TEST REPORT

Product Name	**:**	**Disinfection robot**
Model Number	**:**	**FJT01XD**
FCC ID	**:**	**2A2LLFJT01XD**

Prepared for	:	FJ Dynamics Co., Ltd.
Address	:	Address 1709,WeiXing Building,61 GaoXin South 9th Rd,Nanshan District,Shenzhen,China,518000
Prepared by	:	EMTEK (SHENZHEN) CO., LTD.
Address	:	Building 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China Tel: (0755) 26954280 Fax: (0755) 26954282
Report Number	:	ES210514061W01
Date(s) of Tests	:	May 18,2021 to Jul 12,2021
Date of issue	:	July 13, 2021

TABLE OF CONTENTS

1 TEST RESULT CERTIFICATION

Applicant	:	FJ Dynamics Co., Ltd.
Address	:	Address 1709,WeiXing Building,61 GaoXin South 9th Rd,Nanshan District,Shenzhen,China,518000
Manufacturer	:	FJ Dynamics Co., Ltd.
Address	:	Address 1709,WeiXing Building,61 GaoXin South 9th Rd,Nanshan District,Shenzhen,China,518000
EUT	:	Disinfection robot
Model Name	:	FJT01XD
Trademark	:	FJDynamics

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD	**TEST RESULT**
FCC 47 CFR Part 2 , Subpart J FCC 47 CFR Part 15 , Subpart C	PASS

The above equipment was tested by EMTEK (SHENZHEN) CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 and Part 15.247

The test results of this report relate only to the tested sample identified in this report.

Date of Test : May 18,2021 to Jul 12,2021

Prepared by : Mill Chen /Editor

Reviewer : Sewen Guo /Supervisor

Approve & Authorized Signer : Lisa Wang/Manager

2 EUT TECHNICAL DESCRIPTION

Characteristics	Description
Product:	Disinfection robot
Model Number:	FJT01XD
Sample Number:	2#
IEEE 802.11 WLAN Mode Supported	☒802.11b(20MHz channel bandwidth) ☒802.11g(20MHz channel bandwidth) ☒802.11n(20MHz channel bandwidth) ☒802.11ax(20MHz channel bandwidth) ☒802.11n(40MHz channel bandwidth)
Modulation	☒DSSS with DBPSK/DQPSK/CCK for 802.11b; ☒OFDM with BPSK/QPSK/16QAM/64QAM for 802.11g/n ☒OFDMA with BPSK/QPSK/16QAM/64QAM for 802.11ax;
Operating Frequency Range	☒2412-2462MHz for 802.11b/g; ☒2412-2462MHz for 802.11n(HT20)/802.11ax; ☒2422-2462MHz for 802.11n(HT40)
Number of Channels	☒11 channels for 802.11b/g; ☒11 channels for 802.11n(HT20)/802.11ax; ☒9 channels for 802.11n(HT40)
Antenna Type	Internal Antenna
Antenna Gain	Module AP6356S Antenna1: 3 dBi Antenna2: 3 dBi Module ESP32-S Antenna: 0 dBi
Transmit Power:	Module AP6356S 17.77 dBm Module ESP32-S 15.20 dBm
Power supply	DC 48V,
Date of Received	May 8,2021
Temperature Range	0°C ~ +50°C

Note: *for more details, please refer to the User's manual of the EUT.*

3 SUMMARY OF TEST RESULT

FCC PartClause	Test Parameter	Verdict	Remark
15.247(a)(2)	DTS (6dB) Bandwidth	PASS	
15.247(b)(3)	Maximum Peak Conducted Output Power	PASS	
15.247(e)	Maximum Power Spectral Density Level	PASS	
15.247(d)	Unwanted Emission Into Non-Restricted Frequency Bands	PASS	
15.247(d) 15.209	Unwanted Emission Into Restricted Frequency Bands (conducted)	PASS	
15.247(d) 15.209	Radiated Spurious Emission	PASS	
15.207	Conducted Emission Test	N/A	
15.247(b)	Antenna Application	PASS	
	NOTE1:N/A (Not Applicable) NOTE2: According to FCC OET KDB 558074, the report use radiated measurements in the restricted frequency bands. In addition, the radiated test is also performed to ensure the emissions emanating from the device cabinet also comply with the applicable limits.		

RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is intended for FCC ID: 2A2LLFJT01XD filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

4 TEST METHODOLOGY

4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards:
FCC 47 CFR Part 2, Subpart J
FCC 47 CFR Part 15, Subpart C
FCC KDB 558074 D01 15.247 Meas Guidance v05r02
FCC KDB 662911 D01 Multiple Transmitter Output v02r01

4.2 MEASUREMENT EQUIPMENT USED

Conducted Emission Test Equipment

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Test Receiver	Rohde & Schwarz	ESCI	101384	May 15, 2021	1 Year
L.I.S.N.	Rohde & Schwarz	ENV216	5	May 15, 2021	1 Year
L.I.S.N.	Kyoritsu	KNW-407	8-1492-9	May 16, 2021	1 Year
Absorbing Clamp	Rohde & Schwarz	MDS-21	833711/025	May 15, 2021	1 Year
Loop antenna	Laplace	RF300	8006	May 15, 2021	1 Year
Van der Hoofden test-head	Schwarzbeck	VDHH 9502	9502-054	May 15, 2021	1 Year
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100107	May 15, 2021	1 Year

For Spurious Emissions Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
EMI Test Receiver	Rohde & Schwarz	ESU 26	100154	May 15, 2021	1 Year
Pre-Amplifie	Lunar EM	LNA30M3G-25	J10100000070	May 15, 2021	1 Year
Bilog Antenna	Schwarzbeck	VULB9163	659	May 15, 2021	2 Year
Horn antenna	Schwarzbeck	BBHA9120D	9120D-1177	May 15, 2021	2 Year
Pre-Amplifie	SKET	LNPA_0118G-45	SK2019051801	May 15, 2021	1 Year
Loop Antenna	Schwarzbeck	FMZB1519	1519-012	May 15, 2021	2 Year
Spectrum Analyzer	Rohde & Schwarz	FSV40	100967	May 15, 2021	1 Year
Horn antenna	Schwarzbeck	BBHA9120D	9120D-1198	May 15, 2021	2 Year
Bilog Antenna	Schwarzbeck	VULB9163	660	May 16, 2021	2 Year
Cable	H+B	NmSm-05-C15052	N/A	May 15, 2021	1 Year
Cable	H+B	NmSm-2-C15201	N/A	May 15, 2021	1 Year
Cable	H+B	NmNm-7-C15702	N/A	May 15, 2021	1 Year
Cable	H+B	SAC-40G-1	414	May 15, 2021	1 Year
Cable	H+B	SUCOFLEX104	MY14871/4	May 15, 2021	1 Year
Cable	H+B	BLU18A-NmSm-6500	D8501	May 15, 2021	1 Year
Band reject Filter(50dB)	WI/DE	WRCGV-2400(2400-2485MHz)	2	May 15, 2021	1 Year

For other test items:

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Vector Signal Generater	Agilent	N5182B	My53050553	May 15, 2021	1 Year
Analog Signal Generator	Agilent	N5171B	My53050878	May 15, 2021	1 Year
Signal Analyzer	Agilent	N9010A	My53470879	May 15, 2021	1 Year
Power Analyzer	Agilent	PS-X10-200	N/A	May 15, 2021	1 Year
Wideband Radio Communication Tester	R&S	CMW500	1201.0002K50-140822zk	May 15, 2021	1 Year
Test Accessories	Agilent	PS-X10-100	N/A	May 15, 2021	1 Year
Temperature&Humidity test chamber	ESPEC	EL-02KA	12107166	May 15, 2021	1 Year
Blocking Box	Agilent	AD211	N/A	May 15, 2021	1 Year

Remark: *Each piece of equipment is scheduled for calibration once a year.*

4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.
The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (802.11b: 1 Mbps; 802.11g: 6 Mbps; 802.11n (HT20): MCS0)were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Frequency and Channel list for 802.11 b/g/n (HT20)/802.11ax (20MHz):

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	2427	8	2447		

Test Frequency and Channel for 802.11 b/g/n (HT20)/802.11ax (20MHz):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	6	2437	11	2462

The 2.4G WIFI has two antennas and support Multiple Outputs for 802.11n/ax mode for this report; Antenna 1 Gain is 3.0dBi; Antenna 2 Gain is 3.0dBi; For this function is belong to Correlated Categorization equipment

According to KDB 662911, for identical antenna gains,

Directional gain = 10 log (2) + 3.0dBi=6.0 dBi

5 FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at:

EMTEK (Shenzhen) Co., Ltd.
Building 69, Majialong Industry Zone District, Nanshan District, Shenzhen, China
The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description		
EMC Lab.	:	**Accredited by CNAS** The Certificate Registration Number is L2291. The Laboratory has been assessed and proved to be in compliance with CNAS-CL01 (identical to ISO/IEC 17025:2017) **Accredited by FCC** Designation Number: CN1204 Test Firm Registration Number: 882943 **Accredited by A2LA** The Certificate Number is 4321.01. Accredited by Industry Canada The Conformity Assessment Body Identifier is CN0008
Name of Firm	:	EMTEK (SHENZHEN) CO., LTD.
Site Location	:	Building 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China

6 TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

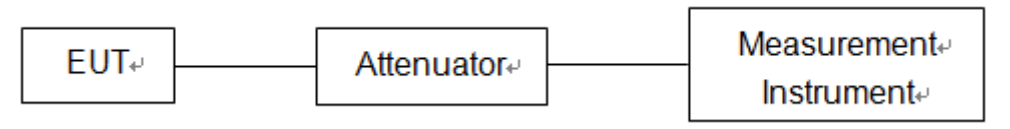
Parameter	Uncertainty
Radio Frequency	±1x10^-5
Maximum Peak Output Power Test	±1.0dB
Conducted Emissions Test	±2.0dB
Radiated Emission Test	±2.0dB
Power Density	±2.0dB
Occupied Bandwidth Test	±1.0dB
Band Edge Test	±3dB
All emission, radiated	±3dB
Antenna Port Emission	±3dB
Temperature	±0.5℃
Humidity	±3%

Measurement Uncertainty for a level of Confidence of 95%

7 SETUP OF EQUIPMENT UNDER TEST

7.1 RADIO FREQUENCY TEST SETUP 1

The WLAN component's antenna ports(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



7.2 RADIO FREQUENCY TEST SETUP 2

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10. The test distance is 3m.The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 22.

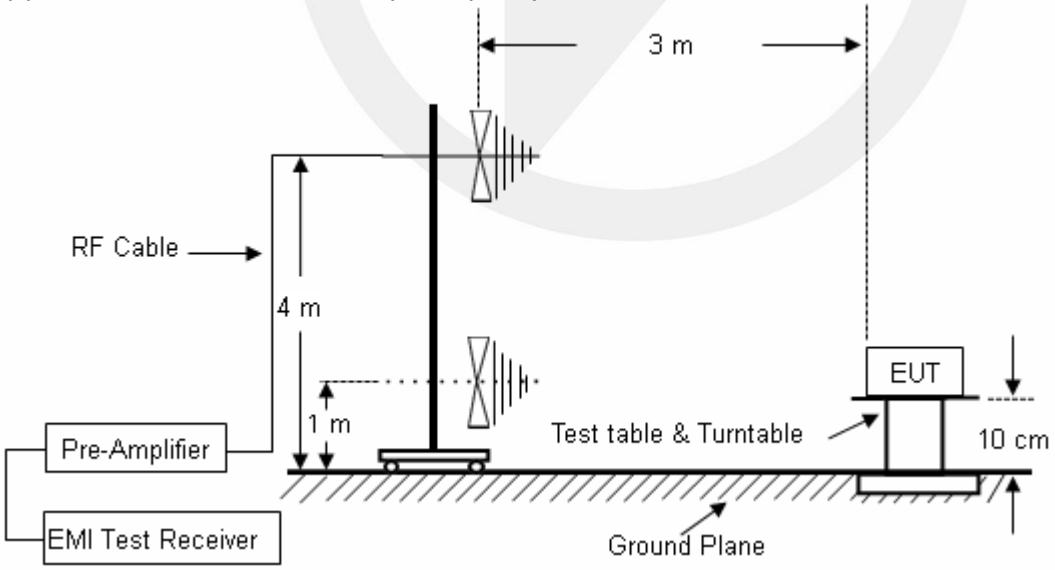
30MHz-1GHz：

The EUT is placed on a plane 0.1 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

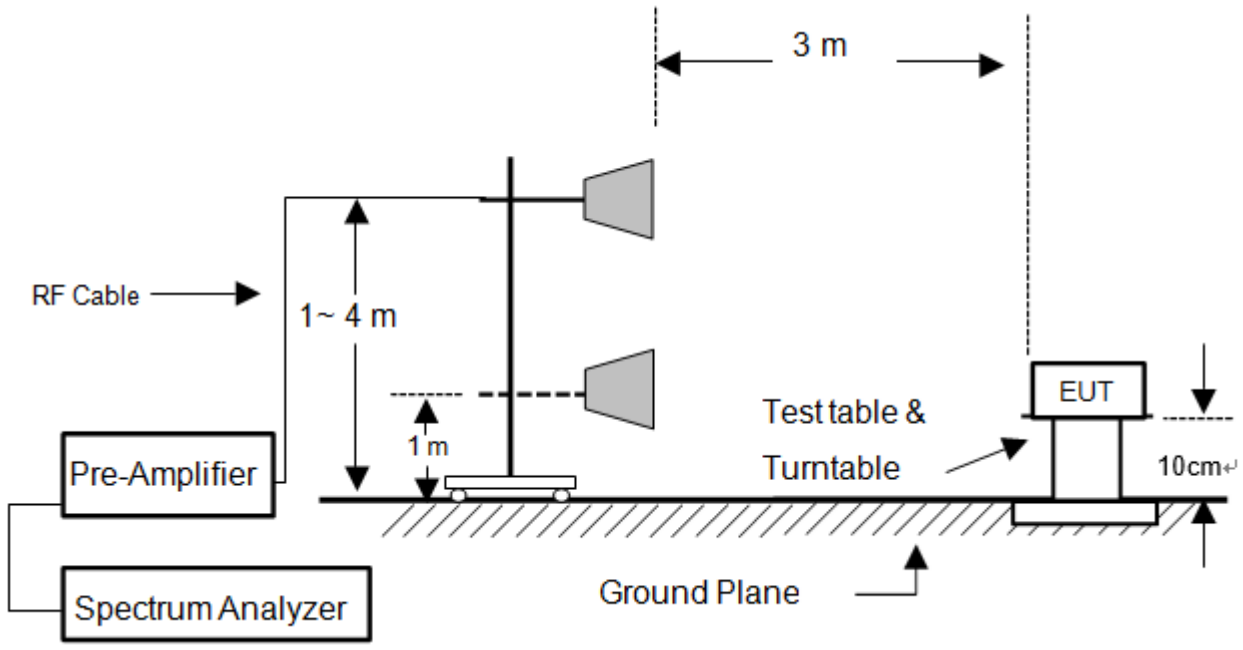
Above 1GHz：

The EUT is placed on plane 0.1 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

(a)Radiated Emission Test Set-Up, Frequency Below 1000MHz

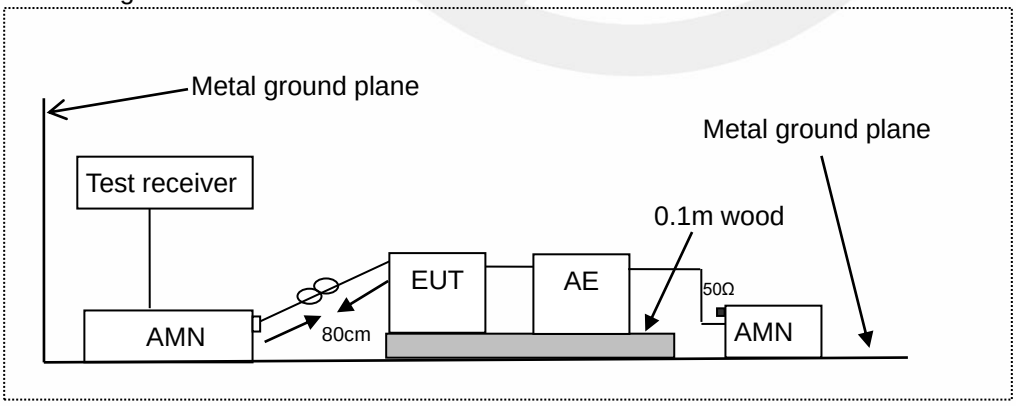


(b) Radiated Emission Test Set-Up, Frequency above 1000MHz

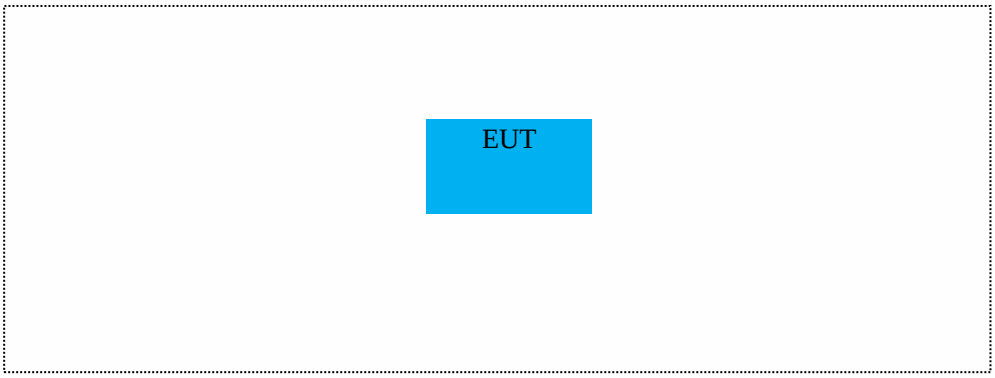


7.3 CONDUCTED EMISSION TEST SETUP

The mains cable of the EUT (maybe per AC/DC Adapter) must be connected to LISN. The LISN shall be placed 0.8 m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8m from the LISN. Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than 0.1 m.
According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.



7.4 BLOCK DIAGRAM CONFIGURATION OF TEST SYSTEM



7.5 SUPPORT EQUIPMENT

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

1. *All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.*
2. *Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.*

8 TEST REQUIREMENTS

8.1 DTS(6DB)BANDWIDTH

8.1.1 Applicable Standard

According to FCC Part15.247 (a)(2) and KDB 558074 D01 15.247 Meas Guidance v05r02

8.1.2 Conformance Limit

The minimum -6 dB bandwidth shall be at least 500 kHz.

8.1.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

8.1.4 Test Procedure

The EUT was operating in IEEE 802.11b/g/n mode and controlled its channel. Printed out the test result from the spectrum by hard copy function.
The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
Set to the maximum power setting and enable the EUT transmit continuously
Set RBW = 100 kHz.
Set the video bandwidth (VBW) =300kHz.
Set Span=2 times OBW
Set Detector = Peak.
Set Trace mode = max hold.
Set Sweep = auto couple.
Allow the trace to stabilize.
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.
Measure and record the results in the test report.

8.1.5 Test Results

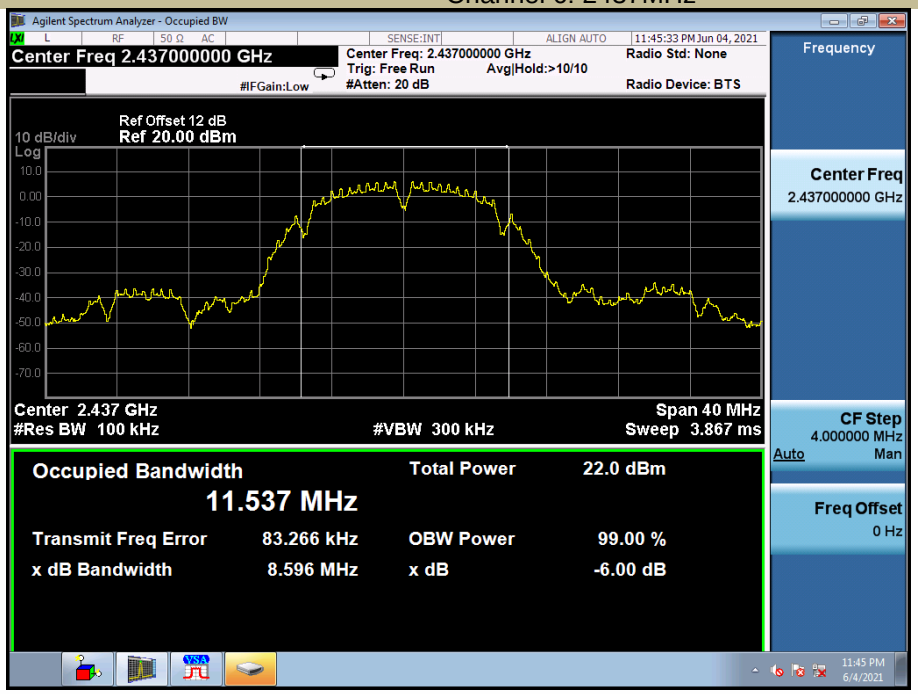
Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

Module AP6356S

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth (MHz)	Limit (kHz)	Verdict
802.11b	1	2412	9.098	>500	PASS
	6	2437	8.596	>500	PASS
	11	2462	8.604	>500	PASS
802.11g	1	2412	16.38	>500	PASS
	6	2437	16.38	>500	PASS
	11	2462	16.38	>500	PASS
802.11n (ht20)	1	2412	17.61	>500	PASS
	6	2437	17.61	>500	PASS
	11	2462	17.61	>500	PASS
802.11ax (20MHz) max.RU	1	2412	17.57	>500	PASS
	6	2437	17.62	>500	PASS
	11	2462	17.62	>500	PASS

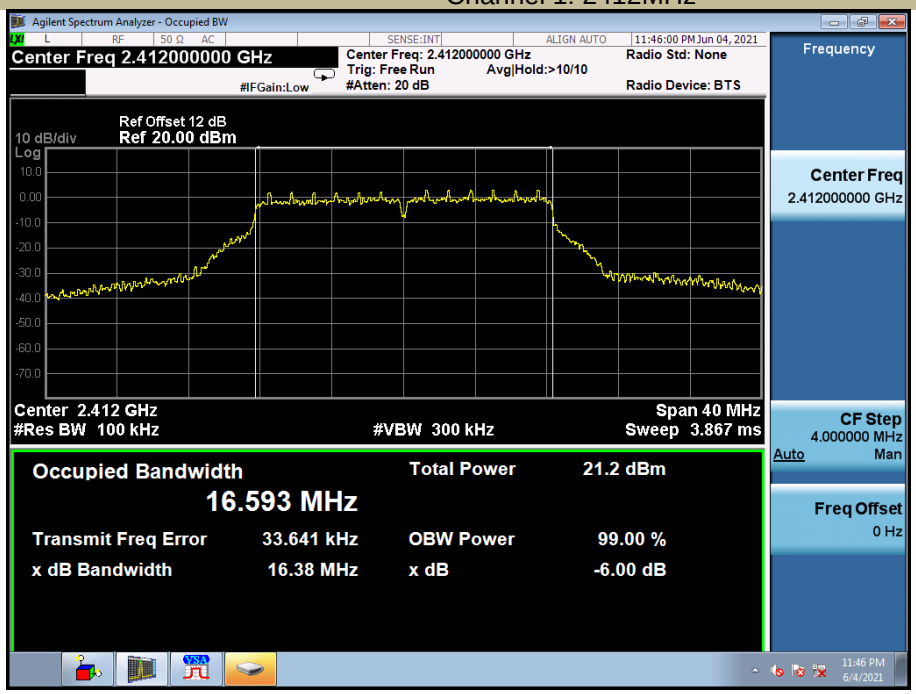
Test Model	DTS (6dB) Bandwidth 802.11b Channel 1: 2412MHz

Test Model	DTS (6dB) Bandwidth 802.11b Channel 6: 2437MHz

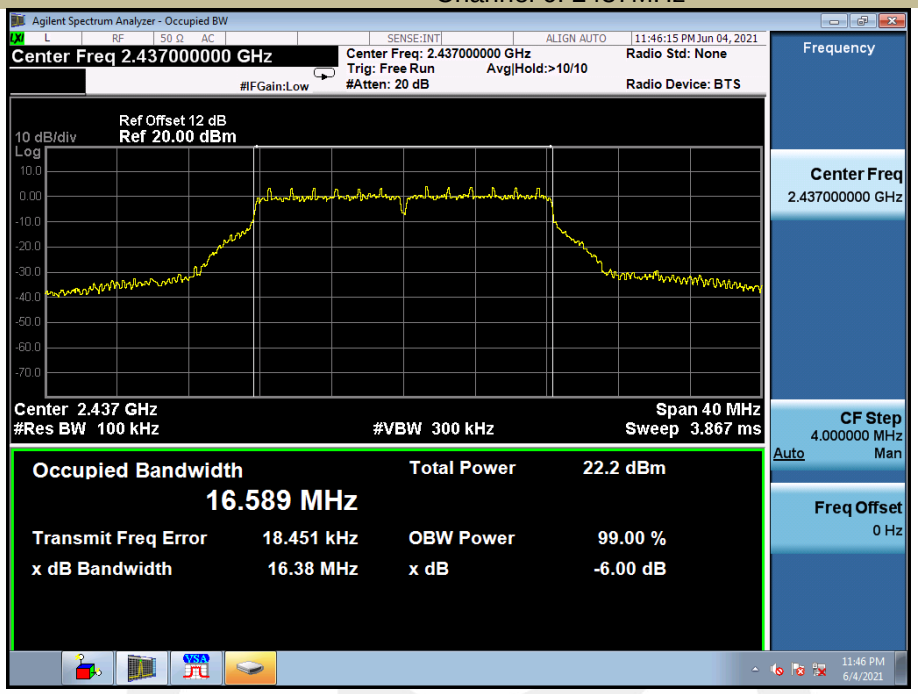


Test Model	DTS (6dB) Bandwidth 802.11b Channel 11: 2462MHz

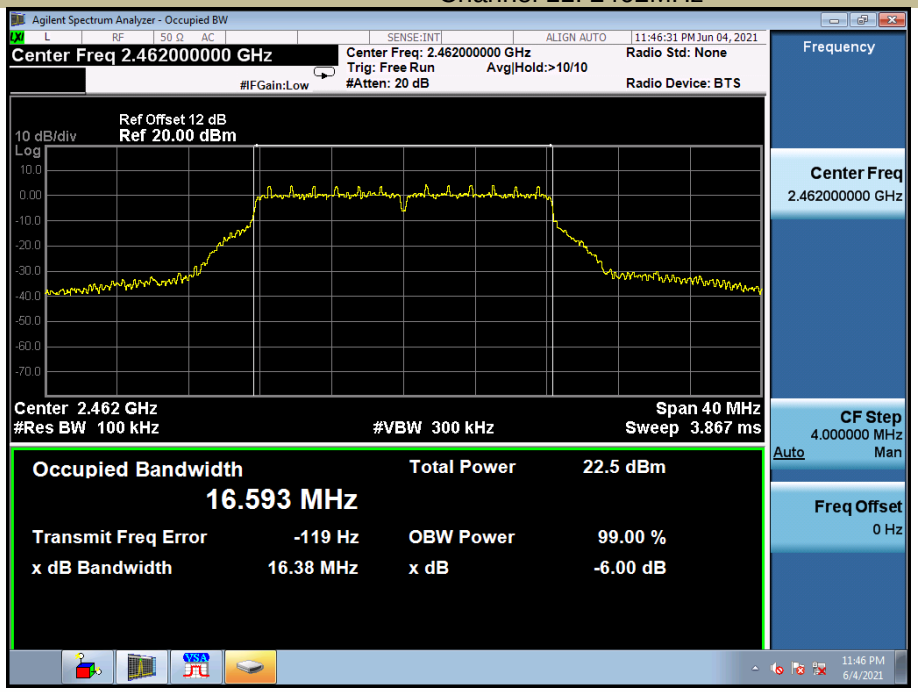
Test Model	DTS (6dB) Bandwidth 802.11g Channel 1: 2412MHz



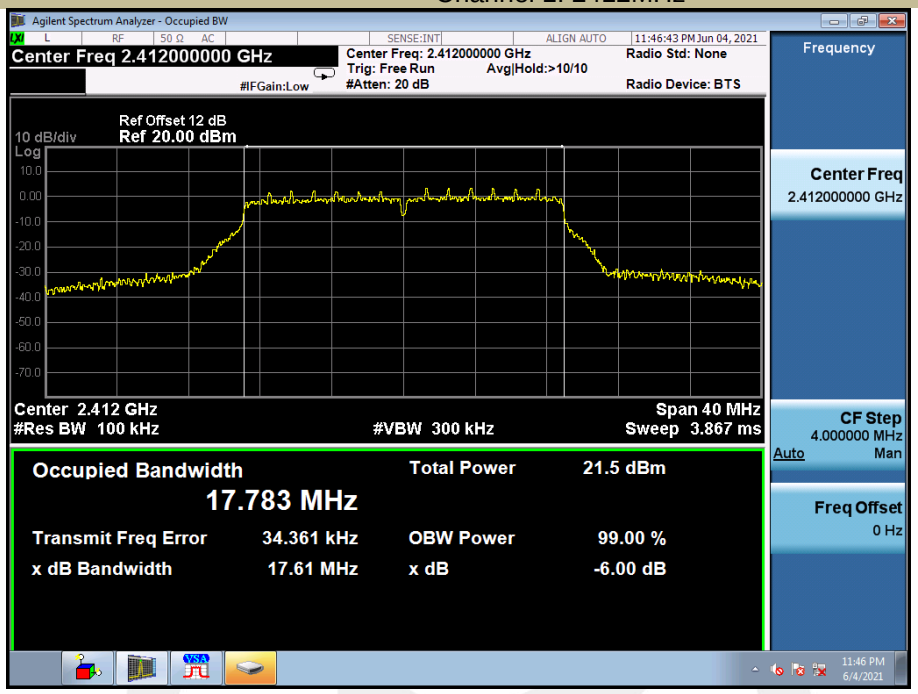
Test Model	DTS (6dB) Bandwidth 802.11g Channel 6: 2437MHz



Test Model	DTS (6dB) Bandwidth 802.11g Channel 11: 2462MHz

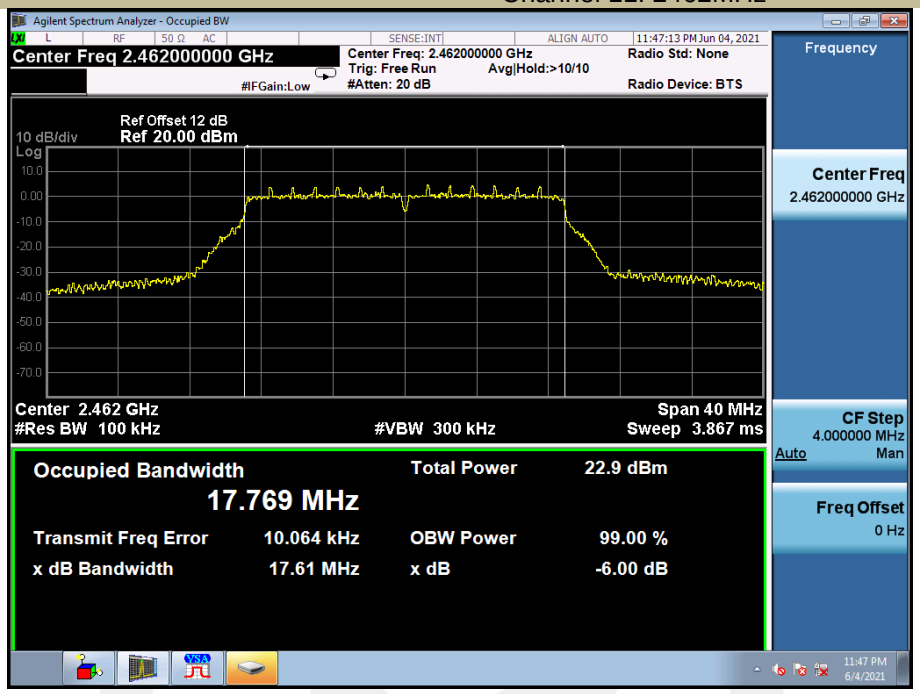


Test Model	DTS (6dB) Bandwidth 802.11n (HT20) Channel 1: 2412MHz

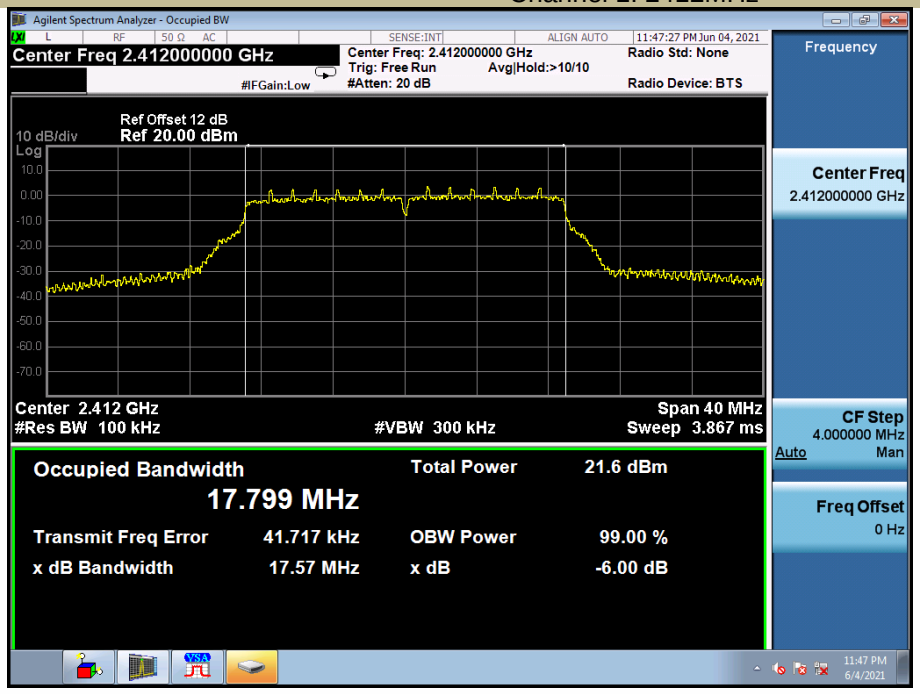


Test Model	DTS (6dB) Bandwidth 802.11n (HT20) Channel 6: 2437MHz

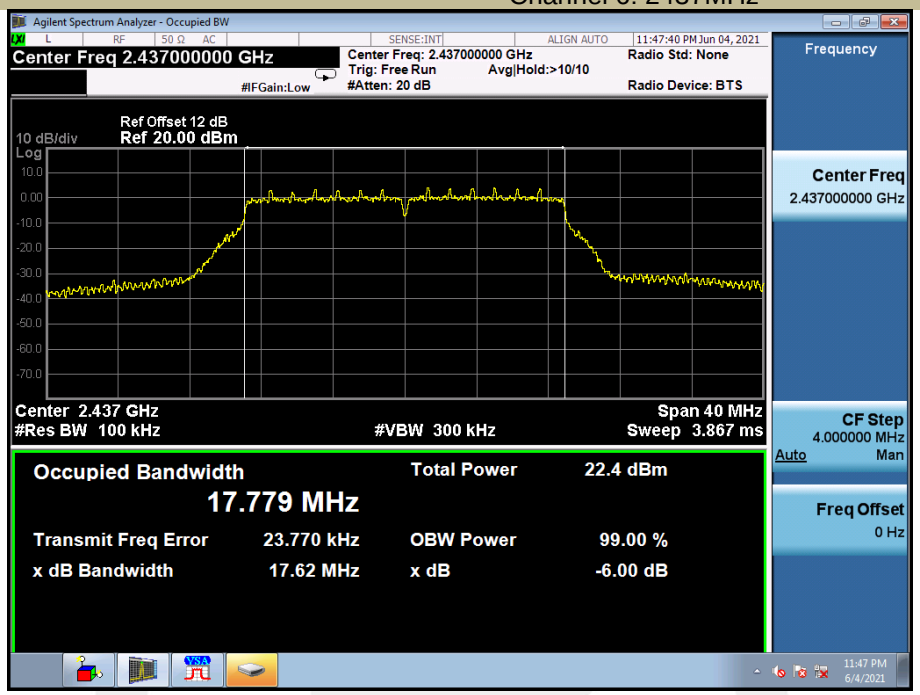
Test Model	DTS (6dB) Bandwidth 802.11n (HT20) Channel 11: 2462MHz



Test Model	DTS (6dB) Bandwidth 802.11ax (20MHz) max.RU Channel 1: 2412MHz



Test Model	DTS (6dB) Bandwidth 802.11ax (20MHz) max.RU Channel 6: 2437MHz

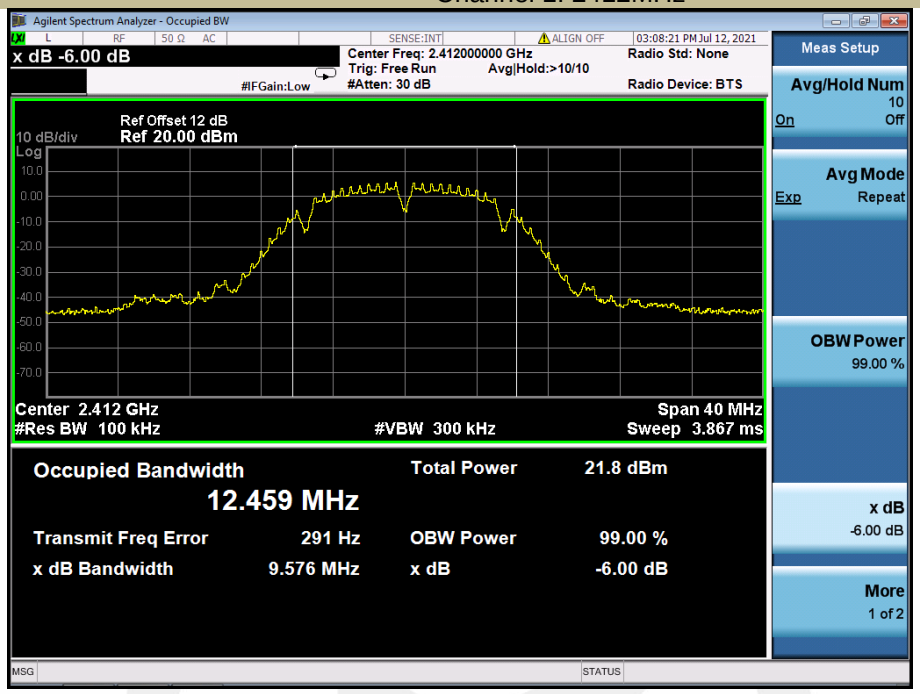


Test Model	DTS (6dB) Bandwidth 802.11ax (20MHz) max.RU Channel 11: 2462MHz

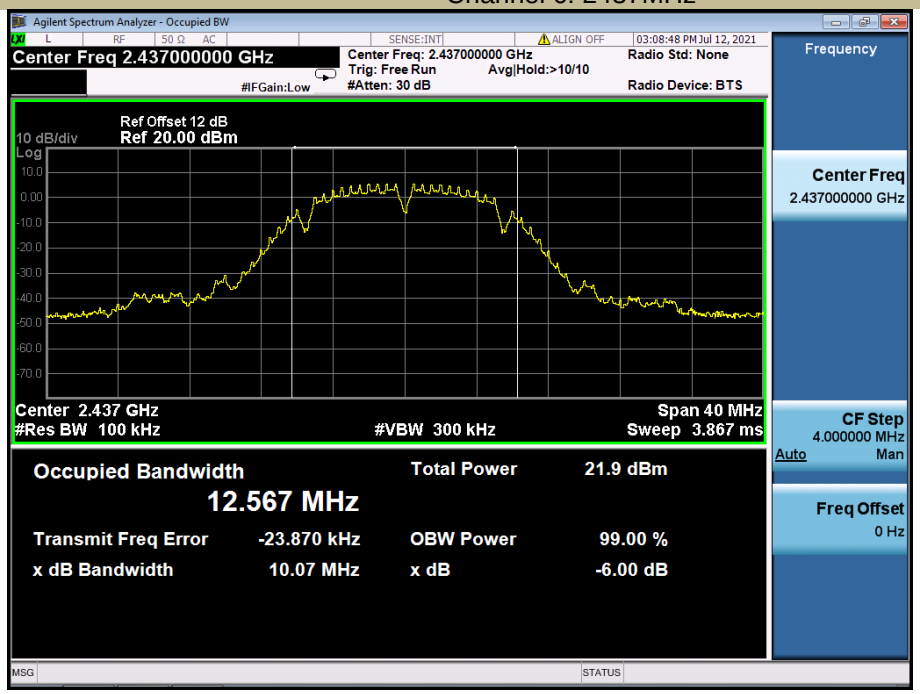
Module ESP32-S

Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth (MHz)	Limit (kHz)	Verdict
802.11b	1	2412	9.576	>500	PASS
	6	2437	10.07	>500	PASS
	11	2462	9.567	>500	PASS
802.11g	1	2412	15.18	>500	PASS
	6	2437	15.18	>500	PASS
	11	2462	15.17	>500	PASS
802.11n (ht20)	1	2412	15.17	>500	PASS
	6	2437	15.50	>500	PASS
	11	2462	15.13	>500	PASS
802.11n (ht40)	3	2422	35.28	>500	PASS
	6	2437	35.82	>500	PASS
	9	2452	35.22	>500	PASS

Test Model	DTS (6dB) Bandwidth 802.11b Channel 1: 2412MHz

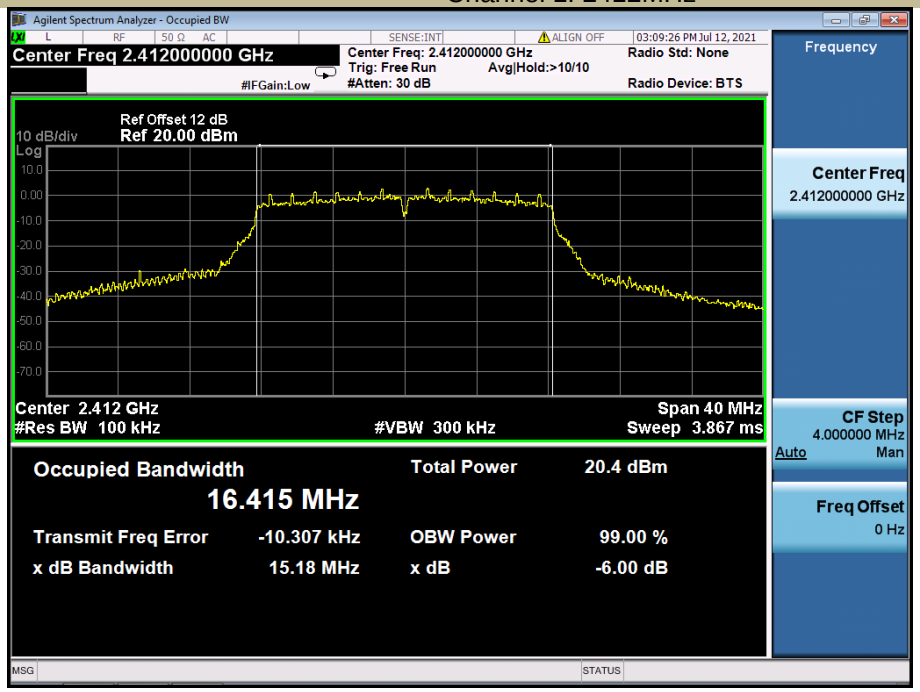


Test Model	DTS (6dB) Bandwidth 802.11b Channel 6: 2437MHz

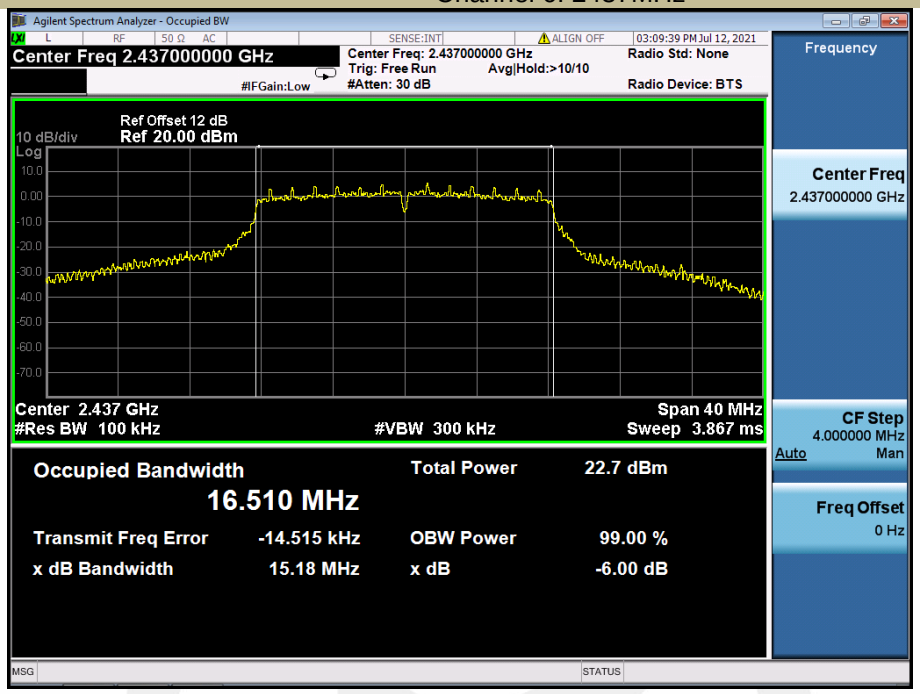


Test Model	DTS (6dB) Bandwidth 802.11b Channel 11: 2462MHz

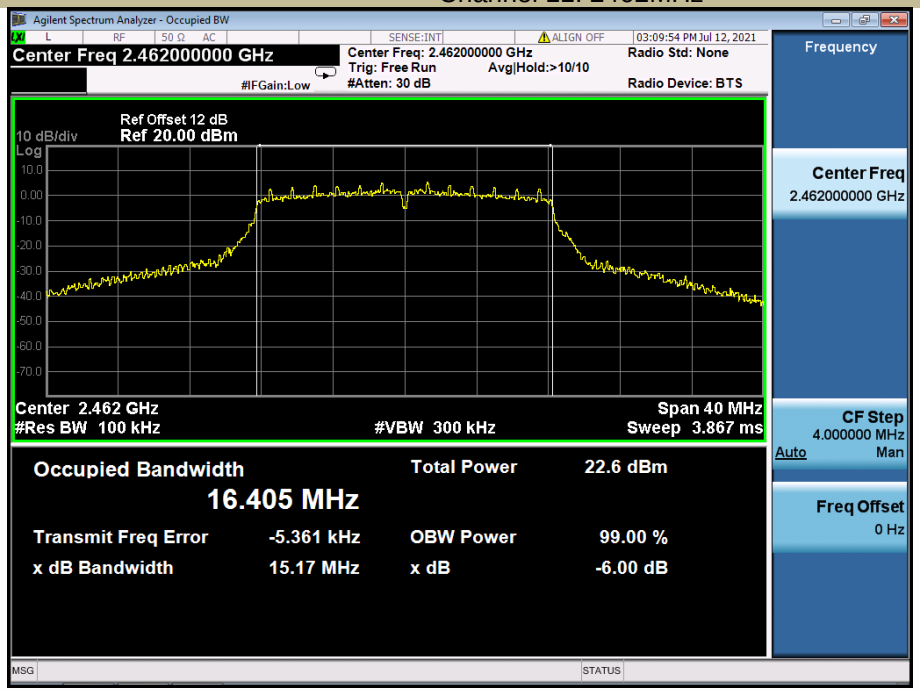
Test Model	DTS (6dB) Bandwidth 802.11g Channel 1: 2412MHz



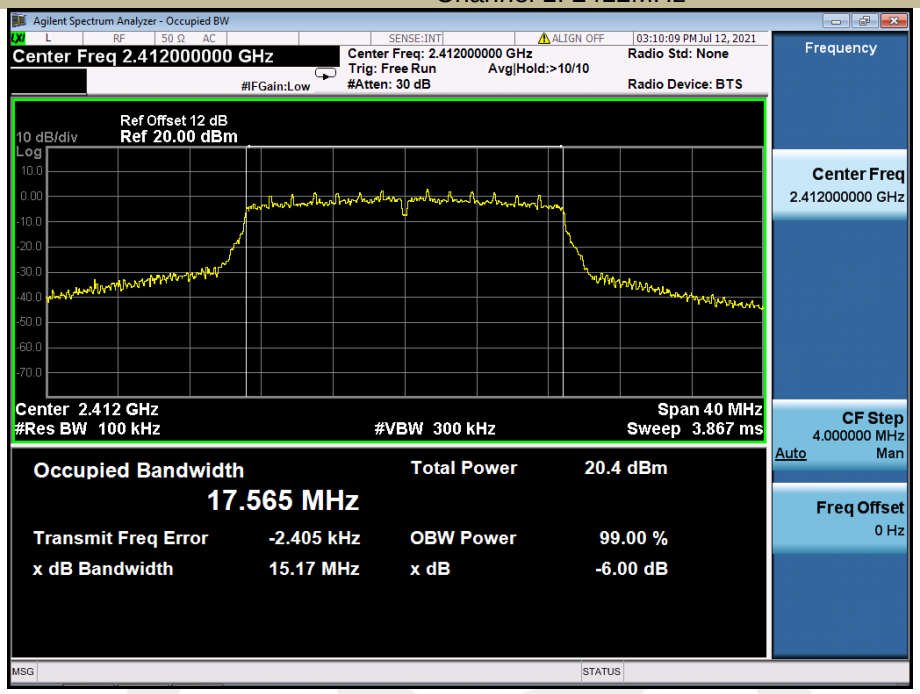
Test Model	DTS (6dB) Bandwidth 802.11g Channel 6: 2437MHz



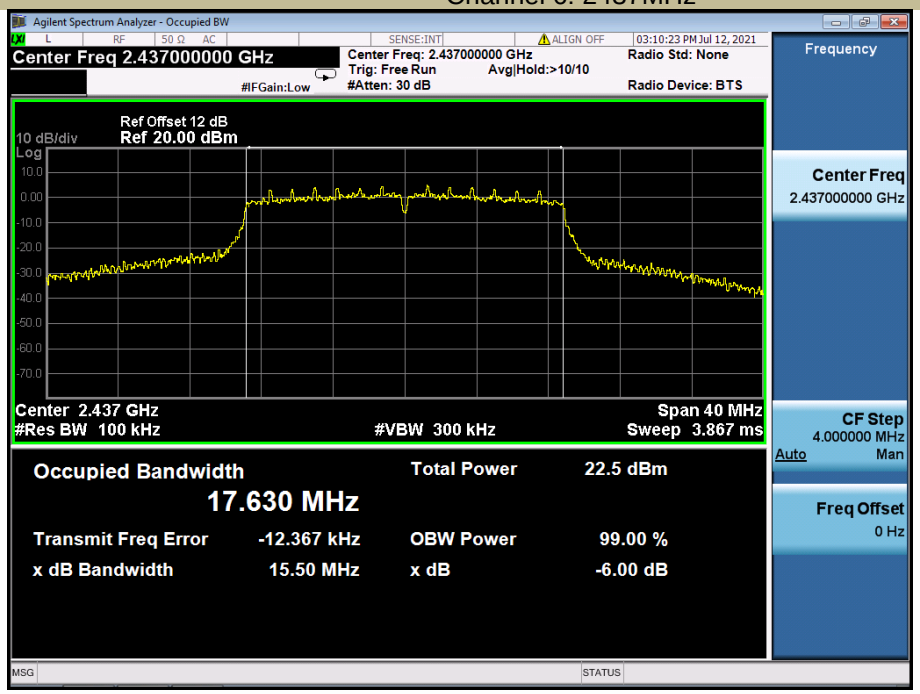
Test Model	DTS (6dB) Bandwidth 802.11g Channel 11: 2462MHz



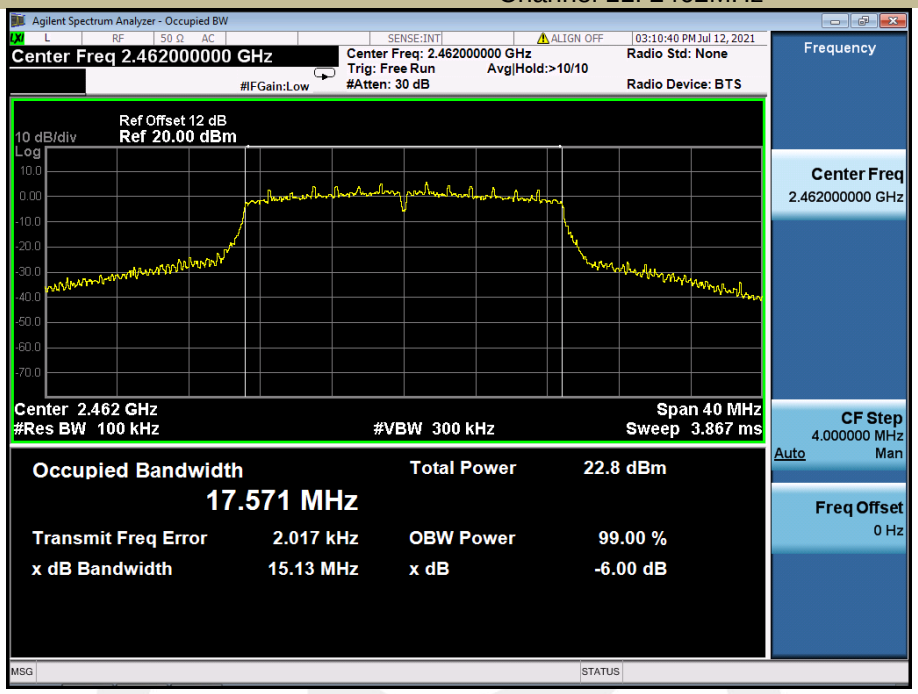
Test Model	DTS (6dB) Bandwidth 802.11n (HT20) Channel 1: 2412MHz



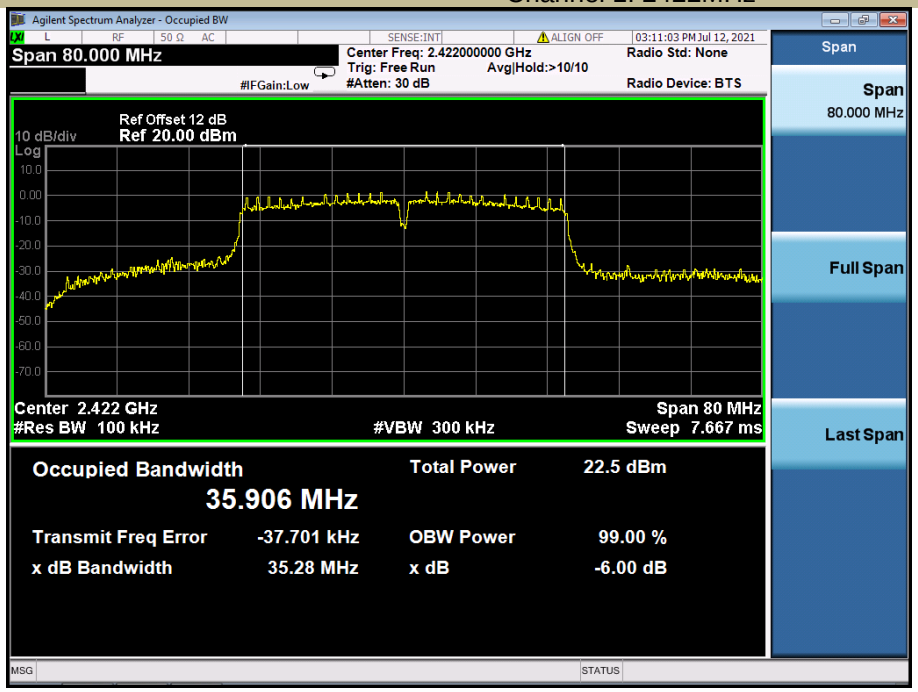
Test Model	DTS (6dB) Bandwidth 802.11n (HT20) Channel 6: 2437MHz



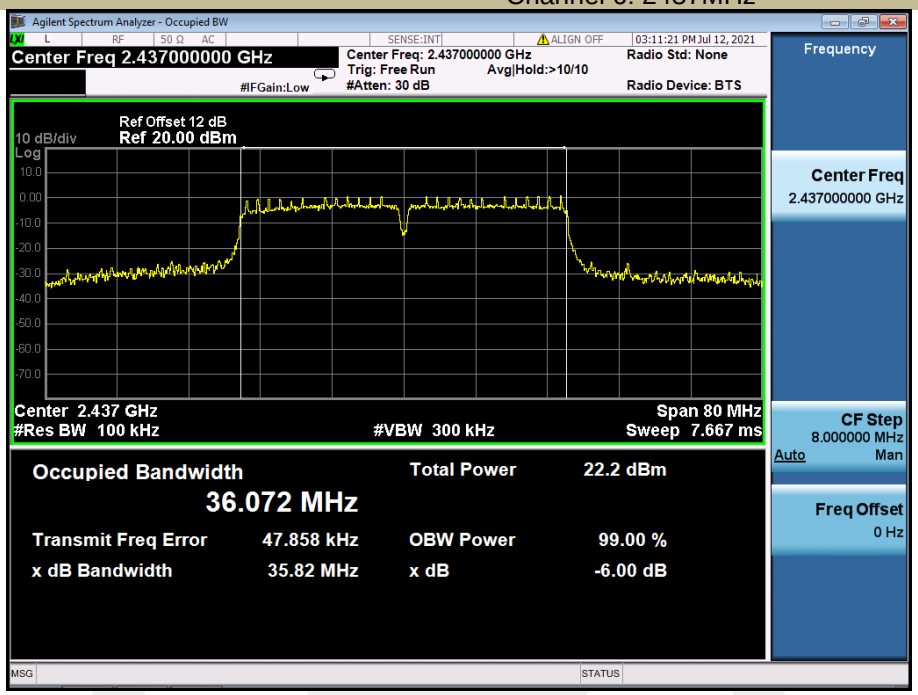
Test Model	DTS (6dB) Bandwidth 802.11n (HT20) Channel 11: 2462MHz



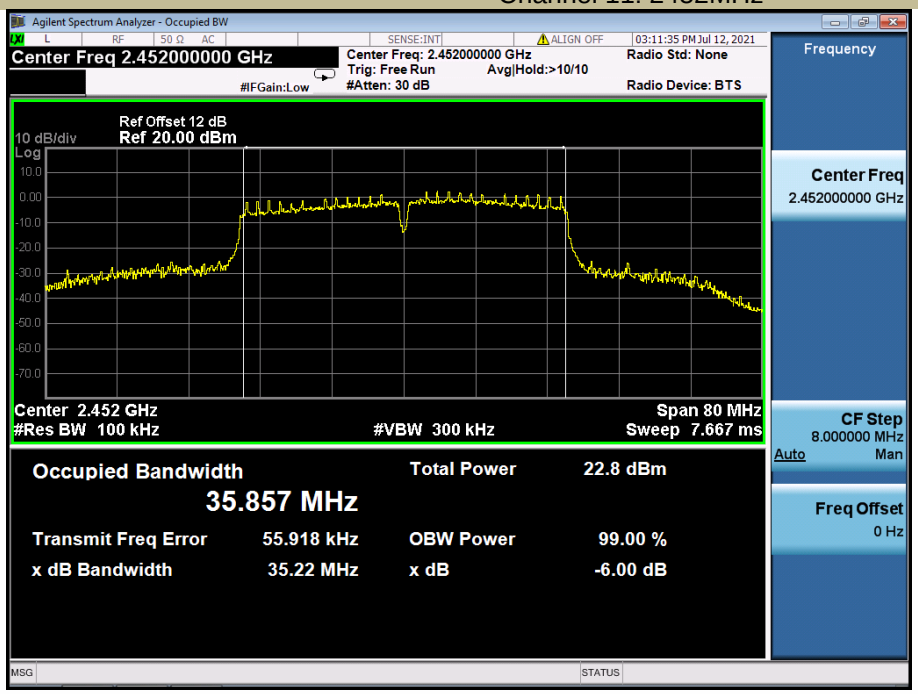
Test Model	DTS (6dB) Bandwidth 802.11n (40MHz) Channel 1: 2422MHz



Test Model	DTS (6dB) Bandwidth 802.11n (40MHz) Channel 6: 2437MHz



Test Model	DTS (6dB) Bandwidth 802.11n(40MHz) Channel 11: 2452MHz



8.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER

8.2.1 Applicable Standard

According to FCC Part15.247 (b)(3) and KDB 558074 D01 15.247 Meas Guidance v05r02

8.2.2 Conformance Limit

The maximum peak conducted output power of the intentional radiator for systems using digital modulation in the 2400 - 2483.5 MHz bands shall not exceed: 1 Watt (30dBm).

8.2.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

8.2.4 Test Procedure

■ According to FCC Part15.247(b)(3)

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.
The testing follows FCC public Notice DA 00-705 Measurement Guidelines.
The RF output of EUT was connected to the power meter by RF cable and attnuator. The path loss was compensated to the results for each measurement.
Set to the maximum output power setting and enable the EUT transmit continuously.
Measure the conducted output power with cable loss and record the results in the test report.
Measure and record the results in the report.

■ According to FCC Part 15.247(b)(4):

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. 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)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
Note: If antenna Gain exceeds 6 dBi, then Output power Limit=30-(Gain- 6)

8.2.5 Test Results

Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

Module AP6356S

Operation Mode	Channel Number	Channel Frequency (MHz)	Maximun Peak Conducted Output Power (dBm)			Limit (dBm)	Verdict
			Ant 1	Ant 2	Ant 1+ Ant 2		
802.11b	1	2412	13.5	13.78	-	30.00	PASS
	6	2437	14.28	14.29	-	30.00	PASS
	11	2462	14.67	14.48	-	30.00	PASS
802.11g	1	2412	13.59	13.93	-	30.00	PASS
	6	2437	14.50	14.55	-	30.00	PASS
	11	2462	14.78	14.74	-	30.00	PASS
802.11n (ht20)	1	2412	13.59	13.82	16.72	30.00	PASS
	6	2437	14.40	14.59	17.51	30.00	PASS
	11	2462	14.78	14.70	17.75	30.00	PASS
802.11ax (20MHz) max.RU	1	2412	13.59	13.81	16.71	30.00	PASS
	6	2437	14.38	14.61	17.51	30.00	PASS
	11	2462	14.78	14.74	17.77	30.00	PASS
Note: For smart antenna systems, Maximum Conducted Output Power is summed at the total transmit power delivered to all antennas.							

Module ESP32-S

Operation Mode	Channel Number	Channel Frequency (MHz)	Maximun Peak Conducted Output Power (dBm)	Limit (dBm)	Verdict
802.11b	1	2412	13.93	30.00	PASS
	6	2437	14.11	30.00	PASS
	11	2462	14.64	30.00	PASS
802.11g	1	2412	12.86	30.00	PASS
	6	2437	14.98	30.00	PASS
	11	2462	15.07	30.00	PASS
802.11n (ht20)	1	2412	13.05	30.00	PASS
	6	2437	14.97	30.00	PASS
	11	2462	15.20	30.00	PASS
802.11n (40MHz)	3	2422	**14.47**	30.00	PASS
	6	2437	14.95	30.00	PASS
	9	2452	14.70	30.00	PASS
Note: For smart antenna systems, Maximum Conducted Output Power is summed at the total transmit power delivered to all antennas.					

8.3 MAXIMUM POWER SPECTRAL DENSITY

8.3.1 Applicable Standard

According to FCC Part15.247(e) and KDB 558074 D01 15.247 Meas Guidance v05r02

8.3.2 Conformance Limit

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

8.3.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

8.3.4 Test Procedure

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance
The transmitter output (antenna port) was connected to the spectrum analyzer
Set analyzer center frequency to DTS channel center frequency.
Set the span to 1.5 times the DTS bandwidth.
Set the RBW to: 3 kHz
Set the VBW to:10 kHz.
Set Detector = peak.
Set Sweep time = auto couple.
Set Trace mode = max hold.
Allow trace to fully stabilize.
Use the peak marker function to determine the maximum amplitude level within the RBW.

8.3.5 Test Results

Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

Module AP6356S

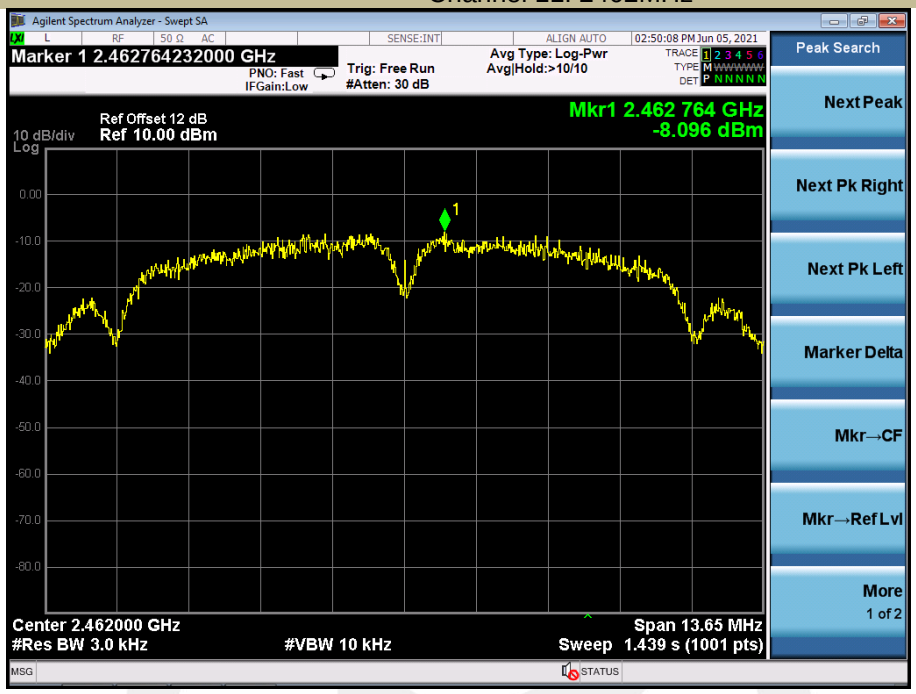
Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm/3kHz)			Limit (dBm/ 3kHz)	Verdict
			Ant 1	Ant 2	Ant 1+ Ant 2		
802.11b	1	2412	-8.813	-8.507	-	<=8	PASS
	6	2437	-7.133	-7.335	-	<=8	PASS
	11	2462	-8.096	-6.198	-	<=8	PASS
802.11g	1	2412	-12.054	-10.853	-	<=8	PASS
	6	2437	-11.252	-10.988	-	<=8	PASS
	11	2462	-9.918	-10.453	-	<=8	PASS
802.11n (ht20)	1	2412	-11.709	-11.962	-8.82	<=8	PASS
	6	2437	-11.013	-10.514	-7.75	<=8	PASS
	11	2462	-10.864	-10.772	-7.81	<=8	PASS
802.11ax (20MHz) max.RU	1	2412	-11.500	-11.849	-8.66	<=8	PASS
	6	2437	-11.090	-10.623	-7.84	<=8	PASS
	11	2462	-10.541	-8.961	-6.67	<=8	PASS
Note: For smart antenna systems, Maximum Conducted Output Power is summed at the total transmit power delivered to all antennas.							

Ant. 1

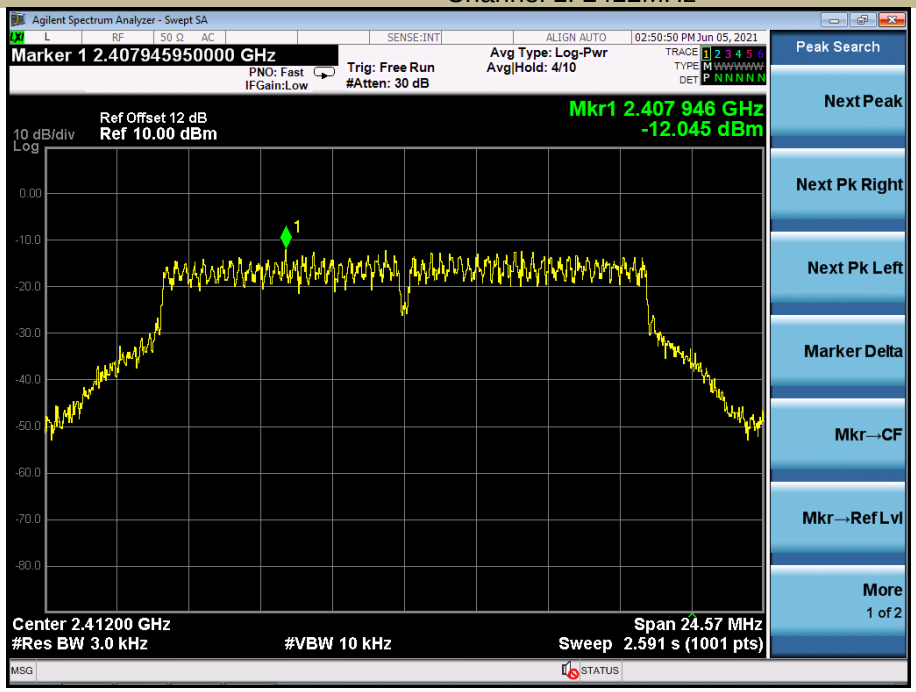
Test Model	Power Spectral Density 802.11b Channel 1: 2412MHz

Test Model	Power Spectral Density 802.11b Channel 6: 2437MHz

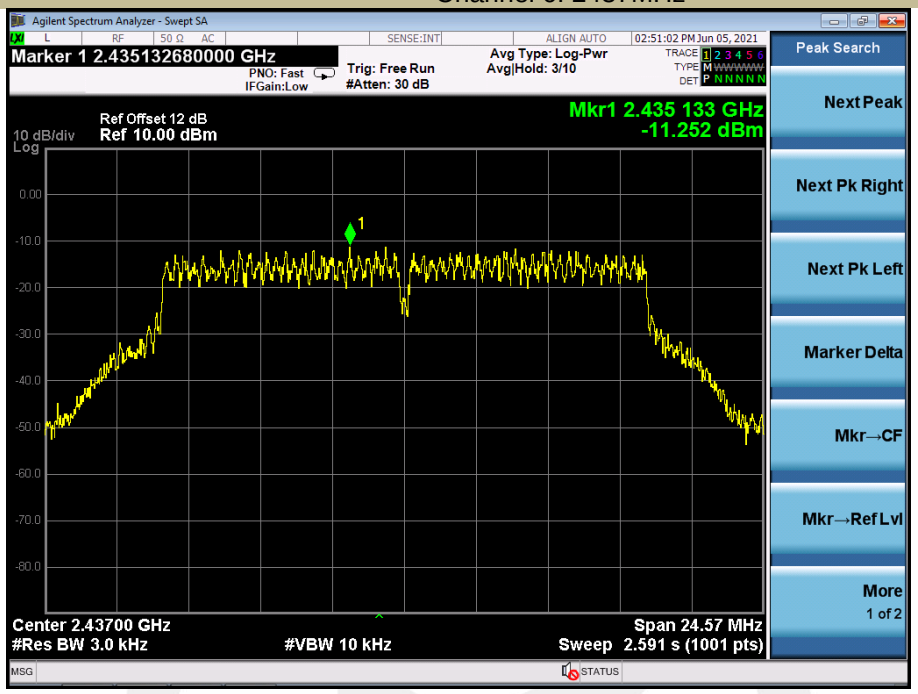
Test Model	Power Spectral Density 802.11b Channel 11: 2462MHz



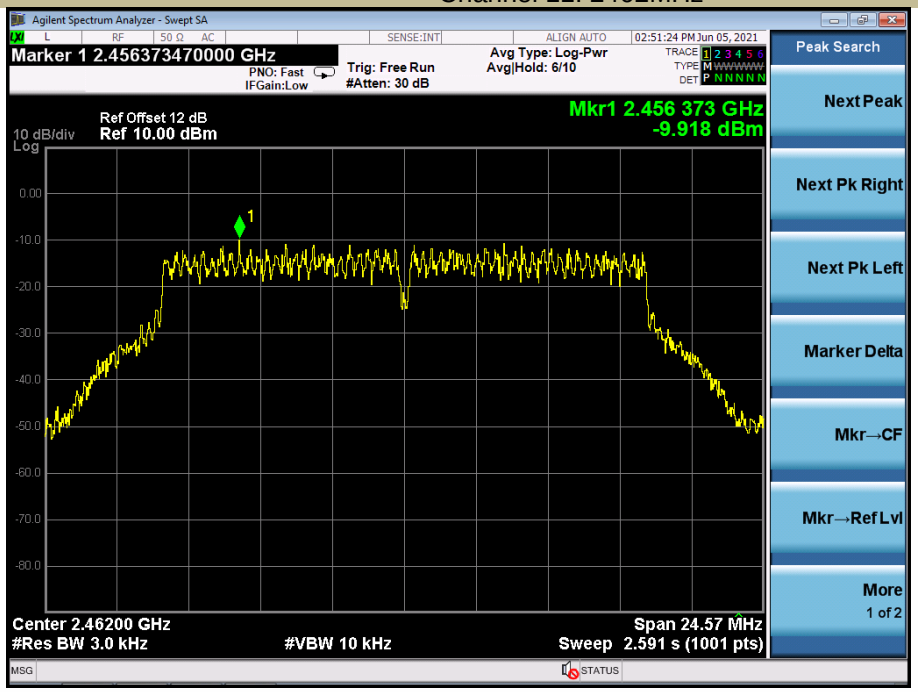
Test Model	Power Spectral Density 802.11g Channel 1: 2412MHz



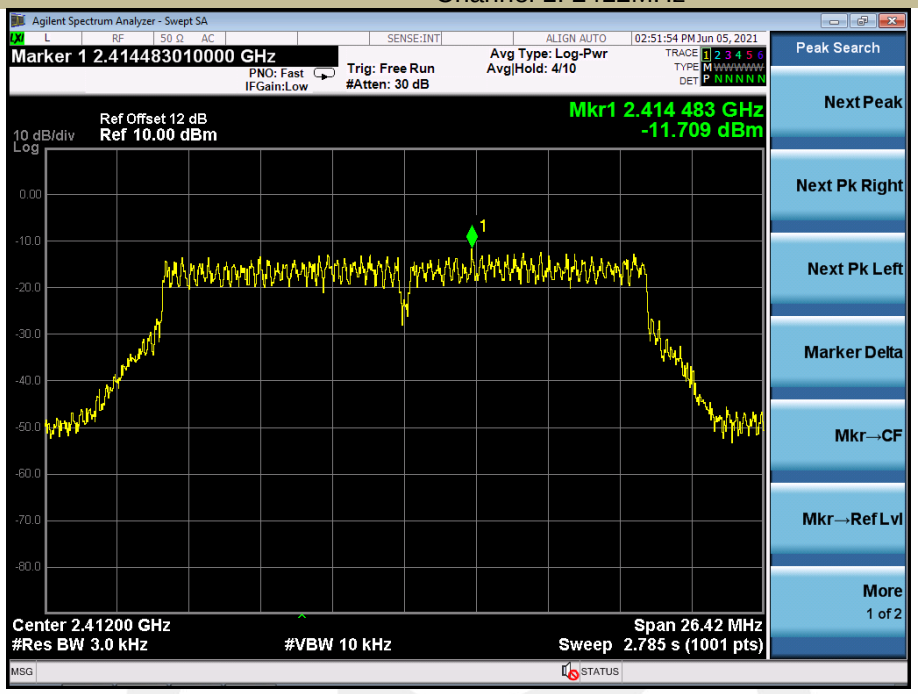
Test Model	Power Spectral Density 802.11g Channel 6: 2437MHz



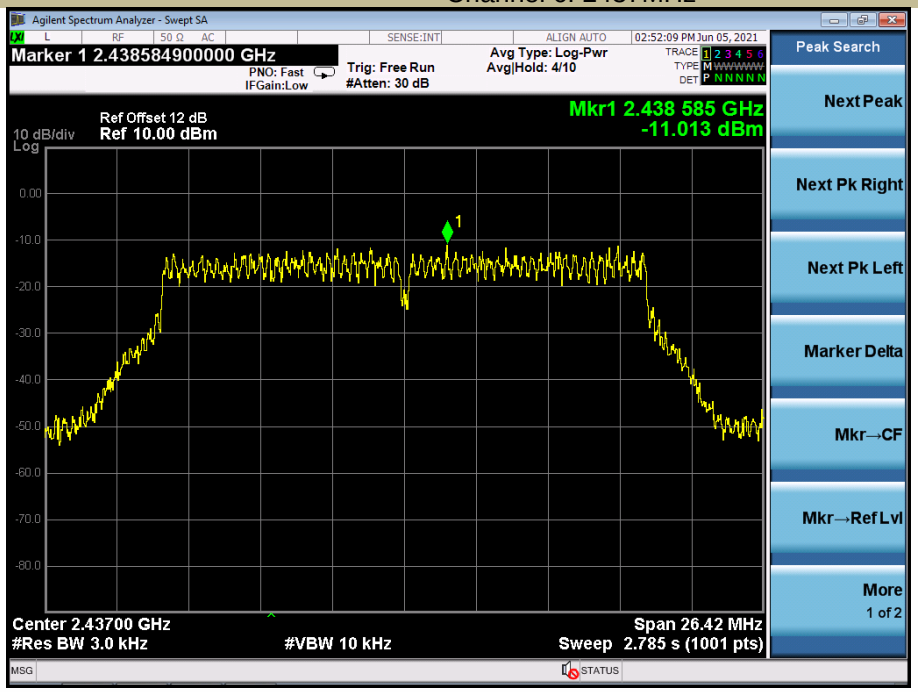
Test Model	Power Spectral Density 802.11g Channel 11: 2462MHz



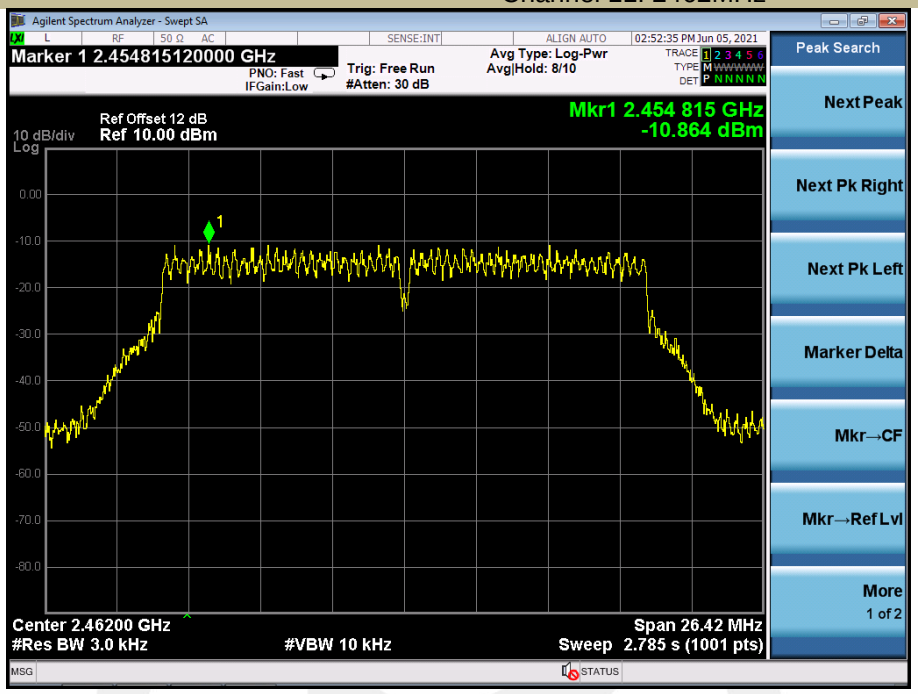
Test Model	Power Spectral Density 802.11n (HT20) Channel 1: 2412MHz



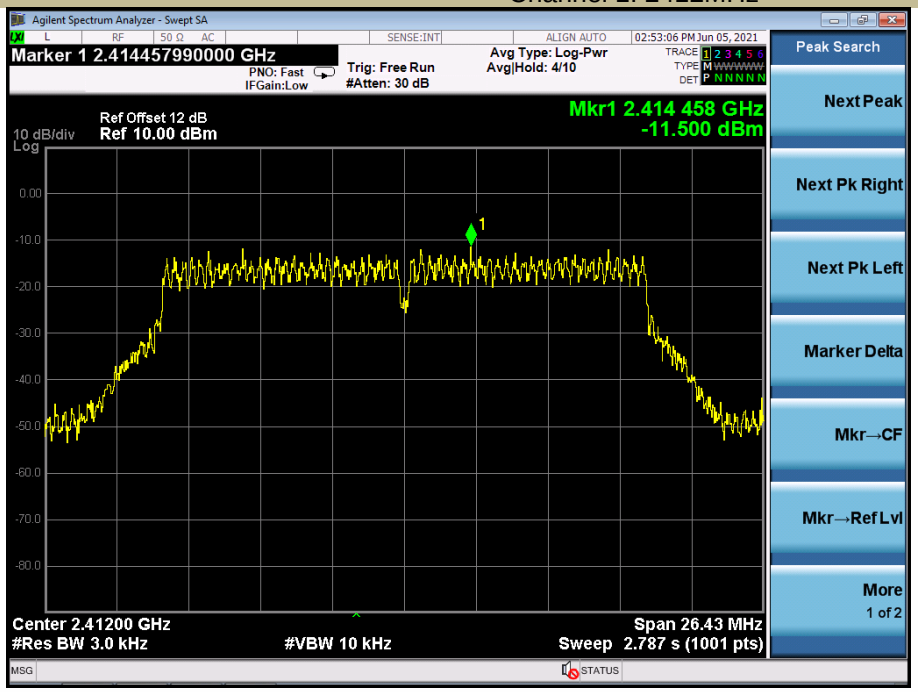
Test Model	Power Spectral Density 802.11n (HT20) Channel 6: 2437MHz



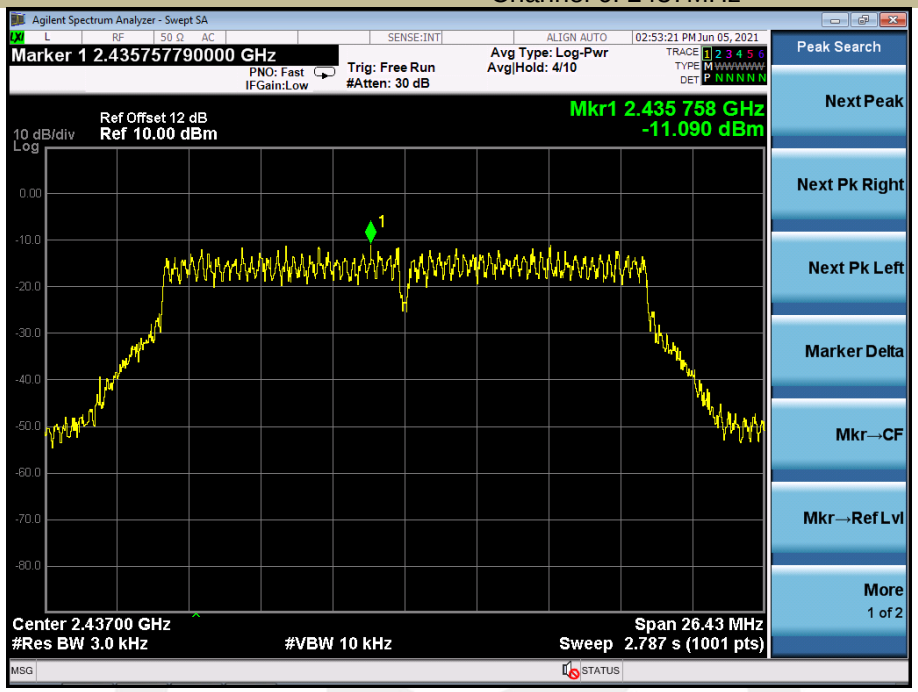
Test Model	Power Spectral Density 802.11n (HT20) Channel 11: 2462MHz



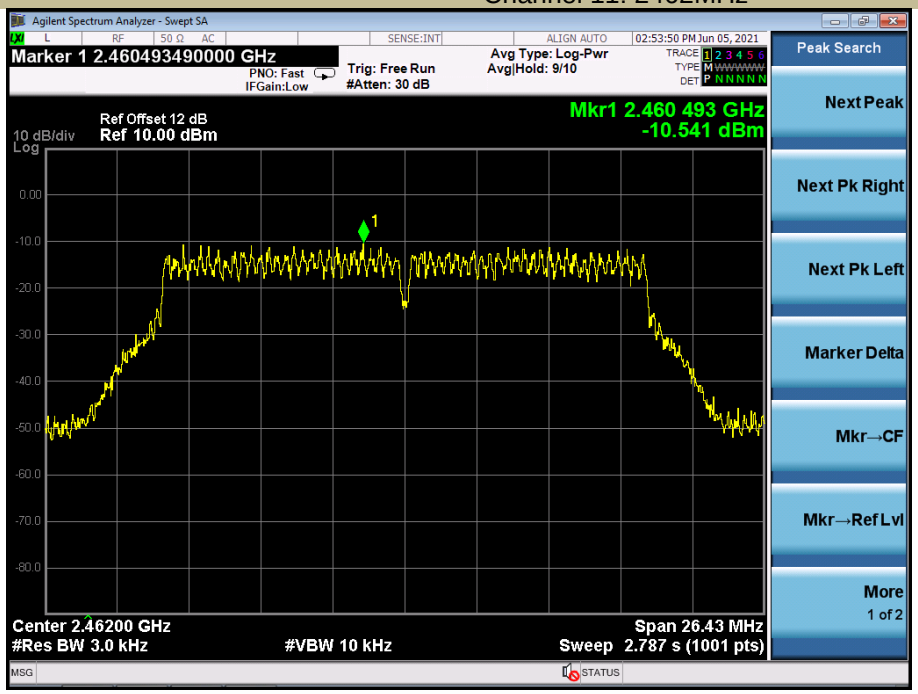
Test Model	Power Spectral Density 802.11ax (20MHz) max.RU Channel 1: 2412MHz



Test Model	Power Spectral Density 802.11ax (20MHz) max.RU Channel 6: 2437MHz



Test Model	Power Spectral Density 802.11ax (20MHz) max.RU Channel 11: 2462MHz



Ant.2

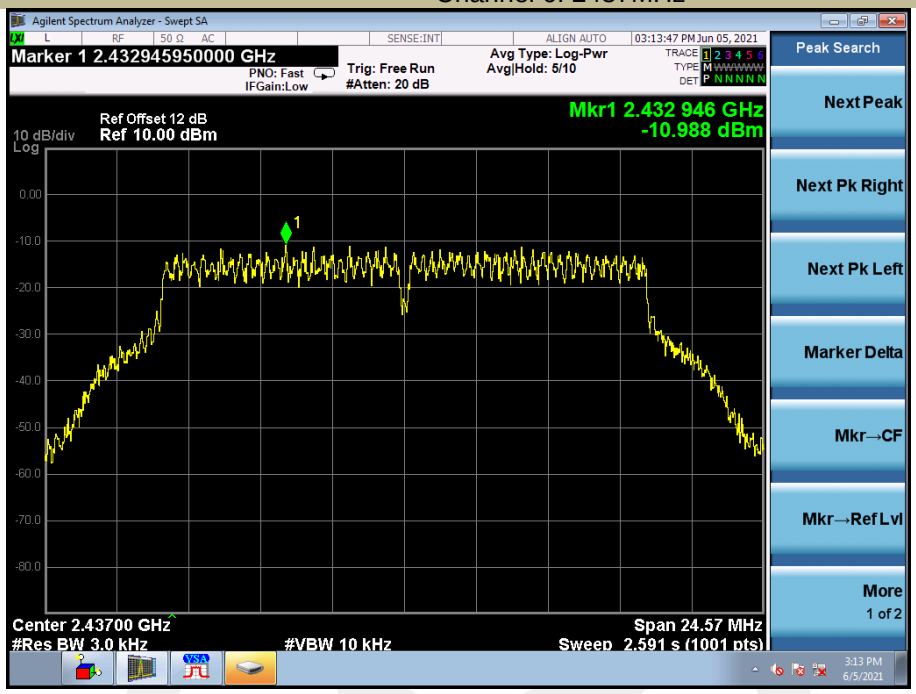
Test Model	Power Spectral Density 802.11b Channel 1: 2412MHz

Test Model	Power Spectral Density 802.11b Channel 6: 2437MHz

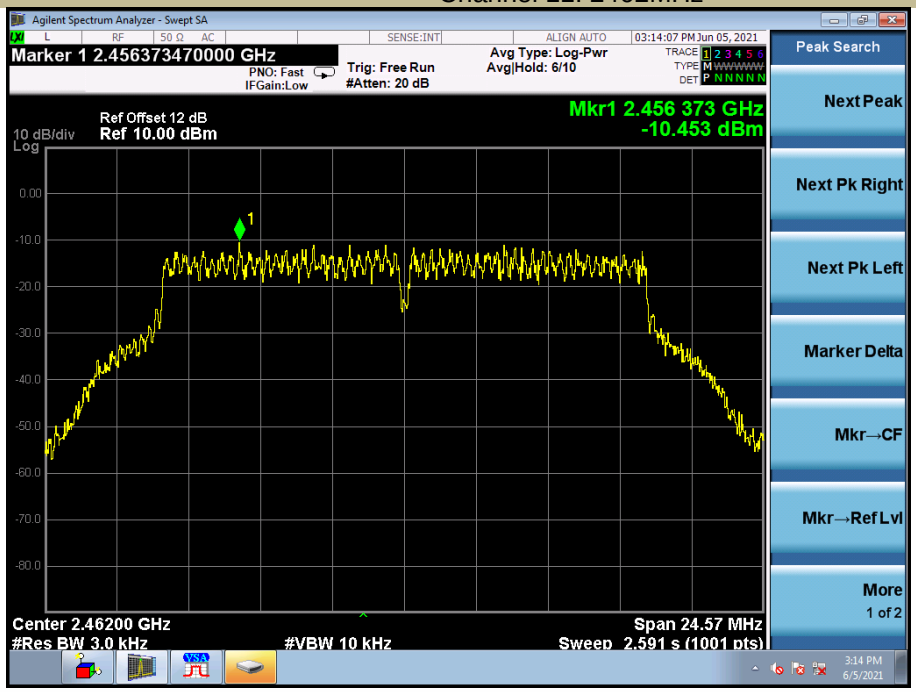
Test Model	Power Spectral Density 802.11b Channel 11: 2462MHz

Test Model	Power Spectral Density 802.11g Channel 1: 2412MHz

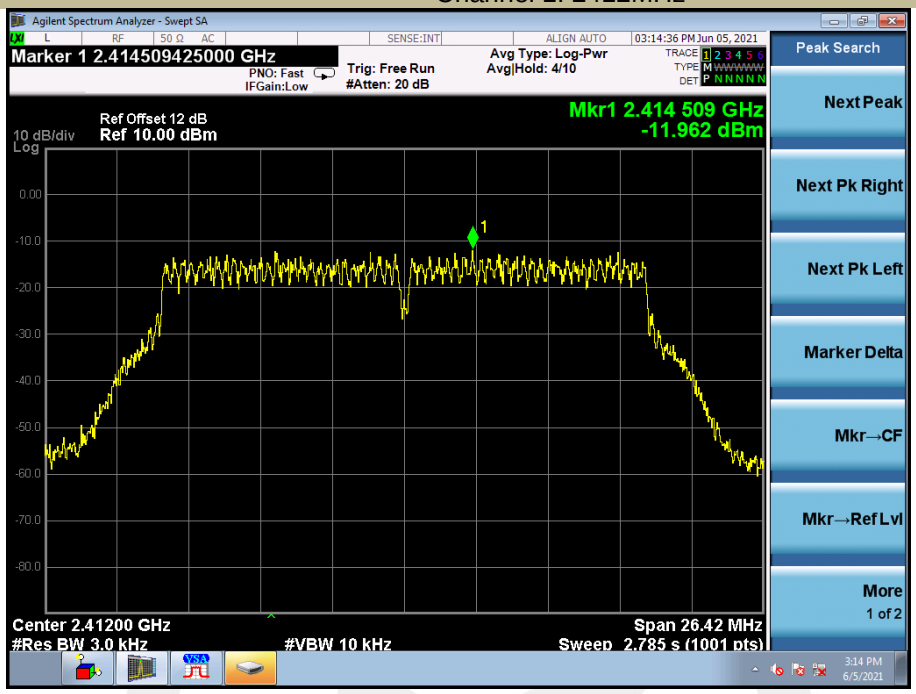
Test Model	Power Spectral Density 802.11g Channel 6: 2437MHz



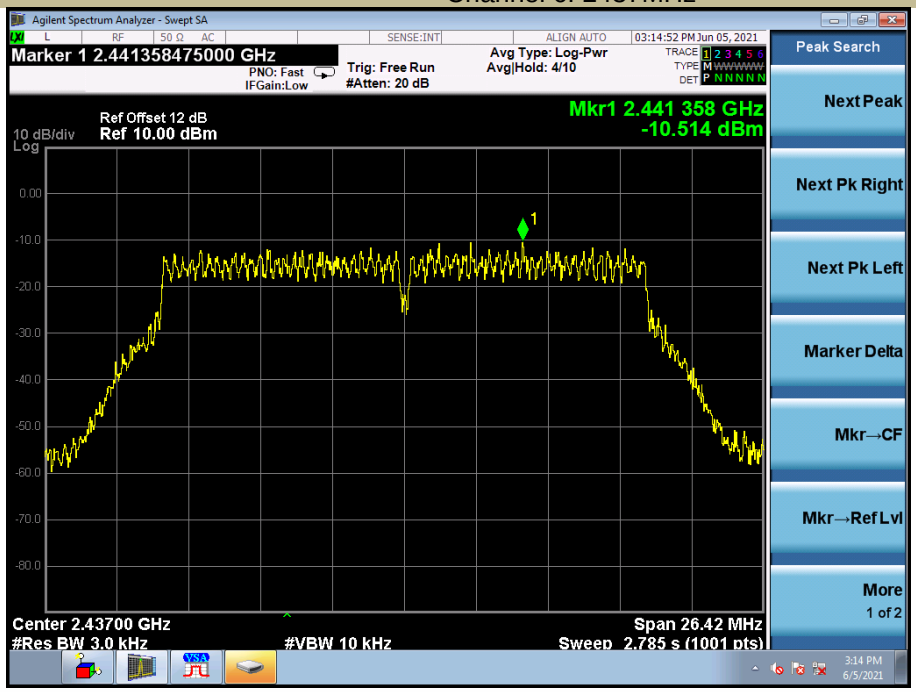
Test Model	Power Spectral Density 802.11g Channel 11: 2462MHz



Test Model	Power Spectral Density 802.11n (HT20) Channel 1: 2412MHz

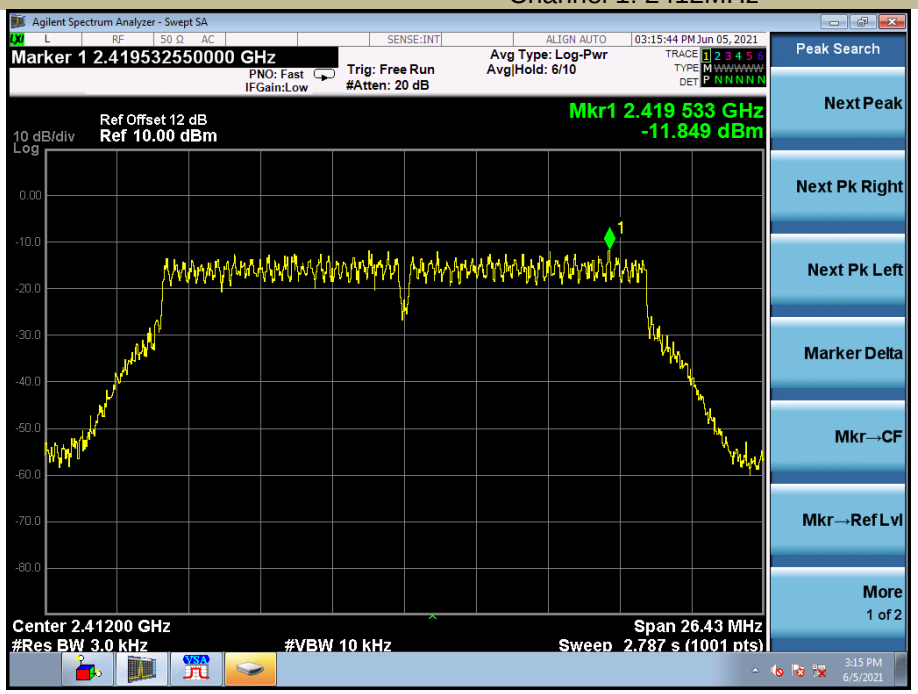


Test Model	Power Spectral Density 802.11n (HT20) Channel 6: 2437MHz

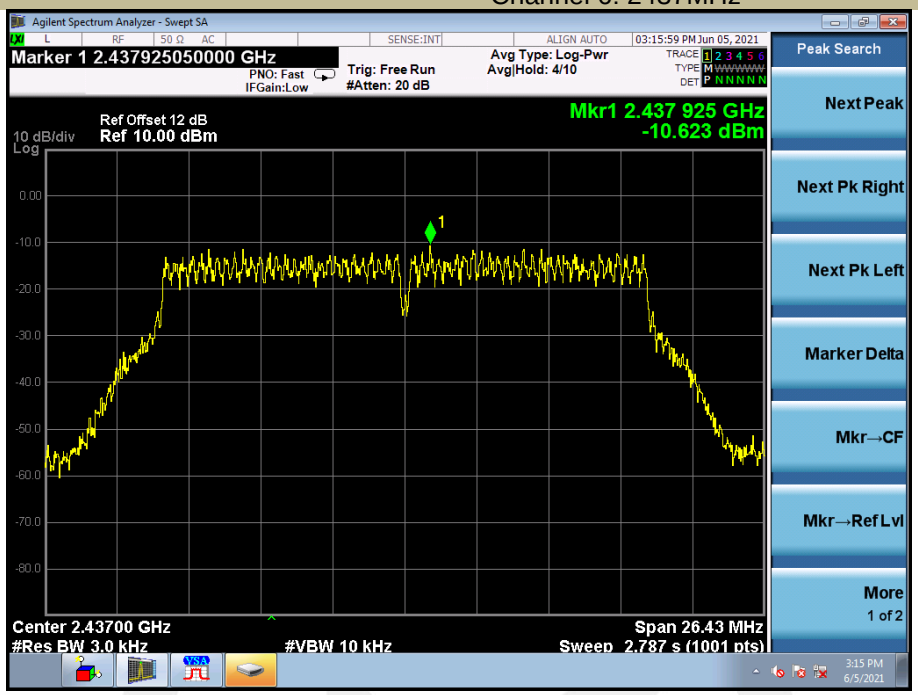


Test Model	Power Spectral Density 802.11n (HT20) Channel 11: 2462MHz

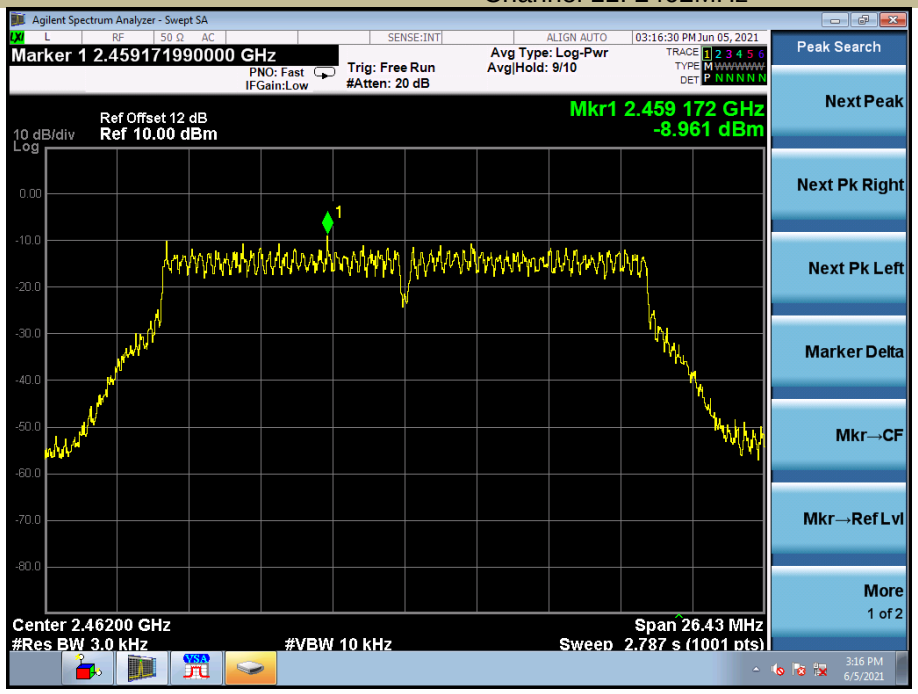
Test Model	Power Spectral Density 802.11ax (20MHz) max.RU Channel 1: 2412MHz



Test Model	Power Spectral Density 802.11ax (20MHz) max.RU Channel 6: 2437MHz



Test Model	Power Spectral Density 802.11ax (20MHz) max.RU Channel 11: 2462MHz



Module ESP32-S

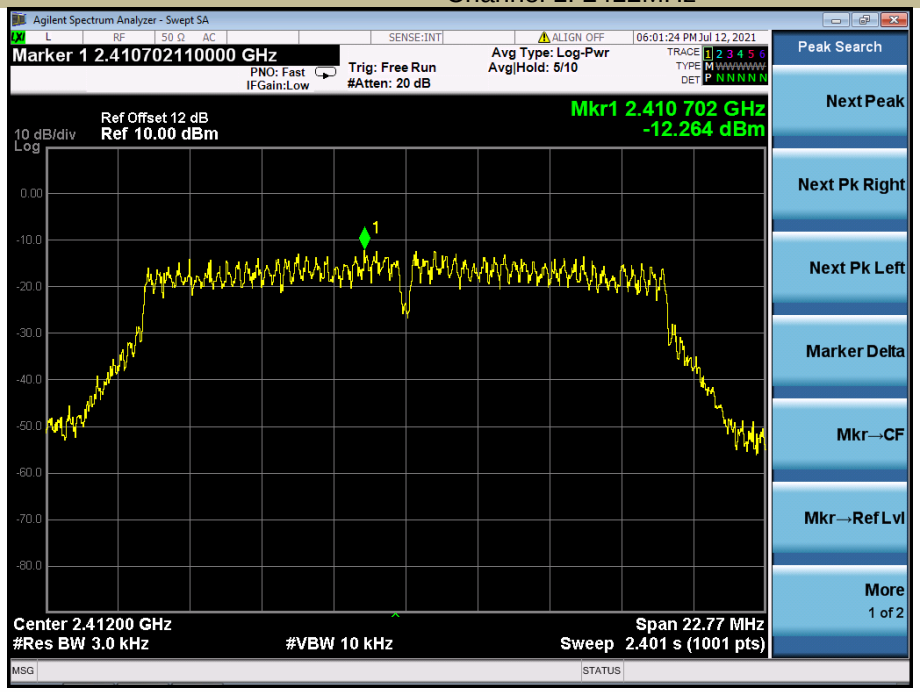
Operation Mode	Channel Number	Channel Frequency (MHz)	Measurement Level (dBm/3kHz)	Limit (dBm/ 3kHz)	Verdict
802.11b	1	2412	-8.380	<=8	PASS
	6	2437	-9.075	<=8	PASS
	11	2462	-8.136	<=8	PASS
802.11g	1	2412	-12.264	<=8	PASS
	6	2437	-8.739	<=8	PASS
	11	2462	-9.631	<=8	PASS
802.11n (ht20)	1	2412	-12.095	<=8	PASS
	6	2437	-10.454	<=8	PASS
	11	2462	-9.014	<=8	PASS
802.11n (40MHz)	3	2412	-13.518	<=8	PASS
	6	2437	-12.846	<=8	PASS
	9	2462	-12.572	<=8	PASS
Note: For smart antenna systems, Maximum Conducted Output Power is summed at the total transmit power delivered to all antennas.					

Test Model	Power Spectral Density 802.11b Channel 1: 2412MHz

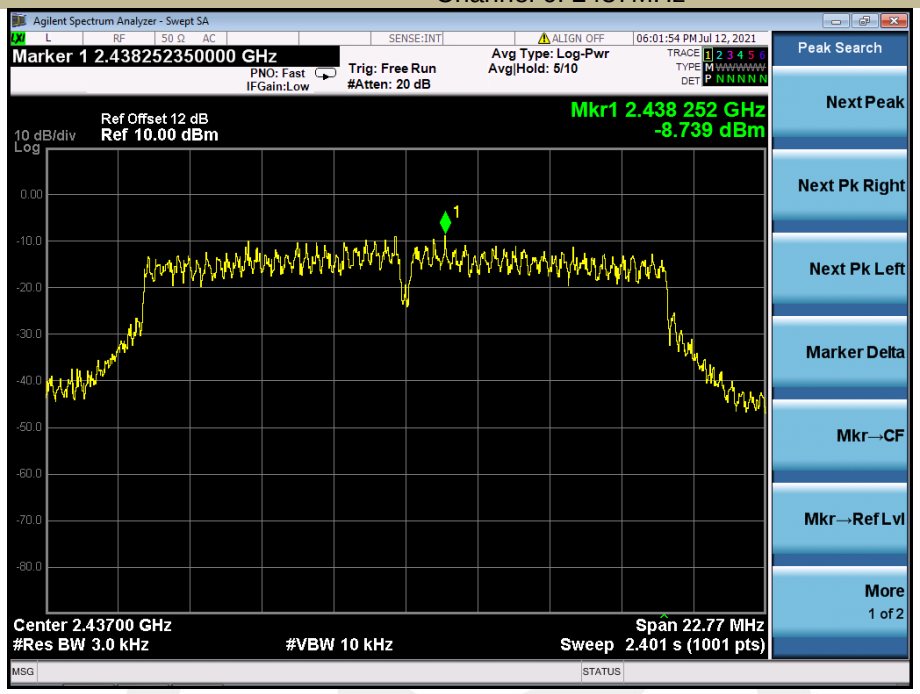
Test Model	Power Spectral Density 802.11b Channel 6: 2437MHz

Test Model	Power Spectral Density 802.11b Channel 11: 2462MHz

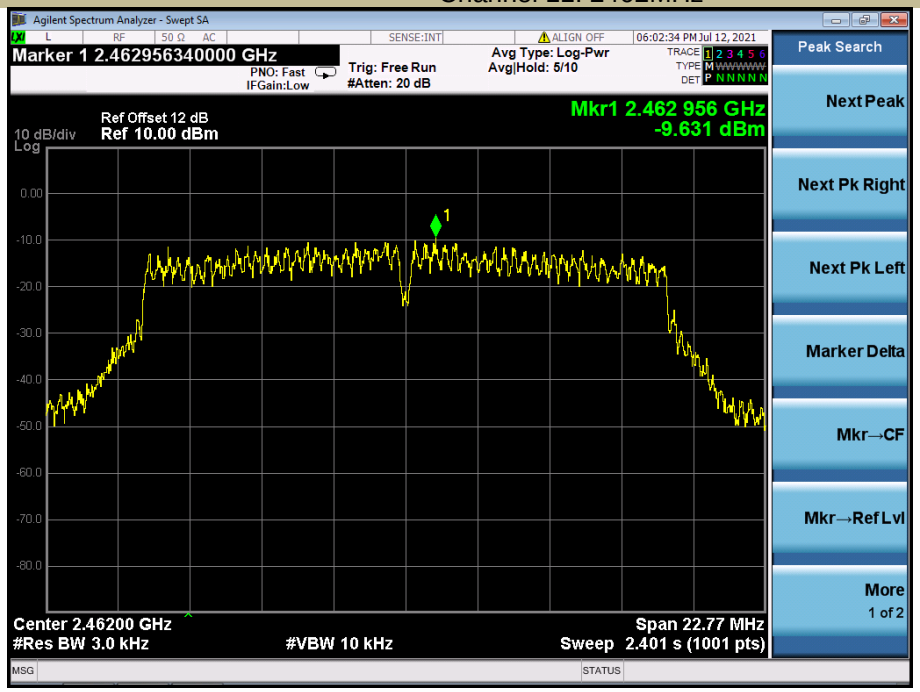
Test Model	Power Spectral Density 802.11g Channel 1: 2412MHz



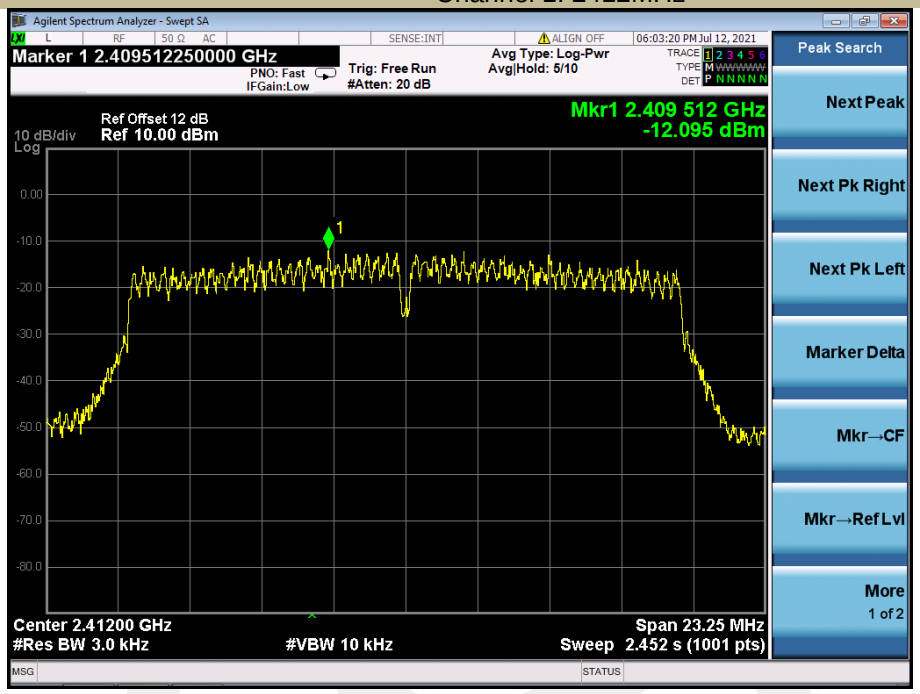
Test Model	Power Spectral Density 802.11g Channel 6: 2437MHz



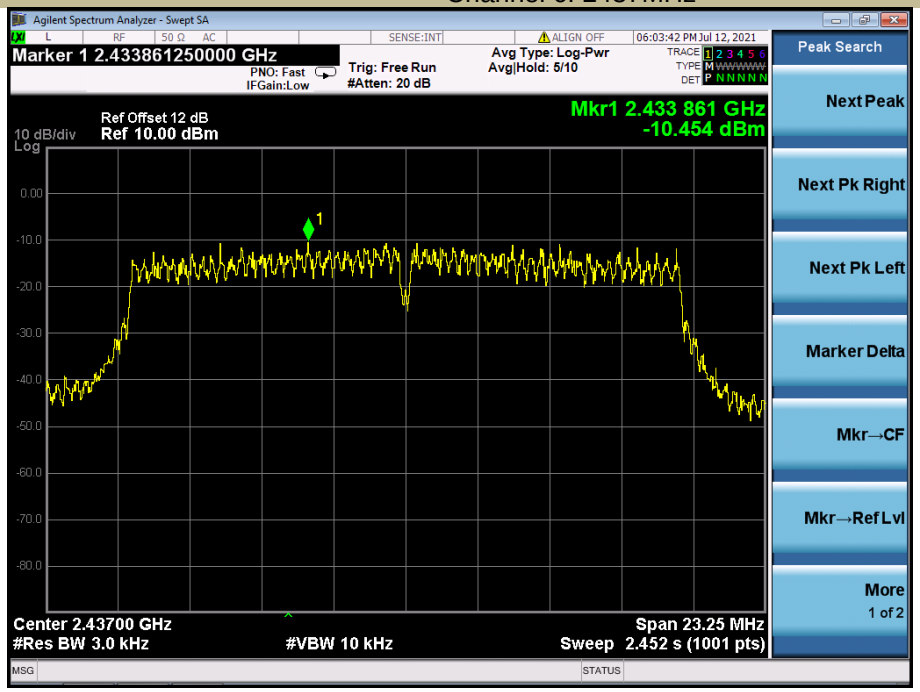
Test Model	Power Spectral Density 802.11g Channel 11: 2462MHz



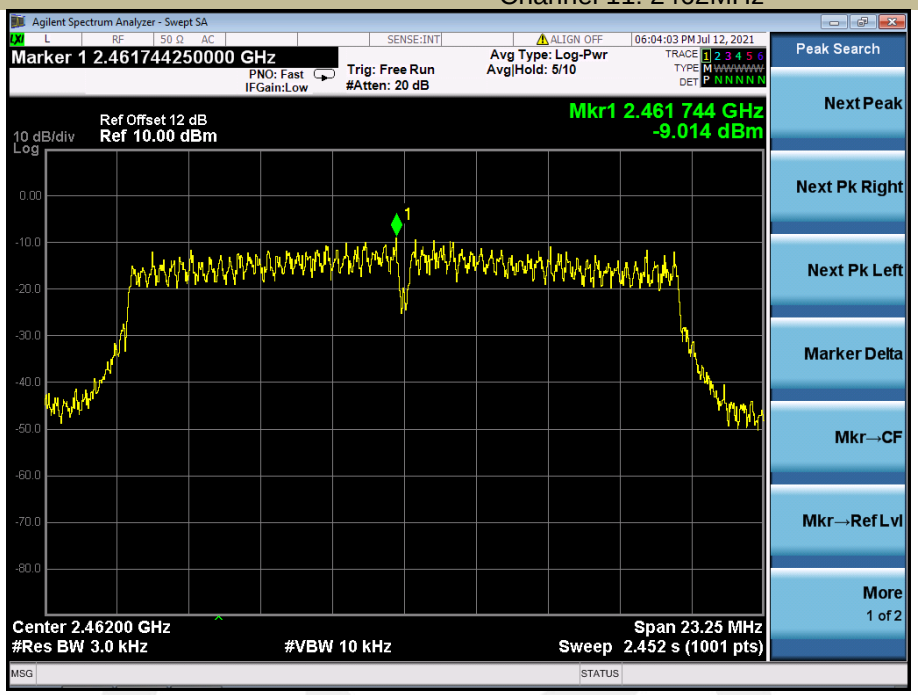
Test Model	Power Spectral Density 802.11n (HT20) Channel 1: 2412MHz



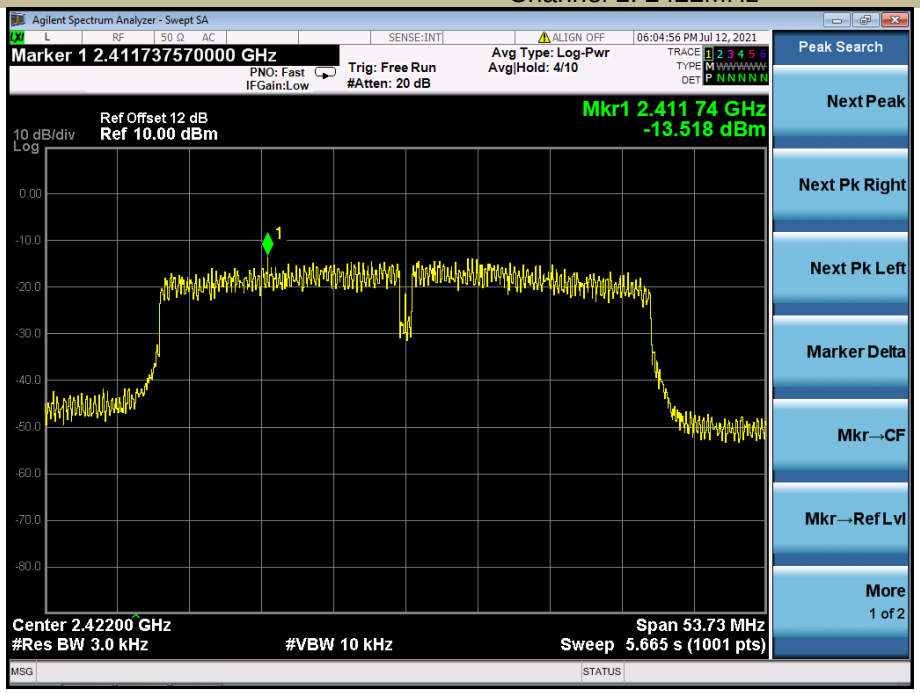
Test Model	Power Spectral Density 802.11n (HT20) Channel 6: 2437MHz



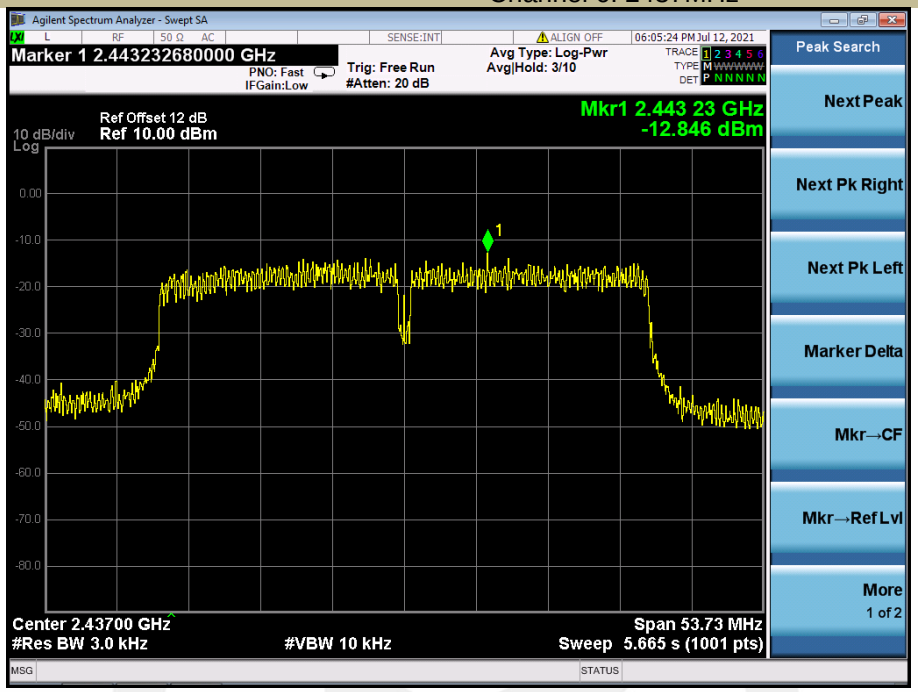
Test Model	Power Spectral Density 802.11n (HT20) Channel 11: 2462MHz



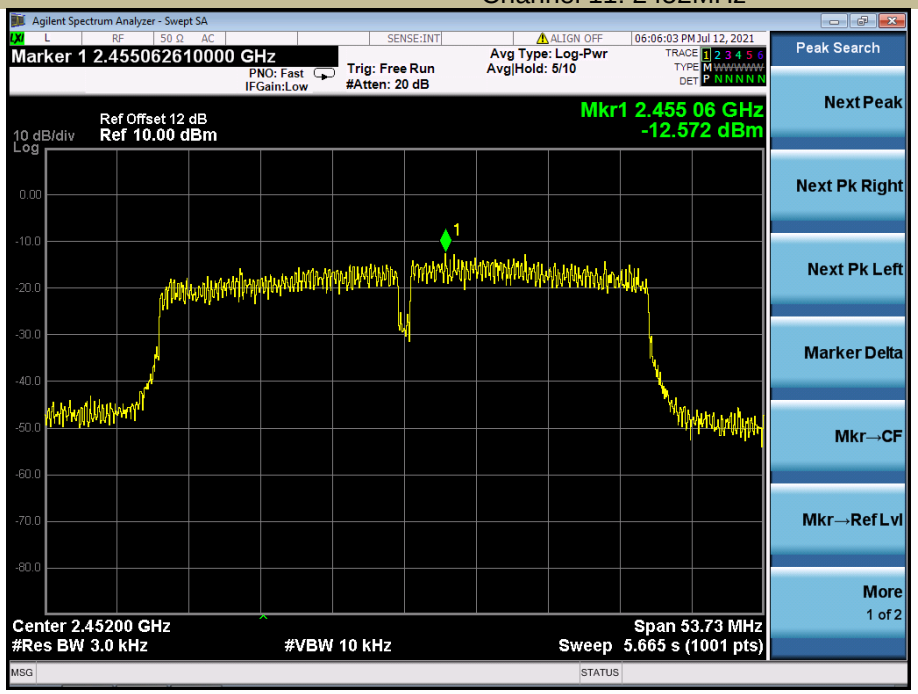
Test Model	Power Spectral Density 802.11n (40MHz) Channel 1: 2422MHz



Test Model	Power Spectral Density 802.11n (40MHz) Channel 6: 2437MHz



Test Model	Power Spectral Density 802.11n (40MHz) Channel 11: 2452MHz



8.4 UNWANTED EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS

8.4.1 Applicable Standard

According to FCC Part15.247(d) and KDB 558074 D01 15.247 Meas Guidance v05r02

8.4.2 Conformance Limit

According to FCC Part 15.247(d):
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

8.4.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

8.4.4 Test Procedure

The transmitter output (antenna port) was connected to the spectrum analyzer

- **Reference level measurement**

Establish a reference level by using the following procedure:
Set instrument center frequency to DTS channel center frequency.
Set the span to ≥ 1.5 times the DTS bandwidth.
Set the RBW = 100 kHz.
Set the VBW ≥ 3 x RBW.
Set Detector = peak.
Set Sweep time = auto couple.
Set Trace mode = max hold.
Allow trace to fully stabilize.
Use the peak marker function to determine the maximum PSD level.
Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

- **Emission level measurement**

Set the center frequency and span to encompass frequency range to be measured.
Set the RBW = 100 kHz.
Set the VBW =300 kHz.
Set Detector = peak
Sweep time = auto couple.
Trace mode = max hold.
Allow trace to fully stabilize.
Use the peak marker function to determine the maximum amplitude level.
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements . Report the three highest emissions relative to the limit.

8.4.5 Test Results

Module AP6356S 1T1R- Antenna 1

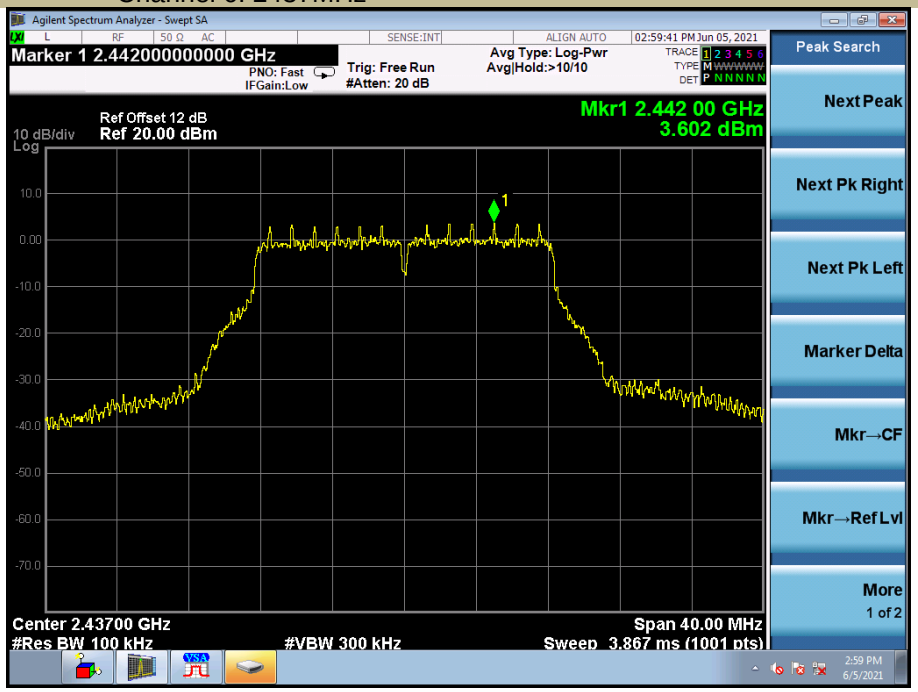
All modes 2.4G 802.11b/g/n/ax have been tested, and the worst result 802.11g recorded was report as below:

PSD(Power Spectral Density) RBW=100kHz				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
	☒Channel 1: 2412MHz	☐Channel 3: 2422MHz		

Unwanted Emissions in non-restricted frequency bands				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
	☒Channel 1: 2412MHz	☐Channel 3: 2422MHz		

Band edge				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
	☒Channel 1: 2412MHz	☐Channel 3: 2422MHz		

PSD(Power Spectral Density) RBW=100kHz				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
	Channel 6: 2437MHz			



Unwanted Emissions In Non-Restricted Frequency Bands				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
Channel 6: 2437MHz				

PSD(Power Spectral Density) RBW=100kHz				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
☒Channel 11: 2462MHz	☐Channel 9: 2452MHz			

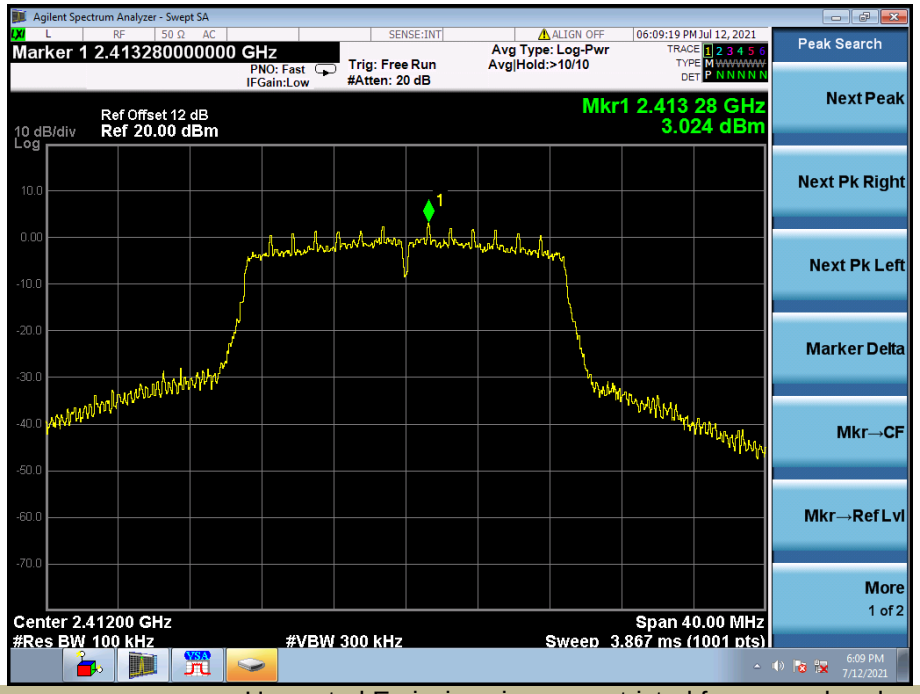
Unwanted Emissions In Non-Restricted Frequency Bands				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
☒Channel 11: 2462MHz	☐Channel 9: 2452MHz			

Band edge				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
☒Channel 11: 2462MHz	☐Channel 9: 2452MHz			

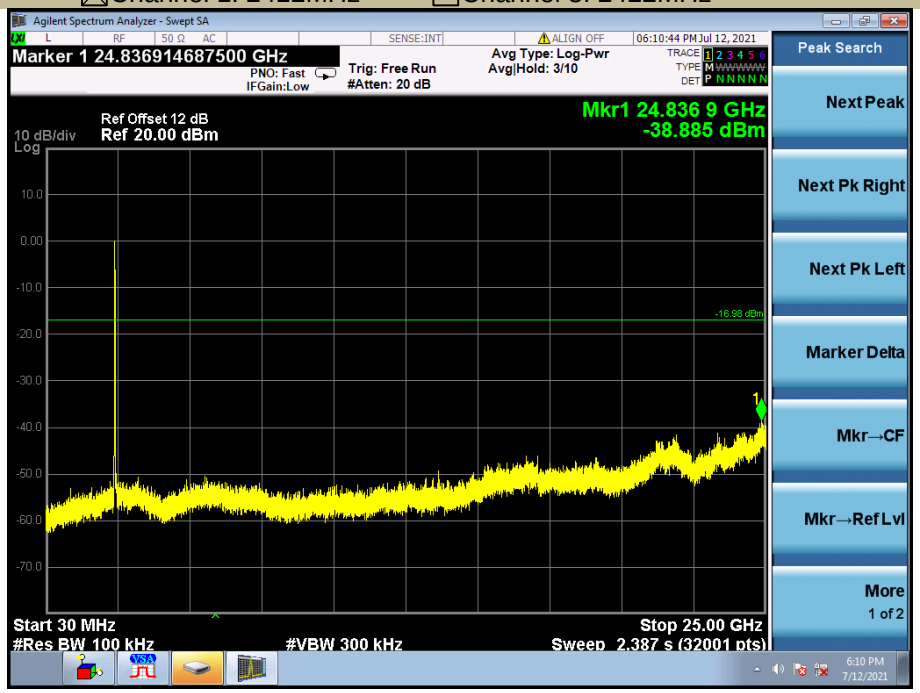
Module ESP32-S

All modes 2.4G 802.11b/g/n/n40 have been tested, and the worst result 802.11g recorded was report as below:

PSD(Power Spectral Density) RBW=100kHz				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
	☒Channel 1: 2412MHz	☐Channel 3: 2422MHz		

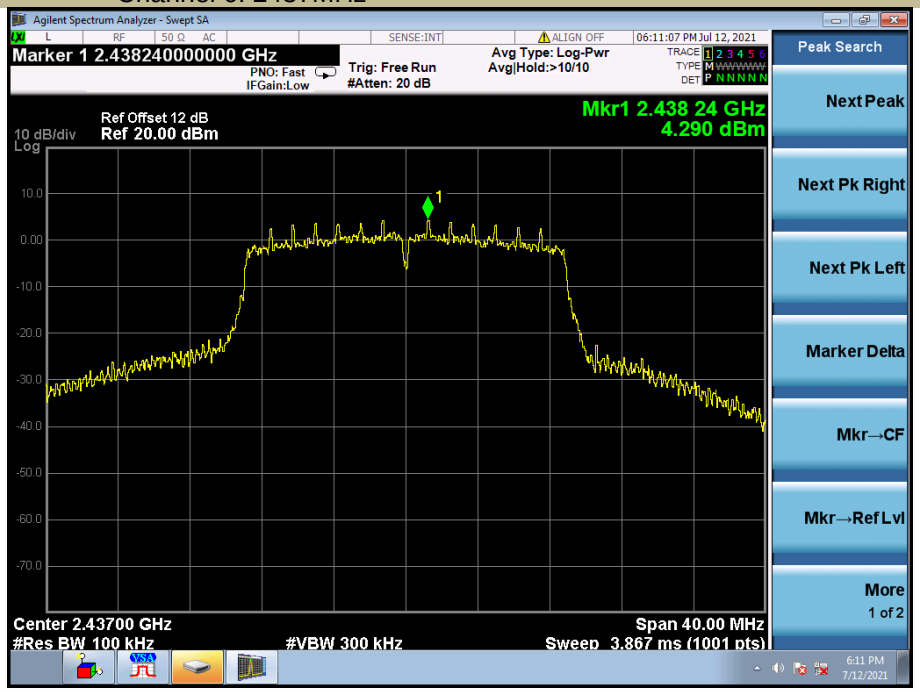


Unwanted Emissions in non-restricted frequency bands				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
	☒Channel 1: 2412MHz	☐Channel 3: 2422MHz		



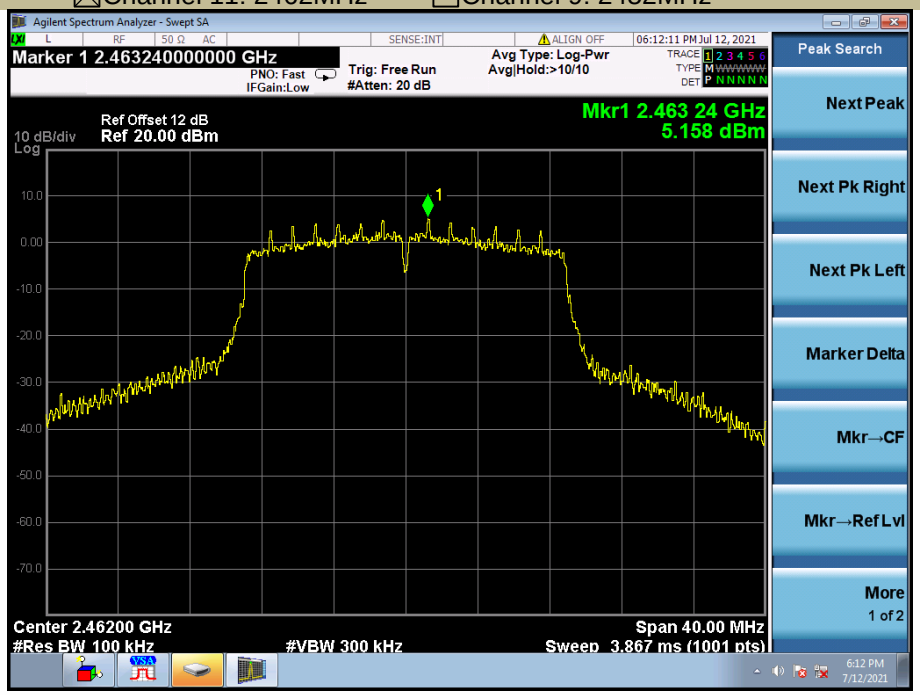
Band edge				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
	☒Channel 1: 2412MHz	☐Channel 3: 2422MHz		

PSD(Power Spectral Density) RBW=100kHz				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
	Channel 6: 2437MHz			



Unwanted Emissions In Non-Restricted Frequency Bands				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
Channel 6: 2437MHz				

PSD(Power Spectral Density) RBW=100kHz				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
☒Channel 11: 2462MHz	☐Channel 9: 2452MHz			



Unwanted Emissions In Non-Restricted Frequency Bands				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
☒Channel 11: 2462MHz	☐Channel 9: 2452MHz			

Band edge				
Test Model	☐802.11b	☒802.11g	☐802.11n(HT20)	☐802.11n(HT40)
☒Channel 11: 2462MHz	☐Channel 9: 2452MHz			

8.5 RADIATED SPURIOUS EMISSION

8.5.1 Applicable Standard

According to FCC Part 15.247(d) and 15.209 and KDB 558074 D01 15.247 Meas Guidance v05r02

8.5.2 Conformance Limit

According to FCC Part 15.247(d): radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
According to FCC Part15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	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	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			

According to FCC Part15.205,the level of any transmitter spurious emission in Restricted bands shall not exceed the level of the emission specified in the following table

Restricted Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance
0.009-0.490	2400/F(KHz)	20 log (uV/m)	300
0.490-1.705	24000/F(KHz)	20 log (uV/m)	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

8.5.3 Test Configuration

Test according to clause 7.2 radio frequency test setup 2

8.5.4 Test Procedure

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:
The EUT was placed on a turn table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz(1GHz to 25GHz), 100 kHz for f < 1 GHz(30MHz to 1GHz), 200Hz for f<150KHz(9KHz to 150KHz), 9KHz for f<30MHz(150KHz to 30KHz)
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the

measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.
Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.
Repeat above procedures until all frequency measured was complete.

8.5.5 Test Results

Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

■ Spurious Emission below 30MHz(9KHz to 30MHz)

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
--	--	--	--	--	--	--	--

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor

Module AP6356S

■ Spurious Emission Above 1GHz(1GHz to 25GHz)

All modes 2.4G 802.11b/g/n/ax have been tested, and the worst result 802.11b was recorded as below:

Test mode: 802.11 b Frequency: Channel 1: 2412MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4929.296	V	45.56	28.56	74	54	-28.44	-25.44
10914.02	V	53.90	35.90	74	54	-20.10	-18.10
17963.61	V	64.12	46.12	74	54	-9.88	-7.88
5077.518	H	44.97	26.94	74	54	-29.03	-27.06
11363.07	H	53.37	35.37	74	54	-20.63	-18.63
17979.2	H	64.25	46.25	74	54	-9.75	-7.75

Test mode: 802.11 b Frequency: Channel 6: 2437MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4663.196	V	45.04	27.04	74	54	-28.96	-26.96
10989.99	V	54.89	36.89	74	54	-19.11	-17.11
17981.8	V	64.08	46.08	74	54	-9.92	-7.92
4813.144	H	44.73	26.73	74	54	-29.27	-27.27
10928.22	H	53.84	35.84	74	54	-20.16	-18.16
17891.07	H	63.84	45.84	74	54	-10.16	-8.16

Test mode: 802.11 b Frequency: Channel 11: 2462MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4970.069	V	44.64	26.64	74	54	-29.36	-27.36
10692.33	V	53.66	35.66	74	54	-20.34	-18.34
17981.8	V	64.47	46.47	74	54	-9.53	-7.53
4960.023	H	44.97	26.97	74	54	-29.03	-27.03
10707.79	H	55.17	35.17	74	54	-18.83	-18.83
17948.04	H	63.54	45.54	74	54	-10.46	-8.46

Note: (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor.
(3) Correct Factor= Ant_F + Cab_L - Preamp
(4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

■ Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

All modes 2.4G 802.11b/g/n/ax have been tested, and the worst result 802.11b was recorded as below:

Test mode: 802.11 b Frequency: Channel 1: 2412MHz

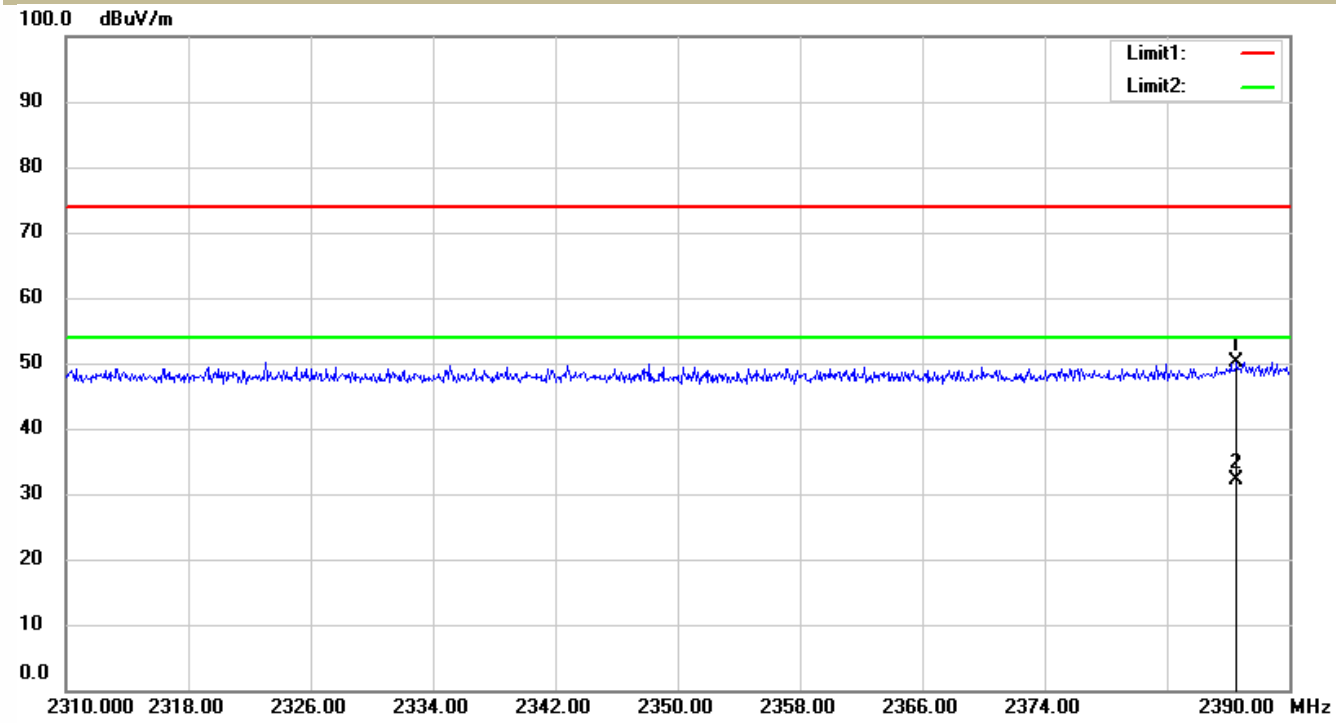
Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	Over(dB)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)	Over(dB)
2386.620	H	50.05	74	-23.95	32.05	54	-21.95
2387.768	V	52.28	74	-21.72	34.28	54	-19.72

Test mode: 802.11 b Frequency: Channel 11: 2462MHz

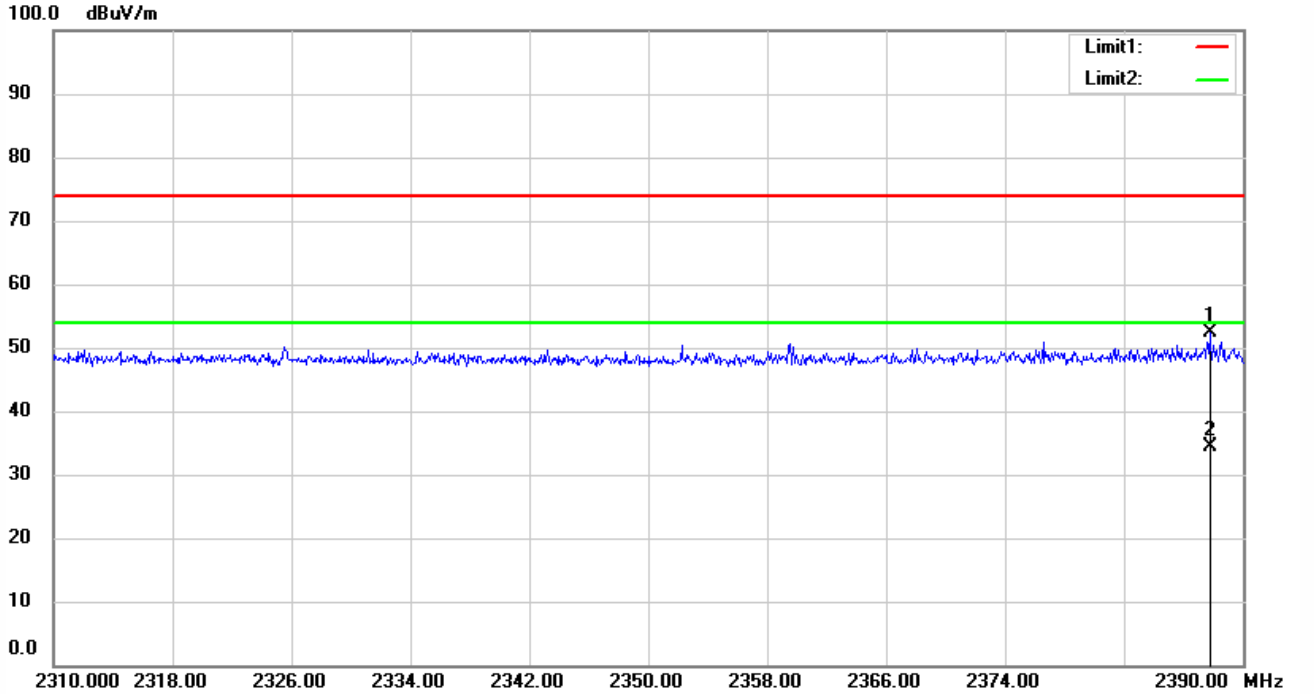
Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	Over(dB)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)	Over(dB)
2483.541	H	54.06	74	-19.94	36.06	54	-19.94
2483.827	V	50.27	74	-23.73	32.27	54	-21.73

Note: (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor.
(3) Correct Factor= Ant_F + Cab_L - Preamp
(4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

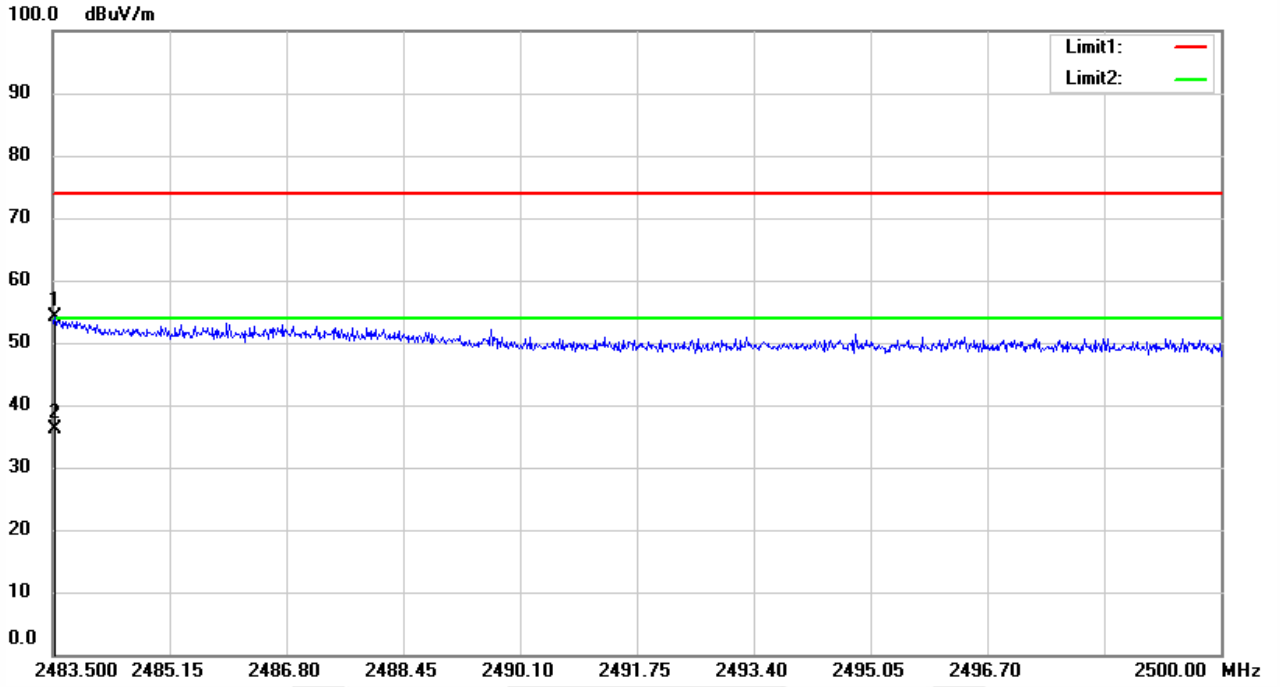
Test Model	Spurious Emission in Restricted Band 2310-2390MHz ☒802.11b ☐802.11g ☐802.11n(HT20) ☐802.11n(HT40) ☒Channel 1: 2412MHz ☐Channel 3: 2422MHz Polarity: H VBW=3MHz



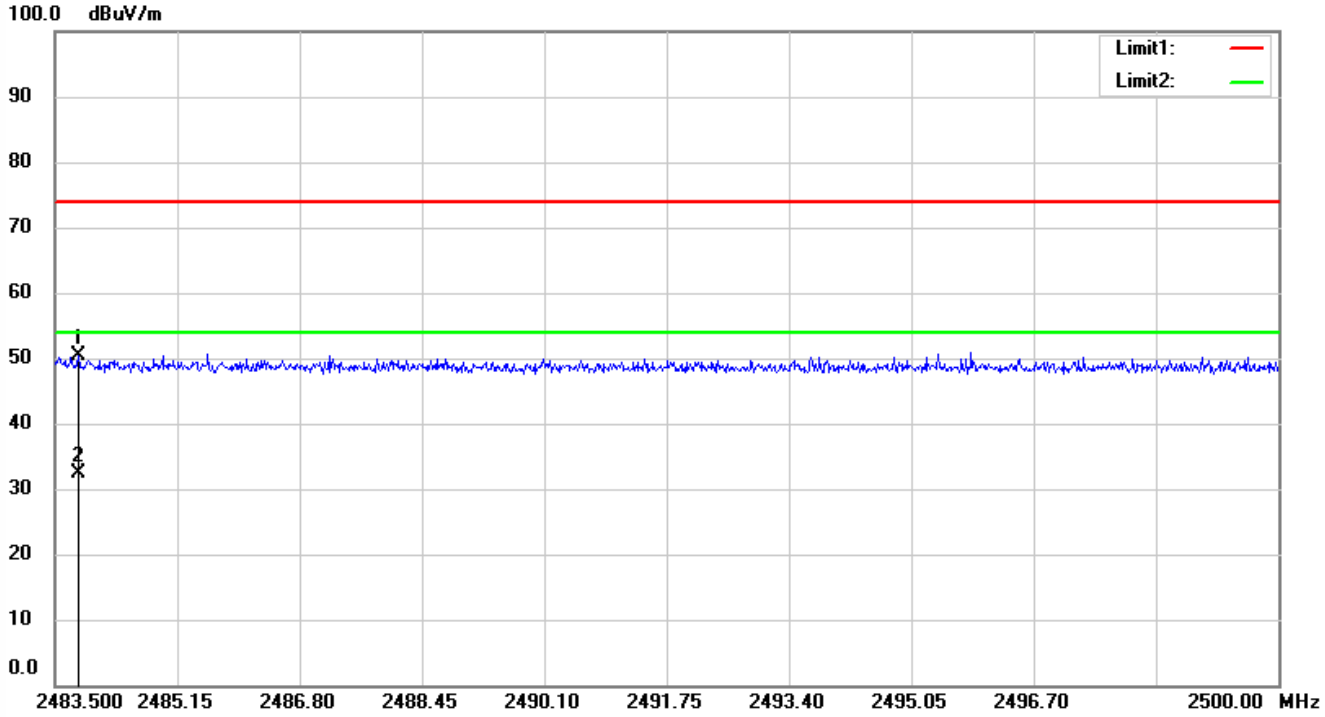
Test Model	Spurious Emission in Restricted Band 2310-2390MHz ☒802.11b ☐802.11g ☐802.11n(HT20) ☐802.11n(HT40) ☒Channel 1: 2412MHz ☐Channel 3: 2422MHz Polarity:V VBW=3MHz



Test Model	Spurious Emission in Restricted Band 2483.5-2500MHz ☒802.11b ☐802.11g ☐802.11n(HT20) ☐802.11n(HT40) ☒Channel 11: 2462MHz ☐Channel 9: 2452MHz Polarity: H VBW=3MHz

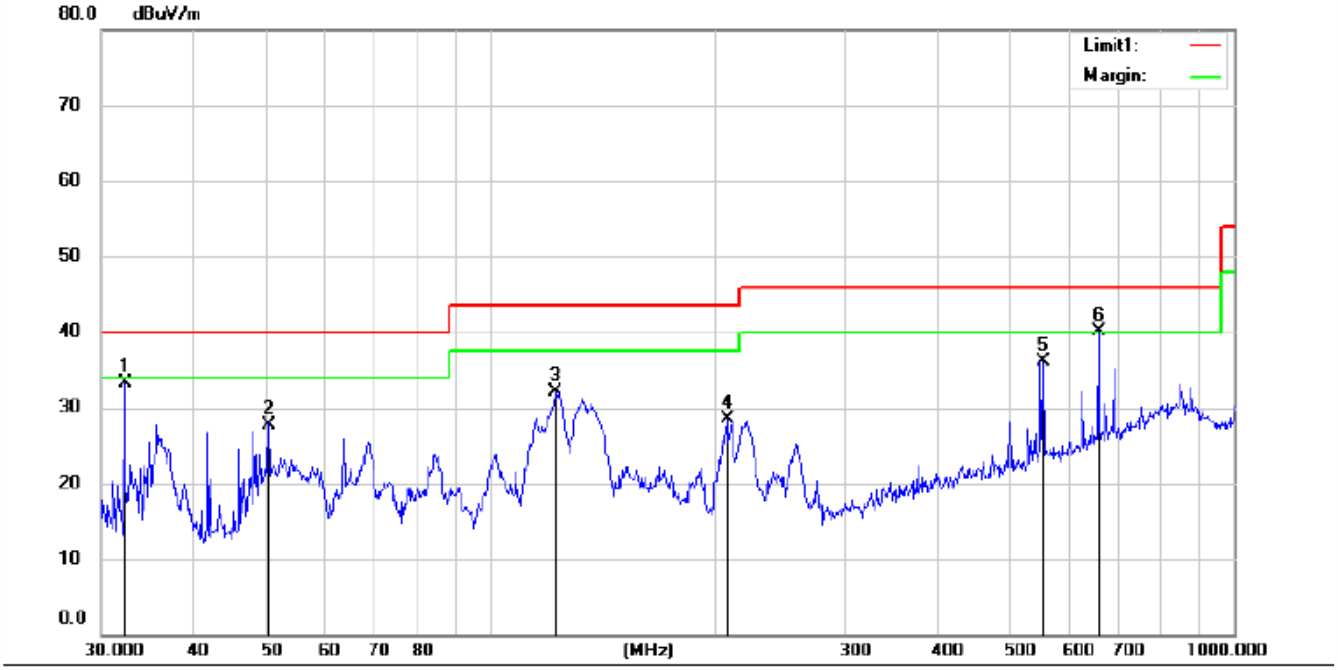


Test Model	Spurious Emission in Restricted Band2483.5-2500MHz ☒802.11b ☐802.11g ☐802.11n(HT20) ☐802.11n(HT40) ☒Channel 11: 2462MHz ☐Channel 9: 2452MHz Polarity: V VBW=3MHz



■ Spurious Emission below 1GHz (30MHz to 1GHz)

All modes 2.4G 802.11b/g/n have been tested, and the worst result 802.11b was recorded as below:



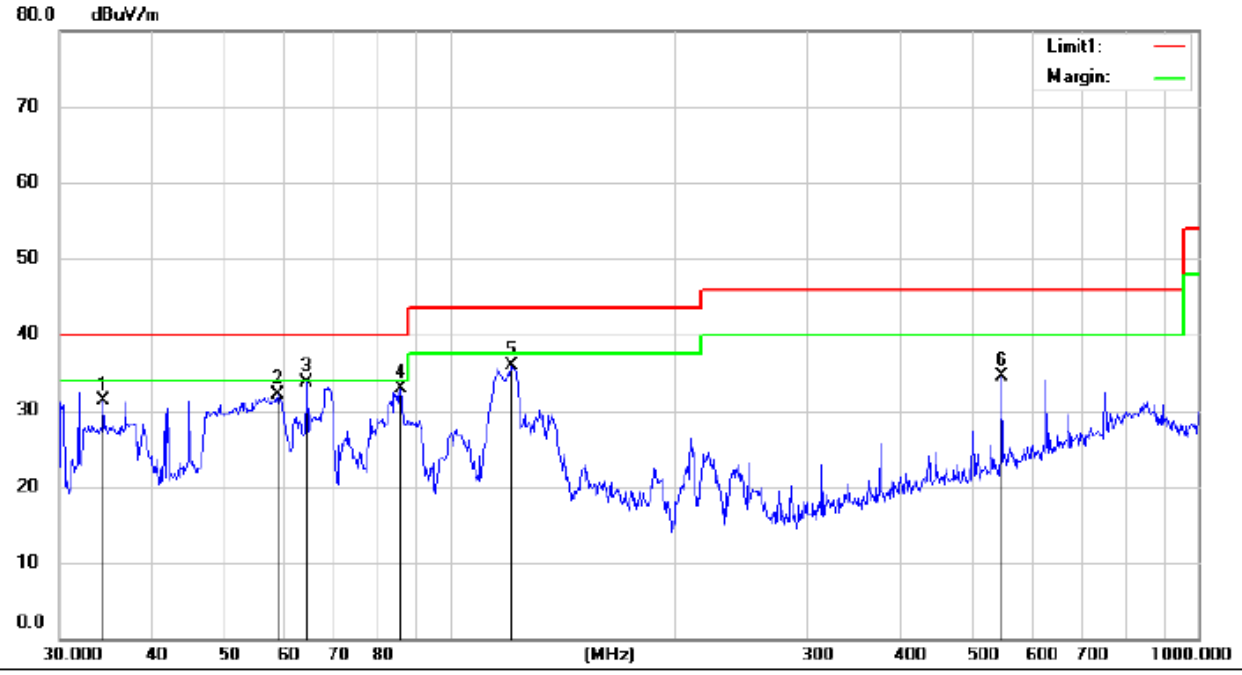
Site 3m Chamber #1 Polarization: *Vertical* Temperature: 29.5 C

Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 48 %

Mode:WIFI 2.4G 2412

Note: BIG

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		32.2218	47.71	-14.43	33.28	40.00	-6.72	QP			
2		50.2765	39.77	-11.97	27.80	40.00	-12.20	QP			
3		122.4577	46.56	-14.37	32.19	43.50	-11.31	QP			
4		208.3975	42.11	-13.52	28.59	43.50	-14.91	QP			
5		552.8832	40.09	-3.95	36.14	46.00	-9.86	QP			
6	*	657.3938	41.67	-1.65	40.02	46.00	-5.98	QP			



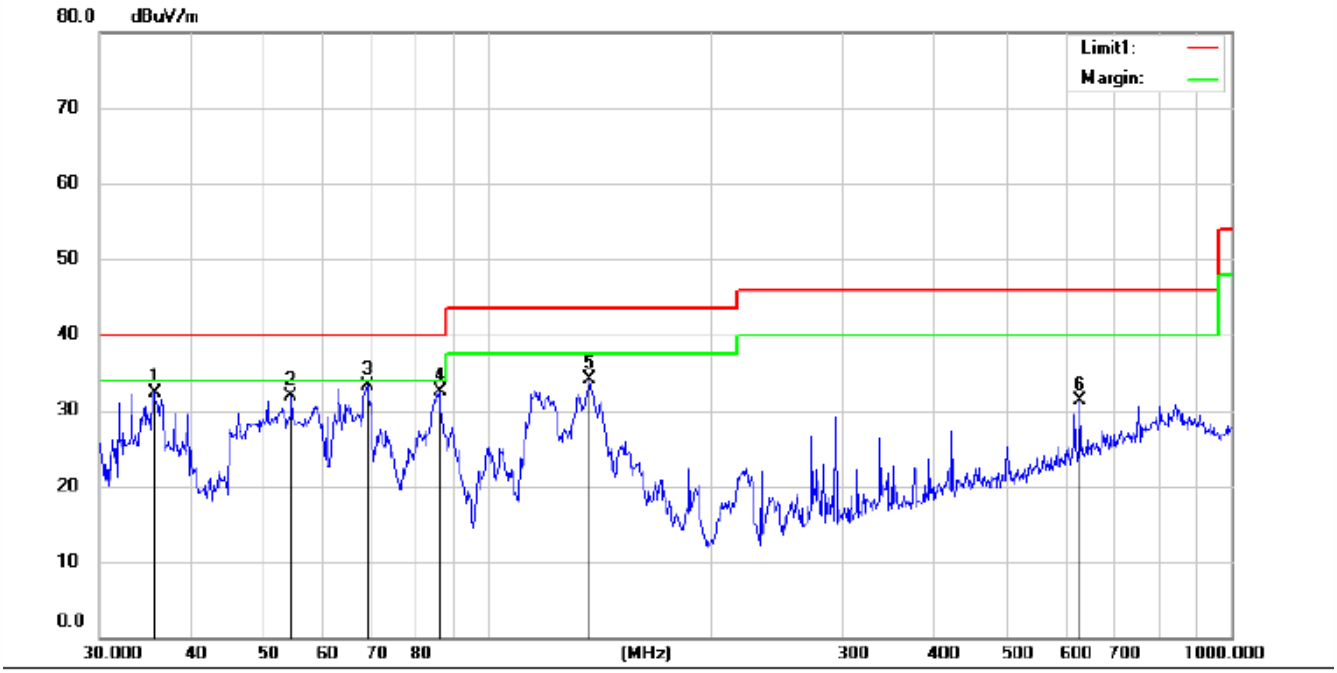
Site 3m Chamber #1 Polarization: *Horizontal* Temperature: 29.5 C

Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 48 %

Mode:WIFI 2.4G 2412

Note: BIG

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		34.3663	45.33	-14.03	31.30	40.00	-8.70	QP			
2		58.6640	44.25	-12.06	32.19	40.00	-7.81	QP			
3	*	64.3484	45.76	-12.09	33.67	40.00	-6.33	QP			
4		85.8231	48.47	-15.48	32.99	40.00	-7.01	QP			
5		120.9640	50.29	-14.36	35.93	43.50	-7.57	QP			
6		545.4215	38.71	-4.22	34.49	46.00	-11.51	QP			



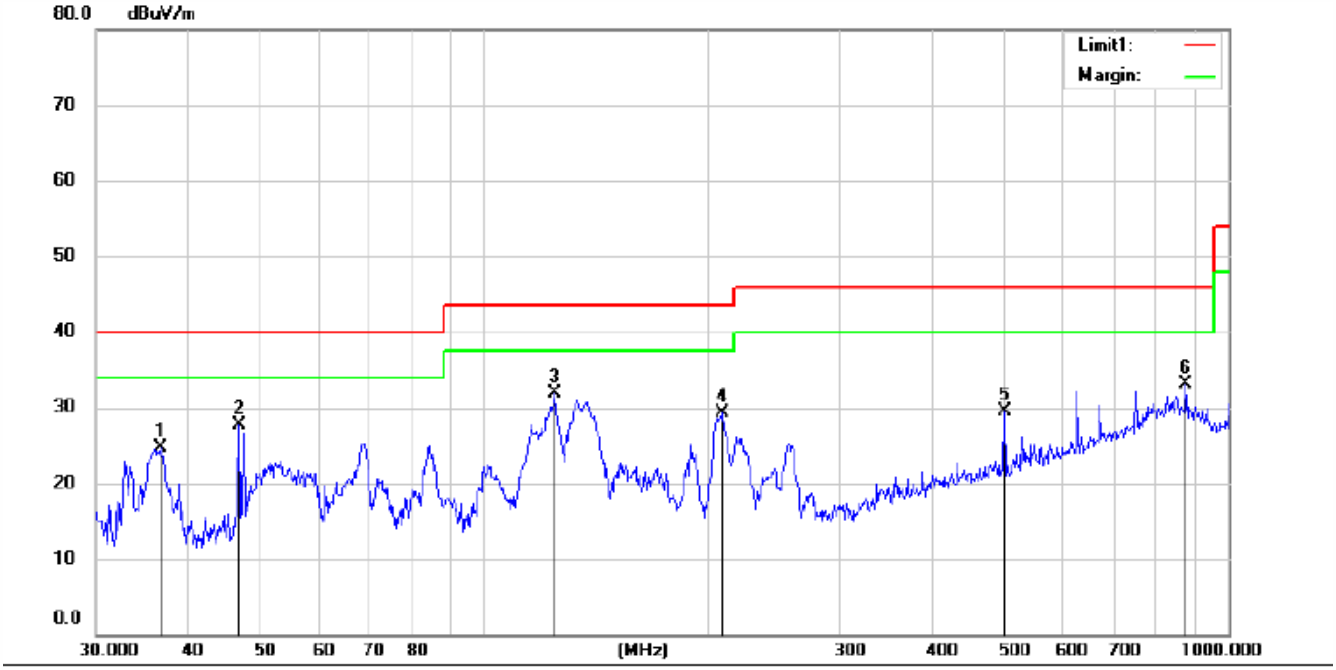
Site 3m Chamber #1 Polarization: *Horizontal* Temperature: 29.5 C

Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 48 %

Mode:WIFI 2.4G 2437

Note: BIG

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		35.5615	45.99	-13.66	32.33	40.00	-7.67	QP			
2		54.3086	43.86	-11.97	31.89	40.00	-8.11	QP			
3	*	68.7214	46.13	-12.89	33.24	40.00	-6.76	QP			
4		86.0114	48.02	-15.49	32.53	40.00	-7.47	QP			
5		137.2395	48.42	-14.30	34.12	43.50	-9.38	QP			
6		625.0780	33.87	-2.49	31.38	46.00	-14.62	QP			



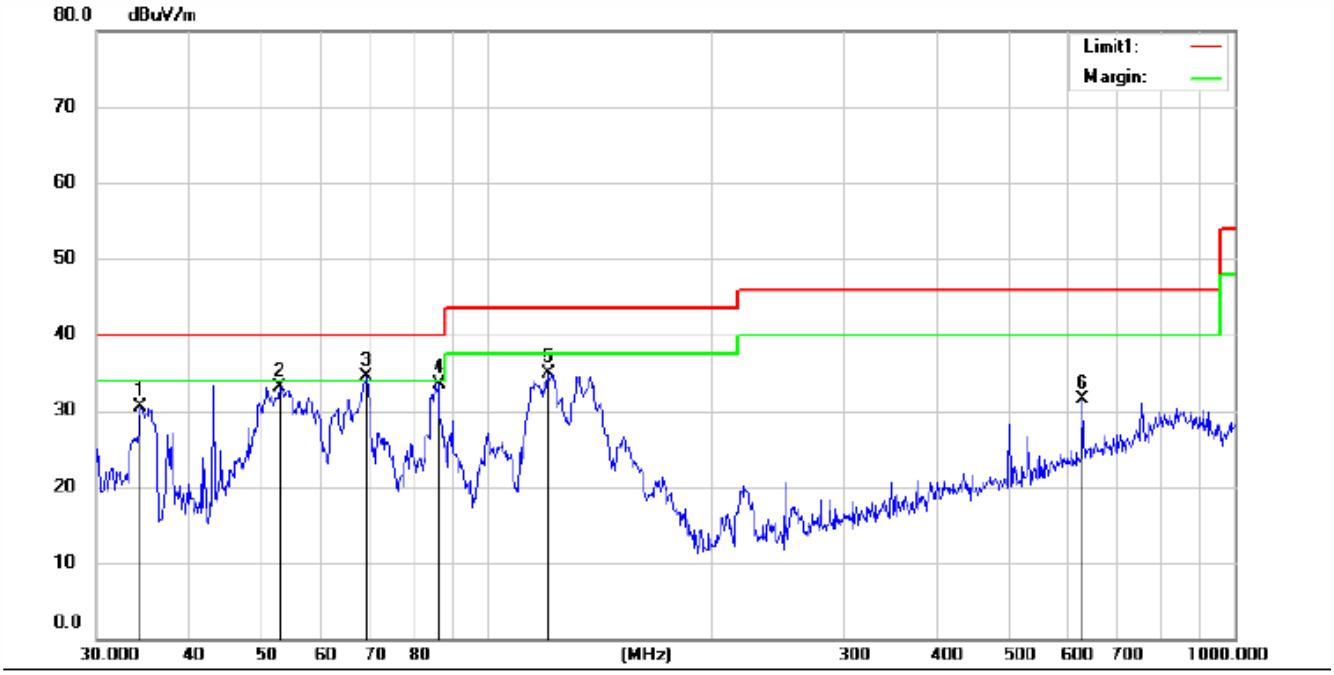
Site 3m Chamber #1 Polarization: *Vertical* Temperature: 29.5 C

Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 48 %

Mode:WIFI 2.4G 2437

Note: BIG

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		36.6054	38.18	-13.46	24.72	40.00	-15.28	QP			
2		46.7688	40.21	-12.47	27.74	40.00	-12.26	QP			
3	*	124.1330	46.22	-14.39	31.83	43.50	-11.67	QP			
4		208.2148	42.75	-13.53	29.22	43.50	-14.28	QP			
5		500.0818	34.39	-4.93	29.46	46.00	-16.54	QP			
6		875.2470	31.41	1.76	33.17	46.00	-12.83	QP			



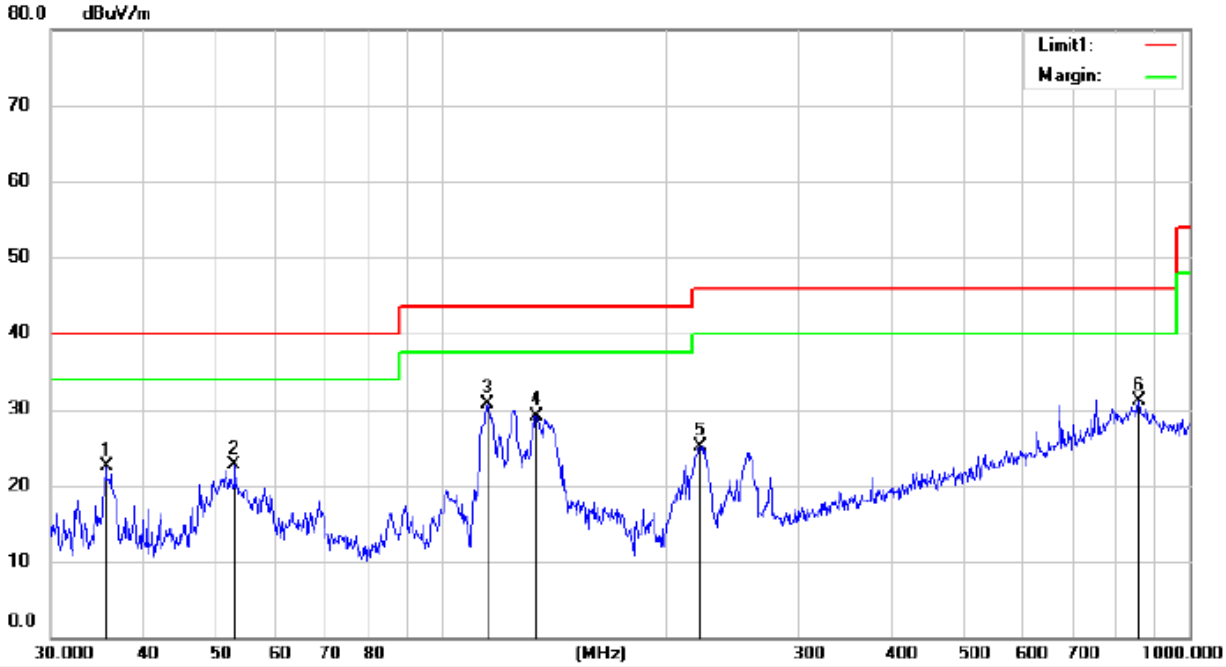
Site 3m Chamber #1 Polarization: *Horizontal* Temperature: 29.5 C

Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 48 %

Mode:WIFI 2.4G 2462

Note: BIG

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		34.3663	44.48	-14.03	30.45	40.00	-9.55	QP			
2		52.5984	45.00	-11.83	33.17	40.00	-6.83	QP			
3	*	68.9023	47.45	-12.93	34.52	40.00	-5.48	QP			
4		85.8984	49.02	-15.49	33.53	40.00	-6.47	QP			
5		121.0170	49.30	-14.36	34.94	43.50	-8.56	QP			
6		625.0780	33.96	-2.49	31.47	46.00	-14.53	QP			



Site 3m Chamber #1 Polarization: *Vertical* Temperature: 29.5 C

Limit: (RE)FCC PART 15 CLASS B Power: AC 120V/60Hz Humidity: 48 %

Mode:WIFI 2.4G 2462

Note: BIG

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		35.5772	36.11	-13.66	22.45	40.00	-17.55	QP			
2		52.8063	34.62	-11.84	22.78	40.00	-17.22	QP			
3	*	115.0177	44.98	-14.21	30.77	43.50	-12.73	QP			
4		133.6774	43.38	-14.20	29.18	43.50	-14.32	QP			
5		221.6834	38.19	-13.03	25.16	46.00	-20.84	QP			
6		854.3992	28.44	2.61	31.05	46.00	-14.95	QP			

Module ESP32-S

- Spurious Emission Above 1GHz(1GHz to 25GHz)
- All modes 2.4G 802.11b/g/n have been tested, and the worst result of 802.11b recorded was report as below:

Test mode: 802.11 b Frequency: Channel 1: 2412MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
5118.04	V	46.49	31.25	74	54	-27.51	-22.75
7833.26	V	51.25	37.25	74	54	-22.75	-16.75
17896.24	V	63.70	45.25	74	54	-10.30	-8.75
5480.92	H	46.89	31.02	74	54	-27.11	-22.98
11888.87	H	58.07	41.25	74	54	-15.93	-12.75
17296.16	H	62.61	46.02	74	54	-11.39	-7.98

Test mode: 802.11 b Frequency: Channel 6: 2437MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
5406.18	V	47.69	32.25	74	54	-26.31	-21.75
11366.36	V	57.70	42.14	74	54	-16.30	-11.86
17911.77	V	61.67	45.96	74	54	-12.33	-8.04
6726.51	H	49.05	34.05	74	54	-24.95	-19.95
11659.17	H	57.61	41.52	74	54	-16.39	-12.48
17997.39	H	61.90	45.24	74	54	-12.10	-8.76

Test mode: 802.11 b Frequency: Channel 11: 2462MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
7806.13	V	51.33	38.21	74	54	-22.67	-15.79
11706.44	V	57.87	40.54	74	54	-16.13	-13.46
17909.18	V	61.52	45.26	74	54	-12.48	-8.74
8080.47	H	51.39	35.29	74	54	-22.61	-18.71
13280.60	H	58.95	42.00	74	54	-15.05	-12.00
17992.19	H	62.80	45.95	74	54	-11.20	-8.05

Note: (1) All Readings are Peak Value (VBW=3MHz) and Peak Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor +Cable Loss.
(3) Correct Factor= Ant_F + Cab_L - Preamp
(4)The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

■ Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

All modes 2.4G 802.11b/g/n have been tested, and the worst result of 802.11b recorded was report as below:

Test mode: 802.11 b Frequency: Channel 1: 2412MHz

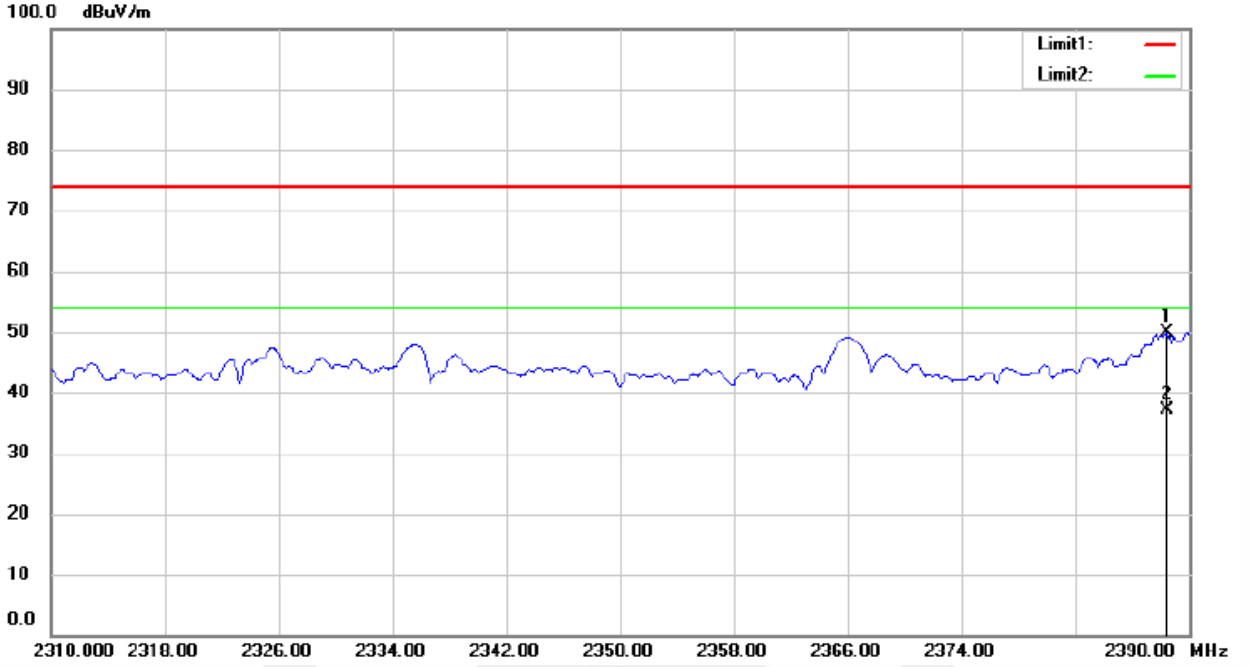
Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2388.480	V	50.00	74	37.24	54
2388.716	H	50.29	74	36.99	54

Test mode: 802.11 b Frequency: Channel 11: 2462MHz

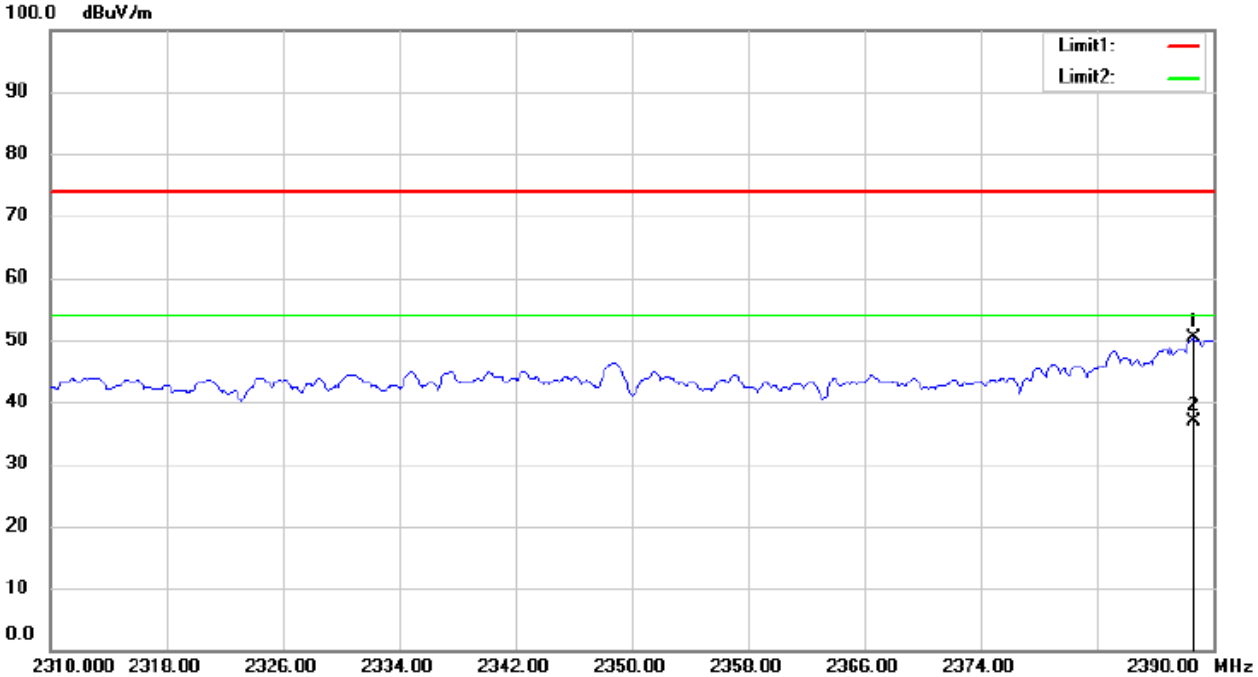
Frequency (MHz)	Polarity	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2483.582	V	50.06	74	36.58	54
2483.500	H	48.73	74	35.02	54

Note: (1) All Readings are Peak Value (VBW=3MHz) and Peak Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor +Cable Loss.
(3) Correct Factor= Ant_F + Cab_L - Preamp
(4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

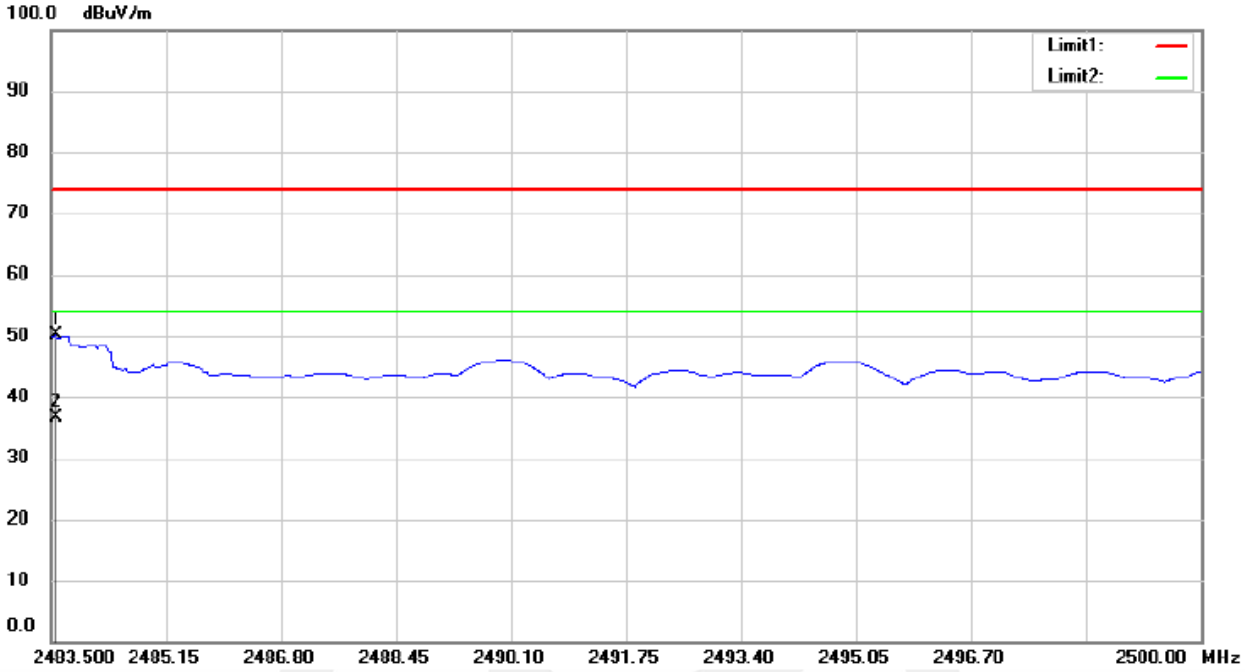
Test Model	Spurious Emission in Restricted Band 2310-2390MHz ☒802.11b ☐802.11g ☐802.11n(HT20) ☐802.11n(HT40) ☒Channel 1: 2412MHz ☐Channel 3: 2422MHz Polarity: H VBW=3MHz



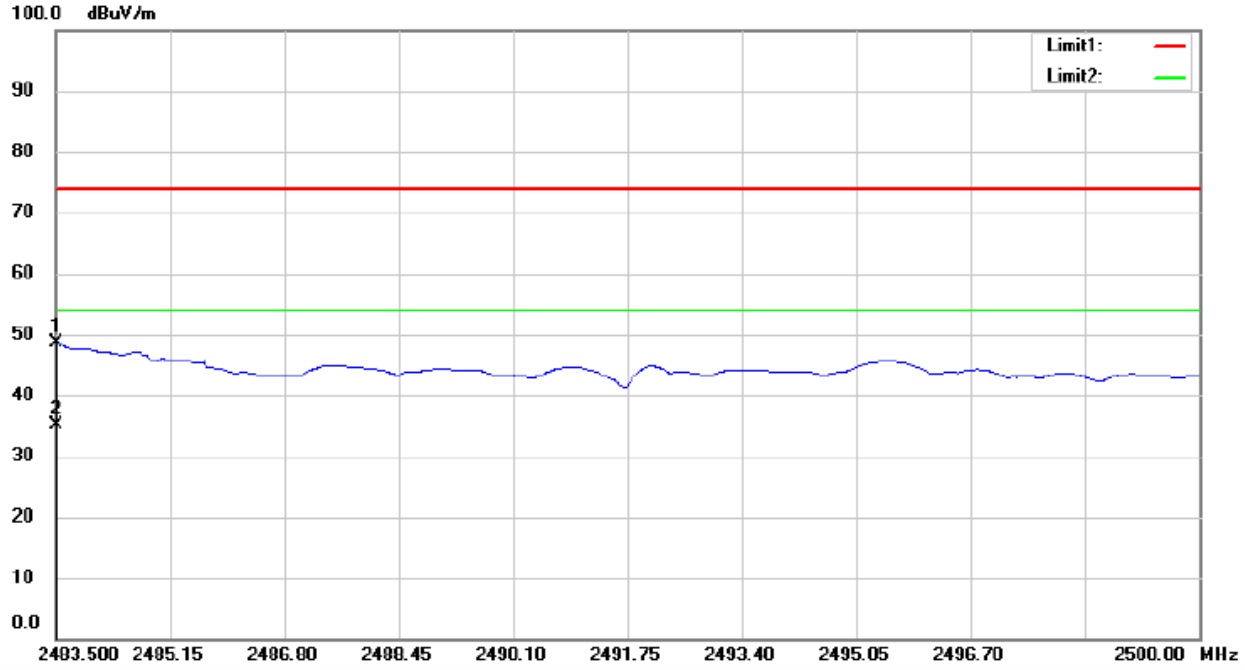
Test Model	Spurious Emission in Restricted Band 2310-2390MHz ☒802.11b ☐802.11g ☐802.11n(HT20) ☐802.11n(HT40) ☒Channel 1: 2412MHz ☐Channel 3: 2422MHz Polarity:V VBW=3MHz



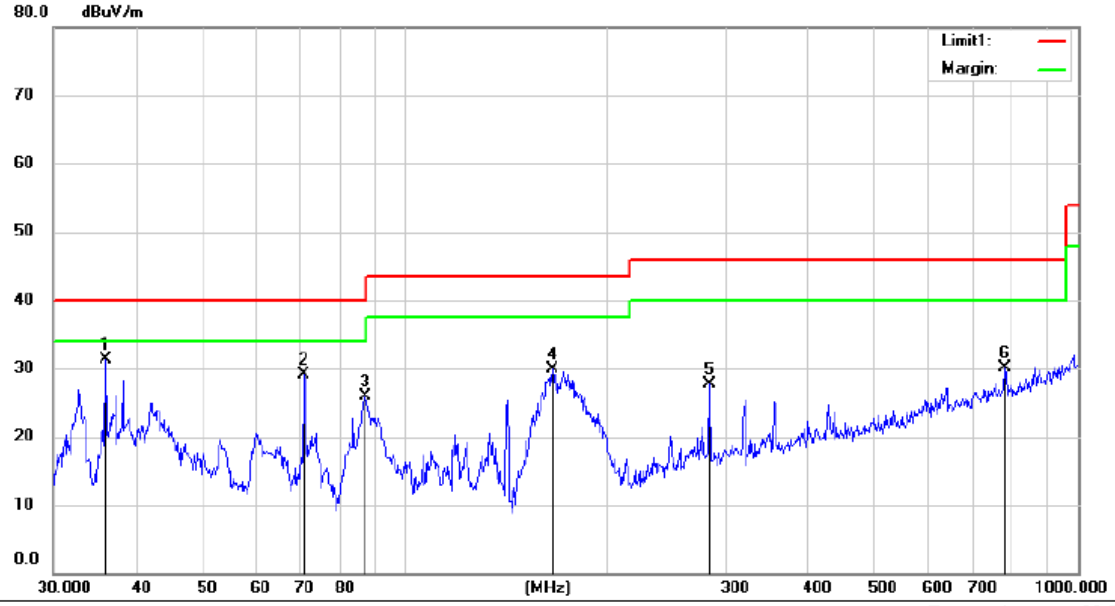
Test Model	Spurious Emission in Restricted Band 2483.5-2500MHz ☒802.11b ☐802.11g ☐802.11n(HT20) ☐802.11n(HT40) ☒Channel 11: 2462MHz ☐Channel 9: 2452MHz Polarity: H VBW=3MHz



Test Model	Spurious Emission in Restricted Band2483.5-2500MHz ☒802.11b ☐802.11g ☐802.11n(HT20) ☐802.11n(HT40) ☒Channel 11: 2462MHz ☐Channel 9: 2452MHz Polarity: V VBW=3MHz



- Spurious Emission below 1GHz (30MHz to 1GHz)
- All modes 2.4G 802.11b/g/n have been tested, and the worst result of 802.11b recorded was report as below:



Site 3m Chamber #1
Limit: (RE)FCC PART 15 C
Mode: TX Low
Note:

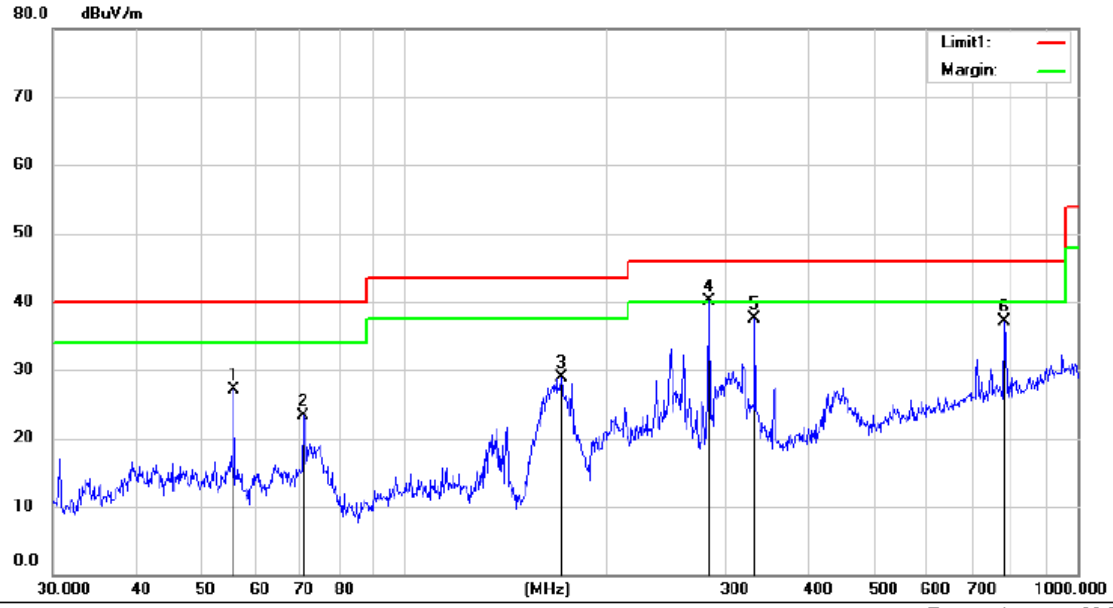
Polarization: *Vertical*
Power: AC 120V/60Hz

Temperature: 29.5 C
Humidity: 48 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	35.9061	44.92	-13.52	31.40	40.00	-8.60	QP			
2		71.0492	44.70	-15.66	29.04	40.00	-10.96	QP			
3		87.1500	41.51	-15.63	25.88	40.00	-14.12	QP			
4		165.9953	44.18	-14.36	29.82	43.50	-13.68	QP			
5		283.1092	36.56	-8.80	27.76	46.00	-18.24	QP			
6		779.9486	30.01	0.13	30.14	46.00	-15.86	QP			

*:Maximum data x:Over limit !:over margin

Operator: KK



Site 3m Chamber #1
Limit: (RE)FCC PART 15 C
Mode: TX Low
Note:

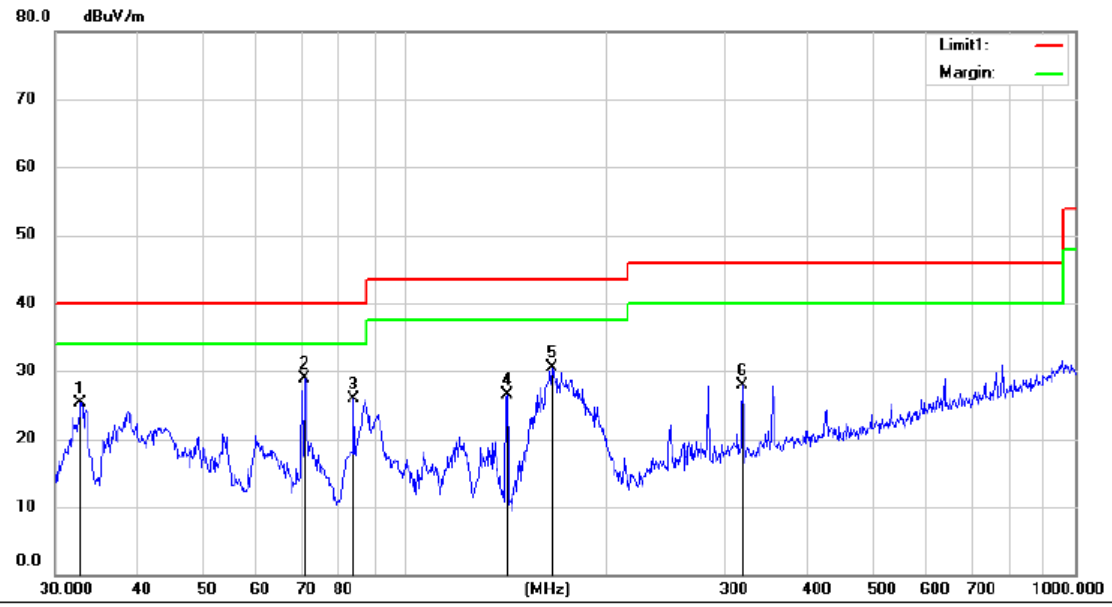
Polarization: *Horizontal*
Power: AC 120V/60Hz

Temperature: 29.5 C
Humidity: 48 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		55.9517	38.99	-11.86	27.13	40.00	-12.87	QP			
2		71.0492	39.03	-15.66	23.37	40.00	-16.63	QP			
3		171.1673	43.20	-14.25	28.95	43.50	-14.55	QP			
4	*	284.3530	48.93	-8.77	40.16	46.00	-5.84	QP			
5		332.2273	44.85	-7.44	37.41	46.00	-8.59	QP			
6		781.6598	37.06	0.13	37.19	46.00	-8.81	QP			

*:Maximum data x:Over limit !:over margin

Operator: KK



Site 3m Chamber #1
Limit: (RE)FCC PART 15 C
Mode: TX Mid
Note:

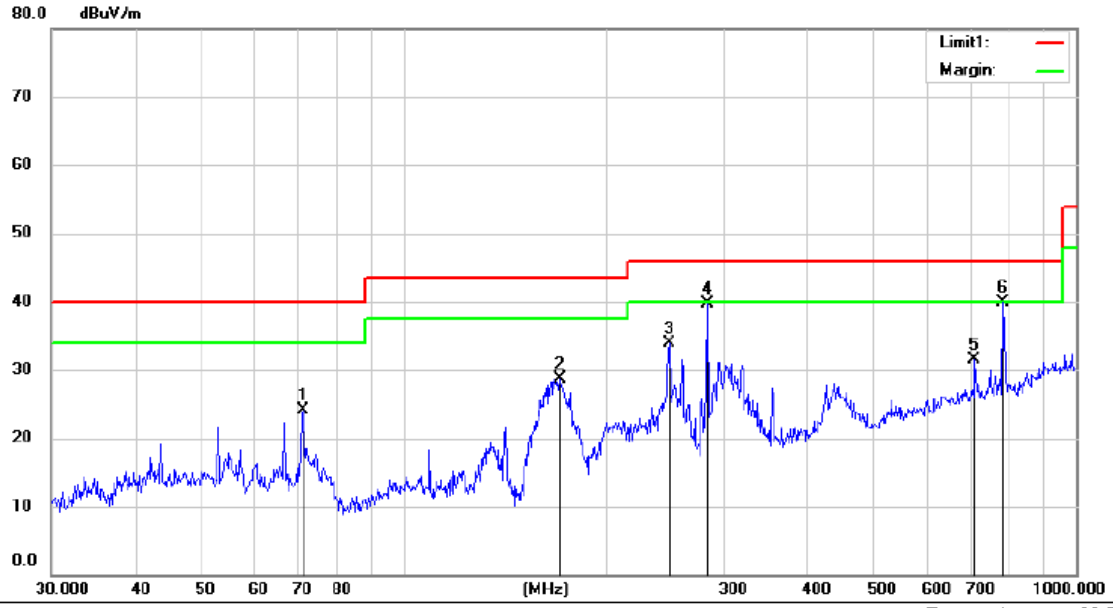
Polarization: *Vertical*
Power: AC 120V/60Hz

Temperature: 29.5 C
Humidity: 48 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		32.8350	39.08	-13.70	25.38	40.00	-14.62	QP			
2	*	71.0492	44.61	-15.66	28.95	40.00	-11.05	QP			
3		83.9995	42.30	-16.49	25.81	40.00	-14.19	QP			
4		142.0751	42.11	-15.60	26.51	43.50	-16.99	QP			
5		165.6320	44.94	-14.37	30.57	43.50	-12.93	QP			
6		319.2366	35.80	-7.94	27.86	46.00	-18.14	QP			

*:Maximum data x:Over limit !:over margin

Operator: KK



Site 3m Chamber #1
Limit: (RE)FCC PART 15 C
Mode: TX Mid
Note:

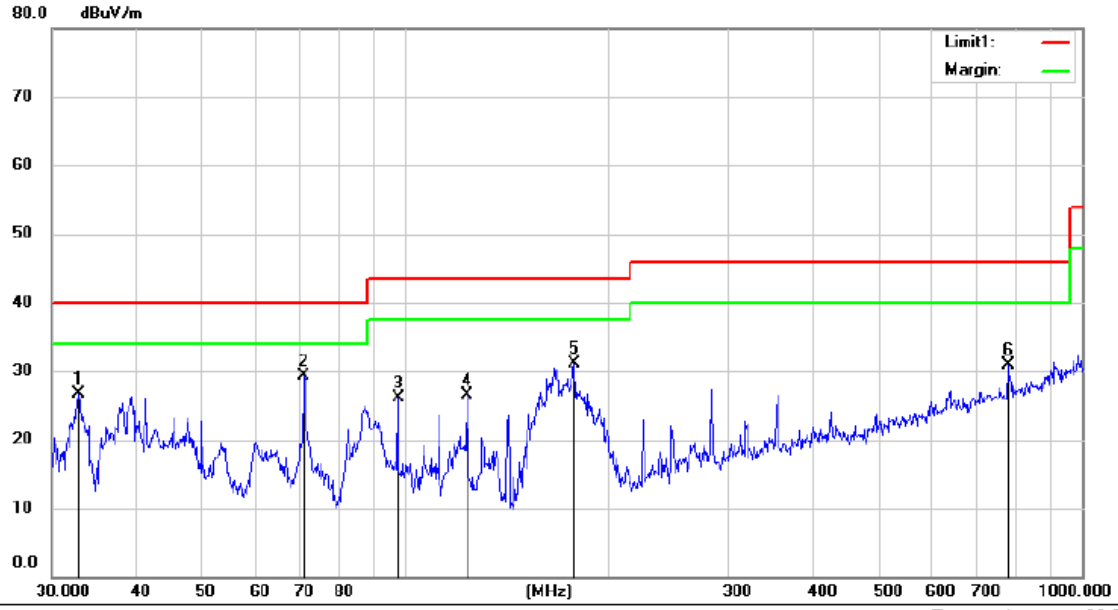
Polarization: *Horizontal*
Power: AC 120V/60Hz

Temperature: 29.5 C
Humidity: 48 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		71.0803	39.71	-15.67	24.04	40.00	-15.96	QP			
2		171.0174	42.94	-14.26	28.68	43.50	-14.82	QP			
3		248.7700	43.77	-9.91	33.86	46.00	-12.14	QP			
4		283.1092	48.43	-8.80	39.63	46.00	-6.37	QP			
5		708.2504	32.29	-0.88	31.41	46.00	-14.59	QP			
6	*	778.5823	39.73	0.12	39.85	46.00	-6.15	QP			

*:Maximum data x:Over limit !:over margin

Operator: KK



Site 3m Chamber #1 Polarization: *Vertical* Temperature: 29.5 C

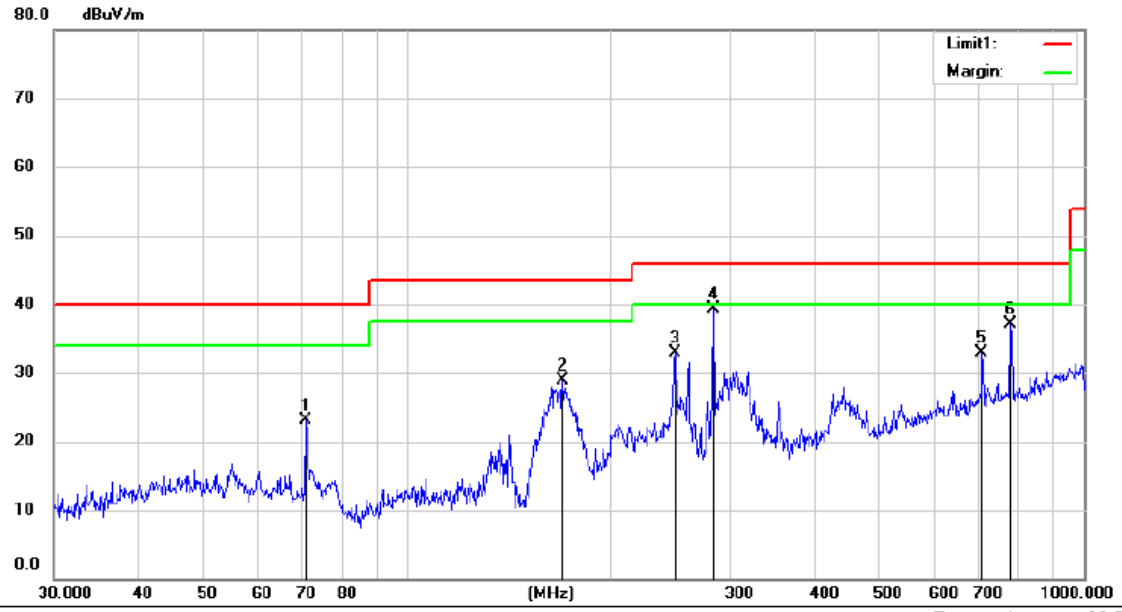
Limit: (RE)FCC PART 15 C Power: AC 120V/60Hz Humidity: 48 %

Mode: TX High

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		32.8637	40.40	-13.68	26.72	40.00	-13.28	QP			
2	*	71.0492	44.87	-15.66	29.21	40.00	-10.79	QP			
3		97.6698	39.15	-13.02	26.13	43.50	-17.37	QP			
4		123.4277	41.18	-14.70	26.48	43.50	-17.02	QP			
5		177.6648	44.86	-13.75	31.11	43.50	-12.39	QP			
6		778.5823	30.70	0.12	30.82	46.00	-15.18	QP			

*:Maximum data x:Over limit !:over margin Operator: KK



Site 3m Chamber #1
Limit: (RE)FCC PART 15 C
Mode: TX High
Note:

Polarization: *Horizontal*
Power: AC 120V/60Hz

Temperature: 29.5 C
Humidity: 48 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		70.8005	38.64	-15.58	23.06	40.00	-16.94	QP			
2		169.8965	43.28	-14.33	28.95	43.50	-14.55	QP			
3		248.7700	42.80	-9.91	32.89	46.00	-13.11	QP			
4	*	283.2333	48.09	-8.80	39.29	46.00	-6.71	QP			
5		707.9400	33.84	-0.89	32.95	46.00	-13.05	QP			
6		781.6598	36.91	0.13	37.04	46.00	-8.96	QP			

*:Maximum data x:Over limit !:over margin

Operator: KK

8.6 CONDUCTED EMISSIONS TEST

8.6.1 Applicable Standard

According to FCC Part 15.207(a)

8.6.2 Conformance Limit

Conducted Emission Limit

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

8.6.3 Test Configuration

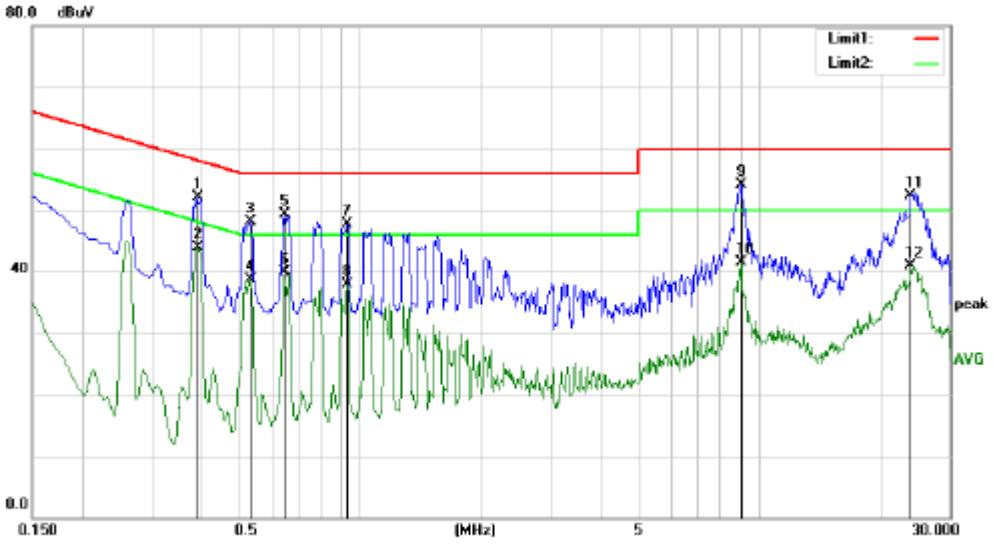
Test according to clause 7.3conducted emission test setup

8.6.4 Test Procedure

The EUT was placed on a table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Repeat above procedures until all frequency measured were complete.

8.6.5 Test Results

Pass



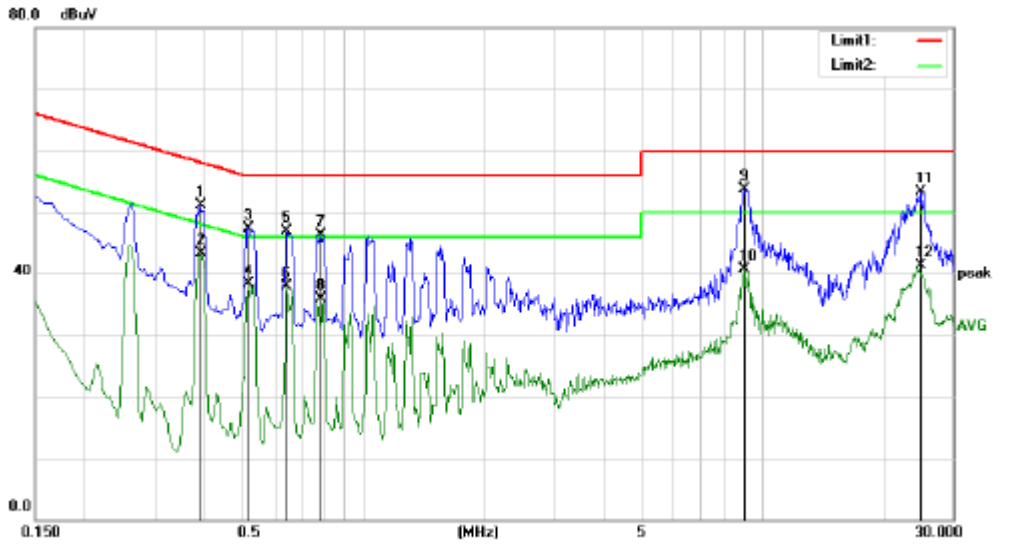
Site Conduction #1 Phase: N Temperature: 19.4

Limit: (CE)FCC PART 15 class B_QP Power: AC 120V/60Hz Humidity: 37 %

Mode: CHARGING

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.3900	42.75	9.33	52.08	58.06	-5.98	QP	
2	*	0.3900	34.52	9.33	43.85	48.06	-4.21	AVG	
3		0.5300	38.93	9.25	48.18	56.00	-7.82	QP	
4		0.5300	29.47	9.25	38.72	46.00	-7.28	AVG	
5		0.6460	40.00	9.27	49.27	56.00	-6.73	QP	
6		0.6460	30.69	9.27	39.96	46.00	-6.04	AVG	
7		0.9260	37.89	9.74	47.63	56.00	-8.37	QP	
8		0.9260	28.23	9.74	37.97	46.00	-8.03	AVG	
9		8.9980	43.96	10.11	54.07	60.00	-5.93	QP	
10		8.9980	31.45	10.11	41.56	50.00	-8.44	AVG	
11		23.9500	42.05	10.20	52.25	60.00	-7.75	QP	
12		23.9500	30.66	10.20	40.86	50.00	-9.14	AVG	



Site Conduction #1 Phase: L1 Temperature: 19.4

Limit: (CE)FCC PART 15 class B_QP Power: AC 120V/60Hz Humidity: 37 %

Mode: CHARGING

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.3900	41.79	9.33	51.12	58.06	-6.94	QP	
2	*	0.3900	33.90	9.33	43.23	48.06	-4.83	AVG	
3		0.5140	38.00	9.25	47.25	56.00	-8.75	QP	
4		0.5140	28.96	9.25	38.21	46.00	-7.79	AVG	
5		0.6420	37.64	9.27	46.91	56.00	-9.09	QP	
6		0.6420	28.61	9.27	37.88	46.00	-8.12	AVG	
7		0.7820	36.88	9.45	46.33	56.00	-9.67	QP	
8		0.7820	26.42	9.45	35.87	46.00	-10.13	AVG	
9		8.9900	43.67	10.11	53.78	60.00	-6.22	QP	
10		8.9900	30.60	10.11	40.71	50.00	-9.29	AVG	
11		24.8580	43.12	10.21	53.33	60.00	-6.67	QP	
12		24.8580	31.11	10.21	41.32	50.00	-8.68	AVG	

8.7 ANTENNA APPLICATION

8.7.1 Antenna Requirement

Standard	Requirement
FCC CRF Part15.203	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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217,§15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

8.7.2 Result

PASS.

- The EUT has 3 Internal Antennas for all Antenna: The two antennas are Module AP6356S 3.0dBi and one antenna is Module ESP32-S 0dBi

Note: ☒ Antenna uses a permanently attached antenna which is not replaceable.
☐ Not using a standard antenna jack or electrical connector for antenna replacement
☐ The antenna has to be professionally installed (please provide method of installation)

Which in accordance to section 15.203, please refer to the internal photos

Detail of factor for radiated emission

Frequency(MHz)	Ant_F(dB)	Cab_L(dB)	Preamp(dB)	Correct Factor(dB)
0.009	20.6	0.03	\	20.63
0.15	20.7	0.1	\	20.8
1	20.9	0.15	\	21.05
10	20.1	0.28	\	20.38
30	18.8	0.45	\	19.25
30	11.7	0.62	27.9	-15.58
100	12.5	1.02	27.8	-14.28
300	12.9	1.91	27.5	-12.69
600	19.2	2.92	27	-4.88
800	21.1	3.54	26.6	-1.96
1000	22.3	4.17	26.2	0.27
1000	25.6	1.76	41.4	-14.04
3000	28.9	3.27	43.2	-11.03
5000	31.1	4.2	44.6	-9.3
8000	36.2	5.95	44.7	-2.55
10000	38.4	6.3	43.9	0.8
12000	38.5	7.14	42.3	3.34
15000	40.2	8.15	41.4	6.95
18000	45.4	9.02	41.3	13.12
18000	37.9	1.81	47.9	-8.19
21000	37.9	1.95	48.7	-8.85
25000	39.3	2.01	42.8	-1.49
28000	39.6	2.16	46.0	-4.24
31000	41.2	2.24	44.5	-1.06
34000	41.5	2.29	46.6	-2.81
37000	43.8	2.30	46.4	-0.3
40000	43.2	2.50	42.2	3.5

*** End of Report ***