SGS-CSTC Standards Technical Services Ltd.

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: sgs_internet_operations@sgs.com

FCC REPORT

Application No:	SZEM1112005290RF
Applicant:	Edifier International Limited
Product Name:	Multimedia Speaker
Operation Frequency:	2402MHz to 2480MHz
FCC ID:	Z9G-EDF02
Standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247:2010
Date of Receipt:	2011-12-14
Date of Test:	2011-12-16 to 2012-01-11
Date of Issue:	2012-01-16
Test Result :	**PASS ***

* 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.

2 Contents

3 Test Summary

Test Item	Section in CFR 47	Result
Antenna Requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(1)	Pass
20dB Occupied Bandwidth	15.247 (a)(1)	Pass
Carrier Frequencies Separation	15.247 (a)(1)	Pass
Hopping Channel Number	15.247 (b)	Pass
Dwell Time	15.247 (a)(1)	Pass
Pseudorandom Frequency Hopping Sequence	15.247(b)(4)&TCB Exclusion List (7 July 2002)	Pass
Radiated Emission	15.205/15.209	Pass
Band Edge	15.247(d)	Pass

Remark: Pass: The EUT complies with the essential requirements in the standard.
Fail: The EUT does not comply with the essential requirements in the standard.

4 General Information

4.1 Client Information

Applicant:	Edifier International Limited
Address of Applicant:	Room 2207-9 Tower Two, Lippo Centre,89 Queensway, Hong Kong
Manufacturer:	Beijing Edifier Technology Co., Ltd.
Address of Manufacturer:	8th floor, ZuoAn Building, NO.68 BeiSiHuanXiLu, Haidian District, Beijing 100080, CHINA
Factory:	Dongguan Edifier technology Co.,Ltd.
Address of Factory:	No.2 Gongyedong Road, Songshan Lake Sci&Tech Industry Park, Dongguan, Guangdong 523808, PR.China

4.2 General Description of E.U.T.

Product Name:	Multimedia Speaker
Model No.:	e3350BT, PrismaBT Only the model No. e3350BT was tested, since the electrical circuit design, layout, components used and internal wiring were identical for all above models, only different on model number and color.
Trade Mark:	EDIFIER
Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	2.1+EDR
Channel Spacing:	1MHz
Channel Numbers:	79
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Antenna Type:	Integral
Antenna Gain:	2.5dBi
EUT Power Supply:	SWITCHING ADAPTER MODEL NO.: ADT-60180 INPUT: AC 100-240 50/60Hz 1.5A OUTPUT: DC 18V 3.00A
AC cable:	<3m
Audio cable:	<3m
Wired remote cable:	<3m

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	21	2422MHz	41	2442MHz	61	2462MHz
2	2403MHz	22	2423MHz	42	2443MHz	62	2463MHz
3	2404MHz	23	2424MHz	43	2444MHz	63	2464MHz
4	2405MHz	24	2425MHz	44	2445MHz	64	2465MHz
5	2406MHz	25	2426MHz	45	2446MHz	65	2466MHz
6	2407MHz	26	2427MHz	46	2447MHz	66	2467MHz
7	2408MHz	27	2428MHz	47	2448MHz	67	2468MHz
8	2409MHz	28	2429MHz	48	2449MHz	68	2469MHz
9	2410MHz	29	2430MHz	49	2450MHz	69	2470MHz
10	2411MHz	30	2431MHz	50	2451MHz	70	2471MHz
11	2412MHz	31	2432MHz	51	2452MHz	71	2472MHz
12	2413MHz	32	2433MHz	52	2453MHz	72	2473MHz
13	2414MHz	33	2434MHz	53	2454MHz	73	2474MHz
14	2415MHz	34	2435MHz	54	2455MHz	74	2475MHz
15	2416MHz	35	2436MHz	55	2456MHz	75	2476MHz
16	2417MHz	36	2437MHz	56	2457MHz	76	2477MHz
17	2418MHz	37	2438MHz	57	2458MHz	77	2478MHz
18	2419MHz	38	2439MHz	58	2459MHz	78	2479MHz
19	2420MHz	39	2440MHz	59	2460MHz	79	2480MHz
20	2421MHz	40	2441MHz	60	2461MHz		

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 for testing see below:

Channel	Frequency
Lowest channel	2402MHz
Middle channel	2441MHz
Highest channel	2480MHz

4.3 E.U.T Operation mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	50 % RH
Atmospheric Pressure:	1025mbar
Test mode:	
Transmitting:	Keep the EUT in transmitting mode at low channel, middle channel and high channel

4.4 Description of Support Units

The EUT was tested with associated equipment as below:

Description	Manufacturer	Model No.
Earphone	SONY	MDR-E10LP
Mobile	Nokia	6300
iPod	Apple	MC027CH/A

4.5 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 3m Semi-anechoic chamber, Full-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.: R-2197, G-416, 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 chamber of SGS-CSTC Standards Technical Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1.

4.6 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
Telephone: +86 (0) 755 2601 2053 Fax: +86 (0) 755 2671 0594
No tests were sub-contracted.

4.7 Other Information Requested by the Customer

None.

4.8 Test Instruments list

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	2012-06-10
2	EMI Test Receiver	Rohde & Schwarz	ESIB26	SEL0023	2012-05-26
3	EMI Test software	AUDIX	E3	SEL0050	N/A
4	Coaxial cable	SGS	N/A	SEL0028	2012-05-29
5	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEL0015	2012-10-29
6	Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEL0006	2012-10-29
7	Horn Antenna (18-26GHz)	ETS-LINDGREN	3160	SEL0076	2012-10-29
8	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEL0053	2012-05-26
9	Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEL0168	2012-10-26
11	Band filter	Amindeon	82346	SEL0094	2012-05-26

Conducted Emission					
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Due date (yyyy-mm-dd)**
1	Shielding Room	ZhongYu Electron	GB-88	SEL0042	2012-06-10
2	LISN	Rohde & Schwarz	ENV216	SEL0152	2012-10-23
3	Two-Line V-Network	ETS-LINDGREN	3816/2	SEL0021	2012-05-26
4	EMI Test Receiver	Rohde & Schwarz	ESCI	SEL0022	2012-05-26
5	Coaxial Cable	SGS	N/A	SEL0024	2012-05-29

RF conducted					
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Due date (yyyy-mm-dd)**
1	Spectrum Analyzer	Rohde & Schwarz	FSP 30	SEL0154	2012-10-23
2	Coaxial cable	SGS	N/A	SEL0028	2012-05-29

General used equipment					
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Due date (yyyy-mm-dd)**
1	Humidity/ Temperature Indicator	Shanghai	ZJ1-2B	SEL0102 to SEL0103	2012-10-27
2	Humidity/ Temperature Indicator	Shanghai	ZJ1-2B	SEL0101	2012-10-27
3	Barometer	ChangChun	DYM3	SEL0088	2012-05-18

5 Test results and Measurement Data

5.1 Antenna requirement:

Standard requirement:	FCC Part15 C Section 15.203 /247(c)

15.203 requirement:

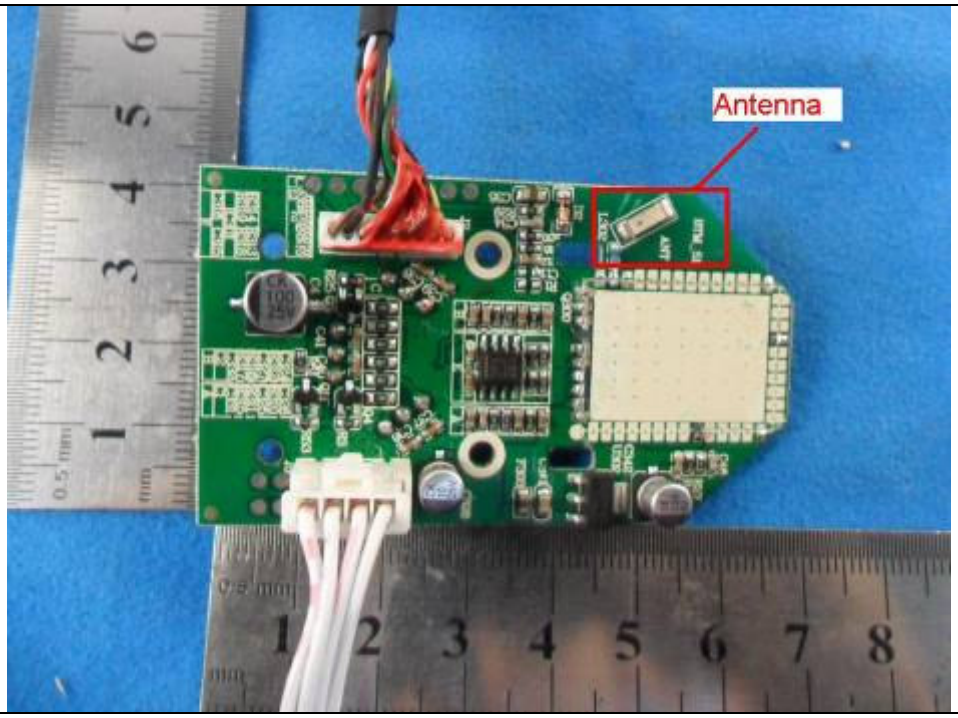
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(c) (1)(i) requirement:

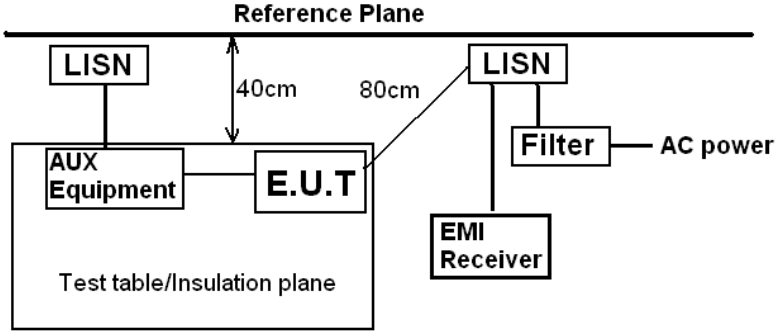
(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

E.U.T Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best gain of the antenna is 2.5dBi.



5.2 Conducted Emissions

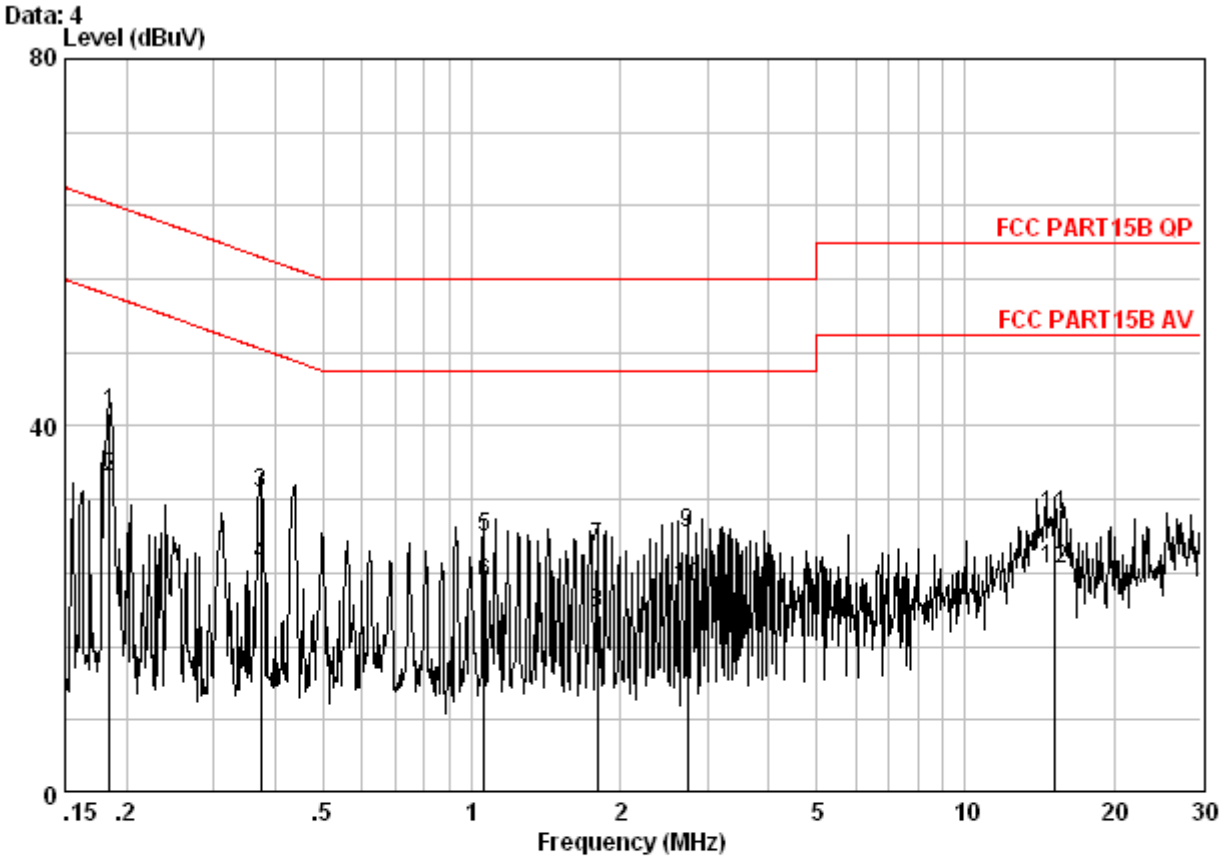
Test Requirement:	FCC Part15 C Section 15.207
Test Method:	ANSI C63.10: 2009
Test Frequency Range:	150kHz to 30MHz
Class / Severity:	Class B
Limit:	Frequency range (MHz) / Limit (dBuV): Quasi-peak / Average 0.15-0.5: 66 to 56* / 56 to 46* 0.5-5: 56 / 46 5-30: 60 / 50 * Decreases with the logarithm of the frequency.
Test procedure	The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.).The provide a 50ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs). Both sides of A.C. line are checked for maximum conducted interference. 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:	 *Remark:* *E.U.T: Equipment Under Test* *LISN: Line Impedence Stabilization Network* *Test table height=0.8m*
Test Instruments:	Refer to section 4.8 for details.
Test mode:	Transmitting mode
Test results:	Pass

Measurement Data

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

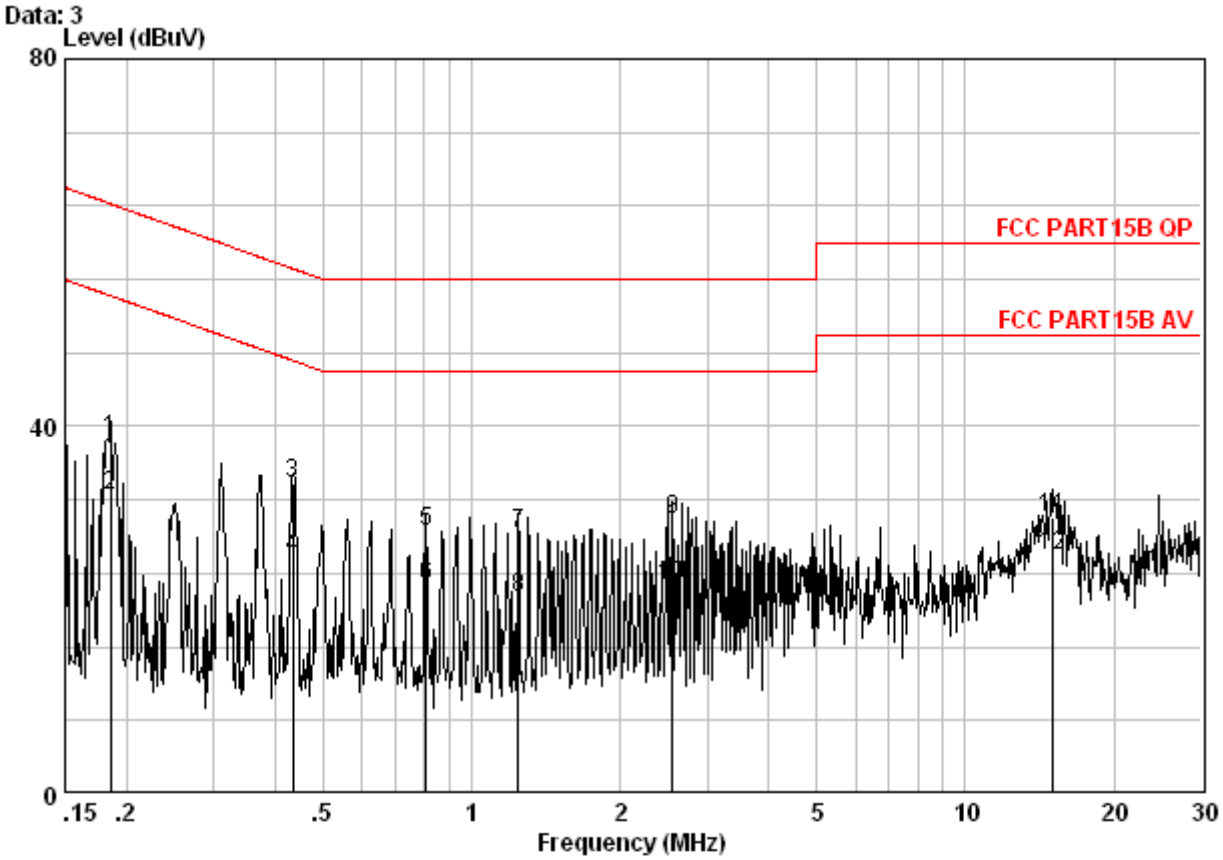
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live line:



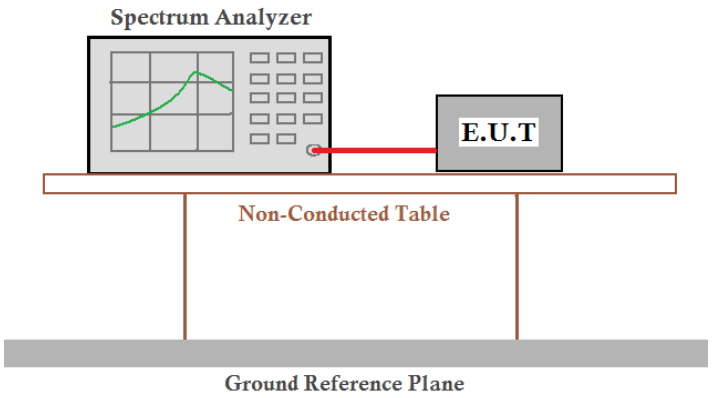
	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1 @	0.18443	0.04	9.60	31.85	41.49	64.28	-22.79	QP
2 @	0.18443	0.04	9.60	24.85	34.49	54.28	-19.79	Average
3	0.37314	0.05	9.60	23.11	32.77	58.43	-25.66	QP
4 @	0.37314	0.05	9.60	15.11	24.77	48.43	-23.66	Average
5	1.060	0.08	9.70	18.03	27.81	56.00	-28.19	QP
6 @	1.060	0.08	9.70	13.03	22.81	46.00	-23.19	Average
7	1.800	0.11	9.70	16.92	26.73	56.00	-29.27	QP
8	1.800	0.11	9.70	9.92	19.73	46.00	-26.27	Average
9	2.736	0.14	9.73	18.52	28.39	56.00	-27.61	QP
10 @	2.736	0.14	9.73	12.52	22.39	46.00	-23.61	Average
11	15.226	0.25	10.00	20.08	30.34	60.00	-29.66	QP
12	15.226	0.25	10.00	14.08	24.34	50.00	-25.66	Average

Neutral line:



	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.18541	0.04	9.60	28.84	38.48	64.24	-25.76	QP
2 @	0.18541	0.04	9.60	22.84	32.48	54.24	-21.76	Average
3 @	0.43511	0.06	9.60	24.14	33.80	57.15	-23.36	QP
4 @	0.43511	0.06	9.60	16.14	25.80	47.15	-21.36	Average
5	0.80876	0.07	9.70	18.84	28.61	56.00	-27.39	QP
6 @	0.80876	0.07	9.70	12.84	22.61	46.00	-23.39	Average
7	1.242	0.09	9.70	18.62	28.41	56.00	-27.59	QP
8 @	1.242	0.09	9.70	11.62	21.41	46.00	-24.59	Average
9	2.554	0.13	9.73	19.90	29.76	56.00	-26.24	QP
10 @	2.554	0.13	9.73	12.90	22.76	46.00	-23.24	Average
11	14.986	0.25	10.00	19.79	30.03	60.00	-29.97	QP
12 @	14.986	0.25	10.00	15.79	26.03	50.00	-23.97	Average

5.3 Conducted Peak Output Power

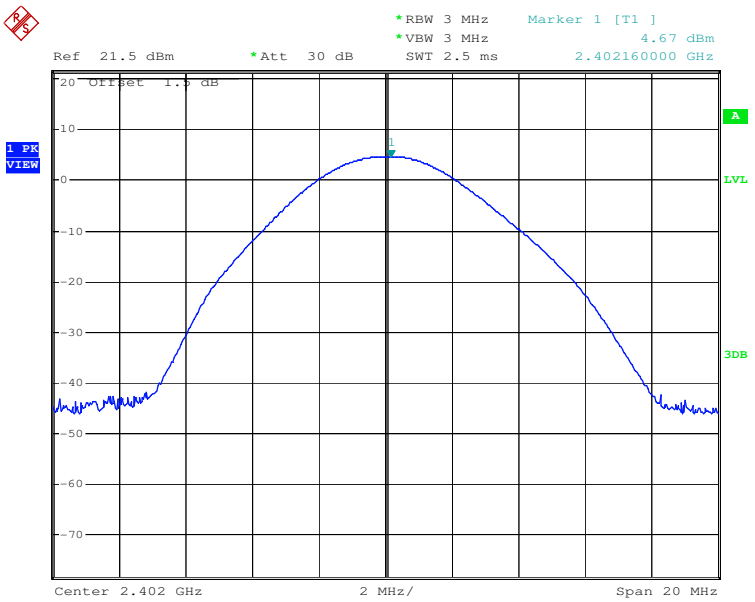
Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2009
Limit:	30dBm
Test setup:	 *Remark:* *Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.*
Test Instruments:	Refer to section 4.8 for details.
Test state:	Non-hopping transmitting with all kinds of modulation.
Test results:	Pass

Measurement Data

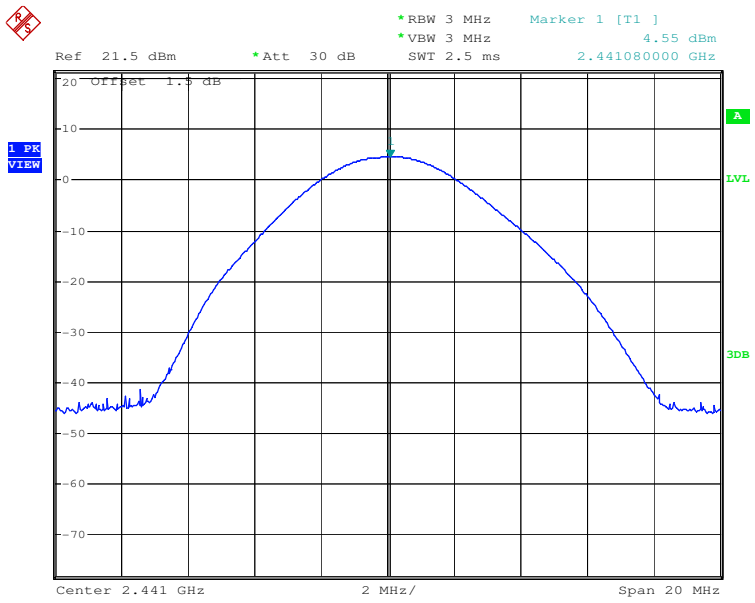
GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	4.67	30.00	Pass
Middle	4.55	30.00	Pass
Highest	4.61	30.00	Pass
π/4DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	3.32	30.00	Pass
Middle	3.23	30.00	Pass
Highest	3.34	30.00	Pass
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	3.67	30.00	Pass
Middle	3.55	30.00	Pass
Highest	3.64	30.00	Pass

Test plot as follows:

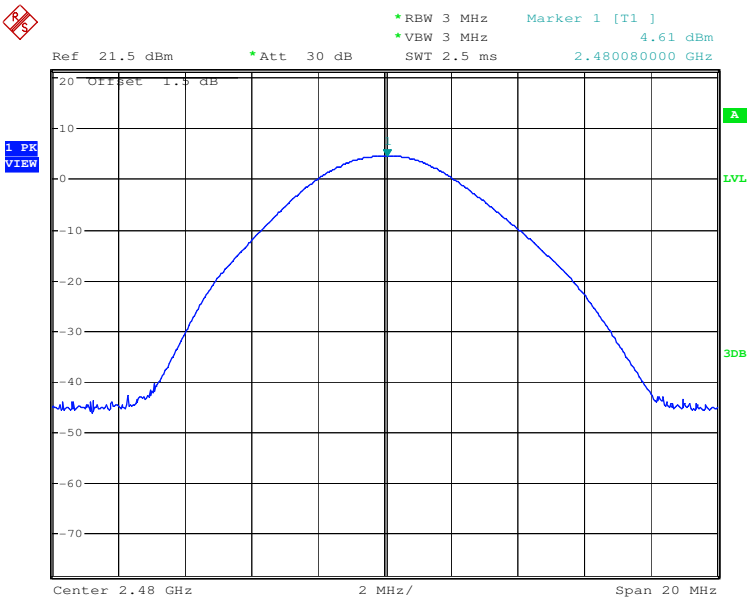
Test mode:	GFSK	Test channel:	Lowest



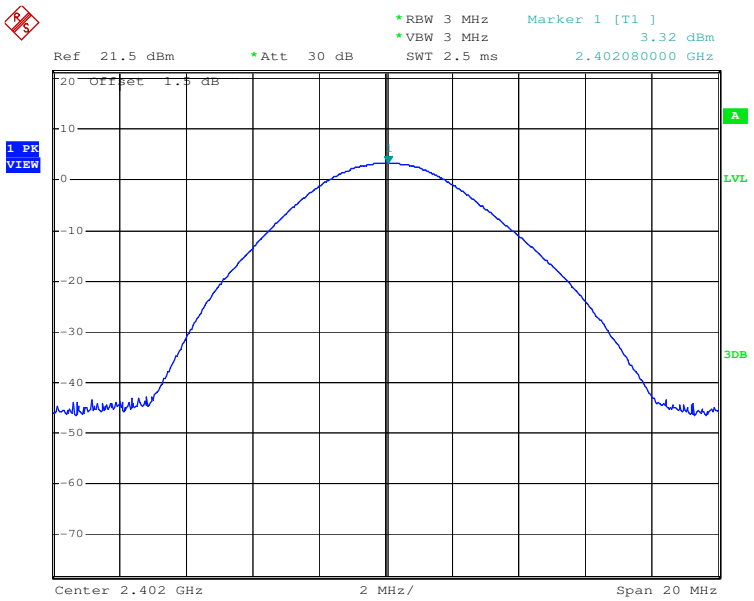
Test mode:	GFSK	Test channel:	Middle



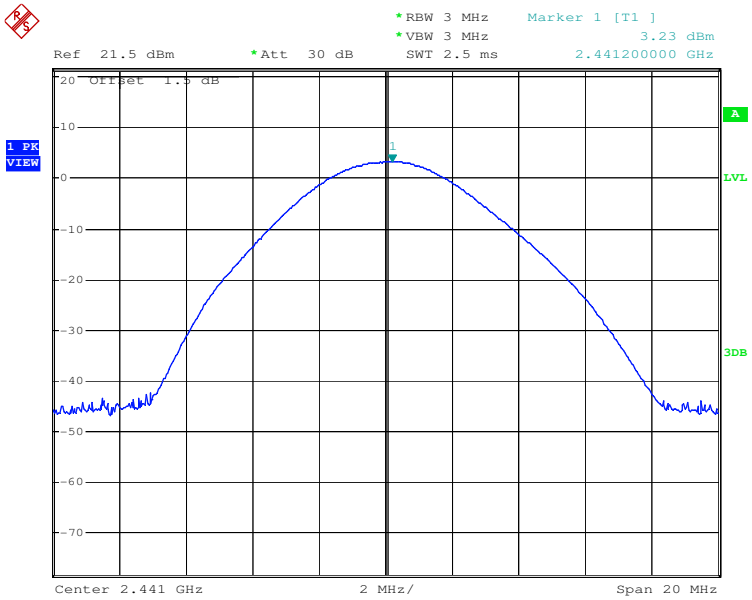
Test mode:	GFSK	Test channel:	Highest



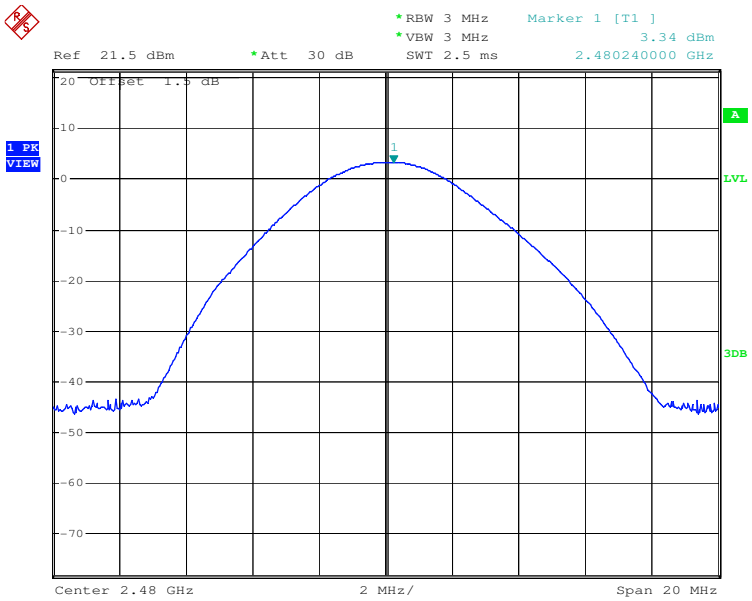
Test mode:	π/4DQPSK	Test channel:	Lowest



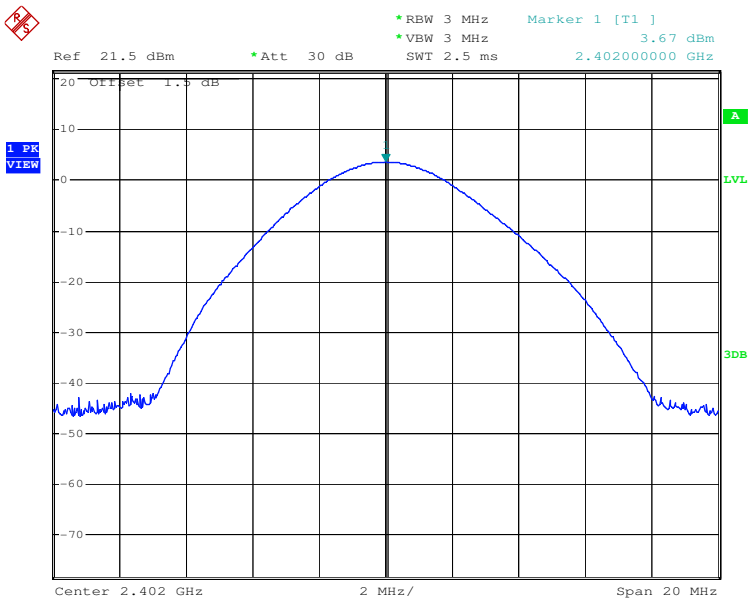
Test mode:	π/4DQPSK	Test channel:	Middle



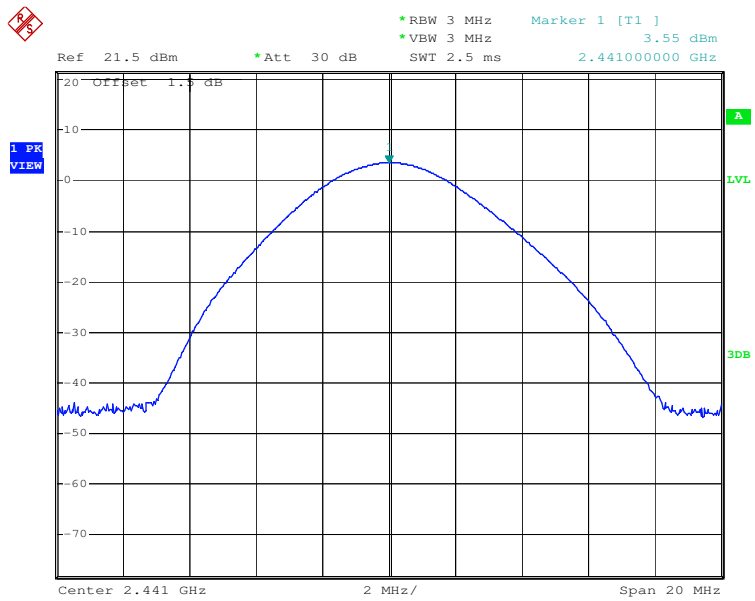
Test mode:	π/4DQPSK	Test channel:	Highest



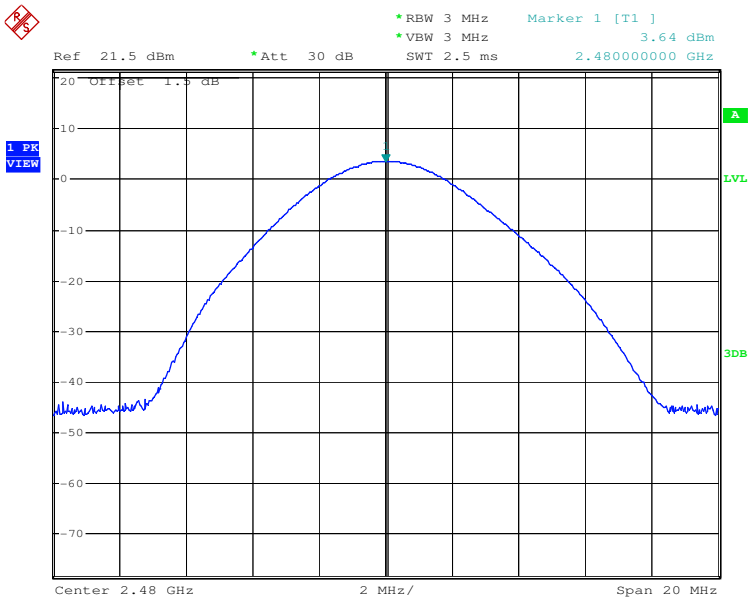
Test mode:	8DPSK	Test channel:	Lowest



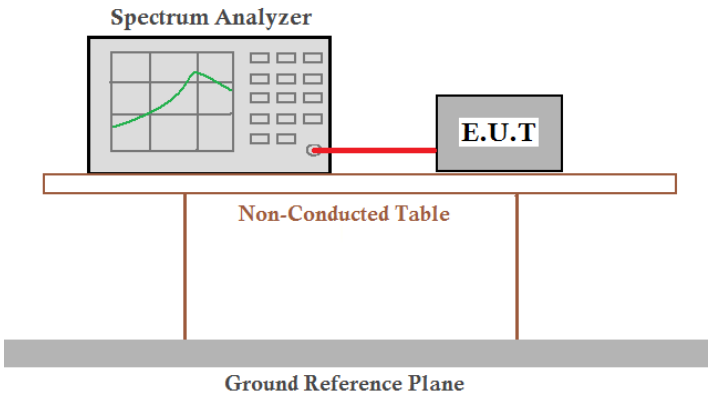
Test mode:	8DPSK	Test channel:	Middle



Test mode:	8DPSK	Test channel:	Highest



5.4 20dB Occupy Bandwidth

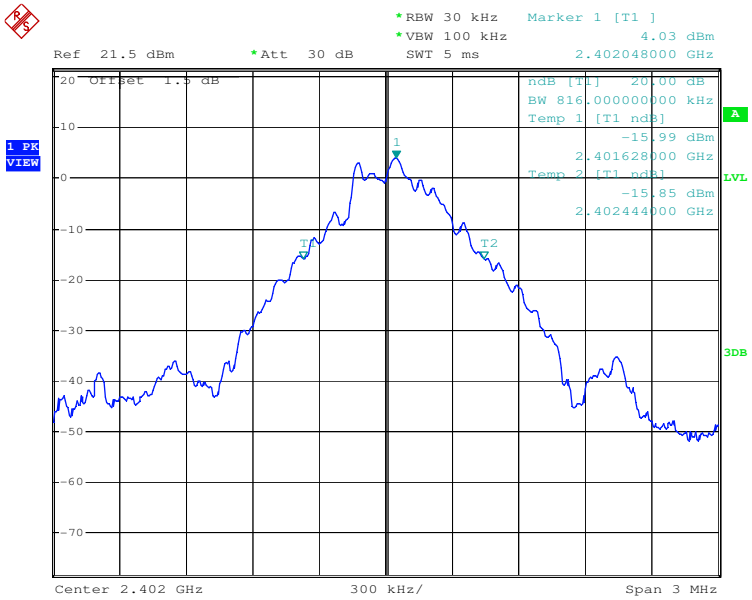
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2009
Limit:	NA
Test setup:	
Test Instruments:	Refer to section 4.8 for details.
Test state:	Non-hopping transmitting with all kinds of modulation.

Measurement Data

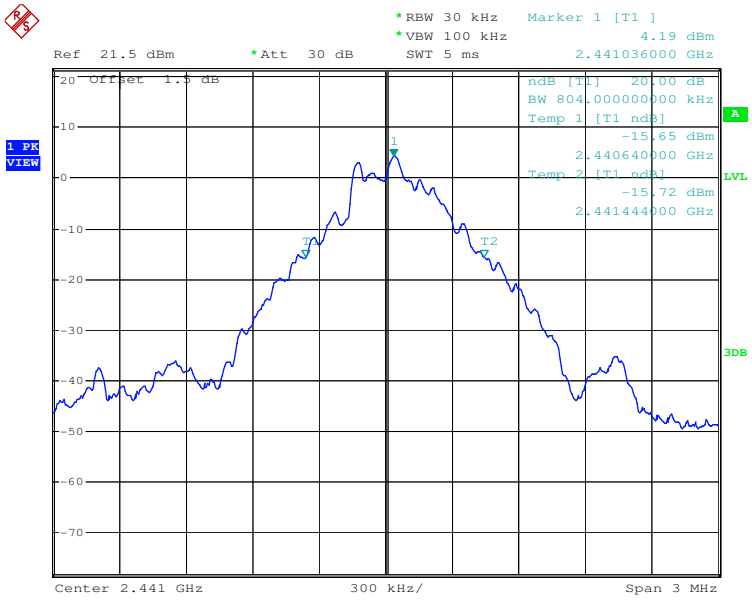
Test channel	20dB Occupy Bandwidth (kHz)		
	GFSK	**π/4DQPSK**	**8DPSK**
Lowest	816	1224	1212
Middle	804	1212	1212
Highest	804	1206	1212

Test plot as follows:

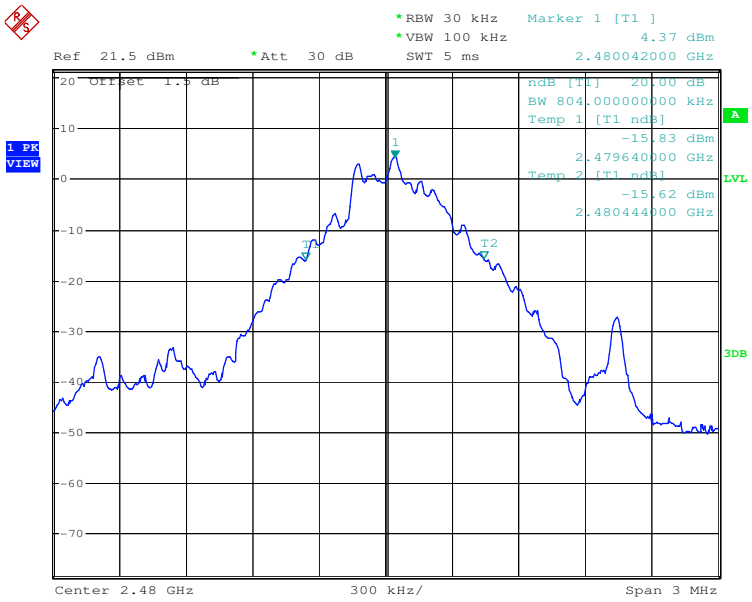
Test mode:	GFSK	Test channel:	Lowest



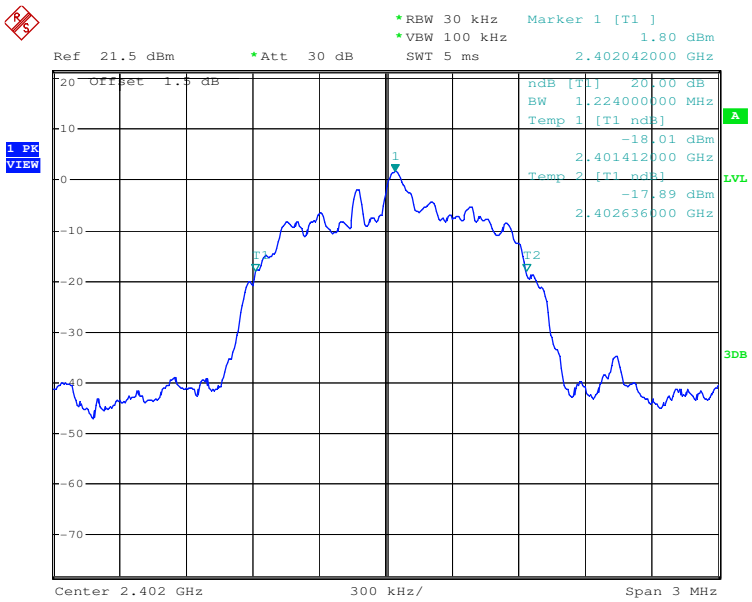
Test mode:	GFSK	Test channel:	Middle



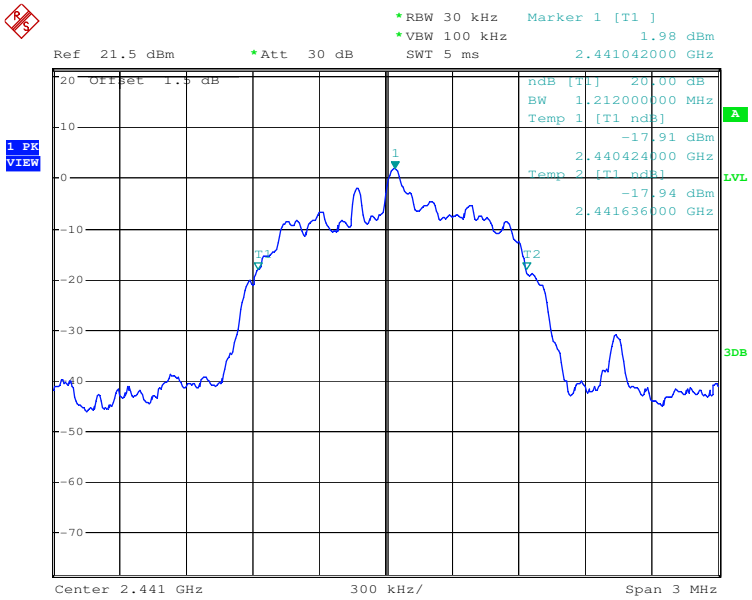
Test mode:	GFSK	Test channel:	Highest



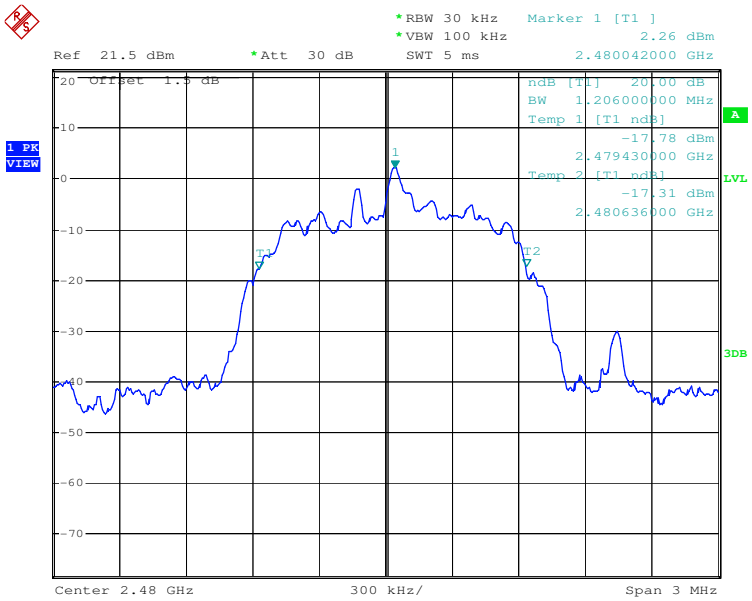
Test mode:	π/4DQPSK	Test channel:	Lowest



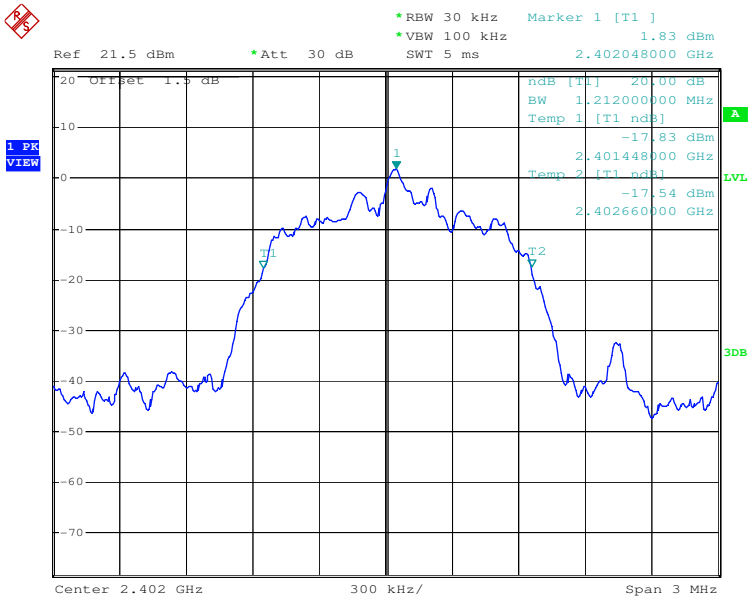
Test mode:	π/4DQPSK	Test channel:	Middle



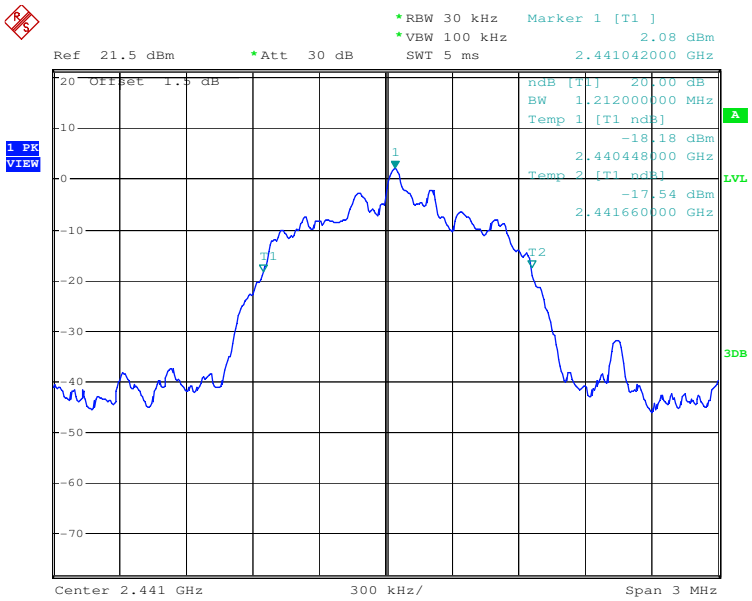
Test mode:	π/4DQPSK	Test channel:	Highest



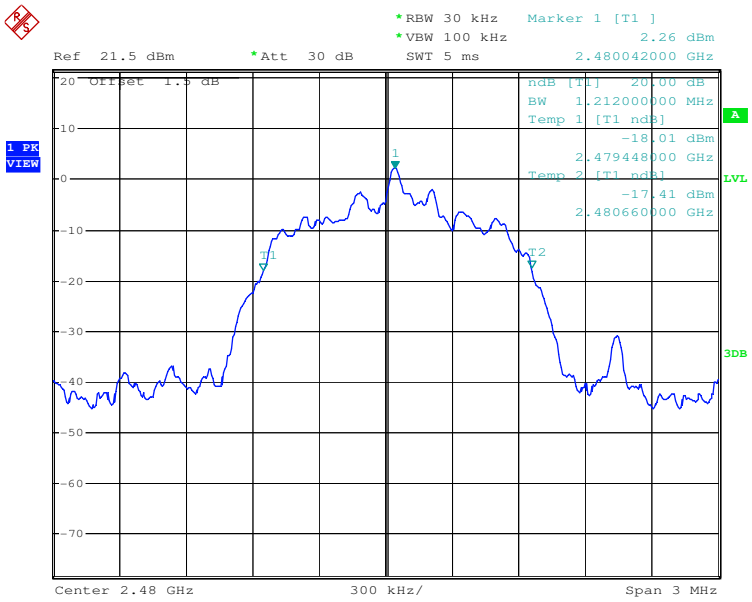
Test mode:	8DPSK	Test channel:	Lowest



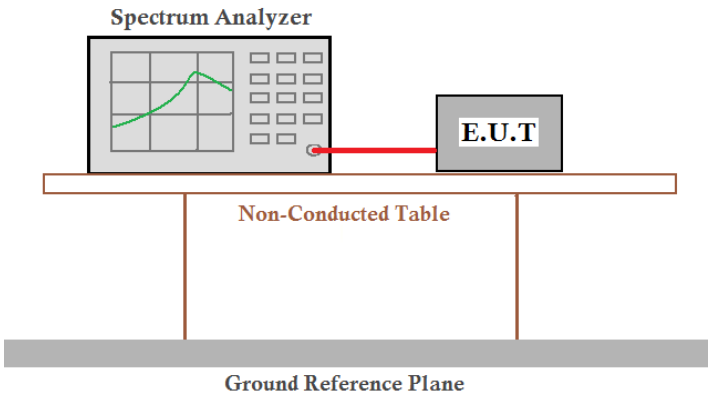
Test mode:	8DPSK	Test channel:	Middle



Test mode:	8DPSK	Test channel:	Highest



5.5 Carrier Frequencies Separation

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2009
Test state:	Hopping transmitting with all kind of modulation.
Test setup:	
Test Instruments:	Refer to section 4.8 for details.
Limit:	0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)
Test results:	Pass

Measurement Data

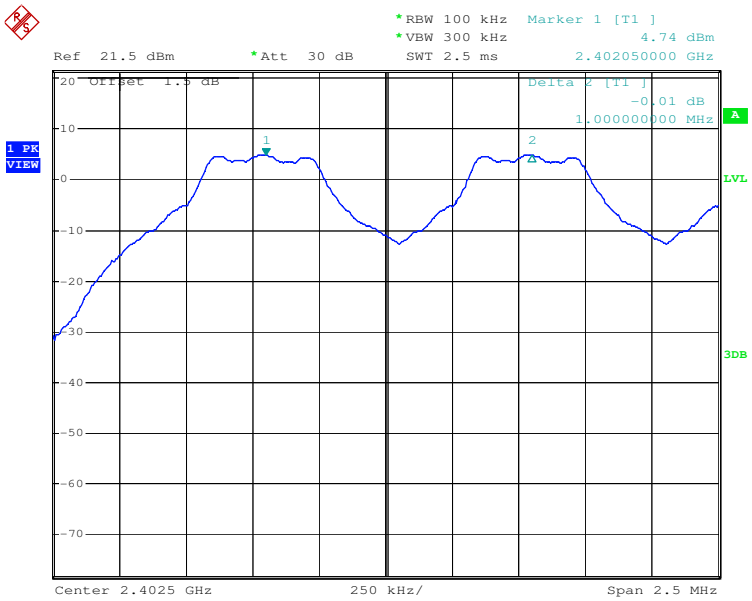
GFSK mode			
Test channel	Carrier Frequencies Separation (KHz)	Limit (KHz)	Result
Lowest	1000	≥816	Pass
Middle	1000	≥816	Pass
Highest	1000	≥816	Pass
π/4DQPSK mode			
Test channel	Carrier Frequencies Separation (KHz)	Limit (KHz)	Result
Lowest	1000	≥816	Pass
Middle	1000	≥816	Pass
Highest	1000	≥816	Pass
8DPSK mode			
Test channel	Carrier Frequencies Separation (KHz)	Limit (KHz)	Result
Lowest	1000	≥816	Pass
Middle	1000	≥816	Pass
Highest	1000	≥816	Pass

Note: According to section 5.4,

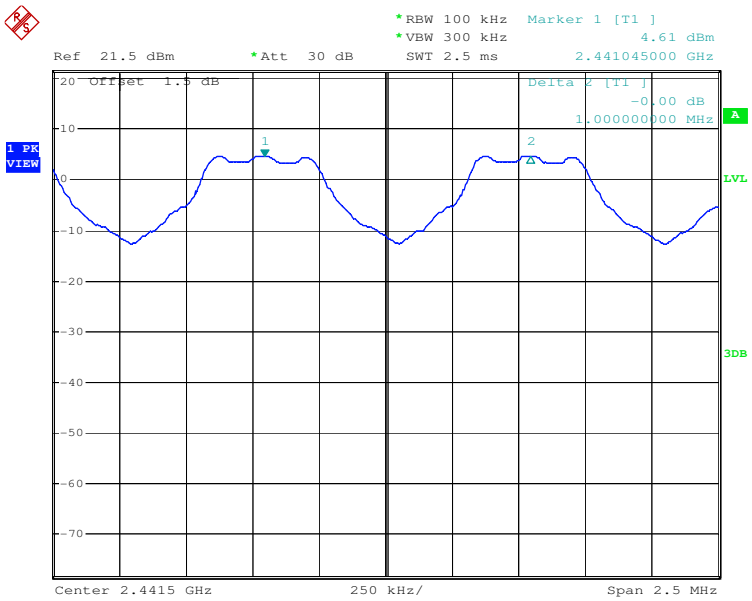
Mode	20dB bandwidth (KHz) (worse case)	Limit (KHz) (Carrier Frequencies Separation)
GFSK	816	544
π/4DQPSK	1224	816
8DPSK	1212	808

Test plot as follows:

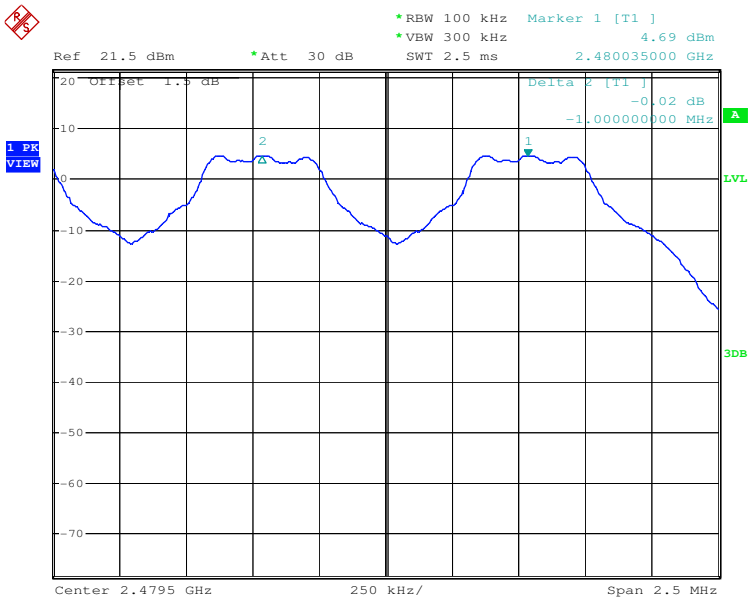
Test mode:	GFSK	Test channel:	Lowest



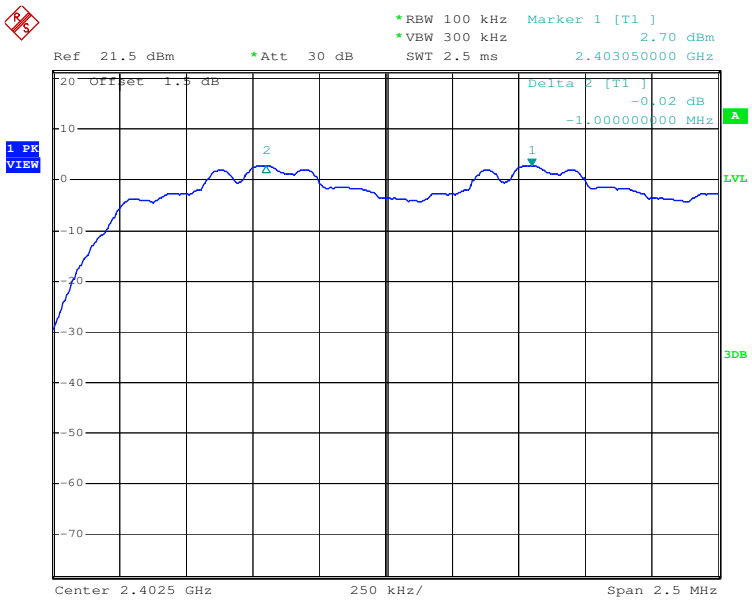
Test mode:	GFSK	Test channel:	Middle



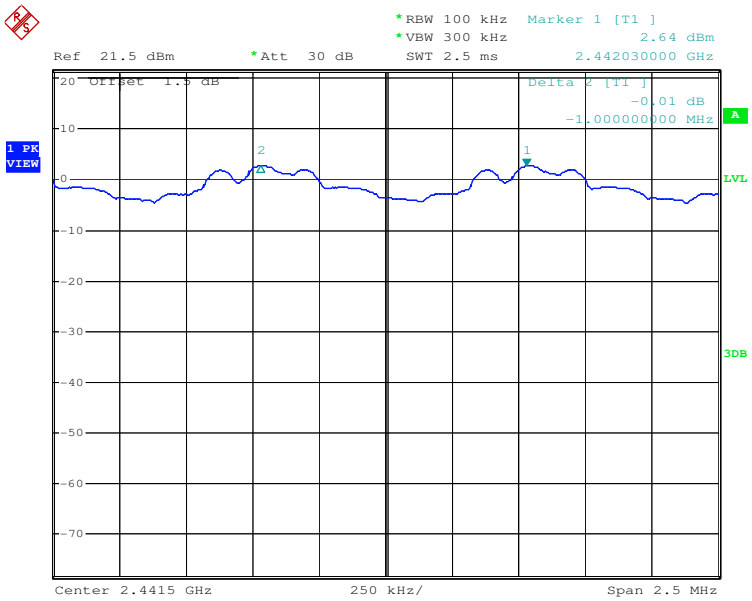
Test mode:	GFSK	Test channel:	Highest



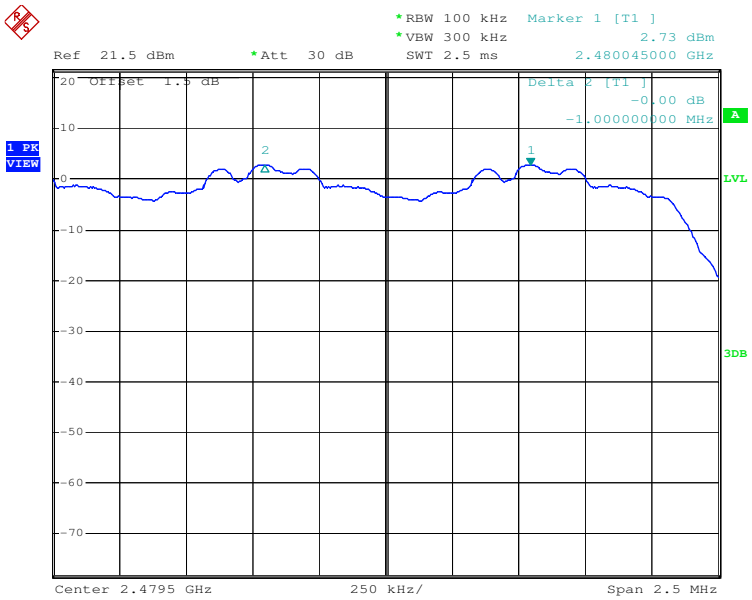
Test mode:	π/4DQPSK	Test channel:	Lowest



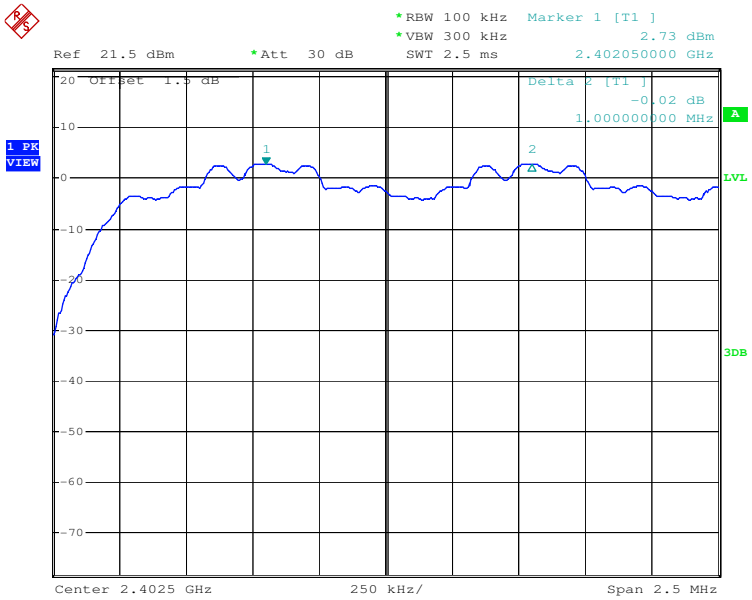
Test mode:	π/4DQPSK	Test channel:	Middle



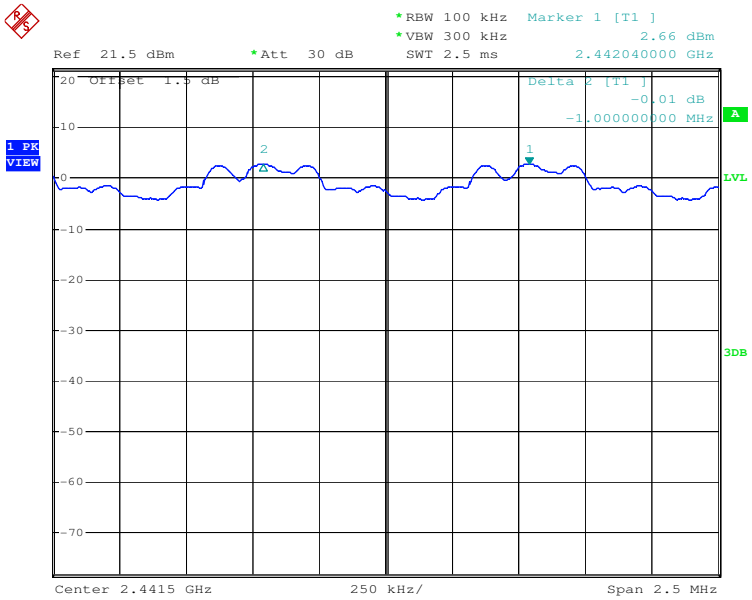
Test mode:	π/4DQPSK	Test channel:	Highest



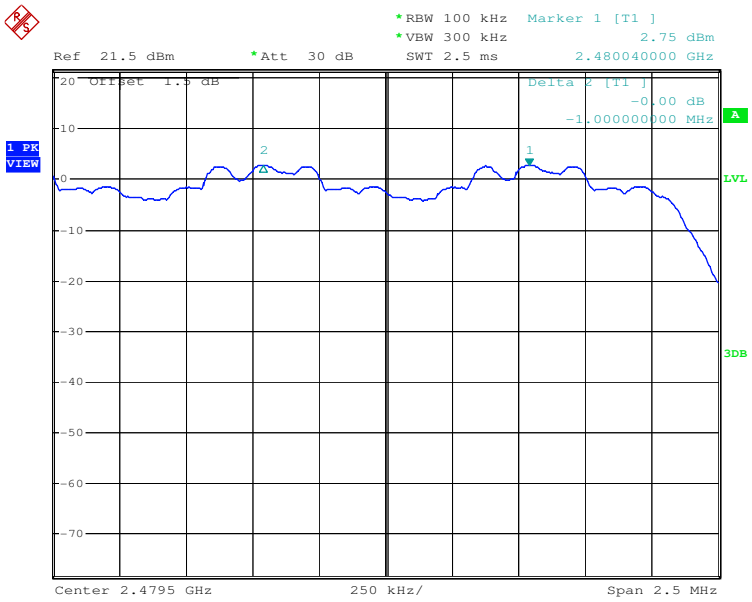
Test mode:	8DPSK	Test channel:	Lowest



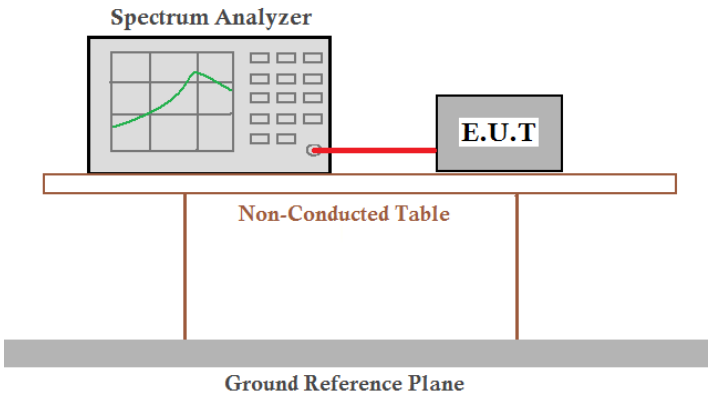
Test mode:	8DPSK	Test channel:	Middle



Test mode:	8DPSK	Test channel:	Highest



5.6 Hopping Channel Number

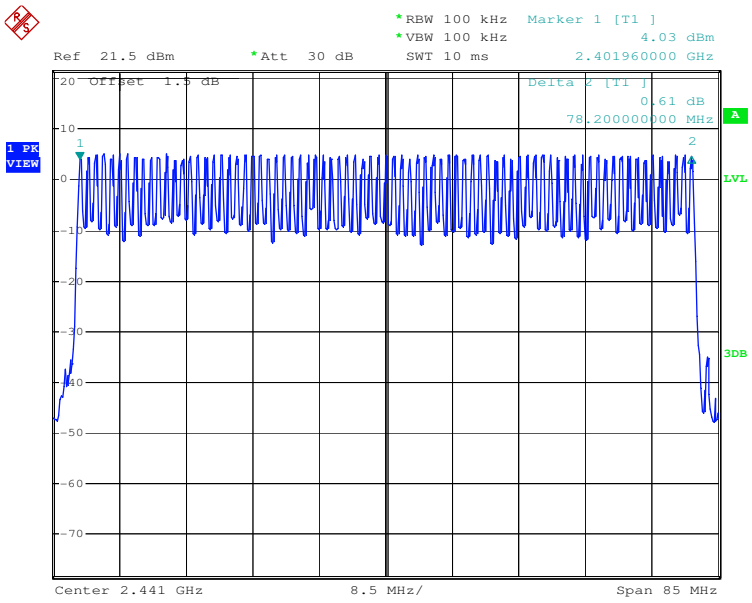
Test Requirement:	FCC Part15 C Section 15.247 (b)
Test Method:	ANSI C63.10:2009
Requirement:	⩾75 channels
Test setup:	
Test Instruments:	Refer to section 4.8 for details.
Test state:	Hopping transmitting with all kind of modulation.
Test results:	Pass

Measurement Data

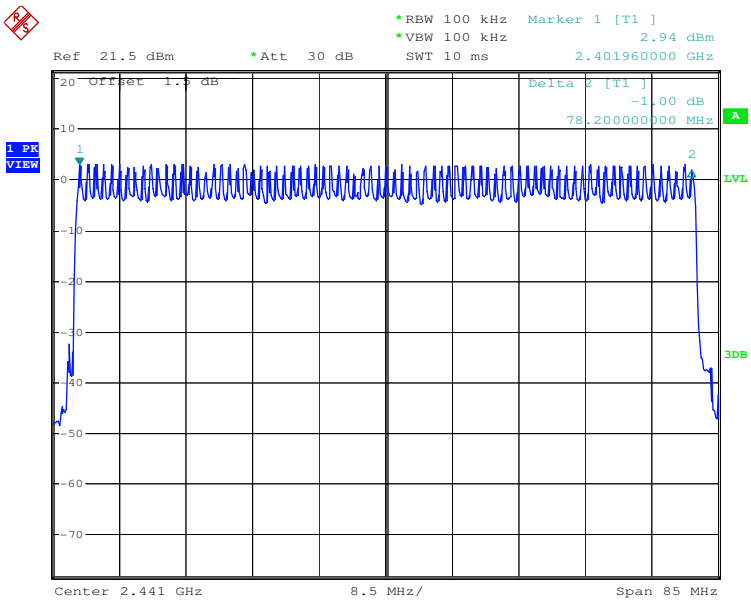
Mode	Hopping channel	Requirement
GFSK	79	⩾75
π/4DQPSK	79	⩾75
8DPSK	79	⩾75

Test plot as follows

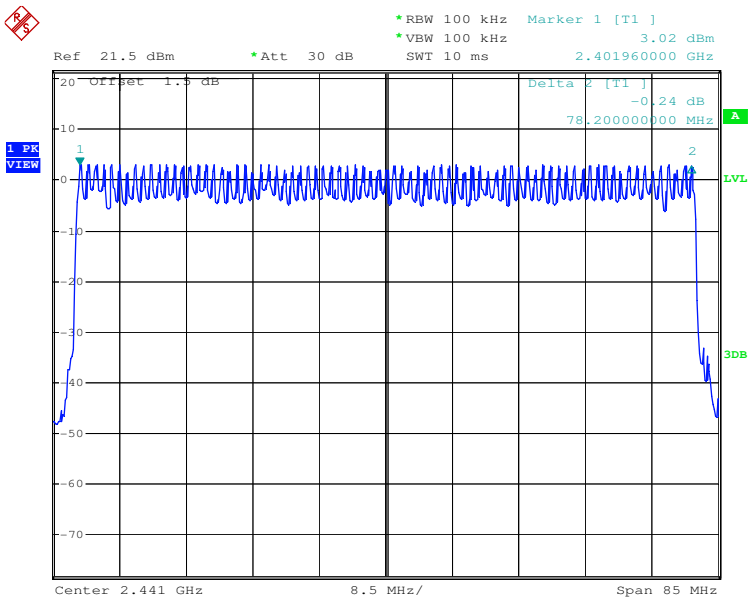
Test mode:	GFSK	



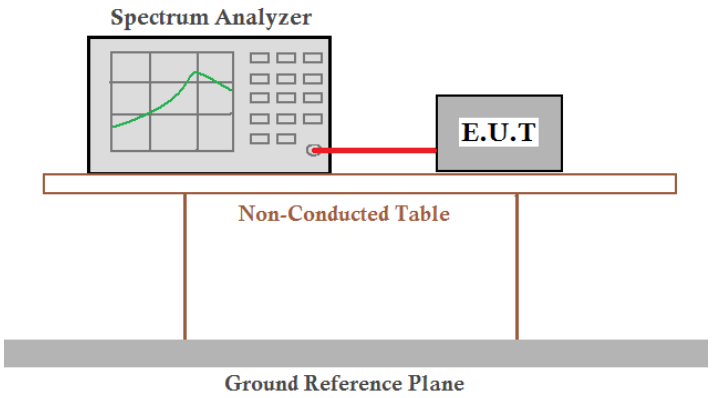
Test mode:	π/4DQPSK	



Test mode:	8DPSK	



5.7 Dwell Time

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2009
Limit:	≤ 0.4 Second
Test setup:	
Test Instruments:	Refer to section 4.8 for details.
Test state:	Hopping transmitting with all kind of modulation.
Test results:	Pass

Measurement Data

Mode	Packet	Dwell time (second)	Limit (second)
GFSK	DH1	0.1648	≤0.4
	DH3	0.2856	≤0.4
	DH5	0.3230	≤0.4
π/4DQPSK	2-DH1	0.1696	≤0.4
	2-DH3	0.2864	≤0.4
	2-DH5	0.1961	≤0.4
8DPSK	3-DH1	0.1680	≤0.4
	3-DH3	0.2840	≤0.4
	3-DH5	0.3219	≤0.4

Test Result:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

The lowest channel (2402MHz), middle channel (2441MHz), highest channel (2480MHz) as below

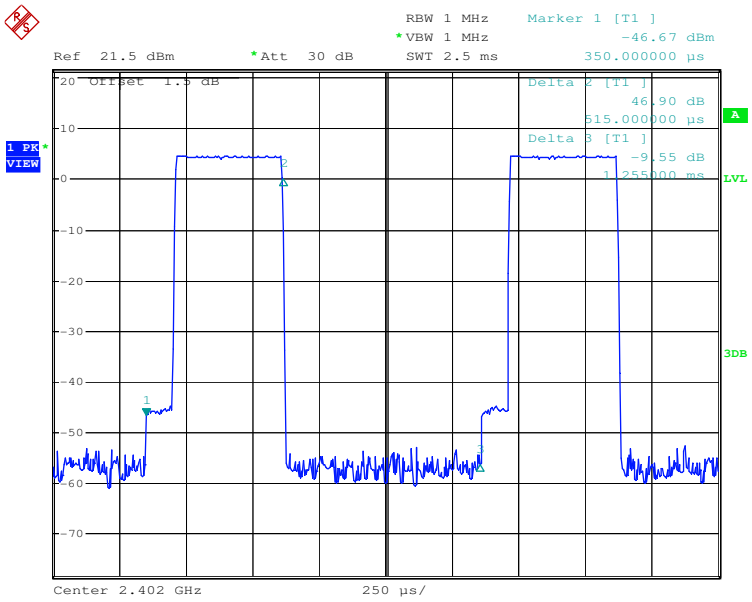
DH1 time slot=0.515(ms)*(1600/ (2*79))*31.6=164.8ms

DH3 time slot=1.785(ms)*(1600/ (4*79))*31.6=285.6ms

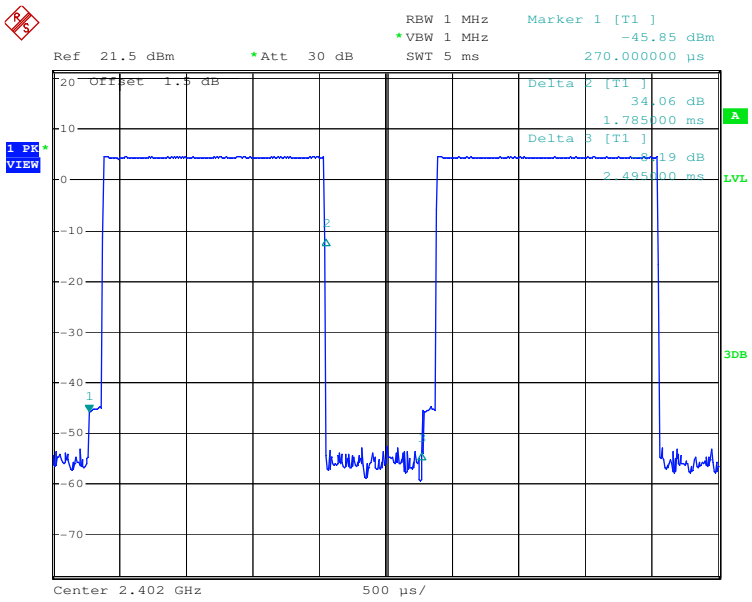
DH5 time slot=3.03(ms)*(1600/ (6*79))*31.6=323.0ms

Test plot as follows

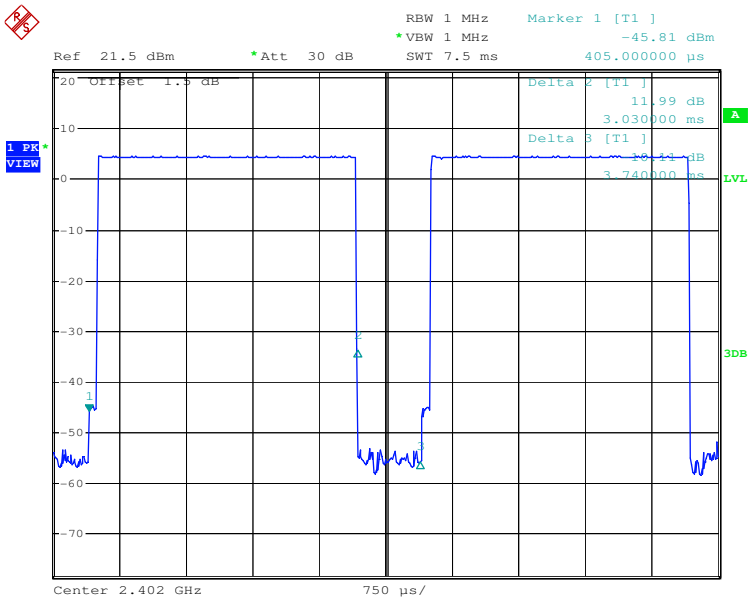
Test mode:	GFSK	Test Packet:	DH1



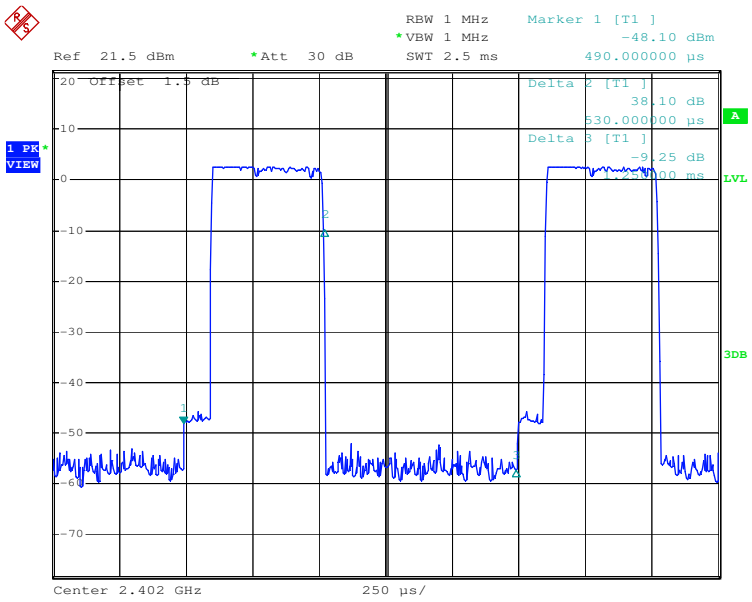
Test mode:	GFSK	Test Packet:	DH3



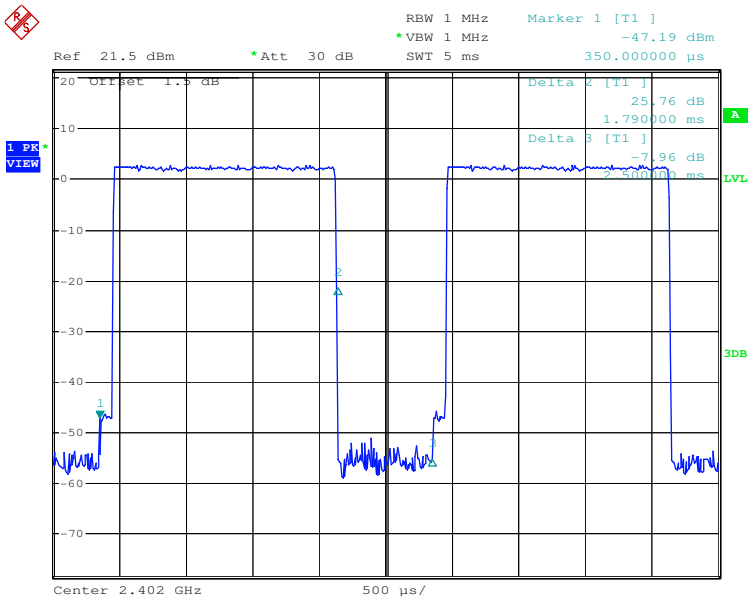
Test mode:	GFSK	Test Packet:	DH5



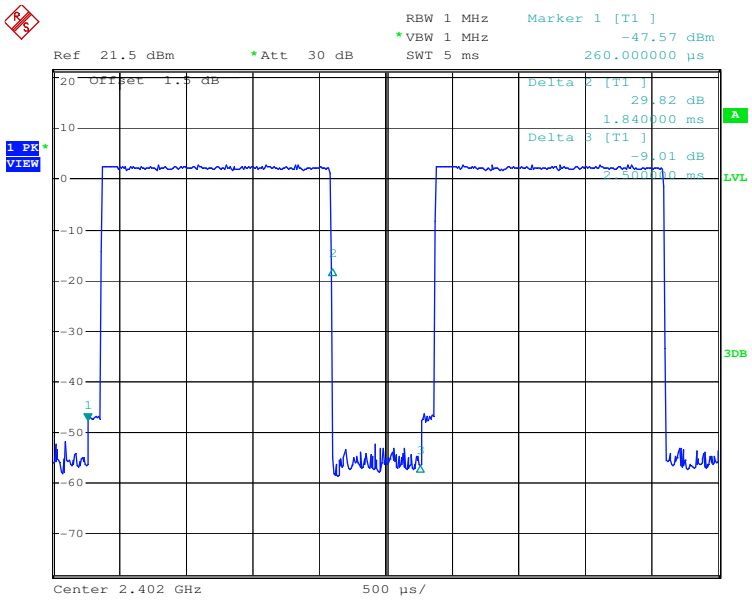
Test mode:	π/4DQPSK	Test Packet:	2-DH1



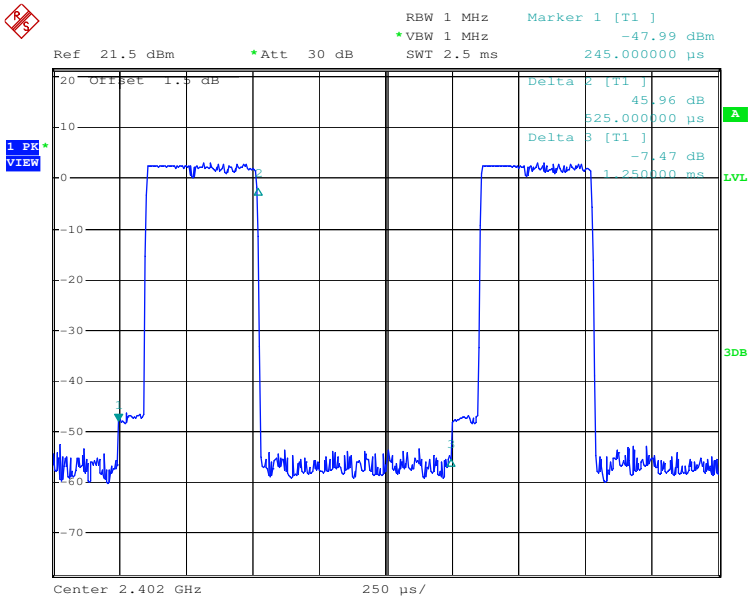
Test mode:	π/4DQPSK	Test Packet:	2-DH3



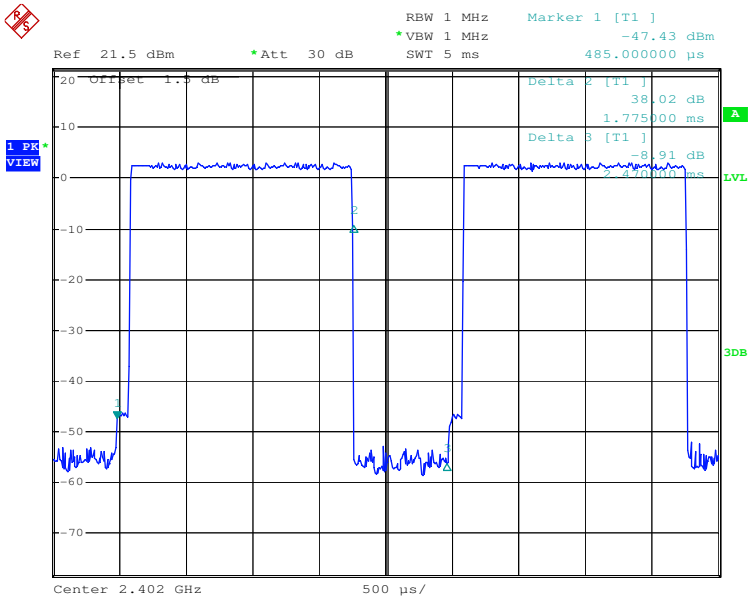
Test mode:	π/4DQPSK	Test Packet:	2-DH5



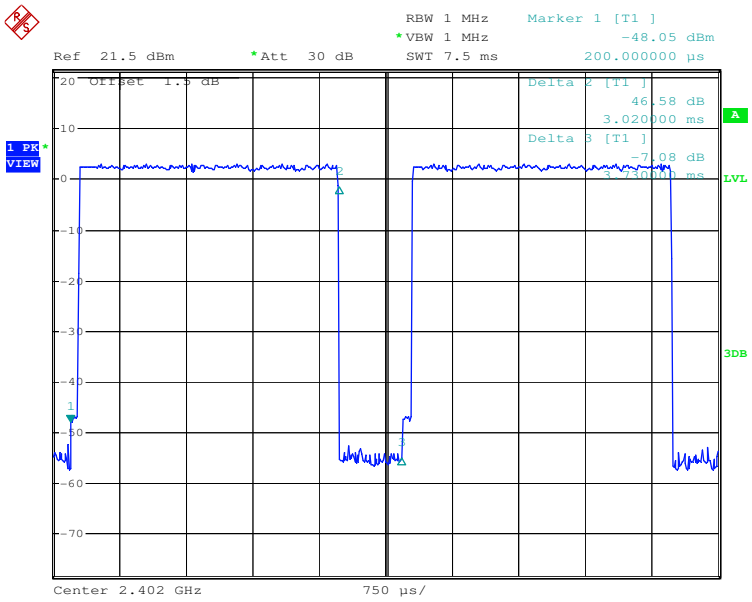
Test mode:	8DPSK	Test Packet:	3-DH1



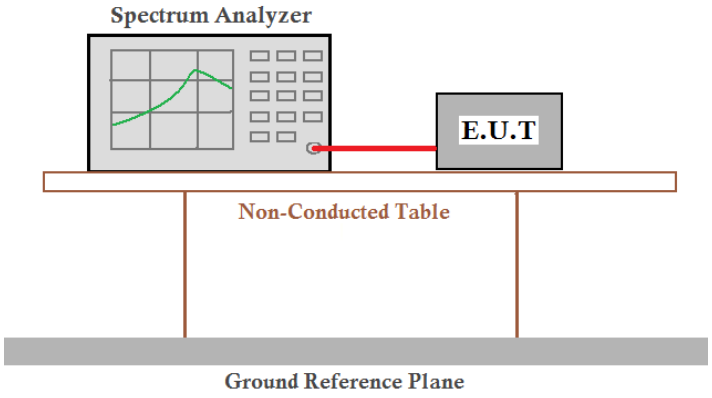
Test mode:	8DPSK	Test Packet:	3-DH3



Test mode:	8DPSK	Test Packet:	3-DH5

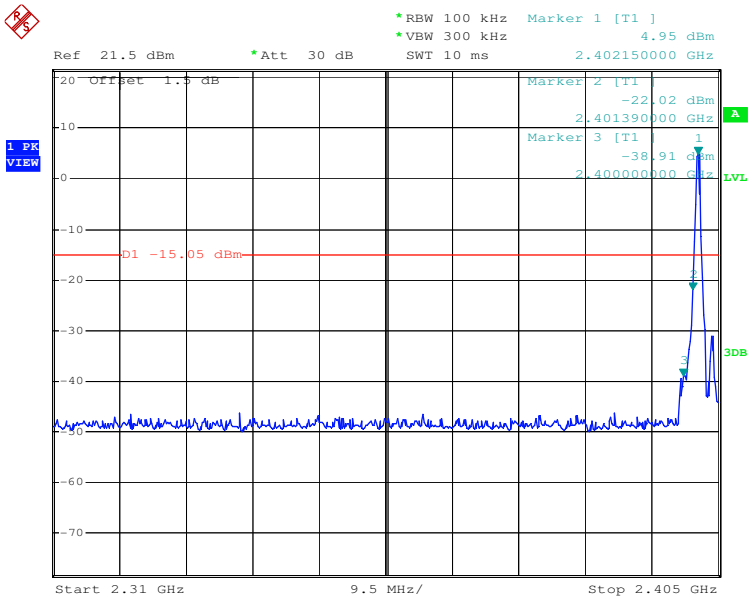


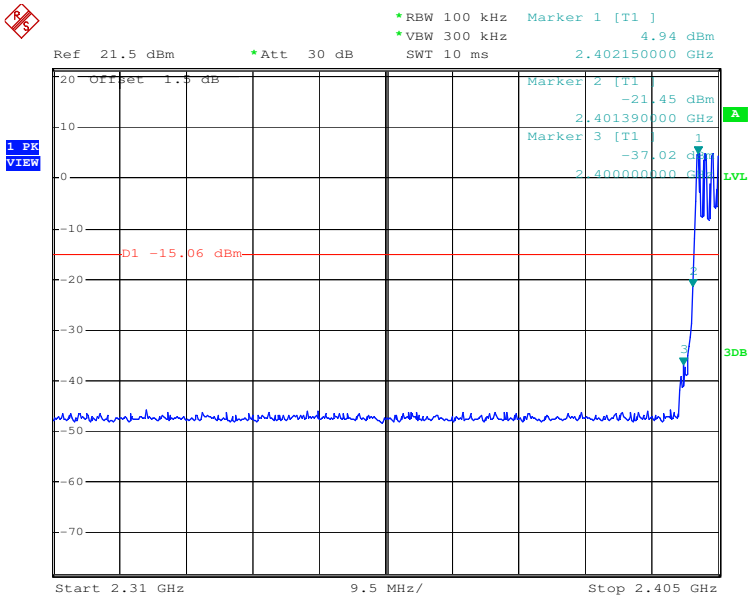
5.8 Band Edge

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2009
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 setup:	 *Remark:* *Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.*
Test Instruments:	Refer to section 4.8 for details.
Test results:	Pass

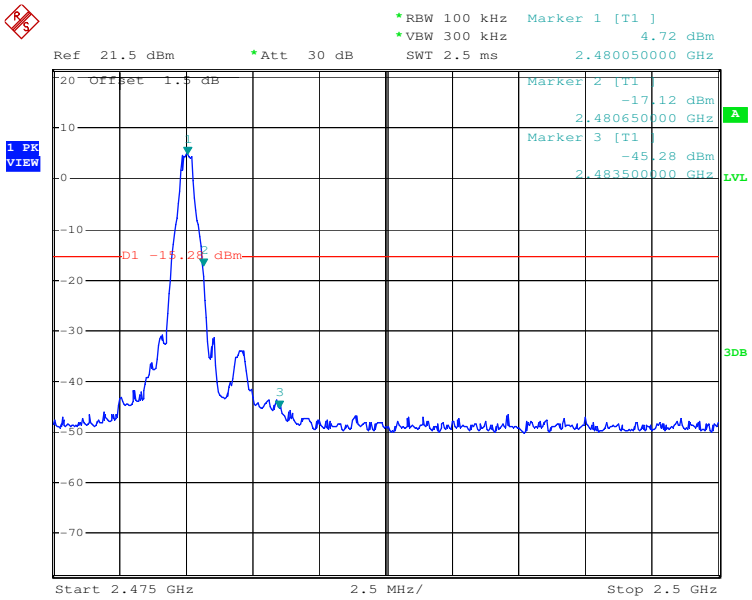
Test plot as follows:

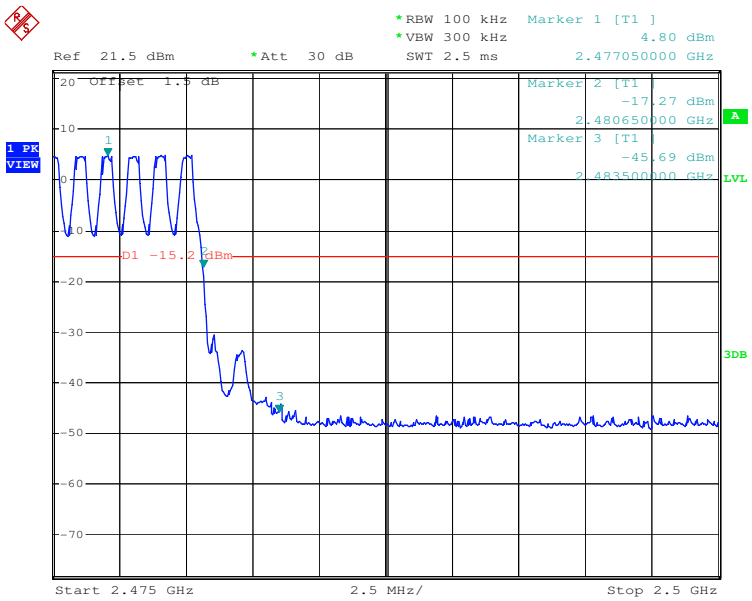
Test mode:	GFSK	Test channel:	Lowest



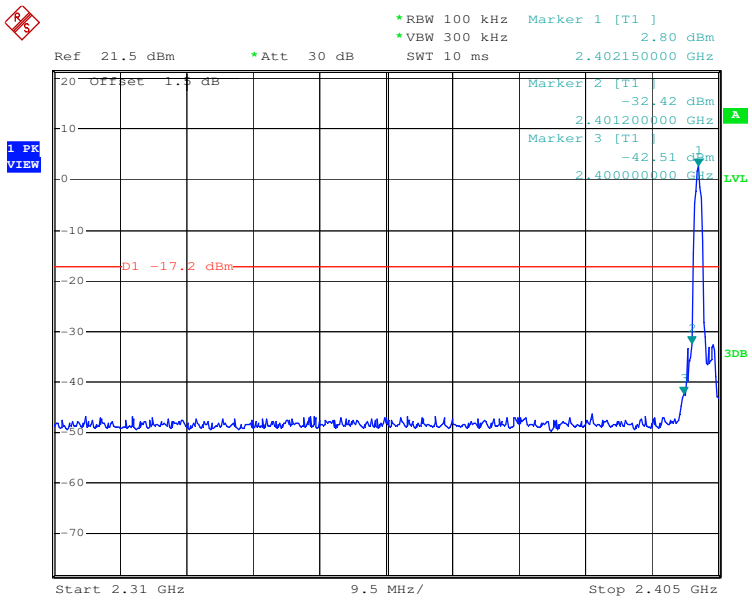


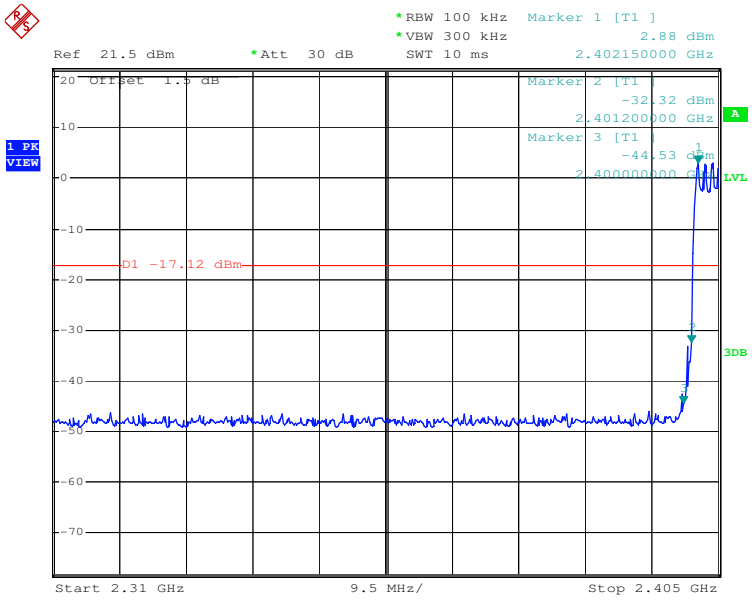
Test mode:	GFSK	Test channel:	Highest



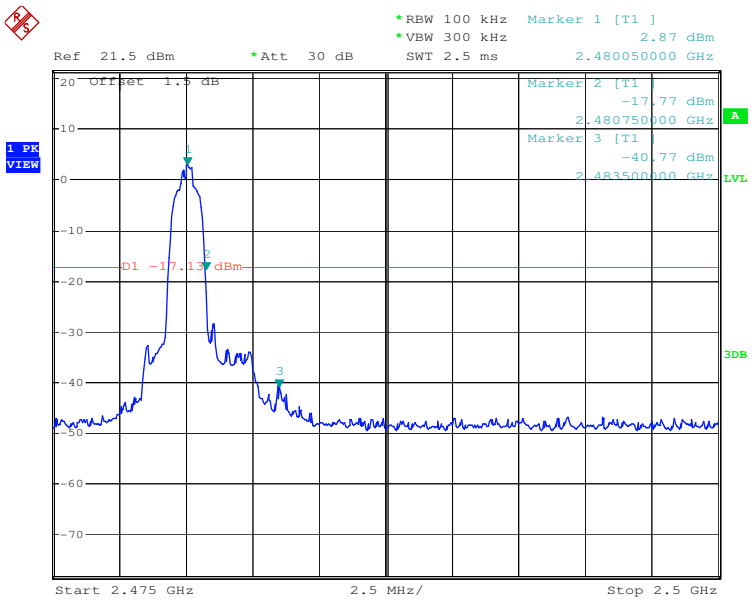


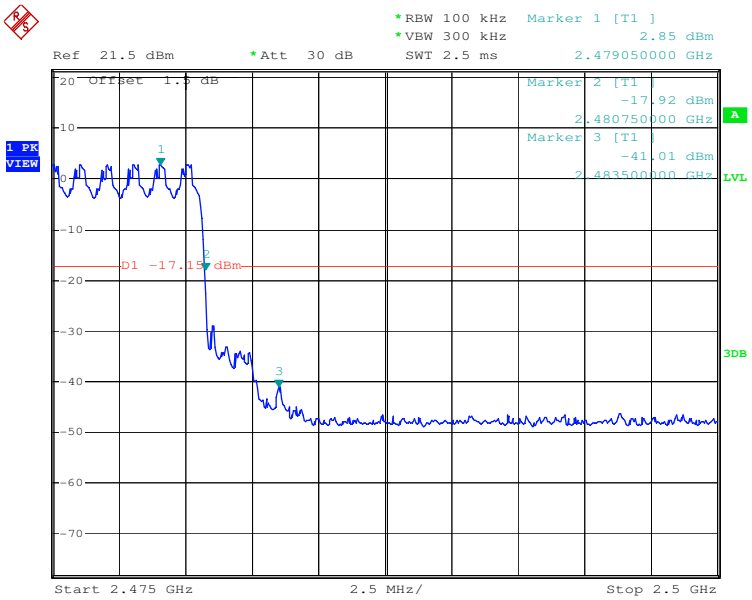
Test mode:	π/4DQPSK	Test channel:	Lowest



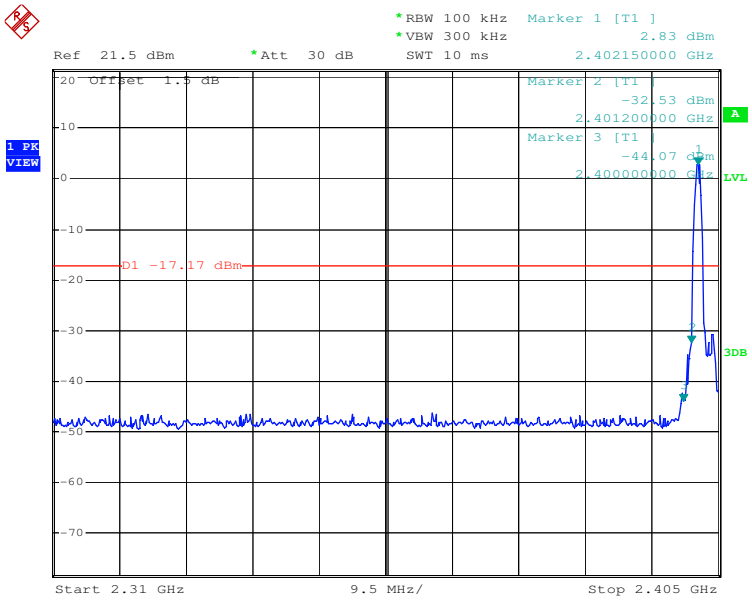


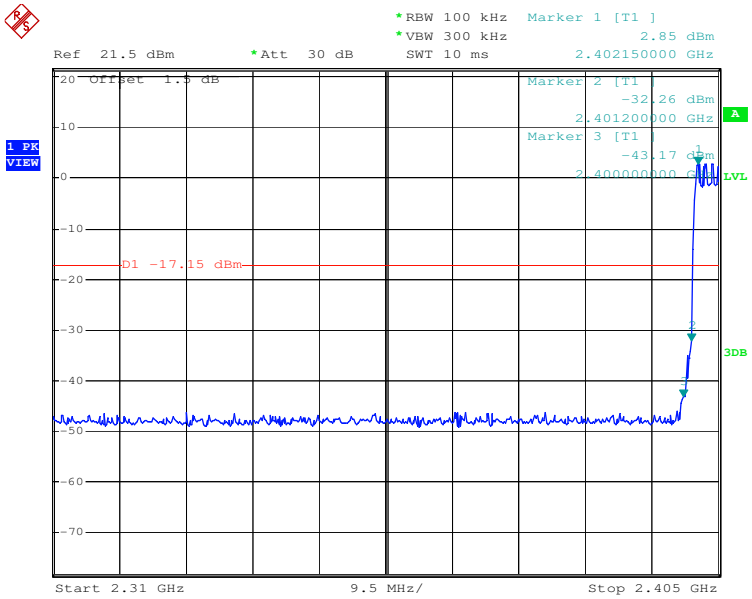
Test mode:	π/4DQPSK	Test channel:	Highest



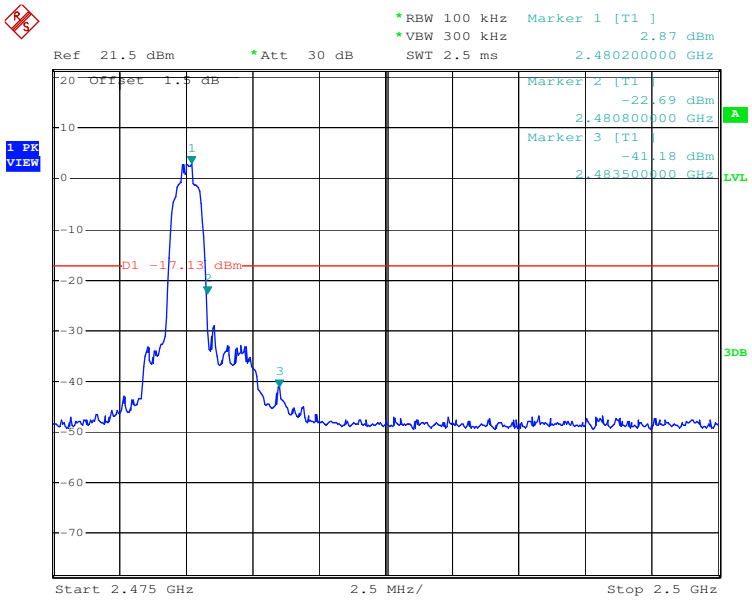


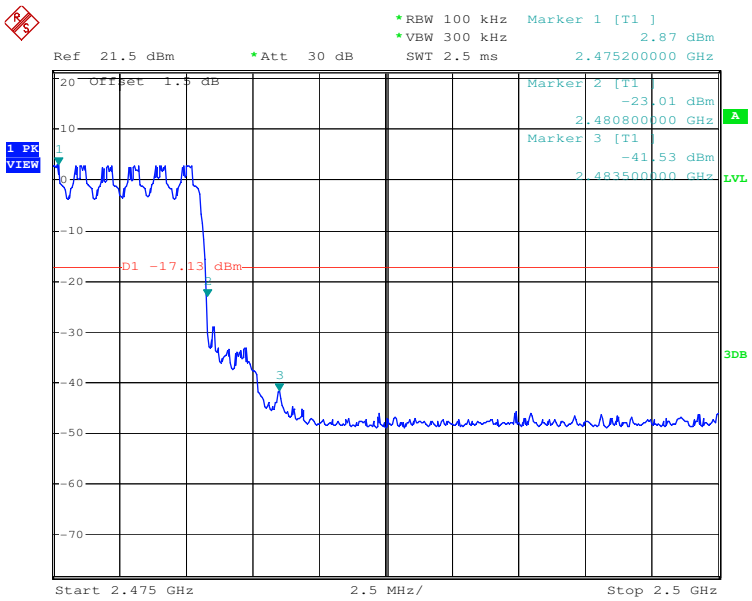
Test mode:	8DPSK	Test channel:	Lowest



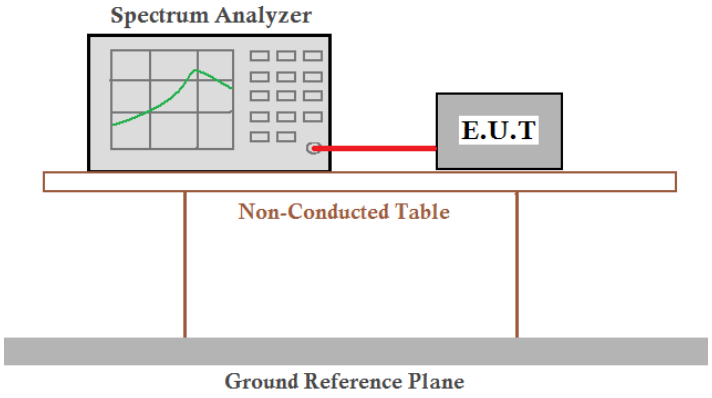


Test mode:	8DPSK	Test channel:	Highest

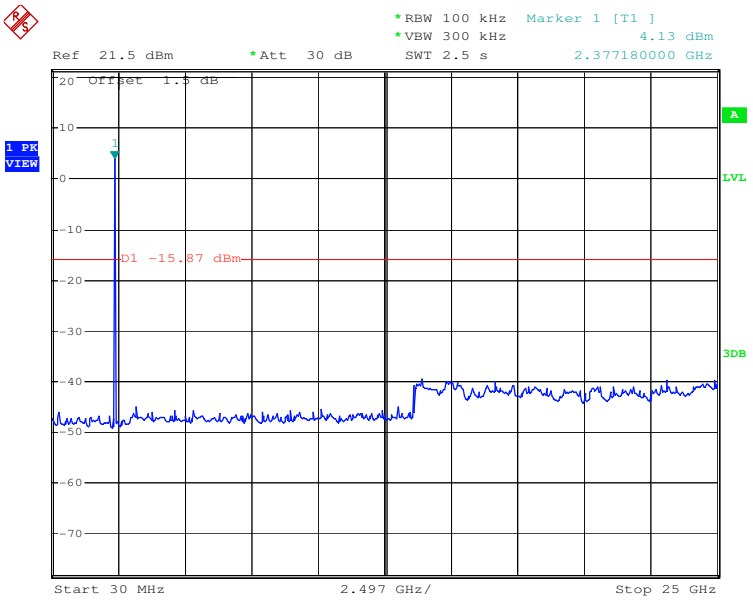




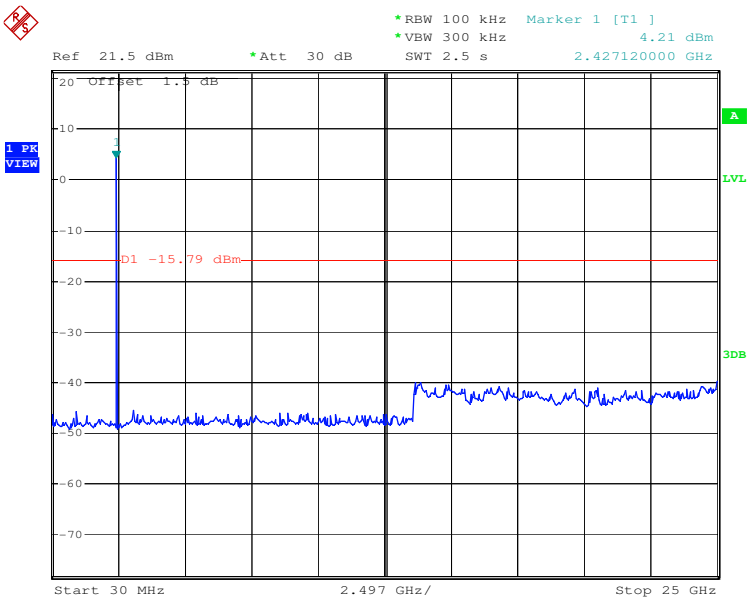
5.9 RF Antenna Conducted spurious emissions

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2009
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 setup:	 *Remark:* *Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.*
Test Instruments:	Refer to section 4.8 for details.
Test results:	Pass

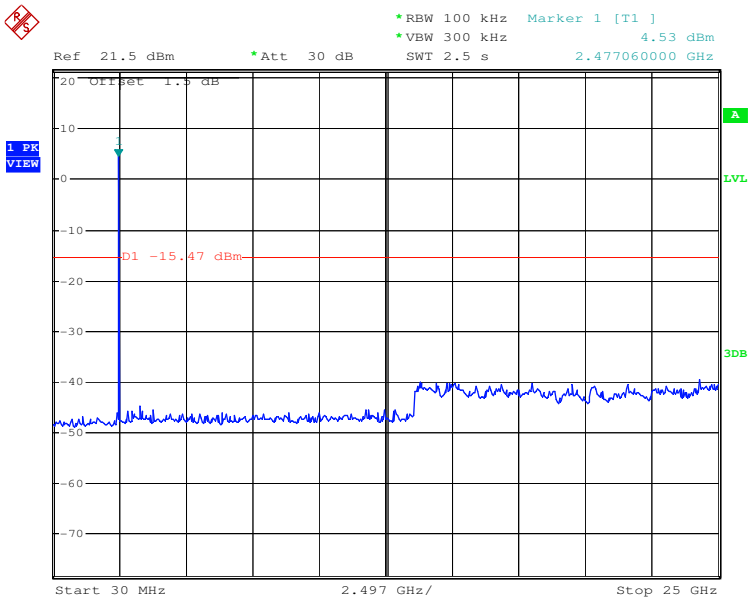
Test mode:	GFSK	Test channel:	Lowest



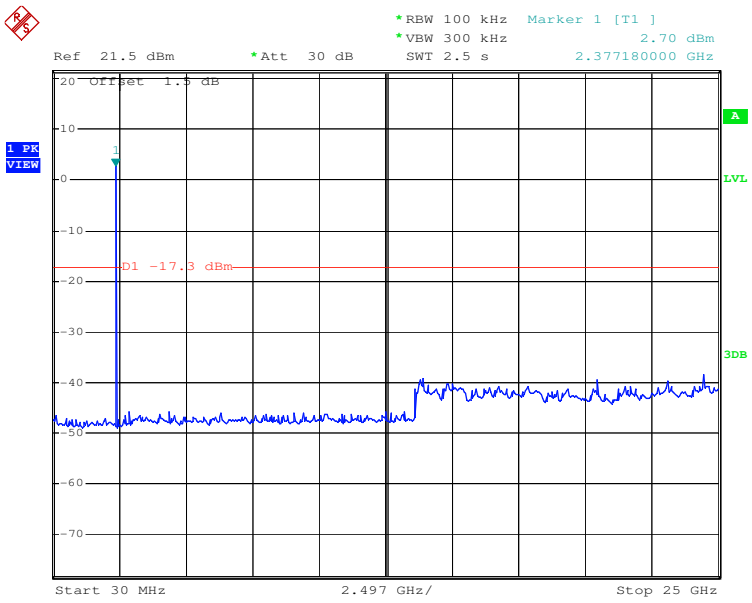
Test mode:	GFSK	Test channel:	Middle



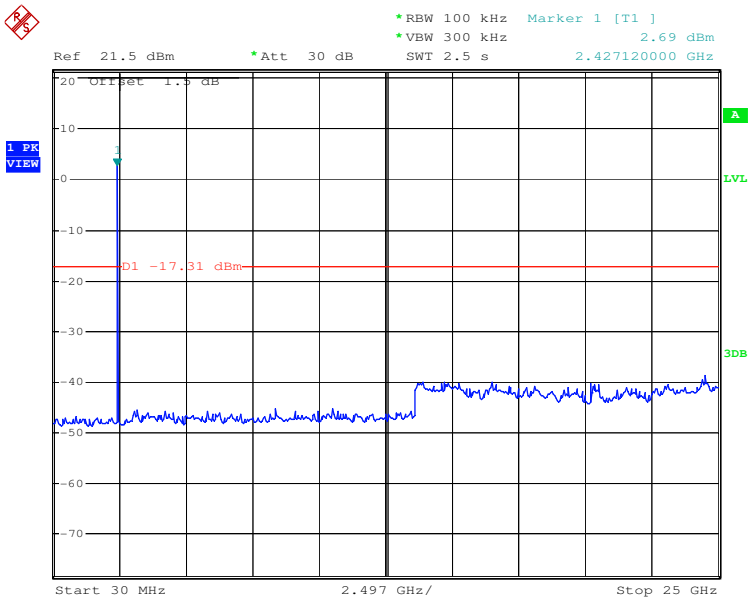
Test mode:	GFSK	Test channel:	Highest



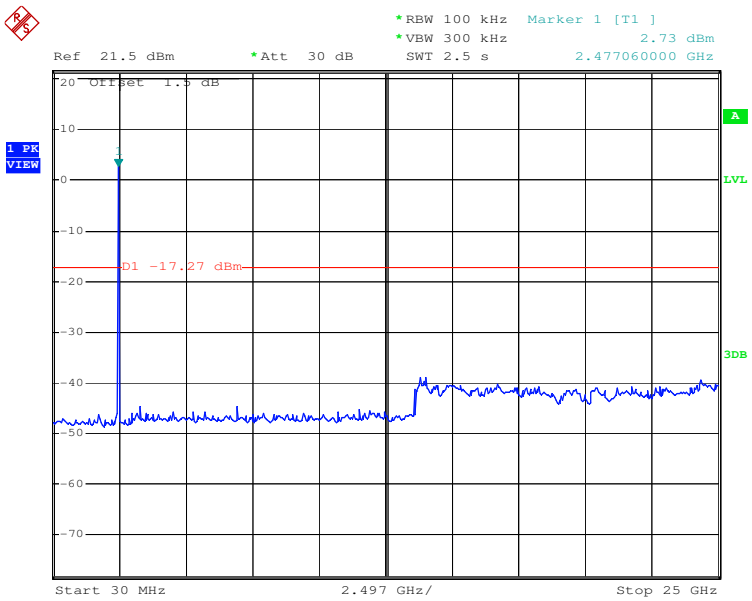
Test mode:	π/4DQPSK	Test channel:	Lowest



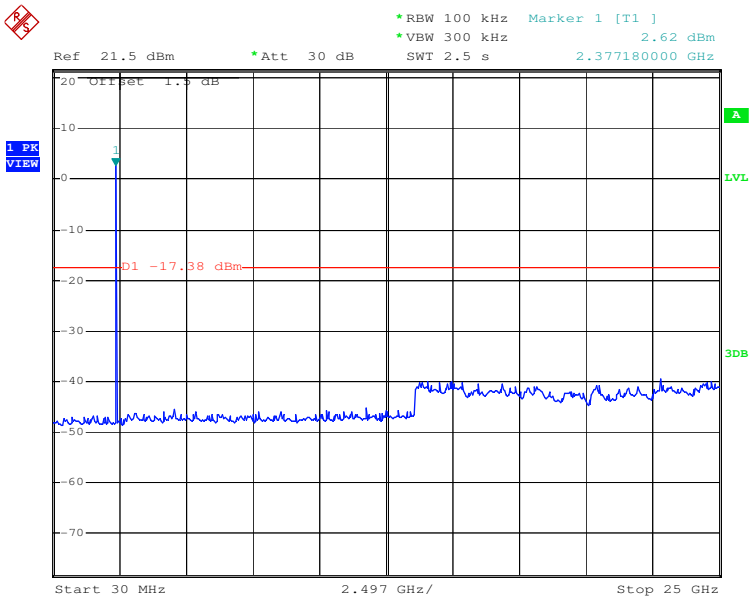
Test mode:	π/4DQPSK	Test channel:	Middle



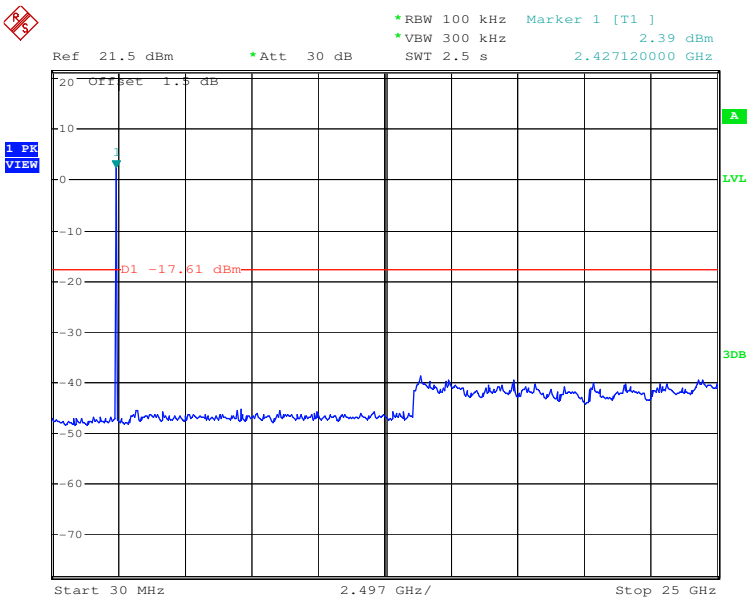
Test mode:	π/4DQPSK	Test channel:	Highest



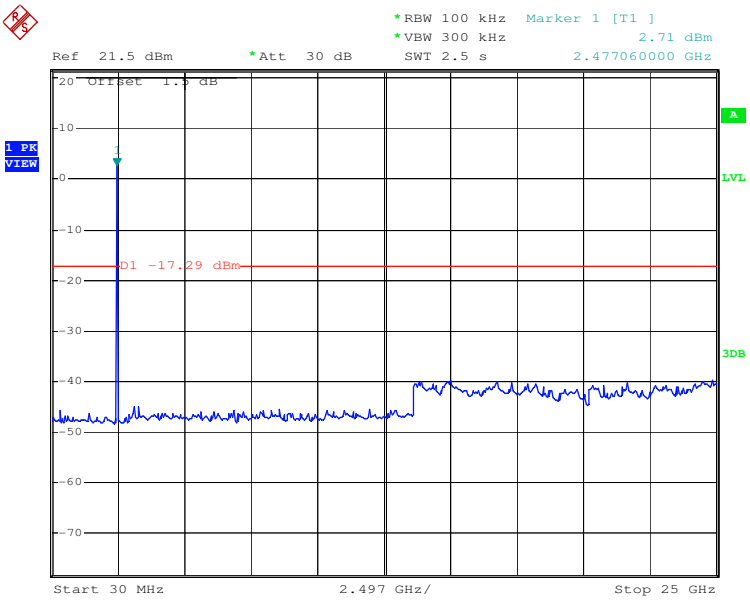
Test mode:	8DPSK	Test channel:	Lowest



Test mode:	8DPSK	Test channel:	Middle



Test mode:	8DPSK	Test channel:	Highest



5.10 Pseudorandom Frequency Hopping Sequence

Test Requirement:	FCC Part15 C Section 15.247 (a)(1) requirement:

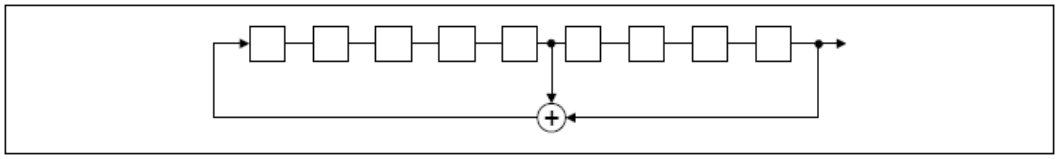
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence

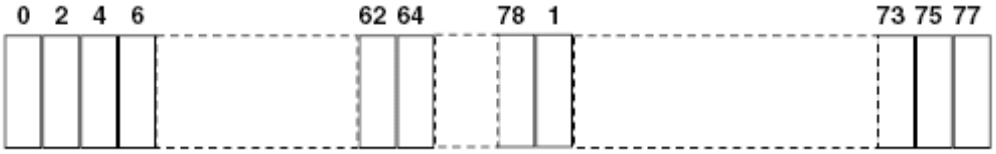
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- *Number of shift register stages: 9*
- *Length of pseudo-random sequence: 2^9 -1 = 511 bits*
- *Longest sequence of zeros: 8 (non-inverted signal)*



Linear Feedback Shift Register for Generation of the PRBS sequence

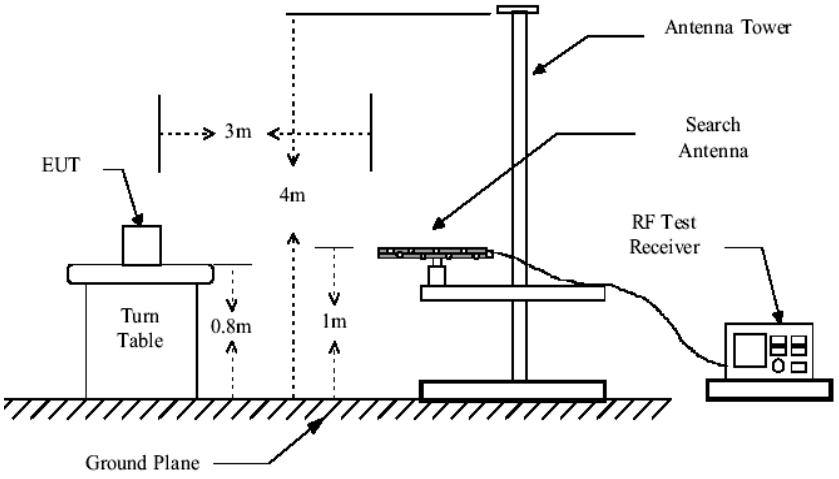
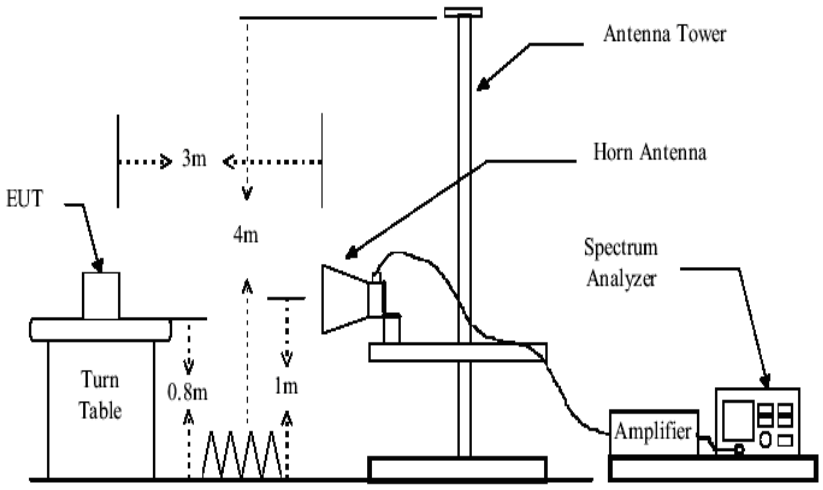
An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.
The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

5.11 Radiated Emission

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209 and 15.205</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10: 2009</td></tr>
<tr><td>Test Frequency Range:</td><td>30MHz to 25GHz</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m (Semi-Anechoic Chamber)</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>100KHz</td><td>300KHz</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><td>Frequency</td><td>Limit (dBuV/m @3m)</td><td>Remark</td></tr>
<tr><td>30MHz-88MHz</td><td>40.0</td><td>Quasi-peak Value</td></tr>
<tr><td>88MHz-216MHz</td><td>43.5</td><td>Quasi-peak Value</td></tr>
<tr><td>216MHz-960MHz</td><td>46.0</td><td>Quasi-peak Value</td></tr>
<tr><td>960MHz-1GHz</td><td>54.0</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>54.0</td><td>Average Value</td></tr>
<tr><td>74.0</td><td>Peak Value</td></tr>
</table>
</td></tr>
<tr><td>Test Procedure:</td><td>a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. 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.
d. 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.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. 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. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.</td></tr>
<tr><td>Test Instruments:</td><td>Refer to section 4.8 for details.</td></tr>
</table>

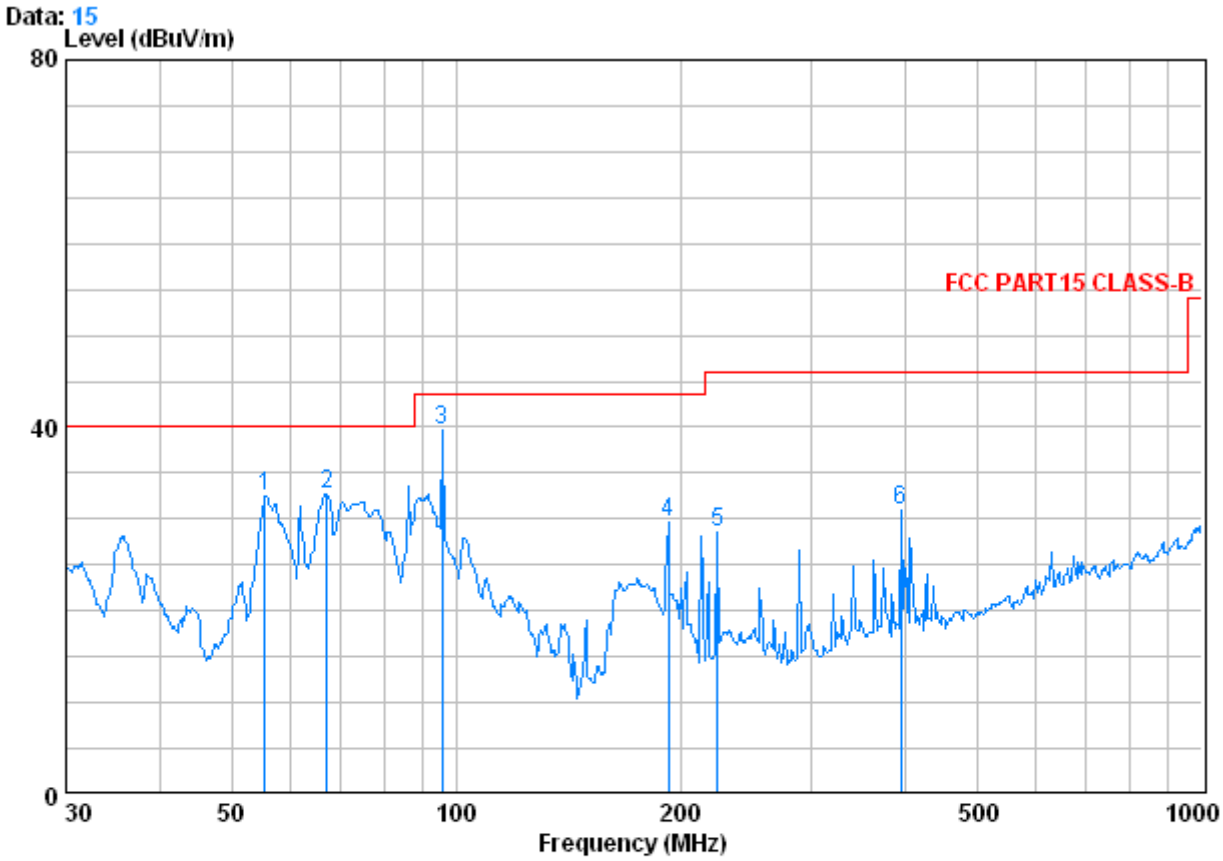
Test mode:	Non-hopping transmitting with modulation. 1. Pre-scan the EUT in GFSK, π/4DQPSK and 8DPSK modes and find out the worst case is GFSK mode. 2. Transmitting mode.
Test results:	Pass
Test setup:	Below 1GHz  Above 1GHz 

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

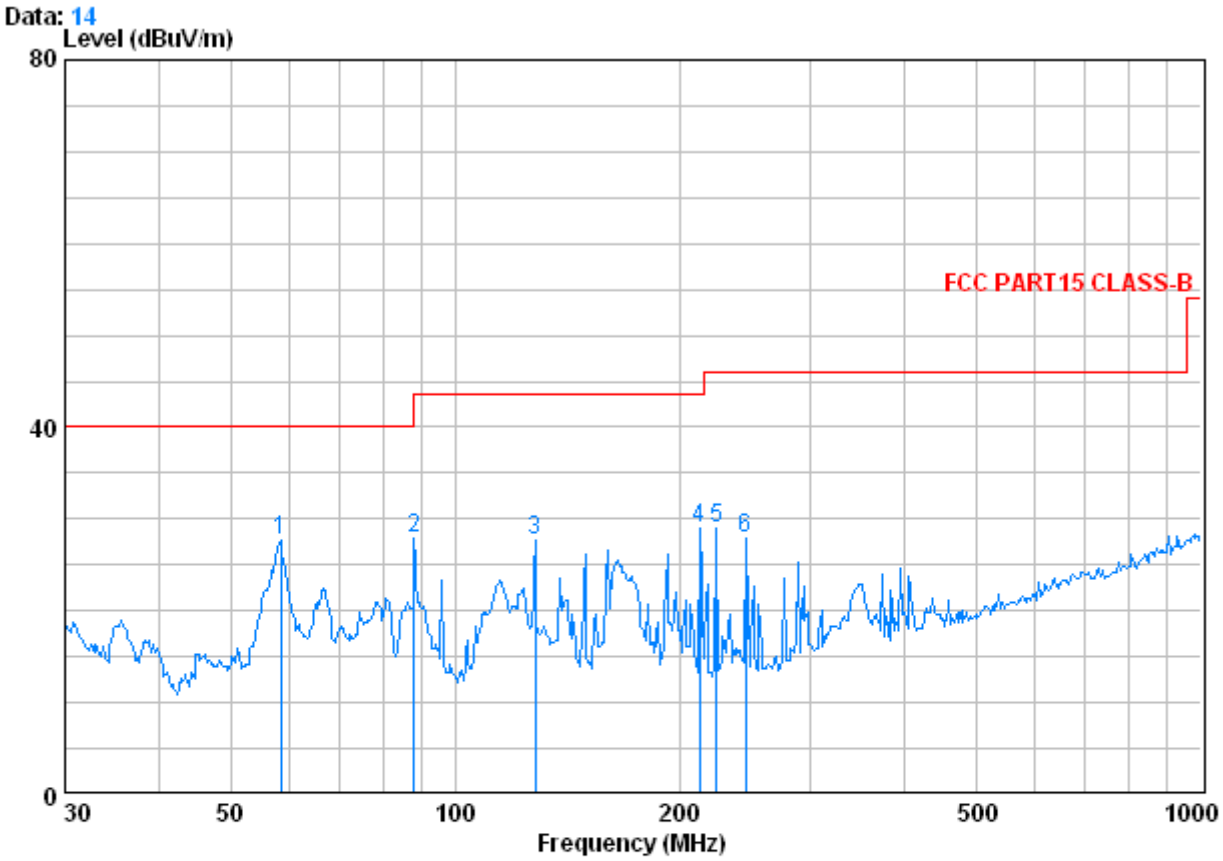
5.11.1 Radiated emission below 1GHz

Vertical



		Freq	Cable Loss	Antenna Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
		MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1		55.415	0.80	7.54	27.28	51.45	32.52	40.00	-7.48
2		67.202	0.80	6.98	27.25	52.26	32.79	40.00	-7.21
3	@	95.762	1.16	8.93	27.21	56.83	39.71	43.50	-3.79
4		192.419	1.39	10.12	26.73	44.91	29.69	43.50	-13.81
5		224.519	1.54	11.46	26.61	42.07	28.46	46.00	-17.54
6		394.855	2.19	16.23	27.09	39.72	31.05	46.00	-14.95

Horizontal



	Freq	Cable Loss	Antenna Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	58.407	0.80	7.39	27.27	46.66	27.58	40.00	-12.42
2	88.033	1.10	8.51	27.22	45.48	27.87	43.50	-15.63
3	128.113	1.27	7.74	27.02	45.67	27.66	43.50	-15.84
4	213.015	1.48	10.89	26.65	43.23	28.94	43.50	-14.56
5	224.519	1.54	11.46	26.61	42.58	28.97	46.00	-17.03
6	245.090	1.65	12.16	26.55	40.55	27.81	46.00	-18.19

5.11.2 Transmitter emission above 1GHz

Worst case mode:	GFSK	Test channel:	Lowest	Remark:	Peak

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Emission Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Antenna polarization
1602.000	3.99	28.84	39.40	59.66	53.09	74.00	-20.91	Vertical
3204.000	5.35	33.32	40.45	52.94	51.16	74.00	-22.84	Vertical
4804.000	7.44	34.70	41.63	54.54	55.05	74.00	-18.95	Vertical
7662.250	9.23	36.00	39.48	49.83	55.58	74.00	-18.42	Vertical
9824.250	9.77	37.53	37.61	46.17	55.86	74.00	-18.14	Vertical
12174.250	11.35	39.07	38.35	47.11	59.18	74.00	-14.82	Vertical
1602.000	3.99	28.84	39.40	57.96	51.39	74.00	-22.61	Horizontal
4804.000	7.44	34.70	41.63	56.50	57.01	74.00	-16.99	Horizontal
6428.500	8.12	36.20	40.55	51.65	55.42	74.00	-18.58	Horizontal
7662.250	9.23	36.00	39.48	50.20	55.95	74.00	-18.05	Horizontal
10094.500	9.91	37.82	37.49	47.33	57.57	74.00	-16.43	Horizontal
11739.500	11.10	38.64	38.17	48.32	59.89	74.00	-14.11	Horizontal

Worst case mode:	GFSK	Test channel:	Lowest	Remark:	Average

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Emission Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Antenna polarization
1602.000	3.99	28.84	39.40	57.25	50.68	54.00	-3.32	Vertical
3204.000	5.35	33.32	40.45	47.19	45.41	54.00	-8.59	Vertical
4804.000	7.44	34.70	41.63	48.42	48.93	54.00	-5.07	Vertical
7662.250	9.23	36.00	39.48	35.18	40.93	54.00	-13.07	Vertical
9824.250	9.77	37.53	37.61	31.88	41.57	54.00	-12.43	Vertical
12174.250	11.35	39.07	38.35	34.06	46.13	54.00	-7.87	Vertical
1602.000	3.99	28.84	39.40	55.00	48.43	54.00	-5.57	Horizontal
4804.000	7.44	34.70	41.63	50.44	50.95	54.00	-3.05	Horizontal
6428.500	8.12	36.20	40.55	37.37	41.14	54.00	-12.86	Horizontal
7662.250	9.23	36.00	39.48	35.28	41.03	54.00	-12.97	Horizontal
10094.500	9.91	37.82	37.49	32.75	42.99	54.00	-11.01	Horizontal
11739.500	11.10	38.64	38.17	33.47	45.04	54.00	-8.96	Horizontal

Worst case mode:	GFSK	Test channel:	Middle	Remark:	Peak

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Emission Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Antenna polarization
1628.000	4.00	29.09	39.41	58.02	51.70	74.00	-22.30	Vertical
3256.000	5.42	33.30	40.49	51.58	49.81	74.00	-24.19	Vertical
4882.000	7.48	34.59	41.68	53.57	53.96	74.00	-20.04	Vertical
7697.500	9.24	36.00	39.46	48.91	54.69	74.00	-19.31	Vertical
10094.500	9.91	37.82	37.49	46.26	56.50	74.00	-17.50	Vertical
11974.500	11.26	38.88	38.27	46.90	58.77	74.00	-15.23	Vertical
1628.000	4.00	29.09	39.41	57.36	51.04	74.00	-22.96	Horizontal
4882.000	7.48	34.59	41.68	53.10	53.49	74.00	-20.51	Horizontal
6522.500	8.15	36.28	40.46	51.21	55.18	74.00	-18.82	Horizontal
7697.500	9.24	36.00	39.46	49.48	55.26	74.00	-18.74	Horizontal
10094.500	9.91	37.82	37.49	46.44	56.68	74.00	-17.32	Horizontal
12174.250	11.35	39.07	38.35	47.43	59.50	74.00	-14.50	Horizontal

Worst case mode:	GFSK	Test channel:	Middle	Remark:	Average

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Emission Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Antenna polarization
1628.000	4.00	29.09	39.41	57.31	50.99	54.00	-3.01	Vertical
3256.000	5.42	33.30	40.49	44.98	43.21	54.00	-10.79	Vertical
4882.000	7.48	34.59	41.68	46.34	46.73	54.00	-7.27	Vertical
7697.500	9.24	36.00	39.46	35.21	40.99	54.00	-13.01	Vertical
10094.500	9.91	37.82	37.49	32.61	42.85	54.00	-11.15	Vertical
11974.500	11.26	38.88	38.27	33.84	45.71	54.00	-8.29	Vertical
1628.000	4.00	29.09	39.41	56.08	49.76	54.00	-4.24	Horizontal
4882.000	7.48	34.59	41.68	48.35	48.74	54.00	-5.26	Horizontal
6522.500	8.15	36.28	40.46	36.19	40.16	54.00	-13.84	Horizontal
7697.500	9.24	36.00	39.46	35.22	41.00	54.00	-13.00	Horizontal
10094.500	9.91	37.82	37.49	32.59	42.83	54.00	-11.17	Horizontal
12174.250	11.35	39.07	38.35	34.01	46.08	54.00	-7.92	Horizontal

Worst case mode:	GFSK	Test channel:	Highest	Remark:	Peak

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Emission Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Antenna polarization
1654.000	4.04	29.21	39.42	57.51	51.34	74.00	-22.66	Vertical
3308.000	5.50	33.28	40.52	51.80	50.06	74.00	-23.94	Vertical
4960.000	7.53	34.46	41.74	50.17	50.42	74.00	-23.58	Vertical
7321.500	8.87	35.93	39.77	49.78	54.81	74.00	-19.19	Vertical
10623.250	10.29	38.35	37.70	45.91	56.85	74.00	-17.15	Vertical
12585.500	11.52	39.44	38.52	47.81	60.25	74.00	-13.75	Vertical
1654.000	4.04	29.21	39.42	57.40	51.23	74.00	-22.77	Horizontal
3308.000	5.50	33.28	40.52	49.76	48.02	74.00	-25.98	Horizontal
4960.000	7.53	34.46	41.74	50.56	50.81	74.00	-23.19	Horizontal
6616.500	8.19	36.20	40.38	51.38	55.39	74.00	-18.61	Horizontal
8884.250	9.59	36.51	38.42	47.83	55.51	74.00	-18.49	Horizontal
11892.250	11.21	38.80	38.23	47.32	59.10	74.00	-14.90	Horizontal

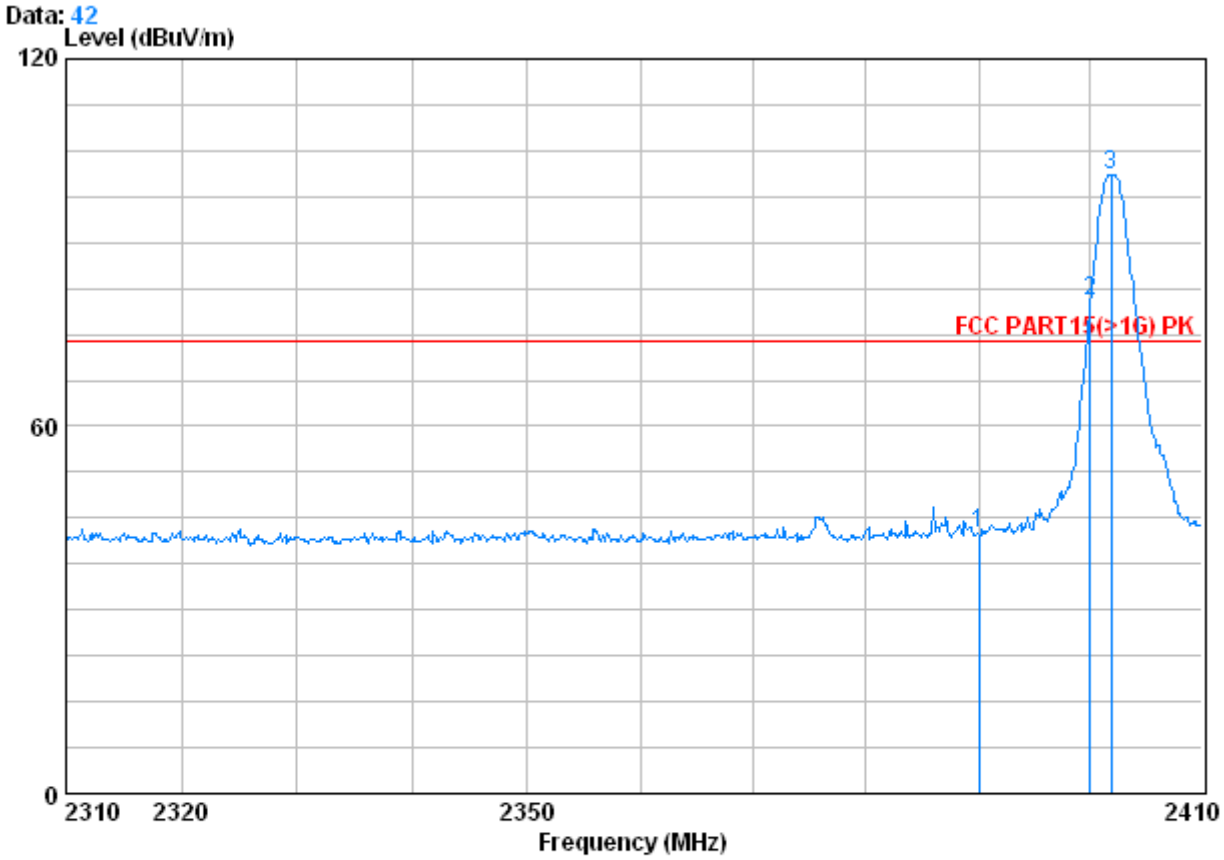
Worst case mode:	GFSK	Test channel:	Highest	Remark:	Average

Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Emission Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Antenna polarization
1654.000	4.04	29.21	39.42	56.52	50.35	54.00	-3.65	Vertical
3308.000	5.50	33.28	40.52	46.05	44.31	54.00	-9.69	Vertical
4960.000	7.53	34.46	41.74	42.63	42.88	54.00	-11.12	Vertical
7321.500	8.87	35.93	39.77	35.83	40.86	54.00	-13.14	Vertical
10623.250	10.29	38.35	37.70	32.70	43.64	54.00	-10.36	Vertical
12585.500	11.52	39.44	38.52	34.12	46.56	54.00	-7.44	Vertical
1654.000	4.04	29.21	39.42	55.78	49.61	54.00	-4.39	Horizontal
3308.000	5.50	33.28	40.52	37.92	36.18	54.00	-17.82	Horizontal
4960.000	7.53	34.46	41.74	39.58	39.83	54.00	-14.17	Horizontal
6616.500	8.19	36.20	40.38	36.50	40.51	54.00	-13.49	Horizontal
8884.250	9.59	36.51	38.42	34.23	41.91	54.00	-12.09	Horizontal
11892.250	11.21	38.80	38.23	33.39	45.17	54.00	-8.83	Horizontal

Remark: The disturbance above 13GHz was very low (>20dB below the limit), and the above harmonics were the highest point could be found when testing, so only the above harmonics have been displayed.

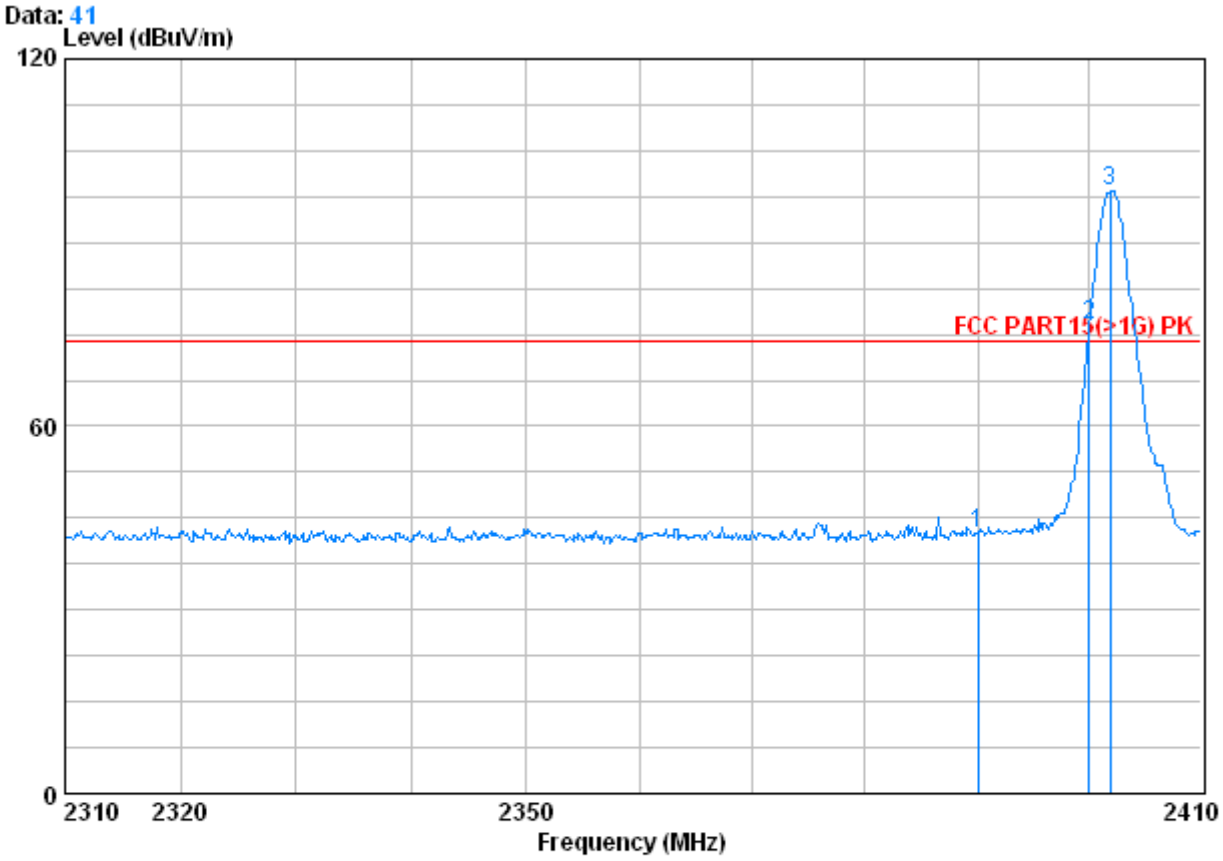
5.11.3 Band edge (Radiated Emission)

Test mode:	Transmitting	Test channel:	Lowest	Remark:	Peak	Vertical



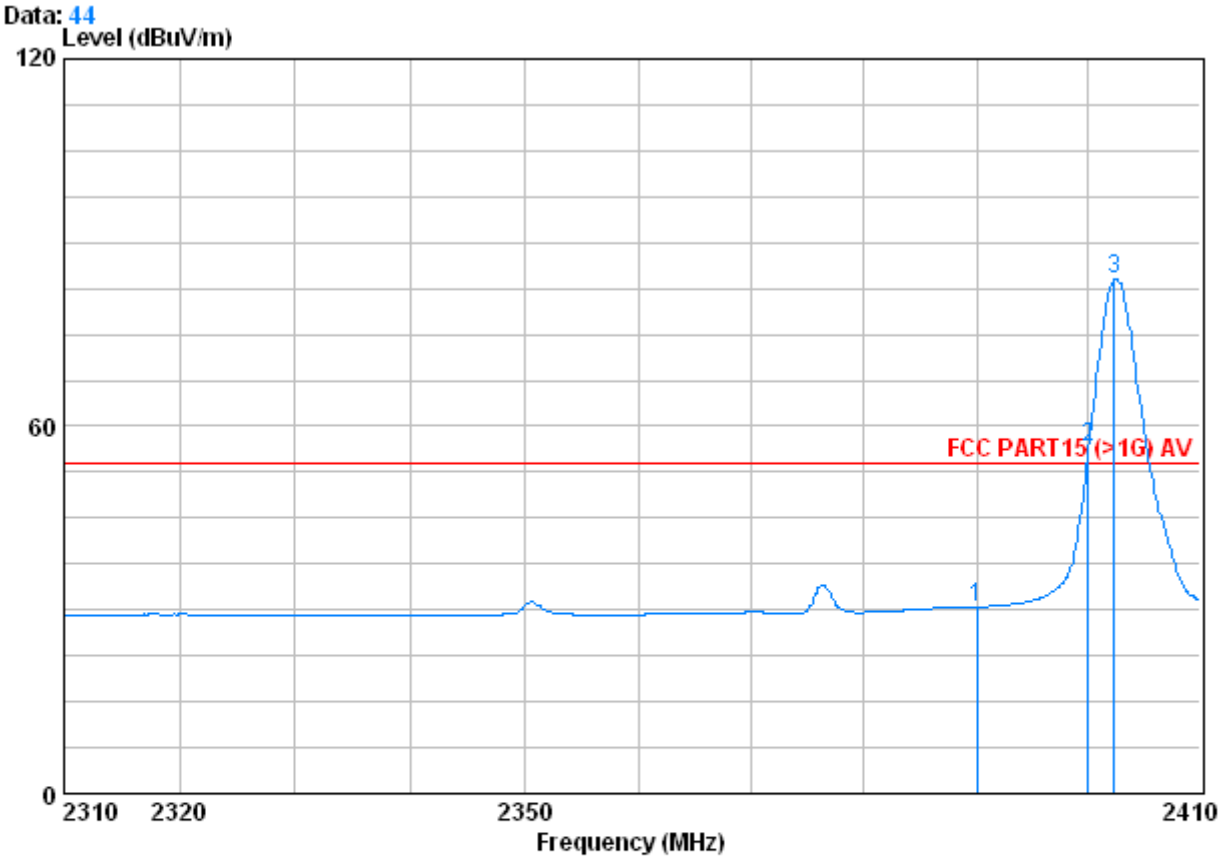
	Freq	Cable Loss	Antenna Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2390.000	2.98	32.51	39.85	46.81	42.46	74.00	-31.54
2 X	2400.000	2.98	32.51	39.86	84.74	80.37	74.00	6.37
3 X	2401.900	2.98	32.51	39.86	105.53	101.16	74.00	27.16

Test mode:	Transmitting	Test channel:	Lowest	Remark:	Peak	Horizontal



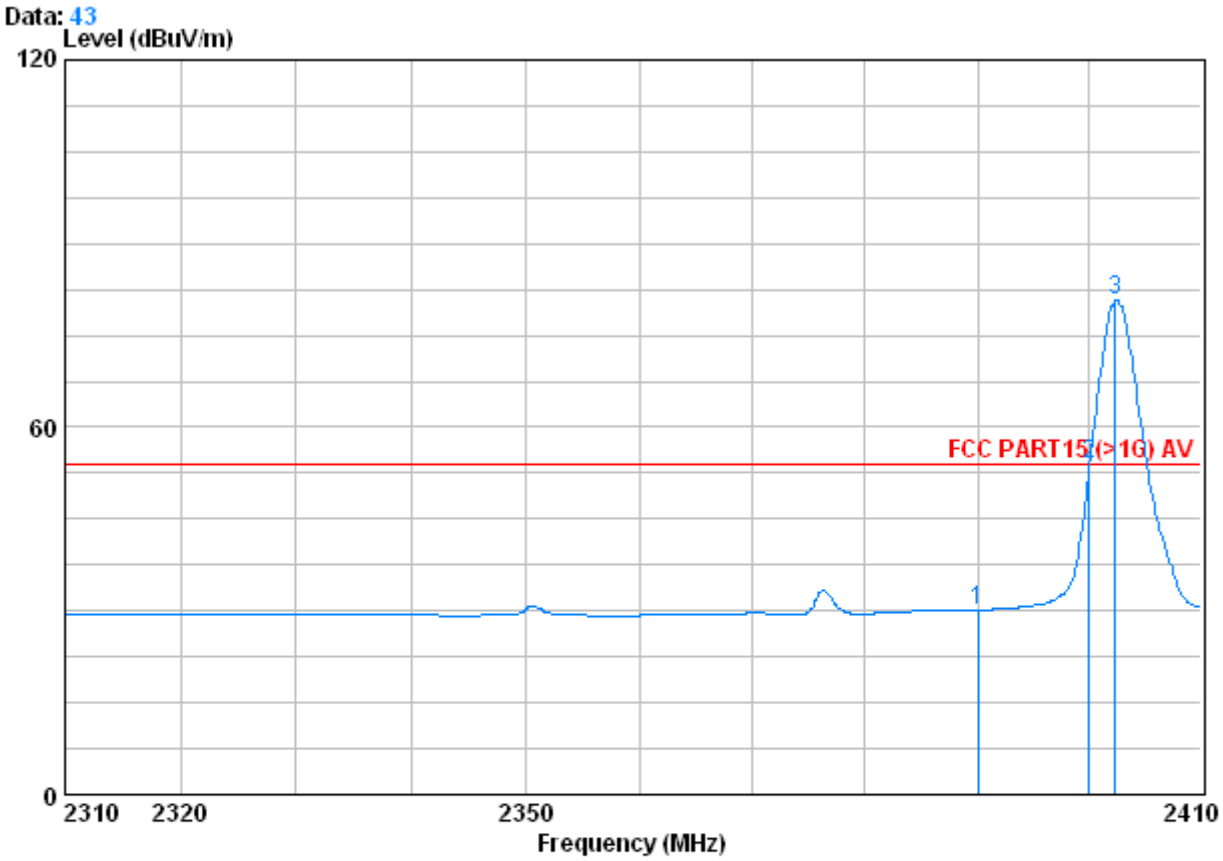
	Freq	Cable Loss	Antenna Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2390.000	2.98	32.51	39.85	47.00	42.65	74.00	-31.35
2 X	2400.000	2.98	32.51	39.86	81.03	76.66	74.00	2.66
3 X	2401.900	2.98	32.51	39.86	102.76	98.39	74.00	24.39

Test mode:	Transmitting	Test channel:	Lowest	Remark:	Average	Vertical



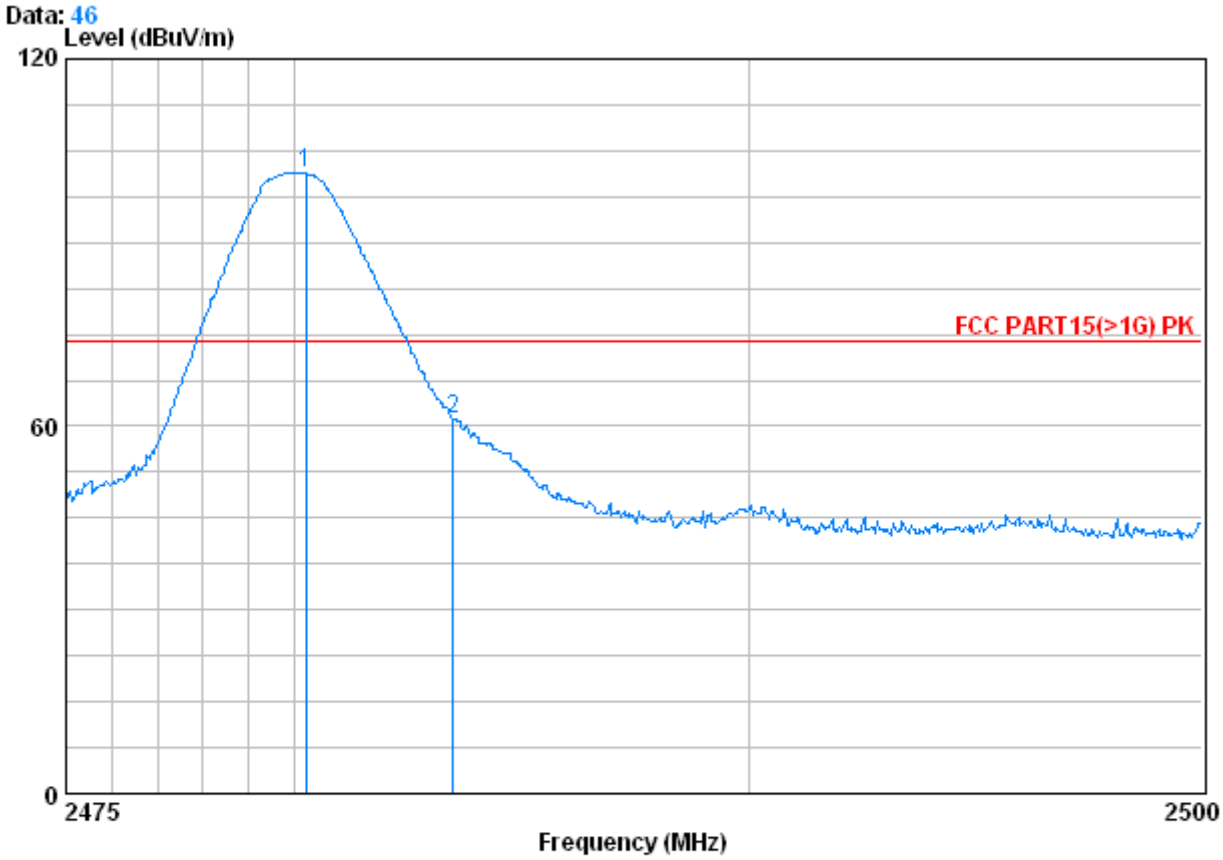
	Freq	Cable Loss	Antenna Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2390.000	2.98	32.51	39.85	34.82	30.46	54.00	-23.54
2 X	2400.000	2.98	32.51	39.86	60.98	56.61	54.00	2.61
3 X	2402.300	2.98	32.51	39.86	88.47	84.11	54.00	30.11

Test mode:	Transmitting	Test channel:	Lowest	Remark:	Average	Horizontal



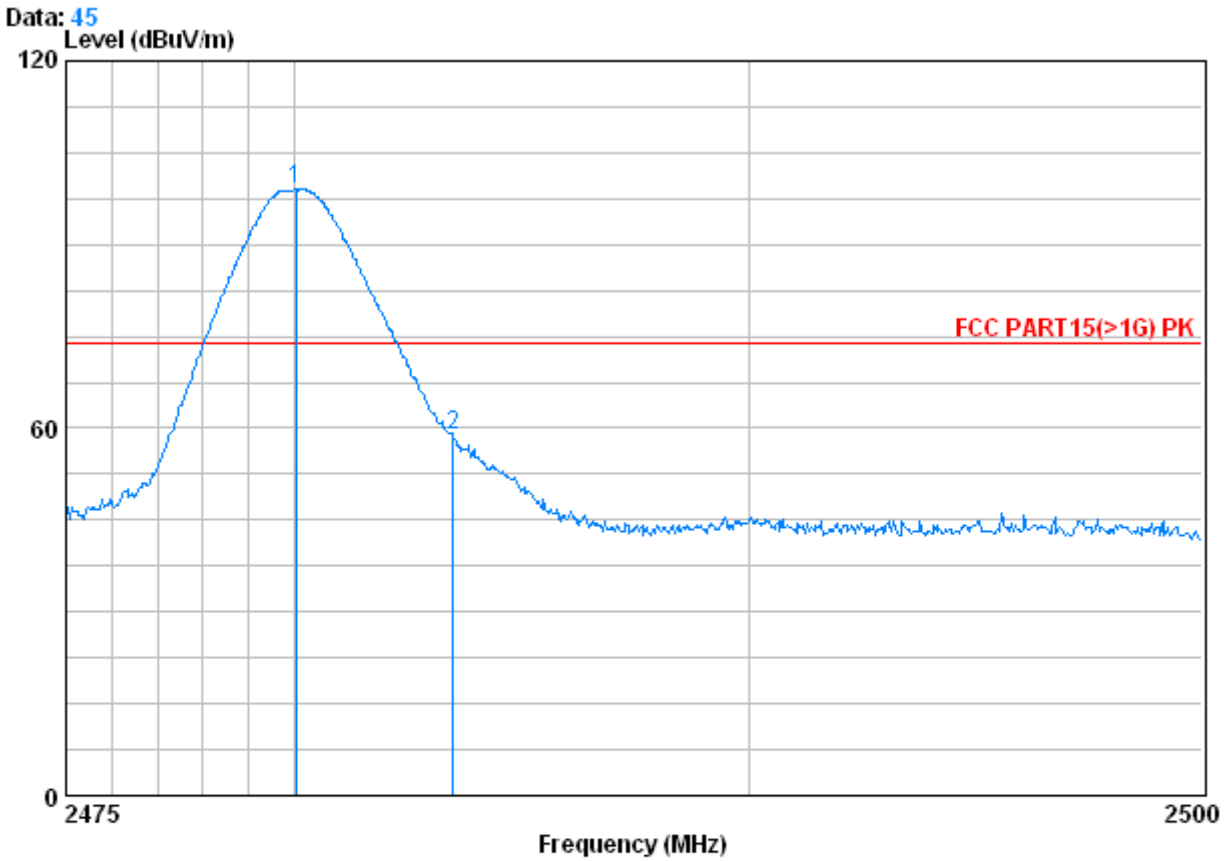
	Freq	Cable Loss	Antenna Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1	2390.000	2.98	32.51	39.85	34.50	30.15	54.00	-23.85
2	2400.000	2.98	32.51	39.86	58.27	53.90	54.00	-0.10
3 X	2402.300	2.98	32.51	39.86	85.10	80.74	54.00	26.74

Test mode:	Transmitting	Test channel:	Highest	Remark:	Peak	Vertical



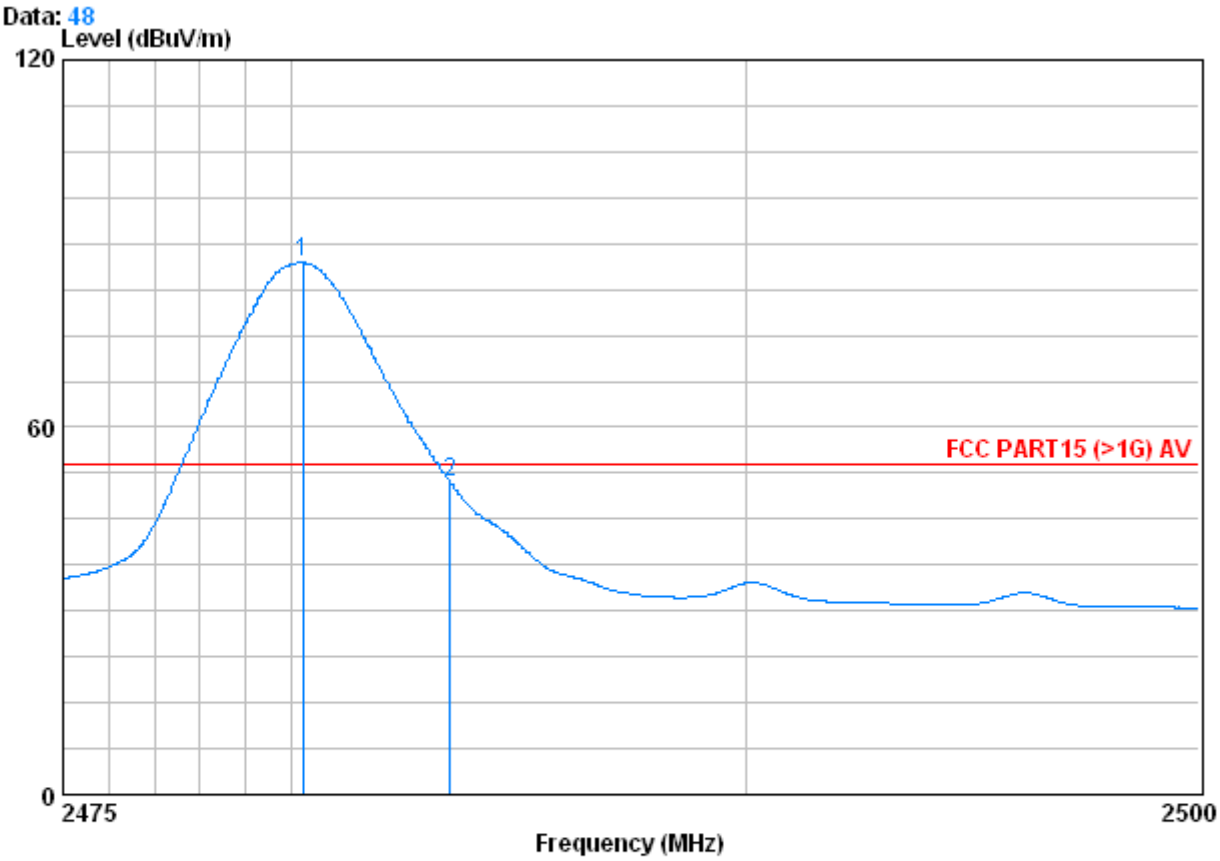
	Freq	Cable Loss	Antenna Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1 X	2480.250	3.03	32.67	39.92	105.49	101.27	74.00	27.27
2	2483.500	3.03	32.67	39.92	65.44	61.22	74.00	-12.78

Test mode:	Transmitting	Test channel:	Highest	Remark:	Peak	Horizontal



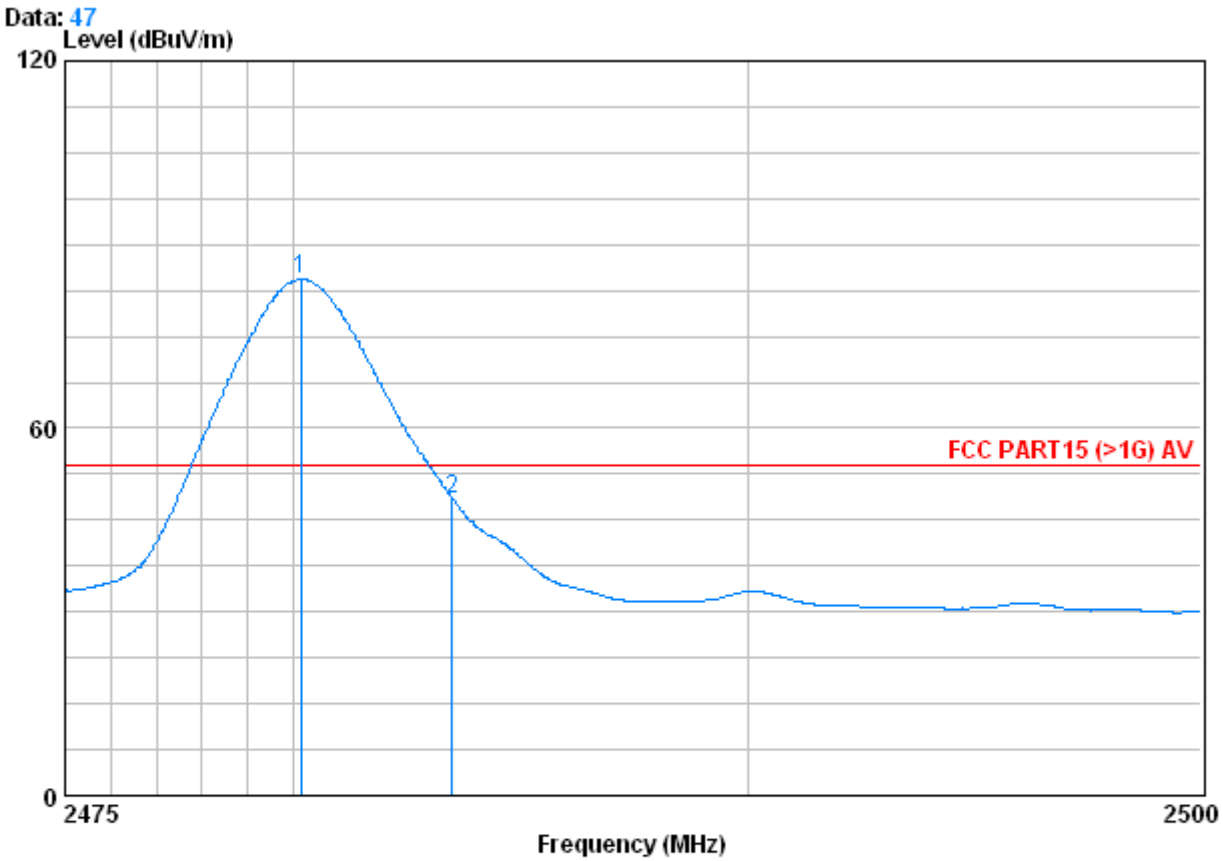
	Freq	Cable Loss	Antenna Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1 X	2480.050	3.03	32.67	39.92	103.34	99.12	74.00	25.12
2	2483.500	3.03	32.67	39.92	62.91	58.69	74.00	-15.31

Test mode:	Transmitting	Test channel:	Highest	Remark:	Average	Vertical



	Freq	Cable Loss	Antenna Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1 @	2480.250	3.03	32.67	39.92	91.10	86.88	54.00	32.88
2	2483.500	3.03	32.67	39.92	55.24	51.02	54.00	-2.98

Test mode:	Transmitting	Test channel:	Highest	Remark:	Average	Horizontal



	Freq	Cable Loss	Antenna Factor	Preamp Factor	Read Level	Level	Limit Line	Over Limit
	MHz	dB	dB/m	dB	dBuV	dBuV/m	dBuV/m	dB
1 X	2480.175	3.03	32.67	39.92	88.54	84.32	54.00	30.32
2	2483.500	3.03	32.67	39.92	52.67	48.45	54.00	-5.55