FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 2

CERTIFICATION TEST REPORT

For

MusicLens

MODEL NUMBER: Modern
ADDITIONAL NUMBER: Geek, Vogue

PROJECT NUMBER: 4788723974

REPORT NUMBER: 4788723974-1

FCC ID: 2ARQG-ML0101

ISSUE DATE: Nov. 14, 2018

Prepared for

MusicLens Inc.

Prepared by

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Revision History

Rev.	Issue Date	Revisions	Revised By
--	11/14/2018	Initial Issue	

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name:	MusicLens Inc.
Address:	311 E VALLEY BLVD#112 PMB27, SANGABRIEL, CA 91776

Manufacturer Information

Company Name:	Hangzhou Kibey Network Technology Co., Ltd.
Address:	9F, Building 8, Sunking International Building, Yuhang Distrct, Hangzhou, Zhejiang, China

EUT Description

Product Name	MusicLens
Model Name	Modern
Additional number	Geek, Vogue
Sample ID	1883286
Sample Received date	October 24, 2018
Date Tested	October 24~November 14, 2018

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	PASS
ISED RSS-247 Issue 2	PASS
ISED RSS-GEN Issue 5	PASS

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Summary of Test Results			
Clause	Test Items	FCC/IC Rules	Test Results
1	6db DTS Bandwidth and 99% Bandwidth	FCC 15.247 (a) (2) RSS-247 Clause 5.2 (a) RSS-Gen Clause 6.6	PASS
2	Peak Conducted Power	FCC 15.247 (b) (3) RSS-247 Clause 5.4 (e)	PASS
3	Power Spectral Density	FCC 15.247 (e) RSS-247 Clause 5.2 (b)	PASS
4	Conducted Band edge And Spurious emission	FCC 15.247 (d) RSS-247 Clause 5.5	PASS
5	Radiated Band edges and Spurious emission	FCC 15.247 (d) FCC 15.209 FCC 15.205 RSS-247 Clause 5.5 RSS-GEN Clause 8.9 RSS-GEN Clause 8.10	PASS
6	Conducted Emission Test For AC Power Port	FCC 15.207 RSS-GEN Clause 8.8	PASS
7	Antenna Requirement	FCC 15.203 RSS-GEN Clause 8.3	PASS
Remark: The product is powered by battery, and the EUT will shut down during the charge mode .			

Tested By:

Kebo Zhang
Engineer

Checked By:

Shawn Wen
Laboratory Leader

Approved By:

Stephen Guo

Laboratory Manager

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013, KDB558074 D01 DTS Meas Guidance v05, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 5, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

Test Location	UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch.
Address	Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China
Accreditation Certificate	**A2LA (Certificate No.: 4102.01)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA. **FCC (FCC Designation No.: CN1187)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Delcaration of Conformity (DoC) and Certification rules **IC(Company No.: 21320)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320. **VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793. Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B , the VCCI registration No. is C-20012 and T-20011

Note:

1. All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China
2. The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.
3. For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. And these measurements below 30MHz had been correlated to measurements performed on an OATS.

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4. CALIBRATION AND UNCERTAINTY

4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognize national standards.

4.2 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty
Uncertainty for Conduction emission test	2.90dB
Uncertainty for Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	2.2dB
Uncertainty for Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	4.52dB
Uncertainty for Radiation Emission test (1GHz to 26GHz)(include Fundamental emission)	5.04dB(1-6GHz)
	5.30dB (6GHz-18Gz)
	5.23dB (18GHz-26Gz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Equipment	MusicLens		
Model Name	Modern		
Product Description	Operation Frequency	2402 MHz ~ 2480 MHz	
	Modulation Type		Data Rate
	GFSK		1Mbps
Power Supply （Battery）	Model No.: PL 401086 Output: 3.7V 245mAh 0.91Wh		
Bluetooth Version	5.0		
	This test report is just for the Bluetooth BLE mode		
Hardware Version	V1R0		

Note: Geek and Vogue have the same technical construction including circuit diagram, PCB layout, components and component layout, all electrical construction and mechanical construction with Modern sample. The difference lies only on shape, color, logo technic, painting material and decorations.

5.2. MAXIMUM OUTPUT POWER

Bluetooth Mode	Frequency (MHz)	Channel Number	Max Output Power (dBm)	EIRP (dBm)
BLE	2402-2480	0-39[40]	-0.24	3.44

5.3. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	11	2424	22	2446	33	2468
1	2404	12	2426	23	2448	34	2470
2	2406	13	2428	24	2450	35	2472
3	2408	14	2430	25	2452	36	2474
4	2410	15	2432	26	2454	37	2476
5	2412	16	2434	27	2456	38	2478
6	2414	17	2436	28	2458	39	2480
7	2416	18	2438	29	2460		
8	2418	19	2440	30	2462		
9	2420	20	2442	31	2464		
10	2422	21	2444	32	2466		

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5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
GFSK	CH 0, CH 19, CH 39	2402MHz, 2440MHz, 2480MHz

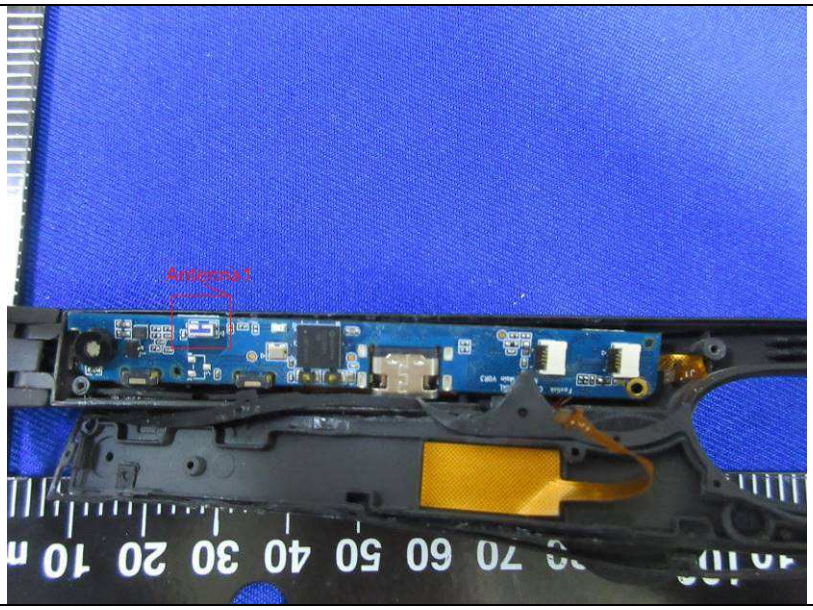
5.5. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band							
Test Software		BlueTest3					
Modulation Type	Transmit Antenna Number	Test Channel					
		CH 00		CH 19		CH 39	
GFSK	1	Ext	Int	Ext	Int	Ext	Int
		255	50	255	50	255	50

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	2402-2480	Internal Antenna	3.68

Test Mode	Transmit and Receive Mode	Description
GFSK	1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.

Antenna


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5.7. WORST-CASE CONFIGURATIONS

Bluetooth Mode	Modulation Technology	Modulation Type	Data Rate (Mbps)
BLE	DTS	GFSK	1Mbit/s

5.8. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	55 ~ 65%	
Atmospheric Pressure:	1005Pa	
Temperature	TN	20°C
Voltage	VL	N/A
	VN	Battery: DC3.7V
	VH	N/A

Note: VL= Lower Extreme Test Voltage
VN= Nominal Voltage
VH= Upper Extreme Test Voltage
TN= Normal Temperature

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5.9. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Remarks
1	Laptop	ThinkPad	E450	N/A

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	USB	USB	Unshielded	0.5	N/A

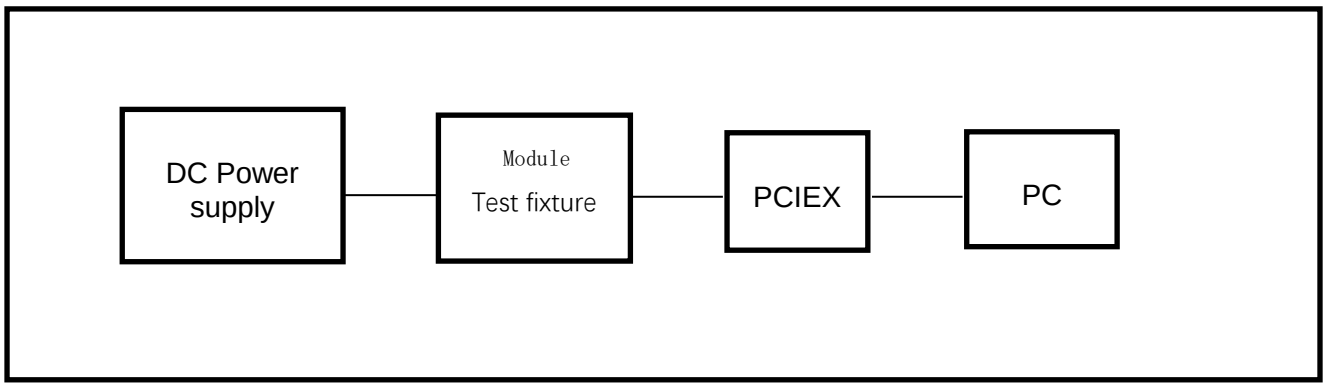
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	N/A	N/A	N/A	N/A

TEST SETUP

The EUT can work in an engineer mode with a software through a PC.

SETUP DIAGRAM FOR TEST



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5.10. MEASURING INSTRUMENT AND SOFTWARE USED

	Conducted Emissions						
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
☑	EMI Test Receiver	R&S	ESR3	101961	Dec.20, 2016	Dec.12, 2017	Dec.11, 2018
☑	Two-Line V-Network	R&S	ENV216	101983	Dec.20, 2016	Dec.12, 2017	Dec.11, 2018
☑	Artificial Mains Networks	Schwarzbeck	NSLK 8126	8126465	Feb.10, 2017	Dec.12, 2017	Dec.11, 2018
	Software						
Used	Description			Manufacturer	Name		Version
☑	Test Software for Conducted disturbance			UL	Antenna port		Ver. 7.2
	Radiated Emissions						
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
☑	MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Feb.24, 2017	Dec.12, 2017	Dec.11, 2018
☑	Hybrid Log Periodic Antenna	TDK	HLP-3003C	130960	N/A	Jan.09, 2016	Jan.08, 2019
☑	Preamplifier	HP	8447D	2944A09099	Feb.13, 2017	Dec.12, 2017	Dec.11, 2018
☑	EMI Measurement Receiver	R&S	ESR26	101377	Dec.20, 2016	Dec.12, 2017	Dec.11, 2018
☑	Horn Antenna	TDK	HRN-0118	130939	N/A	Jan. 09, 2016	Jan. 08, 2019
☑	High Gain Horn Antenna	Schwarzbeck	BBHA-9170	691	N/A	Jan.06, 2016	Jan.05, 2019
☑	Preamplifier	TDK	PA-02-0118	TRS-305-00066	Jan.14, 2017	Dec.12, 2017	Dec.11, 2018
☑	Preamplifier	TDK	PA-02-2	TRS-307-00003	Dec.20, 2016	Dec.12, 2017	Dec.11, 2018
☑	Loop antenna	Schwarzbeck	1519B	00008	N/A	Mar. 26, 2016	Mar. 25, 2019
	Software						
Used	Description			Manufacturer	Name		Version
☑	Test Software for Radiated disturbance			Farad	EZ-EMC		Ver. UL-3A1
	Other instruments						
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
☑	Spectrum Analyzer	Keysight	N9030A	MY55410512	Dec.20, 2016	Dec.12, 2017	Dec.11, 2018
☑	Power Meter	Keysight	N9031A	MY55416024	Feb.13, 2017	Dec.12, 2017	Dec.11, 2018
☑	Power Sensor	Keysight	N9323A	MY55440013	Feb.13, 2017	Dec.12, 2017	Dec.11, 2018

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6. ANTENNA PORT TEST RESULTS

6.1. ON TIME AND DUTY CYCLE

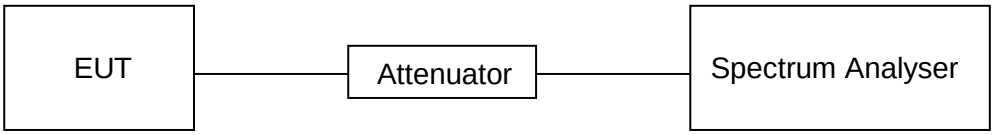
LIMITS

None; for reporting purposes only

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method

TEST SETUP

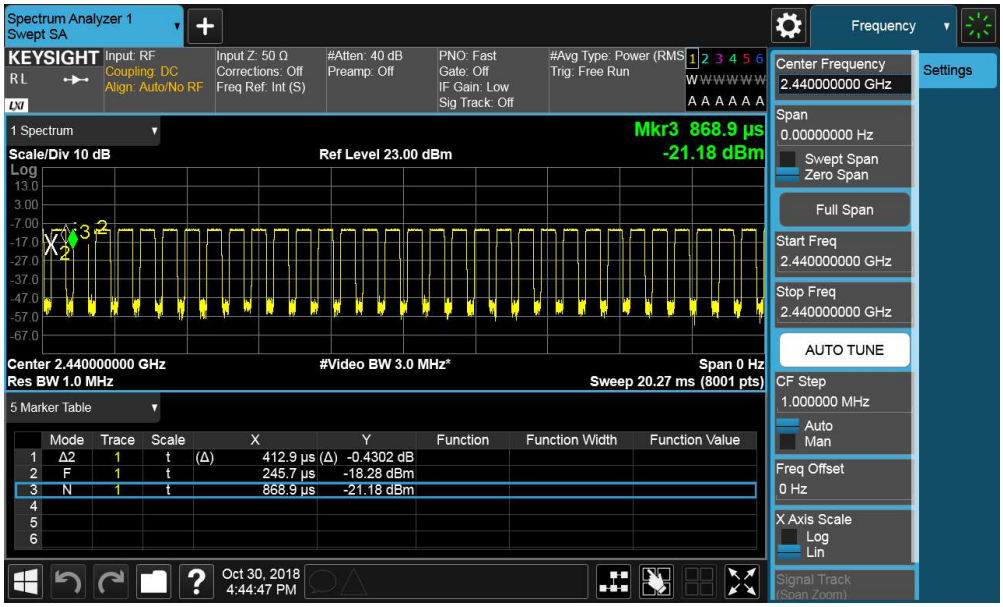


RESULTS

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Corrective Factor (db)	1/T Minimum VBW (KHz)
BLE	0.4129	0.6232	0.6625	66	1.79	2.42

Note: Duty Cycle Corrective Factor=10log(1/x).
Where: x is Duty Cycle(Linear)
Where: T is On Time (transmit duration)

ON TIME AND DUTY CYCLE MID CH



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6.2. 6 dB DTS BANDWIDTH AND 99% BANDWIDTH

LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(a)(2) RSS-247 5.2 (a)	6dB Bandwidth	>= 500KHz	2400-2483.5
RSS-Gen Clause 6.6	99% Bandwidth	For reporting purposes only.	2400-2483.5

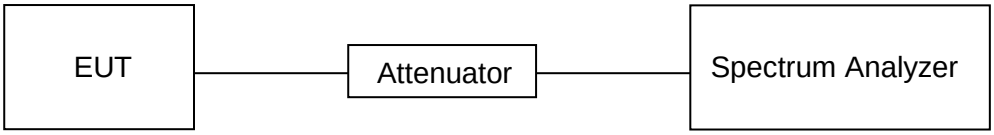
TEST PROCEDURE

Connect the UUT to the spectrum analyzer and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	For 6 dB Bandwidth :100K For 99% Bandwidth :1% to 5% of the occupied bandwidth
VBW	For 6dB Bandwidth : ≥3 × RBW For 99% Bandwidth : approximately 3×RBW
Trace	Max hold
Sweep	Auto couple

Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

TEST SETUP



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RESULTS

Channel	Frequency (MHz)	6dB bandwidth (MHz)	99% bandwidth (MHz)	Limit (kHz)	Result
Low	2402	0.6899	1.0508	500	Pass
Middle	2440	0.6949	1.0490	500	Pass
High	2480	0.7042	1.0491	500	Pass

6 dB BANDWIDTH LOW CH

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6 dB BANDWIDTH MID CH

6 dB BANDWIDTH HIGH CH

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6.3. PEAK CONDUCTED OUTPUT POWER

LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(b)(3) RSS-247 5.4 (e)	Peak Output Power	1 watt or 30dBm	2400-2483.5

TEST PROCEDURE

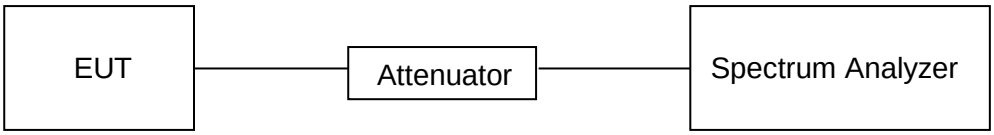
Connect the UUT to the spectrum analyzer and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	≥DTS bandwidth(e.g. 1 MHz for BLE)
VBW	≥3 × RBW
Span	3 x RBW
Trace	Max hold
Sweep time	Auto couple.

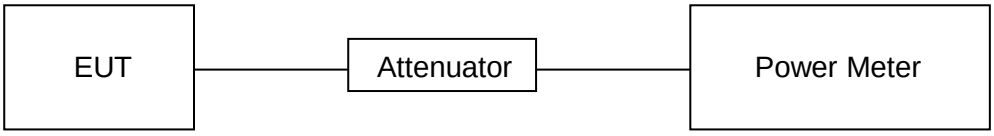
Allow trace to fully stabilize and use peak marker function to determine the peak amplitude level.

TEST SETUP

for peak power measurement:



for average power measurement:



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RESULTS

Part I: Maximum Conducted Output Power(PK)

Test Channel	Frequency	Maximum Conducted Output Power(PK)	EIRP	LIMIT
	(MHz)	(dBm)	(dBm)	dBm
CH00	2402	-0.24	3.34	30
CH19	2440	-0.62	3.06	30
CH39	2480	-1.25	2.43	30

OUTPUT POWER LOW CH

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OUTPUT POWER MID CH

OUTPUT POWER HIGH CH

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Part II: Average Conducted Output Power(AV)

Test Channel	Frequency	Reading Level	Average Conducted Output Power(AV)	EIRP
	(MHz)	(dBm)	(dBm)	(dBm)
CH00	2402	-3.11	-1.32	2.36
CH19	2440	-6.41	-4.62	-0.94
CH39	2480	-5.85	-4.06	-0.38

Note:
1. This part is measured by power meter for calculating the tune-up power.
2. Average Conducted Output Power = Reading Level + Corrective Factor.
3. For the Corrective Factor please refer to clause 6.1. ON TIME AND DUTY CYCLE.

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6.4. POWER SPECTRAL DENSITY

LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC §15.247 (e) RSS-247 5.2 (b)	Power Spectral Density	8 dBm in any 3 kHz band	2400-2483.5

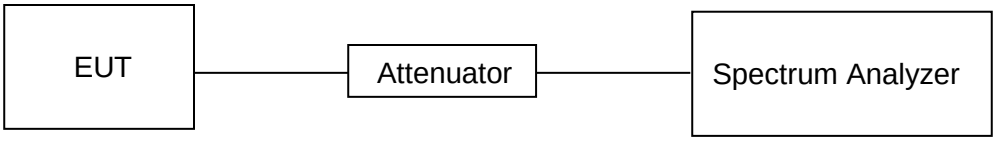
TEST PROCEDURE

Connect the UUT to the spectrum analyzer and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	3 kHz ≤ RBW ≤ 100 kHz
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.
If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST SETUP



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RESULTS

Frequency	Power Spectral Density (dBm/100kHz)	Limit (dBm/3kHz)	Result
2402 MHz	-0.773	8	PASS
2440 MHz	-1.077	8	PASS
2480 MHz	-1.735	8	PASS

PSD LOW CH

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PSD MID CH

PSD HIGH CH

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6.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2		
Section	Test Item	Limit
FCC §15.247 (d) RSS-247 5.5	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

Connect the UUT to the spectrum analyzer and use the following settings:

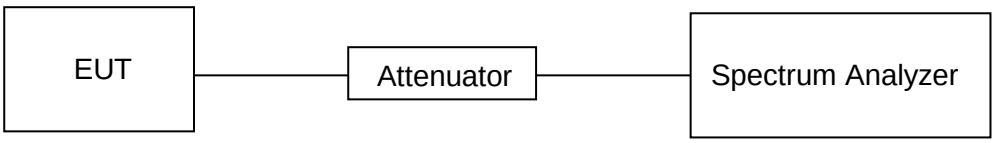
Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	100K
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum PSD level.

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100K
VBW	≥3 × RBW
measurement points	≥span/RBW
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum amplitude level**.**

TEST SETUP



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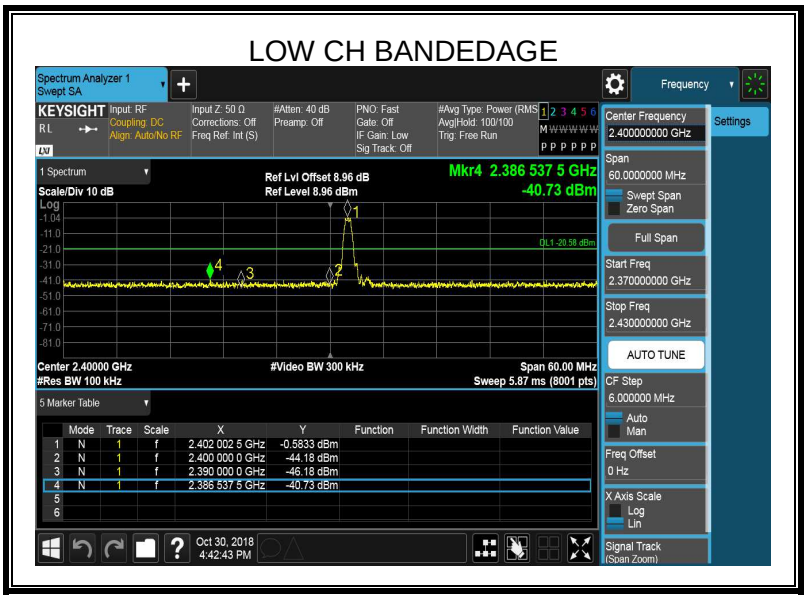
RESULTS



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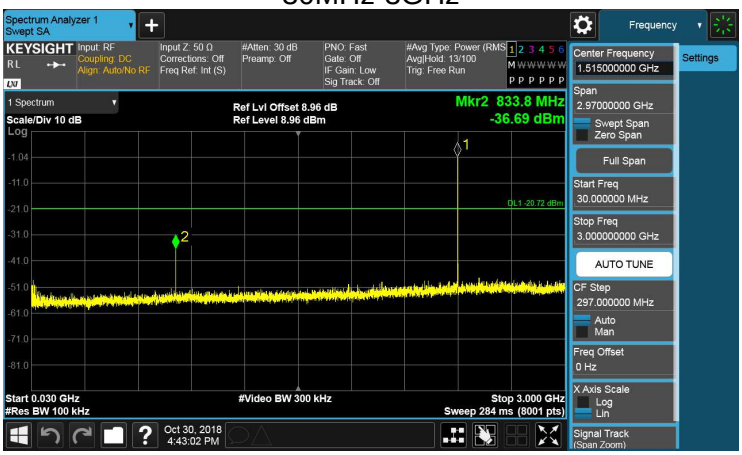
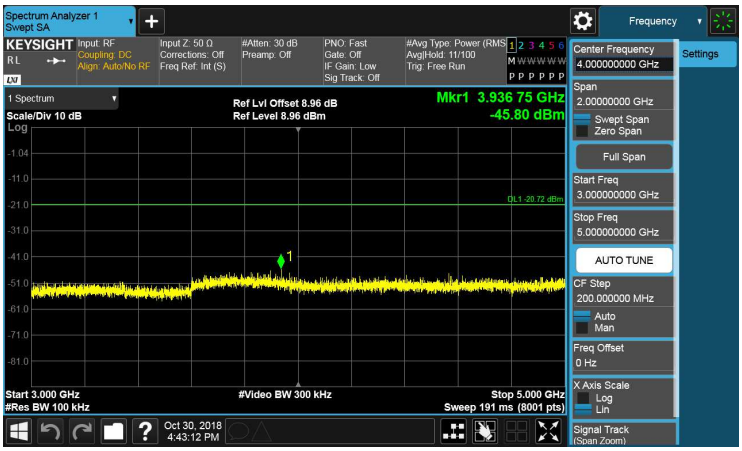
LOW CH SPURIOUS

30MHz-3GHz



3GHz-5GHz



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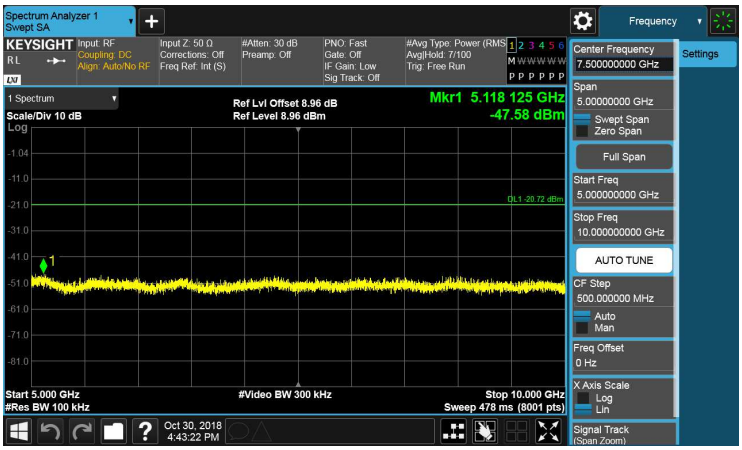
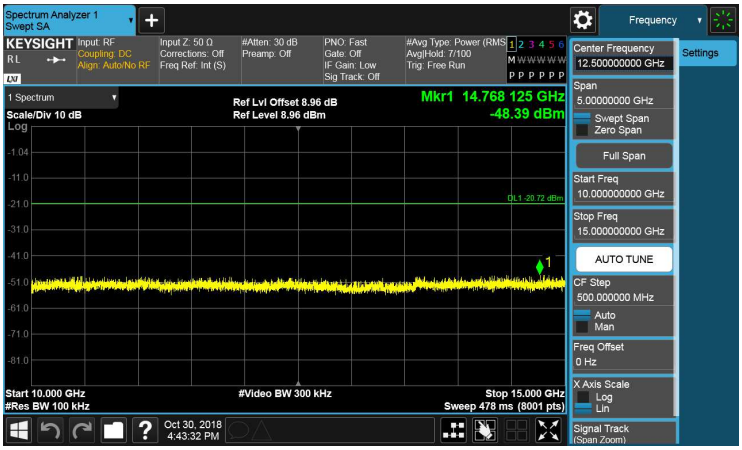
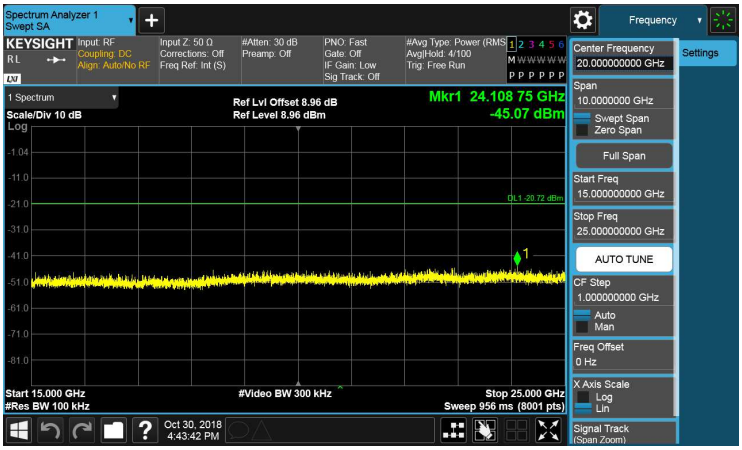
LOW CH SPURIOUS
5GHz - 10GHz



10GHz-15GHz



15GHz-25GHz



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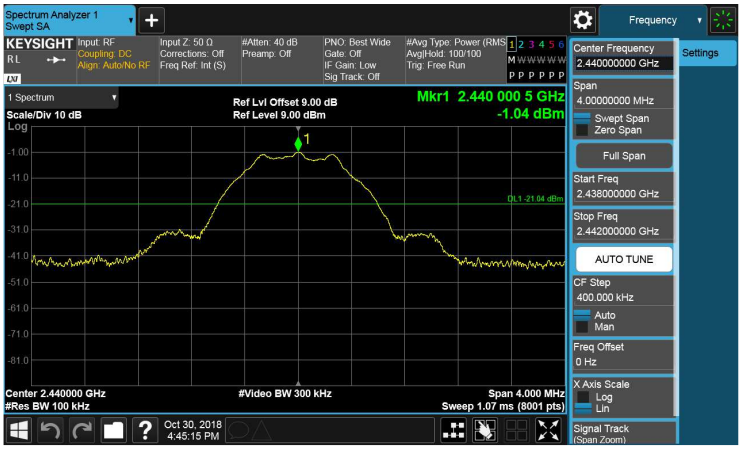
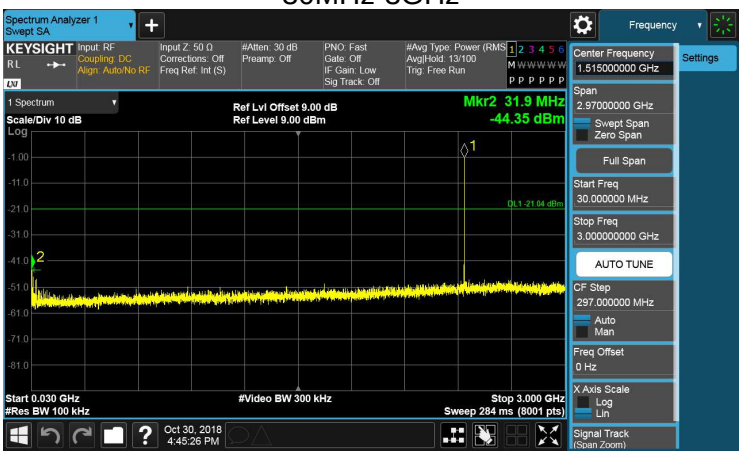
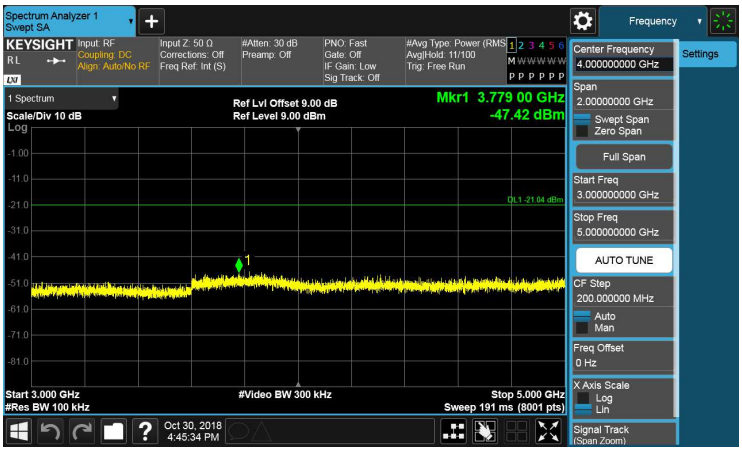
MID CH SPURIOUS



30MHz-3GHz



3GHz-5GHz



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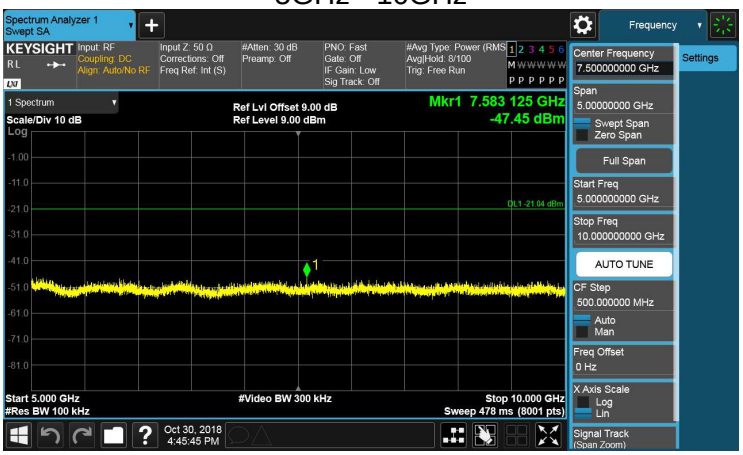
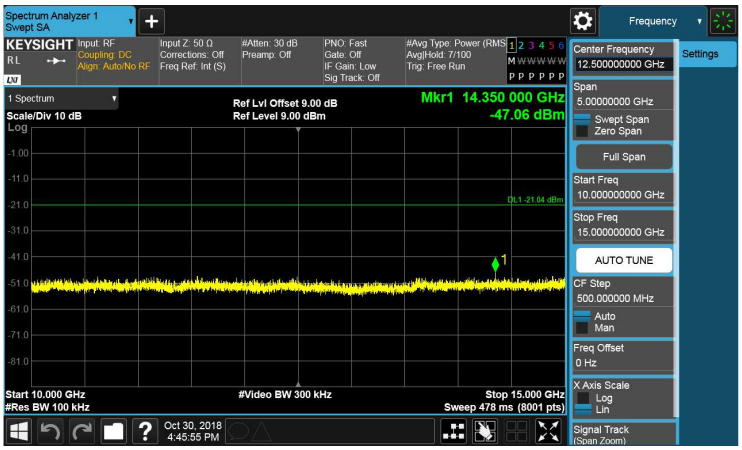
MID CH SPURIOUS

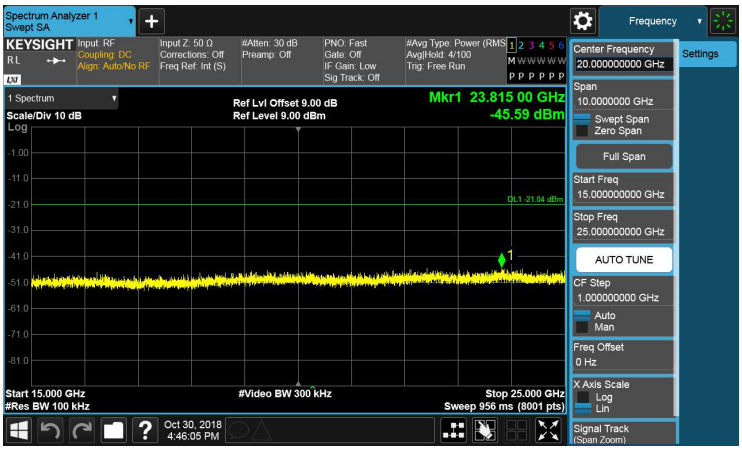
5GHz - 10GHz



10GHz-15GHz



15GHz-25GHz



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HIGH CH BANDEDAGE

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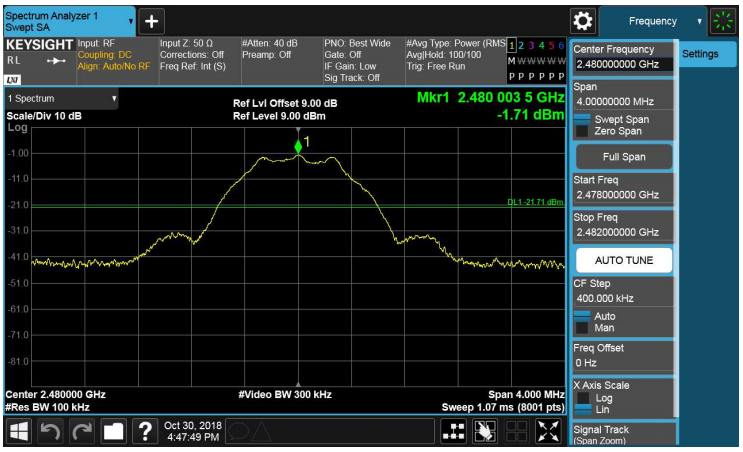
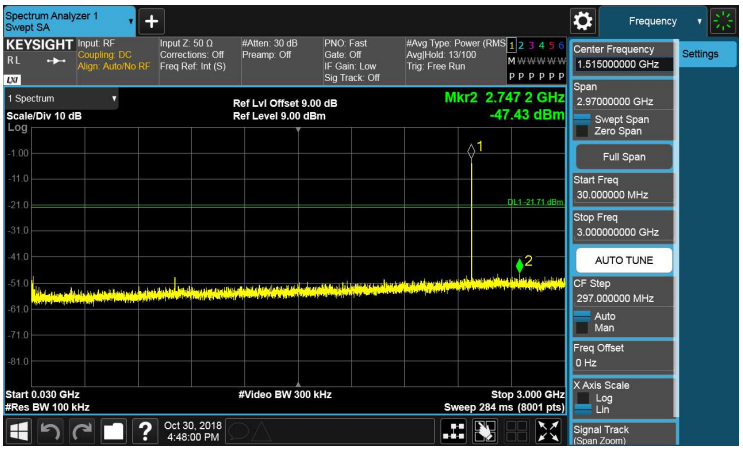
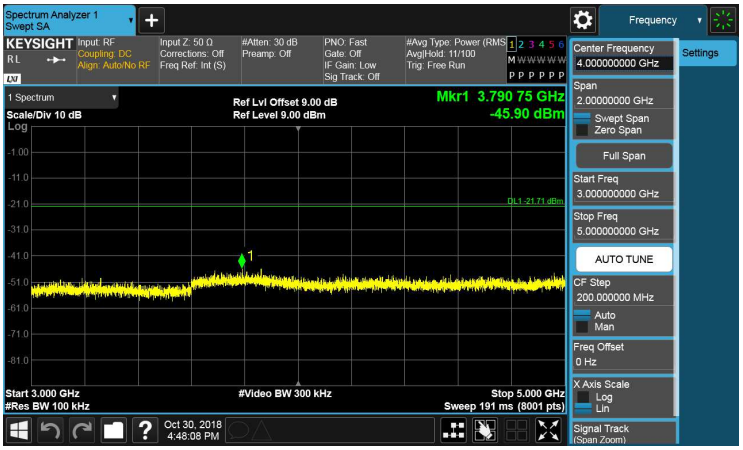
HIG CH SPURIOUS



30MHz-3GHz



3GHz-5GHz



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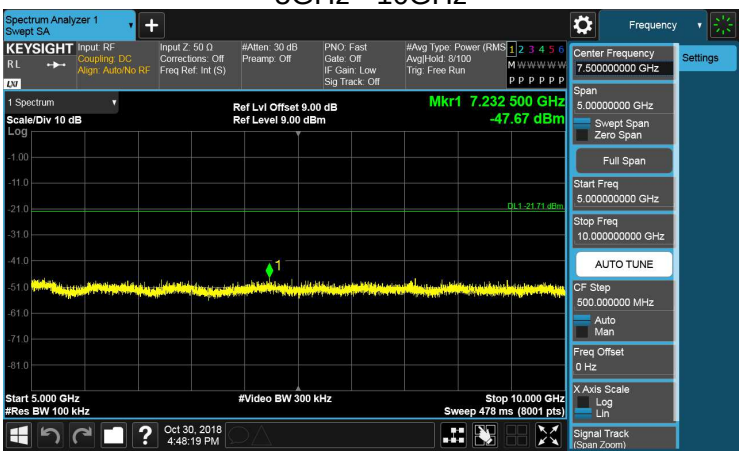
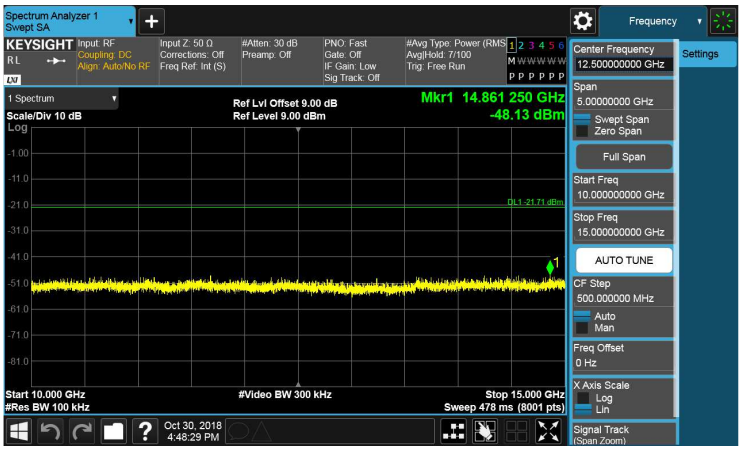
HIG CH SPURIOUS

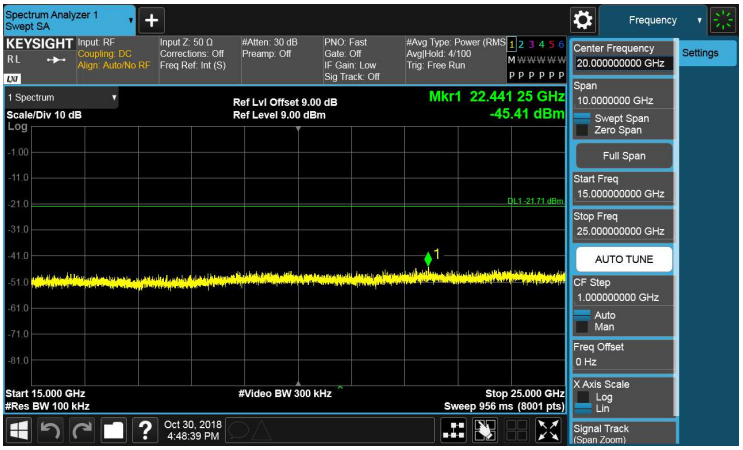
5GHz - 10GHz



10GHz-15GHz



15GHz-25GHz



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7. RADIATED TEST RESULTS

LIMITS

Please refer to FCC §15.205 and §15.209

Please refer to RSS-GEN Clause 8.9 and Clause 8.10

Radiation Disturbance Test Limit for FCC (Class B)(9KHz-1GHz)

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
960~1000	500	3

Note: 1) At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

(2) At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). This paragraph (f) shall not apply to Access BPL devices operating below 30 MHz.

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Radiation Disturbance Test Limit for FCC (Above 1G)

Frequency (MHz)	dB(uV/m) (at 3 meters)	
	Peak	Average
Above 1000	74	54

Restricted bands of operation

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	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

Note: [1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2]Above 38.6c

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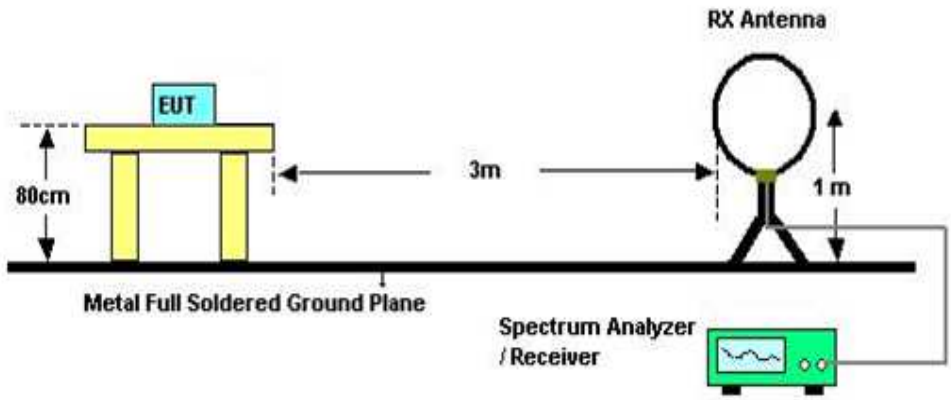
TEST SETUP AND PROCEDURE

Below 30MHz



The setting of the spectrum analyzer

RBW	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)
VBW	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)
Sweep	Auto
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013

2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80cm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. The radiated emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

6. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak and average detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak and average detector and reported.

7. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)

8. Result level = Read level + Antenna Factor + Cable loss

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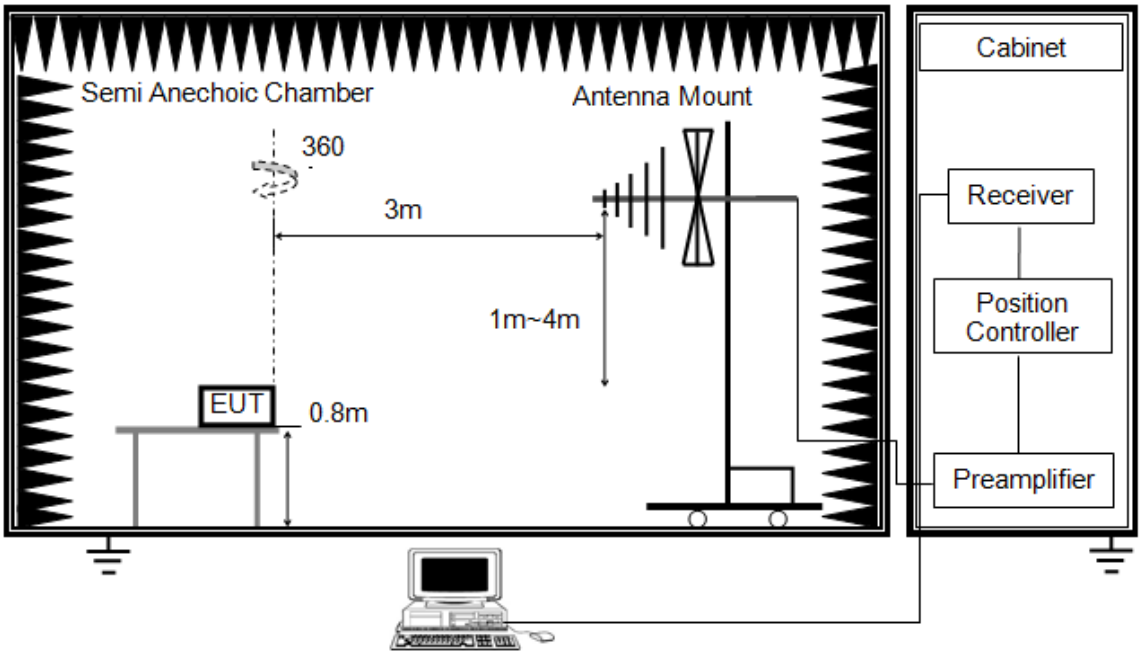
Below 1G and above 30MHz



The setting of the spectrum analyzer

RBW	120K
VBW	300K
Sweep	Auto
Detector	Peak/QP
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013.

2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80cm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

6. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)

7. Result level = Read level + Antenna Factor + Cable loss

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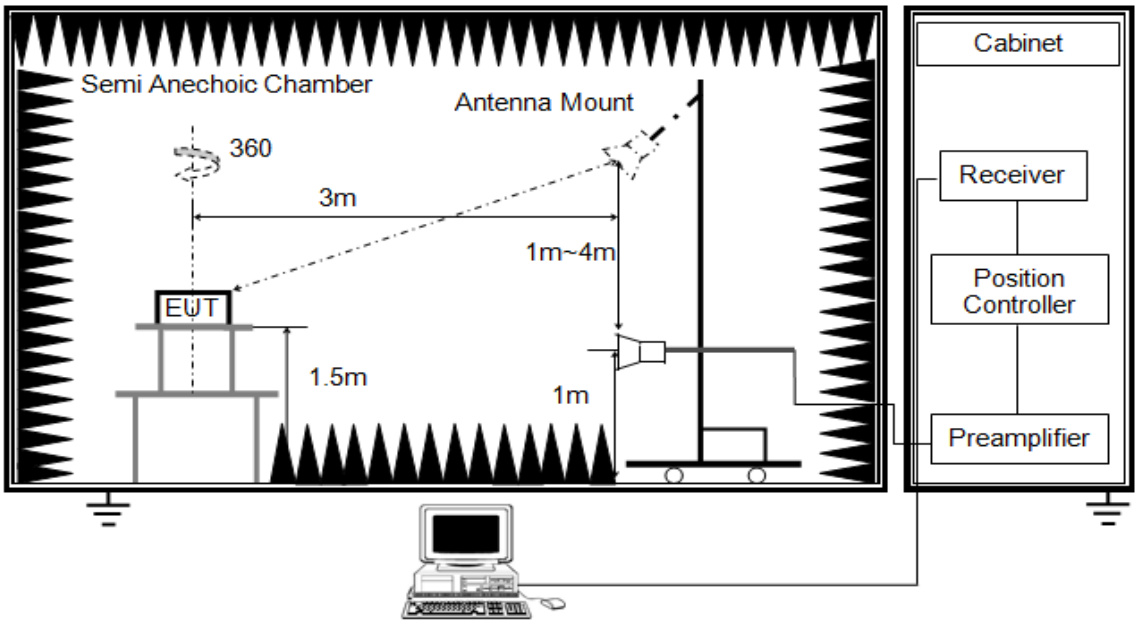

The setting of the spectrum analyzer

RBW	1M
VBW	PEAK: 3M AVG: see note 6
Sweep	Auto
Detector	Peak
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013.

2. The EUT was arranged to its worst case and then tune the antenna tower (1.5 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 1.5m above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector, max hold to be run for at least 50 x (1/duty cycle) traces for average measurements..

6. For the actual test configuration, please refer to the related item in this test report.

7. Result level = Read level + Antenna Factor + Cable loss

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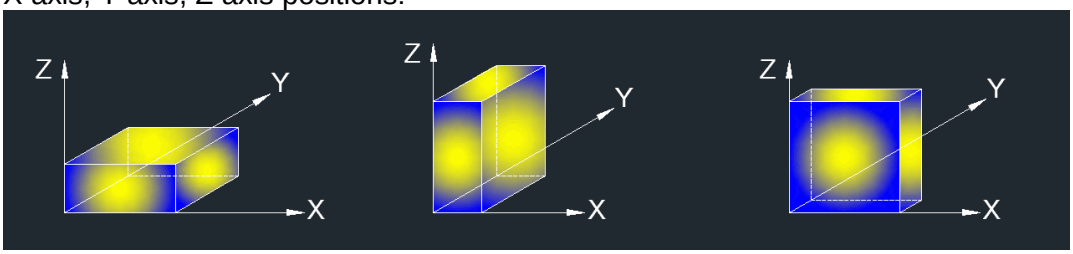
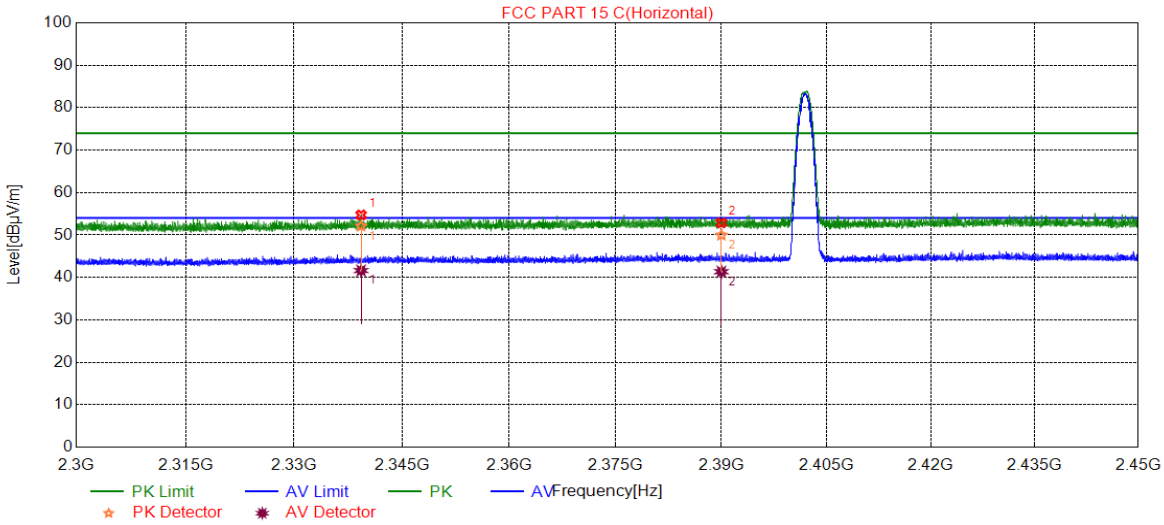
X axis, Y axis, Z axis positions:



Note: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

7.1. RESTRICTED BANDEDGE

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



No.	Frequency	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	(dBuV/m)	(dB)	
1	2339.3039	54.72	74.00	-19.28	peak
	2339.3039	41.62	54.00	-12.38	average
2	2390.0000	49.96	74.00	-24.04	peak
	2390.0000	41.35	54.00	-12.65	average

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.

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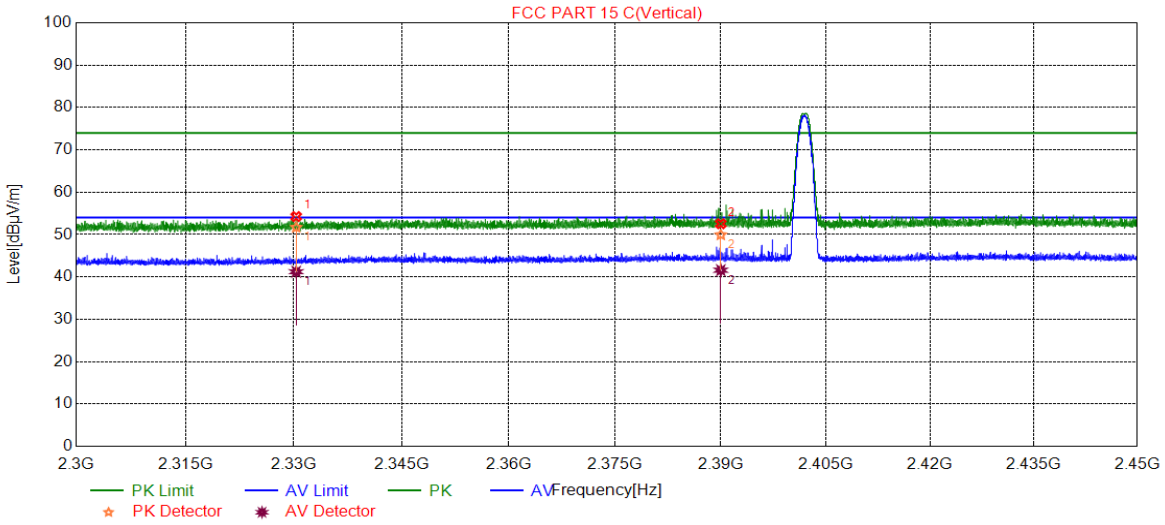
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2330.3180	51.69	74.00	-22.31	peak
	2330.3180	41.22	54.00	-12.78	average
2	2390.0000	49.93	74.00	-24.07	peak
	2390.0000	41.58	54.00	-12.42	average

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.

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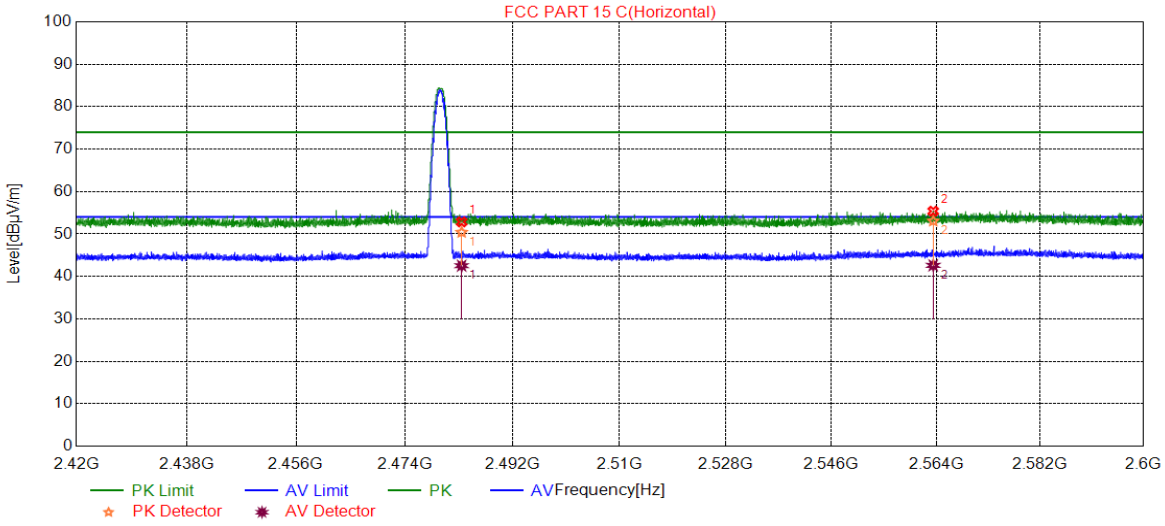
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



No.	Frequency	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.5000	50.39	74.00	-23.61	peak
	2483.5000	42.53	54.00	-11.47	average
2	2563.4743	53.05	74.00	-20.95	peak
	2563.4743	42.60	54.00	-11.40	average

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.

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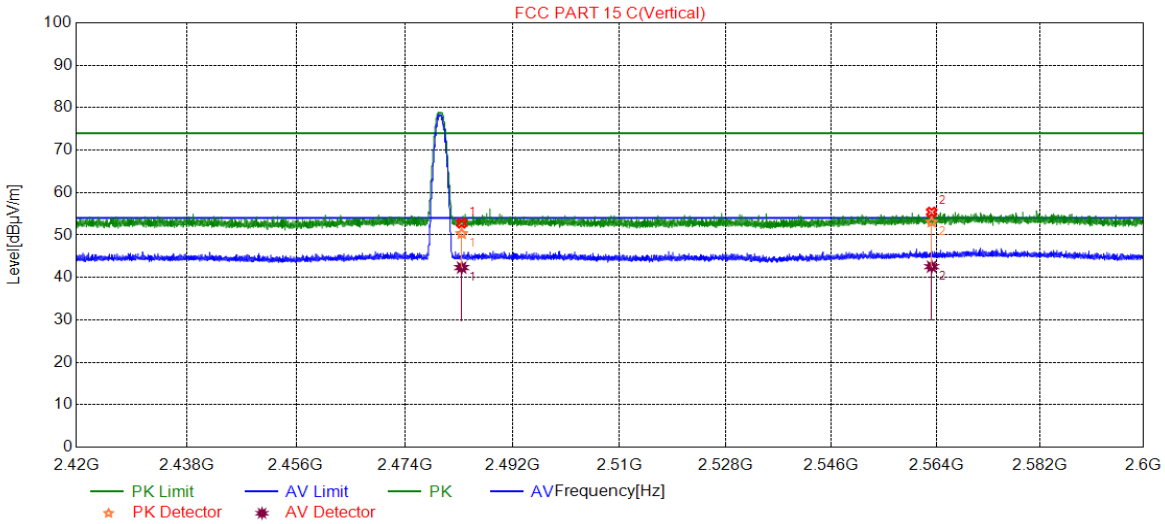
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



No.	Frequency	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.5000	50.31	74.00	-23.69	peak
	2483.5000	42.32	54.00	-11.68	average
2	2563.2043	53.05	74.00	-20.95	peak
	2563.2043	42.54	54.00	-11.46	average

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.

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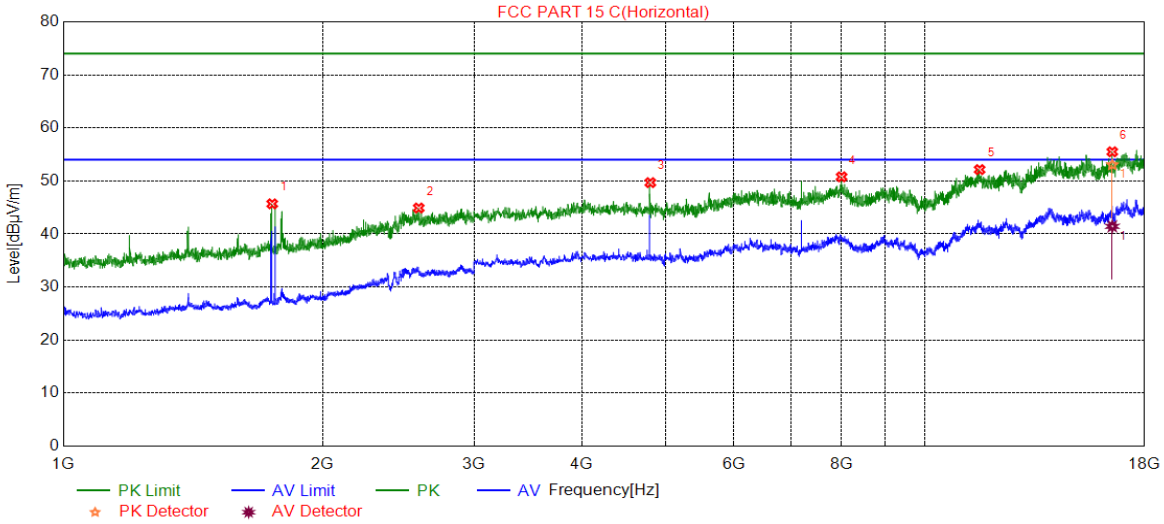
7.2. SPURIOUS EMISSIONS (1~18GHz)

HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1748.2494	45.68	74.00	-28.32	peak
2	2586.5288	44.90	74.00	-29.10	peak
3	4802.8005	49.68	74.00	-24.32	peak
4	8008.3347	50.77	74.00	-23.23	peak
5	11581.4302	52.14	74.00	-21.86	peak
6	16509.7516	53.04	74.00	-20.96	peak
	16509.7516	41.44	54.00	-12.56	average

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.
3. AVG: VBW=1/T, T is On Time (transmit duration)
4. For transmit duration, please refer to clause 7.1.

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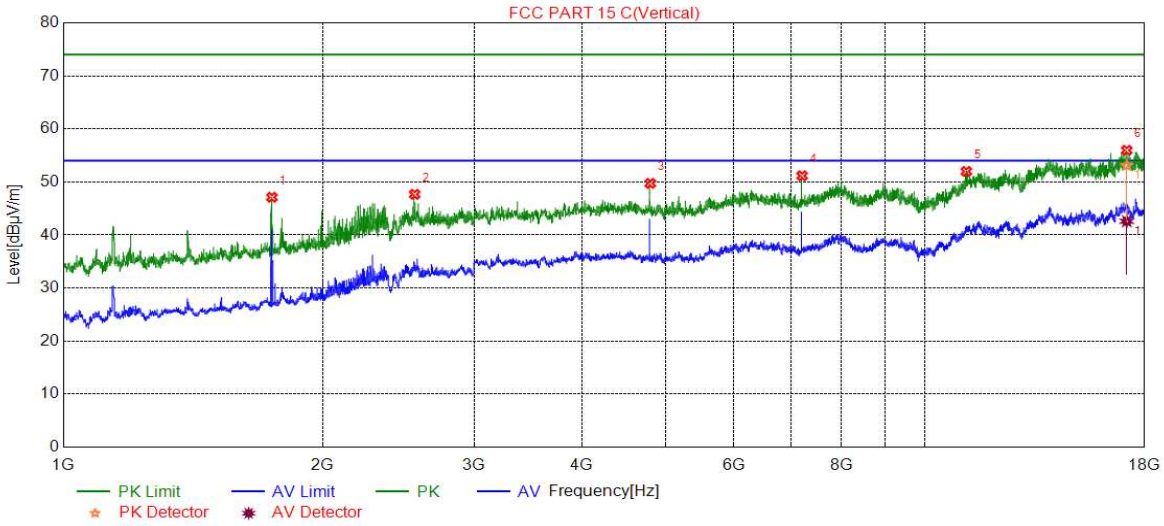
HARMONICS AND SPURIOUS EMISSIONS (LOW CHANNEL, VERTICAL)



No.	Frequency	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	(dBuV/m)	(dB)	
1	1746.9156	47.10	74.00	-26.90	peak
2	2558.5195	47.66	74.00	-26.34	peak
3	4802.8005	49.73	74.00	-24.27	peak
4	7205.7010	51.16	74.00	-22.84	peak
5	11178.8631	51.98	74.00	-22.02	peak
6	17159.8600	53.10	74.00	-20.90	peak
	17159.8600	42.59	54.00	-11.41	average

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.
3. AVG: VBW=1/T, T is On Time (transmit duration)
4. For transmit duration, please refer to clause 7.1.

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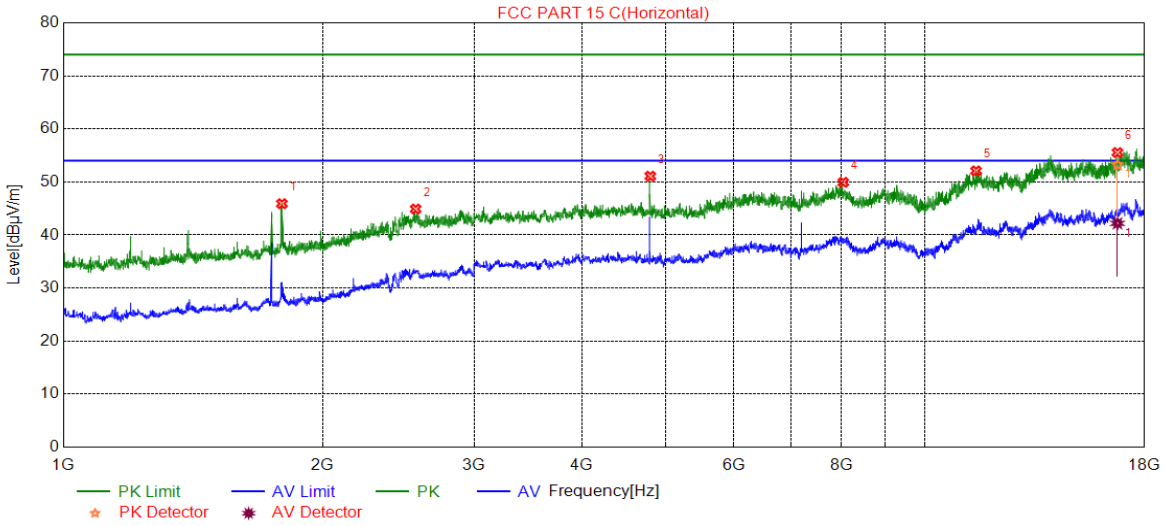
HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1794.2648	45.90	74.00	-28.10	peak
2	2565.1884	44.90	74.00	-29.10	peak
3	4802.8005	51.09	74.00	-22.91	peak
4	8043.3406	49.93	74.00	-24.07	peak
5	11471.4119	52.08	74.00	-21.92	peak
6	16739.7900	53.23	74.00	-20.77	peak
	16739.7900	42.19	54.00	-11.81	average

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.
3. AVG: VBW=1/T, T is On Time (transmit duration)
4. For transmit duration, please refer to clause 7.1.

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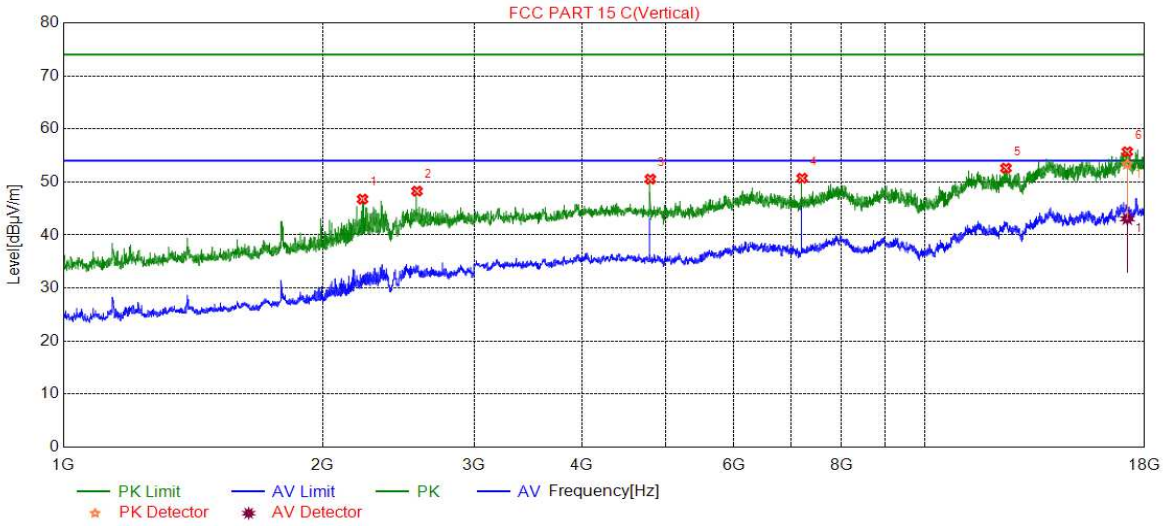
HARMONICS AND SPURIOUS EMISSIONS (MID CHANNEL, VERTICAL)



No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2225.7419	46.76	74.00	-27.24	peak
2	2574.5248	48.27	74.00	-25.73	peak
3	4802.8005	50.53	74.00	-23.47	peak
4	7205.7010	50.70	74.00	-23.30	peak
5	12426.5711	52.59	74.00	-21.41	peak
6	17184.8641	53.34	74.00	-20.66	peak
	17184.8641	43.06	54.00	-10.94	average

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.
3. AVG: VBW=1/T, T is On Time (transmit duration)
4. For transmit duration, please refer to clause 7.1.

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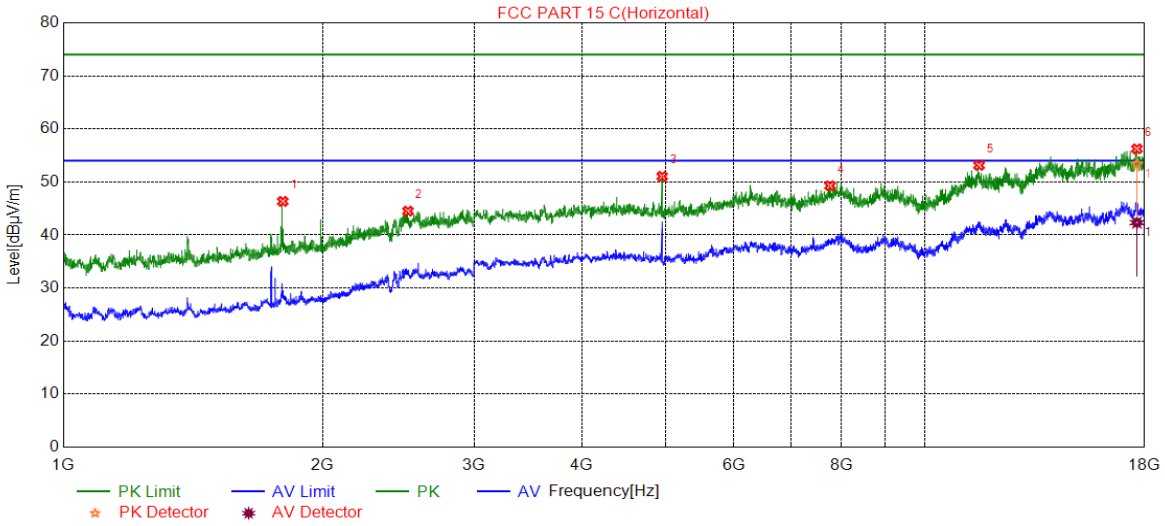
HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, HORIZONTAL)



No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1798.2661	46.33	74.00	-27.67	peak
2	2513.1711	44.50	74.00	-29.50	peak
3	4957.8263	51.05	74.00	-22.95	peak
4	7763.2939	49.27	74.00	-24.73	peak
5	11563.9273	53.13	74.00	-20.87	peak
6	17634.9392	53.37	74.00	-20.63	peak
	17634.9392	42.33	54.00	-11.67	average

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.
3. AVG: VBW=1/T, T is On Time (transmit duration)
4. For transmit duration, please refer to clause 7.1.

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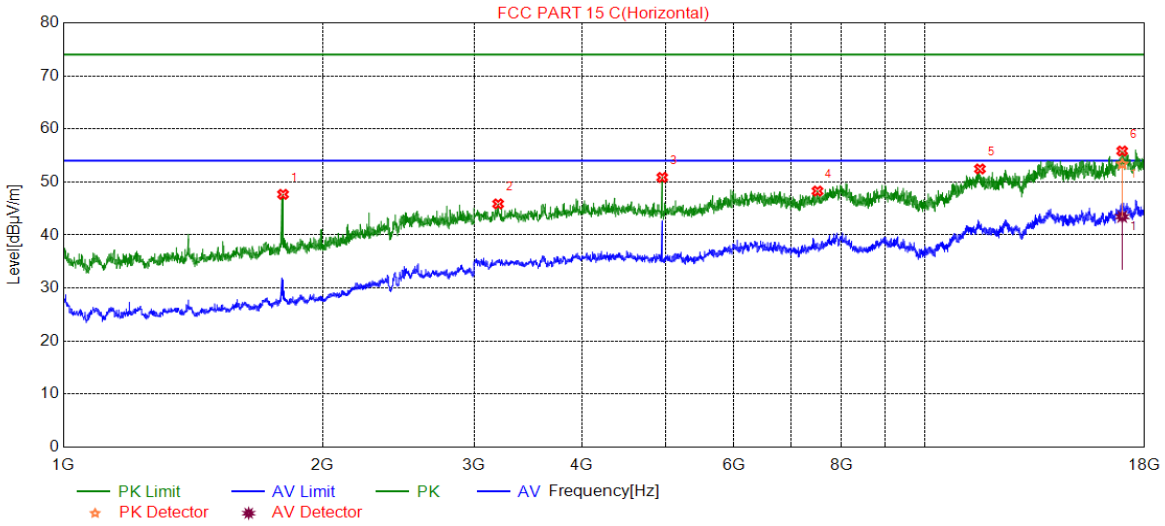
HARMONICS AND SPURIOUS EMISSIONS (HIGH CHANNEL, VERTICAL)



No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	1799.5999	47.66	74.00	-26.34	peak
2	3197.5329	45.86	74.00	-28.14	peak
3	4957.8263	50.85	74.00	-23.15	peak
4	7508.2514	48.28	74.00	-25.72	peak
5	11591.4319	52.45	74.00	-21.55	peak
6	16952.3254	53.37	74.00	-20.63	peak
	16952.3254	43.45	54.00	-10.55	average

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.
3. AVG: VBW=1/T, T is On Time (transmit duration)
4. For transmit duration, please refer to clause 7.1.

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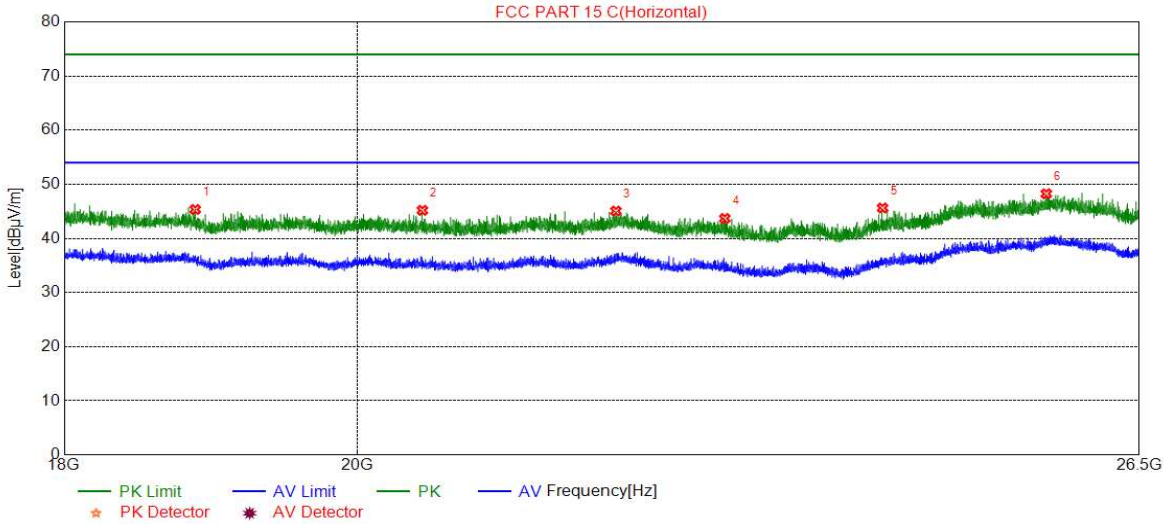
7.3. SPURIOUS EMISSIONS 18G ~ 26GHz

SPURIOUS EMISSIONS (LOW CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	18868.7869	45.34	74.00	-28.66	Peak
2	20476.2976	45.18	74.00	-28.82	Peak
3	21952.8953	45.05	74.00	-28.95	Peak
4	22830.1830	43.68	74.00	-30.32	Peak
5	24163.9664	45.61	74.00	-28.39	Peak
6	25630.3630	48.24	74.00	-25.76	Peak

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.
3. All the channels have been tested, but only the data of the worst case is recorded in the report.

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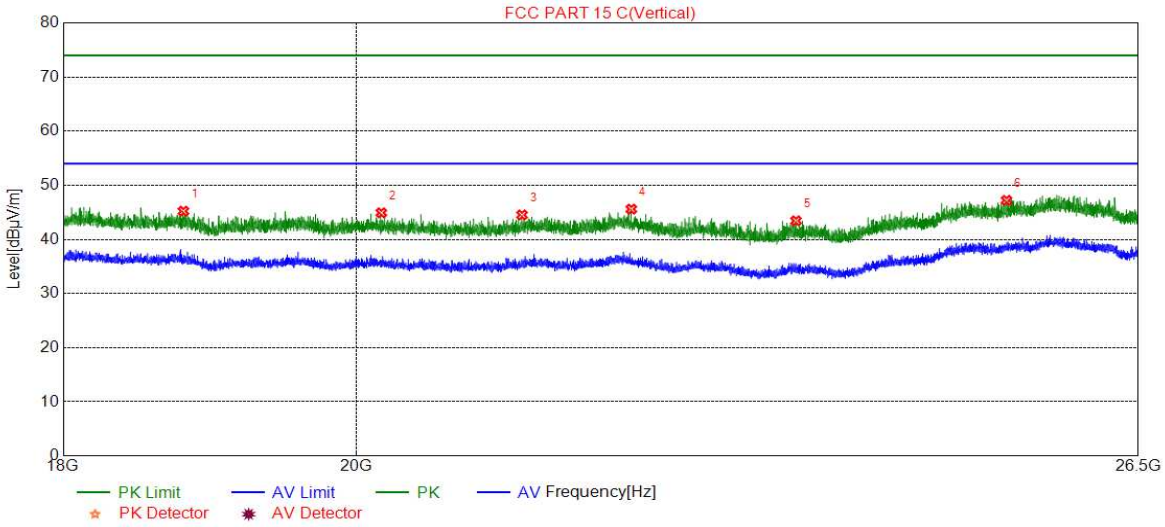
SPURIOUS EMISSIONS (LOW CHANNEL, WORST-CASE CONFIGURATION, VERTICAL)



No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	18795.6796	45.21	74.00	-28.79	Peak
2	20183.0183	44.91	74.00	-29.09	Peak
3	21231.1731	44.52	74.00	-29.48	Peak
4	22082.9583	45.59	74.00	-28.41	Peak
5	23431.1931	43.43	74.00	-30.57	Peak
6	25275.0275	47.21	74.00	-26.79	Peak

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.
3. All the channels have been tested, but only the data of the worst case is recorded in the report.

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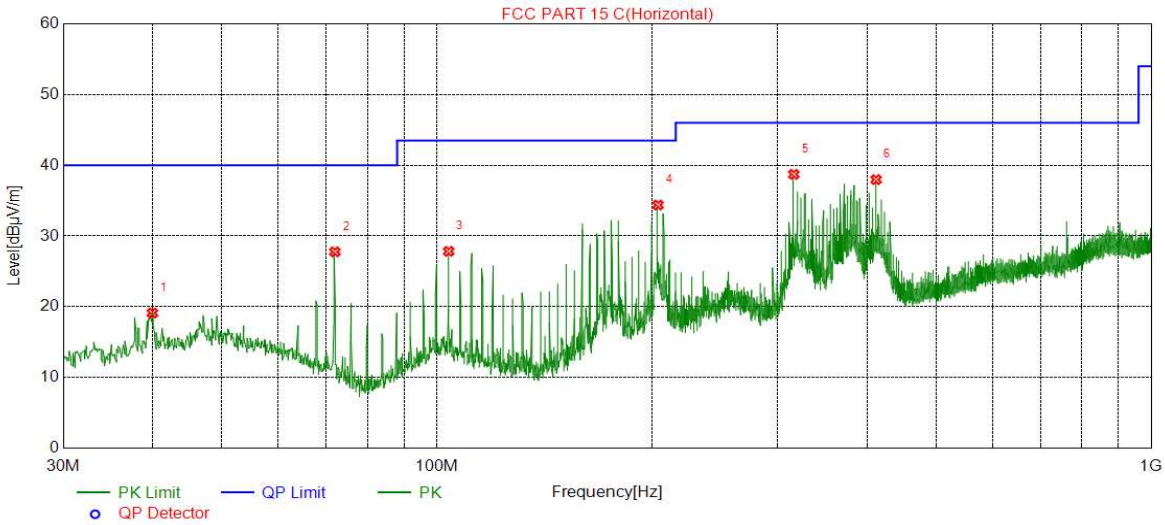
7.4. SPURIOUS EMISSIONS 30M ~ 1 GHz

SPURIOUS EMISSIONS (LOW CHANNEL, WORST-CASE CONFIGURATION, HORIZONTAL)



No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	39.9920	19.11	40.00	-20.89	QP
2	72.0052	27.76	40.00	-12.24	QP
3	103.9214	27.83	43.50	-15.67	QP
4	204.0354	34.38	43.50	-9.12	QP
5	315.9846	38.72	46.00	-7.28	QP
6	412.0242	37.97	46.00	-8.03	QP

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.
3. All the channels have been tested, but only the data of the worst case is recorded in the report.

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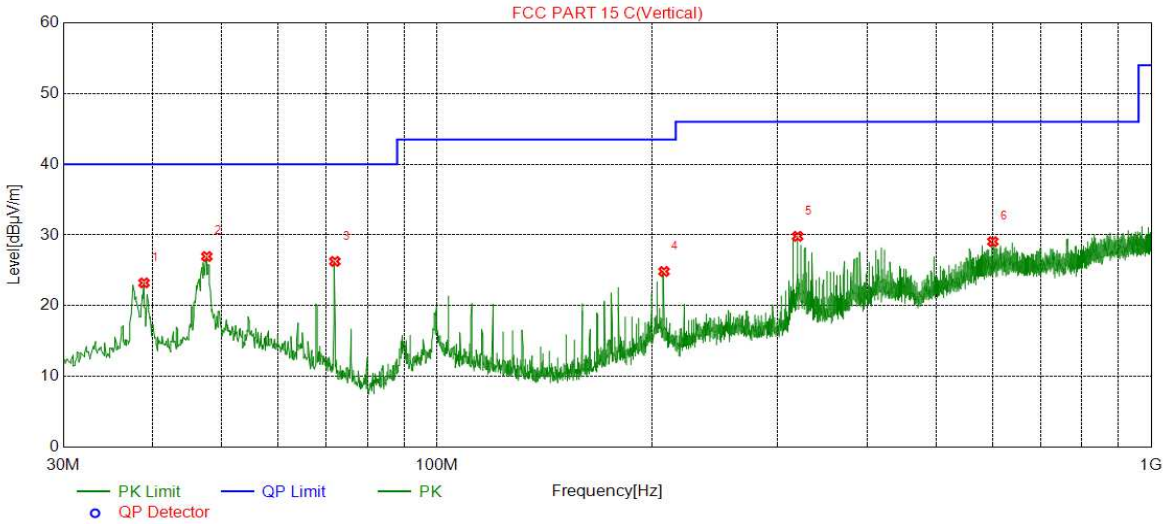
SPURIOUS EMISSIONS (LOW CHANNEL, WORST-CASE CONFIGURATION, VERTICAL)



No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	38.9249	23.23	40.00	-16.77	QP
2	47.6558	26.96	40.00	-13.04	QP
3	72.0052	26.26	40.00	-13.74	QP
4	208.0128	24.84	43.50	-18.66	QP
5	319.9620	29.81	46.00	-16.19	QP
6	600.3200	29.06	46.00	-16.94	QP

Note: 1. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
2. Peak: Peak detector.
3. All the channels have been tested, but only the data of the worst case is recorded in the report.

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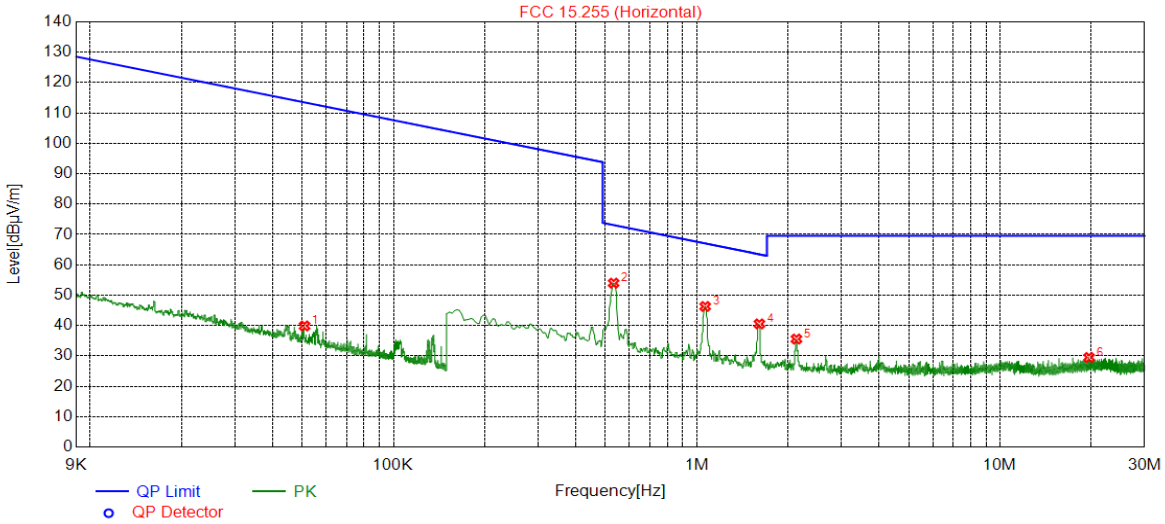
7.5. SPURIOUS EMISSIONS BELOW 30M

SPURIOUS EMISSIONS (LOW CHANNEL, WORST-CASE CONFIGURATION)

9KHz~ 30MHz



No.	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.0509	39.86	113.47	-73.61	Peak
2	0.5321	53.97	73.08	-19.11	Peak
3	1.0665	46.28	67.05	-20.77	Peak
4	1.6098	40.54	63.47	-22.93	Peak
5	2.1322	35.57	69.54	-33.97	Peak
6	19.6768	29.50	69.54	-40.04	Peak

Note:
1. All the modes had been tested, but only the worst data were recorded in the report.
2. If Peak Result complies with AV and QP limit, AV and QP Result are deemed to comply with AV limit.
3. All the channels have been tested, but only the data of the worst case is recorded in the report.

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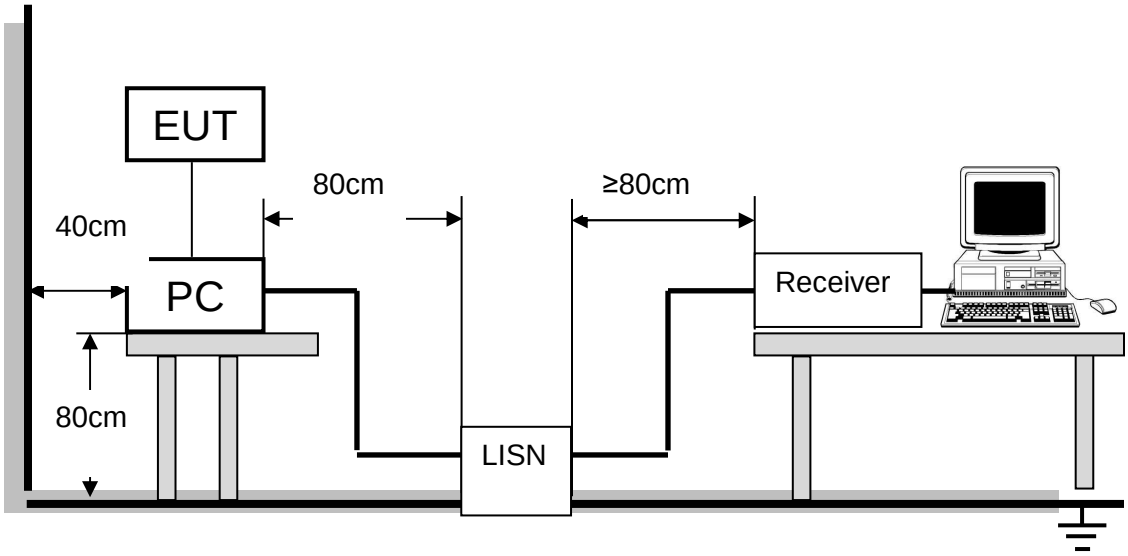
8. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

Please refer to FCC §15.207 (a) and RSS-Gen Clause 8.8

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 -5.0	73.00	60.00	56.00	46.00
5.0 -30.0	73.00	60.00	60.00	50.00

TEST SETUP AND PROCEDURE



The EUT is put on a table of non-conducting material that is 80cm high. The vertical conducting wall of shielding is located 40cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI Measurement Receiver (R&S Test Receiver ESR3) is used to test the emissions from both sides of AC line. According to the requirements in Section 6.2 of ANSI C63.10-2003.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9kHz.
The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

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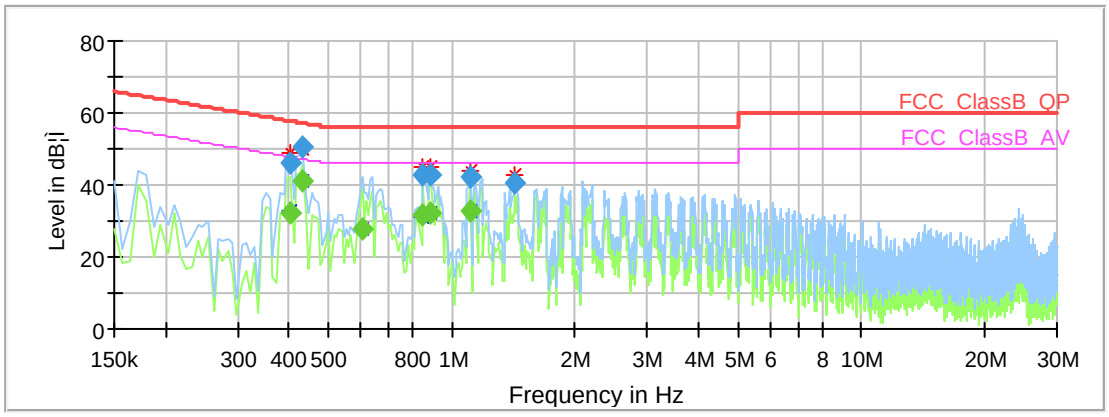
RESULTS (WORST-CASE CONFIGURATION)



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.403725	---	32.30	47.78	15.48	1000.	9.000	L1	OFF	9.6
0.403725	46.19	---	57.78	11.58	1000.	9.000	L1	OFF	9.6
0.433575	---	41.21	47.18	5.97	1000.	9.000	N	OFF	9.6
0.433575	50.47	---	57.18	6.72	1000.	9.000	L1	OFF	9.6
0.605213	---	27.67	46.00	18.33	1000.	9.000	L1	OFF	9.6
0.851475	42.64	---	56.00	13.36	1000.	9.000	N	OFF	9.6
0.851475	---	31.43	46.00	14.57	1000.	9.000	N	OFF	9.6
0.888788	42.96	---	56.00	13.04	1000.	9.000	L1	OFF	9.6
0.888788	---	32.39	46.00	13.61	1000.	9.000	L1	OFF	9.6
1.105200	42.22	---	56.00	13.78	1000.	9.000	N	OFF	9.6
1.105200	---	33.00	46.00	13.00	1000.	9.000	L1	OFF	9.6
1.426088	40.80	---	56.00	15.20	1000.	9.000	L1	OFF	9.7

Note: 1. Result = Reading +Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz).
4. Step size: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

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9. ANTENNA REQUIREMENTS

Applicable requirements

Please refer to FCC §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. 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.

Please refer to FCC §15.247(b)(4)
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.

Antenna Connector

EUT has one Dipole Antenna with a chip Antenna, which supports BT mode and BLE mode.

Antenna Gain

The antenna gain of EUT is less than 6 dBi.

END OF REPORT

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