FCC Test Report

Report No.: AGC07248170702FE03

FCC ID	:	TV7CPGI5ACD2ND
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	RouterBOARD cAP Gi-5acD2nD
BRAND NAME	:	RouterBOARD
MODEL NAME	:	cAP ac
CLIENT	:	Mikrotikls SIA
DATE OF ISSUE	:	Jul, 02, 2017
STANDARD(S) **TEST PROCEDURE(S)**	:	FCC Part 15.407 KDB 789033 D02 KDB 644545 D03 Guidance for IEEE 802.11ac v01 KDB 662911 D01 Multiple Transmitter Output v02r01
REPORT VERSION	:	V1.0

*A*ttestation of *G*lobal *C*ompliance (Shenzhen) Co., Ltd

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jul, 02, 2017	Valid	Original Report

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1. VERIFICATION OF CONFORMITY

Applicant	Mikrotikls SIA
Address	Pernavas 46 Riga Latvia LV-1009
Manufacturer	Mikrotikls SIA
Address	Pernavas 46 Riga Latvia LV-1009
Product Designation	RouterBOARD cAP Gi-5acD2nD
Brand Name	RouterBOARD
Test Model	cAP ac
Date of test	Jun, 28, 2017 to Jul, 02, 2017
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	SNOW . Feng	
	Snow. Feng(Feng. Nianwei)	Jul, 02, 2017
Reviewed by	Bart Xie	
	Bart Xie(Xie Xiaobin))	Jul, 02, 2017
Approved by	Solger Zhang	
	Solger Zhang(Zhang Hongyi) Authorized Officer	Jul, 02, 2017

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as “Master”. 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	5.150 GHz～5.250GHz
Output Power	IEEE 802.11a20:**14.25**dBm IEEE 802.11n20:**16.15**dBm IEEE 802.11n(40):**15.16**dBm IEEE 802.11ac20:**15.81**dBm IEEE 802.11ac40:**14.05**dBm IEEE 802.11ac80:**14.02**dBm
Modulation	BPSK, QPSK, 16QAM, 64QAM, 128QAM, 256QAM,OFDM
Number of channels	13
Hardware Version	r3
Software Version	6.38.5
Antenna Designation	Internal Antenna
Number of transmit chain	2（802.11a20/n20/n40/ac20/ac40/ac80 used ant0+ant1，but only 802.11n20/n40/ac20/ac40/ac80 support mimo）
Antenna Gain	2.5dBi
Power Supply	DC 24V

2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
5.150 GHz～5.250GHz	36	5180 MHz
	38	5190 MHz
	40	5200 MHz
	44	5220 MHz
	46	5230 MHz
	48	5240 MHz
	42	5210 MHz

Note: For 20MHZ bandwidth system use Channel 36,40,44,48; For 40MHZ bandwidth system use Channel 38,46; For 80MHZ bandwidth system use Channel 42;

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

This submittal(s) (test report) is intended for **FCC ID:TV7CPGI5ACD2ND** filing to comply with the FCC Part 15 requirements.

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.

3. MEASUREMENT UNCERTAINTY

Conducted measurement: +/- 3.18dB
Radiated measurement: +/- 3.91dB

4. DESCRIPTION OF TEST MODES

Mode	Available channel	Tested channel	Modulation	Date rate(Mbps)
802.11a/n20/ac20	36,40,44,48	36, 40, 48	OFDM	6/6.5
802.11n40/ac40	38,46	38,46	OFDM	13.5
802.11ac80	42	42,	OFDM	27

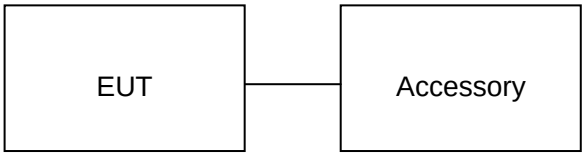
Note:

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.

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	RouterBOARD	cAP ac	TV7CPGI5ACD2ND	EUT
2	PC	SONY	E1412AYCW	Support
3	Adapter	MLF-A00122400380U0141	Input: AC 100-240V, 50/60Hz	Support
4	PC adapter	SONY	A13-040A3A	Support

5.3. SUMMARY OF TEST RESULTS

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

6. TEST FACILITY

Site	Dongguan Precise Testing Service Co., Ltd.
Location	Building D, Baoding Technology Park,Guangming Road2, Dongcheng District, Dongguan, Guangdong, China.
FCC Registration No.	371540
Description	The test site is constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2014.

ALL TEST EQUIPMENT LIST

Radiated Emission Test Site					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
EMI Test Receiver	Rohde & Schwarz	ESCI	101417	July 5, 2016	July 4, 2017
Trilog Broadband Antenna (25M-1GHz)	SCHWARZBECK	VULB9160	9160-3355	July 5, 2016	July 4, 2017
Signal Amplifier	SCHWARZBECK	BBV 9475	9745-0013	July 5, 2016	July 4, 2017
RF Cable	SCHWARZBECK	AK9515E	96221	July 5, 2016	July 4, 2017
3m Anechoic Chamber	CHENGYU	966	PTS-001	July 5, 2016	July 4, 2017
MULTI-DEVICE Positioning Controller	Max-Full	MF-7802	MF780208339	N/A	N/A
Active loop antenna (9K-30MHz)	Schwarzbeck	FMZB1519	1519-038	June 6, 2017	June 5, 2018
Spectrum analyzer	Agilent	E4407B	MY46185649	June 6, 2017	June 5, 2018
Power Sensor	Agilent	U2021XA	MY55050474	June 6, 2017	June 5, 2018
Horn Antenna (1G-18GHz)	SCHWARZBECK	BBHA9120D	9120D-1246	July 11, 2016	July 10, 2017
Horn Ant (18G-40GHz)	Schwarzbeck	BBHA 9170	9170-181	June 6, 2017	June 5, 2018

Conducted Emission Test Site					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
EMI Test Receiver	Rohde & Schwarz	ESCI	101417	July 5, 2016	July 4, 2017
Artificial Mains Network	Narda	L2-16B	000WX31025	July 7, 2016	July 8, 2017
Artificial Mains Network (AUX)	Narda	L2-16B	000WX31026	July 7, 2016	July 8, 2017
RF Cable	SCHWARZBECK	AK9515E	96222	July 5, 2016	July 4, 2017
Shielded Room	CHENGYU	843	PTS-002	June 6, 2017	June 5, 2018

7. MAXIMUM CONDUCTED OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

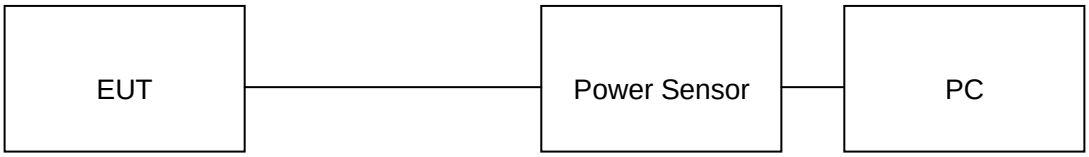
For average power test:

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 D02, KDB 644545 D03 and KDB 662911 D01 for compliance to FCC 47CFR 15.407 requirements.

7.2. TEST SET-UP

Average POWER SETUP



7.3. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT FOR 802.11A20 MODULATION				
Port	**Frequency (MHz)**	**Average Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
Ant0	5180	13.52	30	Pass
	5200	13.65	30	Pass
	5240	13.62	30	Pass
Ant1	5180	13.78	30	Pass
	5200	14.25	30	Pass
	5240	13.71	30	Pass

LIMITS AND MEASUREMENT RESULT FOR 802.11N20 MODULATION				
Port	**Frequency (MHz)**	**Average Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
Ant0	5180	12.99	30	Pass
	5200	13.01	30	Pass
	5240	12.96	30	Pass
Ant1	5180	13.13	30	Pass
	5200	13.19	30	Pass
	5240	13.32	30	Pass
SUM	5180	16.07	30	Pass
	5200	16.11	30	Pass
	5240	16.15	30	Pass

LIMITS AND MEASUREMENT RESULT FOR 802.11N40 MODULATION				
Port	**Frequency (MHz)**	**Average Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
Ant0	5190	11.52	30	Pass
	5230	11.68	30	Pass
Ant1	5190	12.49	30	Pass
	5230	12.58	30	Pass
SUM	5190	15.04	30	Pass
	5230	15.16	30	Pass

LIMITS AND MEASUREMENT RESULT FOR 802.11AC20 MODULATION				
Port	**Frequency (MHz)**	**Average Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
Ant0	5180	13.06	30	Pass
	5200	13.1	30	Pass
	5240	13.04	30	Pass
Ant1	5180	12.49	30	Pass
	5200	12.42	30	Pass
	5240	12.55	30	Pass
SUM	5180	15.79	30	Pass
	5200	15.78	30	Pass
	5240	15.81	30	Pass

LIMITS AND MEASUREMENT RESULT FOR 802.11AC40 MODULATION				
Port	**Frequency (MHz)**	**Average Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
Ant0	5190	11.15	30	Pass
	5230	10.99	30	Pass
Ant1	5190	10.92	30	Pass
	5230	10.96	30	Pass
SUM	5190	14.05	30	Pass
	5230	13.99	30	Pass

LIMITS AND MEASUREMENT RESULT FOR 802.11AC80 MODULATION				
Port	**Frequency (MHz)**	**Average Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
Ant0	5210	10.96	30	Pass
Ant1	5210	11.05	30	Pass
SUM	5210	14.02	30	Pass

8. EMISSION BANDWIDTH

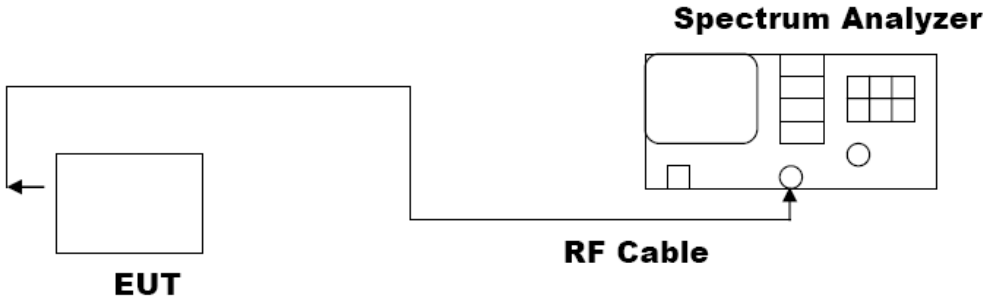
8.1. MEASUREMENT PROCEDURE

a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

The following procedure shall be used for measuring (99 %) power bandwidth:
1. Set center frequency to the nominal EUT channel center frequency.
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. Set VBW $\geqslant$ 3 · RBW
5. Peak detection and max hold mode (until the trace stabilizes) shall be used.
6. Use the 99 % power bandwidth function of the instrument

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)



8.3. LIMITS AND MEASUREMENT RESULTS

LIMITS AND MEASUREMENT RESULT FOR 802.11A20 MODULATION				
Port	**Test Channel**	**-26dBc EBW (MHz)**	**99% OBW (MHz)**	**Criteria**
Ant0	5180MHz	23.79	16.514	PASS
	5200 MHz	21.79	16.461	PASS
	5240MHz	22.84	16.474	PASS
Ant1	5180MHz	23.25	16.434	PASS
	5200 MHz	22.18	16.447	PASS
	5240MHz	22.94	16.533	PASS

LIMITS AND MEASUREMENT RESULT FOR 802.11N20/40 MODULATION				
Port	**Test Channel**	**-26dBc EBW (MHz)**	**99% OBW (MHz)**	**Criteria**
Ant0	5180MHz	22.46	17.587	PASS
	5200 MHz	21.04	17.579	PASS
	5240MHz	22.04	17.579	PASS
	5190MHz	40.96	35.958	PASS
	5230MHz	41.27	35.999	PASS
Ant1	5180MHz	22.22	17.592	PASS
	5200 MHz	21.09	17.611	PASS
	5240MHz	21.64	17.604	PASS
	5190MHz	41.38	36.001	PASS
	5230MHz	40.16	35.994	PASS

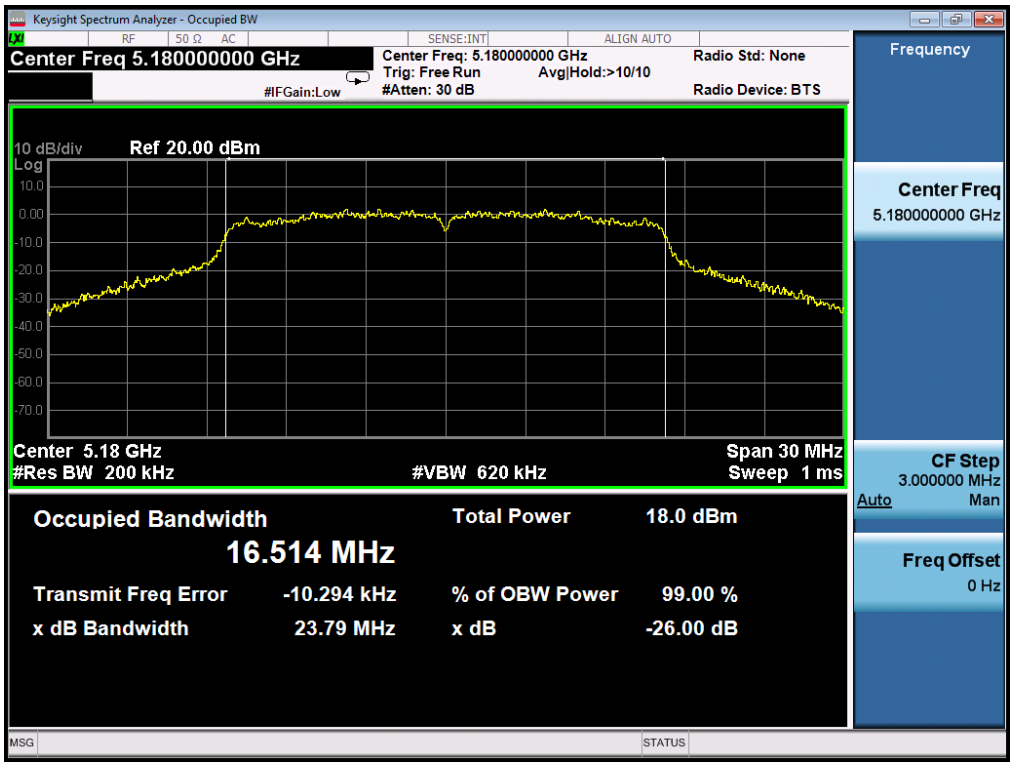
LIMITS AND MEASUREMENT RESULT FOR 802.11AC20/40 MODULATION				
Port	**Test Channel**	**-26dBc EBW (MHz)**	**99% OBW (MHz)**	**Criteria**
Ant0	5180MHz	22.90	17.629	PASS
	5200 MHz	22.59	17.613	PASS
	5240MHz	22.60	17.626	PASS
	5190MHz	44.18	36.092	PASS

	5230MHz	44.05	36.064	PASS
Ant1	5180MHz	22.30	17.625	PASS
	5200 MHz	22.28	17.654	PASS
	5240MHz	23.39	17.646	PASS
	5190MHz	43.88	36.092	PASS
	5230MHz	43.65	36.056	PASS

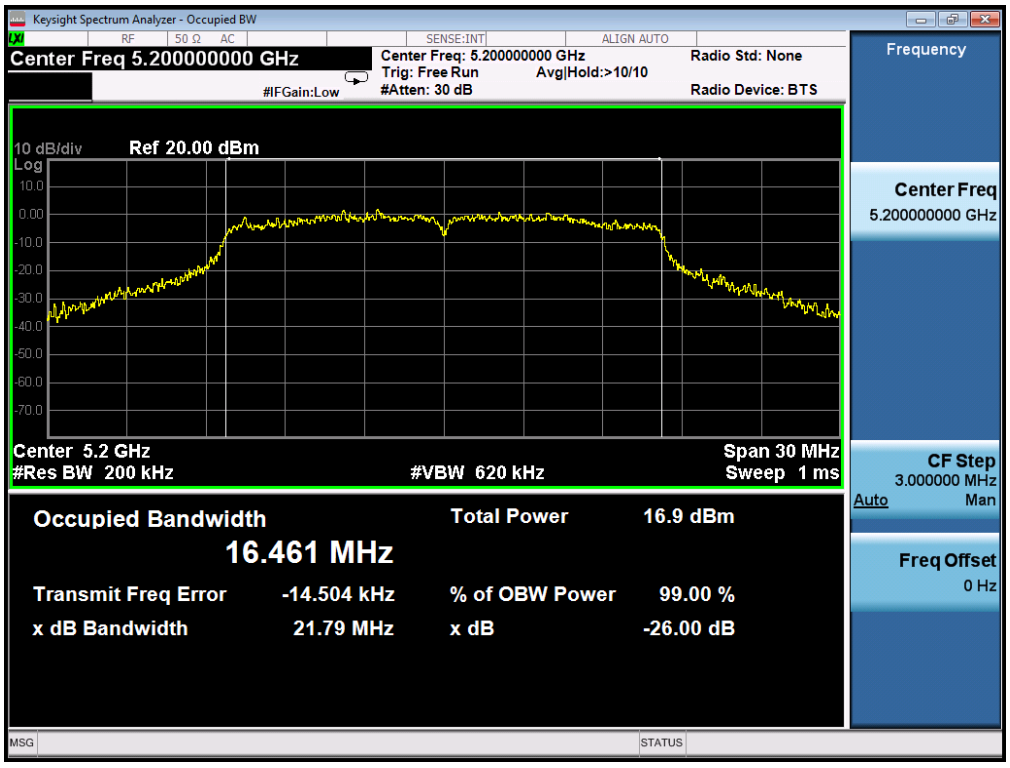
LIMITS AND MEASUREMENT RESULT FOR 802.11AC80 MODULATION				
Port	**Test Channel**	**-26dBc EBW (MHz)**	**99% OBW (MHz)**	**Criteria**
Ant0	5210MHz	85.29	74.973	PASS
Ant1	5210MHz	85.73	75.078	PASS

802.11a20 TEST RESULT-ant0:

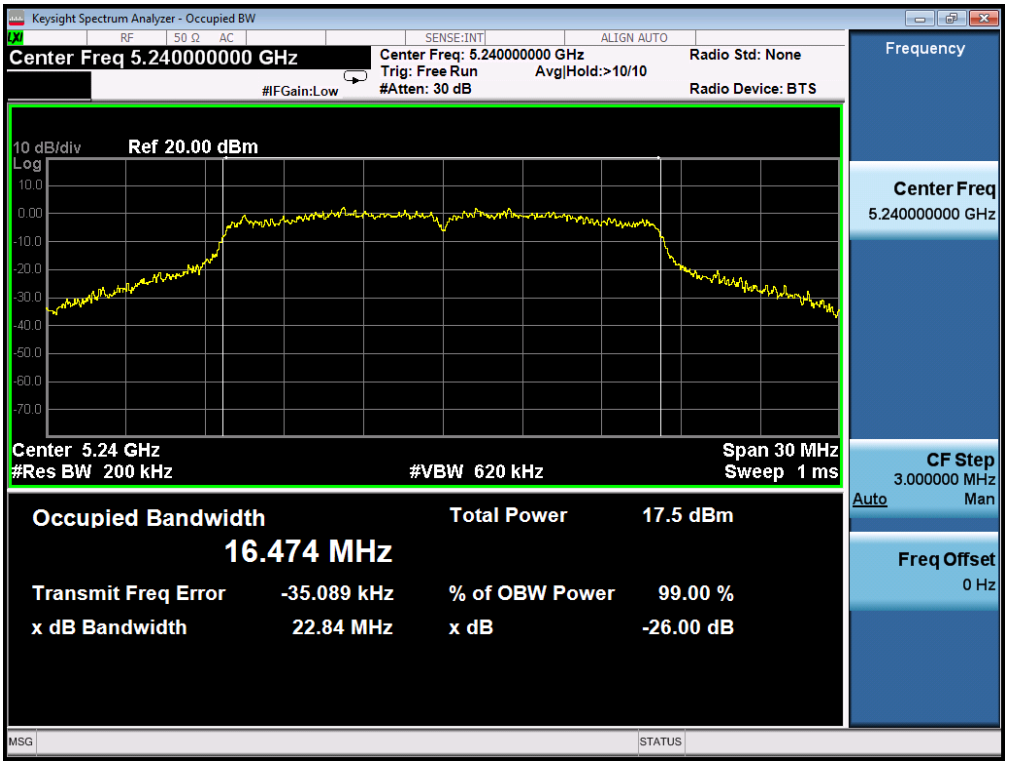
TEST PLOT OF BANDWIDTH FOR 5180MHz



TEST PLOT OF BANDWIDTH FOR 5200MHz

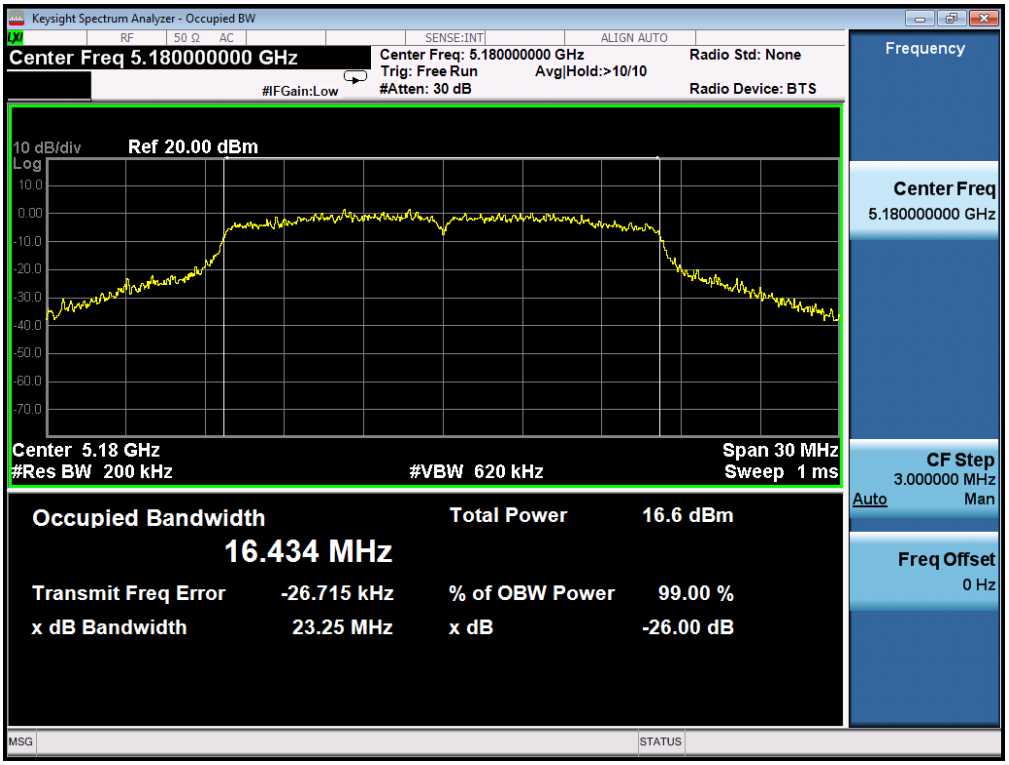


TEST PLOT OF BANDWIDTH FOR 5240MHz

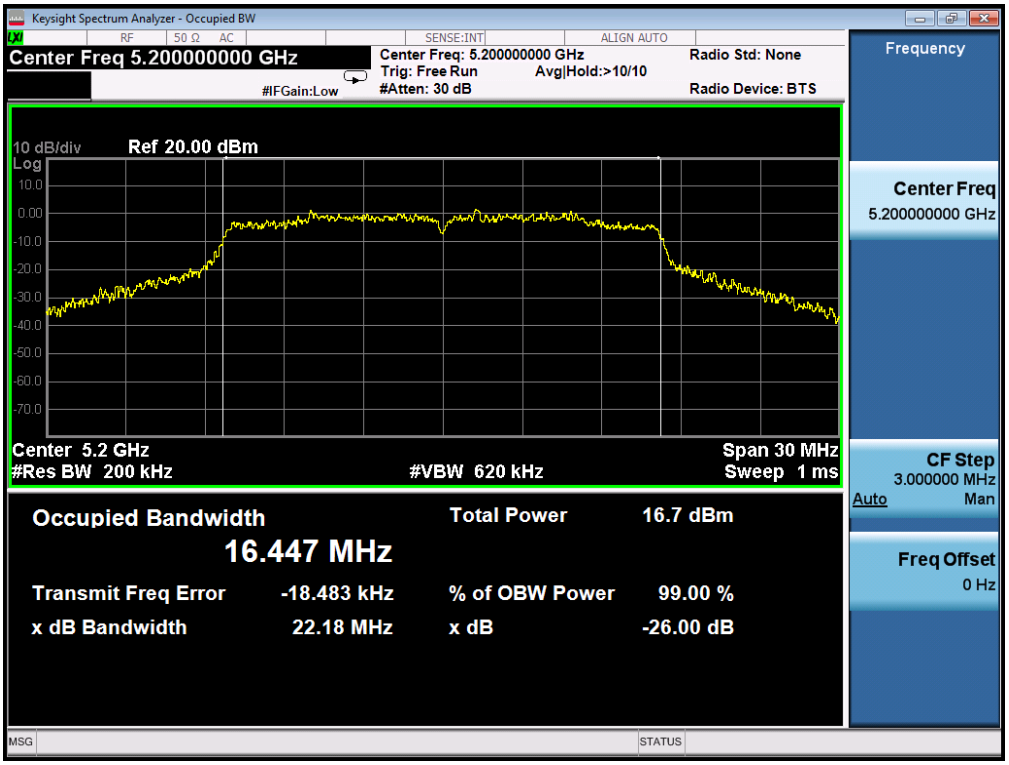


802.11a20 TEST RESULT-ant1:

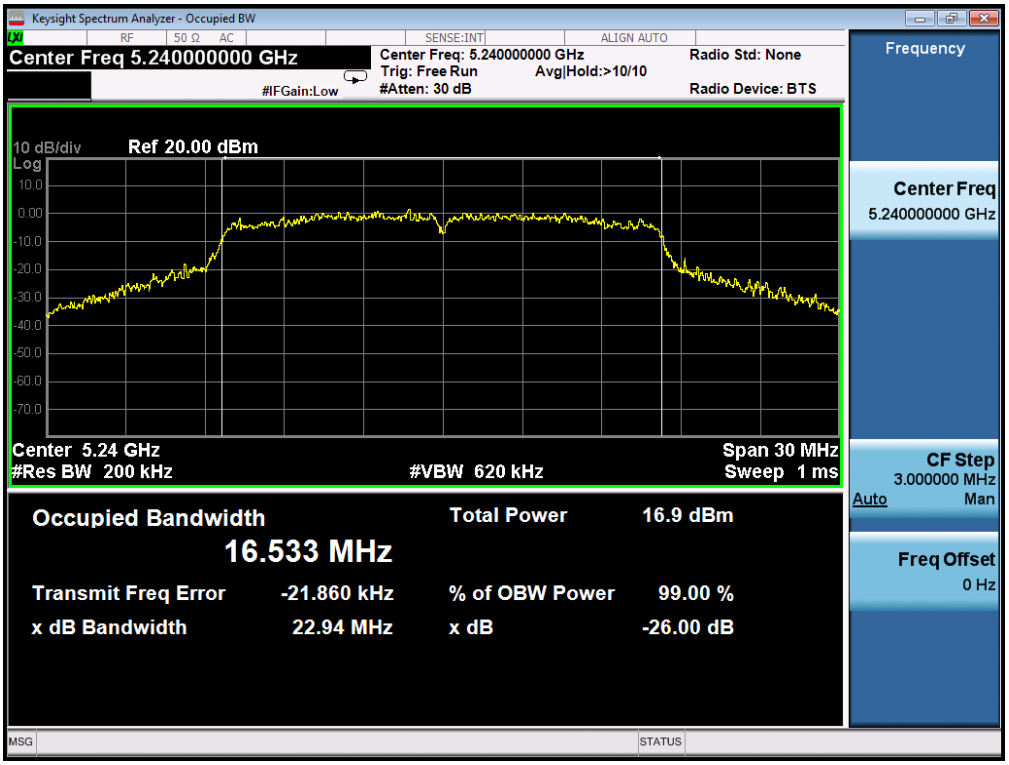
TEST PLOT OF BANDWIDTH FOR 5180MHz



TEST PLOT OF BANDWIDTH FOR 5200MHz

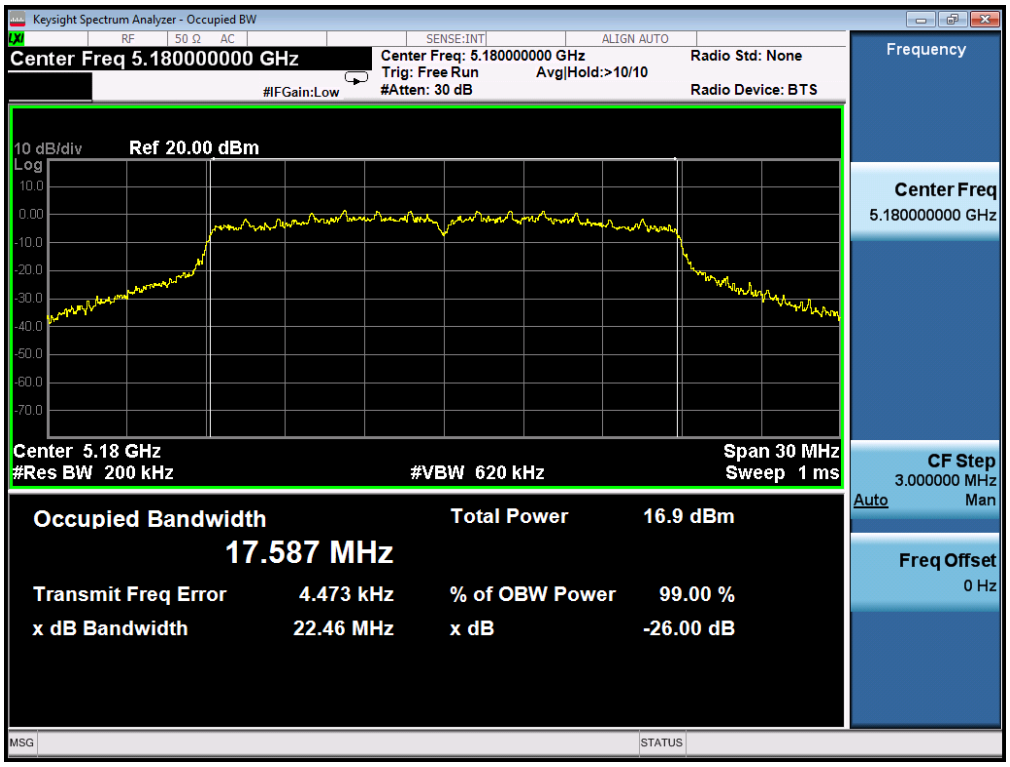


TEST PLOT OF BANDWIDTH FOR 5240MHz

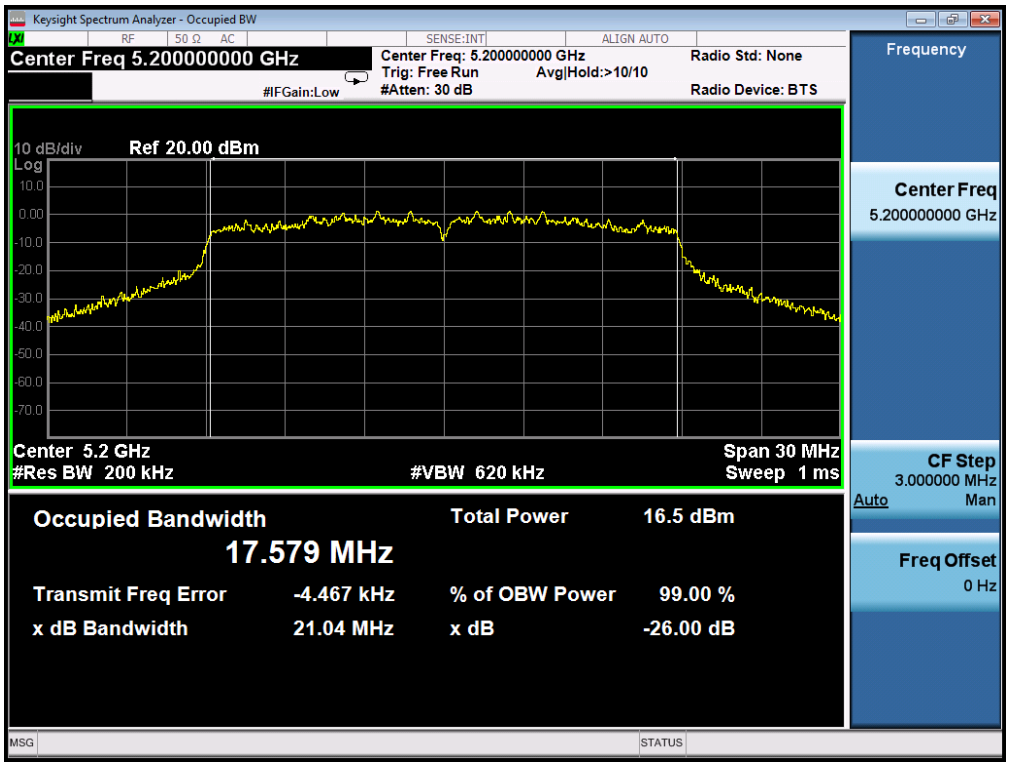


802.11n20 TEST RESULT-ant0：

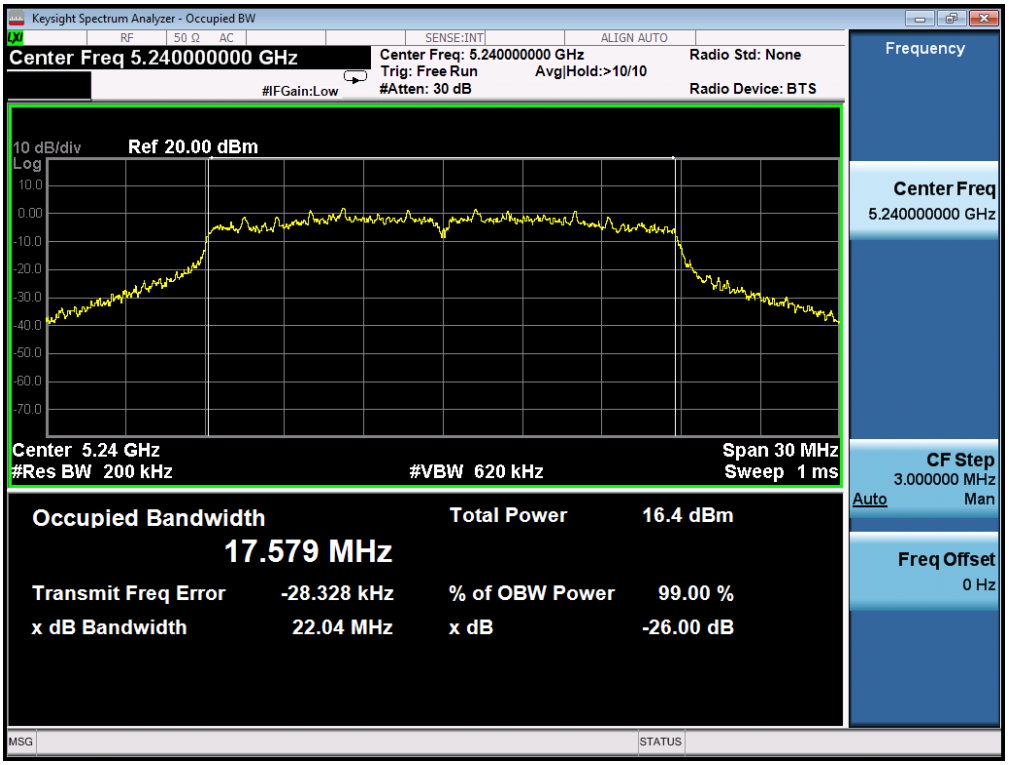
TEST PLOT OF BANDWIDTH FOR 5180MHz



TEST PLOT OF BANDWIDTH FOR 5200MHz

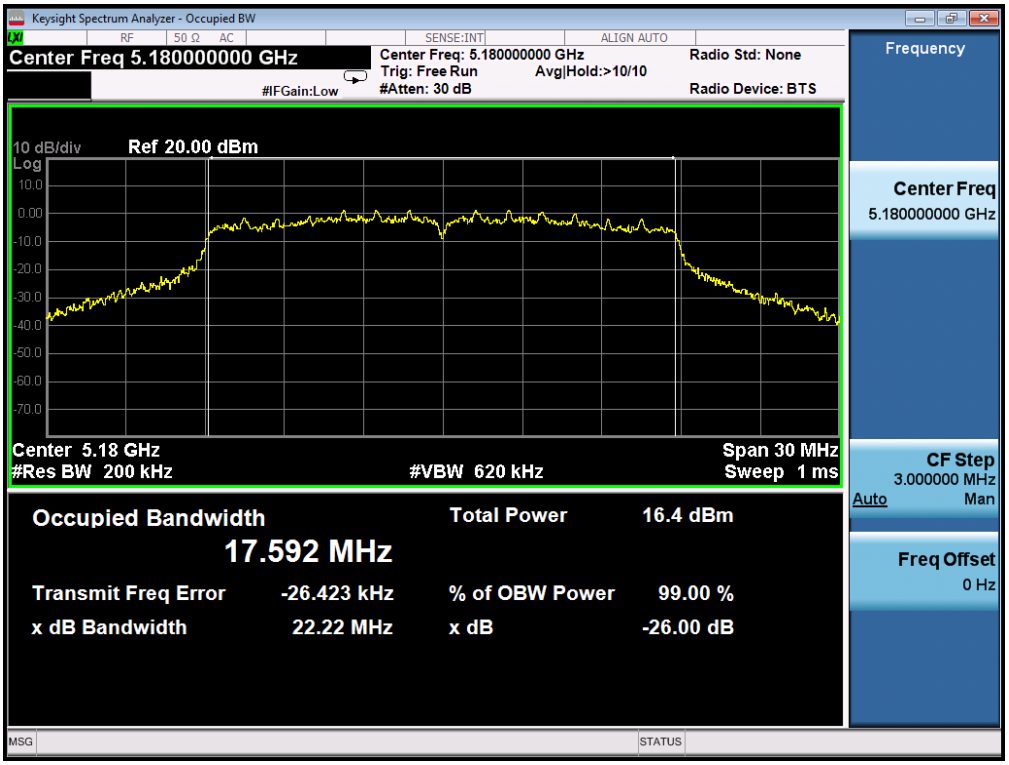


TEST PLOT OF BANDWIDTH FOR 5240MHz

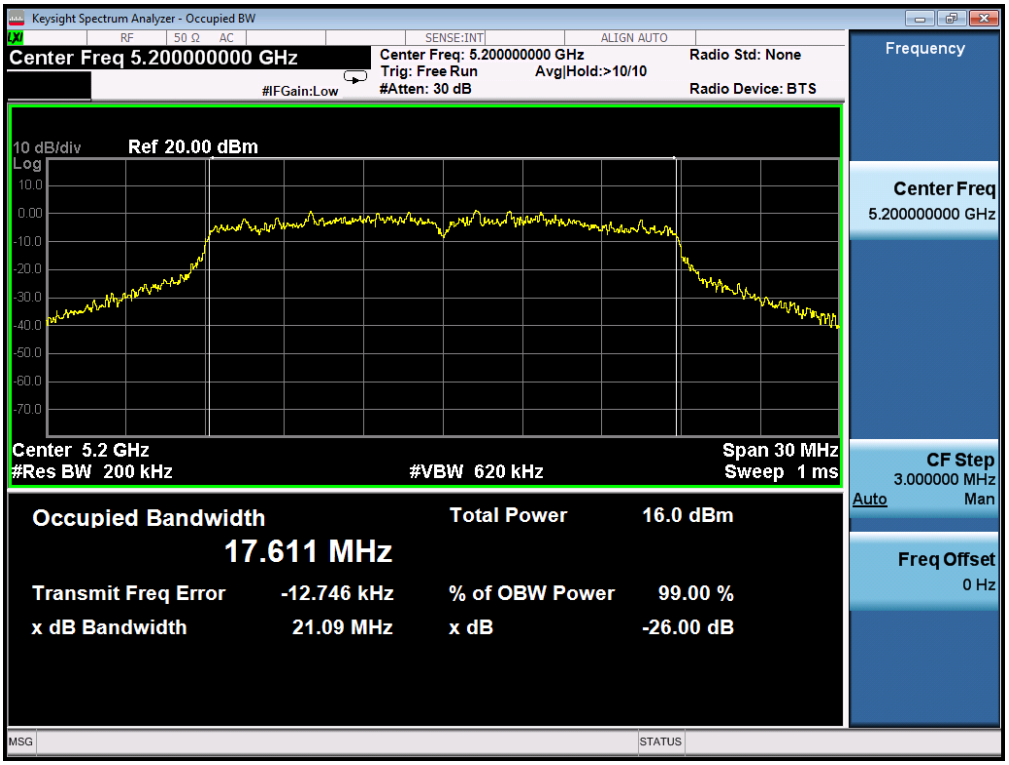


802.11n20 TEST RESULT-ant1:

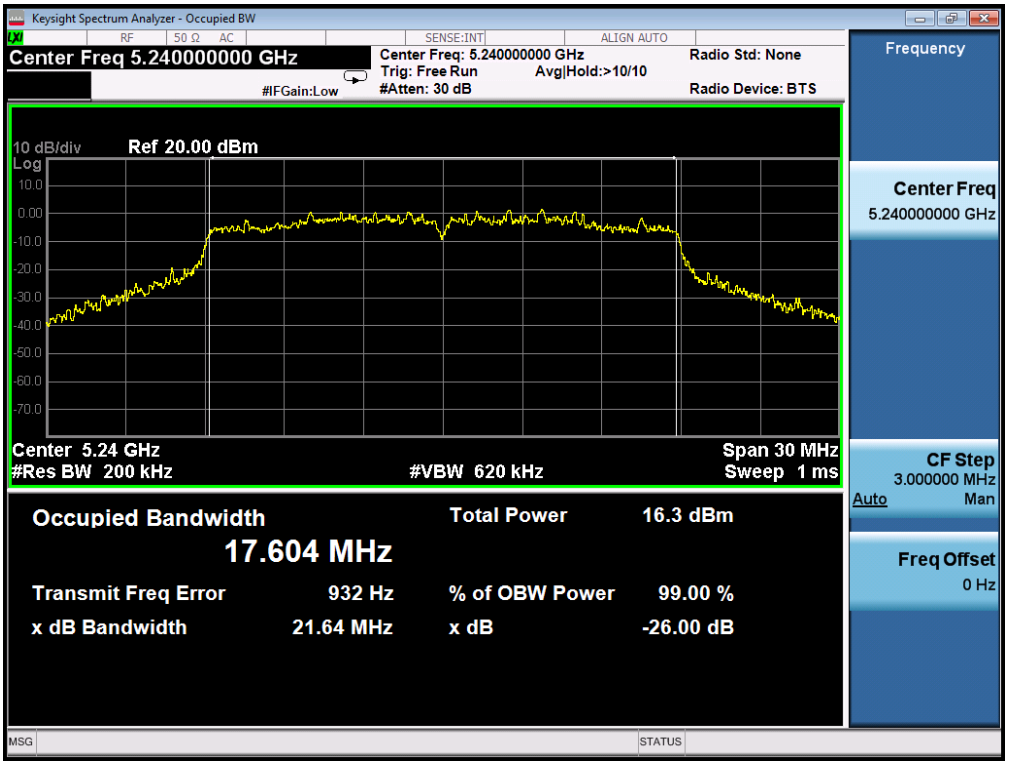
TEST PLOT OF BANDWIDTH FOR 5180MHz



TEST PLOT OF BANDWIDTH FOR 5200MHz



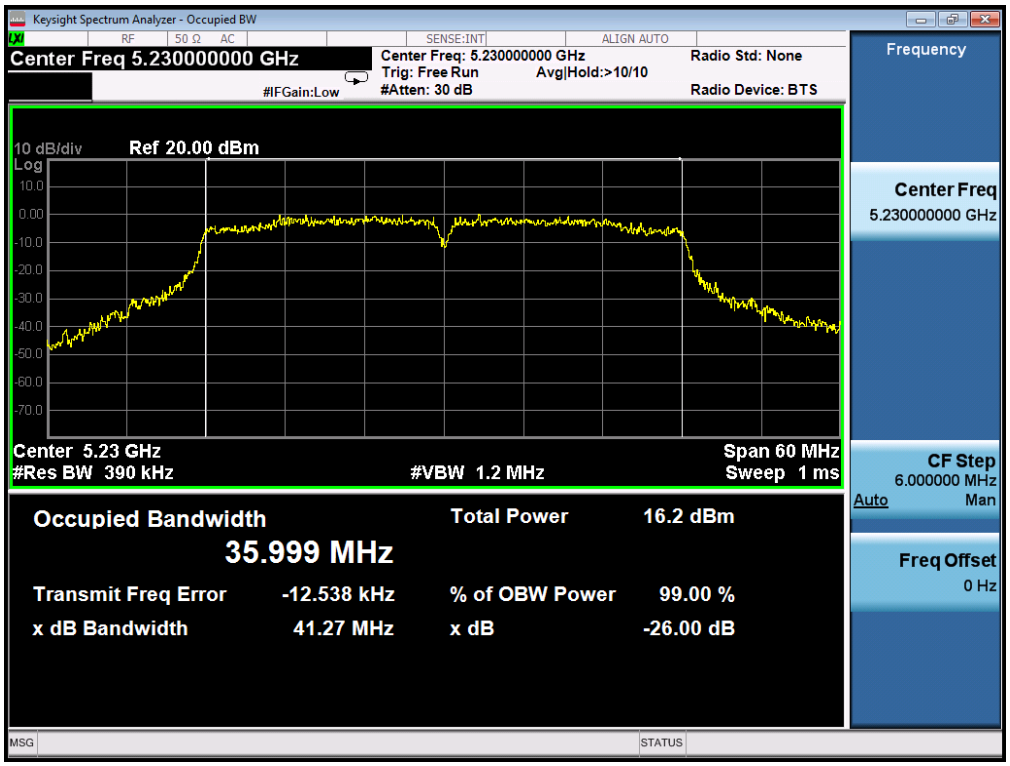
TEST PLOT OF BANDWIDTH FOR 5240MHz



802.11n40 TEST RESULT-ant0:

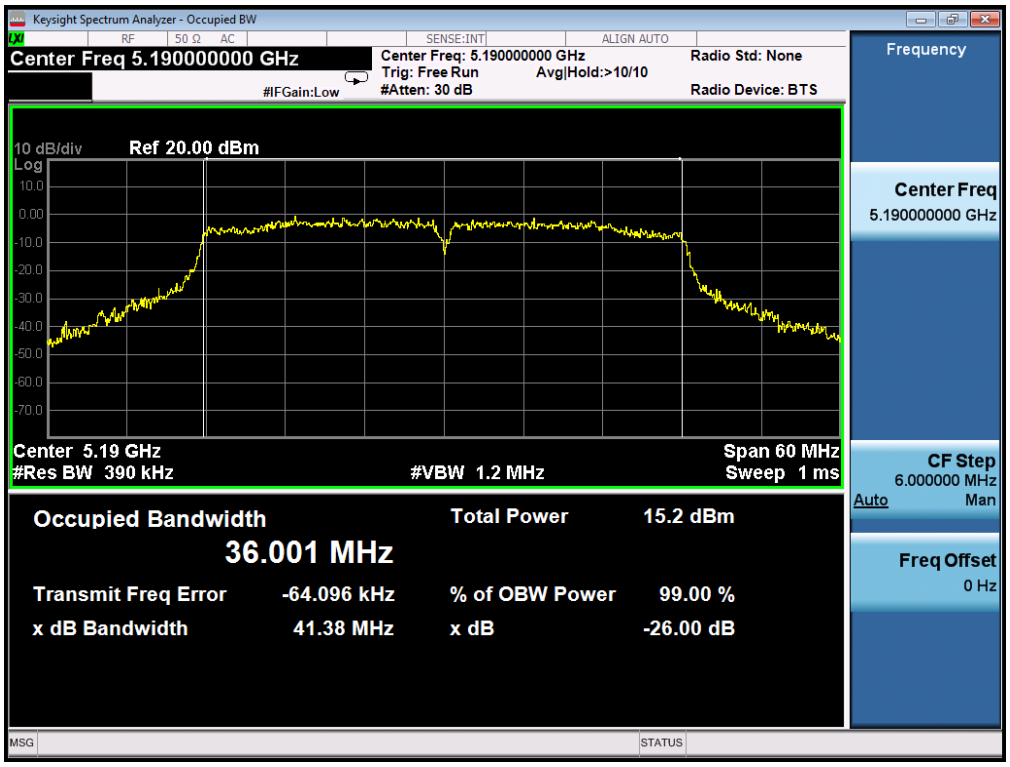
TEST PLOT OF BANDWIDTH FOR 5190MHz

TEST PLOT OF BANDWIDTH FOR 5230MHz

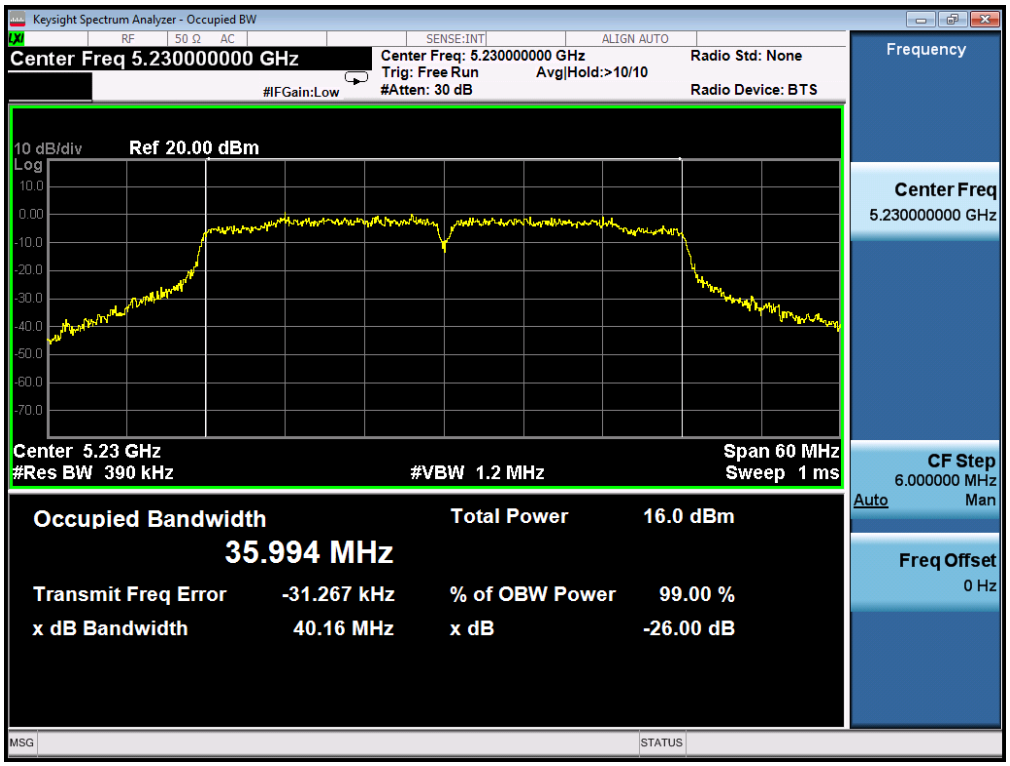


802.11n40 TEST RESULT-ant1：

TEST PLOT OF BANDWIDTH FOR 5190MHz

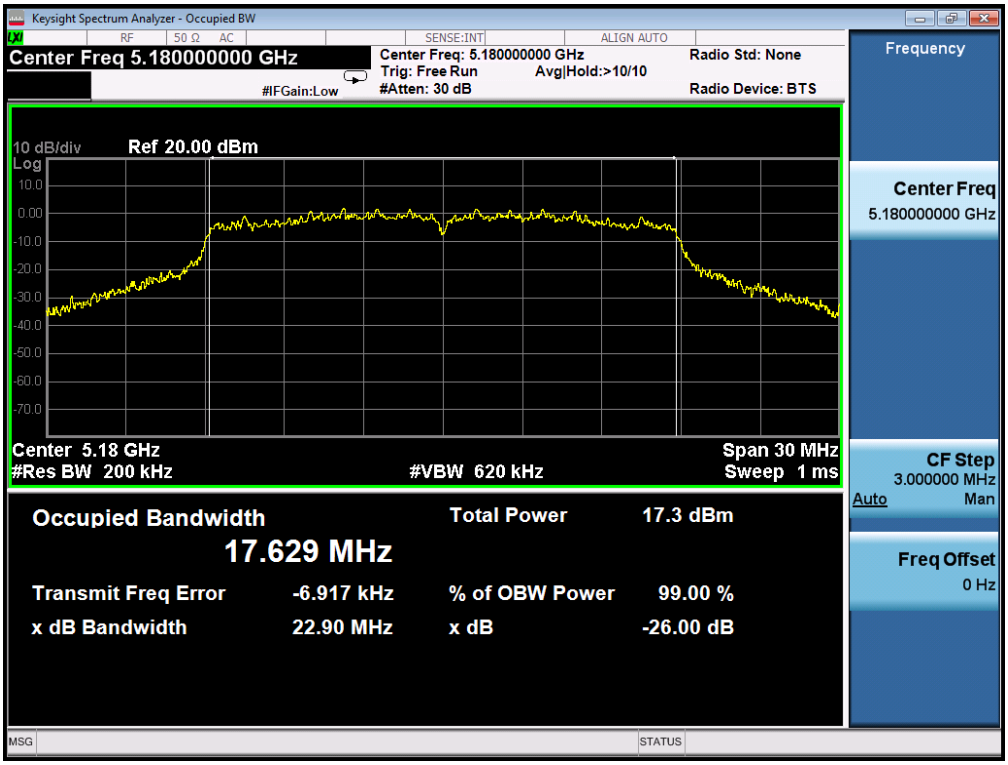


TEST PLOT OF BANDWIDTH FOR 5230MHz

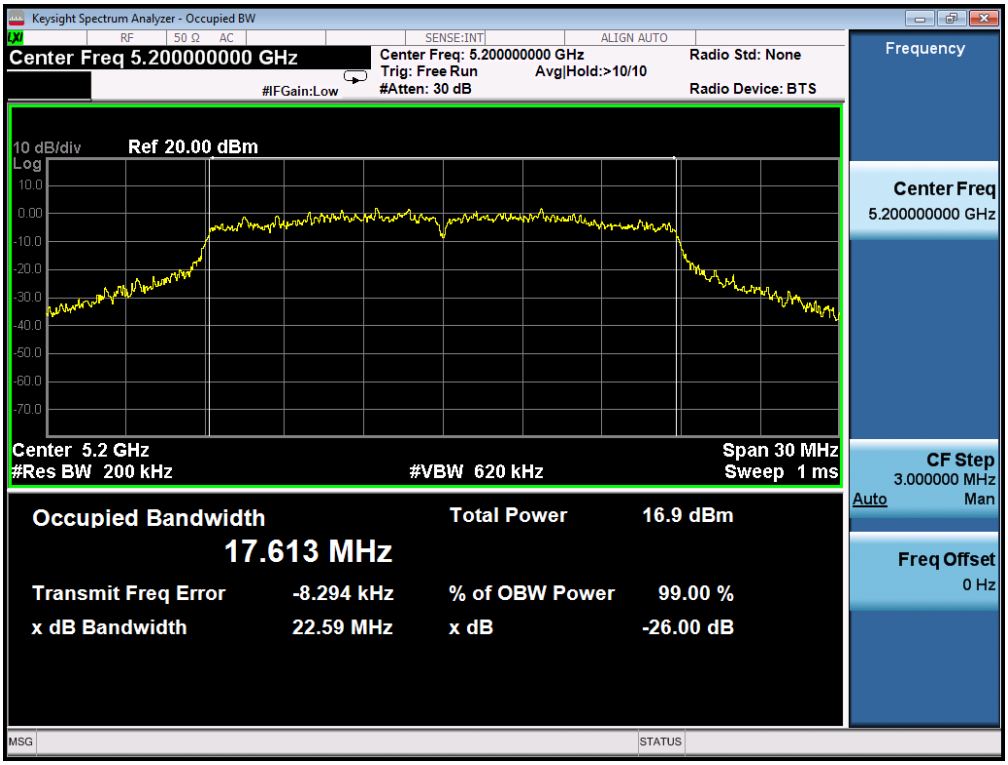


802.11ac20 TEST RESULT-ant0：

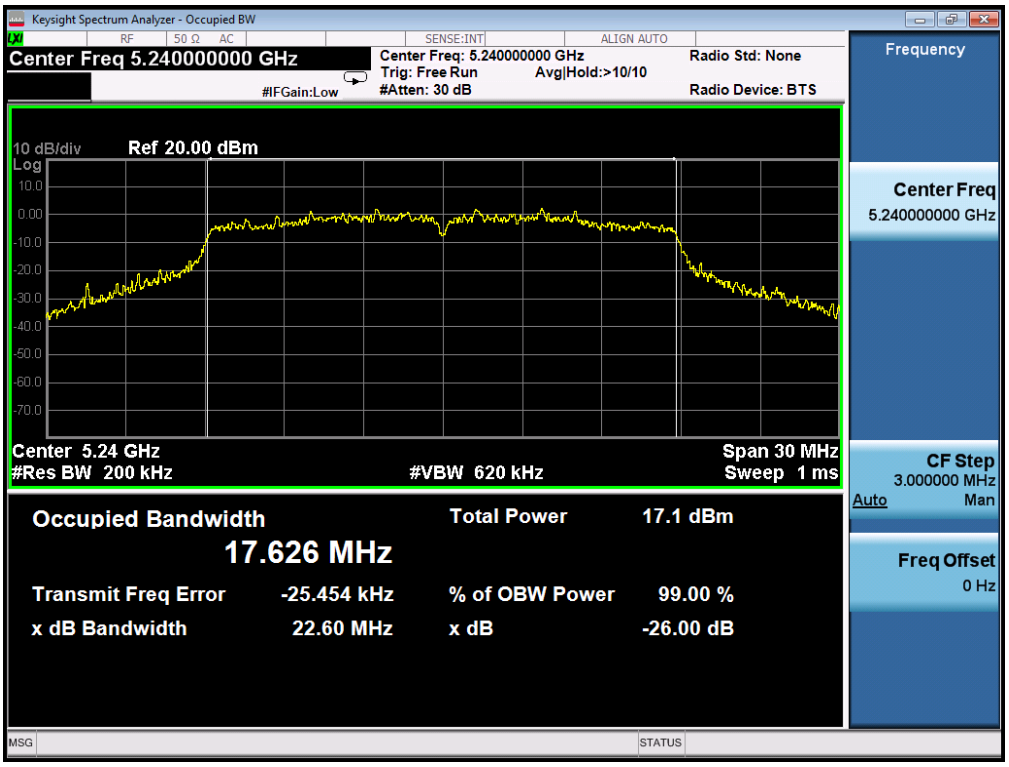
TEST PLOT OF BANDWIDTH FOR 5180MHz



TEST PLOT OF BANDWIDTH FOR 5200MHz

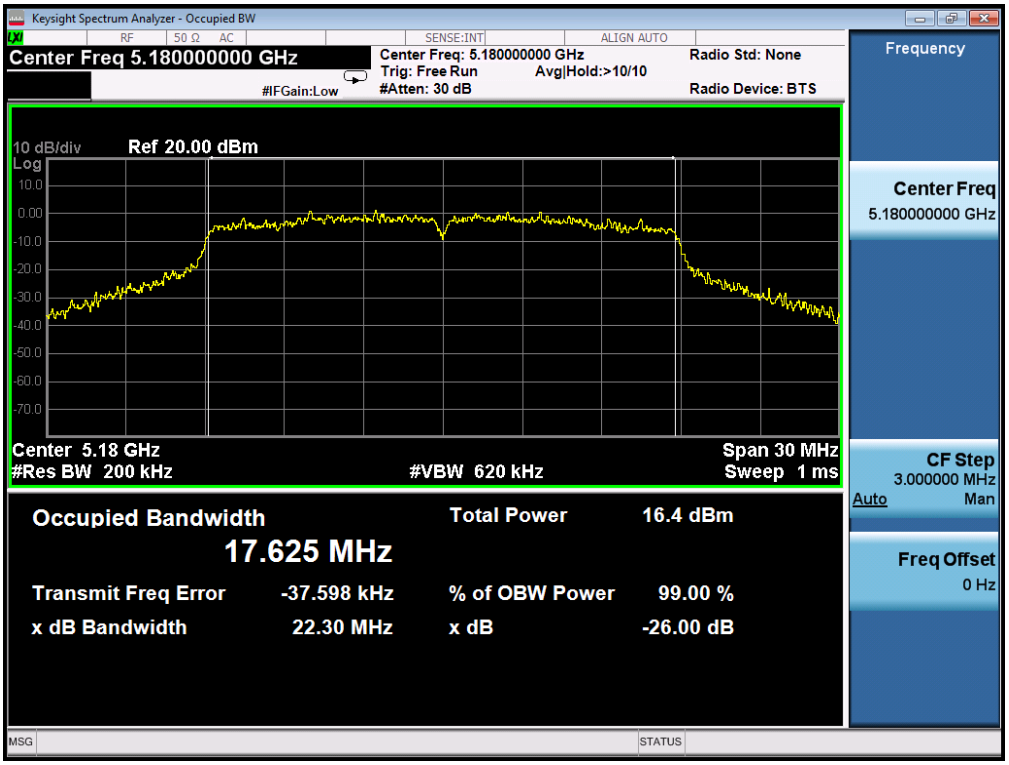


TEST PLOT OF BANDWIDTH FOR 5240MHz

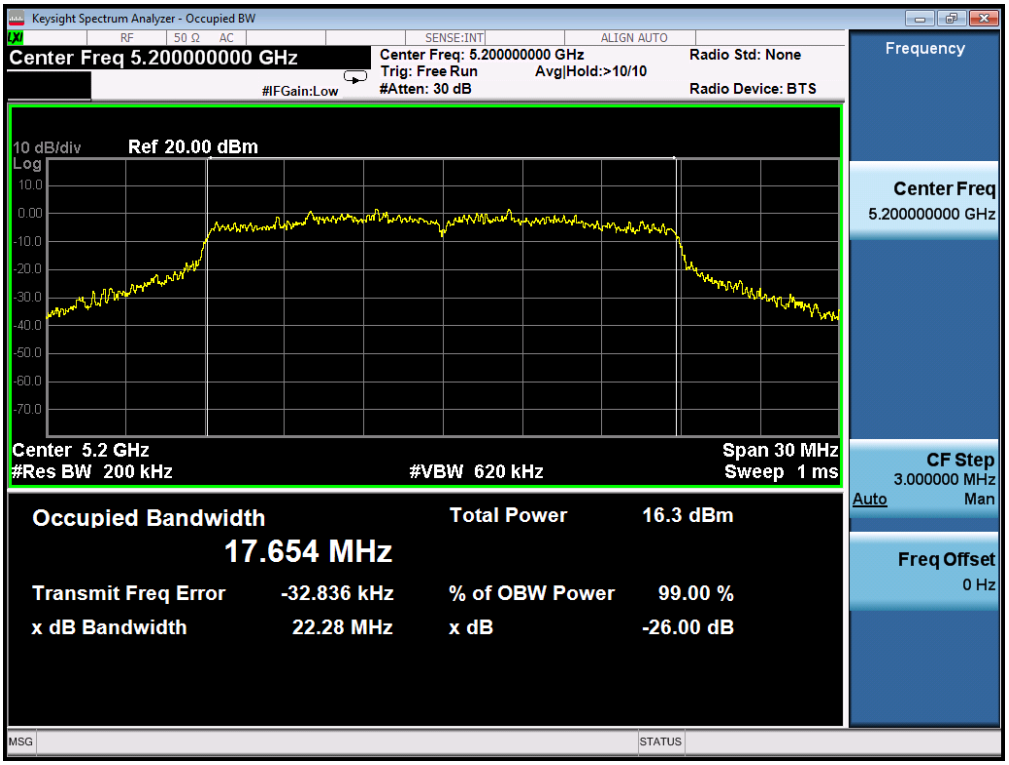


802.11ac20 TEST RESULT-ant1:

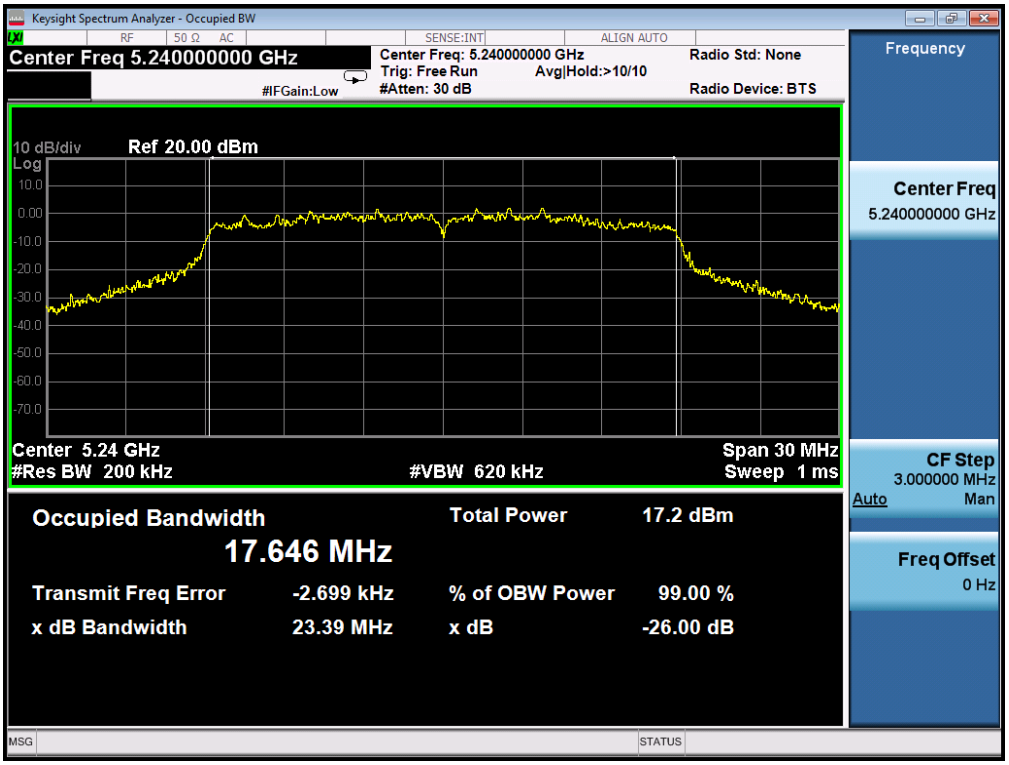
TEST PLOT OF BANDWIDTH FOR 5180MHz



TEST PLOT OF BANDWIDTH FOR 5200MHz

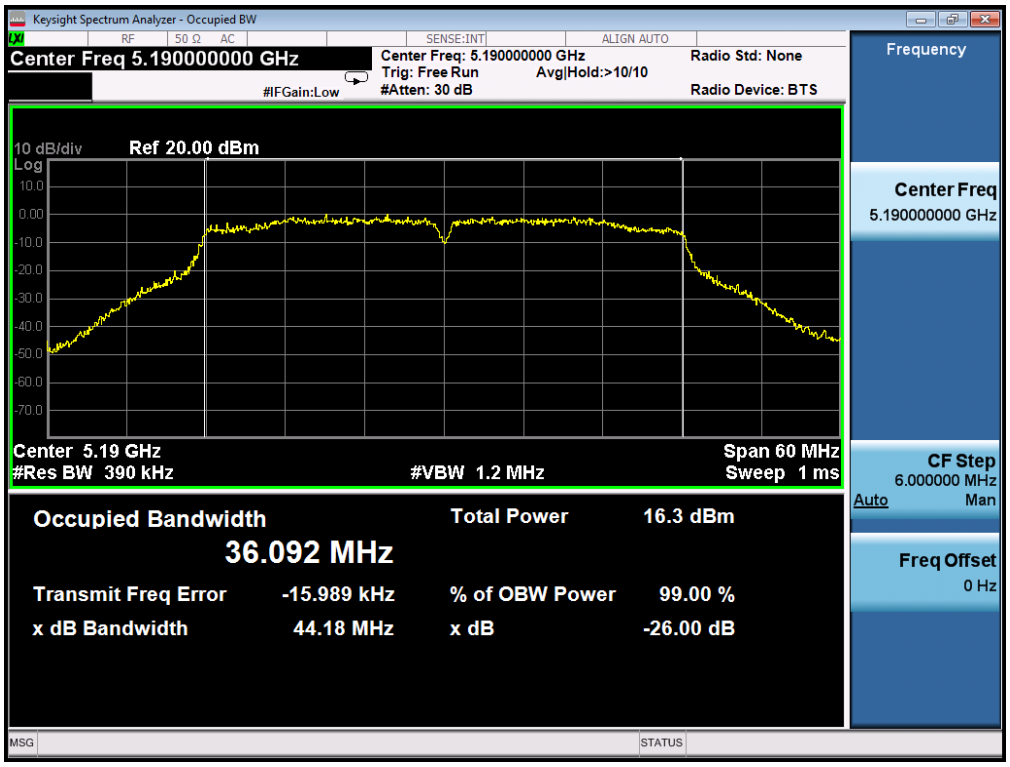


TEST PLOT OF BANDWIDTH FOR 5240MHz

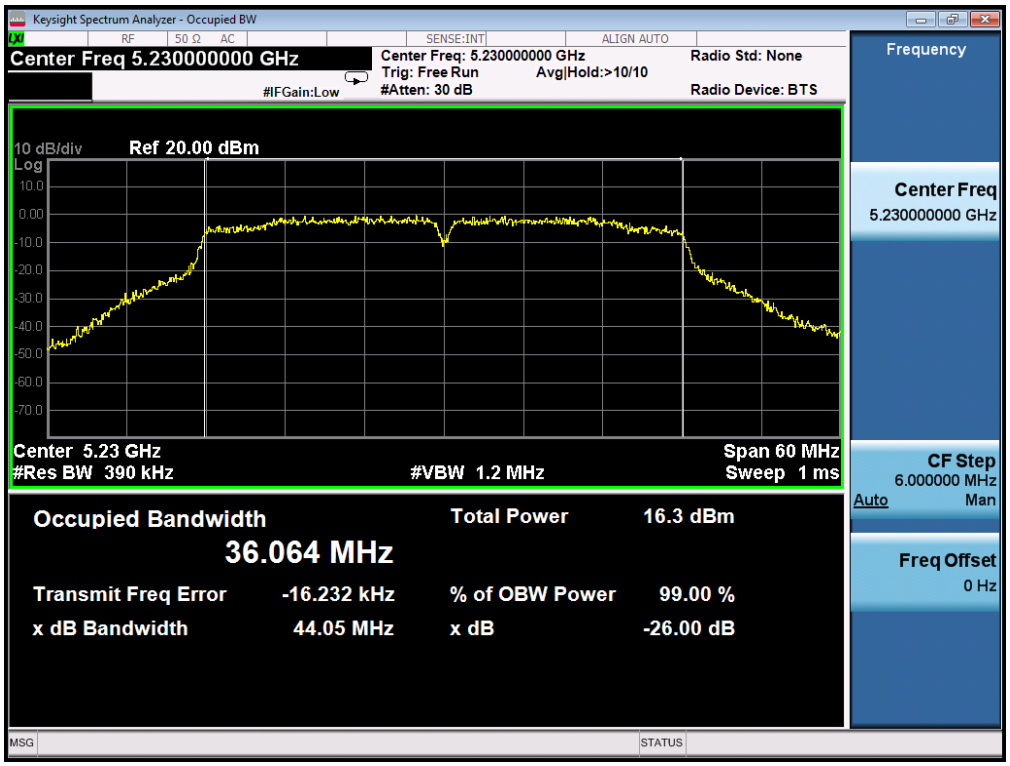


802.11ac40 TEST RESULT-ant0:

TEST PLOT OF BANDWIDTH FOR 5190MHz

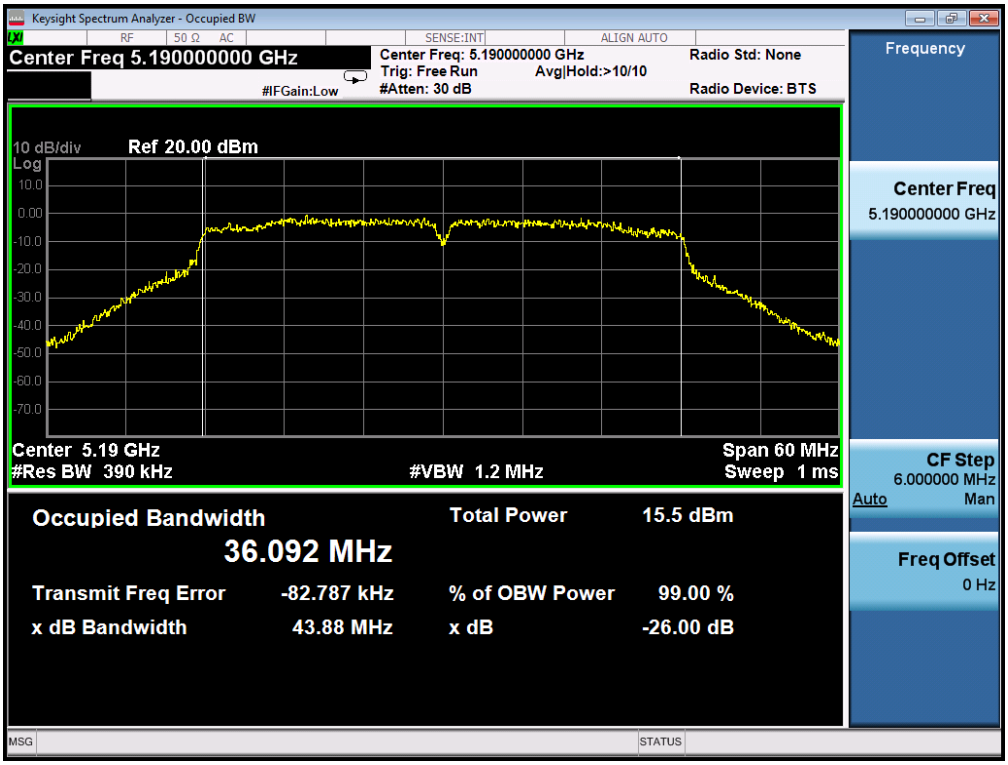


TEST PLOT OF BANDWIDTH FOR 5230MHz

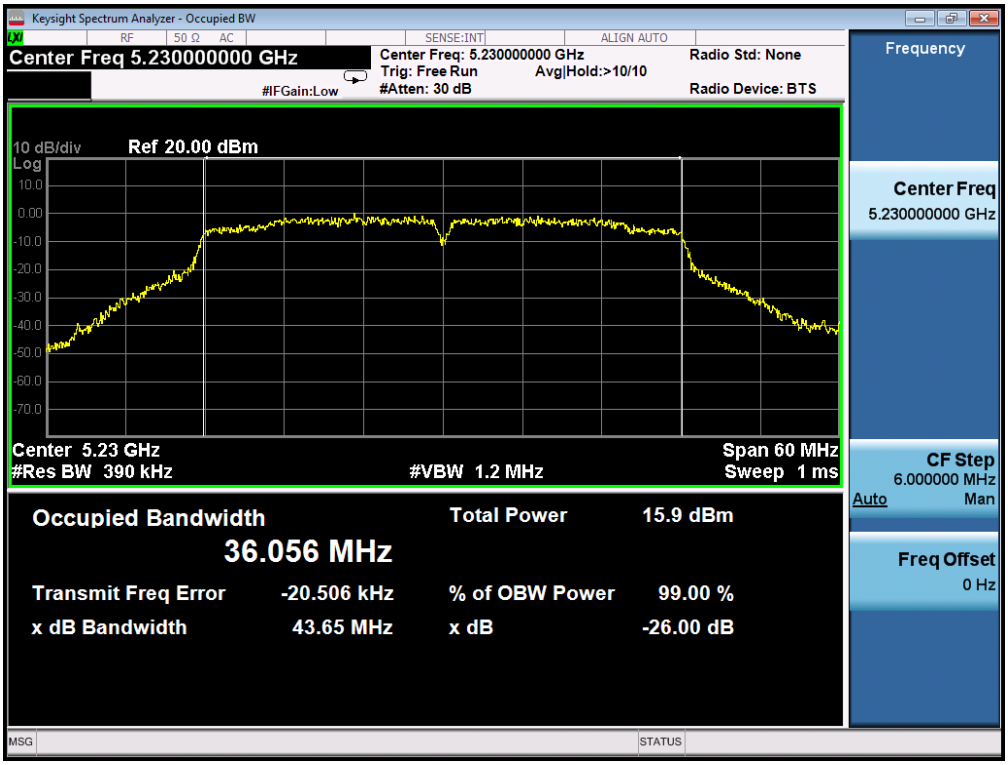


802.11ac40 TEST RESULT-ant1：

TEST PLOT OF BANDWIDTH FOR 5190MHz

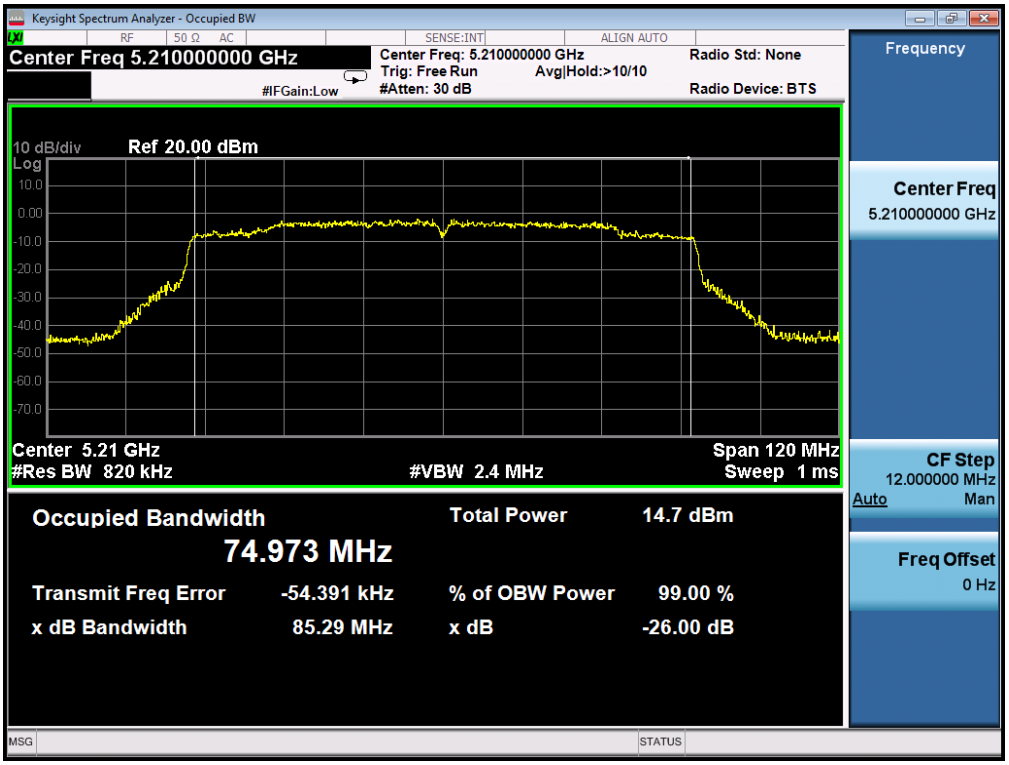


TEST PLOT OF BANDWIDTH FOR 5230MHz



802.11ac80 TEST RESULT-ant0:

TEST PLOT OF BANDWIDTH FOR 5210MHz



802.11ac80 TEST RESULT-ant1：

TEST PLOT OF BANDWIDTH FOR 5210MHz

9. MAXIMUM CONDUCTED OUTPUT PEAK POWER SPECTRAL DENSITY

9.1 MEASUREMENT PROCEDURE

Refer to KDB 789033 section F and KDB 662911

9.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer To Section 8.2.

9.3 MEASUREMENT EQUIPMENT USED

Refer To Section 6.

9.4 LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT FOR 802.11A20 MODULATION				
Port	**Frequency (MHz)**	**Average Power density (dBm/MHz)**	**Applicable Limits (dBm)**	**Pass or Fail**
Ant0	5180	1.887	17	Pass
	5200	2.288	17	Pass
	5240	2.166	17	Pass
Ant1	5180	2.808	17	Pass
	5200	2.048	17	Pass
	5240	2.099	17	Pass

LIMITS AND MEASUREMENT RESULT FOR 802.11N20/40 MODULATION				
Port	**Frequency (MHz)**	**Average Power density (dBm/MHz)**	**Applicable Limits (dBm)**	**Pass or Fail**
Ant0	5180	1.541	17	Pass
	5200	1.616	17	Pass
	5240	1.894	17	Pass
	5190	1.211	17	Pass
	5230	1.487	17	Pass
Ant1	5180	1.792	17	Pass
	5200	1.785	17	Pass
	5240	1.596	17	Pass
	5190	2.162	17	Pass

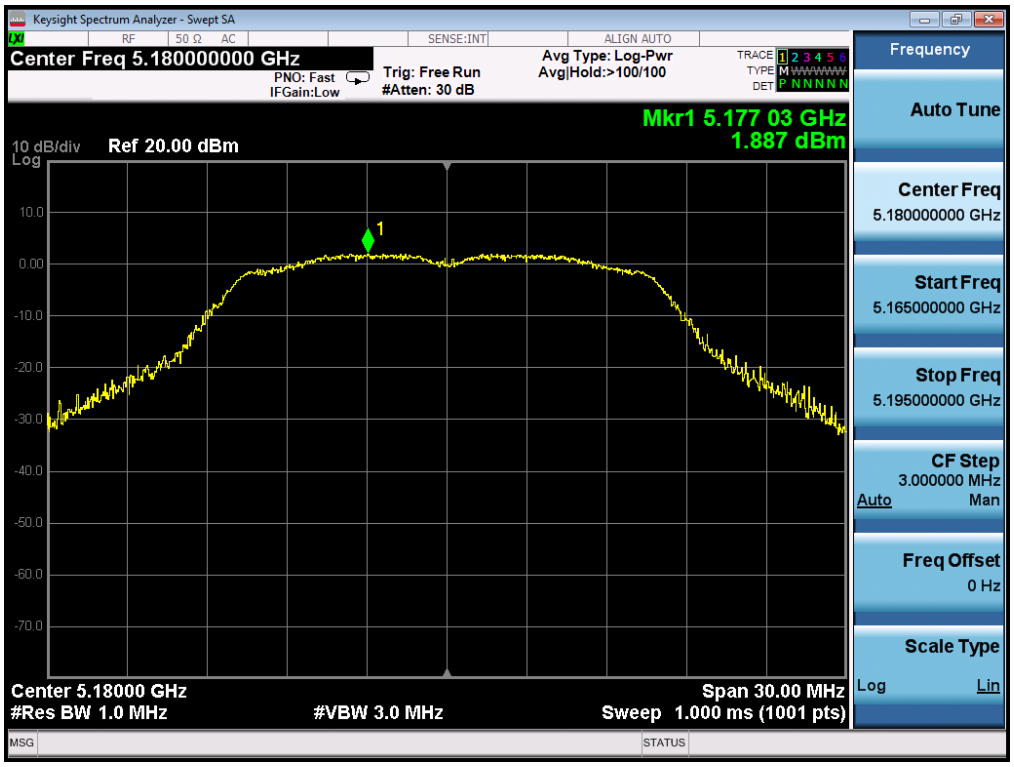
	5230	1.479	17	Pass
Sum	5180	4.68	17	Pass
	5200	4.71	17	Pass
	5240	4.76	17	Pass
	5190	4.72	17	Pass
	5230	4.49	17	Pass

LIMITS AND MEASUREMENT RESULT FOR 802.11AC20/40 MODULATION				
Port	**Frequency (MHz)**	**Average Power density (dBm/MHz)**	**Applicable Limits (dBm)**	**Pass or Fail**
Ant0	5180	2.525	17	Pass
	5200	2.871	17	Pass
	5240	2.777	17	Pass
	5190	2.136	17	Pass
	5230	2.622	17	Pass
Ant1	5180	2.786	17	Pass
	5200	2.866	17	Pass
	5240	2.559	17	Pass
	5190	1.528	17	Pass
	5230	1.433	17	Pass
Sum	5180	5.67	17	Pass
	5200	5.88	17	Pass
	5240	5.68	17	Pass
	5190	4.85	17	Pass
	5230	5.08	17	Pass

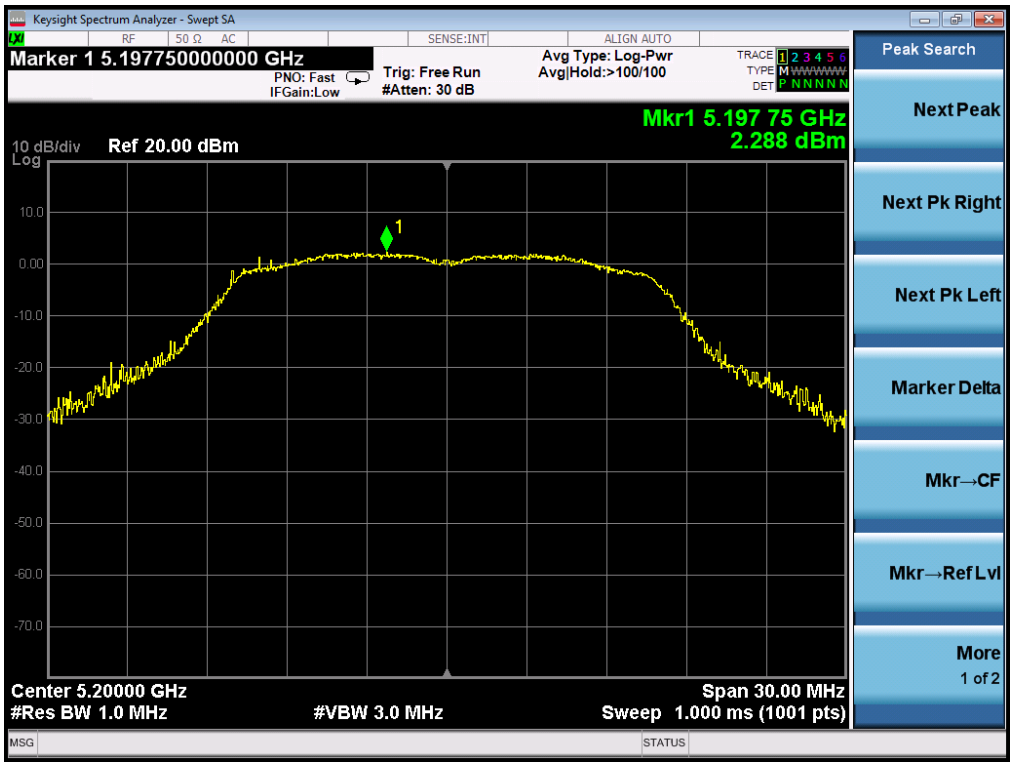
LIMITS AND MEASUREMENT RESULT FOR 802.11AC80 MODULATION				
Port	**Frequency (MHz)**	**Average Power density (dBm/MHz)**	**Applicable Limits (dBm)**	**Pass or Fail**
Ant0	5210	1.057	17	Pass
Ant1	5210	0.668	17	Pass
Sum	5210	3.88	17	Pass

802.11a20 TEST RESULT-ant0:

TEST PLOT FOR 5180MHz



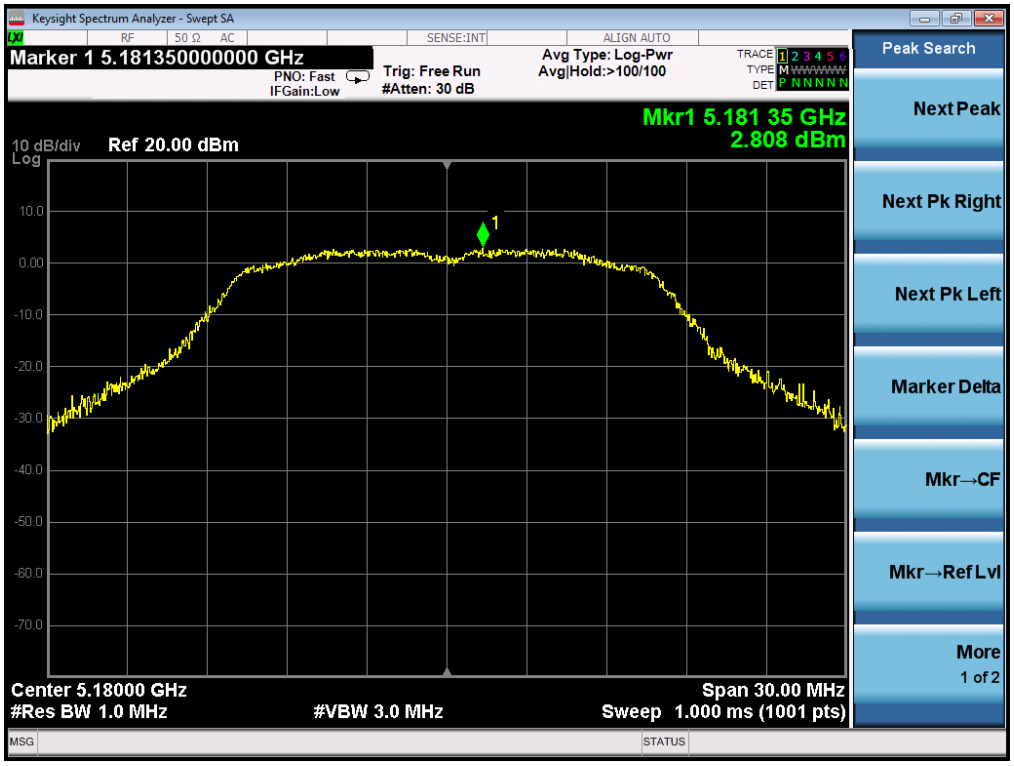
TEST PLOT FOR 5200MHz



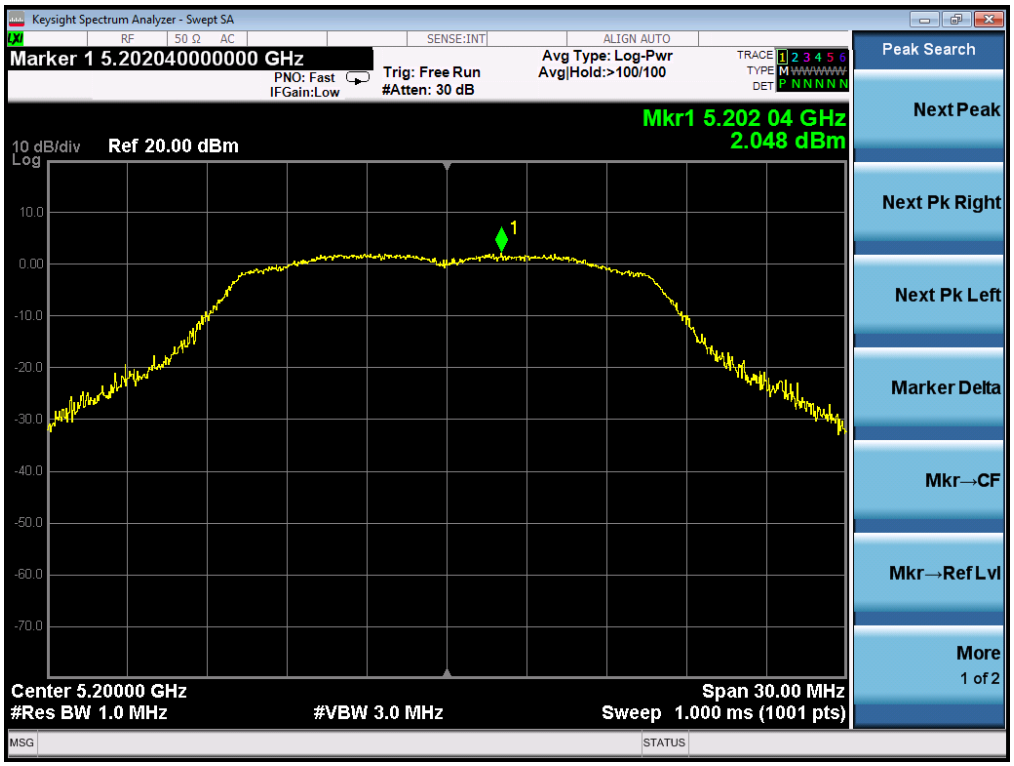
TEST PLOT FOR 5240MHz

802.11a20 TEST RESULT-ant1:

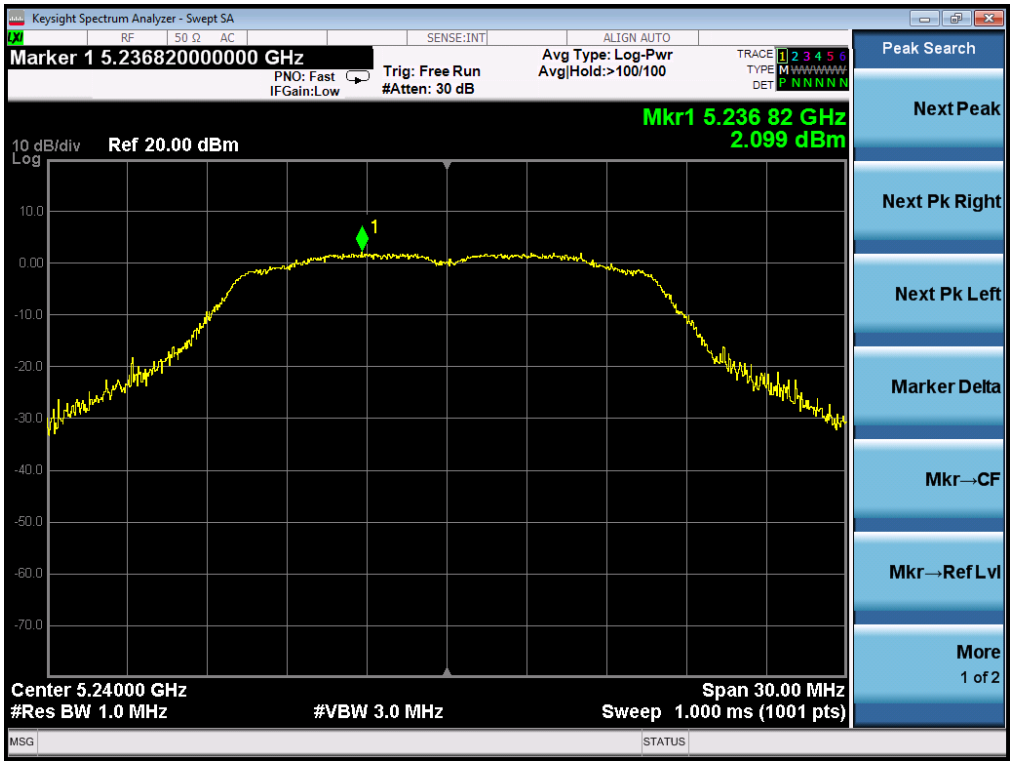
TEST PLOT FOR 5180MHz



TEST PLOT FOR 5200MHz

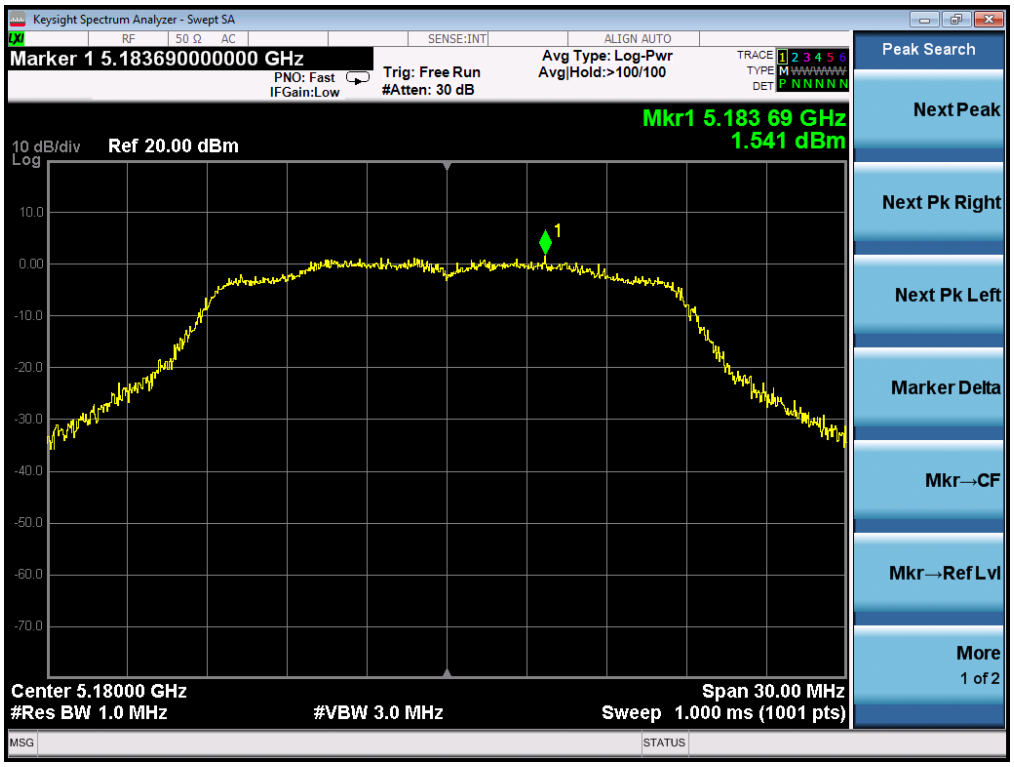


TEST PLOT FOR 5240MHz

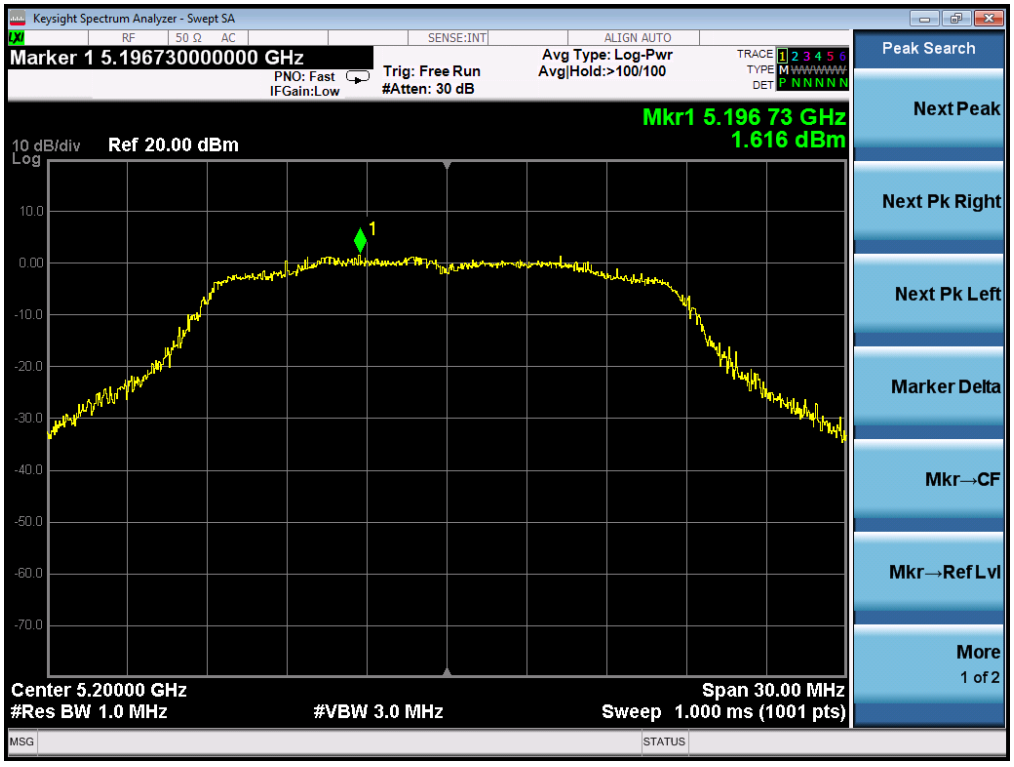


802.11n20 TEST RESULT-ant0

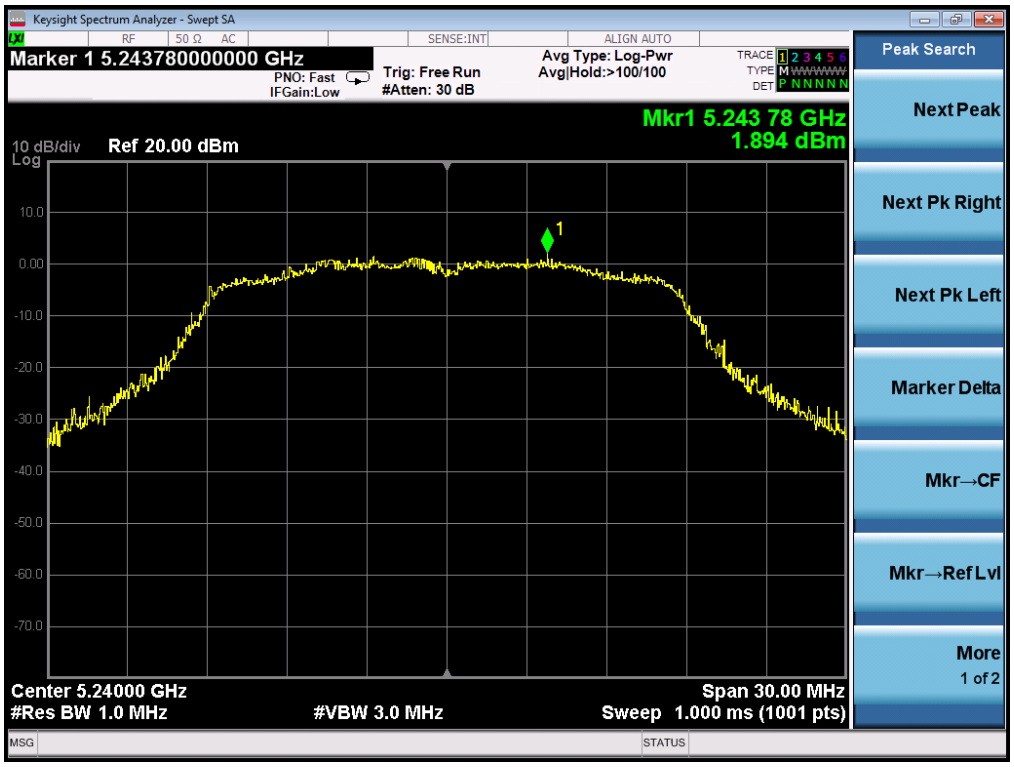
TEST PLOT FOR 5180MHz



TEST PLOT FOR 5200MHz

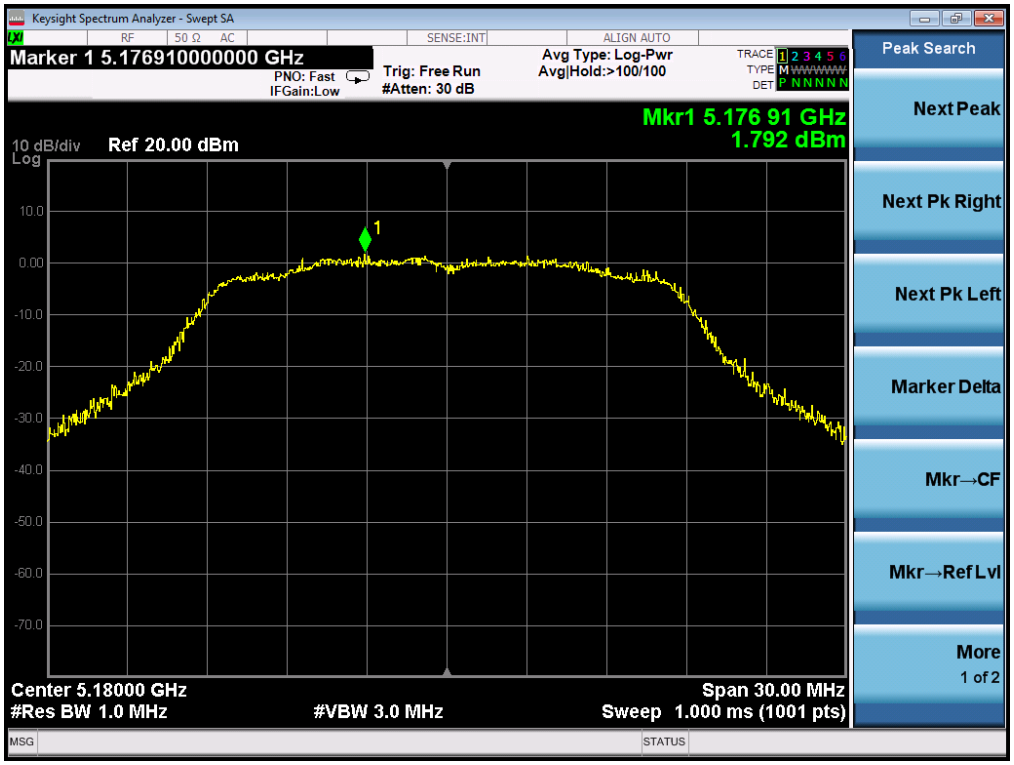


TEST PLOT FOR 5240MHz



802.11n20 TEST RESULT-ant1:

TEST PLOT FOR 5180MHz



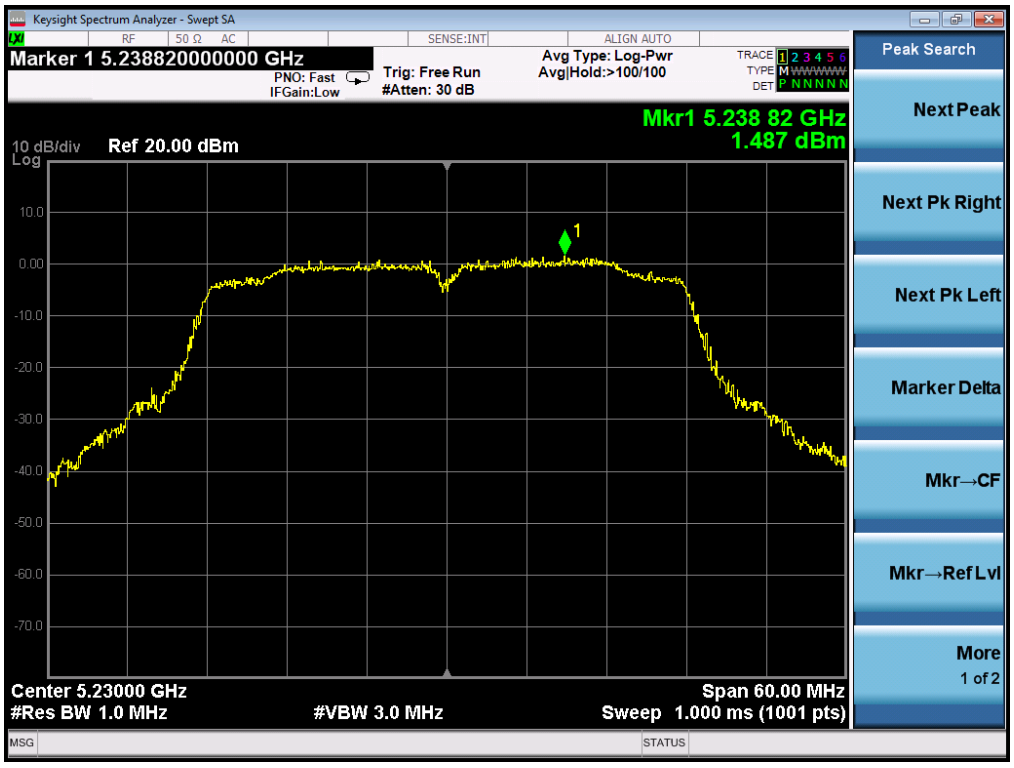
TEST PLOT FOR 5200MHz

TEST PLOT FOR 5240MHz

802.11n40 TEST RESULT-ant0:

TEST PLOT FOR 5190MHz

TEST PLOT FOR 5230MHz



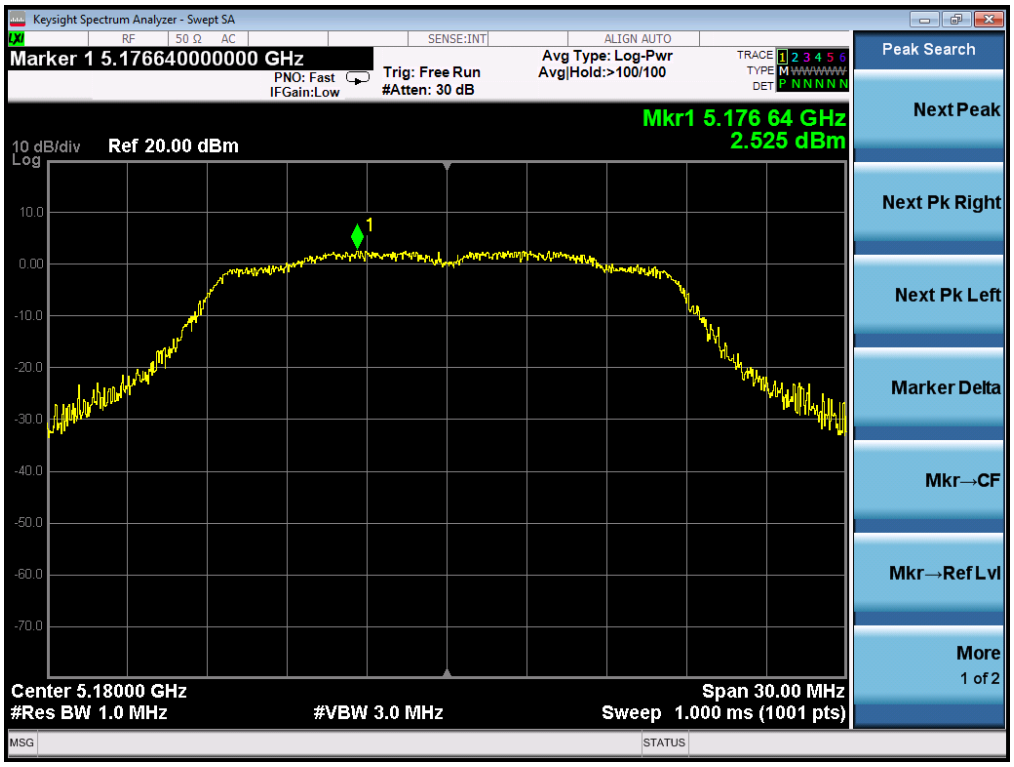
802.11n40 TEST RESULT-ant1:

TEST PLOT FOR 5190MHz

TEST PLOT FOR 5230MHz

802.11ac20 TEST RESULT-ant0

TEST PLOT FOR 5180MHz

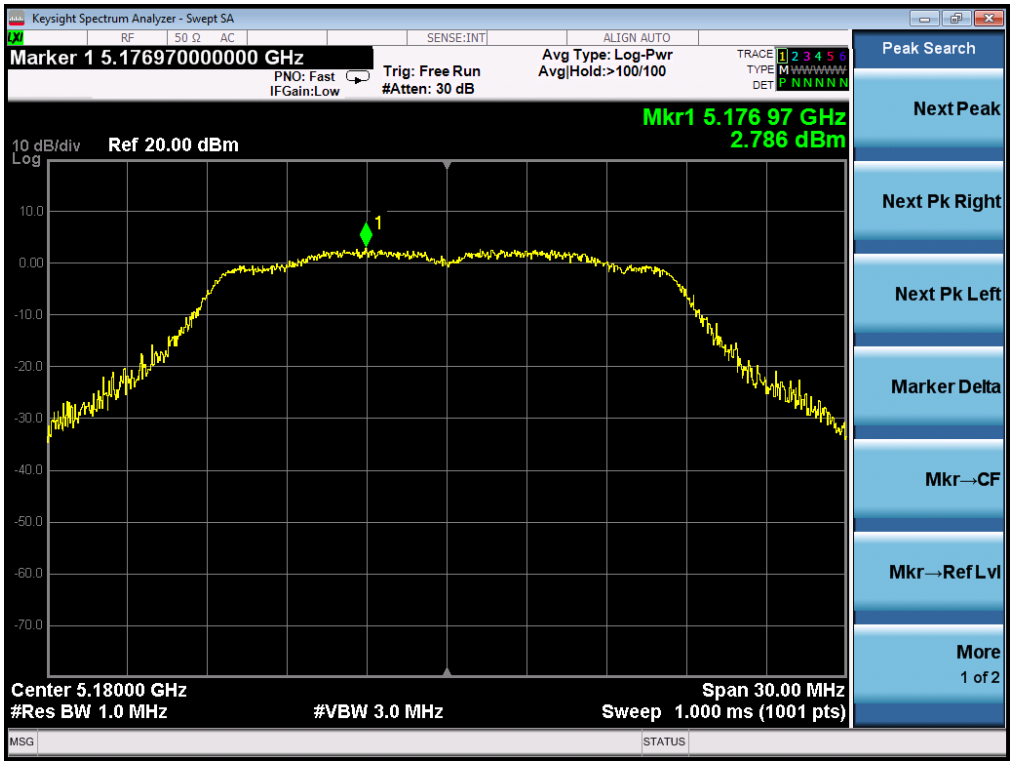


TEST PLOT FOR 5200MHz

TEST PLOT FOR 5240MHz

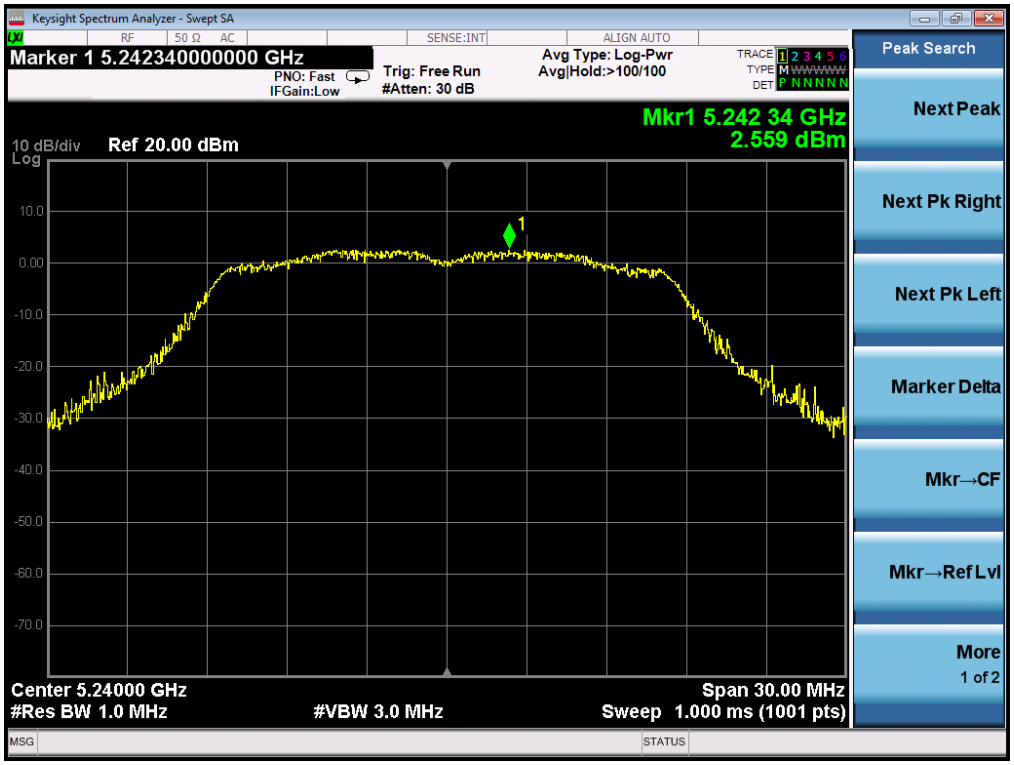
802.11ac20 TEST RESULT-ant1:

TEST PLOT FOR 5180MHz



TEST PLOT FOR 5200MHz

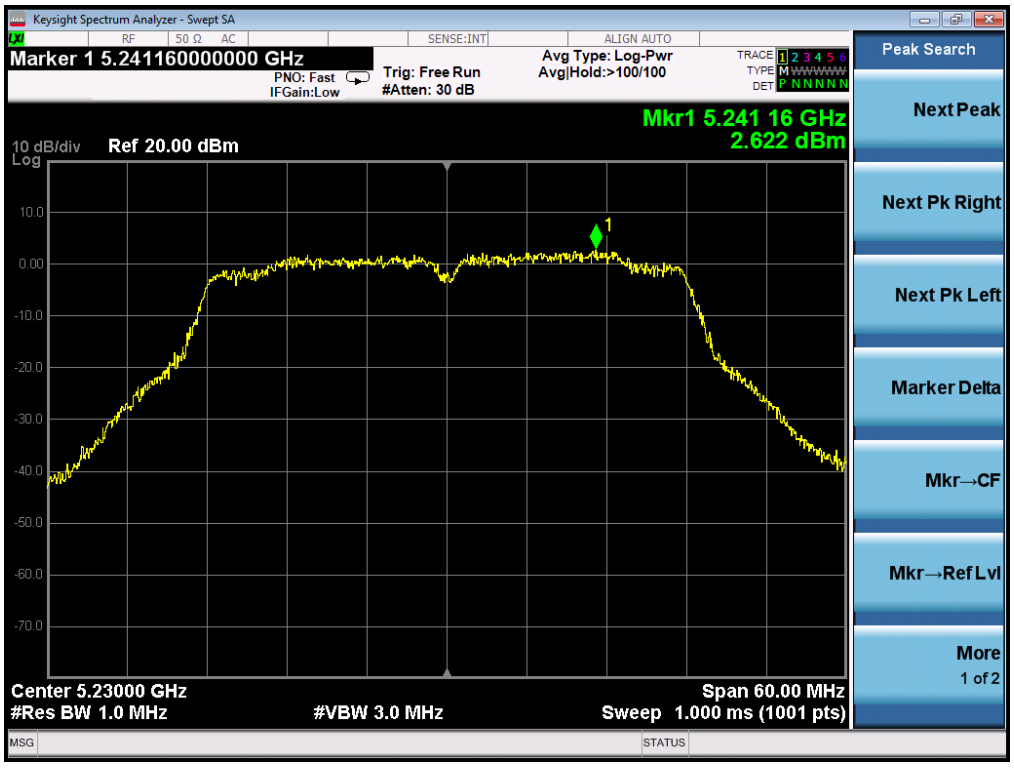
TEST PLOT FOR 5240MHz



802.11ac40 TEST RESULT-ant0:

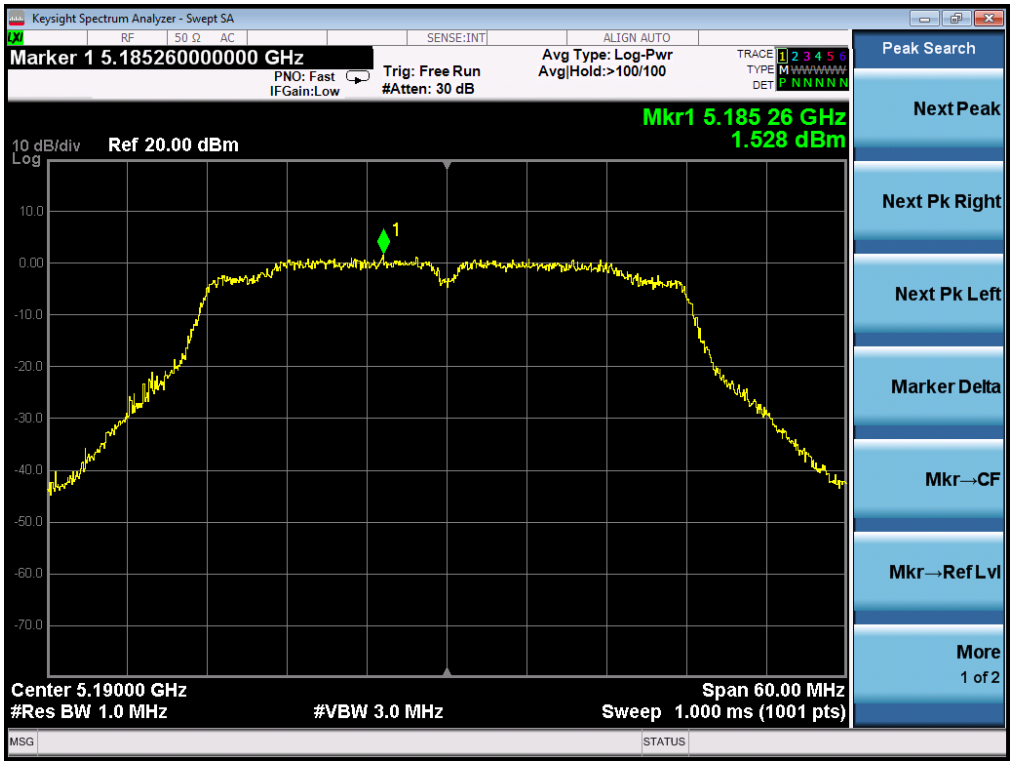
TEST PLOT FOR 5190MHz

TEST PLOT FOR 5230MHz

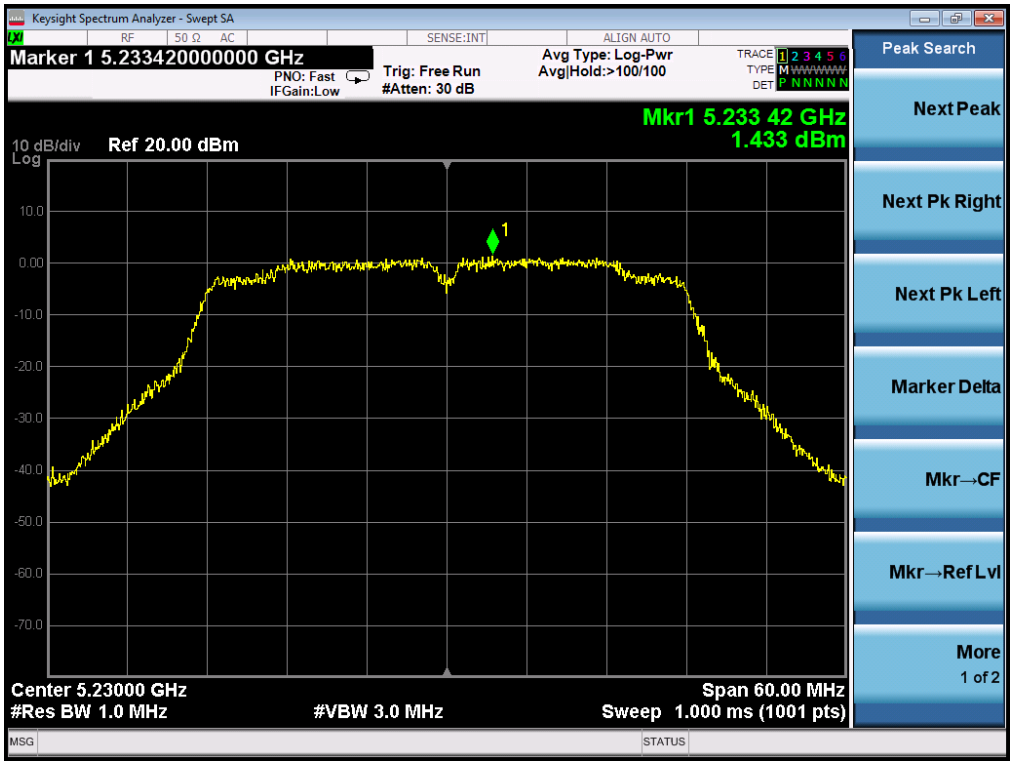


802.11ac40 TEST RESULT-ant1:

TEST PLOT FOR 5190MHz



TEST PLOT FOR 5230MHz



802.11ac80 TEST RESULT-ant0:

TEST PLOT FOR 5210MHz

802.11ac80 TEST RESULT-ant1:

TEST PLOT FOR 5210MHz

10. CONDUCTED SPURIOUS 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 and KDB 662911 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

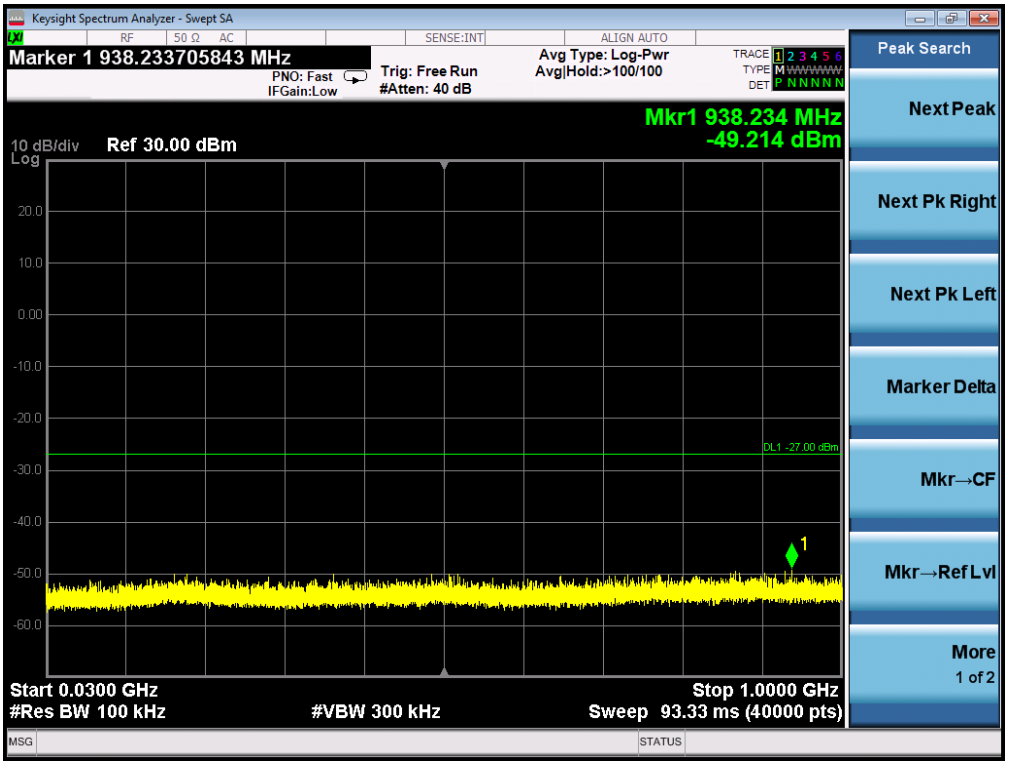
LIMITS AND MEASUREMENT RESULT		
Applicable Limits	Measurement Result	
	Test channel	Criteria
27dBm	5150MHz-5250MHz	PASS

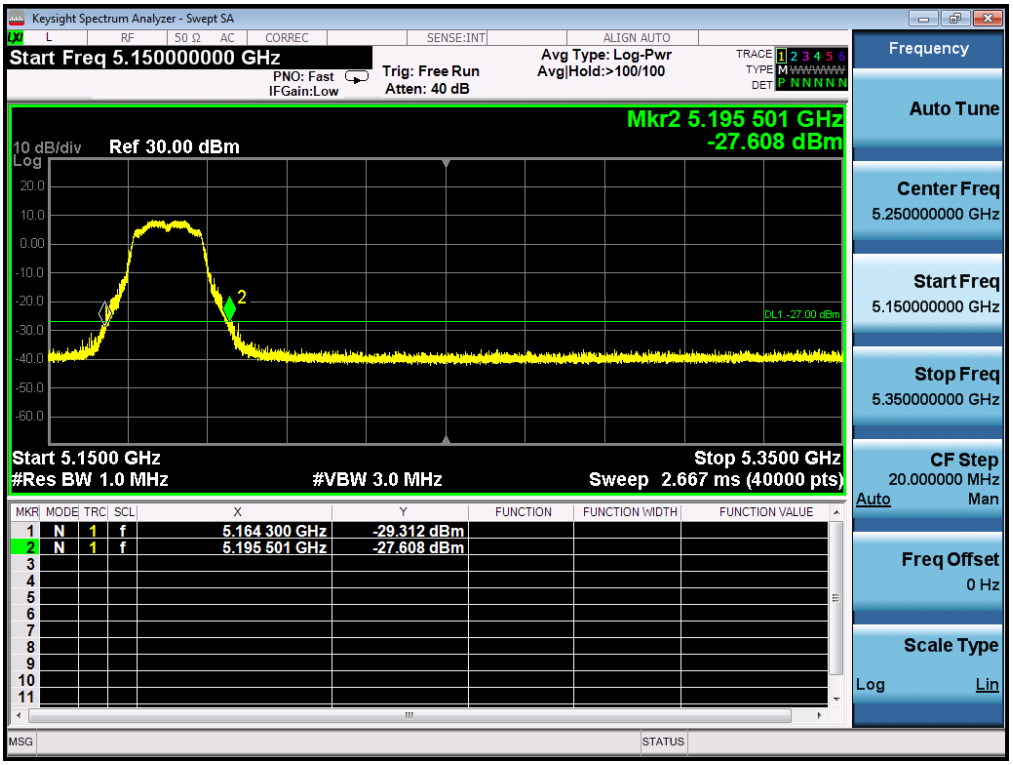
Note：

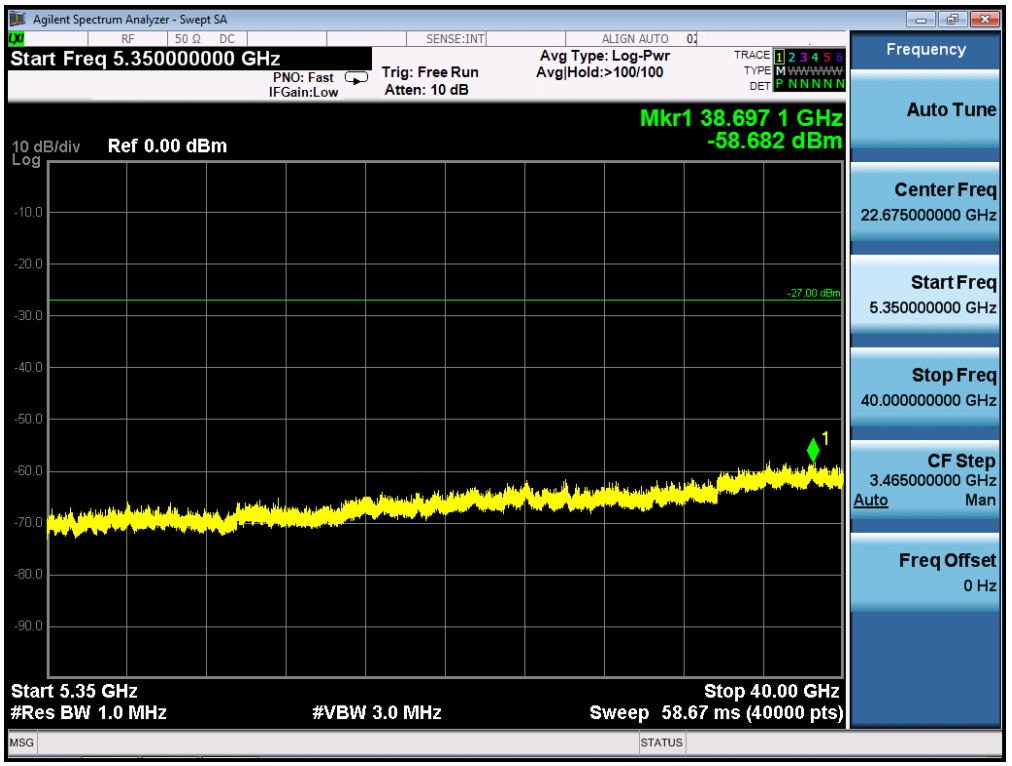
Two transmit chains had been tested, the chain 0 was the worst case and record in the test report.The spurious emission at chain 0 is more than 3dB below the limits, so the MIMO results for the spurious emissions are comply with the requirement.

FOR 802.11A20 MODULATION,ant0

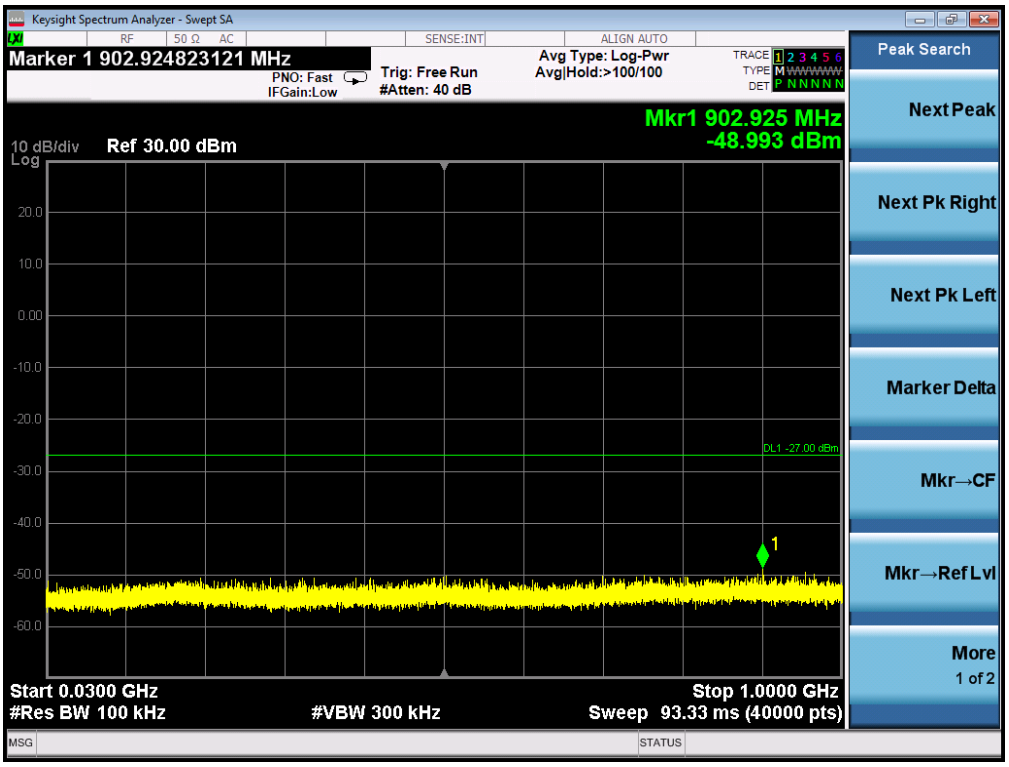
TEST PLOT OF OUT OF BAND EMISSIONS FOR MODULATION IN 5180MHz

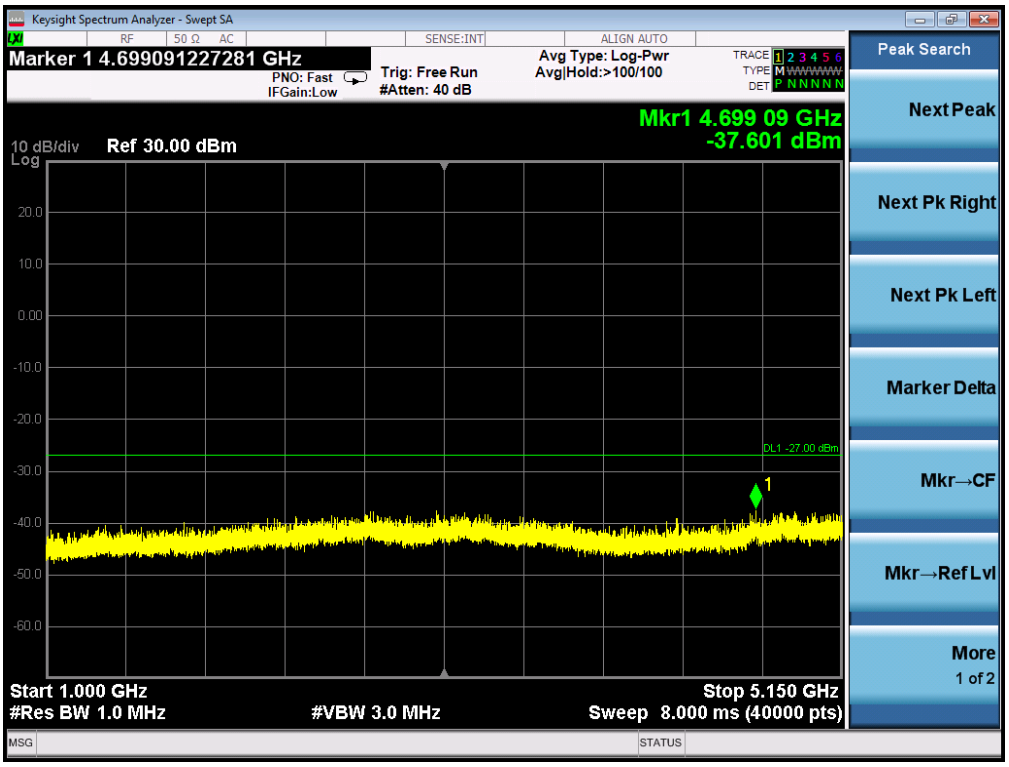


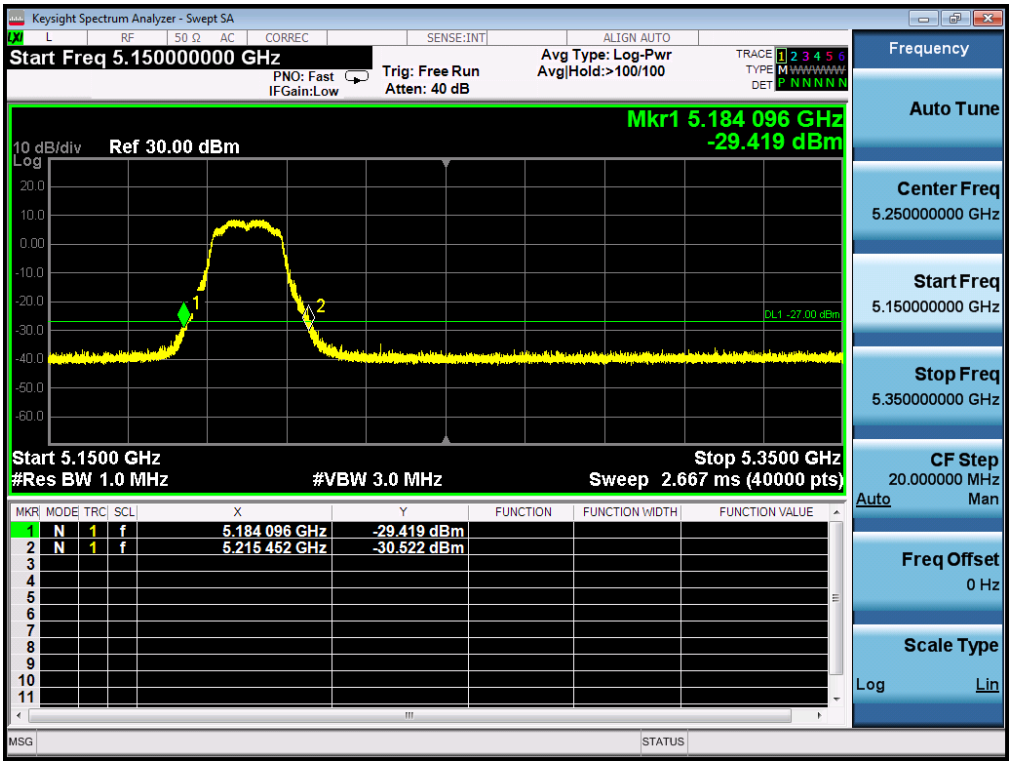

Keysight Spectrum Analyzer - Swept SA
Start Freq 5.150000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr2 5.195 501 GHz
-27.608 dBm
10 dB/div
Log
Ref 30.00 dBm
DL1 -27.00 dBm
Start 5.1500 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 5.3500 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 5.164 300 GHz -29.312 dBm
2 N 1 f 5.195 501 GHz -27.608 dBm
Frequency
Auto Tune
Center Freq
5.250000000 GHz
Start Freq
5.150000000 GHz
Stop Freq
5.350000000 GHz
CF Step
20.000000 MHz
Auto Man
Freq Offset
0 Hz
Scale Type
Log Lin
MSG
STATUS

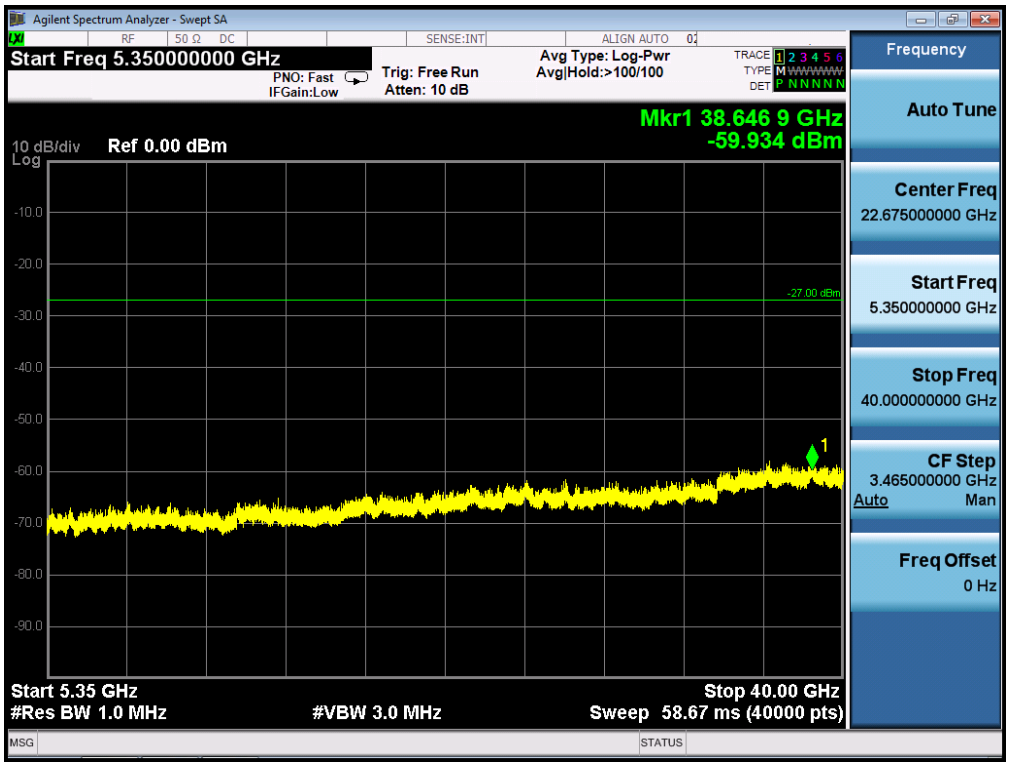

Agilent Spectrum Analyzer - Swept SA
Start Freq 5.350000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 38.697 1 GHz
-58.682 dBm
10 dB/div
Log
Ref 0.00 dBm
-27.00 dBm
Start 5.35 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 40.00 GHz
Sweep 58.67 ms (40000 pts)
Frequency
Auto Tune
Center Freq
22.675000000 GHz
Start Freq
5.350000000 GHz
Stop Freq
40.000000000 GHz
CF Step
3.465000000 GHz
Auto Man
Freq Offset
0 Hz
MSG
STATUS

TEST PLOT OF OUT OF BAND EMISSIONS FOR MODULATION IN 5200MHz

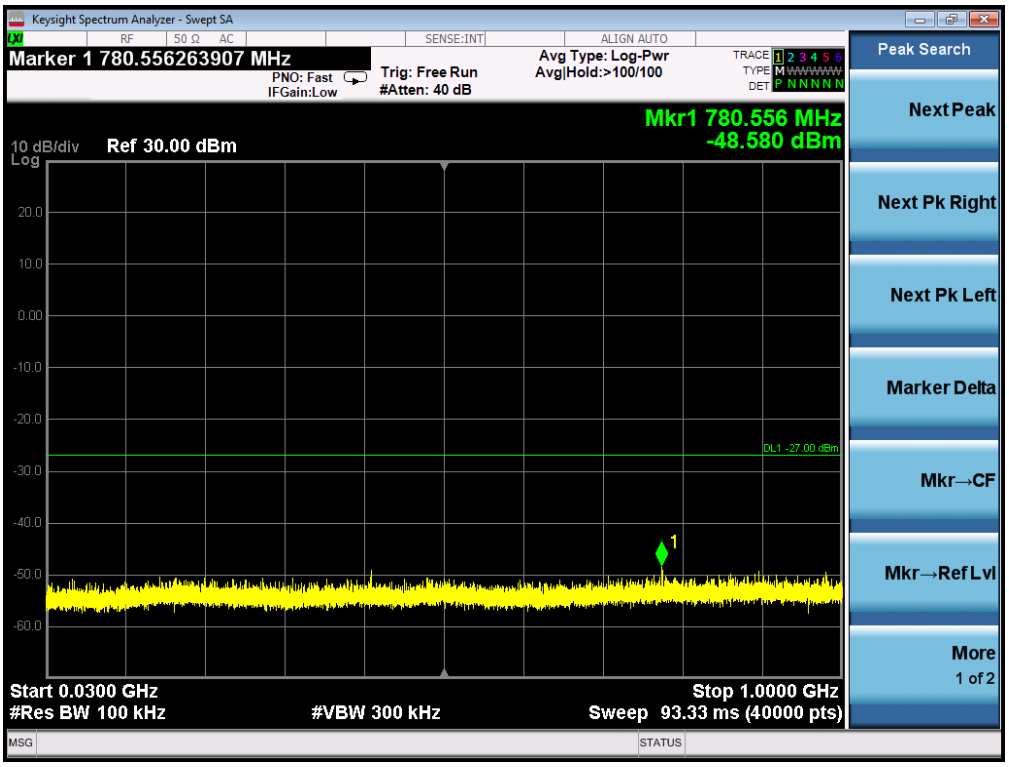


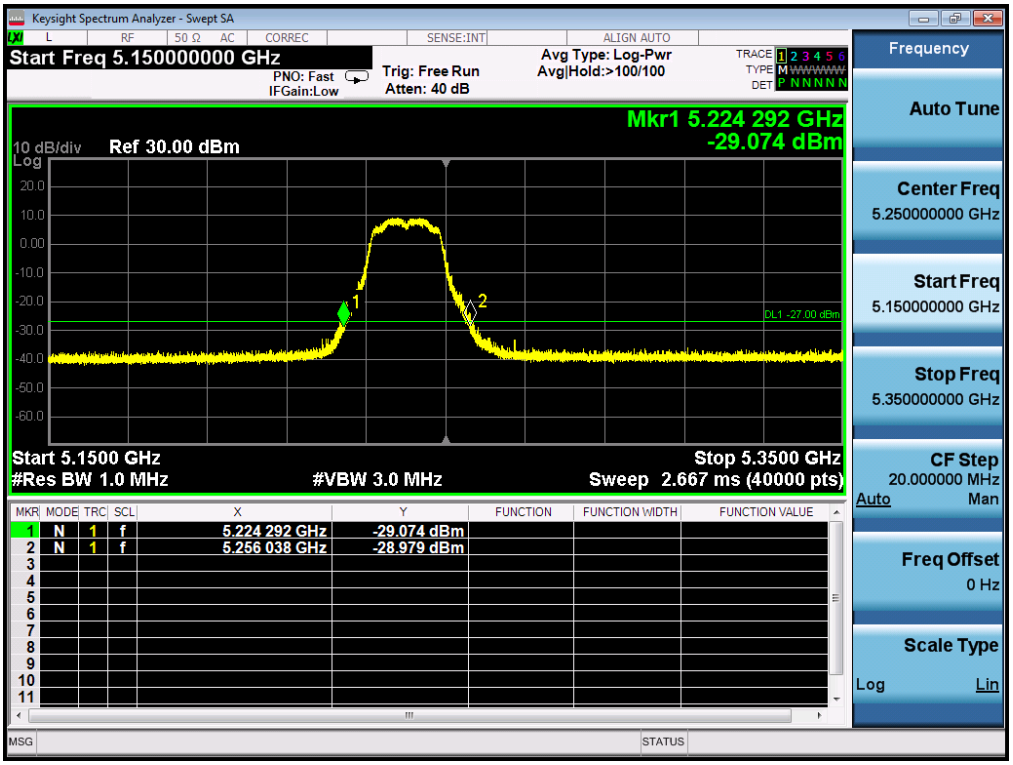


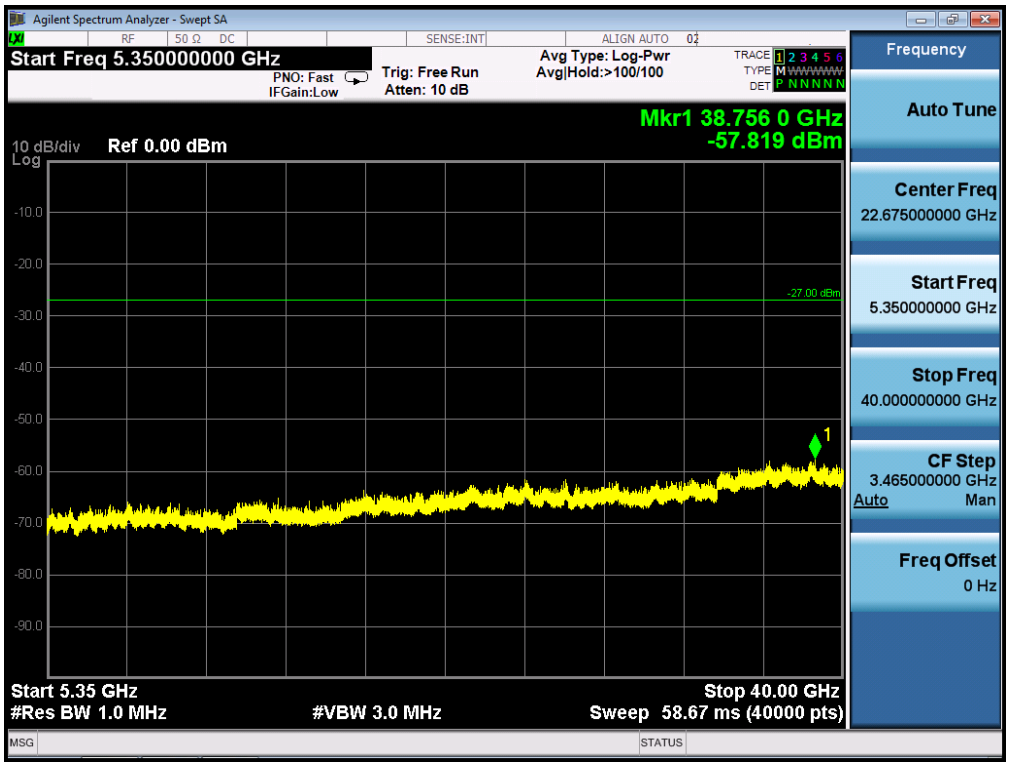

Keysight Spectrum Analyzer - Swept SA
Start Freq 5.150000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 5.184 096 GHz
-29.419 dBm
10 dB/div
Log
Ref 30.00 dBm
DL1 -27.00 dBm
Start 5.1500 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 5.3500 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 5.184 096 GHz -29.419 dBm
2 N 1 f 5.215 452 GHz -30.522 dBm
Frequency
Auto Tune
Center Freq
5.250000000 GHz
Start Freq
5.150000000 GHz
Stop Freq
5.350000000 GHz
CF Step
20.000000 MHz
Auto Man
Freq Offset
0 Hz
Scale Type
Log Lin
MSG
STATUS


Agilent Spectrum Analyzer - Swept SA
Start Freq 5.350000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 38.646 9 GHz
-59.934 dBm
10 dB/div
Log
Ref 0.00 dBm
-27.00 dBm
Start 5.35 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 40.00 GHz
Sweep 58.67 ms (40000 pts)
Frequency
Auto Tune
Center Freq
22.675000000 GHz
Start Freq
5.350000000 GHz
Stop Freq
40.000000000 GHz
CF Step
3.465000000 GHz
Auto Man
Freq Offset
0 Hz
MSG
STATUS

TEST PLOT OF OUT OF BAND EMISSIONS FOR MODULATION IN 5240MHz

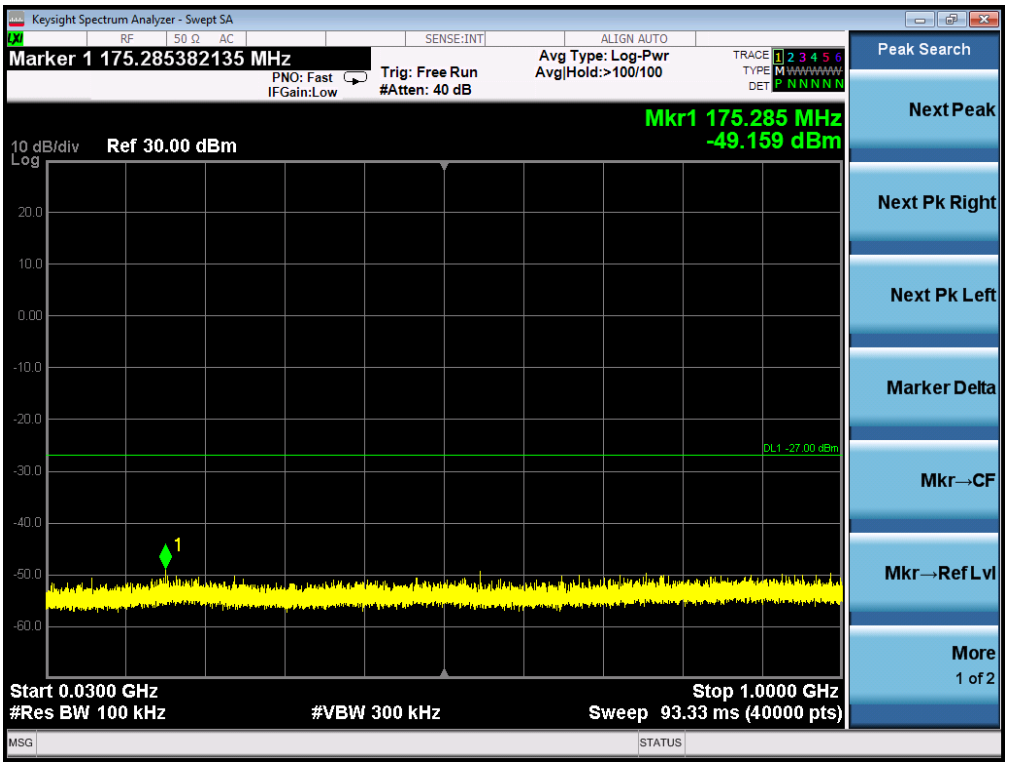


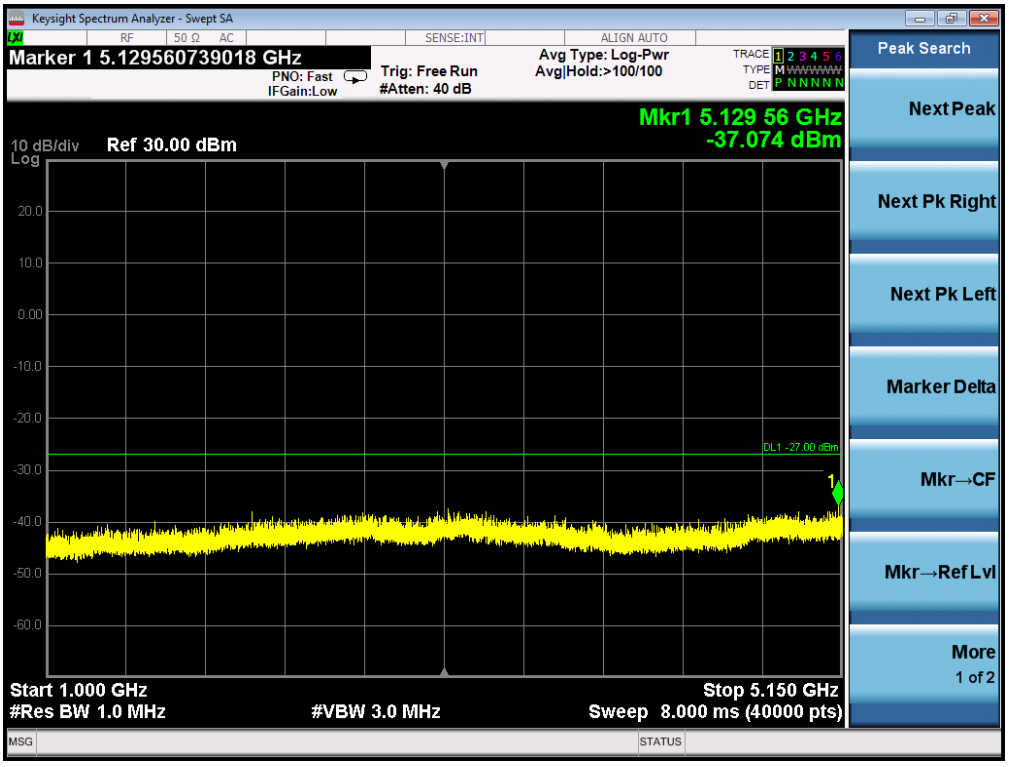

Keysight Spectrum Analyzer - Swept SA
Start Freq 5.150000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 5.224 292 GHz
-29.074 dBm
10 dB/div
Log
Ref 30.00 dBm
DL1 -27.00 dBm
Start 5.1500 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 5.3500 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 5.224 292 GHz -29.074 dBm
2 N 1 f 5.256 038 GHz -28.979 dBm
Frequency
Auto Tune
Center Freq
5.250000000 GHz
Start Freq
5.150000000 GHz
Stop Freq
5.350000000 GHz
CF Step
20.000000 MHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

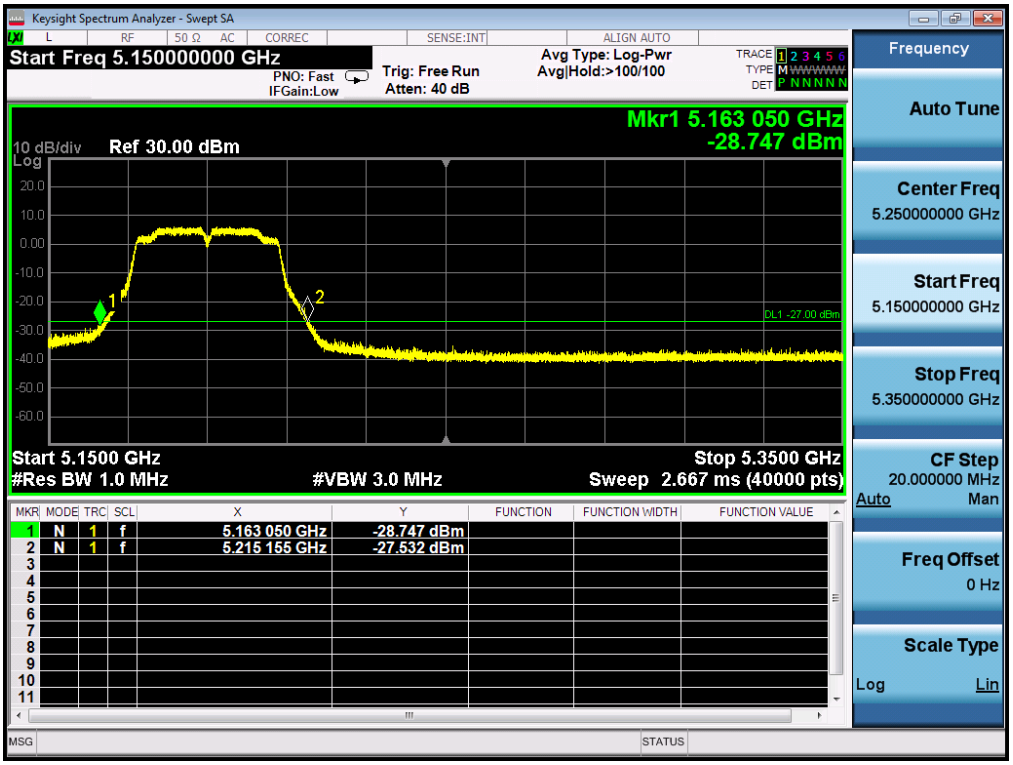

Agilent Spectrum Analyzer - Swept SA
Start Freq 5.350000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 38.756 0 GHz
-57.819 dBm
10 dB/div
Log
Ref 0.00 dBm
-27.00 dBm
Start 5.35 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 40.00 GHz
Sweep 58.67 ms (40000 pts)
Frequency
Auto Tune
Center Freq
22.675000000 GHz
Start Freq
5.350000000 GHz
Stop Freq
40.000000000 GHz
CF Step
3.465000000 GHz
Auto
Man
Freq Offset
0 Hz

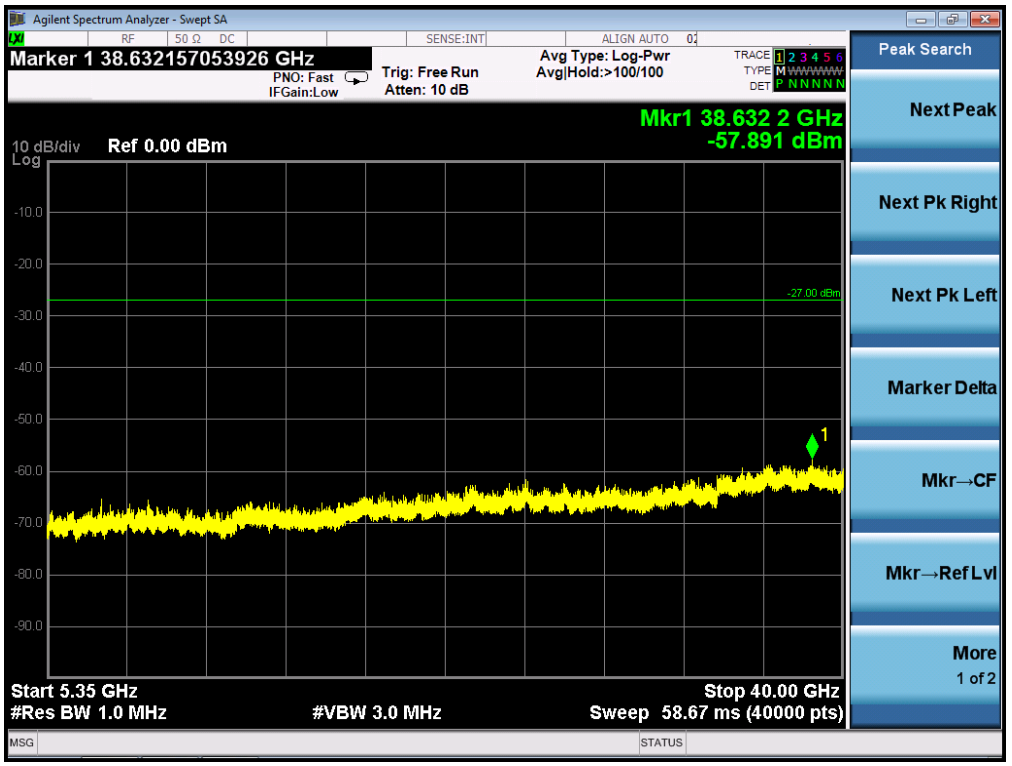
FOR 802.11N40 MODULATION, ant0

TEST PLOT OF OUT OF BAND EMISSIONS FOR MODULATION IN 5190MHz

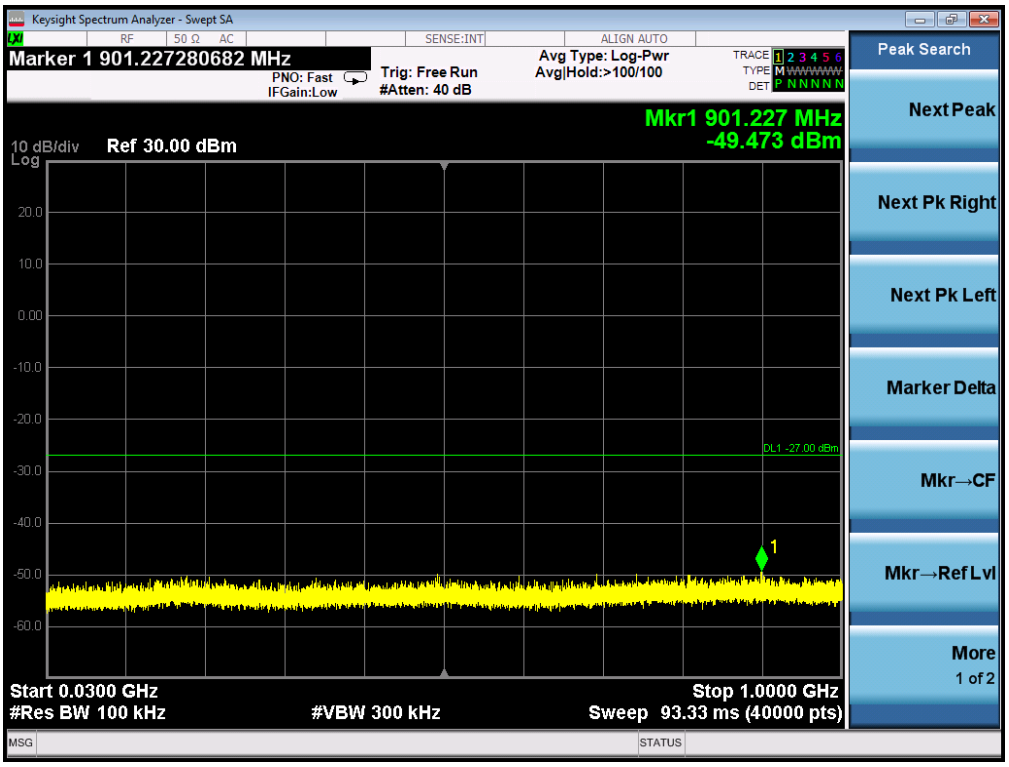


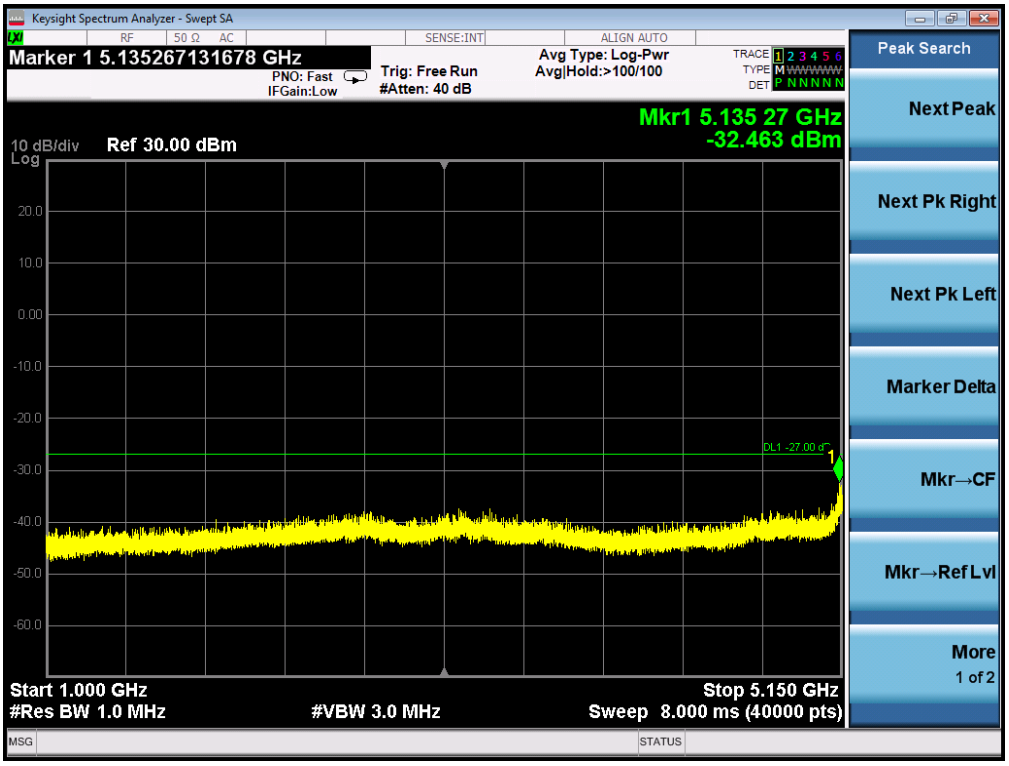


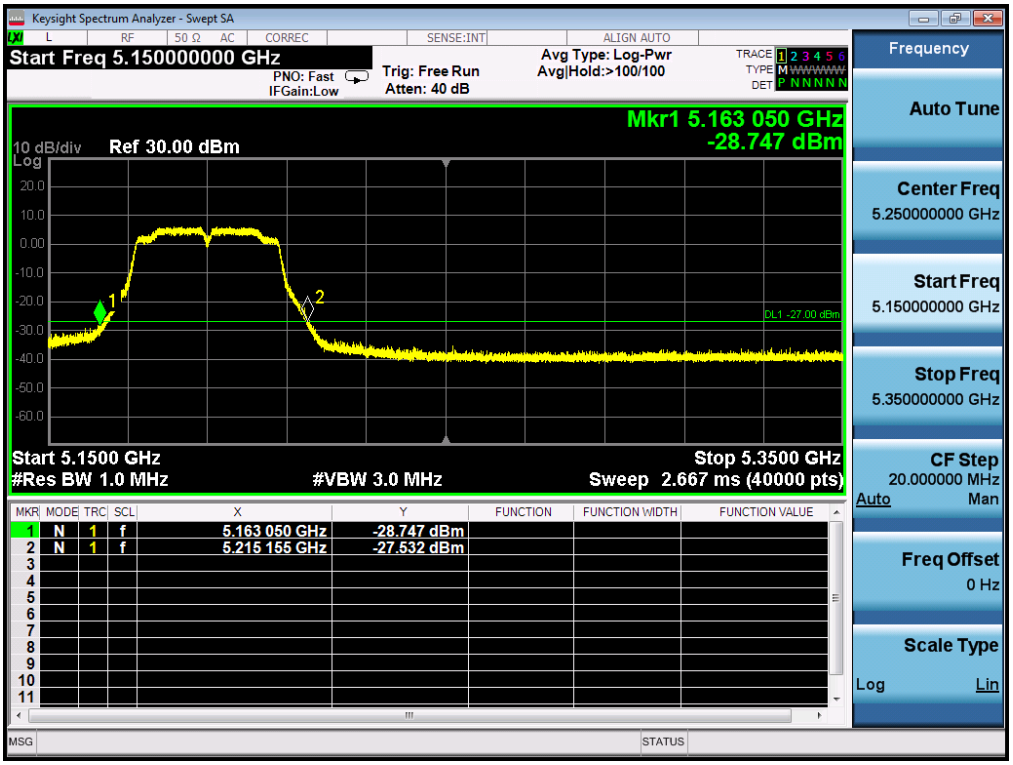

Keysight Spectrum Analyzer - Swept SA
Start Freq 5.150000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 5.163 050 GHz
-28.747 dBm
10 dB/div
Log
Ref 30.00 dBm
DL1 -27.00 dBm
Start 5.1500 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 5.3500 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 5.163 050 GHz -28.747 dBm
2 N 1 f 5.215 155 GHz -27.532 dBm
Frequency
Auto Tune
Center Freq
5.250000000 GHz
Start Freq
5.150000000 GHz
Stop Freq
5.350000000 GHz
CF Step
20.000000 MHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin
MSG
STATUS

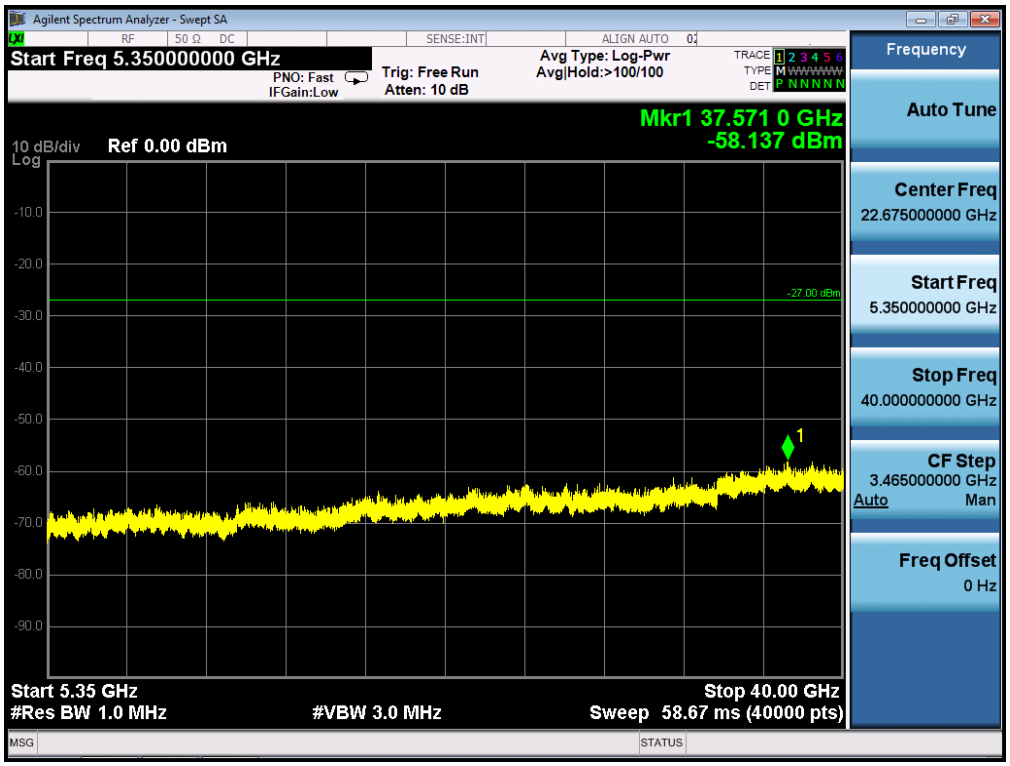

Agilent Spectrum Analyzer - Swept SA
Marker 1 38.632157053926 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 38.632 2 GHz
-57.891 dBm
10 dB/div
Log
Ref 0.00 dBm
-27.00 dBm
Start 5.35 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 40.00 GHz
Sweep 58.67 ms (40000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS

TEST PLOT OF OUT OF BAND EMISSIONS FOR MODULATION IN 5230MHz



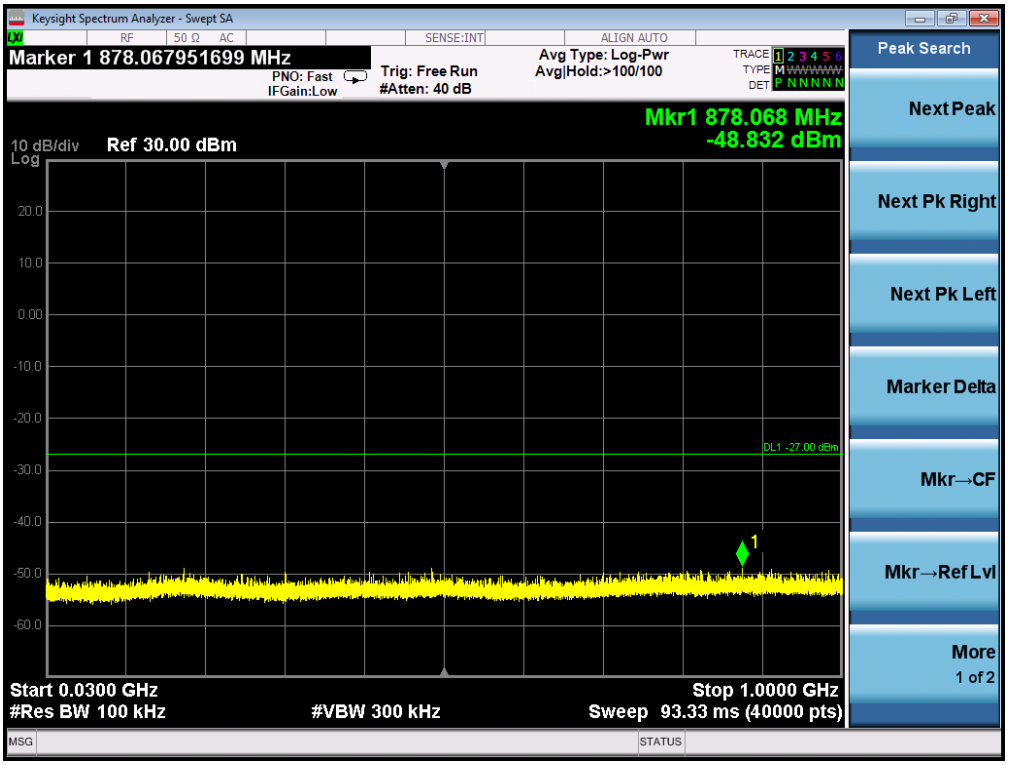


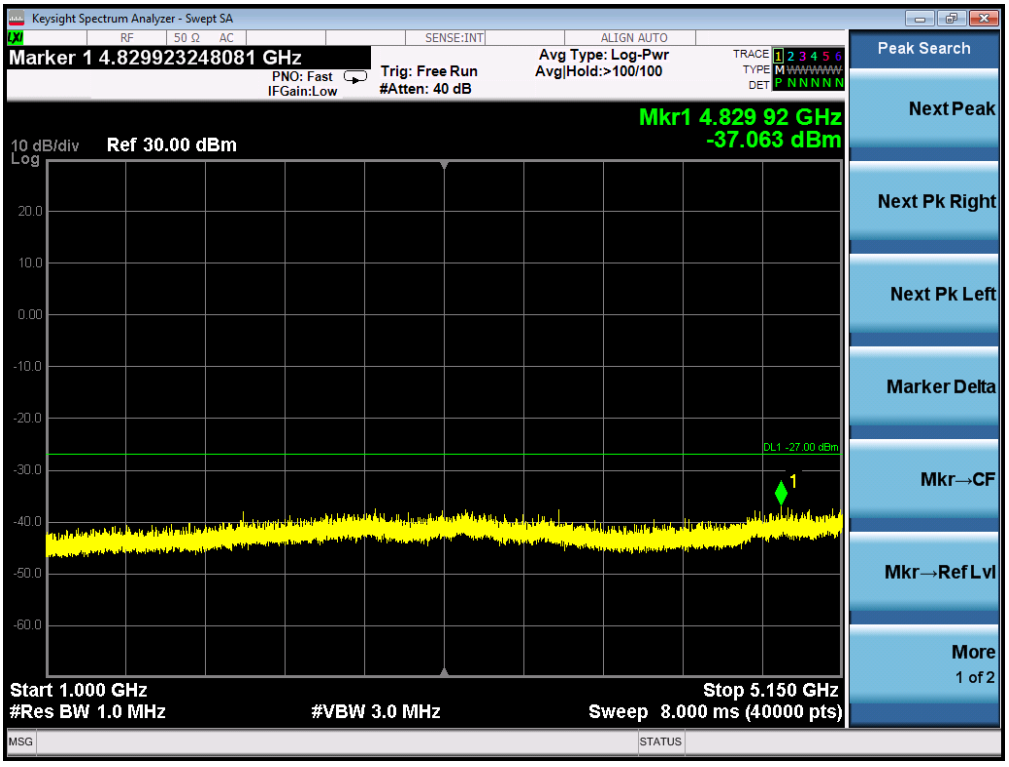

Keysight Spectrum Analyzer - Swept SA
Start Freq 5.150000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 5.163 050 GHz
-28.747 dBm
10 dB/div
Log
Ref 30.00 dBm
DL1 -27.00 dBm
Start 5.1500 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 5.3500 GHz
Sweep 2.667 ms (40000 pts)
1 N 1 f 5.163 050 GHz -28.747 dBm
2 N 1 f 5.215 155 GHz -27.532 dBm
Frequency
Auto Tune
Center Freq
5.250000000 GHz
Start Freq
5.150000000 GHz
Stop Freq
5.350000000 GHz
CF Step
20.000000 MHz
Auto Man
Freq Offset
0 Hz
Scale Type
Log Lin
MSG
STATUS

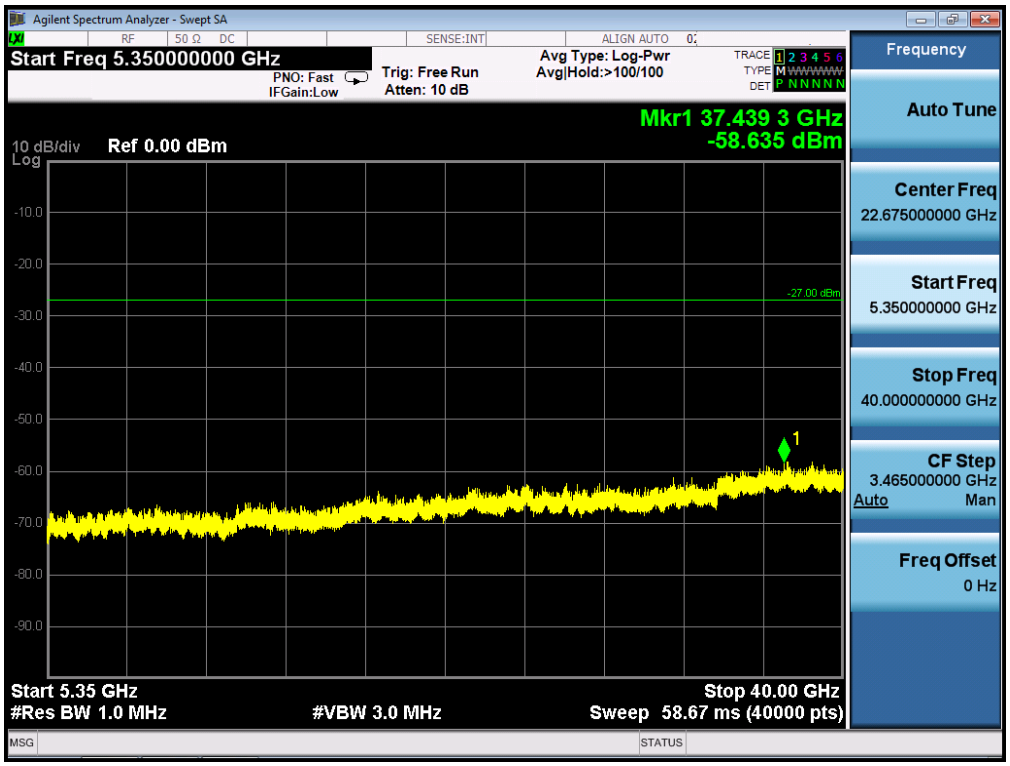

Agilent Spectrum Analyzer - Swept SA
Start Freq 5.350000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 37.571 0 GHz
-58.137 dBm
10 dB/div
Log
Ref 0.00 dBm
-27.00 dBm
Start 5.35 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 40.00 GHz
Sweep 58.67 ms (40000 pts)
Frequency
Auto Tune
Center Freq
22.675000000 GHz
Start Freq
5.350000000 GHz
Stop Freq
40.000000000 GHz
CF Step
3.465000000 GHz
Auto Man
Freq Offset
0 Hz
MSG
STATUS

FOR 802.11AC80 MODULATION, ant0

TEST PLOT OF OUT OF BAND EMISSIONS FOR MODULATION IN 5210MHz







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.

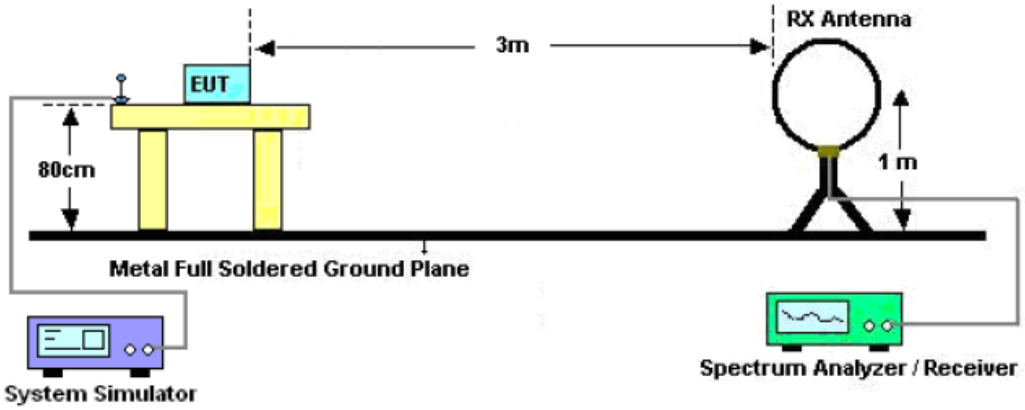
11. RADIATED EMISSION

11.1. MEASUREMENT PROCEDURE

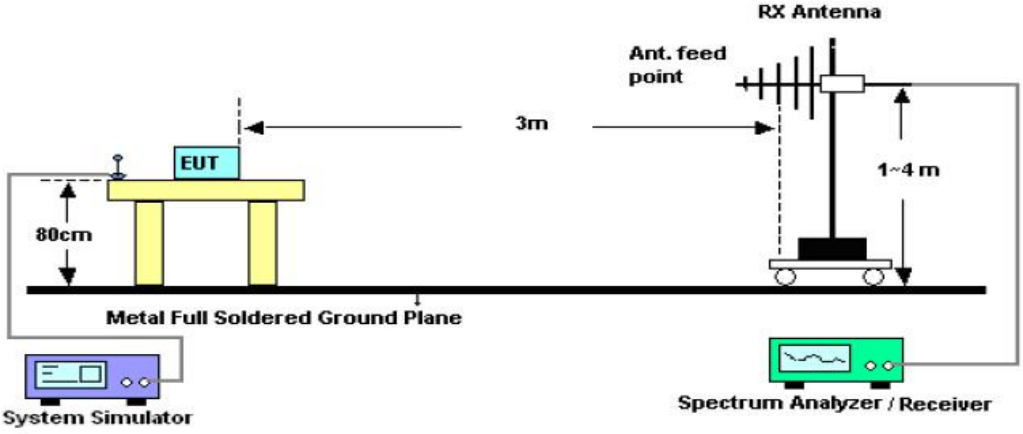
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated 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.

11.2. TEST SETUP

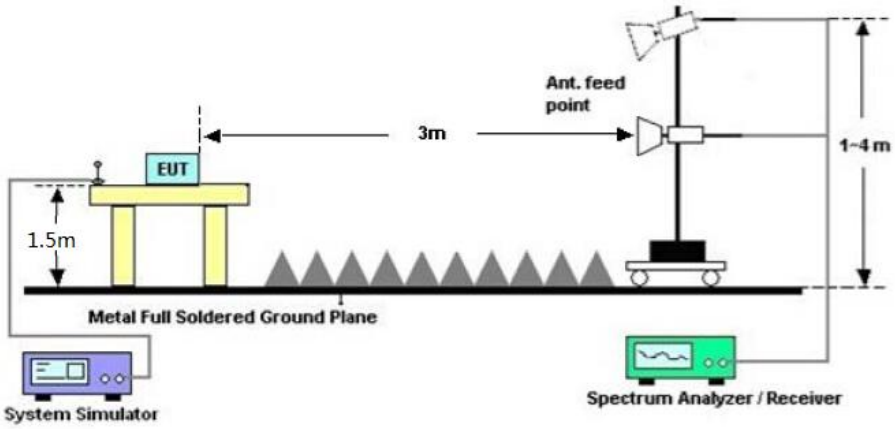
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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.

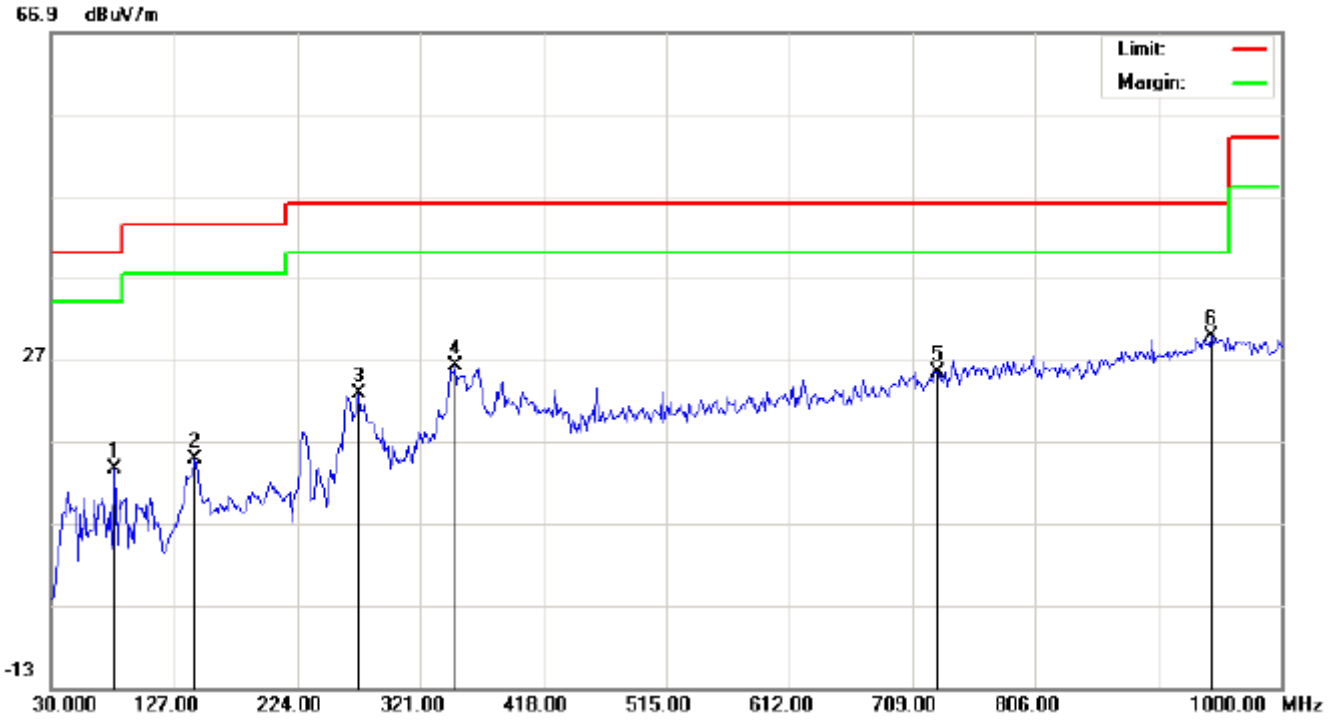
11.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

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

RADIATED EMISSION BELOW 1GHZ

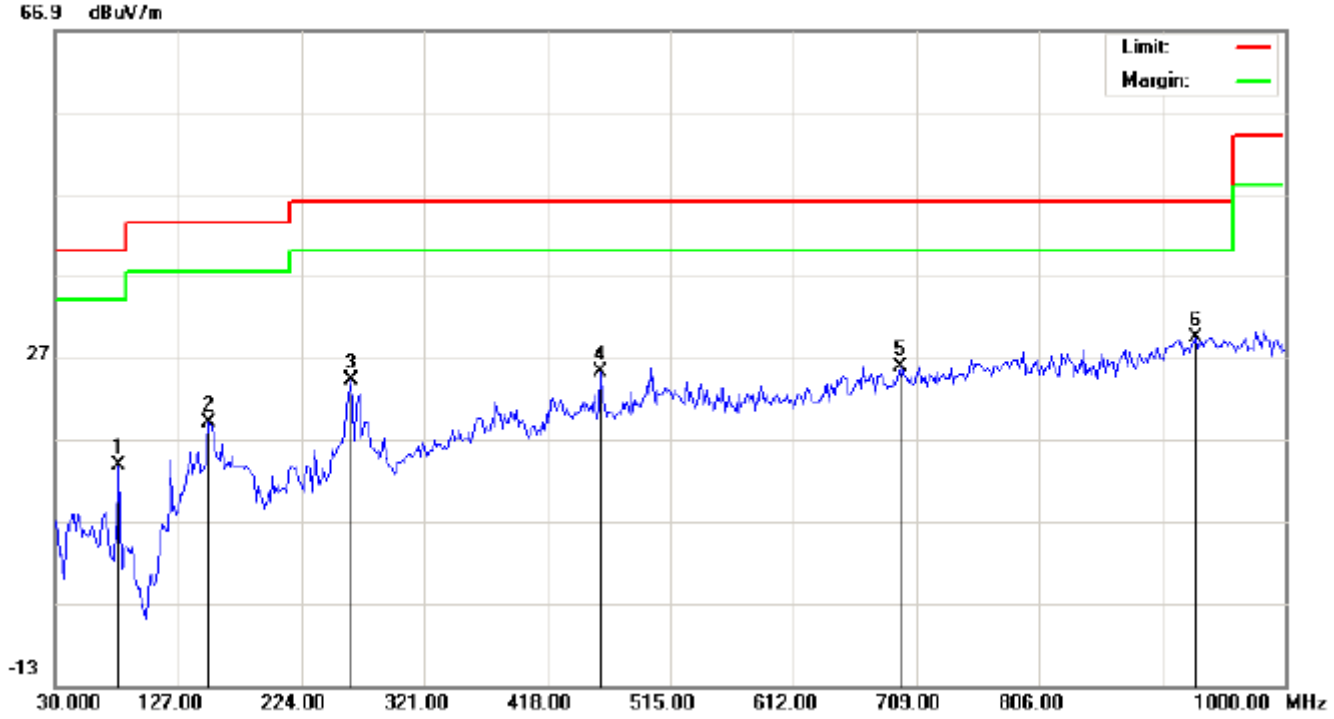
EUT	RouterBOARD cAP	**Model Name**	cAP ac
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11a20 5180MHz,ant0	**Antenna**	Horizontal



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		80.1167	13.14	0.50	13.64	40.00	-26.36	peak			
2		143.1667	0.32	14.43	14.75	43.50	-28.75	peak			
3		272.5000	12.05	10.73	22.78	46.00	-23.22	peak			
4		348.4833	7.58	18.64	26.22	46.00	-19.78	peak			
5		728.4000	-0.56	26.01	25.45	46.00	-20.55	peak			
6	*	945.0333	0.00	29.86	29.86	46.00	-16.14	peak			

RESULT: PASS

EUT	RouterBOARD cAP	Model Name	cAP ac
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11a20 5180MHz,ant0	Antenna	Vertical



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		80.1167	12.02	1.84	13.86	40.00	-26.14	peak			
2		151.2500	3.66	15.27	18.93	43.50	-24.57	peak			
3		262.8000	9.82	14.29	24.11	46.00	-21.89	peak			
4		460.0333	4.43	20.70	25.13	46.00	-20.87	peak			
5		696.0667	0.77	25.08	25.85	46.00	-20.15	peak			
6	*	928.8667	0.09	29.41	29.50	46.00	-16.50	peak			

RESULT: PASS

Note: All test channels had been tested. The 802.11a20 at 5180MHz 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.

RADIATED EMISSION ABOVE 1GHZ

EUT	RouterBOARD cAP	**Model Name**	cAP ac
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11a20 5180MHz,ant0	**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
10360.120	48.08	3.75	51.83	74	-22.17	peak
10360.120	43.41	3.75	47.16	54	-6.84	AVG
15540.180	42.14	8.16	50.3	74	-23.7	peak
15540.180	37.39	8.16	45.55	54	-8.45	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
10360.120	48.08	3.75	51.83	74	-22.17	peak
10360.120	43.41	3.75	47.16	54	-6.84	AVG
15540.180	42.14	8.16	50.3	74	-23.7	peak
15540.180	37.39	8.16	45.55	54	-8.45	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	RouterBOARD cAP	Model Name	cAP ac
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11a20 5200MHz,ant0	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
10400.120	41.23	10.38	51.61	74	-22.39	peak
10400.120	34.64	10.38	45.02	54	-8.98	AVG
15600.180	34.57	10.38	44.95	74	-29.05	peak
15600.180	37.97	9.27	47.24	54	-6.76	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
10400.120	40.74	9.27	50.01	74	-23.99	peak
10400.120	35.86	9.27	45.13	54	-8.87	AVG
15600.180	40.25	10.38	50.63	74	-23.37	peak
15600.180	34.45	10.38	44.83	54	-9.17	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	RouterBOARD cAP	Model Name	cAP ac
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11a20 5240MHz,ant0	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
10480.120	42.47	9.27	51.74	74	-22.26	peak
10480.120	37.61	9.27	46.88	54	-7.12	AVG
15720.180	40.87	10.38	51.25	74	-22.75	peak
15720.180	34.28	10.38	44.66	54	-9.34	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
10480.120	40.38	9.27	49.65	74	-24.35	peak
10480.120	35.5	9.27	44.77	54	-9.23	AVG
15720.180	39.89	10.38	50.27	74	-23.73	peak
15720.180	34.09	10.38	44.47	54	-9.53	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	RouterBOARD cAP	Model Name	cAP ac
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n20mimo 5180MHz,ant0+ant1	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
10360.120	45.75	9.14	54.89	74	-19.11	peak
10360.120	38.69	9.14	47.83	54	-6.17	AVG
15540.180	43.42	10.22	53.64	74	-20.36	peak
15540.180	37.35	10.22	47.57	54	-6.43	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
10360.120	44.58	9.14	53.72	74	-20.28	peak
10360.120	37.94	9.14	47.08	54	-6.92	AVG
15540.180	42.35	10.22	52.57	74	-21.43	peak
15540.180	36.02	10.22	46.24	54	-7.76	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	RouterBOARD cAP	Model Name	cAP ac
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n20mimo 5200MHz,ant0+ant1	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
10400.120	43.07	9.27	52.34	74	-21.66	peak
10400.120	38.21	9.27	47.48	54	-6.52	AVG
15600.180	41.47	10.38	51.85	74	-22.15	peak
15600.180	34.88	10.38	45.26	54	-8.74	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
10400.120	40.98	9.27	50.25	74	-23.75	peak
10400.120	36.1	9.27	45.37	54	-8.63	AVG
15600.180	40.49	10.38	50.87	74	-23.13	peak
15600.180	34.69	10.38	45.07	54	-8.93	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	RouterBOARD cAP	Model Name	cAP ac
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n20mimo 5240MHz,ant0+ant1	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
10480.120	44.55	9.27	53.82	74	-20.18	peak
10480.120	39.64	9.27	48.91	54	-5.09	AVG
15720.180	43.01	10.38	53.39	74	-20.61	peak
15720.180	37.82	10.38	48.2	54	-5.8	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
10480.120	43.92	9.27	53.19	74	-20.81	peak
10480.120	38.55	9.27	47.82	54	-6.18	AVG
15720.180	41.76	10.38	52.14	74	-21.86	peak
15720.180	36.58	10.38	46.96	54	-7.04	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Note: All the case had been tested. The 802.11a 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.

12. BAND EDGE EMISSION

12.1. MEASUREMENT PROCEDURE

1. The EUT operates at transmitting mode. The operate channel is tested to verify the largest transmission and spurious emissions power at the continuous transmission mode.

2. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission: (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

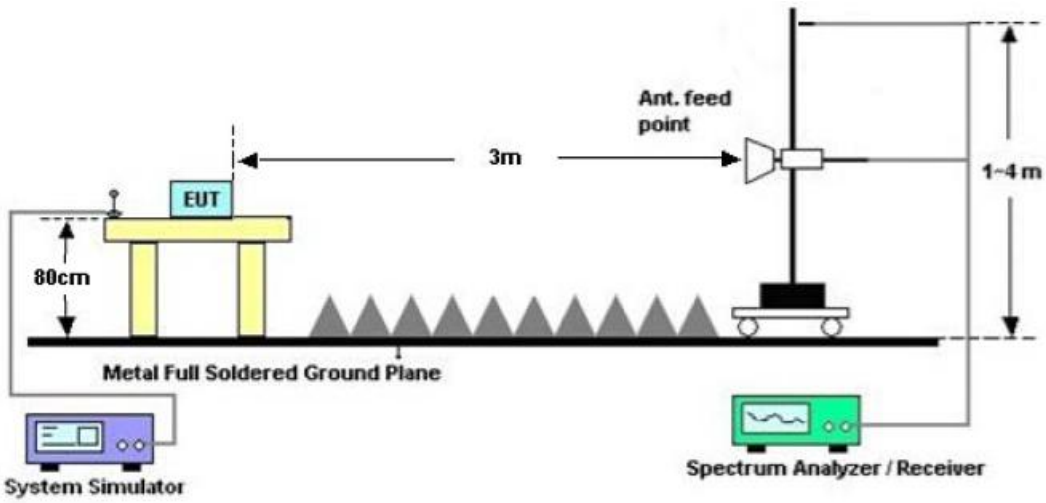
(b) AVERAGE: RBW=1MHz ; VBW=1/on time(1KHz) / Sweep=AUTO

3. Other procedures refer to clause 11.2.

Note:

1. Factor=Antenna Factor + Cable loss - Amplifier gain. Field Strength=Factor + Reading level
2. The factor had been edited in the “Input Correction” of the Spectrum Analyzer. So the Amplitude of test plots is equal to Reading level plus the Factor in dB. Use the A dB(μV) to represent the Amplitude. Use the F dB(μV/m) to represent the Field Strength. So A=F.
3. Only the data of band edge emission at the restricted band 4.5GHz-5.15GHz record in the report. Other restricted band 5.35GHz-5.46GHz and 7.25GHz-7.77GHz were considered as ambient noise. No recording in the test report.

12.2. TEST SET-UP

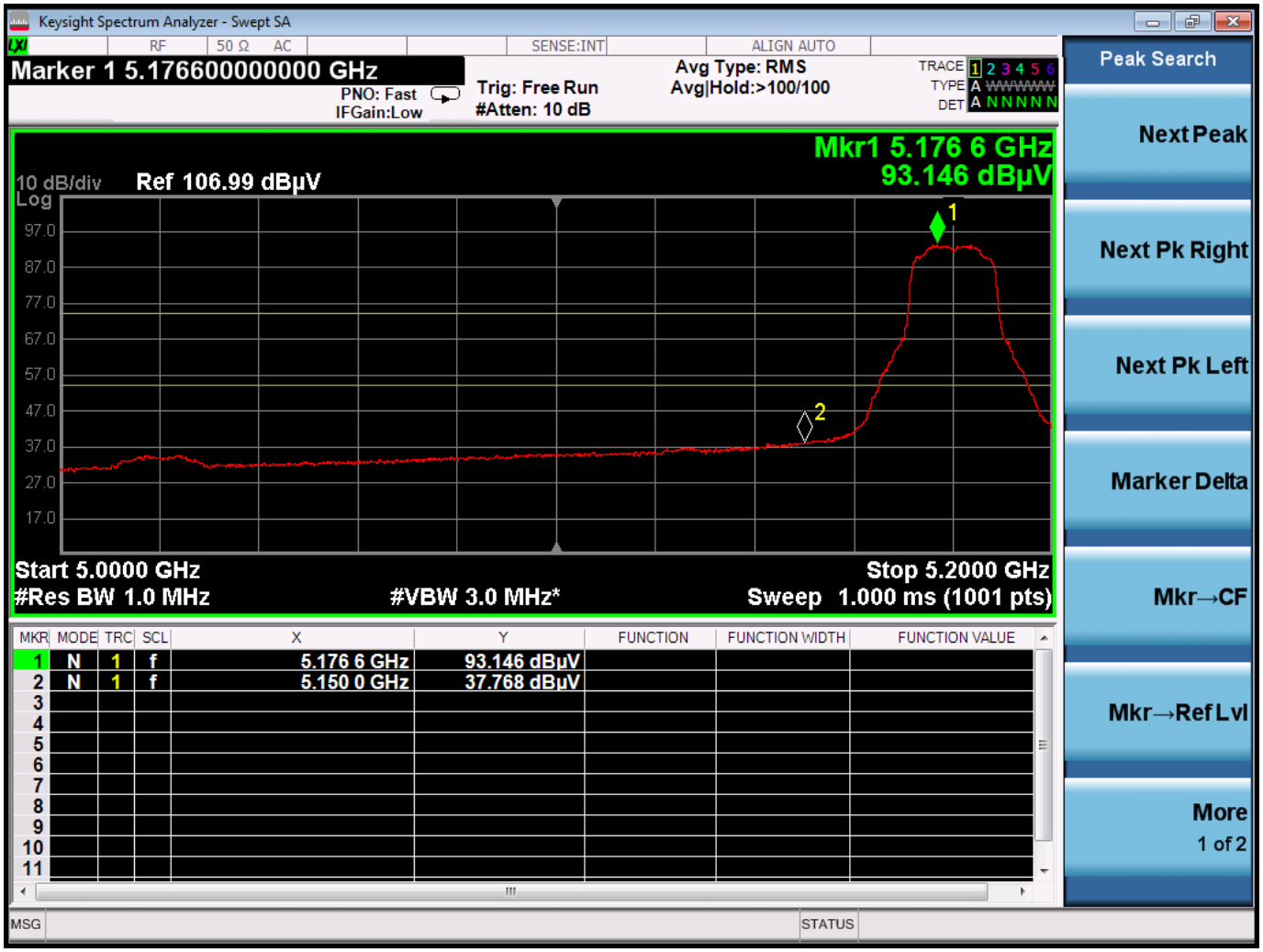


12.3. TEST RESULT

EUT	RouterBOARD cAP	Model Name	cAP ac
Temperature	25℃	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11a20 5180MHz,ant0	Antenna	Horizontal

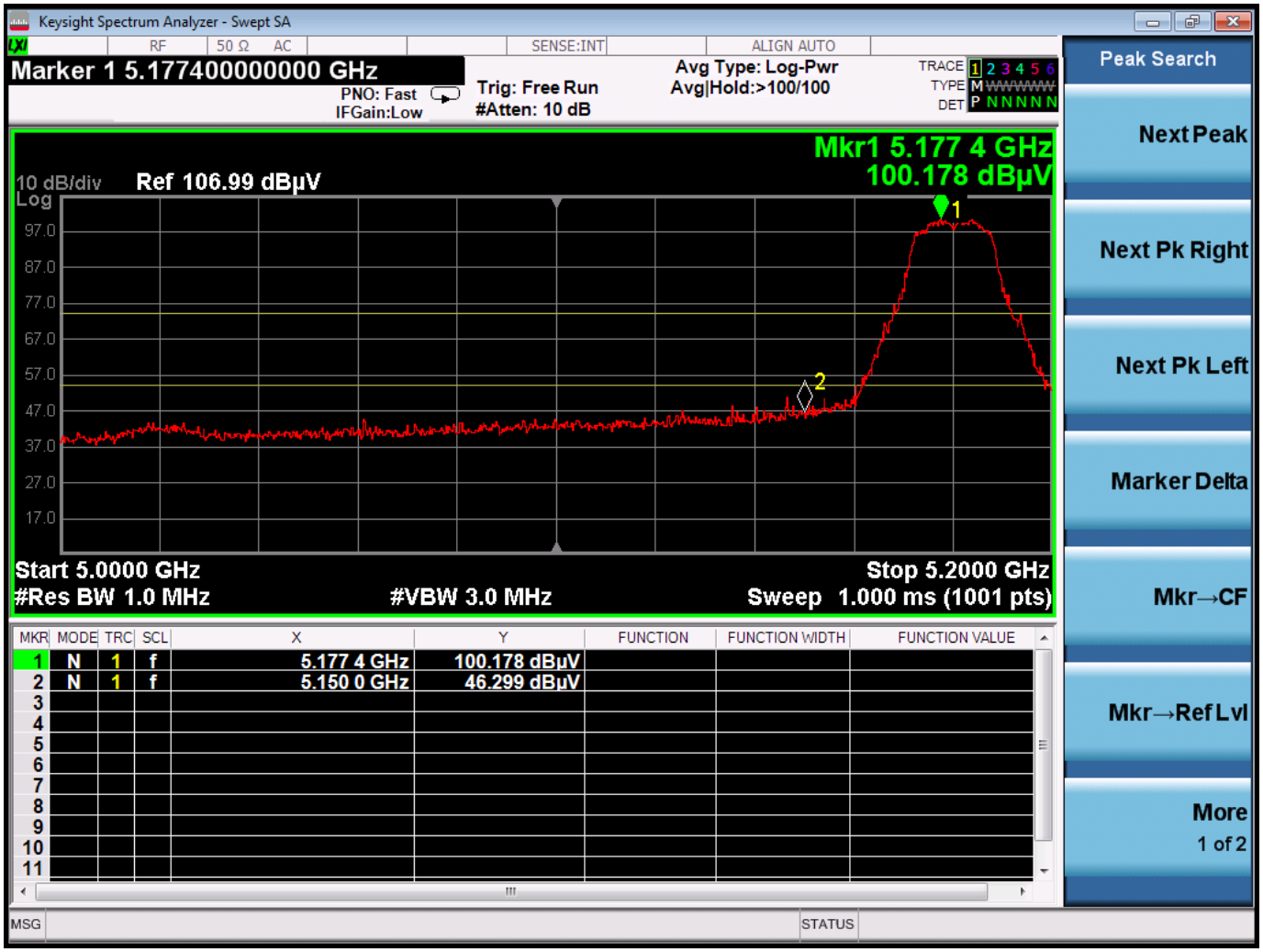
PK Value

AV Value

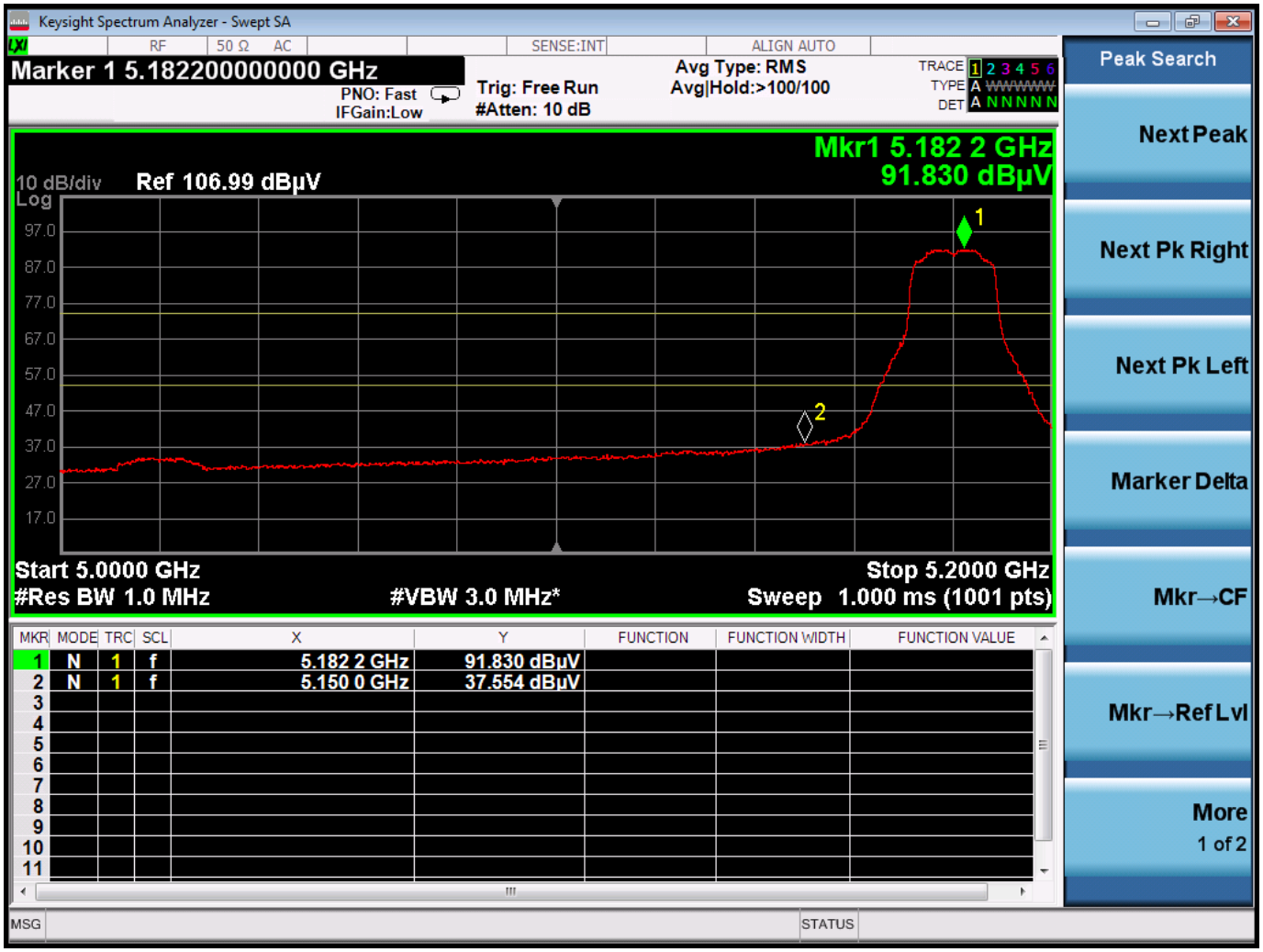

Keysight Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 5.176600000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: RMS
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE A
DET A N N N N N
Mkr1 5.176 6 GHz
93.146 dBµV
10 dB/div
Log
Ref 106.99 dBµV
97.0
87.0
77.0
67.0
57.0
47.0
37.0
27.0
17.0
Start 5.0000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Stop 5.2000 GHz
Sweep 1.000 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 5.176 6 GHz 93.146 dBµV
2 N 1 f 5.150 0 GHz 37.768 dBµV
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS

EUT	RouterBOARD cAP	Model Name	cAP ac
Temperature	25℃	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11a20 5180MHz,ant0	Antenna	Vertical

PK Value

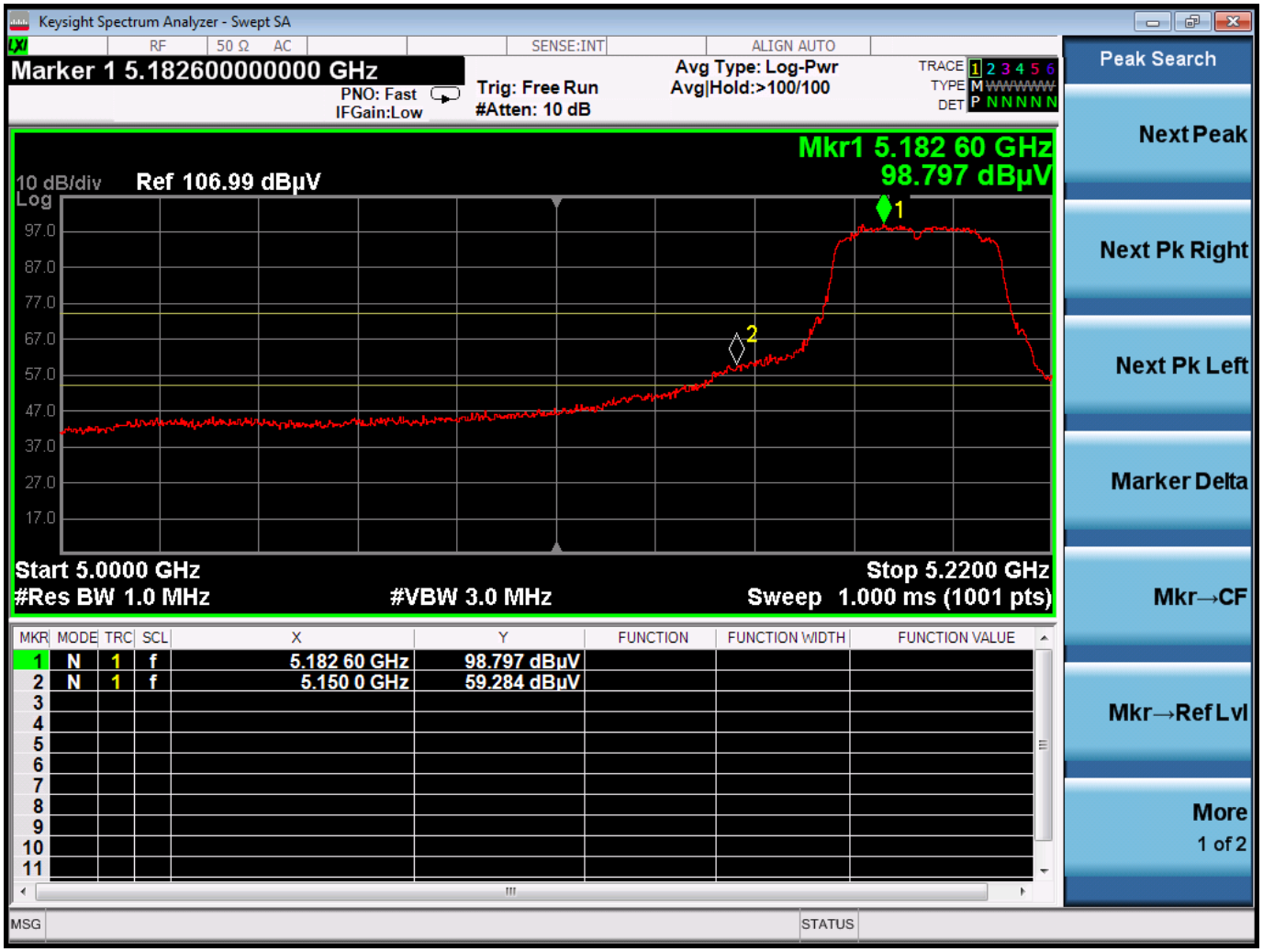


AV Value


Keysight Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 5.182200000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: RMS
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE A
DET A N N N N N
Mkr1 5.182 2 GHz
91.830 dBµV
10 dB/div
Log
Ref 106.99 dBµV
97.0
87.0
77.0
67.0
57.0
47.0
37.0
27.0
17.0
Start 5.0000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Stop 5.2000 GHz
Sweep 1.000 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 5.182 2 GHz 91.830 dBµV
2 N 1 f 5.150 0 GHz 37.554 dBµV
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS

EUT	RouterBOARD cAP	Model Name	cAP ac
Temperature	25℃	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n40 5190MHz,ant0	Antenna	Horizontal

PK Value

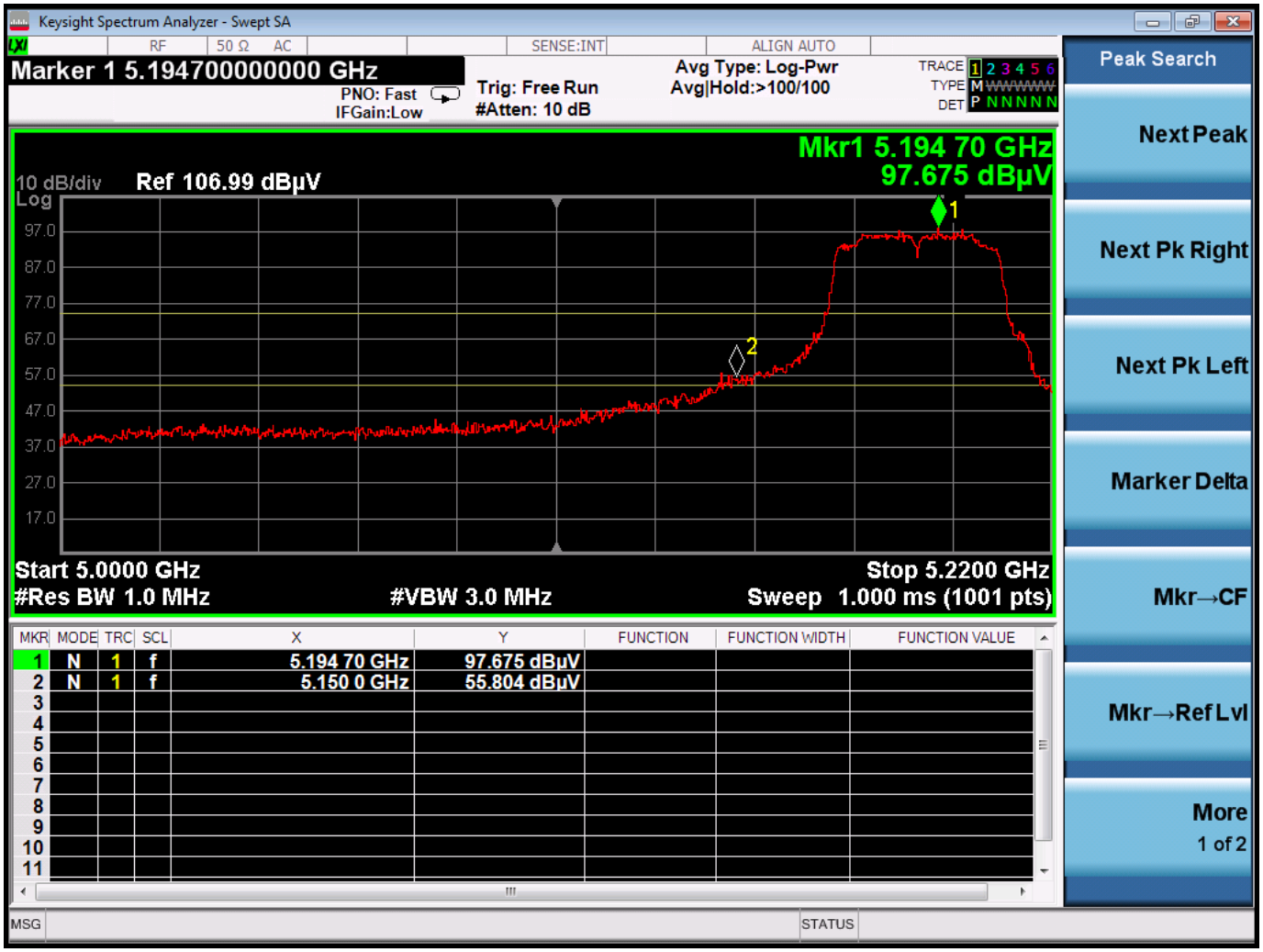


AV Value


Keysight Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 5.184140000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: RMS
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE A
DET A N N N N N
Mkr1 5.184 14 GHz
89.213 dBµV
10 dB/div
Log
Ref 106.99 dBµV
97.0
87.0
77.0
67.0
57.0
47.0
37.0
27.0
17.0
1
2
Start 5.0000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Stop 5.2200 GHz
Sweep 1.000 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 5.184 14 GHz 89.213 dBµV
2 N 1 f 5.150 0 GHz 45.712 dBµV
3
4
5
6
7
8
9
10
11
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

EUT	RouterBOARD cAP	Model Name	cAP ac
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n40 5190MHz,ant0	Antenna	Vertical

PK Value

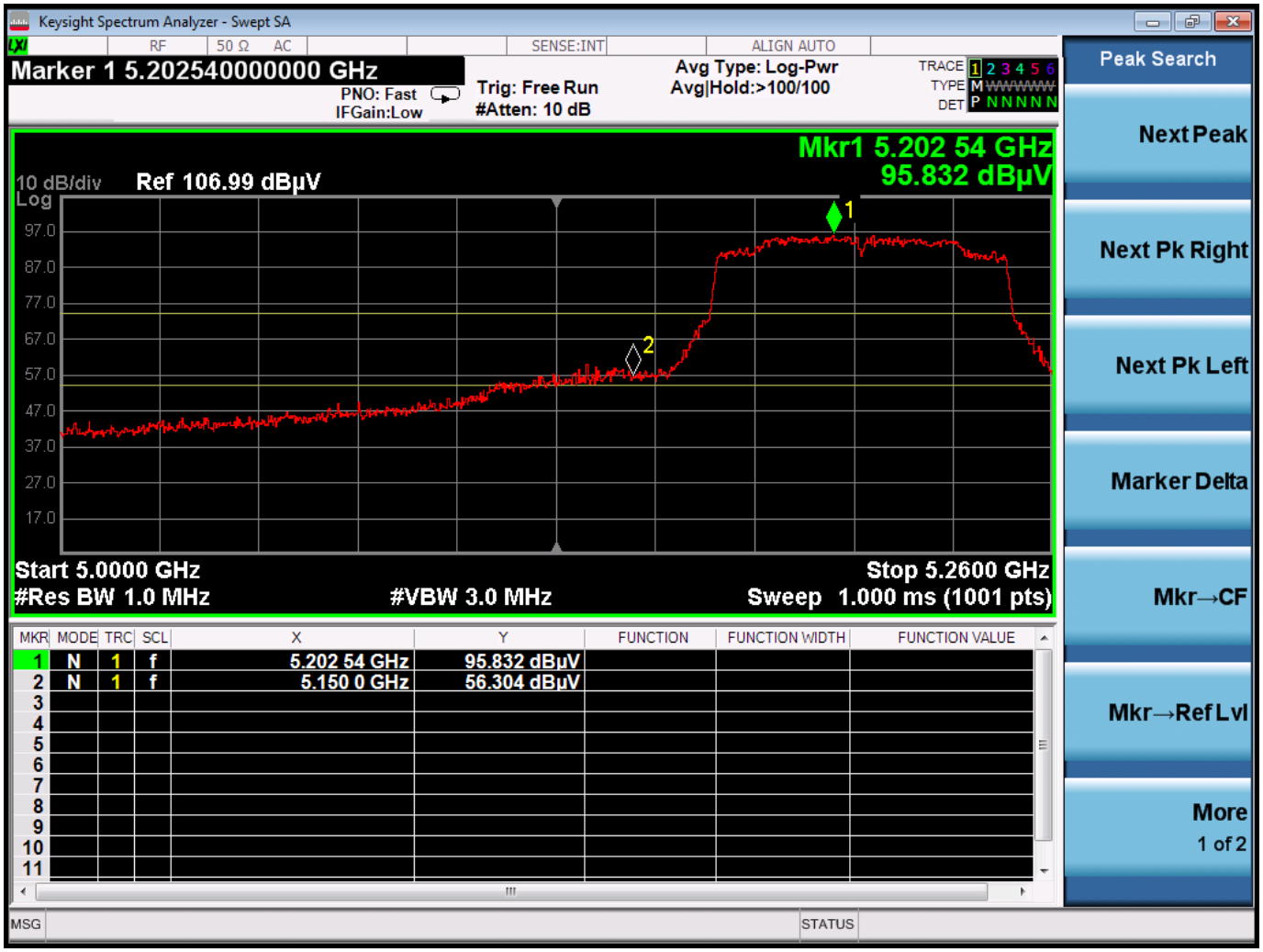


AV Value


Keysight Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 5.196680000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: RMS
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE A
DET A N N N N N
Mkr1 5.196 68 GHz
88.066 dBµV
10 dB/div
Log
Ref 106.99 dBµV
97.0
87.0
77.0
67.0
57.0
47.0
37.0
27.0
17.0
1
2
Start 5.0000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Stop 5.2200 GHz
Sweep 1.000 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 5.196 68 GHz 88.066 dBµV
2 N 1 f 5.150 0 GHz 46.144 dBµV
3
4
5
6
7
8
9
10
11
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS

EUT	RouterBOARD cAP	Model Name	cAP ac
Temperature	25℃	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n80 5210MHz,ant0	Antenna	Horizontal

PK Value

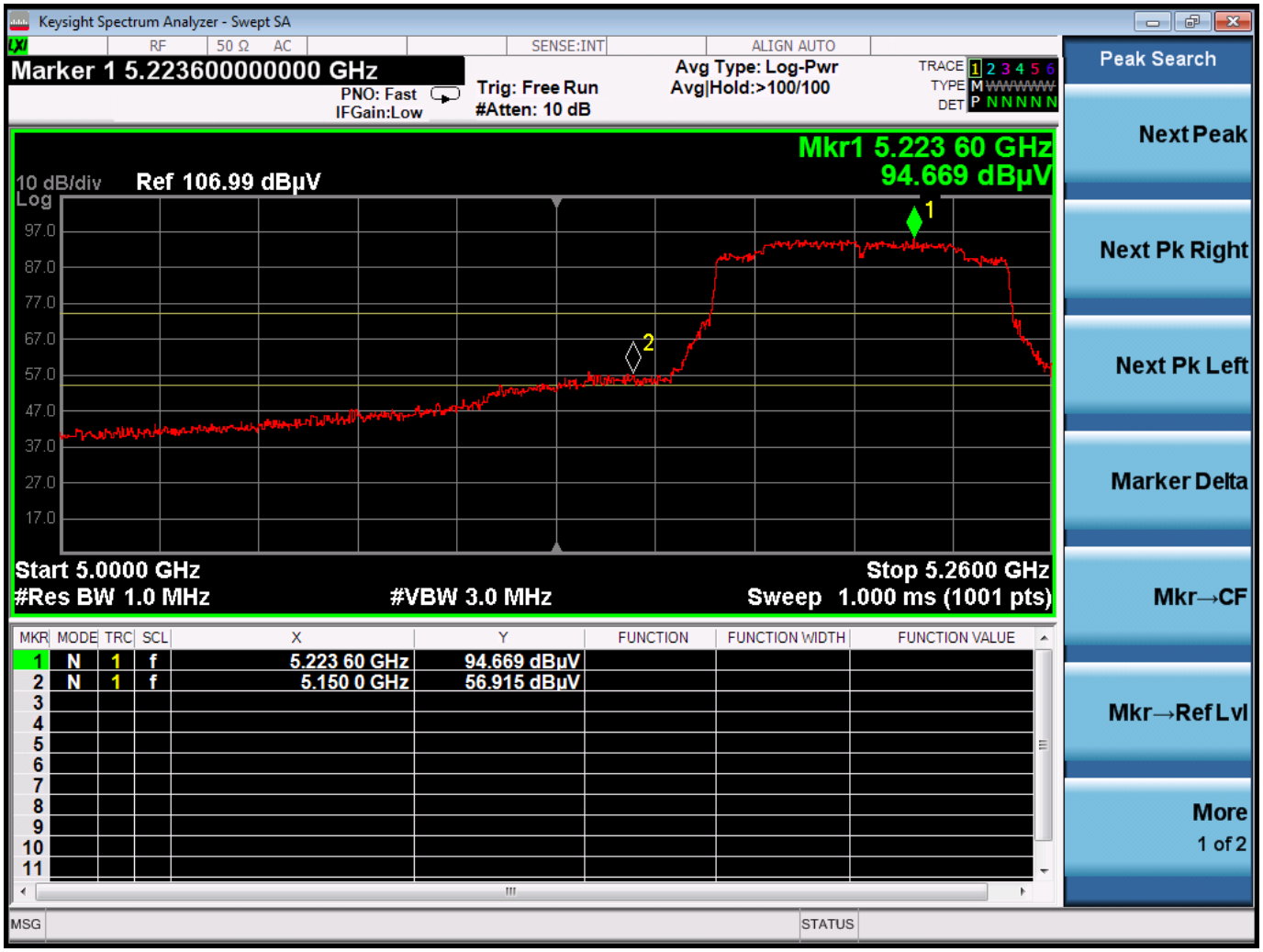


AV Value

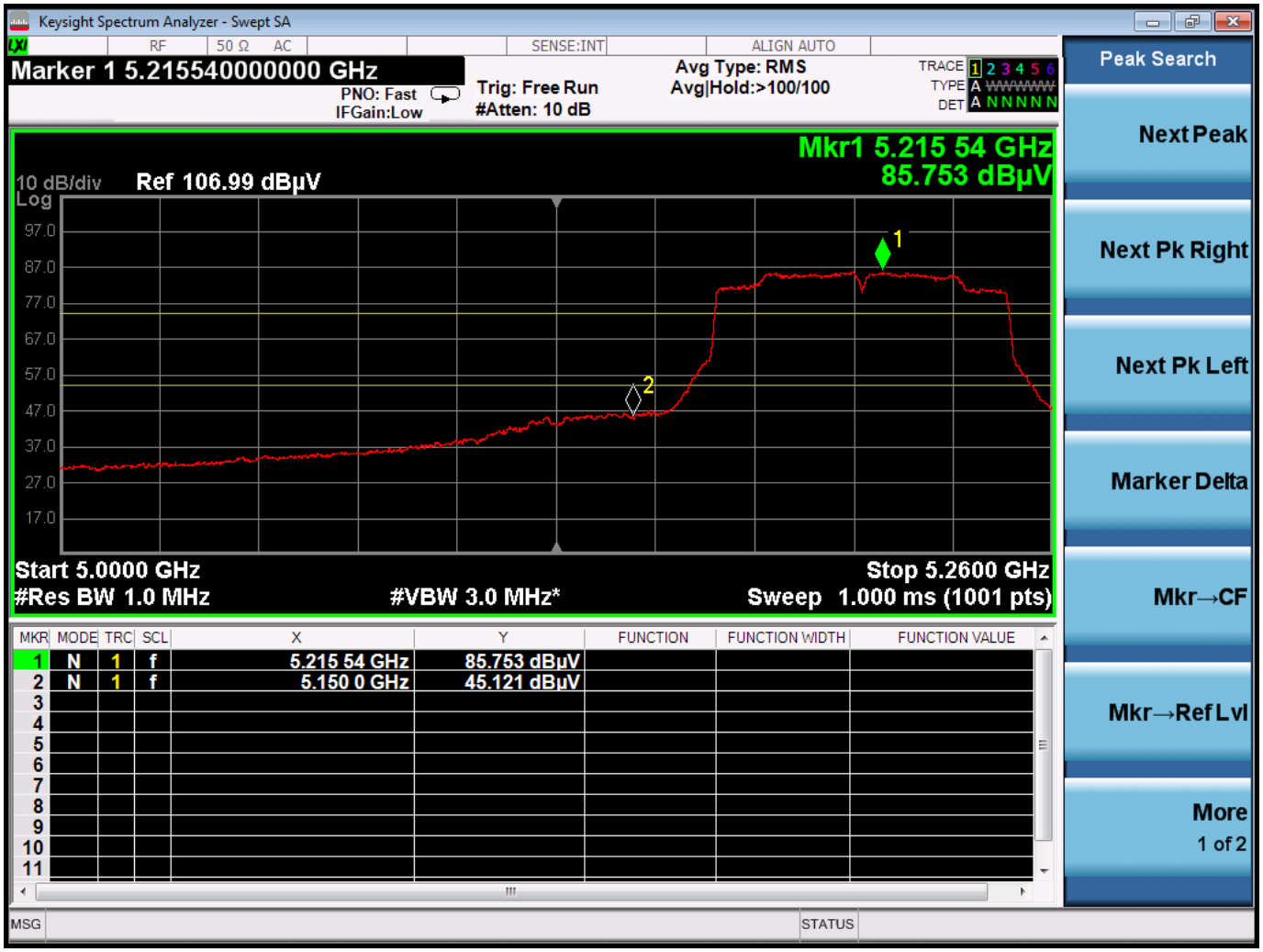

Keysight Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 5.195520000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 10 dB
Avg Type: RMS
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE A
DET A N N N N N
Mkr1 5.195 52 GHz
86.242 dBµV
10 dB/div
Log
Ref 106.99 dBµV
97.0
87.0
77.0
67.0
57.0
47.0
37.0
27.0
17.0
Start 5.0000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Stop 5.2600 GHz
Sweep 1.000 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 5.195 52 GHz 86.210 dBµV
2 N 1 f 5.150 0 GHz 46.433 dBµV
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS

EUT	RouterBOARD cAP	Model Name	cAP ac
Temperature	25℃	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	802.11n80 5210MHz,ant0	Antenna	Vertical

PK Value



AV Value



RESULT: PASS

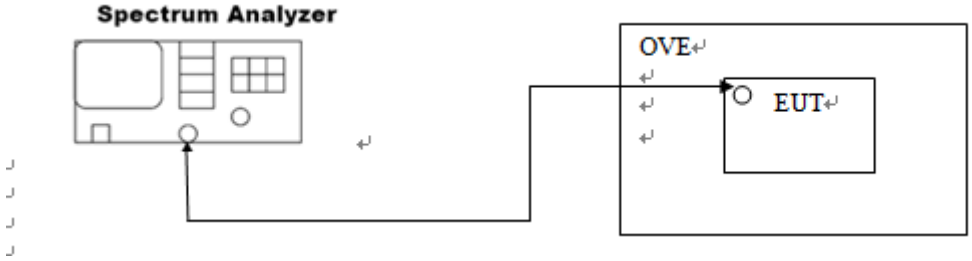
Note: All the 20MHz, 40MHz and 80MHz bandwidth modulation had been tested, the 802.11a20/n20/n40 was the worst case and record in his test report.

13. FREQUENCY STABILITY

13.1. 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.

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



13.3. MEASUREMENT RESULTS

Test Mode	Temperature	Measurement Frequency (MHz)	Result	Conclusion
802.11a	- 10℃	5180	within the band	PASS
	0℃	5180	within the band	PASS
	10℃	5180	within the band	PASS
	20℃	5180	within the band	PASS
	30℃	5180	within the band	PASS
	40℃	5180	within the band	PASS
	50℃	5180	within the band	PASS
	- 10℃	5200	within the band	PASS
	0℃	5200	within the band	PASS
	10℃	5200	within the band	PASS
	20℃	5200	within the band	PASS
	30℃	5200	within the band	PASS
	40℃	5200	within the band	PASS
	50℃	5200	within the band	PASS
	- 10℃	5240	within the band	PASS
	0℃	5240	within the band	PASS
	10℃	5240	within the band	PASS
	20℃	5240	within the band	PASS
	30℃	5240	within the band	PASS
	40℃	5240	within the band	PASS
	50℃	5240	within the band	PASS

Test Mode	Temperature	Measurement Frequency (MHz)	Result	Conclusion
802.11n20	- 10℃	5180	within the band	PASS
	0℃	5180	within the band	PASS
	10℃	5180	within the band	PASS
	20℃	5180	within the band	PASS
	30℃	5180	within the band	PASS
	40℃	5180	within the band	PASS
	50℃	5180	within the band	PASS
	- 10℃	5200	within the band	PASS
	0℃	5200	within the band	PASS
	10℃	5200	within the band	PASS
	20℃	5200	within the band	PASS
	30℃	5200	within the band	PASS
	40℃	5200	within the band	PASS
	50℃	5200	within the band	PASS
	- 10℃	5240	within the band	PASS
	0℃	5240	within the band	PASS
	10℃	5240	within the band	PASS

	20℃	5240	within the band	PASS
	30℃	5240	within the band	PASS
	40℃	5240	within the band	PASS
	50℃	5240	within the band	PASS

Test Mode	Temperature	Measurement Frequency (MHz)	Result	Conclusion
802.11n40	- 10℃	5190	within the band	PASS
	0℃	5190	within the band	PASS
	10℃	5190	within the band	PASS
	20℃	5190	within the band	PASS
	30℃	5190	within the band	PASS
	40℃	5190	within the band	PASS
	50℃	5190	within the band	PASS
	- 10℃	5230	within the band	PASS
	0℃	5230	within the band	PASS
	10℃	5230	within the band	PASS
	20℃	5230	within the band	PASS
	30℃	5230	within the band	PASS
	40℃	5230	within the band	PASS
	50℃	5230	within the band	PASS

Test Mode	Temperature	Measurement Frequency (MHz)	Result	Conclusion
802.11ac20	- 10℃	5180	within the band	PASS
	0℃	5180	within the band	PASS
	10℃	5180	within the band	PASS
	20℃	5180	within the band	PASS
	30℃	5180	within the band	PASS
	40℃	5180	within the band	PASS
	50℃	5180	within the band	PASS
	- 10℃	5200	within the band	PASS
	0℃	5200	within the band	PASS
	10℃	5200	within the band	PASS
	20℃	5200	within the band	PASS
	30℃	5200	within the band	PASS
	40℃	5200	within the band	PASS
	50℃	5200	within the band	PASS
	- 10℃	5240	within the band	PASS
	0℃	5240	within the band	PASS
	10℃	5240	within the band	PASS
	20℃	5240	within the band	PASS
	30℃	5240	within the band	PASS
	40℃	5240	within the band	PASS
	50℃	5240	within the band	PASS

Test Mode	Temperature	Measurement Frequency (MHz)	Result	Conclusion
802.11ac40	- 10℃	5190	within the band	PASS
	0℃	5190	within the band	PASS
	10℃	5190	within the band	PASS
	20℃	5190	within the band	PASS
	30℃	5190	within the band	PASS
	40℃	5190	within the band	PASS
	50℃	5190	within the band	PASS
	- 10℃	5230	within the band	PASS
	0℃	5230	within the band	PASS
	10℃	5230	within the band	PASS
	20℃	5230	within the band	PASS
	30℃	5230	within the band	PASS
	40℃	5230	within the band	PASS
	50℃	5230	within the band	PASS

Test Mode	Temperature	Measurement Frequency (MHz)	Result	Conclusion
802.11ac80	- 10℃	5210	within the band	PASS
	0℃	5210	within the band	PASS
	10℃	5210	within the band	PASS
	20℃	5210	within the band	PASS
	30℃	5210	within the band	PASS
	40℃	5210	within the band	PASS
	50℃	5210	within the band	PASS

14. FCC LINE CONDUCTED EMISSION TEST

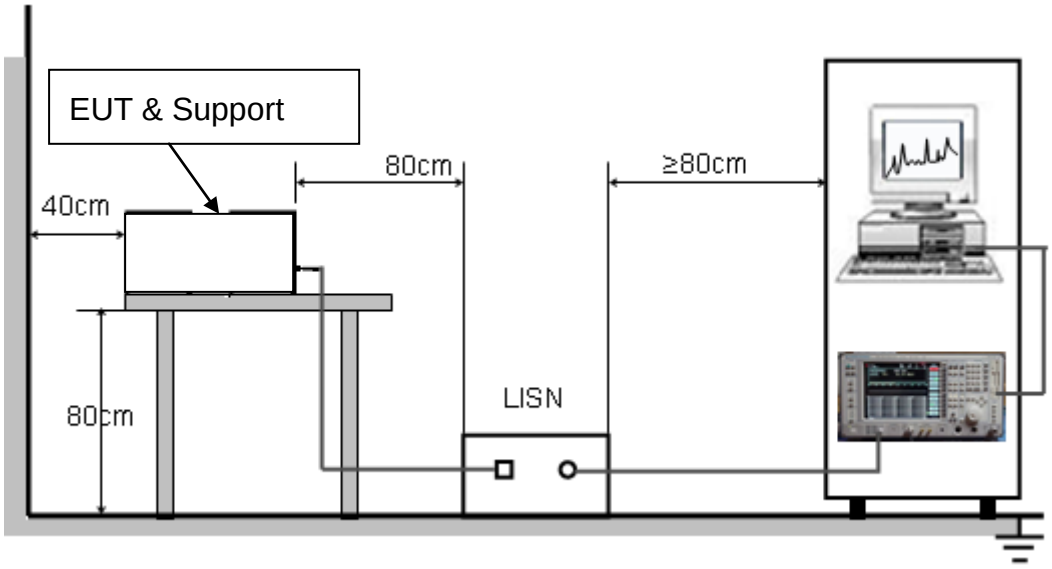
14.1. LIMITS OF LINE CONDUCTED EMISSION TEST

Frequency	Maximum RF Line Voltage	
	Q.P.(dBuV)	Average(dBuV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50MHz.

14.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



14.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipments received AC120V/60Hz power from a LISN, if any.
5. The EUT received charging voltage by adapter which received 120V/60Hzpower by a LISN.
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

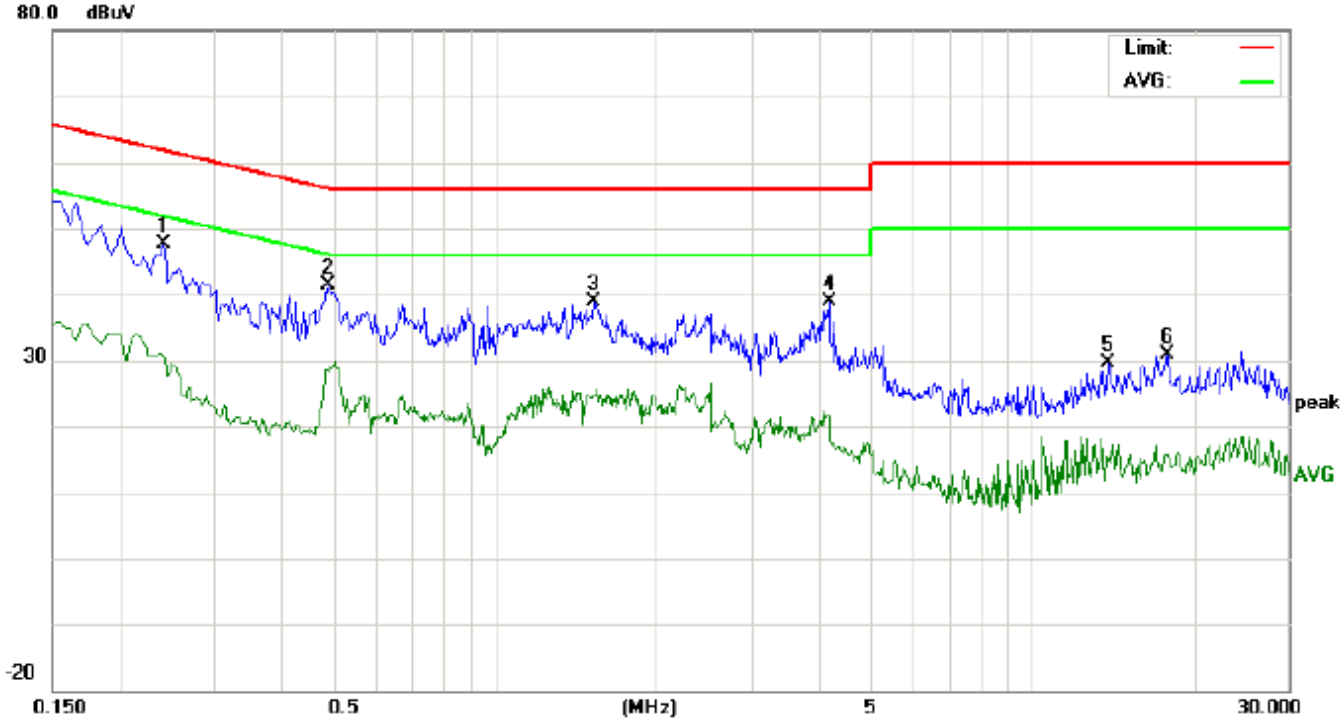
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

14.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

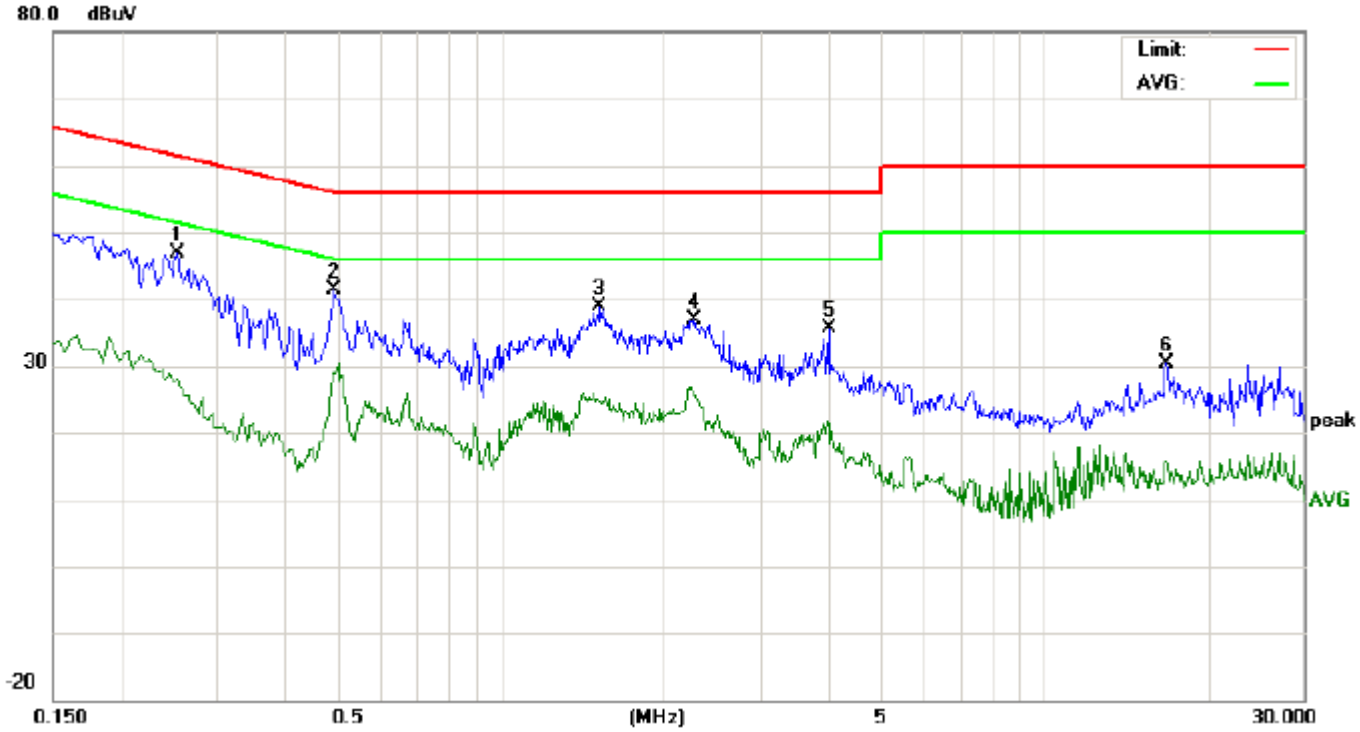
14.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

LINE CONDUCTED EMISSION TEST-L



No.	Freq. (MHz)	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		P/F	Comment
		Peak	QP	AVG	dB	Peak	QP	AVG	QP	AVG	QP	AVG		
1	0.2419	37.40		20.56	10.26	47.66		30.82	62.03	52.03	-14.37	-21.21	P	
2	0.4899	31.09		17.89	10.39	41.48		28.28	56.17	46.17	-14.69	-17.89	P	
3	1.5339	28.52		14.45	10.37	38.89		24.82	56.00	46.00	-17.11	-21.18	P	
4	4.1817	28.43		11.32	10.35	38.78		21.67	56.00	46.00	-17.22	-24.33	P	
5	13.9138	19.62		4.95	10.12	29.74		15.07	60.00	50.00	-30.26	-34.93	P	
6	17.8538	20.67		5.82	10.12	30.79		15.94	60.00	50.00	-29.21	-34.06	P	

LINE CONDUCTED EMISSION TEST-N

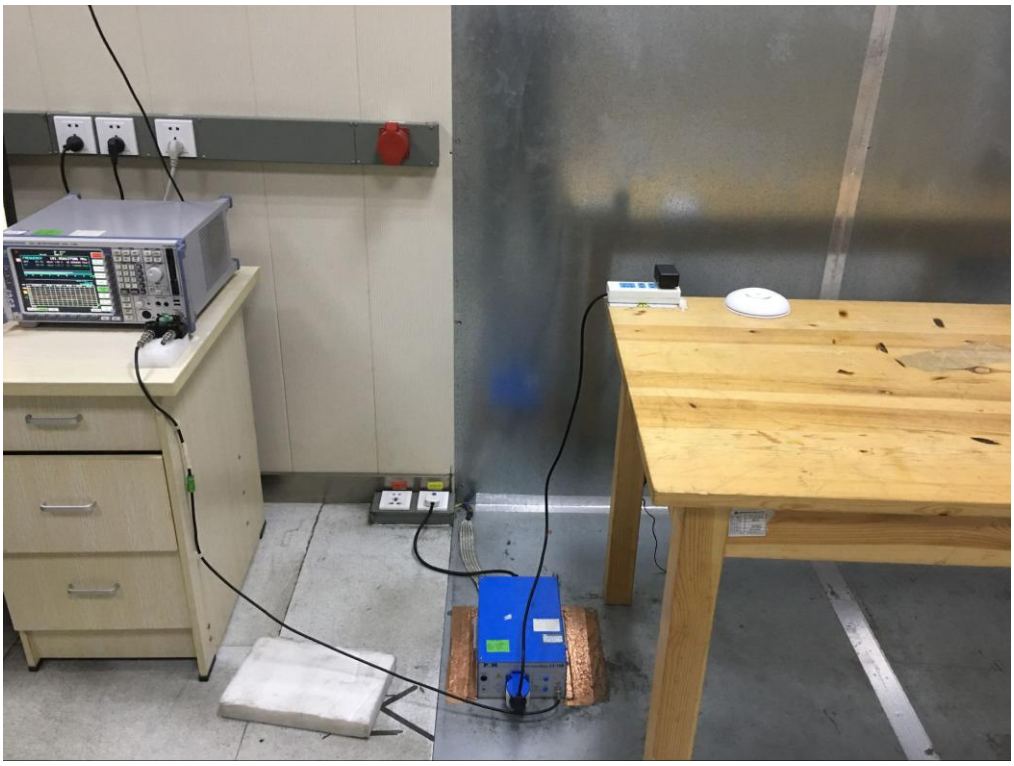


No.	Freq. (MHz)	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		P/F	Comment
		Peak	QP	AVG	dB	Peak	QP	AVG	QP	AVG	QP	AVG		
1	0.2540	36.72		17.85	10.27	46.99		28.12	61.62	51.62	-14.63	-23.50	P	
2	0.4940	30.90		18.41	10.40	41.30		28.81	56.10	46.10	-14.80	-17.29	P	
3	1.5220	28.52		14.34	10.37	38.89		24.71	56.00	46.00	-17.11	-21.29	P	
4	2.2820	26.57		15.20	10.34	36.91		25.54	56.00	46.00	-19.09	-20.46	P	
5	4.0100	25.24		10.71	10.43	35.67		21.14	56.00	46.00	-20.33	-24.86	P	
6	16.7499	20.34		5.75	10.12	30.46		15.87	60.00	50.00	-29.54	-34.13	P	

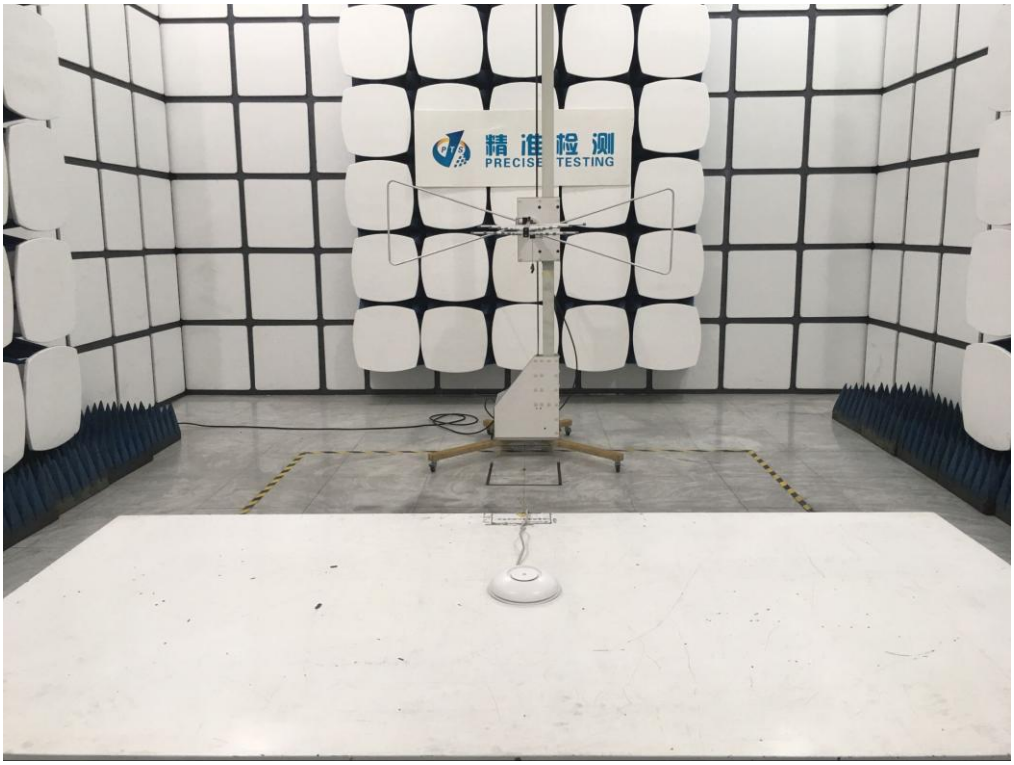
RESULT: PASS

APPENDIX A: PHOTOGRAPHS OF TEST SETUP

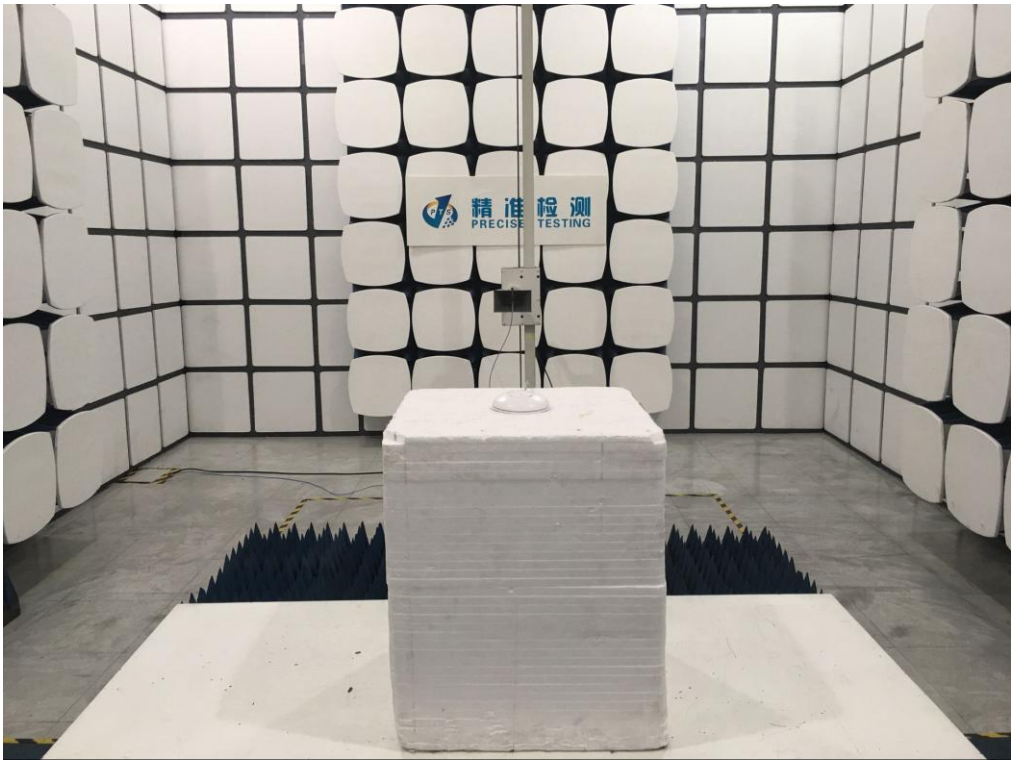
FCC LINE CONDUCTED EMISSION TEST SETUP



FCC RADIATED EMISSION TEST SETUP BELOW 1GHZ



FCC RADIATED EMISSION TEST SETUP ABOVE 1GHZ



----END OF REPORT----