FCC Test Report

Report No.: AGC03923190801FE05

FCC ID	:	2AVAREPM001
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	Pestoptix camera
BRAND NAME	:	Pestoptix
MODEL NAME	:	EPM001
APPLICANT	:	Yarocology LTD
DATE OF ISSUE	:	Oct. 21, 2019
STANDARD(S) **TEST PROCEDURE(S)**	:	FCC Part 15.247
REPORT VERSION	:	V1.0

Attestation 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	/	Oct. 21, 2019	Valid	Initial Release

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1. VERIFICATION OF CONFORMITY

Applicant	Yarocology LTD
Address	POB 918, Shoham, 6085001, Israel
manufacturer	E-Song Digital Limited
Address	6F, Block B, Jintai Industrial Park, Hangcheng Road, Gushu, Xixiang, Bao'an District, Shenzhen City, PRC
Factory	E-Song Digital Limited
Address	6F, Block B, Jintai Industrial Park, Hangcheng Road, Gushu, Xixiang, Bao'an District, Shenzhen City, PRC
Product Designation	Pestoptix camera
Brand Name	Pestoptix
Test Model	EPM001
Date of test	Sep. 04, 2019 to Oct. 16, 2019
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 radiated emission limits of FCC Rules Part 15.247.

Prepared By	Draven Li (Project Engineer)	Oct. 16, 2019
Reviewed By	Max Zhang (Reviewer)	Oct. 21, 2019
Approved By	Forrest Lei (Authorized Officer)	Oct. 21, 2019

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as “Pestoptix camera”. 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(Average)	IEEE 802.11b:17.81dBm; IEEE 802.11g:15.85dBm; IEEE 802.11n(20):13.66dBm; IEEE 802.11n(40):13.93dBm
Modulation	DSSS(DBPSK/DQPSK/CCK);OFDM(BPSK/QPSK/16-QAM/64-QAM)
Number of channels	11
Hardware Version	V1.4
Software Version	Ver10.9
Antenna Designation	PIFA antenna
Antenna Gain	3dBi
Power Supply	DC 3.7V by battery or DC 5V by adapter

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: 2AVAREPM001 filing to comply with the FCC Part 15 requirements.

2.5. TEST METHODOLOGY

KDB 558074 D01 15.247 Meas Guidance v05: Guidance for compliance measurements on Digital transmissio n system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules
ANSI C63.10:2013 : American National Standard for Testing Unlicensed Wireless Devices

2.6. SPECIAL ACCESSORIES

Refer to section 5.2.

2.7. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

3. MEASUREMENT UNCERTAINTY

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

- Uncertainty of Conducted Emission, Uc = ±3.2 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±3.9 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB

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 (13.5/27/40.5/54/81/108/121.5/135)	

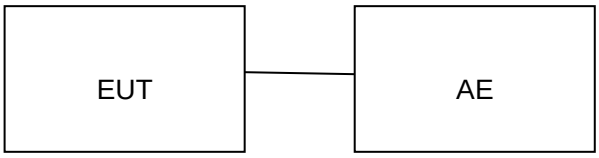
Note:

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. The test software is the SecureCRTPortable_V7.0.0 which can set the EUT into the individual test modes.

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	Pestoptix camera	EPM001	2AVAREPM001	EUT
2	Adapter	KUANTEN	KT05W050100USU	AE
3	Sensor	--	--	Market with EUT

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	Line Conduction Emission	Compliant

6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

TEST EQUIPMENT OF CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	Jun. 12, 2019	Jun. 11, 2020
LISN	R&S	ESH2-Z5	100086	Aug. 26, 2019	Aug. 25, 2020

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Jun. 12, 2019	Jun. 11, 2020
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 20, 2018	Dec. 19, 2019
Power sensor	Aglient	U2021XA	MY54110007	Sep. 10, 2019	Sep. 09, 2020
2.4GHz Fliter	EM Electronics	2400-2500MHz	N/A	Feb. 27, 2019	Feb. 26, 2020
Attenuator	ZHINAN	E-002	N/A	Sep. 09, 2019	Sep. 08, 2020
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 09, 2019	Sep. 08, 2021
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Jun. 14, 2018	Jun. 13, 2020
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May. 26, 2018	May. 25, 2020
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Oct. 25, 2018	Oct. 24, 2019
ANTENNA	SCHWARZBECK	VULB9168	D69250	Sep. 28, 2017	Sep. 27, 2019

7. OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

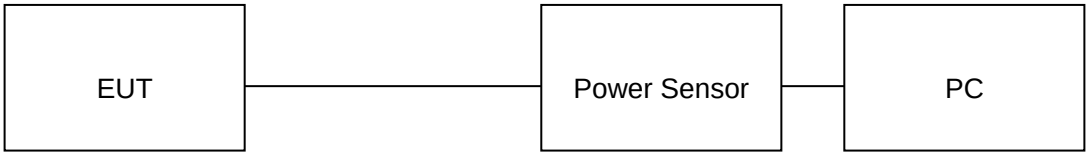
For average power test:

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 ANSI C63.10 (2013) for 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

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	17.81	30	Pass
2.437	17.75	30	Pass
2.462	17.68	30	Pass

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

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	15.85	30	Pass
2.437	15.77	30	Pass
2.462	15.73	30	Pass

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

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	13.60	30	Pass
2.437	13.53	30	Pass
2.462	13.66	30	Pass

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

Frequency (GHz)	Average Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.422	13.54	30	Pass
2.437	13.70	30	Pass
2.452	13.93	30	Pass

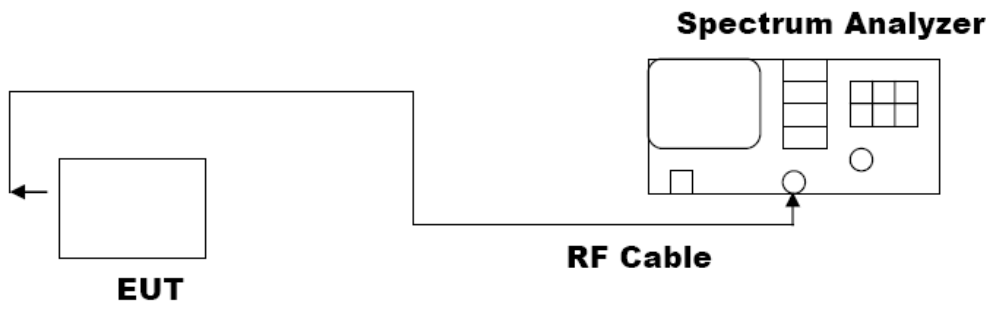
8. 6 DB BANDWIDTH

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 ANSI C63.10 (2013) 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

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	**Applicable Limits**		
	Test Data (MHz)		**Criteria**
>500KHZ	Low Channel	10.04	PASS
	Middle Channel	9.532	PASS
	High Channel	10.04	PASS

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

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	**Applicable Limits**		
	Test Data (MHz)		**Criteria**
>500KHZ	Low Channel	15.10	PASS
	Middle Channel	15.10	PASS
	High Channel	15.11	PASS

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

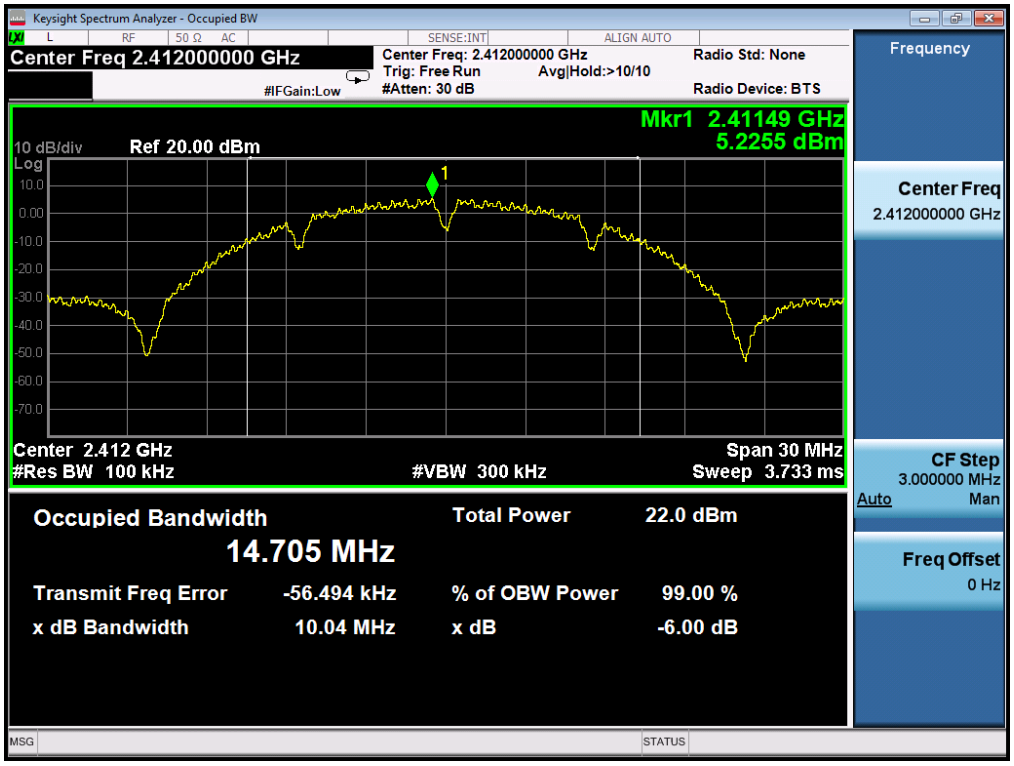
LIMITS AND MEASUREMENT RESULT			
Applicable Limits	**Applicable Limits**		
	Test Data (MHz)		**Criteria**
>500KHZ	Low Channel	15.09	PASS
	Middle Channel	15.10	PASS
	High Channel	15.12	PASS

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

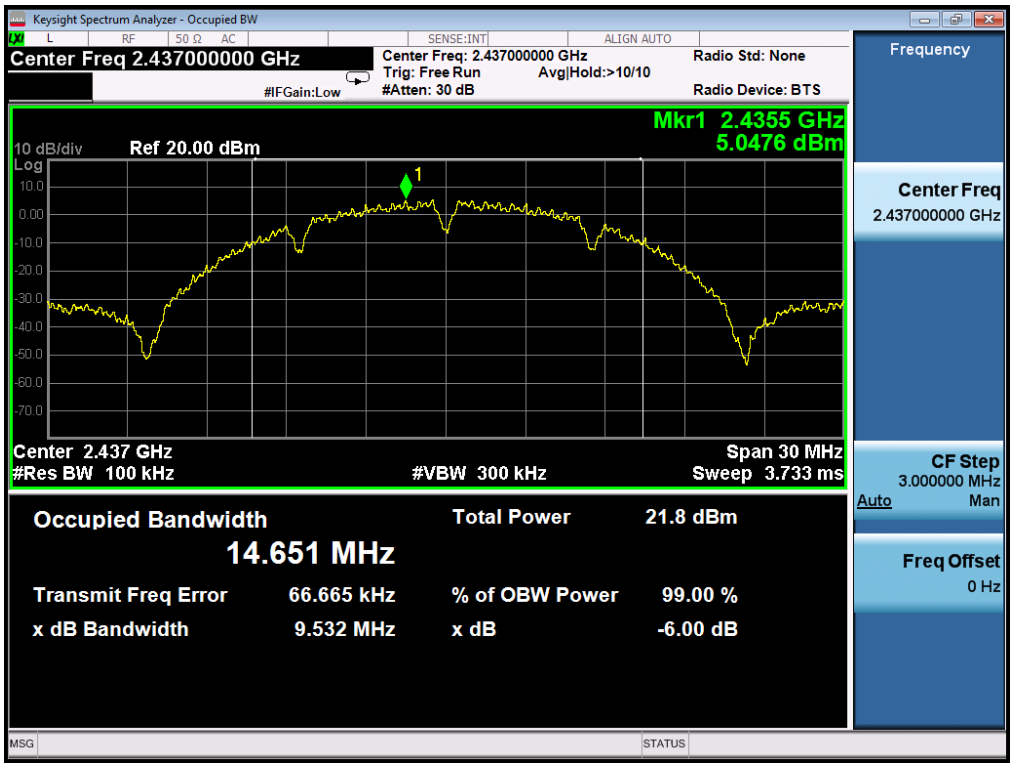
LIMITS AND MEASUREMENT RESULT			
Applicable Limits	**Applicable Limits**		
	Test Data (MHz)		**Criteria**
>500KHZ	Low Channel	35.10	PASS
	Middle Channel	35.06	PASS
	High Channel	35.07	PASS

802.11b TEST RESULT

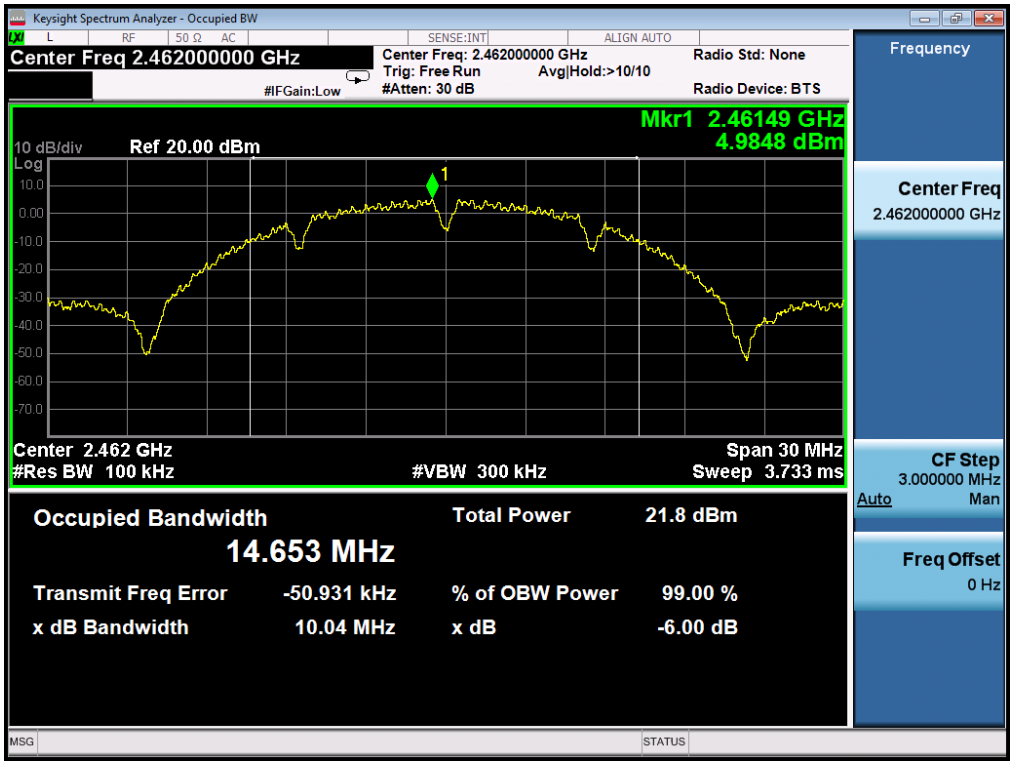
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

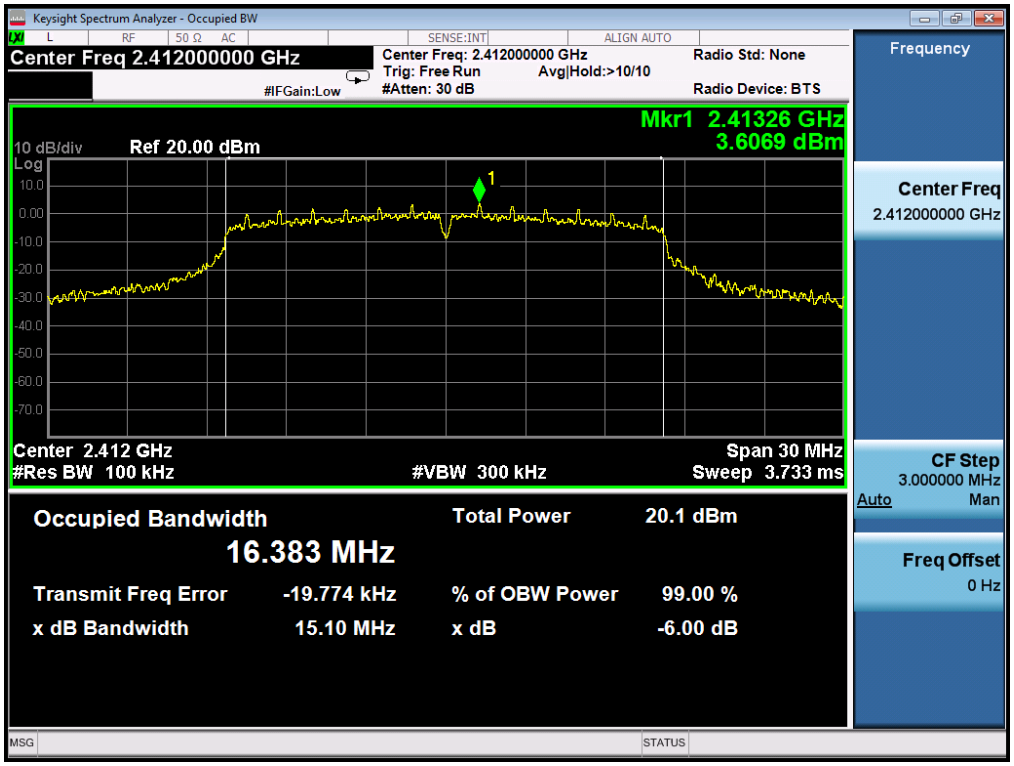


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

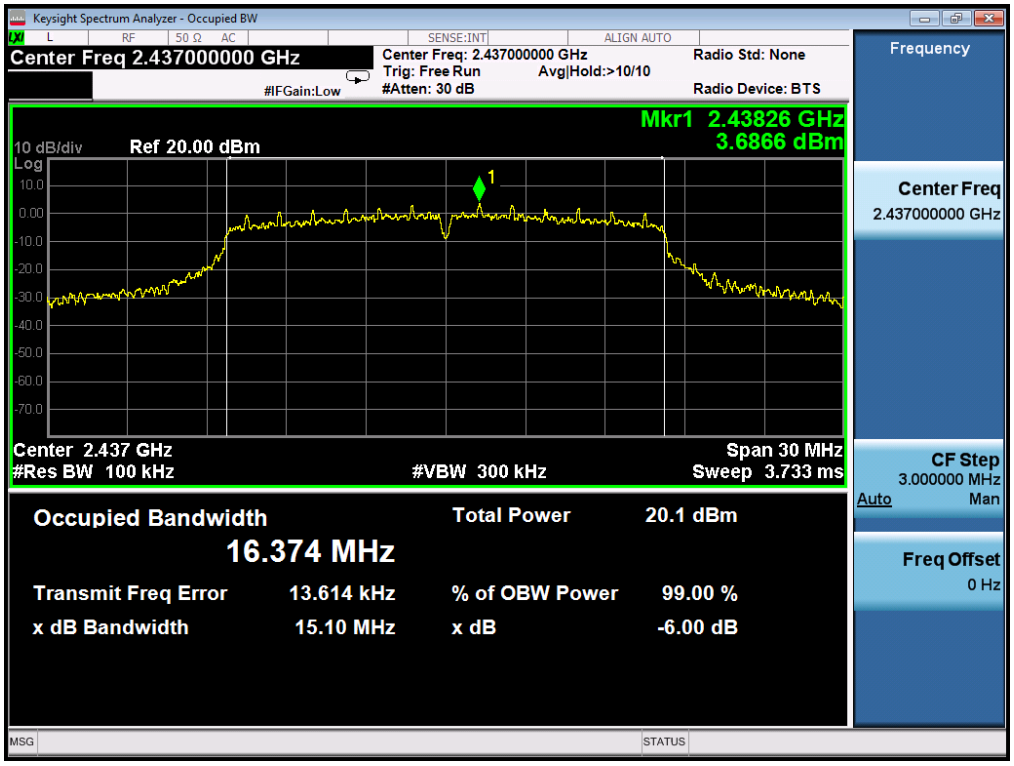


802.11g TEST RESULT

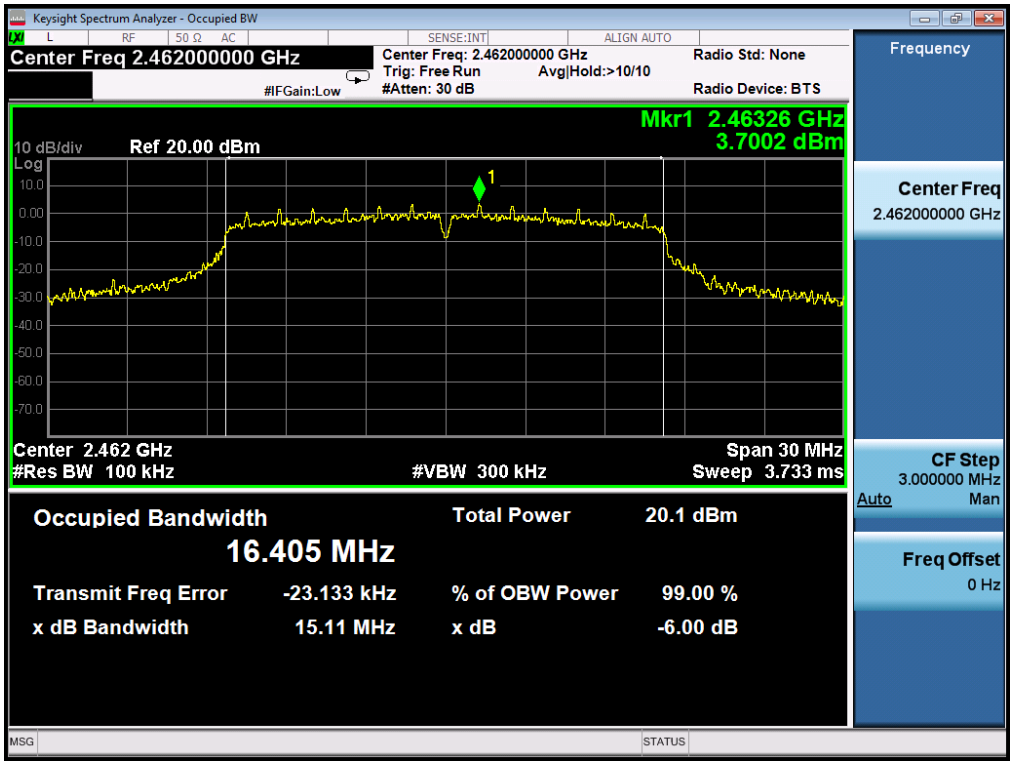
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

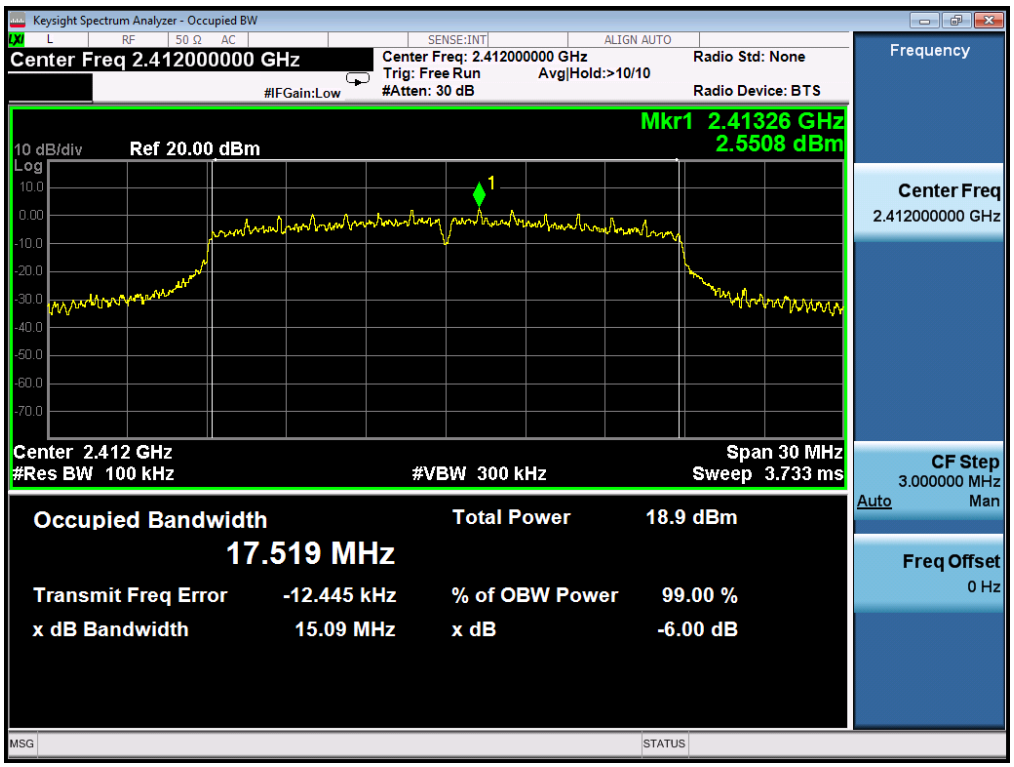


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

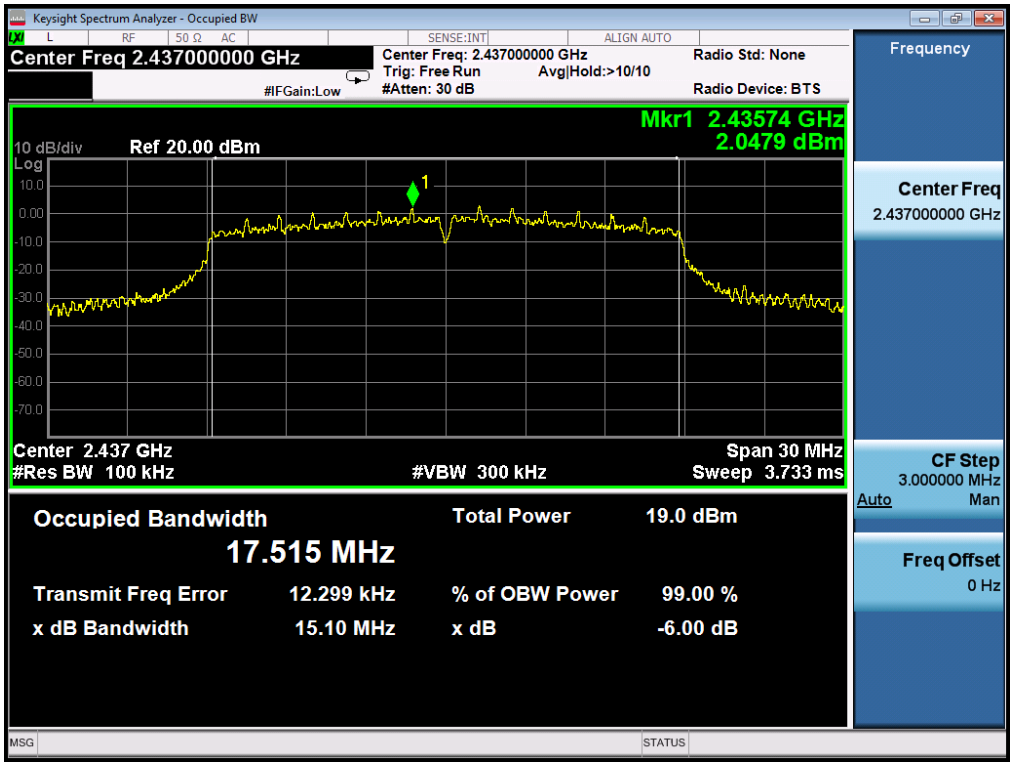


802.11n (20) TEST RESULT

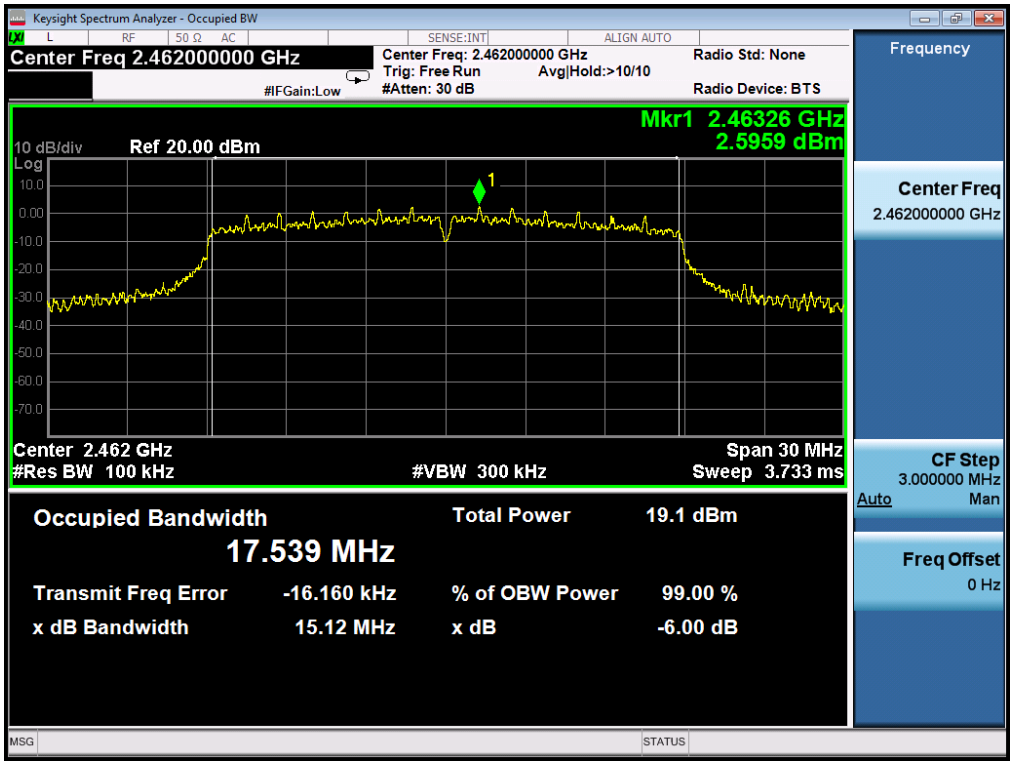
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

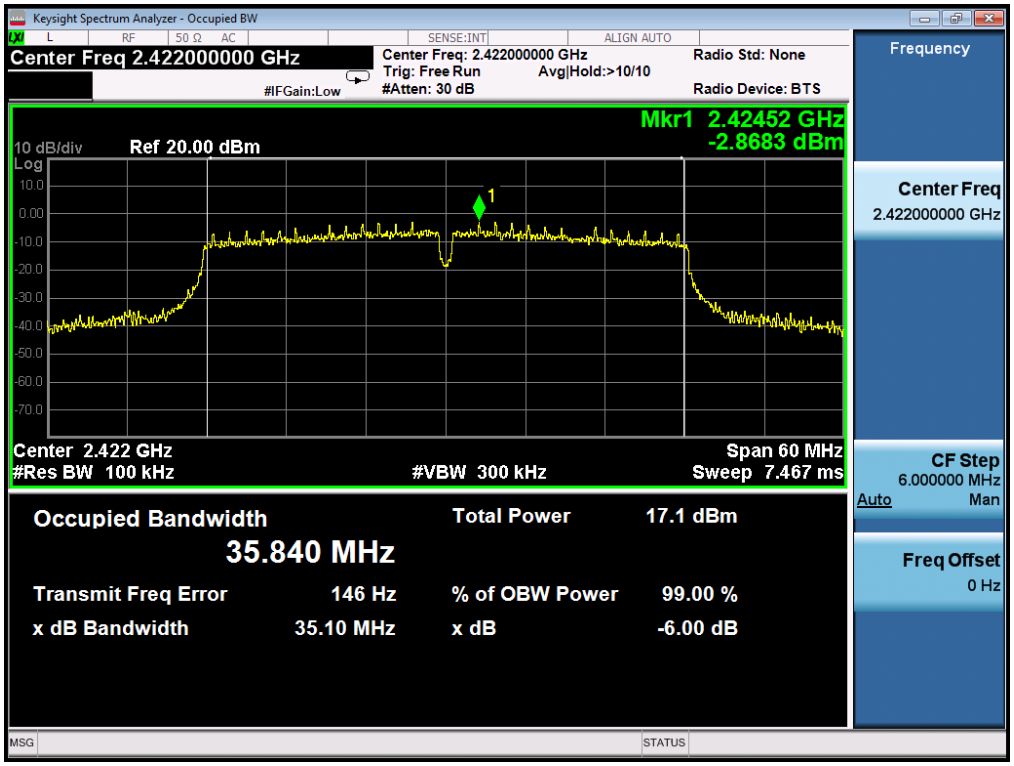


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

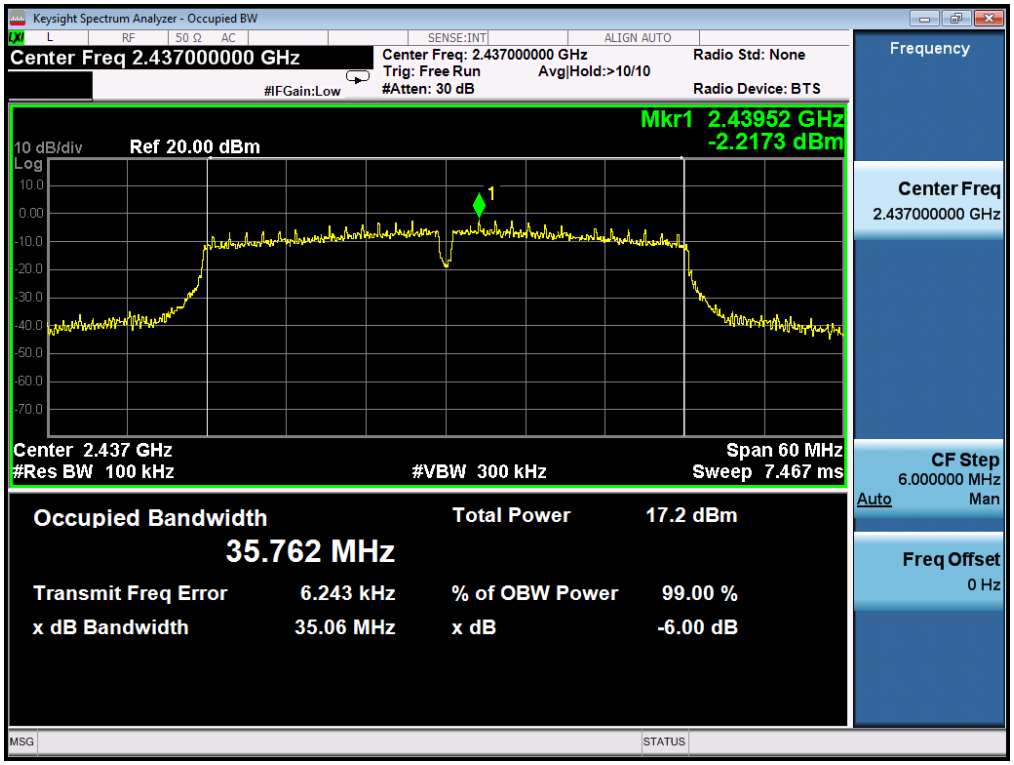


802.11n (40) TEST RESULT

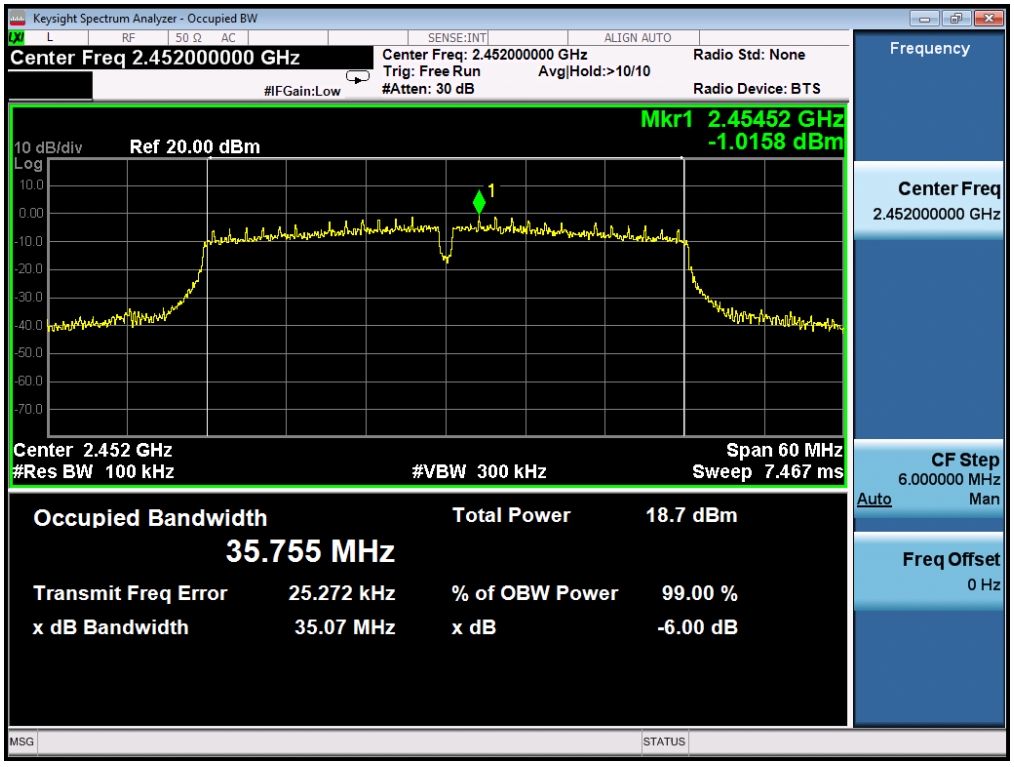
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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 ANSI C63.10 (2013) 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.

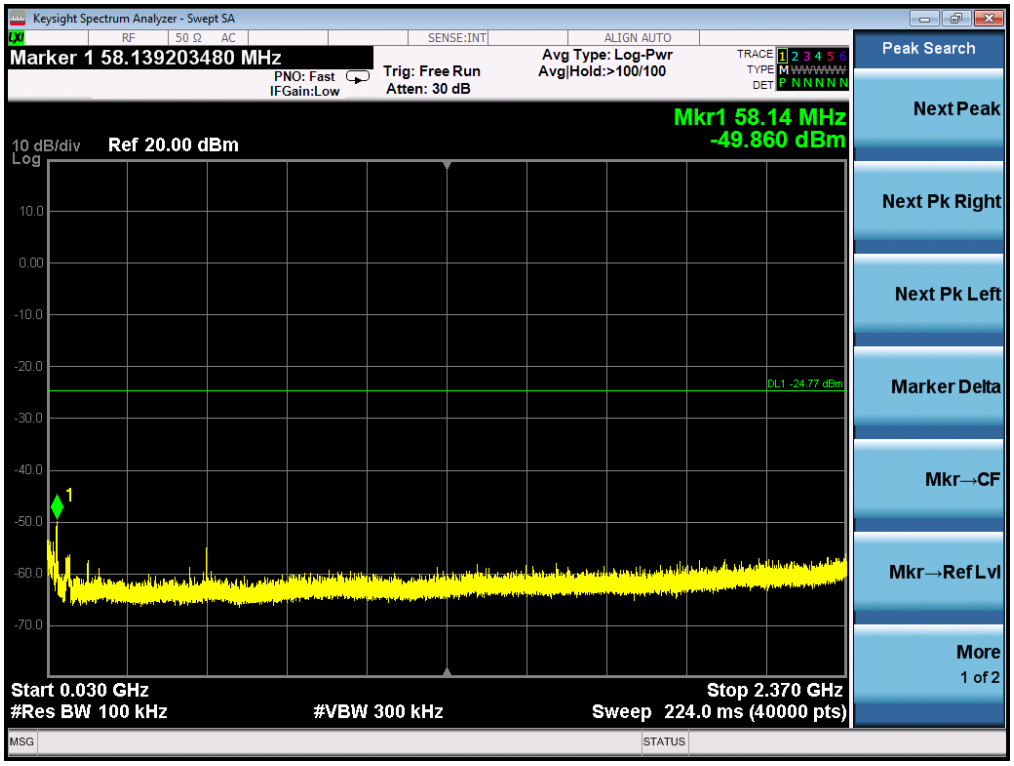
9.3. MEASUREMENT EQUIPMENT USEDJN

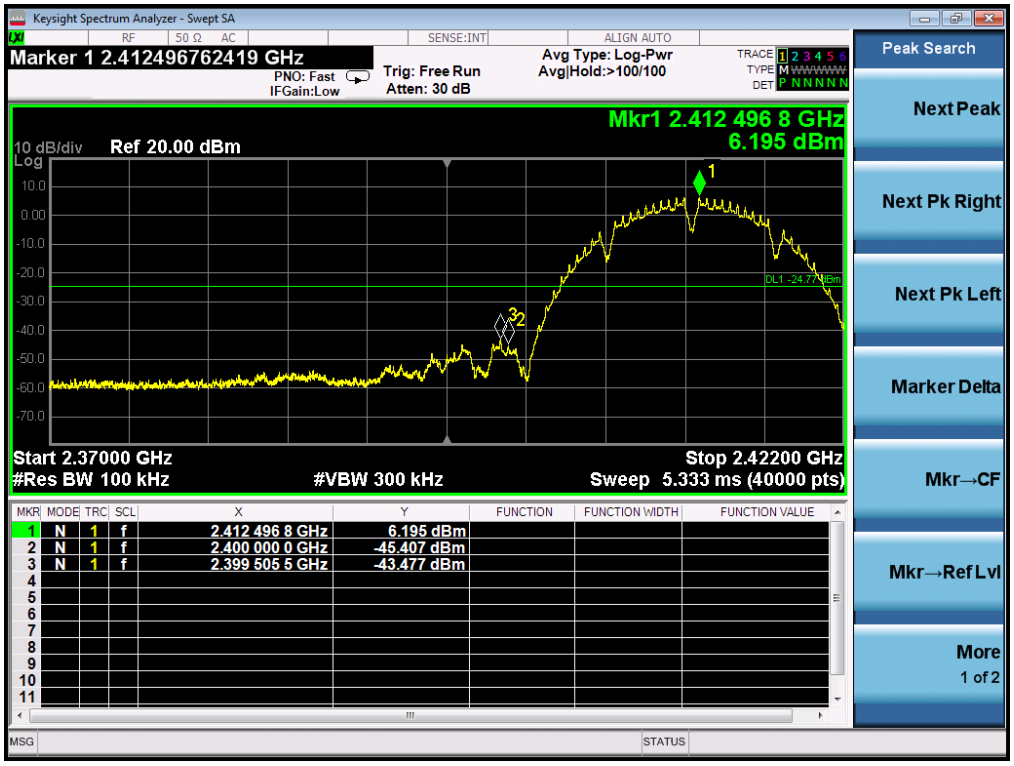
The same as described in section 6.

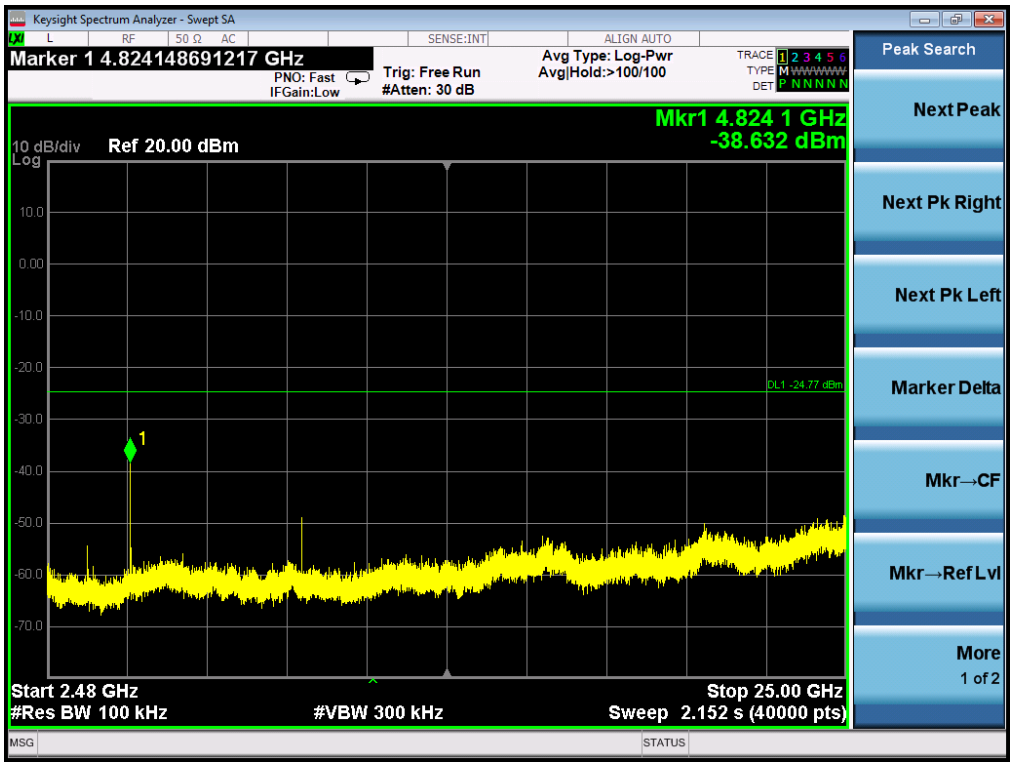
9.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT		
Applicable Limits	**Measurement Result**	
	Test Data	**Criteria**
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))	At least -30dBc than the limit Specified on the BOTTOM Channel	PASS
	At least -30dBc than the limit Specified on the TOP Channel	PASS

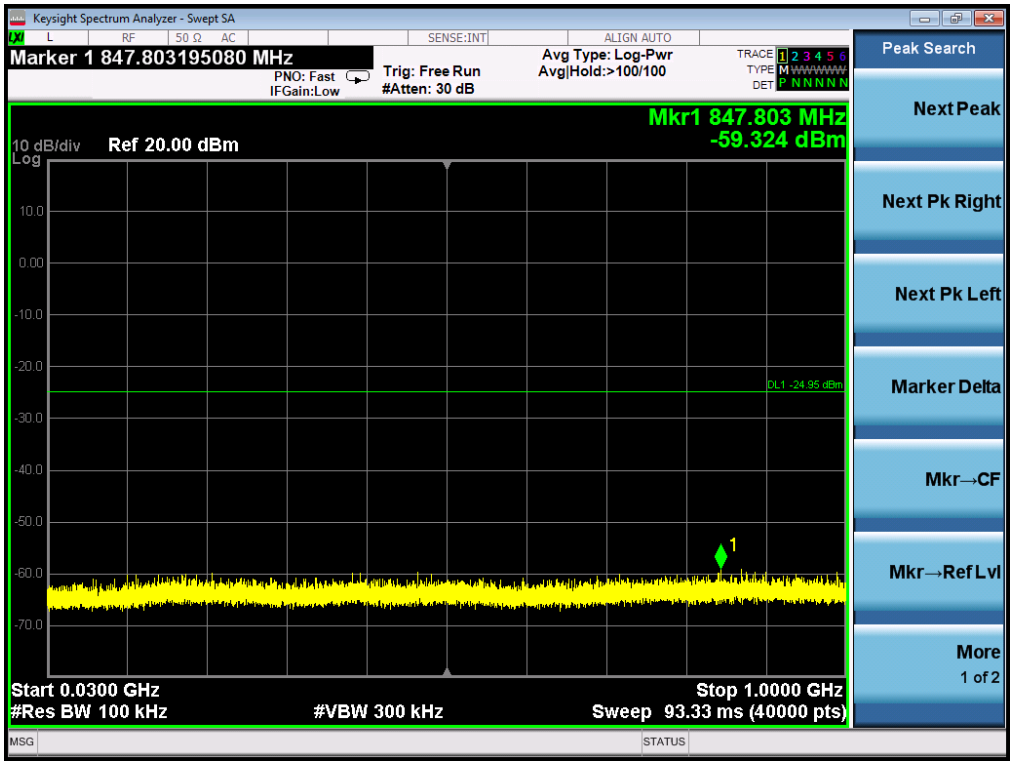
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF 802.11b FOR MODULATION IN LOW CHANNEL

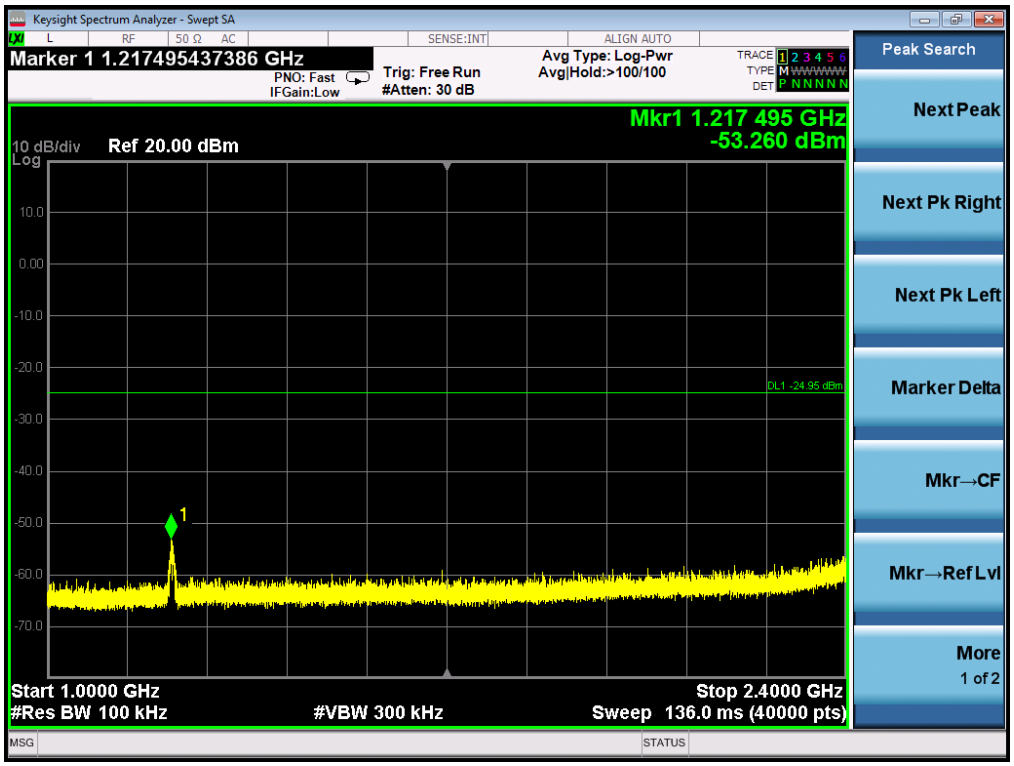


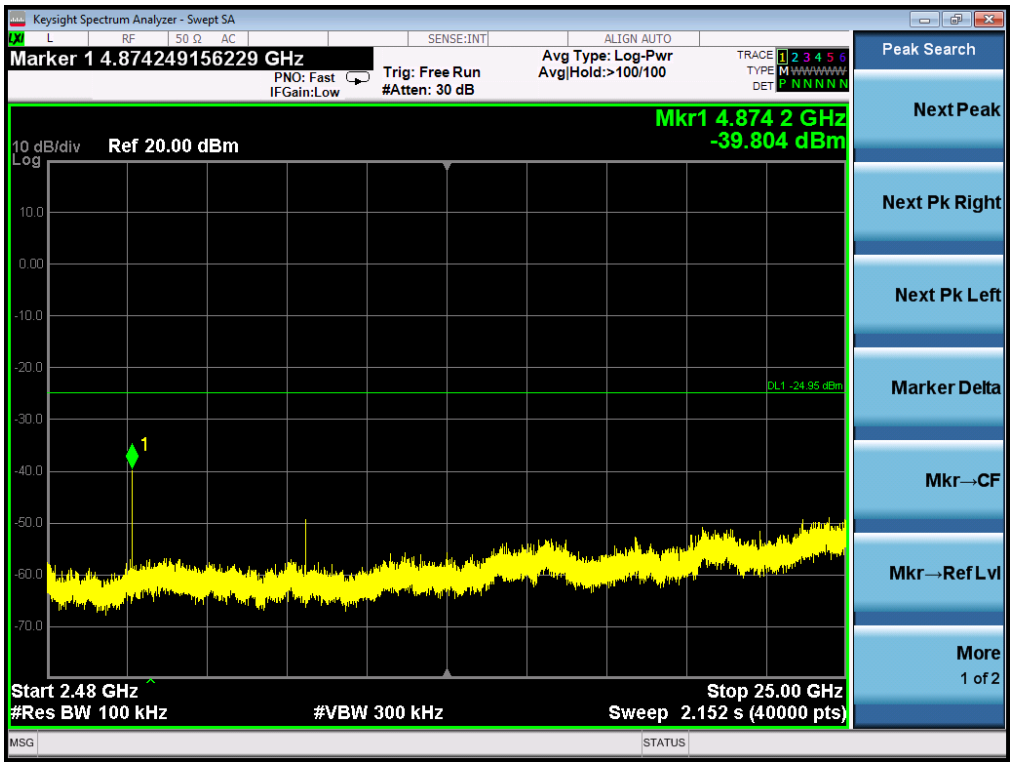




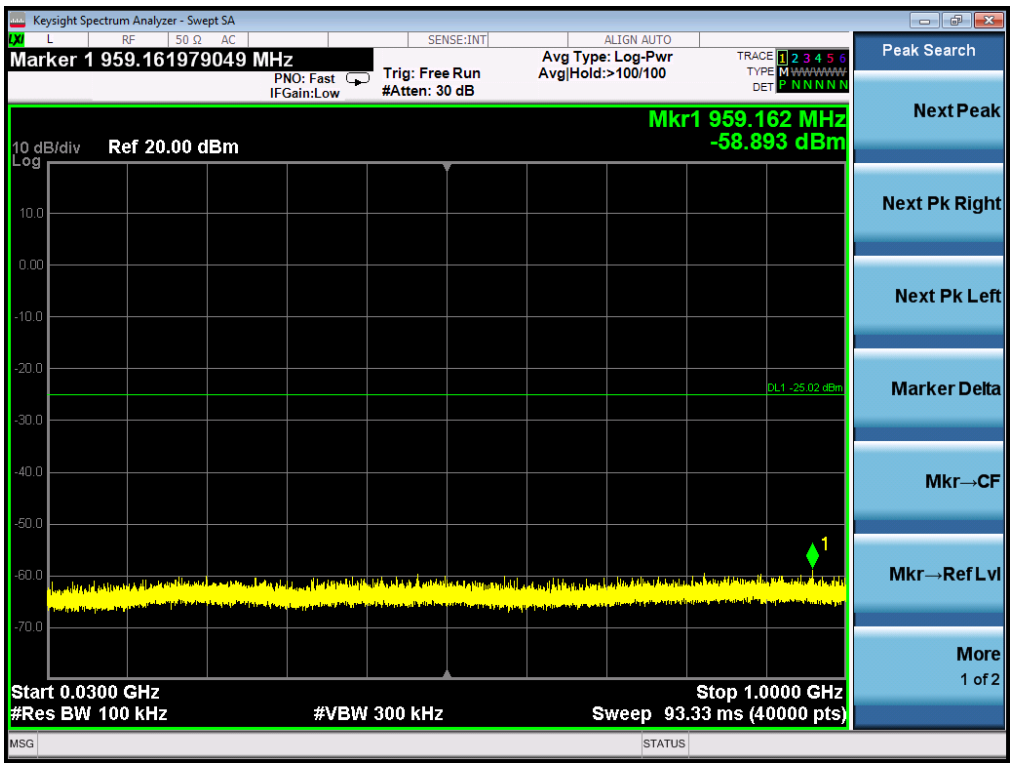
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE OF 802.11b FOR MODULATION IN MIDDLE CHANNEL

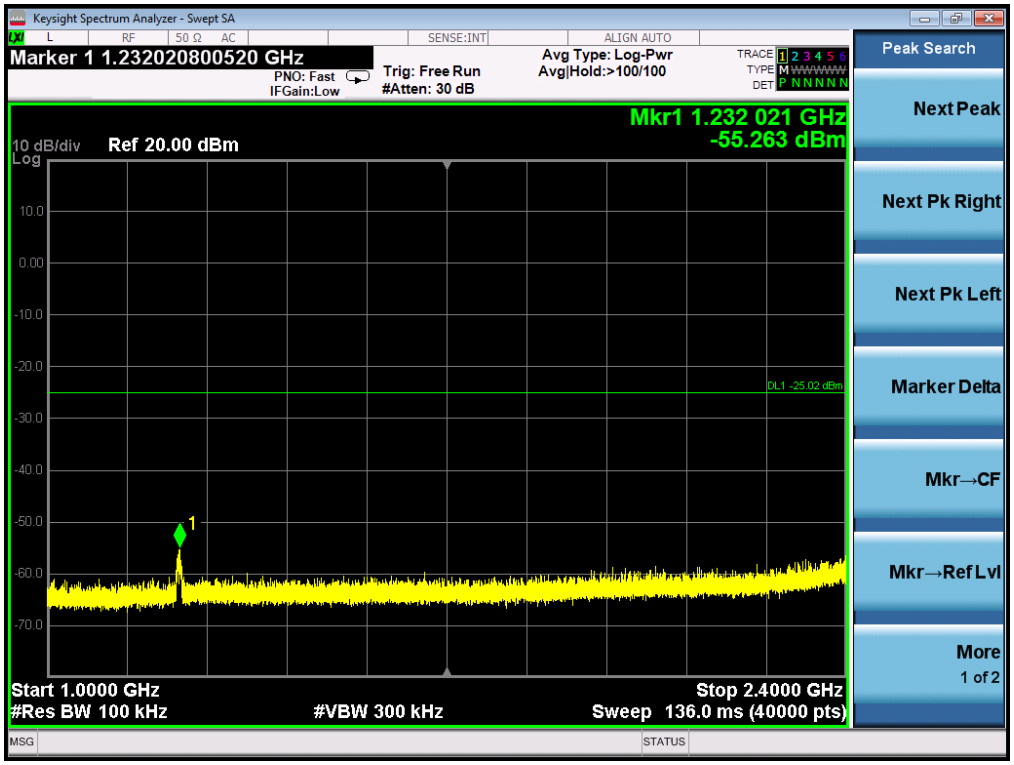


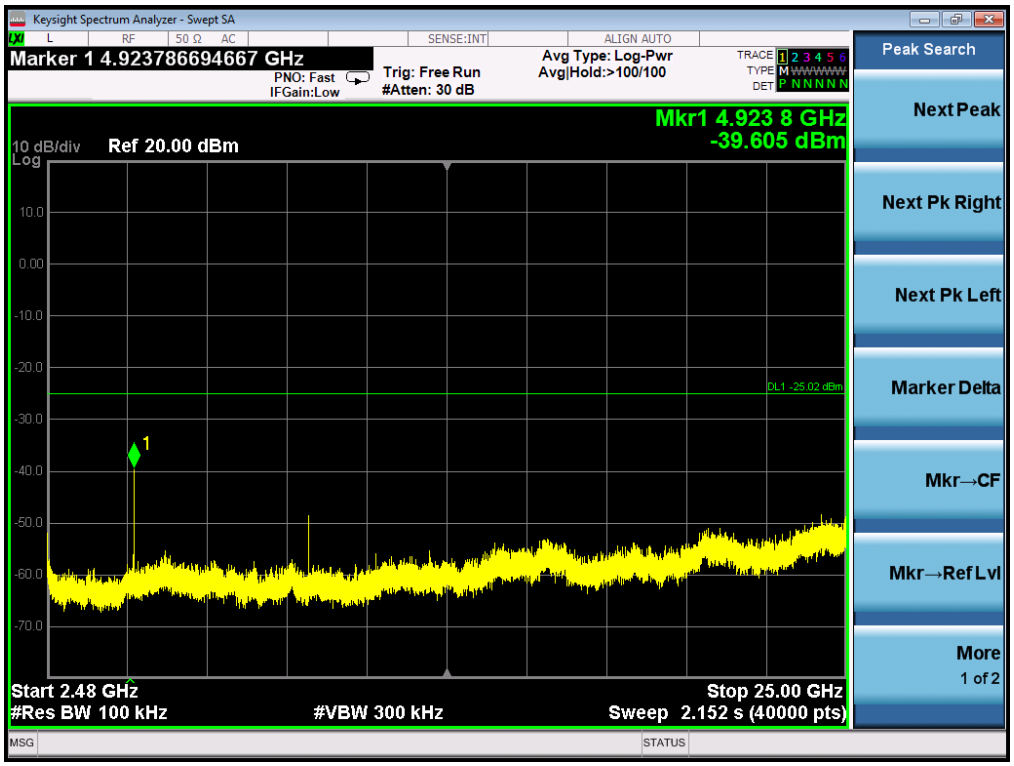

Keysight Spectrum Analyzer - Swept SA
Marker 1 1.217495437386 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 1.217 495 GHz
-53.260 dBm
10 dB/div
Log
Ref 20.00 dBm
DL1 -24.95 dBm
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 136.0 ms (40000 pts)
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
Marker 1 4.874249156229 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 4.874 2 GHz
-39.804 dBm
10 dB/div
Log
Ref 20.00 dBm
DL1 -24.95 dBm
Start 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.152 s (40000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

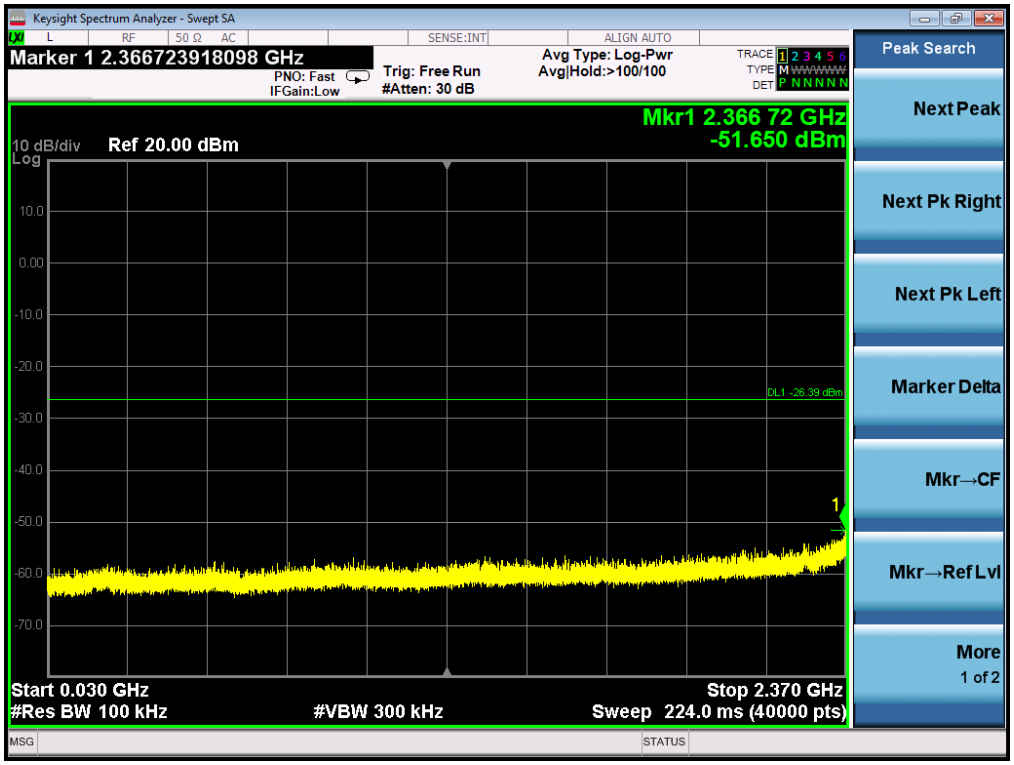
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE
OF 802.11b FOR MODULATION IN HIGH CHANNEL

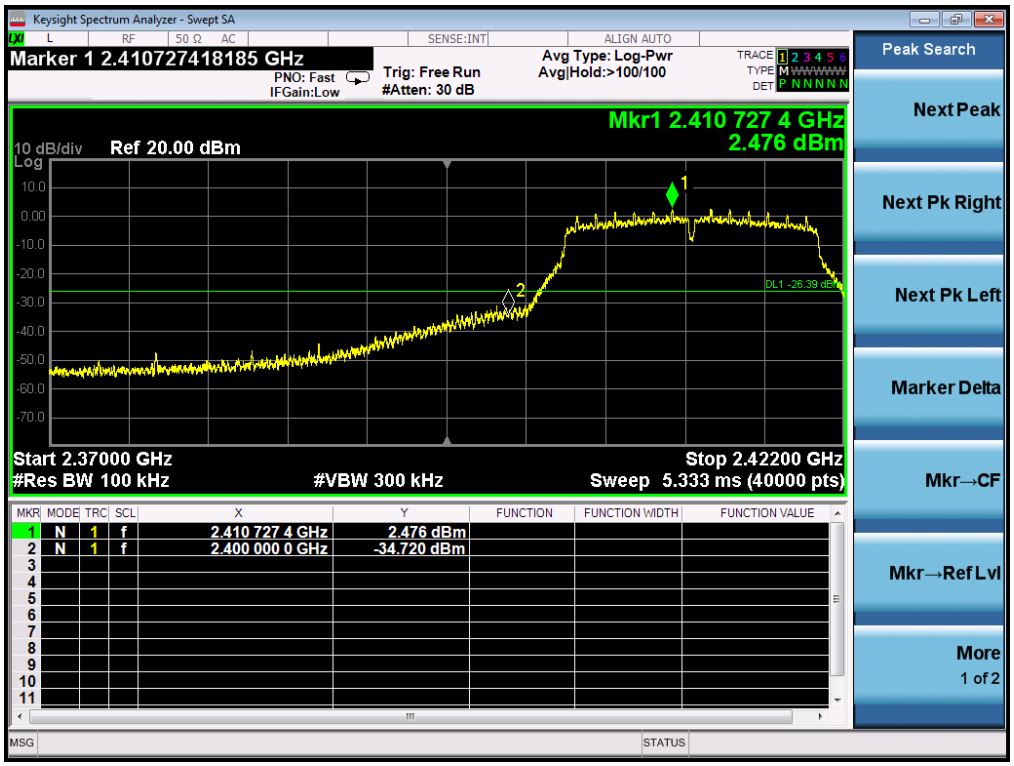


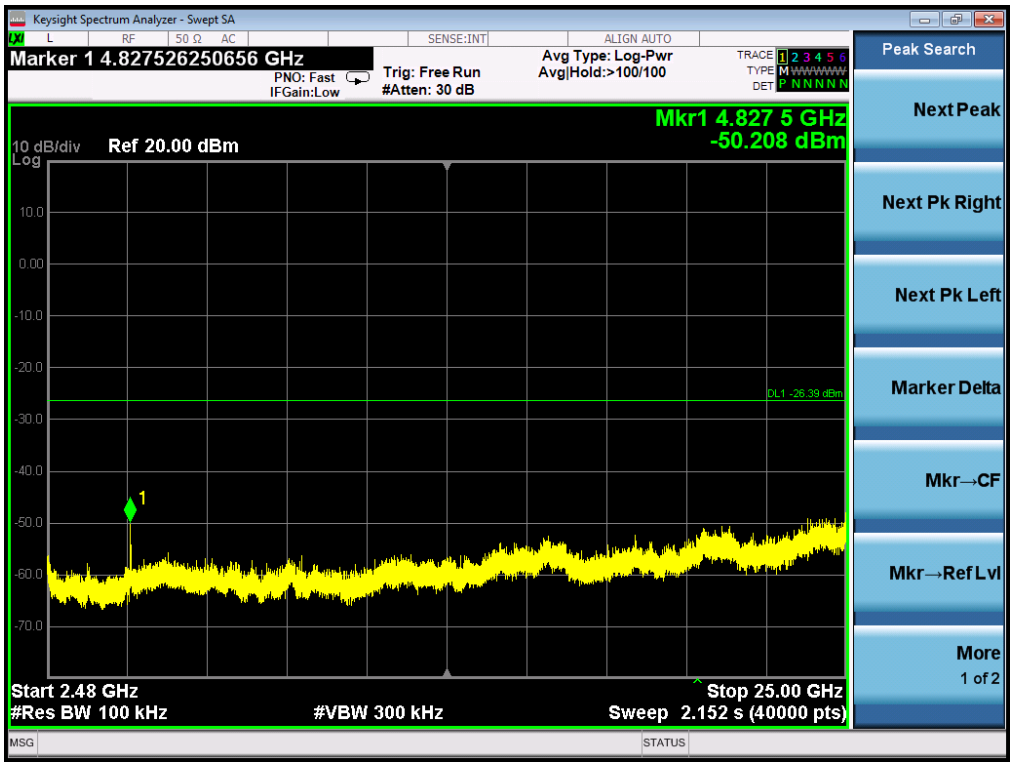




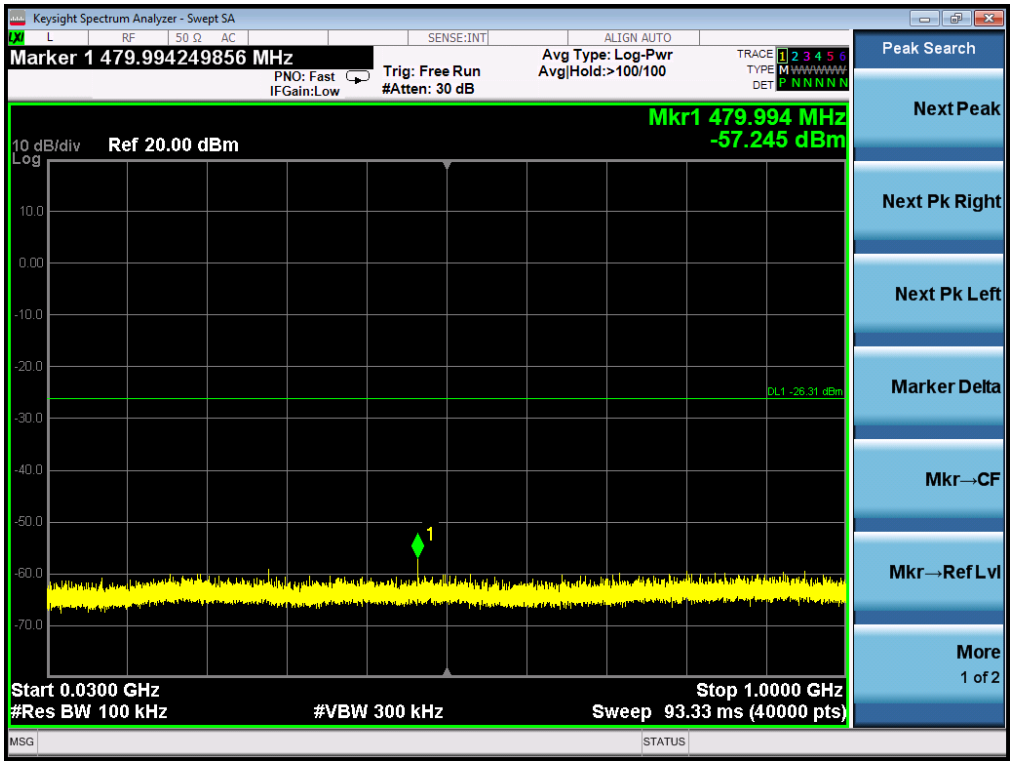
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF 802.11g FOR MODULATION IN LOW CHANNEL

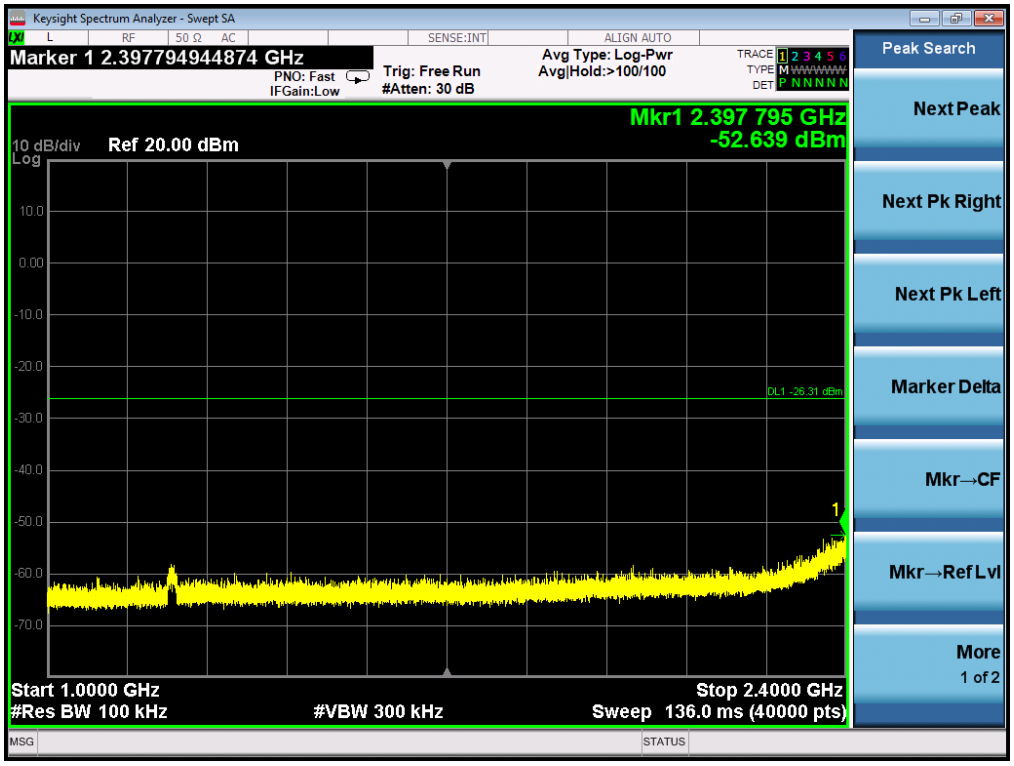


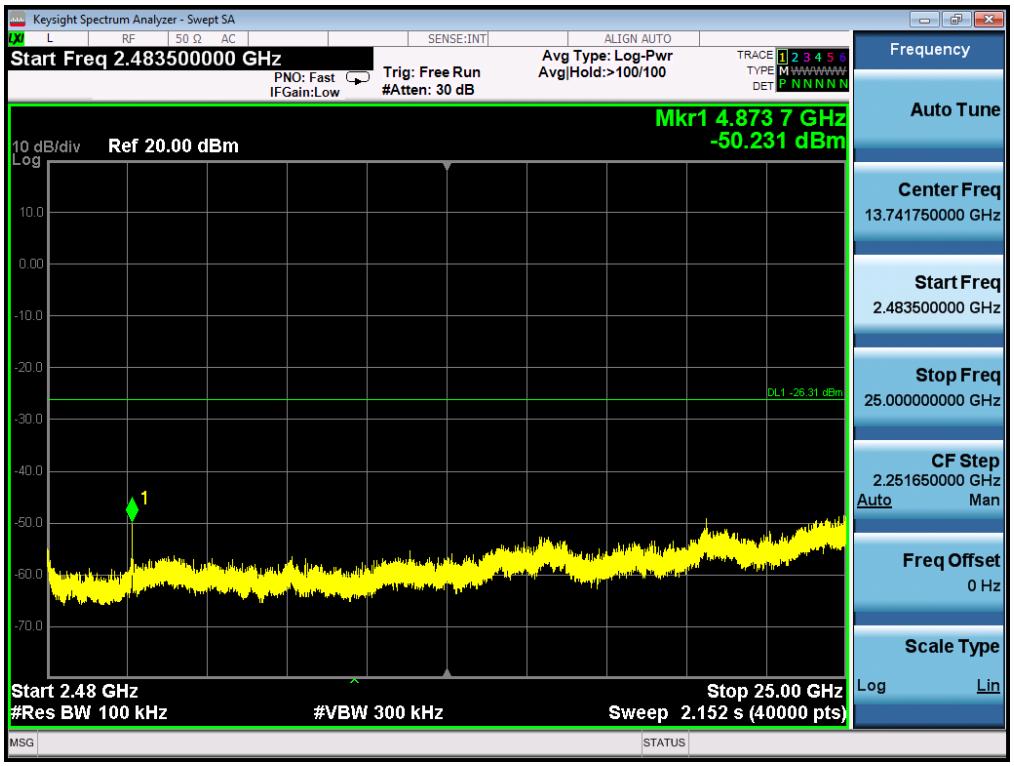

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.410727418185 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.410 727 4 GHz
2.476 dBm
10 dB/div
Ref 20.00 dBm
Log
DL1 -26.39 dBm
Start 2.37000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.42200 GHz
Sweep 5.333 ms (40000 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.410 727 4 GHz 2.476 dBm
2 N 1 f 2.400 000 0 GHz -34.720 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS


Keysight Spectrum Analyzer - Swept SA
Marker 1 4.827526250656 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 4.827 5 GHz
-50.208 dBm
10 dB/div
Ref 20.00 dBm
Log
DL1 -26.39 dBm
Start 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.152 s (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

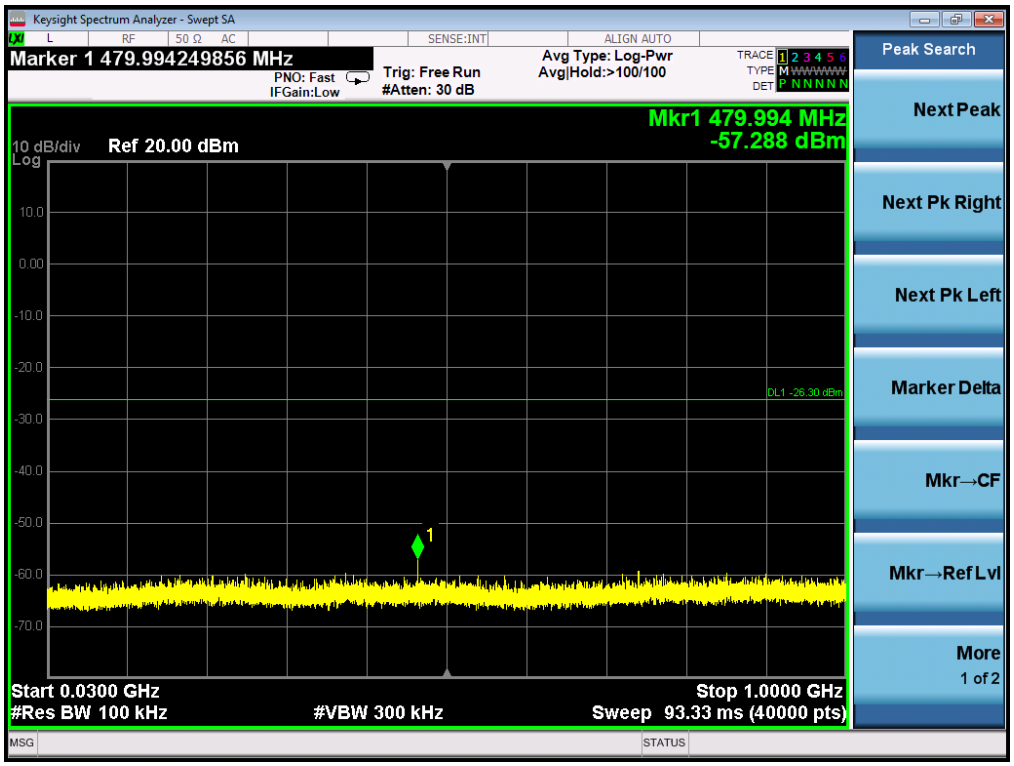
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE
OF 802.11g FOR MODULATION IN MIDDLE CHANNEL

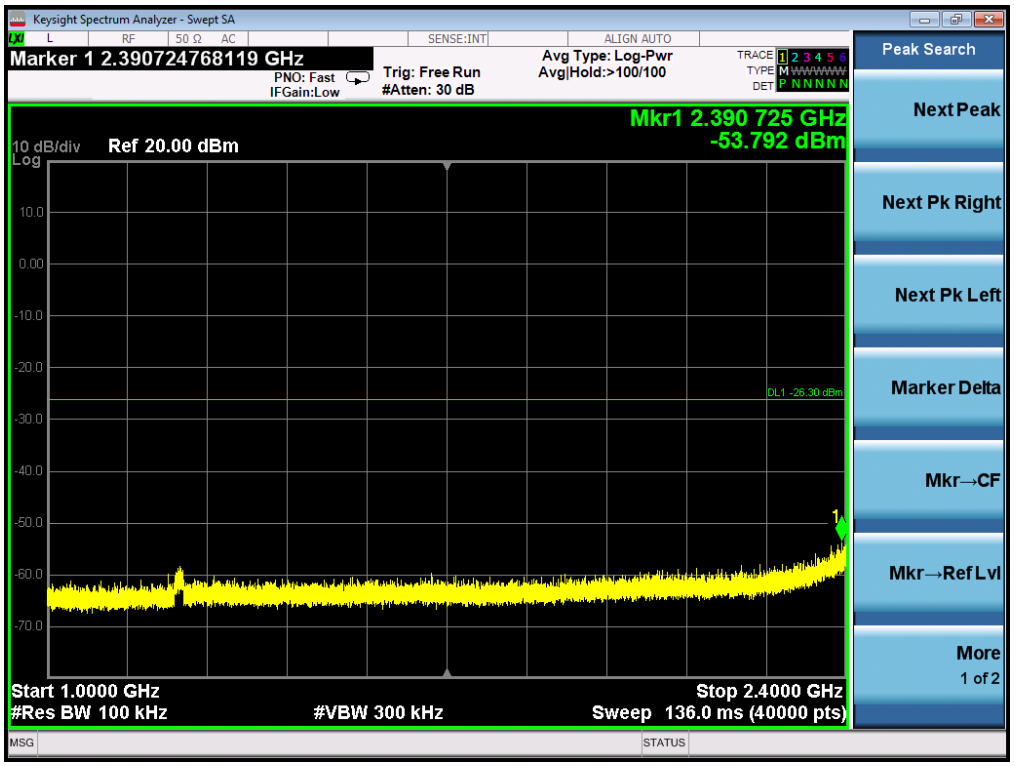


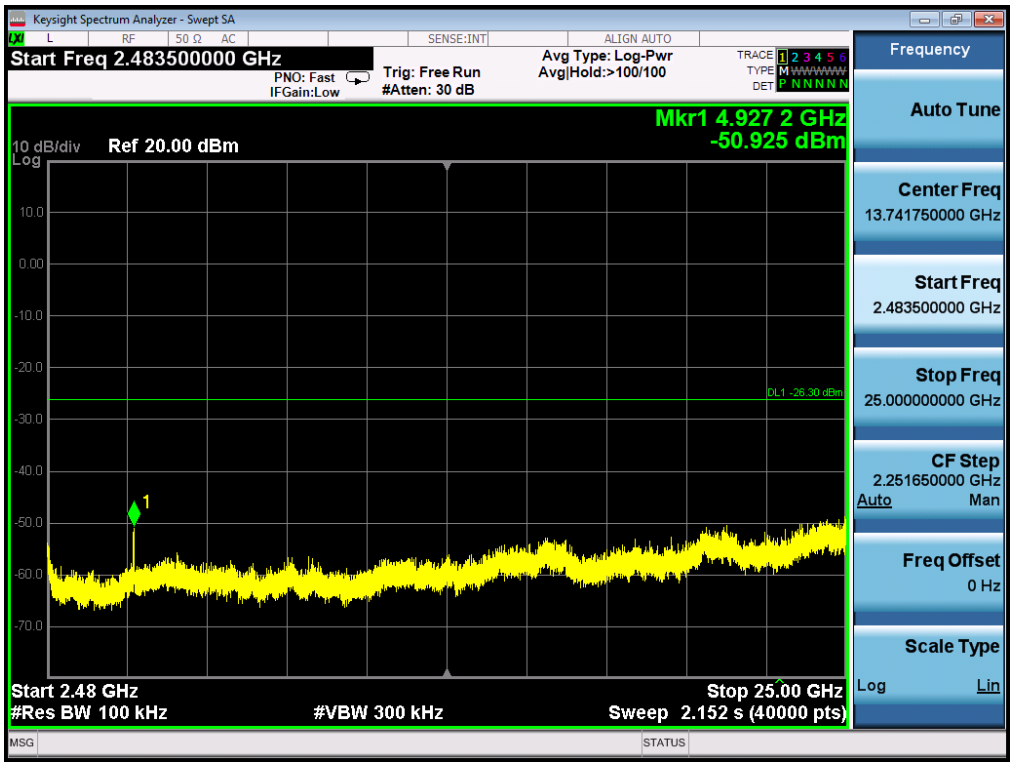




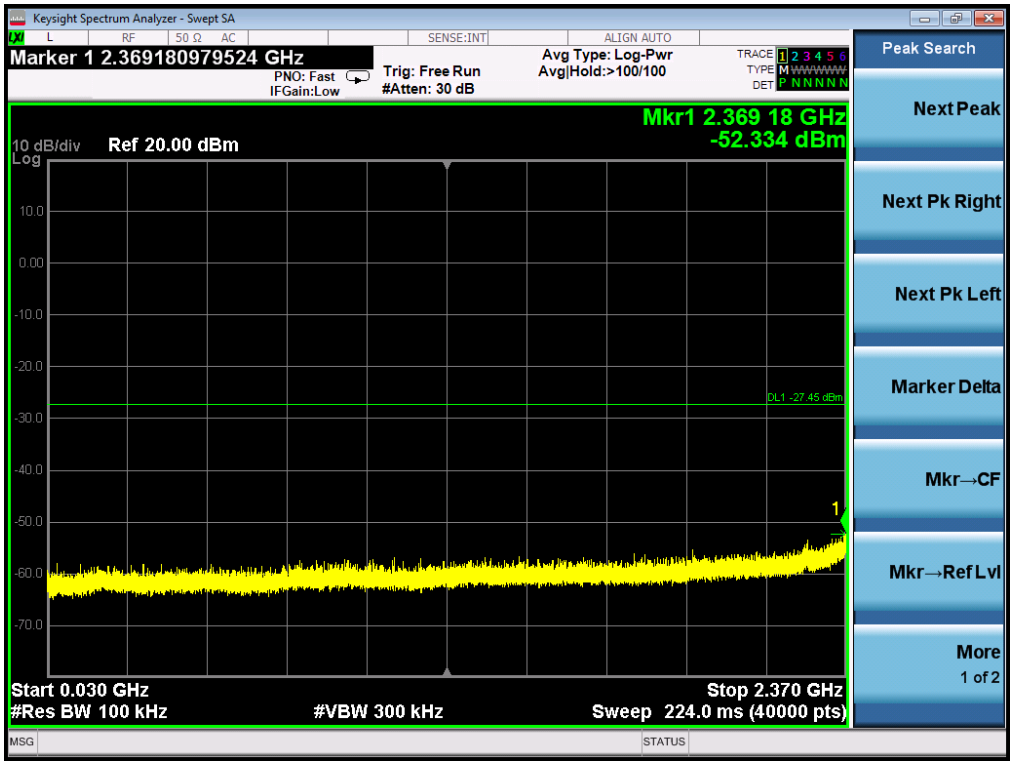
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE OF 802.11g FOR MODULATION IN HIGH CHANNEL

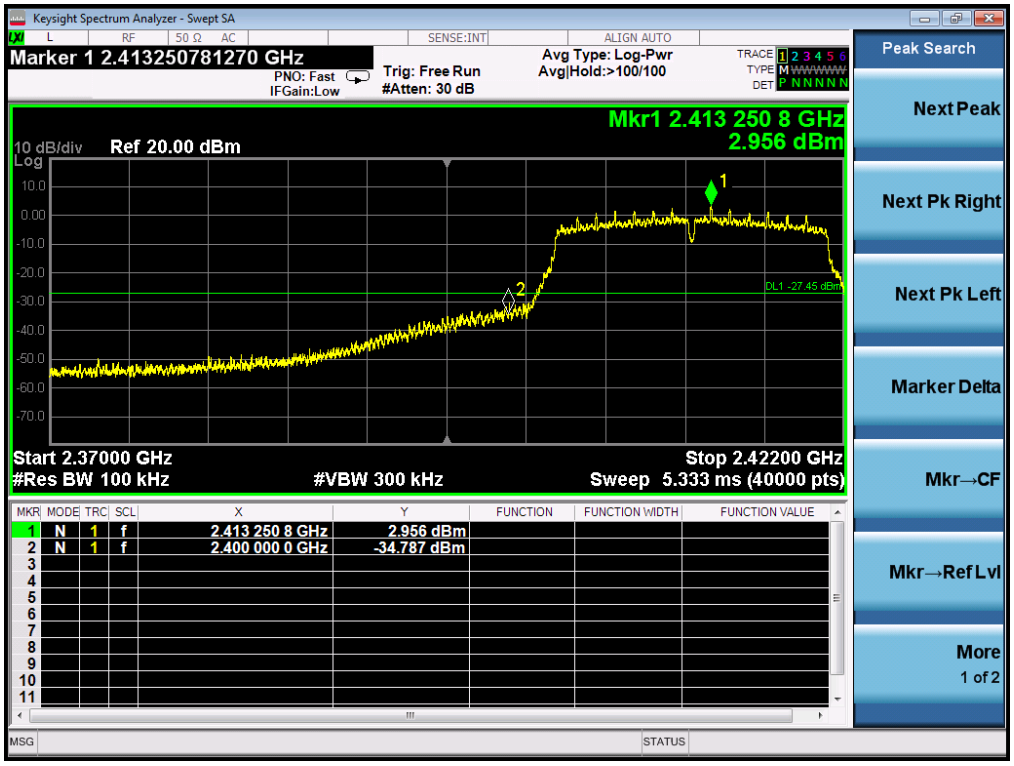



Keysight Spectrum Analyzer - Swept SA
Marker 1 2.390724768119 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.390 725 GHz
-53.792 dBm
10 dB/div
Log
Ref 20.00 dBm
DL1 -26.30 dBm
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 136.0 ms (40000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

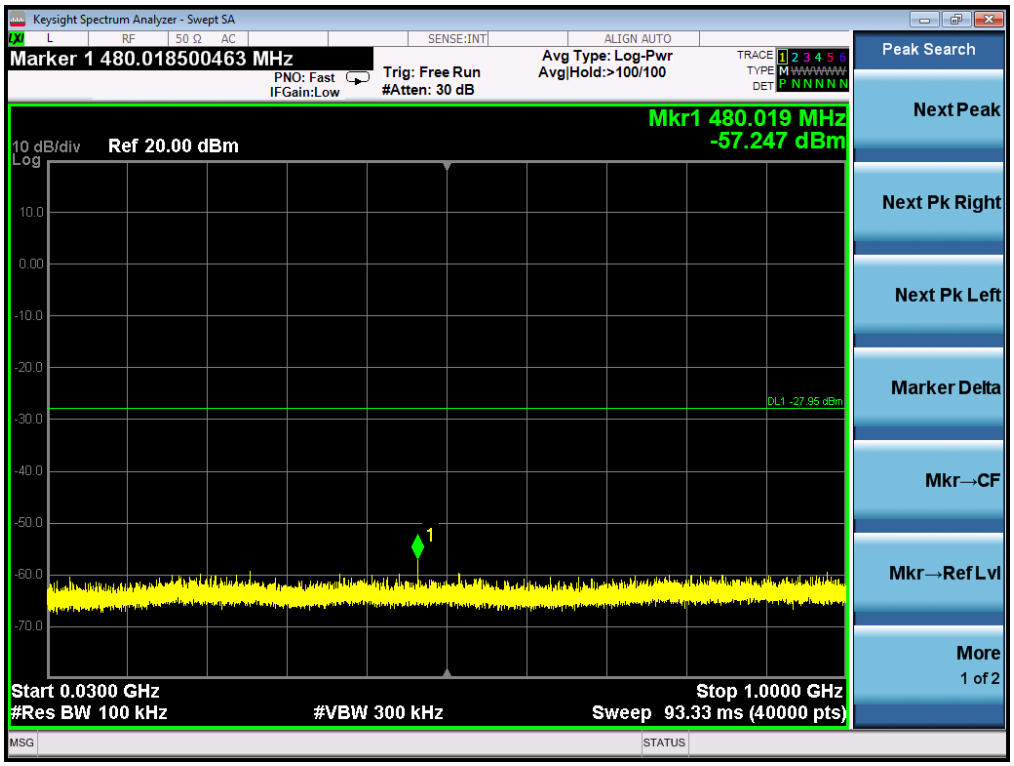

Keysight Spectrum Analyzer - Swept SA
Start Freq 2.483500000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 4.927 2 GHz
-50.925 dBm
10 dB/div
Log
Ref 20.00 dBm
DL1 -26.30 dBm
Start 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.152 s (40000 pts)
Frequency
Auto Tune
Center Freq
13.741750000 GHz
Start Freq
2.483500000 GHz
Stop Freq
25.000000000 GHz
CF Step
2.251650000 GHz
Auto
Man
Freq Offset
0 Hz
Scale Type
Log
Lin

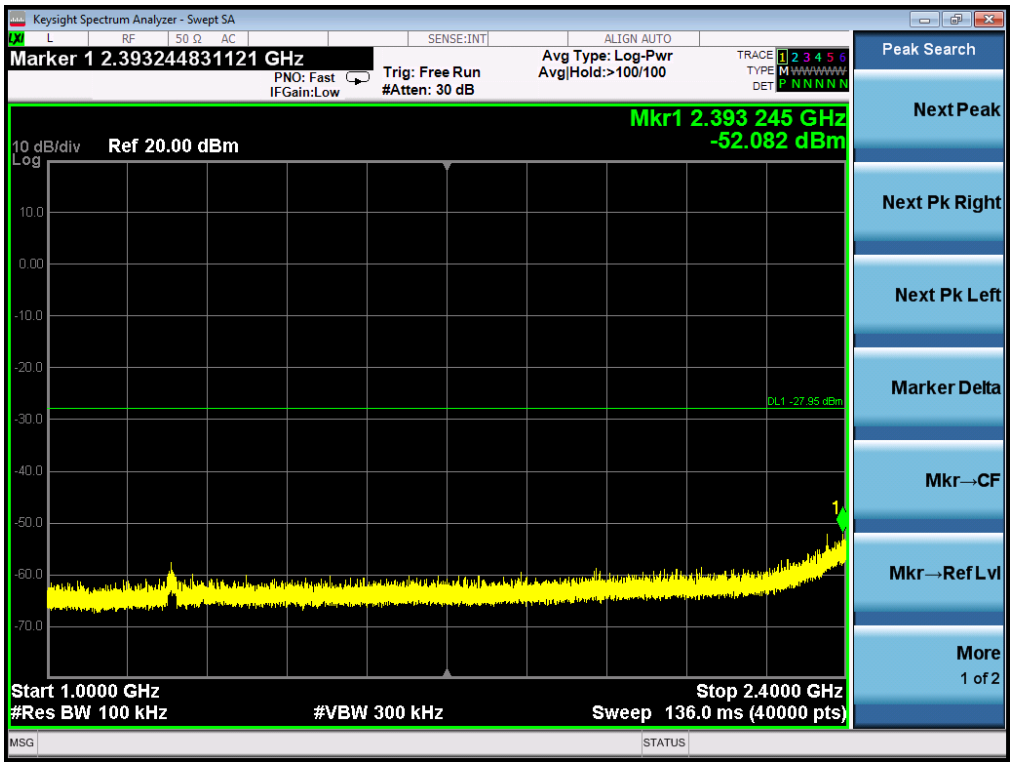
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF 802.11n20 FOR MODULATION IN LOW CHANNEL

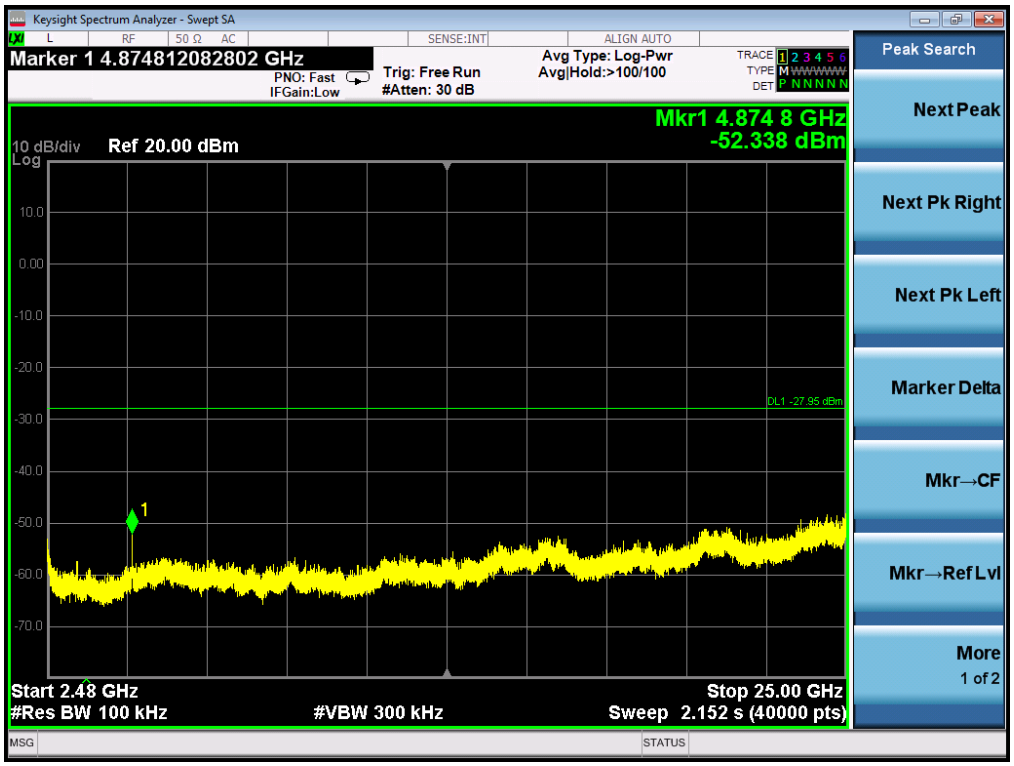




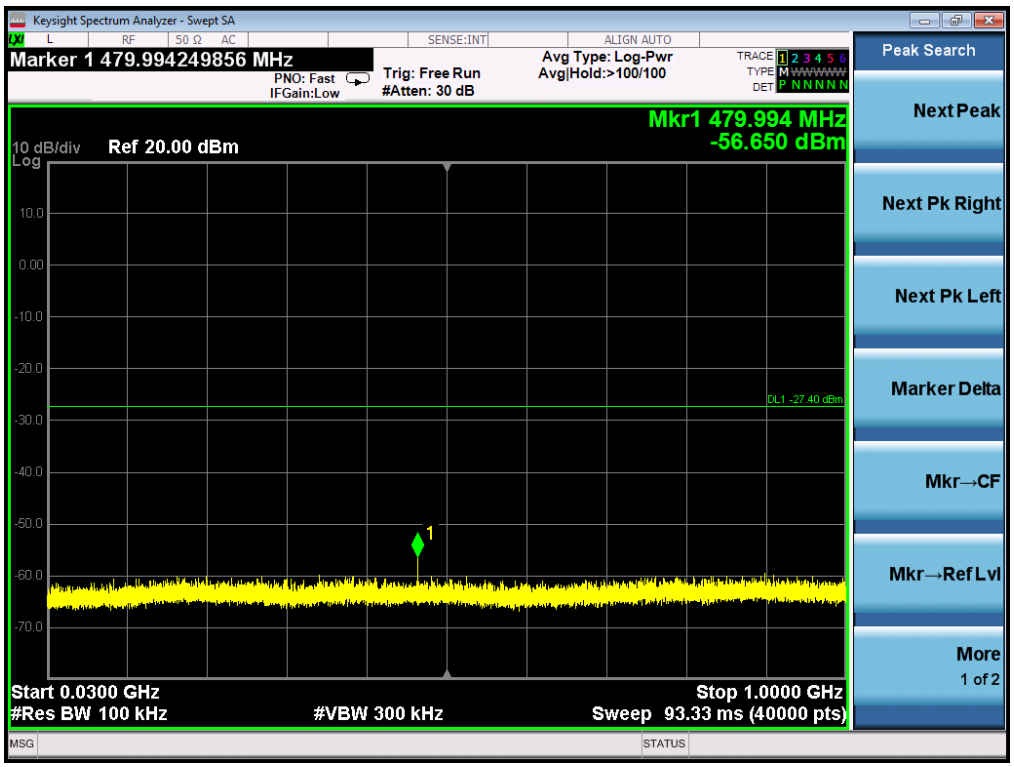
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE OF 802.11n20 FOR MODULATION IN MIDDLE CHANNEL

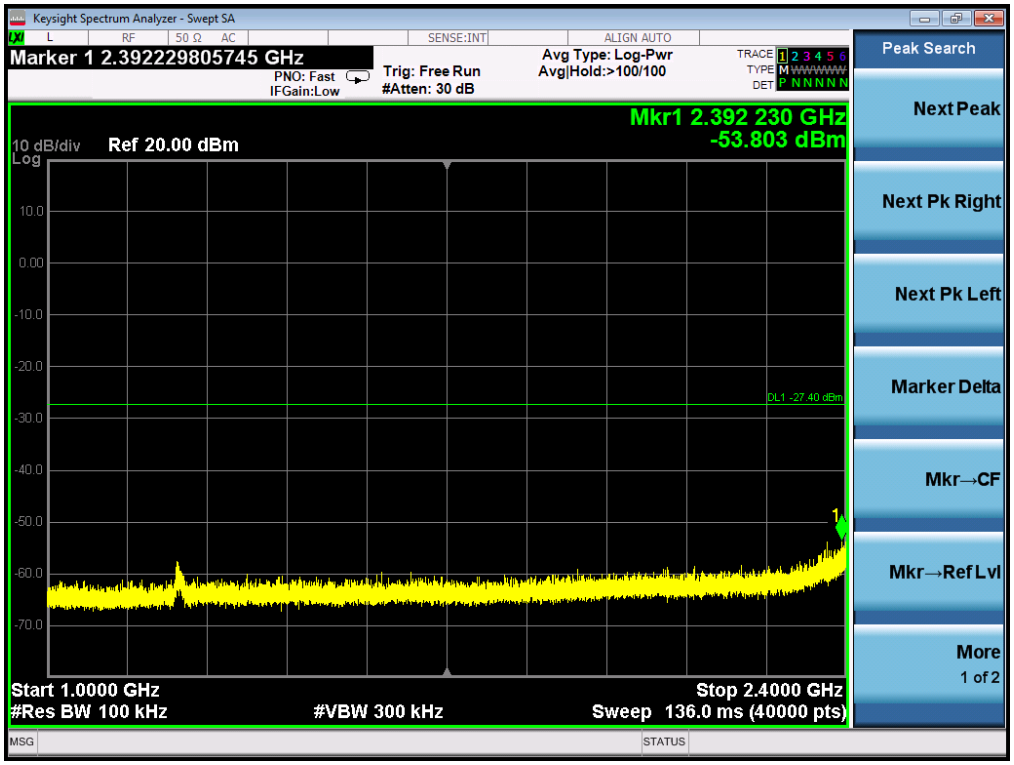


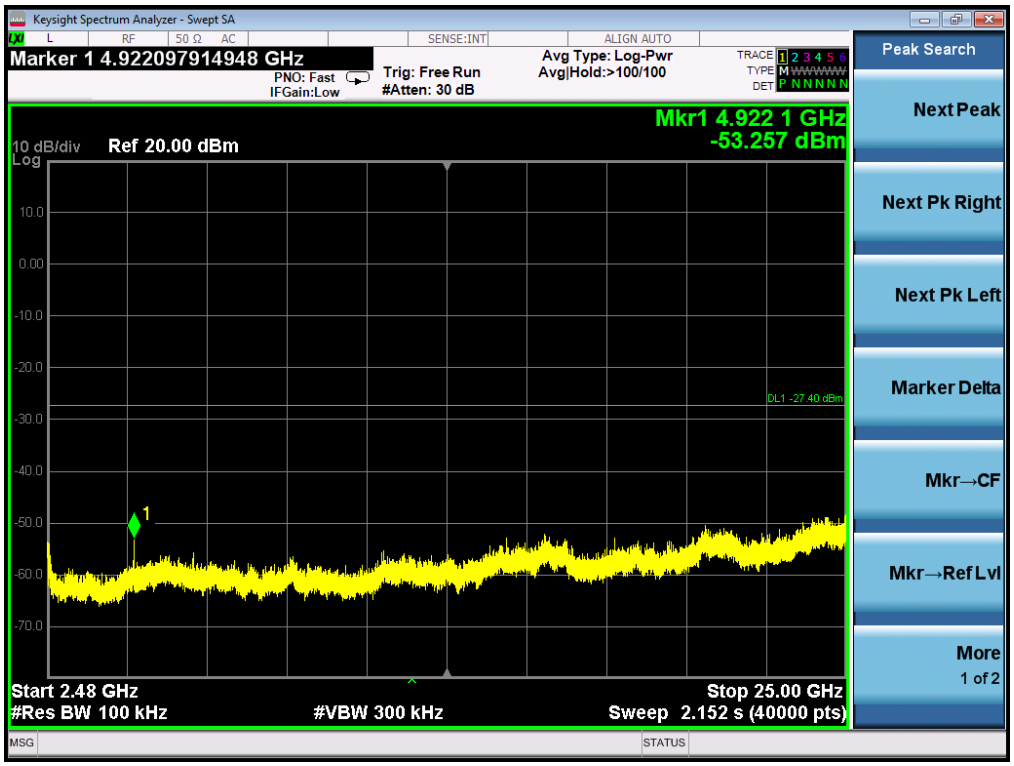

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.393244831121 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.393 245 GHz
-52.082 dBm
10 dB/div
Log
Ref 20.00 dBm
DL1 -27.95 dBm
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 136.0 ms (40000 pts)
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
Marker 1 4.874812082802 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 4.874 8 GHz
-52.338 dBm
10 dB/div
Log
Ref 20.00 dBm
DL1 -27.95 dBm
Start 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.152 s (40000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

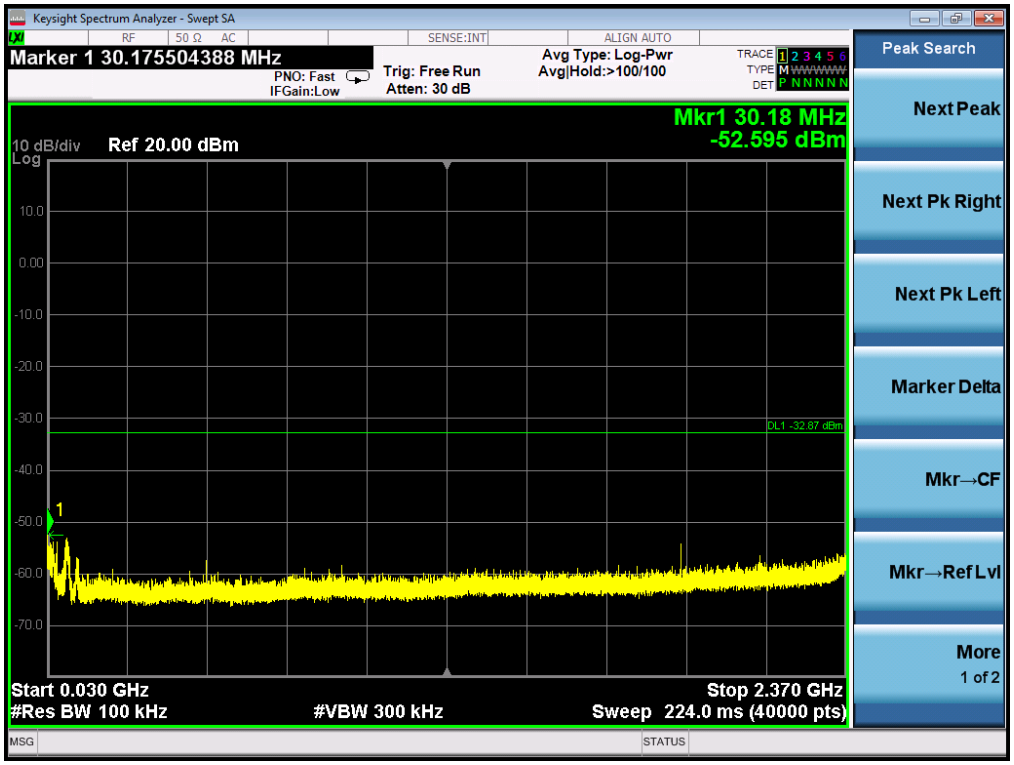
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE
OF 802.11n20 FOR MODULATION IN HIGH CHANNEL

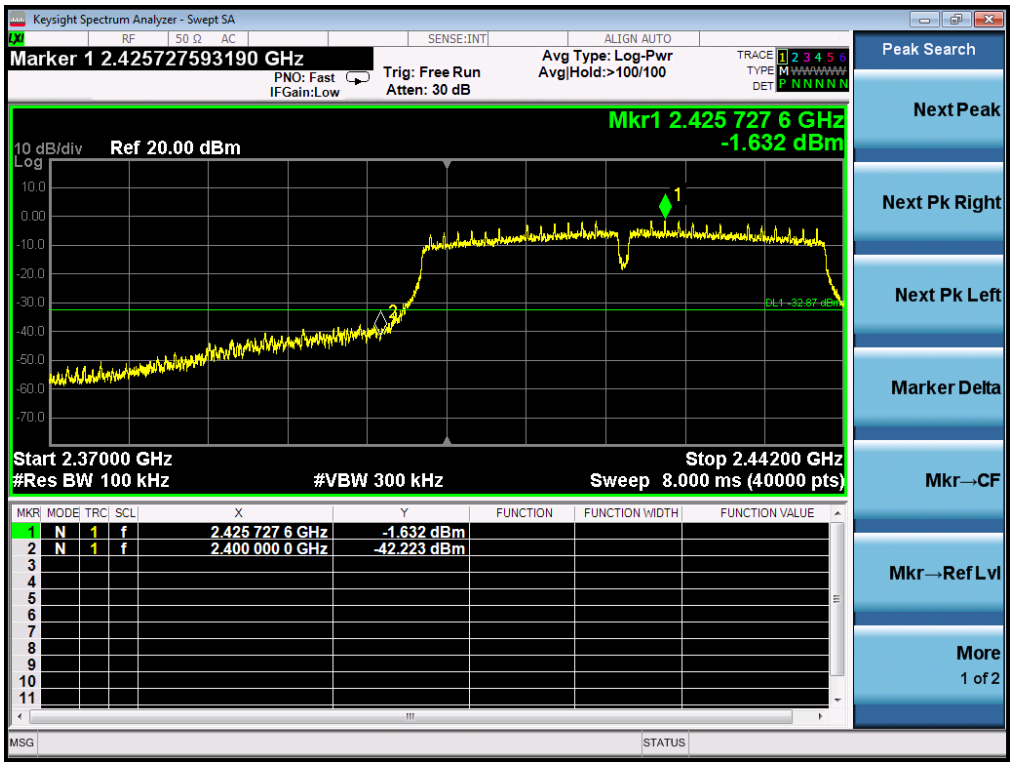






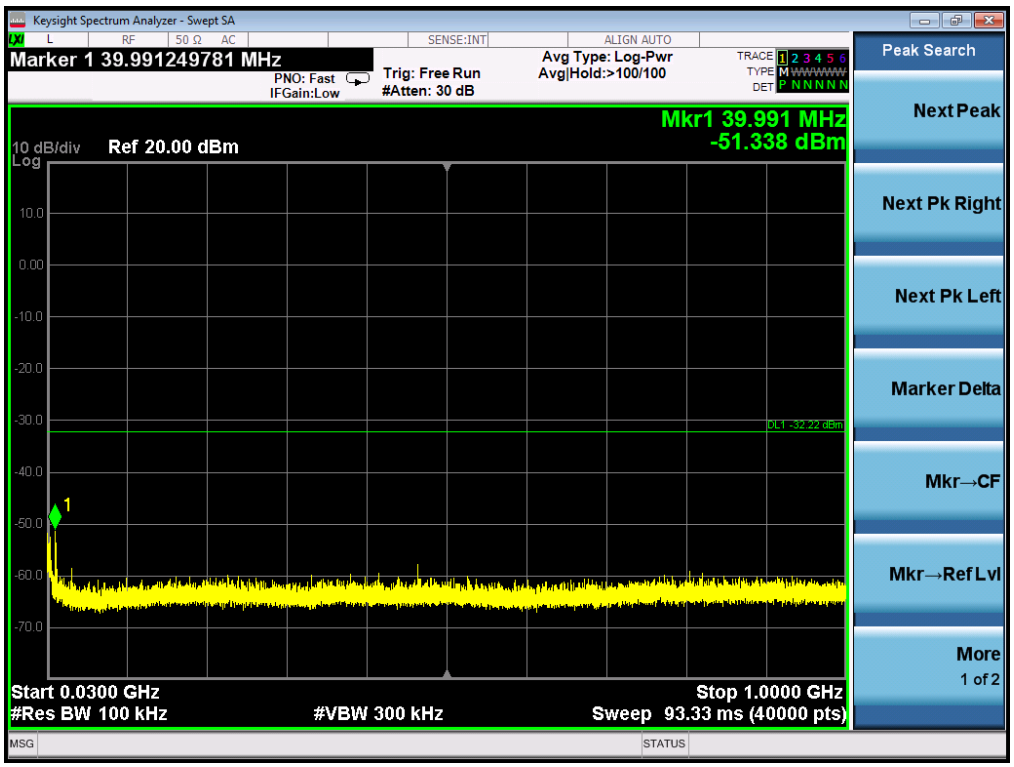
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF 802.11n40 FOR MODULATION IN LOW CHANNEL

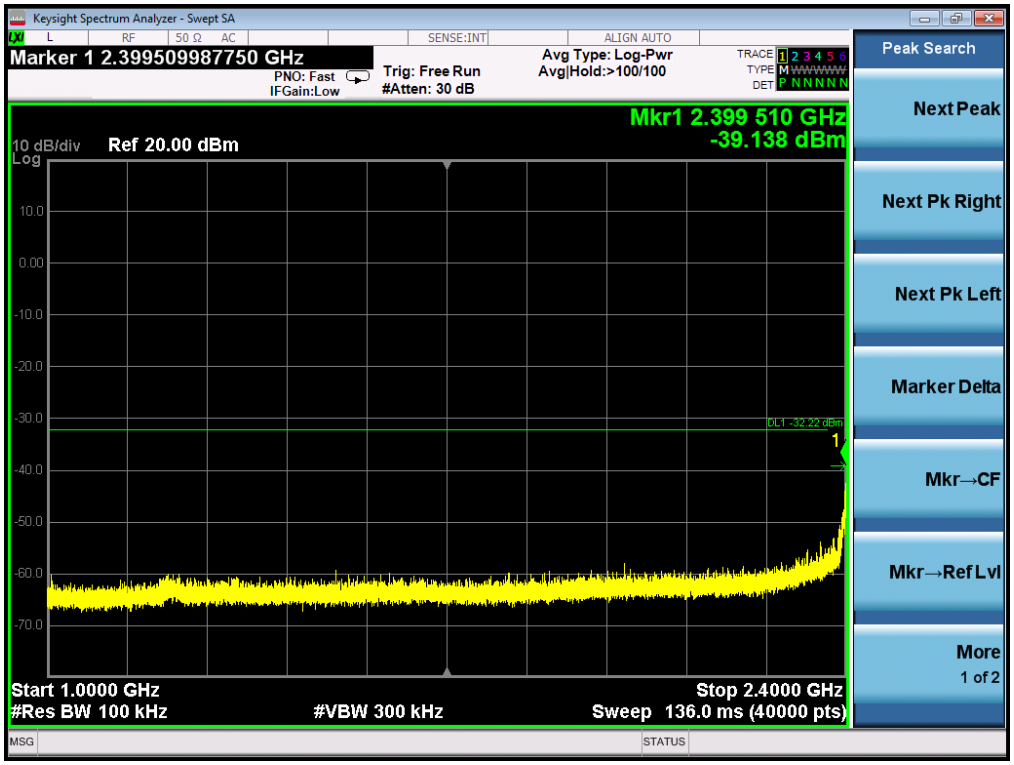



Keysight Spectrum Analyzer - Swept SA
Marker 1 2.425727593190 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.425 727 6 GHz
-1.632 dBm
10 dB/div
Ref 20.00 dBm
Start 2.37000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.44200 GHz
Sweep 8.000 ms (40000 pts)
1 N 1 f 2.425 727 6 GHz -1.632 dBm
2 N 1 f 2.400 000 0 GHz -42.223 dBm
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

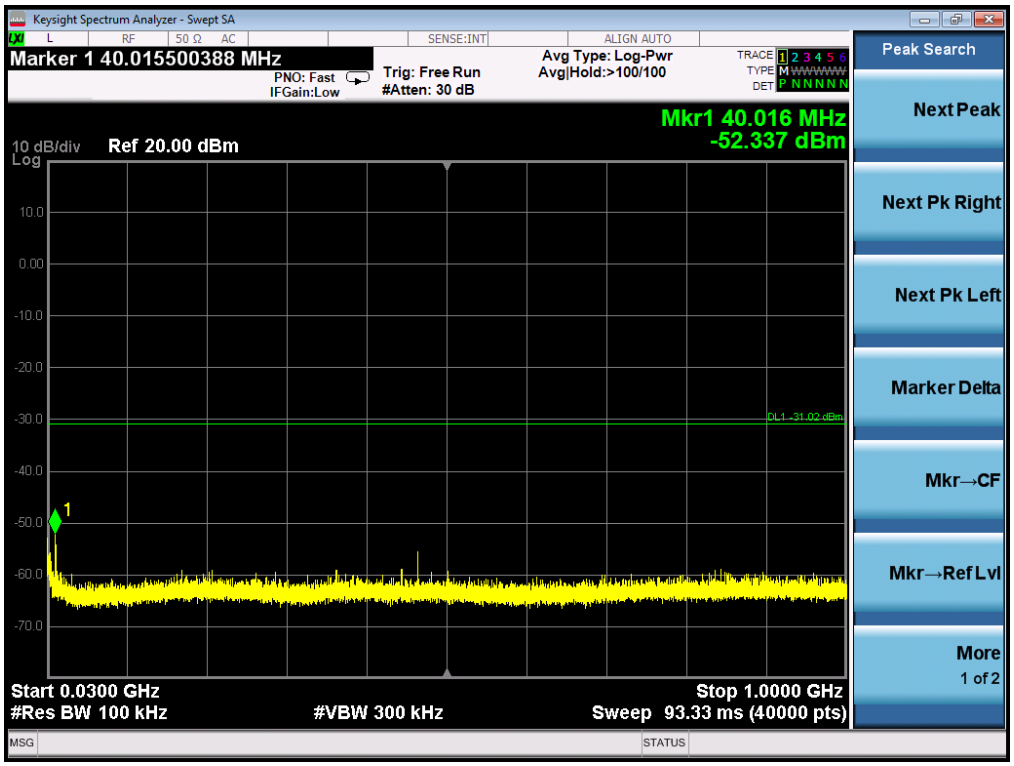
Keysight Spectrum Analyzer - Swept SA
Marker 1 4.843851121278 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 4.843 9 GHz
-54.484 dBm
10 dB/div
Ref 20.00 dBm
Start 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.152 s (40000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

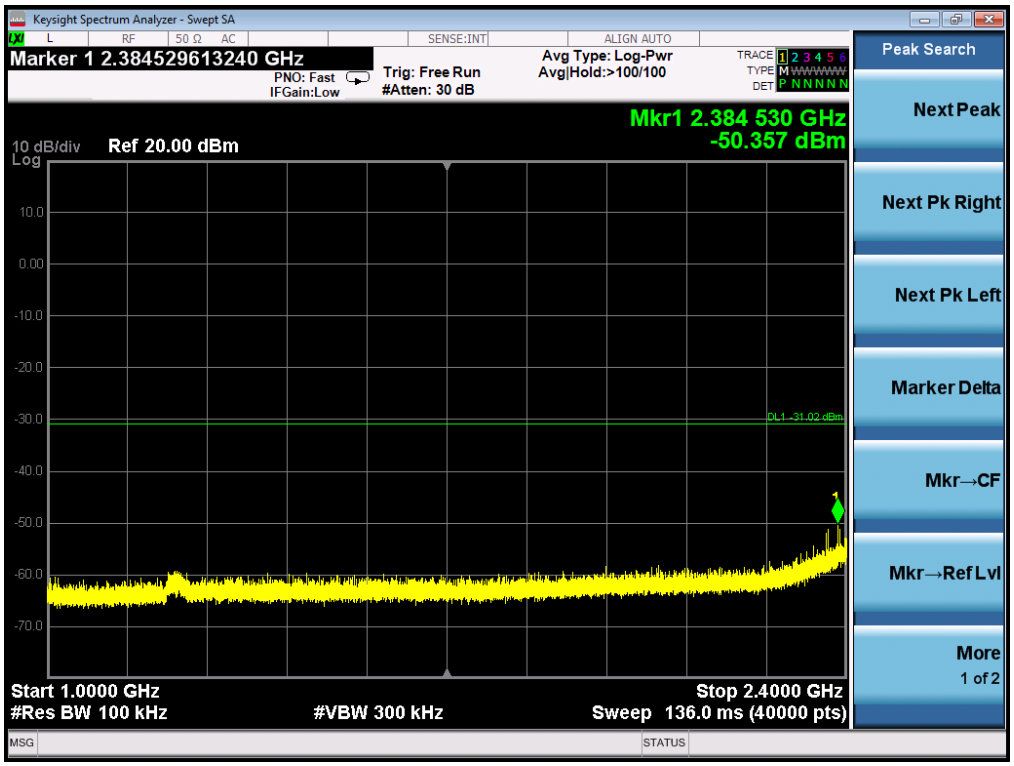
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE
OF 802.11n40 FOR MODULATION IN MIDDLE CHANNEL





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




Keysight Spectrum Analyzer - Swept SA
Marker 1 2.384529613240 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.384 530 GHz
-50.357 dBm
10 dB/div
Log
Ref 20.00 dBm
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 136.0 ms (40000 pts)
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
Marker 1 4.900706705168 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 4.900 7 GHz
-51.725 dBm
10 dB/div
Log
Ref 20.00 dBm
Start 2.48 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.00 GHz
Sweep 2.152 s (40000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

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 AVGPSD-1 in the ANSI C63.10 (2013) item 11.10 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 SPECTRAL DENSITY
TEST MODE	802.11b with data rate 1

Channel No.	**Power density (dBm/20kHz)**	**Limit (dBm/3kHz)**	**Result**
Low Channel	4.759	8	Pass
Middle Channel	4.726	8	Pass
High Channel	4.918	8	Pass

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

Channel No.	**Power density (dBm/20kHz)**	**Limit (dBm/3kHz)**	**Result**
Low Channel	-3.416	8	Pass
Middle Channel	-2.043	8	Pass
High Channel	-2.931	8	Pass

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

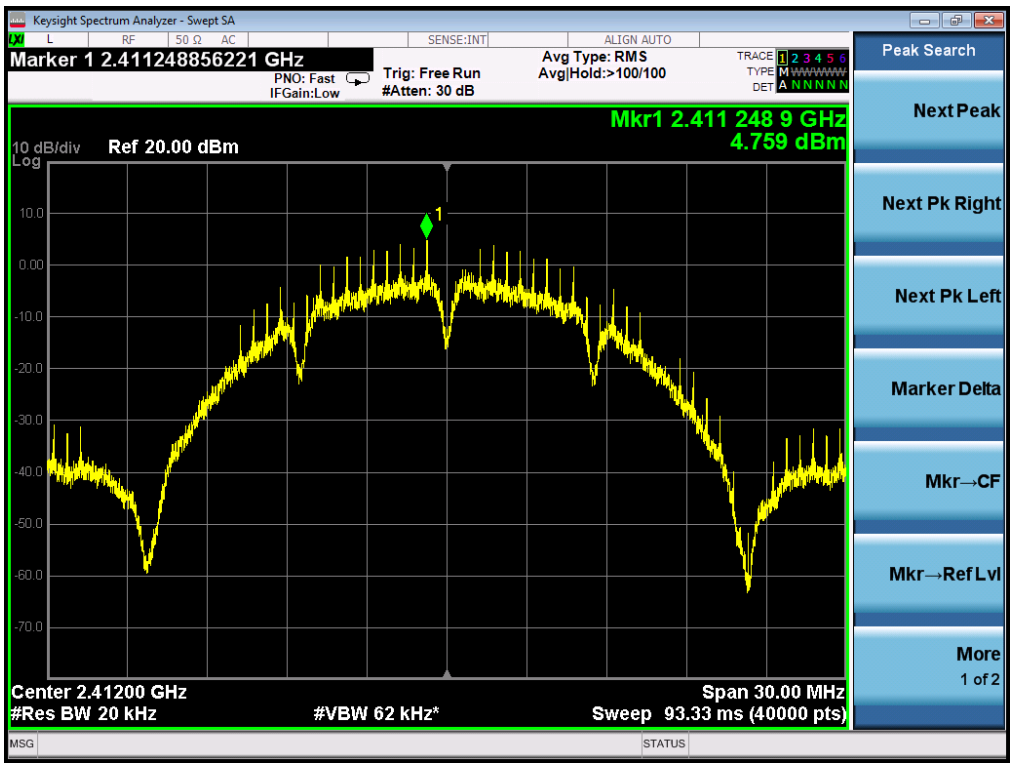
Channel No.	Power density (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-3.377	8	Pass
Middle Channel	-3.134	8	Pass
High Channel	-2.718	8	Pass

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

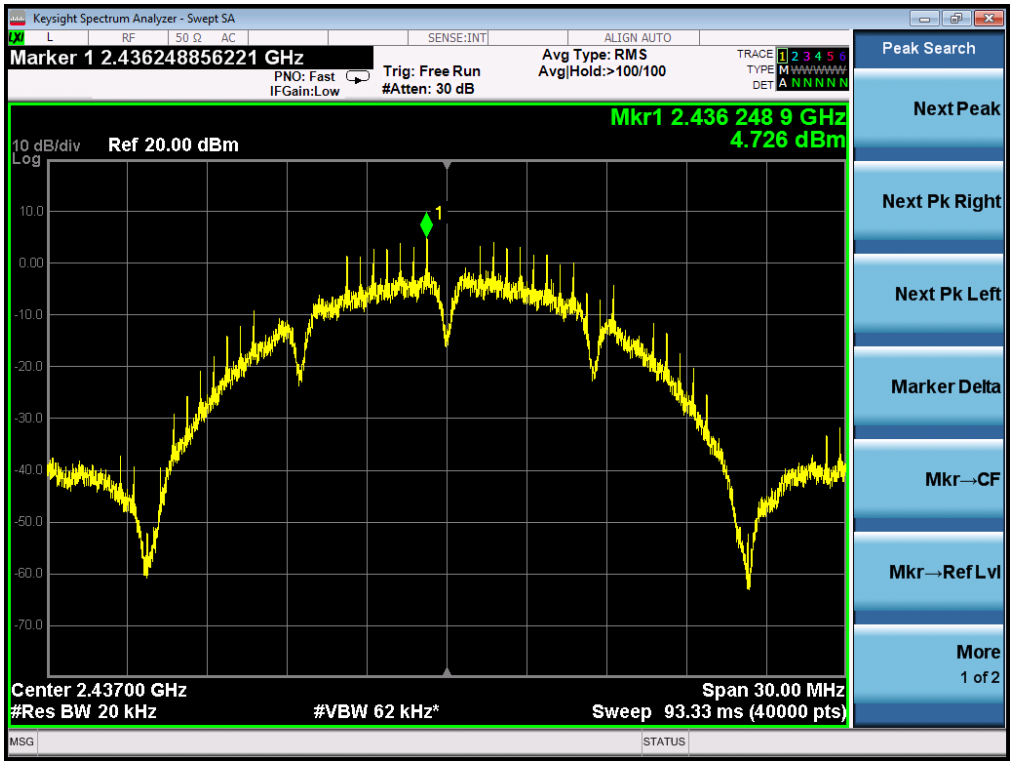
Channel No.	Power density (dBm/20kHz)	Limit (dBm/3kHz)	Result
Low Channel	-8.363	8	Pass
Middle Channel	-7.693	8	Pass
High Channel	-6.403	8	Pass

802.11b TEST RESULT

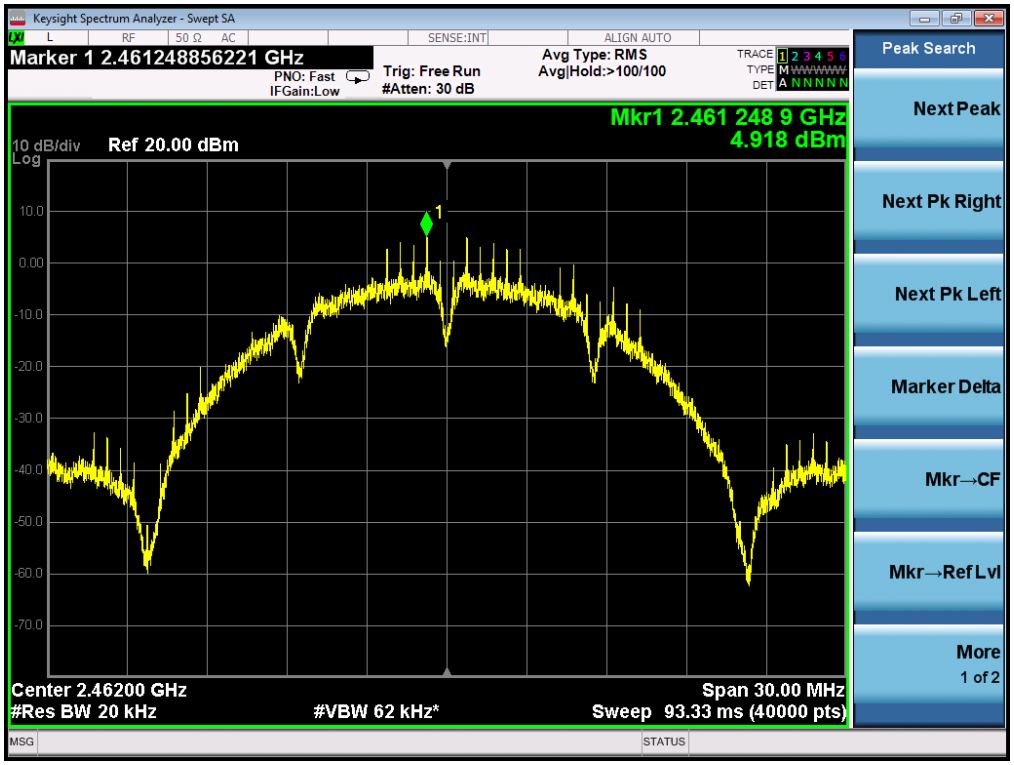
TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL

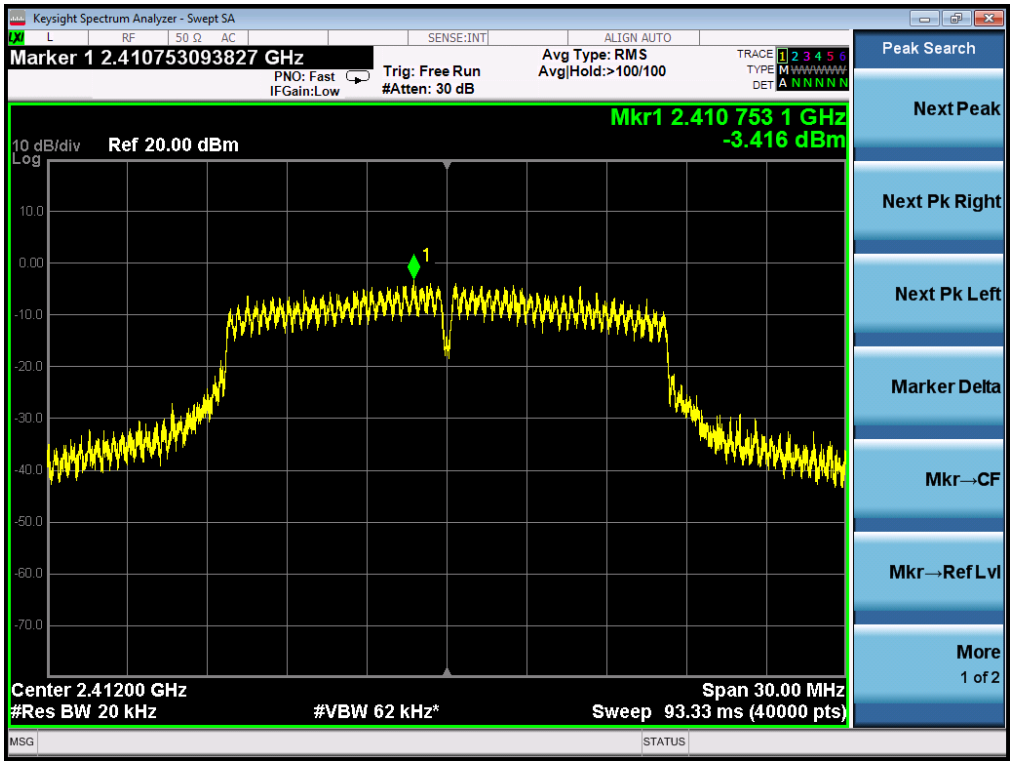


TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL

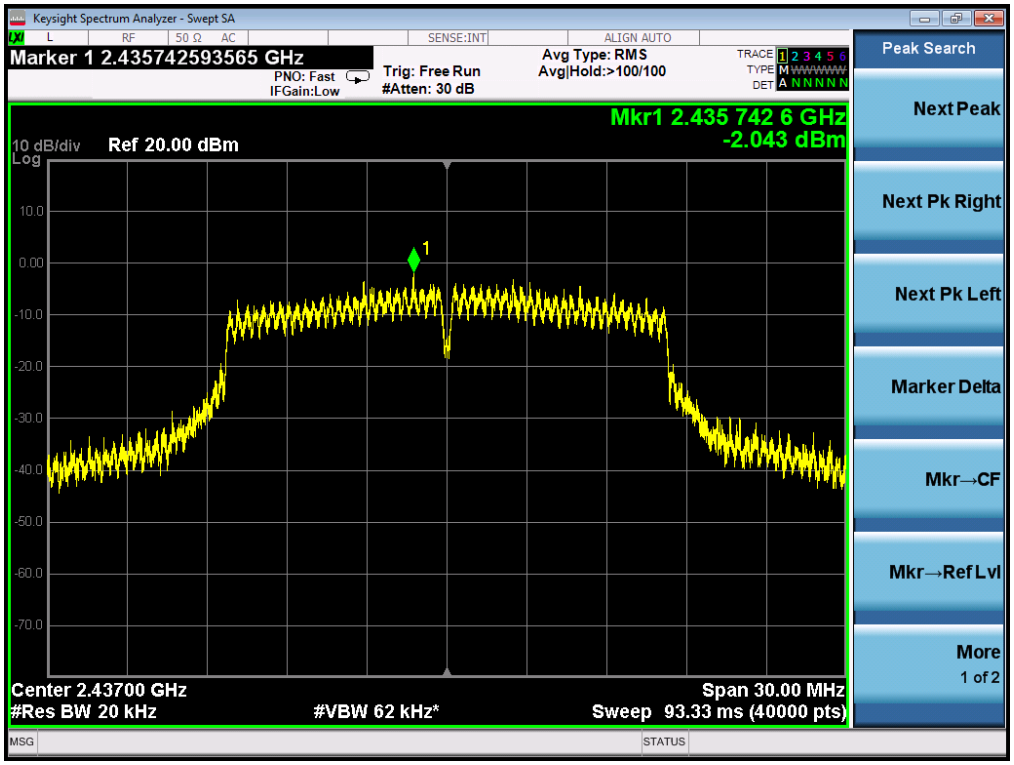


802.11g TEST RESULT

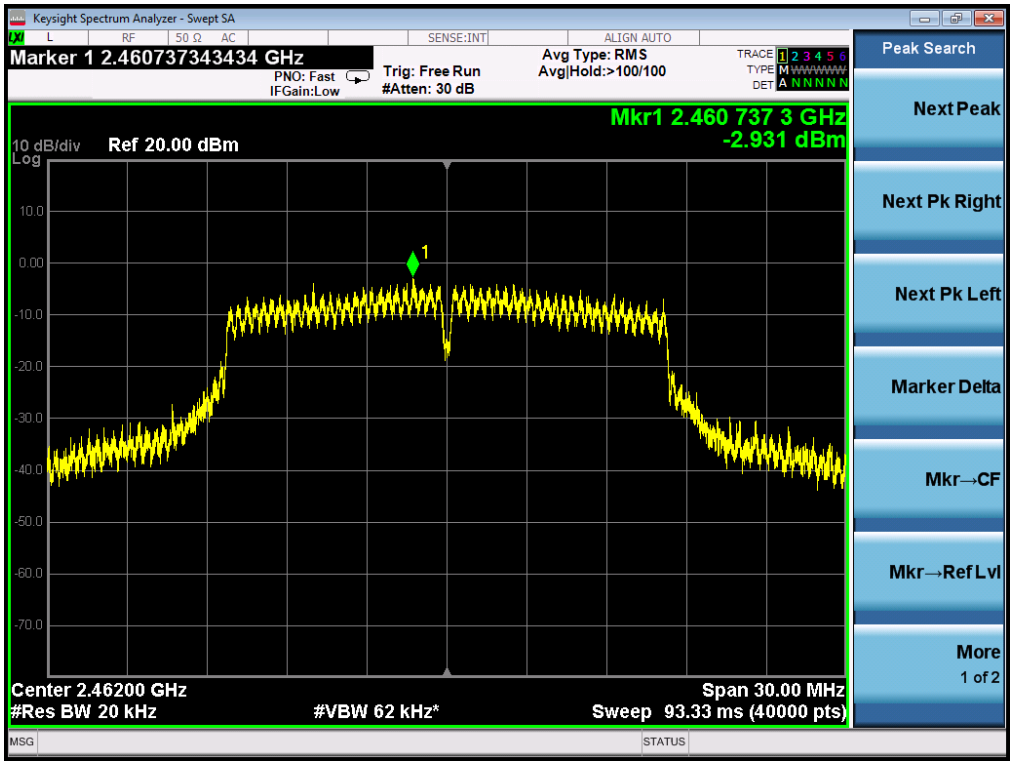
TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL

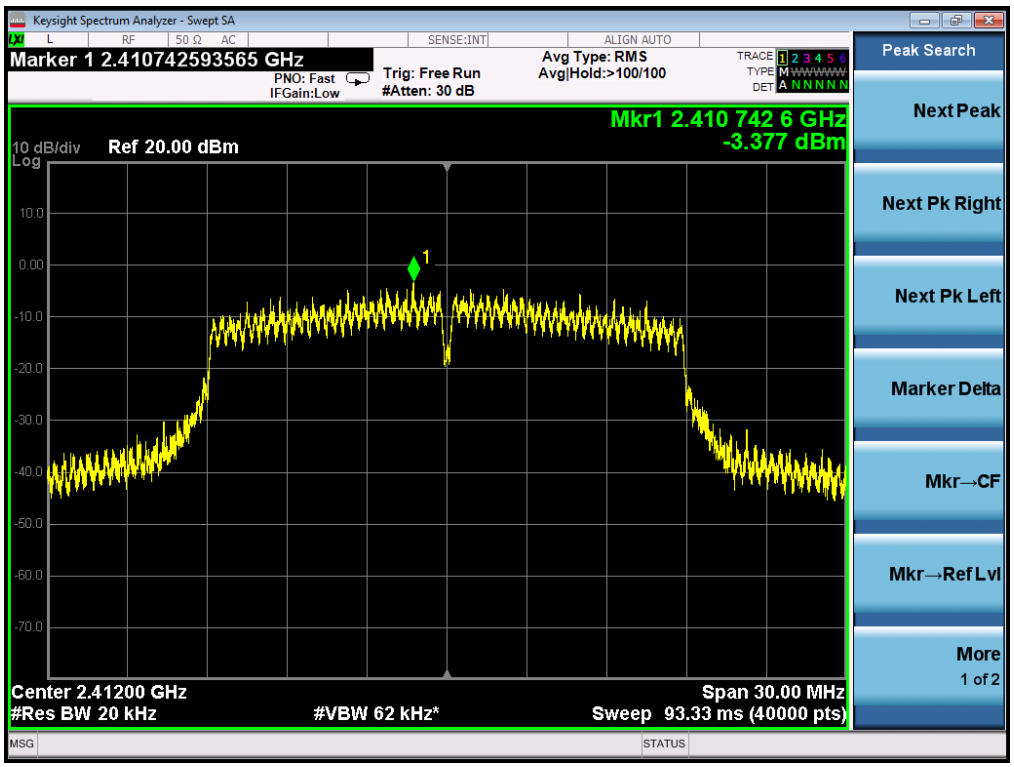


TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL

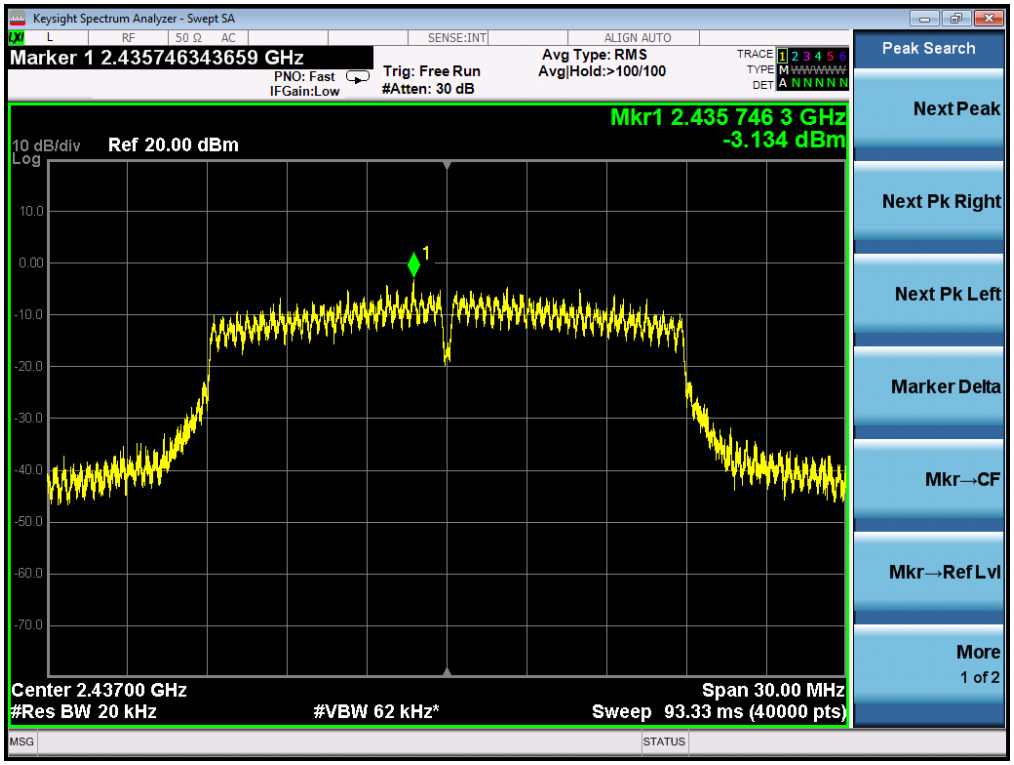


802.11n 20 TEST RESULT

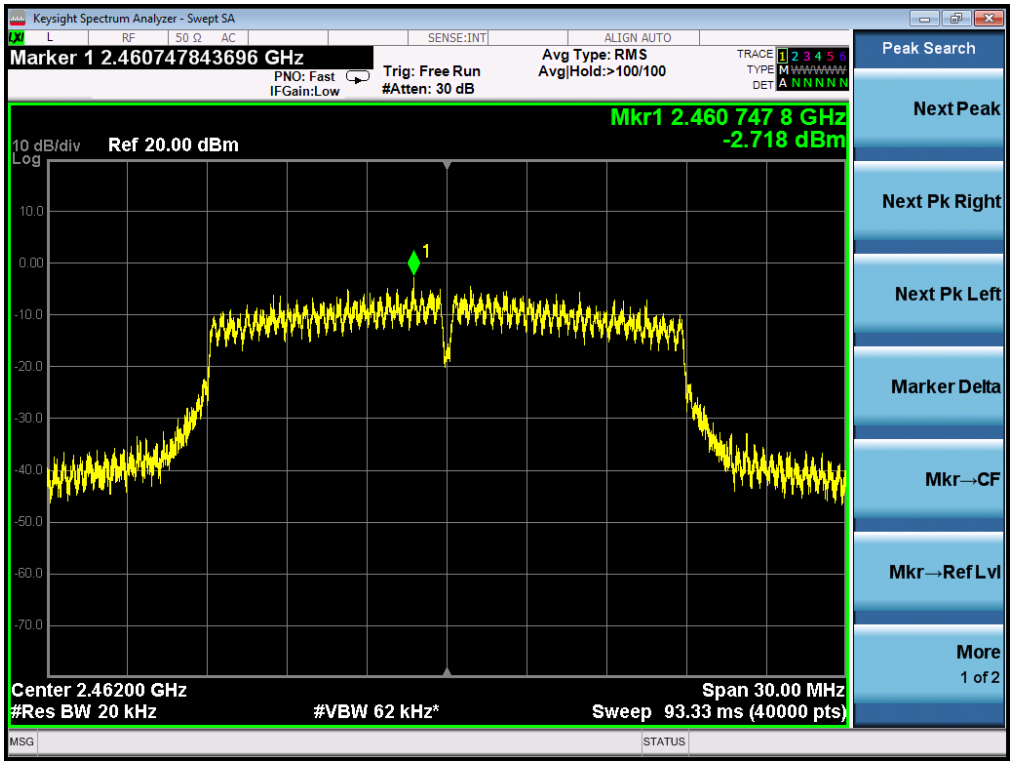
TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL

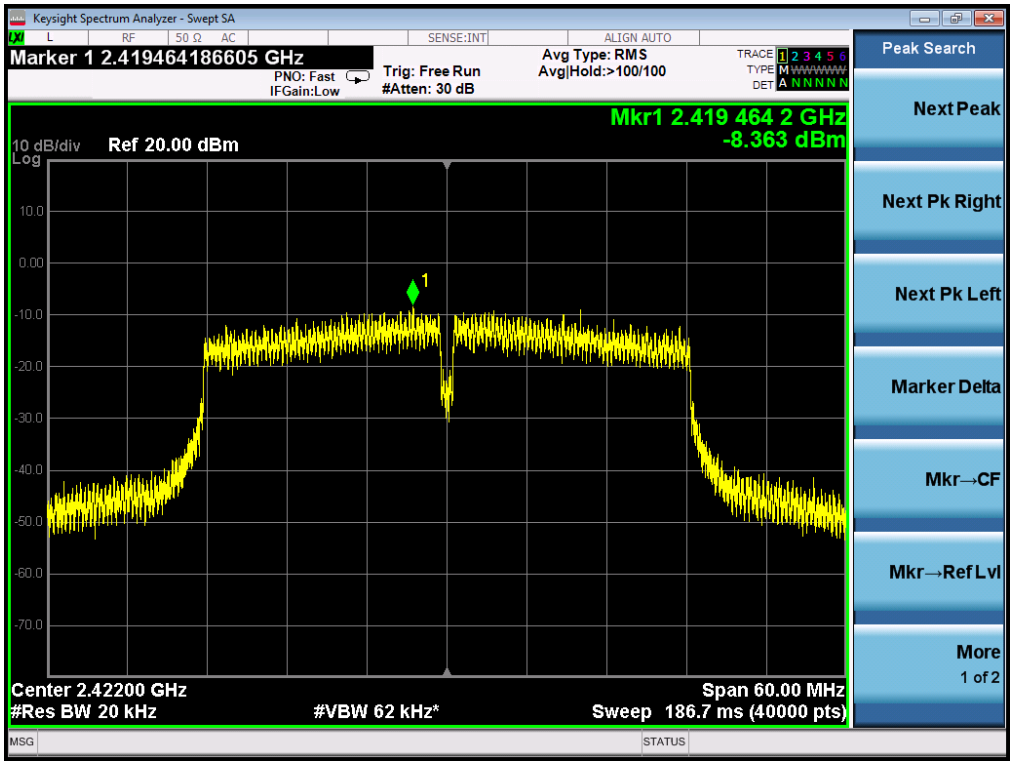


TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL

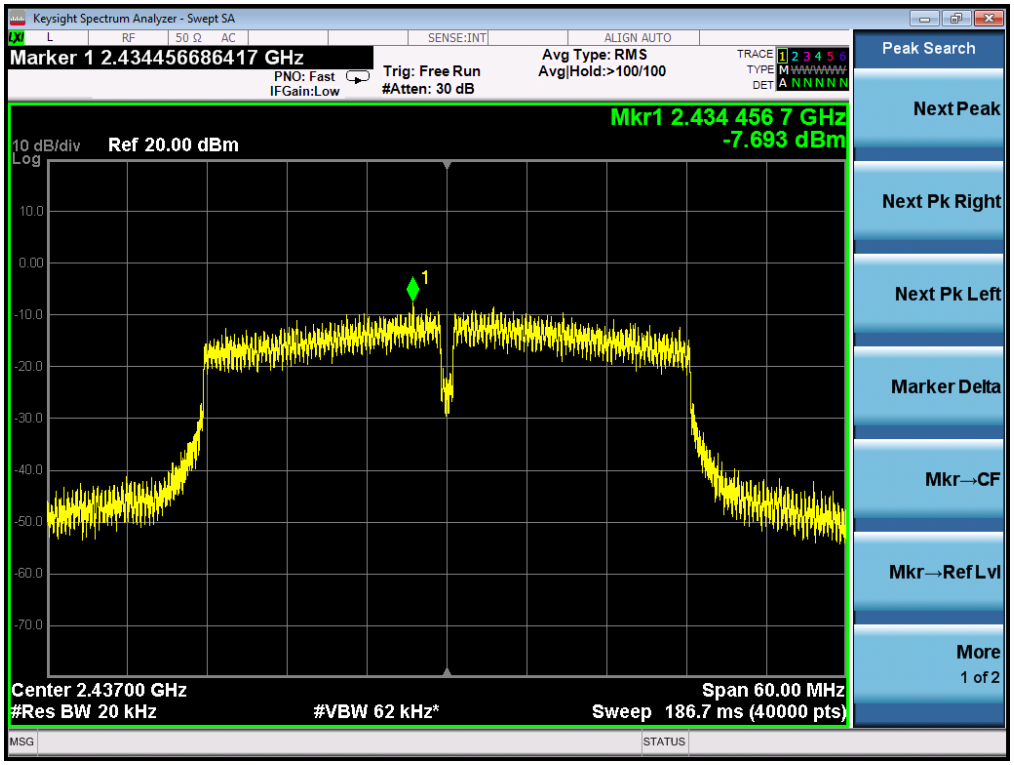


802.11n 40 TEST RESULT

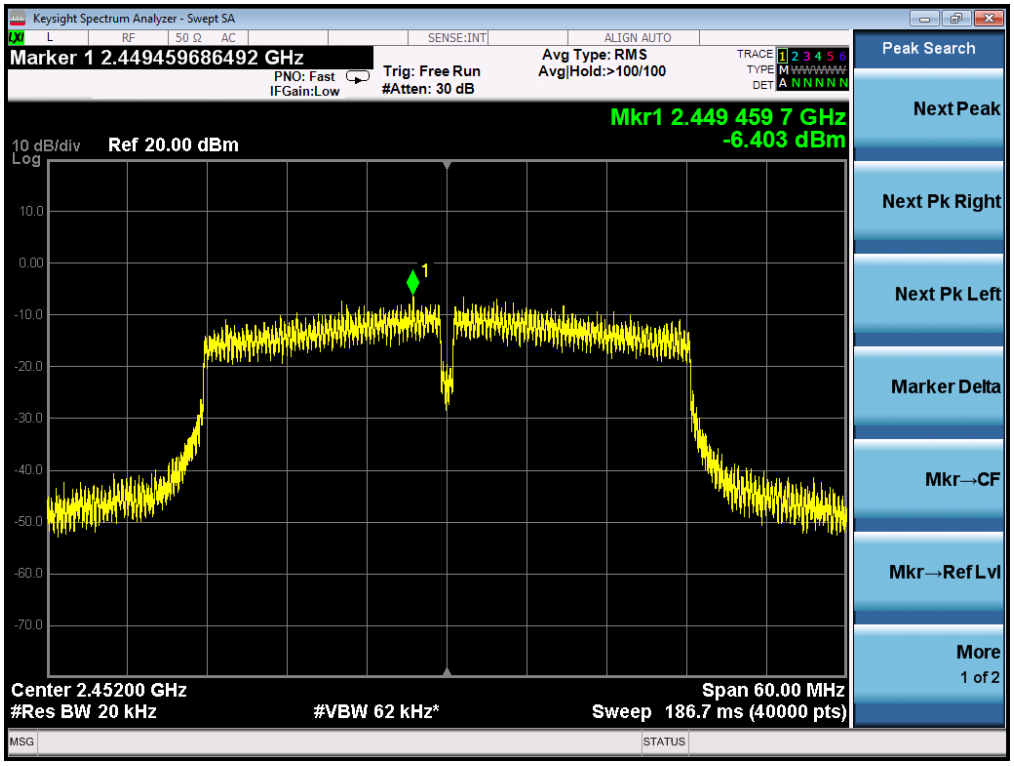
TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL



TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL



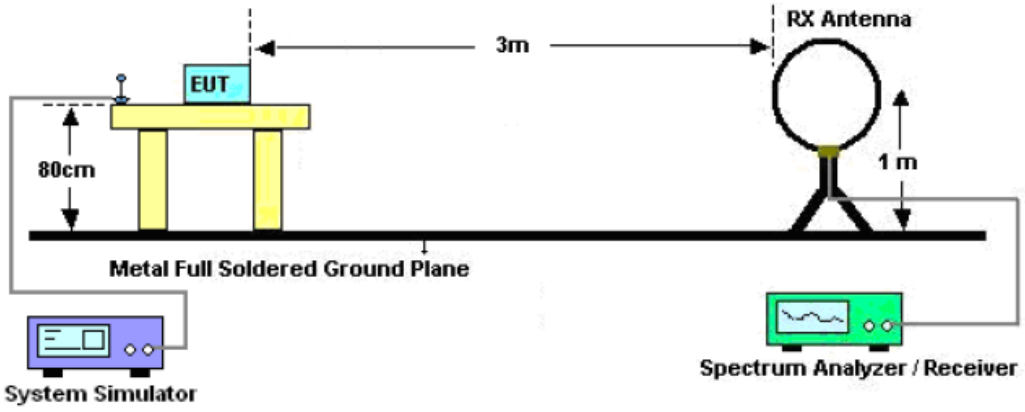
11. RADIATED EMISSION

11.1. MEASUREMENT PROCEDURE

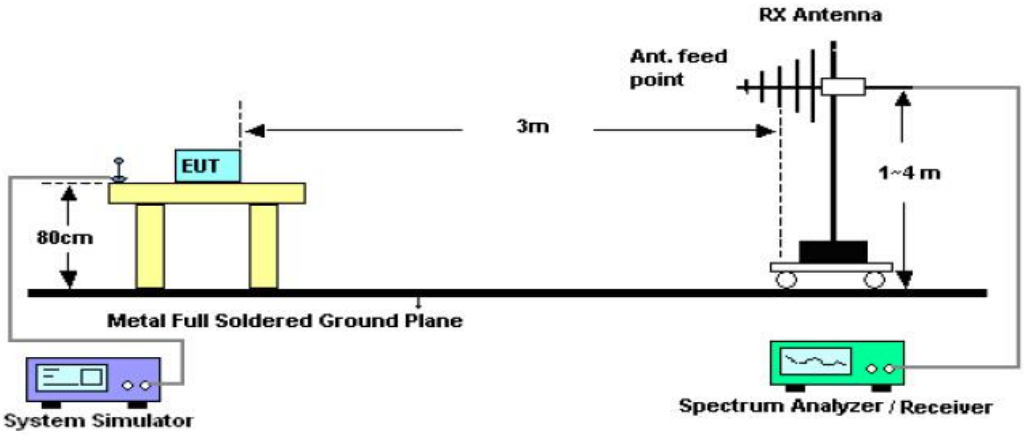
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated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

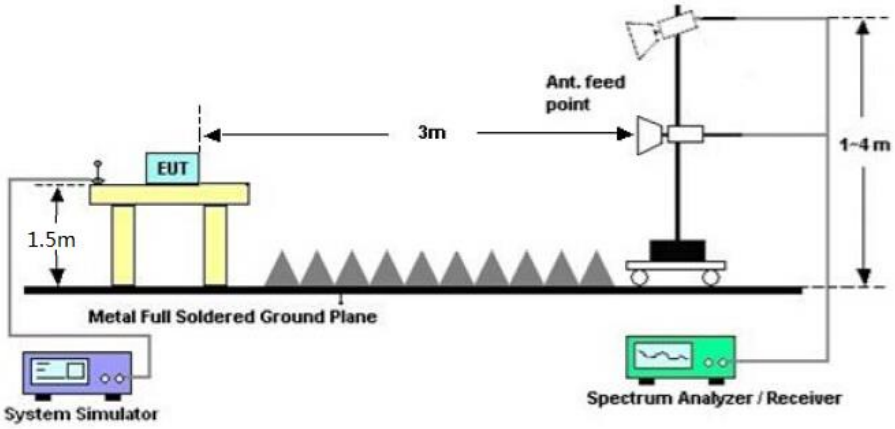
Radiated Emission Test-Setup Frequency Below 30MHz



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.

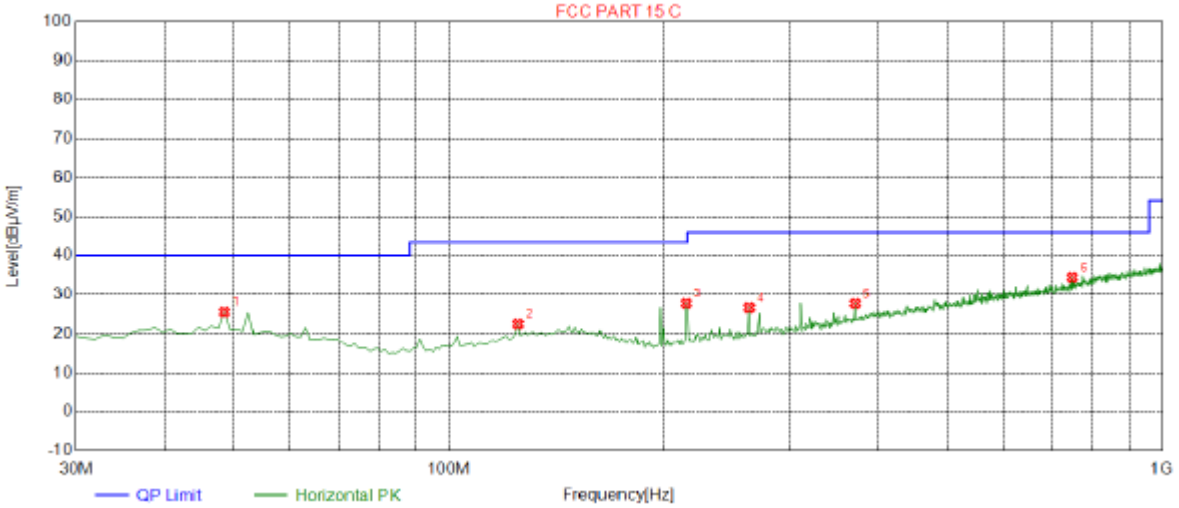
11.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

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

RADIATED EMISSION BELOW 1GHZ

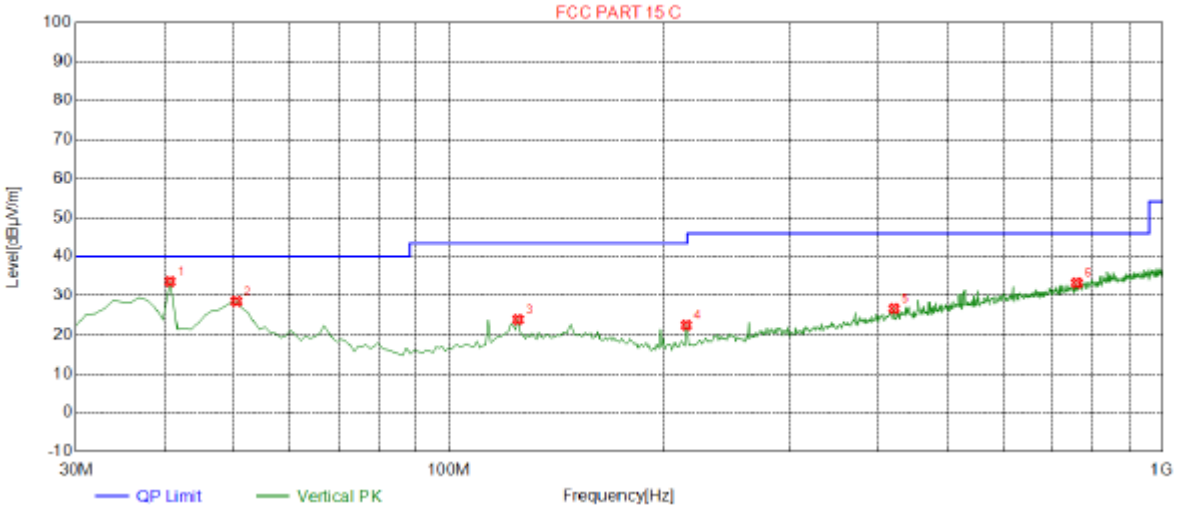
EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2412MHZ	**Antenna**	Horizontal



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	48.4300	25.51	14.71	40.00	14.49	100	196	Horizontal
2	125.060	22.51	13.81	43.50	20.99	100	67	Horizontal
3	215.270	27.72	12.98	43.50	15.78	150	67	Horizontal
4	263.770	26.63	14.88	46.00	19.37	100	142	Horizontal
5	371.440	27.69	18.67	46.00	18.31	100	123	Horizontal
6	748.770	34.47	27.20	46.00	11.53	150	109	Horizontal

RESULT: PASS

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25˚C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2412MHZ	**Antenna**	Vertical



NO.	Freq. [MHz]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	40.6700	33.69	14.91	40.00	6.31	100	194	Vertical
2	50.3700	28.48	14.64	40.00	11.52	100	179	Vertical
3	125.060	23.91	13.81	43.50	19.59	100	65	Vertical
4	215.270	22.46	12.98	43.50	21.04	100	163	Vertical
5	420.910	26.64	20.28	46.00	19.36	100	84	Vertical
6	759.440	33.33	27.42	46.00	12.67	100	357	Vertical

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

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

3. All test modes had been pre-tested. The 802.11b at low channel is the worst case and recorded in the report.

RADIATED EMISSION ABOVE 1GHZ

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2412MHZ	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4824.062	46.99	3.72	50.71	74.00	-23.29	peak
4824.062	43.33	3.72	47.05	54.00	-6.95	AVG
7236.093	36.85	8.15	45.00	74.00	-29.00	peak
7236.093	33.80	8.15	41.95	54.00	-12.05	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2412MHZ	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4824.062	50.00	3.72	53.72	74.00	-20.28	peak
4824.062	44.72	3.72	48.44	54.00	-5.56	AVG
7236.093	38.09	8.15	46.24	74.00	-27.76	peak
7236.093	34.55	8.15	42.70	54.00	-11.30	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2437MHZ	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4874.062	48.23	3.75	51.98	74.00	-22.02	peak
4874.062	43.60	3.75	47.35	54.00	-6.65	AVG
7311.093	36.16	8.16	44.32	74.00	-29.68	peak
7311.093	34.09	8.16	42.25	54.00	-11.75	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2437MHZ	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4874.062	49.03	3.75	52.78	74.00	-21.22	peak
4874.062	44.19	3.75	47.94	54.00	-6.06	AVG
7311.093	38.50	8.16	46.66	74.00	-27.34	peak
7311.093	35.59	8.16	43.75	54.00	-10.25	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2462MHZ	**Antenna**	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4924.062	47.26	3.81	51.07	74.00	-22.93	peak
4924.062	44.80	3.81	48.61	54.00	-5.39	AVG
7386.093	38.89	8.19	47.08	74.00	-26.92	peak
7386.093	33.14	8.19	41.33	54.00	-12.67	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2462MHZ	**Antenna**	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
4924.062	49.52	3.81	53.33	74.00	-20.67	peak
4924.062	44.80	3.81	48.61	54.00	-5.39	AVG
7386.093	38.89	8.19	47.08	74.00	-26.92	peak
7386.093	35.14	8.19	43.33	54.00	-10.67	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

RESULT: PASS

Note:

Other emissions from 1G to 25 GHz are considered as ambient noise. No recording in the test report.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

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

All test modes had been pre-tested. The 802.11b mode is the worst case and recorded in the report.

12. BAND EDGE EMISSION

12.1. MEASUREMENT PROCEDURE

Radiated restricted band edge measurements

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting

12.2. TEST SET-UP

same as 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.

12.3. TEST RESULT

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25˚C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with data rate 1 2412MHZ	**Antenna**	Horizontal

PK

AV

RESULT: PASS

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25˚C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with data rate 1 2412MHZ	**Antenna**	Vertical

PK

AV

RESULT: PASS

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25˚C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with data rate 1 2462MHZ	**Antenna**	Horizontal

PK

AV

RESULT: PASS

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25˚C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with data rate 1 2462MHZ	**Antenna**	Vertical

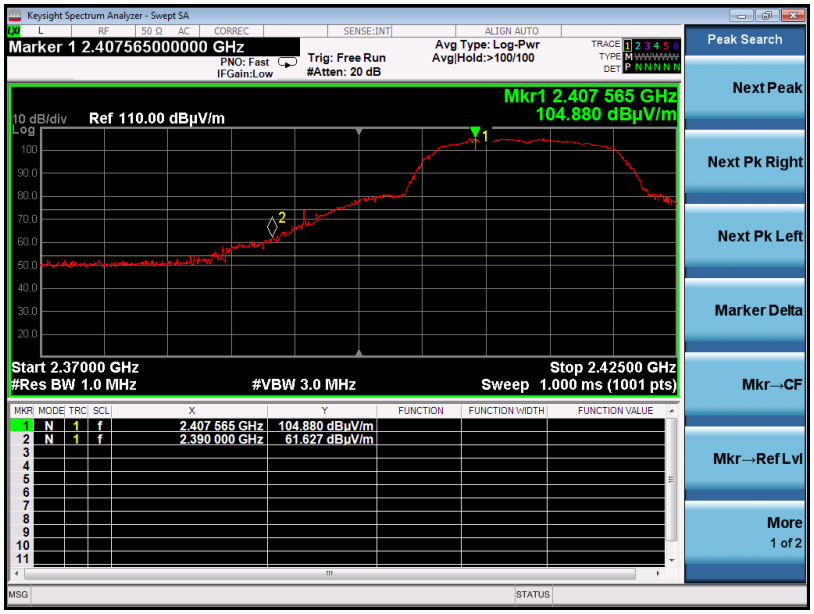
PK

AV

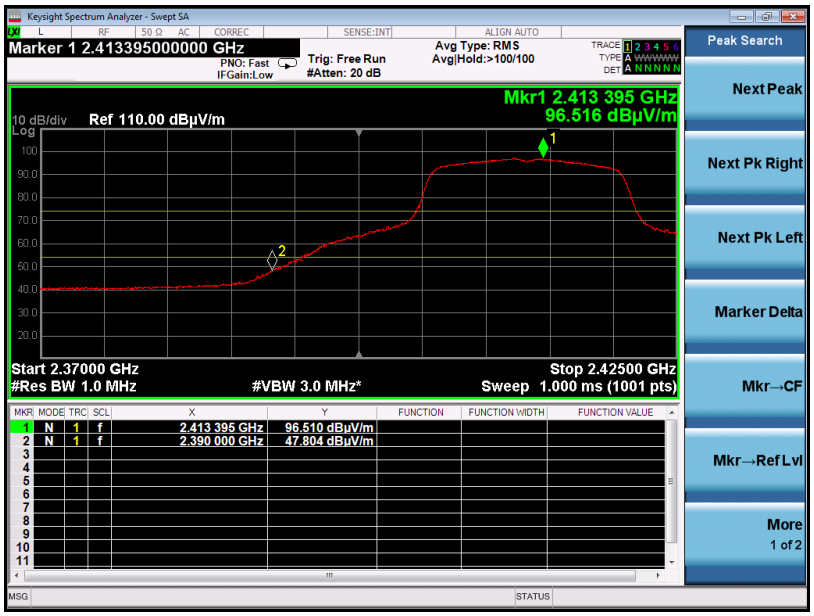
RESULT: PASS

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25˚C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11g with data rate 6 2412MHZ	**Antenna**	Horizontal

PK



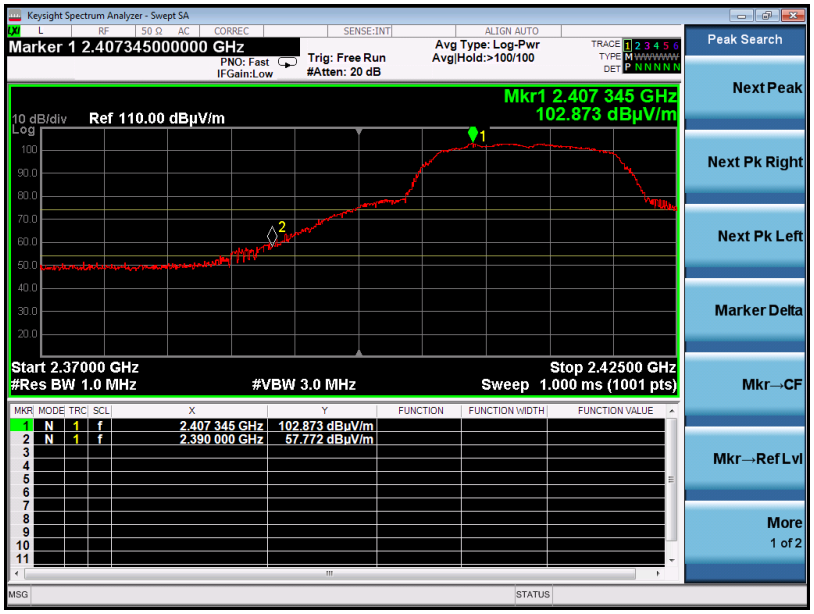
AV



RESULT: PASS

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25˚C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11g with data rate 6 2412MHZ	**Antenna**	Vertical

PK



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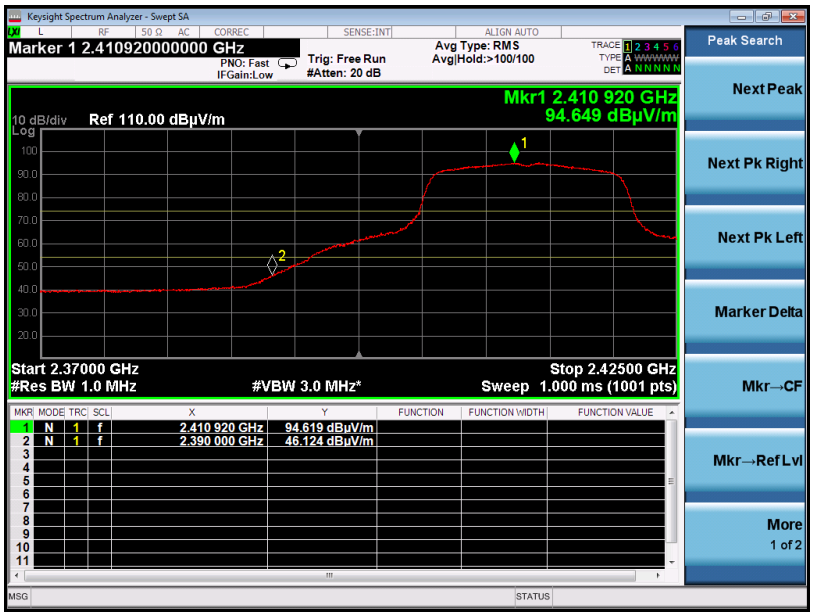
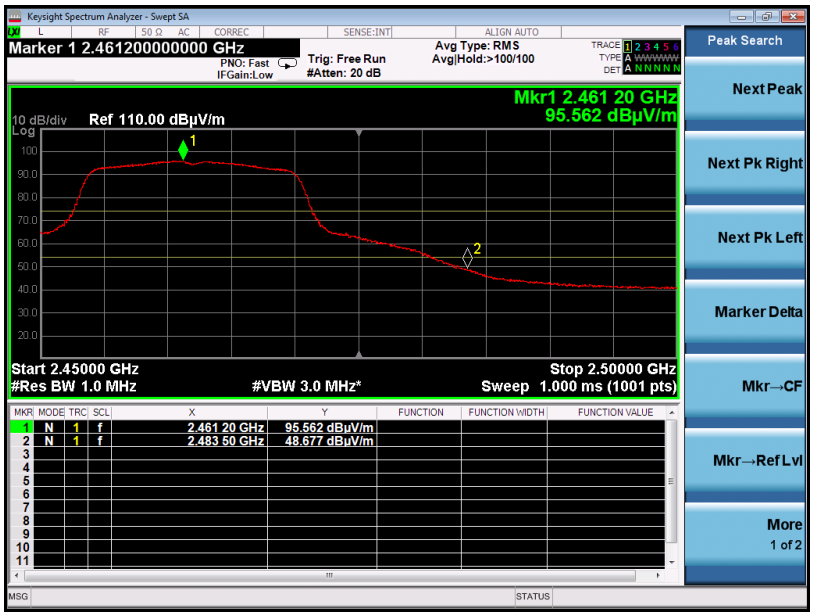


RESULT: PASS

EUT	Pestoptix camera	**Model Name**	EPM001
Temperature	25˚C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11g with data rate 6 2462MHZ	**Antenna**	Horizontal

PK

AV



RESULT: PASS