TCT 通测检测
TESTING CENTRE TECHNOLOGY

TEST REPORT

FCC ID. ..... :	2AYUR-KBK9057A	
Test Report No..... :	TCT210121E020	
Date of issue..... :	Aug. 20, 2021	
Testing laboratory ..... :	SHENZHEN TONGCE TESTING LAB	
Testing location/ address:	TCT Testing Industrial Park Fuqiao 5th Industrial Zone, Fuhai Street, Bao'an District Shenzhen, Guangdong, 518103, People's Republic of China	
Applicant's name..... :	Shenzhen Kitten Technology Co., Ltd	
Address..... :	B-805 Fenghuang zhigu 50tiezai Road Ban'ao Distict, Shenzhen, 518000 China	
Manufacturer's name ... :	Shenzhen Kitten Technology Co., Ltd	
Address..... :	B-805 Fenghuang zhigu 50tiezai Road Ban'ao Distict, Shenzhen, 518000 China	
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	
Test item description ..... :	Future board	
Trade Mark ..... :	KittenBot	
Model/Type reference..... :	KBK9057A, KBK9057B, KBK9057C, KBK9057D, KBK9071A	
Rating(s)..... :	DC 5V	
Date of receipt of test item ..... :	Jan. 21, 2021	
Date (s) of performance of test..... :	See dates for each test case	
Tested by (+signature) ... :	Aaron Mo	Aaron Mo
Check by (+signature).... :	Beryl Zhao	Beryl Zhao
Approved by (+signature):	Tomsin	Tomsin

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Table of Contents

1. General Product Information 3
1.1. EUT description 3
1.2. Model(s) list 3
1.3. Operation Frequency 4
2. Test Result Summary 5
3. General Information 6
3.1. Test environment and mode 6
3.2. Description of Support Units 7
4. Facilities and Accreditations 8
4.1. Facilities 8
4.2. Location 8
4.3. Measurement Uncertainty 8
5. Test Results and Measurement Data 9
5.1. Antenna requirement 9
5.2. Conducted Emission 10
5.3. Maximum Conducted (Average) Output Power 11
5.4. Emission Bandwidth 15
5.5. Power Spectral Density 16
5.6. Conducted Band Edge and Spurious Emission Measurement 17
5.7. Radiated Spurious Emission Measurement 19
Appendix A: Test Result of Conducted Test
Appendix B: Photographs of Test Setup
Appendix C: Photographs of EUT

1. General Product Information

1.1. EUT description

Test item description .....:	Future board
Model/Type reference.....:	KBK9057A
Sample Number.....:	TCT210121E010-0101
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.....:	PCB Antenna
Antenna Gain.....:	-2dBi
Rating(s).....:	DC 5V
Remark.....:	/

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

No.	Model No.	Tested with
1	KBK9057A	☒
Other models	KBK9057B, KBK9057C, KBK9057D, KBK9071A	☐

Note: KBK9057A is tested model, other models are derivative models. The models are identical in circuit and PCB layout, only different on the model names and color. So the test data of KBK9057A can represent the remaining models.

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

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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 Peak 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.

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3. General Information

3.1. Test environment and mode

Operating Environment:		
Condition	Conducted Emission	Radiated Emission
Temperature:	25.0 °C	25.0 °C
Humidity:	55 % RH	55 % RH
Atmospheric Pressure:	1010 mbar	1010 mbar
Test Software:		
Software Information:	ESP_RF_test_tool_v2.5	
Power Level:	Default	
Test Mode:		
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations	

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

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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
Notebook Computer	XiaoXin CHAO5000	PF0WZYD9	/	Lenovo
Adapter	ADLX65CCGC2A	8SSA10M42805C1SG79N12T6	/	Lenovo

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.

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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: TCT Testing Industrial Park Fuqiao 5th Industrial Zone, Fuhai Street, Bao'an District Shenzhen, Guangdong, 518103, People's Republic of China
TEL: +86-755-27673339

4.3. Measurement Uncertainty

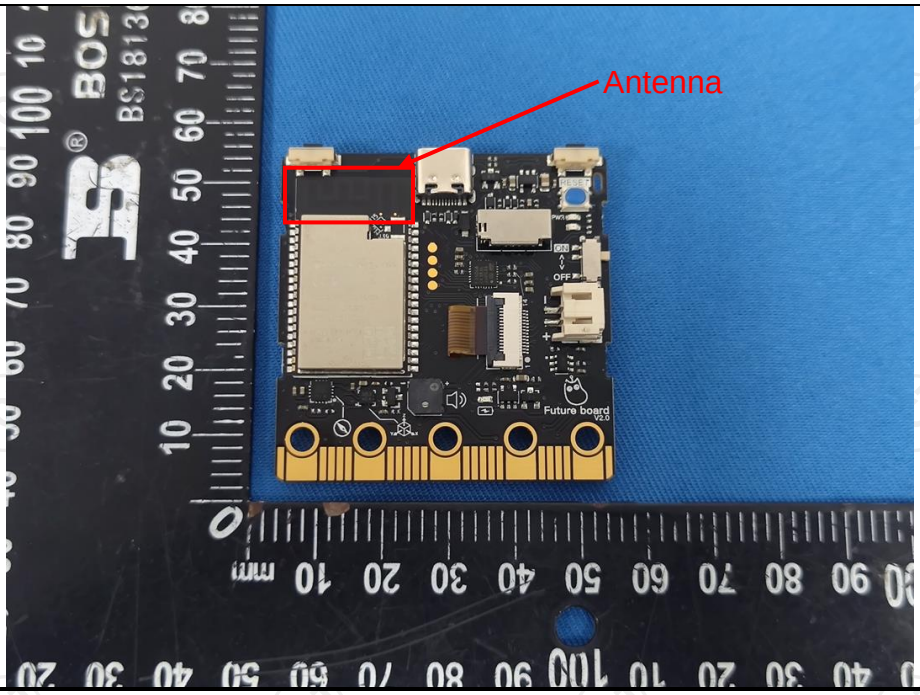
The reported uncertainty of measurement y ± U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

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

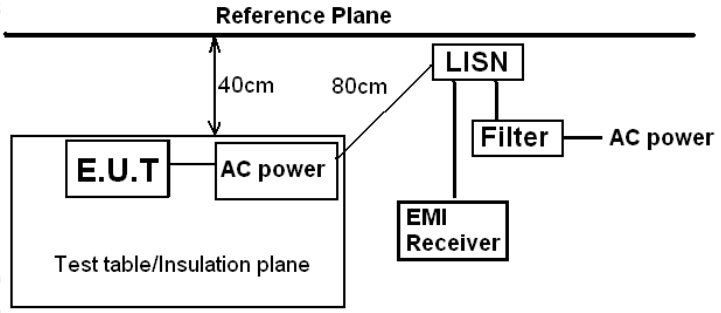
5.1. Antenna requirement

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 PCB antenna which permanently attached, and the best case gain of the antenna is -2dBi.	



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:	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:	 *Remark:* *E.U.T: Equipment Under Test* *LISN: Line Impedence Stabilization Network* *Test table height=0.8m*
Test Mode:	Refer to item 3.1
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

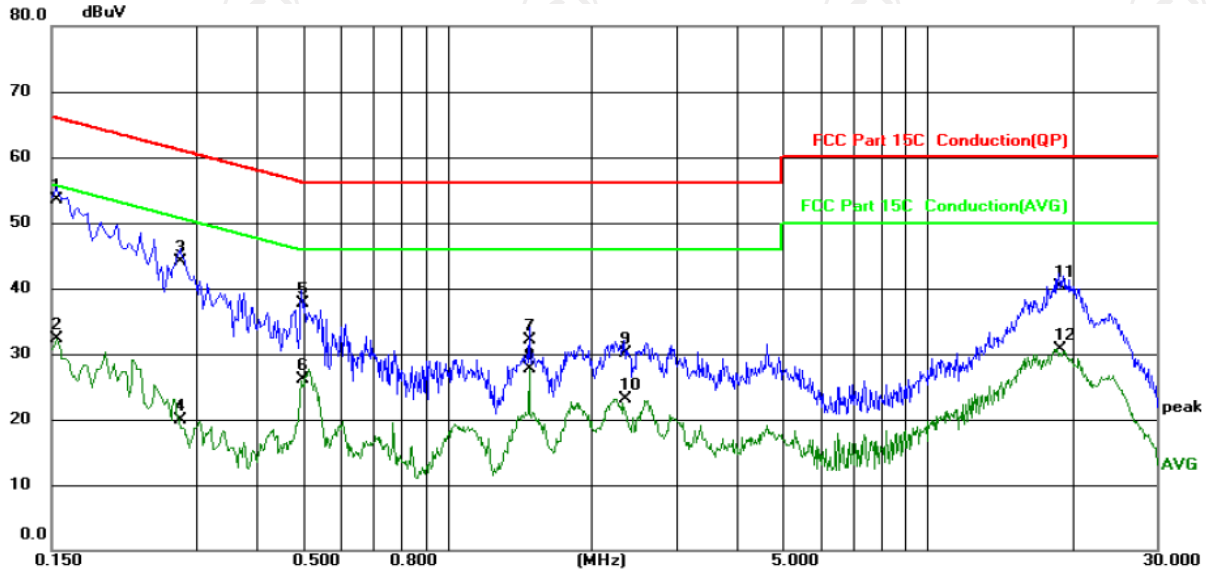
5.2.2. Test Instruments

Conducted Emission Shielding Room Test Site (843)				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI Test Receiver	R&S	ESCI3	100898	Jul. 07, 2022
Line Impedance Stabilisation Newtork(LISN)	Schwarzbeck	NSLK 8126	8126453	Mar. 11, 2022
Line-5	TCT	CE-05	N/A	Jul. 07, 2022
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

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	Phase: *L1*	Temperature:	25 (C)
Limit: FCC Part 15C Conduction(QP)	Power: DC 5V(Notebook Computer Input AC 120V/60 Hz)	Humidity:	55 %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1539	43.46	10.07	53.53	65.79	-12.26	QP	
2		0.1539	22.31	10.07	32.38	55.79	-23.41	AVG	
3		0.2779	33.94	10.09	44.03	60.88	-16.85	QP	
4		0.2779	9.75	10.09	19.84	50.88	-31.04	AVG	
5		0.4980	27.52	10.10	37.62	56.03	-18.41	QP	
6		0.4980	15.92	10.10	26.02	46.03	-20.01	AVG	
7		1.4860	21.86	10.16	32.02	56.00	-23.98	QP	
8		1.4860	17.49	10.16	27.65	46.00	-18.35	AVG	
9		2.3340	19.89	10.19	30.08	56.00	-25.92	QP	
10		2.3340	12.99	10.19	23.18	46.00	-22.82	AVG	
11		18.7700	29.17	11.11	40.28	60.00	-19.72	QP	
12		18.7700	19.66	11.11	30.77	50.00	-19.23	AVG	

Note1:

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

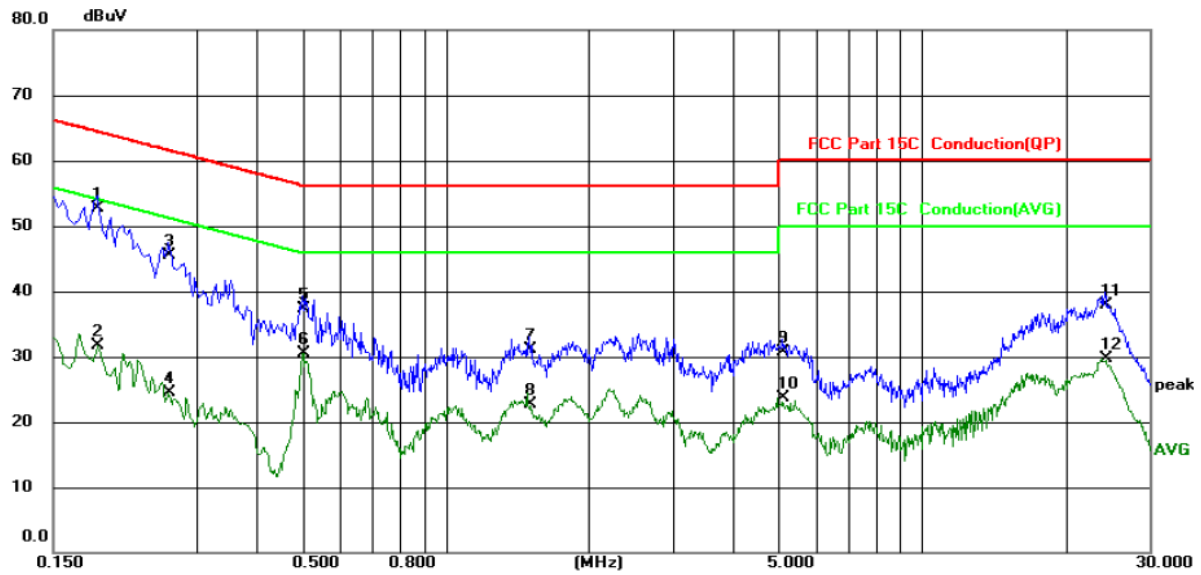
Margin (dB) = Measurement (dBµV) – Limits (dBµV)

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	Phase: N	Temperature:	25 (C)
Limit: FCC Part 15C Conduction(QP)	Power: DC 5V(Notebook Computer Input AC 120V/60 Hz)	Humidity:	55 %RH

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1860	42.53	10.08	52.61	64.21	-11.60	QP	
2		0.1860	21.58	10.08	31.66	54.21	-22.55	AVG	
3		0.2620	35.34	10.08	45.42	61.37	-15.95	QP	
4		0.2620	14.45	10.08	24.53	51.37	-26.84	AVG	
5		0.5020	27.18	10.10	37.28	56.00	-18.72	QP	
6		0.5020	20.37	10.10	30.47	46.00	-15.53	AVG	
7		1.5020	20.87	10.16	31.03	56.00	-24.97	QP	
8		1.5020	12.64	10.16	22.80	46.00	-23.20	AVG	
9		5.0860	20.47	10.28	30.75	60.00	-29.25	QP	
10		5.0860	13.39	10.28	23.67	50.00	-26.33	AVG	
11		24.1500	26.65	11.22	37.87	60.00	-22.13	QP	
12		24.1500	18.53	11.22	29.75	50.00	-20.25	AVG	

Note:

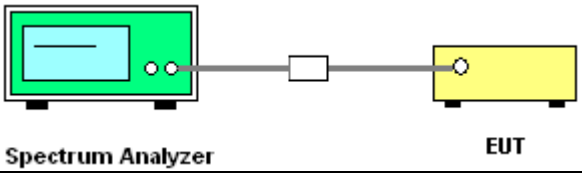
Freq. = Emission frequency in MHz
Reading level (dBµV) = Receiver reading
Corr. Factor (dB) = LISN factor + Cable loss
Measurement (dBµV) = Reading level (dBµV) + Corr. Factor (dB)
Limit (dBµV) = Limit stated in standard
Margin (dB) = Measurement (dBµV) – Limits (dBµV)
Q.P. =Quasi-Peak
AVG =average
** is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.*

Note2:

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

5.3. Maximum Conducted (Average) Output Power

5.3.1. Test Specification

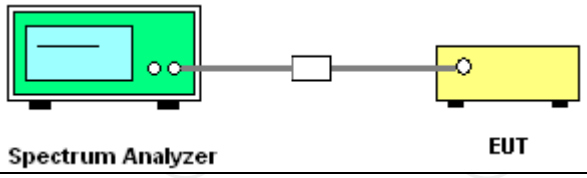
Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	KDB 558074 D01 v05r02
Limit:	30dBm
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the 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

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 18, 2022
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Jul. 18, 2022
Antenna Connector	TCT	RFC-01	N/A	Jul. 18, 2022

5.4. Emission Bandwidth

5.4.1. Test Specification

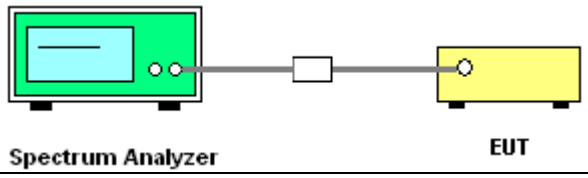
Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	KDB 558074 D01 v05r02
Limit:	>500kHz
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. Set to the maximum power setting and enable the EUT transmit continuously. 2. Make the measurement with the spectrum analyzer's 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

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 18, 2022
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Jul. 18, 2022
Antenna Connector	TCT	RFC-01	N/A	Jul. 18, 2022

5.5. Power Spectral Density

5.5.1. Test Specification

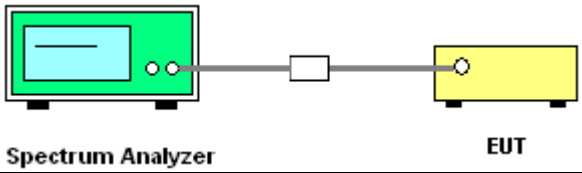
Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	KDB 558074
Limit:	The average power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.
Test Setup:	
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The RF output 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 kHz ≤ RBW ≤ 100 kHz. Video bandwidth VBW ≥ 3 x 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

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 18, 2022
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Jul. 18, 2022
Antenna Connector	TCT	RFC-01	N/A	Jul. 18, 2022

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:	
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

RF Test Room				
Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	N9020A	MY49100619	Jul. 18, 2022
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Jul. 18, 2022
Antenna Connector	TCT	RFC-01	N/A	Jul. 18, 2022

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

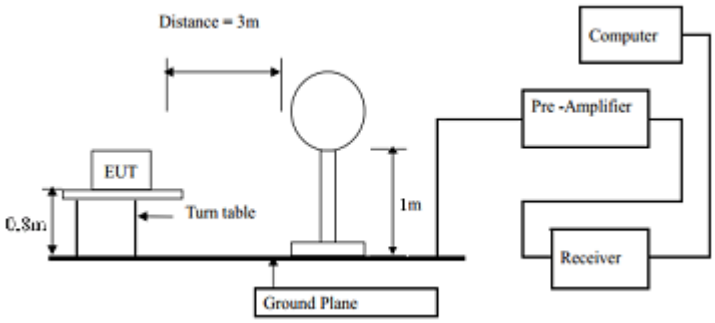
Limit:

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

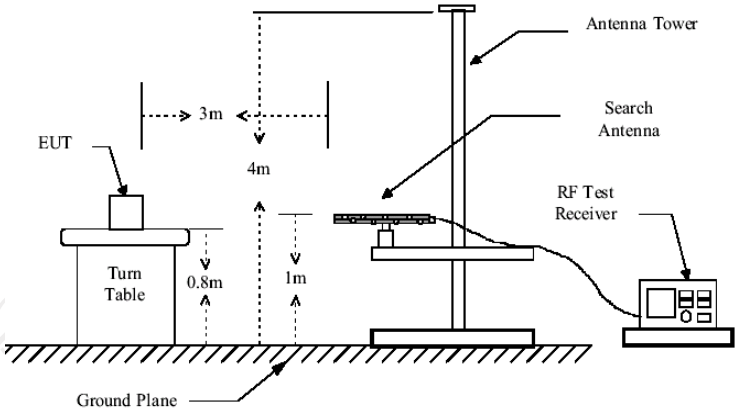
Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)	Detector
Above 1GHz	500	3	Average
	5000	3	Peak

Test setup:

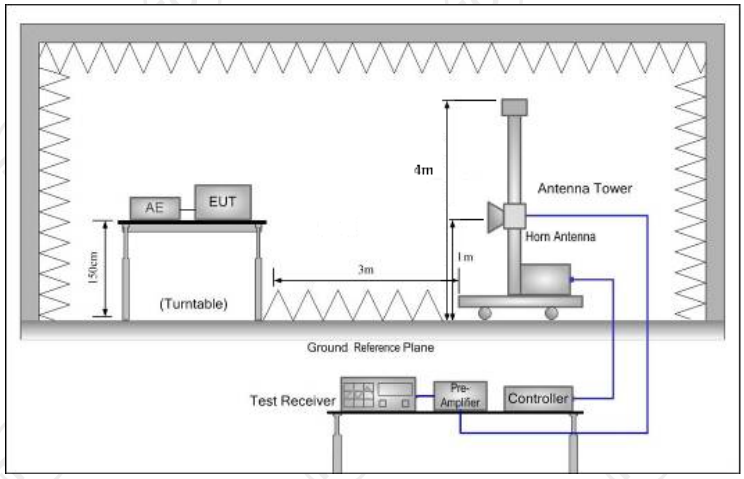
For radiated emissions below 30MHz



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 ≥ 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 ≥ 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

Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

5.7.2. Test Instruments

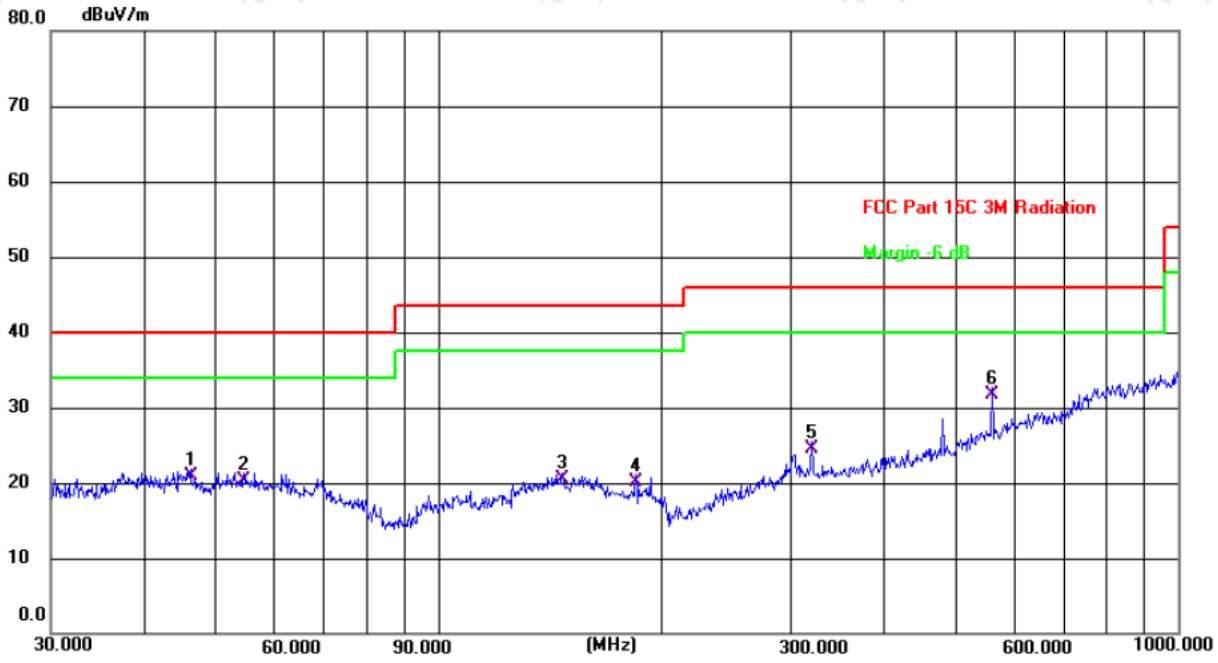
Radiated Emission Test Site (966)				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI Test Receiver	R&S	ESIB7	100197	Jul. 07, 2022
Spectrum Analyzer	R&S	FSQ40	200061	Jul. 07, 2022
Pre-amplifier	SKET	LNPA_0118G-45	SK2021012102	Mar. 11, 2022
Pre-amplifier	SKET	LNPA_1840G-50	SK202109203500	Apr. 08, 2022
Pre-amplifier	HP	8447D	2727A05017	Jul. 07, 2022
Loop antenna	ZHINAN	ZN30900A	12024	Sep. 05, 2022
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 04, 2022
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep. 04, 2022
Horn Antenna	Schwarzbeck	BBHA 9170	00956	Apr. 10, 2023
Antenna Mast	Keleto	RE-AM	N/A	N/A
Coaxial cable	SKET	RC_DC18G-N	N/A	Apr. 08, 2022
Coaxial cable	SKET	RC-DC18G-N	N/A	Apr. 08, 2022
Coaxial cable	SKET	RC-DC40G-N	N/A	Jul. 07, 2022
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

5.7.3. Test Data

Please refer to following diagram for individual

Below 1GHz

Horizontal:



Site

Limit: FCC Part 15C 3M Radiation

Polarization: ***Horizontal***

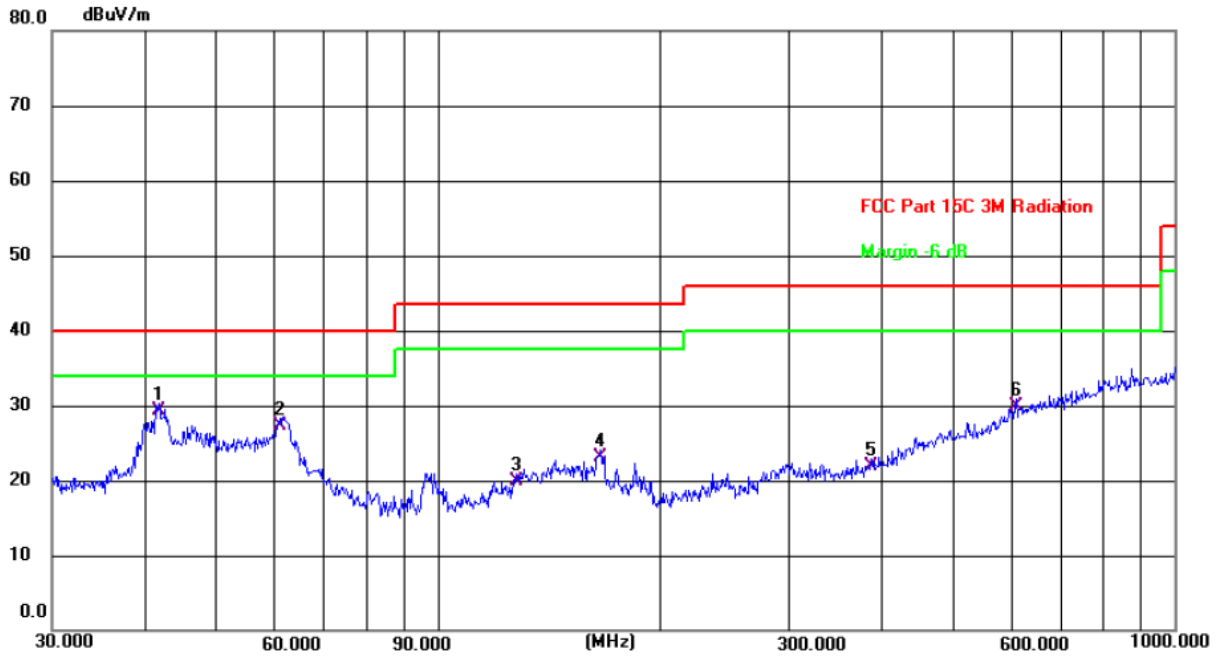
Power: DC 5V(Notebook Computer Input AC 120V/60 Hz)

Temperature: 24.5(C)

Humidity: 48 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	46.3402	7.05	13.85	20.90	40.00	-19.10	QP	P	
2	54.6428	7.11	13.19	20.30	40.00	-19.70	QP	P	
3	147.4036	7.07	13.43	20.50	43.50	-23.00	QP	P	
4	185.1374	8.50	11.60	20.10	43.50	-23.40	QP	P	
5	319.9368	9.97	14.53	24.50	46.00	-21.50	QP	P	
6 *	560.6928	11.34	20.46	31.80	46.00	-14.20	QP	P	

Vertical:



Site	Polarization: *Vertical*	Temperature:	24.5(C)
Limit: FCC Part 15C 3M Radiation	Power: DC 5V(Notebook Computer Input AC 120V/60 Hz)	Humidity:	48 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1 *	41.8594	15.35	13.95	29.30	40.00	-10.70	QP	P	
2	61.1315	15.01	12.39	27.40	40.00	-12.60	QP	P	
3	128.1125	7.35	12.55	19.90	43.50	-23.60	QP	P	
4	166.6511	9.97	13.23	23.20	43.50	-20.30	QP	P	
5	387.9917	5.64	16.26	21.90	46.00	-24.10	QP	P	
6	609.9215	8.40	21.50	29.90	46.00	-16.10	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*

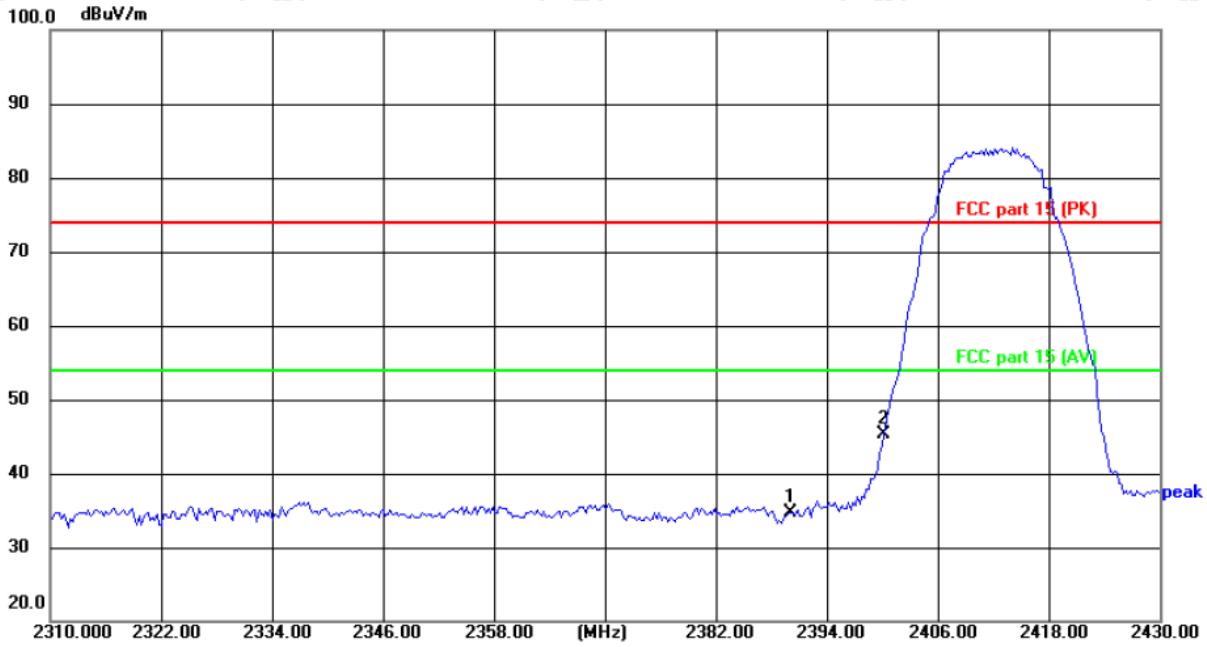
2. Measurements were conducted in all three channels (high, middle, low) and all modulation(802.11b, 802.11g, 802.11n(HT20), 802.11n(HT40)), and the worst case Mode (Lowest channel and 802.11b) was submitted only.

3. Freq. = Emission frequency in MHz
Measurement (dBµV/m) = Reading level (dBµV) + Corr. Factor (dB)
Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
Limit (dBµV/m) = Limit stated in standard
Margin (dB) = Measurement (dBµV/m) – Limits (dBµV/m)
** is meaning the worst frequency has been tested in the test frequency range*

Test Result of Radiated Spurious at Band edges

Lowest channel 2412:

Horizontal:



Site

Limit: FCC part 15 (PK)

Polarization: *Horizontal*

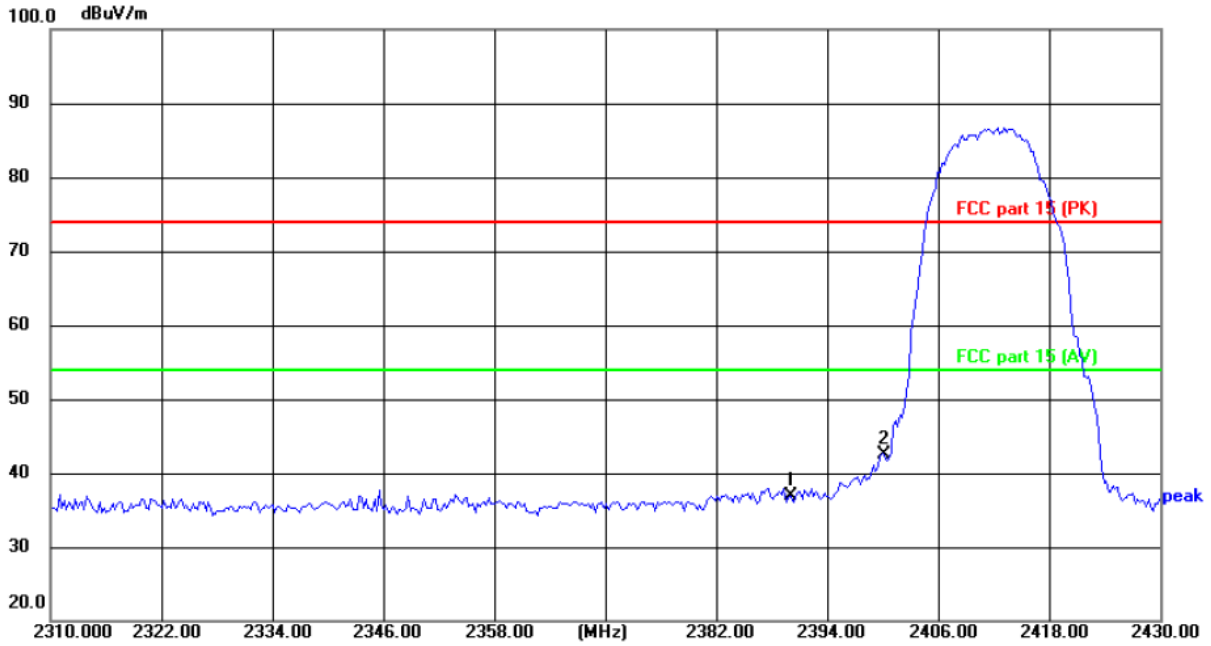
Power: DC 5 V((Notebook Computer Input AC 120V/60 Hz)

Temperature: 25(℃)

Humidity: 55 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	47.89	-13.15	34.74	74.00	-39.26	peak
2 *	2400.000	58.41	-13.12	45.29	74.00	-28.71	peak

Vertical:



Site

Limit: FCC part 15 (PK)

Polarization: *Vertical*

Power: DC 5 V((Notebook Computer Input AC 120V/60 Hz)

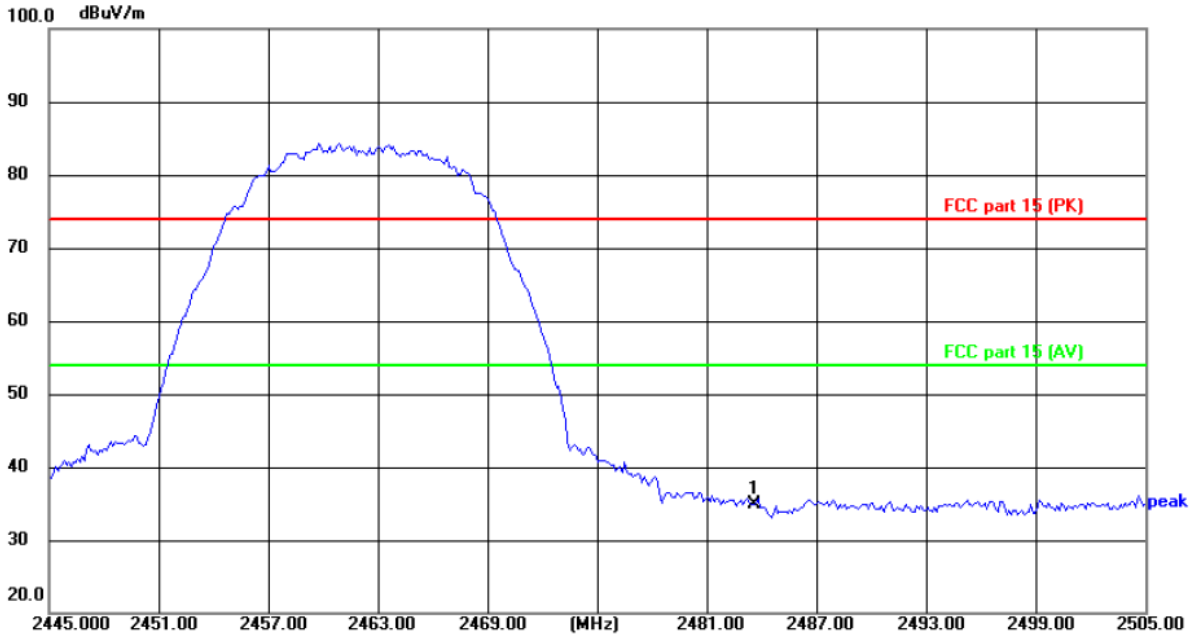
Temperature: 25(℃)

Humidity: 55 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	49.96	-13.15	36.81	74.00	-37.19	peak
2 *	2400.000	55.69	-13.12	42.57	74.00	-31.43	peak

Highest channel 2462:

Horizontal:



Site

Limit: FCC part 15 (PK)

Polarization: *Horizontal*

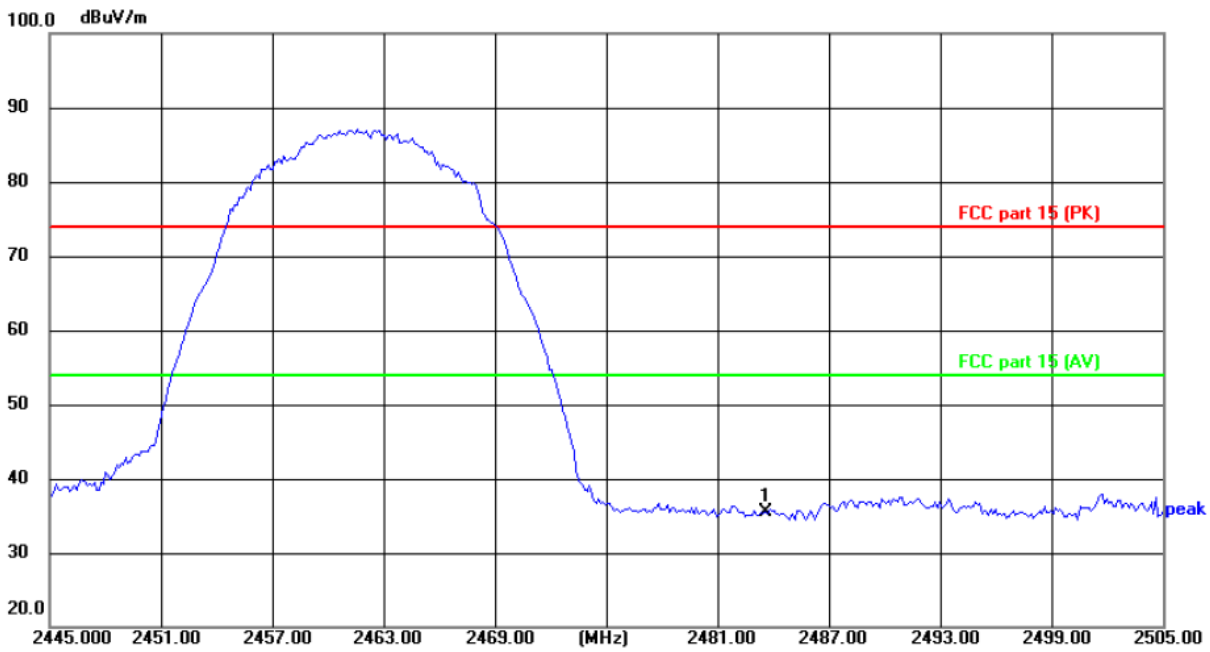
Power: DC 5 V((Notebook Computer Input AC 120V/60 Hz)

Temperature: 25(℃)

Humidity: 55 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	2483.500	47.65	-12.74	34.91	74.00	-39.09	peak

Vertical:



Site

Limit: FCC part 15 (PK)

Polarization: *Vertical*

Power: DC 5 V((Notebook Computer Input AC 120V/60 Hz)

Temperature: 25(℃)

Humidity: 55 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	2483.500	48.18	-12.74	35.44	74.00	-38.56	peak

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 802.11b) was submitted only.*

Above 1GHz

Modulation Type: 802.11b

Low channel: 2412 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBµV)	AV reading (dBuV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBµV/m)	AV limit (dBµV/m)	Margin (dB)
					Peak (dBµV/m)	AV (dBµV/m)			
4824	H	46.04	---	0.75	46.79	---	74	54	-7.21
7236	H	36.32	---	9.87	46.19	---	74	54	-7.81
---	H	---	---	---	---	---	---	---	---
4824	V	44.18	---	0.75	44.93	---	74	54	-9.07
7236	V	33.96	---	9.87	43.83	---	74	54	-10.17
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437MHz									
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	45.85	---	0.97	46.82	---	74	54	-7.18
7311	H	36.43	---	9.83	46.26	---	74	54	-7.74
---	H	---	---	---	---	---	---	---	---
4874	V	45.55	---	0.97	46.52	---	74	54	-7.48
7311	V	36.27	---	9.83	46.10	---	74	54	-7.90
---	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	44.69	---	1.18	45.87	---	74	54	-8.13
7386	H	33.33	---	10.07	43.40	---	74	54	-10.60
---	H	---	---	---	---	---	---	---	---
4924	V	46.62	---	1.18	47.80	---	74	54	-6.20
7386	V	35.25	---	10.07	45.32	---	74	54	-8.68
---	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 (dBuV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4824	H	45.62	---	0.75	46.37	---	74	54	-7.63
7236	H	35.13	---	9.87	45.00	---	74	54	-9.00
---	H	---	---	---	---	---	---	---	---
4824	V	44.36	---	0.75	45.11	---	74	54	-8.89
7236	V	33.05	---	9.87	42.92	---	74	54	-11.08
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437MHz									
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	44.93	---	0.97	45.90	---	74	54	-8.10
7311	H	34.17	---	9.83	44.00	---	74	54	-10.00
---	H	---	---	---	---	---	---	---	---
4874	V	45.39	---	0.97	46.36	---	74	54	-7.64
7311	V	36.15	---	9.83	45.98	---	74	54	-8.02
---	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	45.07	---	1.18	46.25	---	74	54	-7.75
7386	H	36.23	---	10.07	46.30	---	74	54	-7.70
---	H	---	---	---	---	---	---	---	---
4924	V	46.02	---	1.18	47.20	---	74	54	-6.80
7386	V	33.54	---	10.07	43.61	---	74	54	-10.39
---	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 (dBuV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4824	H	46.64	---	0.75	47.39	---	74	54	-6.61
7236	H	37.38	---	9.87	47.25	---	74	54	-6.75
---	H	---	---	---	---	---	---	---	---
4824	V	46.27	---	0.75	47.02	---	74	54	-6.98
7236	V	35.13	---	9.87	45.00	---	74	54	-9.00
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437MHz									
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	46.02	---	0.97	46.99	---	74	54	-7.01
7311	H	36.17	---	9.83	46.00	---	74	54	-8.00
---	H	---	---	---	---	---	---	---	---
4874	V	45.76	---	0.97	46.73	---	74	54	-7.27
7311	V	35.57	---	9.83	45.40	---	74	54	-8.60
---	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	45.26	---	1.18	46.44	---	74	54	-7.56
7386	H	36.14	---	10.07	46.21	---	74	54	-7.79
---	H	---	---	---	---	---	---	---	---
4924	V	43.28	---	1.18	44.46	---	74	54	-9.54
7386	V	34.69	---	10.07	44.76	---	74	54	-9.24
---	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 (dBuV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4844	H	43.25	---	0.75	44.00	---	74	54	-10.00
7266	H	34.84	---	9.87	44.71	---	74	54	-9.29
---	H	---	---	---	---	---	---	---	---
4824	V	46.23	---	0.75	46.98	---	74	54	-7.02
7236	V	37.44	---	9.87	47.31	---	74	54	-6.69
---	V	---	---	---	---	---	---	---	---

Middle channel: 2437MHz									
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	45.37	---	0.97	46.34	---	74	54	-7.66
7311	H	36.76	---	9.83	46.59	---	74	54	-7.41
---	H	---	---	---	---	---	---	---	---
4874	V	47.22	---	0.97	48.19	---	74	54	-5.81
7311	V	36.02	---	9.83	45.85	---	74	54	-8.15
---	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	48.18	---	1.18	49.36	---	74	54	-4.64
7356	H	37.07	---	10.07	47.14	---	74	54	-6.86
---	H	---	---	---	---	---	---	---	---
4904	V	45.42	---	1.18	46.60	---	74	54	-7.40
7356	V	35.13	---	10.07	45.20	---	74	54	-8.80
---	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

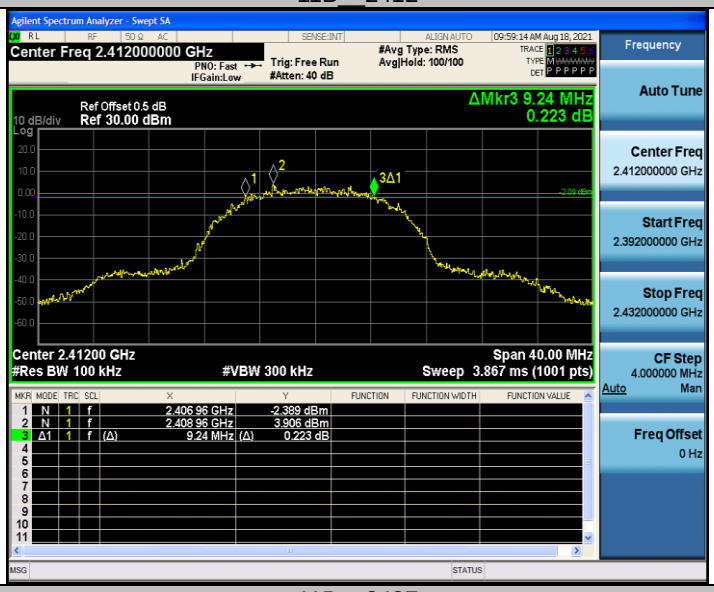
DTS Bandwidth

Test Result

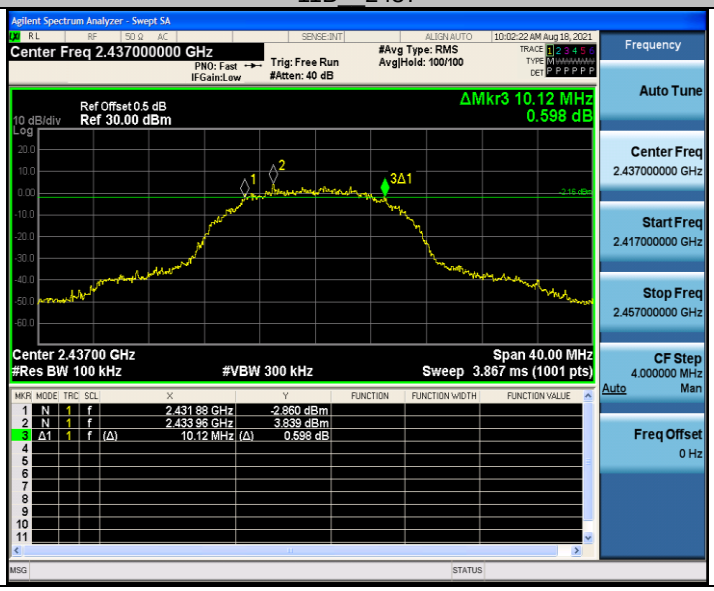
Test Mode	Channel	DTS BW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11B	2412	9.240	2406.960	2416.200	0.5	PASS
	2437	10.120	2431.880	2442.000	0.5	PASS
	2462	10.360	2456.760	2467.120	0.5	PASS
11G	2412	16.360	2403.800	2420.160	0.5	PASS
	2437	16.400	2428.760	2445.160	0.5	PASS
	2462	16.160	2453.800	2469.960	0.5	PASS
11N20SISO	2412	16.400	2403.760	2420.160	0.5	PASS
	2437	16.600	2428.560	2445.160	0.5	PASS
	2462	16.400	2453.760	2470.160	0.5	PASS
11N40SISO	2422	35.840	2404.000	2439.840	0.5	PASS
	2437	36.080	2418.760	2454.840	0.5	PASS
	2452	35.600	2434.000	2469.600	0.5	PASS

Test Graphs

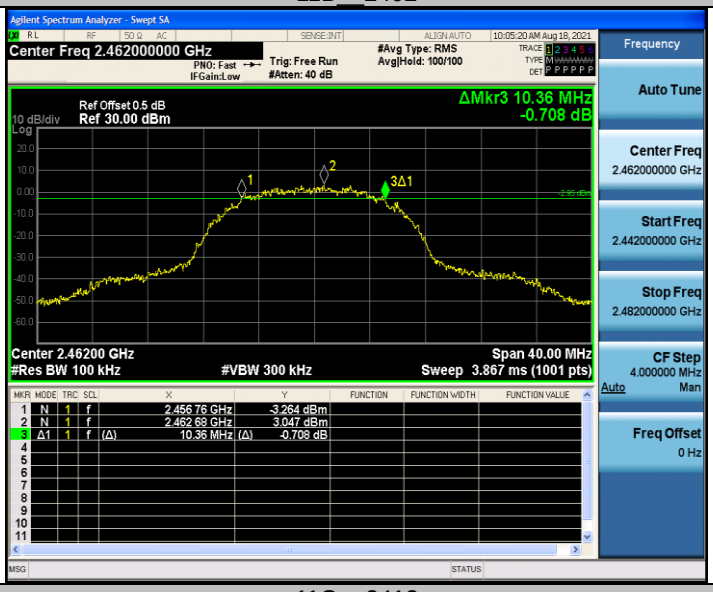
11B__2412



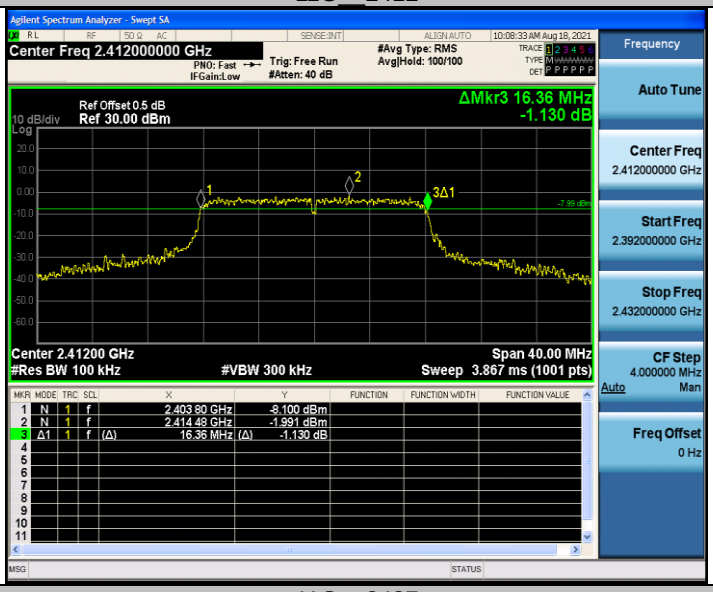
11B__2437



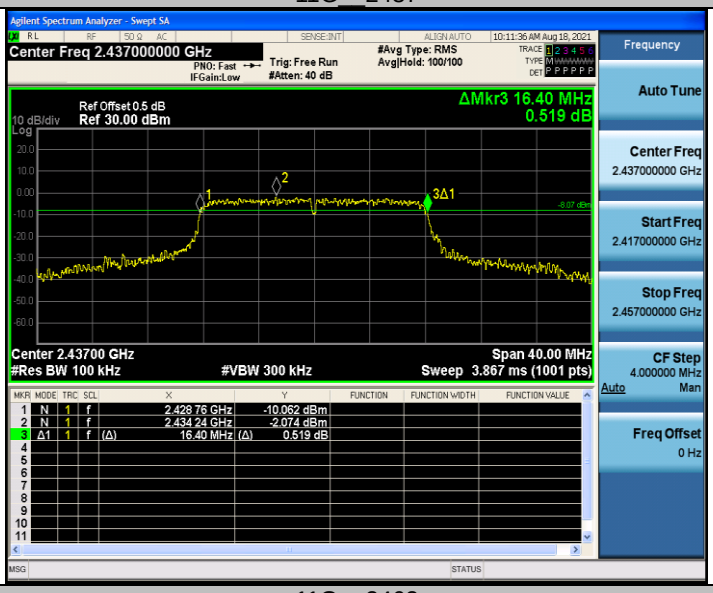
11B_2462



11G_2412



11G_2437



11G_2462

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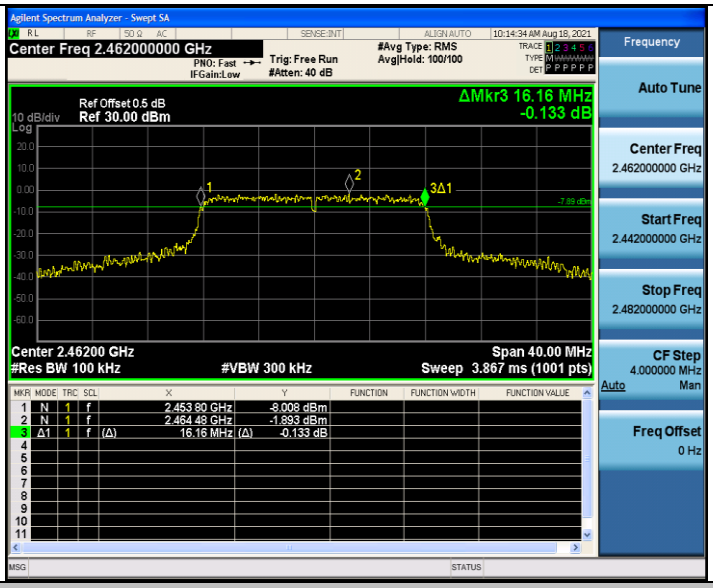
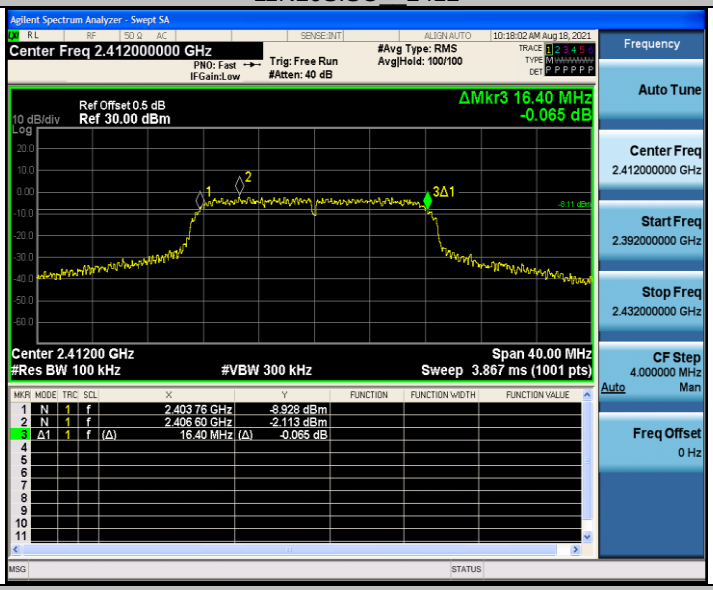
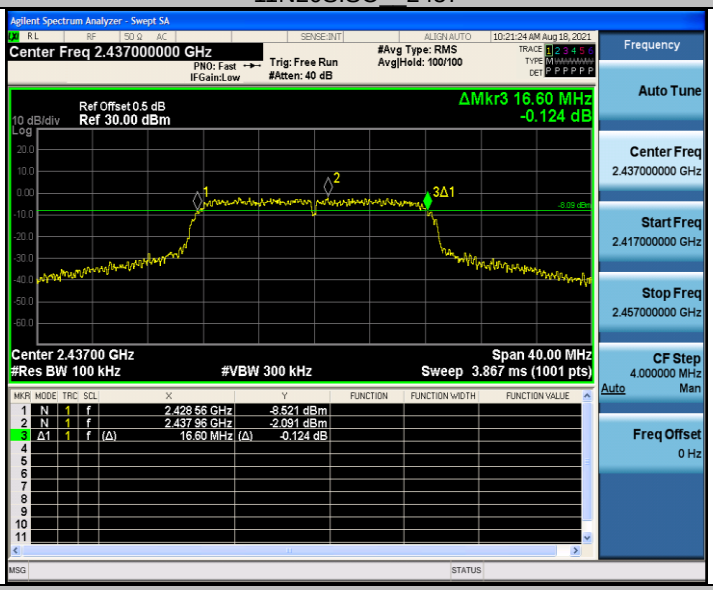


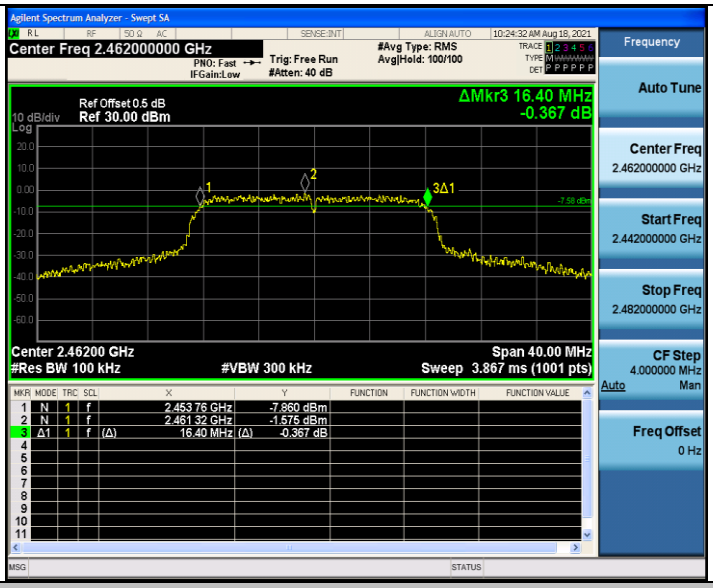
11N20SISO__2412



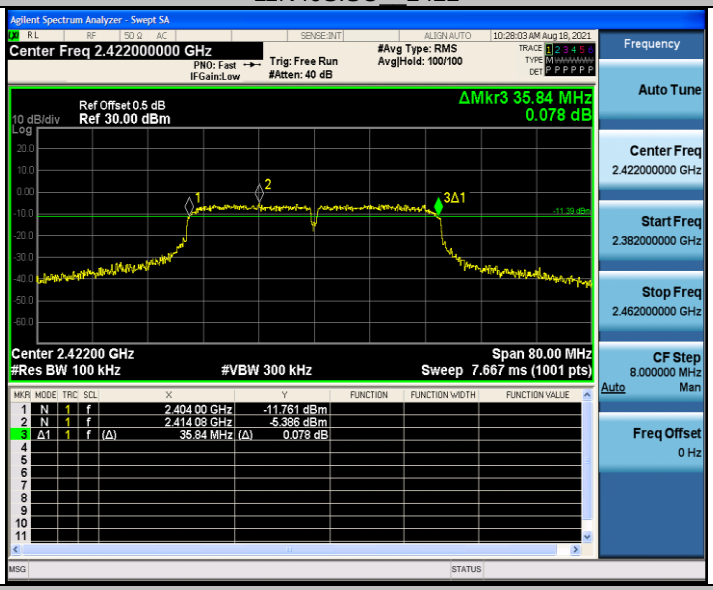
11N20SISO__2437



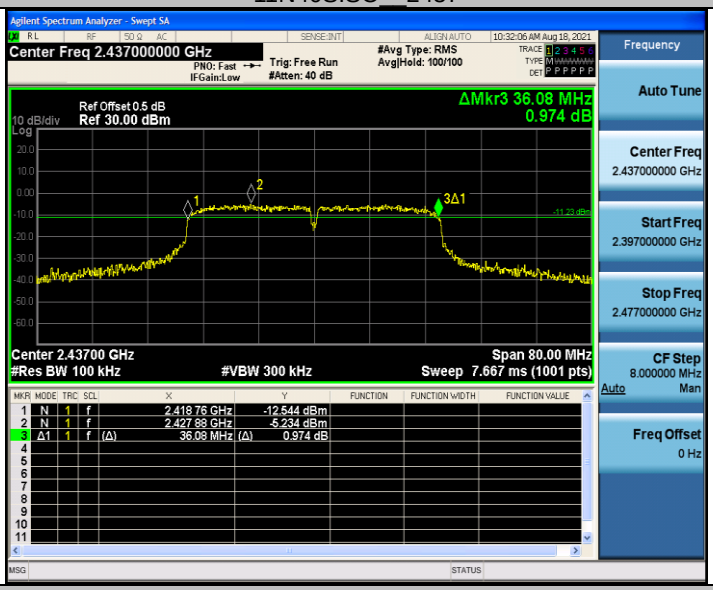
11N20SISO__2462



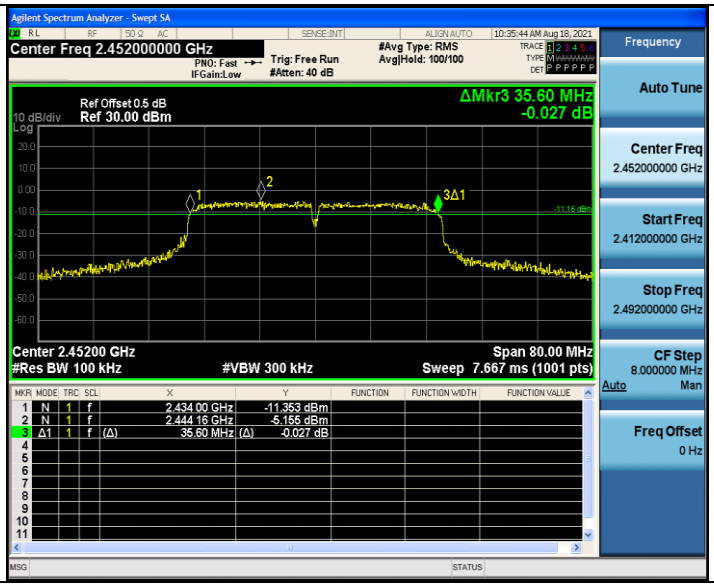
11N40SISO__2422



11N40SISO__2437



11N40SISO__2452


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.452000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 100/100
10:35:44 AM Aug 18, 2021
Ref Offset 0.5 dB
10 dB/div
Ref 30.00 dBm
Log
ΔMkr3 35.60 MHz
-0.027 dB
-11.16 dBm
Center 2.45200 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 80.00 MHz
Sweep 7.667 ms (1001 pts)
1 N 1 f 2.434 00 GHz -11.353 dBm
2 N 1 f 2.444 16 GHz -5.155 dBm
3 Δ1 1 f (Δ) 35.60 MHz (Δ) -0.027 dB
Frequency
Auto Tune
Center Freq
2.452000000 GHz
Start Freq
2.412000000 GHz
Stop Freq
2.492000000 GHz
CF Step
8.000000 MHz
Auto Man
Freq Offset
0 Hz

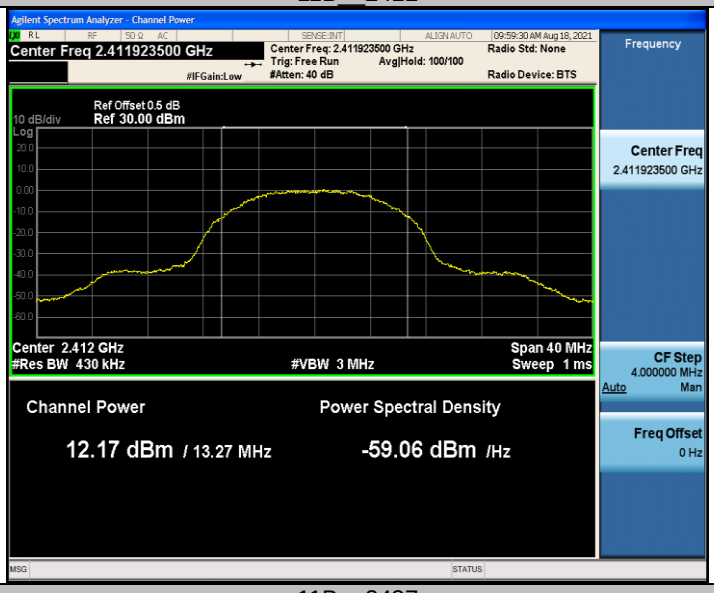
Maximum conducted output power

Test Result

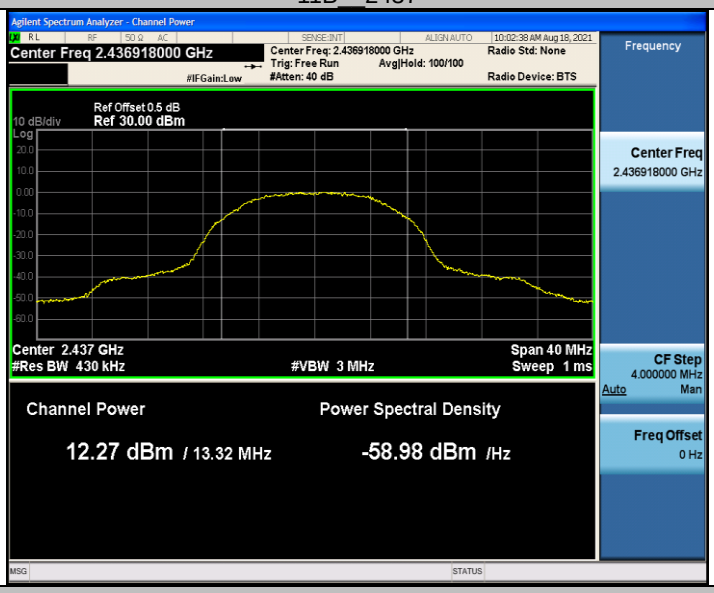
Test Mode	Channel	Result[dBm]	Limit[dBm]	Verdict
11B	2412	12.17	<=30	PASS
	2437	12.27	<=30	PASS
	2462	12.26	<=30	PASS
11G	2412	11.14	<=30	PASS
	2437	11.33	<=30	PASS
	2462	11.37	<=30	PASS
11N20SISO	2412	10.99	<=30	PASS
	2437	11.17	<=30	PASS
	2462	11.17	<=30	PASS
11N40SISO	2422	11.22	<=30	PASS
	2437	11.42	<=30	PASS
	2452	11.40	<=30	PASS

Test Graphs

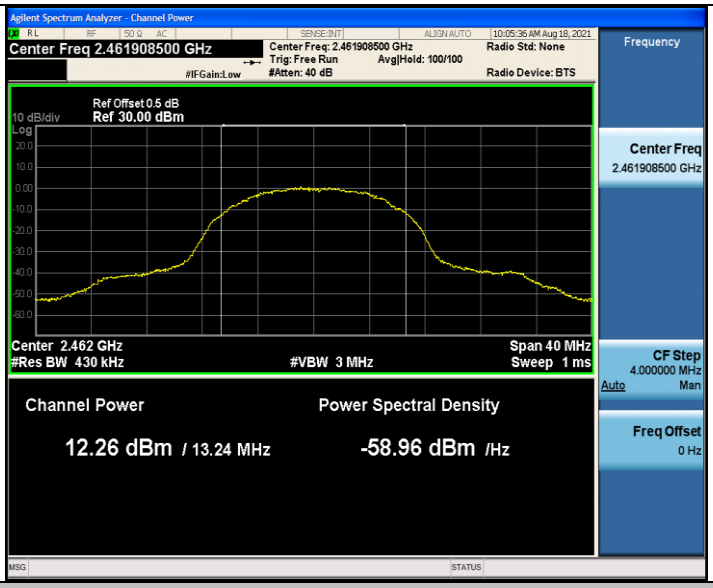
11B_2412



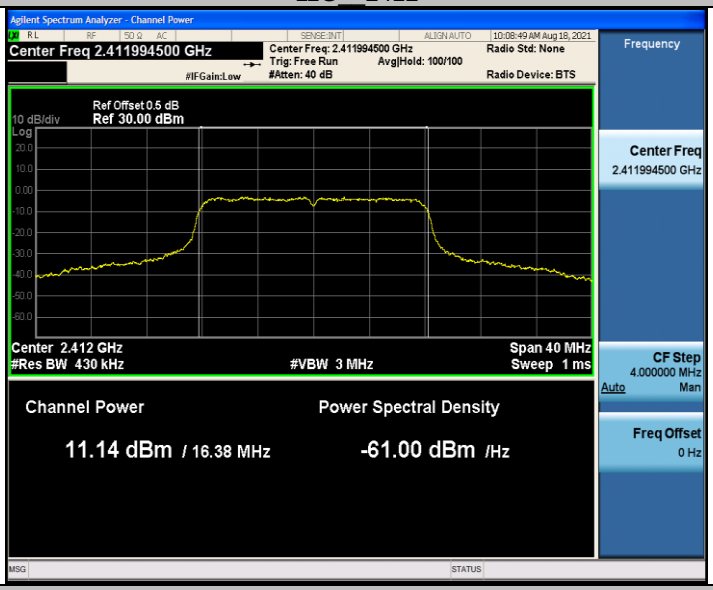
11B_2437



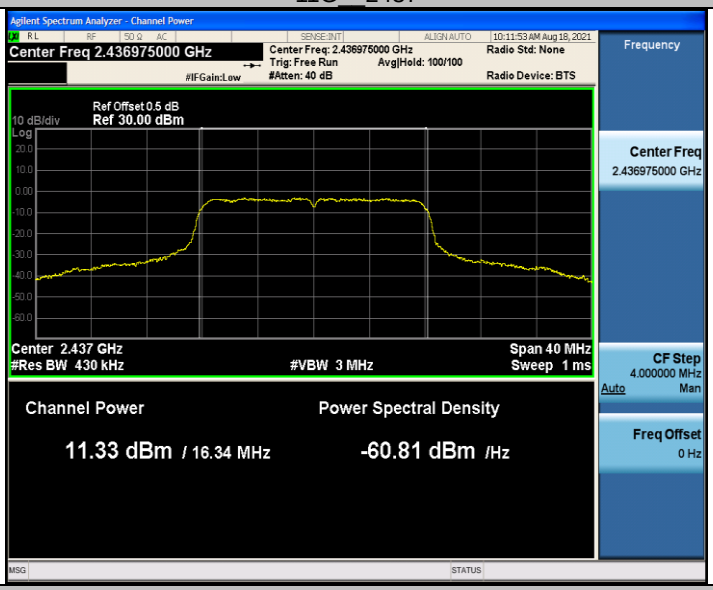
11B_2462



11G_2412



11G_2437



11G_2462

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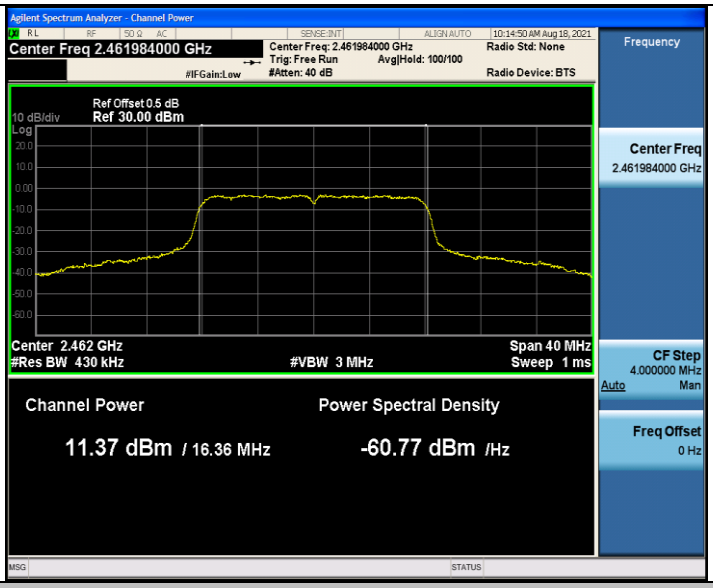
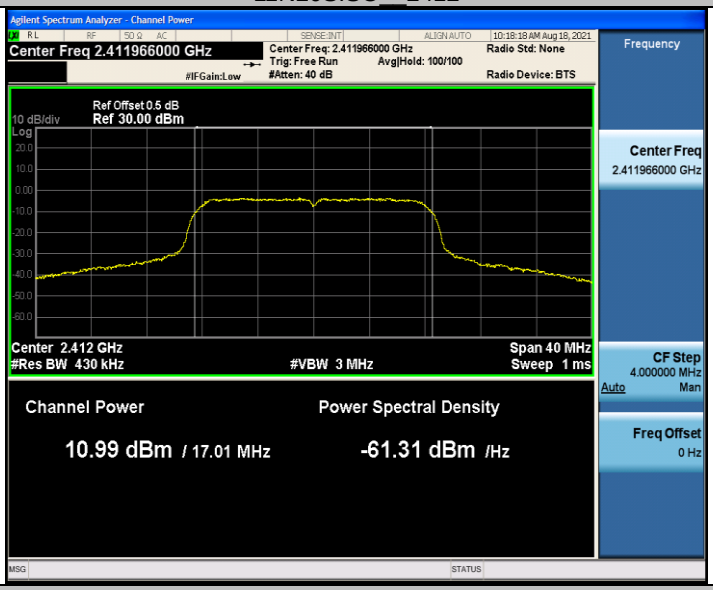
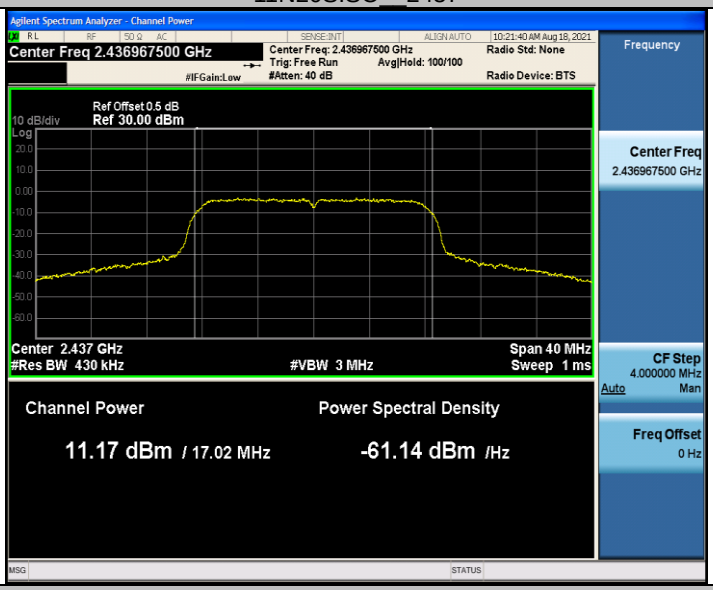


11N20SISO__2412



11N20SISO__2437



11N20SISO__2462

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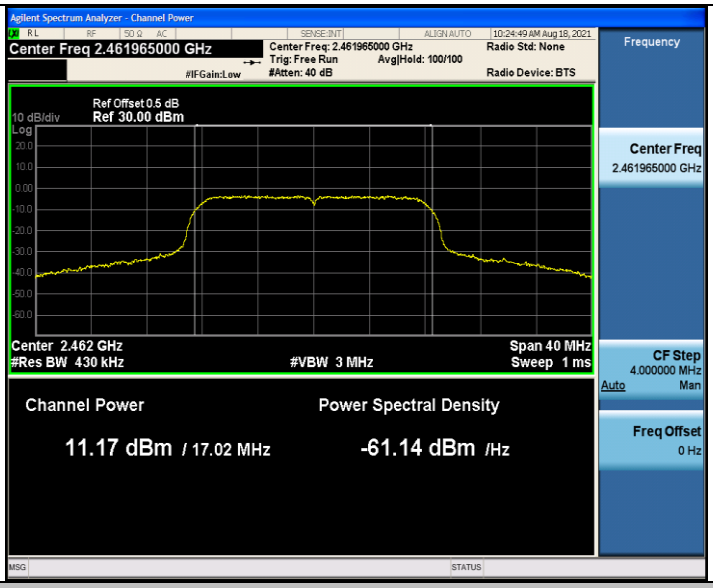
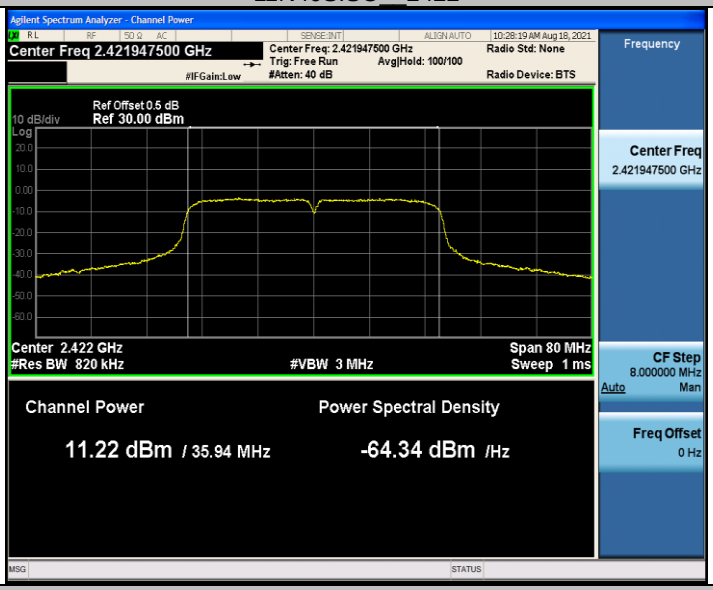
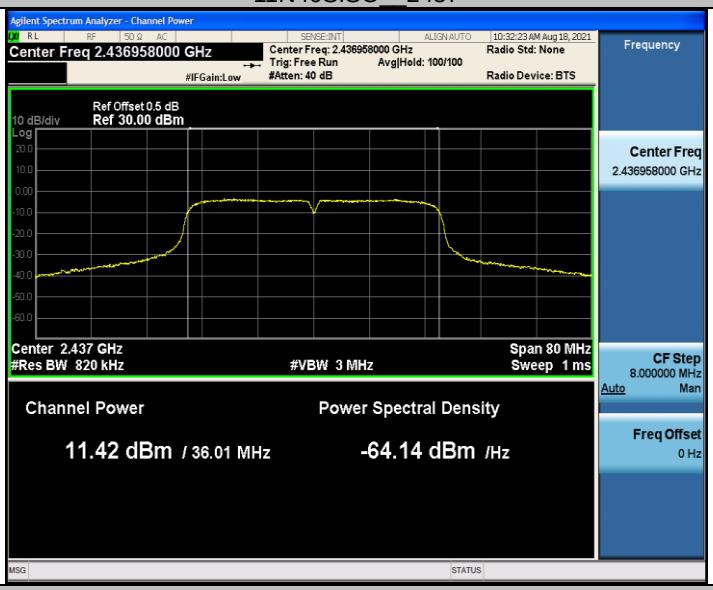


11N40SISO_2422

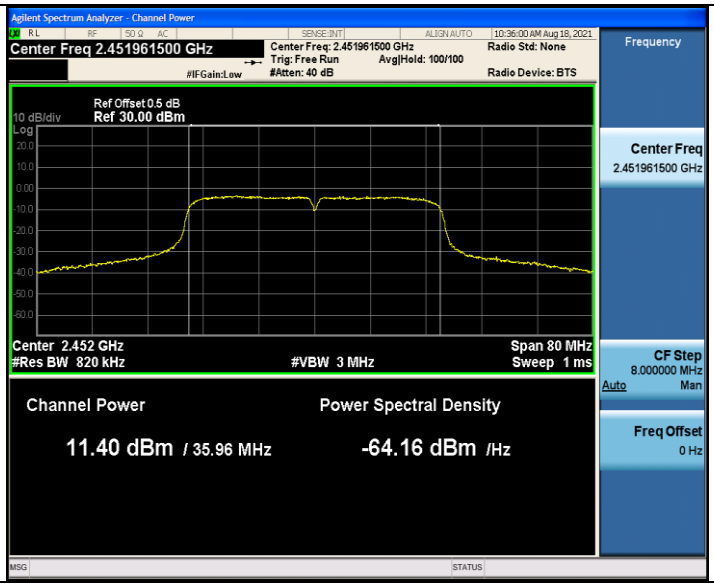


11N40SISO_2437



11N40SISO_2452

Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com



Hotline: 400-6611-140 Tel: 86-755-27673339 Fax: 86-755-27673332 http://www.tct-lab.com

Maximum power spectral density

Test Result

Test Mode	Channel	Result [dBm/30kHz]	Result [dBm/3kHz]	Limit [dBm/3kHz]	Verdict
11B	2412	-9.80	-15.03	<=8	PASS
	2437	-9.88	-15.11	<=8	PASS
	2462	-9.63	-14.86	<=8	PASS
11G	2412	-12.46	-17.69	<=8	PASS
	2437	-12.72	-17.95	<=8	PASS
	2462	-12.62	-17.85	<=8	PASS
11N20SISO	2412	-13.34	-18.57	<=8	PASS
	2437	-13.21	-18.44	<=8	PASS
	2462	-13.02	-18.25	<=8	PASS
11N40SISO	2422	-16.33	-21.56	<=8	PASS
	2437	-15.94	-21.17	<=8	PASS
	2452	-16.46	-21.69	<=8	PASS

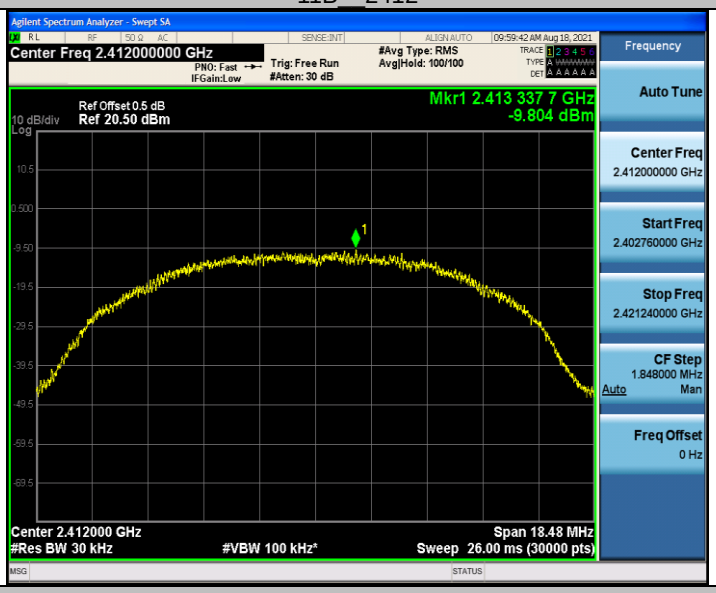
Note: *Compensate 10dB is for Exchange rate of RBW*

*Exchange rate of RBW = 10*log10(Reference bandwidth/RBW at measurement) = -10[dB]*

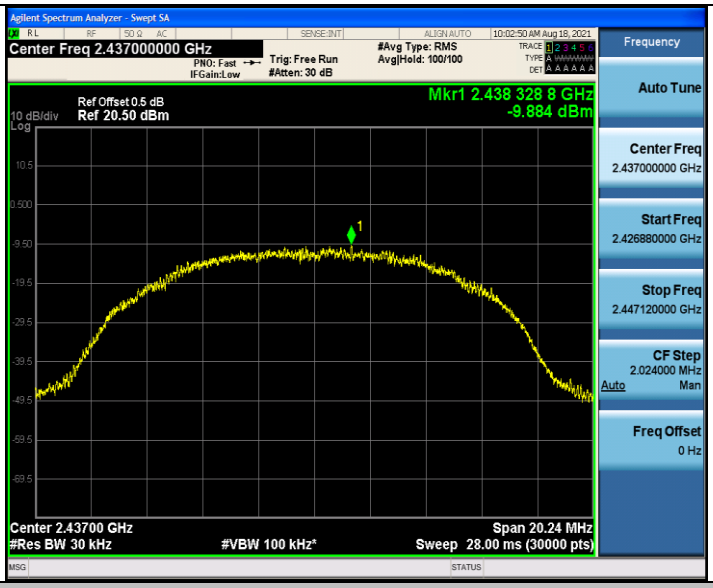
where Reference bandwidth = 3 KHz

Test Graphs

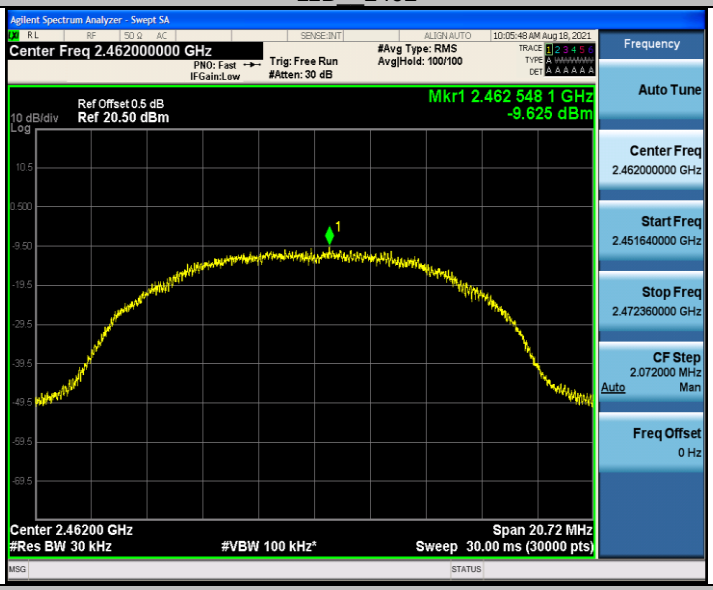
11B__2412



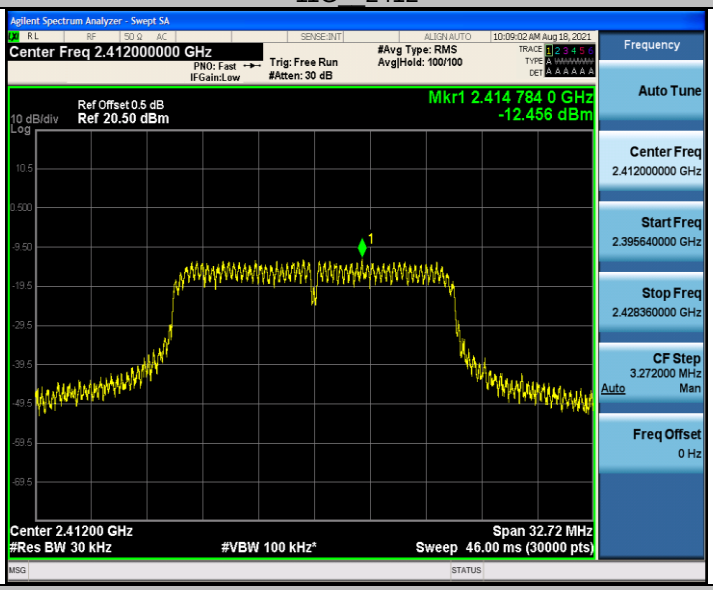
11B__2437



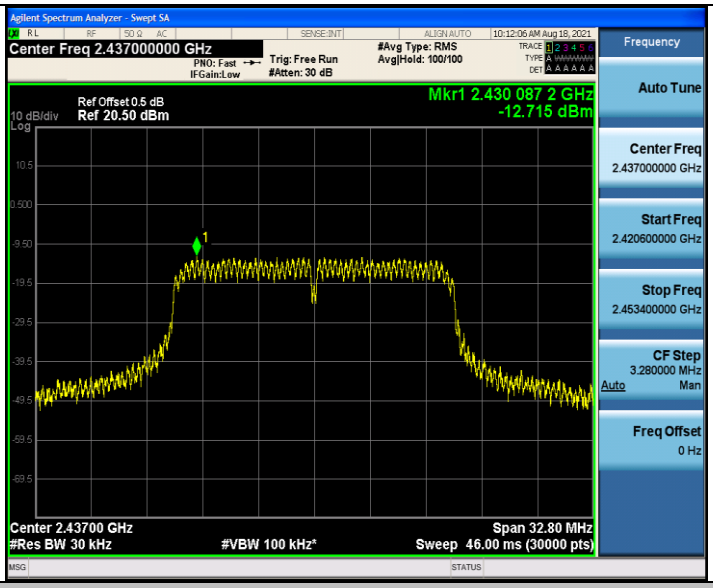
11B__2462



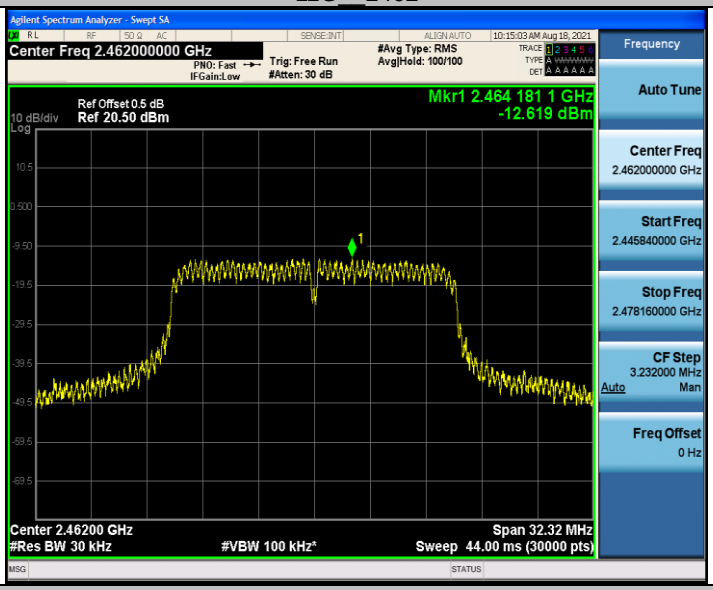
11G__2412



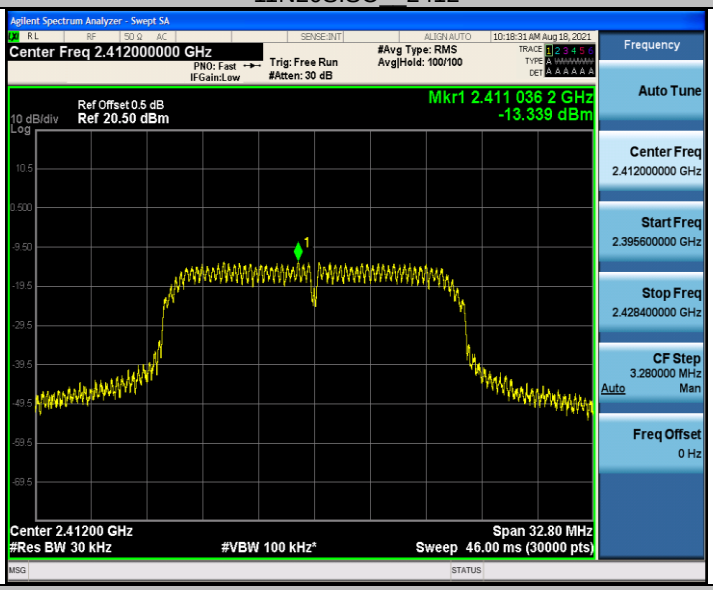
11G__2437



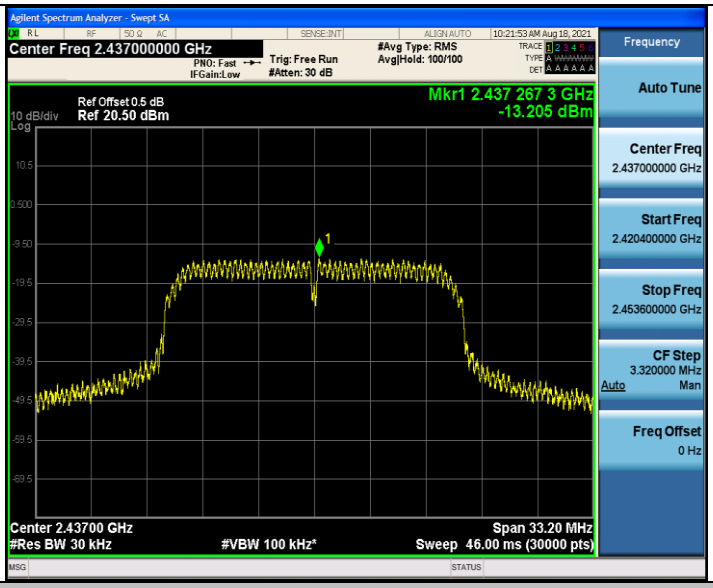
11G__2462



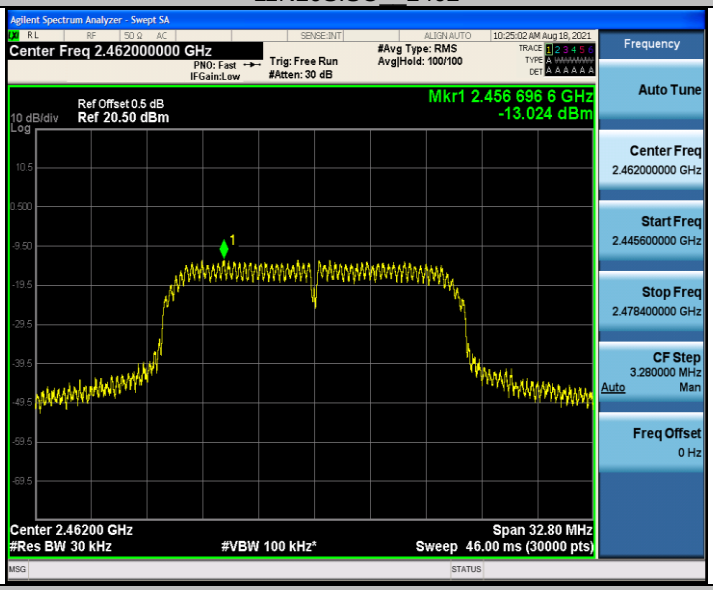
11N20SISO__2412



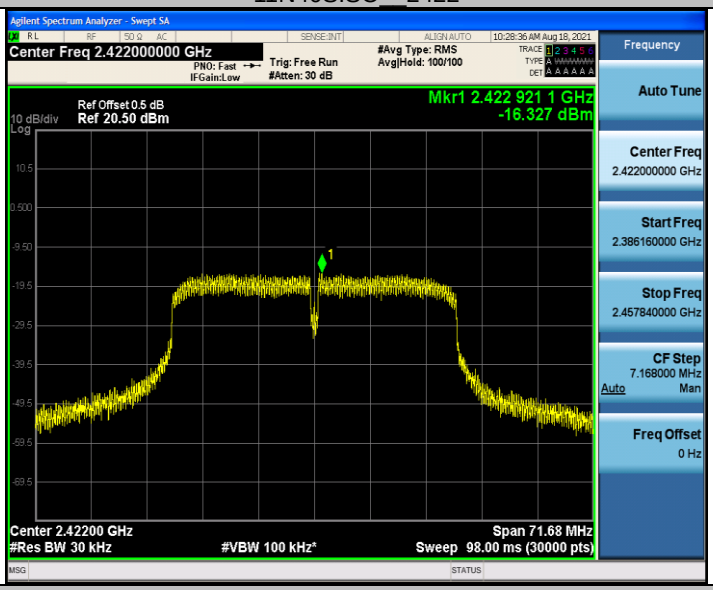
11N20SISO__2437



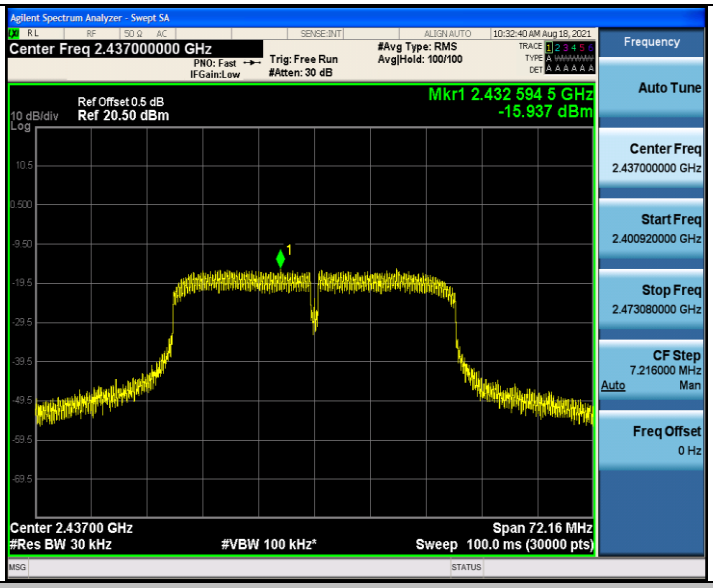
11N20SISO__2462



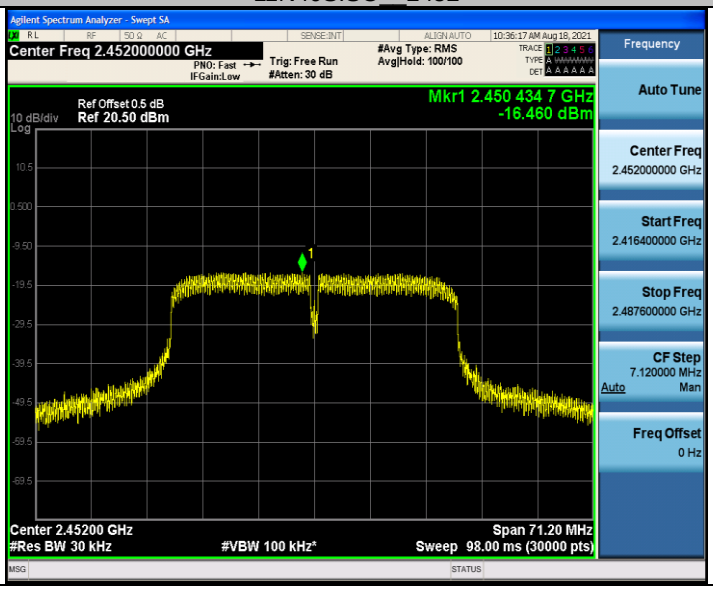
11N40SISO__2422



11N40SISO__2437



11N40SISO_2452



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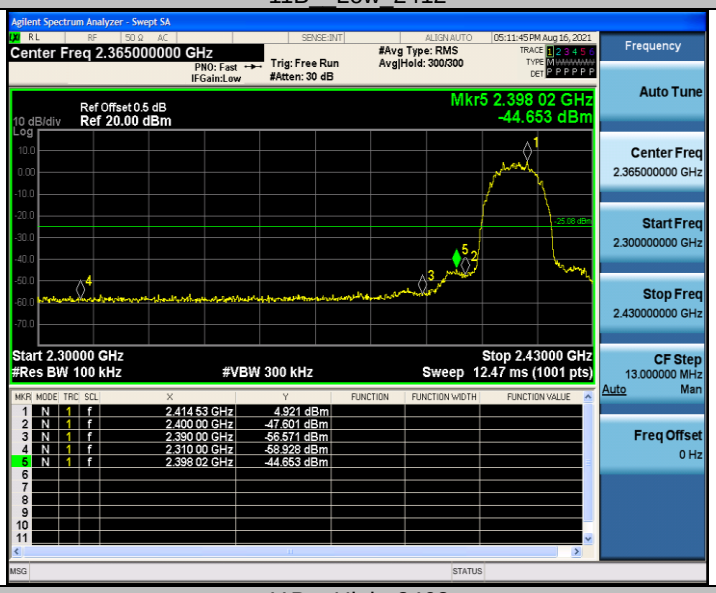
Band edge measurements

Test Result

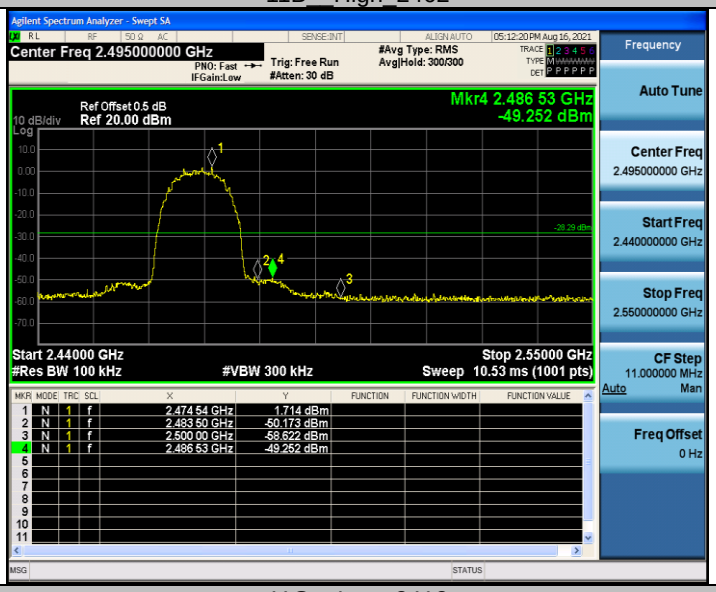
Test Mode	Ch Name	Channel	Ref Level[dBm]	Result[dBm]	Limit[dBm]	Verdict
11B	Low	2412	4.92	-44.65	<=-25.08	PASS
	High	2462	1.71	-49.25	<=-28.29	PASS
11G	Low	2412	-1.30	-39.09	<=-31.3	FAIL
	High	2462	-4.59	-42.52	<=-34.59	PASS
11N20SISO	Low	2412	-1.74	-40.08	<=-31.74	FAIL
	High	2462	-4.20	-41.51	<=-34.2	PASS
11N40SISO	Low	2422	-4.86	-35.34	<=-34.86	FAIL
	High	2452	-7.46	-37.56	<=-37.46	FAIL

Test Graphs

11B__Low_2412



11B__High_2462



11G__Low_2412