

FCC Test Report

Report No.: AGC01035180503FE03

FCC ID : SZR-NVR-2400
APPLICATION PURPOSE : Original Equipment
PRODUCT DESIGNATION : MDVR
BRAND NAME : REI
MODEL NAME : NVR-2400
CLIENT : Radio Engineering industries, Inc
DATE OF ISSUE : Jun. 05, 2018
STANDARD(S) : FCC Part 15.407
TEST PROCEDURE(S) : KDB 789033 D02 v02r01
KDB 662911 D01 v02r01
REPORT VERSION : V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd



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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jun. 05, 2018	Valid	Initial Release

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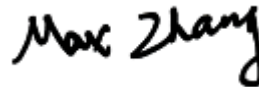
1. VERIFICATION OF CONFORMITY

Applicant	Radio Engineering industries, Inc
Address	6534 L Street Omaha, NE 68117, United States of America
Manufacturer	Radio Engineering industries, Inc
Address	6534 L Street Omaha, NE 68117, United States of America
Product Designation	MDVR
Brand Name	REI
Test Model	NVR-2400
Date of test	May 28, 2018 to Jun. 04, 2018
Deviation	None
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BGN/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (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 requirement of FCC Part 15 Rules requirement.

Tested by



Max Zhang(Zhang Yi) Jun. 05, 2018

Reviewed by



Bart Xie(Xie Xiaobin) Jun. 05, 2018

Approved By



Forrest Lei(Lei Yonggang) Jun. 05, 2018

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

It is designed by way of utilizing the OFDM technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	5.725 GHz~5.825GHz
Output Power	IEEE 802.11a20: 10.54 dBm IEEE 802.11n20: 12.84 dBm IEEE 802.11n(40): 10.15 dBm IEEE 802.11ac20: 12.75 dBm IEEE 802.11ac40: 9.11 dBm IEEE 802.11ac80: 6.92 dBm
Modulation	BPSK, QPSK, 16QAM, 64QAM, 128QAM, 256QAM,OFDM
Number of channels	8
Hardware Version	SVT7.820
Software Version	V1.0
Antenna Designation	External antenna(Use of reverse SMA connector)
Number of transmit chain	2(802.11a used chain 0, 802.11n20/n40/ac used two chains)
Antenna Gain	3dBi
Power Supply	DC 12V

2.2. TABLE OF CARRIER FREQUENCIES

Frequency Band	Channel Number	Frequency
5.725 GHz~5.850GHz	149	5745 MHz
	151	5755 MHz
	153	5765 MHz
	155	5775 MHz
	157	5785 MHz
	159	5795 MHz
	161	5805 MHz
	165	5825MHz

Note: For 20MHZ bandwidth system use Channel149,153,157,161,165; For 40MHZ bandwidth system use Channel 151,159; For 80MHZ bandwidth system use Channel 155.

2.3. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID:SZR-NVR-2400** filing to comply with the FCC Part 15 requirements.

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2.4. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013).

Radiated testing was performed at an antenna to EUT distance 3 meters.

Others testing (listed at item 5.3) was performed according to the procedures in FCC Part 15.407 rules KDB 789033

2.5. SPECIAL ACCESSORIES

Refer to section 5.2.

2.6. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

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3. MEASUREMENT UNCERTAINTY

The uncertainty is calculated using the methods suggested in the “Guide to the Expression of Uncertainty in measurement” (GUM) published by CISPR and ANSI.

- Uncertainty of Conducted Emission, $U_c = \pm 3.2$ dB
- Uncertainty of Radiated Emission below 1GHz, $U_c = \pm 3.9$ dB
- Uncertainty of Radiated Emission above 1GHz, $U_c = \pm 4.8$ dB

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4. DESCRIPTION OF TEST MODES

Mode	Available channel	Tested channel	Modulation	Date rate(Mbps)
802.11a/n20/ac20	149,153,157,161,165	149,157, 165	OFDM	6/6.5
802.11n40/ac40	151,159	151,159	OFDM	13.5
802.11ac80	155	155	OFDM	27

Note:

1. The EUT has been set to operate continuously on tested channel individually, and the EUT is operating at its maximum duty cycle>or equal 98%
2. All modes under which configure applicable have been tested and the worst mode test data recording in the test report, if no other mode data.

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5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Configure:



5.2. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	MDVR	NVR-2400	SZR-NVR-2400	EUT
2	Camera	NVR05	N/A	Support
3	Car battery	N/A	N/A	Support

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.407	6dB Bandwidth	Compliant
§15.407	Maximum conducted output power	Compliant
§15.407	Conducted Spurious Emission and Band edge Emission	Compliant
§15.407	Maximum Conducted Output Power Density	Compliant
§15.209	Radiated Emission	Compliant
§15.407	Frequency Stability	Compliant
§15.207	Line Conduction Emission	N/A

Note: The device is only used in the car, so the conducted emission is not applicable.

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6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2F., Bldg.2, No.1-4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Bao'an District B112-B113, Bldg.12, Baoan Bldg Materials Center, No.1 of Xixiang Inner Ring Road, Baoan District, Shenzhen 518012
NVLAP LAB CODE	600153-0
Designation Number	CN5028
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by National Voluntary Laboratory Accreditation program, NVLAP Code 600153-0

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Jun.20, 2017	Jun.19, 2018
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec.08, 2017	Dec.07, 2018
Power sensor	Aglient	U2021XA	MY54110007	Sep.21, 2017	Sep.20, 2018
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep.20, 2017	Sep.19, 2018
preamplifier	ChengYi	EMC184045SE	980508	Sep.15, 2017	Sep.14, 2018
Active loop antenna (9K-30MHz)	A.H.	SAS-562B	N/A	Mar.01, 2018	Feb.28, 2019
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May.18, 2017	May.17, 2019
Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-205	Jun.20, 2017	Jun.19, 2018
ANTENNA	SCHWARZBECK	VULB9168	D69250	Sep.28, 2017	Sep.27, 2018

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7. MAXIMUM CONDUCTED OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

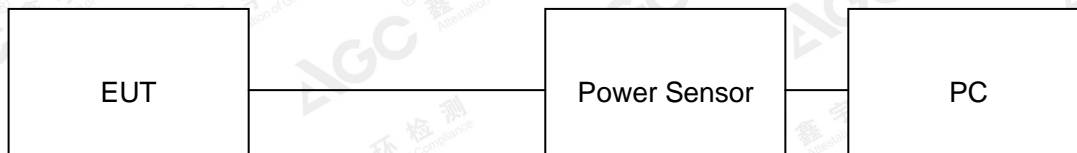
For average power test:

1. Connect EUT RF output port to power sensor through an RF attenuator.
2. Connect the power sensor to the PC.
3. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
4. Record the maximum power from the software.

Note : The EUT was tested according to KDB 789033 for compliance to FCC 47CFR 15.407 requirements.

7.2. TEST SET-UP

AVERAGE POWER SETUP



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7.3. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT FOR 802.11A20 MODULATION			
Frequency (MHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
5745	10.54	30	Pass
5785	10.38	30	Pass
5825	10.42	30	Pass

LIMITS AND MEASUREMENT RESULT FOR 802.11N20 MODULATION					
Frequency (MHz)	Average Power Chain 0(dBm)	Average Power Chain 1(dBm)	Average Power Total(dBm)	Applicable Limits (dBm)	Pass or Fail
5745	10.42	9.14	12.84	30	Pass
5785	10.25	9.04	12.70	30	Pass
5825	9.85	8.53	12.25	30	Pass

LIMITS AND MEASUREMENT RESULT FOR 802.11AC20 MODULATION					
Frequency (MHz)	Average Power Chain 0(dBm)	Average Power Chain 1(dBm)	Average Power Total(dBm)	Applicable Limits (dBm)	Pass or Fail
5745	10.21	9.21	12.75	30	Pass
5785	10.14	9.05	12.64	30	Pass
5825	9.77	8.61	12.24	30	Pass

LIMITS AND MEASUREMENT RESULT FOR 802.11N40 MODULATION					
Frequency (MHz)	Average Power Chain 0(dBm)	Average Power Chain 1(dBm)	Average Power Total(dBm)	Applicable Limits (dBm)	Pass or Fail
5755	7.64	6.58	10.15	30	Pass
5795	7.04	6.02	9.57	30	Pass

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LIMITS AND MEASUREMENT RESULT FOR 802.11AC40 MODULATION

Frequency (MHz)	Average Power Chain 0(dBm)	Average Power Chain 1(dBm)	Average Power Total(dBm)	Applicable Limits (dBm)	Pass or Fail
5755	6.85	5.18	9.11	30	Pass
5795	6.14	4.65	8.47	30	Pass

LIMITS AND MEASUREMENT RESULT FOR 802.11AC80 MODULATION

Frequency (MHz)	Average Power Chain 0(dBm)	Average Power Chain 1(dBm)	Average Power Total(dBm)	Applicable Limits (dBm)	Pass or Fail
5775	4.25	3.54	6.92	30	Pass

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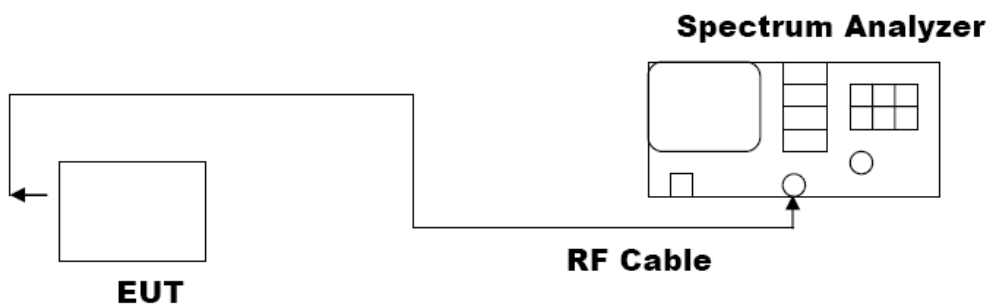
8. 6dB BANDWIDTH

8.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on operation frequency individually.
3. Set RBW = 100kHz.
4. Set the VBW $\geq 3 \times$ RBW. Detector = Peak. Trace mode = max hold.
5. Measure the maximum width of the emission that is 6 dB down from the peak of the emission.

Note: The EUT was tested according to KDB 789033 for compliance to FCC 47CFR 15.407 requirements.

8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



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8.3. LIMITS AND MEASUREMENT RESULTS

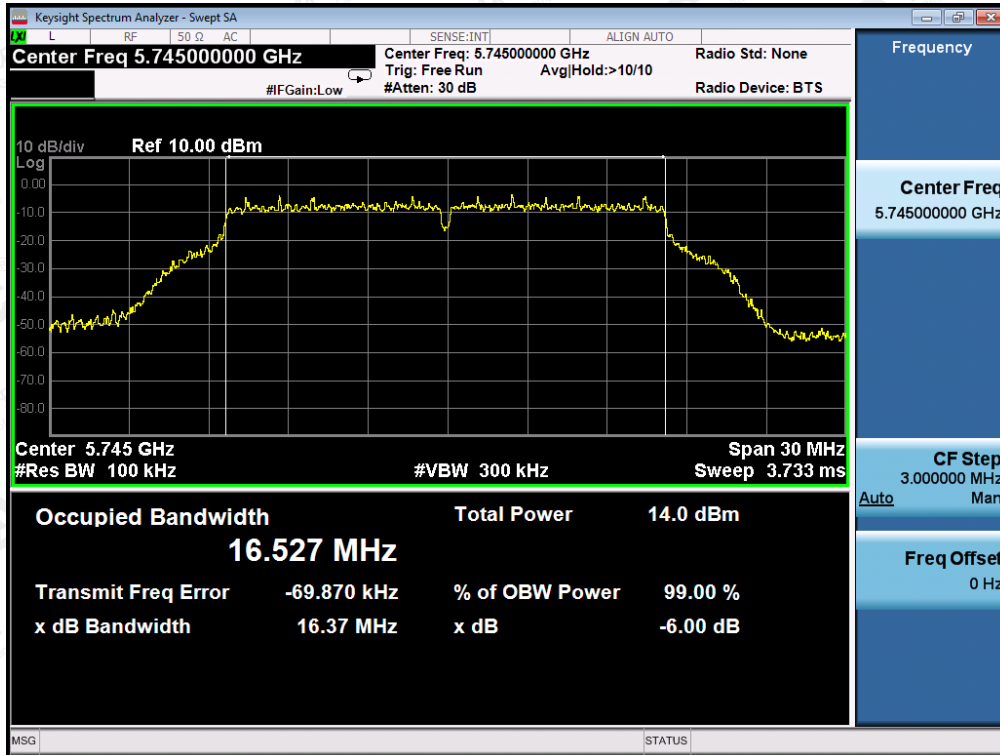
LIMITS AND MEASUREMENT RESULT FOR 802.11A20 MODULATION			
Applicable Limits	Applicable Limits		
	Test Data (MHz)		Criteria
>500KHZ	5745MHz	16.37	PASS
	5785MHz	16.37	PASS
	5825MHz	16.33	PASS

LIMITS AND MEASUREMENT RESULT FOR 802.11N20/40 MODULATION			
Applicable Limits	Applicable Limits		
	Test Data (MHz)		Criteria
>500KHZ	5745MHz	17.55	PASS
	5785MHz	17.60	PASS
	5825MHz	17.58	PASS
	5755MHz	36.33	PASS
	5795MHz	36.36	PASS

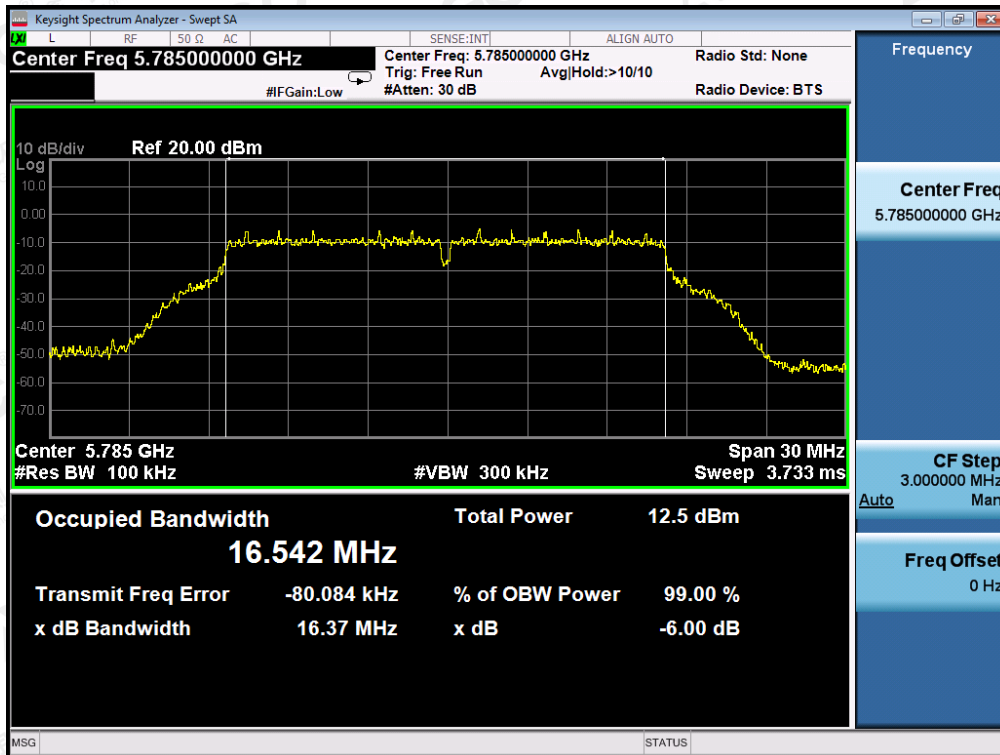
LIMITS AND MEASUREMENT RESULT FOR 802.11AC20/40/80 MODULATION			
Applicable Limits	Applicable Limits		
	Test Data (MHz)		Criteria
>500KHZ	5745MHz	17.62	PASS
	5785MHz	17.67	PASS
	5825MHz	17.64	PASS
	5755MHz	36.34	PASS
	5795MHz	36.39	PASS
	5775MHz	76.38	PASS

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802.11a20 TEST RESULT
TEST PLOT OF BANDWIDTH FOR 5745MHZ

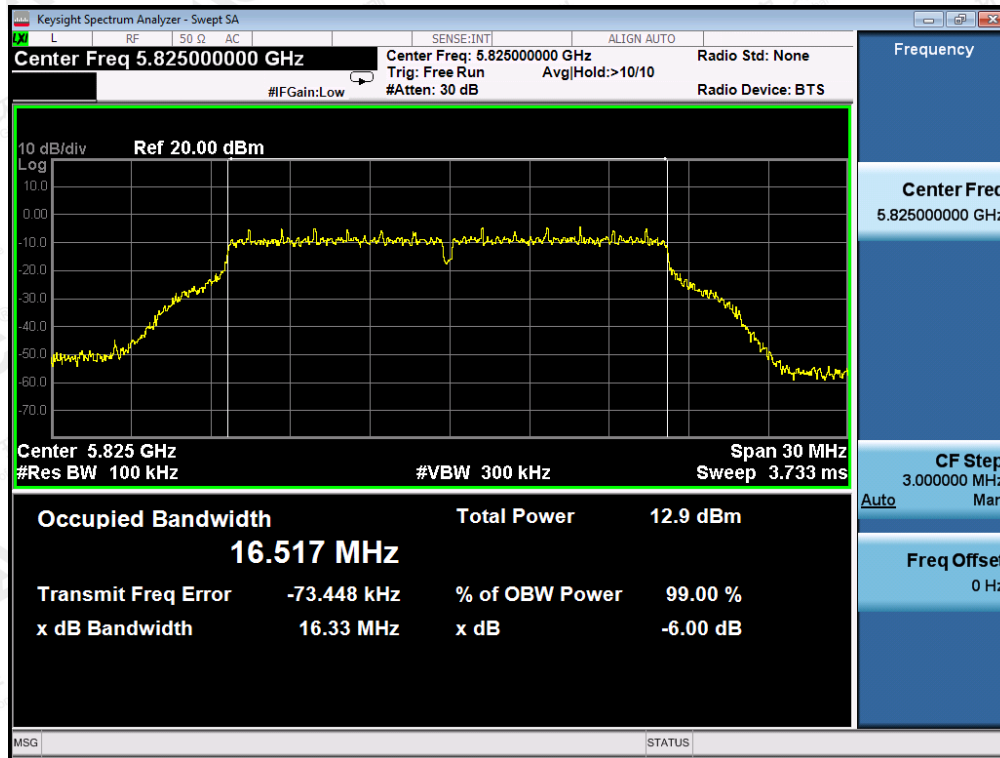


TEST PLOT OF BANDWIDTH FOR 5785MHZ



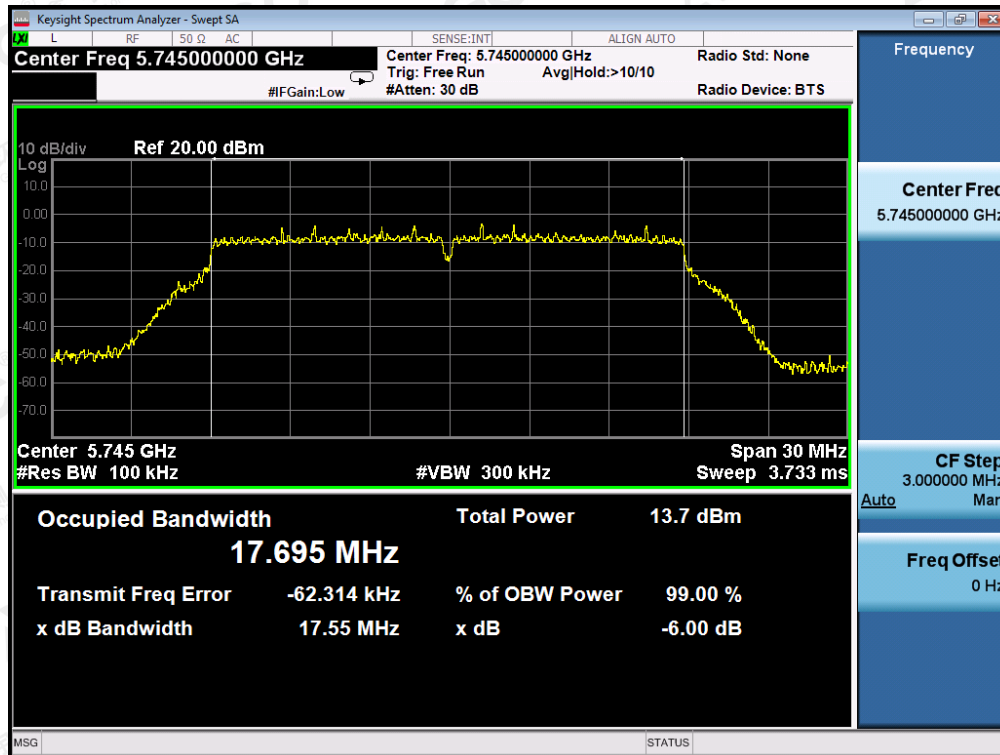
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TEST PLOT OF BANDWIDTH FOR 5825MHZ



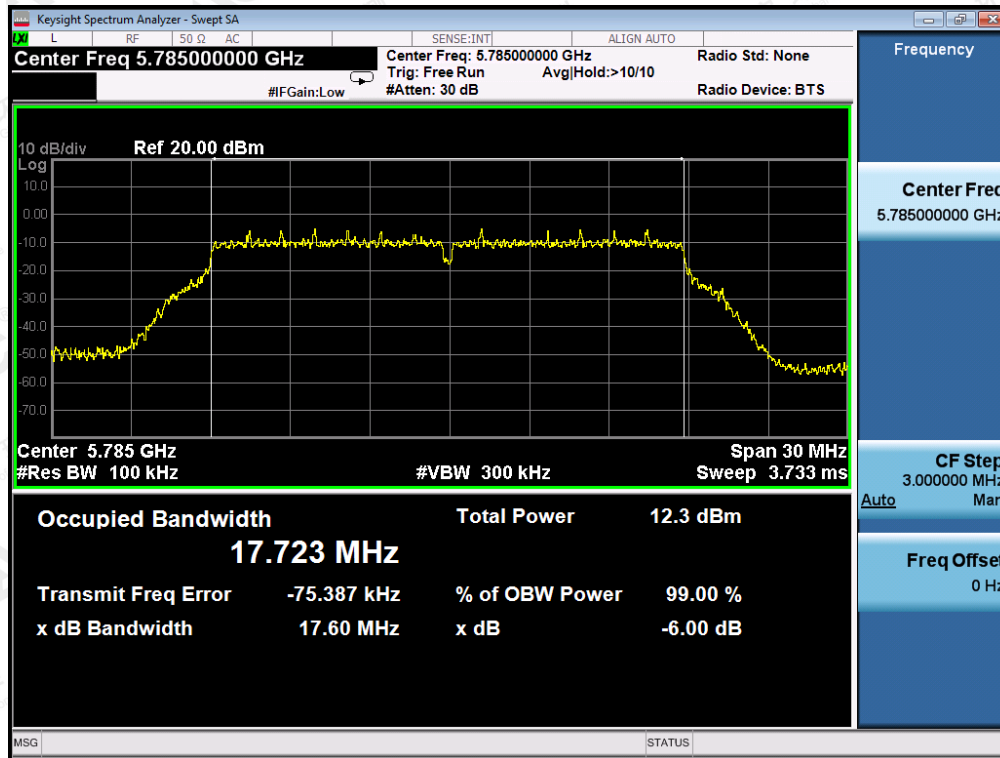
802.11n20 TEST RESULT

TEST PLOT OF BANDWIDTH FOR 5745MHZ

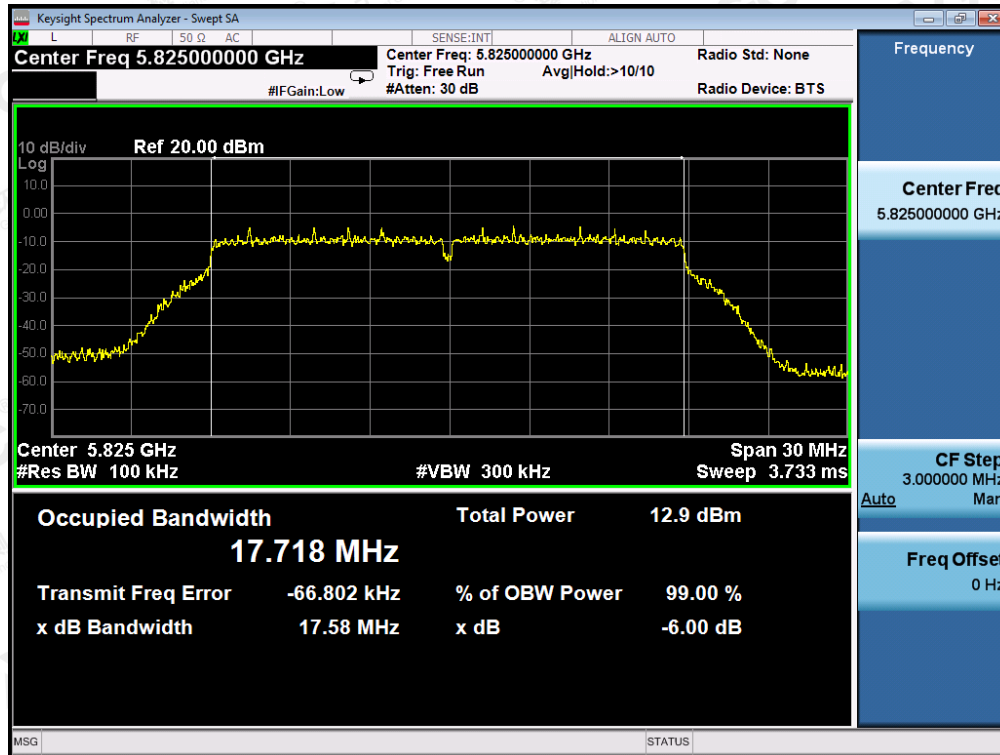


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TEST PLOT OF BANDWIDTH FOR 5785MHz

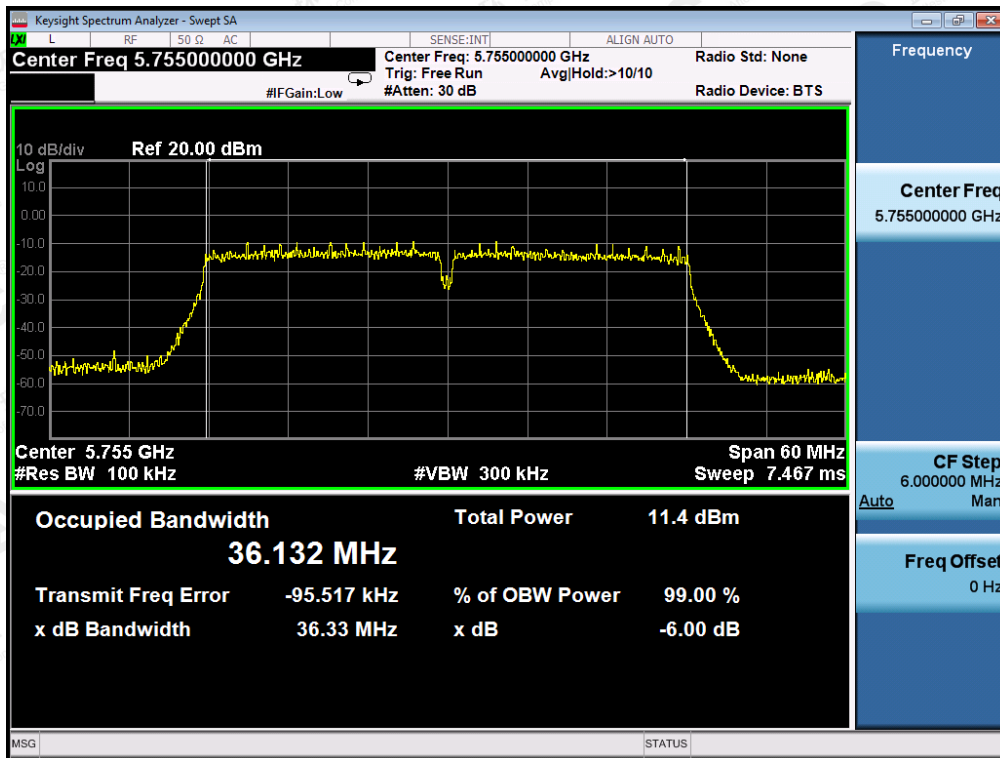


TEST PLOT OF BANDWIDTH FOR 5825MHz

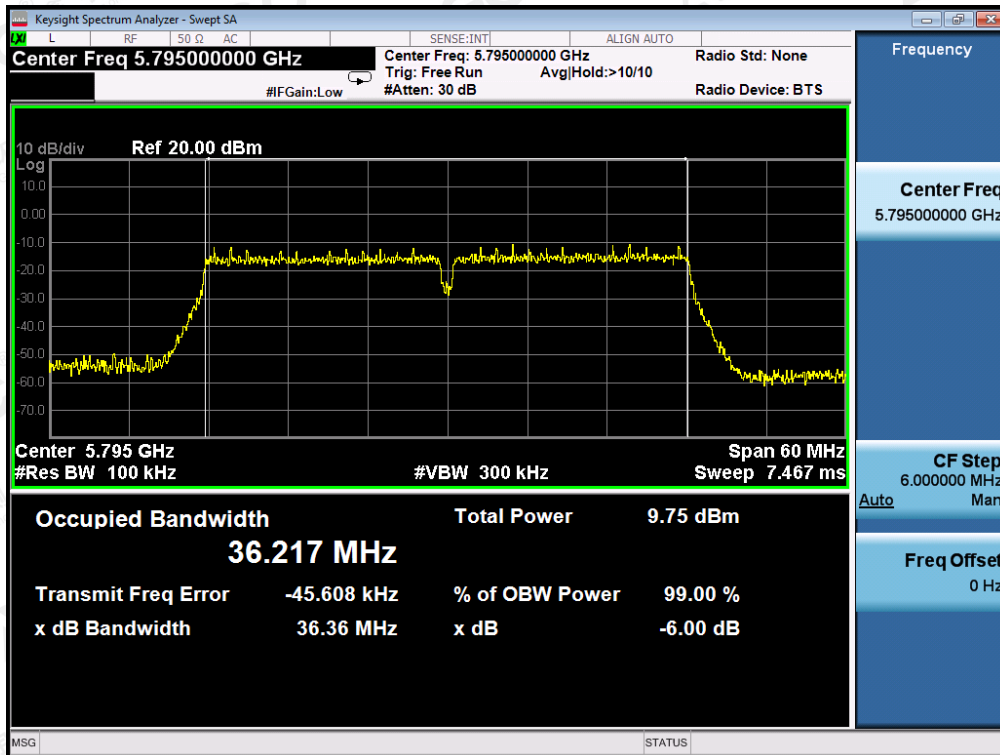


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802.11n40 TEST RESULT
TEST PLOT OF BANDWIDTH FOR 5755MHz

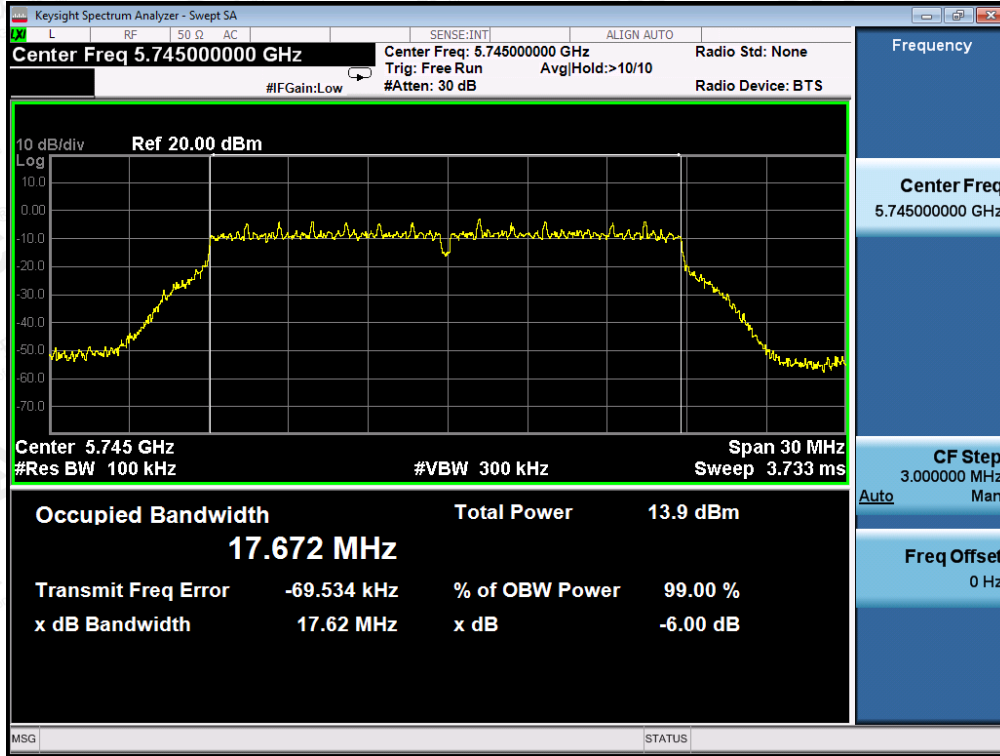


TEST PLOT OF BANDWIDTH FOR 5795MHz

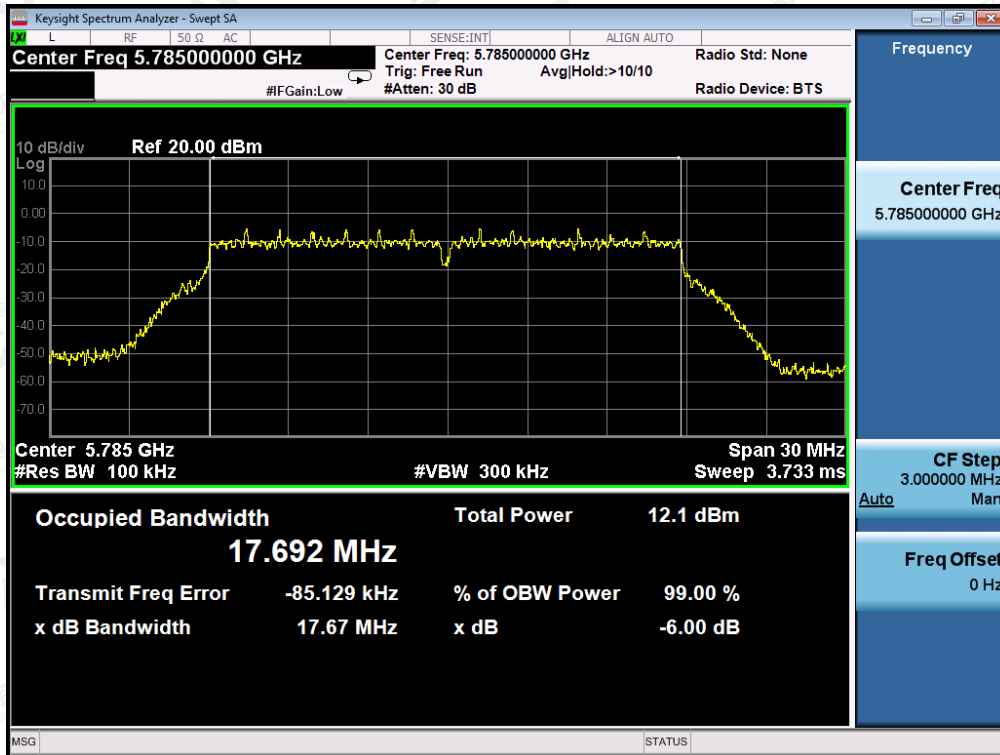


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802.11ac20 TEST RESULT
TEST PLOT OF BANDWIDTH FOR 5745MHZ

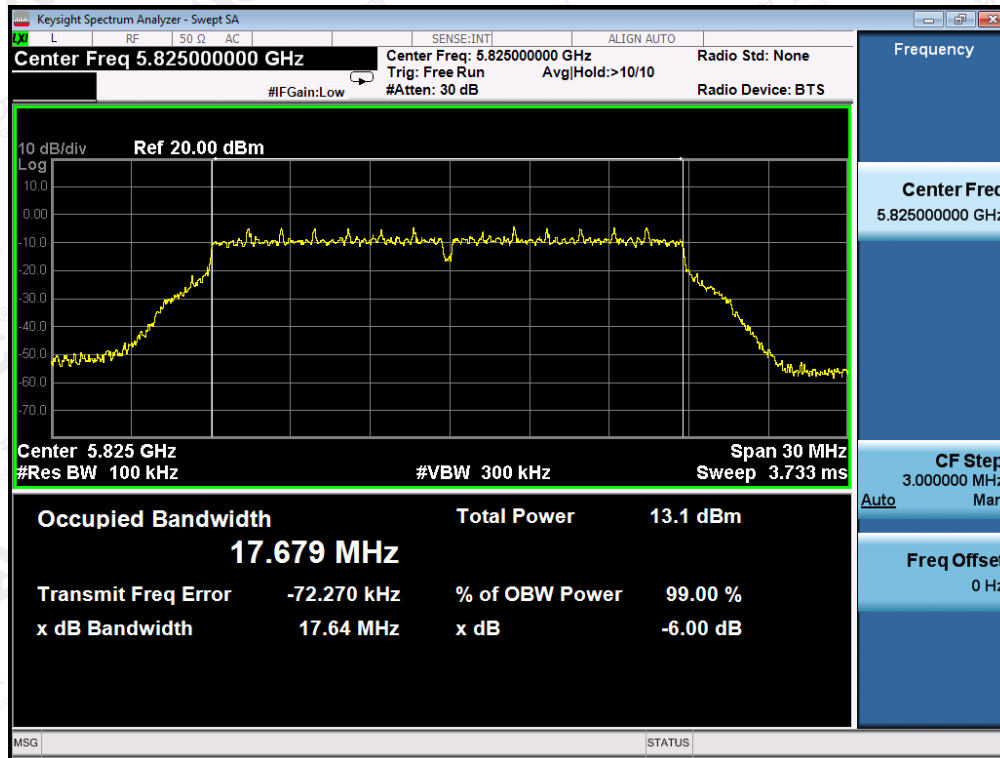


TEST PLOT OF BANDWIDTH FOR 5785MHZ



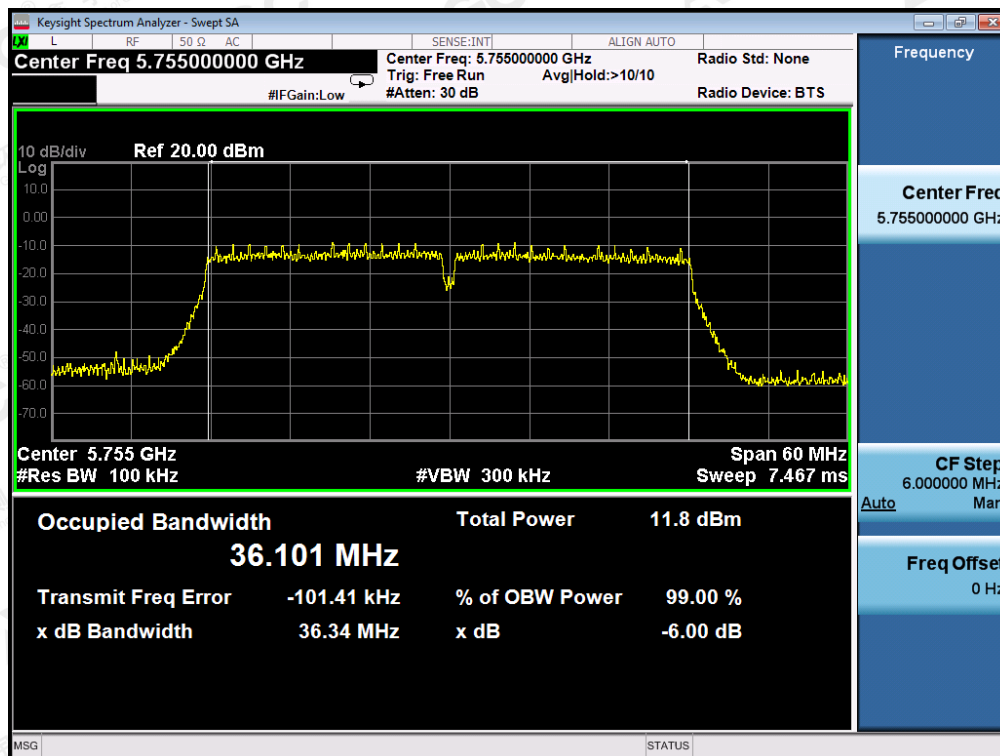
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TEST PLOT OF BANDWIDTH FOR 5825MHZ



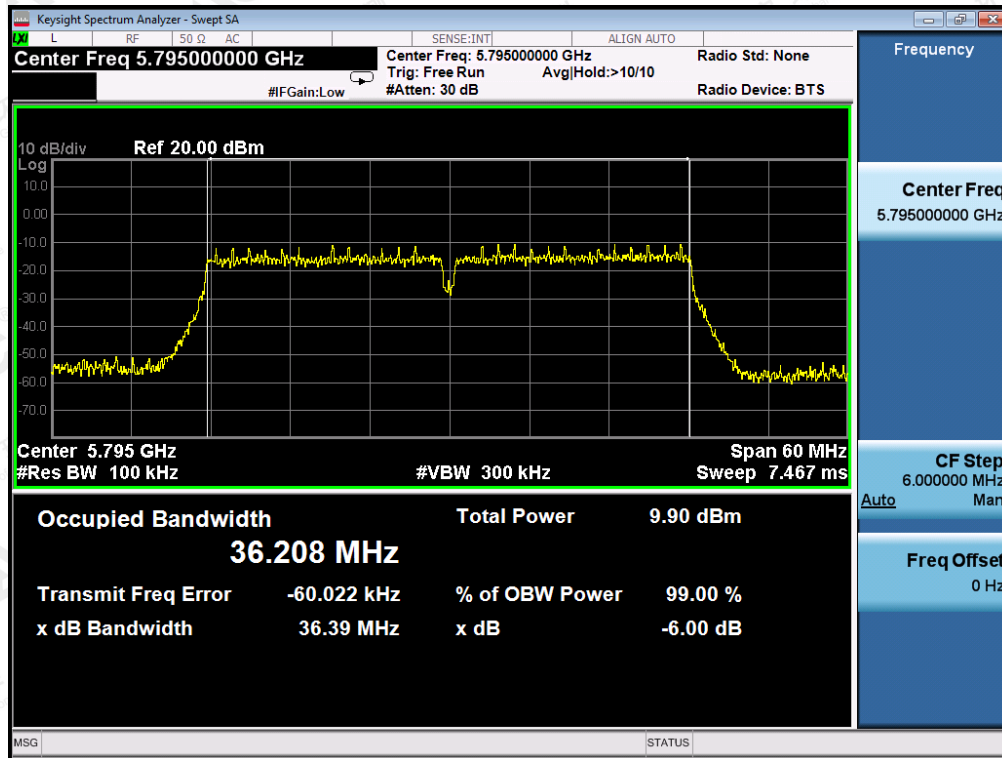
802.11ac40 TEST RESULT

TEST PLOT OF BANDWIDTH FOR 5755MHZ



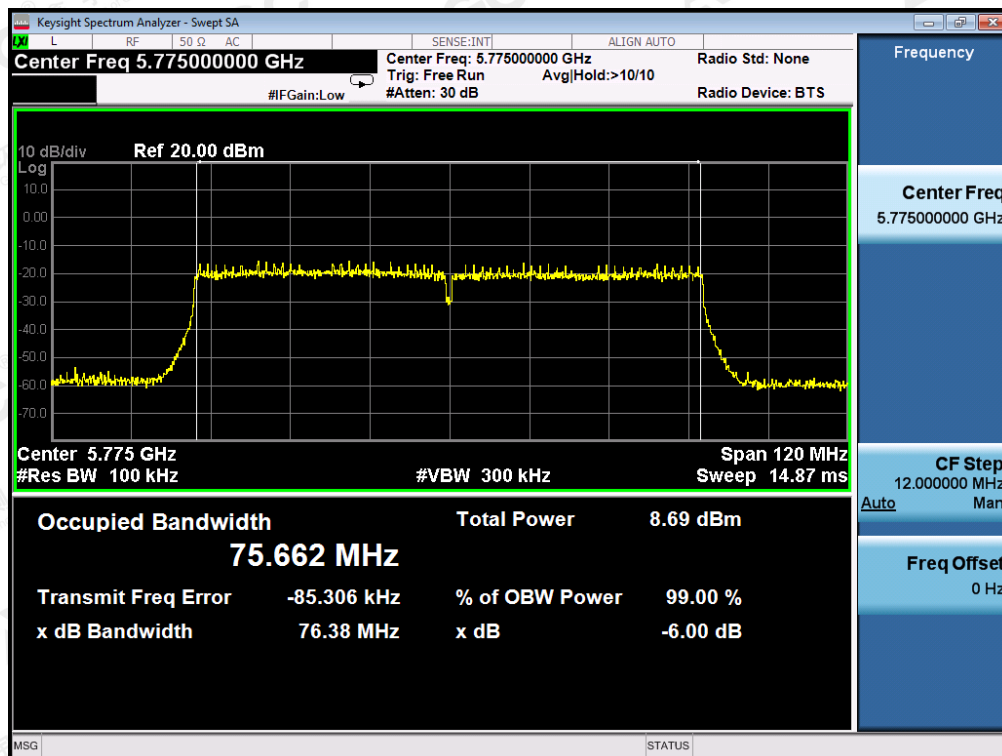
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TEST PLOT OF BANDWIDTH FOR 5795MHz



802.11ac80 TEST RESULT

TEST PLOT OF BANDWIDTH FOR 5775MHz



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9. MAXIMUM CONDUCTED OUTPUT PEAK POWER SPECTRAL DENSITY

9.1 MEASUREMENT PROCEDURE

Refer to KDB 789033 section F

9.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer To Section 8.2.

9.3 MEASUREMENT EQUIPMENT USED

Refer To Section 6.

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9.4 LIMITS AND MEASUREMENT RESULT

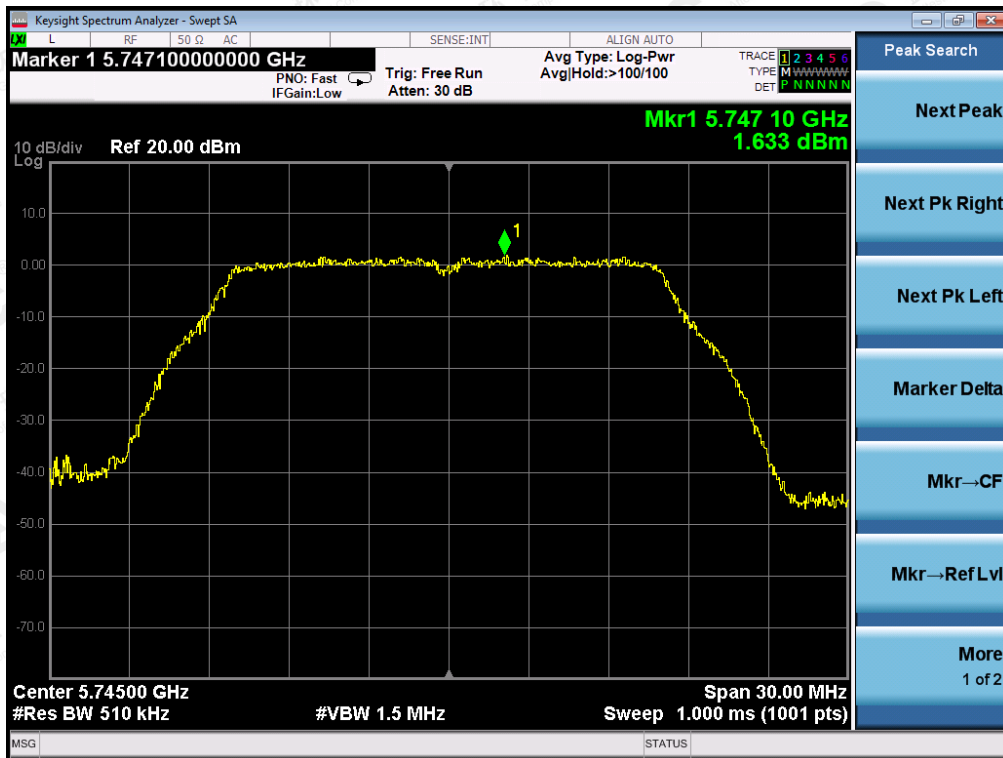
LIMITS AND MEASUREMENT RESULT FOR 802.11A20 MODULATION			
Frequency (MHz)	Power density (dBm/500kHz)	Applicable Limits (dBm)	Pass or Fail
5745	1.633	30	Pass
5785	-0.018	30	Pass
5825	1.068	30	Pass

LIMITS AND MEASUREMENT RESULT FOR 802.11N20/40 MODULATION					
Frequency (MHz)	Power density Chain 0 (dBm/500kHz)	Power density Chain 1 (dBm/500kHz)	Power density Total (dBm/500kHz)	Applicable Limits (dBm)	Pass or Fail
5745	1.866	-0.982	3.682	30	Pass
5785	0.495	-3.772	1.876	30	Pass
5825	0.792	-3.964	2.045	30	Pass
5755	-2.866	-5.383	-0.934	30	Pass
5795	-4.554	-8.477	-3.077	30	Pass

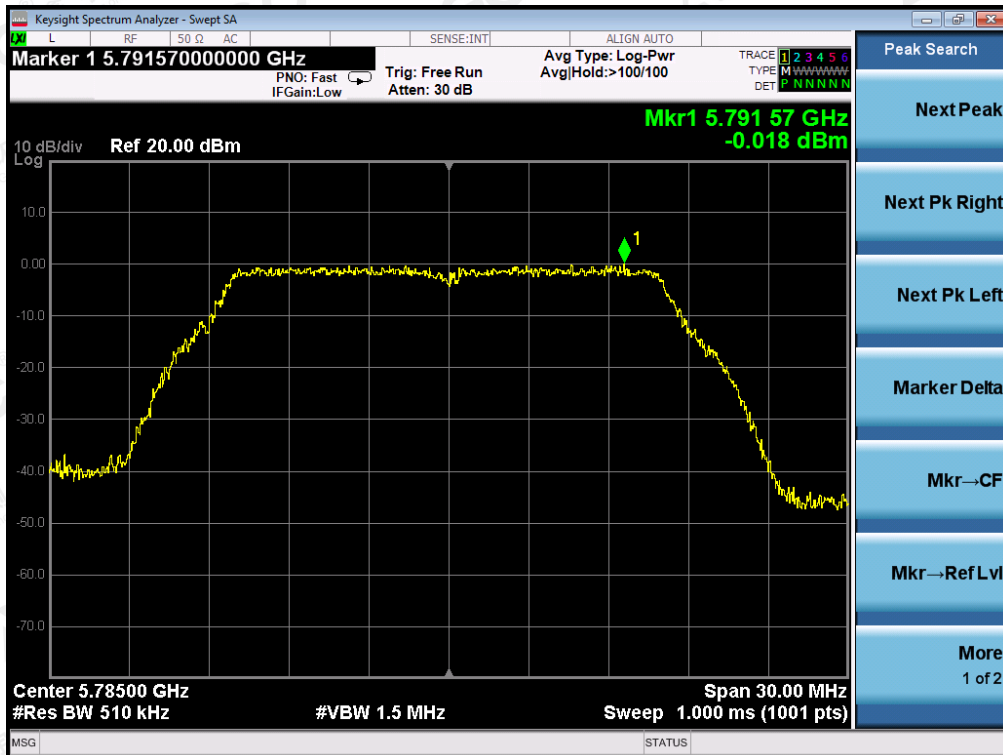
LIMITS AND MEASUREMENT RESULT FOR 802.11AC20/40/80 MODULATION					
Frequency (MHz)	Power density Chain 0 (dBm/500kHz)	Power density Chain 1 (dBm/500kHz)	Power density Total (dBm/500kHz)	Applicable Limits (dBm)	Pass or Fail
5745	1.943	-0.446	3.921	30	Pass
5785	1.039	-2.340	2.680	30	Pass
5825	0.825	-2.457	2.497	30	Pass
5755	-1.651	-5.249	-0.077	30	Pass
5795	-3.494	-7.578	-2.062	30	Pass
5775	-8.330	-10.471	-6.260	30	Pass

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**802.11a20 TEST RESULT:
TEST PLOT FOR 5745MHz**

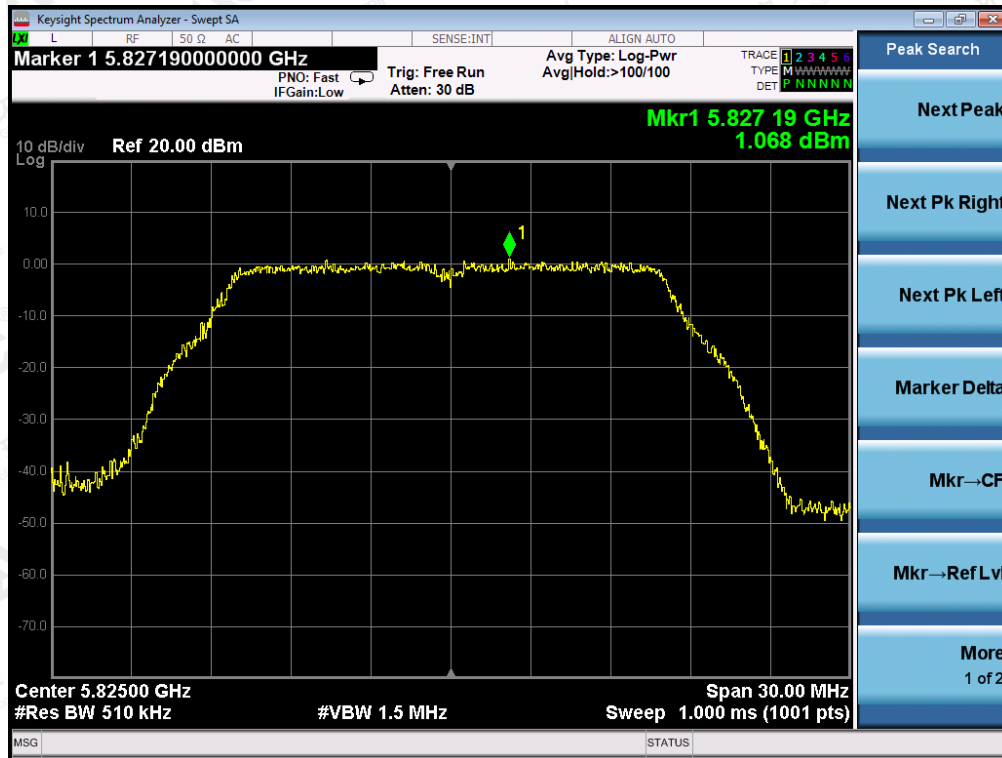


TEST PLOT FOR 5785MHz

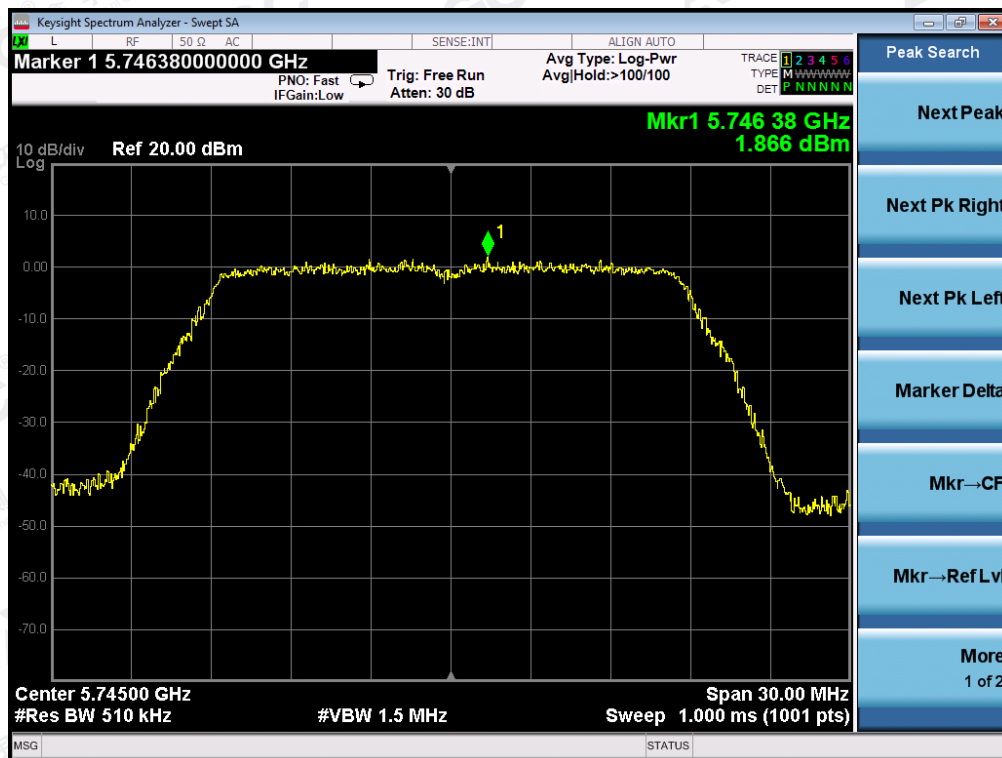


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TEST PLOT FOR 5825MHz

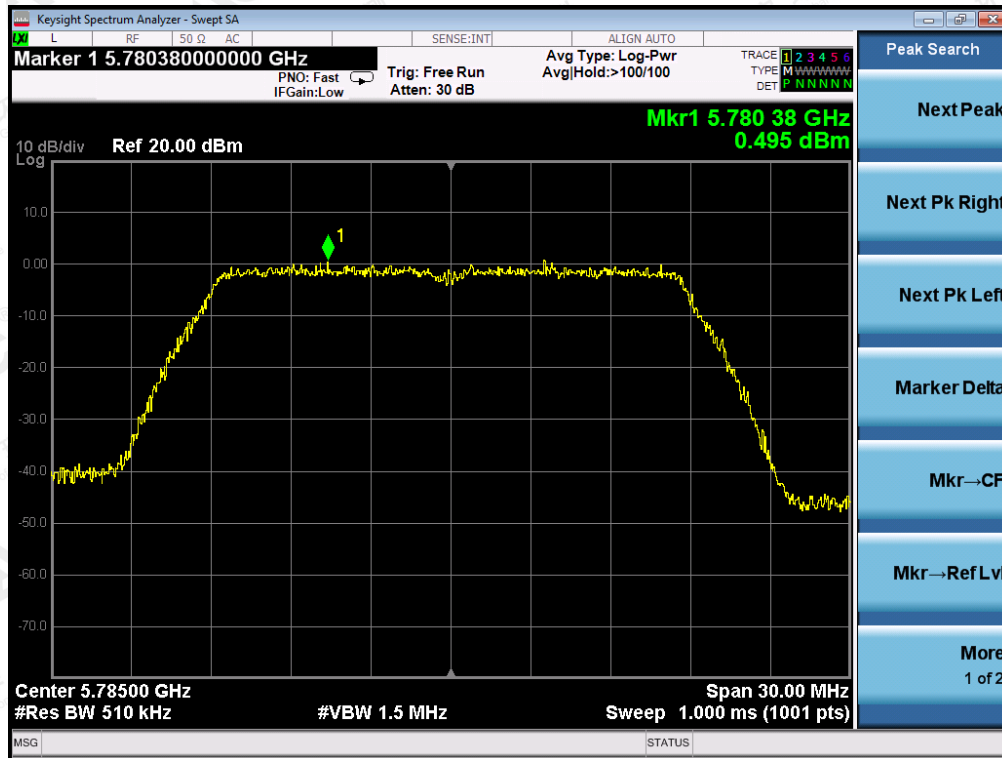


802.11n20 TEST RESULT-ant0
TEST PLOT FOR 5745MHz

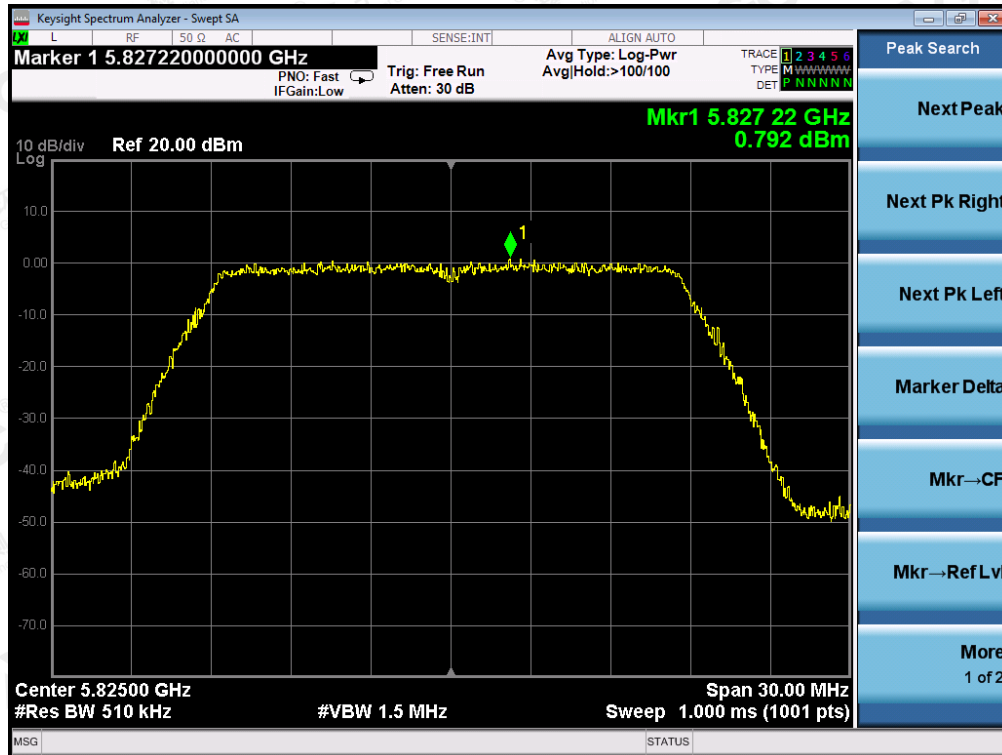


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TEST PLOT FOR 5785MHz

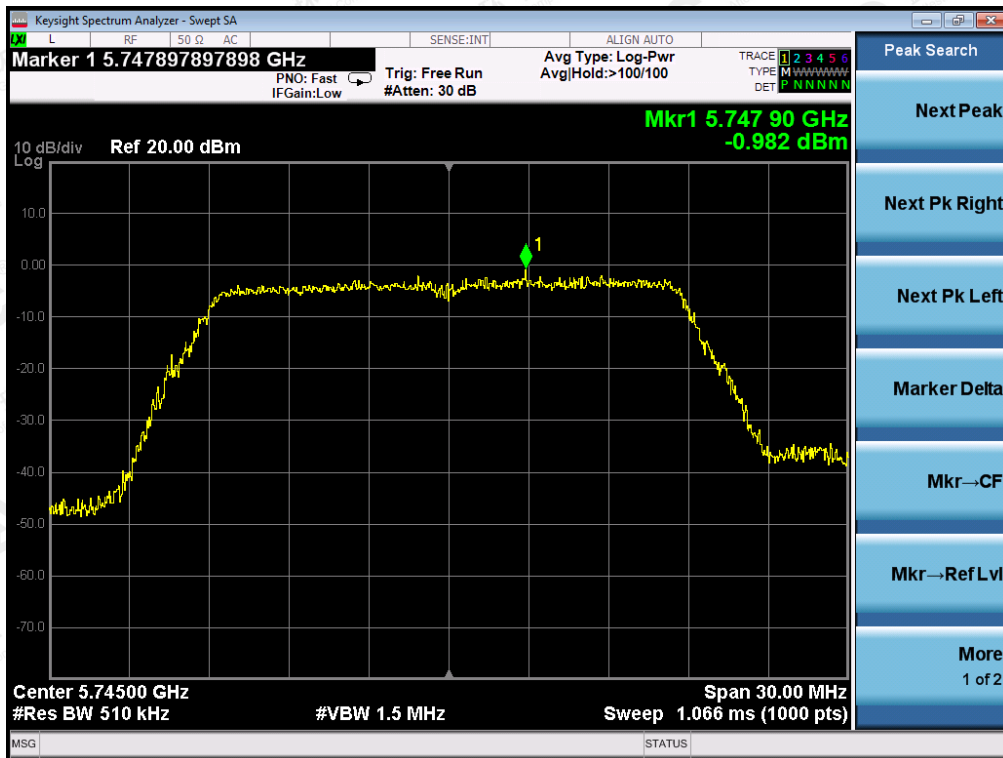


TEST PLOT FOR 5825MHz

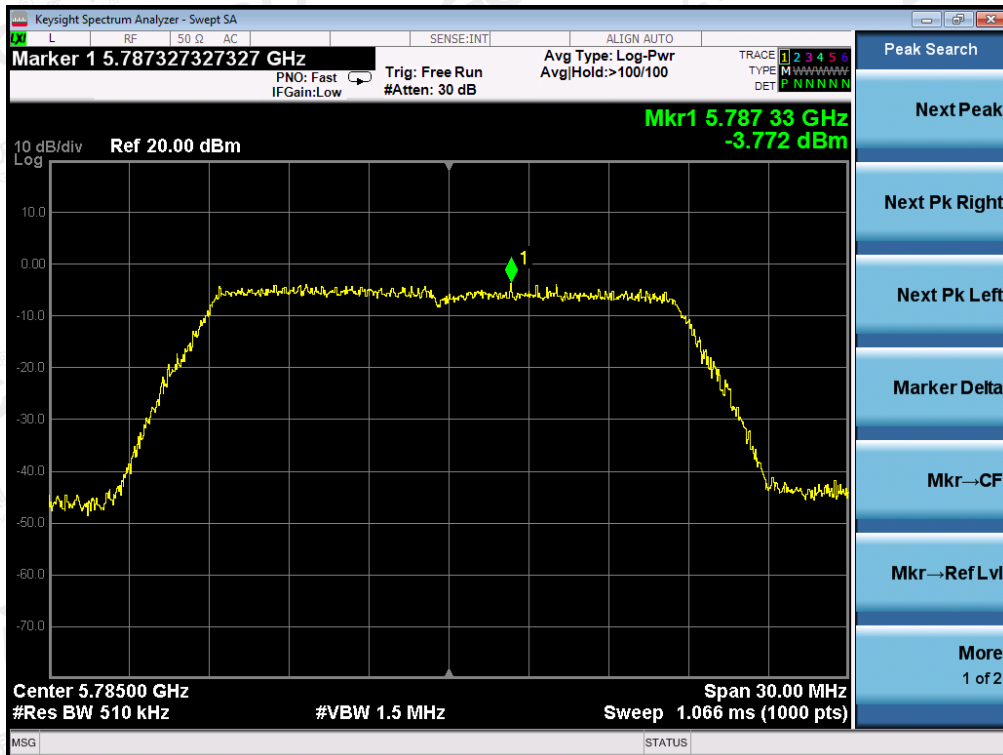


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802.11n20 TEST RESULT-ant1:
TEST PLOT FOR 5745MHz

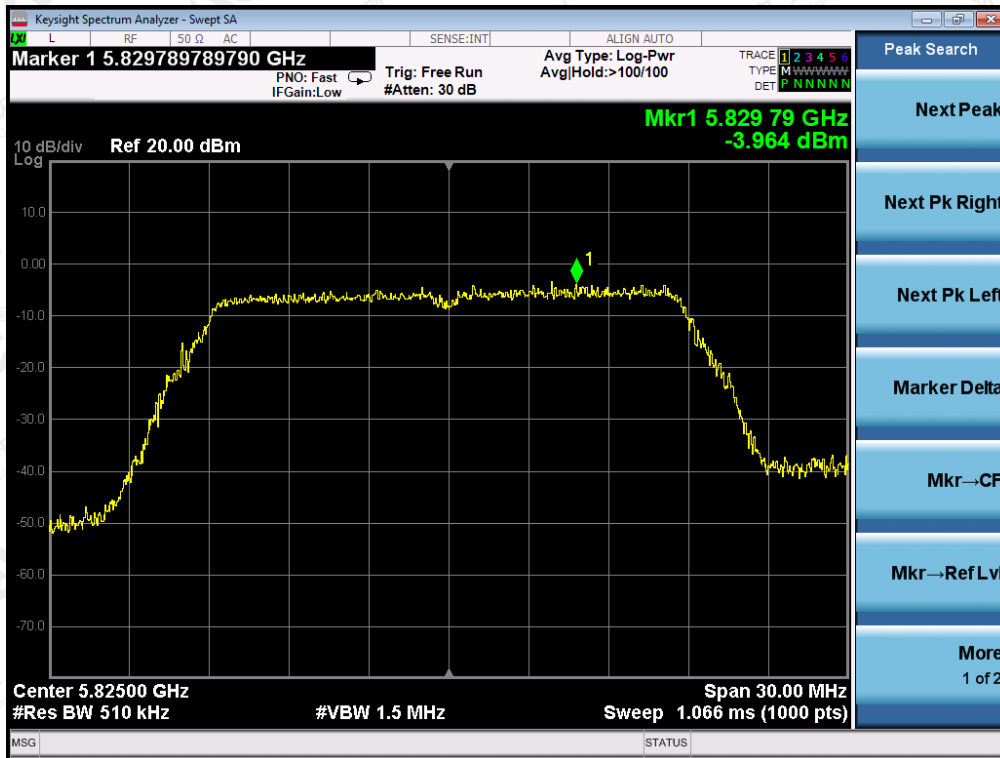


TEST PLOT FOR 5785MHz



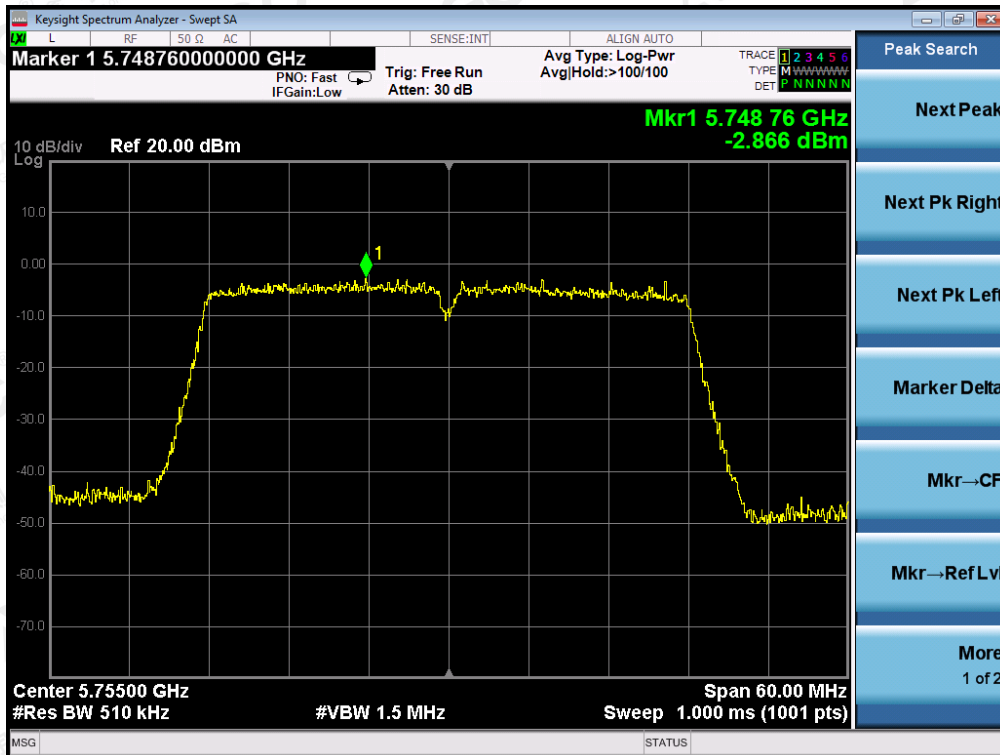
The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

TEST PLOT FOR 5825MHz



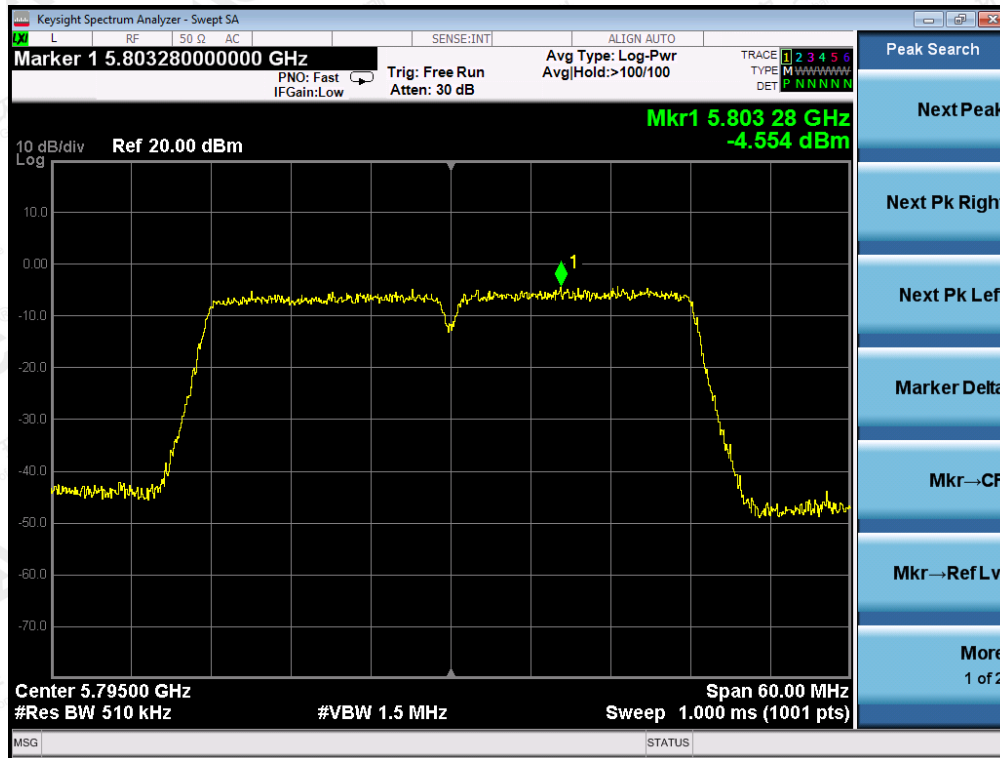
802.11n40 TEST RESULT-ant0:

TEST PLOT FOR 5755MHz

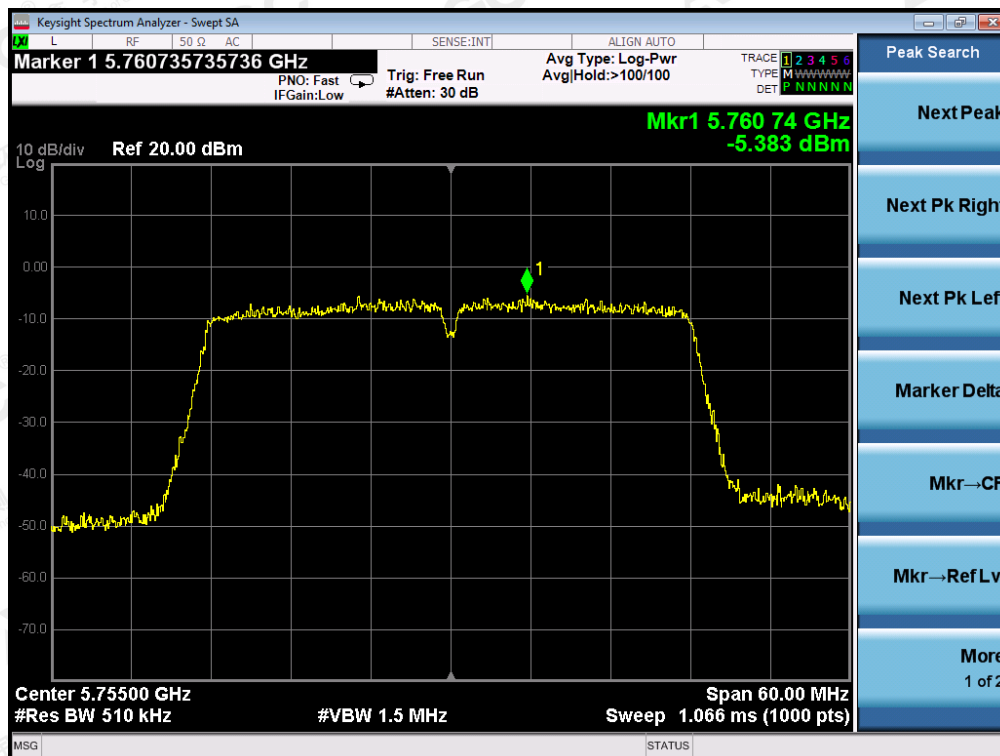


The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

TEST PLOT FOR 5795MHz

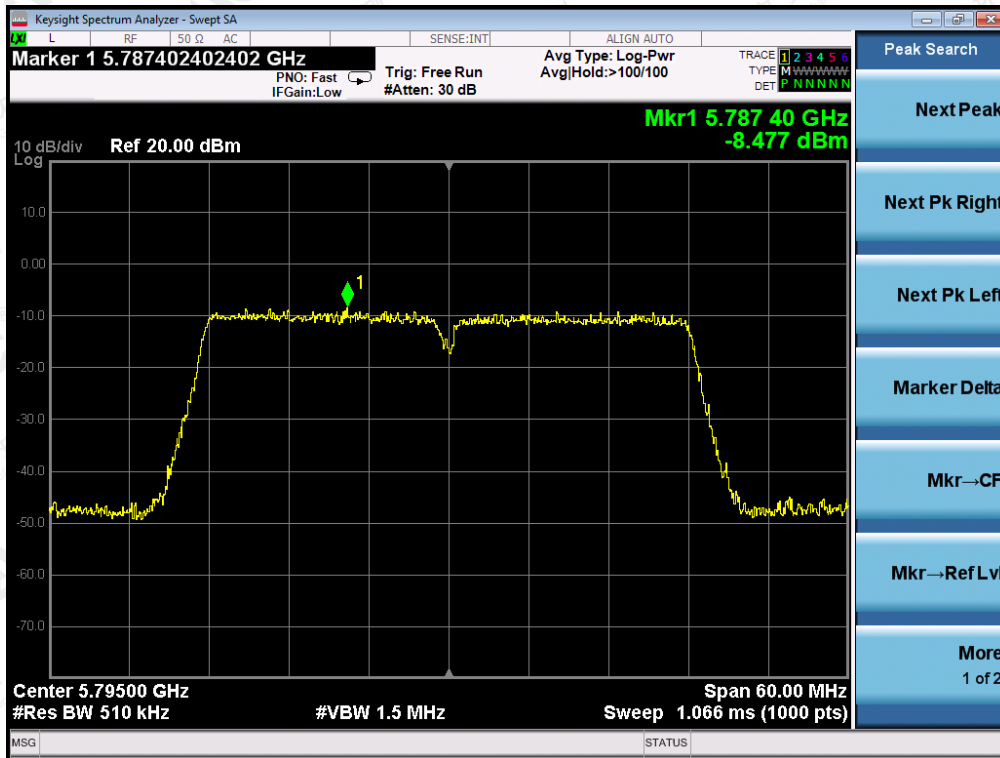


802.11n40 TEST RESULT-ant1:
TEST PLOT FOR 5755MHz



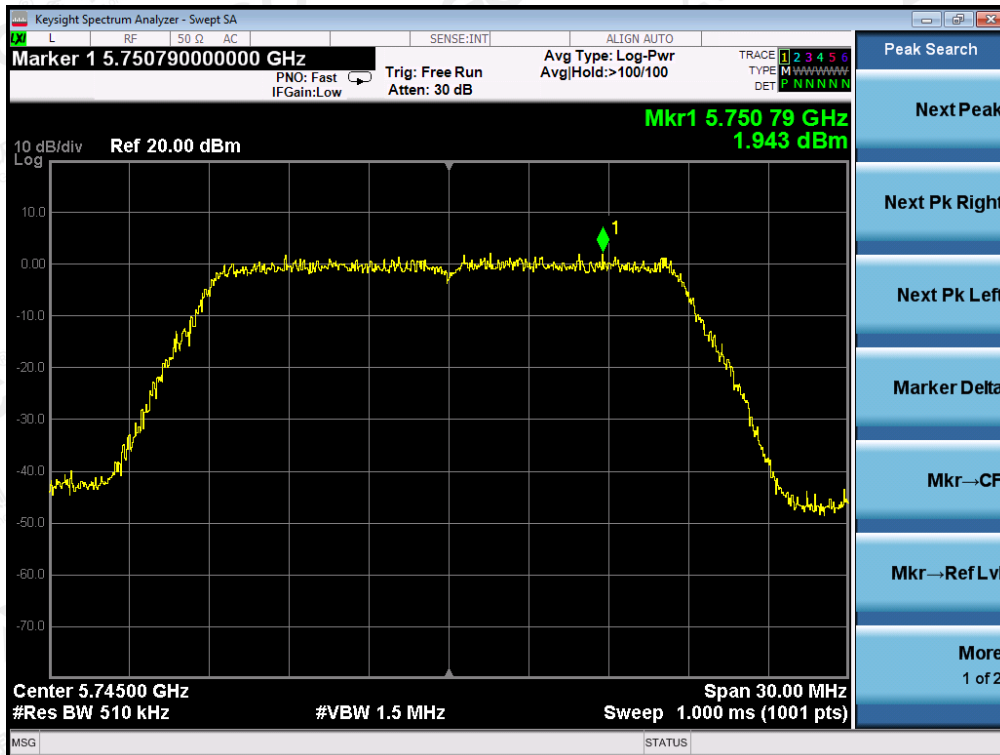
The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

TEST PLOT FOR 5795MHz



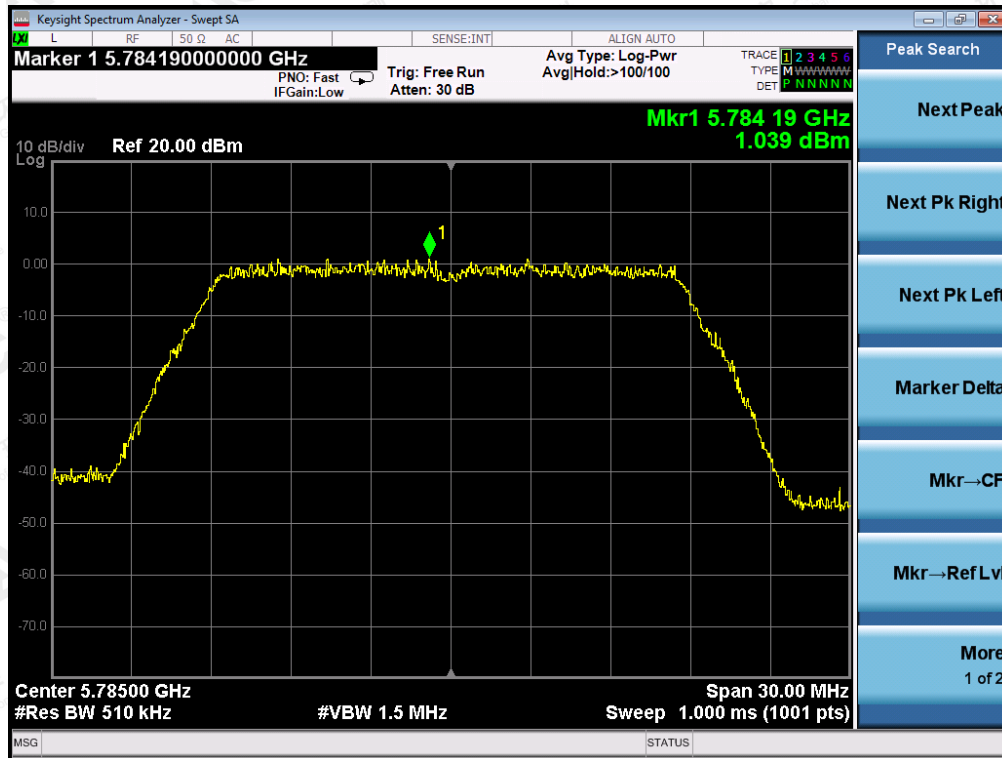
802.11ac20 TEST RESULT-ant0

TEST PLOT FOR 5745MHz

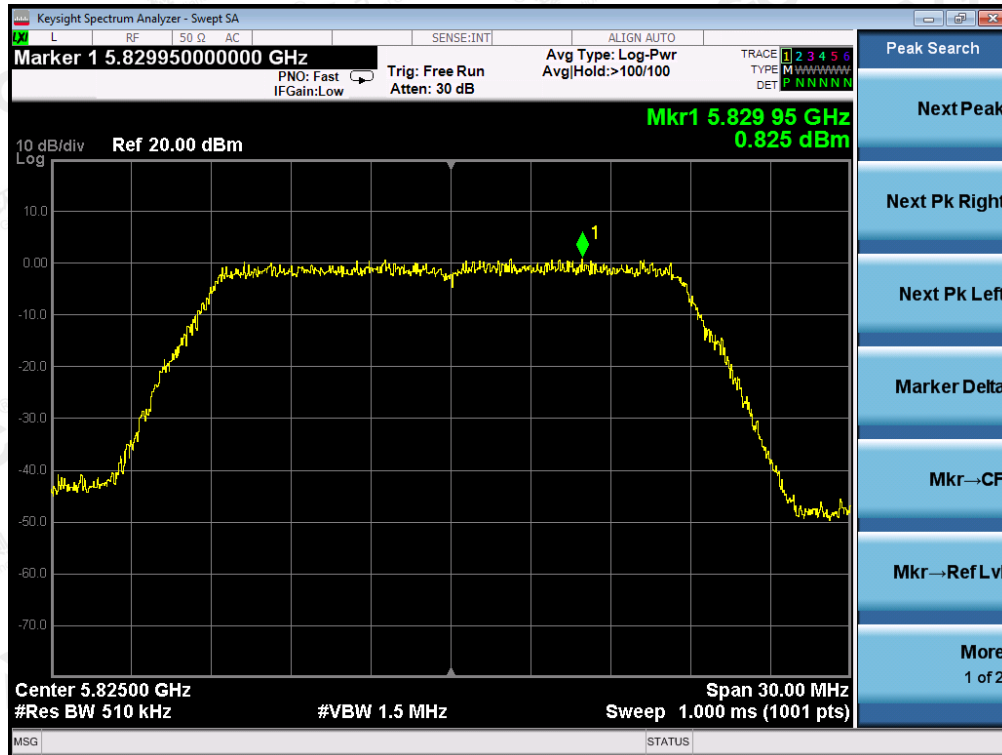


The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

TEST PLOT FOR 5785MHz

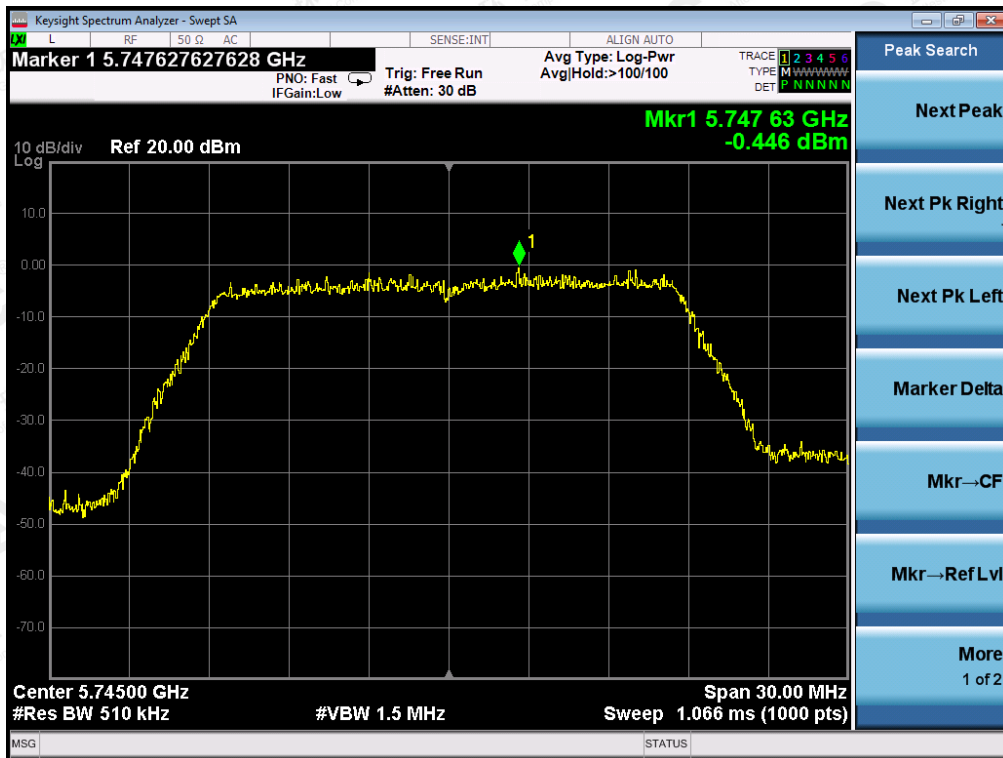


TEST PLOT FOR 5825MHz

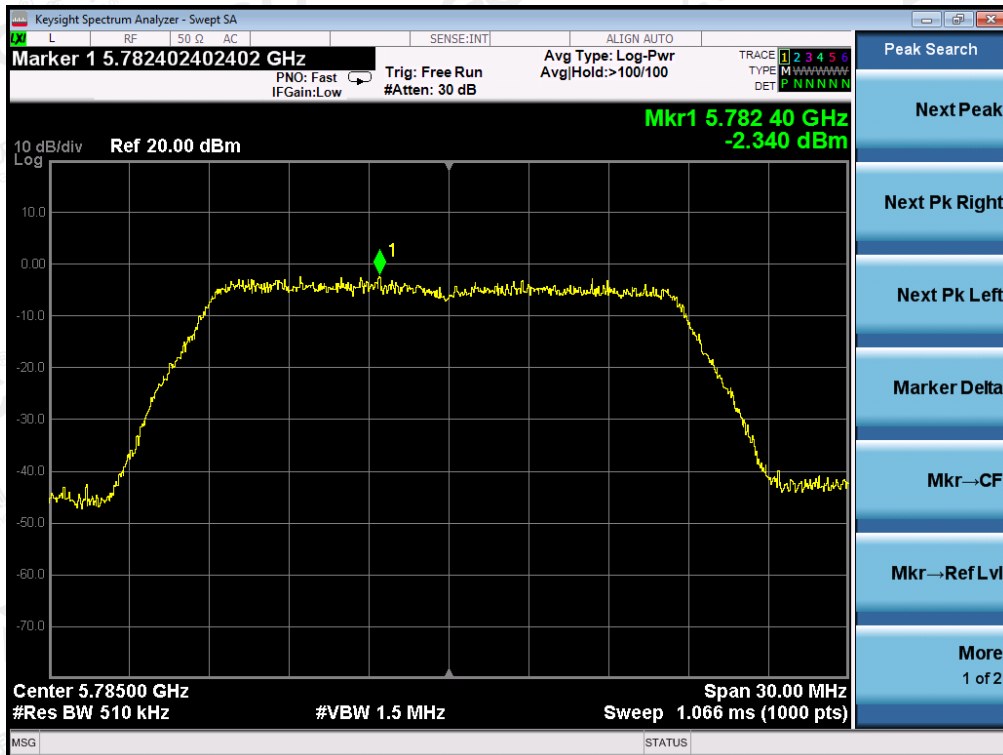


The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

802.11ac20 TEST RESULT-ant1:
TEST PLOT FOR 5745MHz

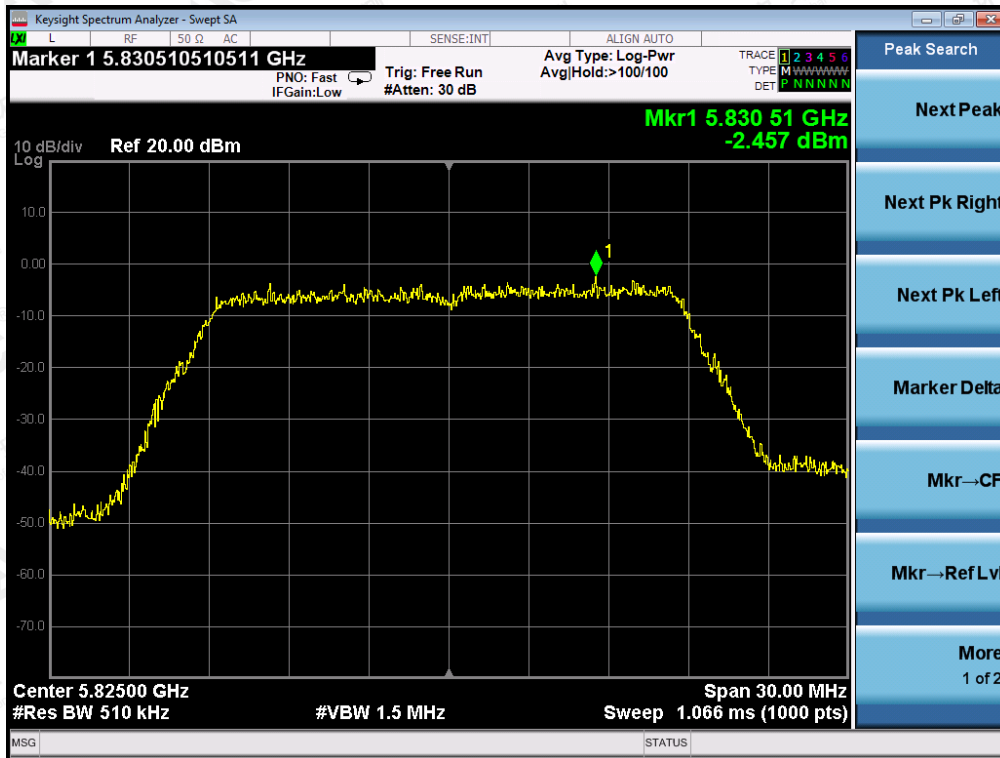


TEST PLOT FOR 5785MHz



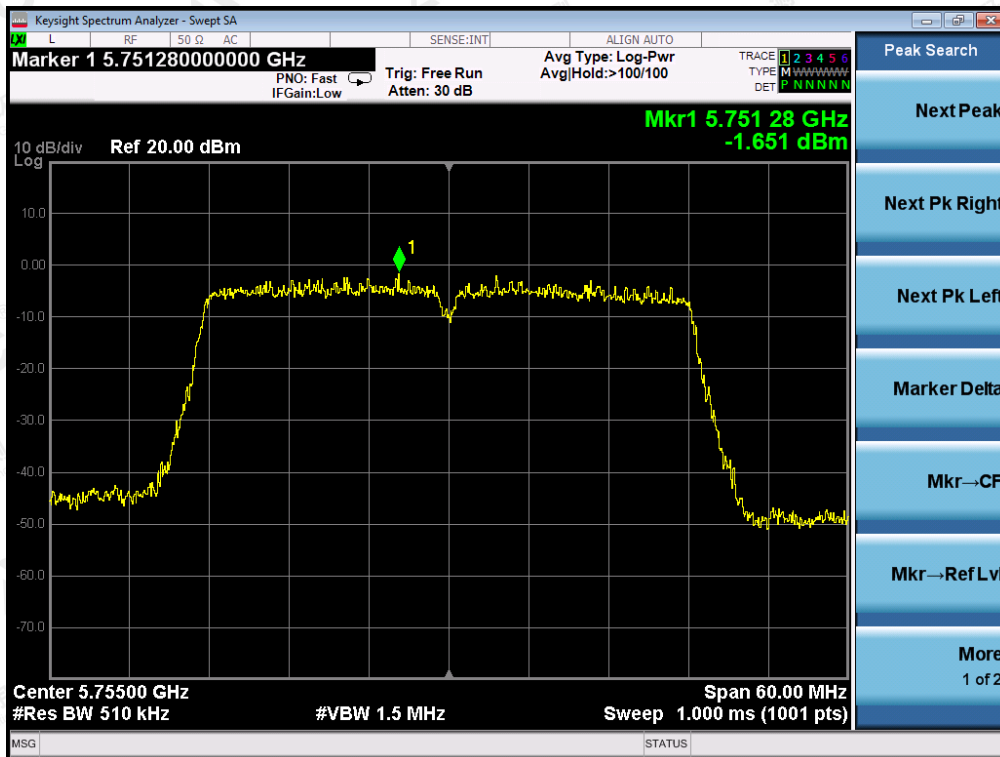
The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

TEST PLOT FOR 5825MHz



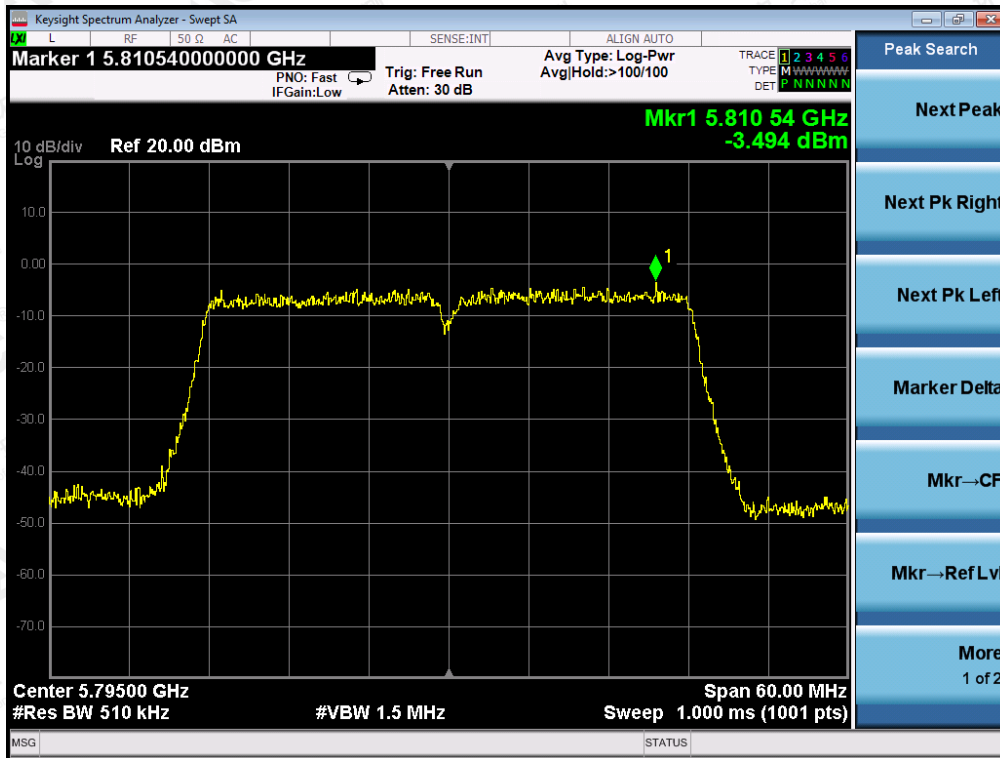
802.11ac40 TEST RESULT-ant0

TEST PLOT FOR 5755MHz



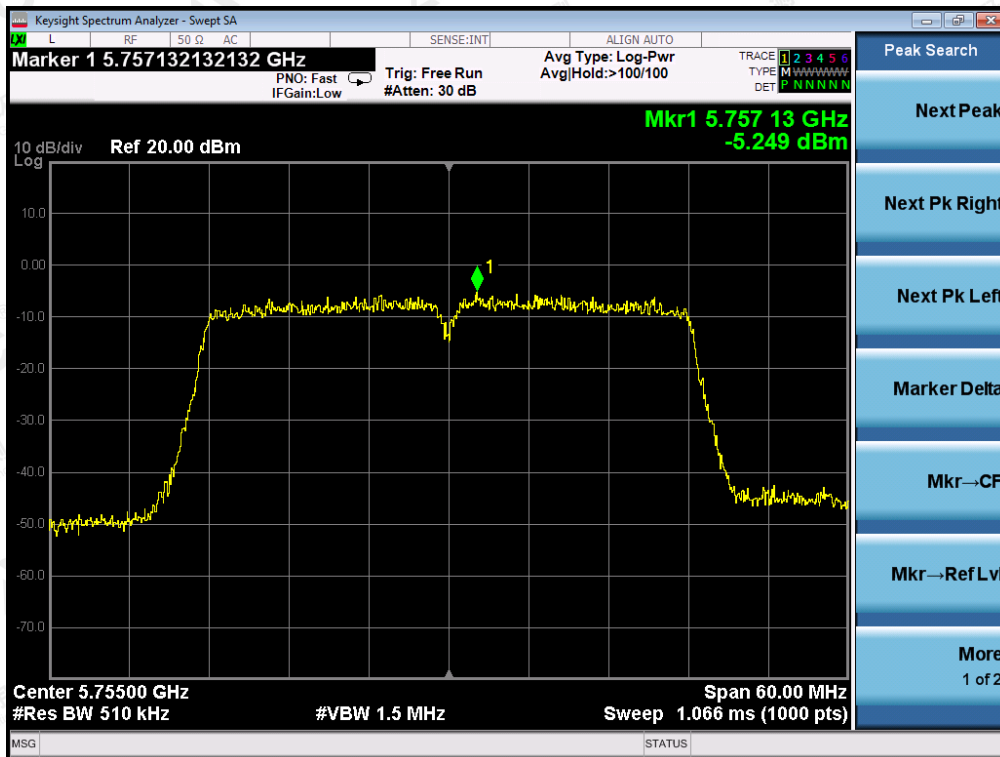
The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

TEST PLOT FOR 5795MHz



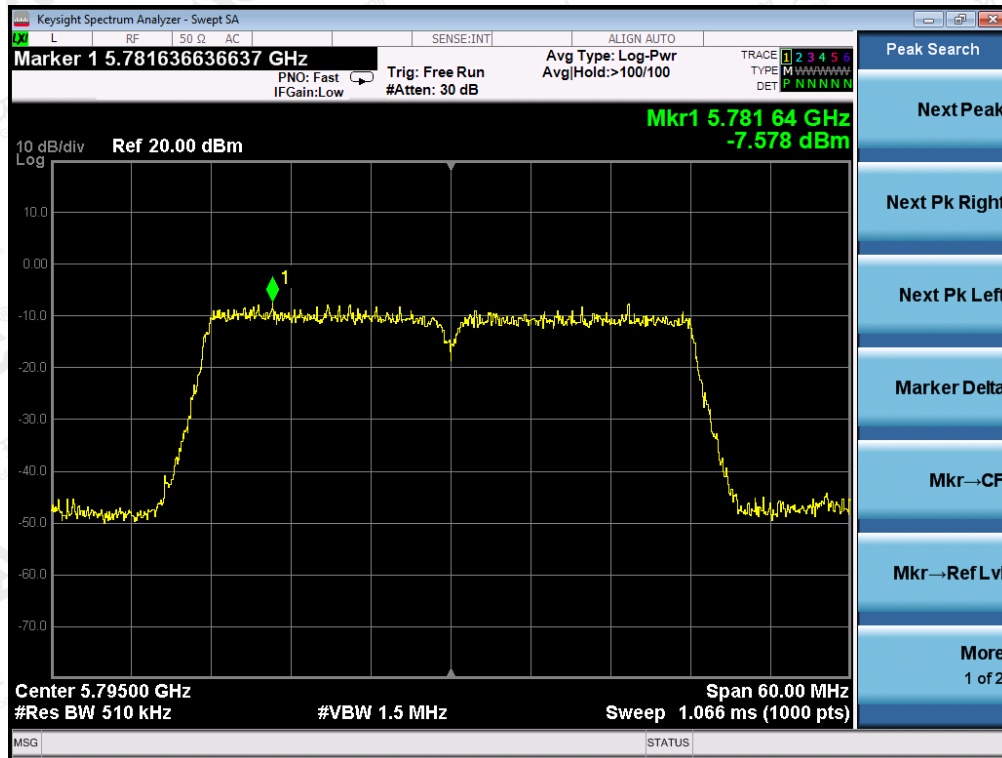
802.11ac40 TEST RESULT-ant1:

TEST PLOT FOR 5755MHz



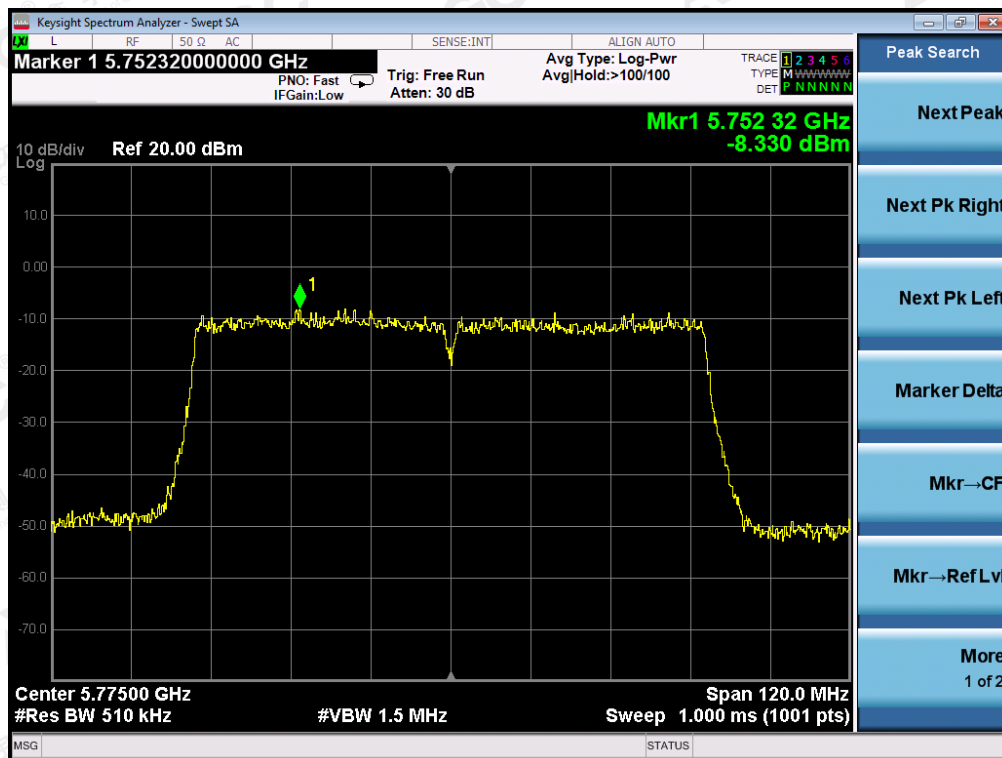
The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 30 days only. The document is issued by AGC, this document cannot be reproduced except in full with our prior written permission. The more details and the authenticity of the report will be confirmed at <http://www.agc-cert.com>.

TEST PLOT FOR 5795MHz



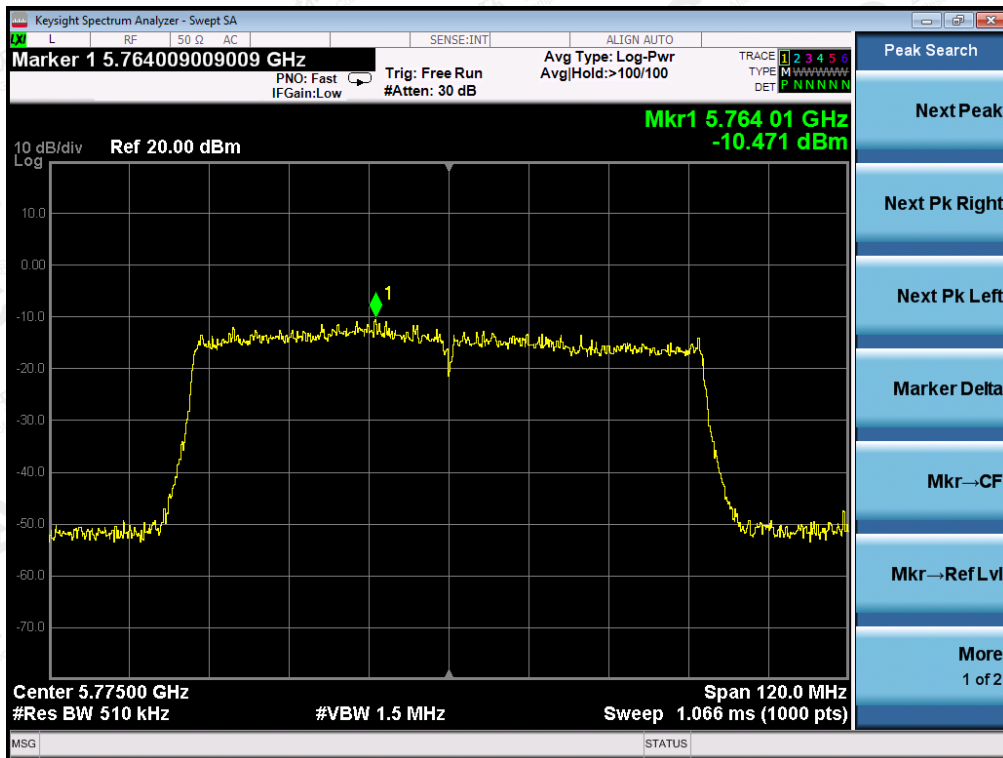
802.11ac80 TEST RESULT-ant0:

TEST PLOT FOR 5775MHz



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802.11ac80 TEST RESULT-ant1:
TEST PLOT FOR 5775MHz



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10. CONDUCTED SPURIOUS EMISSION AND BAND EDGE EMISSION

10.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to KDB 789033 for compliance to FCC 47CFR 15.407 requirements.

10.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2.

10.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6.

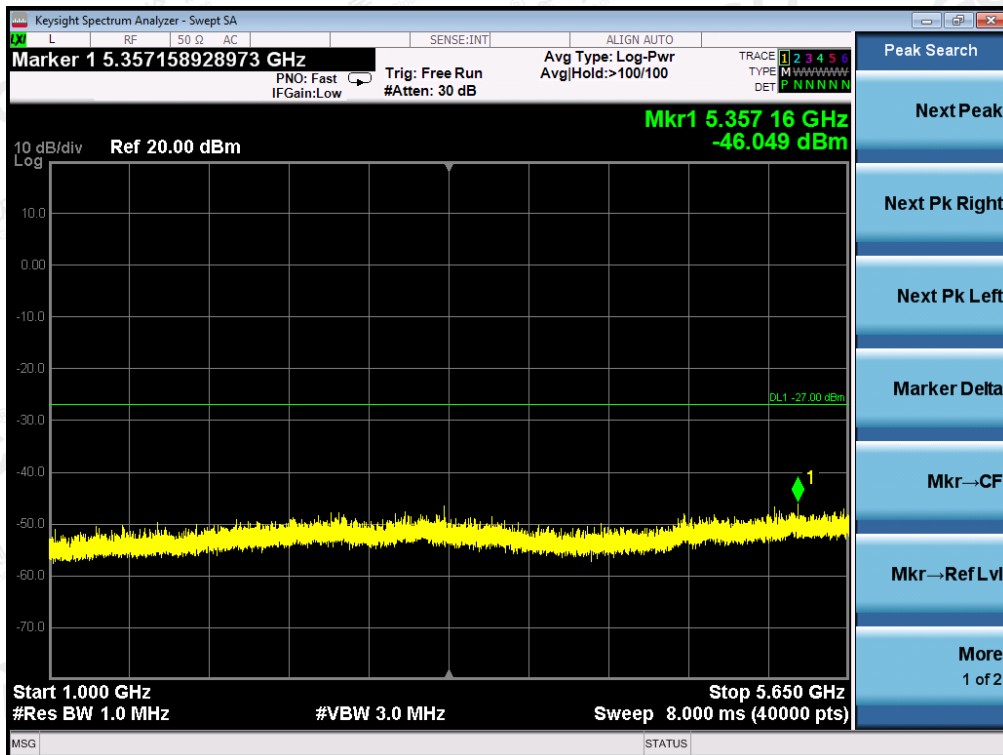
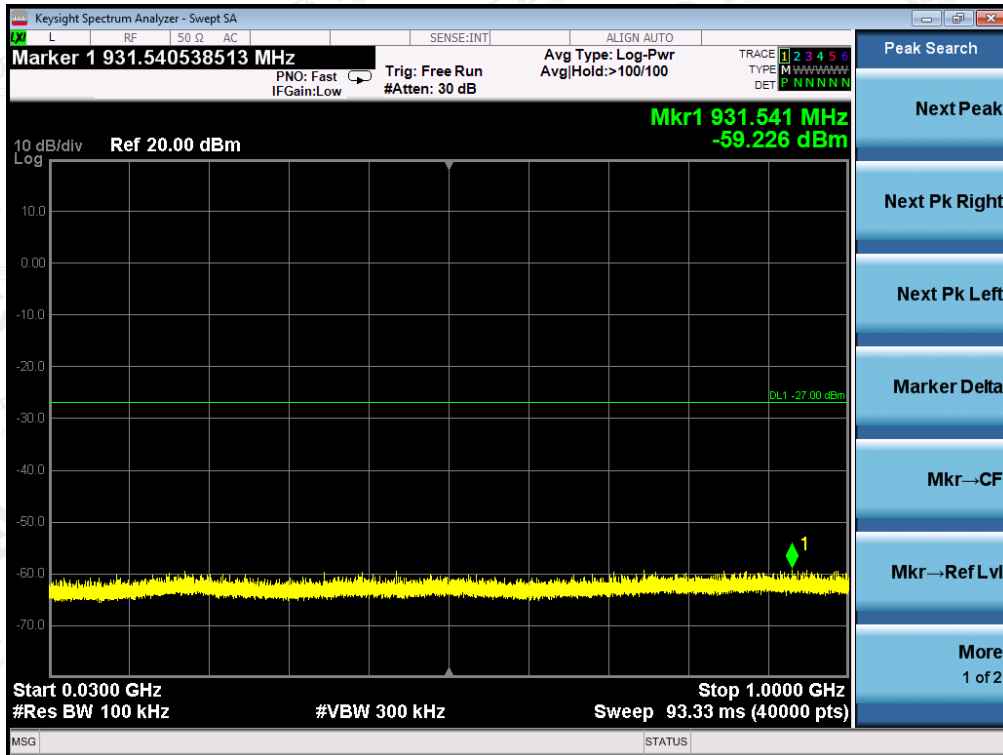
10.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT		
Applicable Limits	Measurement Result	
	Test channel	Criteria
All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.	5725MHz-5850MHz	PASS

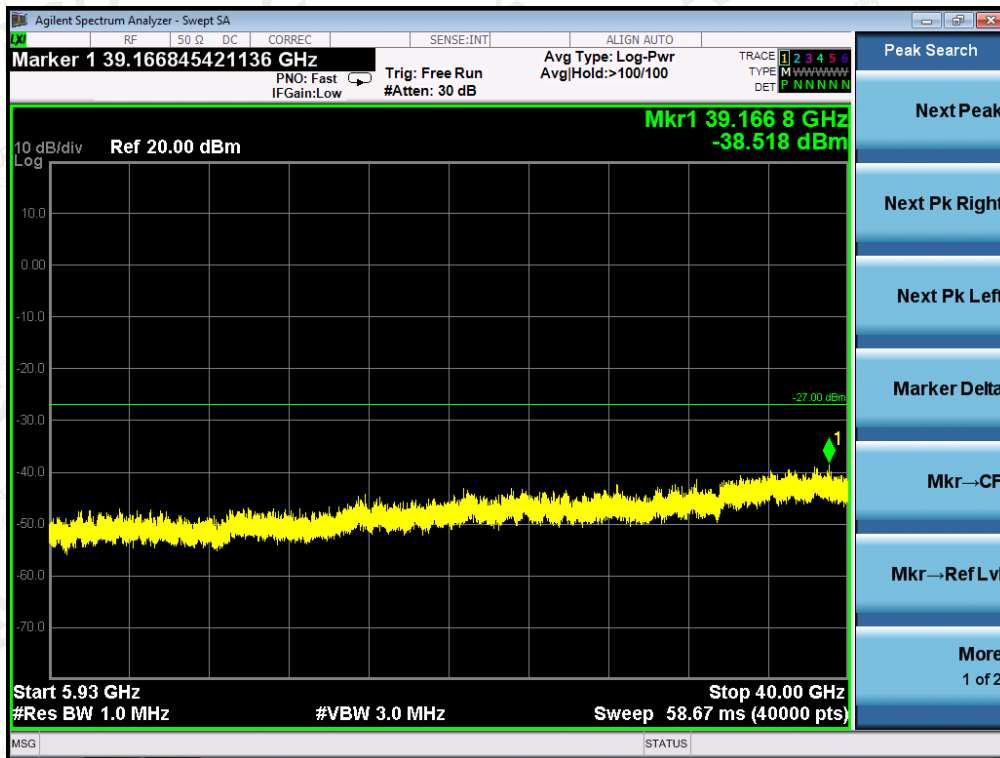
Note:

Two transmit chains had been tested, the chain 0 was the worst case and record in the test report. The spurious emission at chain 0 is more than 3dB below the limits, so the MIMO results for the spurious emissions are comply with the requirement.

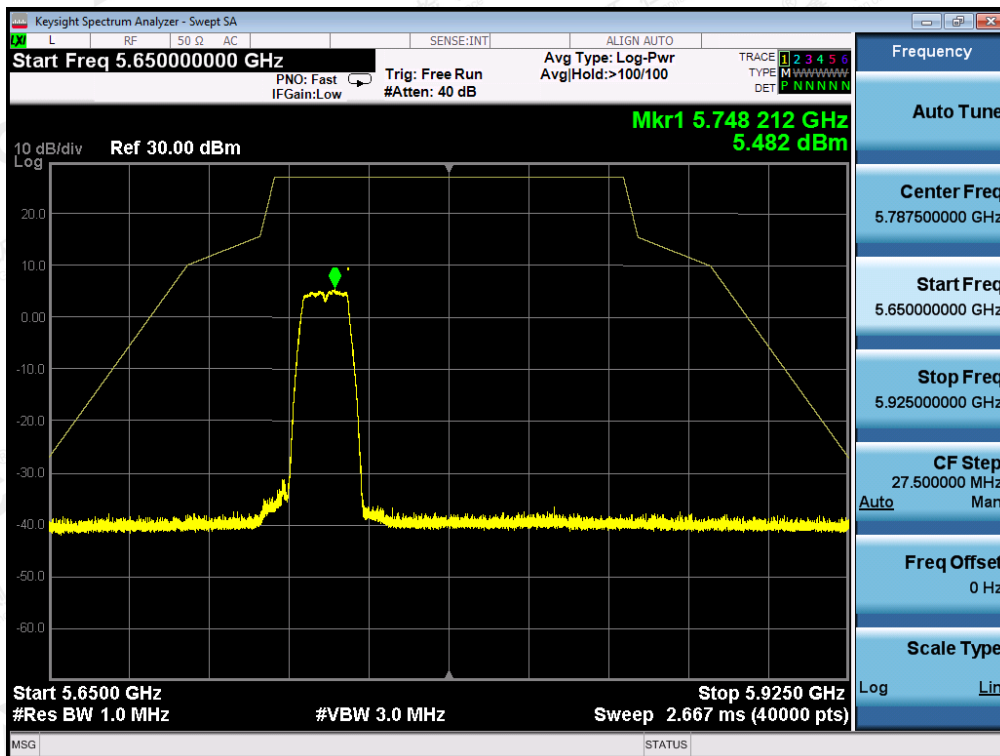
FOR 802.11A20 MODULATION,ant0
TEST PLOT OF OUT OF BAND EMISSIONS FOR MODULATION IN 5745MHZ



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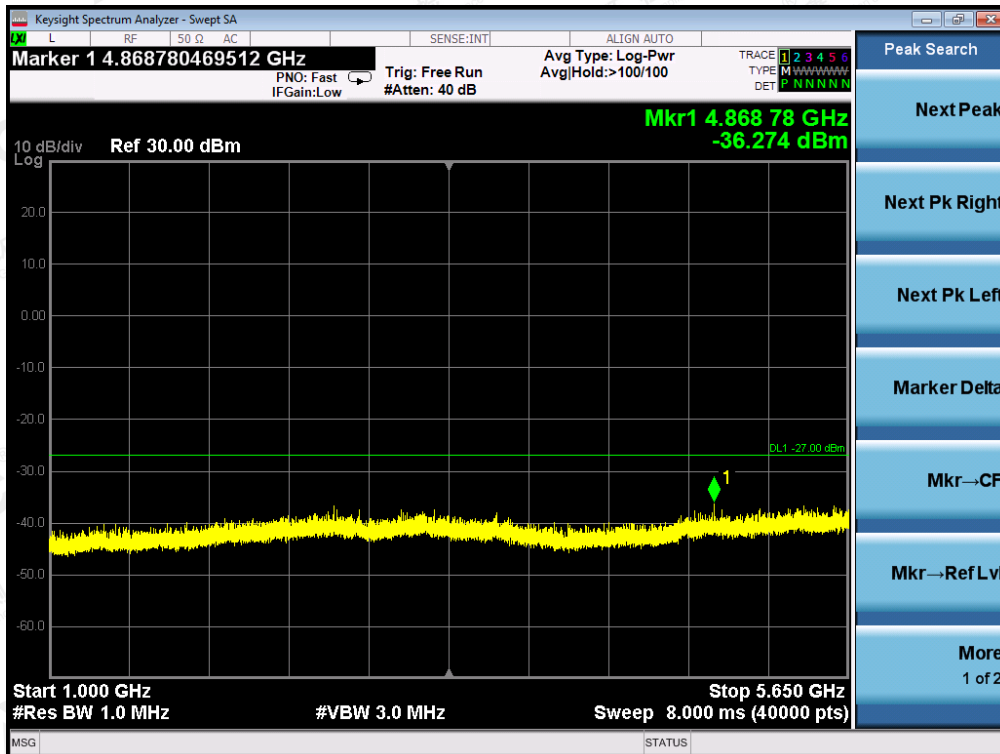
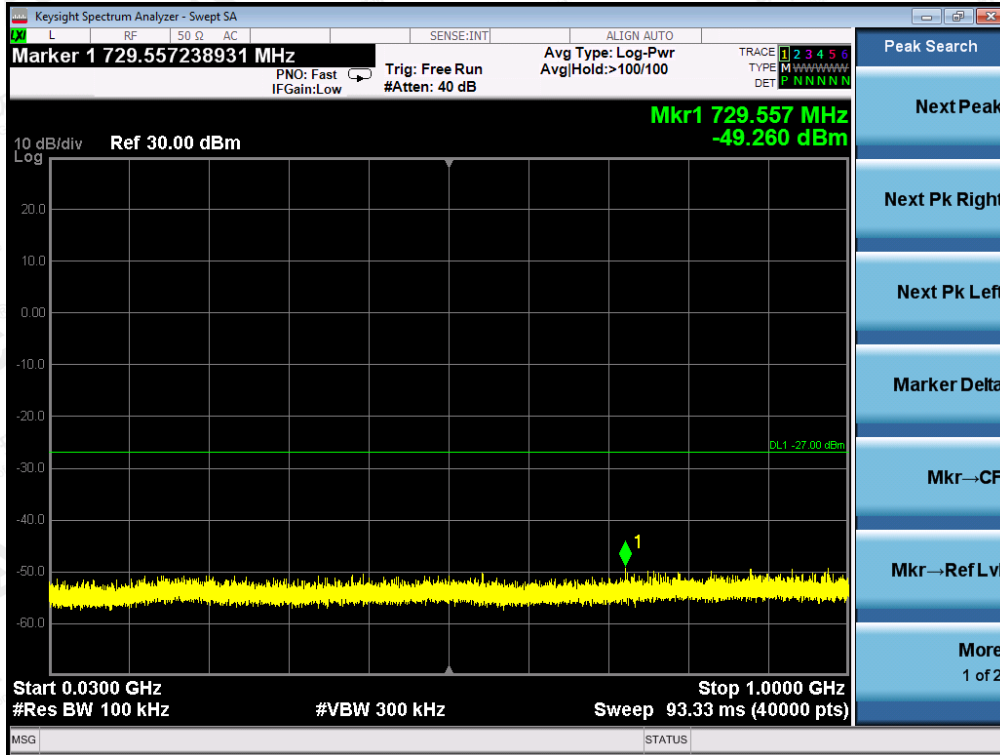


TEST PLOT OF BAND EDGE EMISSION

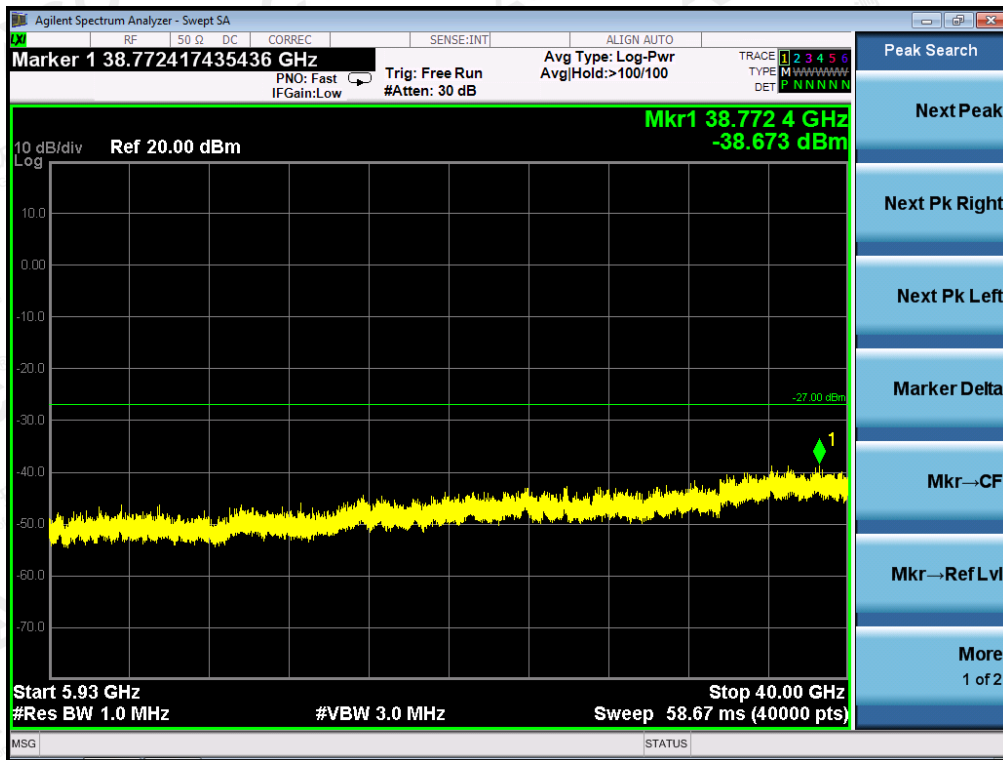


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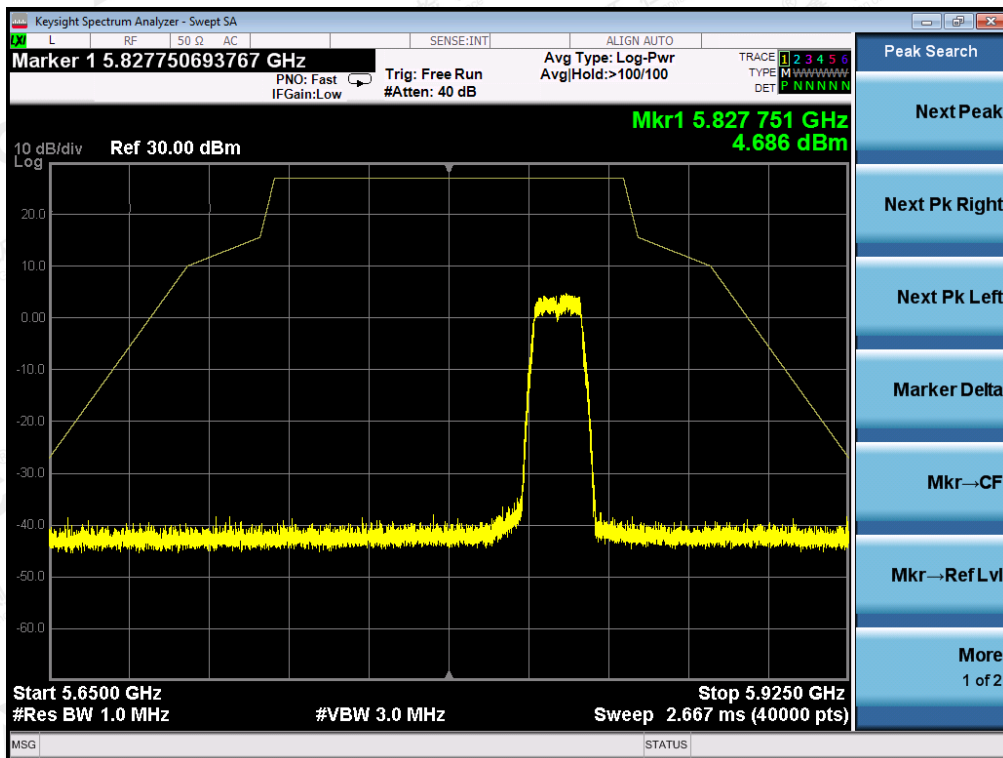
TEST PLOT OF OUT OF BAND EMISSIONS FOR MODULATION IN 5825MHz



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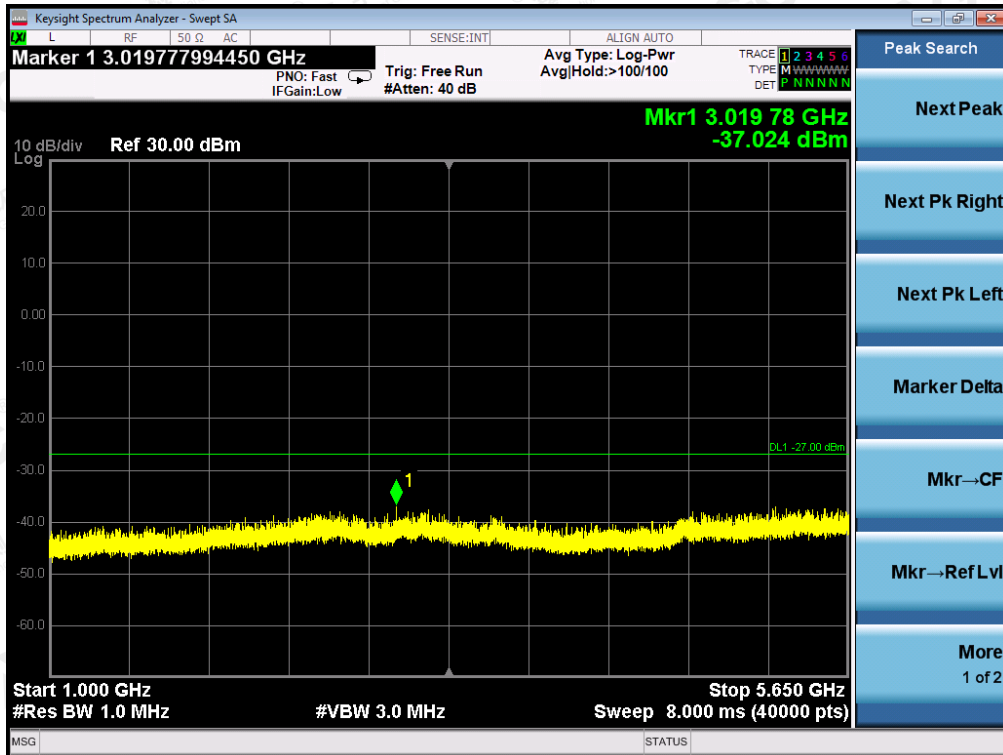
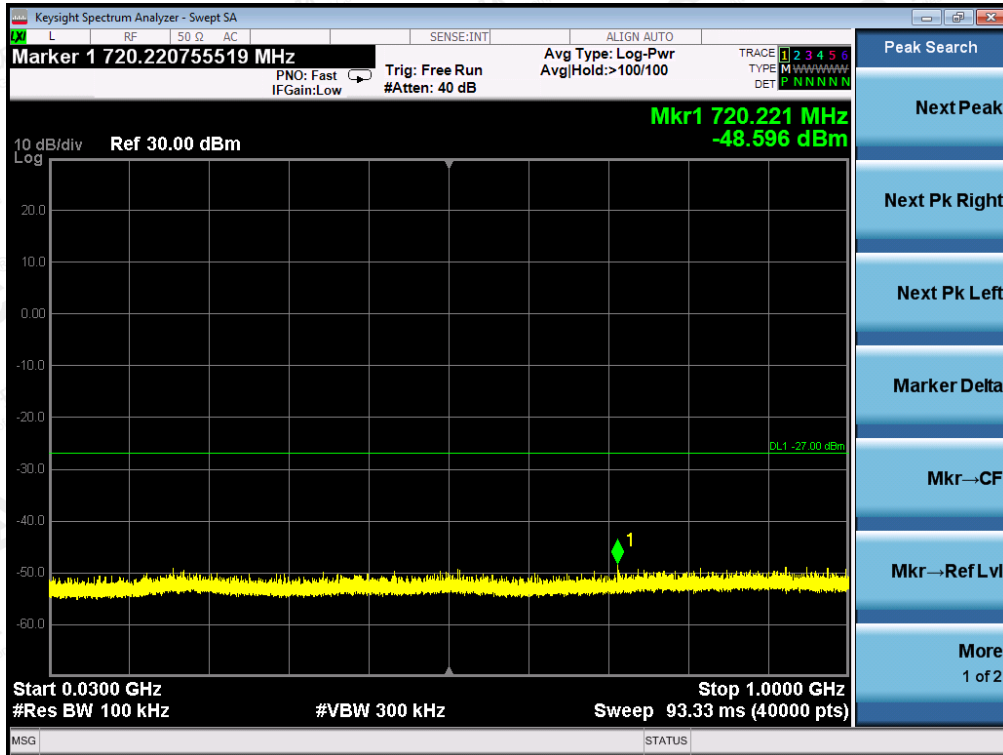
TEST PLOT OF BAND EDGE EMISSION



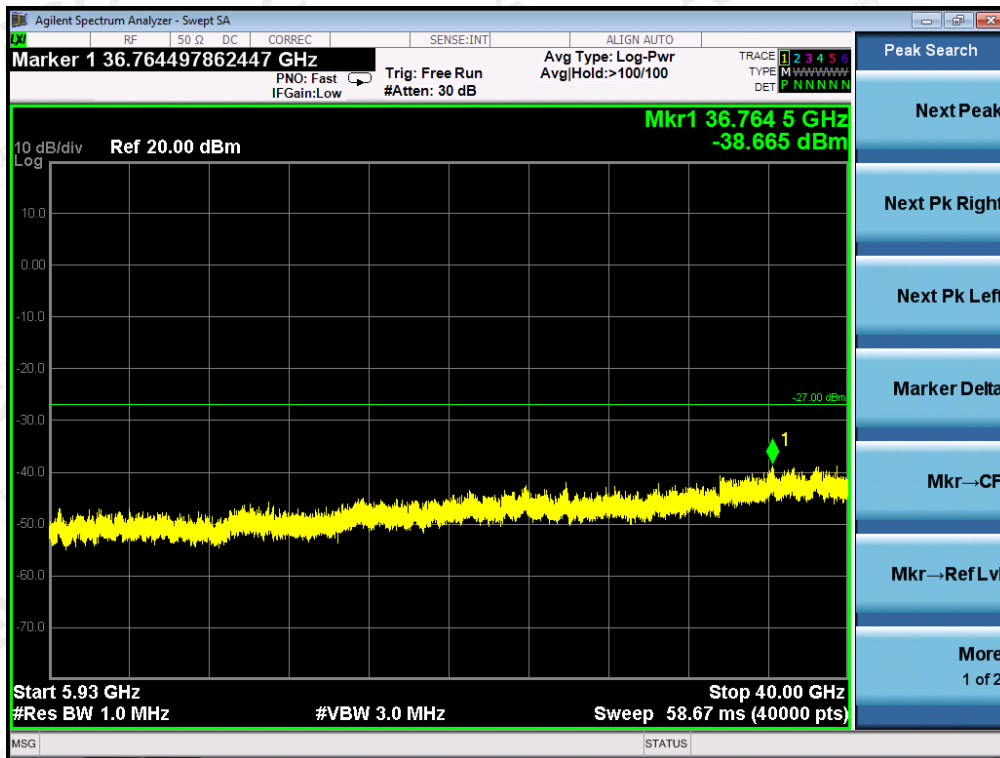
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FOR 802.11N40 MODULATION, ant0

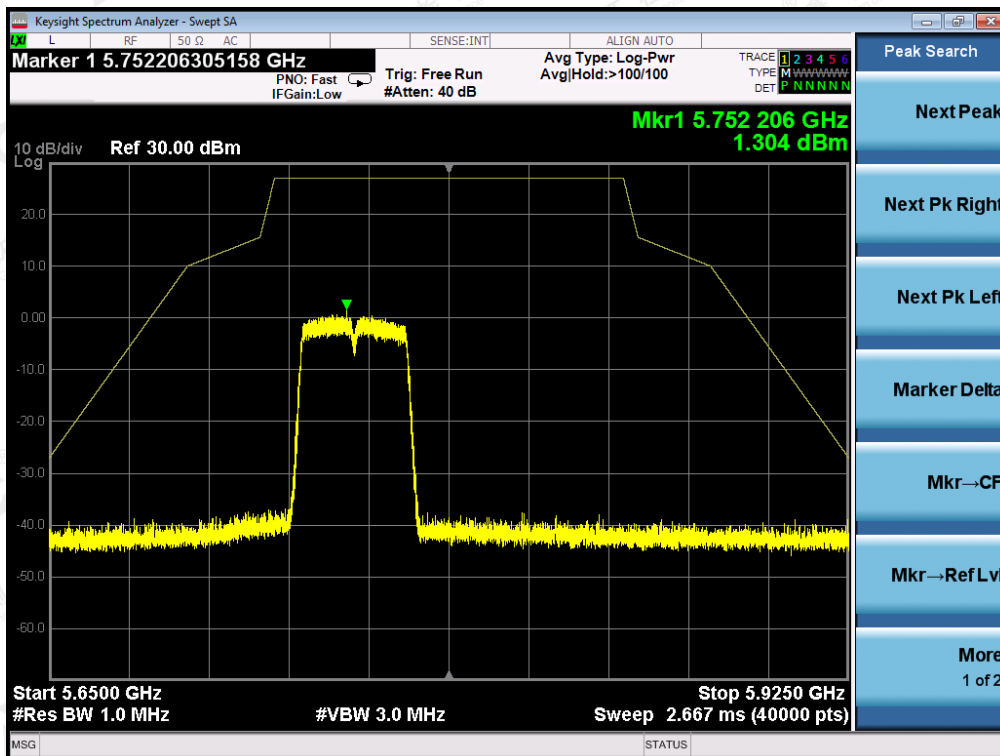
TEST PLOT OF OUT OF BAND EMISSIONS FOR MODULATION IN 5755MHZ



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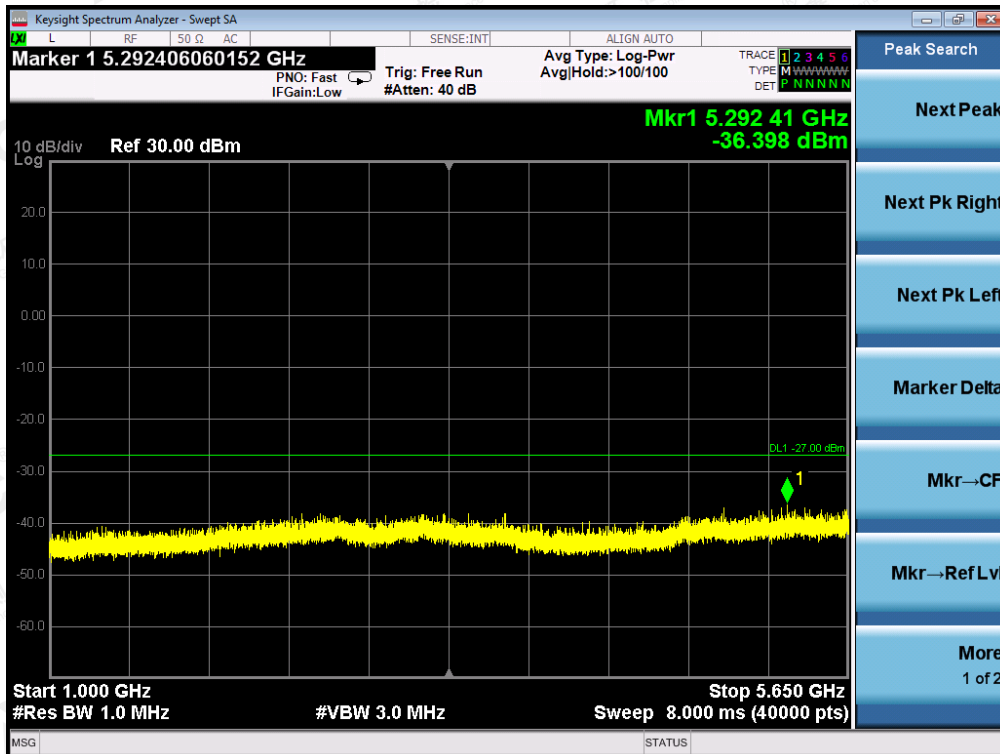
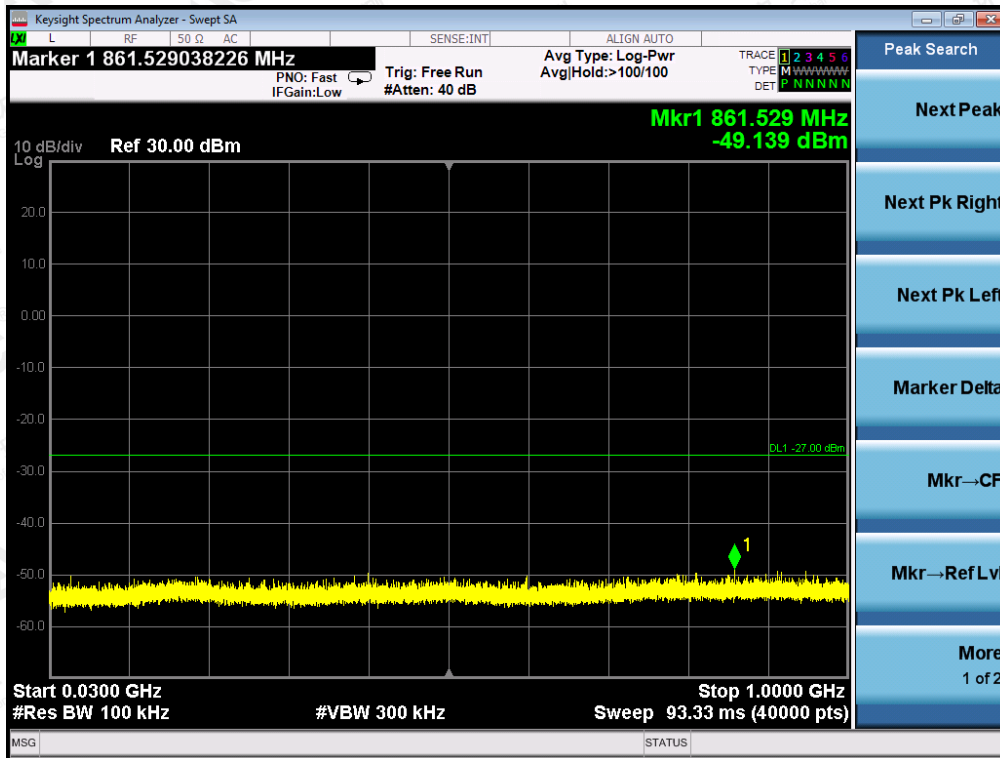


TEST PLOT OF BAND EDGE EMISSION

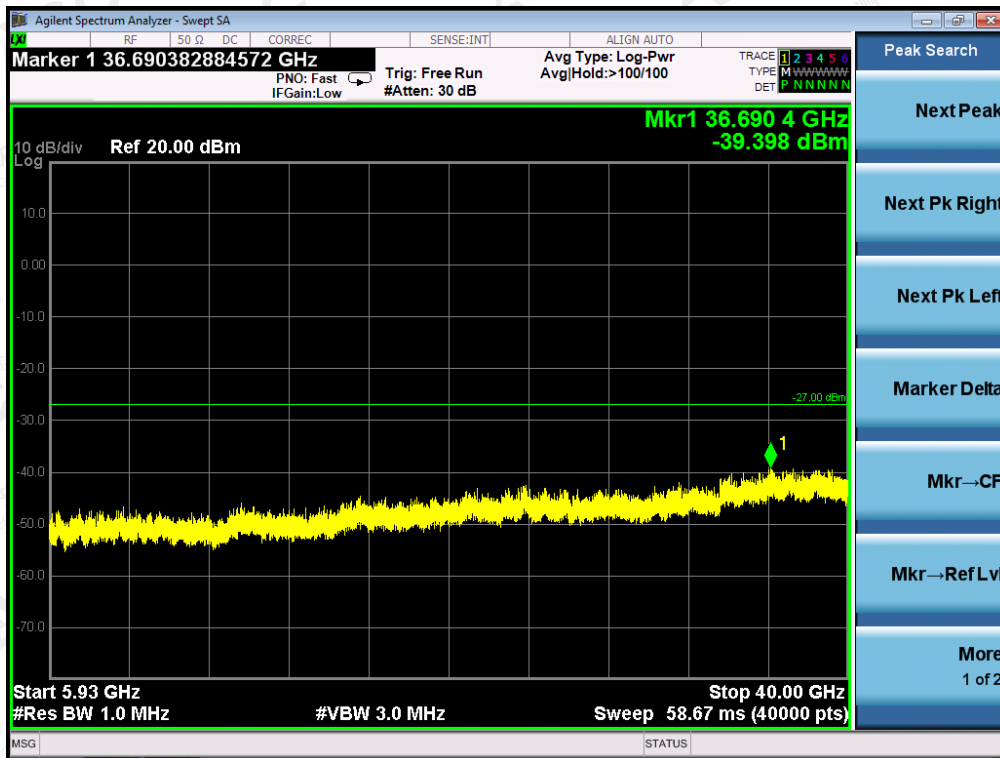


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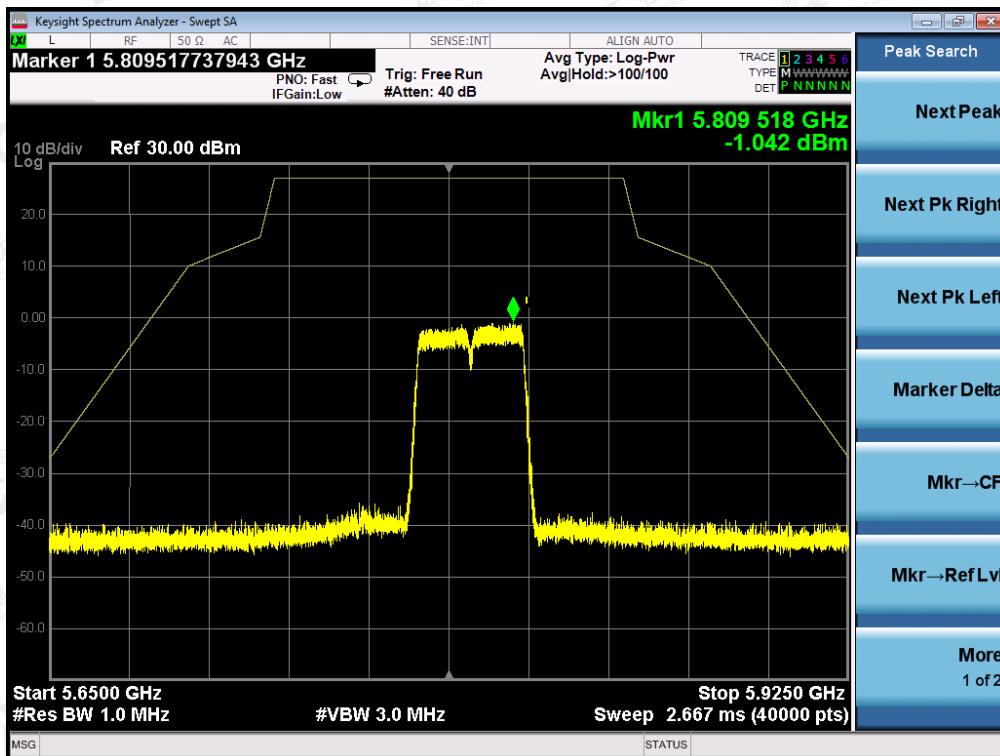
TEST PLOT OF OUT OF BAND EMISSIONS FOR MODULATION IN 5795MHZ



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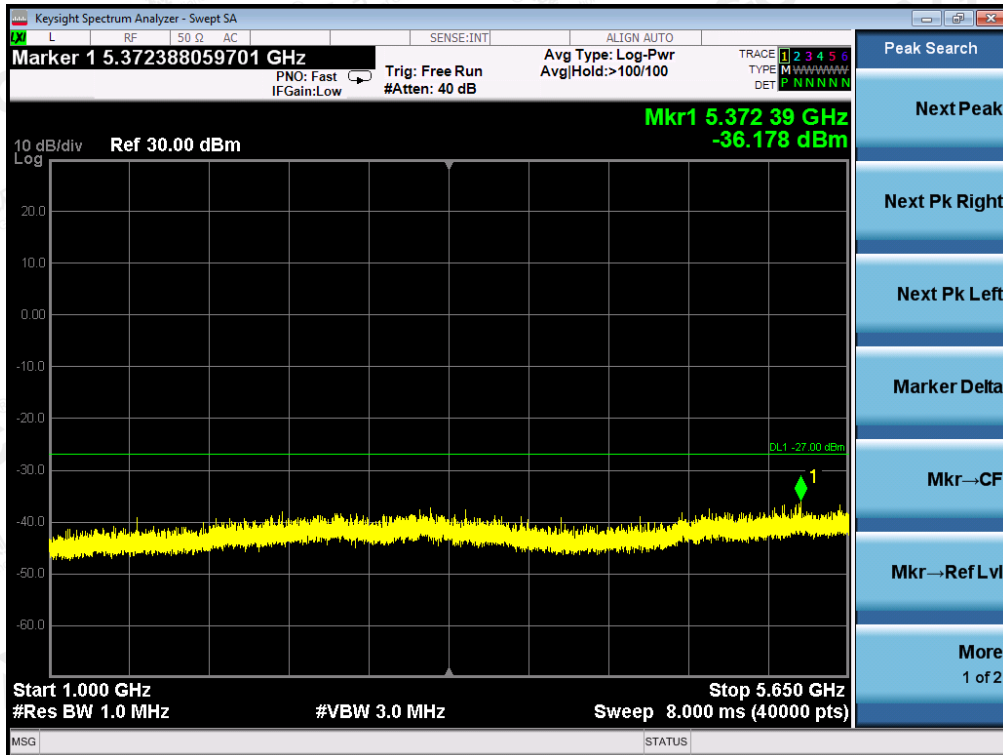
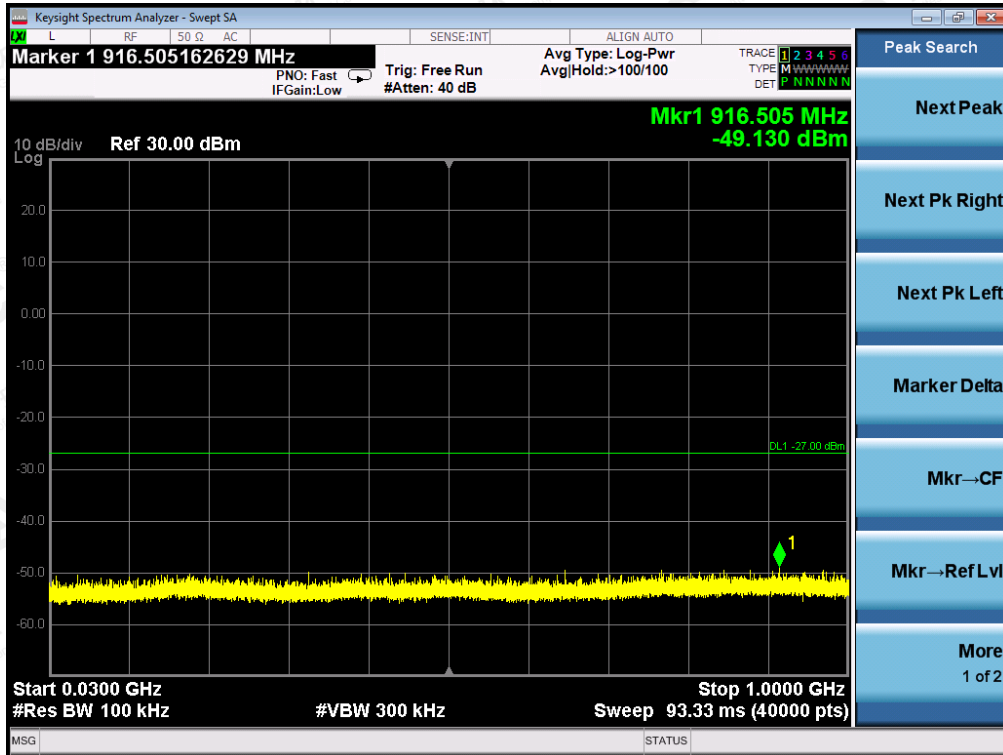
TEST PLOT OF BAND EDGE EMISSION



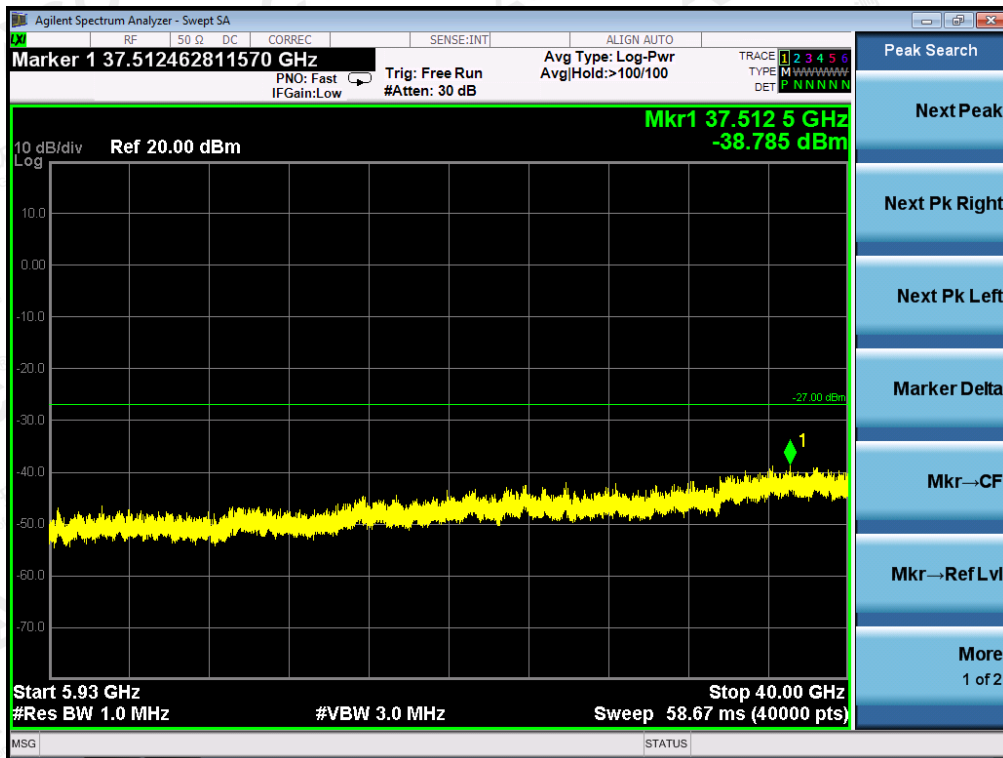
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FOR 802.11AC80 MODULATION, ant0

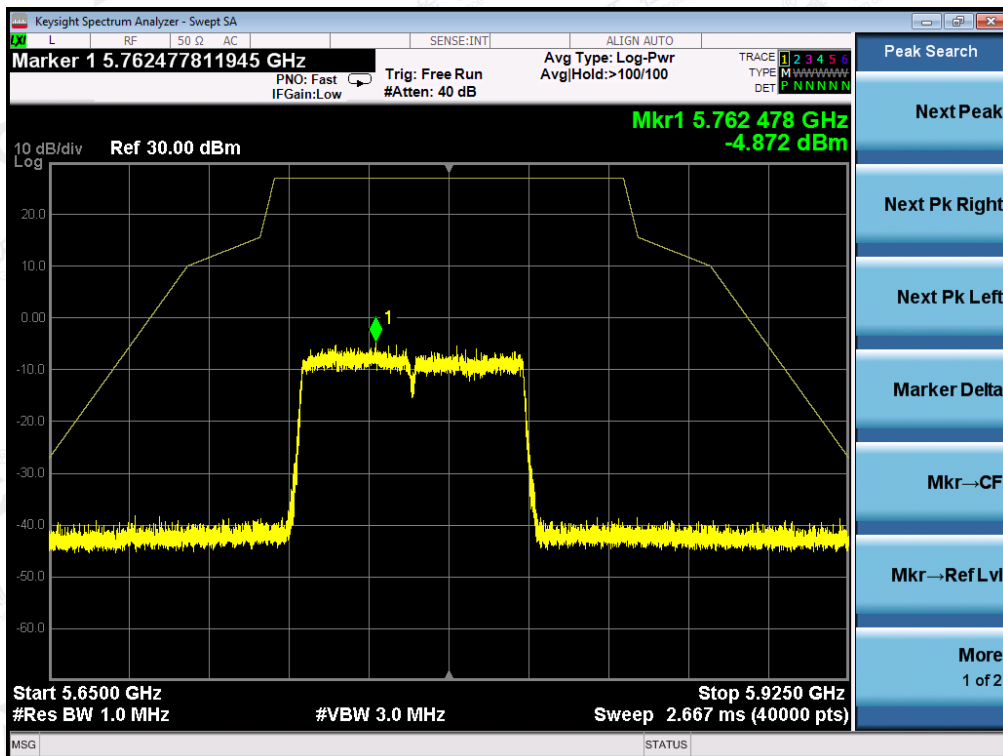
TEST PLOT OF OUT OF BAND EMISSIONS FOR MODULATION IN 5775MHZ



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TEST PLOT OF BAND EDGE EMISSION



Note: All the 20MHz, 40MHz and 80MHz bandwidth modulation had been tested, the 802.11a20/n40/ac80 ant0 was the worst case and record in his test report.

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11. RADIATED EMISSION

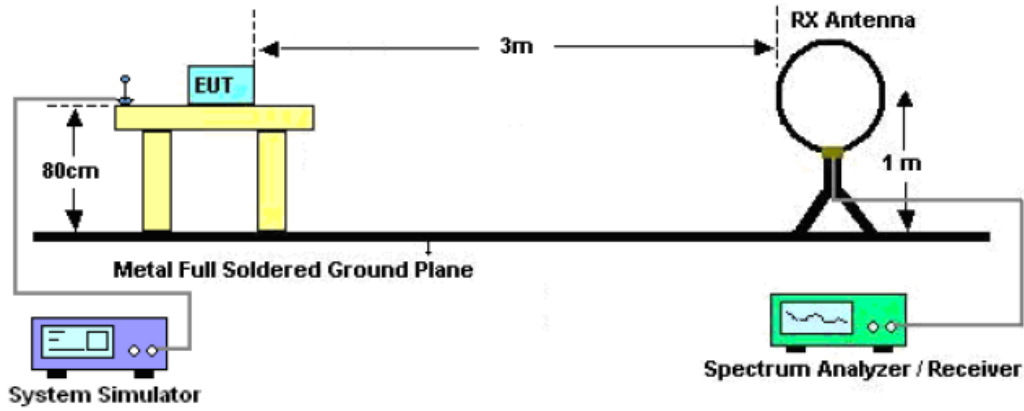
11.1. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3M VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

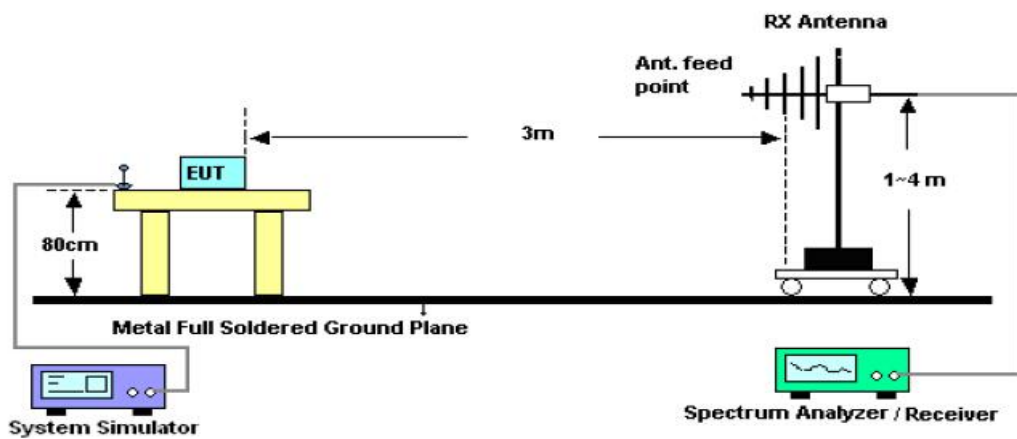
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11.2. TEST SETUP

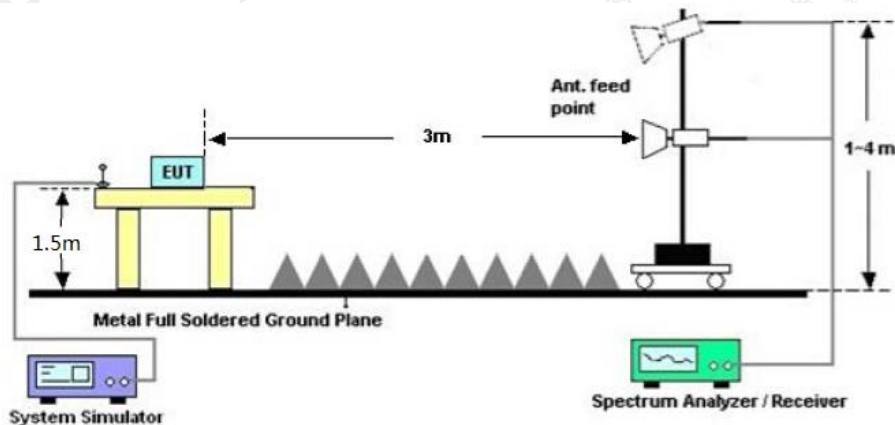
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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11.3. LIMITS AND MEASUREMENT RESULT

15.209(a) Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested For restricted band radiated emission, the test records reported below are the worst result compared to other modes.

11.4. TEST RESULT

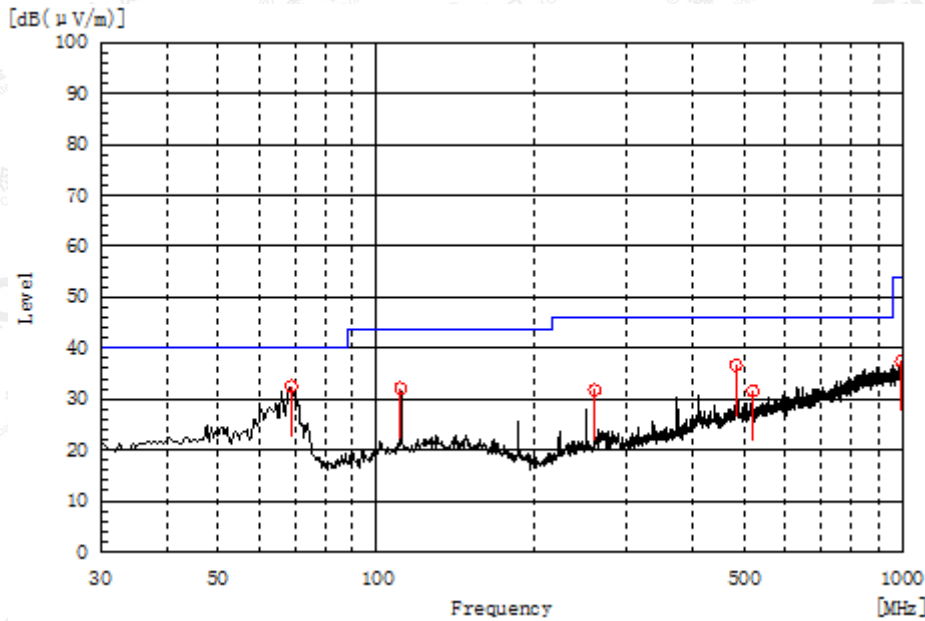
RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.

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RADIATED EMISSION BELOW 1GHZ

EUT	MDVR	Model Name	NVR-2400
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n20 5745MHz,MIMO	Antenna	Horizontal

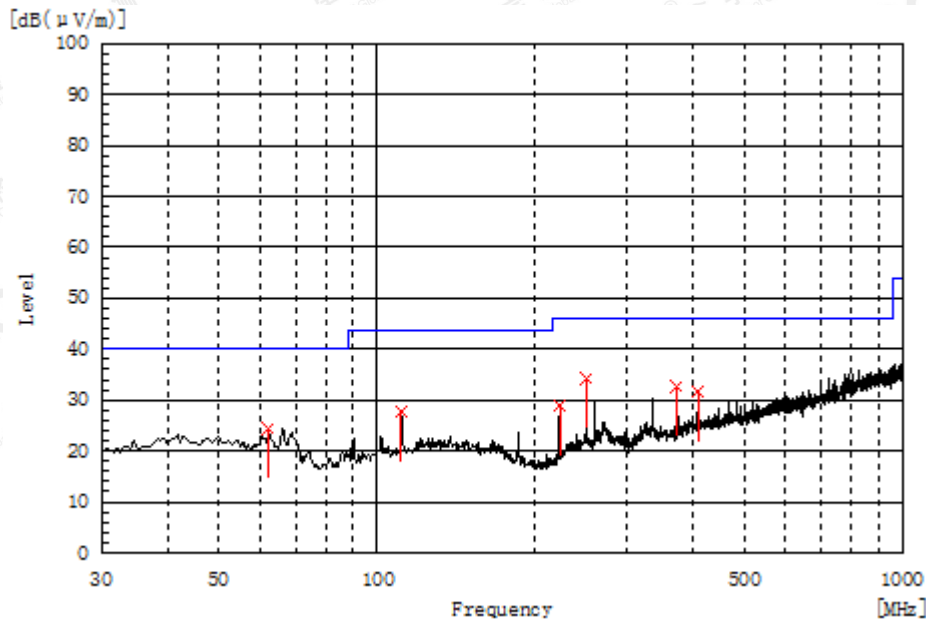


Frequency MHz	Polarization	Reading dB(uV)	Factor dB (1/m)	Level dB(uV/m) PK	Limit dB(uV/m) QP	Margin dB	Pass/Fail	Height cm	Angle deg
68.800	H	17.7	14.8	32.5	40.0	7.5	Pass	100.0	289.2
110.995	H	17.5	14.6	32.1	43.5	11.4	Pass	200.0	139.7
259.890	H	15.9	15.9	31.8	46.0	14.2	Pass	150.0	288.2
482.505	H	14.0	22.6	36.6	46.0	9.4	Pass	200.0	104.7
519.850	H	8.4	23.2	31.6	46.0	14.4	Pass	200.0	33.3
997.090	H	6.4	31.1	37.5	54.0	16.5	Pass	150.0	71.9

RESULT: PASS

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EUT	MDVR	Model Name	NVR-2400
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n20 5745MHz,MIMO	Antenna	Vertical



Frequency MHz	Polarization	Reading dB(uV)	Factor dB (1/m)	Level dB(uV/m) PK	Limit dB(uV/m) QP	Margin dB	Pass/Fail	Height cm	Angle deg
62.010	V	8.5	16.0	24.5	40.0	15.5	Pass	100.0	252.6
110.995	V	13.2	14.6	27.8	43.5	15.7	Pass	150.0	178.3
222.545	V	14.1	15.0	29.1	46.0	16.9	Pass	200.0	237.5
250.190	V	18.3	16.1	34.4	46.0	11.6	Pass	150.0	358.3
371.440	V	13.1	19.7	32.8	46.0	13.2	Pass	150.0	71.9
408.300	V	10.6	21.1	31.7	46.0	14.3	Pass	200.0	93.4

RESULT: PASS

Note: All test channels had been tested. The 802.11n20 at 5745MHz is the worst case and recorded in the test report.

Factor = Antenna Factor + Cable loss - Amplifier gain, Margin= Limit-Level.

The "Factor" value can be calculated automatically by software of measurement system.

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RADIATED EMISSION ABOVE 1GHZ

EUT	MDVR	Model Name	NVR-2400
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n20 5745MHz,MIMO	Antenna	Horizontal/Vertical

RADIATED EMISSION ABOVE 1GHZ–Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
11490.120	42.72	9.42	52.14	74	-22.18	peak
11490.120	36.84	9.42	46.26	54	-7.9	AVG
17235.180	39.72	10.51	50.23	74	-24.65	peak
17235.180	34.54	10.51	45.05	54	-9.36	AVG

Remark:
 Factor = Antenna Factor + Cable Loss – Pre-amplifier.

RADIATED EMISSION ABOVE 1GHZ–Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
11490.120	41.77	9.42	51.19	74	-22.88	peak
11490.120	35.45	9.42	44.87	54	-9.09	AVG
17235.180	38.51	10.51	49.02	74	-24.93	peak
17235.180	33.83	10.51	44.34	54	-9.64	AVG

Remark:
 Factor = Antenna Factor + Cable Loss – Pre-amplifier.

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EUT	MDVR	Model Name	NVR-2400
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n20 5785MHz,MIMO	Antenna	Horizontal/Vertical

RADIATED EMISSION ABOVE 1GHZ–Horizontal

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Value Type
17570.120	42.75	9.42	52.17	74	-21.75	peak
17570.120	37.18	9.42	46.6	54	-7.47	AVG
26355.180	39.22	10.51	49.73	74	-24.22	peak
26355.180	34.51	10.51	45.02	54	-8.93	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

RADIATED EMISSION ABOVE 1GHZ–Vertical

Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Value Type
17570.120	42.21	9.42	51.63	74	-22.45	peak
17570.120	35.84	9.42	45.26	54	-8.66	AVG
26355.180	38.91	10.51	49.42	74	-24.5	peak
26355.180	34.22	10.51	44.73	54	-9.21	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

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EUT	MDVR	Model Name	NVR-2400
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n20 5825MHz,MIMO	Antenna	Horizontal/Vertical

RADIATED EMISSION ABOVE 1GHZ–Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
11650.120	40.81	9.62	50.43	74	-24.03	peak
11650.120	35.34	9.62	44.96	54	-9.37	AVG
17475.180	38.74	10.75	49.49	74	-24.36	peak
17475.180	34.52	10.75	45.27	54	-9.13	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

RADIATED EMISSION ABOVE 1GHZ–Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
11650.120	40.34	9.62	49.96	74	-24.11	peak
11650.120	34.67	9.62	44.29	54	-9.63	AVG
17475.180	38.42	10.75	49.17	74	-25.24	peak
17475.180	33.39	10.75	44.14	54	-9.71	AVG

Remark:

Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Note: All the case had been tested. The 802.11n modulation is the worst case and recorded in the test report. Other frequencies radiation emission from 1GHz to 40GHz at least have 20dB margin and not recorded in the test report.

Factor = Antenna Factor + Cable loss - Amplifier gain, Margin= Limit-Level.

The “Factor” value can be calculated automatically by software of measurement system.

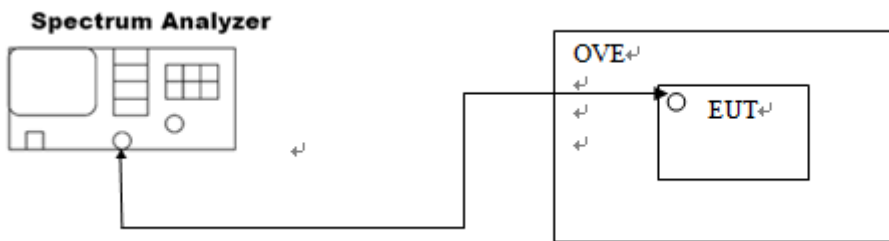
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12. FREQUENCY STABILITY

12.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the operation frequency.
3. Set SPA Centre Frequency = Operation Frequency. SPAN=enough to measure the emission is maintained within the band
4. Set SPA Trace 1 Max hold, then View.
5. Extreme temperature rule is -20°C~60°C.

12.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



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12.3. MEASUREMENT RESULTS

Test Mode	Temperature	Measurement Frequency (MHz)	Result	Conclusion
802.11a	- 10°C	5745	within the band	PASS
	0°C	5745	within the band	PASS
	10°C	5745	within the band	PASS
	20°C	5745	within the band	PASS
	30°C	5745	within the band	PASS
	40°C	5745	within the band	PASS
	50°C	5745	within the band	PASS
	- 10°C	5785	within the band	PASS
	0°C	5785	within the band	PASS
	10°C	5785	within the band	PASS
	20°C	5785	within the band	PASS
	30°C	5785	within the band	PASS
	40°C	5785	within the band	PASS
	50°C	5785	within the band	PASS
	- 10°C	5825	within the band	PASS
	0°C	5825	within the band	PASS
	10°C	5825	within the band	PASS
	20°C	5825	within the band	PASS
	30°C	5825	within the band	PASS
	40°C	5825	within the band	PASS
50°C	5825	within the band	PASS	

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Test Mode	Temperature	Measurement Frequency (MHz)	Result	Conclusion
802.11n20	- 10°C	5745	within the band	PASS
	0°C	5745	within the band	PASS
	10°C	5745	within the band	PASS
	20°C	5745	within the band	PASS
	30°C	5745	within the band	PASS
	40°C	5745	within the band	PASS
	50°C	5745	within the band	PASS
	- 10°C	5785	within the band	PASS
	0°C	5785	within the band	PASS
	10°C	5785	within the band	PASS
	20°C	5785	within the band	PASS
	30°C	5785	within the band	PASS
	40°C	5785	within the band	PASS
	50°C	5785	within the band	PASS
	- 10°C	5825	within the band	PASS
	0°C	5825	within the band	PASS
	10°C	5825	within the band	PASS
	20°C	5825	within the band	PASS
	30°C	5825	within the band	PASS
40°C	5825	within the band	PASS	
50°C	5825	within the band	PASS	

Test Mode	Temperature	Measurement Frequency (MHz)	Result	Conclusion
802.11n40	- 10°C	5755	within the band	PASS
	0°C	5755	within the band	PASS
	10°C	5755	within the band	PASS
	20°C	5755	within the band	PASS
	30°C	5755	within the band	PASS
	40°C	5755	within the band	PASS
	50°C	5755	within the band	PASS
	- 10°C	5795	within the band	PASS
	0°C	5795	within the band	PASS
	10°C	5795	within the band	PASS
	20°C	5795	within the band	PASS
	30°C	5795	within the band	PASS
	40°C	5795	within the band	PASS
	50°C	5795	within the band	PASS

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Test Mode	Temperature	Measurement Frequency (MHz)	Result	Conclusion
802.11ac20	- 10°C	5745	within the band	PASS
	0°C	5745	within the band	PASS
	10°C	5745	within the band	PASS
	20°C	5745	within the band	PASS
	30°C	5745	within the band	PASS
	40°C	5745	within the band	PASS
	50°C	5745	within the band	PASS
	- 10°C	5785	within the band	PASS
	0°C	5785	within the band	PASS
	10°C	5785	within the band	PASS
	20°C	5785	within the band	PASS
	30°C	5785	within the band	PASS
	40°C	5785	within the band	PASS
	50°C	5785	within the band	PASS
	- 10°C	5825	within the band	PASS
	0°C	5825	within the band	PASS
	10°C	5825	within the band	PASS
	20°C	5825	within the band	PASS
	30°C	5825	within the band	PASS
40°C	5825	within the band	PASS	
50°C	5825	within the band	PASS	

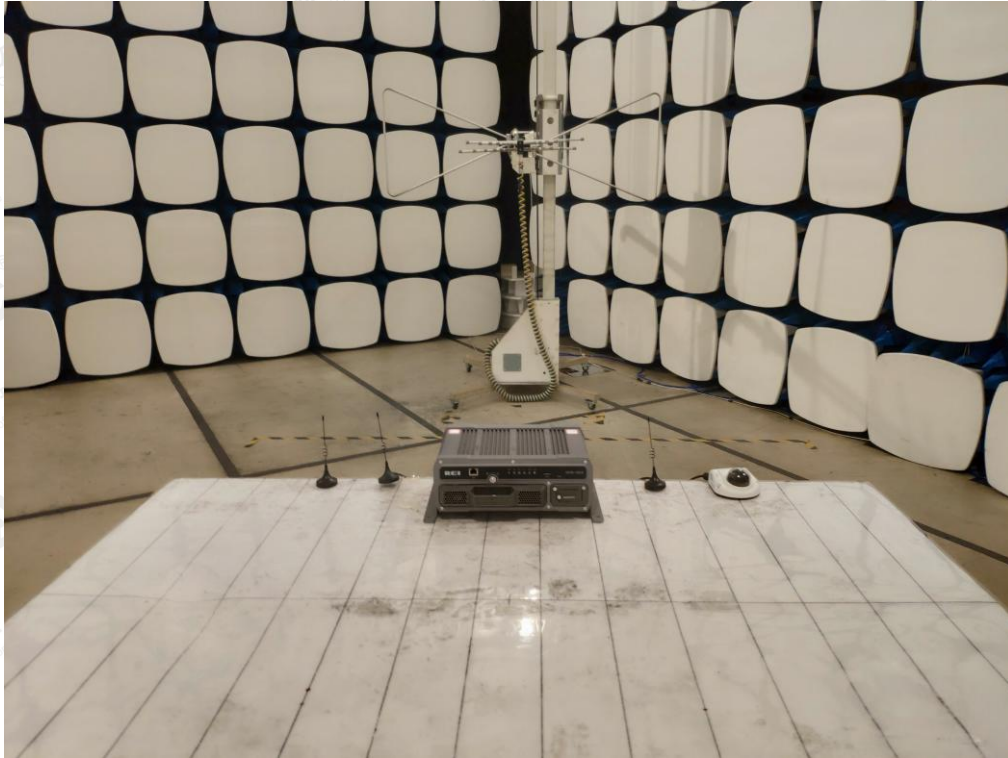
Test Mode	Temperature	Measurement Frequency (MHz)	Result	Conclusion
802.11ac40	- 10°C	5755	within the band	PASS
	0°C	5755	within the band	PASS
	10°C	5755	within the band	PASS
	20°C	5755	within the band	PASS
	30°C	5755	within the band	PASS
	40°C	5755	within the band	PASS
	50°C	5755	within the band	PASS
	- 10°C	5795	within the band	PASS
	0°C	5795	within the band	PASS
	10°C	5795	within the band	PASS
	20°C	5795	within the band	PASS
	30°C	5795	within the band	PASS
	40°C	5795	within the band	PASS
	50°C	5795	within the band	PASS

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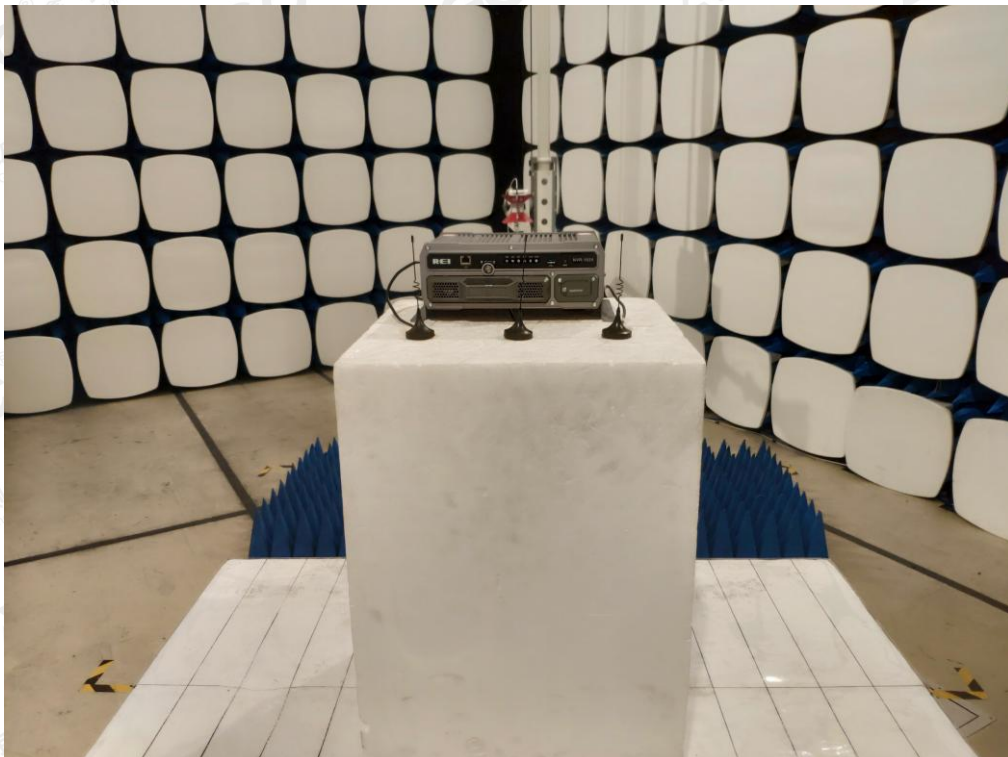
Test Mode	Temperature	Measurement Frequency (MHz)	Result	Conclusion
802.11ac80	- 10°C	5775	within the band	PASS
	0°C	5775	within the band	PASS
	10°C	5775	within the band	PASS
	20°C	5775	within the band	PASS
	30°C	5775	within the band	PASS
	40°C	5775	within the band	PASS
	50°C	5775	within the band	PASS

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APPENDIX A: PHOTOGRAPHS OF TEST SETUP
FCC RADIATED EMISSION TEST SETUP BELOW 1GHZ



FCC RADIATED EMISSION TEST SETUP ABOVE 1GHZ



----END OF REPORT----

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