



FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

For

4MP Dual Band Pan/Tilt Wireless IP Camera

MODEL NUMBER: IP4M-1051B

ADDITIONAL MODEL NUMBER: IP4M-1051B-; IP4M-1051B-***;**

IP4M-1051W; IP4M-1051W-; IP4M-1051W-***;**

"*" can be "A-Z", or "0-9", or blank

PROJECT NUMBER: 4788435051

REPORT NUMBER: 4788435051-1

FCC ID: ZZ2-AMC047

ISSUE DATE: June. 1, 2018

Prepared for

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Prepared by

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Revision History

Rev.	Issue Date	Revisions	Revised By
--	6/1/2018	Initial Issue	

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	4
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	7
4.1. MEASURING INSTRUMENT CALIBRATION	7
4.2. MEASUREMENT UNCERTAINTY.....	7
5. EQUIPMENT UNDER TEST	8
5.1. DESCRIPTION OF EUT	8
5.2. MAXIMUM OUTPUT POWER.....	9
5.3. CHANNEL LIST	9
5.4. TEST CHANNEL CONFIGURATION.....	9
5.5. THE WORSE CASE POWER SETTING PARAMETER	11
5.6. DESCRIPTION OF AVAILABLE ANTENNAS	12
5.7. TEST ENVIRONMENT	13
5.8. DESCRIPTION OF TEST SETUP.....	14
5.9. MEASURING INSTRUMENT AND SOFTWARE USED.....	15
6. ANTENNA PORT TEST RESULTS	16
6.1. ON TIME AND DUTY CYCLE.....	16
6.2. 6 dB BANDWIDTH.....	19
6.3. PEAK CONDUCTED OUTPUT POWER.....	27
6.4. POWER SPECTRAL DENSITY	29
6.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS.....	37
6.6. RADIATED TEST RESULTS	68
6.6.1. LIMITS AND PROCEDURE	68
6.6.2. RESTRICTED BANDEDGE	73
6.6.3. SPURIOUS EMISSIONS	90
6.6.4. SPURIOUS EMISSIONS 18G ~ 26GHz.....	114
6.6.5. SPURIOUS EMISSIONS 30M ~ 1GHz	120
6.6.6. SPURIOUS EMISSIONS BELOW 30M.....	123
7. AC POWER LINE CONDUCTED EMISSIONS	129
8. ANTENNA REQUIREMENTS	132

1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: Amcrest Technologies LLC
Address: 16727 Park Row Dr, Houston, TX 77084

Manufacturer Information

Company Name: Amcrest Technologies LLC
Address: 16727 Park Row Dr, Houston, TX 77084

Factory Information

Company Name: ZHEJIANG DAHUA VISION TECHNOLOGY CO.,LTD
Address: No.1199, Bin'an road, Binjiang District, Hangzhou, P.R.China.

Company Name: ZHEJIANG DAHUA ZHILIAN CO.,LTD.
Address: No.28, Dongqiao Road, Dongzhou Street, Fuyang District, Hangzhou,P.R.China.

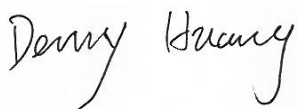
EUT Description

Product Name 4MP Dual Band Pan/Tilt Wireless IP Camera
Model Name IP4M-1051B
Additional No. IP4M-1051B-**; IP4M-1051B-***;
IP4M-1051W; IP4M-1051W-**; IP4M-1051W-***;
"*" can be "A-Z", or "0-9", or blank
Sample Number 1542101-001
Data of Receipt Sample April. 24, 2018
Date Tested April. 25, 2018 ~ May. 25, 2018

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	PASS

Summary of Test Results			
Clause	Test Items	FCC/IC Rules	Test Results
1	6db DTS Bandwidth	FCC 15.247 (a) (2)	Complied
2	Peak Conducted Power	FCC 15.247 (b) (3)	Complied
3	Power Spectral Density	FCC 15.247 (e)	Complied
4	Conducted Band edge And Spurious emission	FCC 15.247 (d)	Complied
5	Radiated Band edges and Spurious emission	FCC 15.247 (d) FCC 15.209 FCC 15.205	Complied
6	Conducted Emission Test For AC Power Port	FCC 15.207	Complied
7	Antenna Requirement	FCC 15.203	Complied

Tested By:



Denny Huang
Engineer Project Associate
Approved By:



Stephen Guo
Laboratory Manage

Check By:



Shawn Wen
Laboratory Leader

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC KDB 558074 D01 DTS Meas Guidance v04, , 414788 D01 Radiated Test Site v01, ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	A2LA (Certificate No.: 4102.01) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA. IAS (Lab Code: TL-702) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has demonstrated compliance with ISO/IEC Standard 17025:2005, General requirements for the competence of testing and calibration laboratories FCC (FCC Designation No.: CN1187) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules IC(Company No.: 21320) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320. VCCI (Registration No.: G-20019, R-20004, C-20012 and T-20011) UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793. Facility Name: Chamber D, the VCCI registration No. is G-20019 and R-20004 Shielding Room B , the VCCI registration No. is C-20012 and T-20011
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Note:

1. All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China
2. The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.
3. For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. And these measurements below 30MHz had been correlated to measurements performed on an OATS.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty
Uncertainty for Conduction emission test	2.90dB
Uncertainty for Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	2.00dB
Uncertainty for Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	4.52dB
Uncertainty for Radiation Emission test (1GHz to 26GHz)(include Fundamental emission)	5.04dB(1-6GHz)
	5.30dB (6GHz-18Gz)
	5.23dB (18GHz-26Gz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Product Name:	4MP Dual Band Pan/Tilt Wireless IP Camera
Model No.:	IP4M-1051B
Operating Frequency:	IEEE 802.11b/g/n(HT20): 2412MHz to 2462MHz IEEE 802.11n(HT40): 2422MHz to 2452MHz IEEE 802.11a/n/ac 20MHz:5180MHz to 5240MHz, 5745 MHz -5825 MHz IEEE 802.11n/ac 40MHz:5190MHz to 5230MHz, 5755 MHz -5795 MHz IEEE 802.11ac 80MHz: 5230MHz, 5775 MHz Remark: For this test report just for the 2.4GHz part
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 and HT40): OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE for 802.11a: OFDM (BPSK,QPSK,16QAM,64QAM) IEEE for 802.ac : OFDM (BPSK,QPSK,16QAM,64QAM,256QAM)
Channels Step:	Channels with 5MHz step
Sample Type:	Fixed production
Test power grade:	33 (manufacturer declare)
Test software of EUT:	Secure CRT (manufacturer declare)
Antenna Type:	PCB Antenna
Antenna Gain:	1.68 dBi
Adapter	MODEL:NBS10B050200VUU INPUT:100-240V,50/60Hz, 0.3A OUTPUT:5.0V $\overline{\text{---}}$ 2.0A

Remark:

Model No.:

Number:	Name:	Number:	Name:	Number:	Name:
1	IP4M-1051B	2	IP4M-1051B-**	3	IP4M-1051B-***
4	IP4M-1051W	5	P4M-1051W-**	6	IP4M-1051W-***
Remark: "*" can be "A-Z", or "0-9", or blank					

Only the main model **IP4M-1051B** was tested and only the data of this model is shown in this test report. Since Their electrical circuit design, layout, components used and internal wiring are identical, only the model name, color and selling area are different.

5.2. MAXIMUM OUTPUT POWER

Frequency Range (MHz)	Number of Transmit Chains (NTX)	IEE Std. 802.11	Channel Number	Max PK Conducted Power (dBm)	Max Average Conducted Power (dBm)
2400-2483.5	1	IEEE 802.11b	1-11[11]	17.36	14.37
2400-2483.5	1	IEEE 802.11g	1-11[11]	15.29	7.93
2400-2483.5	1	IEEE 802.11nHT20	1-11[11]	15.48	8.11
2400-2483.5	1	IEEE 802.11nHT40	3-7[7]	15.37	7.14

5.3. CHANNEL LIST

Channel List for 802.11b/g/n (20 MHz)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	4	2427	7	2442	10	2457
2	2417	5	2432	8	2447	11	2462
3	2422	6	2437	9	2452		

Channel List for 802.11n (40 MHz)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	5	2432	7	2442	9	2452
4	2427	6	2437	8	2447		

5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel (MHz)
IEEE 802.11b	LCH :CH01 2412
	MCH: CH06 2437
	HCH: CH11 2462
IEEE 802.11g	LCH :CH01 2412
	MCH: CH06 2437
	HCH: CH11 2462
IEEE 802.11n HT20	LCH :CH01 2412
	MCH: CH06 2437
	HCH: CH11 2462
IEEE 802.11n HT40	LCH :CH03 2422
	MCH: CH06 2437

5.5. THE WORSE CASE POWER SETTING PARAMETER

Test Software Version	SecureCRT8.1		
Test Mode	Test Channel	Setting TX Power	Setting data rate (Mbps)
IEEE 802.11b	LCH	40	CCK_1Mbps
	MCH	40	CCK_1Mbps
	HCH	40	CCK_1Mbps
IEEE 802.11g	LCH	40	NO HT_6Mbps
	MCH	40	NO HT_6Mbps
	HCH	40	NO HT_6Mbps
IEEE 802.11n HT20	LCH	40	HT20_MCS_0_20
	MCH	40	HT20_MCS_0_20
	HCH	40	HT20_MCS_0_20
IEEE 802.11n HT40	LCH	40	HT40+MCS_0_40
	MCH	40	HT40+MCS_0_40
	HCH	40	HT40+MCS_0_40

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	2400-2483.5	External Antenna	1.68

Test Mode	Transmit and Receive Mode	Description
WIFI	☒ 1TX, 1RX	Antenna 1 can be used as transmitting/receiving antenna.



5.7. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	55 ~ 65%	
Atmospheric Pressure:	1025Pa	
Temperature	TN	23 ~ 28°C
Voltage :	VL	N/A
	VN	DC 5.0V
	VH	N/A

Note: VL= Lower Extreme Test Voltage
VN= Nominal Voltage
VH= Upper Extreme Test Voltage
TN= Normal Temperature

5.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	FCC ID
1	Laptop	ThinkPad	T410	N/A

I/O PORT

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	Network port	physical	Network Cable	2M	Supply by UL SSL Lab

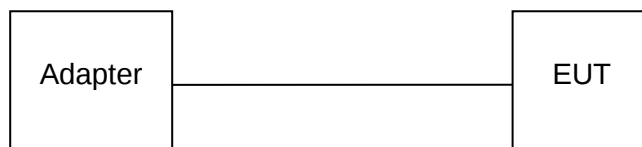
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	SD Card	Kingston	32GB	Supply by UL SSL Lab
2	Earphone	PHILIPS	N/A	Supply by UL SSL Lab

TEST SETUP

The EUT can work in an engineer mode with a software through a table PC.

SETUP DIAGRAM FOR TESTS



5.9. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions(Instrument)						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
☒	EMI Test Receiver	R&S	ESR3	101961	Dec.12, 2017	Dec.11, 2018
☒	Two-Line V-Network	R&S	ENV216	101983	Dec.12, 2017	Dec.11, 2018
☒	Artificial Mains Networks	Schwarzbeck	NSLK 8126	8126465	Dec.12, 2017	Dec.11, 2018
Software						
Used	Description		Manufacturer	Name		Version
☒	Test Software for Conducted disturbance		UL	Antenna port		Ver. 7.2
Radiated Emissions(Instrument)						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
☒	MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Dec. 12, 2017	Dec. 11, 2018
☒	Hybrid Log Periodic Antenna	TDK	HLP-3003C	130960	Jan.09, 2016	Jan.09, 2019
☒	Preamplifier	HP	8447D	2944A09099	Dec. 12, 2017	Dec. 11, 2018
☒	EMI Measurement Receiver	R&S	ESR26	101377	Dec.12, 2017	Dec.11, 2018
☒	Horn Antenna	TDK	HRN-0118	130939	Jan. 09, 2016	Jan. 09, 2019
☒	High Gain Horn Antenna	Schwarzbeck	BBHA-9170	691	Jan.06, 2016	Jan.06, 2019
☒	Preamplifier	TDK	PA-02-0118	TRS-305-00066	Dec. 12, 2017	Dec. 11, 2018
☒	Preamplifier	TDK	PA-02-2	TRS-307-00003	Dec.12, 2017	Dec.11, 2018
☒	Loop antenna	Schwarzbeck	1519B	00008	Mar. 26, 2016	Mar. 26, 2019
☒	Band Reject Filter	Wainwright	WRCJV8-2350-2400-2483.5-2533.5-40SS	4	Dec.12, 2017	Dec.11, 2018
Software						
Used	Description		Manufacturer	Name		Version
☒	Test Software for Radiated disturbance		Farad	EZ-EMC		Ver. UL-3A1
Other instruments						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
☒	Spectrum Analyzer	Keysight	N9030A	MY55410512	Dec.12, 2017	Dec.11, 2018
☒	Power Meter	Keysight	N9031A	MY55416024	Dec.12, 2017	Dec.11, 2018
☒	Power Sensor	Keysight	N9323A	MY55440013	Dec.12, 2017	Dec.11, 2018

6. ANTENNA PORT TEST RESULTS

6.1. ON TIME AND DUTY CYCLE

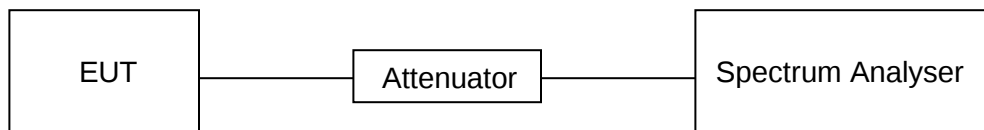
LIMITS

None; for reporting purposes only

PROCEDURE

FCC KDB 558074 Zero-Span Spectrum Analyzer Method

TEST SETUP



RESULTS

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (db)	1/T Minimum VBW (KHz)
11B	100	100	1	100	0	0.01
11G	100	100	1	100	0	0.01
11NSISO20	100	100	1	100	0	0.01
11NSISO40	100	100	1	100	0	0.01

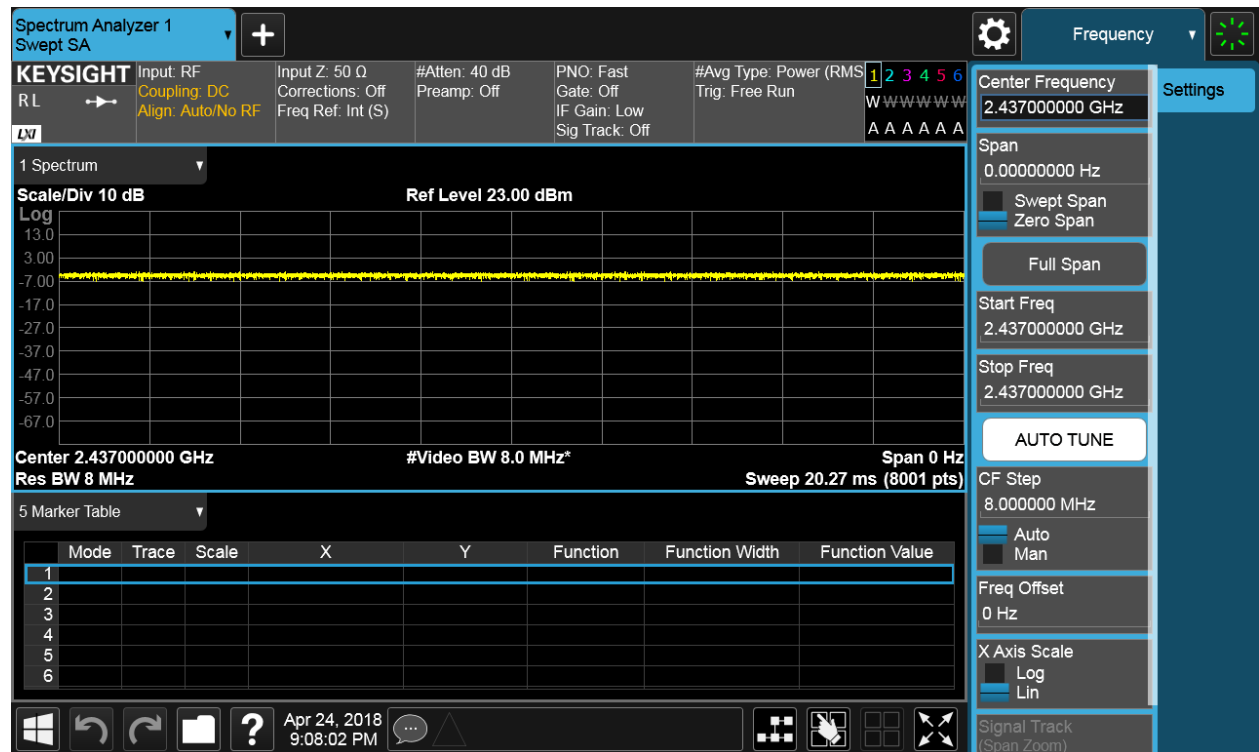
Note: Duty Cycle Correction Factor= $10\log(1/x)$.
Where: x is Duty Cycle(Linear)
Where: T is On Time (transmit duration)

ON TIME AND DUTY CYCLE MID CH

11B



11G



11NSISO20



11NSISO40



6.2. 6 dB BANDWIDTH**LIMITS**

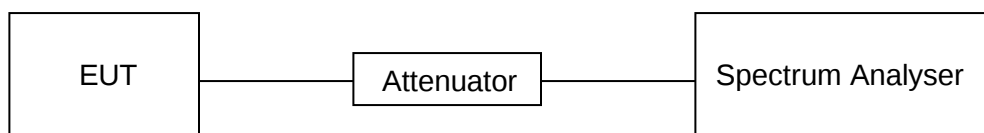
FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(a)(2)	6dB Bandwidth	$\geq 500\text{KHz}$	2400-2483.5

TEST PROCEDURE

Refer to FCC KDB 558074, connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	For 6 dB Bandwidth :100K For 99% Bandwidth :1% to 5% of the occupied bandwidth
VBW	For 6dB Bandwidth : $\geq 3 \times \text{RBW}$ For 99% Bandwidth : approximately $3 \times \text{RBW}$
Trace	Max hold
Sweep	Auto couple

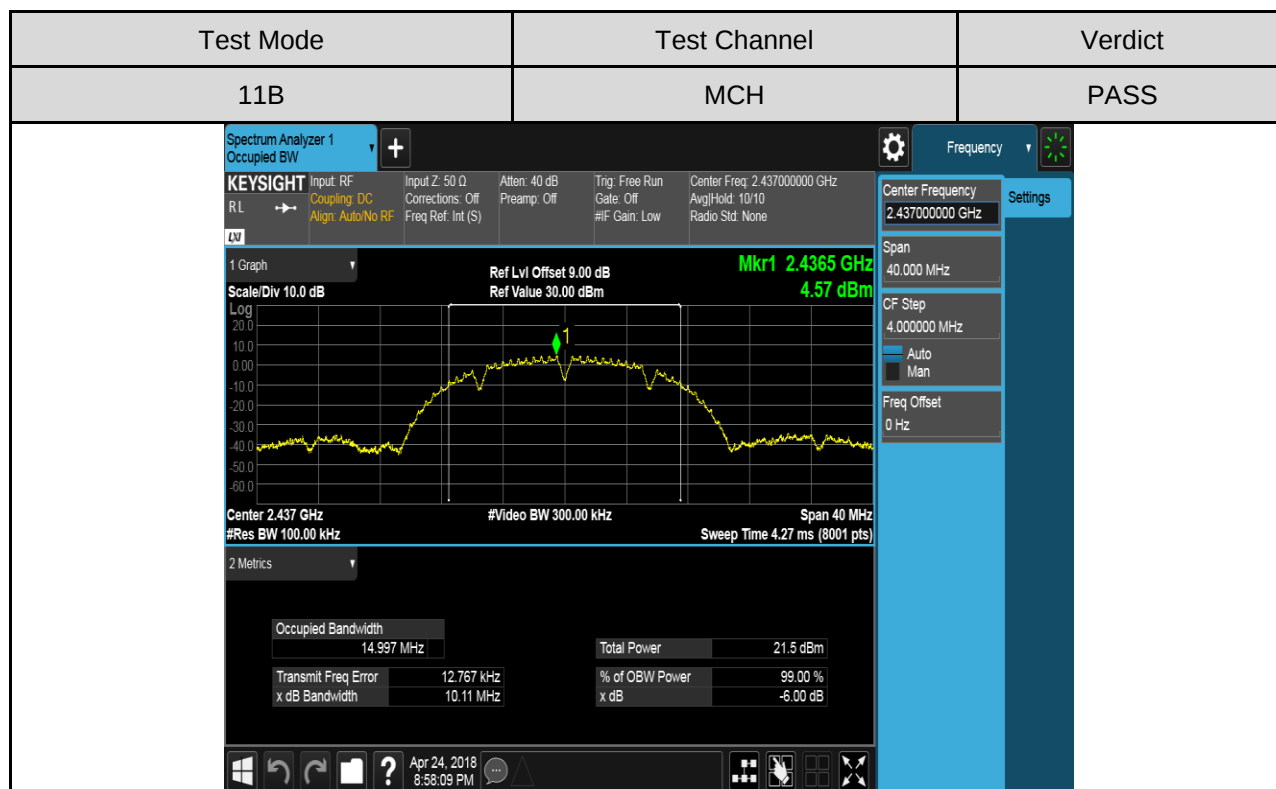
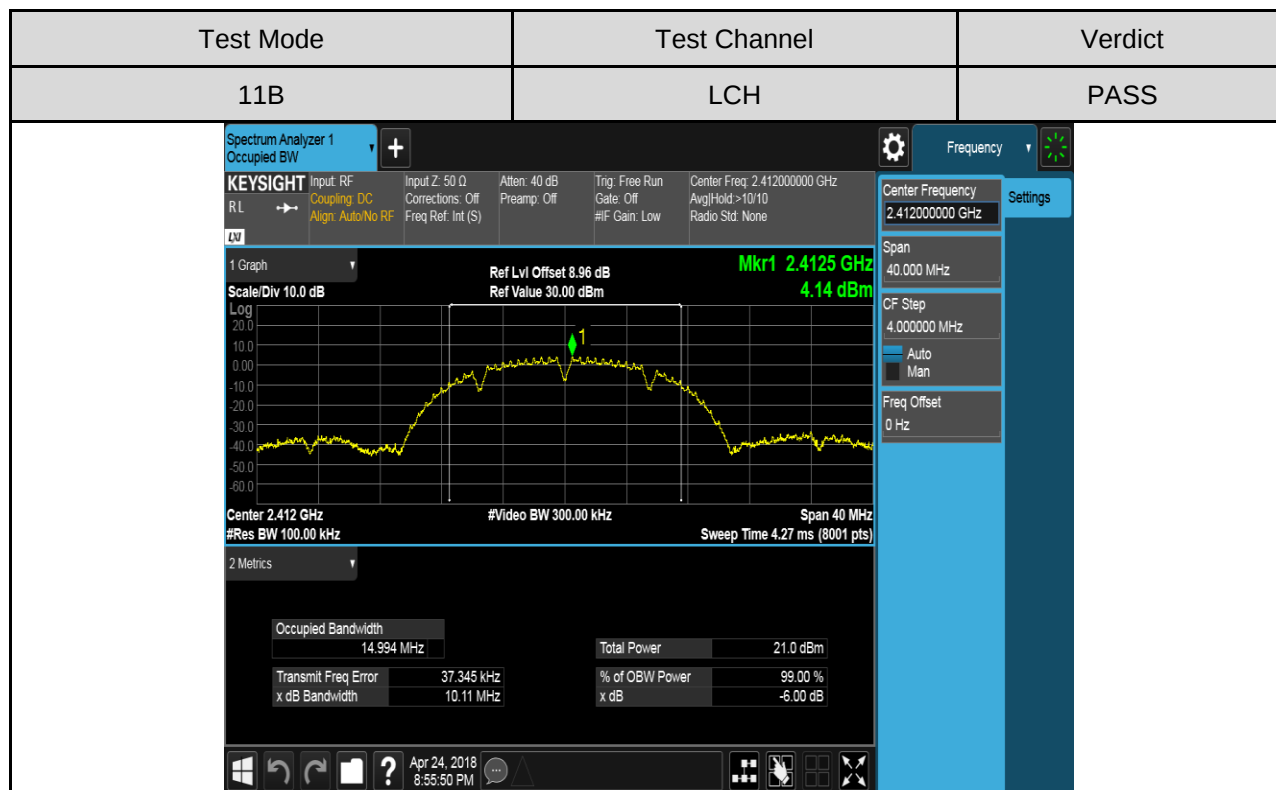
Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

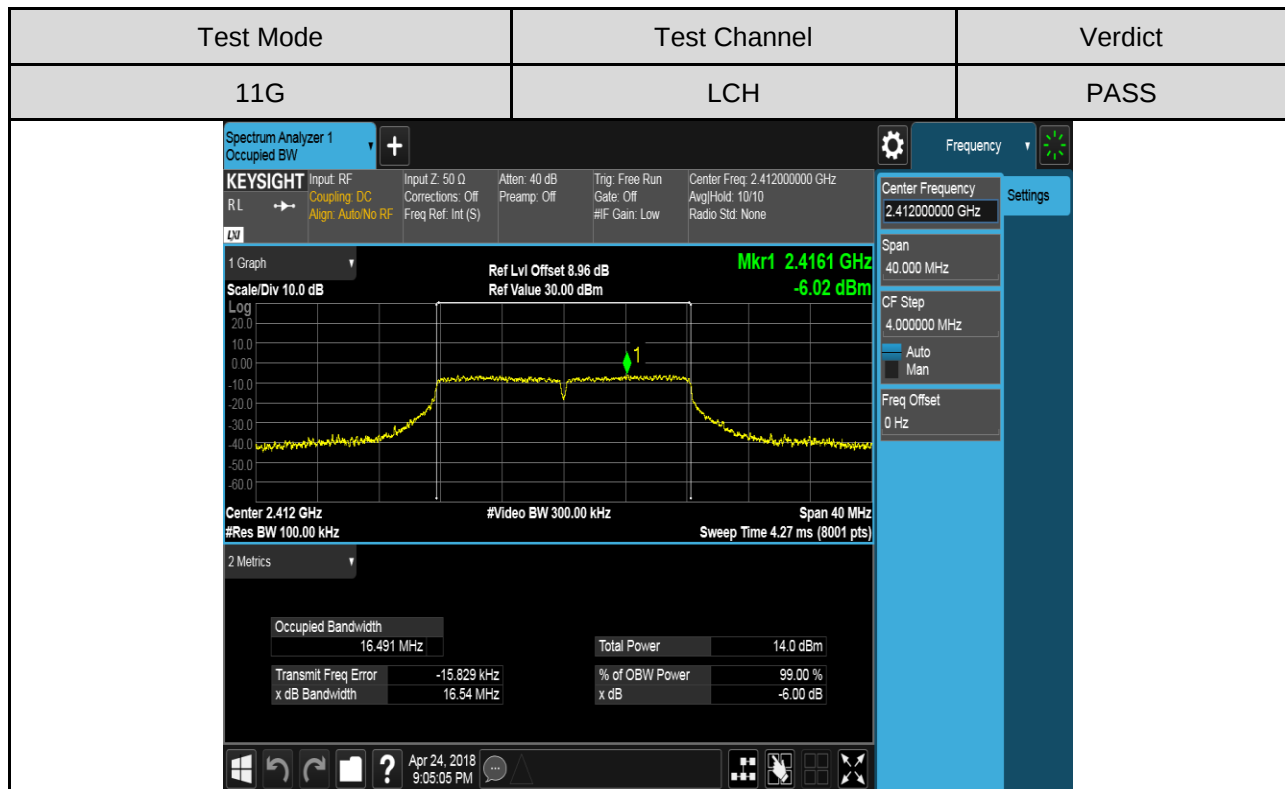
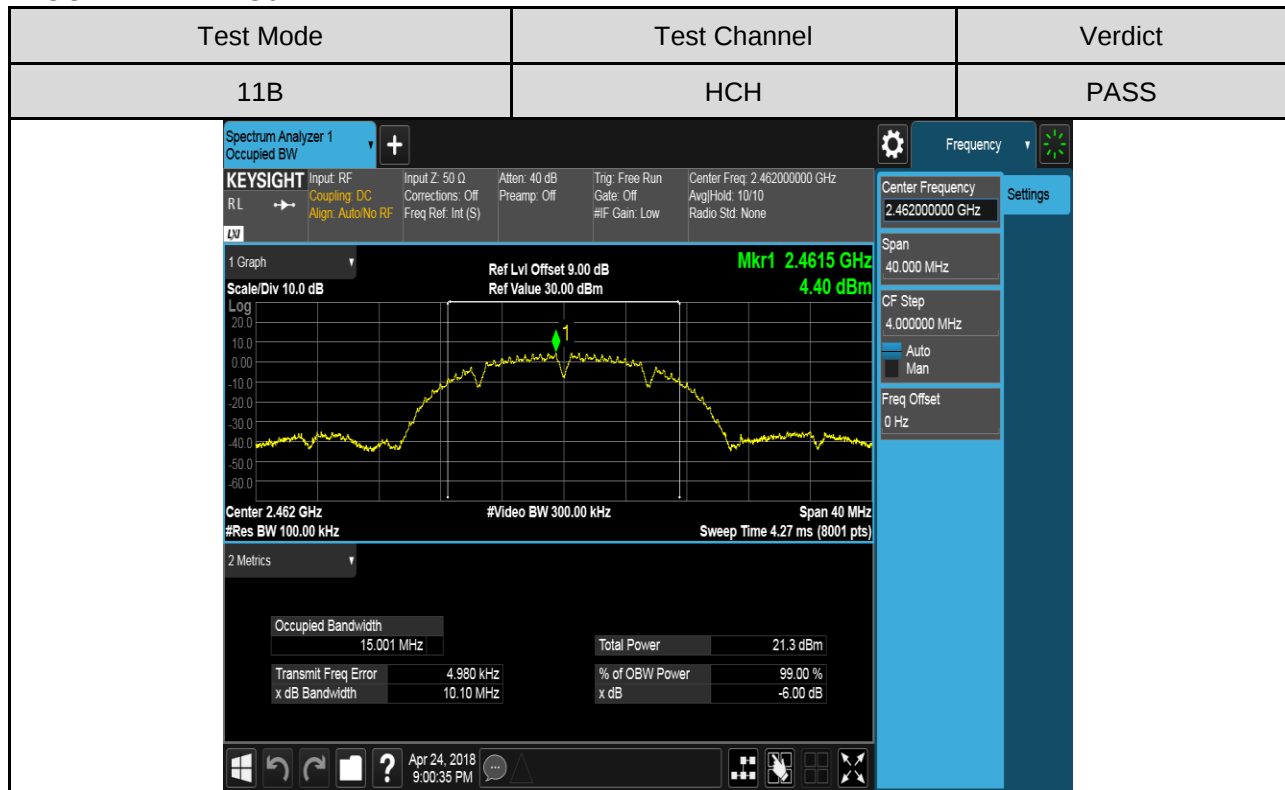
TEST SETUP

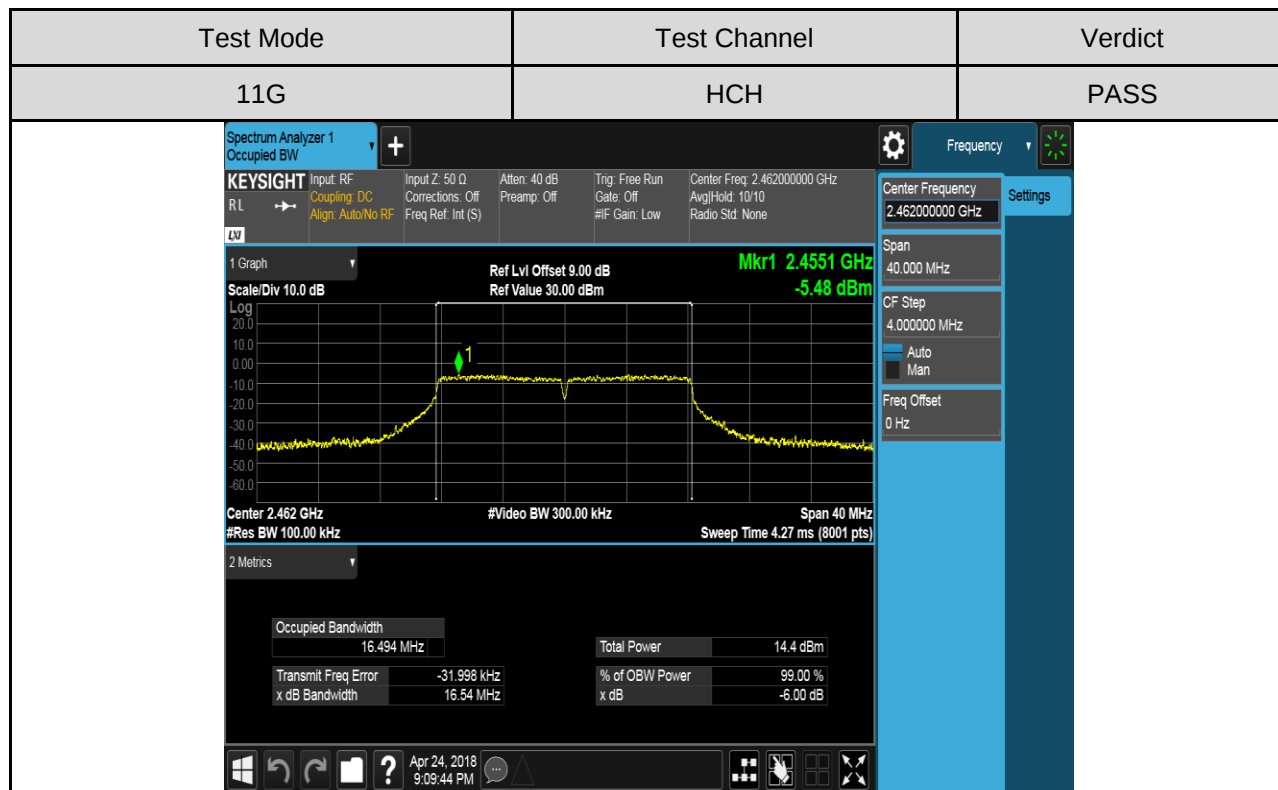
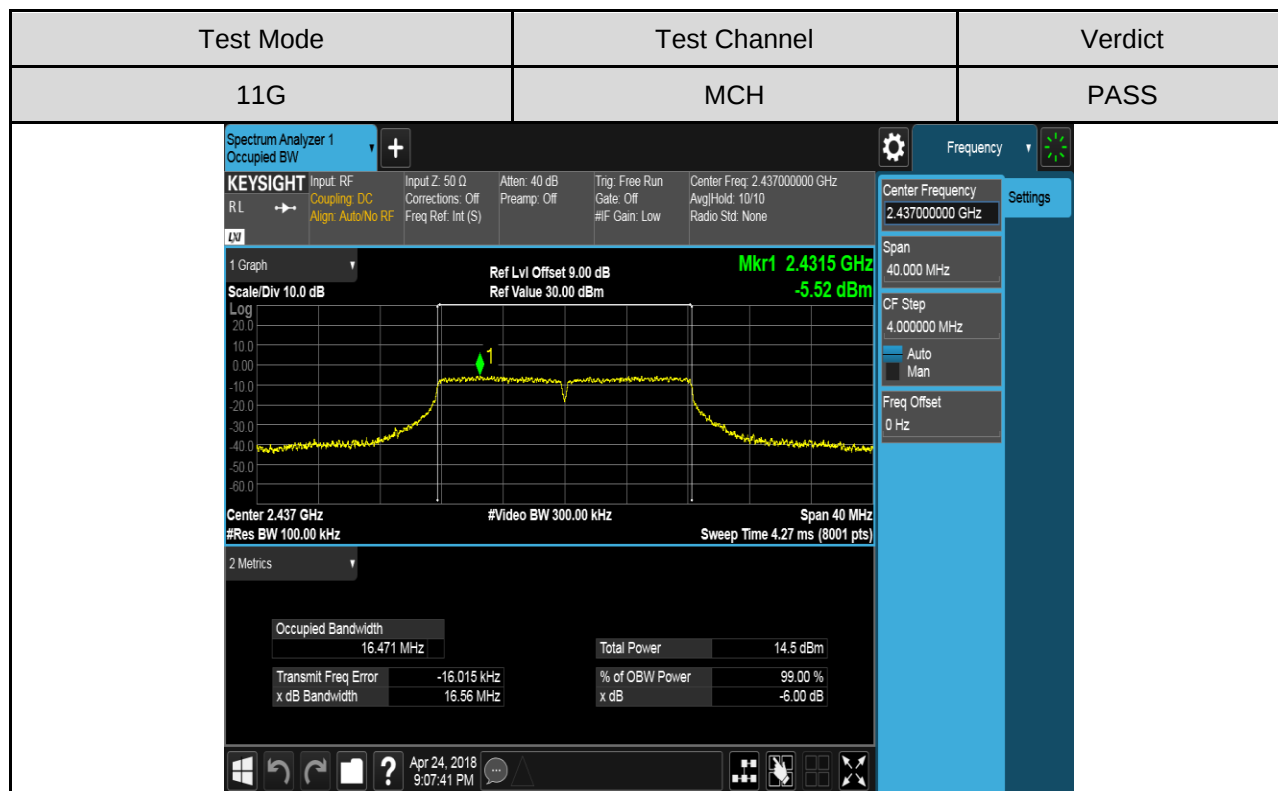
RESULTS

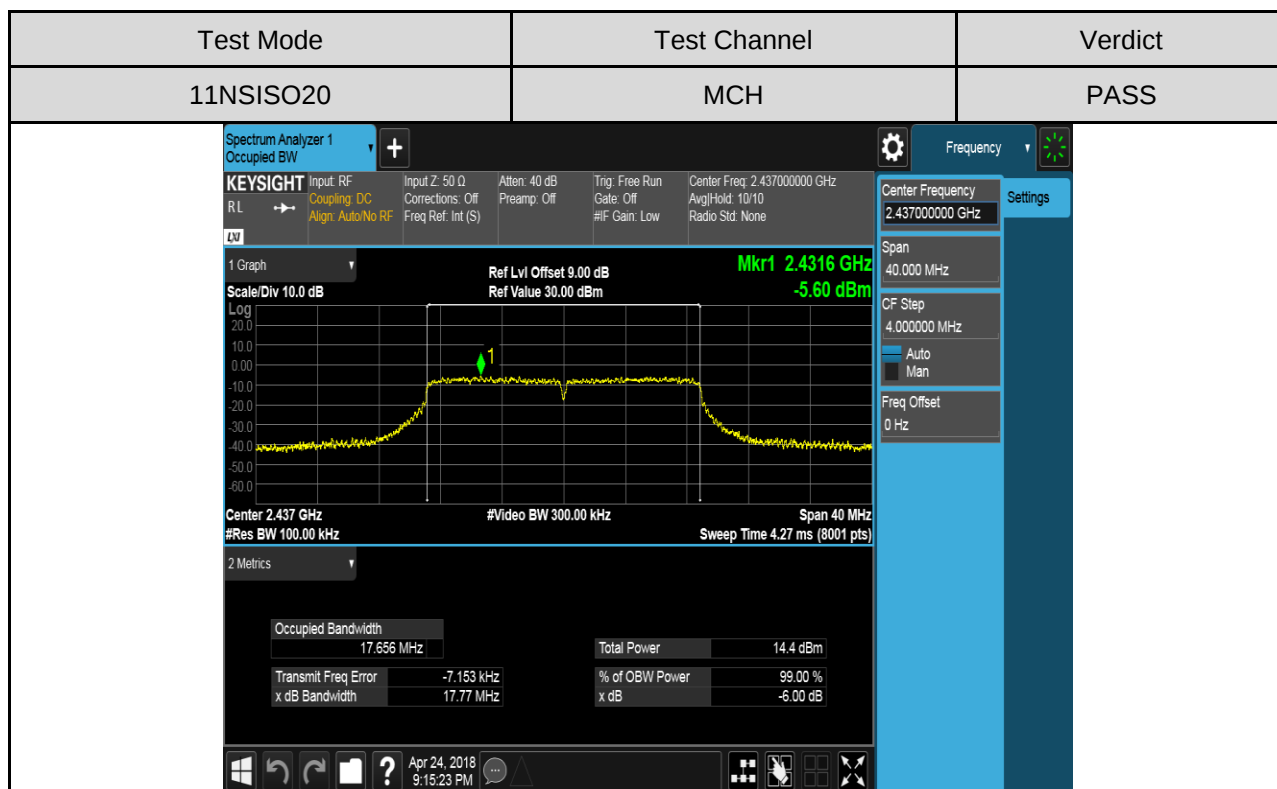
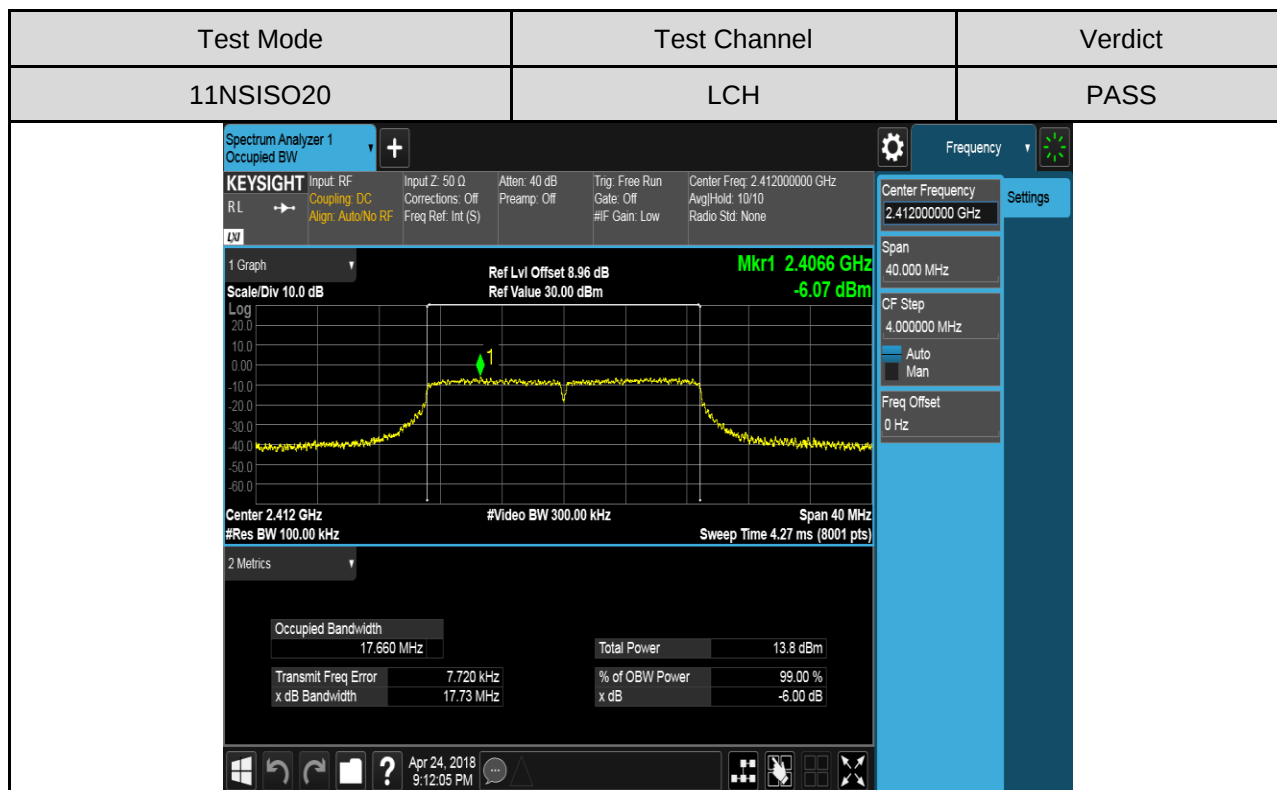
Test Mode	Test Channel	6dB bandwidth (MHz)	Result
11B	LCH	10.11	Pass
	MCH	10.11	Pass
	HCH	10.10	Pass
11G	LCH	16.54	Pass
	MCH	16.56	Pass
	HCH	16.54	Pass
11N20SISO	LCH	17.73	Pass
	MCH	17.77	Pass
	HCH	17.75	Pass
11N40SISO	LCH	36.43	Pass
	MCH	36.43	Pass
	HCH	36.44	Pass

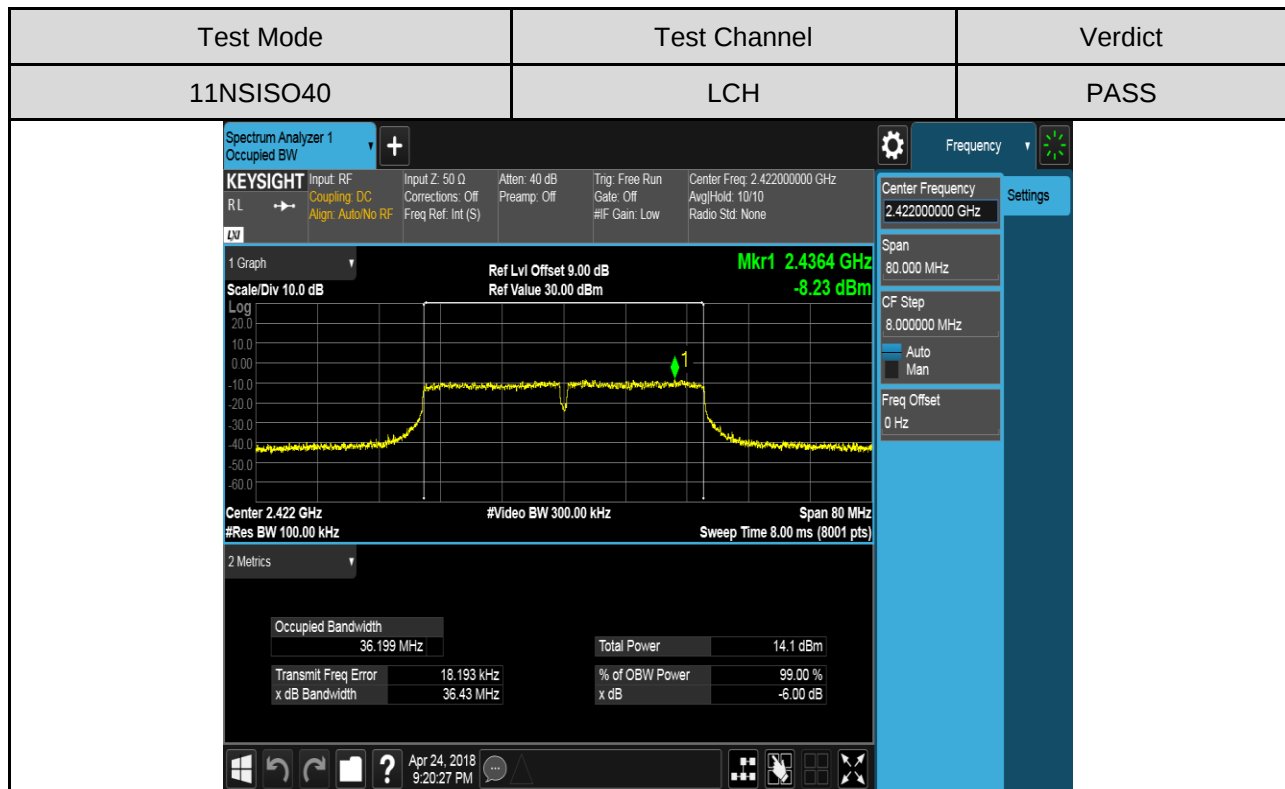
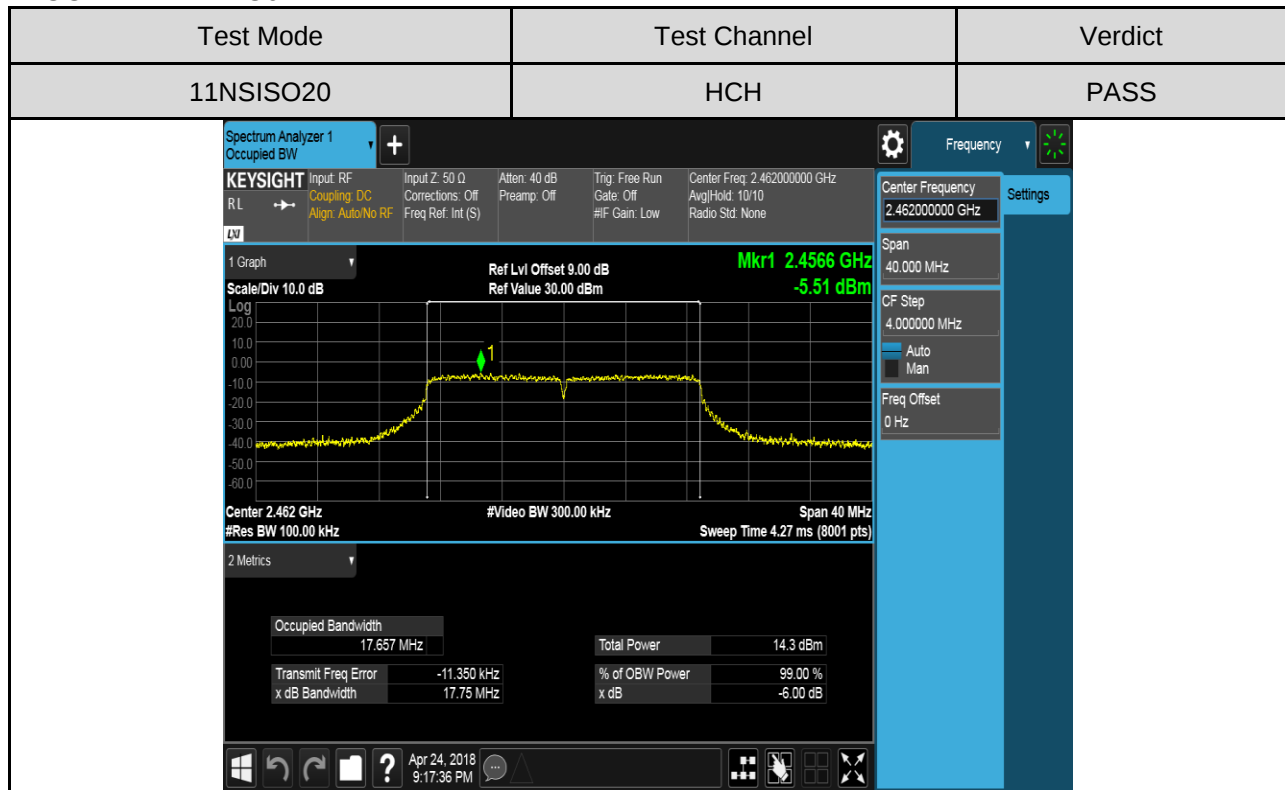
Test Graphs

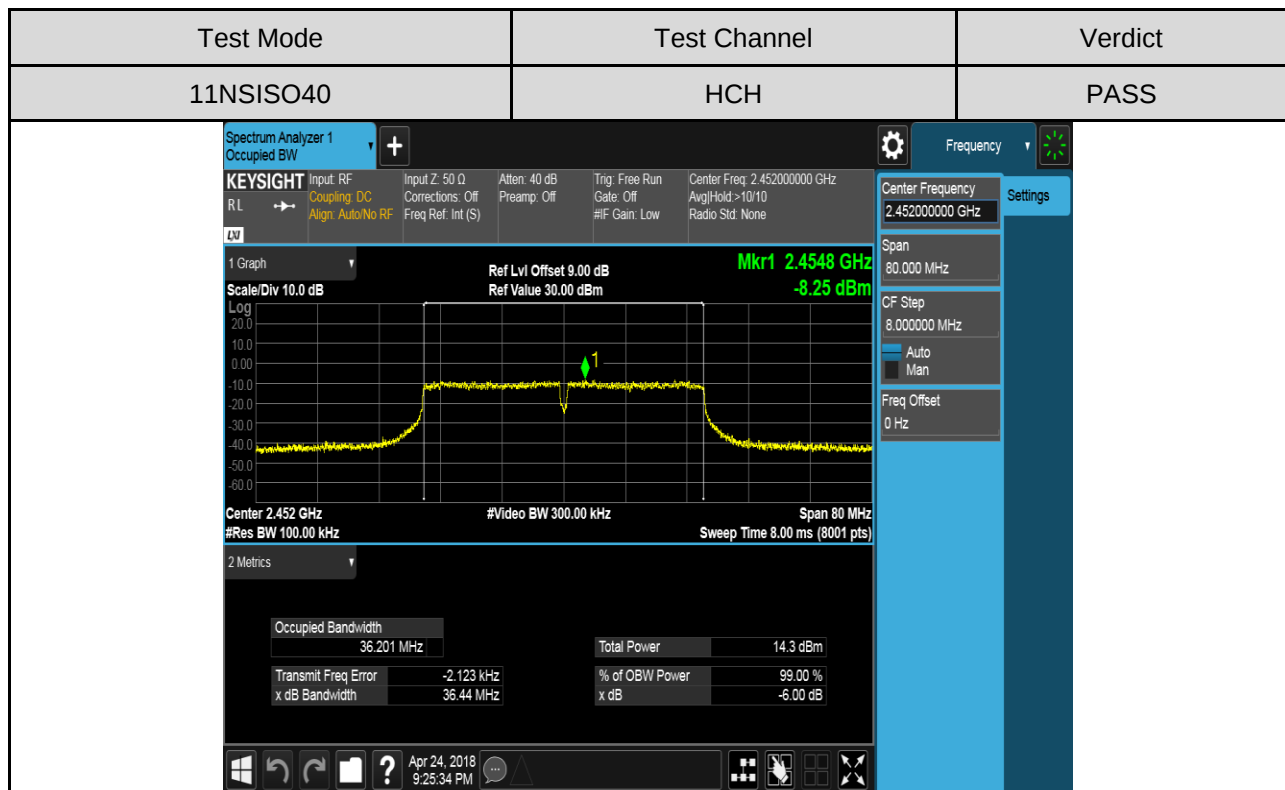
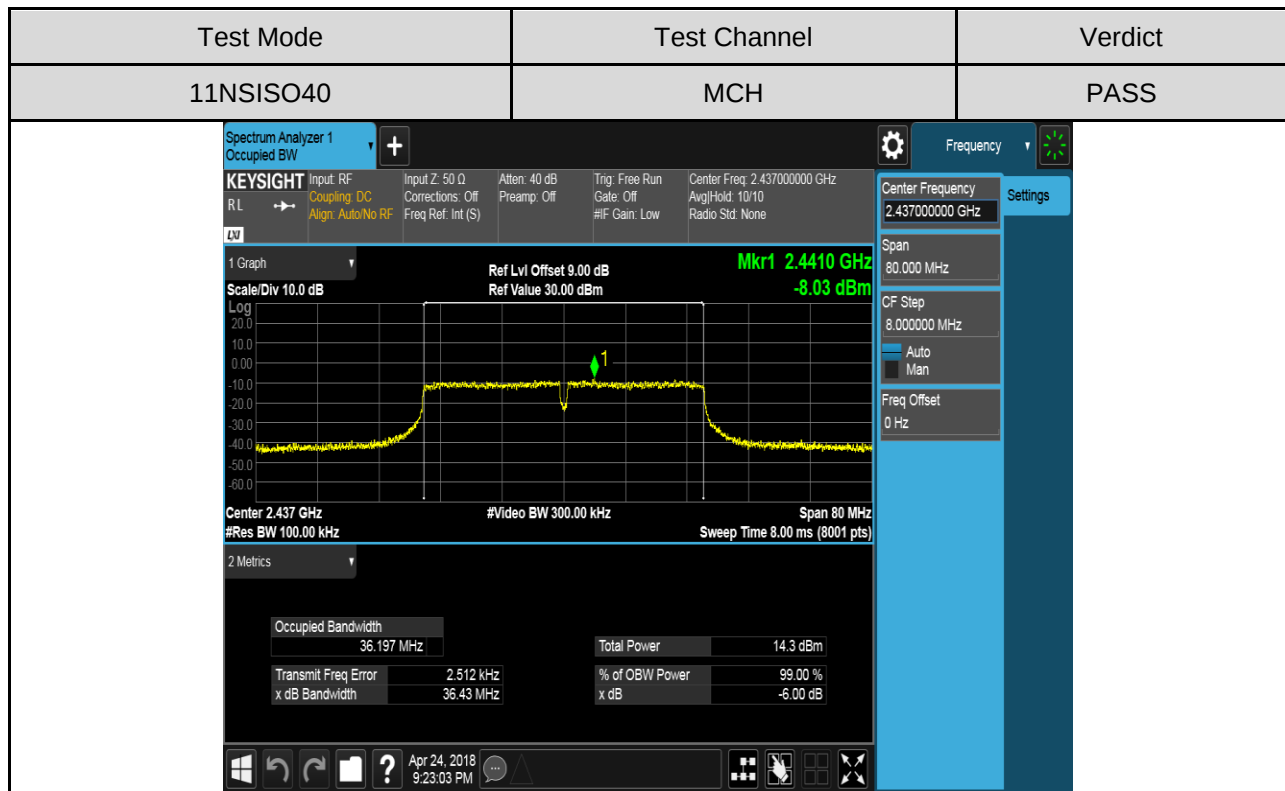












6.3. PEAK CONDUCTED OUTPUT POWER

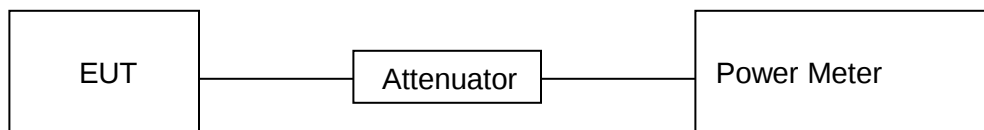
LIMITS

FCC Part15 (15.247) , Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(b)(3)	Peak Output Power	1 watt or 30dBm	2400-2483.5

TEST PROCEDURE

Refer to FCC KDB 558074

TEST SETUP



RESULTS

1) Maximum Peak Conducted Output Power(dBm)

Test Mode	Test Channel	Maximum Peak Conducted Output Power(dBm)	EIRP (dBm)	Result
11B	LCH	16.83	18.51	Pass
	MCH	17.36	19.04	Pass
	HCH	17.18	18.86	Pass
11G	LCH	14.76	16.44	Pass
	MCH	15.29	16.97	Pass
	HCH	15.15	16.83	Pass
11N20SISO	LCH	14.84	16.52	Pass
	MCH	15.48	17.16	Pass
	HCH	15.32	17.00	Pass
11N40SISO	LCH	15.12	16.80	Pass
	MCH	15.37	17.05	Pass
	HCH	15.36	17.04	Pass

2) Maximum Average Conducted Output Power(dBm)

Test Mode	Test Channel	Maximum Peak Conducted Output Power(dBm)	EIRP (dBm)	Result
11B	LCH	13.78	15.46	Pass
	MCH	14.37	16.05	Pass
	HCH	14.45	16.13	Pass
11G	LCH	7.46	9.14	Pass
	MCH	7.93	9.61	Pass
	HCH	7.42	9.10	Pass
11N20SISO	LCH	7.49	9.17	Pass
	MCH	8.11	9.79	Pass
	HCH	7.96	9.64	Pass
11N40SISO	LCH	6.91	8.59	Pass
	MCH	7.08	8.76	Pass
	HCH	7.14	8.82	Pass

6.4. POWER SPECTRAL DENSITY

LIMITS

FCC Part15 (15.247) , Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
FCC §15.247 (e)	Power Spectral Density	8 dBm in any 3 kHz band	2400-2483.5

TEST PROCEDURE

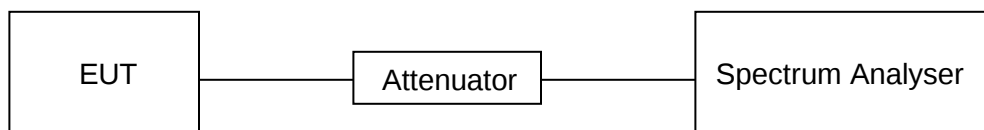
Refer to FCC KDB 558074, connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	$3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
VBW	$\geq 3 \times \text{RBW}$
Span	$1.5 \times \text{DTS bandwidth}$
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

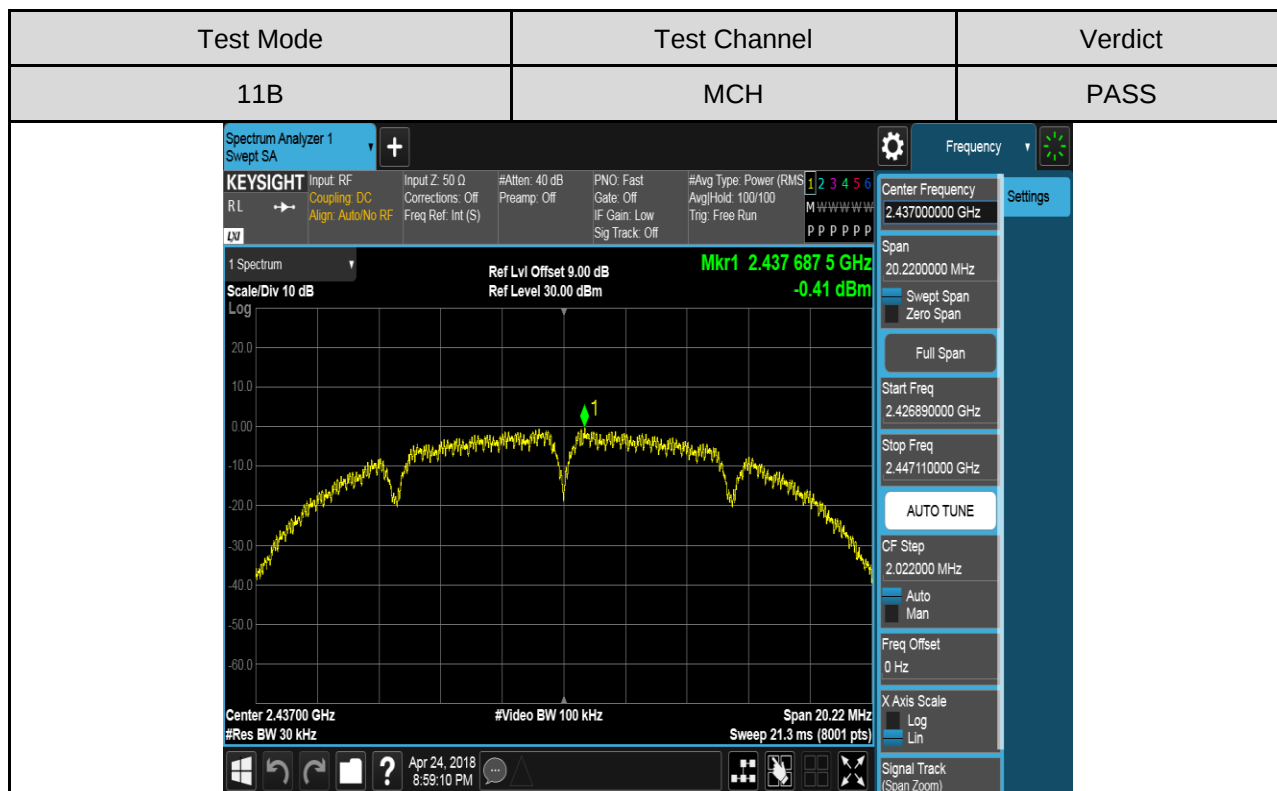
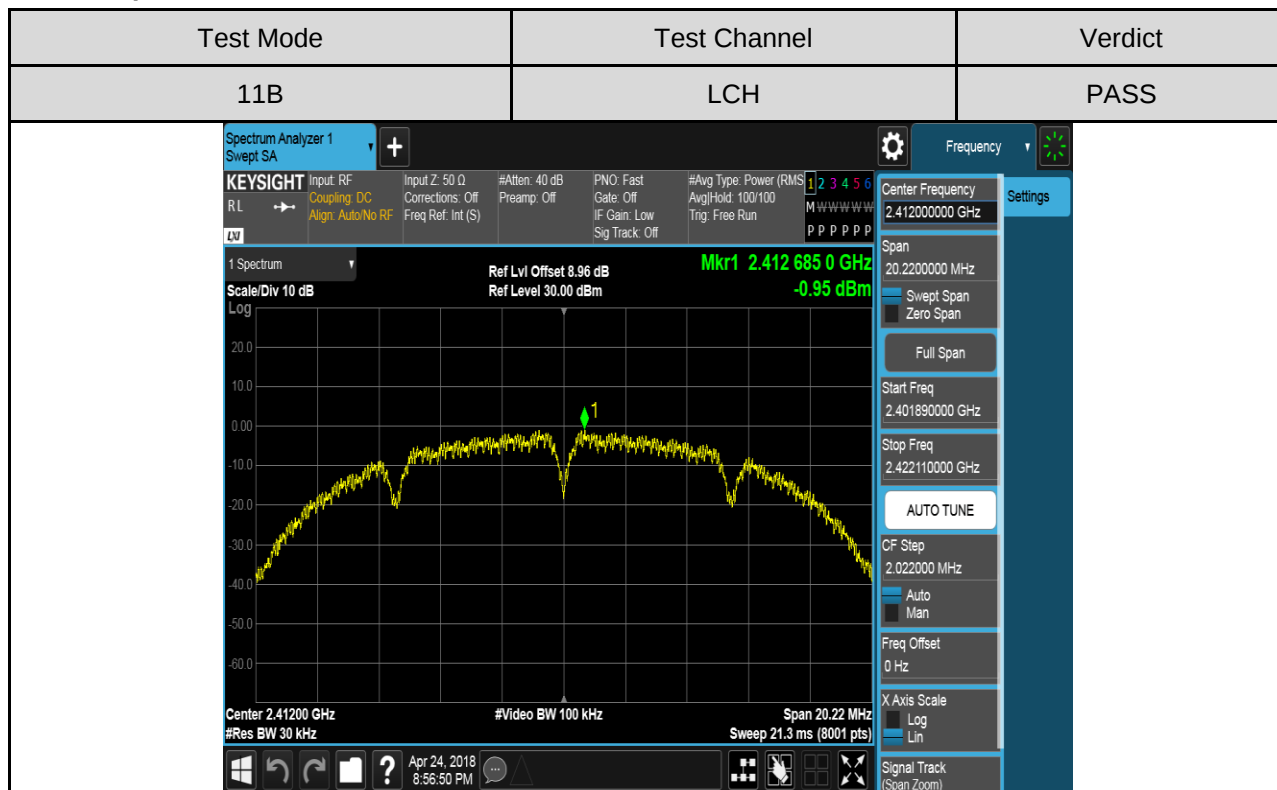
TEST SETUP

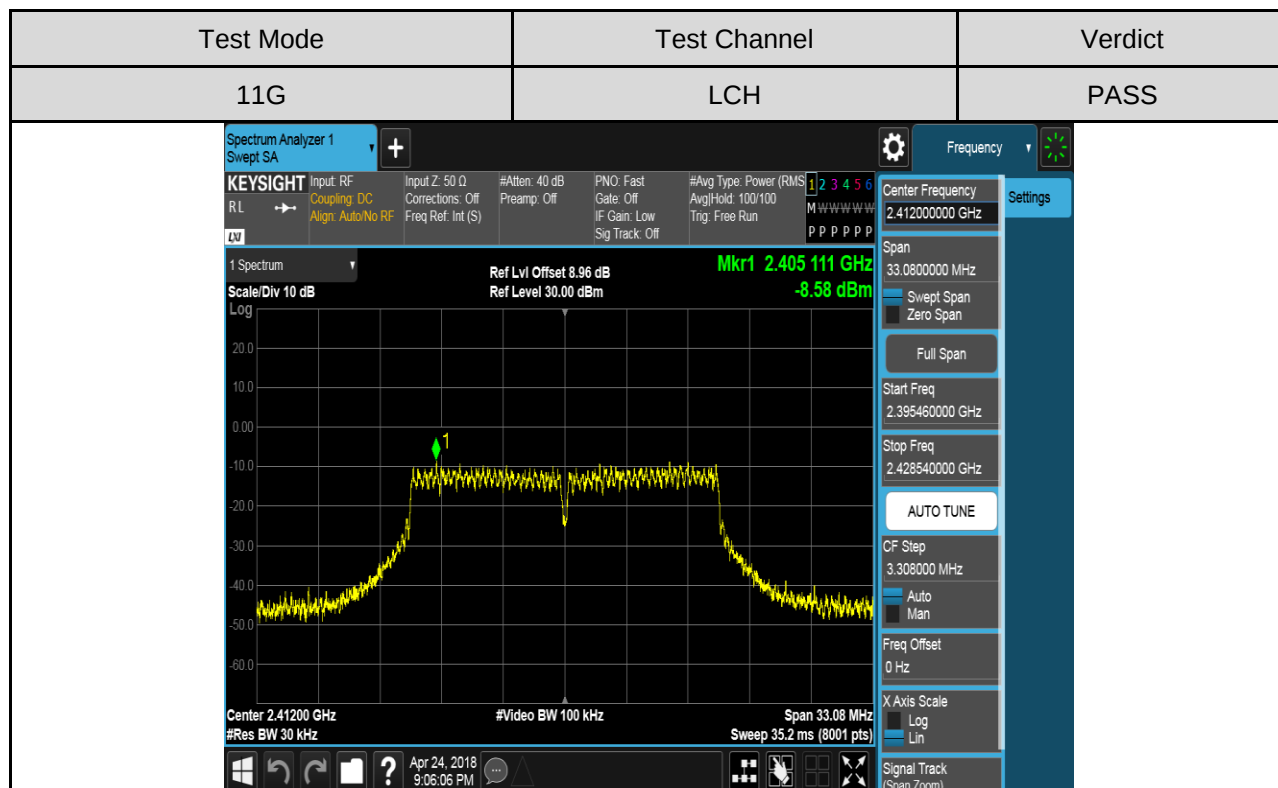
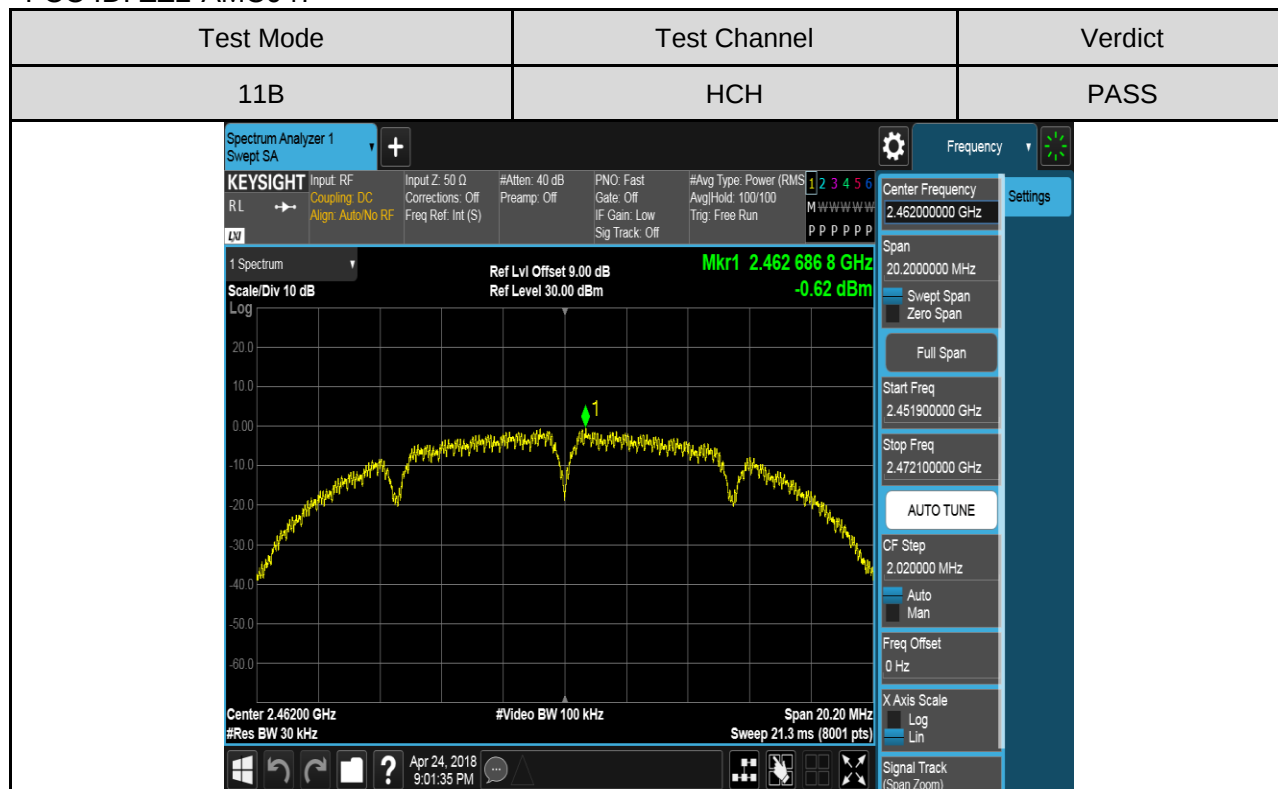


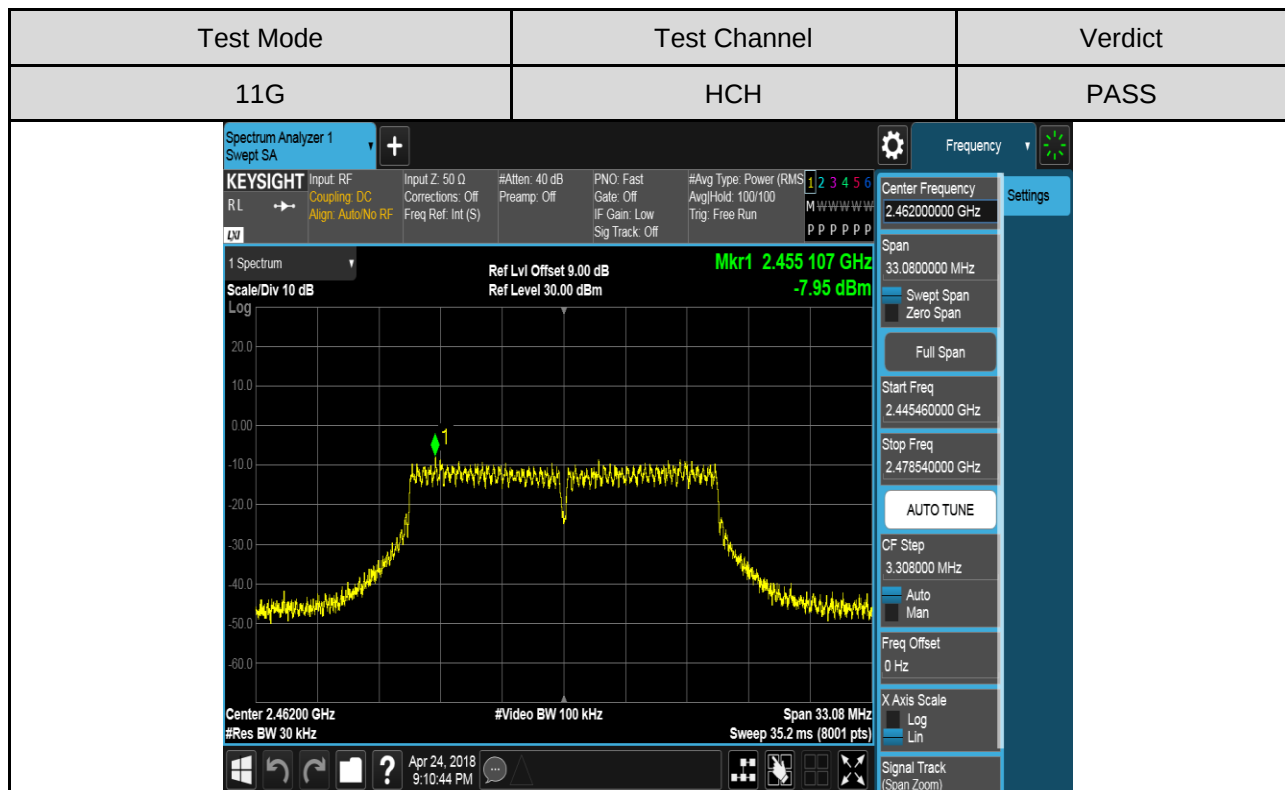
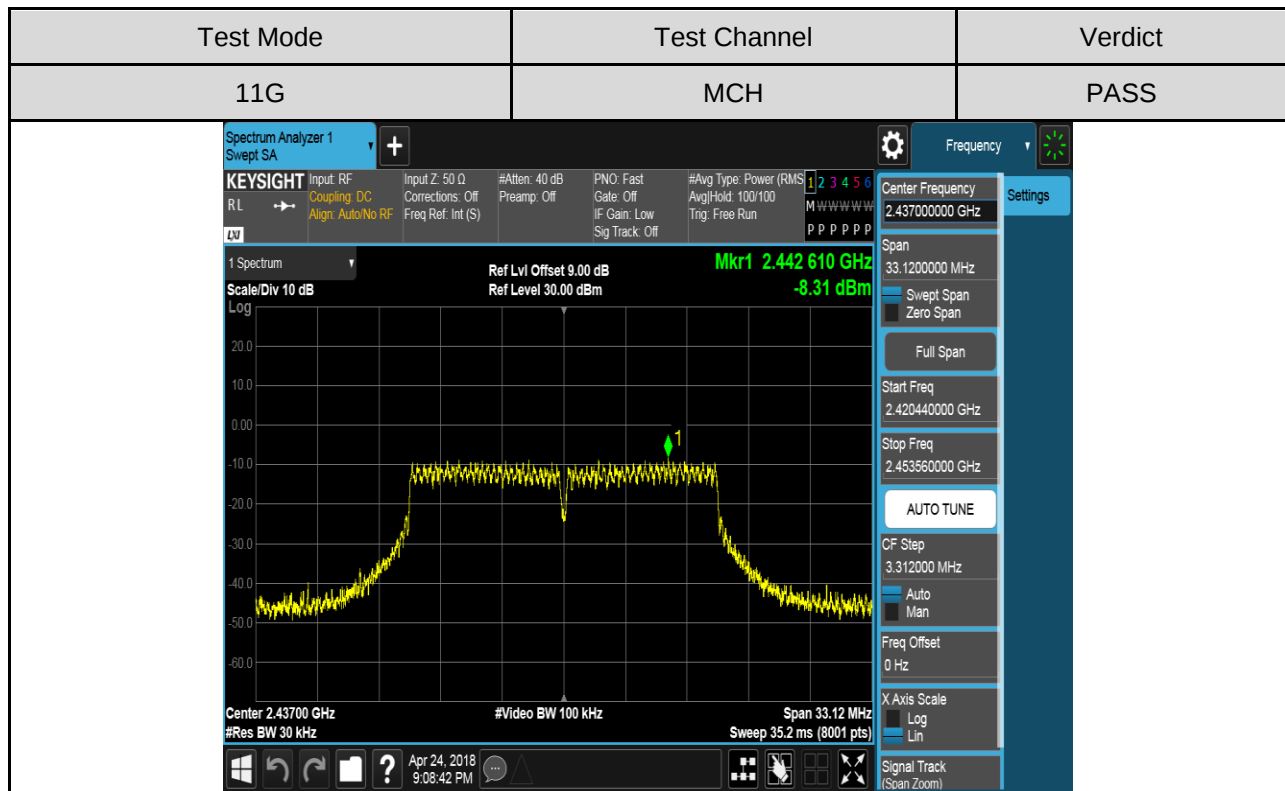
RESULTS

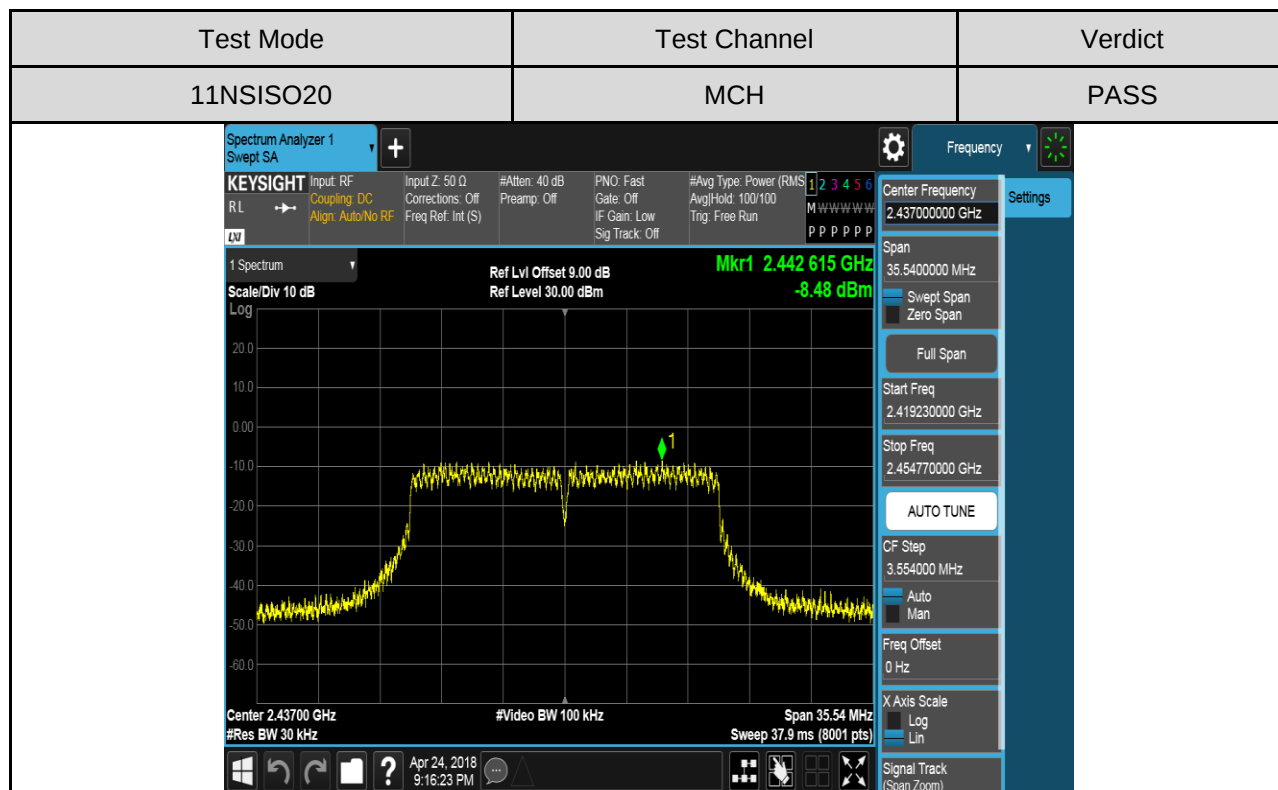
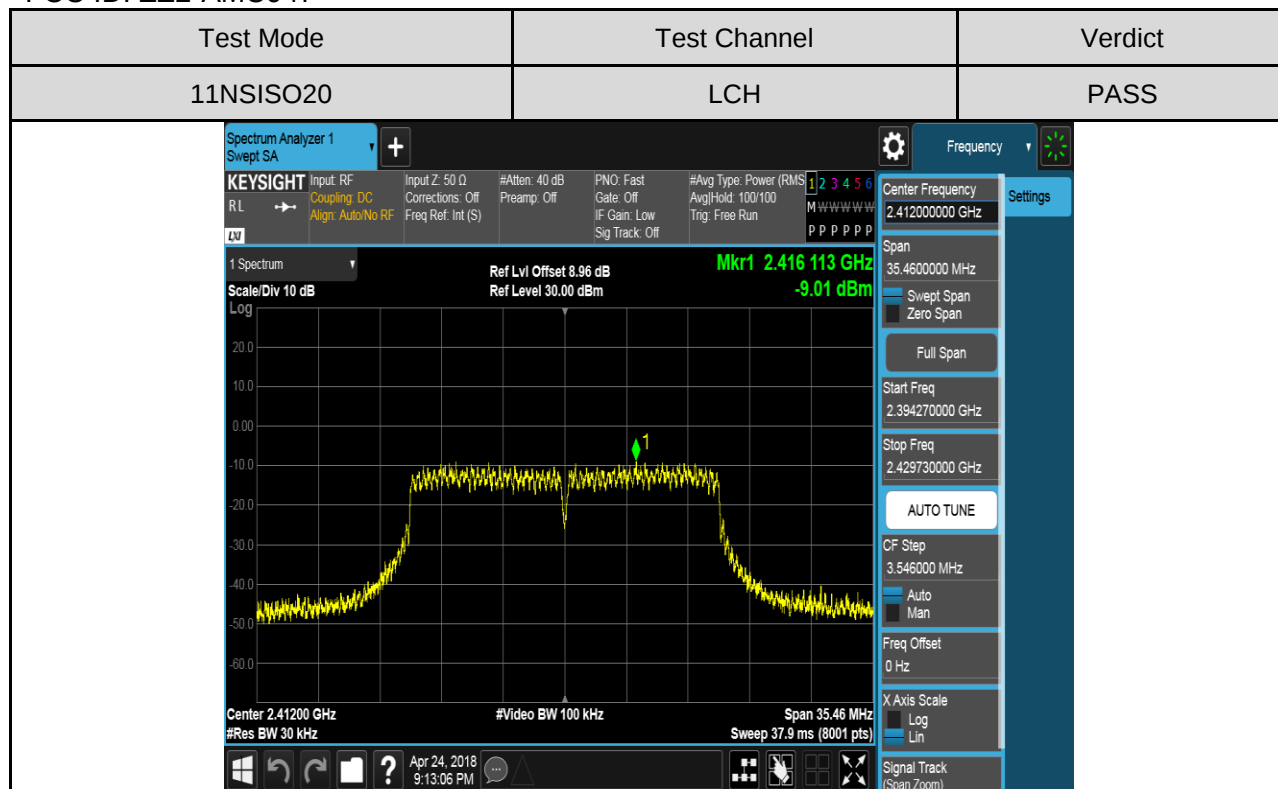
Test Mode	Test Channel	Maximum Peak power spectral density (dBm)	Result
11B	LCH	-0.947	Pass
	MCH	-0.409	Pass
	HCH	-0.62	Pass
11G	LCH	-8.579	Pass
	MCH	-8.312	Pass
	HCH	-7.954	Pass
11N20SISO	LCH	-9.005	Pass
	MCH	-8.481	Pass
	HCH	-8.696	Pass
11N40SISO	LCH	-10.85	Pass
	MCH	-10.60	Pass
	HCH	-10.42	Pass

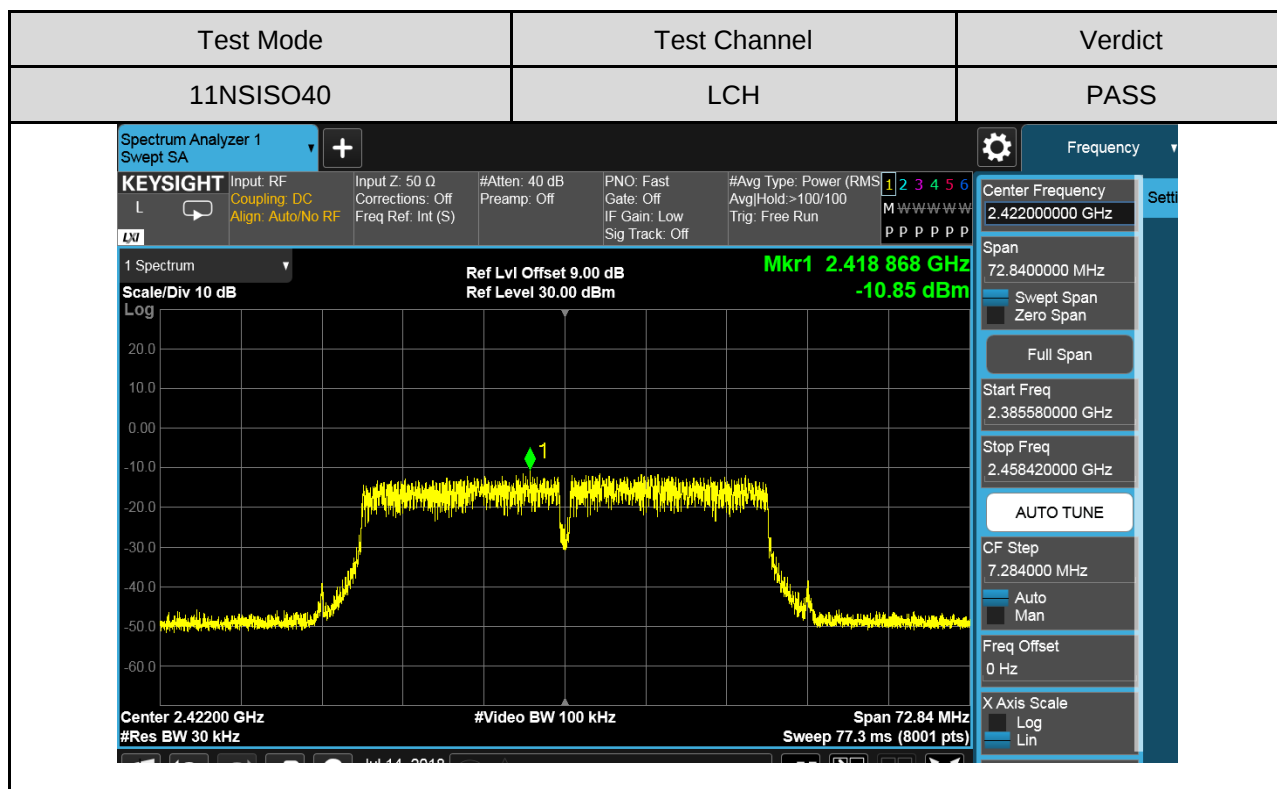
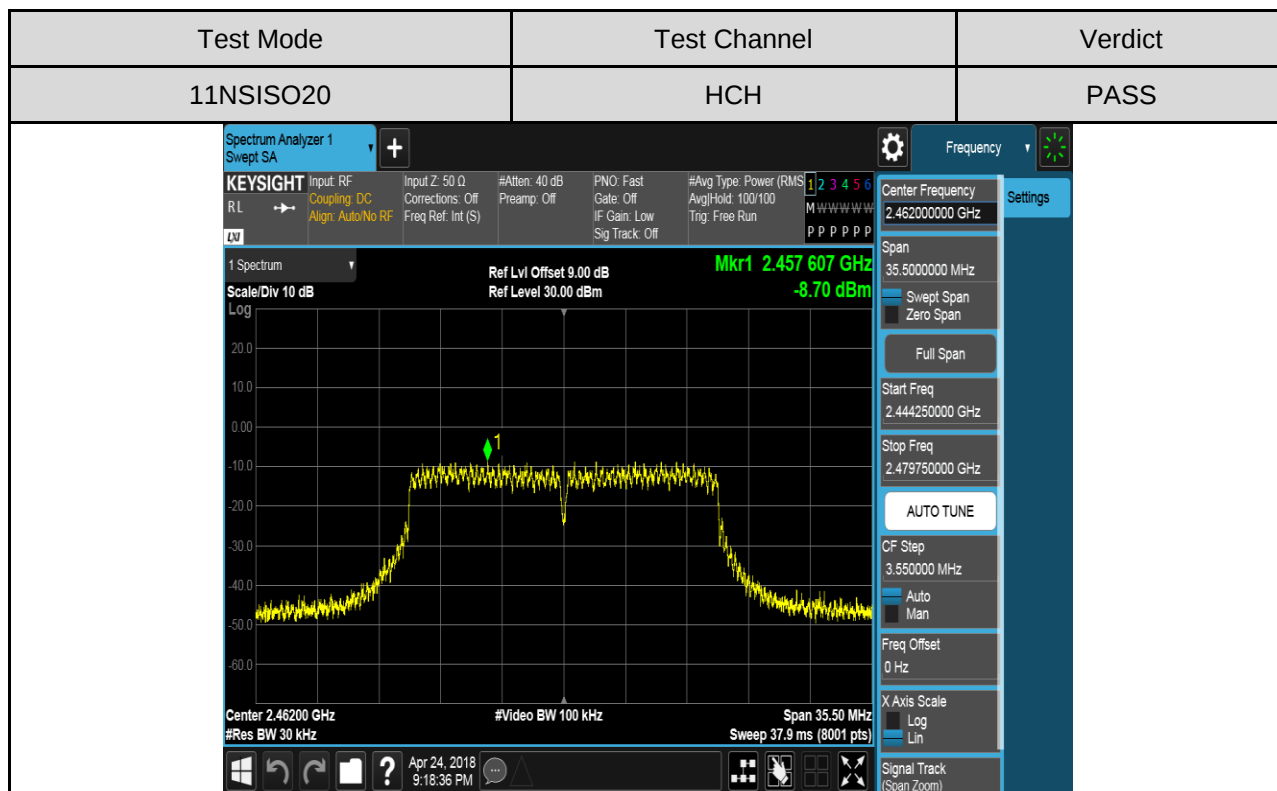
Test Graphs:

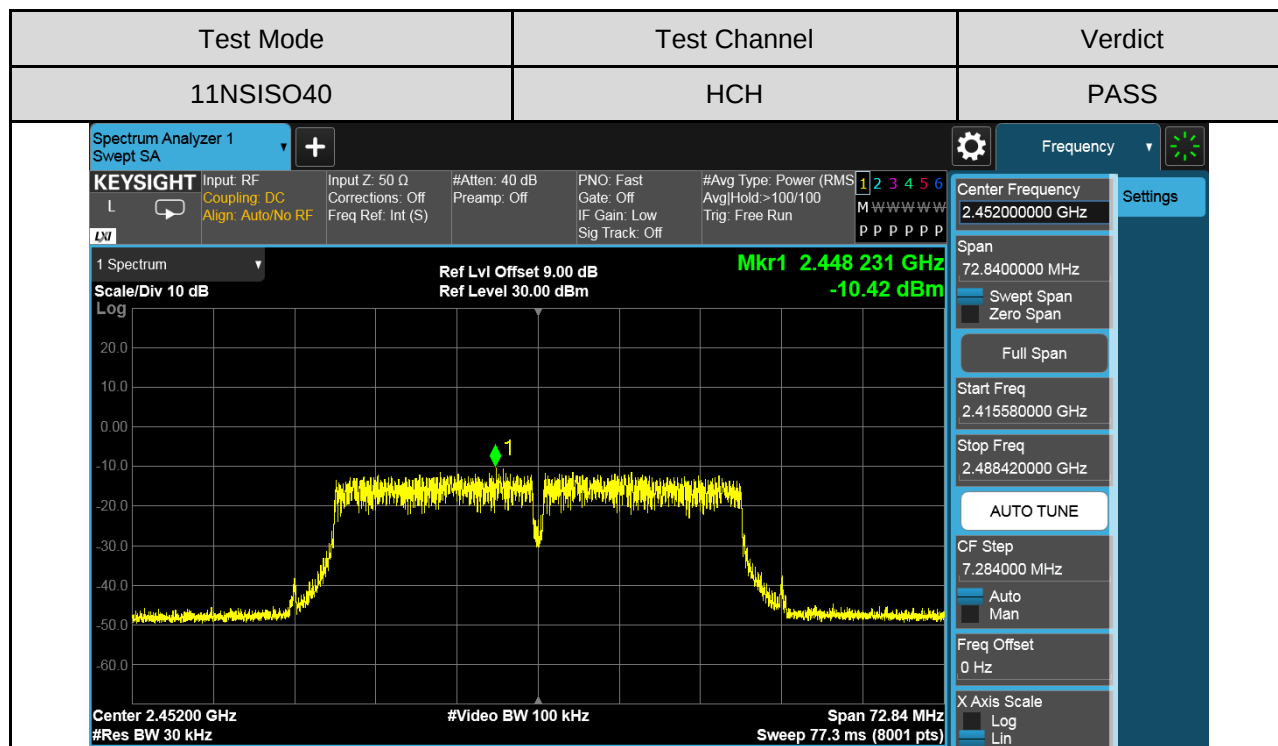
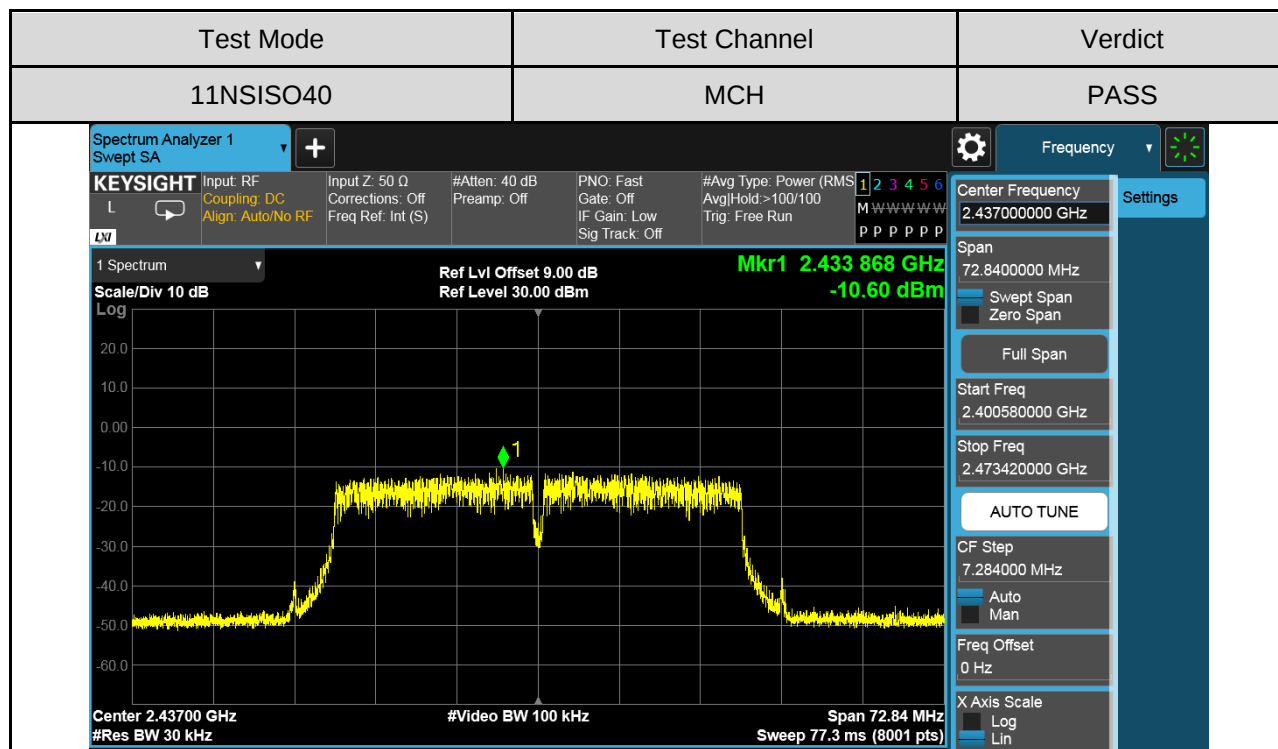












6.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

FCC Part15 (15.247) , Subpart C		
Section	Test Item	Limit
FCC §15.247 (d)	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

Refer to FCC KDB 558074, connect the UUT to the spectrum analyser and use the following

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	100K
VBW	$\geq 3 \times \text{RBW}$
Span	$1.5 \times \text{DTS bandwidth}$
Trace	Max hold
Sweep time	Auto couple.

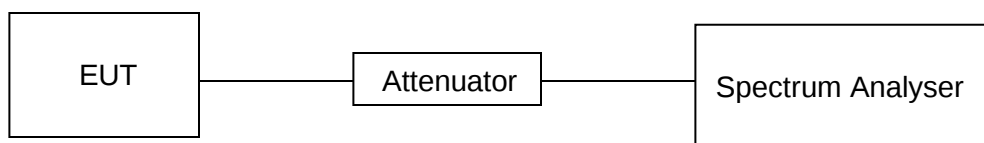
settings:

Use the peak marker function to determine the maximum PSD level.

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100K
VBW	$\geq 3 \times \text{RBW}$
measurement points	$\geq \text{span}/\text{RBW}$
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum amplitude level.

TEST SETUP

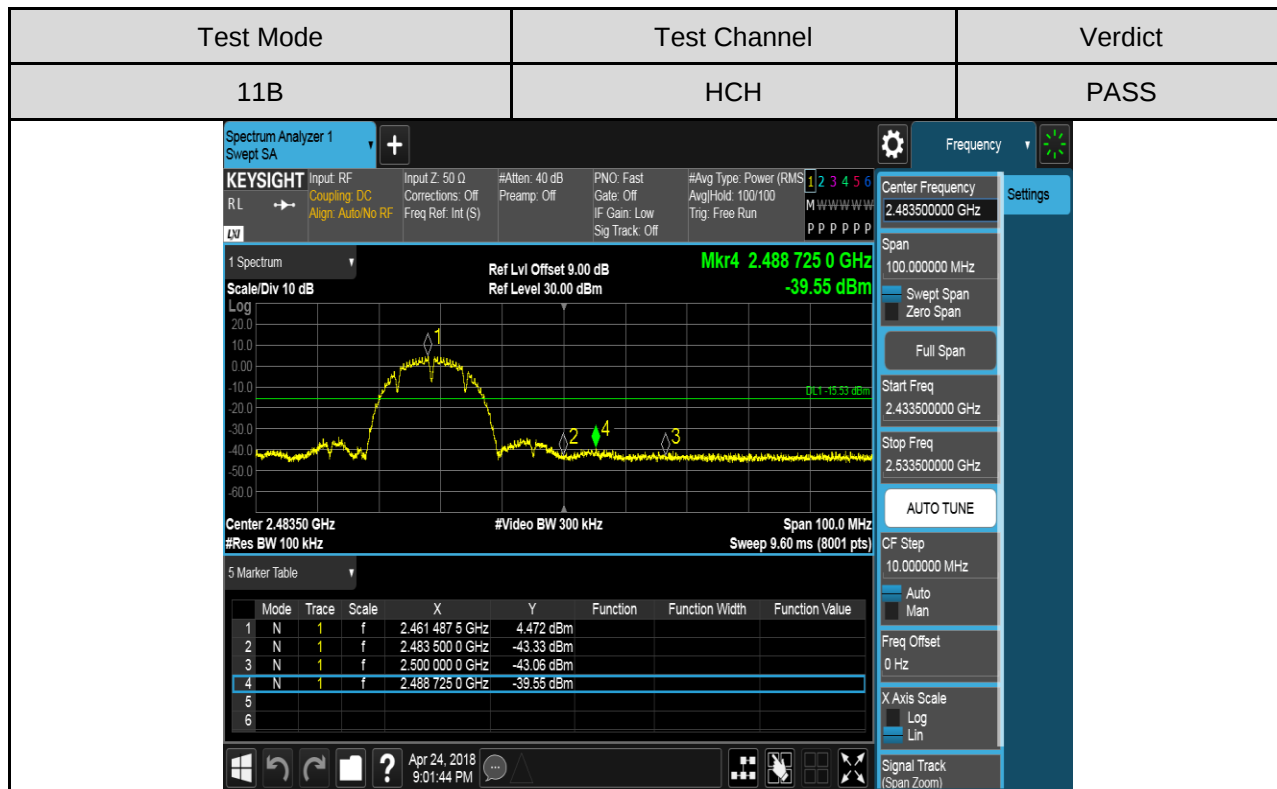
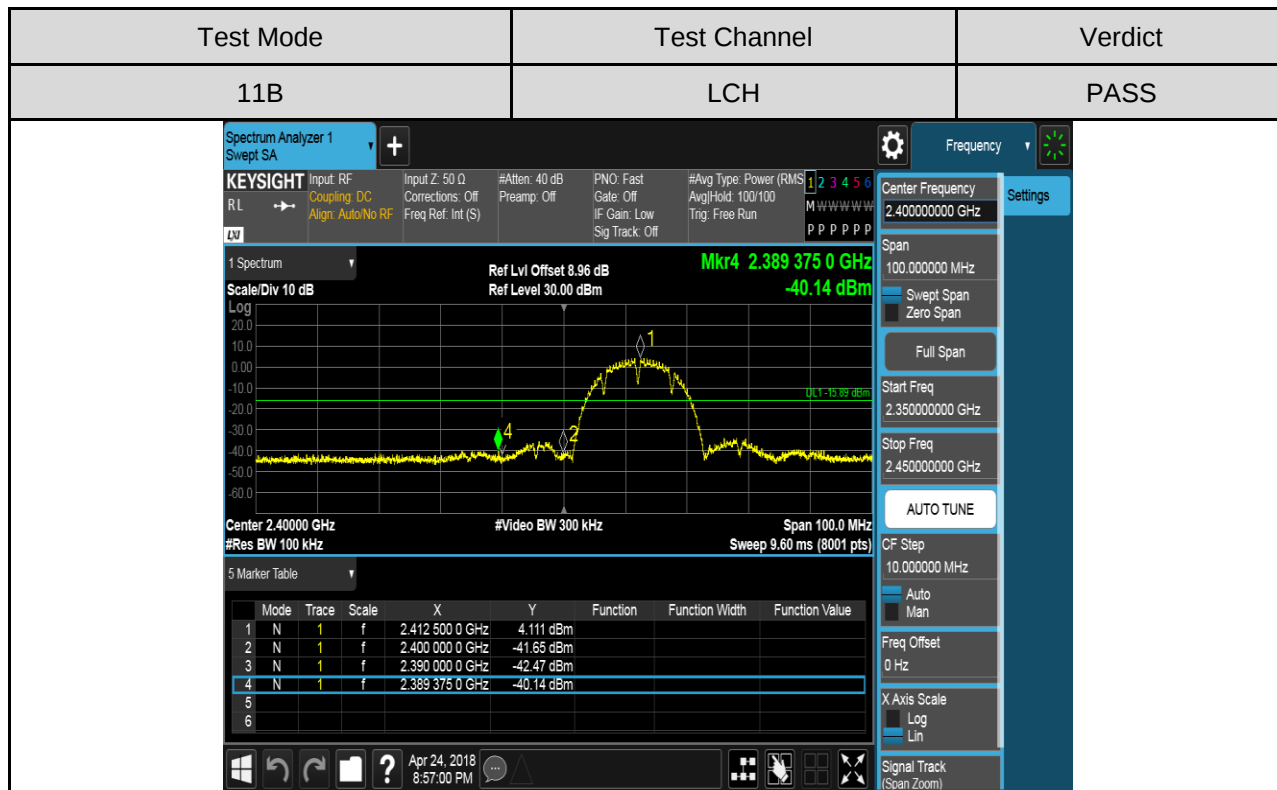


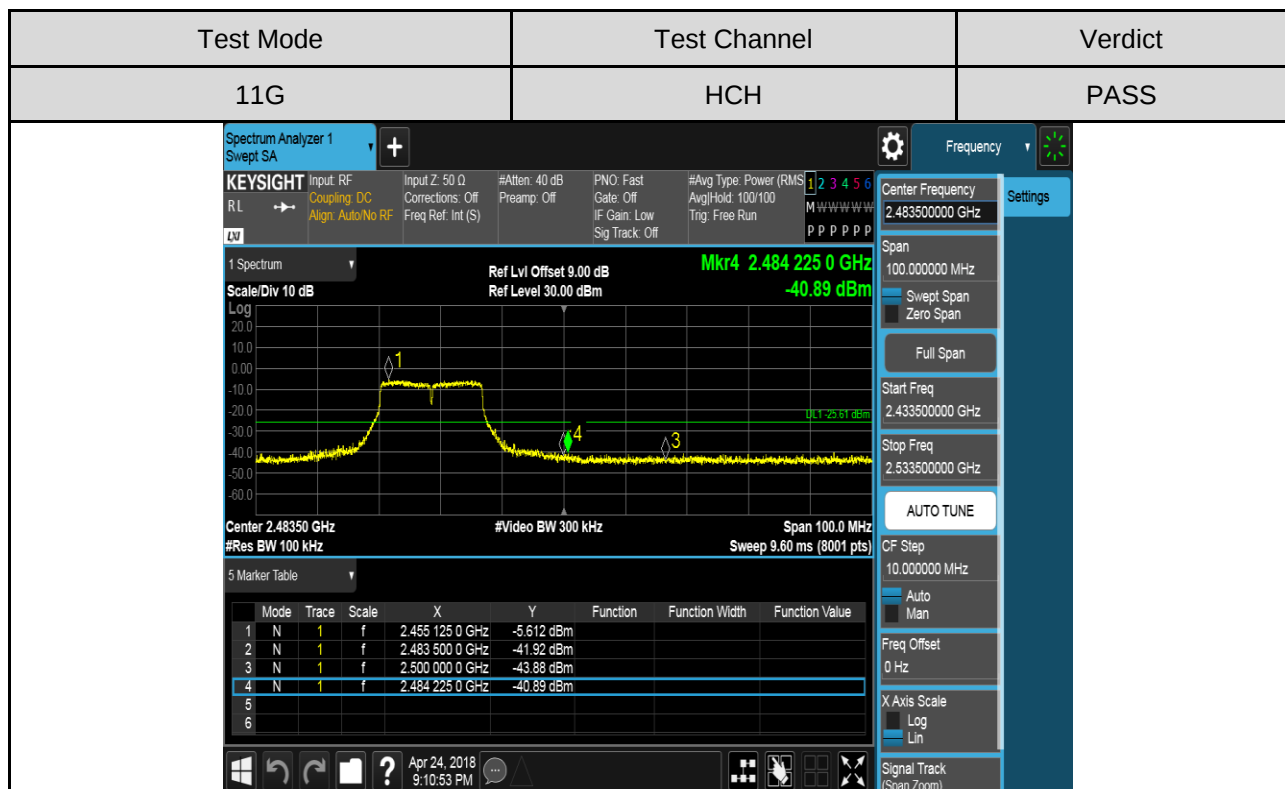
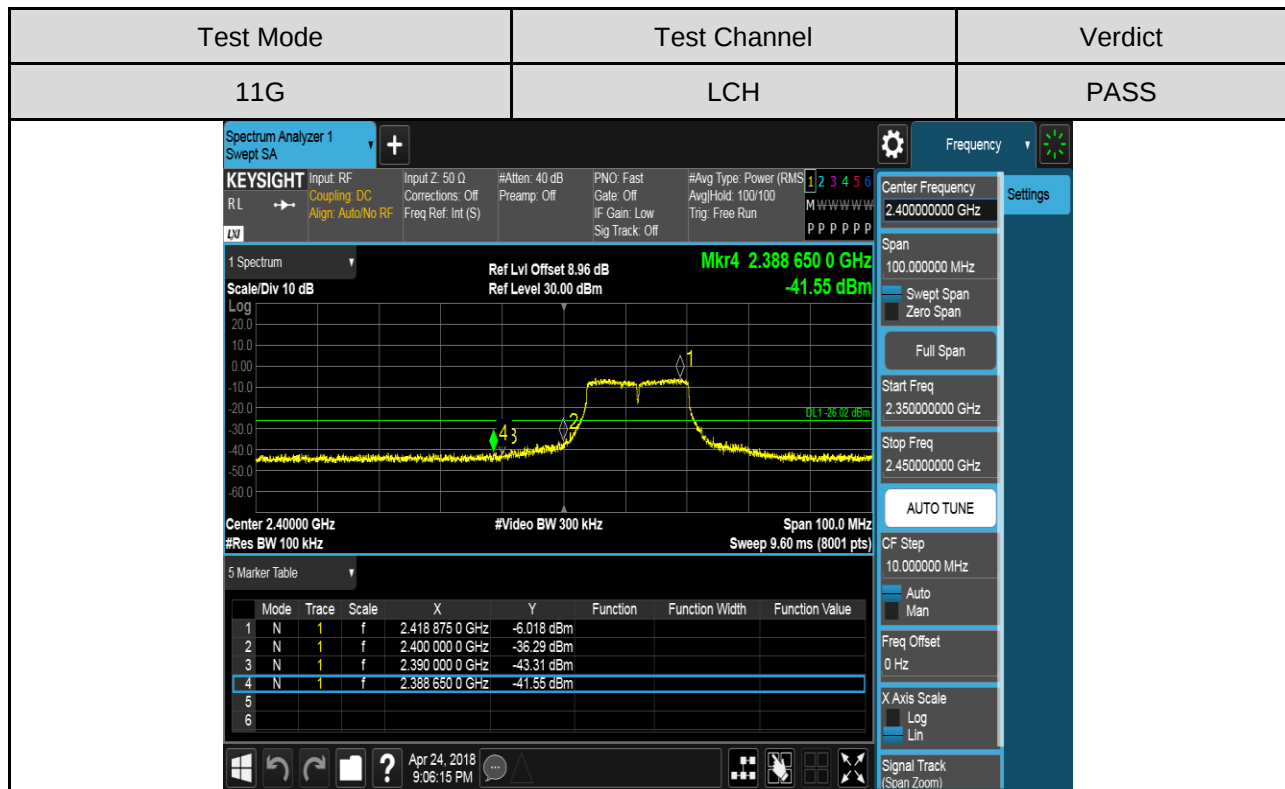
Part I :Conducted Bandedge

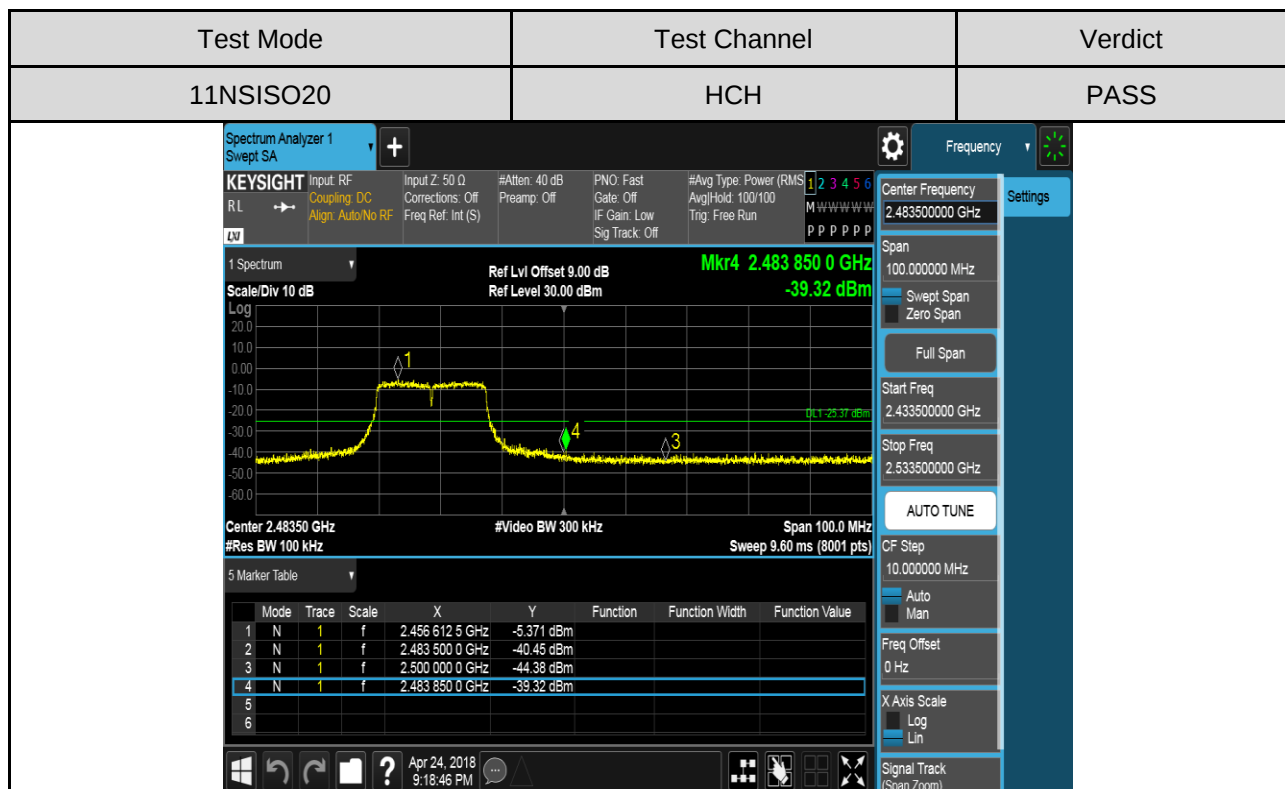
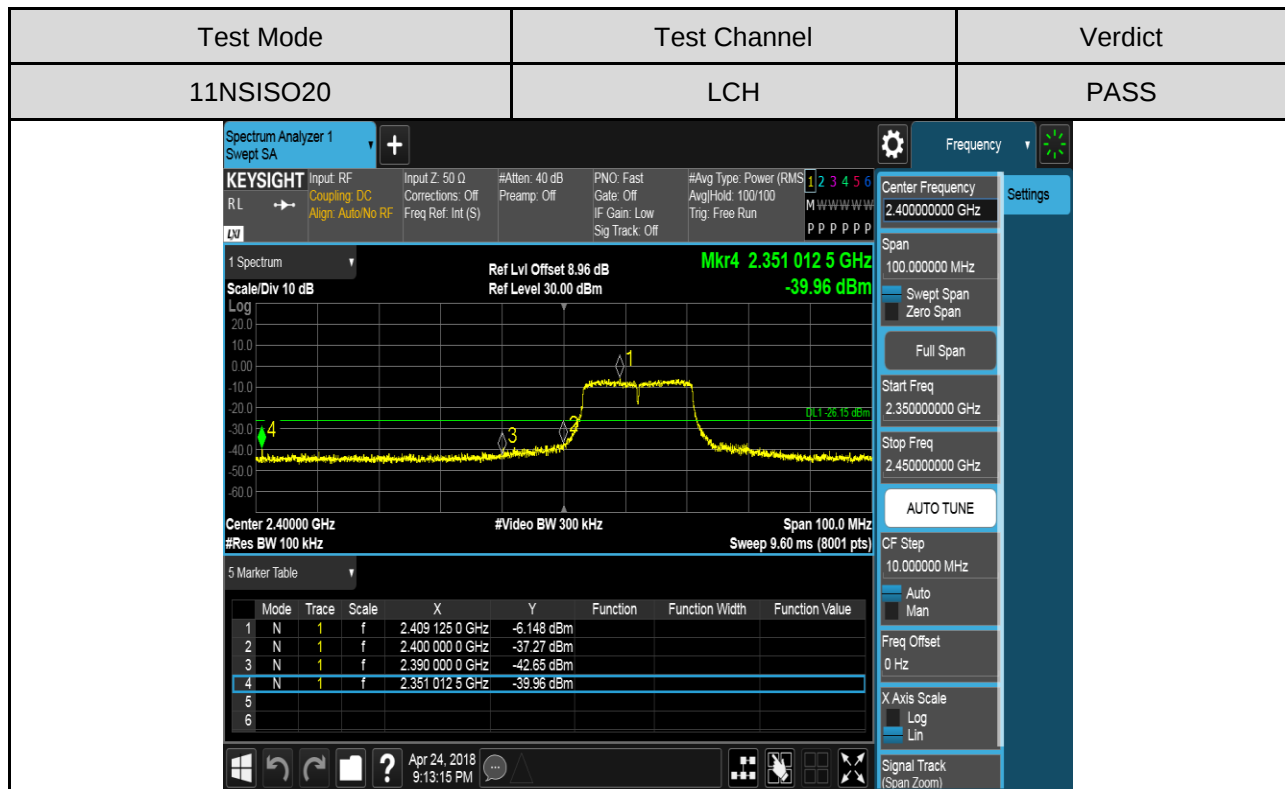
RESULTS TABLE

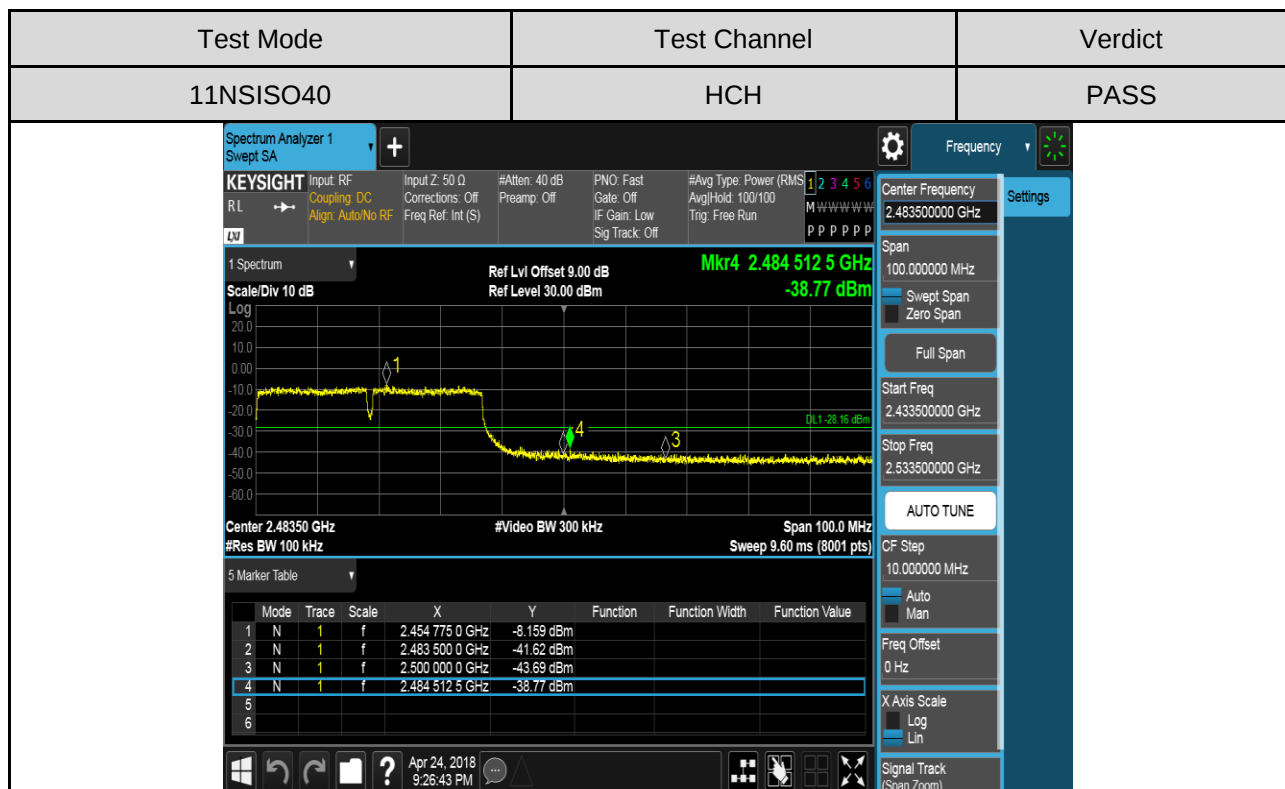
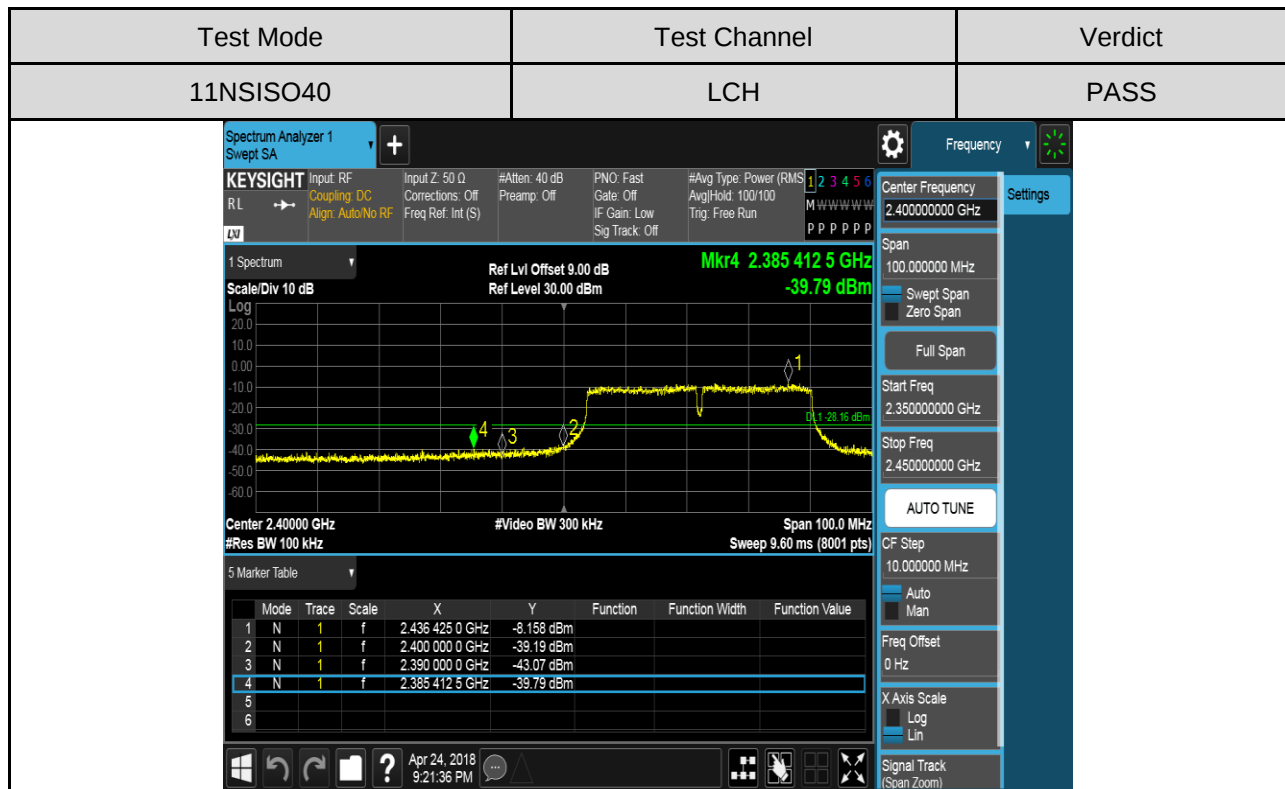
Test Mode	Test Channel	Carrier Power[dBm]	Max. Spurious Level [dBm]	Limit [dBm]	Verdict
11B	LCH	4.111	-40.139	-15.89	PASS
11B	HCH	4.472	-39.548	-15.53	PASS
11G	LCH	-6.018	-41.550	-26.02	PASS
11G	HCH	-5.612	-40.892	-25.61	PASS
11N20SISO	LCH	-6.148	-39.959	-26.15	PASS
11N20SISO	HCH	-5.371	-39.316	-25.37	PASS
11N40SISO	LCH	-8.158	-39.788	-28.16	PASS
11N40SISO	HCH	-8.159	-38.766	-28.16	PASS

TEST GRAPHS









Part II :Conducted Emission

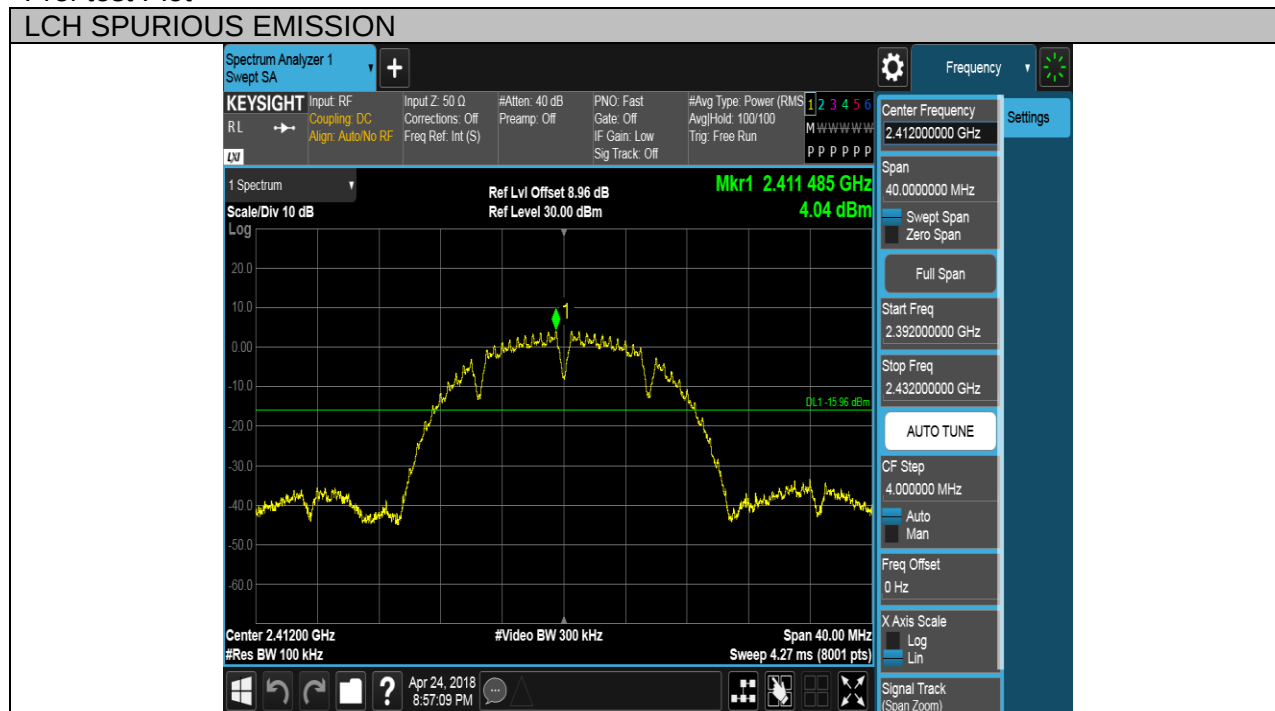
Test Result Table

Test Mode	Channel	Pref(dBm)	Puw(dBm)	Verdict
11B	LCH	4.04	<Limit	PASS
	MCH	4.553	<Limit	PASS
	HCH	4.395	<Limit	PASS
11G	LCH	-6.041	<Limit	PASS
	MCH	-5.73	<Limit	PASS
	HCH	-5.635	<Limit	PASS
11NSISO20	LCH	-5.761	<Limit	PASS
	MCH	-5.485	<Limit	PASS
	HCH	-5.544	<Limit	PASS
11NSISO40	LCH	-8.345	<Limit	PASS
	MCH	-8.042	<Limit	PASS
	HCH	-8.42	<Limit	PASS

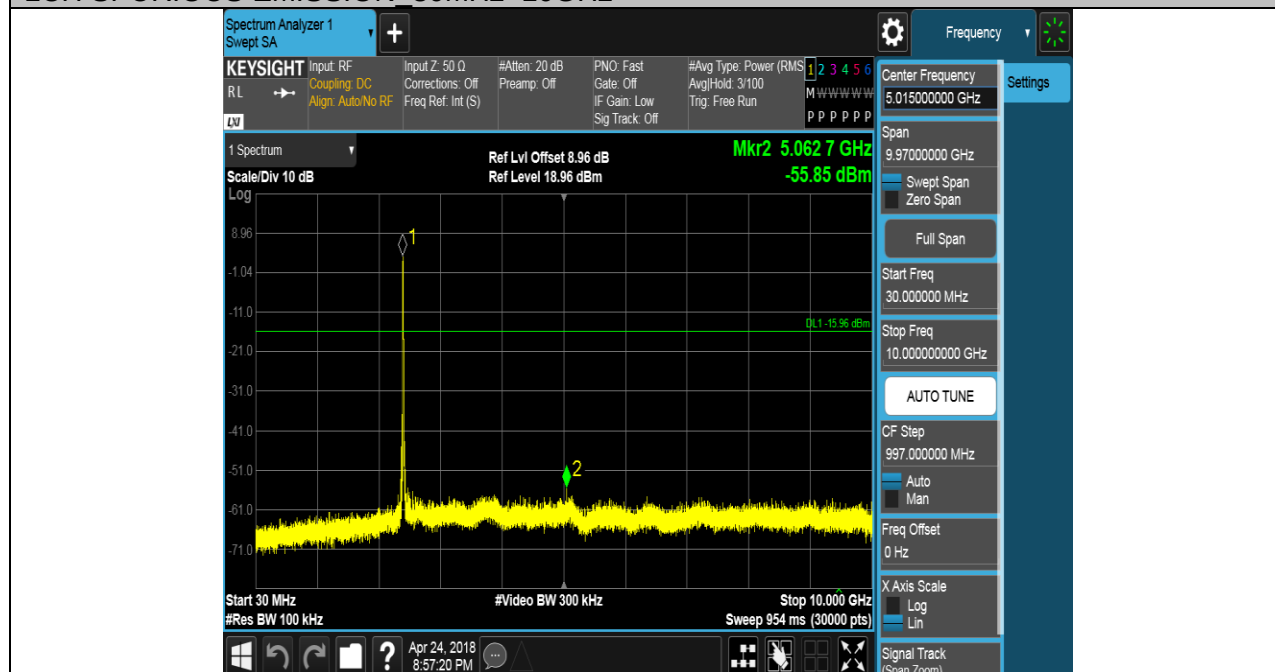
Test Plots

Test Mode	Channel	Verdict
11B	LCH	PASS

Pref test Plot



LCH SPURIOUS EMISSION 30MHz~10GHz



LCH SPURIOUS EMISSION 10GHz~26GHz

