

TEST REPORT

Applicant:	Gleen Company Limited
Address of Applicant:	Unit 1911, Block C, Wah Lok Ind. Ctr., 31-35 Shan Mei Street, Shatin, NT, HK.
Manufacturer:	Hopstech Industries LTD.
Address of Manufacturer:	Room 1411, Block A, 14/F, Hoi Luen Industrial Center, 55 Hoi Yuen Road, Kwun Tong, Kowloon, Hong Kong
Product name:	TR3TX Wetting pad transmitter, TR3TX Sensor pad transmitter
Model:	TR3TX NO (for TR3TX Wetting pad transmitter), TR3TX NC (for TR3TX Sensor pad transmitter)
Rating(s):	Input: DC 2x2477, 3V batteries
Trademark:	 
FCC register number :	935596
Standards:	FCC Part 15.247 :2017
FCC ID:	2AMMH24GPOMTX1
Data of Receipt:	2017-06-05
Date of Test:	2017-06-05~2017-06-26
Date of Issue:	2017-06-28
Test Result	Pass*

* In the configuration tested, the test item complied with the standards specified above.

Authorized for issue by:

Test by:

Jumy qiu

Reviewed by:

Pauler Li

Jun.28.2017 Jumy Qiu

Jun.28.2017

Pauler Li

Project Engineer

Project Engineer

Date

Name/Position

Signature

Date

Name/Position

Signature

Possible test case verdicts:

test case does not apply to the test object ...: N/A

test object does meet the requirement: P (Pass)

test object does not meet the requirement ...: F (Fail)

Testing Laboratory information:

Testing Laboratory Name: I-Test Laboratory

Address.....: 1-2 floor, South Block, Building A2 , No 3 Keyan Lu,
Science City, Guangzhou, Guangdong Province, P.R. China

Testing location : Same as above

Tel : 0086-20-32209330

Fax : 0086-20-62824387

E-mail : itl@i-testlab.com

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

This report would be invalid test report without all the signatures of testing technician and approver.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

Note:

TR3TX NO, TR3TX NC (NC is using the telephone socket, NO is using an audio socket).

The models TR3TX NO and TR3TX NC are identical to each other except for the model name, the telephone socket and the audio socket.

All tests were performed on the model TR3TX NO as representative.

1 Test Summary

Test	Test Requirement	Test method	Result
Antenna Requirement	FCC PART 15 C section 15.247 (c) and Section 15.203	FCC PART 15 C section 15.247 (c) and Section 15.203	PASS
Occupied Bandwidth	FCC PART 15 C section 15.247 (a)(1);	ANSI C63.10:2013 Clause 6.9	PASS
Carrier Frequencies Separated	FCC PART 15 C section 15.247(a)(1);	ANSI C63.10:2013	PASS
Hopping Channel Number	FCC PART 15 C section 15.247(a)(1)(iii)	ANSI C63.10:2013	PASS
Dwell Time	FCC PART 15 C section 15.247(a)(1)(iii);	ANSI C63.10:2013	PASS
Maximum Peak Output Power	FCC PART 15 C section 15.247(b)(1);	ANSI C63.10:2013 Clause 6.10	PASS
Conducted Spurious Emission (30 MHz to 25 GHz)	FCC PART 15 C section 15.247(d);	ANSI C63.10:2013 Clause 6.7	PASS
Radiated Spurious Emission (9 kHz to 25 GHz)	FCC PART 15 C section 15.247(d);	ANSI C63.10:2013 Clause 6.4,6.5 and 6.6	PASS
Band Edges Measurement	FCC PART 15 C section 15.247 (d) &15.205	ANSI C63.10:2013 Clause 6.9	PASS
Conducted Emissions at Mains Terminals	FCC PART 15 C section 15.207;	ANSI C63.10:2013 Clause 6.2	N/A
Remark: N/A: not applicable. Refer to the relative section for the details. EUT: In this whole report EUT means Equipment Under Test. Tx: In this whole report Tx (or tx) means Transmitter. Rx: In this whole report Rx (or rx) means Receiver. RF: In this whole report RF means Radio Frequency. ANSI C63.10:2013 the detail version is ANSI C63.10:2013 in the whole report. DA 00-705: "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"			

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3 General Information

3.1 Client Information

Applicant: Gleen Company Limited
 Address of Applicant: Unit 1911, Block C, Wah Lok Ind. Ctr., 31-35 Shan Mei Street, Shatin, NT, HK.

3.2 General Description of E.U.T.

Name: TR3TX Wetting pad transmitter

Model No.: TR3TX NO

Trade Mark:



Operating Frequency: 2405 MHz to 2478 MHz
 31 channels as below

Channels:

channel	Frequency	channel	Frequency
1	2405	17	2442
2	2406	18	2443
3	2407	19	2444
4	2408	20	2445
5	2409	21	2468
6	2410	22	2469
7	2411	23	2470
8	2412	24	2471
9	2434	25	2472
10	2435	26	2473
11	2436	27	2474
12	2437	28	2475
13	2438	29	2476
14	2439	30	2477
15	2440	31	2478
16	2441		

Type of Modulation: GFSK

Antenna Type: 2.4G Built-in nickel-plated brass antenna

3.3 Details of E.U.T.

EUT Power Supply: Input: DC 2x2477, 3V batteries

Test mode: The program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel lowest (2405MHz), middle (2445MHz) and highest (2478MHz) are chosen for full testing.

Power cord: /

3.4 Description of Support Units

The EUT has been tested as an independent unit for fixed frequency by testing lab.

3.5 Test Location

All tests were performed at:

I-Test Laboratory

1-2 floor, South Block, Building A2 , No 3 Keyan Lu, Science City, Guangzhou, Guangdong Province, P.R. China

0086-20-32209330

itl@i-testlab.com

No tests were sub-contracted.

3.6 Deviation from Standards

Biconical and log periodic antennas were used instead of dipole antennas.

3.7 Abnormalities from Standard Conditions

None.

3.8 Other Information Requested by the Customer

None.

3.9 Test Facility

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

- CNAS(Lab code:L4957)
- FCC (Registration No.:935596)
- IC (Registration NO.:8368A)

3.10 Measurement Uncertainty

The below measurement uncertainties given below are based on a 95% confidence level (base on a coverage factor (k=2).)

Parameter	Uncertainty
Radio frequency	$\pm 1.06 \times 10^{-7}$
total RF power, conducted	1.37 dB
RF power density , conducted	2.89 dB
All emissions, radiated	± 3.35 dB
Temperature	± 0.23 °C
Humidity	± 0.3 %
DC and low frequency voltages	± 0.3 %

4 Instruments Used during Test

No.	Test Equipment	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
ITL-114	Spectrum Analyzer	Agilent	N9010A	MY51250936	2017/01/20	2018/01/20
ITL-154	EMI test receiver 9kHz to 26.5GHz	R&S	ESR26	101257	2017/01/20	2018/01/20
ITL-116	Pre Amplifier	HP	8447F	3113A05905	2017/01/20	2018/01/20
ITL-117	Wideband Amplifier Super Ultra	Mini-circuits	ZVA-183- S+	469101134	2017/01/20	2018/01/20
ITL-105	Biconilog Antenna	ETS•Lindgren	3142D	00108096	2015/01/24	2018/01/24
ITL-110	Horn Antenna	A-INFOMW	JXTXLB- 10180-N	J2031090612 133	2015/01/24	2018/01/24
ITL-102	EMI Test receiver	R&S	ESCI	100910	2017/06/15	2018/06/15
ITL-103	Two-line v- network	R&S	ENV216	100120	2017/06/15	2018/06/15
ITL-115	50Ω Coaxial Cable	Mini-circuits	CBL	C001	2017/06/15	2018/06/15
ITL-100	Semi-Anechoic chamber	ETS•Lindgren	FACT3 2.0	CT09015	2016/11/02	2019/11/02
ITL-145	Loop Antenna	ZHINAN	ZN30900 A	002489	2017/01/20	2018/01/20
ITL-146	Horn Antenna	Schwarzbeck	BBHA 9170	B09806543	2017/06/15	2018/06/15
ITL-101	Shielded Room	ETS•Lindgren	8*4*3	CT09010	2015/03/09	2018/03/09

5 Test Results

5.1 E.U.T. test conditions

Test Voltage: 120V 60Hz

Temperature: 20.0 -25.0 °C

Humidity: 38-50 % RH

Atmospheric Pressure: 1000 -1010 mbar

Test frequencies and frequency range: According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

According to the 15.33 (a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which	Number of	Location in frequency range
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Frequency range of radiated emission measurements

Lowest frequency generated	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz,
At or above 10 GHz to below	5th harmonic of highest fundamental frequency or to 100 GHz,
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz,

EUT channels and frequencies list:

channel	Frequency	channel	Frequency
1	2405	17	2442
2	2406	18	2443
3	2407	19	2444
4	2408	20	2445
5	2409	21	2468
6	2410	22	2469
7	2411	23	2470
8	2412	24	2471
9	2434	25	2472
10	2435	26	2473
11	2436	27	2474
12	2437	28	2475
13	2438	29	2476
14	2439	30	2477
15	2440	31	2478
16	2441		

Test frequencies are the lowest channel: 1 channel (2405 MHz), middle channel: 20 channel (2445 MHz) and highest channel: 31 channel (2478 MHz)

5.2 Antenna requirement

Standard requirement

15.203 requirement:

For intentional device. According to 15.203. 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.

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

(i) Systems operating in the 2400-2483.5 MHz bands that are used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi 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 6 dBi.

EUT Antenna

The antenna is a 2.4G Built-in nickel-plated brass antenna and no consideration of replacement. The best case gain of the antenna is 2dBi.

Test result: The unit does meet the FCC requirements.

5.3 Occupied Bandwidth

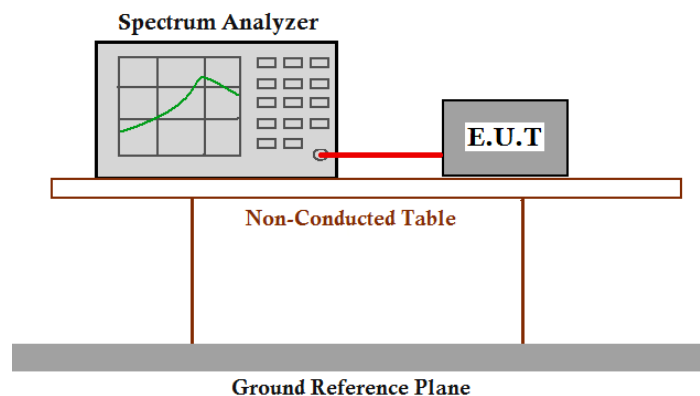
Test Requirement: FCC Part 15 C section 15.247

(a)(1) 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.

Test Method: ANSI C63.10:2013 Clause 6.9

Test Status: The program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel lowest (2405MHz), middle (2445MHz) and highest (2478MHz) are chosen for full testing.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: Span = approximately 2 to 3 times the 20dB bandwidth, centring on a hopping channel;
3. Set the spectrum analyzer: RBW $\geq$ 1% of the 20dB bandwidth VBW $\geq$ RBW. Sweep = auto; Detector Function = Peak. Trace = Max Hold.
4. Mark the peak frequency and -20dB points bandwidth.

Test result (-20dB bandwidth)

Test Channel	Bandwidth(MHz)	2/3 bandwidth(MHz)
Lowest	1.342	0.895
Middle	1.463	0.975
Highest	1.454	0.969

Result plot as follows:

Lowest Channel:



Middle Channel:



Highest Channel:



5.4 Carrier Frequencies Separated

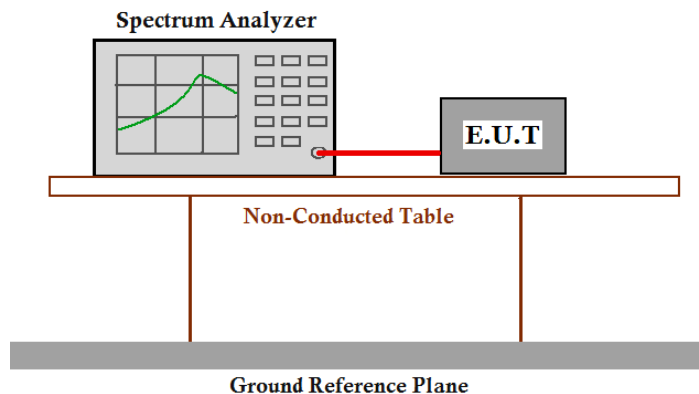
Test Requirement: FCC Part 15 C section 15.247

(a),(1) 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.

Test Method: ANSI C63.10:2013

Test Status: The program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel lowest (2405MHz), middle (2445MHz) and highest (2478MHz) are chosen for full testing.

Test Configuration:



Test Procedure:

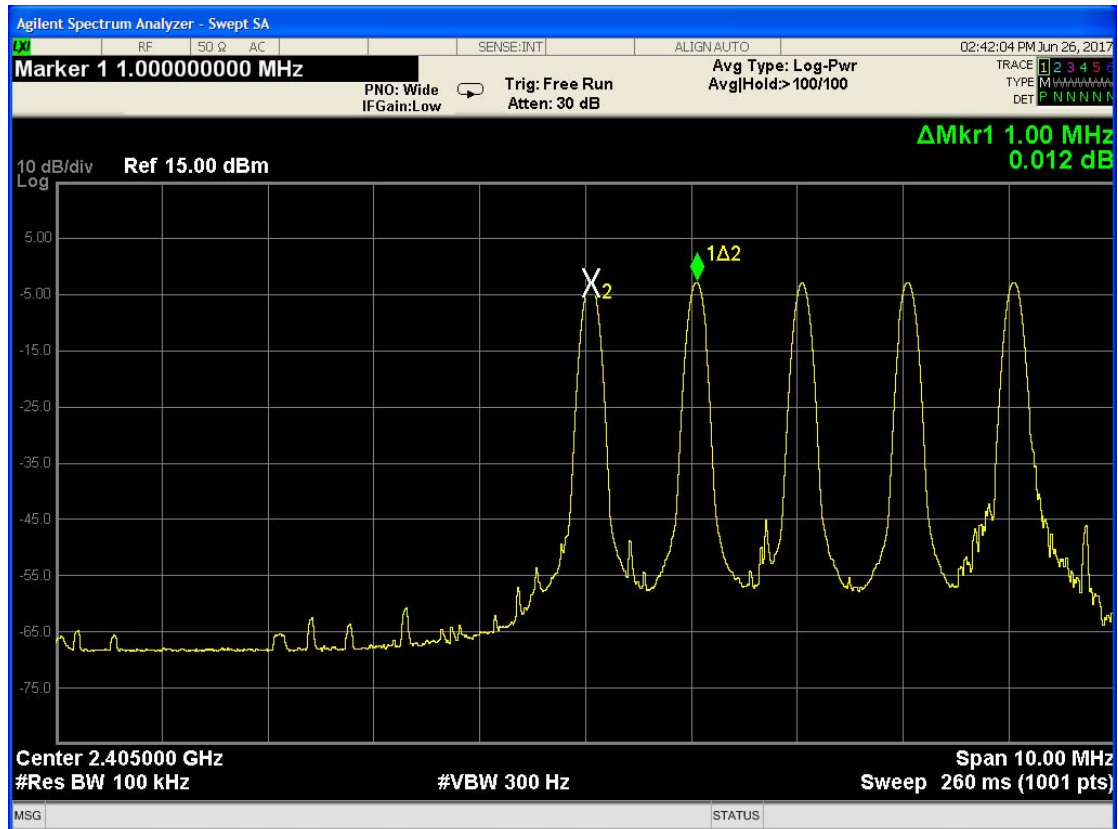
1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW $\geq$ 1% of the span, VBW $\geq$ RBW, Sweep = auto; Detector Function = Peak. Trace = Max, hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

Test result:

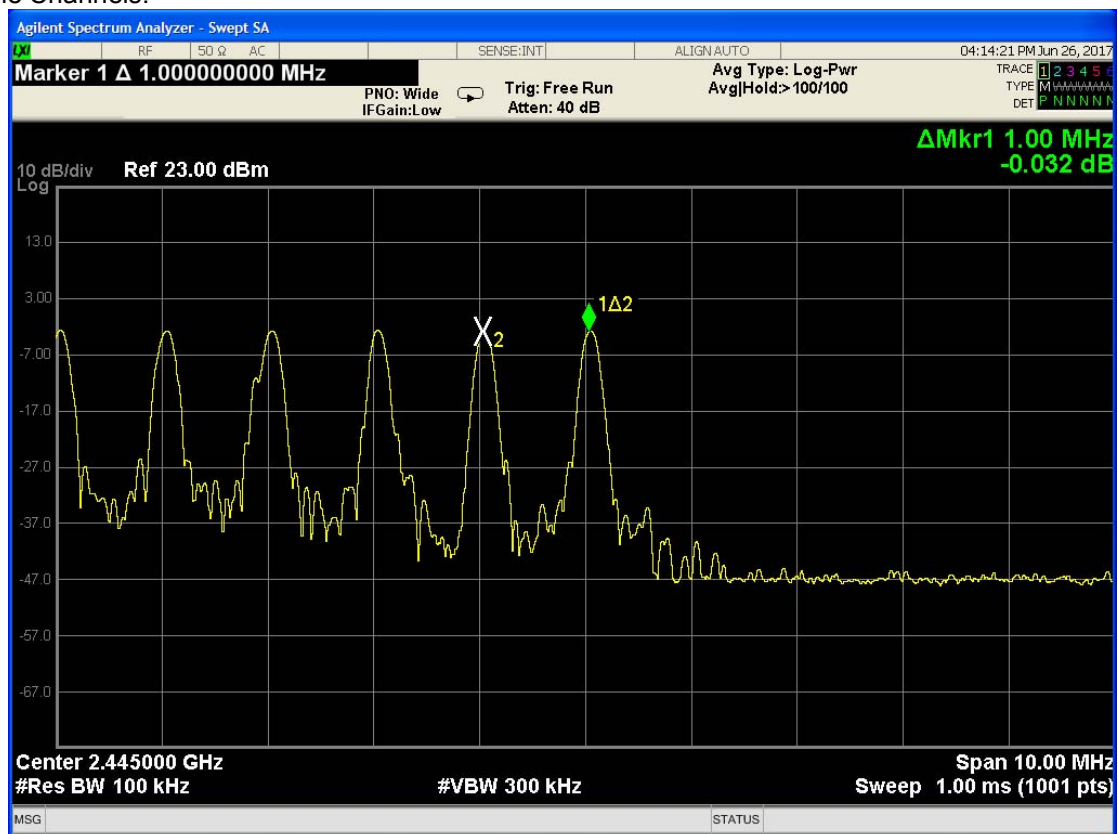
Test Channel	Carrier Frequencies Separated	Pass/Fail
Lower Channels (channel 1 and channel 2)	1.00MHz	Pass
Middle Channels (channel 19 and channel 20)	1.00MHz	Pass
Upper Channels (channel 30 and channel 31)	1.00MHz	Pass
Remark: The limit is maximum two-thirds of the 20 dB bandwidth: 0.975 MHz		

Carrier Frequencies Separated plot:

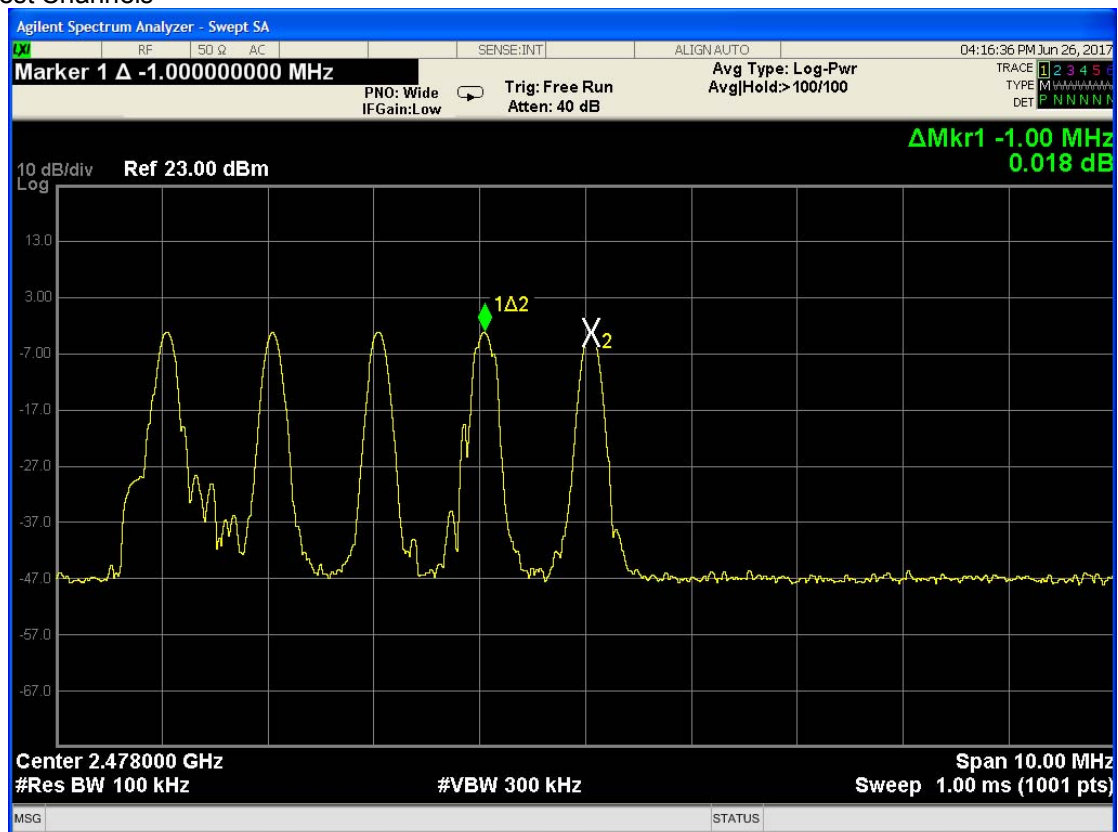
1. Lowest Channels:



2. Middle Channels:



3. Highest Channels



5.5 Hopping Channel Number

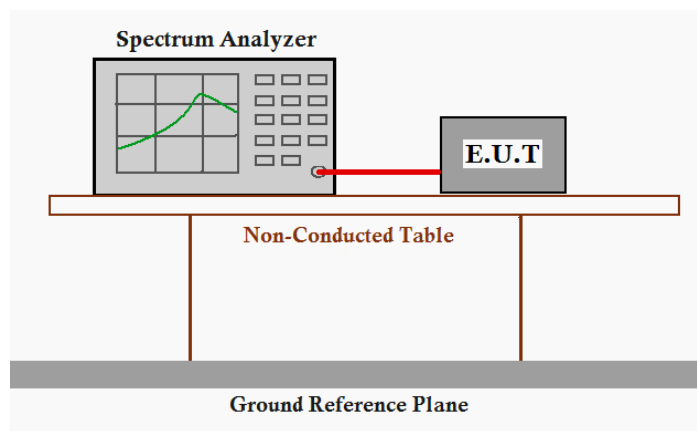
Test Requirement: FCC Part15 C section 15.247

(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

Test Method: ANSI C63.10:2013

Test Status: The program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel lowest (2405MHz), middle (2445MHz) and highest (2478MHz) are chosen for full testing.

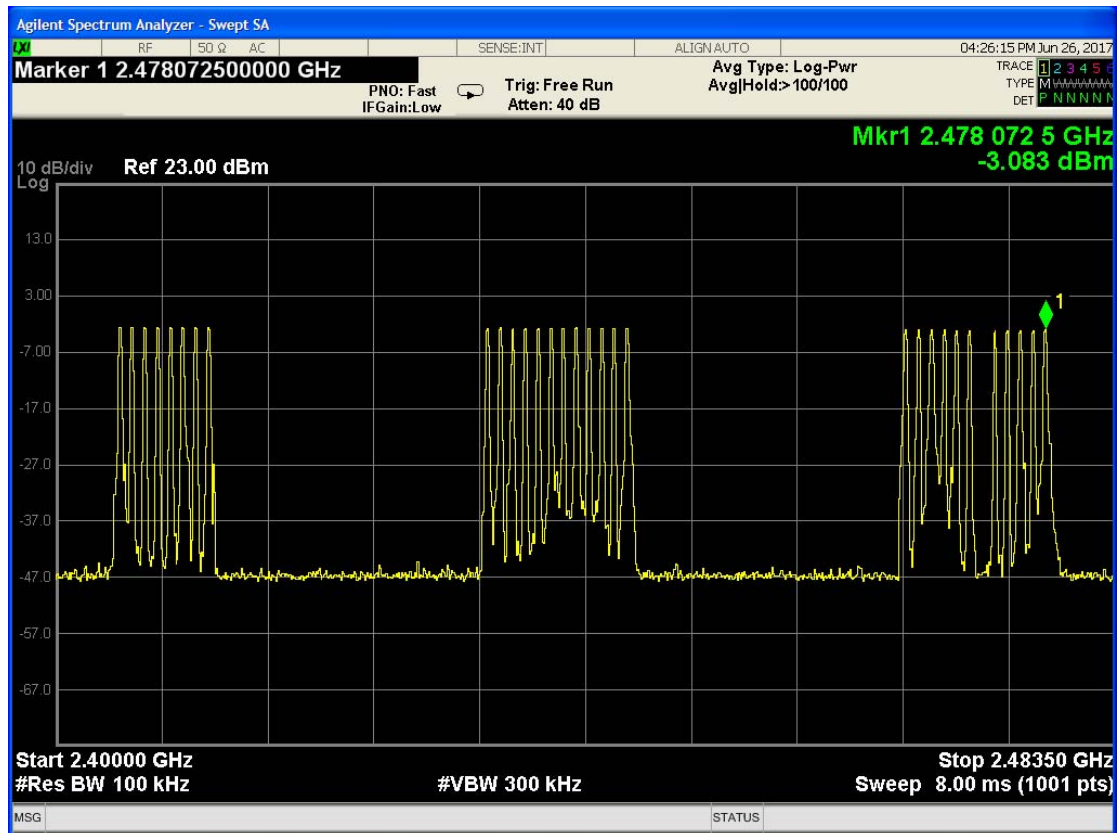
Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100 kHz. VBW = 300 kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: start frequency = 2400 MHz. stop frequency = 2483.5 MHz. Submit the test result graph.

Test result: Total channels are 31 channels.



Test result: The unit does meet the FCC requirements.

5.6 Dwell Time

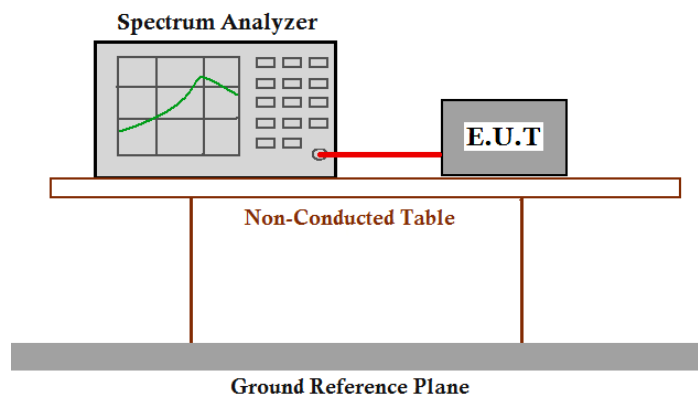
Test Requirement: FCC Part 15 C section 15.247

(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Method: ANSI C63.10:2013

Test Status: The program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel lowest (2405MHz), middle (2445MHz) and highest (2478MHz) are chosen for full testing.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. centered on a hopping channel;
3. Set RBW = 1 MHz and VBW = 3 MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Detector Function = Peak. Trace = View;
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). Repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s). An oscilloscope may be used instead of a spectrum analyzer.

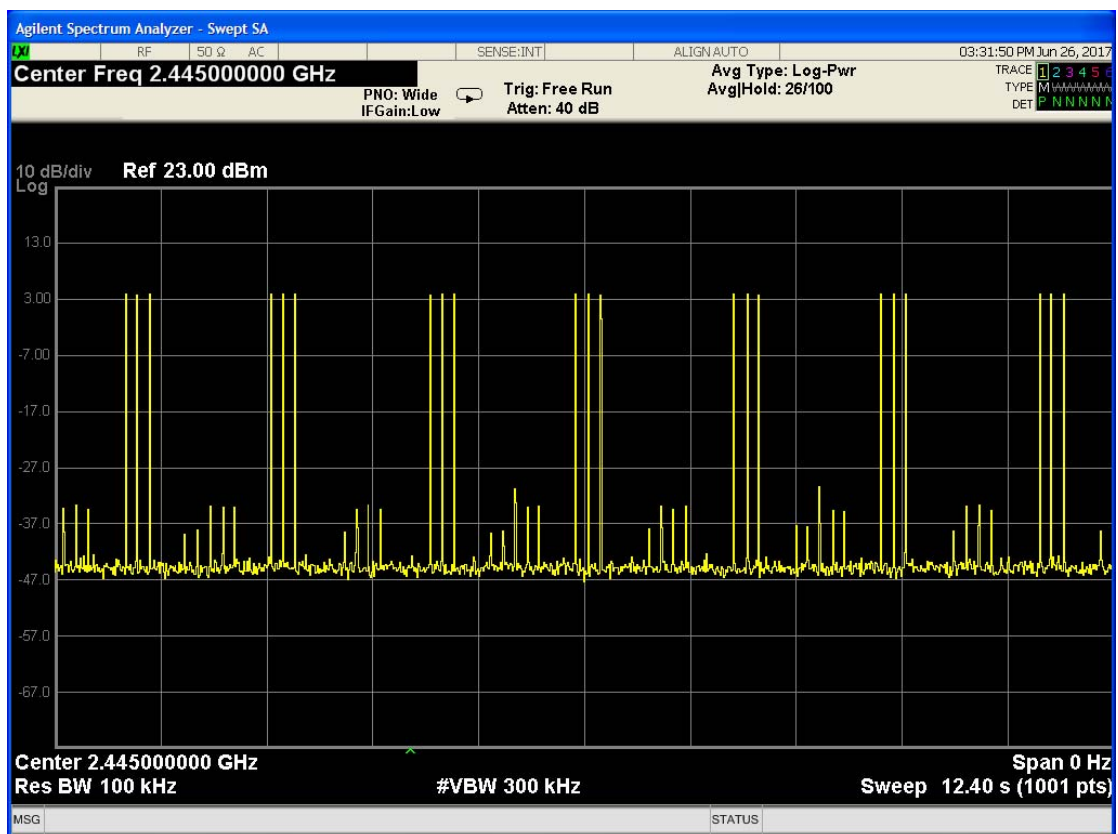
Test Result:

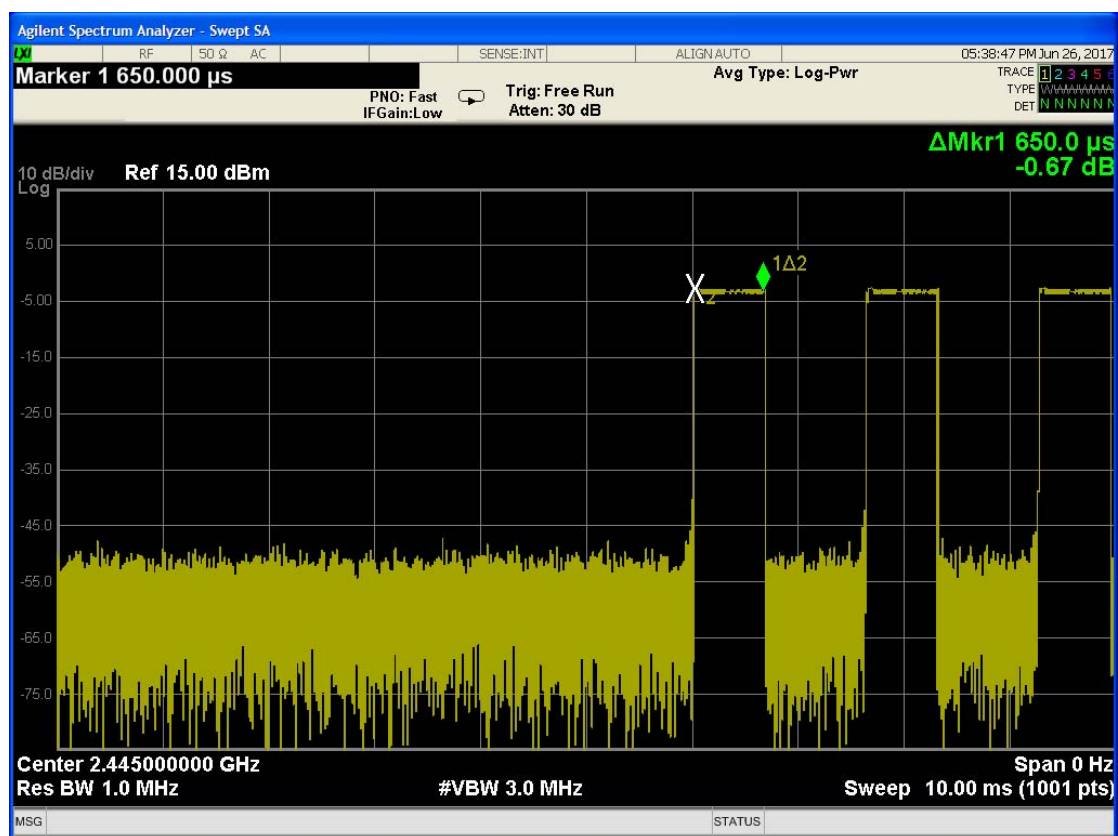
The unit does meet the FCC requirements.

Please refer the graph as below:

Frequency (MHz)	Total Pulse Duration (ms)	Total Dwell Time (s)	Limit (s)	Conclusion
2445	21x0.65=13.65	0.01365	<0.4	Pass

Note 1: A period time=0.4(s)x31=12.4(s)





5.7 Maximum Peak Output Power

Test Requirement: FCC Part 15 C section 15.247

(b)(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band:

0.125 watts.

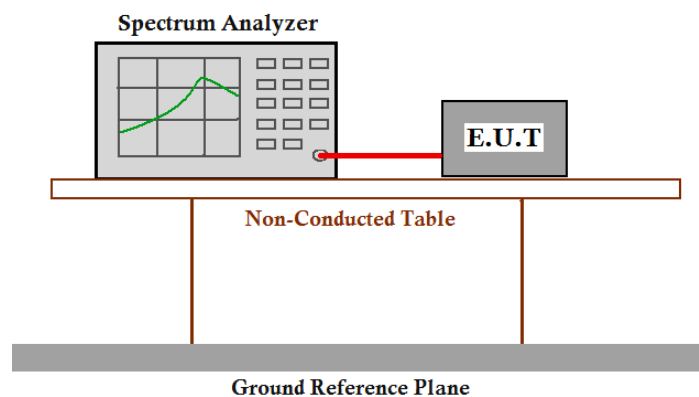
Refer to the result "Hopping channel number" of this document. The 1 watt (30.0 dBm) limit applies.

Test Method: ANSI C63.10:2013 Clause 6.10

Test Limit:

Test mode: The program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel lowest (2405MHz), middle (2445MHz) and highest (2478MHz) are chosen for full testing.

Test Configuration:



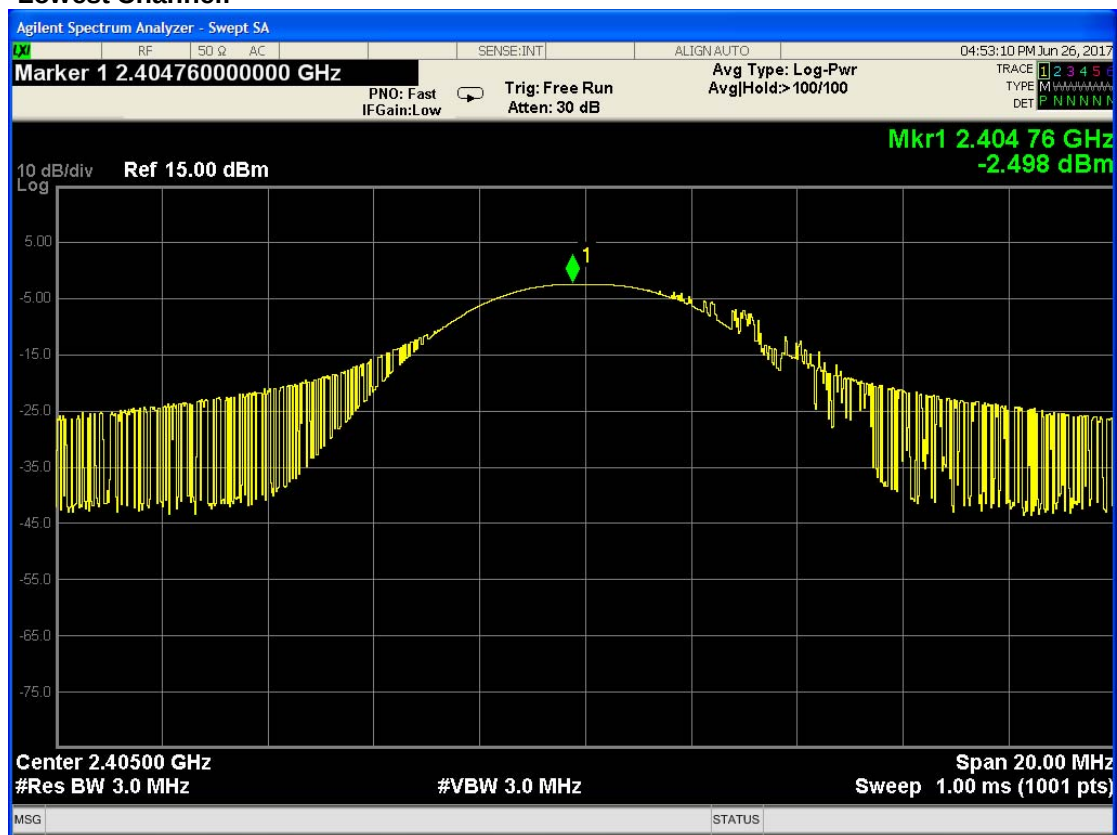
Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3 MHz. VBW = 3 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

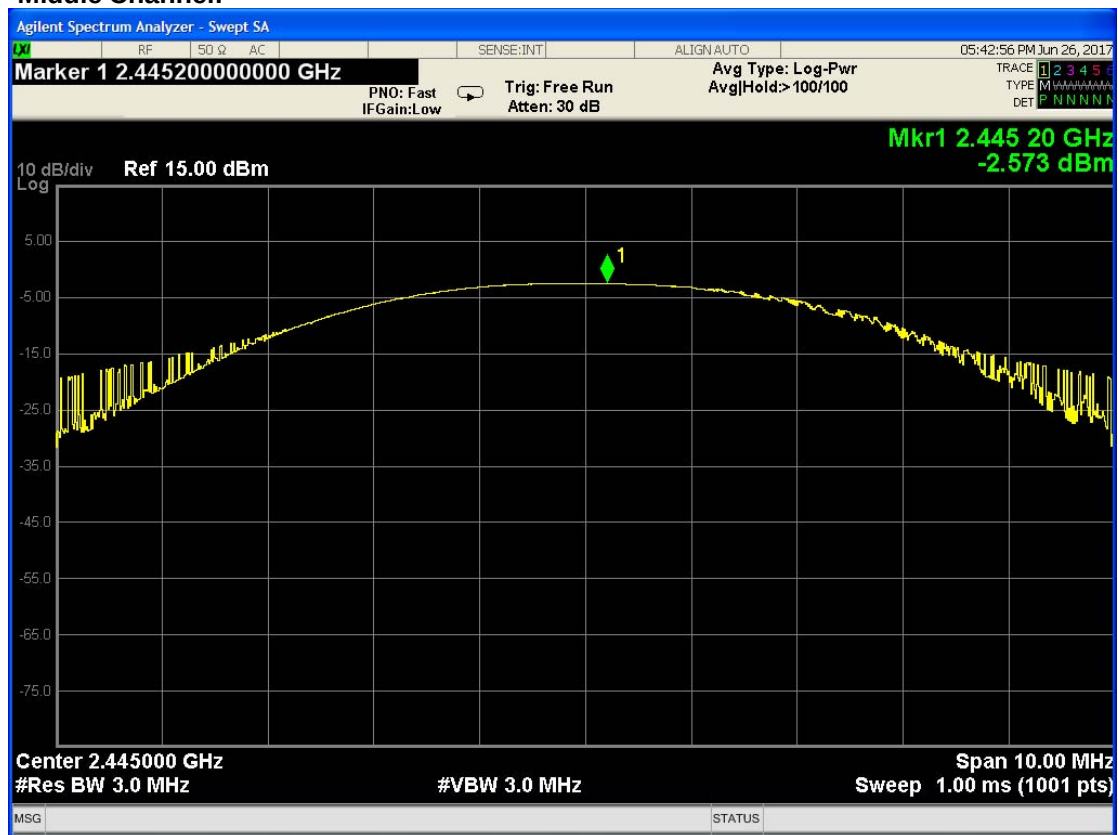
Test Result:				
Normal mode:				
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2405	-2.00	21.0	Pass
Middle	2445	-2.07	21.0	Pass
Highest	2478	-2.68	21.0	Pass
Remark: cable lose=0.5dB				
Test result: The unit does meet the FCC requirements.				
Test result plot as follows:				

Normal mode:

Lowest Channel:



Middle Channel:



Highest Channel:



5.8 Conducted Spurious Emissions

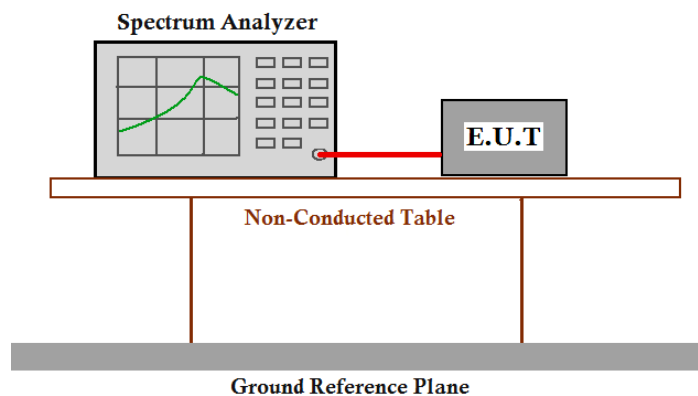
Test Requirement: FCC Part15 C section 15.247

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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. Provided the transmitter demonstrates compliance with the peak conducted power limits.

Test Method: ANSI C63.10:2013 Clause 6.7

Test Status: The program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel lowest (2405MHz), middle (2445MHz) and highest (2478MHz) are chosen for full testing.

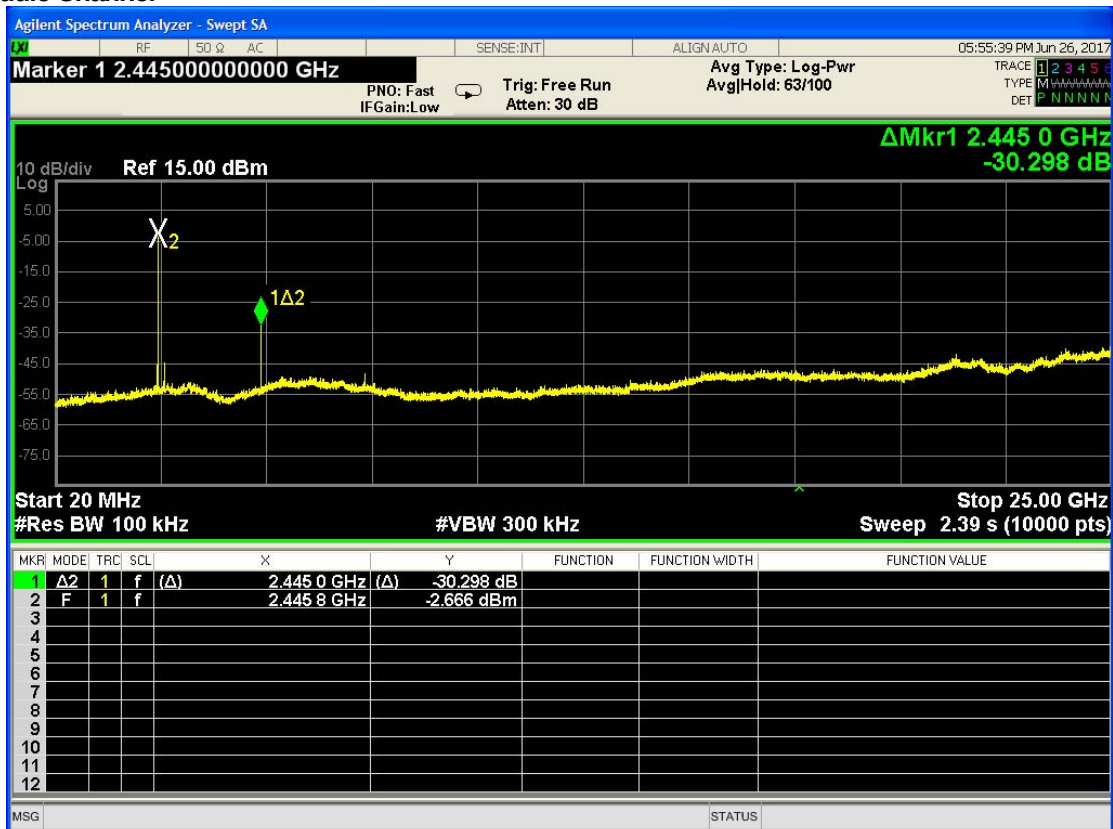
Test Configuration:



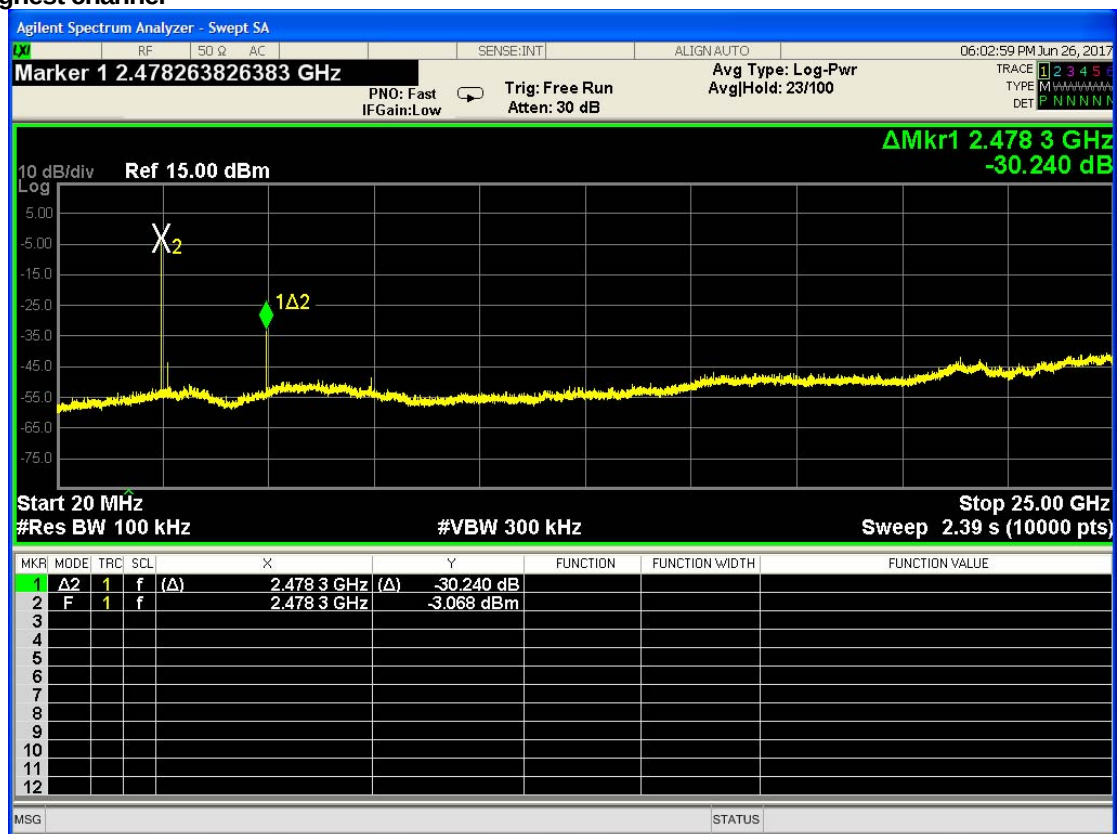
Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100 kHz. VBW $\geq$ RBW. Sweep = auto; Detector Function = Peak (Max. hold).

Lowest Channel:



Highest channel



5.9 Radiated Spurious Emissions

Test Requirement: FCC Part15 C section 15.247

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, and provided the transmitter demonstrates compliance with the peak conducted power limits.

Test Method: ANSI C63.10:2013 Clause 6.4, 6.5 and 6.6

Test Status: The program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel lowest (2405MHz), middle (2445MHz) and highest (2478MHz) are chosen for full testing.

Detector: For PK value:

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz, 9kHz for <30 MHz
VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

For AV value:

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz, 9kHz for <30 MHz

VBW =10 Hz

Sweep = auto

Detector function = peak

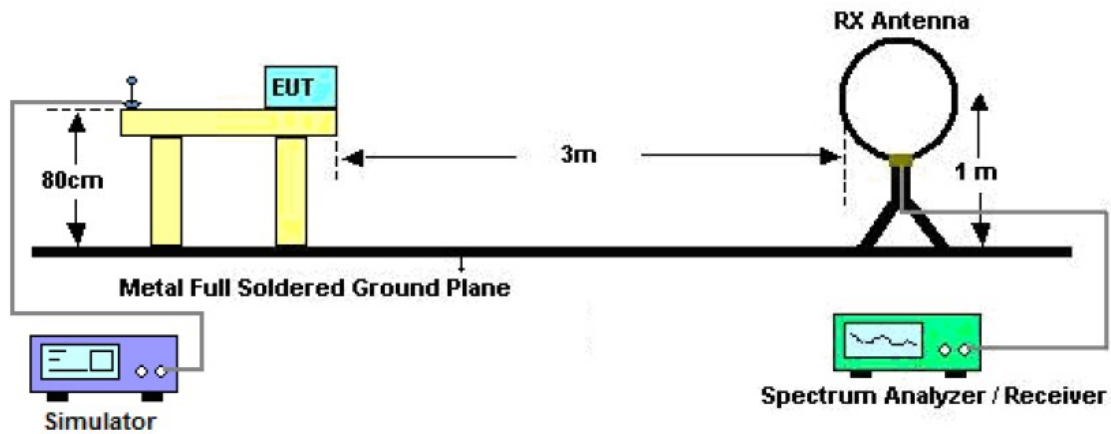
Trace = max hold

15.209 Limit:

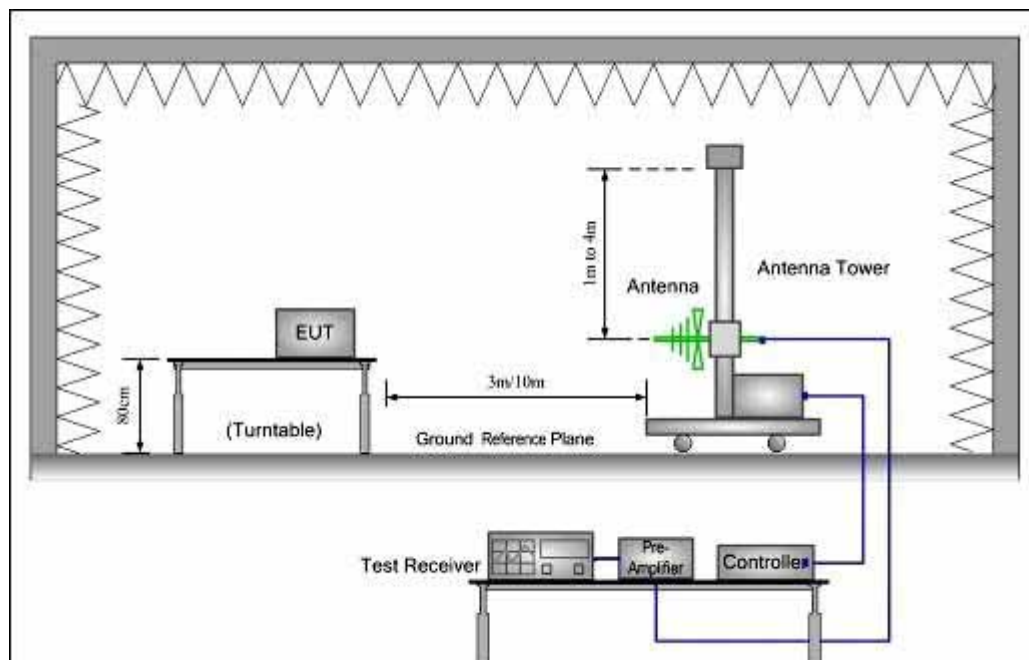
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Test Configuration:

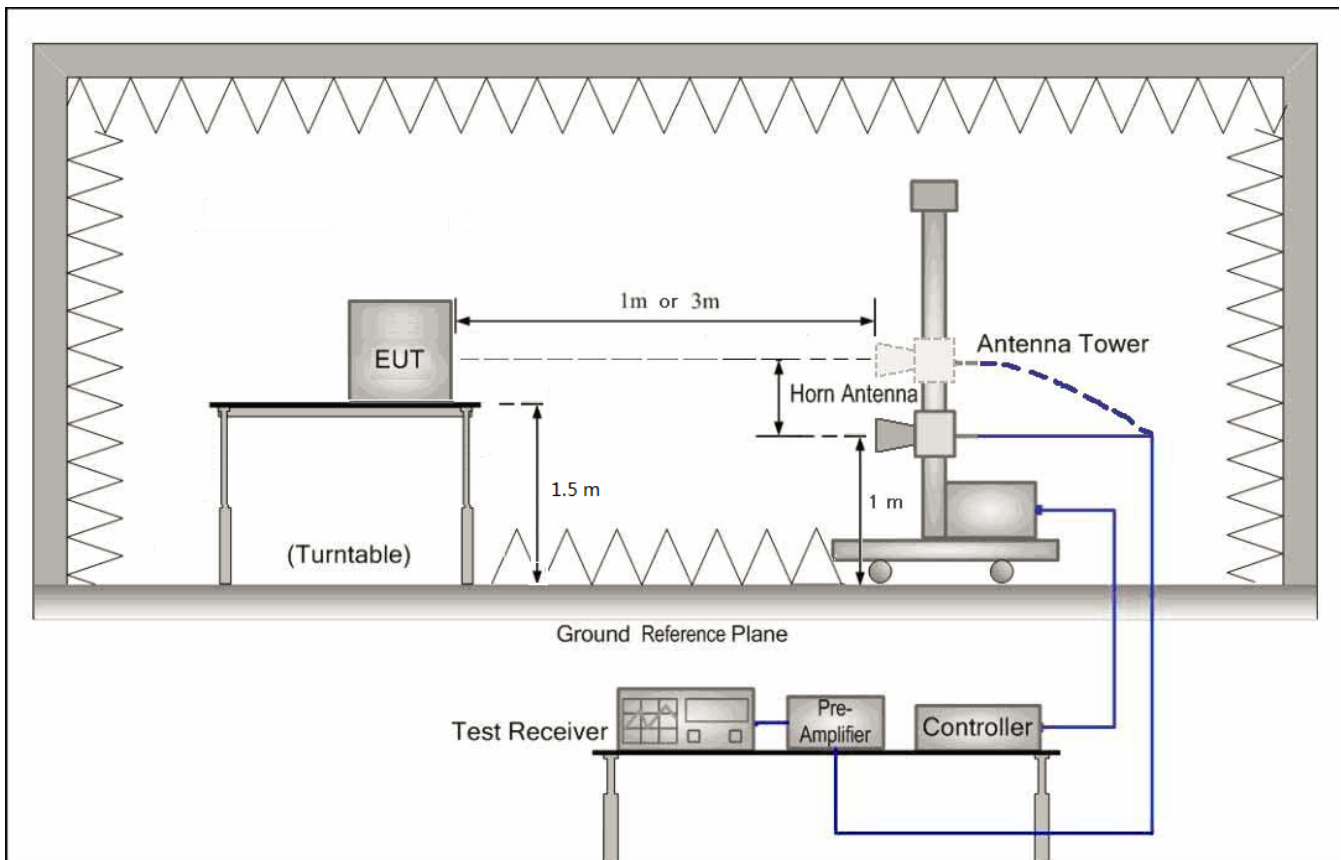
- 1) 9kHz to 30MHz emissions:



- 2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 40 GHz emissions:



Test Procedure: The receiver was scanned from 30MHz to 25GHz. When an emission was found, the table was rotated to produce the maximum signal strength. An initial pre-scan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed a pre-test three orthogonal planes. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. After pre-test, it was found that the worse radiation emission was get at the X position. So the data shown was the X position only. The worst case emissions were reported.

Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from $20\log(\text{dwell time}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit.

Submit this data.

5.9.1 Harmonic and other spurious emissions

Test at low Channel in transmitting status

9kHz~30MHz Test result

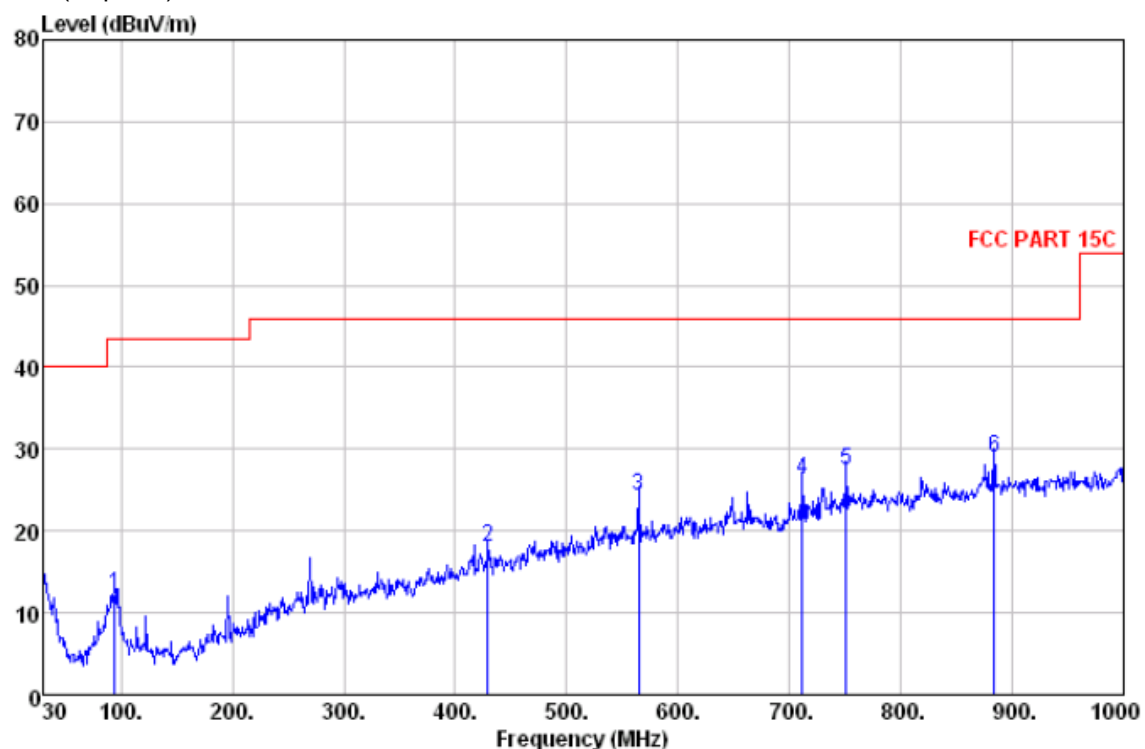
The Low frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not report

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Freq MHz	Read Level dBμV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBμV/m	Limit Line dBμV/m	Over Limit dB	Pol/Phase	Remark
1	94.020	31.31	8.28	1.13	28.57	12.15	43.50	-31.35	HORIZONTAL	QP
2	429.640	27.23	16.40	2.56	28.19	18.00	46.00	-28.00	HORIZONTAL	QP
3	564.470	30.73	19.44	2.96	28.78	24.35	46.00	-21.65	HORIZONTAL	QP
4	711.910	29.89	21.02	3.35	28.07	26.19	46.00	-19.81	HORIZONTAL	QP
5	750.710	29.73	21.81	3.44	27.50	27.48	46.00	-18.52	HORIZONTAL	QP
6	883.600	29.11	23.36	3.76	27.20	29.03	46.00	-16.97	HORIZONTAL	QP

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

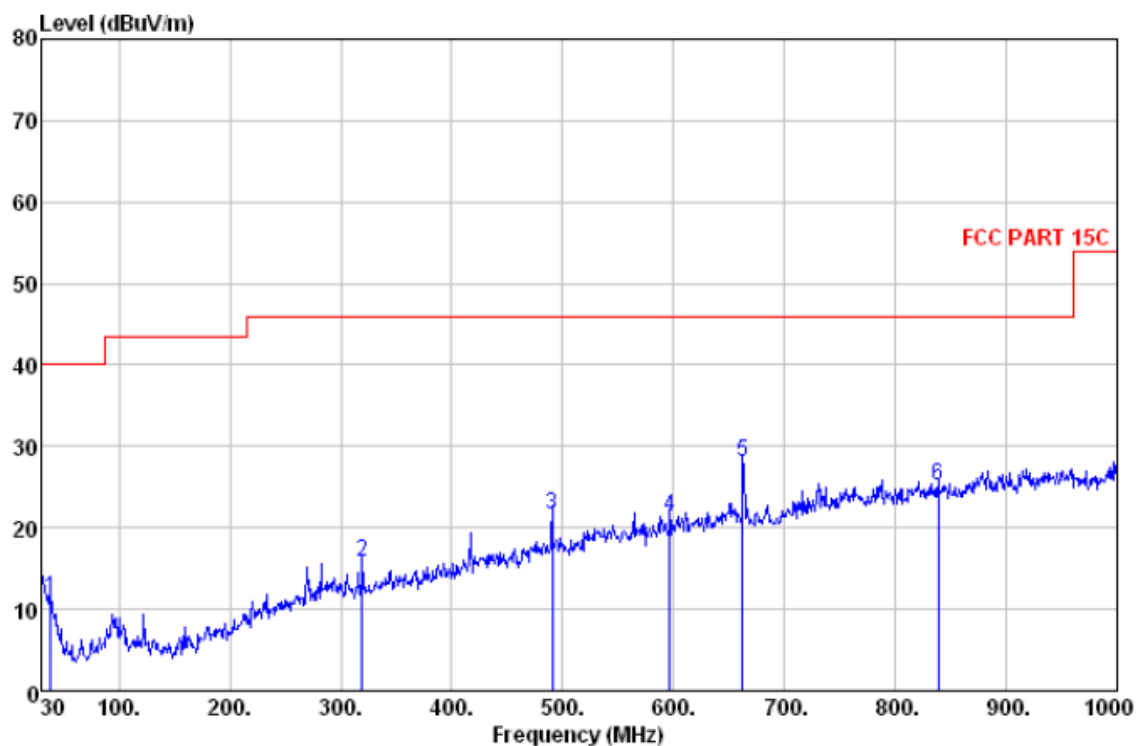
Test at low Channel in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Freq MHz	Read Level dBμV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBμV/m	Limit Line dBμV/m	Over Limit dB	Pol/Phase	Remark
1	38.730	25.91	12.96	0.71	28.22	11.36	40.00	-28.64	VERTICAL	QP
2	319.060	27.32	13.77	2.19	27.52	15.76	46.00	-30.24	VERTICAL	QP
3	490.750	29.45	18.12	2.75	28.65	21.67	46.00	-24.33	VERTICAL	QP
4	596.480	26.74	19.78	3.05	28.27	21.30	46.00	-24.70	VERTICAL	QP
5	662.440	32.59	20.65	3.23	28.50	27.97	46.00	-18.03	VERTICAL	QP
6	838.980	26.29	22.72	3.66	27.56	25.11	46.00	-20.89	VERTICAL	QP

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

Peak Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4810.000	34.32	9.59	27.62	34.52	50.81	74.00	V
7215.000	34.88	12.15	27.33	35.01	54.71	74.00	V
9620.000	37.72	14.41	27.14	35.88	60.87	74.00	V
4810.000	34.32	9.59	27.62	35.65	51.94	74.00	H
7215.000	34.88	12.15	27.33	35.71	55.41	74.00	H
9620.000	37.72	14.41	27.14	36.12	61.11	74.00	H

Average Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4810.000	34.32	9.59	27.62	23.54	39.83	54.00	V
7215.000	34.88	12.15	27.33	25.12	44.82	54.00	V
9620.000	37.72	14.41	27.14	24.66	49.65	54.00	V
4810.000	34.32	9.59	27.62	23.98	40.27	54.00	H
7215.000	34.88	12.15	27.33	24.01	43.71	54.00	H
9620.000	37.72	14.41	27.14	24.04	49.03	54.00	H

Test at Middle Channel in transmitting status

9kHz~30MHz Test result

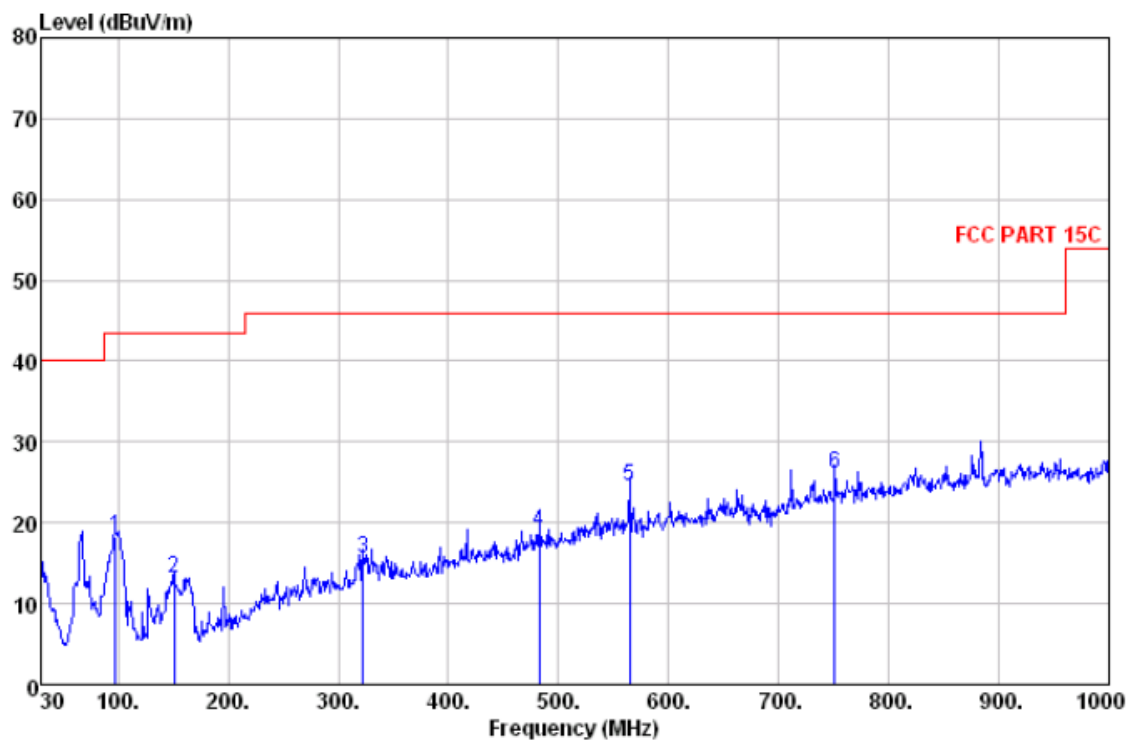
The Low frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not report

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Freq MHz	Read Level dBμV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBμV/m	Limit Line dBμV/m	Over Limit dB	Pol/Phase	Remark
1	97.900	37.21	8.53	1.16	28.72	18.18	43.50	-25.32	HORIZONTAL	QP
2	151.250	32.86	7.35	1.47	28.54	13.14	43.50	-30.36	HORIZONTAL	QP
3	322.940	27.19	13.80	2.20	27.51	15.68	46.00	-30.32	HORIZONTAL	QP
4	482.990	26.71	18.03	2.73	28.53	18.94	46.00	-27.06	HORIZONTAL	QP
5	564.470	31.00	19.44	2.96	28.78	24.62	46.00	-21.38	HORIZONTAL	QP
6	750.710	28.35	21.81	3.44	27.50	26.10	46.00	-19.90	HORIZONTAL	QP

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

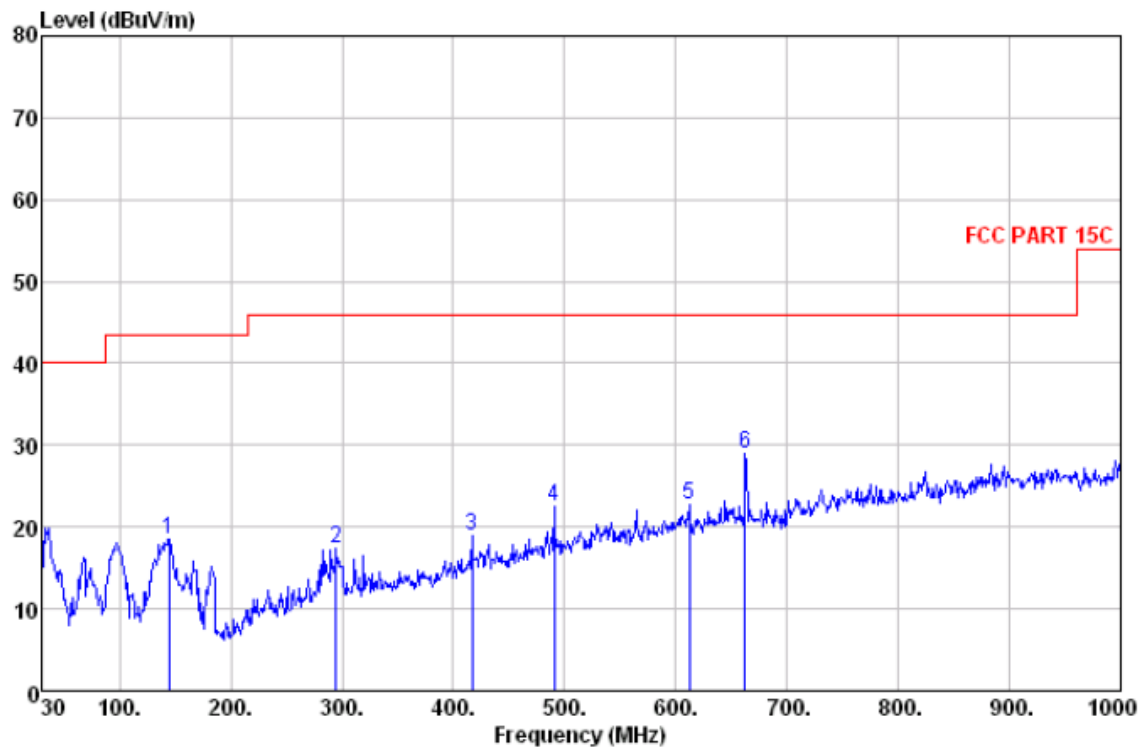
Test at Middle Channel in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Freq MHz	Read Level dBuV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Pol/Phase	Remark
1	144.460	38.20	7.31	1.43	28.38	18.56	43.50	-24.94	VERTICAL	QP
2	294.810	29.31	13.49	2.10	27.55	17.35	46.00	-28.65	VERTICAL	QP
3	417.030	28.31	16.32	2.51	28.13	19.01	46.00	-26.99	VERTICAL	QP
4	490.750	30.23	18.12	2.75	28.65	22.45	46.00	-23.55	VERTICAL	QP
5	612.000	28.04	19.92	3.09	28.39	22.66	46.00	-23.34	VERTICAL	QP
6	662.440	33.51	20.65	3.23	28.50	28.89	46.00	-17.11	VERTICAL	QP

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

Peak Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4890.000	34.33	9.59	27.60	35.76	52.08	74.00	V
7335.000	34.92	12.17	27.31	24.23	44.01	74.00	V
9780.000	37.91	14.49	27.13	33.52	58.79	74.00	V
4890.000	34.33	9.59	27.60	35.33	51.65	74.00	H
7335.000	34.92	12.17	27.31	36.31	56.09	74.00	H
9780.000	37.91	14.49	27.13	35.52	60.79	74.00	H

Average Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4890.000	34.33	9.59	27.60	22.23	38.55	54.00	V
7335.000	34.92	12.17	27.31	23.47	43.25	54.00	V
9780.000	37.91	14.49	27.13	23.37	48.64	54.00	V
4890.000	34.33	9.59	27.60	22.19	38.51	54.00	H
7335.000	34.92	12.17	27.31	24.02	43.80	54.00	H
9780.000	37.91	14.49	27.13	22.75	48.02	54.00	H

Test at high Channel in transmitting status

9kHz~30MHz Test result

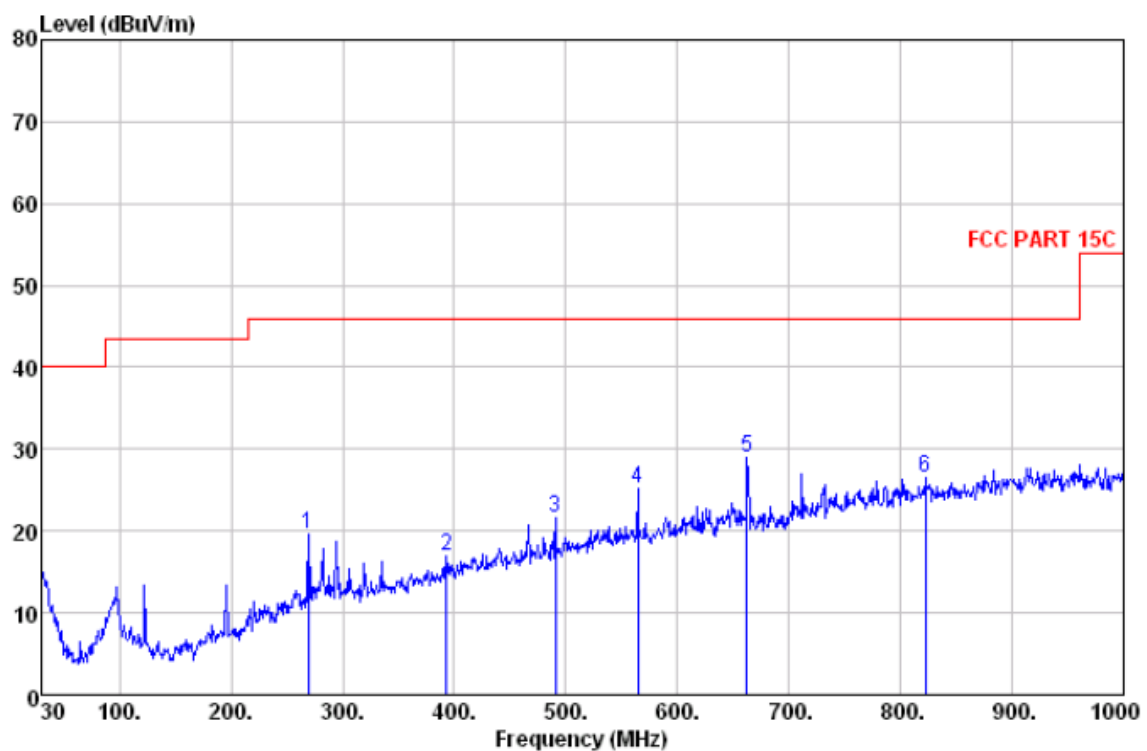
The Low frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not report

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Freq MHz	Read Level dBμV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBμV/m	Limit Line dBμV/m	Over Limit dB	Pol/Phase	Remark
1	269.590	32.06	12.74	2.01	27.22	19.59	46.00	-26.41	HORIZONTAL	QP
2	392.780	27.10	15.58	2.42	28.26	16.84	46.00	-29.16	HORIZONTAL	QP
3	490.750	29.33	18.12	2.75	28.65	21.55	46.00	-24.45	HORIZONTAL	QP
4	564.470	31.62	19.44	2.96	28.78	25.24	46.00	-20.76	HORIZONTAL	QP
5	662.440	33.64	20.65	3.23	28.50	29.02	46.00	-16.98	HORIZONTAL	QP
6	822.490	27.31	23.05	3.62	27.52	26.46	46.00	-19.54	HORIZONTAL	QP

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

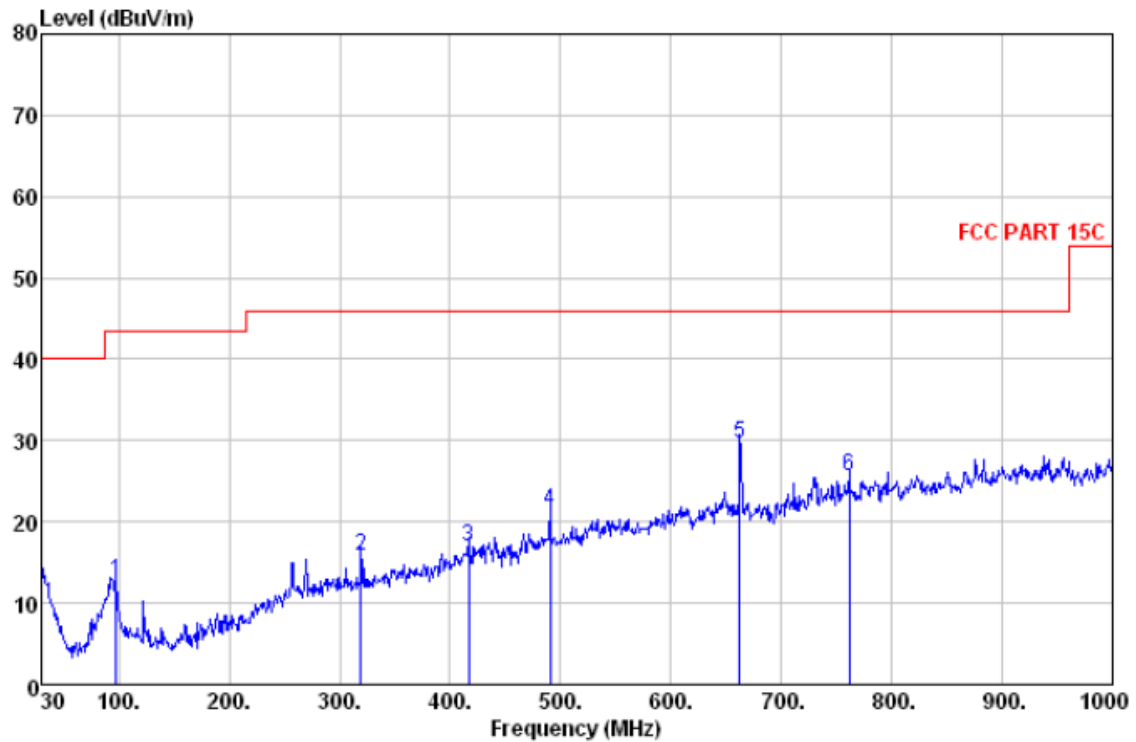
Test at High Channel in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Freq MHz	Read Level dBμV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBμV/m	Limit Line dBμV/m	Over Limit dB	Pol/Phase	Remark
1	97.900	31.69	8.53	1.16	28.72	12.66	43.50	-30.84	VERTICAL	QP
2	319.060	27.46	13.77	2.19	27.52	15.90	46.00	-30.10	VERTICAL	QP
3	417.030	26.32	16.32	2.51	28.13	17.02	46.00	-28.98	VERTICAL	QP
4	490.750	29.18	18.12	2.75	28.65	21.40	46.00	-24.60	VERTICAL	QP
5	662.440	34.27	20.65	3.23	28.50	29.65	46.00	-16.35	VERTICAL	QP
6	761.380	27.60	22.00	3.47	27.45	25.62	46.00	-20.38	VERTICAL	QP

Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

Peak Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4956.000	34.36	9.60	27.61	34.64	50.99	74.00	V
7434.000	34.98	12.19	27.30	35.22	55.09	74.00	V
9912.000	37.96	14.52	27.11	34.16	59.53	74.00	V
4956.000	34.36	9.60	27.61	35.45	51.80	74.00	H
7434.000	34.98	12.19	27.30	35.41	55.28	74.00	H
9912.000	37.96	14.52	27.11	34.15	59.52	74.00	H

Average Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4956.000	34.36	9.60	27.61	22.22	38.57	54.00	V
7434.000	34.98	12.19	27.30	23.15	43.02	54.00	V
9912.000	37.96	14.52	27.11	22.90	48.27	54.00	V
4956.000	34.36	9.60	27.61	23.67	40.02	54.00	H
7434.000	34.98	12.19	27.30	22.86	42.73	54.00	H
9912.000	37.96	14.52	27.11	23.54	48.91	54.00	H

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 Loss – Preamplifier Factor.

- 2). As shown in Section, for frequencies above 1000 MHz. the above 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.
- 3). The test only perform the EUT in transmitting status since the test frequencies were over 1GHz only required transmitting status.

Test result: The unit does meet the FCC requirements.

5.10 Radiated Emissions which fall in the restricted bands

Test Requirement: FCC Part15 C Section 15.247

(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Test Method: ANSI C63.10:2013 Clause 6.4, 6.5 and 6.6

Test Status: The program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel lowest (2405MHz), middle (2445MHz) and highest (2478MHz) are chosen for full testing.

Measurement Distance: 3m (Semi-Anechoic Chamber)

Limit: Section 15.209(a)

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Detector: For PK value:

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold

For AV value:

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW =10 Hz

Sweep = auto

Detector function = peak

Trace = max hold

Test Result:**For Bluetooth****1. Low Channel (2405MHz)**

Antenna polarization: Vertical

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBμV)	Average Reading Level (dBμV)	Peak Emission Level (dBμV/m)	Average Emission Level (dBμV/m)
2310.000	26.65	6.45	27.78	34.24	22.33	39.56	27.65
2390.000	26.56	6.46	27.79	35.22	23.47	40.45	28.70
2500.000	25.70	6.62	27.80	34.76	23.63	39.28	28.15
2483.500	25.79	6.61	27.80	34.48	22.33	39.08	26.93

Antenna polarization: Horizontal

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBμV)	Average Reading Level (dBμV)	Peak Emission Level (dBμV/m)	Average Emission Level (dBμV/m)
2310.000	26.65	6.45	27.78	33.55	23.65	38.87	28.97
2390.000	26.56	6.46	27.79	34.27	22.33	39.50	27.56
2500.000	25.70	6.62	27.80	34.17	24.73	38.69	29.25
2483.500	25.79	6.61	27.80	35.44	24.11	40.04	28.71

2. Middle Channel (2445MHz)

Antenna polarization: Vertical

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBμV)	Average Reading Level (dBμV)	Peak Emission Level (dBμV/m)	Average Emission Level (dBμV/m)
2310.000	26.65	6.45	27.78	33.23	23.43	38.55	28.75
2390.000	26.56	6.46	27.79	34.42	22.44	39.65	27.67
2500.000	25.70	6.62	27.80	34.55	23.65	39.07	28.17
2483.500	25.79	6.61	27.80	35.12	23.22	39.72	27.82

Antenna polarization: Horizontal

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBμV)	Average Reading Level (dBμV)	Peak Emission Level (dBμV/m)	Average Emission Level (dBμV/m)
2310.000	26.65	6.45	27.78	33.23	22.98	38.55	28.30
2390.000	26.56	6.46	27.79	34.98	23.41	40.21	28.64
2500.000	25.70	6.62	27.80	35.08	24.09	39.60	28.61
2483.500	25.79	6.61	27.80	35.01	23.89	39.61	28.49

3. High Channel (2478MHz)

Antenna polarization: Vertical

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBμV)	Average Reading Level (dBμV)	Peak Emission Level (dBμV/m)	Average Emission Level (dBμV/m)
2310.000	26.65	6.45	27.78	34.11	23.34	39.43	28.66
2390.000	26.56	6.46	27.79	33.45	22.21	38.68	27.44
2500.000	25.70	6.62	27.80	34.51	23.55	39.03	28.07
2483.500	25.79	6.61	27.80	35.22	24.91	39.82	29.51

Antenna polarization: Horizontal

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBμV)	Average Reading Level (dBμV)	Peak Emission Level (dBμV/m)	Average Emission Level (dBμV/m)
2310.000	26.65	6.45	27.78	34.21	23.23	39.53	28.55
2390.000	26.56	6.46	27.79	34.32	24.66	39.55	29.89
2500.000	25.70	6.62	27.80	35.61	25.15	40.13	29.67
2483.500	25.79	6.61	27.80	35.26	24.24	39.86	28.84

Remark: No any other emission which falls in restricted bands can be detected and be reported.

Test result: The unit does meet the FCC requirements.

5.11 Band Edges Requirement

Test Requirement: FCC Part15 C section 15.247

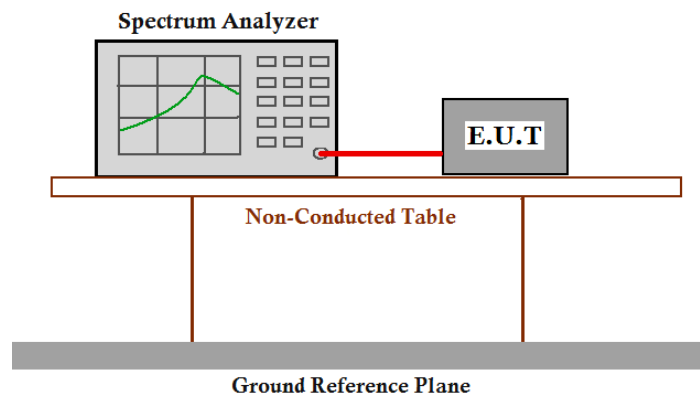
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Frequency Band: 2400 MHz to 2483.5 MHz

Test Method: ANSI C63.10:2013 Clause 6.9

Test Status: The program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel lowest (2405MHz), middle (2445MHz) and highest (2478MHz) are chosen for full testing.

Test Configuration:



Test Procedure:

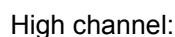
Set RBW of spectrum analyzer to 100 kHz and VBW of spectrum analyzer to 300 kHz with suitable frequency span including 10MHz bandwidth from band edge.

The band edges was measured and recorded Result:

The Lower Edges attenuated more than 20dB.

The Upper Edges attenuated more than 20dB.

Low channel:



Low channel:



igh channel:



Test result: The unit does meet the FCC requirements.

5.12 Conducted Emissions at Mains Terminals 150 kHz to 30 MHz

Test Requirement: FCC Part 15 C section 15.207

Test Method: ANSI C63.10:2013 Clause 6.2

Test Voltage: /

Frequency Range: 150 kHz to 30 MHz

Detector: Peak for pre-scan (9 kHz Resolution Bandwidth)

Test Limit

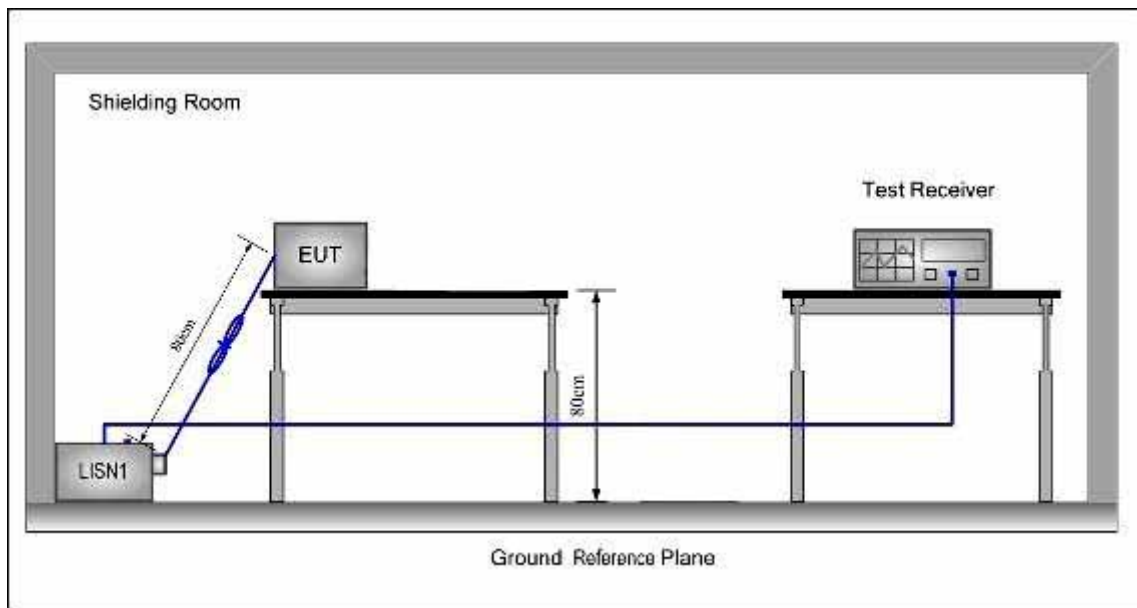
Limits for conducted disturbance at the mains ports of class B

Frequency Range	Class B Limit dB(μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
NOTE 1 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

EUT Operation:

Test in normal operating mode. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Test Configuration:**Test procedure:**

1. The mains terminal disturbance voltage test was conducted in a shielded room.
2. 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, but separated from metallic contact with the ground reference plane by 0.1m of insulation.

5.12.1 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. For EUT the communicating was worst case mode.

The following Quasi-Peak and Average measurements were performed on the EUT
Live line

Peak Scan:

Level (dB μ V)

/

Quasi-peak and Average measurement

/

Neutral Line

Peak Scan:

Level (dB μ V)

/

Quasi-peak and Average measurement

/

--End of Report--