



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

No. 1 Workshop, M-10, Middle section, Science & Technology Park,

Shenzhen, Guangdong, China 518057

Telephone: +86 (0) 755 2601 2053

Fax: +86 (0) 755 2671 0594

Email: ee.shenzhen@sgs.com

Report No.: SZEM161201083901

Page: 1 of 42

## FCC REPORT

**Application No:** SZEM1612010839CR  
**Applicant:** Develco Products A/S  
**Manufacturer:** Develco Products A/S  
**Factory:** EDA Electronics Co. Ltd.  
**EUT Name:** ZigBee Humidity Sensor  
**Model No.:** HMSZB-110  
**Trade mark:** Develco Products  
**FCC ID:** 2AHNM-HMSZB110  
**Standards:** 47 CFR Part 15, Subpart C (2015)  
**Date of Receipt:** 2016-12-20  
**Date of Test:** 2016-12-20 to 2016-12-27  
**Date of Issue:** 2016-12-28

<b>Test Result:</b>	<b>PASS *</b>
---------------------	---------------

\* 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.

This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at <http://www.sgs.com/en/Terms-and-Conditions.aspx> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <http://www.sgs.com/en/Terms-and-Conditions/Terms-e-Document.aspx>. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.



## 2 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
00		2016-12-28		Original

		<i>Edison Li</i>		2016-12-27
<b>Tested By</b>		_____ (Edison Li) /Project Engineer		_____ <b>Date</b>
		<i>Eric Fu</i>		2016-12-28
<b>Checked By</b>		_____ (Eric Fu) /Reviewer		_____ <b>Date</b>



### 3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203/15.247 (c)	ANSI C63.10 2013	PASS
Conducted Peak Output Power	47 CFR Part 15, Subpart C Section 15.247 (b)(3)	ANSI C63.10 2013	PASS
6dB Occupied Bandwidth	47 CFR Part 15, Subpart C Section 15.247 (a)(2)	ANSI C63.10 2013	PASS
Power Spectral Density	47 CFR Part 15, Subpart C Section 15.247 (e)	ANSI C63.10 2013	PASS
Band-edge for RF Conducted Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	ANSI C63.10 2013	PASS
RF Conducted Spurious Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	ANSI C63.10 2013	PASS
Radiated Spurious Emissions	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 2013	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 2013	PASS



## 4 Contents

	Page
<b>1 COVER PAGE</b> .....	<b>1</b>
<b>2 VERSION</b> .....	<b>2</b>
<b>3 TEST SUMMARY</b> .....	<b>3</b>
<b>4 CONTENTS</b> .....	<b>4</b>
<b>5 GENERAL INFORMATION</b> .....	<b>5</b>
5.1 CLIENT INFORMATION .....	5
5.2 GENERAL DESCRIPTION OF EUT .....	5
5.3 TEST ENVIRONMENT .....	7
5.4 DESCRIPTION OF SUPPORT UNITS .....	7
5.5 TEST LOCATION .....	7
5.6 TEST FACILITY .....	8
5.7 DEVIATION FROM STANDARDS .....	8
5.8 ABNORMALITIES FROM STANDARD CONDITIONS.....	8
5.9 OTHER INFORMATION REQUESTED BY THE CUSTOMER.....	8
5.10 EQUIPMENT LIST .....	9
<b>6 TEST RESULTS AND MEASUREMENT DATA</b> .....	<b>11</b>
6.1 ANTENNA REQUIREMENT .....	11
6.2 CONDUCTED PEAK OUTPUT POWER.....	12
6.3 6dB OCCUPY BANDWIDTH.....	15
6.4 POWER SPECTRAL DENSITY .....	18
6.5 BAND-EDGE FOR RF CONDUCTED EMISSIONS .....	21
6.6 SPURIOUS RF CONDUCTED EMISSIONS .....	23
6.7 RADIATED SPURIOUS EMISSION .....	29
6.7.1 <i>Spurious Emissions</i> .....	29
6.8 RESTRICTED BANDS AROUND FUNDAMENTAL FREQUENCY .....	36
<b>7 PHOTOGRAPHS - EUT TEST SETUP</b> .....	<b>42</b>
7.1 RADIATED EMISSION .....	42
7.2 RADIATED SPURIOUS EMISSION .....	42
<b>8 PHOTOGRAPHS - EUT CONSTRUCTIONAL DETAILS</b> .....	<b>42</b>



## 5 General Information

### 5.1 Client Information

Applicant:	Develco Products A/S
Address of Applicant:	Olof Palmes Alle 40, 8200 Aarhus N, Denmark.
Manufacturer:	Develco Products A/S
Address of Manufacturer:	Oluf Palmes alle 40, 8200 Aarhus N, Denmark
Factory:	EDA Electronics Co. Ltd.
Address of Factory:	Shui Wei Industrial Zone, TangJiao, Chashan Town, DongGuan City,

### 5.2 General Description of EUT

Product Name:	ZigBee Humidity Sensor
Model No.:	HMSZB-110
Trade Mark:	Develco Products
Frequency Range:	2405-2480MHz
Modulation Type:	QPSK
Channel Numbers:	16 Channels
Channel Separation:	5MHz
Antenna Type:	Integral
Antenna Gain:	1dBi
Battery:	3.0V DC ( 1.5V x 2 "AA" Size Batteries )



Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2405MHz	5	2425MHz	9	2445MHz	13	2465MHz
2	2410MHz	6	2430MHz	10	2450MHz	14	2470MHz
3	2415MHz	7	2435MHz	11	2455MHz	15	2475MHz
4	2420MHz	8	2440MHz	12	2460MHz	16	2480MHz

Note:

Using test software was control EUT work in continuous transmitter and receiver mode. And select test channel as below:

Channel	Frequency
The lowest channel (CH1)	2405MHz
The middle channel (CH9)	2445MHz
The highest channel (CH16)	2480MHz



### 5.3 Test Environment

Operating Environment:	
Temperature:	25.0 °C
Humidity:	53 % RH
Atmospheric Pressure:	1010mbar

### 5.4 Description of Support Units

The EUT has been tested as an independent unit.

### 5.5 Test Location

All tests were performed at:

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

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)**

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber 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-1, 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

RF connected test						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm-dd)	Cal. Due date (yyyy-mm-dd)
1	DC Power Supply	ZhaoXin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
2	Spectrum Analyzer	Rohde & Schwarz	FSP	SEM004-06	2016-10-09	2017-10-09
3	Signal Generator	Rohde & Schwarz	SML03	SEM006-02	2016-04-25	2017-04-25
4	Power Meter	Rohde & Schwarz	NRVS	SEM014-02	2016-10-09	2017-10-09

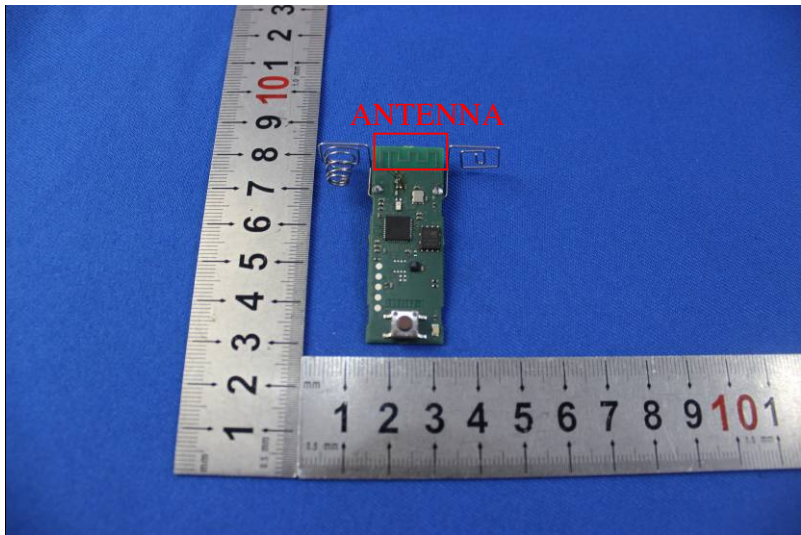
RE in Chamber						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm-dd)	Cal. Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEM001-01	2016-05-13	2017-05-13
2	EMI Test Receiver	Agilent Technologies	N9038A	SEM004-05	2016-10-09	2017-10-09
3	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEM003-01	2014-11-01	2017-11-01
4	Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEM003-11	2015-10-17	2018-10-17
5	Horn Antenna (18-26GHz)	ETS-LINDGREN	3160	SEM003-12	2014-11-24	2017-11-24
6	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEM005-01	2016-04-25	2017-04-25
7	Band filter	Amindeon	Asi 3314	SEM023-01	N/A	N/A
8	DC Power Supply	Zhao Xin	RXN-305D	SEM011-02	2016-10-09	2017-10-09
9	Loop Antenna	Beijing Daze	ZN30401	SEM003-09	2015-05-13	2018-05-13



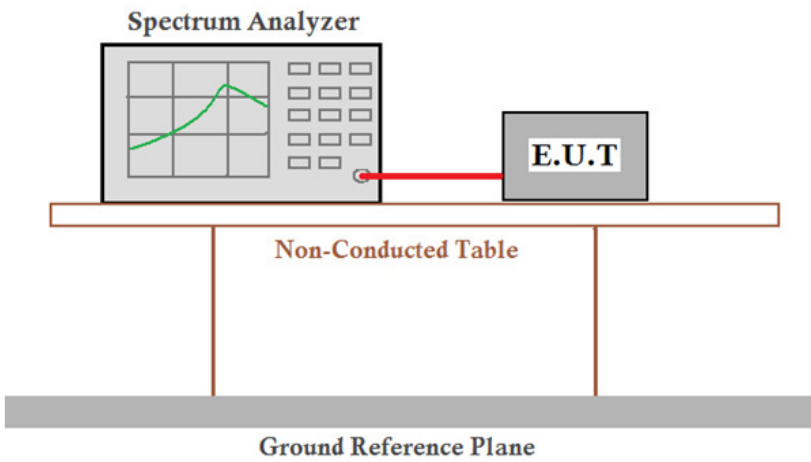
RE in Chamber						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date (yyyy-mm-dd)	Cal. Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	AUDIX	N/A	SEM001-02	2016-05-13	2017-05-13
2	EXA Spectrum Analyzer	Agilent Technologies Inc	N9010A	SEM004-09	2016-07-19	2017-07-19
3	BiConiLog Antenna (26-3000MHz)	ETS-Lindgren	3142C	SEM003-02	2014-11-15	2017-11-15
4	Amplifier (0.1-1300MHz)	HP	8447D	SEM005-02	2016-10-09	2017-10-09
5	Horn Antenna (1-18GHz)	Rohde & Schwarz	HF907	SEM003-07	2015-06-14	2018-06-14
6	Horn Antenna (18-26GHz)	ETS-Lindgren	3160	SEM003-12	2014-11-24	2017-11-24
7	Horn Antenna(26GHz-40GHz)	A.H.Systems, inc.	SAS-573	SEM003-13	2015-02-12	2018-02-12
8	Low Noise Amplifier	Black Diamond Series	BDLNA-0118-352810	SEM005-05	2016-10-09	2017-10-09
9	Band filter	Amindeon	Asi 3314	SEM023-01	N/A	N/A

## 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:          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>	
<b>EUT Antenna:</b>	
<p>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 :2013 Section 11.9.1
Test Setup:	 <p><i>Remark:</i> Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.</p>
Limit:	30dBm
Test Mode:	Transmitting with QPSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

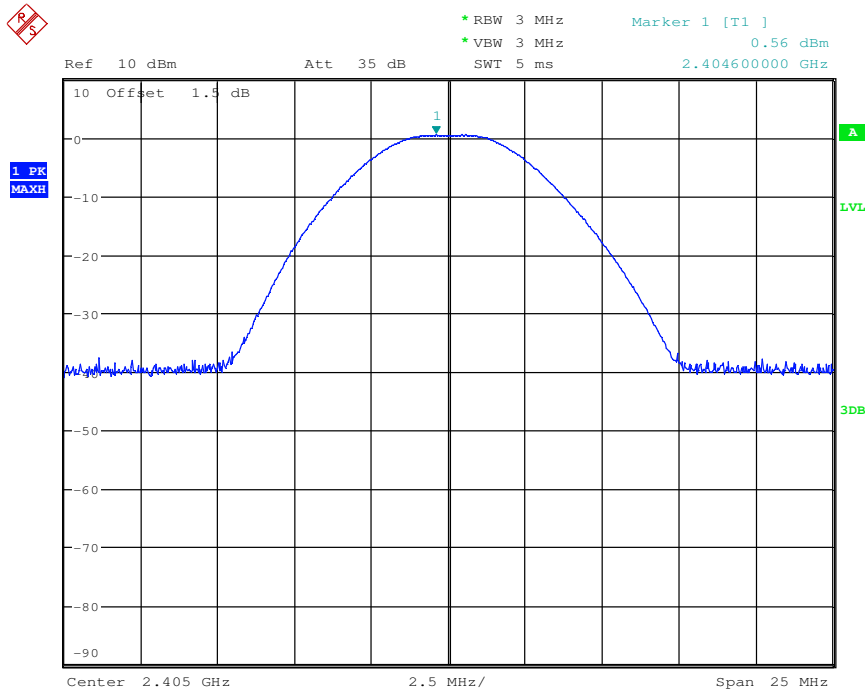
### Measurement Data

QPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	0.56	30.00	Pass
Middle	1.25	30.00	Pass
Highest	1.31	30.00	Pass

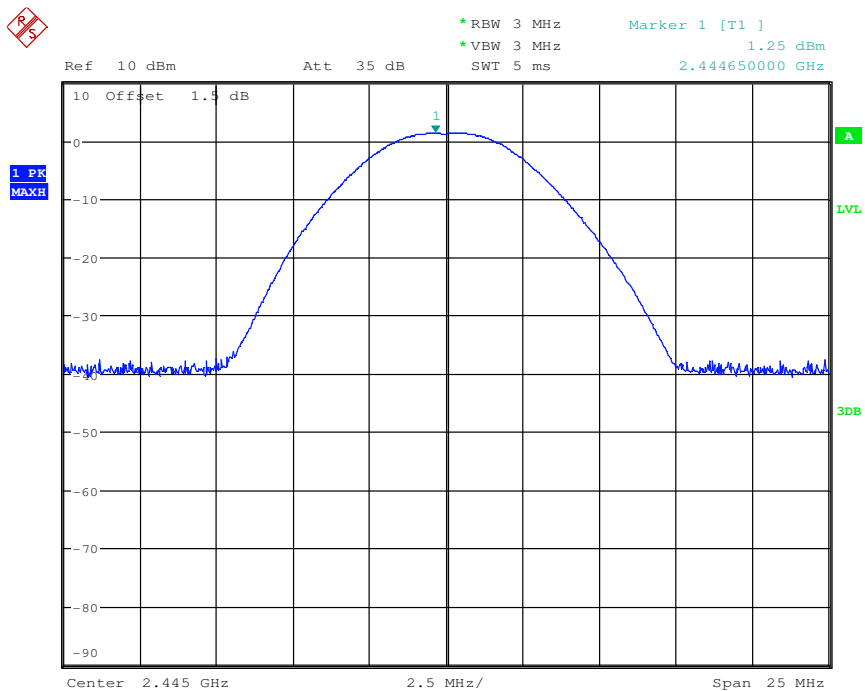


Test plot as follows:

Test mode:	QPSK	Test channel:	Lowest
------------	------	---------------	--------

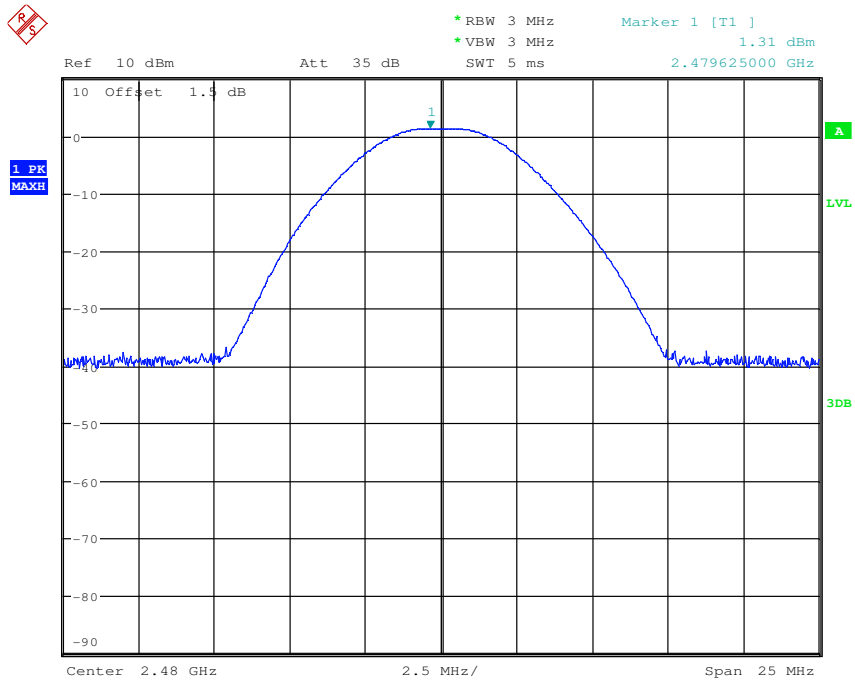


Test mode:	QPSK	Test channel:	Middle
------------	------	---------------	--------

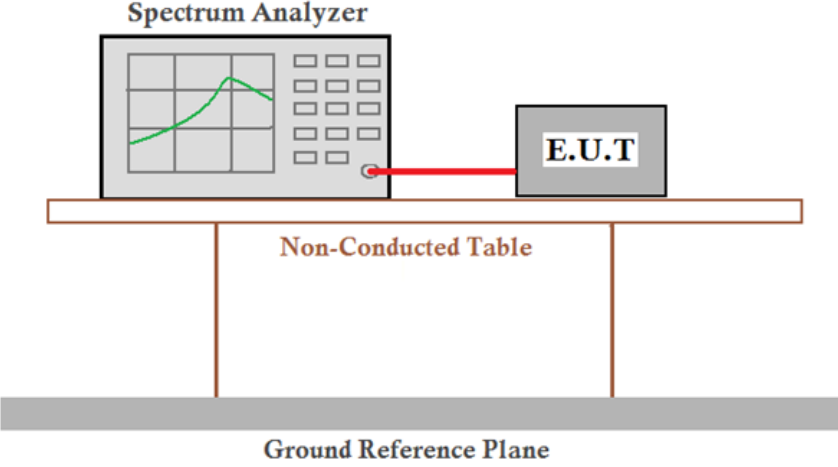




Test mode:	QPSK	Test channel:	Highest
------------	------	---------------	---------



### 6.3 6dB Occupy Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10: 2013 Section 11.8
Test Setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Limit:	≥ 500 kHz
Test Mode:	Transmitting with QPSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

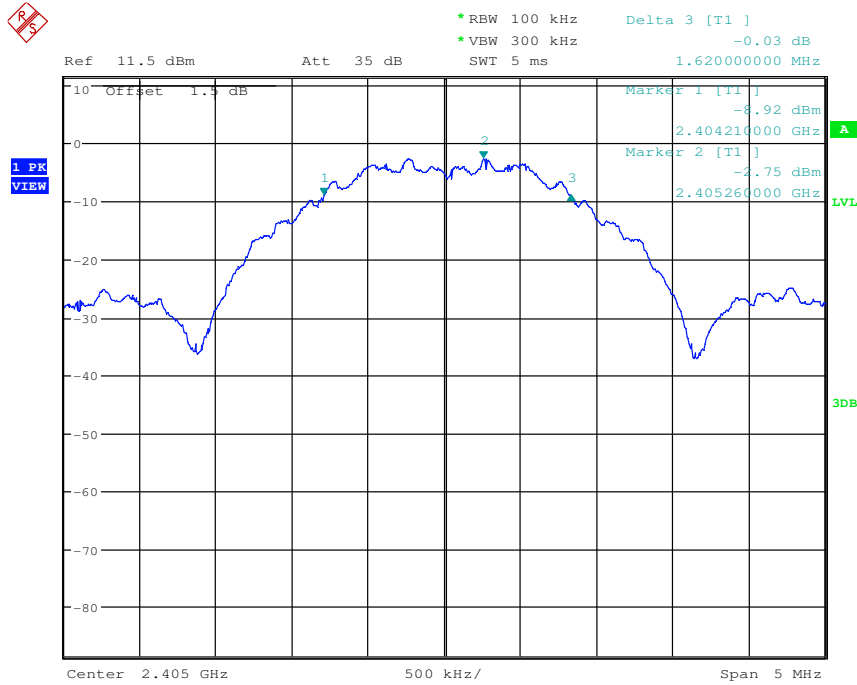
#### Measurement Data

QPSK mode			
Test channel	6dB Occupy Bandwidth (MHz)	Limit (kHz)	Result
Lowest	1.620	≥500	Pass
Middle	1.615	≥500	Pass
Highest	1.610	≥500	Pass

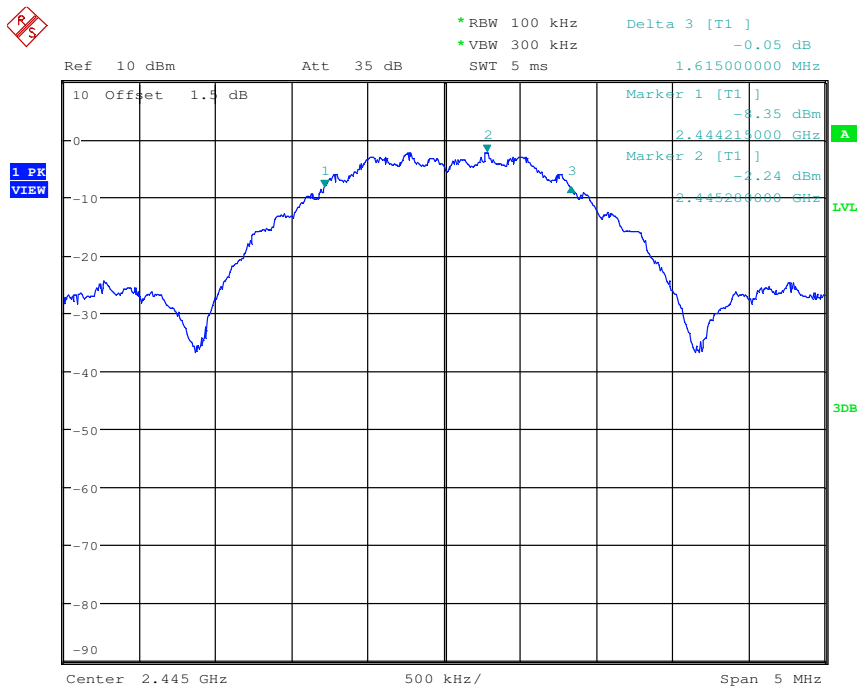


Test plot as follows:

Test mode:	QPSK	Test channel:	Lowest
------------	------	---------------	--------



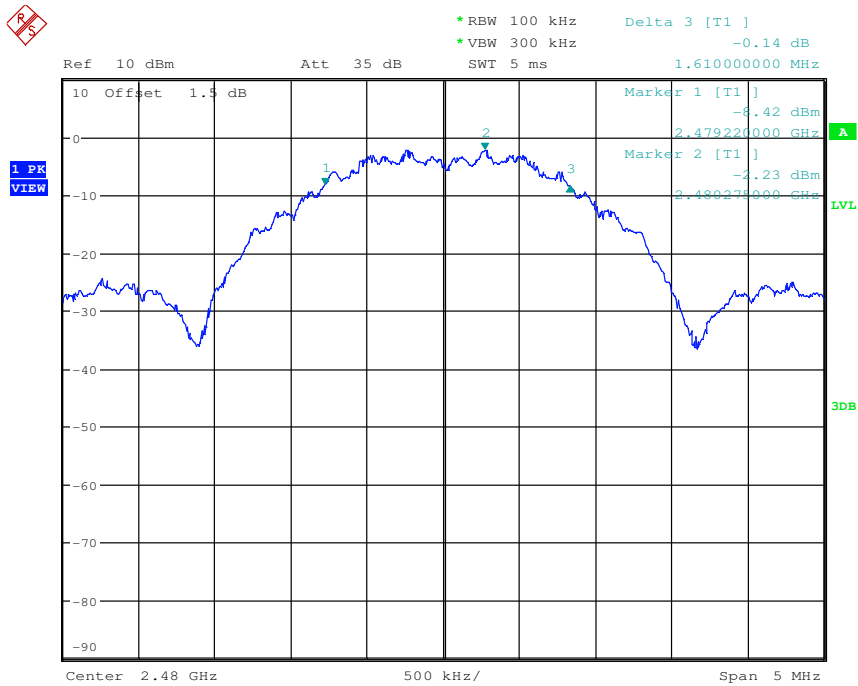
Test mode:	QPSK	Test channel:	Middle
------------	------	---------------	--------



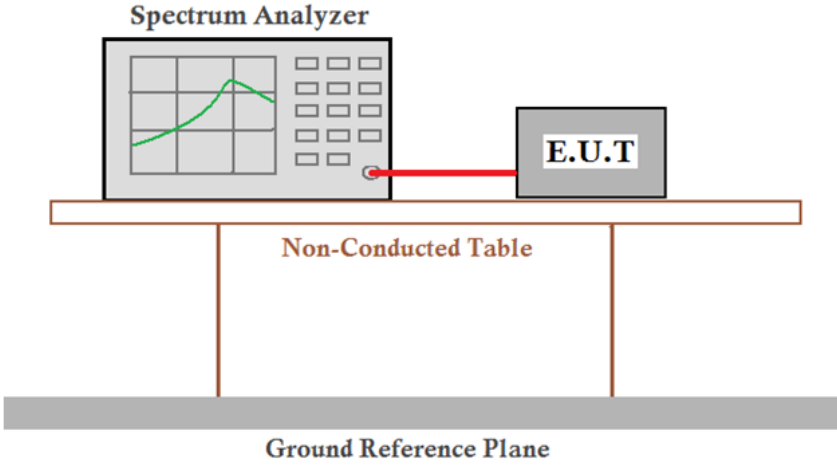




Test mode:	QPSK	Test channel:	Highest
------------	------	---------------	---------



## 6.4 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 QPSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

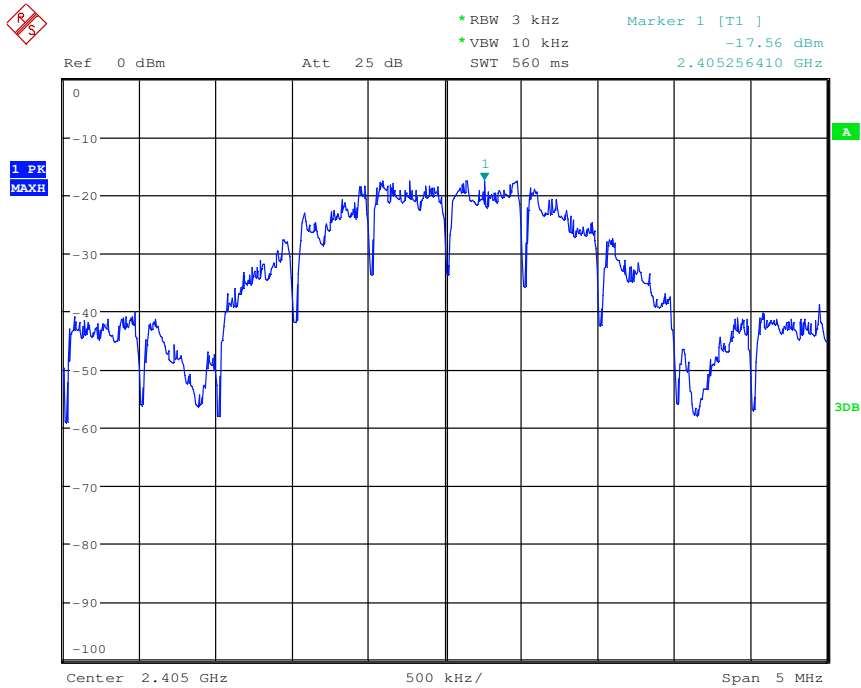
### Measurement Data

QPSK mode			
Test channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
Lowest	-17.56	≤8.00	Pass
Middle	-15.52	≤8.00	Pass
Highest	-15.24	≤8.00	Pass

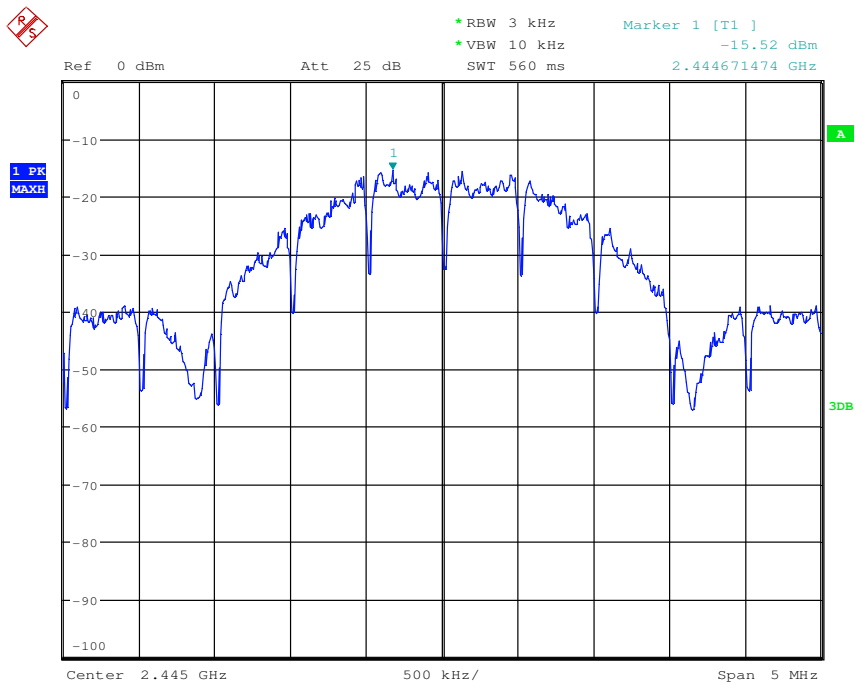


Test plot as follows:

Test mode:	QPSK	Test channel:	Lowest
------------	------	---------------	--------

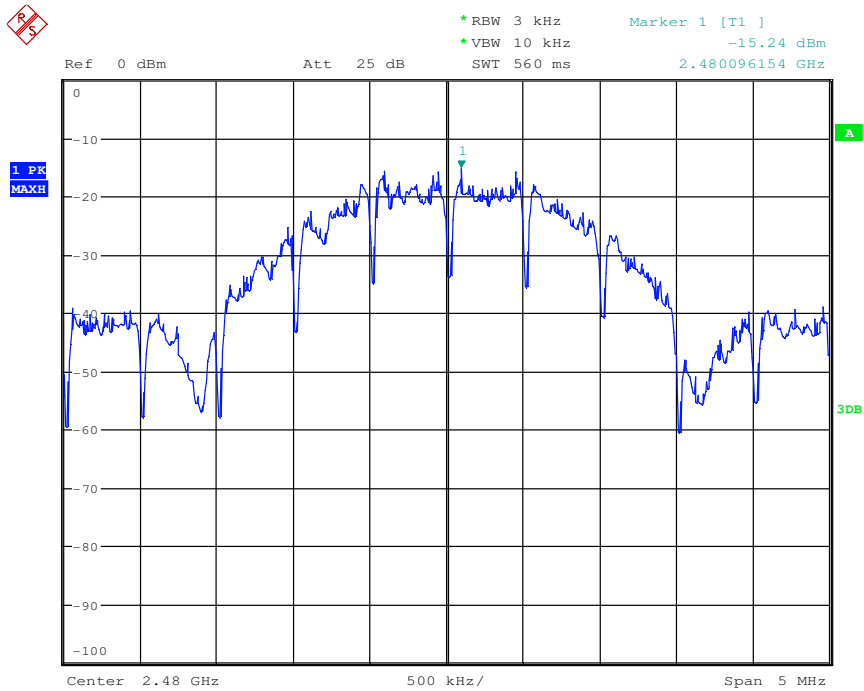


Test mode:	QPSK	Test channel:	Middle
------------	------	---------------	--------

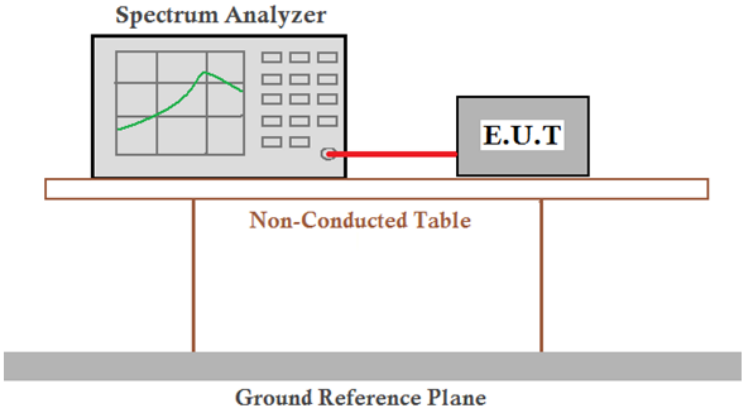




Test mode:	QPSK	Test channel:	Highest
------------	------	---------------	---------



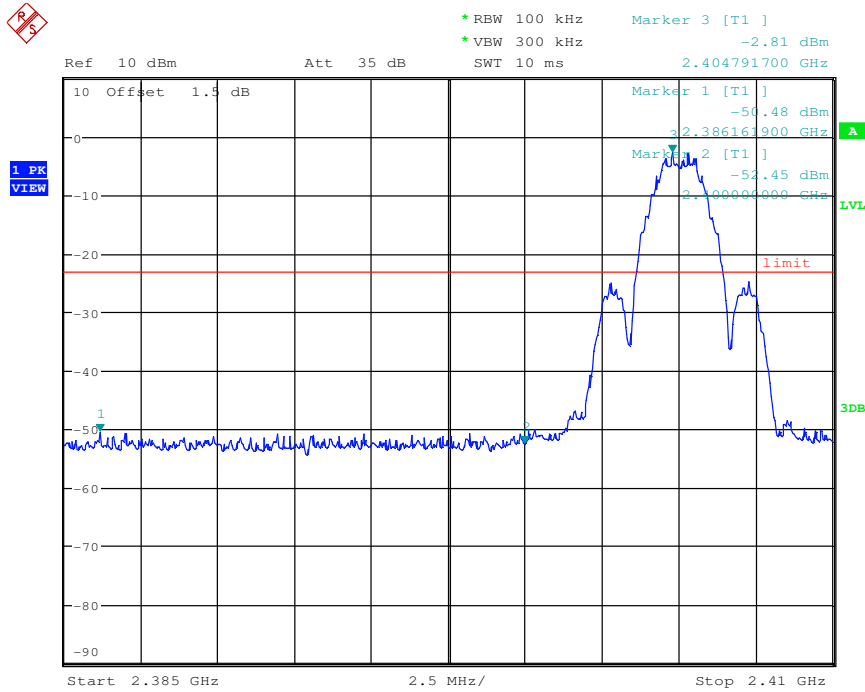
## 6.5 Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.13
Test Setup:	 <p>Remark: Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.</p>
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 QPSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

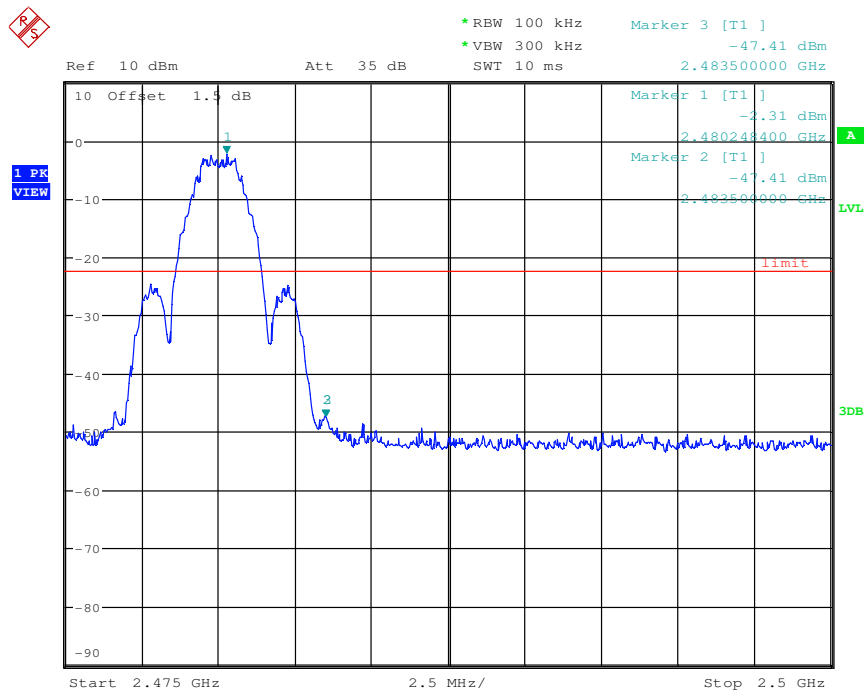


Test plot as follows:

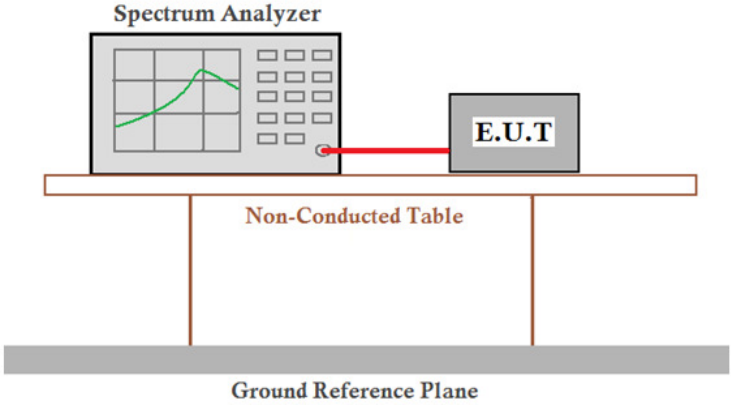
Test mode:	QPSK	Test channel:	Lowest
------------	------	---------------	--------



Test mode:	QPSK	Test channel:	Highest
------------	------	---------------	---------



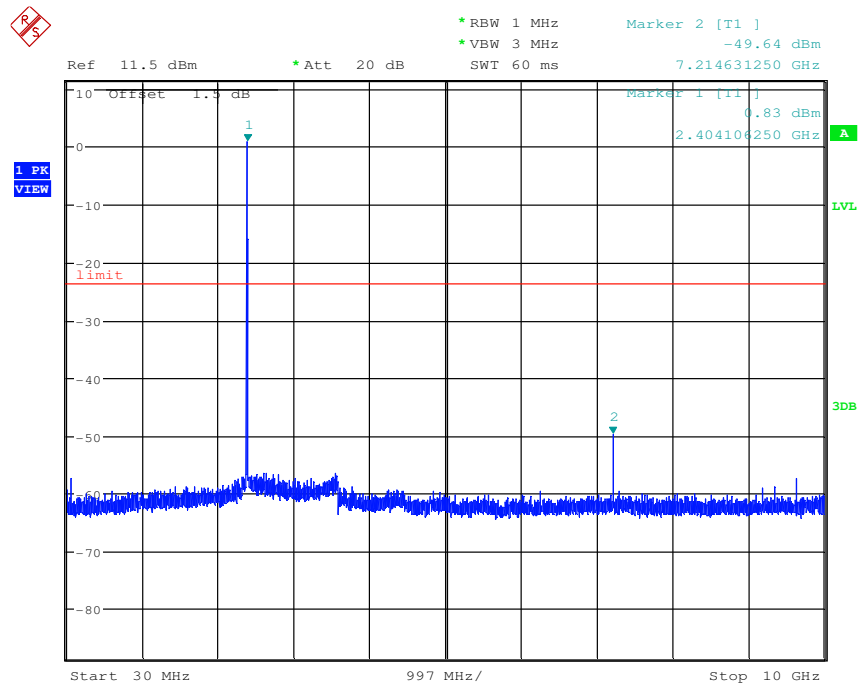
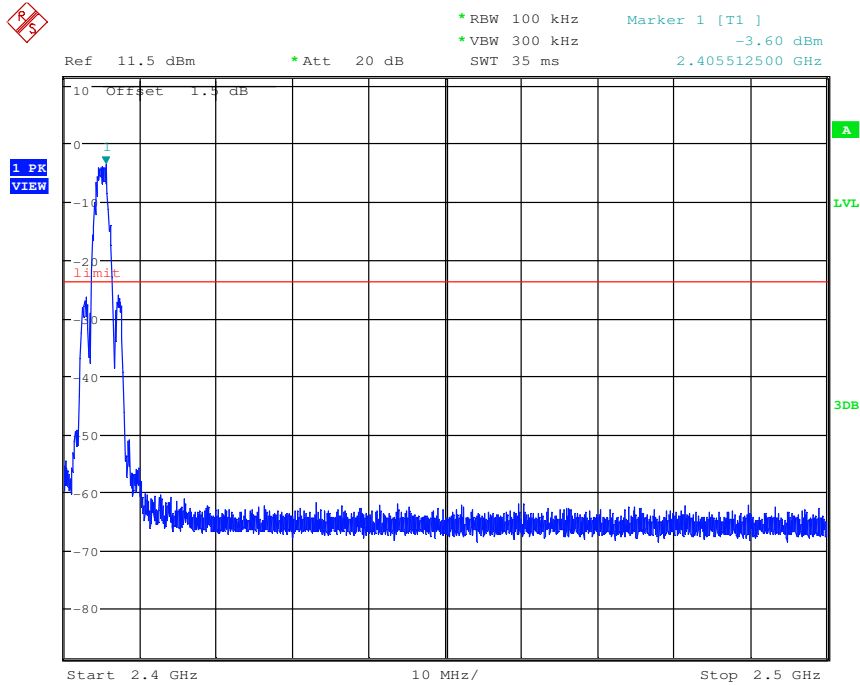
## 6.6 Spurious RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10: 2013 Section 11.11
Test Setup:	 <p>Remark: Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.</p>
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 QPSK modulation.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

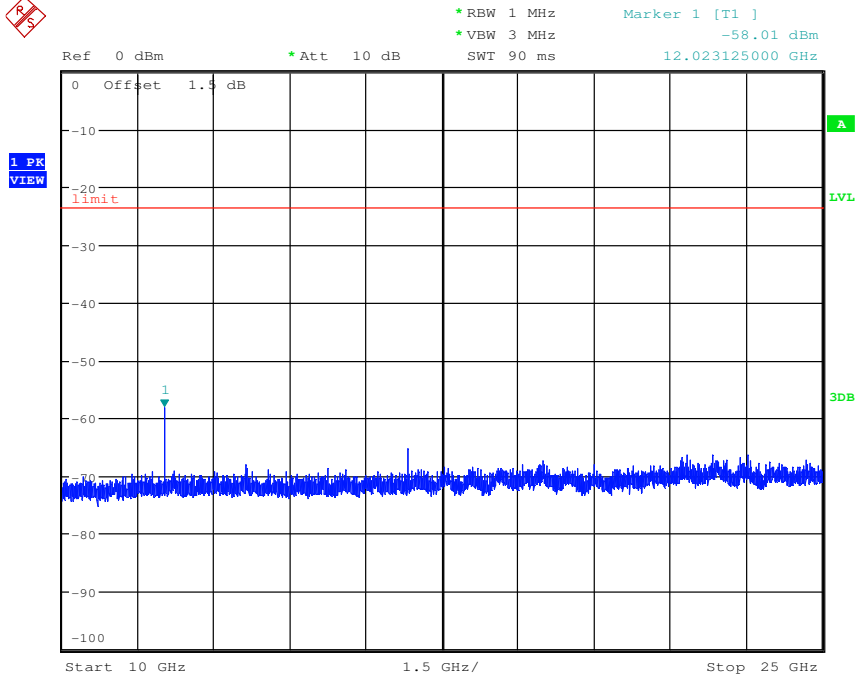


Test plot as follows:

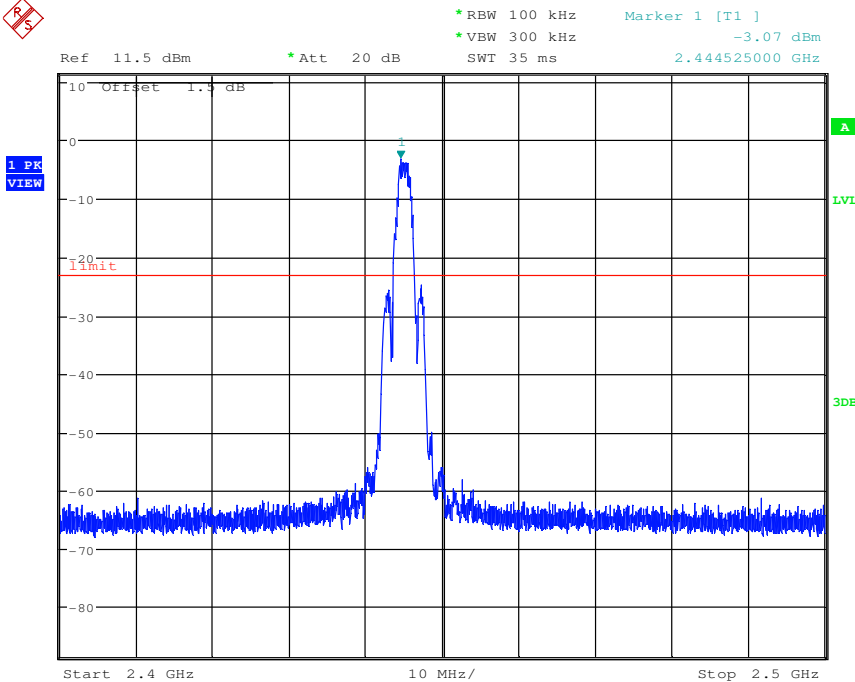
Test mode:	QPSK	Test channel:	Lowest
------------	------	---------------	--------

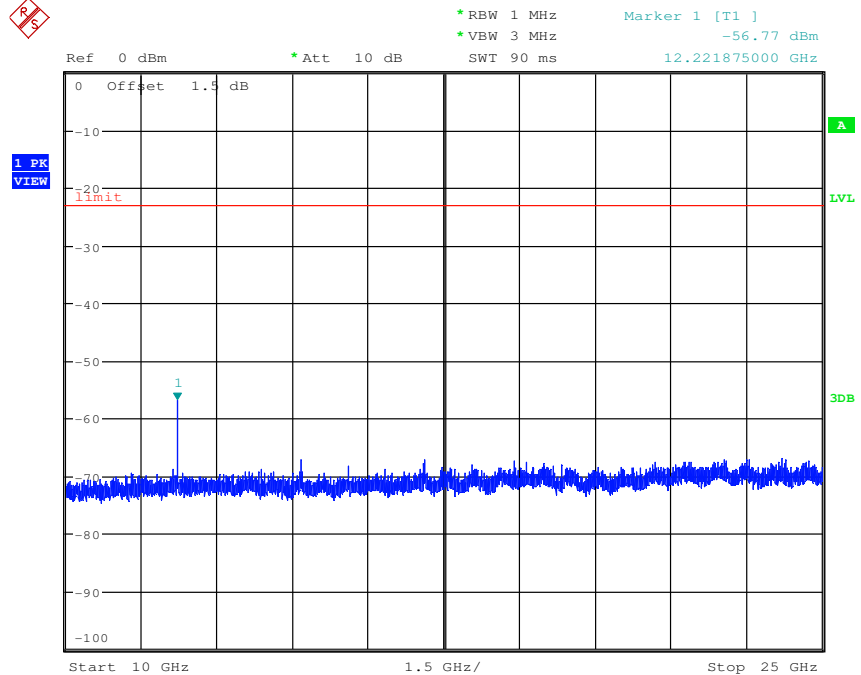
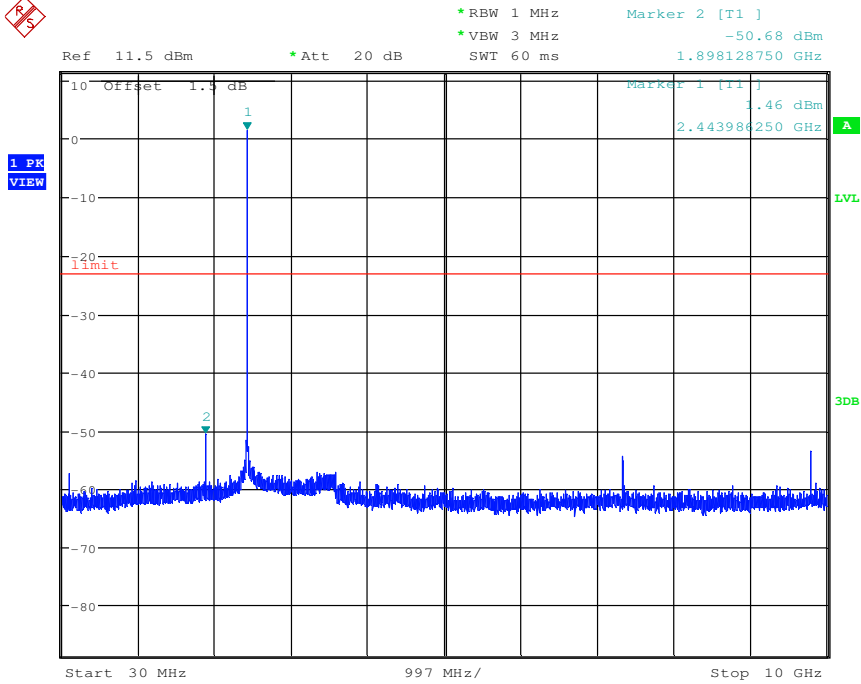






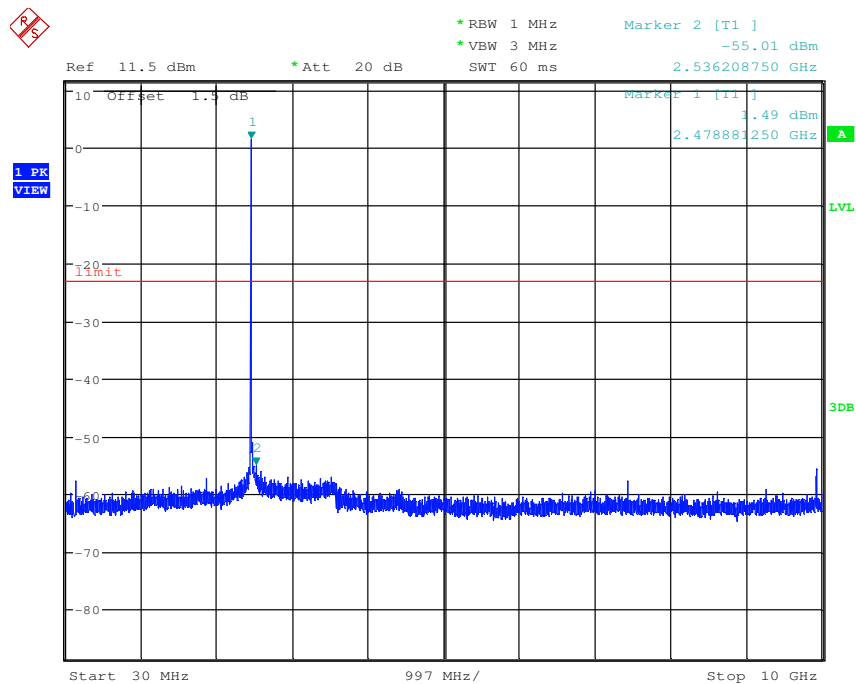
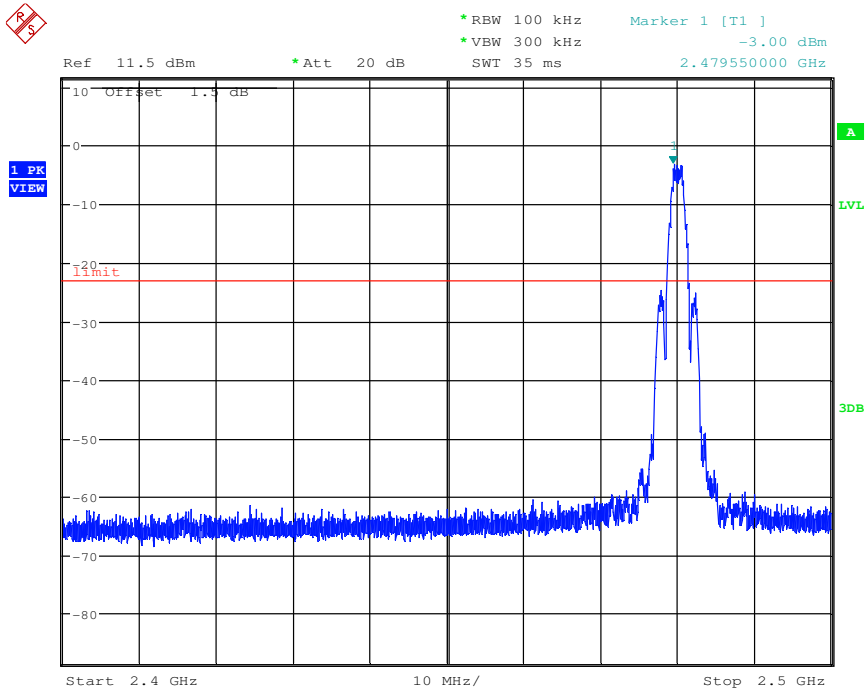
Test mode:	QPSK	Test channel:	Middle
------------	------	---------------	--------

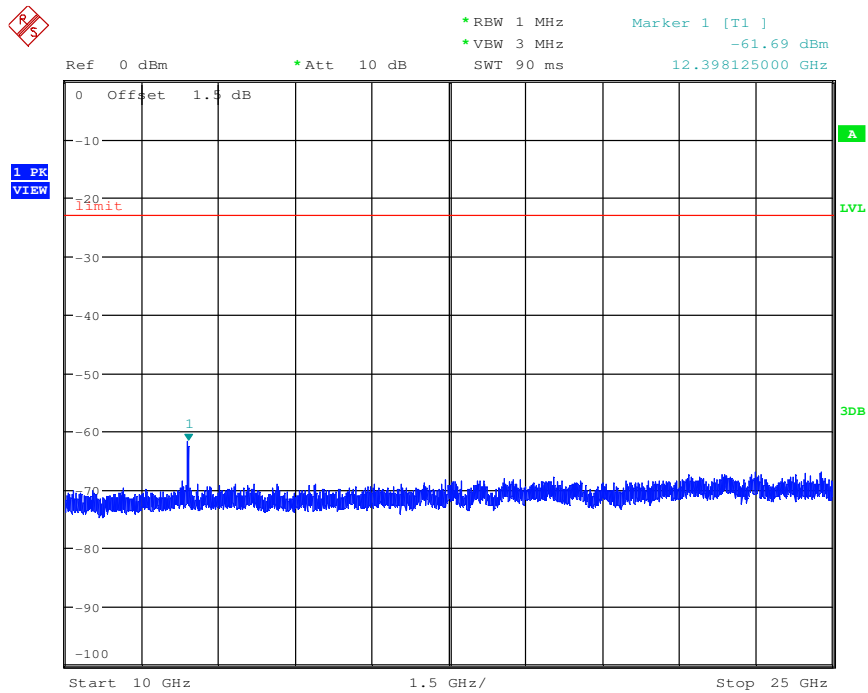






Test mode:	QPSK	Test channel:	Highest
------------	------	---------------	---------





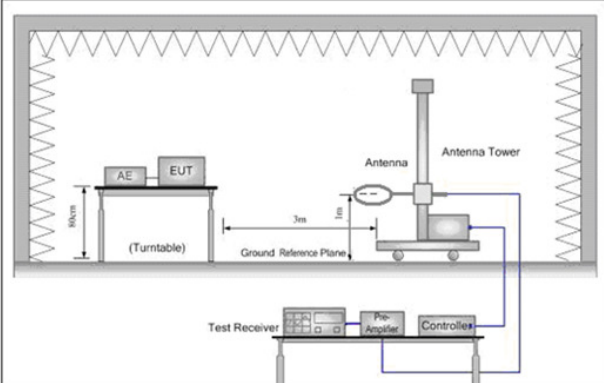
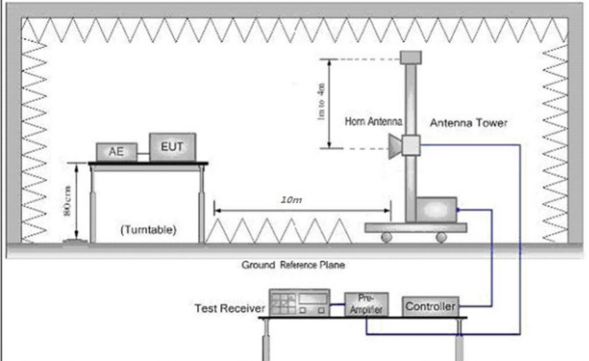
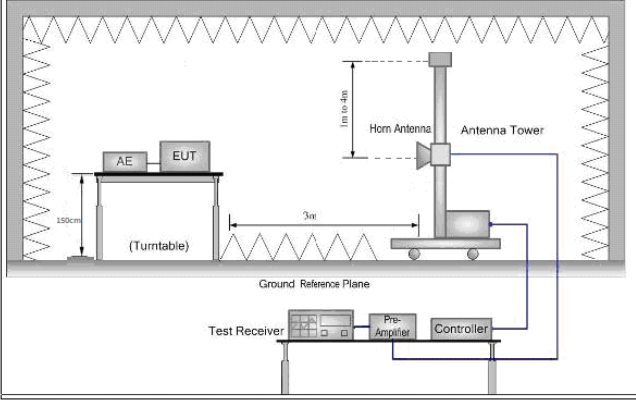
Remark:

Use 100kHz RBW to determine the relative limit in the band 2.4GHz to 2.5GHz, and Use 1MHz RBW to measure spurious emissions in the band 30MHz to 10GHz and 10GHz to 25GHz. The sweep points set to 30001.



## 6.7 Radiated Spurious Emission

6.7.1 Spurious Emissions					
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				
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
<p>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.</p>					

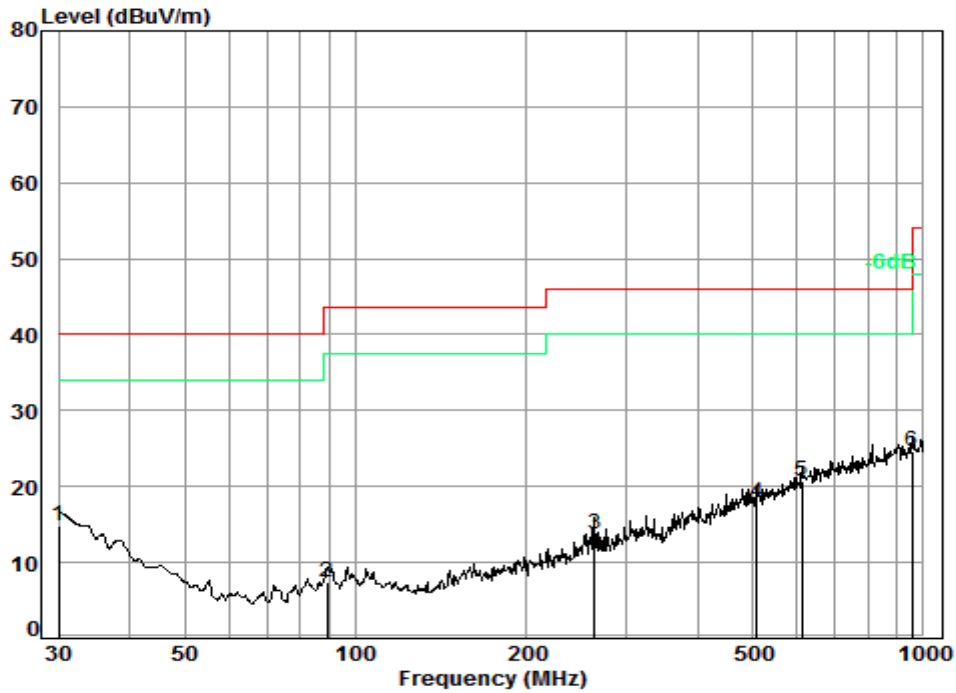
Test Setup:	
	
<p style="text-align: center;">Figure 1. Below 30MHz <span style="float: right;">Figure 2. 30MHz to 1GHz</span></p>	
	
<p style="text-align: center;">Figure 3. Above 1 GHz</p>	
<p><b>Test Procedure:</b></p>	<ol style="list-style-type: none"> <li>a. For below 1GHz, the EUT was placed on 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>b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter full-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.</li> <li>c. 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>d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</li> <li>e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for 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.</li> <li>f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>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</li> </ol>



	<p>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 QPSK modulation. Transmitting mode
Final Test Mode:	Transmitting with QPSK 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		
30MHz~1GHz (QP)		
Test mode:	Transmitting mode	Vertical



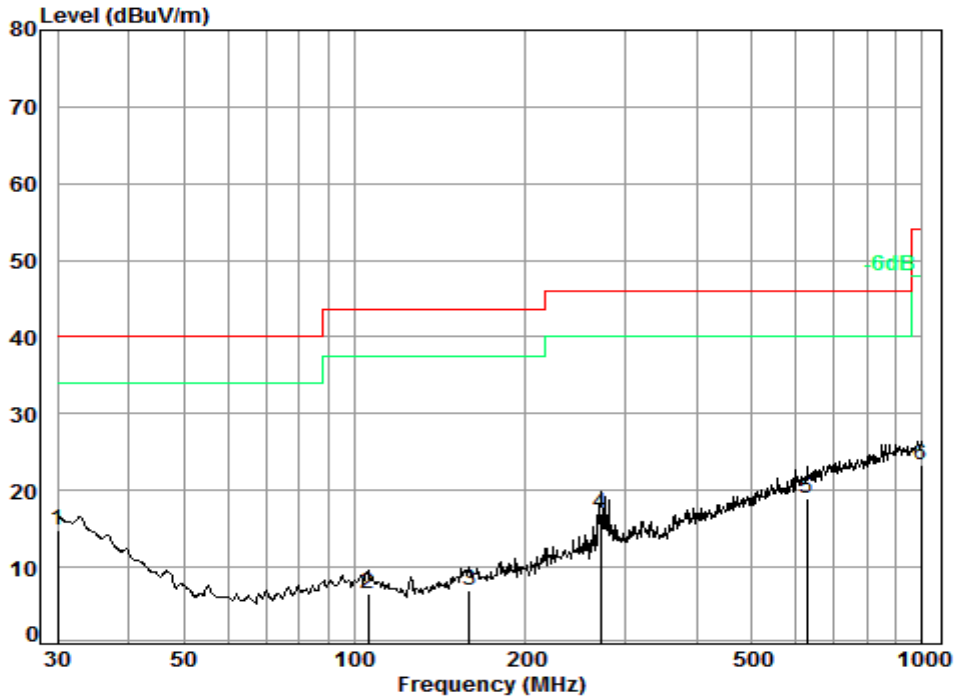
Condition: 3m VERTICAL  
Job No. : 10839CR  
Test mode: TX mode

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	30.00	0.60	18.70	27.36	22.87	14.81	40.00	-25.19
2	89.28	1.10	8.63	27.22	24.97	7.48	43.50	-36.02
3	263.82	1.74	12.58	26.50	25.99	13.81	46.00	-32.19
4	510.04	2.61	18.08	27.68	24.84	17.85	46.00	-28.15
5	612.06	2.73	20.14	27.53	25.43	20.77	46.00	-25.23
6 pp	955.44	3.66	23.30	26.51	24.14	24.59	46.00	-21.41





Test mode:	Transmitting mode	Horizontal
------------	-------------------	------------



Condition: 3m HORIZONTAL  
Job No. : 10839CR  
Test mode: TX mode

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1 pp	30.00	0.60	18.70	27.36	22.92	14.86	40.00	-25.14
2	105.64	1.22	8.82	27.16	23.66	6.54	43.50	-36.96
3	159.23	1.33	9.55	26.86	22.92	6.94	43.50	-36.56
4	271.32	1.77	12.73	26.47	28.91	16.94	46.00	-29.06
5	627.27	2.76	20.51	27.51	23.25	19.01	46.00	-26.99
6	993.01	3.69	24.02	26.33	22.05	23.43	54.00	-30.57



Transmitter Emission above 1GHz									
Test mode:		QPSK		Test channel:		Lowest		Remark:	Peak
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	
3842.163	33.18	7.76	38.63	44.78	47.09	74	-26.91	Vertical	
4810.000	34.17	8.88	39.03	45.33	49.35	74	-24.65	Vertical	
6069.413	34.76	10.47	38.96	44.52	50.79	74	-23.21	Vertical	
7215.000	36.41	10.68	38.17	43.26	52.18	74	-21.82	Vertical	
9620.000	37.52	12.51	36.98	40.75	53.8	74	-20.2	Vertical	
12639.790	38.87	14.55	38.95	38.61	53.08	74	-20.92	Vertical	
3786.970	33.03	7.74	38.6	44.89	47.06	74	-26.94	Horizontal	
4810.000	34.17	8.88	39.03	45.09	49.11	74	-24.89	Horizontal	
6247.618	34.9	10.24	38.84	45.08	51.38	74	-22.62	Horizontal	
7215.000	36.41	10.68	38.17	43.48	52.4	74	-21.6	Horizontal	
9620.000	37.52	12.51	36.98	40.25	53.3	74	-20.7	Horizontal	
12190.740	38.72	14.4	38.5	39	53.62	74	-20.38	Horizontal	

Test mode:		QPSK		Test channel:		Middle		Remark:	Peak
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	
3909.457	33.36	7.78	38.66	44.87	47.35	74	-26.65	Vertical	
4890.000	34.31	8.99	39.06	45.41	49.65	74	-24.35	Vertical	
6238.584	34.89	10.25	38.85	44.81	51.1	74	-22.9	Vertical	
7335.000	36.36	10.73	38.05	43.37	52.41	74	-21.59	Vertical	
9780.000	37.56	12.59	36.91	40.17	53.41	74	-20.59	Vertical	
12050.440	38.63	14.52	38.35	38.35	53.15	74	-20.85	Vertical	
3732.570	32.87	7.72	38.58	44.96	46.97	74	-27.03	Horizontal	
4890.000	34.31	8.99	39.06	45.27	49.51	74	-24.49	Horizontal	
6166.787	34.84	10.34	38.89	44.07	50.36	74	-23.64	Horizontal	
7335.000	36.36	10.73	38.05	42.83	51.87	74	-22.13	Horizontal	
9780.000	37.56	12.59	36.91	40.53	53.77	74	-20.23	Horizontal	
12279.26	38.77	14.33	38.59	38.27	52.78	74	-21.22	Horizontal	



Test mode:		QPSK		Test channel:		Highest		Remark:		Peak
Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization		
3960.700	33.5	7.8	38.68	44.75	47.37	74	-26.63	Vertical		
4960.000	34.43	9.09	39.09	45.52	49.95	74	-24.05	Vertical		
5939.103	34.66	10.39	39.01	44.66	50.7	74	-23.3	Vertical		
7440.000	36.32	10.77	37.94	43.75	52.9	74	-21.1	Vertical		
9920.000	37.58	12.67	36.84	39.55	52.96	74	-21.04	Vertical		
12694.780	38.86	14.7	39	39.04	53.6	74	-20.4	Vertical		
3847.726	33.19	7.76	38.63	44.37	46.69	74	-27.31	Horizontal		
4960.000	34.43	9.09	39.09	44.88	49.31	74	-24.69	Horizontal		
6069.413	34.76	10.47	38.96	44.74	51.01	74	-22.99	Horizontal		
7440.000	36.32	10.77	37.94	43.03	52.18	74	-21.82	Horizontal		
9920.000	37.58	12.67	36.84	40.4	53.81	74	-20.19	Horizontal		
12332.670	38.8	14.29	38.64	39.24	53.69	74	-20.31	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: 2013 Section 11.12		
Test Site:	Measurement Distance: 3m		
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:

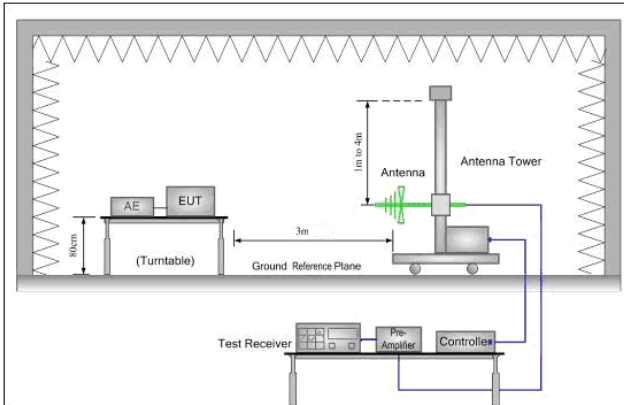


Figure 1. 30MHz to 1GHz

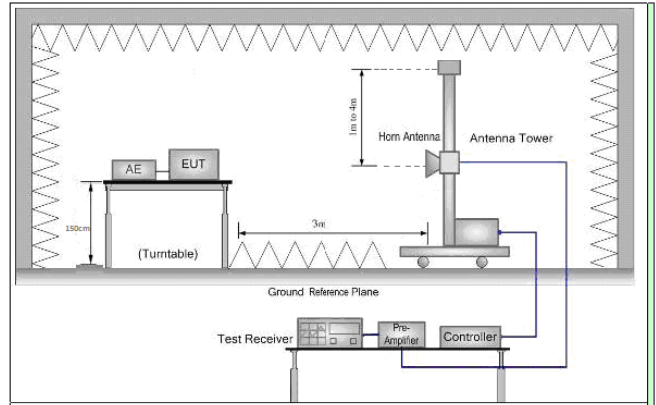


Figure 2. Above 1 GHz

Test Procedure:	<ol style="list-style-type: none"> <li>For below 1GHz, 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>For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter full-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> <li>Test the EUT in the lowest channel , the Highest channel</li> <li>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> </ol>
-----------------	--

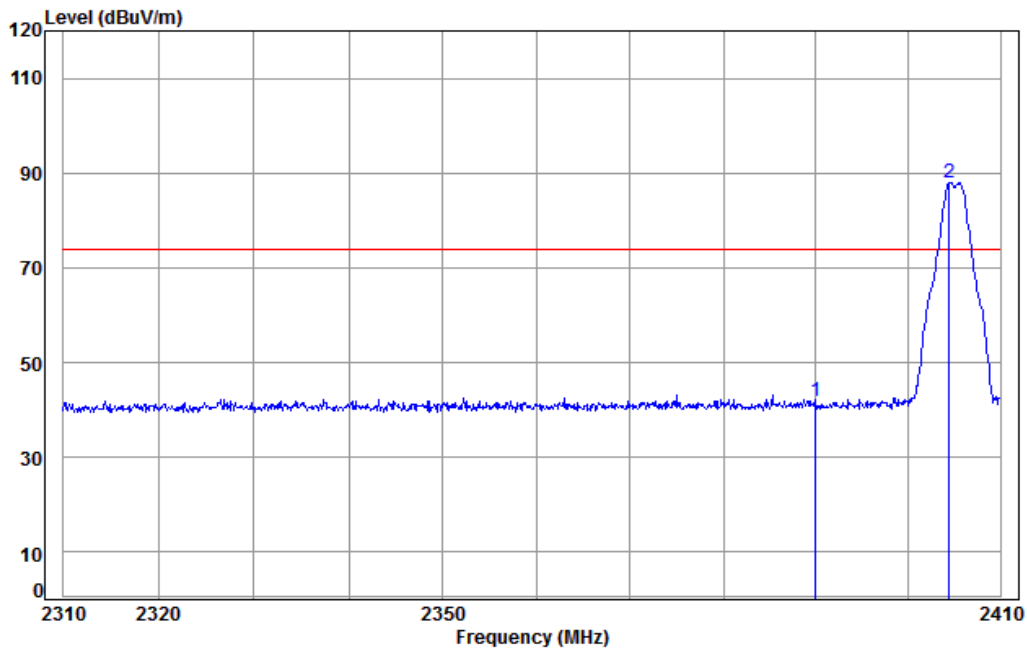


	j. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with QPSK modulation. Transmitting mode.
Final Test Mode:	Transmitting with QPSK modulation. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass



Test plot as follows:

Test channel:	Lowest	Remark:	Peak	Vertical
---------------	--------	---------	------	----------



Condition: 3m Vertical

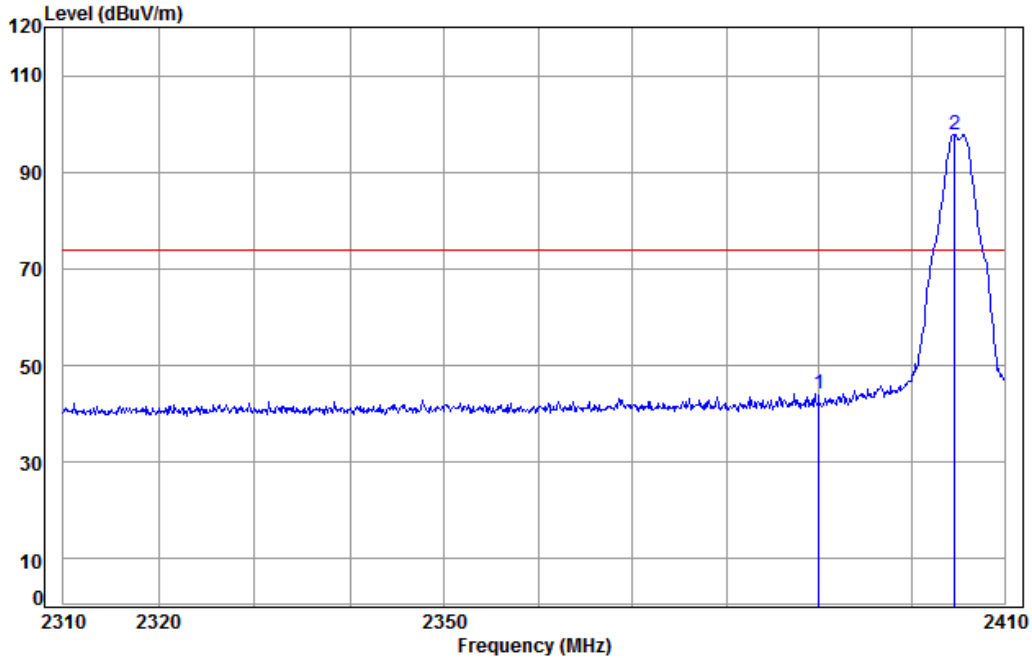
Job No: : 10839CR

Mode: : 2405 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2390.000	5.34	29.08	38.14	45.57	41.85	74.00	-32.15	Peak
2 pp	2404.491	5.35	29.12	38.15	91.72	88.04	74.00	14.04	Peak



Test channel:	Lowest	Remark:	Peak	Horizontal
---------------	--------	---------	------	------------



Condition: 3m Horizontal

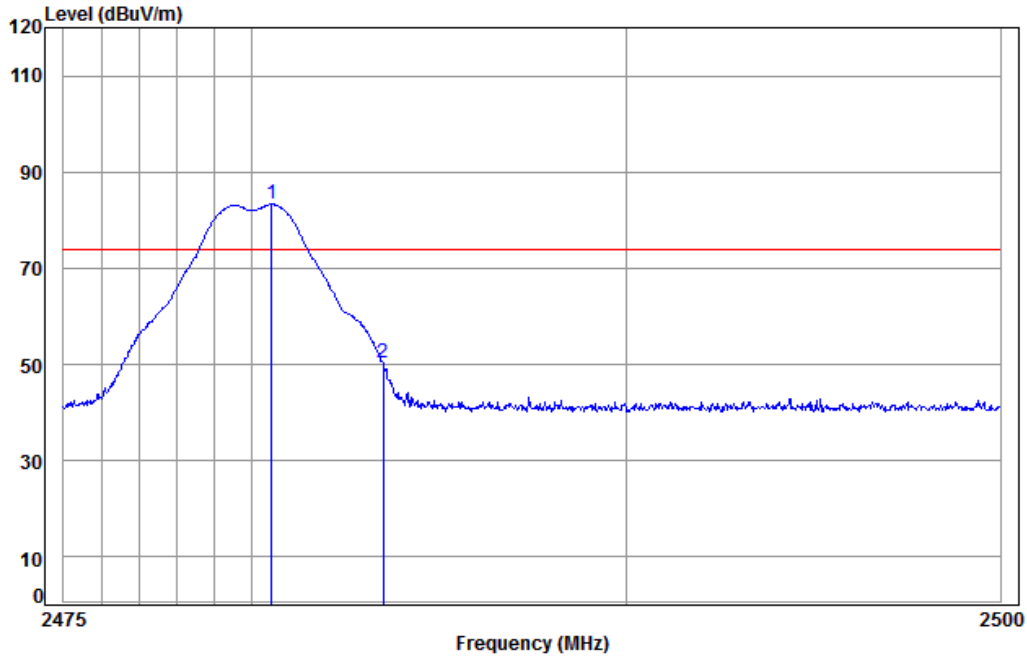
Job No: : 10839CR

Mode: : 2405 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2390.000	5.34	29.08	38.14	47.73	44.01	74.00	-29.99	Peak
2 pp	2404.593	5.35	29.12	38.15	101.55	97.87	74.00	23.87	Peak



Test channel:	Highest	Remark:	Peak	Vertical
---------------	---------	---------	------	----------



Condition: 3m Vertical

Job No: : 10839CR

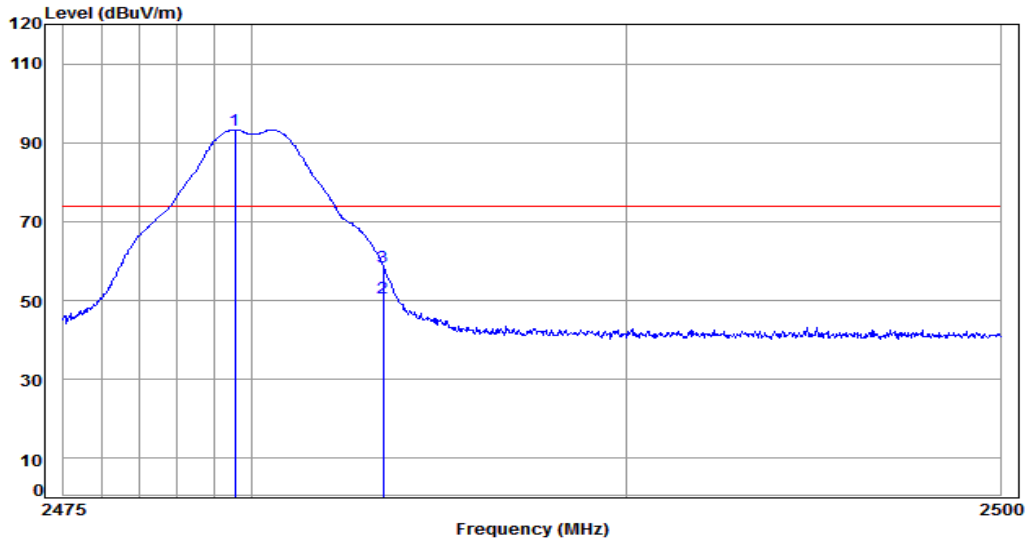
Mode: : 2480 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 pp	2480.528	5.41	29.34	38.15	86.66	83.26	74.00	9.26	Peak
2	2483.500	5.41	29.35	38.15	53.84	50.45	74.00	-23.55	Peak





Test channel:	Highest	Remark:	Peak	Horizontal
---------------	---------	---------	------	------------



Condition: 3m Horizontal  
Job No: : 10839CR  
Mode: : 2480 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB	
1 pp	2479.556	5.40	29.34	38.15	96.65	93.24	74.00	19.24	Peak
2 av	2483.500	5.41	29.35	38.15	54.10	50.71	54.00	-3.29	Average
3	2483.500	5.41	29.35	38.15	62.08	58.69	74.00	-15.31	Peak

**Note:**

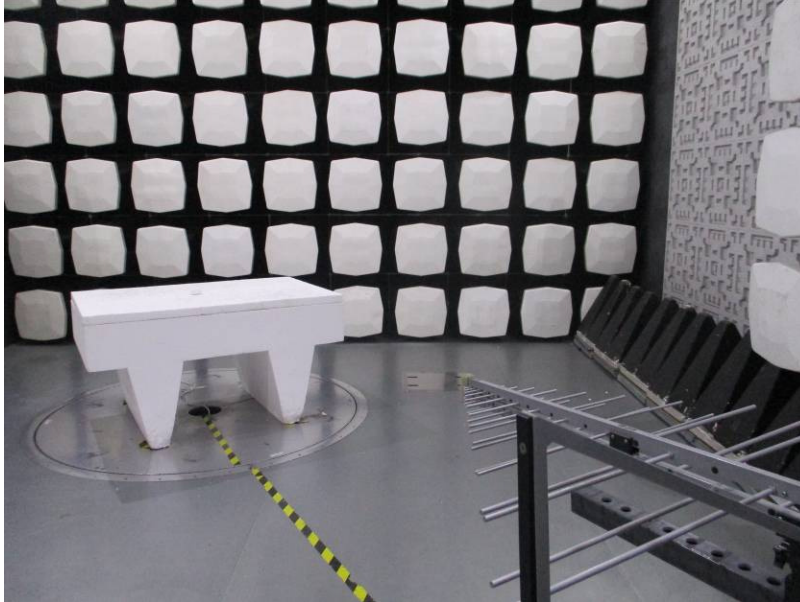
The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

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

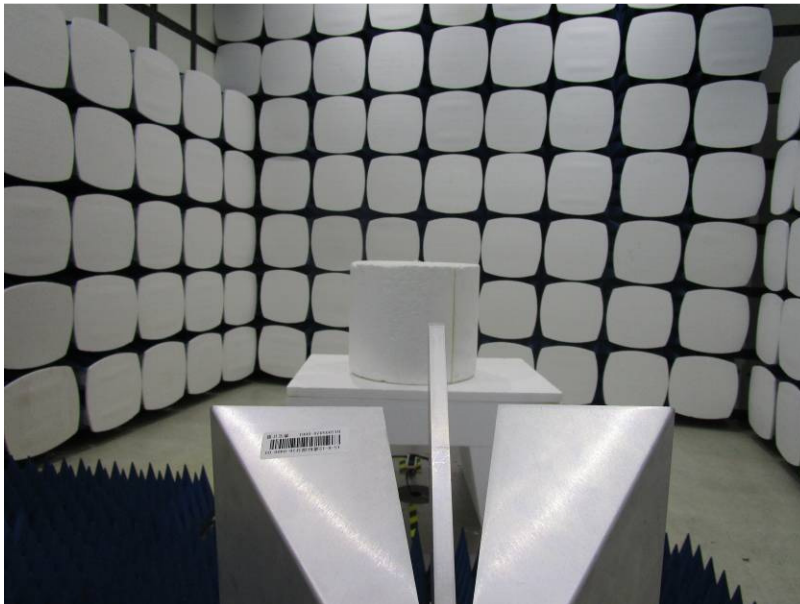
## 7 Photographs - EUT Test Setup

Test model No.: HMSZB-110

### 7.1 Radiated Emission



### 7.2 Radiated Spurious Emission



## 8 Photographs - EUT Constructional Details

Refer to Appendix A - Photographs of EUT Constructional Details for SZEM1612010839CR.