

TEST REPORT

Product Name : **WIFI Module**
Model Number : **WF-M63B-USX2, WF-M63B-USX3**
FCC ID : **2AOKI-WFM63BUSX3**

Prepared for : Sichuan AI-Link Technology Co., Ltd.
Address : Anzhou Industrial Park, Mianyang, Sichuan, P.R.C

Prepared by : EMTEK (SHENZHEN) CO., LTD.
Address : Building 69, Majialong Industry Zone, Nanshan District,
Shenzhen, Guangdong, China

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Report Number : ENS2112160024W00104R
Date(s) of Tests : December 16, 2021 to January 4, 2022
Date of issue : January 4, 2022

1 TEST RESULT CERTIFICATION

Applicant : Sichuan AI-Link Technology Co., Ltd.
 Address : Anzhou Industrial Park, Mianyang, Sichuan, P.R.C
 Manufacturer : Sichuan AI-Link Technology Co., Ltd.
 Address : Anzhou Industrial Park, Mianyang, Sichuan, P.R.C
 EUT : WIFI Module
 Model Name : WF-M63B-USX2, WF-M63B-USX3
 Trademark : N/A

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 2, Subpart J FCC 47 CFR Part 15, Subpart E	PASS

The above equipment was tested by EMTEK (SHENZHEN) CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 2 and Part 15.407

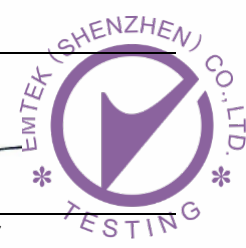
The test results of this report relate only to the tested sample identified in this report.

Date of Test : December 16, 2021 to January 4, 2022

Prepared by : 
 Luo peiye /Editor

Reviewer : 
 Joe Xia /Supervisor

Approve & Authorized Signer : 
 Lisa Wang/Manager



Modified History

Version	Report No.	Revision Date	Summary
V1.0	ENS2112160024W00104R	/	Original Report



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2 EUT TECHNICAL DESCRIPTION

Characteristics	Description																																
Product:	WIFI Module																																
Model Number:	WF-M63B-USX2, WF-M63B-USX3 (The models are identical in electrical, mechanical, and physical structure; The difference is that WF-M63B-USX2 has two antennas: ANT0 for Bluetooth, WIFI2.4G and WIFI5G, ANT1 for WiFi2.4G and WIFI5G. WF-M63B-USX3 has three antennas: ANT0 for Bluetooth, ANT1 for WIFI2.4G and WIFI5G, and ANT2 for WiFi2.4G and WIFI5G. Use only for different marketing purposes; We chose WF-M63B-USX3 as the final test prototype.)																																
Sample Number:	2#																																
Wifi Type:	<input checked="" type="checkbox"/> Wifi 5G with 5150MHz-5250MHz Band <input checked="" type="checkbox"/> Wifi 5G with 5250MHz-5350MHz Band <input checked="" type="checkbox"/> Wifi 5G with 5470MHz-5725MHz Band <input checked="" type="checkbox"/> Wifi 5G with 5725MHz-5850MHz Band																																
WLAN Supported:	<input checked="" type="checkbox"/> 802.11a <input checked="" type="checkbox"/> 802.11n(20MHz channel bandwidth) <input checked="" type="checkbox"/> 802.11n(40MHz channel bandwidth) <input checked="" type="checkbox"/> 802.11ac(20MHz channel bandwidth) <input checked="" type="checkbox"/> 802.11ac(40MHz channel bandwidth) <input checked="" type="checkbox"/> 802.11ac(80MHz channel bandwidth)																																
Data Rate :	<input checked="" type="checkbox"/> 802.11a:54/48/36/24/18/12/9/6Mbps <input checked="" type="checkbox"/> 802.11n:up to 300 Mbps <input checked="" type="checkbox"/> 802.11ac:up to 867 Mbps																																
Modulation:	<input checked="" type="checkbox"/> OFDM with BPSK/QPSK/16QAM/64QAM for 802.11a/n <input checked="" type="checkbox"/> OFDM with BPSK/QPSK/16QAM/64QAM/256QAM for 802.11ac																																
Frequency Range:	<table border="0"> <tr> <td colspan="2"><input checked="" type="checkbox"/>UNII-1: 5150MHz-5250MHz Band</td> </tr> <tr> <td><input checked="" type="checkbox"/>5180-5240MHz for 802.11a;</td> <td><input checked="" type="checkbox"/>5190-5230MHz for 802.11n(HT40);</td> </tr> <tr> <td><input checked="" type="checkbox"/>5180-5240MHz for 802.11n(HT20);</td> <td><input checked="" type="checkbox"/>5190-5230MHz for 802.11ac(HT40);</td> </tr> <tr> <td><input checked="" type="checkbox"/>5180-5240MHz for 802.11ac(HT20);</td> <td><input checked="" type="checkbox"/>5210MHz for 802.11ac(HT80);</td> </tr> <tr> <td colspan="2"><input checked="" type="checkbox"/>UNII-2A: 5250MHz-5350MHz Band</td> </tr> <tr> <td><input checked="" type="checkbox"/>5260-5320MHz for 802.11a;</td> <td><input checked="" type="checkbox"/>5270-5310MHz for 802.11n(HT40);</td> </tr> <tr> <td><input checked="" type="checkbox"/>5260-5320MHz for 802.11n(HT20);</td> <td><input checked="" type="checkbox"/>5270-5310MHz for 802.11ac(HT40);</td> </tr> <tr> <td><input checked="" type="checkbox"/>5260-5320MHz for 802.11ac(HT20);</td> <td><input checked="" type="checkbox"/>5290MHz for 802.11ac(HT80);</td> </tr> <tr> <td colspan="2"><input checked="" type="checkbox"/>UNII-2C: 5470MHz-5725MHz Band</td> </tr> <tr> <td><input checked="" type="checkbox"/>5500-5700MHz for 802.11a;</td> <td><input checked="" type="checkbox"/>5510-5670MHz for 802.11n(HT40);</td> </tr> <tr> <td><input checked="" type="checkbox"/>5500-5700MHz for 802.11n(HT20);</td> <td><input checked="" type="checkbox"/>5510-5670MHz for 802.11ac(HT40);</td> </tr> <tr> <td><input checked="" type="checkbox"/>5500-5700MHz for 802.11ac(HT20);</td> <td><input checked="" type="checkbox"/>5530MHz for 802.11ac(HT80);</td> </tr> <tr> <td colspan="2"><input checked="" type="checkbox"/>UNII-3 with 5725MHz-5850MHz Band</td> </tr> <tr> <td><input checked="" type="checkbox"/>5745-5825MHz for 802.11a;</td> <td><input checked="" type="checkbox"/>5755-5795MHz for 802.11n(HT40);</td> </tr> <tr> <td><input checked="" type="checkbox"/>5745-5825MHz for 802.11n(HT20);</td> <td><input checked="" type="checkbox"/>5755-5795MHz for 802.11ac(HT40);</td> </tr> <tr> <td><input checked="" type="checkbox"/>5745-5825MHz for 802.11ac(HT20);</td> <td><input checked="" type="checkbox"/>5775MHz for 802.11ac(HT80);</td> </tr> </table>	<input checked="" type="checkbox"/> UNII-1: 5150MHz-5250MHz Band		<input checked="" type="checkbox"/> 5180-5240MHz for 802.11a;	<input checked="" type="checkbox"/> 5190-5230MHz for 802.11n(HT40);	<input checked="" type="checkbox"/> 5180-5240MHz for 802.11n(HT20);	<input checked="" type="checkbox"/> 5190-5230MHz for 802.11ac(HT40);	<input checked="" type="checkbox"/> 5180-5240MHz for 802.11ac(HT20);	<input checked="" type="checkbox"/> 5210MHz for 802.11ac(HT80);	<input checked="" type="checkbox"/> UNII-2A: 5250MHz-5350MHz Band		<input checked="" type="checkbox"/> 5260-5320MHz for 802.11a;	<input checked="" type="checkbox"/> 5270-5310MHz for 802.11n(HT40);	<input checked="" type="checkbox"/> 5260-5320MHz for 802.11n(HT20);	<input checked="" type="checkbox"/> 5270-5310MHz for 802.11ac(HT40);	<input checked="" type="checkbox"/> 5260-5320MHz for 802.11ac(HT20);	<input checked="" type="checkbox"/> 5290MHz for 802.11ac(HT80);	<input checked="" type="checkbox"/> UNII-2C: 5470MHz-5725MHz Band		<input checked="" type="checkbox"/> 5500-5700MHz for 802.11a;	<input checked="" type="checkbox"/> 5510-5670MHz for 802.11n(HT40);	<input checked="" type="checkbox"/> 5500-5700MHz for 802.11n(HT20);	<input checked="" type="checkbox"/> 5510-5670MHz for 802.11ac(HT40);	<input checked="" type="checkbox"/> 5500-5700MHz for 802.11ac(HT20);	<input checked="" type="checkbox"/> 5530MHz for 802.11ac(HT80);	<input checked="" type="checkbox"/> UNII-3 with 5725MHz-5850MHz Band		<input checked="" type="checkbox"/> 5745-5825MHz for 802.11a;	<input checked="" type="checkbox"/> 5755-5795MHz for 802.11n(HT40);	<input checked="" type="checkbox"/> 5745-5825MHz for 802.11n(HT20);	<input checked="" type="checkbox"/> 5755-5795MHz for 802.11ac(HT40);	<input checked="" type="checkbox"/> 5745-5825MHz for 802.11ac(HT20);	<input checked="" type="checkbox"/> 5775MHz for 802.11ac(HT80);
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TPC Function:	<input type="checkbox"/> Applicable	<input checked="" type="checkbox"/> Not Applicable
Antenna Port:	<input checked="" type="checkbox"/> Antenna port 1 <input checked="" type="checkbox"/> Antenna port 2	
Antenna Type:	FPCAntenna	
Antenna Gain:	<input checked="" type="checkbox"/> ANT 1: 2 dBi <input checked="" type="checkbox"/> ANT 2: 2 dBi	
Transmit Power:	5150MHz-5250MHz : 14.20 dBm 5250MHz-5350MHz : 14.03 dBm 5470MHz-5725MHz : 15.12 dBm 5725MHz-5850MHz : 14.72 dBm	
Power Supply :	DC 3.3V	
Date of Received:	December 16, 2021	
Temperature Range:	-10°C ~ +70°C	

Note: For more details, please refer to the User's manual of the EUT.

3 SUMMARY OF TEST RESULT

FCC Part Clause	Test Parameter	Verdict	Remark
15.407 (a) 15.407 (e)	99% , 6dB and 26dB Bandwidth	PASS	
15.407 (a)	Maximum Conducted Output Power	PASS	
15.407 (a)	Peak Power Spectral Density	PASS	
15.407 (b)	Radiated Spurious Emission	PASS	
15.407(g)	Frequency Stability	PASS	
15.407 (b)(6) 15.207	Power Line Conducted Emission	PASS	
15.407(a) 15.203	Antenna Application	PASS	
<p>NOTE1: N/A (Not Applicable) NOTE2: According to FCC OET KDB 789033 D2 General UNII Test Procedures New Rules v02r01, In addition, the radiated test is also performed to ensure the emissions emanating from the device cabinet also comply with the applicable limits.</p>			

RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is intended for FCC ID: 2AOKI-WFM63BUSX3 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

4 TEST METHODOLOGY

4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards:

FCC 47 CFR Part 2, Subpart J

FCC 47 CFR Part 15, Subpart E

FCC KDB 662911 D01 Multiple Transmitter Output v02r01

FCC KDB 789033 D2 General UNII Test Procedures New Rules v02r01

4.2 MEASUREMENT EQUIPMENT USED

For Spurious Emissions Test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Pre-Amplifier	HP	8447F	2944A07999	2021/5/15	1 Year
EMI Test Receiver	Rohde & Schwarz	ESCI	101414	2021/5/15	1 Year
Bilog Antenna	Schwarzbeck	VULB9163	712	2021/7/5	2 Year
Horn antenna	Schwarzbeck	BBHA9120D	9120D-1178	2020/7/4	2 Year
Pre-Amplifie	Lunar EM	LNA1G18-48	J101113101000 1	2021/5/15	1 Year
Spectrum Analyzer	Rohde & Schwarz	FSV40	100967	2021/5/15	1 Year
EMI Test Receiver	Rohde & Schwarz	ESU 26	100154	2021/5/15	1 Year
Pre-Amplifie	Lunar EM	LNA30M3G-25	J10100000070	2021/5/15	1 Year
Bilog Antenna	Schwarzbeck	VULB9163	659	2021/8/22	2 Year
Horn antenna	Schwarzbeck	BBHA9120D	9120D-1177	2020/7/4	2 Year
Pre-Amplifie	SKET	LNPA_0118G-45	SK2019051801	2021/5/15	1 Year
Loop Antenna	Schwarzbeck	FMZB1519	1519-012	2021/6/12	2 Year
Cable	H+B	NmSm-05-C15052	N/A	2021/5/15	1 Year
Cable	H+B	NmSm-2-C15201	N/A	2021/5/15	1 Year
Cable	H+B	NmNm-7-C15702	N/A	2021/5/15	1 Year
Cable	H+B	SAC-40G-1	414	2021/5/15	1 Year
Cable	H+B	SUCOFLEX104	MY14871/4	2021/5/15	1 Year
Cable	H+B	BLU18A-NmSm-650 0	D8501	2021/5/15	1 Year
Band reject Filter(50dB)	WI/DE	WRCGV-2400(2400-2485MHz)	2	May 15, 2021	1 Year

For other test items:

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
Signal Analyzer	Agilent	N9010A	My53470879	2021/5/16	1 Year
Power meter	Anritsu	ML2495A	0824006	2021/5/15	1 Year
Power sensor	Anritsu	MA2411B	0738172	2021/5/15	1 Year
Spectrum Analyzer	Rohde & Schwarz	FSV40	100967	2021/5/15	1 Year

4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.

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.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Wifi 5G with U-NII - 1

Frequency and Channel list for 802.11a, 802.11n (HT20), 802.11ac (HT20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	44	5220		
40	5200	48	5240		

Frequency and Channel list for 802.11n (HT40), 802.11ac (HT40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
38	5190	46	5230		

Frequency and Channel list for 802.11ac (HT80):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
42	5210				

Test Frequency and Channel for 802.11a, 802.11n (HT20), 802.11ac (HT20):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
36	5180	40	5200	48	5240

Test Frequency and channel for 802.11n (HT40), 802.11ac (HT40):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
38	5190	N/A	N/A	46	5230

Test Frequency and channel for 802.11ac (HT80):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
42	5210	N/A	N/A	N/A	N/A

Wifi 5G with U-NII -2A

Frequency and Channel list 802.11a, 802.11n (HT20), 802.11ac (HT20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
52	5260	60	5300		
56	5280	64	5320		

Frequency and Channel list for 802.11n (HT40), 802.11ac (HT40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
54	5270				
62	5310				

Frequency and Channel list for 802.11ac (HT80):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
58	5290				

Test Frequency and Channel for 802.11a, 802.11n (HT20), 802.11ac (HT20):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
52	5260	56	5280	64	5320

Test Frequency and channel for 802.11n (HT40), 802.11ac (HT40):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
54	5270	N/A	N/A	62	5310

Test Frequency and channel for 802.11ac (HT80):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
58	5290				

Wifi 5G with U-NII -2C

Frequency and Channel list for 802.11a, 802.11n (HT20), 802.11ac (HT20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
100	5500	116	5580	132	5660
104	5520	120	5600	136	5680
108	5540	124	5620	140	5700
112	5560	128	5640		

Frequency and Channel list for 802.11n (HT40), 802.11ac (HT40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
102	5510	118	5590	134	5670
110	5550	126	5630		

Frequency and Channel list for 802.11ac (HT80):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
106	5530	122	5610		

Test Frequency and Channel for 802.11a, 802.11n (HT20), 802.11ac (HT20):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
100	5500	116	5580	140	5700

Test Frequency and channel for 802.11n (HT40), 802.11ac (HT40):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
102	5510			134	5670

Test Frequency and channel for 802.11ac (HT80):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
106	5530				

Wifi 5G with U-NII -3

Frequency and Channel list for 802.11a, 802.11n (HT20), 802.11ac (HT20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	157	5785	165	5825
153	5765	161	5805		

Frequency and Channel list for 802.11n (HT40), 802.11ac (HT40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
151	5755	159	5795		

Frequency and Channel list for 802.11ac (HT80):

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
155	5775				

Test Frequency and Channel for 802.11a, 802.11n (HT20), 802.11ac (HT20):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
149	5745	157	5785	165	5825

Test Frequency and channel for 802.11n (HT40), 802.11ac (HT40):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
151	5755	N/A	N/A	159	5795

Test Frequency and channel for 802.11ac (HT80):

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
155	5775				

The 5G WIFI has two antennas and support Multiple Outputs for 802.11n/ac mode for this report; Antenna 1 Gain is 2 dBi; Antenna 2 Gain is 2 dBi; for this function is belong to Correlated Categorization equipment

According to KDB 662911, for Unequal antenna gains,

$$\text{Directional gain} = 10 \log [(10^{2/20} + 10^{2/20})^2 / 2] \text{ dBi} = 5.01 \text{ dBi}$$

5 FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at:

EMTEK (Shenzhen) Co., Ltd.

Building 69, Majialong Industry Zone District, Nanshan District, Shenzhen, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5.3 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description	
EMC Lab.	<p>Accredited by CNAS The Certificate Registration Number is L2291. The Laboratory has been assessed and proved to be in compliance with CNAS-CL01 (identical to ISO/IEC 17025:2017)</p> <p>Accredited by FCC Designation Number: CN1204 Test Firm Registration Number: 882943</p> <p>Accredited by A2LA The Certificate Number is 4321.01.</p> <p>Accredited by Industry Canada The Conformity Assessment Body Identifier is CN0008</p>
Name of Firm	: EMTEK (SHENZHEN) CO., LTD.
Site Location	: Building 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China

6 TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

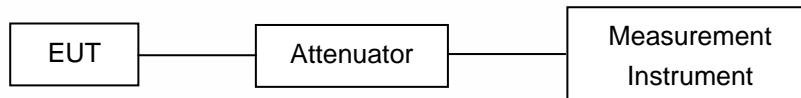
Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$
Maximum Peak Output Power Test	$\pm 1.0\text{dB}$
Conducted Emissions Test	$\pm 2.0\text{dB}$
Radiated Emission Test	$\pm 2.0\text{dB}$
Power Density	$\pm 2.0\text{dB}$
Occupied Bandwidth Test	$\pm 1.0\text{dB}$
Band Edge Test	$\pm 3\text{dB}$
All emission, radiated	$\pm 3\text{dB}$
Antenna Port Emission	$\pm 3\text{dB}$
Temperature	$\pm 0.5^\circ\text{C}$
Humidity	$\pm 3\%$

Measurement Uncertainty for a level of Confidence of 95%

7 SETUP OF EQUIPMENT UNDER TEST

7.1 RADIO FREQUENCY TEST SETUP

The WLAN component's antenna ports(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



7.2 RADIO FREQUENCY TEST SETUP

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10. The test distance is 3m. The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 22.

Below 30MHz:

The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna (loop antenna). The Antenna should be positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop shall be 1 m above the ground. For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT.

Above 30MHz:

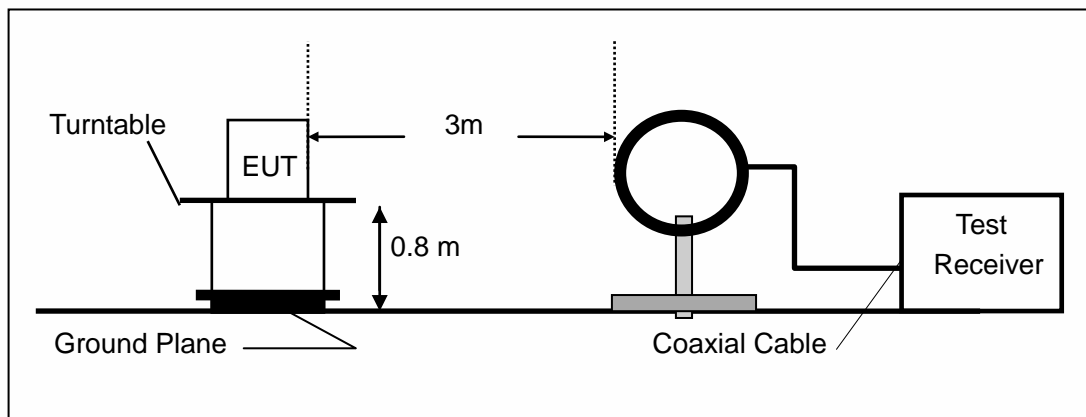
The EUT is placed on a turntable 0.8 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

Above 1GHz:

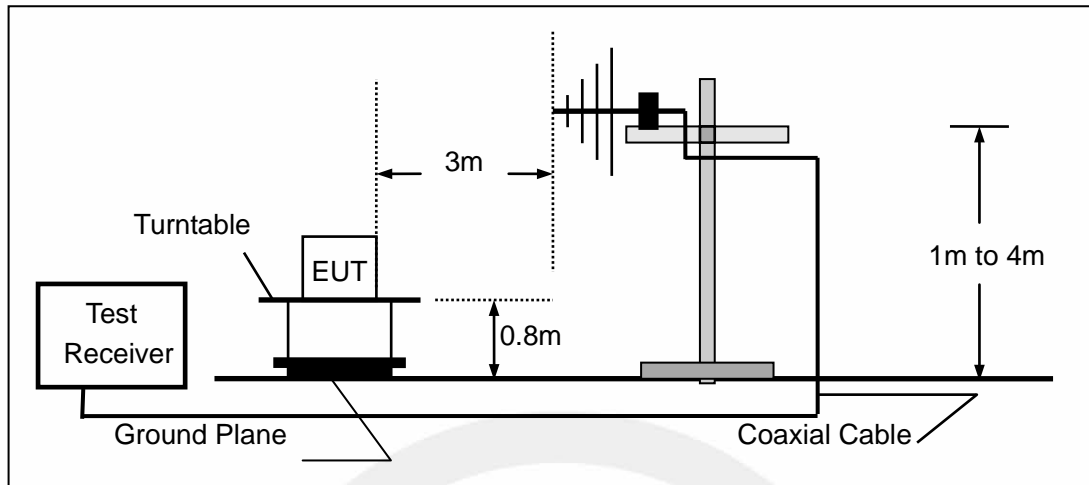
(Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.)

The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

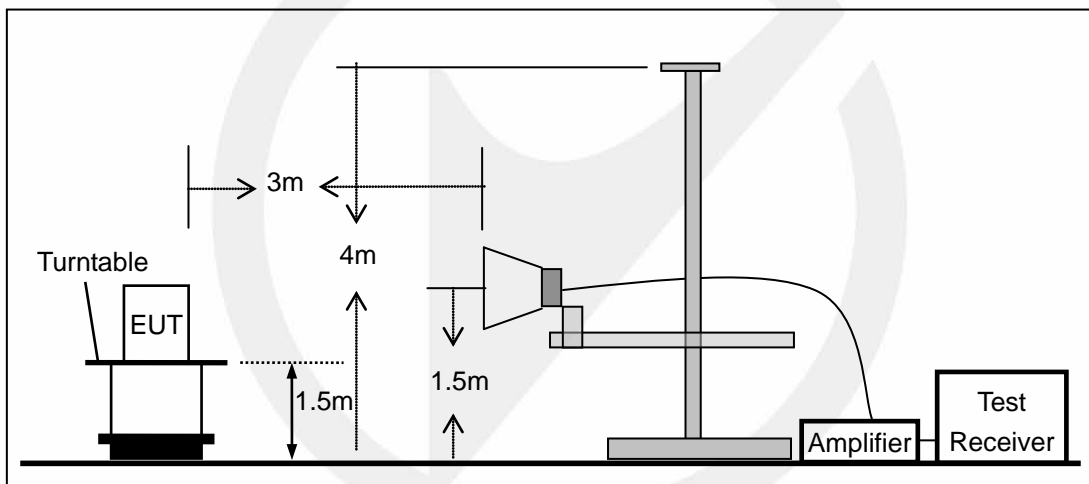
(a) Radiated Emission Test Set-Up, Frequency Below 30MHz



(b) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(c) Radiated Emission Test Set-Up, Frequency above 1000MHz

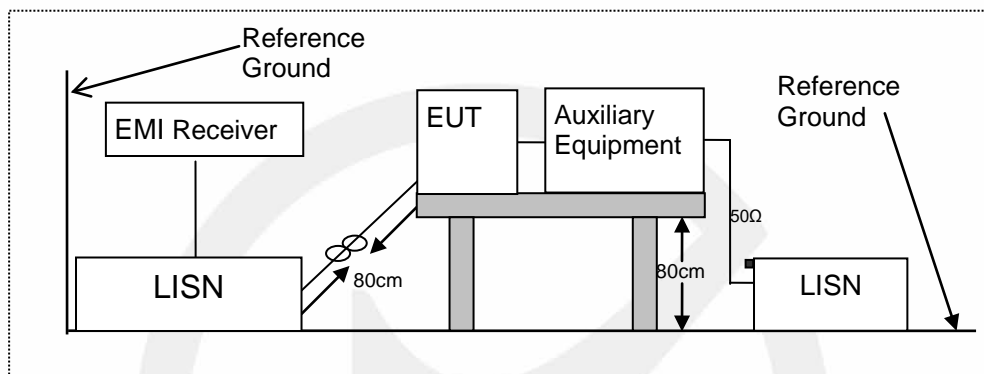


7.3 CONDUCTED EMISSION TEST SETUP

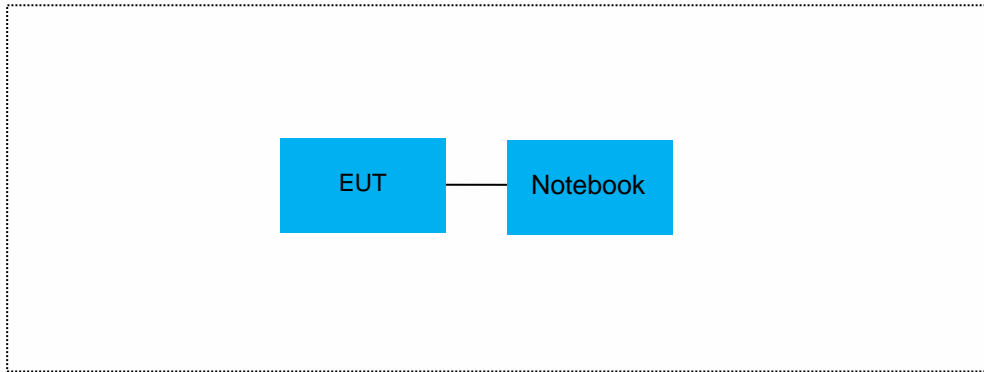
The mains cable of the EUT (maybe per AC/DC Adapter) must be connected to LISN. The LISN shall be placed 0.8 m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8m from the LISN.

Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than 0.1 m.

According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.



7.4 BLOCK DIAGRAM CONFIGURATION OF TEST SYSTEM



7.5 SUPPORT EQUIPMENT

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Notebook	LENOVO	M713A	SA12582190

Notes:

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.

8 TEST REQUIREMENTS

8.1 BANDWIDTH MEASUREMENT

8.1.1 Applicable Standard

According to FCC Part 15.407(a)(1) for UNII Band I
According to FCC Part 15.407(a)(2) for UNII Band II-A and UNII Band II-C
According to FCC Part 15.407(a)(3) for UNII Band III
According to FCC Part 15.407(e) for UNII Band III
According to 789033 D02 Section II(C)
According to 789033 D02 Section II(D)

8.1.2 Conformance Limit

(1) For the band 5.15-5.25 GHz.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(e) Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

8.1.3 Test Configuration

Test according to clause 7.1 radio frequency test setup

8.1.4 Test Procedure

According to 789033 D02 v02r01 section C&D, the following is the measurement procedure.

1. Emission Bandwidth (EBW)

- Set RBW = approximately 1% of the emission bandwidth.
- Set the VBW > RBW.
- Detector = Peak.
- Trace mode = max hold.
- Measure the maximum width of the emission that is 26 dB down from the maximum of the emission.

Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

2. Minimum Emission Bandwidth for the band 5.725-5.85 GHz

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) 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.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

D. 99 Percent Occupied Bandwidth

The 99-percent occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 % of the total mean power of the given emission. Measurement of the 99-percent occupied bandwidth is required only as a condition for using the optional band-edge measurement techniques described in section II.G.3.d). Measurements of 99-percent occupied bandwidth may also optionally be used in lieu of the EBW to 789033 D02 v01r02 General UNII Test Procedures New Rules v01 define the minimum frequency range over which the spectrum is integrated when measuring maximum conducted output power as described in section II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with 15.407(a).

The following procedure shall be used for measuring (99 %) power bandwidth:

- 1. Set center frequency to the nominal EUT channel center frequency.
- 2. Set span = 1.5 times to 5.0 times the OBW.
- 3. Set RBW = 1 % to 5 % of the OBW
- 4. Set VBW $\geq 3 \cdot$ RBW
- 5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- 6. Use the 99 % power bandwidth function of the instrument (if available).
- 7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

8.1.5 Test Results

Temperature:	25° C
Relative Humidity:	45%
ATM Pressure:	1011 mbar

**26 dB Emission Bandwidth
11A and 11N20**

TestMode	Antenna	Frequency[MHz]	26db EBW [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
11A 802.11A	Ant1	5180	20.280	5169.880	5190.160	---	PASS
	Ant2	5180	20.120	5170.000	5190.120	---	PASS
	Ant1	5220	20.200	5209.960	5230.160	---	PASS
	Ant2	5220	20.440	5209.960	5230.400	---	PASS
	Ant1	5240	20.400	5229.800	5250.200	---	PASS
	Ant2	5240	20.200	5229.920	5250.120	---	PASS
	Ant1	5260	20.680	5249.680	5270.360	---	PASS
	Ant2	5260	20.360	5249.800	5270.160	---	PASS
	Ant1	5300	20.240	5289.880	5310.120	---	PASS
	Ant2	5300	20.200	5289.920	5310.120	---	PASS
	Ant1	5320	20.240	5309.960	5330.200	---	PASS
	Ant2	5320	20.160	5309.960	5330.120	---	PASS
	Ant1	5500	20.280	5489.920	5510.200	---	PASS
	Ant2	5500	20.160	5489.920	5510.080	---	PASS
	Ant1	5580	20.160	5569.920	5590.080	---	PASS
	Ant2	5580	20.200	5569.960	5590.160	---	PASS
	Ant1	5700	20.240	5689.840	5710.080	---	PASS
	Ant2	5700	20.080	5689.960	5710.040	---	PASS
	Ant1	5745	20.200	5734.800	5755.000	---	PASS
	Ant2	5745	20.200	5734.880	5755.080	---	PASS
	Ant1	5785	20.520	5774.680	5795.200	---	PASS
	Ant2	5785	20.200	5774.880	5795.080	---	PASS
	Ant1	5825	20.280	5814.920	5835.200	---	PASS
	Ant2	5825	20.360	5814.800	5835.160	---	PASS
11N20SISO 802.11N(HT20)	Ant1	5180	20.360	5169.880	5190.240	---	PASS
	Ant2	5180	20.400	5169.840	5190.240	---	PASS
	Ant1	5220	20.600	5209.800	5230.400	---	PASS
	Ant2	5220	20.400	5209.840	5230.240	---	PASS
	Ant1	5240	20.520	5229.800	5250.320	---	PASS
	Ant2	5240	20.600	5229.720	5250.320	---	PASS
	Ant1	5260	20.480	5249.800	5270.280	---	PASS
	Ant2	5260	20.520	5249.720	5270.240	---	PASS
	Ant1	5300	20.520	5289.760	5310.280	---	PASS
	Ant2	5300	20.680	5289.640	5310.320	---	PASS
	Ant1	5320	20.480	5309.840	5330.320	---	PASS
	Ant2	5320	20.440	5309.840	5330.280	---	PASS
	Ant1	5500	20.400	5489.840	5510.240	---	PASS
	Ant2	5500	20.520	5489.720	5510.240	---	PASS
	Ant1	5580	20.400	5569.800	5590.200	---	PASS
	Ant2	5580	20.440	5569.840	5590.280	---	PASS
	Ant1	5700	20.560	5689.720	5710.280	---	PASS
	Ant2	5700	20.600	5689.720	5710.320	---	PASS
	Ant1	5745	20.520	5734.800	5755.320	---	PASS
	Ant2	5745	20.360	5734.840	5755.200	---	PASS
	Ant1	5785	20.360	5774.800	5795.160	---	PASS
	Ant2	5785	20.480	5774.800	5795.280	---	PASS
	Ant1	5825	20.600	5814.760	5835.360	---	PASS
	Ant2	5825	20.400	5814.840	5835.240	---	PASS

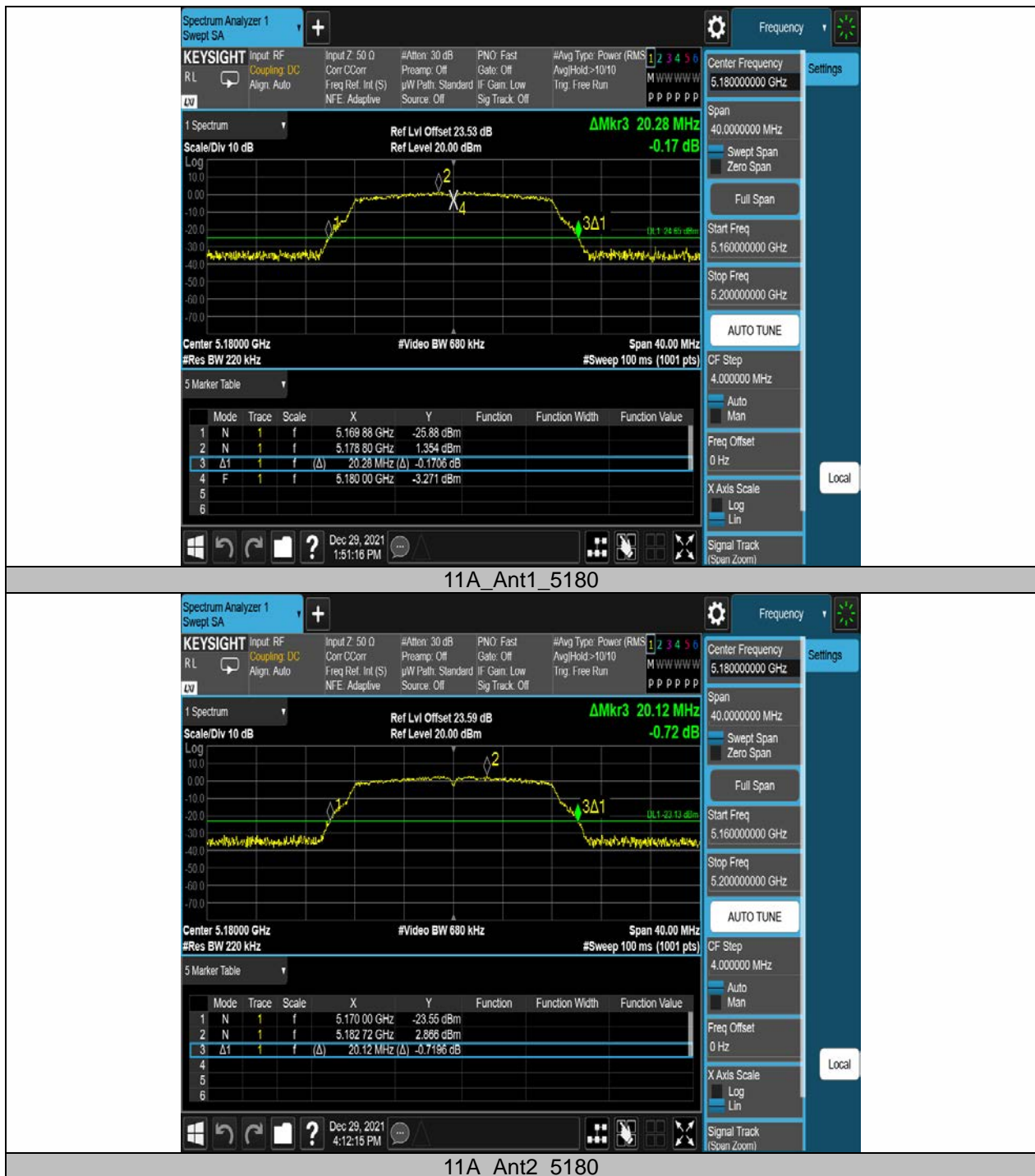
11N40 and 11AC20

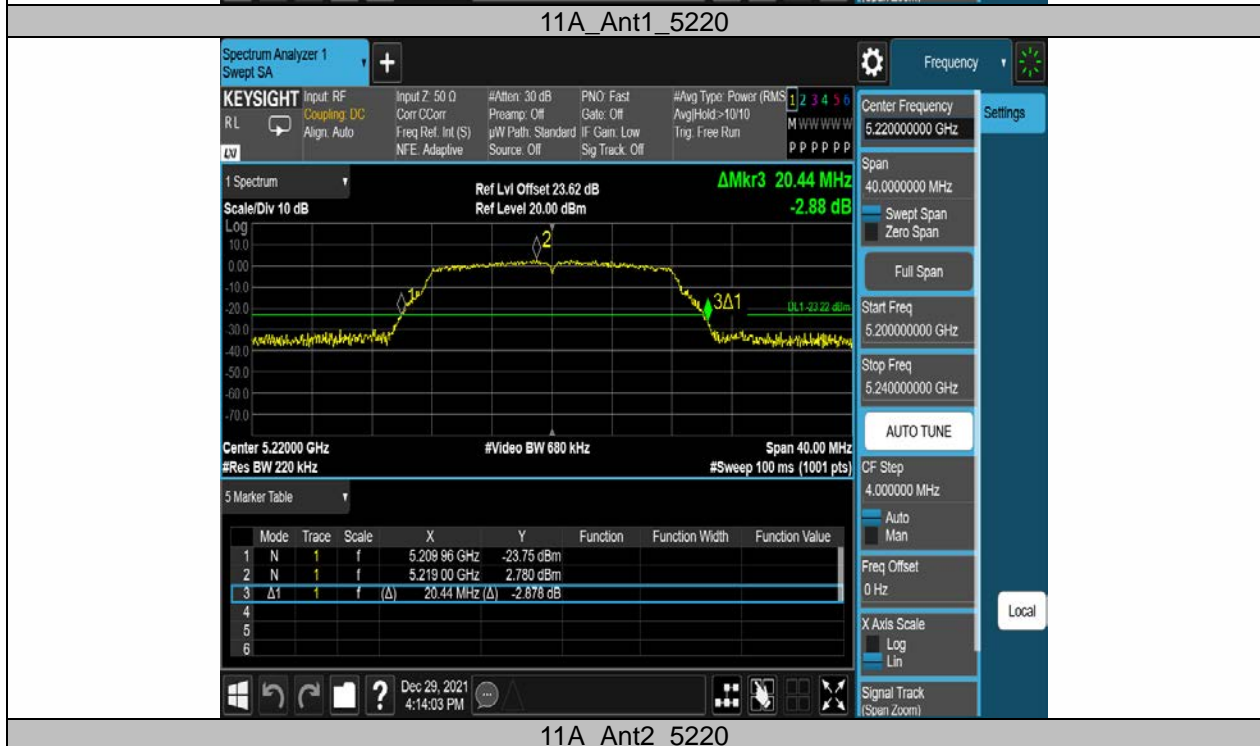
11N40SISO 802.11N(HT40)	Ant1	5190	41.200	5169.520	5210.720	---	PASS
	Ant2	5190	41.040	5169.520	5210.560	---	PASS
	Ant1	5230	41.920	5209.280	5251.200	---	PASS
	Ant2	5230	40.960	5209.520	5250.480	---	PASS
	Ant1	5270	41.600	5248.960	5290.560	---	PASS
	Ant2	5270	40.800	5249.680	5290.480	---	PASS
	Ant1	5310	40.880	5289.600	5330.480	---	PASS
	Ant2	5310	40.880	5289.520	5330.400	---	PASS
	Ant1	5510	41.040	5489.360	5530.400	---	PASS
	Ant2	5510	40.720	5489.760	5530.480	---	PASS
	Ant1	5550	41.280	5529.360	5570.640	---	PASS
	Ant2	5550	41.200	5529.440	5570.640	---	PASS
	Ant1	5670	41.280	5649.280	5690.560	---	PASS
	Ant2	5670	40.800	5649.680	5690.480	---	PASS
	Ant1	5755	40.960	5734.520	5775.480	---	PASS
	Ant2	5755	40.960	5734.520	5775.480	---	PASS
	Ant1	5795	41.440	5774.200	5815.640	---	PASS
	Ant2	5795	40.880	5774.600	5815.480	---	PASS
11AC20SISO 802.11AC(HT20)	Ant1	5180	20.440	5169.800	5190.240	---	PASS
	Ant2	5180	20.280	5169.920	5190.200	---	PASS
	Ant1	5220	20.600	5209.680	5230.280	---	PASS
	Ant2	5220	20.360	5209.840	5230.200	---	PASS
	Ant1	5240	20.760	5229.640	5250.400	---	PASS
	Ant2	5240	20.440	5229.800	5250.240	---	PASS
	Ant1	5260	20.440	5249.800	5270.240	---	PASS
	Ant2	5260	20.440	5249.800	5270.240	---	PASS
	Ant1	5300	20.640	5289.760	5310.400	---	PASS
	Ant2	5300	20.440	5289.840	5310.280	---	PASS
	Ant1	5320	20.520	5309.640	5330.160	---	PASS
	Ant2	5320	20.520	5309.760	5330.280	---	PASS
	Ant1	5500	20.400	5489.760	5510.160	---	PASS
	Ant2	5500	20.320	5489.920	5510.240	---	PASS
	Ant1	5580	20.680	5569.720	5590.400	---	PASS
	Ant2	5580	20.600	5569.640	5590.240	---	PASS
	Ant1	5700	20.560	5689.720	5710.280	---	PASS
	Ant2	5700	20.360	5689.800	5710.160	---	PASS
	Ant1	5745	20.560	5734.800	5755.360	---	PASS
	Ant2	5745	20.480	5734.760	5755.240	---	PASS
	Ant1	5785	20.640	5774.760	5795.400	---	PASS
	Ant2	5785	20.280	5774.840	5795.120	---	PASS
	Ant1	5825	20.560	5814.760	5835.320	---	PASS
	Ant2	5825	20.480	5814.800	5835.280	---	PASS

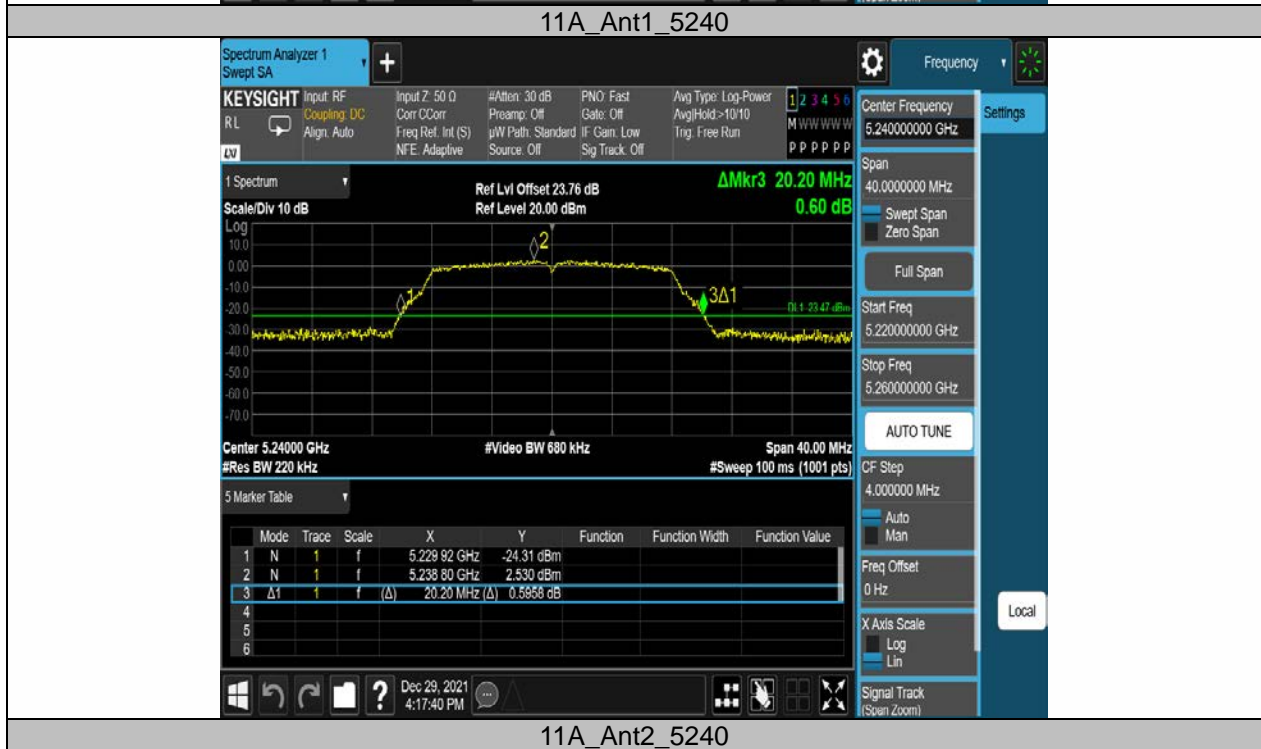
11AC40 and 11AC80

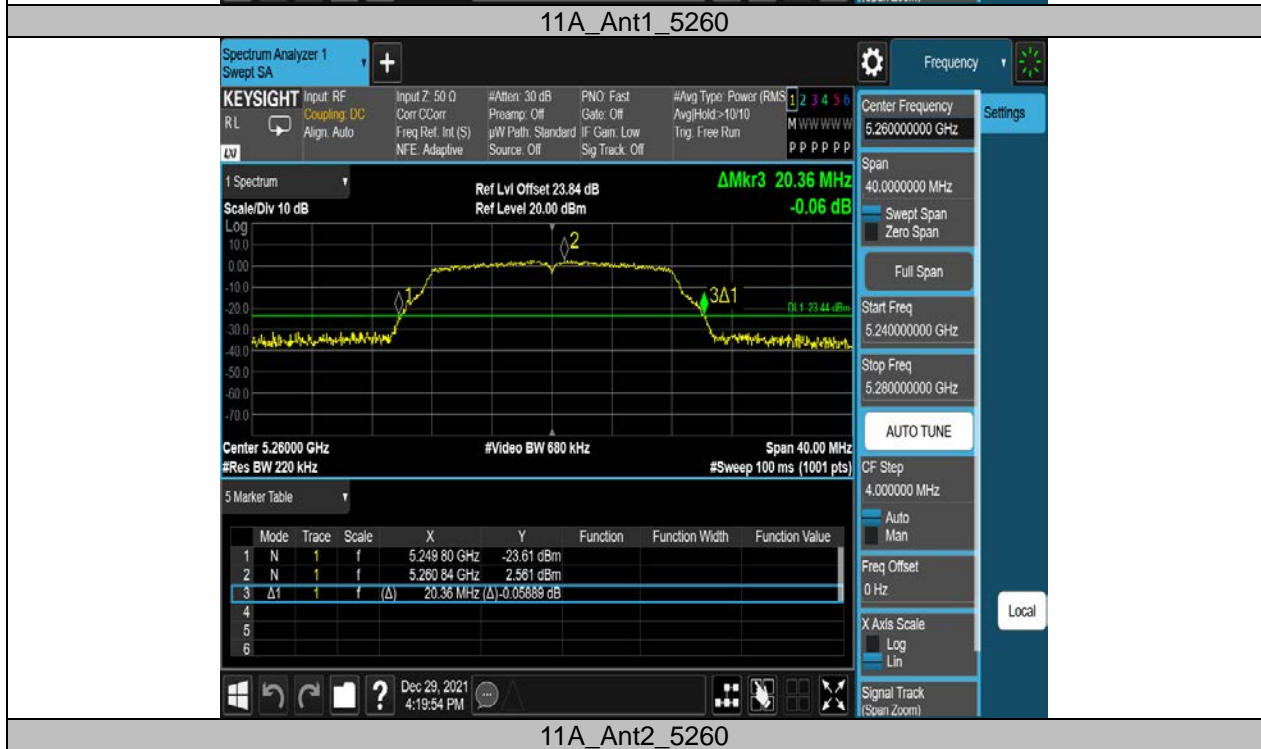
11AC40SISO 802.11AC(HT40)	Ant1	5190	40.960	5169.360	5210.320	---	PASS	
	Ant2	5190	40.160	5170.000	5210.160	---	PASS	
	Ant1	5230	41.200	5209.440	5250.640	---	PASS	
	Ant2	5230	40.400	5209.840	5250.240	---	PASS	
	Ant1	5270	40.880	5249.600	5290.480	---	PASS	
	Ant2	5270	40.160	5249.920	5290.080	---	PASS	
	Ant1	5310	40.880	5289.680	5330.560	---	PASS	
	Ant2	5310	40.720	5289.680	5330.400	---	PASS	
	Ant1	5510	41.360	5489.200	5530.560	---	PASS	
	Ant2	5510	40.720	5489.760	5530.480	---	PASS	
	Ant1	5550	41.280	5529.360	5570.640	---	PASS	
	Ant2	5550	40.320	5529.920	5570.240	---	PASS	
	Ant1	5670	40.960	5649.520	5690.480	---	PASS	
	Ant2	5670	40.640	5649.680	5690.320	---	PASS	
	Ant1	5755	41.120	5734.280	5775.400	---	PASS	
	Ant2	5755	40.640	5734.840	5775.480	---	PASS	
	11AC80SISO 802.11AC(HT80)	Ant1	5795	41.840	5773.960	5815.800	---	PASS
		Ant2	5795	40.560	5774.840	5815.400	---	PASS
Ant1		5210	81.120	5169.520	5250.640	---	PASS	
Ant2		5210	80.480	5169.680	5250.160	---	PASS	
Ant1		5290	81.600	5248.880	5330.480	---	PASS	
Ant2		5290	80.960	5249.520	5330.480	---	PASS	
Ant1		5530	81.280	5489.360	5570.640	---	PASS	
Ant2		5530	80.800	5489.680	5570.480	---	PASS	
Ant1		5610	81.440	5569.200	5650.640	---	PASS	
Ant2		5610	81.120	5569.520	5650.640	---	PASS	
Ant1		5775	81.600	5734.040	5815.640	---	PASS	
Ant2		5775	80.800	5734.680	5815.480	---	PASS	

Test Graphs

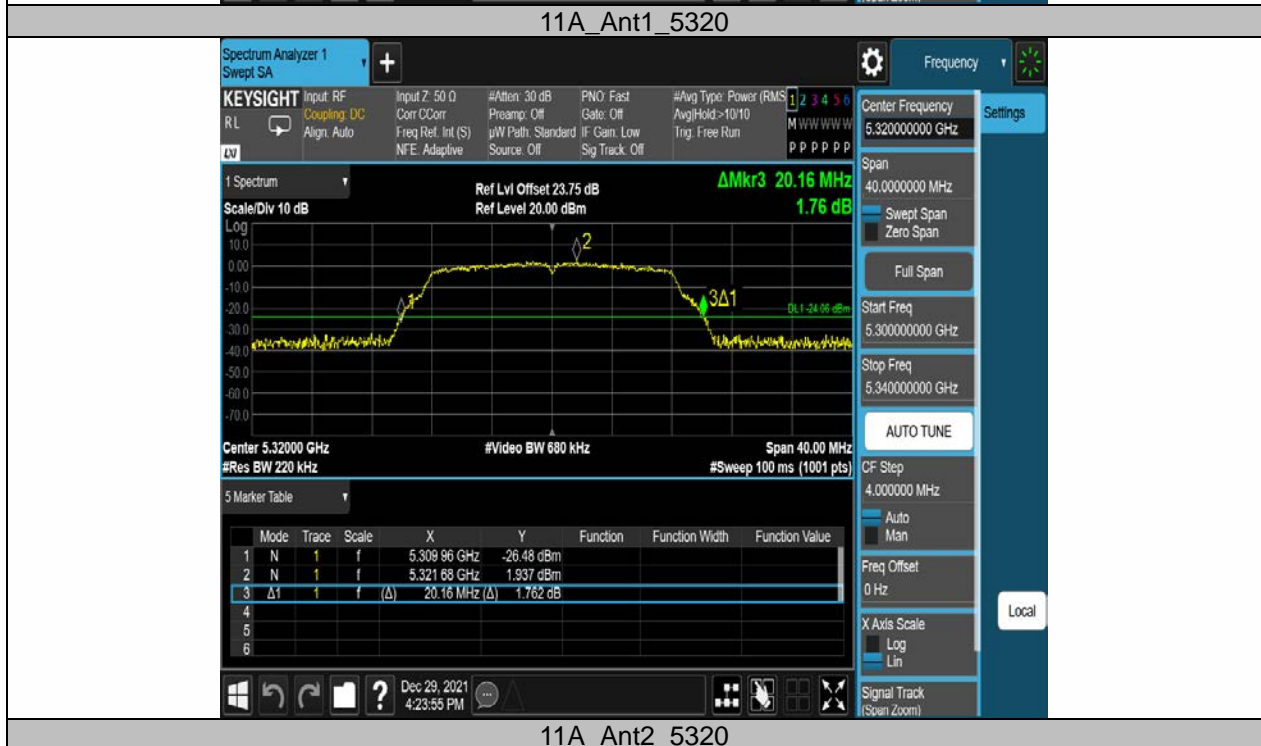


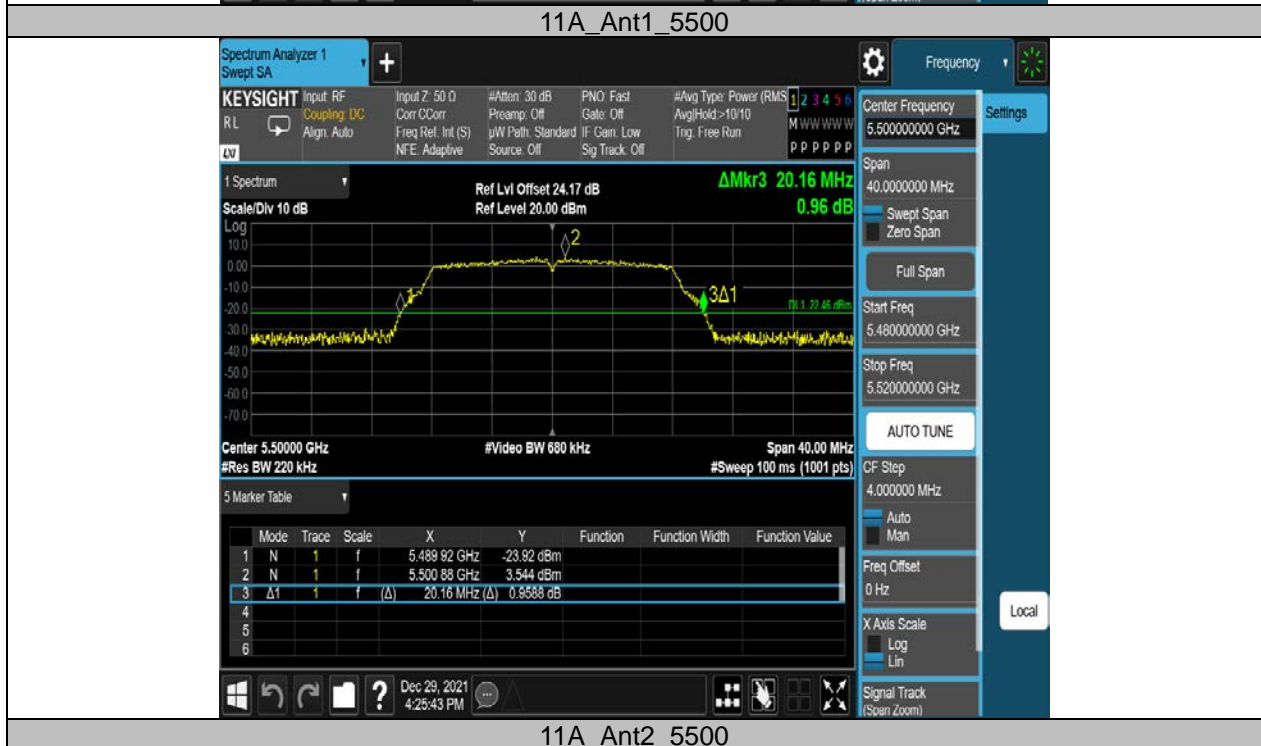


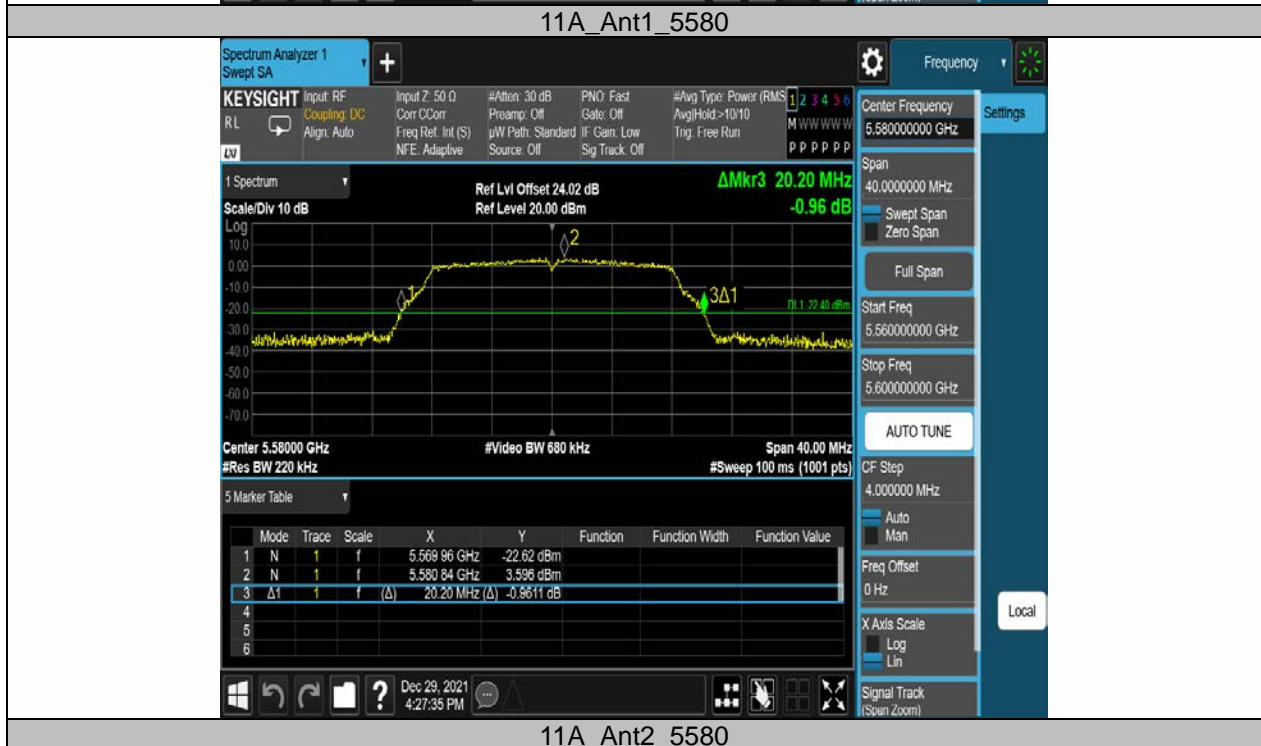


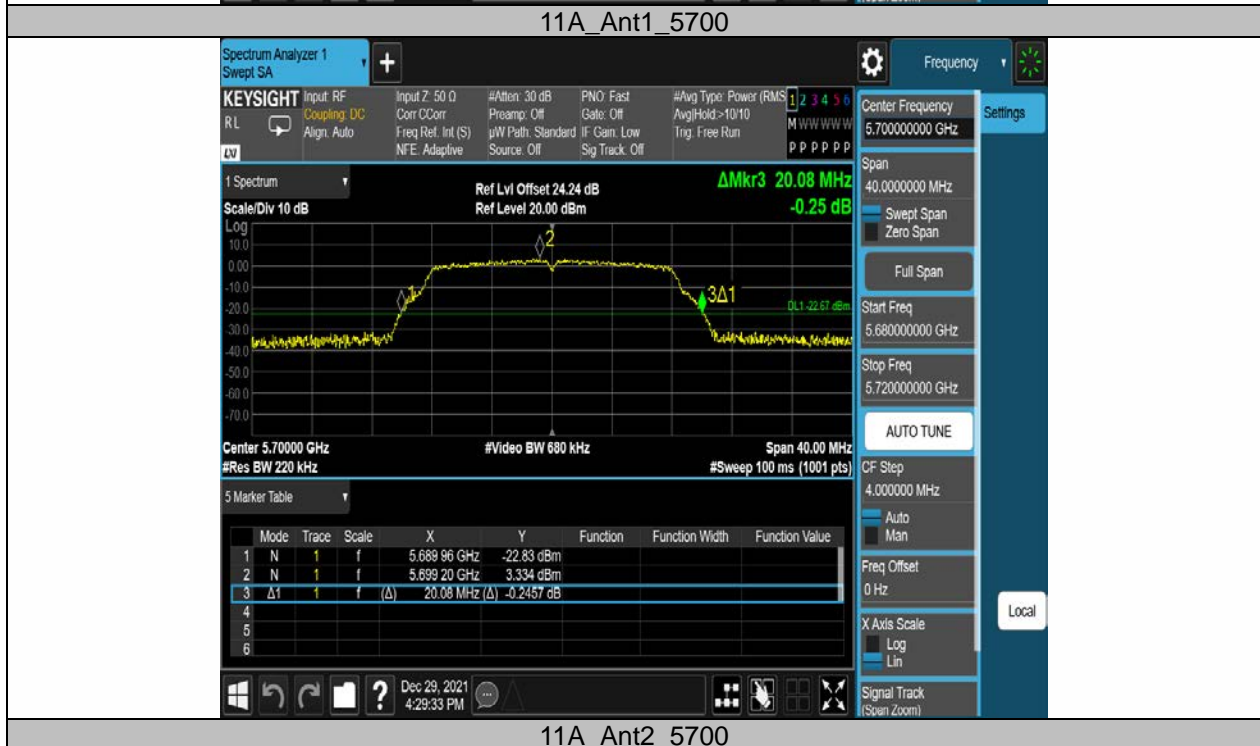


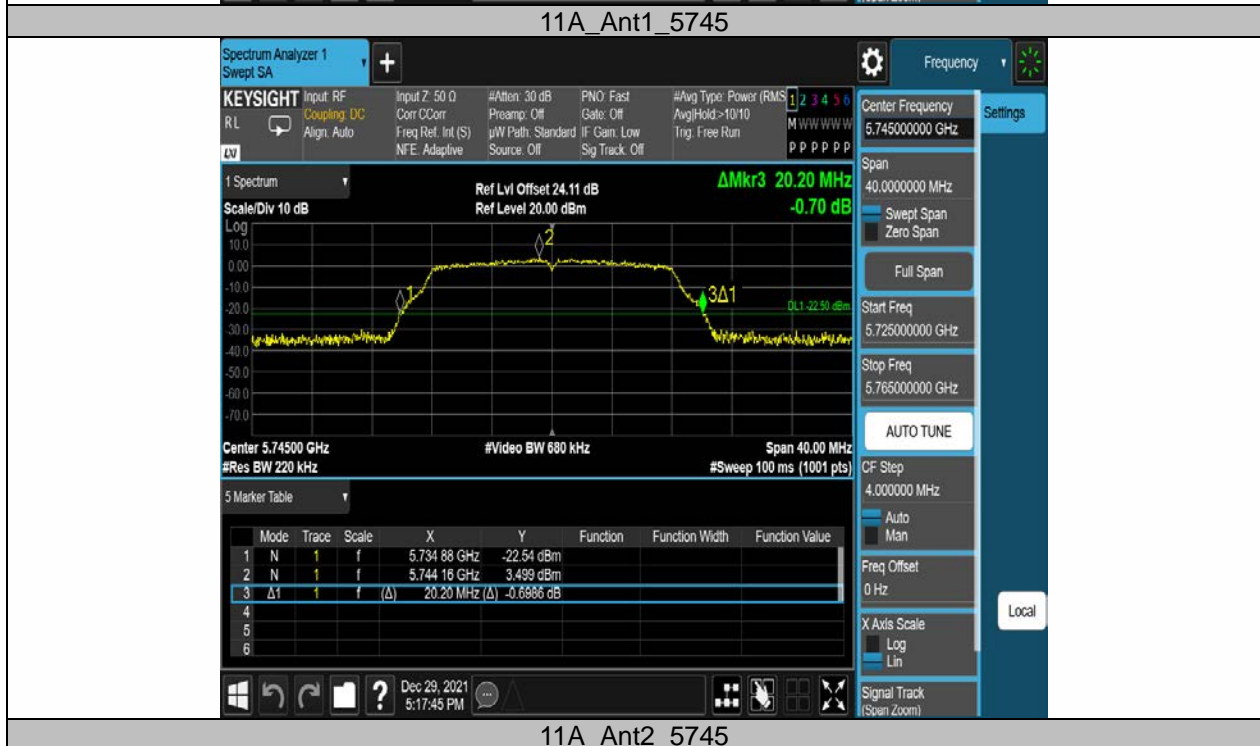


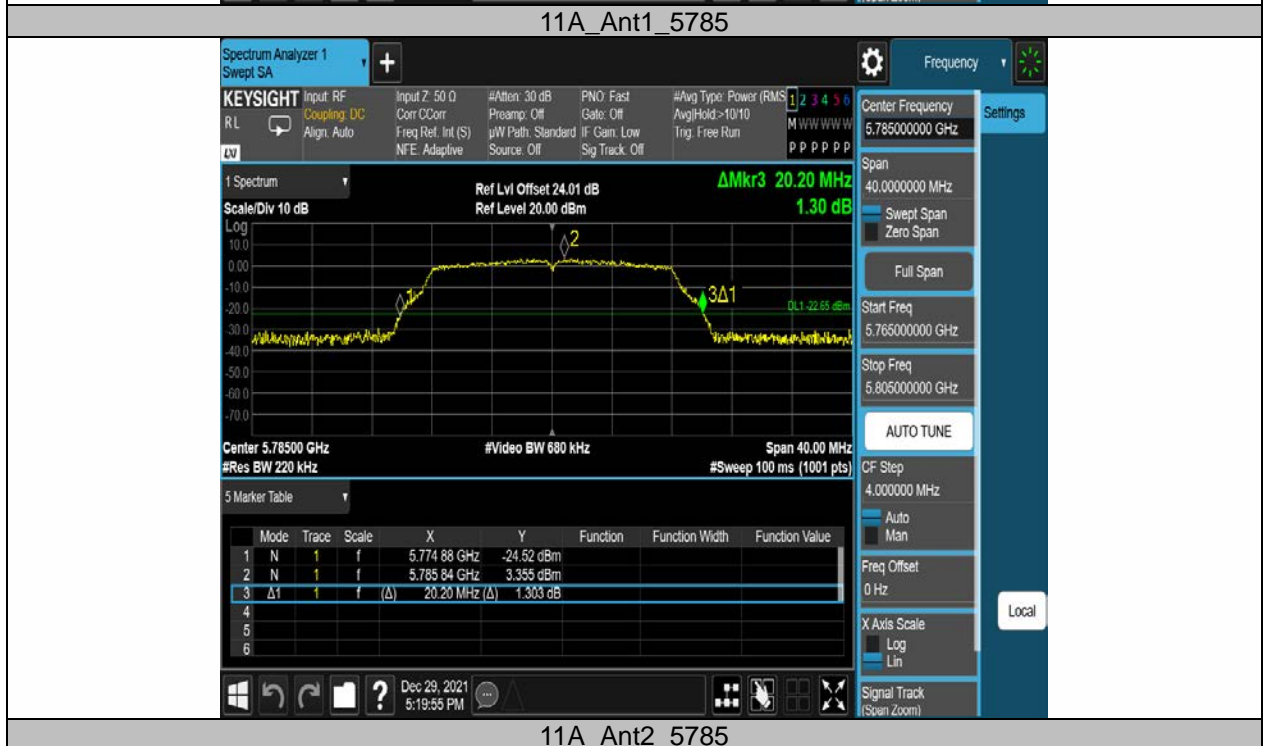


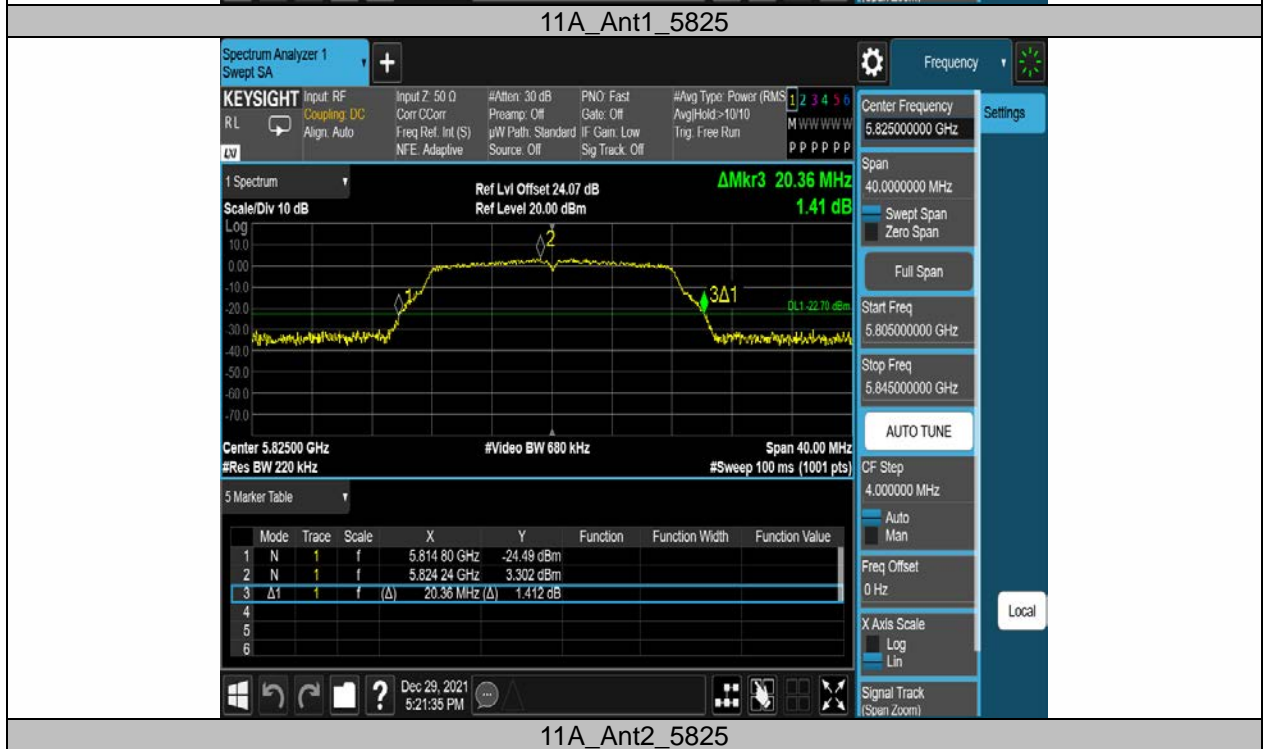


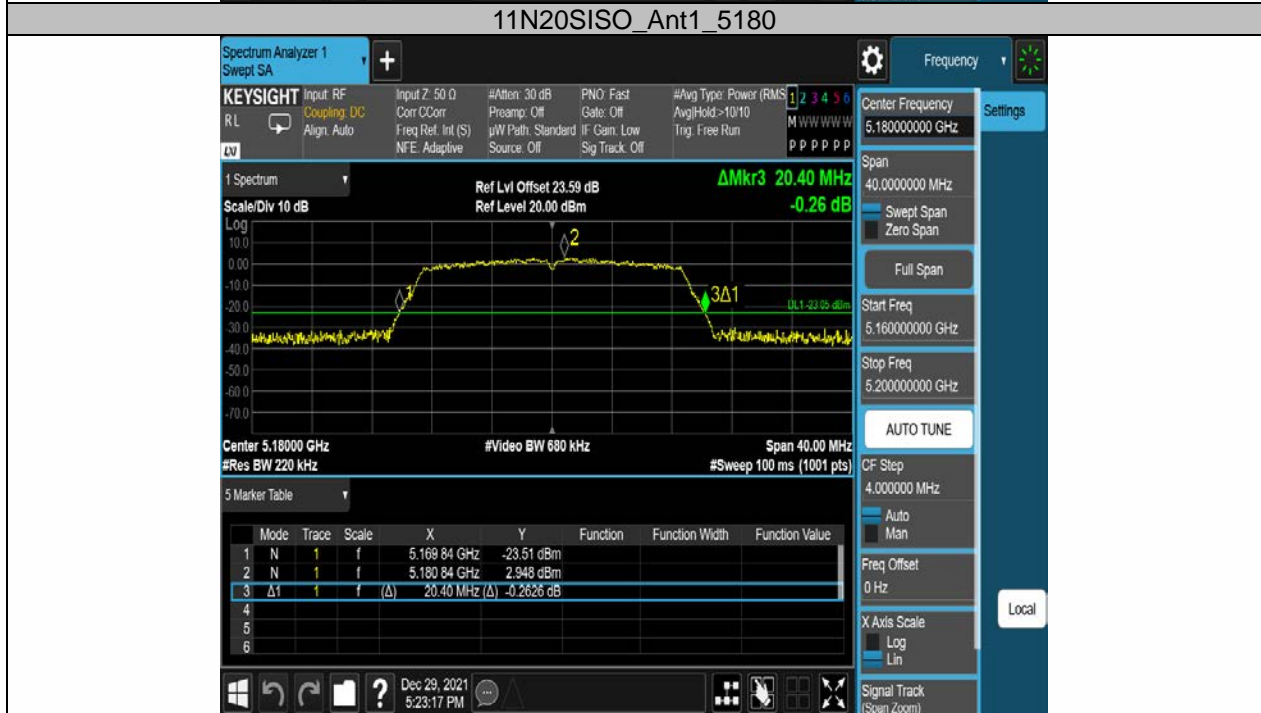


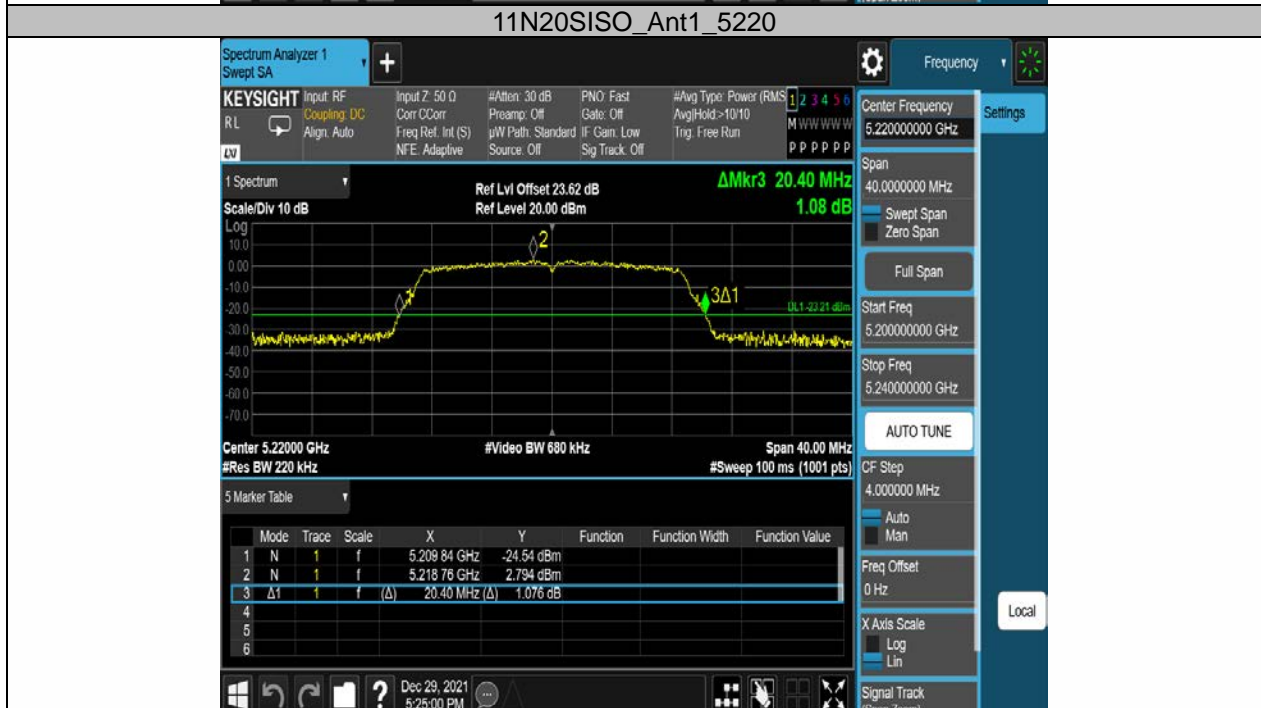






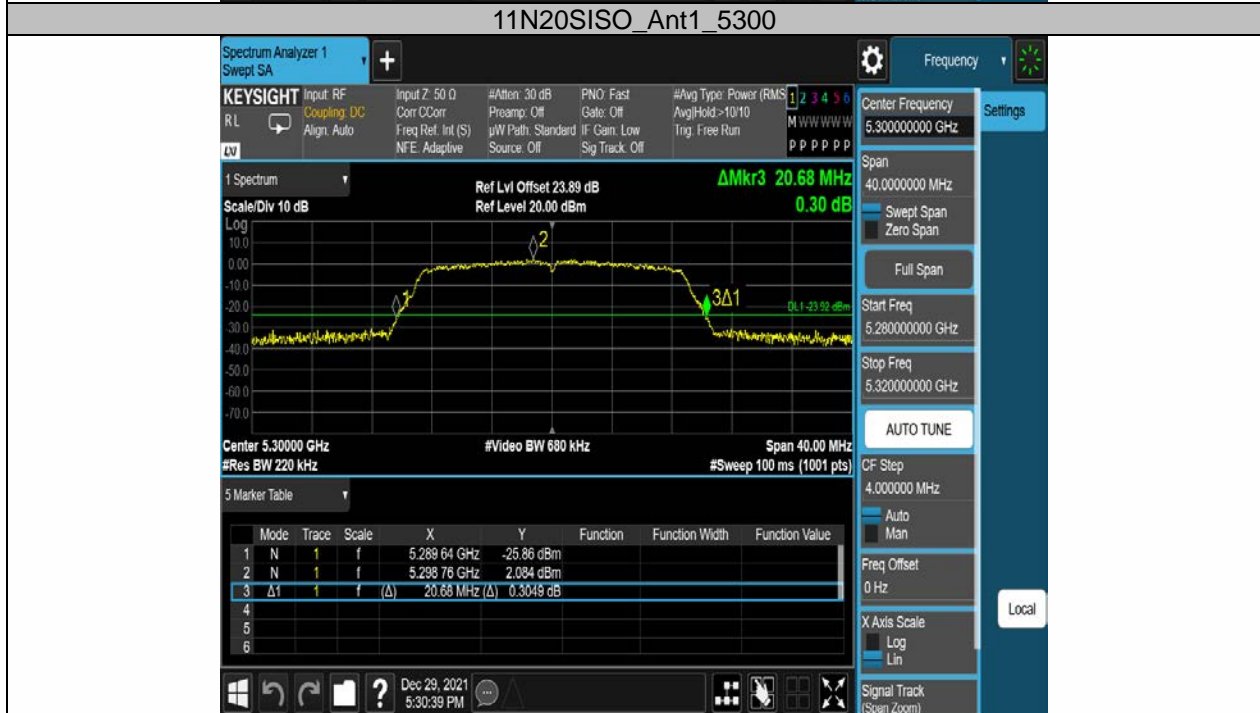


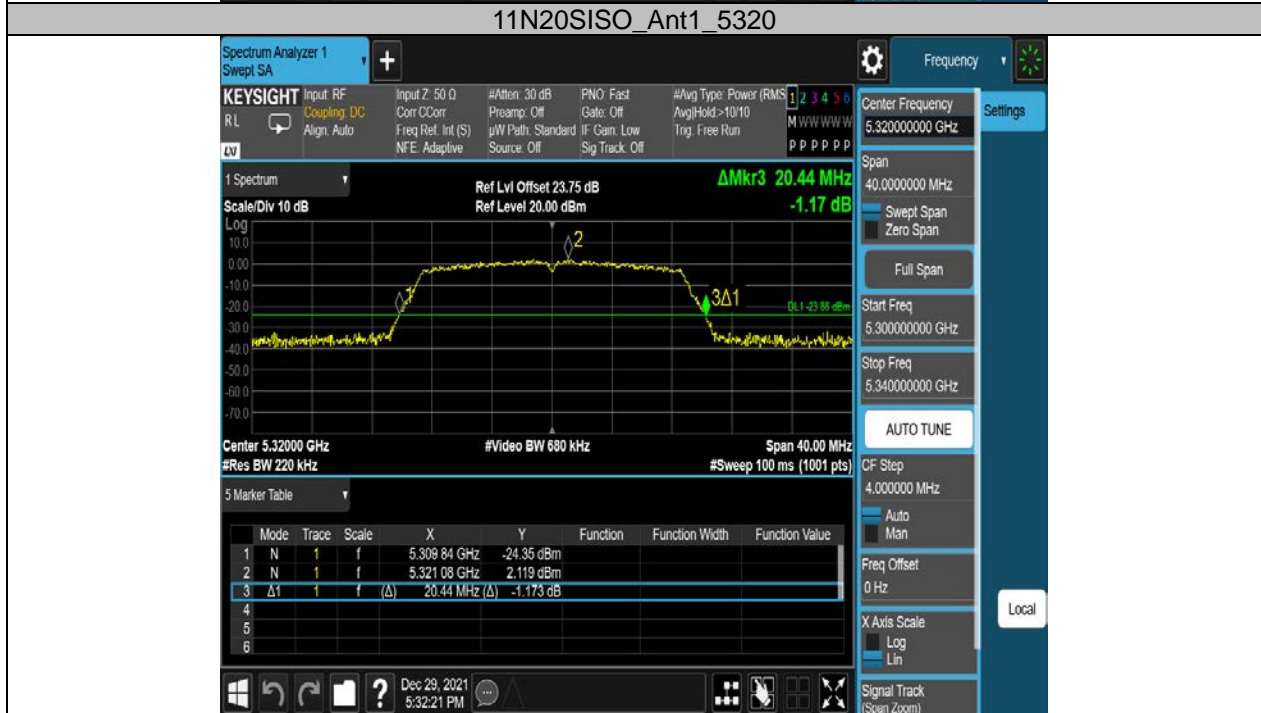


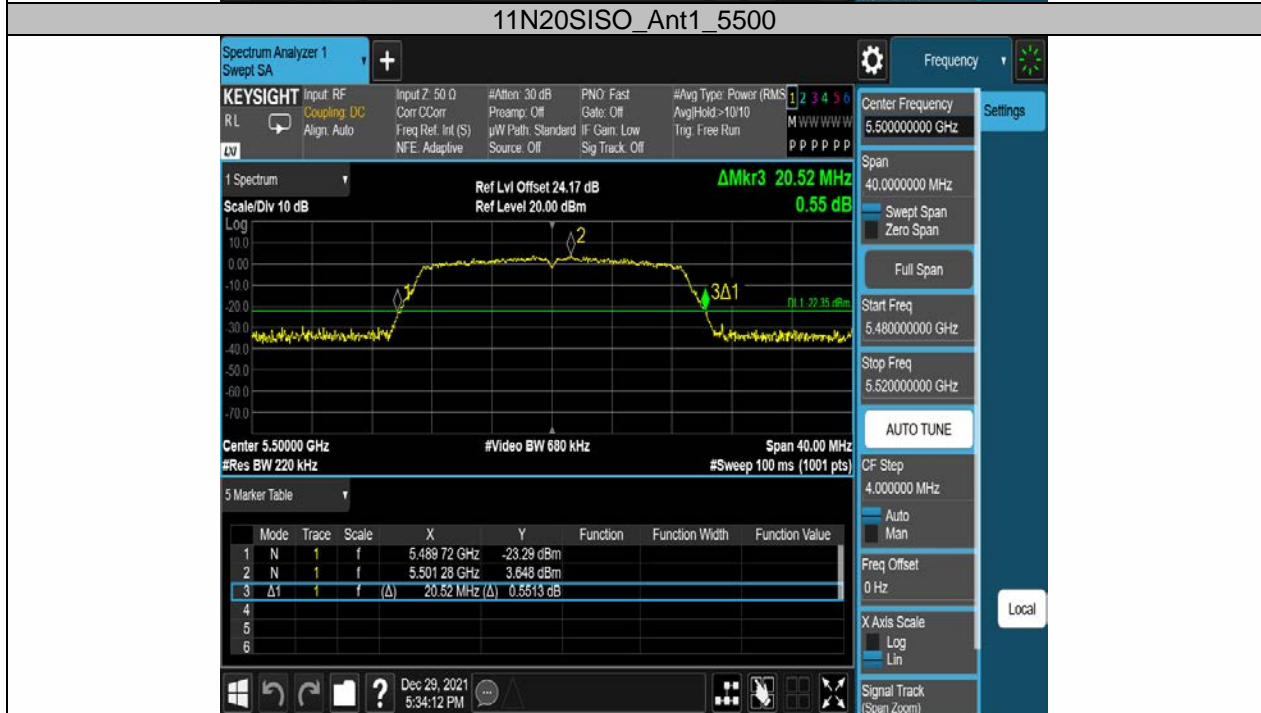


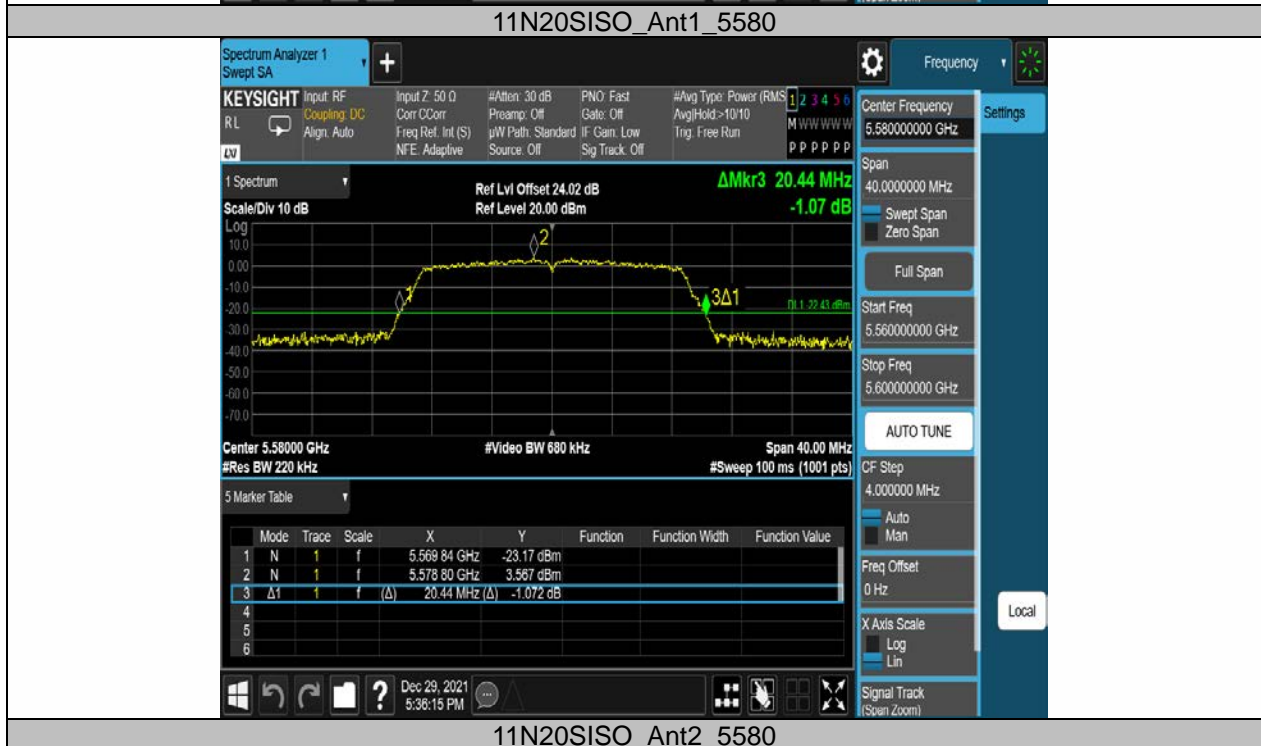














11N20SISO_Ant1_5700



11N20SISO_Ant2_5700







11N20SISO_Ant1_5825



11N20SISO_Ant2_5825



