FCC 47 CFR PART 15 SUBPART E

CERTIFICATION TEST REPORT

For

1080p FHD Wi-Fi Deterrence Camera

MODEL NUMBER: W281AA-Z
ADDITIONAL MODEL NUMBER: W281AA, W281AAx, W281AAx-y, (x can be blank or any letter A-Z, y can be blank or any letter A-Z)

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Prepared for

LOREX Technology Inc.

Prepared by

UL-CCIC COMPANY LIMITED
No. 2, Chengwan Road, Suzhou Industrial Park, People's Republic of China
Tel: +86 769 22038881
Fax: +86 769 33244054
Website: www.ul.com

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TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS 5

2. TEST METHODOLOGY 7

3. FACILITIES AND ACCREDITATIO 7

4. CALIBRATION AND UNCERTAINTY 8

4.1. MEASURING INSTRUMENT CALIBRATION 8

4.2. MEASUREMENT UNCERTAINTY 8

5. EQUIPMENT UNDER TEST 9

5.1. DESCRIPTION OF EUT 9

5.2. CHANNELS LIST 10

5.1. DESCRIPTION OF AVAILABLE ANTENNAS 11

5.2. TEST ENVIRONMENT 12

5.1. WORST-CASE CONFIGURATIONS 13

5.2. DESCRIPTION OF TEST SETUP 14

5.3. MEASURING INSTRUMENT AND SOFTWARE USED 15

6. ANTENNA PORT TEST RESULTS 17

6.1. ON TIME AND DUTY CYCLE 17

6.1.1. LIMITS 17

6.1.2. TEST ENVIRONMENT 17

6.1.3. RESULTS 17

6.2. 6/26 dB BANDWIDTH 20

6.2.1. LIMITS 20

6.2.2. TEST PROCEDUREC 20

6.2.3. TEST SETUP 20

6.2.4. TEST ENVIRONMENT 20

6.2.5. RESULTS 21

6.3. MAXIMUM AVERAGE CONDUCTED OUTPUT POWER 31

6.3.1. LIMITS 31

6.3.2. TEST PROCEDURE 31

6.3.3. TEST SETUP 31

6.3.4. TEST ENVIRONMENT 32

6.4. POWER SPECTRAL DENSITY 35

6.4.1. LIMITS 35

6.4.2. TEST PROCEDURE 35

6.4.3. TEST SETUP 36

6.4.4. RESULTS 37

6.4.5. Test Graphs 40

7. RADIATED TEST RESULTS 58

7.1. LIMITS 58

7.2. TEST SETUP AND PROCEDURE 60

7.3. TEST ENVIRONMENT 63

7.4. RESTRICTED BANDEDGE 64

7.4.1. UNII BAND I 64

7.4.2. UNII BAND III 79

7.5. HARMONICS AND SPURIOUS EMISSIONS 94

7.5.1. UNII-I BAND 94

7.5.2. UNII-III BAND 113

7.6. SPURIOUS EMISSIONS 18~26.5GHz 132

7.7. SPURIOUS EMISSIONS 26.5~40GHz 135

7.8. SPURIOUS EMISSIONS 30M ~ 1 GHz 138

7.9. SPURIOUS EMISSIONS BELOW 30M (WORST-CASE CONFIGURATION) 141

8. FREQUENCY STABILITY 145

9. AC POWER LINE CONDUCTED EMISSIONS 148

10. ANTENNA REQUIREMENTS 152

1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name:	LOREX Technology Inc.
Address:	250 Royal Crest Court, Markham, ON L3R 3S1 Canada

Manufacturer Information

Company Name:	LOREX Technology Inc.
Address:	250 Royal Crest Court, Markham, ON L3R 3S1 Canada

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	1080p FHD Wi-Fi Deterrence Camera
Model Name	W281AA-Z
Additional No.	W281AA, W281AAx, W281AAx-y, (x can be blank or any letter A-Z, y can be blank or any letter A-Z)
Sample Number	2369250
Data of Receipt Sample	Jun. 24, 2019
Date Tested	Jun. 24, 2019~ Aug. 14, 2019

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart E	Pass

Summary of Test Results			
Clause	Test Items	FCC Rules	Test Results
1	6/26db Bandwidth	FCC 15.407 (a)&(e)	PASS
2	Maximum Average Conducted Output Power	FCC 15.407 (a)	PASS
3	Power Spectral Density	FCC 15.407 (a)	PASS
4	Radiated Bandedge and Spurious Emission	FCC 15.407 (a) FCC 15.209 FCC 15.205	PASS
5	Conducted Emission Test For AC Power Port	FCC 15.207	PASS
6	Frequency Stability	FCC 15.407 (g)	PASS
7	Antenna Requirement	FCC 15.203	PASS
Remark: 1) The measurement result for the sample received is <Pass> according to < ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15> when <Accuracy Method> decision rule is applied.			

Prepared By:

Tom Tang

Tom Tang
Engineer Project Associate

Reviewed By:

Chris Zhong

Chris Zhong
Senior Project Engineer

Authorized By:

Scholl Zhang

Scholl Zhang
Laboratory Leader

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, KDB 789033 D02 v02r01, KDB 662911 D01 v02r01, and KDB414788 D01 Radiated Test Site v01r01.

3. FACILITIES AND ACCREDITATIO

Accreditation Certificate	**A2LA (Certificate No.: 4829.01)** **UL-CCIC COMPANY LIMITED has been assessed and proved to be in compliance with A2LA.** **FCC (FCC Designation No.: CN1247)** **UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.** **IC (IC Designation No.: 25056)** **UL-CCIC COMPANY LIMITED has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules.**

Note 1: All tests measurement facilities use to collect the measurement data are located at No. 2, Chengwan Road, Suzhou Industrial Park, Suzhou 215122, People's Republic of China

Note 2: For below 30MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. These measurements below 30MHz had been correlated to measurements performed on an OFS.

Note 3: The test anechoic chamber in UL-CCIC COMPANY LIMITED 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.

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 recognize 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
Conduction emission	3.00dB
Radiation Emission test(include Fundamental emission) (9KHz-30MHz)	3.32dB
Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	3.27dB
Radiation Emission test (1GHz to 40GHz)(include Fundamental emission)	3.80dB (1GHz-18Gz)
	4.11dB (18GHz-26.5Gz)
	4.51dB (26.5GHz-40Gz)
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:	1080p FHD Wi-Fi Deterrence Camera		
Model No.:	W281AA-Z		
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 5GHz 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:	35 (manufacturer declare)		
Test software of EUT:	Secure CRT (manufacturer declare)		
Antenna Type:	PCB Antenna		
Antenna Gain:	Antenna1	5150MHz~5250MHz:2.03 dBi	5725MHz~5825MHz:2.24 dBi
	Antenna2	5150MHz~5250MHz:4.35 dBi	5725MHz~5825MHz:6.81 dBi
Adapter	NAME:SWITCHING POWER SUPPLY MODEL:S0188YU1200150 INPUT:100-240V,50/60Hz, 600mA OUTPUT:5V/9V/12V ⎓ 3A/2A/1.5A		

Remark:
Model No.:

Number:	Name:	Number:	Name:	Number:	Name:
1	W281AA-Z	2	W281AA	3	W281AAx
4	W281AAx-y				
Remark: x can be blank or any letter A-Z, y can be blank or any letter A-Z					

Only the main model **W281AA-Z** 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 and selling area are different.

5.2. CHANNELS LIST

20 MHz Bandwidth Channel frequencies		
Band	Channel	Frequency (MHz)
UNII-1	36	5180
	40	5200
	44	5220
	48	5240
UNII-3	149	5745
	153	5765
	157	5785
	161	5805
	165	5825

40 MHz Bandwidth Channel frequencies		
Band	Channel	Frequency (MHz)
UNII-1	38	5190
	46	5230
UNII-3	151	5755
	159	5795

80 MHz Bandwidth Channel frequencies		
Band	Channel	Frequency (MHz)
UNII-1	42	5210
UNII-3	155	5775

Remark:
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected

5.1. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	5150-5250	PCB Antenna	2.03
	5725-5825	PCB Antenna	2.24

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
2	5150-5250	PCB Antenna	4.35
	5725-5825	PCB Antenna	6.81

Test Mode	Transmit and Receive Mode	Description
802.11a	2TX, 2RX	Antenna 1 and Antenna2 can both be used as transmitting/receiving antenna.
802.11n HT20	2TX, 2RX	Antenna 1 and Antenna2 can both be used as transmitting/receiving antenna.
802.11n HT40	2TX, 2RX	Antenna 1 and Antenna2 can both be used as transmitting/receiving antenna.
802.11ac HT20	2TX, 2RX	Antenna 1 and Antenna2 can both be used as transmitting/receiving antenna.
802.11ac HT40	2TX, 2RX	Antenna 1 and Antenna2 can both be used as transmitting/receiving antenna.
802.11ac HT80	2TX, 2RX	Antenna 1 and Antenna2 can both be used as transmitting/receiving antenna.
Remark: For this product, it has two antennas, antenna1 and antenna2, the 802.11a is use the SISO technical, but the ant1 and ant2 can transmitter in the same time under those modes. The 802.11n and 802.11ac are both use the SISO and MIMO technical.		

Directional gain					
Mode	Frequency (MHz)	Max Antenna Gain (dBi)		For power measurements Directional gain Gain (dBi)	For power spectral density (PSD) measurements Directional gain Gain (dBi)
		Antenna1	Antenna2		
SISO	5150-5250	2.03	4.35	6.28	6.28
SISO	5725-5825	2.24	6.81	7.83	7.83
CDD 2TX	5150-5250	2.03	4.35	6.28	6.28
CDD 2TX	5725-5825	2.24	6.81	7.83	7.83

Note:
1） Directional gain= 10log $[(10^{G1/20}+10^{G2/20})^2/N_{ANT}]$
2） N_{ANT}: the number of Antenna
3) For this product, it has two antennas, antenna1 and antenna2, the 802.11a is use the SISO technical, but the ant1 and ant2 can transmitter in the same time under those modes. The 802.11n and 802.11ac are both use the SISO and MIMO technical.
4) All the modes had been tested but only the worst data in the report.

5.2. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	55 ~ 65%	
Atmospheric Pressure:	1025Pa	
Temperature	TN	23 ~ 28°C
	TL	-10°C
	TH	45°C
Voltage :	VL	AC108
	VN	AC 120V/60Hz
	VH	AC132

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

5.1. WORST-CASE CONFIGURATIONS

IEE Std. 802.11	Modulation Technology	Modulation Type	Data Rate (Mbps)	Worst Case (Mbps)
a	OFDM	BPSK,QPSK,16QAM, 64QAM	54/48/36/24/18/12/9/6	6

IEE Std. 802.11	Modulation Technology	Modulation Type	Data Rate	Worst Case
n HT20	OFDM	BPSK, QPSK, 16QAM, 64QAM	(MCS0~MCS23)	MCS0
n HT40	OFDM	BPSK, QPSK, 16QAM, 64QAM	(MCS0~MCS23)	MCS0

IEE Std. 802.11	Modulation Technology	Modulation Type	Data Rate	Worst Case
ac HT20	OFDM	BPSK, QPSK, 16QAM, 64QAM	(MCS0~MCS9)	MCS0
ac HT40	OFDM	BPSK, QPSK, 16QAM, 64QAM	(MCS0~MCS9)	MCS0
ac HT80	OFDM	BPSK, QPSK, 16QAM, 64QAM	(MCS0~MCS9)	MCS0

Remark:
1) For this product, it has two antennas, antenna1 and antenna2, the 802.11a is use the SISO technical, but the ant1 and ant2 can transmitter in the same time under those modes. The 802.11n and 802.11ac are both use the SISO and MIMO technical.
2) EUT support for SISO and CDD MIMO Transmission, only 802.11n/ac supports CDD MIMO Mode, SISO mode sets the same power level as MIMO mode, so MIMO mode is the worst case.
3) 11n HT20 mode set the same power level as 11ac HT20 mode, and 11n HT40 mode set the same power level as 11ac HT40 mode, besides the 11ac HT20 mode and 11ac HT40 mode were worse case, so only the 11ac HT20 mode and 11ac HT40 mode were tested in this report.

5.2. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Description
1	Laptop	ThinkPad	E550c	N/A
2	Fixed Frequency Board	N/A	N/A	Supply by UL Lab

I/O PORT

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
1	N/A	N/A	N/A	N/A	N/A

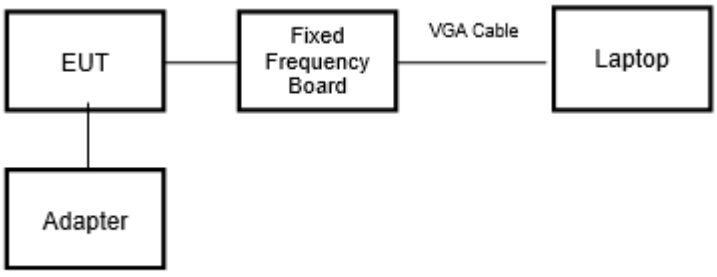
ACCESSORY

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

TEST SETUP

The EUT can work in engineering mode with a software through a PC.

SETUP DIAGRAM FOR TEST



5.3. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions (Instrument**)**							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
☑	EMI Test Receiver	R&S	ESR3	126700	2017-12-14	2018-12-13	2019-12-12
☑	Two-Line V-Network	R&S	ENV216	126701	2017-12-14	2018-12-13	2019-12-12
☑	Artificial Mains Networks	R&S	ENY81	126711	2017-12-14	2018-12-13	2019-12-12
Software							
Used	Description		Manufacturer	Name	Version		
☑	Test Software for Conducted disturbance		R&S	EMC32	Ver. 9.25		
Radiated Emissions (Instrument**)**							
Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
☑	Spectrum Analyzer	Keysight	N9010B	MY57110128	2018-05-30	2019-05-29	2020-05-28
☑	EMI test receiver	R&S	ESR26	1267603	2017-12-14	2018-12-13	2019-12-22
☑	Receiver Antenna (9kHz-30MHz)	Schwarzbeck	FMZB 1513	513-265	2018-06-17	2019-06-16	2020-06-15
☑	Receiver Antenna (30MHz-1GHz)	SunAR RF Motion	JB1	126704	N/A	2019-01-28	2022-01-27
☑	Receiver Antenna (1GHz-18GHz)	R&S	HF907	126705	2018-01-27	2019-01-26	2020-01-26
☑	Receiver Antenna (18GHz-26.5GHz)	Schwarzbeck	BBHA9170	126706	2018-02-07	2019-02-06	2020-02-05
☑	Receiver Antenna (26.5GHz-40GHz)	TOYO	HAP 26-40W	00000012	2018-07-25	2019-07-23	2020-07-22
☑	Pre-amplification (To 1GHz)	R&S	SCU-03D	134666	2018-02-07	2019-02-06	2020-02-05
☑	Pre-amplification (To 18GHz)	Compliance Direction System Inc.	PAP-1G18-50	14140-13467	N/A	2019-03-18	2020-03-17
☑	Pre-amplification (To 26.5GHz)	R&S	SCU-26D	134668	2018-02-07	2019-02-06	2020-02-05
☑	Band Reject Filter	Wainwright	WRCJV8-2350-2400-2483.5-2533.5-40SS	1	2018-05-30	2019-05-29	2020-05-28
☑	Highpass Filter	Wainwright	WHKX10-2700-3000-18000-40SS	2	2018-05-30	2019-05-29	2020-05-28
Software							
Used	Description		Manufacturer	Name	Version		
☑	Test Software for Radiated disturbance		Tonscend	JS32	V2.5		
Other instruments							

Used	Equipment	Manufacturer	Model No.	Serial No.	Upper Last Cal.	Last Cal.	Next Cal.
☑	Spectrum Analyzer	Keysight	N9010B	MY57110128	2018-05-30	2019-05-29	2020-05-28
☑	Power Meter	Keysight	U2021XA	MY57110002	2018-06-13	2019-06-12	2020-06-11

6. ANTENNA PORT TEST RESULTS

6.1. ON TIME AND DUTY CYCLE

6.1.1. LIMITS

None; for reporting purposes only.

6.1.2. TEST ENVIRONMENT

Temperature	22°C	Relative Humidity	56%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V

6.1.3. RESULTS

UNII Band III

Mode	ON Time (ms)	Period (ms)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (KHz)
11a 1TX	100	100	1	100%	0	0.01
11ac HT20 MIMO	100	100	1	100%	0	0.01
11ac HT40 MIMO	100	100	1	100%	0	0.01
11ac HT80 MIMO	100	100	1	100%	0	0.01

Remark:

1) Duty Cycle Correction Factor=10log(1/x).
2) Where: x is Duty Cycle(Linear)
3) UNII Band I and UNII Band III have the same duty cycle, only UNII Band III data is shown in this report.
4) Antenna 1 and Antenna 2 have the same duty cycle, only Antenna B data show here.
5) If that calculated VBW is not available on the analyzer then the next higher value should be used.
6) Pre-testing all test modes and channels, only the data of the worst case is shown in this report.

DUTY CYCLE 802.11a MODE(THE WORST CASE)

DUTY CYCLE 802.11ac HT20 MIMO MODE(THE WORST CASE)

DUTY CYCLE 802.11ac HT40 MIMO MODE(THE WORST CASE)

DUTY CYCLE 802.11ac HT80 MODE(THE WORST CASE)

6.2. 6/26 dB BANDWIDTH

6.2.1. LIMITS

FCC Part15, Subpart E		
Test Item	Limit	Frequency Range (MHz)
Bandwidth	26 dB Bandwidth	5150-5250
	Minimum 500kHz 6dB Bandwidth	5725-5850

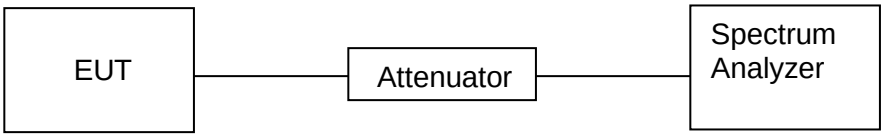
6.2.2. TEST PROCEDUREC

Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	For 6dB Bandwidth: RBW=100kHz For 26dB Bandwidth: approximately 1% of the emission bandwidth.
VBW	For 6dB Bandwidth : VBW=300kHz For 26dB Bandwidth : >3RBW
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 6/26 dB relative to the maximum level measured in the fundamental emission.

6.2.3. TEST SETUP



6.2.4. TEST ENVIRONMENT

Temperature	22°C	Relative Humidity	56%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V

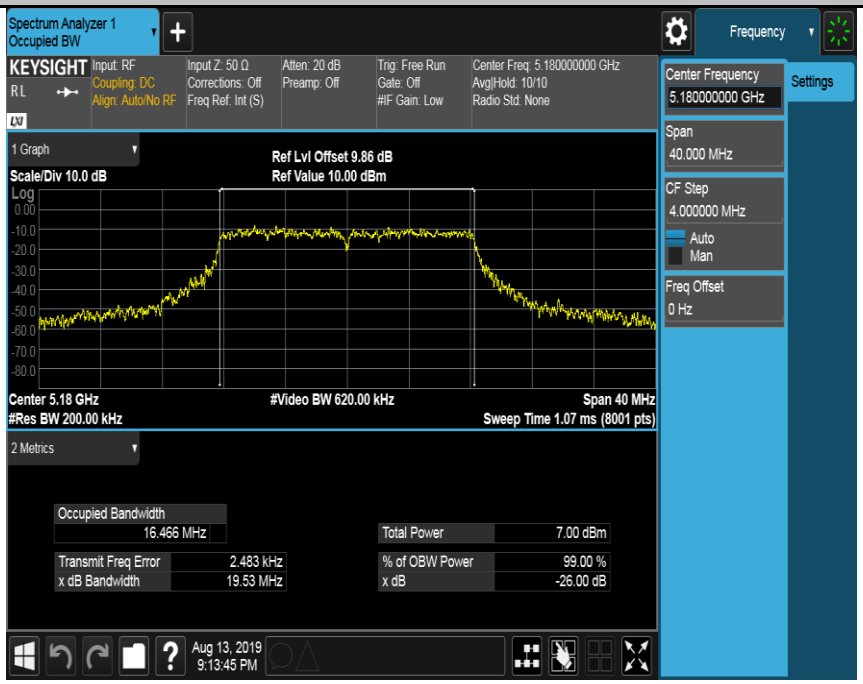
6.2.5. RESULTS

Test Mode	Test Channel	Ant	EBW[MHz]	Limit[MHz]	Verdict
11A	5180	Ant2	19.53	---	PASS
11A	5200	Ant2	20.37	---	PASS
11A	5240	Ant2	20.07	---	PASS
11A	5745	Ant2	16.42	0.5	PASS
11A	5785	Ant2	16.45	0.5	PASS
11A	5825	Ant2	16.43	0.5	PASS
11AC20	5180	Ant2	20.69	---	PASS
11AC20	5200	Ant2	20.76	---	PASS
11AC20	5240	Ant2	20.13	---	PASS
11AC20	5745	Ant2	17.69	0.5	PASS
11AC20	5785	Ant2	17.60	0.5	PASS
11AC20	5825	Ant2	17.76	0.5	PASS
11AC40	5190	Ant2	41.95	---	PASS
11AC40	5230	Ant2	41.07	---	PASS
11AC40	5755	Ant2	36.49	0.5	PASS
11AC40	5795	Ant2	36.35	0.5	PASS
11AC80	5210	Ant2	80.70	---	PASS
11AC80	5775	Ant2	75.81	0.5	PASS

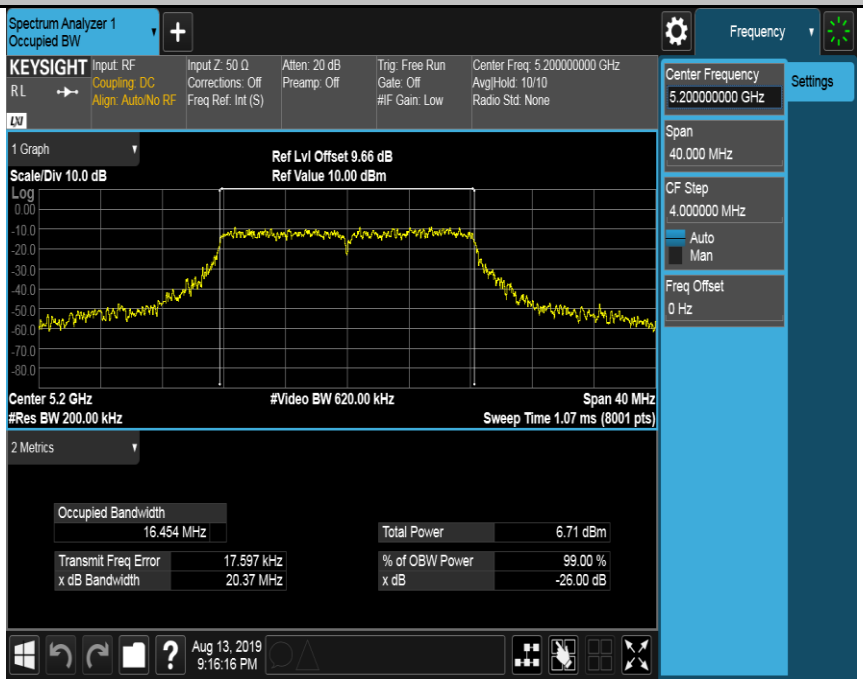
Remark: Pre-testing all test modes and both antennas, and find the Antenna 2 of MIMO mode which is the worst case, so only the data of worst case is included in this test report.

Test Graphs
Antenna2(WORST-CASE CONFIGURATION)

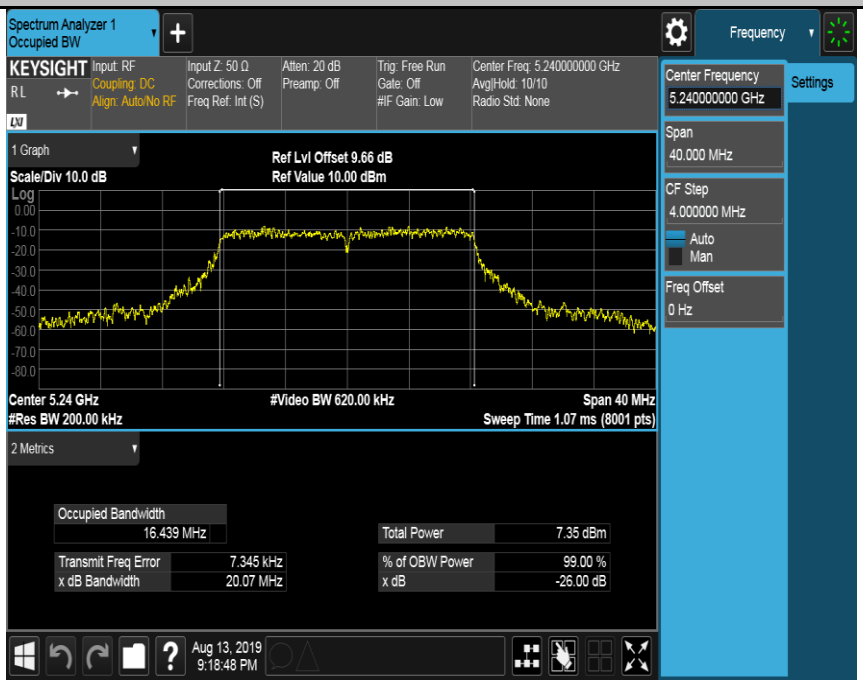
TEST PLOT
Emission Bandwidth Measurement_11A_5180



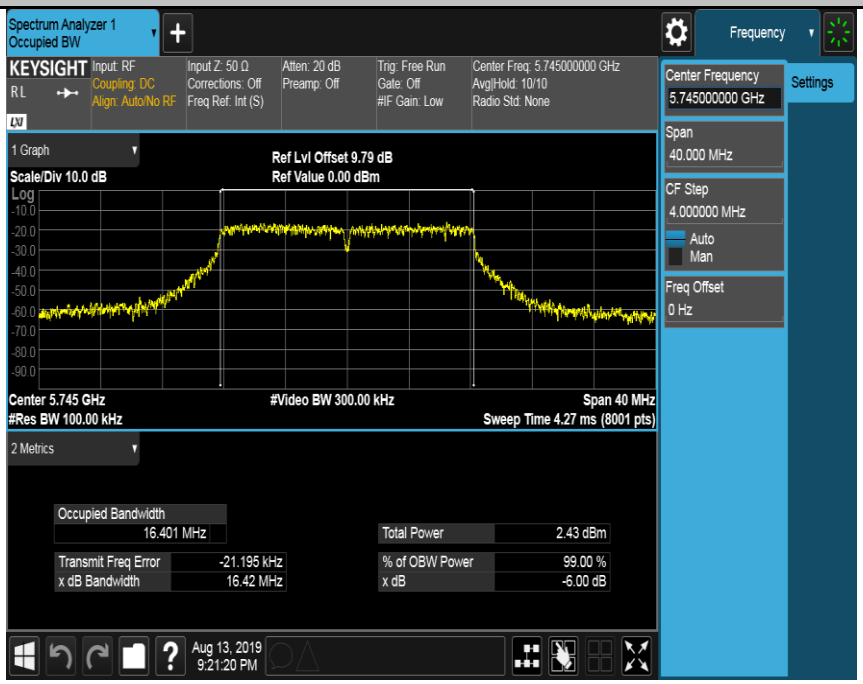
Emission Bandwidth Measurement_11A_5200



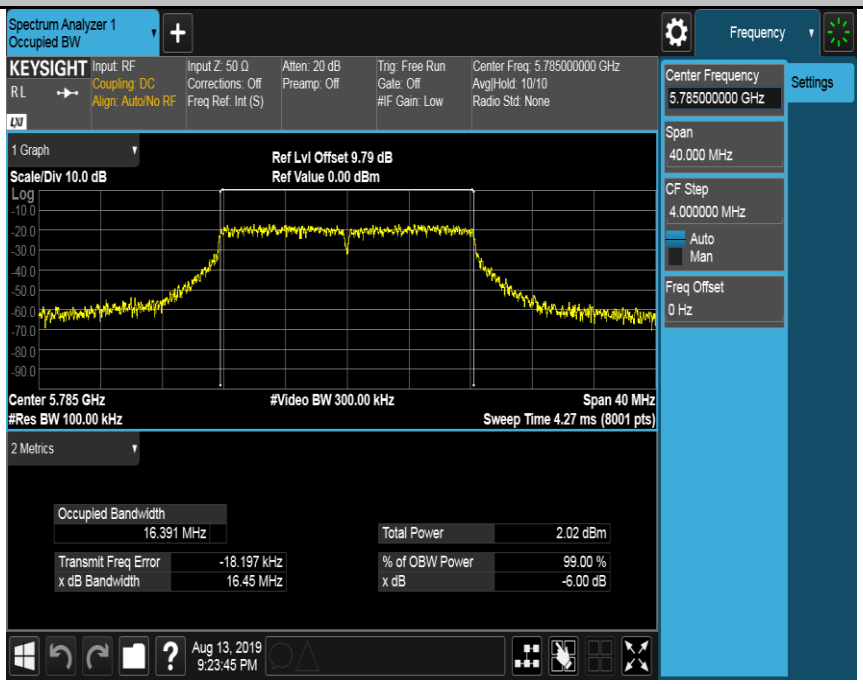
Emission Bandwidth Measurement_11A_5240



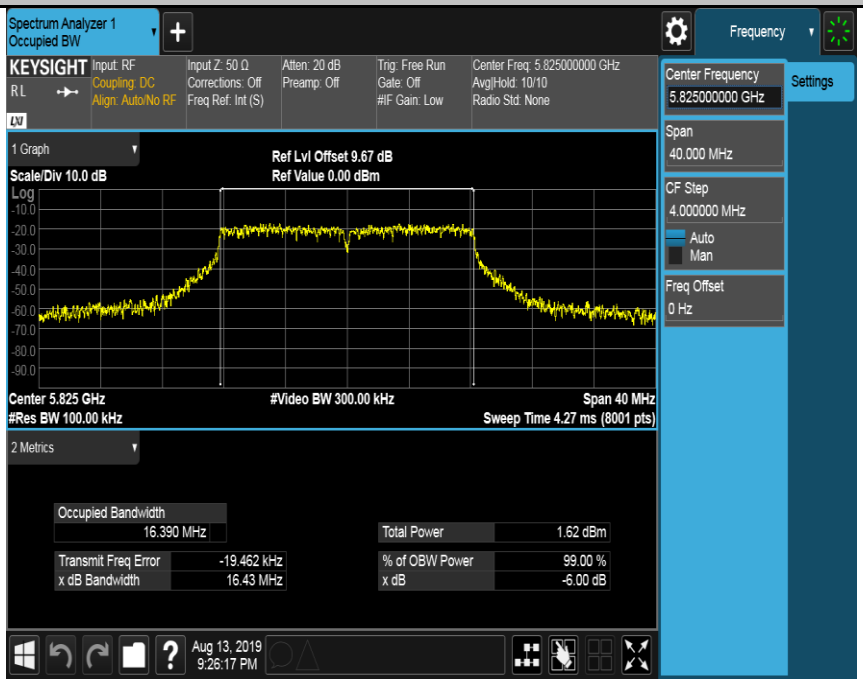
Emission Bandwidth Measurement_11A_5745



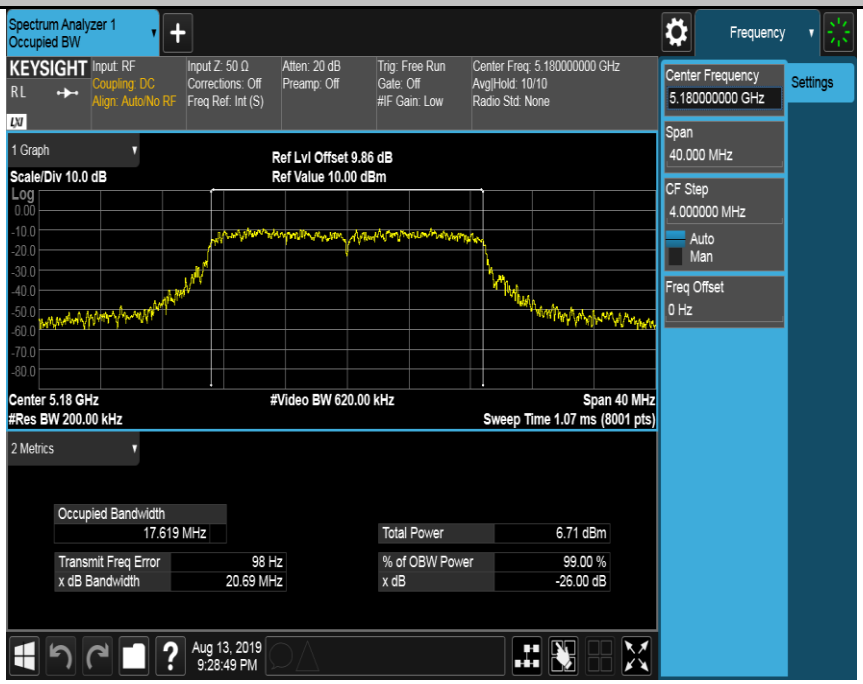
Emission Bandwidth Measurement_11A_5785



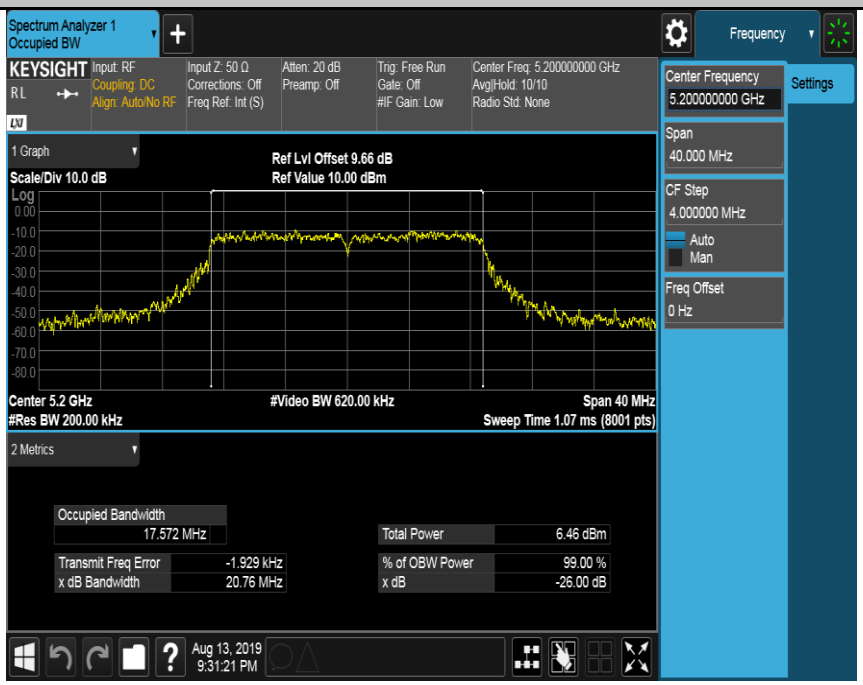
Emission Bandwidth Measurement_11A_5825



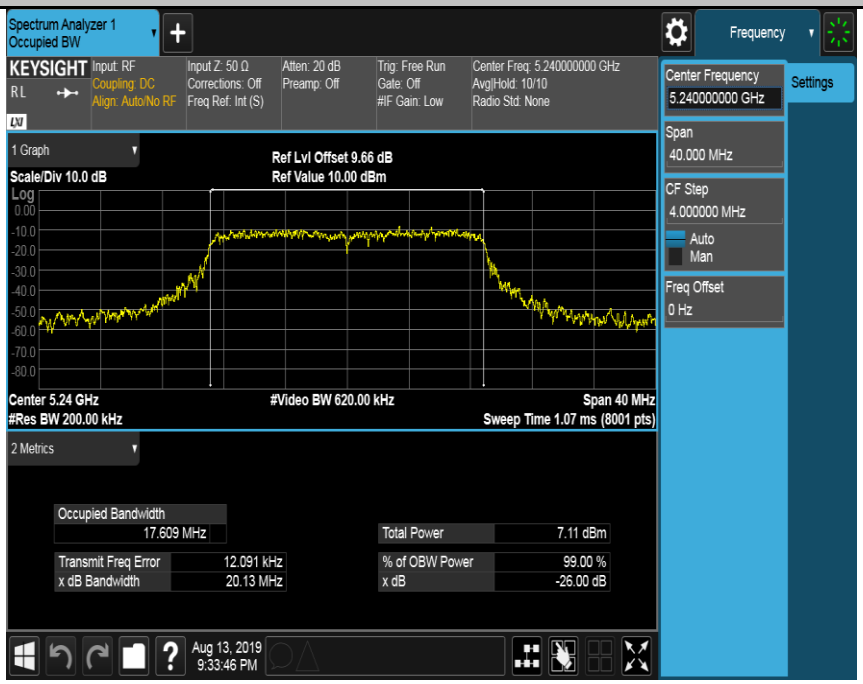
Emission Bandwidth Measurement_11AC20_5180



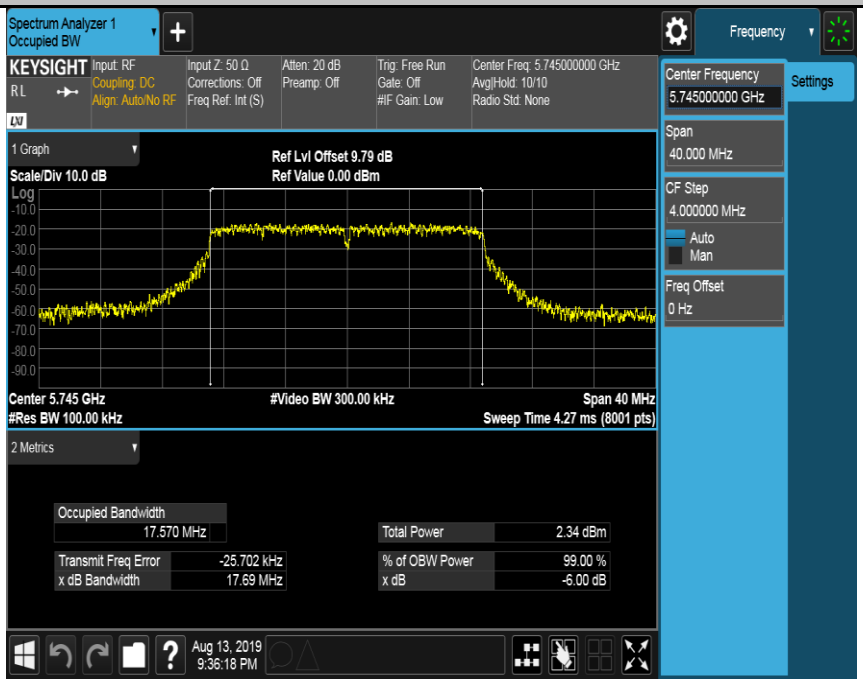
Emission Bandwidth Measurement_11AC20_5200



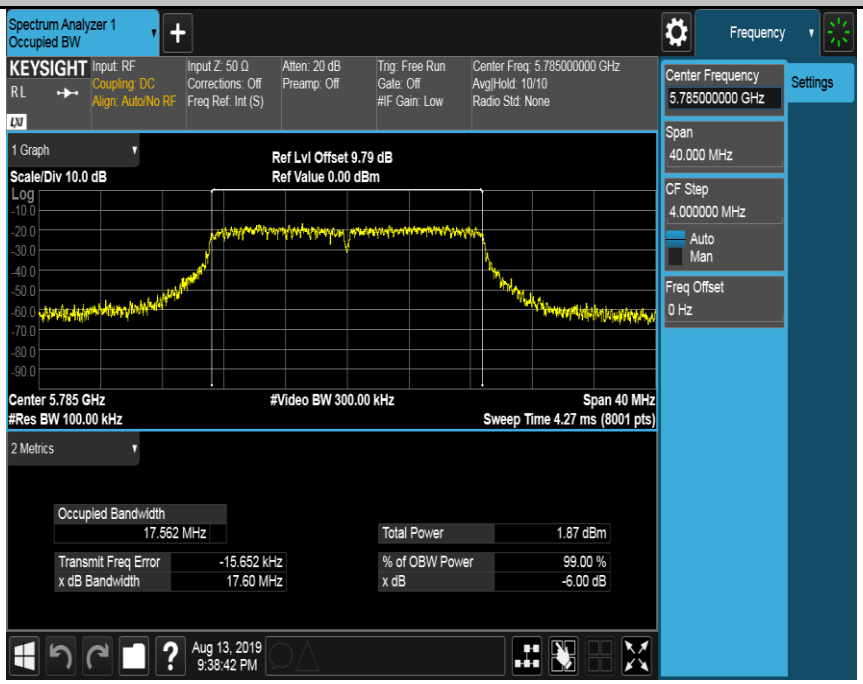
Emission Bandwidth Measurement_11AC20_5240



Emission Bandwidth Measurement_11AC20_5745



Emission Bandwidth Measurement_11AC20_5785



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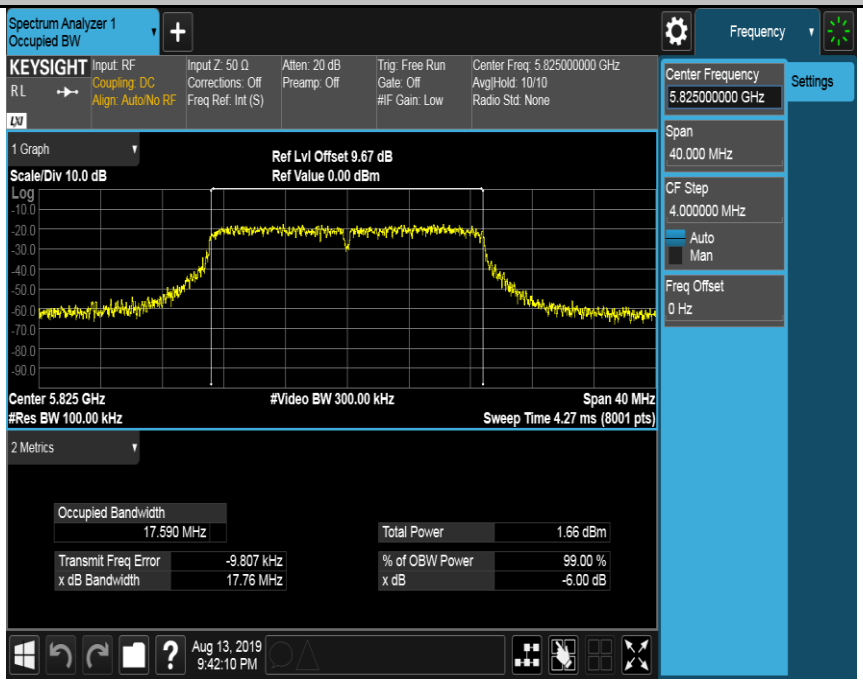
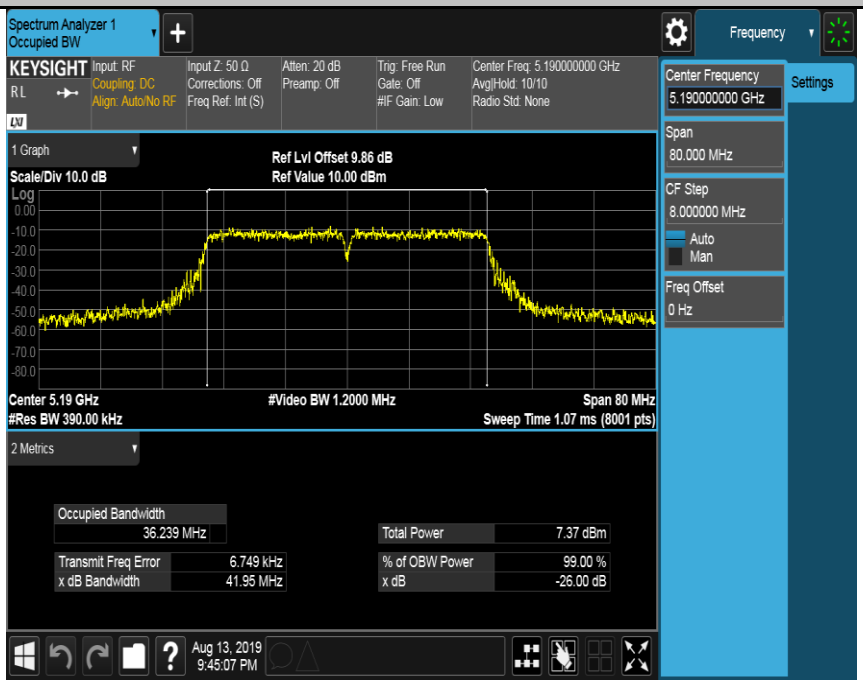
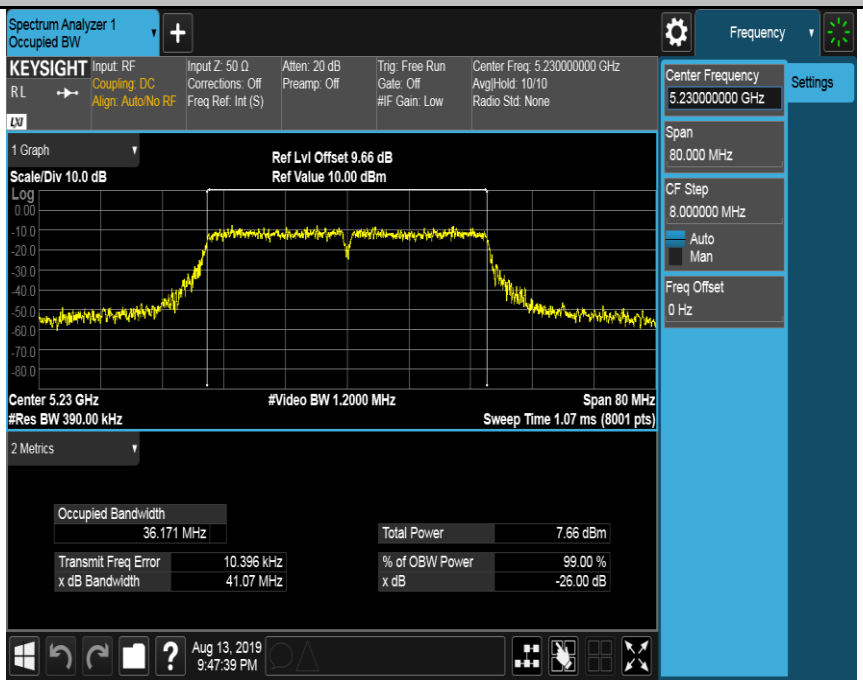


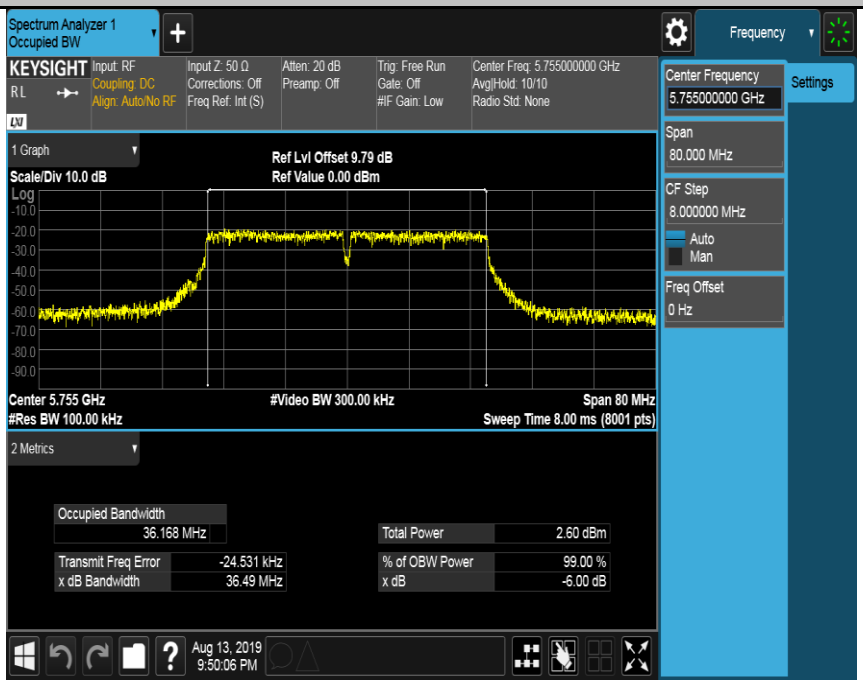
Emission Bandwidth Measurement_11AC40_5190



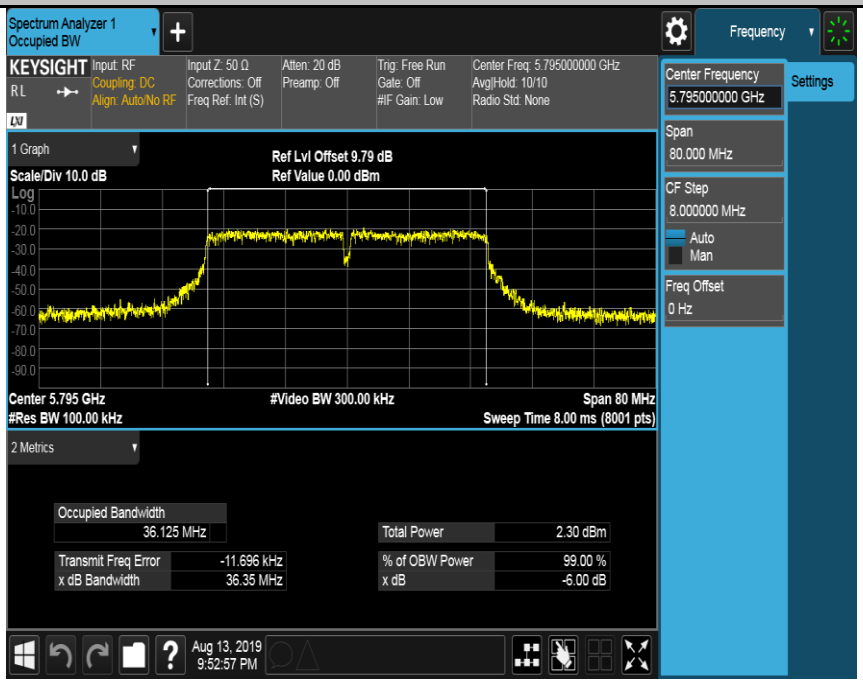
Emission Bandwidth Measurement_11AC40_5230



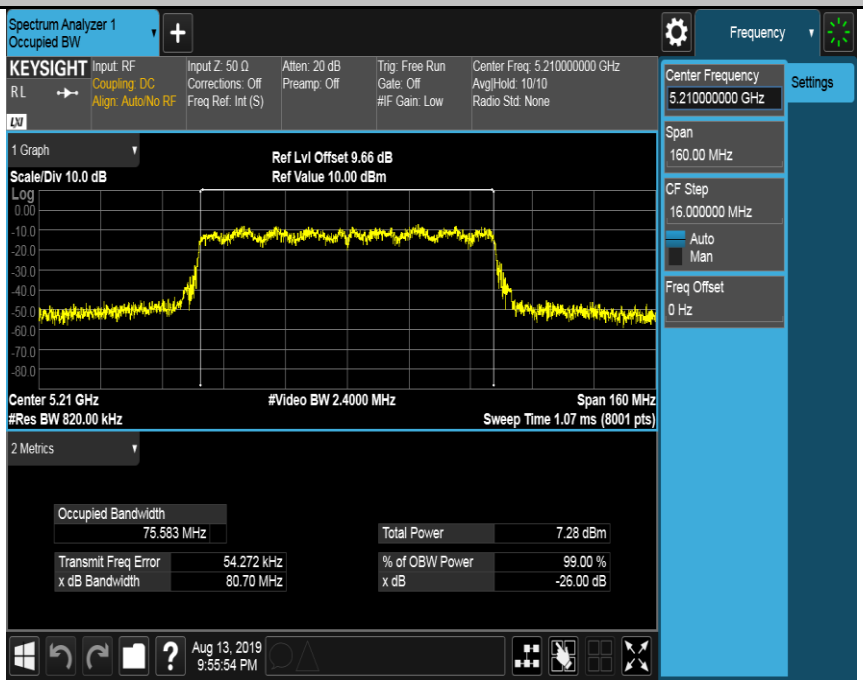
Emission Bandwidth Measurement_11AC40_5755



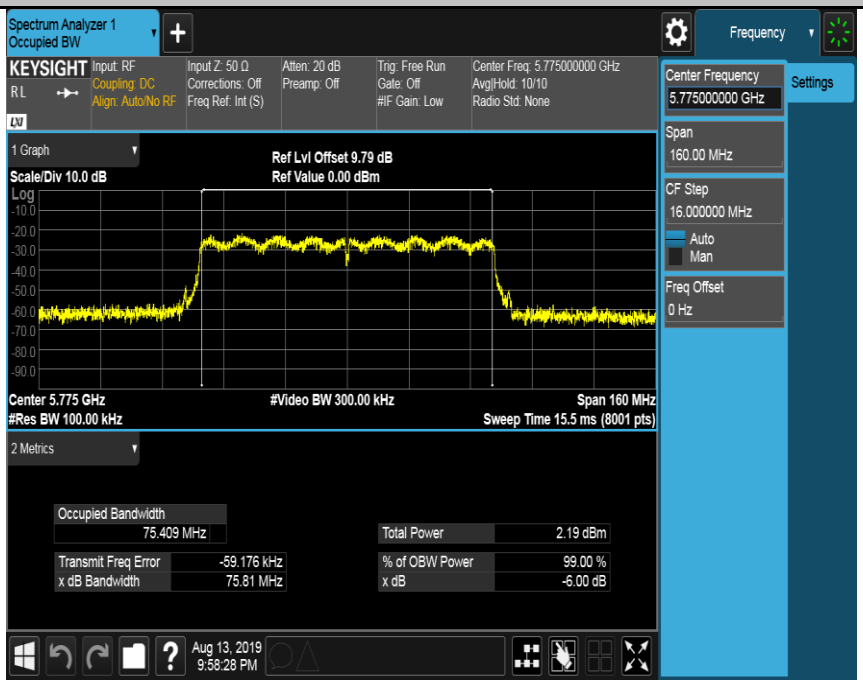
Emission Bandwidth Measurement_11AC40_5795



Emission Bandwidth Measurement_11AC80_5210



Emission Bandwidth Measurement_11AC80_5775



6.3. MAXIMUM AVERAGE CONDUCTED OUTPUT POWER

6.3.1. LIMITS

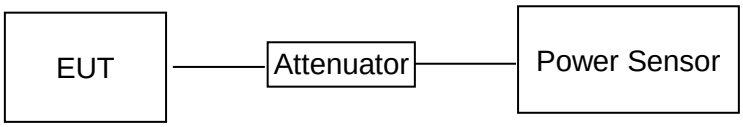
FCC Part15, Subpart E		
Test Item	Limit	Frequency Range (MHz)
Conducted Output Power	For FCC client devices :250mW (24dBm)	5150-5250
	1 Watt (30dBm)	5725-5850
1. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. 2. Limit: ① For Band I: Limit=24dBm – (Directional gain -6)dBi Directional gain = 10log $[(10^{G1/20}+10^{G2/20})^2/N_{ANT}]$ =6.28＞6dBi,where the NANT is the numbers of antenna. So, the power limit shall be reduced to 24 – (6.28-6) = 23.72 dBm ② For Band III: Limit=30dBm – (Directional gain -6)dBi Directional gain = 10log $[(10^{G1/20}+10^{G2/20})^2/N_{ANT}]$ =7.83＞6dBi,where the NANT is the numbers of antenna. So, the power limit shall be reduced to 30 – (7.83-6) = 28.17 dBm		

6.3.2. TEST PROCEDURE

Refer to KDB 789033 D02 General UNII Test Procedures New Rules v02r01

Connect the EUT to the a broadband average(RMS) RF power meter, the power meter shall have a video bandwidth that is greater than or equal to the bandwidth and shall utilize a fast-responding diode detector.

6.3.3. TEST SETUP



6.3.4. TEST ENVIRONMENT

Temperature	22°C	Relative Humidity	56%
Atmosphere Pressure	101kPa	Test Voltage	AC 120V

RESULTS

Test Mode	Test Channel	Ant	Level [dBm]	10log(1/x) Factor [dB]	Power [dBm]	EIRP [dBm]	Limit [dBm]	Verdict
11A	5180	Ant1	4.55	0.00	4.55	6.58	24	PASS
		Ant2	7.50	0.00	7.50	11.85	24	PASS
		Ant 1+2	9.28	0.00	9.28	15.56	23.72	PASS
11A	5200	Ant1	5.03	0.00	5.03	7.06	24	PASS
		Ant2	7.28	0.00	7.28	11.63	24	PASS
		Ant 1+2	9.31	0.00	9.31	15.59	23.72	PASS
11A	5240	Ant1	6.08	0.00	6.08	8.11	24	PASS
		Ant2	7.76	0.00	7.76	12.11	24	PASS
		Ant 1+2	10.01	0.00	10.01	16.29	23.72	PASS
11A	5745	Ant1	8.95	0.00	8.95	11.19	30	PASS
		Ant2	3.01	0.00	3.01	9.82	30	PASS
		Ant 1+2	9.94	0.00	9.94	17.77	28.17	PASS
11A	5785	Ant1	8.22	0.00	8.22	10.46	30	PASS
		Ant2	2.32	0.00	2.32	9.13	30	PASS
		Ant 1+2	9.21	0.00	9.21	17.04	28.17	PASS
11A	5825	Ant1	7.22	0.00	7.22	9.46	30	PASS
		Ant2	1.98	0.00	1.98	8.79	30	PASS
		Ant 1+2	8.36	0.00	8.36	16.19	28.17	PASS
11AC20	5180	Ant1	4.96	0.00	4.96	6.99	24	PASS
		Ant2	7.69	0.00	7.69	12.04	24	PASS
		Ant 1+2	9.49	0.00	9.49	15.77	23.72	PASS
11AC20	5200	Ant1	5.42	0.00	5.42	7.45	24	PASS
		Ant2	7.24	0.00	7.24	11.59	24	PASS
		Ant 1+2	9.43	0.00	9.43	15.71	23.72	PASS
11AC20	5240	Ant1	6.31	0.00	6.31	8.34	24	PASS
		Ant2	8.07	0.00	8.07	12.42	24	PASS
		Ant 1+2	10.29	0.00	10.29	16.57	23.72	PASS
11AC20	5745	Ant1	9.16	0.00	9.16	11.4	30	PASS
		Ant2	3.08	0.00	3.08	9.89	30	PASS
		Ant 1+2	10.12	0.00	10.12	17.95	28.17	PASS
11AC20	5785	Ant1	8.38	0.00	8.38	10.62	30	PASS

		Ant2	2.47	0.00	2.47	9.28	30	PASS
		Ant 1+2	9.37	0.00	9.37	17.2	28.17	PASS
11AC20	5825	Ant1	7.47	0.00	7.47	9.71	30	PASS
		Ant2	2.20	0.00	2.20	9.01	30	PASS
		Ant 1+2	8.81	0.00	8.81	16.64	28.17	PASS
11AC40	5190	Ant1	5.62	0.00	5.62	7.65	24	PASS
		Ant2	7.89	0.00	7.89	12.24	24	PASS
		Ant 1+2	9.91	0.00	9.91	16.19	23.72	PASS
11AC40	5230	Ant1	6.54	0.00	6.54	8.57	24	PASS
		Ant2	7.87	0.00	7.87	12.22	24	PASS
		Ant 1+2	10.27	0.00	10.27	16.55	23.72	PASS
11AC40	5755	Ant1	10.12	0.00	10.12	12.15	24	PASS
		Ant2	3.88	0.00	3.88	8.23	24	PASS
		Ant 1+2	11.05	0.00	11.05	17.33	23.72	PASS
11AC40	5795	Ant1	9.02	0.00	9.02	11.26	30	PASS
		Ant2	3.31	0.00	3.31	10.12	30	PASS
		Ant 1+2	10.05	0.00	10.05	17.88	28.17	PASS
11AC80	5210	Ant1	5.69	0.00	5.69	7.93	30	PASS
		Ant2	7.50	0.00	7.50	14.31	30	PASS
		Ant 1+2	9.70	0.00	9.70	17.53	28.17	PASS
11AC80	5775	Ant1	9.15	0.00	9.15	11.39	30	PASS
		Ant2	3.01	0.00	3.01	9.82	30	PASS
		Ant 1+2	10.10	0.00	10.10	17.93	28.17	PASS

NOTE: 1.EIRP= Maximum Conducted Output Power + ANT GAIN

2. Maximum Conducted Output Power= Conducted Output Power+ Correction Factor
3. About correction Factor please refer to section 6.1
4. For this product, it has two antennas, antenna1 and antenna2, the 802.11a is use the SISO technical, but the ant1 and ant2 can transmitter in the same time under those modes. The 802.11n and 802.11ac are both use the SISO and MIMO technical.
5. EUT support for SISO and CDD MIMO Transmission, only 802.11n/ac supports CDD MIMO Mode, SISO mode sets the same power level as MIMO mode, so MIMO mode is the worst case.
6. 11n HT20 mode set the same power level as 11ac HT20 mode, and 11n HT40 mode set the same power level as 11ac HT40 mode, besides the 11ac HT20 mode and 11ac HT40 mode were worse case, so only the 11ac HT20 mode and 11ac HT40 mode were tested in this report.

6.4. POWER SPECTRAL DENSITY

6.4.1. LIMITS

FCC Part15, Subpart E		
Test Item	Limit	Frequency Range (MHz)
Power Spectral Density	For FCC: Other than Mobile and portable:17dBm/MHz Mobile and portable:11dBm/MHz	5150-5250
	30dBm/500kHz	5725-5850
1. 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 6dBi. 2. Limit: ① For Band I: Limit=24dBm – (Directional gain -6)dBi Directional gain = 10log $[(10^{G1/20}+10^{G2/20})^2/N_{ANT}]$ =6.28＞6dBi,where the NANT is the numbers of antenna. So, the power limit shall be reduced to 17 – (6.28-6) = 16.72 dBm ② For Band III: Limit=30dBm – (Directional gain -6)dBi Directional gain = 10log $[(10^{G1/20}+10^{G2/20})^2/N_{ANT}]$ =7.83＞6dBi,where the NANT is the numbers of antenna. So, the power limit shall be reduced to 30 – (7.83-6) = 28.17 dBm		

6.4.2. TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

For U-NII-1,:

Center Frequency	The center frequency of the channel under test
Detector	RMS
RBW	1MHz
VBW	≥3 × RBW
Span	Encompass the entire emissions bandwidth (EBW) of the signal
Trace	Max hold
Sweep time	Auto

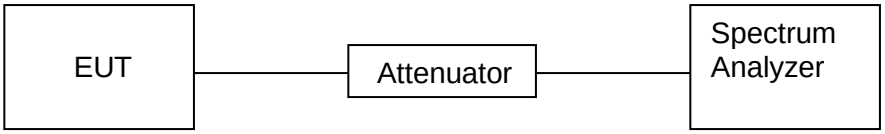
For U-NII-3:

Center Frequency	The center frequency of the channel under test
Detector	RMS
RBW	300KHz
VBW	≥3 × RBW
Span	Encompass the entire emissions bandwidth (EBW) of the signal
Trace	Max hold
Sweep time	Auto

Note:
1. For UNII-3, according to KDB publication 789033 D02 General UNII Test Procedures New Rules V01, section FII.5, it is acceptable to use a RBW that is less than 500kHz. The value measured at the narrower RBW is to be corrected by 10Log(500kHz/RBW).

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

6.4.3. TEST SETUP



6.4.4. RESULTS

6.4.4.1. UNII-I BAND

Test Mode	Test Channel	Ant	PSD [dBm/MHz]	Limit [dBm/MHz]	Verdict
11A	5180	Ant1	-2.88	17	PASS
		Ant2	-0.18	17	PASS
		Ant1+2	1.69	16.72	PASS
11A	5200	Ant1	-2.59	17	PASS
		Ant2	-0.45	17	PASS
		Ant1+2	1.62	16.72	PASS
11A	5240	Ant1	-1.59	17	PASS
		Ant2	0.04	17	PASS
		Ant1+2	2.31	16.72	PASS
11AC20	5180	Ant1	-3.26	17	PASS
		Ant2	-0.65	17	PASS
		Ant1+2	1.25	16.72	PASS
11AC20	5200	Ant1	-2.78	17	PASS
		Ant2	-0.79	17	PASS
		Ant1+2	1.34	16.72	PASS
11AC20	5240	Ant1	-1.88	17	PASS
		Ant2	-0.27	17	PASS
		Ant1+2	2.01	16.72	PASS
11AC40	5190	Ant1	-5.50	17	PASS
		Ant2	-3.34	17	PASS
		Ant1+2	-1.28	16.72	PASS
11AC40	5230	Ant1	-4.58	17	PASS
		Ant2	-2.90	17	PASS
		Ant1+2	-0.65	16.72	PASS
11AC80	5210	Ant1	-7.02	17	PASS
		Ant2	-5.65	17	PASS
		Ant1+2	-3.27	16.72	PASS

Remark:
1. About correction Factor please refer to section 6.1.

2. For this product, it has two antennas, antenna1 and antenna2, the 802.11a is use the SISO technical, but the ant1 and ant2 can transmitter in the same time under those modes. The 802.11n and 802.11ac are both use the SISO and MIMO technical.
3. EUT support for SISO and CDD MIMO Transmission, only 802.11n/ac supports CDD MIMO Mode, SISO mode sets the same power level as MIMO mode, so MIMO mode is the worst case.
4. 11n HT20 mode set the same power level as 11ac HT20 mode, and 11n HT40 mode set the same power level as 11ac HT40 mode, besides the 11ac HT20 mode and 11ac HT40 mode were worse case, so only the 11ac HT20 mode and 11ac HT40 mode were tested in this report.

6.4.4.2. UNII-III BAND

Test Mode	Test Channel	Ant	PSD [dBm/300KHz]	10log(1/x) Factor[dB]	10log(500kHz/ RBW) Factor [dB]	PSD [dBm/500KHz]	Limit [dBm/500KHz]	Verdict
11A	5745	Ant1	-4.60	0	2.22	-2.38	30	PASS
		Ant2	-10.40	0	2.22	-8.18	30	PASS
		Ant1+2	--	0	--	-1.37	28.17	PASS
11A	5785	Ant1	-5.44	0	2.22	-3.22	30	PASS
		Ant2	-11.04	0	2.22	-8.82	30	PASS
		Ant1+2	--	0	--	-2.16	28.17	PASS
11A	5825	Ant1	-6.40	0	2.22	-4.18	30	PASS
		Ant2	-11.28	0	2.22	-9.06	30	PASS
		Ant1+2	--	0	--	-2.96	28.17	PASS
11AC20	5745	Ant1	-4.24	0	2.22	-2.02	30	PASS
		Ant2	-10.11	0	2.22	-7.89	30	PASS
		Ant1+2	--	0	--	-1.02	28.17	PASS
11AC20	5785	Ant1	-5.30	0	2.22	-3.08	30	PASS
		Ant2	-11.03	0	2.22	-8.81	30	PASS
		Ant1+2	--	0	--	-2.05	28.17	PASS
11AC20	5825	Ant1	-6.06	0	2.22	-3.84	30	PASS
		Ant2	-11.18	0	2.22	-8.96	30	PASS
		Ant1+2	--	0	--	-2.68	28.17	PASS
11AC40	5755	Ant1	-6.20	0	2.22	-3.98	30	PASS
		Ant2	-12.29	0	2.22	-10.07	30	PASS
		Ant1+2	--	0	--	-3.02	28.17	PASS
11AC40	5795	Ant1	-7.42	0	2.22	-5.2	30	PASS
		Ant2	-13.08	0	2.22	-10.86	30	PASS
		Ant1+2	--	0	--	-4.16	28.17	PASS
11AC80	5775	Ant1	-9.59	0	2.22	-7.37	30	PASS

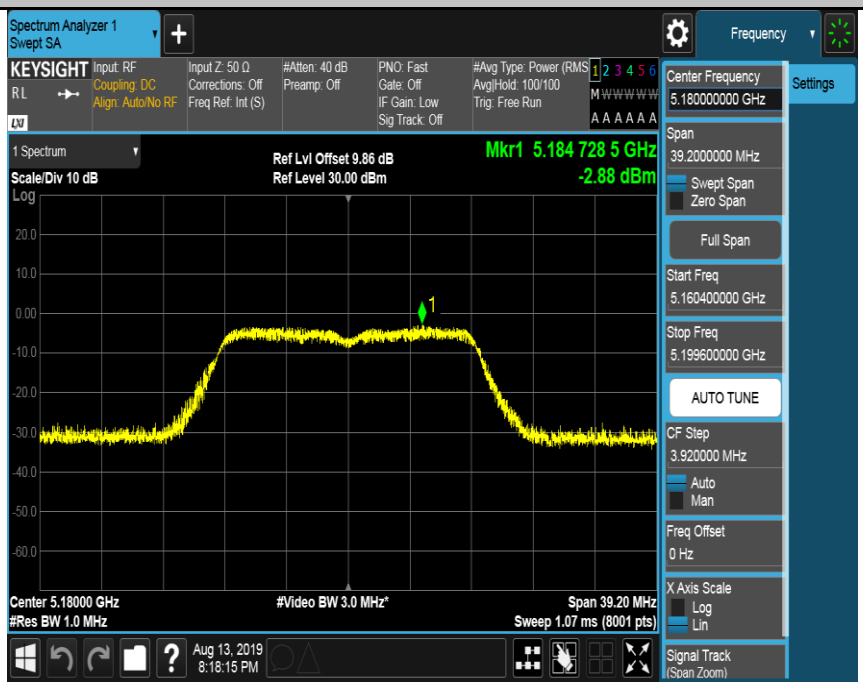
		Ant2	-16.09	0	2.22	-13.87	30	PASS
		Ant1+2	--	0	--	-6.49	28.17	PASS

Remark:
1.PSD=Meas. Level+ Correction Factor
2. About correction Factor please refer to section 6.1
3. For this product, it has two antennas, antenna1 and antenna2, the 802.11a is use the SISO technical, but the ant1 and ant2 can transmitter in the same time under those modes. The 802.11n and 802.11ac are both use the SISO and MIMO technical.
4. EUT support for SISO and CDD MIMO Transmission, only 802.11n/ac supports CDD MIMO Mode, SISO mode sets the same power level as MIMO mode, so MIMO mode is the worst case.
5. 11n HT20 mode set the same power level as 11ac HT20 mode, and 11n HT40 mode set the same power level as 11ac HT40 mode, besides the 11ac HT20 mode and 11ac HT40 mode were worse case, so only the 11ac HT20 mode and 11ac HT40 mode were tested in this report.

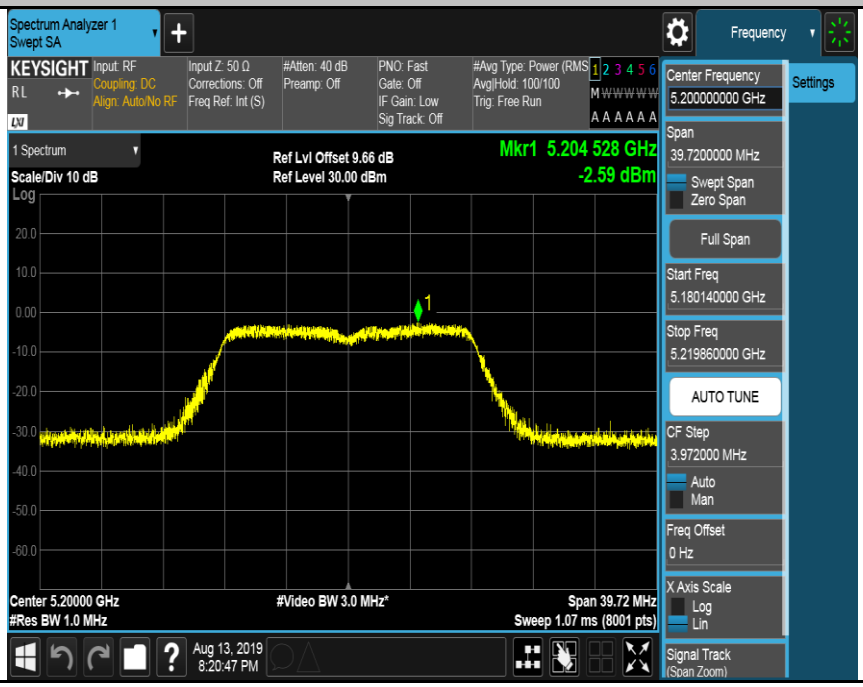
6.4.5. Test Graphs

Antenna 1:

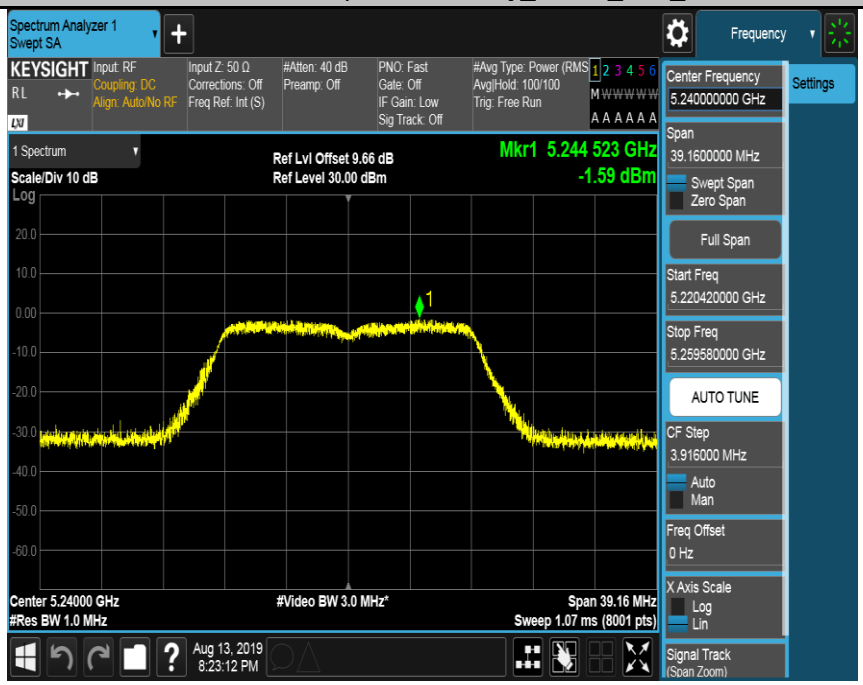
TEST PLOT
Maximum Power Spectral Density_TNVN_11A_5180_Ant1



Maximum Power Spectral Density_TNVN_11A_5200

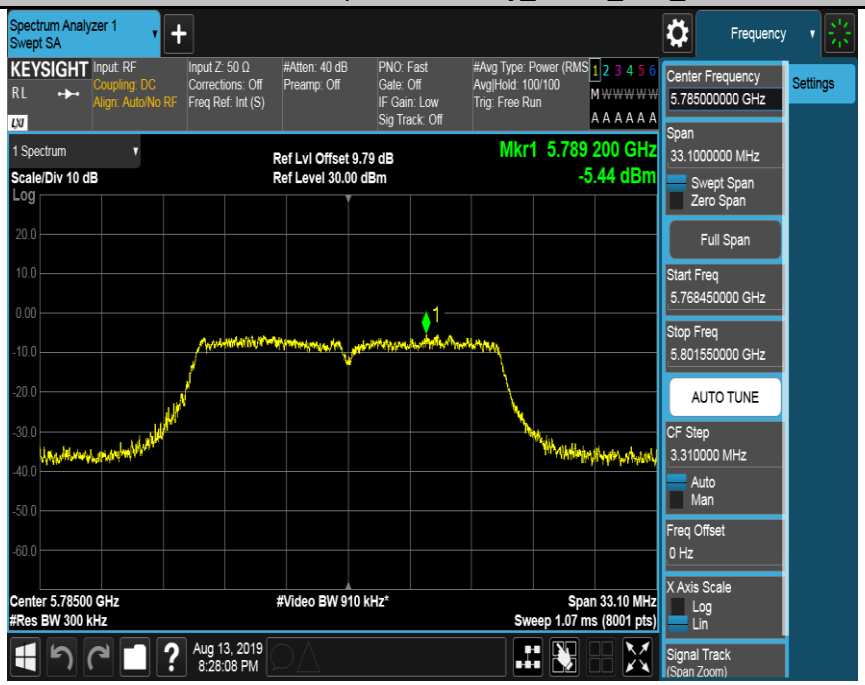


Maximum Power Spectral Density_TNVN_11A_5240

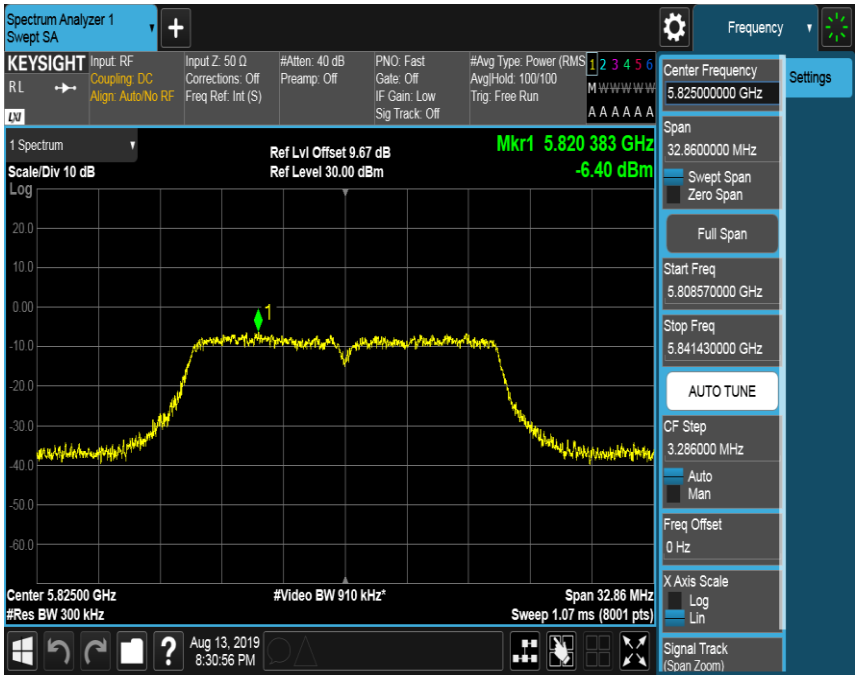


Maximum Power Spectral Density_TNVN_11A_5745

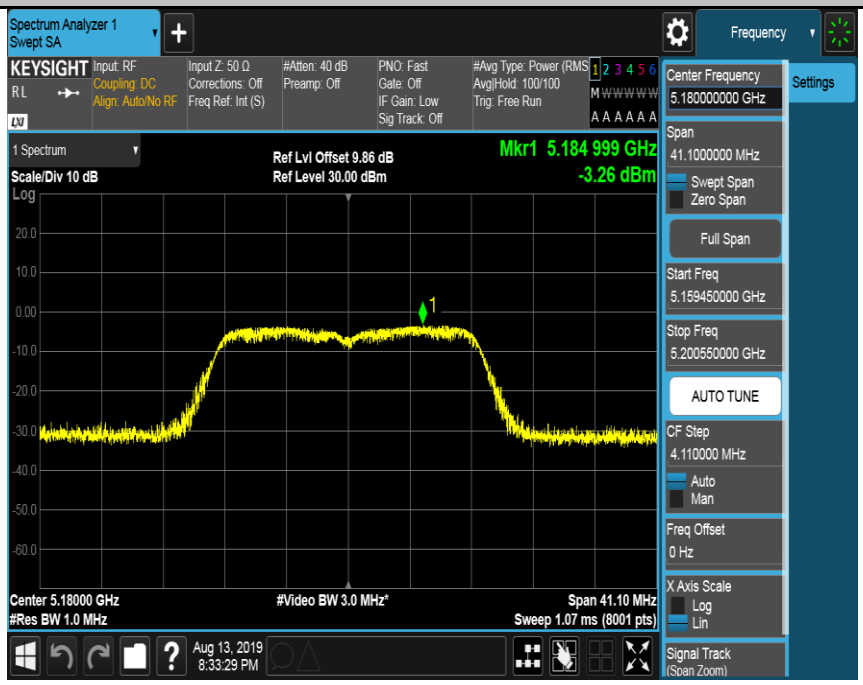
Maximum Power Spectral Density_TNVN_11A_5785



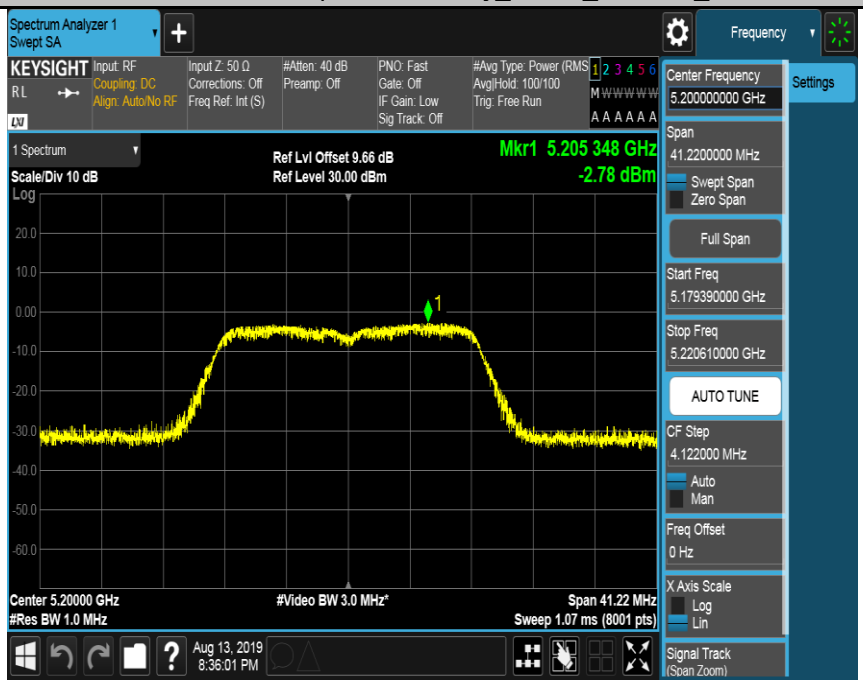
Maximum Power Spectral Density_TNVN_11A_5825



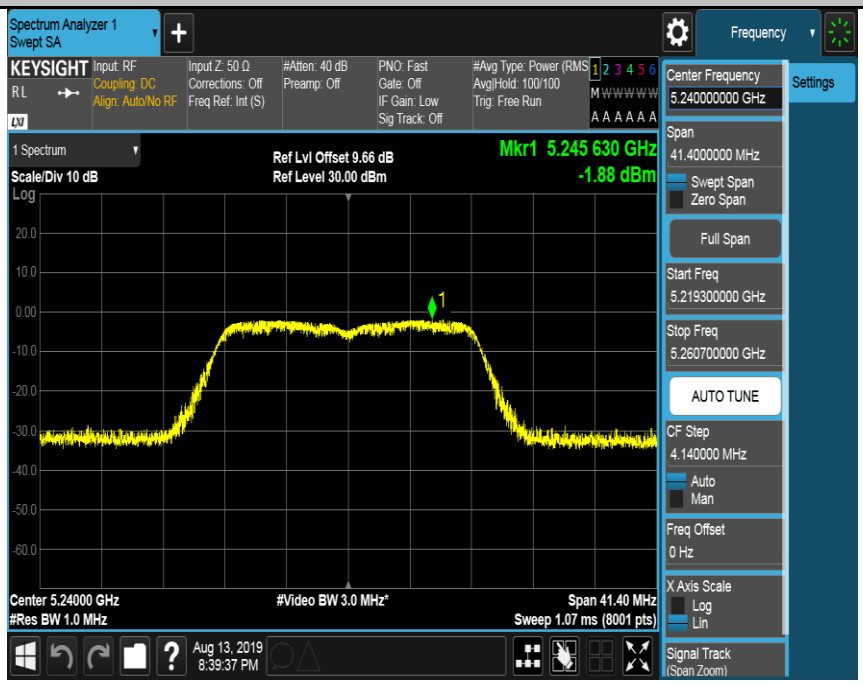
Maximum Power Spectral Density_TNVN_11AC20_5180



Maximum Power Spectral Density_TNVN_11AC20_5200

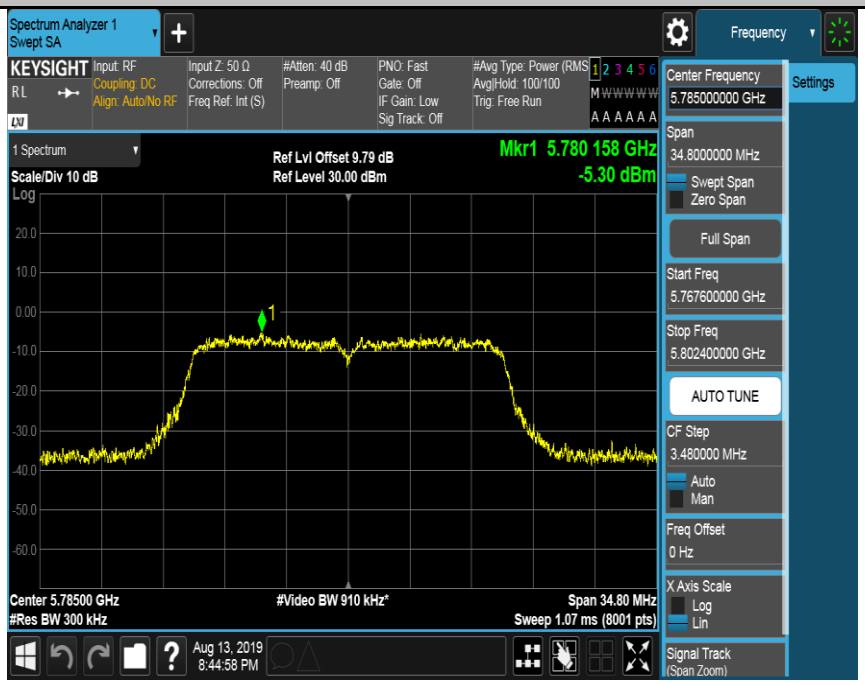


Maximum Power Spectral Density_TNVN_11AC20_5240



Maximum Power Spectral Density_TNVN_11AC20_5745

Maximum Power Spectral Density_TNVN_11AC20_5785



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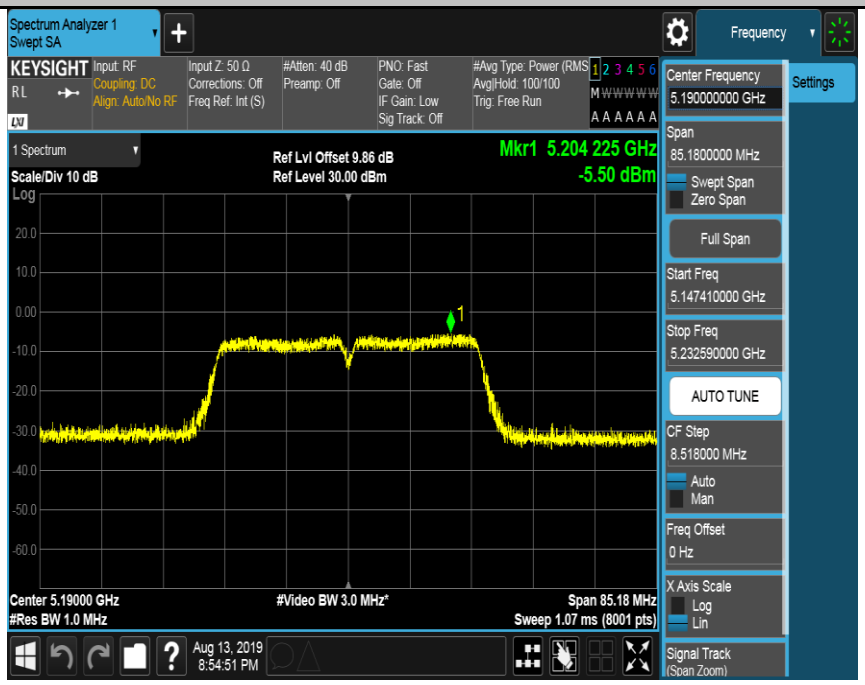
Maximum Power Spectral Density_TNVN_11AC40_5190



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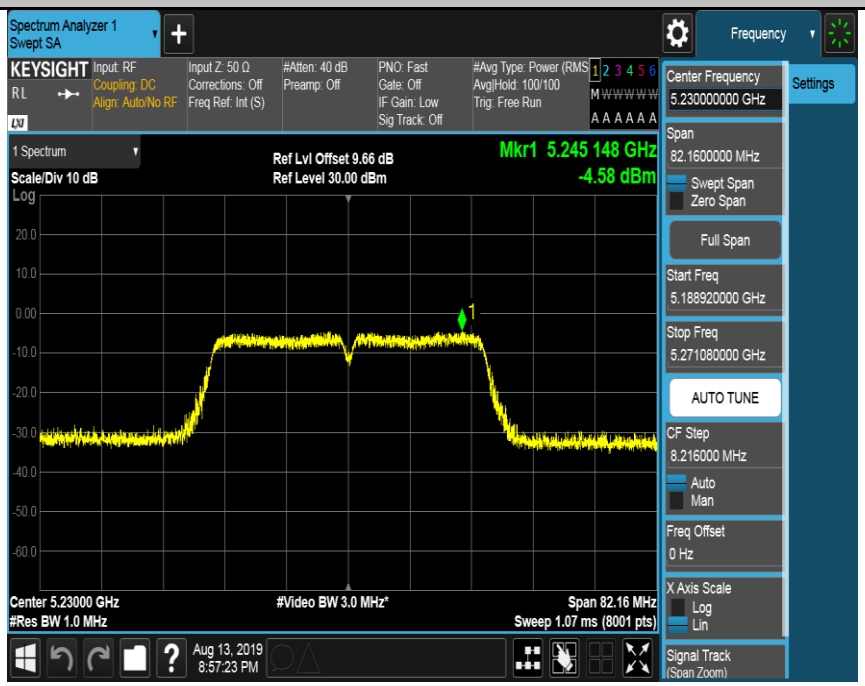
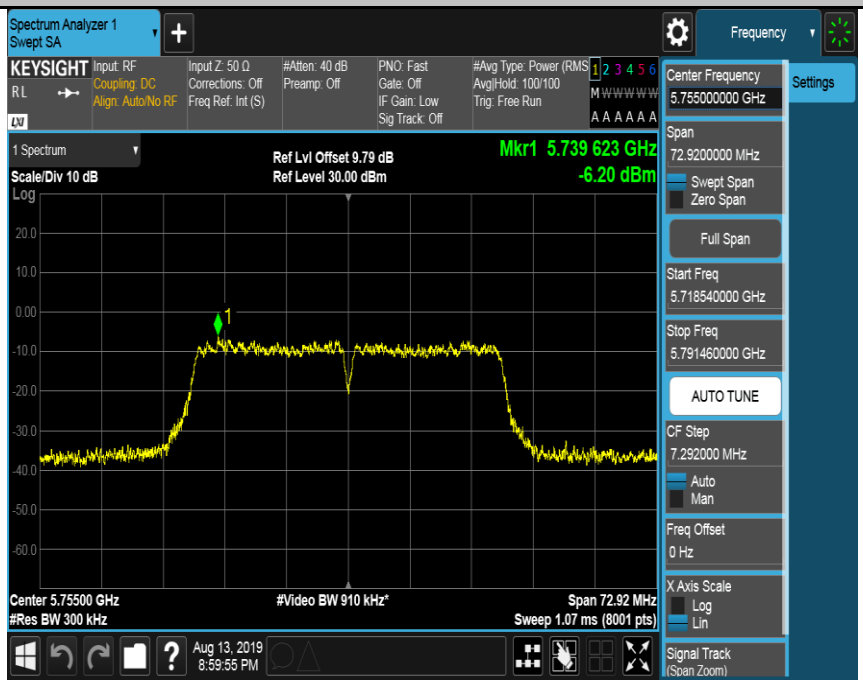


Maximum Power Spectral Density_TNVN_11AC40_5755



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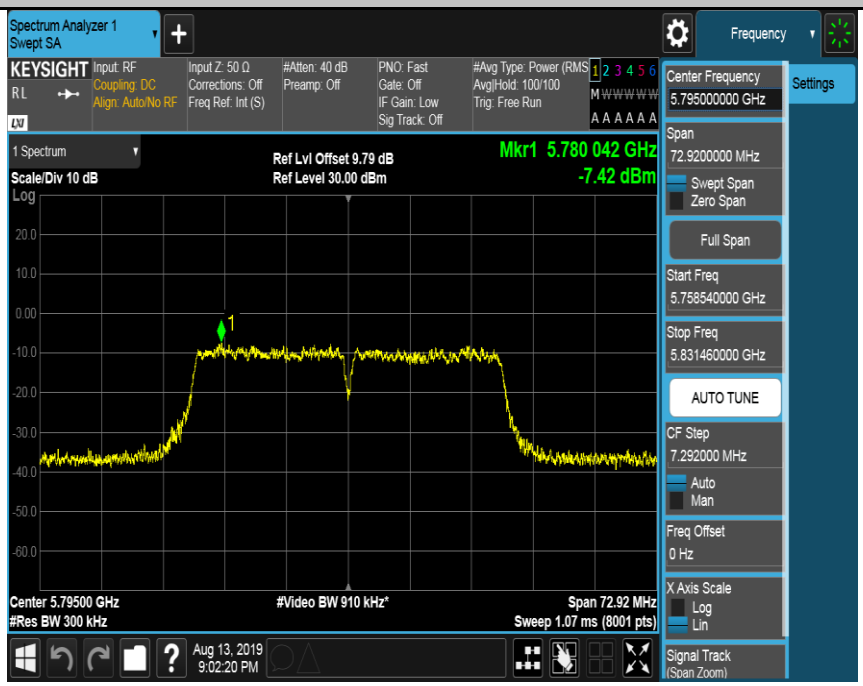
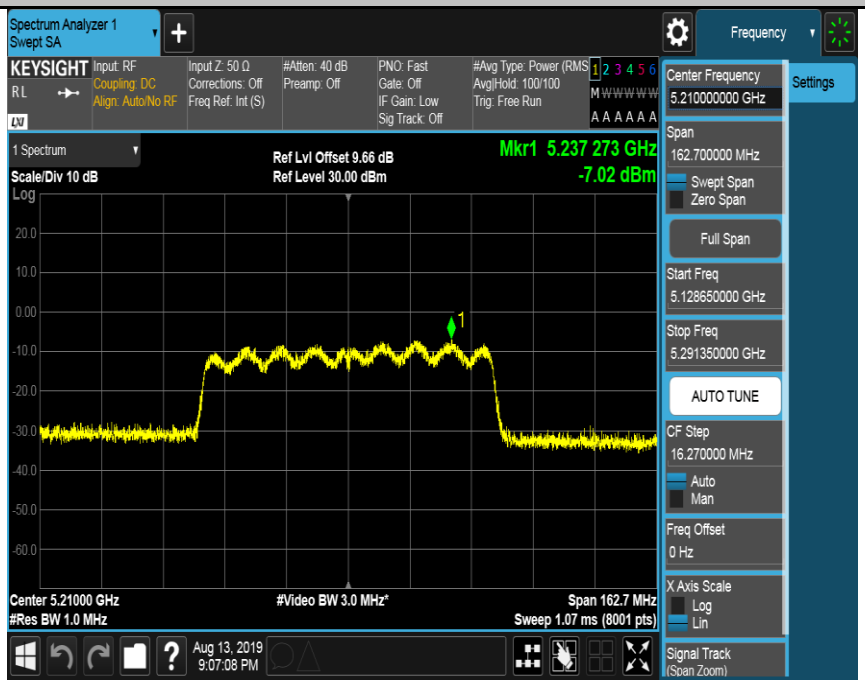
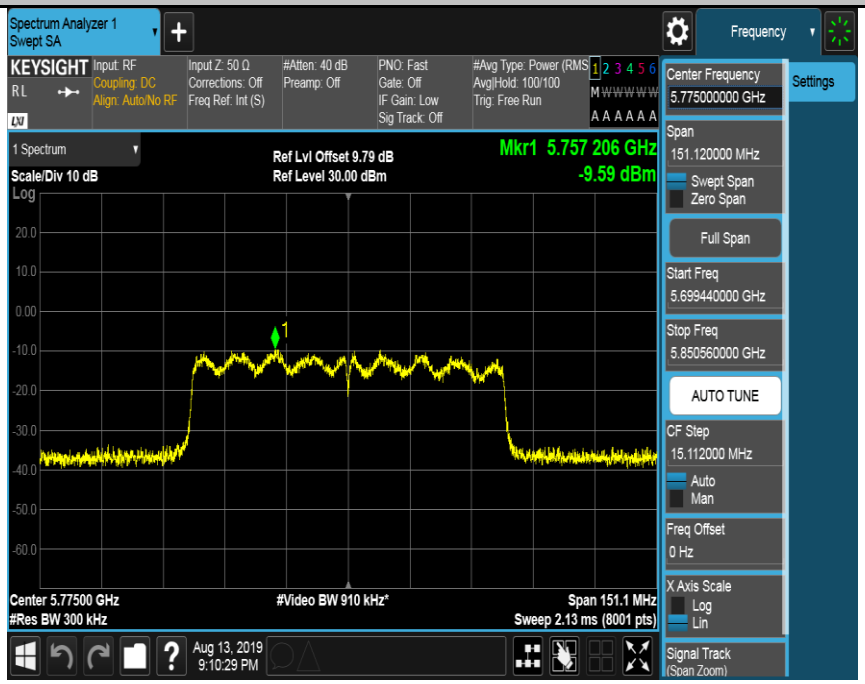


Maximum Power Spectral Density_TNVN_11AC80_5210

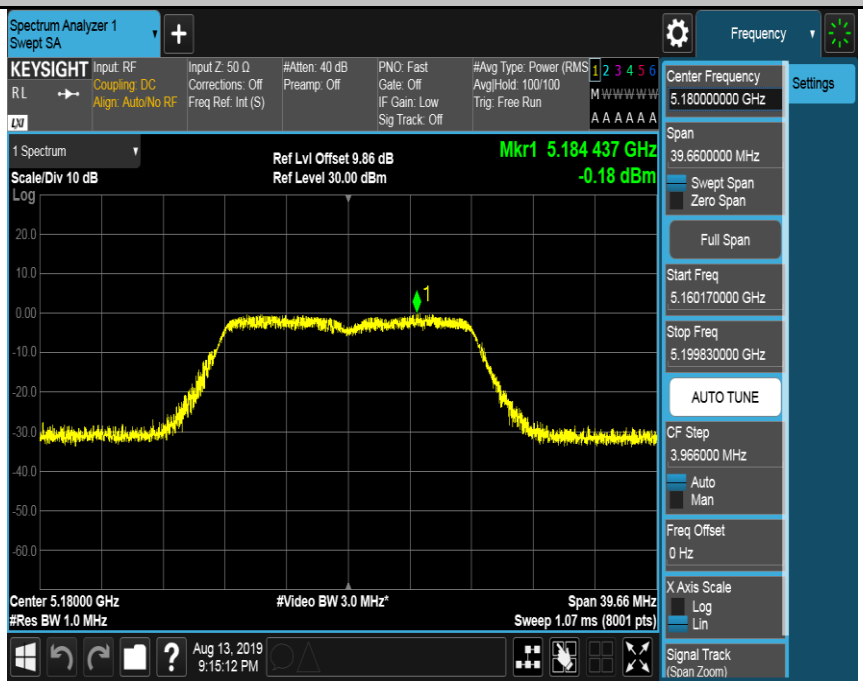


Maximum Power Spectral Density_TNVN_11AC80_5775



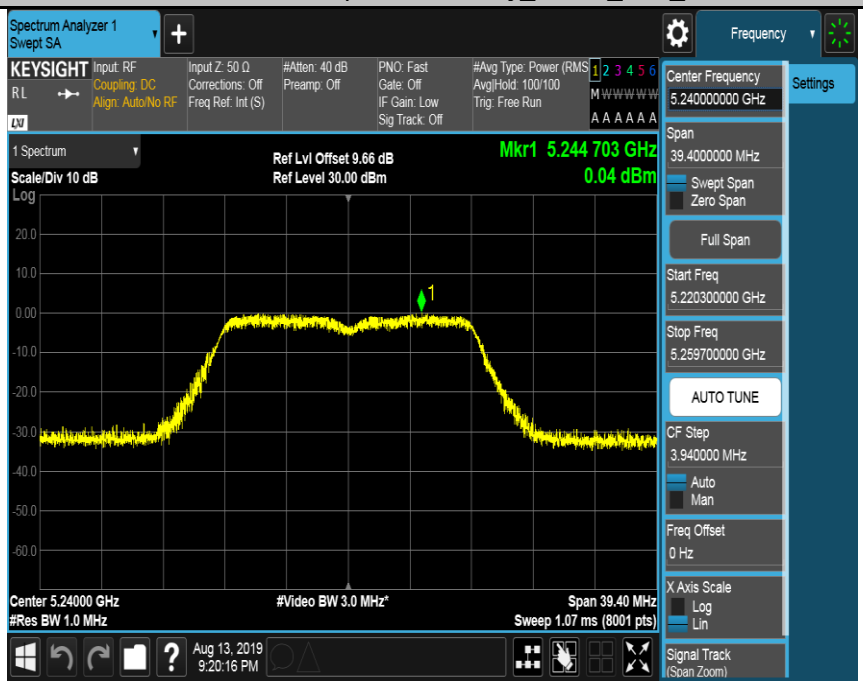
Antenna2:

TEST PLOT
Maximum Power Spectral Density_TNVN_11A_5180



Maximum Power Spectral Density_TNVN_11A_5200

Maximum Power Spectral Density_TNVN_11A_5240



Maximum Power Spectral Density_TNVN_11A_5745