canada (IC)**

The 3m Semi-anechoic chambers and the 10m Semi-anechoic chambers of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-2, 4620C-3.

## **5.7 Deviation from Standards**

None.

## **5.8 Abnormalities from Standard Conditions**

None.

## **5.9 Other Information Requested by the Customer**

None.

**5.10 Equipment List**

Conducted Emission						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)
1	Shielding Room	ZhongYu Electron	GB-88	SEL0042	2015-05-13	2016-05-13
2	LISN	Rohde & Schwarz	ENV216	SEL0152	2015-10-09	2016-10-09
3	LISN	ETS-LINDGREN	3816/2	SEL0021	2015-05-13	2016-05-13
4	8 Line ISN	Fischer Custom Communications Inc.	FCC-TLIS N-T8-02	SEL0162	2015-08-30	2016-08-30
5	4 Line ISN	Fischer Custom Communications Inc.	FCC-TLIS N-T4-02	SEL0163	2015-08-30	2016-08-30
6	2 Line ISN	Fischer Custom Communications Inc.	FCC-TLIS N-T2-02	SEL0164	2015-08-30	2016-08-30
7	EMI Test Receiver	Rohde & Schwarz	ESCI	SEL0022	2015-05-13	2016-05-13
8	Coaxial Cable	SGS	N/A	SEL0025	2015-05-13	2016-05-13
9	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2015-10-09	2016-10-09
10	Humidity/ Temperature Indicator	Shanghai Qixiang	ZJ1-2B	SEL0103	2015-10-24	2016-10-24
11	Barometer	Chang Chun	DYM3	SEL0088	2015-05-13	2016-05-13

RE in Chamber						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. date (yyyy-mm-dd)	Cal.Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEL0017	2015-05-13	2016-05-13
2	EMI Test Receiver	Agilent Technologies	N9038A	SEL0312	2015-09-16	2016-09-16
3	EMI Test software	AUDIX	E3	SEL0050	N/A	N/A
4	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEL0015	2014-11-15	2017-11-15
5	Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEL0006	2015-10-17	2016-10-17
6	Horn Antenna (18-26GHz)	ETS-LINDGREN	3160	SEL0076	2014-11-24	2017-11-24
7	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEL0053	2015-05-13	2016-05-13
8	Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEL0168	2015-10-17	2016-10-17
9	Coaxial cable	SGS	N/A	SEL0027	2015-05-13	2016-05-13
10	Coaxial cable	SGS	N/A	SEL0189	2015-05-13	2016-05-13
11	Coaxial cable	SGS	N/A	SEL0121	2015-05-13	2016-05-13
12	Coaxial cable	SGS	N/A	SEL0178	2015-05-13	2016-05-13
13	Band filter	Amindeon	82346	SEL0094	2015-05-13	2016-05-13
14	Barometer	Chang Chun	DYM3	SEL0088	2015-05-13	2016-05-13
15	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2015-10-09	2016-10-09
16	Humidity/ Temperature Indicator	Shanghai Qixiang	ZJ1-2B	SEL0103	2015-10-24	2016-10-24
17	Signal Generator (10M-27GHz)	Rohde & Schwarz	SMR27	SEL0067	2015-05-13	2016-05-13
18	Loop Antenna	Beijing Daze	ZN30401	SEL0203	2015-05-13	2016-05-13



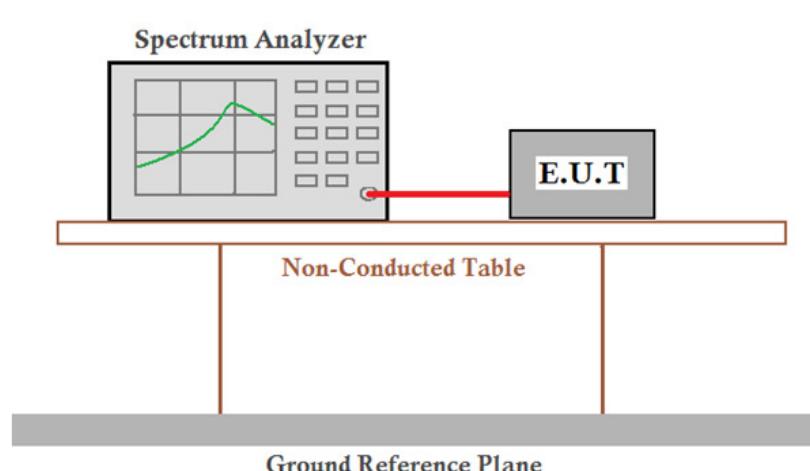
<b>RF connected test</b>						
<b>Item</b>	<b>Test Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Inventory No.</b>	<b>Cal. date (yyyy-mm-dd)</b>	<b>Cal.Due date (yyyy-mm-dd)</b>
1	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2015-10-09	2016-10-09
2	Humidity/ Temperature Indicator	HYGRO	ZJ1-2B	SEL0033	2015-10-24	2016-10-24
3	Spectrum Analyzer	Rohde & Schwarz	FSP	SEL0154	2015-10-17	2016-10-17
4	Coaxial cable	SGS	N/A	SEL0178	2015-05-13	2016-05-13
5	Coaxial cable	SGS	N/A	SEL0179	2015-05-13	2016-05-13
6	Barometer	ChangChun	DYM3	SEL0088	2015-05-13	2016-05-13
7	Signal Generator	Rohde & Schwarz	SML03	SEL0068	2015-04-25	2016-04-25
8	POWER METER	R & S	NRVS	SEL0144	2015-10-09	2016-10-09
9	Attenuator	Beijing feihang taida	TST-2-6dB	SEL0205	2015-04-25	2016-04-25

## 6 Test results and Measurement Data

### 6.1 Antenna Requirement

<b>Standard requirement:</b>	47 CFR Part 15C Section 15.203 /247(c)
<p>15.203 requirement:</p> <p>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:</p> <p>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>	
<b>EUT Antenna:</b>	
<p>In radio and telecommunications a dipole antenna or doublet is the simplest and most widely used class of antenna. It consists of two identical conductive elements such as metal wires or rods, This contrasts with a monopole antenna, which consists of a single rod or conductor with one side of the feedline connected to it, and the other side connected to some type of ground.</p> <p>Bar228 dipole is two straight wires oriented end to end on the same axis, the length of the dipole elements is determined by the wavelength of BLE 2.4G band, in which each of the two wire is approximately 1/4 wavelength long, so the whole antenna is a half-wavelength long. The radiation pattern is omnidirectional;The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 1dBi.</p>	

## 6.2 Conducted Peak Output Power

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(1)
Test Method:	ANSI C63.10 2009
Test Setup:	 <p><b>Spectrum Analyzer</b> A block diagram showing a spectrum analyzer with a grid display showing a signal peak. A red cable connects the spectrum analyzer to the <b>E.U.T</b> (Equipment Under Test). The <b>E.U.T</b> is a grey rectangular box. The entire setup is placed on a <b>Non-Conducted Table</b>, which is supported by a grey <b>Ground Reference Plane</b>.</p>
Remark:	Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.
Limit:	30dBm
Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

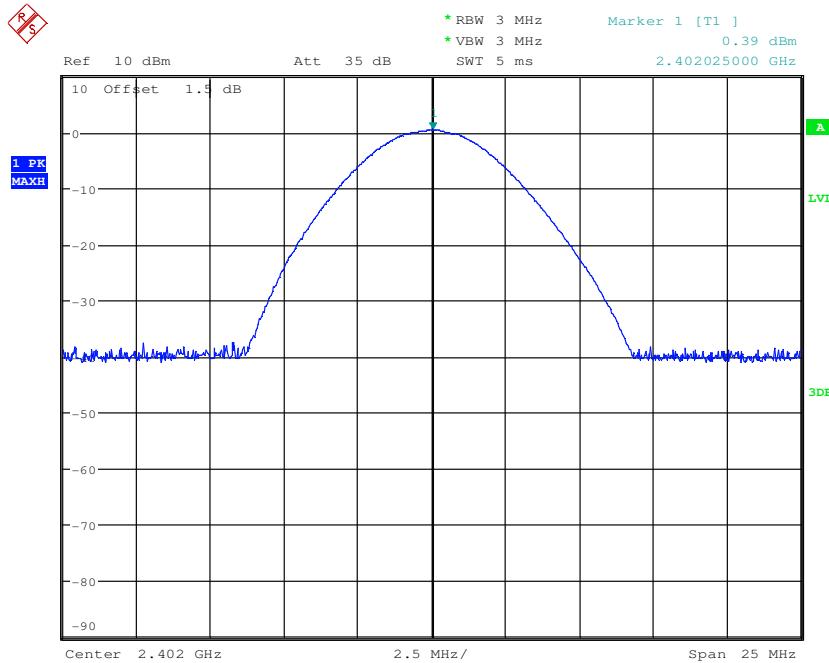
**Model No.: BAR228**

### Measurement Data

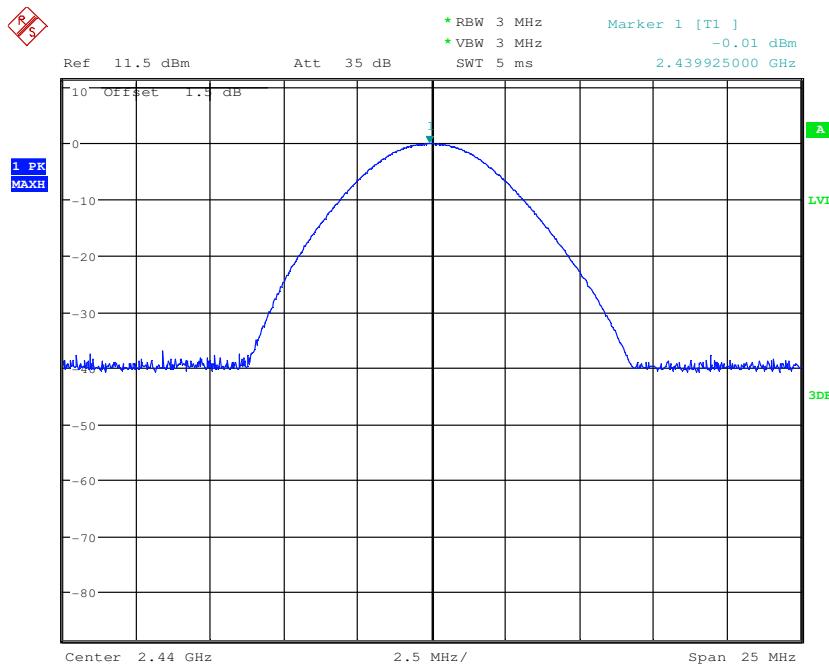
GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	0.39	30.00	Pass
Middle	-0.01	30.00	Pass
Highest	-0.35	30.00	Pass

**Test plot as follows:**

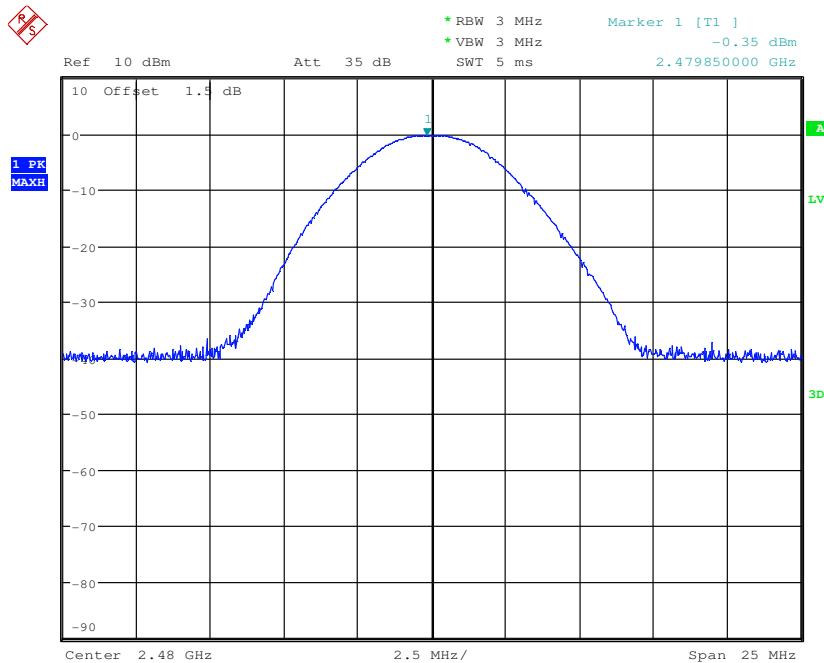
Test mode:	GFSK	Test channel:	Lowest
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Test mode:	GFSK	Test channel:	Middle
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Test mode:	GFSK	Test channel:	Highest
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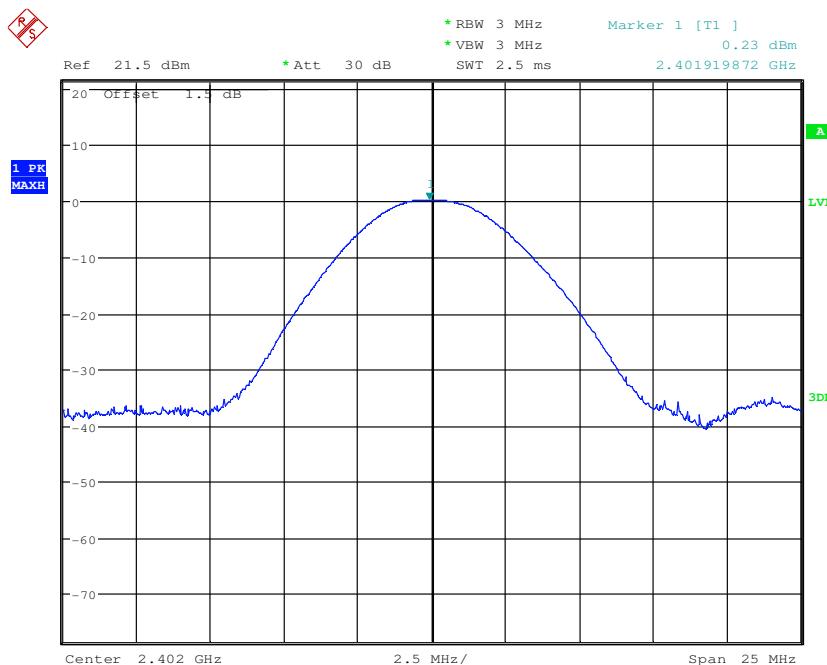


**Model No.: EM221****Measurement Data**

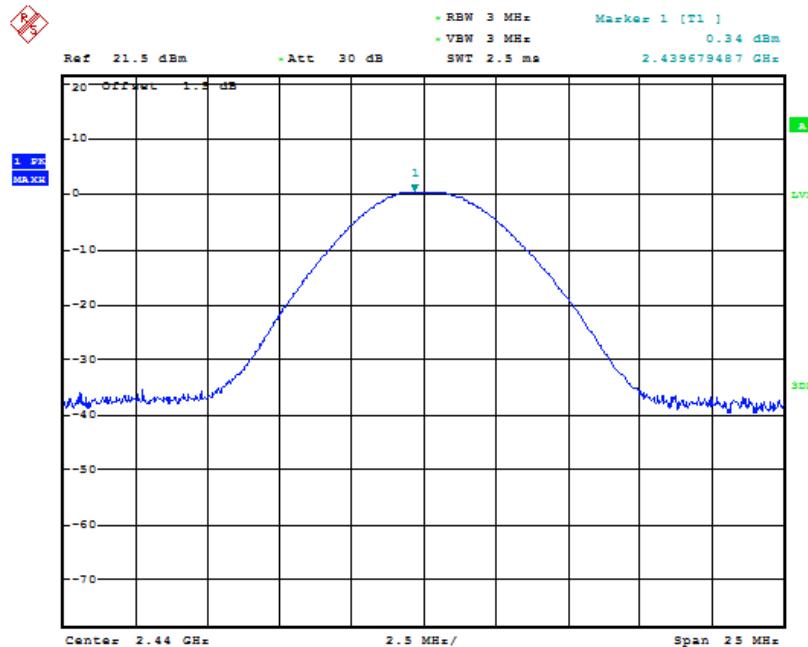
GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	0.23	30.00	Pass
Middle	0.34	30.00	Pass
Highest	0.15	30.00	Pass

**Test plot as follows:**

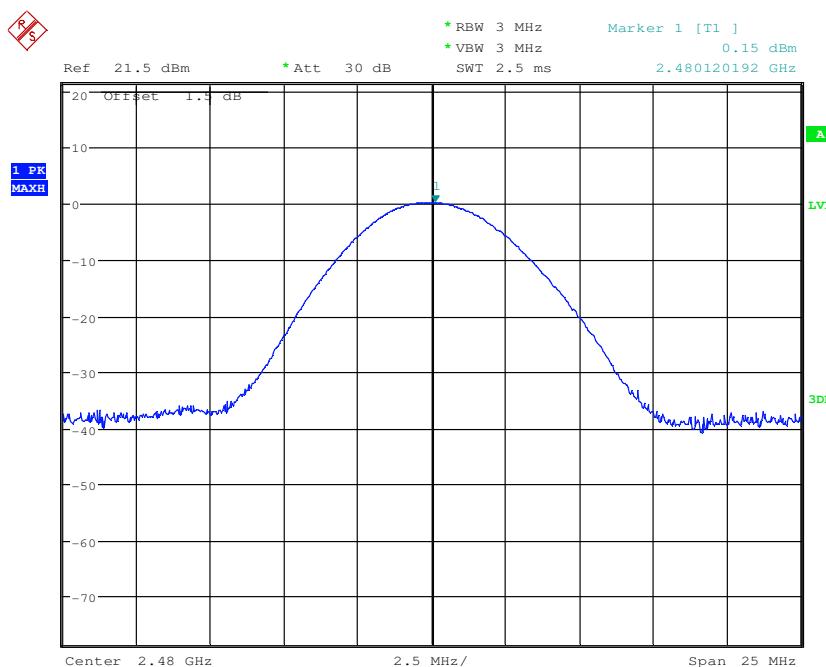
Test mode:	GFSK	Test channel:	Lowest
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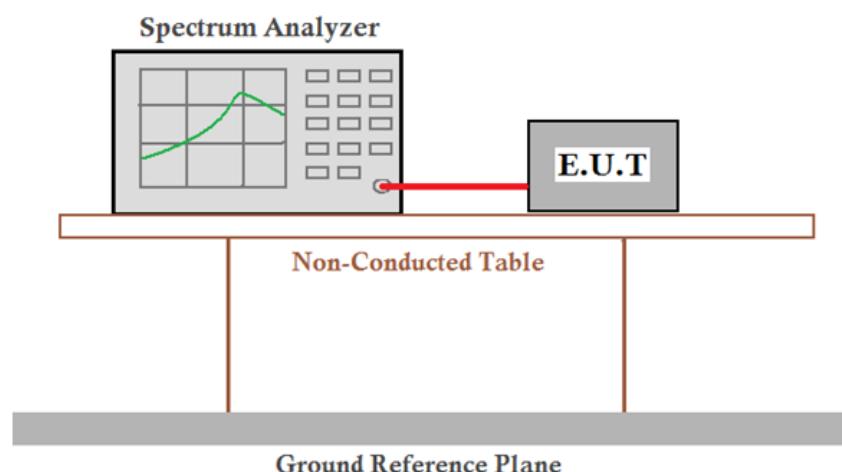
Test mode:	GFSK	Test channel:	Middle
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Test mode:	GFSK	Test channel:	Highest
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### 6.3 6dB Occupy Bandwidth

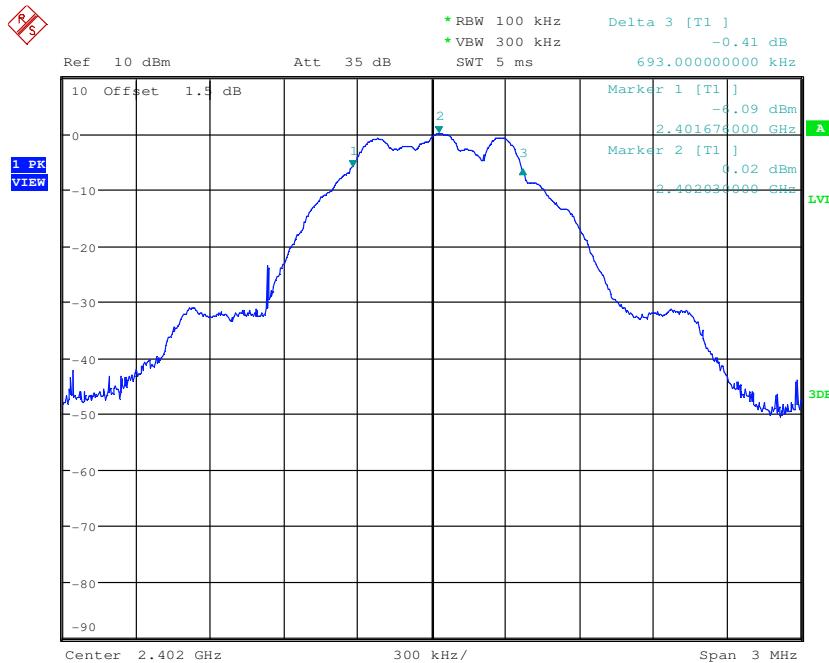
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10 2009
Test Setup:	
Limit:	$\geq 500$ kHz
Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

#### Measurement Data

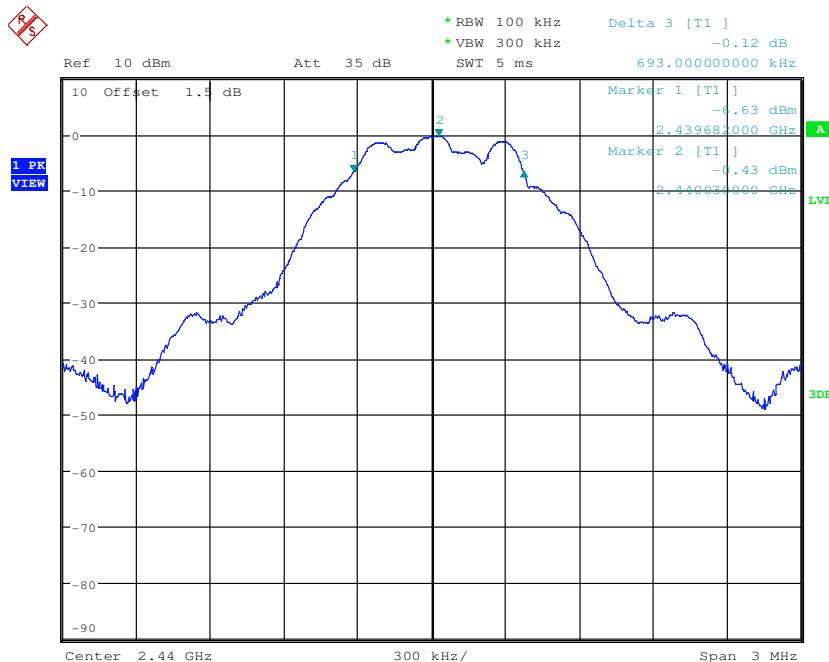
GFSK mode			
Test channel	6dB Occupy Bandwidth (MHz)	Limit (kHz)	Result
Lowest	0.693	$\geq 500$	Pass
Middle	0.693	$\geq 500$	Pass
Highest	0.687	$\geq 500$	Pass

**Test plot as follows:**

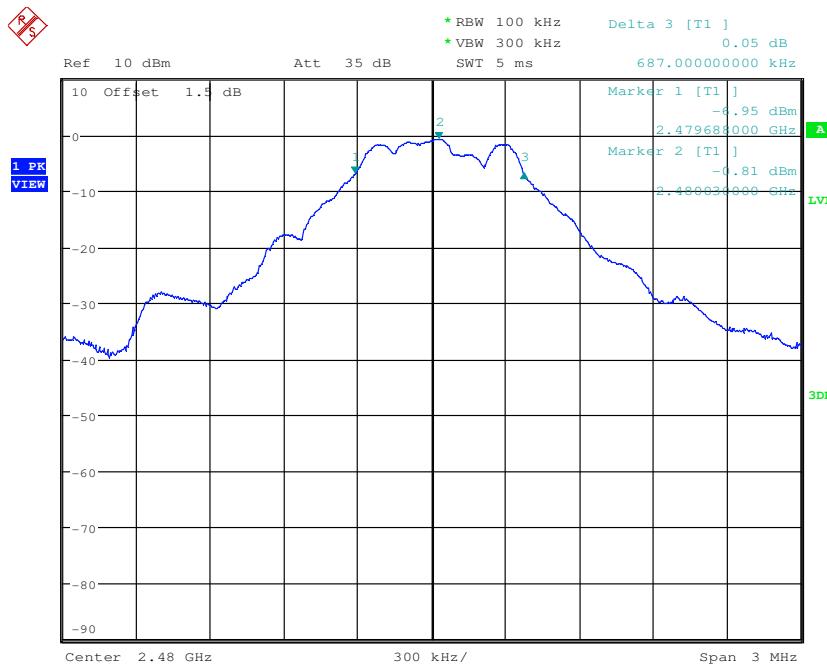
Test mode:	GFSK	Test channel:	Lowest
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Test mode:	GFSK	Test channel:	Middle
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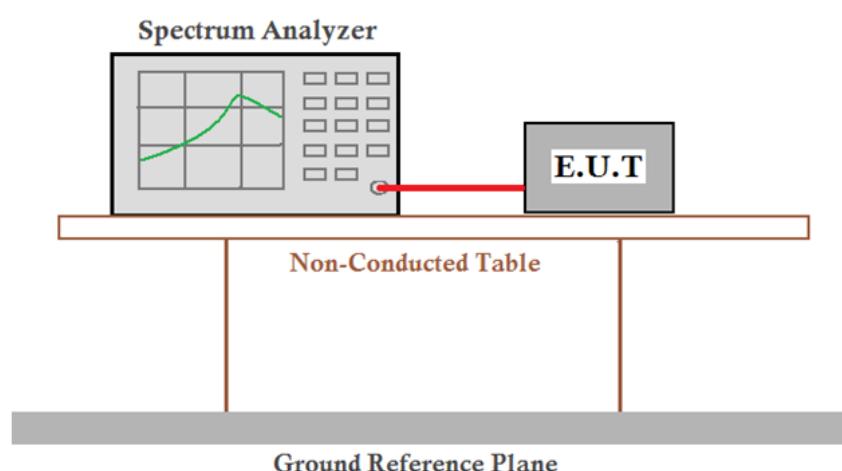


Test mode:	GFSK	Test channel:	Highest
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## 6.4 Power Spectral Density

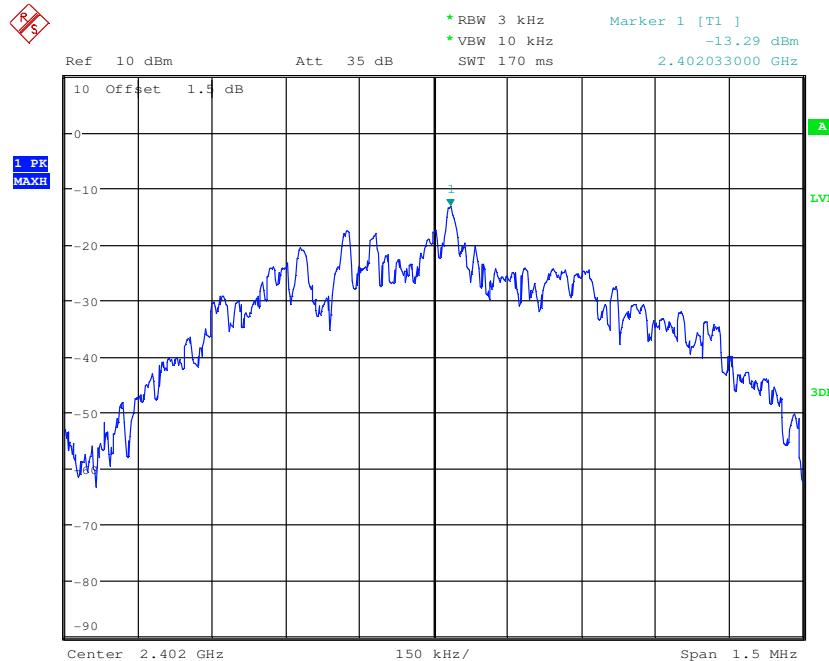
Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10 2009
Test Setup:	
Limit:	$\le 8.00 \text{dBm}/3\text{kHz}$
Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

### Measurement Data

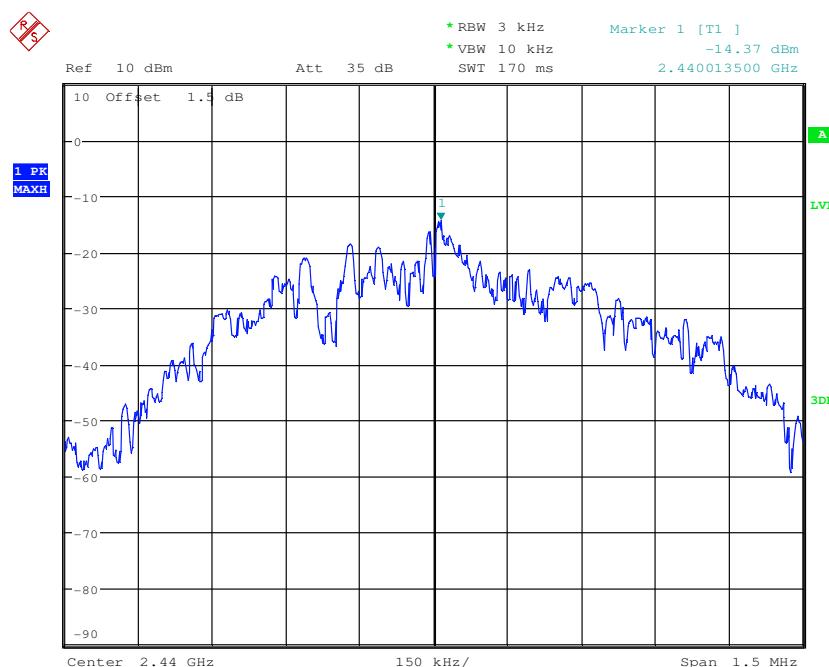
GFSK mode			
Test channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
Lowest	-13.29	$\le 8.00$	Pass
Middle	-14.37	$\le 8.00$	Pass
Highest	-15.13	$\le 8.00$	Pass

**Test plot as follows:**

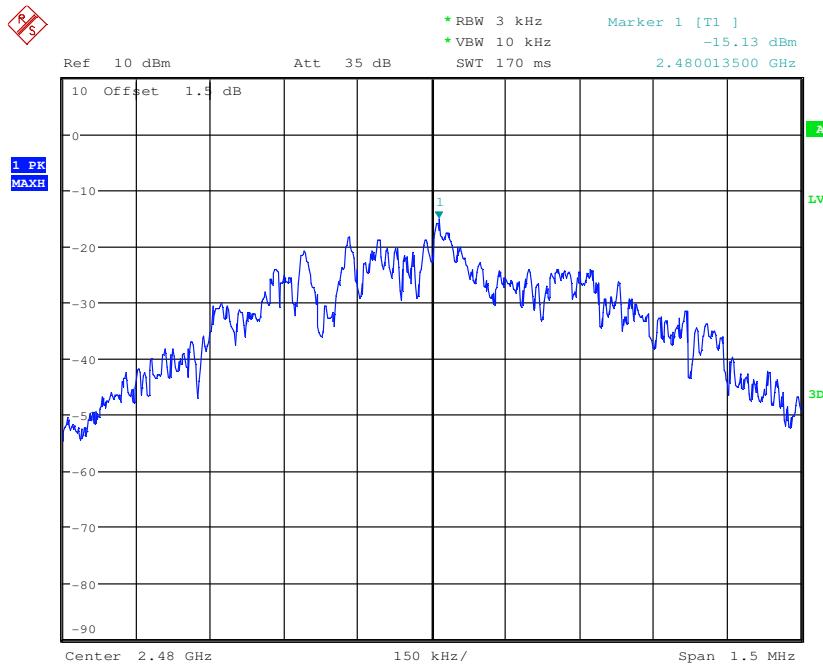
Test mode:	GFSK	Test channel:	Lowest
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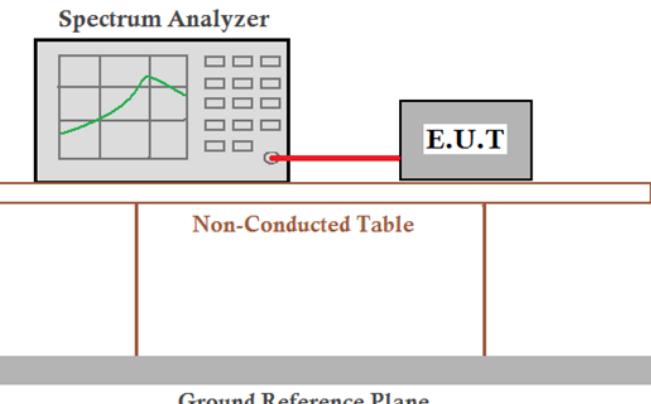
Test mode:	GFSK	Test channel:	Middle
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Test mode:	GFSK	Test channel:	Highest
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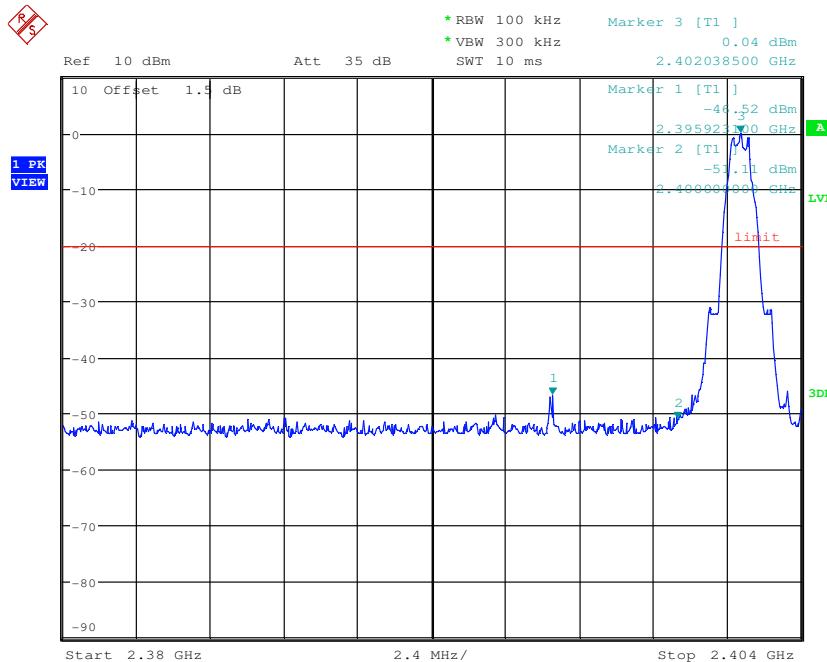


## 6.5 Band-edge for RF Conducted Emissions

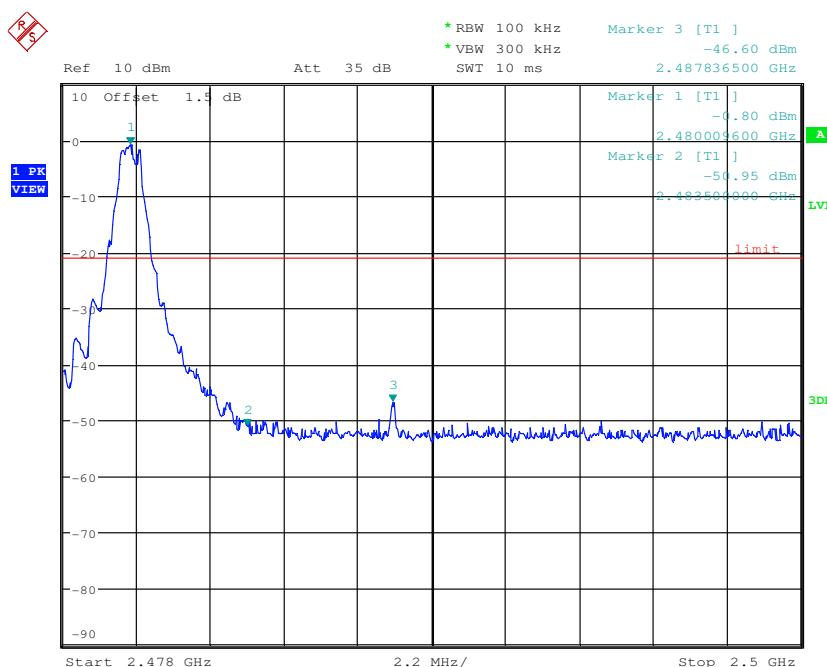
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10 2009
Test Setup:	 <p>Diagram illustrating the test setup for RF Conducted Emissions. A Spectrum Analyzer is connected to the E.U.T (Equipment Under Test) via a cable. The E.U.T is placed on a Non-Conducted Table, which is positioned above a Ground Reference Plane. The entire setup is shown in perspective, with the Spectrum Analyzer on the left and the E.U.T on the right.</p>
Remark:	Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.
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

**Test plot as follows:**

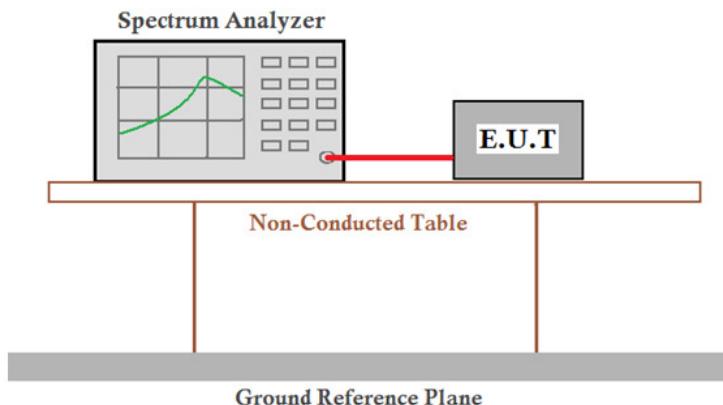
Test mode:	GFSK	Test channel:	Lowest
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Test mode:	GFSK	Test channel:	Highest
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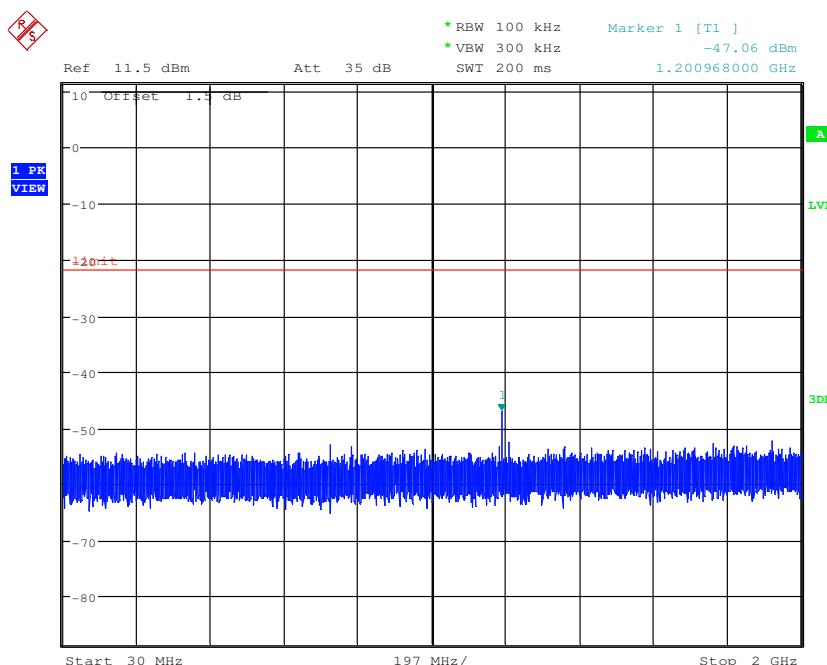
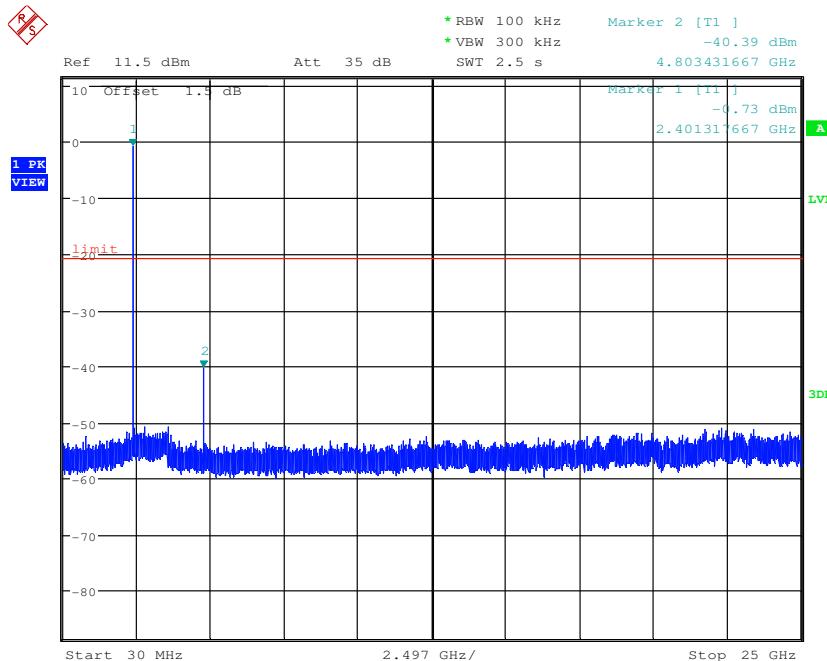


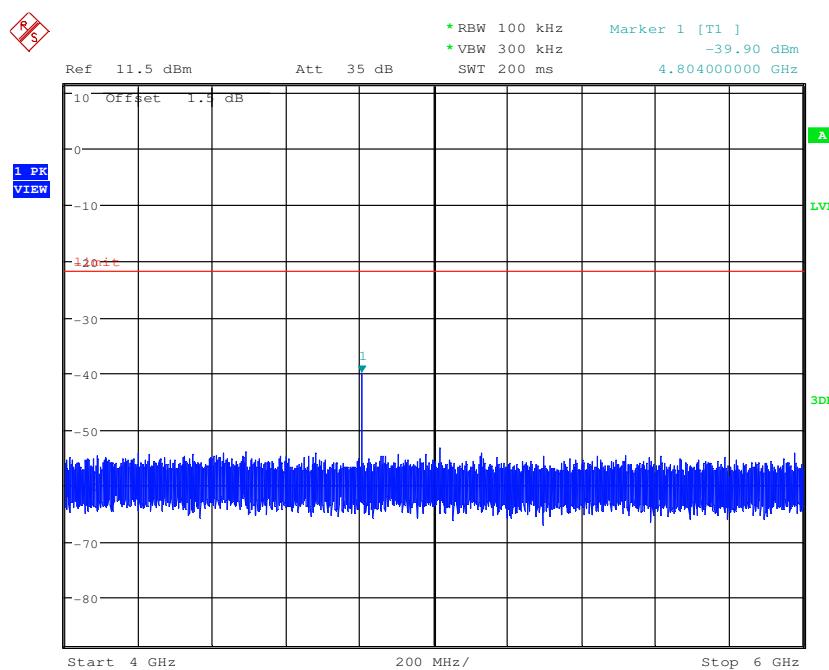
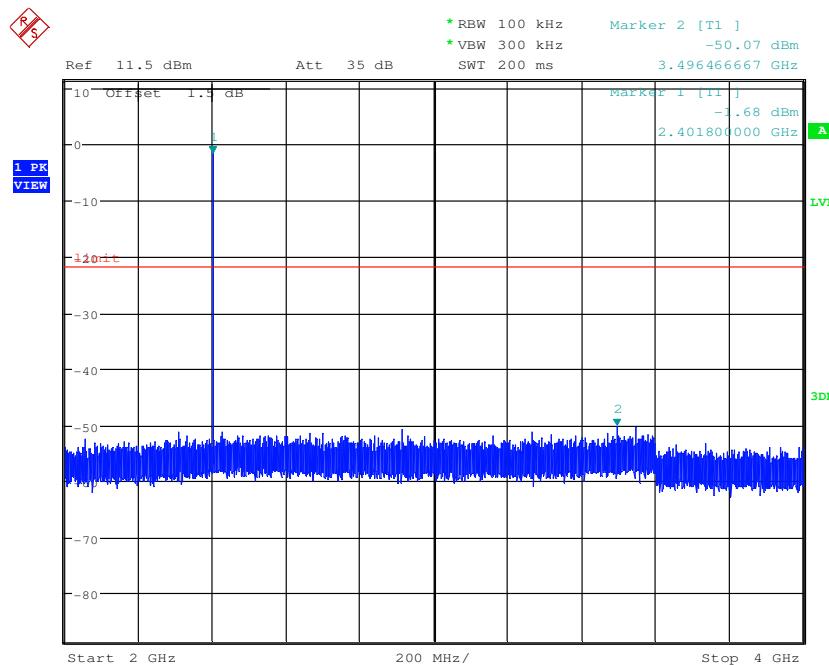
## 6.6 Spurious RF Conducted Emissions

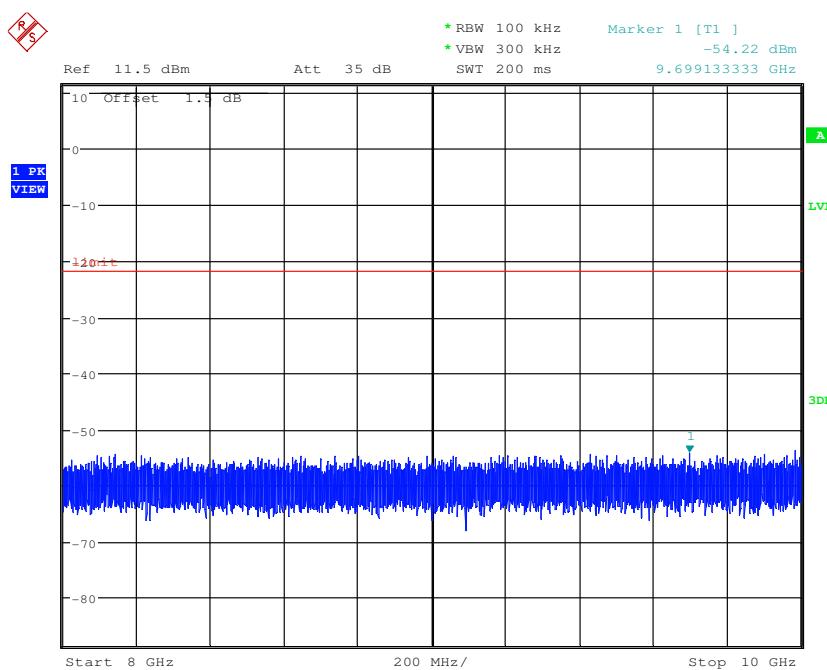
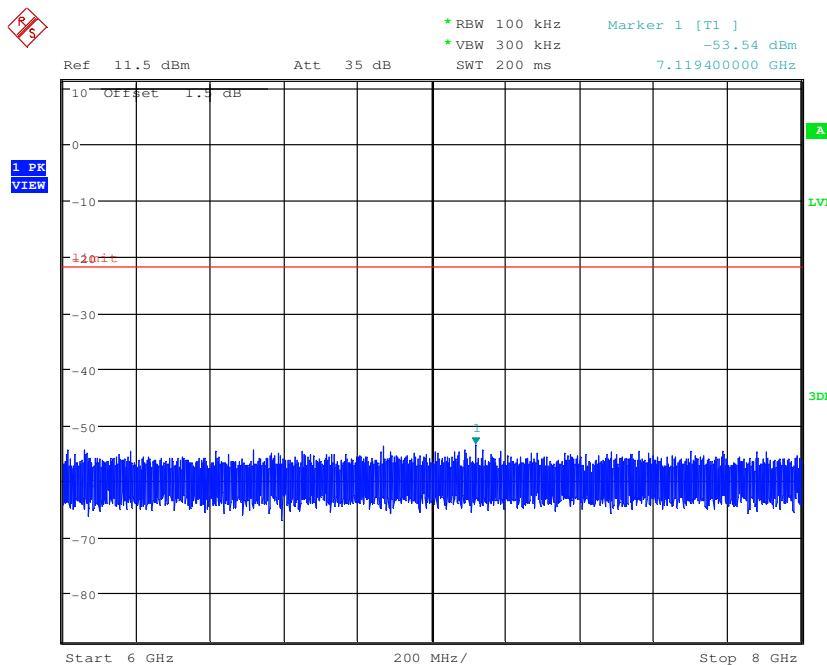
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10 2009
Test Setup:	 <p>The diagram illustrates the test setup for spurious RF conducted emissions. A Spectrum Analyzer is connected to the E.U.T (Equipment Under Test) via a cable. The E.U.T is placed on a Non-Conducted Table. The entire setup is positioned above a Ground Reference Plane.</p>
Remark:	Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.
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

**Test plot as follows:**

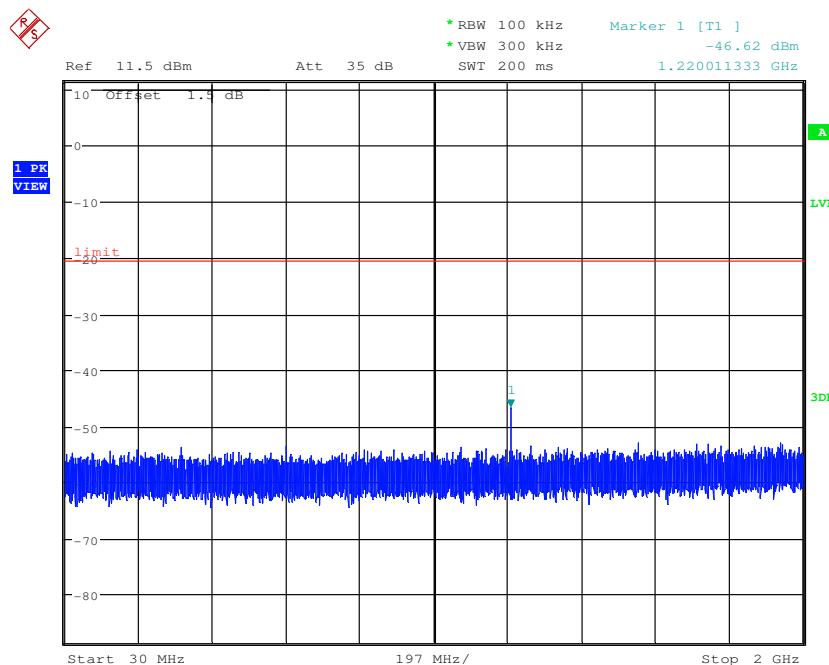
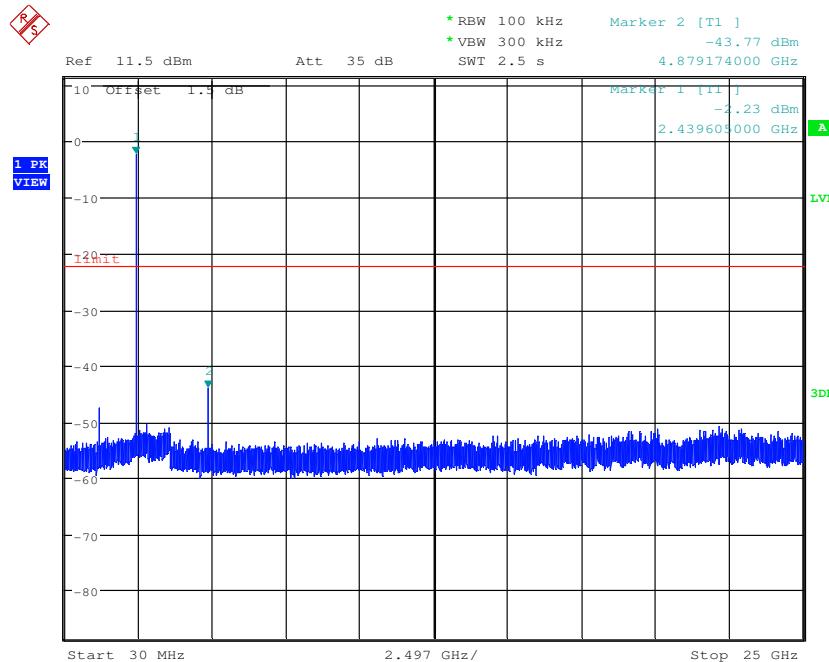
Test mode:	GFSK	Test channel:	Lowest
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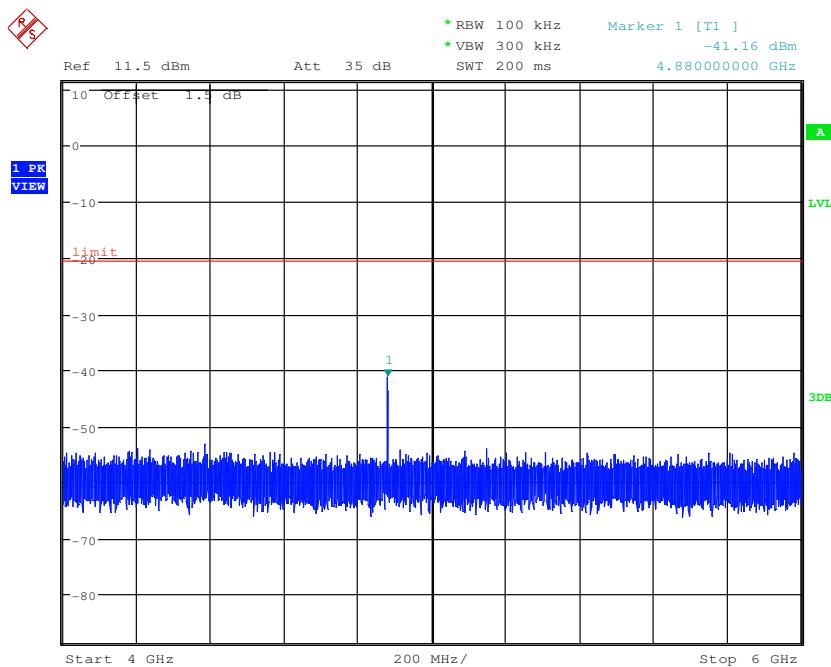
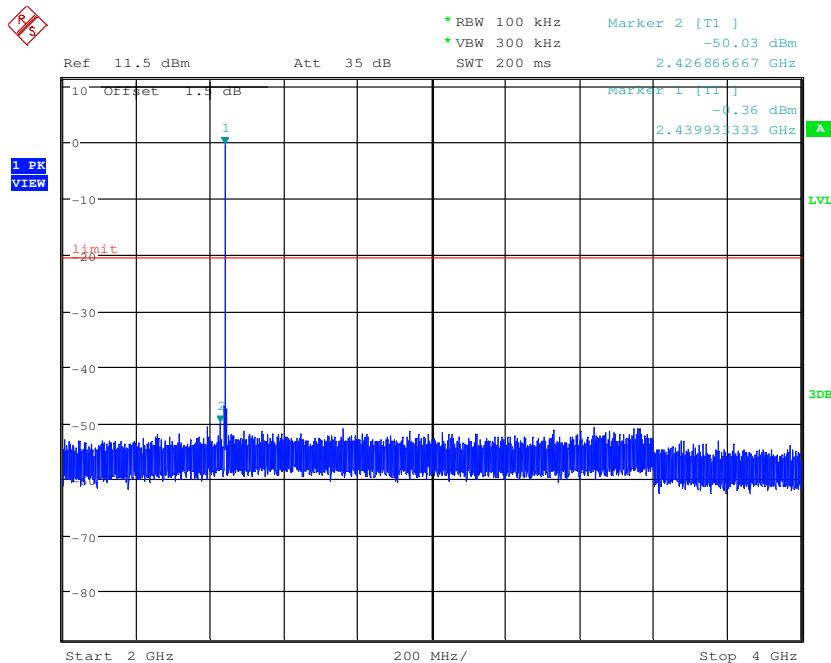


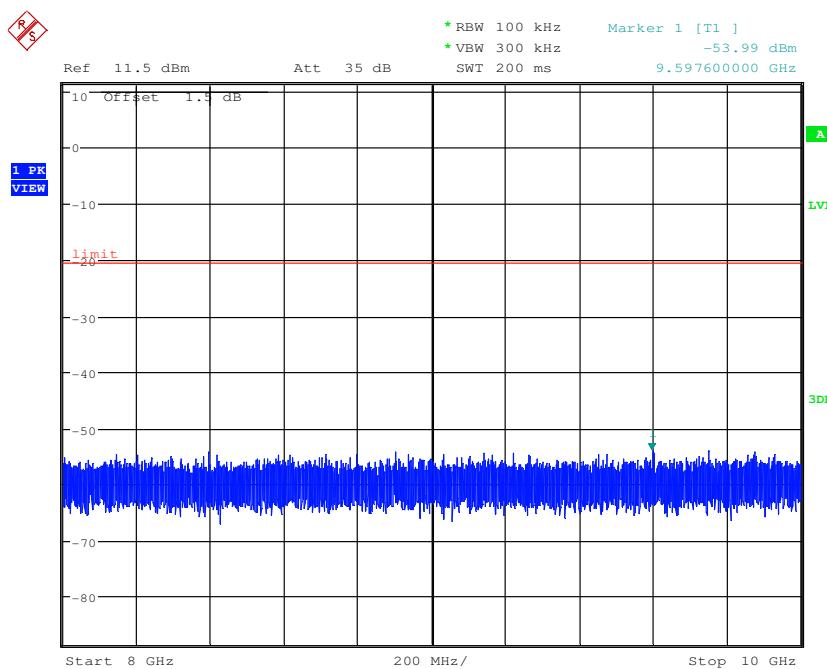
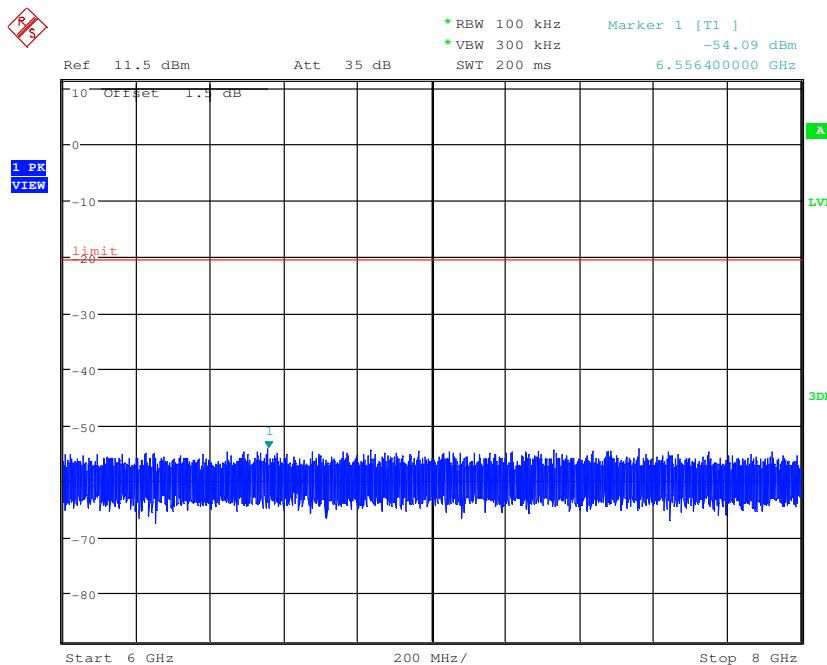




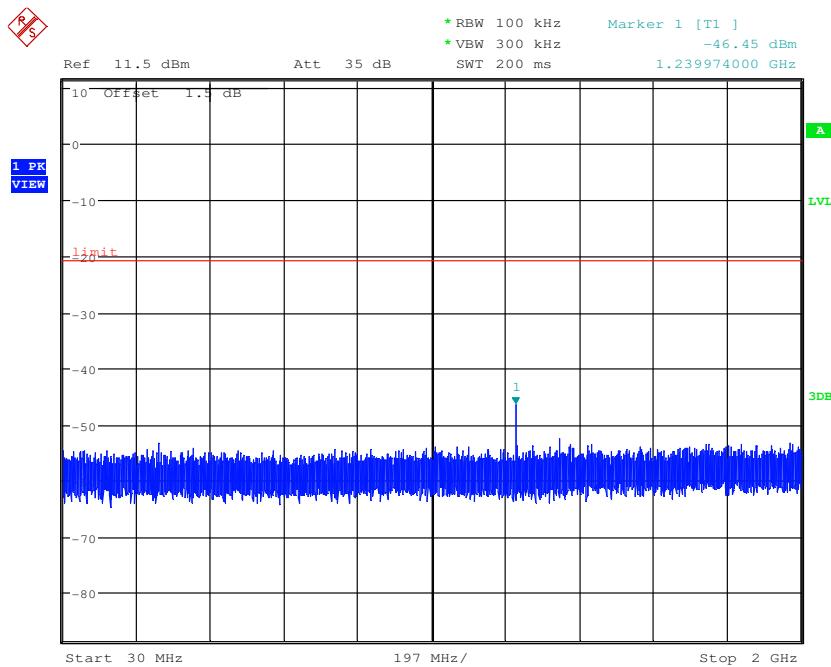
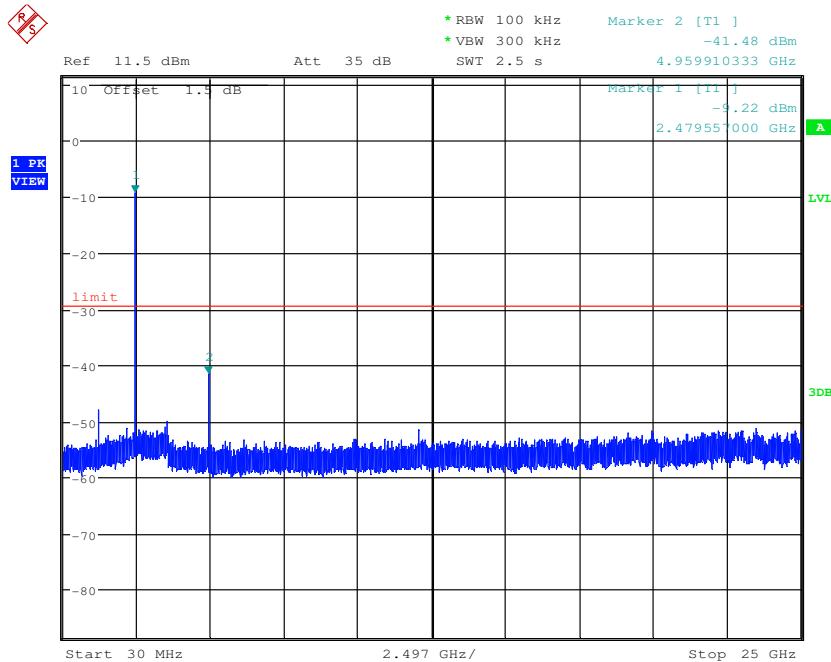
Test mode:	GFSK	Test channel:	Middle
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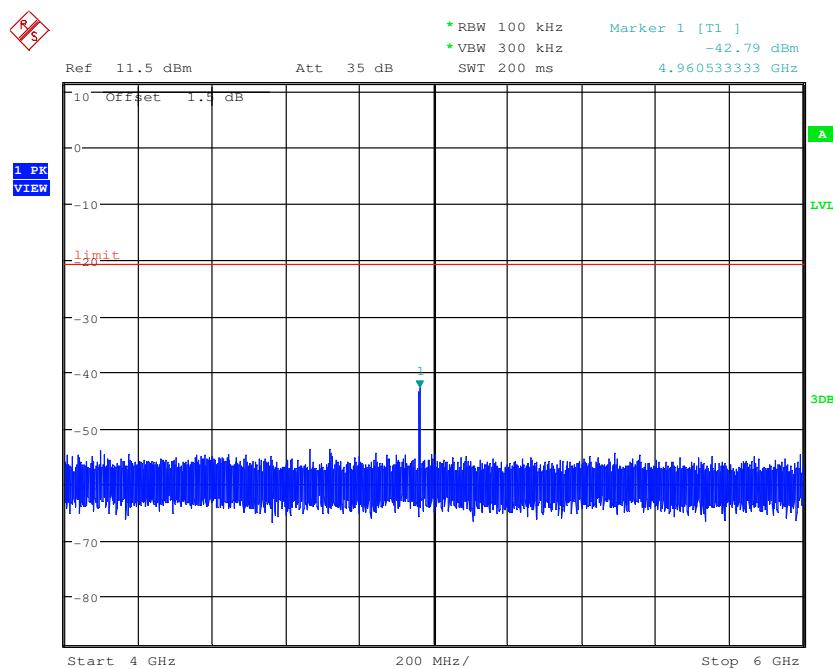
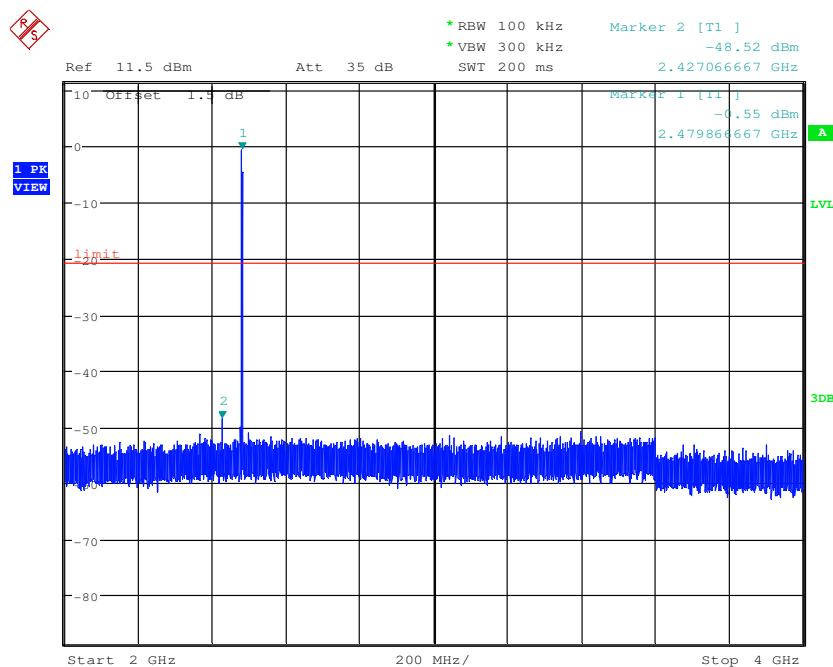


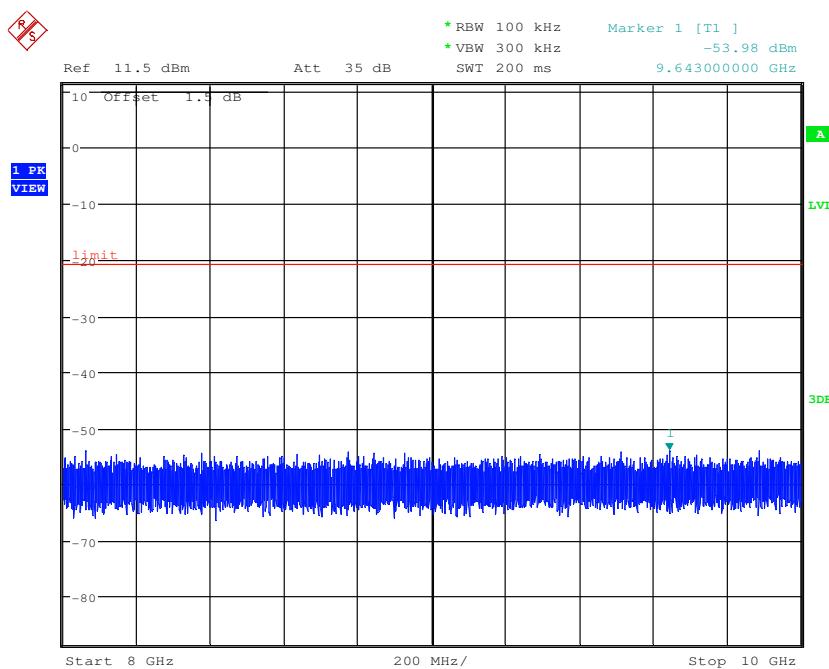
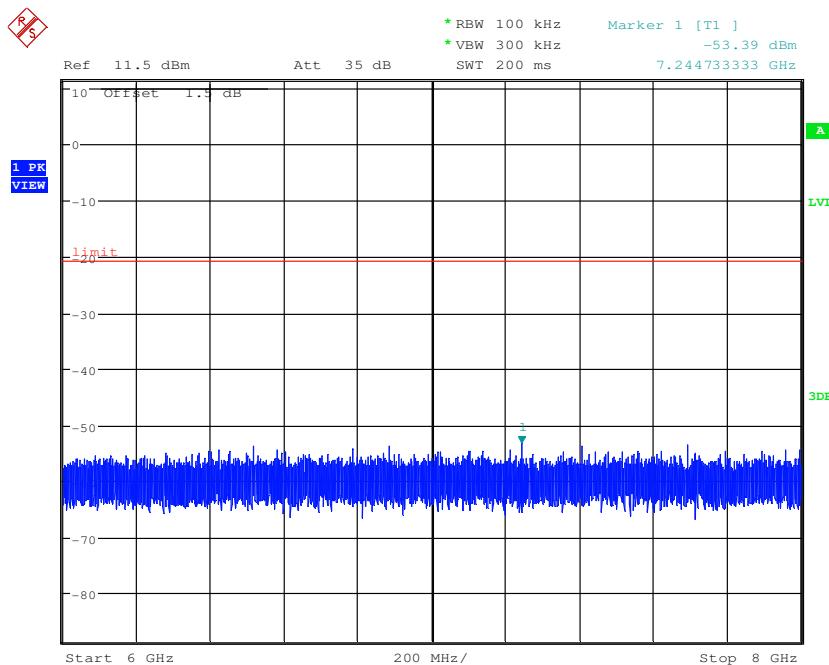




Test mode:	GFSK	Test channel:	Highest
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**Remark:**

Pretest 9kHz to 25GHz, find the highest point when testing, so only the worst data were shown in the test report. Per FCC Part 15.33 (a) and 15.31 (o) ,The amplitude of spurious emissions from intentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

## 6.7 Radiated Spurious Emission

<b>6.7.1 Spurious Emissions</b>					
Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10 2009				
Test Site:	Measurement Distance: 3m (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
Note: 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.					

Test Setup:	

Figure 1. Below 30MHz

Figure 2. 30MHz to 1GHz

Figure 3. Above 1 GHz

**Test Procedure:**

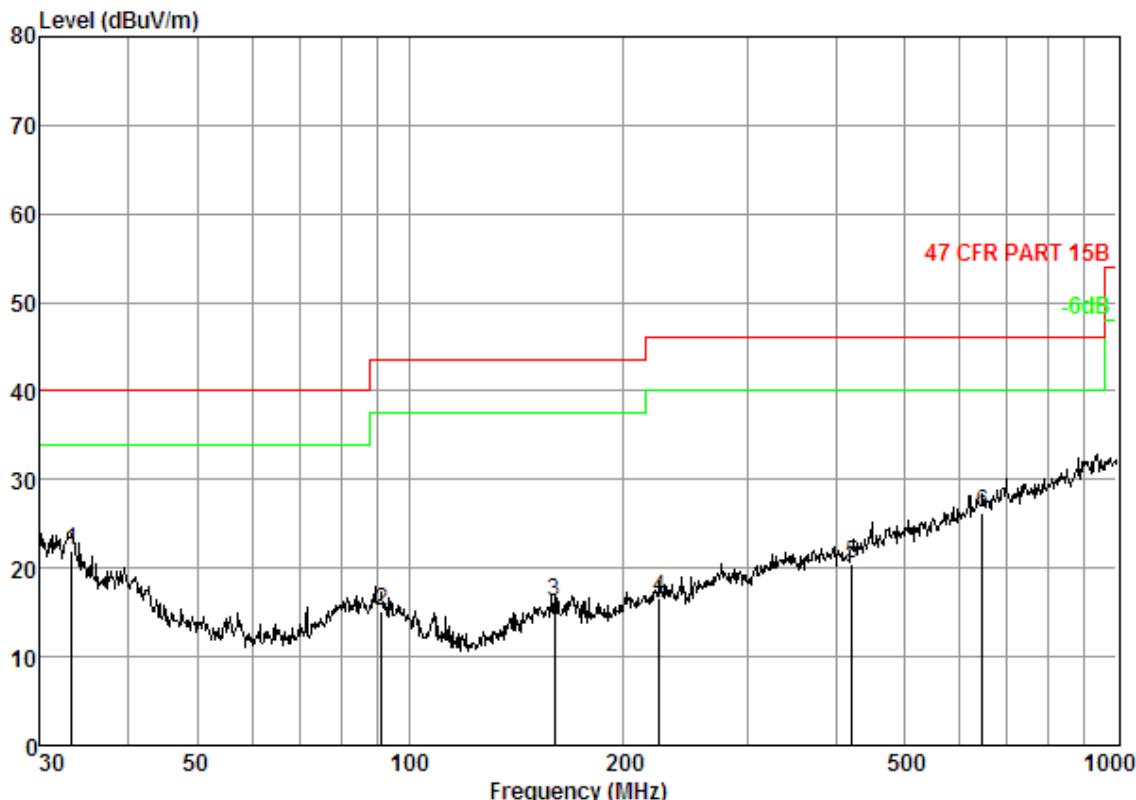
- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top 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.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- 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.
- Test the EUT in the lowest channel (2402MHz), the middle channel (2440MHz), the Highest channel (2480MHz)
- 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. i. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with GFSK modulation. Transmitting mode
Final Test Mode:	Transmitting with GFSK modulation. 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

**Radiated Emission below 1GHz BAR228**

30MHz~1GHz (QP)

Test mode: Transmitting mode Vertical



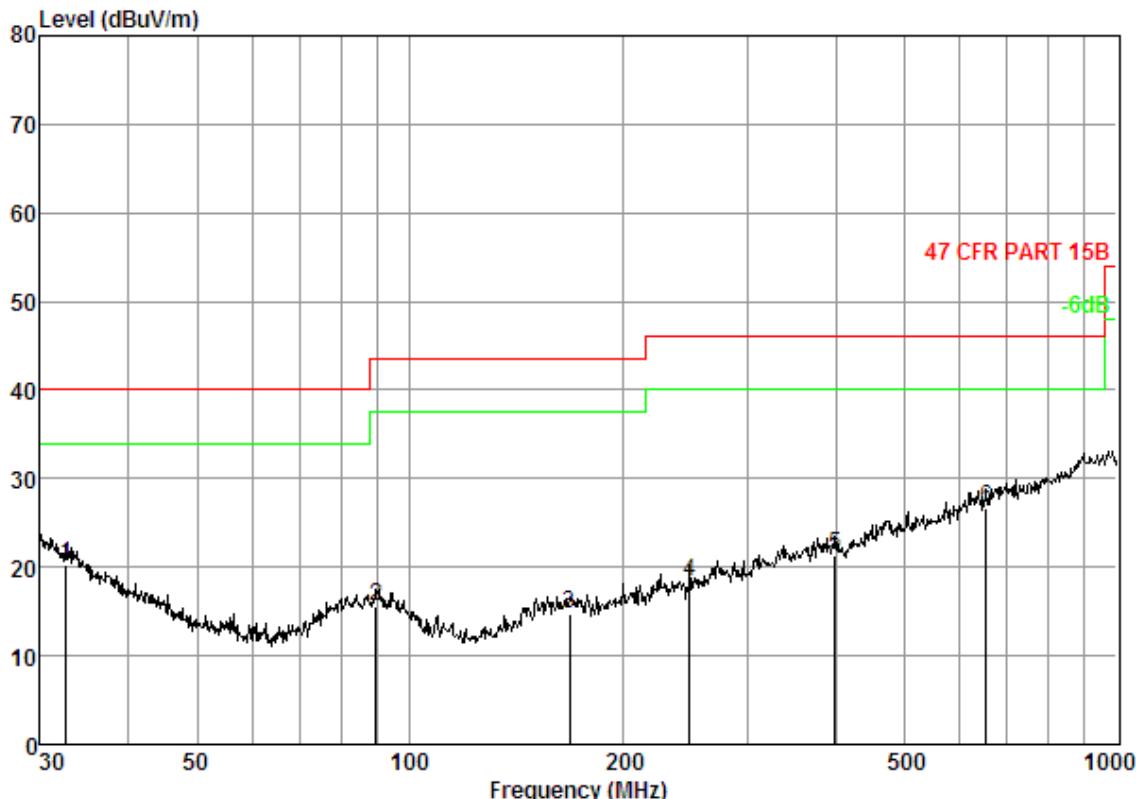
Condition: 47 CFR PART 15B 3m 3142C VERTICAL

Job No. : 5387CR

Test mode: TX

Freq	Cable		Antenna	Preamp	Read	Limit	Over	
	Loss	Factor	Factor		Level			
MHz	dB	dB/m		dB	dBuV	dBuV/m	dBuV/m	dB
1	33.21	0.69	19.58	25.71	27.31	21.87	40.00	-18.13
2	91.17	1.37	13.61	25.52	25.75	15.21	43.50	-28.29
3	160.35	1.93	13.09	25.60	26.75	16.17	43.50	-27.33
4	225.31	2.30	14.10	24.78	24.97	16.59	46.00	-29.41
5	422.06	3.38	17.69	25.42	24.84	20.49	46.00	-25.51
6	645.12	4.38	21.66	26.69	26.95	26.30	46.00	-19.70

Test mode:	Transmitting mode	Horizontal
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Condition: 47 CFR PART 15B 3m 3142C HORIZONTAL

Job No. : 5387CR

Test mode: TX

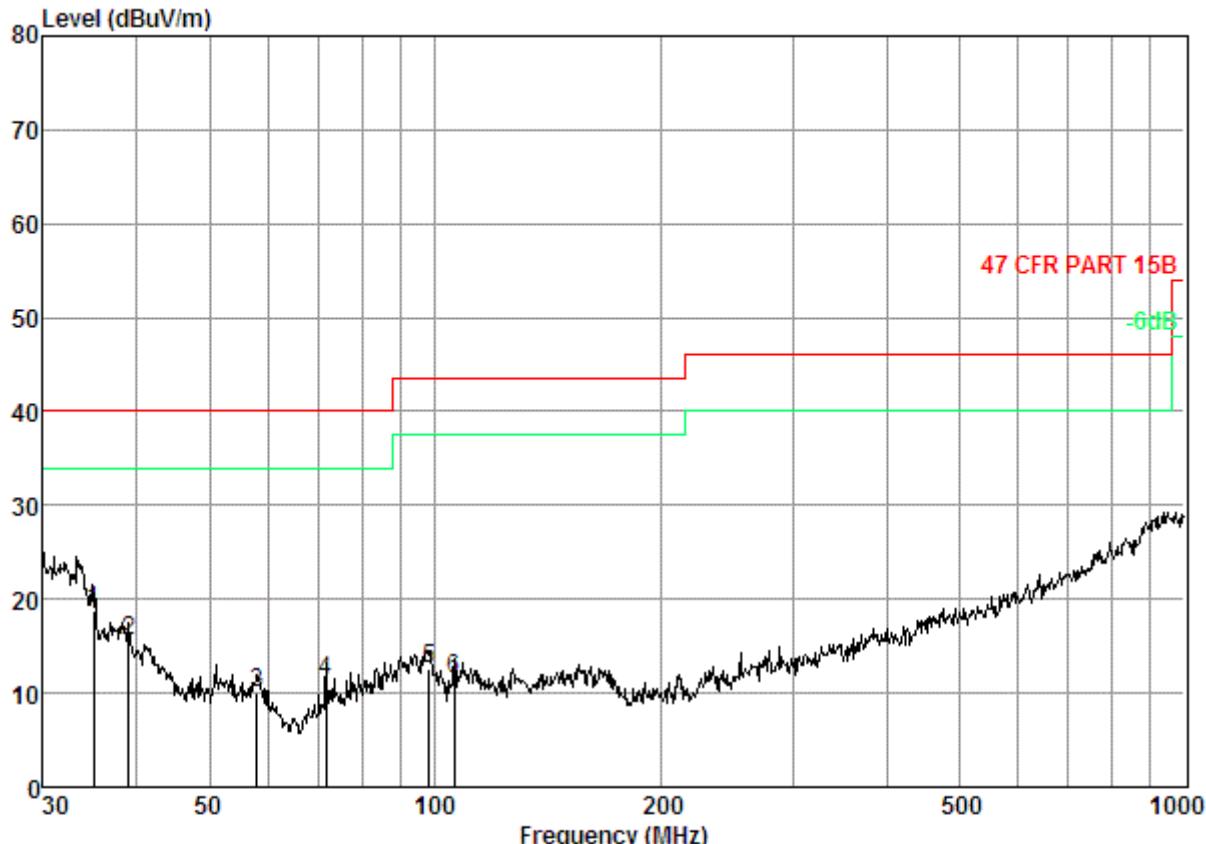
Freq	Cable Loss	Antenna Factor	Preamp Factor	Read	Limit Line	Over Limit		
				Level				
MHz	dB	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB
1	32.63	0.69	19.96	25.71	25.40	20.34	40.00	-19.66
2	89.59	1.34	13.77	25.36	25.79	15.54	43.50	-27.96
3	168.41	1.94	12.94	24.96	24.79	14.71	43.50	-28.79
4	248.55	2.45	14.20	25.16	26.86	18.35	46.00	-27.65
5	399.03	3.29	17.59	25.48	25.98	21.38	46.00	-24.62
6	654.23	4.31	21.76	26.21	26.86	26.72	46.00	-19.28



**Radiated Emission below 1GHz EM221**

30MHz~1GHz (QP)

Test mode: Transmitting mode Vertical



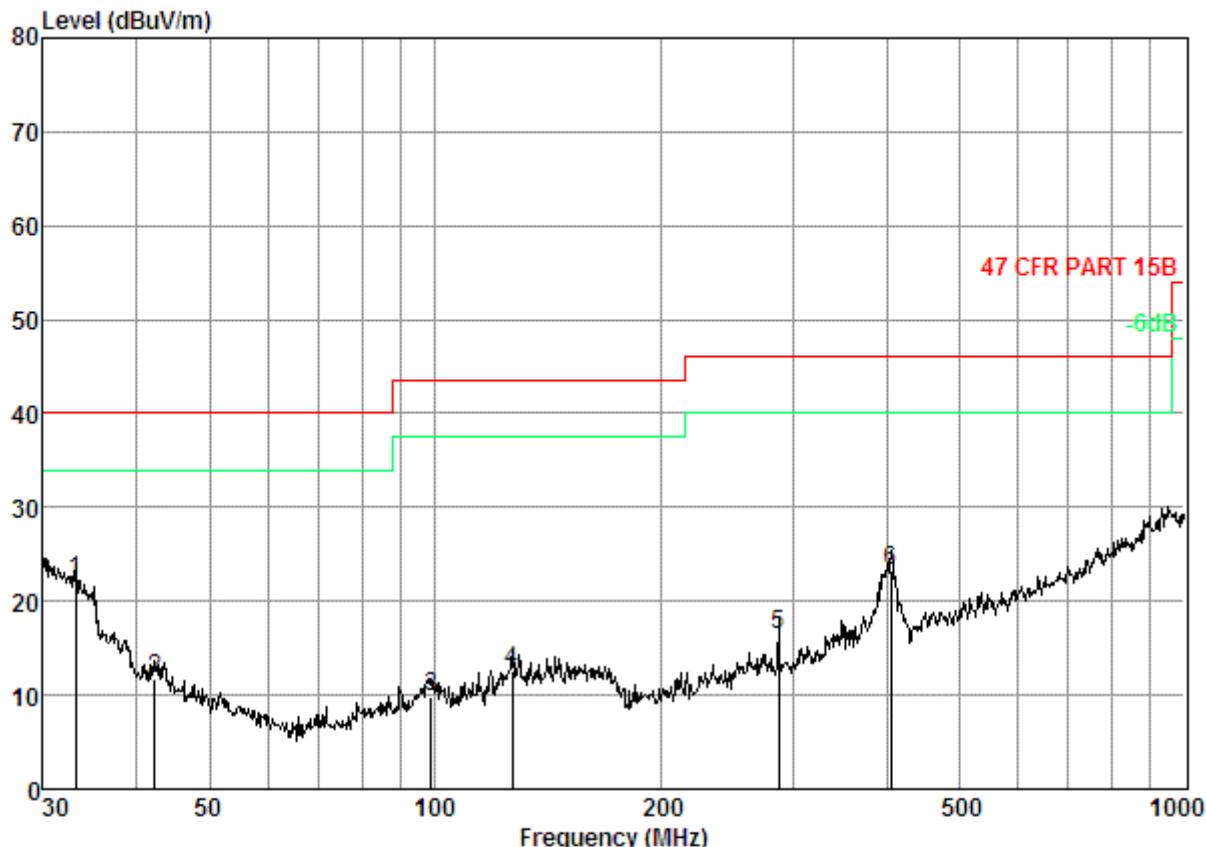
Condition: 47 CFR PART 15B 3m 3142C VERTICAL

Job No. : 5387CR

Test Mode: TX

Freq	Cable		Antenna	Preamp	Read	Limit	Over
	Loss	Factor	Factor	Level	Level		
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	35.00	0.74	18.90	25.76	24.89	18.77	40.00 -21.23
2	39.02	0.77	13.43	25.75	27.15	15.60	40.00 -24.40
3	57.80	1.01	5.97	25.91	28.90	9.97	40.00 -30.03
4	71.58	1.17	4.77	26.02	31.36	11.28	40.00 -28.72
5	98.14	1.42	6.30	25.50	30.32	12.54	43.50 -30.96
6	106.01	1.46	7.06	26.18	29.28	11.62	43.50 -31.88

Test mode:	Transmitting mode	Horizontal
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Condition: 47 CFR PART 15B 3m 3142C HORIZONTAL

Job No. : 5387CR

Test Mode: TX

Freq	Cable			Antenna	Preamp	Read	Limit	Over
	Loss	Antenna	Preamp	Factor	Level	Level		
1	33.09	0.69	20.50	25.71	26.66	22.14	40.00	-17.86
2	42.30	0.86	10.63	25.71	25.90	11.68	40.00	-28.32
3	98.83	1.43	6.50	25.56	27.43	9.80	43.50	-33.70
4	126.77	1.64	8.01	24.88	27.88	12.65	43.50	-30.85
5	286.98	2.69	9.25	24.75	29.24	16.43	46.00	-29.57
6	406.09	3.29	11.50	25.68	34.23	23.34	46.00	-22.66

**Model BAR228:**

Transmitter Emission above 1GHz										
Test mode:		GFSK		Test channel:		Lowest		Remark:		Peak
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization		
3770.567	6.81	33.13	38.86	44.86	45.94	74	-28.06	Vertical		
4804.000	6.42	34.70	39.24	46.46	48.34	74	-25.66	Vertical		
5836.872	7.83	35.98	39.20	45.93	50.54	74	-23.46	Vertical		
7206.000	8.92	35.63	39.07	44.10	49.58	74	-24.42	Vertical		
9608.000	9.99	37.33	37.93	41.58	50.97	74	-23.03	Vertical		
12226.070	10.95	38.98	38.89	41.95	52.99	74	-21.01	Vertical		
3684.279	6.86	33.06	38.82	45.04	46.14	74	-27.86	Horizontal		
4804.000	6.42	34.70	39.24	50.14	52.02	74	-21.98	Horizontal		
6157.871	8.04	36.13	39.17	46.49	51.49	74	-22.51	Horizontal		
7206.000	8.92	35.63	39.07	44.93	50.41	74	-23.59	Horizontal		
9608.000	9.99	37.33	37.93	42.65	52.04	74	-21.96	Horizontal		
12226.070	10.95	38.98	38.89	42.00	53.04	74	-20.96	Horizontal		

Test mode:		GFSK		Test channel:		Middle		Remark:		Peak
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization		
3678.952	6.87	33.06	38.82	44.91	46.02	74	-27.98	Vertical		
4880.000	6.58	34.78	39.26	45.07	47.17	74	-26.83	Vertical		
6175.716	8.04	36.11	39.17	46.13	51.11	74	-22.89	Vertical		
7320.000	9.07	35.51	39.06	46.02	51.54	74	-22.46	Vertical		
9760.000	9.90	37.80	37.84	40.74	50.60	74	-23.40	Vertical		
12512.420	11.31	39.23	39.13	41.42	52.83	74	-21.17	Vertical		
3786.970	6.80	33.14	38.86	45.77	46.85	74	-27.15	Horizontal		
4880.000	6.58	34.78	39.26	49.63	51.73	74	-22.27	Horizontal		
6175.716	8.04	36.11	39.17	46.76	51.74	74	-22.26	Horizontal		
7320.000	9.07	35.51	39.06	46.05	51.57	74	-22.43	Horizontal		
9760.000	9.90	37.80	37.84	41.33	51.19	74	-22.81	Horizontal		
12208.390	10.93	38.96	38.88	42.69	53.70	74	-20.30	Horizontal		

Test mode:		GFSK		Test channel:		Highest		Remark:		Peak
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization		
3754.236	6.82	33.12	38.85	45.44	46.53	74	-27.47	Vertical		
4960.000	6.76	34.86	39.29	45.93	48.26	74	-25.74	Vertical		
6016.949	8.08	36.28	39.18	45.15	50.33	74	-23.67	Vertical		
7440.000	9.23	35.43	39.05	45.07	50.68	74	-23.32	Vertical		
9920.000	9.81	38.27	37.75	41.21	51.54	74	-22.46	Vertical		
12226.070	10.95	38.98	38.89	42.10	53.14	74	-20.86	Vertical		
3657.721	6.88	33.04	38.81	45.18	46.29	74	-27.71	Horizontal		
4960.000	6.76	34.86	39.29	49.07	51.40	74	-22.60	Horizontal		
6122.333	8.05	36.16	39.17	45.56	50.60	74	-23.40	Horizontal		
7440.000	9.23	35.43	39.05	44.61	50.22	74	-23.78	Horizontal		
9920.000	9.81	38.27	37.75	40.86	51.19	74	-22.81	Horizontal		
12173.120	10.87	38.92	38.85	41.70	52.64	74	-21.36	Horizontal		

**Model EM221:**

Transmitter Emission above 1GHz										
Test mode:		GFSK		Test channel:		Lowest		Remark:		Peak
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization		
3652.432	10.18	32.31	38.43	39.45	43.51	74	-30.49	Vertical		
4804.000	11.63	34.10	38.75	45.22	52.20	74	-21.80	Vertical		
5982.226	12.97	34.66	38.96	38.57	47.24	74	-26.76	Vertical		
7206.000	14.57	35.60	37.64	34.85	47.38	74	-26.62	Vertical		
9608.000	17.40	37.10	36.35	29.06	47.21	74	-26.79	Vertical		
12458.220	21.30	37.76	37.61	30.76	52.21	74	-21.79	Vertical		
3631.354	10.16	32.23	38.42	39.86	43.83	74	-30.17	Horizontal		
4804.000	11.63	34.10	38.75	46.89	53.87	74	-20.13	Horizontal		
6211.563	13.21	34.80	38.68	38.00	47.33	74	-26.67	Horizontal		
7206.000	14.57	35.60	37.64	35.23	47.76	74	-26.24	Horizontal		
9608.000	17.40	37.10	36.35	29.94	48.09	74	-25.91	Horizontal		
12458.220	21.30	37.76	37.61	30.58	52.03	74	-21.97	Horizontal		

Test mode:		GFSK		Test channel:		Middle		Remark:		Peak
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization		
3716.403	10.25	32.57	38.45	39.15	43.52	74	-30.48	Vertical		
4880.000	11.70	34.18	38.76	43.87	50.99	74	-23.01	Vertical		
5930.516	12.93	34.53	38.95	37.79	46.30	74	-27.70	Vertical		
7320.000	14.84	35.54	37.59	33.75	46.54	74	-27.46	Vertical		
9760.000	17.89	37.10	36.14	31.28	50.13	74	-23.87	Vertical		
12458.220	21.30	37.76	37.61	30.55	52.00	74	-22.00	Vertical		
3694.956	10.23	32.49	38.44	39.56	43.84	74	-30.16	Horizontal		
4880.000	11.70	34.18	38.76	46.03	53.15	74	-20.85	Horizontal		
5973.576	12.96	34.63	38.96	38.04	46.67	74	-27.33	Horizontal		
7320.000	14.84	35.54	37.59	35.59	48.38	74	-25.62	Horizontal		
9760.000	17.89	37.10	36.14	31.78	50.63	74	-23.37	Horizontal		
12494.320	21.35	37.79	37.65	30.37	51.86	74	-22.14	Horizontal		

Test mode:		GFSK		Test channel:		Highest		Remark:		Peak
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization		
3847.726	10.38	32.95	38.50	39.30	44.13	74	-29.87	Vertical		
4960.000	11.78	34.26	38.78	43.03	50.29	74	-23.71	Vertical		
5982.226	12.97	34.66	38.96	39.45	48.12	74	-25.88	Vertical		
7440.000	15.13	35.60	37.54	34.10	47.29	74	-26.71	Vertical		
9920.000	18.40	37.22	35.93	33.40	53.09	74	-20.91	Vertical		
12603.270	21.43	37.90	37.75	30.94	52.52	74	-21.48	Vertical		
3705.664	10.24	32.53	38.45	39.26	43.58	74	-30.42	Horizontal		
4960.000	11.78	34.26	38.78	46.14	53.40	74	-20.60	Horizontal		
6202.582	13.20	34.80	38.70	36.76	46.06	74	-27.94	Horizontal		
7440.000	15.13	35.60	37.54	33.23	46.42	74	-27.58	Horizontal		
9920.000	18.40	37.22	35.93	32.26	51.95	74	-22.05	Horizontal		
12494.320	21.35	37.79	37.65	30.85	52.34	74	-21.66	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:  
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
- 2) Scan from 9kHz to 25GHz, the disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. 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.

## 6.8 Restricted bands around fundamental frequency

Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10 2009		
Test Site:	Measurement Distance: 3m (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:

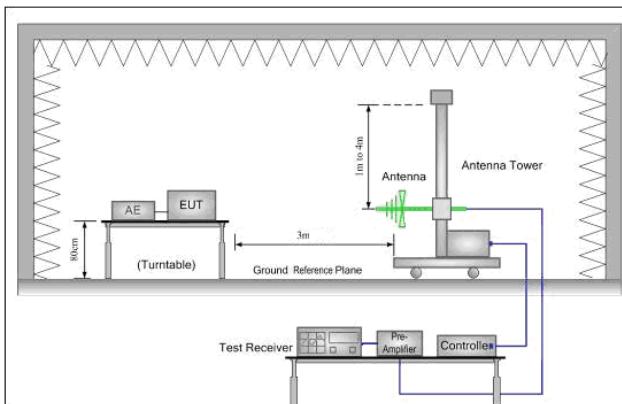


Figure 1. 30MHz to 1GHz

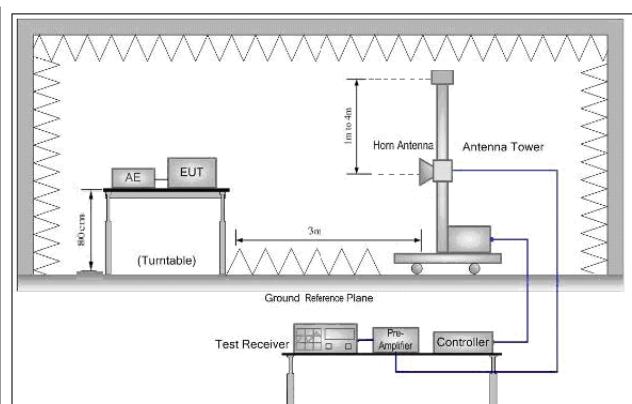


Figure 2. Above 1 GHz

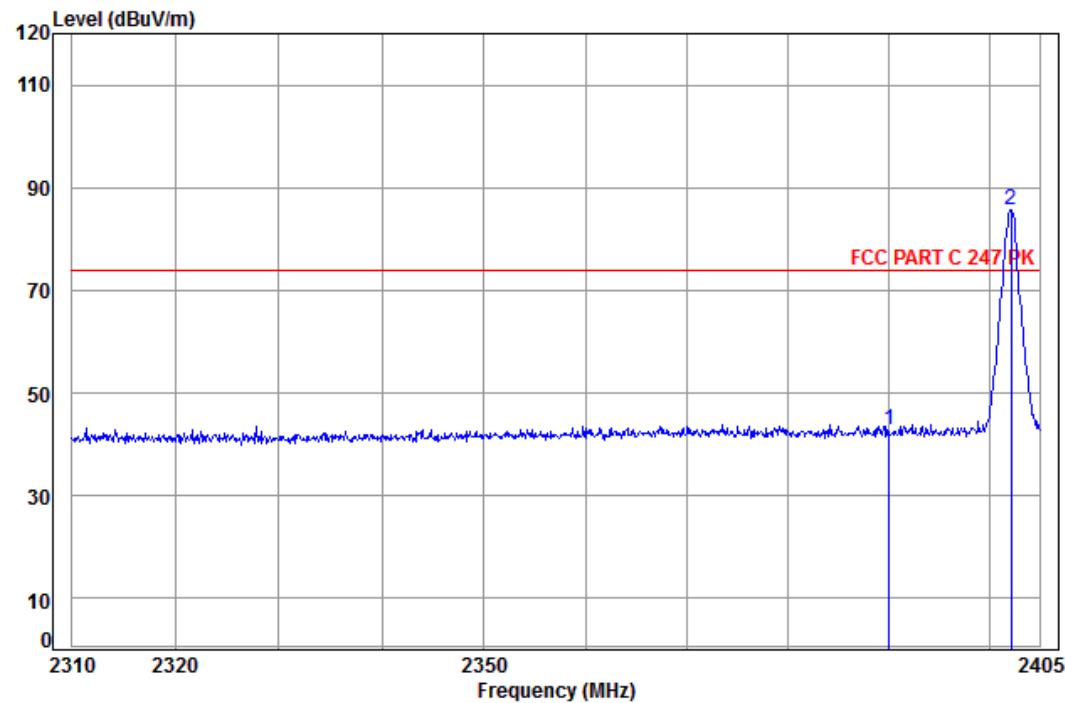
Test Procedure:	<ol style="list-style-type: none"> <li>The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.</li> <li>The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</li> <li>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.</li> <li>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.</li> <li>The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>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</li> </ol>
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	<ul style="list-style-type: none"><li>g. Test the EUT in the lowest channel , the Highest channel</li><li>h. 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.</li><li>i. Repeat above procedures until all frequencies measured was complete.</li></ul>
Exploratory Test Mode:	Transmitting with GFSK modulation. Transmitting mode
Final Test Mode:	Transmitting with GFSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

**Test plot as follows:**

Test mode:	GFSK	Test channel:	Lowest	Remark:	Peak	Vertical
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Data: 332



Site : chamber

Condition: FCC PART C 247 PK 3m Vertical

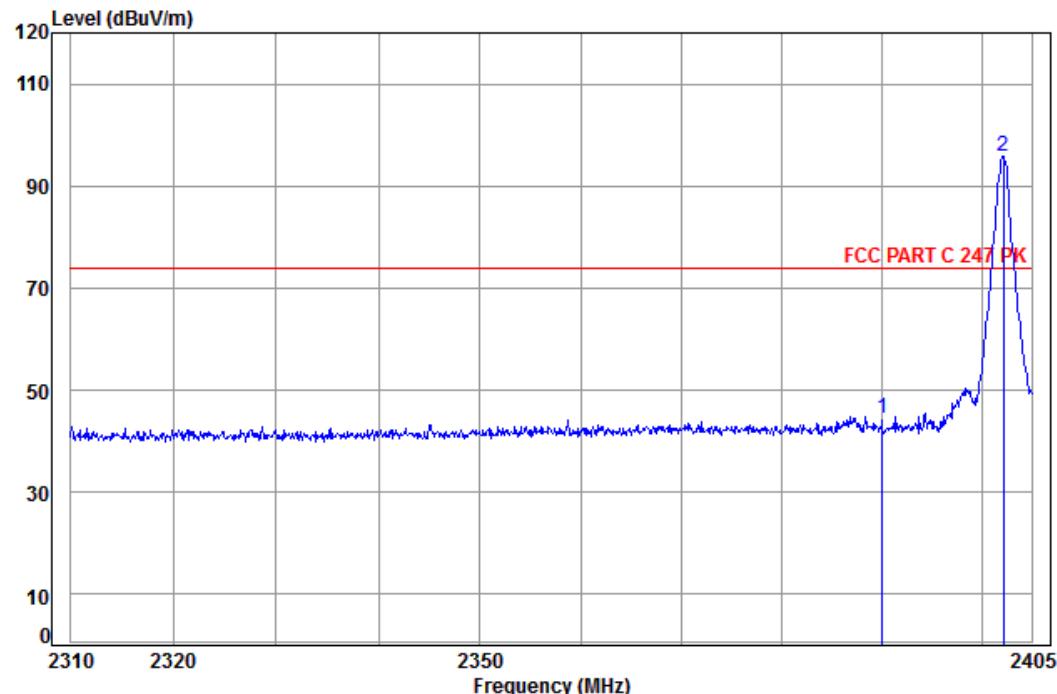
Job No: : 5387CR

Mode: : 2402 Band edge

	Cable	Ant	Preamp	Read	Limit	Over		
Freq	Loss	Factor	Factor	Level	Level	Line	Limit	
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1 pk	2390.00	4.90	32.35	38.46	44.09	42.88	74.00	-31.12
2 pp	2402.19	4.92	32.41	38.46	86.83	85.70	74.00	11.70

Test mode:	GFSK	Test channel:	Lowest	Remark:	Peak	Horizontal
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Data: 334



Site : chamber

Condition: FCC PART C 247 PK 3m Horizontal

Job No: : 5387CR

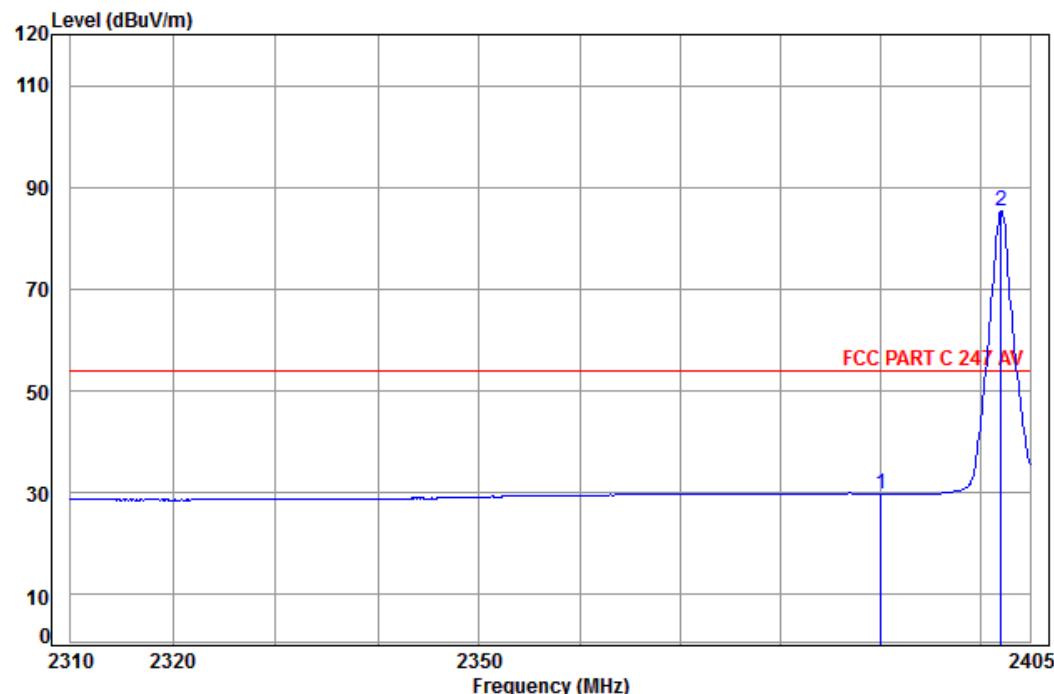
Mode: : 2402 Band edge

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Level	Line	Limit
MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1 pk	2390.00	4.90	32.35	38.46	45.68	44.47	74.00 -29.53
2 pp	2402.19	4.92	32.41	38.46	96.87	95.74	74.00 21.74



Test mode:	GFSK	Test channel:	Lowest	Remark:	Average	Vertical
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Data: 333



Site : chamber

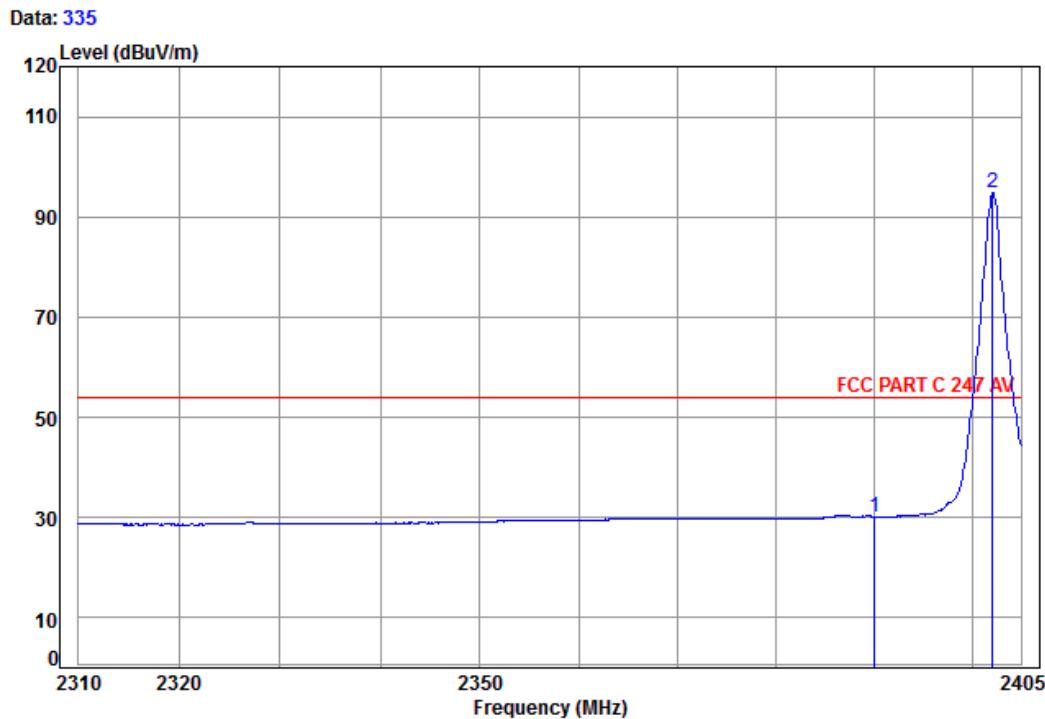
Condition: FCC PART C 247 AV 3m Vertical

Job No: : 5387CR

Mode: : 2402 Band edge

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Level	Line	Limit
1 av	2390.00	4.90	32.35	38.46	30.99	29.78	54.00 -24.22
2 pp	2402.09	4.92	32.41	38.46	86.60	85.47	54.00 31.47

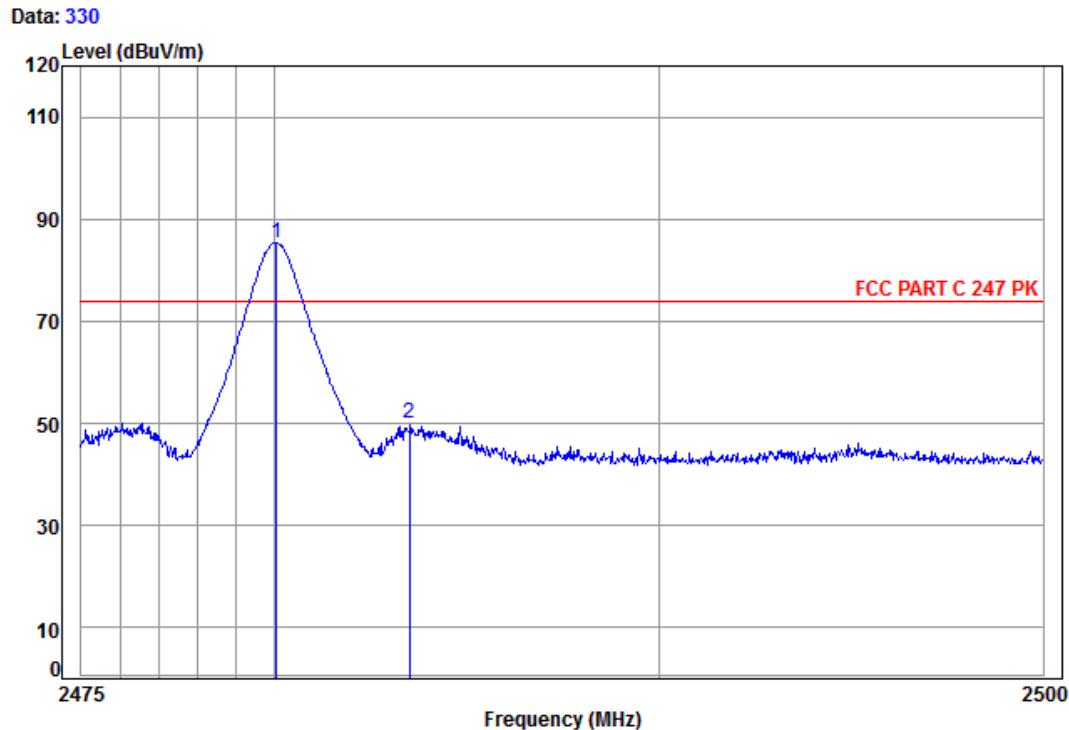
Test mode:	GFSK	Test channel:	Lowest	Remark:	Average	Horizontal
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Site : chamber  
Condition: FCC PART C 247 AV 3m Horizontal  
Job No: : 5387CR  
Mode: : 2402 Band edge

	Cable	Ant	Preamp	Read	Limit	Over		
Freq	Loss	Factor	Factor	Level	Level	Line	Limit	
1 av	2390.00	4.90	32.35	38.46	31.33	30.12	54.00	-23.88
2 pp	2402.09	4.92	32.41	38.46	96.02	94.89	54.00	40.89

Test mode:	GFSK	Test channel:	Highest	Remark:	Peak	Vertical
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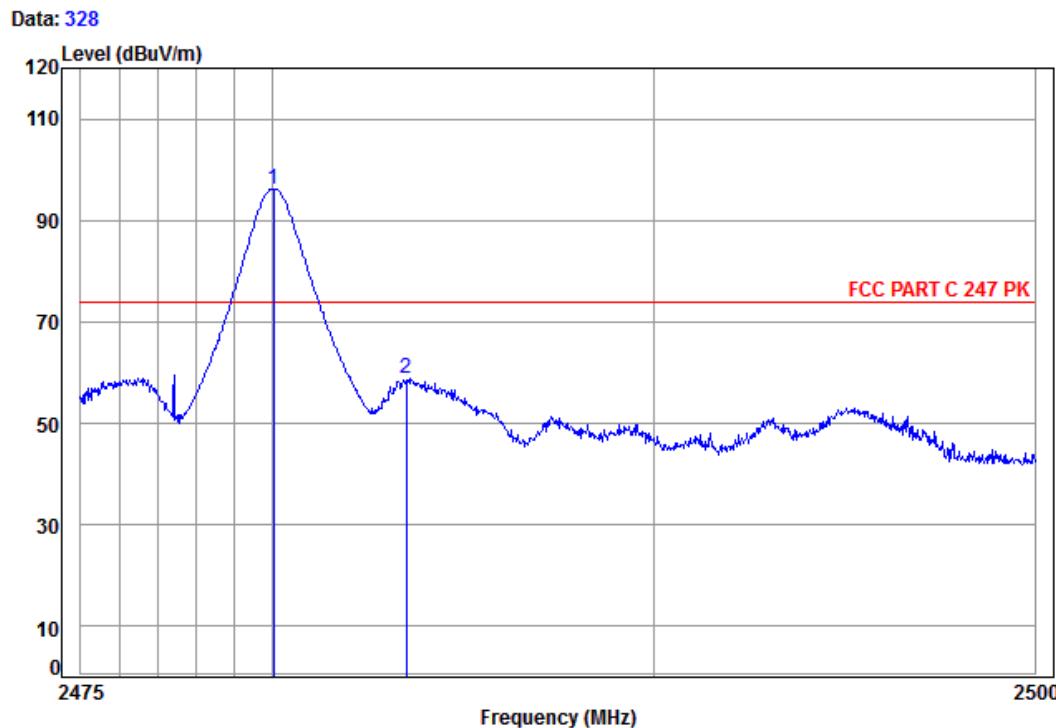
Site : chamber  
Condition: FCC PART C 247 PK 3m Vertical

Job No: : 5387CR

Mode: : 2480 Band edge

		Cable	Ant	Preamp	Read	Limit	Over
	Freq	Loss	Factor	Factor	Level	Level	Line
		MHz	dB	dB/m	dB	dBuV	dBuV/m
1 pp	2480.06	5.02	32.44	38.47	86.39	85.38	74.00 11.38
2 pk	2483.50	5.03	32.44	38.47	50.99	49.99	74.00 -24.01

Test mode:	GFSK	Test channel:	Highest	Remark:	Peak	Horizontal
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Site : chamber  
Condition: FCC PART C 247 PK 3m Horizontal

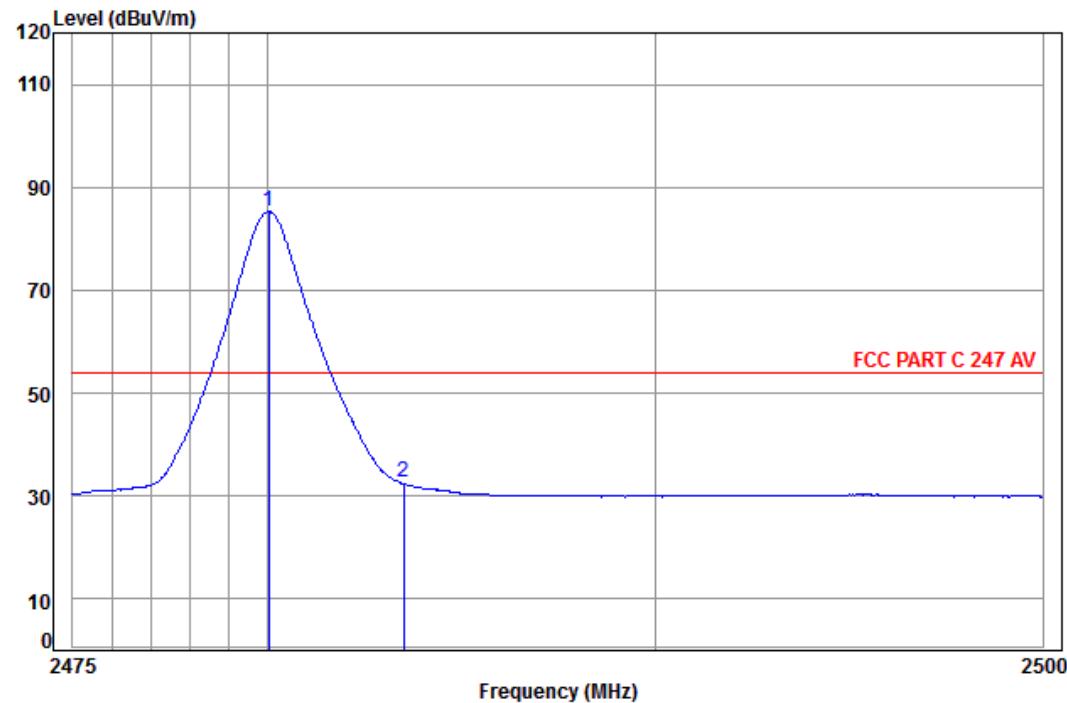
Job No: : 5387CR

Mode: : 2480 Band edge

	Cable	Ant	Preamp	Read	Limit	Over
Freq	Loss	Factor	Factor	Level	Level	Line
	MHz	dB	dB/m	dB	dBuV	dBuV/m
1 pp	2480.03	5.02	32.44	38.47	97.25	96.24
2 pk	2483.50	5.03	32.44	38.47	59.76	58.76
					74.00	74.00
					-22.24	-15.24

Test mode:	GFSK	Test channel:	Highest	Remark:	Average	Vertical
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Data: 331



Site : chamber

Condition: FCC PART C 247 AV 3m Vertical

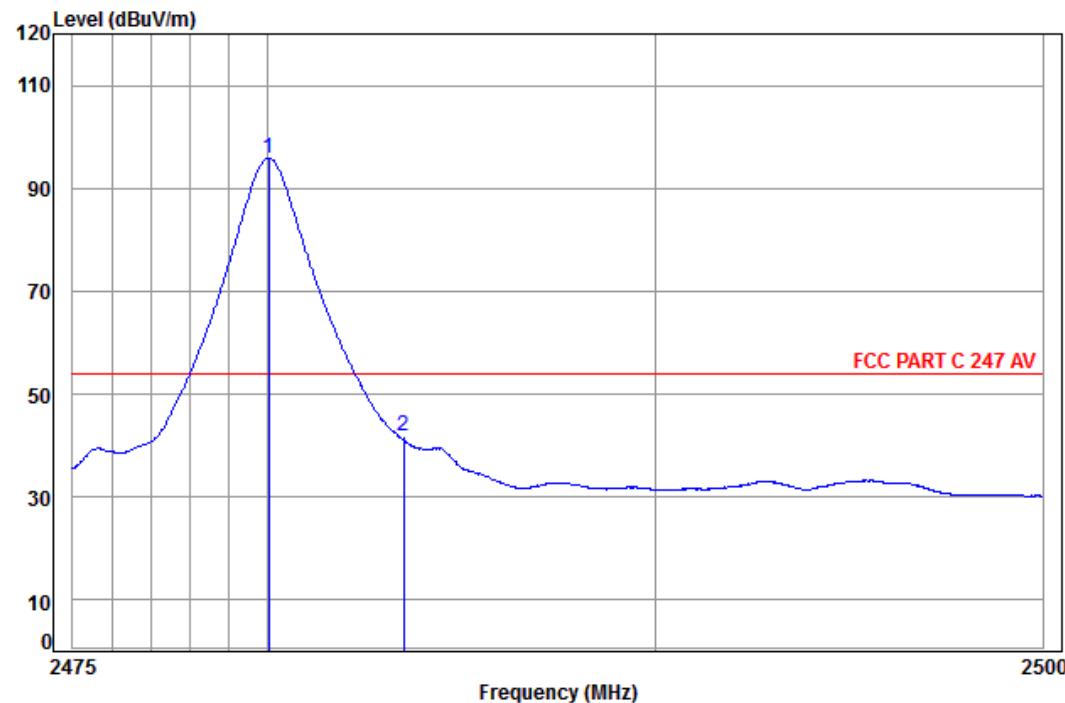
Job No: : 5387CR

Mode: : 2480 Band edge

	Cable Freq	Ant Loss	Preamp Factor	Read Level	Limit Level	Over Line	Over Limit	
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1 pp	2480.03	5.02	32.44	38.47	86.32	85.31	54.00	31.31
2 av	2483.50	5.03	32.44	38.47	33.55	32.55	54.00	-21.45

Test mode:	GFSK	Test channel:	Highest	Remark:	Average	Horizontal
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Data: 329



Site : chamber

Condition: FCC PART C 247 AV 3m Horizontal

Job No: : 5387CR

Mode: : 2480 Band edge

	Cable	Ant	Preamp	Read	Limit	Over
Freq	Loss	Factor	Factor	Level	Level	Line
1 pp	2480.03	5.02	32.44	38.47	96.83	95.82
2 av	2483.50	5.03	32.44	38.47	42.85	41.85

MHz dB dB/m dB dBuV dBuV/m dBuV/m dB

1 pp 2480.03 5.02 32.44 38.47 96.83 95.82 54.00 41.82  
2 av 2483.50 5.03 32.44 38.47 42.85 41.85 54.00 -12.15

**Note:**

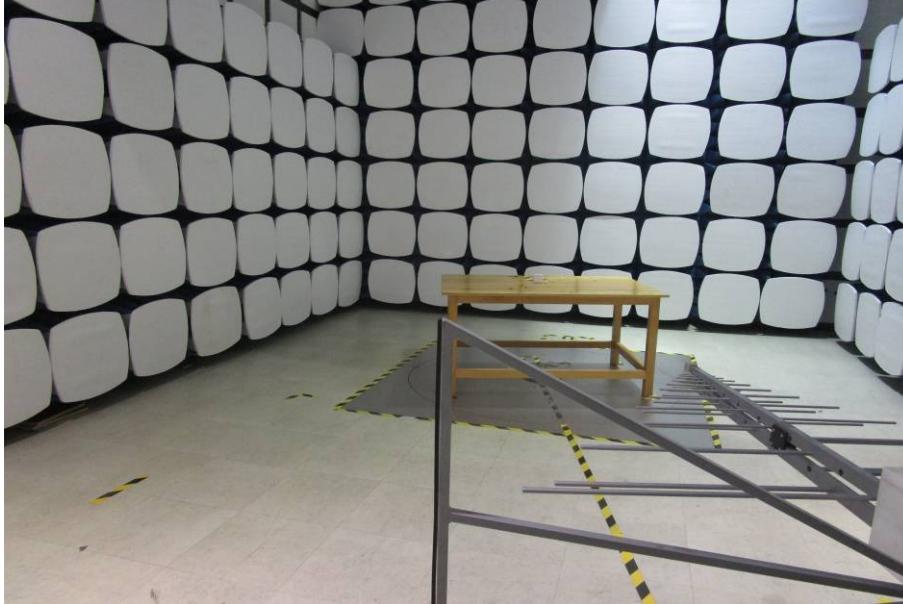
The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

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

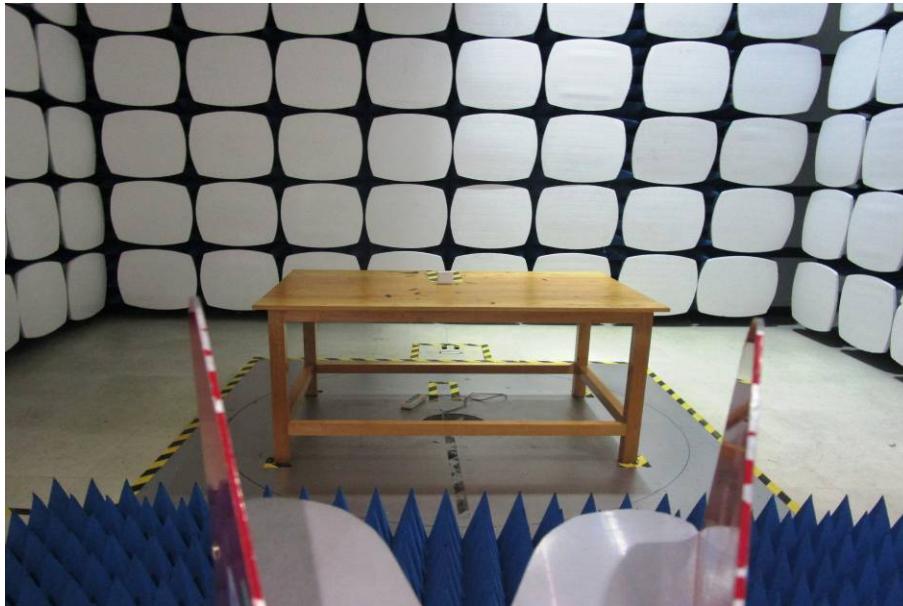
## 7 Photographs - EUT Test Setup

Test model No.: BAR228

### 7.1 Radiated Emission



### 7.2 Radiated Spurious Emission



## 8 Photographs - EUT Constructional Details

Test model No.: BAR228

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM1508005387CR.