

FCC RF Test Report

For

Beijing Inhand Networks Technology Co., Ltd.

Test Standards:	FCC Part 15 Subpart E §15. 407
Product Description:	<u>Edge computing gateway</u>
Tested Model:	<u>IG902</u>
Brand Name:	<u>InHand</u>
FCC ID:	<u>2AANYIG9</u>
Classification	<u>(NII)Unlicensed National Information Infrastructure</u>
Report No.:	<u>EC1902004RF02</u>
Tested Date:	<u>2019-03-12 to 2020-01-02</u>
Issued Date:	<u>2020-01-08</u>
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Note: The test results in this report apply exclusively to the tested model / sample. Without written approval of Hunan Ecloud Testing Technology Co., Ltd., the test report shall not be reproduced except in full.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	2020.01.08	Valid	Original Report

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Summary of Test Result

FCC Rule	Description	Limit	Result	Remark
2.1049	26dB & 99%	-	Pass	U-NII-1
15.403(i)	Bandwidth	>500kHz	Pass	U-NII-3
15.407(a)	Maximum Conducted Output Power	≤30dBm	Pass	U-NII-1
		≤30dBm	Pass	U-NII-3
15.407(a)	Power Spectral Density	≤17dBm/MHz	Pass	U-NII-1
		≤30dBm/500kHz	Pass	U-NII-3
15.407(b)	Unwanted Emissions	15.407(b) 15.209(a)	Pass	Under limit 1.27 dB at 875.840 MHz
15.207	AC Conducted Emission	15.207(a)	Pass	Under limit 18.23 dB at 0.549 MHz
15.407(g)	Frequency Stability	Within Operation Band	Pass	-
15.407(c)	Automatically Discontinue Transmission	Discontinue Transmission	Pass	-
15.203 & 15.407(a)	Antenna Requirement	N/A	Pass	-

1 Test Laboratory

1.1 Test facility

CNAS (accreditation number: L11138)

Hunan Ecloud Testing Technology Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (Designation number: CN1244 , Test Firm Registration Number: 793308)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

ISED(CAB identifier: CN0012, ISED# :24347)

Hunan Ecloud Testing Technology Co., Ltd. has been listed on the Wireless Device Testing Laboratories list of innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.

A2LA (Certificate Code: 4895.01)

Hunan Ecloud Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

2 General Description

2.1 Applicant

Beijing Inhand Networks Technology Co., Ltd.

Room 501, floor 5, building 3, yard 18, ziyue road, chaoyang district, Beijing

2.2 Manufacturer

Beijing Inhand Networks Technology Co., Ltd.

Room 501, floor 5, building 3, yard 18, ziyue road, chaoyang district, Beijing

2.3 General Description Of EUT

Product	Edge computing gateway
Model No.	IG902
Additional No.	IG912,IG952,IG962,IG992,IG903,IG913,IG953,IG963,IG993,IG904,IG914,IG954,IG964,IG994,IG905,IG915,IG955,IG965,IG995,IG906,IG916,IG956,IG966,IG996
Difference Description	The only difference is that the different models are used in different markets.
FCC ID	2AANYIG9
HW Version	V13
SW Version	V1.0.0
Power Supply	12Vdc (adapter or host equipment)
Modulation Technology	256QAM,64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Type	802.11a/n/ac : OFDM
Operating Frequency	U-NII-1:5150~5250MHz U-NII-3:5725~5850MHz
Max. Average Output Power	802.11a : 13.68 dBm (0.023 W) 802.11n HT20 : 12.92 dBm (0.020 W) 802.11n HT40 : 13.08 dBm (0.020 W) 802.11ac VHT20 : 13.15 dBm (0.021 W) 802.11ac VHT40 : 13.45 dBm (0.022 W) 802.11ac VHT80 : 12.97 dBm (0.020 W)
Antenna Type	Sucker antenna
Antenna Gain (dBi)	2at U-NII-1 2at U-NII-3
I/O Ports	Refer to user's manual
Cable Supplied	Refer to user's manual

NOTE:

1. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.
2. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in test report.
3. Antenna listed as below

Cable No.	Description	Connector	Length	Supplied by
1	WIFI Antenna	RP-SMA-J	2.5m	Applicant
2	GPS Antenna	SMA-J	3.0m	Applicant
3	4G Antenna	SMA-J	2.0m	Applicant
4	4G Antenna	SMA-J	2.0m	Applicant

4. Each model has two part number. The part number names begin with "H" is the high level version, The part number names begin with "B" is the basic version. The difference between the two versions is that the high level version has one more industrial protocol board which is mainly used for serial communication than the basic version. This two version products have been tested, and found that the high level version is worse than basic version. So only reported the high level version.

2.4 Modification of EUT

No modifications are made to the EUT during all test items.

2.5 Applicable Standards

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

- FCC Part 15 Subpart E §15.407
- ANSI C63.10-2013
- FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01

Remark:

1. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B recorded in a separate test report.

3 Test Configuration of Equipment Under Test

3.1 Carrier Frequency and Channel

U-NII-1

Channel	Frequency	Channel	Frequency
36	5180 MHz	40	5200 MHz
38	5190 MHz	46	5230 MHz
40	5200 MHz	48	5240 MHz
42	5210 MHz		

U-NII-3

Channel	Frequency	Channel	Frequency
149	5745 MHz	157	5785 MHz
151	5755 MHz	159	5795 MHz
153	5765 MHz	161	5805 MHz
155	5775 MHz	165	5825 MHz

3.2 Test Mode

Based on the baseline scan, the worst - case data rates were:

802.11a mode: 6 Mbps

802.11n HT20 mode: MCS0

802.11n HT40 mode: MCS0

802.11n VHT20 mode: MCS0

802.11n VHT40 mode: MCS0

802.11n VHT80 mode: MCS0

3.2.1 Antenna Port Conducted Measurement

Summary table of Test Cases				
Test Item	Modulation			
	802.11 a	802.11n HT20/ 802.11ac VHT20	802.11n HT40/ 802.11ac VHT40	802.11ac VHT80
U-NII-1	Mode 1: CH36 Mode 2: CH40 Mode 3: CH48	Mode 1: CH36 Mode 2: CH40 Mode 3: CH48	Mode 1: CH38 Mode 2: CH46 Mode 3: -	Mode 1: CH42 Mode 2: - Mode 3: -

Summary table of Test Cases				
Test Item	Modulation			
	802.11 a	802.11n HT20/ 802.11ac VHT20	802.11n HT40/ 802.11ac VHT40	802.11ac VHT80
U-NII-3	Mode 1: CH149	Mode 1: CH149	Mode 1: CH151	Mode 1: CH155
	Mode 2: CH157	Mode 2: CH157	Mode 2: CH159	Mode 2: -
	Mode 3: CH165	Mode 3: CH165		Mode 3: -

3.2.2 Radiated Emission Test (Below 1GHz)

Radiated Test Cases	Modulation
	802.11a CH149

Note : 1. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type. It was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.

2. Following channel(s) was (were) selected for the final test as listed above

3.2.3 Radiated Bandedge and Radiated Emission Test (Above 1GHz)

Summary table of Test Cases				
Test Item	Modulation			
	802.11 a	802.11n HT20/ 802.11ac VHT20	802.11n HT40/ 802.11ac VHT40	802.11ac VHT80
U-NII-1	Mode 1: CH36	Mode 1: CH36	Mode 1: CH38	Mode 1: CH42
	Mode 2: CH40	Mode 2: CH40	Mode 2: CH46	Mode 2: -
	Mode 3: CH48	Mode 3: CH48	Mode 3: -	Mode 3: -

Summary table of Test Cases				
Test Item	Modulation			
	802.11 a	802.11n HT20/ 802.11ac VHT20	802.11n HT40/ 802.11ac VHT40	802.11ac VHT80
U-NII-3	Mode 1: CH149	Mode 1: CH149	Mode 1: CH151	Mode 1: CH155
	Mode 2: CH157	Mode 2: CH157	Mode 2: CH159	Mode 2: -
	Mode 3: CH165	Mode 3: CH165		Mode 3: -

- Note : 1. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, XYZ axis, antenna ports (if EUT with antenna diversity architecture) and packet type. It was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation.
2. Following channel(s) was (were) selected for the final test as listed above
3. For frequency above 18GHz, the measured value is much lower than the limit, therefore, it is not reflected in the report.

3.2.4 Power Line Conducted Emission Test:

AC Conducted Emission	Mode 1 : SD Card +RJ45(LAN) Link + RLAN Link + Adapter
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3.3 Support Equipment

Support equipment

Manufacturer	Description	Model	Serial Number	Certificate	Supplied by
Lenovo	PC	Xiaoxinchao5000	PF0QPQMH	DOC	Ecloud

Support adapter

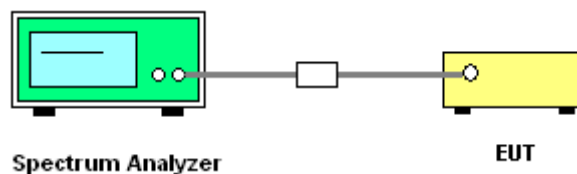
Adapter	
Brand:	KUANTEN
Model:	KT10W120100USD
Input:	AC 100-240V, 50/60Hz, 0.4A
Output:	DC 12V, 1A
Supplied by	Applicant

3.4 Test Setup

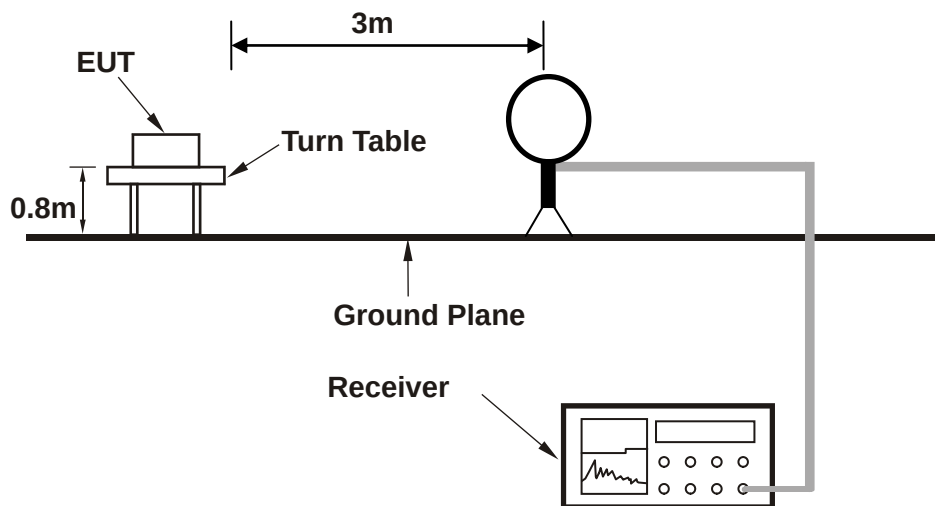
The EUT is continuously communicating to the Bluetooth tester during the tests.

EUT was set in the Hidden menu mode to enable BT communications.

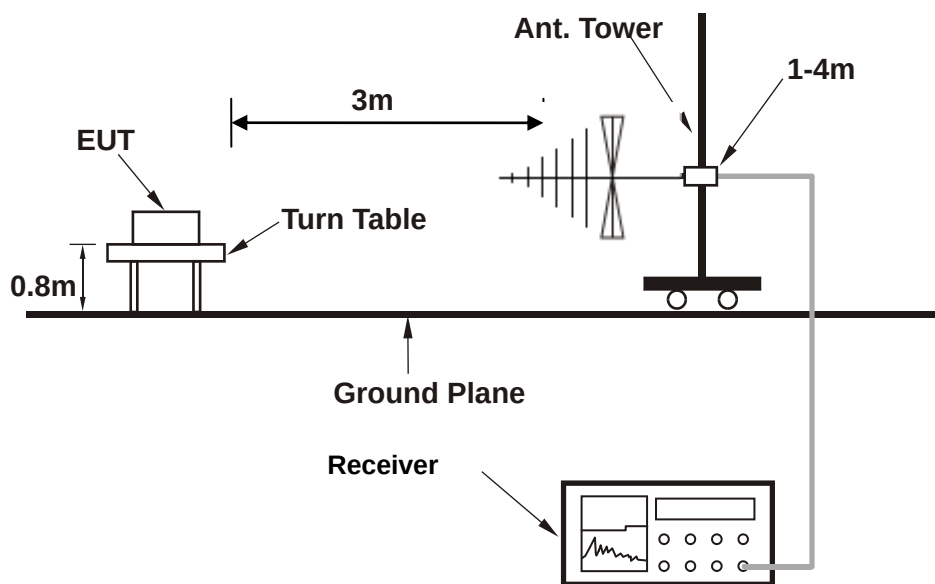
Setup diagram for Conducted Test



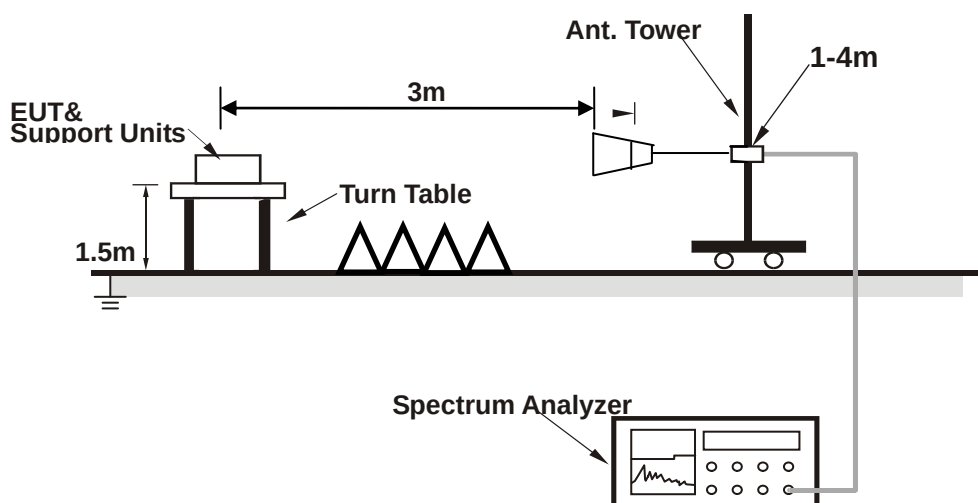
Setup diagram for Raidation(9KHz~30MHz) Test



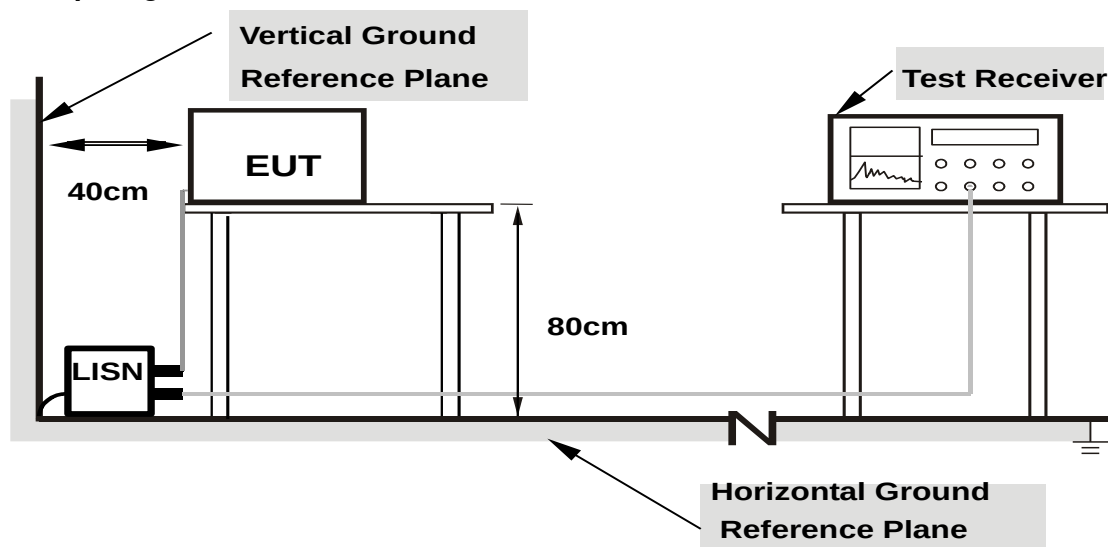
Setup diagram for Raidation(Below 1G) Test



Setup diagram for Raidation(Above1G) Test



Setup diagram for AC Conducted Emission Test



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.5 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 5 dB and 10dB attenuator.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 5 + 10 = 15 \text{ (dB)}\end{aligned}$$

4 Test Result

4.1 26dB and 99% Occupied Bandwidth Measurement

4.1.1 Limit of 6dB 26dB and 99% Bandwidth

There is no limit bandwidth for U-NII-1, U-NII-2-A and U-NII-2-C.

The minimum 6 dB bandwidth shall be at least 500 kHz for U-NII-3.

4.1.2 Test Procedures

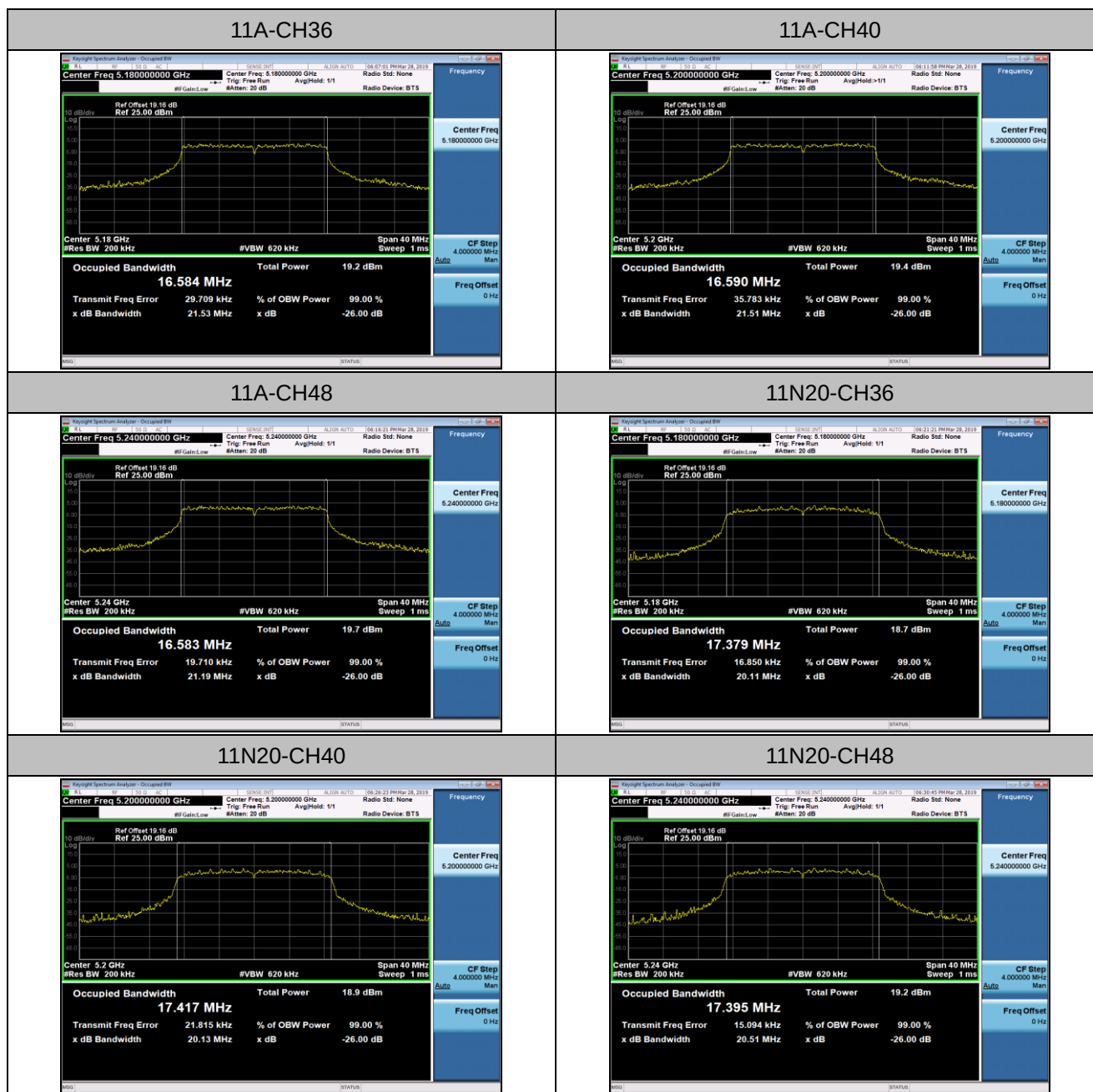
1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the Antenna port to the spectrum analyzer.
4. 26dB Band width Measurement: Set the spectrum analyzer as 1% of emission BW Sweep=auto,Detector = Peak, Trace Mode = Max Hold, VBW>RBW, Manually readjust RBW until the RBW/EBW ratio is 1% based on EBW as observed on the result of pre-sequence measurement.
5. 99% Band width Measurement: Set the spectrum analyzer as 1%~5% of emission BW Sweep=auto,Detector = Peak, Trace Mode = Max Hold, VBW $\geq$ 3*RBW, span=1.5 times to 5.0 times the OBW, Manually readjust RBW until the RBW/EBW ratio is 1% based on EBW as observed on the result of pre-sequence measurement.
6. Minimum Emission Bandwidth Measurement: Set the spectrum analyzer RBW=100KHz, VBW $\geq$ 3*RBW, Sweep=auto,Detector = Peak, Trace Mode = Max Hold,
7. Mark the peak frequency and -6dB (upper and lower) frequency.
8. Repeat the procedures as list above until all test default channels (low, middle, and high) are completed.
9. Measure and record the results in the test report.

4.1.3 Test Result of 6dB Bandwidth, 26dB and 99% Bandwidth

Test Mode :		Tx Mode		Temperature :	24~26℃
Test Engineer :		Victorique Gao		Relative Humidity :	50~53%
Mode	Band	Channel	26dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
11a	U-NII-1	36	21.53	16.562	PASS
11a	U-NII-1	40	21.51	16.557	PASS
11a	U-NII-1	48	21.19	16.530	PASS
11n HT20	U-NII-1	36	20.11	17.387	PASS
11n HT20	U-NII-1	40	20.13	17.415	PASS
11n HT20	U-NII-1	48	20.51	17.426	PASS
11n HT40	U-NII-1	38	41.97	35.793	PASS
11n HT40	U-NII-1	46	41.63	35.794	PASS
11ac VHT20	U-NII-1	36	19.88	17.400	PASS
11ac VHT20	U-NII-1	40	19.78	17.422	PASS
11ac VHT20	U-NII-1	48	20.02	17.407	PASS
11ac VHT40	U-NII-1	38	40.51	35.808	PASS
11ac VHT40	U-NII-1	46	40.56	35.747	PASS
11ac VHT80	U-NII-1	42	82.53	75.094	PASS
11a	U-NII-3	149	24.360	17.333	PASS
11a	U-NII-3	157	25.880	17.332	PASS
11a	U-NII-3	165	24.760	17.409	PASS
11n HT20	U-NII-3	149	21.360	17.563	PASS
11n HT20	U-NII-3	157	20.480	17.513	PASS
11n HT20	U-NII-3	165	20.040	17.508	PASS
11n HT40	U-NII-3	151	43.520	36.121	PASS
11n HT40	U-NII-3	159	42.320	36.069	PASS
11ac VHT20	U-NII-3	149	22.640	16.635	PASS
11ac VHT20	U-NII-3	157	20.120	16.515	PASS
11ac VHT20	U-NII-3	165	20.120	16.521	PASS
11ac VHT40	U-NII-3	151	72.880	40.458	PASS
11ac VHT40	U-NII-3	159	73.200	40.143	PASS
11ac VHT80	U-NII-3	155	108.640	77.690	PASS

Test Mode :		Tx Mode		Temperature :	24~26℃
Test Engineer :		Victorique Gao		Relative Humidity :	错误!未找到引用源。
Mode	Band	Channel	Min emission bandwidth(MHz)	Limit(MHz)	Verdict
11a	U-NII-3	149	16.560	0.5	PASS
11a	U-NII-3	157	16.560	0.5	PASS
11a	U-NII-3	165	16.560	0.5	PASS
11n HT20	U-NII-3	149	15.160	0.5	PASS
11n HT20	U-NII-3	157	15.160	0.5	PASS
11n HT20	U-NII-3	165	15.240	0.5	PASS
11n HT40	U-NII-3	151	35.200	0.5	PASS
11n HT40	U-NII-3	159	35.200	0.5	PASS
11ac VHT20	U-NII-3	149	14.520	0.5	PASS
11ac VHT20	U-NII-3	157	15.200	0.5	PASS
11ac VHT20	U-NII-3	165	15.240	0.5	PASS
11ac VHT40	U-NII-3	151	36.400	0.5	PASS
11ac VHT40	U-NII-3	159	36.400	0.5	PASS
11ac VHT80	U-NII-3	155	76.000	0.5	PASS

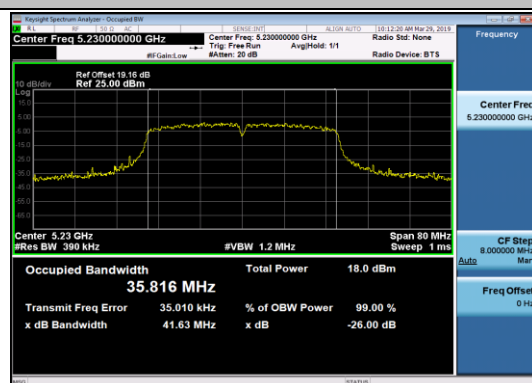
26dB Bandwidth Plot



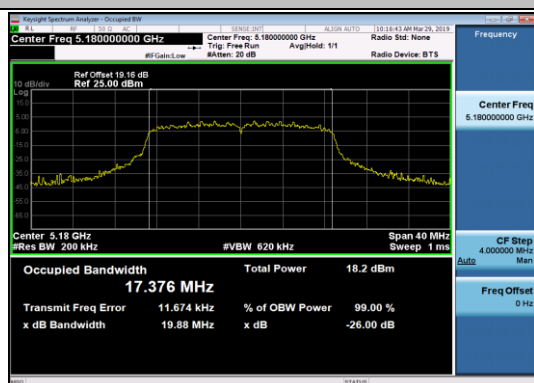
11N40-CH38



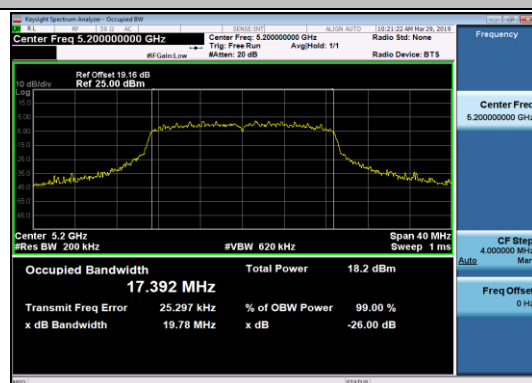
11N40-CH46



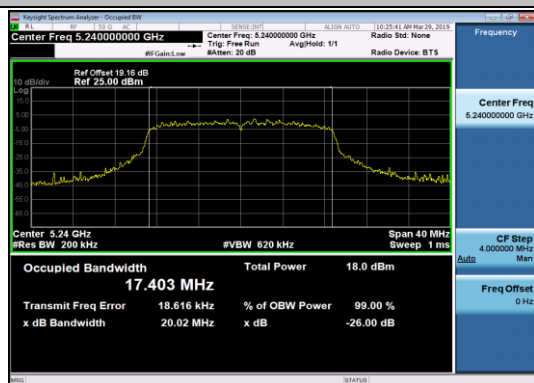
11AC20-CH36



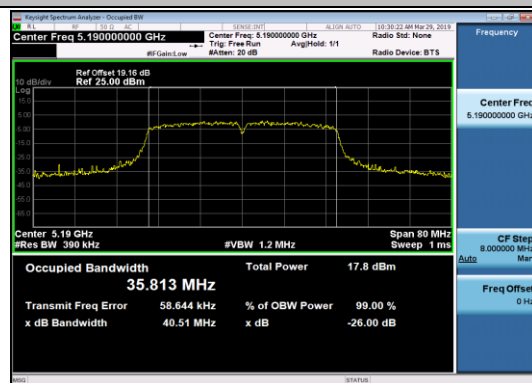
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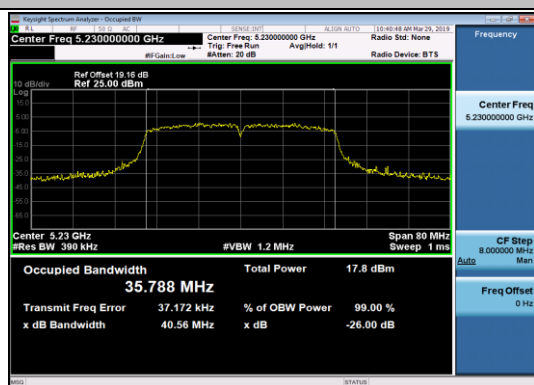
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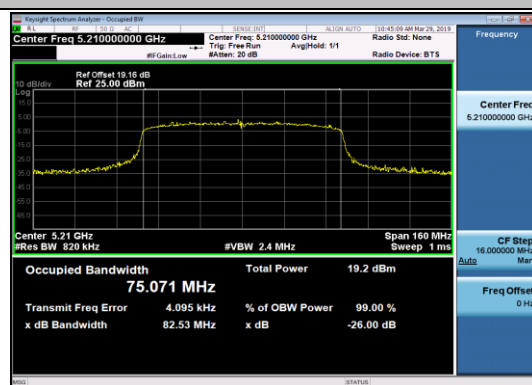
11AC40-CH38



11AC40-CH46



11AC80-CH50



11A-CH149



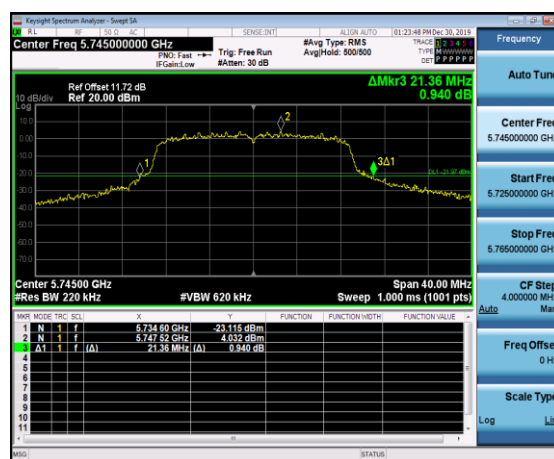
11A-CH157



11A-CH165



11N20-CH149



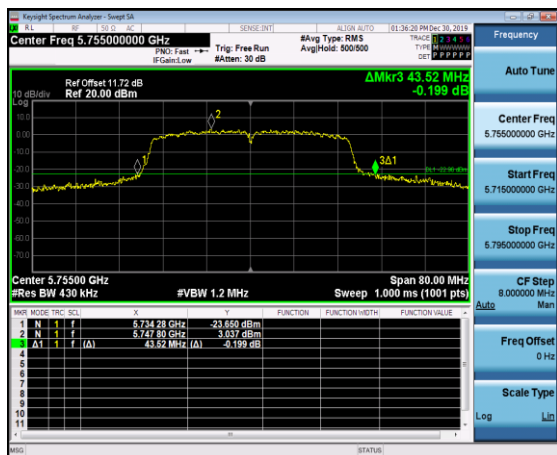
11N20-CH157



11N20-CH165



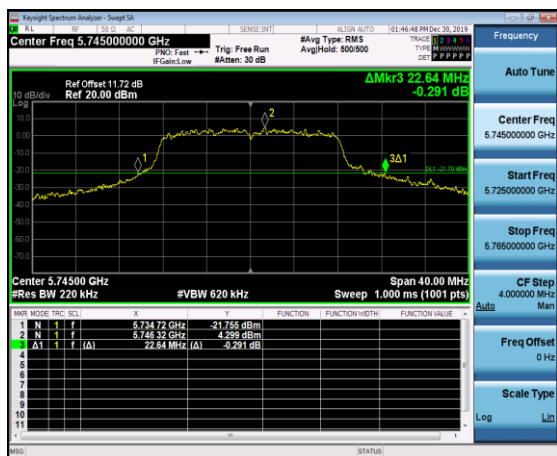
11N40-CH151



11N40-CH159



11AC20-CH149



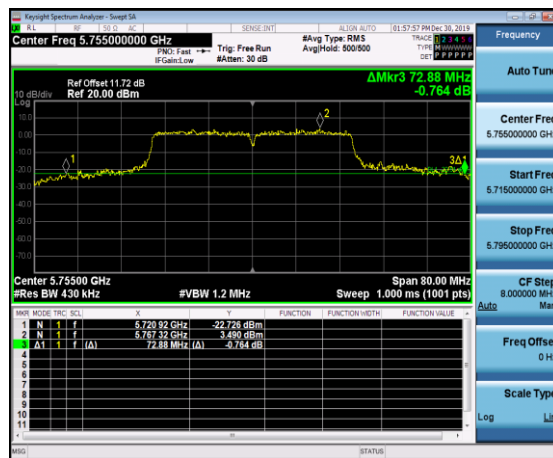
11AC20-CH157



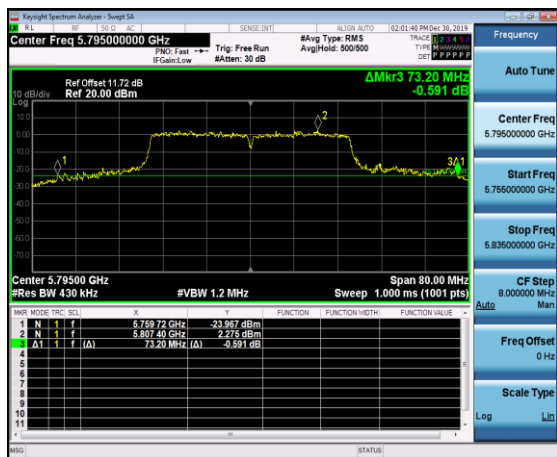
11AC20-CH165



11AC40-CH151



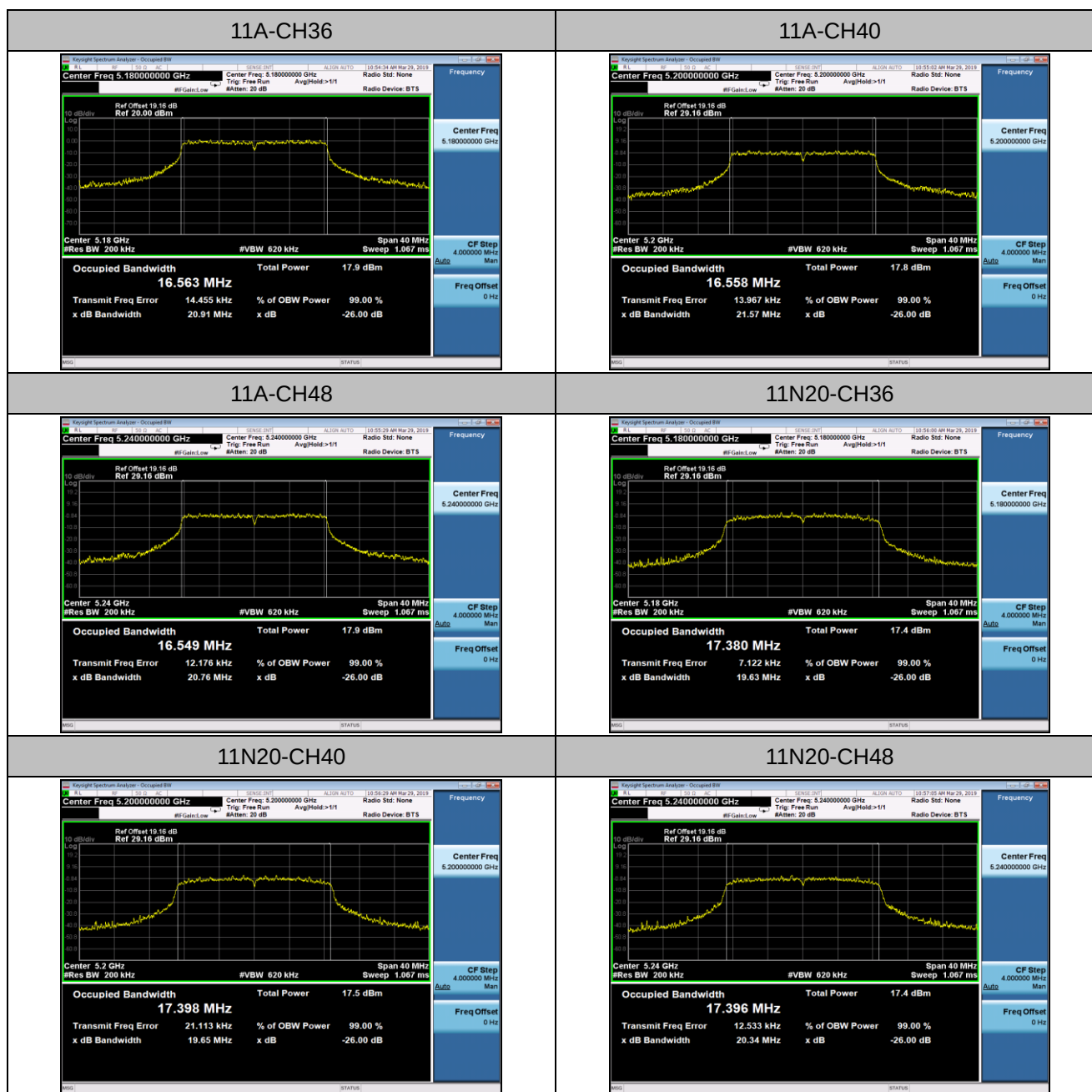
11AC40-CH159



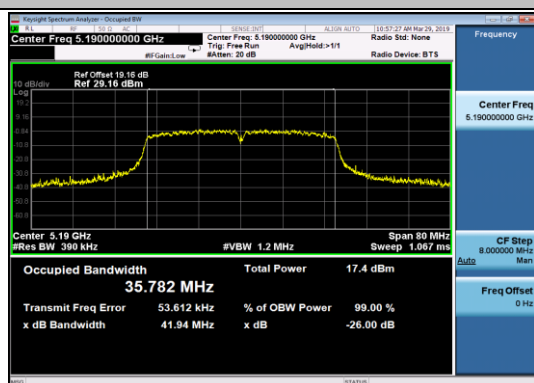
11AC80-CH155



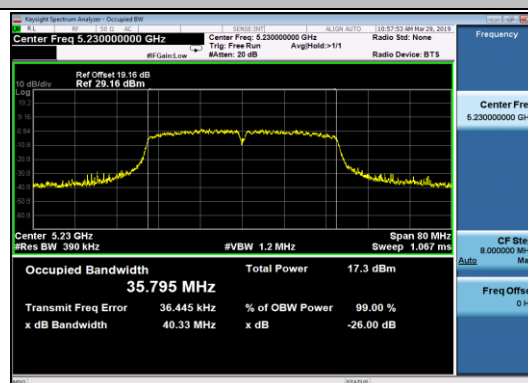
99% Bandwidth Plot



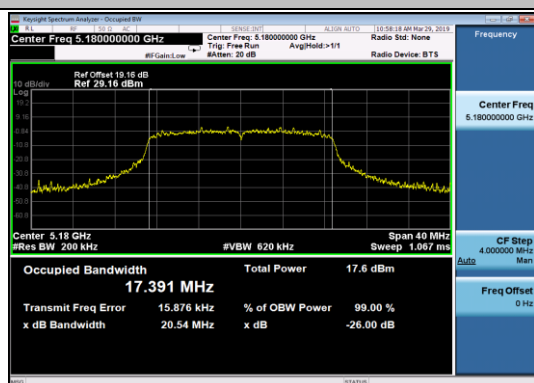
11N40-CH38



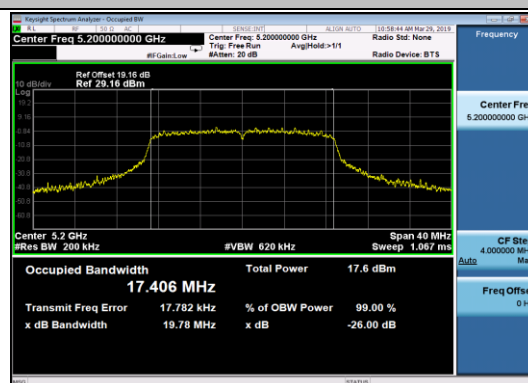
11N40-CH46



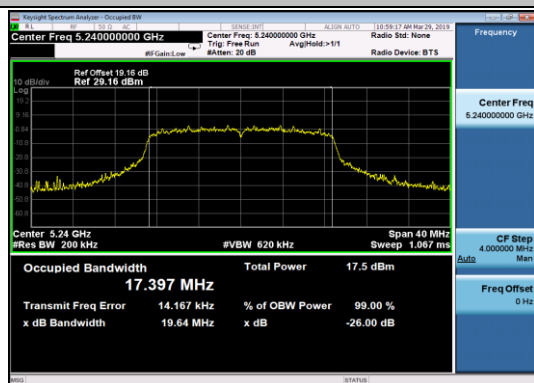
11AC20-CH36



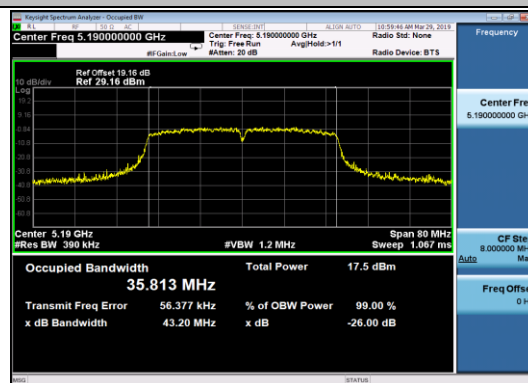
11AC20-CH40



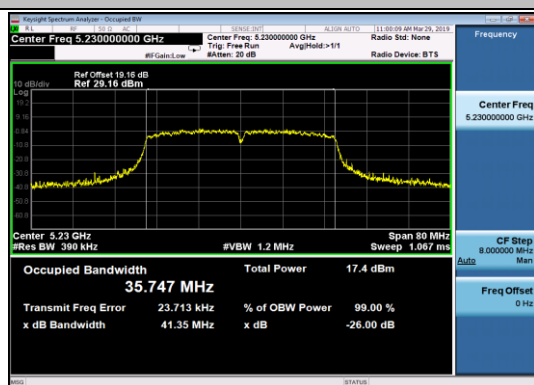
11AC20-CH48



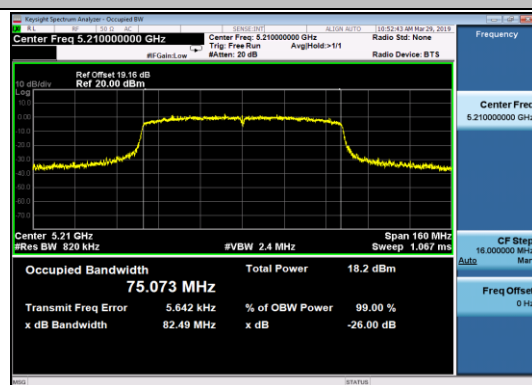
11AC40-CH38



11AC40-CH46



11AC80-CH50



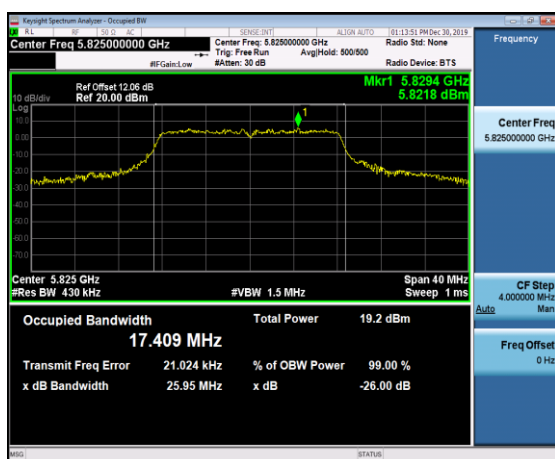
11A-CH149



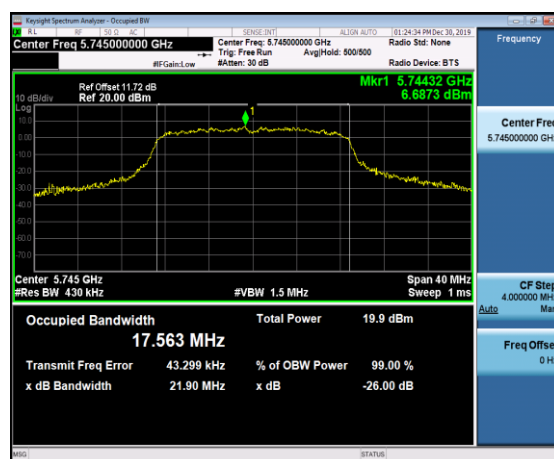
11A-CH157



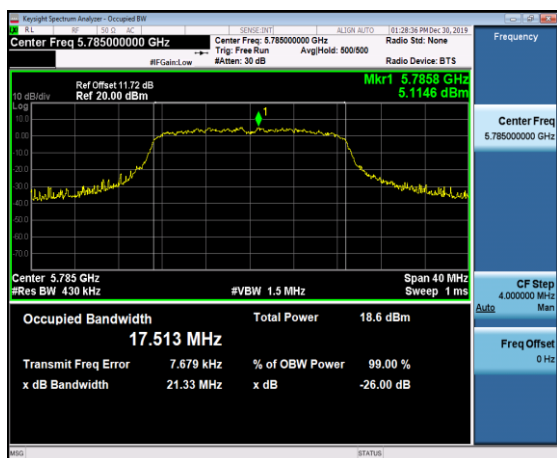
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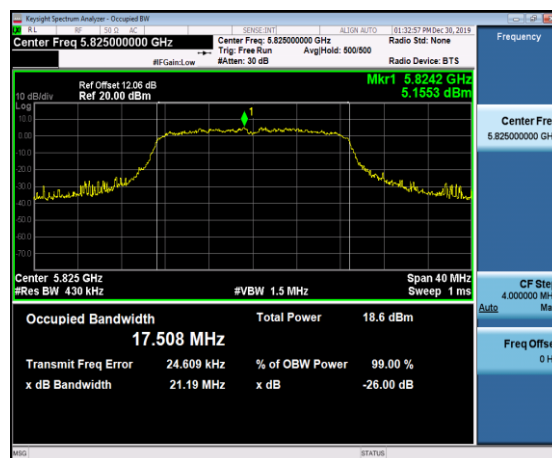
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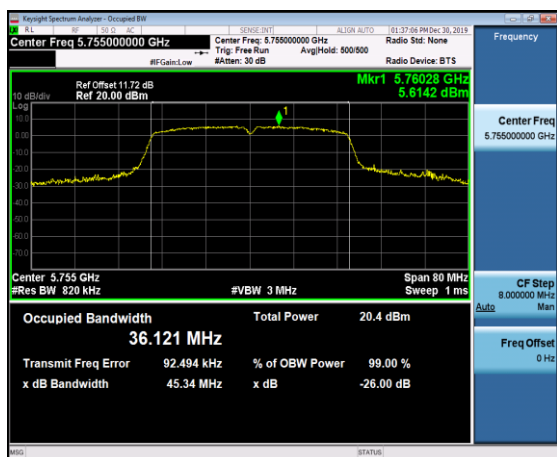
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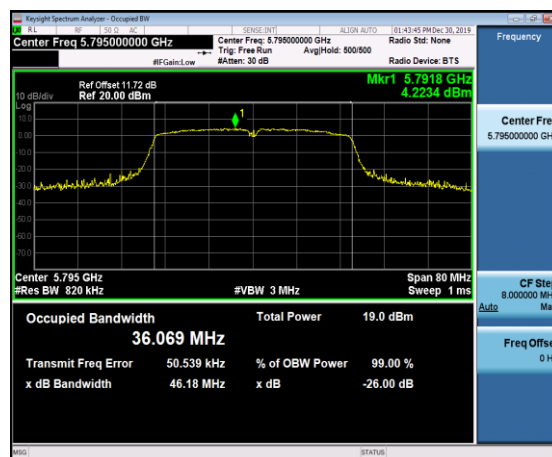
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11N40-CH151



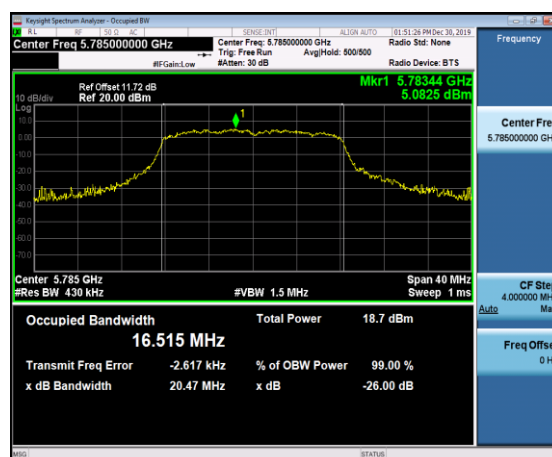
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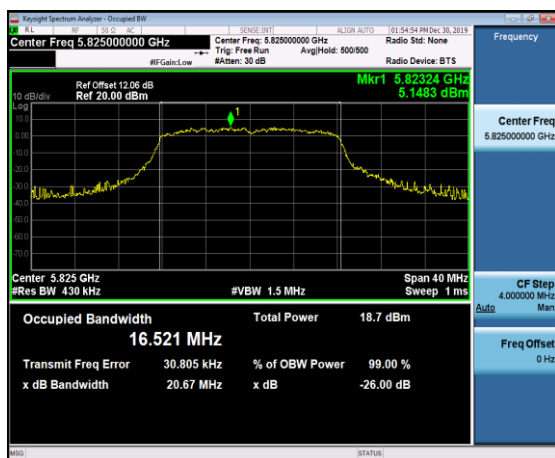
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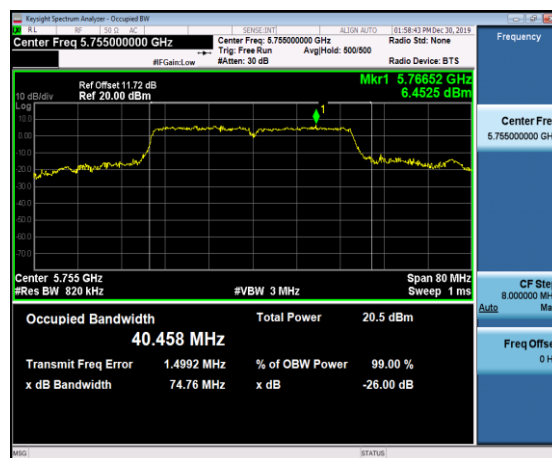
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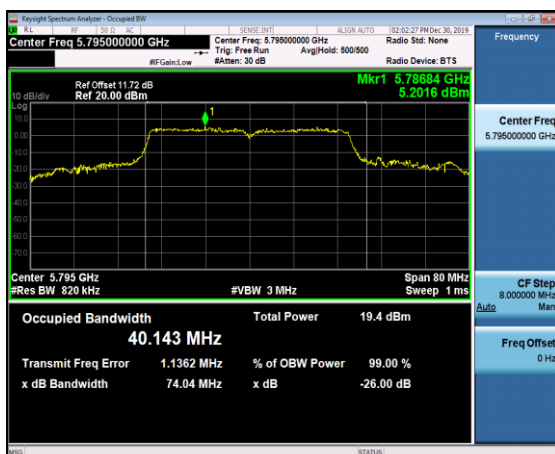
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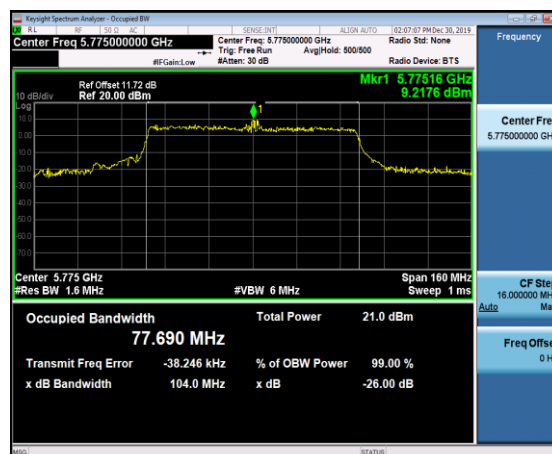
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11AC40-CH159



11AC80-CH155



-6dB Bandwidth Plot

11A-CH149



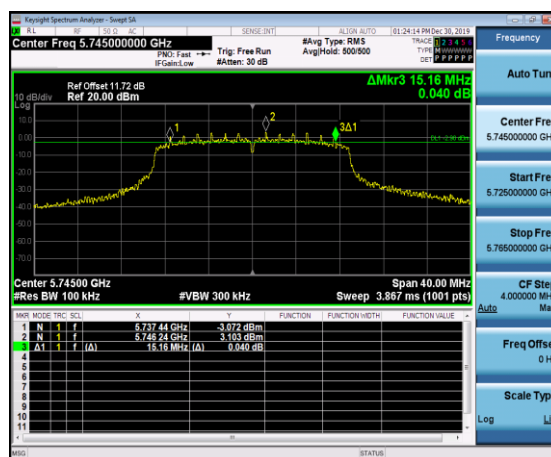
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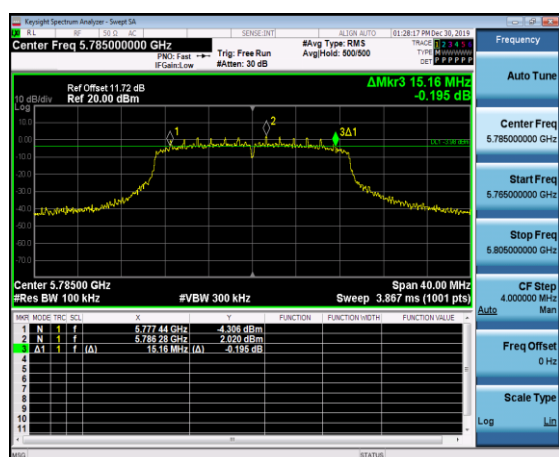
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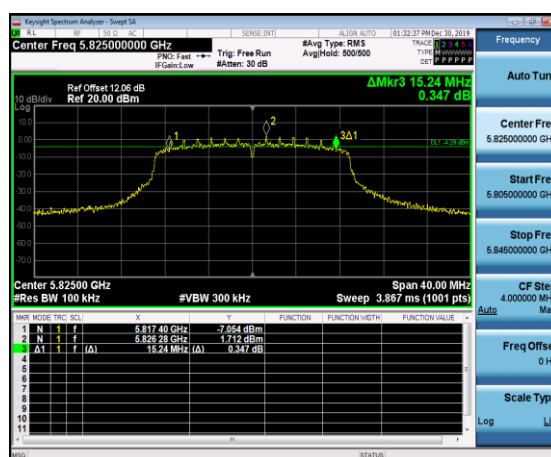
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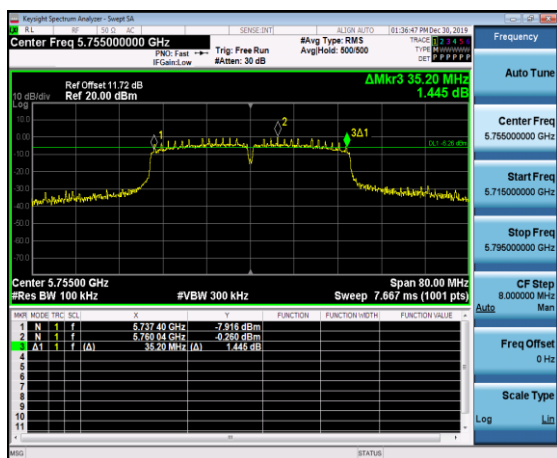
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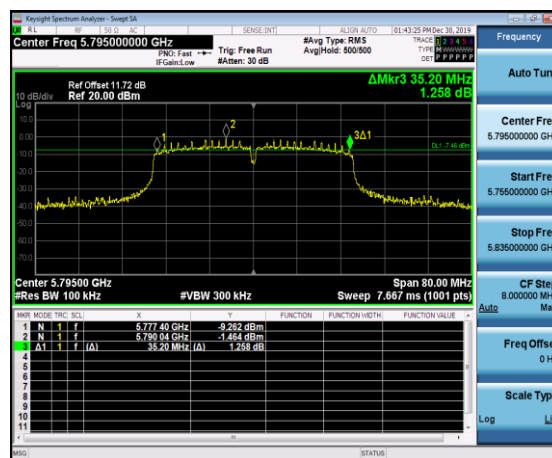
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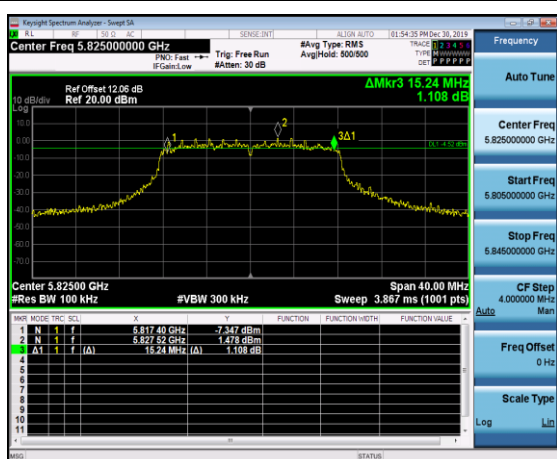
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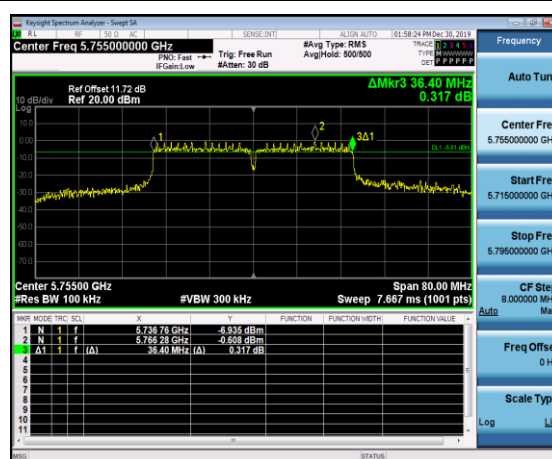
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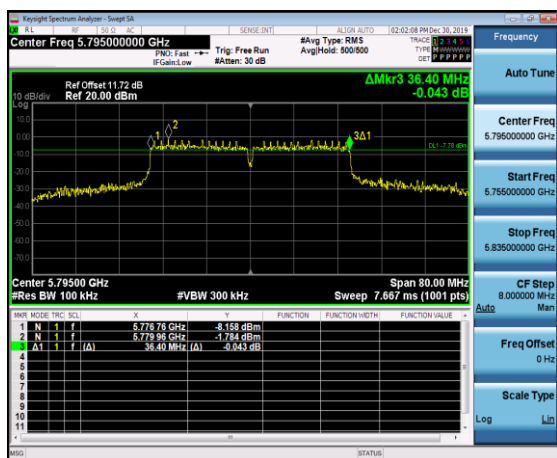
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11AC40-CH151



11AC40-CH159



11AC80-CH155

