



**FCC PART 15 SUBPART C
CERTIFICATION TEST REPORT**

For

LED Lamp

**MODEL NUMBER: MK-020011002115,
MK-020011002118**

FCC ID: 2AY5GMK020011002115

REPORT NUMBER: 4789738938.2-15

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Prepared for

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10-EM-F0878 – Issue 2.0

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Revision History

Rev.	Issue Date	Revisions	Revised By
--	03/10/2021	Initial Issue	--



Summary of Test Results			
Clause	Test Items	FCC Rules	Test Results
1	6 dB Bandwidth	FCC 15.247 (a) (2)	Pass
2	Peak Conducted Output Power	FCC 15.247 (b) (3)	Pass
3	Power Spectral Density	FCC 15.247 (e)	Pass
4	Conducted Bandedge and Spurious Emission	FCC 15.247 (d)	Pass
5	Radiated Bandedge and Spurious Emission	FCC 15.247 (d) FCC 15.209 FCC 15.205	Pass
6	Conducted Emission Test For AC Power Port	FCC 15.207	Pass
7	Antenna Requirement	FCC 15.203	Pass
Remark: 1) The measurement result for the sample received is <Pass> according to < CFR 47 FCC PART 15 SUBPART C, when <Accuracy Method> decision rule is applied.			



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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: Zhejiang MEKA Electric Co.,Ltd
Address: NO.8 Canghai Road,Lihai Town,Binhai New
City,Shaoxing,zhejiang Province

Manufacturer Information

Company Name: Zhejiang MEKA Electric Co.,Ltd
Address: NO.8 Canghai Road,Lihai Town,Binhai New
City,Shaoxing,zhejiang Province

EUT Description

EUT Name: LED Lamp
Model: MK-020011002115, MK-020011002118
Model Difference: Only the model name, appearance, size and power are different,
the others are the same
Brand Name: MKOPTO
Sample Status: Normal
Sample ID: N/A
Sample Received Date: Feb 25, 2021
Date of Tested: Feb 25, 2021 ~ Mar 10, 2021

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC Part 15 Subpart C	PASS

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with 558074 D01 15.247 Meas Guidance v05r02, 414788 D01 Radiated Test Site v01r01, FCC CFR 47 Part 2, FCC CFR 47 Part 15 ANSI C63.10-2013.

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	A2LA (Certificate No.: 4338.01) Shenzhen STS Test Services Co., Ltd. has been assessed and proved to be in compliance with A2LA. CNAS (Registration No.: L7649) Shenzhen STS Test Services Co., Ltd. has been assessed and proved to be in compliance with CNAS. FCC (FCC Designation No.: 625569) Shenzhen STS Test Services Co., Ltd. has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules IC(Company No.: 12108A) Shenzhen STS Test Services Co., Ltd. has been registered and fully described in a report filed with Industry Canada. The Company Number is 12108A.
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Note: All tests measurement facilities use to collect the measurement data are located at A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China



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

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	RF output power, conducted	$\pm 0.7\text{dB}$
2	Unwanted Emissions, conducted	$\pm 3.0\text{dB}$
3	All emissions, radiated 9K-30MHz	$\pm 2.7\text{dB}$
4	All emissions, radiated 30M-1GHz	$\pm 4.4\text{dB}$
5	All emissions, radiated 1G-6GHz	$\pm 5.1\text{dB}$
6	All emissions, radiated >6G	$\pm 5.5\text{dB}$
7	Conducted Emission (9KHz-150KHz)	$\pm 2.8\text{dB}$
8	Conducted Emission (150KHz-30MHz)	$\pm 2.8\text{dB}$



5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

EUT Name	LED Lamp
EUT Description	The EUT is a LED Lamp
Model	MK-020011002115
Radio Technology	IEEE802.11b/g/n HT20
Operation frequency	IEEE 802.11b: 2412MHz—2462MHz IEEE 802.11g: 2412MHz—2462MHz IEEE 802.11n HT20: 2412MHz—2462MHz
Modulation	IEEE 802.11b: DSSS(CCK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK)
Power Supply	Input: AC 110-130V 60Hz
Hardware Version	1.0.3
Software Version	2.9.12

5.2. MAXIMUM OUTPUT POWER

Frequency Range (MHz)	Number of Transmit Chains (NTX)	IEE Std. 802.11	Frequency (MHz)	Channel Number	Max PK Conducted Power (dBm)
2400-2483.5	1	IEEE 802.11b	2412-2462	1-11[11]	17.54
2400-2483.5	1	IEEE 802.11g	2412-2462	1-11[11]	22.89
2400-2483.5	1	IEEE 802.11nHT20	2412-2462	1-11[11]	21.48

5.3. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency(MHz)	Channel	Frequency (MHz)
1	2412	5	2432	9	2452
2	2417	6	2437	10	2457
3	2422	7	2442	11	2462
4	2425	8	2447	N/A	N/A



5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
WiFi TX(802.11b)	CH 1, CH 6, CH 11	2412MHz, 2437MHz, 2462MHz
WiFi TX(802.11g)	CH 1, CH 6, CH 11	2412MHz, 2437MHz, 2462MHz
WiFi TX(802.11n HT20)	CH 1, CH 6, CH 11	2412MHz, 2437MHz, 2462MHz

5.5. THE WORSE CASE CONFIGURATIONS

The Worst Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Modulation Mode	Transmit Antenna Number	Test Channel		
		NCB: 20MHz		
		CH 1	CH 6	CH 11
802.11b	1	Default	Default	Default
802.11g	1	Default	Default	Default
802.11n HT20	1	Default	Default	Default

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	2412-2462	PCB Antenna	1

Test Mode	Transmit and Receive Mode	Description
IEEE 802.11b	☒1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.
IEEE 802.11g	☒1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.
IEEE 802.11n HT20	☒1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.



5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	P/N
1	PC	LENOVO	ThinkPad E470	N/A

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(cm)	Remarks
1	USB Cable	N/A	N/A	150cm	N/A

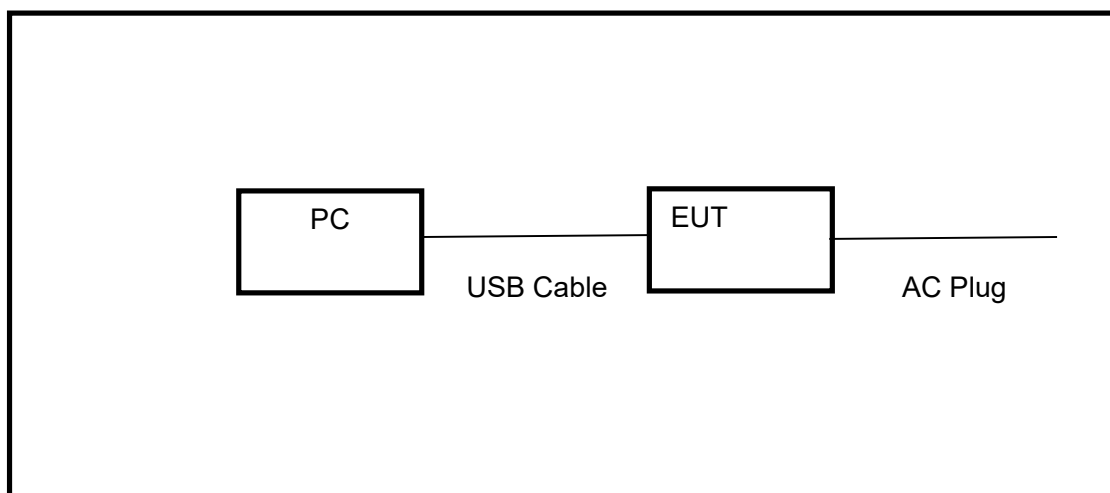
ACCESSORY

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

TEST SETUP

The EUT can work in engineering mode with firmware QRCT from QUALCOMM through a Laptop.

SETUP DIAGRAM FOR TESTS





6. MEASURING INSTRUMENT AND SOFTWARE USED

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2020.10.12	2021.10.11
Signal Analyzer	R&S	FSV 40-N	101823	2020.10.10	2021.10.09
Active loop Antenna	ZHINAN	ZN30900C	16035	2019.07.11	2021.07.10
Bilog Antenna	TESEQ	CBL6111D	34678	2020.10.12	2022.10.11
Horn Antenna	SCHWARZBECK	BBHA 9120D	02014	2019.10.15	2021.10.14
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2020.10.12	2022.10.11
Pre-Amplifier (0.1M-3GHz)	EM	EM330	060665	2020.10.12	2021.10.11
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2020.10.12	2021.10.11
Pre-Amplifier (18G-40GHz)	SKET	LNPA-1840-50	SK2018101801	2020.10.10	2021.10.09
Temperature & Humidity	HH660	Mieo	N/A	2020.10.12	2021.10.11
Turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A
Band Reject Filter (2.4-2.5GHz)	COM-MW	ZBSF-2400-2500	N/A	2020.10.12	2021.10.11
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2020.10.12	2021.10.11
LISN	R&S	ENV216	101242	2020.10.12	2021.10.11
LISN	EMCO	3810/2NM	23625	2020.10.12	2021.10.11
Temperature & Humidity	HH660	Mieo	N/A	2020.10.13	2021.10.12
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			



RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Power Sensor	Keysight	U2021XA	MY55520005	2020.10.10	2021.10.09
			MY55520006	2020.10.10	2021.10.09
			MY56120038	2020.10.10	2021.10.09
			MY56280002	2020.10.10	2021.10.09
Signal Analyzer	Agilent	N9020A	MY51110105	2020.03.05	2021.03.04
Temperature & Humidity	HH660	Mieo	N/A	2020.10.13	2021.10.12
MIMO Power measurement test Set	Keysight	U2021XA	MY55520005	2020.10.10	2021.10.09
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			



7. MEASUREMENT METHODS

No.	Test Item	KDB Name	Section
1	6 dB Bandwidth	558074 D01 15.247 Meas Guidance v05r02	8.2
2	Peak Output Power	558074 D01 15.247 Meas Guidance v05r02	8.1.3
3	Power Spectral Density	558074 D01 15.247 Meas Guidance v05r02	8.4
4	Out-of-band emissions in non-restricted bands	558074 D01 15.247 Meas Guidance v05r02	8.5
5	Out-of-band emissions in restricted bands	558074 D01 15.247 Meas Guidance v05r02	8.6
6	Band-edge	558074 D01 15.247 Meas Guidance v05r02	8.7
7	Conducted Emission Test For AC Power Port	ANSI C63.10-2013	6.2



8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

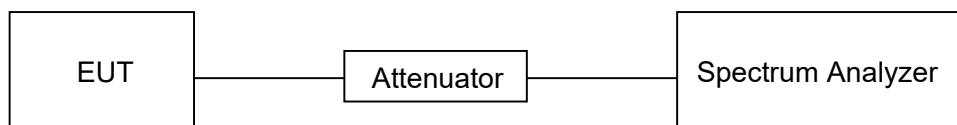
LIMITS

None; for reporting purposes only

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method

TEST SETUP



TEST ENVIRONMENT

Temperature	25°C	Relative Humidity	60%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V/60Hz

RESULTS

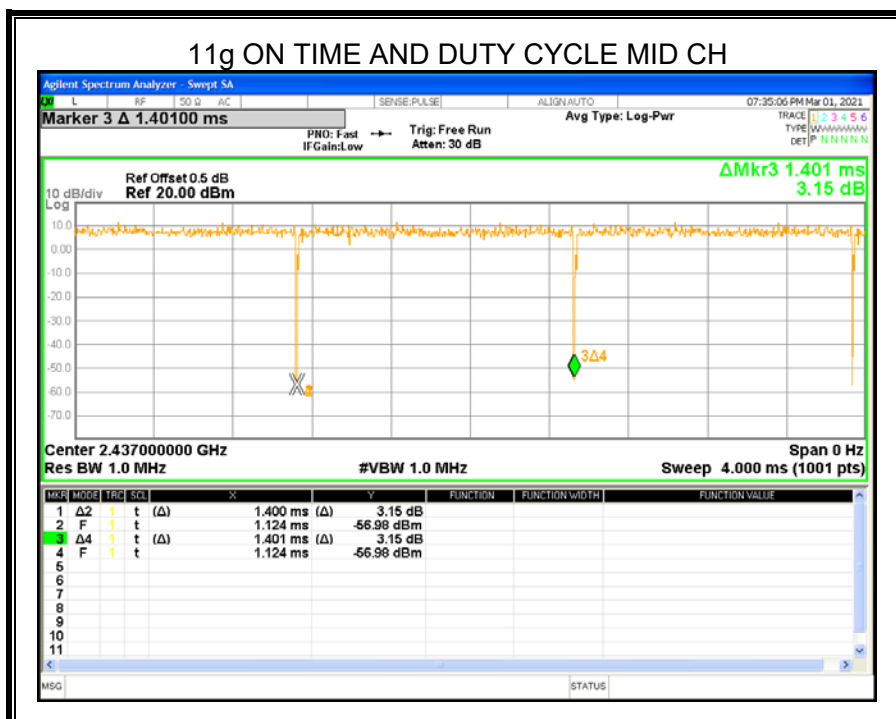
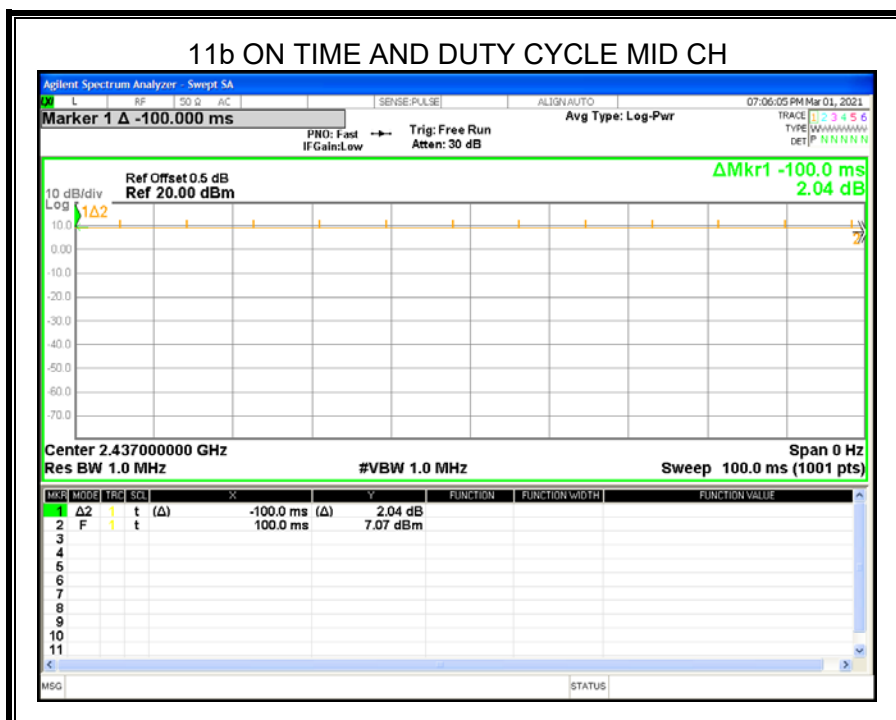
Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (db)	1/B Minimum VBW (KHz)
11b	100.000	100.000	1.0000	100.00%	0.00	0.01
11g	1.400	1.401	0.9993	99.93%	0.01	0.71
11n20	1.316	1.317	0.9992	99.92%	0.01	0.76

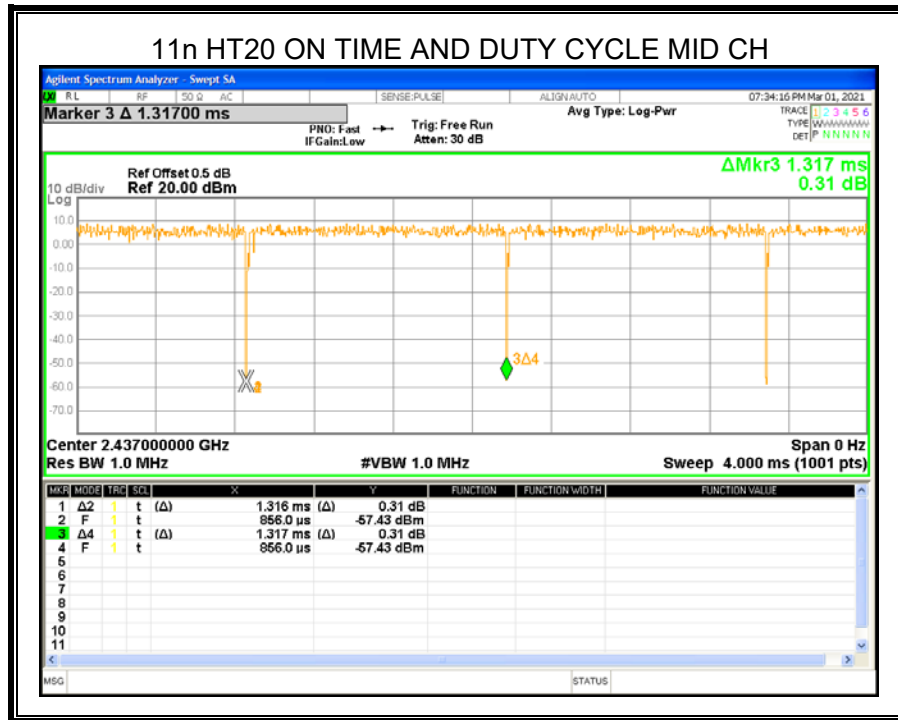
Note: Duty Cycle Correction Factor = $10\log(1/x)$.

Where: x is Duty Cycle(Linear)

Where: B is On Time

Duty Cycle > 98%, set the final test VBW = 10KHz ($VBW \leq RBW/100$)







8.2. 6 dB DTS BANDWIDTH

LIMITS

FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(a)(2)	6 dB Bandwidth	$\geq 500\text{KHz}$	2400-2483.5

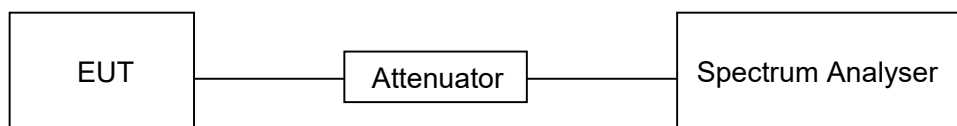
TEST PROCEDURE

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

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	For 6dB Bandwidth : 100K
VBW	For 6dB Bandwidth : $\geq 3 \times \text{RBW}$
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





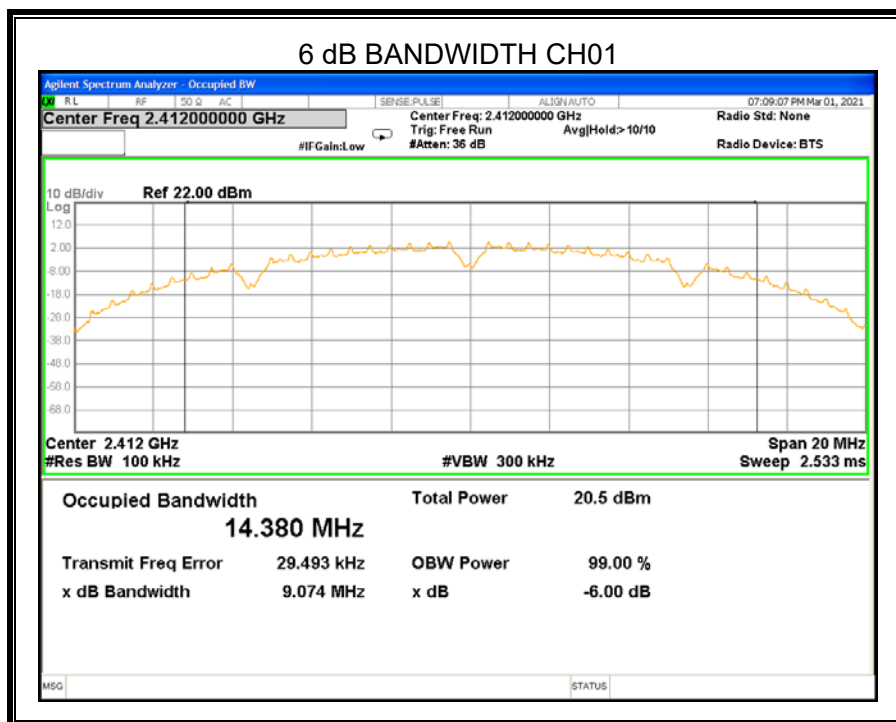
TEST ENVIRONMENT

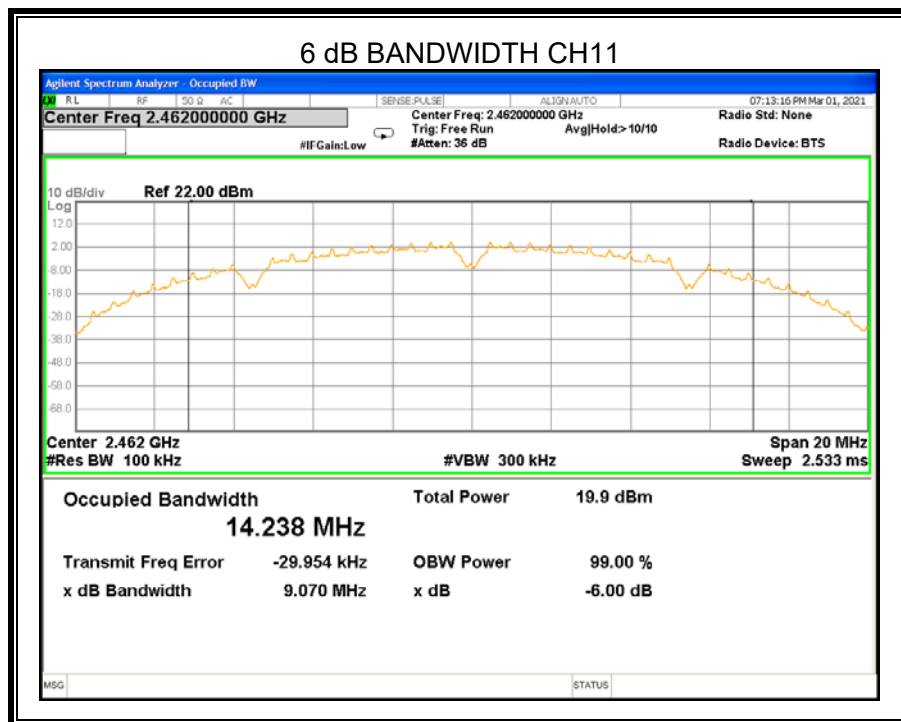
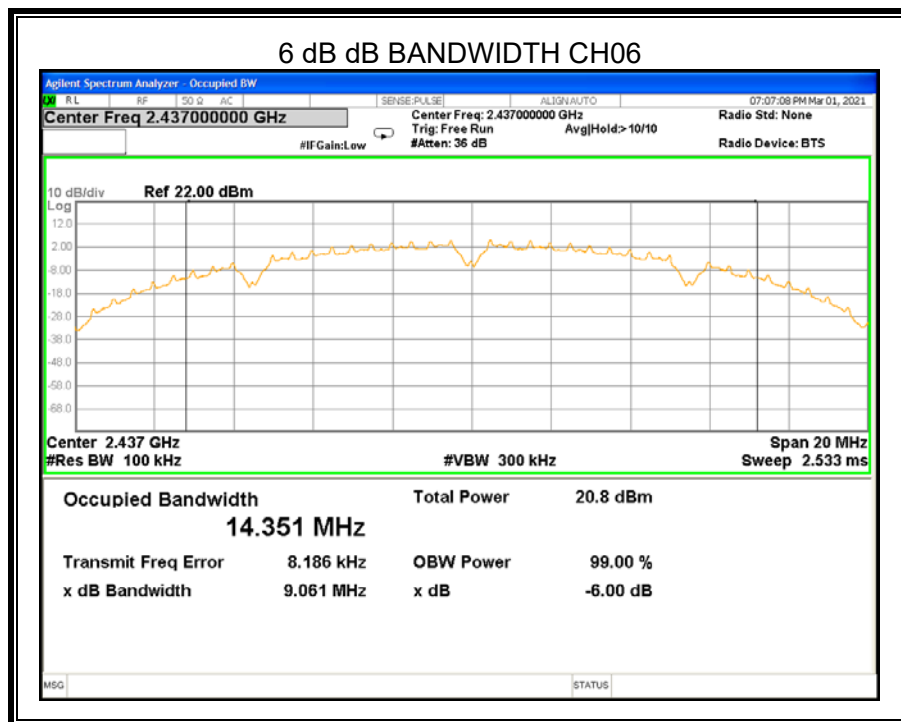
Temperature	25°C	Relative Humidity	60%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V/60Hz

RESULTS

8.2.1. 802.11b MODE

Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	9.074	≥500KHz	Pass
CH06	2437	9.061	≥500KHz	Pass
CH11	2462	9.070	≥500KHz	Pass

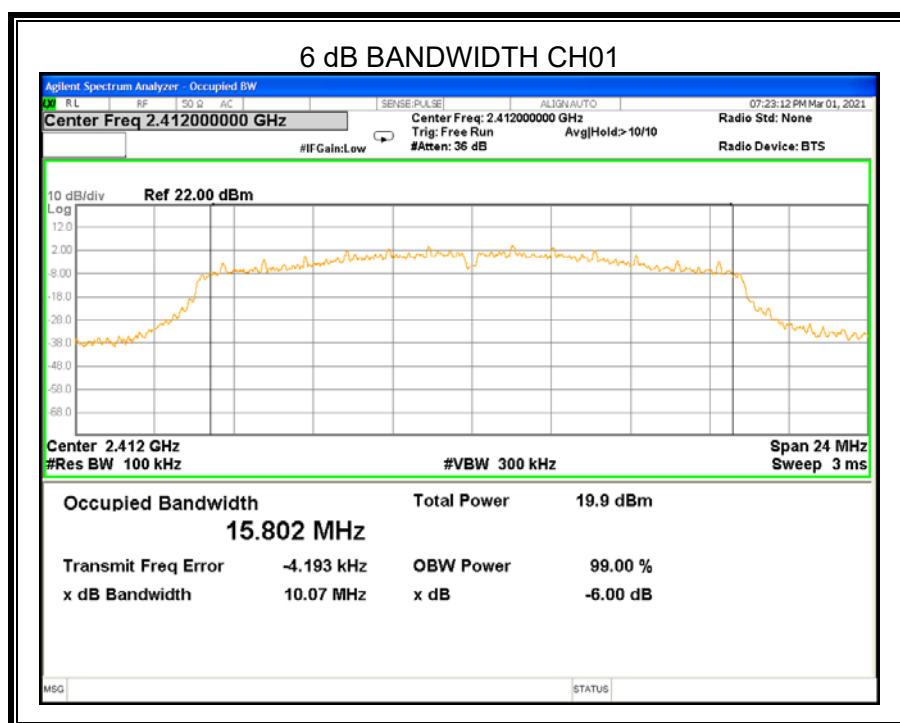


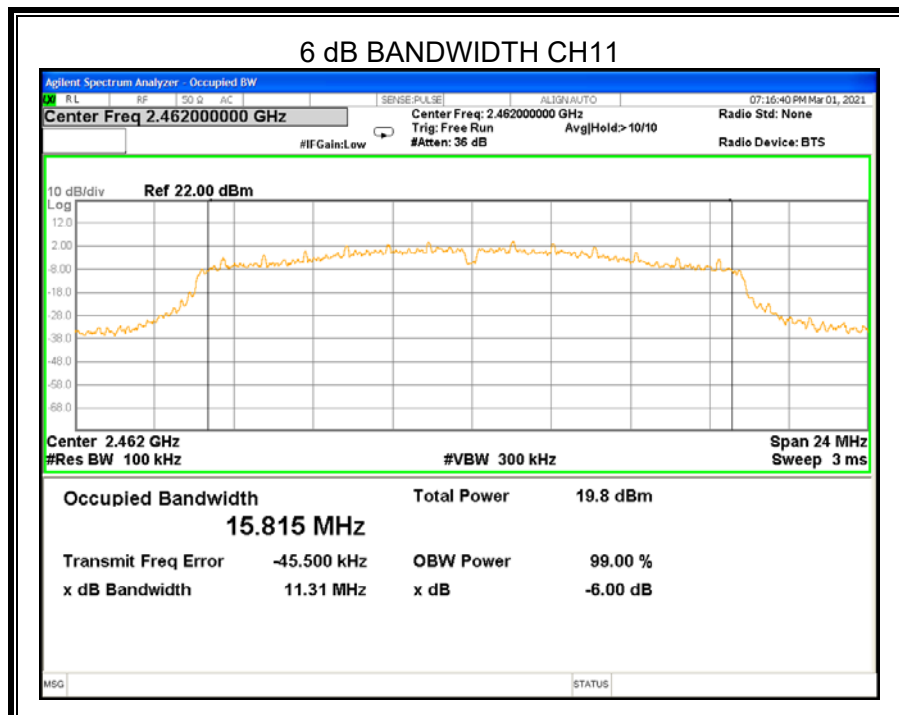
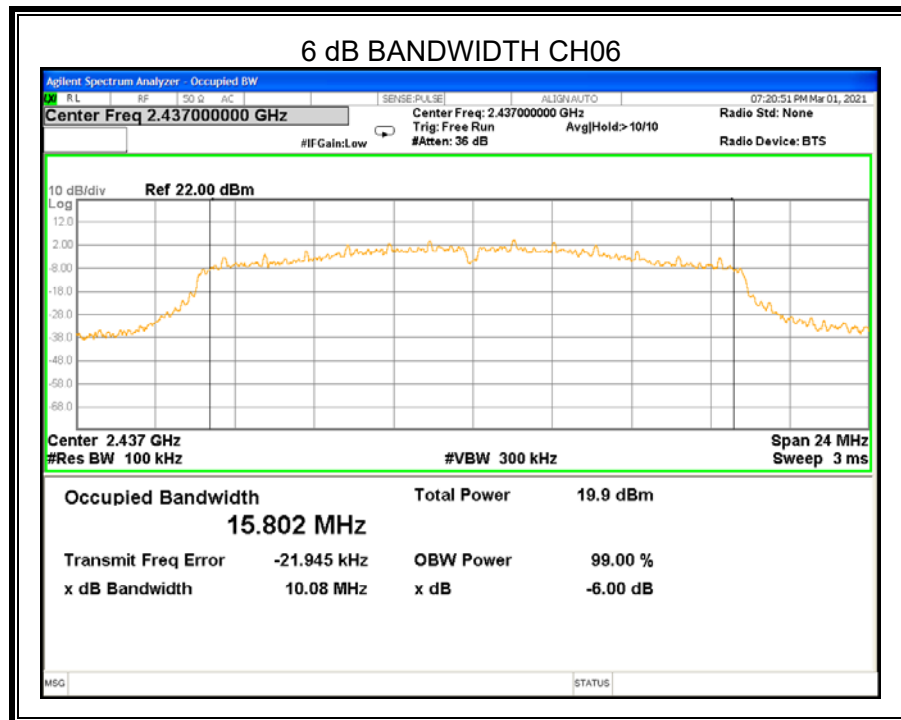




8.2.2. 802.11g MODE

Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	10.07	≥500KHz	Pass
CH06	2437	10.08	≥500KHz	Pass
CH11	2462	11.31	≥500KHz	Pass

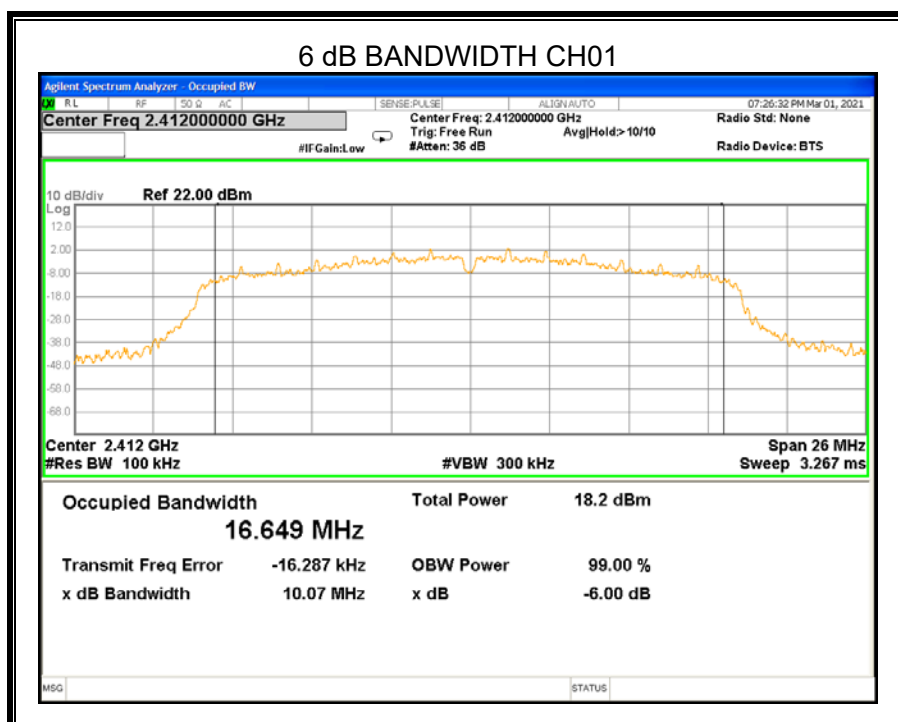


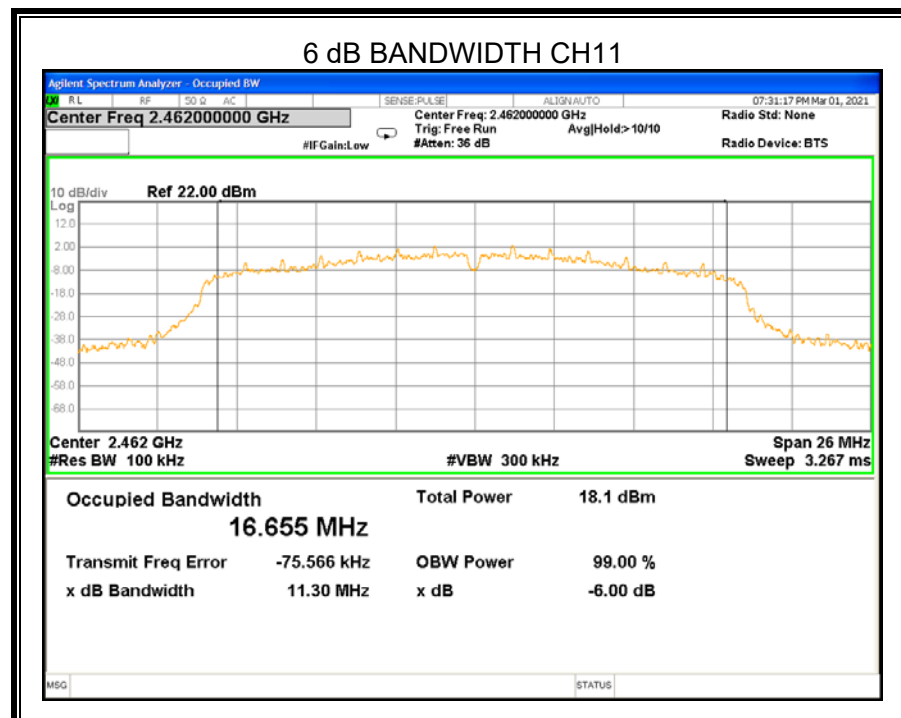
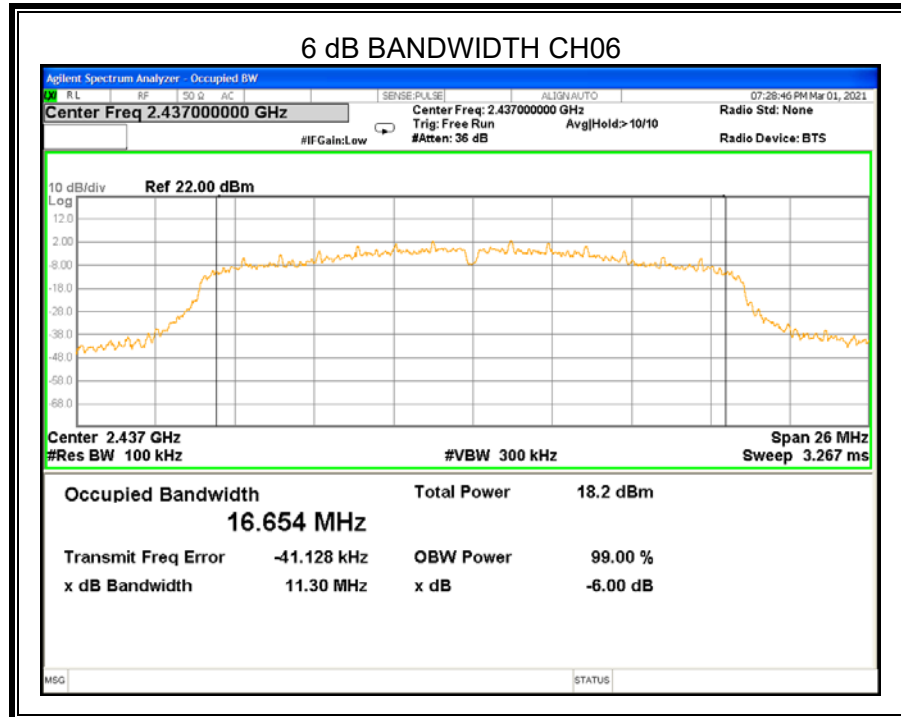




8.2.3. 802.11n HT20 MODE

Channel	Frequency (MHz)	6dB bandwidth (MHz)	Limit (kHz)	Result
CH01	2412	10.07	≥500KHz	Pass
CH06	2437	11.30	≥500KHz	Pass
CH11	2462	11.30	≥500KHz	Pass







8.3. PEAK CONDUCTED OUTPUT POWER

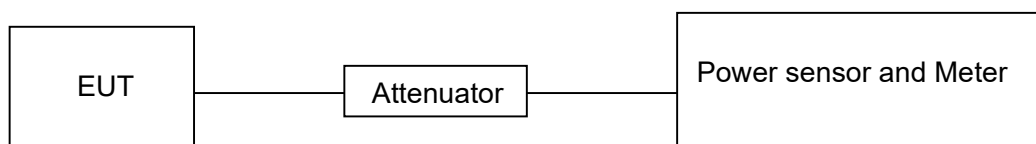
LIMITS

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

TEST PROCEDURE

Place the EUT on the table and set it in the transmitting mode.
Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Power sensor.
Measure peak power each channel.

TEST SETUP



TEST ENVIRONMENT

Temperature	25°C	Relative Humidity	60%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V/60Hz



RESULTS

8.3.1. 802.11b MODE

Test Channel	Frequency	Maximum Conducted Output Power(PK)	LIMIT
	(MHz)	(dBm)	dBm
CH01	2412	17.36	30
CH06	2437	17.54	30
CH11	2462	16.71	30

8.3.2. 802.11g MODE

Test Channel	Frequency	Maximum Conducted Output Power(PK)	LIMIT
	(MHz)	(dBm)	dBm
CH01	2412	22.89	30
CH06	2437	22.65	30
CH11	2462	22.25	30

8.3.3. 802.11n HT20 MODE

Test Channel	Frequency	Maximum Conducted Output Power(PK)	LIMIT
	(MHz)	(dBm)	dBm
CH01	2412	21.48	30
CH06	2437	21.46	30
CH11	2462	21.27	30



8.4. POWER SPECTRAL DENSITY

LIMITS

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

TEST PROCEDURE

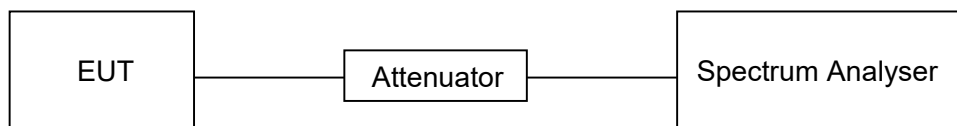
Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	$3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$
VBW	$\geq 3 \times \text{RBW}$
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



TEST ENVIRONMENT

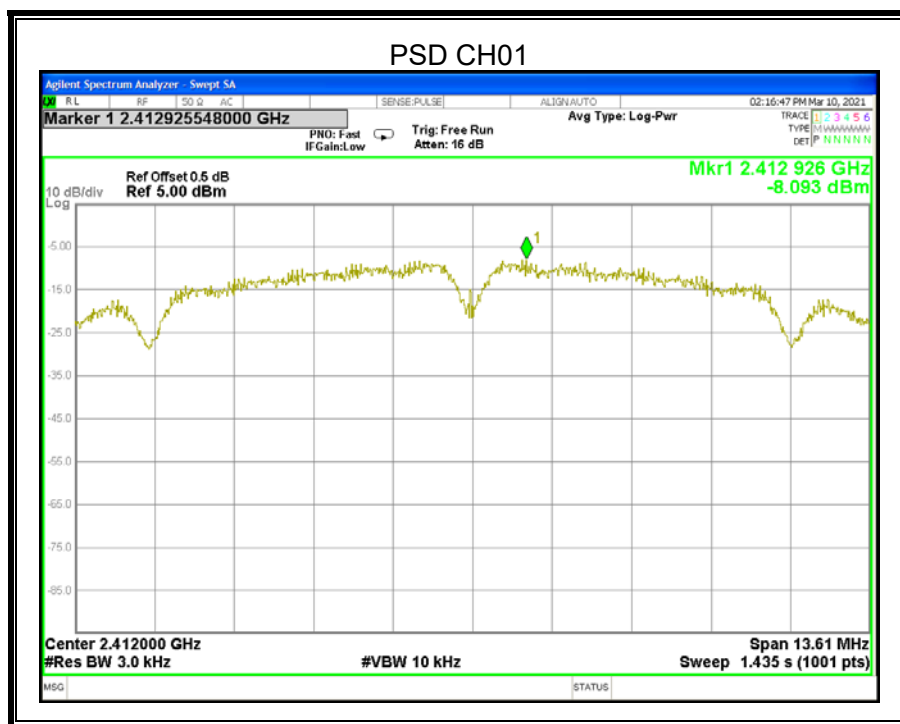
Temperature	25°C	Relative Humidity	60%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V/60Hz

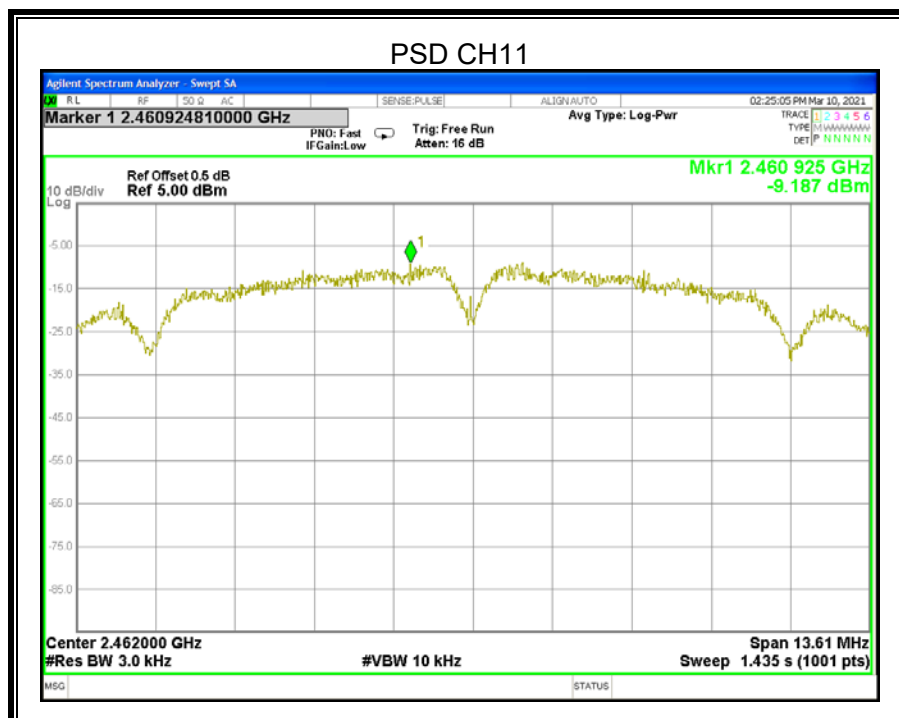
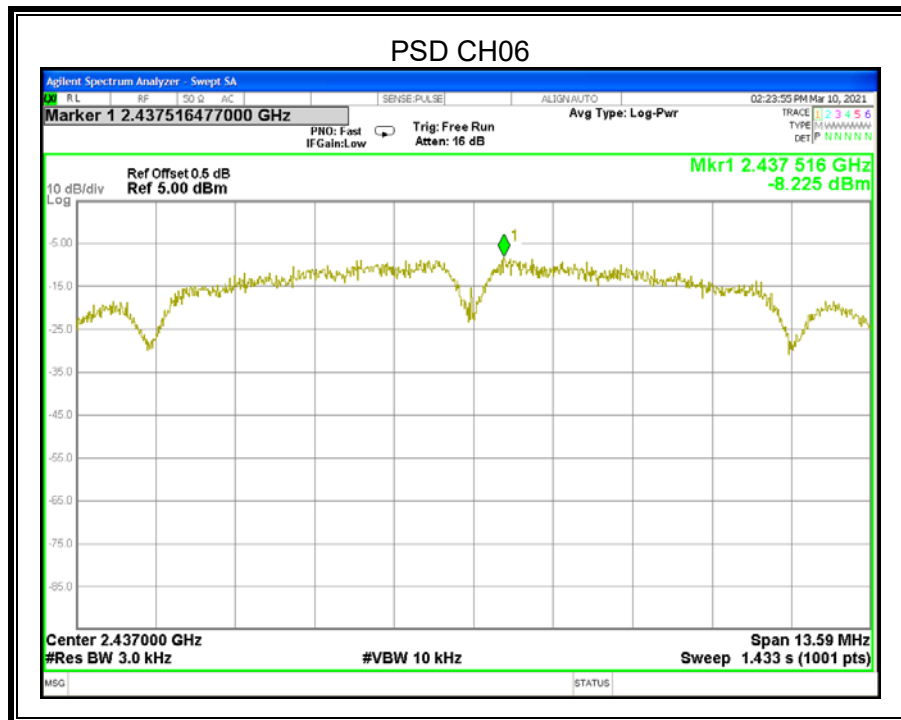


RESULTS

8.4.1. 802.11b MODE

Test Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
CH01	2412	-8.093	≤8	PASS
CH06	2437	-8.225	≤8	PASS
CH11	2462	-9.187	≤8	PASS

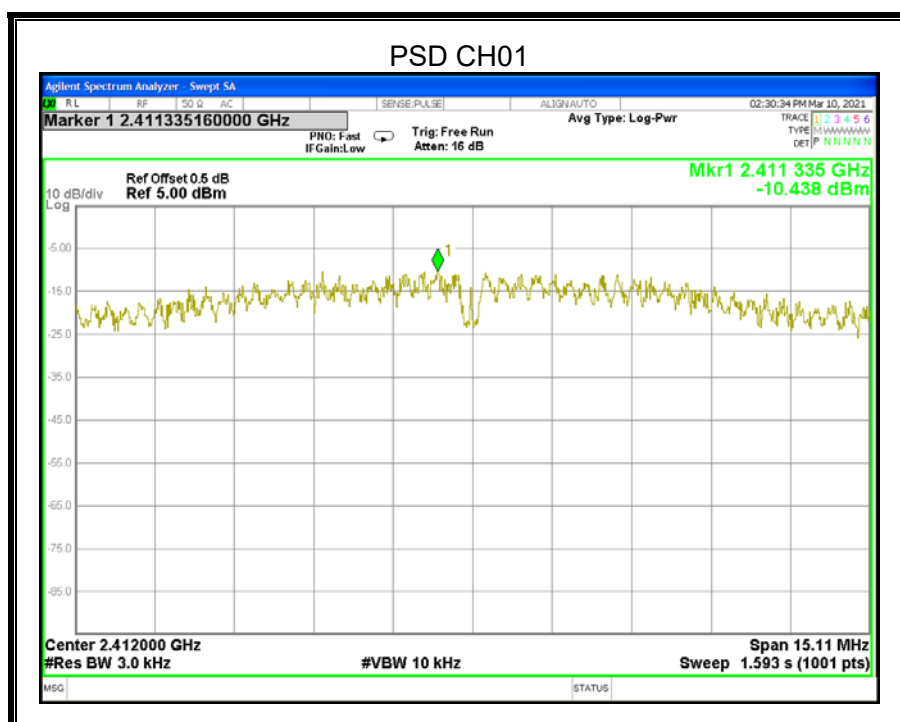


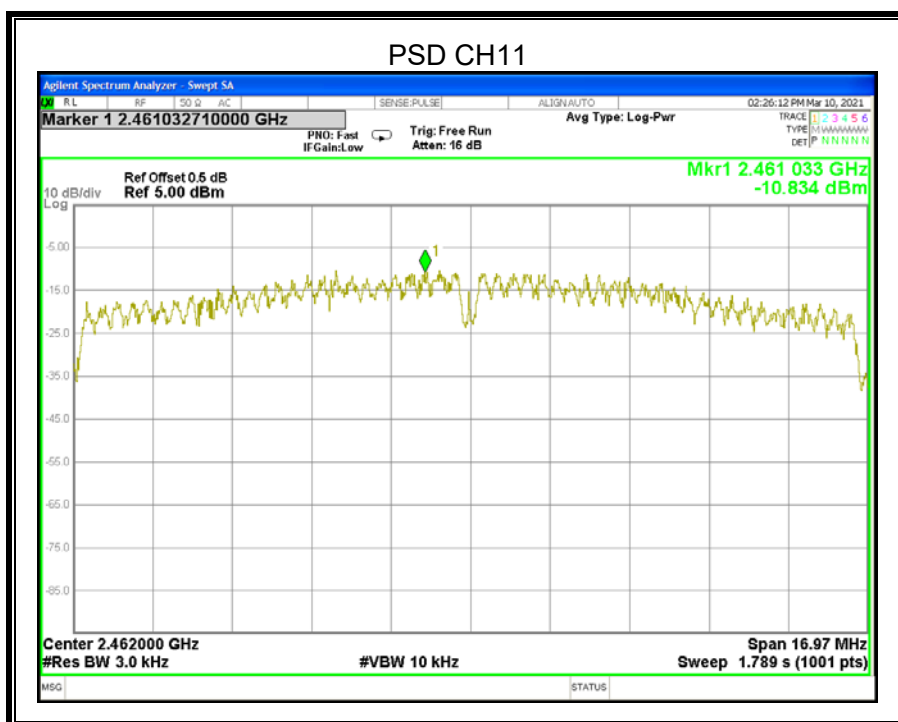
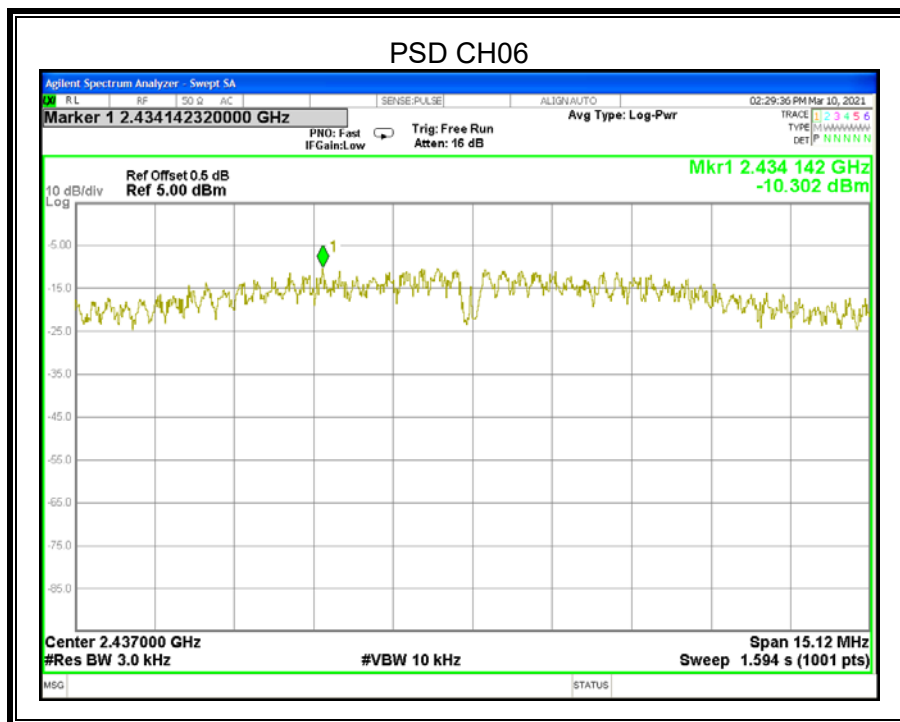




8.4.2. 802.11g MODE

Test Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
CH01	2412	-10.438	≤8	PASS
CH06	2437	-10.302	≤8	PASS
CH11	2462	-10.834	≤8	PASS

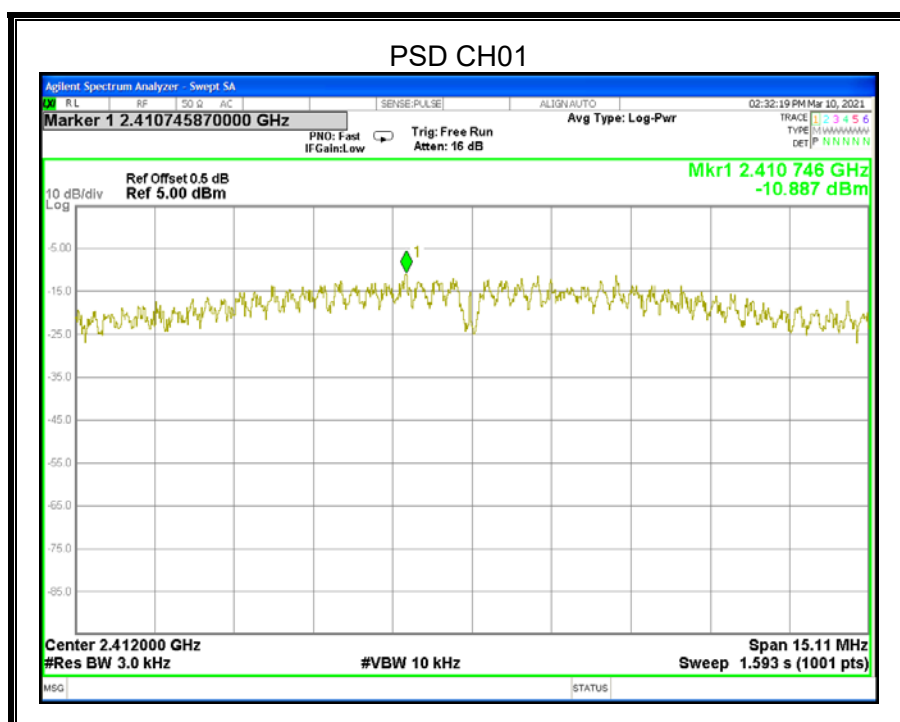


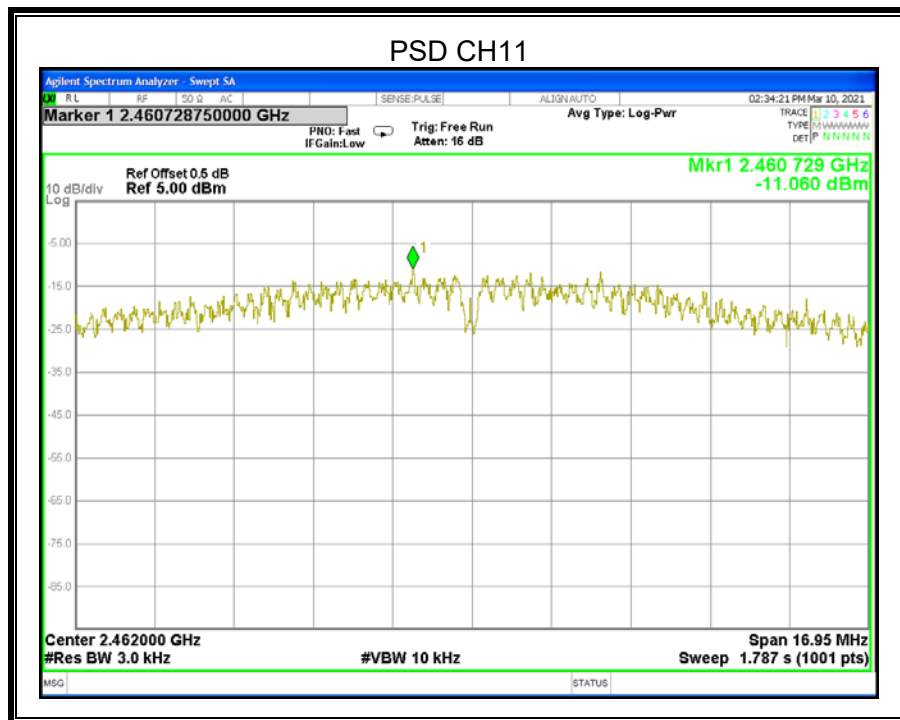
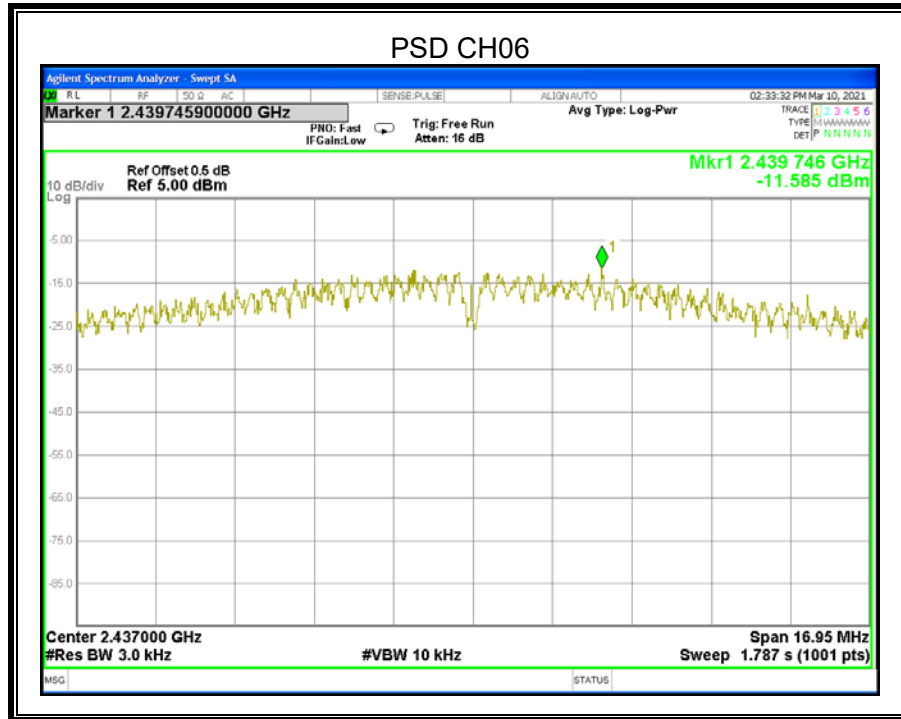




8.4.3. 802.11n HT20 MODE

Test Channel	Frequency (MHz)	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
CH01	2412	-10.887	≤8	PASS
CH06	2437	-11.585	≤8	PASS
CH11	2462	-11.060	≤8	PASS







8.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

FCC Part15 (15.247) Subpart C		
Section	Test Item	Limit
FCC §15.247 (d)	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

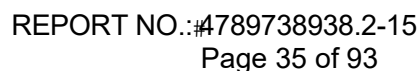
Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	100K
VBW	$\geq 3 \times \text{RBW}$
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	$\geq 3 \times \text{RBW}$
measurement points	$\geq \text{span}/\text{RBW}$
Trace	Max hold
Sweep time	Auto couple.

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

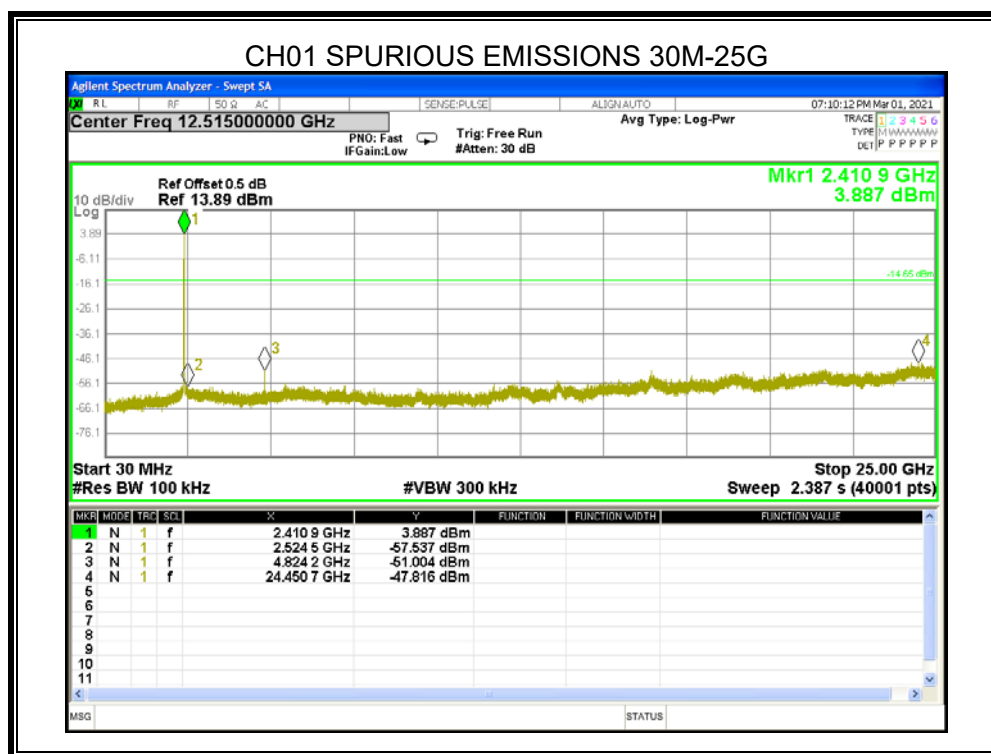


```
graph LR; EUT[EUT] --- Attenuator[Attenuator]; Attenuator --- SA[Spectrum Analyser]
```

A block diagram showing the connection between three components: EUT (Equipment Under Test), Attenuator, and Spectrum Analyser. The EUT is connected to the Attenuator, which is then connected to the Spectrum Analyser.

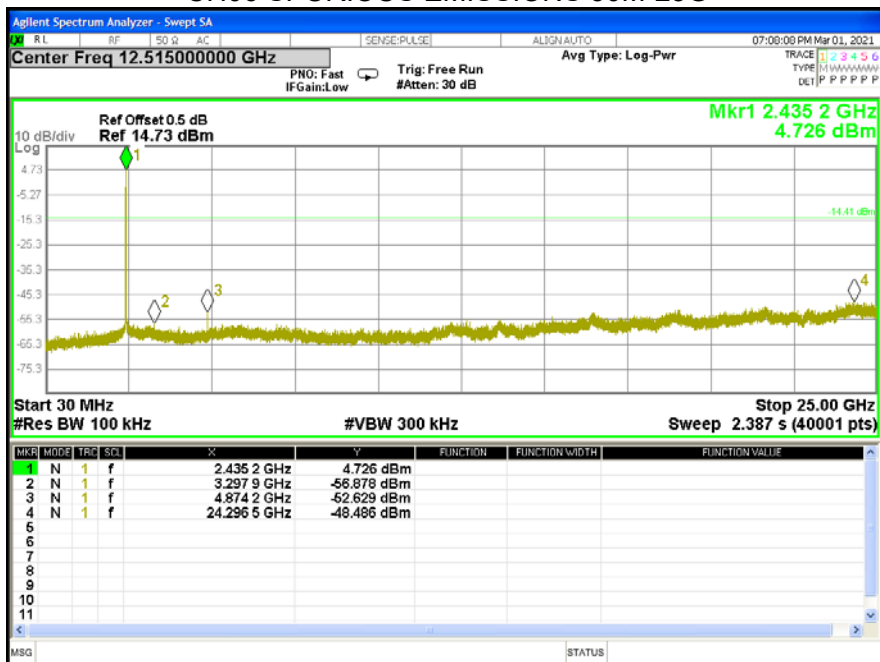
Temperature	25°C	Relative Humidity	60%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V/60Hz

8.5.1. 802.11b MODE

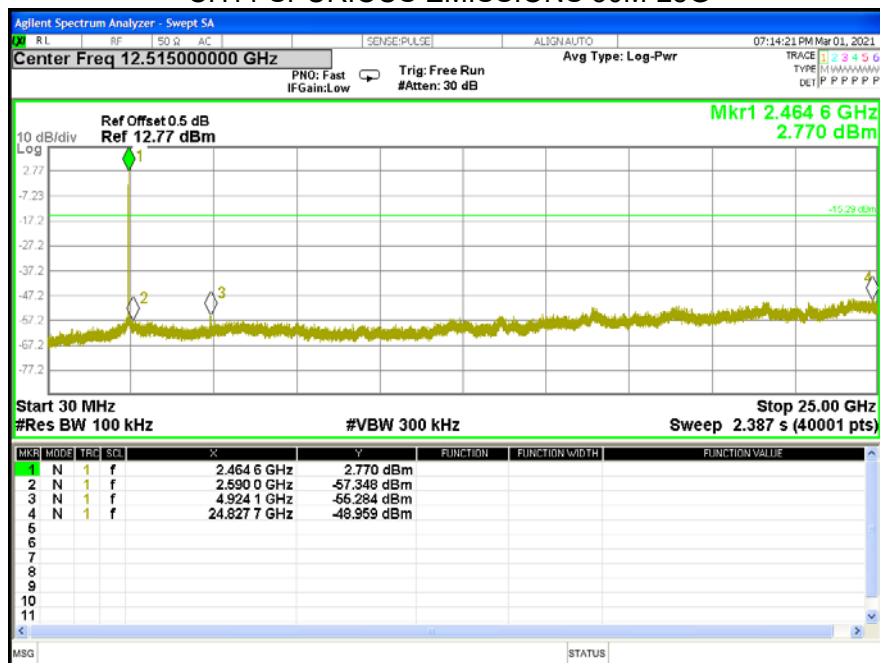




CH06 SPURIOUS EMISSIONS 30M-25G

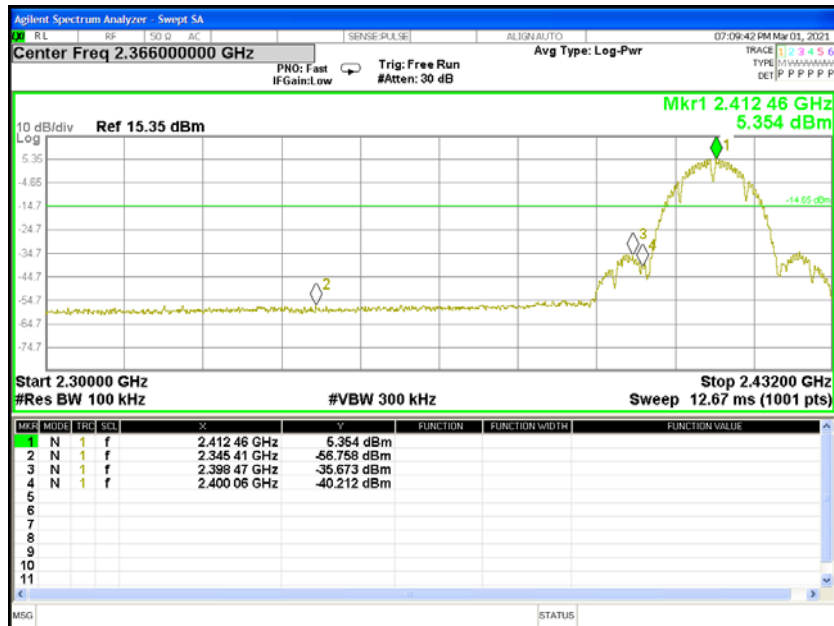


CH11 SPURIOUS EMISSIONS 30M-25G



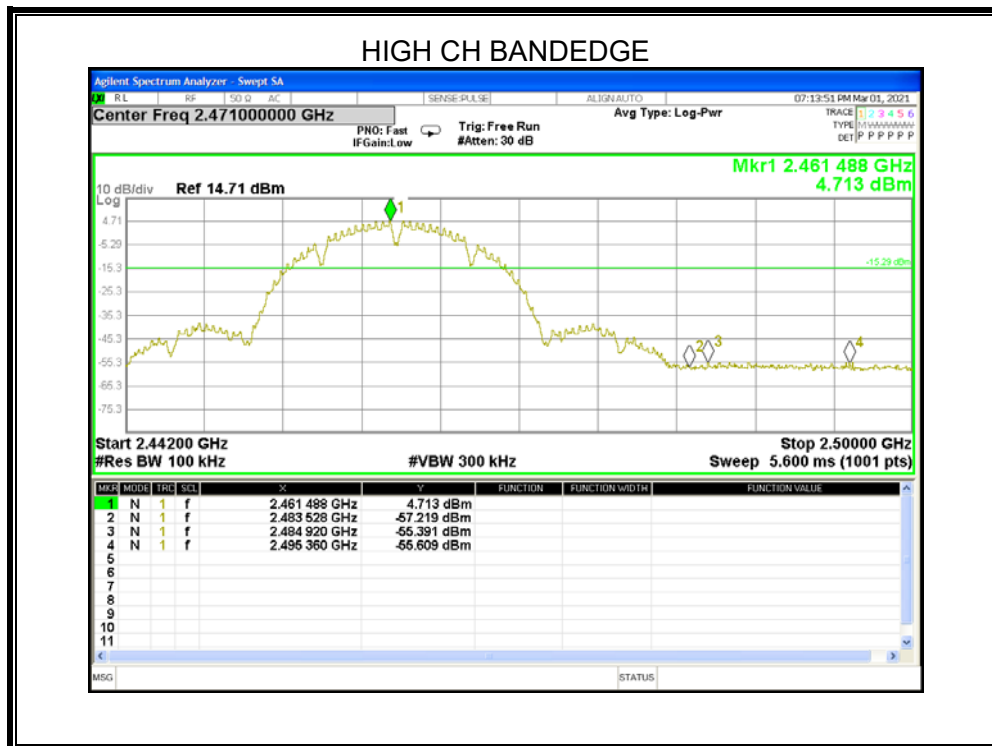


LOW CH BANDEDGE



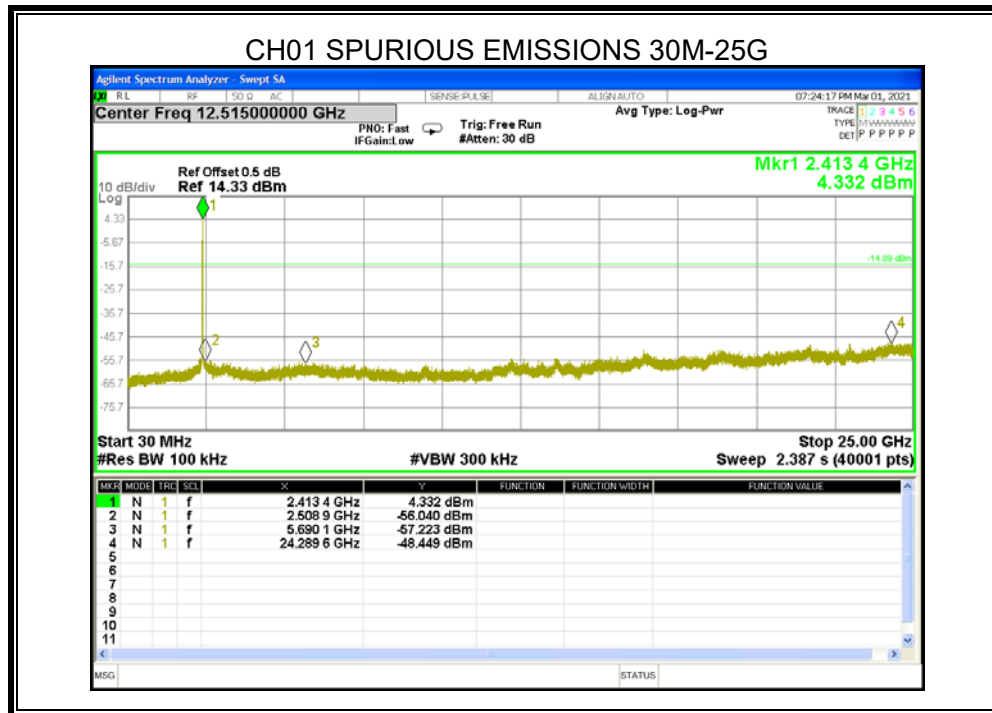
MID CH BANDEDGE





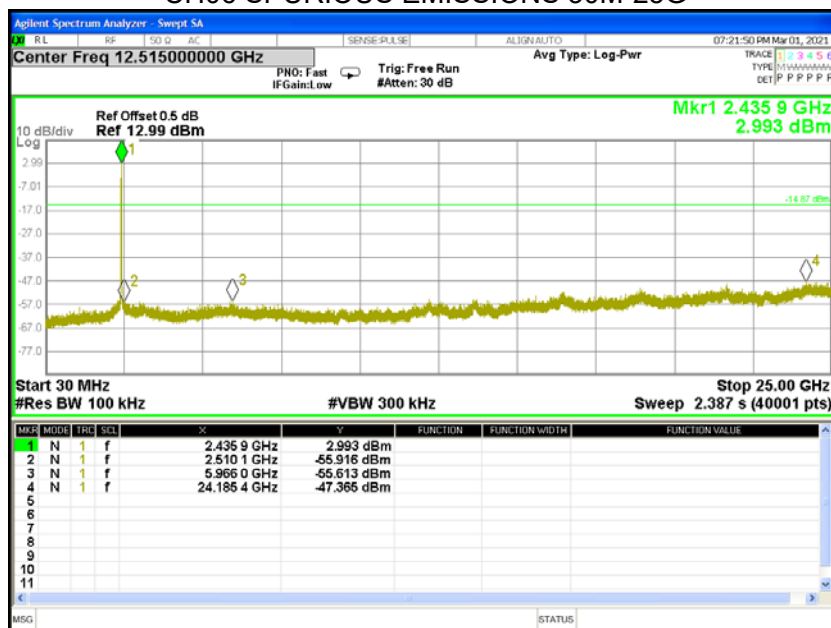


8.5.2. 802.11g MODE

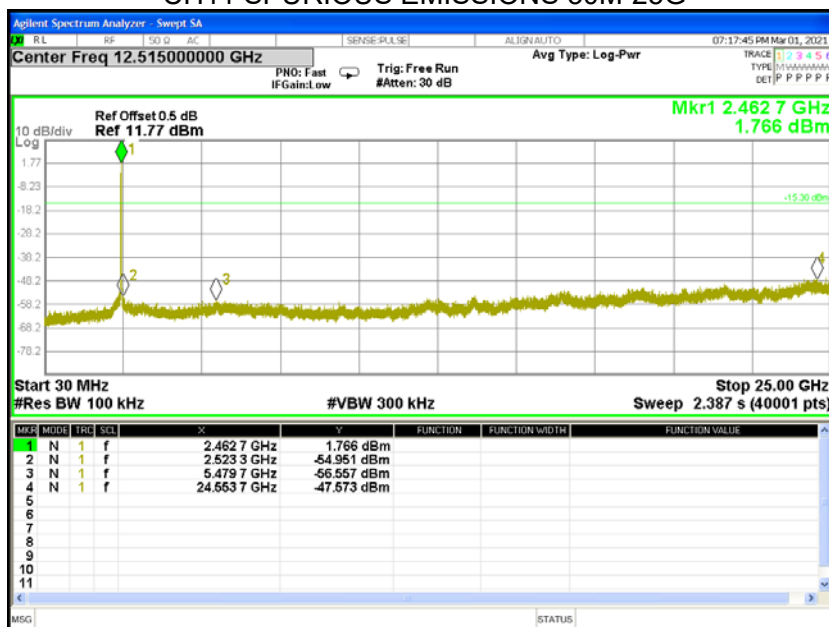




CH06 SPURIOUS EMISSIONS 30M-25G

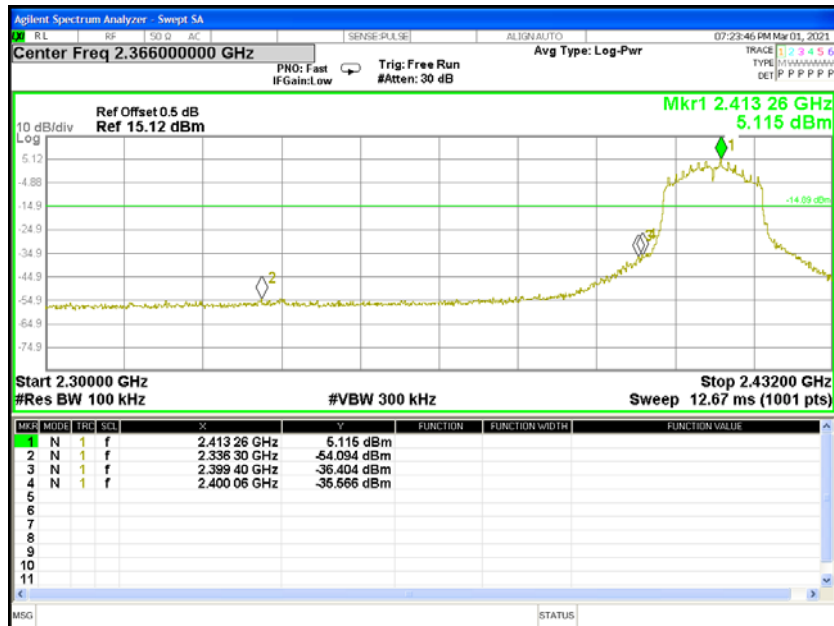


CH11 SPURIOUS EMISSIONS 30M-25G

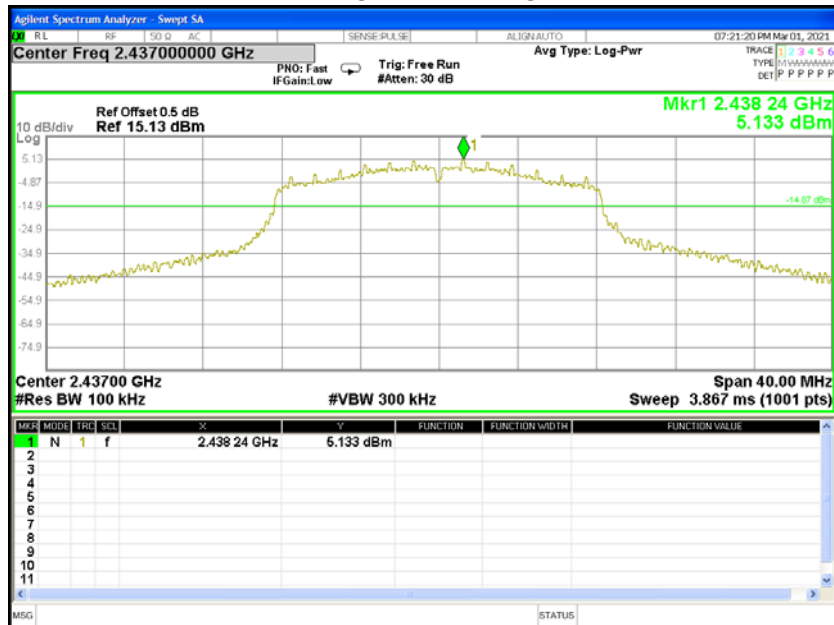


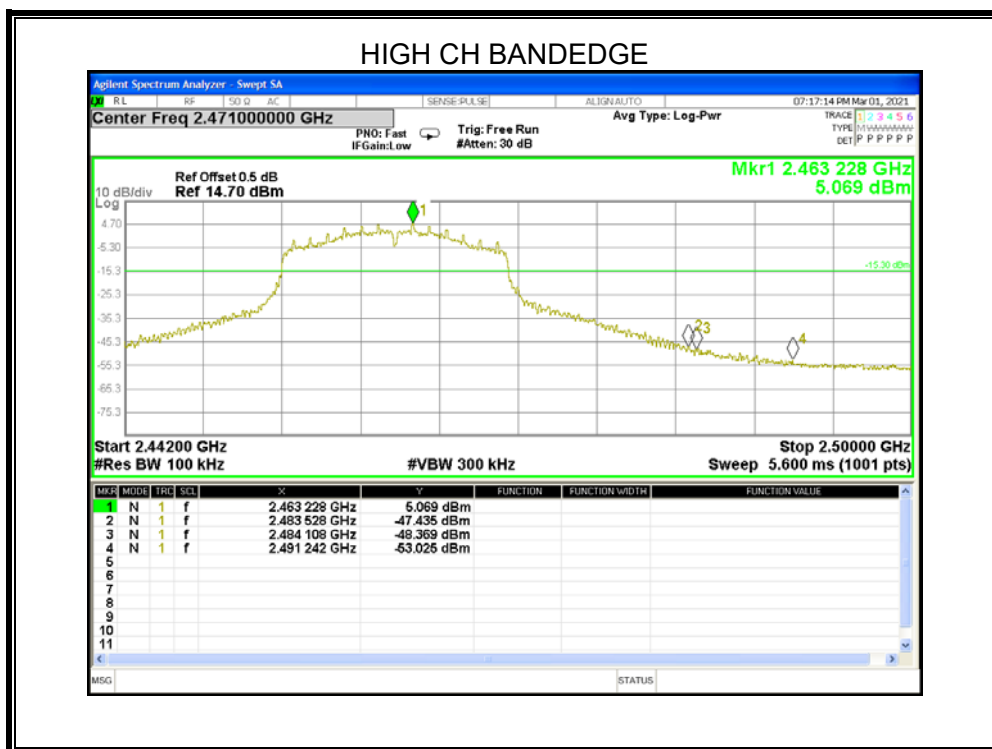


LOW CH BANDEDGE

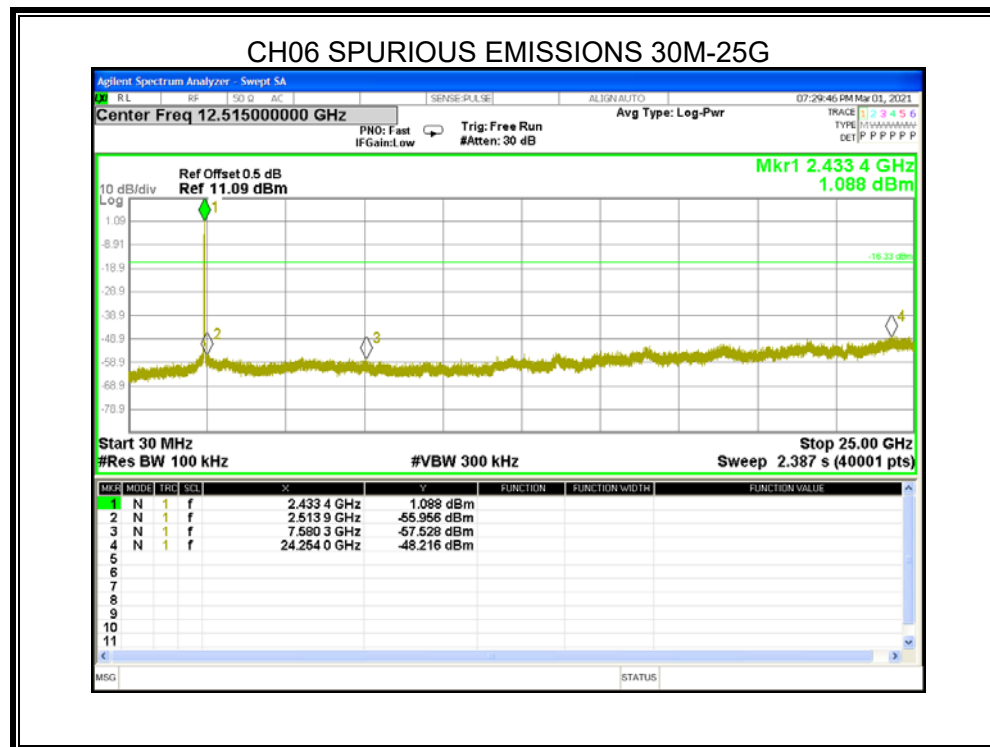
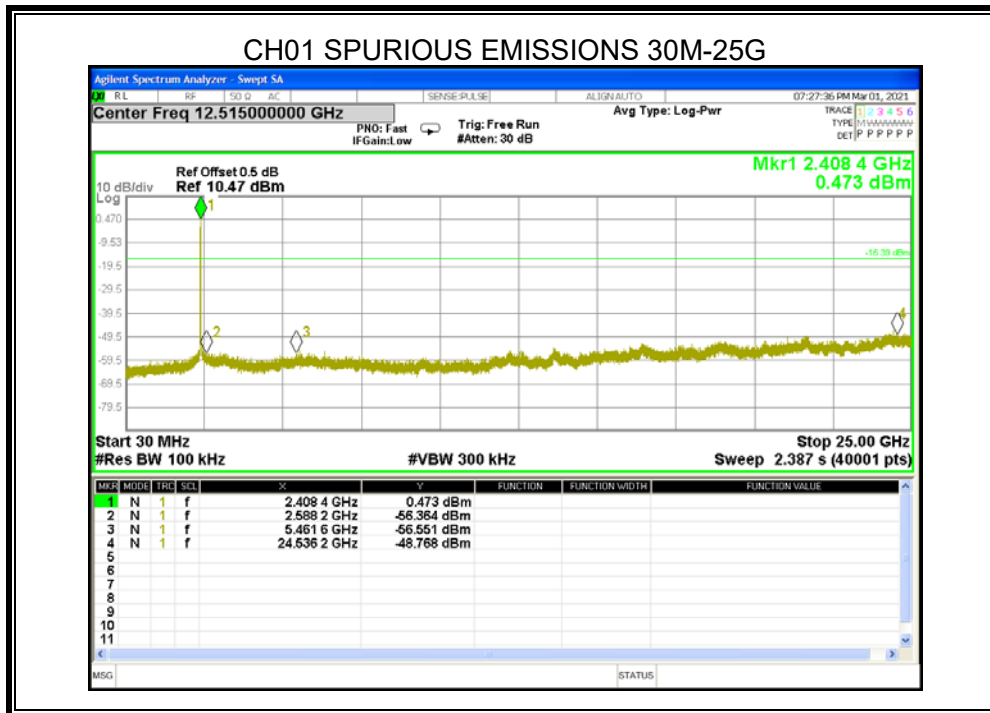


MID CH BANDEDGE



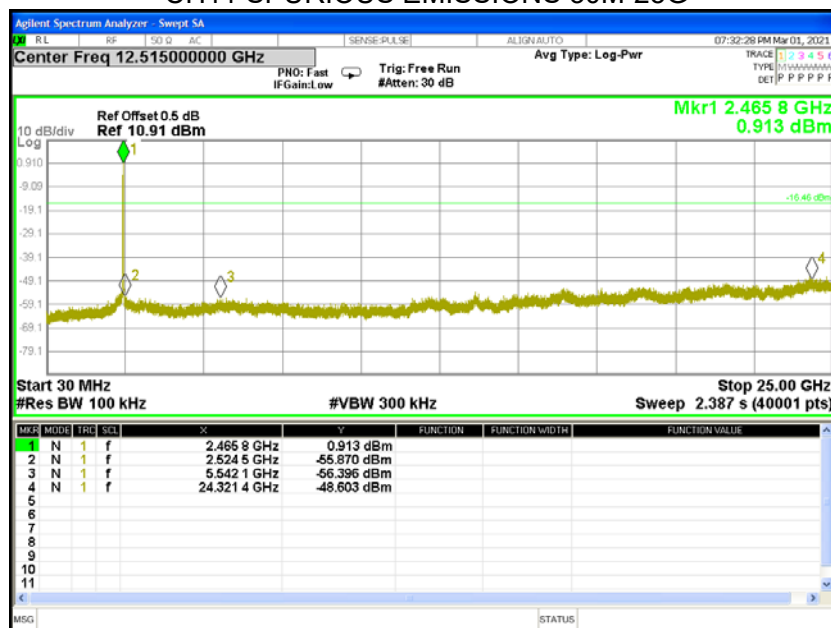


8.5.3. 802.11n HT20 MODE

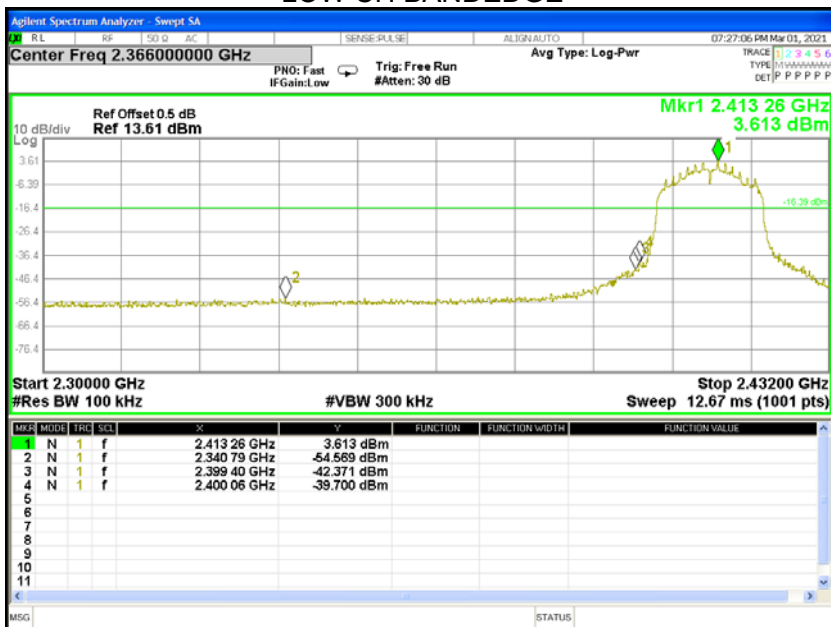




CH11 SPURIOUS EMISSIONS 30M-25G

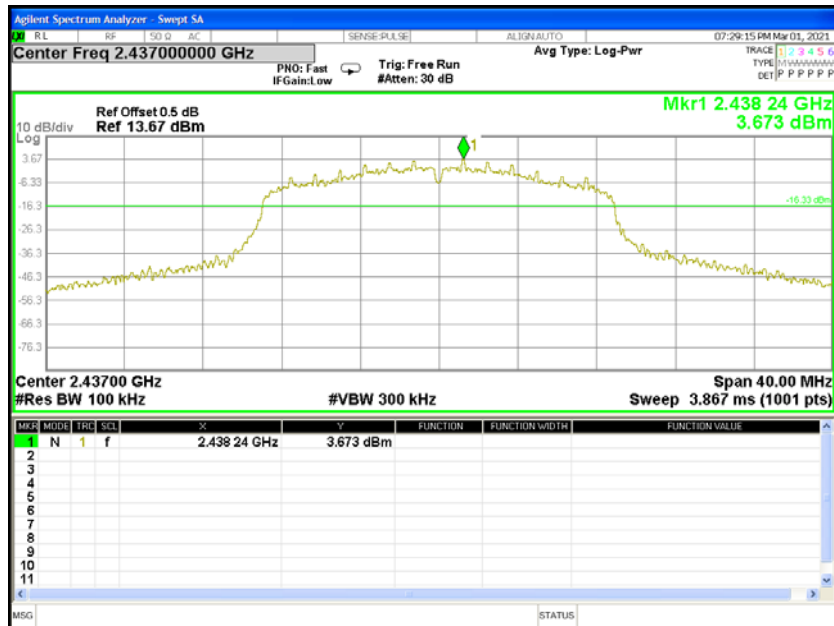


LOW CH BANDEDGE

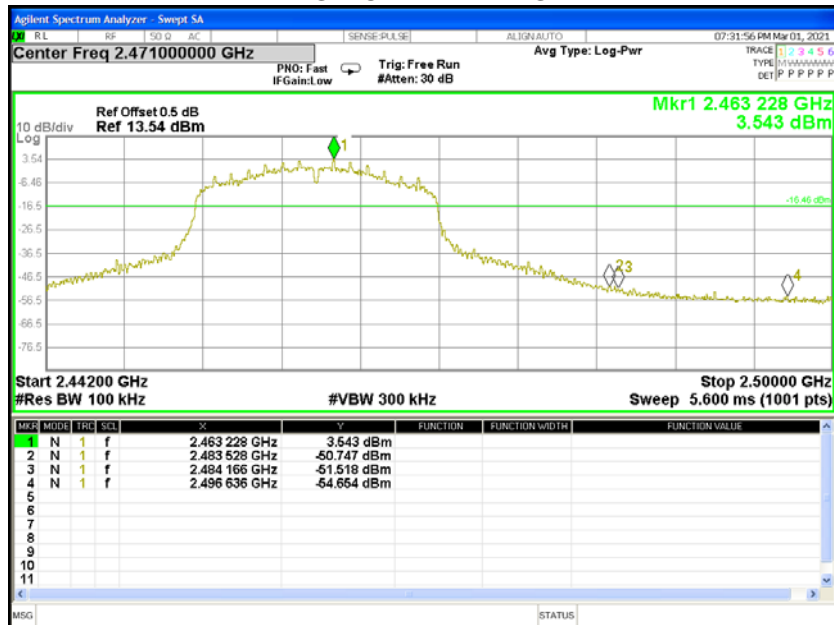




MID CH BANDEDGE



HIGH CH BANDEDGE





9. RADIATED TEST RESULTS

LIMITS

Please refer to FCC §15.205 and §15.209

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.



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

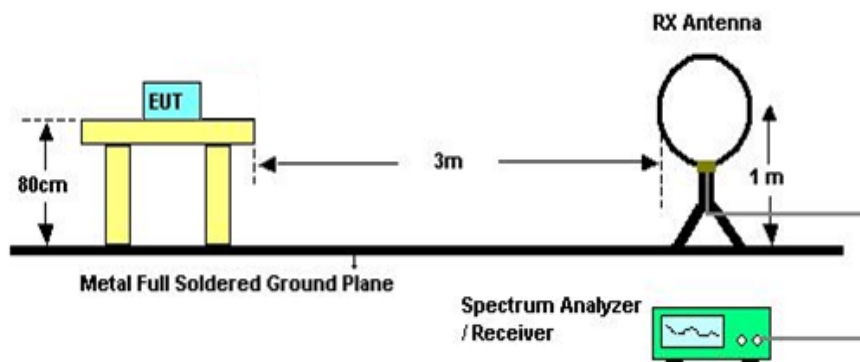
MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
¹ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	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: ¹Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

²Above 38.6c

TEST SETUP AND PROCEDURE

Below 30MHz



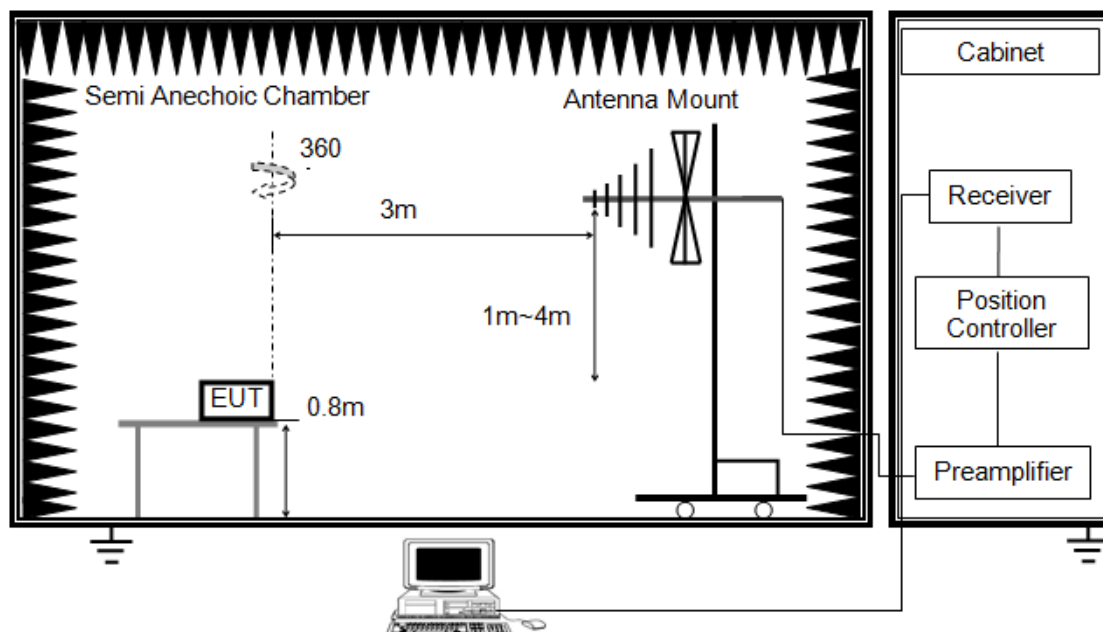
The setting of the spectrum analyser

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
Detector	Peak/QP/ Average
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 0.8 meter 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)

Note: Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

Below 1G

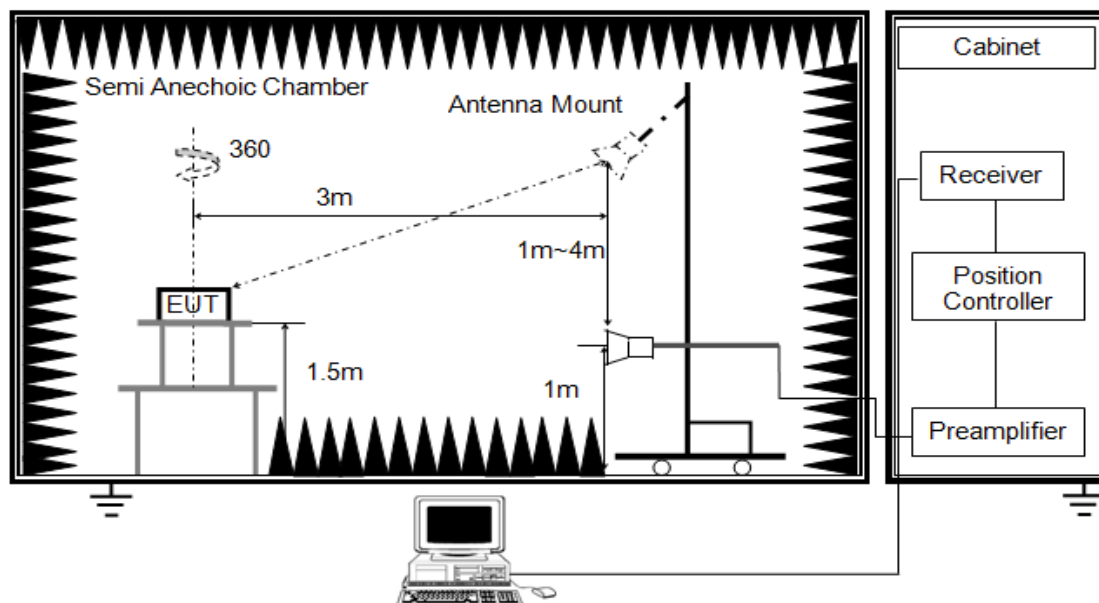


The setting of the spectrum analyser

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 0.8 meter 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)

ABOVE 1G



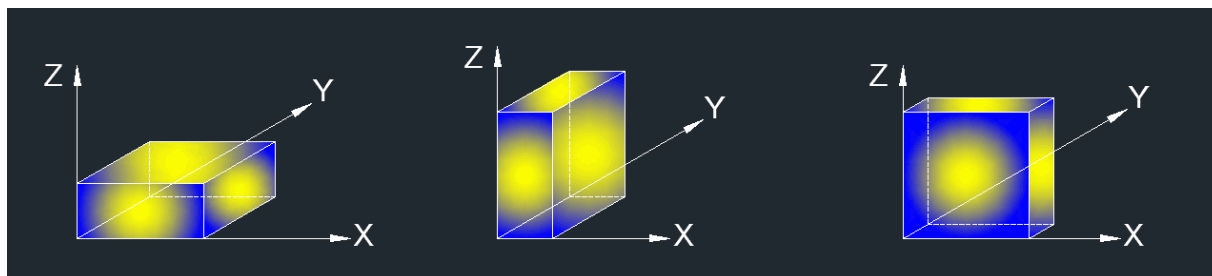
The setting of the spectrum analyser

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 (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 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 measurement above 1GHz, the emission measurement will be measured by the peak detector. This peak level, once corrected, must comply with the limit specified in Section 15.209.
6. 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 10KHz video bandwidth with peak detector for average measurements.
7. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)



X axis, Y axis, Z axis positions:



8.The EUT as shown in Figure 1 is the worst mode, the report only shown the worst mode data.

TEST ENVIRONMENT

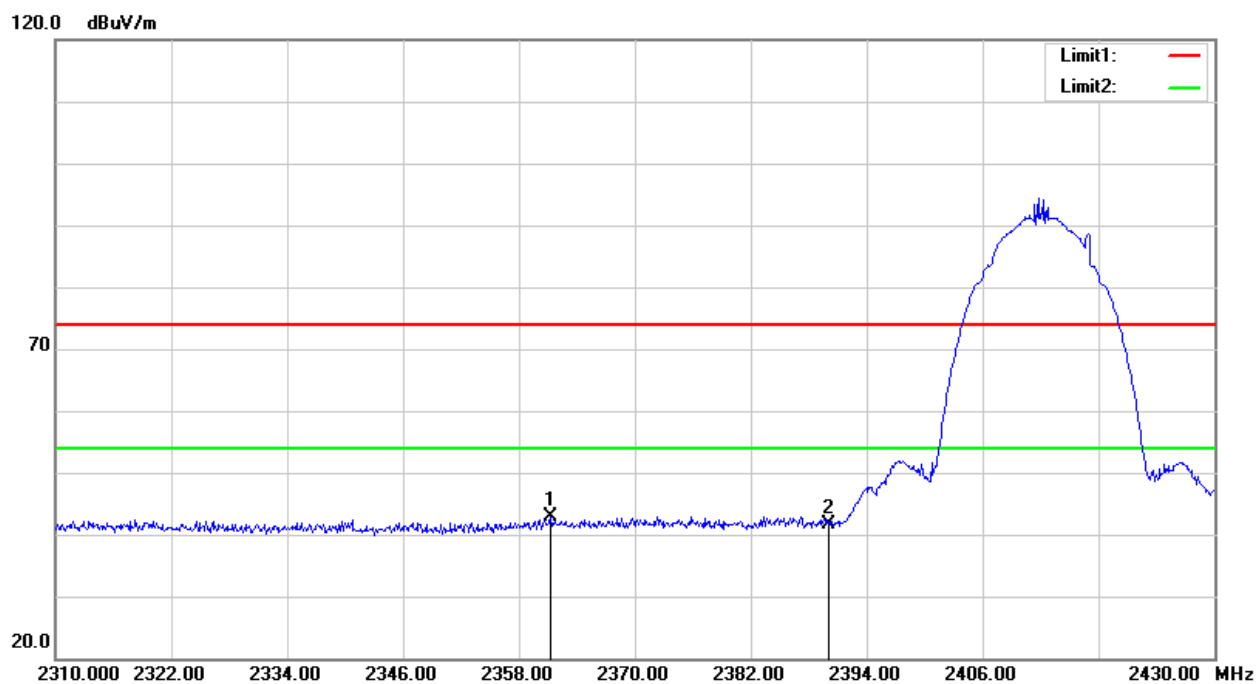
Temperature	23.1°C	Relative Humidity	60%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V/60Hz



9.1. RESTRICTED BANDEDGE

802.11 b mode

RESTRICTED BANDEDGE (01 CHANNEL, HORIZONTAL)

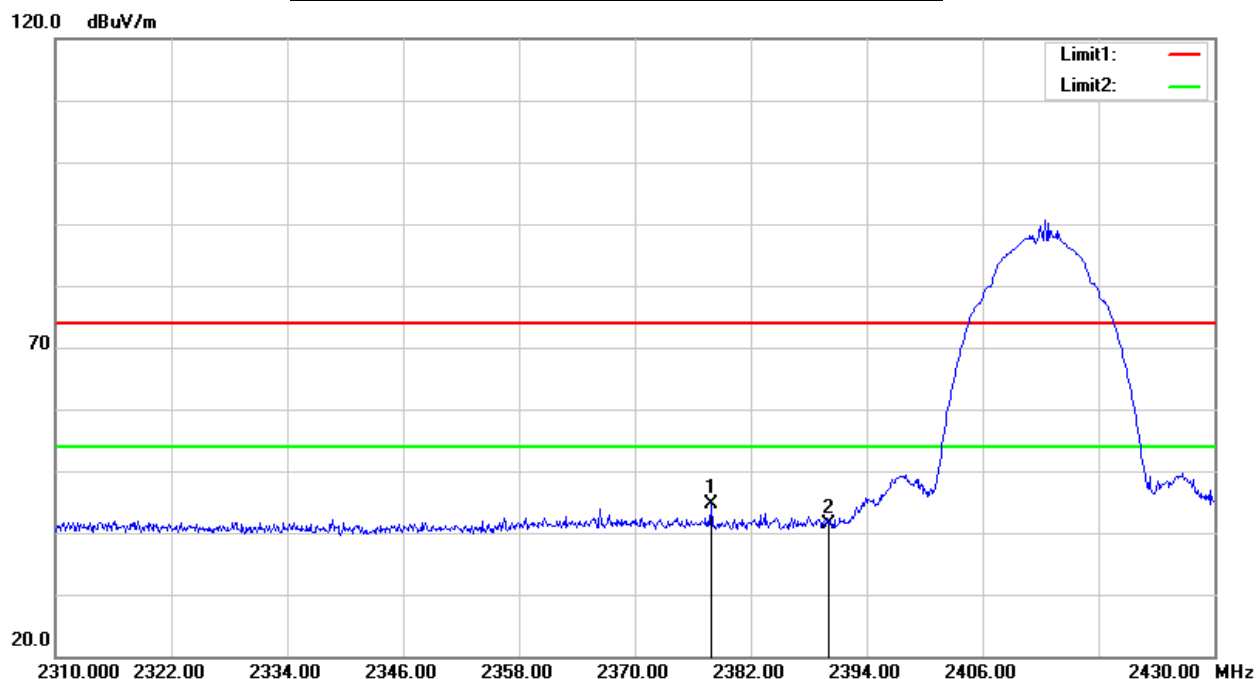


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2361.240	39.02	3.91	42.93	74.00	-31.07	peak
2	2390.000	37.41	4.34	41.75	74.00	-32.25	peak

Note: Measurement = Reading Level + Correct Factor.



RESTRICTED BANDEDGE (01 CHANNEL, VERTICAL)

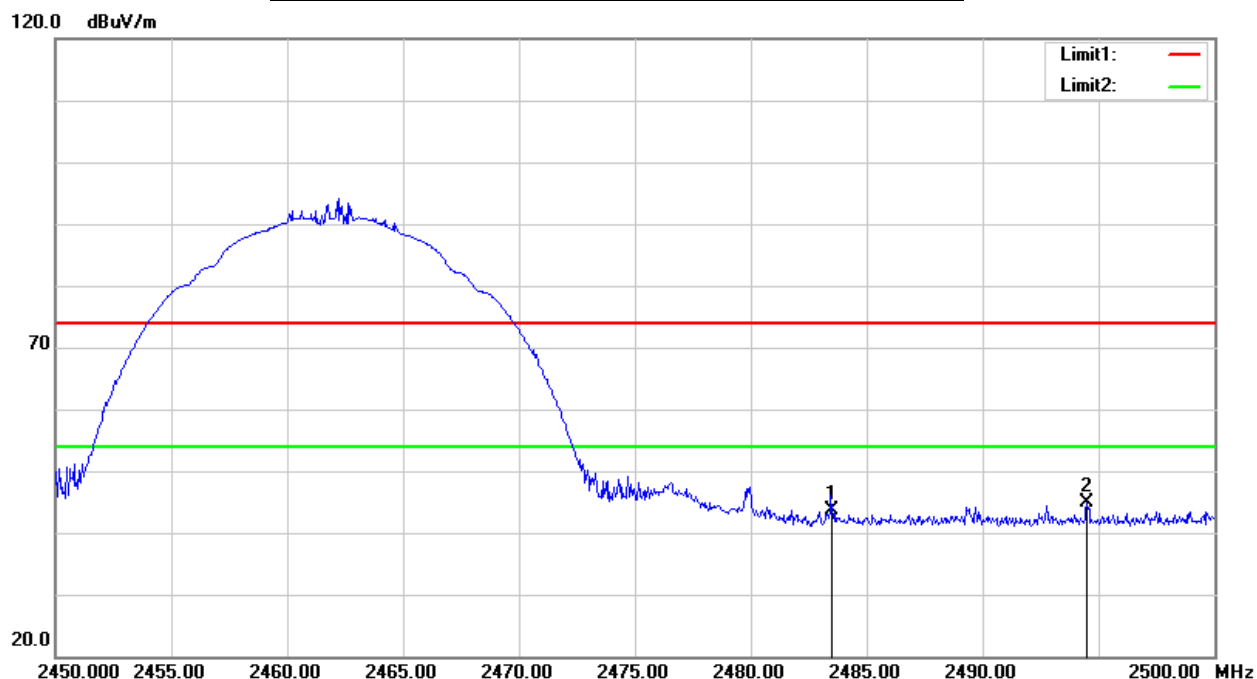


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2377.920	40.48	4.15	44.63	74.00	-29.37	peak
2	2390.000	36.96	4.34	41.30	74.00	-32.70	peak

Note: Measurement = Reading Level + Correct Factor.



RESTRICTED BANDEDGE (11 CHANNEL, HORIZONTAL)

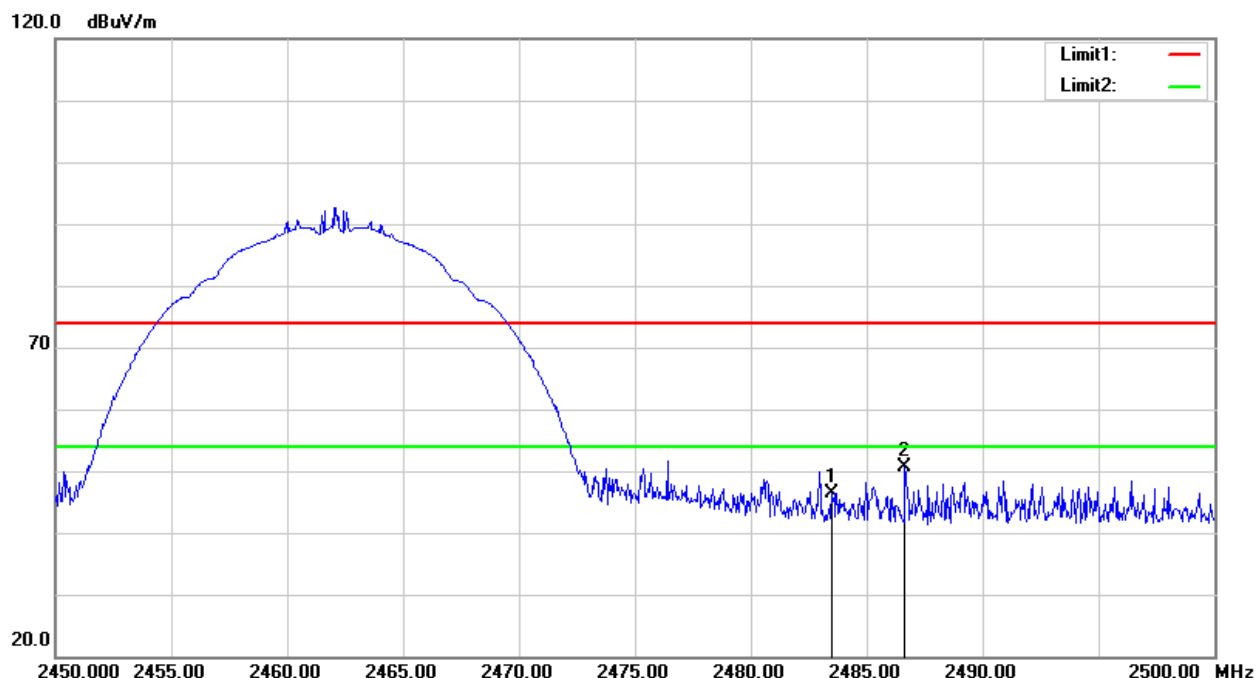


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	38.91	4.60	43.51	74.00	-30.49	peak
2	2494.500	40.20	4.63	44.83	74.00	-29.17	peak

Note: Measurement = Reading Level + Correct Factor.



RESTRICTED BANDEDGE (11 CHANNEL, VERTICAL)



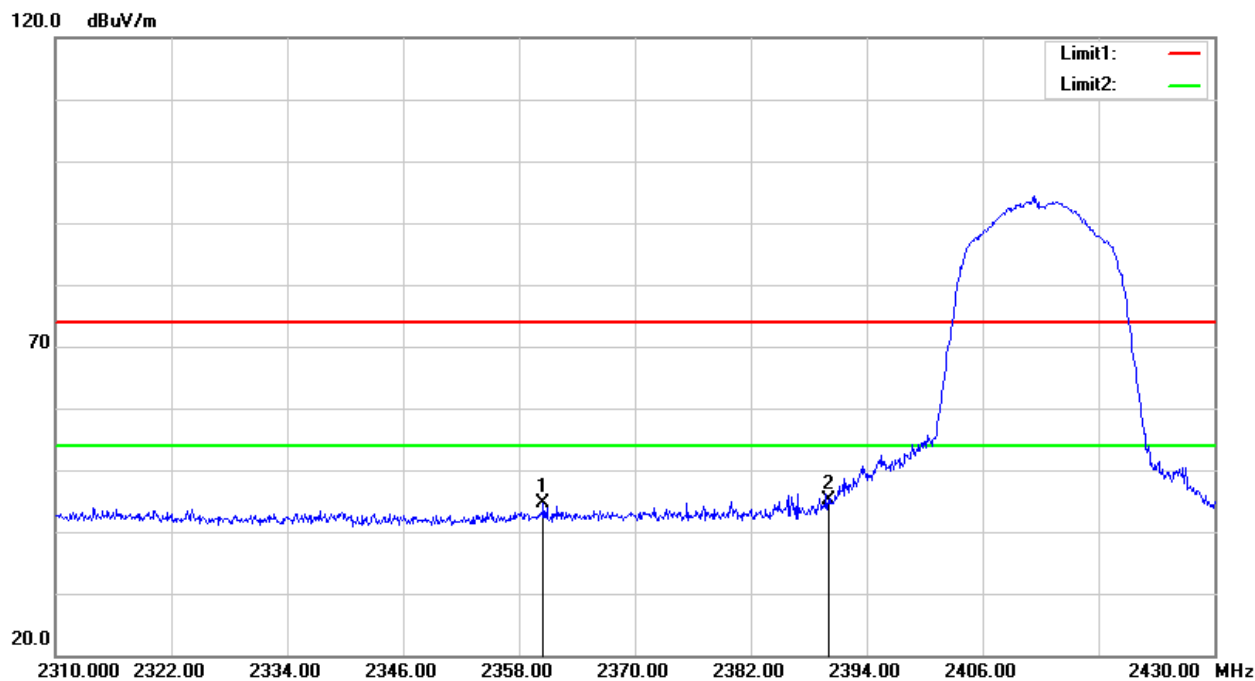
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	41.69	4.60	46.29	74.00	-27.71	peak
2	2486.650	46.06	4.61	50.67	74.00	-23.33	peak

Note: Measurement = Reading Level + Correct Factor.



802.11 g mode

RESTRICTED BANDEDGE (01 CHANNEL, HORIZONTAL)

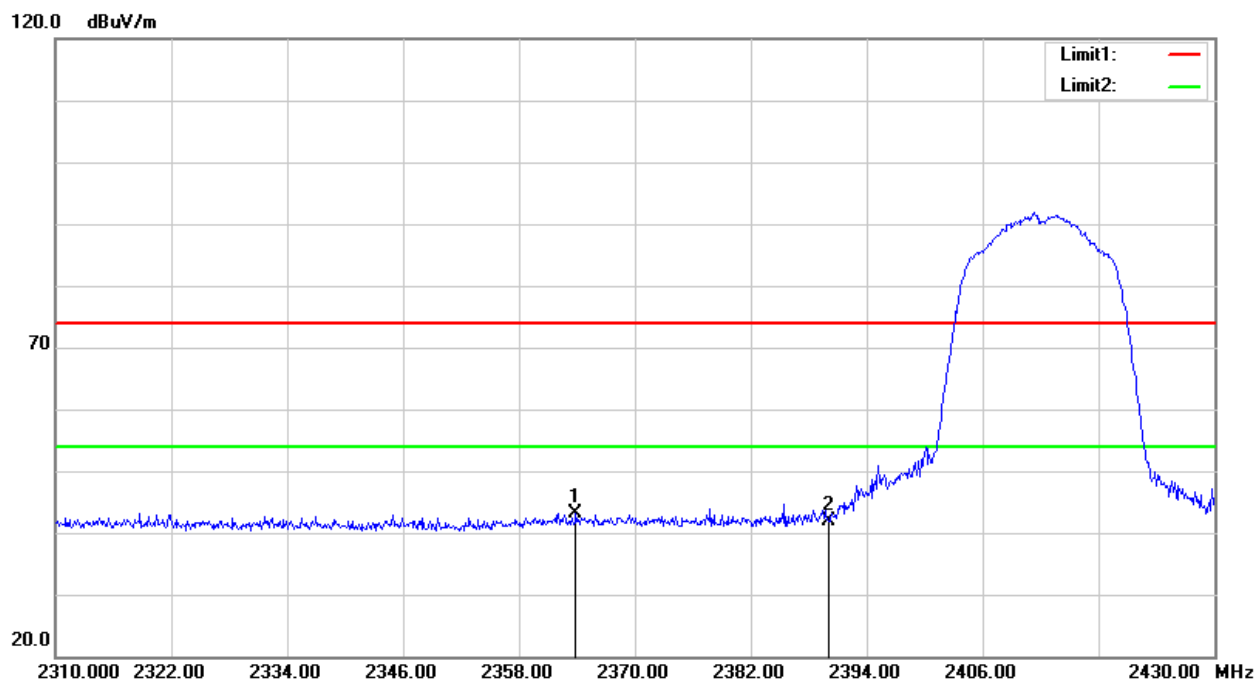


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2360.520	40.66	3.90	44.56	74.00	-29.44	peak
2	2390.000	40.74	4.34	45.08	74.00	-28.92	peak

Note: Measurement = Reading Level + Correct Factor.



RESTRICTED BANDEDGE (01 CHANNEL, VERTICAL)

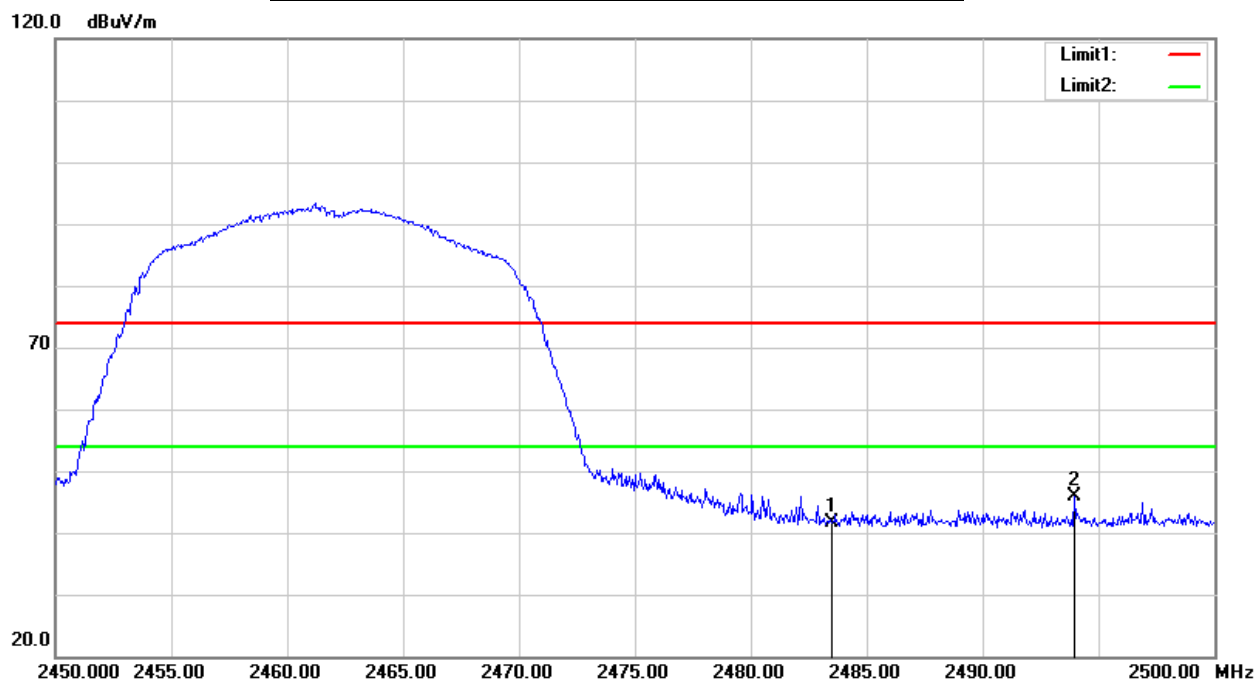


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2363.880	39.26	3.95	43.21	74.00	-30.79	peak
2	2390.000	37.64	4.34	41.98	74.00	-32.02	peak

Note: Measurement = Reading Level + Correct Factor.



RESTRICTED BANDEDGE (11 CHANNEL, HORIZONTAL)

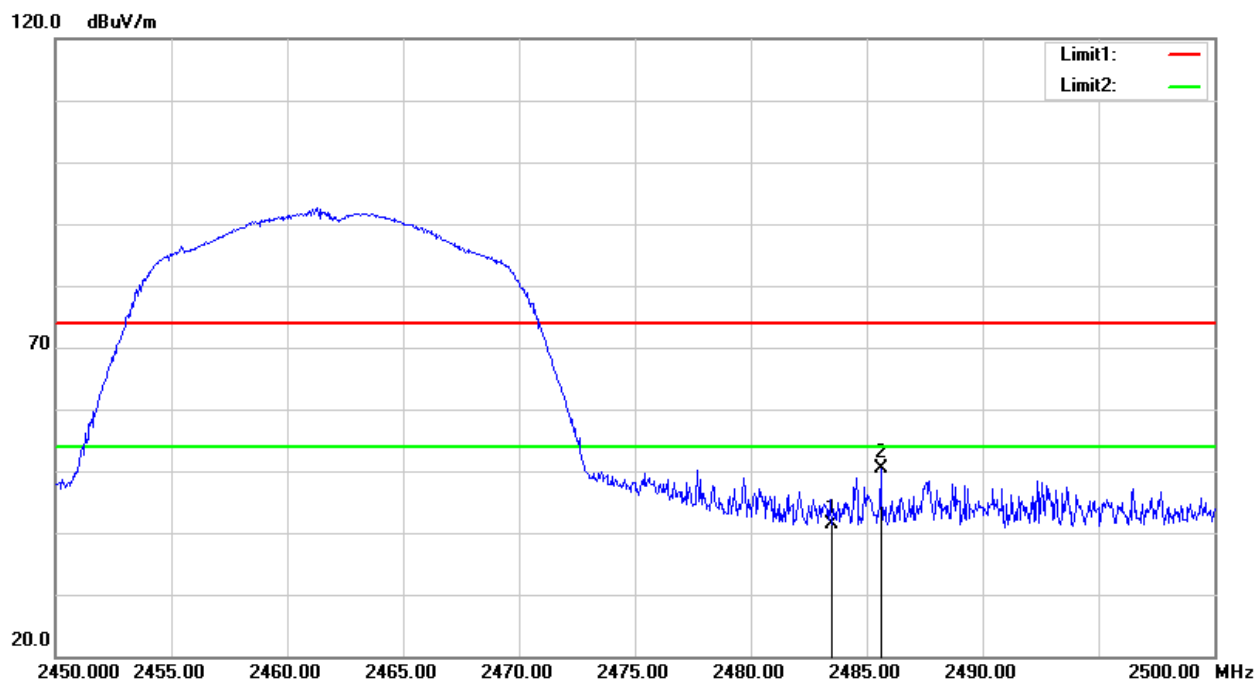


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	37.13	4.60	41.73	74.00	-32.27	peak
2	2493.950	41.28	4.63	45.91	74.00	-28.09	peak

Note: Measurement = Reading Level + Correct Factor.



RESTRICTED BANDEDGE (11 CHANNEL, VERTICAL)



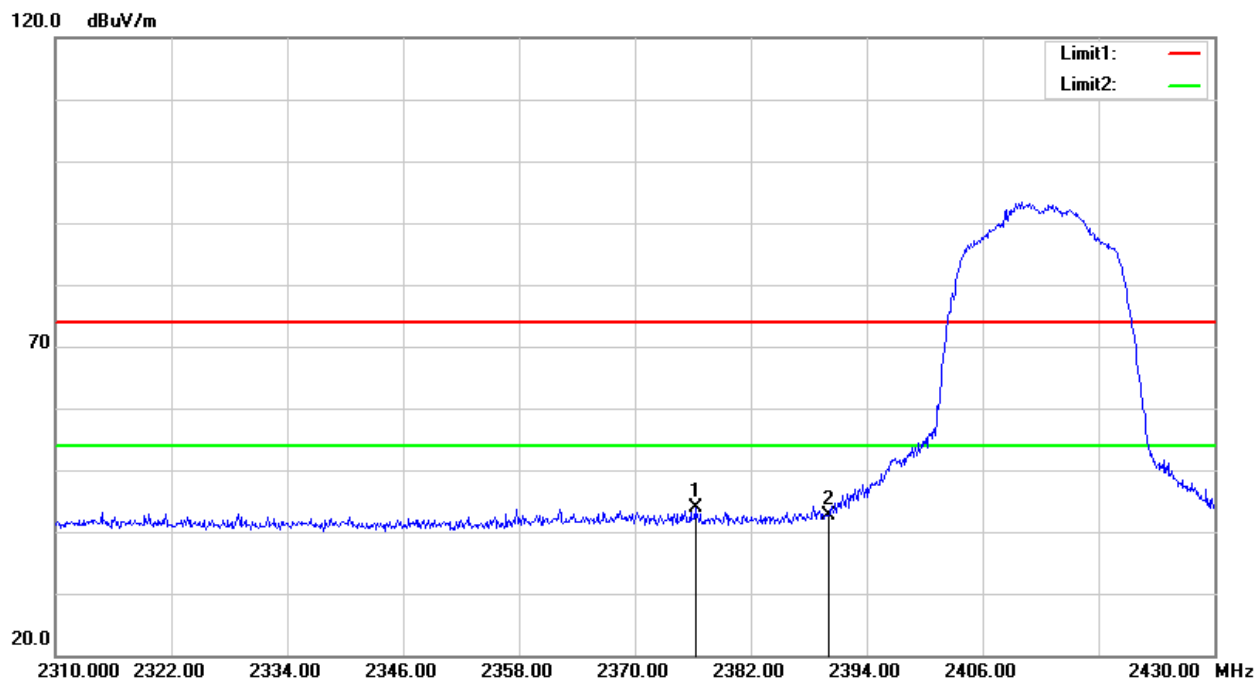
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	36.79	4.60	41.39	74.00	-32.61	peak
2	2485.600	45.81	4.61	50.42	74.00	-23.58	peak

Note: Measurement = Reading Level + Correct Factor.



802.11 n20 mode

RESTRICTED BANDEDGE (01 CHANNEL, HORIZONTAL)

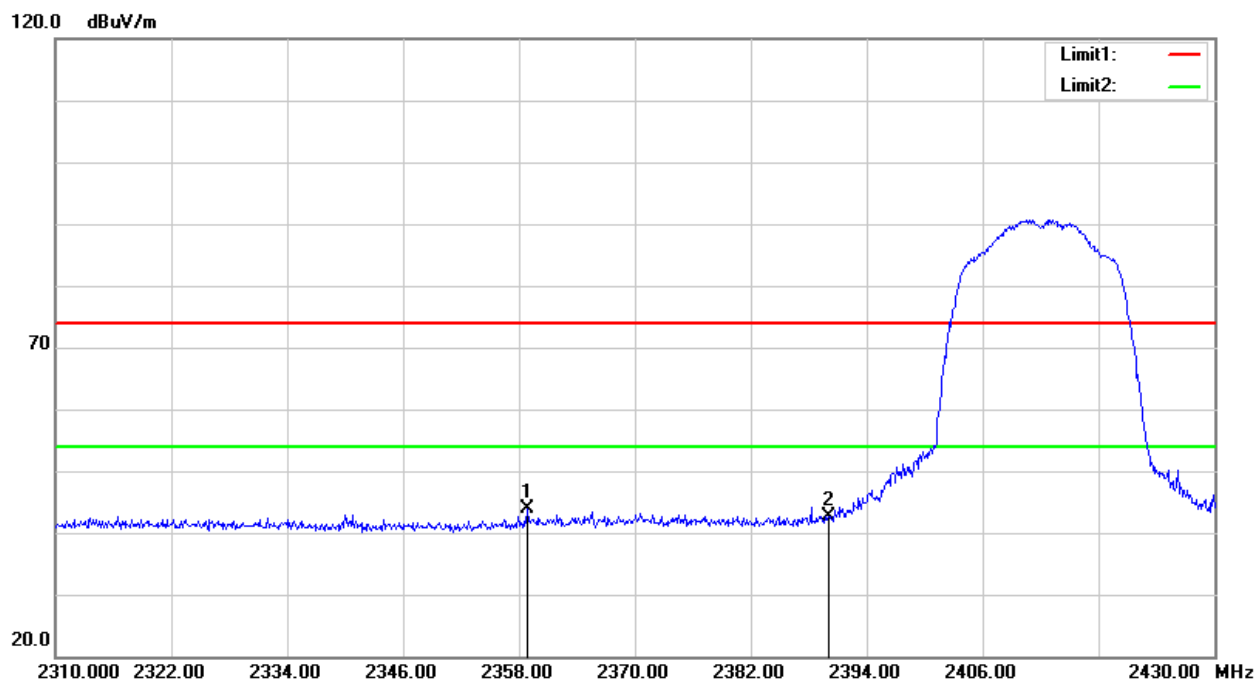


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2376.240	39.85	4.13	43.98	74.00	-30.02	peak
2	2390.000	38.24	4.34	42.58	74.00	-31.42	peak

Note: Measurement = Reading Level + Correct Factor.



RESTRICTED BANDEDGE (01 CHANNEL, VERTICAL)

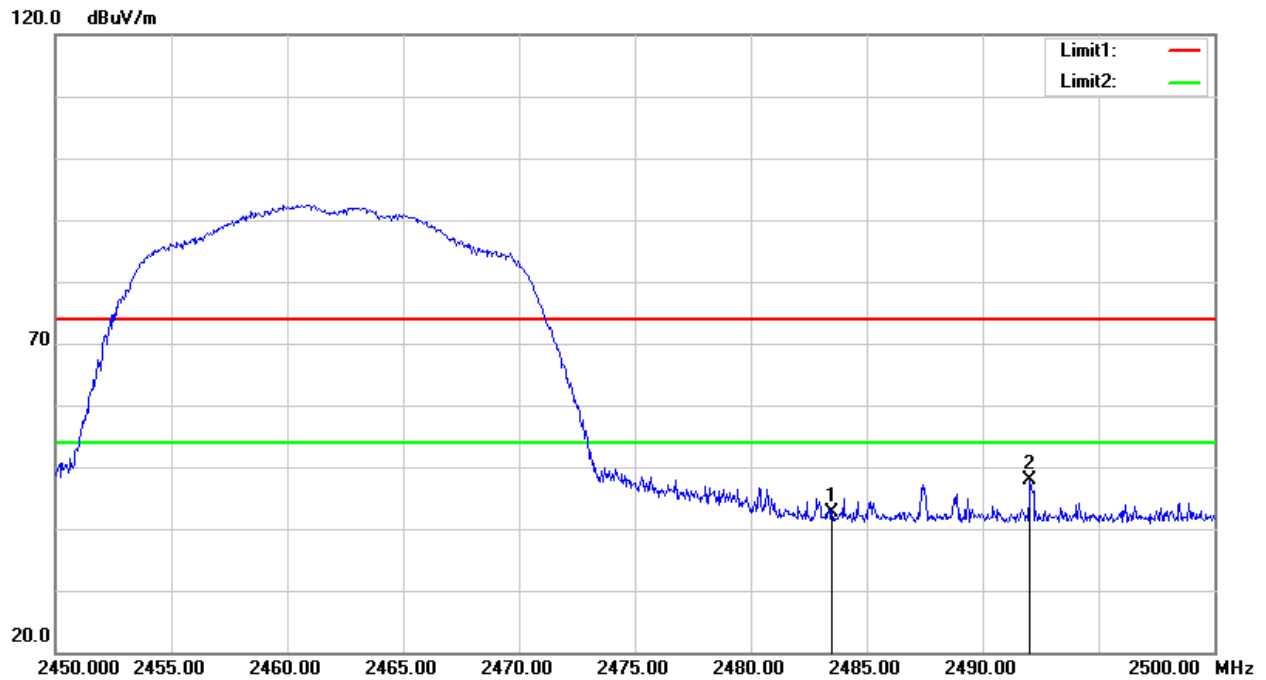


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2358.840	39.91	3.87	43.78	74.00	-30.22	peak
2	2390.000	38.41	4.34	42.75	74.00	-31.25	peak

Note: Measurement = Reading Level + Correct Factor.



RESTRICTED BANDEDGE (11 CHANNEL, HORIZONTAL)

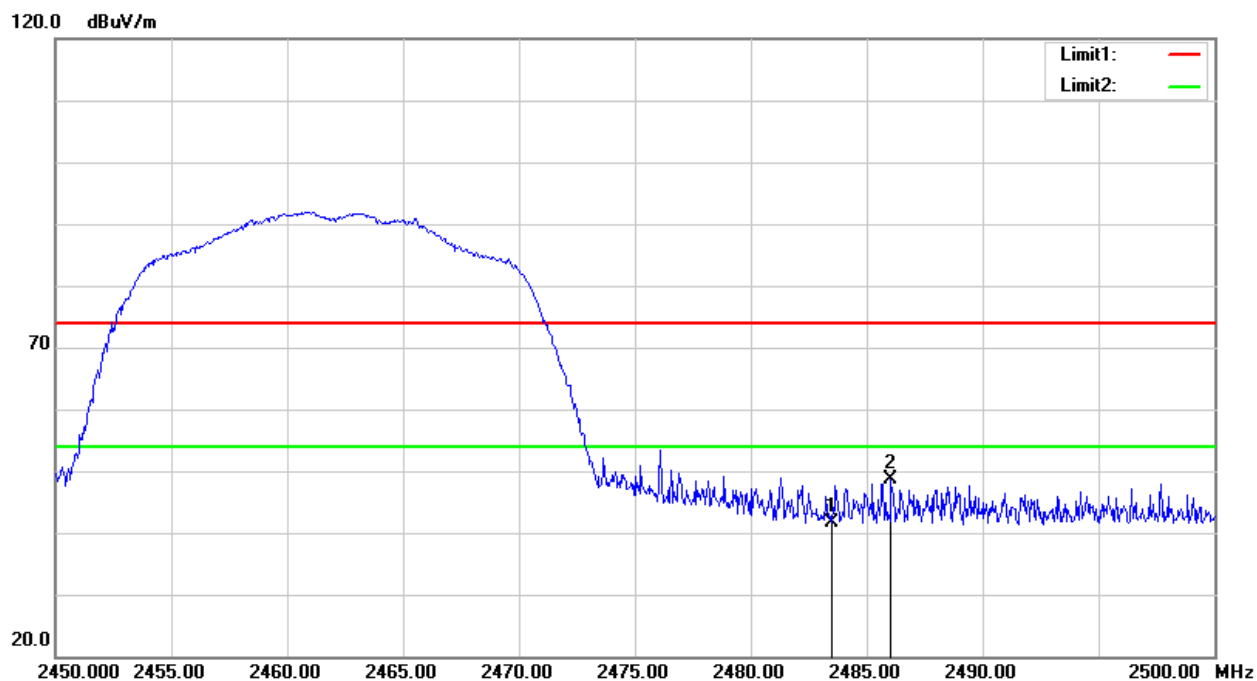


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	38.11	4.60	42.71	74.00	-31.29	peak
2	2492.050	43.21	4.63	47.84	74.00	-26.16	peak

Note: Measurement = Reading Level + Correct Factor.



RESTRICTED BANDEDGE (11 CHANNEL, VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	36.95	4.60	41.55	74.00	-32.45	peak
2	2486.050	43.95	4.61	48.56	74.00	-25.44	peak

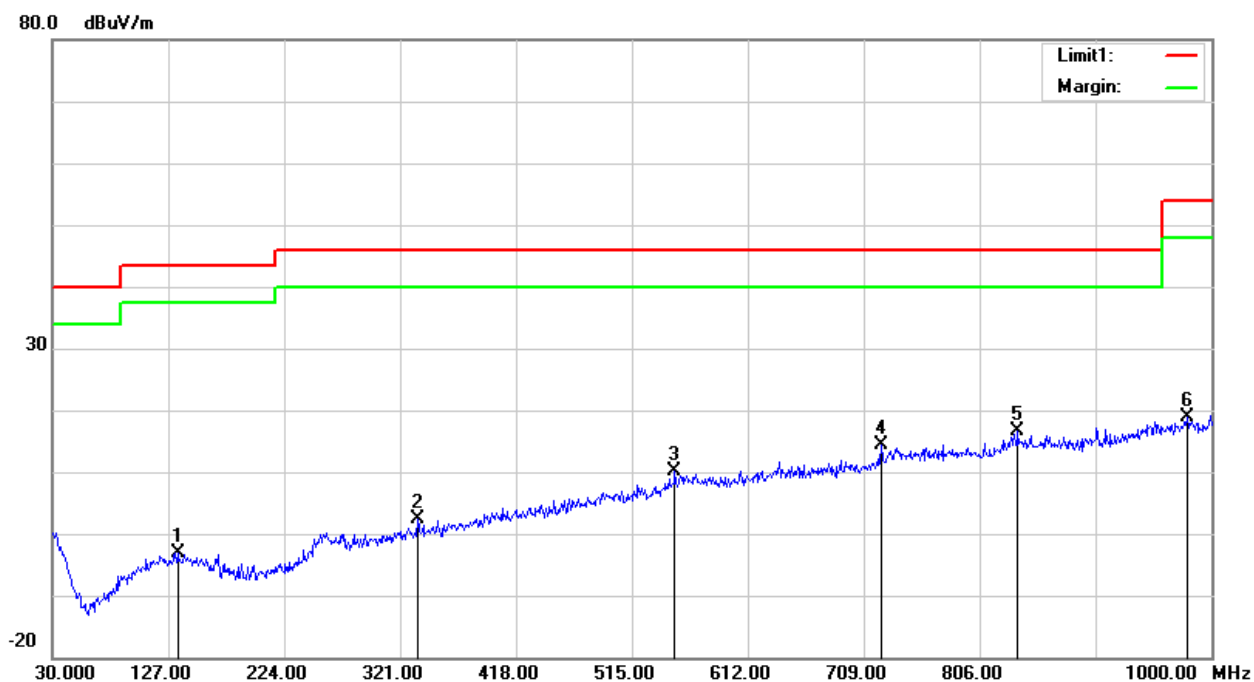
Note: Measurement = Reading Level + Correct Factor.



9.2. SPURIOUS EMISSIONS (30-1GHz)

802.11 b mode

HARMONICS AND SPURIOUS EMISSIONS (HORIZONTAL)

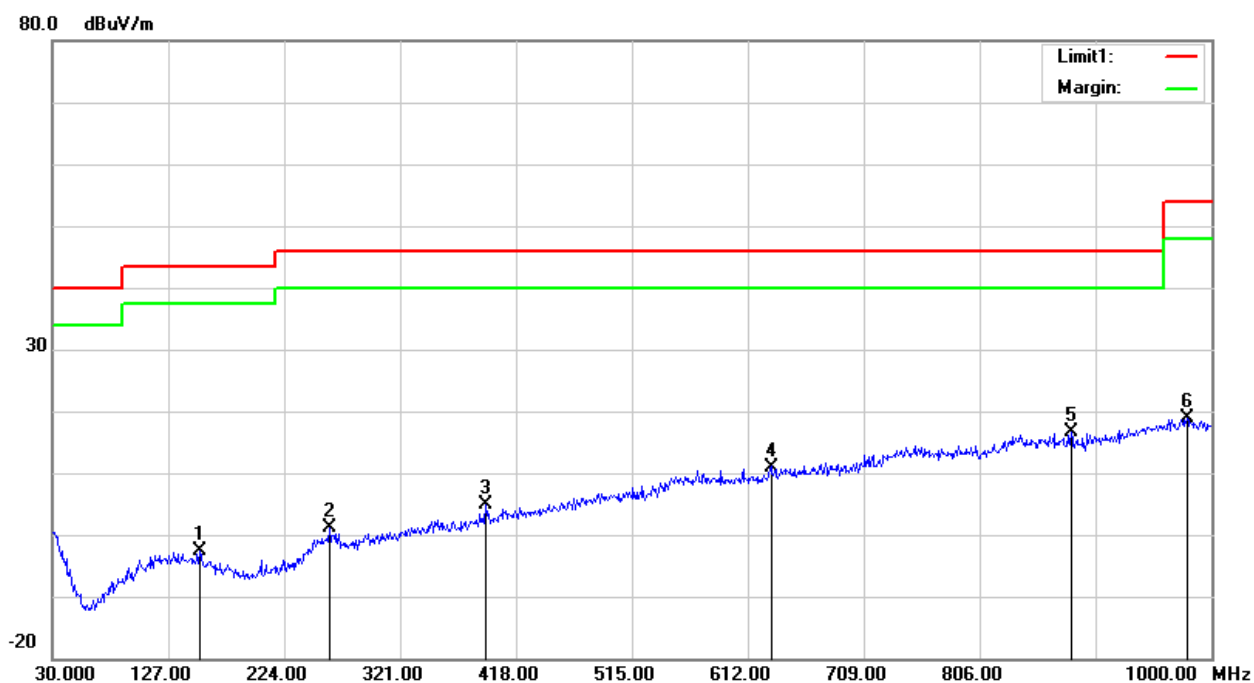


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	134.7600	14.96	-18.11	-3.15	43.50	-46.65	QP
2	335.5500	15.85	-13.54	2.31	46.00	-43.69	QP
3	550.8900	15.75	-5.74	10.01	46.00	-35.99	QP
4	723.5500	17.36	-2.97	14.39	46.00	-31.61	QP
5	838.0100	17.17	-0.42	16.75	46.00	-29.25	QP
6	979.6300	16.15	2.65	18.80	54.00	-35.20	QP

Note: Measurement = Reading Level + Correct Factor.



HARMONICS AND SPURIOUS EMISSIONS (VERTICAL)



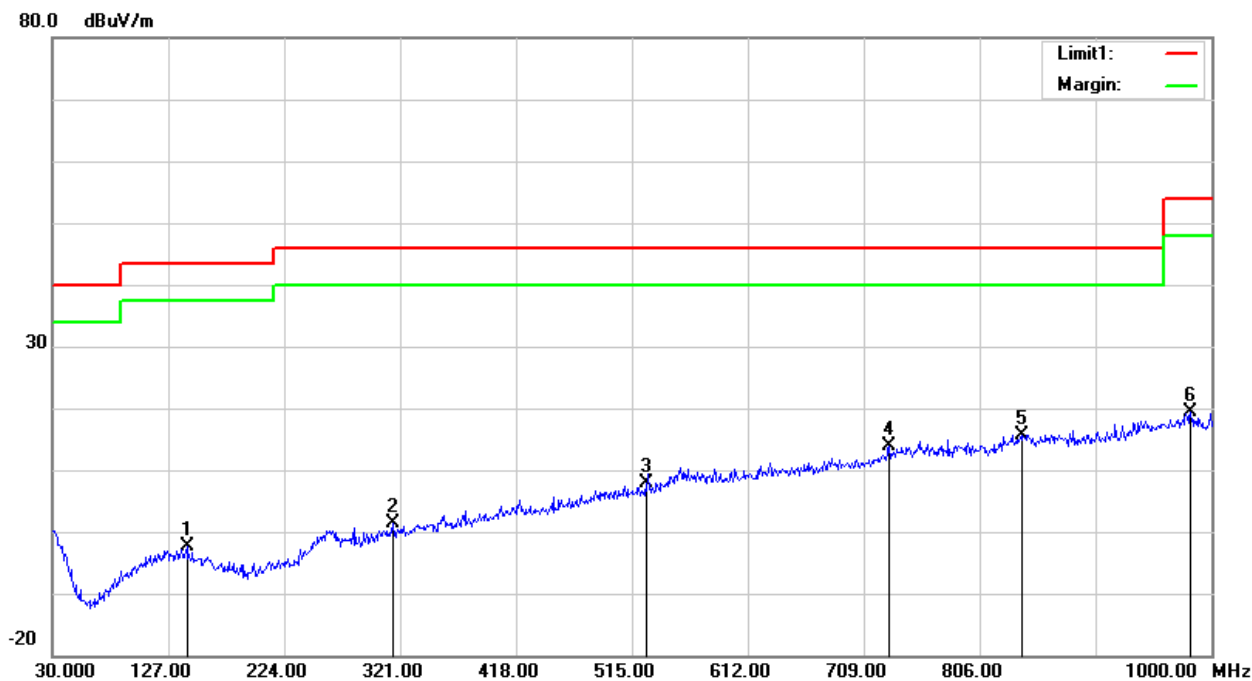
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	153.1900	16.05	-18.58	-2.53	43.50	-46.03	QP
2	261.8300	15.81	-14.77	1.04	46.00	-44.96	QP
3	392.7800	16.35	-11.46	4.89	46.00	-41.11	QP
4	631.4000	16.01	-5.01	11.00	46.00	-35.00	QP
5	882.6300	17.26	-0.67	16.59	46.00	-29.41	QP
6	979.6300	16.17	2.65	18.82	54.00	-35.18	QP

Note: Measurement = Reading Level + Correct Factor.



802.11 g mode

HARMONICS AND SPURIOUS EMISSIONS (HORIZONTAL)

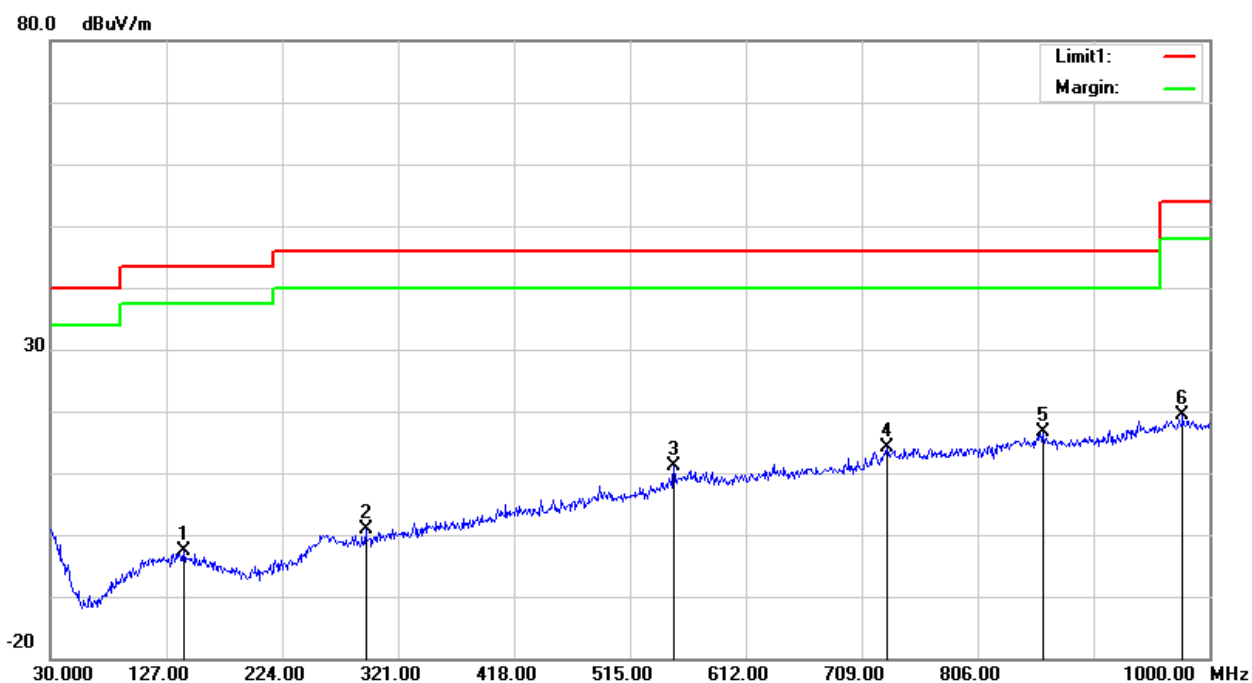


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	142.5200	15.89	-18.18	-2.29	43.50	-45.79	QP
2	315.1800	15.68	-14.22	1.46	46.00	-44.54	QP
3	526.6400	15.44	-7.58	7.86	46.00	-38.14	QP
4	730.3400	16.33	-2.46	13.87	46.00	-32.13	QP
5	841.8900	16.14	-0.42	15.72	46.00	-30.28	QP
6	982.5400	16.87	2.52	19.39	54.00	-34.61	QP

Note: Measurement = Reading Level + Correct Factor.



HARMONICS AND SPURIOUS EMISSIONS (VERTICAL)



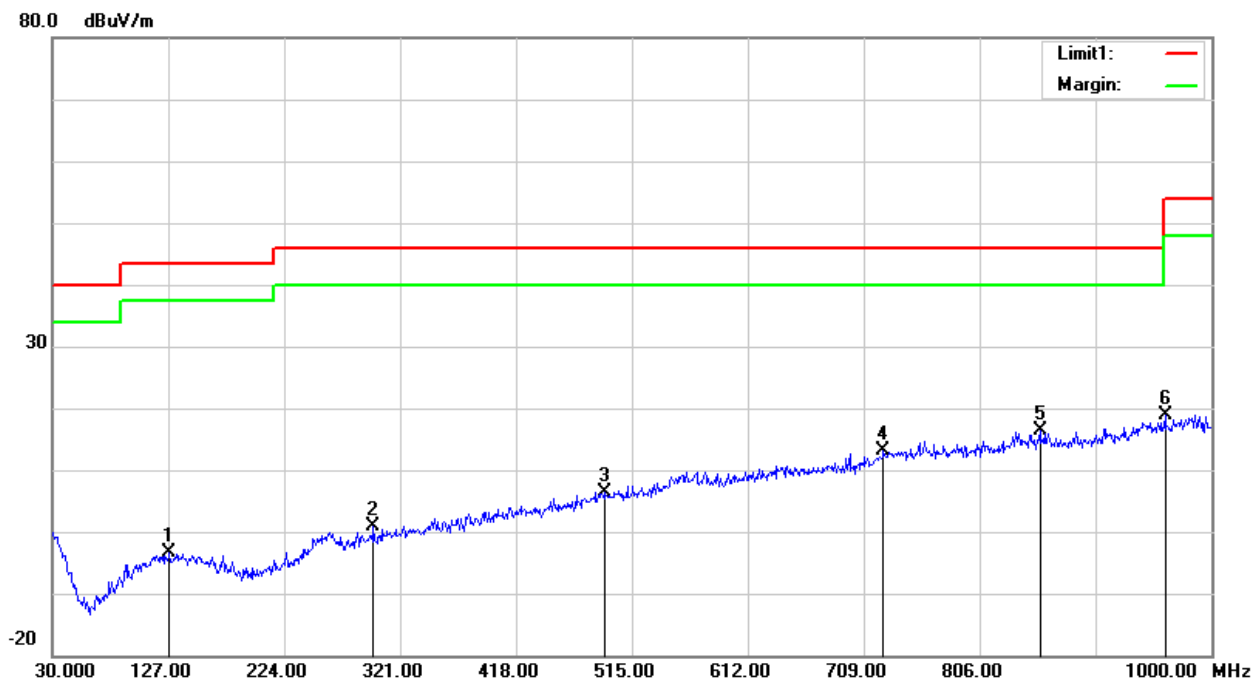
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	141.5500	15.42	-18.11	-2.69	43.50	-46.19	QP
2	293.8400	15.81	-15.02	0.79	46.00	-45.21	QP
3	551.8600	16.79	-5.72	11.07	46.00	-34.93	QP
4	730.3400	16.67	-2.46	14.21	46.00	-31.79	QP
5	860.3200	17.00	-0.42	16.58	46.00	-29.42	QP
6	977.6900	16.85	2.52	19.37	54.00	-34.63	QP

Note: Measurement = Reading Level + Correct Factor.



802.11 n20 mode

HARMONICS AND SPURIOUS EMISSIONS (HORIZONTAL)

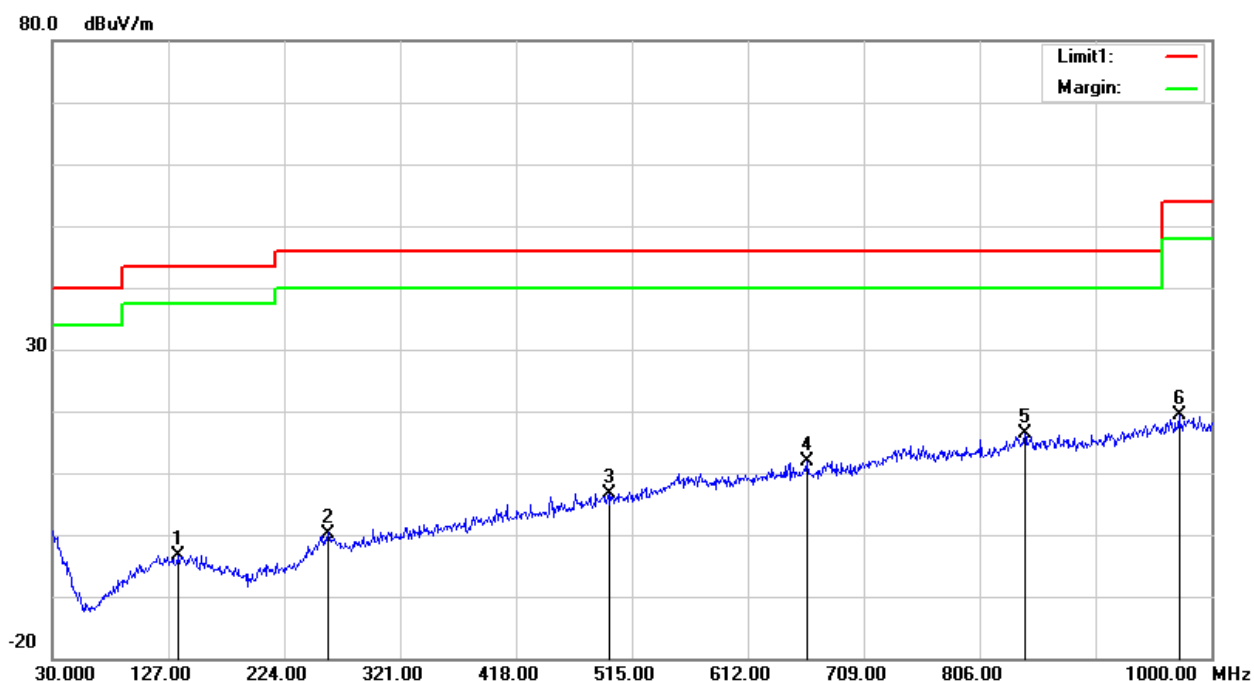


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	127.9700	14.88	-18.25	-3.37	43.50	-46.87	QP
2	298.6900	15.75	-14.86	0.89	46.00	-45.11	QP
3	492.6900	14.63	-8.17	6.46	46.00	-39.54	QP
4	725.4900	15.91	-2.82	13.09	46.00	-32.91	QP
5	856.4400	16.95	-0.53	16.42	46.00	-29.58	QP
6	961.2000	17.19	1.79	18.98	54.00	-35.02	QP

Note: Measurement = Reading Level + Correct Factor.



HARMONICS AND SPURIOUS EMISSIONS (VERTICAL)



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	134.7600	14.77	-18.11	-3.34	43.50	-46.84	QP
2	260.8600	15.03	-14.78	0.25	46.00	-45.75	QP
3	495.6000	14.78	-8.10	6.68	46.00	-39.32	QP
4	661.4700	16.66	-4.78	11.88	46.00	-34.12	QP
5	843.8300	16.83	-0.49	16.34	46.00	-29.66	QP
6	972.8400	17.18	2.19	19.37	54.00	-34.63	QP

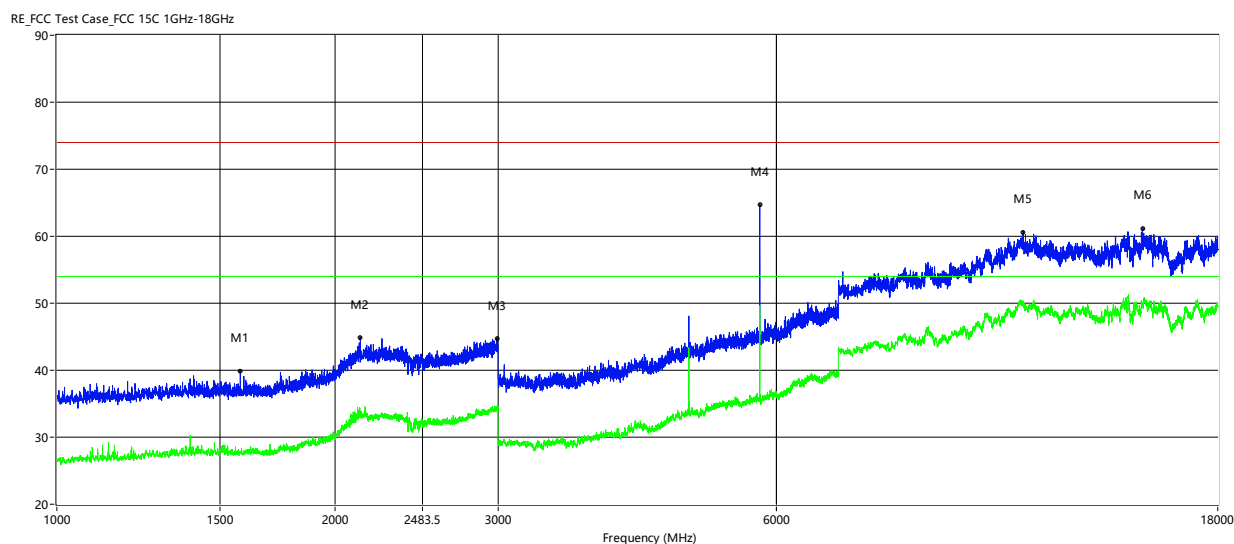
Note: Measurement = Reading Level + Correct Factor.



9.3. SPURIOUS EMISSIONS (1GHz-18GHz)

802.11 b mode

HARMONICS AND SPURIOUS EMISSIONS (01 CHANNEL, HORIZONTAL)



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1579.000	39.87	27.89	-0.54	74.0	54.0	-26.11	Horizontal	Pass
2129.000	44.90	33.46	4.28	74.0	54.0	-20.54	Horizontal	Pass
2991.500	44.76	34.61	6.07	74.0	54.0	-19.39	Horizontal	Pass
5755.000	64.65	49.61	-3.95	74.0	54.0	-4.39	Horizontal	Pass
11092.000	60.57	49.55	9.72	74.0	54.0	-4.45	Horizontal	Pass
14922.750	61.10	49.83	10.00	74.0	54.0	-4.17	Horizontal	Pass

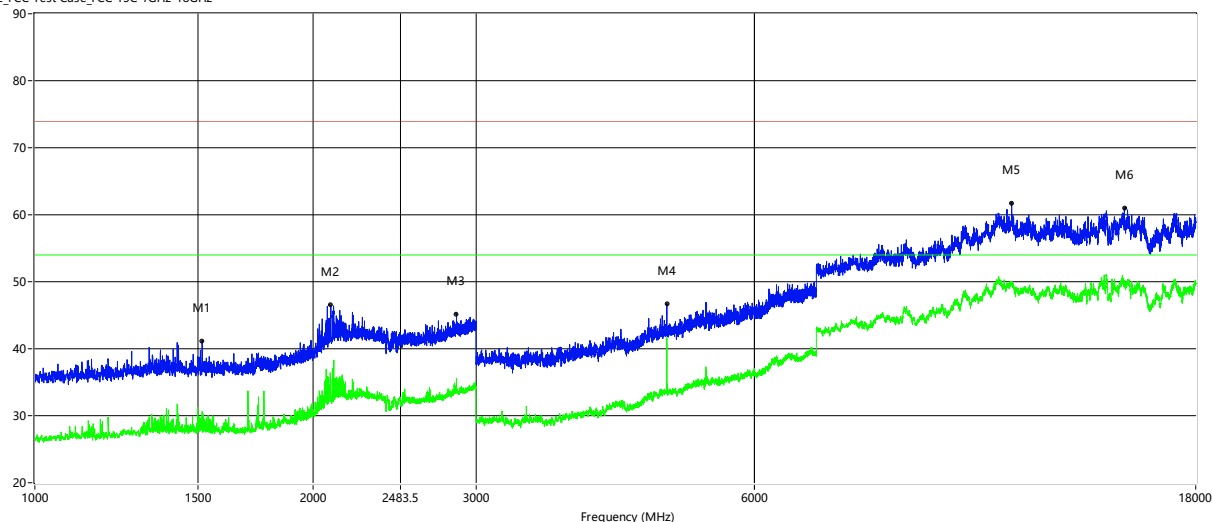
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (01 CHANNEL, VERTICAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1516.500	41.16	30.62	-0.58	74.0	54.0	-23.38	Horizontal	Pass
2089.500	46.55	35.28	3.59	74.0	54.0	-18.72	Horizontal	Pass
2856.500	45.15	35.57	5.61	74.0	54.0	-18.43	Horizontal	Pass
4824.000	46.70	41.65	-6.84	74.0	54.0	-12.35	Horizontal	Pass
11383.500	61.68	49.66	9.71	74.0	54.0	-4.34	Horizontal	Pass
15074.000	61.03	50.01	10.33	74.0	54.0	-3.99	Horizontal	Pass

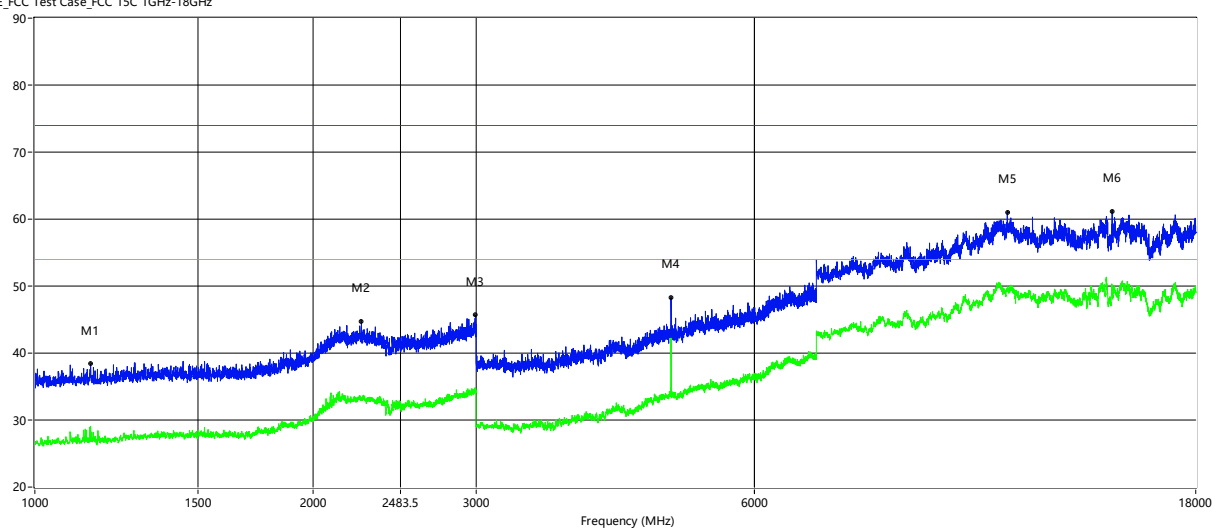
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (06 CHANNEL, HORIZONTAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1149.000	38.42	29.06	-1.38	74.0	54.0	-24.94	Horizontal	Pass
2254.500	44.74	33.08	4.63	74.0	54.0	-20.92	Horizontal	Pass
2996.500	45.67	34.78	6.09	74.0	54.0	-19.22	Horizontal	Pass
4874.000	48.31	42.23	-6.54	74.0	54.0	-11.77	Horizontal	Pass
11259.750	61.02	49.60	9.56	74.0	54.0	-4.40	Horizontal	Pass
14620.250	61.15	50.10	11.16	74.0	54.0	-3.90	Horizontal	Pass

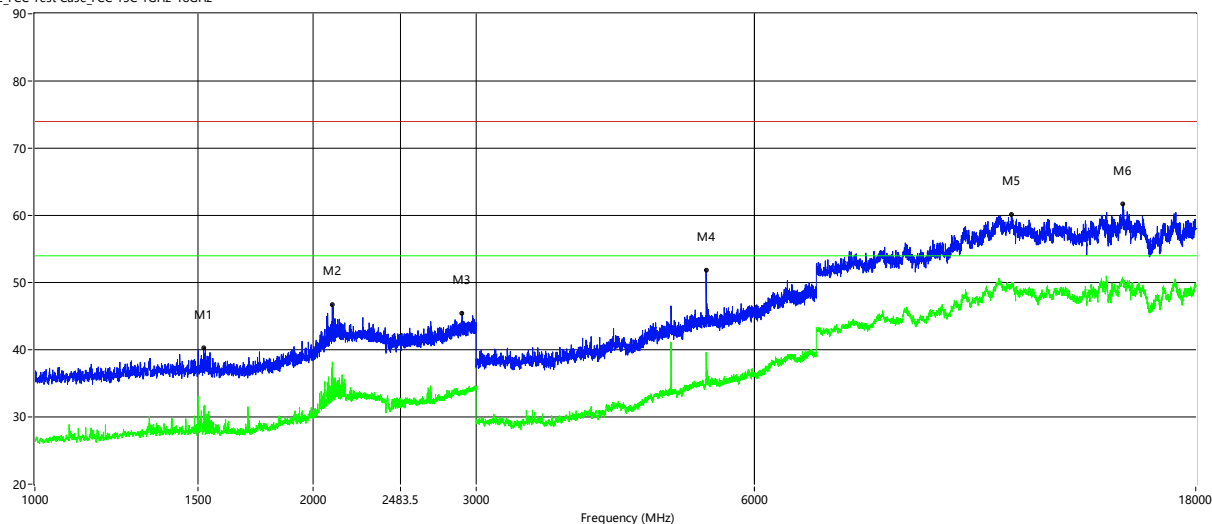
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (06 CHANNEL, VERTICAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1522.500	40.29	31.59	-0.58	74.0	54.0	-22.41	Horizontal	Pass
2097.000	46.75	38.19	3.73	74.0	54.0	-15.81	Horizontal	Pass
2897.000	45.37	33.71	5.61	74.0	54.0	-20.29	Horizontal	Pass
5320.000	51.80	39.61	-4.96	74.0	54.0	-14.39	Horizontal	Pass
11375.250	60.08	49.23	9.69	74.0	54.0	-4.77	Horizontal	Pass
15021.750	61.64	49.97	10.38	74.0	54.0	-4.03	Horizontal	Pass

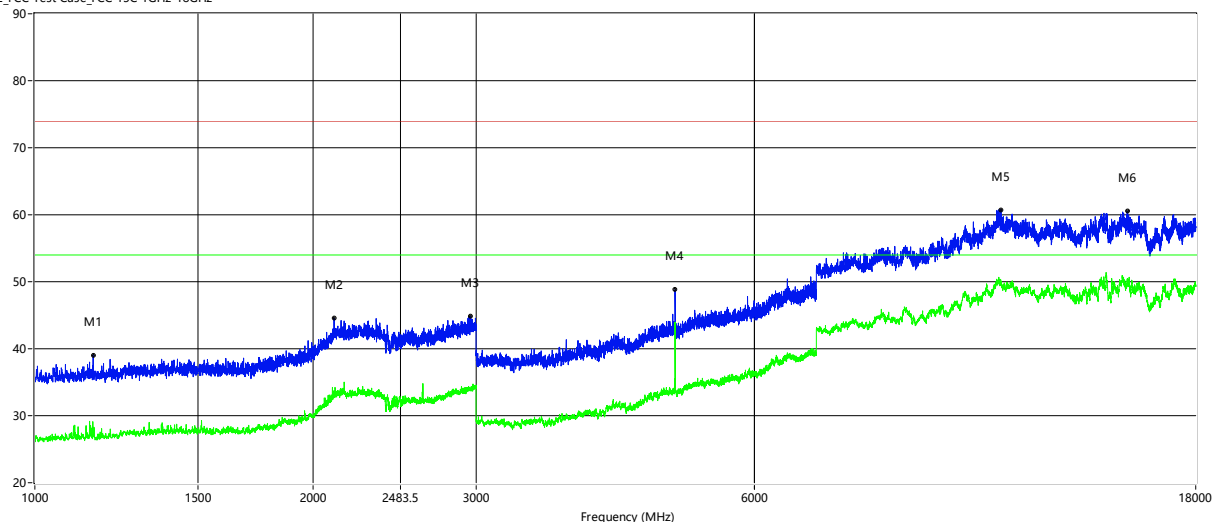
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (11 CHANNEL, HORIZONTAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1156.000	39.02	27.15	-1.36	74.0	54.0	-26.85	Horizontal	Pass
2106.500	44.55	32.72	3.90	74.0	54.0	-21.28	Horizontal	Pass
2956.500	44.83	33.84	5.92	74.0	54.0	-20.16	Horizontal	Pass
4924.000	48.80	43.99	-6.39	74.0	54.0	-10.01	Horizontal	Pass
11083.750	60.78	49.84	9.77	74.0	54.0	-4.16	Horizontal	Pass
15175.750	60.57	50.45	10.86	74.0	54.0	-3.55	Horizontal	Pass

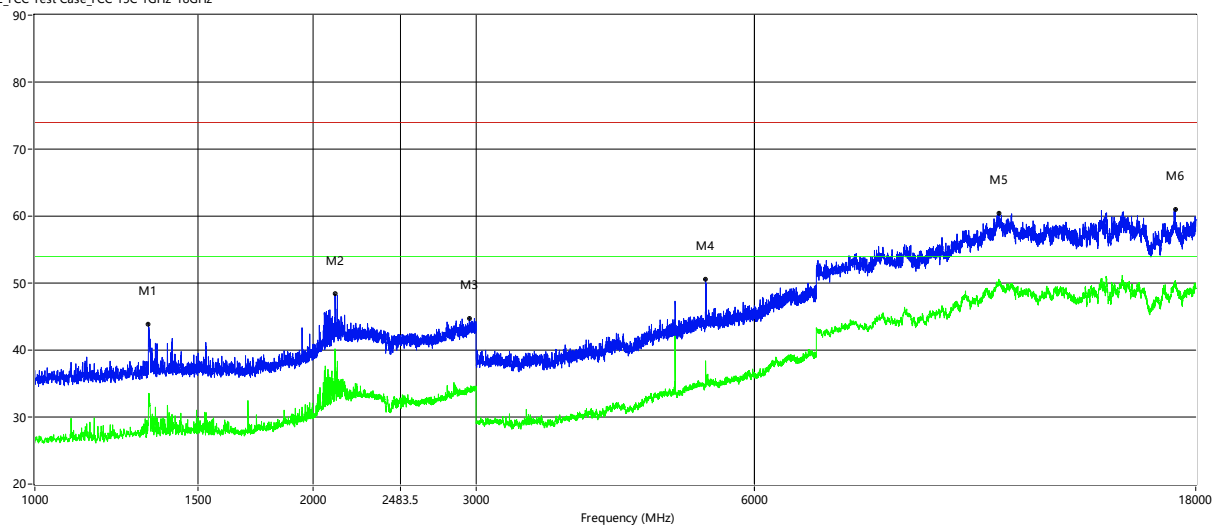
Remark:

- Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
- Margin = Limit - Emission Level
- Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
- Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (11 CHANNEL, VERTICAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1327.000	43.86	32.11	-0.86	74.0	54.0	-21.89	Horizontal	Pass
2111.500	48.38	40.19	3.98	74.0	54.0	-13.81	Horizontal	Pass
2952.000	44.73	34.15	5.90	74.0	54.0	-19.85	Horizontal	Pass
5313.000	50.57	38.39	-4.98	74.0	54.0	-15.61	Horizontal	Pass
11028.750	60.41	50.52	10.06	74.0	54.0	-3.48	Horizontal	Pass
17109.000	61.04	50.37	10.43	74.0	54.0	-3.63	Horizontal	Pass

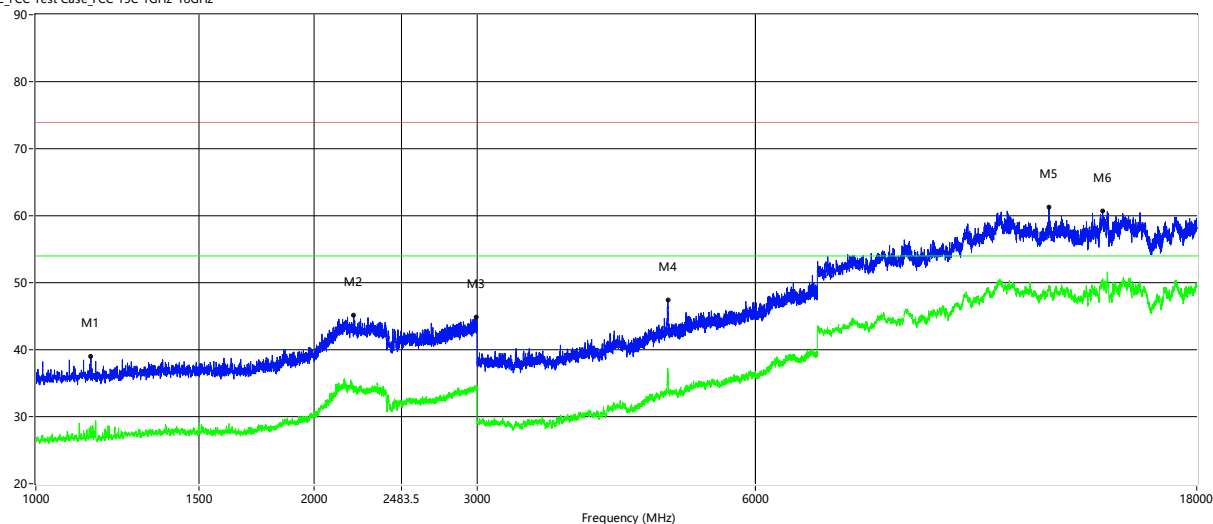
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



802.11 g mode
HARMONICS AND SPURIOUS EMISSIONS (01 CHANNEL, HORIZONTAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1147.000	39.01	28.59	-1.39	74.0	54.0	-25.41	Horizontal	Pass
2207.000	45.15	34.30	4.18	74.0	54.0	-19.70	Horizontal	Pass
2997.000	44.86	34.26	6.10	74.0	54.0	-19.74	Horizontal	Pass
4825.000	47.42	35.86	-6.83	74.0	54.0	-18.14	Horizontal	Pass
12461.500	61.27	49.51	8.69	74.0	54.0	-4.49	Horizontal	Pass
14243.500	60.77	49.90	11.26	74.0	54.0	-4.10	Horizontal	Pass

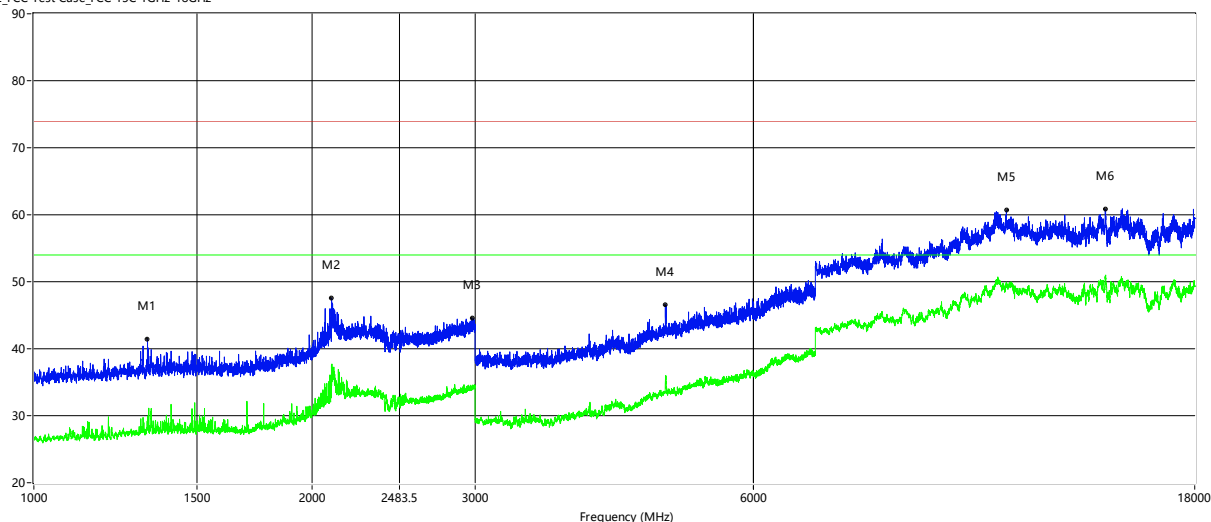
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (01 CHANNEL, VERTICAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1327.000	41.44	29.96	-0.86	74.0	54.0	-24.04	Horizontal	Pass
2098.500	47.55	34.45	3.76	74.0	54.0	-19.55	Horizontal	Pass
2977.000	44.54	34.49	6.01	74.0	54.0	-19.51	Horizontal	Pass
4818.000	46.60	34.93	-6.87	74.0	54.0	-19.07	Horizontal	Pass
11265.250	60.69	49.76	9.55	74.0	54.0	-4.24	Horizontal	Pass
14416.750	60.79	50.94	11.23	74.0	54.0	-3.06	Horizontal	Pass

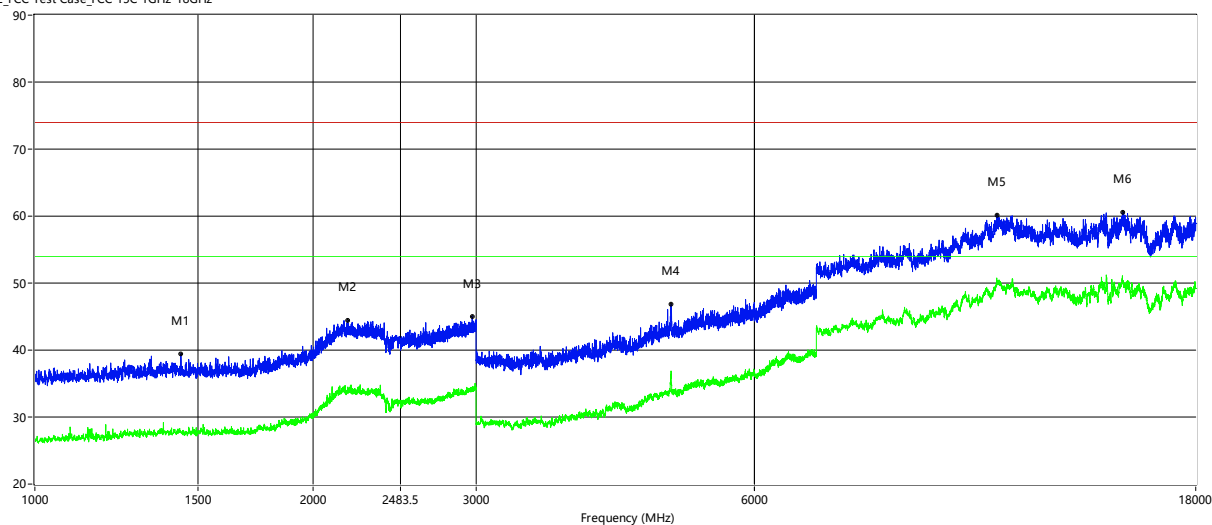
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (06 CHANNEL, HORIZONTAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1438.500	39.48	27.73	-0.60	74.0	54.0	-26.27	Horizontal	Pass
2179.000	44.42	34.03	4.32	74.0	54.0	-19.97	Horizontal	Pass
2970.500	45.07	34.15	5.98	74.0	54.0	-19.85	Horizontal	Pass
4876.000	46.82	36.10	-6.53	74.0	54.0	-17.90	Horizontal	Pass
10971.000	60.08	50.24	10.00	74.0	54.0	-3.76	Horizontal	Pass
15016.250	60.57	50.09	10.38	74.0	54.0	-3.91	Horizontal	Pass

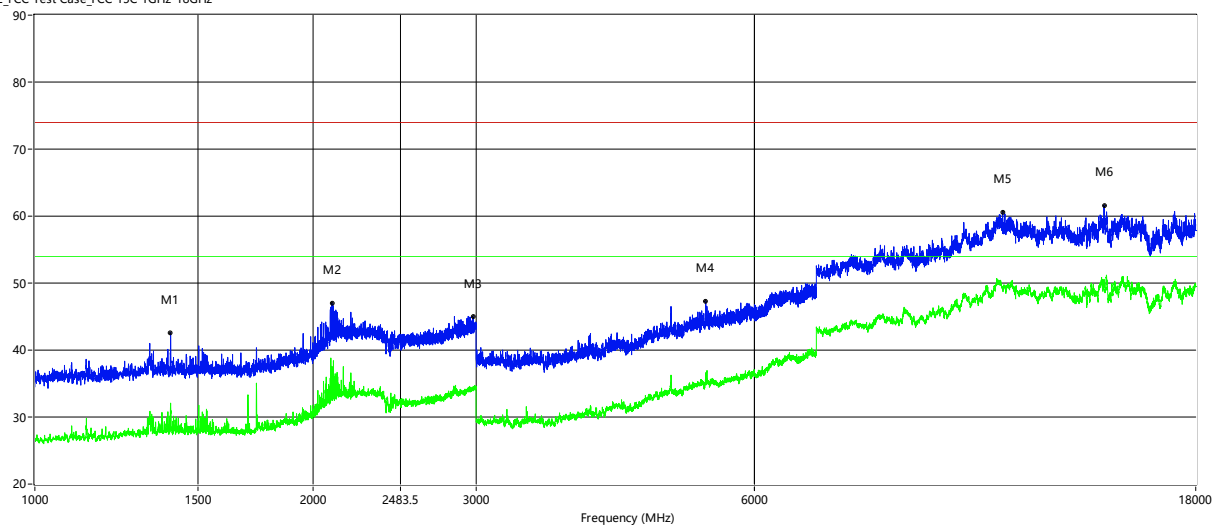
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (06 CHANNEL, VERTICAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1402.000	42.64	32.08	-0.66	74.0	54.0	-21.92	Horizontal	Pass
2095.500	47.05	37.56	3.70	74.0	54.0	-16.44	Horizontal	Pass
2978.500	45.01	33.91	6.02	74.0	54.0	-20.09	Horizontal	Pass
5315.000	47.26	35.99	-4.97	74.0	54.0	-18.01	Horizontal	Pass
11130.500	60.59	49.44	9.66	74.0	54.0	-4.56	Horizontal	Pass
14328.750	61.64	50.23	11.00	74.0	54.0	-3.77	Horizontal	Pass

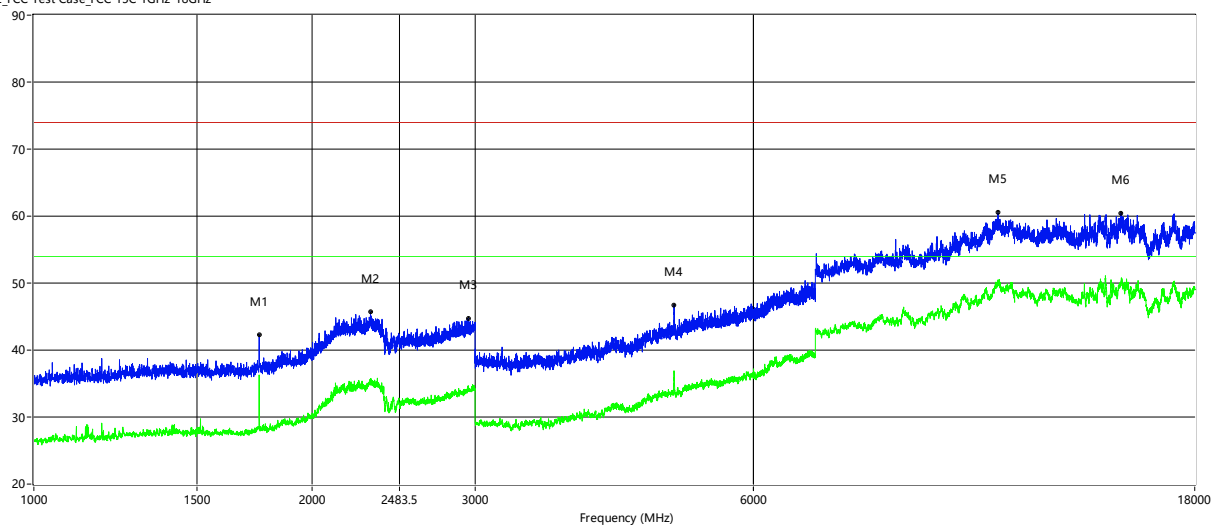
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (11 CHANNEL, HORIZONTAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1752.500	42.36	36.03	0.05	74.0	54.0	-17.97	Horizontal	Pass
2311.500	45.71	34.88	4.54	74.0	54.0	-19.12	Horizontal	Pass
2950.000	44.71	33.81	5.90	74.0	54.0	-20.19	Horizontal	Pass
4924.000	46.75	36.90	-6.39	74.0	54.0	-17.10	Horizontal	Pass
11031.500	60.50	50.49	10.05	74.0	54.0	-3.51	Horizontal	Pass
14980.500	60.45	50.06	10.30	74.0	54.0	-3.94	Horizontal	Pass

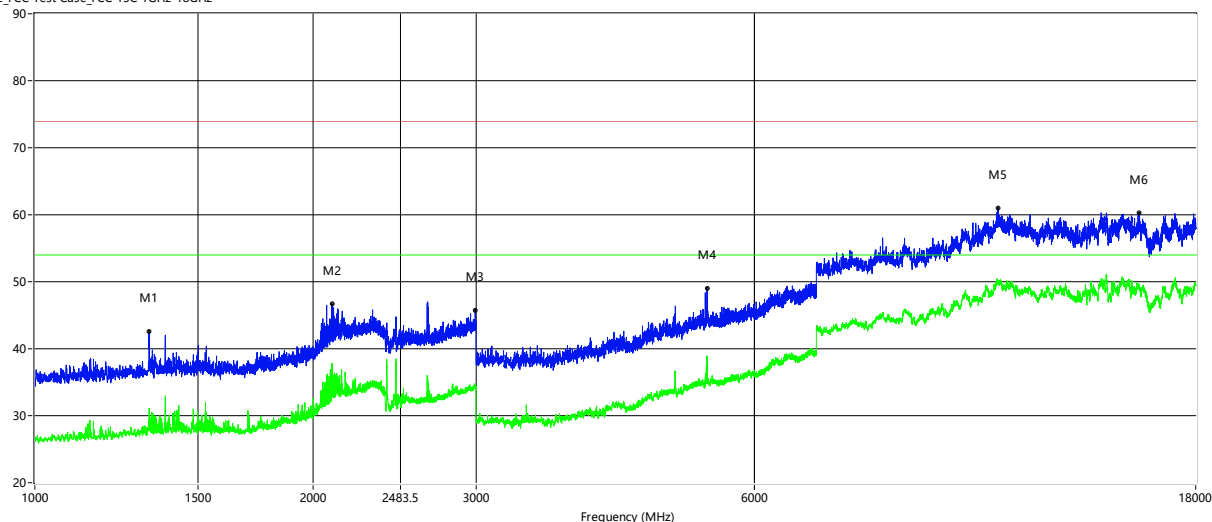
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (11 CHANNEL, VERTICAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



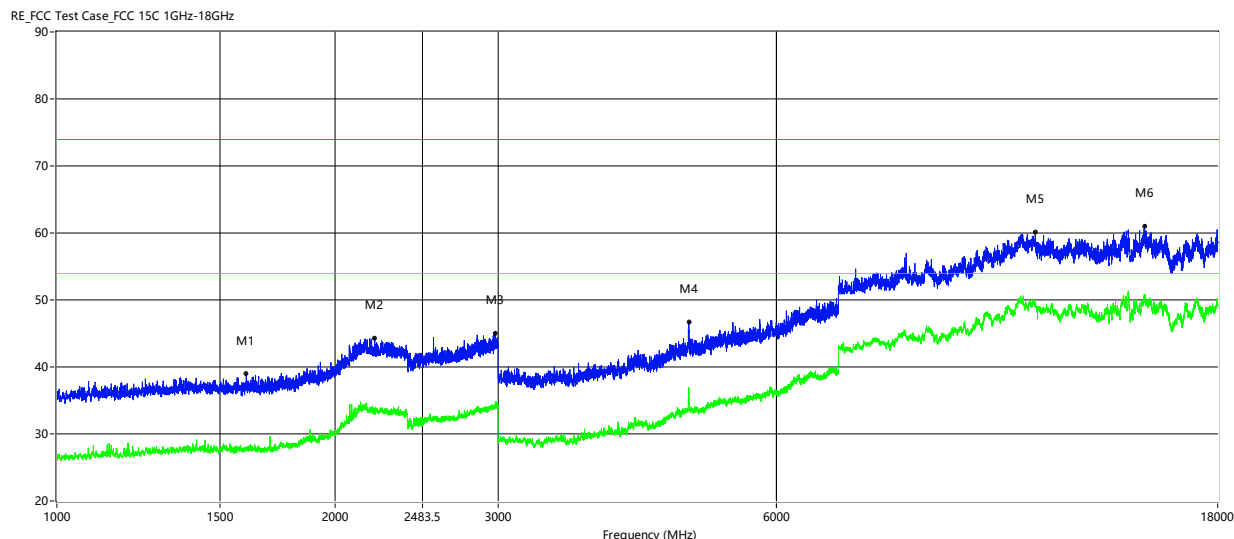
Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1328.500	42.52	30.65	-0.85	74.0	54.0	-23.35	Horizontal	Pass
2095.500	46.69	37.82	3.70	74.0	54.0	-16.18	Horizontal	Pass
2993.500	45.71	34.48	6.08	74.0	54.0	-19.52	Horizontal	Pass
5332.000	48.98	38.94	-4.93	74.0	54.0	-15.06	Horizontal	Pass
11001.250	60.94	50.14	10.21	74.0	54.0	-3.86	Horizontal	Pass
15651.500	60.34	48.85	10.00	74.0	54.0	-5.15	Horizontal	Pass

Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



802.11 n20 mode
HARMONICS AND SPURIOUS EMISSIONS (01 CHANNEL, HORIZONTAL)



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1602.500	38.98	27.73	-0.49	74.0	54.0	-26.27	Horizontal	Pass
2206.500	44.30	33.25	4.17	74.0	54.0	-20.75	Horizontal	Pass
2976.000	45.04	34.03	6.01	74.0	54.0	-19.97	Horizontal	Pass
4823.000	46.72	36.12	-6.84	74.0	54.0	-17.88	Horizontal	Pass
11430.250	60.13	49.25	9.81	74.0	54.0	-4.75	Horizontal	Pass
14997.000	60.96	50.32	10.38	74.0	54.0	-3.68	Horizontal	Pass

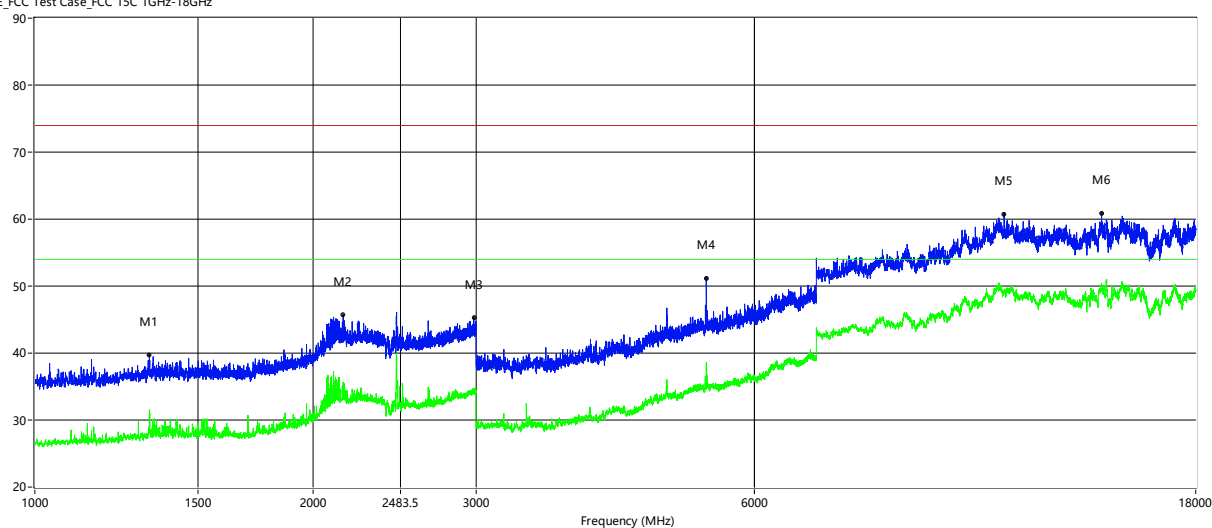
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (01 CHANNEL, VERTICAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1330.000	39.74	31.54	-0.85	74.0	54.0	-22.46	Horizontal	Pass
2154.500	45.65	35.67	4.59	74.0	54.0	-18.33	Horizontal	Pass
2983.000	45.32	34.18	6.04	74.0	54.0	-19.82	Horizontal	Pass
5321.000	51.13	37.96	-4.96	74.0	54.0	-16.04	Horizontal	Pass
11171.750	60.77	49.15	9.62	74.0	54.0	-4.85	Horizontal	Pass
14240.750	60.81	50.31	11.28	74.0	54.0	-3.69	Horizontal	Pass

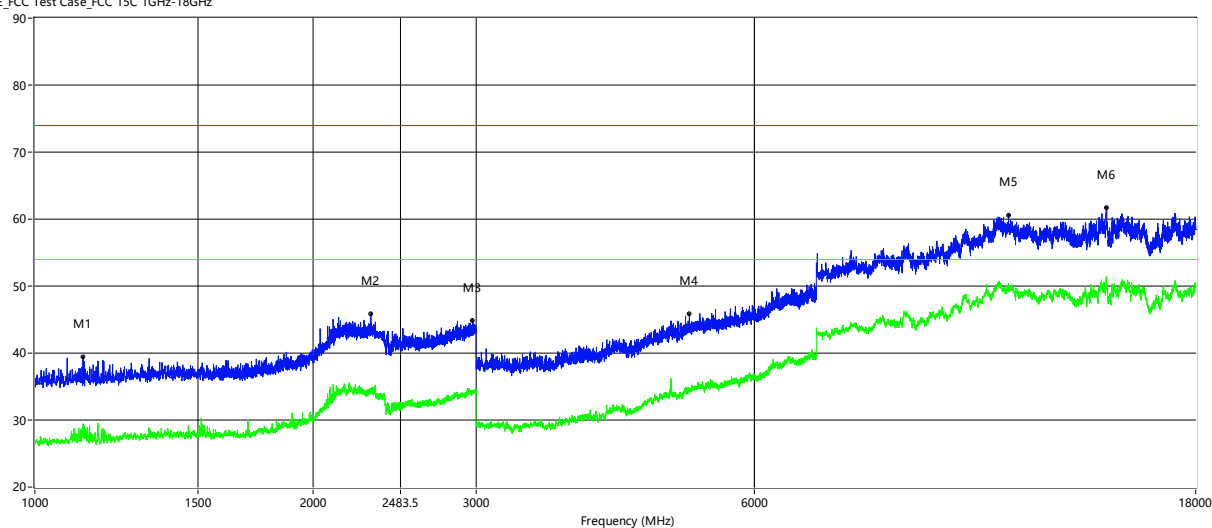
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (06 CHANNEL, HORIZONTAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1127.500	39.47	29.46	-1.43	74.0	54.0	-24.54	Horizontal	Pass
2308.500	45.81	34.51	4.55	74.0	54.0	-19.49	Horizontal	Pass
2974.500	44.79	34.33	6.00	74.0	54.0	-19.67	Horizontal	Pass
5102.000	45.81	34.49	-5.53	74.0	54.0	-19.51	Horizontal	Pass
11295.500	60.56	50.01	9.53	74.0	54.0	-3.99	Horizontal	Pass
14419.500	61.77	51.25	11.19	74.0	54.0	-2.75	Horizontal	Pass

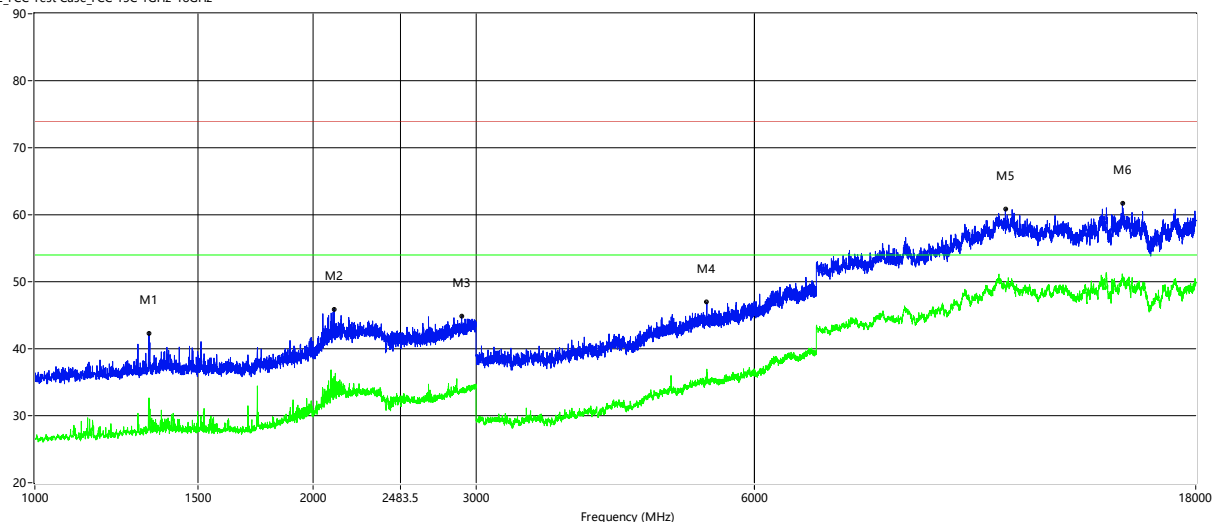
Remark:

- Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
- Margin = Limit - Emission Level
- Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
- Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (06 CHANNEL, VERTICAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1328.500	42.27	32.64	-0.85	74.0	54.0	-21.36	Horizontal	Pass
2107.000	45.92	34.63	3.91	74.0	54.0	-19.37	Horizontal	Pass
2894.000	44.82	33.49	5.61	74.0	54.0	-20.51	Horizontal	Pass
5328.000	46.93	36.96	-4.94	74.0	54.0	-17.04	Horizontal	Pass
11204.750	60.79	49.02	9.60	74.0	54.0	-4.98	Horizontal	Pass
14999.750	61.74	50.40	10.40	74.0	54.0	-3.60	Horizontal	Pass

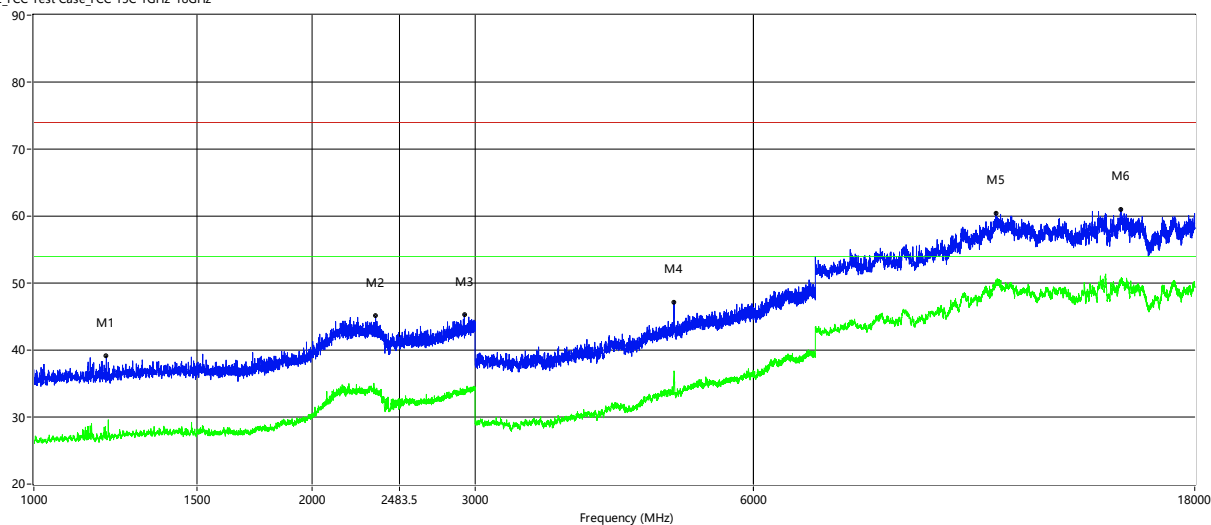
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (11 CHANNEL, HORIZONTAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1197.500	39.10	27.44	-1.22	74.0	54.0	-26.56	Horizontal	Pass
2341.500	45.09	33.72	4.42	74.0	54.0	-20.28	Horizontal	Pass
2921.000	45.34	33.51	5.73	74.0	54.0	-20.49	Horizontal	Pass
4922.000	47.12	36.42	-6.39	74.0	54.0	-17.58	Horizontal	Pass
10968.250	60.49	50.11	9.98	74.0	54.0	-3.89	Horizontal	Pass
14983.250	61.06	50.20	10.31	74.0	54.0	-3.80	Horizontal	Pass

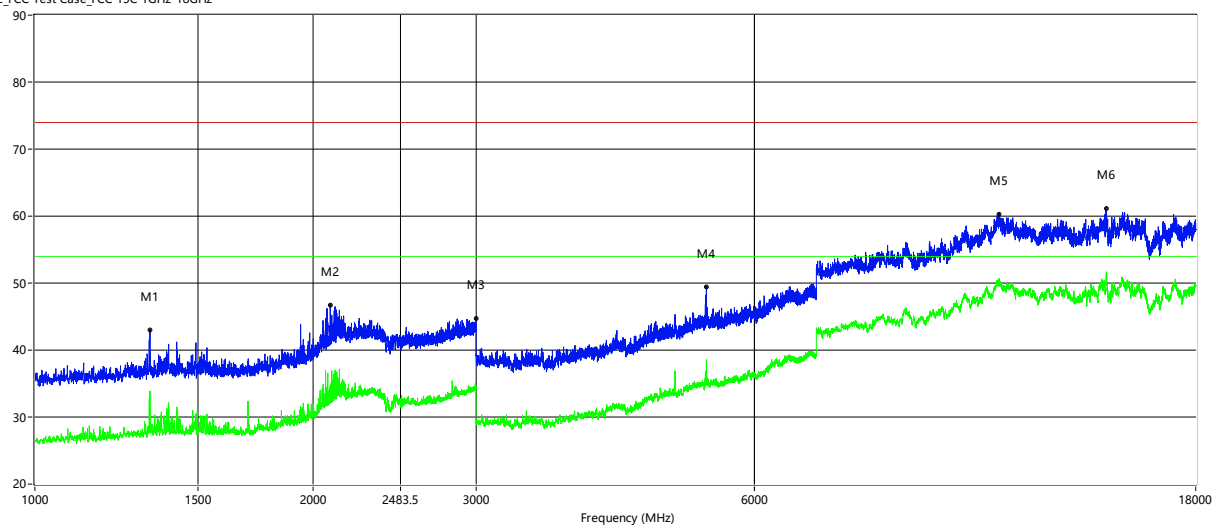
Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



HARMONICS AND SPURIOUS EMISSIONS (11 CHANNEL, VERTICAL)

RE_FCC Test Case_FCC 15C 1GHz-18GHz



Frequency (MHz)	Peak Level (dBuV/m)	Average Level (dBuV/m)	Factor (dB)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Over Limit (dB)	ANT	Verdict
1331.500	43.06	33.88	-0.85	74.0	54.0	-20.12	Horizontal	Pass
2086.500	46.73	34.69	3.53	74.0	54.0	-19.31	Horizontal	Pass
2998.000	44.77	34.69	6.10	74.0	54.0	-19.31	Horizontal	Pass
5323.000	49.47	38.52	-4.95	74.0	54.0	-15.48	Horizontal	Pass
11031.500	60.30	50.19	10.05	74.0	54.0	-3.81	Horizontal	Pass
14397.500	61.11	49.64	11.41	74.0	54.0	-4.36	Horizontal	Pass

Remark:

1. Factor = Antenna Factor + Cable Loss – Pre-amplifier + BRF Factor.
2. Margin = Limit - Emission Level
3. Tests were performed in three frequency range 1GHz~3GHz, 3GHz~13GHz, 13GHz~18GHz.
4. Above 18GHz emissions are mainly from the environment noise, not show in report.



9.4. SPURIOUS EMISSIONS BELOW 30M

Freq.	Reading	Limit	Margin	State	Test Result
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F	
--	--	--	--	--	PASS
--	--	--	--	--	PASS

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance/test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

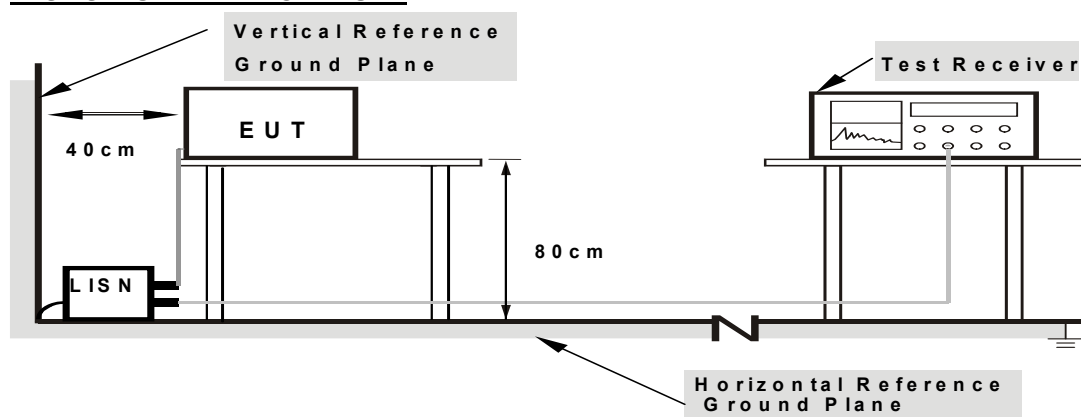
10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

Please refer to FCC §15.207 (a)

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

TEST SETUP AND PROCEDURE



- Note: 1.Support units were connected to second LISN .
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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 7 and 13 of ANSI C63.10-2013. 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.

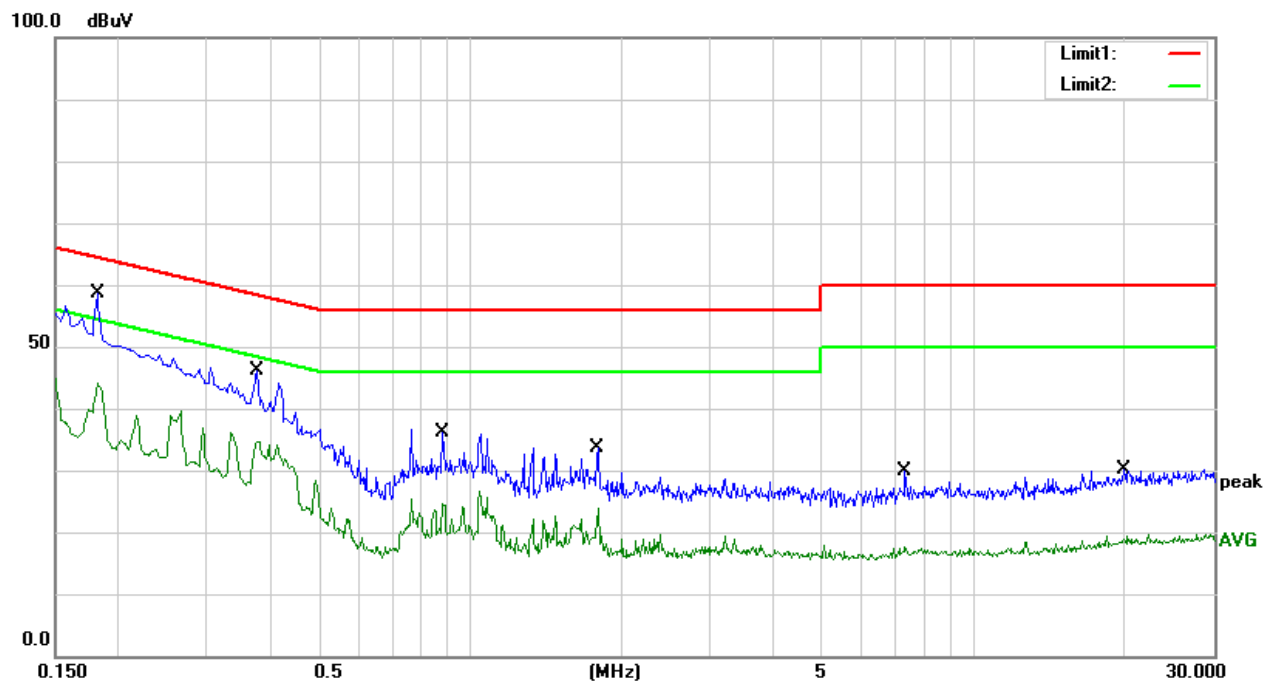
TEST ENVIRONMENT

Temperature	22°C	Relative Humidity	36%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V/60Hz



TEST RESULTS

Neutral N RESULTS

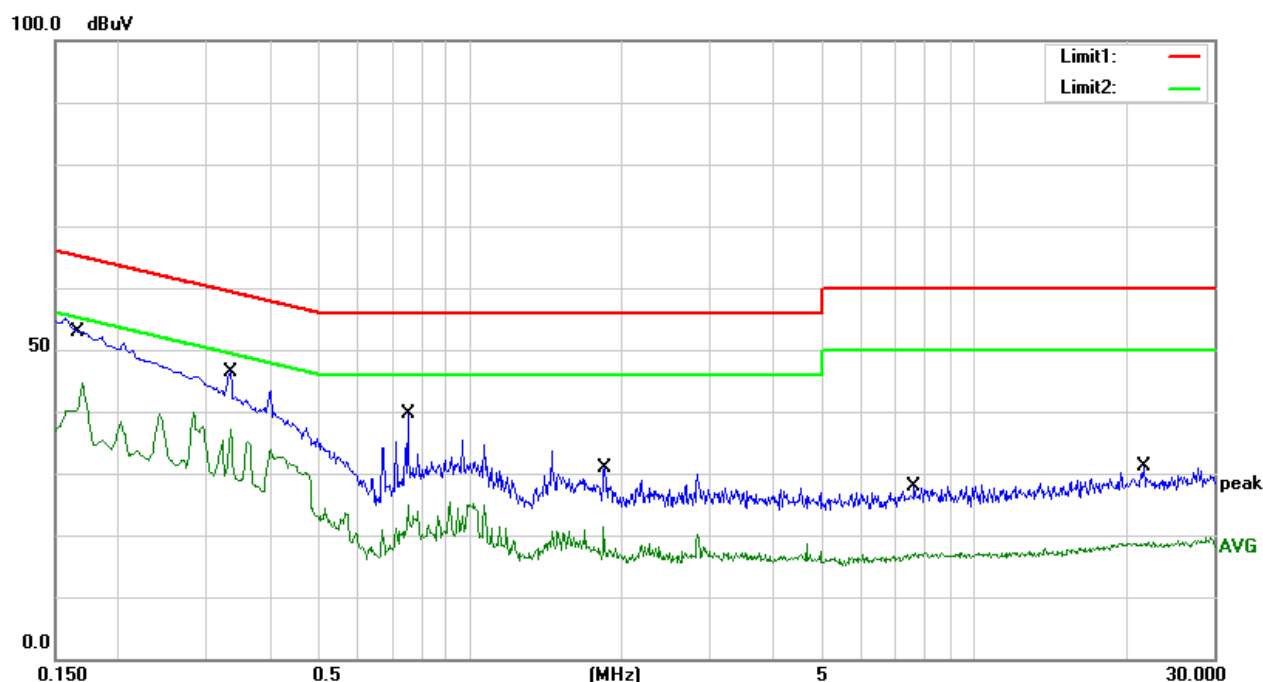


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1820	38.25	20.31	58.56	64.39	-5.83	QP
2	0.1820	23.90	20.31	44.21	54.39	-10.18	AVG
3	0.3780	25.57	20.59	46.16	58.32	-12.16	QP
4	0.3780	14.00	20.59	34.59	48.32	-13.73	AVG
5	0.8820	15.91	20.32	36.23	56.00	-19.77	QP
6	0.8820	4.41	20.32	24.73	46.00	-21.27	AVG
7	1.7980	13.27	20.30	33.57	56.00	-22.43	QP
8	1.7980	3.48	20.30	23.78	46.00	-22.22	AVG
9	7.3060	9.21	20.64	29.85	60.00	-30.15	QP
10	7.3060	-2.94	20.64	17.70	50.00	-32.30	AVG
11	19.9340	7.16	22.89	30.05	60.00	-29.95	QP
12	19.9340	-3.47	22.89	19.42	50.00	-30.58	AVG

- 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.



LINE L RESULTS



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1676	32.58	20.33	52.91	65.08	-12.17	QP
2	0.1676	24.21	20.33	44.54	55.08	-10.54	AVG
3	0.3340	25.81	20.68	46.49	59.35	-12.86	QP
4	0.3340	16.38	20.68	37.06	49.35	-12.29	AVG
5	0.7540	19.18	20.34	39.52	56.00	-16.48	QP
6	0.7540	4.64	20.34	24.98	46.00	-21.02	AVG
7	1.8500	10.69	20.30	30.99	56.00	-25.01	QP
8	1.8500	0.97	20.30	21.27	46.00	-24.73	AVG
9	7.6420	7.13	20.72	27.85	60.00	-32.15	QP
10	7.6420	-3.79	20.72	16.93	50.00	-33.07	AVG
11	21.7620	8.39	22.79	31.18	60.00	-28.82	QP
12	21.7620	-3.99	22.79	18.80	50.00	-31.20	AVG

- 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.



11. 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 a PCB Antenna without antenna connector.

ANTENNA GAIN

The antenna gain of EUT is less than 6 dBi.



Test photos

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

END OF REPORT