MRT Technology (Suzhou) Co., Ltd
Phone: +86-512-66308358
Fax: +86-512-66308368
Web: www.mrt-cert.com

Report No.: 1401RSU00702
Report Version: V03
Issue Date: 07-04-2014

MEASUREMENT REPORT

FCC PART 15.407 / IC RSS-210

FCC ID:	QB8LT5G
IC:	4679A-LT5G
APPLICANT:	DragonWave Inc.
Application Type:	Certification
Product:	Microwave Outdoor Unit
Model No.:	Harmony Lite 5GHz
Brand Name:	DragonWave
FCC Classification:	Unlicensed National Information Infrastructure (UNII)
FCC Rule Part(s):	Part 15.407
IC Rule(s):	RSS-210 Issue 8
Test Procedure(s):	ANSI C63.10-2009, KDB 789033 D01v01r03 KDB 662911 D01v02r01, KDB 662911 D02v01
Test Date:	January 13 ~ 21, 2014

Reviewed By : Robin Wu
(Robin Wu)

Approved By : Marlin Chen
(Marlin Chen)

The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in KDB 789033 D01v01r03. Test results reported herein relate only to the item(s) tested.

Revision History

Report No.	Version	Description	Issue Date
1401RSU00702	Rev. 01	Initial report	04-24-2014
1401RSU00702	Rev. 02	Revised the antenna information	05-22-2014
1401RSU00702	Rev. 03	Corrected some limits and the referenced rule sections, delete the beam-forming description of the antenna	07-04-2014

CONTENTS

Description Page

§2.1033 General Information

Applicant:	DragonWave Inc.
Applicant Address:	600-411 Legget Drive, Kanata ON K2K 3C9, CANADA
Manufacturer:	DragonWave Inc.
Manufacturer Address:	600-411 Legget Drive, Kanata ON K2K 3C9, CANADA
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
MRT FCC Registration No.:	809388
MRT IC Registration No.:	11384A
FCC Rule Part(s):	Part 15.407
IC Rule(s):	RSS-210 Issue 8
Model No.:	Harmony Lite 5GHz
FCC ID:	QB8LT5G
IC:	4679A-LT5G
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering
FCC Classification:	Unlicensed National Information Infrastructure (UNII)
Date(s) of Test:	January 13 ~ July 04, 2014
Test Report S/N:	1401RSU00702

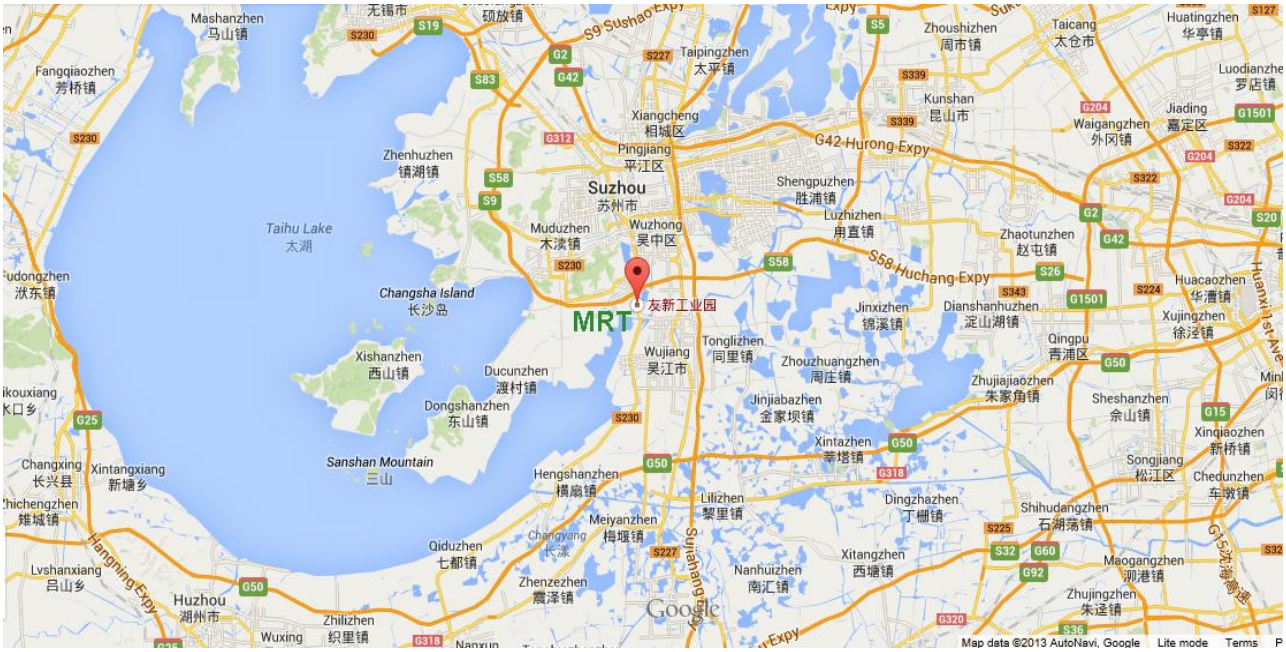
1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on September 30, 2013.



2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name	Microwave Outdoor Unit
Model No.	Harmony Lite 5GHz
Frequency Range	For 20MHz Channel Bandwidth: 5260~5320MHz, 5500~5580MHz, 5660~5700MHz For 40MHz Channel Bandwidth: 5270~5310MHz, 5510~5550MHz, 5670MHz
Maximum Output Power	20MHz Channel Bandwidth: 3.68dBm 40MHz Channel Bandwidth: 5.63dBm
Type of Modulation	OFDM

2.2. Description of Available Antennas

Integrated Antenna	Manufacturer	Model	Freq. (GHz)	Type	Tx Paths	Correlated Gain (dBi)
190mm	MTI	MT-485053/SVH/A	5.3~5.7	Cross-polarized antennas	2	19.5
190mm	Rosenberger	S-Wave 51-17-19D			2	19.5
305mm	MTI	MT–465017/SVH/B			2	23.5
305mm	Rosenberger	S-Wave 55-10-22D-SMA			2	23.5

Note:

1. The Antenna (yellow marker) was used this test report.

2. The transmitter output signals are correlated as defined in attachment KDB 662911 D01, which don't support a 90-degree phase-shifted replica for MIMO antennas. Cross-polarized antennas with N_{ANT} = 2. In the case of a transmitter with only two outputs driving a pair of antennas that are cross-polarized (e.g., vertical and horizontal or left-circular and right-circular), directional gain is the gain of an individual antenna. If the two antennas have different gains, the larger gain applies.

Six configurations description and code number:

Harmony Lite 5.x GHz Integrated	
Code	**Description**
T561LT5G190.00	5.x GHz Lite with P+E and integrated 190mm dual-pol flat antenna
T561LT5G305.00	5.x GHz Lite with P+E and integrated 305mm dual-pol flat antenna
T561LT5G190.01	5.x GHz Lite with PoE+ and integrated 190mm dual-pol flat antenna
T561LT5G305.01	5.x GHz Lite with PoE+ and integrated 305mm dual-pol flat antenna
Harmony Lite 5.x GHz External	
Code	**Description**
T561LT5GSAN.00	5.x GHz Lite with P+E and box cover for external antenna
T561LT5GSAN.01	5.x GHz Lite with PoE+ and box cover for external antenna

Note: The yellow markers were used to testing for Radiated and Conducted.

2.3. Frequency / Channel Opreation

Channels for 20MHz Channel Bandwidth

Channel	Frequency	Channel	Frequency	Channel	Frequency
52	5260 MHz	56	5280 MHz	60	5300 MHz
64	5320 MHz	100	5500 MHz	104	5520 MHz
108	5540 MHz	112	5560 MHz	116	5580 MHz
132	5660 MHz	136	5680 MHz	140	5700 MHz

Channels for 40MHz Channel Bandwidth

Channel	Frequency	Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz	102	5510 MHz
110	5550 MHz	134	5670 MHz	--	--

Note: The EUT was prohibited in TDWR band (5600-5650MHz).

2.4. Data Rate Verification

N_{Tx}	Modulation type	Coding rate	Data Rate (Mbps)			
			20MHz Bandwidth		40MHz Bandwidth	
			800ns GI	400ns GI	800ns GI	400ns GI
2	BPSK	1/2	13.0	14.4	27.0	30.0
2	QPSK	1/2	26.0	28.9	54.0	60.0
2	QPSK	3/4	39.0	43.3	81.0	90.0
2	16-QAM	1/2	52.0	57.8	108.0	120.0
2	16-QAM	3/4	78.0	86.7	162.0	180.0
2	64-QAM	2/3	104.0	115.6	216.0	240.0
2	64-QAM	3/4	117.0	130.0	243.0	270.0
2	64-QAM	5/6	130.0	144.0	270.0	300.0

Note: Power output test was verified over all data rates of each mode shown as above, and then choose the maximum power output (yellow marker) for final test of each channel.

2.5. Device Capabilities

This device contains the following capabilities:

5GHz (DTS/NII)

Note: 5GHz (DTS/NII) operation is possible in 20MHz and 40MHz channel bandwidths. The maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = peak per the guidance of Section B)2)b) of KDB 789033 D01v01r03. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

- 20MHz Bandwidth – 93.75%
- 40MHz Bandwidth – 91.40%

2.6. Test Configuration

The Microwave Outdoor Unit FCC ID: QB8LT5G was tested per the guidance of KDB 789033 D01v01r03. ANSI C63.10-2009 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.7. Test Software

The test utility software used during testing was ART2 Version 2.28.6.

Power Parameter Value of the test software setting:

Channel Bandwidth	Test frequency (MHz)	Power setting (dBm)	Channel Bandwidth	Test frequency (MHz)	Power setting (dBm)
20MHz	5260	1	40MHz	5270	3
	5300	2		5310	3
	5320	2		5510	3
	5500	2		5550	3
	5580	1		5670	3
	5700	1		--	--

Note: The device just supports 2x2 MIMO.

2.8. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.9. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the trade name and FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2009), and the guidance provided in KDB 789033 D01v01r03 were used in the measurement of the **Microwave Outdoor Unit FCC ID: QB8LT5G.**
Deviation from measurement procedure…….....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.
The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.
Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or resolution, clock or data exchange speed, scrolling H pattern to the EUT and/or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions is used for final measurements on the same test site.
Line conducted emissions test results are shown in Section 7.10.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GH absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. An MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.
For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 0.8 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.
Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beamwidth of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:
"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- The antenna of the Microwave Outdoor Unit is **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:
The **Microwave Outdoor Unit FCC ID: QB8LT5G** unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATA

AC Conducted Emissions Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
EMI Test Receiver	R&S	ESR7	101209	2014/07/16
Two-Line V-Network	R&S	ENV216	101683	2014/07/21
Two-Line V-Network	R&S	ENV216	101684	2014/07/21
Temperature/ Meter Humidity	Anymetre	TH101B	SR2-01	2014/08/15

Radiated Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9010A	MY51440164	2014/08/15
Preamplifier	MRT	AP01G18	1310002	2014/10/08
Loop Antenna	Schwarzbeck	FMZB1519	1519-041	2014/09/12
TRILOG Antenna	Schwarzbeck	VULB9162	9162-047	2014/09/12
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1167	2014/09/12
Broadband Horn Antenna	Schwarzbeck	BBHA9170	9170-549	2014/09/12
Temperature/Humidity Meter	Anymetre	TH101B	AC1-01	2014/08/15

Conducted Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9010A	MY51440164	2014/08/15
Power Meter	Agilent	U2021XA	MY52450003	2014/12/14
Temperature & Humidity Chamber	BAOYT	BYH-1500L	1309W043	2014/10/08
DC Power Supply	APECC	DFS-336030D	00002016	2014/12/14
Temperature/Humidity Meter	Anymetre	TH101B	TR3-01	2014/08/15

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

AC Conducted Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 150kHz~30MHz: ±3.5dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): Horizontal: 30MHz~1GHz: 4.07dB 1GHz~18GHz: 4.16dB 18GHz~40GHz: 4.24dB Vertical: 30MHz~1GHz: 4.18dB 1GHz~18GHz: 4.76dB 18GHz~40GHz: 4.65dB

7. TEST RESULT

7.1. Summary

Company Name: **DragonWave Inc.**
FCC ID: **QB8LT5G**
IC: **4679A-LT5G**
FCC Classification: **Unlicensed National Information Infrastructure (UNII)**
Data Rate(s) Tested: **13.0/14.4Mbps ~ 130.0/144.0Mbps (20MHz BW);**
27.0/30.0Mbps ~ 270.0/300.0Mbps (40MHz BW);

FCC Part Section(s)	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.407(a)	RSS-210 [A9.2]	26dB Bandwidth (FCC) Occupied Bandwidth (IC)	N/A	Conducted	Pass	Section 7.2
15.407(a)(2)	RSS-210 [A9.2]	Maximum Conducted Output Power	< 6.48dBm (FCC) < 17 + 10log10(99% BW) dBm (IC)		Pass	Section 7.3
15.407(h)(1)	RSS-210 [A9.2]	Transmit Power Control (TPC)	< 24dBm		Pass	Section 7.4
15.407(a)(2),(5)	RSS-210 [A9.2]	Peak Power Spectral Density	< -6.5dBm/MHz (FCC) < 11dBm/MHz (IC)		Pass	Section 7.5
15.407(a)(6)	N/A	Peak Excursion	< 13dB/MHz maximum difference		Pass	Section 7.6
15.407(g)	N/A	Frequency Stability	N/A		Pass	Section 7.7
15.407(b)(2),(3)	RSS-210 [A9.2]	Undesirable Emissions	< -27dBm/MHz EIRP	Radiated	Pass	Section 7.8 & 7.9
15.205 15.209 15.407(b)(6)	RSS-Gen [7.2.2]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-210 table 3 limits)		Pass	
15.207	RSS-Gen [7.2.4]	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits < RSS-Gen table 2 limits	Line Conducted	N/A	Section 7.10

Notes:

1) All channels, modes, and modulations/data rates were investigated among all UNII bands. The test results shown in the following sections represent the worst case emissions.
2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer.

The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.

3) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.

7.2. 26dB Bandwidth Measurement *§15.407 (a); RSS-210 [A9.2]*

7.2.1. Test Limit

N/A

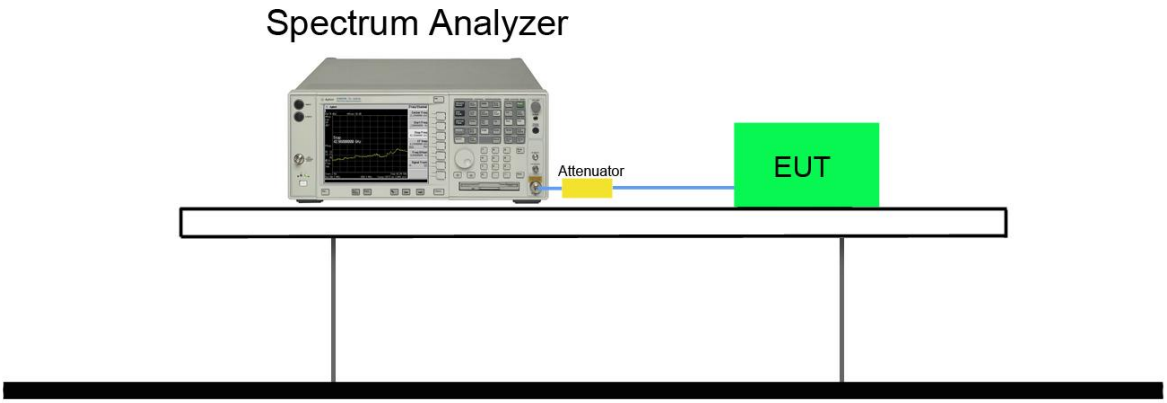
7.2.2. Test Procedure used

KDB 789033 D01v01r03 – Section C

7.2.3. Test Setting

1. The analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 26. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediated power nulls in the fundamental emission.
2. RBW = approximately 1% of the emission bandwidth.
3. VBW ≥ 3 × RBW
4. Detector = Peak
5. Trace mode = max hold

7.2.4. Test Setup



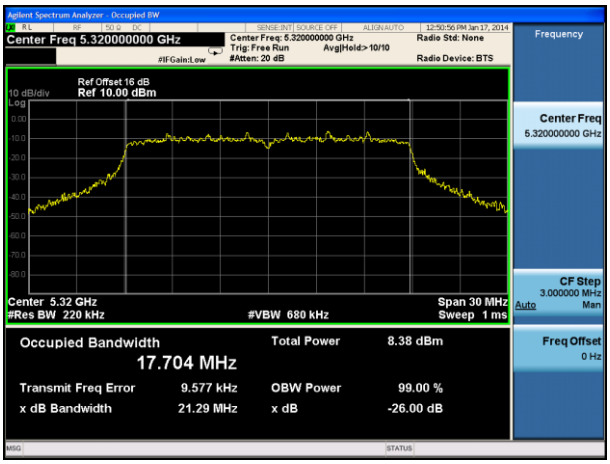
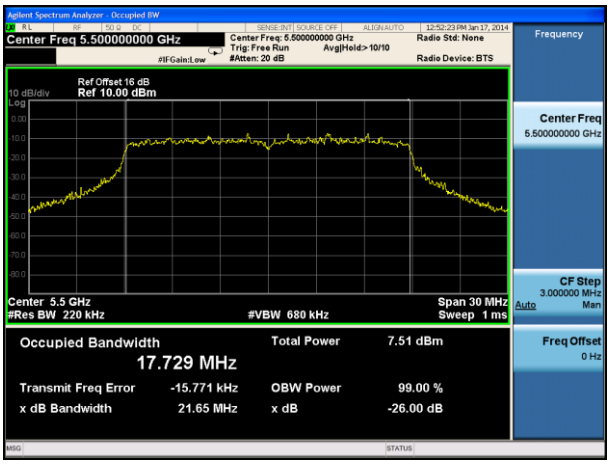
7.2.5. Test Result

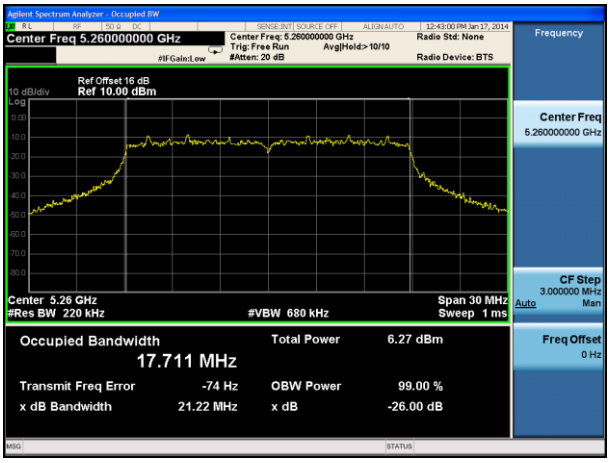
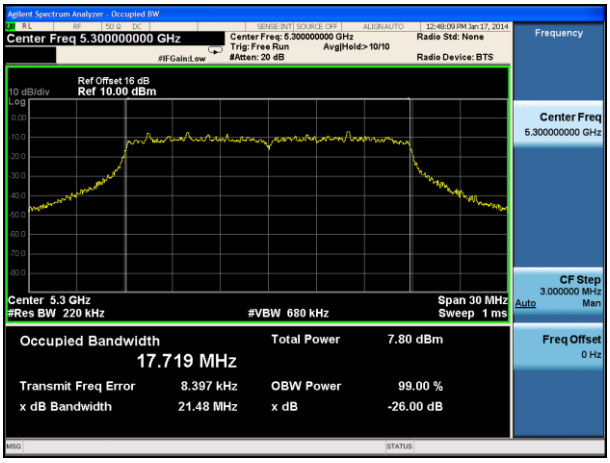
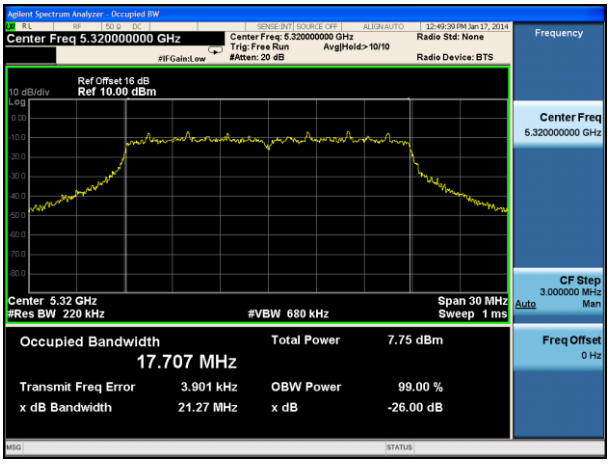
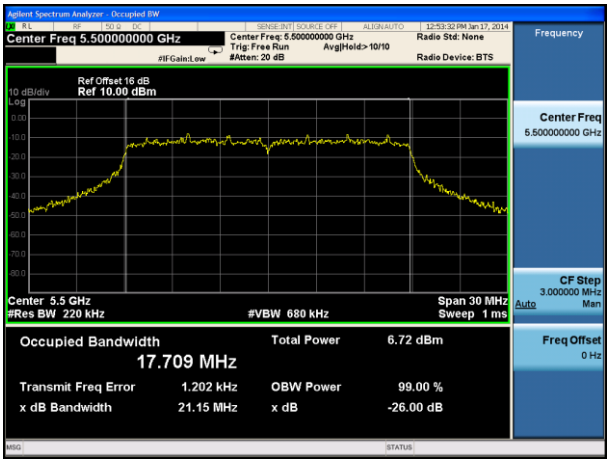
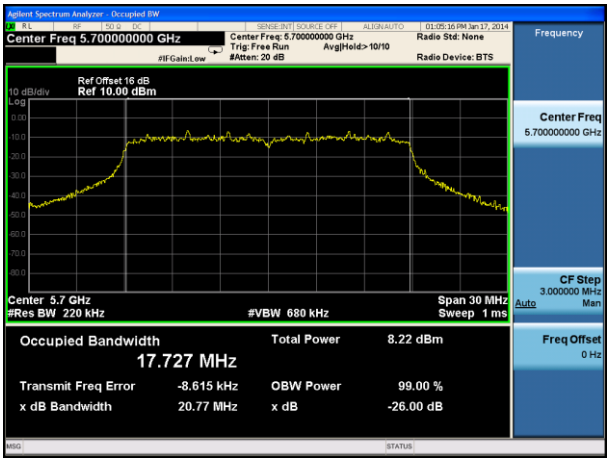
Channel Bandwidth	Data Rate (Mbps)	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
Chain 0						
20MHz	13.0	52	5260	21.15	17.75	Pass
20MHz	13.0	60	5300	21.21	17.73	Pass
20MHz	13.0	64	5320	21.29	17.70	Pass
20MHz	13.0	100	5500	21.65	17.73	Pass
20MHz	13.0	116	5580	21.31	17.74	Pass
20MHz	13.0	140	5700	21.55	17.72	Pass
Chain 1						
20MHz	13.0	52	5260	21.22	17.71	Pass
20MHz	13.0	60	5300	21.48	17.72	Pass
20MHz	13.0	64	5320	21.27	17.71	Pass
20MHz	13.0	100	5500	21.15	17.71	Pass
20MHz	13.0	116	5580	21.55	17.71	Pass
20MHz	13.0	140	5700	20.77	17.73	Pass

20MHz Channel Bandwidth 26dB Bandwidth - Chain 0

Channel 52 (5260MHz)

Channel 60 (5300MHz)

Channel 64 (5320MHz)	Channel 100 (5500MHz)
	
Channel 116 (5580MHz)	**Channel 140 (5700MHz)**
	

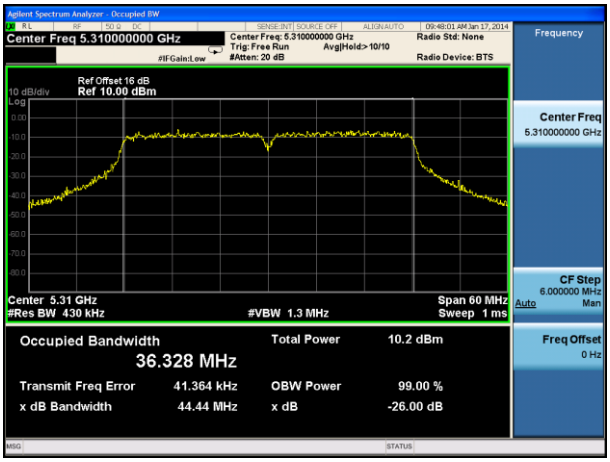
20MHz Channel Bandwidth 26dB Bandwidth - Chain 1	
Channel 52 (5260MHz)	**Channel 60 (5300MHz)**
	
Channel 64 (5320MHz)	**Channel 100 (5500MHz)**
	
Channel 116 (5580MHz)	**Channel 140 (5700MHz)**
	

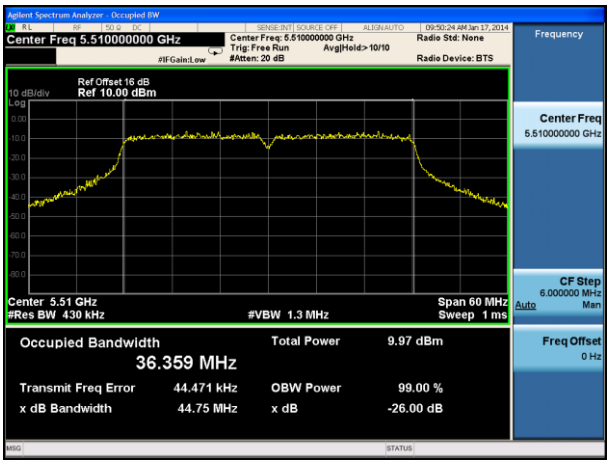
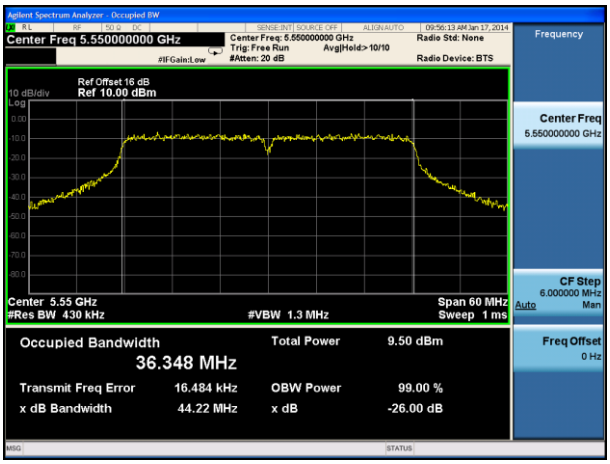
Channel Bandwidth	Data Rate (Mbps)	Channel No.	Frequency (MHz)	26dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
Chain 0						
40MHz	27.0	54	5270	43.15	36.38	Pass
40MHz	27.0	62	5310	44.44	36.33	Pass
40MHz	27.0	102	5510	44.75	36.36	Pass
40MHz	27.0	110	5550	44.22	36.35	Pass
40MHz	27.0	134	5670	46.37	36.41	Pass
Chain 1						
40MHz	27.0	54	5270	43.60	36.35	Pass
40MHz	27.0	62	5310	44.27	36.29	Pass
40MHz	27.0	102	5510	44.23	36.32	Pass
40MHz	27.0	110	5550	43.88	36.29	Pass
40MHz	27.0	134	5670	43.39	36.27	Pass

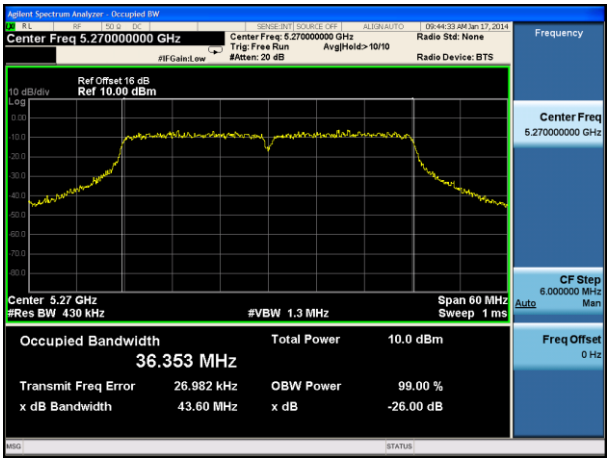
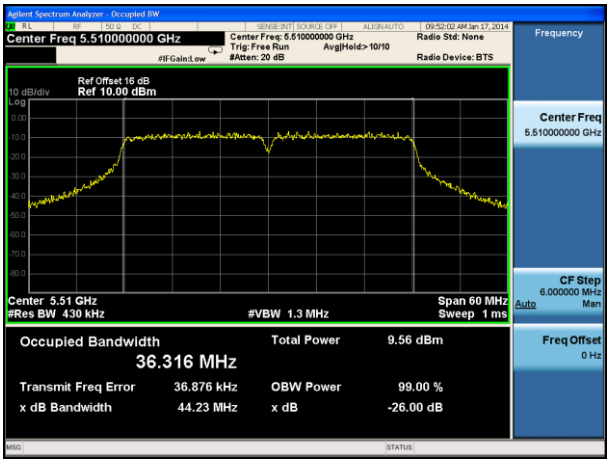
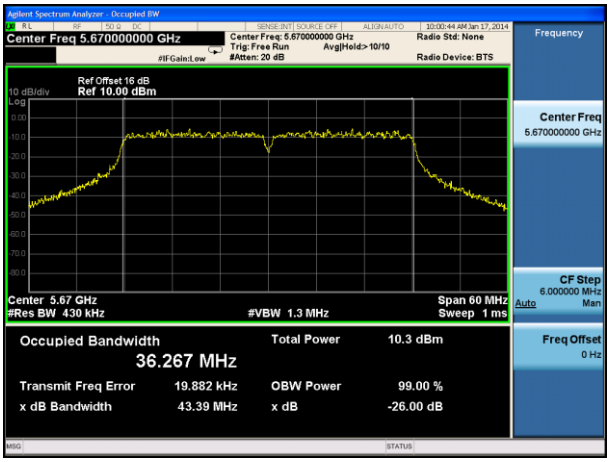
40MHz Channel Bandwidth 26dB Bandwidth - Chain 0

Channel 54 (5270MHz)

Channel 62 (5310MHz)



Channel 102 (5510MHz)	Channel 110 (5550MHz)
	
Channel 134 (5670MHz)	
	

40MHz Channel Bandwidth 26dB Bandwidth - Chain 1	
Channel 54 (5270MHz)	**Channel 62 (5310MHz)**
	
Channel 102 (5510MHz)	**Channel 110 (5550MHz)**
	
Channel 134 (5670MHz)	
	

7.3. Output Power Measurement *§15.407 (a)(2); RSS-210 [A9.2]*

7.3.1. Test Limit

For FCC

In the 5.25 – 5.35 GHz and 5.47 – 5.725 GHz bands, the maximum permissible conducted output power is the lesser of 250mW (23.98dBm) and 11dBm + 10*Log (26dB BW) = 11dBm + $10\log_{10}(20.77)$ = 24.17dBm.

If transmitting antennas of directional gain greater than 6dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

5.25-5.35GHz, 5.47-5.725GHz: Limit (dBm) = 23.98dBm – (23.5dBi - 6dBi) = 6.48dBm

For IC

In the 5.25-5.35GHz, 5.47-5.60GHz and 5.65-5.725GHz bands, the maximum e.i.r.p. shall not exceed 1W (30dBm) or 17dBm + $10\log_{10}$(99% BW), whichever power is less. B is the 99% emission bandwidth in MHz.

5.25-5.35GHz, 5.47-5.60GHz and 5.65-5.725GHz: Limit (dBm) = 29.48dBm for 20MHz BW

5.25-5.35GHz, 5.47-5.60GHz and 5.65-5.725GHz: Limit (dBm) = 30dBm for 40MHz BW

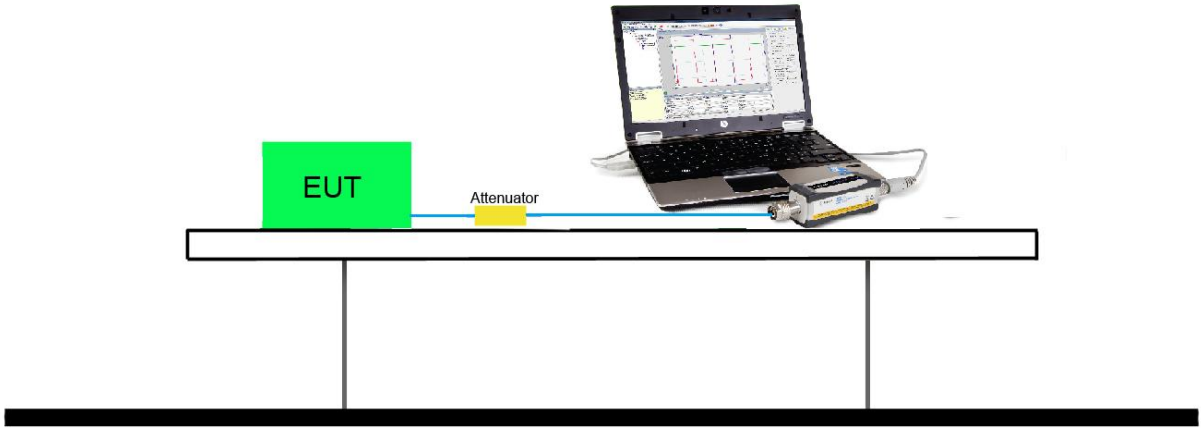
7.3.2. Test Procedure Used

KDB 789033 D01v01r03 - Section E) 3) b) Method PM-G

7.3.3. Test Setting

Average power measurements were perform only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

7.3.4. Test Setup



7.3.5. Test Result

Output power at various data rates for Chain 0:

Channel Bandwidth	Channel	Frequency (MHz)	Data Rate (Mbps)	RMS Power (dBm)
20MHz	60	5300	13.0	0.83
			78.0	0.37
			130.0	0.12
40MHz	62	5310	27.0	2.33
			162.0	1.59
			270.0	1.71

Channel Bandwidth	N_{Tx}	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Chain 0 Average Power (dBm)	Chain 1 Average Power (dBm)	Total Average Power (dBm)	Limit (dBm)	E.I.R.P (dBm)	E.I.R.P Limit (dBm)	Result
20MHz	2	13.0	52	5260	-0.17	-1.42	2.26	≤ 6.48	25.76	≤ 29.48	Pass
20MHz	2	13.0	60	5300	0.83	0.17	3.52	≤ 6.48	27.02	≤ 29.48	Pass
20MHz	2	13.0	64	5320	0.84	0.47	3.67	≤ 6.48	27.17	≤ 29.48	Pass
20MHz	2	13.0	100	5500	0.99	0.32	3.68	≤ 6.48	27.18	≤ 29.48	Pass
20MHz	2	13.0	116	5580	-0.32	0.44	3.09	≤ 6.48	26.59	≤ 29.48	Pass
20MHz	2	13.0	140	5700	0.45	0.28	3.38	≤ 6.48	26.88	≤ 29.48	Pass
40MHz	2	27.0	54	5270	2.93	1.58	5.32	≤ 6.48	28.82	≤ 30	Pass
40MHz	2	27.0	62	5310	2.33	1.61	5.00	≤ 6.48	28.50	≤ 30	Pass
40MHz	2	27.0	102	5510	1.95	2.08	5.03	≤ 6.48	28.53	≤ 30	Pass
40MHz	2	27.0	110	5550	2.27	2.57	5.43	≤ 6.48	28.93	≤ 30	Pass
40MHz	2	27.0	134	5670	2.46	2.78	5.63	≤ 6.48	29.13	≤ 30	Pass

Note: E.I.R.P = Average Power + Correlated Gain.

7.4. Transmit Power Control *§15.407 (h)(1); RSS-210 [A9.2]*

7.4.1. Test Limit

The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm.

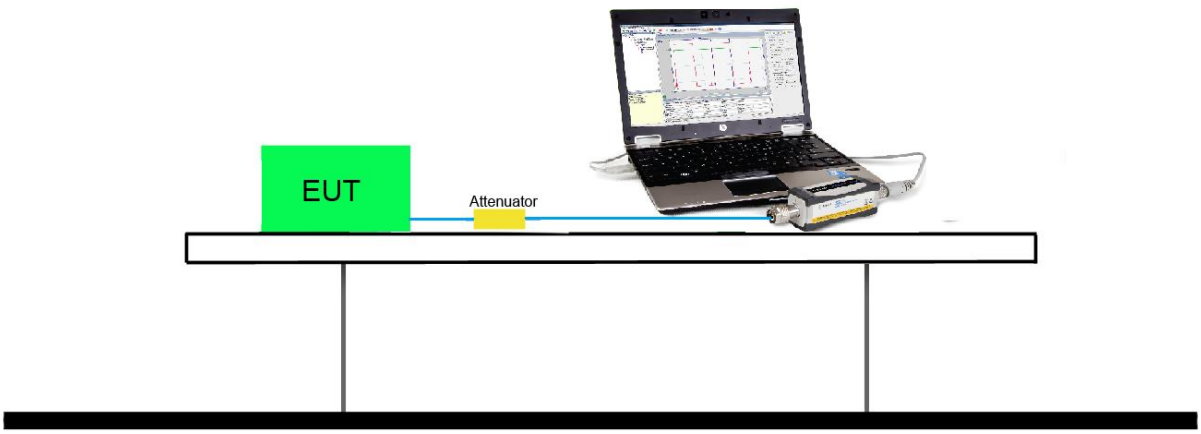
7.4.2. Test Procedure Used

KDB 789033 D01v01r03 - Section E) 3) b) Method PM-G

7.4.3. Test Setting

Average power measurements were perform only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The power meter implemented triggering and gating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter. The trace was averaged over 100 traces to obtain the final measured average power.

7.4.4. Test Setup



7.4.5. Test Result

Channel Bandwidth	N_{Tx}	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Chain 0 Average Power (dBm)	Chain 1 Average Power (dBm)	Total Average Power (dBm)	E.I.R.P (dBm)	E.I.R.P Limit (dBm)	Result
20MHz	2	13.0	52	5260	-5.82	-7.12	-3.41	20.09	≤ 24.00	Pass
20MHz	2	13.0	60	5300	-4.97	-5.83	-2.37	21.13	≤ 24.00	Pass
20MHz	2	13.0	64	5320	-5.14	-5.70	-2.40	21.10	≤ 24.00	Pass
20MHz	2	13.0	100	5500	-4.98	-5.38	-2.17	21.33	≤ 24.00	Pass
20MHz	2	13.0	116	5580	-5.56	-5.00	-2.26	21.24	≤ 24.00	Pass
20MHz	2	13.0	140	5700	-5.06	-5.58	-2.30	21.20	≤ 24.00	Pass
40MHz	2	27.0	54	5270	-3.54	-4.83	-1.13	22.37	≤ 24.00	Pass
40MHz	2	27.0	62	5310	-4.02	-4.79	-1.38	22.12	≤ 24.00	Pass
40MHz	2	27.0	102	5510	-4.09	-4.10	-1.08	22.42	≤ 24.00	Pass
40MHz	2	27.0	110	5550	-3.83	-4.09	-0.95	22.55	≤ 24.00	Pass
40MHz	2	27.0	134	5670	-3.90	-4.04	-0.96	22.54	≤ 24.00	Pass

Note: E.I.R.P = Average Power + Correlated Gain.

7.5. Power Spectral Density Measurement *§15.407 (a)(2),(5) / RSS-210 [A9.2]*

7.5.1. Test Limit

For FCC:

In the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum permissible power spectral density is 11dBm/MHz.

If transmitting antennas of directional gain greater than 6dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

5.25-5.35 GHz and 5.47-5.725 GHz: Limit (dBm/MHz) = -6.5dBm/MHz

For IC:

In the 5.25-5.35GHz, 5.47-5.6GHz and 5.65-5.725GHz bands, the power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

5.25-5.35GHz, 5.47-5.6GHz and 5.65-5.725GHz: Limit (dBm/MHz) = 11dBm/MHz

7.5.2. Test Procedure Used

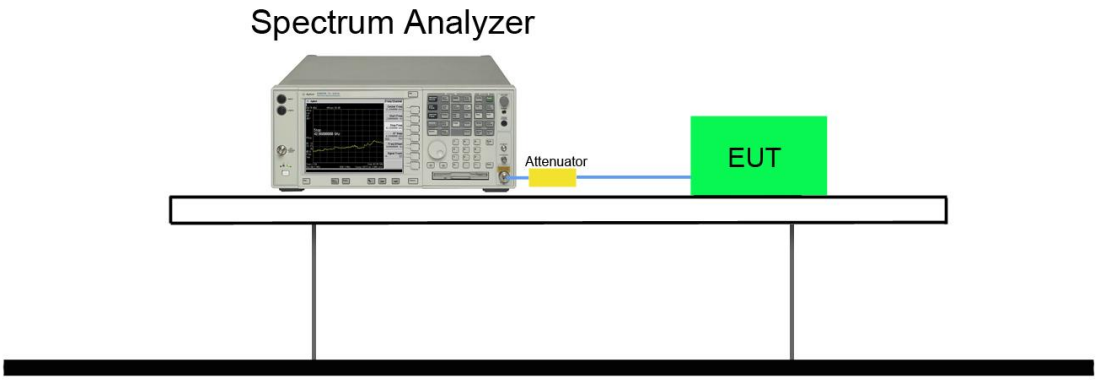
KDB 789033 D01v01r03 - Section F

7.5.3. Test Setting

1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire 26dB EBW of the signal.
3. RBW = 1MHz
4. VBW = 3MHz
5. Number of sweep points ≥ 2 × (span / RBW)
6. Detector = power averaging (RMS)
7. Sweep time = auto
8. Perform a single sweep.
9. Compute power by integrating the spectrum across the 26 dB EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the 26 dB EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

10. Add 10*log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10*log(1/0.25) = 6 dB if the duty cycle is 25 percent.

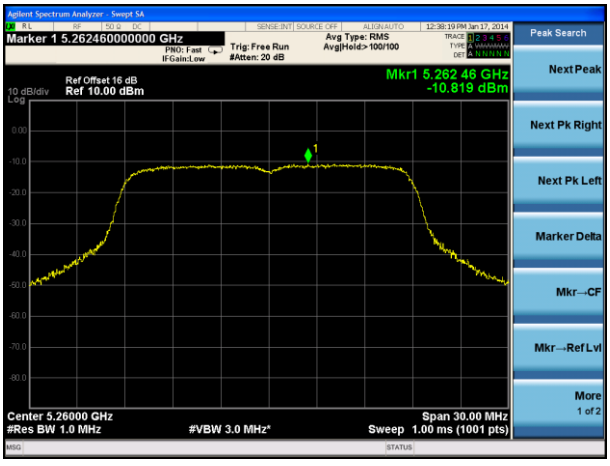
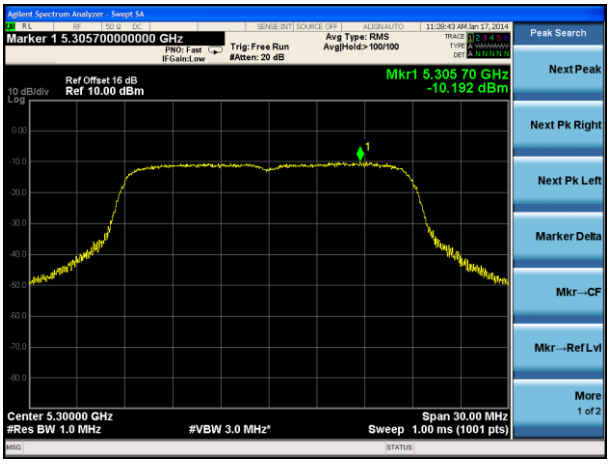
7.5.4. Test Setup

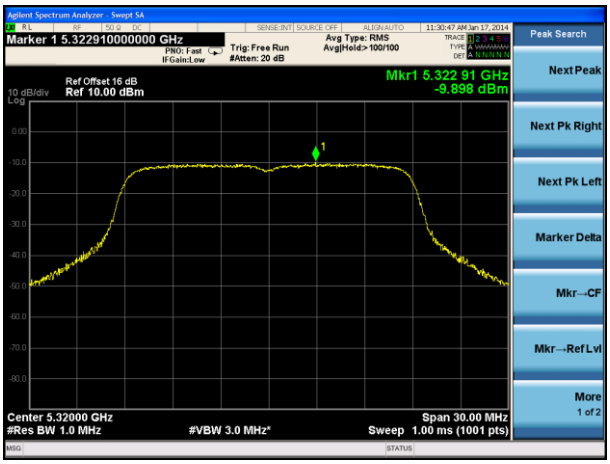
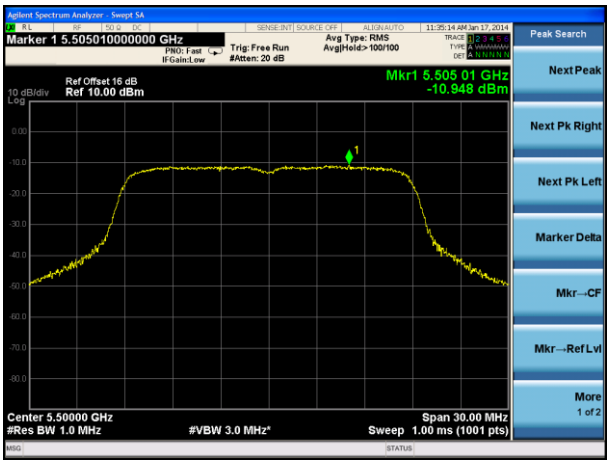
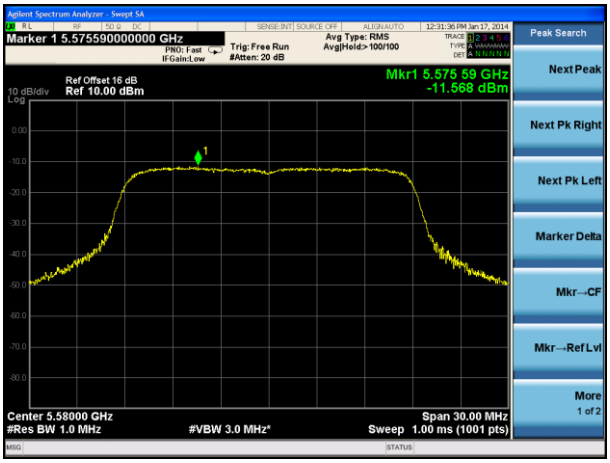
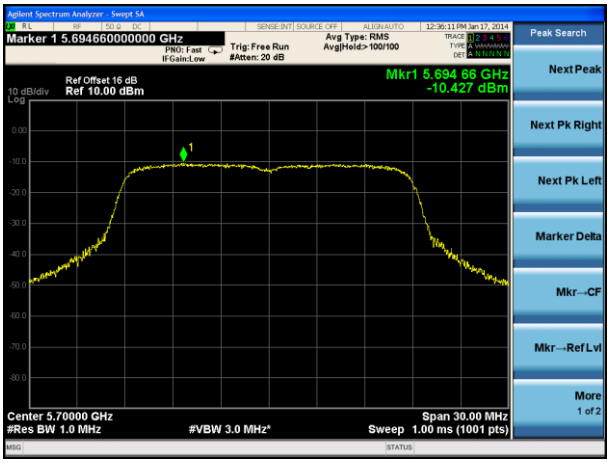


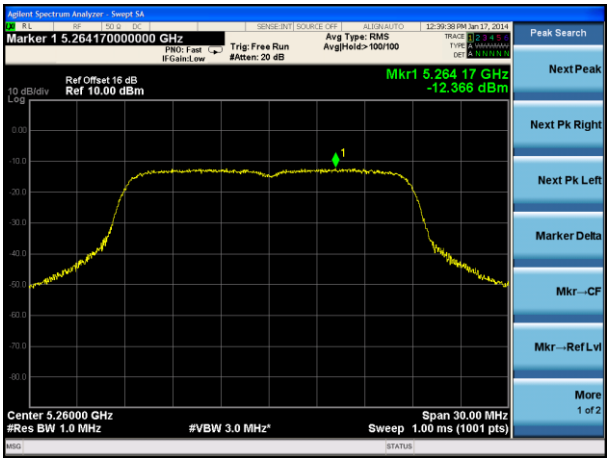
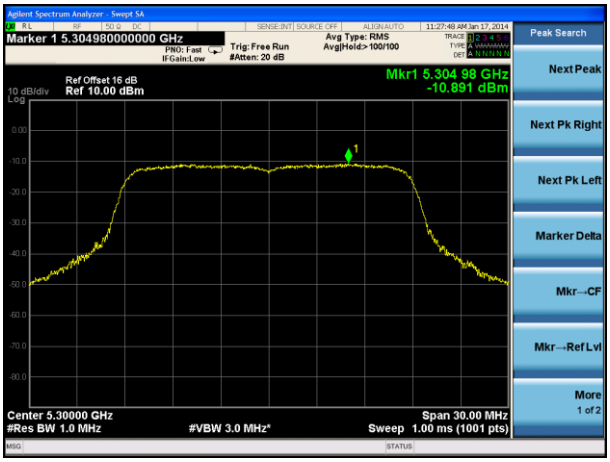
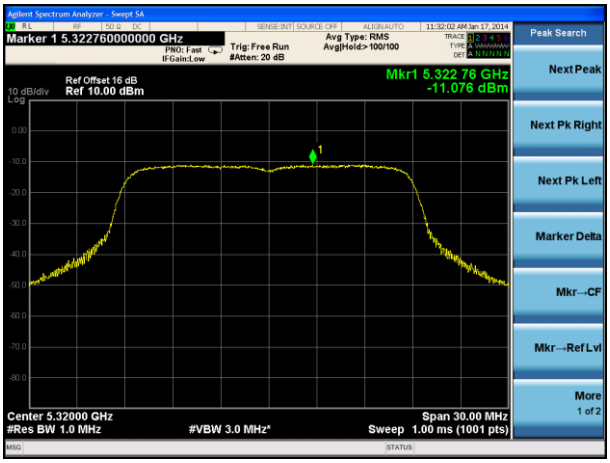
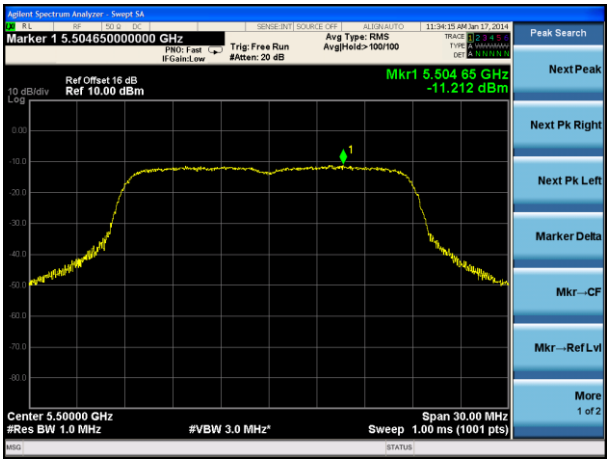
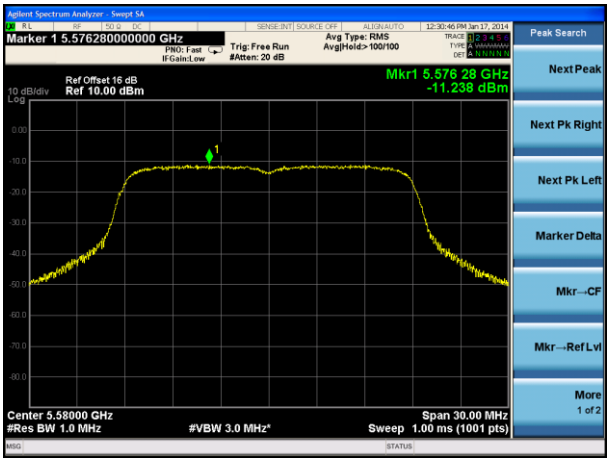
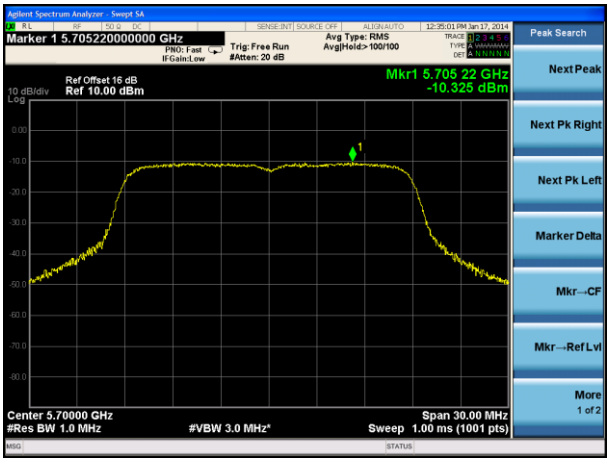
7.5.5. Test Result

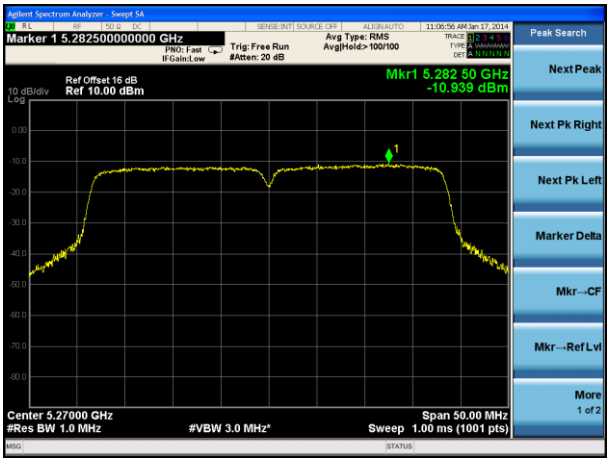
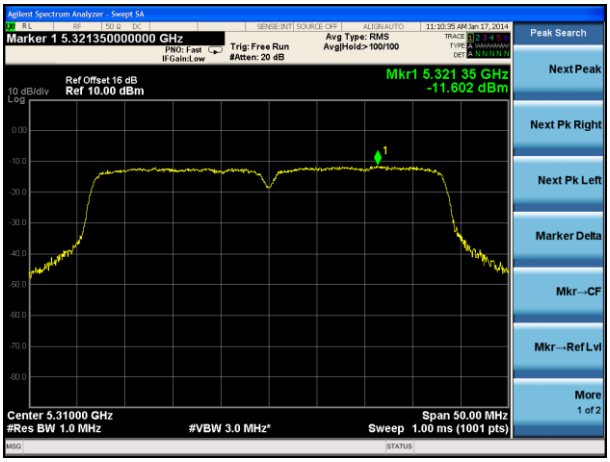
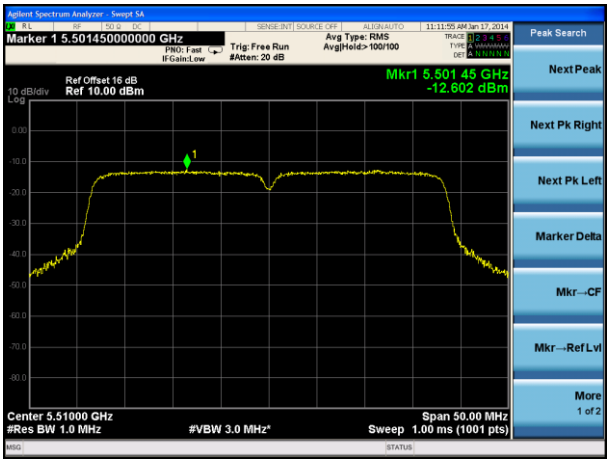
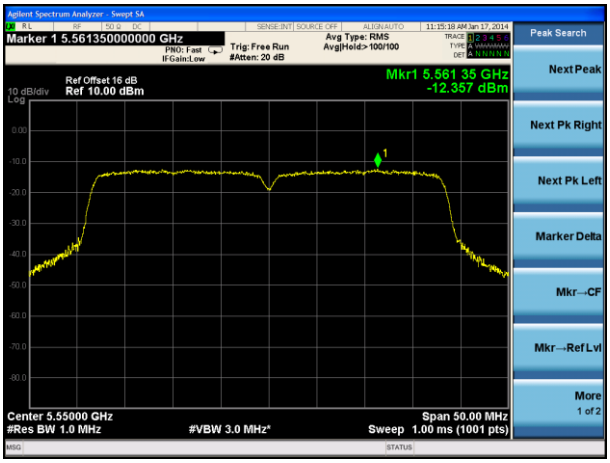
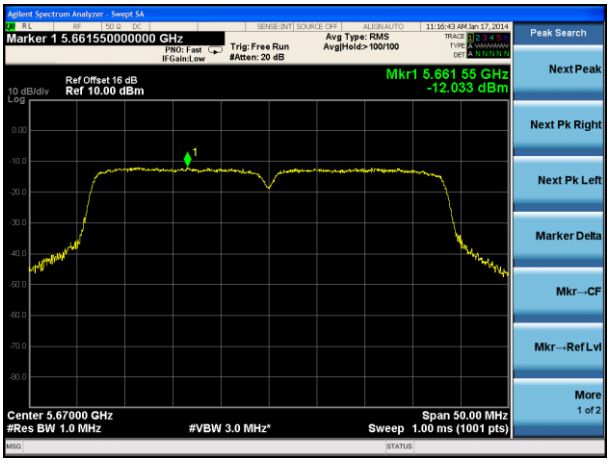
Channel Bandwidth	N_{Tx}	Data Rate (Mbps)	Channel No.	Freq. (MHz)	Chain 0 PSD (dBm)	Chain 1 PSD (dBm)	Duty Cycle (%)	Total PSD (dBm)	Limit (dBm /MHz)	Result
20MHz	2	13.0	52	5260	-10.819	-12.366	93.75	-8.233	≤ -6.5	Pass
20MHz	2	13.0	60	5300	-10.192	-10.891	93.75	-7.237	≤ -6.5	Pass
20MHz	2	13.0	64	5320	-9.898	-11.076	93.75	-7.157	≤ -6.5	Pass
20MHz	2	13.0	100	5500	-10.948	-11.212	93.75	-7.787	≤ -6.5	Pass
20MHz	2	13.0	116	5580	-11.568	-11.238	93.75	-8.109	≤ -6.5	Pass
20MHz	2	13.0	140	5700	-10.427	-10.325	93.75	-7.085	≤ -6.5	Pass
40MHz	2	27.0	54	5270	-10.939	-12.706	91.40	-8.332	≤ -6.5	Pass
40MHz	2	27.0	62	5310	-11.602	-12.598	91.40	-8.671	≤ -6.5	Pass
40MHz	2	27.0	102	5510	-12.602	-12.950	91.40	-9.372	≤ -6.5	Pass
40MHz	2	27.0	110	5550	-12.357	-12.143	91.40	-8.848	≤ -6.5	Pass
40MHz	2	27.0	134	5670	-12.033	-11.740	91.40	-8.483	≤ -6.5	Pass

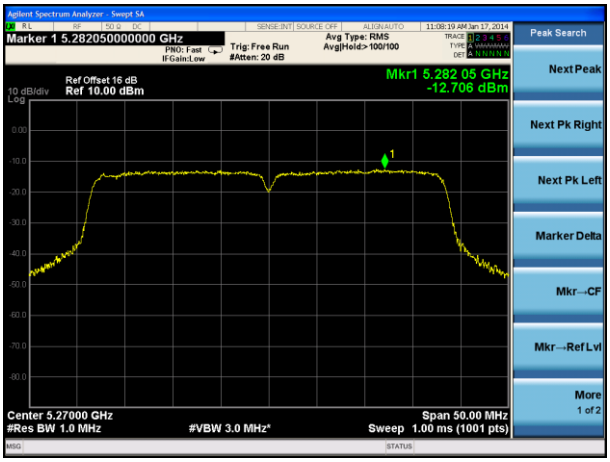
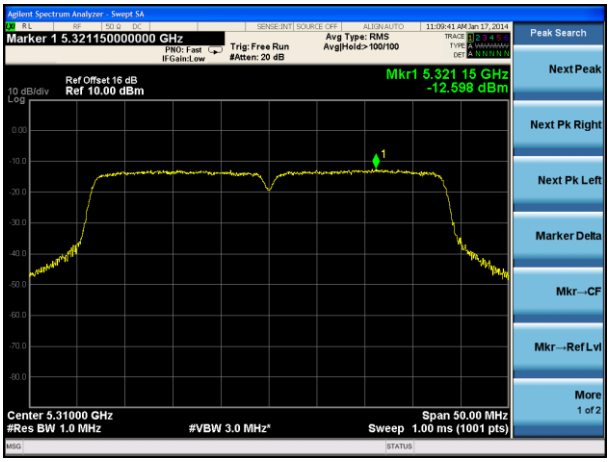
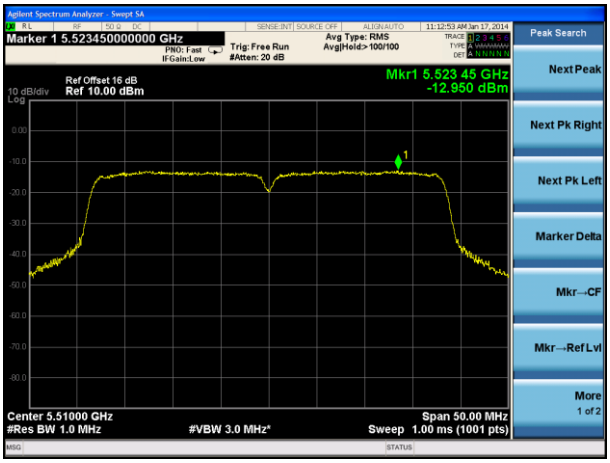
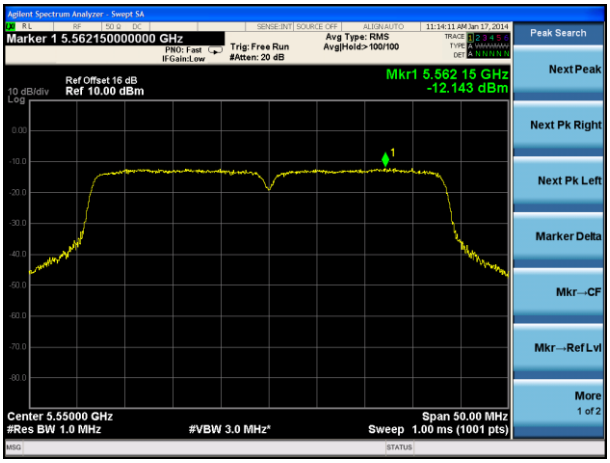
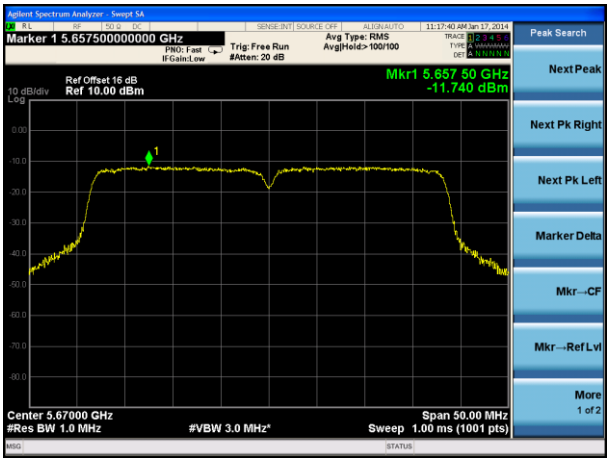
Note: When EUT duty cycle < 98%, the total PSD = $10*\log\{10^{(\text{Chain 0 PSD}/10)}+10^{(\text{Chain 1 PSD}/10)}\} + 10*\log(1/\text{duty cycle})$

20MHz Channel Bandwidth PSD - Chain 0	
Channel 52 (5260MHz)	Channel 60 (5300MHz)
	

Channel 64 (5320MHz)	Channel 100 (5500MHz)
	
Channel 116 (5580MHz)	**Channel 140 (5700MHz)**
	

20MHz Channel Bandwidth PSD - Chain 1	
Channel 52 (5260MHz)	**Channel 60 (5300MHz)**
	
Channel 64 (5320MHz)	**Channel 100 (5500MHz)**
	
Channel 116 (5580MHz)	**Channel 140 (5700MHz)**
	

40MHz Channel Bandwidth PSD - Chain 0	
Channel 54 (5270MHz)	**Channel 62 (5310MHz)**
	
Channel 102 (5510MHz)	**Channel 110 (5550MHz)**
	
Channel 134 (5670MHz)	
	

40MHz Channel Bandwidth PSD - Chain 1	
Channel 54 (5270MHz)	**Channel 62 (5310MHz)**
	
Channel 102 (5510MHz)	**Channel 110 (5550MHz)**
	
Channel 134 (5670MHz)	
	

7.6. Peak Excursion Ratio Measurement *§15.407(a)(6)*

7.6.1. Test Limit

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

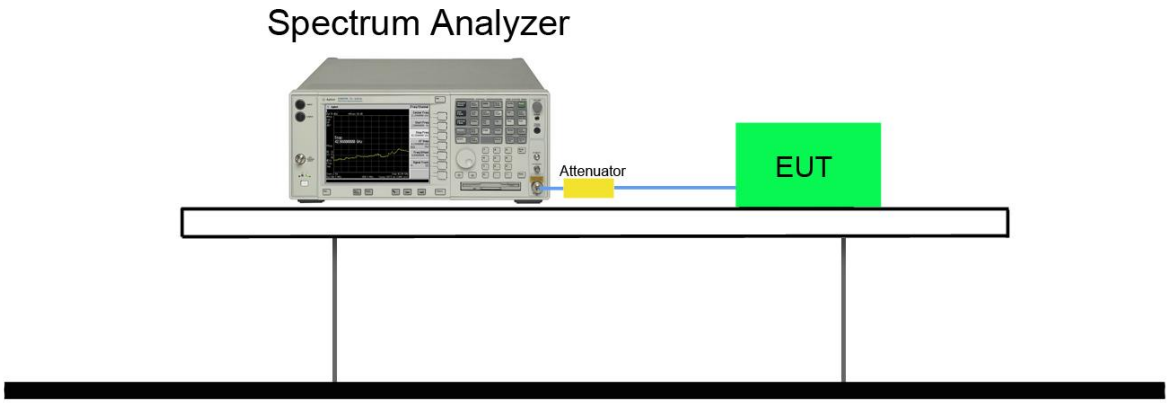
7.6.2. Test Procedure Used

KDB 789033 D01v01r03 – Section G

7.6.3. Test Setting

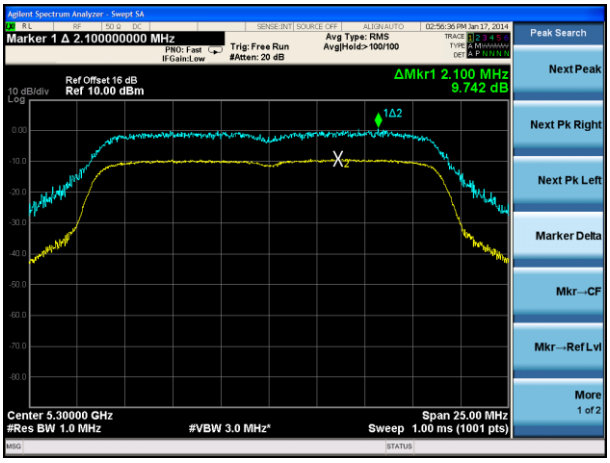
1. Analyzer was set to the center frequency of the UNII channel under investigation
2. Span was set to encompass the entire emission bandwidth of the signal
3. RBW = 1MHz
4. VBW = 3MHz
5. Detector = Peak
6. Trace mode = max hold
7. Trace was allowed to stabilize
8. The peak search function of the spectrum analyzer was used to find the peak of the spectrum. This level was compared to the peak power density level found from the previous section to determine the peak excursion.

7.6.4. Test Setup



7.6.5. Test Result

Channel Bandwidth	Data Rate (Mbps)	Channel No.	Frequency (MHz)	Peak Excursion Ratio (dB)	Max. Permissible Peak Excursion Ratio (dB)	Result
20MHz	13.0	60	5300	9.742	13	Pass
40MHz	27.0	62	5310	9.269	13	Pass

Peak Excursion	
20MHz Channel Bandwidth Channel 60 (5300MHz)	**40MHz Channel Bandwidth Channel 62 (5310MHz)**
	

7.7. Frequency Stability Measurement *§15.407(g)*

7.7.1. Test Limit

Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

7.7.2. Test Procedure Used

Frequency Stability Under Temperature Variations:

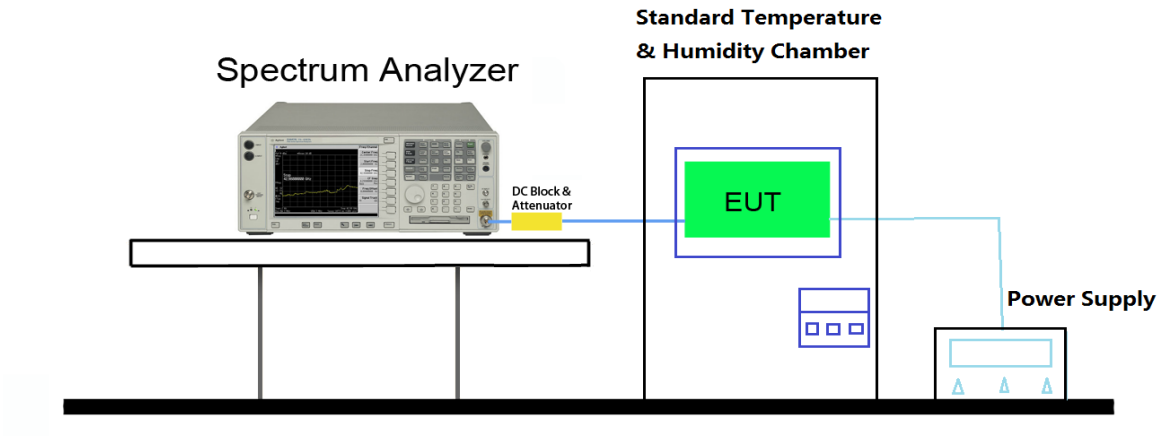
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to highest. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C decreased per stage until the lowest temperature reached.

Frequency Stability Under Voltage Variations:

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, record the maximum frequency change.

7.7.3. Test Setup



7.7.4. Test Result

Channel Bandwidth:	20MHz	Test Site:	TR3
Test Channel:	60	Test Engineer:	Roy Cheng
Remark:	5300MHz		

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100%	48	+ 20 (Ref)	5299989311.548	-10688.452	-0.00000202
100%		- 40	5300003529.190	3529.190	0.00000067
100%		- 30	5300024994.822	24994.822	0.00000472
100%		- 20	5300024721.763	24721.763	0.00000466
100%		- 10	5300017535.292	17535.292	0.00000331
100%		0	5300012409.178	12409.178	0.00000234
100%		+ 10	5299998232.971	-1767.029	-0.00000033
100%		+ 20	5299989311.548	-10688.452	-0.00000202
100%		+ 30	5300012698.512	12698.512	0.00000240
100%		+ 40	5299997504.301	-2495.699	-0.00000047
100%		+ 50	5299986400.916	-13599.084	-0.00000257
100%		+ 60	5299985009.286	-14990.714	-0.00000283
100%		+ 65	5299987975.052	-12024.948	-0.00000227
115%	55.2	+ 20	5299987449.329	-12550.671	-0.00000237
85%	40.8	+ 20	5299987279.624	-12720.376	-0.00000240

Channel Bandwidth:	40MHz	Test Site:	TR3
Test Channel:	62	Test Engineer:	Roy Cheng
Remark:	5310MHz		

Voltage (%)	Power (VDC)	Temp (°C)	Frequency (Hz)	Freq. Dev. (Hz)	Deviation (%)
100%	48	+ 20 (Ref)	5309984677.651	-15322.349	-0.00000289
100%		- 40	5310000184.586	184.586	0.00000003
100%		- 30	5310020126.951	20126.951	0.00000379
100%		- 20	5310020770.131	20770.131	0.00000391
100%		- 10	5310016241.552	16241.552	0.00000306
100%		0	5310008062.806	8062.806	0.00000152
100%		+ 10	5309994194.426	-5805.574	-0.00000109
100%		+ 20	5309984677.651	-15322.349	-0.00000289
100%		+ 30	5310009921.356	9921.356	0.00000187
100%		+ 40	5309996238.096	-3761.904	-0.00000071
100%		+ 50	5309976430.198	-23569.802	-0.00000444
100%		+ 60	5309980137.244	-19862.756	-0.00000374
100%		+ 65	5309981156.909	-18843.091	-0.00000355
115%	55.2	+ 20	5309983039.354	-16960.646	-0.00000319
85%	40.8	+ 20	5309981078.829	-18921.171	-0.00000356

7.8. Radiated Spurious Emission Measurement *§15.407(b)(6)§15.205§15.209;RSS-Gen [7.2.2]*

7.8.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [V/m]	Measured Distance [Meters]
0.009 – 0.490	2400/F (kHz)	300
0.490 – 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

7.8.2. Test Procedure Used

KDB 789033 D01v01r03 – Section H

7.8.3. Test Setting

Peak Measurements above 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Quasi-Peak Measurements below 1GHz

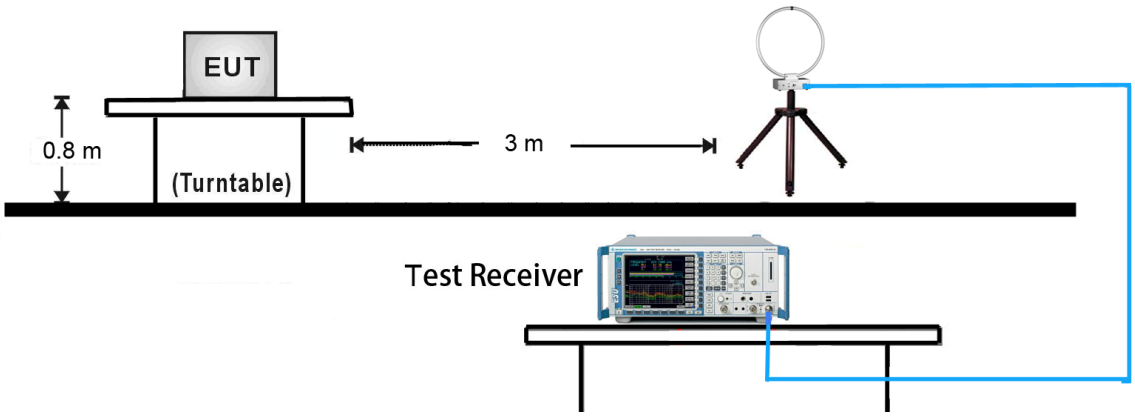
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Span was set greater than 1MHz
3. RBW = 120 kHz
4. Detector = CISPR quasi-peak
5. Sweep time = auto couple
6. Trace was allowed to stabilize

Average Measurements above 1GHz (Method AD)

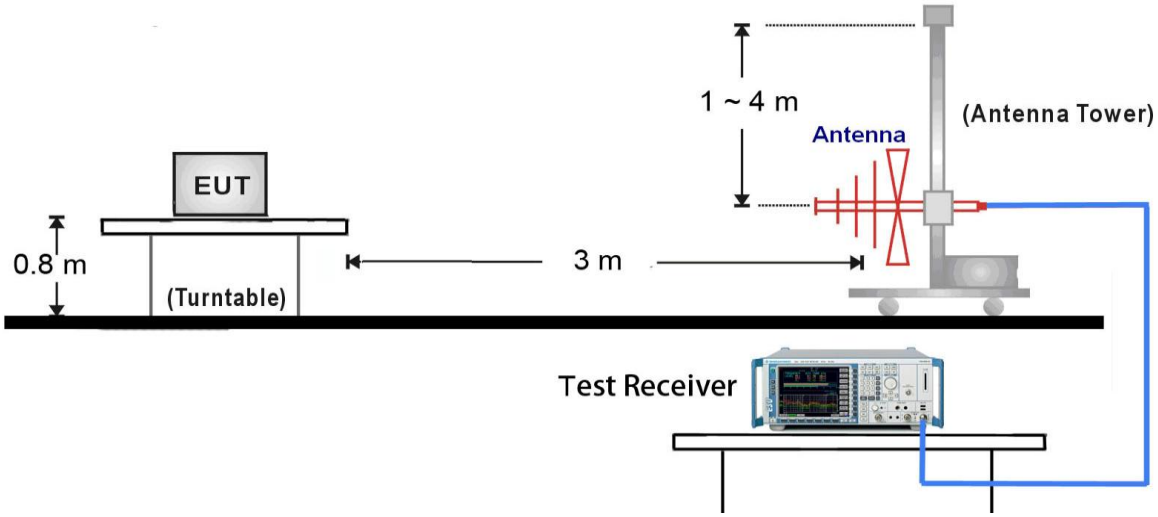
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = power average (RMS)
5. Number of measurement points = 1001 (Number of points must be > 2 x span/RBW)
6. Sweep time = auto
7. Trace was averaged over at 100 sweeps

7.8.4. Test Setup

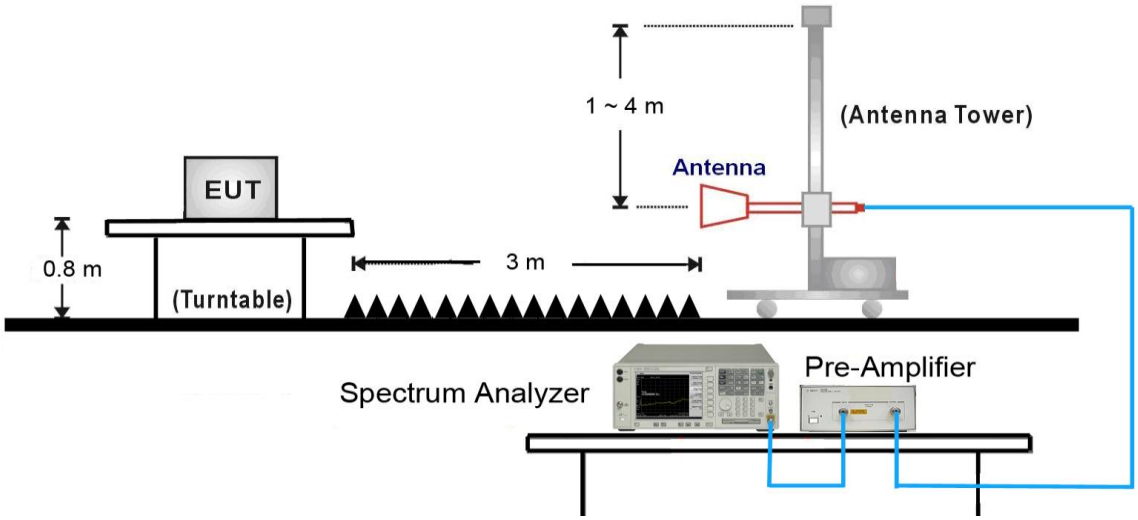
9kHz ~ 30MHz Test Setup:



30MHz ~ 1GHz Test Setup:



1GHz ~18GHz Test Setup:



18GHz ~40GHz Test Setup: