SGS-CSTC Standards Technical Services Ltd.

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FCC REPORT

Application No:	SZEM1308004544RF
Applicant:	KEEN HIGH HOLDING (HK) LIMITED
Manufacturer:	HEWLETT-PACKARD COMPANY
Factory:	1. Inventec (Pudong) Corporation 2. INVENTEC HI-TECH CORPORATION 3. INVENTEC (CHONGQING) CORP.
Product Name:	Tablet
Model No.(EUT):	HSTNH-K13C
FCC ID:	ZYQ-HHK13C
Standards:	47 CFR Part 15, Subpart C (2012)
Date of Receipt:	2013-08-16
Date of Test:	2013-08-16 to 2013-09-03
Date of Issue:	2013-09-16
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 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)	KDB558074D01v01r03	PASS
6dB Occupied Bandwidth	47 CFR Part 15, Subpart C Section 15.247 (a)(2)	KDB558074D01v01r03	PASS
Power Spectral Density	47 CFR Part 15, Subpart C Section 15.247 (e)	KDB558074D01v01r03	PASS
Pseudorandom Frequency Hopping Sequence	47 CFR Part 15, Subpart C Section 15.247(b)(4)&TCB Exclusion List (7 July 2002)	ANSI C63.10 (2009)	PASS
Band-edge for RF Conducted Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	KDB558074D01v01r03	PASS
RF Conducted Spurious Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	KDB558074D01v01r03	PASS
Radiated Spurious Emissions	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 2009	PASS
Band Edge (Radiated Emission)	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 2009	PASS

3 Contents

4 General Information

4.1 Client Information

Applicant:	KEEN HIGH HOLDING (HK) LIMITED
Address of Applicant:	Unit 13, 7/F Technology Park, 18 On Lai street Shatin New Territories HK
Manufacturer:	HEWLETT-PACKARD COMPANY
Address of Manufacturer:	3500 Deercreek Rd. Palo Alto California 94304 United States
Factory:	1. Inventec (Pudong) Corporation 2. INVENTEC HI-TECH CORPORATION 3. INVENTEC (CHONGQING) CORP.
Address of Factory:	1. Caohejing Export Processing Zone 699, Puxing Road, Minhang District, Shanghai, China 2. Caohejing Export Processing Zone 789, Puxing Road, Minhang District, Shanghai, China 3. No. 66, West District 2nd Rd., Shapingba District, Chongqing, China

4.2 General Description of EUT

Product Name:	Tablet	
Model No.:	HSTNH-K13C	
Trade Mark:	HP	
Operation Frequency:	2402MHz~2480MHz	
Bluetooth Version:	Bluetooth 4.0 BLE mode	
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)	
Modulation Type:	GFSK	
Number of Channel:	40	
Hopping Channel Type:	Adaptive Frequency Hopping systems	
Sample Type:	Portable production	
Test Power Grade:	N/A (manufacturer declare)	
Test Software of EUT:	N/A (manufacturer declare)	
Antenna Type	Integral	
Antenna Gain	1.65dBi	
Power Supply:	Adapter:	Model : W12-010N3A Input: 100V-240V 50-60Hz 0.3A Output: 5V ⎓ 2A
	Battery:	3.7V 4000 mAh Li-ion Battery
Test Voltage:	AC 120V~ 60Hz	
USB Cable:	104cm	

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	11	2422MHz	21	2442MHz	31	2462MHz
2	2404MHz	12	2424MHz	22	2444MHz	32	2464MHz
3	2406MHz	13	2426MHz	23	2446MHz	33	2466MHz
4	2408MHz	14	2428MHz	24	2448MHz	34	2468MHz
5	2410MHz	15	2430MHz	25	2450MHz	35	2470MHz
6	2412MHz	16	2432MHz	26	2452MHz	36	2472MHz
7	2414MHz	17	2434MHz	27	2454MHz	37	2474MHz
8	2416MHz	18	2436MHz	28	2456MHz	38	2476MHz
9	2418MHz	19	2438MHz	29	2458MHz	39	2478MHz
10	2420MHz	20	2440MHz	30	2460MHz	40	2480MHz

Note:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest channel	2402MHz
The Middle channel	2440MHz
The Highest channel	2480MHz

4.3 Test Environment

Operating Environment:	
Temperature:	22.0 °C
Humidity:	53 % RH
Atmospheric Pressure:	1000mbar

4.4 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.
TF Card	Kingston	N/A
Earphone	Supply by SGS	N/A

4.5 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.

4.6 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 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)**

  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-1 & 4620C-2.

4.7 Deviation from Standards

None.

4.8 Abnormalities from Standard Conditions

None.

4.9 Other Information Requested by the Customer

None.

4.10 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	2014-06-10
2	LISN	Rohde & Schwarz	ENV216	SEL0152	2013-10-24
3	LISN	ETS-LINDGREN	3816/2	SEL0021	2014-05-16
4	8 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T8-02	SEL0162	2013-11-10
5	4 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T4-02	SEL0163	2013-11-10
6	2 Line ISN	Fischer Custom Communications Inc.	FCC-TLISN-T2-02	SEL0164	2013-11-10
7	EMI Test Receiver	Rohde & Schwarz	ESCI	SEL0022	2014-05-16
8	Coaxial Cable	SGS	N/A	SEL0025	2014-05-29
9	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2013-10-24
10	Humidity/ Temperature Indicator	Shanhai Qixiang	ZJ1-2B	SEL0103	2013-10-24
11	Barometer	Chang Chun	DYM3	SEL0088	2014-05-24

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	2014-06-10
2	EMI Test Receiver	Rohde & Schwarz	ESIB26	SEL0023	2014-05-16
3	EMI Test software	AUDIX	E3	SEL0050	N/A
4	BiConiLog Antenna (26-3000MHz)	ETS-LINDGREN	3142C	SEL0015	2013-10-24
5	Double-ridged horn (1-18GHz)	ETS-LINDGREN	3117	SEL0006	2013-10-24
6	Horn Antenna (18-26GHz)	ETS-LINDGREN	3160	SEL0076	2013-10-24
7	Pre-amplifier (0.1-1300MHz)	Agilent Technologies	8447D	SEL0053	2014-05-16
8	Pre-Amplifier (0.1-26.5GHz)	Compliance Directions Systems Inc.	PAP-0126	SEL0168	2013-10-24
9	Coaxial cable	SGS	N/A	SEL0027	2014-05-29
10	Coaxial cable	SGS	N/A	SEL0189	2014-05-29
11	Coaxial cable	SGS	N/A	SEL0121	2014-05-29
12	Coaxial cable	SGS	N/A	SEL0178	2014-05-29
13	Band filter	Amindeon	82346	SEL0094	2014-05-16
14	Barometer	Chang Chun	DYM3	SEL0088	2014-05-24
15	DC Power Supply	Zhao Xin	RXN-305D	SEL0117	2013-10-24
16	Humidity/ Temperature Indicator	Shanhai Qixiang	ZJ1-2B	SEL0103	2013-10-24
17	Signal Generator (10M-27GHz)	Rohde & Schwarz	SMR27	SEL0067	2014-05-16
18	Signal Generator	Rohde & Schwarz	SMY01	SEL0155	2013-10-24
19	Loop Antenna	Beijing Daze	ZN30401	SEL0203	2014-06-04

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	2013-10-24
2	Humidity/ Temperature Indicator	HYGRO	ZJ1-2B	SEL0033	2013-10-24
3	Spectrum Analyzer	Rohde & Schwarz	FSP	SEL0154	2013-10-24
4	Coaxial cable	SGS	N/A	SEL0178	2014-05-29
5	Coaxial cable	SGS	N/A	SEL0179	2014-05-29
6	Barometer	ChangChun	DYM3	SEL0088	2014-05-24
7	Signal Generator	Rohde & Schwarz	SML03	SEL0068	2014-05-16
8	Band filter	amideon	82346	SEL0094	2014-05-16
9	POWER METER	R & S	NRVS	SEL0144	2013-10-24
10	Attenuator	Beijin feihang taida	TST-2-6dB	SEL0205	2014-05-16
11	Power Divider(splitter)	Agilent Technologies	11636B	SEL0130	2013-10-24

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

5 Test results and Measurement Data

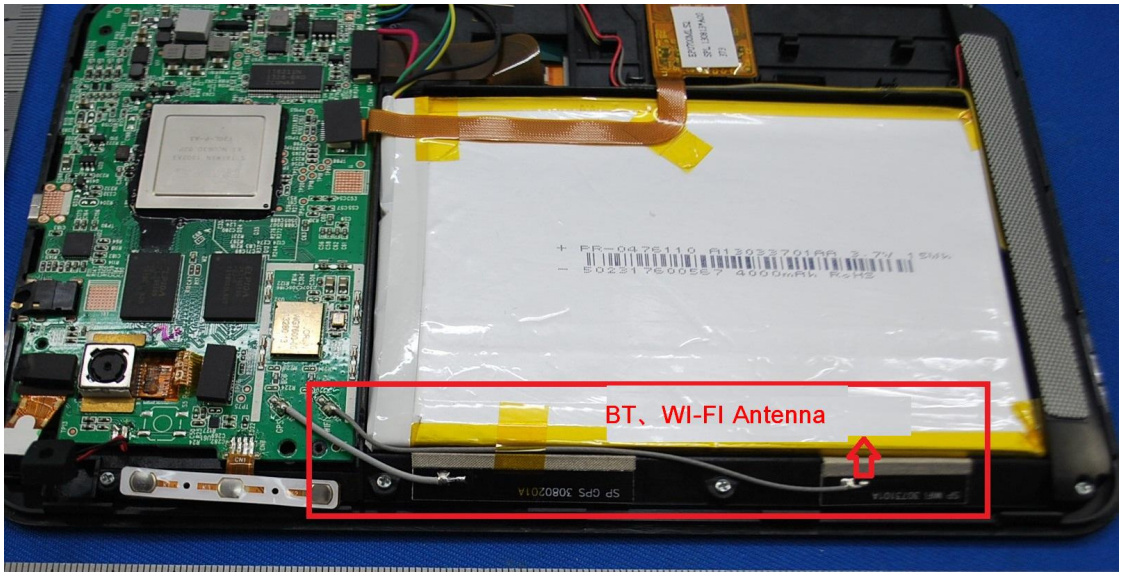
5.1 Antenna Requirement

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.
15.247(b) (4) requirement:
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

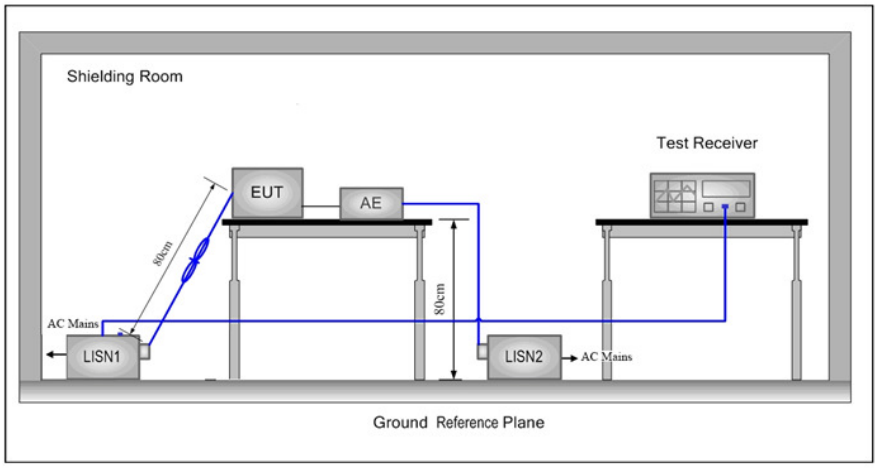
EUT Antenna:	

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 1.65dBi.



5.2 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:	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 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 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.

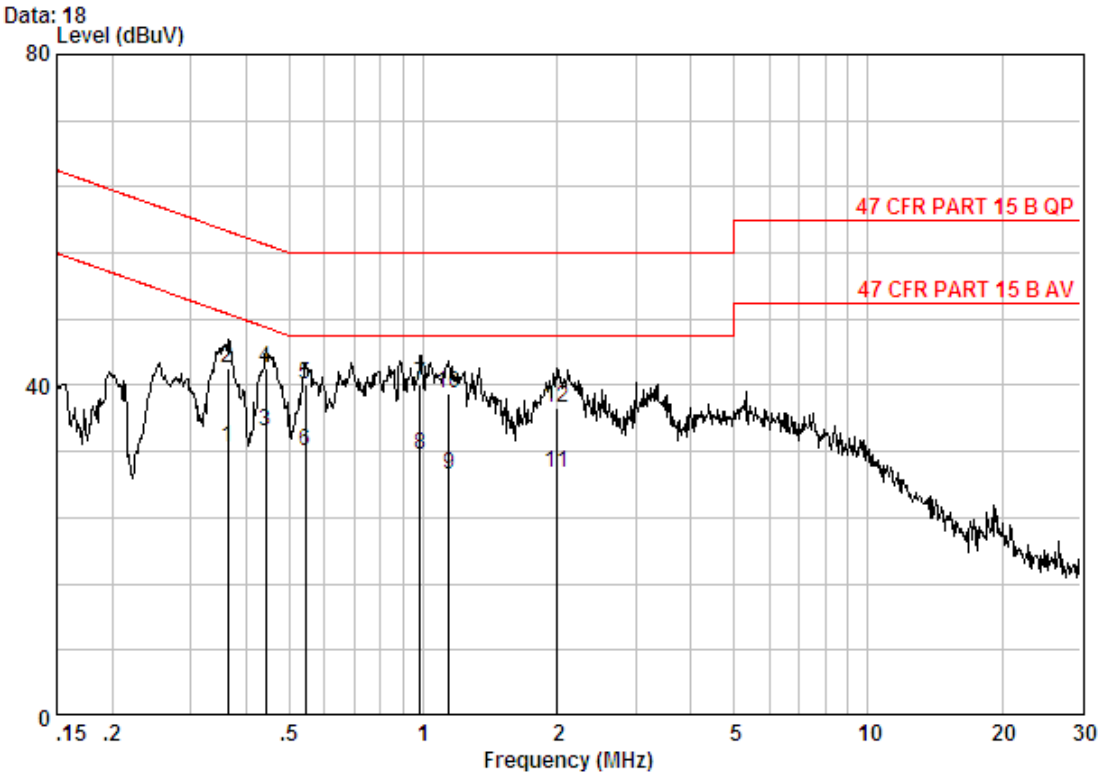
Test Setup:	
Test Mode:	AC Charge + Transmitting mode.
Instruments Used:	Refer to section 4.10 for details
Test Results:	Pass

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.

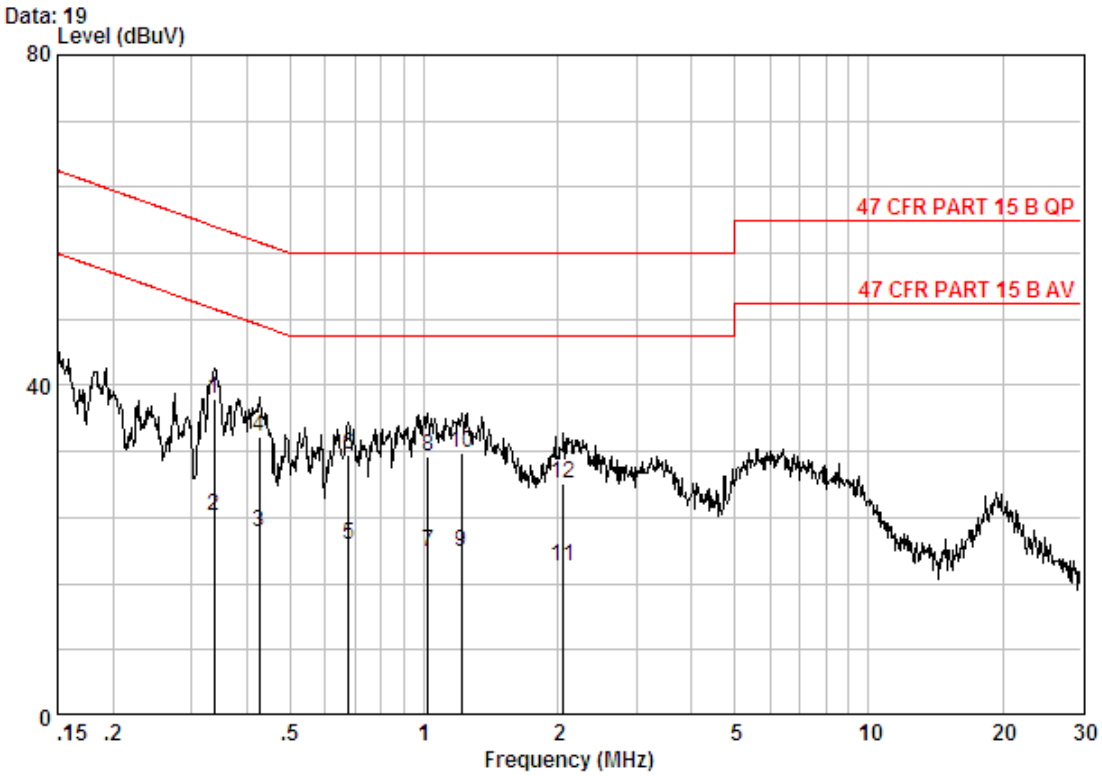
Live line:



Site : Shielding Room
Condition : 47 CFR PART 15 B QP CE LINE
Job No. : 4544RF
Mode : AC charge + TX

	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.36300	0.01	9.77	22.70	32.48	48.66	-16.18	Average
2	0.36300	0.01	9.77	32.20	41.98	58.66	-16.68	QP
3	0.44200	0.01	9.80	24.60	34.41	47.02	-12.61	Average
4	0.44200	0.01	9.80	32.30	42.11	57.02	-14.91	QP
5	0.54300	0.01	9.80	30.20	40.01	56.00	-15.99	QP
6	0.54300	0.01	9.80	22.30	32.11	46.00	-13.89	Average
7	0.98300	0.02	9.80	30.26	40.08	56.00	-15.92	QP
8	0.98300	0.02	9.80	21.81	31.63	46.00	-14.37	Average
9	1.141	0.02	9.80	19.30	29.12	46.00	-16.88	Average
10	1.141	0.02	9.80	29.20	39.02	56.00	-16.98	QP
11	2.001	0.02	9.80	19.60	29.42	46.00	-16.58	Average
12	2.001	0.02	9.80	27.40	37.22	56.00	-18.78	QP

Neutral line:



Site : Shielding Room
Condition : 47 CFR PART 15 B QP CE NEUTRAL
Job No. : 4544RF
Mode : AC charge + TX

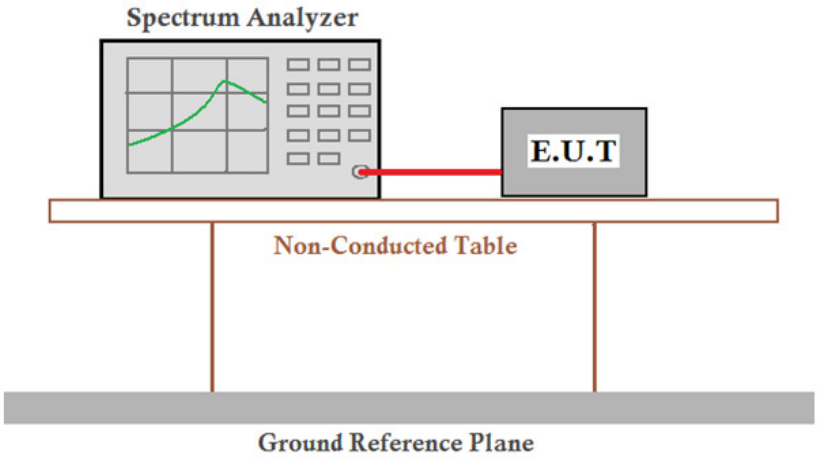
	Freq	Cable Loss	LISN Factor	Read Level	Level	Limit Line	Over Limit	Remark
	MHz	dB	dB	dBuV	dBuV	dBuV	dB	
1	0.33740	0.01	9.74	28.59	38.34	59.27	-20.92	QP
2	0.33740	0.01	9.74	14.38	24.13	49.27	-25.14	AVERAGE
3	0.42598	0.01	9.80	12.50	22.31	47.33	-25.02	AVERAGE
4	0.42598	0.01	9.80	23.95	33.76	57.33	-23.57	QP
5	0.67544	0.02	9.80	10.97	20.79	46.00	-25.21	AVERAGE
6	0.67544	0.02	9.80	21.89	31.71	56.00	-24.29	QP
7	1.021	0.02	9.80	9.98	19.80	46.00	-26.20	AVERAGE
8	1.021	0.02	9.80	21.49	31.31	56.00	-24.69	QP
9	1.216	0.02	9.80	10.11	19.93	46.00	-26.07	AVERAGE
10	1.216	0.02	9.80	22.09	31.91	56.00	-24.09	QP
11	2.055	0.02	9.80	8.17	17.99	46.00	-28.01	AVERAGE
12	2.055	0.02	9.80	18.28	28.10	56.00	-27.90	QP

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:

2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

5.3 Conducted Peak Output Power

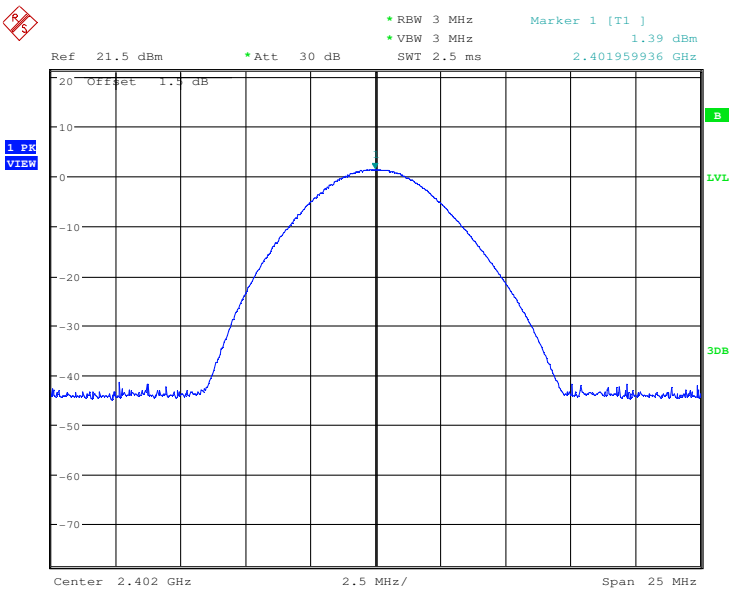
Test Requirement:	47 CFR Part 15C Section 15.247 (b)(1)
Test Method:	KDB558074D01v01r03
Test Setup:	 *Remark:* *Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.*
Limit:	30dBm
Test Mode:	Non-hopping transmitting with GFSK modulation
Instruments Used:	Refer to section 4.10 for details
Test Results:	Pass

Measurement Data

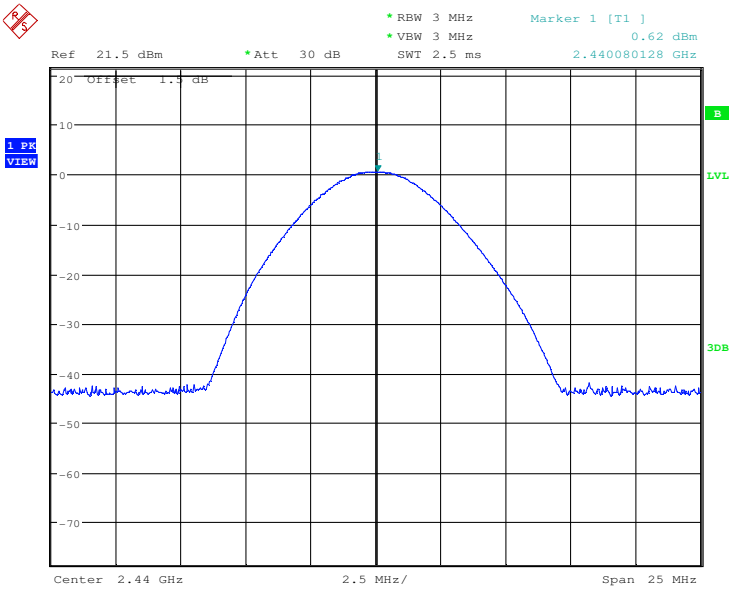
GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	1.39	30.00	Pass
Middle	0.62	30.00	Pass
Highest	0.33	30.00	Pass

Test plot as follows:

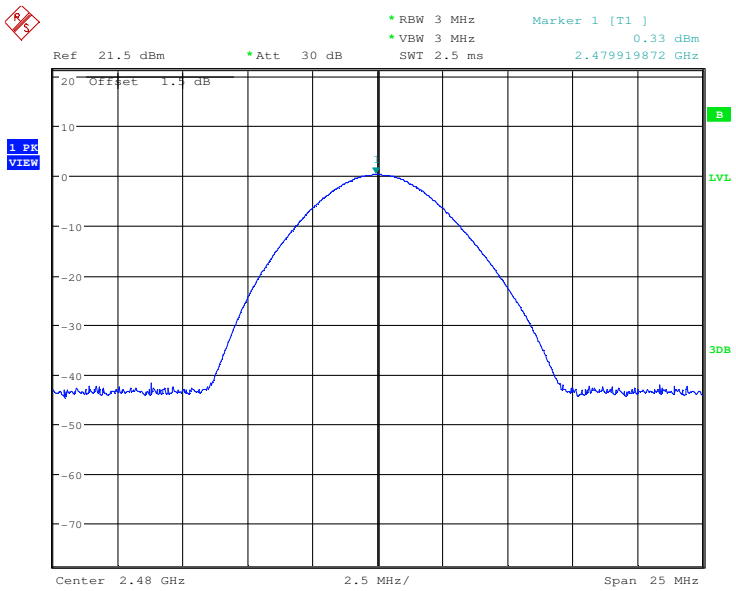
Test mode:	GFSK	Test channel:	Lowest



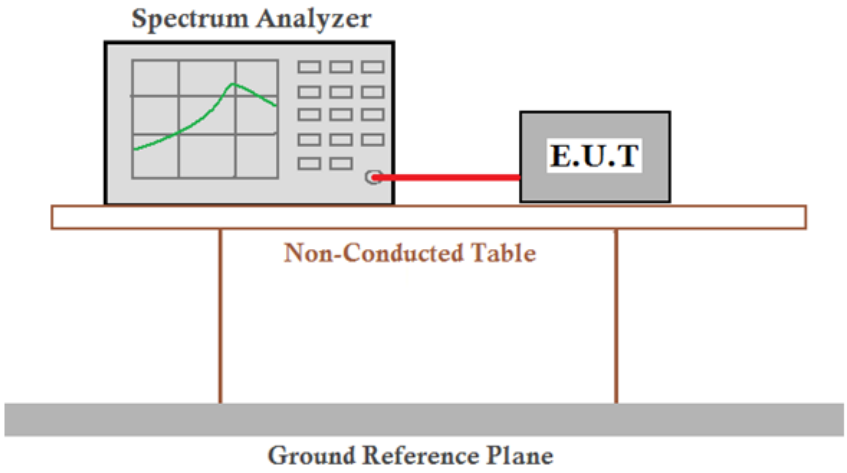
Test mode:	GFSK	Test channel:	Middle



Test mode:	GFSK	Test channel:	Highest



5.4 6dB Occupy Bandwidth

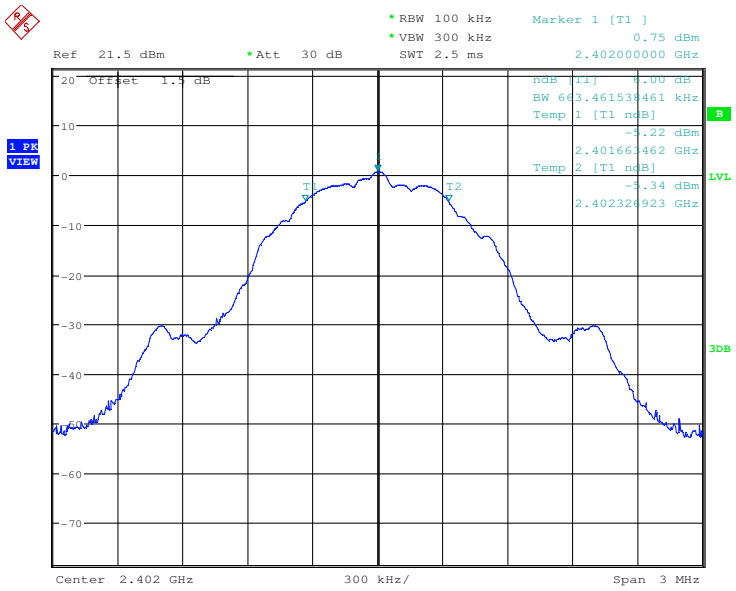
Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)
Test Method:	KDB558074D01v01r03
Test Setup:	
Limit:	≥ 500 kHz
Test Mode:	Non-hopping transmitting with GFSK modulation
Instruments Used:	Refer to section 4.10 for details
Test Results:	Pass

Measurement Data

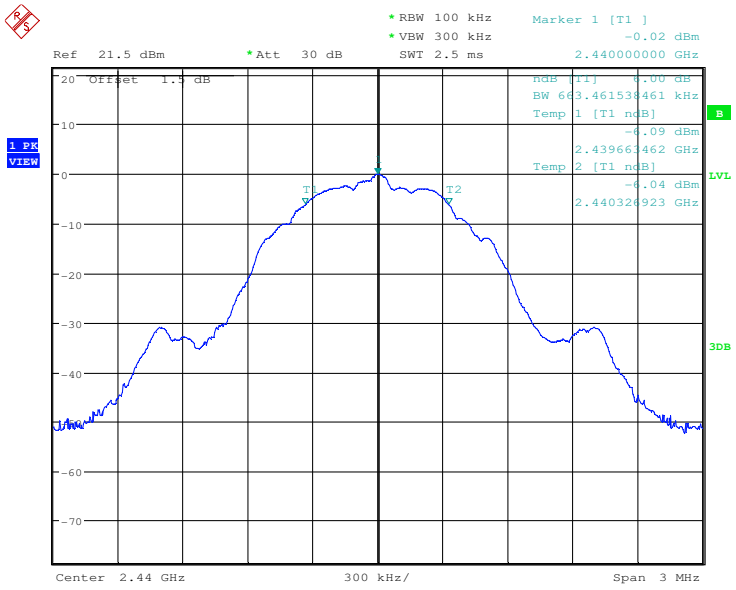
Test channel	6dB Occupy Bandwidth (MHz)	Limit (kHz)	Result
Lowest	0.663461538461	≥500	Pass
Middle	0.663461538461	≥500	Pass
Highest	0.668269230769	≥500	Pass

Test plot as follows:

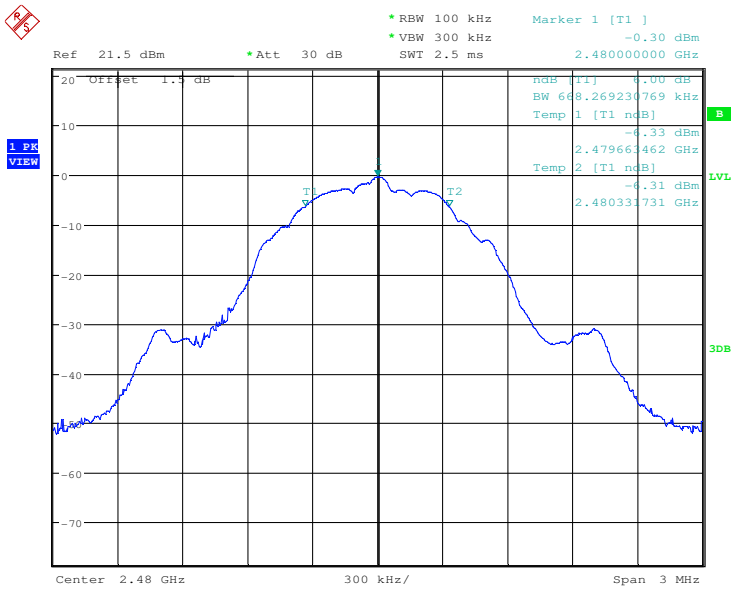
Test mode:	GFSK	Test channel:	Lowest



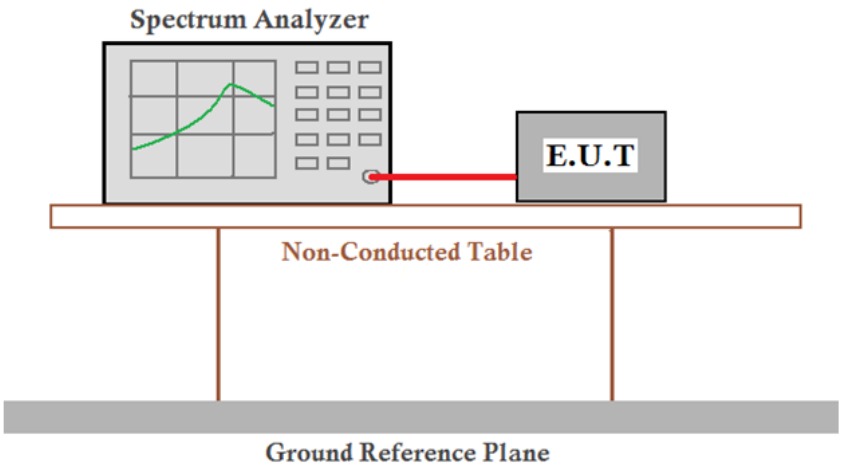
Test mode:	GFSK	Test channel:	Middle



Test mode:	GFSK	Test channel:	Highest



5.5 Power Spectral Density

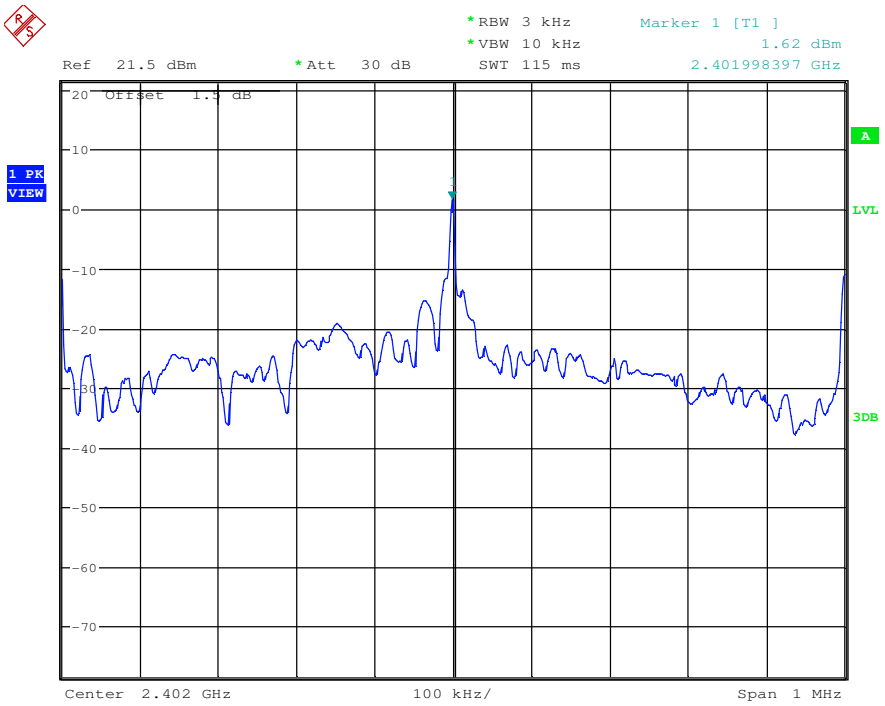
Test Requirement:	47 CFR Part 15C Section 15.247 (e)
Test Method:	KDB558074D01v01r03
Test Setup:	
Limit:	≤8.00 dBm/3kHz
Exploratory Test Mode:	Non-hopping transmitting with GFSK modulation
Instruments Used:	Refer to section 4.10 for details
Test Results:	Pass

Measurement Data

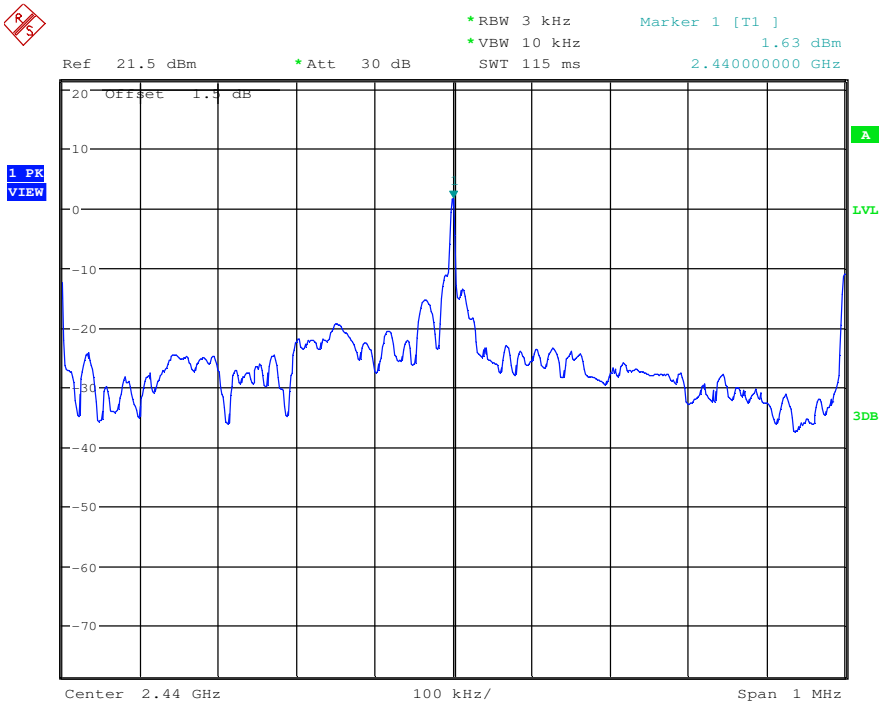
GFSK mode			
Test channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
Lowest	1.62	≤8.00	Pass
Middle	1.63	≤8.00	Pass
Highest	1.08	≤8.00	Pass

Test plot as follows:

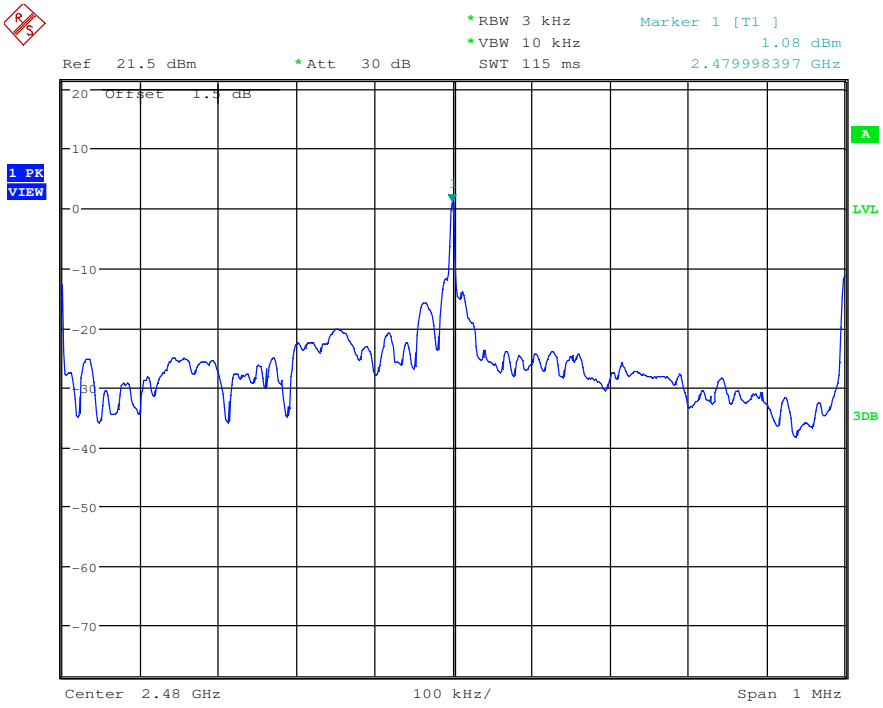
Test mode:	GFSK	Test channel:	Lowest



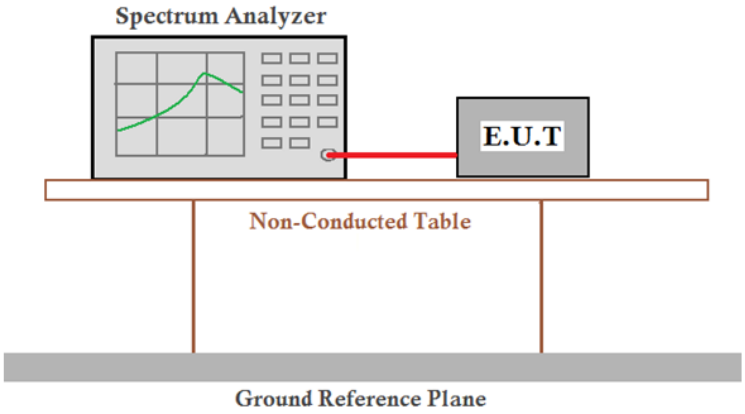
Test mode:	GFSK	Test channel:	Middle



Test mode:	GFSK	Test channel:	Highest

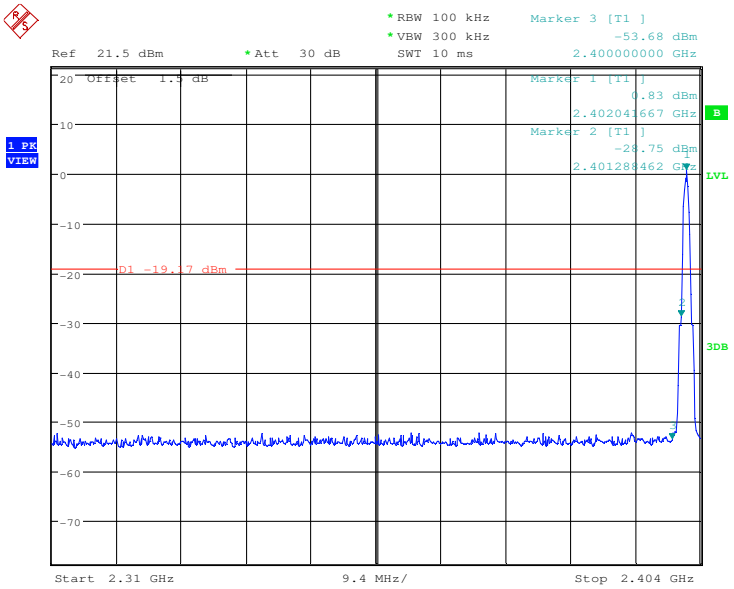


5.6 Band-edge for RF Conducted Emissions

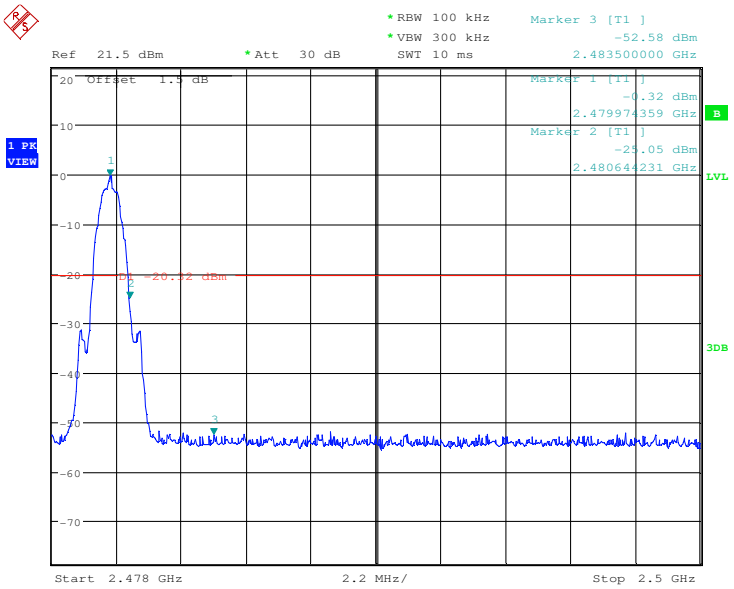
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	KDB558074D01v01r03
Test Setup:	 Remark: Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the 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:	Non-hopping and hopping transmitting with GFSK modulation
Instruments Used:	Refer to section 4.10 for details
Test Results:	Pass

Test plot as follows:

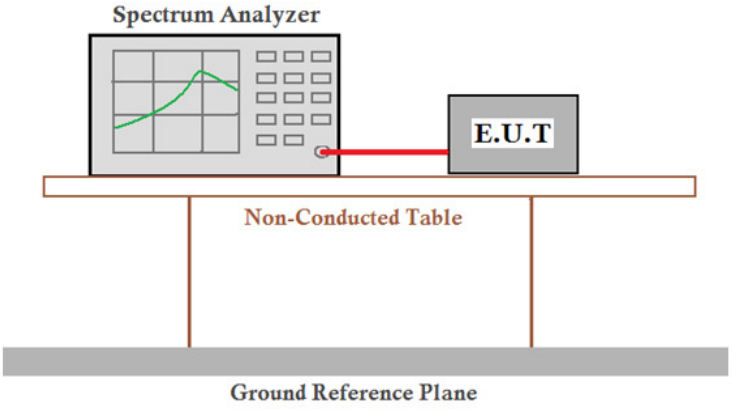
Test mode:	GFSK	Test channel:	Lowest



Test mode:	GFSK	Test channel:	Highest

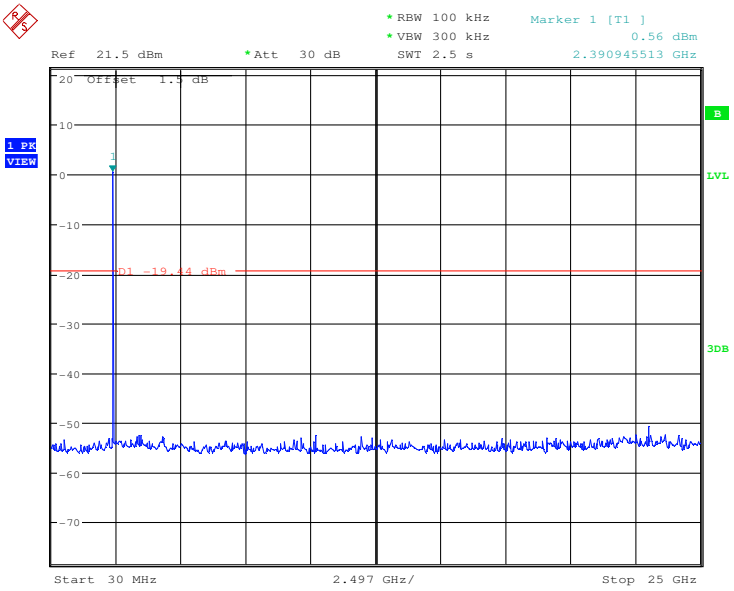


5.7 Spurious RF Conducted Emissions

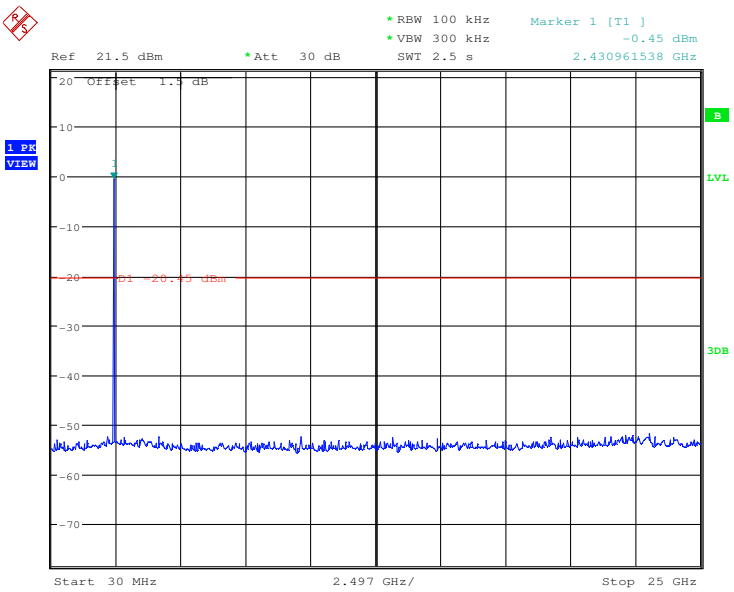
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	KDB558074D01v01r03
Test Setup:	 Remark: Offset the High-Frequency cable loss 1.5dB in the spectrum analyzer.
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the 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:	Non-hopping transmitting with GFSK modulation
Instruments Used:	Refer to section 4.10 for details
Test Results:	Pass

Test plot as follows:

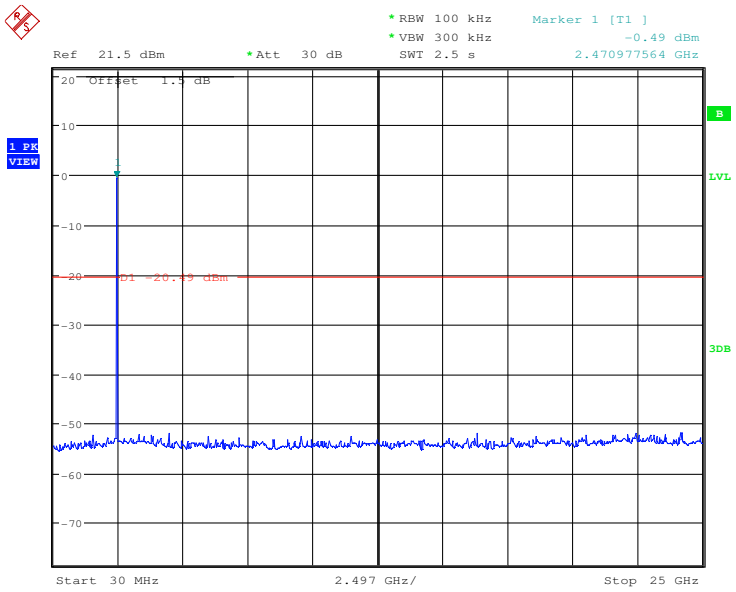
Test mode:	GFSK	Test channel:	Lowest



Test mode:	GFSK	Test channel:	Middle



Test mode:	GFSK	Test channel:	Highest



5.8 Pseudorandom Frequency Hopping Sequence

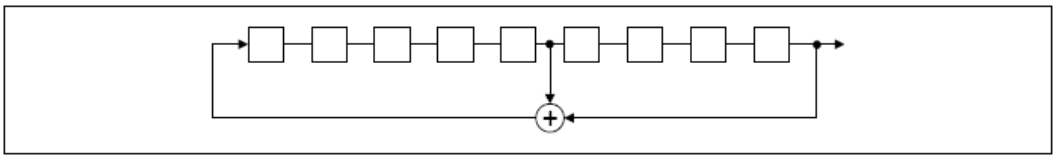
Test Requirement:	47 CFR Part 15**C Section 15.247 (a)(1) requirement:**

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

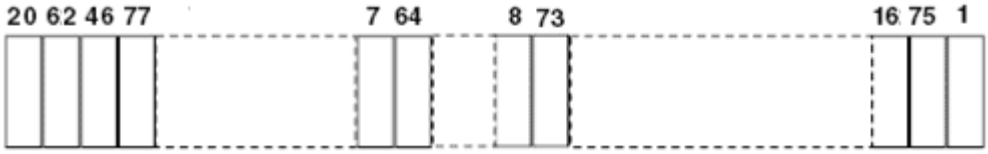
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized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

- Number of shift register stages: 9
- Length of pseudo-random sequence: 29 -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.

5.9 Radiated Spurious Emission

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:

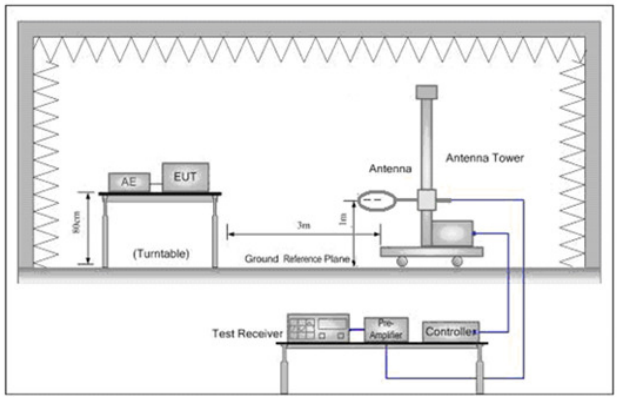


Figure 1. Below 30MHz

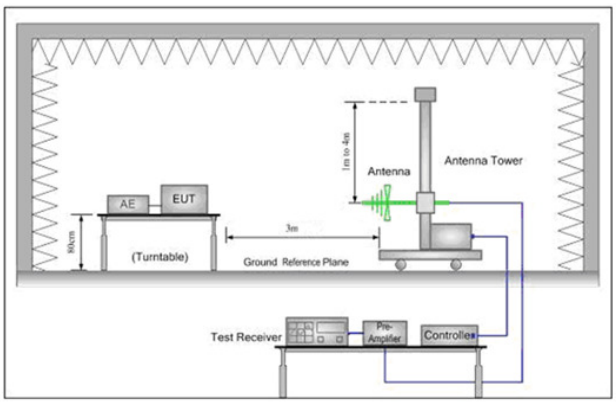


Figure 2. 30MHz to 1GHz

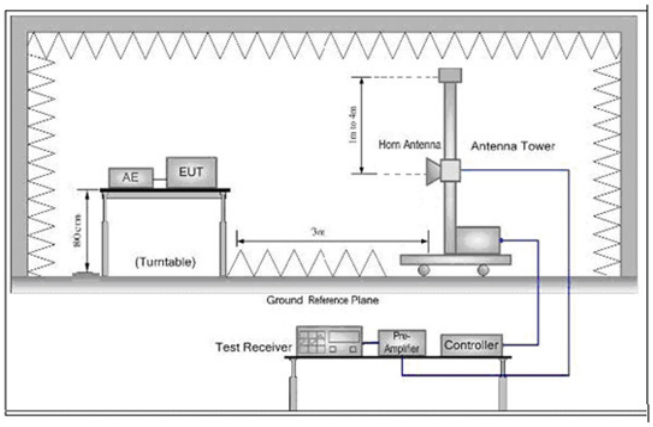
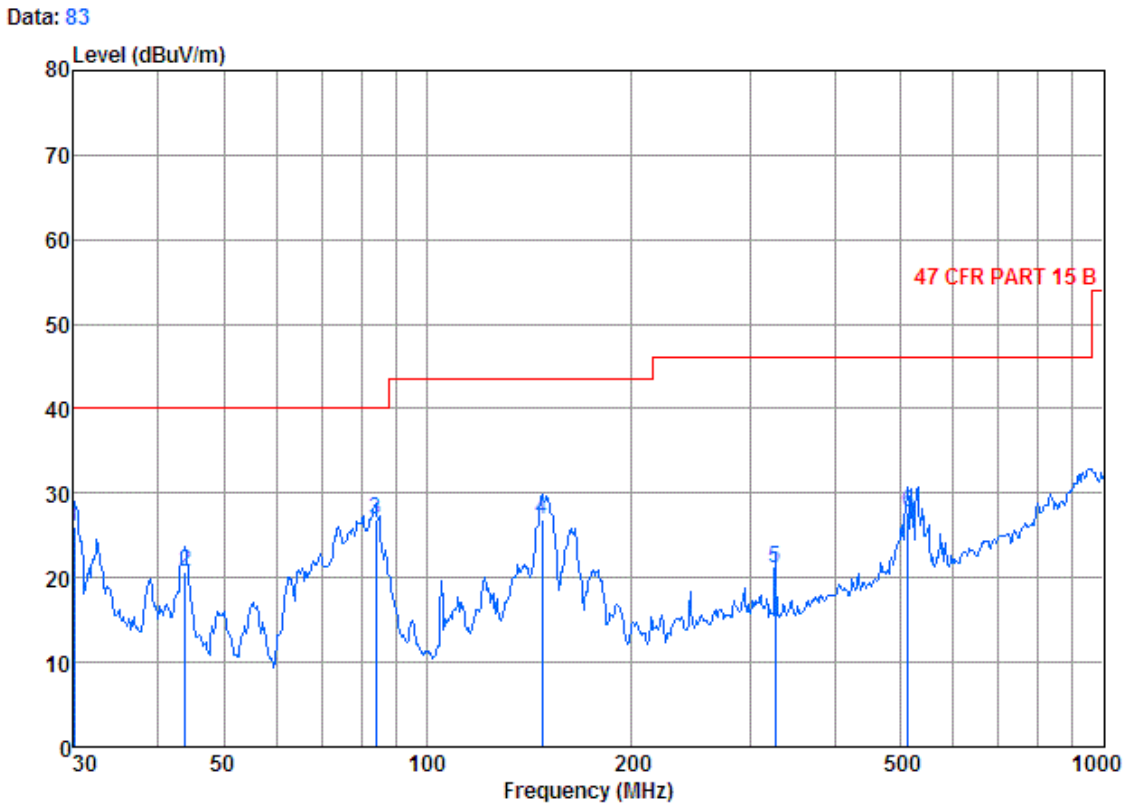


Figure 3. Above 1 GHz

Test Procedure:	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 (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. 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. g. Test the EUT in the lowest channel (2402MHz),the middle channel (2440MHz),the Highest channel (2480MHz) h. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report. i. Repeat above procedures until all frequencies measured was complete.
Test Mode:	Non-hopping transmitting mode with GFSK modulation
Instruments Used:	Refer to section 4.10 for details
Test Results:	Pass

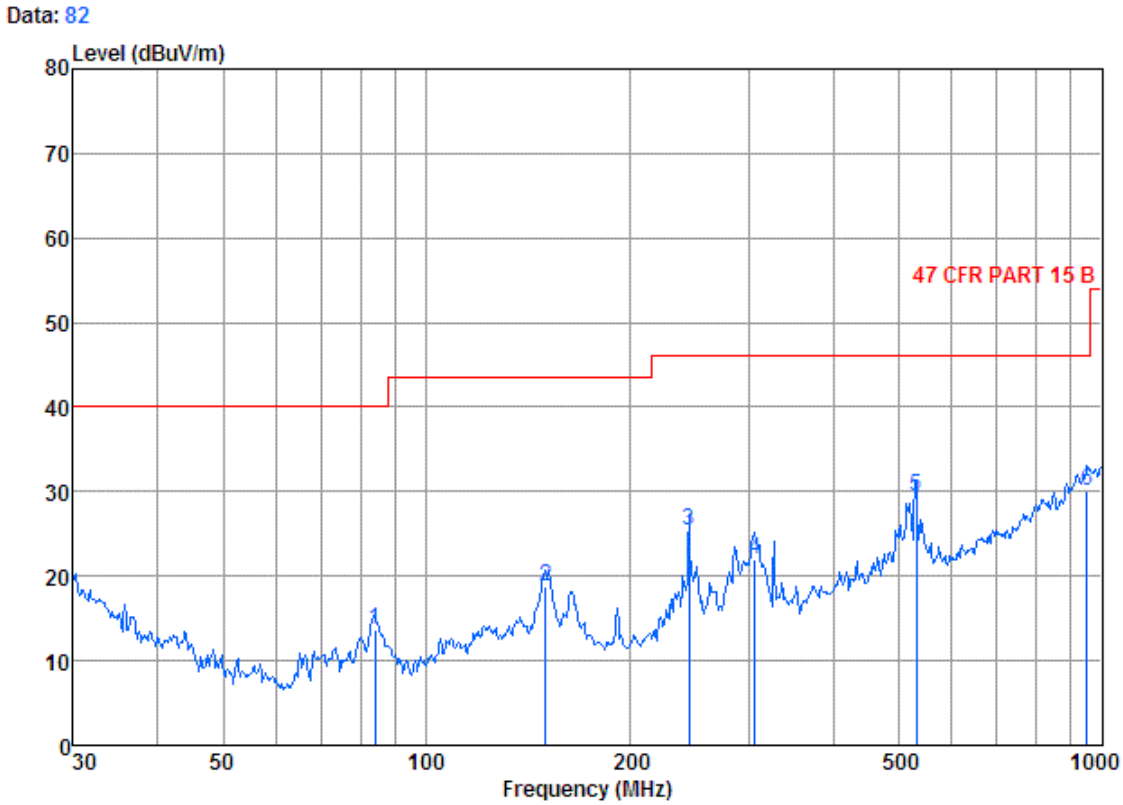
Radiated Emission below 1GHz		
30MHz~1GHz (QP)		
Test mode:	AC Charge + Transmitting	Vertical



Condition: 47 CFR PART 15 B 3m 3142C VERTICAL
Job No. : 4544RF
Test Mode: AC charge+TX

	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	30.00	0.60	17.90	27.36	34.79	25.93	40.00	-14.07
2	43.81	0.68	10.33	27.31	37.00	20.70	40.00	-19.30
3	83.82	1.10	5.74	27.22	47.21	26.83	40.00	-13.17
4	147.92	1.31	9.17	26.91	43.20	26.77	43.50	-16.73
5	326.74	1.99	10.18	26.60	35.48	21.05	46.00	-24.95
6	513.63	2.62	13.83	27.67	38.97	27.75	46.00	-18.25

Test mode:	AC Charge + Transmitting	Horizontal



Condition: 47 CFR PART 15 B 3m 3142C HORIZONTAL
Job No. : 4544RF
Test Mode: AC charge+TX

	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	83.82	1.10	5.74	27.22	34.01	13.63	40.00	-26.37
2	150.01	1.32	9.30	26.91	35.00	18.71	43.50	-24.79
3	245.09	1.65	8.00	26.55	42.18	25.28	46.00	-20.72
4	306.75	1.92	9.83	26.44	36.77	22.08	46.00	-23.92
5	531.96	2.63	14.30	27.65	40.16	29.44	46.00	-16.56
6	952.09	3.65	21.30	26.54	31.57	29.98	46.00	-16.02

Remark: The emission below 1G,Pretest the Low, Mid and High channels of GFSK,and then find the worst case is low channel of GFSK.Only the worst case was show in the test report.

Transmitter Emission above 1GHz								
Test mode:	GFSK	Test channel:	Lowest	Remark:	Peak			
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
3350.560	3.61	33.26	40.56	48.93	45.24	74	-28.76	Vertical
4804.000	4.69	34.70	41.63	52.36	50.12	74	-23.88	Vertical
6764.538	5.33	36.04	40.27	49.77	50.87	74	-23.13	Vertical
7206.000	5.77	35.88	39.87	49.78	51.56	74	-22.44	Vertical
9608.000	5.99	37.30	37.80	46.78	52.27	74	-21.73	Vertical
10944.090	6.21	38.48	37.84	46.89	53.74	74	-20.26	Vertical
3308.185	3.58	33.28	40.52	48.82	45.16	74	-28.84	Horizontal
4804.000	4.69	34.70	41.63	51.23	48.99	74	-25.01	Horizontal
6347.466	5.22	36.12	40.63	50.03	50.74	74	-23.26	Horizontal
7206.000	5.77	35.88	39.87	50.23	52.01	74	-21.99	Horizontal
9608.000	5.99	37.30	37.80	45.88	51.37	74	-22.63	Horizontal
10348.050	6.06	38.12	37.59	47.31	53.90	74	-20.10	Horizontal

Test mode:	GFSK	Test channel:	Middle	Remark:	Peak			
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
3376.244	3.64	33.25	40.58	49.21	45.52	74	-28.48	Vertical
4880.000	4.72	34.59	41.68	51.26	48.89	74	-25.11	Vertical
5532.263	4.96	34.96	41.32	50.35	48.95	74	-25.05	Vertical
7320.000	5.92	35.93	39.77	51.26	53.34	74	-20.66	Vertical
9760.000	5.98	37.46	37.66	45.48	51.26	74	-22.74	Vertical
11027.980	6.23	38.49	37.88	46.44	53.28	74	-20.72	Vertical
3625.669	3.84	33.34	40.76	48.98	45.40	74	-28.60	Horizontal
4880.000	4.72	34.59	41.68	51.89	49.52	74	-24.48	Horizontal
6816.394	5.35	35.99	40.22	50.33	51.45	74	-22.55	Horizontal
7320.000	5.92	35.93	39.77	49.86	52.21	74	-21.79	Horizontal
9760.000	5.98	37.46	37.66	46.08	51.86	74	-22.14	Horizontal
10560.940	6.11	38.32	37.68	46.84	53.59	74	-20.41	Horizontal

Test mode:		GFSK		Test channel:	Highest		Remark:	Peak
Frequency (MHz)	Cable Loss (dB)	Antenna Factor (dB/m)	Preamp Factor (dB)	Read Level (dBuV)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
3672.110	3.88	33.41	40.80	50.51	47.00	74	-27.00	Vertical
4960.000	4.76	34.46	41.74	53.44	50.92	74	-23.08	Vertical
6561.030	5.27	36.25	40.43	50.25	51.34	74	-22.66	Vertical
7440.000	6.04	35.98	39.67	50.16	52.51	74	-21.49	Vertical
9920.000	5.98	37.63	37.53	46.28	52.36	74	-21.64	Vertical
10587.850	6.12	38.33	37.69	46.78	53.54	74	-20.46	Vertical
3552.582	3.78	33.26	40.70	48.95	45.29	74	-28.71	Horizontal
4960.000	4.76	34.46	41.74	52.64	50.12	74	-23.88	Horizontal
6347.466	5.22	36.12	40.63	50.03	50.74	74	-23.26	Horizontal
7440.000	6.04	35.98	39.67	49.86	52.21	74	-21.79	Horizontal
9920.000	5.98	37.63	37.53	45.63	51.71	74	-22.29	Horizontal
11112.520	6.25	38.48	37.91	46.33	53.15	74	-20.85	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) The disturbance range 9kHz ~ 30MHz and 13GHz~25GHz was very low, the emissions more than 20dB below the limit, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed.
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.

5.10 Band edge (Radiated Emission)

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:

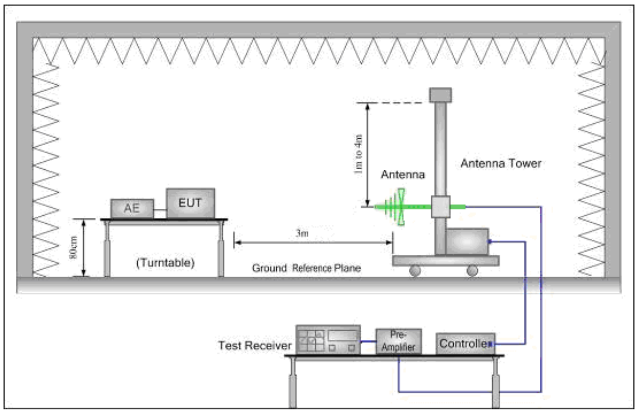


Figure 1. 30MHz to 1GHz

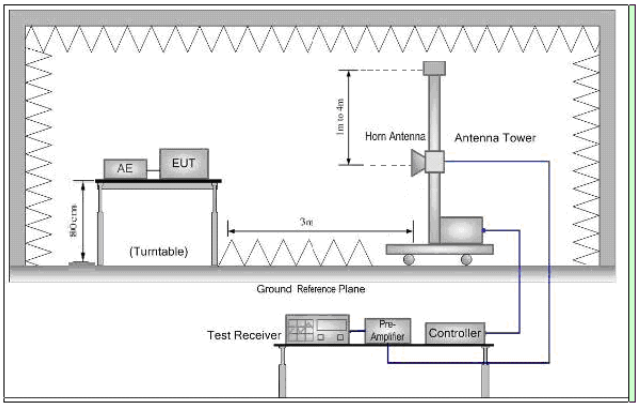


Figure 2. Above 1 GHz

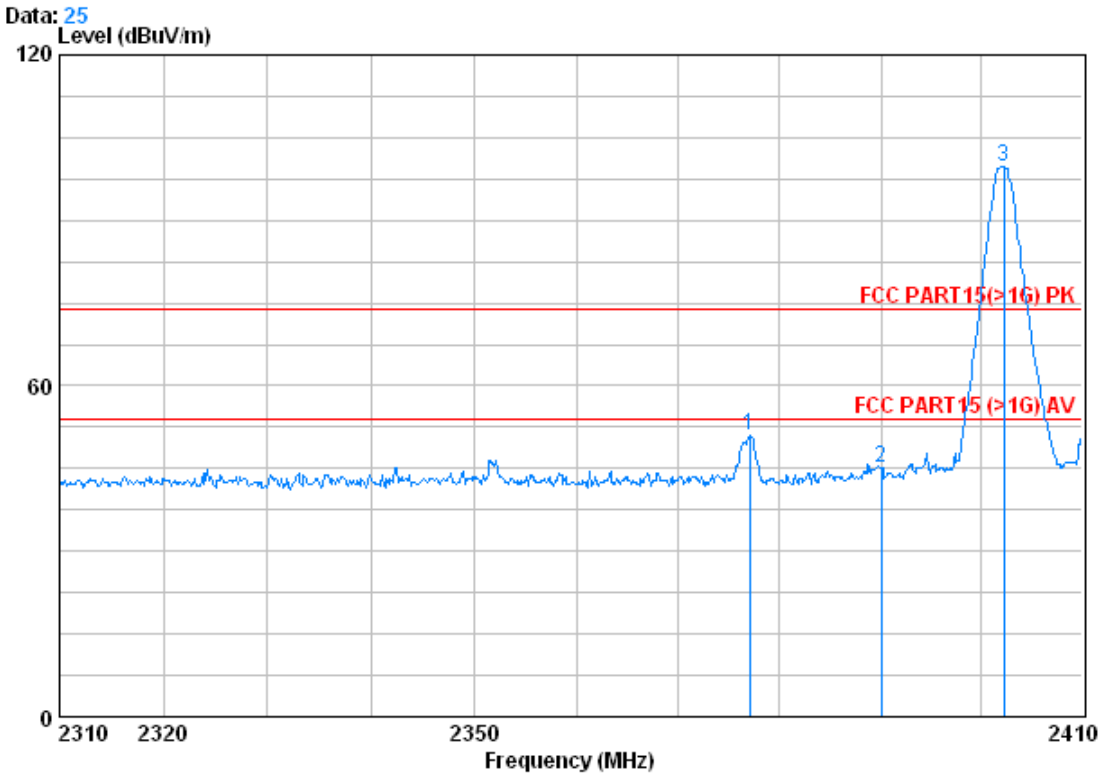
Test Procedure:

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. 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. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report. i. Repeat above procedures until all frequencies measured was complete.
Test Mode:	Non-hopping transmitting mode with GFSK modulation
Instruments Used:	Refer to section 4.10 for details
Test Results:	Pass

Test plot as follows:

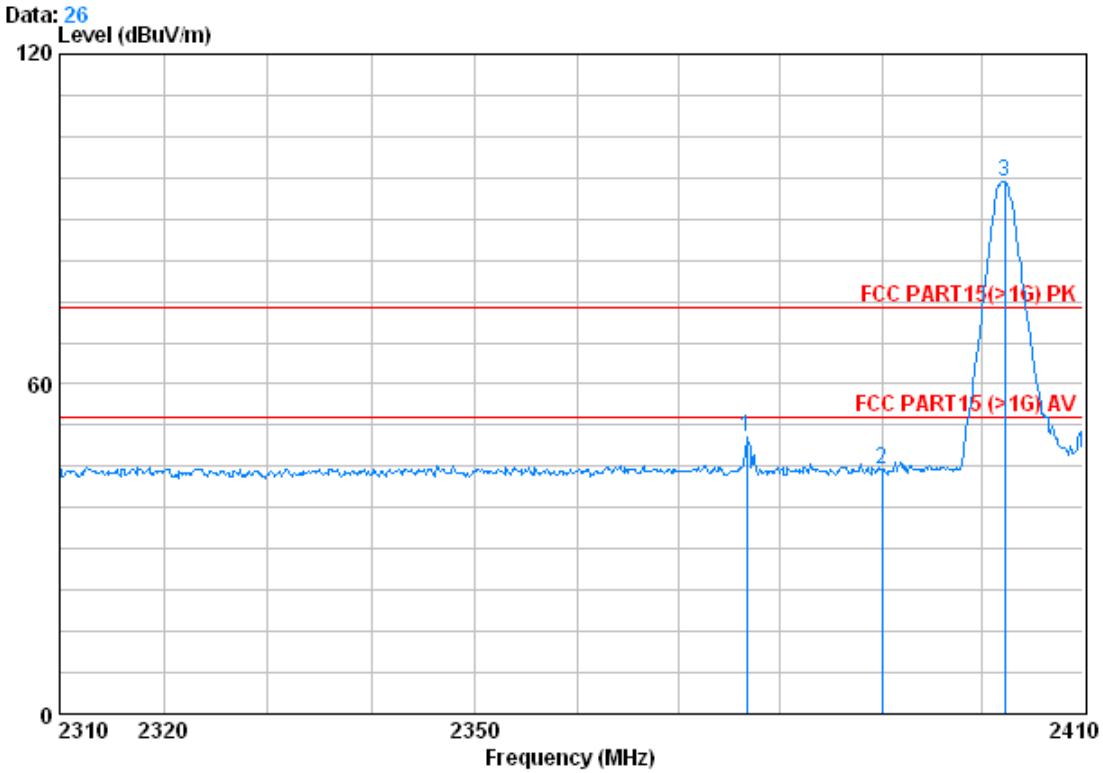
Band edge (Radiated Emission)						
Test mode:	GFSK	Test channel:	Lowest	Remark:	Peak	Vertical



Condition : FCC PART15(>1G) PK 3m HORIZONTAL
Job No. : 4544RF
Test mode : Bandedge 2402M
: BT4.0

	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	2377.000	2.98	32.48	39.84	55.50	51.13	74.00	-22.87
2	2390.000	2.98	32.51	39.85	49.44	45.08	74.00	-28.92
3 @	2402.200	2.98	32.51	39.86	104.00	99.63	74.00	25.63

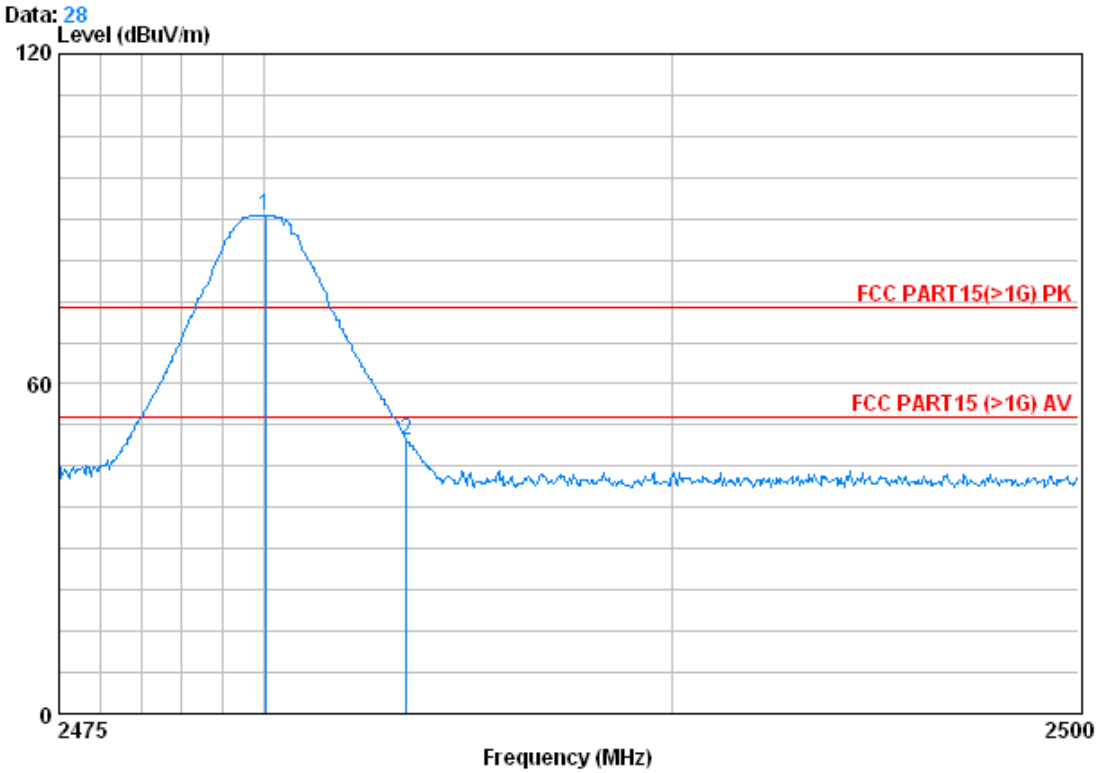
Test mode:	GFSK	Test channel:	Lowest	Remark:	Peak	Horizontal



Condition : FCC PART15(>1G) PK 3m VERTICAL
Job No. : 4544RF
Test mode : Bandedge 2402M
: BT4.0

	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	2376.700	2.98	32.48	39.84	54.79	50.41	74.00	-23.59
2	2390.000	2.98	32.51	39.85	48.78	44.43	74.00	-29.57
3 X	2402.200	2.98	32.51	39.86	101.06	96.69	74.00	22.69

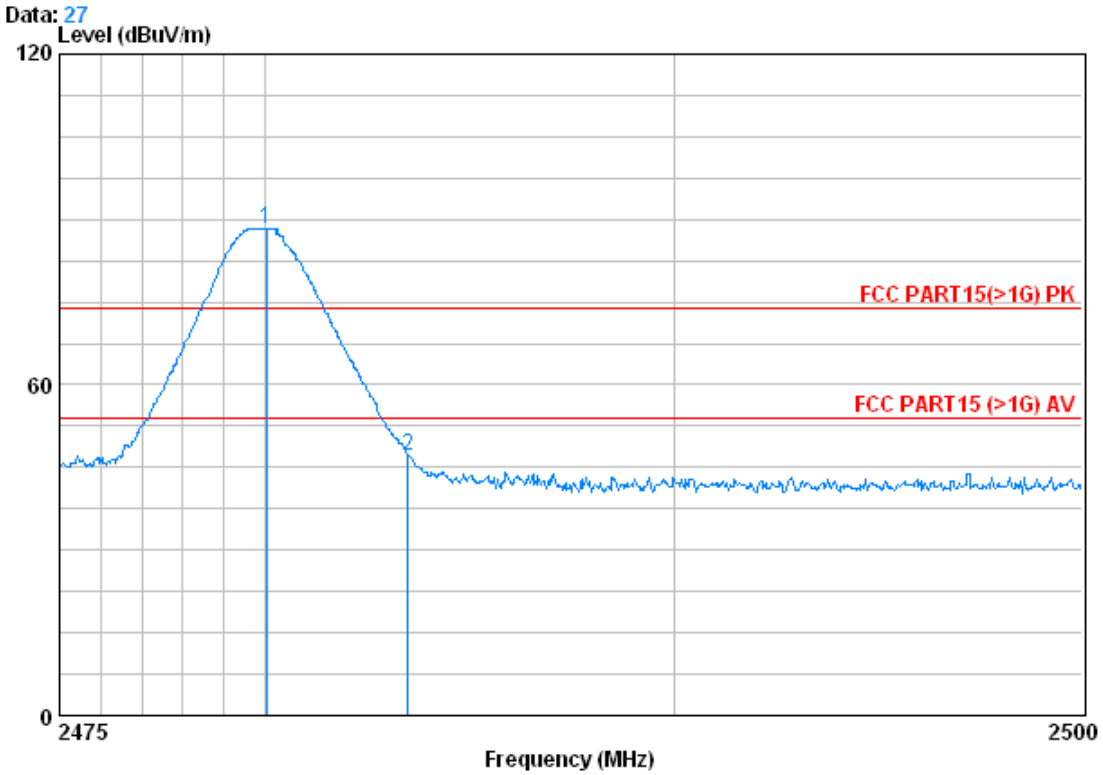
Test mode:	GFSK	Test channel:	Highest	Remark:	Peak	Vertical



Condition : FCC PART15(>1G) PK 3m VERTICAL
Job No. : 4544RF
Test mode : Bandedge 2480M
: BT4.0

	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	94.86	90.64	74.00	16.64
2	2483.500	3.03	32.67	39.92	53.95	49.73	74.00	-24.27

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



Condition : FCC PART15(>1G) PK 3m HORIZONTAL
Job No. : 4544RF
Test mode : Bandedge 2480M
: BT4.0

	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	92.58	88.36	74.00	14.36
2	2483.500	3.03	32.67	39.92	51.29	47.07	74.00	-26.93

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

Remark:

1) As shown in this section, 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.