TEST REPORT

Product	:	Wireless Vibration Temperature Smart Sensor
Trade mark	:	MHCC™
Model/Type reference	:	WS500
Serial Number	:	N/A
Report Number	:	EED32K00269601
FCC ID	:	2ARK7WS001
Date of Issue	:	Dec. 20, 2018
Test Standards	:	47 CFR Part 15Subpart C
Test result	:	PASS

Prepared for:

Guanwei Monitoring Technology Wuxi Co., Ltd.
Level 6 Building A Jingyuzuo iPark III, Xinwu District,
Wuxi, Jiangsu, China

Prepared by:

Centre Testing International Group Co., Ltd.
Hongwei Industrial Zone, Bao'an 70 District,
Shenzhen, Guangdong, China
TEL: +86-755-3368 3668
FAX: +86-755-3368 3385

Tested by: Peter Compiled by: Kevin Lan

Reviewed by: Tom-chen Approved by: Kevin Tang

Date: Dec. 20, 2018 Check No.:2447632439

CENTRE TESTING INTERNATIONAL GROUP CO.,LTD. CTI Report Seal

2 Version

Version No.	Date	Description
00	Dec. 20, 2018	Original

3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15 Subpart C Section 15.203/15.247 (c)	ANSI C63.10-2013	PASS
AC Power Line Conducted Emission	47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013	N/A
Conducted Peak Output Power	47 CFR Part 15 Subpart C Section 15.247 (b)(3)	ANSI C63.10-2013	PASS
6dB Occupied Bandwidth	47 CFR Part 15 Subpart C Section 15.247 (a)(2)	ANSI C63.10-2013	PASS
Power Spectral Density	47 CFR Part 15 Subpart C Section 15.247 (e)	ANSI C63.10-2013	PASS
Band-edge for RF Conducted Emissions	47 CFR Part 15 Subpart C Section 15.247(d)	ANSI C63.10-2013	PASS
RF Conducted Spurious Emissions	47 CFR Part 15 Subpart C Section 15.247(d)	ANSI C63.10-2013	PASS
Radiated Spurious Emissions	47 CFR Part 15 Subpart C Section 15.205/15.209	ANSI C63.10-2013	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15 Subpart C Section 15.205/15.209	ANSI C63.10-2013	PASS

Remark:
Test according to ANSI C63.4-2014 & ANSI C63.10-2013.
The tested sample(s) and the sample information are provided by the client.
N/A:The device is only battery operated, the test related AC mains is not applicable.

4 Content

1 COVER PAGE 1

2 VERSION 2

3 TEST SUMMARY 3

4 CONTENT 4

5 TEST REQUIREMENT 5

5.1 TEST SETUP 5
5.1.1 For Conducted test setup 5
5.1.2 For Radiated Emissions test setup 5
5.1.3 For Conducted Emissions test setup 6
5.2 TEST ENVIRONMENT 6
5.3 TEST CONDITION 6

6 GENERAL INFORMATION 7

6.1 CLIENT INFORMATION 7
6.2 GENERAL DESCRIPTION OF EUT 7
6.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD 7
6.4 DESCRIPTION OF SUPPORT UNITS 8
THE EUT HAS BEEN TESTED INDEPENDENTLY 8
6.5 TEST LOCATION 8
6.6 DEVIATION FROM STANDARDS 8
6.7 ABNORMALITIES FROM STANDARD CONDITIONS 8
6.8 OTHER INFORMATION REQUESTED BY THE CUSTOMER 8
6.9 MEASUREMENT UNCERTAINTY (95% CONFIDENCE LEVELS, K=2) 8

7 EQUIPMENT LIST 9

8 RADIO TECHNICAL REQUIREMENTS SPECIFICATION 11

Appendix A): Conducted Peak Output Power 12
Appendix B): 6dB Occupied Bandwidth 16
Appendix C): Band-edge for RF Conducted Emissions 20
Appendix D): RF Conducted Spurious Emissions 23
Appendix E): Power Spectral Density 30
Appendix F): Antenna Requirement 34
Appendix G): Restricted bands around fundamental frequency (Radiated) 35
Appendix H): Radiated Spurious Emissions 48

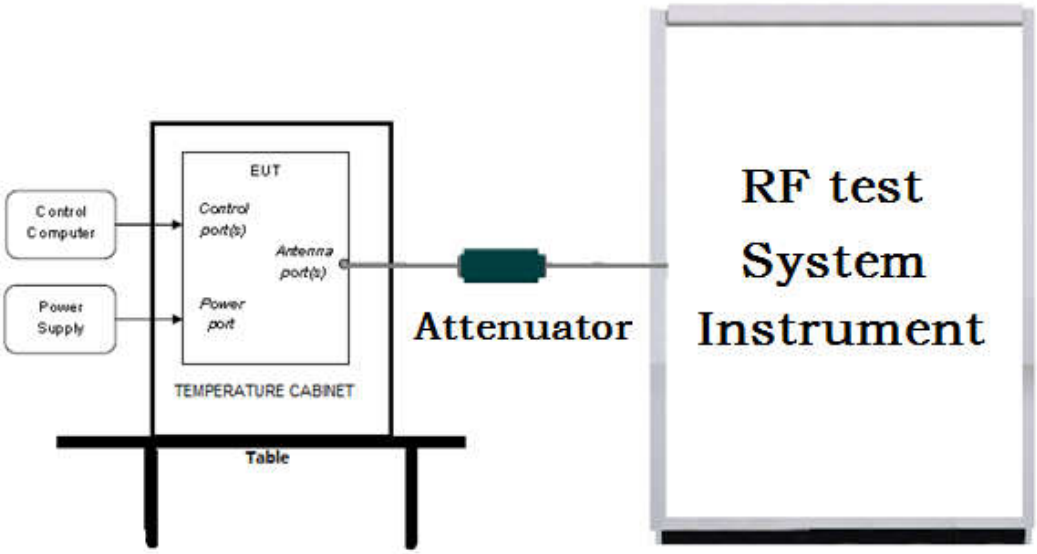
PHOTOGRAPHS OF TEST SETUP 56

PHOTOGRAPHS OF EUT CONSTRUCTIONAL DETAILS 58

5 Test Requirement

5.1 Test setup

5.1.1 For Conducted test setup



5.1.2 For Radiated Emissions test setup

Radiated Emissions setup:

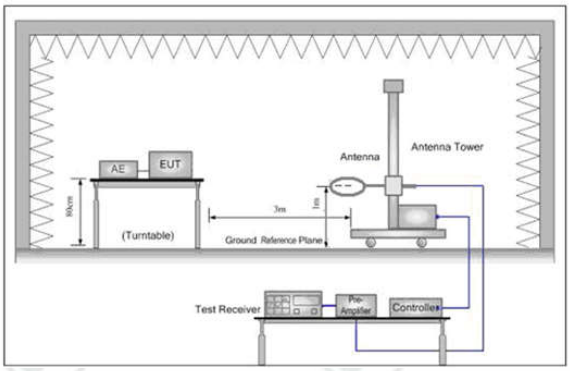


Figure 1. Below 30MHz

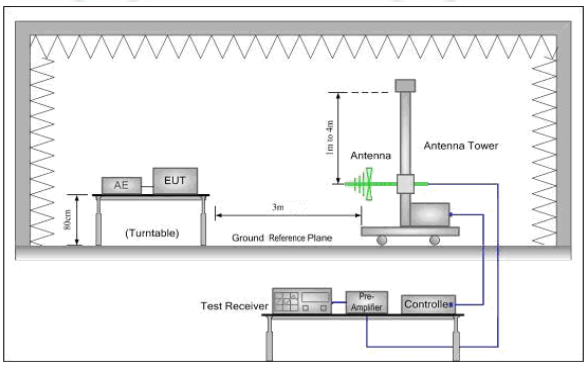


Figure 2. 30MHz to 1GHz

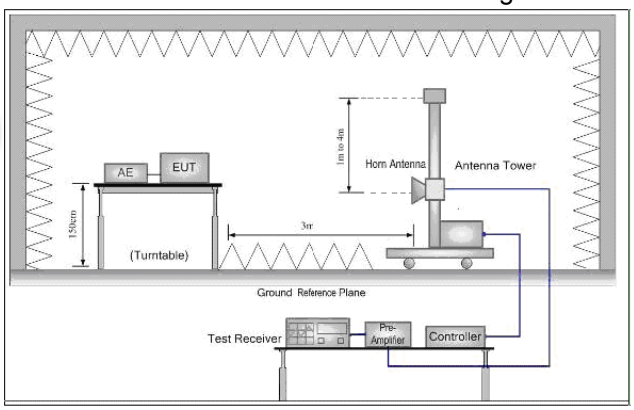
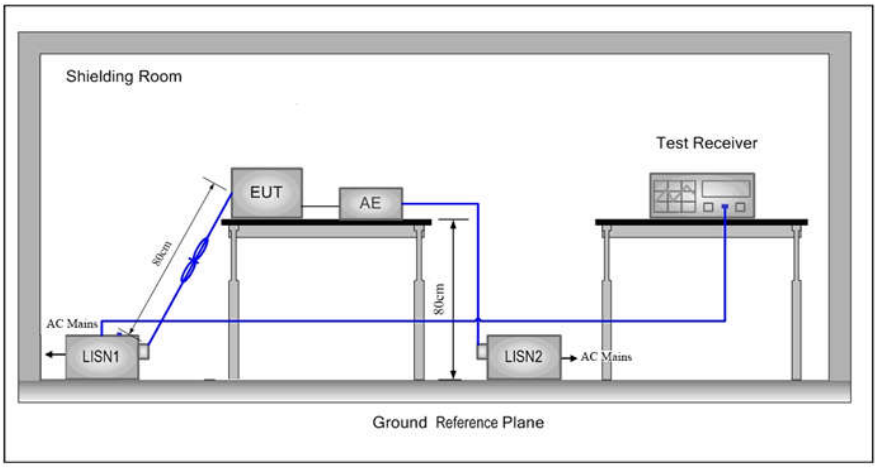


Figure 3. Above 1GHz

5.1.3 For Conducted Emissions test setup

Conducted Emissions setup



5.2 Test Environment

Operating Environment:	
Temperature:	25°C
Humidity:	55% RH
Atmospheric Pressure:	1010mbar

5.3 Test Condition

Test channel:

Test Mode	Tx/Rx	RF Channel		
		Low(L)	Middle(M)	High(H)
802.11b/g/n(HT20)	2412MHz ~2462 MHz	Channel 1	Channel 6	Channel11
		2412MHz	2437MHz	2462MHz
TX mode:	The EUT transmitted the continuous signal at the specific channel(s).			

Test mode:

Pre-scan under all rate at lowest channel 1

Mode	**802.11b**			
Data Rate	**1Mbps**	**2Mbps**	**5.5Mbps**	**11Mbps**
Power(dBm)	15.87	16.07	16.24	16.58

Mode	**802.11g**							
Data Rate	**6Mbps**	**9Mbps**	**12Mbps**	**18Mbps**	**24Mbps**	**36Mbps**	**48Mbps**	**54Mbps**
Power(dBm)	11.37	11.11	10.89	10.65	10.42	10.22	10.07	9.85

Mode	**802.11n (HT20)**							
Data Rate	**6.5Mbps**	**13Mbps**	**19.5Mbps**	**26Mbps**	**39Mbps**	**52Mbps**	**58.5Mbps**	**65Mbps**
Power(dBm)	10.38	10.27	10.12	10.05	9.91	9.77	9.62	9.44

Through Pre-scan, 11Mbps of rate is the worst case of 802.11b; 6Mbps of rate is the worst case of 802.11g; 6.5Mbps of rate is the worst case of 802.11n(HT20).

6 General Information

6.1 Client Information

Applicant:	Guanwei Monitoring Technology Wuxi Co., Ltd.
Address of Applicant:	Level 6 Building A Jingyuzuo iPark III, Xinwu District, Wuxi, Jiangsu, China
Manufacturer:	Guanwei Monitoring Technology Wuxi Co., Ltd.
Address of Manufacturer:	Level 6 Building A Jingyuzuo iPark III, Xinwu District, Wuxi, Jiangsu, China
Factory:	Guanwei Monitoring Technology Wuxi Co., Ltd.
Address of Factory:	Level 6 Building A Jingyuzuo iPark III, Xinwu District, Wuxi, Jiangsu, China

6.2 General Description of EUT

Product Name:	Wireless Vibration Temperature Smart Sensor
Model No.(EUT):	WS500
Trade Mark:	MHCC™
EUT Supports Radios application:	WiFi 802.11b/g/n(HT20): 2412MHz to 2462MHz
Power Supply:	Battery: 3.6V 4800mAh
Sample Received Date:	Oct. 08, 2018
Sample tested Date:	Nov. 07, 2018 to Dec. 03, 2018

6.3 Product Specification subjective to this standard

Operation Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz
Channel Numbers:	IEEE 802.11b/g, IEEE 802.11n HT20: 11 Channels
Channel Separation:	5MHz
Type of Modulation:	IEEE for 802.11b: DSSS(CCK,DQPSK,DBPSK) IEEE for 802.11g :OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE for 802.11n(HT20) : OFDM (64QAM, 16QAM, QPSK, BPSK)
Sample Type:	Fixed production
Test Power Grade:	N/A
Test Software of EUT:	CC3100/CC3200 Radio Tool v1.2.5942.19689(manufacturer declare)
Antenna Type:	PCB Antenna
Antenna Gain:	1dBi
Software version:	WS500: Ver 62.04(manufacturer declare)
Hardware version:	RevG(manufacturer declare)
Test Voltage:	Battery: 3.6V 4800mAh

Operation Frequency each of channel(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		

6.4 Description of Support Units

The EUT has been tested independently.

6.5 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd

Building C, Hongwei Industrial Park Block 70, Bao'an District, Shenzhen, China

Telephone: +86 (0) 755 33683668 Fax:+86 (0) 755 33683385

No tests were sub-contracted.

FCC Designation No.: CN1164

6.6 Deviation from Standards

None.

6.7 Abnormalities from Standard Conditions

None.

6.8 Other Information Requested by the Customer

None.

6.9 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.9×10^{-8}
2	RF power, conducted	0.46dB (30MHz-1GHz)
		0.55dB (1GHz-18GHz)
3	Radiated Spurious emission test	4.3dB (30MHz-1GHz)
		4.5dB (1GHz-12.75GHz)
4	Conduction emission	3.5dB (9kHz to 150kHz)
		3.1dB (150kHz to 30MHz)
5	Temperature test	0.64°C
6	Humidity test	3.8%
7	DC power voltages	0.026%

7 Equipment List

RF test system					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. Date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
Signal Generator	Keysight	E8257D	MY53401106	03-13-2018	03-12-2019
Spectrum Analyzer	Keysight	N9010A	MY54510339	03-13-2018	03-12-2019
Signal Generator	Keysight	N5182B	MY53051549	03-13-2018	03-12-2019
High-pass filter	Sinoscite	FL3CX03WG18NM12-0398-002	---	01-10-2018	01-09-2019
High-pass filter	MICRO-TRONICS	SPA-F-63029-4	---	01-10-2018	01-09-2019
DC Power	Keysight	E3642A	MY54426035	03-13-2018	03-12-2019
PC-1	Lenovo	R4960d	---	03-13-2018	03-12-2019
BT&WI-FI Automatic control	R&S	OSP120	101374	03-13-2018	03-12-2019
RF control unit	JS Tonscend	JS0806-2	15860006	03-13-2018	03-12-2019
RF control unit	JS Tonscend	JS0806-1	15860004	03-13-2018	03-12-2019
RF control unit	JS Tonscend	JS0806-4	158060007	03-13-2018	03-12-2019
BT&WI-FI Automatic test software	JS Tonscend	JS1120-2	---	03-13-2018	03-12-2019
Temperature/ Humidity Indicator	biaozhi	HM10	1804186	10-12-2018	10-11-2019

3M Semi/full-anechoic Chamber					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
3M Chamber & Accessory Equipment	TDK	SAC-3	---	06-04-2016	06-03-2019
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-401	10-28-2018	10-27-2019
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-618	07-30-2018	07-29-2019
Microwave Preamplifier	Agilent	8449B	3008A02425	08-21-2018	08-20-2019
Microwave Preamplifier	Tonscend	EMC051845SE	980380	01-19-2018	01-18-2019
Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-1869	04-25-2018	04-23-2021
Horn Antenna	ETS-LINDGREN	3117	00057410	06-05-2018	06-03-2021
Double ridge horn antenna	A.H.SYSTEMS	SAS-574	6042	06-05-2018	06-04-2021
Pre-amplifier	A.H.SYSTEMS	PAP-1840-60	6041	06-05-2018	06-04-2021
Loop Antenna	ETS	6502	00071730	06-22-2017	06-21-2019
Spectrum Analyzer	R&S	FSP40	100416	05-11-2018	05-10-2019
Receiver	R&S	ESCI	100435	05-25-2018	05-24-2019
Receiver	R&S	ESCI7	100938-003	11-22-2017	11-23-2018
Receiver	R&S	ESCI7	100938-003	11-23-2018	11-22-2019
Multi device Controller	maturo	NCD/070/10711112	---	01-10-2018	01-09-2019
LISN	schwarzbeck	NNBM8125	81251547	05-11-2018	05-10-2019
LISN	schwarzbeck	NNBM8125	81251548	05-11-2018	05-10-2019
Signal Generator	Agilent	E4438C	MY45095744	03-13-2018	03-12-2019
Signal Generator	Keysight	E8257D	MY53401106	03-13-2018	03-12-2019
Temperature/ Humidity Indicator	Shanghai qixiang	HM10	1804298	10-11-2017	10-12-2018
Temperature/ Humidity Indicator	Shanghai qixiang	HM10	1804298	10-12-2018	10-11-2019
Communication test set	Agilent	E5515C	GB47050534	03-16-2018	03-15-2019
Cable line	Fulai(7M)	SF106	5219/6A	01-10-2018	01-09-2019
Cable line	Fulai(6M)	SF106	5220/6A	01-10-2018	01-09-2019
Cable line	Fulai(3M)	SF106	5216/6A	01-10-2018	01-09-2019
Cable line	Fulai(3M)	SF106	5217/6A	01-10-2018	01-09-2019
Communication test set	R&S	CMW500	104466	02-05-2018	02-04-2019
High-pass filter	Sinoscite	FL3CX03WG18NM12-0398-002	---	01-10-2018	01-09-2019
High-pass filter	MICRO-TRONICS	SPA-F-63029-4	---	01-10-2018	01-09-2019
band rejection filter	Sinoscite	FL5CX01CA09CL12-0395-001	---	01-10-2018	01-09-2019
band rejection filter	Sinoscite	FL5CX01CA08CL12-0393-001	---	01-10-2018	01-09-2019
band rejection filter	Sinoscite	FL5CX02CA04CL12-0396-002	---	01-10-2018	01-09-2019
band rejection filter	Sinoscite	FL5CX02CA03CL12-0394-001	---	01-10-2018	01-09-2019

8 Radio Technical Requirements Specification

Reference documents for testing:

No.	Identity	Document Title
1	FCC Part15C	Subpart C-Intentional Radiators
2	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices

Test Results List:

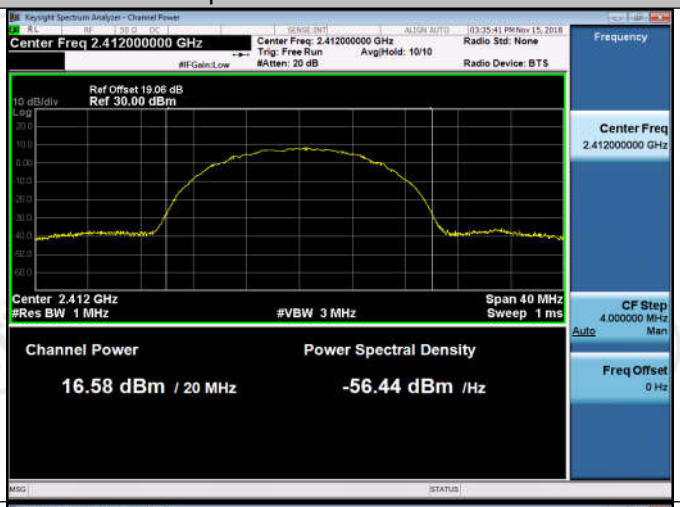
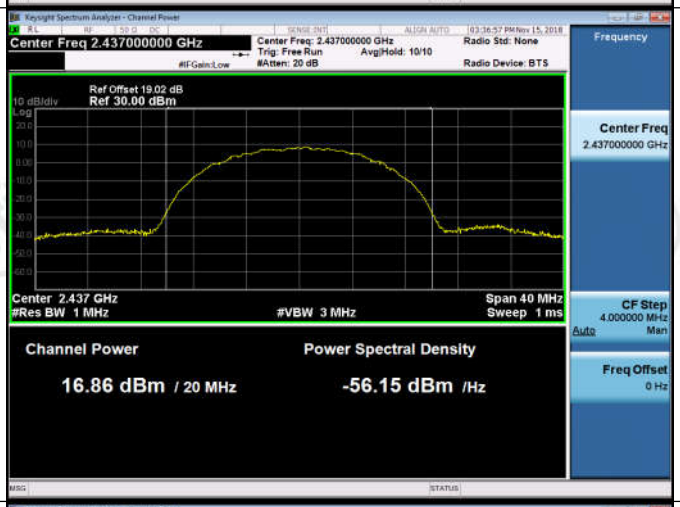
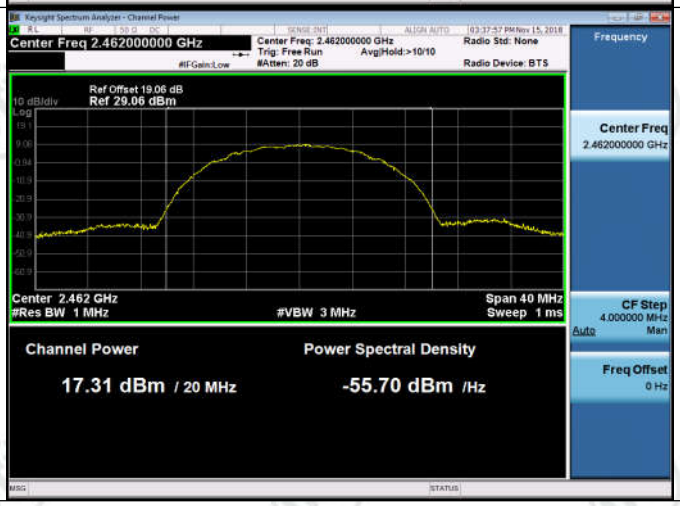
Test Requirement	Test method	Test item	Verdict	Note
Part15C Section 15.247 (b)(3)	ANSI C63.10	Conducted Peak Output Power	PASS	Appendix A)
Part15C Section 15.247 (a)(2)	ANSI C63.10	6dB Occupied Bandwidth	PASS	Appendix B)
Part15C Section 15.247(d)	ANSI C63.10	Band-edge for RF Conducted Emissions	PASS	Appendix C)
Part15C Section 15.247(d)	ANSI C63.10	RF Conducted Spurious Emissions	PASS	Appendix D)
Part15C Section 15.247 (e)	ANSI C63.10	Power Spectral Density	PASS	Appendix E)
Part15C Section 15.203/15.247 (c)	ANSI C63.10	Antenna Requirement	PASS	Appendix F)
Part15C Section 15.207	ANSI C63.10	AC Power Line Conducted Emission	N/A	N/A
Part15C Section 15.205/15.209	ANSI C63.10	Restricted bands around fundamental frequency (Radiated Emission)	PASS	Appendix G)
Part15C Section 15.205/15.209	ANSI C63.10	Radiated Spurious Emissions	PASS	Appendix H)

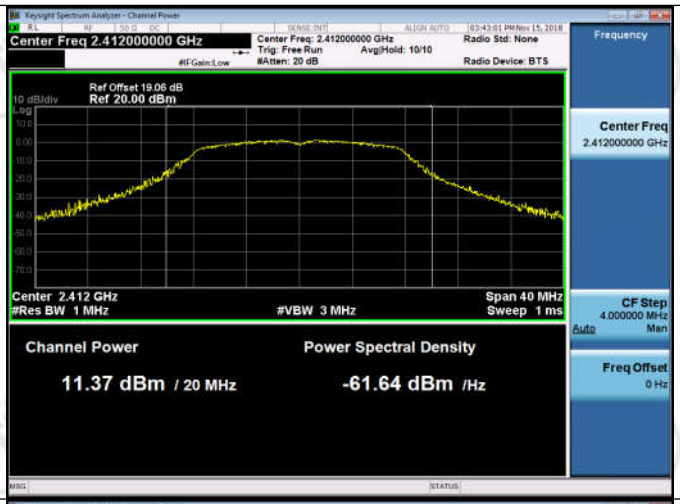
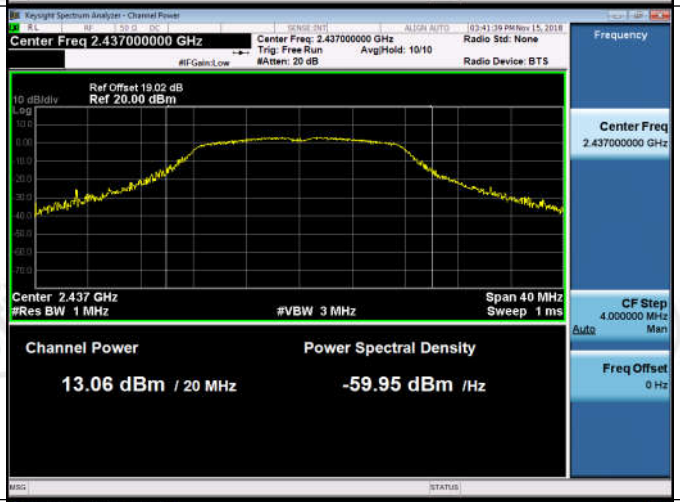
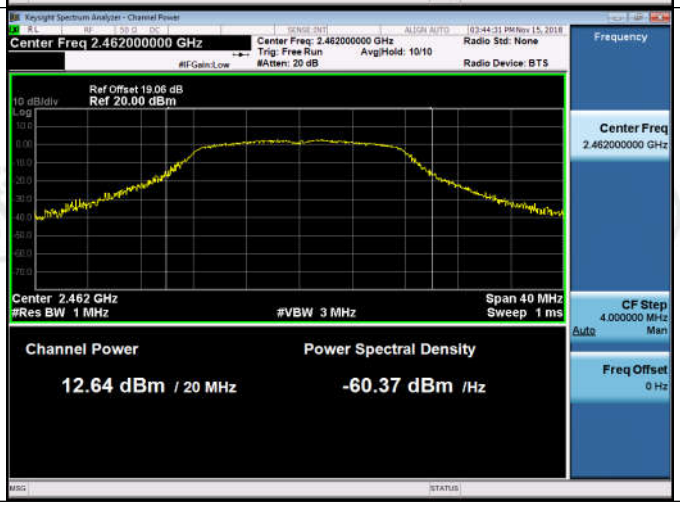
Appendix A): Conducted Peak Output Power

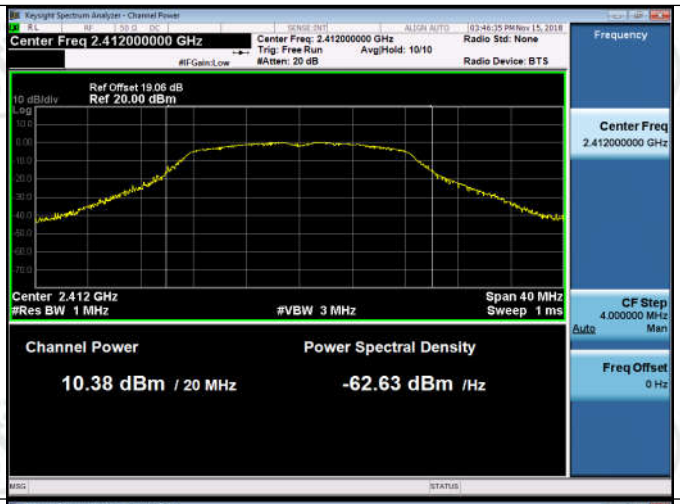
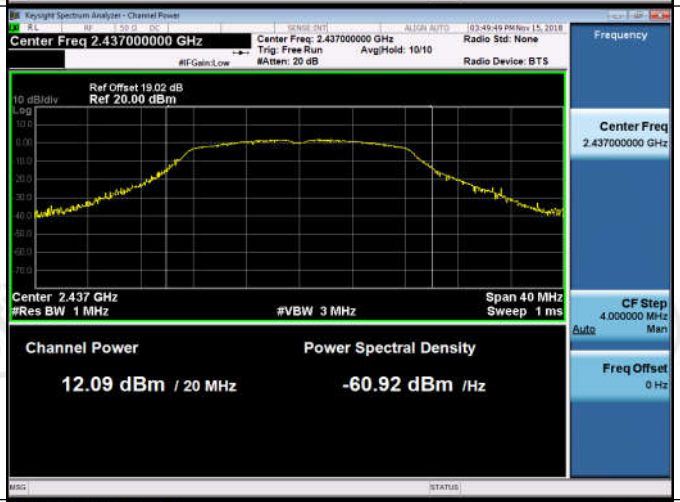
Result Table

Mode	Channel	Conducted Peak Output Power [dBm]	Verdict
11B	LCH	16.58	PASS
11B	MCH	16.86	PASS
11B	HCH	17.31	PASS
11G	LCH	11.37	PASS
11G	MCH	13.06	PASS
11G	HCH	12.64	PASS
11N20SISO	LCH	10.38	PASS
11N20SISO	MCH	12.09	PASS
11N20SISO	HCH	11.53	PASS

Test Graph

Graphs			
11B/LCH			
11B/MCH			
11B/HCH			

11G/LCH			
11G/MCH			
11G/HCH			

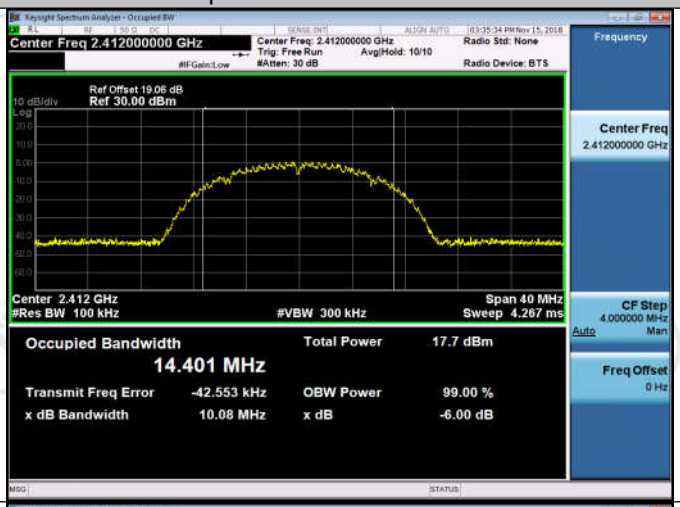
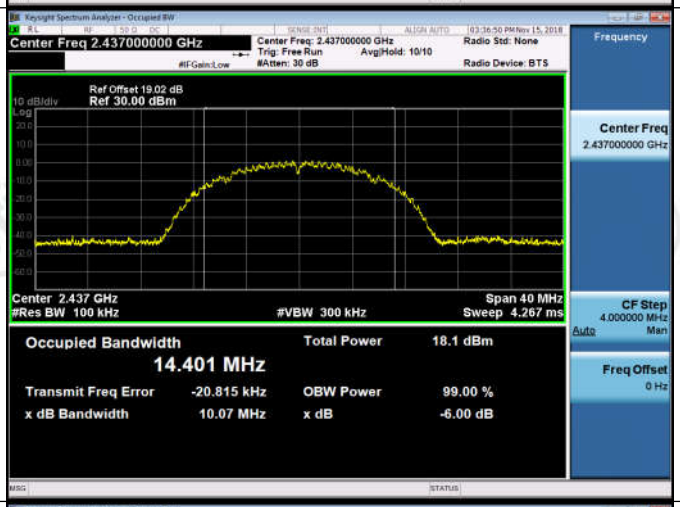
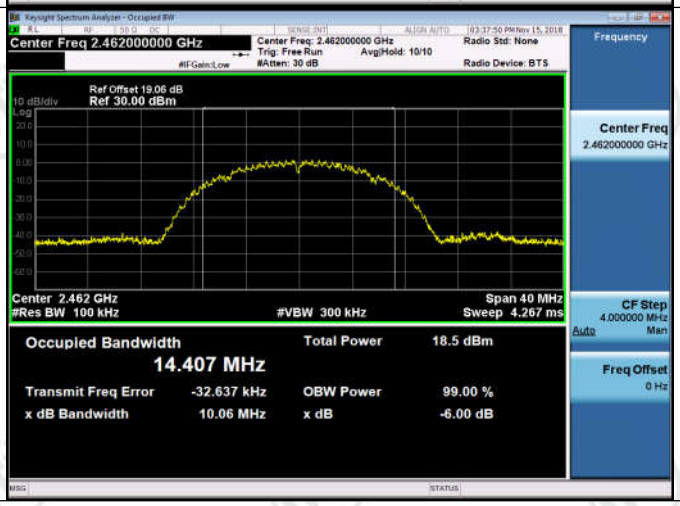
11N20SISO/LCH			
11N20SISO/MCH			
11N20SISO/HCH			

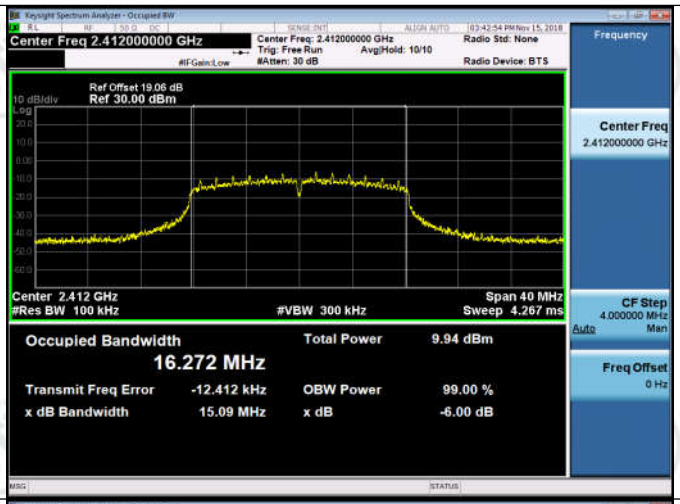
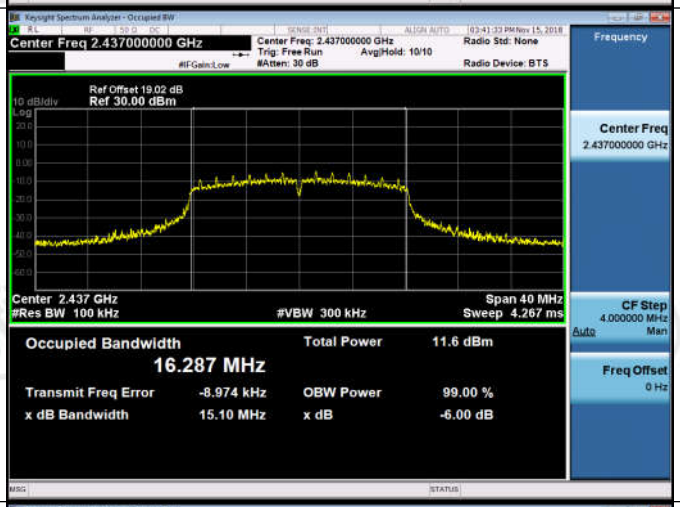
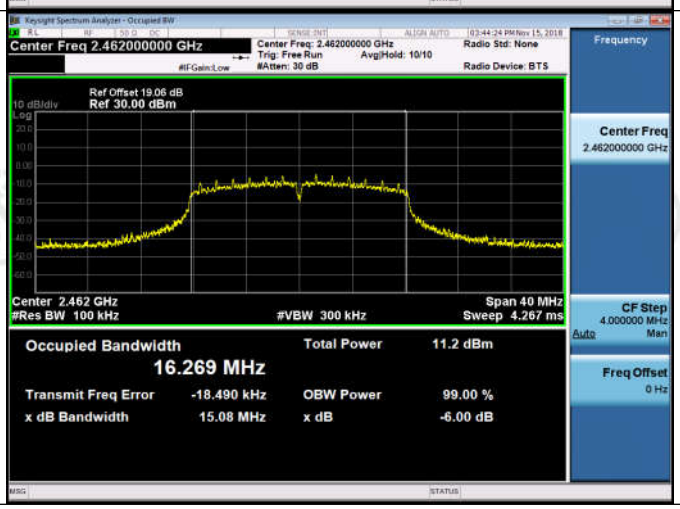
Appendix B): 6dB Occupied Bandwidth

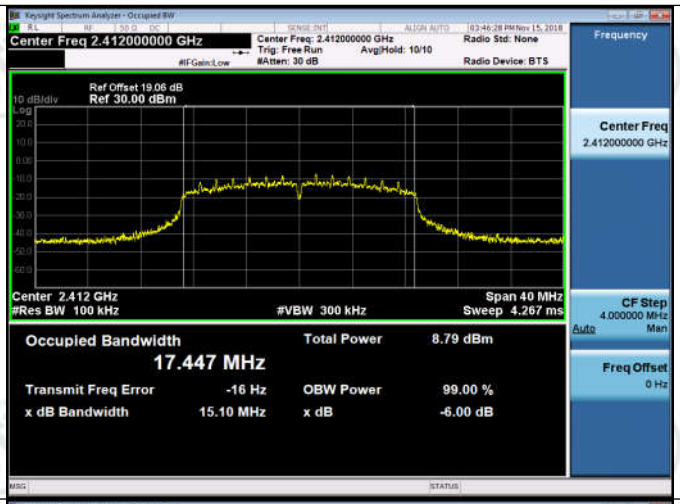
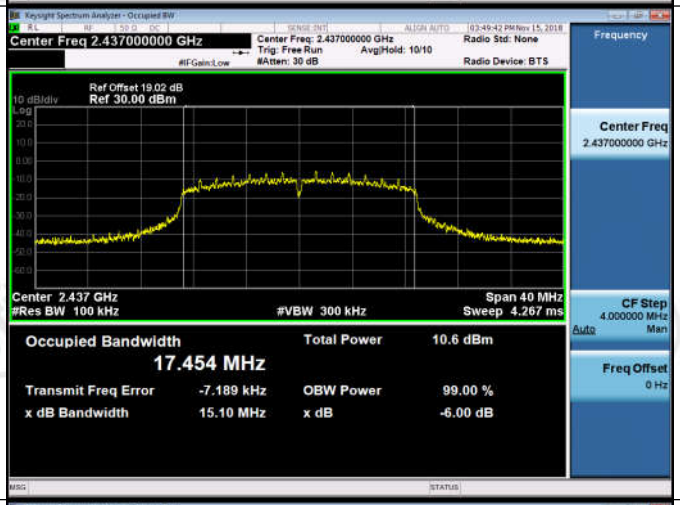
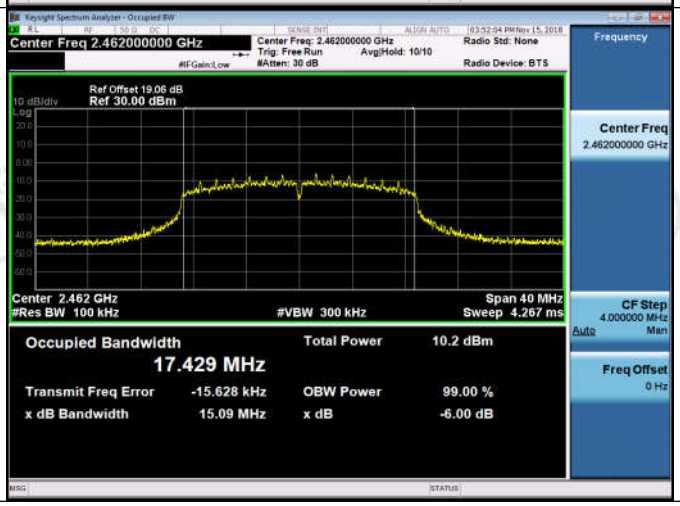
Result Table

Mode	Channel	6dB Bandwidth [MHz]	99% OBW [MHz]	Verdict	Remark
11B	LCH	10.08	14.401	PASS	Peak detector
11B	MCH	10.07	14.401	PASS	
11B	HCH	10.06	14.407	PASS	
11G	LCH	15.09	16.272	PASS	
11G	MCH	15.10	16.287	PASS	
11G	HCH	15.08	16.269	PASS	
11N20SISO	LCH	15.10	17.447	PASS	
11N20SISO	MCH	15.10	17.454	PASS	
11N20SISO	HCH	15.09	17.429	PASS	

Test Graph

Graphs			
11B/LCH			
11B/MCH			
11B/HCH			

11G/LCH			
11G/MCH			
11G/HCH			

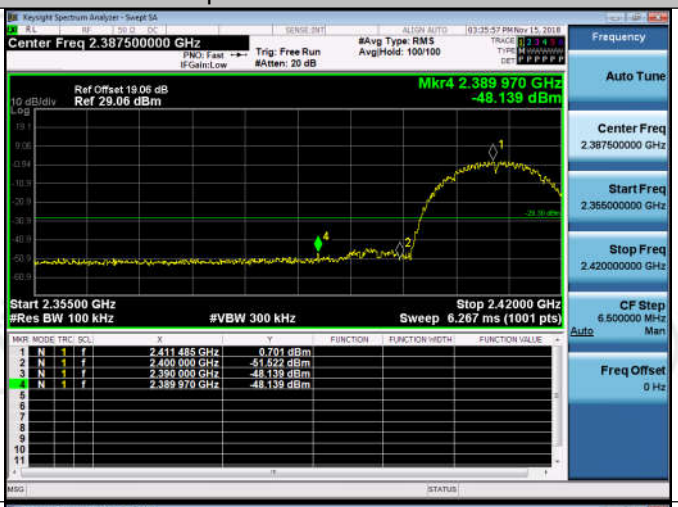
11N20SISO/LCH			
11N20SISO/MCH			
11N20SISO/HCH			

Appendix C): Band-edge for RF Conducted Emissions

Result Table

Mode	Channel	Carrier Power[dBm]	Max.Spurious Level [dBm]	Limit [dBm]	Verdict
11B	LCH	0.701	-48.139	-29.30	PASS
11B	HCH	1.384	-48.696	-28.62	PASS
11G	LCH	-6.223	-50.694	-36.22	PASS
11G	HCH	-5.099	-50.658	-35.10	PASS
11N20SISO	LCH	-7.356	-50.586	-37.36	PASS
11N20SISO	HCH	-5.973	-50.374	-35.97	PASS

Test Graph

Graphs			
11B/LCH			
11B/HCH			
11G/LCH			

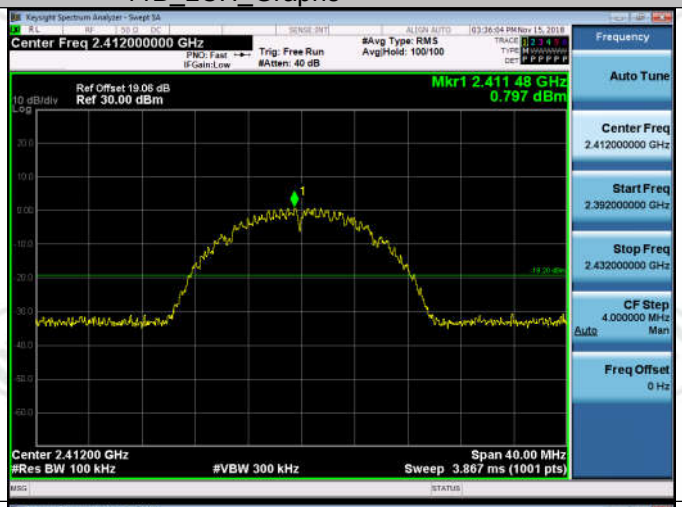
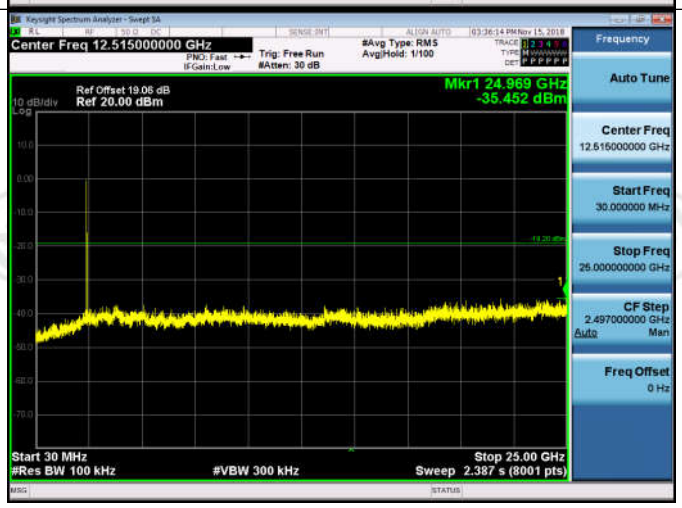
11G/HCH			
11N20SISO/LCH			
11N20SISO/HCH			

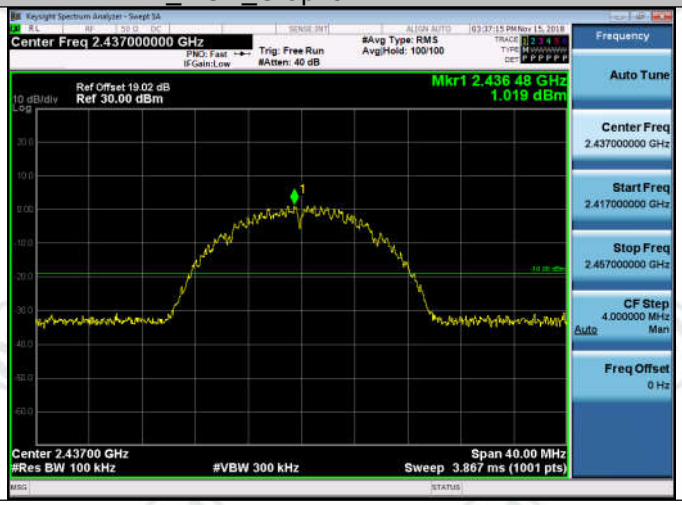
Appendix D): RF Conducted Spurious Emissions

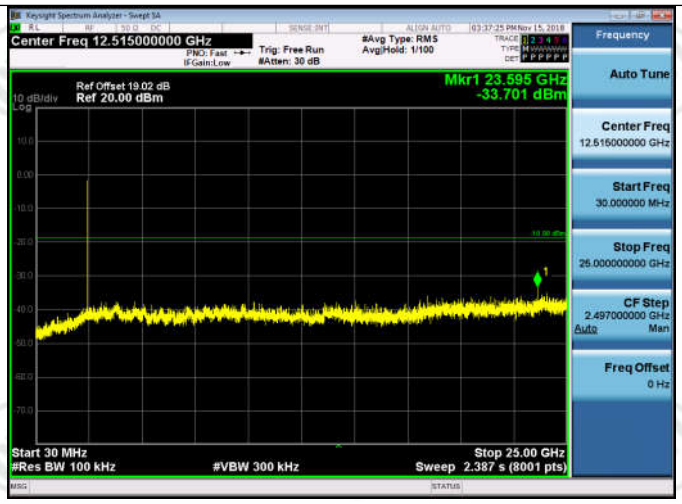
Result Table

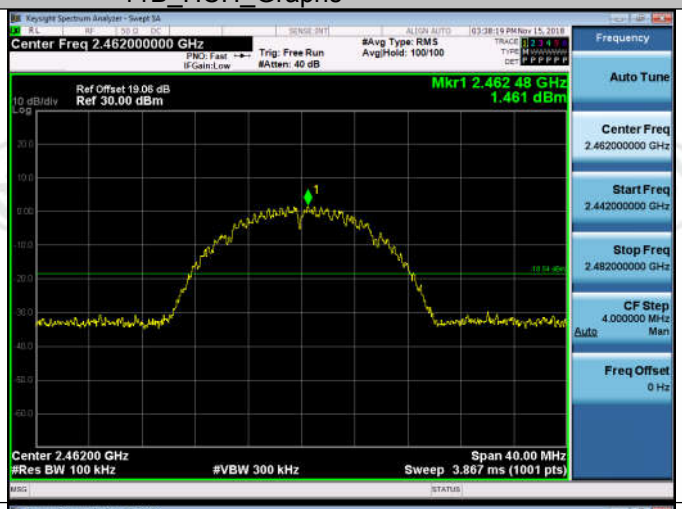
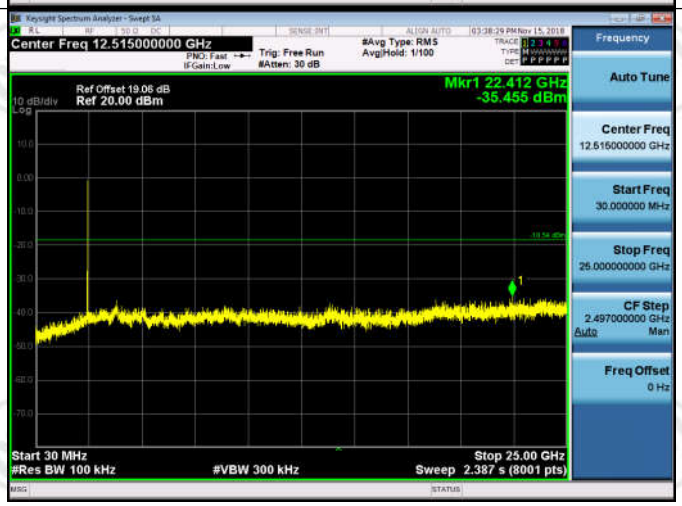
Mode	Channel	Pref [dBm]	Puw[dBm]	Verdict
11B	LCH	0.797	<Limit	PASS
11B	MCH	1.019	<Limit	PASS
11B	HCH	1.461	<Limit	PASS
11G	LCH	-6.074	<Limit	PASS
11G	MCH	-4.499	<Limit	PASS
11G	HCH	-4.925	<Limit	PASS
11N20SISO	LCH	-7.171	<Limit	PASS
11N20SISO	MCH	-5.279	<Limit	PASS
11N20SISO	HCH	-5.953	<Limit	PASS

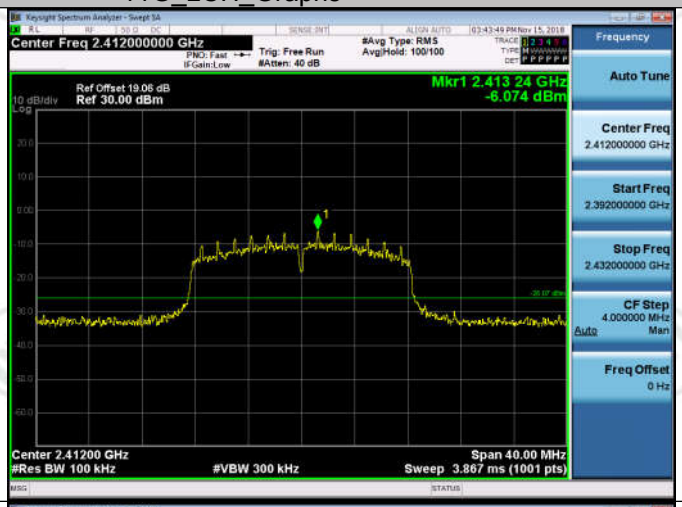
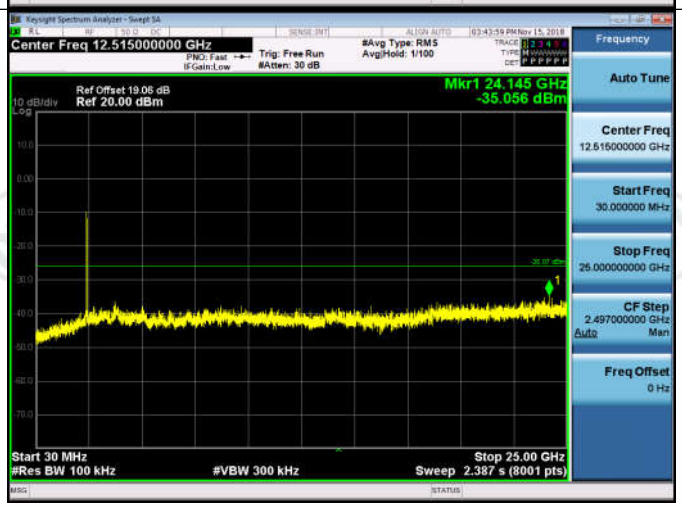
Test Graph

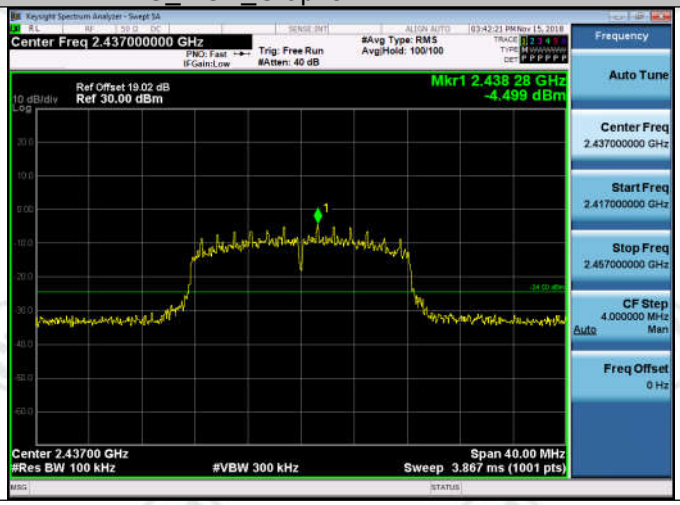
11B_LCH_Graphs	
Pref/11B/LCH	
Puw/11B/LCH	

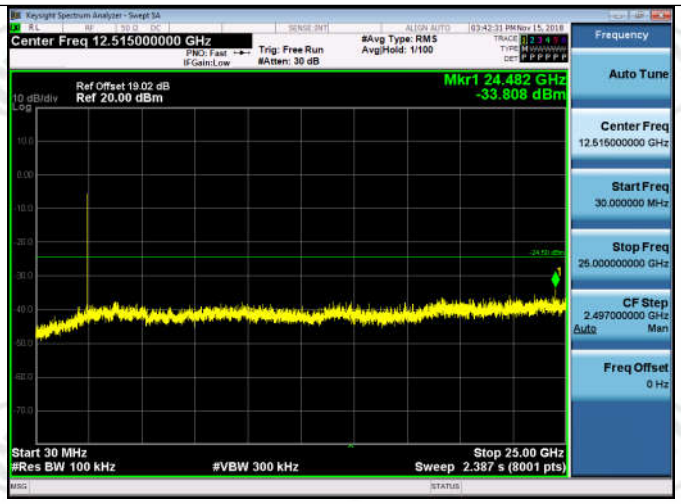
11B_MCH_Graphs	
Pref/11B/MCH	

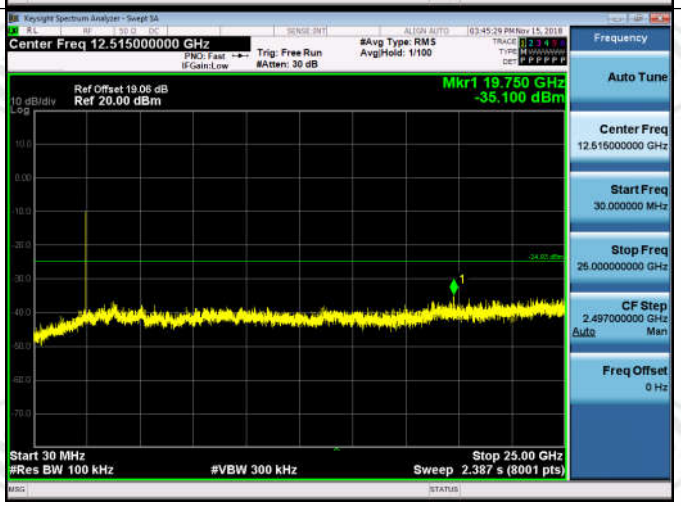
Puw/11B/MCH	

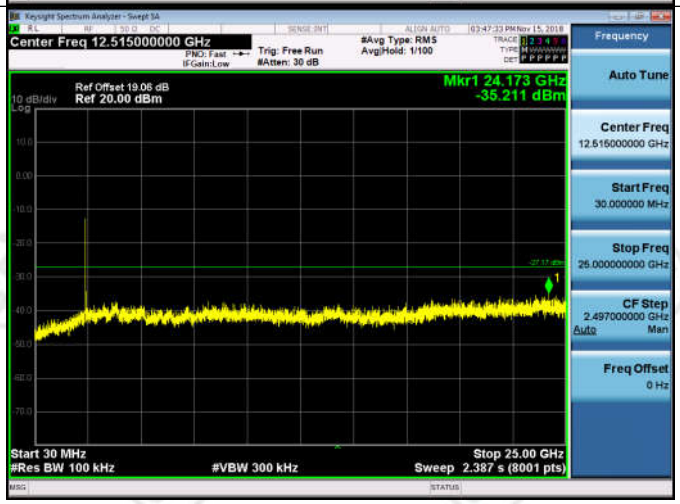
11B_HCH_Graphs	
Pref/11B/HCH	
Puw/11B/HCH	

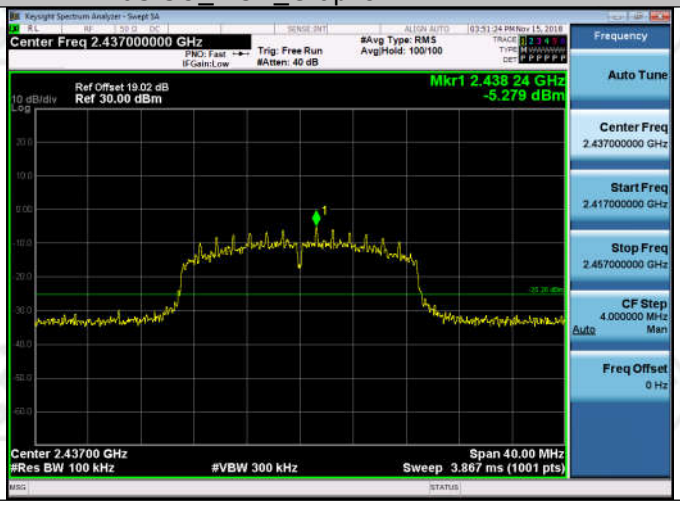
11G_LCH_Graphs	
Pref/11G/LCH	
Puw/11G/LCH	

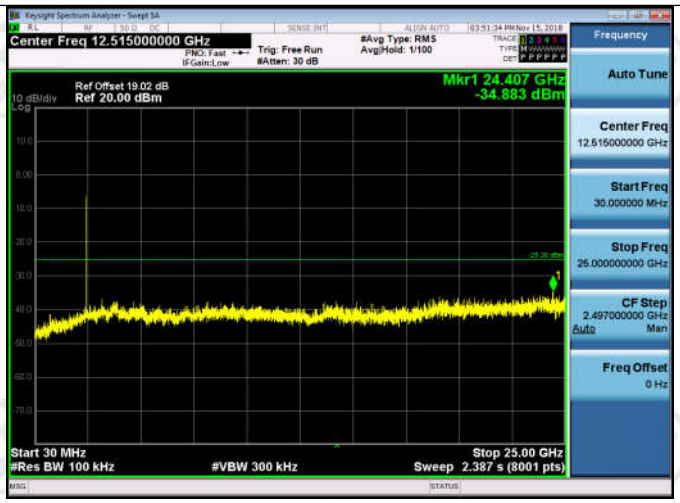
11G_MCH_Graphs	
Pref/11G/MCH	

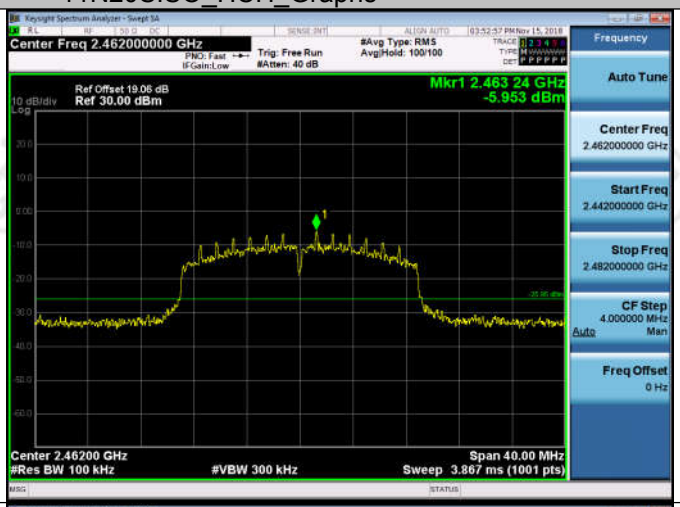
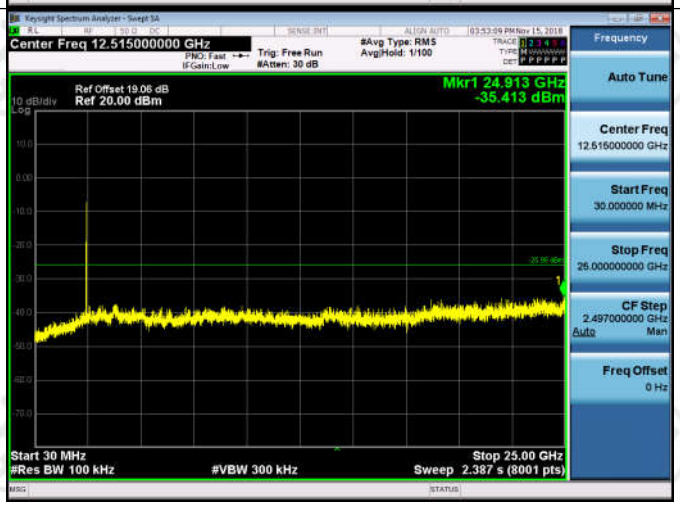
Puw/11G/MCH	

11G_HCH_Graphs		
Pref/11G/HCH	
Puw/11G/HCH	

11N20SISO_LCH_Graphs	
Pref/11N20SISO /LCH	
/11N20SISO/LCH	

11N20SISO_MCH_Graphs	
Pref/11N20SISO /MCH	

Puw/11N20SISO /MCH	

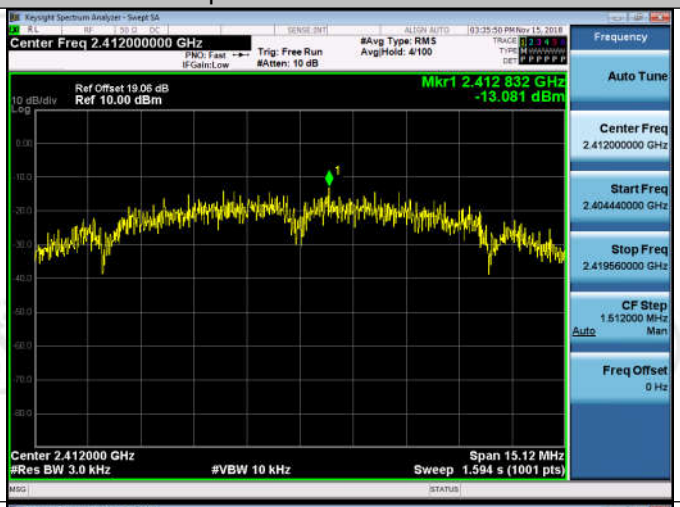
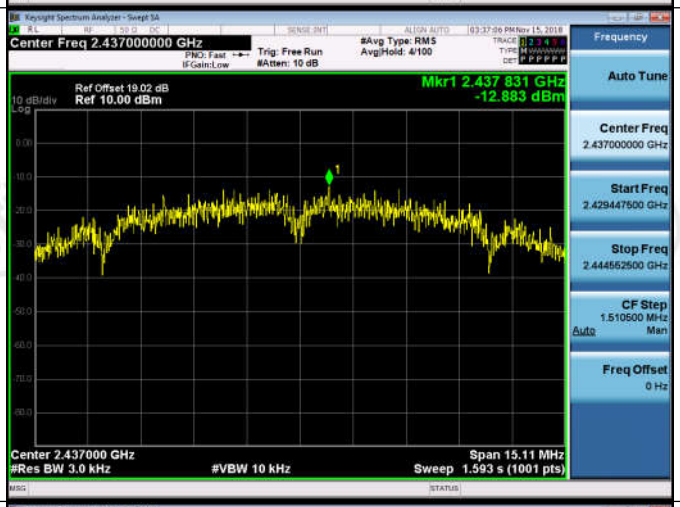
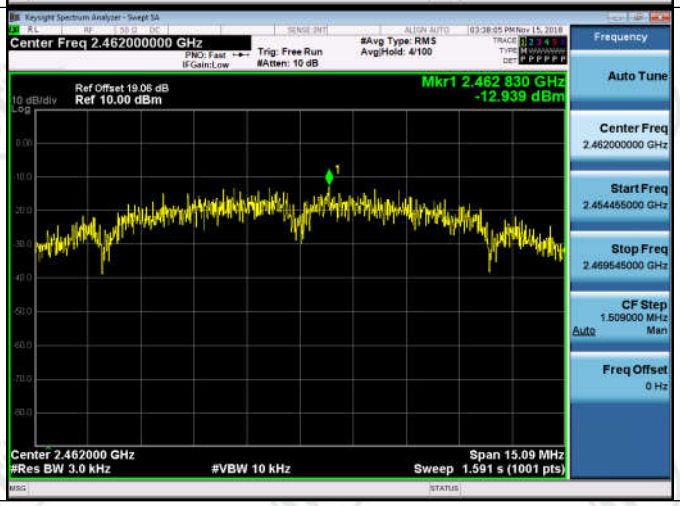
11N20SISO_HCH_Graphs		
Pref/11N20SISO /HCH		
Puw/11N20SISO /HCH		

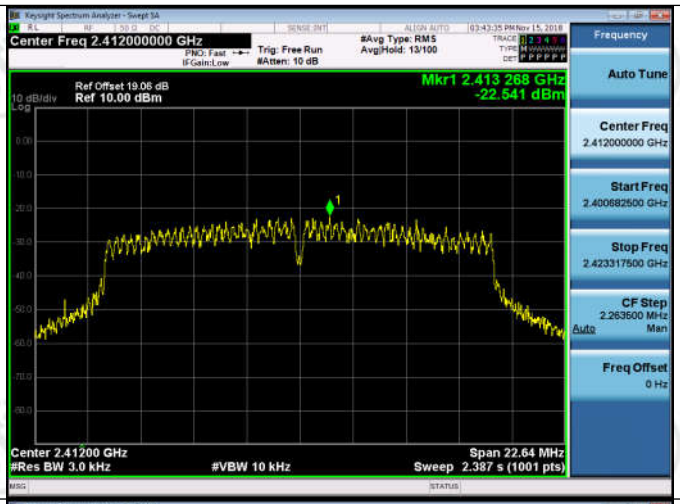
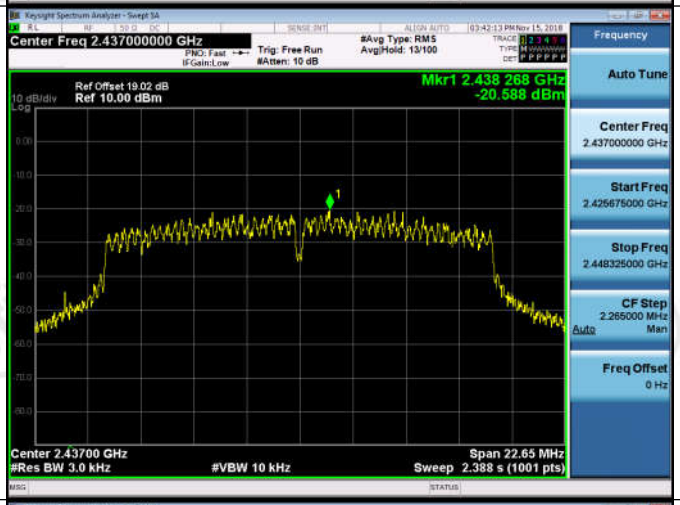
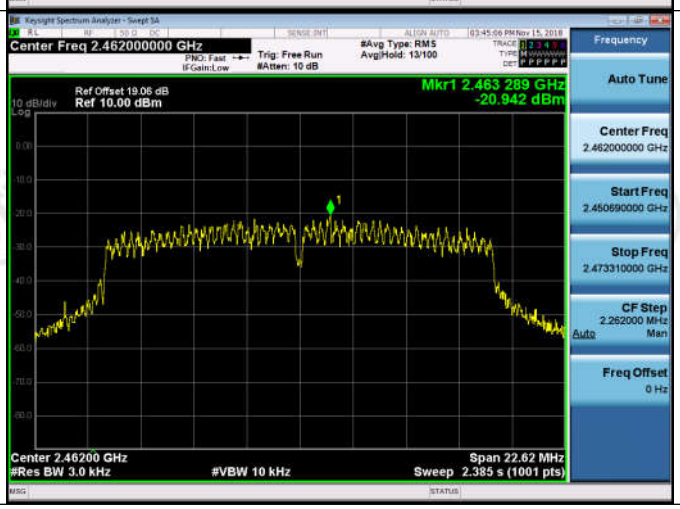
Appendix E): Power Spectral Density

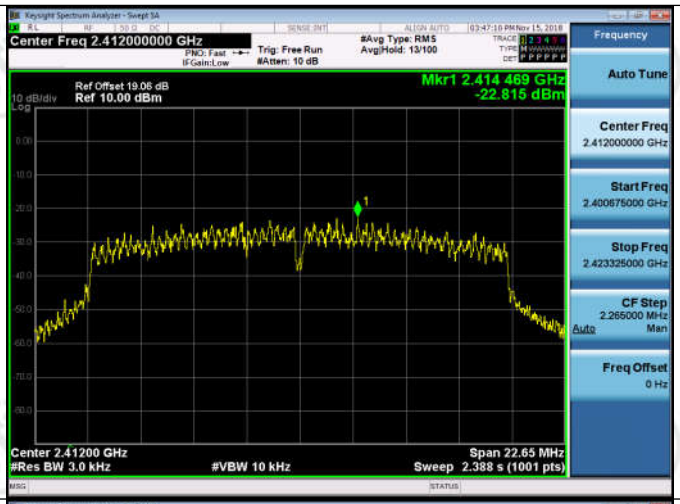
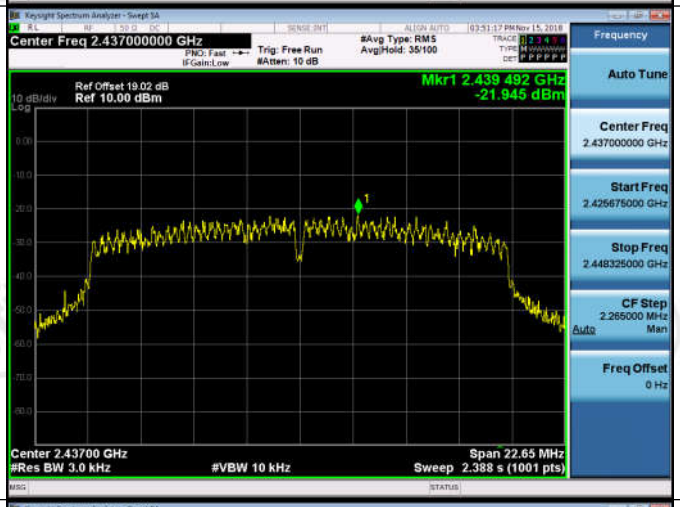
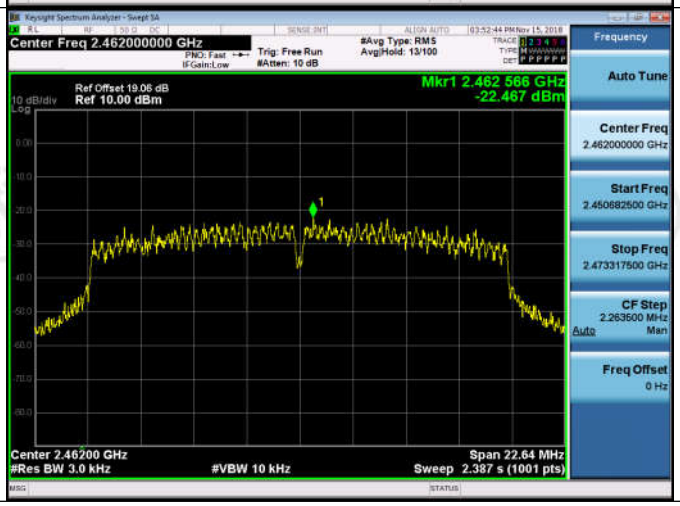
Result Table

Mode	Channel	Power Spectral Density[dBm/3kHz]	Limit [dBm/3kHz]	Verdict
11B	LCH	-13.081	8	PASS
11B	MCH	-12.883	8	PASS
11B	HCH	-12.939	8	PASS
11G	LCH	-22.541	8	PASS
11G	MCH	-20.588	8	PASS
11G	HCH	-20.942	8	PASS
11N20SISO	LCH	-22.815	8	PASS
11N20SISO	MCH	-21.945	8	PASS
11N20SISO	HCH	-22.467	8	PASS

Test Graph

Graphs			
11B/LCH			
11B/MCH			
11B/HCH			

11G/LCH			
11G/MCH			
11G/HCH			

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