FCC Test Report

Report No.: AGC07248170703FE02

FCC ID	:	TV7LHG2ND
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	RouterBOARD LHG 2nD-XL
BRAND NAME	:	RouterBOARD
MODEL NAME	:	LHG XL 2
CLIENT	:	Mikrotikls SIA
DATE OF ISSUE	:	Jul, 02, 2017
STANDARD(S) **TEST PROCEDURE(S)**	:	FCC Part 15.247 KDB 558074 D01 DTS Meas Guidance v04 KDB 662911 D01 Multiple Transmitter Output v02r01
REPORT VERSION	:	V1.0

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

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Report Revise Record

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

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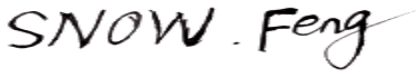
1. VERIFICATION OF CONFORMITY

Applicant	Mikrotikls SIA
Address	Pernavas 46 Riga Latvia LV-1009
Manufacturer	Mikrotikls SIA
Address	Pernavas 46 Riga Latvia LV-1009
Product Designation	RouterBOARD LHG 2nD-XL
Brand Name	RouterBOARD
Test Model	LHG XL 2
Date of test	Jun, 28, 2017 to Jul, 01, 2017
Deviation	None
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BGN/RF

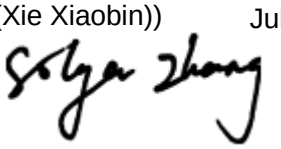
We hereby certify that:
The above equipment was tested by Dongguan Precise Testing Service Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rules Part 15.247.

Tested by 

Snow. Feng(Feng. Nianwei) Jul, 02, 2017

Reviewed by 

Bart Xie(Xie Xiaobin)) Jul, 02, 2017

Approved by 

Solger Zhang(Zhang Hongyi) Jul, 02, 2017
Authorized Officer

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as “Master ”. It is designed by way of utilizing the DSSS and OFDM technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	2.412 GHz～2.462GHz
Output Power	Ant0: IEEE 802.11b:**15.86**dBm; IEEE 802.11g:**14.53**dBm; IEEE 802.11n(20)siso:**13.25**dBm; IEEE 802.11n(40)siso:**12.95**dBm Ant1: IEEE 802.11b:**15.03**dBm; IEEE 802.11g:**14.03**dBm; IEEE 802.11n(20)siso:**13.35**dBm; IEEE 802.11n(40)siso:**12.66**dBm Ant0+ant1: 802.11n(20)mimo:**16.30**dBm; IEEE 802.11n(40)mimo: **15.76**dBm
Modulation	DSSS(DBPSK/DQPSK/CCK);OFDM(BPSK/QPSK/16-QAM/64-QAM)
Number of channels	11
Hardware Version	r4
Software Version	6.38.5
Antenna Designation	Internal Antenna
Number of transmit chain	2(802.11b/g/n used two antennas,but only 802.11n support MIMO)
Antenna Gain	21dBi
Directional Gain	24 dBi
Power Supply	DC 24 V

Note: Directional Gain= Gant+10log(Nant)dBi;
-Gant: Number of Transmit Antennas
-Nant: Gain of Individual Antennas (Same for Each Antenna)

2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
2400~2483.5MHZ	1	2412 MHZ
	2	2417 MHZ
	3	2422 MHZ
	4	2427 MHZ
	5	2432 MHZ
	6	2437 MHZ
	7	2442 MHZ

	8	2447 MHZ
	9	2452 MHZ
	10	2457 MHZ
	11	2462 MHZ

Note: For 20MHZ bandwidth system use Channel 1 to Channel 11
For 40MHZ bandwidth system use Channel 3 to Channel 9

2.3. IEEE 802.11N MODULATION SCHEME

MCS Index	Nss	Modulation	R	NBPSC	NCBPS		NDBPS		Data rate(Mbps)	
									800nsGI	
					20MHz	40MHz	20MHz	40MHz	20MHz	40MHz
0	1	BPSK	1/2	1	52	108	26	54	6.5	13.5
1	1	QPSK	1/2	2	104	216	52	108	13.0	27.0
2	1	QPSK	3/4	2	104	216	78	162	19.5	40.5
3	1	16-QAM	1/2	4	208	432	104	216	26.0	54.0
4	1	16-QAM	3/4	4	208	432	156	324	39.0	81.0
5	1	64-QAM	2/3	6	312	648	208	432	52.0	108.0
6	1	64-QAM	3/4	6	312	648	234	489	58.5	121.5
7	1	64-QAM	5/6	6	312	648	260	540	65.0	135.0

Symbol	Explanation
NSS	Number of spatial streams
R	Code rate
NBPSC	Number of coded bits per single carrier
NCBPS	Number of coded bits per symbol
NDBPS	Number of data bits per symbol
GI	Guard interval

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

This submittal(s) (test report) is intended for **FCC ID: TV7LHG2ND** filing to comply with the FCC Part 15 requirements.

2.5. 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 15.247 rules KDB 558074 D01 DTS Meas Guidance v04.

2.6. SPECIAL ACCESSORIES

Refer to section 5.2.

2.7. 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

NO.	TEST MODE DESCRIPTION
1	Low channel TX
2	Middle channel TX
3	High channel TX
4	Normal operating
Note: Transmit by 802.11b with Date rate (1/2/5.5/11) Transmit by 802.11g with Date rate (6/9/12/18/24/36/48/54) Transmit by 802.11n (20MHz) with Date rate (6.5/13/19.5/26/39/52/58.5/65) Transmit by 802.11n (40MHz) with Date rate (13.5/27/40.5/54.0/81.0/108.0/121.5/135.0)	

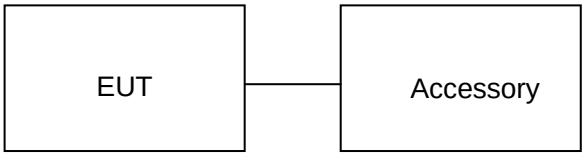
Note:

1. The EUT has been set to operate continuously on the lowest, middle and highest operation frequency 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.
3. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

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 LHG 2nD-XL	LHG XL 2	TV7LHG2ND	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
§15.247	Output Power	Compliant
§15.247	6 dB Bandwidth	Compliant
§15.247	Conducted Spurious Emission	Compliant
§15.247	Maximum Conducted Output Power SPECTRAL Density	Compliant
§15.209	Radiated Emission	Compliant
§15.247	Band Edges	Compliant
§15.207	Conducted 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 6, 2017
Artificial Mains Network (AUX)	Narda	L2-16B	000WX31026	July 7, 2016	July 6, 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. OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

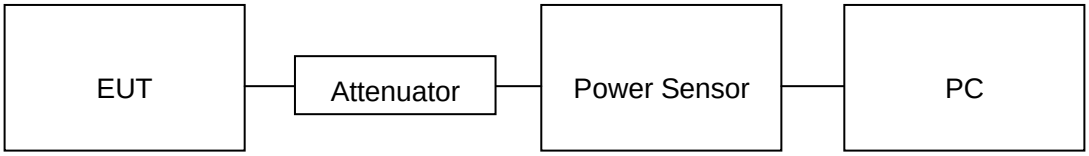
For average power test:

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 558074 and KDB 662911for compliance to FCC 47CFR 15.247 requirements.

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

AVERAGE POWER SETUP



7.3. LIMITS AND MEASUREMENT RESULT

TEST ITEM	OUTPUT POWER
TEST MODE	802.11b with data rate 1

Ant0：

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	15.76	24	Pass
2.437	15.86	24	Pass
2.462	15.74	24	Pass

Ant1:

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	15.01	24	Pass
2.437	15.03	24	Pass
2.462	14.95	24	Pass

TEST ITEM	OUTPUT POWER
TEST MODE	802.11g with data rate 6

Ant0：

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	14.31	24	Pass
2.437	14.45	24	Pass
2.462	14.53	24	Pass

Ant1:

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	13.95	24	Pass
2.437	13.9	24	Pass
2.462	14.03	24	Pass

TEST ITEM	OUTPUT POWER
TEST MODE	802.11n 20 with data rate 6.5

Port	Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
Ant0	2.412	13.16	24	Pass
	2.437	13.25	24	Pass
	2.462	13.13	24	Pass
Ant1	2.412	13.35	24	Pass
	2.437	13.33	24	Pass
	2.462	13.21	24	Pass
Sum	2.412	16.27	24	Pass
	2.437	16.30	24	Pass
	2.462	16.18	24	Pass

TEST ITEM	OUTPUT POWER
TEST MODE	802.11n 40 with data rate 13.5

Port	Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
Ant0	2.412	12.95	24	Pass
	2.437	12.82	24	Pass
	2.462	12.83	24	Pass
Ant1	2.412	12.53	24	Pass
	2.437	12.55	24	Pass
	2.462	12.66	24	Pass
Sum	2.412	15.76	24	Pass
	2.437	15.70	24	Pass
	2.462	15.76	24	Pass

Note: 1) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

2) EUT can working at 802.11b/g/n mode by used two antenna (ant0+ant1), but at 802.11b/g mode EUT cannot use two antenna at the same time, only at 802.11n mimo mode two antenna (ant0+ant1) work at the same time.

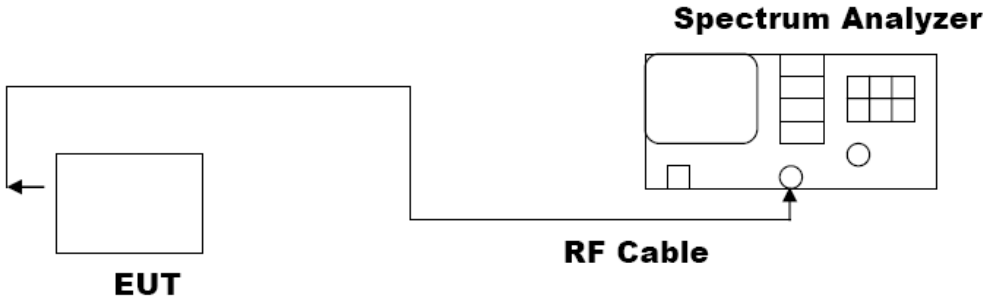
8. 6 DB BANDWIDTH

8.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 KHz, VBW≥3×RBW.
4. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

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



8.3. LIMITS AND MEASUREMENT RESULTS

TEST ITEM	6DB BANDWIDTH
TEST MODE	802.11b with data rate 11

Ant0：

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (MHz)		Criteria
>500KHZ	Low Channel	10.11	PASS
	Middle Channel	10.06	PASS
	High Channel	10.09	PASS

Ant1：

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (MHz)		Criteria
>500KHZ	Low Channel	10.16	PASS
	Middle Channel	10.26	PASS
	High Channel	10.21	PASS

TEST ITEM	6DB BANDWIDTH
TEST MODE	802.11g with data rate 54

Ant0:

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (MHz)		Criteria
>500KHZ	Low Channel	15.65	PASS
	Middle Channel	15.04	PASS
	High Channel	15.67	PASS

Ant1：

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (MHz)		Criteria
>500KHZ	Low Channel	15.74	PASS
	Middle Channel	16.46	PASS
	High Channel	15.74	PASS

TEST ITEM	6DB BANDWIDTH
TEST MODE	802.11n 20 with data rate 65

Ant0：

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (MHz)		Criteria
>500KHZ	Low Channel	15.64	PASS
	Middle Channel	15.13	PASS
	High Channel	16.29	PASS

Ant1：

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (MHz)		Criteria
>500KHZ	Low Channel	16.38	PASS
	Middle Channel	17.65	PASS
	High Channel	16.39	PASS

TEST ITEM	6DB BANDWIDTH
TEST MODE	802.11n 40 with data rate 135

Ant0:

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (MHz)		Criteria
>500KHZ	Low Channel	30.12	PASS
	Middle Channel	35.13	PASS
	High Channel	31.32	PASS

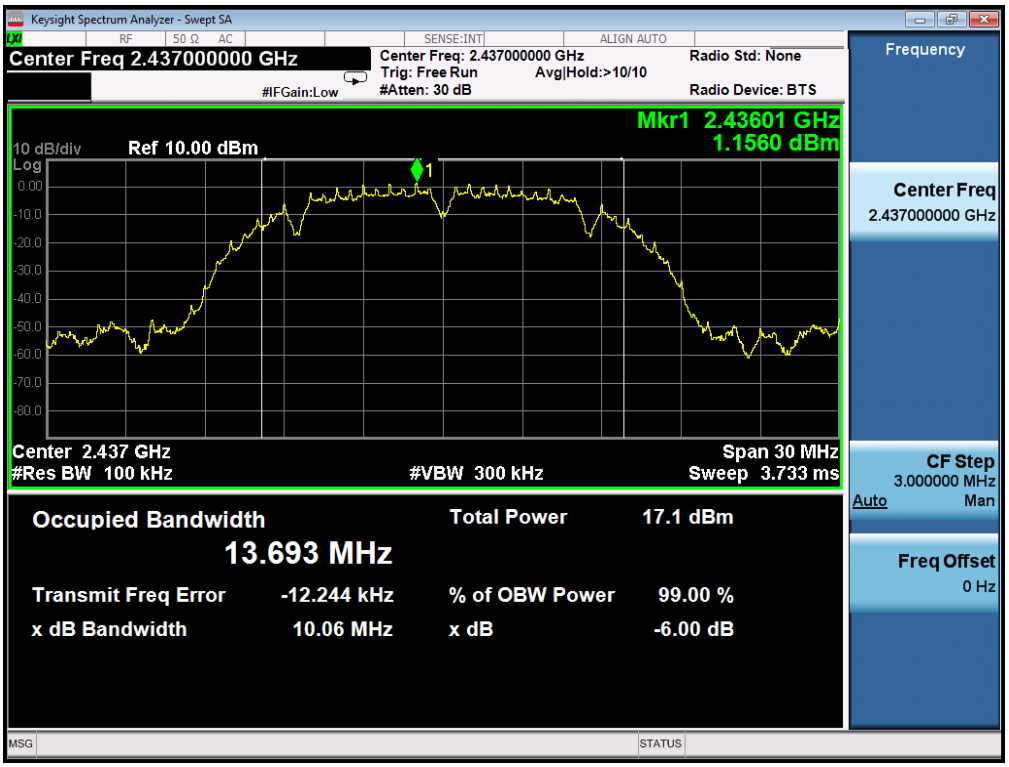
Ant1：

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (MHz)		Criteria
>500KHZ	Low Channel	31.95	PASS
	Middle Channel	36.36	PASS
	High Channel	33.19	PASS

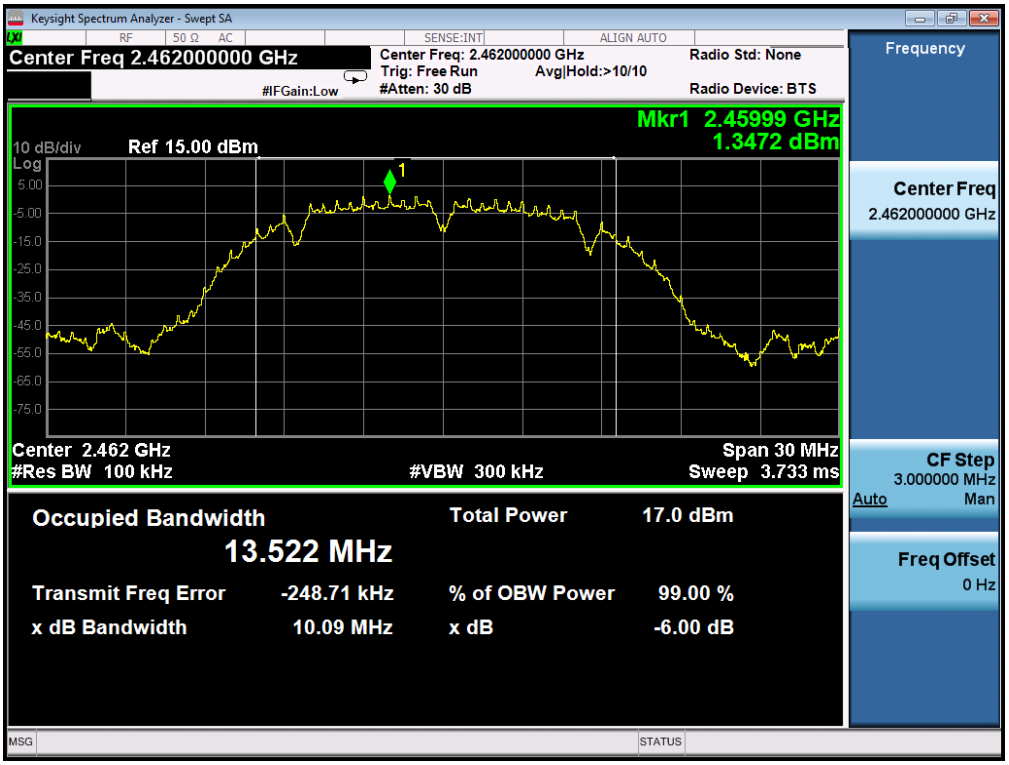
802.11b TEST RESULT-Ant0:

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

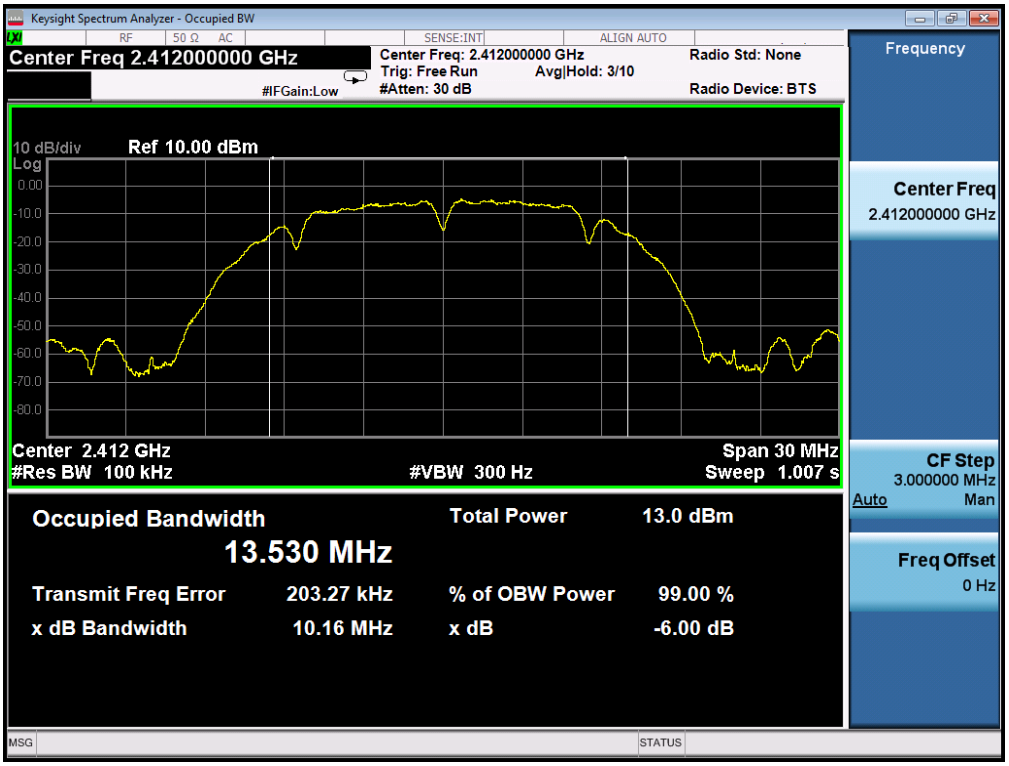


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

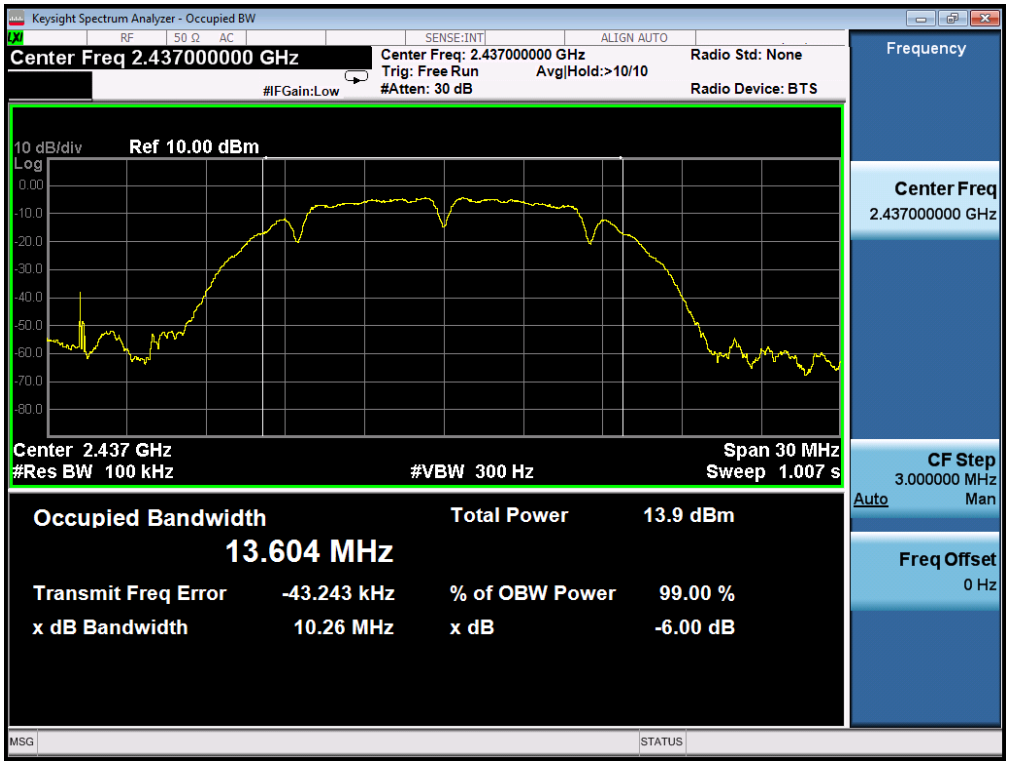


802.11b TEST RESULT-Ant1:

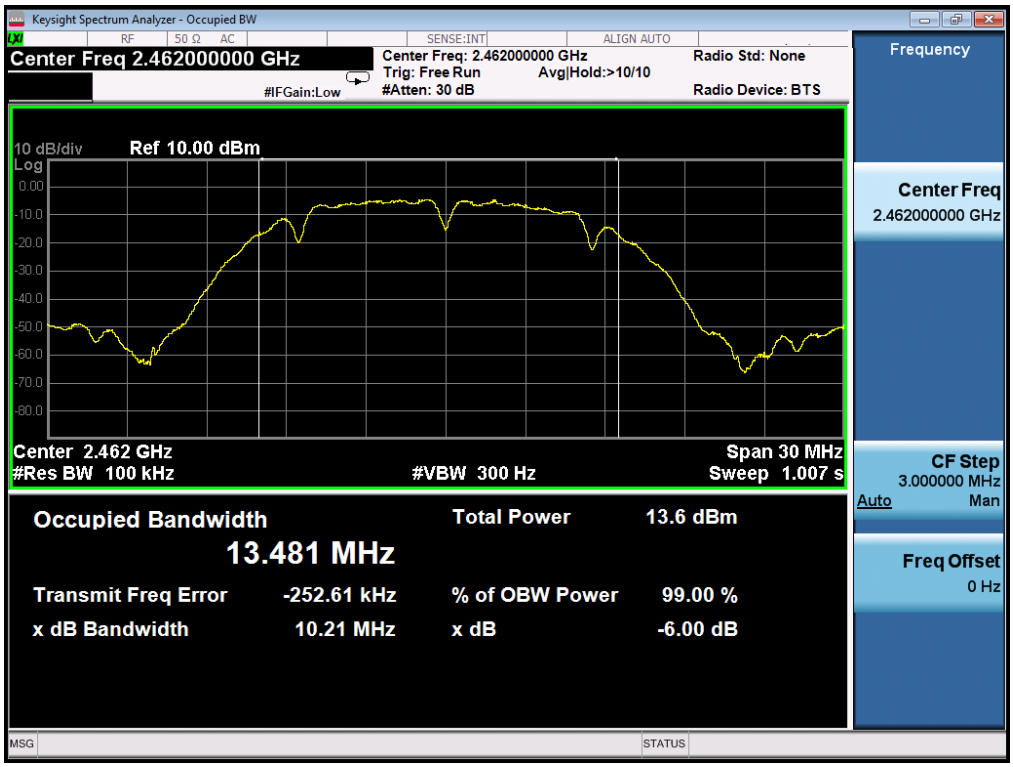
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

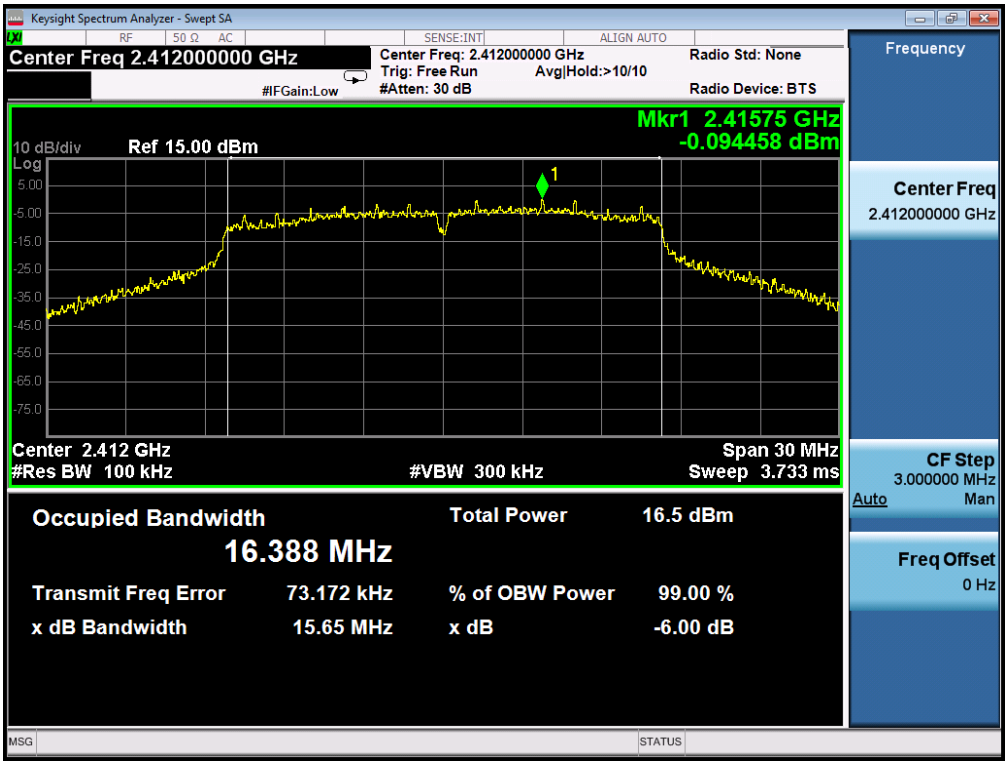


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

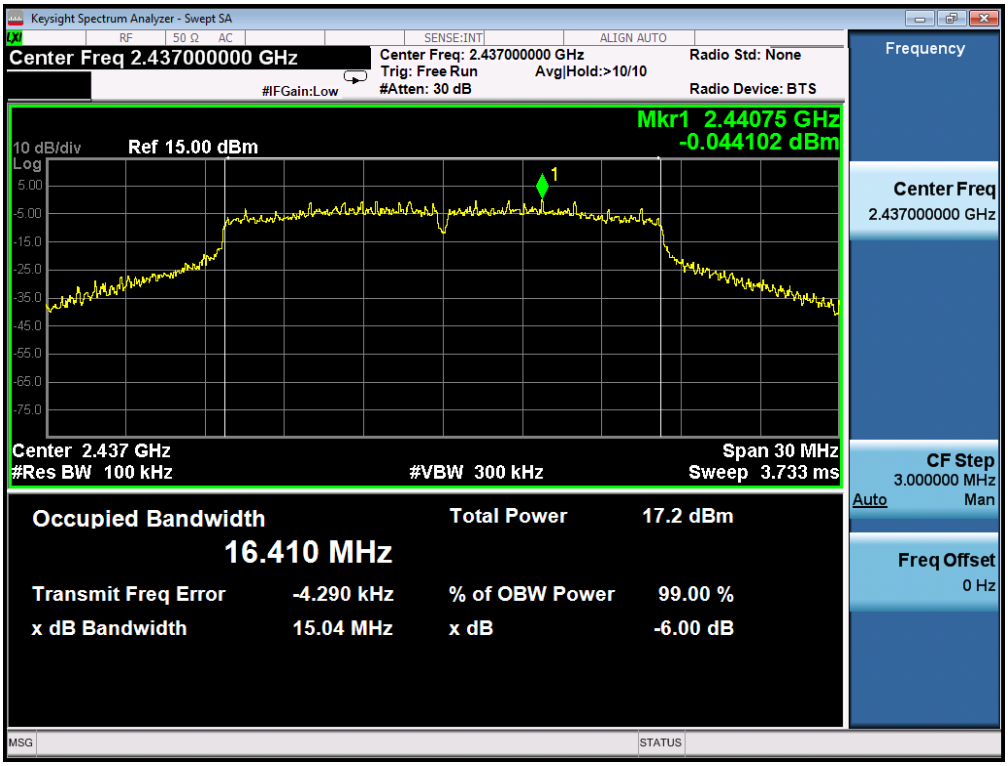


802.11g TEST RESULT-Ant0:

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



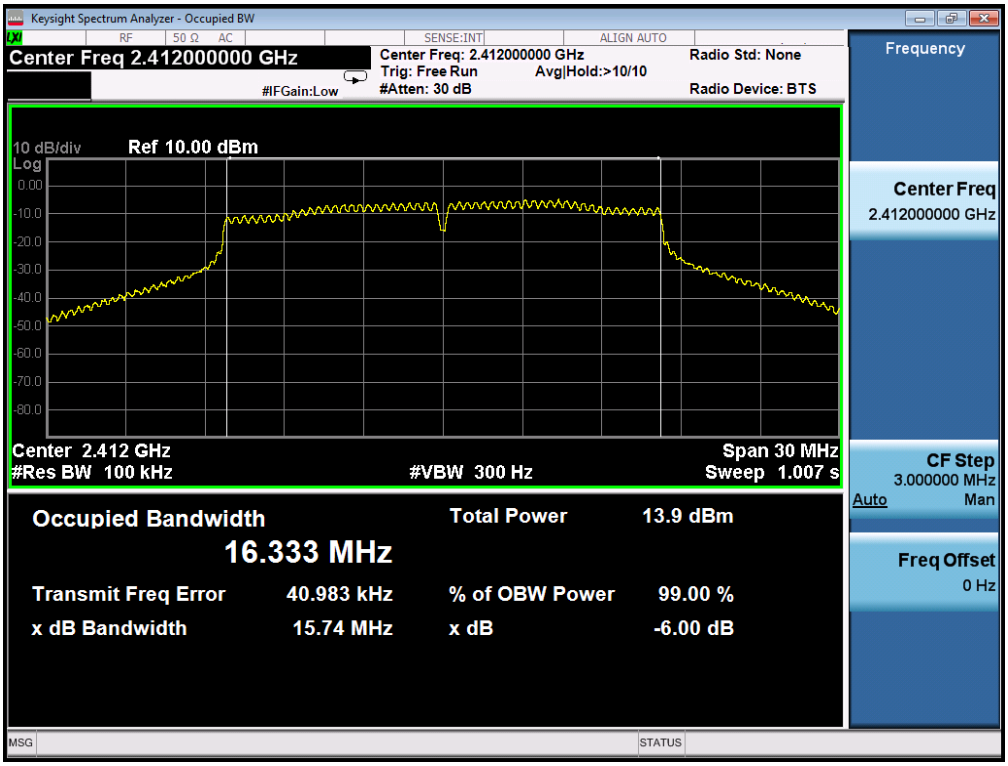
TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



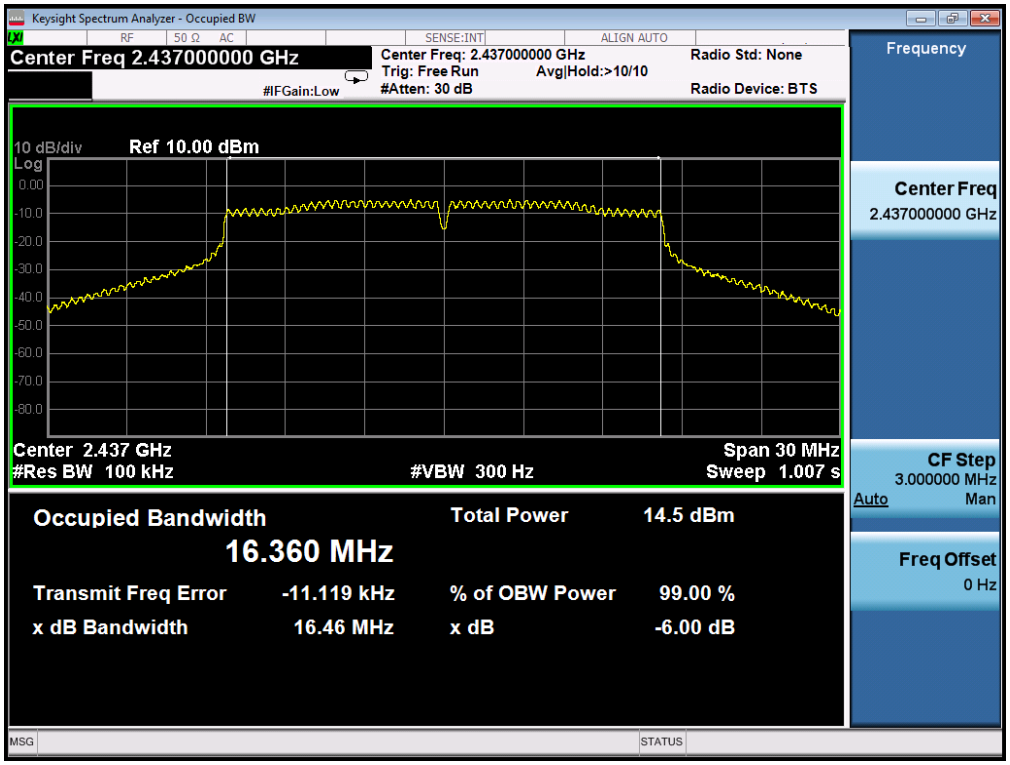
TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

802.11g TEST RESULT-Ant1:

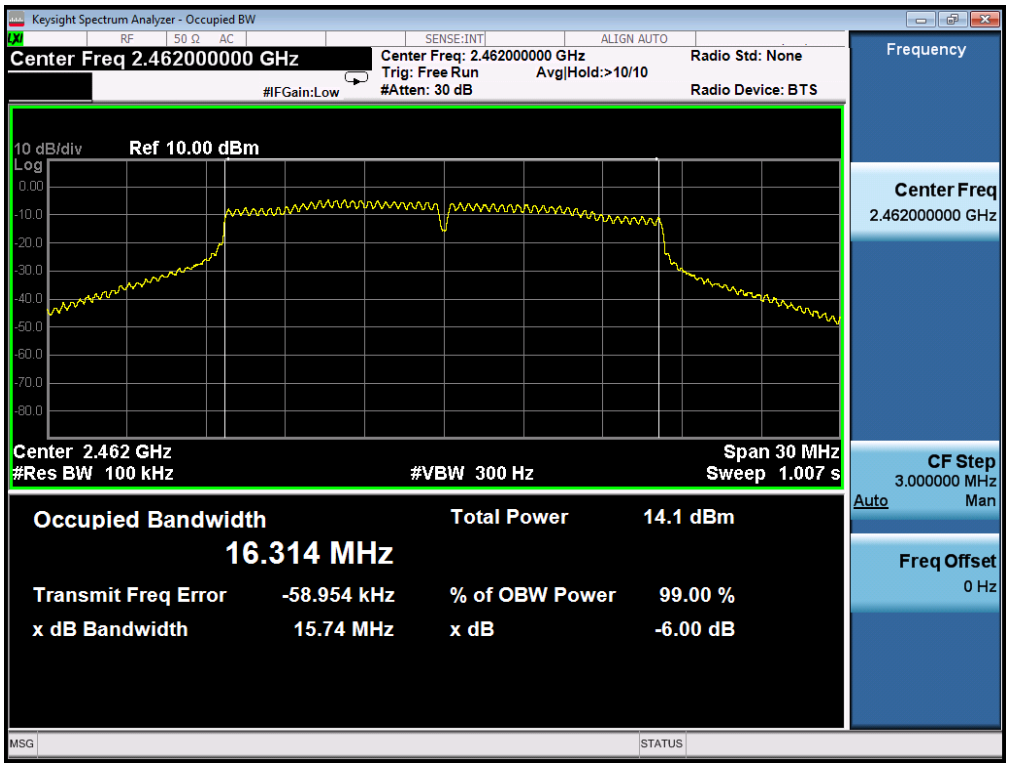
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

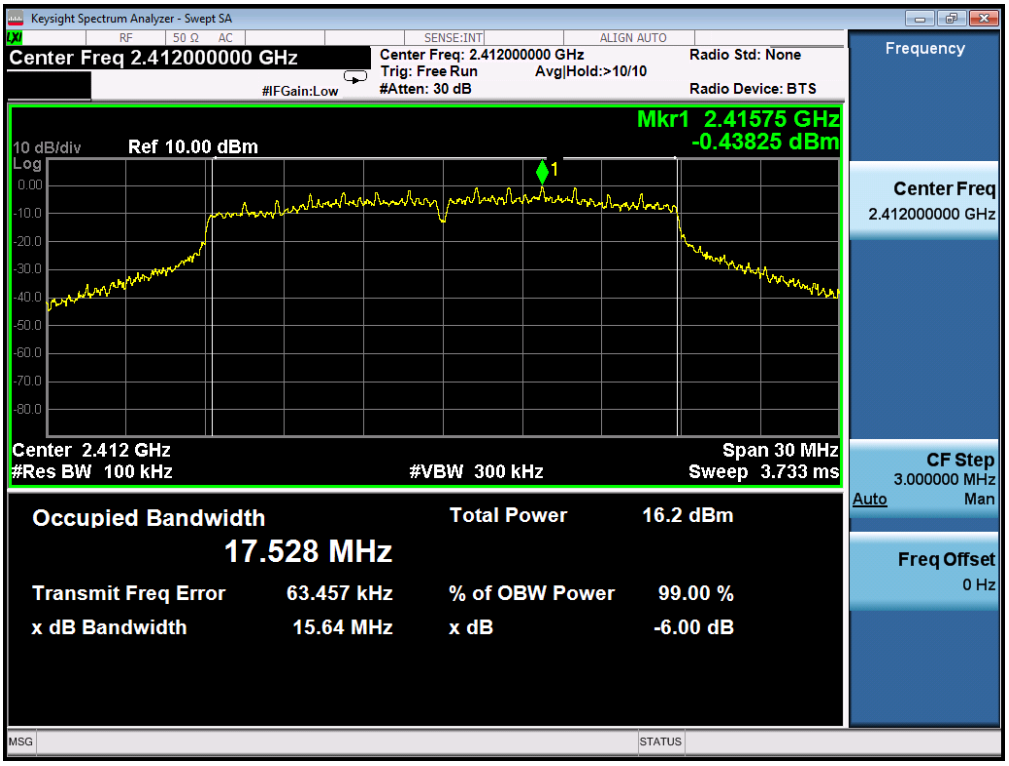


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

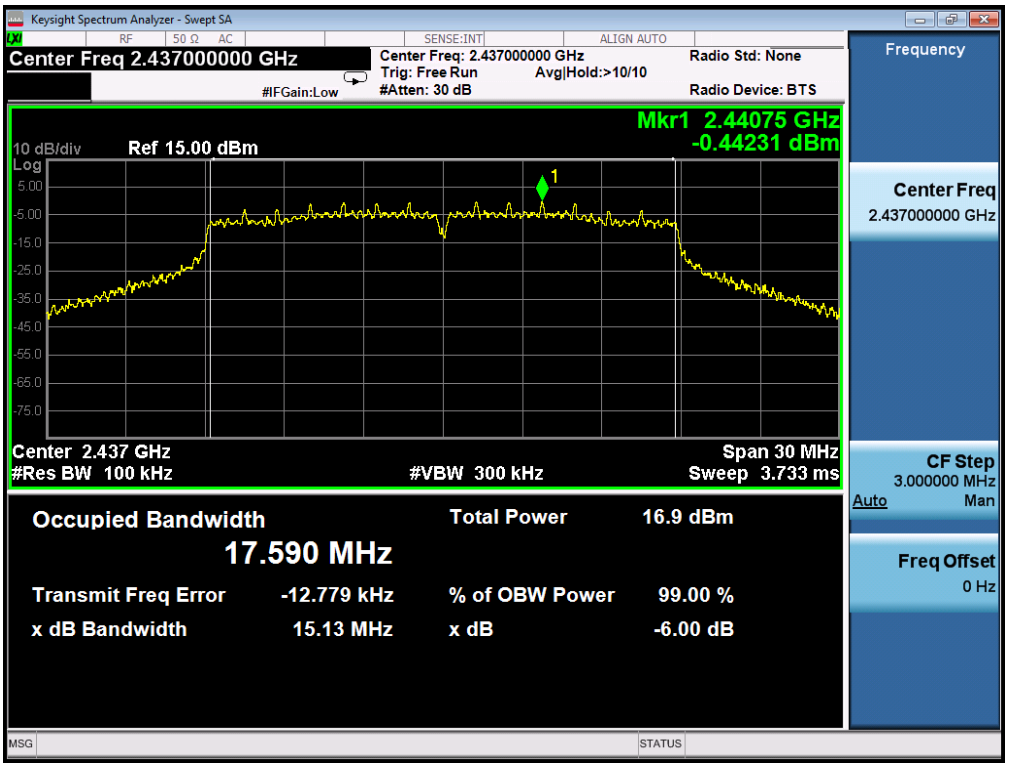


802.11n (20) TEST RESULT-Ant0:

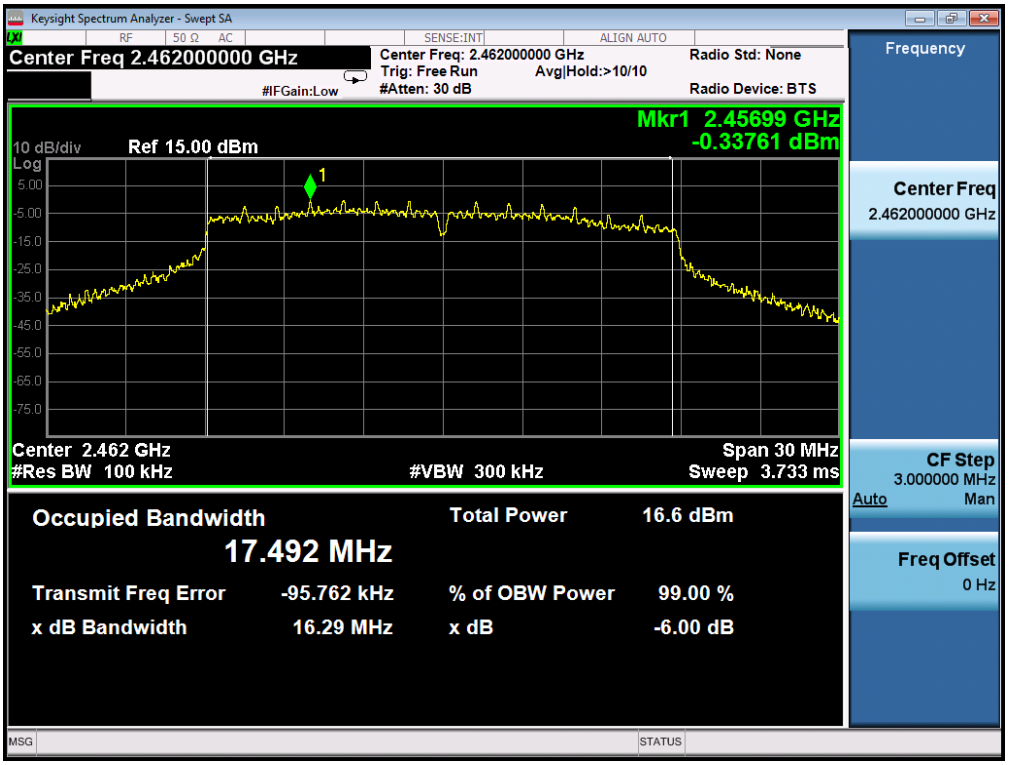
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

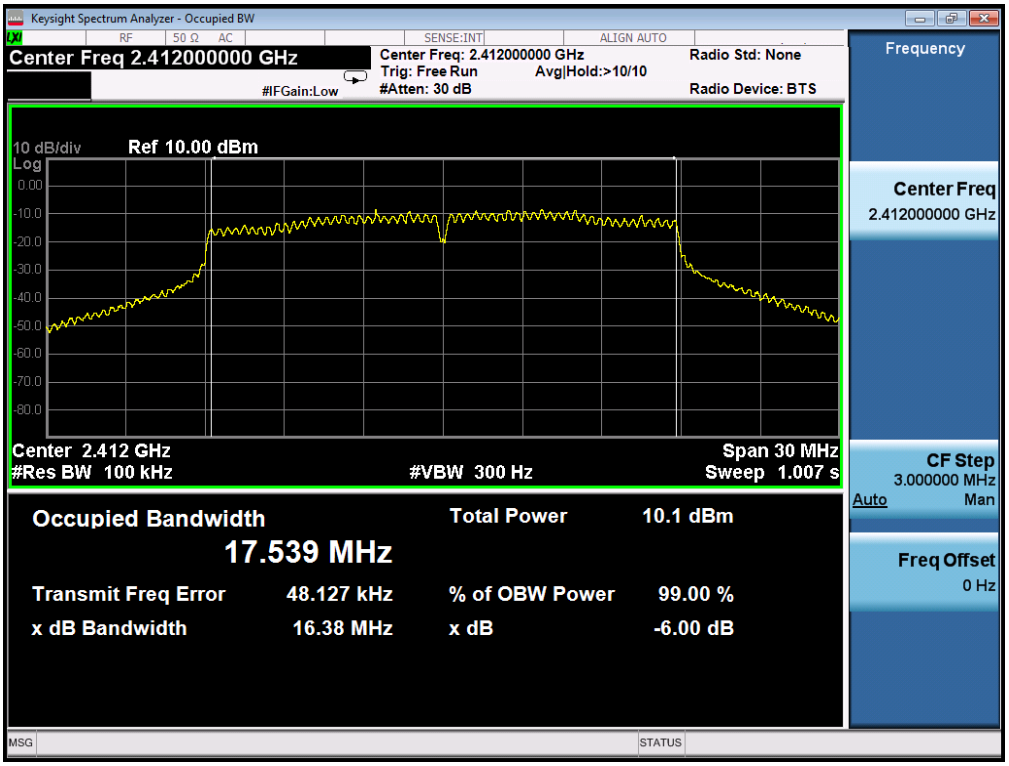


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

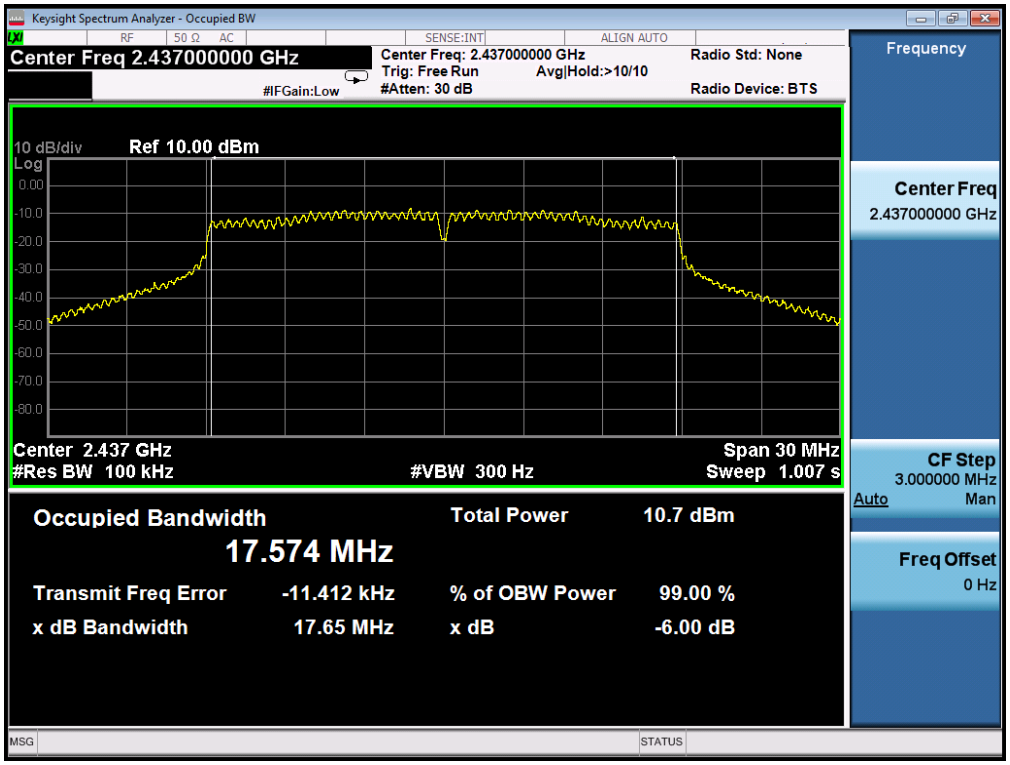


802.11n20 TEST RESULT-Ant1:

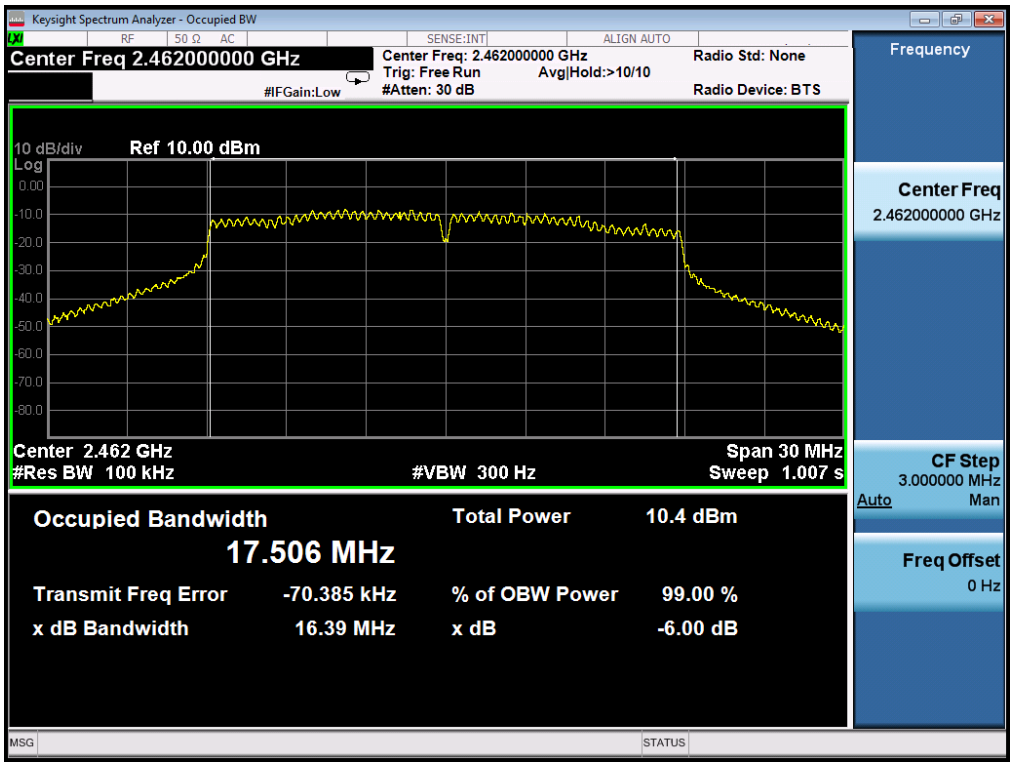
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

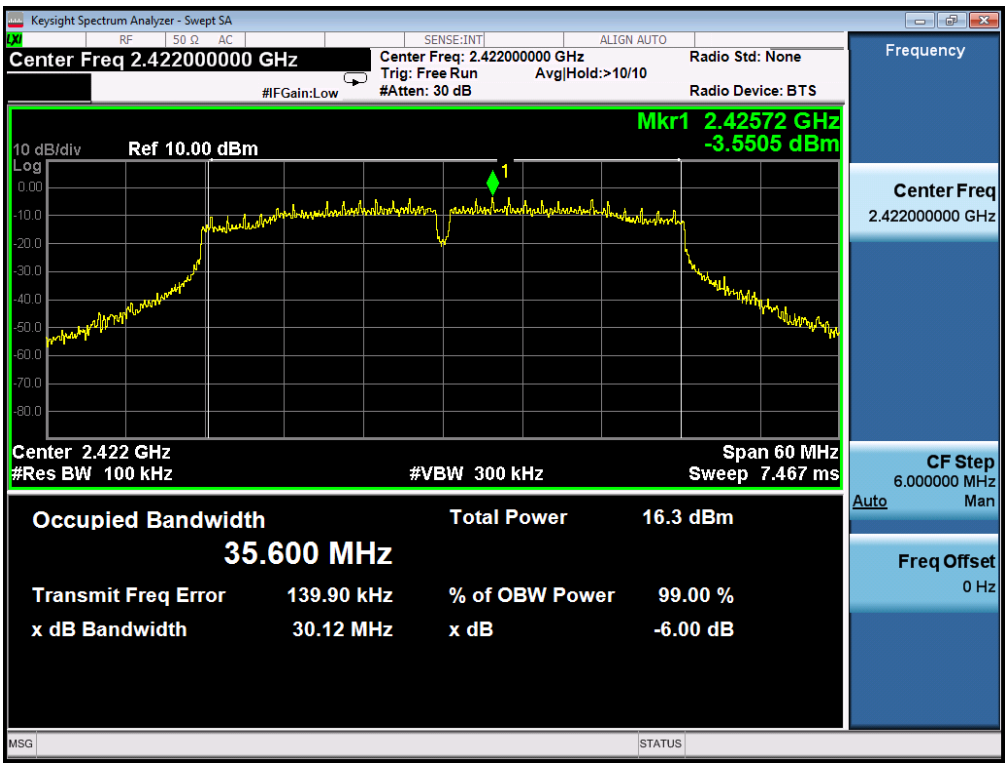


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

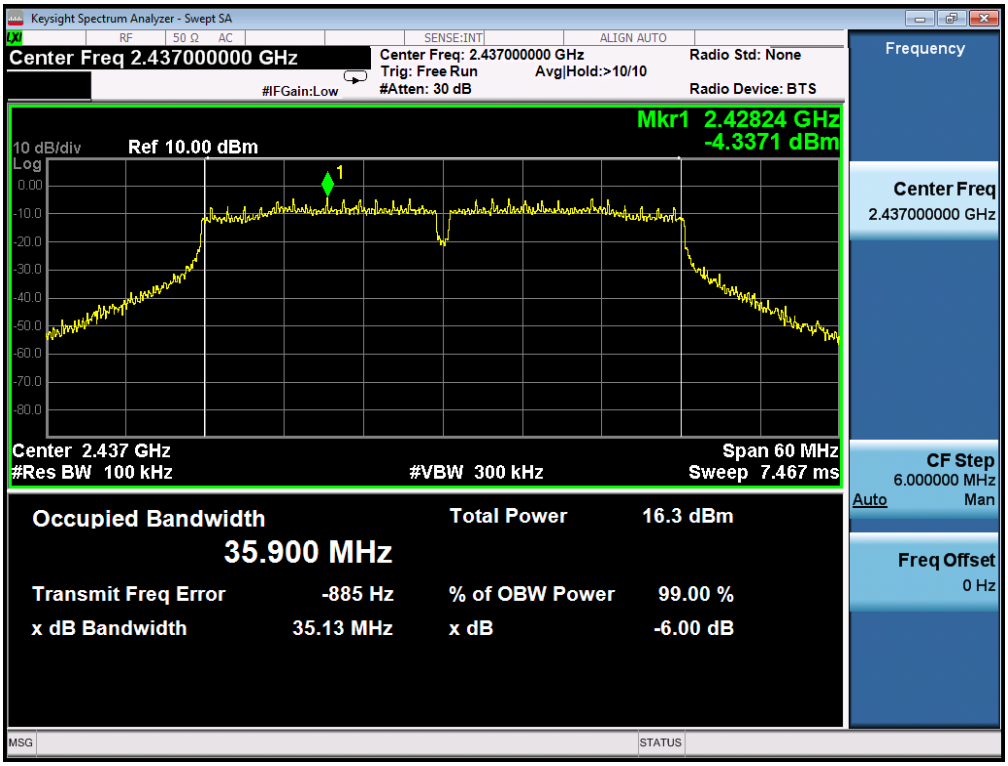


802.11n (40) TEST RESULT

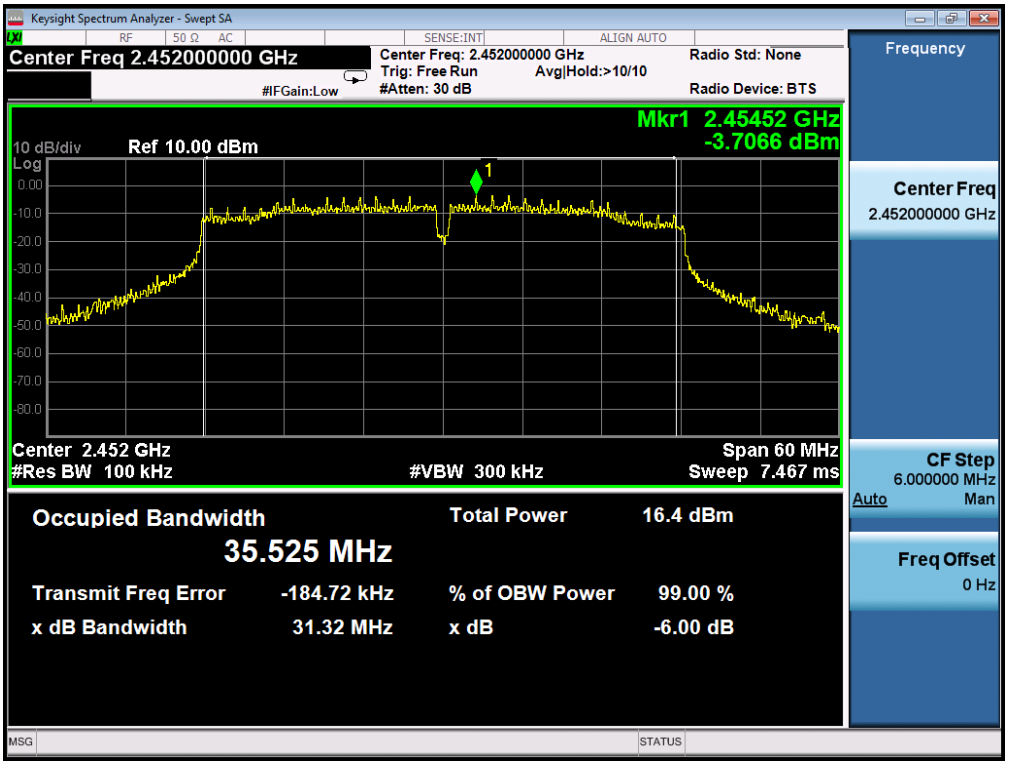
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

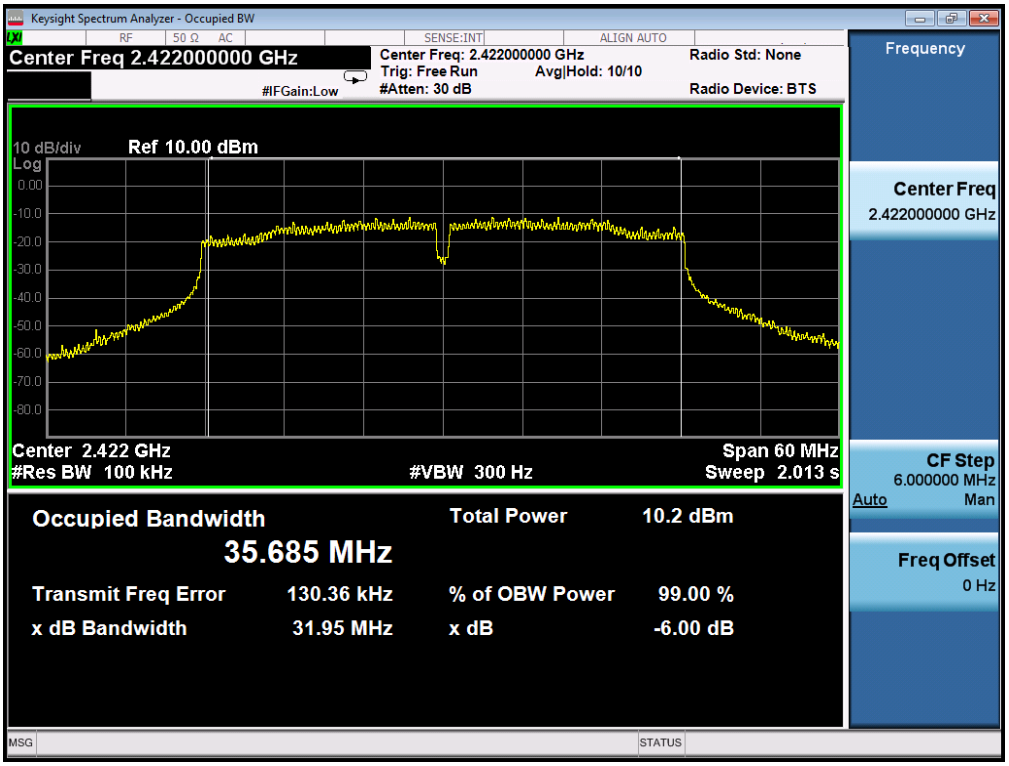


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

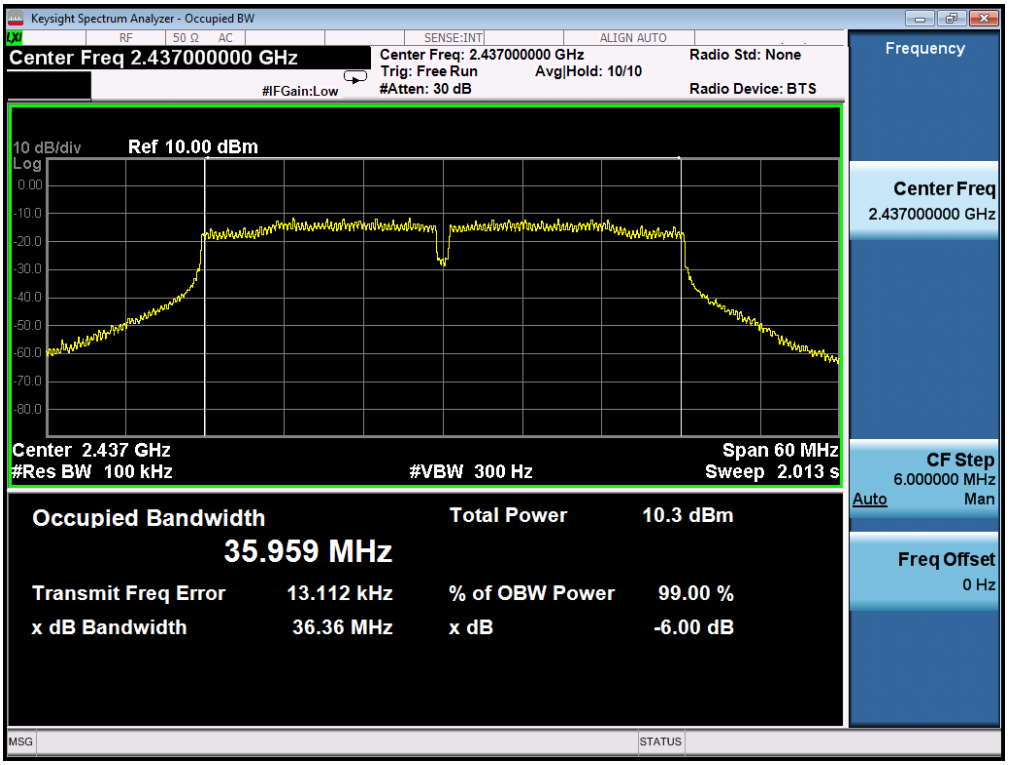


802.11n(40) TEST RESULT-Ant1:

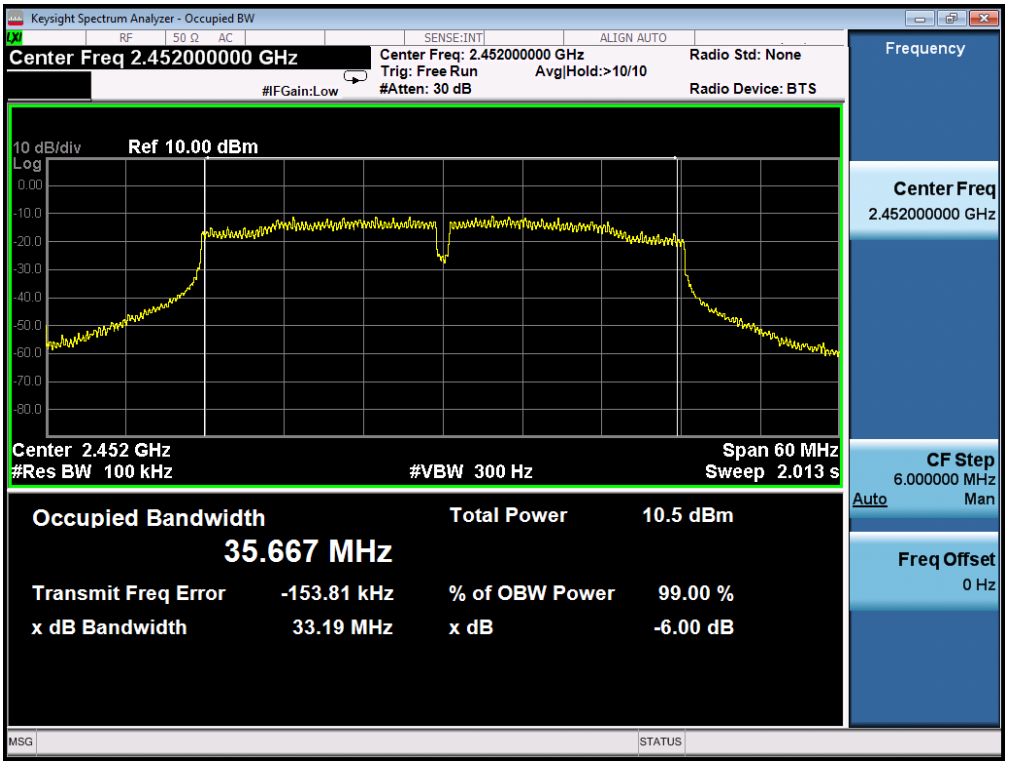
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



NOTE: EUT can working at 802.11b/g/n mode by used two antenna (ant0+ant1), but at 802.11b/g mode EUT cannot use two antenna at the same time, only at 802.11n mimo mode two antenna (ant0+ant1) work at the same time.

9. CONDUCTED SPURIOUS EMISSION

9.1. 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 558074 for compliance to FCC 47CFR 15.247 requirements. Owing to satisfy the requirements of the number of measurement points, we set the RBW=1MHz, VBW＞RBW, scan up through 10th harmonic, and consider the tested results as the worst case, if the tested results conform to the requirement, we can deem that the real tested results(set the RBW=100KHz, VBW＞RBW) are conform to the requirement.

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

The same as described in section 8.2.

9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6.

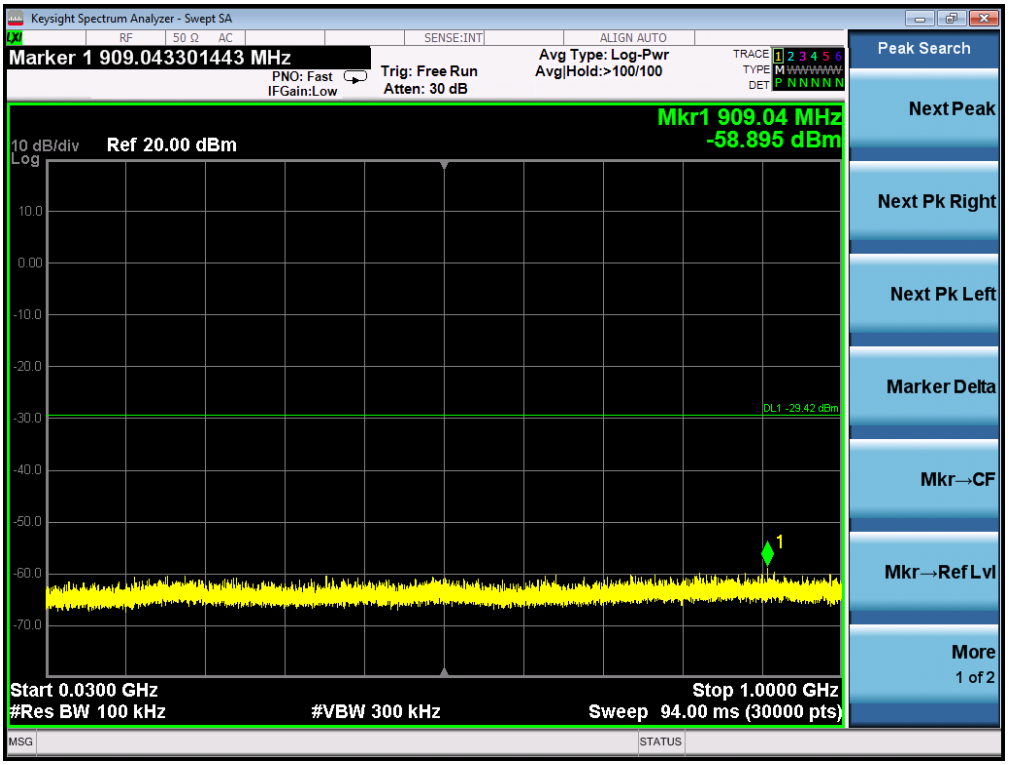
9.4. LIMITS AND MEASUREMENT RESULT

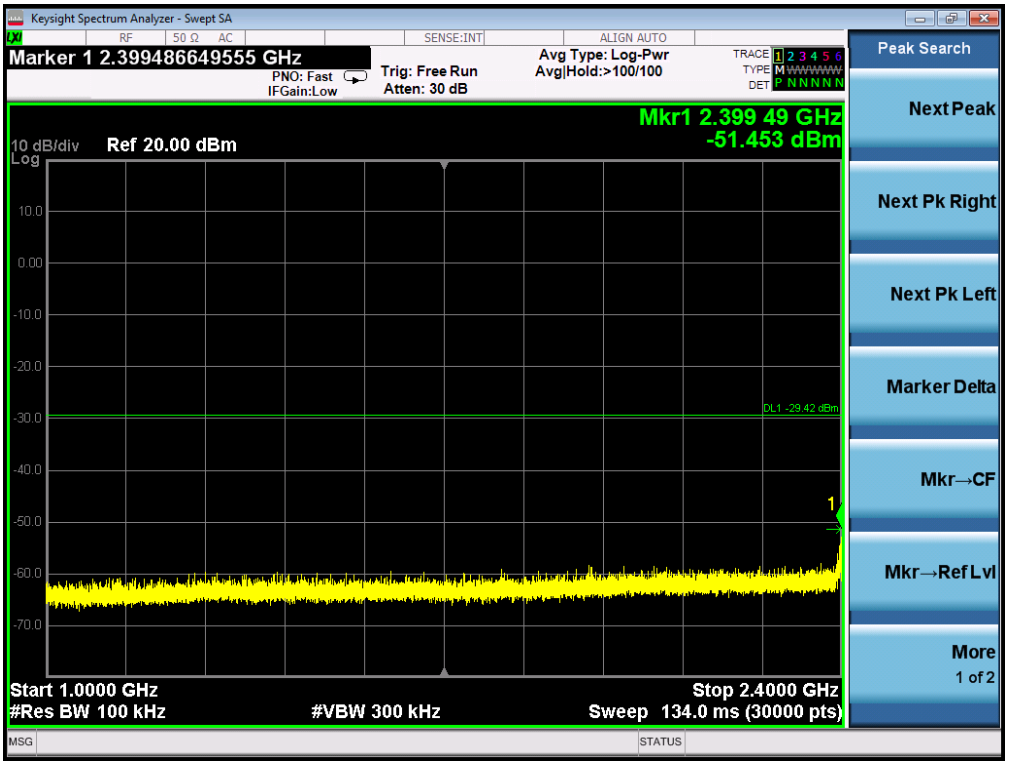
<table>
<tr><th colspan="3">LIMITS AND MEASUREMENT RESULT</th></tr>
<tr><th rowspan="2">Applicable Limits</th><th colspan="2">Measurement Result</th></tr>
<tr><th>Test Data</th><th>Criteria</th></tr>
<tr><td rowspan="2">In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 30 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power.
In addition, radiation emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in§15.209(a))</td><td>At least -30dBc than the limit Specified on the BOTTOM Channel</td><td>PASS</td></tr>
<tr><td>At least -30dBc than the limit Specified on the TOP Channel</td><td>PASS</td></tr>
</table>

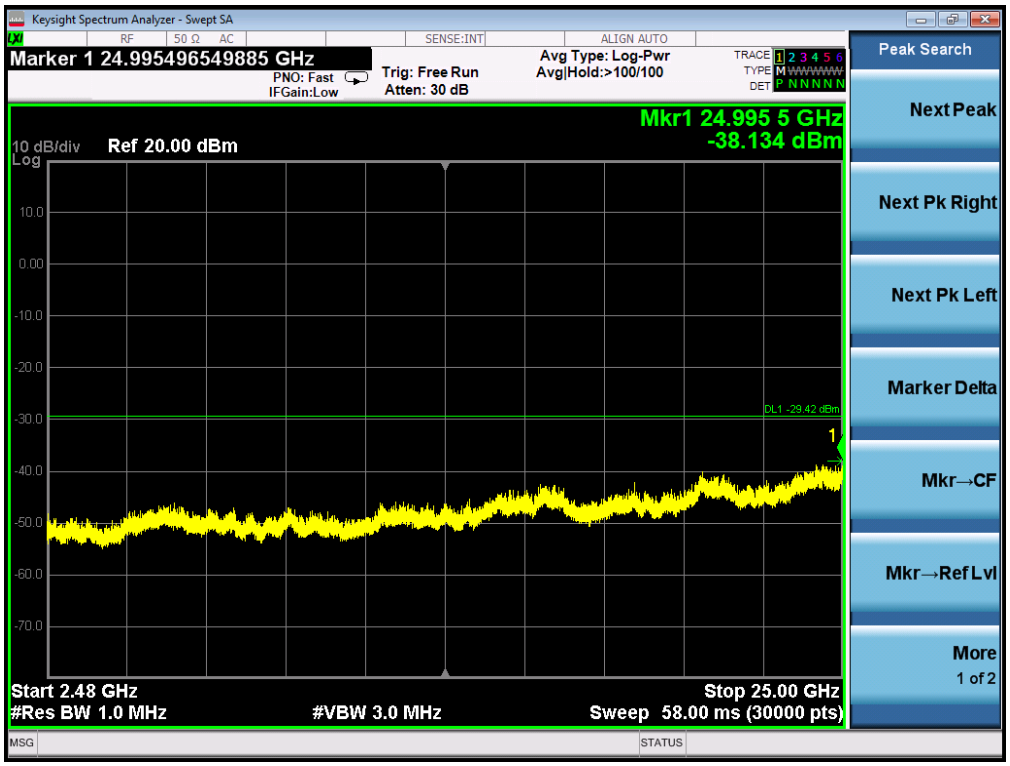
Note: 1) Two transmit chains had been tested; the chain 0 was the worst case and record in the test report. The spurious emission at chain 0 is more than 3dB below the limits, so the results for the spurious emissions a re comply with the requirement.

2) EUT can working at 802.11b/g/n mode by used two antenna (ant0+ant1), but at 802.11b/g mode EUT cannot use two antenna at the same time, only at 802.11n mimo mode two antenna (ant0+ant1) work at the same time.

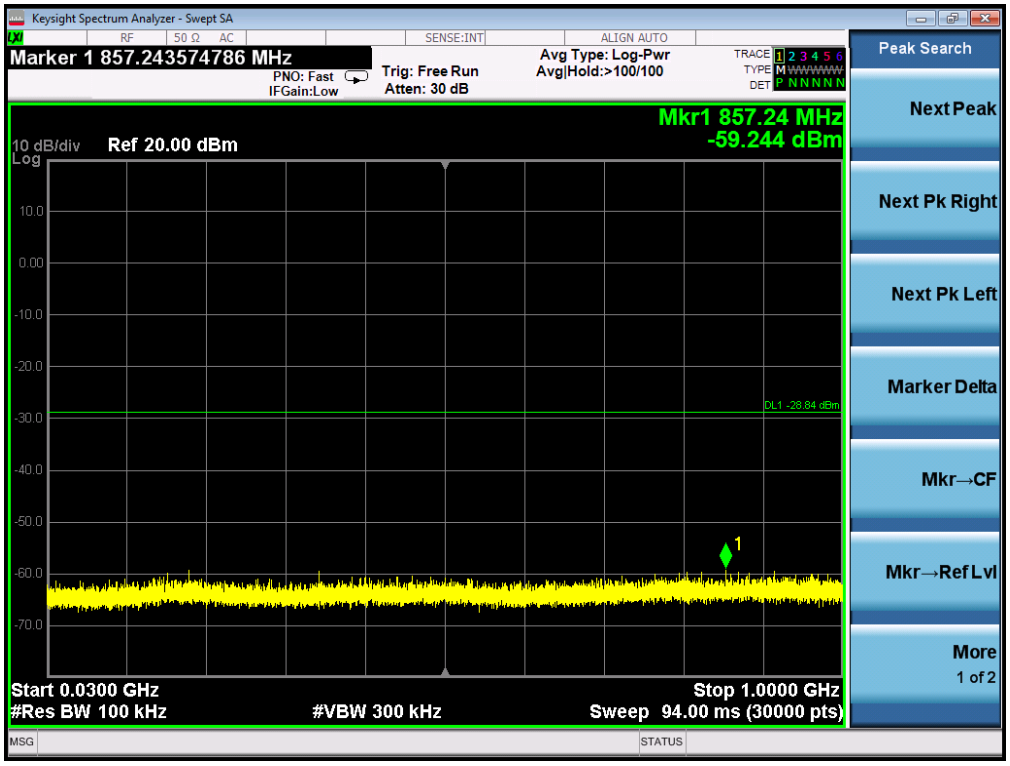
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF 802.11b FOR MODULATION IN LOW CHANNEL

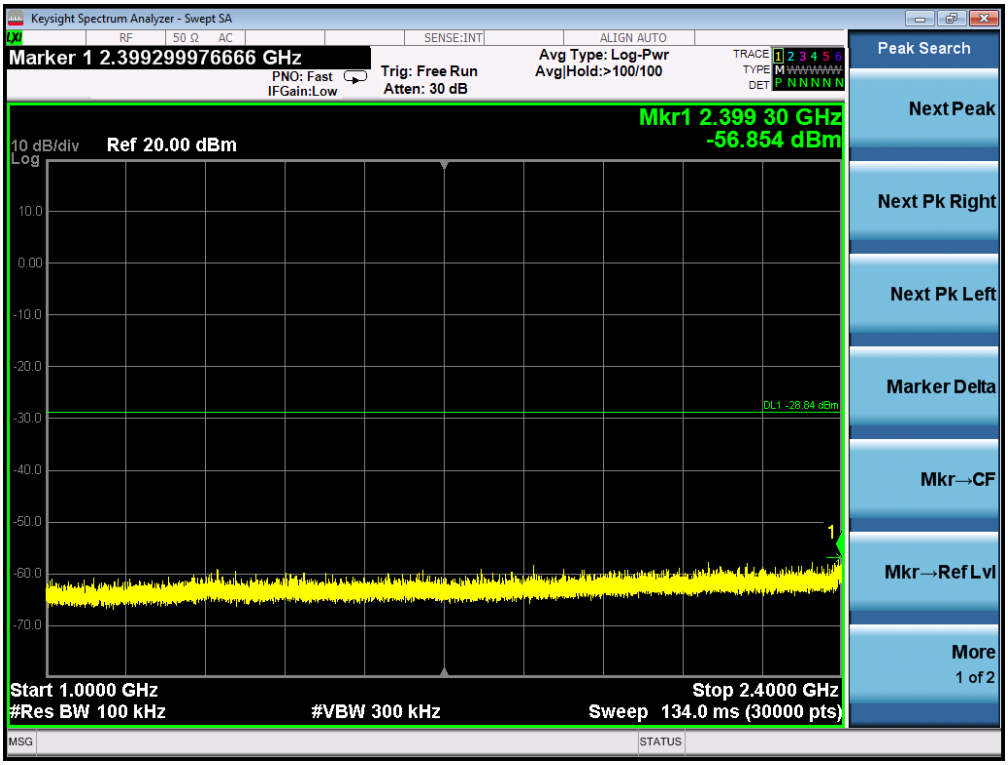






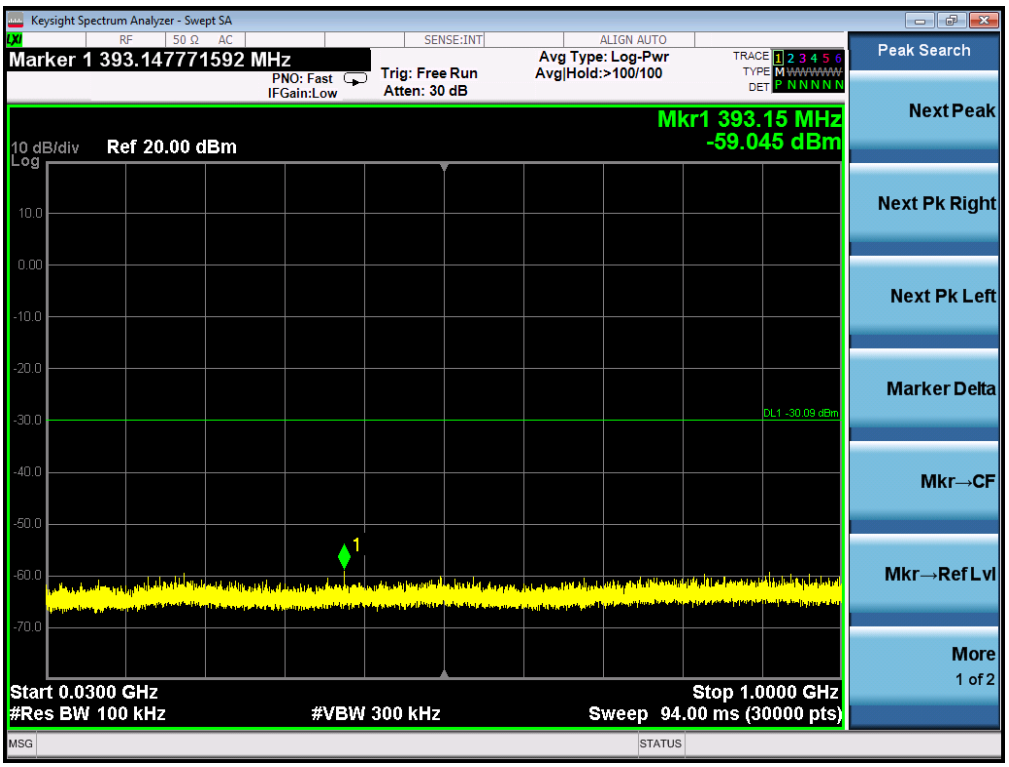
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE OF 802.11b FOR MODULATION IN MIDDLE CHANNEL

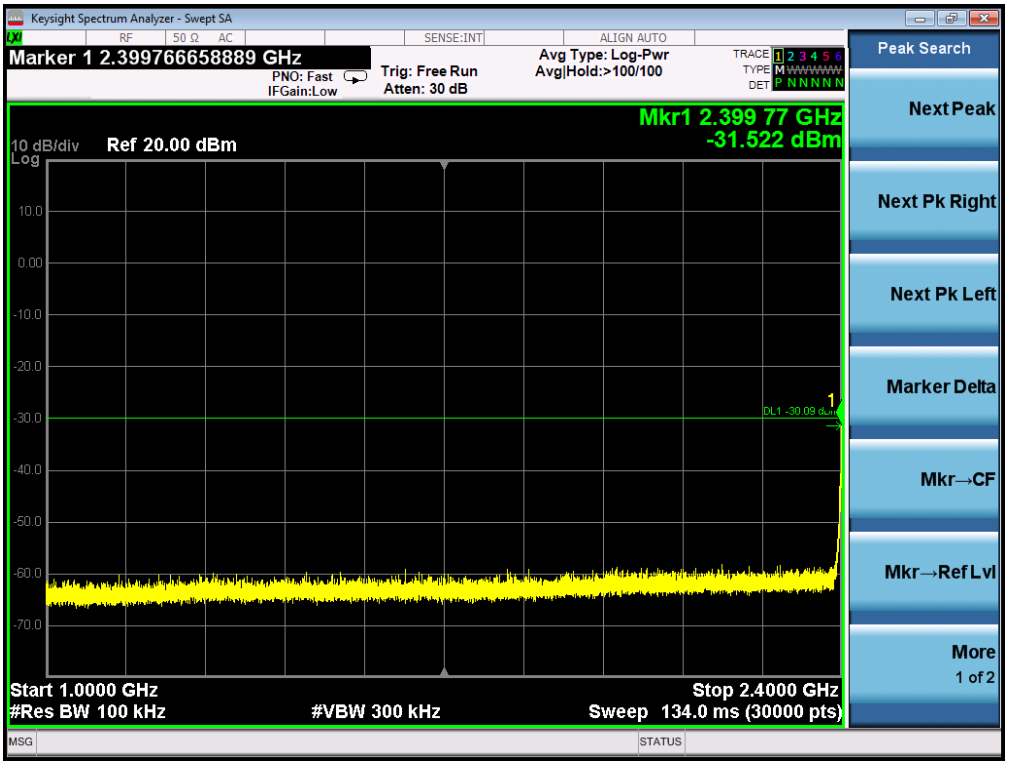


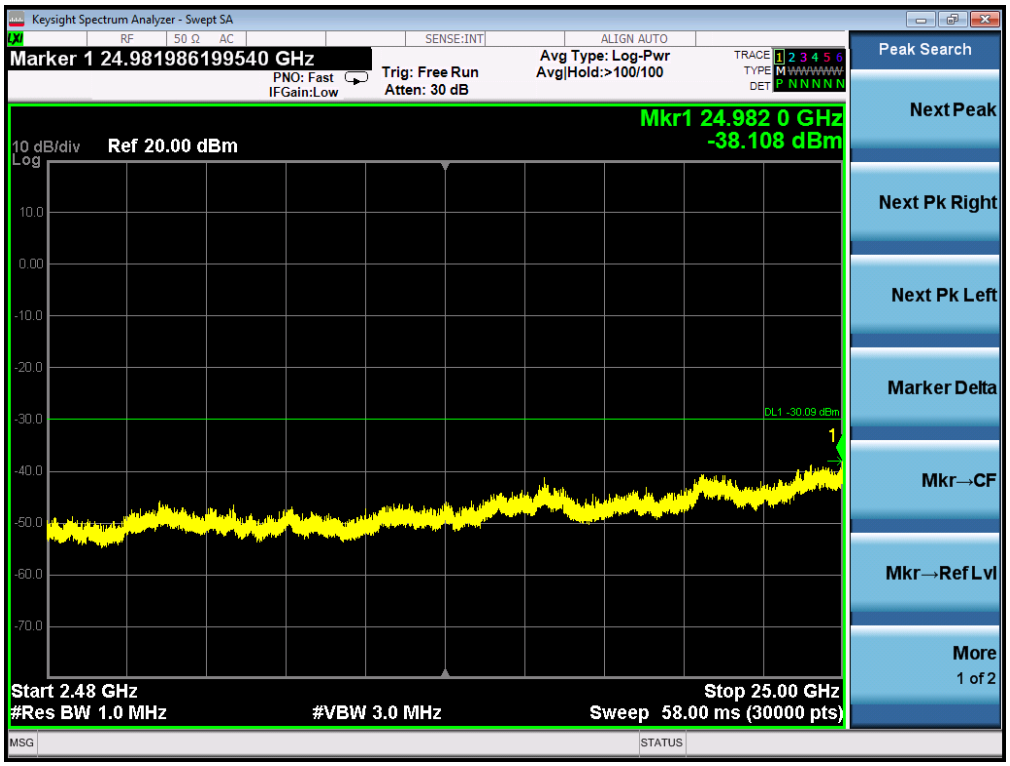

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 2.399299976666 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 2.399 30 GHz
-56.854 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
DL1 -28.84 dBm
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 134.0 ms (30000 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Keysight Spectrum Analyzer - Swept SA
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 24.476098636621 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 24.476 1 GHz
-38.047 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
DL1 -28.84 dBm
Start 2.48 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.00 GHz
Sweep 58.00 ms (30000 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

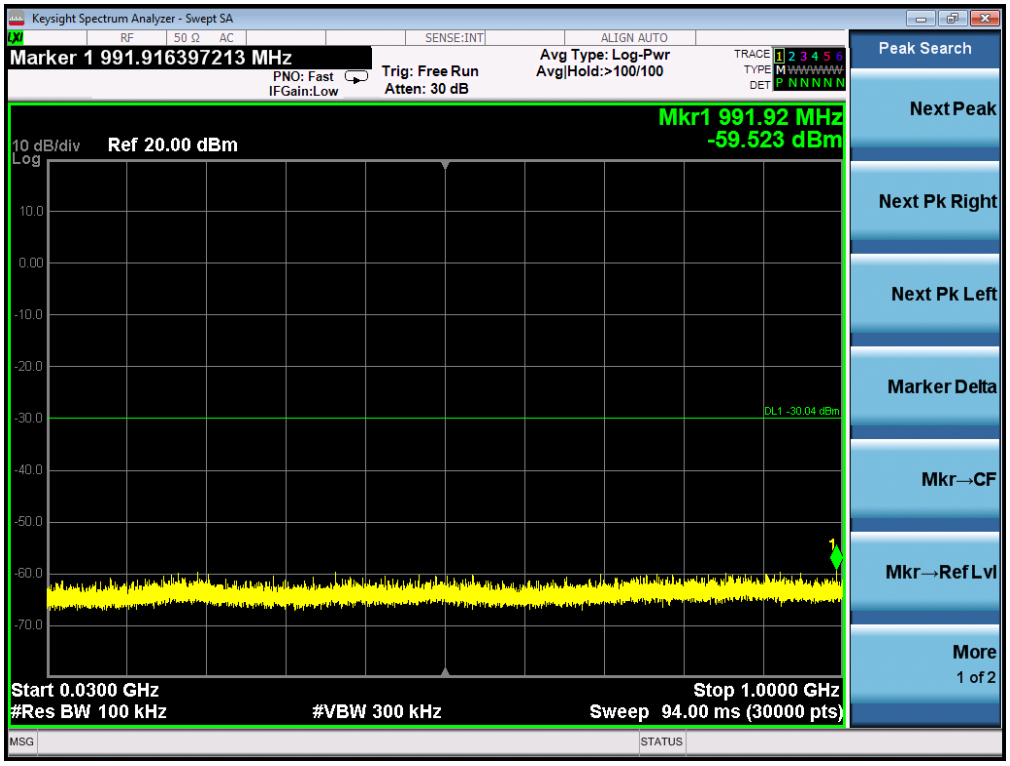
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE
OF 802.11b FOR MODULATION IN HIGH CHANNEL

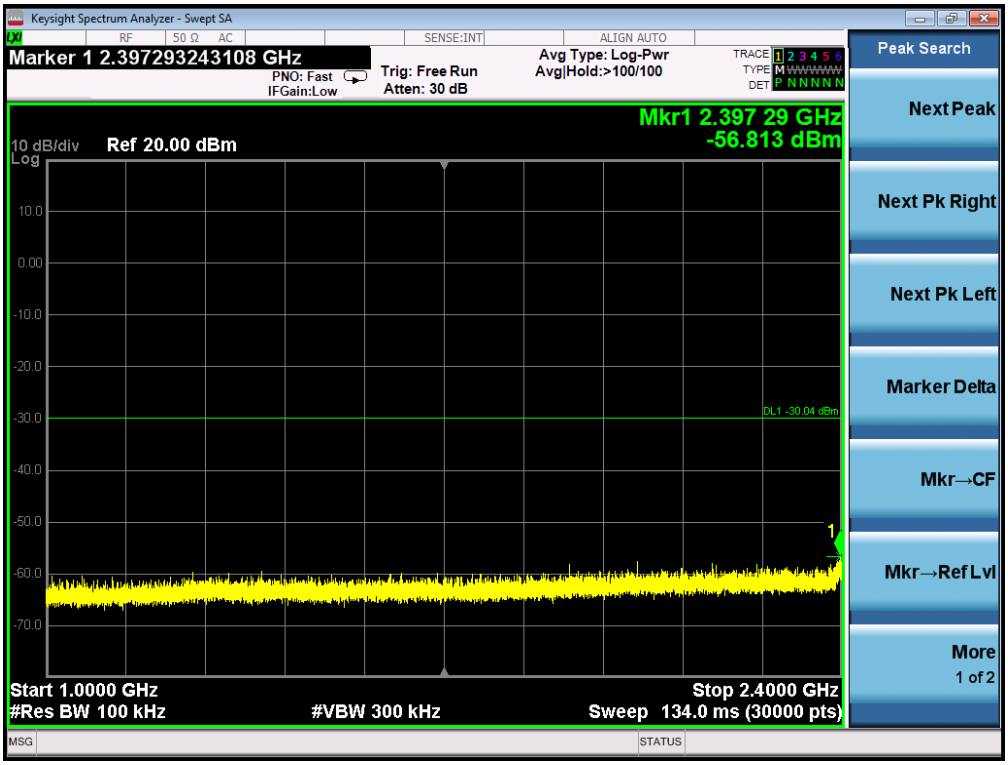






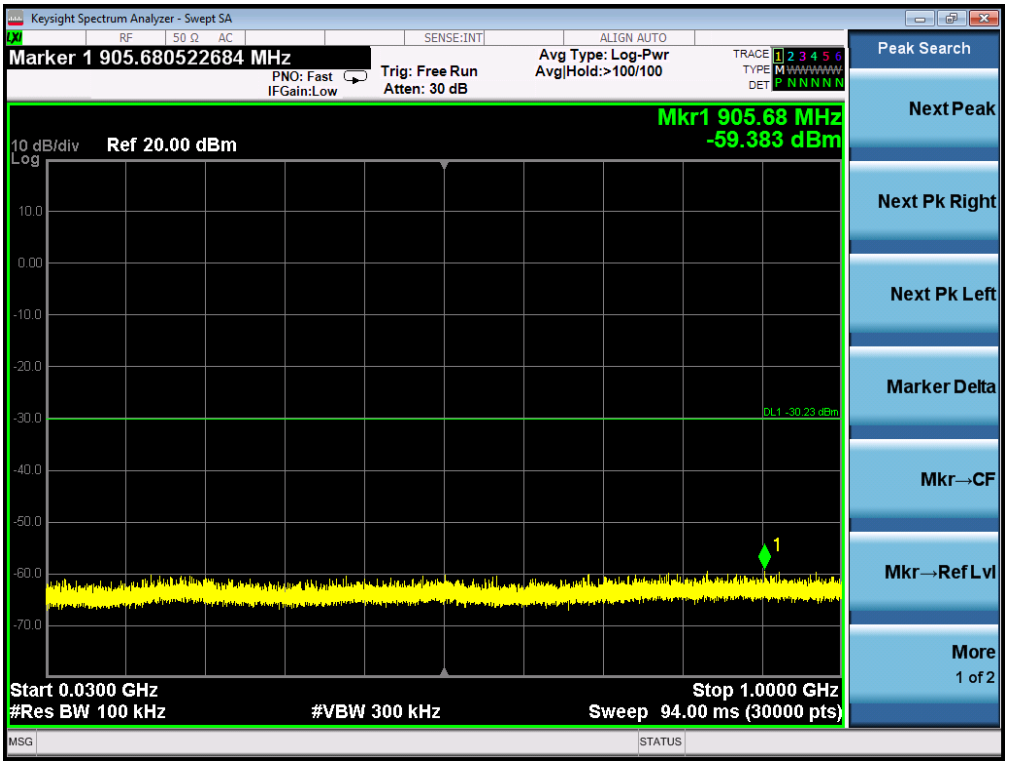
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF 802.11g FOR MODULATION IN LOW CHANNEL

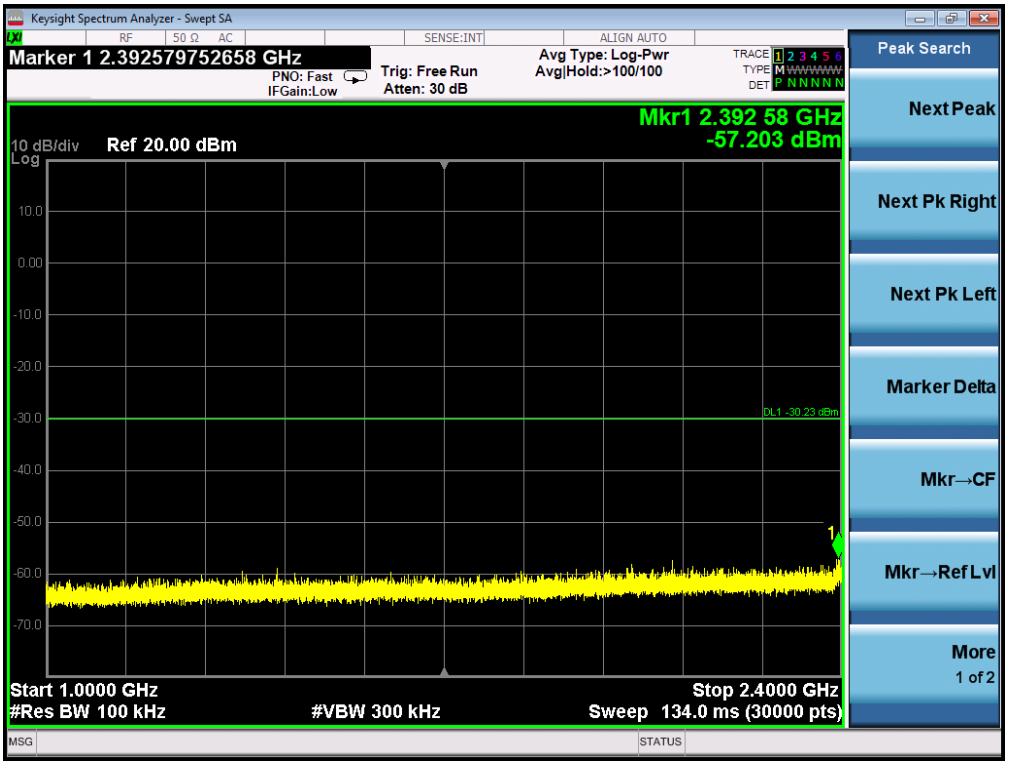



Keysight Spectrum Analyzer - Swept SA
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 2.397293243108 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 2.397 29 GHz
-56.813 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
DL1 -30.04 dBm
1
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 134.0 ms (30000 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

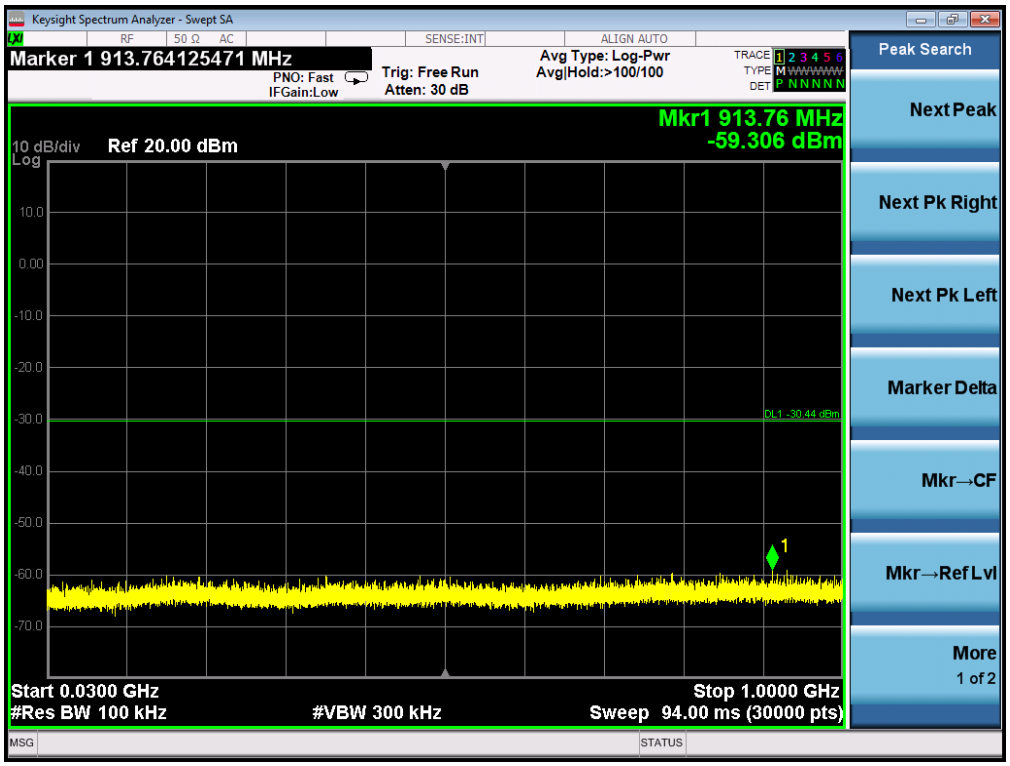

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 24.934699973332 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 24.934 7 GHz
-37.525 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
DL1 -30.04 dBm
1
Start 2.48 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.00 GHz
Sweep 58.00 ms (30000 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

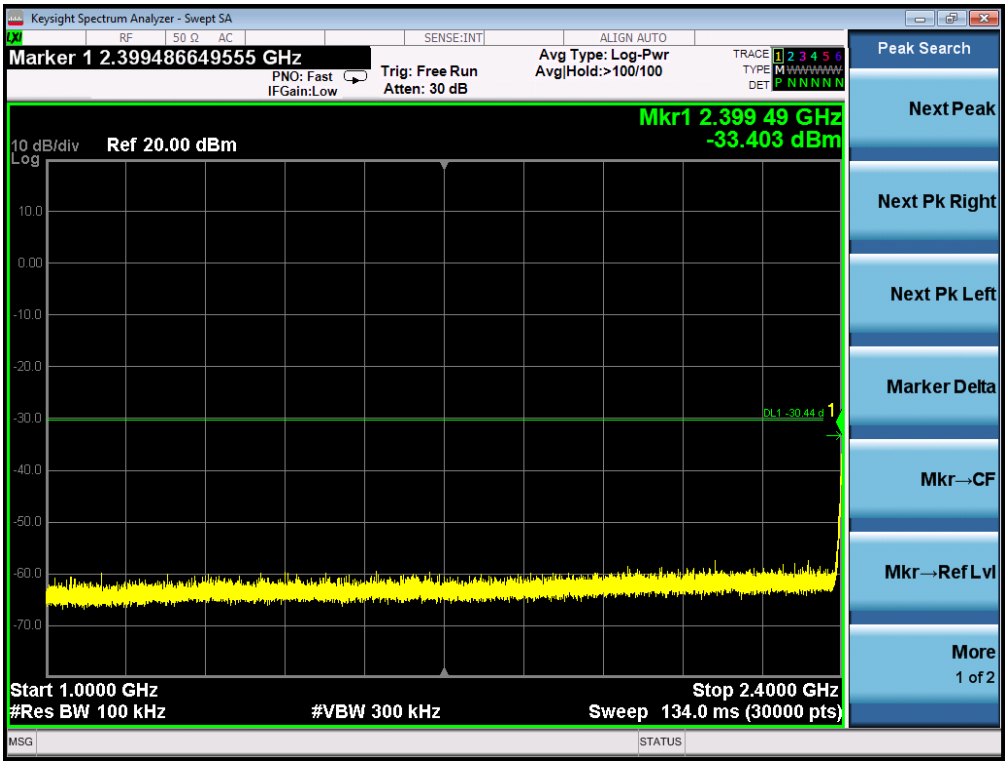
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE
OF 802.11g FOR MODULATION IN MIDDLE CHANNEL





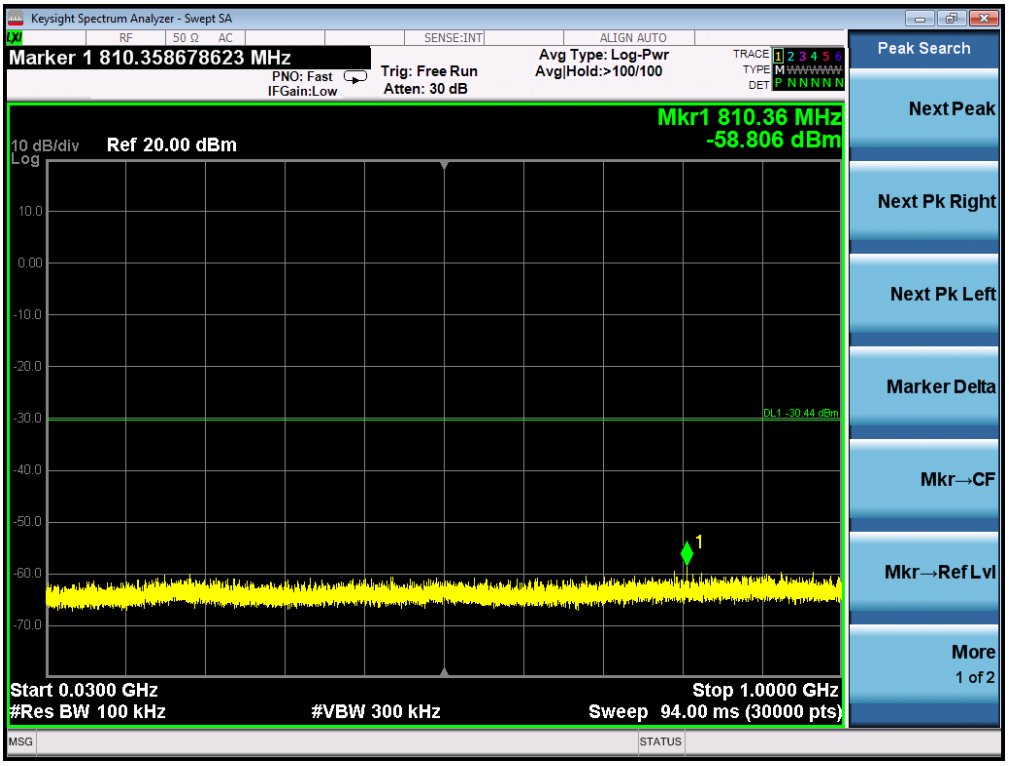
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE OF 802.11g FOR MODULATION IN HIGH CHANNEL

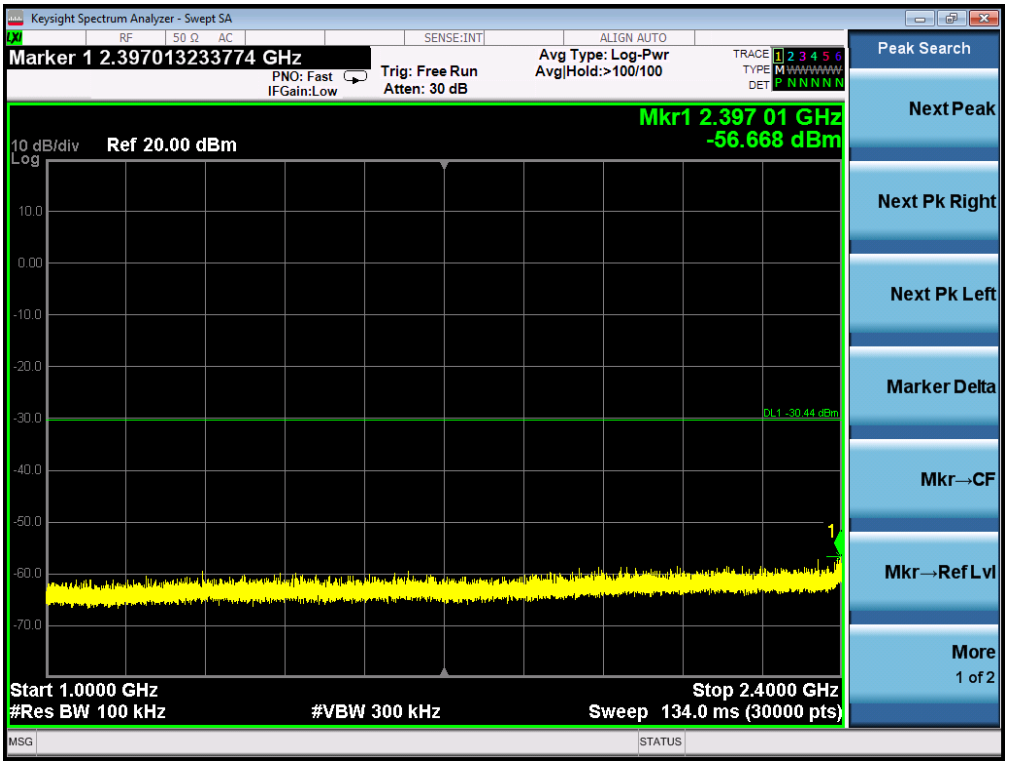


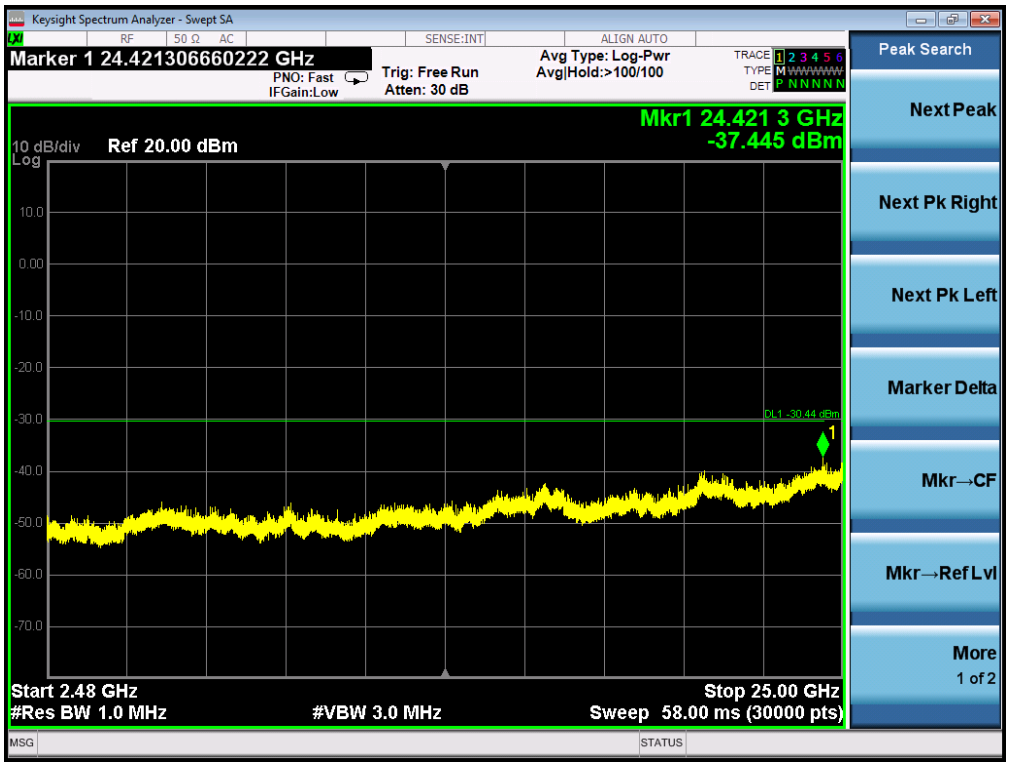

Keysight Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 2.399486649555 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Mkr1 2.399 49 GHz
-33.403 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
DL1 -30.44 d
1
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 134.0 ms (30000 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Keysight Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 24.957967798927 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Mkr1 24.958 0 GHz
-38.284 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
DL1 -30.44 dBm
1
Start 2.48 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.00 GHz
Sweep 58.00 ms (30000 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

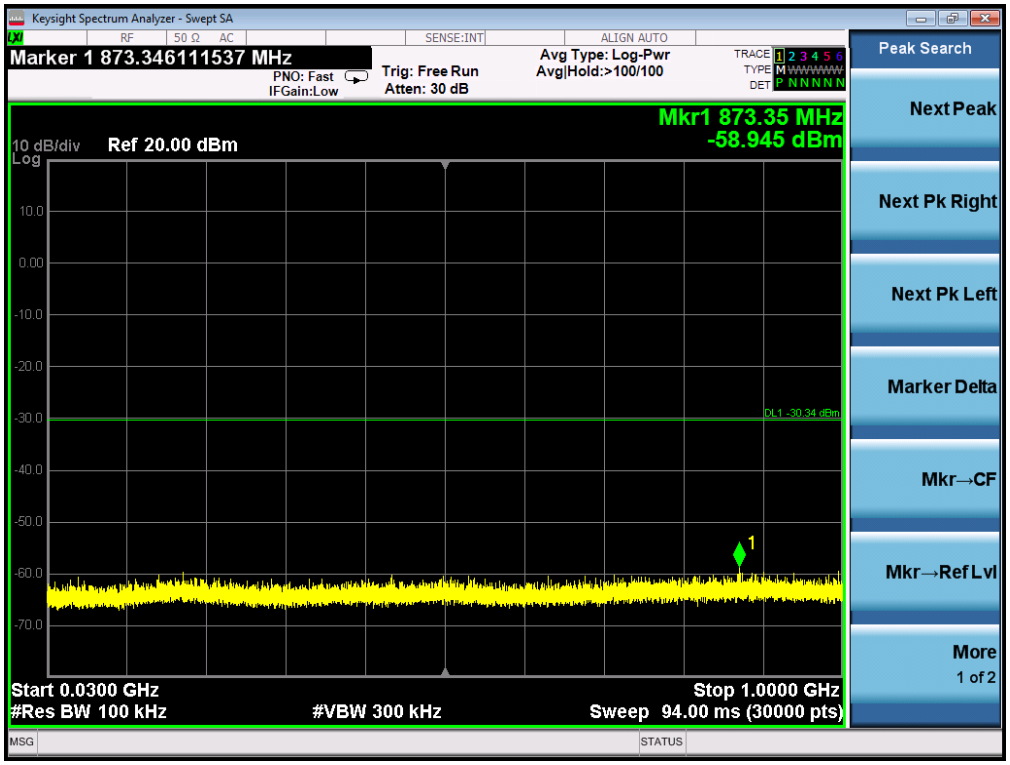
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE
OF 802.11n20 FOR MODULATION IN LOW CHANNEL

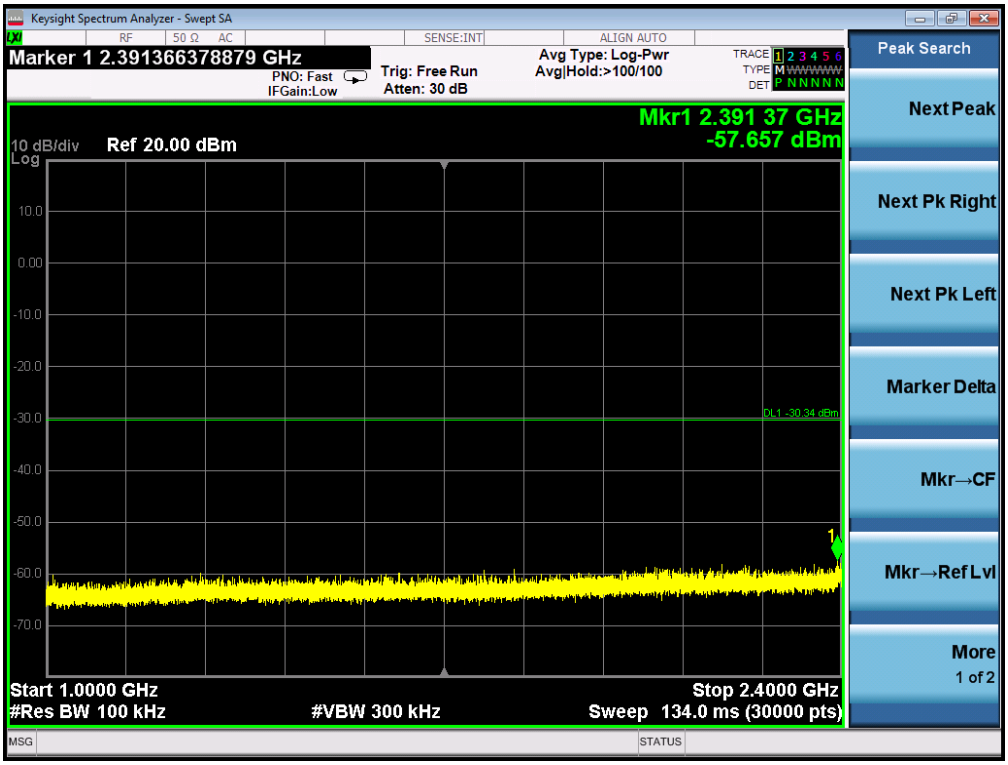






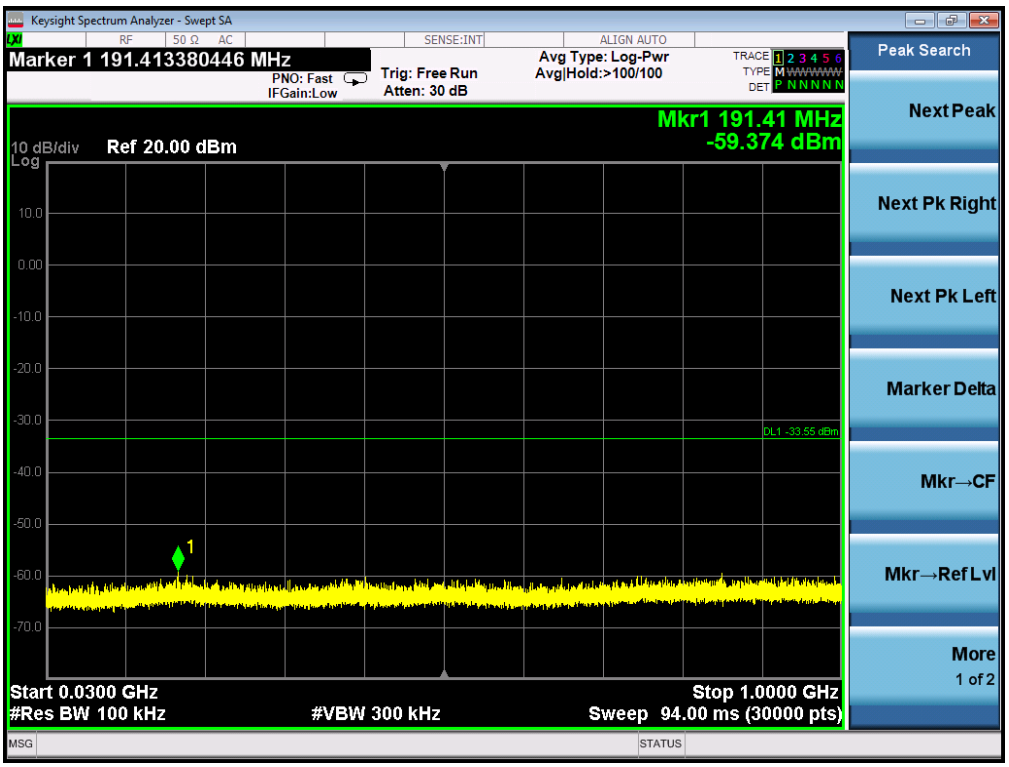
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE OF 802.11n20 FOR MODULATION IN MIDDLE CHANNEL

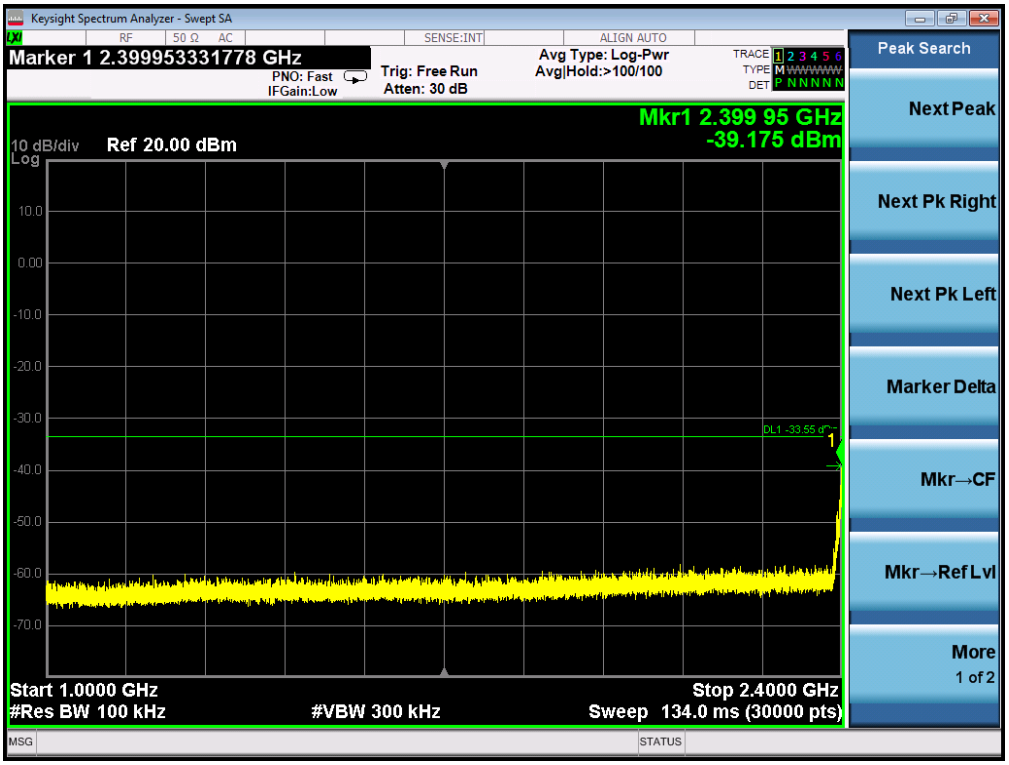



Keysight Spectrum Analyzer - Swept SA
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 2.391366378879 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 2.391 37 GHz
-57.657 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
DL1 -30.34 dBm
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 134.0 ms (30000 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Keysight Spectrum Analyzer - Swept SA
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 24.994745974866 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 24.994 7 GHz
-38.068 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
DL1 -30.34 dBm
Start 2.48 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.00 GHz
Sweep 58.00 ms (30000 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

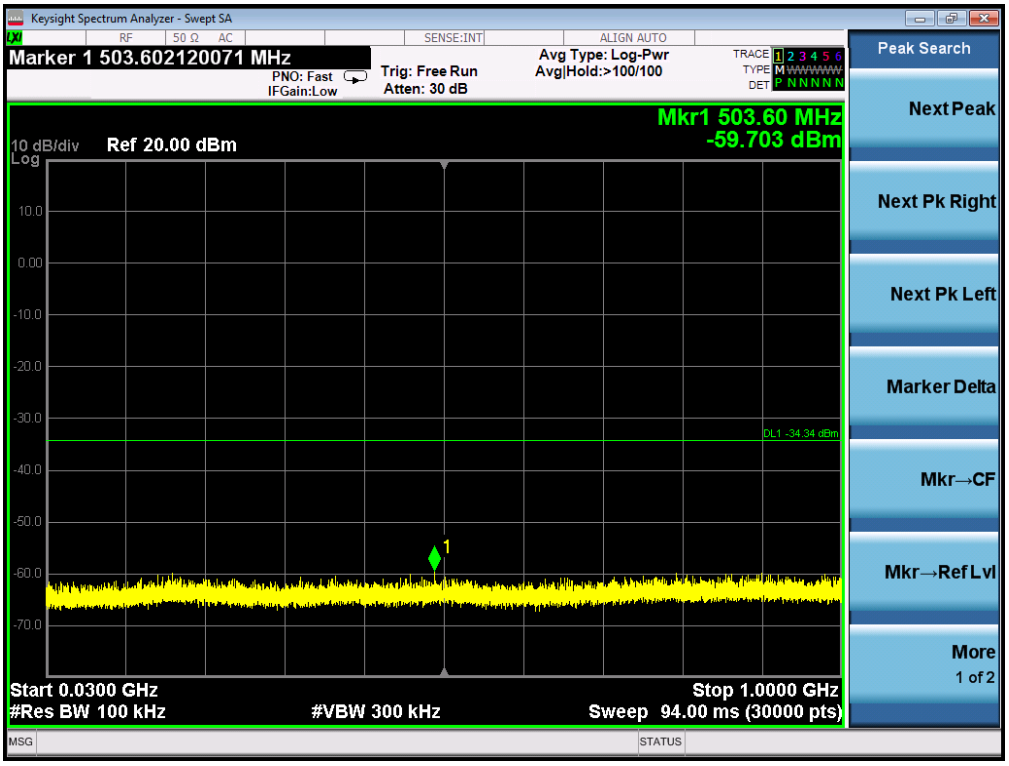
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE
OF 802.11n20 FOR MODULATION IN HIGH CHANNEL

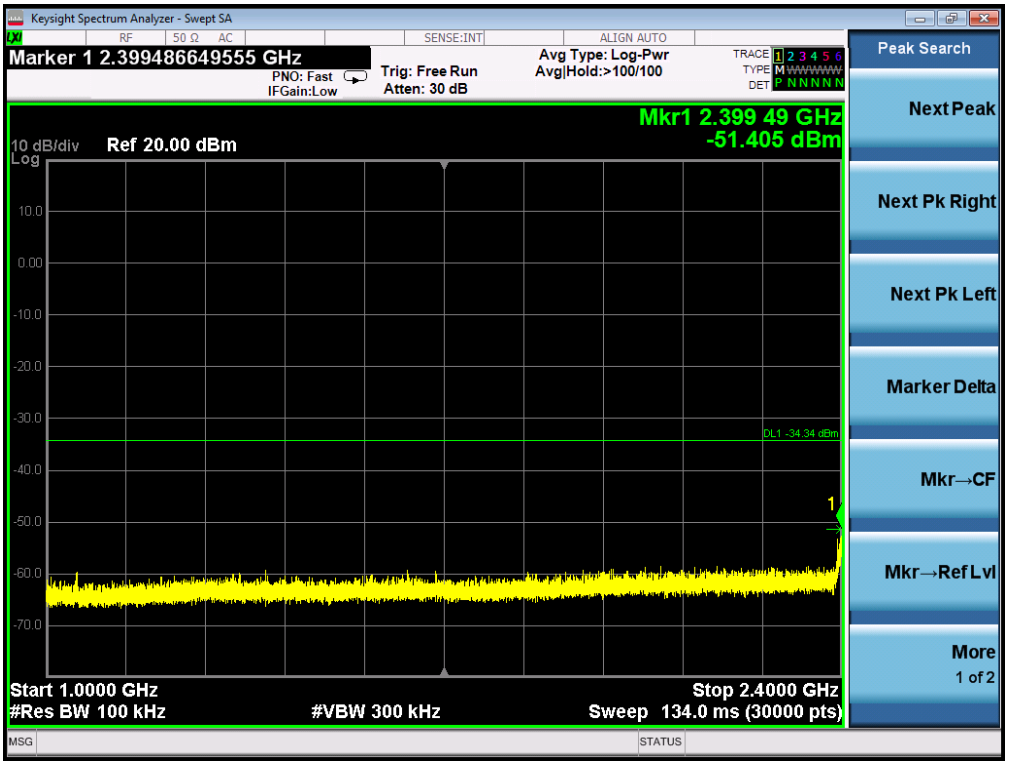


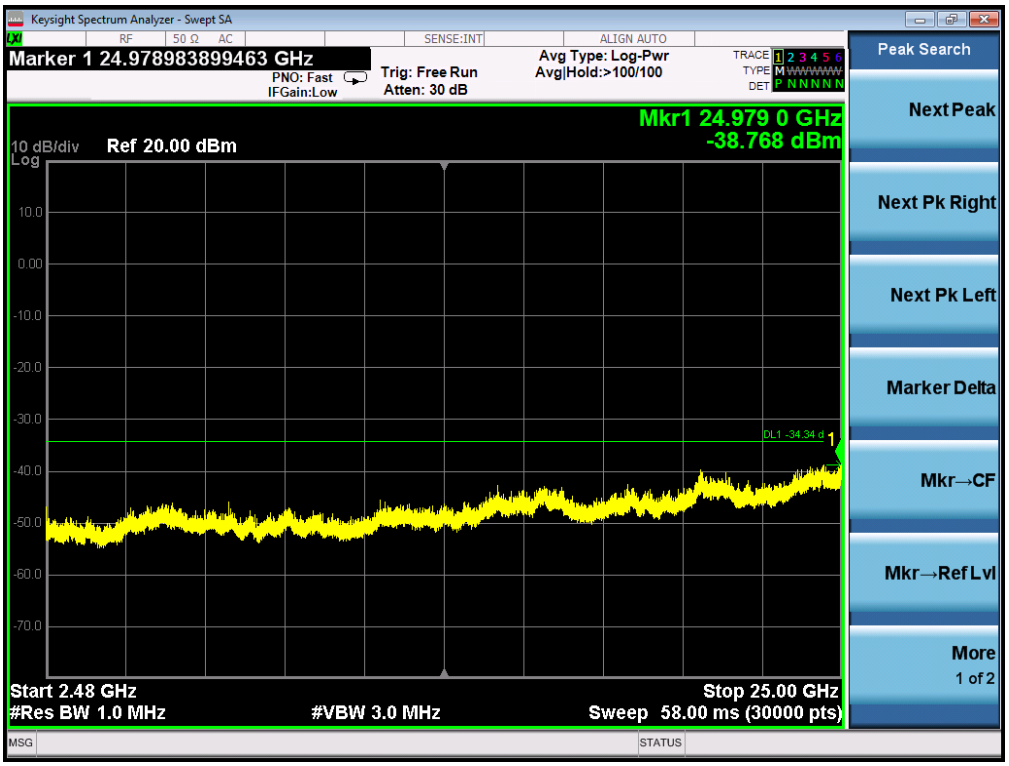



Keysight Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 24.259182456082 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
Mkr1 24.259 2 GHz
-37.994 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
DL1 -33.55
Start 2.48 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.00 GHz
Sweep 58.00 ms (30000 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

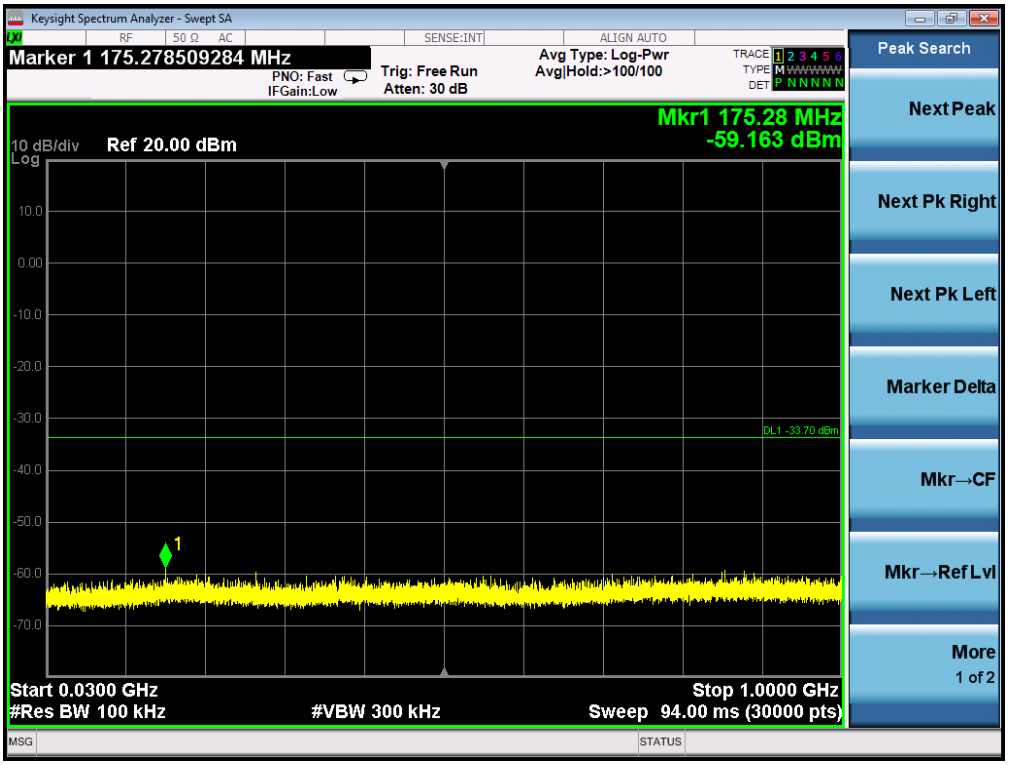
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF 802.11n40 FOR MODULATION IN LOW CHANNEL

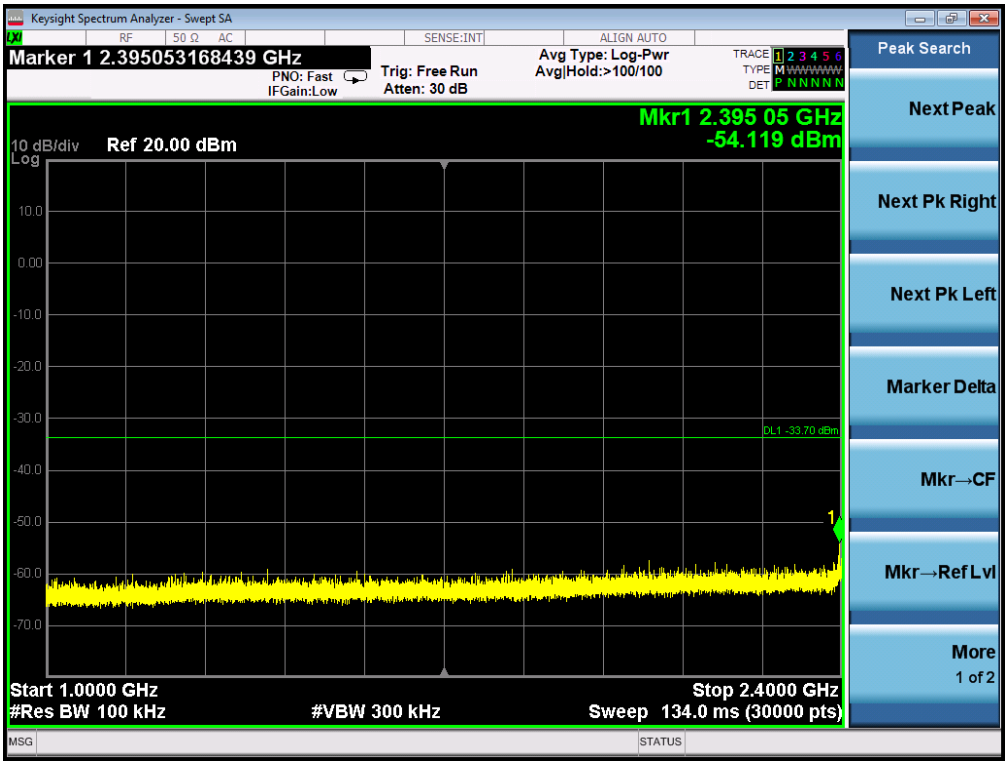






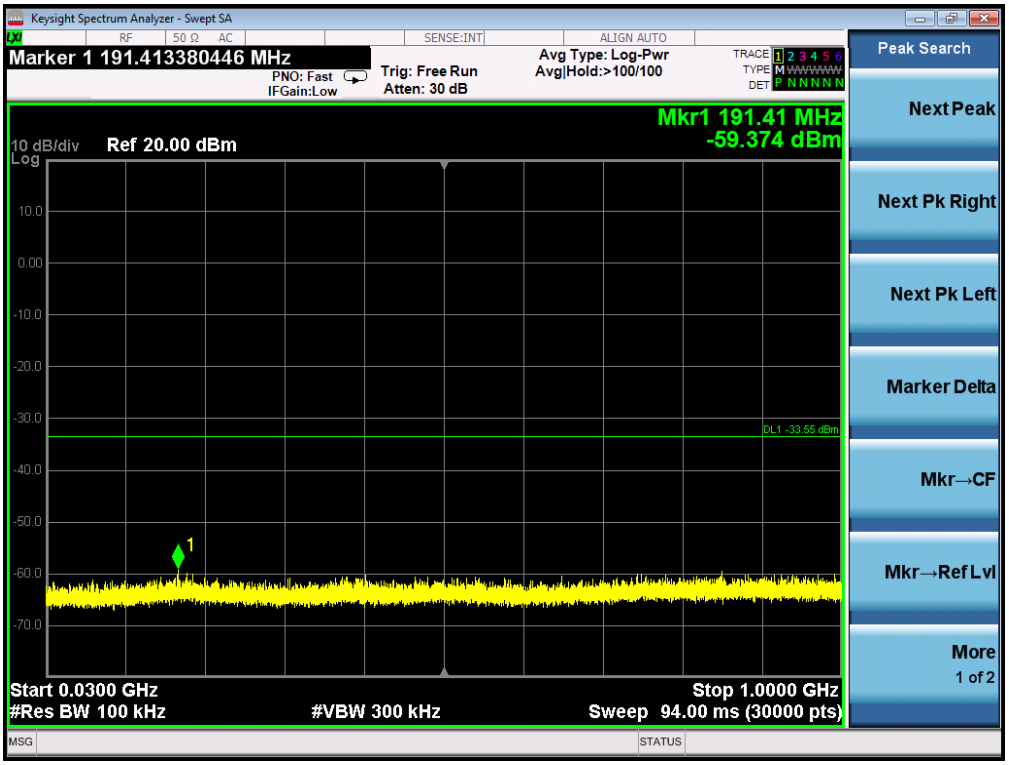
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE OF 802.11n40 FOR MODULATION IN MIDDLE CHANNEL

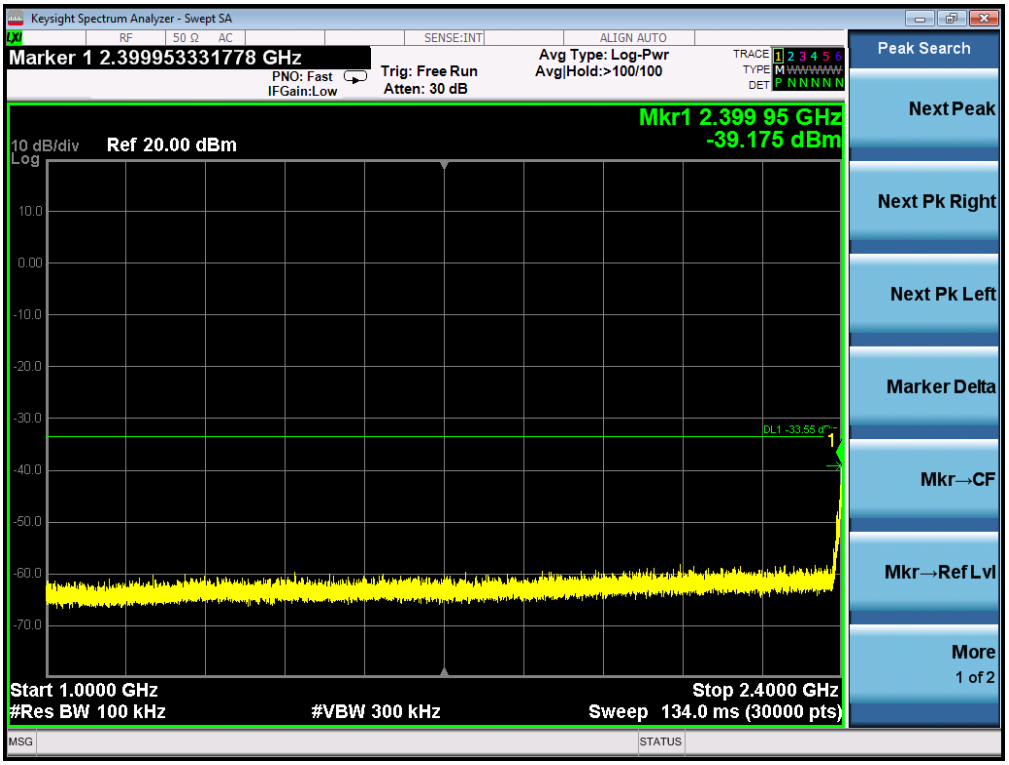


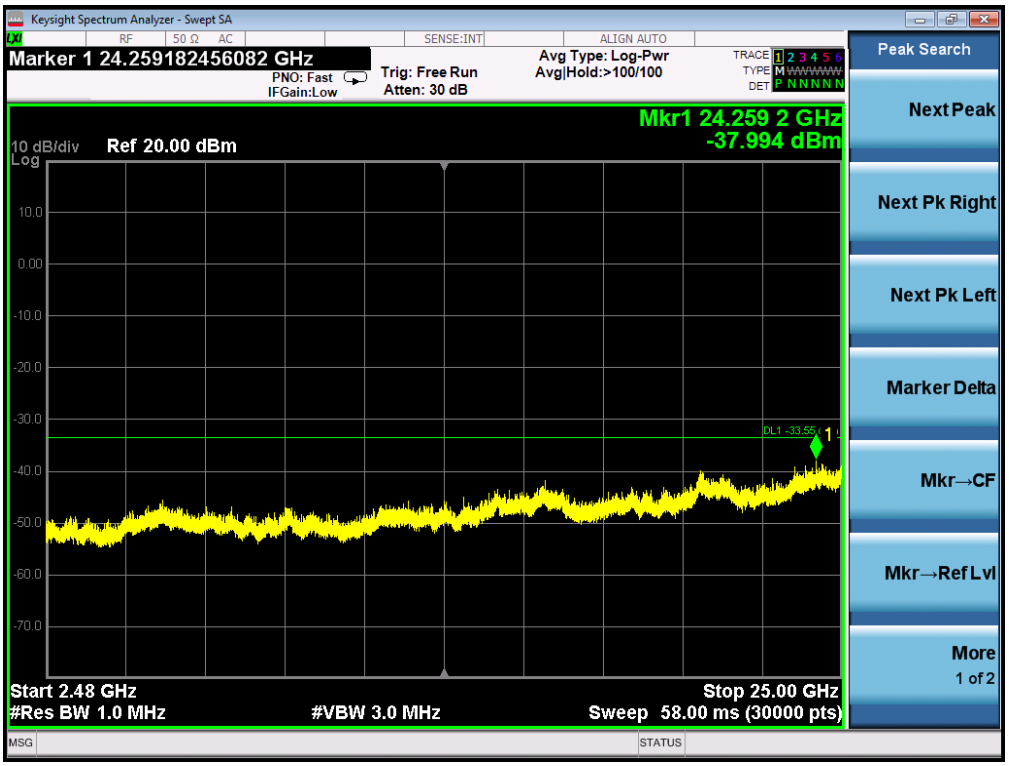

Keysight Spectrum Analyzer - Swept SA
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 2.395053168439 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Mkr1 2.395 05 GHz
-54.119 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
DL1 -33.70 dBm
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 134.0 ms (30000 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Keysight Spectrum Analyzer - Swept SA
RF 50 Ω AC
SENSE:INT
ALIGN AUTO
Marker 1 24.979734474483 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
TRACE 1 2 3 4 5 6
TYPE M
DET P N N N N N
Mkr1 24.979 7 GHz
-37.970 dBm
10 dB/div
Log
Ref 20.00 dBm
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
DL1 -33.70 d
Start 2.48 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.00 GHz
Sweep 58.00 ms (30000 pts)
MSG
STATUS
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE
OF 802.11n40 FOR MODULATION IN HIGH CHANNEL







Note: The 100kHz RBW used in the conducted spurious test from 2.4835GHz to 25GHz may result in long measuring times, To avoid such long measuring times, the 1MHz RBW can be used for pre-test. If the emission level exceeded the limit at one or more frequencies, the 100kHz RBW would be used for final test at the special frequency.

10. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

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 method of AVPSD in the KDB 558074 and KDB 662911 item 10.3 was used in this testing.

10.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer To Section 8.2.

10.3 MEASUREMENT EQUIPMENT USED

Refer To Section 6.

10.4 LIMITS AND MEASUREMENT RESULT

TEST ITEM	POWER PECTRAL DENSITY
TEST MODE	802.11b with data rate 1

Ant0:

Channel No.	PSD (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-1.565	8	Pass
Middle Channel	-0.640	8	Pass
High Channel	-0.886	8	Pass

Ant1:

Channel No.	PSD (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-3.854	8	Pass
Middle Channel	-2.801	8	Pass
High Channel	-2.541	8	Pass

TEST ITEM	POWER PECTRAL DENSITY
TEST MODE	802.11g with data rate 6

Ant0:

Channel No.	PSD (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-6.068	8	Pass
Middle Channel	-5.491	8	Pass
High Channel	-5.181	8	Pass

Ant1:

Channel No.	PSD (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-7.377	8	Pass
Middle Channel	-6.655	8	Pass
High Channel	-6.758	8	Pass

TEST ITEM	POWER PECTRAL DENSITY
TEST MODE	802.11n 20 with data rate 6.5

Ant0:

Channel No.	PSD (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-6.048	8	Pass
Middle Channel	-6.234	8	Pass
High Channel	-6.441	8	Pass

Ant1:

Channel No.	PSD (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-8.250	8	Pass
Middle Channel	-7.385	8	Pass
High Channel	-7.598	8	Pass

SUM:

Channel No.	PSD (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-4.001	8	Pass
Middle Channel	-3.761	8	Pass
High Channel	-3.971	8	Pass

TEST ITEM	POWER PECTRAL DENSITY
TEST MODE	802.11n 40 with data rate 13.5

Ant0:

Channel No.	PSD (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-7.453	8	Pass
Middle Channel	-8.741	8	Pass
High Channel	-8.220	8	Pass

Ant1:

Channel No.	PSD (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-6.725	8	Pass
Middle Channel	-10.506	8	Pass
High Channel	-8.205	8	Pass

SUM:

Channel No.	PSD (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-4.063	8	Pass
Middle Channel	-6.524	8	Pass
High Channel	-5.202	8	Pass

NOTE: EUT can working at 802.11b/g/n mode by used two antenna (ant0+ant1), but at 802.11b/g mode EUT cannot use two antenna at the same time, only at 802.11n mimo mode two antenna (ant0+ant1) work at the same time.

802.11b TEST RESULT-Ant0:

TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL

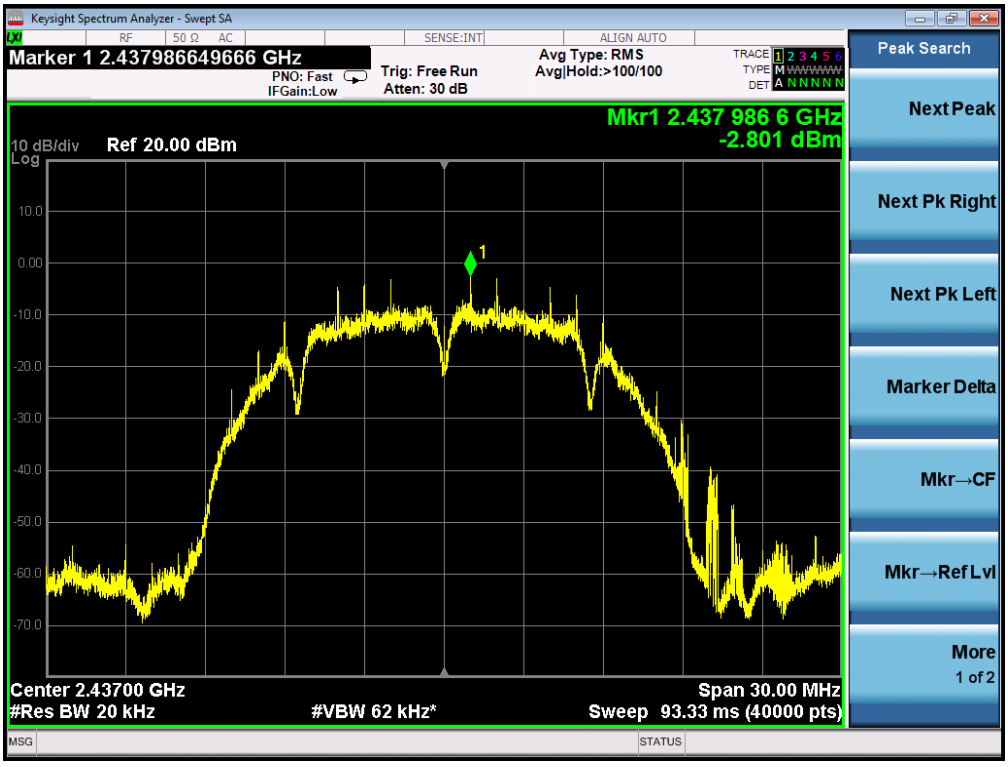
TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL

TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL

802.11b TEST RESULT-Ant1:

TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL

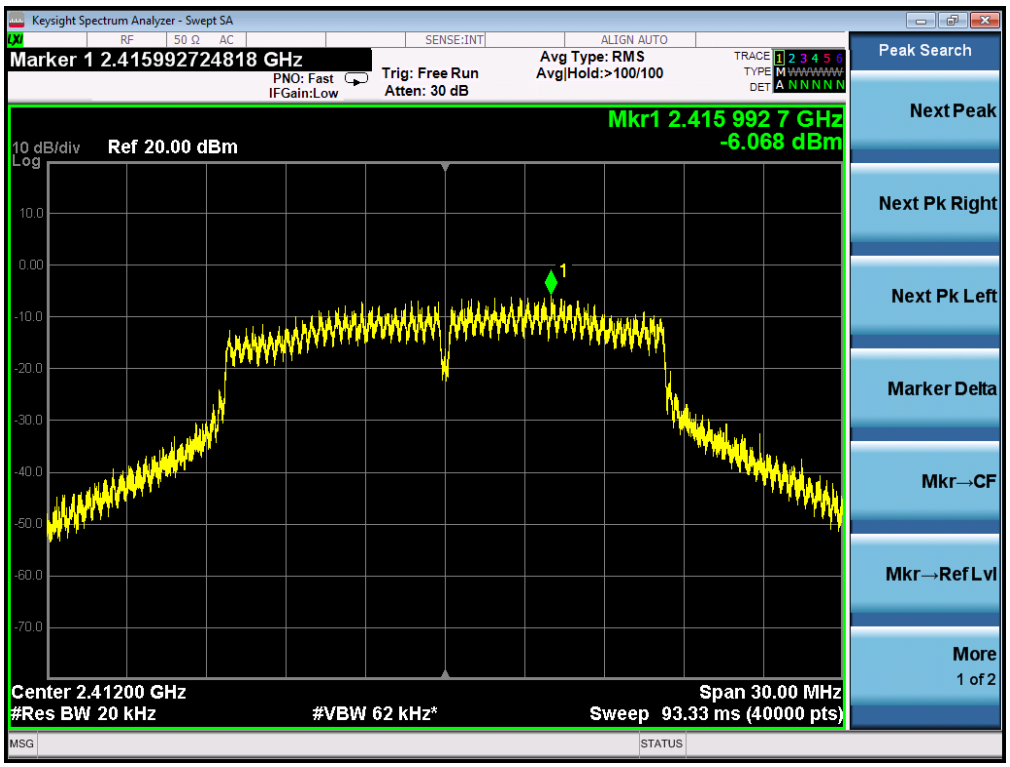
TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL



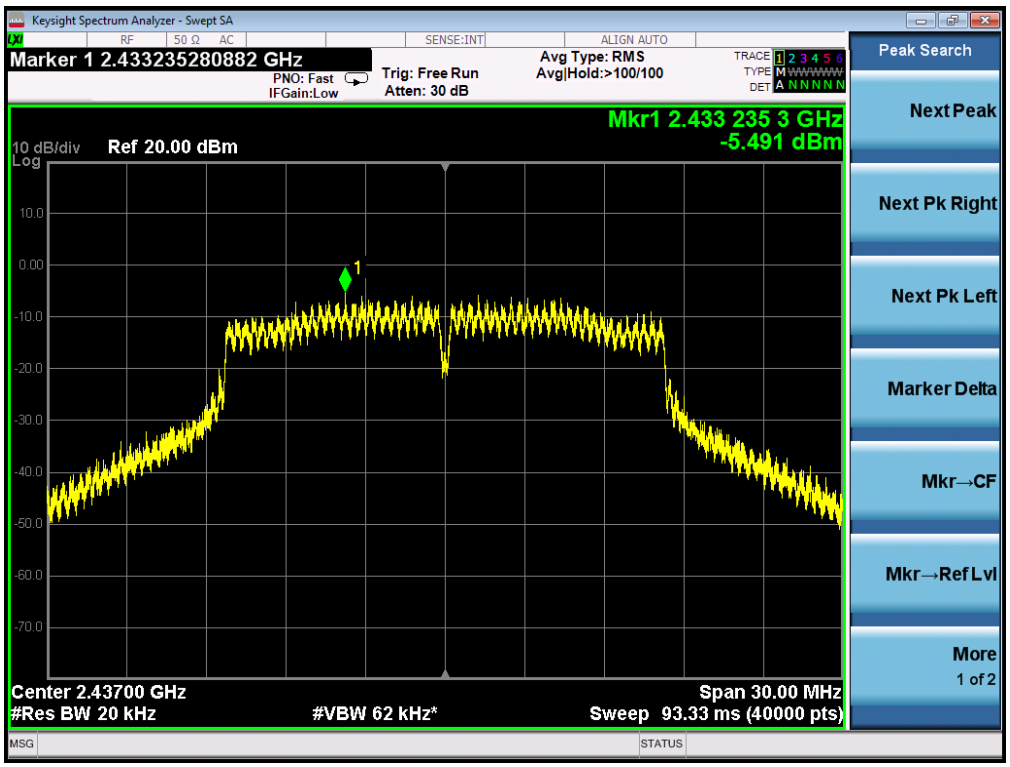
TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL

802.11g TEST RESULT-Ant0:

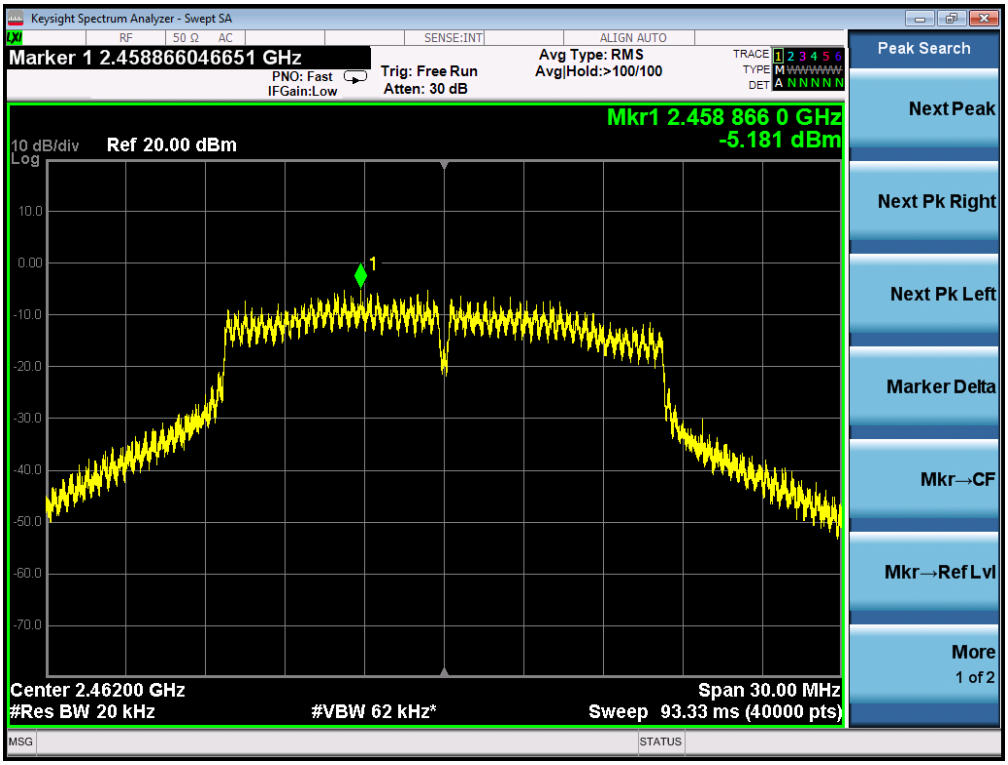
TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL

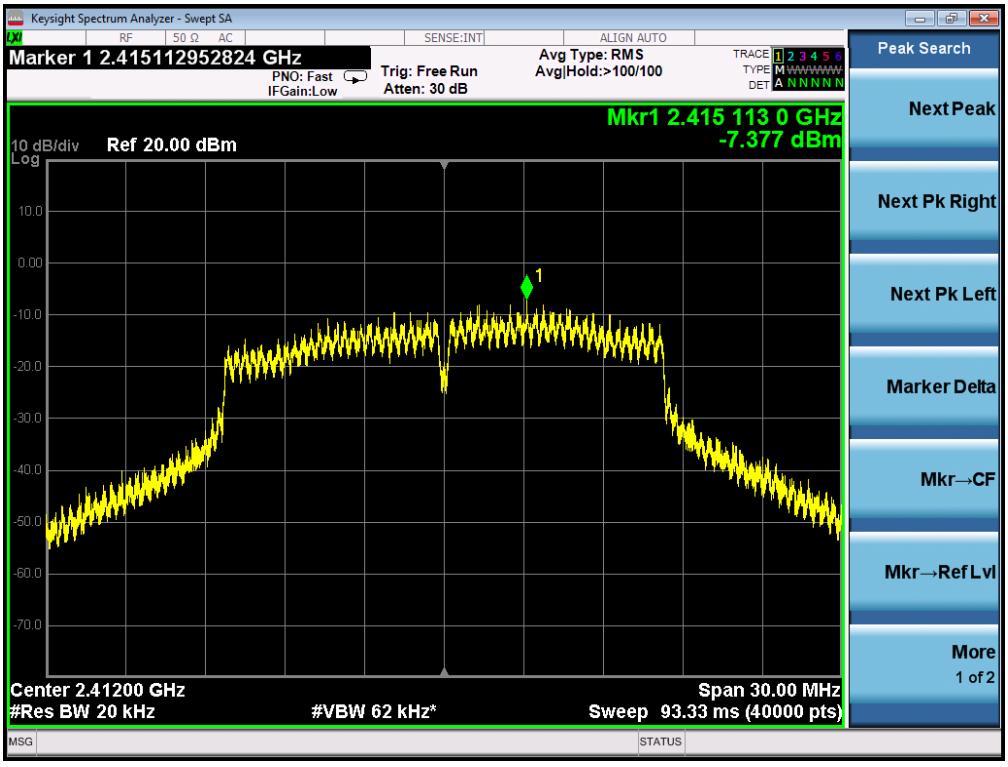


TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL

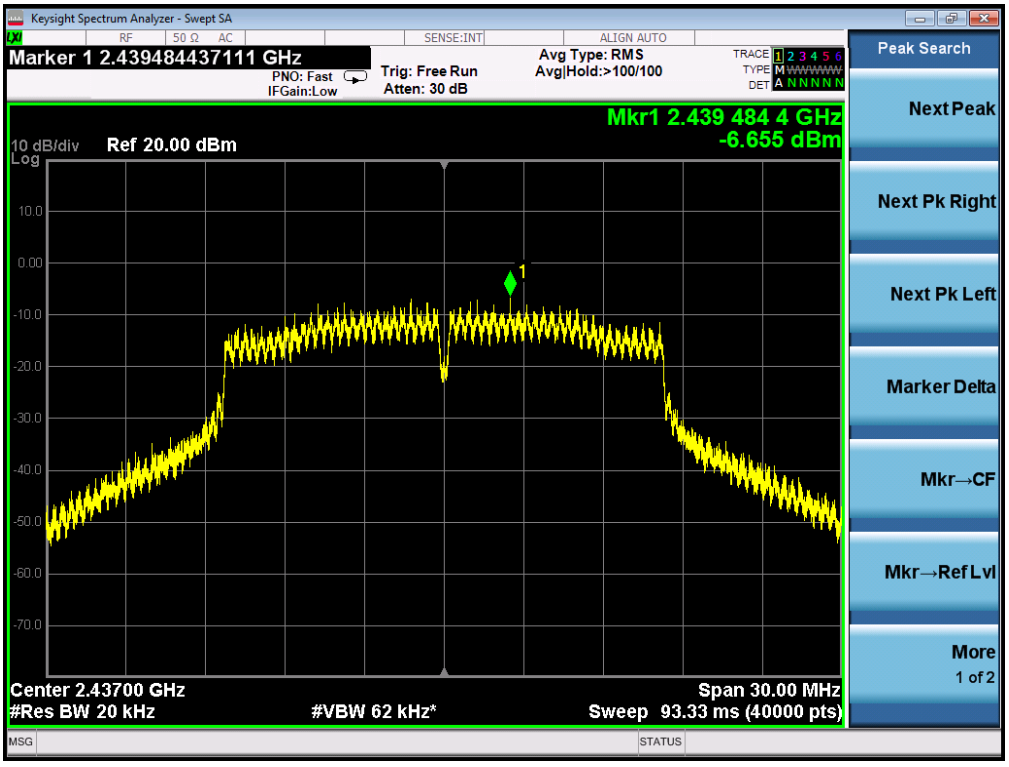


802.11g TEST RESULT-Ant1:

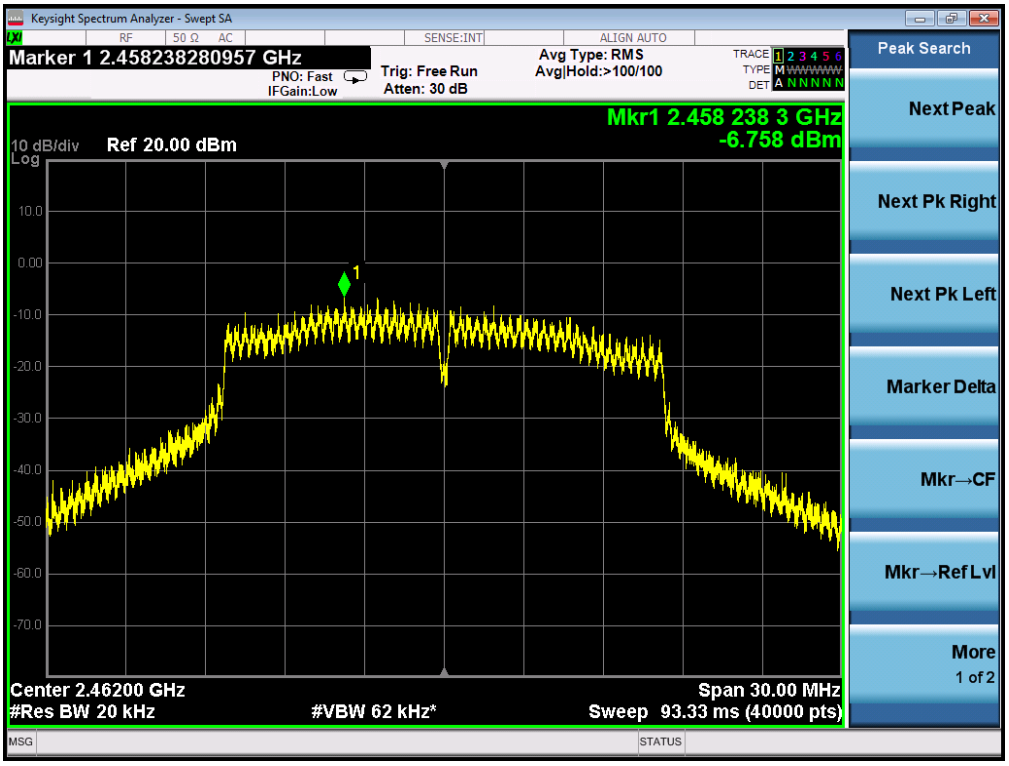
TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL

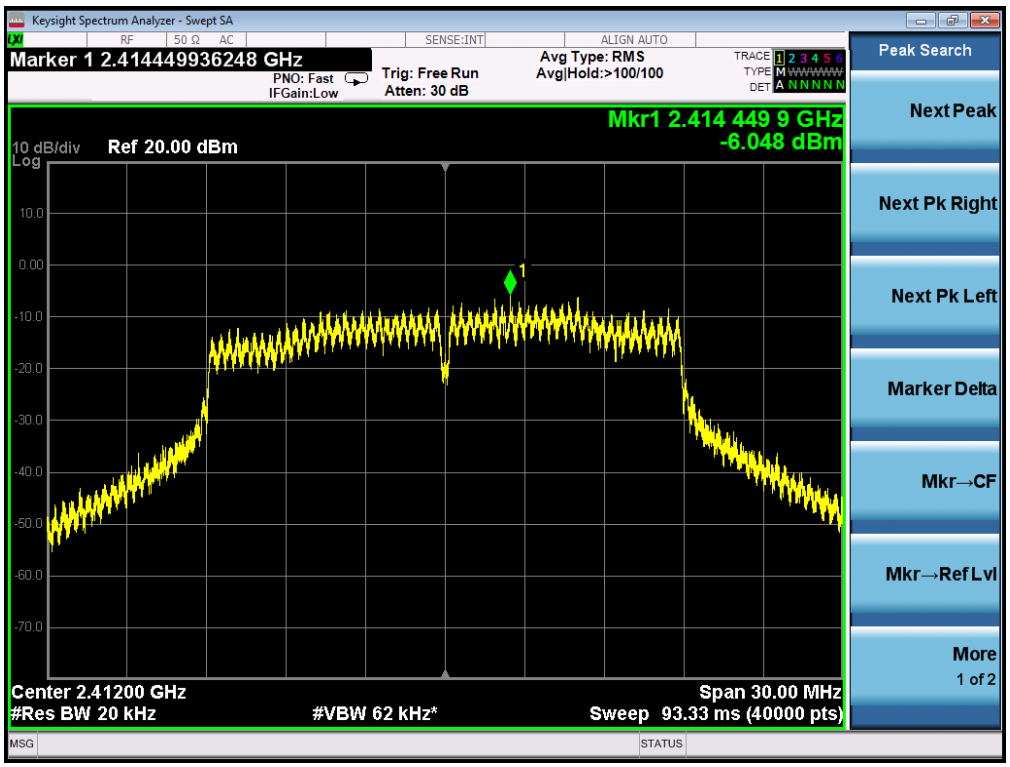


TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL

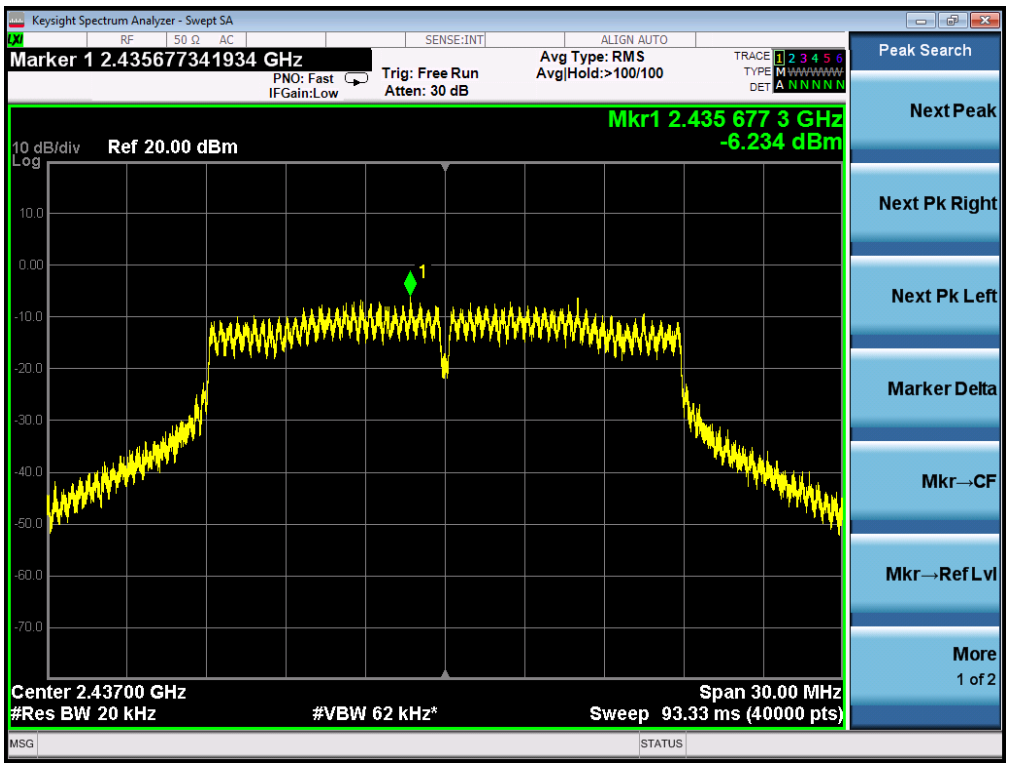


802.11n 20 TEST RESULT-Ant0:

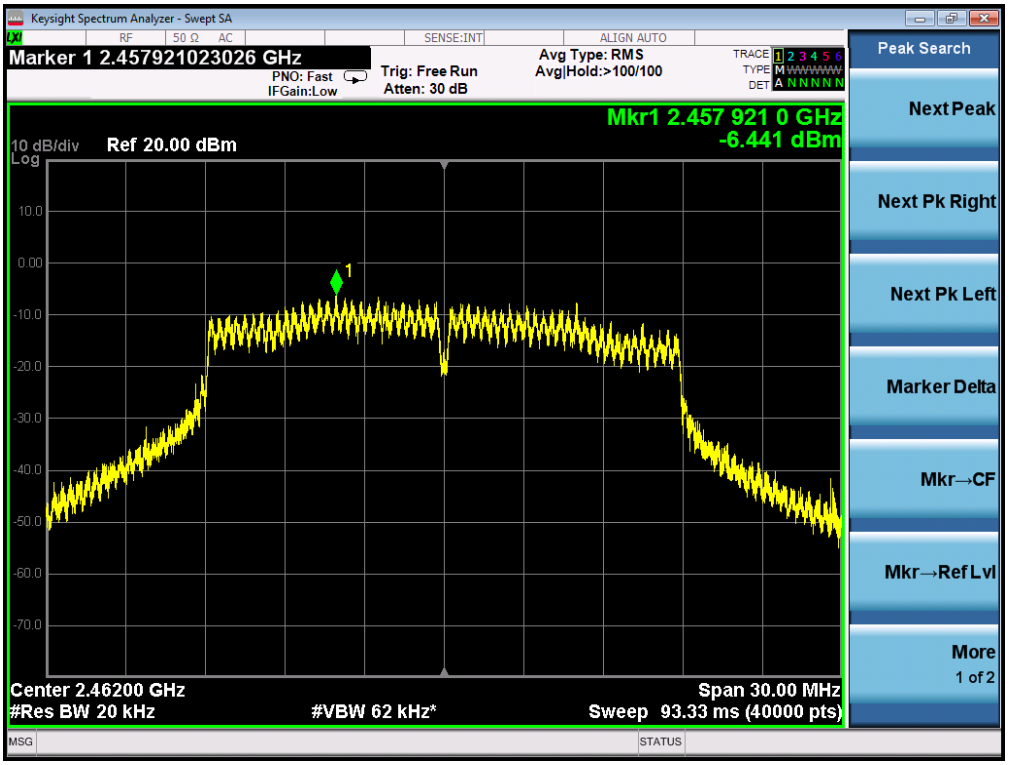
TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL

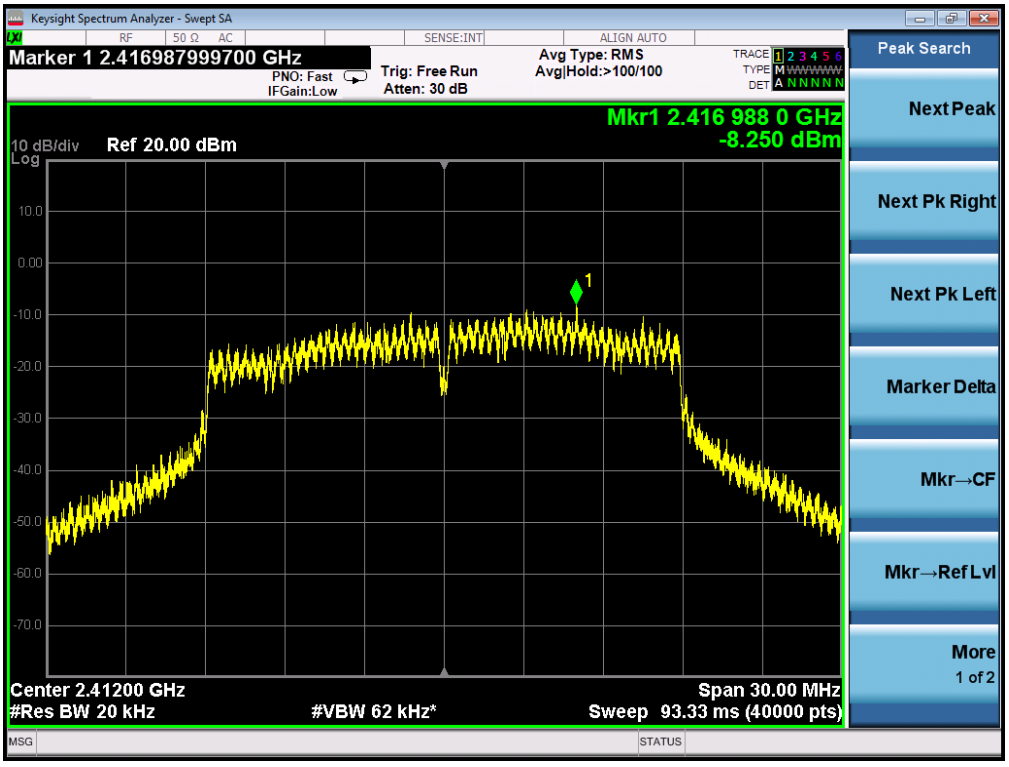


TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL

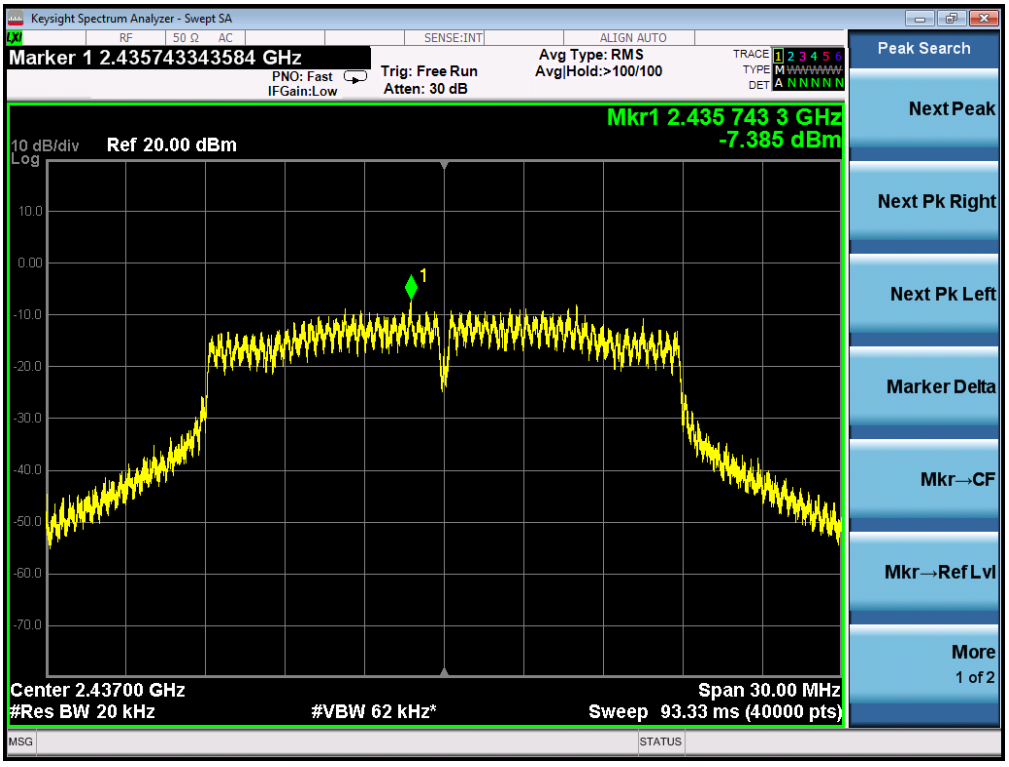


802.11n20 TEST RESULT-Ant1:

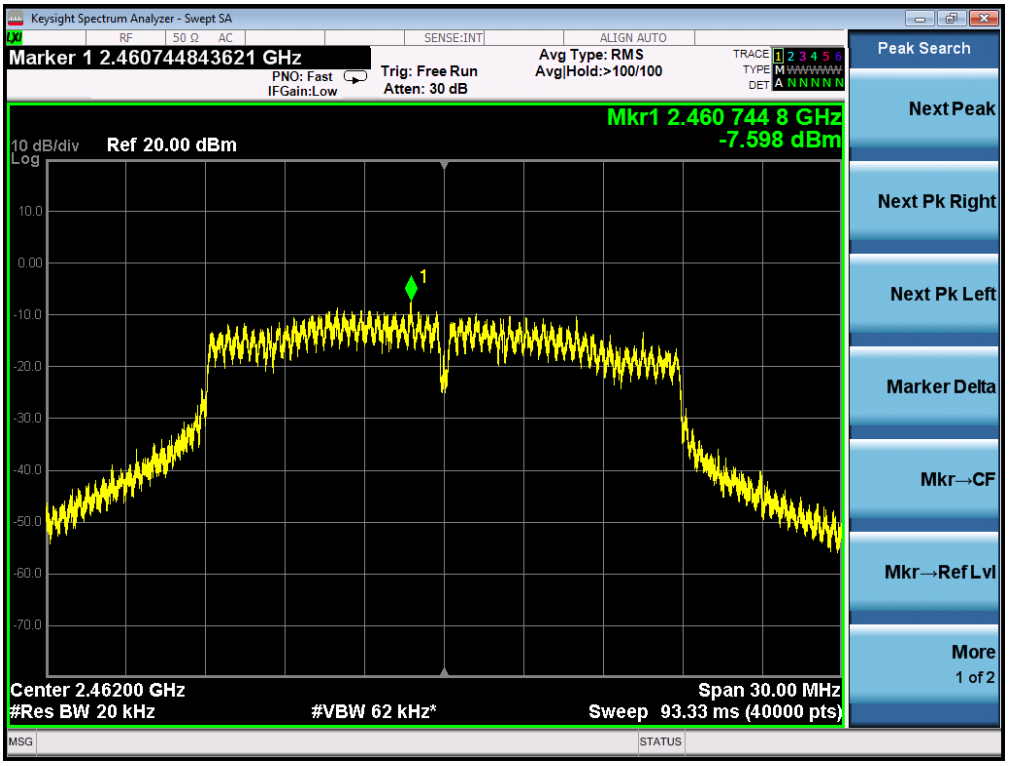
TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL

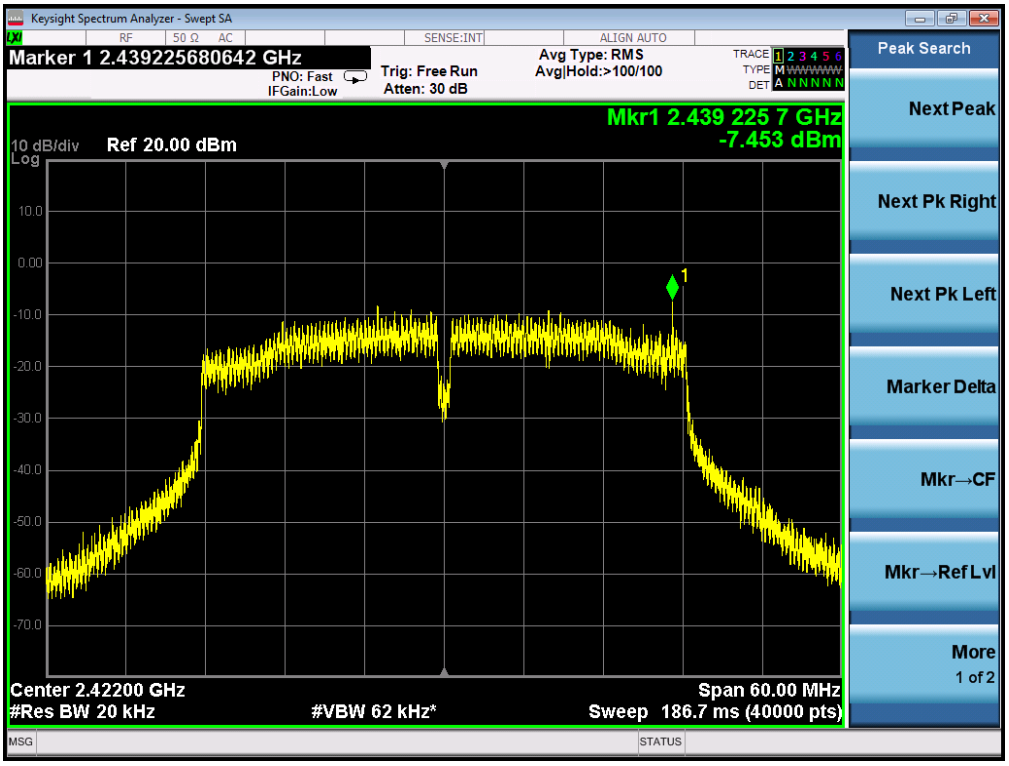


TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL

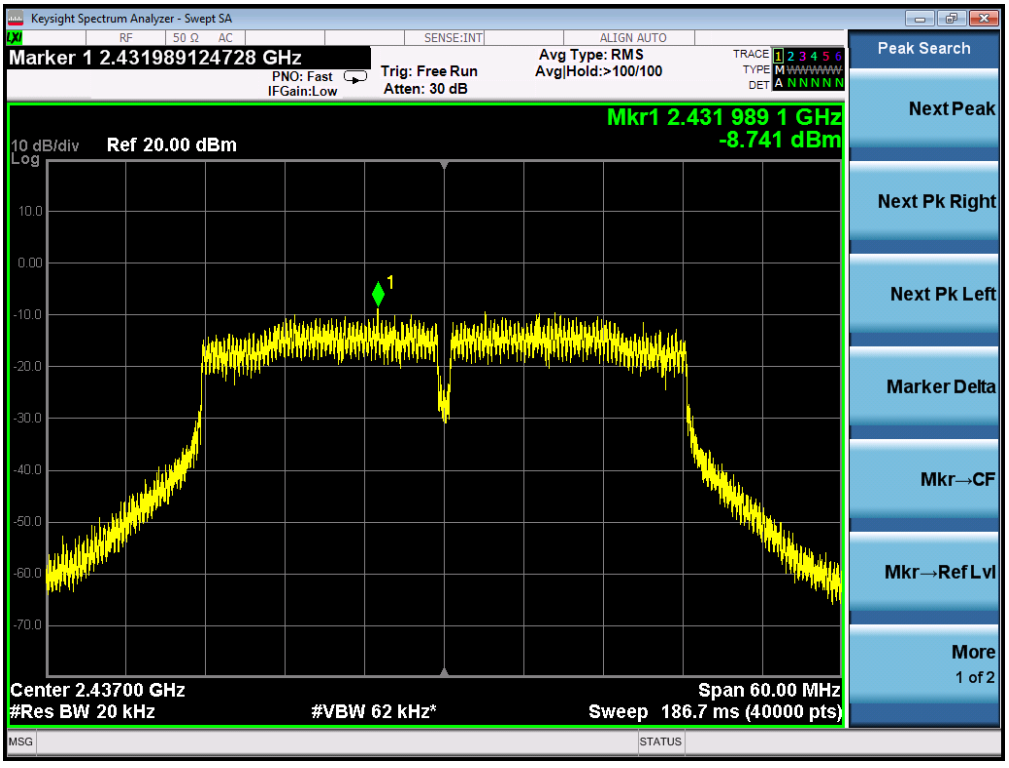


802.11n 40 TEST RESULT-Ant0:

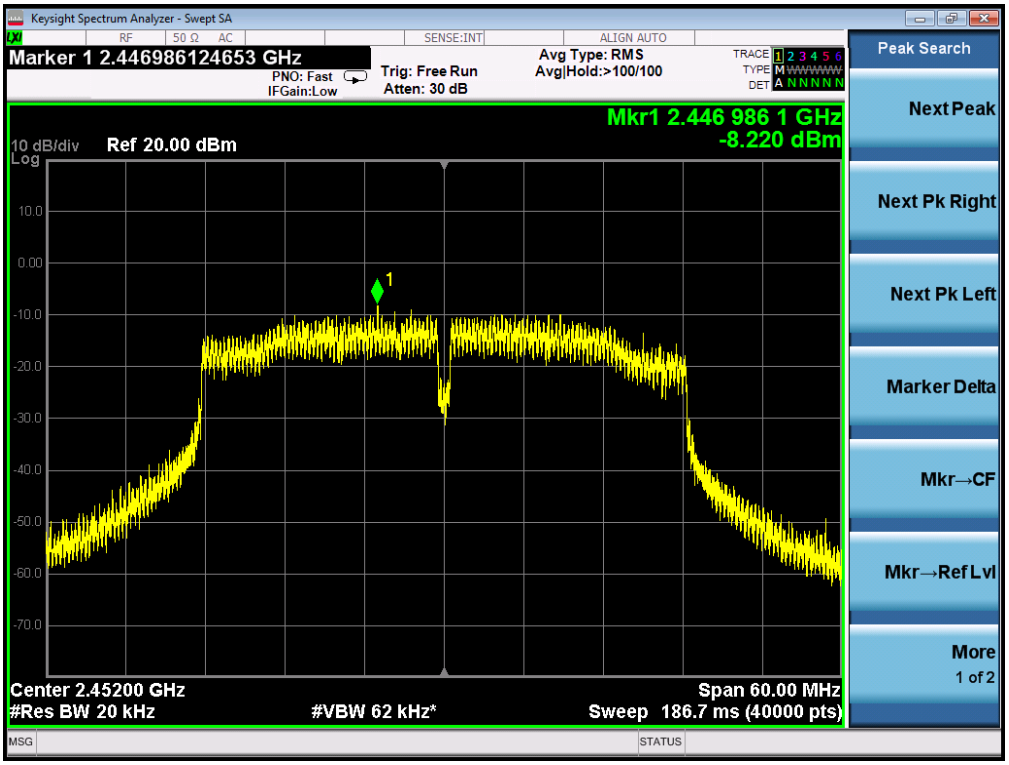
TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL



802.11n(40) TEST RESULT-Ant1:

TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL