TEST REPORT

Applicant:	Filisia Interfaces
Address of Applicant:	71–75 Shelton Street, London, WC2H 9JQ, UK
Manufacturer:	Filisia Interfaces
Address of Manufacturer:	71–75 Shelton Street, London, WC2H 9JQ, UK
Product name:	Electronic Accessibility Device
Model(s):	COSMO V2
Rating(s):	DC 3.7V, 850mAh Battery
Trademark:	/
Standards:	47 CFR PART 15 Subpart C: 2019 section 15.247
FCC ID:	2AT9O-COSMO2
Data of Receipt:	2019-07-12
Date of Test:	2019-07-12~2019-08-07
Date of Issue:	2019-08-08
Test Result	**Pass***

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

Authorized for issue by:

Test by:

Aug.08, 2019 Eleven Liang
Project Engineer

Date *Name/Position* *Signature*

Reviewed by:

Aug.08, 2019 Pauler Li Pauler Li
Project Manager

Date *Name/Position* *Signature*

Testing Laboratory information:

Testing Laboratory Name	:	ITL Co., Ltd
Address	:	No. 8 Jinqianling Street 5, Huangjiang Town, Dongguan, Guangdong, 523757 P.R.C.
Testing location	:	Same as above
Tel	:	0086-769-39001678
Fax	:	0086-20-62824387
E-mail	:	itl@i-testlab.com

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)

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.

General product information:

/

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)(2)	ANSI C63.10:2013	PASS
Maximum Peak Output Power	FCC PART 15 C section 15.247(b)(3)	ANSI C63.10: 2013	PASS
Peak Power Spectral Density	FCC PART 15 C section 15.247(e)	ANSI C63.10:2013	PASS
Conducted Spurious Emission (30MHz to 25GHz)	FCC PART 15 C section 15.209 &15.247(d)	ANSI C63.10:2013	PASS
Radiated Spurious Emission (30 MHz to 25 GHz)	FCC PART 15 C section 15.209 &15.247(d)	ANSI C63.10:2013	PASS
Band Edges Measurement	FCC PART 15 C section 15.209 &15.247(d)	ANSI C63.10:2013	PASS
Conducted Emissions at Mains Terminals	FCC PART 15 C section 15.207	ANSI C63.10:2013	N/A

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3 General Information

3.1 Client Information

Applicant: Filisia Interfaces

Address of Applicant: 71–75 Shelton Street, London, WC2H 9JQ, UK

3.2 General Description of E.U.T.

Name: Electronic Accessibility Device

Model No.: COSMO V2

Trade Mark: /

Operating Frequency: 2402 MHz to 2480 MHz for bluetooth

Bluetooth Version: 4.2

This report is for BLE mode.

Channels: 40 channels with 2MHz step

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

Type of Modulation GFSK

Antenna Type: Chip Antenna with 1.3dBi peak Gain

Function: Electronic Accessibility Device

3.3 Details of E.U.T.

EUT Power Supply: DC 3.7V (Battery)

Test mode: The program used to control the EUT for staying in continuous transmitting and receiving mode is programmed. Channel lowest (2402MHz), middle (2440MHz) and highest (2480MHz) are chosen for full testing.

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:

ITL Co., Ltd
No. 8 Jinqianling Street 5, Huangjiang Town, Dongguan, Guangdong, 523757 P.R.C.
0086-769-39001678
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:L9342**
- **FCC Designation No.:CN5035**
- **IC Registration NO.: 12593A**
- **NVLAP LAB CODE: 600199-0**

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	2.25%
total RF power, conducted	±1.34 dB
RF power density , conducted	±1.49 dB
All emissions, radiated	±2.72 dB
Temperature	±5.02 dB
Humidity	±0.8°C
DC and low frequency voltages	±1.5 %

4 Instruments Used during Test

No.	Test Equipment	Manufacturer	Model	Serial No.	Last Cal.	Cal. Due
ITL-114	Spectrum Analyzer	Agilent	N9010A	MY51250936	2019/01/28	2020/01/27
ITL-154	EMI test receiver 9kHz to 26.5GHz	R&S	ESR26	101257	2019/01/29	2020/01/28
ITL-116	Pre Amplifier	HP	8447F	3113A05905	2019/01/28	2020/01/27
ITL-117	Wideband Amplifier Super Ultra	Mini-circuits	ZVA-183-S+	469101134	2019/01/28	2020/01/27
ITL-164	Trilog-Broadband Antenna	Schwarzbeck	VULB 9168	9168-0844	2017/11/16	2020/11/16
ITL-110	Horn Antenna	A-INFOMW	JXTXLB-10180-N	J2031090612133	2019/01/28	2020/01/27
ITL-102	EMI Test receiver	R&S	ESCI	100910	2019/06/19	2020/06/18
ITL-103	Two-line v-network	R&S	ENV216	100120	2019/06/19	2020/06/18
ITL-115	50Ω Coaxial Cable	Mini-circuits	CBL	C001	2019/06/19	2020/06/18
ITL-100	Semi-Anechoic chamber	ETS•Lindgren	FACT3 2.0	CT09015	2018/12/29	2021/12/28
ITL-101	Shielded Room	ETS•Lindgren	8*4*3	CT09010	2018/01/27	2021/01/26
ITL-165	Power Meter	R&S	NRVS	838246/026	2018/09/28	2019/09/27
ITL-163	Active Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-062	2017/11/16	2020/11/16

5 Test Results

5.1 E.U.T. test conditions

Test Voltage: 120Vac, 60Hz

Temperature: 23.2 -25.0 °C

Humidity: 38-50 % RH

Atmospheric Pressure: 1000 -1010 mbar

Requirements:

15.31(e): 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. For battery operated equipment, the equipment tests shall be performed using a new battery.

15.32: Power supplies and CPU boards used with personal computers and for which separate authorizations are required to be obtained shall be tested as follows: Testing shall be in accordance with the procedures specified in Section 15.31 of this part.

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

Test frequencies are the lowest channel: 1 channel (2402MHz), middle channel: 20 channel (2440 MHz) and highest channel: 40 channel (2480 MHz)

Test the EUT in continuous transmission mode, duty cycle > 98%.

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 Chip Antenna and no consideration of replacement. The best case gain of the antenna is 1.3dBi.

Test result: The unit does meet the FCC requirements.

5.3 Occupied Bandwidth

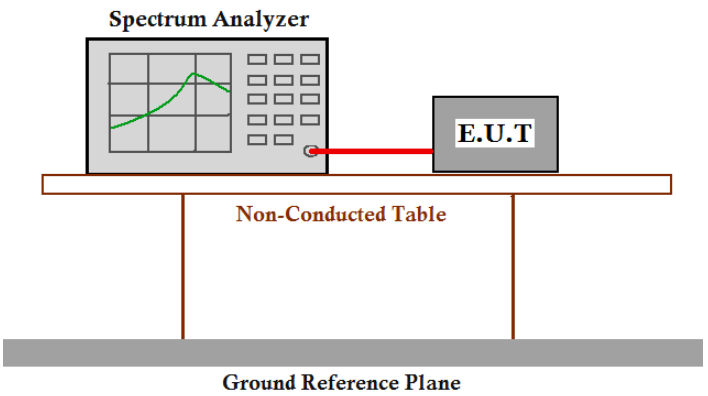
Test Requirement: FCC Part 15 C section 15.247

(a)(2)Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test Method: ANSI C63.10:2013

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, channels and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attention attenuation RF cable (Cable loss =0.5dB) from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW=100kHz. VBW = 300kHz, Sweep = auto; Detector Function = Peak. Trace = Max Hold, Set span to encompass the entire emission bandwidth of the signal.
3. Mark the peak power frequency and -6dB (upper and lower) power frequency.
4. Repeat until all the test status is investigated.
5. Report the worst case.

Test result (6 dB bandwidth)

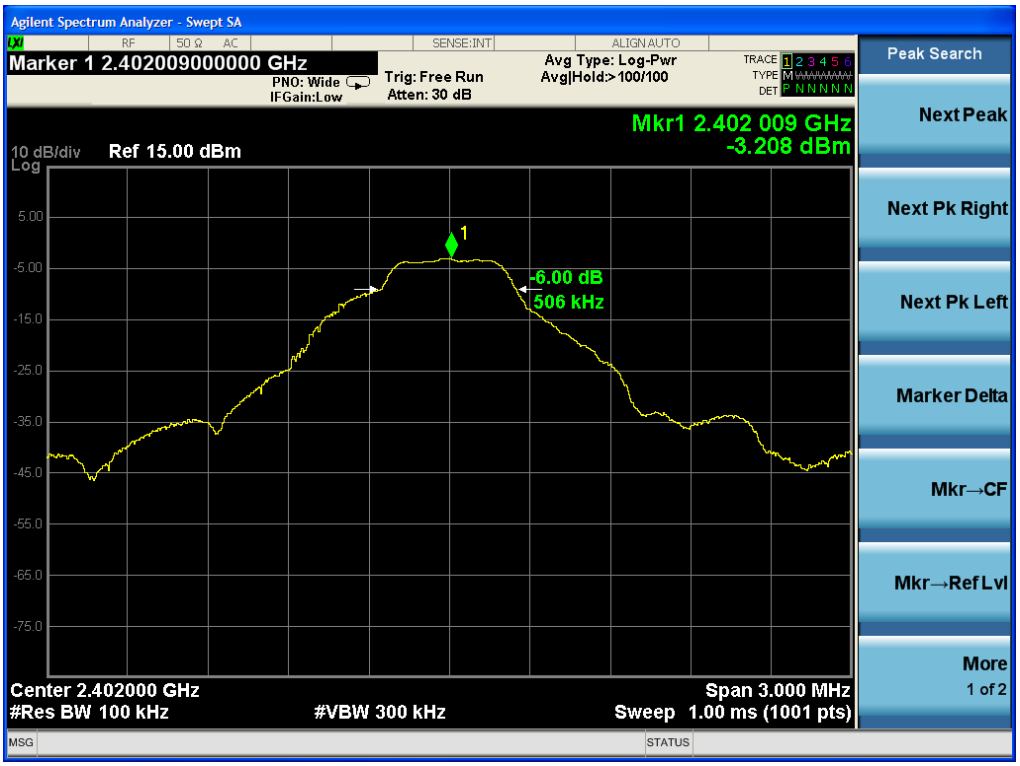
Channel No.	Frequency (MHz)	Measured 6dB bandwidth (MHz)	Limit	Result
1	2402	0.506	≥500KHz	Pass
20	2440	0.502		Pass
40	2480	0.506		Pass

The unit does meet the FCC requirements.

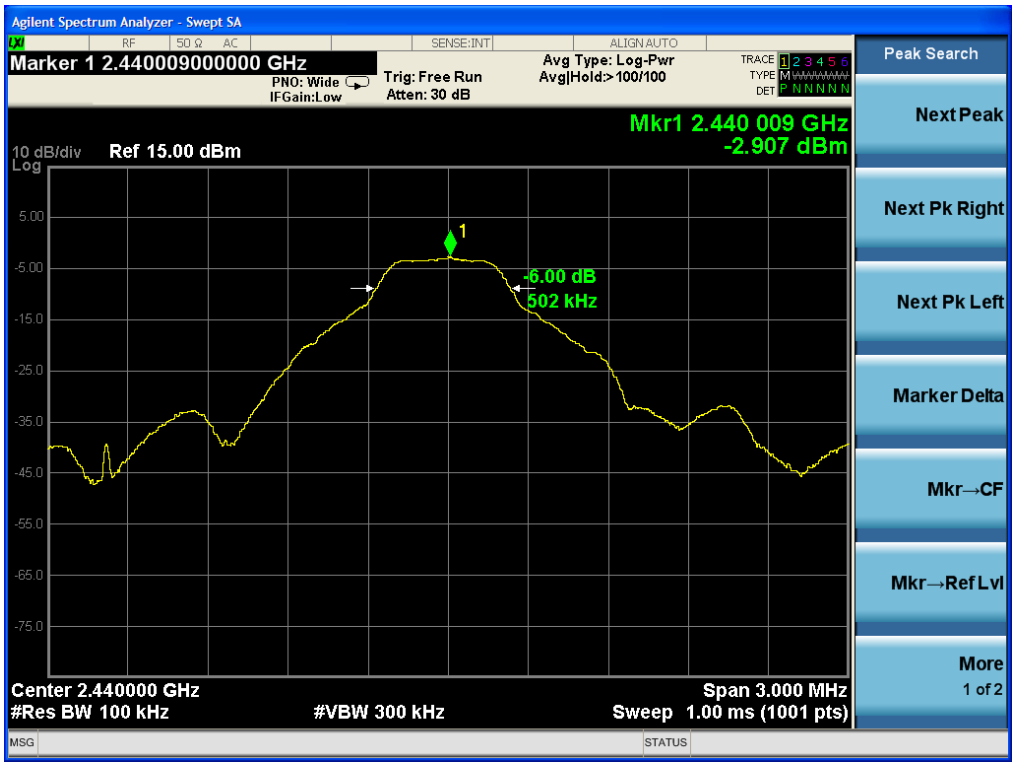
6dB bandwidth:

Result plot as follows:

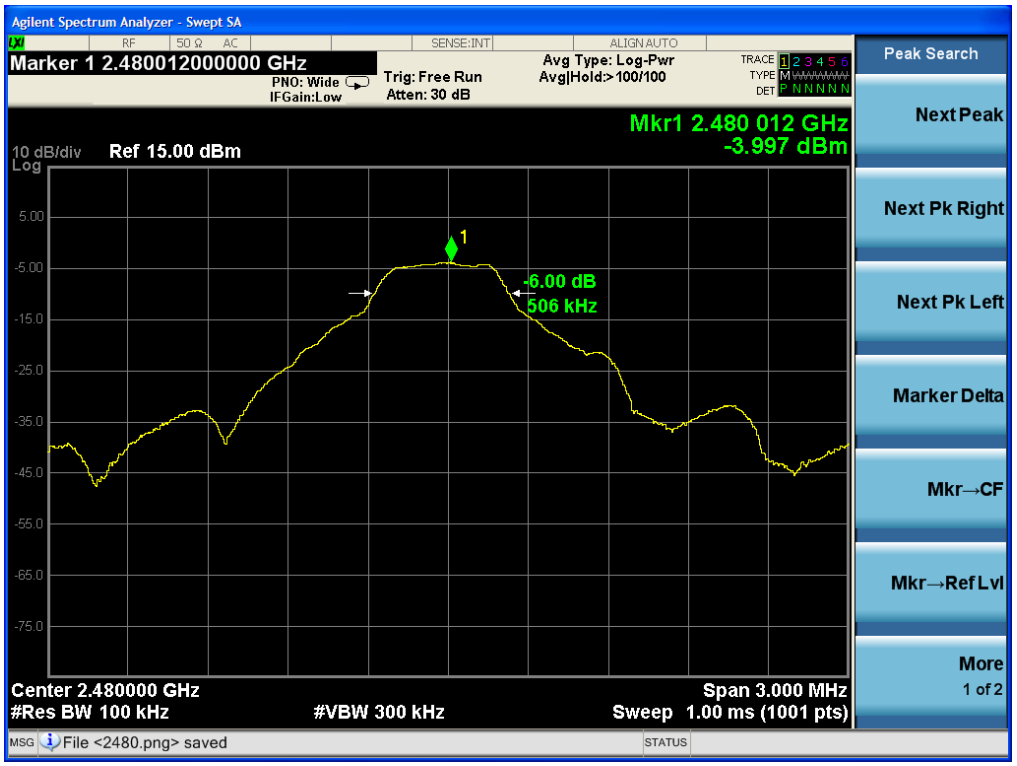
Channel 1:2.402GHz:



Channel 20:2.440GHz:



Channel 40:2.480GHz:



5.4 Maximum Peak Output Power

Test Requirement: FCC Part 15 C section 15.247

(b)(3) For systems using digital modulation in the 902-928 MHz,

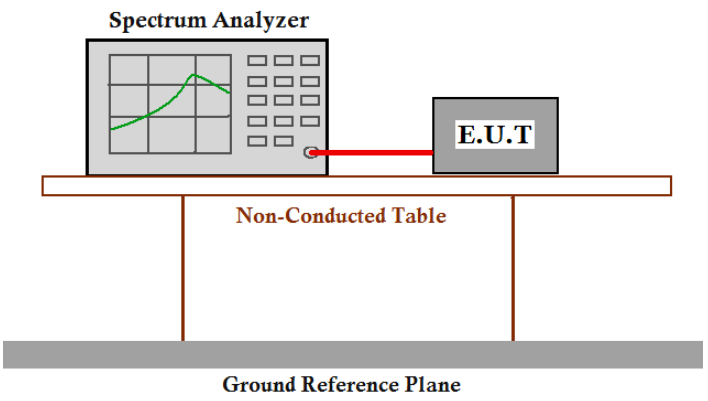
2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

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.

Test Method: ANSI C63.10:2013

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, channels and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attention attenuation RF cable (Cable loss =0.5dB) from the antenna port to the spectrum.
2. Set the RBW ≥ DTS bandwidth
3. Set VBW ≥ 3 x RBW
4. Set span ≥3 x RBW.
5. Sweep time = auto.
6. Detector = peak.
7. Trace mode = max hold.
8. Allow trace to fully stabilize
9. Use peak marker function to determine the peak amplitude level

Report the worst case.

Test Data:

Channel No.	Frequency (MHz)	Measured Power (dBm)	Limit (dBm)	Result
1	2402	-2.52	30	Pass
20	2440	-2.14		Pass
40	2480	-3.17		Pass
Remark: cable loss=0.5dB				

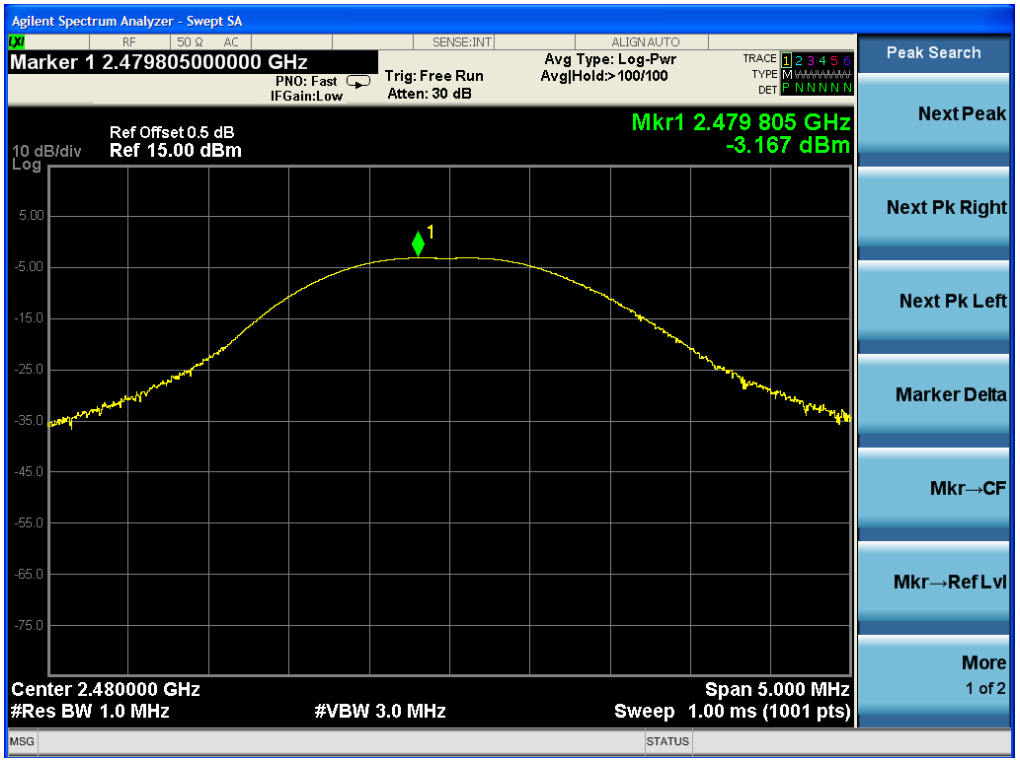
The unit does meet the FCC requirements.

Result plot as follows:

Channel 1:2.402GHz:

Channel 20:2.440GHz:

Channel 40:2.480GHz:



5.5 Peak Power Spectral Density

Test Requirement: FCC Part 15 C section 15.247

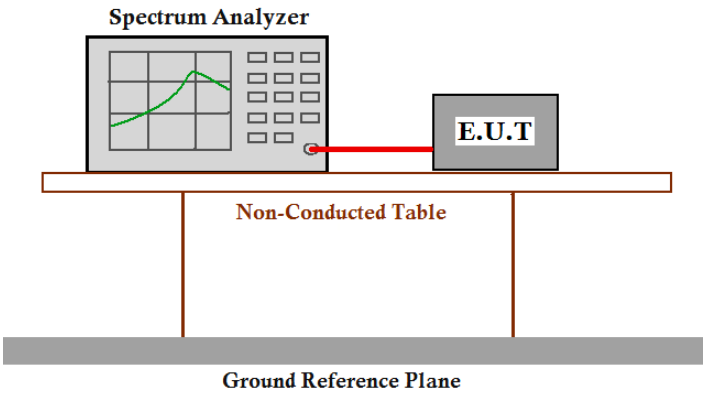
(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Method: ANSI C63.10:2013

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, channel and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attention attenuation RF cable (Cable loss =0.5 dB) from the antenna port to the spectrum analyzer or power meter.
2. Set the spectrum analyzer:

a) Set instrument center frequency to DTS channel center frequency.

b) Set the instrument span to 1.5 times the OBW.

c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.

d) Set the VBW ≥ [3 × RBW].

e) Detector = power average (rms).

f) Ensure that the number of measurement points in the sweep ≥ 2 × span / RBW.

g) Manually set the sweep time to: ≥ [10 × (number of measurement points in sweep) × (transmission symbol period)], but no less than the auto sweep time.

NOTE—The transmission symbol period (in seconds) is the reciprocal of the symbol rate (in baud or symbols per second). Note that each symbol can represent one or several data bits, and thus, the symbol rate should not be confused with the gross bit rate (expressed in bits/second). In no case should the sweep time be set less than the auto sweep time.

h) Perform the measurement over a single sweep.

i) Use the peak marker function to determine the maximum amplitude level.

j) If measured value exceeds requirement, then reduce RBW (but no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span to meet the minimum measurement point requirement as the RBW is reduced).

3. Repeat until all the test status is investigated.
4. Report the worst case.

Test result:

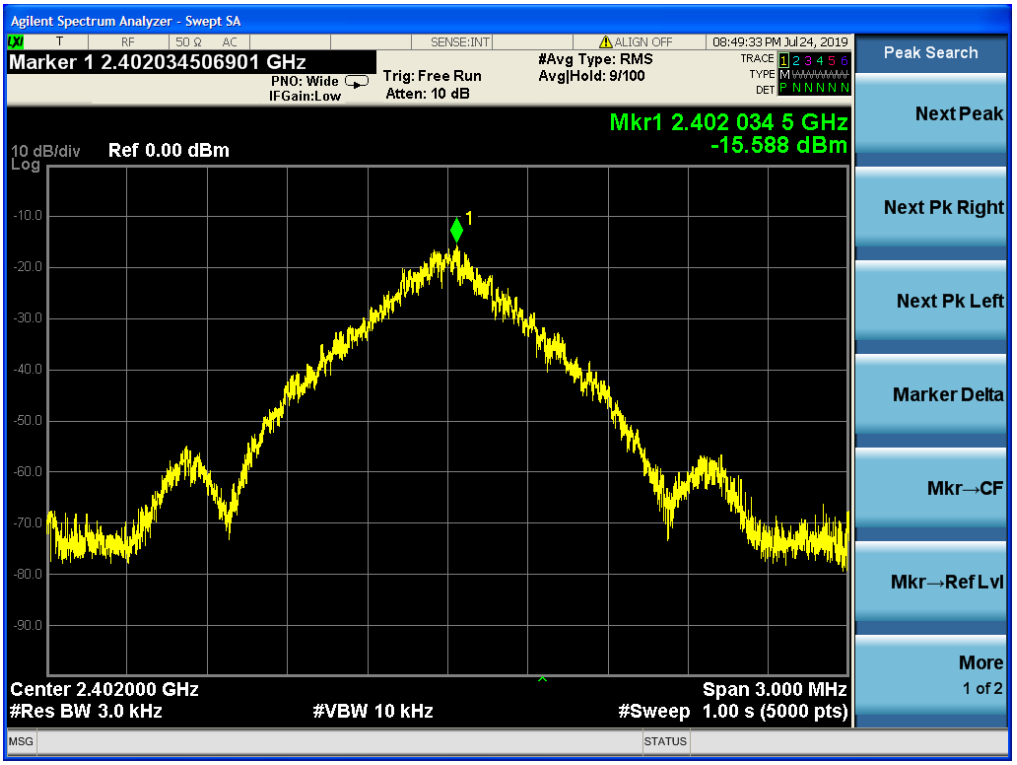
Channel No.	Frequency (MHz)	Measured Peak Power Spectral Density (dBm/3kHz)	Limit	Result
1	2402	-15.09	8dBm/3kHz	Pass
20	2440	-15.32		Pass
40	2480	-15.03		Pass

Remark: 1) Output Peak Power=Reading Peak Power+Cable loss
2) Cable loss=0.5dB

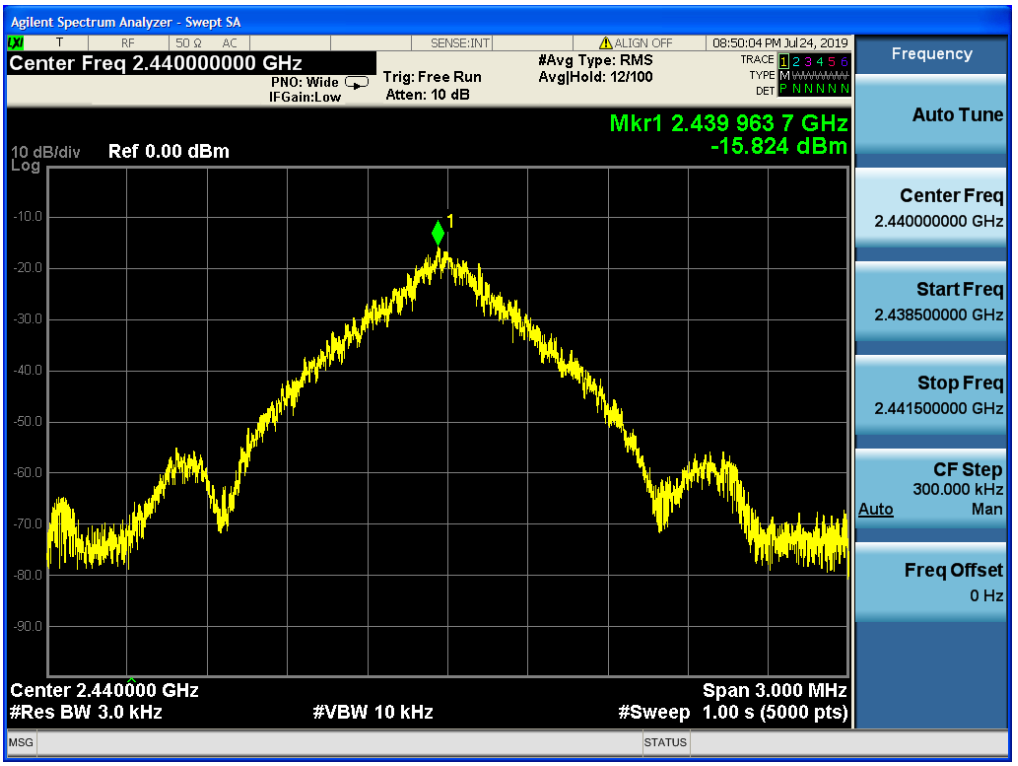
The unit does meet the FCC requirements.

Result plot as follows:

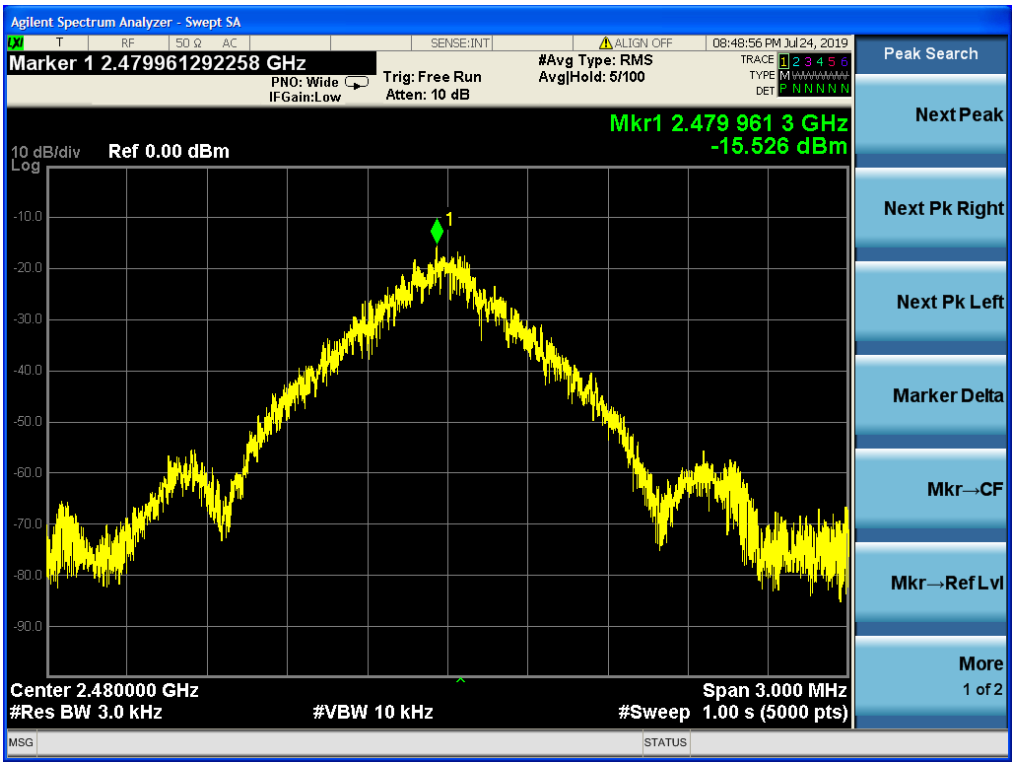
Channel 1:2.402 GHz:



Channel 20:2.440GHz:



Channel 40:2.480 GHz:



5.6 Conducted Spurious Emissions

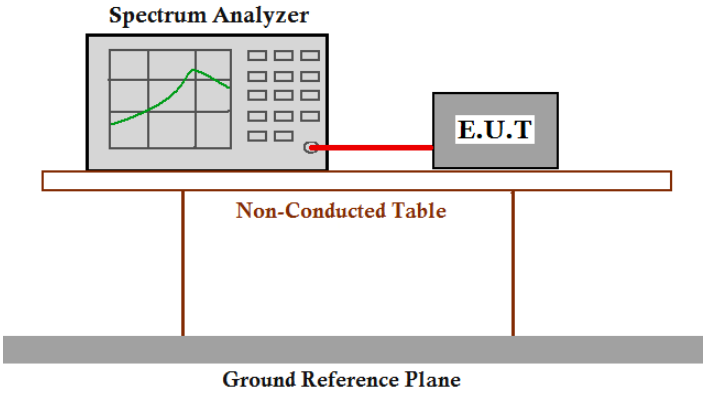
Test Requirement: FCC Part 15 C section 15.247

(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

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, channel and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

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 analyzer or power meter.
2. Set the spectrum analyzer: RBW=100 KHz, VBW = 300KHz. Sweep = auto; Detector Function = Peak. Trace = Max Hold, Scan up through 10th harmonic.
3. Measure the Conducted Spurious Emissions of the test frequency with special test status.
4. Repeat until all the test status is investigated.
5. Report the worst case.

Result plot as follows:

Channel 1: 2.402 GHz

Channel 20: 2.440 GHz

Channel 40: 2.480 GHz

The results do meet the FCC requirements.

5.7 Radiated Spurious Emissions

Test Requirement: FCC Part 15 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

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, channels and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Detector: For PK value:

RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

For AV value:

RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f <1 GHz, 9kHz for <30MHz

VBW =10Hz

Sweep = auto

Detector function = peak

Trace = max hold

15.209 Limit: 40.0 dBµV/m between 30MHz & 88MHz

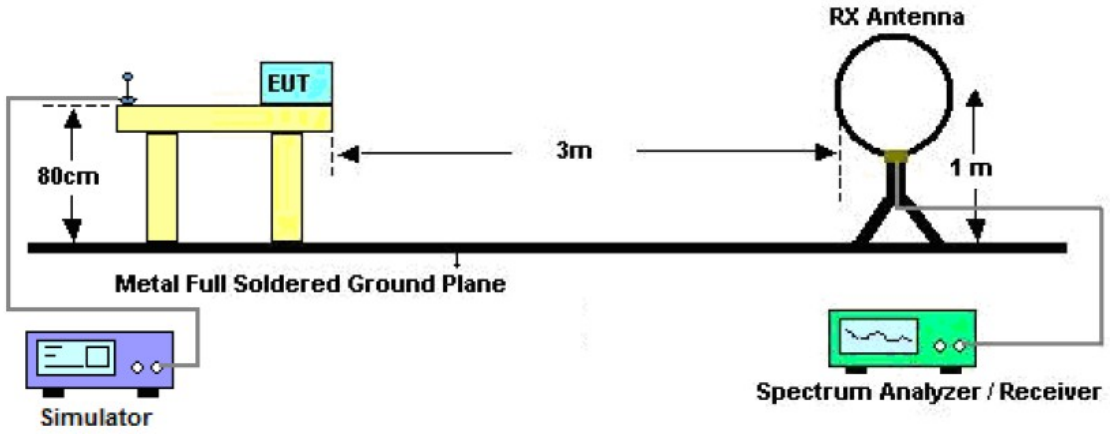
43.5 dBµV/m between 88MHz & 216MHz

46.0 dBµV/m between 216MHz & 960MHz

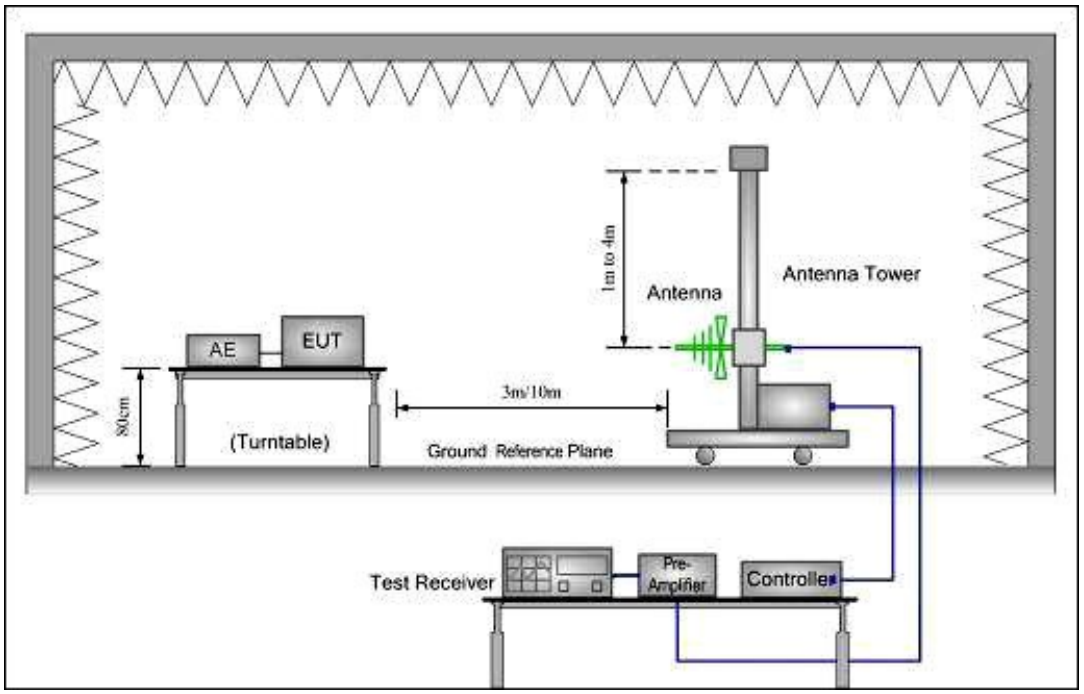
54.0 dBµV/m above 960MHz

Test Configuration:

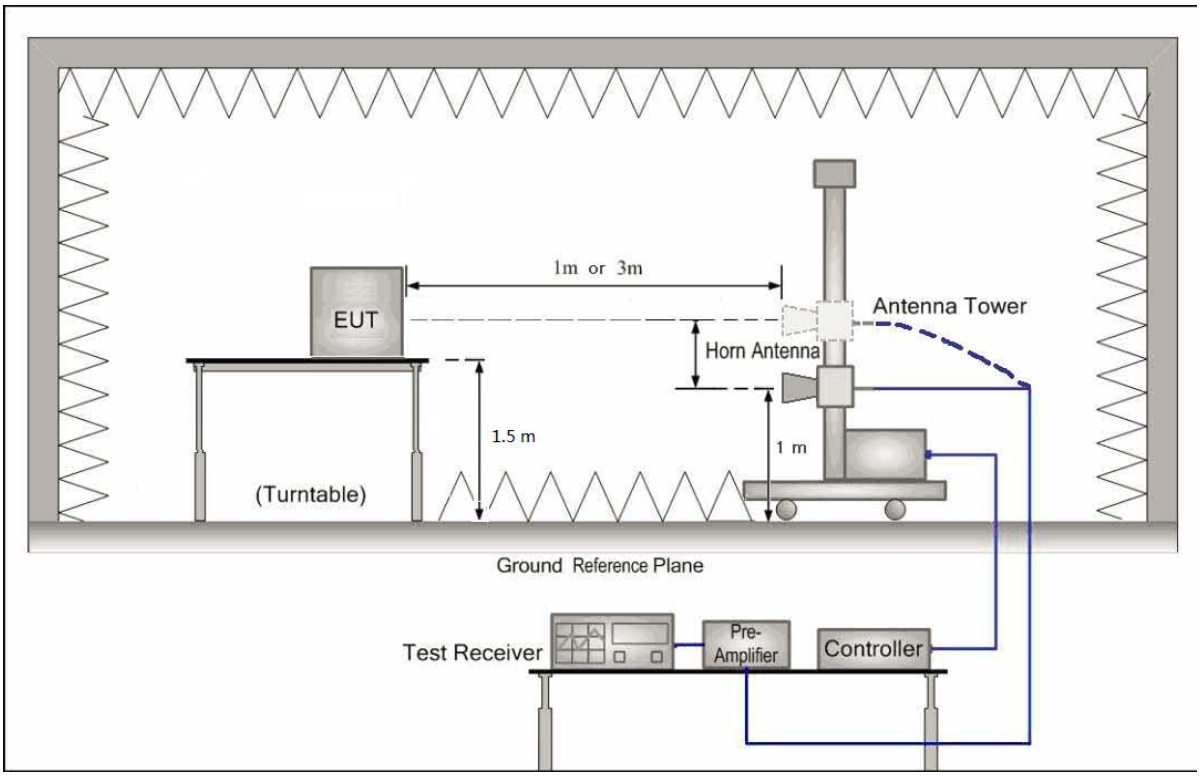
1) 9kHz to 30MHz emissions:



2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 40 GHz emissions:



Test Procedure: (1) The receiver was scanned from 0.009MHz 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.

(2) 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 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

(3) Pre-test under all modes below 1GHz, choose the worst case mode record On the report.

5.7.1 Harmonic and other spurious emissions

Test at Channel 1 (2.402 GHz) in transmitting status

9kHz~30MHz Test result

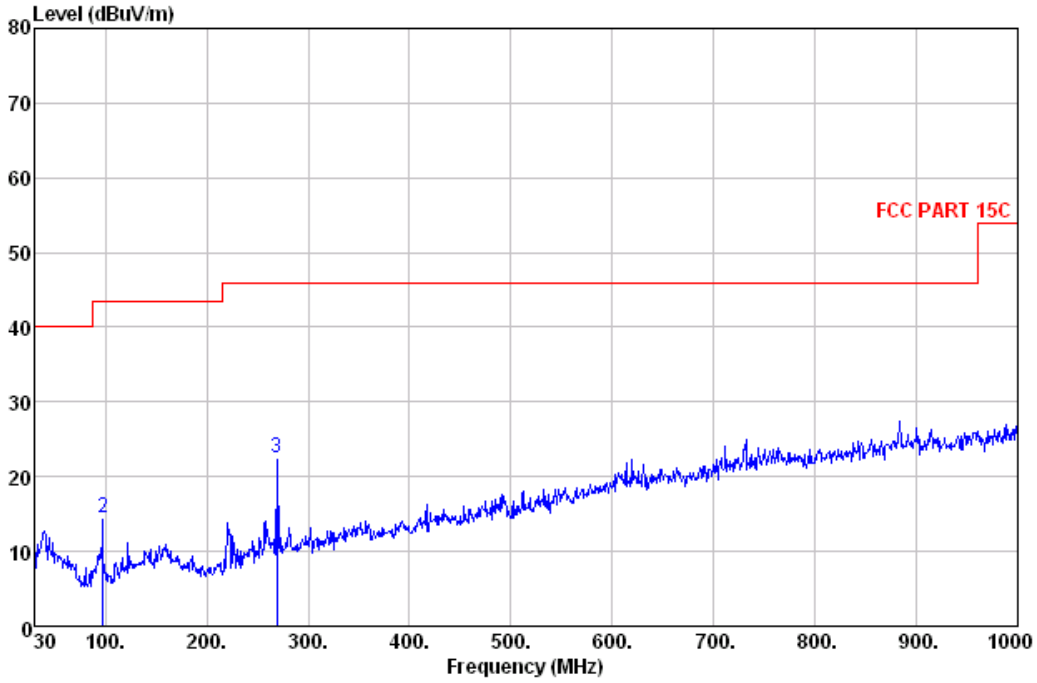
The Low frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not report

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

Horizontal:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

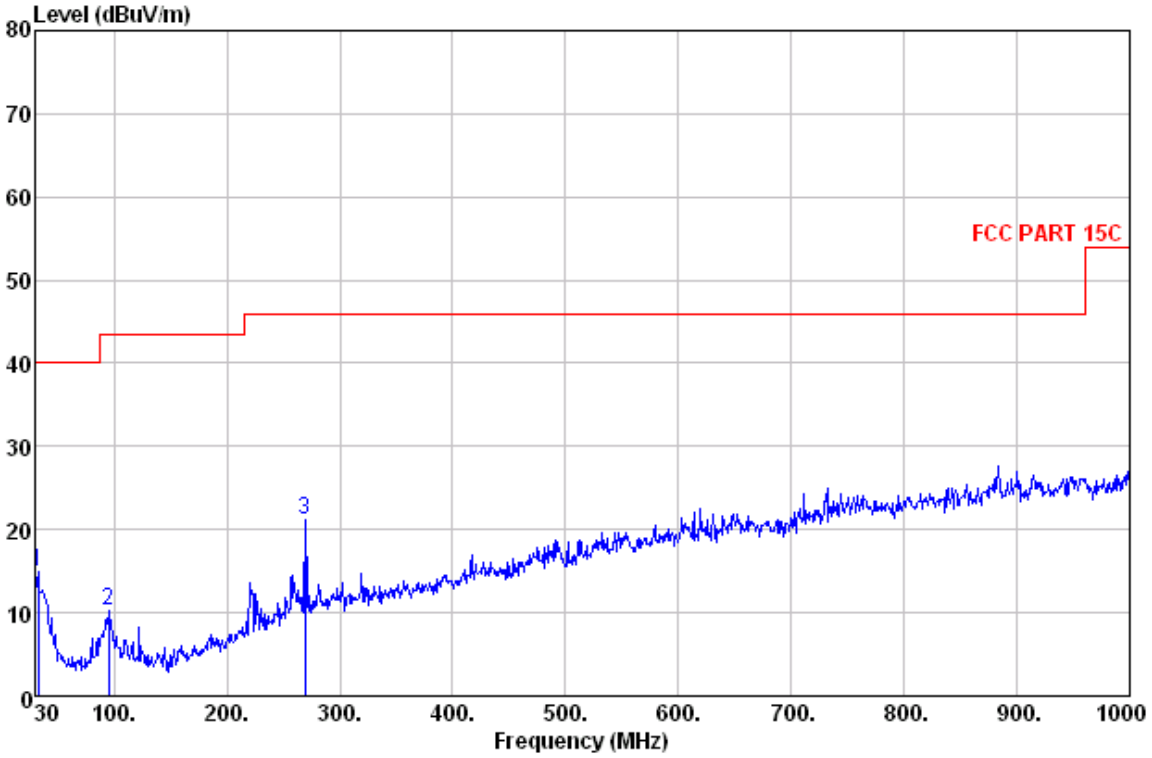
No.	Freq MHz	Read Level dBuV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Pol/Phase	Remark
1	30.000	30.86	12.00	0.63	28.50	14.99	40.00	-25.01	HORIZONTAL	QP
2	97.900	33.03	8.93	1.16	28.72	14.40	43.50	-29.10	HORIZONTAL	QP
3	269.590	35.51	12.13	2.01	27.22	22.43	46.00	-23.57	HORIZONTAL	QP

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

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	32.910	26.39	16.51	0.66	28.56	15.00	40.00	-25.00	VERTICAL	QP
2	94.990	29.34	8.30	1.14	28.60	10.18	43.50	-33.32	VERTICAL	QP
3	269.590	33.71	12.74	2.01	27.22	21.24	46.00	-24.76	VERTICAL	QP

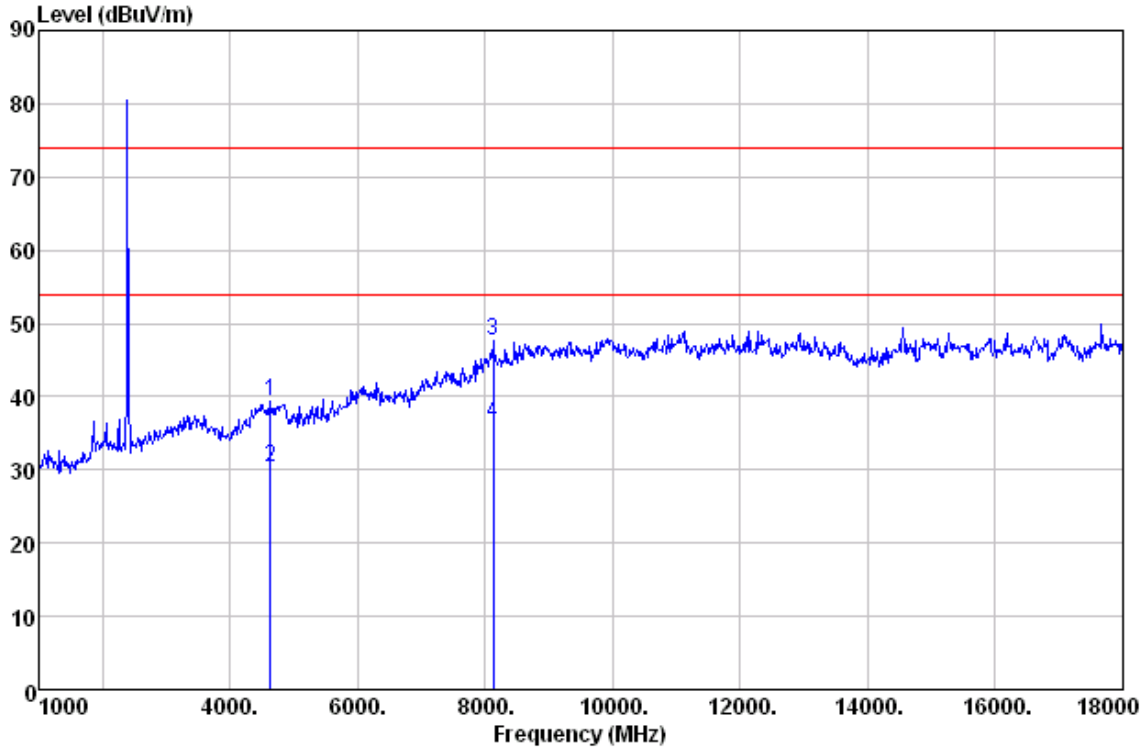
Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

Spurious emissions above 1GHz

Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

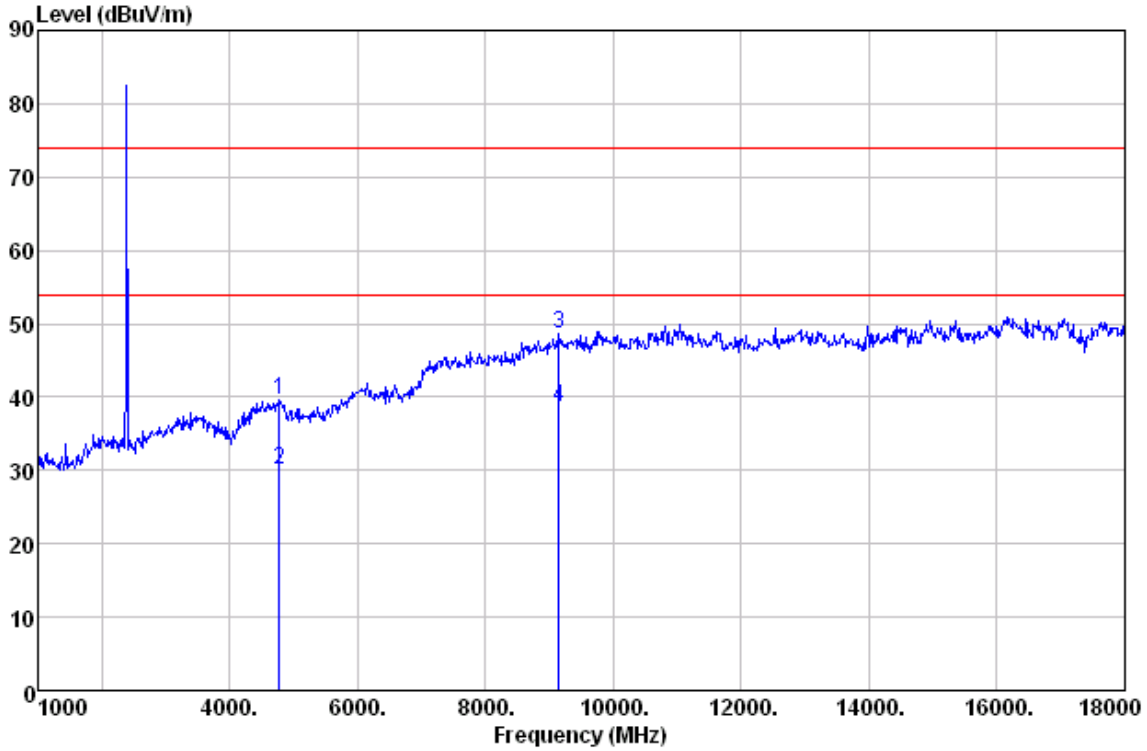
No.	Freq MHz	Read Level dBuV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Pol/Phase	Remark
1	4638.000	24.51	33.21	9.39	27.66	39.45	74.00	-34.55	HORIZONTAL	Peak
2	4638.000	15.44	33.21	9.39	27.66	30.38	54.00	-23.62	HORIZONTAL	Averag
3	8123.000	24.57	37.20	13.03	27.29	47.51	74.00	-26.49	HORIZONTAL	Peak
4	8123.000	13.49	37.20	13.03	27.29	36.43	54.00	-17.57	HORIZONTAL	Averag

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

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	4774.000	24.37	33.32	9.54	27.63	39.60	74.00	-34.40	VERTICAL	Peak
2	4774.000	14.91	33.32	9.54	27.63	30.14	54.00	-23.86	VERTICAL	Averag
3	9143.000	22.97	38.80	14.02	27.19	48.60	74.00	-25.40	VERTICAL	Peak
4	9143.000	12.90	38.80	14.02	27.19	38.53	54.00	-15.47	VERTICAL	Averag

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

Test at Channel 20 (2.440 GHz) in transmitting status

9 kHz~30MHz Test result

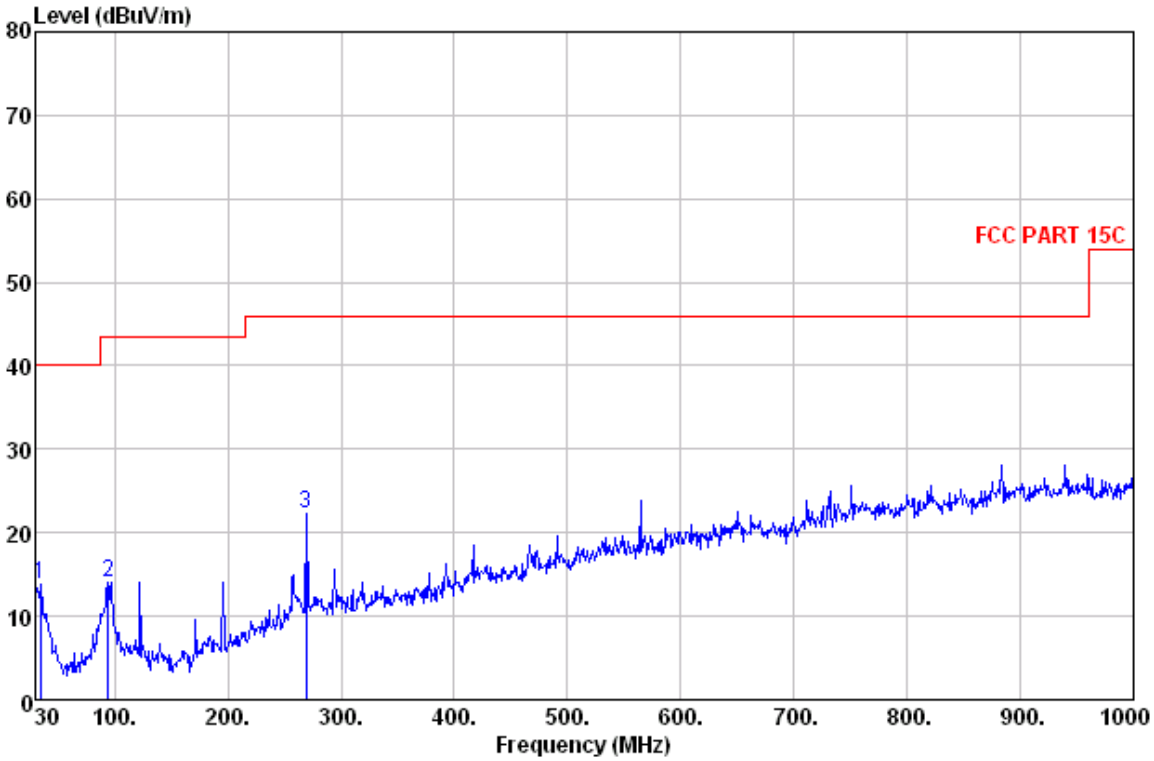
The Low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not report

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

Horizontal:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

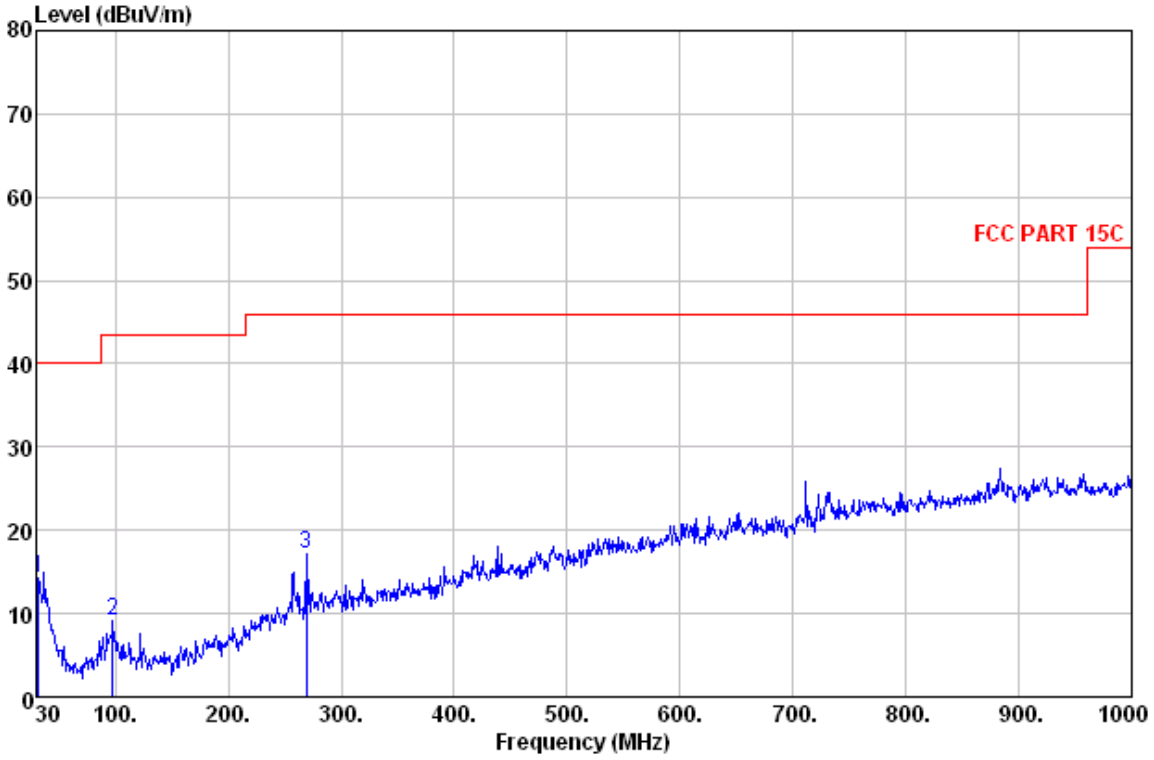
No.	Freq MHz	Read Level dBuV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Pol/Phase	Remark
1	34.850	26.26	15.38	0.67	28.60	13.71	40.00	-26.29	HORIZONTAL	QP
2	94.020	33.19	8.28	1.13	28.57	14.03	43.50	-29.47	HORIZONTAL	QP
3	269.590	34.82	12.74	2.01	27.22	22.35	46.00	-23.65	HORIZONTAL	QP

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

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	31.940	24.97	17.12	0.65	28.54	14.20	40.00	-25.80	VERTICAL	QP
2	97.900	28.25	8.53	1.16	28.72	9.22	43.50	-34.28	VERTICAL	QP
3	269.590	29.54	12.74	2.01	27.22	17.07	46.00	-28.93	VERTICAL	QP

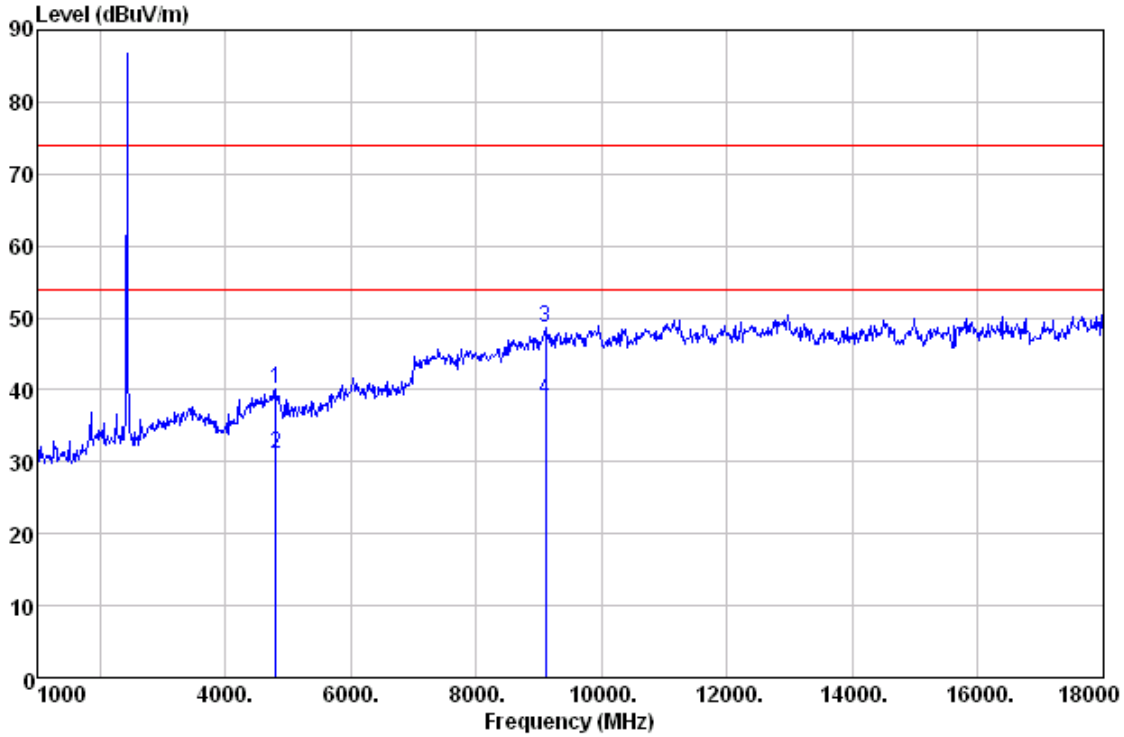
Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

Spurious emissions above 1GHz

Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

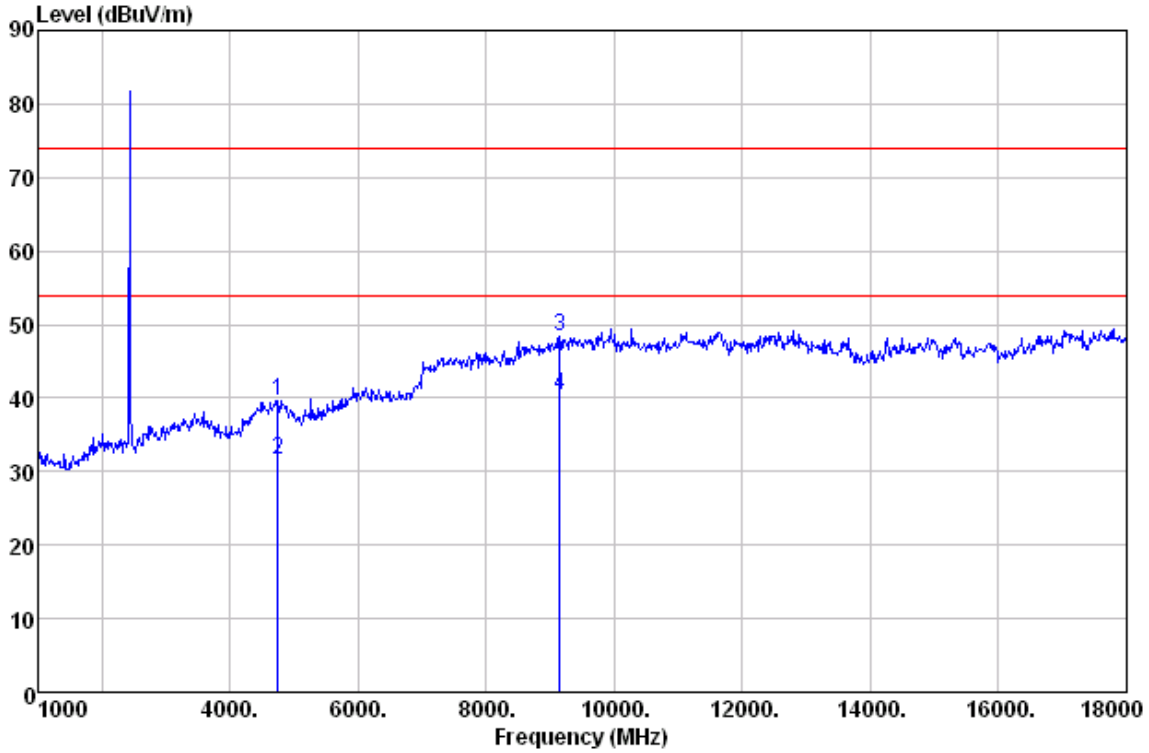
No.	Freq MHz	Read Level dBuV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Pol/Phase	Remark
1	4808.000	24.75	33.35	9.58	27.62	40.06	74.00	-33.94	HORIZONTAL	Peak
2	4808.000	15.78	33.35	9.58	27.62	31.09	54.00	-22.91	HORIZONTAL	Averag
3	9109.000	23.07	38.80	13.99	27.20	48.66	74.00	-25.34	HORIZONTAL	Peak
4	9109.000	13.02	38.80	13.99	27.20	38.61	54.00	-15.39	HORIZONTAL	Averag

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

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	4740.000	24.55	33.29	9.50	27.64	39.70	74.00	-34.30	VERTICAL	Peak
2	4740.000	16.52	33.29	9.50	27.64	31.67	54.00	-22.33	VERTICAL	Averag
3	9143.000	22.73	38.80	14.02	27.19	48.36	74.00	-25.64	VERTICAL	Peak
4	9143.000	14.69	38.80	14.02	27.19	40.32	54.00	-13.68	VERTICAL	Averag

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

Test at Channel 40 (2.480 GHz) in transmitting status

9kHz~30MHz Test result

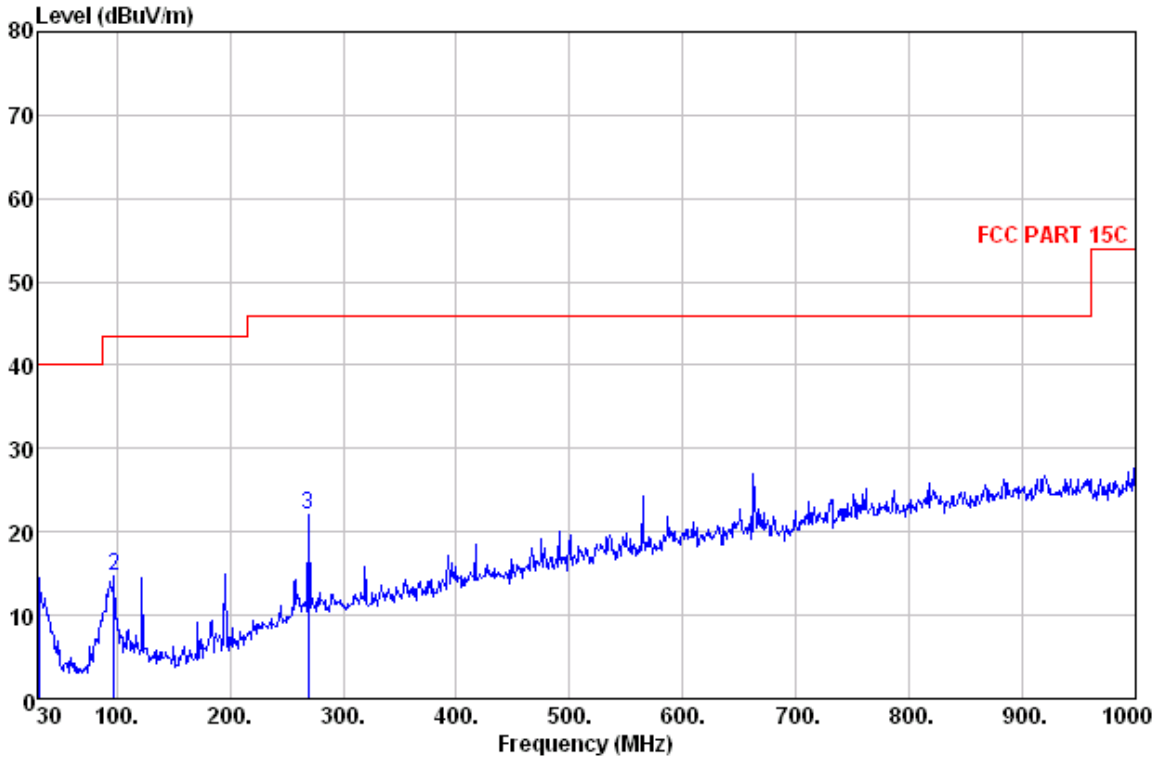
The Low frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not report

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

Horizontal:

Peak scan

Level (dBµV/m)



Quasi-peak measurement

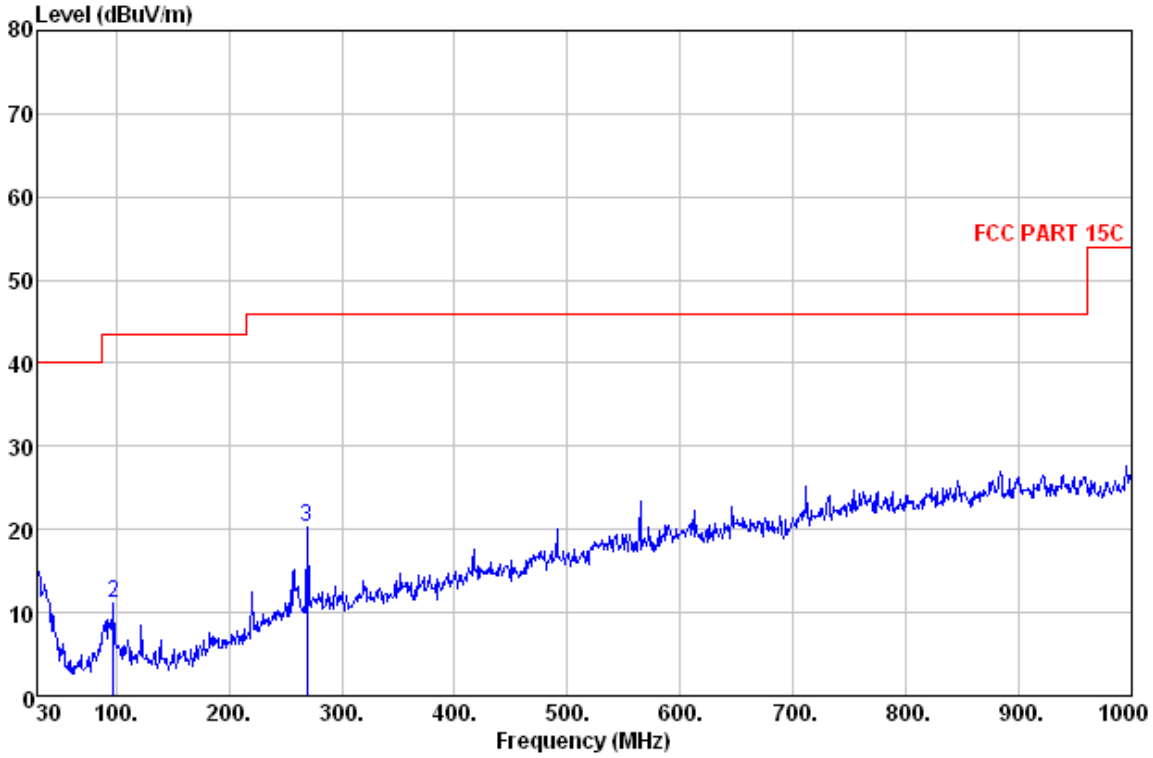
No.	Freq MHz	Read Level dBuV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Pol/Phase	Remark
1	30.970	24.91	17.41	0.64	28.52	14.44	40.00	-25.56	HORIZONTAL	QP
2	97.900	33.76	8.53	1.16	28.72	14.73	43.50	-28.77	HORIZONTAL	QP
3	269.590	34.43	12.74	2.01	27.22	21.96	46.00	-24.04	HORIZONTAL	QP

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

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	30.000	25.43	17.70	0.63	28.50	15.26	40.00	-24.74	VERTICAL	QP
2	97.900	30.27	8.53	1.16	28.72	11.24	43.50	-32.26	VERTICAL	QP
3	269.590	32.70	12.74	2.01	27.22	20.23	46.00	-25.77	VERTICAL	QP

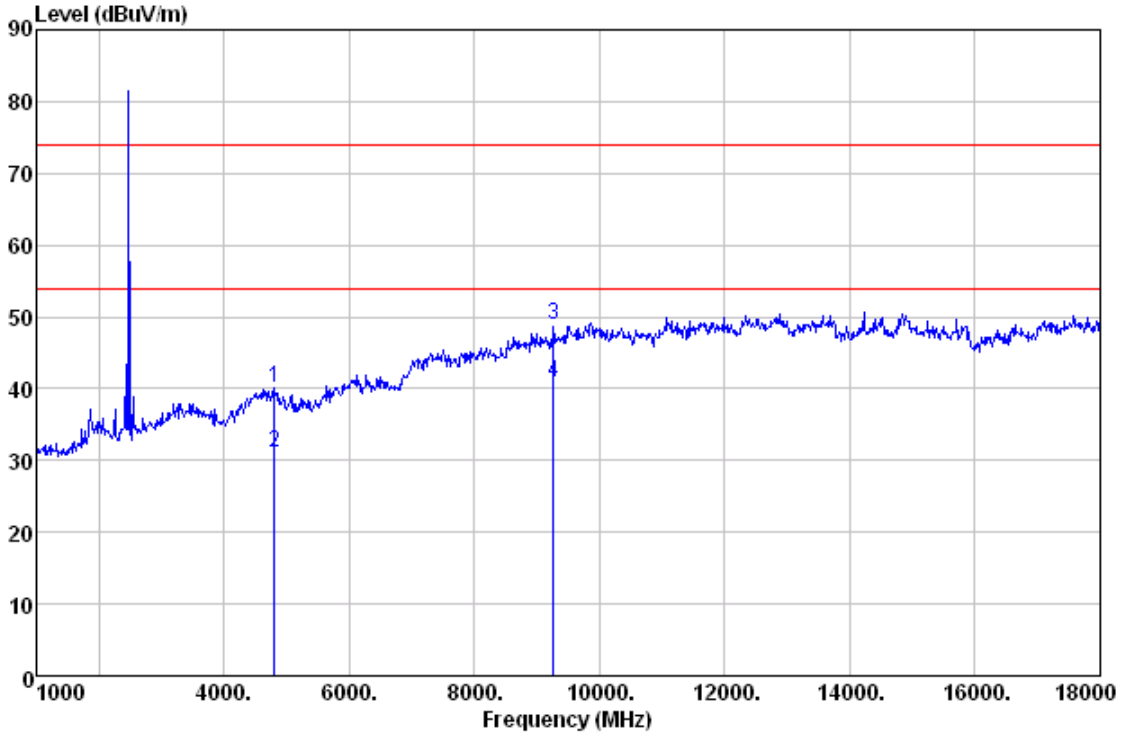
Level=Read Level + Antenna Factor + Cable Loss - Preamp Factor

Spurious emissions above 1GHz

Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

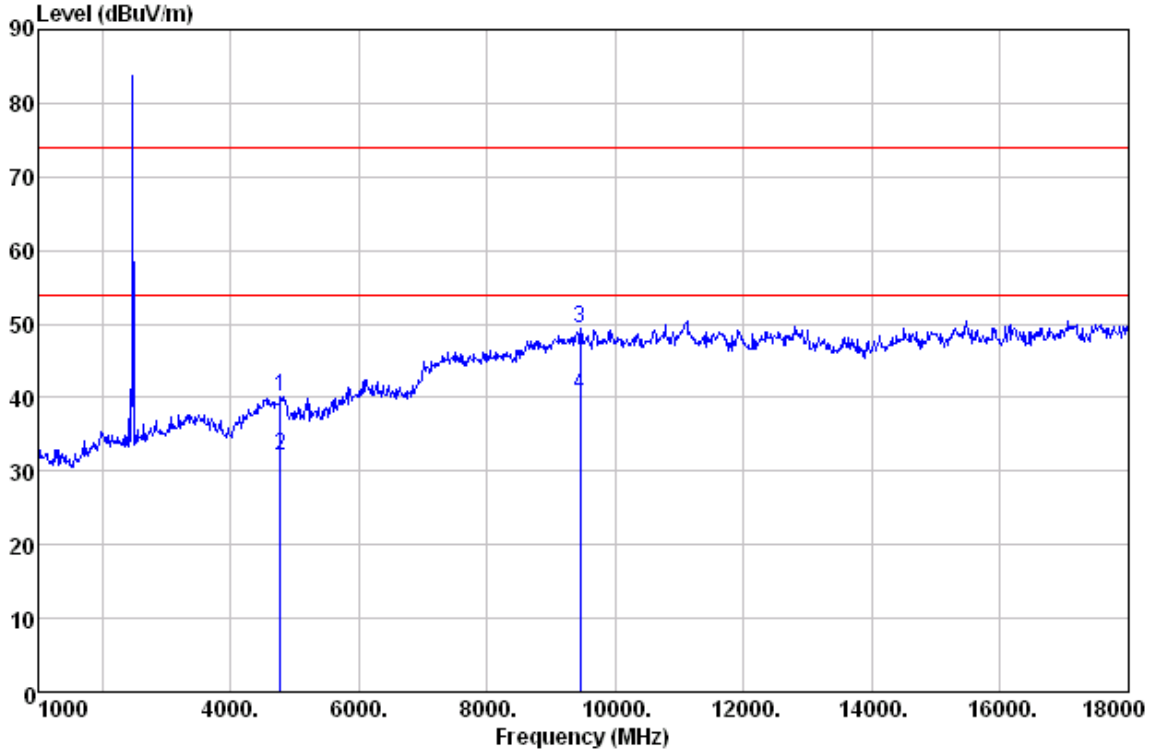
No.	Freq MHz	Read Level dBuV	Antenna Factor dB	Cable Loss dB	Preamp Factor dB	Level dBuV/m	Limit Line dBuV/m	Over Limit dB	Pol/Phase	Remark
1	4808.000	24.82	33.35	9.58	27.62	40.13	74.00	-33.87	HORIZONTAL	Peak
2	4808.000	15.88	33.35	9.58	27.62	31.19	54.00	-22.81	HORIZONTAL	Averag
3	9262.000	23.16	38.80	14.13	27.18	48.91	74.00	-25.09	HORIZONTAL	Peak
4	9262.000	15.09	38.80	14.13	27.18	40.84	54.00	-13.16	HORIZONTAL	Averag

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

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	4774.000	24.91	33.32	9.54	27.63	40.14	74.00	-33.86	VERTICAL	Peak
2	4774.000	16.87	33.32	9.54	27.63	32.10	54.00	-21.90	VERTICAL	Averag
3	9449.000	23.39	38.80	14.29	27.16	49.32	74.00	-24.68	VERTICAL	Peak
4	9449.000	14.32	38.80	14.29	27.16	40.25	54.00	-13.75	VERTICAL	Averag

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

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.

No any other emissions level which are attenuated less than 20dB below the limit.

According to 15.31(o), the amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this Part.

Hence there no other emissions have been reported.

Remark:

1) .For this intentional radiator operates below 25 GHz. The spectrum shall be investigated to the tenth harmonics of the highest fundamental frequency. And above the third harmonic of this intentional radiator, the disturbance is very low. So the test result only displays to 3rd harmonic.
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.

5.8 Radiated Emissions which fall in the restricted bands

Test Requirement:	FCC Part 15 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
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, channels and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.
Test site:	Measurement Distance: 3m (Semi-Anechoic Chamber)
Limit:	40.0 dBμV/m between 30MHz & 88MHz; 43.5 dBμV/m between 88MHz & 216MHz; 46.0 dBμV/m between 216MHz & 960MHz; 54.0 dBμV/m above 960MHz.
Detector:	For PK value: RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz VBW ≥ RBW Sweep = auto Detector function = peak Trace = max hold For AV value: RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz VBW =10Hz Sweep = auto Detector function = peak Trace = max hold

Section 15.205 Restricted bands of operation.

(a) Except as shown in paragraph (d) of this section. Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	
13.36 - 13.41	322 - 335.4		

Test Result:

Test at Channel 1 (2.402 GHz) in transmitting status

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	35.73	23.53	41.05	28.85
2390.000	26.56	6.46	27.79	34.16	24.75	39.39	29.98
2500.000	25.70	6.62	27.80	34.85	23.25	39.37	27.77
2483.500	25.79	6.61	27.80	35.64	23.64	40.24	28.24

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	34.75	22.43	40.07	27.75
2390.000	26.56	6.46	27.79	34.47	23.64	39.70	28.87
2500.000	25.70	6.62	27.80	35.73	22.98	40.25	27.50
2483.500	25.79	6.61	27.80	35.36	23.85	39.96	28.45

Test at Channel 20 (2.440 GHz) in transmitting status

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	36.12	23.43	41.44	28.75
2390.000	26.56	6.46	27.79	35.64	24.26	40.87	29.49
2500.000	25.70	6.62	27.80	36.63	23.55	41.15	28.07
2483.500	25.79	6.61	27.80	35.54	23.73	40.14	28.33

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	36.14	23.12	41.46	28.44
2390.000	26.56	6.46	27.79	35.53	22.87	40.76	28.10
2500.000	25.70	6.62	27.80	35.72	23.62	40.24	28.14
2483.500	25.79	6.61	27.80	35.03	22.76	39.63	27.36

Test at Channel 40 (2.480 GHz) in transmitting status

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	34.86	23.65	40.18	28.97
2390.000	26.56	6.46	27.79	35.57	22.38	40.80	27.61
2500.000	25.70	6.62	27.80	35.12	23.77	39.64	28.29
2483.500	25.79	6.61	27.80	35.74	23.74	40.34	28.34

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	35.43	23.26	40.75	28.58
2390.000	26.56	6.46	27.79	33.96	22.37	39.19	27.60
2500.000	25.70	6.62	27.80	34.56	24.43	39.08	28.95
2483.500	25.79	6.61	27.80	35.34	23.68	39.94	28.28

5.9 Band Edges Requirement

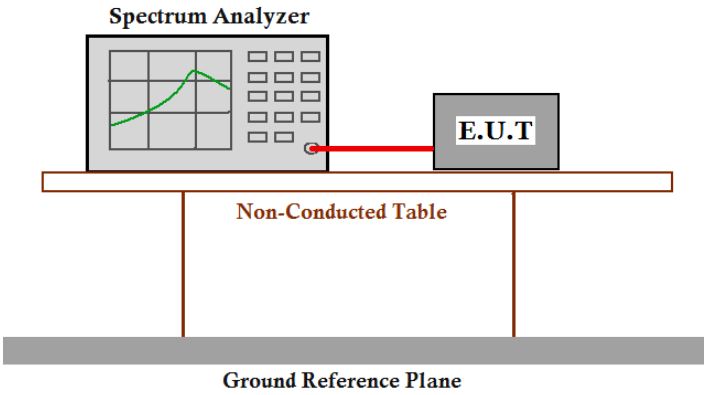
Test Requirement: FCC Part 15 C section 15.247
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 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.

Frequency Band: 2400 MHz to 2483.5 MHz

Test Method: ANSI C63.10:2013

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, channels and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

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 analyzer or power meter.
2. Set RBW=100 kHz, VBW=300 KHz, suitable frequency span including 1000 kHz bandwidth from band edge.
3. Measure the Conducted Spurious Emissions and Radiated Emissions of the test frequency with special test status.
4. Repeat until all the test status is investigated.
5. Report the worse.

Test result with plots as follows:

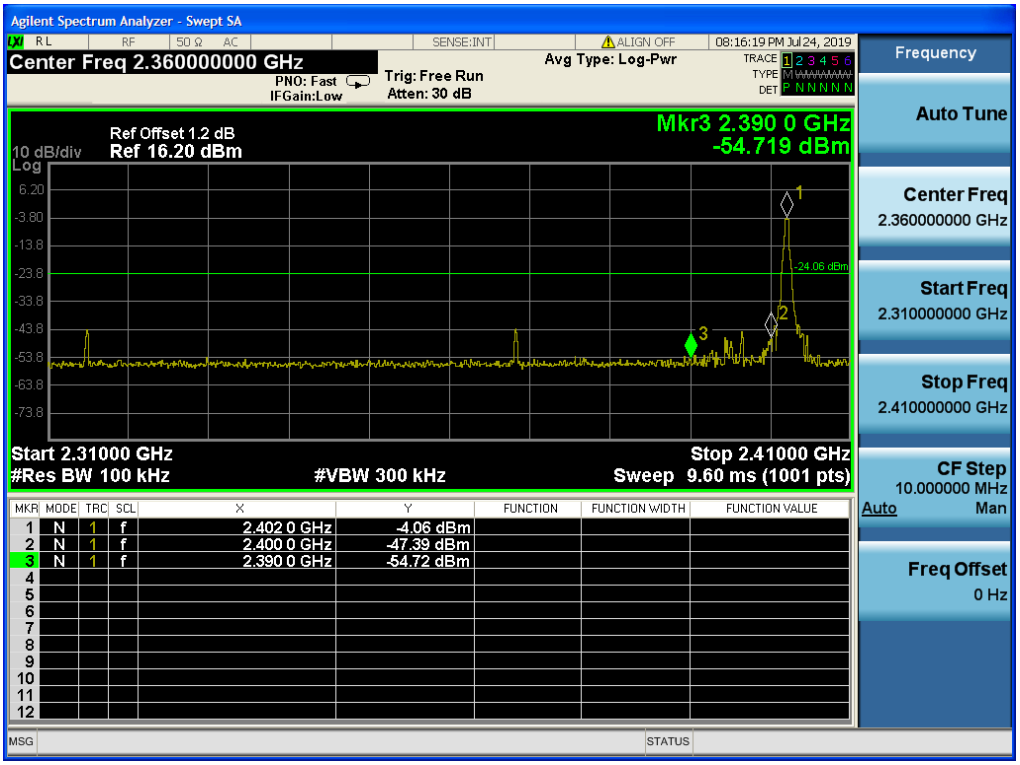
The band edges was measured and recorded Result:

The Lower Edges attenuated more than 20dB.

The Upper Edges attenuated more than 20dB.

Result plot as follows:

Channel 1: 2.402 GHz



Channel 40: 2.480 GHz

Test result: The unit does meet the FCC requirements.

5.10 Conducted Emissions at Mains Terminals 150 kHz to 30MHz

Test Requirement: FCC Part 15 C section 15.207

Test Voltage: 120V~ 60Hz

Test Method: ANSI C63.10:2013 Clause 6.2

Frequency Range: 150 kHz to 30 MHz

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

Test Limit

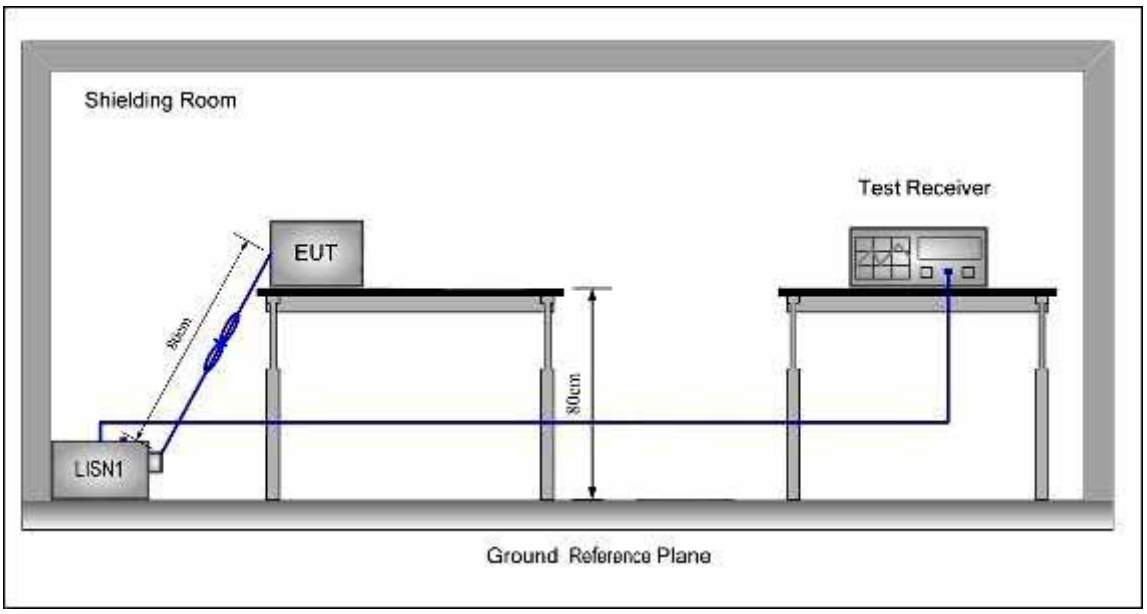
Limits for conducted disturbance at the mains ports of class B

- Frequency Range	Class B Limit dB(μV)	
	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, channels 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 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, but separated from metallic contact with the ground reference plane by 0.1m of insulation.

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.

5.10.1 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 (dBμV)

/

Quasi-peak and Average measurement

/

Neutral Line

Peak Scan:

Level (dBμV)

/

Quasi-peak and Average measurement

/

-- End of test report --