

TEST REPORT

FCC ID. :	HLEEA630PBWNW	
Test Report No..... :	TCT220824E017	
Date of issue..... :	Sep. 27, 2022	
Testing laboratory	SHENZHEN TONGCE TESTING LAB	
Testing location/ address:	2101 & 2201, Zhenchang Factory Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China	
Applicant's name..... :	Unitech Electronics Co., Ltd.	
Address..... :	5F, No. 136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan	
Manufacturer's name ... :	Unitech Electronics Co., Ltd.	
Address..... :	5F, No. 136, Lane 235, Pao-Chiao Rd., Hsin-Tien Dist., New Taipei City, Taiwan	
Standard(s)	FCC CFR Title 47 Part 15 Subpart C Section 15.247 FCC KDB 558074 D01 15.247 Meas Guidance v05r02 ANSI C63.10:2013	
Product Name..... :	Rugged Handheld Computer	
Trade Mark	unitech	
Model/Type reference..... :	EA630 Plus	
Rating(s)..... :	Refer to EUT description of page 3	
Date of receipt of test item	Aug. 24, 2022	
Date (s) of performance of test..... :	Aug. 24, 2022 - Sep. 27, 2022	
Tested by (+signature) ... :	Brews XU	
Check by (+signature).... :	Beryl ZHAO	
Approved by (+signature):	Tomsin	



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1. General Product Information

1.1. EUT description

Product Name.....:	Rugged Handheld Computer
Model/Type reference.....:	EA630 Plus
Sample Number.....:	TCT220824E003-0101
Operation Frequency	2412MHz~2462MHz (802.11b/802.11g/802.11n(HT20)) 2422MHz~2452MHz (802.11n(HT40))
Channel Separation.....:	5MHz
Number of Channel	11 for 802.11b/802.11g/802.11n(HT20) 7 for 802.11n(HT40)
Modulation Technology	802.11b: Direct Sequence Spread Spectrum (DSSS) 802.11g/802.11n: Orthogonal Frequency Division Multiplexing(OFDM)
Data speed	802.11b: 1Mbps, 2Mbps, 5.5Mbps, 11Mbps 802.11g: 6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps 802.11n: Up to 150Mbps
Antenna Type.....:	LDS Antenna
Antenna Gain.....:	0.2dBi
Rating(s).....:	Adapter Information: MODEL: S018BYU1200150 INPUT: AC 100-240V, 50/60Hz, 0.6A OUTPUT: DC 5V, 3A/ DC 9V, 2A/ DC 12V, 1.5A Rechargeable Li-ion Battery DC 3.85V

Note: The antenna gain listed in this report is provided by applicant, and the test laboratory is not responsible for this parameter.

1.2. Model(s) list

None.

1.3. Operation Frequency

For 802.11b/g/n(HT20)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412MHz	4	2427MHz	7	2442MHz	10	2457MHz
2	2417MHz	5	2432MHz	8	2447MHz	11	2462MHz
3	2422MHz	6	2437MHz	9	2452MHz	--	--

For 802.11n (HT40)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
--	--	4	2427MHz	7	2442MHz	--	--
--	--	5	2432MHz	8	2447MHz	--	--
3	2422MHz	6	2437MHz	9	2452MHz		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

802.11b/802.11g/802.11n (HT20)

Channel	Frequency
The lowest channel	2412MHz
The middle channel	2437MHz
The Highest channel	2462MHz

802.11n (HT40)

Channel	Frequency
The lowest channel	2422MHz
The middle channel	2437MHz
The Highest channel	2452MHz

2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna requirement	§15.203/§15.247 (c)	PASS
AC Power Line Conducted Emission	§15.207	PASS
Conducted Output Power	§15.247 (b)(3)	PASS
6dB Emission Bandwidth	§15.247 (a)(2)	PASS
Power Spectral Density	§15.247 (e)	PASS
Band Edge	§15.247(d)	PASS
Spurious Emission	§15.205/§15.209	PASS

Note:

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

3. General Information

3.1. Test environment and mode

Operating Environment:		
Condition	Conducted Emission	Radiated Emission
Temperature:	25.3 °C	24.1 °C
Humidity:	56 % RH	52 % RH
Atmospheric Pressure:	1010 mbar	1010 mbar
Test Software:		
Software Information:	QRCT	
Power Level:	15	
Test Mode:		
Engineer mode:	Keep the EUT in continuous transmitting by select channel and modulations with Fully-charged battery	
The sample was placed 0.8m & 1.5m for the measurement below & above 1GHz above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case(Z axis) are shown in Test Results of the following pages.		

We have verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Per-scan all kind of data rate in lowest channel, and found the follow list which it was worst case.

Mode	Data rate
802.11b	1Mbps
802.11g	6Mbps
802.11n(H20)	6.5Mbps
802.11n(H40)	13.5Mbps

3.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note:

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.
3. For conducted measurements (Output Power, 6dB Emission Bandwidth, Power Spectral Density, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

4. Facilities and Accreditations

4.1. Facilities

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

- FCC - Registration No.: 645098

SHENZHEN TONGCE TESTING LAB

Designation Number: CN1205

The testing lab has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1

SHENZHEN TONGCE TESTING LAB

CAB identifier: CN0031

The testing lab has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing.

4.2. Location

SHENZHEN TONGCE TESTING LAB

Address: 2101 & 2201, Zhenchang Factory Renshan Industrial Zone, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, 518103, People's Republic of China

TEL: +86-755-27673339

4.3. Measurement Uncertainty

The reported uncertainty of measurement $y \pm U$, where expended 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	MU
1	Conducted Emission	± 3.10 dB
2	RF power, conducted	± 0.12 dB
3	Spurious emissions, conducted	± 0.11 dB
4	All emissions, radiated(<1 GHz)	± 4.56 dB
5	All emissions, radiated(1 GHz - 18 GHz)	± 4.22 dB
6	All emissions, radiated(18 GHz- 40 GHz)	± 4.36 dB

5. Test Results and Measurement Data

5.1. Antenna requirement

Standard requirement:

FCC Part15 C Section 15.203 /247(c)

15.203 requirement:

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, 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.

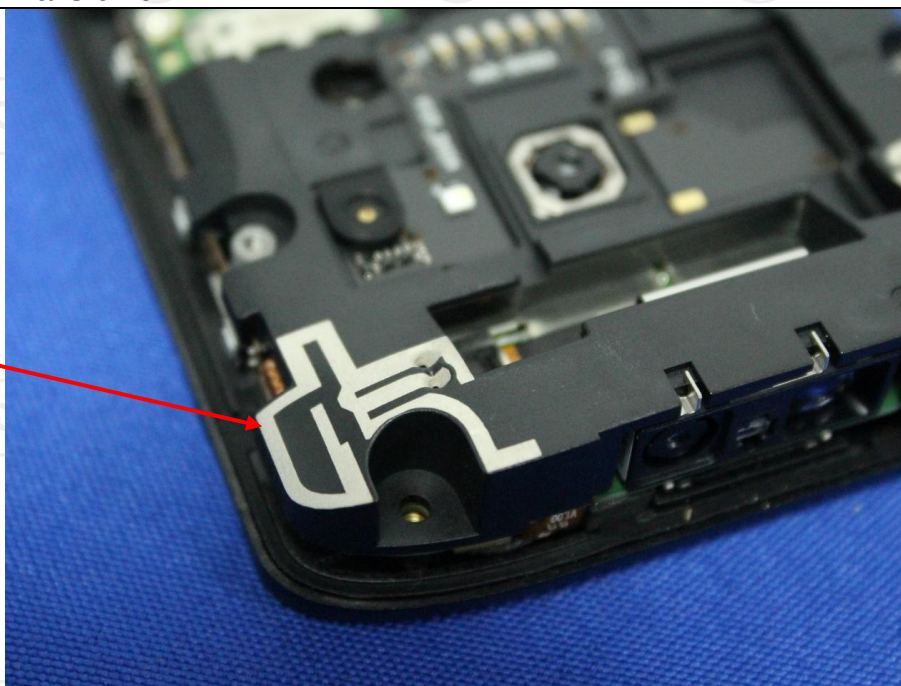
15.247(c) (1)(i) requirement:

(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

E.U.T Antenna:

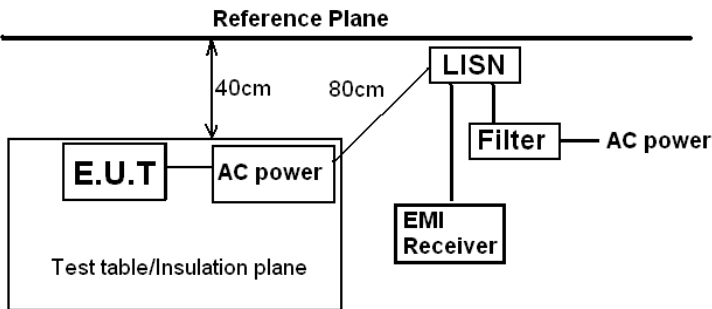
The WIFI antenna is LDS antenna which permanently attached, and the best case gain of the antenna is 0.2dBi.

Antenna



5.2. Conducted Emission

5.2.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.207														
Test Method:	ANSI C63.10:2013														
Frequency Range:	150 kHz to 30 MHz														
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto														
Limits:	<table><tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBuV)</th></tr><tr><th>Quasi-peak</th><th>Average</th></tr><tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr><tr><td>0.5-5</td><td>56</td><td>46</td></tr><tr><td>5-30</td><td>60</td><td>50</td></tr></table>	Frequency range (MHz)	Limit (dBuV)		Quasi-peak	Average	0.15-0.5	66 to 56*	56 to 46*	0.5-5	56	46	5-30	60	50
Frequency range (MHz)	Limit (dBuV)														
	Quasi-peak	Average													
0.15-0.5	66 to 56*	56 to 46*													
0.5-5	56	46													
5-30	60	50													
Test Setup:	Reference Plane  Remark E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m														
Test Mode:	Charging + Transmitting Mode														
Test Procedure:	1. The E.U.T is connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.														
Test Result:	PASS														

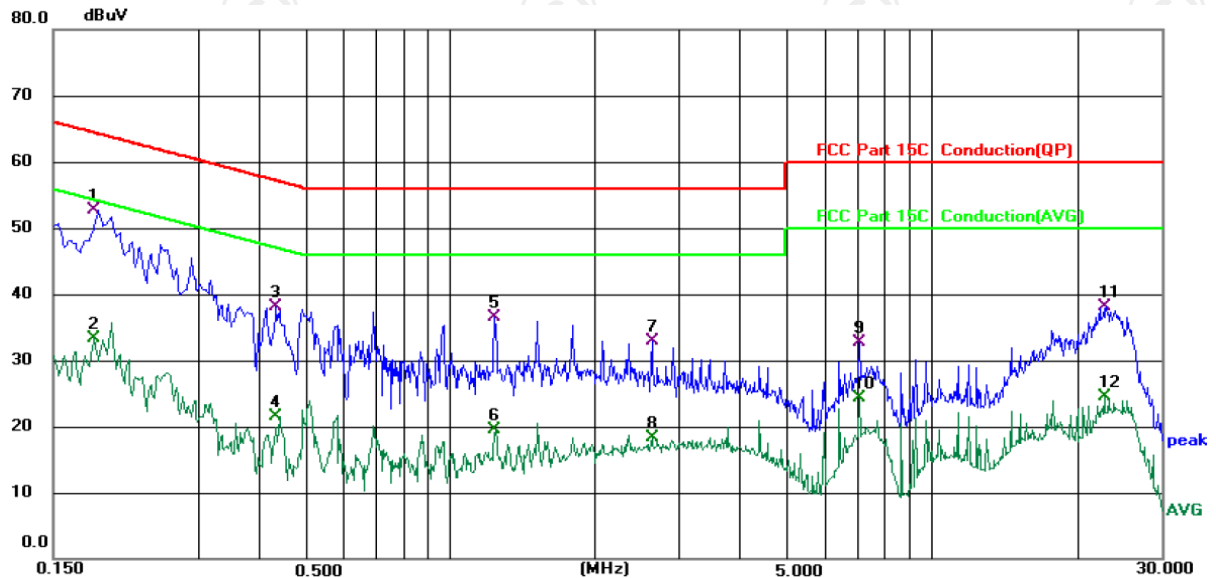
5.2.2. Test Instruments

Conducted Emission Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESCI3	100898	Jul. 03, 2023
Line Impedance Stabilisation Newtork(LISN)	Schwarzbeck	NSLK 8126	8126453	Feb. 24, 2023
Line-5	TCT	CE-05	/	Jul. 03, 2023
EMI Test Software	Shurple Technology	EZ-EMC	/	/

5.2.3. Test data

Please refer to following diagram for individual

Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



Site 844 Shielding Room

Phase: **L1**

Temperature: 25.3 (°C)

Humidity: 56 %

Limit: FCC Part 15C Conduction(QP)

Power: AC 120 V/60 Hz

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1819	42.29	10.51	52.80	64.40	-11.60	QP	
2		0.1819	22.89	10.51	33.40	54.40	-21.00	AVG	
3		0.4339	27.87	10.18	38.05	57.18	-19.13	QP	
4		0.4339	11.33	10.18	21.51	47.18	-25.67	AVG	
5		1.2419	26.43	10.09	36.52	56.00	-19.48	QP	
6		1.2419	9.51	10.09	19.60	46.00	-26.40	AVG	
7		2.6259	22.96	10.02	32.98	56.00	-23.02	QP	
8		2.6259	8.28	10.02	18.30	46.00	-27.70	AVG	
9		7.0780	22.63	10.16	32.79	60.00	-27.21	QP	
10		7.0780	14.16	10.16	24.32	50.00	-25.68	AVG	
11		22.8060	27.64	10.49	38.13	60.00	-21.87	QP	
12		22.8060	14.05	10.49	24.54	50.00	-25.46	AVG	

Note:

Freq. = Emission frequency in MHz

Reading level (dBμV) = Receiver reading

Corr. Factor (dB) = LISN factor + Cable loss

Measurement (dBμV) = Reading level (dBμV) + Corr. Factor (dB)

Limit (dBμV) = Limit stated in standard

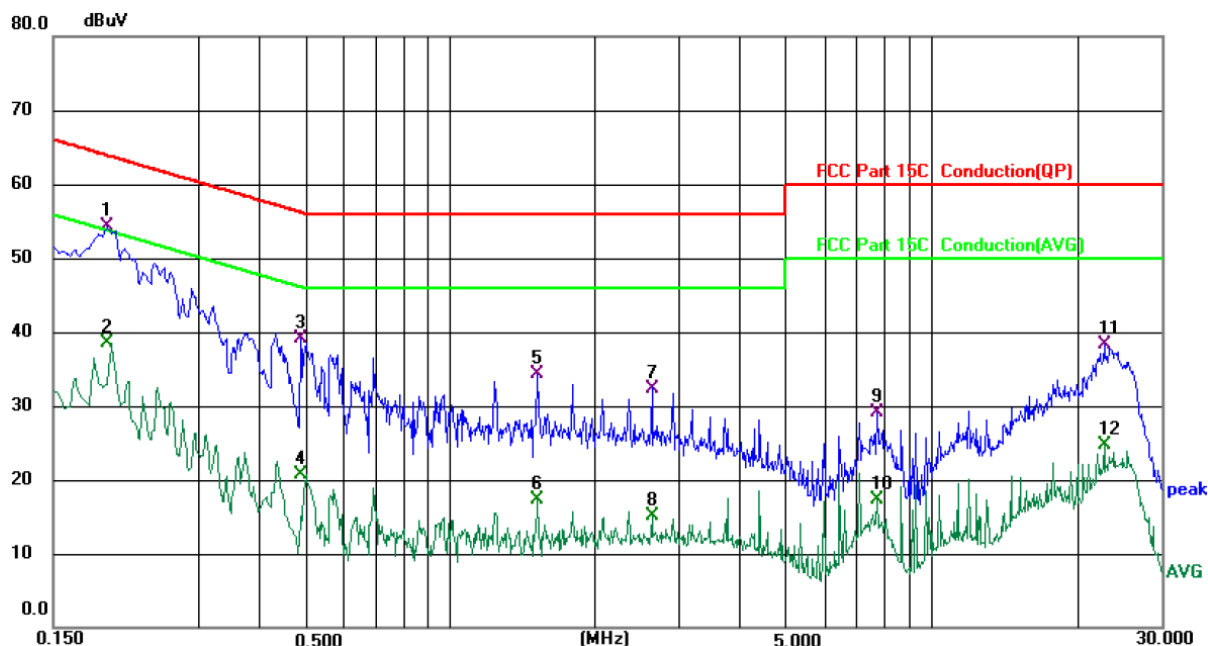
Margin (dB) = Measurement (dBμV) – Limits (dBμV)

Q.P. =Quasi-Peak

AVG =average

* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz

Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)



Site 844 Shielding Room

Phase: N

Temperature: 25.3 (°C)

Humidity: 56 %

Limit: FCC Part 15C Conduction(QP)

Power: AC 120 V/60 Hz

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1940	43.90	10.48	54.38	63.86	-9.48	QP	
2		0.1940	27.93	10.48	38.41	53.86	-15.45	AVG	
3		0.4900	29.03	10.15	39.18	56.17	-16.99	QP	
4		0.4900	10.55	10.15	20.70	46.17	-25.47	AVG	
5		1.5180	24.22	10.11	34.33	56.00	-21.67	QP	
6		1.5180	7.18	10.11	17.29	46.00	-28.71	AVG	
7		2.6300	22.28	10.12	32.40	56.00	-23.60	QP	
8		2.6300	5.06	10.12	15.18	46.00	-30.82	AVG	
9		7.7060	18.86	10.26	29.12	60.00	-30.88	QP	
10		7.7060	7.04	10.26	17.30	50.00	-32.70	AVG	
11		22.8060	27.75	10.46	38.21	60.00	-21.79	QP	
12		22.8060	14.25	10.46	24.71	50.00	-25.29	AVG	

Note:

Freq. = Emission frequency in MHz

Reading level (dBμV) = Receiver reading

Corr. Factor (dB) = LISN factor + Cable loss

Measurement (dBμV) = Reading level (dBμV) + Corr. Factor (dB)

Limit (dBμV) = Limit stated in standard

Margin (dB) = Measurement (dBμV) – Limits (dBμV)

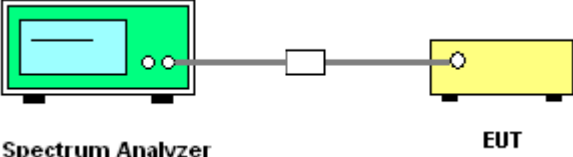
Q.P. =Quasi-Peak

AVG =average

* is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

5.3. Maximum Conducted (Average) Output Power

5.3.1. Test Specification

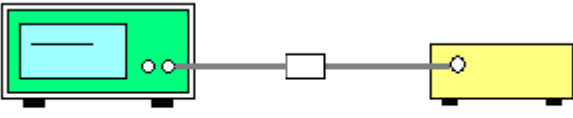
Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	KDB 558074 D01 v05r02
Limit:	30dBm
Test Setup:	 Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Measure the conducted output power and record the results in the test report.
Test Result:	PASS

5.3.2. Test Instruments

Name	Manufacturer	Model No.	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 04, 2023
Combiner Box	Ascentest	AT890-RFB	/	/

5.4. Emission Bandwidth

5.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	KDB 558074 D01 v05r02
Limit:	>500kHz
Test Setup:	 Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. Set to the maximum power setting and enable the EUT transmit continuously. 2. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 kHz. 3. Measure and record the results in the test report.
Test Result:	PASS

5.4.2. Test Instruments

Name	Manufacturer	Model No.	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 04, 2023
Combiner Box	Ascentest	AT890-RFB	/	/

5.5. Power Spectral Density

5.5.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	KDB 558074
Limit:	The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.
Test Setup:	 Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. 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. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW): $3\text{ kHz} \leq \text{RBW} \leq 100\text{ kHz}$. Video bandwidth VBW $\geq 3 \times \text{RBW}$. Set the span to at least 1.5 times the OBW. 4. Detector = RMS, Sweep time = auto couple. 5. Employ trace averaging (RMS) mode over a minimum of 100 traces. Use the peak marker function to determine the maximum power level. 6. Measure and record the results in the test report.
Test Result:	PASS

5.5.2. Test Instruments

Name	Manufacturer	Model No.	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 04, 2023
Combiner Box	Ascentest	AT890-RFB	/	/

5.6. Conducted Band Edge and Spurious Emission Measurement

5.6.1. Test Specification

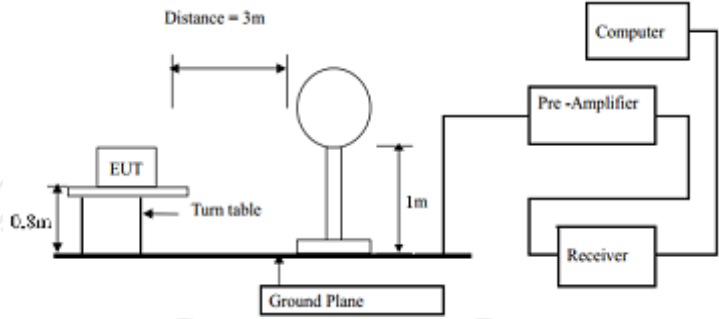
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	KDB558074
Limit:	In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).
Test Setup:	 Spectrum Analyzer EUT
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. 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. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d). 4. Measure and record the results in the test report. 5. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test Result:	PASS

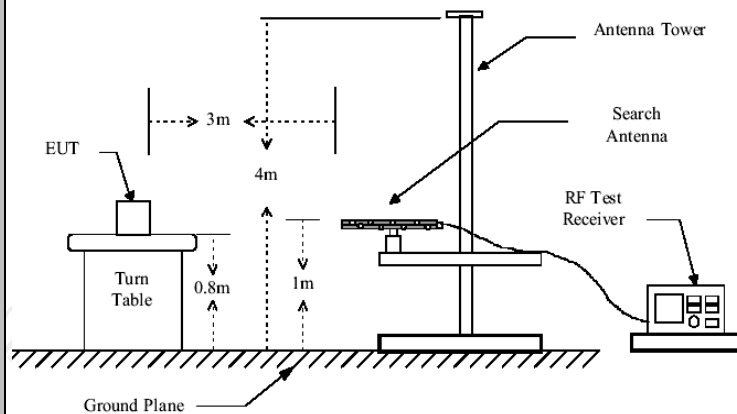
5.6.2. Test Instruments

Name	Manufacturer	Model No.	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 04, 2023
Combiner Box	Ascentest	AT890-RFB	/	/

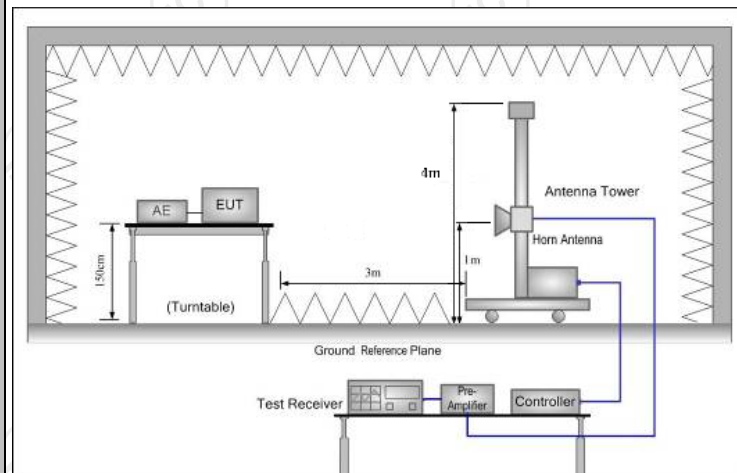
5.7. Radiated Spurious Emission Measurement

5.7.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Frequency Range:	9 kHz to 25 GHz				
Measurement Distance:	3 m				
Antenna Polarization:	Horizontal & Vertical				
Operation mode:	Transmitting mode with modulation				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
	150kHz- 30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		Peak	1MHz	10Hz	Average Value
Limit:	Frequency		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		30		30
	30-88		100		3
	88-216		150		3
	216-960		200		3
	Above 960		500		3
	Frequency		Field Strength (microvolts/meter)	Measurement Distance (meters)	Detector
	Above 1GHz		500	3	Average
			5000	3	Peak
	For radiated emissions below 30MHz				
					
	30MHz to 1GHz				



Above 1GHz



Test Procedure:

1. For the radiated emission test below 1GHz:
The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. 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.
For the radiated emission test above 1GHz:
Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which

	maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. 3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level 4. For measurement below 1GHz, 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. 5. Use the following spectrum analyzer settings: (1) Span shall wide enough to fully capture the emission being measured; (2) Set RBW=120 kHz for $f < 1$ GHz; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold; (3) Set RBW = 1 MHz, VBW= 3MHz for $f > 1$ GHz for peak measurement. For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
Test results:	PASS

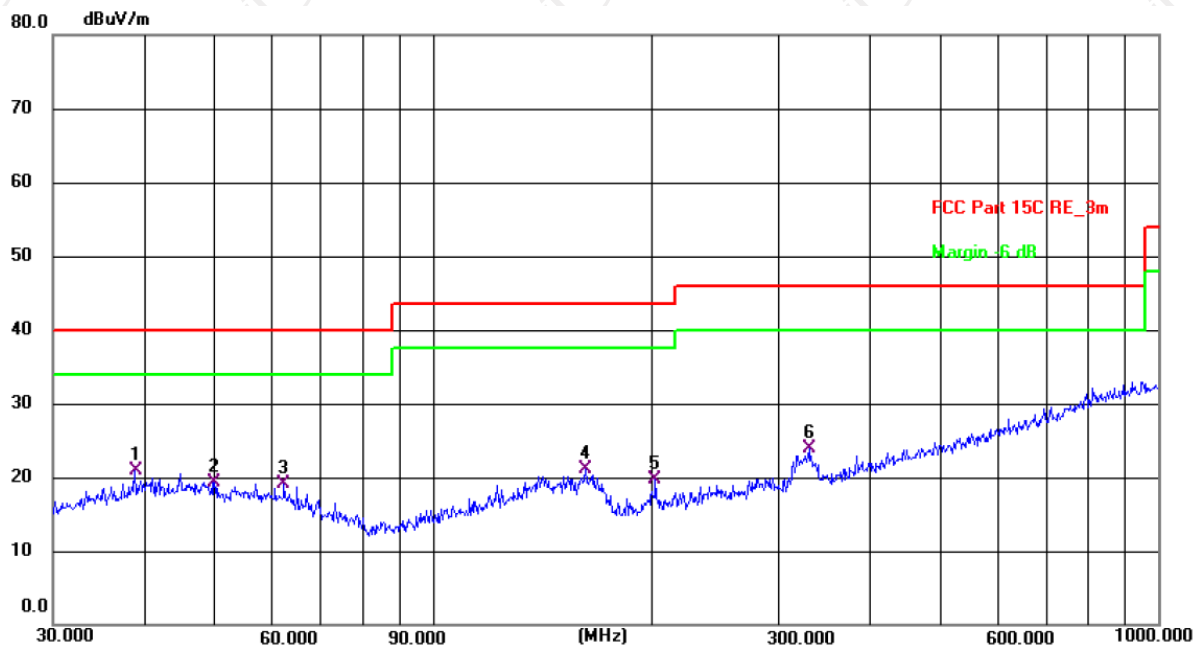
5.7.2. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EMI Test Receiver	R&S	ESIB7	100197	Jul. 03, 2023
Spectrum Analyzer	R&S	FSQ40	200061	Jul. 03, 2023
Pre-amplifier	SKET	LNPA_0118G-45	SK2021012102	Feb. 24, 2023
Pre-amplifier	SKET	LNPA_1840G-50	SK202109203500	Feb. 24, 2023
Pre-amplifier	HP	8447D	2727A05017	Jul. 03, 2023
Loop antenna	Schwarzbeck	FMZB1519B	00191	Jun. 11, 2024
Broadband Antenna	Schwarzbeck	VULB9163	340	Jul. 05, 2024
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Jul. 05, 2024
Horn Antenna	Schwarzbeck	BBHA 9170	00956	Apr. 10, 2023
Antenna Mast	Keleto	RE-AM	/	/
Coaxial cable	SKET	RC-18G-N-M	/	Feb. 24, 2024
Coaxial cable	SKET	RC_40G-K-M	/	Feb. 24, 2024
EMI Test Software	Shurple Technology	EZ-EMC	/	/

5.7.3. Test Data

Please refer to following diagram for individual
Below 1GHz

Horizontal:



Site #2 3m Anechoic Chamber

Polarization: **Horizontal**

Temperature: 24.1(C)

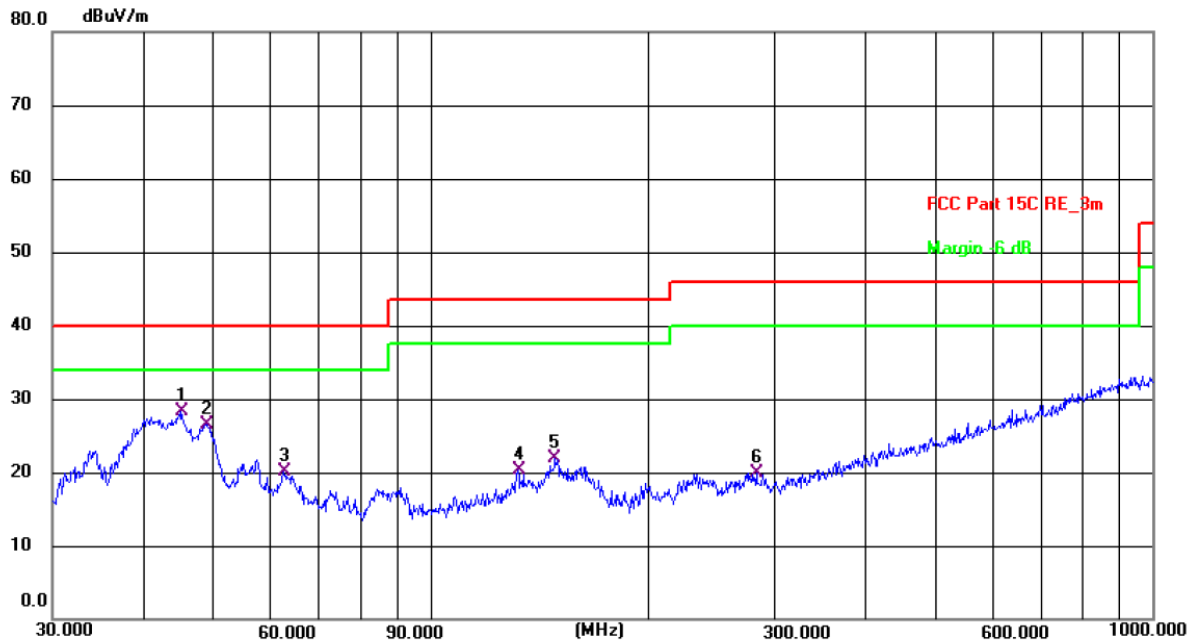
Humidity: 52 %

Limit: FCC Part 15C RE_3m

Power: DC 3.85 V

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1 *	38.8878	7.13	13.84	20.97	40.00	-19.03	QP	P	
2	50.0566	5.53	13.78	19.31	40.00	-20.69	QP	P	
3	62.4313	6.47	12.63	19.10	40.00	-20.90	QP	P	
4	162.6105	8.03	13.13	21.16	43.50	-22.34	QP	P	
5	202.8103	9.22	10.41	19.63	43.50	-23.87	QP	P	
6	330.1948	9.20	14.77	23.97	46.00	-22.03	QP	P	

Vertical:



Site #2 3m Anechoic Chamber

Polarization: **Vertical**

Temperature: 24.1(C) Humidity: 52 %

Limit: FCC Part 15C RE_3m

Power: DC 3.85 V

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1 *	45.2166	14.34	13.89	28.23	40.00	-11.77	QP	P	
2	48.8428	12.67	13.80	26.47	40.00	-13.53	QP	P	
3	62.6506	7.55	12.58	20.13	40.00	-19.87	QP	P	
4	132.2205	7.52	12.75	20.27	43.50	-23.23	QP	P	
5	148.9624	8.54	13.32	21.86	43.50	-21.64	QP	P	
6	282.9851	5.83	14.08	19.91	46.00	-26.09	QP	P	

Note: 1. The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported

2. Measurements were conducted in all three channels (high, middle, low) and all modulation(802.11b, 802.11g, 802.11n(HT20), 802.11n(HT40)), and the worst case Mode (Middle channel and 802.11g) was submitted only.

3. Freq. = Emission frequency in MHz

Measurement (dBuV/m) = Reading level (dBuV) + Corr. Factor (dB)

Correction Factor= Antenna Factor + Cable loss – Pre-amplifier

Limit (dBuV/m) = Limit stated in standard

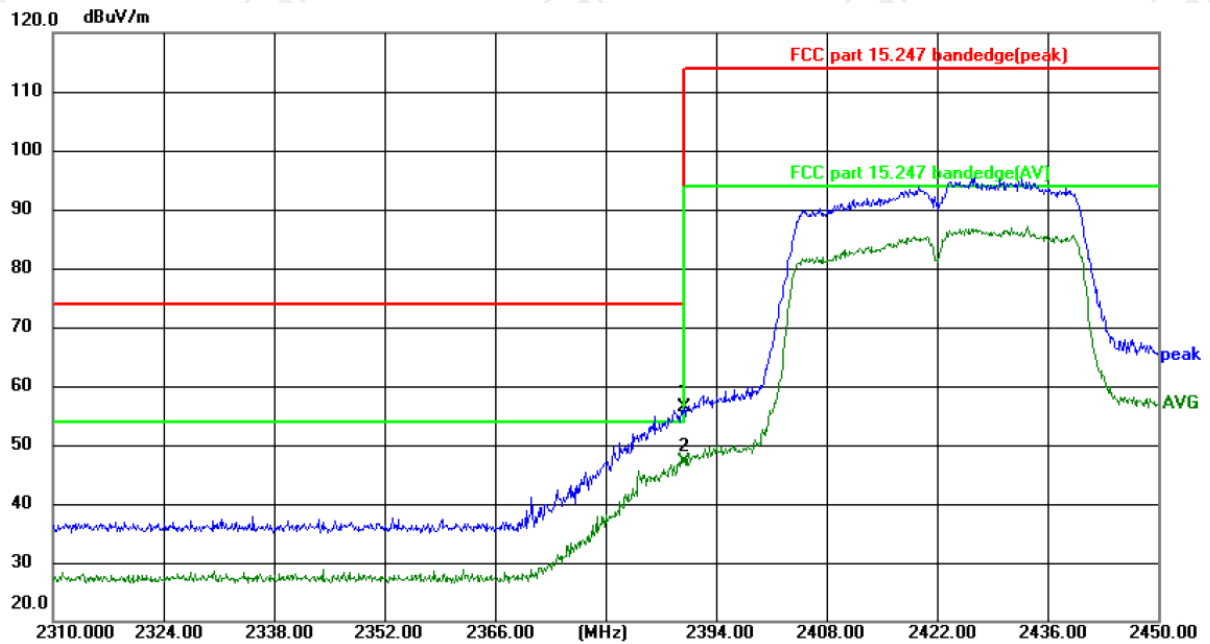
Margin (dB) = Measurement (dBuV/m) – Limits (dBuV/m)

* is meaning the worst frequency has been tested in the test frequency range.

Test Result of Radiated Spurious at Band edges

Lowest channel 2422:

Horizontal:



Site

Polarization: **Horizontal**

Temperature: 24(°C)

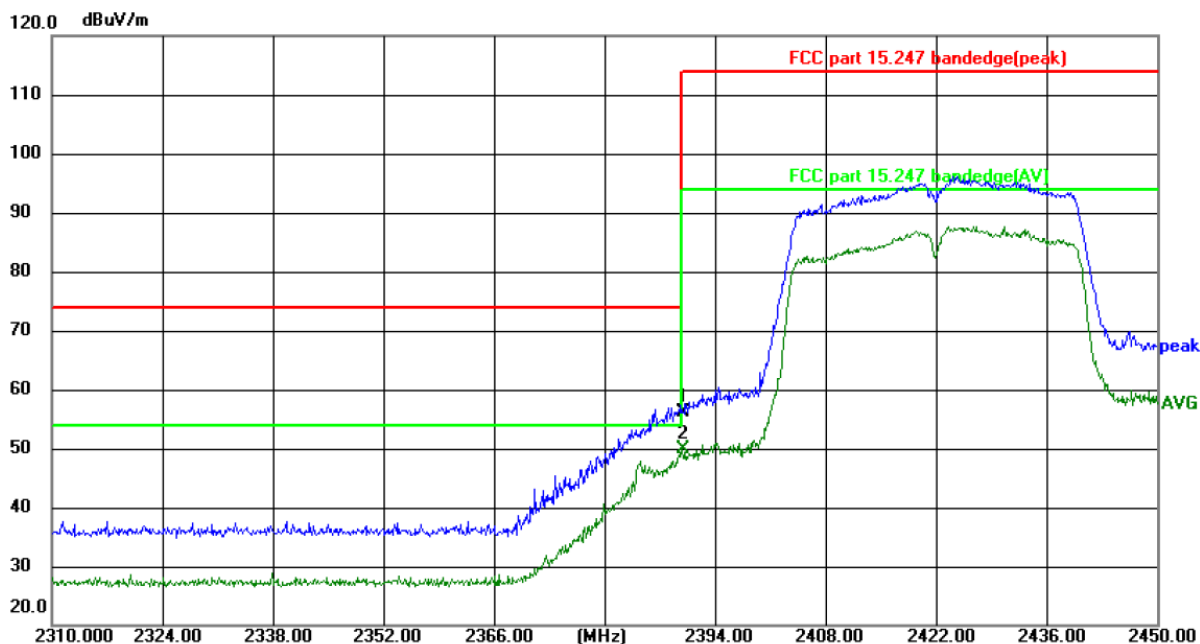
Limit: FCC part 15.247 bandedge(peak)

Power: DC 3.85 V

Humidity: 52 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	2390.000	72.17	-15.76	56.41	74.00	-17.59	peak	P	
2 *	2390.000	62.85	-15.76	47.09	54.00	-6.91	AVG	P	

Vertical:



Site

Polarization: **Vertical**

Temperature: 24(°C)

Limit: FCC part 15.247 bandedge(peak)

Power: DC 3.85 V

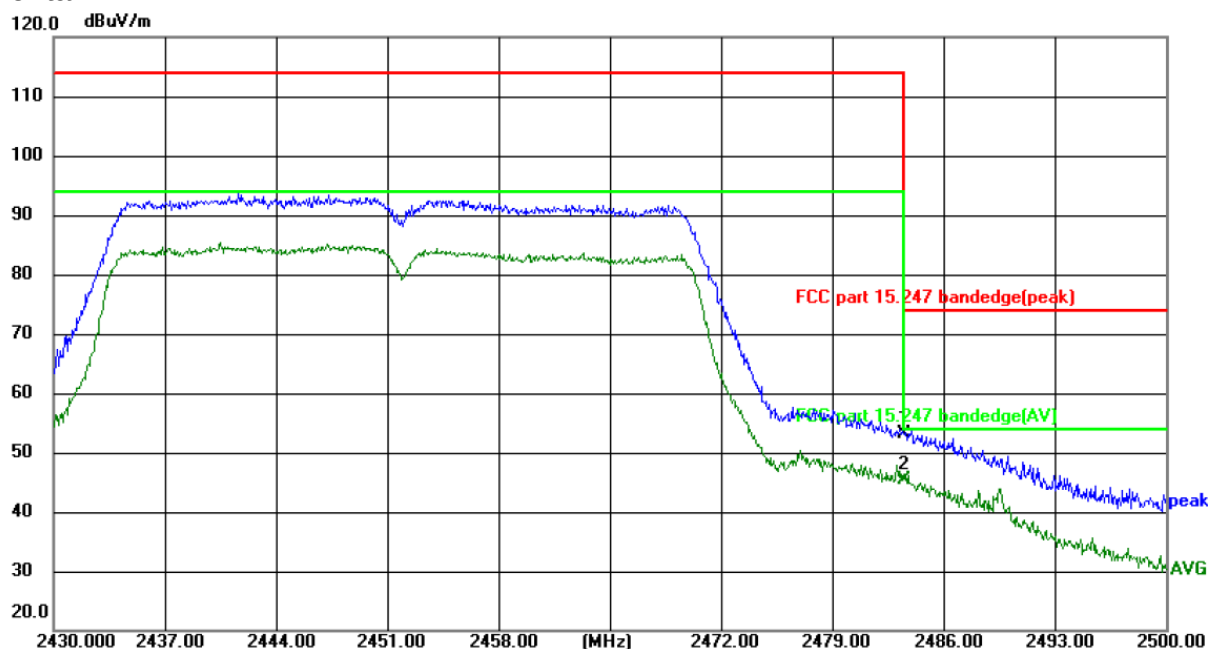
Humidity: 52 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	2390.000	71.80	-15.76	56.04	74.00	-17.96	peak	P	
2 *	2390.000	65.53	-15.76	49.77	54.00	-4.23	AVG	P	

Note: Measurements were conducted in all two channels (high, low) and all modulation (802.11b, 802.11g, 802.11n(HT20), 802.11n(HT40)), and the worst case Mode 802.11n(HT40) was submitted only.

Highest channel 2452:

Horizontal:



Site

Polarization: **Horizontal**

Temperature: 24(°C)

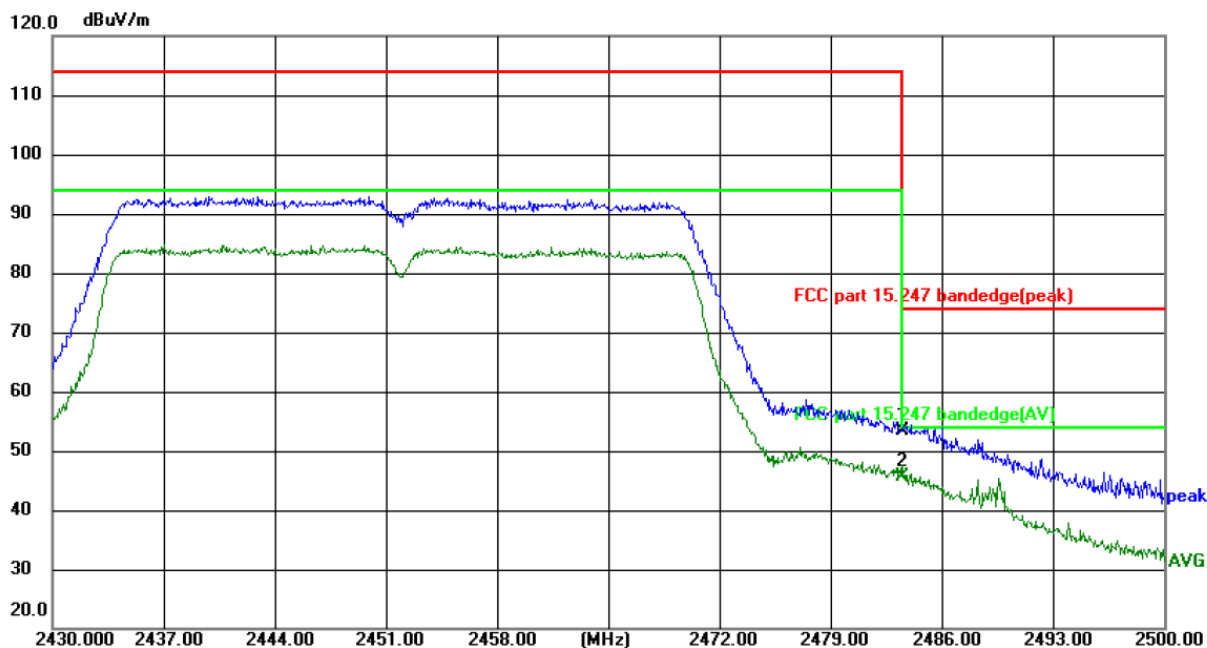
Limit: FCC part 15.247 bandedge(peak)

Power: DC 3.85 V

Humidity: 52 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	2483.500	68.66	-15.41	53.25	74.00	-20.75	peak	P	
2 *	2483.500	60.71	-15.41	45.30	54.00	-8.70	AVG	P	

Vertical:



Site: Polarization: **Vertical** Temperature: 24(°C)
 Limit: FCC part 15.247 bandedge(peak) Power: DC 3.85 V Humidity: 52 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	2483.500	68.85	-15.41	53.44	74.00	-20.56	peak	P	
2 *	2483.500	61.12	-15.41	45.71	54.00	-8.29	AVG	P	

Note:

1. Peak Final Emission Level=Peak Reading + Correction Factor;
2. Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
3. Measurements were conducted in all modulation(802.11b, 802.11g, 802.11n(HT20), 802.11n(HT40)), and the worst case Mode 802.11n(HT40) was submitted only.

Above 1GHz

Modulation Type: 802.11b

Low channel: 2412 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4824	H	45.24	---	0.75	45.99	---	74	54	-8.01
7236	H	34.86	---	9.87	44.73	---	74	54	-9.27
---	H	---	---	---	---	---	---	---	---
4824	V	44.51	---	0.75	45.26	---	74	54	-8.74
7236	V	34.74	---	9.87	44.61	---	74	54	-9.39
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4874	H	44.70	---	0.97	45.67	---	74	54	-8.33
7311	H	34.63	---	9.83	44.46	---	74	54	-9.54
---	H	---	---	---	---	---	---	---	---
4874	V	46.29	---	0.97	47.26	---	74	54	-6.74
7311	V	36.86	---	9.83	46.69	---	74	54	-7.31
---	V	---	---	---	---	---	---	---	---

High channel: 2462 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4924	H	44.51	---	1.18	45.69	---	74	54	-8.31
7386	H	34.78	---	10.07	44.85	---	74	54	-9.15
---	H	---	---	---	---	---	---	---	---
4924	V	45.13	---	1.18	46.31	---	74	54	-7.69
7386	V	34.95	---	10.07	45.02	---	74	54	-8.98
---	V	---	---	---	---	---	---	---	---

Note:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dBμV/m)-Average limit (dBμV/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.
5. Data of measurement shown “---“in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.
6. All the restriction bands are compliance with the limit of 15.209.

Modulation Type: 802.11g

Low channel: 2412 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4824	H	45.82	---	0.75	46.57	---	74	54	-7.43
7236	H	36.06	---	9.87	45.93	---	74	54	-8.07
---	H	---	---	---	---	---	---	---	---
4824	V	44.52	---	0.75	45.27	---	74	54	-8.73
7236	V	34.14	---	9.87	44.01	---	74	54	-9.99
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4874	H	46.64	---	0.97	47.61	---	74	54	-6.39
7311	H	36.38	---	9.83	46.21	---	74	54	-7.79
---	H	---	---	---	---	---	---	---	---
4874	V	45.57	---	0.97	46.54	---	74	54	-7.46
7311	V	36.02	---	9.83	45.85	---	74	54	-8.15
---	V	---	---	---	---	---	---	---	---

High channel: 2462 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4924	H	45.08	---	1.18	46.26	---	74	54	-7.74
7386	H	34.75	---	10.07	44.82	---	74	54	-9.18
---	H	---	---	---	---	---	---	---	---
4924	V	46.45	---	1.18	47.63	---	74	54	-6.37
7386	V	35.29	---	10.07	45.36	---	74	54	-8.64
---	V	---	---	---	---	---	---	---	---

Note:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dBμV/m)-Average limit (dBμV/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.
5. Data of measurement shown “---“in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.
6. All the restriction bands are compliance with the limit of 15.209.

Modulation Type: 802.11n (HT20)

Low channel: 2412 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4824	H	46.43	---	0.75	47.18	---	74	54	-6.82
7236	H	36.20	---	9.87	46.07	---	74	54	-7.93
---	H	---	---	---	---	---	---	---	---
4824	V	44.03	---	0.75	44.78	---	74	54	-9.22
7236	V	34.25	---	9.87	44.12	---	74	54	-9.88
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4874	H	44.98	---	0.97	45.95	---	74	54	-8.05
7311	H	34.41	---	9.83	44.24	---	74	54	-9.76
---	H	---	---	---	---	---	---	---	---
4874	V	45.65	---	0.97	46.62	---	74	54	-7.38
7311	V	35.13	---	9.83	44.96	---	74	54	-9.04
---	V	---	---	---	---	---	---	---	---

High channel: 2462 MHz

Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4924	H	46.27	---	1.18	47.45	---	74	54	-6.55
7386	H	35.41	---	10.07	45.48	---	74	54	-8.52
---	H	---	---	---	---	---	---	---	---
4924	V	45.54	---	1.18	46.72	---	74	54	-7.28
7386	V	34.91	---	10.07	44.98	---	74	54	-9.02
---	V	---	---	---	---	---	---	---	---

Note:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dBμV/m)-Average limit (dBμV/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.
5. Data of measurement shown “---“in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.
6. All the restriction bands are compliance with the limit of 15.209.

Modulation Type: 802.11n (HT40)

Low channel: 2422 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4844	H	45.37	---	0.75	46.12	---	74	54	-7.88
7266	H	35.06	---	9.87	44.93	---	74	54	-9.07
---	H	---	---	---	---	---	---	---	---
4824	V	44.69	---	0.75	45.44	---	74	54	-8.56
7236	V	34.14	---	9.87	44.01	---	74	54	-9.99
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4874	H	45.71	---	0.97	46.68	---	74	54	-7.32
7311	H	35.43	---	9.83	45.26	---	74	54	-8.74
---	H	---	---	---	---	---	---	---	---
4874	V	46.30	---	0.97	47.27	---	74	54	-6.73
7311	V	37.16	---	9.83	46.99	---	74	54	-7.01
---	V	---	---	---	---	---	---	---	---

High channel: 2452 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4904	H	46.67	---	1.18	47.85	---	74	54	-6.15
7356	H	36.29	---	10.07	46.36	---	74	54	-7.64
---	H	---	---	---	---	---	---	---	---
4904	V	45.99	---	1.18	47.17	---	74	54	-6.83
7356	V	36.85	---	10.07	46.92	---	74	54	-7.08
---	V	---	---	---	---	---	---	---	---

Note:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dBμV/m)-Average limit (dBμV/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency. The highest test frequency is 25GHz.
5. Data of measurement shown “---“in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.
6. All the restriction bands are compliance with the limit of 15.209.

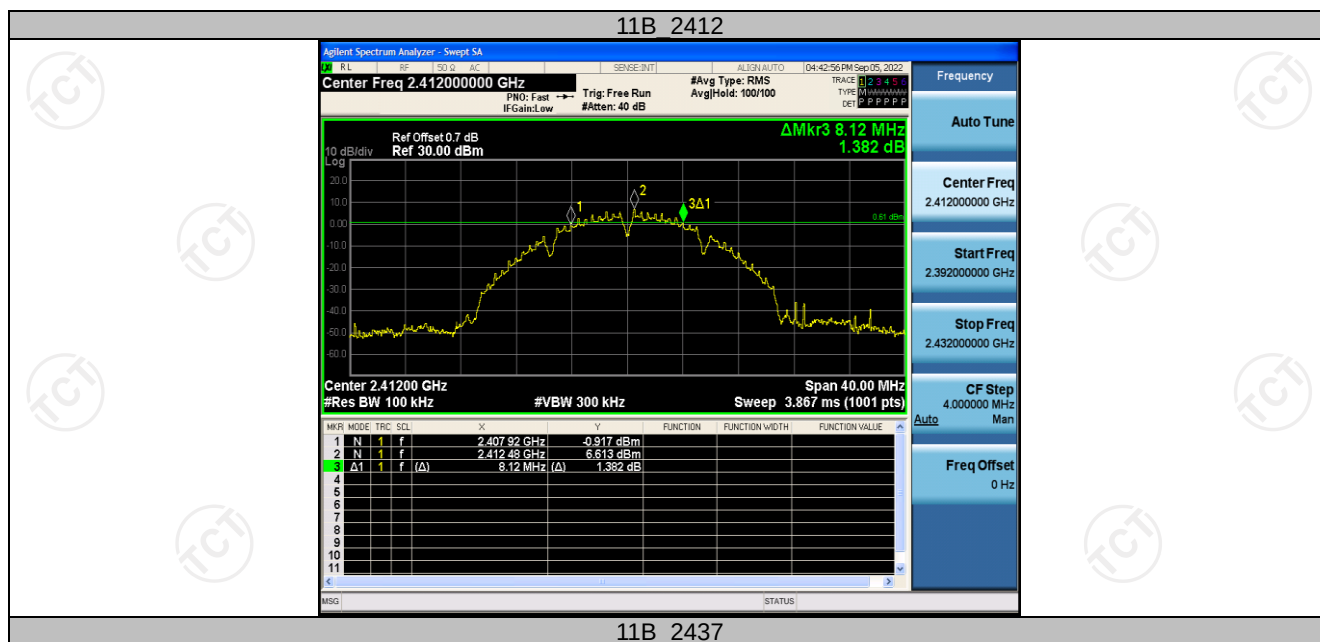
Appendix A: Test Result of Conducted Test

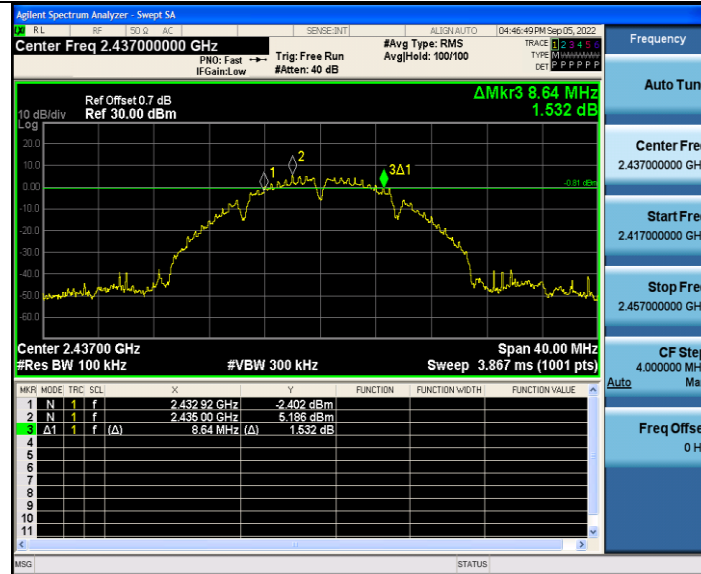
DTS Bandwidth

Test Result

Test Mode	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	2412	8.120	2407.920	2416.040	0.5	PASS
	2437	8.640	2432.920	2441.560	0.5	PASS
	2462	8.120	2457.920	2466.040	0.5	PASS
11G	2412	13.760	2406.160	2419.920	0.5	PASS
	2437	15.080	2429.480	2444.560	0.5	PASS
	2462	16.440	2453.760	2470.200	0.5	PASS
11N20SISO	2412	17.240	2403.600	2420.840	0.5	PASS
	2437	17.000	2428.800	2445.800	0.5	PASS
	2462	17.000	2453.400	2470.400	0.5	PASS
11N40SISO	2422	34.640	2405.600	2440.240	0.5	PASS
	2437	36.240	2419.000	2455.240	0.5	PASS
	2452	35.040	2434.560	2469.600	0.5	PASS

Test Graphs





11B 2462



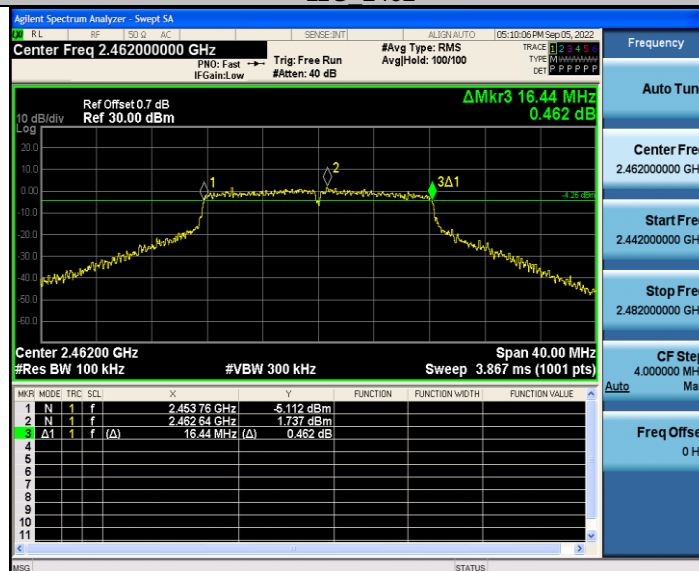
11G 2412



11G 2437



11G 2462



11N20SISO 2412



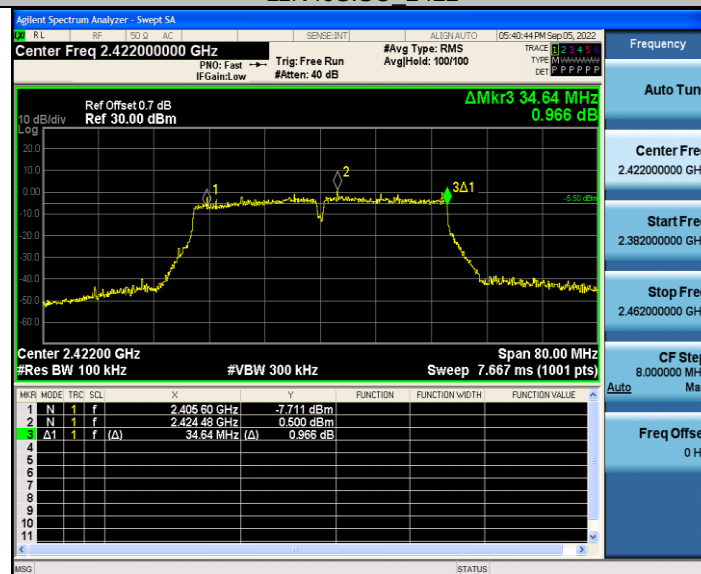
11N20SISO 2437



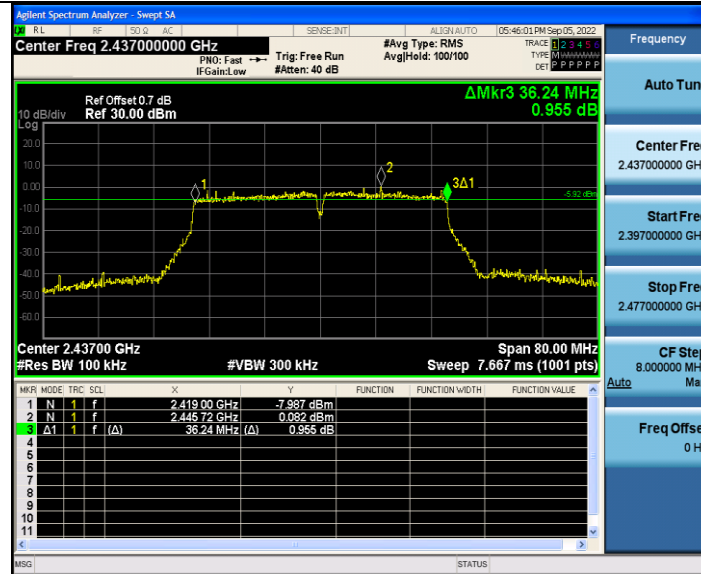
11N20SISO 2462



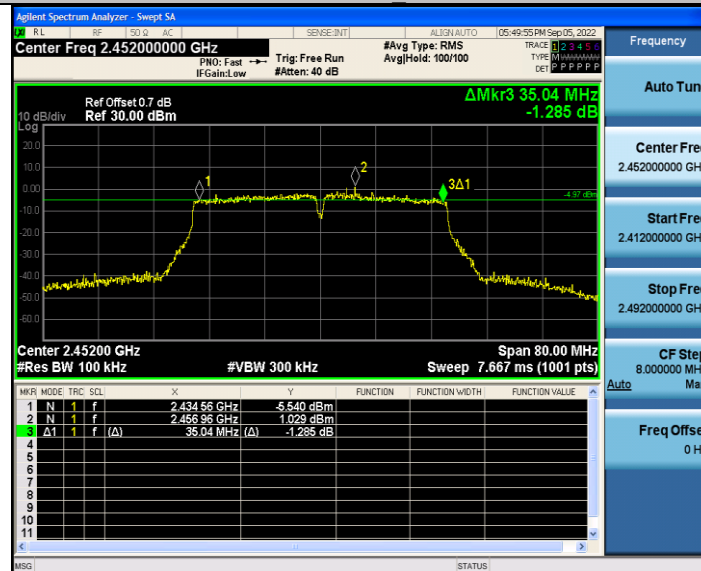
11N40SISO 2422



11N40SISO 2437



11N40SISO 2452



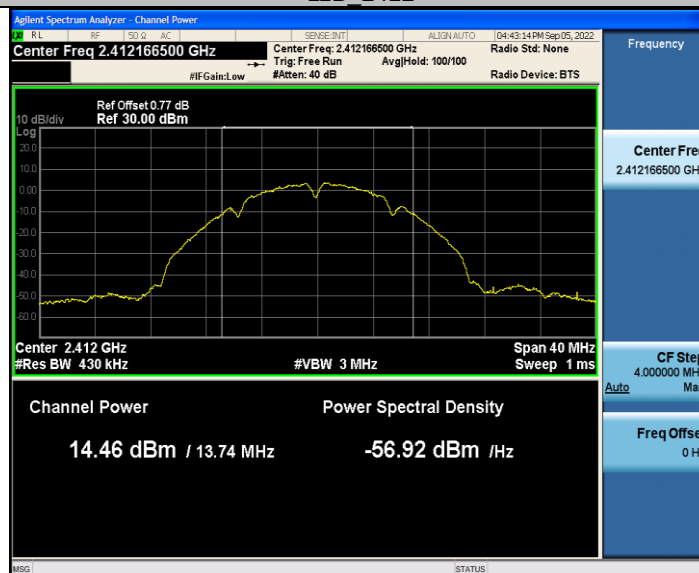
Maximum conducted output power

Test Result

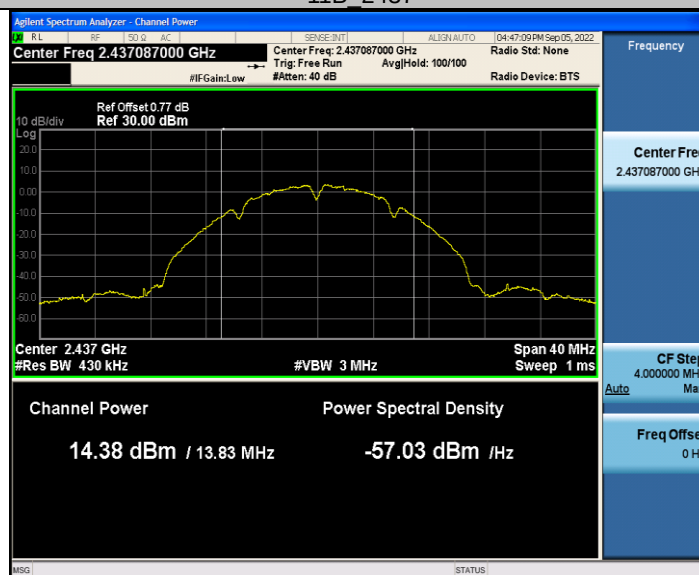
Test Mode	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	2412	14.46	<=30	PASS
	2437	14.38	<=30	PASS
	2462	14.17	<=30	PASS
11G	2412	14.44	<=30	PASS
	2437	14.70	<=30	PASS
	2462	14.52	<=30	PASS
11N20SISO	2412	13.39	<=30	PASS
	2437	13.67	<=30	PASS
	2462	13.46	<=30	PASS
11N40SISO	2422	14.37	<=30	PASS
	2437	14.33	<=30	PASS
	2452	14.31	<=30	PASS

Test Graphs

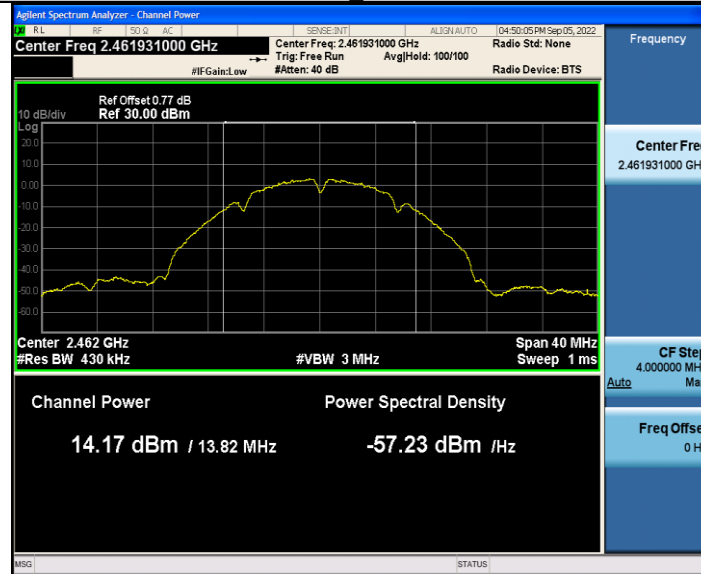
11B_2412



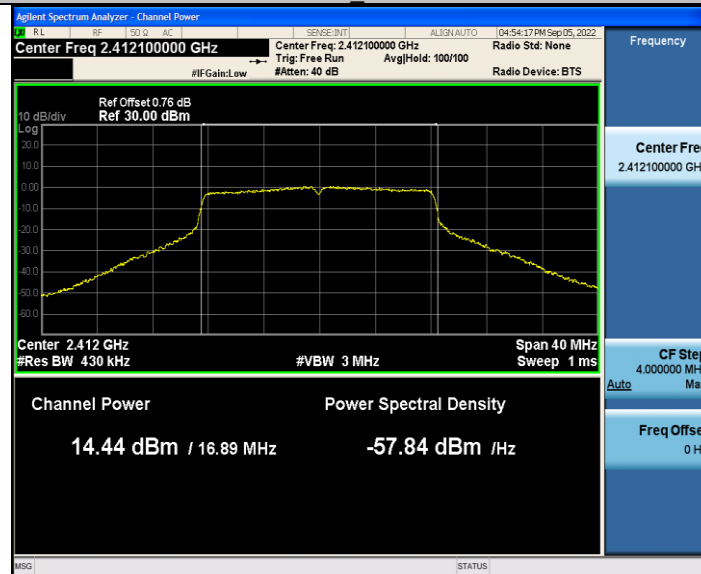
11B_2437



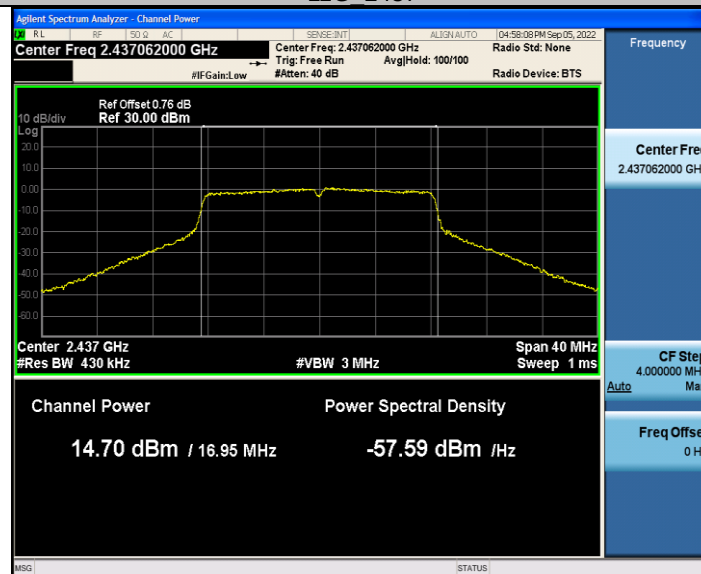
11B 2462



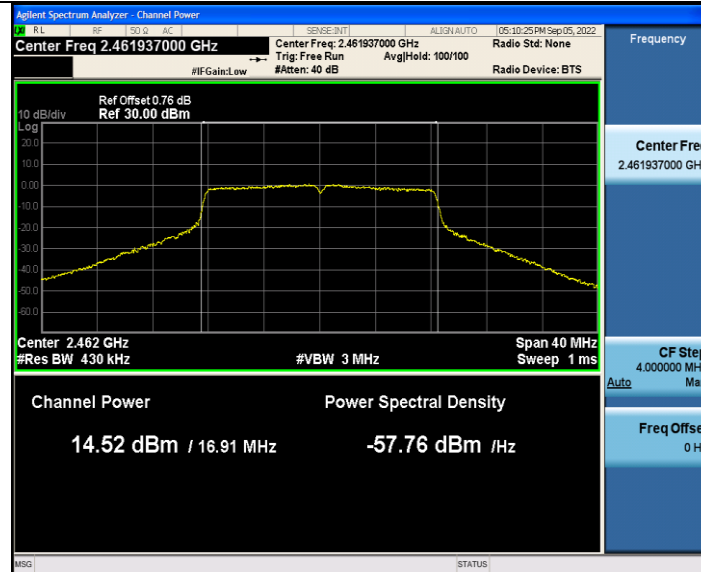
11G 2412



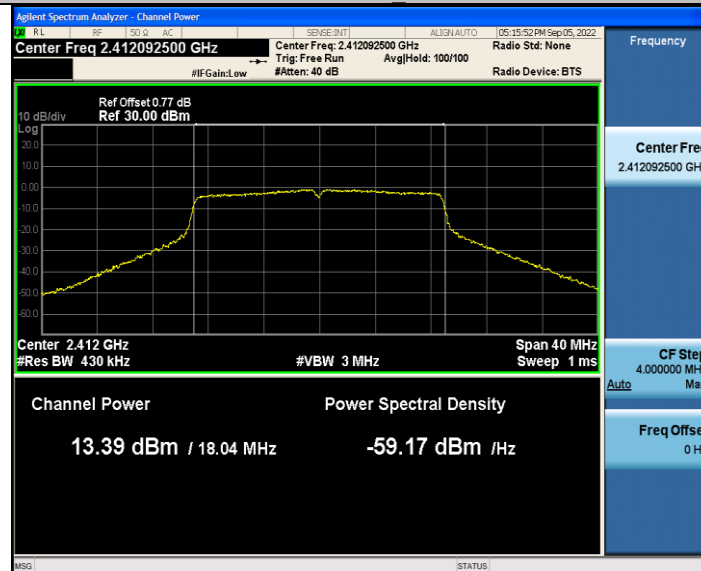
11G 2437



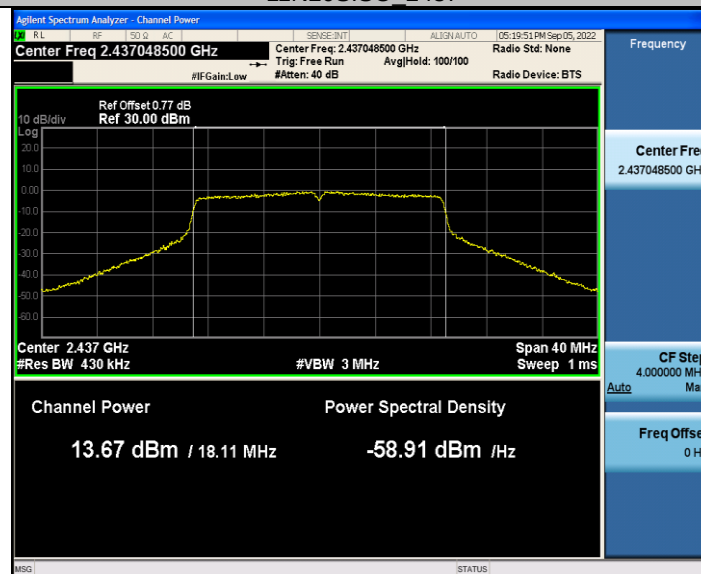
11G 2462



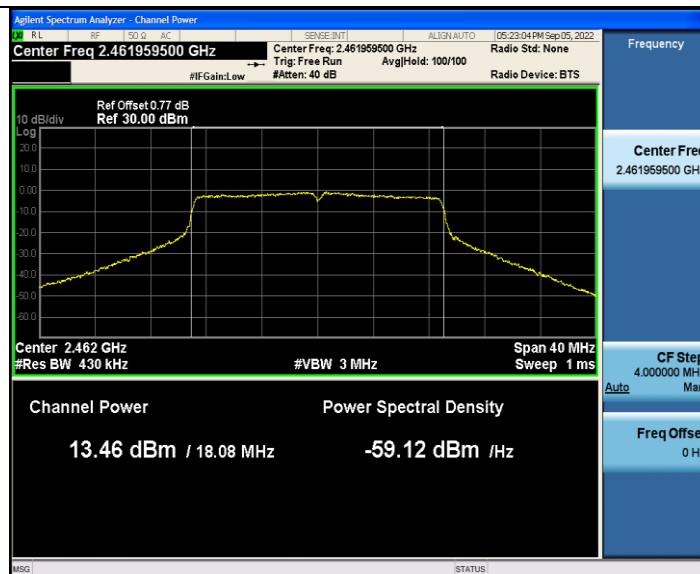
11N20SISO 2412



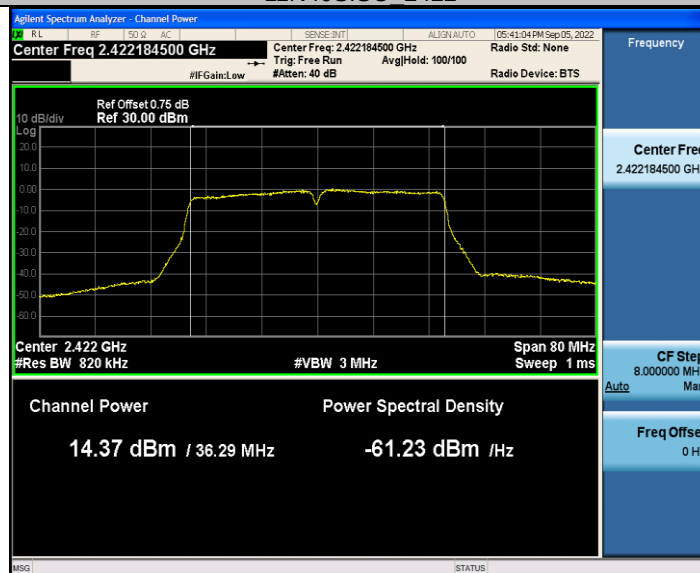
11N20SISO 2437



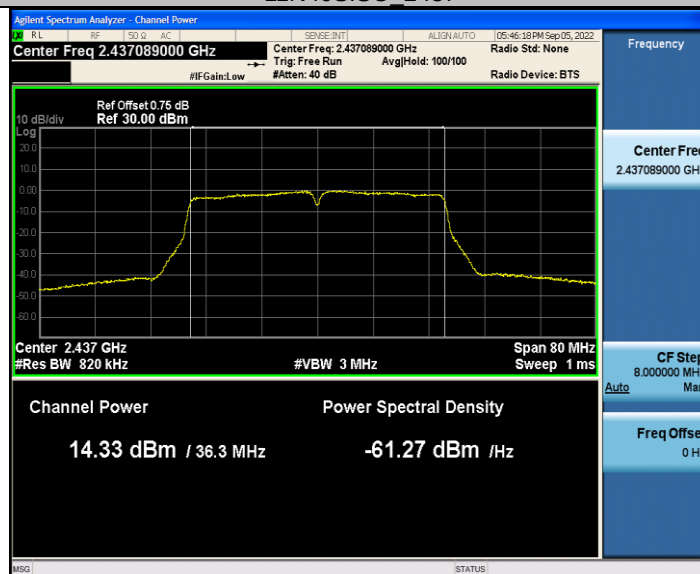
11N20SISO 2462



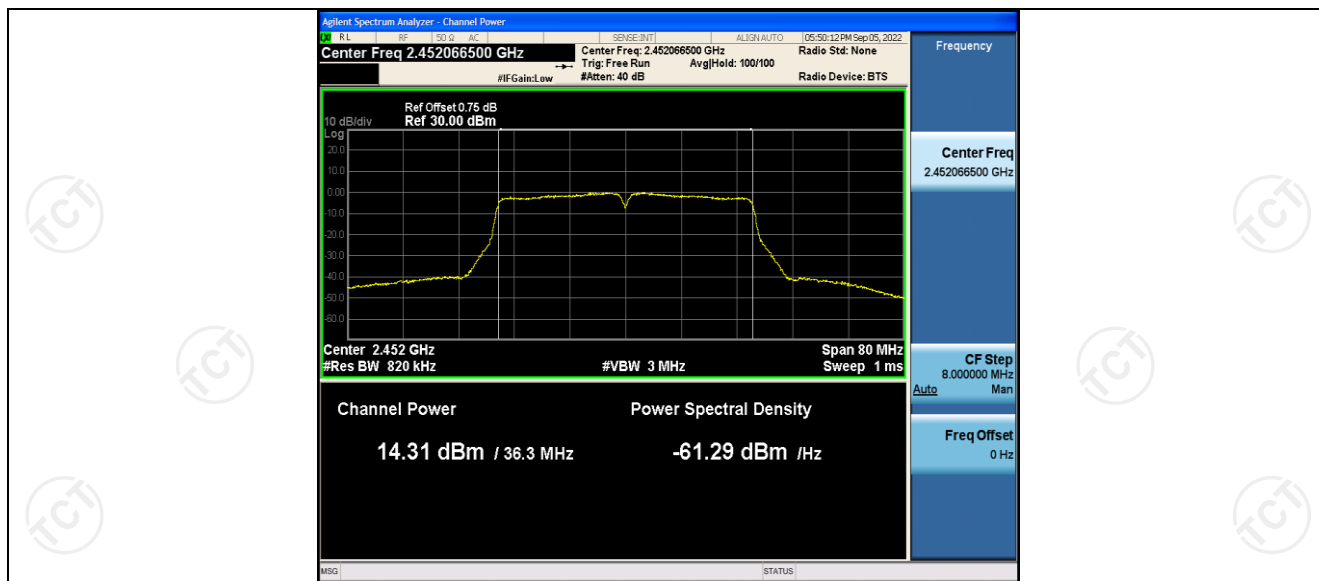
11N40SISO 2422



11N40SISO 2437



11N40SISO 2452



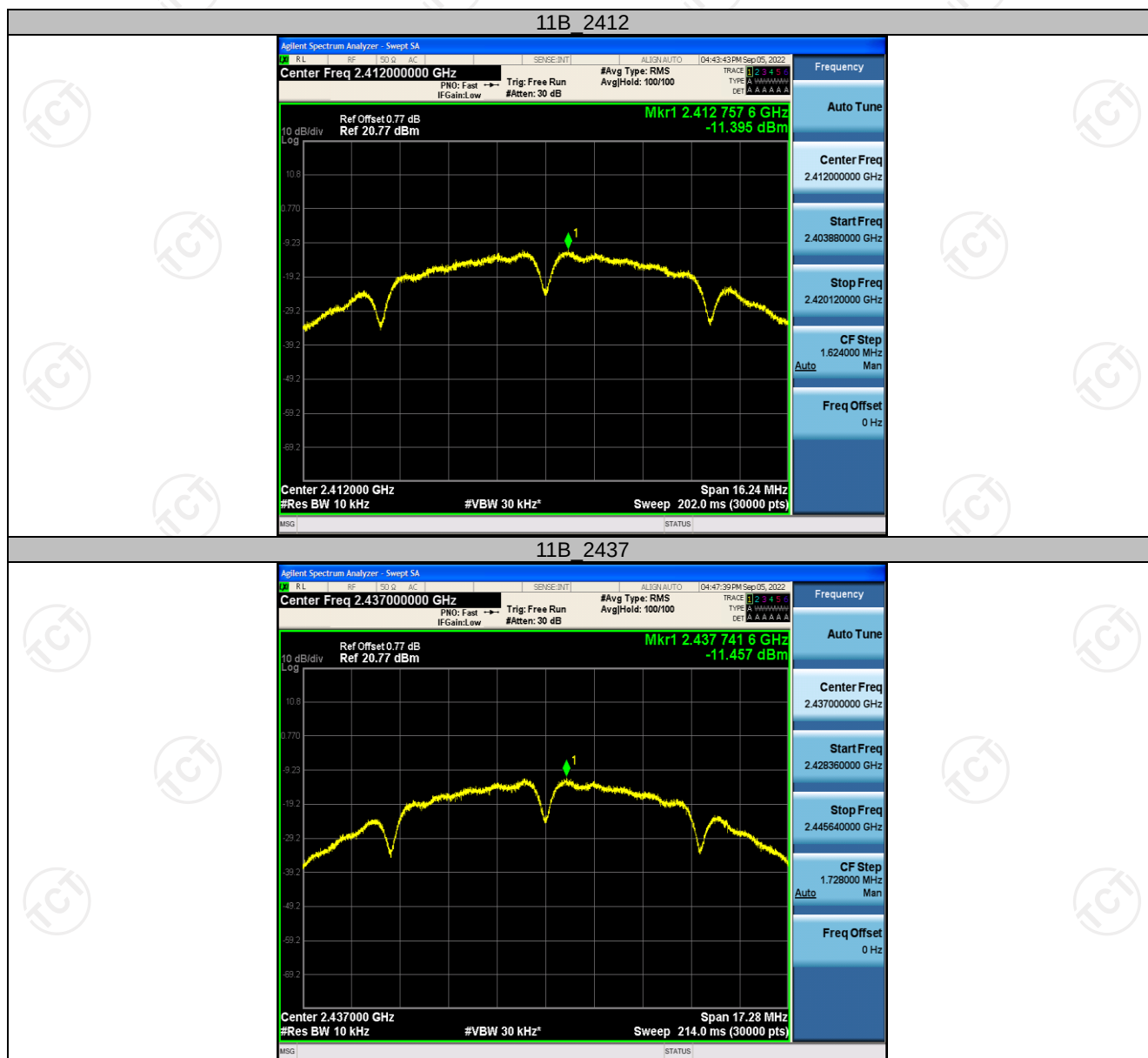
Maximum power spectral density

Test Result

Test Mode	Channel	Result [dBm/10kHz]	Result [dBm/3kHz]	Limit [dBm/3kHz]	Verdict
11B	2412	-11.40	-16.63	<=8	PASS
	2437	-11.46	-16.69	<=8	PASS
	2462	-11.89	-17.12	<=8	PASS
11G	2412	-13.57	-18.80	<=8	PASS
	2437	-13.33	-18.56	<=8	PASS
	2462	-13.94	-19.17	<=8	PASS
11N20SISO	2412	-14.93	-20.16	<=8	PASS
	2437	-14.73	-19.96	<=8	PASS
	2462	-14.87	-20.10	<=8	PASS
11N40SISO	2422	-17.15	-22.38	<=8	PASS
	2437	-17.00	-22.23	<=8	PASS
	2452	-17.25	-22.48	<=8	PASS

Note: Result [dBm/3kHz] = Result [dBm/10kHz] + 10log(3kHz/10kHz)

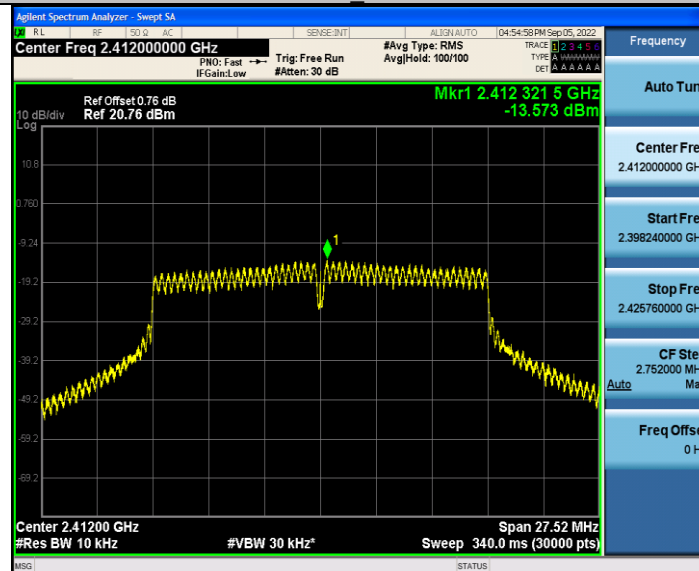
Test Graphs



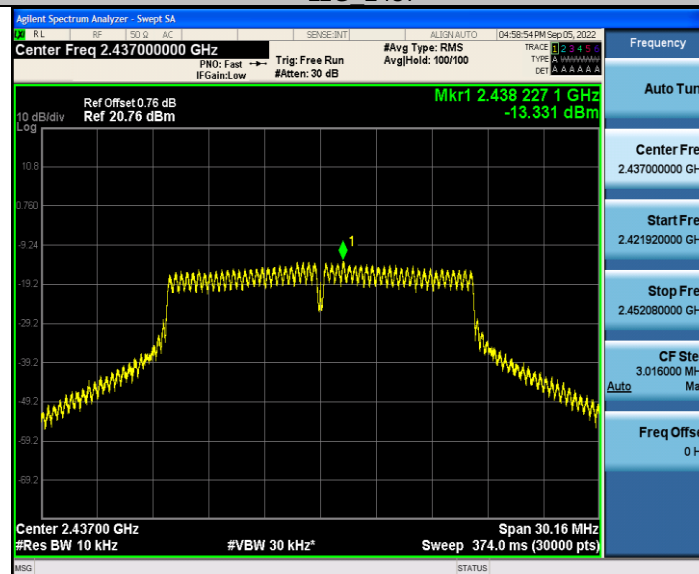
11B 2462



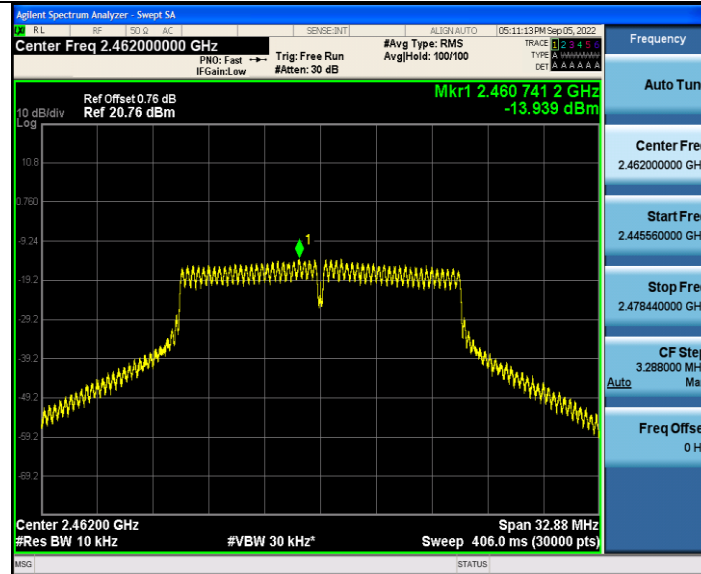
11G 2412



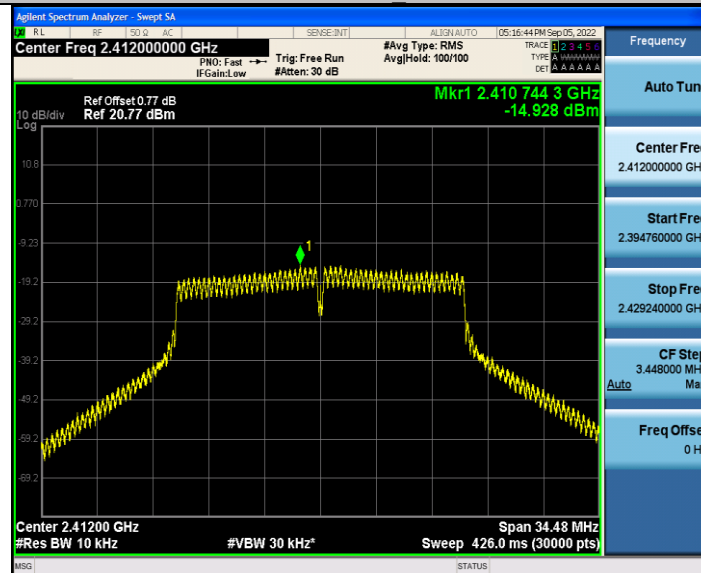
11G 2437



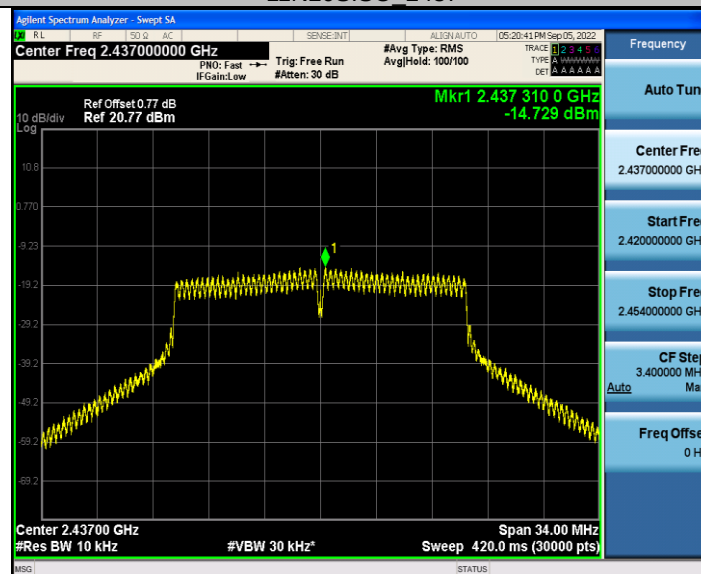
11G 2462



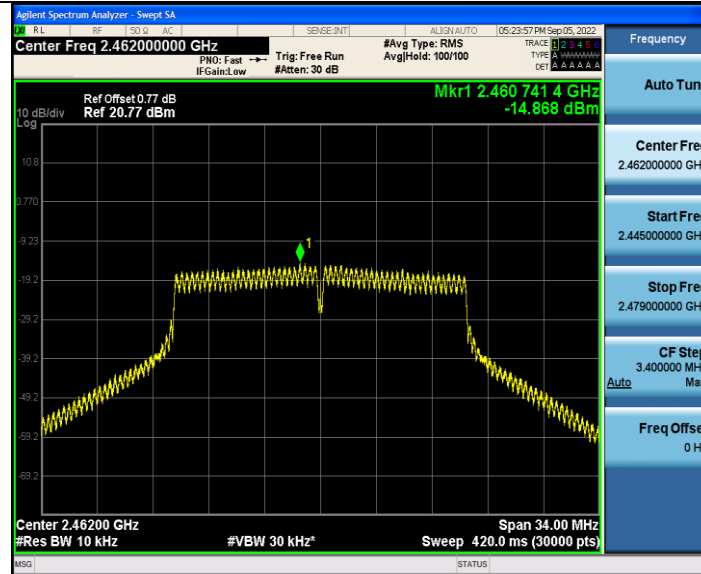
11N20SISO 2412



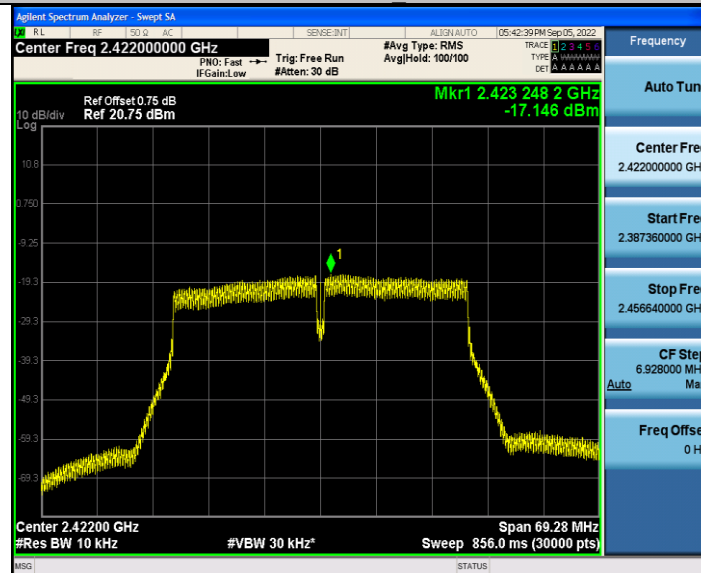
11N20SISO 2437



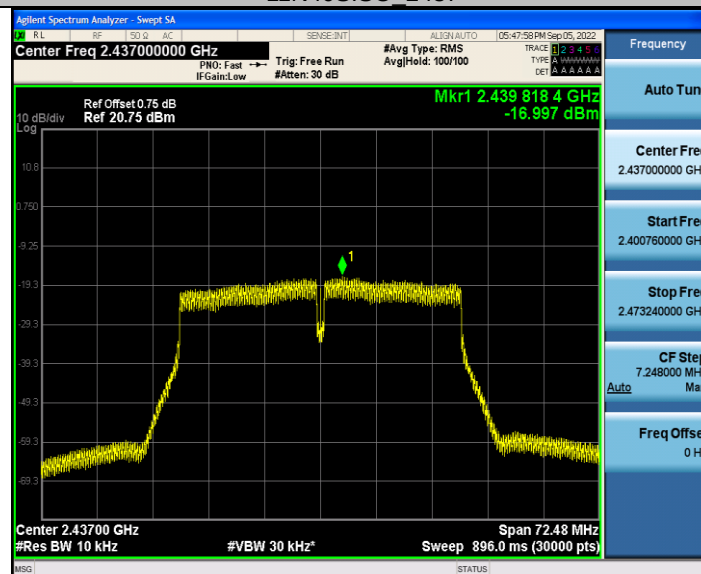
11N20SISO 2462



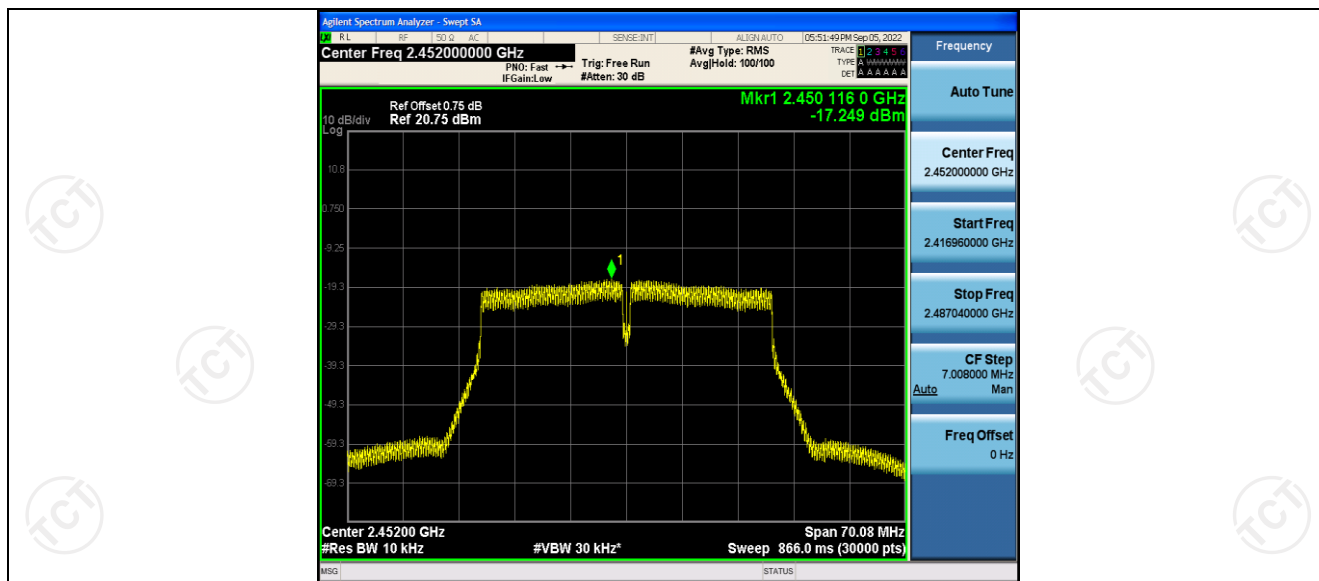
11N40SISO 2422



11N40SISO 2437



11N40SISO 2452



Band edge measurements

Test Result

Test Mode	Ch Name	Channel	Ref Level [dBm]	Result [dBm]	Limit [dBm]	Verdict
11B	Low	2412	6.40	-39.20	<=-23.60	PASS
	High	2462	5.95	-44.27	<=-24.05	PASS
11G	Low	2412	4.51	-26.76	<=-25.49	PASS
	High	2462	4.16	-48.33	<=-25.84	PASS
11N20SISO	Low	2412	3.60	-27.29	<=-26.40	PASS
	High	2462	4.01	-49.07	<=-25.99	PASS
11N40SISO	Low	2422	1.47	-38.63	<=-28.53	PASS
	High	2452	1.00	-41.01	<=-29.00	PASS

Test Graphs

