FCC Test Report

Report No.: AGC08739161201FE05

FCC ID	:	2AK43RD-601
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	DLP Smart Projector
BRAND NAME	:	Rigal
MODEL NAME	:	RD-601, RD-602, RD-603, RD-604, RD-605, RD-606, RD-607, RD-608, RD-609, RD-610, RD-611, RD-612, RD-613, RD-614, RD-615, RD-616 ,RD-617, RD-618, RD-619, RD-620, RD-621, RD-622, RD-623, RD-624, RD-625, RD-626, RD-627 ,RD-628, RD-629, RD-630
CLIENT	:	Guangzhou Rigal Electronics Co., Ltd.
DATE OF ISSUE	:	Jan. 11, 2017
STANDARD(S) **TEST PROCEDURE(S)**	:	FCC Part 15.247 KDB 558074 v03r05
REPORT VERSION	:	V1.0

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

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jan. 11, 2017	Valid	Original Report

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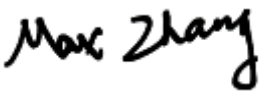
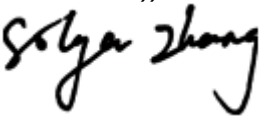
1. VERIFICATION OF CONFORMITY

Applicant	Guangzhou Rigal Electronics Co., Ltd.
Address	Floor 1, Floor 2, Floor 3, Factory Building, NO.30, The north of Hongmiandadao, Xiuquan Street, Huadu District, Guangzhou China
Manufacturer	Guangzhou Rigal Electronics Co., Ltd.
Address	Floor 1, Floor 2, Floor 3, Factory Building, NO.30, The north of Hongmiandadao, Xiuquan Street, Huadu District, Guangzhou China
Product Designation	DLP Smart Projector
Brand Name	Rigal
Test Model	RD-601
Series Model	RD-602, RD-603, RD-604, RD-605, RD-606 ,RD-607, RD-608, RD-609,RD-610, RD-611, RD-612, RD-613, RD-614, RD-615, RD-616 ,RD-617, RD-618, RD-619, RD-620, RD-621, RD-622, RD-623, RD-624, RD-625, RD-626, RD-627 ,RD-628, RD-629, RD-630
Model Difference	All the same except the model name.
Date of test	Jan. 09, 2017 to Jan. 11, 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 
Max Zhang(Zhang Yi) Jan. 11, 2017

Reviewed by 
Bart Xie(Xie Xiaobin)) Jan. 11, 2017

Approved by 
Solger Zhang(Zhang Hongyi) Jan. 11, 2017
Authorized Officer

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as “DLP Smart Projector”. 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	IEEE 802.11b:15.29dBm; IEEE 802.11g:14.41dBm; IEEE 802.11n(20):14.06dBm; IEEE 802.11n(40):9.59dBm
Modulation	DSSS(DBPSK/DQPSK/CCK);OFDM(BPSK/QPSK/16-QAM/64-QAM)
Number of channels	11
Hardware Version	ZY-8S31A-MAIN-V2
Software Version	N/A
Antenna Designation	Fixed Antenna
Number of transmit chain	2
Antenna Gain	2dBi
Power Supply	DC 19V 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: 2AK43RD-601** 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 v03r05.

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

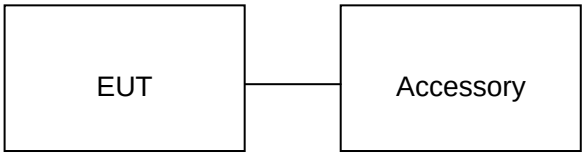
Note:

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. 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	DLP Smart Projector	RD-601	2AK43RD-601	EUT
2	Adapter	FJ-SW1903420D	DC19V/3.42A	Marketed 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

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 3, 2016	July 2, 2017
Trilog Broadband Antenna (25M-1GHz)	SCHWARZBECK	VULB9160	9160-3355	July 3, 2016	July 2, 2017
Signal Amplifier	SCHWARZBECK	BBV 9475	9745-0013	July 3, 2016	July 2, 2017
RF Cable	SCHWARZBECK	AK9515E	96221	July 3, 2016	July 2, 2017
3m Anechoic Chamber	CHENGYU	966	PTS-001	June 3, 2016	June 2, 2017
MULTI-DEVICE Positioning Controller	Max-Full	MF-7802	MF780208339	N/A	N/A
Active loop antenna (9K-30MHz)	Schwarzbeck	FMZB1519	1519-038	June 3, 2016	June 2, 2017
Spectrum analyzer	Agilent	E4407B	MY46185649	June 3, 2016	June 2, 2017
Power Sensor	Agilent	U2021XA	MY55050474	June 3, 2016	June 2, 2017
Horn Antenna (1G-18GHz)	SCHWARZBECK	BBHA9120D	9120D-1246	June 3, 2016	June 2, 2017
Horn Ant (18G-40GHz)	Schwarzbeck	BBHA 9170	9170-181	June 3, 2016	June 2, 2017

Conducted Emission Test Site					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
EMI Test Receiver	Rohde & Schwarz	ESCI	101417	July 3, 2016	July 2, 2017
Artificial Mains Network	Narda	L2-16B	000WX31025	July 3, 2016	July 2, 2017
Artificial Mains Network (AUX)	Narda	L2-16B	000WX31026	July 3, 2016	July 2, 2017
RF Cable	SCHWARZBECK	AK9515E	96222	July 3, 2016	July 2, 2017
Shielded Room	CHENGYU	843	PTS-002	June 3, 2016	June 2, 2017

7. OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

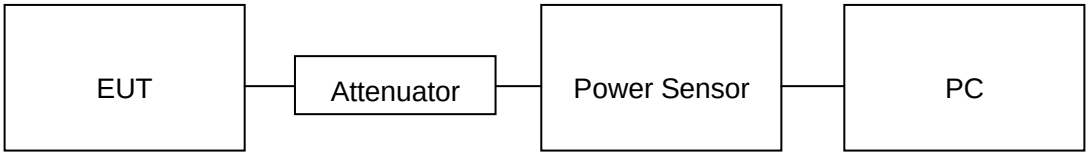
For average power test:

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 558074v03r05 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 Chain 0 (dBm)	Average Power Chain 1 (dBm)	Average Power Total (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	12.36	11.85	15.12	30	Pass
2.437	12.42	12.13	15.29	30	Pass
2.462	12.16	11.72	14.96	30	Pass

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

Frequency (GHz)	Average Power Chain 0 (dBm)	Average Power Chain 1 (dBm)	Average Power Total (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	11.25	11.07	14.17	30	Pass
2.437	11.47	11.33	14.41	30	Pass
2.462	11.35	11.16	14.27	30	Pass

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

Frequency (GHz)	Average Power Chain 0 (dBm)	Average Power Chain 1 (dBm)	Average Power Total (dBm)	Applicable Limits (dBm)	Pass or Fail
2.412	10.98	10.86	13.93	30	Pass
2.437	11.16	10.94	14.06	30	Pass
2.462	10.75	10.52	13.65	30	Pass

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

Frequency (GHz)	Average Power Chain 0 (dBm)	Average Power Chain 1 (dBm)	Average Power Total (dBm)	Applicable Limits (dBm)	Pass or Fail
2.422	6.52	6.15	9.35	30	Pass
2.437	6.74	6.41	9.59	30	Pass
2.452	6.33	5.89	9.13	30	Pass

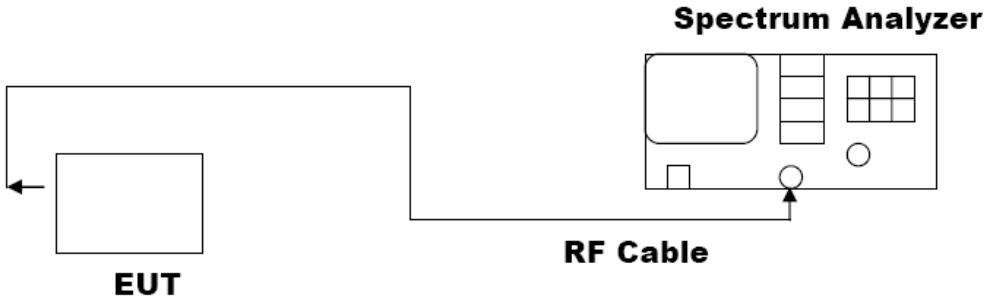
8. 6 DB BANDWIDTH

8.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port 1(antenna 0) 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.
5. Repeat test from step 1 to step 4 for RF output port 2(antenna 1).

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 1

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	**Applicable Limits**		
	Test Data (MHz)		**Criteria**
>500KHZ	Low Channel	10.02	PASS
	Middle Channel	10.02	PASS
	High Channel	10.02	PASS

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

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	**Applicable Limits**		
	Test Data (MHz)		**Criteria**
>500KHZ	Low Channel	15.12	PASS
	Middle Channel	15.12	PASS
	High Channel	15.14	PASS

TEST ITEM	6DB BANDWIDTH
TEST MODE	802.11n 20 with data rate 6.5

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	**Applicable Limits**		
	Test Data (MHz)		**Criteria**
>500KHZ	Low Channel	15.13	PASS
	Middle Channel	15.12	PASS
	High Channel	16.01	PASS

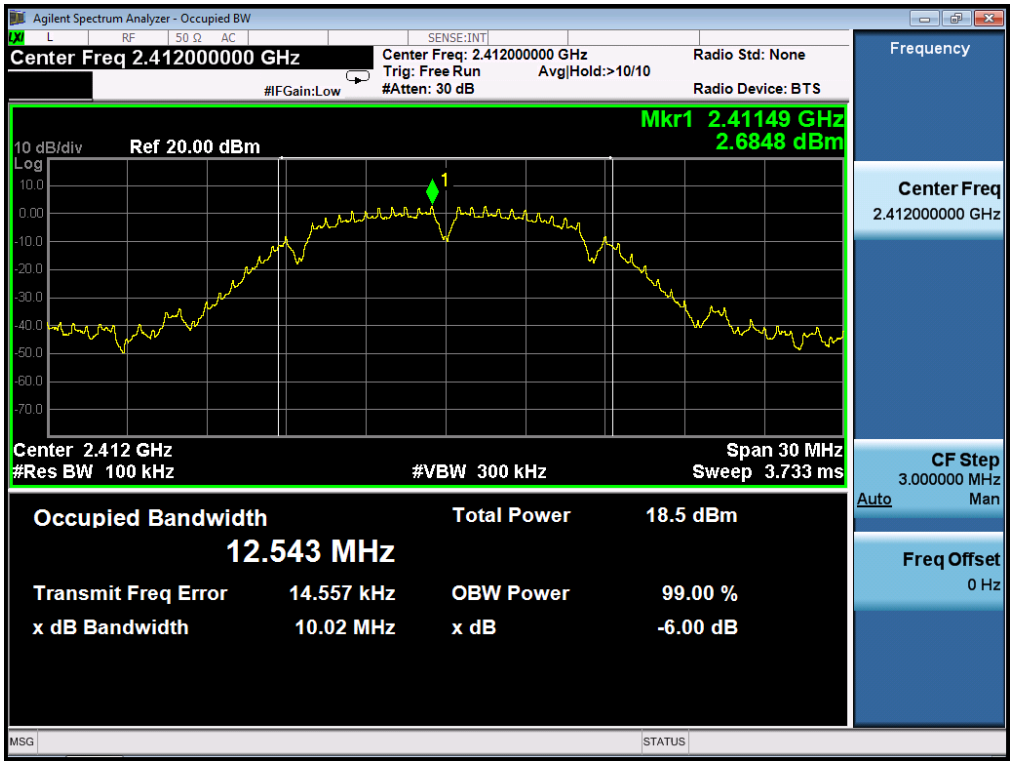
TEST ITEM	6DB BANDWIDTH
TEST MODE	802.11n 40 with data rate 13.5

LIMITS AND MEASUREMENT RESULT			
Applicable Limits	**Applicable Limits**		
	Test Data (MHz)		**Criteria**
>500KHZ	Low Channel	35.17	PASS
	Middle Channel	35.17	PASS
	High Channel	35.18	PASS

Note：Two transmit antennas had been tested, the antenna 0 was the worst case and record in the test report.

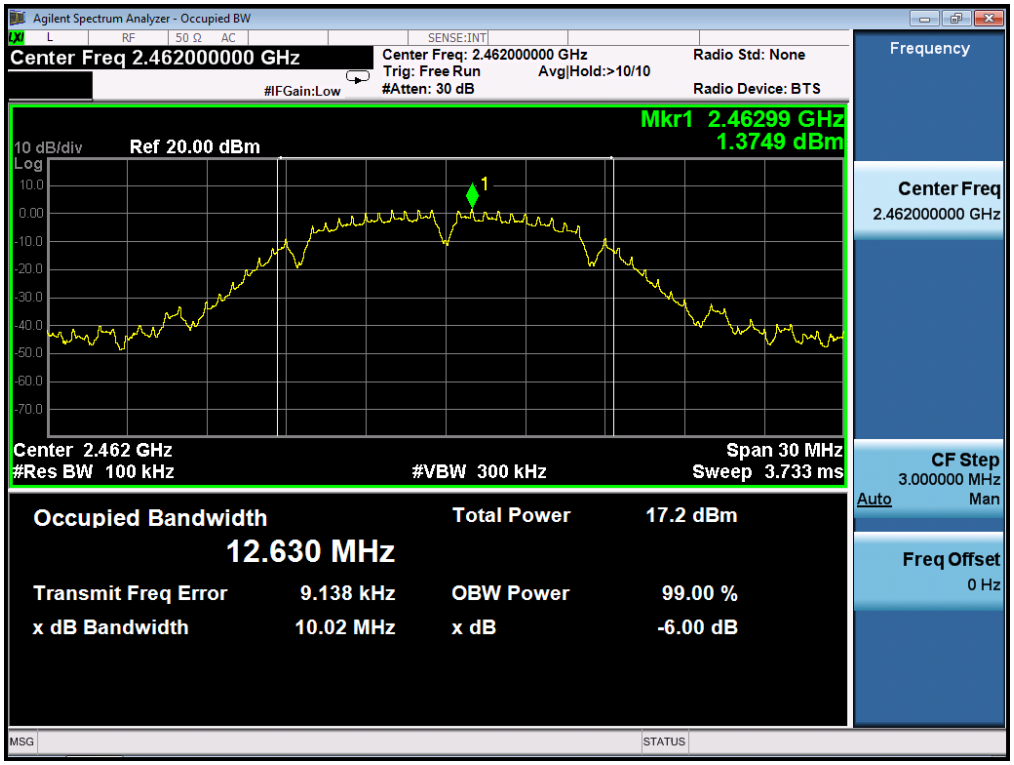
802.11b TEST RESULT

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



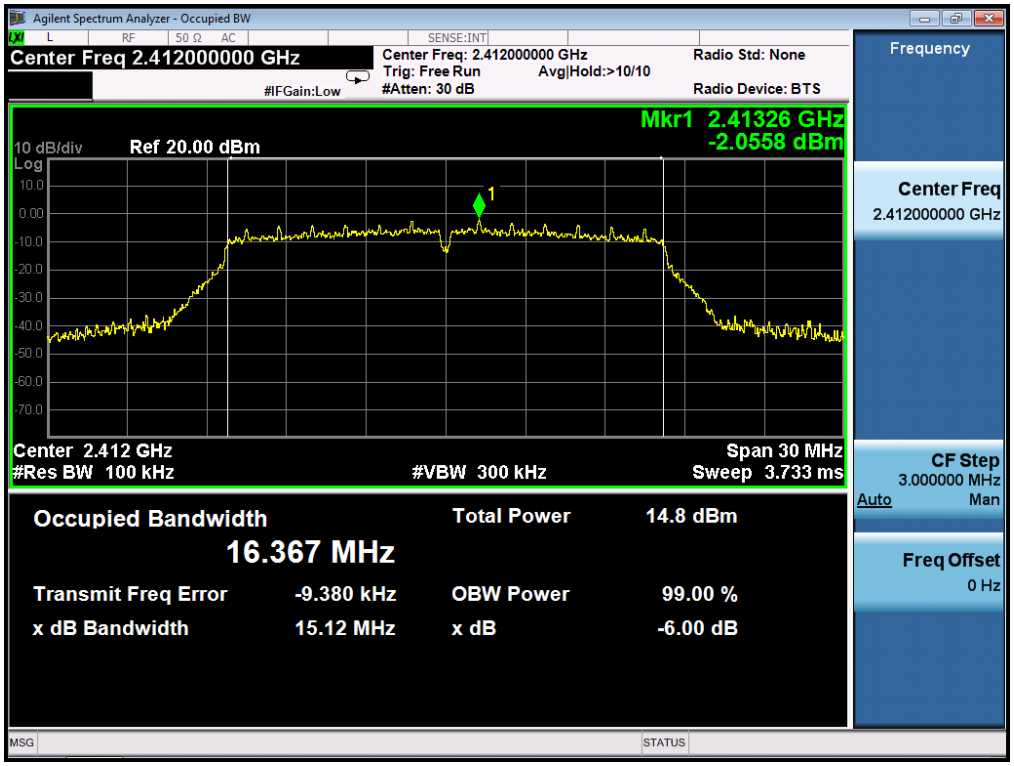
TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

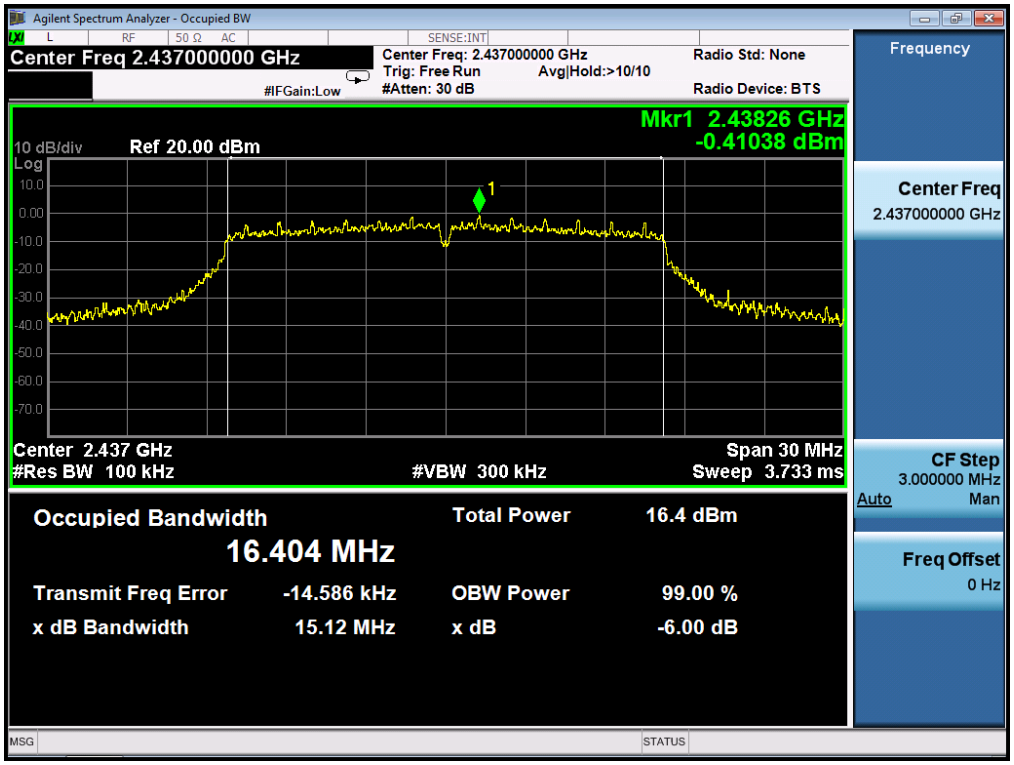


802.11g TEST RESULT

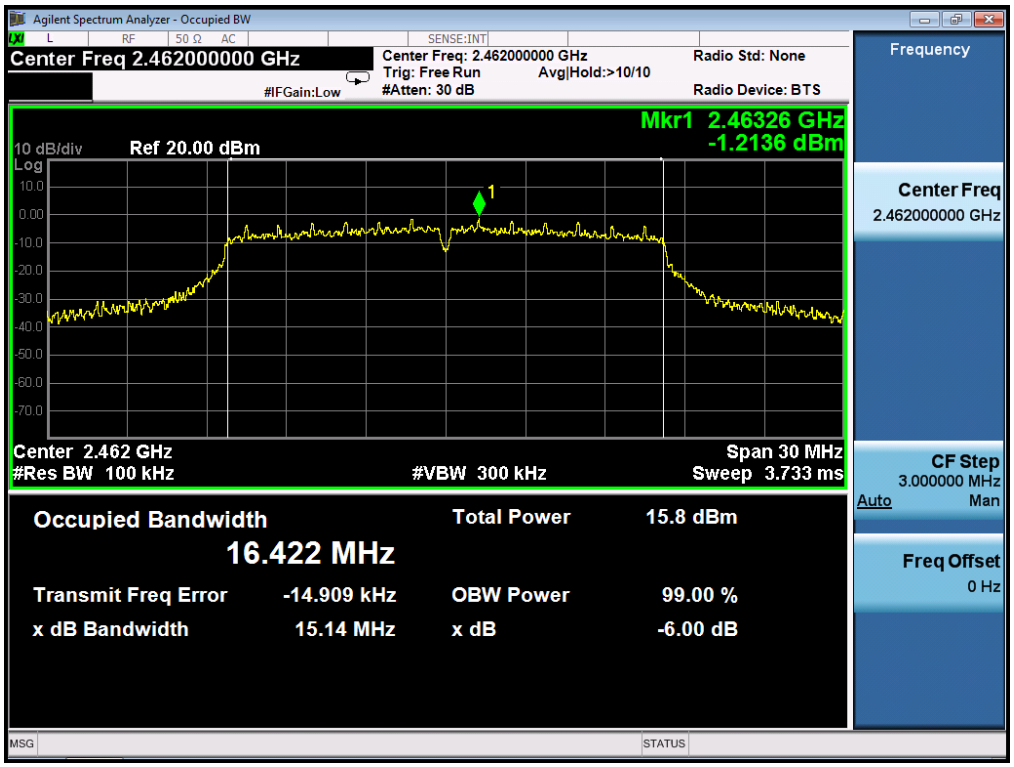
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

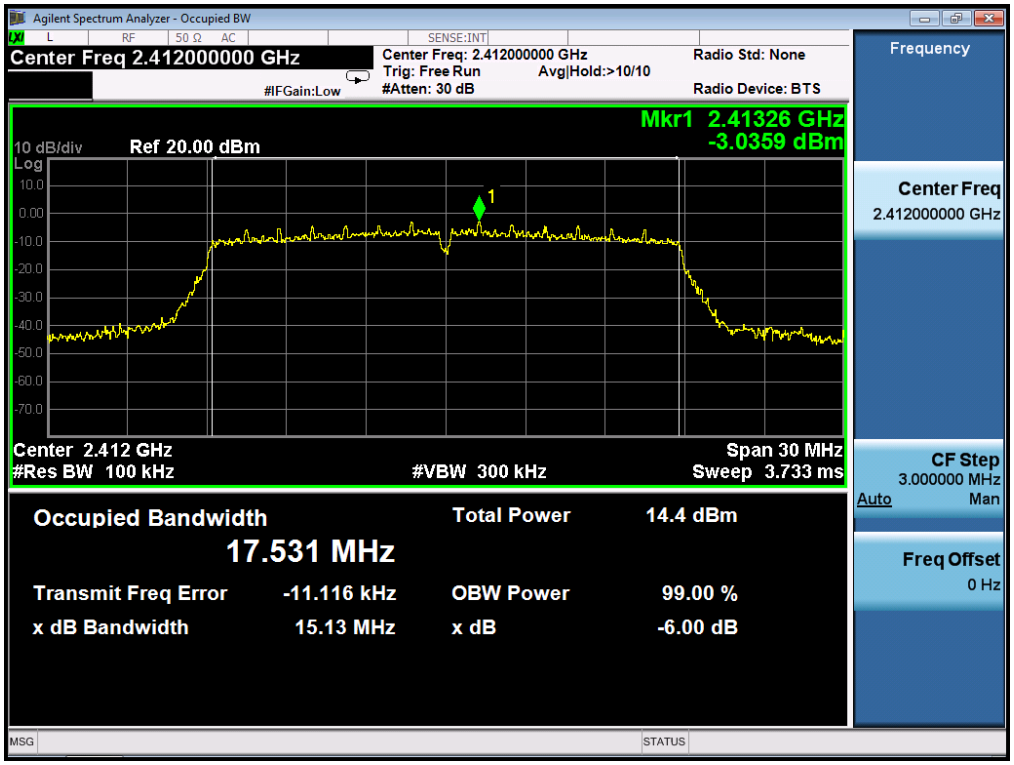


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

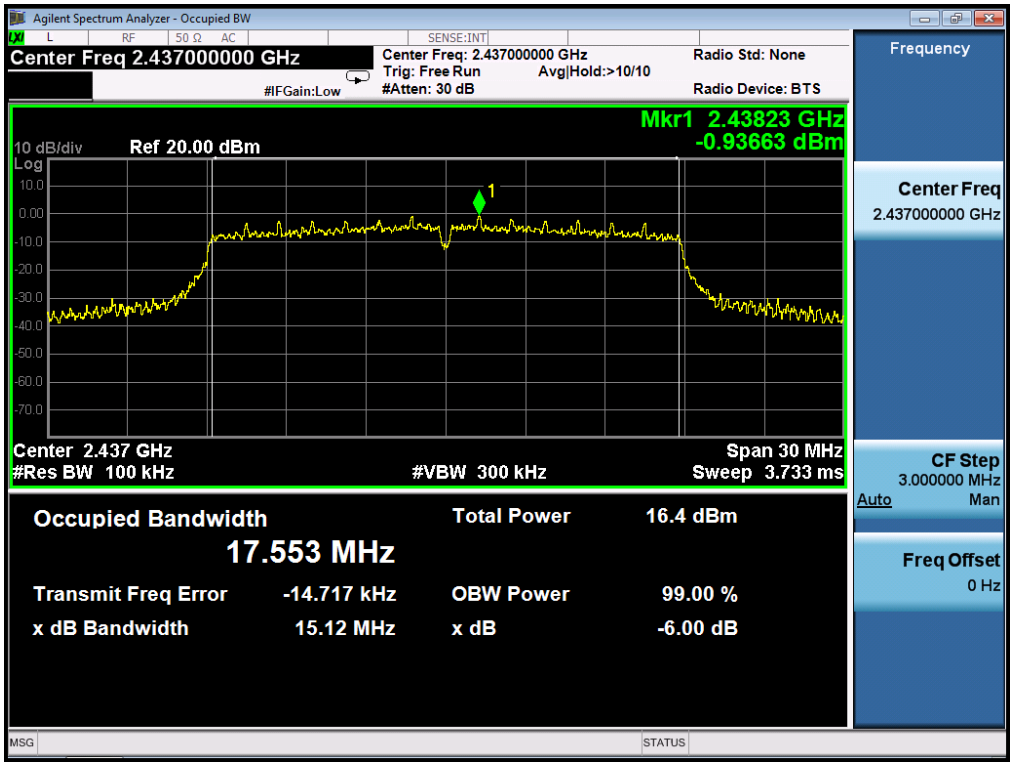


802.11n (20) TEST RESULT

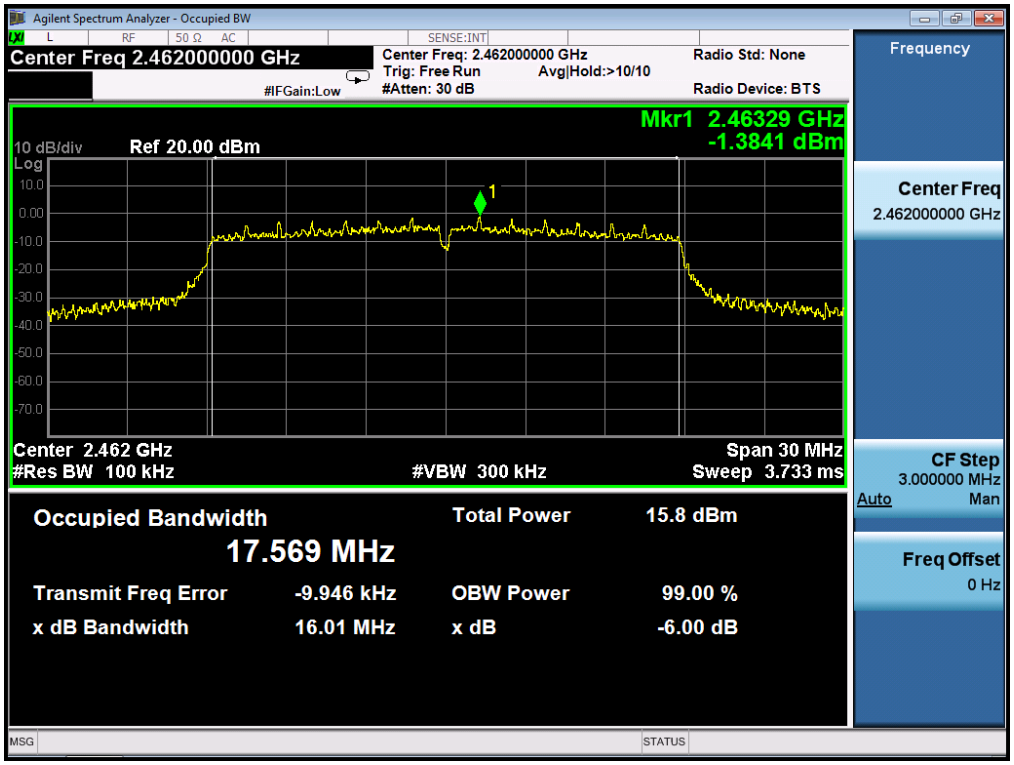
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

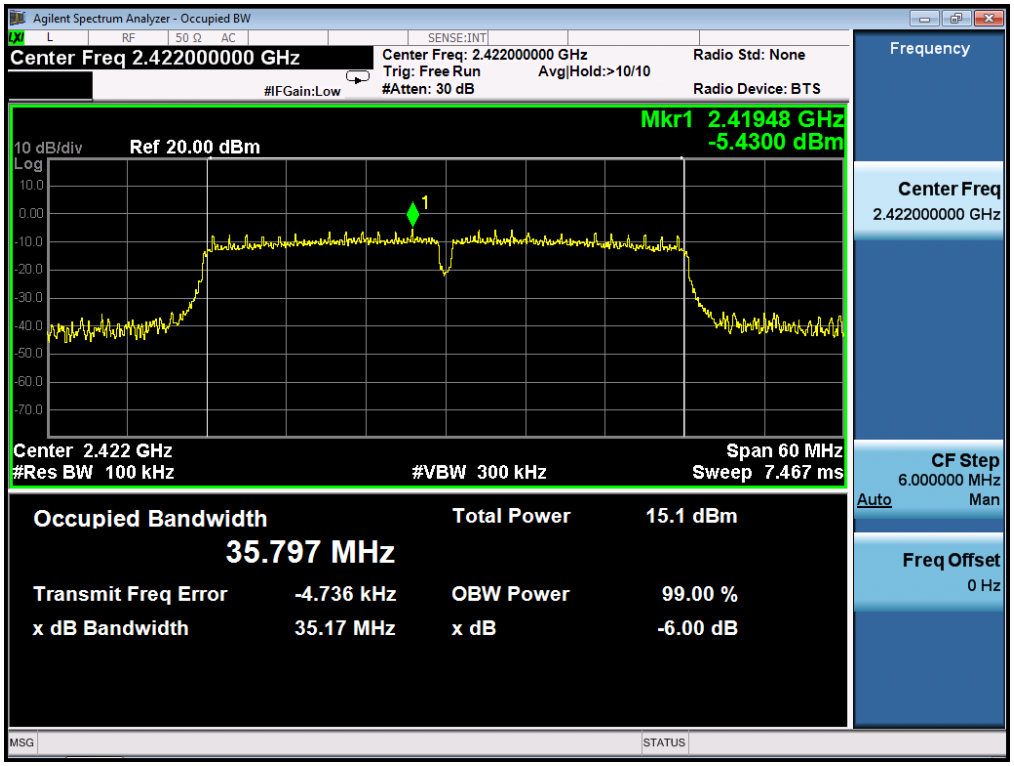


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

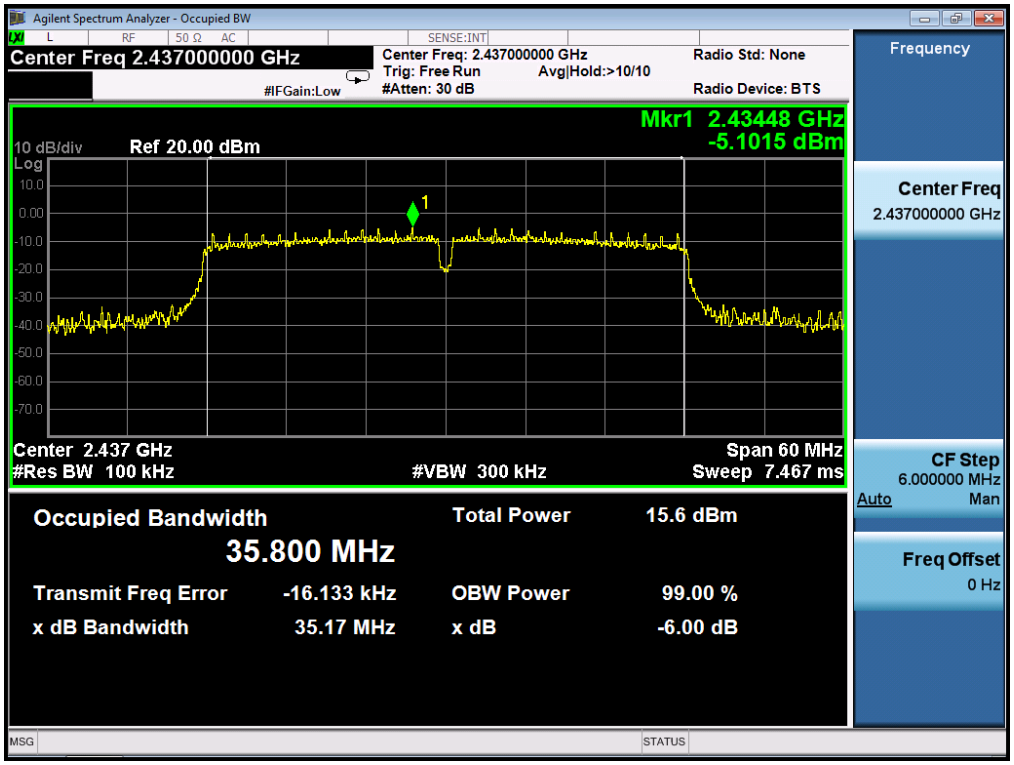


802.11n (40) TEST RESULT

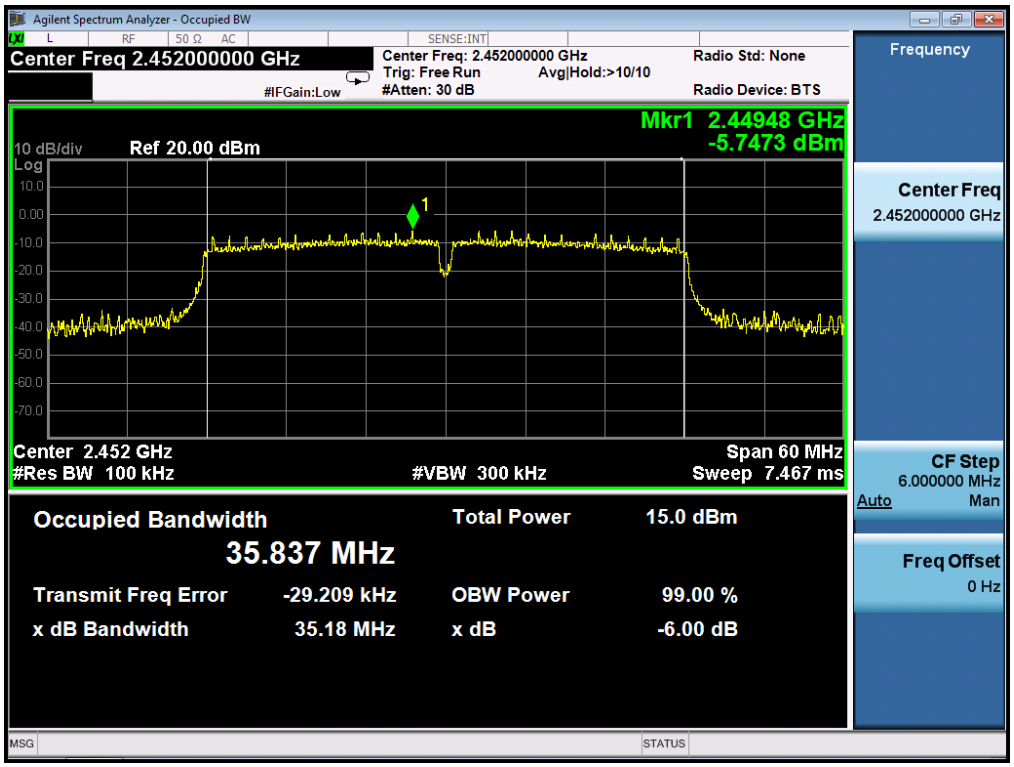
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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 1(antenna 0) 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.
4. Repeat test from step 1 to step 3 for RF output port 2(antenna 1).

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.

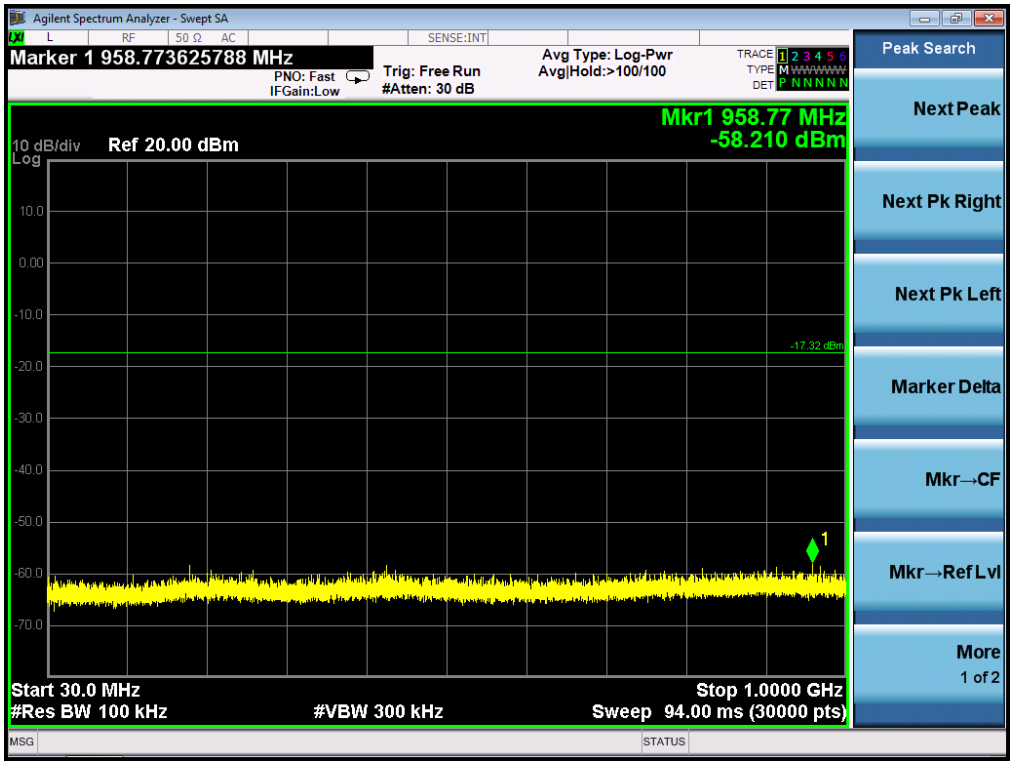
9.3. MEASUREMENT EQUIPMENT USED

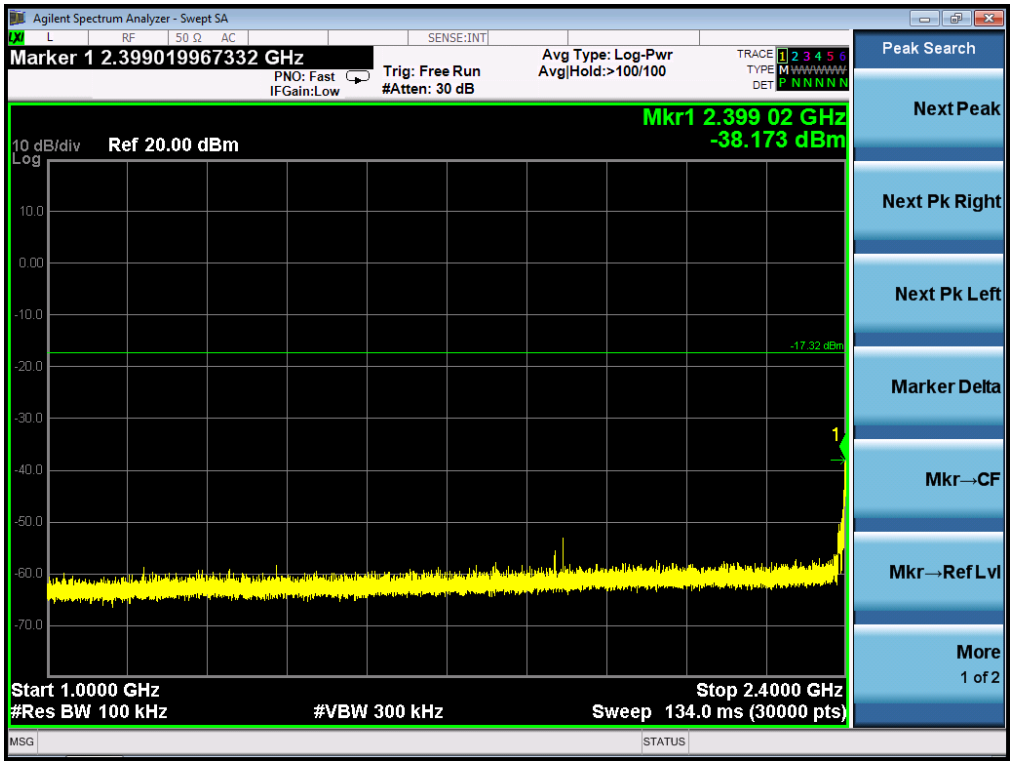
The same as described in section 6.

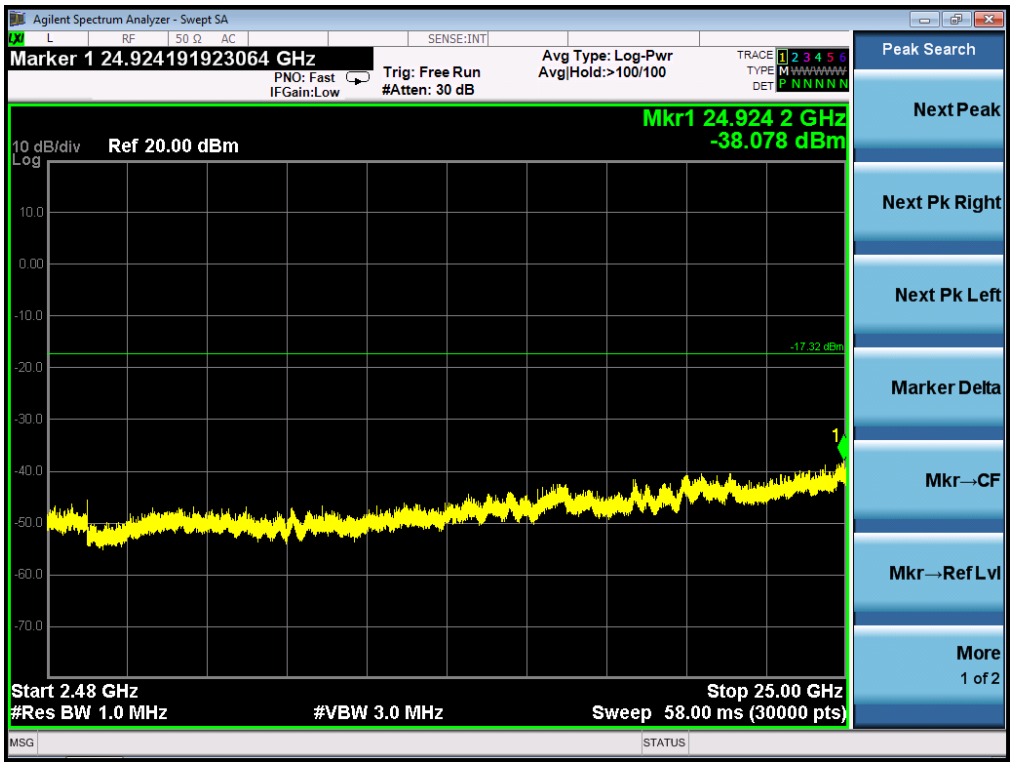
9.4. LIMITS AND MEASUREMENT RESULT

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 20 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 -20dBc than the limit Specified on the BOTTOM Channel	PASS
	At least -20dBc than the limit Specified on the TOP Channel	PASS

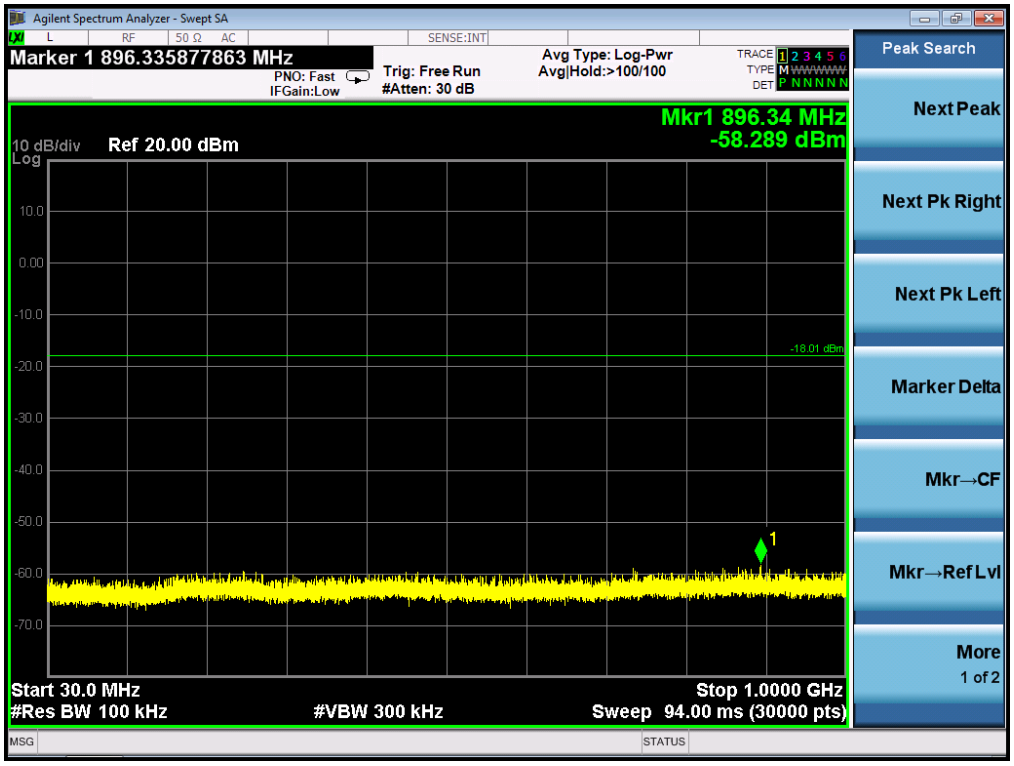
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE
OF 802.11b FOR MODULATION IN LOW CHANNEL

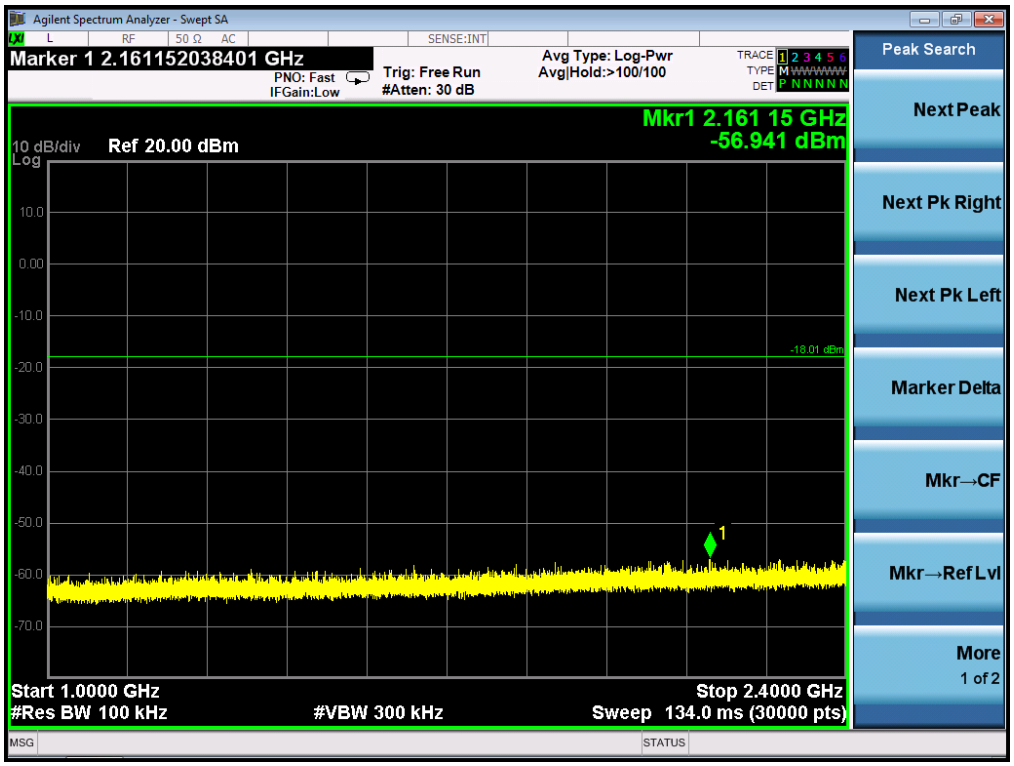


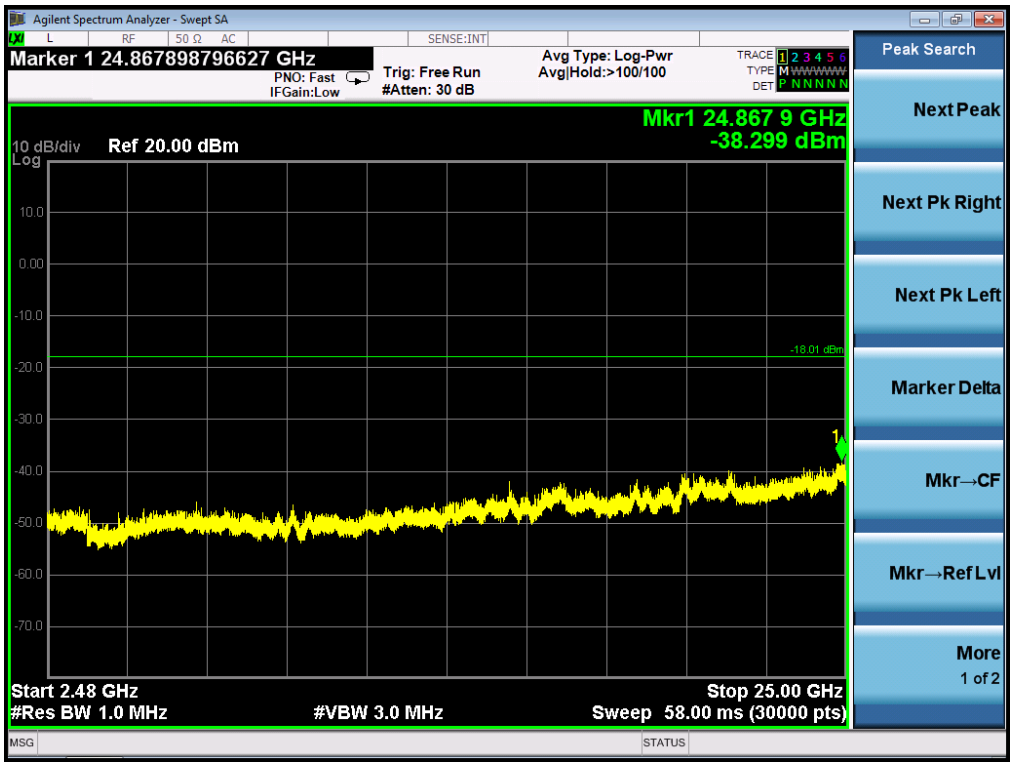




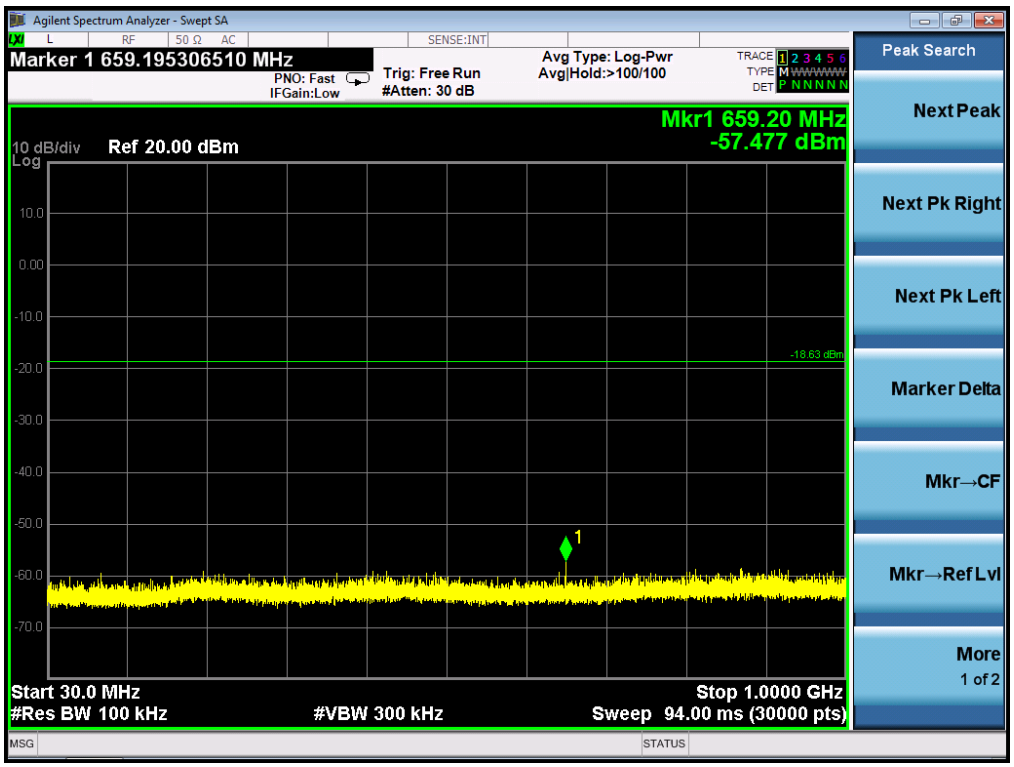
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE OF 802.11b FOR MODULATION IN MIDDLE CHANNEL

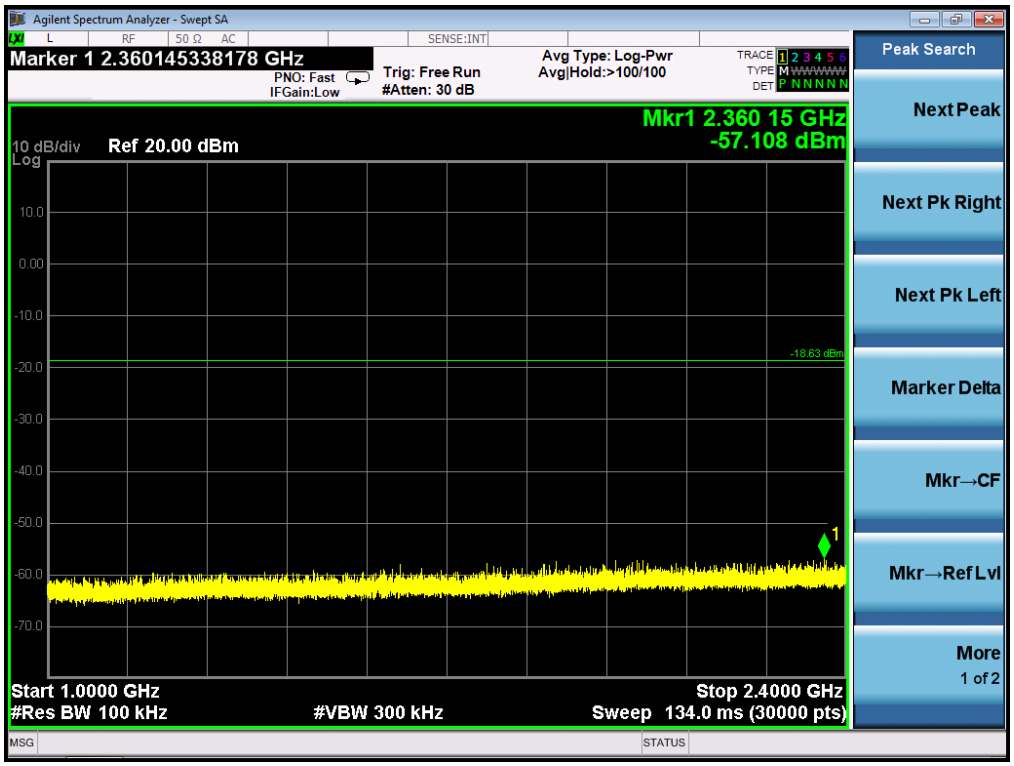


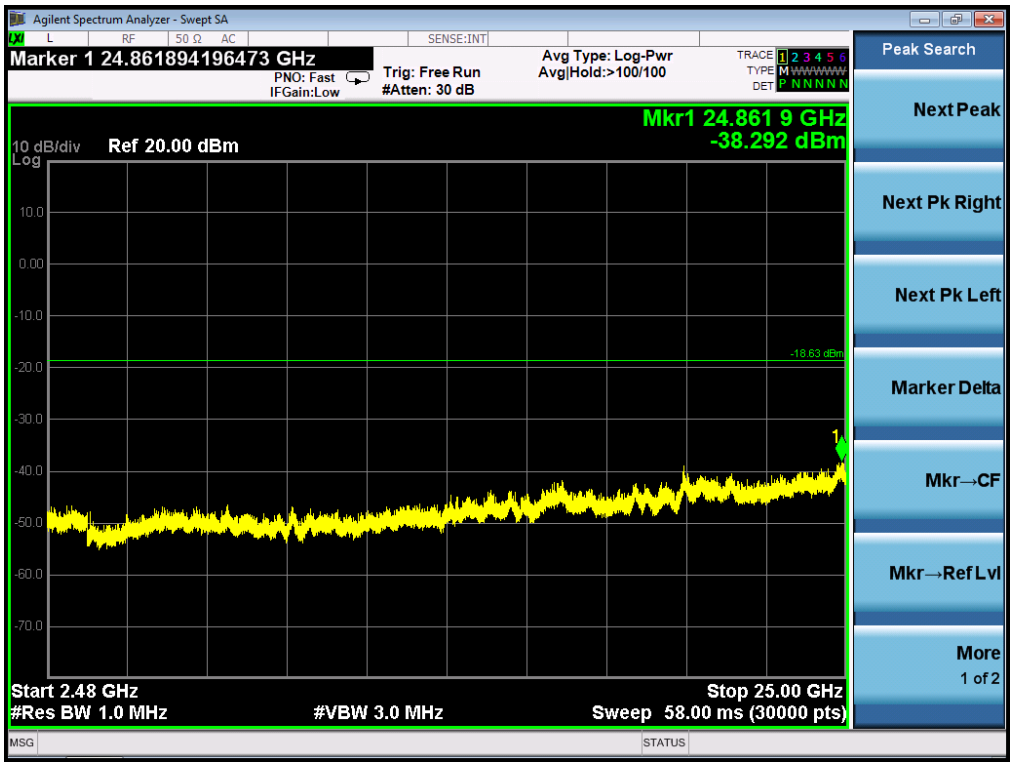

Agilent Spectrum Analyzer - Swept SA
Marker 1 2.161152038401 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.161 15 GHz
-56.941 dBm
10 dB/div
Log
Ref 20.00 dBm
-18.01 dBm
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 134.0 ms (30000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Agilent Spectrum Analyzer - Swept SA
Marker 1 24.867898796627 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 24.867 9 GHz
-38.299 dBm
10 dB/div
Log
Ref 20.00 dBm
-18.01 dBm
Start 2.48 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.00 GHz
Sweep 58.00 ms (30000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

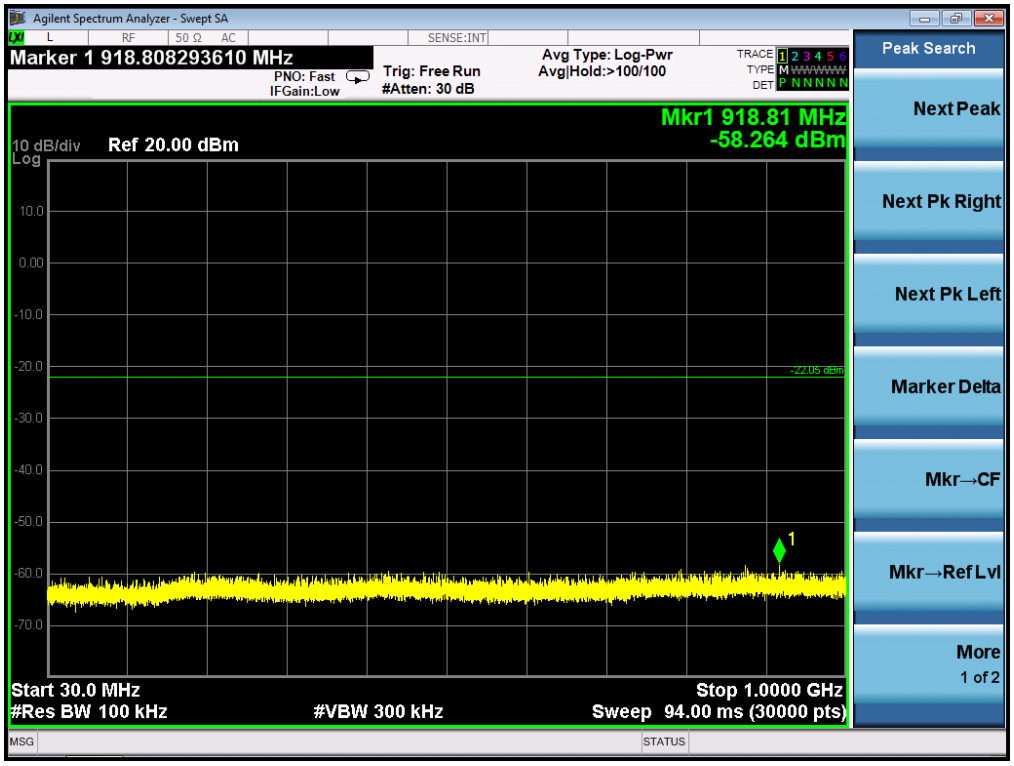
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE
OF 802.11b FOR MODULATION IN HIGH CHANNEL

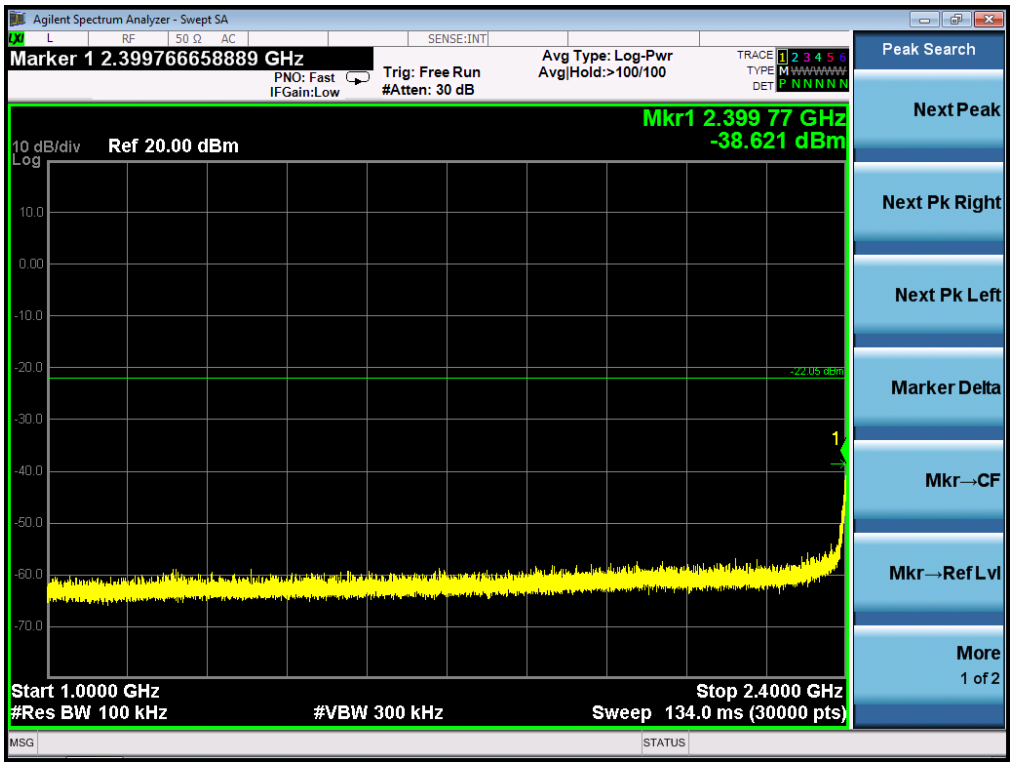


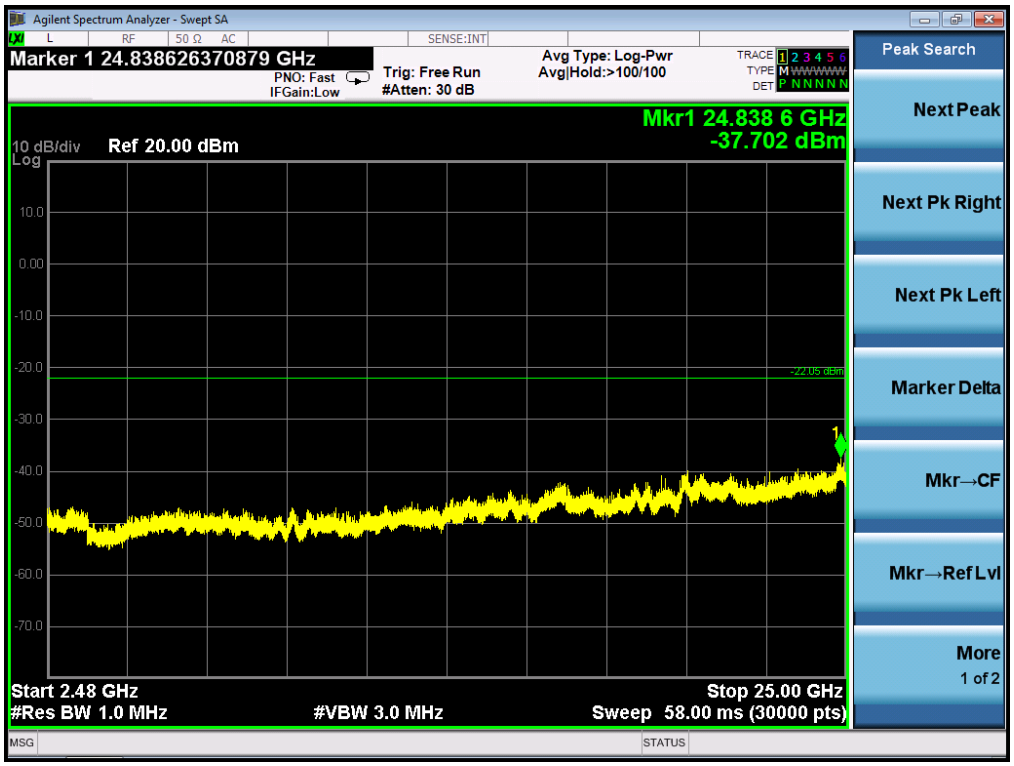




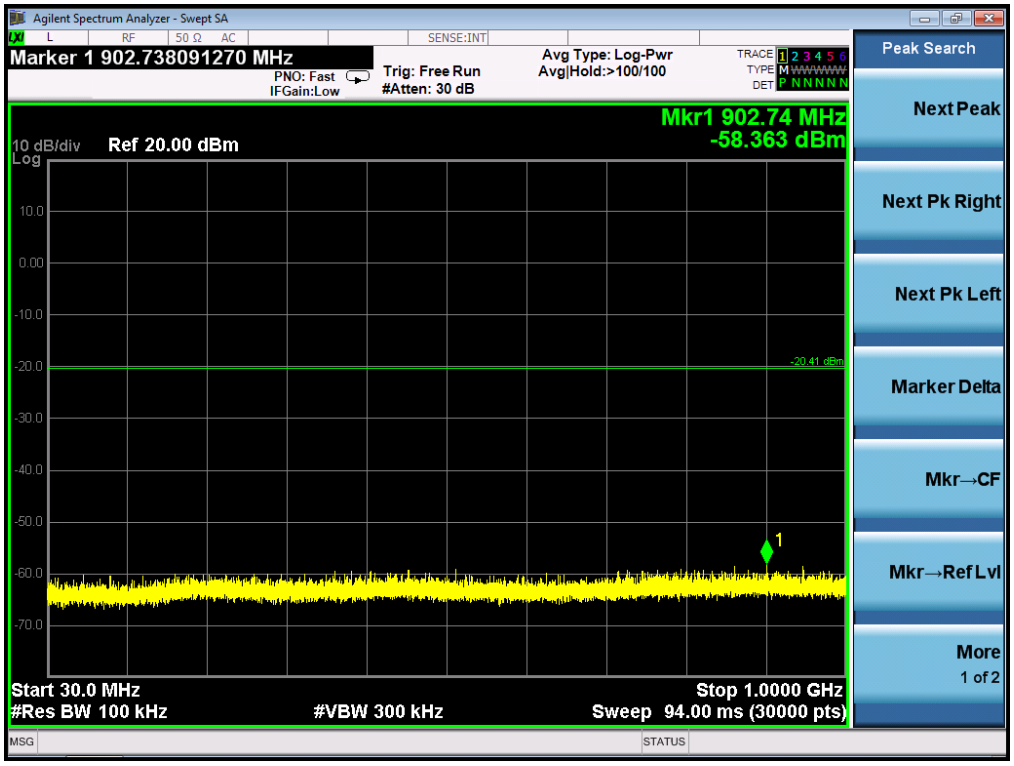
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF 802.11g FOR MODULATION IN LOW CHANNEL

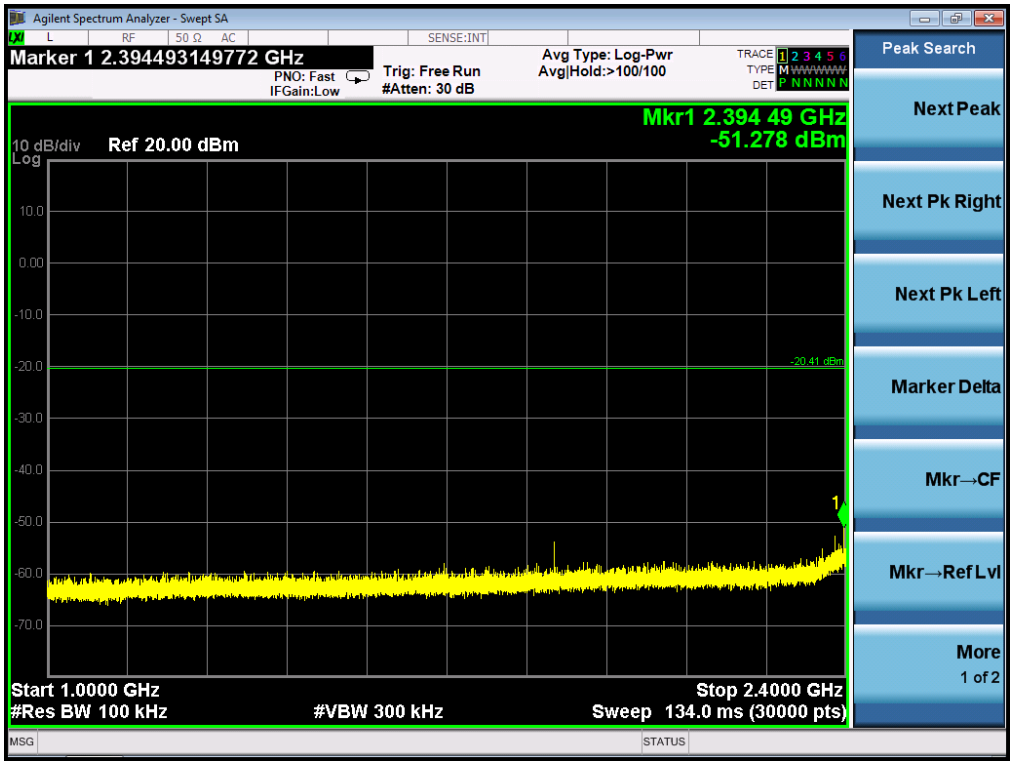


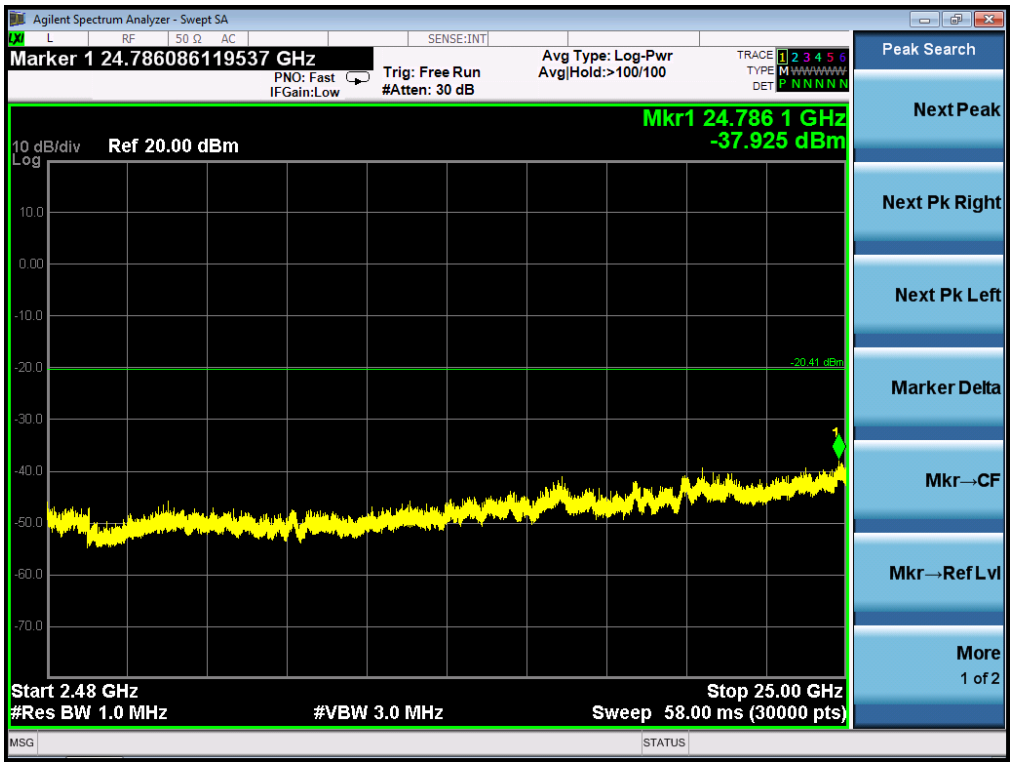

Agilent Spectrum Analyzer - Swept SA
Marker 1 2.399766658889 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.399 77 GHz
-38.621 dBm
10 dB/div
Log
Ref 20.00 dBm
-22.05 dBm
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 134.0 ms (30000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Agilent Spectrum Analyzer - Swept SA
Marker 1 24.838626370879 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 24.838 6 GHz
-37.702 dBm
10 dB/div
Log
Ref 20.00 dBm
-22.05 dBm
Start 2.48 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.00 GHz
Sweep 58.00 ms (30000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

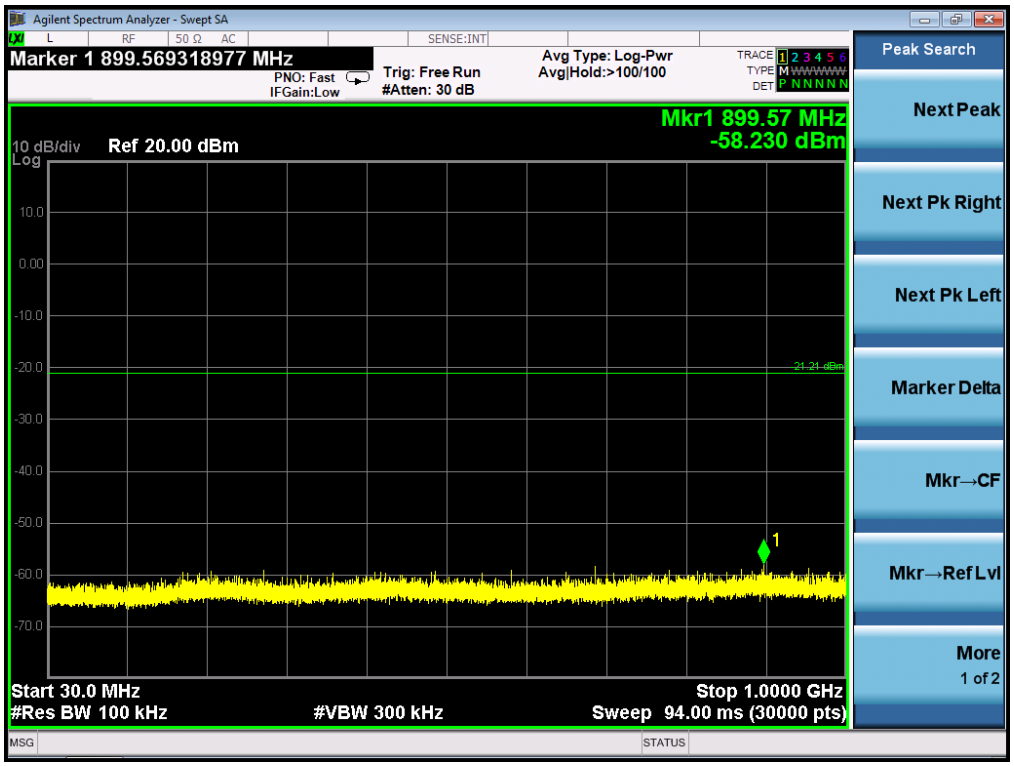
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE
OF 802.11g FOR MODULATION IN MIDDLE CHANNEL

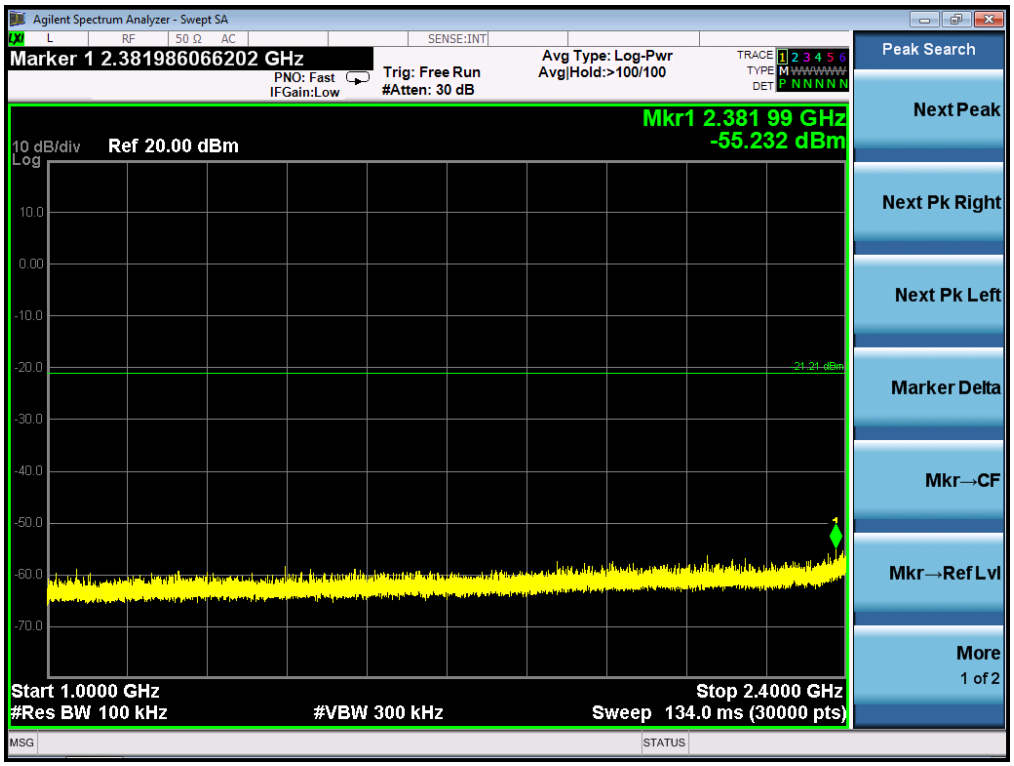


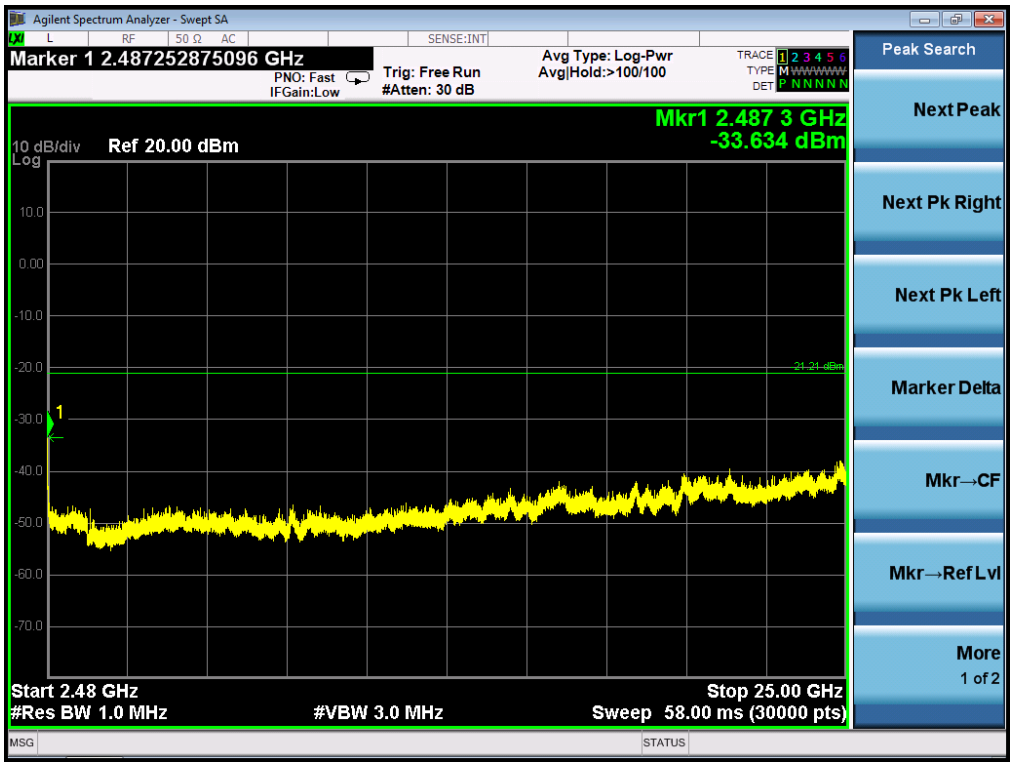




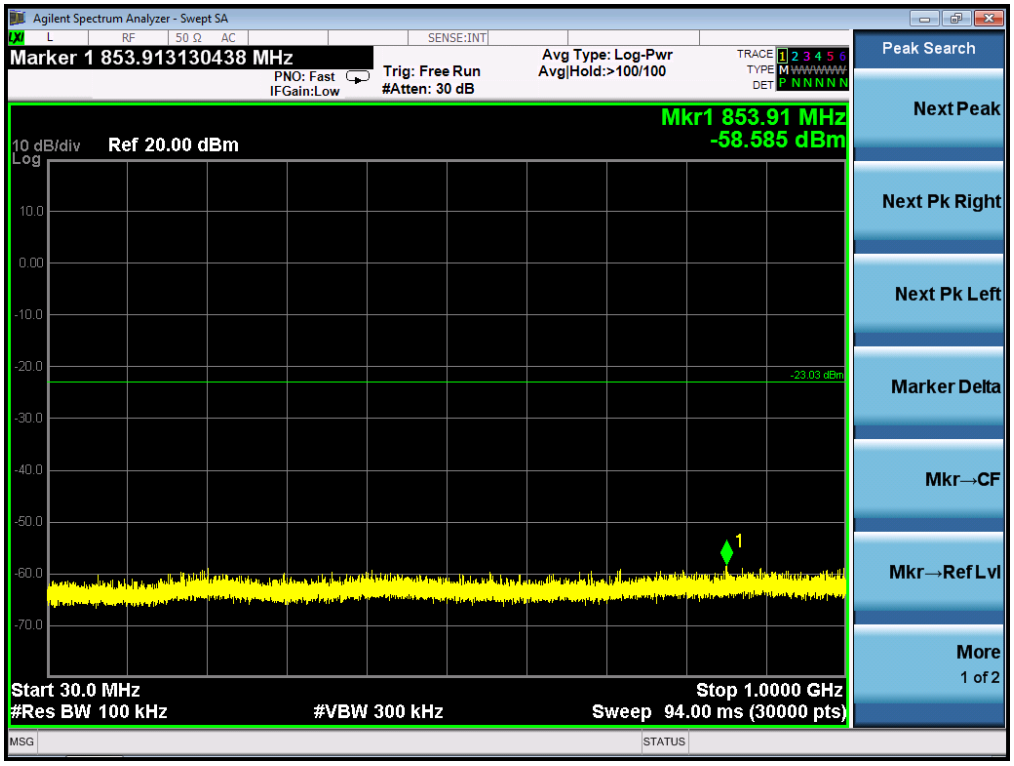
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE OF 802.11g FOR MODULATION IN HIGH CHANNEL

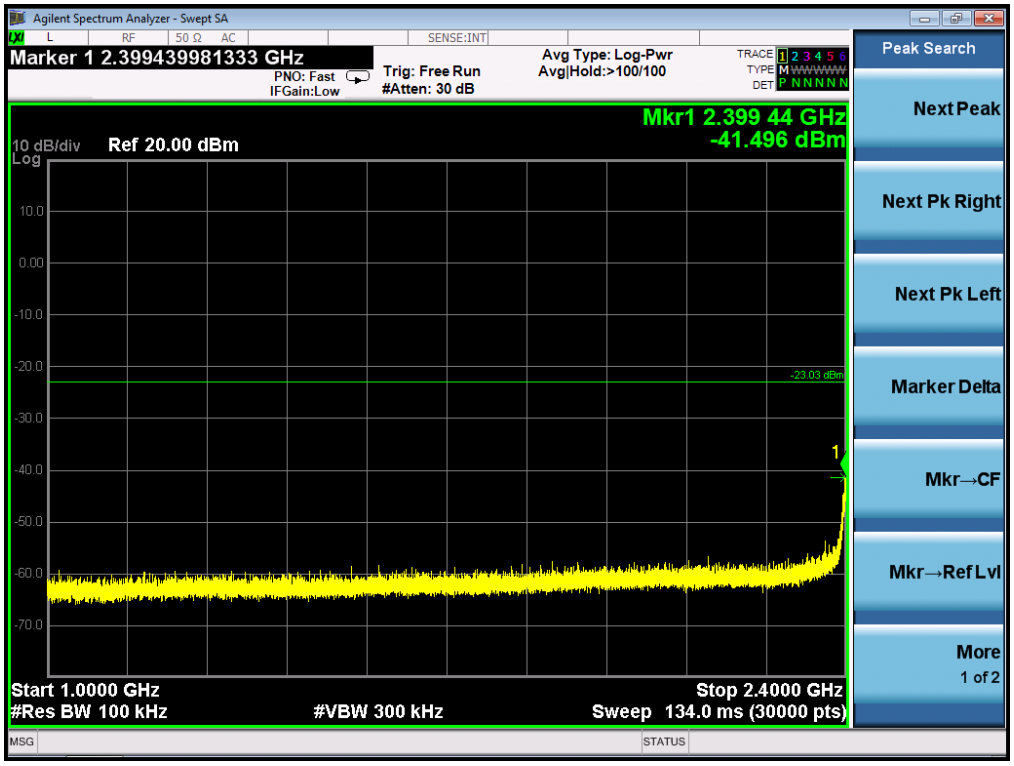


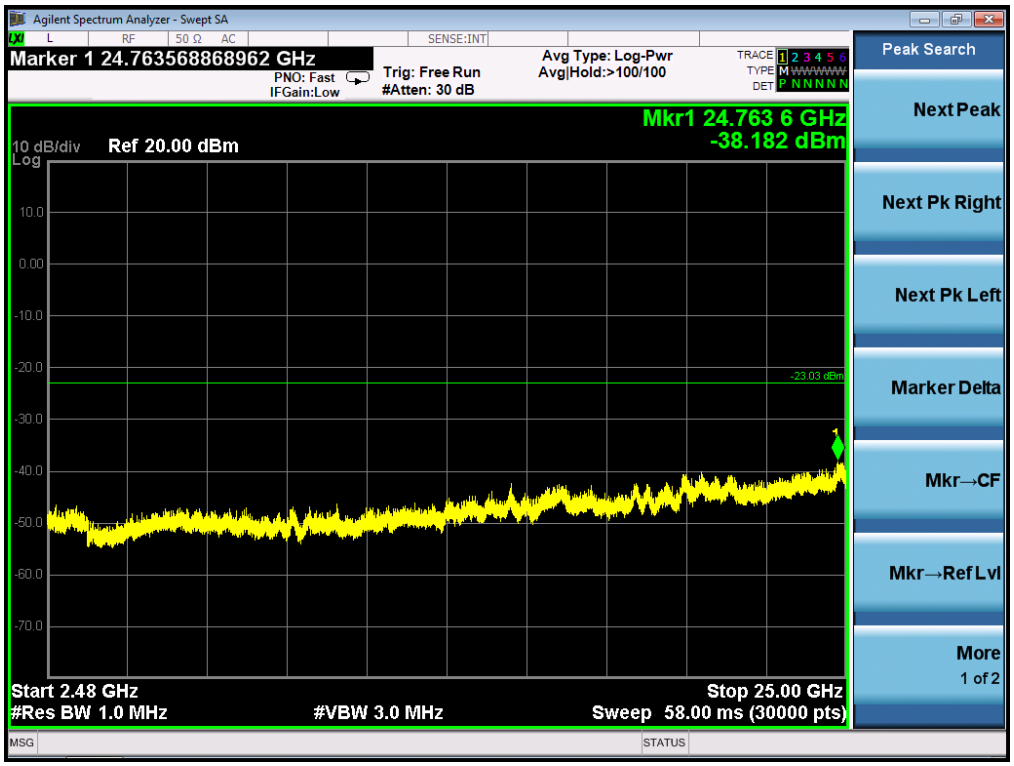

Agilent Spectrum Analyzer - Swept SA
Marker 1 2.381986066202 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.381 99 GHz
-55.232 dBm
10 dB/div
Log
Ref 20.00 dBm
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 134.0 ms (30000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.487252875096 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.487 3 GHz
-33.634 dBm
10 dB/div
Log
Ref 20.00 dBm
Start 2.48 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.00 GHz
Sweep 58.00 ms (30000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

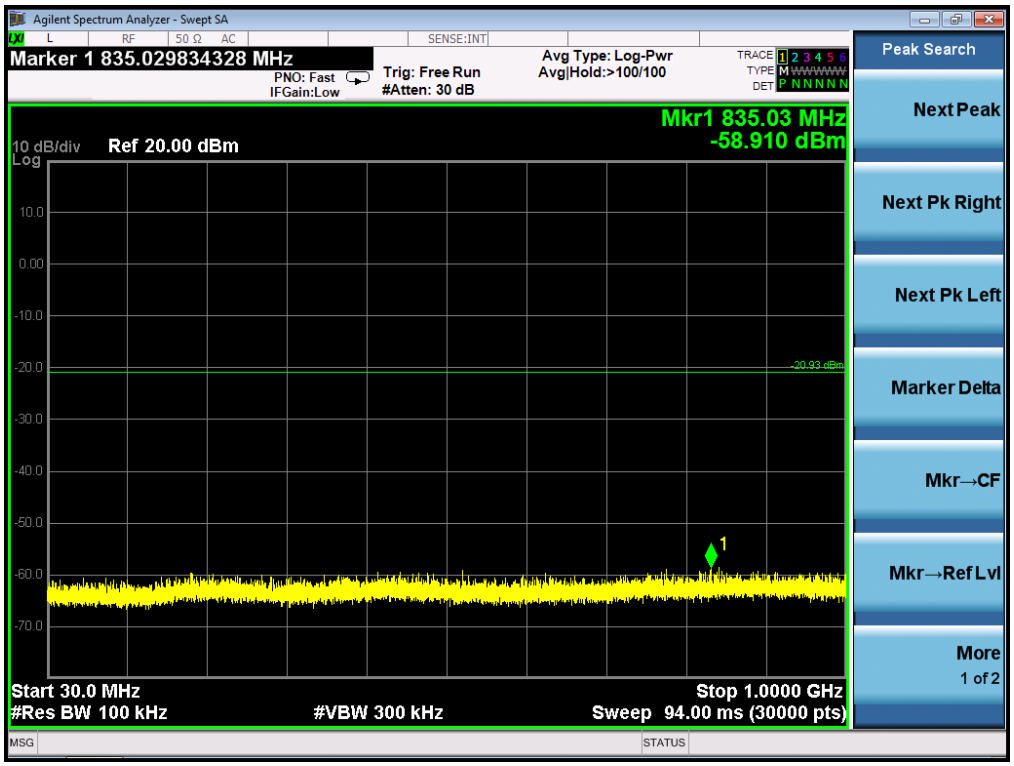
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE
OF 802.11n20 FOR MODULATION IN LOW CHANNEL

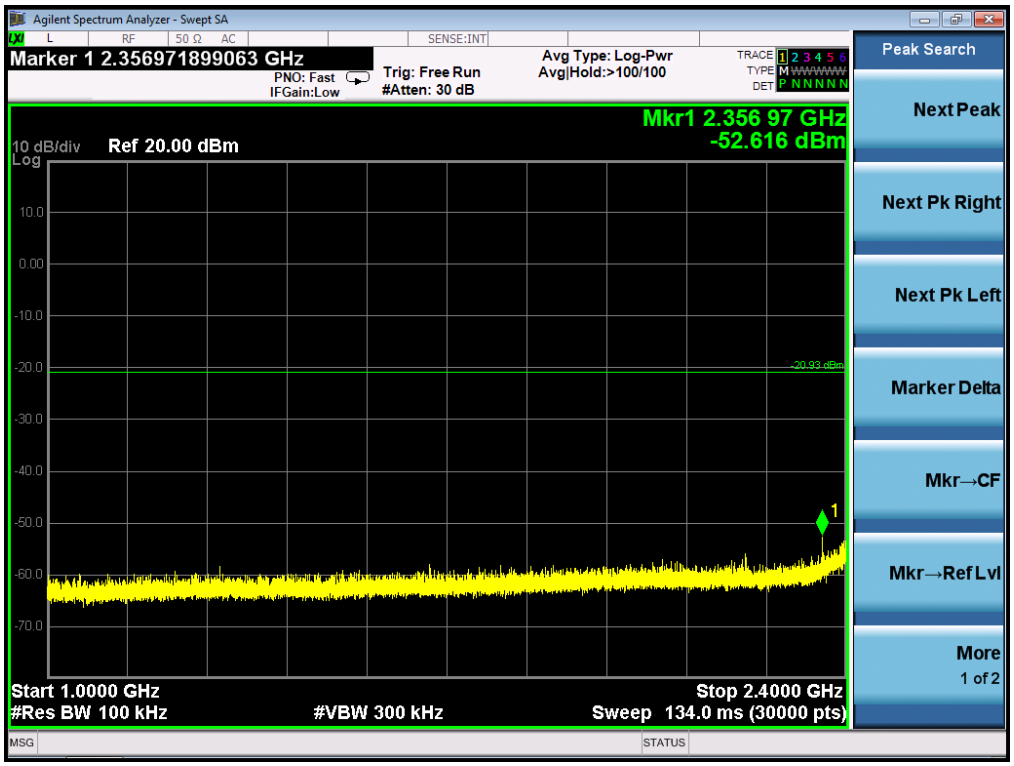


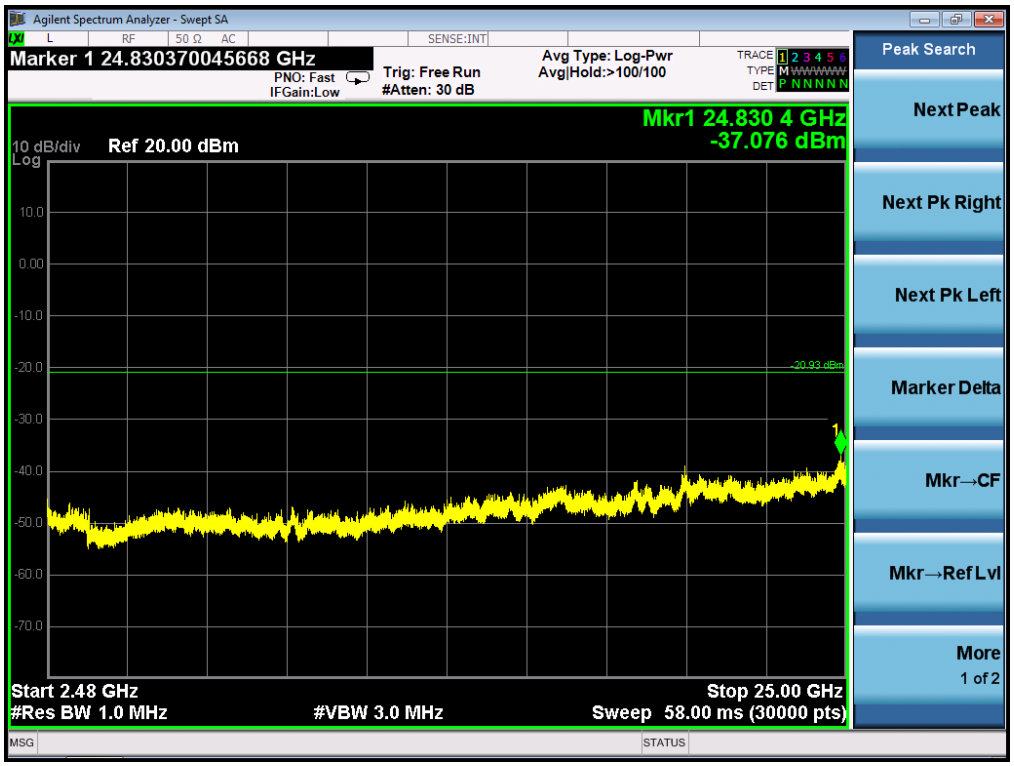




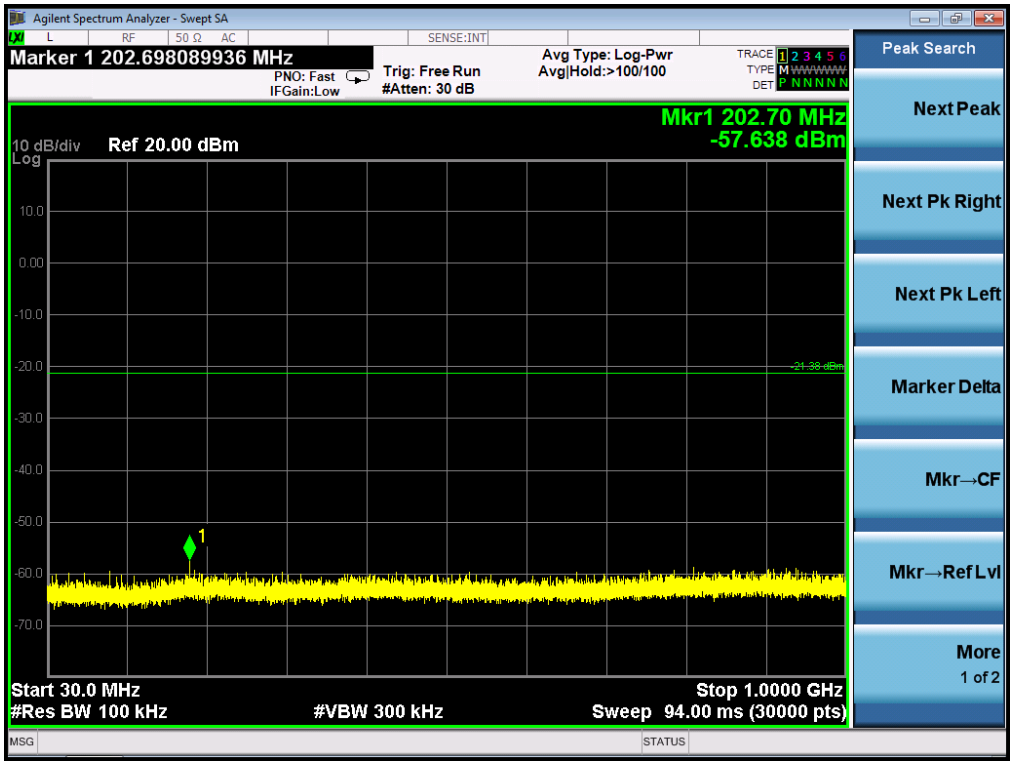
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE OF 802.11n20 FOR MODULATION IN MIDDLE CHANNEL

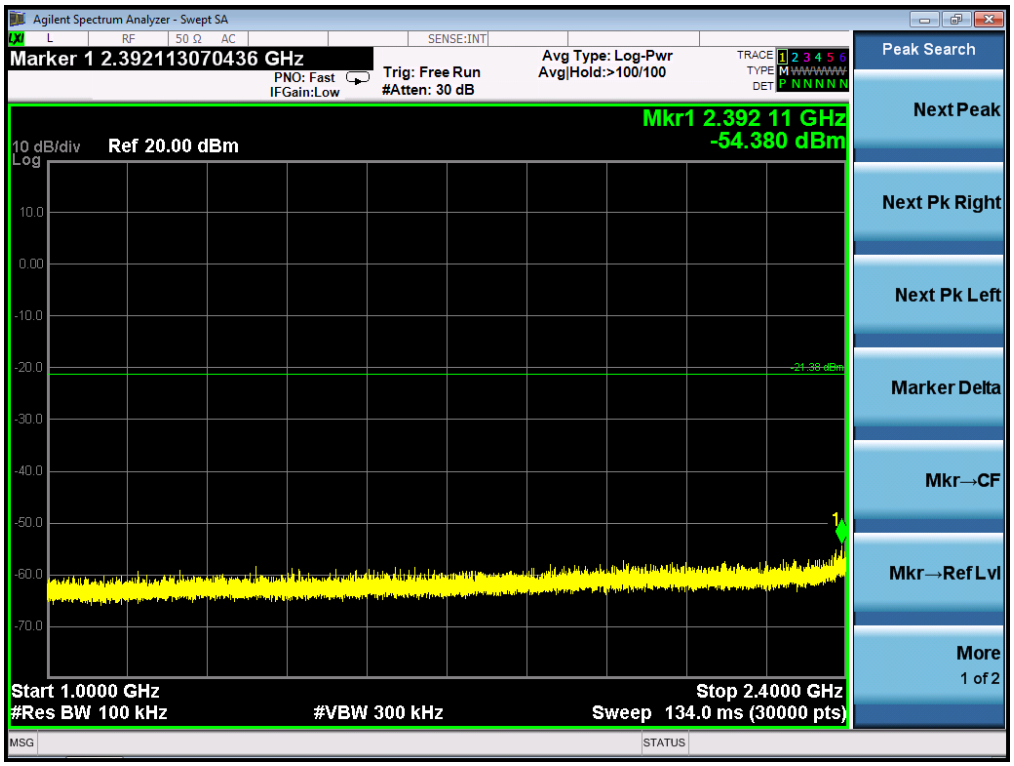


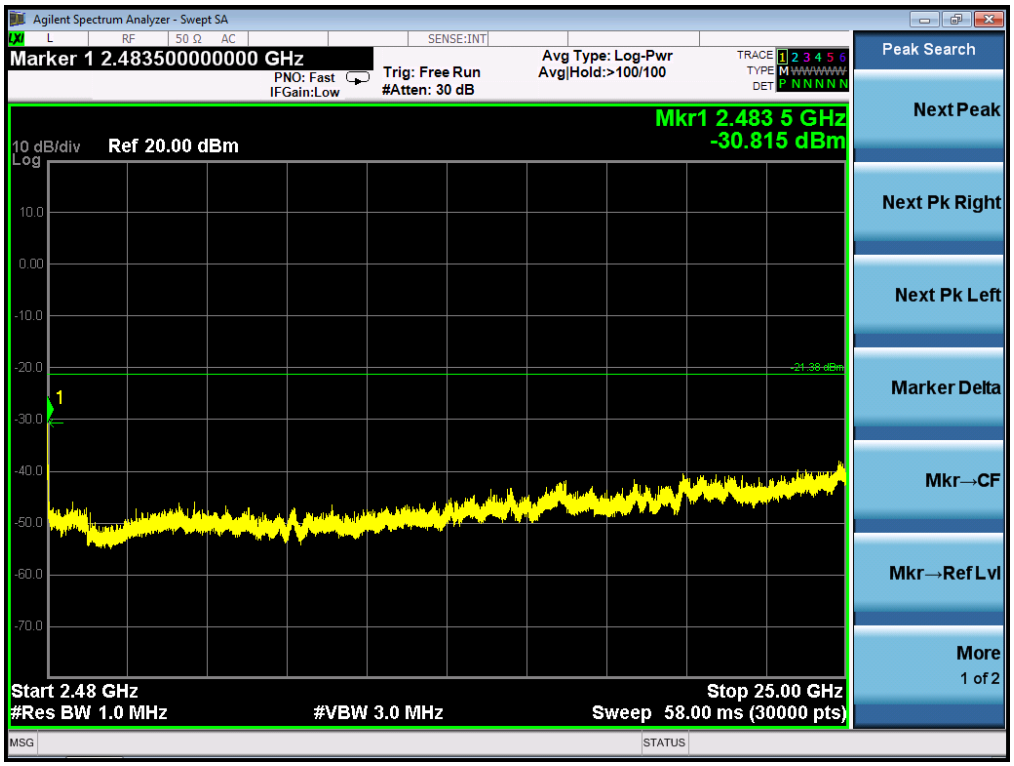

Agilent Spectrum Analyzer - Swept SA
Marker 1 2.356971899063 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.356 97 GHz
-52.616 dBm
10 dB/div
Log
Ref 20.00 dBm
-20.93 dBm
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 134.0 ms (30000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Agilent Spectrum Analyzer - Swept SA
Marker 1 24.830370045668 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 24.830 4 GHz
-37.076 dBm
10 dB/div
Log
Ref 20.00 dBm
-20.93 dBm
Start 2.48 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.00 GHz
Sweep 58.00 ms (30000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

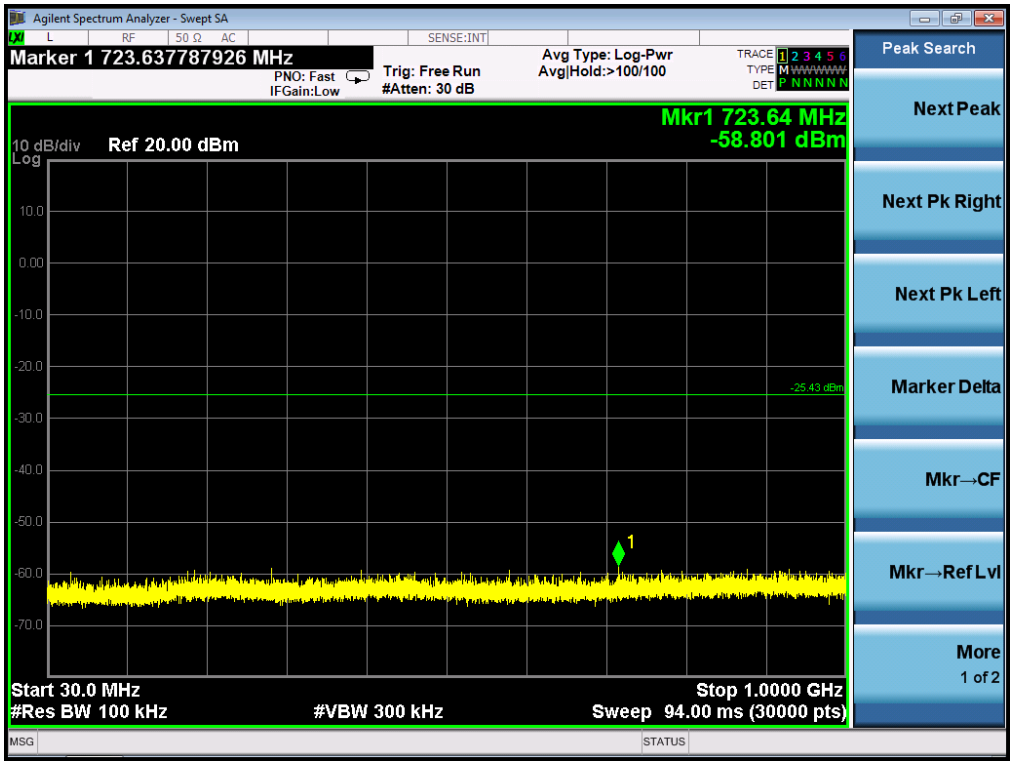
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE
OF 802.11n20 FOR MODULATION IN HIGH CHANNEL

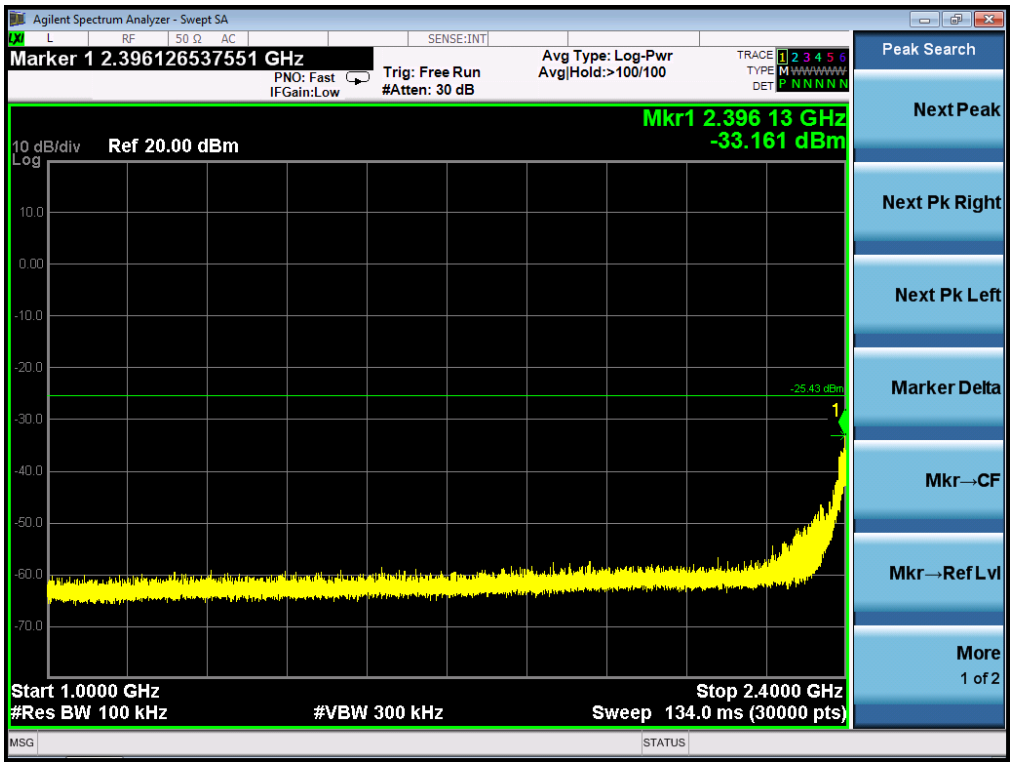


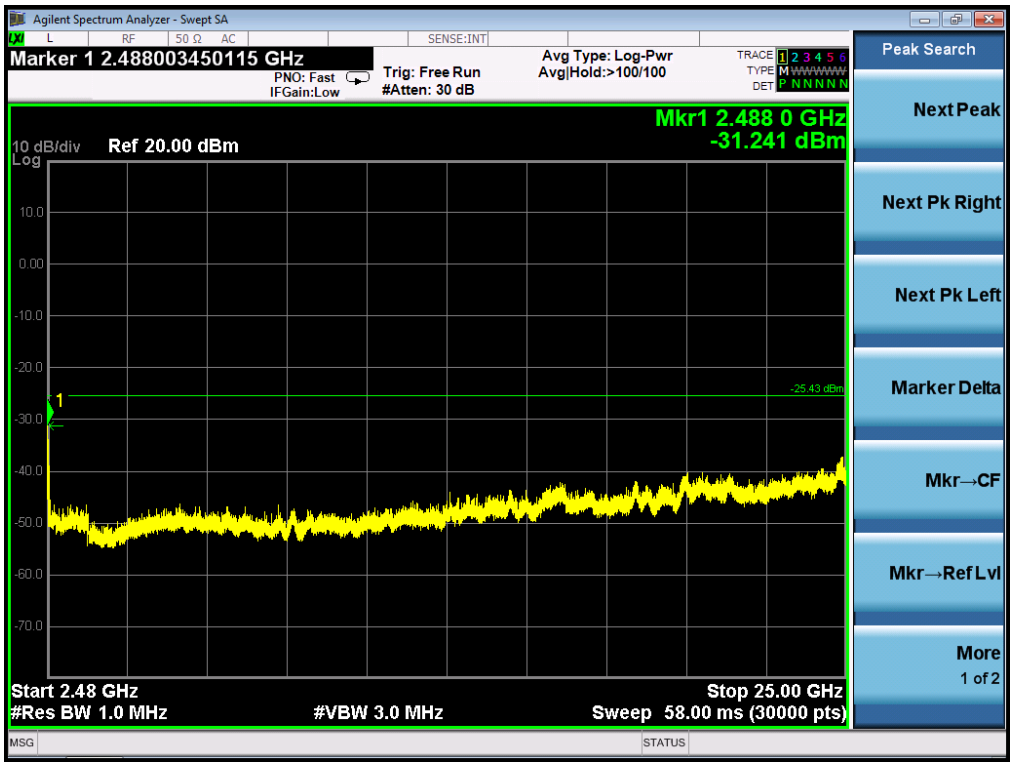




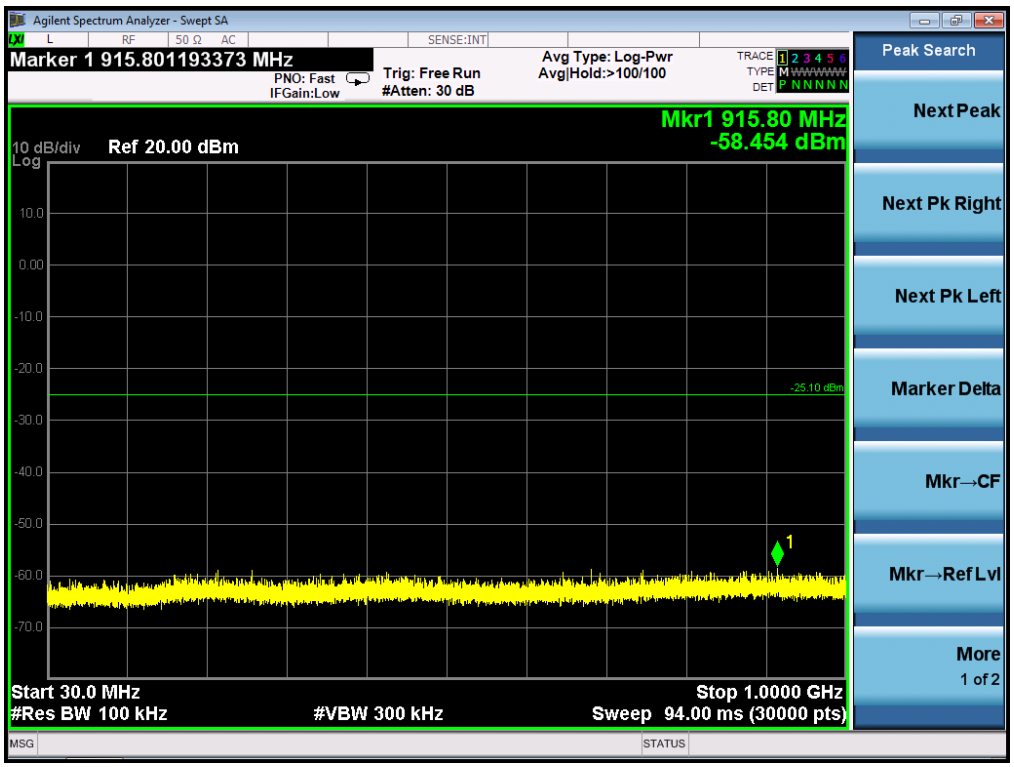
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF 802.11n40 FOR MODULATION IN LOW CHANNEL

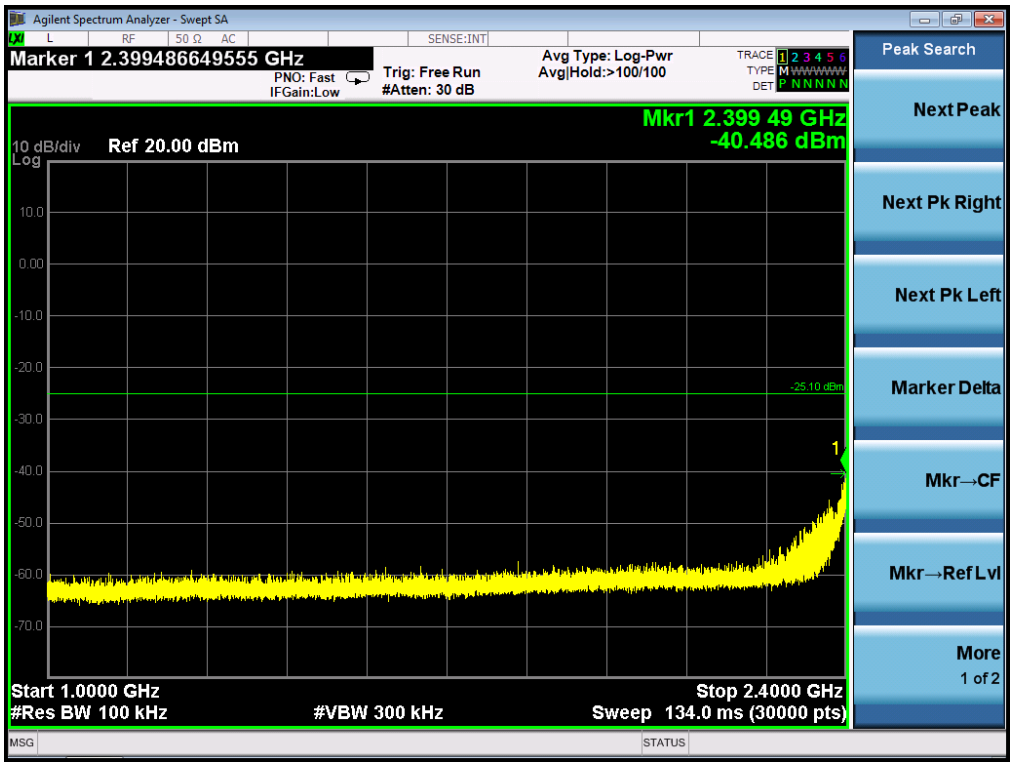


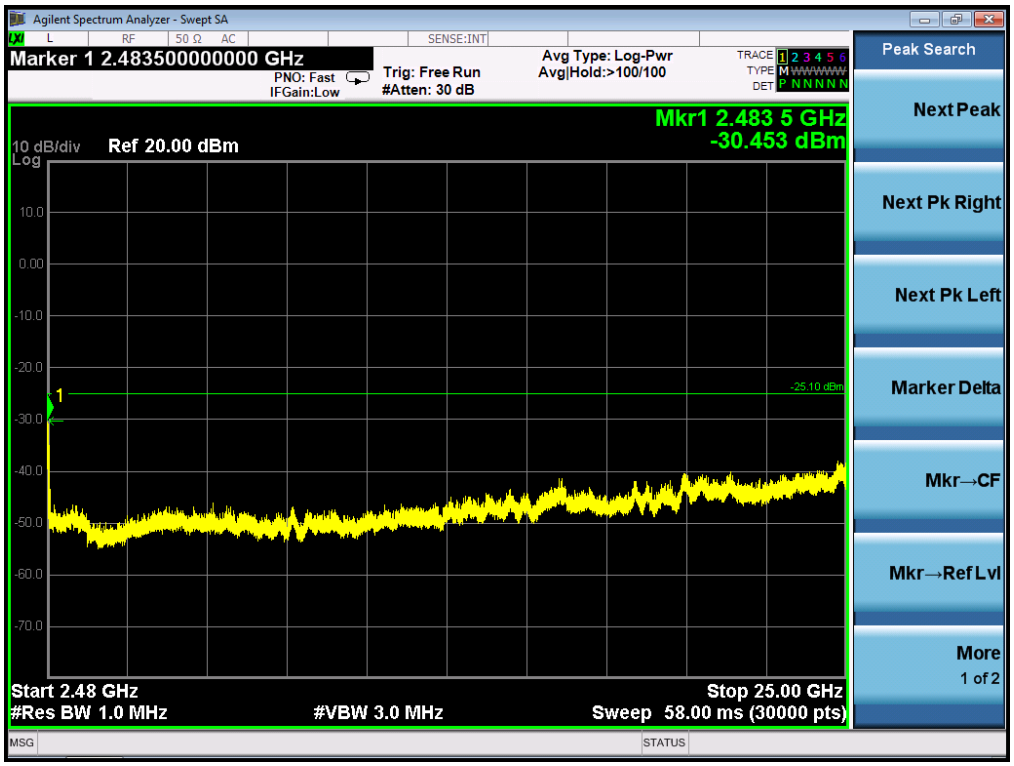

Agilent Spectrum Analyzer - Swept SA
Marker 1 2.396126537551 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.396 13 GHz
-33.161 dBm
10 dB/div
Log
Ref 20.00 dBm
-25.43 dBm
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 134.0 ms (30000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.488003450115 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
Mkr1 2.488 0 GHz
-31.241 dBm
10 dB/div
Log
Ref 20.00 dBm
-25.43 dBm
Start 2.48 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz
Stop 25.00 GHz
Sweep 58.00 ms (30000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

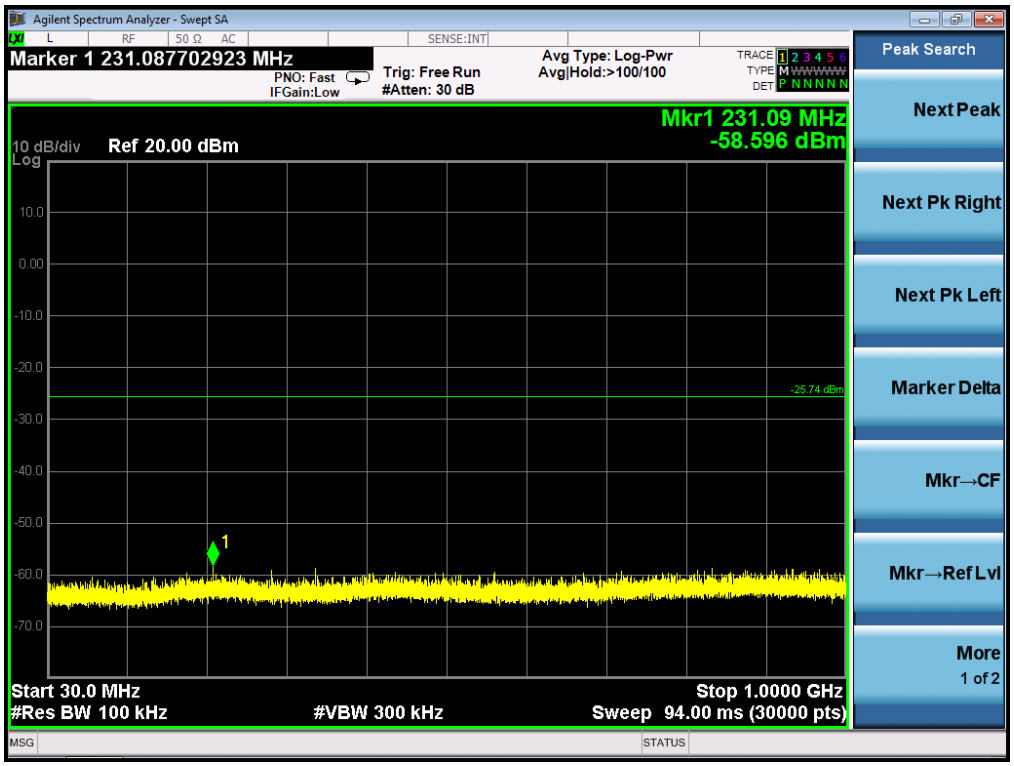
TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE
OF 802.11n40 FOR MODULATION IN MIDDLE CHANNEL

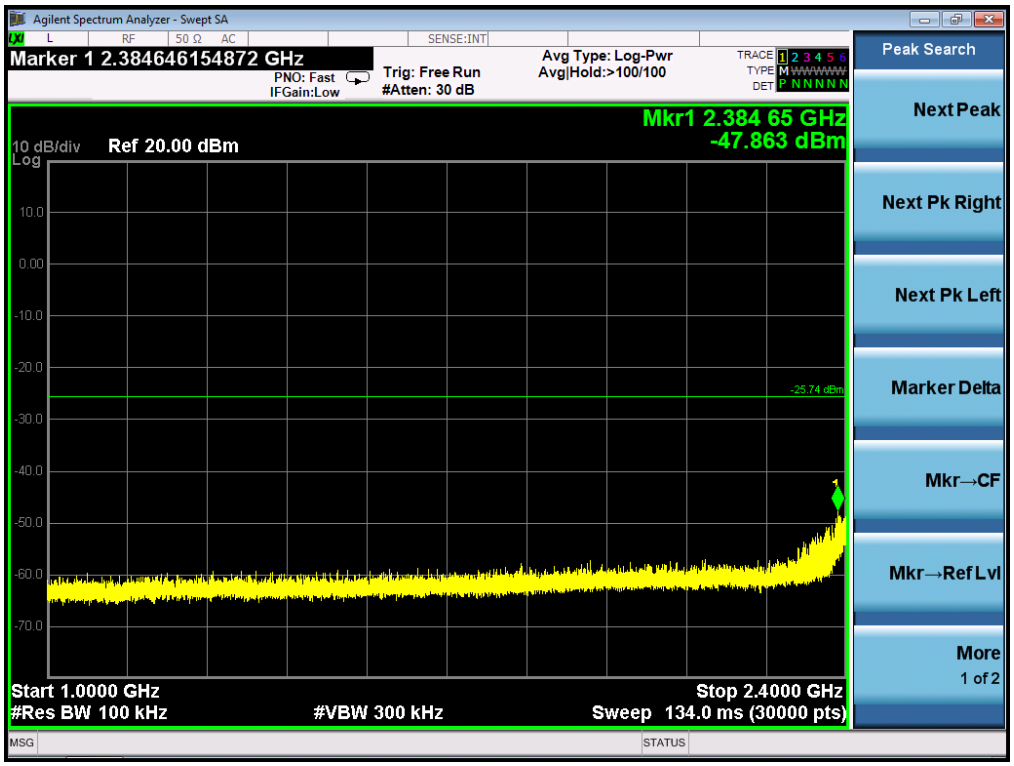


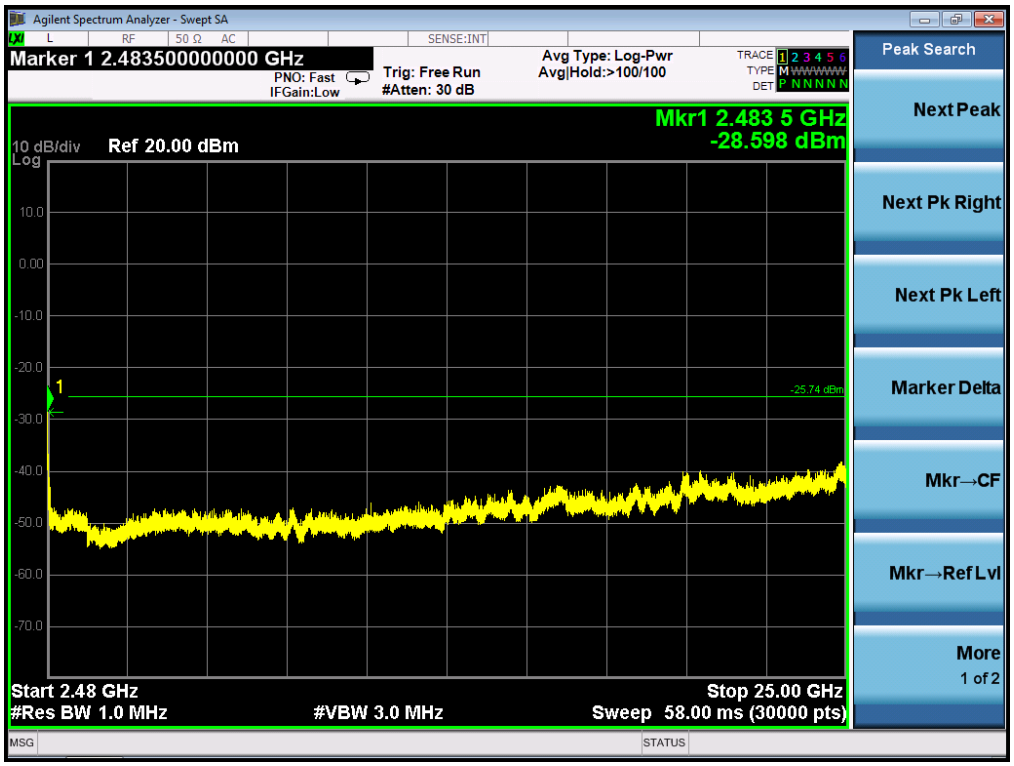




TEST PLOT OF OUT OF BAND EMISSIONS THE WORST CASE OF 802.11n40 FOR MODULATION IN HIGH CHANNEL







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. Two transmit antennas had been tested, the antenna 0 was the worst case and record in the test report.

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 KDB 558074 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

Channel No.	Power density Chain 0 (dBm/3kHz)	Power density Chain 1 (dBm/3kHz)	Power density Total (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	-11.315	-11.875	-8.576	8	Pass
Middle Channel	-11.074	-11.426	-8.236	8	Pass
High Channel	-11.257	-11.771	-8.496	8	Pass

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

Channel No.	Power density Chain 0 (dBm/3kHz)	Power density Chain 1 (dBm/3kHz)	Power density Total (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	-12.964	-13.185	-10.063	8	Pass
Middle Channel	-12.754	-12.913	-9.822	8	Pass
High Channel	-12.769	-12.966	-9.856	8	Pass

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

Channel No.	Power density Chain 0 (dBm/3kHz)	Power density Chain 1 (dBm/3kHz)	Power density Total (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	-13.851	-14.254	-11.038	8	Pass
Middle Channel	-13.674	-13.911	-10.781	8	Pass
High Channel	-13.718	-13.975	-10.834	8	Pass

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

Channel No.	Power density Chain 0 (dBm/3kHz)	Power density Chain 1 (dBm/3kHz)	Power density Total (dBm/3kHz)	Limit (dBm/3kHz)	Result
Low Channel	-17.542	-17.869	-14.692	8	Pass
Middle Channel	-17.318	-17.522	-14.409	8	Pass
High Channel	-17.457	-17.913	-14.669	8	Pass

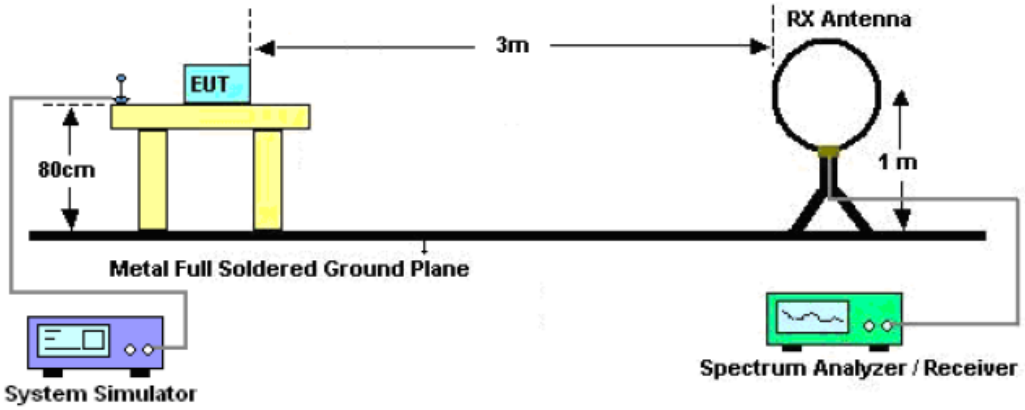
11. RADIATED EMISSION

11.1. MEASUREMENT PROCEDURE

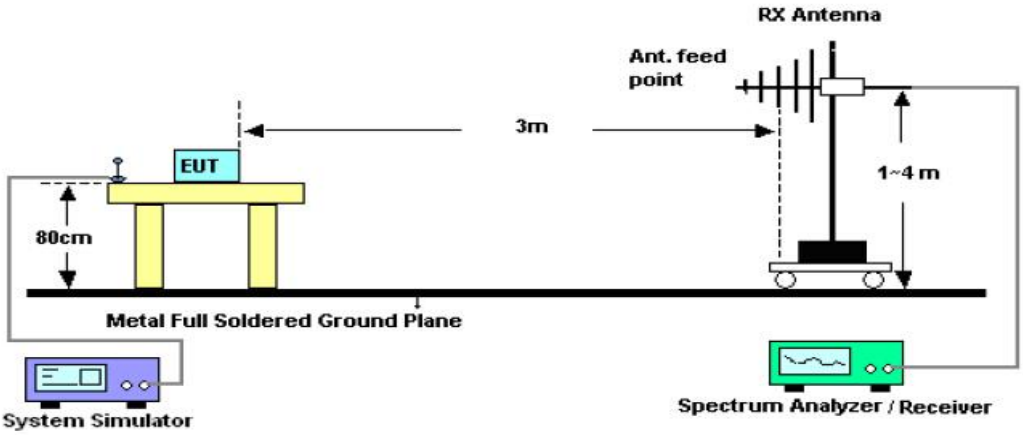
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated 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 VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. 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

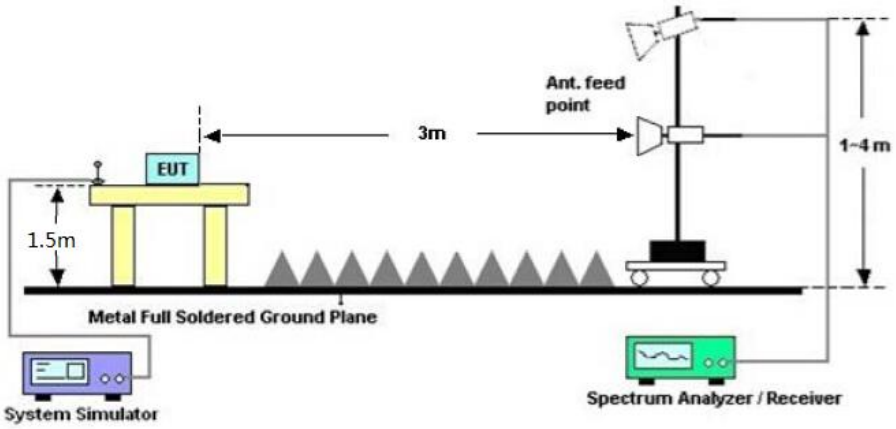
Radiated Emission Test-Setup Frequency Below 30MHz



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.

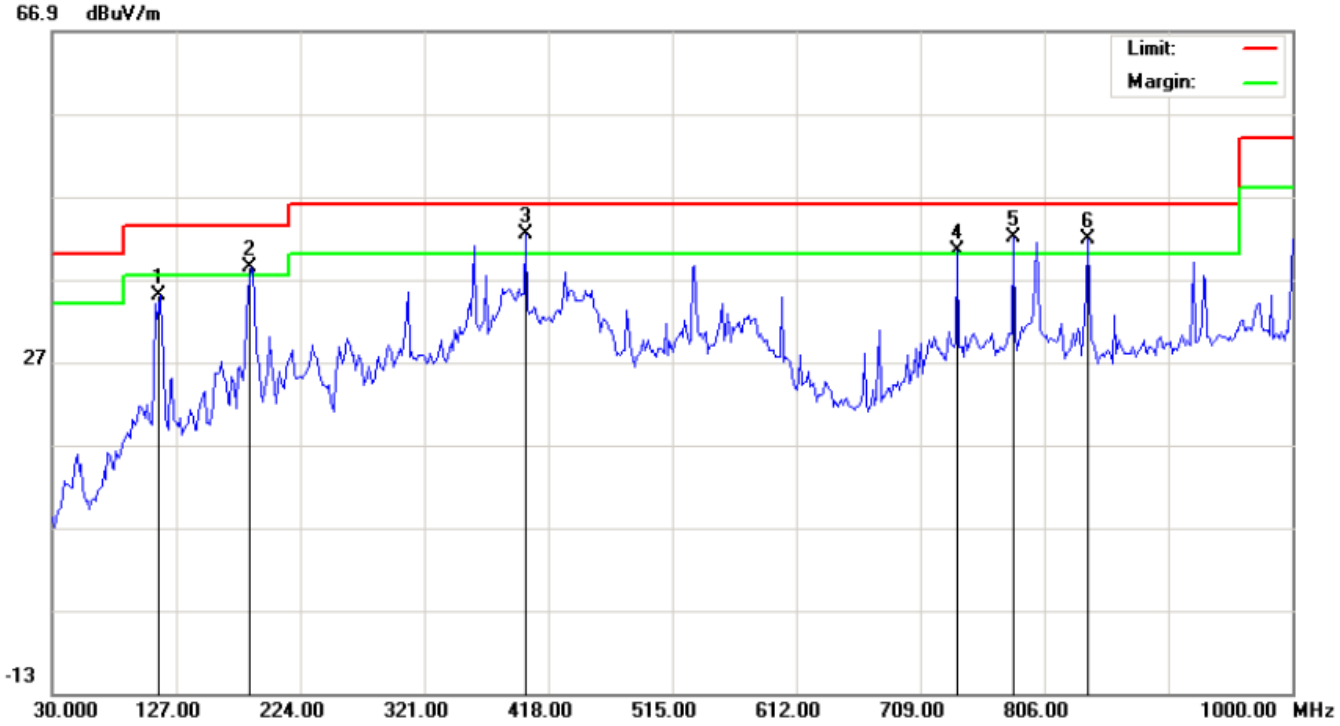
11.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

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

RADIATED EMISSION BELOW 1GHZ

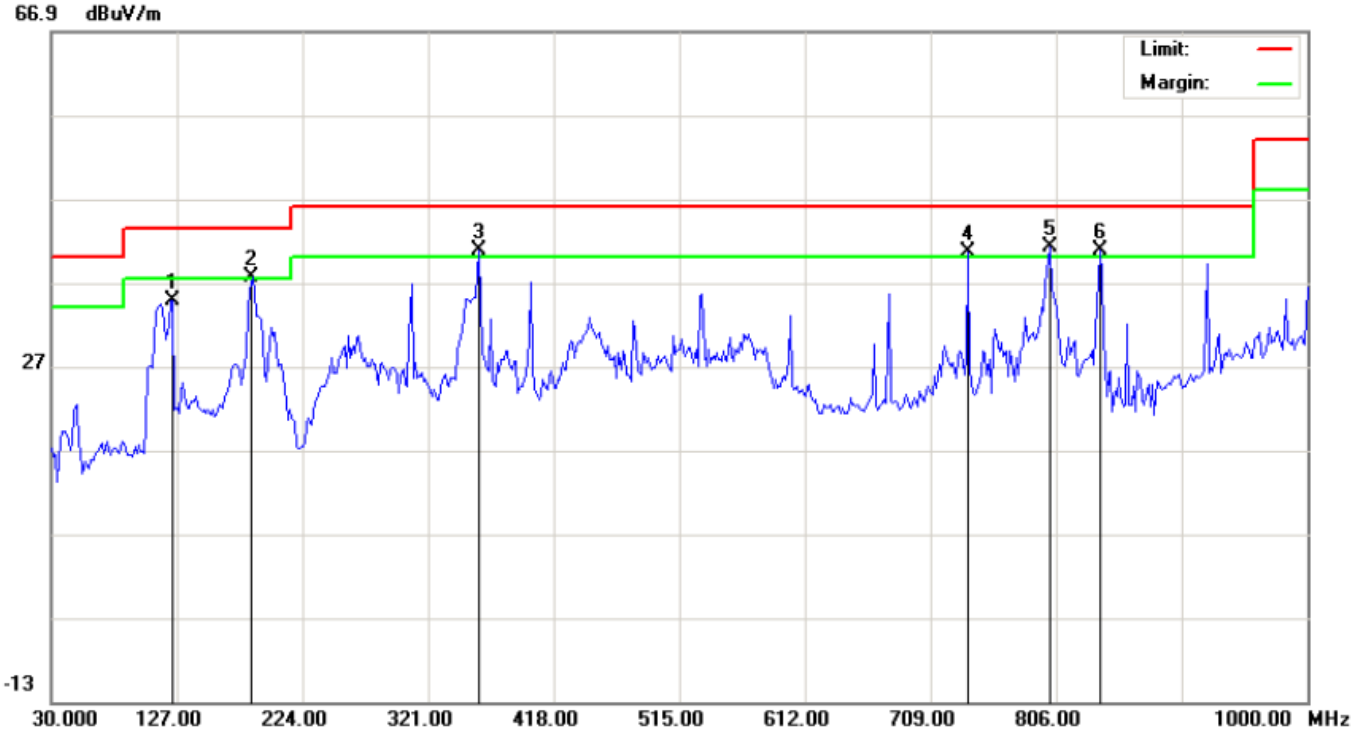
EUT	DLP Smart Projector	**Model Name**	RD-601
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	802.11b with date rate 1 2412MHZ	**Antenna**	Horizontal



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		114.0665	27.84	7.23	35.07	43.50	-8.43	peak			
2	!	185.1999	27.17	11.31	38.48	43.50	-5.02	peak			
3	*	400.2167	23.24	19.08	42.32	46.00	-3.68	peak			
4	!	738.1000	14.05	26.29	40.34	46.00	-5.66	peak			
5	!	781.7500	14.91	27.07	41.98	46.00	-4.02	peak			
6	!	839.9500	14.46	27.31	41.77	46.00	-4.23	peak			

RESULT: PASS

EUT	DLP Smart Projector	Model Name	RD-601
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.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		123.7667	26.40	8.43	34.83	43.50	-8.67	peak			
2	!	185.1999	24.86	12.75	37.61	43.50	-5.89	peak			
3	!	359.8000	21.91	18.80	40.71	46.00	-5.29	peak			
4	!	738.1000	14.40	26.29	40.69	46.00	-5.31	peak			
5	*	801.1499	13.80	27.32	41.12	46.00	-4.88	peak			
6	!	839.9500	13.49	27.31	40.80	46.00	-5.20	peak			

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. The two antennas transmit simultaneously for radiated emission.

4. 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	DLP Smart Projector	**Model Name**	RD-601
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
4824.107	46.12	3.72	49.84	74	-24.16	peak
4824.107	40.56	3.72	44.28	54	-9.72	AVG
7236.100	42.33	8.15	50.48	74	-23.52	peak
7236.098	37.69	8.15	45.84	54	-8.16	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	DLP Smart Projector	**Model Name**	RD-601
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
4824.117	46.15	3.72	49.87	74	-24.13	peak
4824.032	40.53	3.72	44.25	54	-9.75	AVG
7236.023	43.74	8.15	51.89	74	-22.11	peak
7236.097	38.12	8.15	46.27	54	-7.73	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	DLP Smart Projector	Model Name	RD-601
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
4874.036	47.55	3.75	51.3	74	-22.7	peak
4874.064	42.64	3.75	46.39	54	-7.61	AVG
7311.063	42.16	8.16	50.32	74	-23.68	peak
7311.066	36.83	8.16	44.99	54	-9.01	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	DLP Smart Projector	Model Name	RD-601
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
4874.042	47.54	3.75	51.29	74	-22.71	peak
4874.041	42.61	3.75	46.36	54	-7.64	AVG
7311.041	41.55	8.16	49.71	74	-24.29	peak
7311.063	36.74	8.16	44.9	54	-9.1	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	DLP Smart Projector	Model Name	RD-601
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
4924.094	48.15	3.81	51.96	74	-22.04	peak
4924.051	42.33	3.81	46.14	54	-7.86	AVG
7386.117	43.54	8.19	51.73	74	-22.27	peak
7386.119	37.61	8.19	45.8	54	-8.2	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	DLP Smart Projector	Model Name	RD-601
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
4924.030	47.22	3.81	51.03	74	-22.97	peak
4924.069	41.18	3.81	44.99	54	-9.01	AVG
7386.066	42.43	8.19	50.62	74	-23.38	peak
7386.023	37.58	8.19	45.77	54	-8.23	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.
The two antennas transmit simultaneously for radiated emission.

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

The two antennas transmit simultaneously for the band edge emission.

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.