FCC RADIO TEST REPORT

The device described below is tested by Dongguan Nore Testing Center Co., Ltd. to determine the maximum emission levels emanating from the device, the severe levels which the device can endure and E.U.T.'s performance criterion. The test results, data evaluation, test procedures, and equipment of configurations shown in this report were made in accordance with the procedures in ANSI C63.10(2013).

Applicant/ Manufacturer	:	Shenzhen Interthings Technology Co., Ltd.
Address	:	Room305, T3 Building, Silicon Valley Compound, Longhua District, Shenzhen, China.
Factory	:	Yinghe Digital Technology (Guangdong) Co.,Ltd.
Address	:	5F, Building G, Zijin Industrial Area, Yongning Road, Xinnan Community, Qishi Town, Dongguan, Guangdong
E.U.T.	:	IP camera
Brand Name	:	VIVITAR, ALTEC LANSING
Model No.	:	IPC139, IPC156, IPC120, ALT-220 (For model difference refer to section 1)
FCC ID	:	2AQ7B-IPC001
Measurement Standard	:	FCC PART 15.247
Date of Receiver	:	June 22, 2018
Date of Test	:	June 22, 2018 to July 16, 2018
Date of Report	:	July 16, 2018

This Test Report is Issued Under the Authority of :

Prepared by	Approved & Authorized Signer
Sundiy jiang / Engineer	Iori Fan / Authorized Signatory

This test report is for the customer shown above and their specific product only. This report applies to above tested sample only and shall not be reproduced in part without written approval of Dongguan Nore Testing Center Co., Ltd.

TEL: +86-769-22022444 FAX: +86-769-22022799 Web: www.ntc-c.com
Address: Building D, Gaosheng Science and Technology park, Hongtu road, Nancheng district, Dongguan city, Guangdong province, China

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Revision History of This Test Report

Report Number	Description	Issued Date
NTC1906270FV00	Initial Issue	2019-07-16

1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test

E.U.T.	:	IP camera
Main model number	:	IPC156
Additional Model number	:	IPC139, IPC120, ALT-220
Description of model difference	:	These of models have the same circuit schematic, construction, PCB Layout and critical components. The difference is model number, brand name and exterior decoration only due to trading purpose.
Brand Name	:	VIVITAR, ALTEC LANSING
E.U.T. Type	:	Class B
Rating	:	DC 5V(from external adapter)
Test Voltage	:	AC 120V/60Hz, 240V/60Hz (Only the worst case was recorded in this report)
Cable	:	DC Cable: 1.21m unshielded
Adapter	:	Manufacturer: I.T.E M/N:JHC-A20UL50100 Input: AC100-240V ~50/60Hz 0.3A max Output: DC 5V 1A
Hardware version	:	V1.0
Software version	:	V1.0
Note	:	According to the model difference, all tests were performed on model IPC156.

Technical parameters

Frequency Range	:	2412MHz~2462MHz(802.11b/802.11g/802.11n(HT20)) 2422MHz~2452MHz(802.11n(HT40))
Modulation Type	:	CCK, DQPSK, DBPSK for 802.11b OFDM for 802.11g/n(HT20)/n(HT40)
Number of Channel	:	11 for 802.11b/g/n(HT20) 7 for 802.11n(HT40)
Channel space	:	5MHz
Date Rate	:	802.11b:1~11Mbps, 802.11g:6~54Mbps 802.11n(HT20): 6.5~72.2Mbps 802.11n(HT40): 13.5~135Mbps
Antenna Type	:	Chip antenna
Antenna Gain	:	2 dBi

WIFI Channel List

802.11 b/g/n(HT20)		802.11 n(HT40)	
Channel	**Frequency MHz**	**Channel**	**Frequency MHz**
1	2412	--	--
2	2417	--	--
3	2422	3	2422
4	2427	4	2427
5	2432	5	2432
6	2437	6	2437
7	2442	7	2442
8	2447	8	2447
9	2452	9	2452
10	2457	--	--
11	2462	--	--

Note: According to section 15.31(m), regards to the operating frequency range over 10MHz, the Lowest, middle, and the Highest frequency of channel were selected to perform the test. The selected frequency see below:

802.11b/g/n(HT20)		802.11n(HT40)	
Channel	**Frequency MHz**	**Channel**	**Frequency MHz**
1	2412	3	2422
6	2437	6	2437
11	2462	9	2452

Test SW version	Realtek USB WLAN MP

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: **2AQ7B-IPC001** filing to comply with Section 15.247 of the FCC Part 15(2017), Subpart C Rule.

1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). Radiated emission measurement was performed in semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters.

1.4 Equipment Modifications

Not available for this EUT intended for grant.

1.5 Support Device

Notebook	:	Manufacturer: IBM Model: 1834 P/N: 13N5615 CE, FCC: DOC
Adapter (For Notebook)	:	Manufacturer: Huntkey Model: HKA09019047-6D I/P: AC 100-240V 50-60Hz, 1.5A O/P: DC 19V 4.74A

1.6 Test Facility and Location

Site Description

EMC Lab	:	Listed by CNAS, August 13, 2018 The certificate is valid until August 13, 2024 The Laboratory has been assessed and proved to be in compliance with CNAS/CL01 The Certificate Registration Number is L5795. Listed by A2LA, November 01, 2017 The certificate is valid until December 31, 2019 The Laboratory has been assessed and proved to be in compliance with ISO17025 The Certificate Registration Number is 4429.01 Listed by FCC, November 06, 2017 The Designation Number is CN1214 Test Firm Registration Number: 907417 Listed by Industry Canada, June 08, 2017 The Certificate Registration Number. Is 46405-9743
Name of Firm	:	Dongguan Nore Testing Center Co., Ltd. (Dongguan NTC Co., Ltd.)
Site Location	:	Building D, Gaosheng Science and Technology park, Hongtu road, Nancheng district, Dongguan city, Guangdong province, China

1.7 Summary of Test Results

FCC Rules	Description Of Test	Uncertainty	Result
§15.207 (a)	AC Power Conducted Emission	±1.06dB	Compliant
§15.247(b)(3)	Max. Conducted Output Power	±1.06dB	Compliant
§15.247(a)(2)	6dB Bandwidth	±1.42 x10^{-4}%	Compliant
§15.247(e)	Power Spectral Density	±1.06dB	Compliant
§15.247(d)	Band Edge and Conducted Spurious Emissions	±1.70dB	Compliant
§15.247(d),§15.209, §15.205	Radiated Spurious Emissions and Restricted Bands	±3.70dB	Compliant
§15.203	Antenna Requirement	N/A	Compliant

2. System Test Configuration

2.1 EUT Configuration

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

2.2 Special Accessories

Not available for this EUT intended for grant.

2.3 Description of test modes

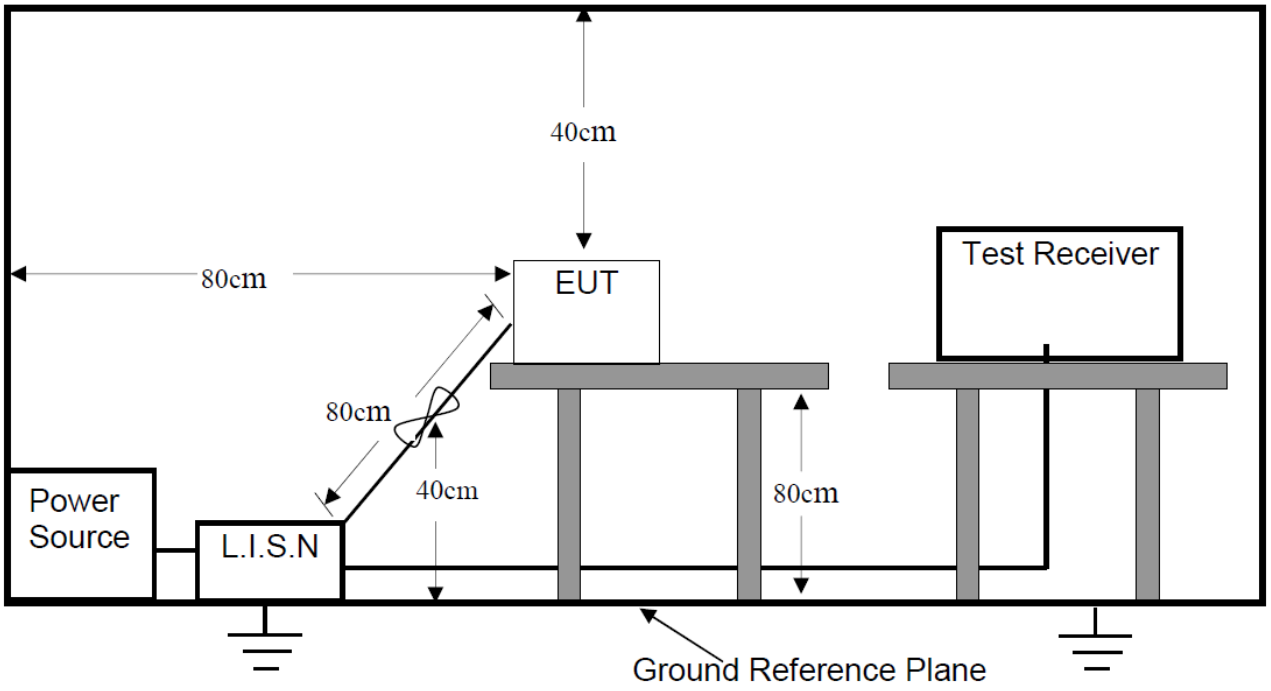
The EUT has been tested under continuous operating condition. Test program used to control the EUT staying in continuous transmitting mode. The Lowest, middle and highest channel were chosen for testing, and modulation type CCK, DQPSK, DBPSK, OFDM and all data rate were tested. But only the worst case data is shown in this report.

2.4 EUT Exercise

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

3. Conducted Emissions Test

3.1 Test SET-UP (Block Diagram of Configuration)



3.2 Test Condition

Test Requirement: FCC Part 15.207

Frequency Range: 150 KHz ~ 30 MHz

Detector: RBW 9 KHz, VBW 30 KHz

Operation Mode: TX

3.3 Measurement Results

Please refer to following plots of the worst case: 802.11n(HT20) High channel

Dongguan NTC Co., Ltd.
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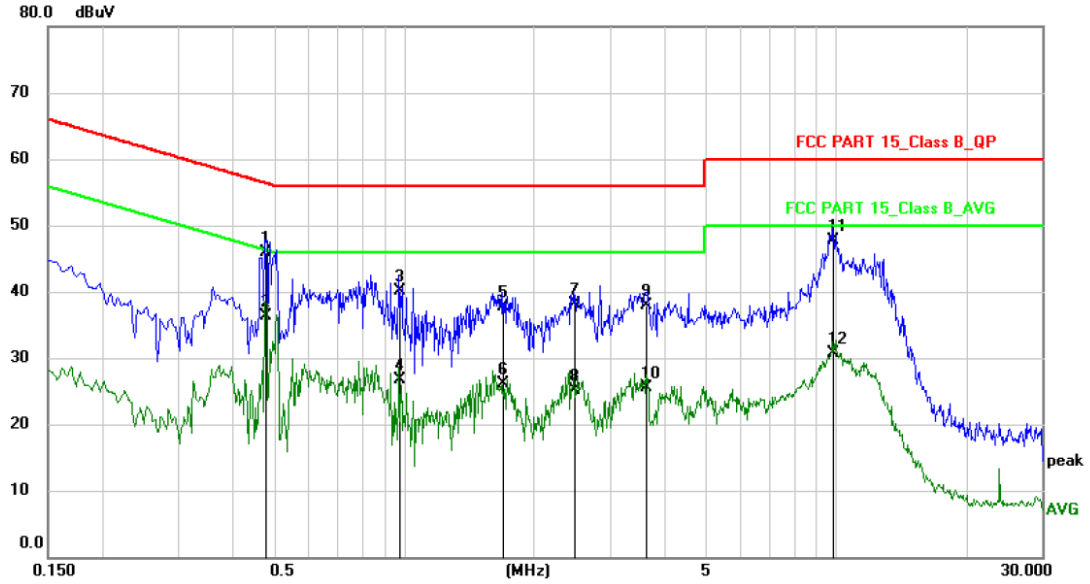
Web: Http://www.ntc-c.com

Conducted Emission Measurement

File :IPC156 Data :#1 Date: 2019/6/27 Time: 9:23:07



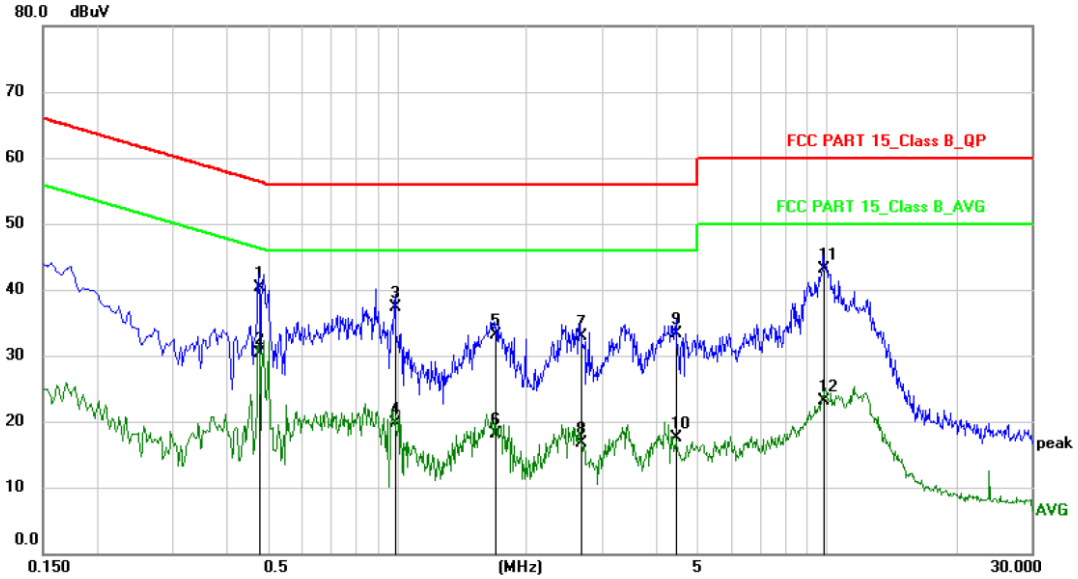
Site Phase: *L1* Temperature: 26
Limit: FCC PART 15_Class B_QP Power: AC120V/60Hz Humidity: 50 %
EUT: IP camera
M/N: IPC156
Mode: TX
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.4780	35.28	10.62	45.90	56.37	-10.47	QP	
2	*	0.4780	25.78	10.62	36.40	46.37	-9.97	AVG	
3		0.9740	29.55	10.65	40.20	56.00	-15.80	QP	
4		0.9740	16.05	10.65	26.70	46.00	-19.30	AVG	
5		1.6940	27.15	10.65	37.80	56.00	-18.20	QP	
6		1.6940	15.55	10.65	26.20	46.00	-19.80	AVG	
7		2.4820	27.45	10.65	38.10	56.00	-17.90	QP	
8		2.4820	14.55	10.65	25.20	46.00	-20.80	AVG	
9		3.6260	27.34	10.66	38.00	56.00	-18.00	QP	
10		3.6260	14.84	10.66	25.50	46.00	-20.50	AVG	
11		9.8139	37.13	10.67	47.80	60.00	-12.20	QP	
12		9.8139	20.03	10.67	30.70	50.00	-19.30	AVG	

Dongguan NTC Co., Ltd.
Tel: +86-769-22022444 Fax: +86-769-22022799
Web: Http://www.ntc-c.com

Conducted Emission Measurement

File :IPC156 Data :#2 Date: 2019/6/27 Time: 9:24:58



Site Phase: N Temperature: 26
Limit: FCC PART 15_Class B_QP Power: AC120V/60Hz Humidity: 50 %
EUT: IP camera
M/N: IPC156
Mode: TX
Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.4780	29.78	10.62	40.40	56.37	-15.97	QP	
2		0.4780	19.78	10.62	30.40	46.37	-15.97	AVG	
3		0.9900	26.65	10.65	37.30	56.00	-18.70	QP	
4		0.9900	9.15	10.65	19.80	46.00	-26.20	AVG	
5		1.6980	22.45	10.65	33.10	56.00	-22.90	QP	
6		1.6980	7.45	10.65	18.10	46.00	-27.90	AVG	
7		2.6780	22.25	10.65	32.90	56.00	-23.10	QP	
8		2.6780	6.15	10.65	16.80	46.00	-29.20	AVG	
9		4.4620	22.74	10.66	33.40	56.00	-22.60	QP	
10		4.4620	6.84	10.66	17.50	46.00	-28.50	AVG	
11		9.8340	32.53	10.67	43.20	60.00	-16.80	QP	
12		9.8340	12.43	10.67	23.10	50.00	-26.90	AVG	

4. Max. Peak Conducted Output Power

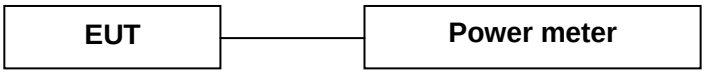
4.1 Measurement Procedure

Maximum Conducted Output power at Antenna Terminals, FCC Rules 15.247(b)(3):

One of the following procedures may be used to determine the maximum peak conducted output power of a DTS EUT.

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

4.2 Test SET-UP (Block Diagram of Configuration)



4.3 Measurement Results

Pass

Please refer to following table.

Temperature :	22 ℃	Humidity :	53%
Test By:	Sance	Test Date :	July 04, 2019
Test Result:	PASS		
Frequency MHz	Data Rate Mbps	Peak Output Power dBm	Limit dBm
IEEE 802.11b Mode (CCK, Antenna Gain=2 dBi)			
Low Channel: 2412	1	8.16	30
Middle Channel: 2437	1	9.43	30
High Channel: 2462	1	10.25	30
IEEE 802.11g Mode (OFDM, Antenna Gain=2 dBi)			
Low Channel: 2412	6	10.24	30
Middle Channel: 2437	6	11.65	30
High Channel: 2462	6	11.59	30
IEEE 802.11n(HT20) Mode (OFDM, Antenna Gain=2 dBi)			
Low Channel: 2412	6.5	9.83	30
Middle Channel: 2437	6.5	11.74	30
High Channel: 2462	6.5	12.83	30
IEEE 802.11n(HT40) Mode (OFDM, Antenna Gain=2 dBi)			
Low Channel: 2422	13.5	10.22	30
Middle Channel: 2437	13.5	10.82	30
High Channel: 2452	13.5	11.88	30
Duty Cycle of test signal is ≥98%			

Note: CCK was worst case of the 802.11b

5. 6dB Bandwidth

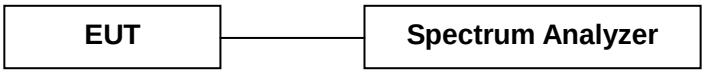
5.1 Measurement Procedure

DTS 6dB Channel Bandwidth, FCC Rule 15.247(a)(2):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer was set as below according to FCC KDB558074(v05):

1. Set resolution bandwidth (RBW) = 100kHz
2. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
3. Trace mode = max hold.
4. Sweep = auto couple.
5. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

5.2 Test SET-UP (Block Diagram of Configuration)



5.3 Measurement Results

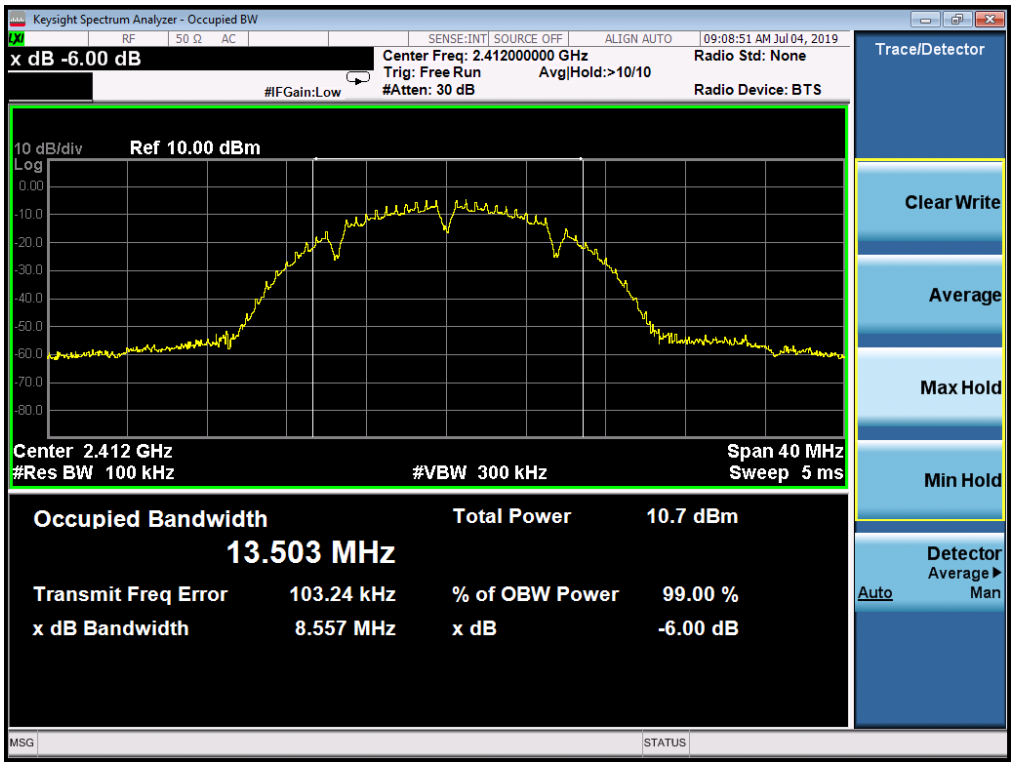
Pass

Please refer to following table and plots.

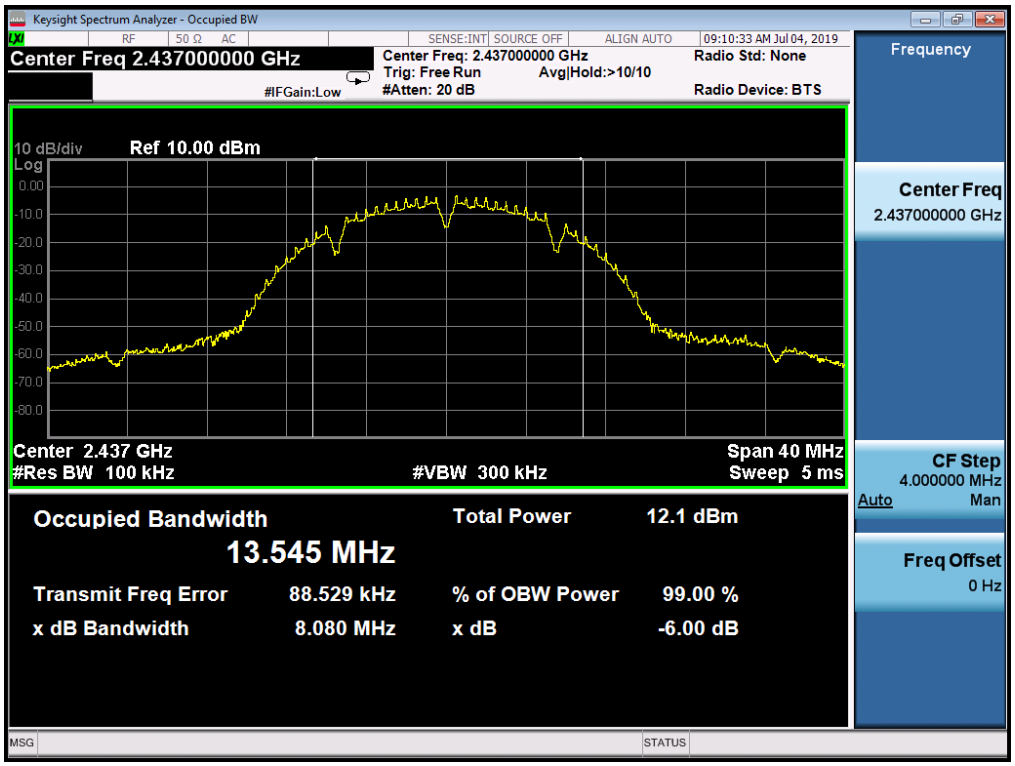
Temperature :	22 ℃	Humidity : 53 %	
Test By:	Sance	Test Date : July 04, 2019	
Test Result:	PASS		
Frequency MHz	Data Rate Mbps	6dB Bandwidth MHz	Limit
IEEE 802.11b Mode (CCK)			
Low Channel: 2412	1	8.557	>500KHz
Middle Channel: 2437	1	8.080	>500KHz
High Channel: 2462	1	9.010	>500KHz
IEEE 802.11g Mode (OFDM)			
Low Channel: 2412	6	16.380	>500KHz
Middle Channel: 2437	6	16.410	>500KHz
High Channel: 2462	6	16.450	>500KHz
IEEE 802.11n(HT20) Mode (OFDM)			
Low Channel: 2412	6.5	17.35	>500KHz
Middle Channel: 2437	6.5	17.600	>500KHz
High Channel: 2462	6.5	17.600	>500KHz
IEEE 802.11n(HT40) Mode (OFDM)			
Low Channel: 2422	13.5	35.750	>500KHz
Middle Channel: 2437	13.5	35.760	>500KHz
High Channel: 2452	13.5	35.760	>500KHz

Note: CCK was worst case of the 802.11b

802.11b Low Channel

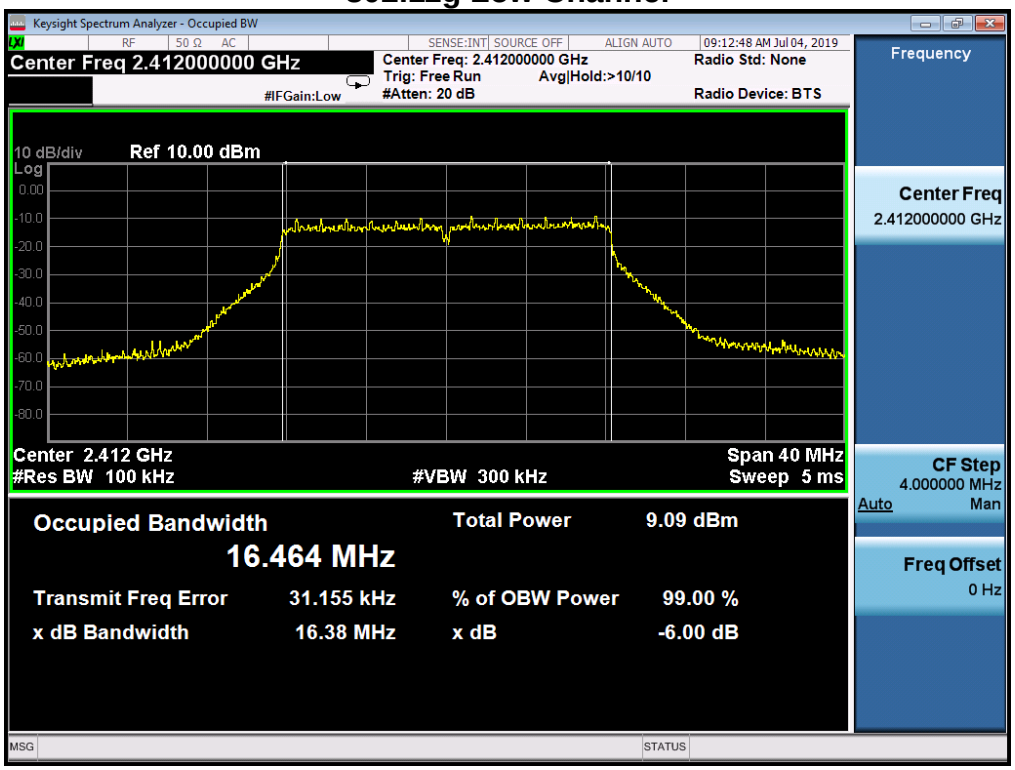


802.11b Middle Channel

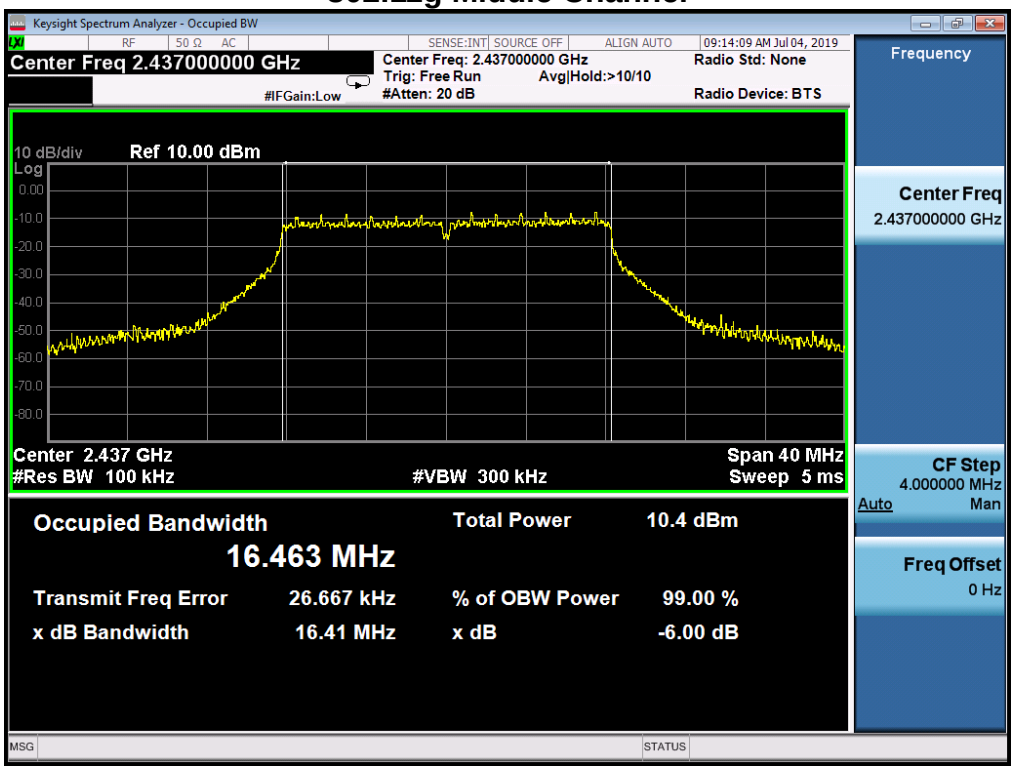


802.11b High Channel

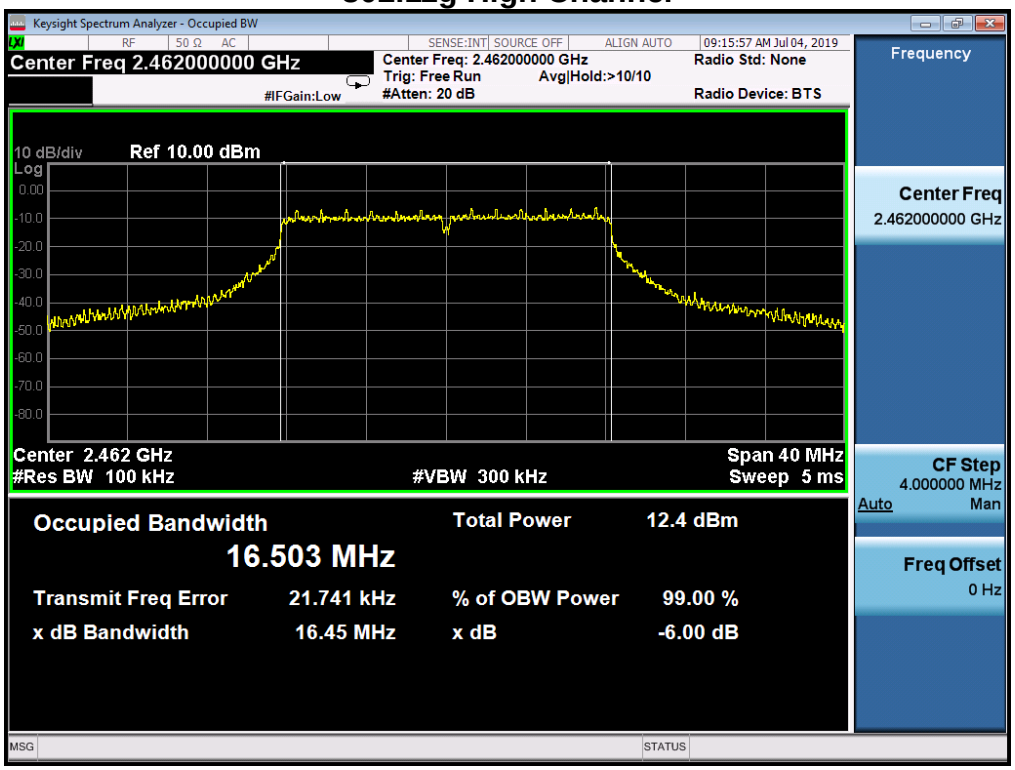
802.11g Low Channel



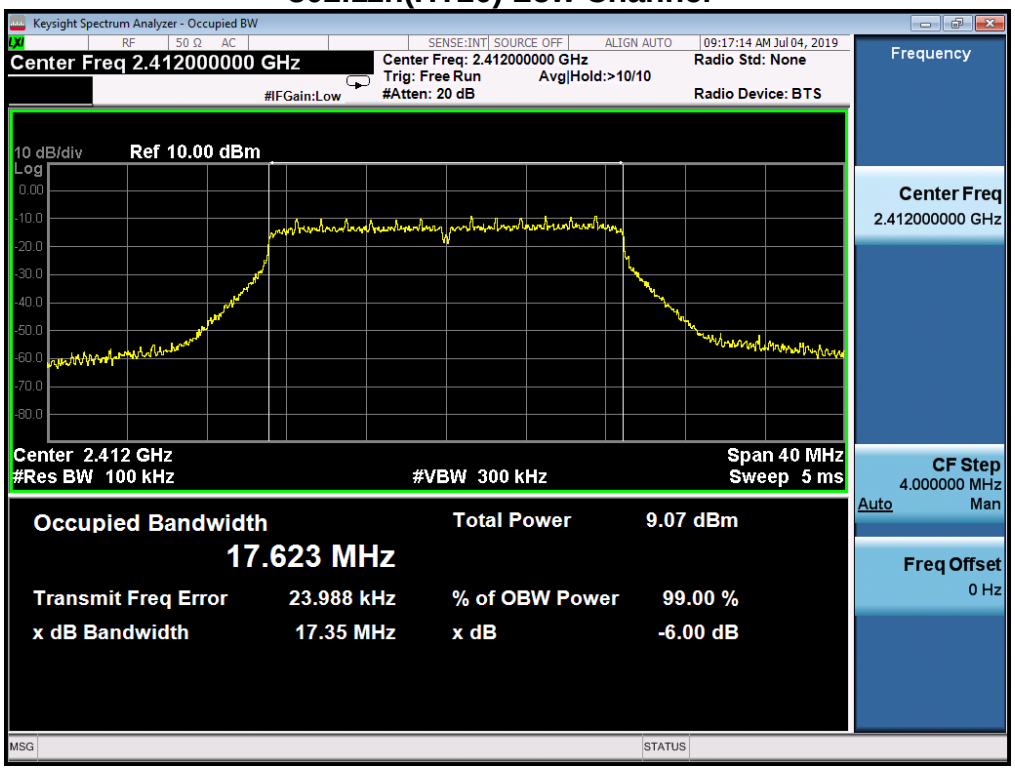
802.11g Middle Channel



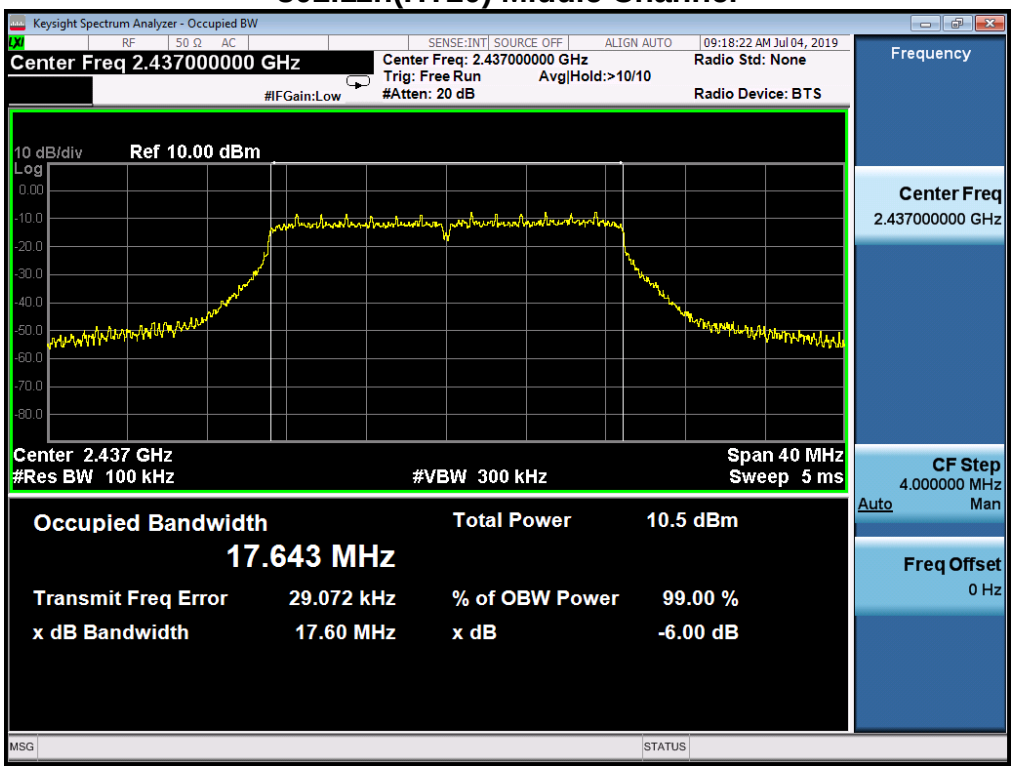
802.11g High Channel



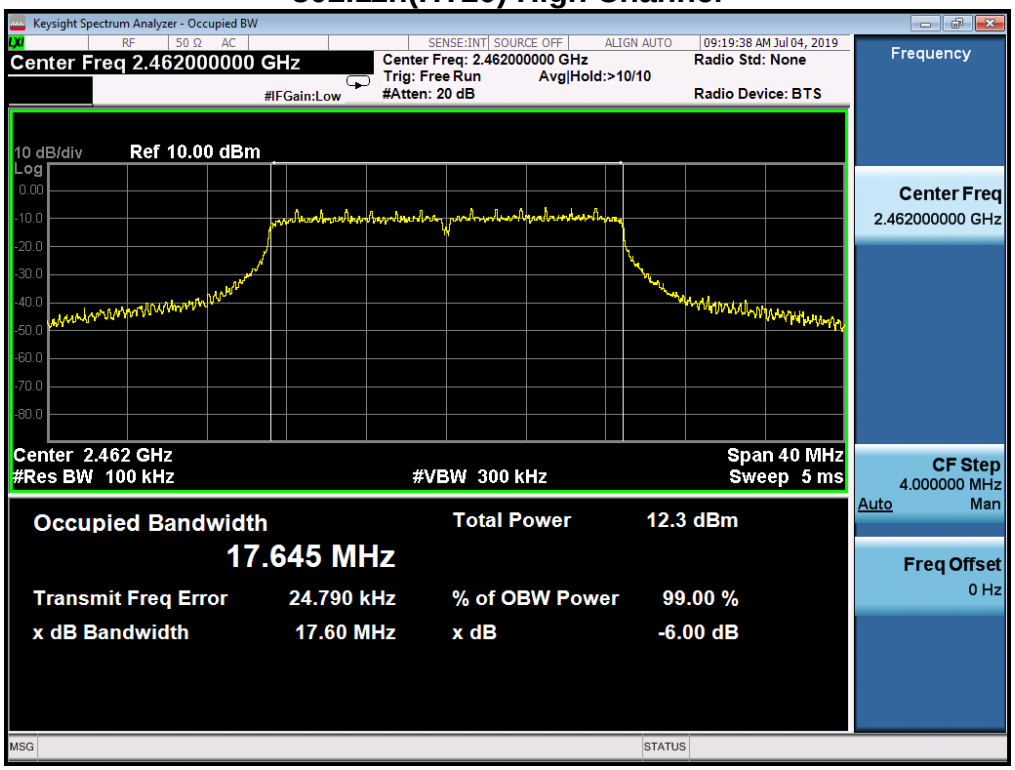
802.11n(HT20) Low Channel



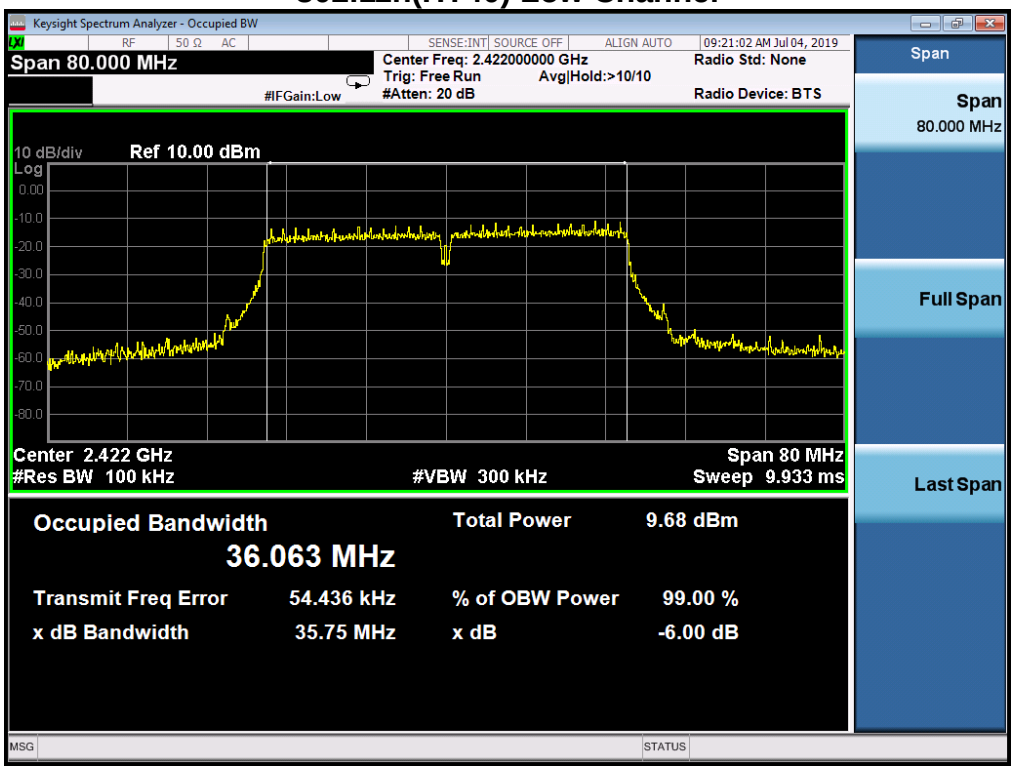
802.11n(HT20) Middle Channel



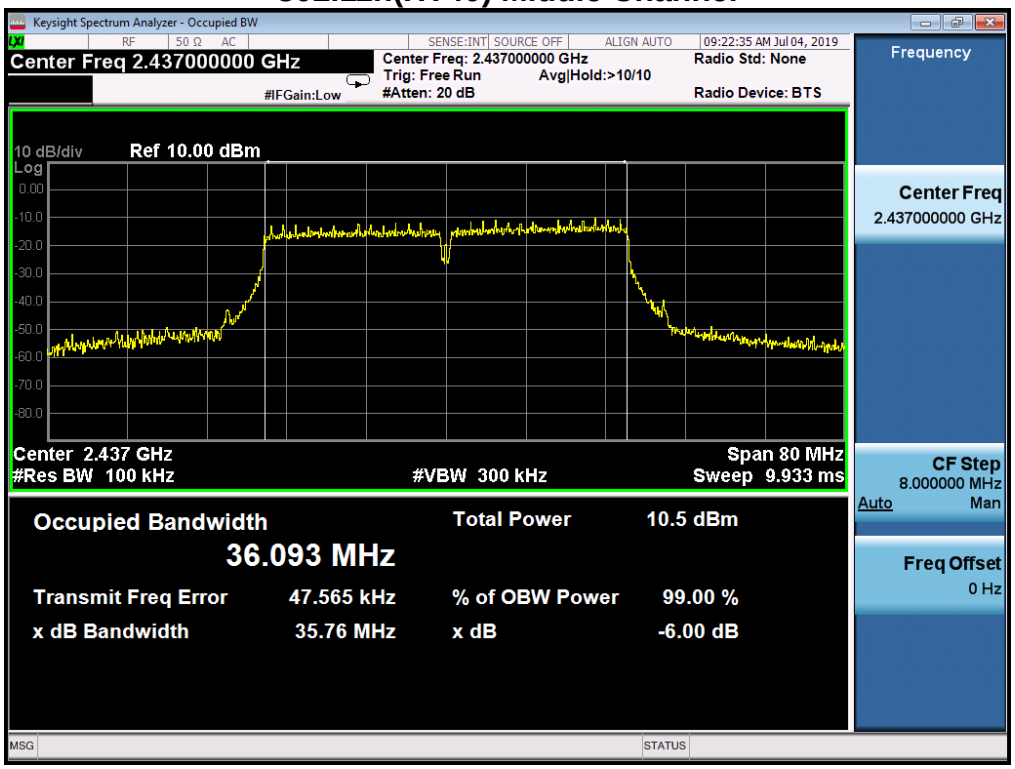
802.11n(HT20) High Channel



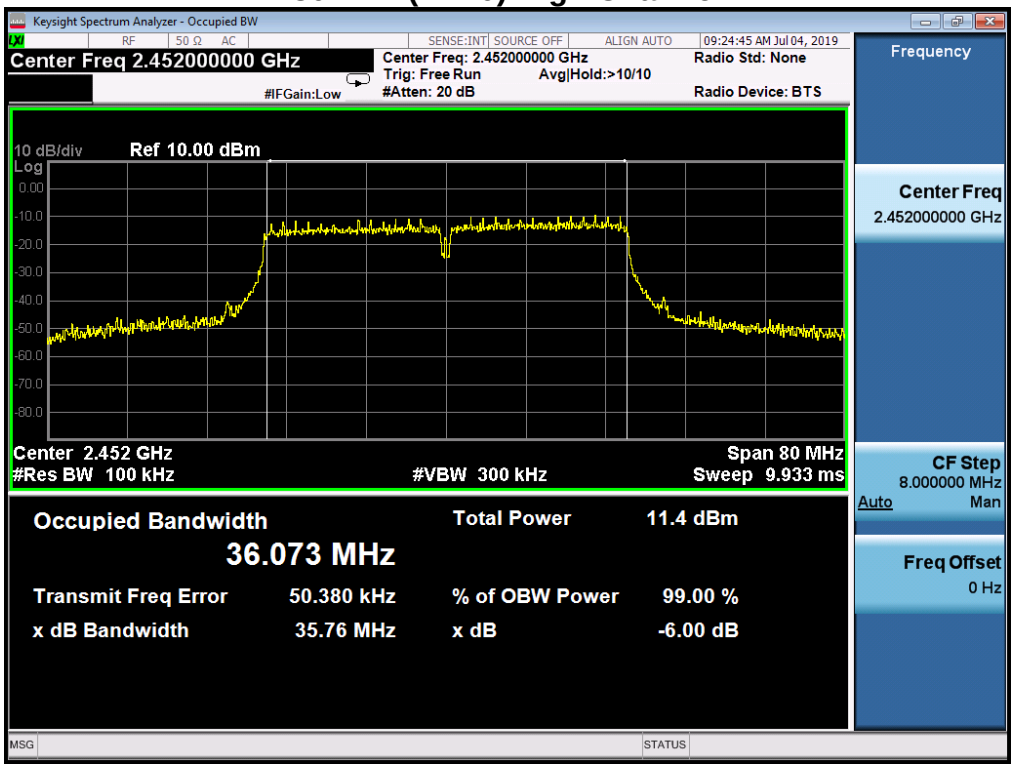
802.11n(HT40) Low Channel



802.11n(HT40) Middle Channel



802.11n(HT40) High Channel



6. Power Spectral Density

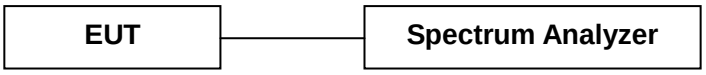
6.1 Measurement Procedure

Power Spectral Density, FCC Rule 15.247(e):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer was set as below according to FCC KDB558074 (v05):

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz≤RBW≤100KHz
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.2 Test SET-UP (Block Diagram of Configuration)



6.3 Measurement Results

Pass

Please refer to following table and plots.

Temperature :	22 ℃	Humidity :	53 %
Test By:	Sance	Test Date :	July 04, 2019
Test Result:	PASS		
Frequency MHz	Data Rate Mbps	PSD dBm/3kHz	Limit dBm/3kHz
IEEE 802.11b Mode (CCK)			
Low Channel: 2412	1	-17.268	8
Middle Channel: 2437	1	-15.412	8
High Channel: 2462	1	-13.686	8
IEEE 802.11g Mode (OFDM)			
Low Channel: 2412	6	-20.760	8
Middle Channel: 2437	6	-19.966	8
High Channel: 2462	6	-17.333	8
IEEE 802.11n(HT20) Mode (OFDM)			
Low Channel: 2412	6.5	-20.815	8
Middle Channel: 2437	6.5	-20.554	8
High Channel: 2462	6.5	-18.458	8
IEEE 802.11n(HT40) Mode (OFDM)			
Low Channel: 2422	13.5	-20.735	8
Middle Channel: 2437	13.5	-20.864	8
High Channel: 2452	13.5	-18.357	8

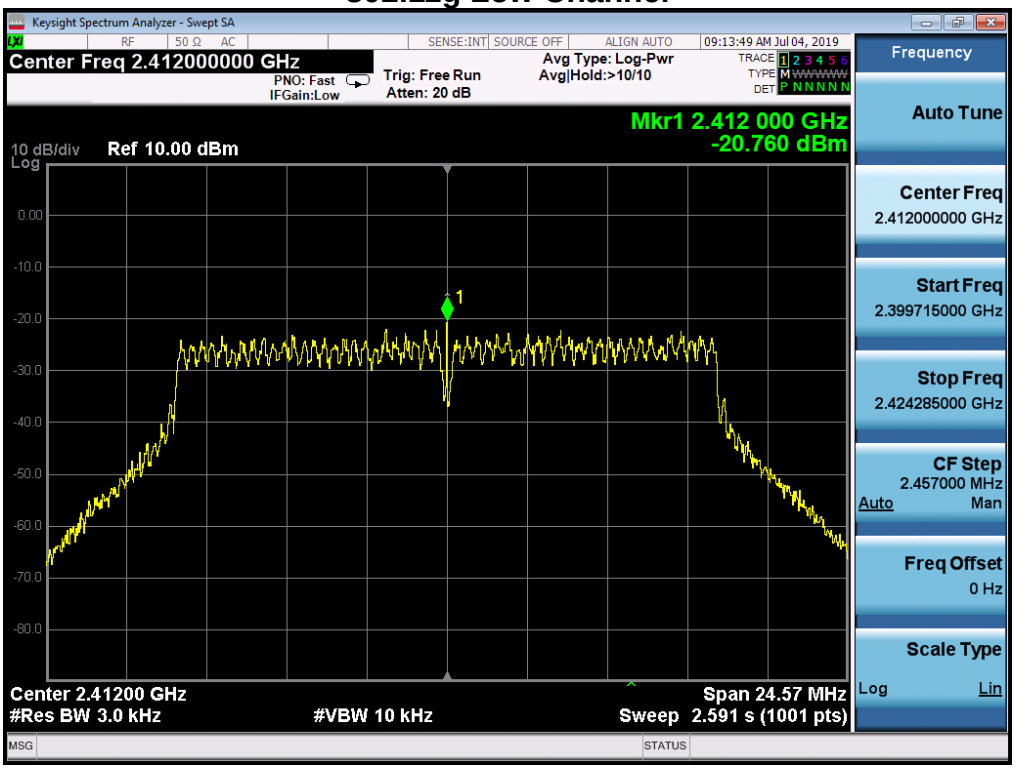
Note: CCK was worst case of the 802.11b

802.11b Low Channel

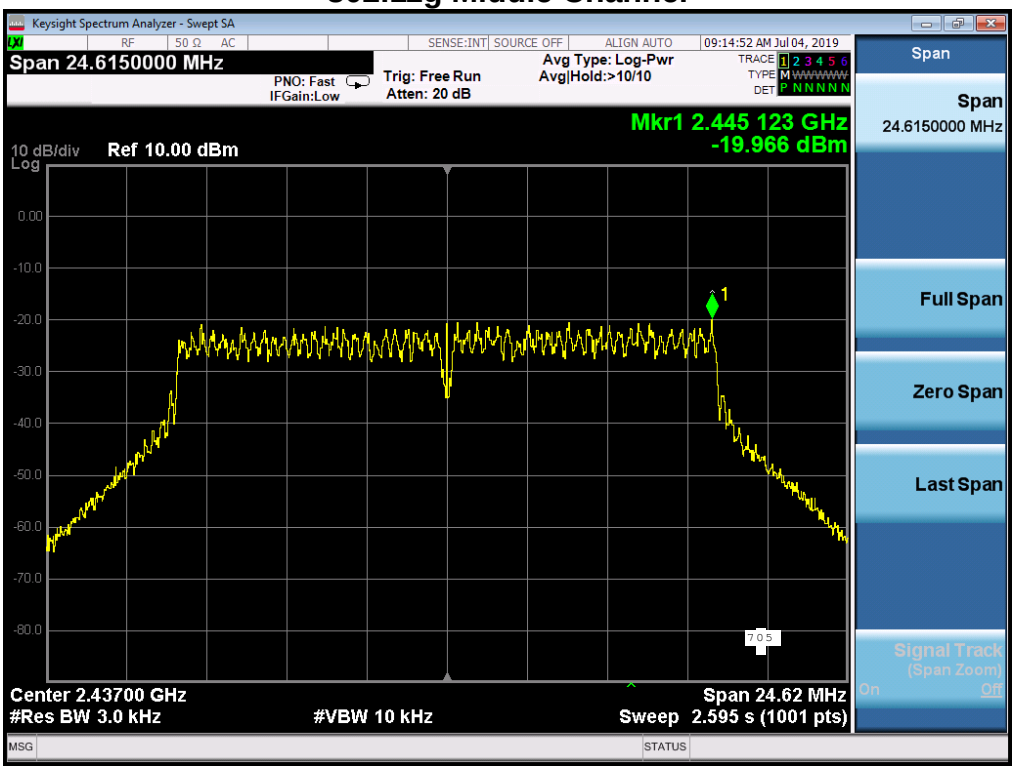
802.11b Middle Channel

802.11b High Channel

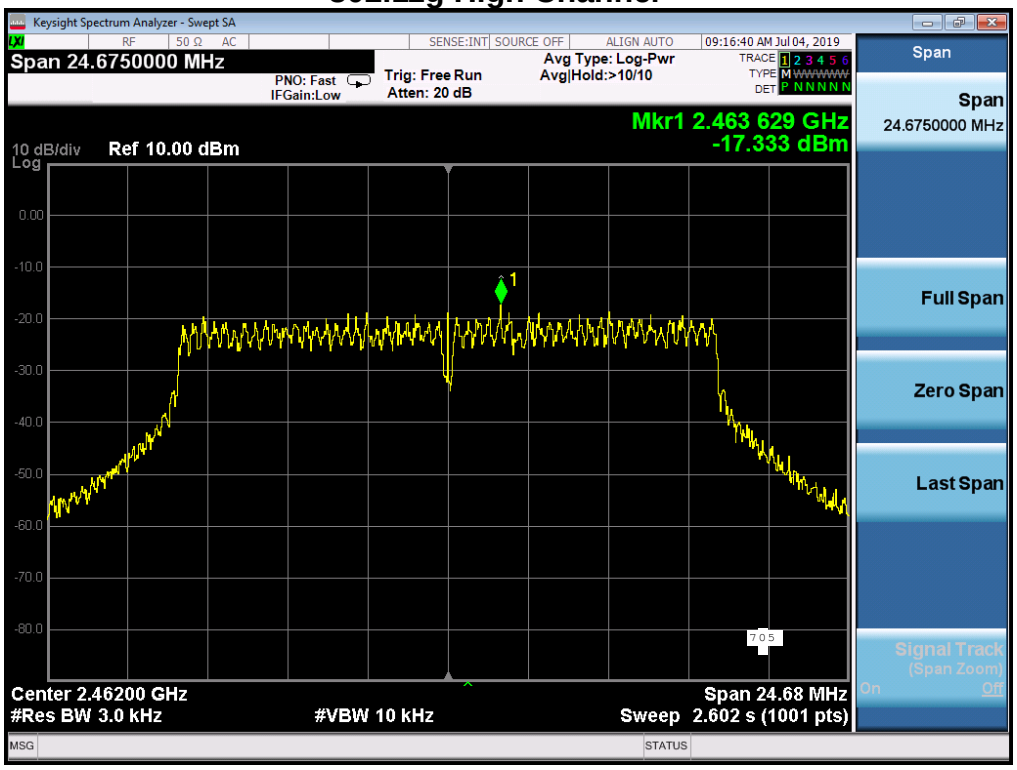
802.11g Low Channel



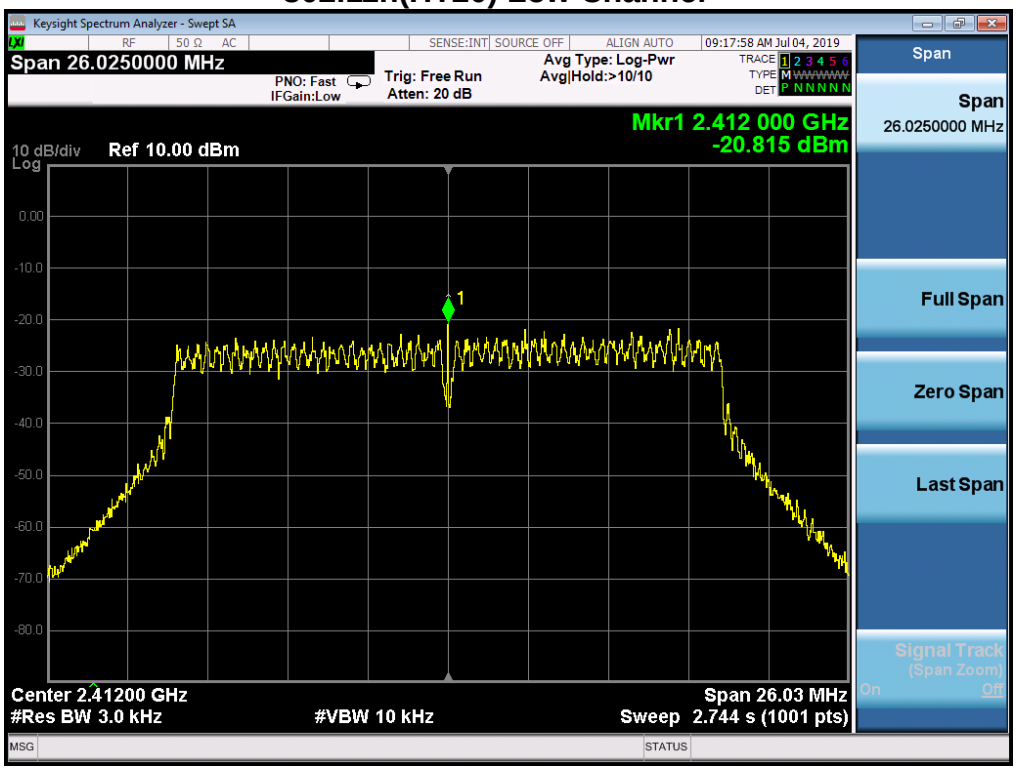
802.11g Middle Channel



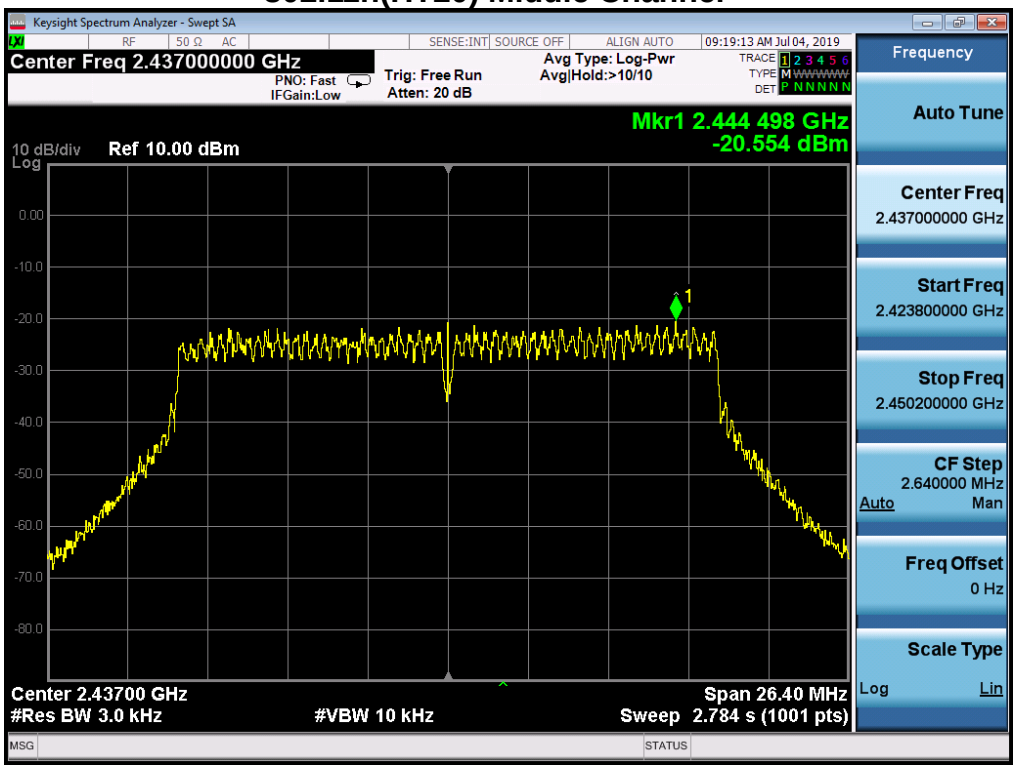
802.11g High Channel



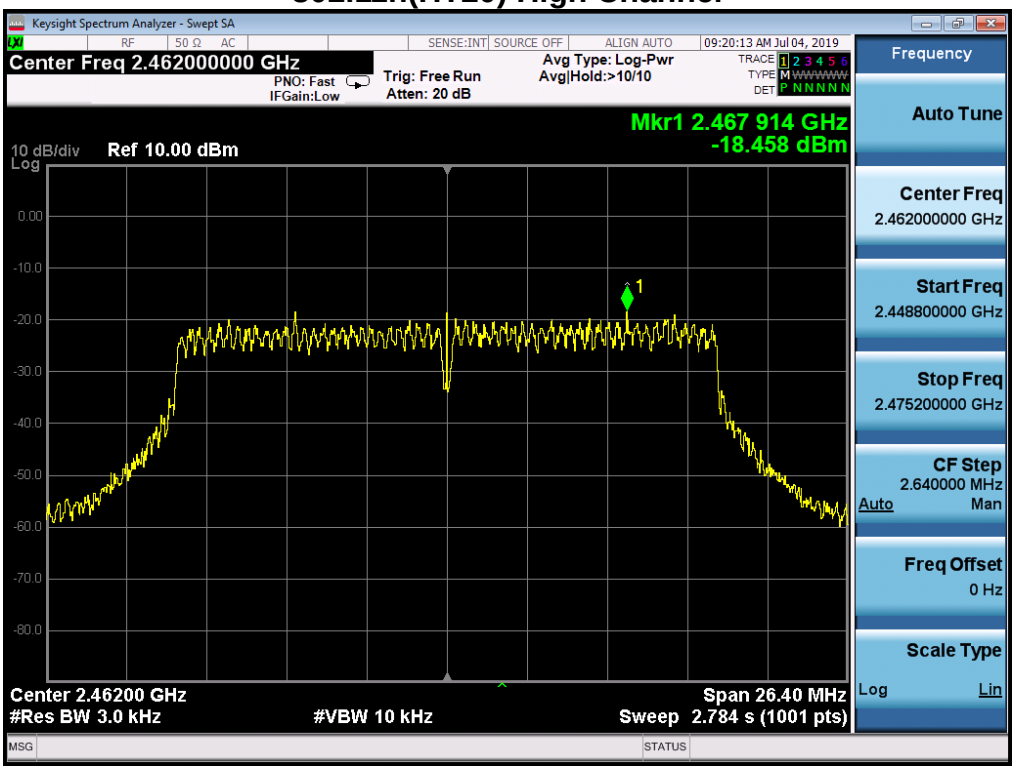
802.11n(HT20) Low Channel



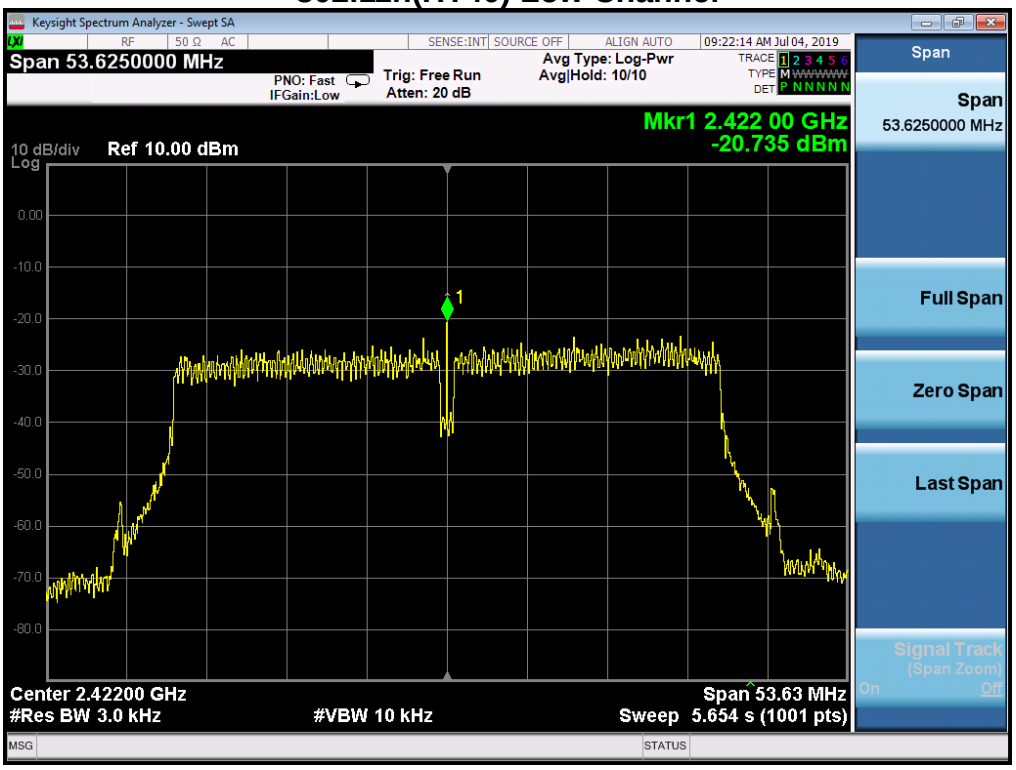
802.11n(HT20) Middle Channel



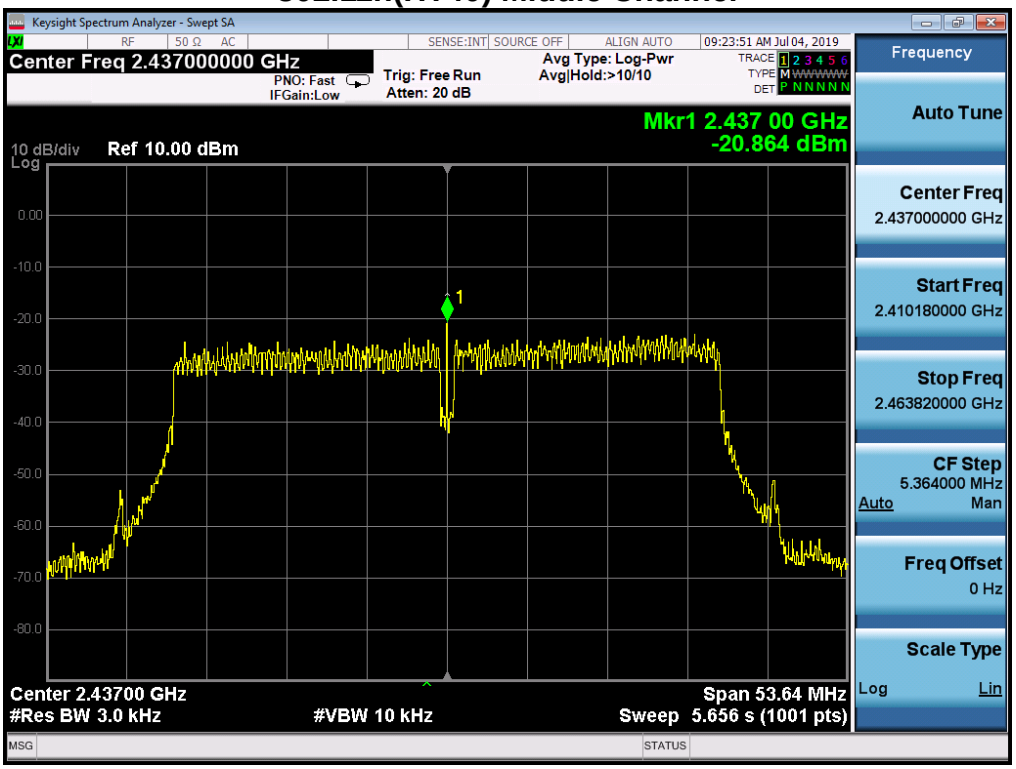
802.11n(HT20) High Channel



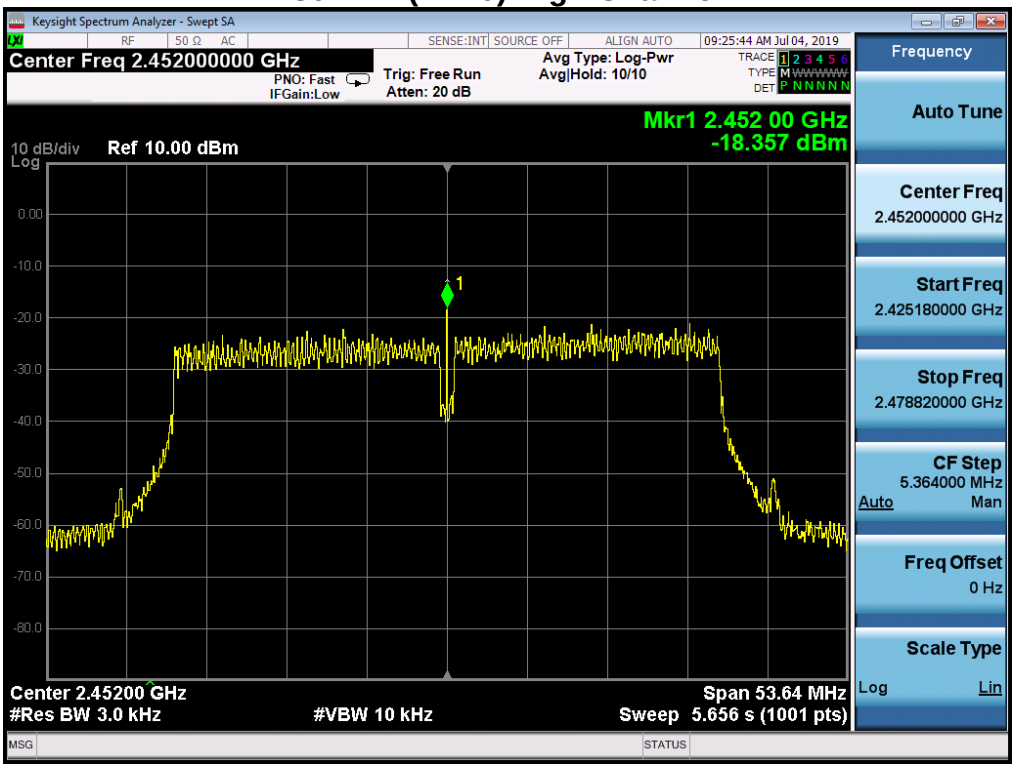
802.11n(HT40) Low Channel



802.11n(HT40) Middle Channel



802.11n(HT40) High Channel



7. Band Edge and Conducted Spurious Emissions

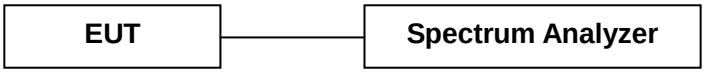
7.1 Requirement and Measurement Procedure

In any 100KHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer was set as below.

MEASUREMENT PROCEDURE REF
1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOBE
1. Set RBW = 100 kHz.
2. Set VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

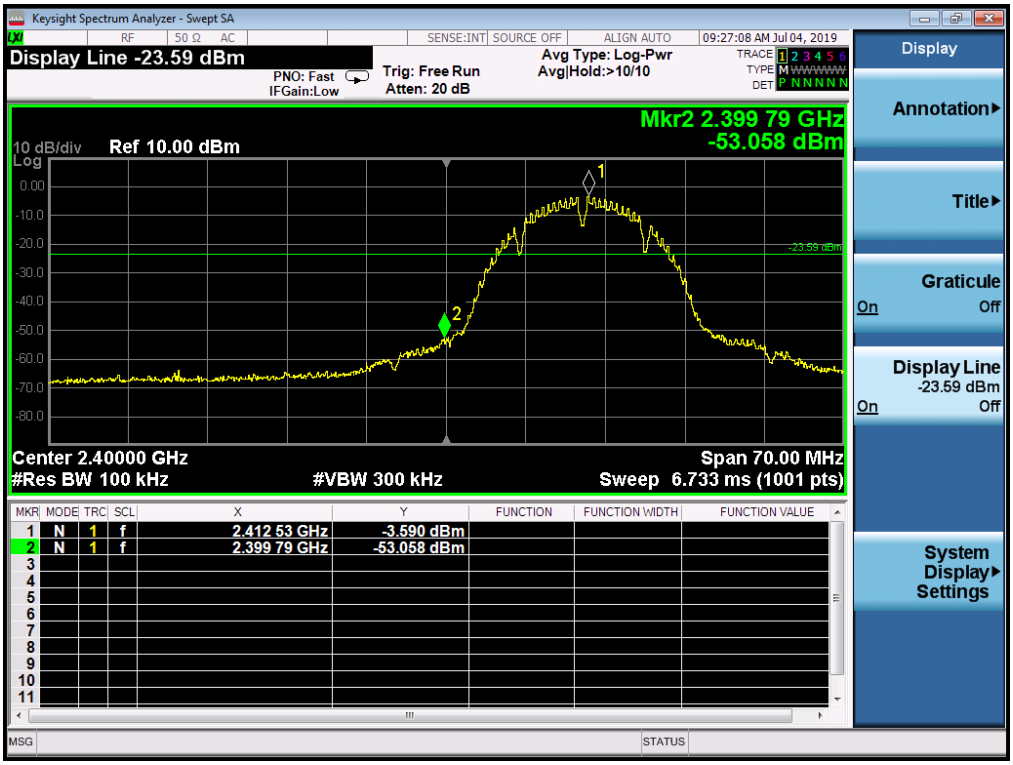
7.2 Test SET-UP (Block Diagram of Configuration)



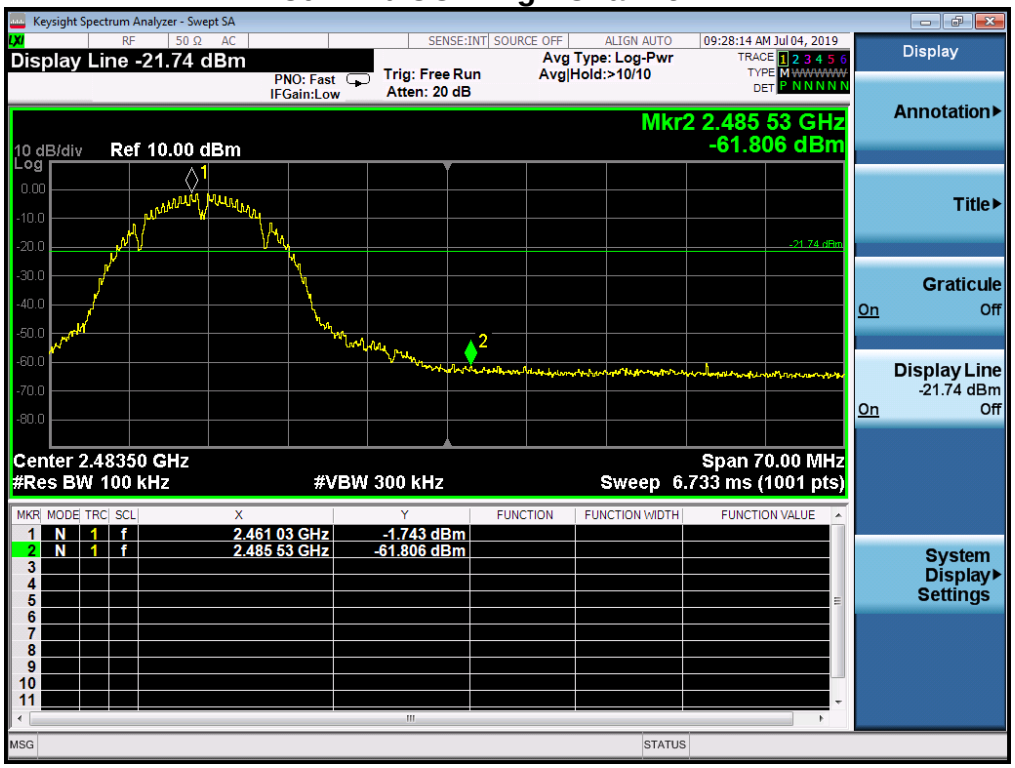
7.3 Measurement Results

The test plots and table showed all spurious emission and up to the tenth harmonic was measured and they were found to be at least 20dB below the highest level of the desired power in the passband. Please refer to below plots.

Band Edge
802.11b CCK Low Channel

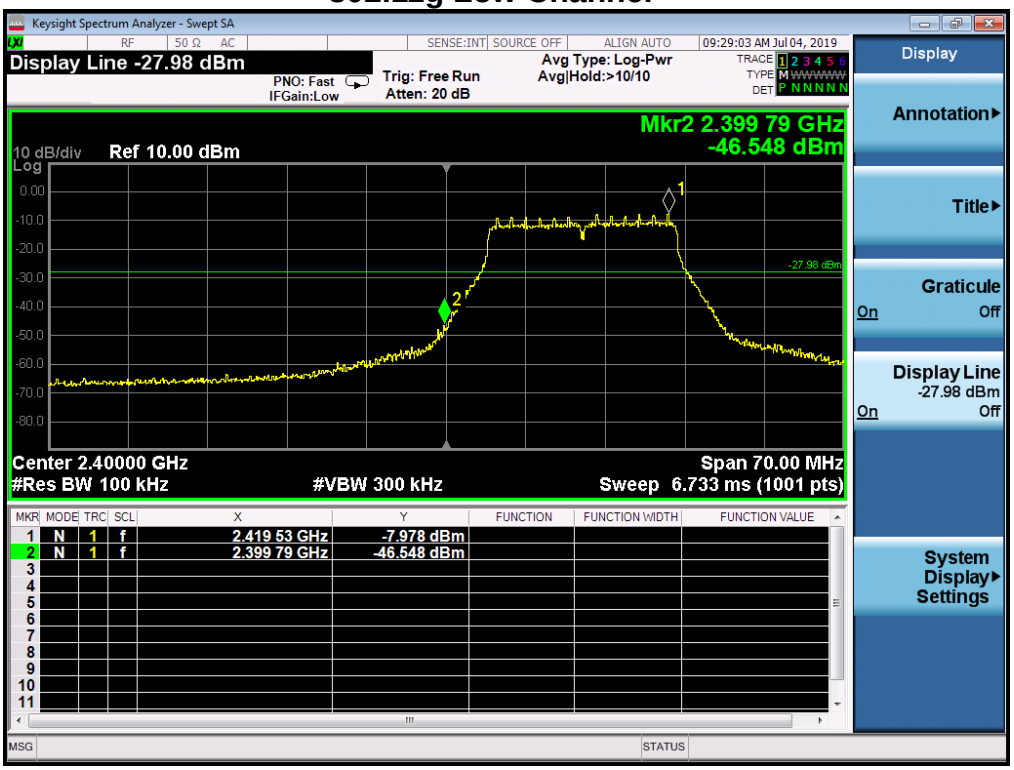


802.11b CCK High Channel

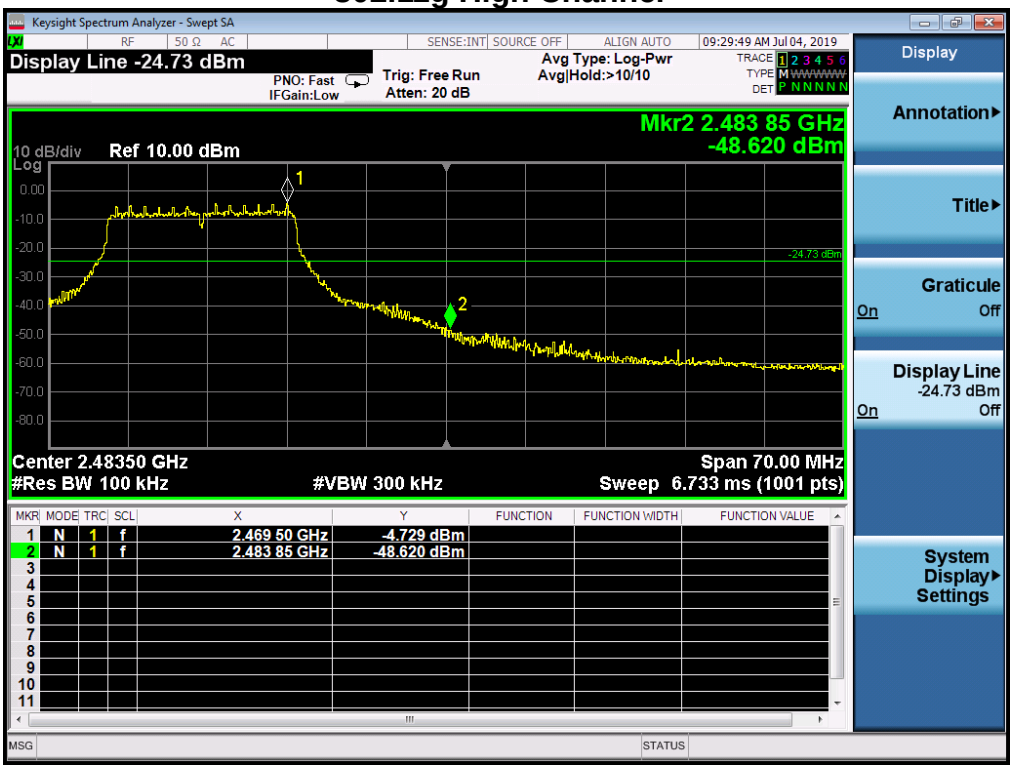


Note: CCK was worst case of the 802.11b

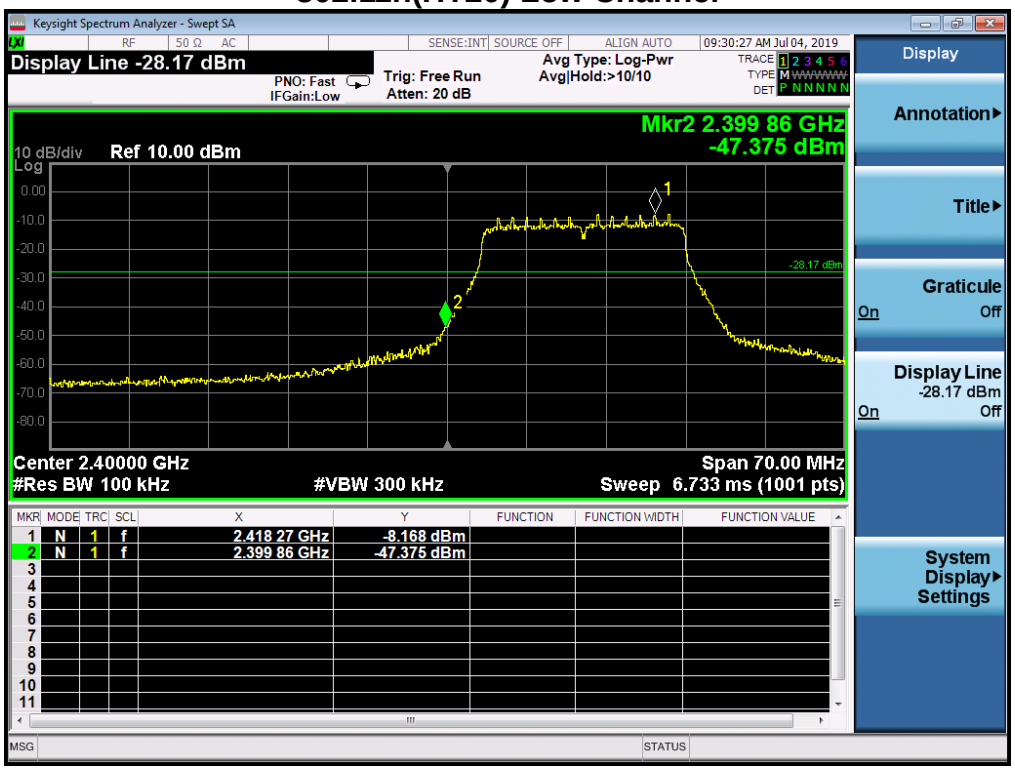
802.11g Low Channel



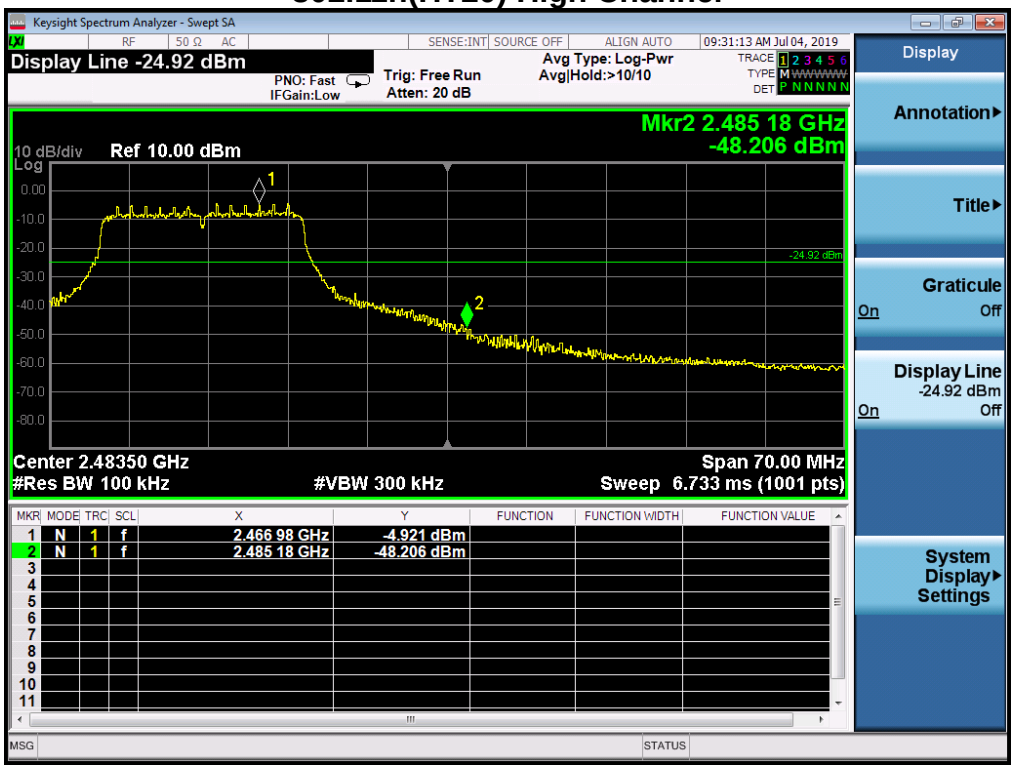
802.11g High Channel



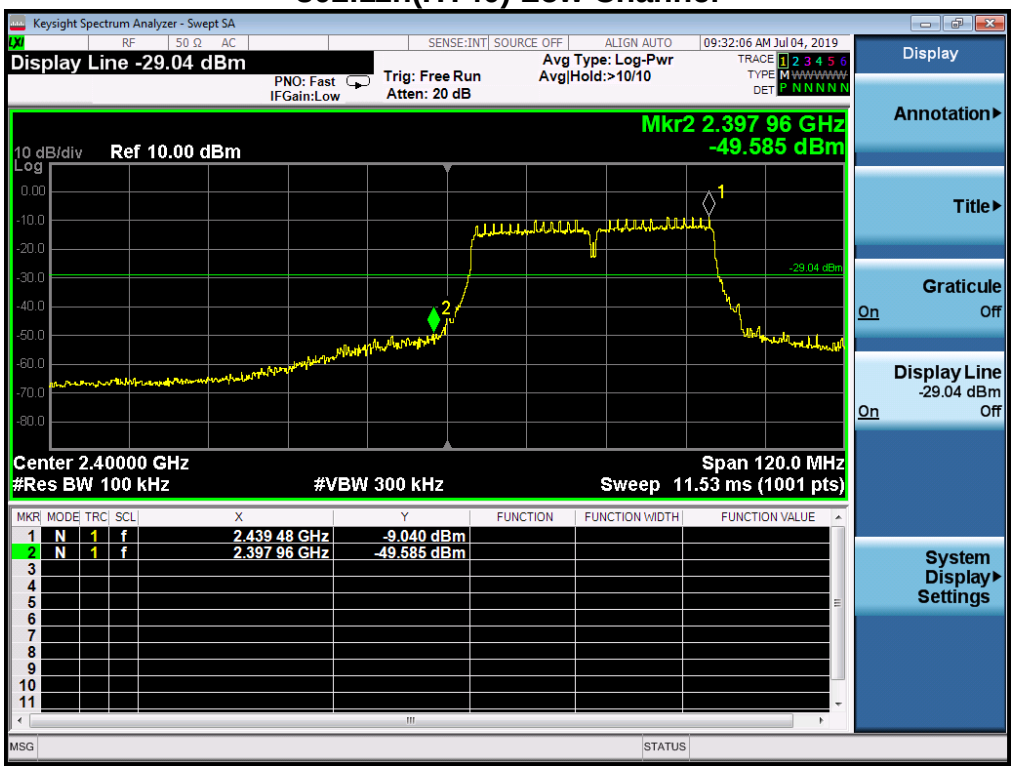
802.11n(HT20) Low Channel



802.11n(HT20) High Channel



802.11n(HT40) Low Channel

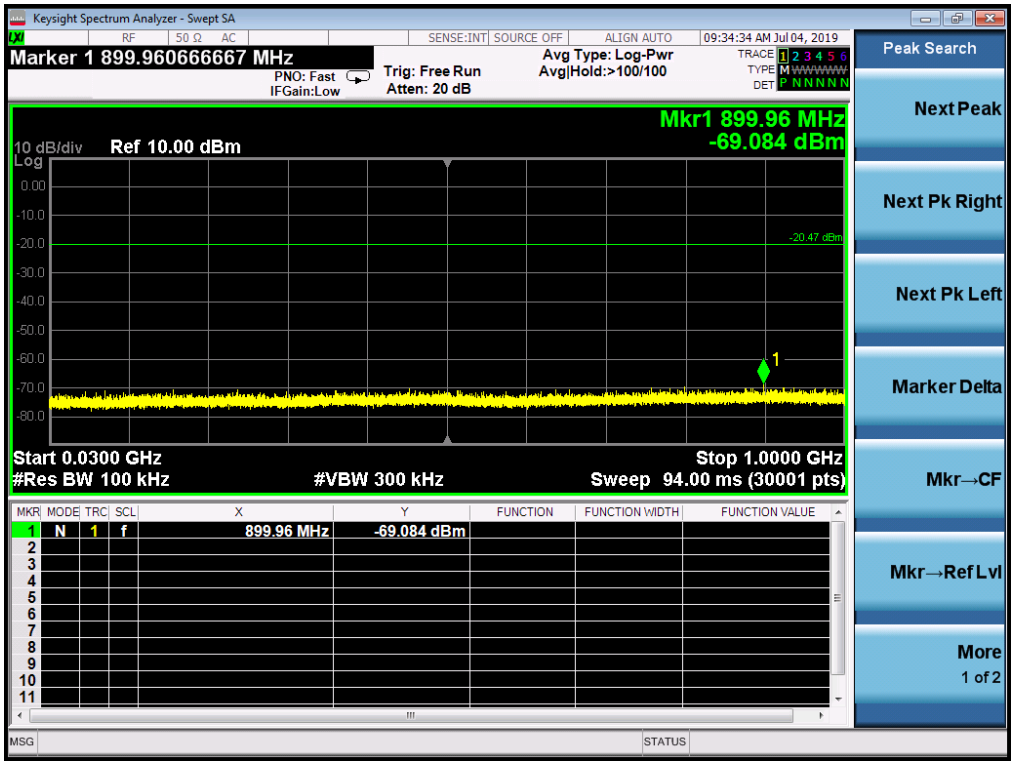


802.11n(HT40) High Channel

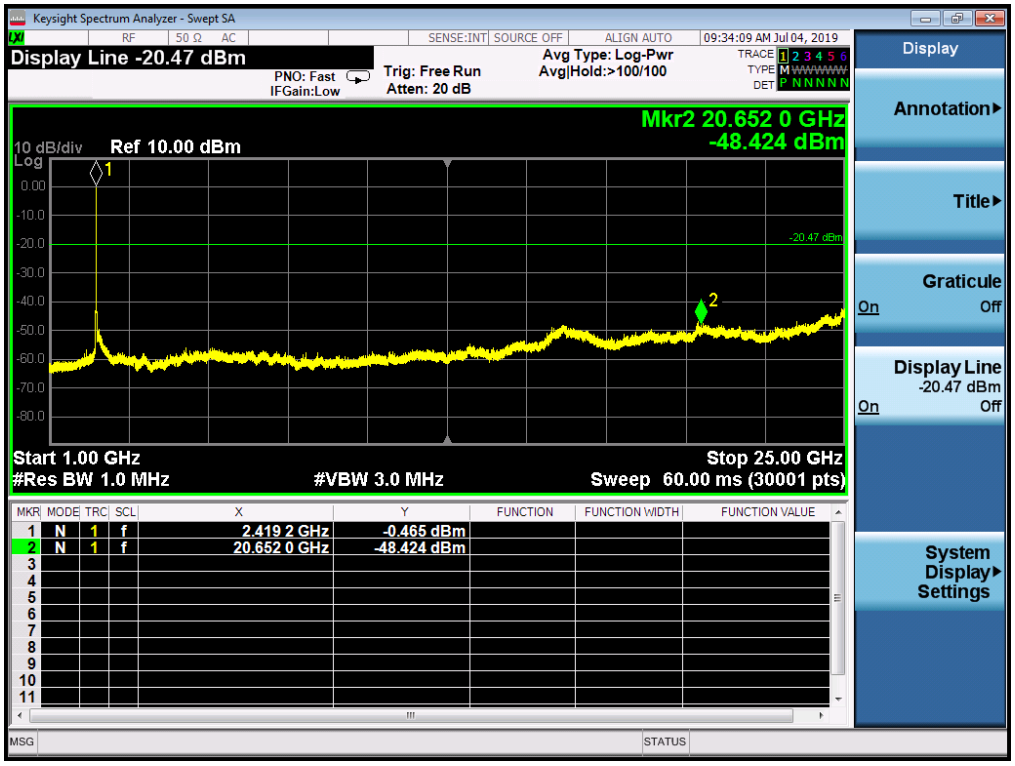
Conducted Spurious Emissions

The worst case: 802.11n(HT20)

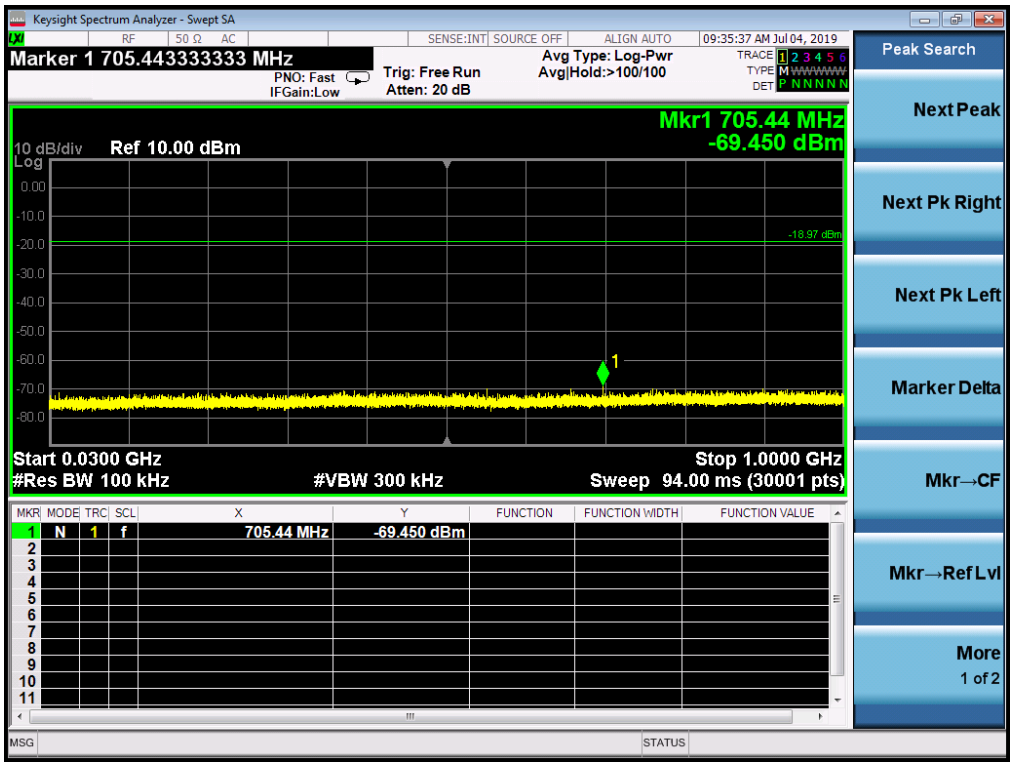
Low Channel Below 1G



Above 1G

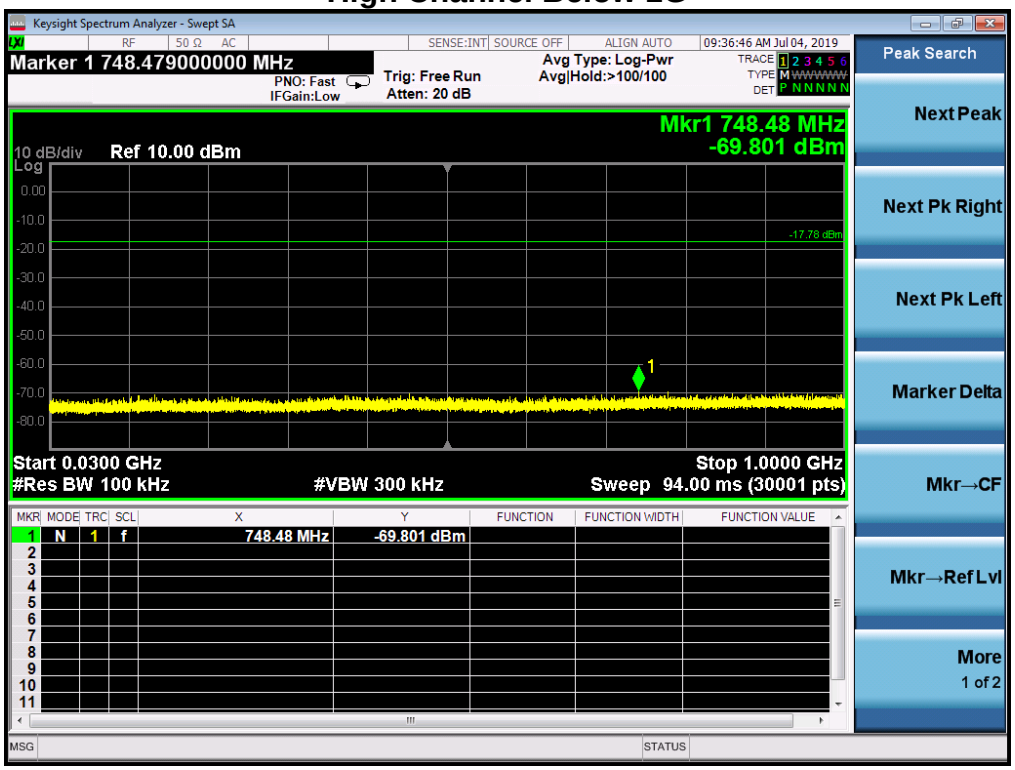


Middle Channel Below 1G

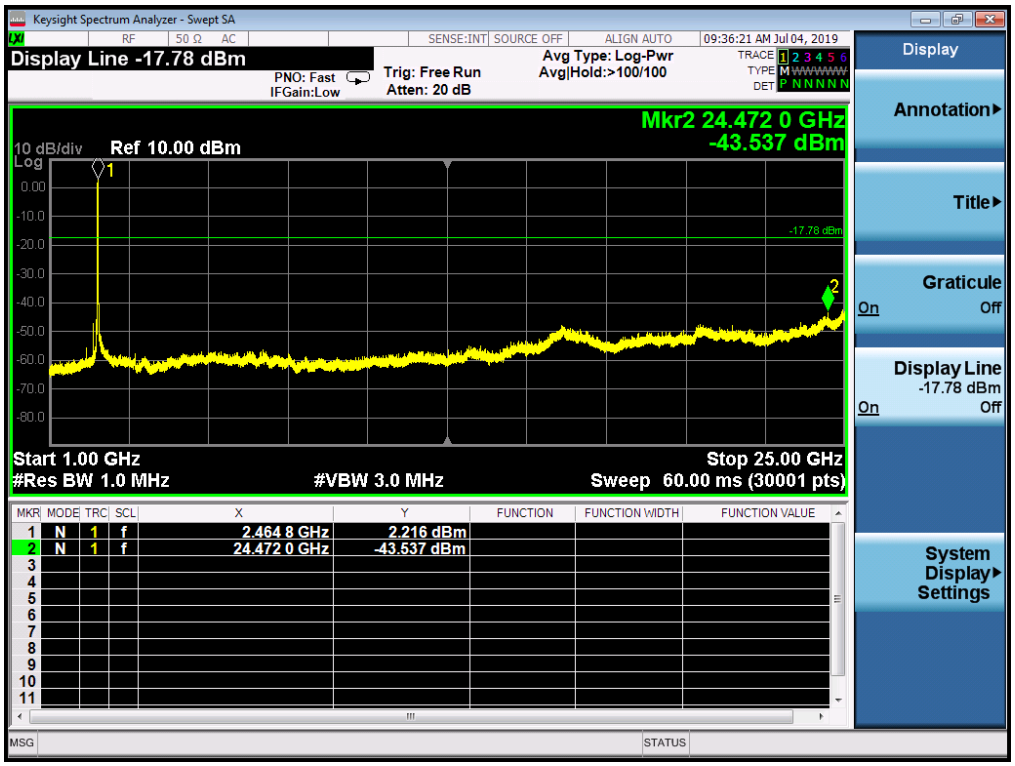


Above 1G

High Channel Below 1G



Above 1G

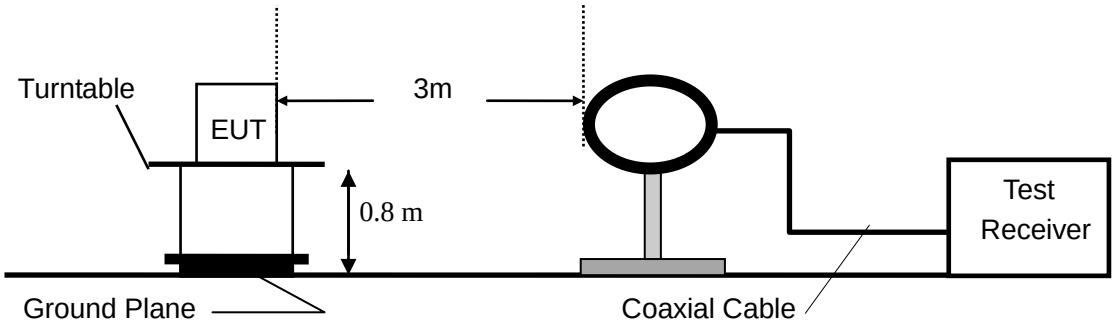


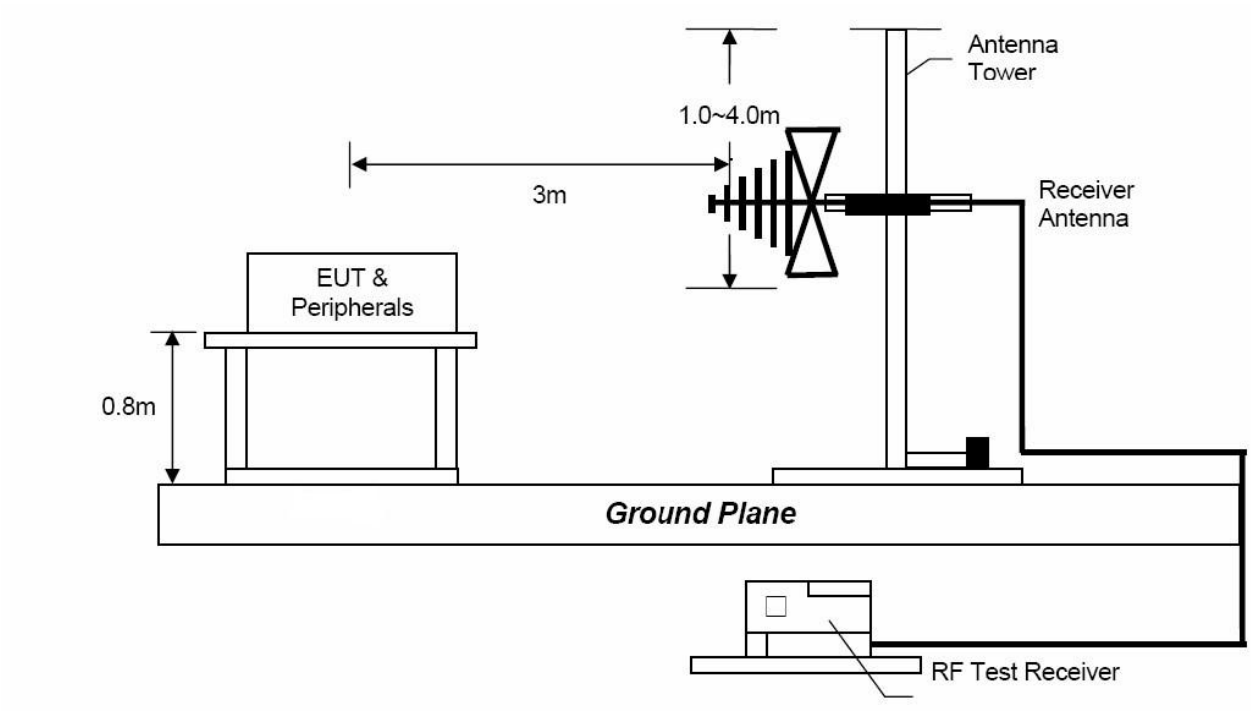
Note: Sweep points=30001pts

8. Radiated Spurious Emissions and Restricted Bands

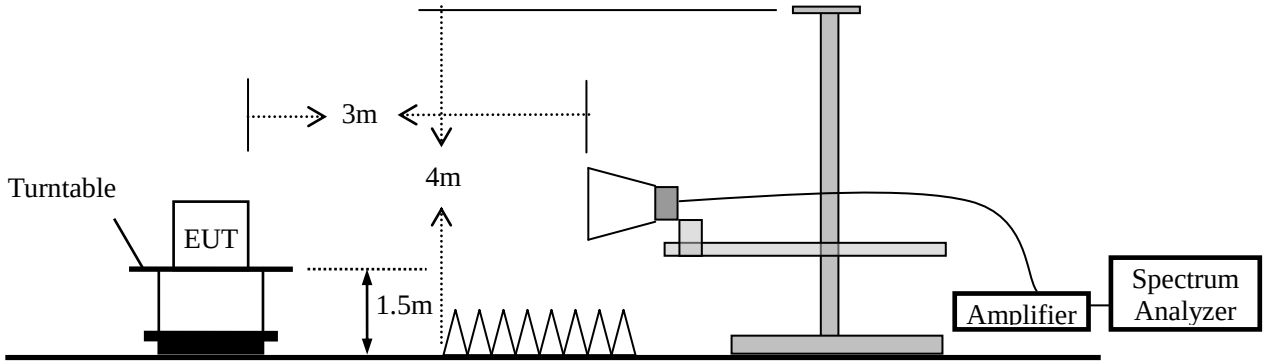
8.1 Test SET-UP (Block Diagram of Configuration)

8.1.1 Radiated Emission Test Set-Up, Frequency Below 30MHz





8.1.2 Radiated Emission Test Set-Up, Frequency above 1GHz



8.2 Measurement Procedure

a. Blow 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi- anechoic chamber room.
b. For the radiated emission test above 1GHz:
   The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter full anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation. Place the measurement antenna 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.
c. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
d. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to peak detect function and specified bandwidth with maximum hold mode.
f. A Quasi-peak measurement was then made for that frequency point for below 1GHz test. PK and AV for above 1GHz emission test.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Band (MHz)	Level	Resolution Bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz
Above 1000	Peak	1 MHz	3 MHz
	Average	1 MHz	10 Hz

8.3 Limit

Frequency range MHz	Distance Meters	Field Strengths Limit (15.209) μV/m
0.009 ~ 0.490	300	2400/F(kHz)
0.490 ~ 1.705	30	24000/F(kHz)
1.705 ~ 30	30	30
30 ~ 88	3	100
88 ~ 216	3	150
216 ~ 960	3	200
Above 960	3	500

Remark : (1) Emission level (dB)μV = 20 log Emission level μV/m

(2) The smaller limit shall apply at the cross point between two frequency bands.

(3) As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

(4) The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.

(5) §15.247(d) specifies that emissions which fall in the restricted bands, as defined in §15.205 comply with radiated emission limits specified in §15.209.

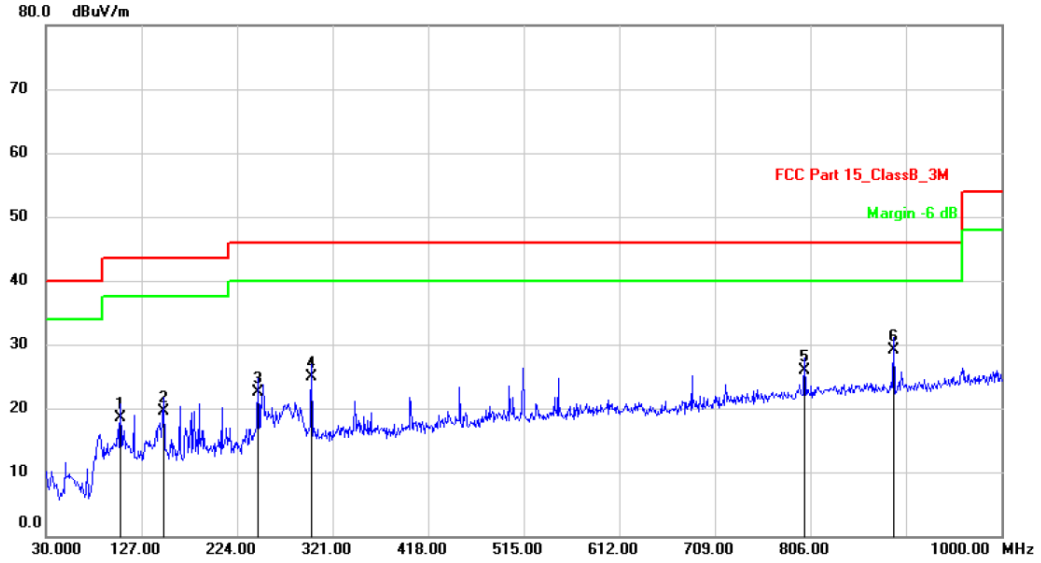
8.4 Measurement Results

Please refer to following plots of the worst case: 802.11n(HT20) High Channel.

Dongguan NTC Co., Ltd.
Tel:+86-769-22022444 Fax:+86-769-22022799
Web: Http://www.ntc-c.com

Radiated Emission Measurement

File :IPC156 Data :#21 Date: 2019/7/3 Time: 11:52:55



Site: 3m Chamber
Limit: FCC Part 15_ClassB_3M
EUT: IP camera
M/N: IPC156
Mode: TX
Note:

Polarization: ***Horizontal***
Power: AC120V/60Hz
Distance: 3m

Temperature: 26
Humidity: 47 %

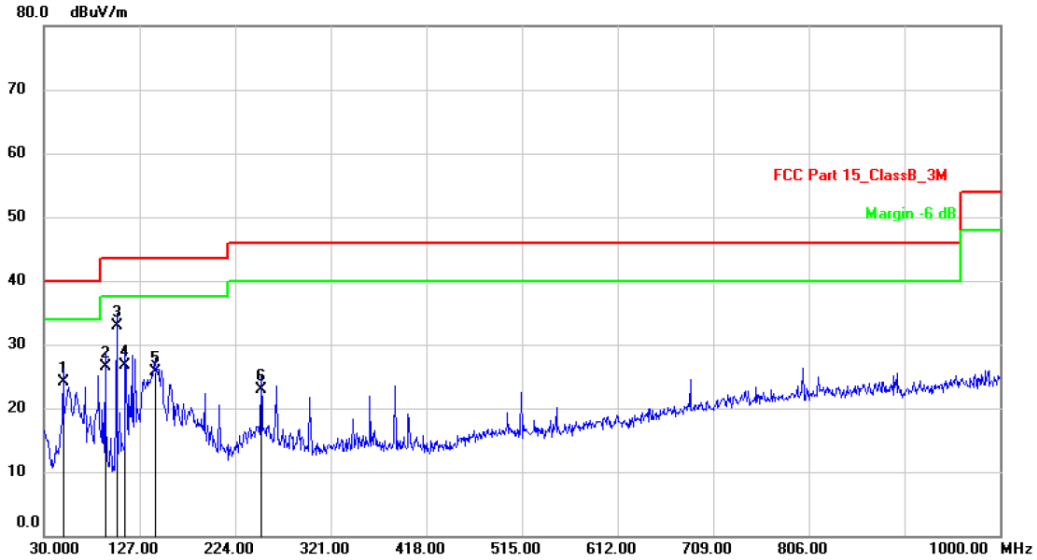
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		105.6600	30.76	-12.16	18.60	43.50	-24.90	QP			
2		149.3100	35.12	-15.52	19.60	43.50	-23.90	QP			
3		245.3400	34.45	-11.85	22.60	46.00	-23.40	QP			
4		299.6600	35.37	-10.47	24.90	46.00	-21.10	QP			
5		800.1800	27.85	-1.95	25.90	46.00	-20.10	QP			
6	*	890.3900	30.29	-1.19	29.10	46.00	-16.90	QP			

Note: Below 30MHz, the emissions are lower than 20dB below the allowable limit.

Dongguan NTC Co., Ltd.
Tel:+86-769-22022444 Fax:+86-769-22022799
Web: Http://www.ntc-c.com

Radiated Emission Measurement

File :IPC156 Data :#22 Date: 2019/7/3 Time: 11:59:04



Site: 3m Chamber
Limit: FCC Part 15_ClassB_3M
EUT: IP camera
M/N: IPC156
Mode: TX
Note:

Polarization: ***Vertical***
Power: AC120V/60Hz
Distance: 3m

Temperature: 26
Humidity: 47 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		49.4000	37.59	-13.39	24.20	40.00	-15.80	QP			
2		92.0800	43.05	-16.45	26.60	43.50	-16.90	QP			
3	*	103.7200	48.89	-15.99	32.90	43.50	-10.60	QP			
4		112.4500	42.78	-16.08	26.70	43.50	-16.80	QP			
5		142.5200	44.40	-18.60	25.80	43.50	-17.70	QP			
6		250.1900	36.69	-13.69	23.00	46.00	-23.00	QP			

Note: Below 30MHz, the emissions are lower than 20dB below the allowable limit.

Test Mode:	The worst case: 802.11n(HT20)	Test Date :	July 04, 2019
Frequency Range:	Above 1GHz	Temperature :	24℃
Test Result:	PASS	Humidity :	47 %
Measured Distance:	3m	Test By:	Sance

Freq. (MHz)	Ant.Pol. (H/V)	Reading Level(dBuV)		Factor (dB/m)	Emission Level (dBuV)		Limit 3m (dBuV/m)		Margin (dB)	
		PK	AV		PK	AV	PK	AV	PK	AV
Operation Mode: TX Mode (Low)										
4824	V	48.84	33.47	6.45	55.32	39.92	74.00	54.00	-18.68	-14.08
7236	V	46.37	31.16	6.45	56.90	41.69	74.00	54.00	-17.10	-12.31

4824	H	47.69	32.62	6.45	54.14	39.07	74.00	54.00	-19.86	-14.93
7236	H	45.86	31.04	10.53	56.39	41.57	74.00	54.00	-17.61	-12.43

Operation Mode: TX Mode (Mid)										
4874	V	49.20	34.14	6.56	55.76	40.70	74.00	54.00	-18.24	-13.30
7311	V	46.21	31.25	10.53	56.74	41.78	74.00	54.00	-17.26	-12.22

4874	H	47.89	34.14	6.56	54.45	40.70	74.00	54.00	-19.55	-13.30
7311	H	46.00	31.17	10.53	56.53	41.70	74.00	54.00	-17.47	-12.30

Operation Mode: TX Mode (High)										
4924	V	48.40	33.37	6.68	55.08	40.05	74.00	54.00	-18.92	-13.95
7386	V	46.27	31.32	10.55	56.82	41.87	74.00	54.00	-17.18	-12.13

4924	H	48.69	33.17	6.68	55.37	39.85	74.00	54.00	-18.63	-14.15
7386	H	45.70	31.18	10.55	56.25	41.73	74.00	54.00	-17.75	-12.27

Note:
(1) All Readings are Peak Value and AV.
(2) Emission Level= Reading Level + Factor
(3) Factor= Antenna Gain + Cable Loss – Amplifier Gain
(4) Data of measurement within this frequency range shown " ---" in the table above means the reading of emissions are attenuated more than 10dB below the permissible limits.
(5) Measurement uncertainty : ±3.7dB.
(6) Horn antenna used for the emission over 1000MHz.

Spurious Emission in restricted band:

Operation Mode:	TX	Test Date :	July 04, 2019
Frequency Range:	Above 1GHz	Temperature :	24 ℃
Test Result:	PASS	Humidity :	47 %
Measured Distance:	3m	Test By:	Sance

Freq. (MHz)	Ant.Pol. (H/V)	Reading Level(dBuV)		Factor (dB/m)	Emission Level (dBuV)		Limit 3m (dBuV/m)		Margin (dB)	
		PK	AV		PK	AV	PK	AV	PK	AV
The worst case: Test Mode: 802.11n(HT20)										
2390.000	H	61.24	38.28	0.13	61.37	38.41	74.00	54.00	-12.63	-15.59
2390.000	V	63.21	40.15	0.13	63.34	40.28	74.00	54.00	-10.66	-13.72
2483.500	H	57.41	40.14	0.35	57.76	40.49	74.00	54.00	-16.24	-13.51
2483.500	V	59.09	41.98	0.35	59.44	42.33	74.00	54.00	-14.56	-11.67

Note: (1) All Readings are Peak Value and AV.
(2) Emission Level= Reading Level+Probe Factor +Cable Loss
(3) Measurement uncertainty : ±3.7dB

9. Antenna Application

9.1 Antenna requirement

According to of FCC part 15C section 15.203 and 15.240:

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

9.2 Measurement Results

The antenna is Chip antenna that no antenna other than furnished by the responsible party shall be used with the device, and the best case gain of the antenna is 2 dBi, So, the antenna is consider meet the requirement.

10. Test Equipment List

Description	Manufacturer	Model Number	Serial Number	Characteristics	Calibration Date	Calibration Due Date
Test Receiver	Rohde & Schwarz	ESCI7	100837	9KHz~7GHz	Mar. 13, 2019	1 Year
Antenna	Schwarzbeck	VULB9162	9162-010	30MHz~7GHz	Mar. 22, 2019	1 Year
Spectrum Analyzer	Rohde & Schwarz	FSU26	200409/026	20Hz~26.5GHz	Mar. 13, 2019	1 Year
Spectrum Analyzer	Keysight	N9020A	MY54200831	20Hz~26.5GHz	Apr. 23, 2019	1 Year
Spectrum Analyzer	Rohde & Schwarz	FSV40	101003	10Hz~40GHz	Apr. 23, 2019	1 Year
Horn Antenna	Schwarzbeck	BBHA9170	9170-372	15GHz~40GHz	Mar. 22, 2019	1 Year
Pre-Amplifier	EMCI	EMC 184045	980102	18GHz~40GHz	Apr. 23, 2019	1 Year
Power Sensor	DARE	RPR3006W	15I00041SNO64	100MHz~6GHz	Mar. 13, 2019	1 Year
Communication Tester	Rohde & Schwarz	CMW500	149004	70MHz~6GHz	Mar. 13, 2019	1 Year
Horn Antenna	COM-Power	AH-118	071078	500MHz~18GHz	Mar. 22, 2019	1 Year
Pre-Amplifier	HP	HP 8449B	3008A00964	1GHz~26.5GHz	Mar. 13, 2019	1 Year
Pre-Amplifier	HP	HP 8447D	1145A00203	100KHz~1.3GHz	Mar. 13, 2019	1 Year
Loop Antenna	Schwarzbeck	FMZB 1513	1513-272	9KHz~30MHz	Apr. 23, 2019	1 Year
Temperature & Humidity Chamber	REMAFEE	SYHR225L	N/A	-40~150℃	Apr. 23, 2019	1 Year
DC Source	MY	MY8811	N/A	0~30V	N/A	N/A
Temporary antenna connector	TESCOM	SS402	N/A	9KHz~25GHz	N/A	N/A
Power Meter	Anritsu	ML2495A	1139001	100k-65GHz	Apr. 23, 2019	1 Year
Power Sensor	Anritsu	MA2411B	100345	300M-40GHz	Apr. 23, 2019	1 Year
Test Software	EZ	EZ_EMC	N/A	N/A	N/A	N/A

Note: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

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