

TEST REPORT

FCC ID: 2ASQU-ROUNDAI

Product: Panoramic IP Camera

Model No.: Round Ai

Additional Model No.: N/A

Trade Mark: N/A

Report No.: TCT191127E006

Issued Date: Jan. 02, 2020

Issued for:

HDTELECOM

**#708, E&C Venture Dream Tower 6th, 41, Digital-ro 31-gil, Guro-gu, Seoul
08375, South Korea**

Issued By:

Shenzhen Tongce Testing Lab.

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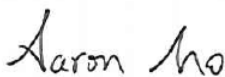
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1. Test Certification

Product:	Panoramic IP Camera
Model No.:	Round Ai
Additional Model:	N/A
Trade Mark:	N/A
Applicant:	HDTELECOM
Address:	#708, E&C Venture Dream Tower 6th, 41, Digital-ro 31-gil, Guro-gu, Seoul 08375, South Korea
Manufacturer:	Sinda Technology International Co., Ltd
Address:	C303, Xinyuan Sheng building, Xuegang North road, Longgang district, Shenzhen, China.
Date of Test:	Nov. 28, 2019 - Dec. 31, 2019
Applicable Standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247 FCC KDB 558074 D01 15.247 Meas Guidance v05r02 ANSI C63.10:2013

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By:



Aaron Mo

Date:

Dec. 31, 2019

Reviewed By:



Beryl Zhao

Date:

Jan. 02, 2020

Approved By:



Tomsin

Date:

Jan. 02, 2020

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.

3. EUT Description

Product:	Panoramic IP Camera
Model No.:	Round Ai
Additional Model:	N/A
Trade Mark:	N/A
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: (IEEE 802.11b)	Direct Sequence Spread Spectrum (DSSS)
Modulation Technology: (IEEE 802.11g/802.11n)	Orthogonal Frequency Division Multiplexing(OFDM)
Data speed (IEEE 802.11b):	1Mbps, 2Mbps, 5.5Mbps, 11Mbps
Data speed (IEEE 802.11g):	6Mbps, 9Mbps, 12Mbps, 18Mbps, 24Mbps, 36Mbps, 48Mbps, 54Mbps
Data speed (IEEE 802.11n):	Up to 150Mbps
Antenna Type:	Internal Antenna
Antenna Gain:	2dBi
Power Supply:	DC 5V by USB port

Operation Frequency each of channel 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	--	--

Operation Frequency each of channel 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

4. General Information

4.1. 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 Mode:		
Engineering 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

Final Test Mode:

Operation mode:	Keep the EUT in continuous transmitting with modulation
-----------------	---

1. For WIFI function, the engineering test program was provided and enabled to make EUT continuous transmit/receive.

2. According to ANSI C63.10 standards, the test results are both the "worst case" and "worst setup" 1Mbps for 802.11b, 6Mbps for 802.11g, 6.5Mbps for 802.11n(H20), 13.5Mbps for 802.11(H40). Duty cycle setting during the transmission is 98.46% with maximum power setting for all modulations.

4.2. 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
Adapter	JD-050200	20120109075767 35	/	/

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.

5. Facilities and Accreditations

5.1. Facilities

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

- FCC - Registration No.: 645098

Shenzhen Tongce Testing Lab

The 3m Semi-anechoic chamber 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

The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

5.2. Location

Shenzhen Tongce Testing Lab

Address: 1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China

TEL: +86-755-27673339

5.3. Measurement Uncertainty

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

No.	Item	MU
1	Conducted Emission	$\pm 2.56\text{dB}$
2	RF power, conducted	$\pm 0.12\text{dB}$
3	Spurious emissions, conducted	$\pm 0.11\text{dB}$
4	All emissions, radiated(<1G)	$\pm 3.92\text{dB}$
5	All emissions, radiated(>1G)	$\pm 4.28\text{dB}$
6	Temperature	$\pm 0.1^{\circ}\text{C}$
7	Humidity	$\pm 1.0\%$

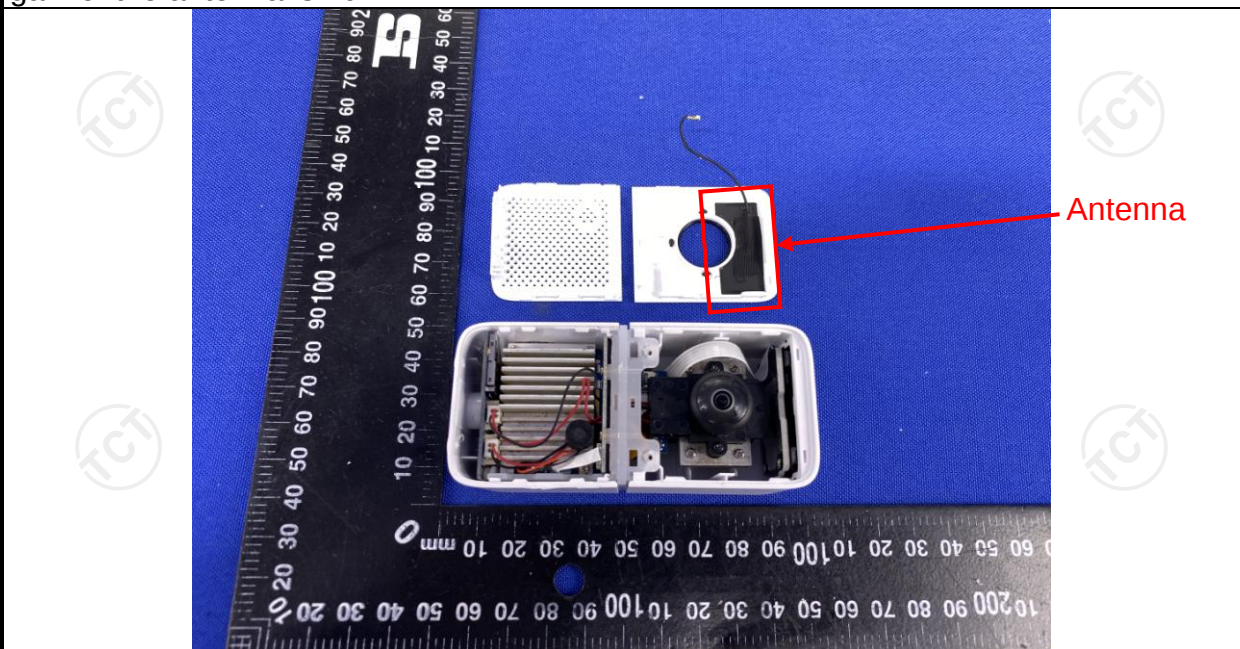
6. Test Results and Measurement Data

6.1. 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 internal antenna which permanently attached, and the best case gain of the antenna is 2dBi.



6.2. Conducted Emission

6.2.1. 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 with modulation														
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														

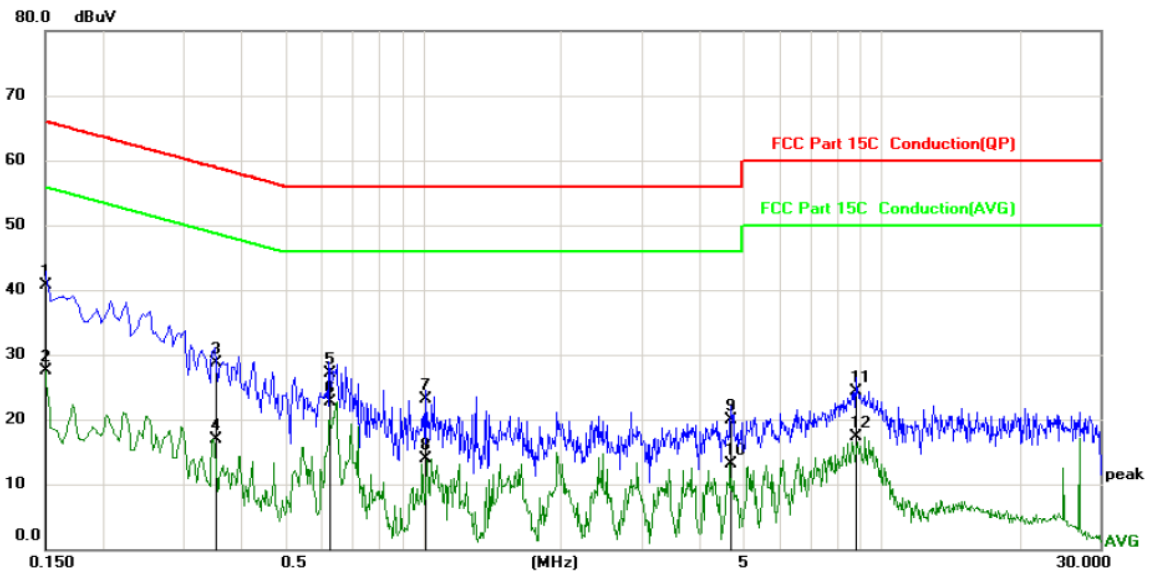
6.2.2. Test Instruments

Conducted Emission Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Test Receiver	R&S	ESPI	101402	Jul. 29, 2020
LISN	Schwarzbeck	NSLK 8126	8126453	Sep. 11, 2020
Coax cable (9KHz-30MHz)	TCT	CE-05	N/A	Sep. 08, 2020
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.2.3. 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
Limit: FCC Part 15C Conduction(QP) Power: Humidity: 55 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1500	30.56	10.23	40.79	66.00	-25.21	QP	
2		0.1500	17.29	10.23	27.52	56.00	-28.48	AVG	
3		0.3525	18.45	10.22	28.67	58.90	-30.23	QP	
4		0.3525	6.75	10.22	16.97	48.90	-31.93	AVG	
5		0.6270	16.96	10.23	27.19	56.00	-28.81	QP	
6	*	0.6270	12.38	10.23	22.61	46.00	-23.39	AVG	
7		1.0140	12.75	10.36	23.11	56.00	-32.89	QP	
8		1.0140	3.52	10.36	13.88	46.00	-32.12	AVG	
9		4.6859	9.36	10.48	19.84	56.00	-36.16	QP	
10		4.6859	2.55	10.48	13.03	46.00	-32.97	AVG	
11		8.8170	13.75	10.55	24.30	60.00	-35.70	QP	
12		8.8170	6.84	10.55	17.39	50.00	-32.61	AVG	

Note:

Freq. = Emission frequency in MHz

Reading level (dBuV) = Receiver reading

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

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

Limit (dBuV) = Limit stated in standard

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

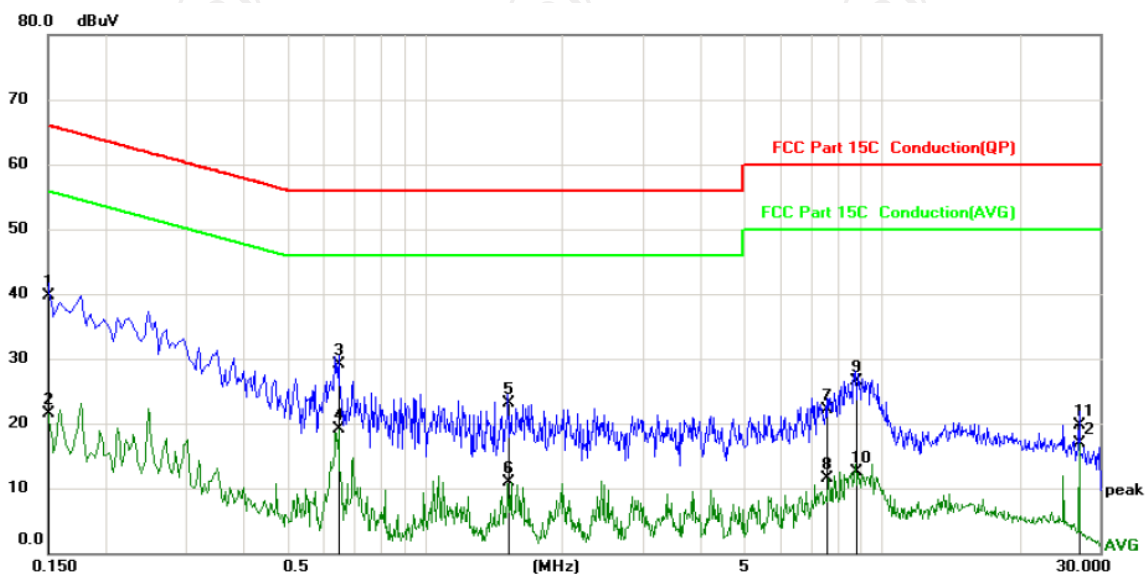
Q.P. =Quasi-Peak

AVG =average

Any value more than 10dB below limit have not been specifically reported.

* 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
Limit: FCC Part 15C Conduction(QP) Power: Humidity: 55 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1500	29.45	10.23	39.68	66.00	-26.32	QP	
2		0.1500	11.33	10.23	21.56	56.00	-34.44	AVG	
3		0.6495	18.95	10.22	29.17	56.00	-26.83	QP	
4		0.6495	8.95	10.22	19.17	46.00	-26.83	AVG	
5		1.5225	12.74	10.41	23.15	56.00	-32.85	QP	
6		1.5225	0.52	10.41	10.93	46.00	-35.07	AVG	
7		7.5750	11.66	10.52	22.18	60.00	-37.82	QP	
8		7.5750	0.95	10.52	11.47	50.00	-38.53	AVG	
9		8.7495	15.95	10.54	26.49	60.00	-33.51	QP	
10		8.7495	1.95	10.54	12.49	50.00	-37.51	AVG	
11		27.0015	8.56	11.09	19.65	60.00	-40.35	QP	
12		27.0015	5.77	11.09	16.86	50.00	-33.14	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

Any value more than 10dB below limit have not been specifically reported.

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

6.3. Maximum Conducted (Average) Output Power

6.3.1. 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

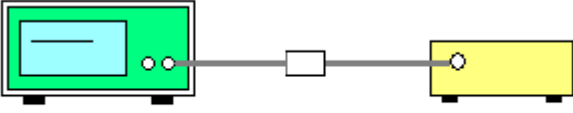
6.3.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 12, 2020
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 12, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2020

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.4. Emission Bandwidth

6.4.1. 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

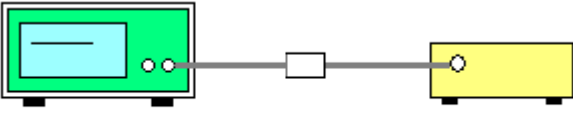
6.4.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 12, 2020
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 12, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2020

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.5. Power Spectral Density

6.5.1. 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:	 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

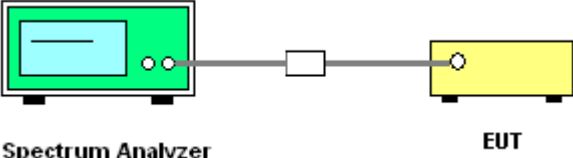
6.5.2. Test Instruments

RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 12, 2020
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 12, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2020

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.6. Conducted Band Edge and Spurious Emission Measurement

6.6.1. 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

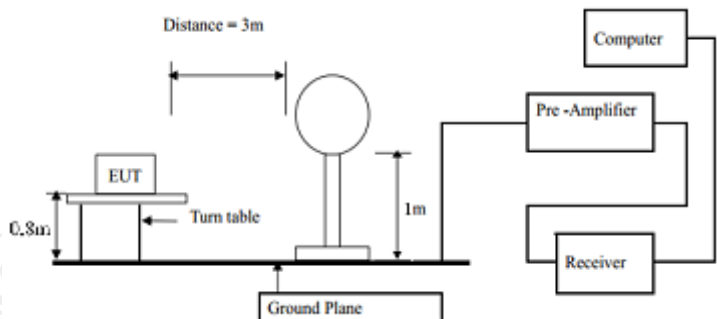
6.6.2. Test Instruments

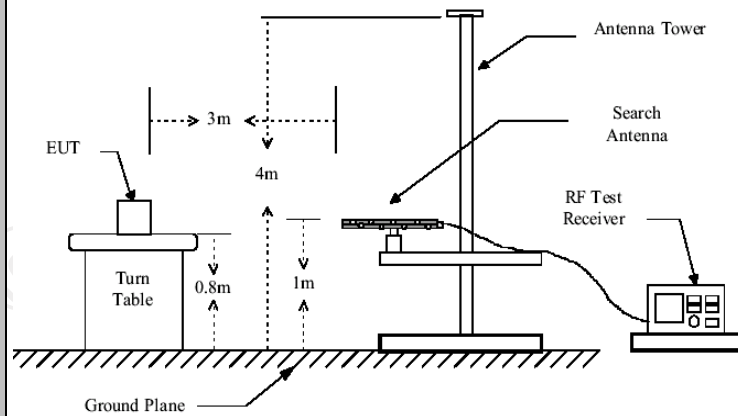
RF Test Room				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	Agilent	N9020A	MY49100619	Sep. 12, 2020
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Sep. 12, 2020
Antenna Connector	TCT	RFC-01	N/A	Sep. 12, 2020

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

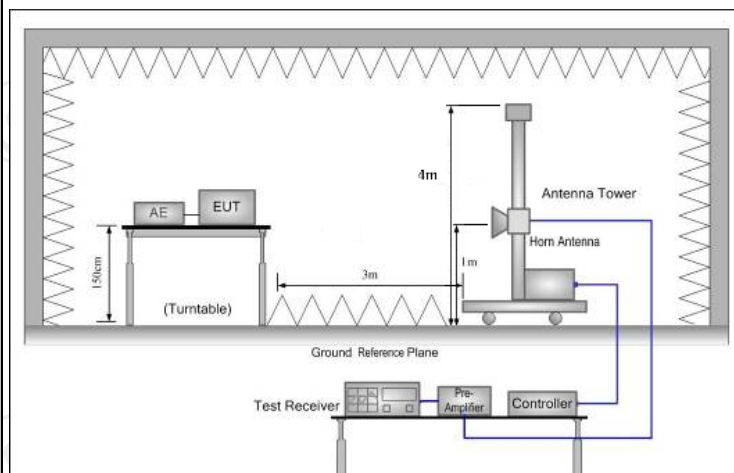
6.7. Radiated Spurious Emission Measurement

6.7.1. 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 $\geq$ 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

6.7.2. Test Instruments

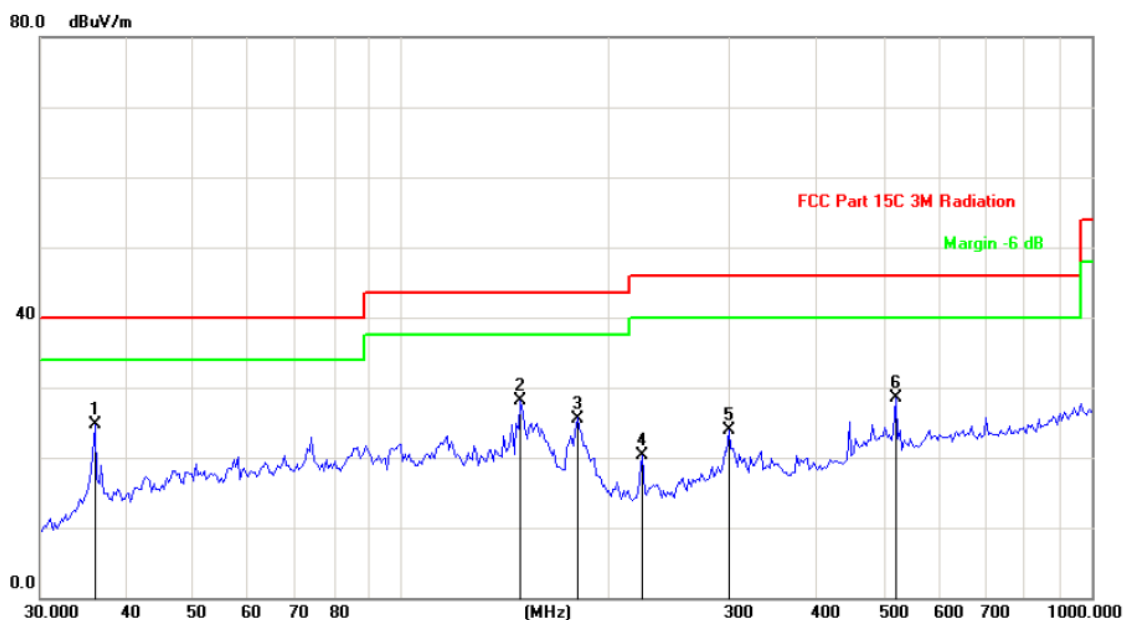
Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Test Receiver	ROHDE&SCHW ARZ	ESIB7	100197	Jul. 29, 2020
Spectrum Analyzer	ROHDE&SCHW ARZ	FSQ40	200061	Sep. 12, 2020
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep. 08, 2020
Pre-amplifier	HP	8447D	2727A05017	Sep. 08, 2020
Loop antenna	ZHINAN	ZN30900A	12024	Sep. 12, 2020
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 06, 2020
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep. 06, 2020
Horn Antenna	A-INFO	LB-180400-KF	J211020657	Sep. 06, 2020
Antenna Mast	Keleto	RE-AM	N/A	N/A
Coax cable (9KHz-40GHz)	TCT	RE-high-02	N/A	Sep. 08, 2020
Coax cable (9KHz-40GHz)	TCT	RE-high-04	N/A	Sep. 08, 2020
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.7.3. Test Data

Please refer to following diagram for individual
Below 1GHz

Horizontal:



Site

Polarization: **Horizontal**

Temperature: 25

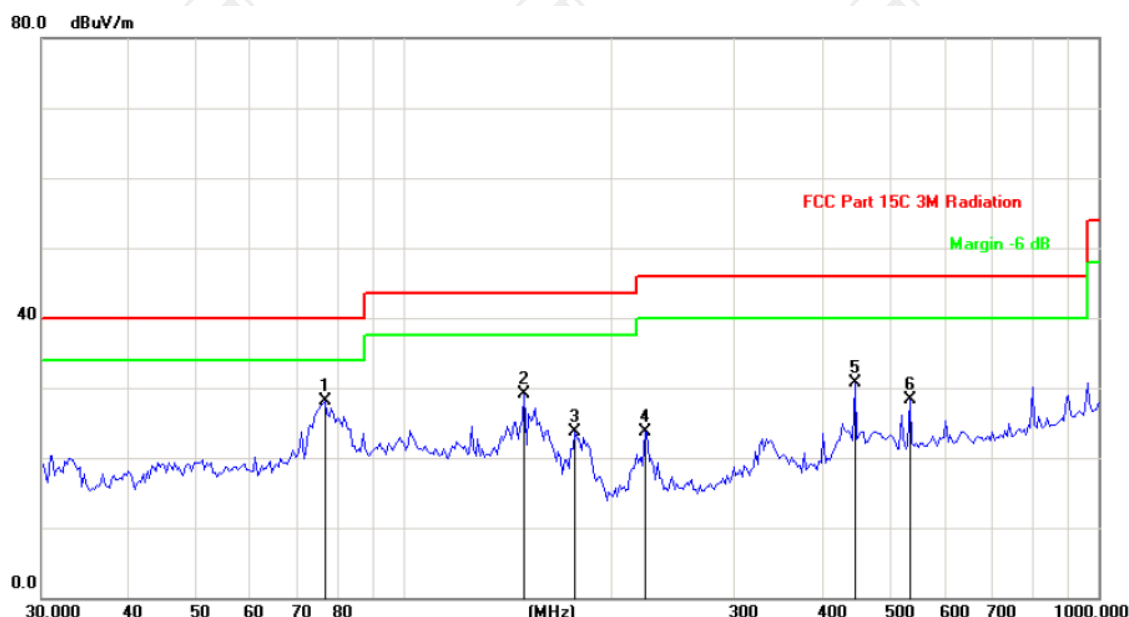
Limit: FCC Part 15C 3M Radiation

Power: AC 120V/60Hz

Humidity: 55 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1	*	36.0138	35.72	-11.03	24.69	40.00	-15.31	peak
2		148.9173	44.28	-16.24	28.04	43.50	-15.46	peak
3		180.0302	40.51	-14.91	25.60	43.50	-17.90	peak
4		223.8480	33.55	-13.32	20.23	46.00	-25.77	peak
5		298.5932	34.96	-10.97	23.99	46.00	-22.01	peak
6		520.2078	35.83	-7.24	28.59	46.00	-17.41	peak

Vertical:



Site

Polarization: **Vertical**

Temperature: 25

Limit: FCC Part 15C 3M Radiation

Power: AC 120V/60Hz

Humidity: 55 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Detector
1	*	76.9256	44.46	-16.38	28.08	40.00	-11.92	peak
2		148.9173	45.35	-16.24	29.11	43.50	-14.39	peak
3		176.2744	38.75	-15.07	23.68	43.50	-19.82	peak
4		222.2803	37.06	-13.37	23.69	46.00	-22.31	peak
5		445.6931	39.04	-8.38	30.66	46.00	-15.34	peak
6		535.0375	35.49	-7.12	28.37	46.00	-17.63	peak

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 (Highest channel and 802.11b) 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)

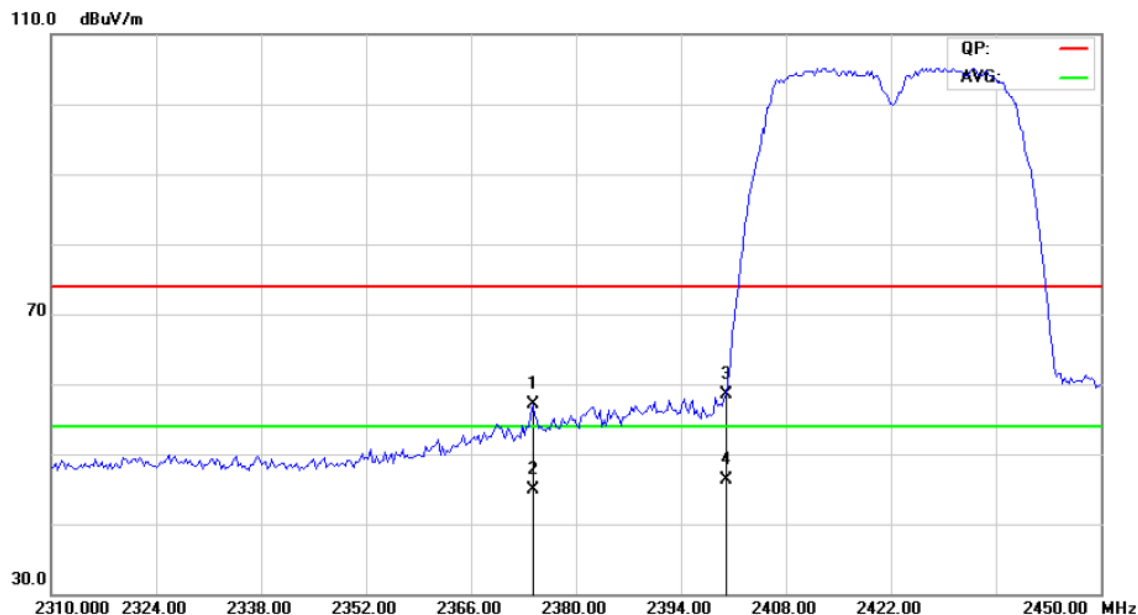
Any value more than 10dB below limit have not been specifically reported.

* 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

Polarization: **Horizontal**

Temperature: 25 (C)

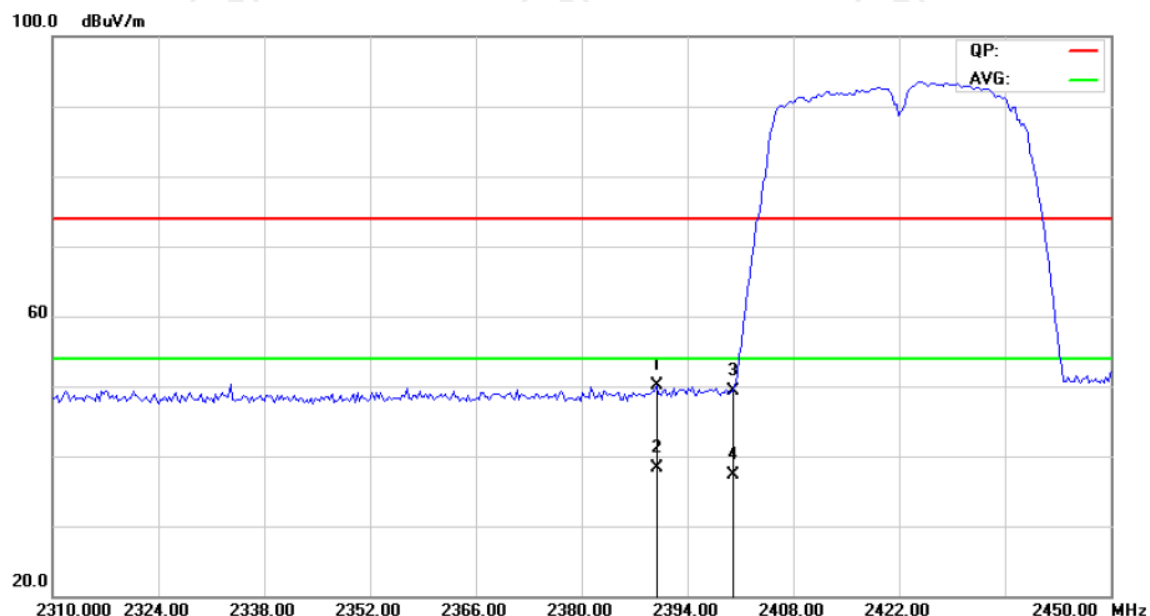
Limit: FCC part 15 (PK)

Power: AC 120V/60Hz

Humidity: 55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		2374.245	54.41	2.66	57.07	74.00	-16.93	peak
2		2374.245	42.09	2.66	44.75	54.00	-9.25	AVG
3		2400.000	55.88	2.66	58.54	74.00	-15.46	peak
4	*	2400.000	43.59	2.66	46.25	54.00	-7.75	AVG

Vertical:



Site

Polarization: **Vertical**

Temperature: 25 (C)

Limit: FCC part 15 (PK)

Power: AC 120V/60Hz

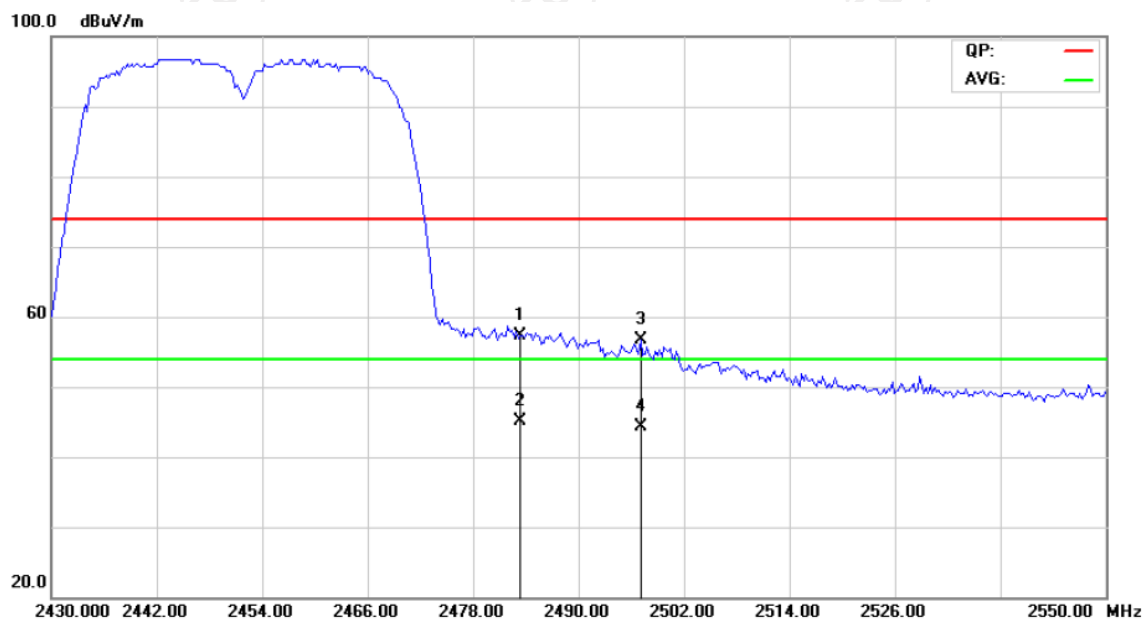
Humidity: 55 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		2389.958	47.30	2.66	49.96	74.00	-24.04	peak
2	*	2389.958	35.51	2.66	38.17	54.00	-15.83	AVG
3		2400.000	46.53	2.66	49.19	74.00	-24.81	peak
4		2400.000	34.62	2.66	37.28	54.00	-16.72	AVG

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 802.11b.

Highest channel 2462:

Horizontal:



Site

Polarization: **Horizontal**

Temperature: 25 (C)

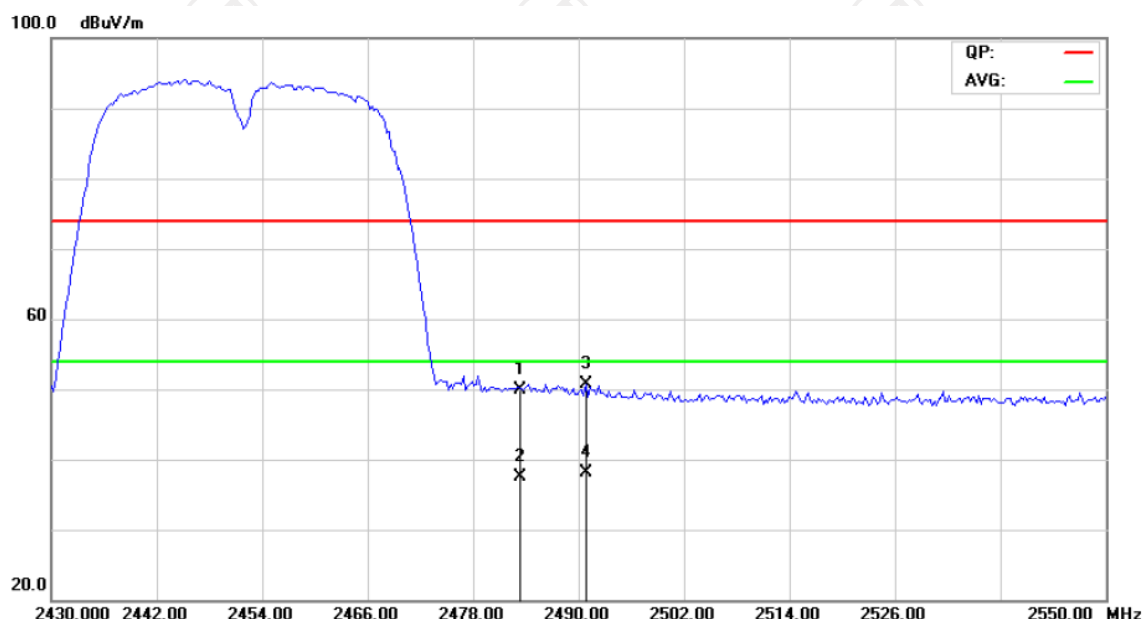
Limit: FCC part 15 (PK)

Power: AC 120V/60Hz

Humidity: 55 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		2483.500	54.57	2.67	57.24	74.00	-16.76	peak
2	*	2483.500	42.33	2.67	45.00	54.00	-9.00	AVG
3		2497.090	53.87	2.67	56.54	74.00	-17.46	peak
4		2497.090	41.65	2.67	44.32	54.00	-9.68	AVG

Vertical:



Site

Polarization: **Vertical**

Temperature: 25 (C)

Limit: FCC part 15 (PK)

Power: AC 120V/60Hz

Humidity: 55 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector
1		2483.500	47.24	2.67	49.91	74.00	-24.09	peak
2		2483.500	34.70	2.67	37.37	54.00	-16.63	AVG
3		2490.839	47.93	2.67	50.60	74.00	-23.40	peak
4	*	2490.839	35.41	2.67	38.08	54.00	-15.92	AVG

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 (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	48.24	---	0.75	48.99	---	74	54	-5.01
7236	H	39.07	---	9.87	48.94	---	74	54	-5.06
---	H	---	---	---	---	---	---	---	---
4824	V	47.45	---	0.75	48.20	---	74	54	-5.80
7236	V	40.31	---	9.87	50.18	---	74	54	-3.82
---	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	49.17	---	0.97	50.14	---	74	54	-3.86
7311	H	40.23	---	9.83	50.06	---	74	54	-3.94
---	H	---	---	---	---	---	---	---	---
4874	V	49.57	---	0.97	50.54	---	74	54	-3.46
7311	V	38.79	---	9.83	48.62	---	74	54	-5.38
---	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	49.08	---	1.18	50.26	---	74	54	-3.74
7386	H	39.15	---	10.07	49.22	---	74	54	-4.78
---	H	---	---	---	---	---	---	---	---
4924	V	49.81	---	1.18	50.99	---	74	54	-3.01
7386	V	40.04	---	10.07	50.11	---	74	54	-3.89
---	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	45.73	---	0.75	46.48	---	74	54	-7.52
7236	H	34.18	---	9.87	44.05	---	74	54	-9.95
---	H	---	---	---	---	---	---	---	---
4824	V	46.27	---	0.75	47.02	---	74	54	-6.98
7236	V	35.94	---	9.87	45.81	---	74	54	-8.19
---	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	44.61	---	0.97	45.58	---	74	54	-8.42
7311	H	35.35	---	9.83	45.18	---	74	54	-8.82
---	H	---	---	---	---	---	---	---	---
4874	V	47.82	---	0.97	48.79	---	74	54	-5.21
7311	V	38.06	---	9.83	47.89	---	74	54	-6.11
---	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	43.39	---	1.18	44.57	---	74	54	-9.43
7386	H	34.50	---	10.07	44.57	---	74	54	-9.43
---	H	---	---	---	---	---	---	---	---
4924	V	42.18	---	1.18	43.36	---	74	54	-10.64
7386	V	33.35	---	10.07	43.42	---	74	54	-10.58
---	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	44.87	---	0.75	45.62	---	74	54	-8.38
7236	H	35.04	---	9.87	44.91	---	74	54	-9.09
---	H	---	---	---	---	---	---	---	---
4824	V	44.48	---	0.75	45.23	---	74	54	-8.77
7236	V	34.76	---	9.87	44.63	---	74	54	-9.37
---	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	46.53	---	0.97	47.50	---	74	54	-6.50
7311	H	35.17	---	9.83	45.00	---	74	54	-9.00
---	H	---	---	---	---	---	---	---	---
4874	V	44.61	---	0.97	45.58	---	74	54	-8.42
7311	V	34.25	---	9.83	44.08	---	74	54	-9.92
---	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	43.30	---	1.18	44.48	---	74	54	-9.52
7386	H	33.92	---	10.07	43.99	---	74	54	-10.01
---	H	---	---	---	---	---	---	---	---
4924	V	42.83	---	1.18	44.01	---	74	54	-9.99
7386	V	33.28	---	10.07	43.35	---	74	54	-10.65
---	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	49.03	---	0.75	49.78	---	74	54	-4.22
7266	H	40.45	---	9.87	50.32	---	74	54	-3.68
---	H	---	---	---	---	---	---	---	---
4824	V	47.14	---	0.75	47.89	---	74	54	-6.11
7236	V	39.86	---	9.87	49.73	---	74	54	-4.27
---	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	47.25	---	0.97	48.22	---	74	54	-5.78
7311	H	40.01	---	9.83	49.84	---	74	54	-4.16
---	H	---	---	---	---	---	---	---	---
4874	V	47.35	---	0.97	48.32	---	74	54	-5.68
7311	V	40.16	---	9.83	49.99	---	74	54	-4.01
---	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	48.37	---	1.18	49.55	---	74	54	-4.45
7356	H	39.96	---	10.07	50.03	---	74	54	-3.97
---	H	---	---	---	---	---	---	---	---
4904	V	47.12	---	1.18	48.30	---	74	54	-5.70
7356	V	40.24	---	10.07	50.31	---	74	54	-3.69
---	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.

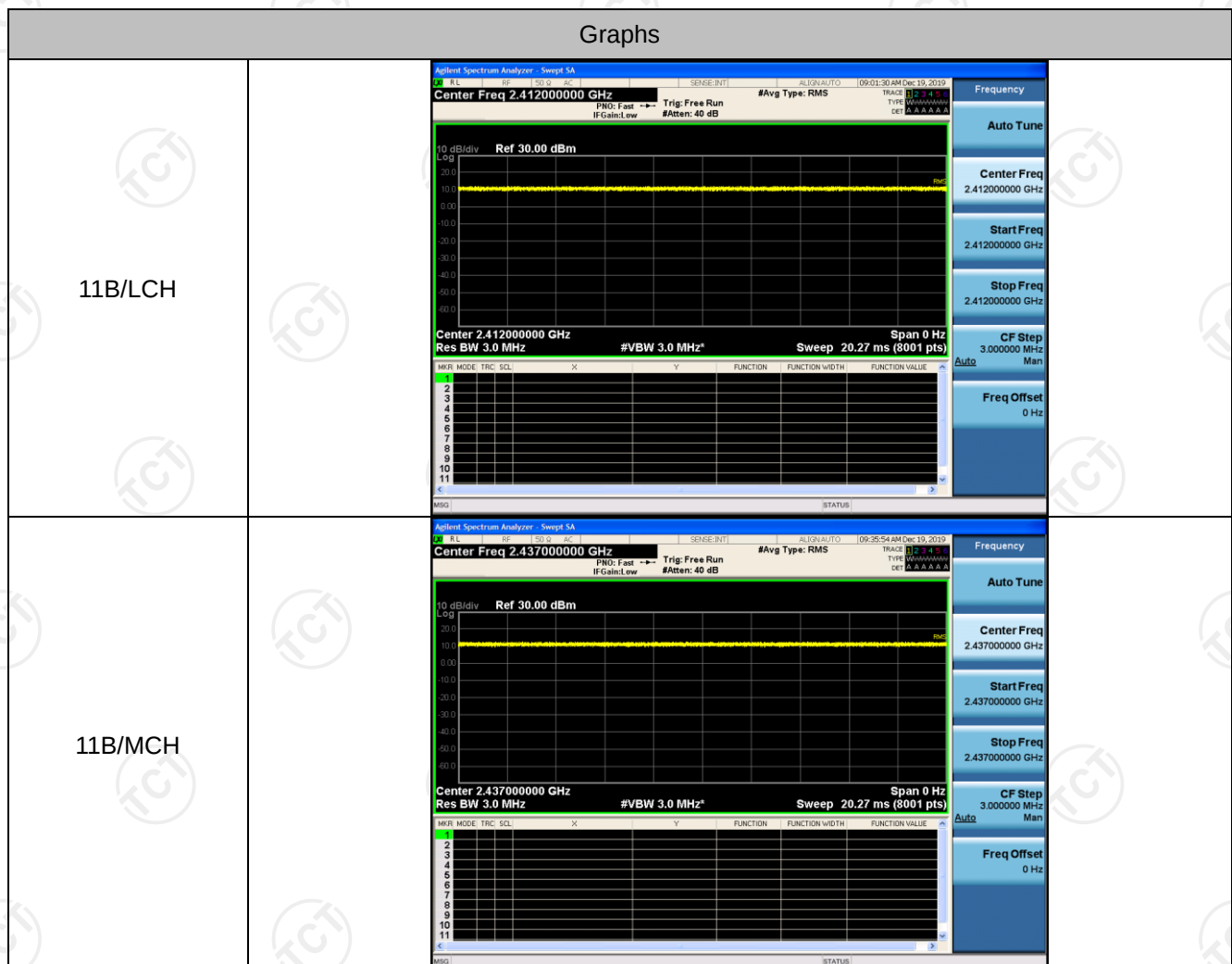
Appendix A: Test Result of Conducted Test

Duty Cycle

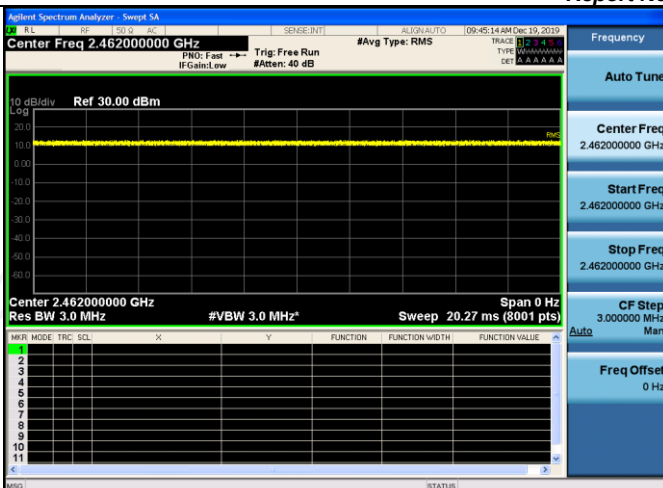
Result Table

Mode	Channel	Meas.Level [dBm]
11B	LCH	100
11B	MCH	100
11B	HCH	100
11G	LCH	100
11G	MCH	100
11G	HCH	100
11N20SISO	LCH	100
11N20SISO	MCH	100
11N20SISO	HCH	100
11N40SISO	LCH	100
11N40SISO	MCH	100
11N40SISO	HCH	100

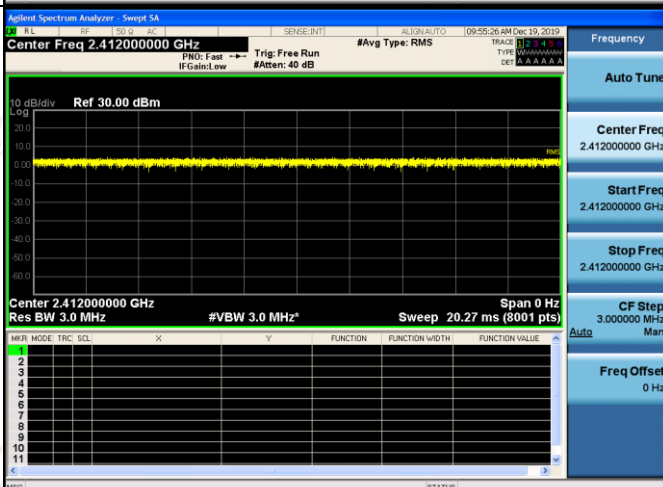
Test Graph



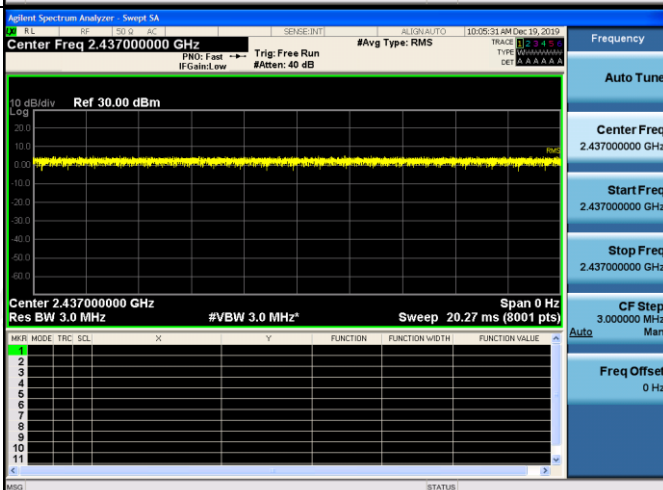
11B/HCH



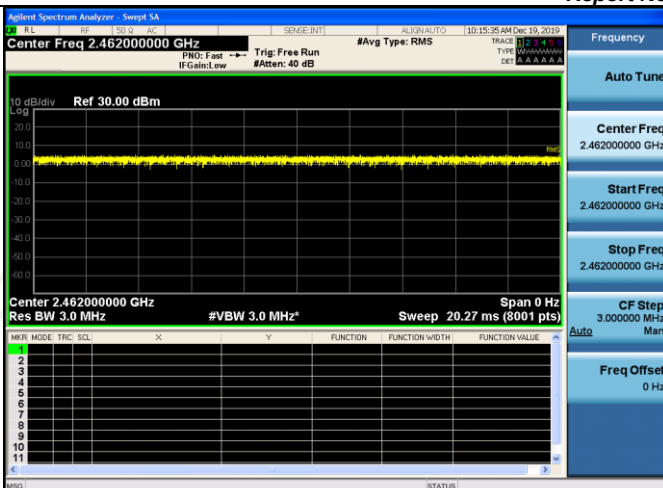
11G/LCH



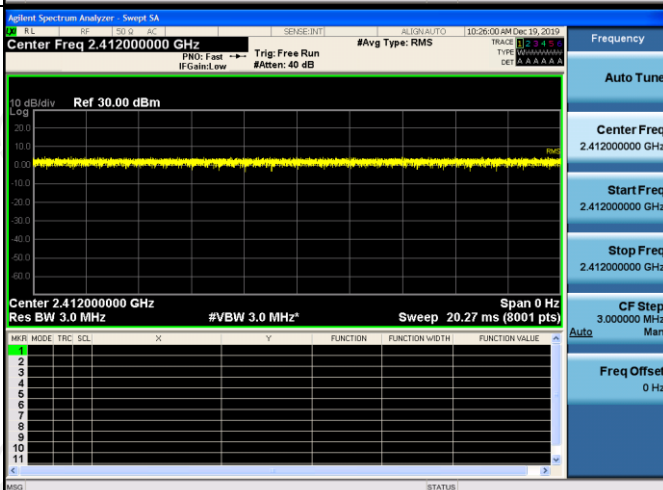
11G/MCH



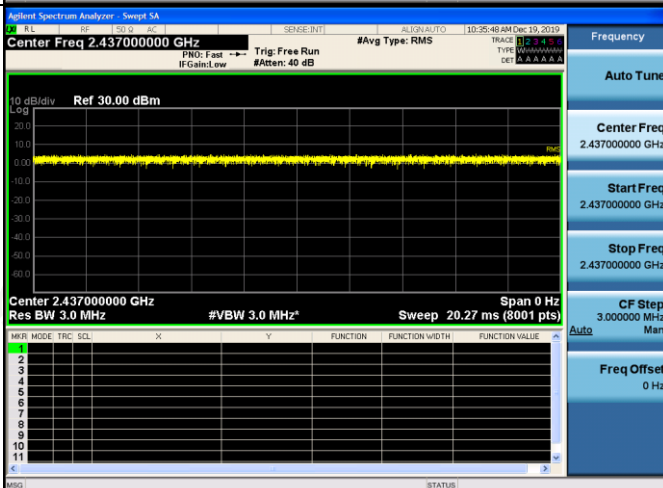
11G/HCH

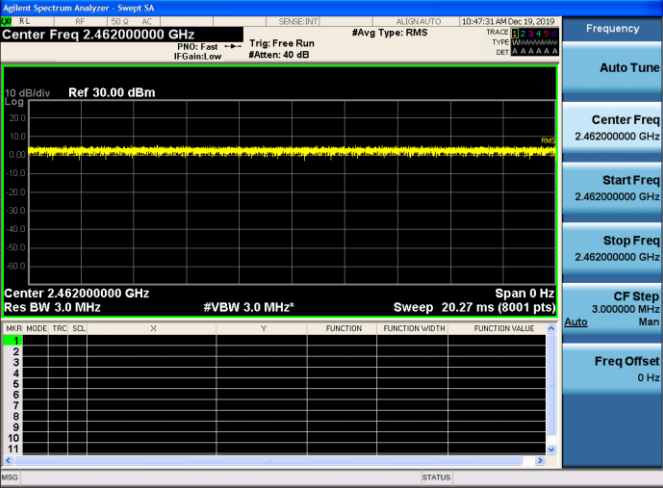
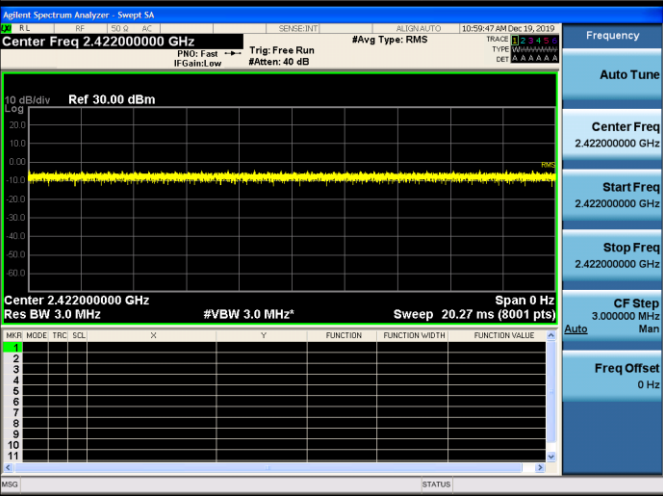
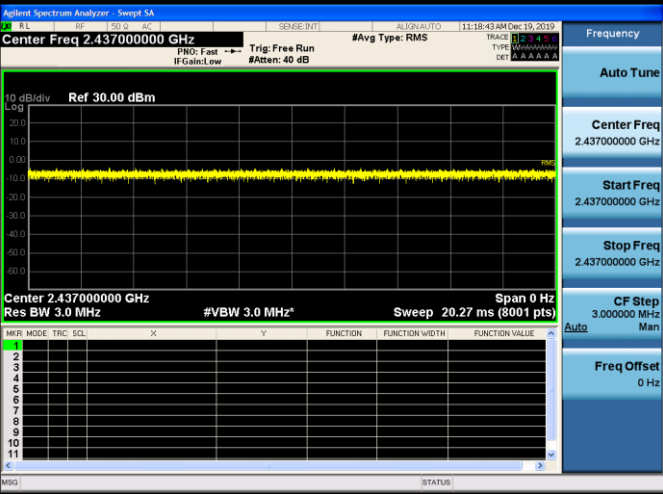


11N20SISO/LCH

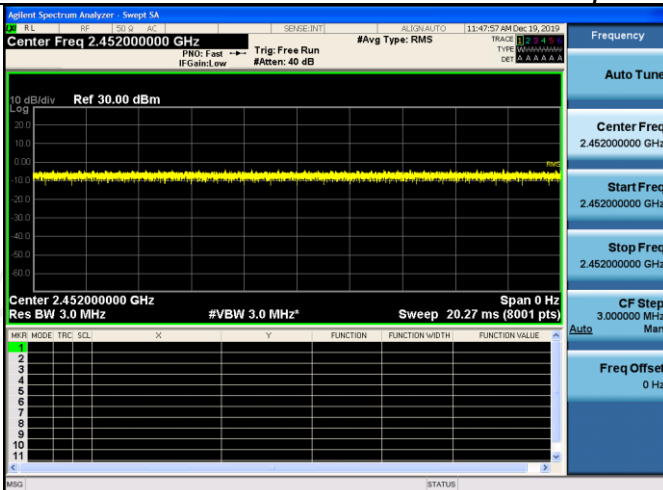


11N20SISO/MCH



11N20SISO/HCH	
11N40SISO/LCH	
11N40SISO/MCH	

11N40SISO/HCH



Conducted Average Output Power

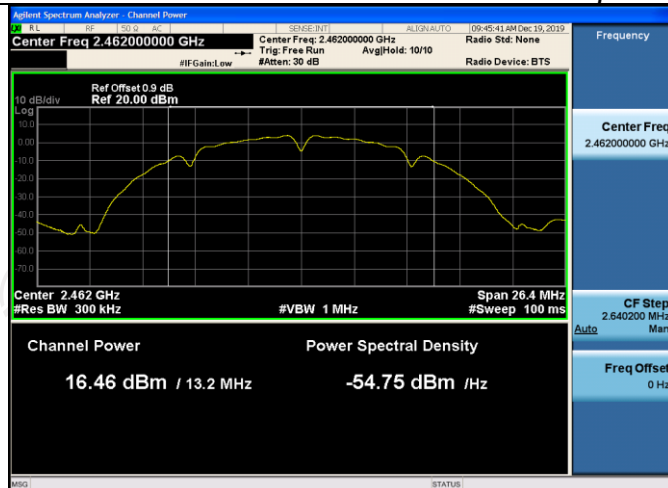
Result Table

Mode	Channel	Meas.Level [dBm]	Verdict
11B	LCH	15.62	PASS
11B	MCH	16.10	PASS
11B	HCH	16.46	PASS
11G	LCH	10.04	PASS
11G	MCH	10.49	PASS
11G	HCH	10.78	PASS
11N20SISO	LCH	10.07	PASS
11N20SISO	MCH	10.41	PASS
11N20SISO	HCH	10.80	PASS
11N40SISO	LCH	10.29	PASS
11N40SISO	MCH	10.49	PASS
11N40SISO	HCH	10.71	PASS

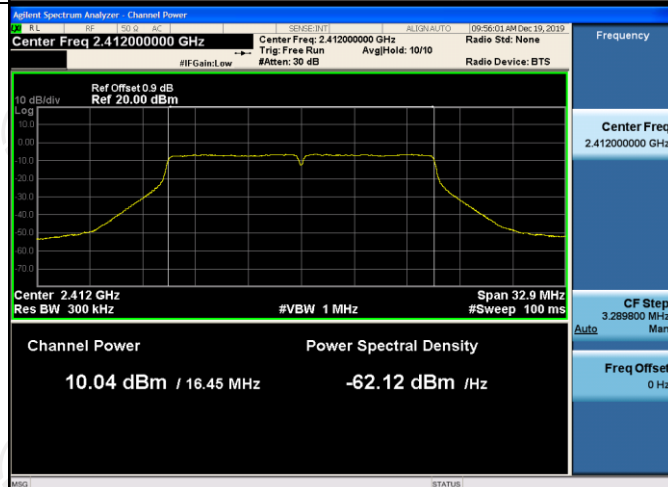
Test Graph



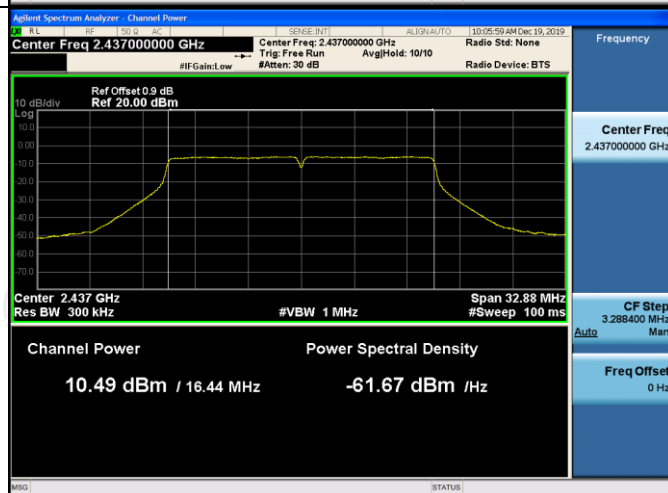
11B/HCH



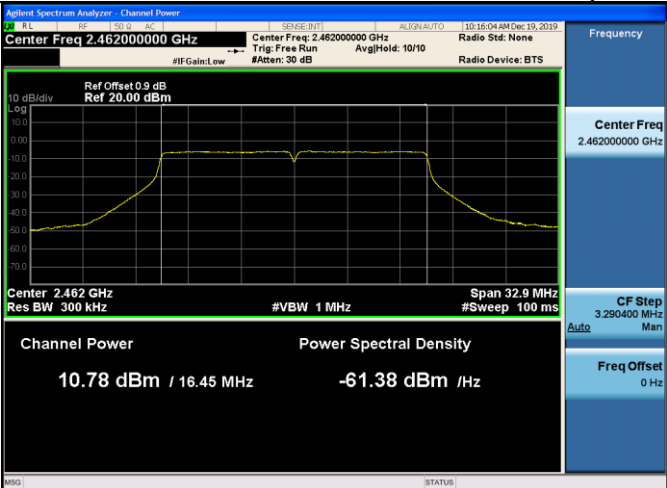
11G/LCH



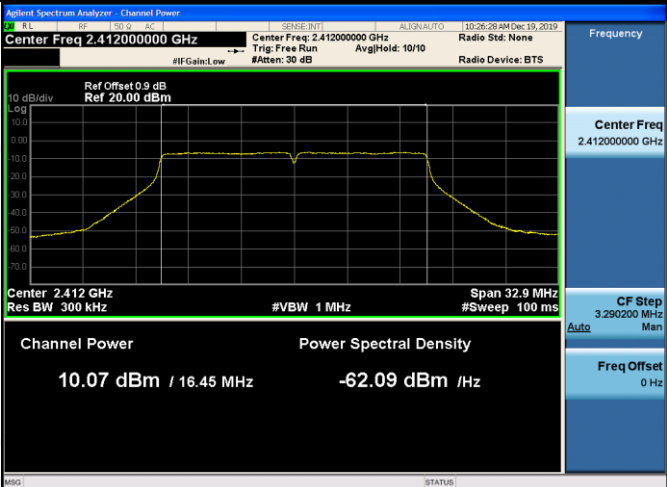
11G/MCH



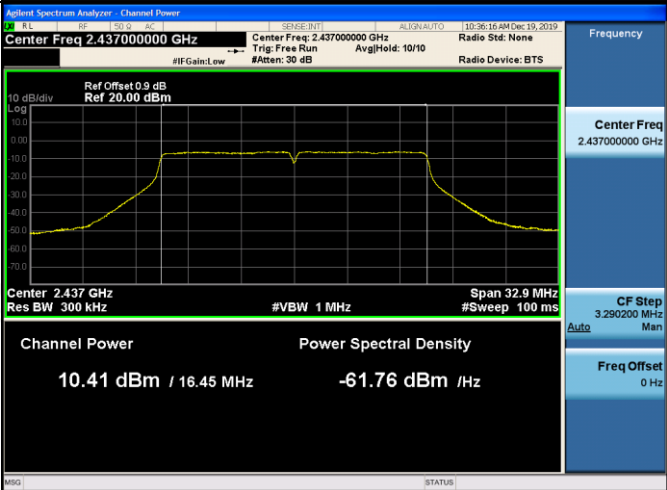
11G/HCH

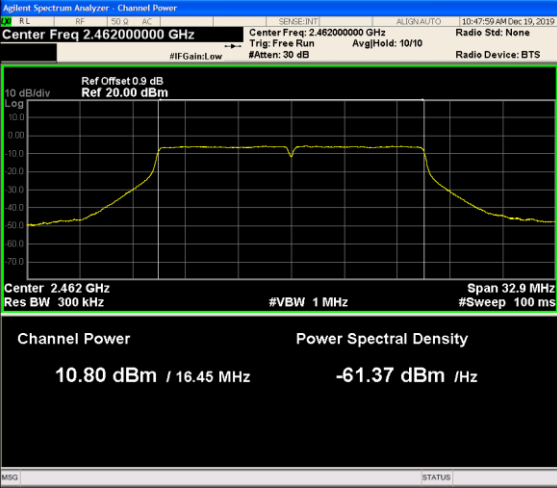
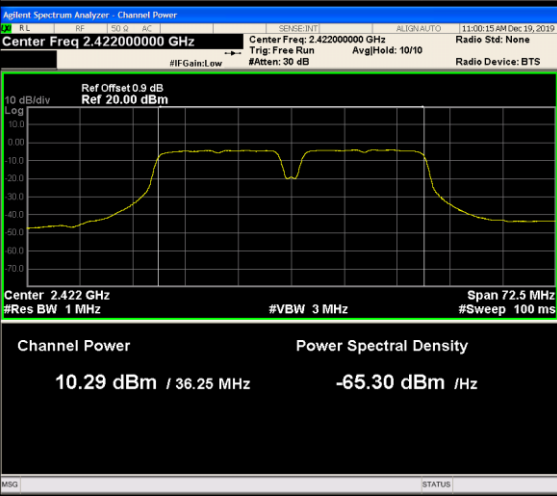
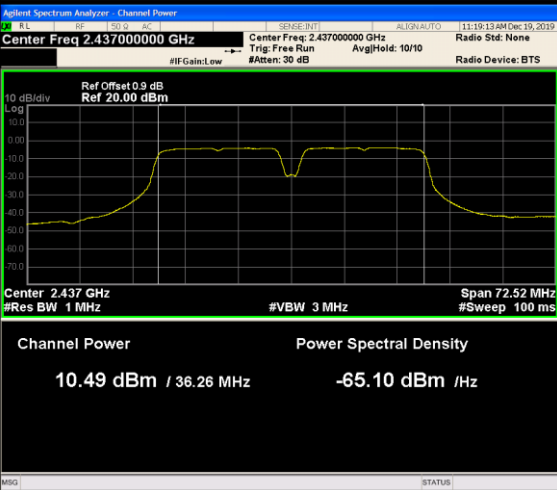


11N20SISO/LCH

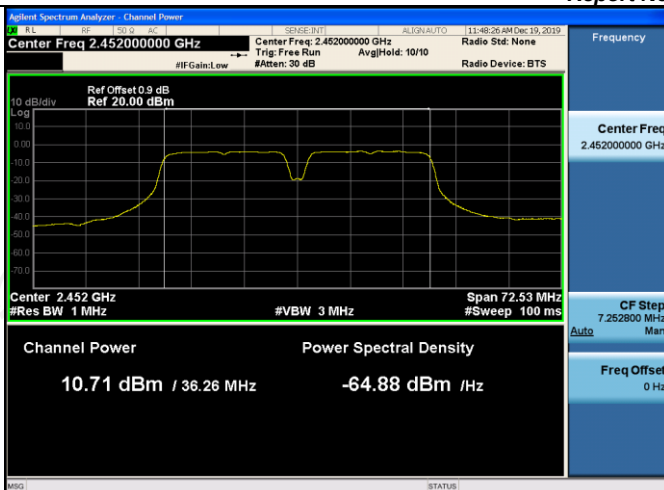


11N20SISO/MCH



11N20SISO/HCH	 Agilent Spectrum Analyzer - Channel Power Center Freq 2.462000000 GHz Ref Offset 0.9 dB Ref 20.00 dBm Center 2.462 GHz Res BW 300 kHz Channel Power: 10.80 dBm / 16.45 MHz Power Spectral Density: -61.37 dBm / Hz Span 32.9 MHz #Sweep 100 ms	Frequency Center Freq 2.462000000 GHz CF Step 3.290400 MHz Freq Offset 0 Hz
11N40SISO/LCH	 Agilent Spectrum Analyzer - Channel Power Center Freq 2.422000000 GHz Ref Offset 0.9 dB Ref 20.00 dBm Center 2.422 GHz Res BW 1 MHz Channel Power: 10.29 dBm / 36.25 MHz Power Spectral Density: -65.30 dBm / Hz Span 72.5 MHz #Sweep 100 ms	Frequency Center Freq 2.422000000 GHz CF Step 7.250400 MHz Freq Offset 0 Hz
11N40SISO/MCH	 Agilent Spectrum Analyzer - Channel Power Center Freq 2.437000000 GHz Ref Offset 0.9 dB Ref 20.00 dBm Center 2.437 GHz Res BW 1 MHz Channel Power: 10.49 dBm / 36.26 MHz Power Spectral Density: -65.10 dBm / Hz Span 72.52 MHz #Sweep 100 ms	Frequency Center Freq 2.437000000 GHz CF Step 7.252400 MHz Freq Offset 0 Hz

11N40SISO/HCH

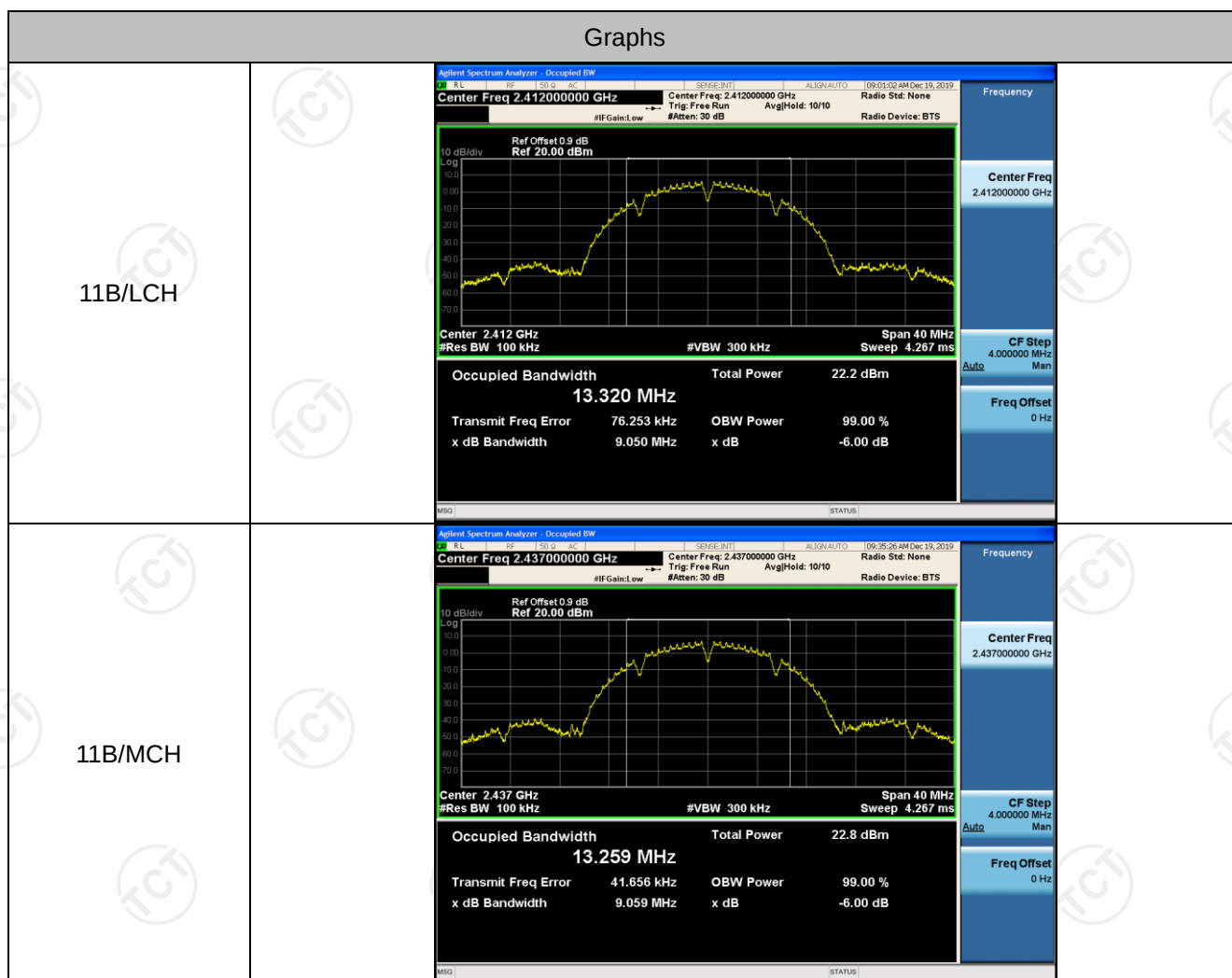


6dB Occupied Bandwidth

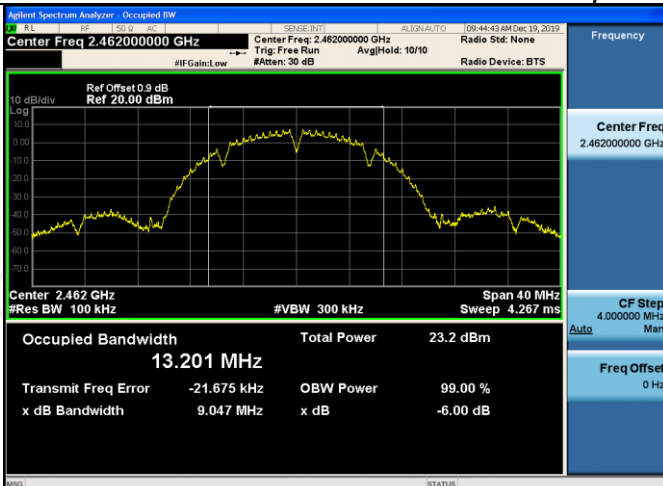
Result Table

Mode	Channel	6dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
11B	LCH	9.050	13.320	PASS
11B	MCH	9.059	13.259	PASS
11B	HCH	9.047	13.201	PASS
11G	LCH	16.52	16.449	PASS
11G	MCH	16.50	16.442	PASS
11G	HCH	16.52	16.452	PASS
11N20SISO	LCH	16.52	16.451	PASS
11N20SISO	MCH	16.53	16.451	PASS
11N20SISO	HCH	16.52	16.452	PASS
11N40SISO	LCH	36.50	36.252	PASS
11N40SISO	MCH	36.50	36.262	PASS
11N40SISO	HCH	36.51	36.264	PASS

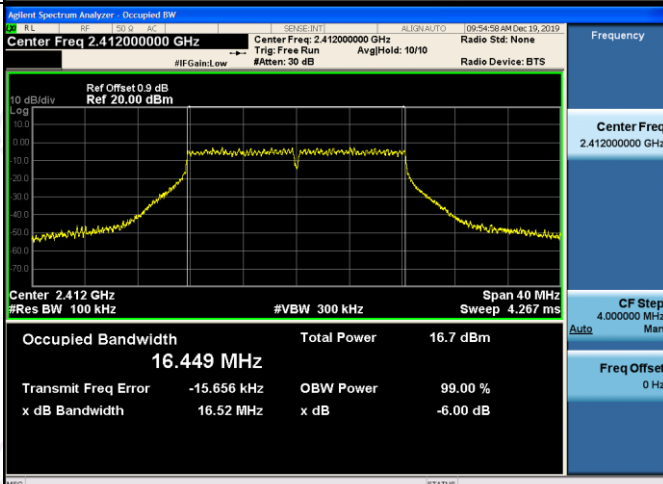
Test Graph



11B/HCH



11G/LCH



11G/MCH

