

ELECTROMAGNETIC EMISSION COMPLIANCE REPORT FOR LOW-POWER, NON-LICENSED TRANSMITTER

Test Report No. : W156R-D016
AGR No. : A155A-050
Applicant : LG Electronics USA
Address : 1000 Sylvan Avenue, Englewood Cliffs, New Jersey, United States, 7632
Manufacturer : LG Electronics Inc.
Address : 222 LG-ro, Jinwi-Myeon, Pyeongtaek-Si, Gyeonggi-Do, 451-713, Korea
Type of Equipment : WLAN Module
FCC ID. : BEJ9QK-TWFMB008D
Model Name : TWFM-B008D
Multiple Model Name : N/A
Serial number : N/A
Total page of Report : 115 pages (including this page)
Date of Incoming : May 08, 2015
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SUMMARY

The equipment complies with the regulation; *FCC PART 15 SUBPART E Section 15.407*
 This test report only contains the result of a single test of the sample supplied for the examination.
 It is not a generally valid assessment of the features of the respective products of the mass-production.

Reviewed by: 

 Jae-Ho, Lee / Chief Engineer
 ONETECH Corp.

Approved by: 

 Sung-Ik, Han/ Managing Director
 ONETECH Corp.

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
W156R-D016	June 16, 2015	Initial Issue	All

1. VERIFICATION OF COMPLIANCE

Applicant : LG Electronics USA
 Address : 1000 Sylvan Avenue, Englewood Cliffs, New Jersey, United States, 7632
 Contact Person : Yongduk Kwon / Research Engineer
 Telephone No. : +82-31-610-9606
 FCC ID : BEJ9QK-TWFMB008D
 Model Name : TWFM-B008D
 Serial Number : N/A
 Date : June 16, 2015

EQUIPMENT CLASS	Unlicensed National Information infrastructure(UNII)
E.U.T. DESCRIPTION	Modular Transmitter, WLAN Module
THIS REPORT CONCERNS	Class II Permissive Change
MEASUREMENT PROCEDURES	ANSI C63.10: 2013
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART E Section 15.407
Modifications on the Equipment to Achieve Compliance	None
Final Test was Conducted On	3 m, Semi Anechoic Chamber

-. The above equipment was tested by ONETECH Corp. for compliance with the requirement set forth in the FCC Rules and Regulations. This said equipment in the configuration described in this report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

2. TEST SUMMARY

2.1 Test items and results

SECTION	TEST ITEMS	RESULTS
15.407(a)	26 dB Bandwidth	PASS
15.407(e)	6 dB Bandwidth	PASS
15.407(a)	Maximum Conducted Output Power	Met the Limit / PASS
15.407(a)	Peak Power Spectral Density	Met the Limit / PASS
15.407(g)	Frequency Stability	Met the Limit / PASS
15.407(b)	Undesirable Emissions	Met the Limit / PASS
15.205, 15.407(b)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Met the Limit / PASS
15.207	AC Conducted Emissions 150 kHz-30 MHz	Met the Limit / PASS
15.407(h)	Dynamic frequency Selection	N/A(See the Note1)

Note 1: The test is not performed because ETU doesn't use the DFS band.

2.2 Additions, deviations, exclusions from standards

No additions, deviations or exclusions have been made from standard.

2.3 Related Submittal(s) / Grant(s)

Antennas are added. (NP8350 V3_B, NP8350 V3) / C2PC.

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in FCC PART 15 SUBPART E Section 15.407

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 a distance of 3 m from EUT to the antenna.

2.6 Test Facility

The Onetech Corp. has been designated to perform equipment testing in compliance with ISO/IEC 17025.

The Electromagnetic compatibility measurement facilities are located at 301-14, Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do, 464-862 Korea.

-. Site Filing:

VCCI (Voluntary Control Council for Interference) – Registration No. R-4112/ C-4617/ G-666/ T-1842 IC (Industry Canada) – Registration No. Site# 3736-3

-. Site Accreditation:

KOLAS (Korea Laboratory Accreditation Scheme) - Accreditation No. 85

FCC (Federal Communications Commission) - Accreditation No. KR0013

RRA (Radio Research Agency) – Designation No. KR0013

3. GENERAL INFORMATION

3.1 Product Description

The LG Electronics USA, Model TWFM-B008D (referred to as the EUT in this report) is a WLAN Module. Product specification information described herein was obtained from product data sheet or user’s manual.

DEVICE TYPE	WLAN Module		
FREQUENCY RANGE	5 150 MHz ~ 5 250 MHz Band	5 180 MHz ~ 5 240 MHz_20 MHz BW	
		5 190 MHz ~ 5 230 MHz_40 MHz BW	
	5 725 MHz ~ 5 850 MHz Band	5 745 MHz ~ 5 825 MHz_20 MHz BW	
		5 755 MHz ~ 5 795 MHz_40 MHz BW	
MAX. RF OUTPUT POWER	Ant.0	5 150 MHz ~ 5 250 MHz Band	Wi-Fi 802.11a (10.06 dBm) Wi-Fi 802.11n_20 MHz (10.58 dBm) Wi-Fi 802.11n_40 MHz (12.47 dBm)
		5 725 MHz ~ 5 850 MHz Band	Wi-Fi 802.11a (13.48 dBm) Wi-Fi 802.11n_20 MHz (14.13 dBm) Wi-Fi 802.11n_40 MHz (13.84 dBm)
	Ant.1	5 150 MHz ~ 5 250 MHz Band	Wi-Fi 802.11a (9.58 dBm) Wi-Fi 802.11n_20 MHz (9.44 dBm) Wi-Fi 802.11n_40 MHz (12.57 dBm)
		5 725 MHz ~ 5 850 MHz Band	Wi-Fi 802.11a (13.33 dBm) Wi-Fi 802.11n_20 MHz (14.78 dBm) Wi-Fi 802.11n_40 MHz (13.89 dBm)
MODULATION TYPE	802.11a/g/n(HT20)/n(HT40): OFDM Modulation(BPSK/QPSK/16QAM/64QAM)		
Antenna Gain	2.4 GHz Band	NP8350 V3_B : -0.79 dBi	
		NP8350 V3 : -1.08 dBi	
	5.15 GHz Band	NP8350 V3_B : 3.69 dBi	
		NP8350 V3 : 1.14 dBi	
	5.8 GHz Band	NP8350 V3_B : 2.88 dBi	
		NP8350 V3 : 2.04 dBi	
List of each Osc. or crystal Freq.(Freq. >= 1 MHz)	20 MHz		

3.2 Alternative type(s)/model(s); also covered by this test report.

-. None

4. EUT MODIFICATIONS

-. None

5. SYSTEM TEST CONFIGURATION

5.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	LG Electronics Inc.	TWFM-B008D	BEJ9QK-TWFMB008D

5.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	Description	Connected to
TWFM-B008D	LG Electronics Inc.	WLAN Module (EUT)	Notebook PC (2)
LGR 51	LG Electronics Inc.	Notebook PC (1)	
PA-1900-08	DONGGUANG LITE POWER 2ND PLANT	ADAPTER (1)	
Pavilion g6	HP	Notebook PC (2)	EUT
Series PPP009L-E	LITE-ON TECHNOLOGY CO, LTD.	ADAPTER (2)	
DIR-825	D-LINK	Router	Notebook PC (1)
LYD1201000	D-LINK	ADAPTER (3)	

5.3 Mode of operation during the test

For the testing, software used to control the EUT for staying in continuous transmitting mode is programmed.

The worse case data rate for each modulation is determined 9 Mbps(Ant.0) / 9 Mbps(Ant.1) for IEEE 802.11a, 26 Mbps(Ant.0) / 26 Mbps(Ant.1) for HT20, 13.5 Mbps(Ant.0) / 13.5 Mbps(Ant.1) for HT40.

- To get a maximum emission levels from the EUT, the EUT was moved throughout the XY, XZ, and YZ planes and the worst case is “XY” axis.

5.4 Configuration of Test System

Line Conducted Test: The EUT was connected to USB and the power of USB was connected to Notebook PC. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 meter open area test site. The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

5.5 Antenna Requirement

For intentional device, according to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Construction:

The transmitter antenna of the EUT is a PIFA antenna, so no consideration of replacement by the user.

6. PRELIMINARY TEST

6.1 AC Power line Conducted Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	-

6.2 General Radiated Emissions Tests

During Preliminary Test, the following operating mode was investigated.

Operation Mode	The Worse operating condition (Please check one only)
Transmitting Mode	X

7. MINIMUM BANDWIDTH

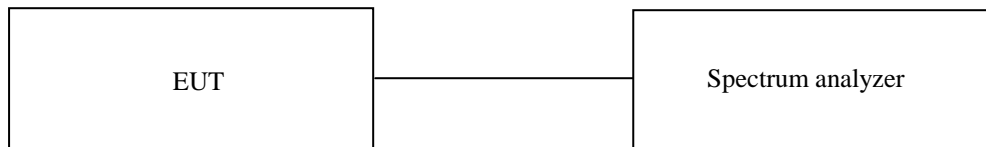
7.1 Operating environment

Temperature : 22 °C

Relative humidity : 49 % R.H.

7.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz, and peak detection was used. The 26 dB/6 dB bandwidth is defined as the total spectrum over which the power is higher than the peak power minus 26 dB/6 dB.



7.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 30, 2014 (1Y)

All test equipment used is calibrated on a regular basis.

7.4 Test data for 802.11a RLAN Mode

7.4.1 Test data for Antenna 0

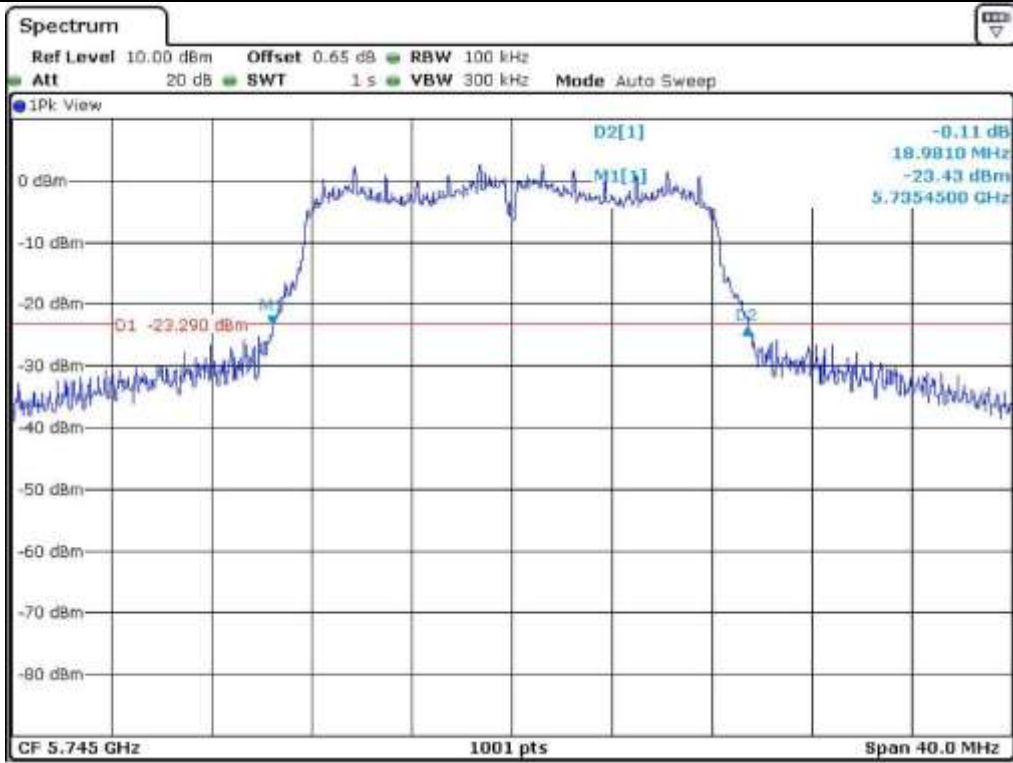
-. Test Date : May 26, 2015

-. Test Result : Pass

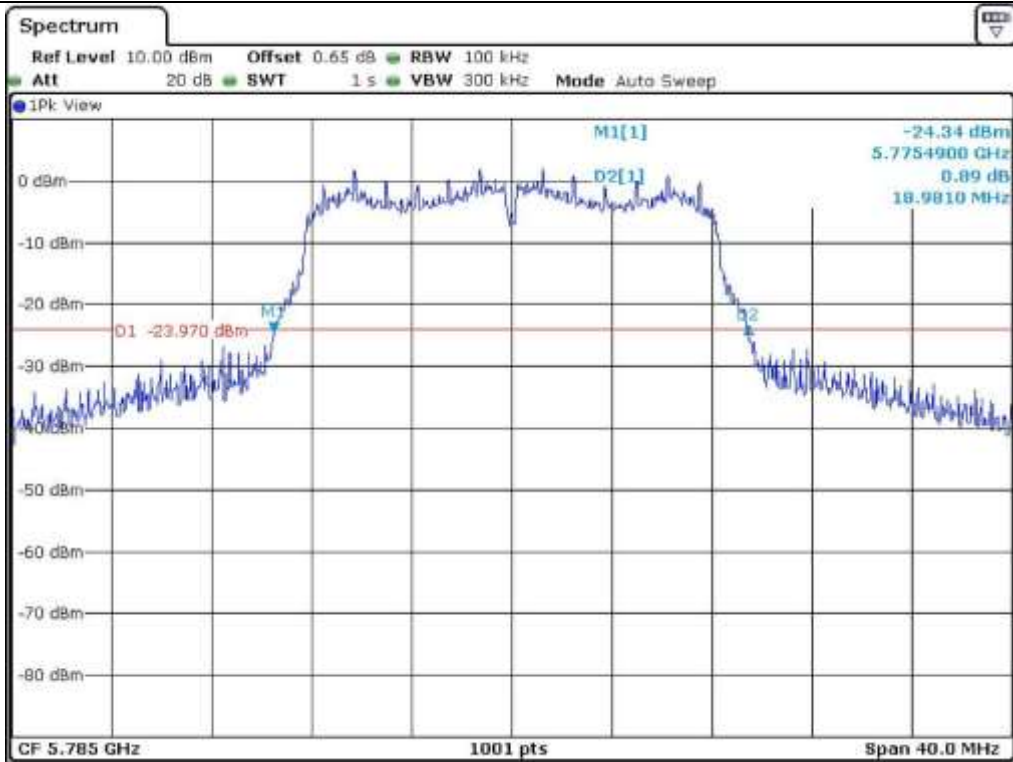
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 745	18.98
	Middle	5 785	18.98
	High	5 825	18.98
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 745	15.33
	Middle	5 785	15.33
	High	5 825	15.33



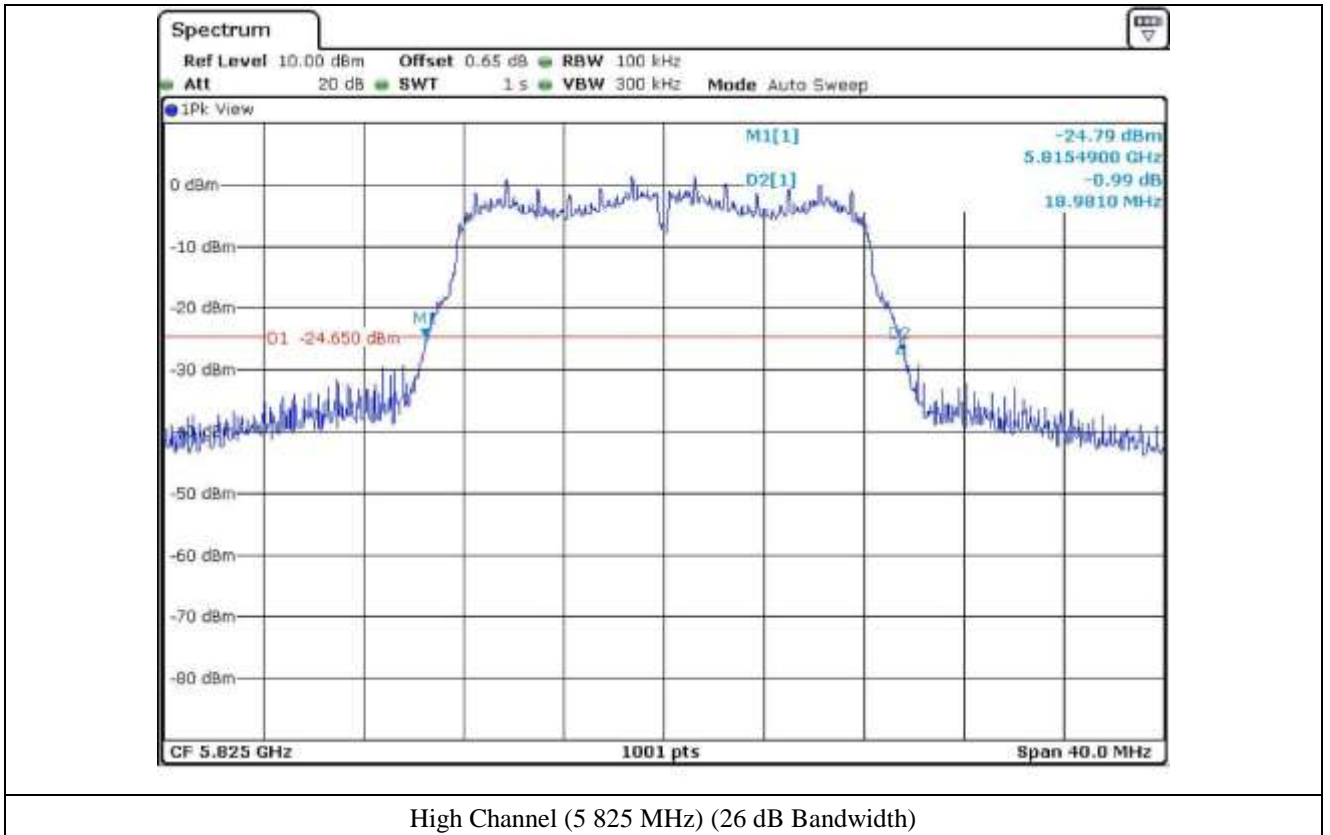
Tested by: Jun-Hui, Lee / Senior Engineer

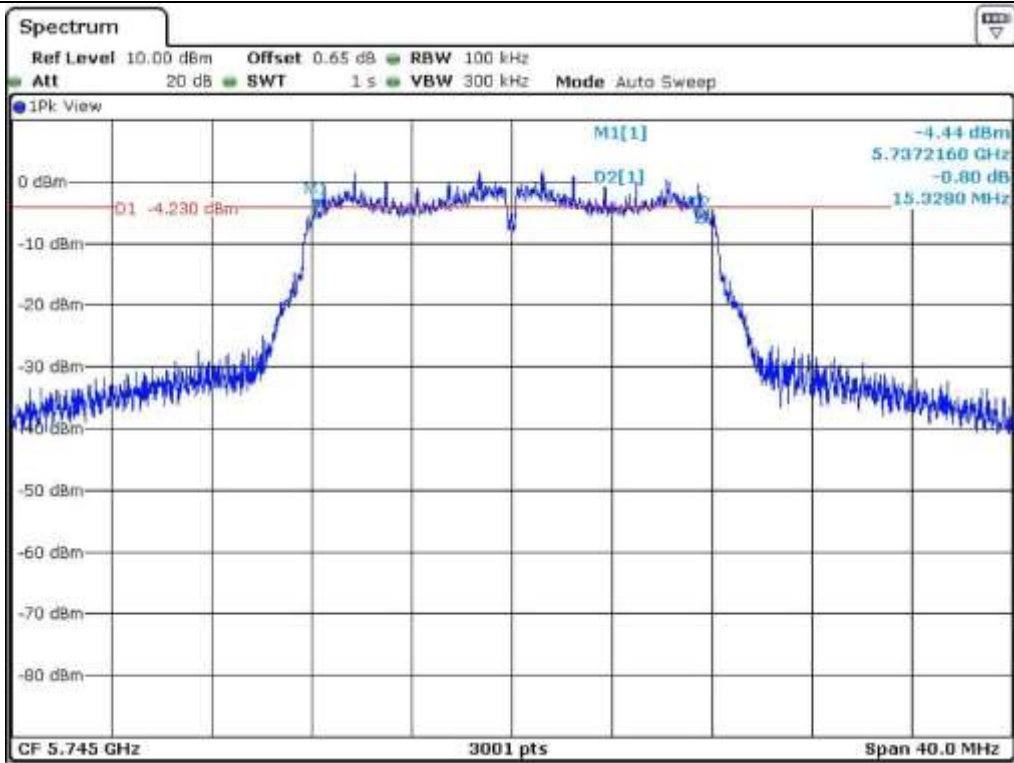


Low Channel (5.745 MHz) (26 dB Bandwidth)

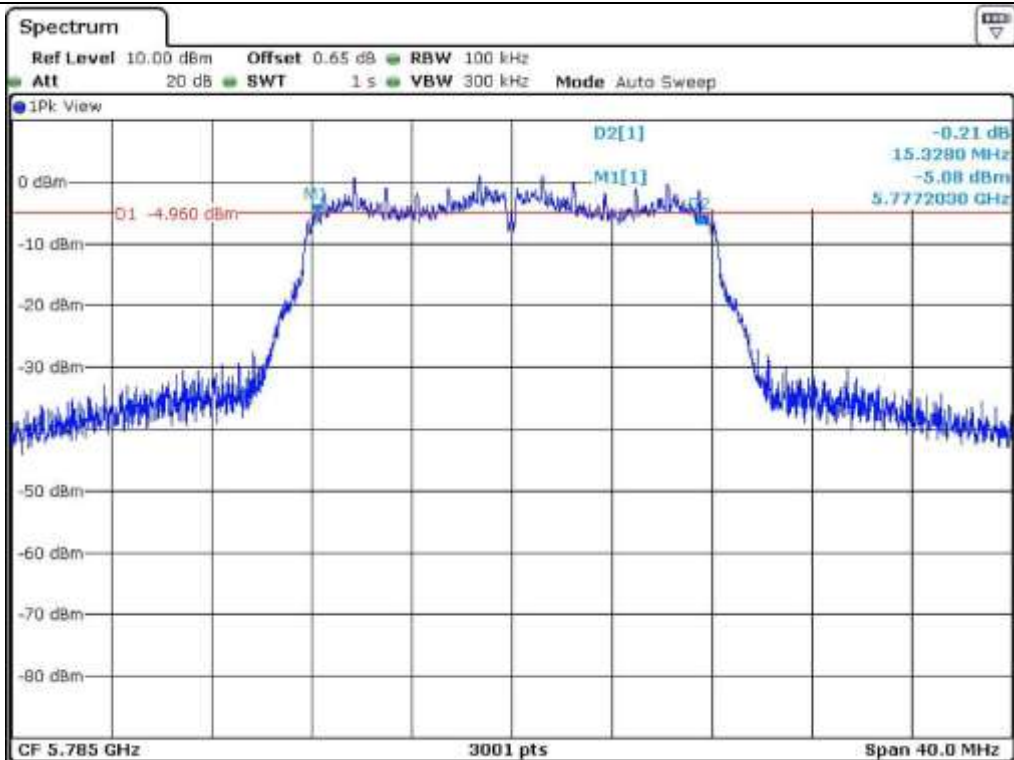


Middle Channel (5.785 MHz) (26 dB Bandwidth)

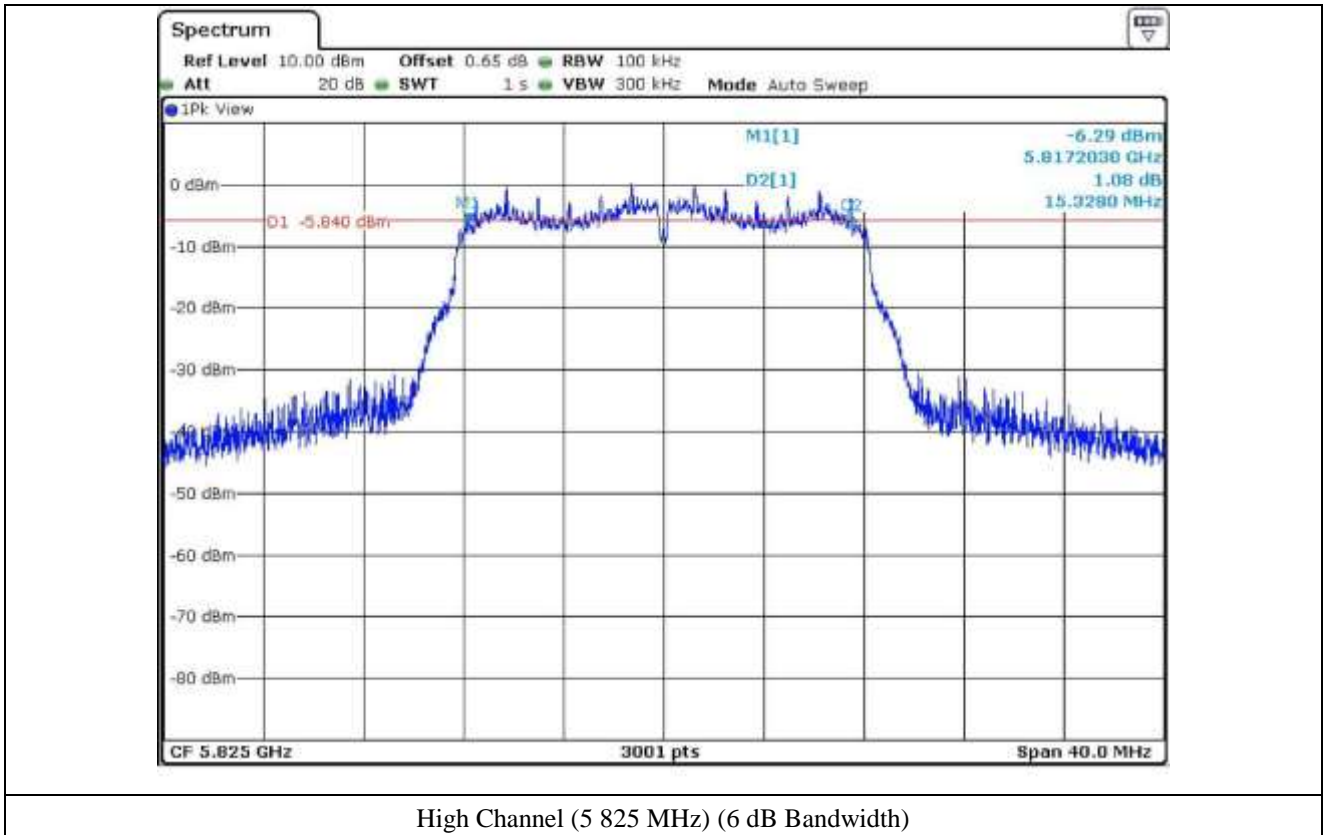




Low Channel (5.745 MHz) (6 dB Bandwidth)



Middle Channel (5.785 MHz) (6 dB Bandwidth)



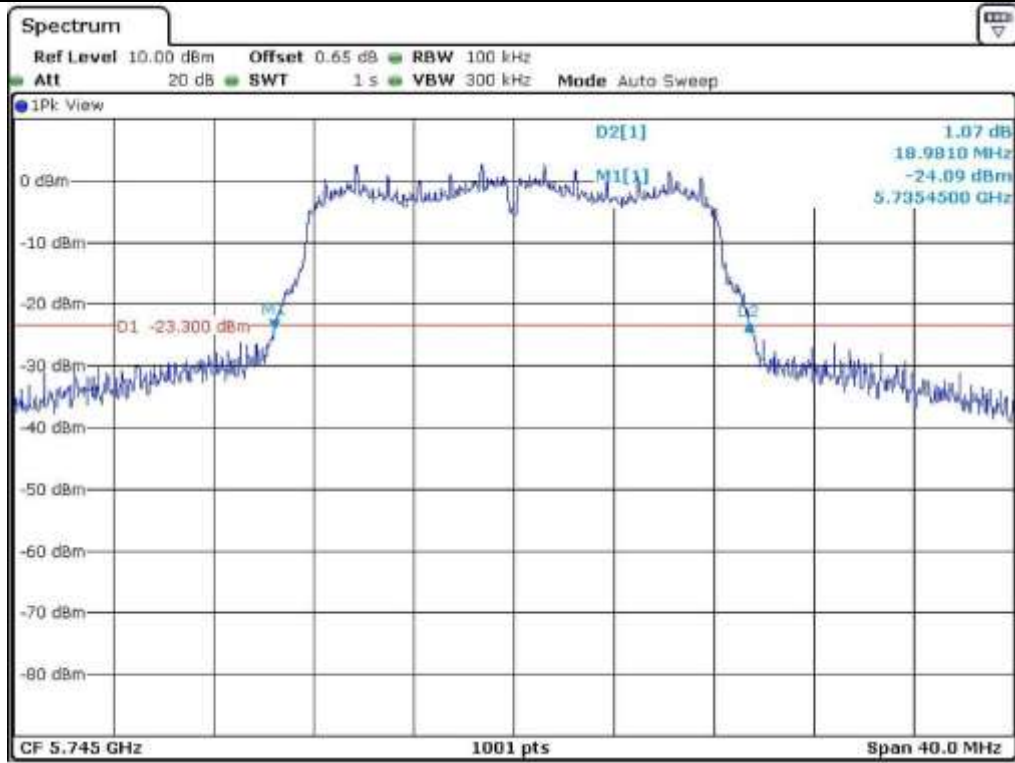
7.4.2 Test data for Antenna 1

- Test Date : May 26, 2015
 - Test Result : Pass

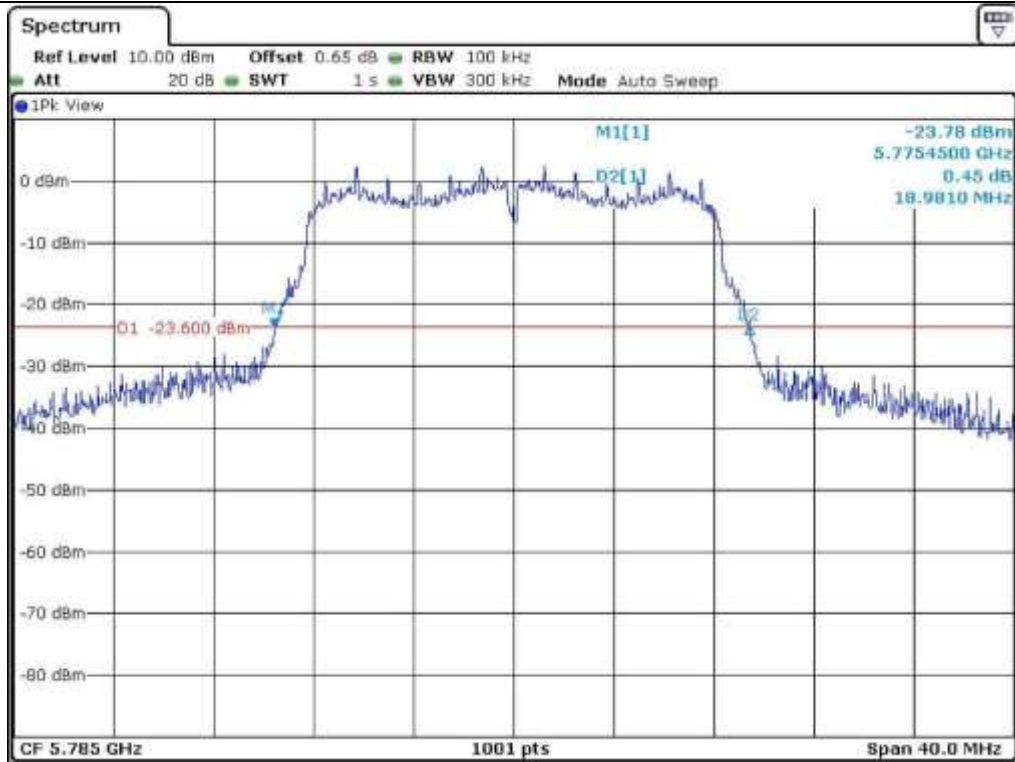
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 745	18.98
	Middle	5 785	18.98
	High	5 825	18.98
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 745	15.33
	Middle	5 785	15.33
	High	5 825	15.33



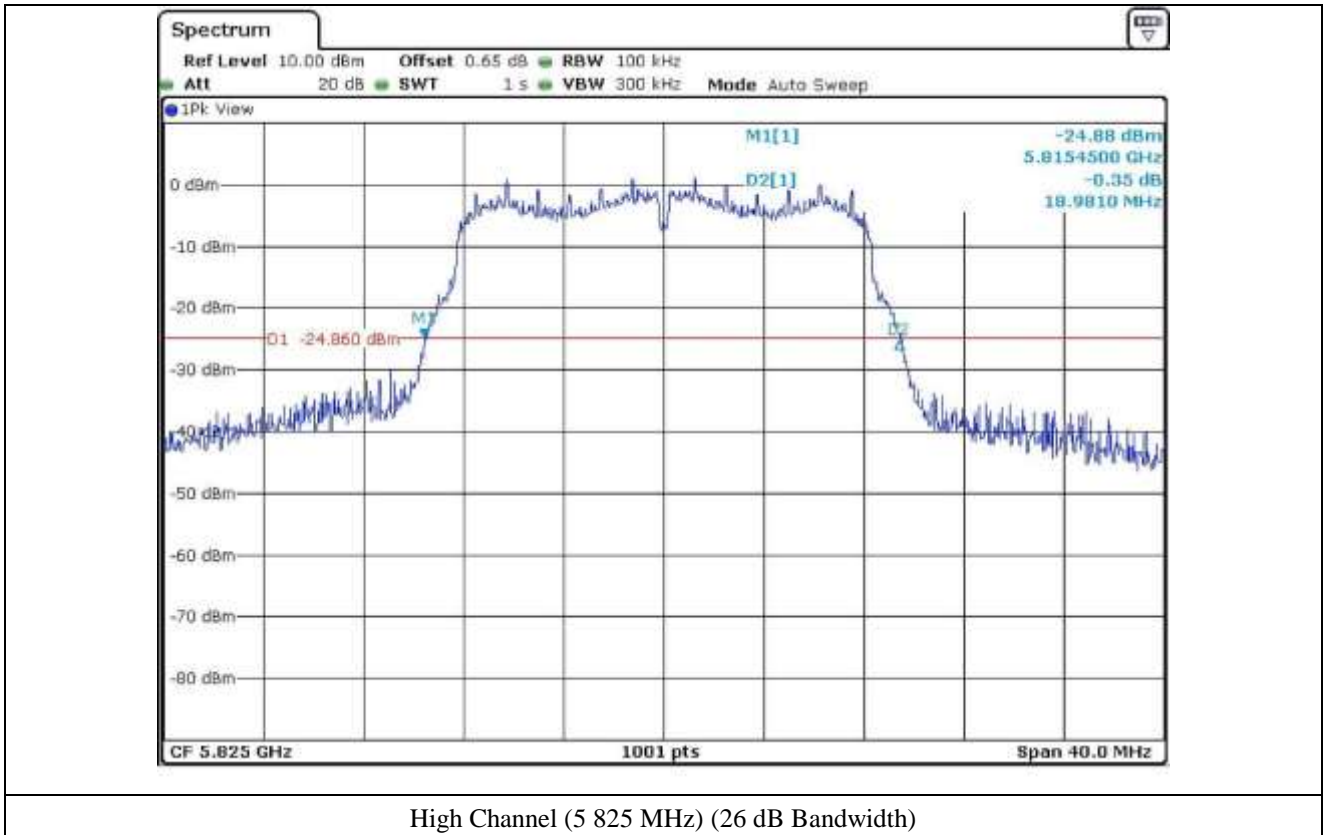
Tested by: Jun-Hui, Lee / Senior Engineer

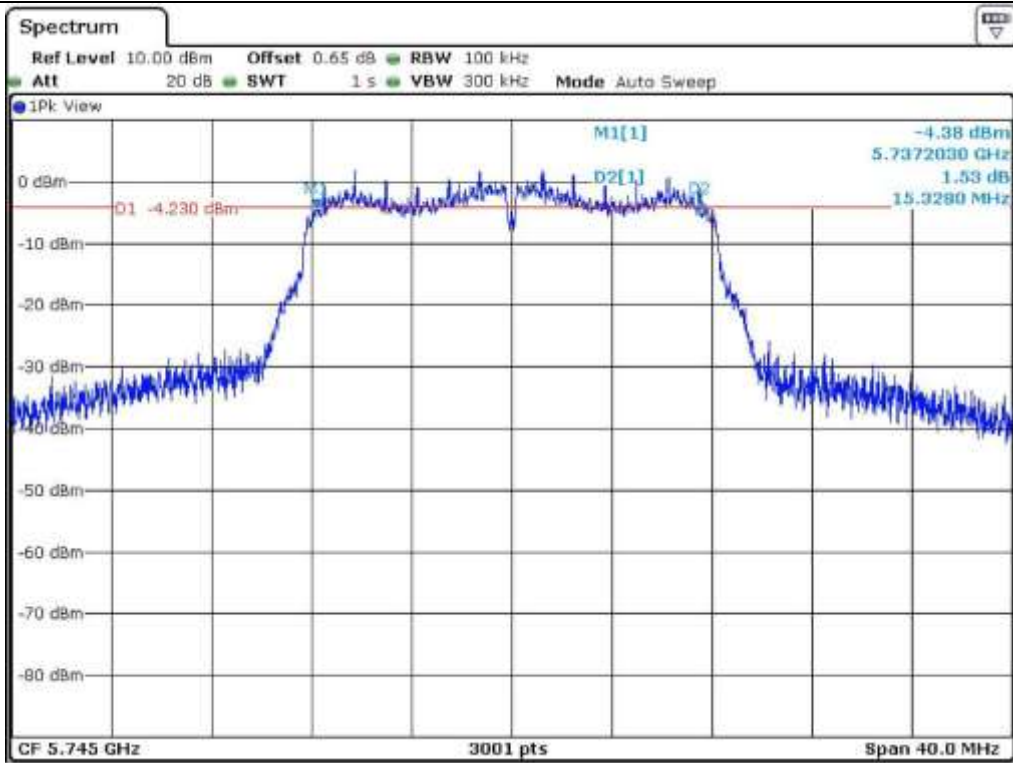


Low Channel (5 745 MHz) (26 dB Bandwidth)

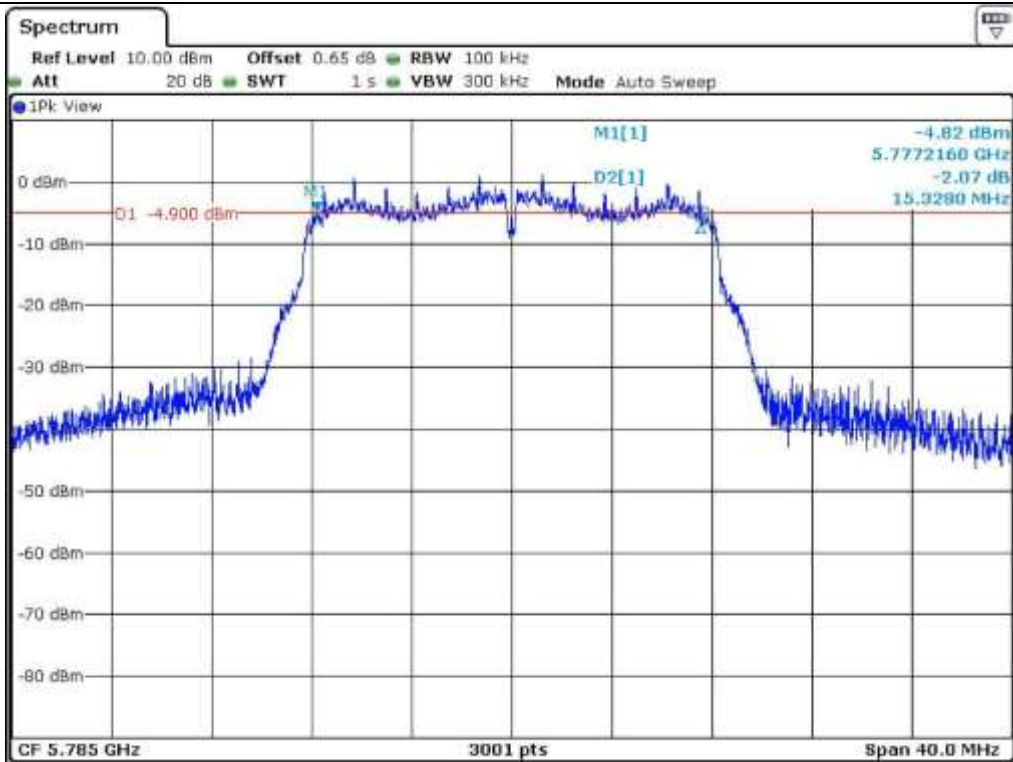


Middle Channel (5 785 MHz) (26 dB Bandwidth)

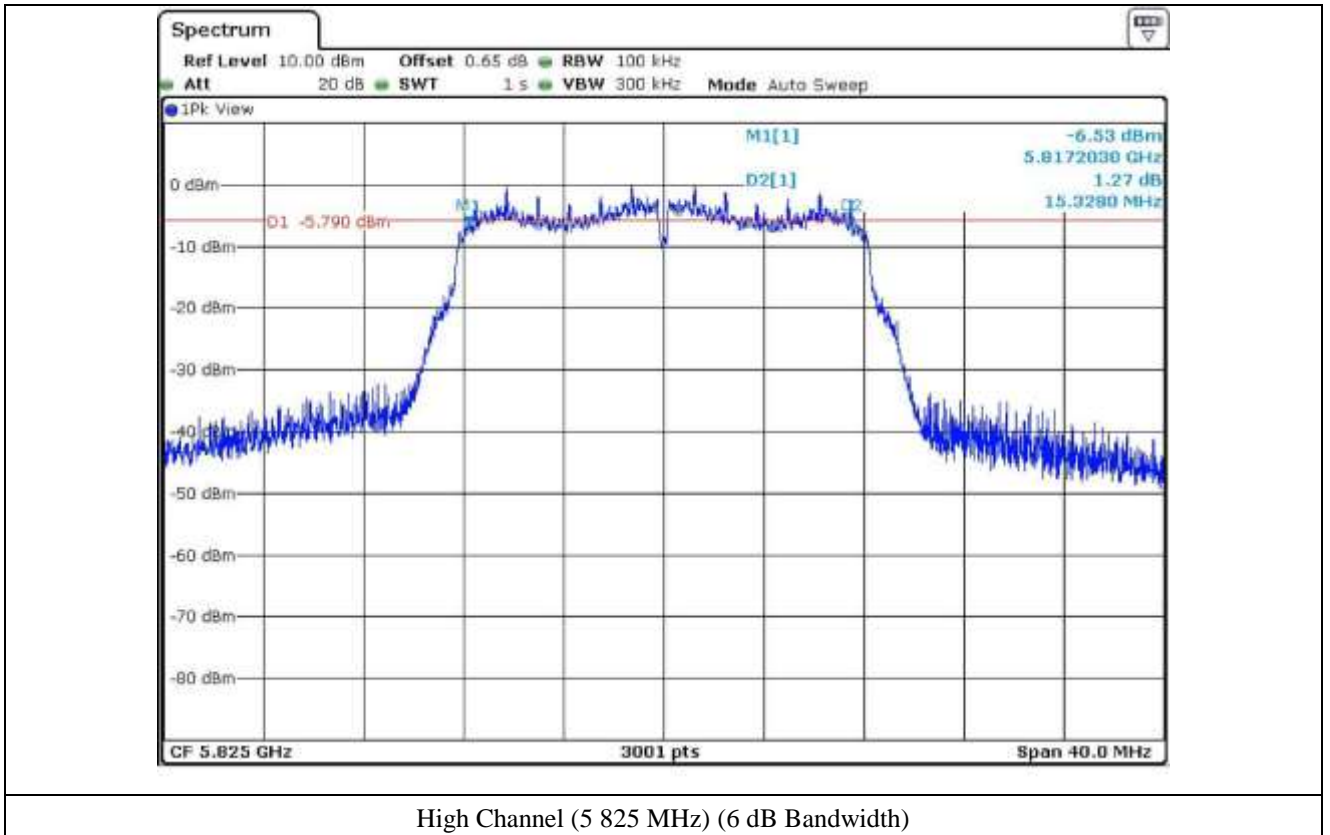




Low Channel (5.745 MHz) (6 dB Bandwidth)



Middle Channel (5.785 MHz) (6 dB Bandwidth)



7.5 Test data for 802.11n_HT20 RLAN Mode

7.5.1 Test data for Antenna 0

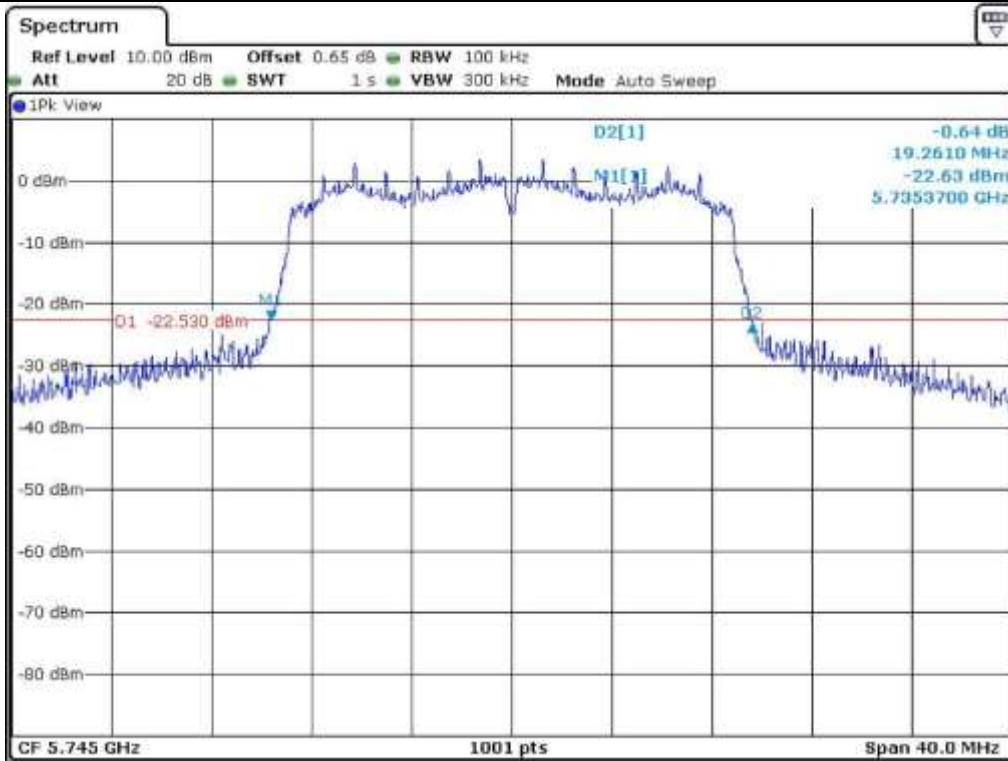
-. Test Date : May 26, 2015

-. Test Result : Pass

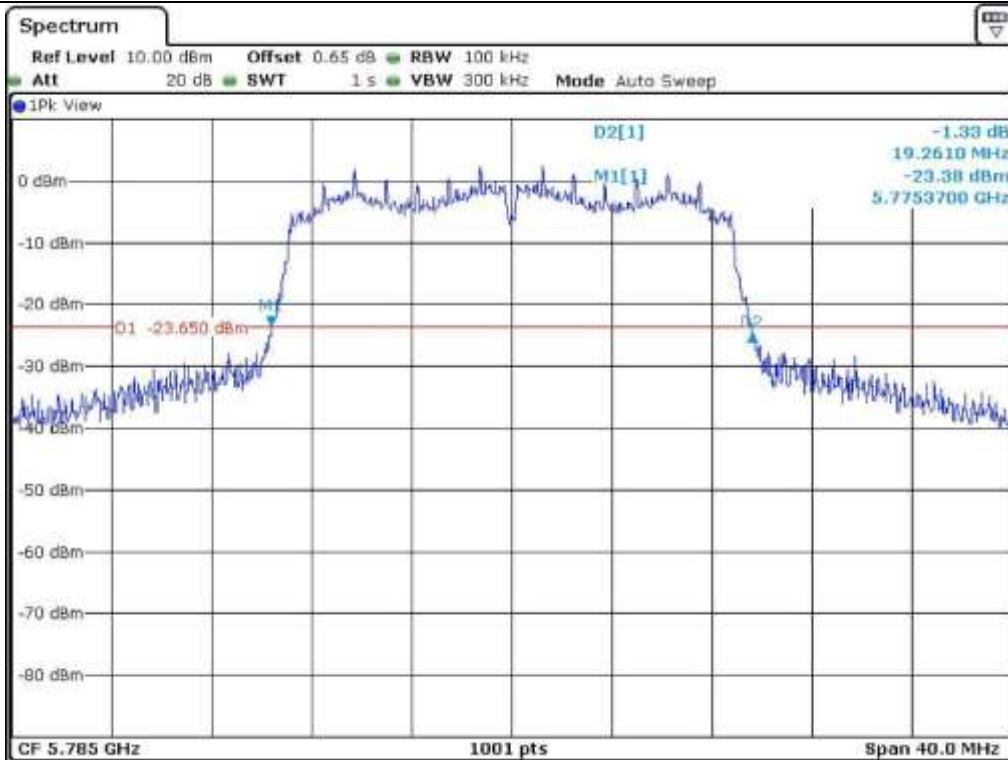
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 745	19.26
	Middle	5 785	19.26
	High	5 825	19.26
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 745	15.52
	Middle	5 785	15.52
	High	5 825	15.52



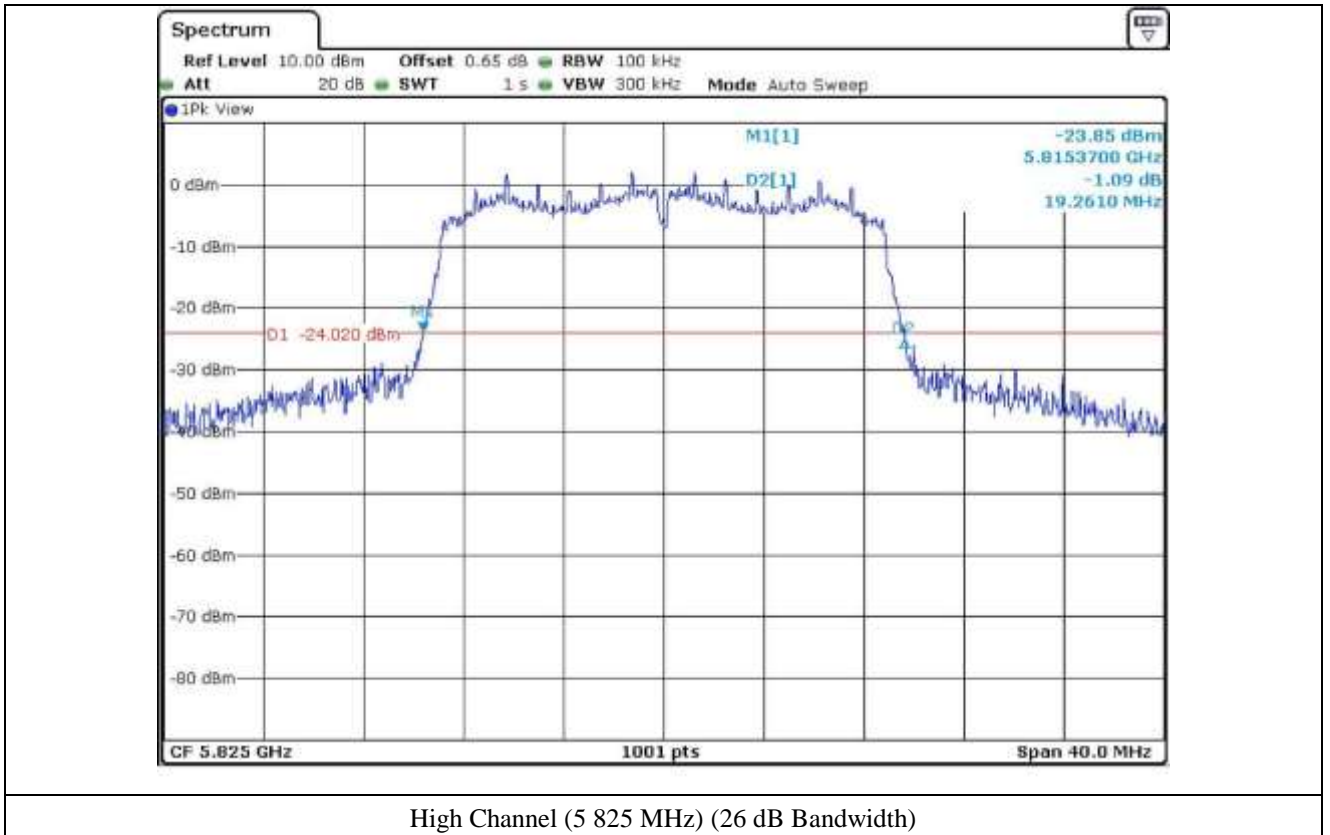
Tested by: Jun-Hui, Lee / Senior Engineer

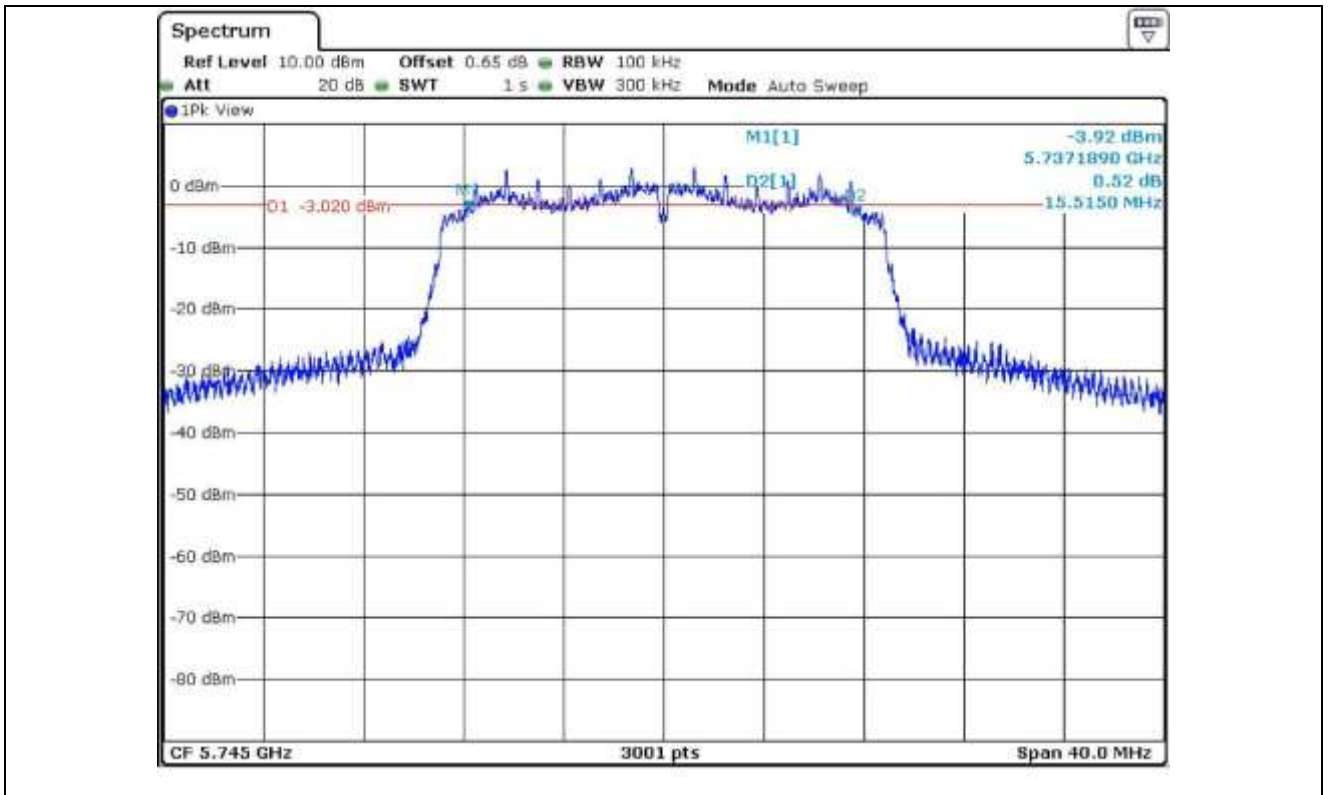


Low Channel (5 745 MHz) (26 dB Bandwidth)

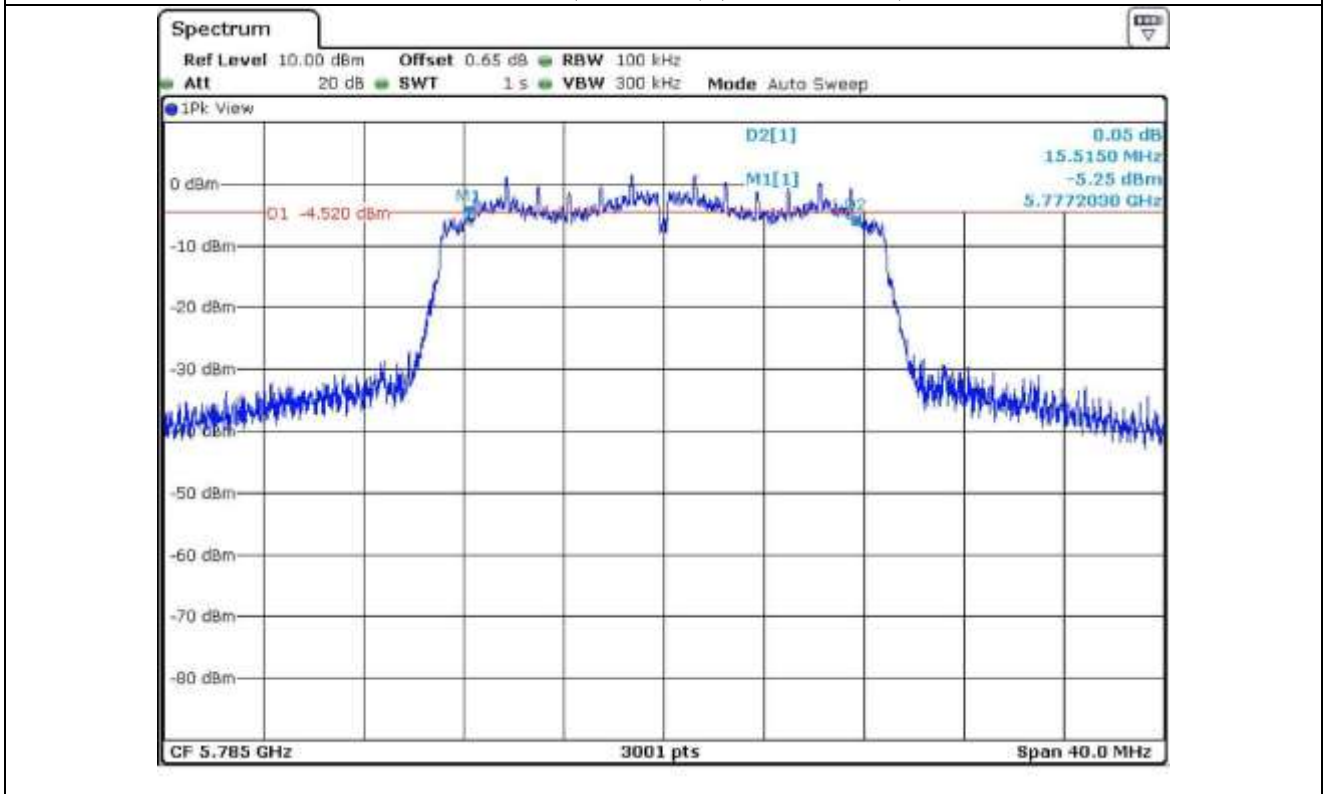


Middle Channel (5 785 MHz) (26 dB Bandwidth)

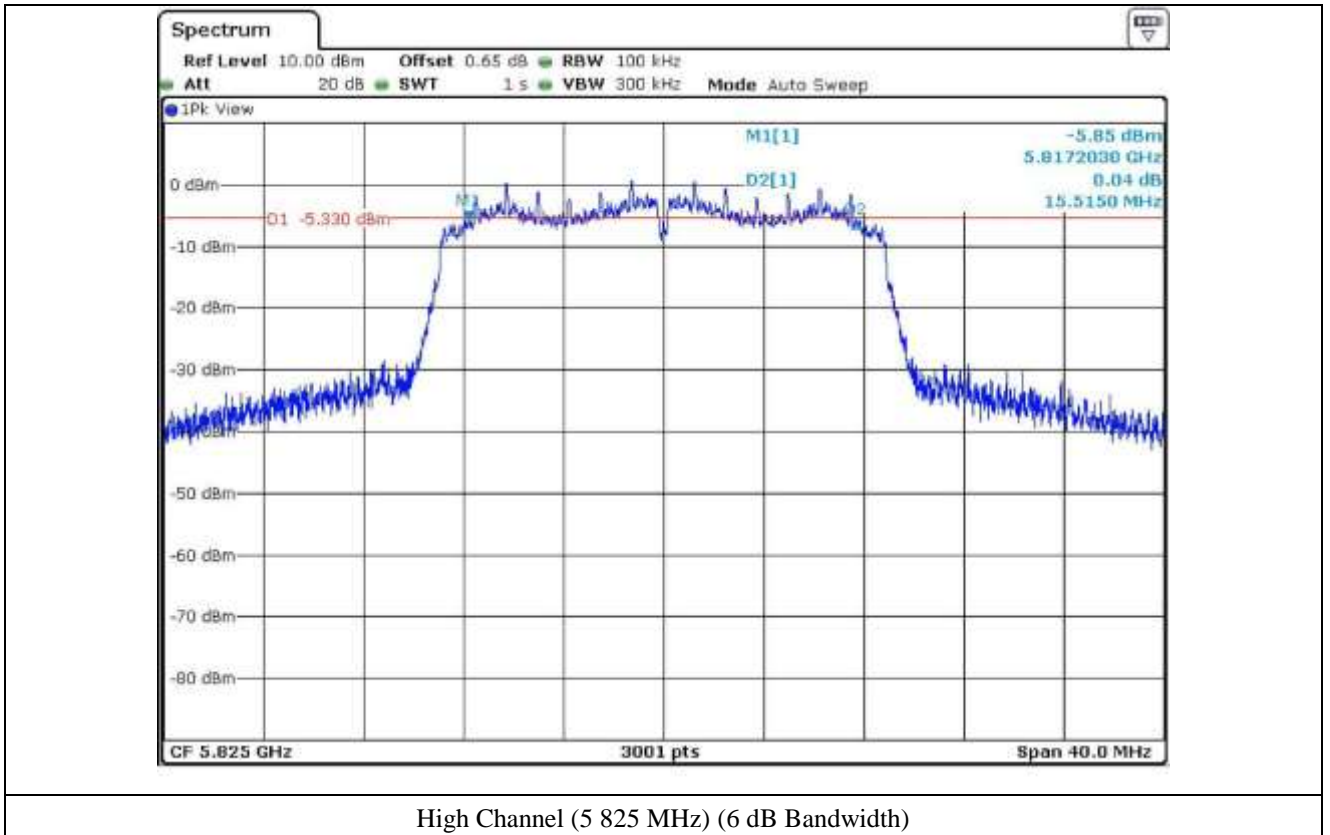




Low Channel (5.745 MHz) (6 dB Bandwidth)



Middle Channel (5.785 MHz) (6 dB Bandwidth)



7.5.2 Test data for Antenna 1

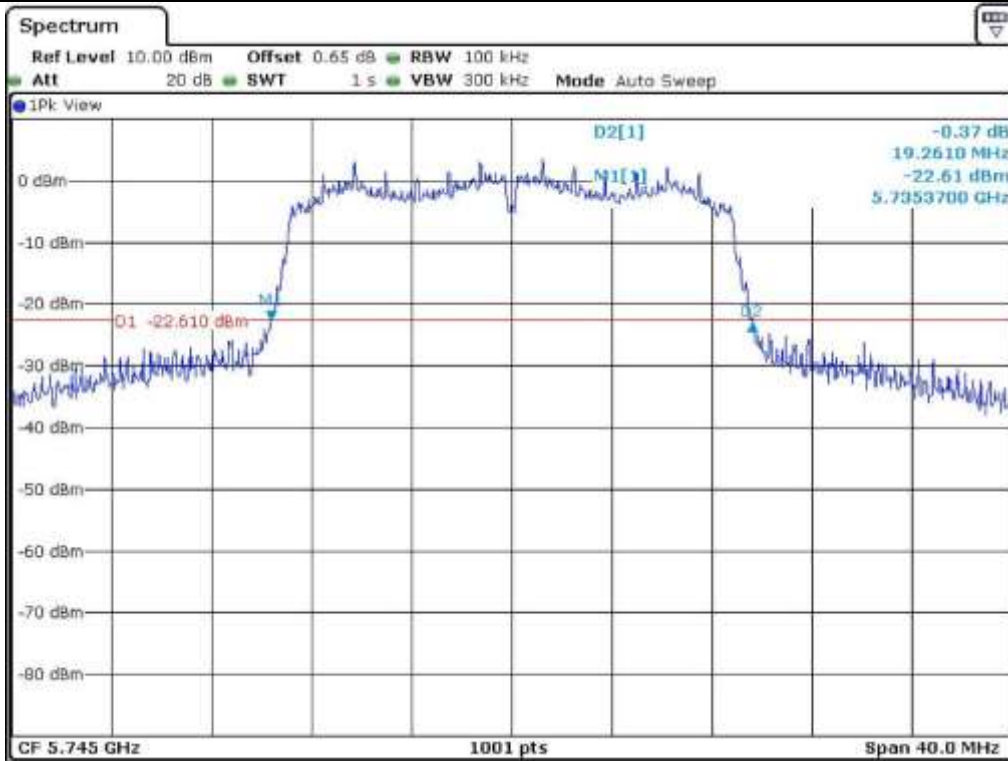
- Test Date : May 26, 2015

- Test Result : Pass

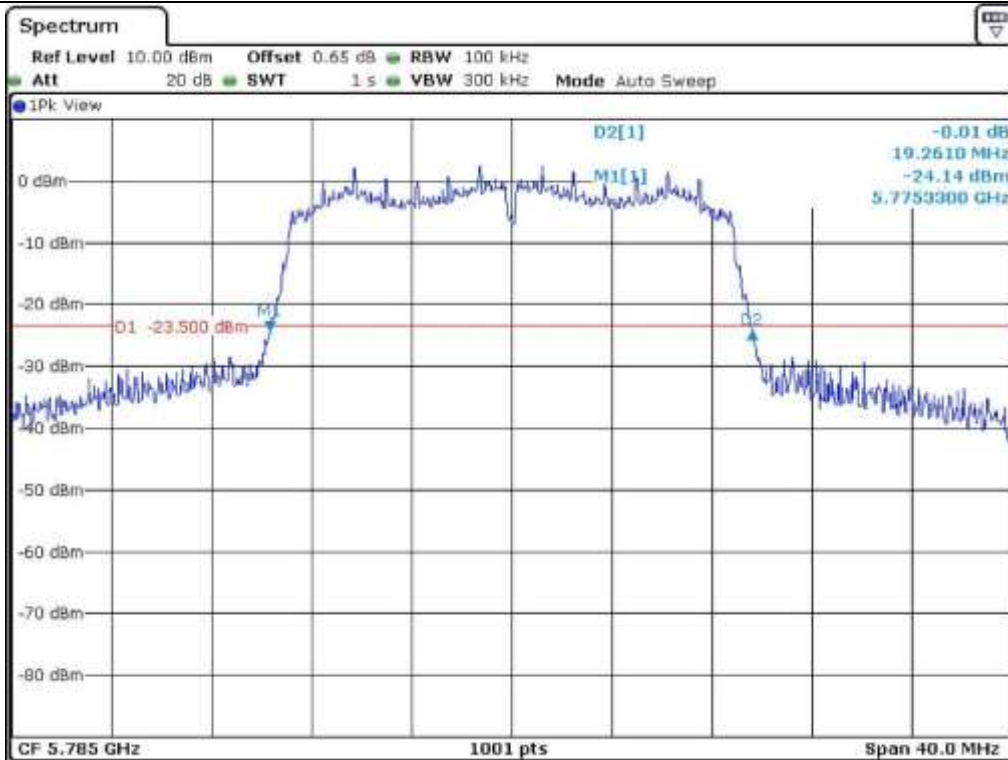
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 745	19.26
	Middle	5 785	19.26
	High	5 825	19.26
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 745	15.52
	Middle	5 785	15.52
	High	5 825	15.52



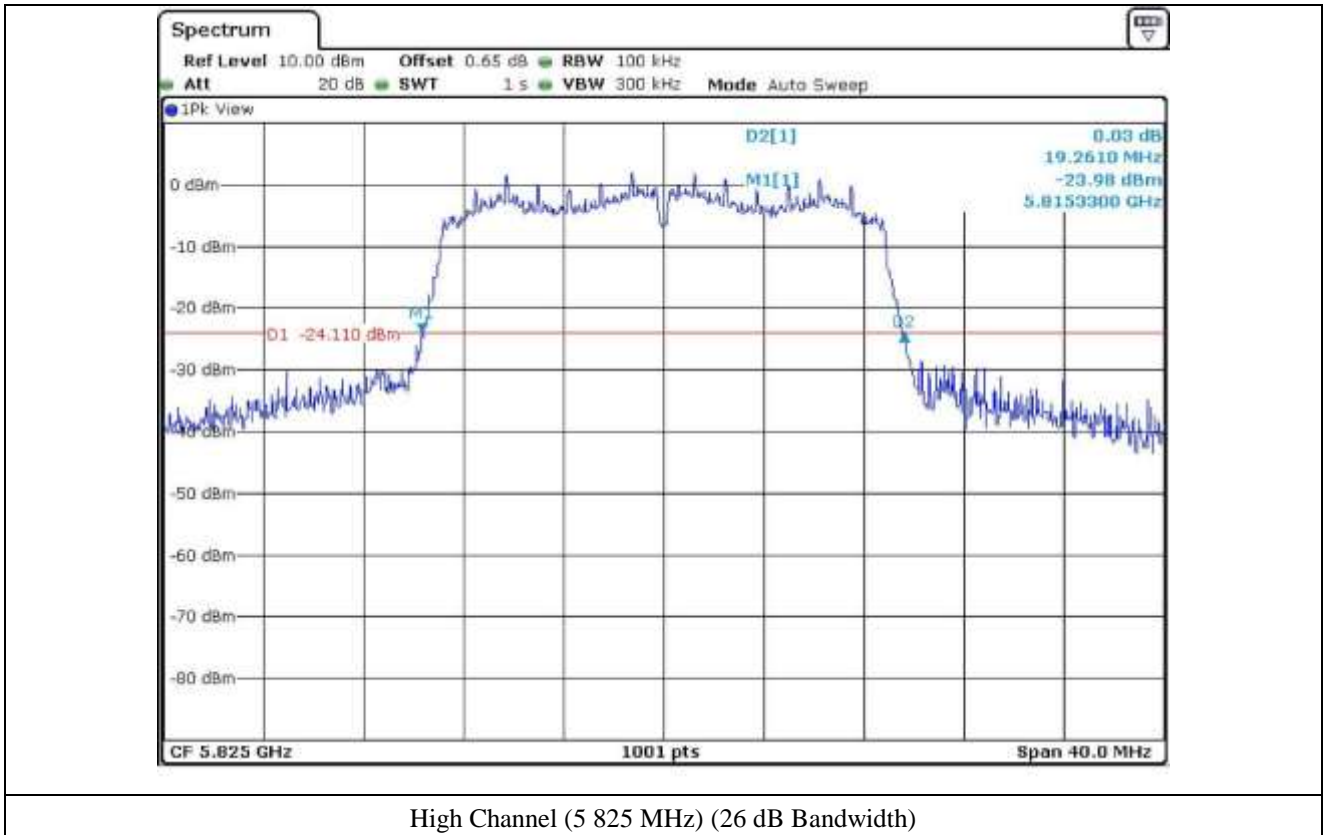
Tested by: Jun-Hui, Lee / Senior Engineer

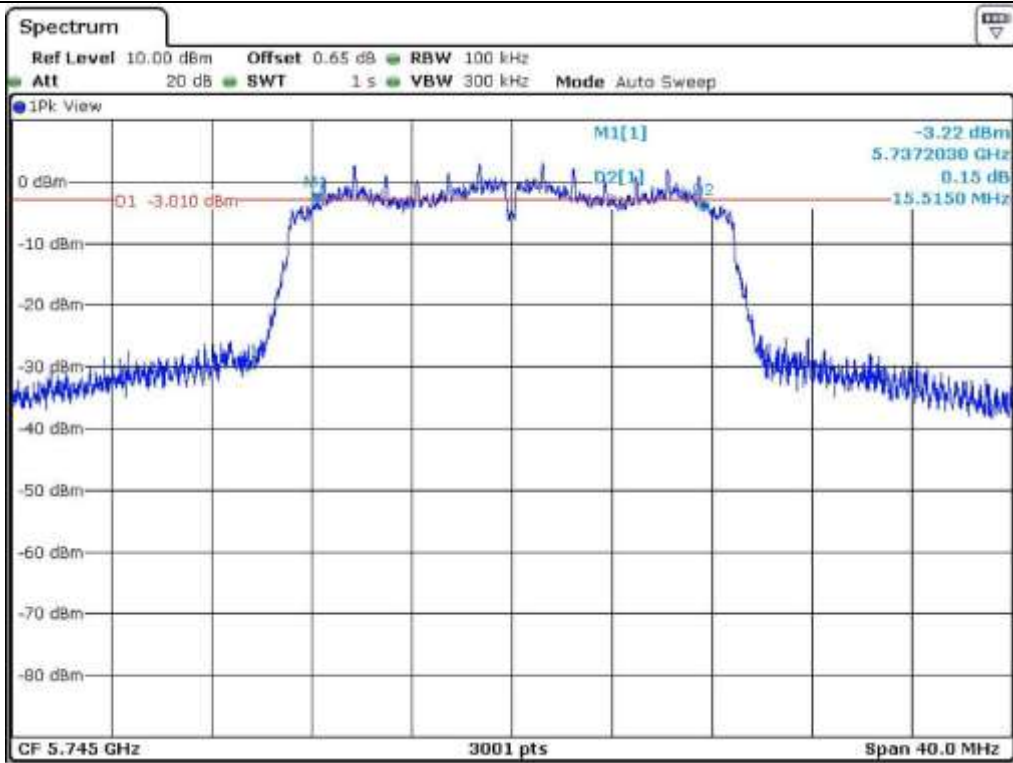


Low Channel (5 745 MHz) (26 dB Bandwidth)

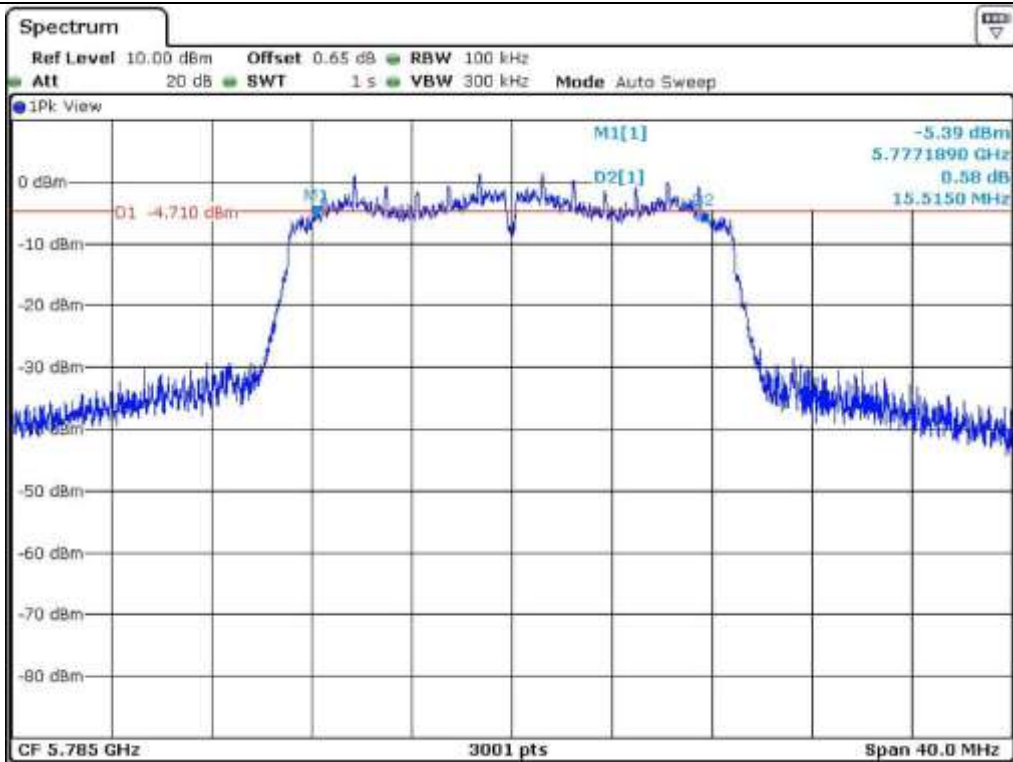


Middle Channel (5 785 MHz) (26 dB Bandwidth)

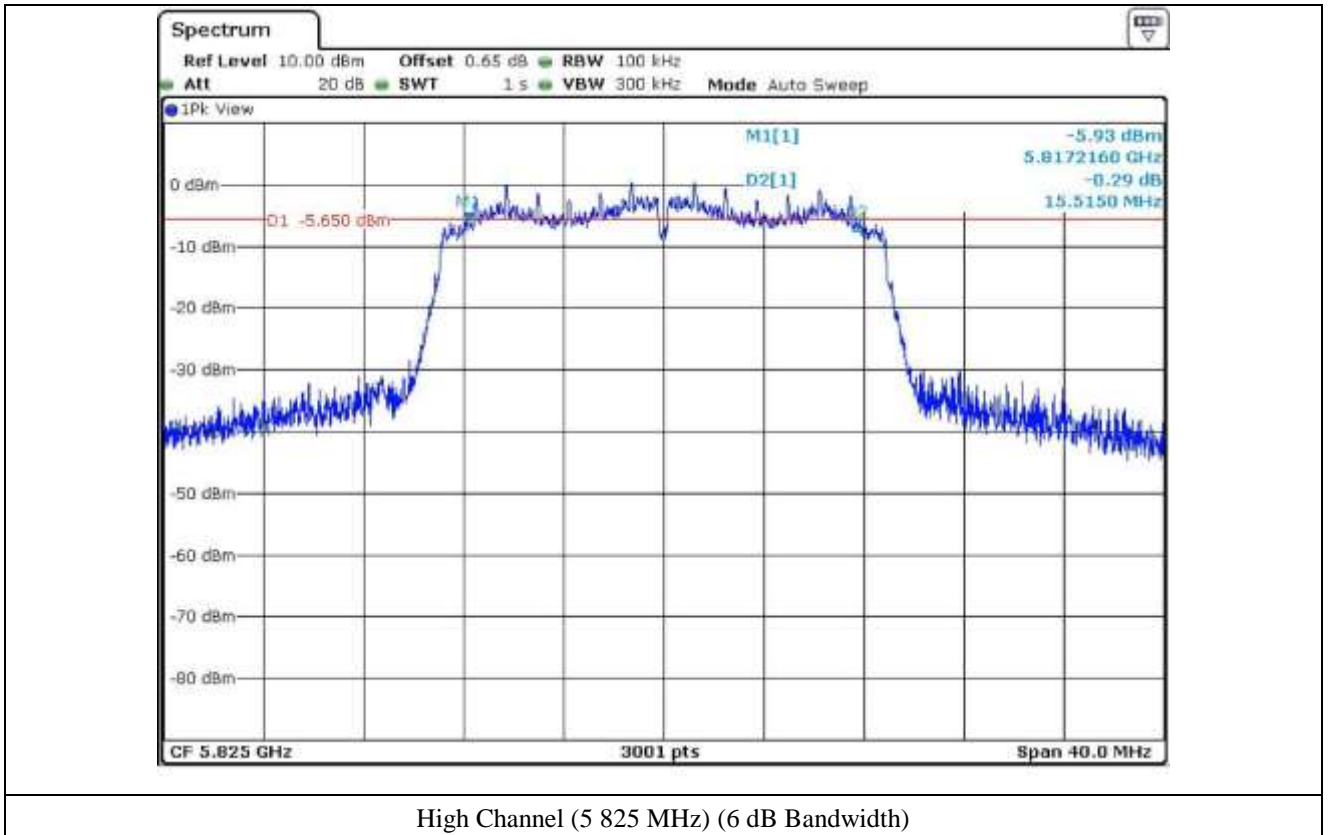




Low Channel (5.745 MHz) (6 dB Bandwidth)



Middle Channel (5.785 MHz) (6 dB Bandwidth)



7. 6 Test data for 802.11n_HT40 RLAN Mode

7.6.1 Test data for Antenna 0

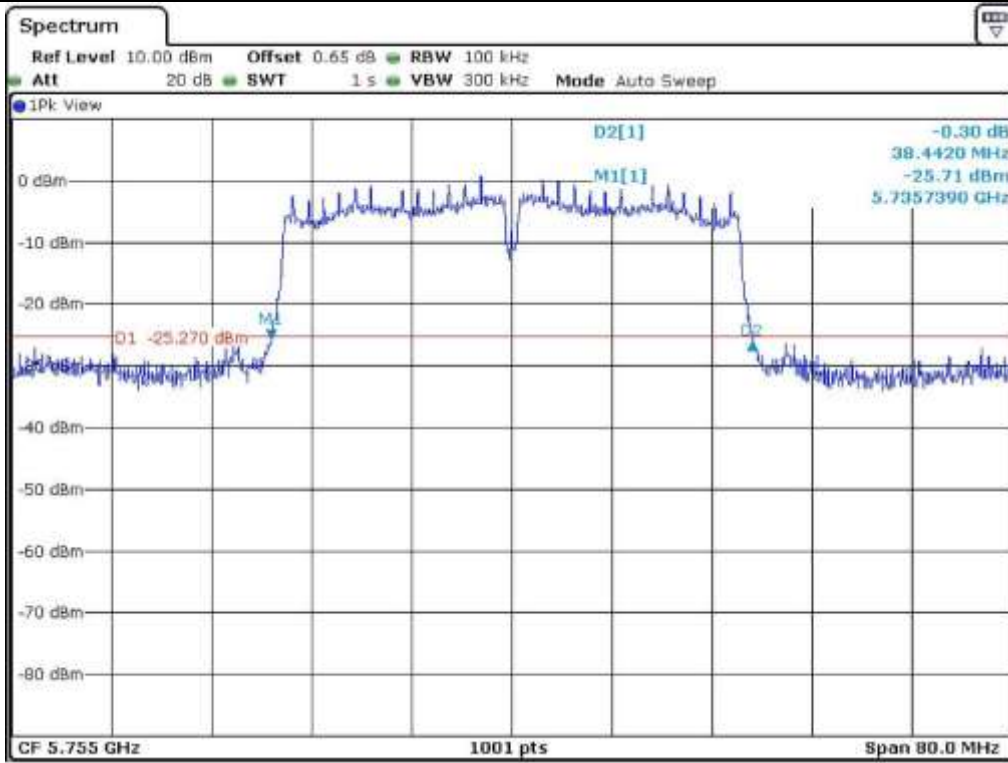
- Test Date : May 26, 2015

- Test Result : Pass

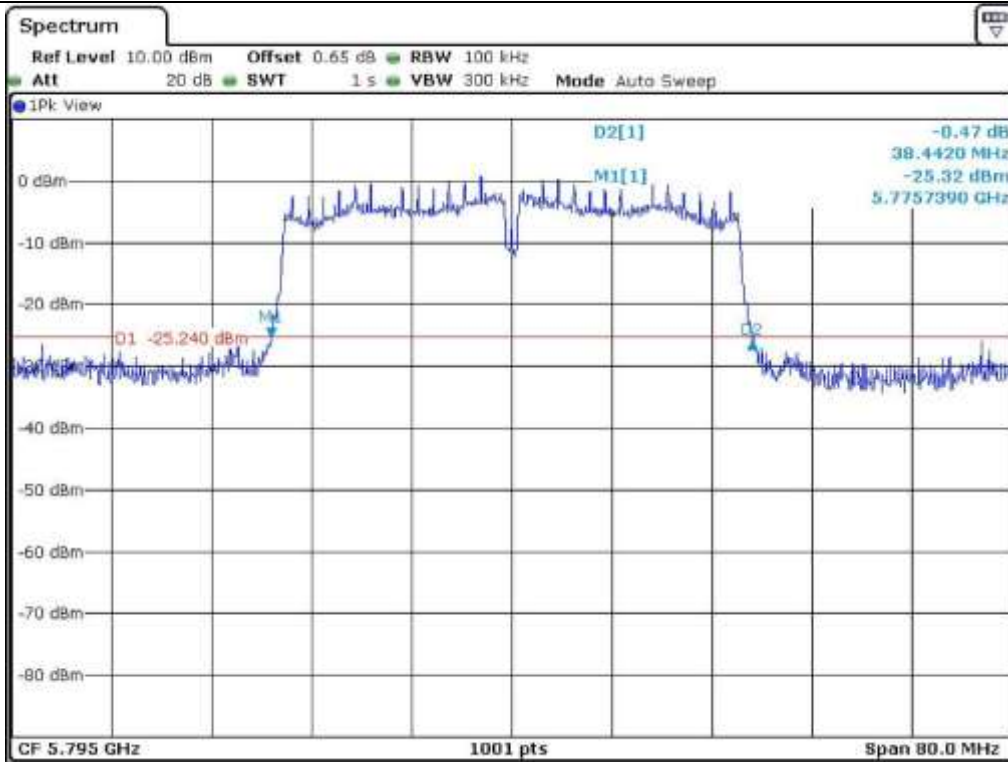
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 755	38.44
	High	5 795	38.44
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 755	35.70
	High	5 795	35.70



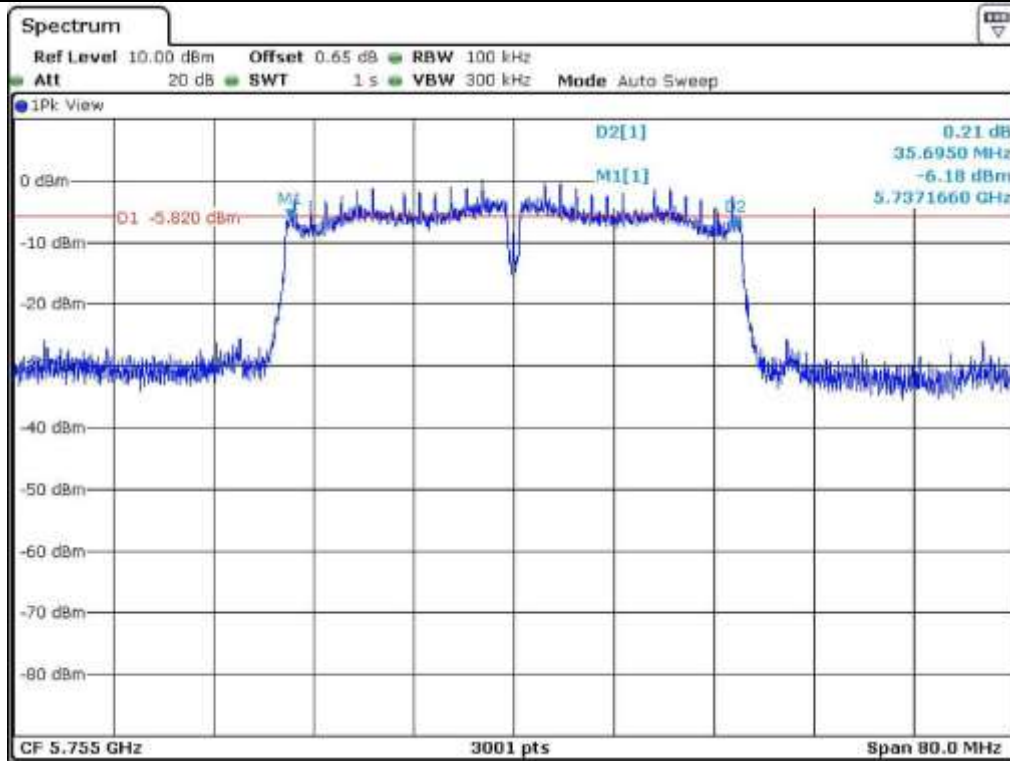
Tested by: Jun-Hui, Lee / Senior Engineer



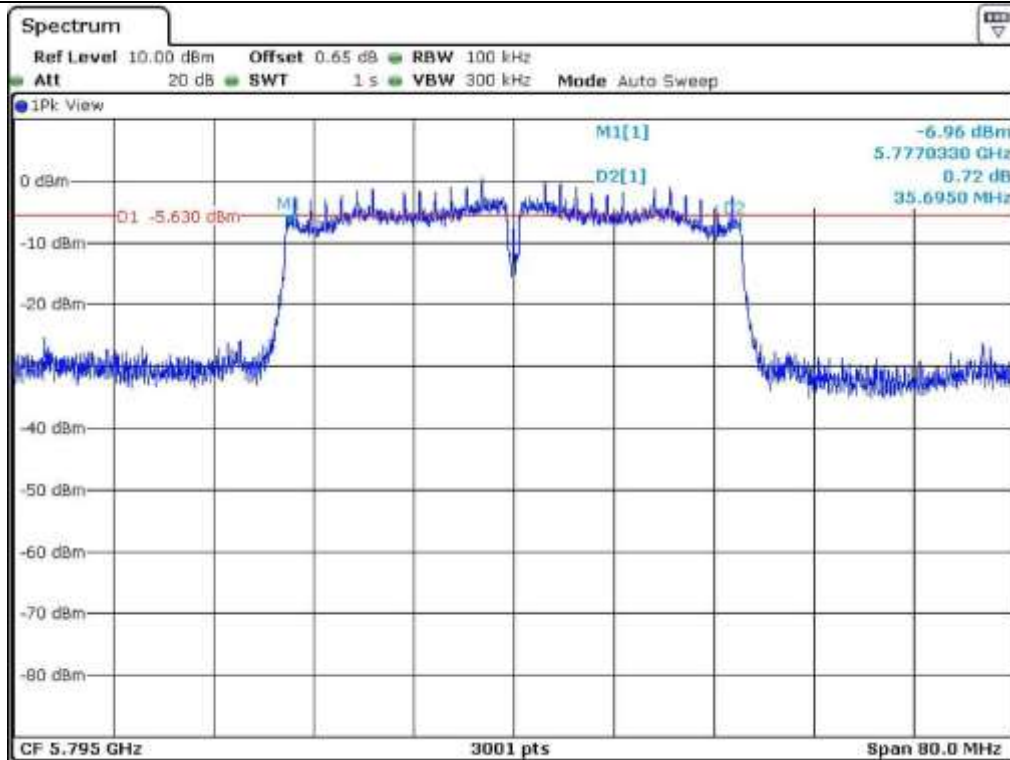
Low Channel (5 755 MHz) (26 dB Bandwidth)



High Channel (5 795 MHz) (26 dB Bandwidth)



Low Channel (5 755 MHz) (6 dB Bandwidth)



High Channel (5 795 MHz) (6 dB Bandwidth)

7.6.2 Test data for Antenna 1

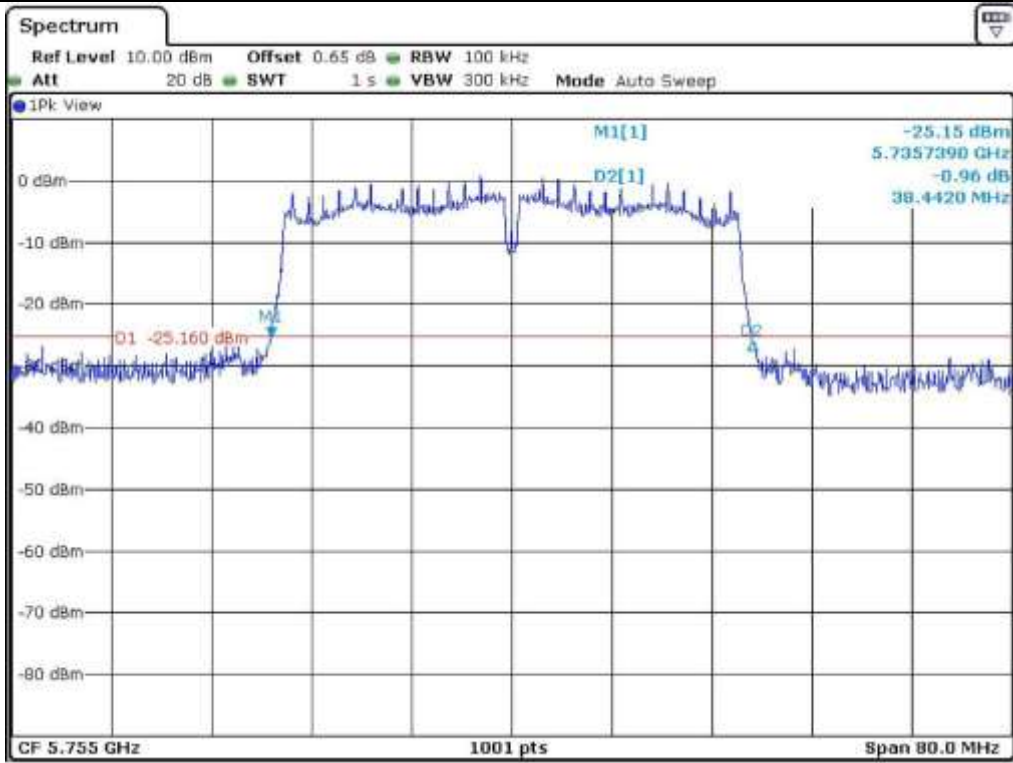
-. Test Date : May 26, 2015

-. Test Result : Pass

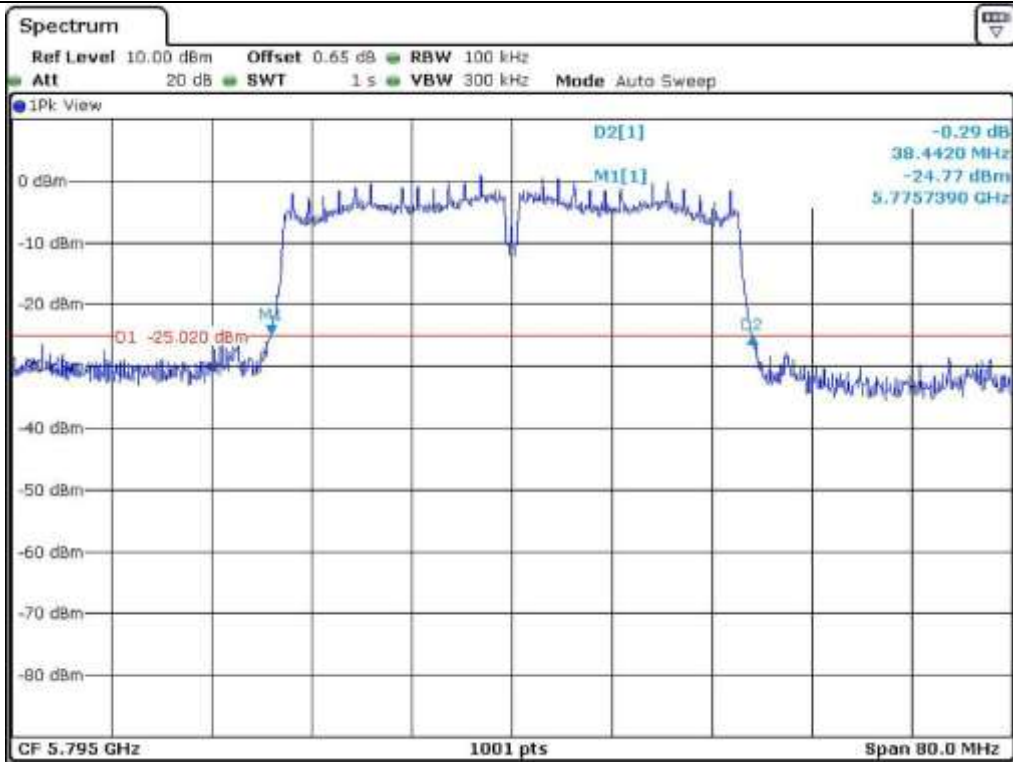
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 755	38.44
	High	5 795	38.44
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)
5 725 ~ 5 850	Low	5 755	35.70
	High	5 795	35.70



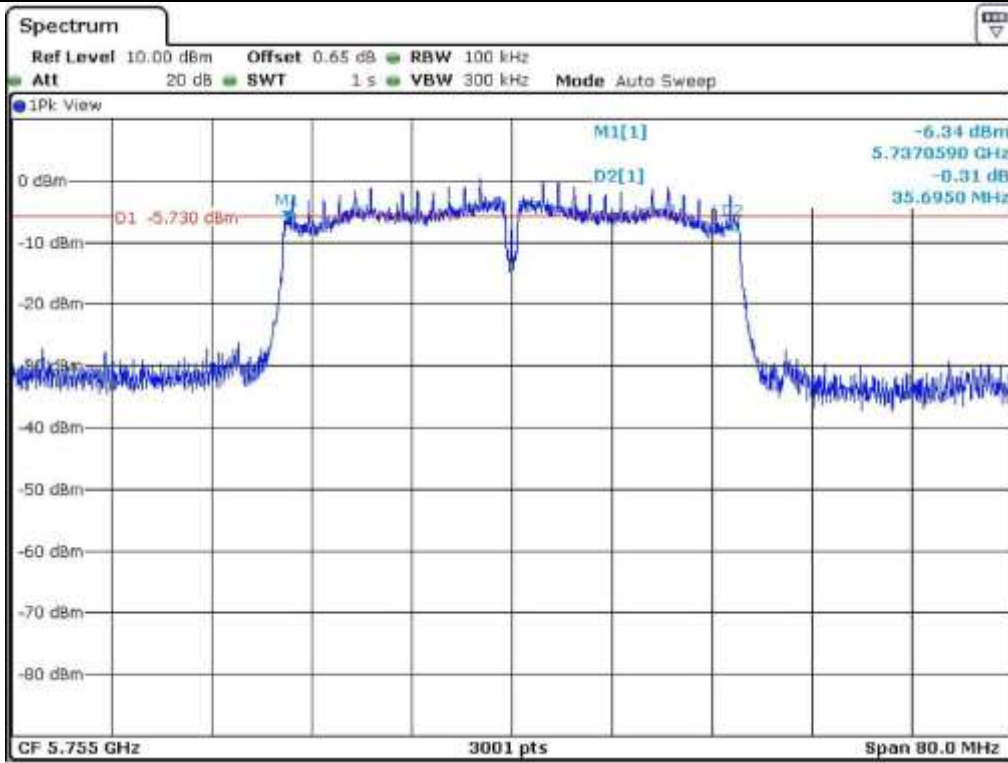
Tested by: Jun-Hui, Lee / Senior Engineer



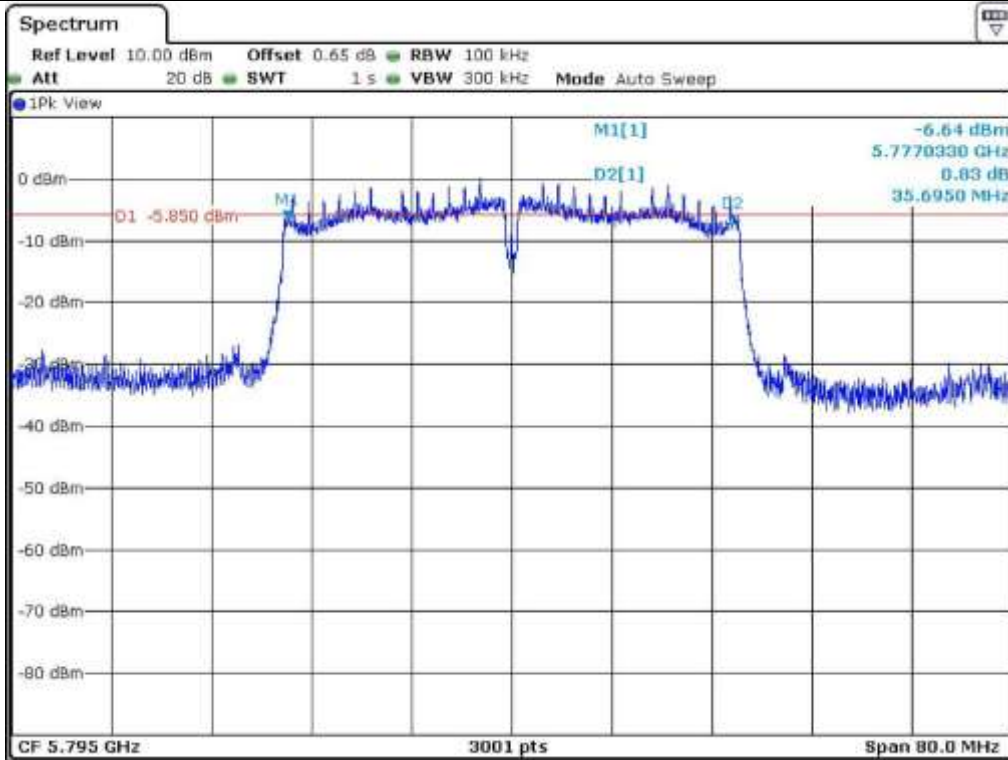
Low Channel (5 755 MHz) (26 dB Bandwidth)



High Channel (5 795 MHz) (26 dB Bandwidth)



Low Channel (5 755 MHz) (6 dB Bandwidth)



High Channel (5 795 MHz) (6 dB Bandwidth)

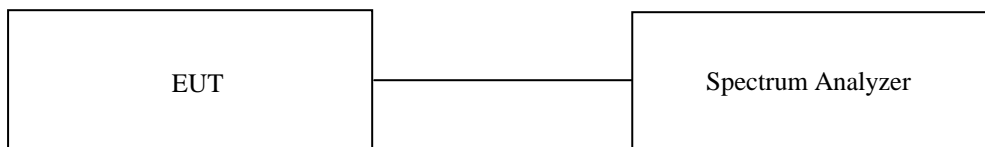
8. MAXIMUM PEAK OUTPUT POWER

8.1 Operating environment

Temperature : 22 °C
 Relative humidity : 49 % R.H.

8.2 Test set-up

The maximum peak output power was measured with the spectrum analyzer connected to the antenna output of the EUT. The spectrum analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99 % bandwidth. The EUT was operating in transmit mode at the appropriate center frequency.



8.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 30, 2014 (1Y)

All test equipment used is calibrated on a regular basis.

8.4 Test data for 802.11a RLAN Mode

8.4.1 Test data for Antenna 0

- Test Date : May 26, 2015

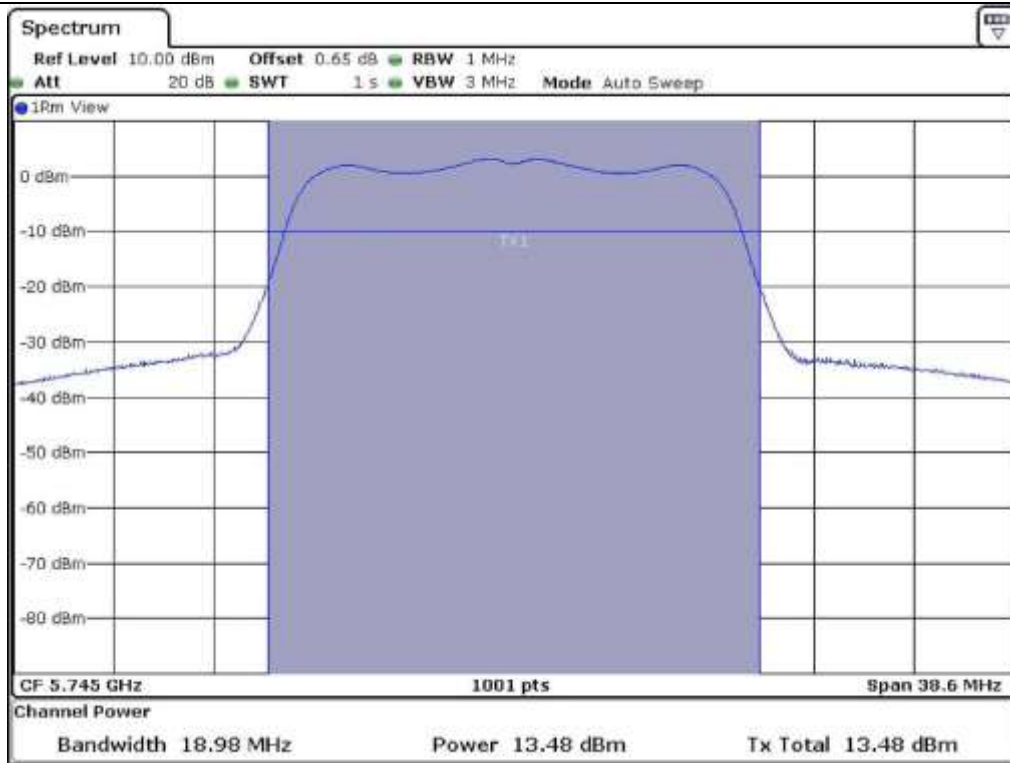
- Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	18.98	13.48	30.00	16.52
	Middle	5 785	18.98	12.58	30.00	17.42
	High	5 825	18.98	11.88	30.00	18.12
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	15.33	13.19	30.00	16.81
	Middle	5 785	15.33	12.11	30.00	17.89
	High	5 825	15.33	10.56	30.00	19.44

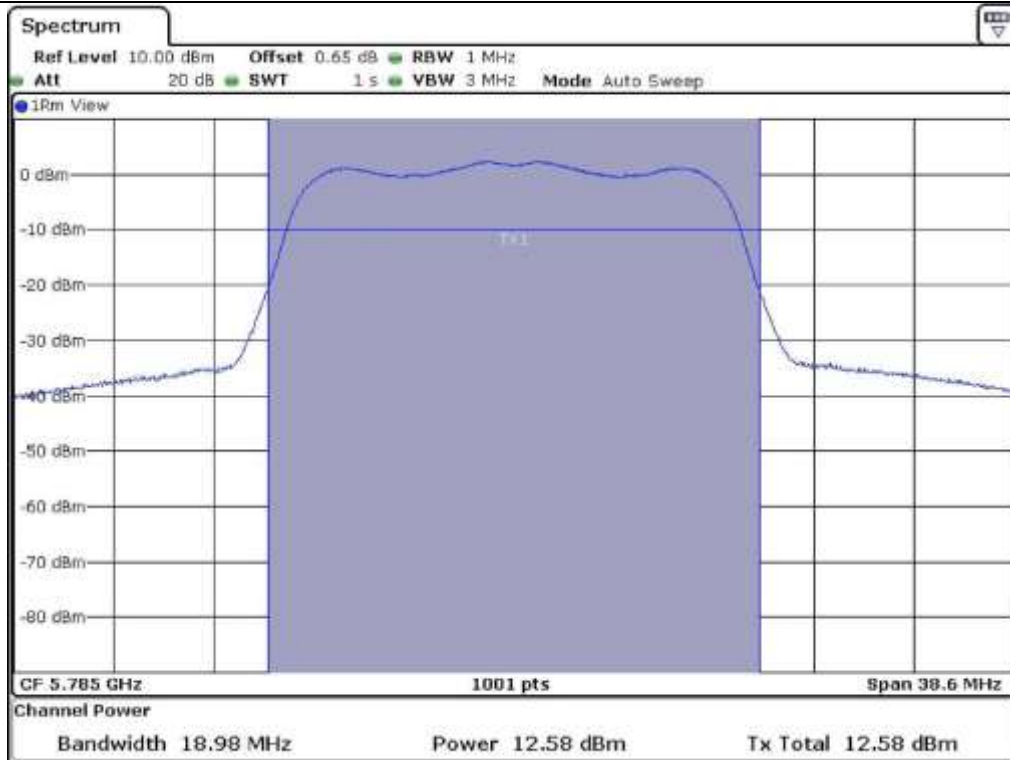
Remark: See next page for measurement data.



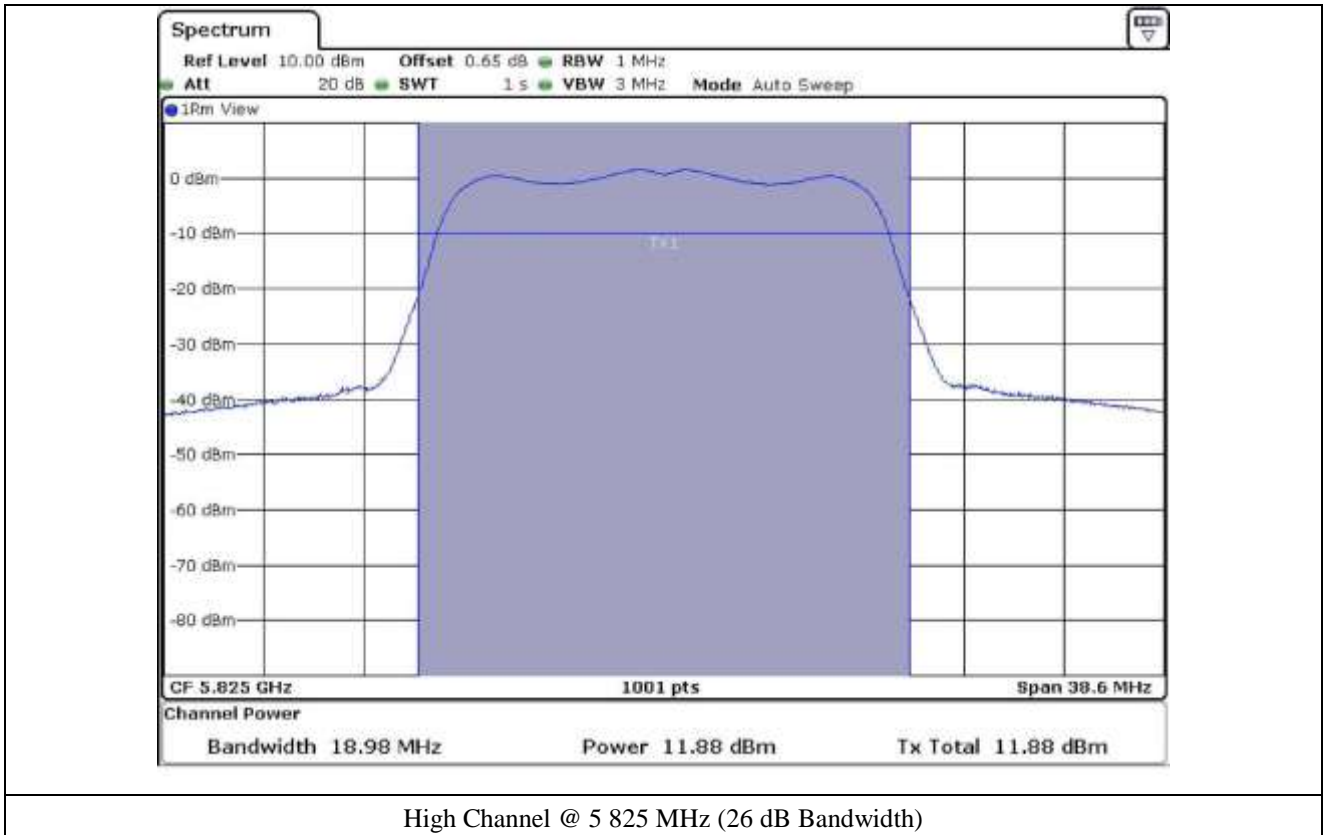
Tested by: Jun-Hui, Lee / Senior Engineer

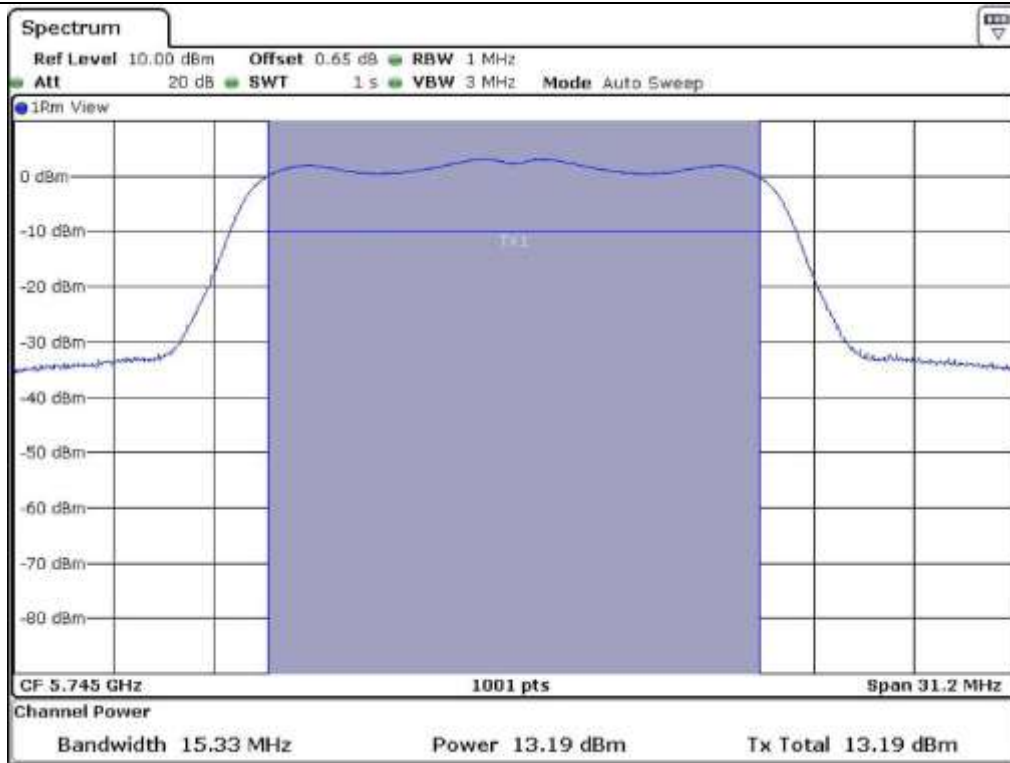


Low Channel @ 5.745 MHz (26 dB Bandwidth)

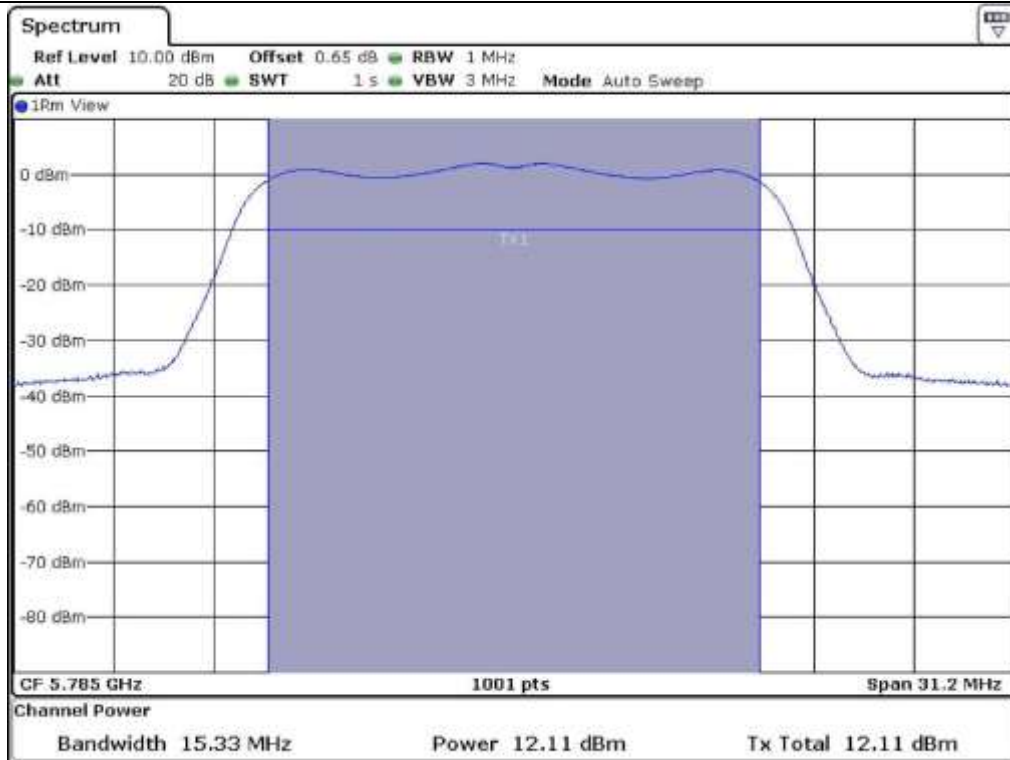


Middle Channel @ 5.785 MHz (26 dB Bandwidth)

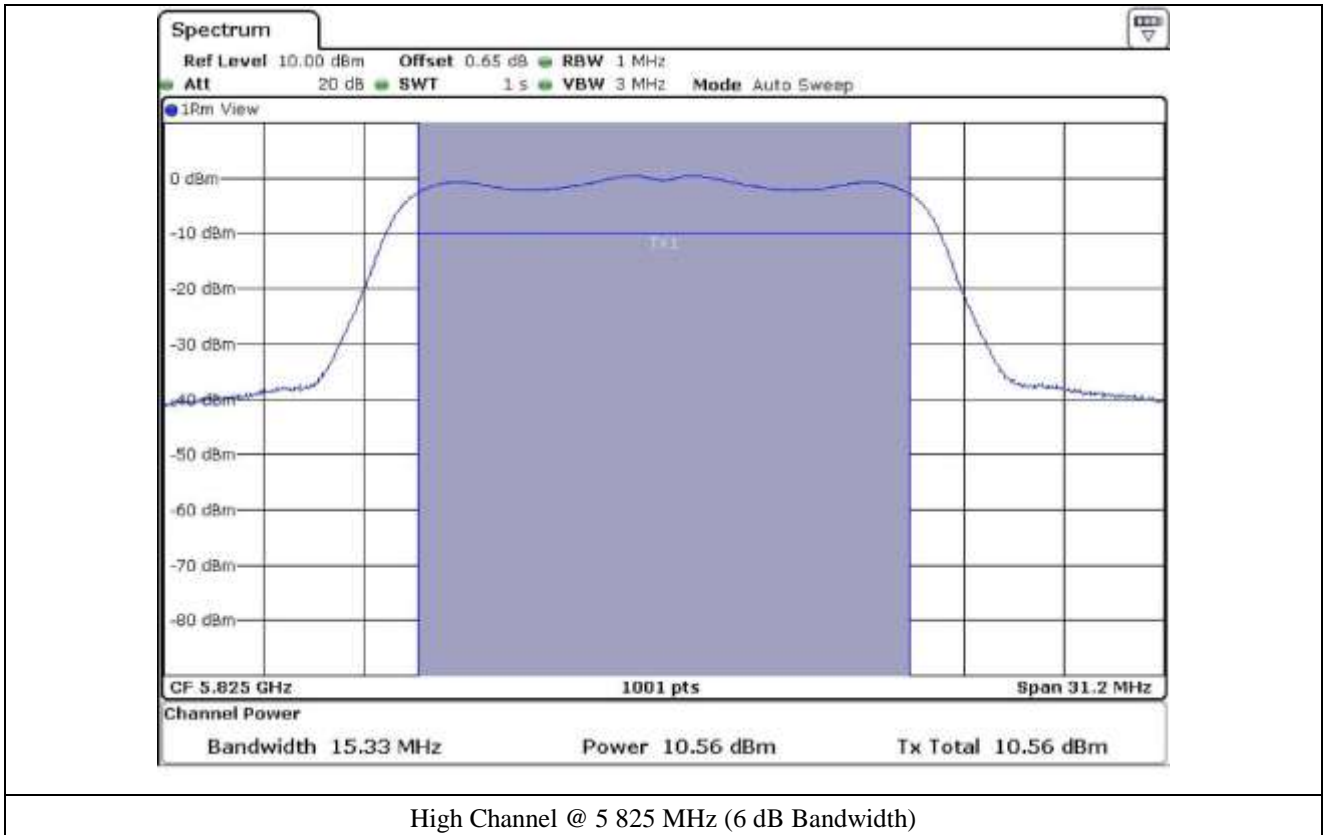




Low Channel @ 5 745 MHz (6 dB Bandwidth)



Middle Channel @ 5 785 MHz (6 dB Bandwidth)



8.4.2 Test data for Antenna 1

- Test Date : May 26, 2015

- Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	18.98	13.33	30.00	16.67
	Middle	5 785	18.98	13.03	30.00	16.97
	High	5 825	18.98	11.90	30.00	18.10
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	15.33	12.46	30.00	17.54
	Middle	5 785	15.33	11.92	30.00	18.08
	High	5 825	15.33	10.54	30.00	19.46

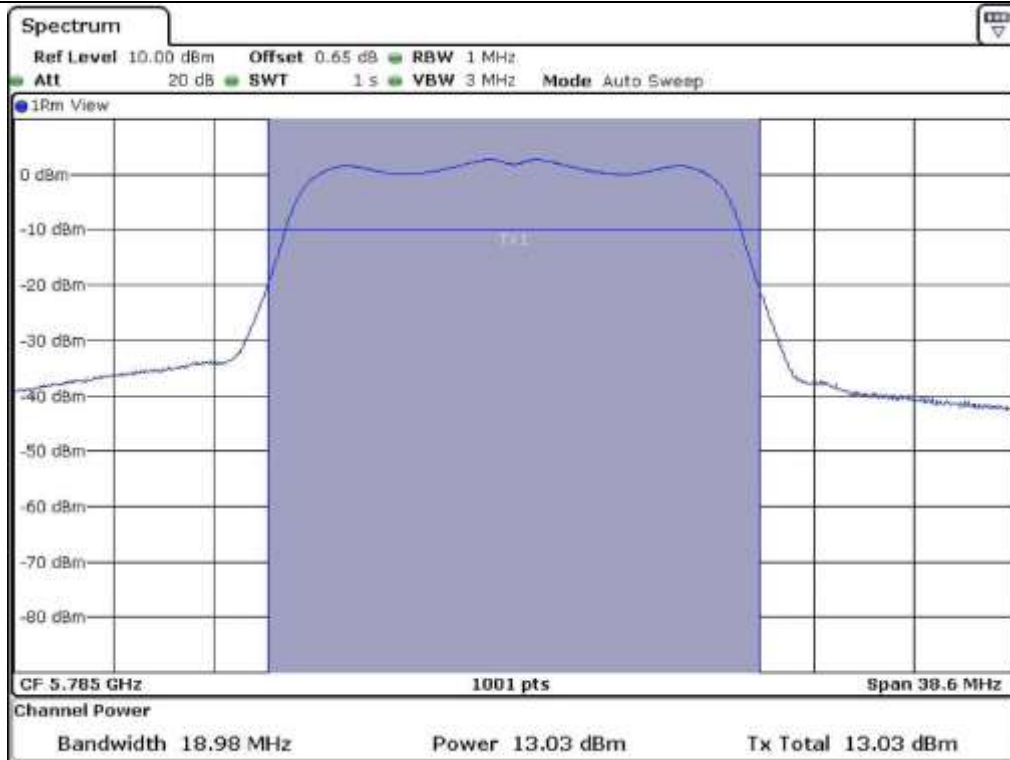
Remark: See next page for measurement data.



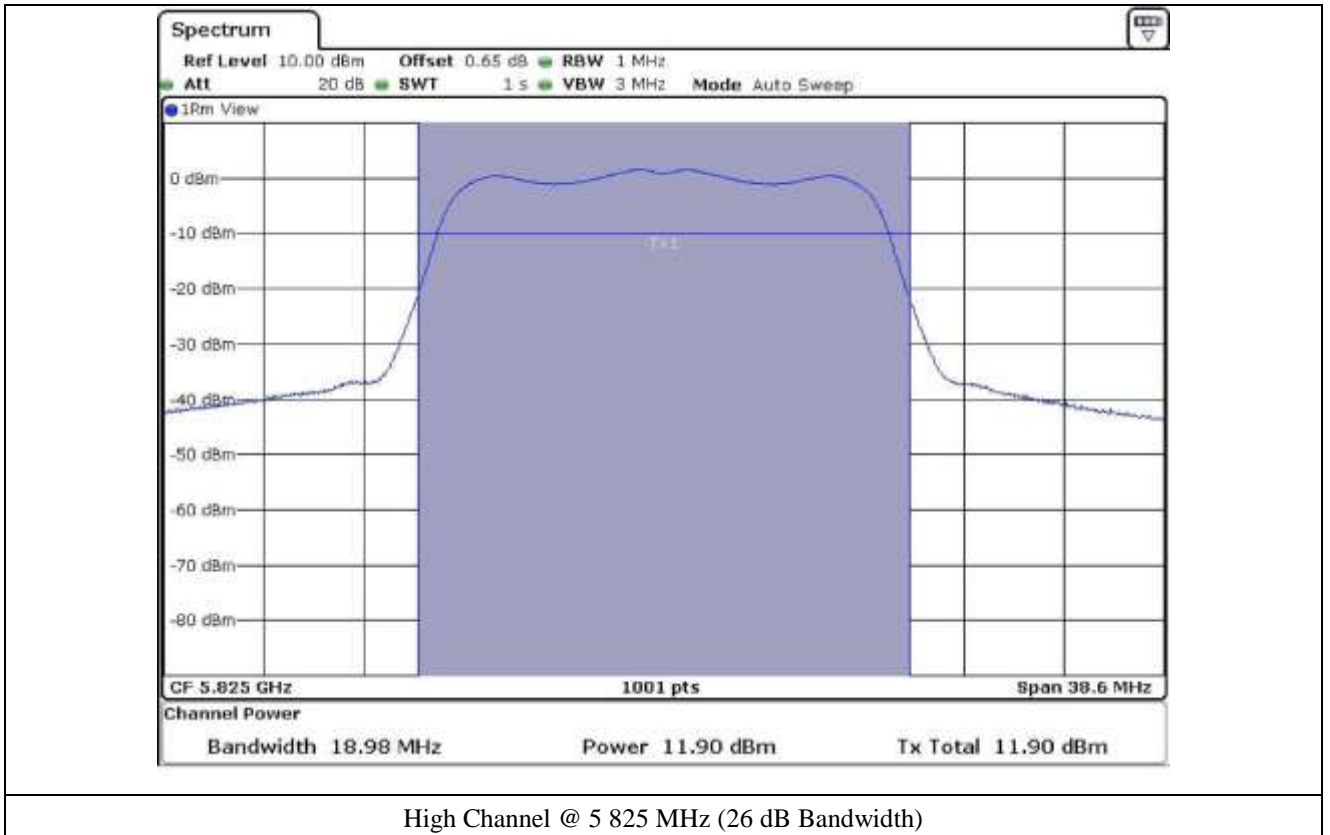
Tested by: Jun-Hui, Lee / Senior Engineer

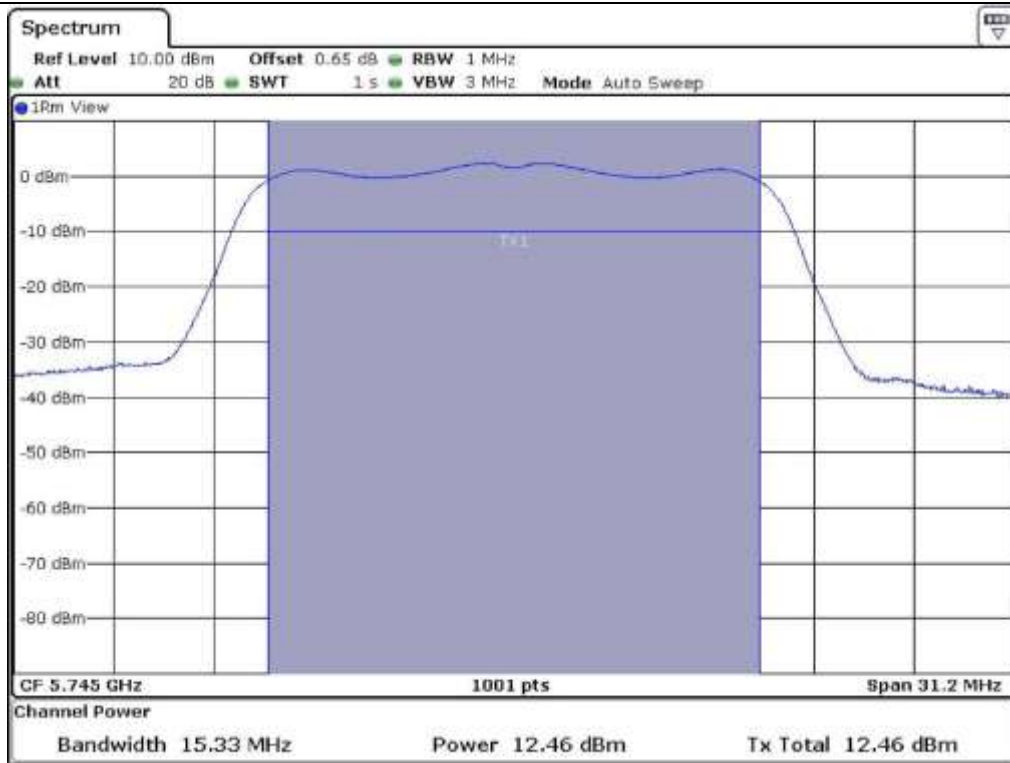


Low Channel @ 5.745 MHz (26 dB Bandwidth)

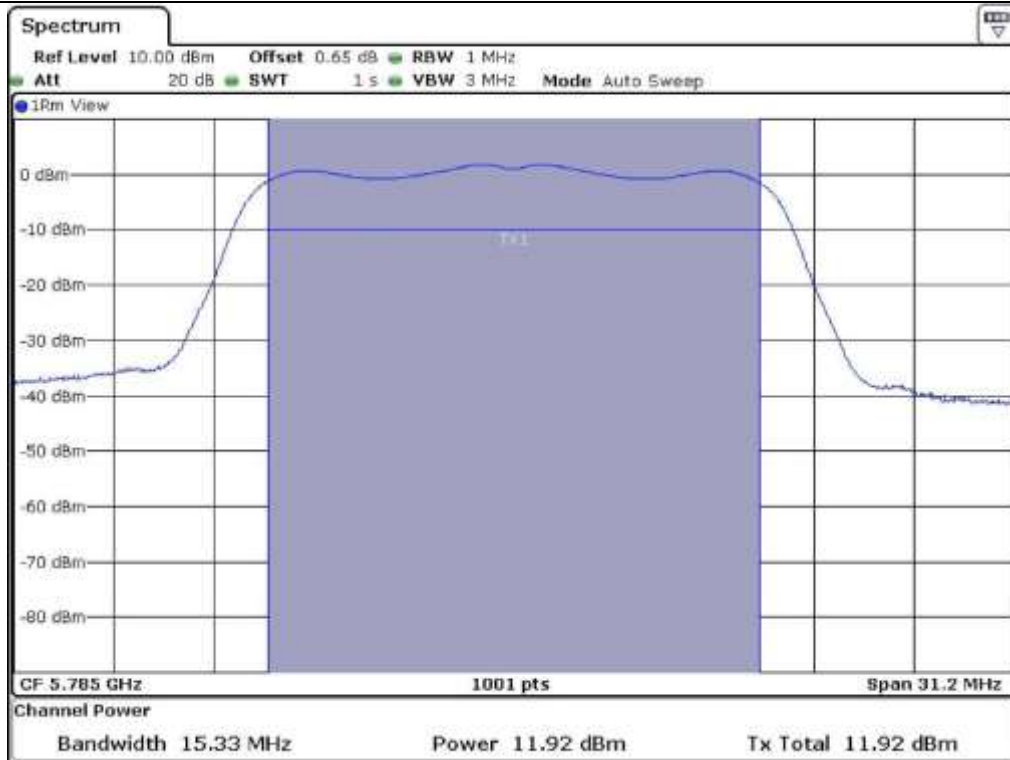


Middle Channel @ 5.785 MHz (26 dB Bandwidth)

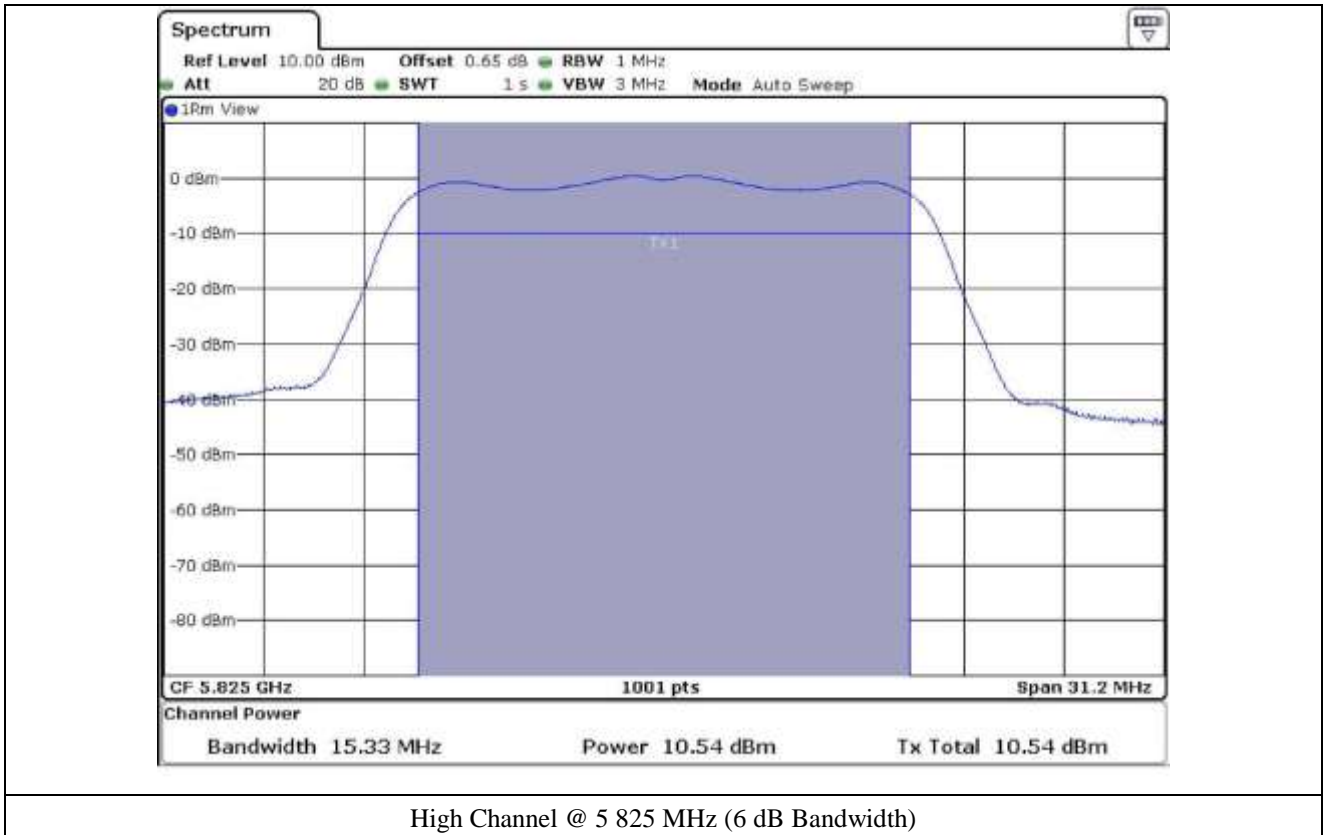




Low Channel @ 5 745 MHz (6 dB Bandwidth)



Middle Channel @ 5 785 MHz (6 dB Bandwidth)



8.4.3 Test data for Multiple Transmit

-. Test Date : May 26, 2015

-. Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	16.42	30.00	13.58
	Middle	5 785	15.82	30.00	14.18
	High	5 825	14.90	30.00	15.10
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	15.85	30.00	14.15
	Middle	5 785	15.03	30.00	14.97
	High	5 825	13.56	30.00	16.44

Remark 1 : Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Remark 2 : Calculated Output Power= $10\log (10^{(Antenna1 \text{ Output Power}/10)}+10^{(Antenna2 \text{ Output Power}/10)})$



Tested by: Jun-Hui, Lee / Senior Engineer

8.5 Test data for 802.11n_HT20 RLAN Mode

8.5.1 Test data for Antenna 0

- Test Date : May 26, 2015

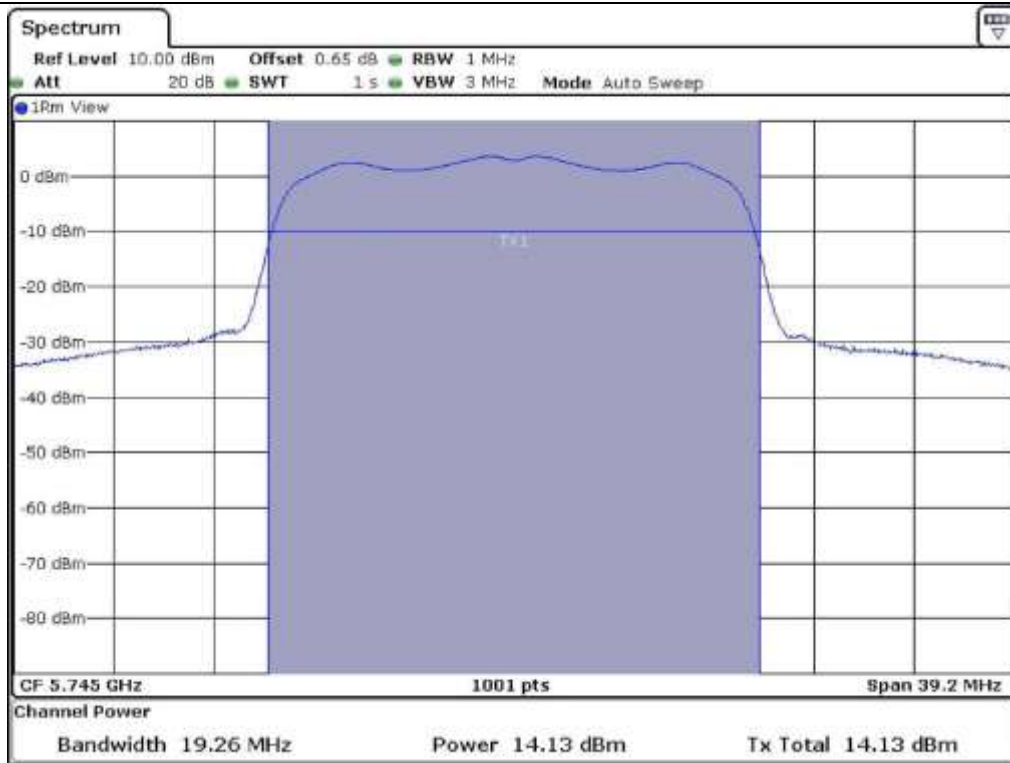
- Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	19.26	14.13	30.00	15.87
	Middle	5 785	19.26	12.67	30.00	17.33
	High	5 825	19.26	12.40	30.00	17.60
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	17.58	13.90	30.00	16.10
	Middle	5 785	17.58	12.66	30.00	17.34
	High	5 825	17.58	12.21	30.00	17.79

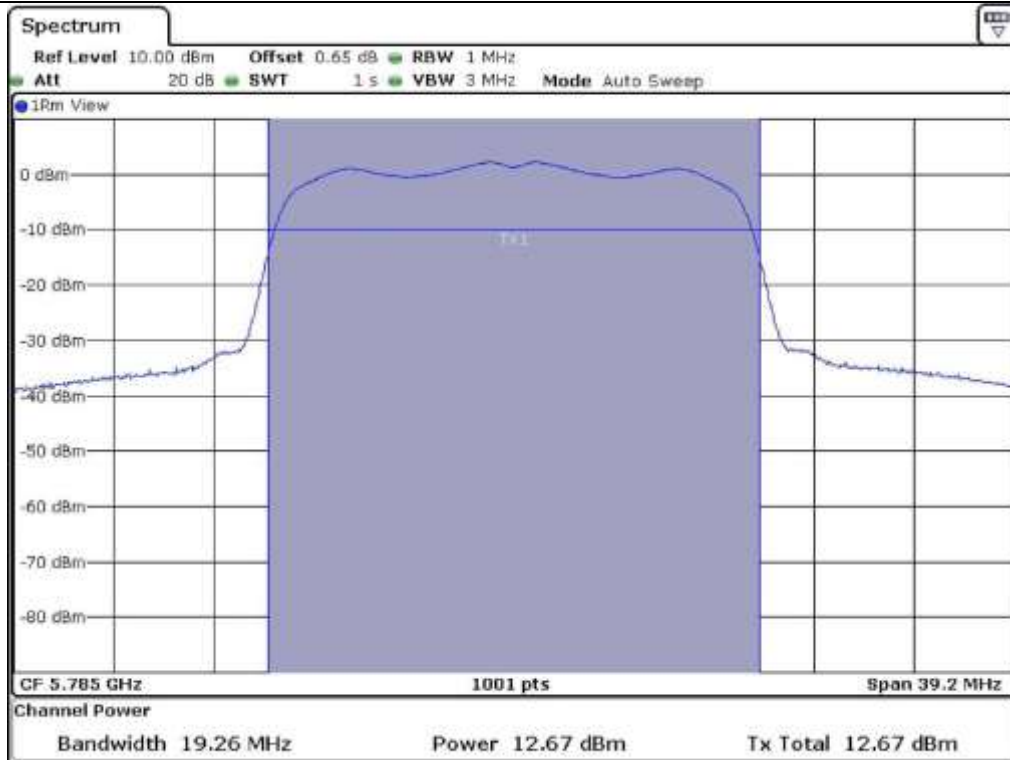
Remark: See next page for measurement data.



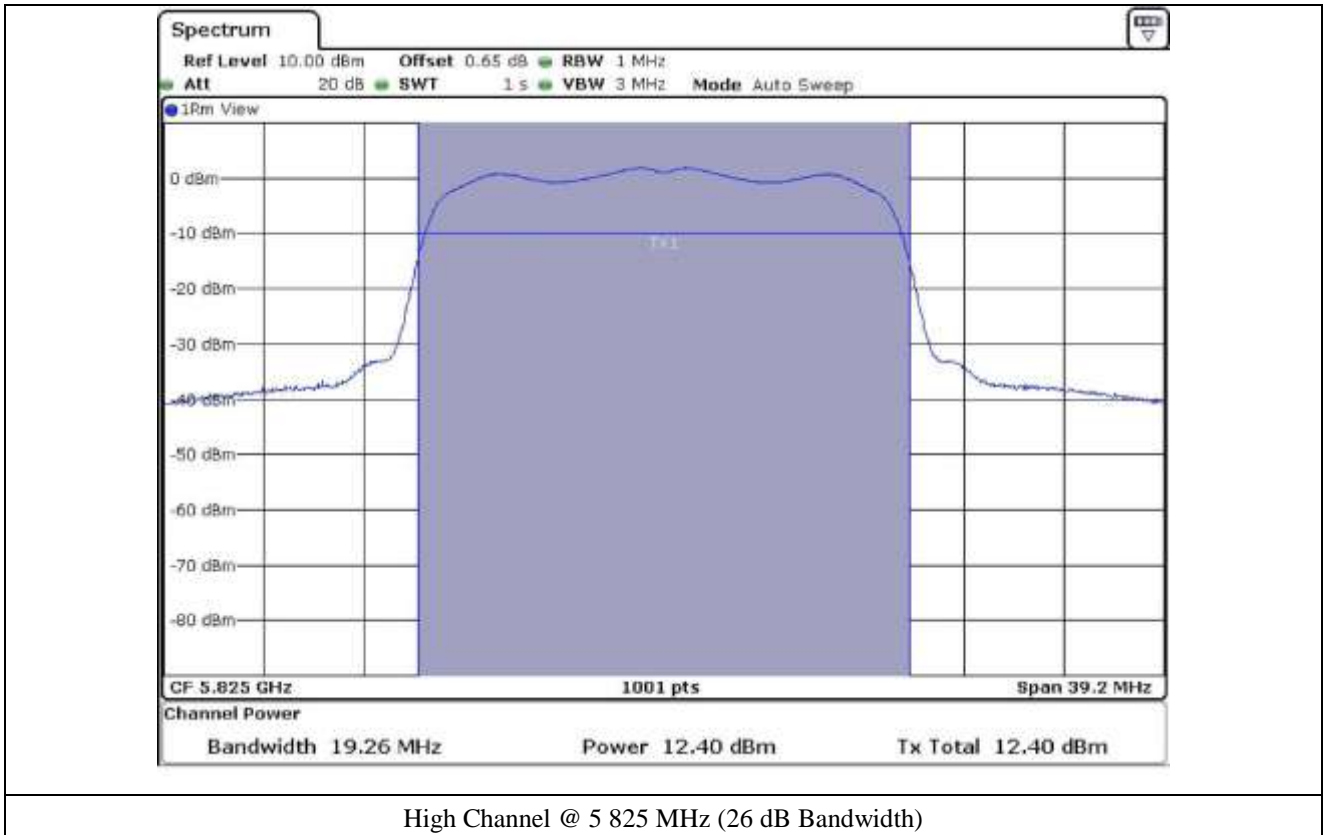
Tested by: Jun-Hui, Lee / Senior Engineer

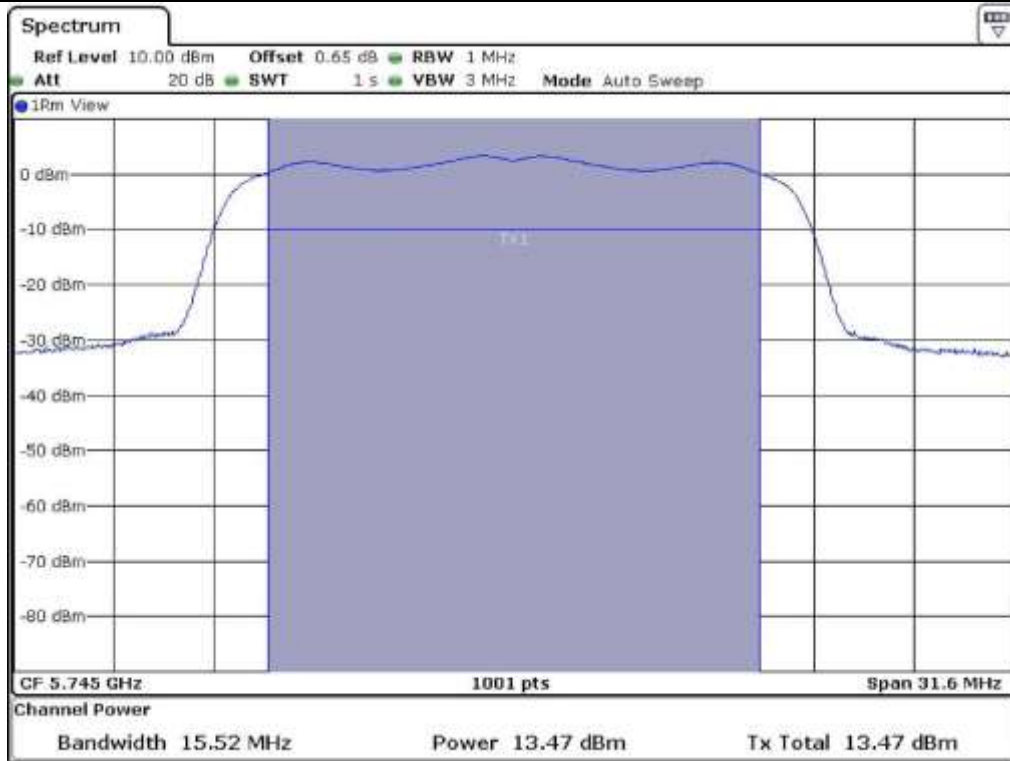


Low Channel @ 5.745 MHz (26 dB Bandwidth)

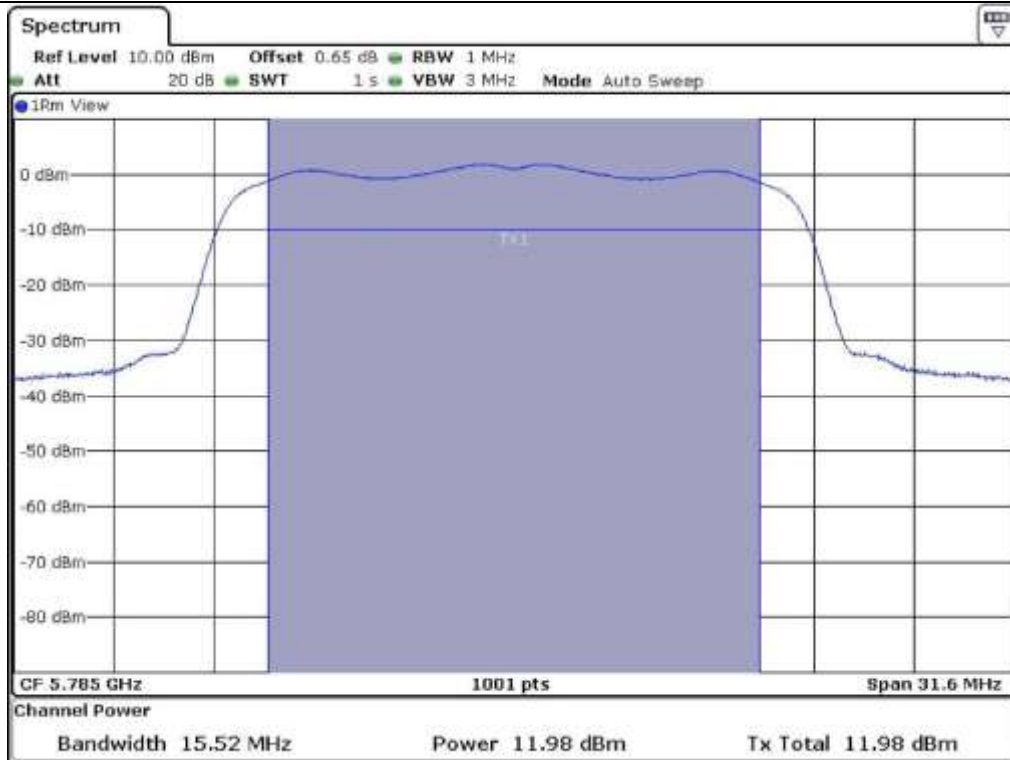


Middle Channel @ 5.785 MHz (26 dB Bandwidth)

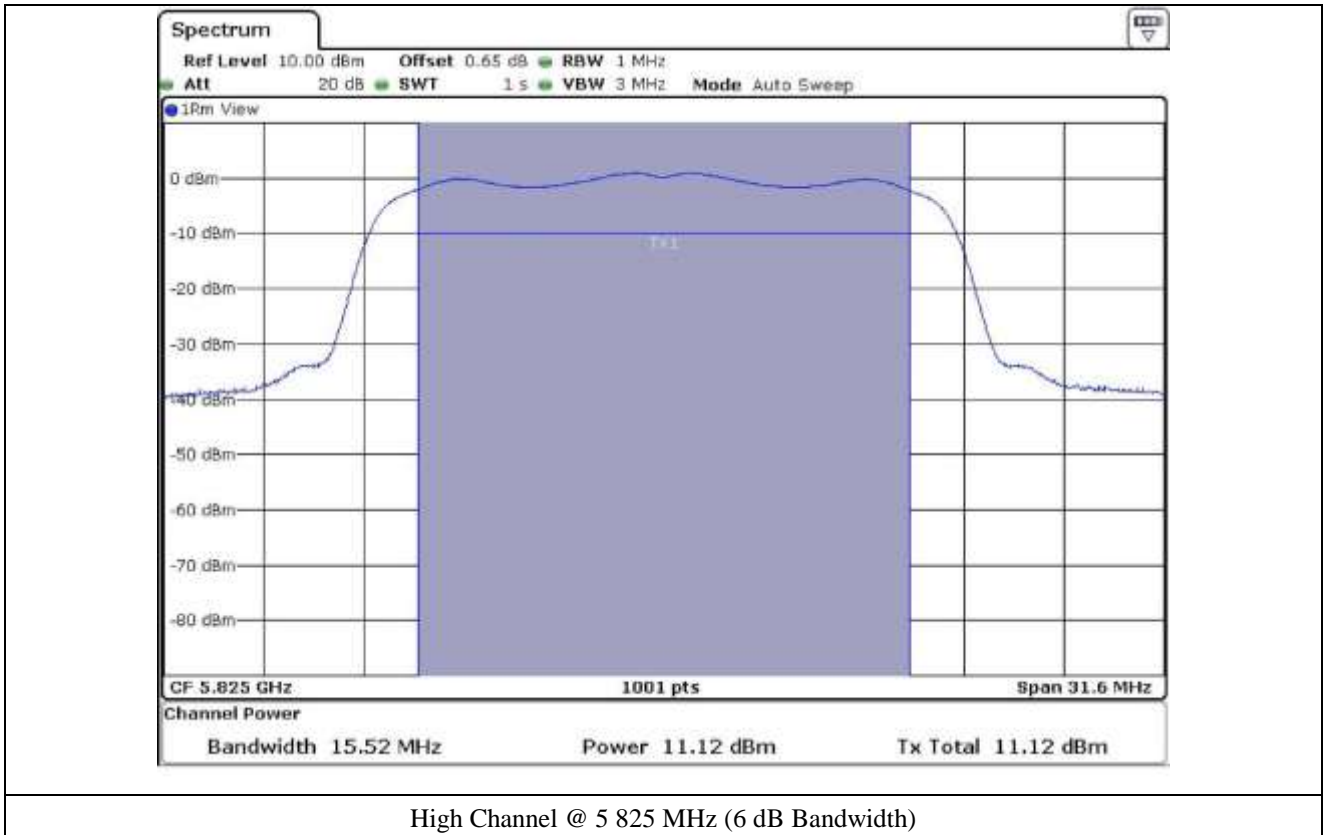




Low Channel @ 5.745 MHz (6 dB Bandwidth)



Middle Channel @ 5.785 MHz (6 dB Bandwidth)



8.5.2 Test data for Antenna 1

- Test Date : May 26, 2015

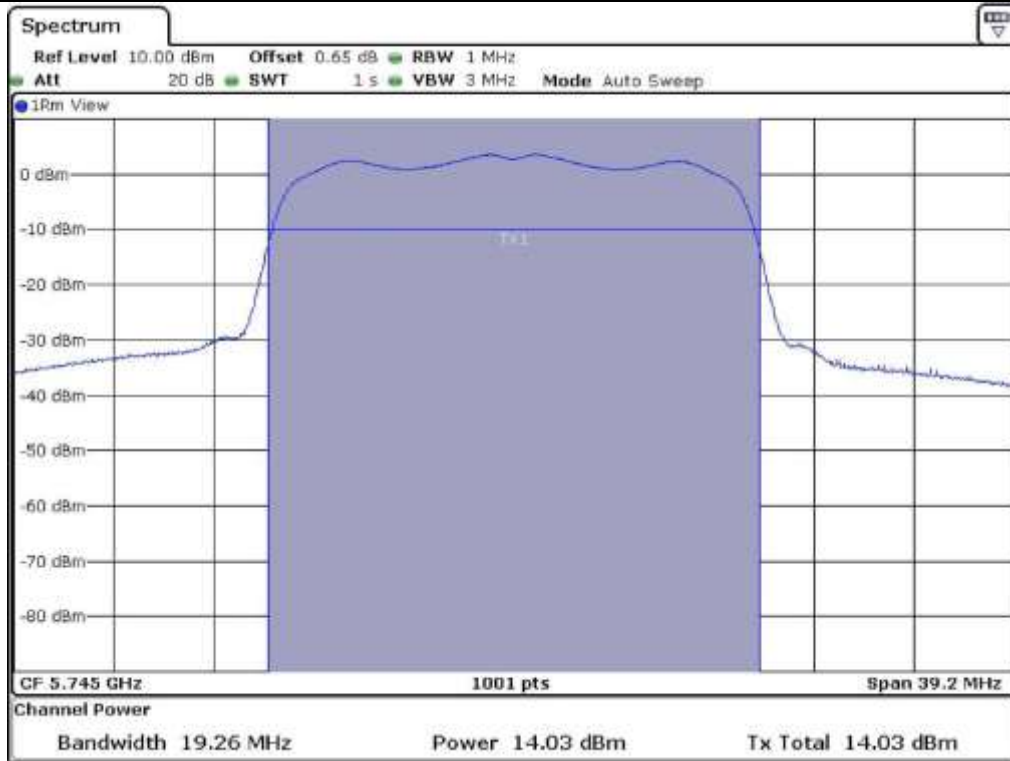
- Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	19.26	14.03	30.00	15.97
	Middle	5 785	19.26	14.78	30.00	15.22
	High	5 825	19.26	12.70	30.00	17.30
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	17.54	14.08	30.00	15.92
	Middle	5 785	17.54	13.07	30.00	16.93
	High	5 825	17.54	12.48	30.00	17.52

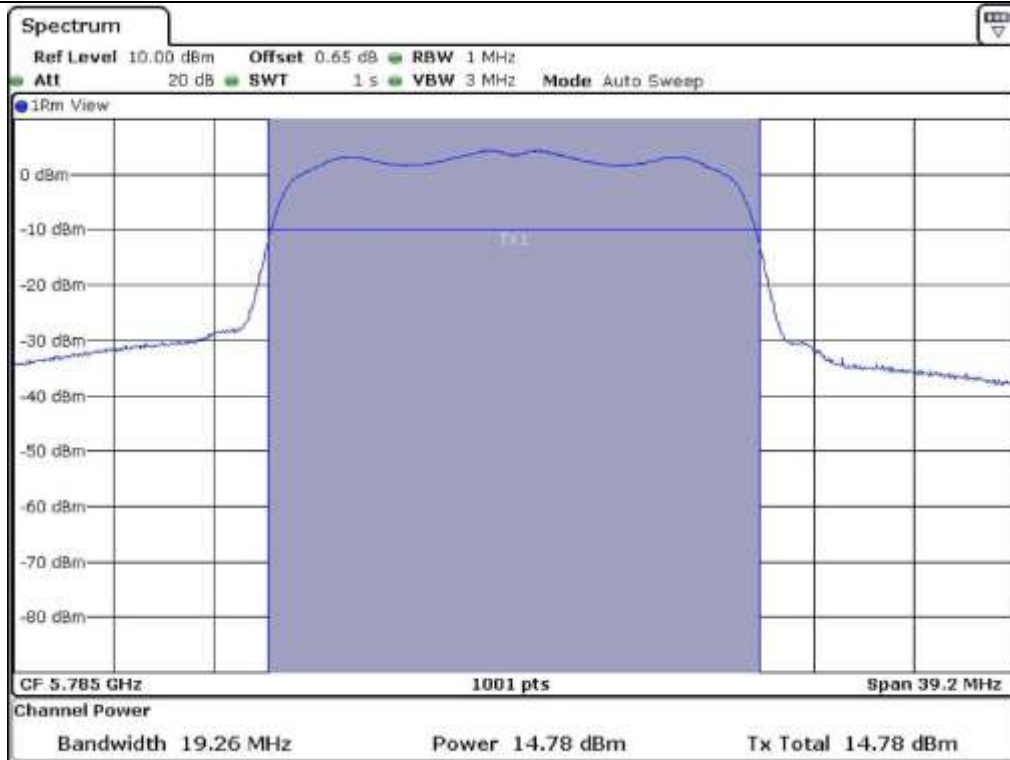
Remark: See next page for measurement data.



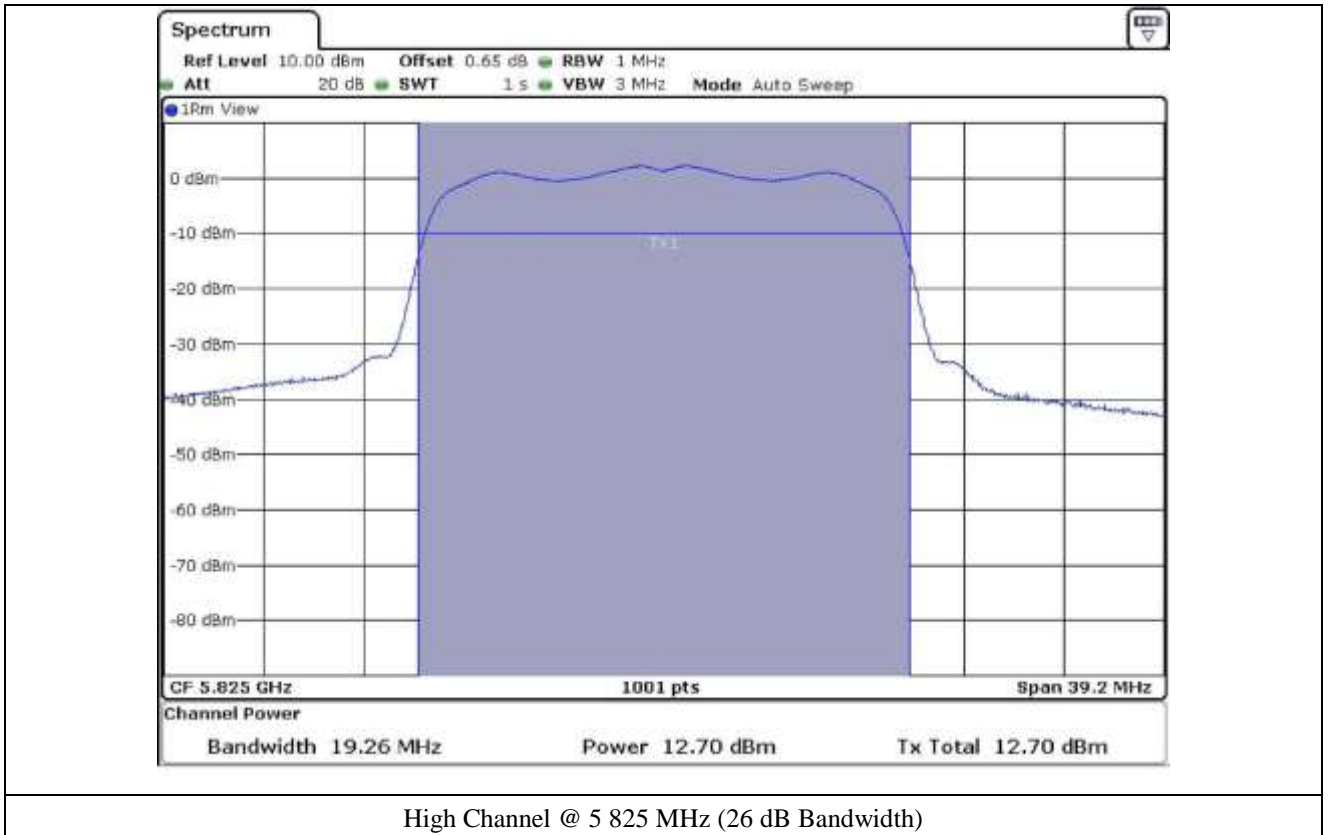
Tested by: Jun-Hui, Lee / Senior Engineer

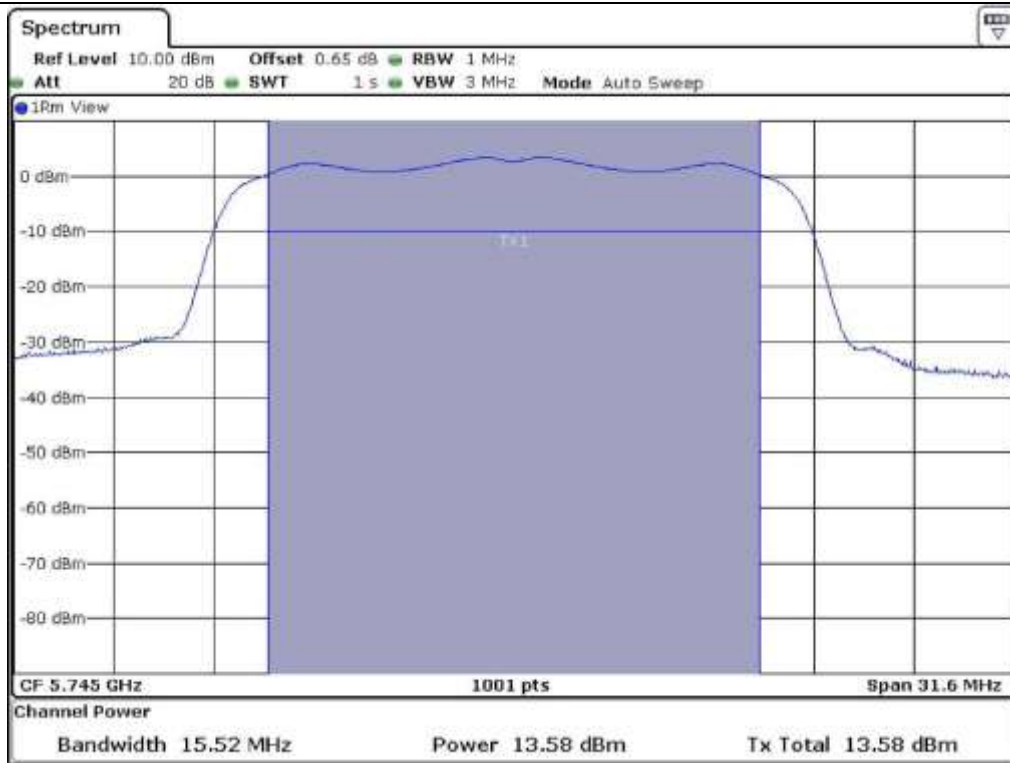


Low Channel @ 5.745 MHz (26 dB Bandwidth)

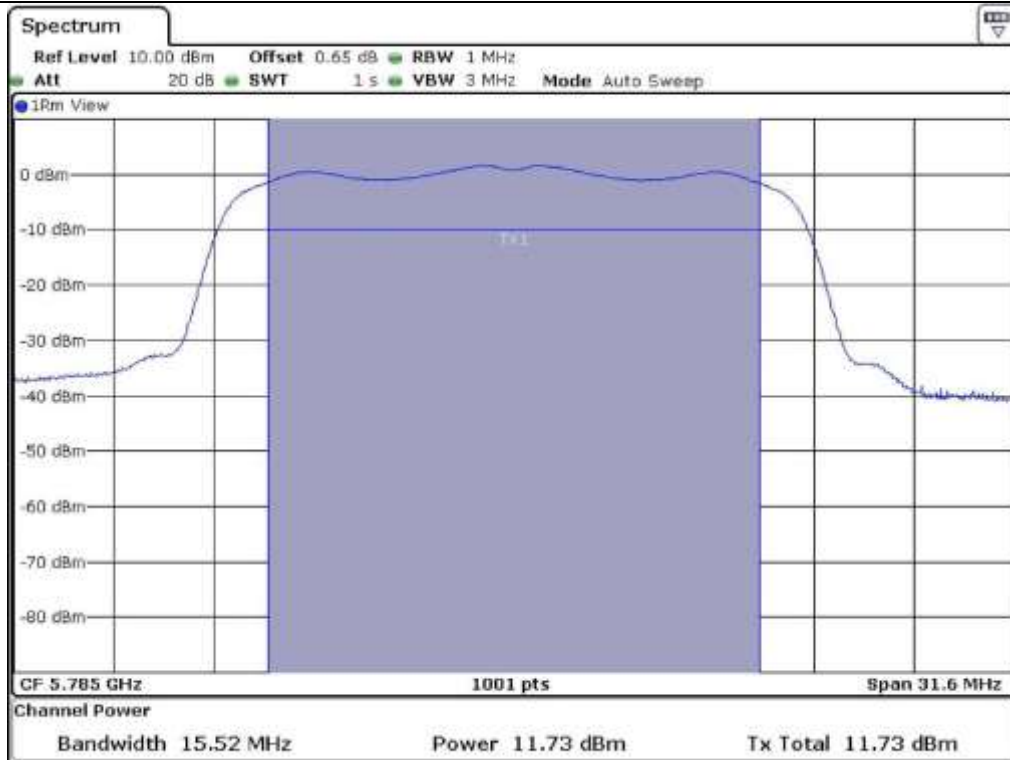


Middle Channel @ 5.785 MHz (26 dB Bandwidth)

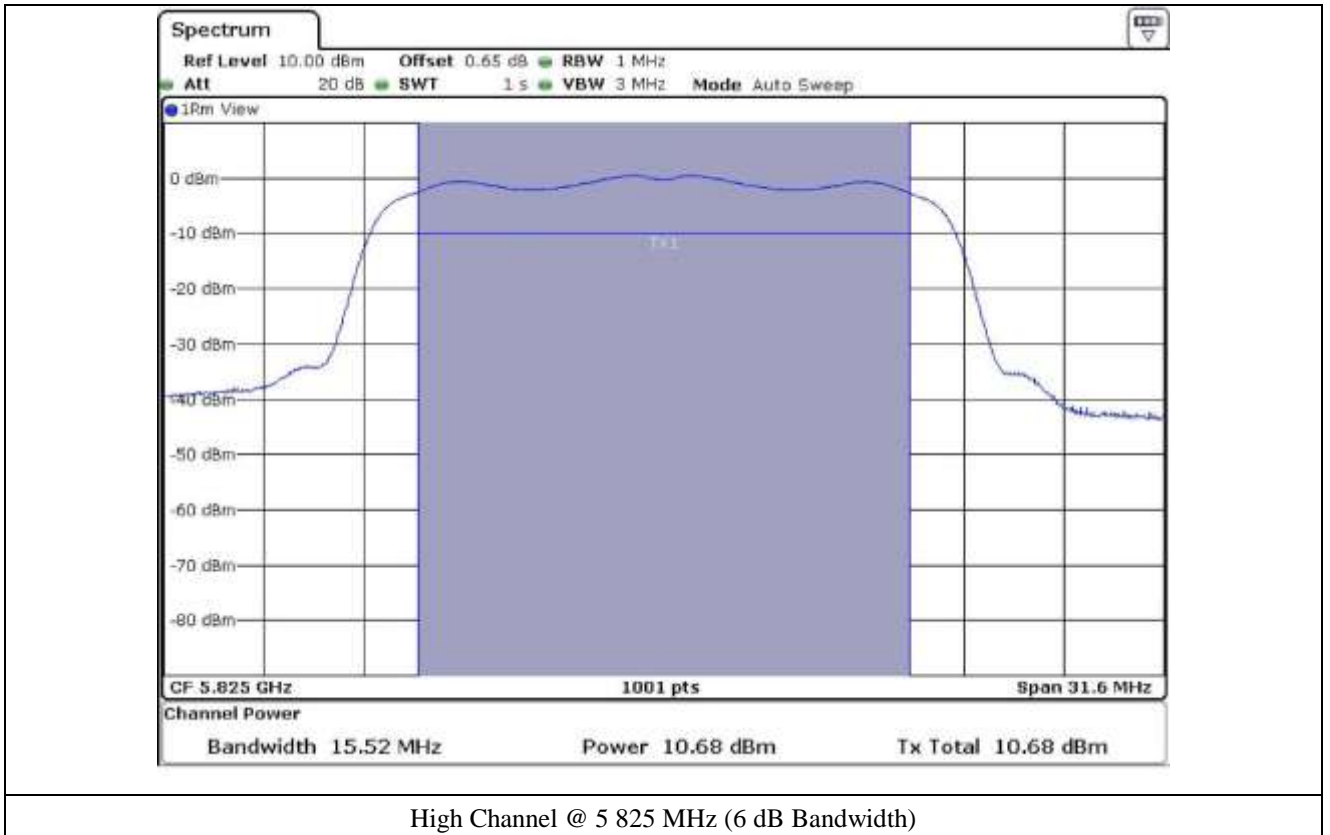




Low Channel @ 5.745 MHz (6 dB Bandwidth)



Middle Channel @ 5.785 MHz (6 dB Bandwidth)



8.5.3 Test data for Multiple transmit

- Test Date : May 26, 2015
 - Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	17.09	30.00	12.91
	Middle	5 785	16.86	30.00	13.14
	High	5 825	15.56	30.00	14.44
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	17.00	30.00	13.00
	Middle	5 785	15.88	30.00	14.12
	High	5 825	15.36	30.00	14.64

Remark 1 : Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Remark 2 : Calculated Output Power= $10\log (10^{(Antenna1 \text{ Output Power}/10)}+10^{(Antenna2 \text{ Output Power}/10)})$



Tested by: Jun-Hui, Lee / Senior Engineer

8.6 Test data for 802.11n_HT40 RLAN Mode

8.6.1 Test data for Antenna 0

-. Test Date : May 26, 2015

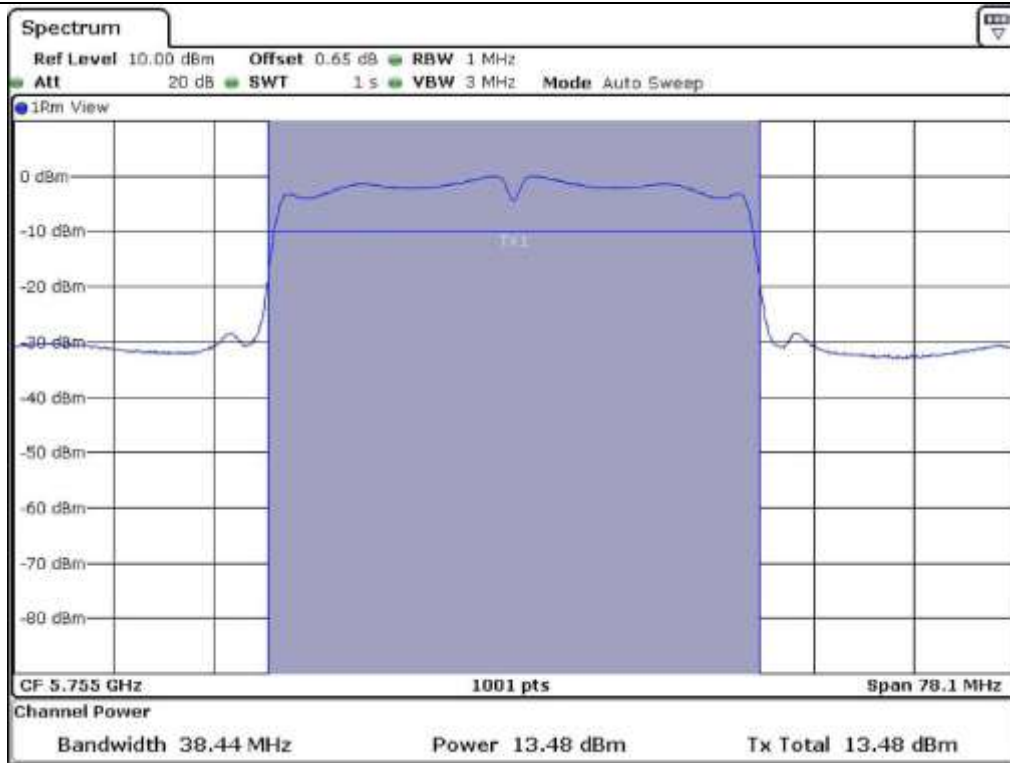
-. Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 755	38.44	13.48	30.00	16.52
	High	5 795	38.44	13.84	30.00	16.16
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	6 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 755	36.36	13.64	30.00	16.36
	High	5 795	36.36	14.13	30.00	15.87

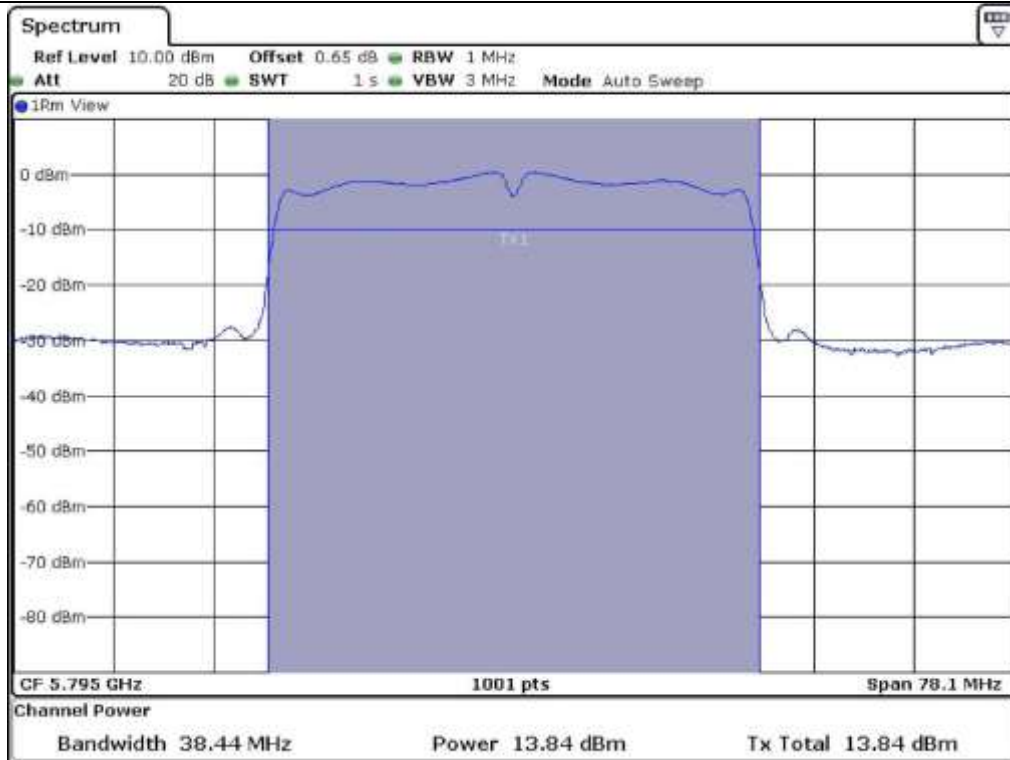
Remark: See next page for measurement data.



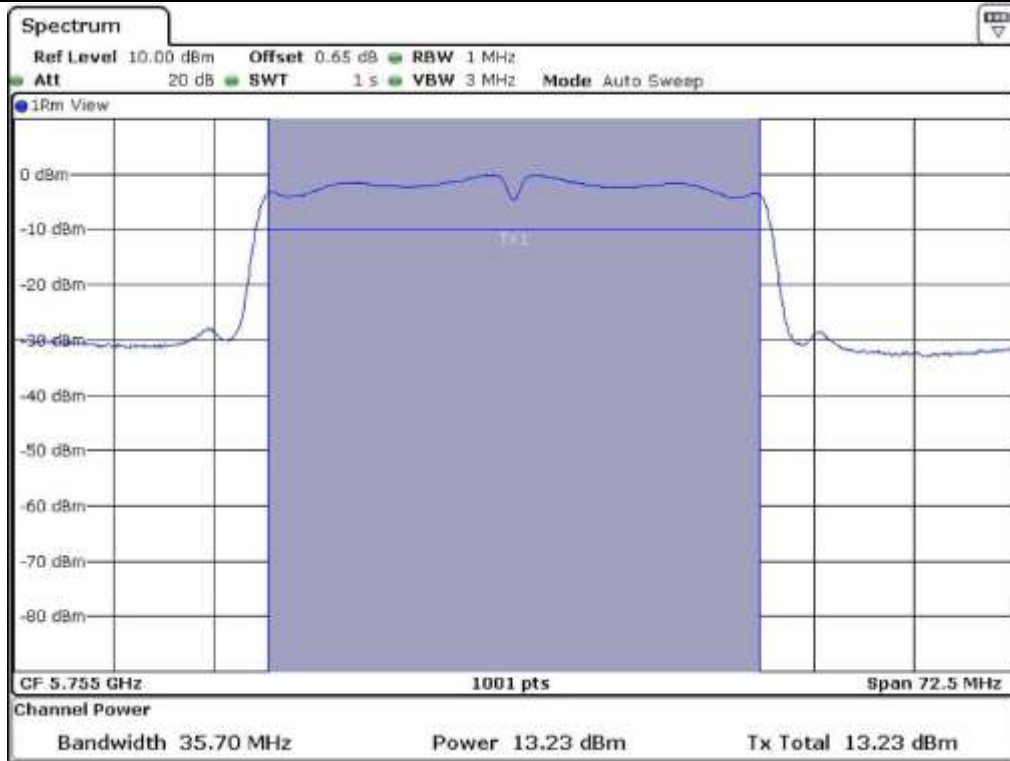
Tested by: Jun-Hui, Lee / Senior Engineer



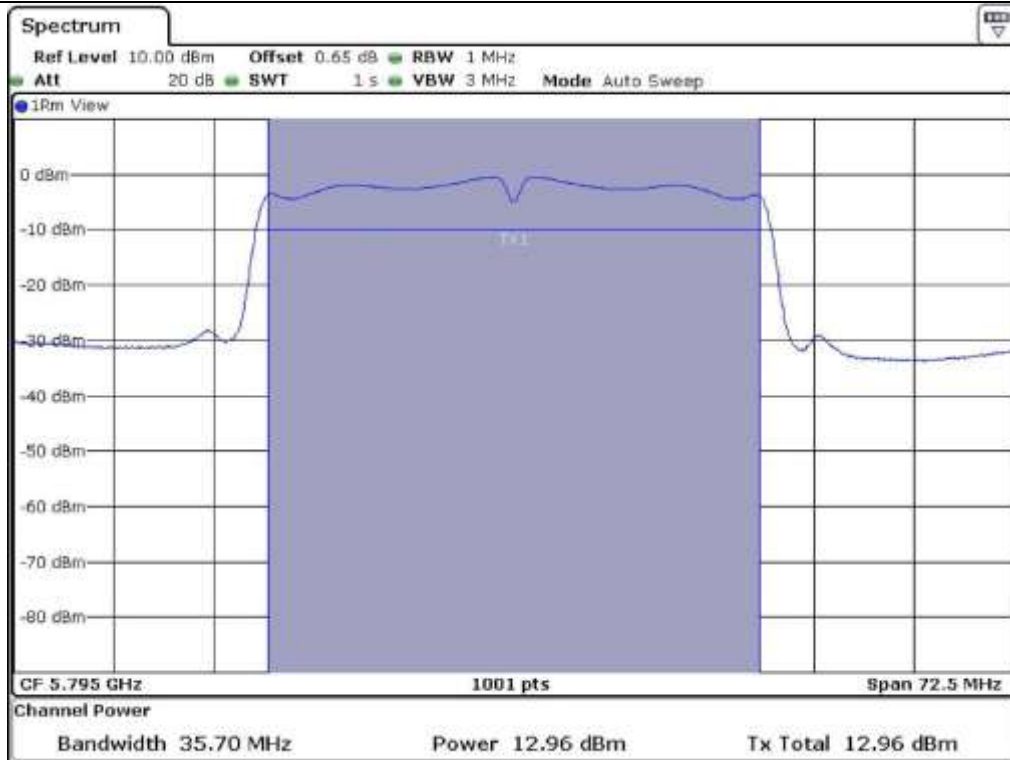
Low Channel @ 5 755 MHz (26 dB Bandwidth)



Middle Channel @ 5 795 MHz (26 dB Bandwidth)



Low Channel @ 5.755 MHz (6 dB Bandwidth)



Middle Channel @ 5.795 MHz (6 dB Bandwidth)

8.6.2 Test data for Antenna 1

-. Test Date : May 26, 2015

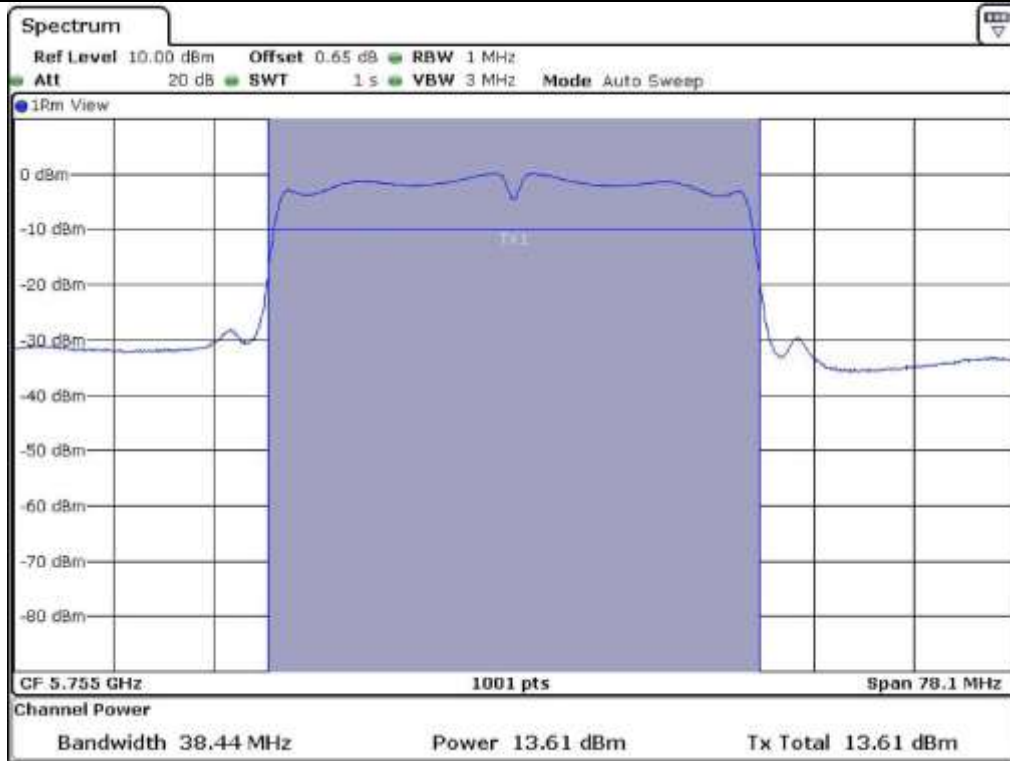
-. Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 755	38.44	13.61	30.00	16.39
	High	5 795	38.44	13.89	30.00	16.11
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	26 dB Bandwidth (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 755	36.20	13.65	30.00	16.35
	High	5 795	36.20	13.86	30.00	16.14

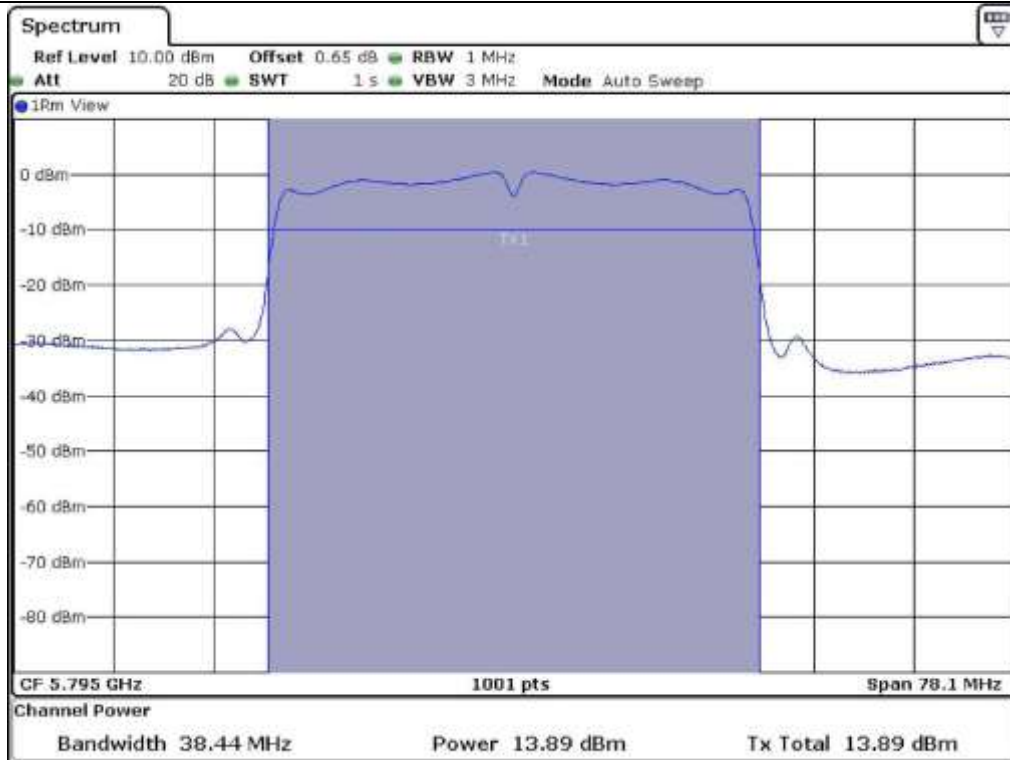
Remark: See next page for measurement data.



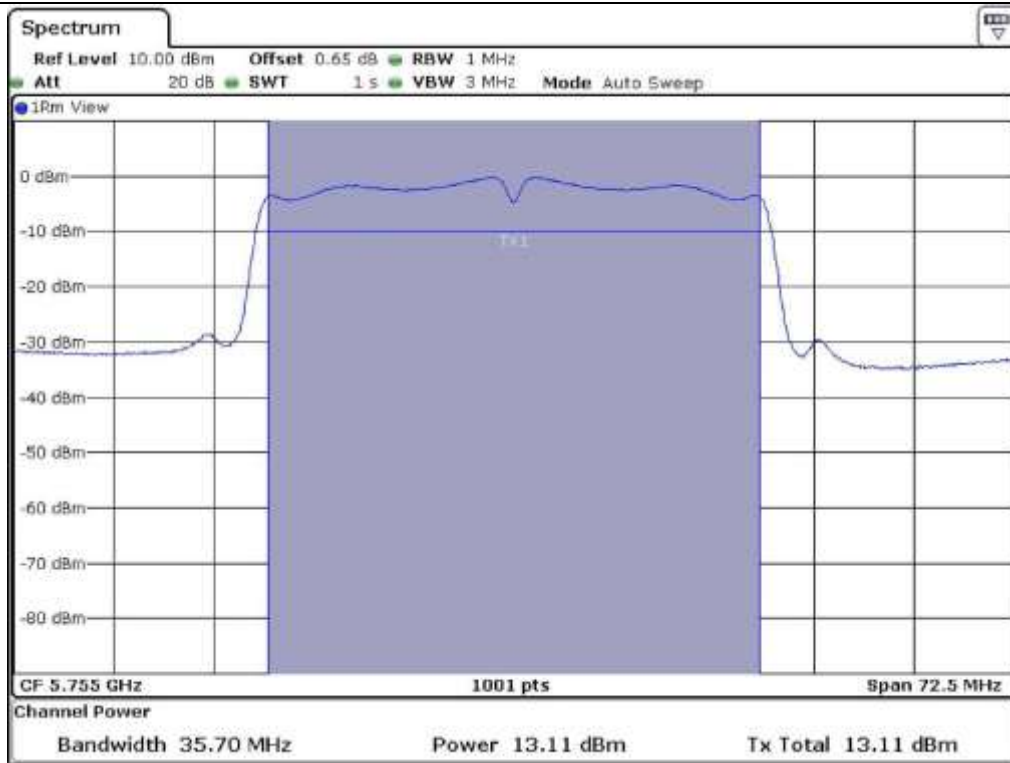
Tested by: Jun-Hui, Lee / Senior Engineer



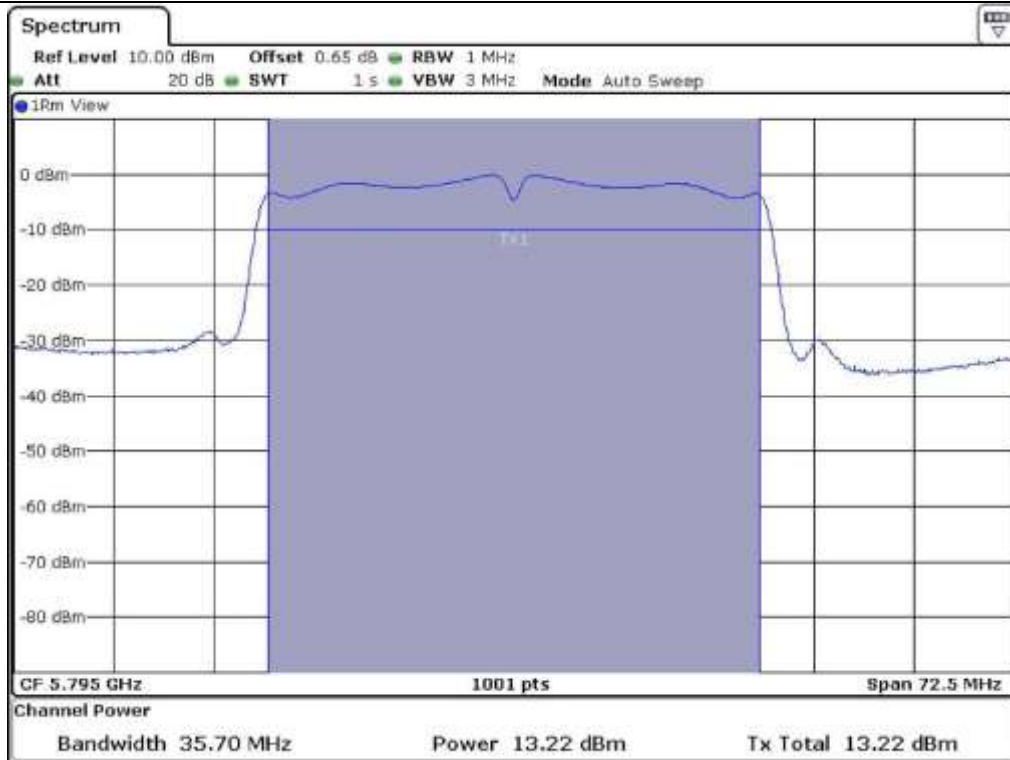
Low Channel @ 5 755 MHz (26 dB Bandwidth)



Middle Channel @ 5 795 MHz (26 dB Bandwidth)



Low Channel @ 5.755 MHz (6 dB Bandwidth)



Middle Channel @ 5.795 MHz (6 dB Bandwidth)

8.6.3 Test data for Multiple transmit


-. Test Date : May 26, 2015

-. Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 755	16.56	30.00	13.44
	High	5 795	16.88	30.00	13.12
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	MEASURED VLAUE (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 755	16.66	30.00	13.34
	High	5 795	17.01	30.00	12.99

Remark 1 : Margin = Limit – Measured Value (=Receiver Reading + Cable Loss)

Remark 2 : Calculated Output Power= $10\log (10^{(Antenna1 \text{ Output Power}/10)}+10^{(Antenna2 \text{ Output Power}/10)})$



Tested by: Jun-Hui, Lee / Senior Engineer

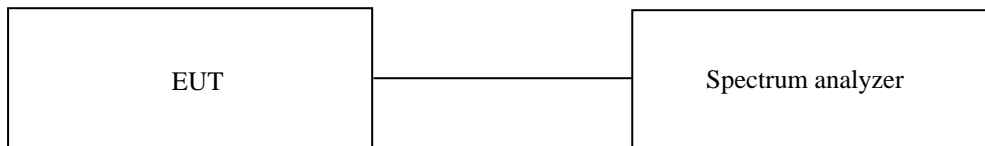
9. PEAK POWER SPECTRAL DENSITY

9.1 Operating environment

Temperature : 22 °C
 Relative humidity : 49 % R.H.

9.2 Test set-up

The antenna output of the EUT was connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz, the video bandwidth is set to 3 times the resolution bandwidth. The maximum level from the EUT in 1 MHz bandwidth was measured with above condition.



9.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 30, 2014 (1Y)

All test equipment used is calibrated on a regular basis.

9.4 Test data for 802.11a RLAN Mode

9.4.1 Test data for Antenna 0

- Test Date : May 26, 2015
- Operating condition : Highest Output Power Transmitting Mode
- Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENC Y (MHz)	MEASURED VLAUE (dBm)	Compensated Value (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	3.18	0.18	30.00	29.82
	Middle	5 785	2.31	-0.69	30.00	30.69
	High	5 825	1.49	-1.51	30.00	31.51

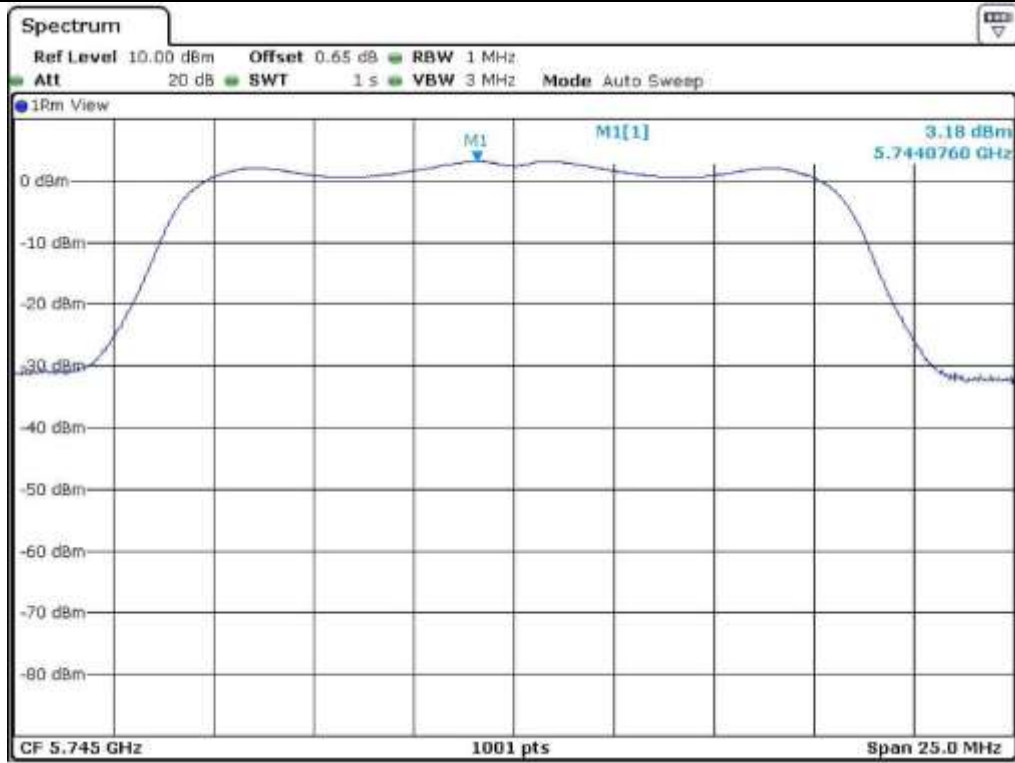
Remark 1 : See next page for measurement data.

Remark 2 : A compensation value according to a RBW is compensated as follows.

$$10\log(500 \text{ kHz}/1 \text{ MHz}) = -3 \text{ dB}$$



Tested by: Jun-Hui, Lee / Senior Engineer



Low Channel (5.745 MHz)



Middle Channel (5.785 MHz)



9.4.2 Test data for Antenna 1

- Test Date : May 26, 2015
- Operating condition : Highest Output Power Transmitting Mode
- Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENC Y (MHz)	MEASURED VLAUE (dBm)	Compensated Value (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	3.39	0.39	30.00	29.61
	Middle	5 785	2.85	-0.15	30.00	30.15
	High	5 825	1.44	-1.56	30.00	31.56

Remark 1 : See next page for measurement data.

Remark 2 : A compensation value according to a RBW is compensated as follows.

$$10\log(500 \text{ kHz}/1 \text{ MHz}) = -3 \text{ dB}$$



Tested by: Jun-Hui, Lee / Senior Engineer



Low Channel (5 745 MHz)



Middle Channel (5 785 MHz)



High Channel (5 825 MHz)

9.4.3 Test data for Multiple Transmit

- Test Date : May 26, 2015
- Operating condition : Highest Output Power Transmitting Mode
- Test Result : Pass

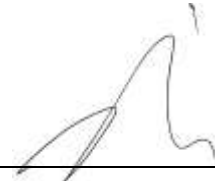
FREQUENCY RANGE (MHz)	CHANNEL	FREQUENC Y (MHz)	MEASURED VLAUE (dBm)	Compensated Value (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	6.30	3.30	30.00	26.70
	Middle	5 785	5.60	2.60	30.00	27.40
	High	5 825	4.48	1.48	30.00	28.52

Remark 1 : Margin = Limit – Measured value

Remark 2 : Calculated Power Density = $10\log (10^{(\text{Antenna1 Power Density}/10)} + 10^{(\text{Antenna2 Power Density}/10)})$

Remark 3 : A compensation value according to a RBW is compensated as follows.

$$10\log(500 \text{ kHz}/1 \text{ MHz}) = -3 \text{ dB}$$



Tested by: Jun-Hui, Lee / Senior Engineer

9.5 Test data for 802.11n_HT20 RLAN Mode

9.5.1 Test data for Antenna 0


- Test Date : May 26, 2015
- Operating condition : Highest Output Power Transmitting Mode
- Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENC Y (MHz)	MEASURED VLAUE (dBm)	Compensated Value (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	3.61	0.61	30.00	29.39
	Middle	5 785	2.20	-0.80	30.00	30.80
	High	5 825	1.61	-1.39	30.00	31.39

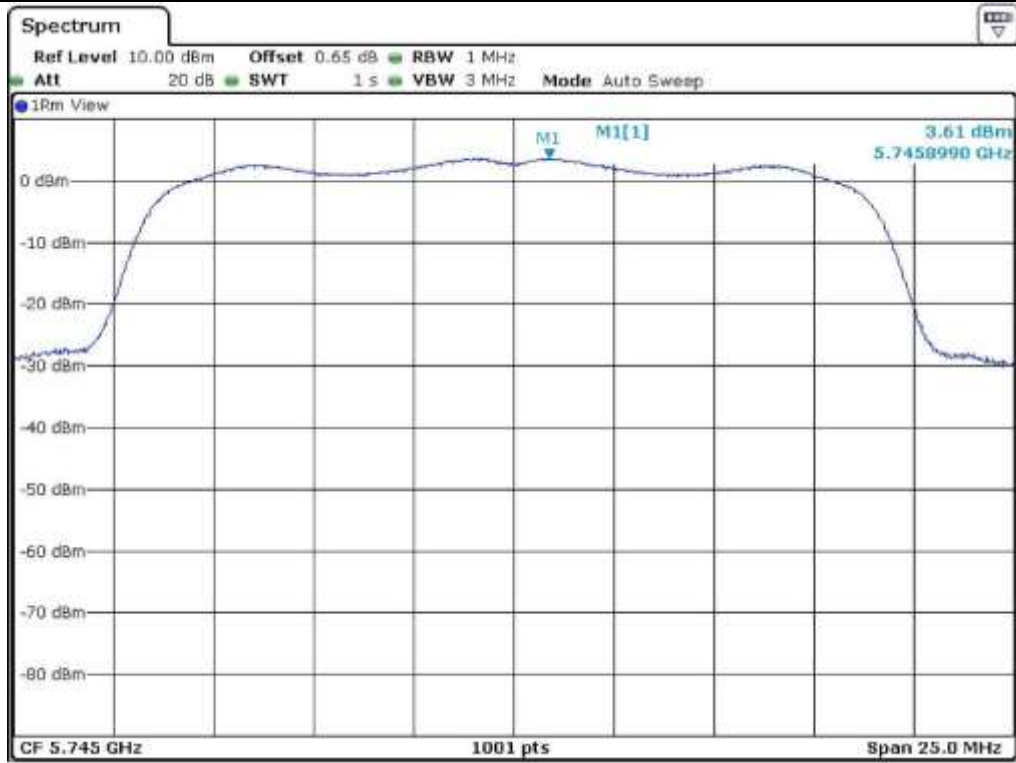
Remark 1 : See next page for measurement data.

Remark 2 : A compensation value according to a RBW is compensated as follows.

$$10\log(500 \text{ kHz}/1 \text{ MHz}) = -3 \text{ dB}$$



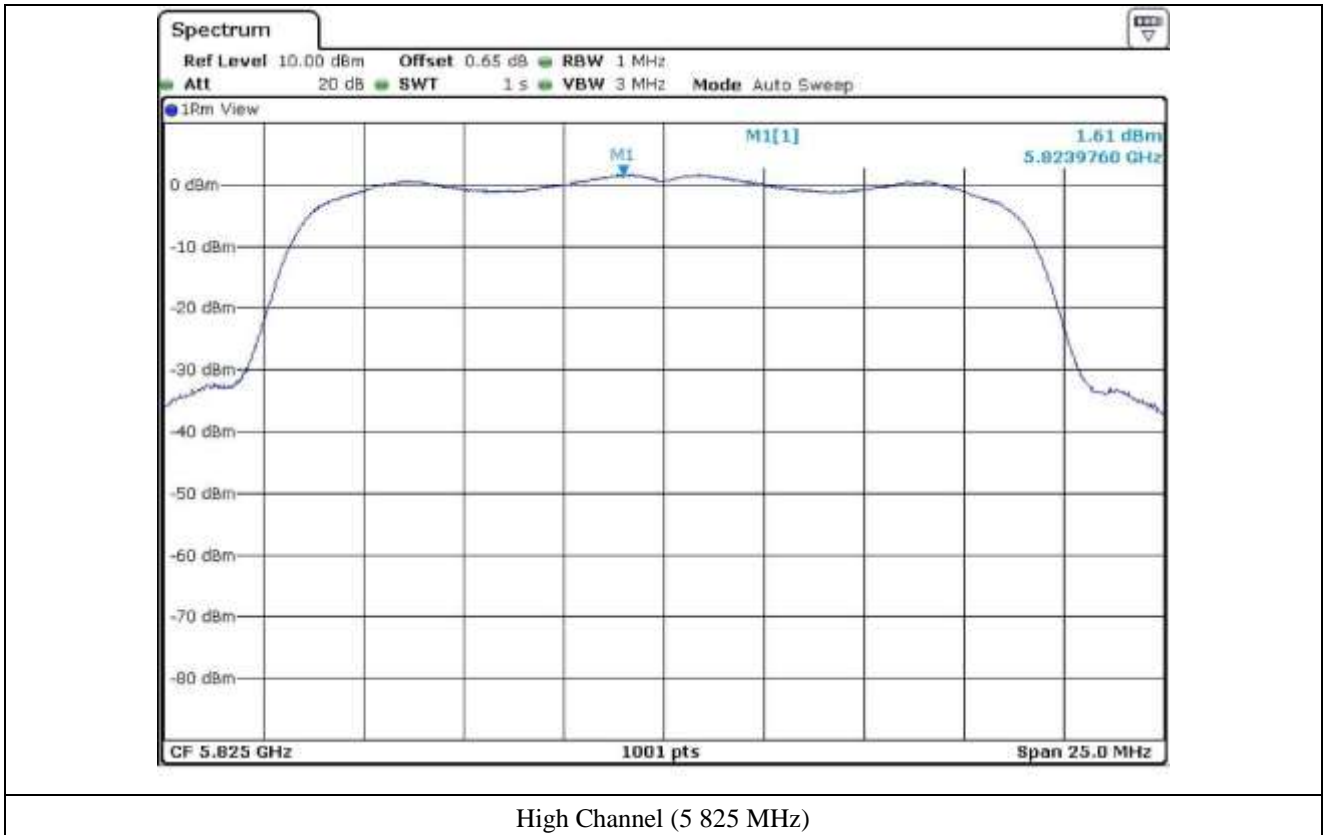
Tested by: Jun-Hui, Lee / Senior Engineer



Low Channel (5.745 MHz)



Middle Channel (5.785 MHz)



9.5.2 Test data for Antenna 1

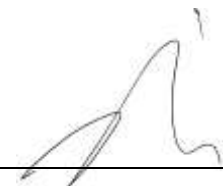
- Test Date : May 26, 2015
- Operating condition : Highest Output Power Transmitting Mode
- Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENC Y (MHz)	MEASURED VLAUE (dBm)	Compensated Value (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	3.86	0.86	30.00	29.14
	Middle	5 785	2.68	-0.32	30.00	30.32
	High	5 825	1.17	-1.83	30.00	31.83

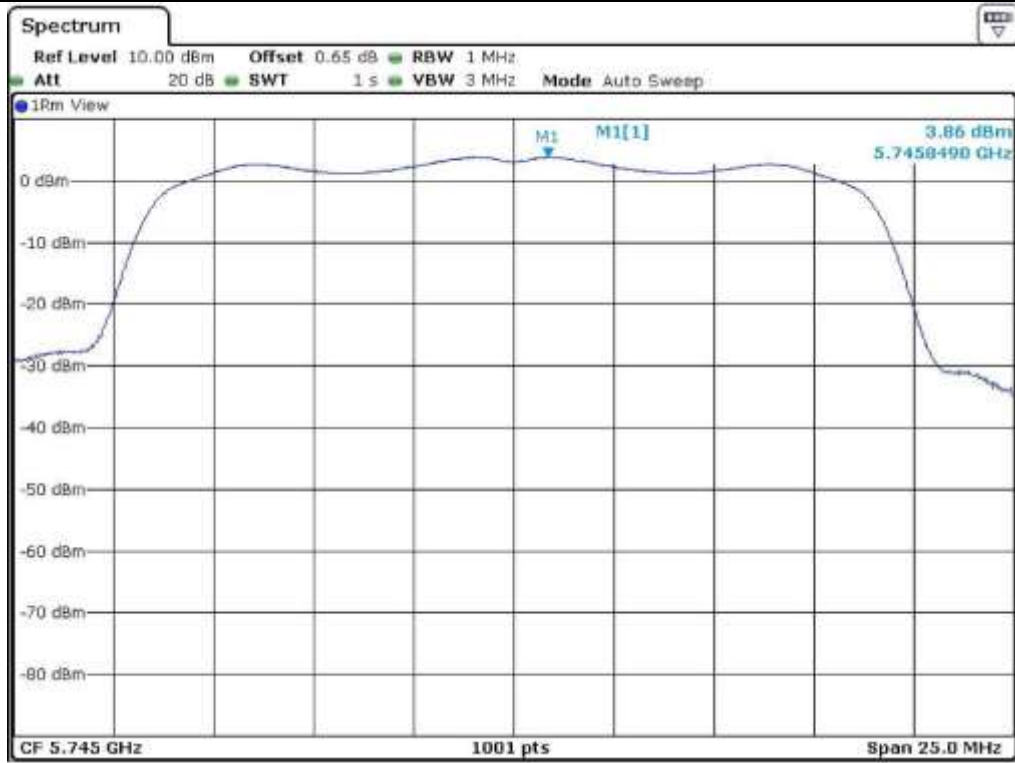
Remark 1 : See next page for measurement data.

Remark 2 : A compensation value according to a RBW is compensated as follows.

$$10\log(500 \text{ kHz}/1 \text{ MHz}) = -3 \text{ dB}$$



Tested by: Jun-Hui, Lee / Senior Engineer



Low Channel (5.745 MHz)



Middle Channel (5.785 MHz)



9.5.3 Test data for Multiple transmit

- Test Date : May 26, 2015
- Operating condition : Highest Output Power Transmitting Mode
- Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENCY (MHz)	MEASURED VALUE (dBm)	Compensated Value (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 745	6.75	3.75	30.00	26.25
	Middle	5 785	5.46	2.46	30.00	27.54
	High	5 825	4.41	1.41	30.00	28.59

Remark 1 : Margin = Limit – Measured value

Remark 2 : Calculated Power Density = $10\log (10^{(\text{Antenna1 Power Density}/10)} + 10^{(\text{Antenna2 Power Density}/10)})$

Remark 3 : A compensation value according to a RBW is compensated as follows.

$$10\log(500 \text{ kHz}/1 \text{ MHz}) = -3 \text{ dB}$$



Tested by: Jun-Hui, Lee / Senior Engineer

9.6 Test data for 802.11n_HT40 RLAN Mode

9.6.1 Test data for Antenna 0

- Test Date : May 26, 2015
- Operating condition : Highest Output Power Transmitting Mode
- Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENC Y (MHz)	MEASURED VLAUE (dBm)	Compensated Value (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 755	0.22	-2.78	30.00	32.78
	High	5 795	0.71	-2.29	30.00	32.29

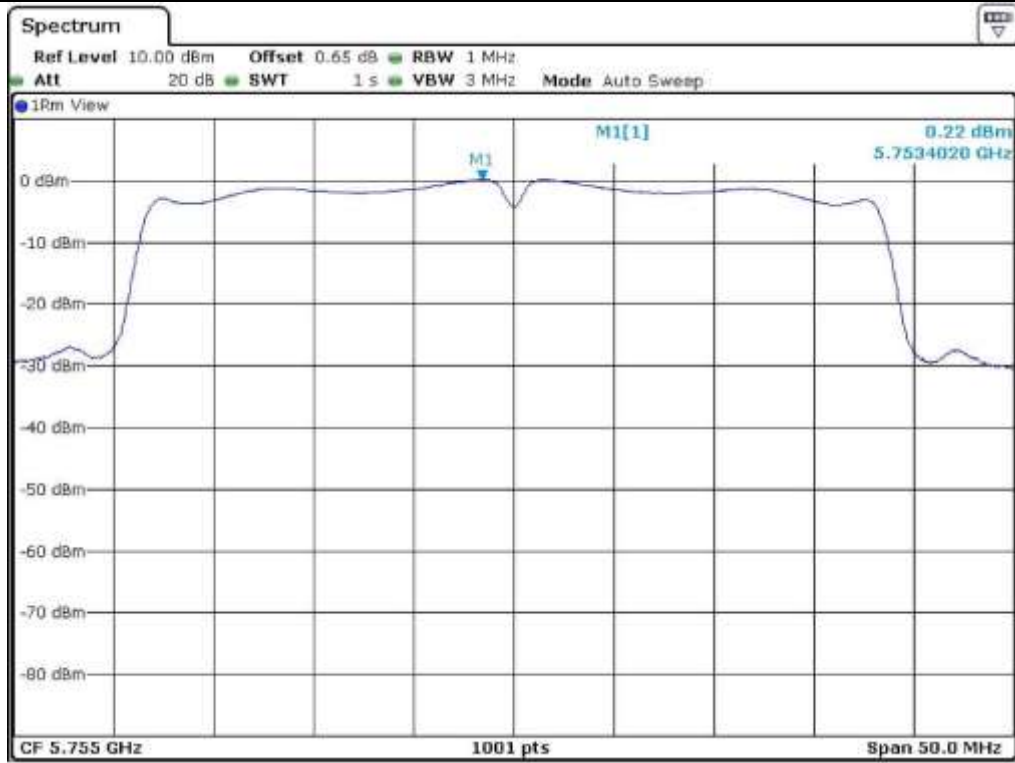
Remark 1 : See next page for measurement data.

Remark 2 : A compensation value according to a RBW is compensated as follows.

$$10\log(500 \text{ kHz}/1 \text{ MHz}) = -3 \text{ dB}$$



Tested by: Jun-Hui, Lee / Senior Engineer



Low Channel (5 755 MHz)



High Channel (5 795 MHz)

9.6.2 Test data for Antenna 1

- Test Date : May 26, 2015
- Operating condition : Highest Output Power Transmitting Mode
- Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENC Y (MHz)	MEASURED VLAUE (dBm)	Compensated Value (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 755	0.37	-2.63	30.00	32.63
	High	5 825	0.24	-2.76	30.00	32.76

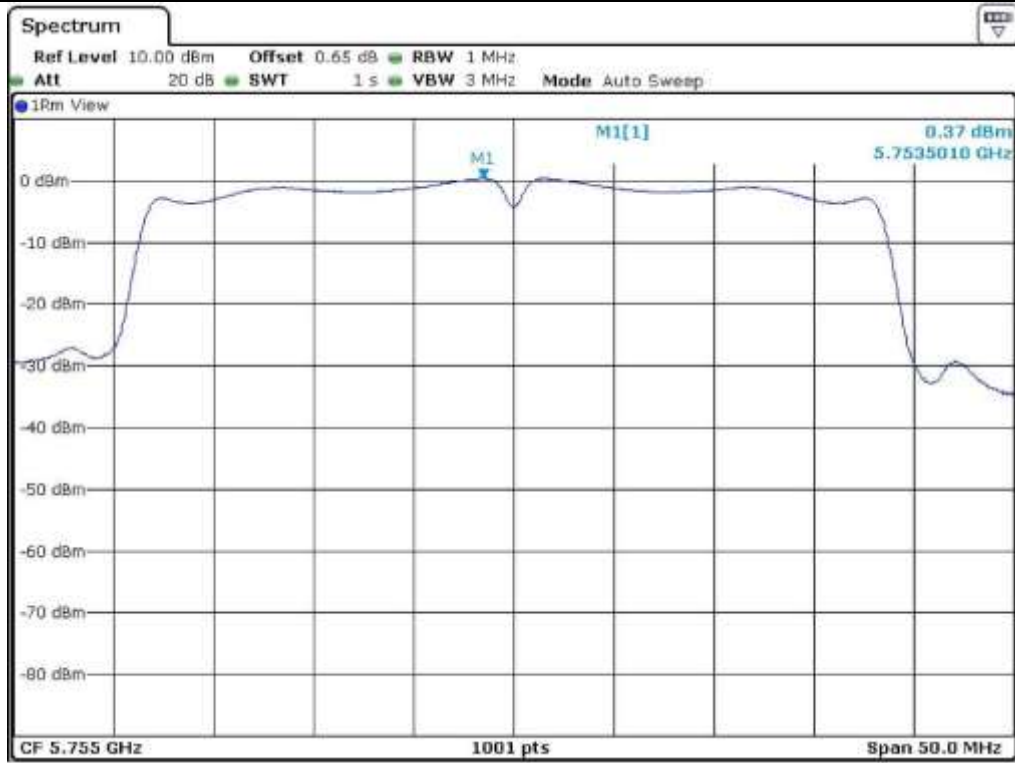
Remark 1 : See next page for measurement data.

Remark 2 : A compensation value according to a RBW is compensated as follows.

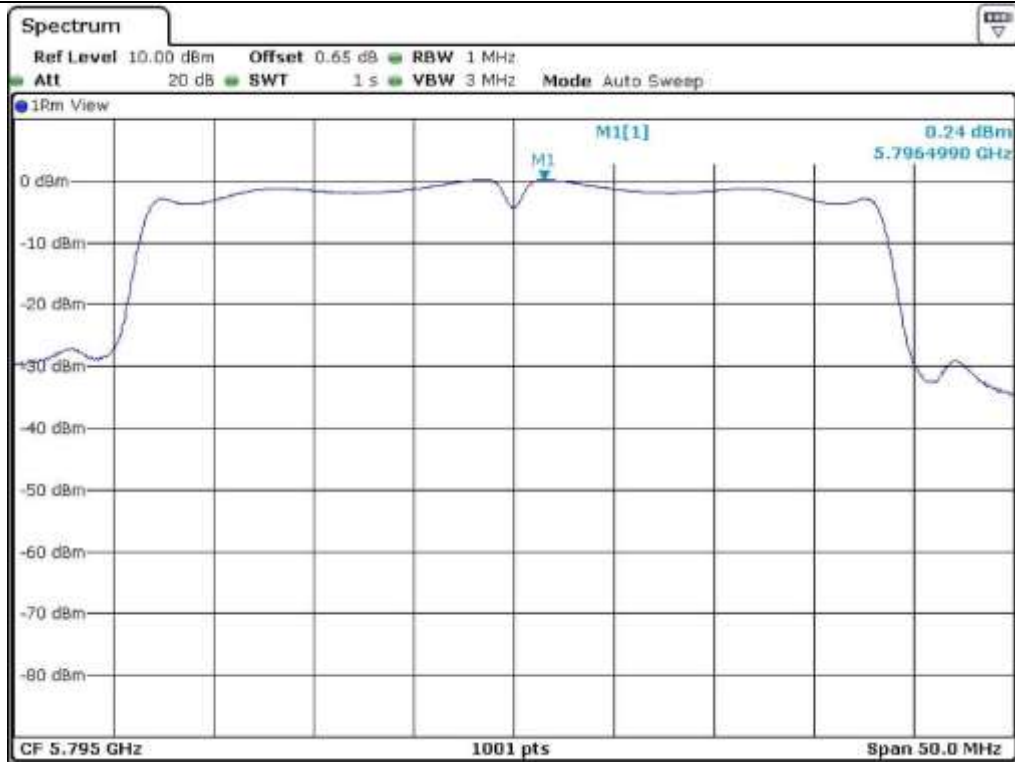
$$10\log(500 \text{ kHz}/1 \text{ MHz}) = -3 \text{ dB}$$



Tested by: Jun-Hui, Lee / Senior Engineer



Low Channel (5 755 MHz)



High Channel (5 795 MHz)

9.6.3 Test data for Multiple transmit

- Test Date : May 26, 2015
- Operating condition : Highest Output Power Transmitting Mode
- Test Result : Pass

FREQUENCY RANGE (MHz)	CHANNEL	FREQUENC Y (MHz)	MEASURED VLAUE (dBm)	Compensated Value (dBm)	LIMIT (dBm)	MARGIN (dB)
5 725 ~ 5 850	Low	5 755	3.31	0.31	30.00	29.69
	High	5 795	3.49	0.49	30.00	29.51

Remark 1 : Margin = Limit – Measured value

Remark 2 : Calculated Power Density = $10\log(10^{(\text{Antenna1 Power Density}/10)} + 10^{(\text{Antenna2 Power Density}/10)})$

Remark 3 : A compensation value according to a RBW is compensated as follows.

$$10\log(500 \text{ kHz}/1 \text{ MHz}) = -3 \text{ dB}$$



Tested by: Jun-Hui, Lee / Senior Engineer

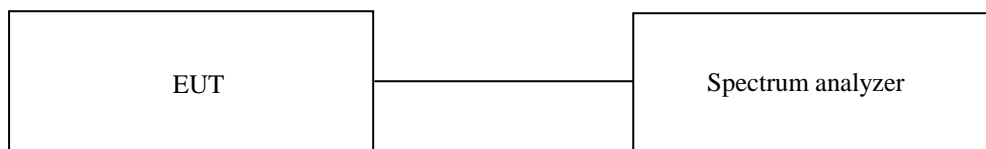
10. FREQUENCY STABILITY WITH TEMPERATURE VARIATION

10.1 Operating environment

Temperature : 22 °C
 Relative humidity : 49 % R.H.

10.2 Test set-up

Turn EUT off and set chamber temperature to -30 °C and then allow sufficient time (approximately 20 min to 30 min after chamber reach the assigned temperature) for EUT to stabilize. Turn on the EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from 0 °C to +65 °C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.



10.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul 30, 2014 (1Y)
■ - SSE-43CI-A	Samkun Tech	Humidity Chamber	060712	May 15, 2015 (1Y)
■ - DRP-305DN	DIGITAL Elec.	DC Power supply	4030195	Sep. 03, 2014 (1Y)

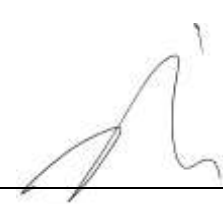
All test equipment used is calibrated on a regular basis.

10.4 Test Data for 5 725 MHz ~ 5 850 MHz Band

-. Test Date : May 26, 2015

-. Result : Pass

Temperature (°C)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Frequency Error (kHz)
0	5 745 000 000	5 744 987 401	-12.599
10		5 744 972 542	-27.458
20		5 744 961 505	-38.495
30		5 744 958 620	-41.380
40		5 744 962 304	-37.696
50		5 744 968 421	-31.579
60		5 744 971 086	-28.914
65		5 744 973 497	-26.503
0	5 785 000 000	5 784 988 186	-11.814
10		5 784 972 435	-27.565
20		5 784 961 314	-38.686
30		5 784 957 123	-42.877
40		5 784 960 176	-39.824
50		5 784 967 125	-32.875
60		5 784 972 677	-27.323
65		5 784 974 121	-25.879
0	5 825 000 000	5 824 986 428	-13.572
10		5 824 973 560	-26.440
20		5 824 961 644	-38.356
30		5 824 957 854	-42.146
40		5 824 962 649	-37.351
50		5 824 970 323	-29.677
60		5 824 974 763	-25.237
65		5 824 976 124	-23.876



Tested by: Jun-Hui, Lee / Senior Engineer

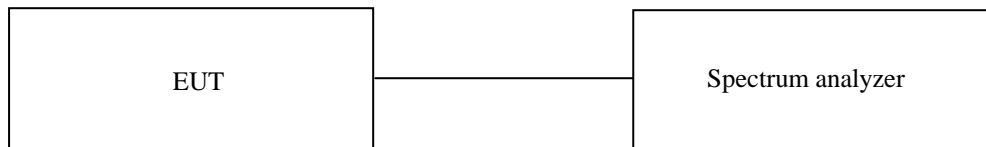
11. FREQUENCY STABILITY WITH VOLTAGE VARIATION

11.1 Operating environment

Temperature : 22 °C
 Relative humidity : 49 % R.H.

11.2 Test set-up

An external DC power supply was connected to the input of the EUT. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.



11.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul 30, 2014 (1Y)
■ - DRP-305DN	DIGITAL Elec.	DC Power supply	4030195	Sep. 03, 2014 (1Y)

All test equipment used is calibrated on a regular basis.

11.4 Test Data for 5 725 MHz ~ 5 850 MHz Band

-. Test Date : May 26, 2015

-. Result : Pass

Voltage (Vdc)	Carrier Freq. (Hz)	Measured Freq. (Hz)	Frequency Error (kHz)
4.025	5 745 000 000	5 744 961 513	-38.487
3.500		5 744 961 505	-38.495
2.975		5 744 961 410	-38.590
4.025	5 785 000 000	5 784 961 412	-38.588
3.500		5 784 961 314	-38.686
2.975		5 784 961 138	-38.862
4.025	5 825 000 000	5 824 961 719	-38.281
3.500		5 824 961 644	-38.356
2.975		5 824 961 487	-38.513



Tested by: Jun-Hui, Lee / Senior Engineer

12. RADIATED SPURIOUS EMISSIONS

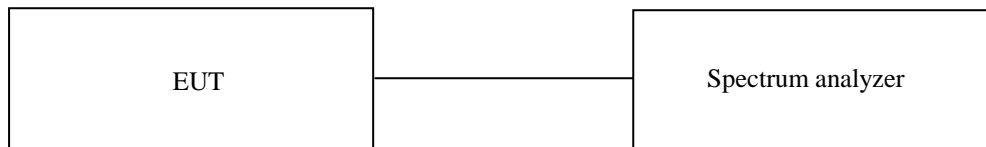
12.1 Operating environment

Temperature : 22 ~ 23 °C
 Relative humidity : 54 ~ 55 % R.H.

12.2 Test set-up for conducted measurement

The radiated emissions measurements were performed on the 3 m, open-field test site. The EUT was placed on a non-conductive turntable above the ground plane.

The frequency spectrum from 30 MHz to 40 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.



12.3 Test equipment used

	Model Number	Manufacturer	Description	Serial Number	Last Cal.(Interval)
■ -	FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 30, 2014 (1Y)
■ -	ESCI	Rohde & Schwarz	Test Receiver	101012	Nov. 03, 2014 (1Y)
■ -	310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 29, 2015 (1Y)
■ -	SCU-18	Rohde & Schwarz	Pre-Amplifier	10041	Nov. 25, 2014 (1Y)
■ -	DT3000	Innco System	Turn Table	930611	N/A
■ -	MA4000-EP	Innco System	Antenna Master	3320611	N/A
■ -	VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-421	Jul. 10, 2014 (2Y)
■ -	BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	Sep. 05, 2013 (2Y)
■ -	BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Sep. 05, 2013 (2Y)

All test equipment used is calibrated on a regular basis.

12.4 Test data for 5 725 MHz ~ 5 850 MHz Band

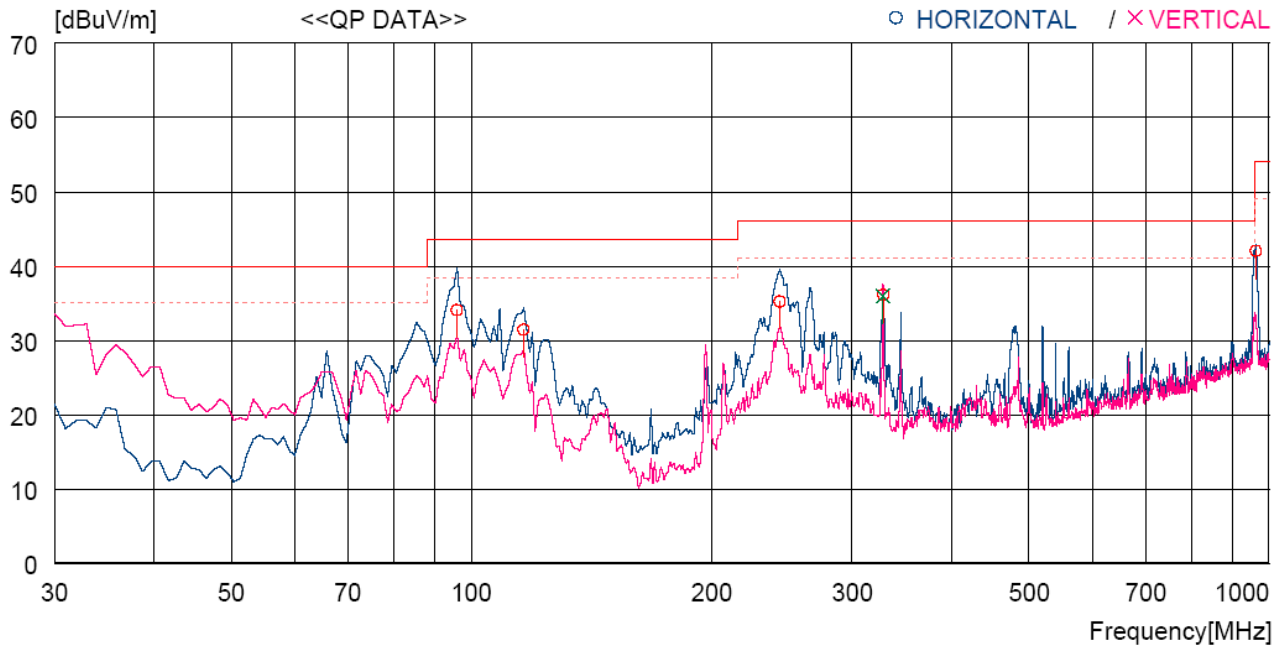
12.4.1 Test data for 802.11a RLAN Mode

12.4.1.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 54 ~ 55 % R.H. Temperature: 22 ~ 23 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

EUT : WLAN Module Date: June 09, 2015
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

-Ant0, Ant1 and Multiple transmit with Low, Middle and High Channels were tested, but the worst data were recorded.



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	95.960	53.2	11.2	2.7	33.1	34.0	43.5	9.5	300	165
2	116.330	50.6	10.6	3.3	33.1	31.4	43.5	12.1	300	152
3	243.400	51.7	12.2	4.2	32.9	35.2	46.0	10.8	100	137
4	328.760	50.0	14.2	4.8	32.9	36.1	46.0	9.9	100	0
5	962.157	42.7	22.5	8.7	31.9	42.0	54.0	12.0	100	60
----- Vertical -----										
6	327.790	49.8	14.2	4.8	32.9	35.9	46.0	10.1	200	172

12.4.1.2 Test data for Below 30 MHz

- Test Date : June 09, 2015
- Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- Frequency range : 9 kHz ~ 30 MHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dB μ V)	Ant. Pol. (H/V)	Ant. Height (m)	Angle ($^{\circ}$)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
It was not observed any emissions from the EUT.									

12.4.1.3 Test data for above 1 GHz

- Test Date : June 09, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dB μ V)	Ant. Pol. (H/V)	Ant. Height (m)	Angle ($^{\circ}$)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dB μ V/m)	Limits (dB μ V/m)	Margin (dB)
It was not observed any emissions from the EUT.									



Tested by: Jun-Hui, Lee / Senior Engineer

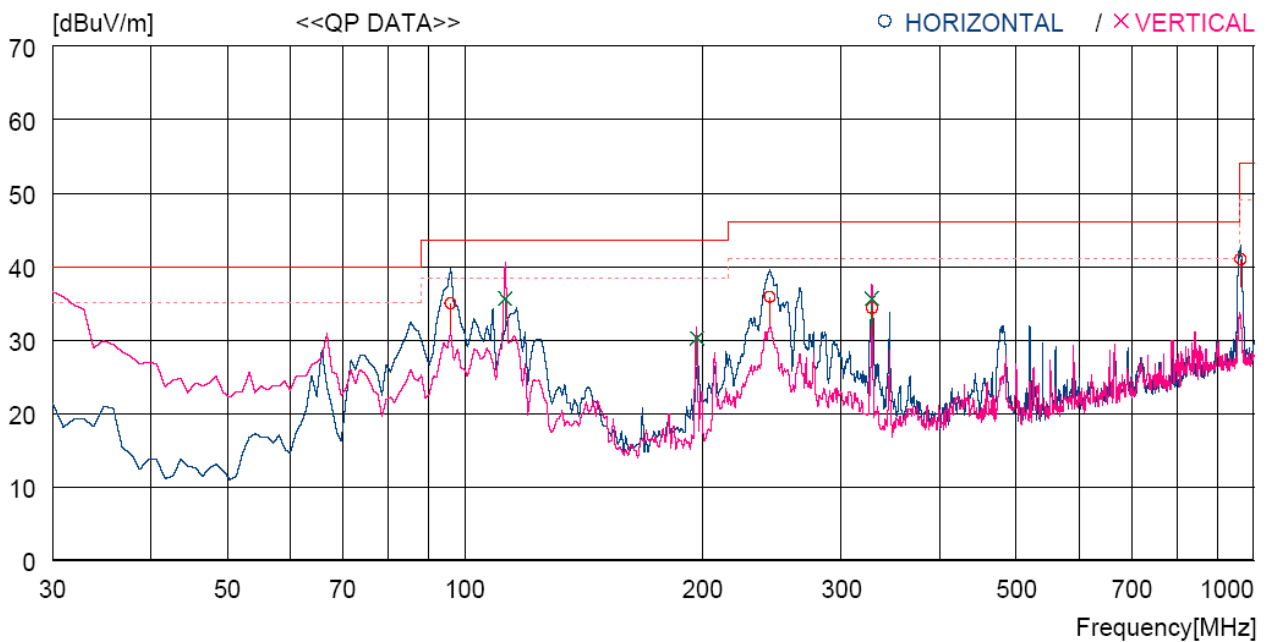
12.4.2 Test data for 802.11n_HT20 RLAN Mode

12.4.2.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 54 ~ 55 % R.H. Temperature: 22 ~ 23 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

EUT : WLAN Module Date: June 09, 2015
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

-.Ant0, Ant1 and Multiple transmit with Low, Middle and High Channels were tested, but the worst data were recorded.



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	95.960	54.1	11.2	2.7	33.1	34.9	43.5	8.6	300	165
2	243.400	52.3	12.2	4.2	32.9	35.8	46.0	10.2	100	137
3	328.760	48.2	14.2	4.8	32.9	34.3	46.0	11.7	100	0
4	962.157	41.6	22.5	8.7	31.9	40.9	54.0	13.1	100	60
----- Vertical -----										
5	112.450	54.8	10.9	3.0	33.1	35.6	43.5	7.9	100	359
6	196.840	48.7	10.6	3.8	32.9	30.2	43.5	13.3	100	359
7	327.790	49.5	14.2	4.8	32.9	35.6	46.0	10.4	200	172

12.4.2.2 Test data for Below 30 MHz


- Test Date : June 09, 2015
- Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- Frequency range : 9 kHz ~ 30 MHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

12.4.2.3 Test data for above 1 GHz

- Test Date : June 09, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBµV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBµV/m)	Limits (dBµV/m)	Margin (dB)
It was not observed any emissions from the EUT.									



Tested by: Jun-Hui, Lee / Senior Engineer

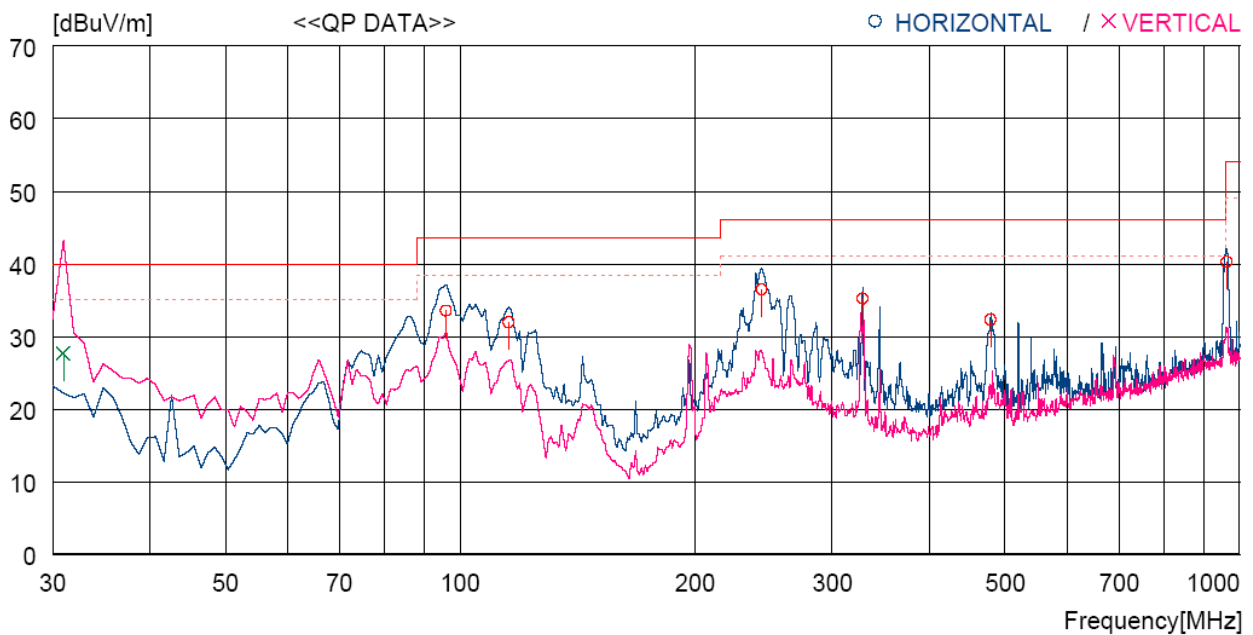
12.4.3 Test data for 802.11n_HT40 RLAN Mode

12.4.3.1 Test data for 30 MHz ~ 1 000 MHz

Humidity Level : 54 ~ 55 % R.H. Temperature: 22 ~ 23 °C
 Limits apply to : FCC CFR 47, PART 15, SUBPART C, SECTION 15.247
 Result : PASSED

EUT : WLAN Module Date: June 09, 2015
 Detector : CISPR Quasi-Peak (6 dB Bandwidth: 120 kHz)

-Ant0, Ant1 and Multiple transmit with Low, Middle and High Channels were tested, but the worst data were recorded.



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	95.960	52.7	11.2	2.7	33.1	33.5	43.5	10.0	300	0
2	115.360	51.2	10.6	3.2	33.1	31.9	43.5	11.6	300	0
3	243.400	52.9	12.2	4.2	32.9	36.4	46.0	9.6	100	0
4	328.760	49.1	14.2	4.8	32.9	35.2	46.0	10.8	100	0
5	479.111	42.6	17.0	5.9	33.2	32.3	46.0	13.7	100	30
6	962.157	40.9	22.5	8.7	31.9	40.2	54.0	13.8	100	0
----- Vertical -----										
7	30.970	40.8	13.0	7.0	33.2	27.6	40.0	12.4	400	0

12.4.3.2 Test data for Below 30 MHz

- Test Date : June 09, 2015
- Resolution bandwidth : 200 Hz (from 9 kHz to 0.15 MHz), 9 kHz (from 0.15 MHz to 30 MHz)
- Frequency range : 9 kHz ~ 30 MHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									

12.4.3.3 Test data for above 1 GHz

- Test Date : June 09, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Frequency range : 1 GHz ~ 40 GHz
- Measurement distance : 3 m
- Operating mode : Transmitting mode

Frequency (MHz)	Reading (dBμV)	Ant. Pol. (H/V)	Ant. Height (m)	Angle (°)	Ant. Factor (dB/m)	Cable Loss	Emission Level(dBμV/m)	Limits (dBμV/m)	Margin (dB)
It was not observed any emissions from the EUT.									



Tested by: Jun-Hui, Lee / Senior Engineer

13. RADIATED RESTRICTED BAND EDGE MEASUREMENTS

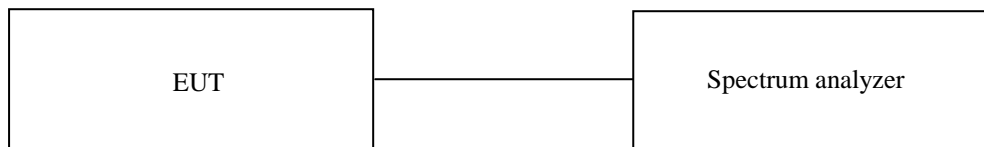
13.1 Operating environment

Temperature : 24 °C
 Relative humidity : 50 % R.H.

13.2 Test set-up for conducted measurement

The radiated emissions measurements were performed on the 3 m, open-field test site. The EUT was placed on a non-conductive turntable above the ground plane.

The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.



13.3 Test equipment used

■ - FSV40	Rohde & Schwarz	Signal Analyzer	101009	Jul. 30, 2014 (1Y)
■ - ESCI	Rohde & Schwarz	Test Receiver	101012	Nov. 03, 2014 (1Y)
■ - 310N	Sonoma Instrument	Pre-Amplifier	312544	Apr. 29, 2015 (1Y)
■ - SCU-18	Rohde & Schwarz	Pre-Amplifier	10041	Nov. 25, 2014 (1Y)
■ - DT3000	Innco System	Turn Table	930611	N/A
■ - MA4000-EP	Innco System	Antenna Master	3320611	N/A
■ - VULB9163	Schwarzbeck	TRILOG Broadband Antenna	9163-421	Jul. 10, 2014 (2Y)
■ - BBHA9120D	Schwarzbeck	Horn Antenna	BBHA9120D294	Sep. 05, 2013 (2Y)
■ - BBHA9170	Schwarzbeck	Horn Antenna	BBHA9170178	Sep. 05, 2013 (2Y)

All test equipment used is calibrated on a regular basis.

13.4 Test data for Frequency 5 725 MHz Band

13.4.1 Test data for 802.11a RLAN Mode

13.4.1.1 Test data for Antenna 0

- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5 725.00	57.78	Peak	H	31.90	12.10	42.20	59.58	74.00	14.42
	33.48	Average	H				35.28	54.00	18.72
	61.04	Peak	V				62.84	74.00	11.16
	36.78	Average	V				38.58	54.00	15.42
High Channel									
5 850.00	46.71	Peak	H	32.10	12.20	42.20	48.81	74.00	25.19
	25.47	Average	H				27.57	54.00	26.43
	50.73	Peak	V				52.83	74.00	21.17
	28.24	Average	V				30.34	54.00	23.66

Tabulated test data for Restricted Band

Remark - "H": Horizontal, "V": Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Emission Level (dB}\mu\text{V/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

13.4.1.2 Test data for Antenna 1

- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5 725.00	59.46	Peak	H	31.90	12.10	42.20	61.26	74.00	12.74
	36.81	Average	H				38.61	54.00	15.39
	64.26	Peak	V				66.06	74.00	7.94
	41.71	Average	V				43.51	54.00	10.49
High Channel									
5 850.00	44.15	Peak	H	32.10	12.20	42.20	46.25	74.00	27.75
	26.88	Average	H				28.98	54.00	25.02
	48.50	Peak	V				50.60	74.00	23.40
	30.44	Average	V				32.54	54.00	21.46

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Emission Level (dB}\mu\text{V/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

13.4.1.3 Test data for Multiple transmit

- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
5 725.00	63.53	Peak	H	31.90	12.10	42.20	65.33	74.00	8.67
	40.00	Average	H				41.80	54.00	12.20
	65.79	Peak	V				67.59	74.00	6.41
	42.78	Average	V				44.58	54.00	9.42
High Channel									
5 850.00	52.18	Peak	H	32.10	12.20	42.20	54.28	74.00	19.72
	29.39	Average	H				31.49	54.00	22.51
	53.05	Peak	V				55.15	74.00	18.85
	31.28	Average	V				33.38	54.00	20.62

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dBµV/m)} - \text{Emission Level (dBµV/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

13.4.2 Test data for 802.11n_HT20 RLAN Mode

13.4.2.1 Test data for Antenna 0

- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5 725.00	57.83	Peak	H	31.90	12.10	42.20	59.63	74.00	14.37
	35.29	Average	H				37.09	54.00	16.91
	64.71	Peak	V				66.51	74.00	7.49
	39.69	Average	V				41.49	54.00	12.51
High Channel									
5 850.00	47.83	Peak	H	32.10	12.20	42.20	49.93	74.00	24.07
	28.89	Average	H				30.99	54.00	23.01
	49.78	Peak	V				51.88	74.00	22.12
	31.99	Average	V				34.09	54.00	19.91

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Emission Level (dB}\mu\text{V/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

13.4.2.2 Test data for Antenna 1

- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5 725.00	60.75	Peak	H	31.90	12.10	42.20	62.55	74.00	11.45
	40.38	Average	H				42.18	54.00	11.82
	66.59	Peak	V				68.39	74.00	5.61
	45.10	Average	V				46.90	54.00	7.10
High Channel									
5 850.00	51.18	Peak	H	32.10	12.20	42.20	53.28	74.00	20.72
	31.55	Average	H				33.65	54.00	20.35
	52.43	Peak	V				54.53	74.00	19.47
	35.71	Average	V				37.81	54.00	16.19

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dB}\mu\text{V/m)} - \text{Emission Level (dB}\mu\text{V/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

13.4.2.3 Test data for Multiple transmit

- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
5 725.00	60.97	Peak	H	31.90	12.10	42.20	62.77	74.00	11.23
	40.27	Average	H				42.07	54.00	11.93
	68.26	Peak	V				70.06	74.00	3.94
	44.11	Average	V				45.91	54.00	8.09
High Channel									
5 850.00	54.03	Peak	H	32.10	12.20	42.20	56.13	74.00	17.87
	33.98	Average	H				36.08	54.00	17.92
	57.66	Peak	V				59.76	74.00	14.24
	37.64	Average	V				39.74	54.00	14.26

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dBµV/m)} - \text{Emission Level (dBµV/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

13.4.3 Test data for 802.11n_HT40 RLAN Mode

13.4.3.1 Test data for Antenna 0

- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBμV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBμV/m)	Limits (dBμV/m)	Margin (dB)
Low Channel									
5 725.00	60.85	Peak	H	31.90	12.10	42.20	62.65	74.00	11.35
	39.54	Average	H				41.34	54.00	12.66
	64.06	Peak	V				65.86	74.00	8.14
	43.07	Average	V				44.87	54.00	9.13
High Channel									
5 850.00	45.70	Peak	H	32.10	12.20	42.20	47.80	74.00	26.20
	26.10	Average	H				28.20	54.00	25.80
	51.22	Peak	V				53.32	74.00	20.68
	29.07	Average	V				31.17	54.00	22.83

Tabulated test data for Restricted Band

Remark - "H": Horizontal, "V": Vertical

Margin (dB) = Limits (dBμV/m) - Emission Level (dBμV/m)



Tested by: Jun-Hui, Lee / Senior Engineer

13.4.3.2 Test data for Antenna 1

- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
5 725.00	60.98	Peak	H	31.90	12.10	42.20	62.78	74.00	11.22
	43.21	Average	H				45.01	54.00	8.99
	66.02	Peak	V				67.82	74.00	6.18
	47.19	Average	V				48.99	54.00	5.01
High Channel									
5 850.00	46.25	Peak	H	32.10	12.20	42.20	48.35	74.00	25.65
	27.86	Average	H				29.96	54.00	24.04
	53.96	Peak	V				56.06	74.00	17.94
	31.87	Average	V				33.97	54.00	20.03

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dBµV/m)} - \text{Emission Level (dBµV/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

13.4.3.3 Test data for Multiple transmit

- Test Date : June 07, 2015
- Resolution bandwidth : 1 MHz for Peak and Average Mode for the emissions fall in restricted band,
100 kHz for Peak Mode for the emissions outside restricted band
- Video bandwidth : 1 MHz for Peak Mode, 10 Hz for Average Mode
- Measurement distance : 3 m
- Result : Pass

Frequency (MHz)	Reading (dBµV)	Detector Mode	Ant. Pol. (H/V)	Ant. Factor	Cable Loss	Amp Gain	Total (dBµV/m)	Limits (dBµV/m)	Margin (dB)
Low Channel									
5 725.00	63.00	Peak	H	31.90	12.10	42.20	64.80	74.00	9.20
	41.97	Average	H				43.77	54.00	10.23
	66.60	Peak	V				68.40	74.00	5.60
	45.63	Average	V				47.43	54.00	6.57
High Channel									
5 850.00	48.97	Peak	H	32.10	12.20	42.20	51.07	74.00	22.93
	30.24	Average	H				32.34	54.00	21.66
	53.83	Peak	V				55.93	74.00	18.07
	33.82	Average	V				35.92	54.00	18.08

Tabulated test data for Restricted Band

Remark - “H”: Horizontal, “V”: Vertical

$$\text{Margin (dB)} = \text{Limits (dBµV/m)} - \text{Emission Level (dBµV/m)}$$



Tested by: Jun-Hui, Lee / Senior Engineer

14. CONDUCTED EMISSION TEST

14.1 Operating environment

Temperature : 22 ~ 23 °C
 Relative humidity : 43 ~ 44 % R.H.

14.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

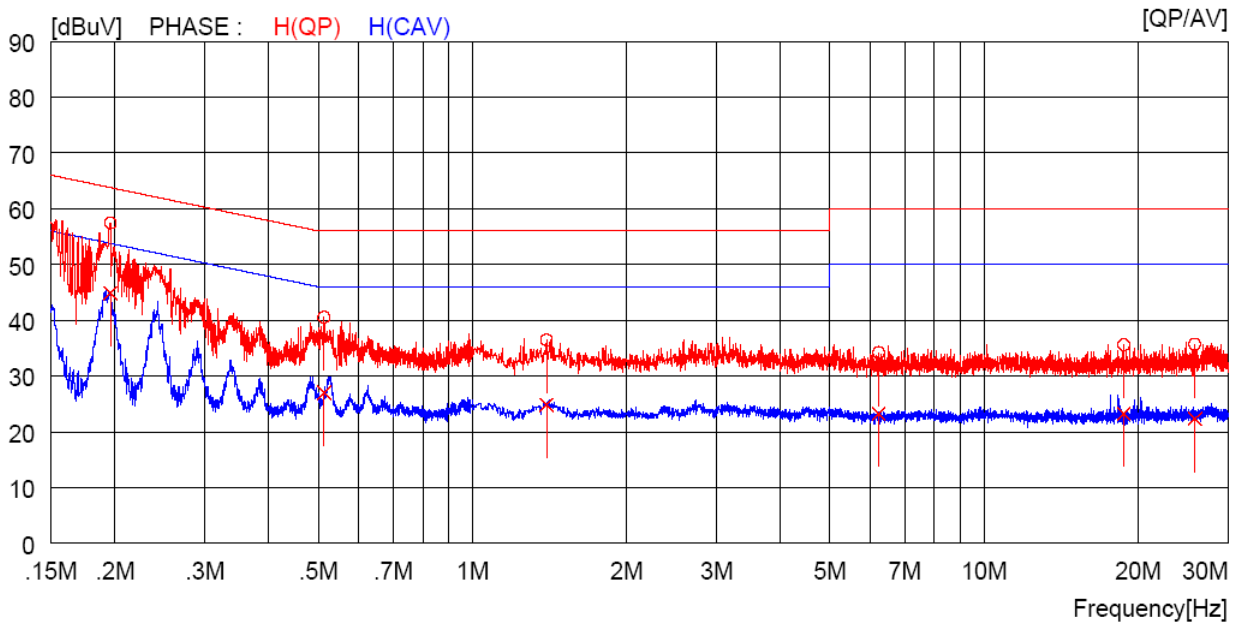
14.3 Test equipment used

Model Number	Manufacturer	Description	Serial Number	Last Cal. (Interval)
■ - ESPI	Rohde & Schwarz	EMI Test Receiver	101278	Nov. 03, 2014 (1Y)
□ - ESHS10	Rohde & Schwarz	EMI Test Receiver	834467/007	Jul. 15, 2014 (1Y)
□ - NSLK8128	Schwarzbeck	AMN	8128-216	Apr. 06, 2015 (1Y)
■ - NSLK8126	Schwarzbeck	AMN	8126-404	Jul. 11, 2014 (1Y)
□ - 3825/2	EMCO	AMN	9109-1869	Apr. 29, 2015 (1Y)
■ -- 3825/2	EMCO	AMN	9109-1867	Apr. 29, 2015 (1Y)

All test equipment used is calibrated on a regular basis.

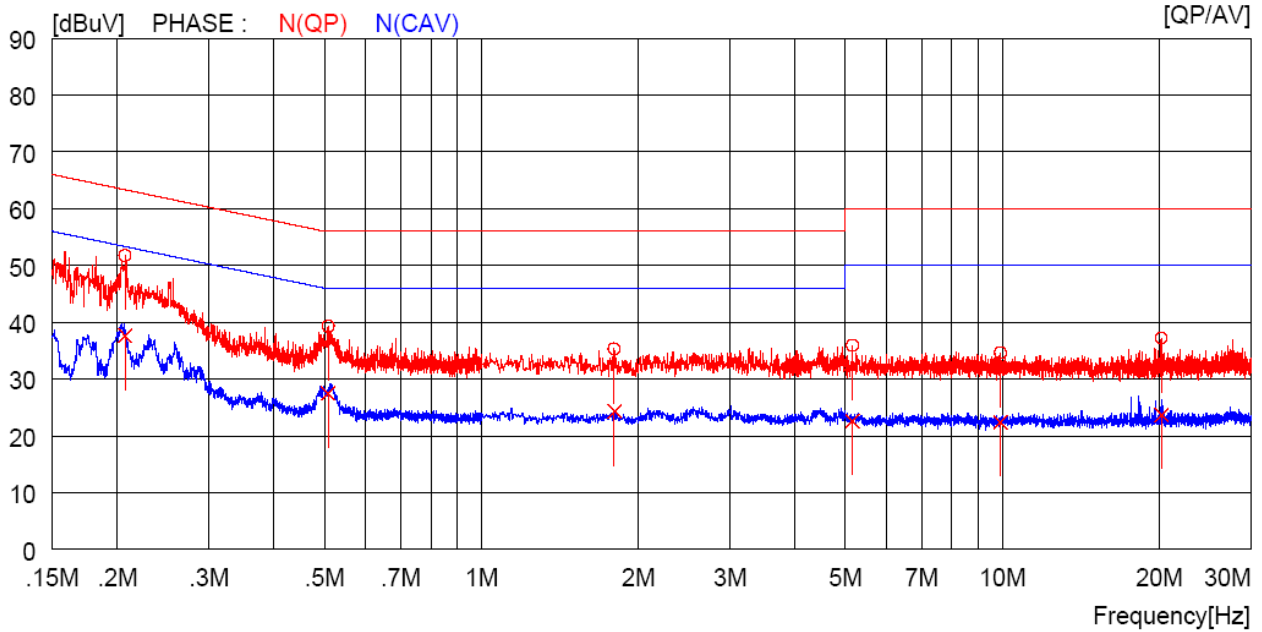
14.4 Test data

- Test Date : June 09, 2015
- Resolution bandwidth : 9 kHz
- Frequency range : 0.15 MHz ~ 30 MHz
- Tested Line : HOT LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.19600	37.2	----	20.2	57.4	----	63.8	----	6.4	----	H (QP)
2	0.51300	20.3	----	20.2	40.5	----	56.0	----	15.5	----	H (QP)
3	1.39600	16.1	----	20.3	36.4	----	56.0	----	19.6	----	H (QP)
4	6.22500	13.8	----	20.4	34.2	----	60.0	----	25.8	----	H (QP)
5	18.77000	15.3	----	20.3	35.6	----	60.0	----	24.4	----	H (QP)
6	25.82000	15.2	----	20.5	35.7	----	60.0	----	24.3	----	H (QP)
7	0.19600	----	24.6	20.2	----	44.8	----	53.8	----	9.0	H (CAV)
8	0.51300	----	6.8	20.2	----	27.0	----	46.0	----	19.0	H (CAV)
9	1.39600	----	4.5	20.3	----	24.8	----	46.0	----	21.2	H (CAV)
10	6.22500	----	2.9	20.4	----	23.3	----	50.0	----	26.7	H (CAV)
11	18.77000	----	3.0	20.3	----	23.3	----	50.0	----	26.7	H (CAV)
12	25.82000	----	1.8	20.5	----	22.3	----	50.0	----	27.7	H (CAV)


-. Tested Line : NEUTRAL LINE



NO	FREQ [MHz]	READING		C. FACTOR [dB]	RESULT		LIMIT		MARGIN		PHASE
		QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
1	0.20700	31.5	----	20.2	51.7	----	63.3	----	11.6	----	N(QP)
2	0.50800	19.1	----	20.2	39.3	----	56.0	----	16.7	----	N(QP)
3	1.80000	15.0	----	20.3	35.3	----	56.0	----	20.7	----	N(QP)
4	5.15500	15.5	----	20.4	35.9	----	60.0	----	24.1	----	N(QP)
5	9.92000	14.2	----	20.4	34.6	----	60.0	----	25.4	----	N(QP)
6	20.20000	16.8	----	20.4	37.2	----	60.0	----	22.8	----	N(QP)
7	0.20700	----	17.4	20.2	----	37.6	----	53.3	----	15.7	N(CAV)
8	0.50800	----	7.3	20.2	----	27.5	----	46.0	----	18.5	N(CAV)
9	1.80000	----	4.0	20.3	----	24.3	----	46.0	----	21.7	N(CAV)
10	5.15500	----	2.2	20.4	----	22.6	----	50.0	----	27.4	N(CAV)
11	9.92000	----	2.0	20.4	----	22.4	----	50.0	----	27.6	N(CAV)
12	20.20000	----	3.3	20.4	----	23.7	----	50.0	----	26.3	N(CAV)

Remark: Margin (dB) = Limit – Level (Result)

The emission level in above table is included the transducer factor that means insertion loss (LISN), cable loss and attenuator.



Tested by: Jun-Hui, Lee / Senior Engineer