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Report No.: SZEM150400215101
Page : 1 of 62

FCC REPORT

Application No: SZEM1504002151CR
Applicant: Freescale Semiconductor, Inc
Manufacturer: Freescale Semiconductor, Inc
Factory: IONOTE Electronics (Dongguan) Ltd
Product Name: FRDM-KW24D512
Model No.(EUT): FRDM-KW24D512
FCC ID: RUN-FRDM-KW24D512
Standards: 47 CFR Part 15, Subpart C (2014)
Date of Receipt: 2015-05-11
Date of Test: 2015-05-13 to 2015-08-04
Date of Issue: 2015-08-06

Test Result:	PASS *
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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		2015-08-06		Original

Authorized for issue by:			
Tested By		2015-08-04	
	(Eric Fu) /Project Engineer	Date	
Prepared By		2015-08-06	
	(Hedy Wen) /Clerk	Date	
Checked By		2015-08-06	
	(Owen Zhou) /Reviewer	Date	

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

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5 General Information

5.1 Client Information

Applicant:	Freescale Semiconductor, Inc
Address of Applicant:	6501 West William Cannon Dr, Austin, TX, USA
Manufacturer:	Freescale Semiconductor, Inc
Address of Manufacturer:	6501 West William Cannon Dr, Austin, TX, USA
Factory:	IONOTE Electronics (Dongguan) Ltd
Address of Factory:	No.6 Ling Dong 3 Road, Lincun Industrial Center, Tangxia, 523710 Dongguan, Guangdong Province, China

5.2 General Description of EUT

Product Name:	FRDM-KW24D512
Model No.:	FRDM-KW24D512
Wireless Technology	Zigbee
Frequency Range:	2405~2480MHz
Modulation Type:	O-QPSK
Number of Channels:	16
Test software of EUT	Hyperterminal
Antenna Gain:	0 dBi
Antenna Type:	Integral
EUT Power Supply:	Power supply by USB port 5V

EUT channels and frequencies list:

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

Test frequency is the lowest channel: 0 channel(2405MHz), middle channel: 8 channel(2440MHz) and highest channel: 16 channel(2480MHz)

5.3 Test Environment

Operating Environment:	
Temperature:	25.0 °C
Humidity:	55% 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.

- **VCCI**

The 10m Semi-anechoic chamber and Shielded Room (7.5m x 4.0m x 3.0m) 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 of SGS-CSTC Standards Technical Services Co., Ltd. have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-2.

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.Due date (yyyy-mm-dd)
1	Shielding Room	ZhongYu Electron	GB-88	SEL0042	2016-05-13
2	LISN	Rohde & Schwarz	ENV216	SEL0152	2015-10-24
3	LISN	ETS-LINDGREN	3816/2	SEL0021	2016-05-13
4	8 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T8-02	SEL0162	2015-08-30
5	4 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T4-02	SEL0163	2015-08-30
6	2 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T2-02	SEL0164	2015-08-30
7	EMI Test Receiver	Rohde & Schwarz	ESCI	SEL0022	2016-05-13
8	Coaxial Cable	SGS	N/A	SEL0025	2016-05-13
9	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2015-10-24
10	Humidity/ Temperature Indicator	Shanghai Qixiang	ZJ1-2B	SEL0103	2015-10-24
11	Barometer	Chang Chun	DYM3	SEL0088	2016-05-13

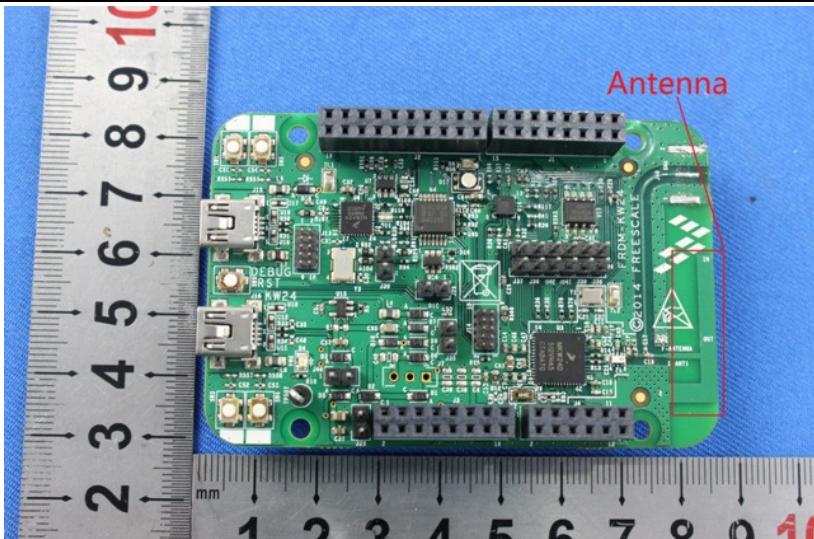
RE in Chamber					
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Due date (yyyy-mm-dd)
1	3m Semi-Anechoic Chamber	ETS-LINDGREN	N/A	SEL0017	2016-05-13
2	EMI Test Receiver	Agilent Technologies	N9038A	SEL0312	2015-09-16
3	EMI Test software	AUDIX	E3	SEL0050	N/A
4	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEL0015	2015-10-24
5	Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEL0006	2015-10-24
6	Horn Antenna (18-26GHz)	ETS-LINDGREN	3160	SEL0076	2015-10-24
7	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEL0053	2016-05-13
8	Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEL0168	2015-10-24
9	Coaxial cable	SGS	N/A	SEL0027	2016-05-13
10	Coaxial cable	SGS	N/A	SEL0189	2016-05-13
11	Coaxial cable	SGS	N/A	SEL0121	2016-05-13
12	Coaxial cable	SGS	N/A	SEL0178	2016-05-13
13	Band filter	Amindeon	82346	SEL0094	2016-05-13
14	Barometer	Chang Chun	DYM3	SEL0088	2016-05-13
15	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2015-10-24
16	Humidity/Temperature Indicator	Shanghai Qixiang	ZJ1-2B	SEL0103	2015-10-24
17	Signal Generator (10M-27GHz)	Rohde & Schwarz	SMR27	SEL0067	2016-05-13
18	Signal Generator	Rohde & Schwarz	SMY01	SEL0155	2015-10-24
19	Loop Antenna	Beijing Daze	ZN30401	SEL0203	2016-05-13

RF connected test					
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Due date (yyyy-mm-dd)
1	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2015-10-24
2	Humidity/ Temperature Indicator	HYGRO	ZJ1-2B	SEL0033	2015-10-24
3	Spectrum Analyzer	Rohde & Schwarz	FSP	SEL0154	2015-10-24
4	Coaxial cable	SGS	N/A	SEL0178	2016-05-13
5	Coaxial cable	SGS	N/A	SEL0179	2016-05-13
6	Barometer	ChangChun	DYM3	SEL0088	2016-05-13
7	Signal Generator	Rohde & Schwarz	SML03	SEL0068	2016-04-25
8	Band filter	amideon	82346	SEL0094	2016-05-13
9	POWER METER	R & S	NRVS	SEL0144	2015-10-24
10	Attenuator	Beijin feihang taida	TST-2-6dB	SEL0205	2016-04-25
11	Power Divider(splitter)	Agilent Technologies	11636B	SEL0130	2015-10-24

Note: The calibration interval is one year, all the instruments are valid.

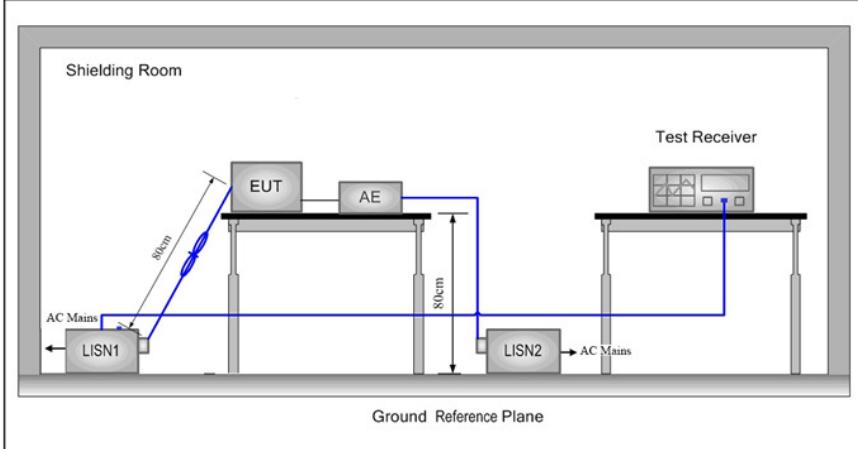
6 Test results and Measurement Data

6.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
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.
EUT Antenna:	 <p>The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0dBi.</p>

6.2 Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10: 2009		
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:	<ol style="list-style-type: none">1) The mains terminal disturbance voltage test was conducted in a shielded room.2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 5\Omega$ 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.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,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 2.5) 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: 2009 on conducted measurement.		

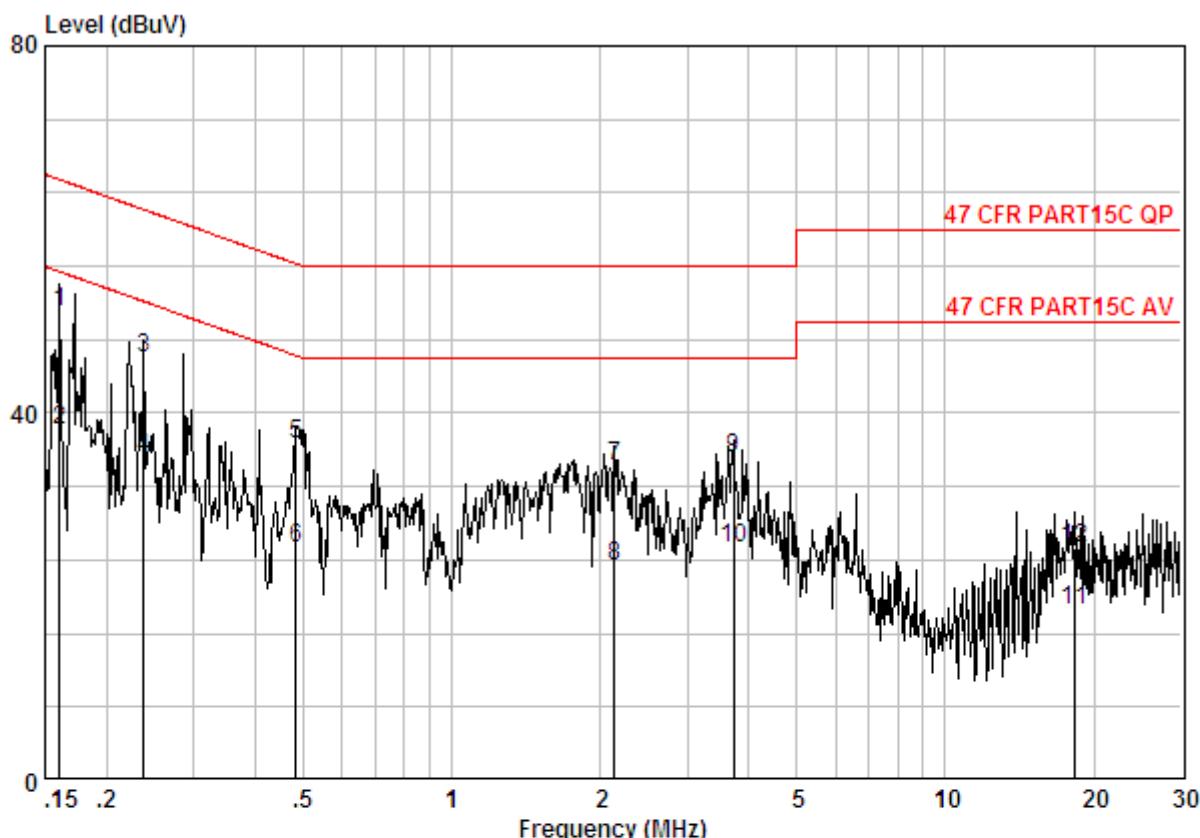
Test Setup:	
Test Mode:	Transmitting with O-QPSK modulation Transmitting mode
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

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.

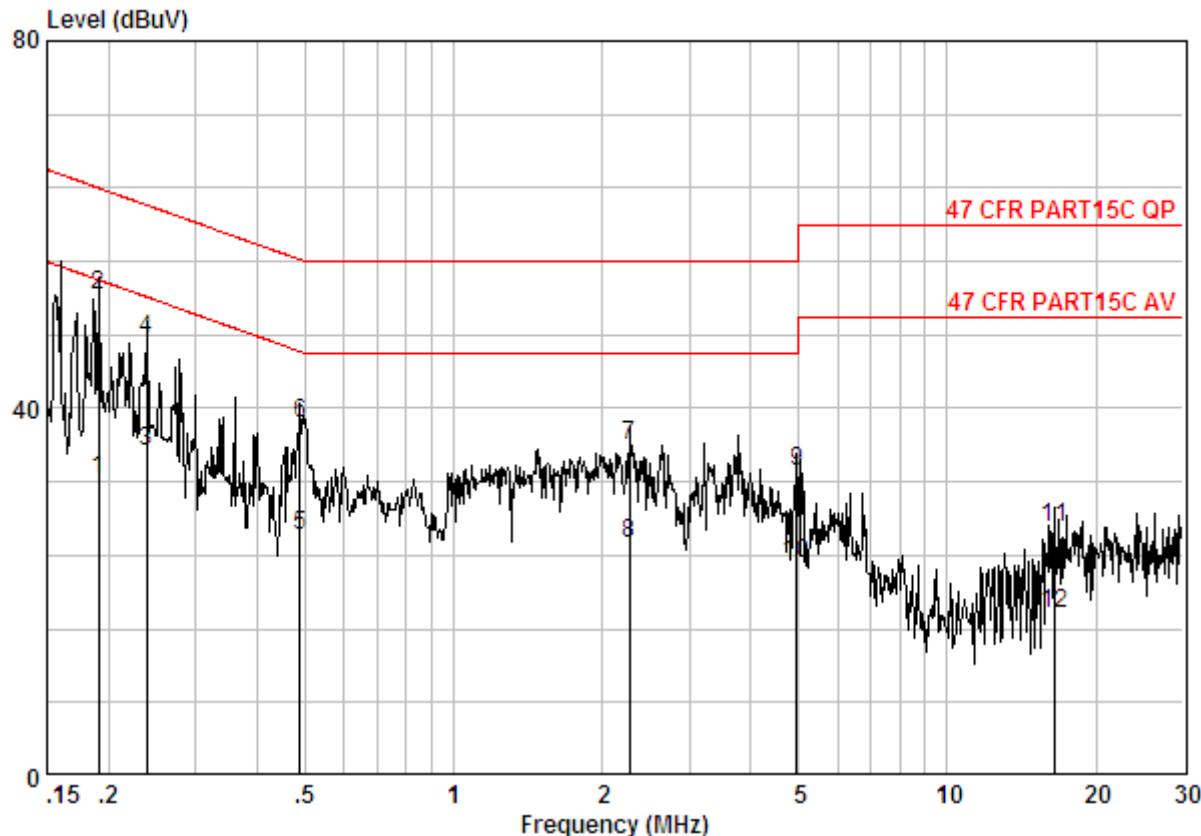
Live line:



Site : Shielding Room
Condition : 47 CFR PART15C QP CE LINE
Job No. : 2151CR
Test Mode : TX mode

	Freq	Cable	LISN	Read	Limit	Over	Remark
		Loss	Factor	Level			
	MHz	dB	dB	dBuV	dBuV	dBuV	dB
1 @	0.16070	0.02	9.70	41.25	50.97	65.43	-14.46 QP
2	0.16070	0.02	9.70	28.46	38.18	55.43	-17.25 Average
3	0.23784	0.02	9.70	36.32	46.03	62.17	-16.14 QP
4	0.23784	0.02	9.70	25.48	35.20	52.17	-16.98 Average
5	0.48375	0.01	9.80	26.75	36.56	56.27	-19.71 QP
6	0.48375	0.01	9.80	15.48	25.29	46.27	-20.98 Average
7	2.133	0.02	9.81	24.49	34.32	56.00	-21.68 QP
8	2.133	0.02	9.81	13.49	23.32	46.00	-22.68 Average
9	3.720	0.02	9.87	25.12	35.00	56.00	-21.00 QP
10	3.720	0.02	9.87	15.49	25.37	46.00	-20.63 Average
11	18.328	0.02	10.10	8.46	18.58	50.00	-31.42 Average
12	18.328	0.02	10.10	15.07	25.19	60.00	-34.81 QP

Neutral line:



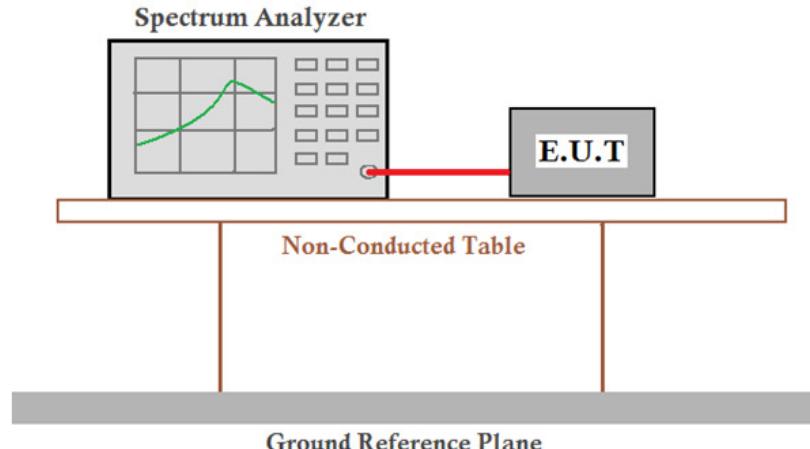
Site : Shielding Room
 Condition : 47 CFR PART15C QP CE NEUTRAL
 Job No. : 2151CR
 Test Mode : TX mode

	Freq	Cable	LISN	Read	Limit	Over	Remark
		MHz	dB	dB	dBuV	dBuV	dB
1	0.19039	0.02	9.70	22.58	32.30	54.02	-21.72 Average
2 @	0.19039	0.02	9.70	42.62	52.34	64.02	-11.68 QP
3	0.23910	0.02	9.70	25.64	35.36	52.13	-16.77 Average
4	0.23910	0.02	9.70	37.74	47.46	62.13	-14.67 QP
5	0.48890	0.01	9.80	16.38	26.19	46.19	-20.00 Average
6	0.48890	0.01	9.80	28.65	38.46	56.19	-17.73 QP
7	2.273	0.02	9.81	26.03	35.87	56.00	-20.13 QP
8	2.273	0.02	9.81	15.48	25.31	46.00	-20.69 Average
9	4.952	0.01	9.90	23.17	33.08	56.00	-22.92 QP
10	4.952	0.01	9.90	13.17	23.08	46.00	-22.92 Average
11	16.486	0.02	10.03	17.06	27.11	60.00	-32.89 QP
12	16.486	0.02	10.03	7.68	17.73	50.00	-32.27 Average

Notes:

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

6.3 Conducted Peak Output Power

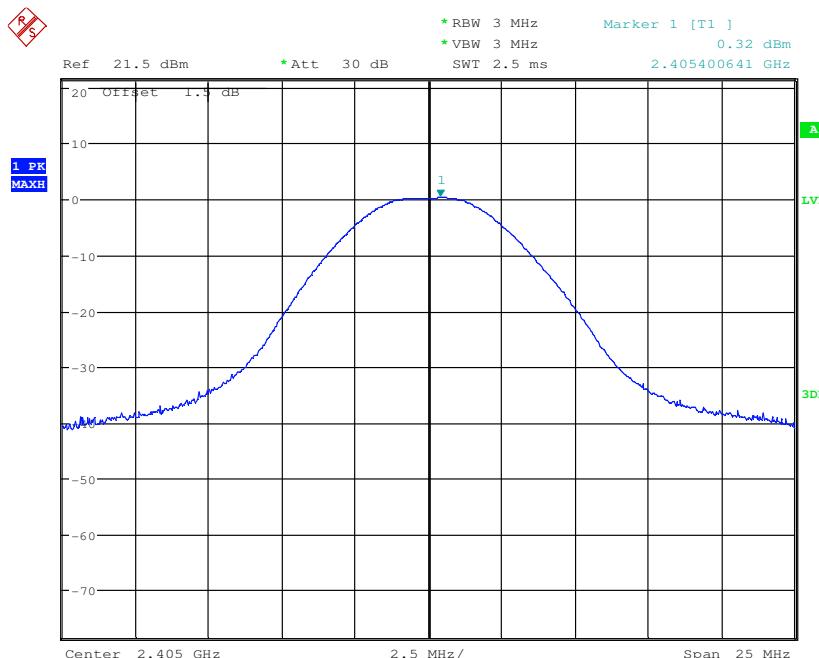
Test Requirement:	47 CFR Part 15C Section 15.247 (b)(1)
Test Method:	ANSI C63.10 2009
Test Setup:	 <p>Spectrum Analyzer E.U.T Non-Conducted Table Ground Reference Plane</p> <p><i>Remark:</i> <i>Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.</i></p>
Limit:	30dBm
Test Mode:	Transmitting with O-QPSK modulation
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

Measurement Data

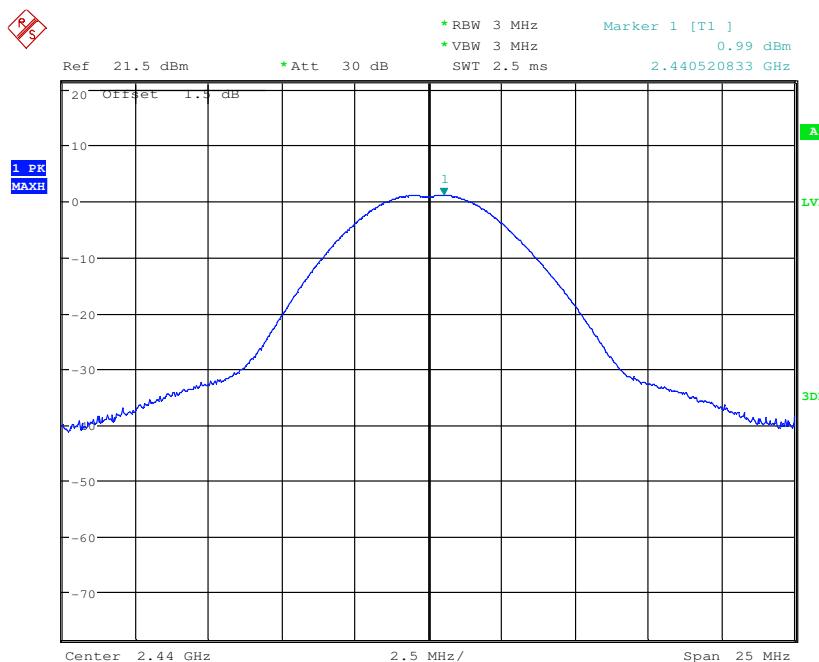
O-QPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	0.32	30.00	Pass
Middle	0.99	30.00	Pass
Highest	1.38	30.00	Pass

Test plot as follows:

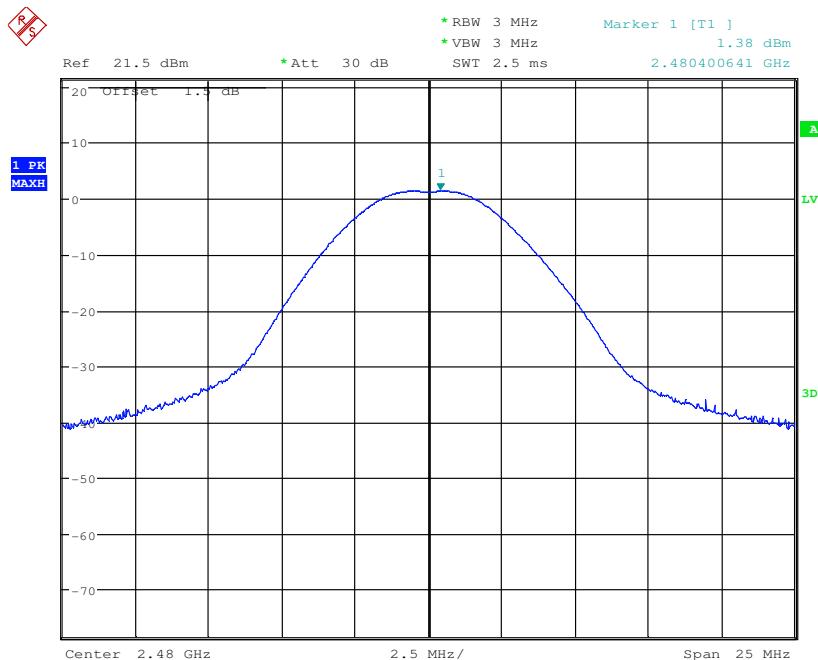
Test mode:	O-QPSK	Test channel:	Lowest
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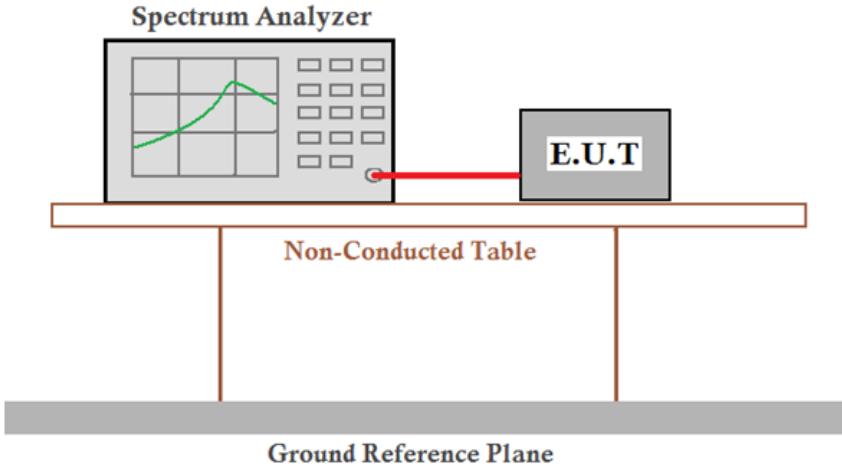
Test mode:	O-QPSK	Test channel:	Middle
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Test mode:	O-QPSK	Test channel:	Highest
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6.4 6dB Occupy Bandwidth

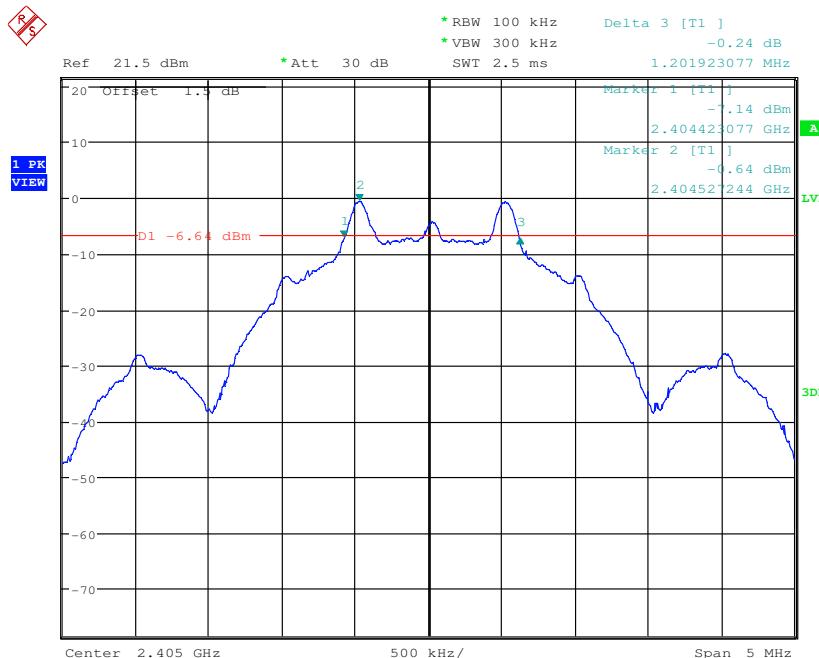
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	ANSI C63.10 2009
Test Setup:	
Limit:	≥ 500 kHz
Test Mode:	Transmitting with O-QPSK modulation
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

Measurement Data

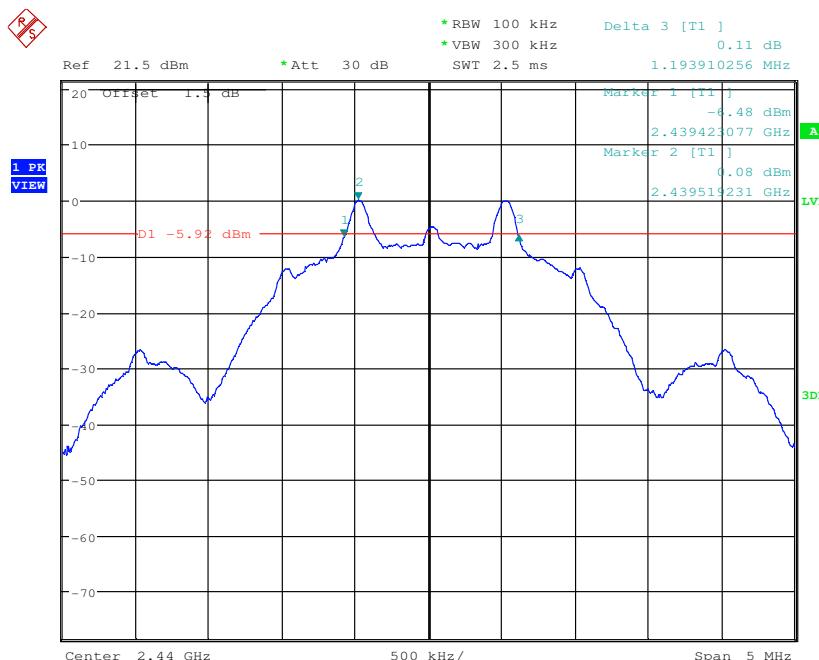
Test channel	6dB Occupy Bandwidth (MHz)	Limit (kHz)	Result
Lowest	1.202	≥ 500	Pass
Middle	1.194	≥ 500	Pass
Highest	1.194	≥ 500	Pass

Test plot as follows:

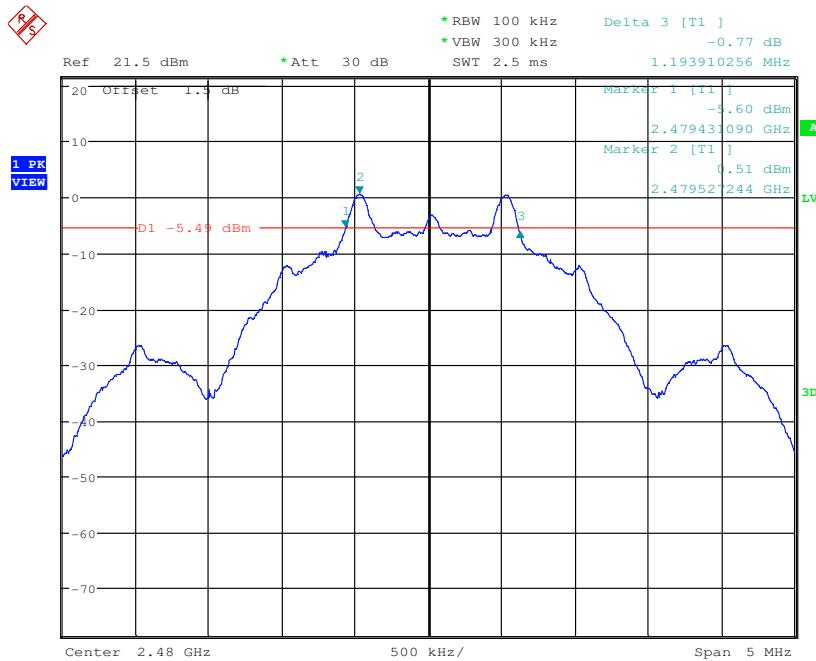
Test mode:	O-QPSK	Test channel:	Lowest
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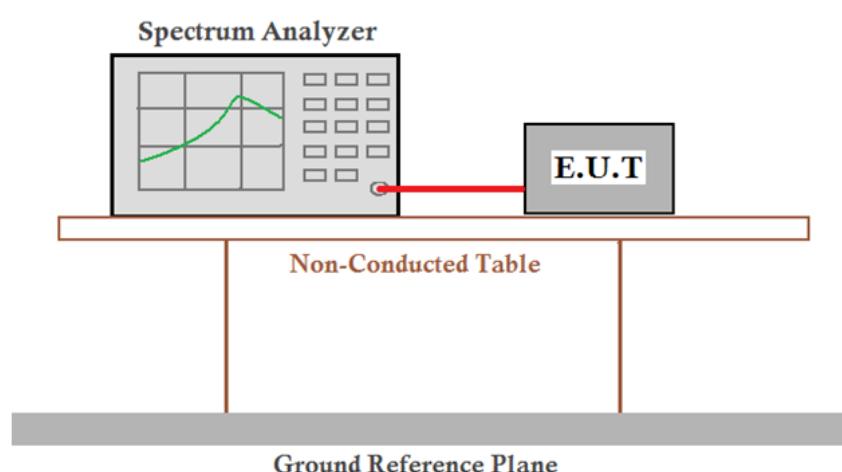
Test mode:	O-QPSK	Test channel:	Middle
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Test mode:	O-QPSK	Test channel:	Highest
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6.5 Power Spectral Density

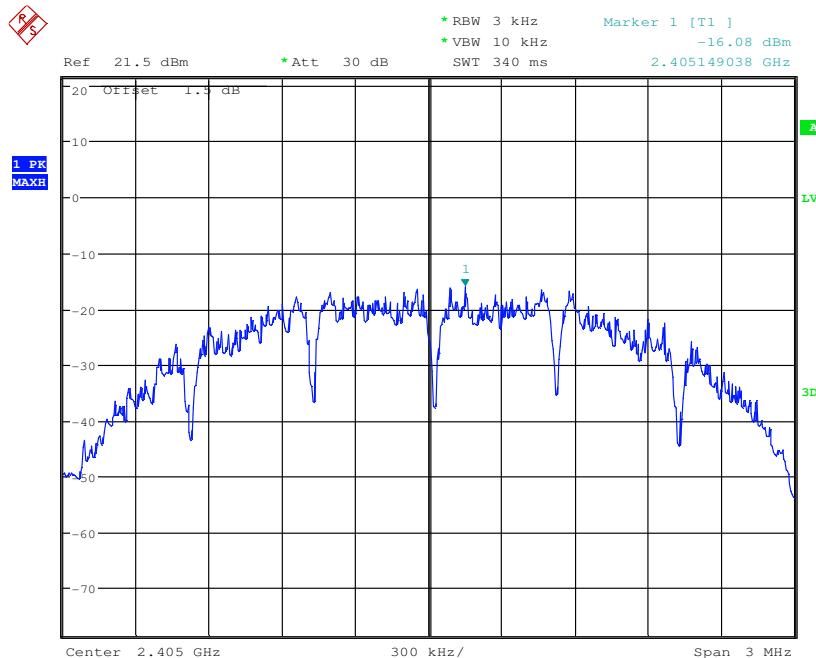
Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	ANSI C63.10 2009
Test Setup:	
Limit:	$\leq 8.00 \text{dBm}/3\text{kHz}$
Test Mode:	Transmitting with O-QPSK modulation
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

Measurement Data

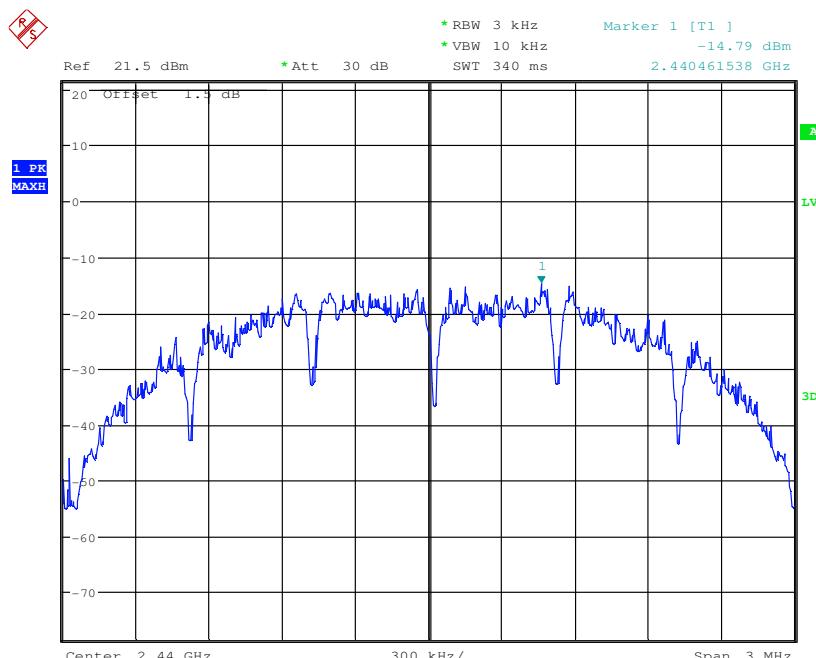
O-QPSK mode			
Test channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
Lowest	-16.08	≤ 8.00	Pass
Middle	-14.79	≤ 8.00	Pass
Highest	-13.39	≤ 8.00	Pass

Test plot as follows:

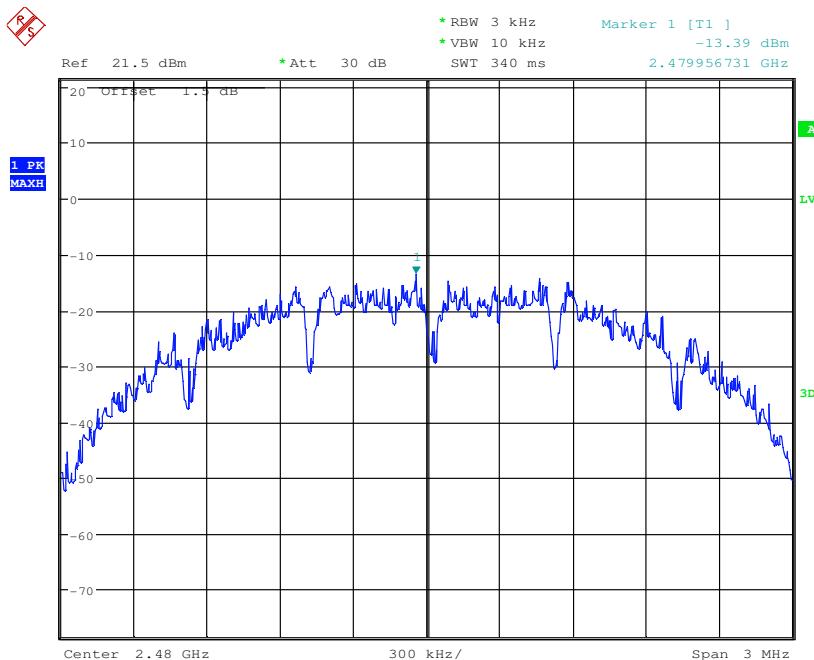
Test mode:	O-QPSK	Test channel:	Lowest
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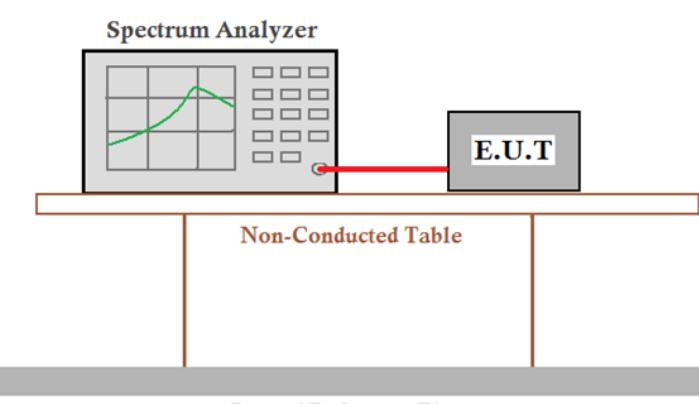
Test mode:	O-QPSK	Test channel:	Middle
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Test mode:	O-QPSK	Test channel:	Highest
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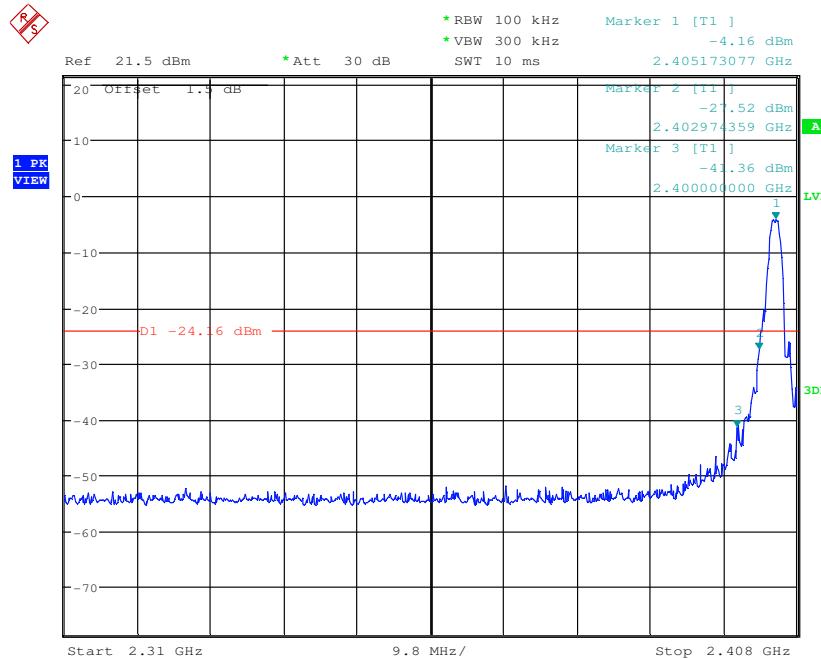


6.6 Band-edge for RF Conducted Emissions

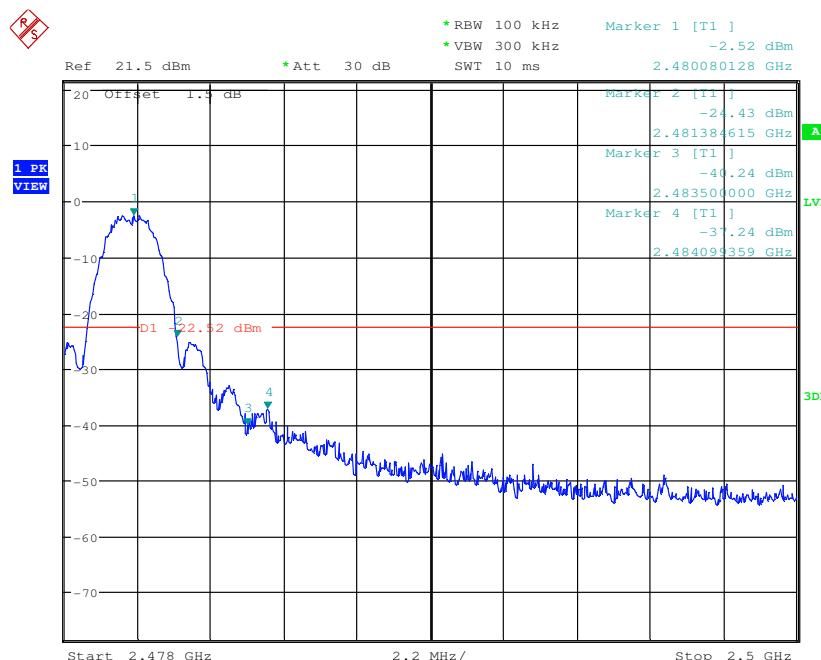
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10 2009
Test Setup:	 <p>The diagram illustrates the test setup for RF Conducted Emissions. A Spectrum Analyzer is connected to an E.U.T (Equipment Under Test) via a cable. The E.U.T is placed on a Non-Conducted Table. The entire 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 O-QPSK modulation
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

Test plot as follows:

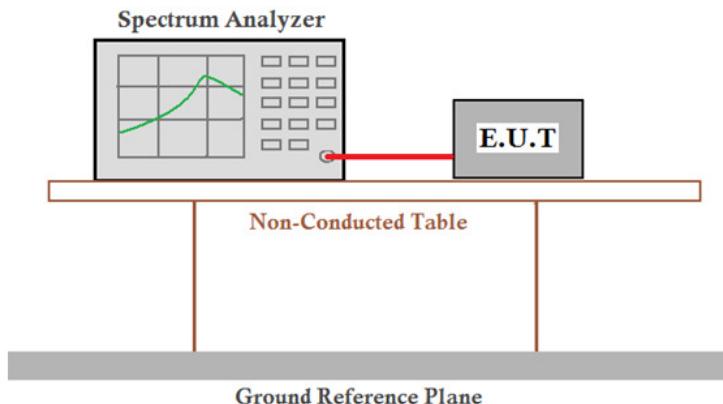
Test mode:	O-QPSK	Test channel:	Lowest
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Test mode:	O-QPSK	Test channel:	Highest
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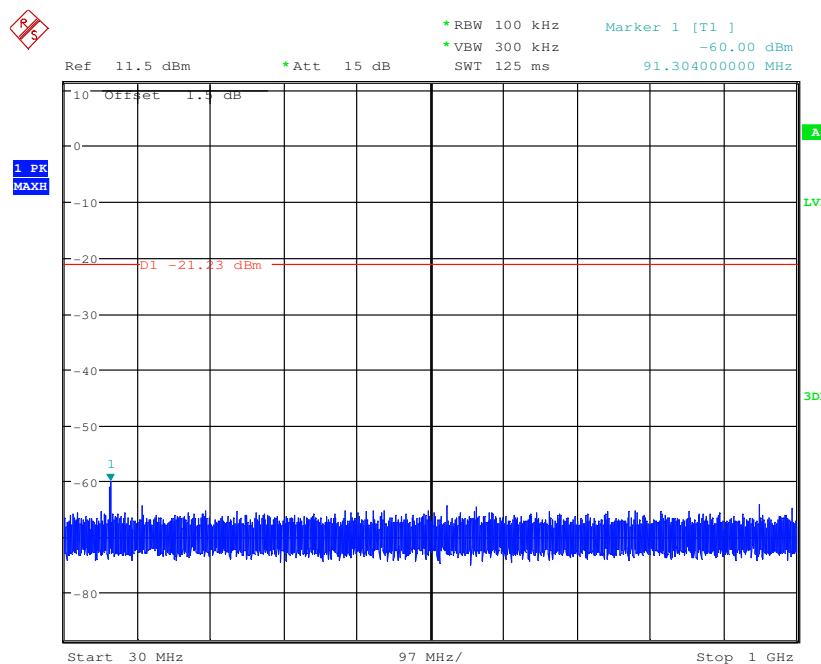
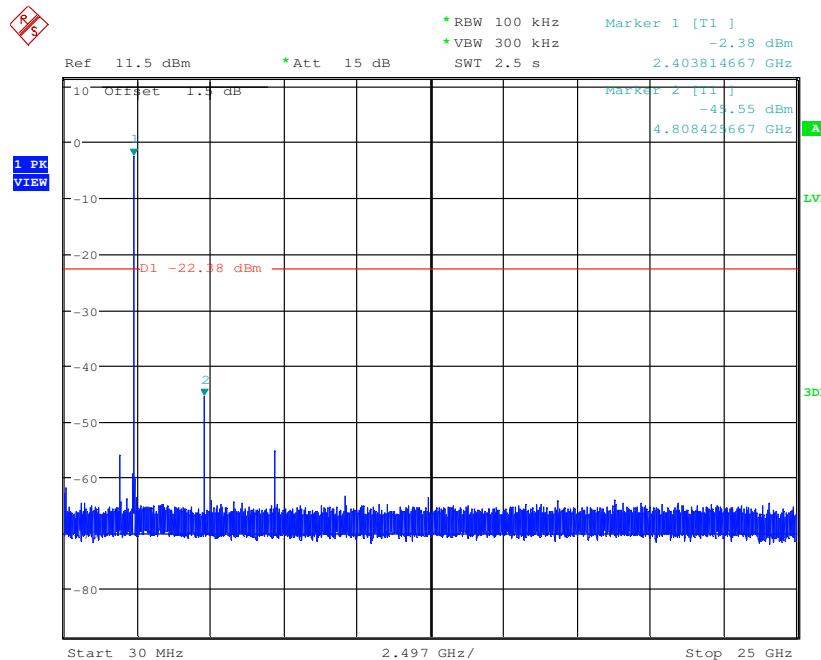


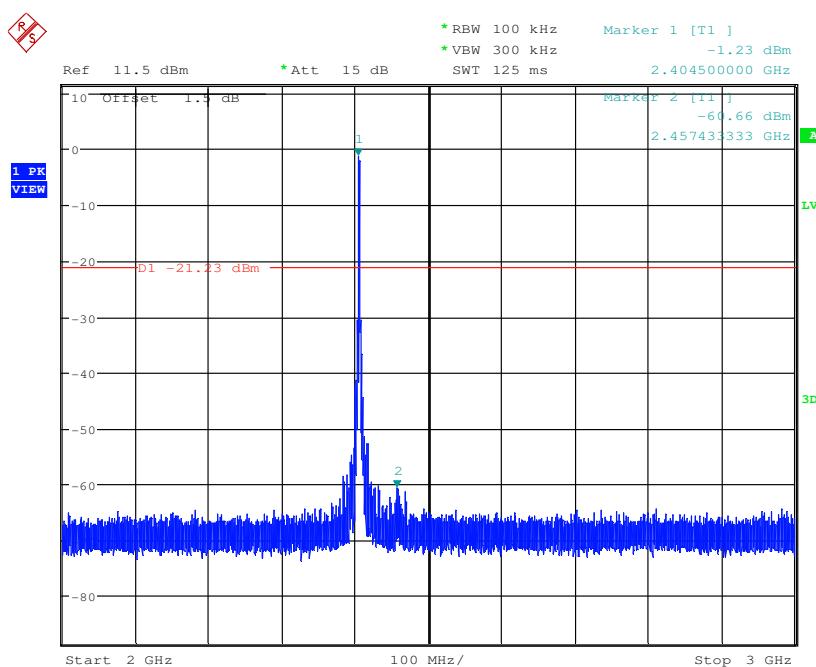
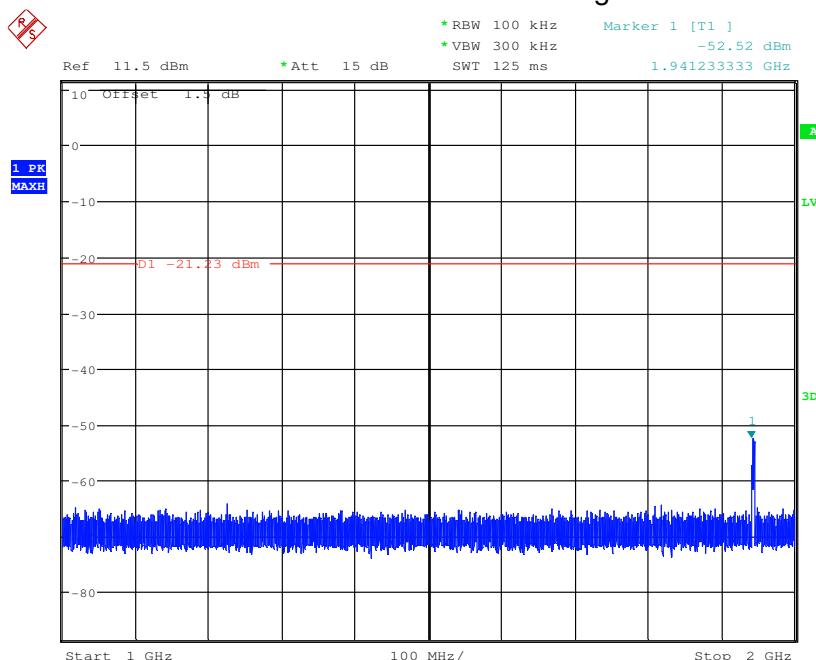
6.7 Spurious RF Conducted Emissions

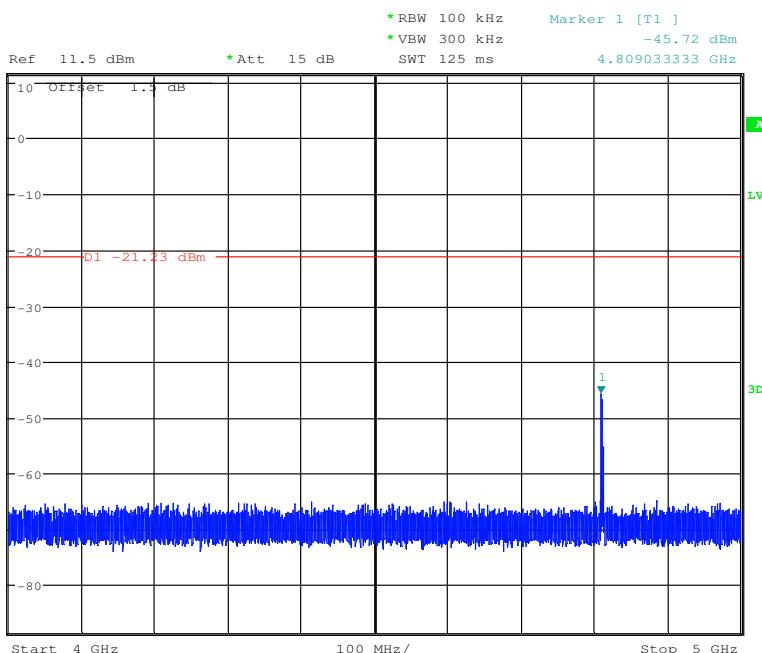
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10 2009
Test Setup:	
Remark:	Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio 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 O-QPSK modulation
Instruments Used:	Refer to section 5.10 for details.
Test Results:	Pass

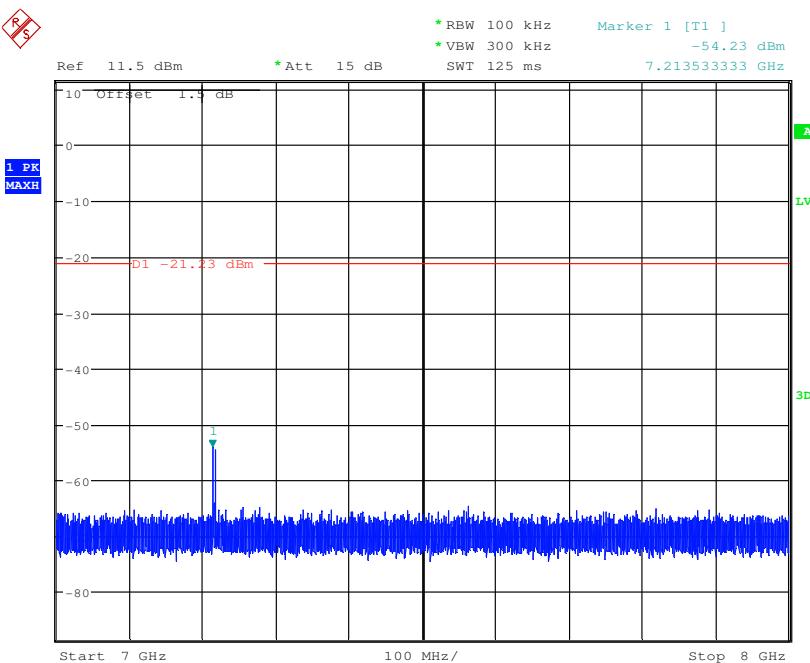


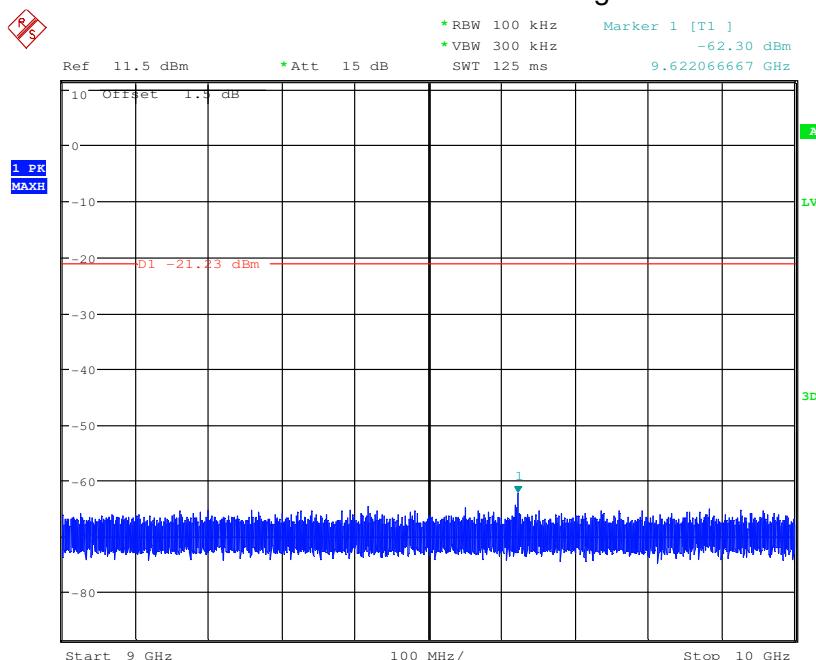
Test mode:	O-QPSK	Test channel:	Lowest
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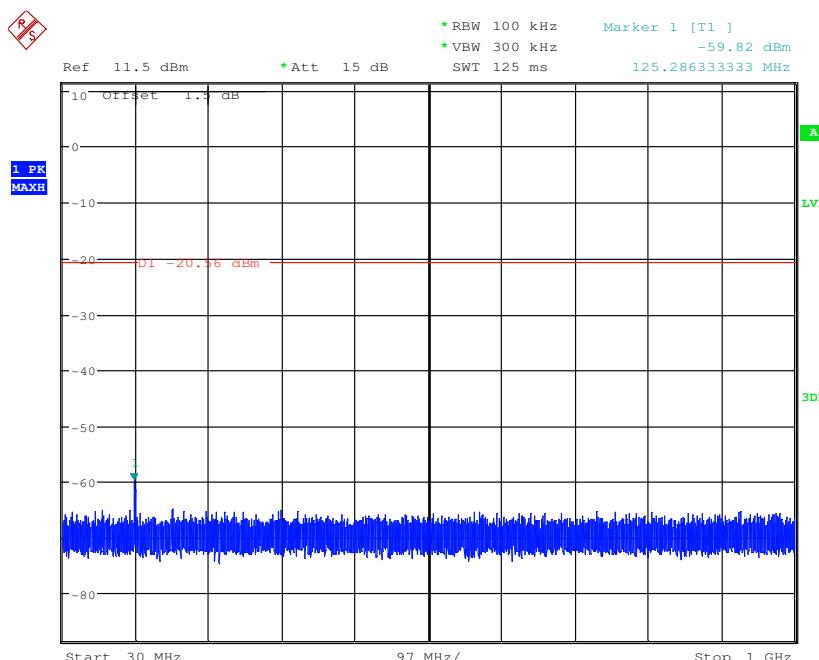
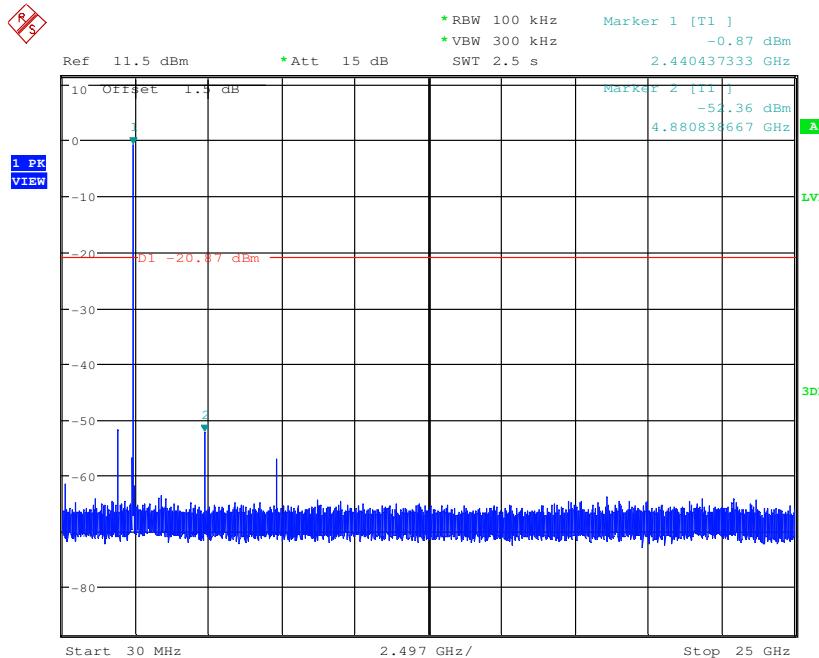


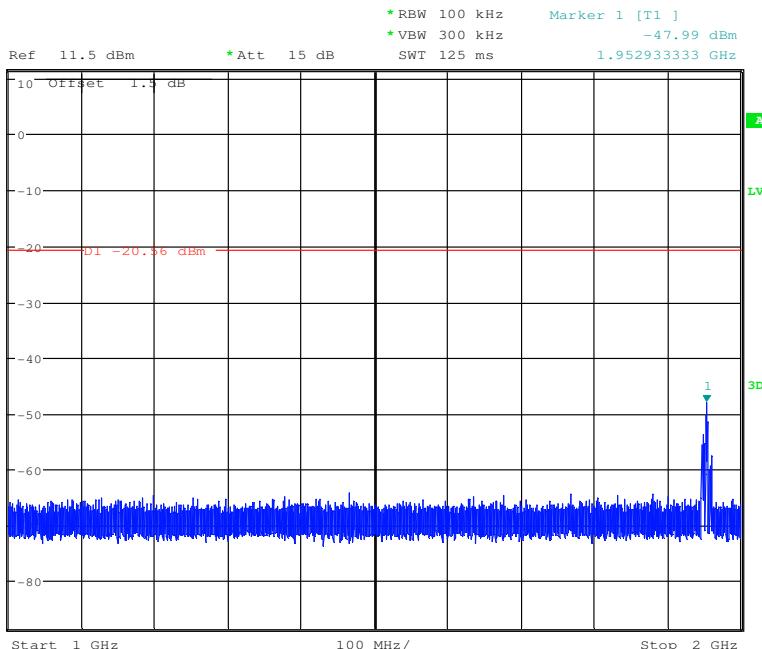



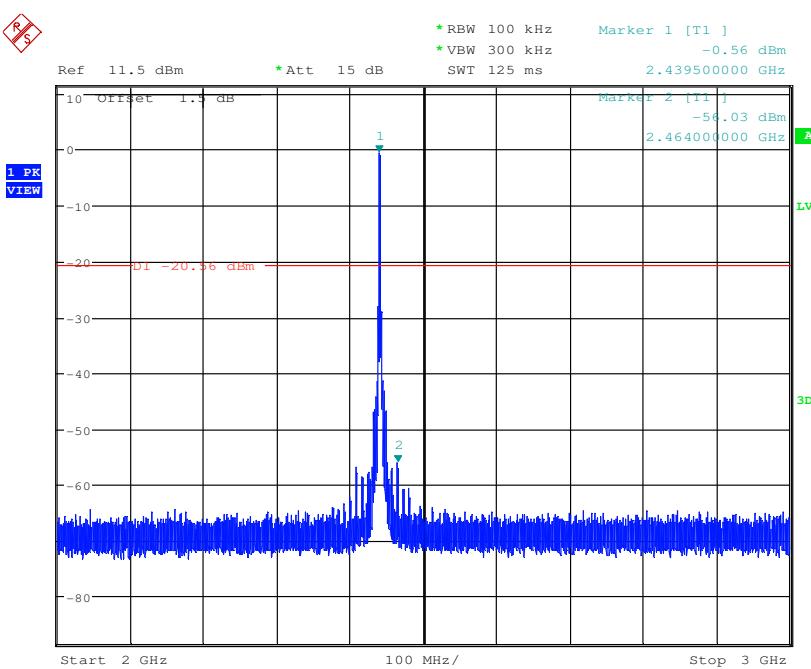


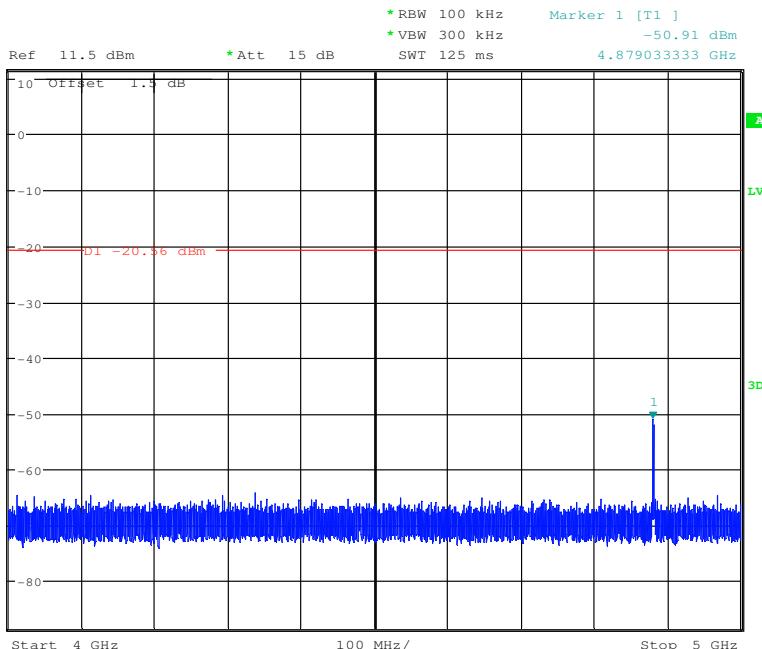


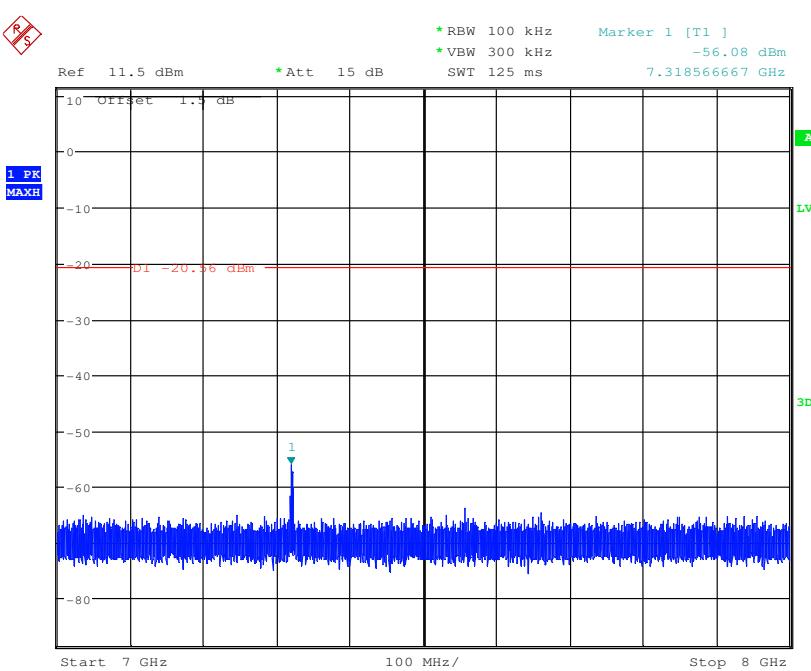
Test mode:	O-QPSK	Test channel:	Middle
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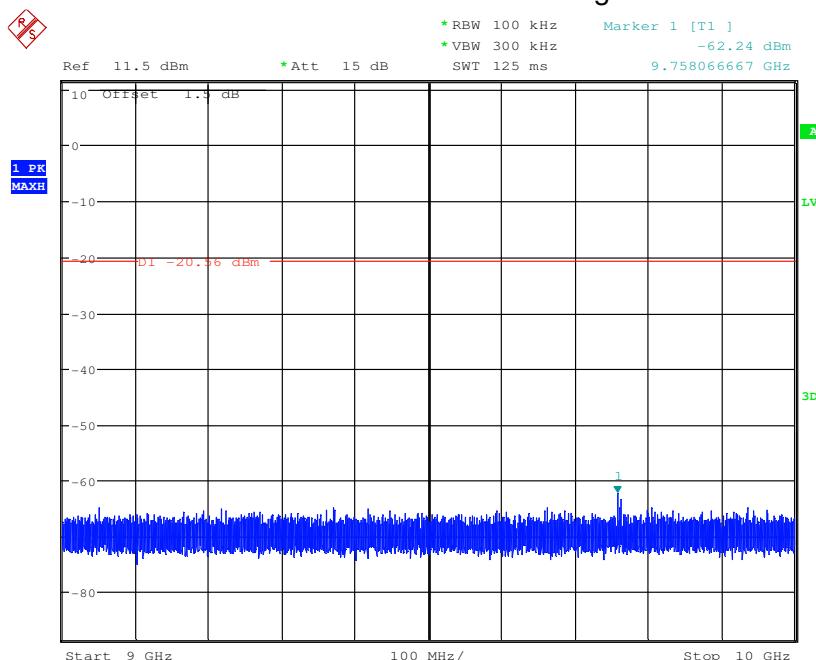


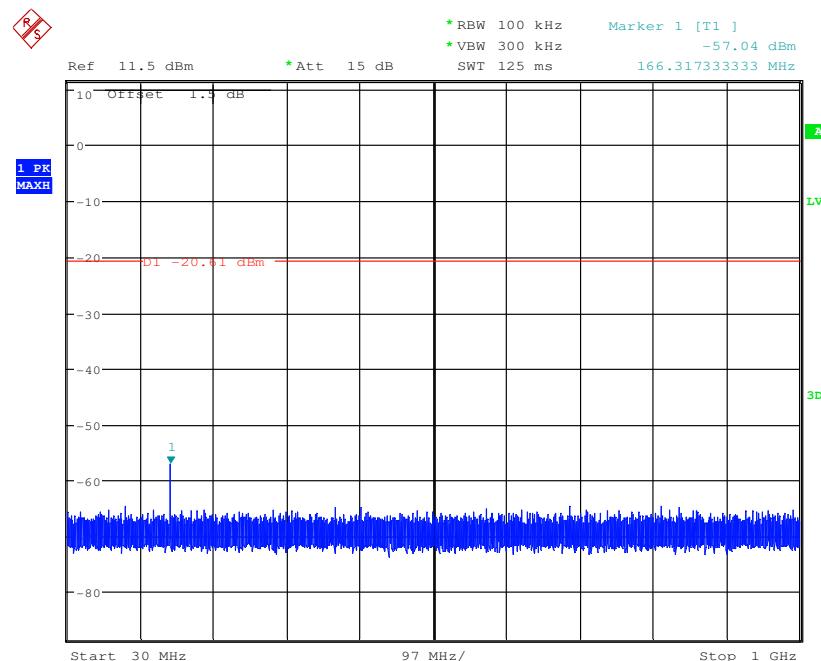
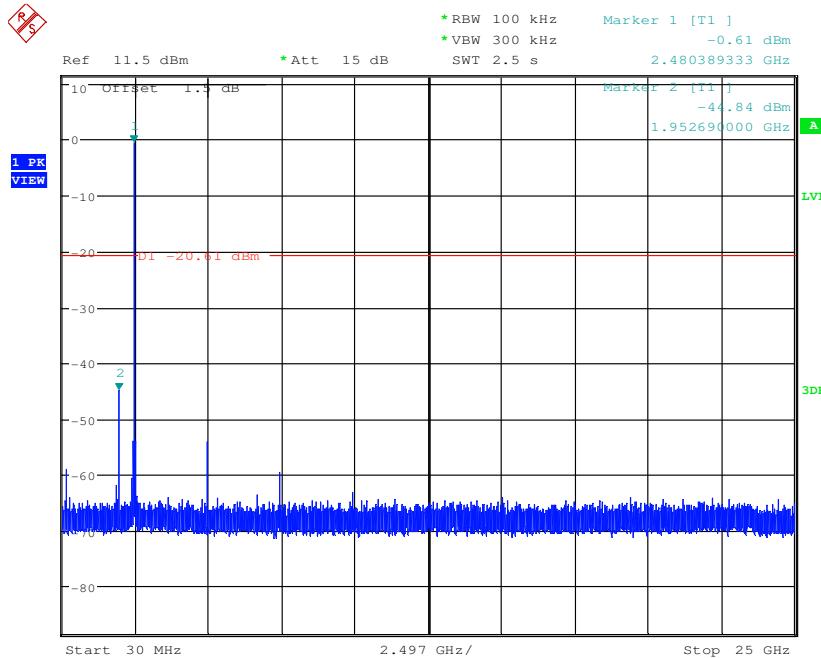


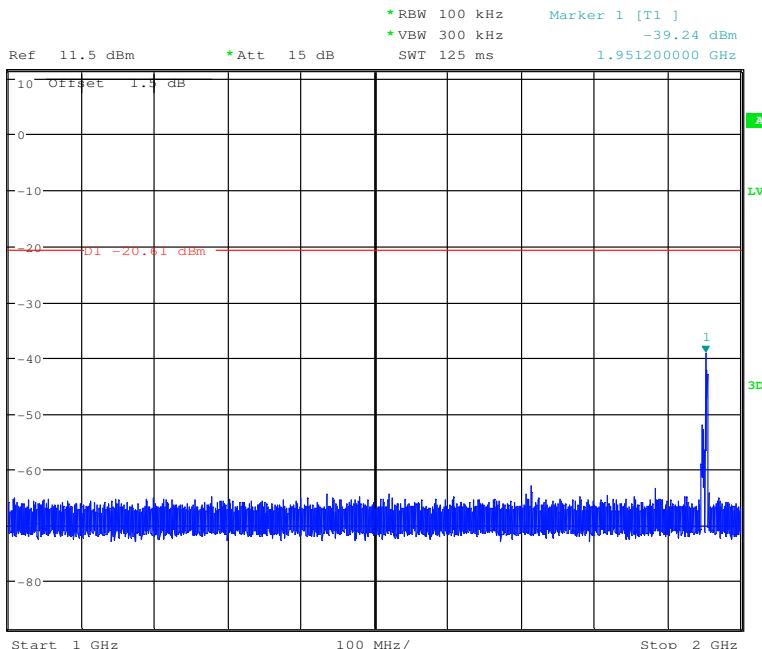
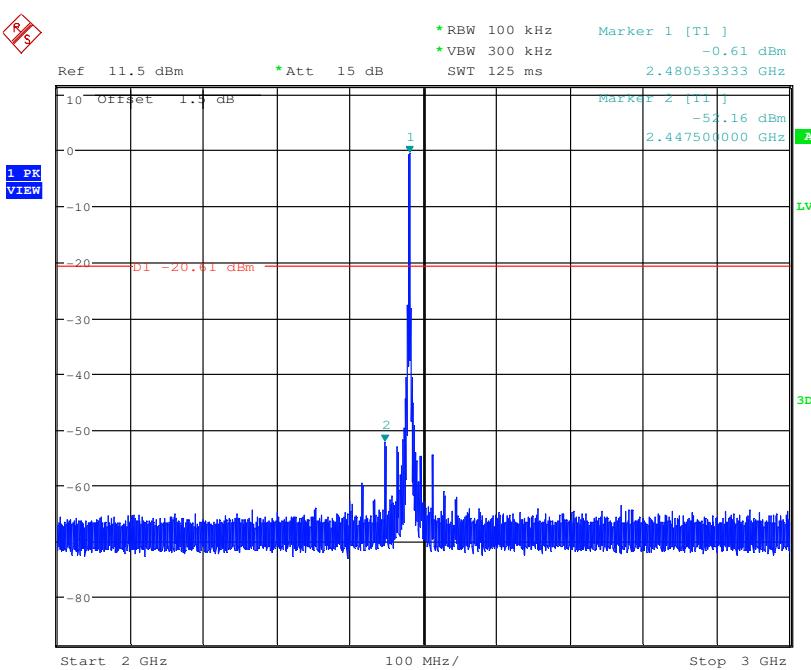



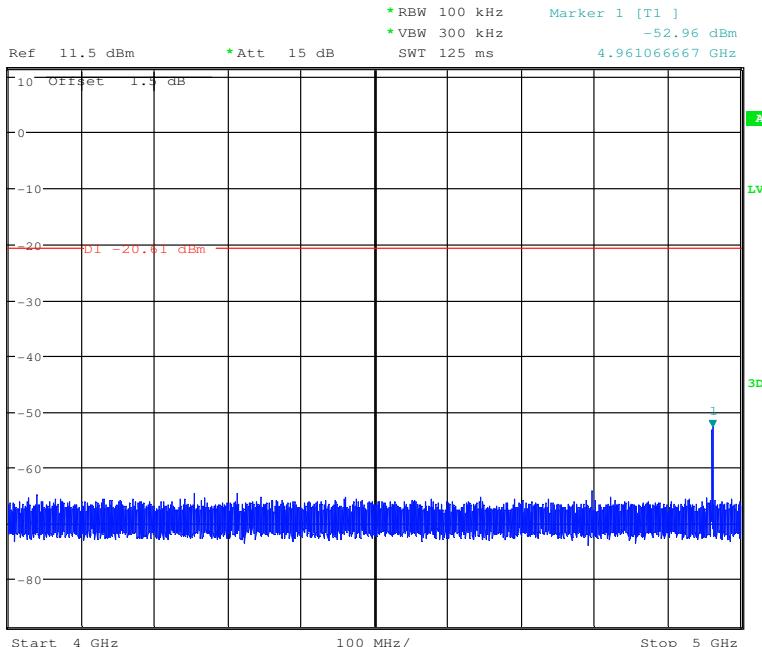


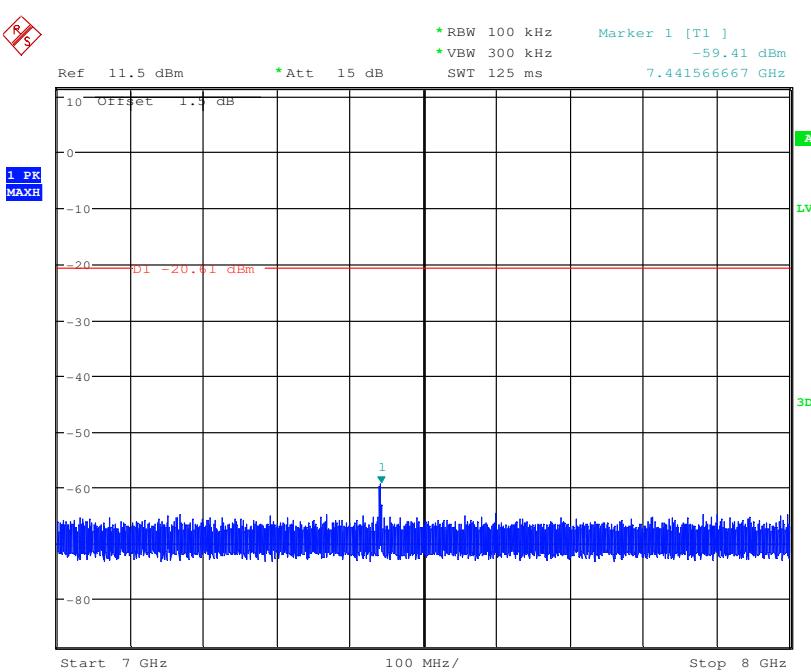


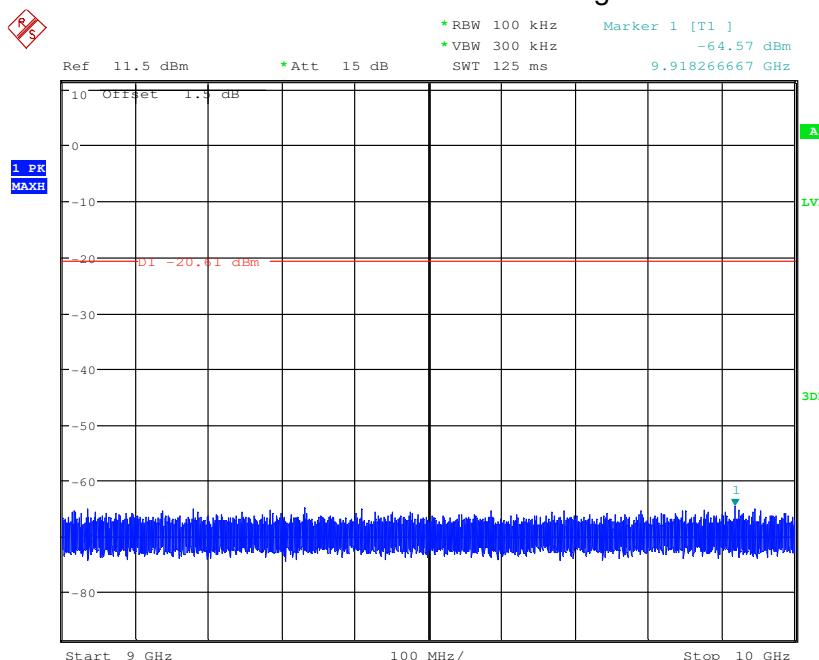
Test mode:	O-QPSK	Test channel:	Highest
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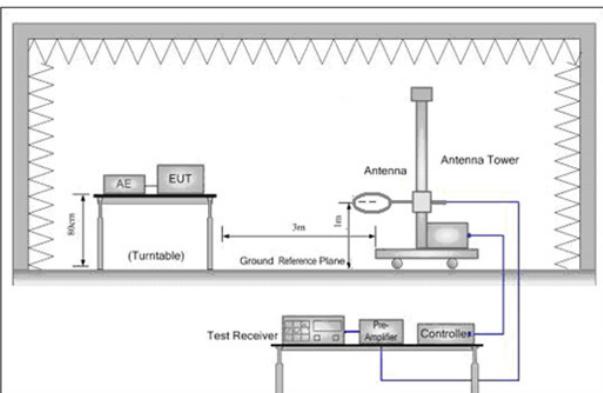
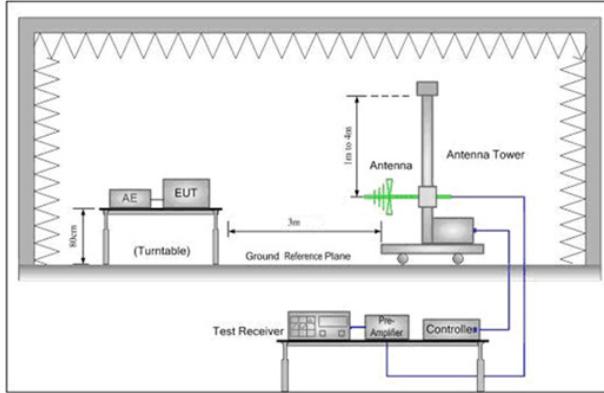
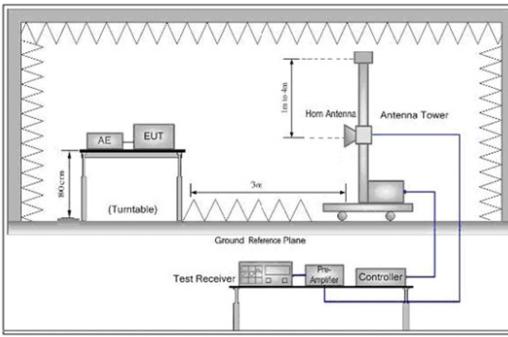


**Remark:**

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.

6.8 Radiated Spurious Emission

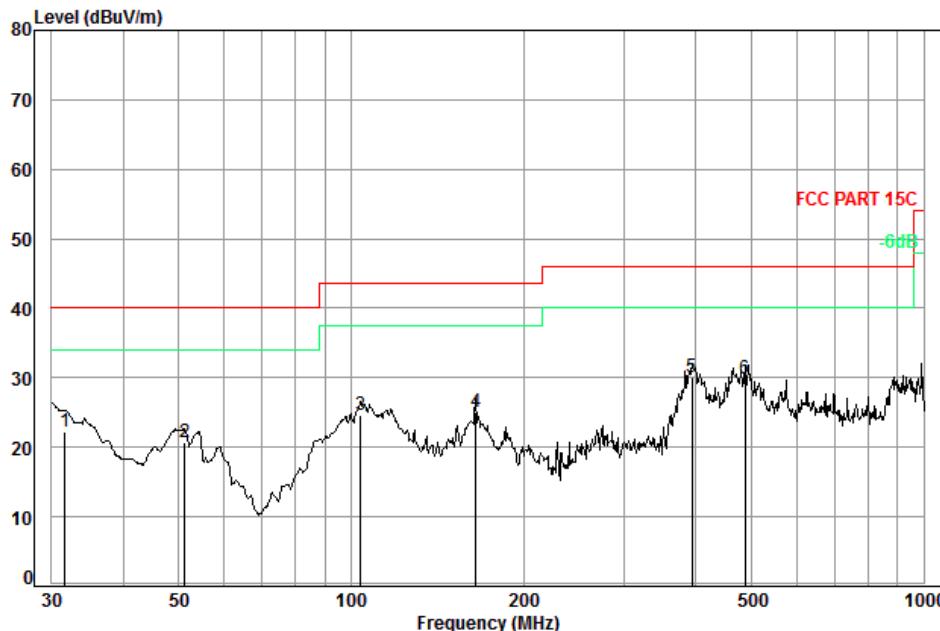
6.8.1 Spurious Emissions					
Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205				
Test Method:	ANSI C63.10 2009				
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	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:	<ol style="list-style-type: none"> 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



	<p>(2440MHz),the Highest channel (2480MHz)</p> <p>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.</p> <p>i. Repeat above procedures until all frequencies measured was complete.</p>
Exploratory Test Mode:	Transmitting with O-QPSK modulation Transmitting mode
Final Test Mode:	Transmitting with O-QPSK modulation Pretest the EUT at Transmitting mode, found the Transmitting mode which it is worse case 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	Vertical



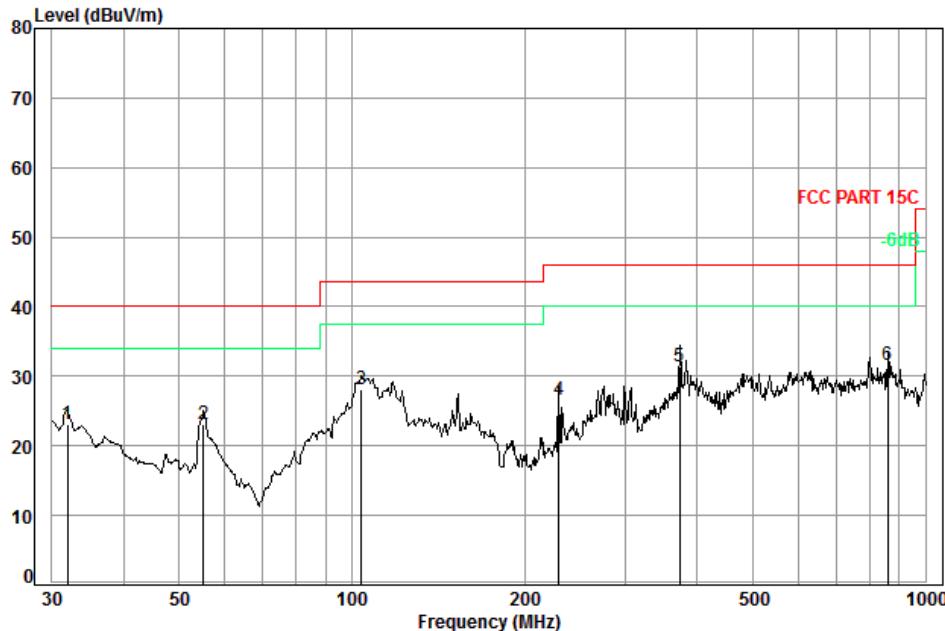
Condition: FCC PART 15C 3m Vertical

Job No. : 2151CR

Test Mode: TX mode

Freq	Cable Loss	Ant Factor	Preamp Factor	Read	Limit Line	Over Limit
				Level		
1	31.66	0.60	17.77	27.35	31.18	22.20 40.00 -17.80
2	51.26	0.80	8.51	27.29	38.65	20.67 40.00 -19.33
3	104.06	1.21	8.90	27.17	41.63	24.57 43.50 -18.93
4	165.42	1.35	9.55	26.83	40.96	25.03 43.50 -18.47
5	394.29	2.19	16.23	27.09	38.75	30.08 46.00 -15.92
6	487.25	2.55	17.80	27.64	37.10	29.81 46.00 -16.19

Test mode:	Transmitting	Horizontal
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Condition: FCC PART 15C 3m Horizontal

Job No. : 2151CR

Test Mode: TX mode

Freq	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	31.90	0.60	17.64	27.35	32.30	23.19	40.00	-16.81
2	55.14	0.80	7.93	27.28	41.65	23.10	40.00	-16.90
3	104.06	1.21	8.90	27.17	45.08	28.02	43.50	-15.48
4	229.74	1.57	11.65	26.59	40.01	26.64	46.00	-19.36
5	373.29	2.13	15.86	26.95	40.43	31.47	46.00	-14.53
6	861.02	3.45	22.66	26.96	32.48	31.63	46.00	-14.37



Transmitter Emission above 1GHz										
Test mode:		O-QPSK		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		
3647.151	6.88	33.04	38.81	45.88	46.99	74	-27.01	Vertical		
4810.000	6.43	34.71	39.24	51.66	53.56	74	-20.44	Vertical		
5973.576	8.04	36.25	39.19	47.22	52.32	74	-21.68	Vertical		
7215.000	8.93	35.62	39.07	46.38	51.86	74	-22.14	Vertical		
9620.000	9.98	37.36	37.93	43.8	53.21	74	-20.79	Vertical		
11723.670	10.49	38.43	38.57	43.13	53.48	74	-20.52	Vertical		
3492.224	6.98	32.88	38.74	45.42	46.54	74	-27.46	Horizontal		
4810.000	6.43	34.71	39.24	49.49	51.39	74	-22.61	Horizontal		
5999.562	8.08	36.3	39.18	46.18	51.38	74	-22.62	Horizontal		
7215.000	8.93	35.62	39.07	46.63	52.11	74	-21.89	Horizontal		
9620.000	9.98	37.36	37.93	43.43	52.84	74	-21.16	Horizontal		
11438.810	10.38	38.18	38.44	43.26	53.38	74	-20.62	Horizontal		

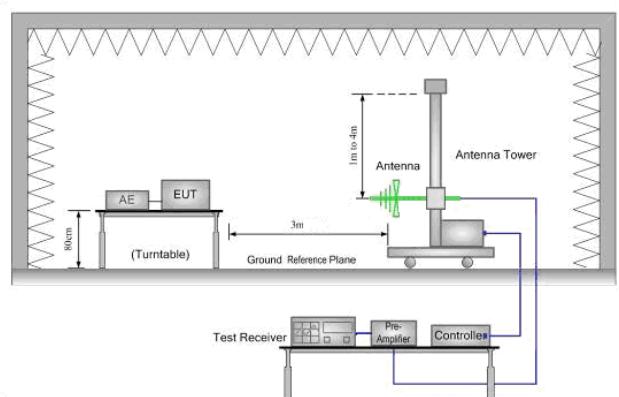
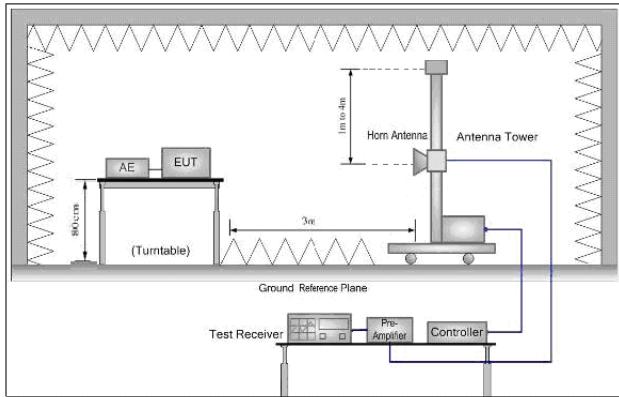
Test mode:		O-QPSK		Test channel:		Middle		Remark:		Peak
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization		
3497.281	6.98	32.89	38.74	46.36	47.49	74	-26.51	Vertical		
4880.000	6.58	34.78	39.26	51.79	53.89	74	-20.11	Vertical		
5990.888	8.07	36.28	39.18	46.71	51.88	74	-22.12	Vertical		
7320.000	9.07	35.51	39.06	46.32	51.84	74	-22.16	Vertical		
9760.000	9.90	37.80	37.84	43.18	53.04	74	-20.96	Vertical		
11639.160	10.45	38.34	38.53	42.82	53.08	74	-20.92	Vertical		
3568.847	6.93	32.97	38.77	45.69	46.82	74	-27.18	Horizontal		
4880.000	6.58	34.78	39.26	48.45	50.55	74	-23.45	Horizontal		
5956.314	8.01	36.22	39.19	46.91	51.95	74	-22.05	Horizontal		
7320.000	9.07	35.51	39.06	46.68	52.20	74	-21.80	Horizontal		
9760.000	9.90	37.80	37.84	42.91	52.77	74	-21.23	Horizontal		
11555.260	10.41	38.27	38.49	43.06	53.25	74	-20.75	Horizontal		

Test mode:		O-QPSK		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		
3620.861	6.90	33.02	38.79	46.09	47.22	74	-26.78	Vertical		
4960.000	6.76	34.86	39.29	45.26	47.59	74	-26.41	Vertical		
5999.562	8.08	36.30	39.18	47.25	52.45	74	-21.55	Vertical		
7440.000	9.23	35.43	39.05	46.85	52.46	74	-21.54	Vertical		
9920.000	9.81	38.27	37.75	42.55	52.88	74	-21.12	Vertical		
11488.580	10.39	38.22	38.46	43.71	53.86	74	-20.14	Vertical		
3721.784	6.84	33.09	38.84	47.14	48.23	74	-25.77	Horizontal		
4960.000	6.76	34.86	39.29	51.09	53.42	74	-20.58	Horizontal		
6060.637	8.07	36.23	39.18	47.20	52.32	74	-21.68	Horizontal		
7440.000	9.23	35.43	39.05	46.33	51.94	74	-22.06	Horizontal		
9920.000	9.81	38.27	37.75	42.83	53.16	74	-20.84	Horizontal		
11471.960	10.38	38.20	38.45	43.16	53.29	74	-20.71	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

6.9 Restricted bands around fundamental frequency

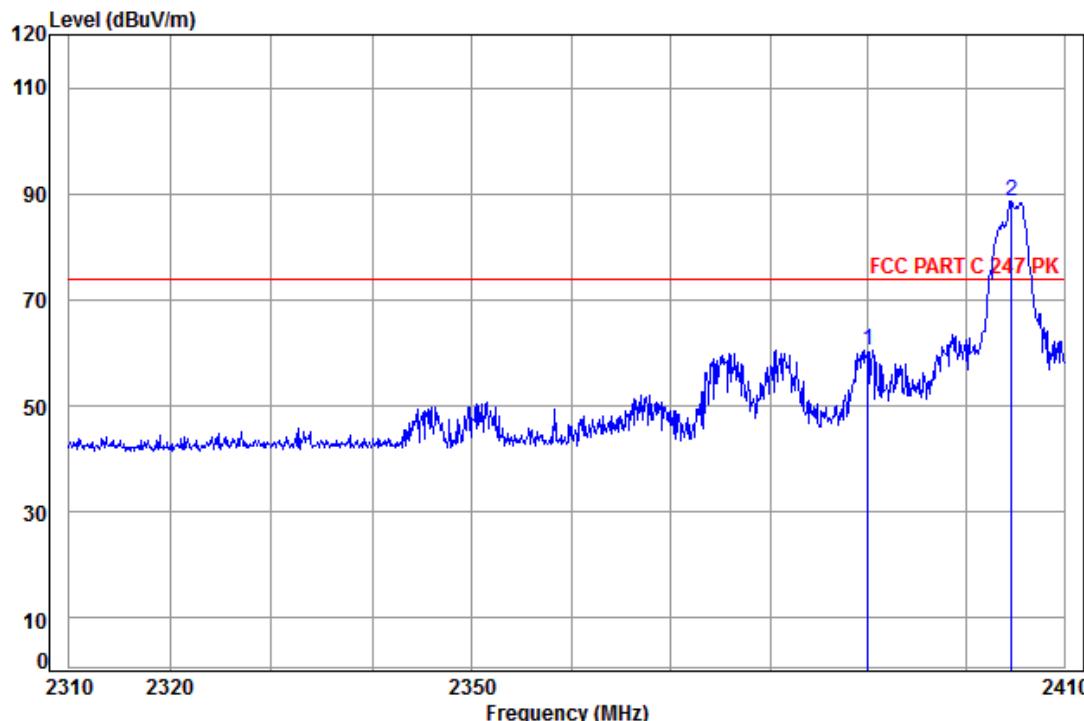
Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205		
Test Method:	ANSI C63.10 2009		
Test Site:	Measurement Distance: 3m (Semi-Anechoic Chamber)		
Limit:	Frequency	Limit (dBuV/m @3m)	Remark
	30MHz-88MHz	40.0	Quasi-peak Value
	88MHz-216MHz	43.5	Quasi-peak Value
	216MHz-960MHz	46.0	Quasi-peak 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"> 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 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 g. Test the EUT in the lowest channel , the Highest channel 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. i. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with O-QPSK modulation Transmitting mode
Final Test Mode:	Transmitting with O-QPSK modulation Pretest the EUT at Transmitting mode, found the Transmitting mode which it is worse case 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 mode:	O-QPSK	Test channel:	Lowest	Remark:	Peak	Vertical
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Data: 56



Site : chamber

Condition: FCC PART C 247 PK 3m Vertical

Job No: : 2151CR

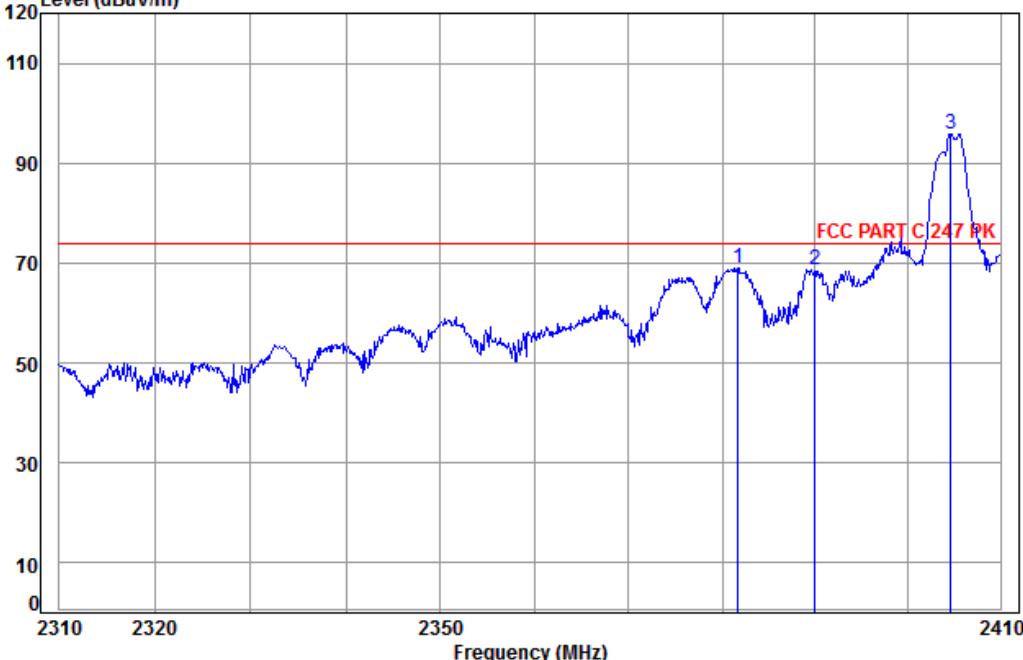
Mode: : 2405 Band edge

		Cable Freq	Ant Loss	Preamp Factor	Read Level	Limit Level	Line Limit	Over Limit	
		MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2390.00	4.90	32.35	38.46	61.66	60.45	74.00	-13.55	
2 pp	2404.59	4.92	32.41	38.46	89.62	88.49	74.00	14.49	

Test mode:	O-QPSK	Test channel:	Lowest	Remark:	Peak	Horizontal
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Data: 54

Level (dBuV/m)



Site : chamber

Condition: FCC PART C 247 PK 3m Horizontal

Job No: : 2151CR

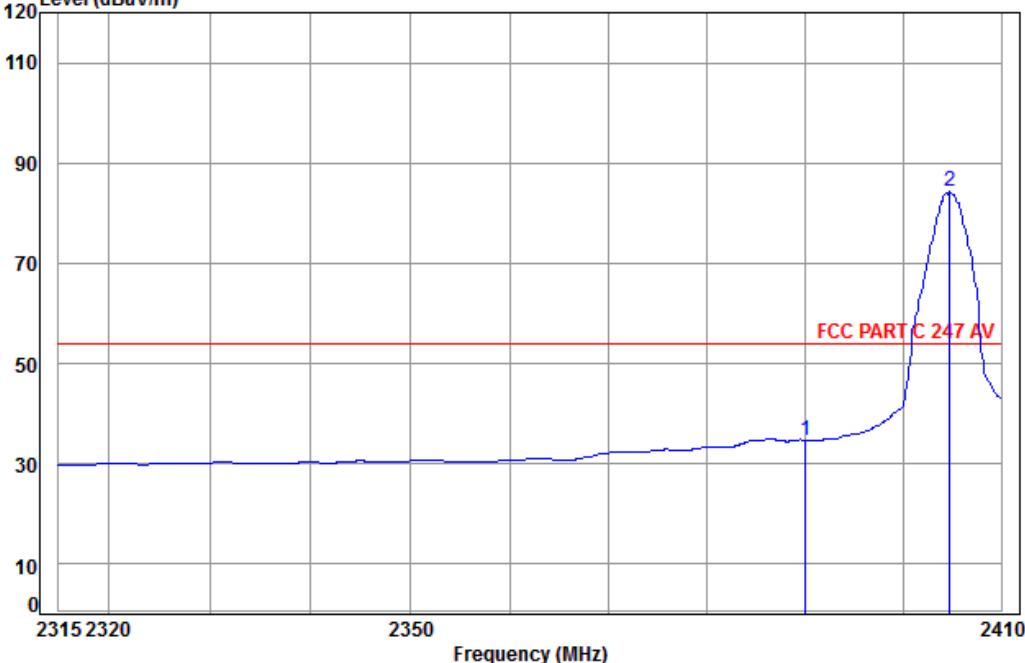
Mode: : 2405 Band edge

Freq	Cable Loss	Ant Factor	Preamp Factor	Read	Limit Line	Over Limit
				Level		
1	2381.67	4.89	32.29	38.46	70.24	68.96
2	2390.00	4.90	32.35	38.46	69.98	68.77
3 pp	2404.59	4.92	32.41	38.46	96.96	95.83
					74.00	-5.04
					74.00	-5.23
					74.00	21.83

Test mode:	O-QPSK	Test channel:	Lowest	Remark:	Average	Vertical
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Data: 51

Level (dBuV/m)



Site : chamber

Condition: FCC PART C 247 AV 3m Vertical

Job No: : 2151CR

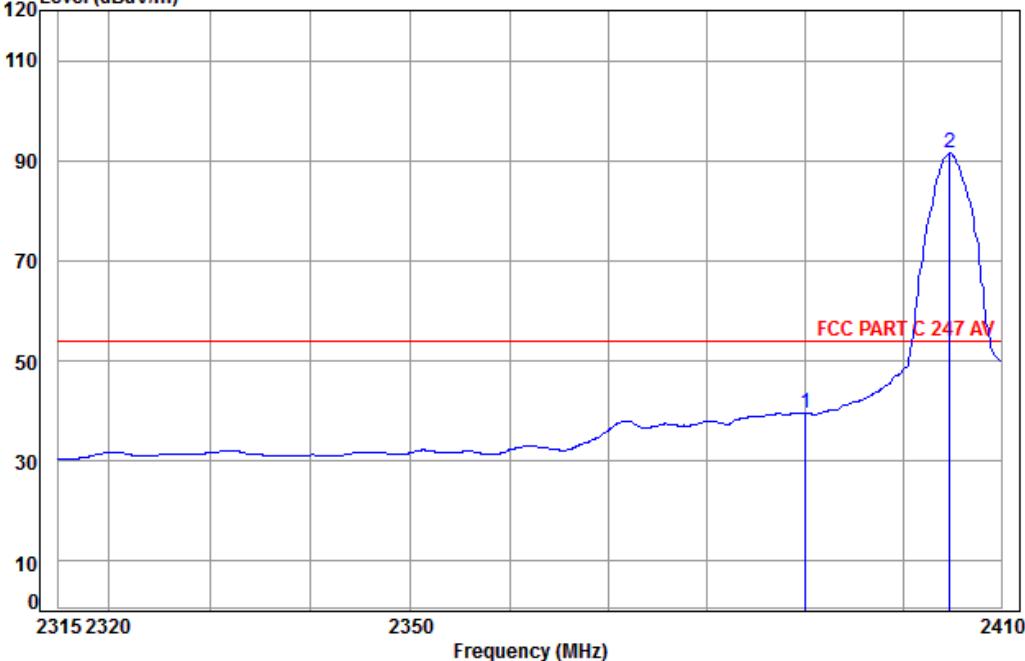
Mode: : 2405 Band edge

	Cable Freq	Ant Loss	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit	
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2390.00	4.90	32.35	38.46	36.01	34.80	54.00	-19.20
2 pp	2404.77	4.92	32.41	38.46	85.33	84.20	54.00	30.20

Test mode:	O-QPSK	Test channel:	Lowest	Remark:	Average	Horizontal
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Data: 50

Level (dBuV/m)



Site : chamber

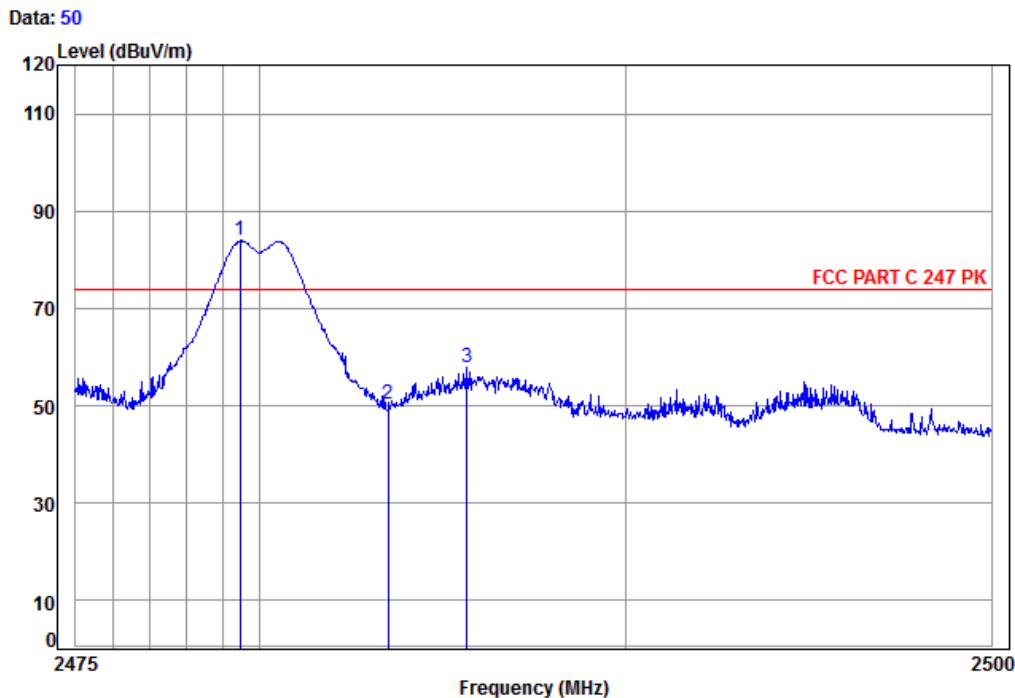
Condition: FCC PART C 247 AV 3m Horizontal

Job No: : 2151CR

Mode: : 2405 Band edge

	Cable Freq	Ant Loss	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit	
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2390.00	4.90	32.35	38.46	40.76	39.55	54.00	-14.45
2 pp	2404.77	4.92	32.41	38.46	92.75	91.62	54.00	37.62

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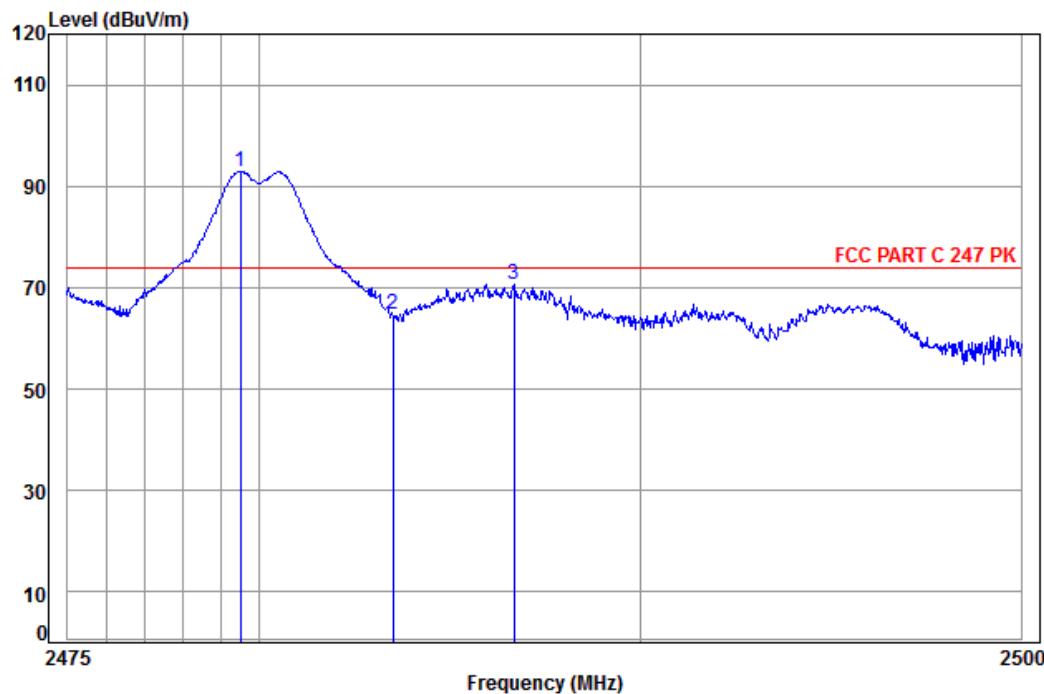
Site : chamber
Condition: FCC PART C 247 PK 3m Vertical

Job No: : 2151CR
Mode: : 2480 Band edge

	Freq	Cable Loss	Ant Factor	Preamp Factor	Read Level	Limit Level	Limit Line	Over Limit
1 pp	2479.48	5.02	32.44	38.47	84.90	83.89	74.00	9.89
2	2483.50	5.03	32.44	38.47	51.36	50.36	74.00	-23.64
3	2485.64	5.03	32.44	38.47	58.76	57.76	74.00	-16.24

Test mode:	O-QPSK	Test channel:	Highest	Remark:	Peak	Horizontal
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Data: 52

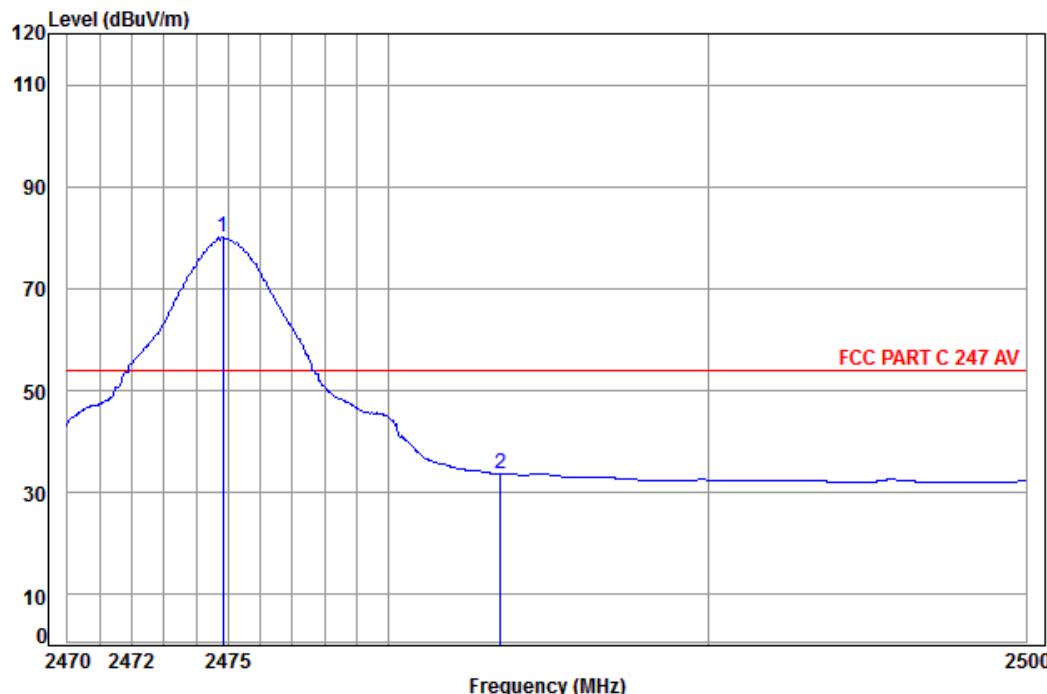


Site : chamber
Condition: FCC PART C 247 PK 3m Horizontal
Job No: : 2151CR
Mode: : 2480 Band eedge

		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	pp	2479.51	5.02	32.44	38.47	93.90	92.89	74.00	18.89
2		2483.50	5.03	32.44	38.47	65.74	64.74	74.00	-9.26
3		2486.67	5.03	32.44	38.47	71.59	70.59	74.00	-3.41

Test mode:	O-QPSK	Test channel:	Highest	Remark:	Average	Vertical
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Data: 49



Site : chamber

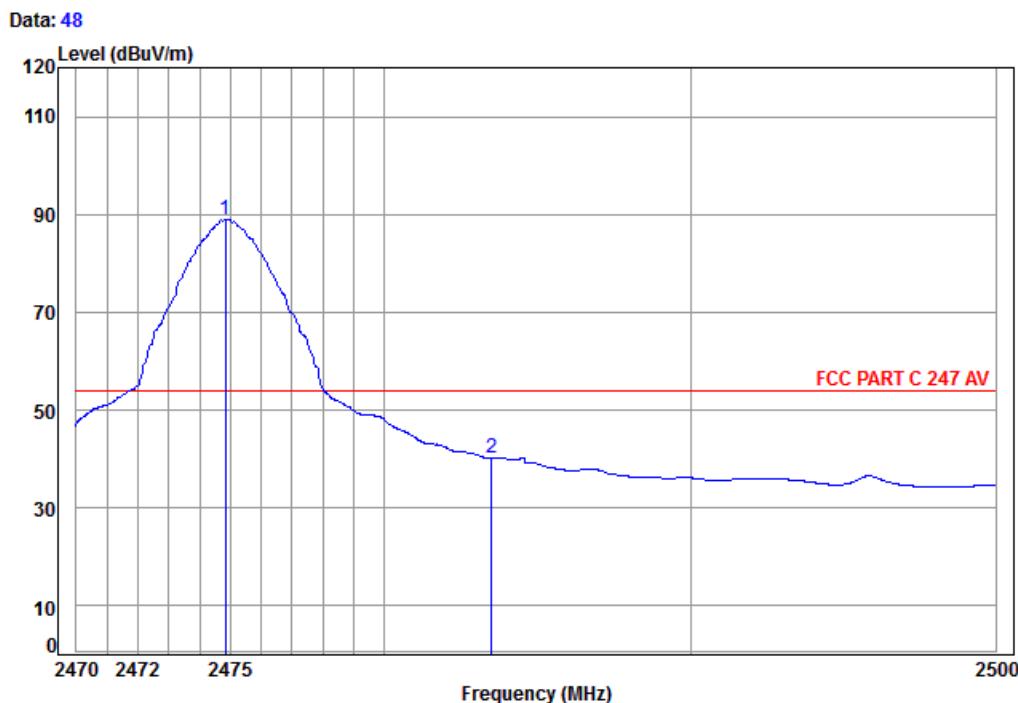
Condition: FCC PART C 247 AV 3m Vertical

Job No: : 2151CR

Mode: : 2475 Band edge

	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	2474.84	5.02	32.44	38.46	81.12	80.12	54.00	26.12
2	2483.50	5.03	32.44	38.47	34.65	33.65	54.00	-20.35

Test mode:	O-QPSK	Test channel:	Highest	Remark:	Average	Horizontal
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Site : chamber
Condition: FCC PART C 247 AV 3m Horizontal
Job No: : 2151CR
Mode: : 2475 Band edge

	Cable	Ant	Preamp	Read	Limit	Over	
Freq	Loss	Factor	Factor	Level	Level	Line	Limit
1 pp	2474.84	5.02	32.44	38.46	90.08	89.08	54.00 35.08
2	2483.50	5.03	32.44	38.47	41.26	40.26	54.00 -13.74

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

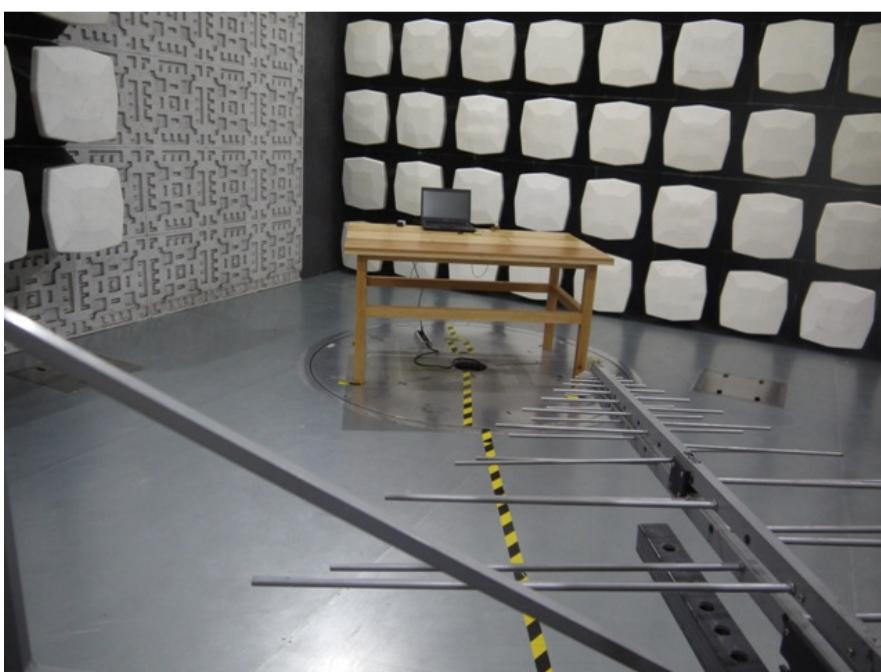
7 Photographs - EUT Test Setup

Test model No.: FRDM-KW24D512

7.1 Conducted Emission



7.2 Radiated Emission



7.3 Radiated Spurious Emission



8 Photographs - EUT Constructional Details

Test model No.: FRDM-KW24D512

