RF TEST REPORT

Test item	:	AIRXEL
Model No.	:	AX400
Order No.	:	DTNC1507-03334
Date of receipt	:	2015-07-03
Test duration	:	2015-08-12 ~ 2015-08-26
Date of issue	:	2015-09-15
Use of report	:	FCC Original Grant

Applicant : INNOIO
#1306, kolon Aston B/D 212 Gasan Digital 1-ro Guemcheon-gu, Seoul, 153-768, South Korea

Test laboratory : DT&C Co., Ltd.
42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935

Test specification	:	FCC Part 15.407 Subpart E
Test environment	:	See appended test report
Test result	:	☒ Pass ☐ Fail

Tested by:

Tested by
KwiCheol Yeom

Reviewed by:

Technical Manager
Geunki Son

Test Report Version

Test Report No.	Date	Description
DRTFCC1509-0200	Sep. 15, 2015	Initial issue

CONTENTS

1. EUT Description

FCC Equipment Class	Unlicensed National Information Infrastructure (UNII)
Product	AIRXEL
Model Name	AX400
Hardware version	MAIN PCB REV0.4 / Wireless PCB REV0.3
Software version	MAIN F/W 1.0.47 / Wireless F/W 1.0.21
Power Supply	DC 7.4 V
Frequency Range	**U-NII 1 (5150 ~ 5250MHz)** ▪ 802.11a / n(HT20): 5180 ~ 5240 MHz **U-NII 3 (5725 ~ 5850MHz)** ▪ 802.11a / n(HT20): 5745 ~ 5825 MHz
Max. RF Output Power	**U-NII 1** ▪ 802.11a: 12.57 dBm ▪ 802.11n(HT20): 11.27 dBm **U-NII 3** ▪ 802.11a: 11.95 dBm ▪ 802.11n(HT20): 11.12 dBm
Modulation type	OFDM
Antenna Specification	**Antenna type** : Internal Antenna **Antenna gain** ▪ U-NII 1 : -1.773 dBi ▪ U-NII 3 : 2.376 dBi

2. Information about test items

2.1 Test mode / Channel Information

5GHz Band	Mode	Data Rate
U-NII 1	802.11a	6Mbps
	802.11n(HT20)	MCS 0
U-NII 3	802.11a	6Mbps
	802.11n(HT20)	MCS 0

Note 1: The worst case data rate is determined as above test mode according to the power measurements. And all test items were performed at the worst case data rate.

2.2 Tested Channel Information

5GHz Band	802.11a/n(HT20)	
	Channel	Frequency [MHz]
U-NII 1	36	5180
	40	5200
	48	5240
U-NII 3	149	5745
	157	5785
	165	5825

2.3 Auxiliary equipment

Equipment	Model No.	Serial No.	Manufacturer	Note
-	-	-	-	-
-	-	-	-	-

2.4 Tested environment

Temperature	:	23 ºC ~ 25 ºC
Relative humidity content	:	48 % ~ 51 % R.H.
Details of power supply	:	DC 7.4 V

2.5 EMI Suppression Device(s) / Modifications

EMI suppression device(s) added and/or modifications made during testing
→ None

3. Summary of Tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status Note 1
I. Transmitter Mode (TX)				
15.407(a)	Emission Bandwidth (26 dB Bandwidth)	N/A	Conducted	C
15.407(e)	Minimum Emission Bandwidth (6 dB Bandwidth)	> 500 kHz in 5725 ~ 5850 MHz		C
15.407(a)	Maximum Conducted Output Power	5150 ~ 5250 MHz : < 30 dBm or < 23.97 dBm 5250 ~ 5350 MHz & 5470 ~ 5725 MHz : 250 mW or < 11 + 10 $\log_{10}$(B) dBm, whichever power is less. 5725 ~ 5850 MHz : < 30 dBm		C Note 3
15.407(a)	Peak Power Spectral Density	5150 ~ 5250 MHz : 11 dBm/MHz or 17 dBm/MHz 5250 ~ 5350 MHz & 5470 ~ 5725 MHz: 11 dBm/MHz 5725 ~ 5850 MHz: 30 dBm/500kHz		C Note 4
15.407(g)	Frequency Stability	N/A		C
15.407(b)	Undesirable Emissions	5150 ~ 5725 MHz: < -27 dBm/MHz EIRP 5725 ~ 5850 MHz: < -17 dBm/MHz EIRP or < -27 dBm/MHz EIRP	Radiated	C Note 5
15.205 15.209 15.407(b)	General Field Strength Limits(Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		C Note 6
15.407(h)	Dynamic Frequency Selection	FCC 15.407(h)	Conducted	NA Note 7
15.207	AC Conducted Emissions	FCC 15.207	AC Line Conducted	C
15.203	Antenna Requirements	FCC 15.203	-	C

Note 1: **C** = Comply **NC** = Not Comply **NT** = Not Tested **NA** = Not Applicable

Note 2: The test items were performed according to the KDB789033 D02 V01 and ANSI C63.10-2013

Note 3: (i) For access point operating in the band 5.15 - 5.25 GHz: < 30 dBm
(ii) For mobile and portable client devices in the 5.15 - 5.25 GHz band: < 23.97 dBm

Note 4: (i) For access point operating in the band 5.15 - 5.25 GHz: < 17 dBm/MHz
(ii) For mobile and portable client devices in the 5.15 - 5.25 GHz band: < 11 dBm/MHz

Note 5: For transmitters operating in the 5.725 - 5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz

Note 6: These test items were performed in each axis and the worst case data was reported.

Note 7: This device is not supported DFS Band.

4. Test Methodology

Generally the tests were performed according to the KDB789033 D02 v01. And ANSI C63.10-2013 was used to reference appropriate EUT setup and maximizing procedures of radiated spurious emission and AC line conducted emission testing

4.1 EUT configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

4.2 EUT exercise

The EUT was operated in the test mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.407 under the FCC Rules Part 15 Subpart C.

4.3 General test procedures

Conducted Emissions

The power-line conducted emission test procedure is not described on the KDB789033 D02 v01. So this test was fulfilled with the requirements in Section 6.2 of ANSI C63.10-2013.

The EUT is placed on the wooden table, which is 0.8 m above ground plane and the conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-peak and Average detector.

Radiated Emissions

Basically the radiated tests were performed with KDB789033 D02 v01. But some requirements and procedures like test site requirements, EUT setup and maximizing procedure were fulfilled with the requirements in Section 5 and 6 of the ANSI C63.10-2013 as stated on KDB789033 D02 v01.

The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the highest emission, the relative positions of the EUT were rotated through three orthogonal axis.

4.4 Description of test modes

A test program is used to control the EUT for staying in continuous transmitting mode with maximum fixed duty cycle.

5. Instrument Calibration

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

6. Facilities and Accreditations

6.1 Facilities

The open area test site(OATS) or semi anechoic chamber and conducted measurement facility used to collect the radiated and conducted test data are located at the 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935. The site is constructed in conformance with the requirements..

- Semi anechoic chamber registration Number : 165783

6.2 Equipment

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and peak, quasi-peak detectors are used to perform radiated measurements. Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements. All receiving equipment conforms to CISPR Publication 16 - 1, “Radio Interference Measuring Apparatus and Measurement Methods.”

7. Antenna Requirements

According to FCC 47 CFR §15.203:

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 is permanently attached. (Refer to Internal photo file.)
Therefore this E.U.T Complies with the requirement of §15.203

8. TEST RESULT

8.1 Emission Bandwidth (26 dB Bandwidth)

▣ Test Requirements

The bandwidth at 26 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies. The 26 dB bandwidth is used to determine the conducted output power limit.

▣ Test Configuration

Refer to the Appendix I.

▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02 V01**.

1. Set resolution bandwidth (RBW) = approximately **1 %** of the EBW.
2. Set the video bandwidth **(VBW) > RBW**.
3. Detector = **Peak**.
4. Trace mode = **Max hold**.
   Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW / EBW ratio is approximately 1 %.

▣ TEST RESULTS: Comply

Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]
802.11a	U-NII 1	36	5180	18.68
		40	5200	18.96
		48	5240	18.80
802.11n(HT20)	U-NII 1	36	5180	19.16
		40	5200	19.04
		48	5240	19.20

▣ Result Plots

26 dB Bandwidth

Test Mode: 802.11a & Ch.36

26 dB Bandwidth

Test Mode: 802.11a & Ch.40

26 dB Bandwidth Test Mode: 802.11a & Ch.48

26 dB Bandwidth Test Mode: 802.11n(HT20) & Ch.36

26 dB Bandwidth Test Mode: 802.11n(HT20) & Ch.40

26 dB Bandwidth Test Mode: 802.11n(HT20) & Ch.48

8.2 Minimum Emission Bandwidth (6 dB Bandwidth)

▣ Test Requirements

Within the 5.725 - 5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

▣ TEST CONFIGURATION

Refer to the APPENDIX I.

▣ TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer and used following test procedure of **KDB789033 D02 V01**.

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth **≥ 3 x RBW**.
3. Detector = **Peak**.
4. Trace mode = **Max hold**.
   Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

▣ TEST RESULTS: Comply

Mode	Band	Channel	Frequency [MHz]	Test Result [MHz]
802.11a	U-NII 3	149	5745	15.16
		157	5785	15.16
		165	5825	15.16
802.11n(HT20)	U-NII 3	149	5745	15.12
		157	5785	15.20
		165	5825	15.16

▣ RESULT PLOTS

6 dB Bandwidth

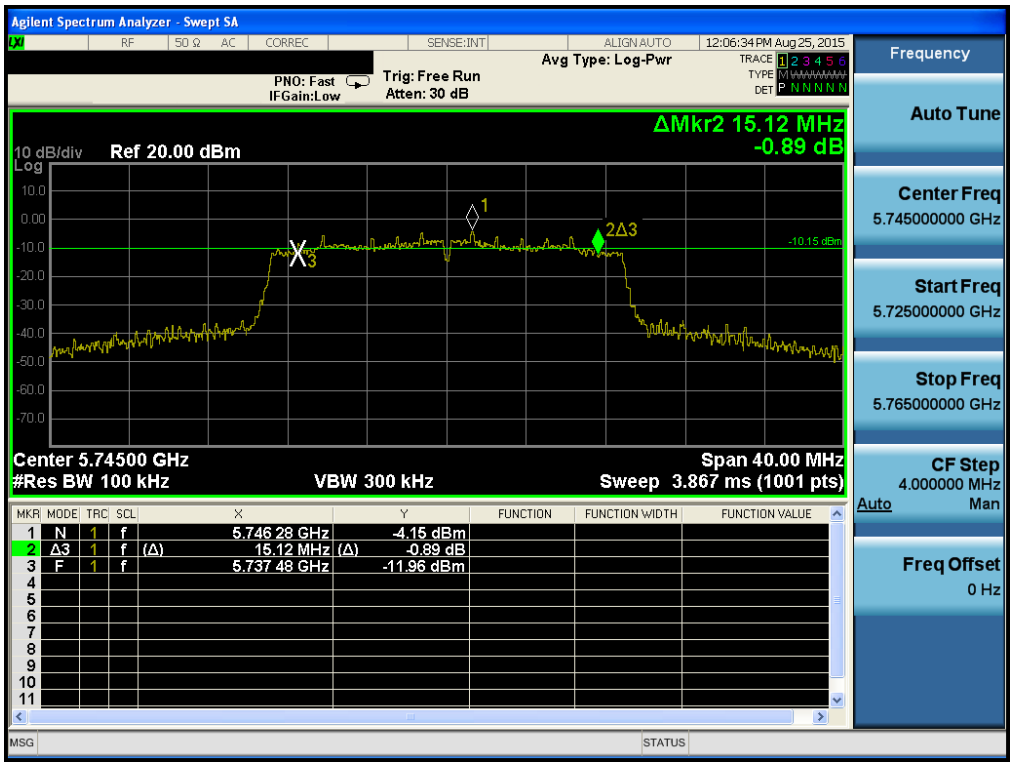
Test Mode: 802.11a & Ch.149

6 dB Bandwidth

Test Mode: 802.11a & Ch.157

6 dB Bandwidth Test Mode: 802.11a & Ch.165

6 dB Bandwidth Test Mode: 802.11a & Ch.149



6 dB Bandwidth Test Mode: 802.11n(HT20) & Ch.157

6 dB Bandwidth Test Mode: 802.11n(HT20) & Ch.165

8.3 Maximum Conducted Output Power

▣ **Test Requirements**

(1) For the band 5.15 - 5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

(iv) For mobile and portable client devices in the 5.15 - 5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(2) For the 5.25 - 5.35 GHz and 5.47 - 5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

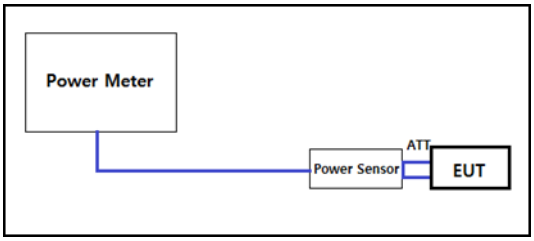
(3) For the band 5.725 - 5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

- Output power Limit Calculation

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	ANT Gain	Determined Limit [dBm]
U-NII 1	802.11a	1000	**30.00**	**-1.773**	**30.00**
	802.11n(HT20)	1000	**30.00**	**-1.773**	**30.00**

Bands	Mode	Power Limit [mW]	Calculated Limit [dBm]	ANT Gain	Determined Limit [dBm]
U-NII 3	802.11a	1000	**30.00**	**2.376**	**30.00**
	802.11n(HT20)	1000	**30.00**	**2.376**	**30.00**

▣ **Test Configuration**



▣ **Test Procedure**

Maximum Conducted Output Power is measured using Measurement Procedure **Method PM - G of KDB789033 D02 V01**

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

▣ **Test Results: Comply**

Mode	Channel	Frequency [MHz]	Test Result [dBm]
802.11a	**36**	**5180**	**12.57**
	40	5200	12.37
	48	5240	12.24
	149	**5745**	**11.95**
	157	5785	11.87
	165	5825	11.69
802.11n(HT20)	**36**	**5180**	**11.27**
	40	5200	11.24
	48	5240	11.03
	149	**5745**	**11.12**
	157	5785	11.07
	165	5825	10.88

8.4 Maximum Power Spectral Density

▣ **Test requirements**

(1) For the band 5.15 - 5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band. **note1**

(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band. note1

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

(iv) For mobile and portable client devices in the 5.15 - 5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 MHz band. note1

(2) For the 5.25 - 5.35 GHz and 5.47 - 5.725 GHz bands, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. note1

(3) For the band 5.725 - 5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band.note1,note2

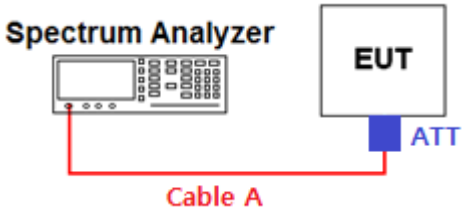
Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note2: Fixed point - to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

- Peak Power Spectral Density Limit Calculation

Band	Limit [dBm]	ANT Gain [dBi]	Determined Limit [dBm]
U-NII-1	17	-1.773	17
U-NII-3	30	2.376	30

▣ **Test configuration**



▣ **Test procedure**

Maximum Power Spectral Density is measured using Measurement Procedure **of KDB789033 D02 V01**

1) Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA - 1, SA - 2, SA - 3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power…”. (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)

2) Use the peak search function on the instrument to find the peak of the spectrum and record its value.

3) Make the following adjustments to the peak value of the spectrum, if applicable:
a) If Method SA - 2 or SA - 2 Alternative was used, add 10 log(1 / x), where x is the duty cycle, to the peak of the spectrum.
b) If Method SA - 3 Alternative was used and the linear mode was used in step II.E.2.g (viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.

4) The result is the Maximum PSD over 1 MHz reference bandwidth.

5) For devices operating in the bands 5.15 - 5.25 GHz, 5.25 - 5.35 GHz, and 5.47 - 5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in §15.407(a)(5). For devices operating in the band 5.725 - 5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1 / T, where T is defined in section II.B.1.a). (Refer to Appendix II)

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log(500 kHz / RBW) to the measured result, whereas RBW (< 500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log(1 MHz / RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the sections 5.c) and 5.d) above, since RBW = 100 kHz is available on nearly all spectrum analyzers.

▣ **Test result: Comply**

- U-NII 1

Mode	Channel	Frequency [MHz]	Reading [dBm]	T.F [dB] Note 1	Test Result [dBm]
802.11a	36	5180	-0.310	0.14	-0.170
	40	**5200**	**-0.210**		**-0.070**
	48	5240	-2.850		-2.710
802.11n(HT20)	36	5180	-1.760	0.14	-1.620
	40	**5200**	**-1.540**		**-1.400**
	48	5240	-1.690		-1.550

Note 1: T.F = 10log(1 MHz / 1MHz) + D.C.F
For D.C.F., please refer to appendix II.
Note 2: Test Result = Measurement Data + T.F

- U-NII 3

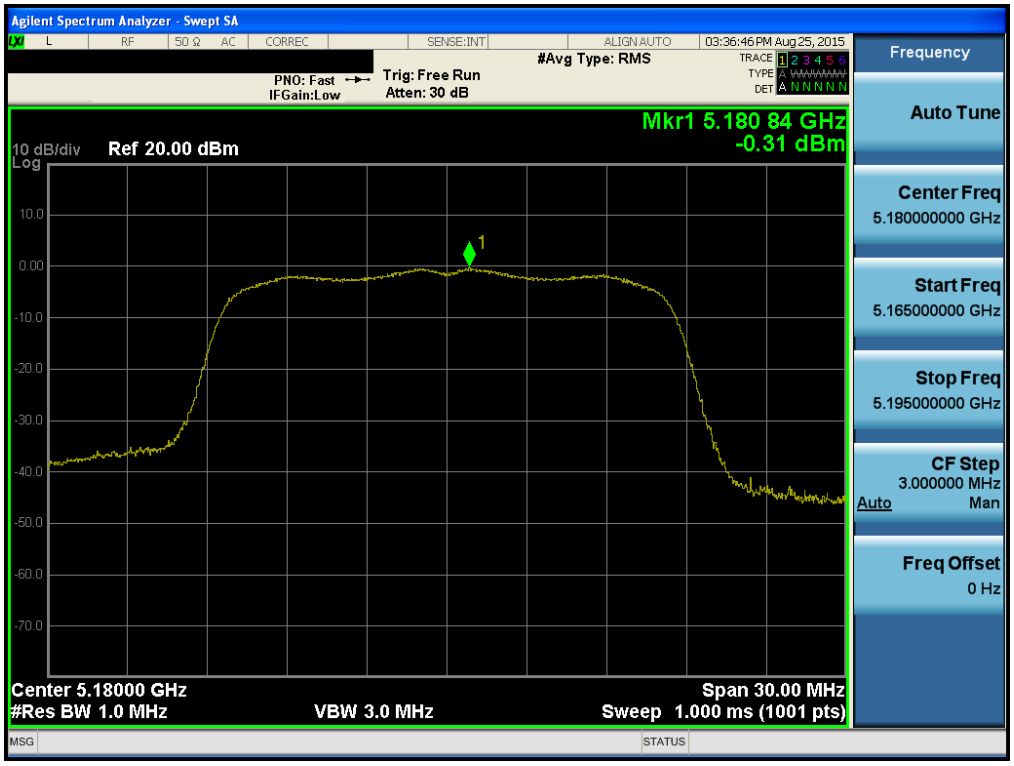
Mode	Channel	Frequency [MHz]	Reading [dBm]	T.F [dB] Note 1	Test Result [dBm]
802.11a	149	5745	-11.390	7.13	-4.260
	157	5785	-11.190		-4.060
	165	**5825**	**-10.720**		**-3.590**
802.11n(HT20)	149	5745	-12.500	7.13	-5.370
	157	5785	-12.330		-5.200
	165	**5825**	**-11.720**		**-4.590**

Note 1: T.F = 10log(500 kHz / 100 kHz) + D.C.F
For D.C.F., please refer to appendix II.
Note 2: Test Result = Measurement Data + T.F

▣ RESULT PLOTS

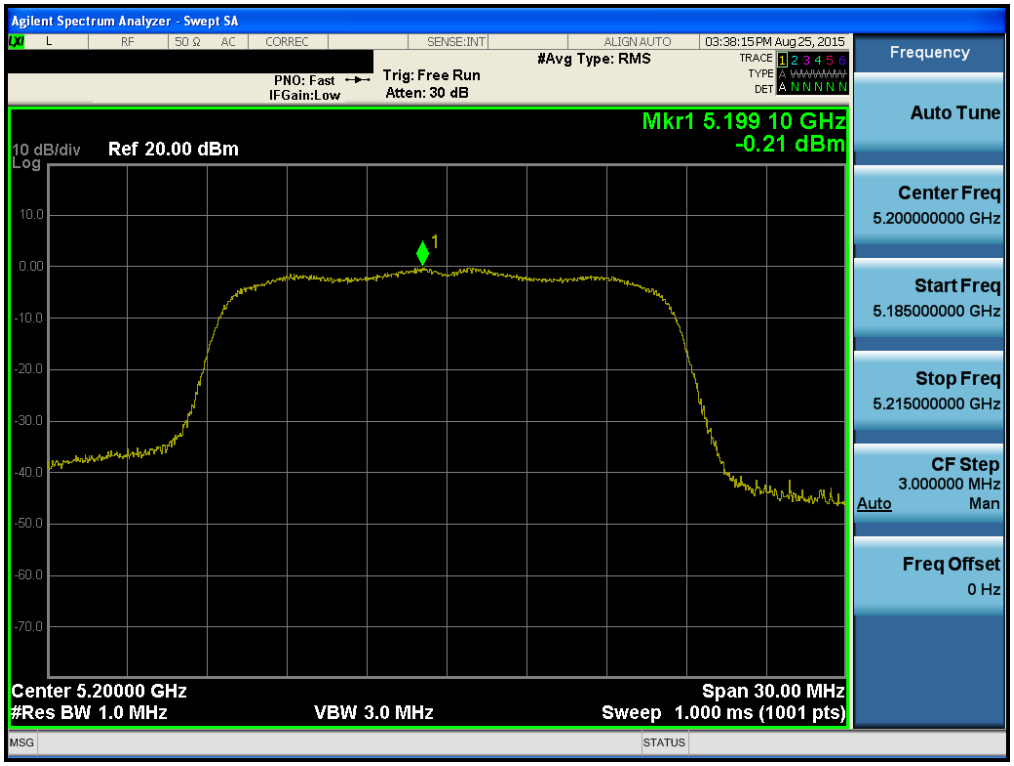
Maximum Power Spectral Density

Test Mode: 802.11a & Ch.36

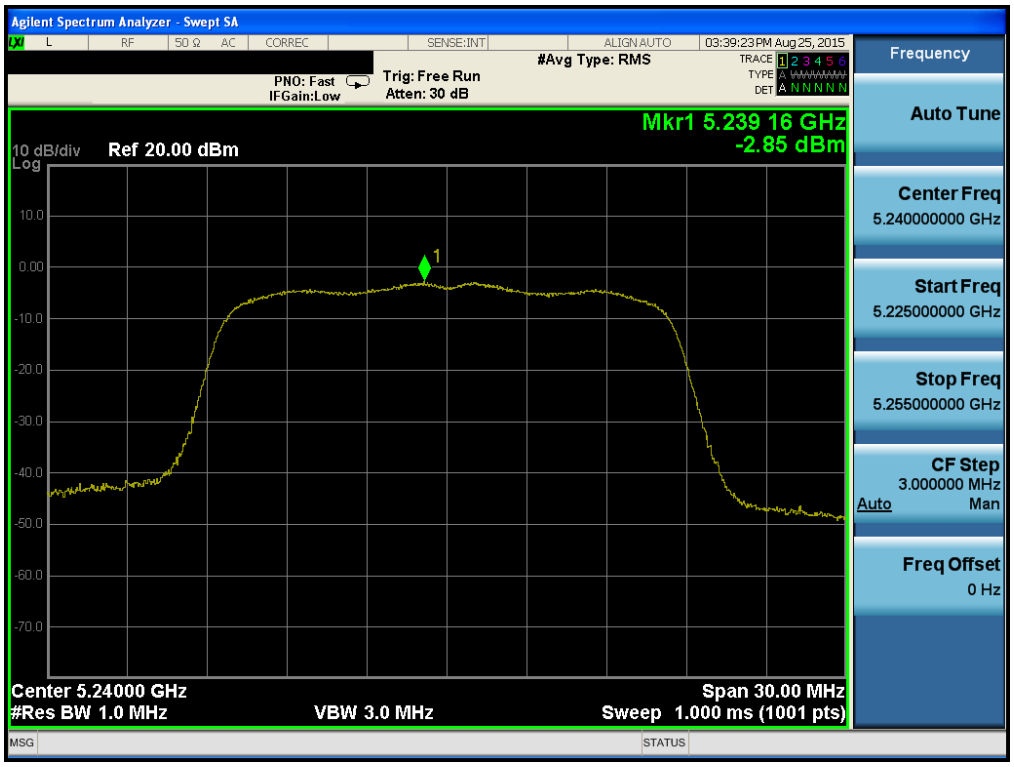


Maximum Power Spectral Density

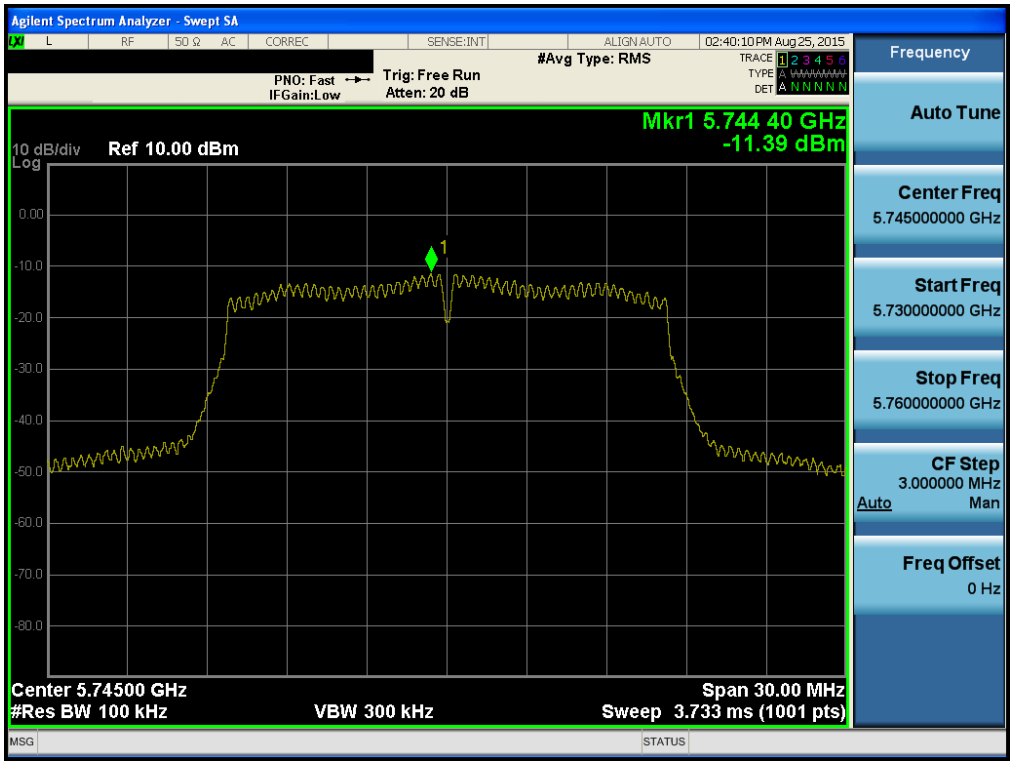
Test Mode: 802.11a & Ch.40



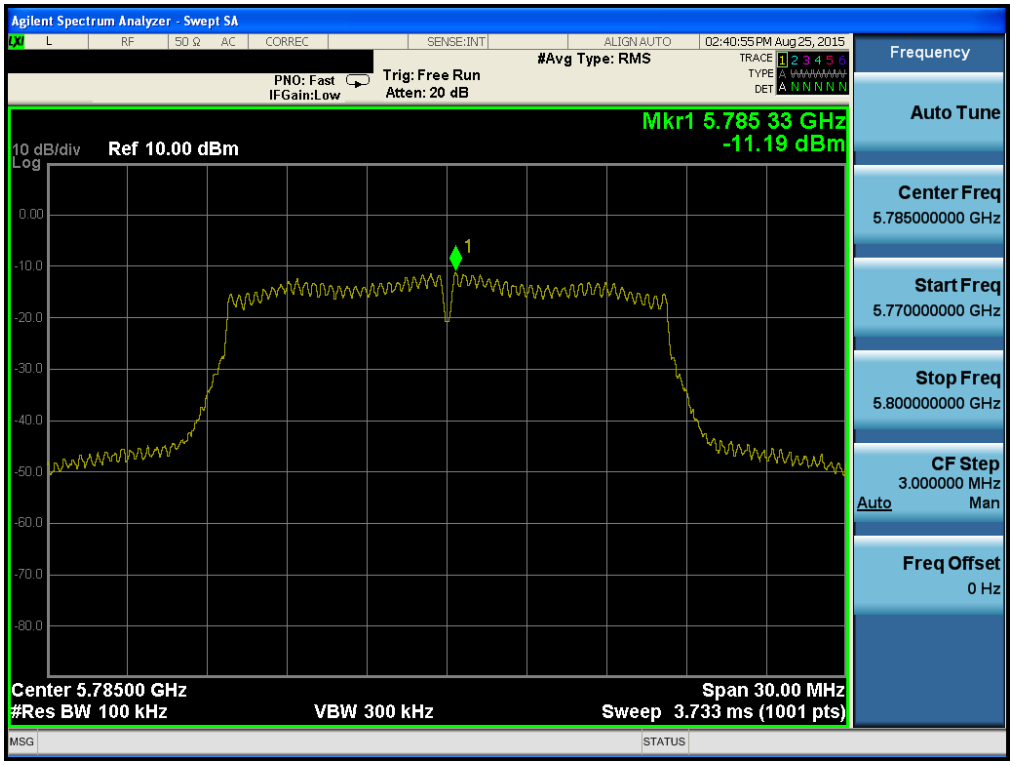
Maximum Power Spectral Density Test Mode: 802.11a & Ch.48



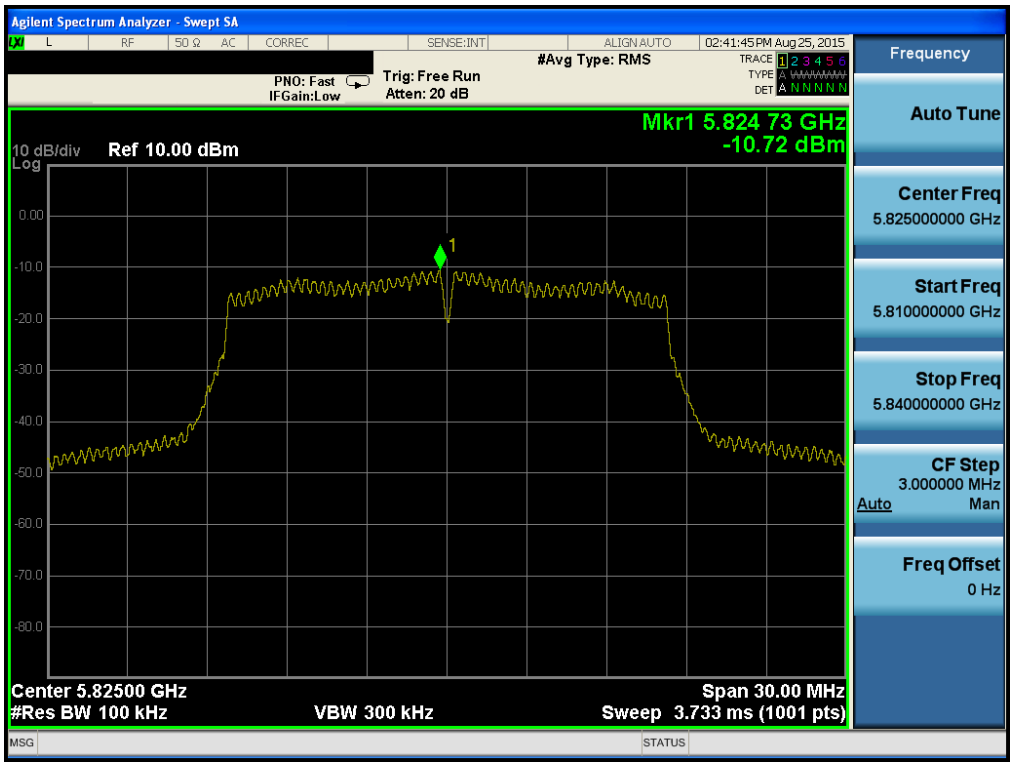
Maximum Power Spectral Density Test Mode: 802.11a & Ch.149



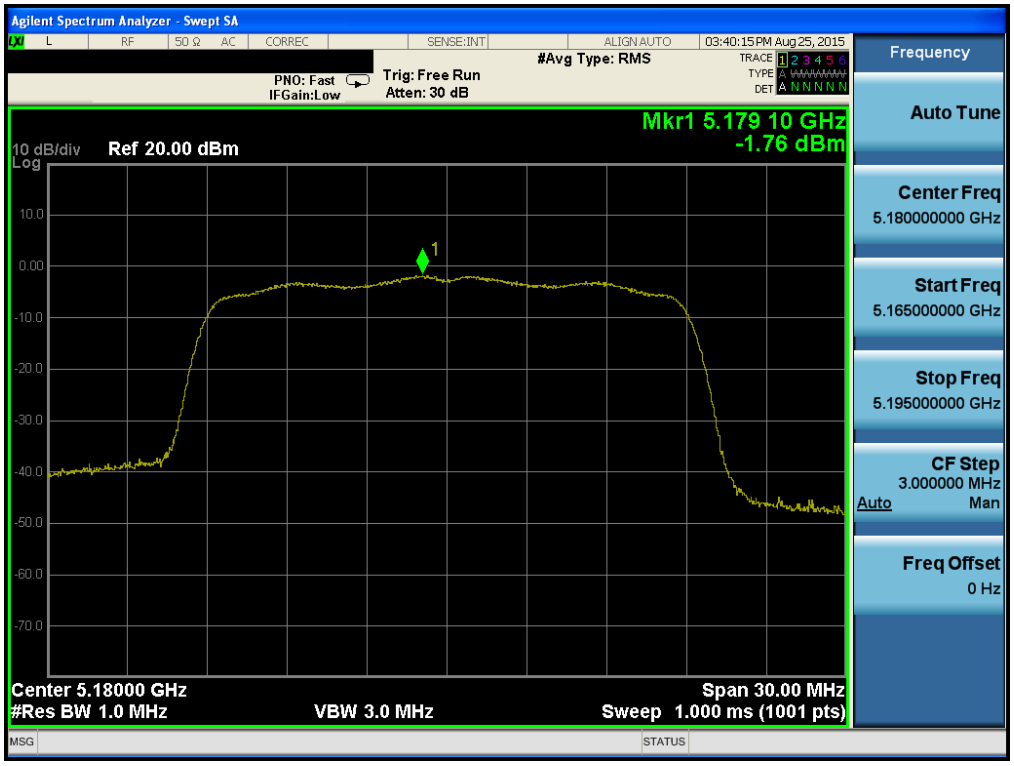
Maximum Power Spectral Density Test Mode: 802.11a & Ch.157



Maximum Power Spectral Density Test Mode: 802.11a & Ch.165



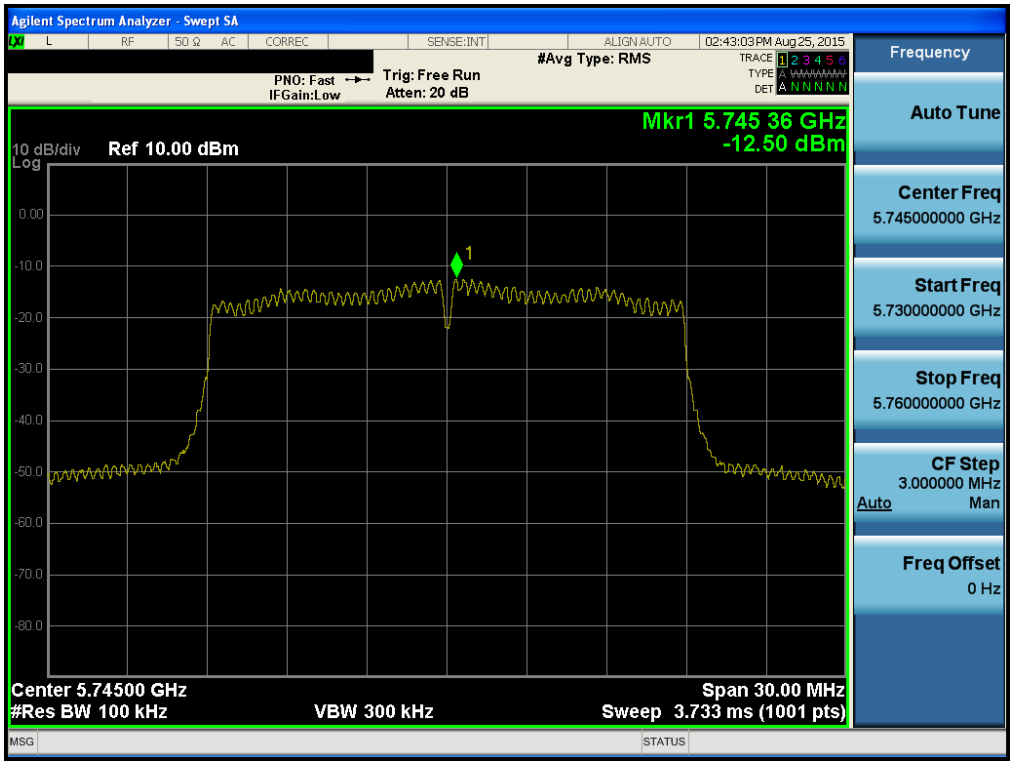
Maximum Power Spectral Density Test Mode: 802.11n(HT20) & Ch.36



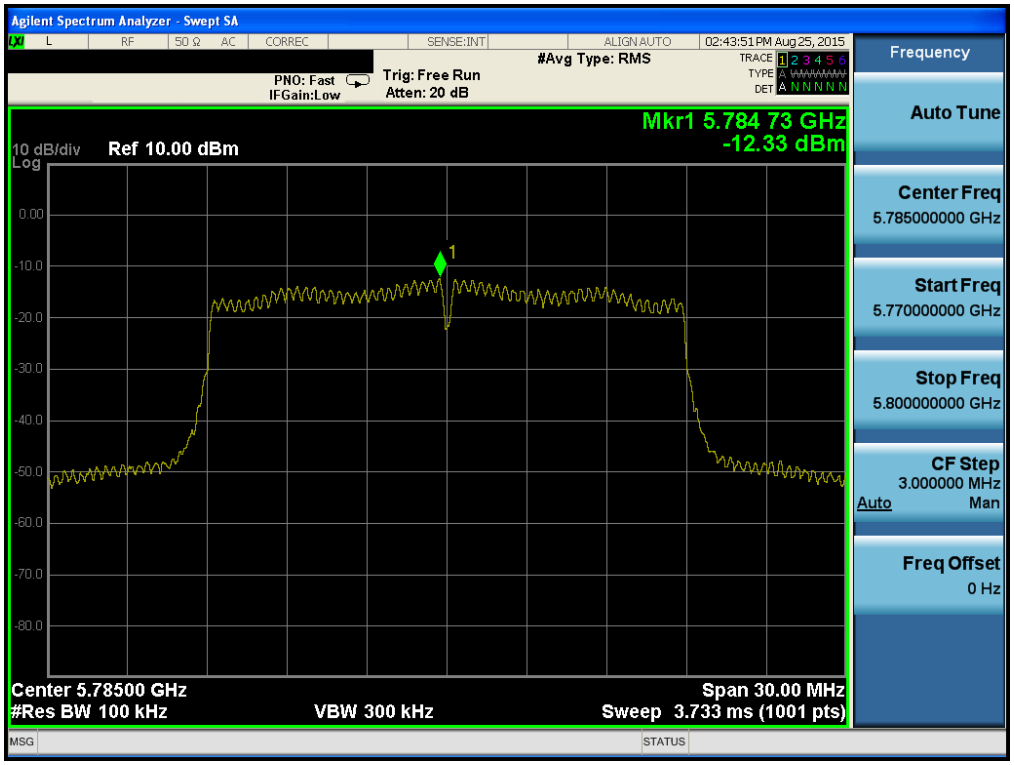
Maximum Power Spectral Density Test Mode: 802.11n(HT20) & Ch.40

Maximum Power Spectral Density Test Mode: 802.11n(HT20) & Ch.48

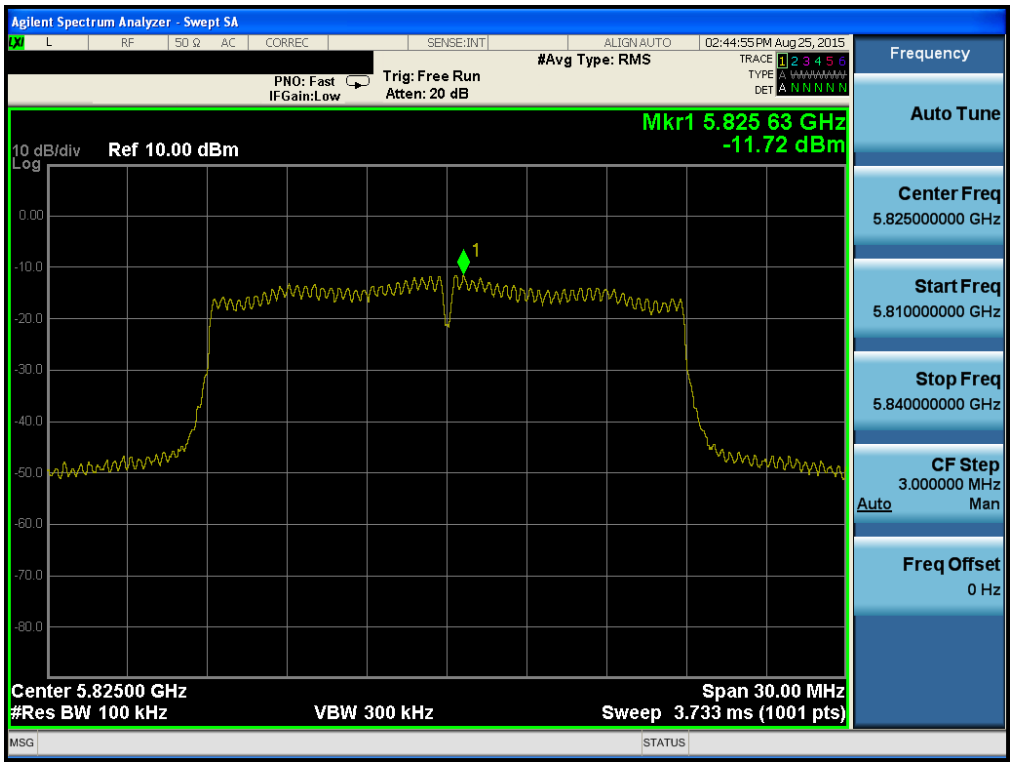
Maximum Power Spectral Density Test Mode: 802.11n(HT20) & Ch.149



Maximum Power Spectral Density Test Mode: 802.11n(HT20) & Ch.157



Maximum Power Spectral Density Test Mode: 802.11n(HT20) & Ch.165



8.5 Frequency Stability

▣ **Test requirements**

Manufacturers 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.

▣ **Test Procedure**

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between -20 ℃ and +50 ℃. The temperature was incremented by 10 ℃ intervals and the unit was allowed to stabilize at each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.

▣ **Test Result : Comply**

U-NII-1 & U-NII-2A : (5150 MHz ~ 5350 MHz)

26 dB Bandwidth Reference	
Low edge(MHz)	**High edge(MHz)**
5,170.720	NA

Supply Voltage (V DC)	TEMP (℃)	Operating Frequency					
		5180 MHz			NA		
		Measured Frequency (Hz)	Deviation (%)	26dBc low edge Note 1 (Hz)	Measured Frequency (Hz)	Deviation (%)	26dBc High edge Note 2 (Hz)
7.400	+25(Ref)	5,180,032,215	0.000622	5,170,752,215	-	-	-
	+50	5,180,062,153	0.001200	5,170,782,153	-	-	-
	+40	5,180,061,542	0.001188	5,170,781,542	-	-	-
	+30	5,180,060,365	0.001165	5,170,780,365	-	-	-
	+20	5,180,059,315	0.001145	5,170,779,315	-	-	-
	+10	5,180,058,032	0.001120	5,170,778,032	-	-	-
	0	5,180,056,988	0.001100	5,170,776,988	-	-	-
	-10	5,180,056,006	0.001081	5,170,776,006	-	-	-
	-20	5,180,055,417	0.001070	5,170,775,417	-	-	-
6.290	+25	5,180,032,363	0.000625	5,170,752,363	-	-	-
8.510	+25	5,180,032,177	0.000621	5,170,752,177	-	-	-

Note 1: **26 dB Bandwidth Reference Low edge (Hz)** + (**Measured Frequency (Hz)** - **Operating Frequency (Hz)**) = **26dBc low edge (Hz)**

Note 2: **26 dB Bandwidth Reference High edge (Hz)** + (**Measured Frequency (Hz)** - **Operating Frequency (Hz)**) = **26dBc High edge (Hz)**

U-NII-3 : (5725 MHz ~ 5850 MHz)

6 dB Bandwidth Reference	
Low edge(MHz)	**High edge(MHz)**
5,737.480	5,832.600

Supply Voltage (V DC)	TEMP (℃)	Operating Frequency					
		5745 MHz			5825 MHz		
		Measured Frequency (Hz)	Deviation (%)	6dBc low edge Note 1 (Hz)	Measured Frequency (Hz)	Deviation (%)	6dBc High edge Note 2 (Hz)
7.400	+25(Ref)	5,745,038,746	0.000674	5,737,518,746	5,825,039,341	0.000675	5,832,639,341
	+50	5,745,071,991	0.001253	5,737,551,991	5,825,074,569	0.001280	5,832,674,569
	+40	5,745,070,684	0.001230	5,737,550,684	5,825,072,684	0.001248	5,832,672,684
	+30	5,745,068,556	0.001193	5,737,548,556	5,825,071,914	0.001235	5,832,671,914
	+20	5,745,067,069	0.001167	5,737,547,069	5,825,069,267	0.001189	5,832,669,267
	+10	5,745,065,897	0.001147	5,737,545,897	5,825,067,694	0.001162	5,832,667,694
	0	5,745,063,955	0.001113	5,737,543,955	5,825,065,319	0.001121	5,832,665,319
	-10	5,745,062,684	0.001091	5,737,542,684	5,825,063,037	0.001082	5,832,663,037
	-20	5,745,061,078	0.001063	5,737,541,078	5,825,060,951	0.001046	5,832,660,951
6.290	+25	5,745,038,808	0.000676	5,737,518,808	5,825,039,352	0.000676	5,832,639,352
8.510	+25	5,745,038,704	0.000674	5,737,518,704	5,825,039,198	0.000673	5,832,639,198

Note 1 / 2: **6 dB Bandwidth Reference Low edge (Hz)** + (**Measured Frequency (Hz)** - **Operating Frequency (Hz)**) = **6dBc low edge (Hz)**
Note 3: **6 dB Bandwidth Reference High edge (Hz)** + (**Measured Frequency (Hz)** - **Operating Frequency (Hz)**) = **6dBc High edge (Hz)**

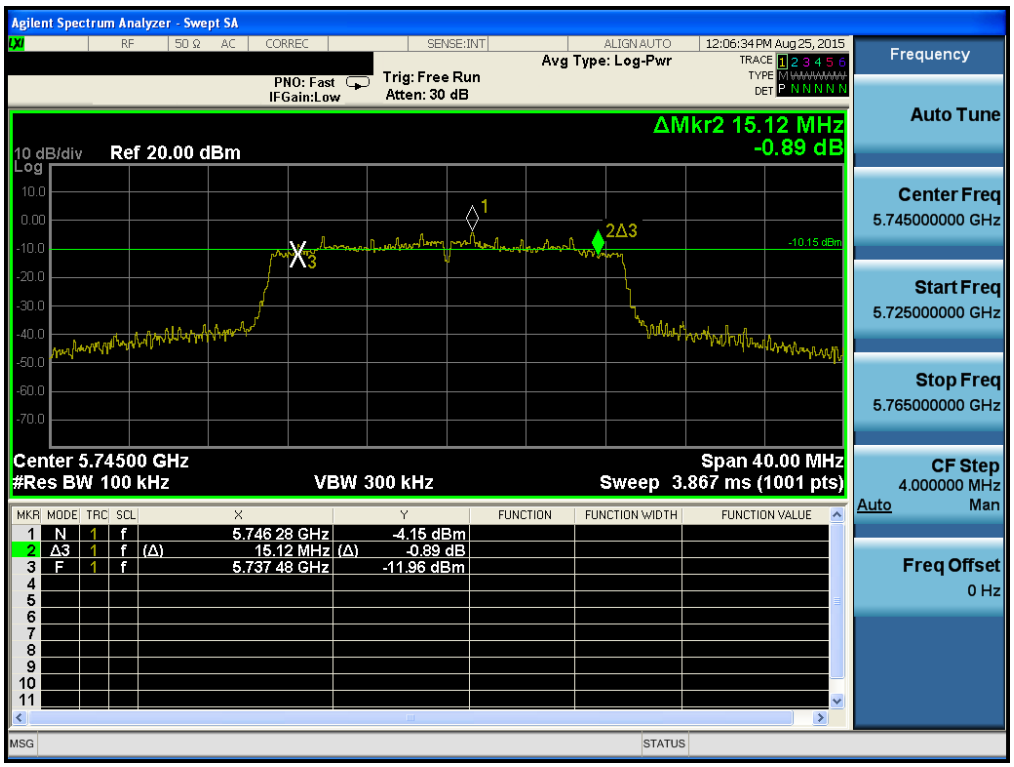
▣ RESULT PLOTS

26 dB Bandwidth Reference

Test Mode: 802.11a & Ch.36

6 dB Bandwidth Reference

Test Mode: 802.11n(HT20) & Ch.149



6 dB Bandwidth Reference Test Mode: 802.11n(HT20) & Ch.165

8.6 Radiated Spurious Emission Measurements

▣ Test Procedure

▪ **FCC Part 15.209(a) and (b)**

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 – 0.490	2400/F(KHz)	300
0.490 – 1.705	24000/F(KHz)	30
1.705 – 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 - 72 MHz, 76 – 88 MHz, 174 – 216 MHz or 470 – 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

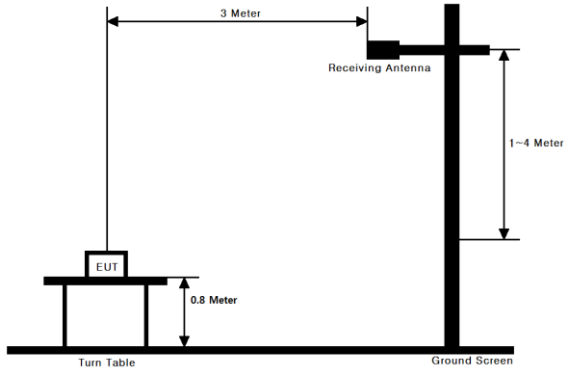
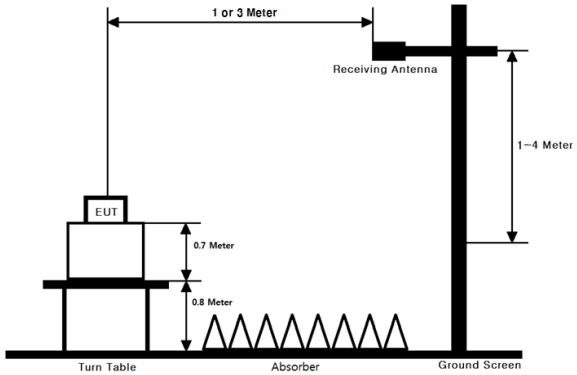
MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~ 12.52025	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.57675 ~ 12.57725	160.52475 ~ 160.52525	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	13.36 ~ 13.41	160.7 ~ 160.9	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	16.42 ~ 16.423	162.0125 ~ 167.17	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	16.69475 ~ 16.69525	167.72 ~ 173.2	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.80425 ~ 16.80475	240 ~ 285	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	25.5 ~ 25.67	322 ~ 335.4	2655 ~ 2900		
8.291 ~ 8.294	37.5 ~ 38.25	399.90 ~ 410	3260 ~ 3267		
8.362 ~ 8.366	73 ~ 74.6	608 ~ 614	3332 ~ 3339		
8.37625 ~ 8.38675	74.8 ~ 75.2	960 ~ 1240	3345.8 ~ 3358		
			3600 ~ 4000		

▪ **FCC Part 15.205(b):** The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

▪ **FCC Part 15.407 (b):** Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the **5.15 - 5.25 GHz band**: all emissions outside of the **5.15 - 5.35 GHz band** shall not exceed an **EIRP of -27 dBm / MHz**.
(2) For transmitters operating in the **5.25 - 5.35 GHz band**: all emissions outside of the **5.15 - 5.35 GHz band** shall not exceed an **EIRP of -27 dBm / MHz**.
(3) For transmitters operating in the **5.47 - 5.725 GHz band**: all emissions outside of the **5.47 - 5.725 GHz band** shall not exceed an **EIRP of -27 dBm / MHz.**
(4) For transmitters operating in the **5.725 - 5.85 GHz band**: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm / MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm / MHz.
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
(6) Unwanted emissions **below 1 GHz** must comply with the general field strength limits set forth in **Section 15.209**. Further, any U-NII devices using an **AC power line** are required to comply also with the conducted limits set forth in **Section 15.207**.
(7) The provisions of §15.205 apply to intentional radiators operating under this section
(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

▣ Test Procedure

Below 1GHz	Above 1GHz
	

▣ Test Procedure

1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
2. The turn table shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3 m away from the receiving antenna, which is varied from 1m to 4 m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

Radiated spurious emission measured using following Measurement Procedure **of KDB789033 D02 V01**

► **General Requirements for Unwanted Emissions Measurements**

The following requirements apply to all unwanted emissions measurements, both in and outside of the restricted bands:

- EUT Duty Cycle

(1) The EUT shall be configured or modified to **transmit continuously** except as stated in (ii), below. The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (**to no lower than 98 percent**) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

(2) If **continuous transmission (or at least 98 percent duty cycle) cannot be achieved** due to hardware limitations of the EUT (e.g., overheating), the following additions to the measurement and reporting procedures are required:

- The EUT shall be configured to operate at the maximum achievable duty cycle.
- Measure the duty cycle, x, of the transmitter output signal.
- Adjustments to measurement procedures (e.g., increasing test time and number of traces averaged) shall be performed as described in the procedures below.
- The test report shall include the following additional information:
  - The reason for the duty cycle limitation.
  - The duty cycle achieved for testing and the associated transmit duration and interval between transmissions.
  - The sweep time and the amount of time used for trace stabilization during max-hold measurements for peak emission measurements.

(3) **Reduction of the measured emission amplitude levels to account for operational duty factor is not permitted. Compliance is based on emission levels occurring during transmission - not on an average across on and off times of the transmitter.**

► **Measurements below 1000 MHz**

a) Follow the requirements in section II.G.3, “General Requirements for Unwanted Emissions Measurements”.

b) Compliance shall be demonstrated using **CISPR quasi-peak detection**; however, **peak detection** is permitted as an alternative to quasi-peak detection.

► **Measurements Above 1000 MHz (Peak)**

a) Follow the requirements in section II.G.3, “General Requirements for Unwanted Emissions Measurements”.
b) Peak emission levels are measured by setting the analyzer as follows:
(i) **RBW = 1 MHz.**
(ii) **VBW ≥ 3 MHz.**
(iii) **Detector = Peak.**
(iv) Sweep time = Auto.
(v) Trace mode = Max hold.
(vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

► **Measurements Above 1000 MHz (Method AD)**

(i) **RBW = 1 MHz.**
(ii) **VBW ≥ 3 MHz.**
(iii) **Detector = RMS**, if span / (# of points in sweep) ≤ RBW / 2. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, the detector mode shall be set to peak.
(iv) Averaging type = power (i.e., RMS)
• As an alternative, the detector and averaging type may be set for linear voltage averaging. Some analyzers require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.
(v) Sweep time = Auto.
(vi) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 percent duty cycle, at least 200 traces shall be averaged.
(vii) If tests are performed with the EUT transmitting at a duty cycle less than 98 percent, a correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
• **If power averaging (RMS) mode was used in step (iv) above, the correction factor is 10 log(1/x), where x is the duty cycle.**
For example, if the transmit duty cycle was 50 percent, then 3 dB must be added to the measured emission levels.
• If linear voltage averaging mode was used in step (iv) above, the correction factor is 20 log (1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 6 dB must be added to the measured emission levels.
• If a specific emission is demonstrated to be continuous (100 percent duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.

▣ Measurement Data:

Radiated Spurious Emissions data(9kHz ~ 40GHz) : *802.11a & U-NII-1*

Tested Channel	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36 (5180 MHz)	5149.970	V	Z	PK	57.84	11.70	N/A	N/A	69.54	74.00	4.46
	5149.990	V	Z	AV	39.86	11.70	0.14	N/A	51.70	54.00	2.30
	10360.010	V	Z	PK	42.31	13.91	N/A	-9.54	46.68	68.20	21.52
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
40 (5200 MHz)	10399.420	V	Z	PK	42.38	14.02	N/A	-9.54	46.86	68.20	21.34
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
48 (5240 MHz)	10480.440	V	Z	PK	41.97	14.25	N/A	-9.54	46.68	68.20	21.52
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-

Radiated Spurious Emissions data(9kHz ~ 40GHz) : *802.11a & U-NII-3*

Tested Channel	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
149 (5745 MHz)	5710.380	V	Z	PK	51.81	12.70	N/A	N/A	64.51	68.20	3.69
	5724.200	V	Z	PK	61.84	12.72	N/A	N/A	74.56	78.20	3.64
	11489.730	V	Z	PK	42.36	15.82	N/A	-9.54	48.64	74.00	25.36
	11490.520	V	Z	AV	31.41	15.82	0.14	-9.54	37.83	54.00	16.17
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
157 (5785 MHz)	11569.900	V	Z	PK	41.48	16.06	N/A	-9.54	48.00	74.00	26.00
	11570.720	V	Z	AV	31.45	16.06	0.14	-9.54	38.11	54.00	15.89
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
165 (5825 MHz)	5850.390	V	Z	PK	52.68	12.97	N/A	N/A	65.65	78.20	12.55
	5861.960	V	Z	PK	46.55	13.01	N/A	N/A	59.56	68.20	8.64
	11649.830	V	Z	PK	42.01	16.32	N/A	-9.54	48.79	74.00	25.21
	11649.840	V	Z	AV	31.48	16.32	0.14	-9.54	38.40	54.00	15.60
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
3. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   Therefore Distance Correction Factor (DCF) : - 9.54 dB = 20*log (1m / 3m)
4. The limit is converted to field strength.
   E [dBuV/m] = EIRP [dBm] + 95.2 dB = -27 dBm + 95.2 = 68.2 dBuV/m
   = -17 dBm + 95.2 = 78.2 dBuV/m
5. If peak measurement satisfy the average limit, then average measurement are not required.

▣ Measurement Data:

Radiated Spurious Emissions data(9kHz ~ 40GHz) : *802.11n(HT20) & U-NII-1*

Tested Channel	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
36 (5180 MHz)	5148.790	V	Z	PK	52.64	11.70	N/A	N/A	64.34	74.00	9.66
	5148.780	V	Z	AV	38.16	11.70	0.14	N/A	50.00	54.00	4.00
	10360.050	V	Z	PK	42.07	13.91	N/A	-9.54	46.44	68.20	21.76
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
40 (5200 MHz)	10400.380	V	Z	PK	41.91	14.02	N/A	-9.54	46.39	68.20	21.81
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
48 (5240 MHz)	10480.460	V	Z	PK	42.03	14.25	N/A	-9.54	46.74	68.20	21.46
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-

Radiated Spurious Emissions data(9kHz ~ 40GHz) : *802.11n(HT20) & U-NII-3*

Tested Channel	Frequency (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
149 (5745 MHz)	5714.240	V	Z	PK	42.80	12.70	N/A	N/A	55.50	68.20	12.70
	5724.870	V	Z	PK	62.41	12.72	N/A	N/A	75.13	78.20	3.07
	11490.540	V	Z	PK	42.41	15.82	N/A	-9.54	48.69	74.00	25.31
	11490.240	V	Z	AV	31.64	15.82	0.14	-9.54	38.06	54.00	15.94
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
157 (5785 MHz)	11570.350	V	Z	PK	42.11	16.06	N/A	-9.54	48.63	74.00	25.37
	11570.260	V	Z	AV	31.30	16.06	0.14	-9.54	37.96	54.00	16.04
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
165 (5825 MHz)	5850.040	V	Z	PK	47.61	12.97	N/A	N/A	60.58	78.20	17.62
	5865.560	V	Z	PK	45.37	13.01	N/A	N/A	58.38	68.20	9.82
	11649.300	V	Z	PK	42.26	16.32	N/A	-9.54	49.04	74.00	24.96
	11649.460	V	Z	AV	31.64	16.32	0.14	-9.54	38.56	54.00	15.44
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
3. Measurement Distance = 3 m for below 10 GHz, Measurement Distance = 1 m for above 10 GHz.
   Therefore Distance Correction Factor (DCF) : - 9.54 dB = 20*log (1m / 3m)
4. The limit is converted to field strength.
   E [dBuV/m] = EIRP [dBm] + 95.2 dB = -27 dBm + 95.2 = 68.2 dBuV/m
   = -17 dBm + 95.2 = 78.2 dBuV/m
5. If peak measurement satisfy the average limit, then average measurement are not required.

8.7 AC Conducted Emissions

▣ **TEST PROCEDURE:**

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. Emissions closest to the limit are measured in the quasi-peak mode (QP) and average mode (AV) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

▣ **Measurement Data: Comply**

Note 1: See next pages for actual measured spectrum plots and data.

▣ **Minimum Standard: FCC Part 15.207(a)**

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

AC Line Conducted Emissions (Graph)

Test Mode: U-NII 1 & 802.11a

Results of Conducted Emission

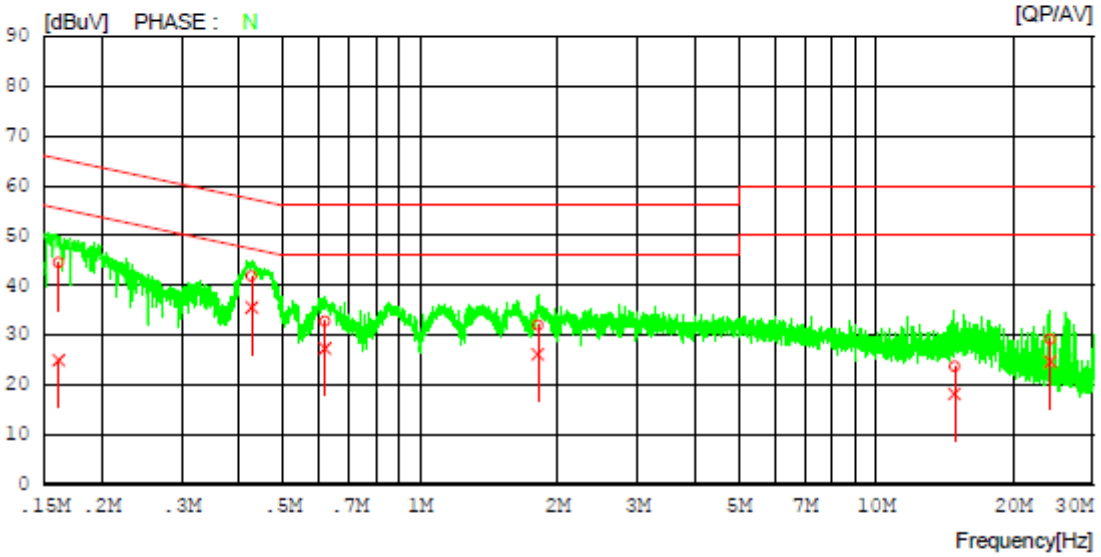
DTNC

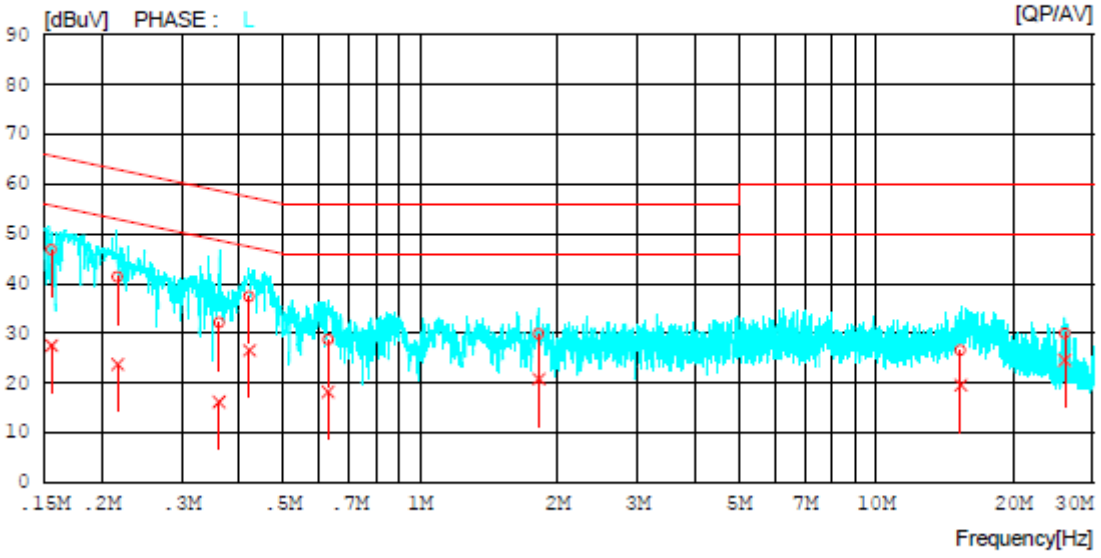
Date : 2015-08-24

Order No.	:		Referrence No.	:	
Model No.	:	AX400	Power Supply	:	120 V 60 Hz
Serial No.	:		Temp/Humi.	:	23 'C 46 % R.H.
Test Condition	:	802.11a_5.1G	Operator	:	K.C.Yeom

Memo :

LIMIT : FCC P15.207 QP
FCC P15.207 AV





AC Line Conducted Emissions (Data List)

Test Mode: U-NII 1 & 802.11a

Results of Conducted Emission

DTNC

Date : 2015-08-24

Order No.	:		Referrence No.	:	
Model No.	:	AX400	Power Supply	:	120 V 60 Hz
Serial No.	:		Temp/Humi.	:	23 'C 46 % R.H.
Test Condition	:	802.11a_5.1G	Operator	:	K.C.Yeom

Memo :

LIMIT : FCC P15.207 QP
FCC P15.207 AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.16109	34.5	14.9	10.0	44.5	24.9	65.4	55.4	20.9	30.5	N
2	0.42726	31.7	25.4	10.1	41.8	35.5	57.3	47.3	15.5	11.8	N
3	0.61866	22.6	17.2	10.1	32.7	27.3	56.0	46.0	23.3	18.7	N
4	1.81280	21.8	16.0	10.1	31.9	26.1	56.0	46.0	24.1	19.9	N
5	14.89020	13.1	7.6	10.5	23.6	18.1	60.0	50.0	36.4	31.9	N
6	24.14600	18.3	13.8	10.8	29.1	24.6	60.0	50.0	30.9	25.4	N
7	0.15540	36.6	17.5	10.1	46.7	27.6	65.7	55.7	19.0	28.1	L
8	0.21703	31.3	13.6	10.1	41.4	23.7	62.9	52.9	21.5	29.2	L
9	0.36231	22.0	6.1	10.1	32.1	16.2	58.7	48.7	26.6	32.5	L
10	0.42181	27.3	16.6	10.0	37.3	26.6	57.4	47.4	20.1	20.8	L
11	0.62878	18.8	8.2	10.0	28.8	18.2	56.0	46.0	27.2	27.8	L
12	1.82220	19.8	10.6	10.1	29.9	20.7	56.0	46.0	26.1	25.3	L
13	15.35320	15.8	8.8	10.8	26.6	19.6	60.0	50.0	33.4	30.4	L
14	25.97480	18.7	13.4	11.2	29.9	24.6	60.0	50.0	30.1	25.4	L

AC Line Conducted Emissions (Graph)

Test Mode: U-NII 3 & 802.11a

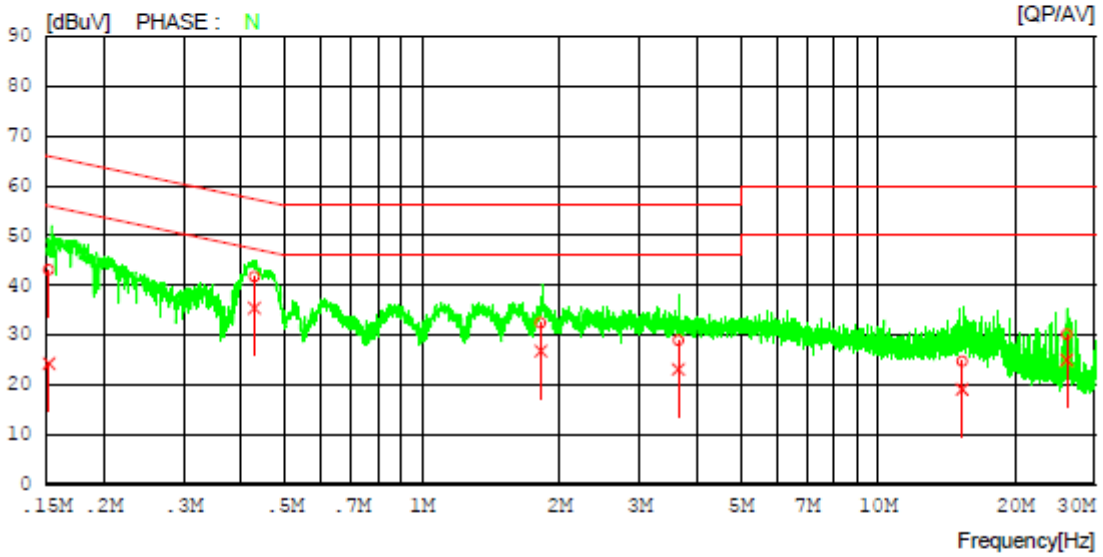
Results of Conducted Emission

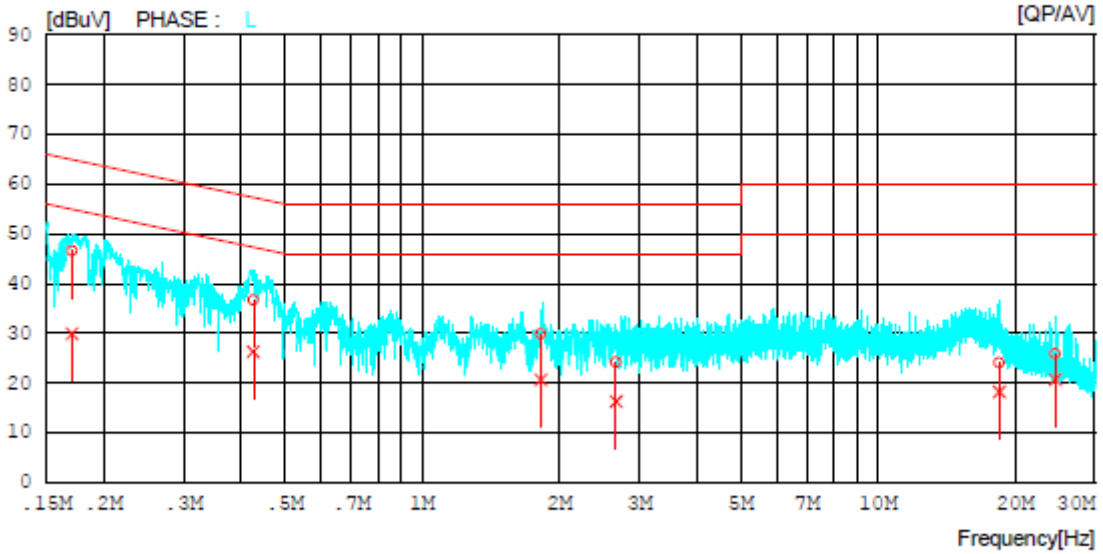
DTNC

Date : 2015-08-24

Order No.	:		Referrence No.	:	
Model No.	:	AX400	Power Supply	:	120 V 60 Hz
Serial No.	:		Temp/Humi.	:	23 'C 46 % R.H.
Test Condition	:	802.11a_5.7G	Operator	:	K.C.Yeom
Memo	:				

LIMIT : FCC P15.207 QP
FCC P15.207 AV





AC Line Conducted Emissions (Data List)

Test Mode: U-NII 3 & 802.11a

Results of Conducted Emission

DTNC Date : 2015-08-24

Order No.	:		Referrence No.	:	
Model No.	:	AX400	Power Supply	:	120 V 60 Hz
Serial No.	:		Temp/Humi.	:	23 'C 46 % R.H.
Test Condition	:	802.11a_5.7G	Operator	:	K.C.Yeom

Memo :

LIMIT : FCC P15.207 QP
FCC P15.207 AV

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.15179	33.0	14.2	10.1	43.1	24.3	65.9	55.9	22.8	31.6	N
2	0.42879	31.6	25.3	10.1	41.7	35.4	57.3	47.3	15.6	11.9	N
3	1.82200	22.3	16.6	10.1	32.4	26.7	56.0	46.0	23.6	19.3	N
4	3.65040	18.8	13.1	10.0	28.8	23.1	56.0	46.0	27.2	22.9	N
5	15.31040	14.2	8.5	10.5	24.7	19.0	60.0	50.0	35.3	31.0	N
6	25.97340	19.3	14.2	10.8	30.1	25.0	60.0	50.0	29.9	25.0	N
7	0.17055	36.5	19.8	10.1	46.6	29.9	64.9	54.9	18.3	25.0	L
8	0.42611	26.7	16.3	10.0	36.7	26.3	57.3	47.3	20.6	21.0	L
9	1.82180	19.8	10.5	10.1	29.9	20.6	56.0	46.0	26.1	25.4	L
10	2.66280	14.0	6.1	10.2	24.2	16.3	56.0	46.0	31.8	29.7	L
11	18.48520	13.2	7.4	10.8	24.0	18.2	60.0	50.0	36.0	31.8	L
12	24.50780	14.7	9.6	11.1	25.8	20.7	60.0	50.0	34.2	29.3	L

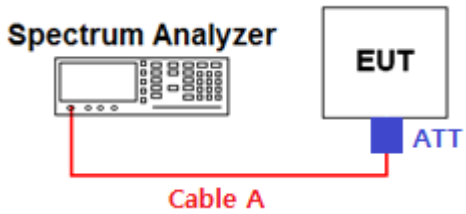
9. List of Test Equipment

Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
MXA Signal Analyzer	Agilent	N9020A	14/09/15	15/09/15	MY50200834
PXA Signal Analyzer	Agilent Technologies	N9030A	14/10/21	15/10/21	MY53310140
DIGITAL MULTIMETER	Agilent	34401A	15/01/06	16/01/06	US36099541
DC Power Supply	SM techno	SDP30-5D	15/01/06	16/01/06	305DLJ204
Vector Signal Generator	Rohde Schwarz	SMBV100A	15/01/06	16/01/06	255571
Signal Generator	Rohde Schwarz	SMF100A	15/06/29	16/06/29	102341
10dB Attenuator	Aeroflex/Weinschel	86-10-11	14/09/12	15/09/12	446
			15/09/09	16/09/09	
Thermohygrometer	BODYCOM	BJ5478	15/05/08	16/05/08	120612-2
Temp & Humi Test Chamber	SJ Science	SJ-TH-S50	15/02/26	16/02/26	SJ-TH-S50-140205
LOOP Antenna	Schwarzbeck	FMZB1513	14/04/29	16/04/29	1513-128
TRILOG Broadband Test-Antenna	Schwarzbeck	VULB 9160	14/04/30	16/04/30	3358
Double-Ridged Guide Antenna	ETS	3117	14/05/12	16/05/12	140394
Horn Antenna	A.H.Systems	SAS-574	15/04/30	17/04/30	2015.01.07
Low Noise Pre Amplifier	tsj	MLA-010K01-B01-27	15/04/09	16/04/09	1844538
PreAmplifier	Agilent	8449B	15/02/26	16/02/26	3008A00370
PreAmplifier	A.H. SYSTEMS	PAM-1840VH	14/12/12	15/12/12	163
High pass Filter	Wainwright Instruments	WHNX6-6320-8000-26500-40CC	14/10/17	15/10/17	1
EMI TEST RECEIVER	R&S	ESR7	14/10/21	15/10/21	101109
EMI TEST RECEIVER	R&S	ESCI	15/02/25	16/02/25	100364
SINGLE-PHASE MASTER	NF	4420	14/09/11	15/09/11	3049354420023
			15/09/09	16/09/09	
ARTIFICIAL MAINS NETWORK	Narda S.T.S. / PMM	PMM L2-16B	15/06/26	16/06/26	000WX20305
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2495A MA2490A	15/03/26	16/03/26	1306007 1249001

APPENDIX I

Conducted Test set up Diagram

- **Conducted Measurement**



APPENDIX II

Duty Cycle Information

▣ **Test Procedure**

Duty Cycle [X = On Time / (On + Off time)] is measured using Measurement Procedure **of KDB789033 D02 V01**

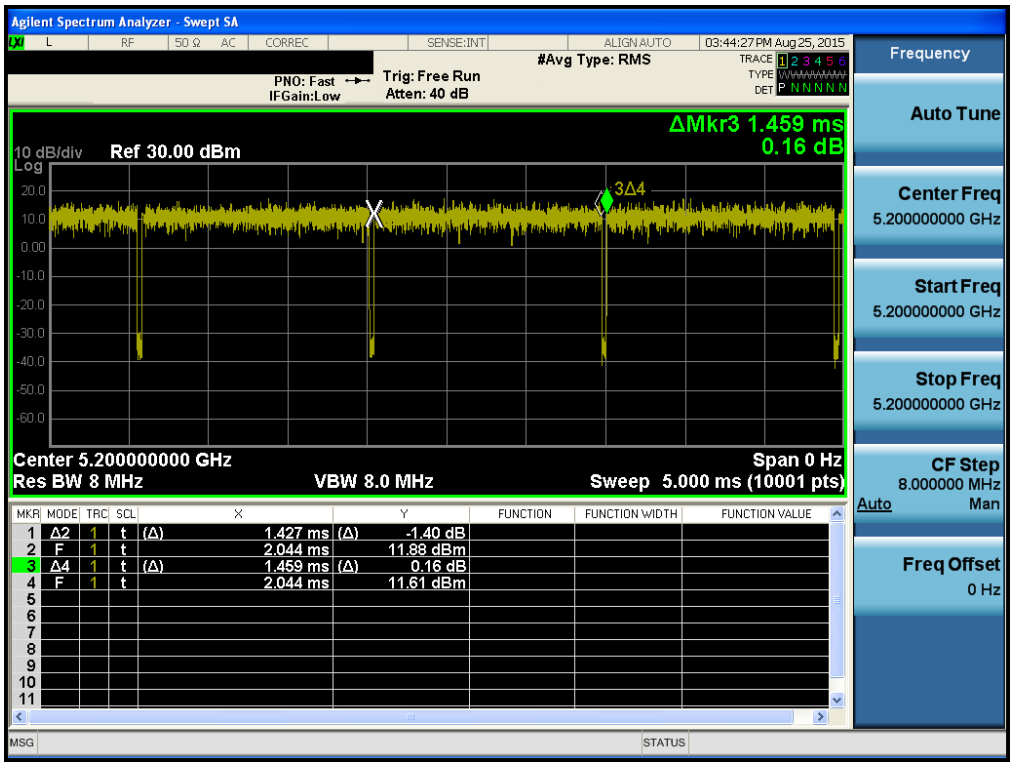
1. Set the center frequency of the spectrum analyzer to the center frequency of the transmission.
2. Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value.
3. Set VBW ≥ RBW. Set detector = peak.
4. Note : The zero-span measurement method shall not be used unless both **RBW and VBW are > 50 / *T***, where *T* is defined in section II.B.1.a), and **the number of sweep points across duration *T* exceeds 100**. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if *T* ≤ 16.7 microseconds.)

T: The minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
(***T* = On time** of the above table since the EUT operates with above fixed Duty Cycle and it is the minimum On time)

TEST DATA

Mode	Channel	Tested Frequency [MHz]	Maximum Achievable Duty Cycle (*x*) = On / (On+Off)			Duty Cycle Correction Factor [dB]	1/*T* [Hz]
			On Time [ms]	On+OffTime [ms]	*x*		
802.11a	40	5200	1.427	1.459	0.97	0.14	700.78
802.11n (HT20)	40	5200	1.336	1.368	0.97	0.14	748.51

Duty Cycle Test Mode: 802.11a & Ch.40



Duty Cycle Test Mode: 802.11n(HT20) & Ch.40