FCC CFR47 Part 15 Subpart E Certification Test Report

For the

Product	**: S-DAQ**
Model	**: SRC-BAMVC2**
FCC ID	**: A3LSRC-BAMVC2**
Applicant	**: Samsung Electronics Co., Ltd.**
FCC Rule	**: CFR 47 Part 15 Subpart E**

We hereby certify that the above product has been tested by us with the listed rules and found in compliance with the regulation. The test data and results are issued on the test report no. **TR-W1511-010**

Signature

Park, Young-cheol / Technical Manager

Date: 2015-11-10

Test Laboratory: ENG Co., Ltd.

FCC CERTIFICATION TEST REPORT

Project Number	**: EA1506Q-002**
Test Report Number	**: TR-W1511-010**
Type of Equipment	**: S-DAQ**
FCC ID	**: A3LSRC-BAMVC2**
Model Name	**: SRC-BAMVC2**
Multiple Model Name	**: N/A**
Applicant	**: Samsung Electronics**
Address	**: (Maetan dong)129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyenggi-do, 443-742, Korea**
Manufacturer	**: Samsung Electronics**
Address	**: (Maetan dong)129, Samsung-ro, Yeongtong-gu, Suwon-si, Gyenggi-do, 443-742, Korea**
Regulation	**: FCC Part 15 Subpart E 15.407**
Total page of Report	**: 1 Pages**
Date of Receipt	**: September 8, 2015**
Date of Issue	**: November 12, 2015**
Test Result	**: PASS**

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.

Prepared by Jang, Seung-man / Project Engineer _____ (Signature) 2015-11-12 (Date)

Reviewed by Park, Young-cheol / Technical Manager _____ (Signature) 2015-11-12 (Date)

CONTENTS

Release Control Record

Issue Report No.	Issued Date	Revisions	Effect Section
TR-W1511-010	November 12, 2015	Initial Release	All

1. TEST SUMMARY

1.1 Regulations and results

The sample submitted for evaluation(Referred to below as the EUT) has been tested in accordance with the following regulations or standards.

FCC Reference Section	Description	P (Pass)	F (Fail)	N.T. (Not Tested)	Note
15.203	Antenna Requirement	P			
15.205, 15.209,15.407(b)(5), (6), (7)	Radiated Unwanted Emissions	P			
15.407 (a)	26 dB Bandwidth	P			
15.407 (a)(1)(ii),(3)	Maximum Conducted Output Power	P			
15.407 (a)(1)(ii),(3),(5)	Power Spectral Density	P			
15.407 (b)(1),(4)	Undesirable Emissions	P			
15.407 (e)	6 dB Occupied Bandwidth	P			
15.407(g)	Frequency Satiability	P			
15.207, 15.407(b)(6)	AC-Line Conducted Emission	P			

1.2 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.

1.3 Test Methodology

The tests mentioned in clause 1.1 in this test report were performed according to FCC CFR 47 Part 2, CFR 47 Part 15 and ANSI C63.10-2013.

KDB 789033 D02 General U-NII Test Procedures New Rules V01

1.3 Additions, deviations, exclusions from standards

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

1.4 Test Facility

Site Qualification	Registration on IC effective through February 09, 2015 IC Registration No.: 12721A-1 Registration on FCC effective through February 24, 2015 FCC Registration No.: 955964 Appointed Laboratory acc. to ISO/IEC 17025 by TUV Rheinland on June 22, 2015 Appointment No: UA 50314109-0001 Designated Laboratory acc. to ISO/IEC 17025 by Radio Research Agency in Korea on October 20, 2015 Designated No: KR0160
Test Site	ENG Co., Ltd.
Site Location	135-60 Gyeongchung-daero, Gonjiam-eup, Gwangju-si, Gyeonggi-do, Korea.

2. EUT (Equipment Under Test)

2.1 General Description

The EUT is a device for transferring voltage signal and equipment information to an agent PC through wired/wireless communication. For wireless communication, the EUT has WLAN module has function for 802.11a/b/g, so this report covers 802.11 a only and another report covers function for 802.11b/g.

Description of equipment	S-DAQ
Model Name	SRC-BAMVC2
Serial Number	N/A
Operating Frequency	2 412 ~ 2 462 MHz, 5 180 MHz ~ 5 240 MHz, 5 745 ~ 5 805 MHz
Channel Bandwidth	20 MHz
Max. RF Output Power	13.21 dBm (802.11a)
Modulation Types	CCK(802.11 b), OFDM(802,11 a/g)
Number of Channels	2 412 ~ 2 462 MHz : 11 CH (802.11 b/g) 5 180 ~ 5 240 MHz : 4 CH (802.11 a) 5 745 ~ 5 805 MHz: 4 CH (802.11 a)
Generated or used Freq. in EUT	32.768 kHz, 12 MHz, 24 MHz, 25 MHz, 33 MHz, 37.4 MHz
Type of Antenna	☐ Integrated Type (PCB Type) ■ Dedicated Type
Antenna Gain	2.4 GHz Band : 4.16 dBi 5 GHz Band : 3.92 dBi
Operating Temperature	0 ℃ ~ 50 ℃
Normal Test Voltage	DC 24 V
Electrical Rating	DC 21.6 V ~ DC 26.4 V

2.4 Available channel number and frequency

Operating Mode: 802.11 a (U-NII Band 1 & Band 3), 20 MHz Channel Bandwidth					
Channel	Frequency(MHz)	Channel	Frequency(MHz)	Channel	Frequency(MHz)
36	5 180	40	5 200	44	5 220
48	5 240				
149	5 745	153	5 765	157	5 785
161	5 805				

2.5 Additional Model

None

3. TEST CONDITION

3.1 Equipment Used During Test

The following peripheral devices and/or interface cables were connected during the measurement:

Description	Model No.	Serial No.	Manufacturer.
S-DAQ (EUT)	SRC-BAMVC2	N/A	Samsung Electronics
Notebook PC	LG15U34	411NZJV003852	LG Electronics Nanjing Display Co., Ltd.

3.2 Mode of operation during the test

For finding worse case configuration and operating mode, preliminary testing was performed and radiated emission and conducted emission were performed with the EUT set to transmit at the channel with the highest output power as worse case scenario.

Based on preliminary testing following operating modes were selected for the final test as listed below.

3.2.1 Radiated Emission Test Mode Above 1 GHz

All data rates have been investigated and the worst one was set for final test as following table.

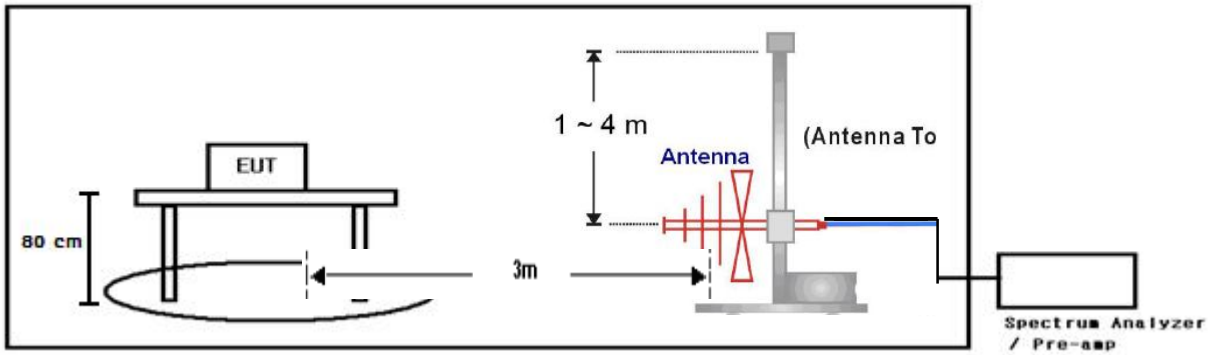
Operating Mode	Channel	Frequency (MHz)	Data rate (Mbps)	Output Power (dBm)
802.11a (U-NII Band 1)	Low	5 180	6	12.82
	Middle	5 200	6	13.02
	High	5 240	6	13.23
802.11a (U-NII Band 3)	Low	5 745	6	8.58
	Middle	5 765	6	8.40
	High	5 805	6	7.85

3.2.1 Radiated Emission Test Mode below 1 GHz and AC Power Line Conducted Emission

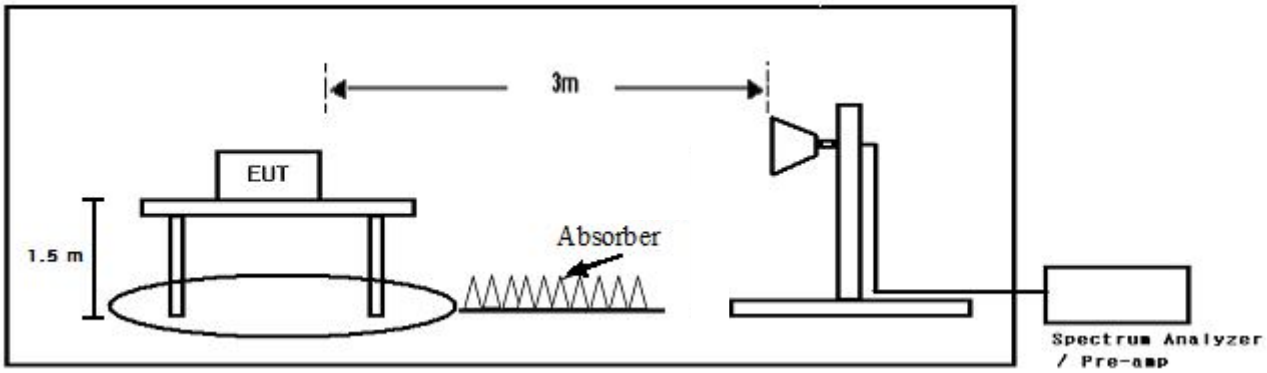
Operating Mode	Tested Channel	Data rate (Mbps)	Output Power (dBm)
802.11a (U-NII Band 1)	High	6	13.23

3.3 Test Setup Drawing

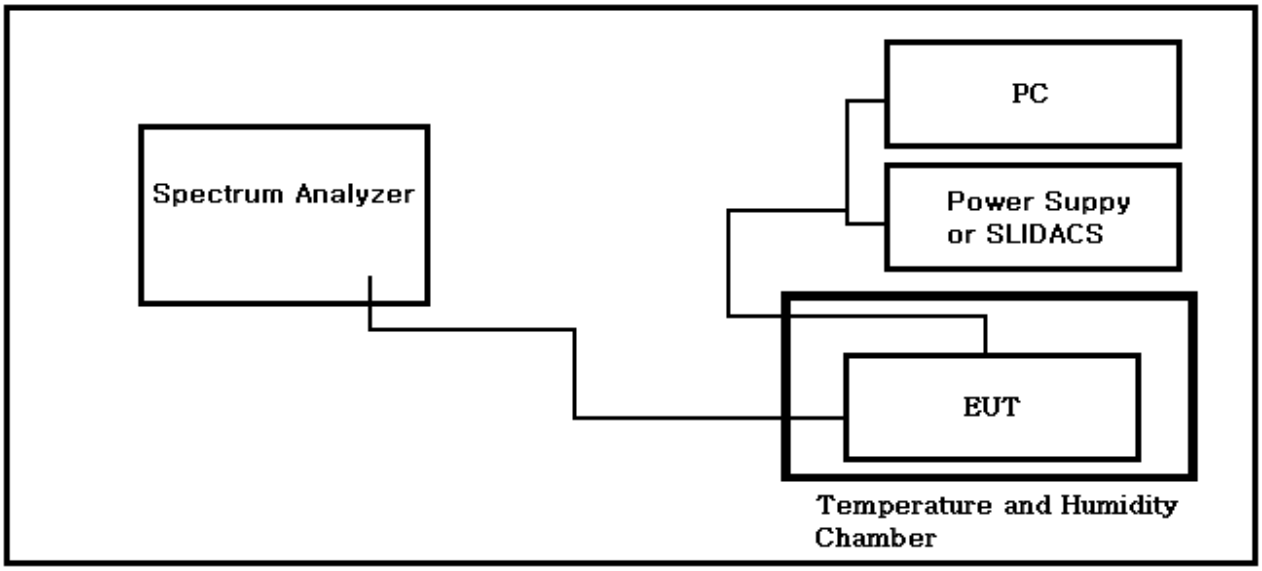
(Radiated Test Below 1 GHz)



(Radiated Test Above 1 GHz)



(Conducted Test)



3.5 EUT Modifications

Following modifications were implemented on the EUT for fixing the problem caused by EMC testing and the product will have all of the modifications incorporated into the product when manufactured and placed on the market.

- None.

4. ANTENNA REQUIREMENT

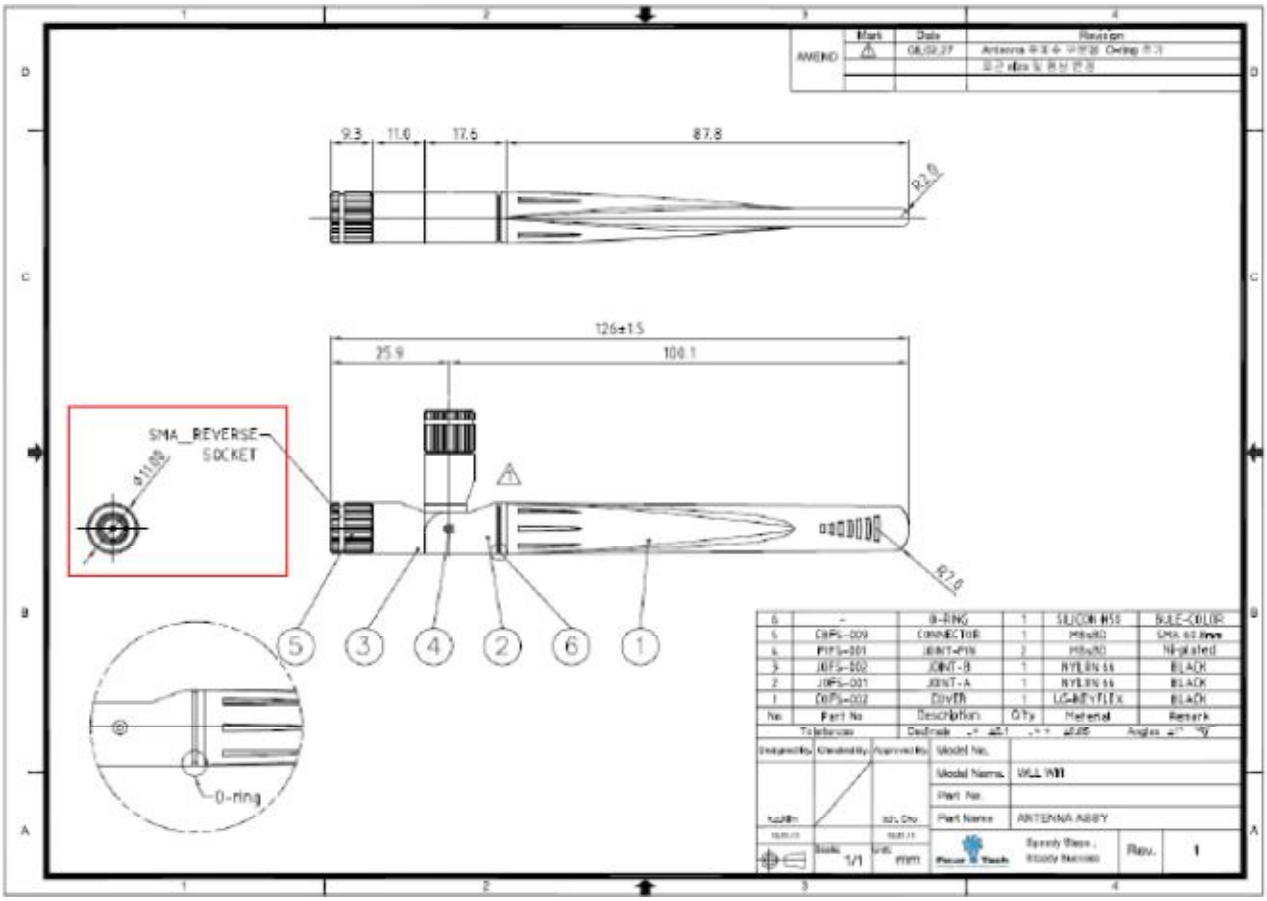
According to FCC CFR 47 Part 15 section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provision of this section.

4.1 Antenna Description

Frequency Band (GHz)	Antenna Type	Tx Parh	Max Peak Gain (dBi)	Connector Type
2.4	Dipole Antenna	1	4.16	Reversed SMA
5	Dipole Antenna	1	3.92	Reversed SMA

4.2 Conclusion

The antenna connector type of the EUT is Reversed SMA, so the EUT met the requirement.



5. TEST RESULT

5.1 26 dB BANDWIDTH

5.1.1 Limit

NONE

5.1.2 Method of Measurement

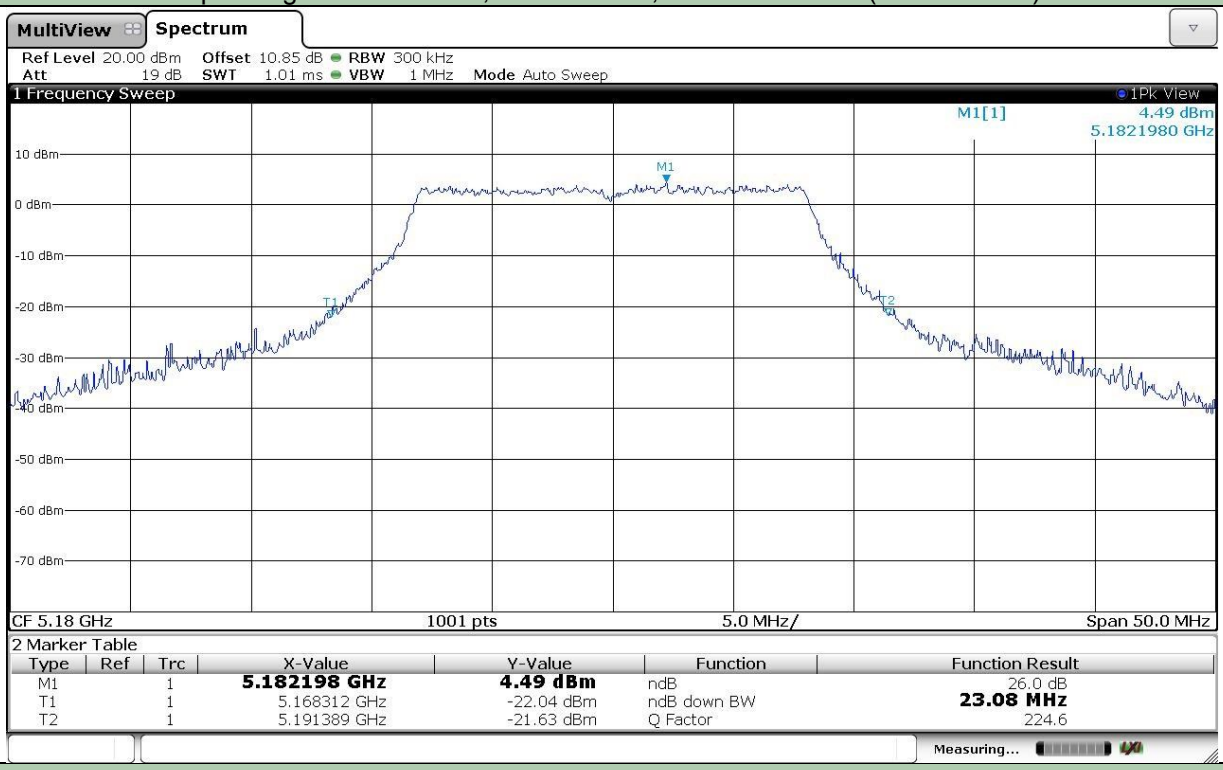
Reference to KDB 789033 D02 General UNII Test Procedures New Rules v01 Section C.1 EBW

5.1.3 Test Data

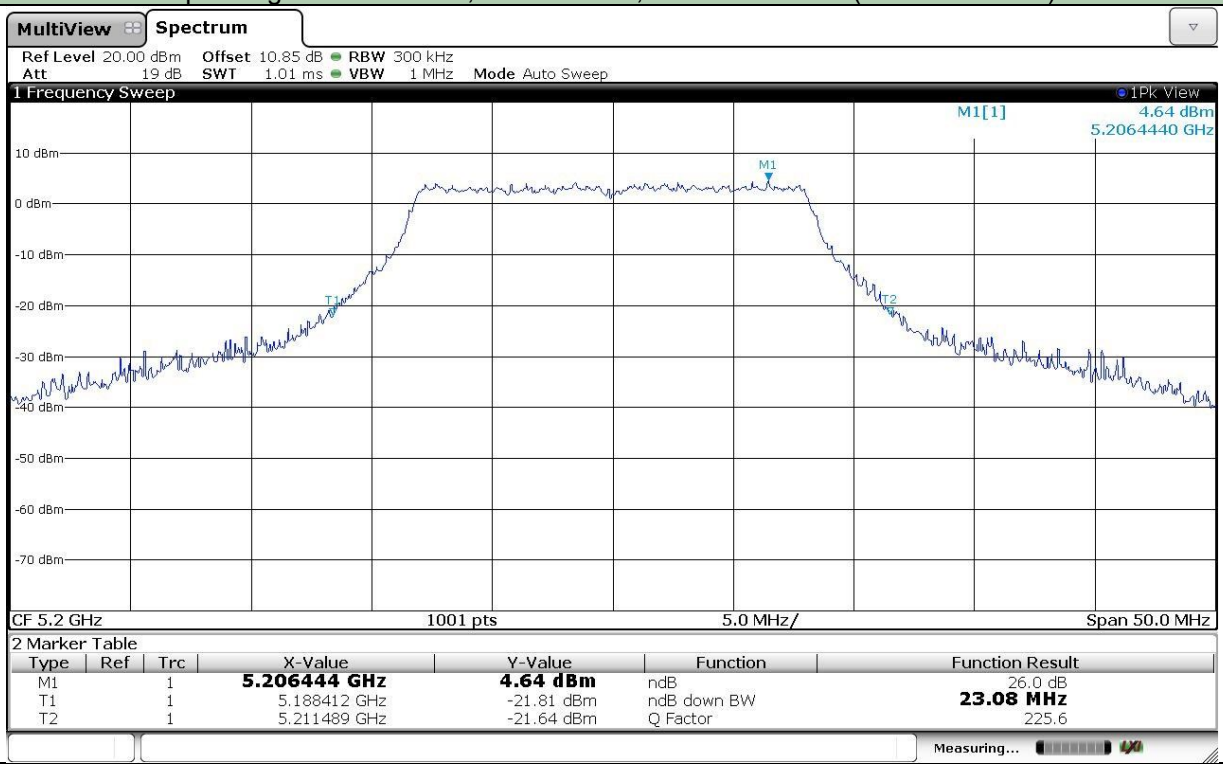
Test Date: Oct. 20, 2015		Tested by: S. M. Jang		
Operating Mode: U-NII Band 1				
Channel	Frequency (MHz)	26 dB Bandwidth	99 % Bandwidth	Result
Low	5 180	23.08 MHz	17.33 MHz	PASS
Middle	5 200	23.08 MHz	17.38 MHz	
High	5 240	23.28 MHz	17.38 MHz	
Operating Mode: U-NII Band 3				
Channel	Frequency (MHz)	26 dB Bandwidth	99 % Bandwidth	Result
Low	5745	23.43 MHz	17.33 MHz	PASS
Middle	5 765	23.33 MHz	17.33 MHz	
High	5 805	23.03 MHZ	17.33 MHz	

5.1.4 Test Plots

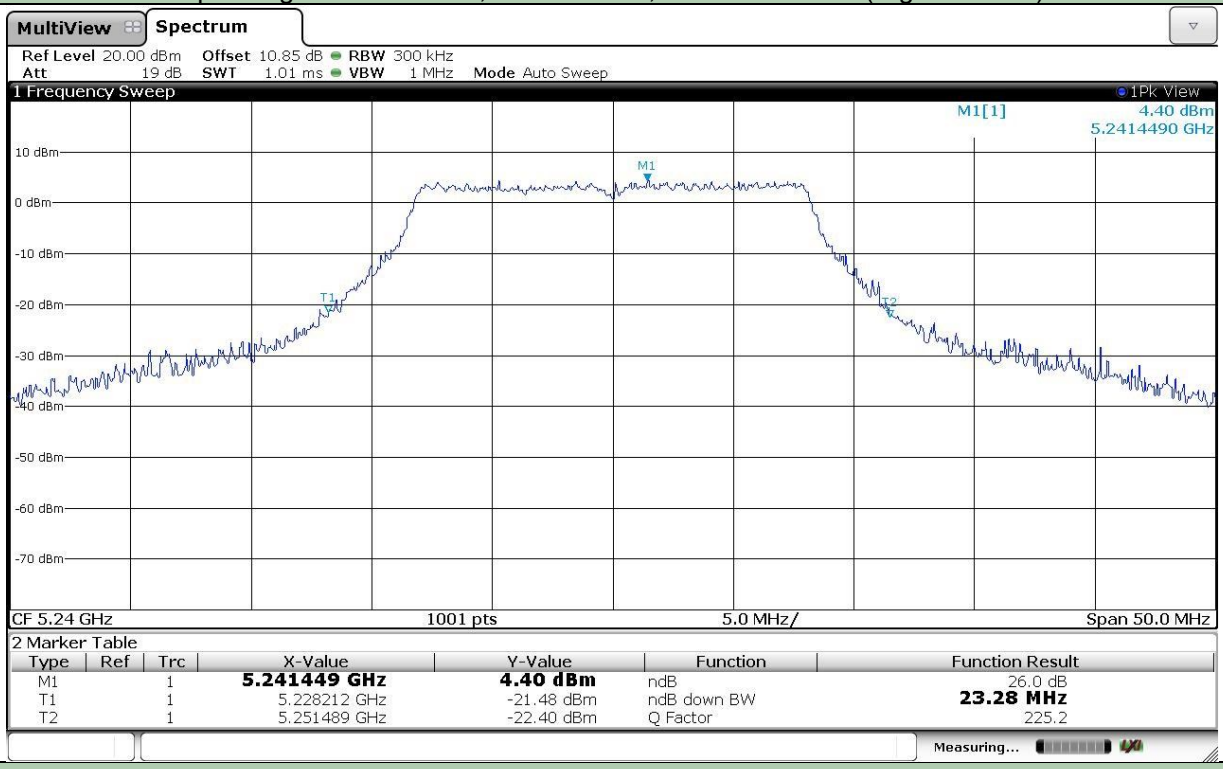
Operating Mode: 802.11a, U-NII Band 1, 26dB Bandwidth (Low Channel)



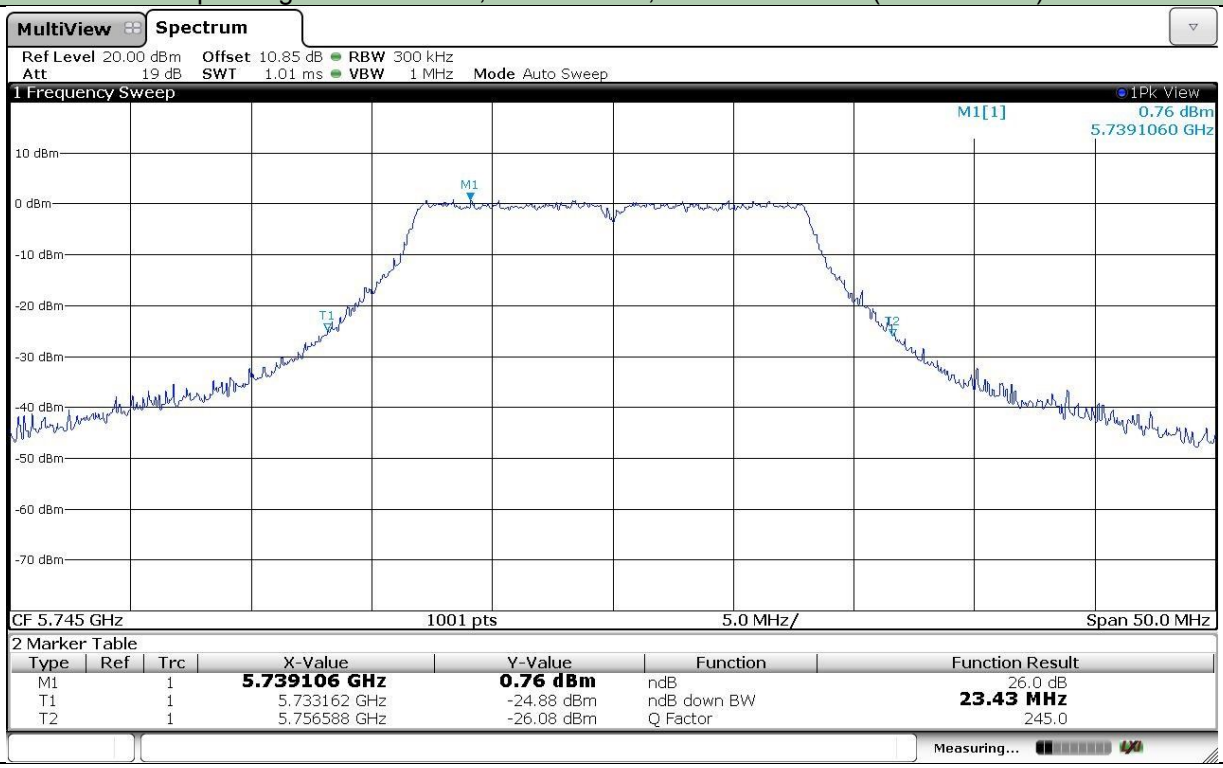
Operating Mode: 802.11a, U-NII Band 1, 26dB Bandwidth (Middle Channel)



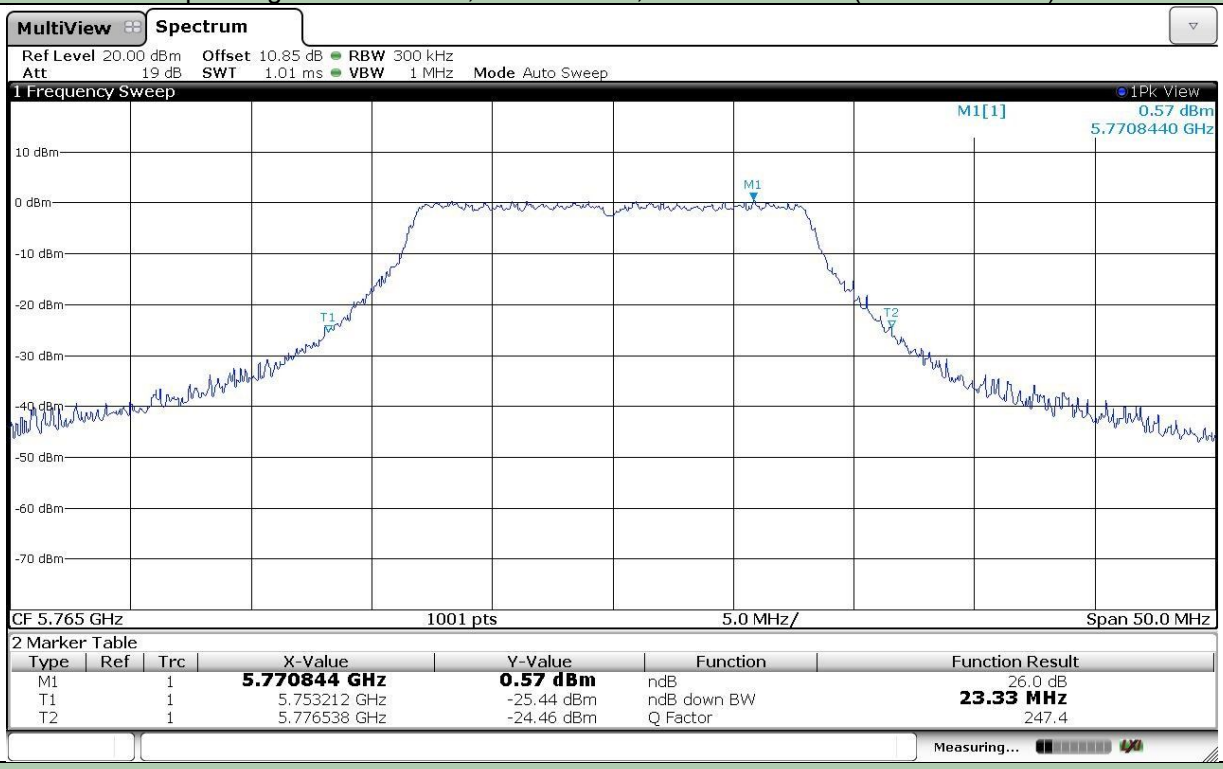
Operating Mode: 802.11a, U-NII Band 1, 26dB Bandwidth (High Channel)



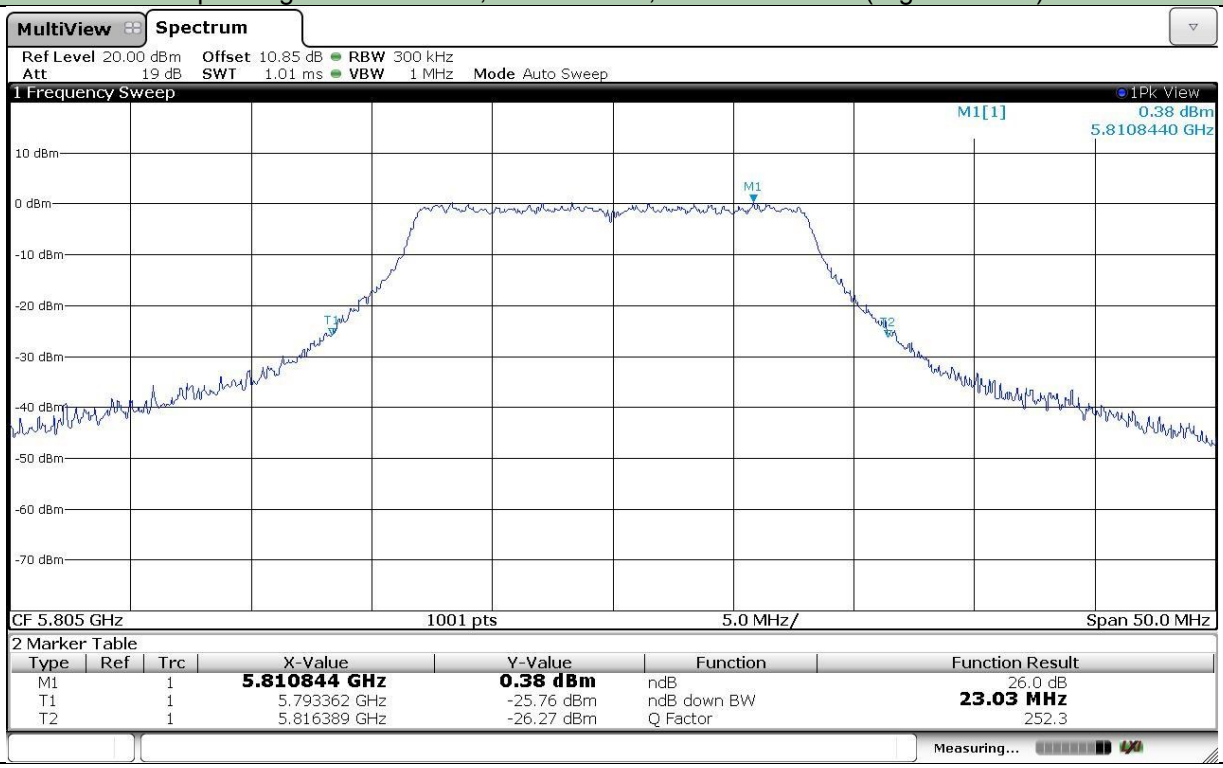
Operating Mode: 802.11a, U-NII Band 3, 26 dB Bandwidth (Low Channel)



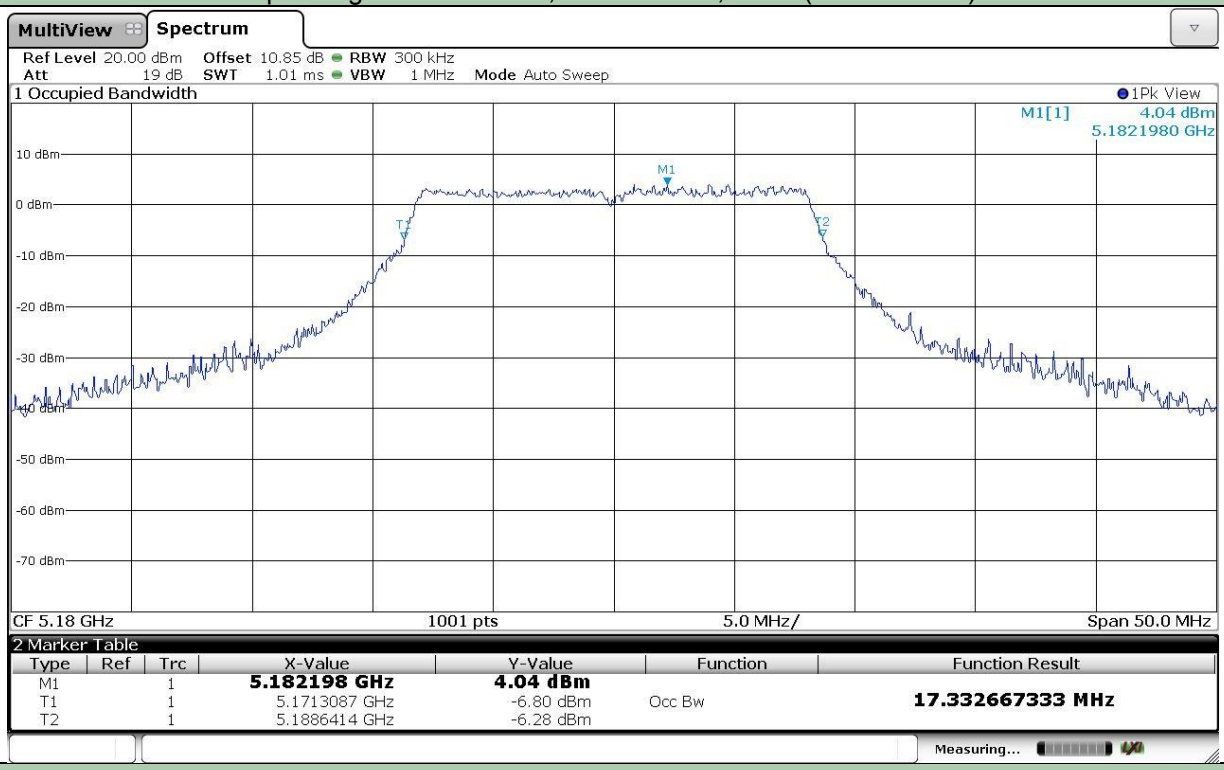
Operating Mode: 802.11a, U-NII Band 3, 26dB Bandwidth (Middle Channel)



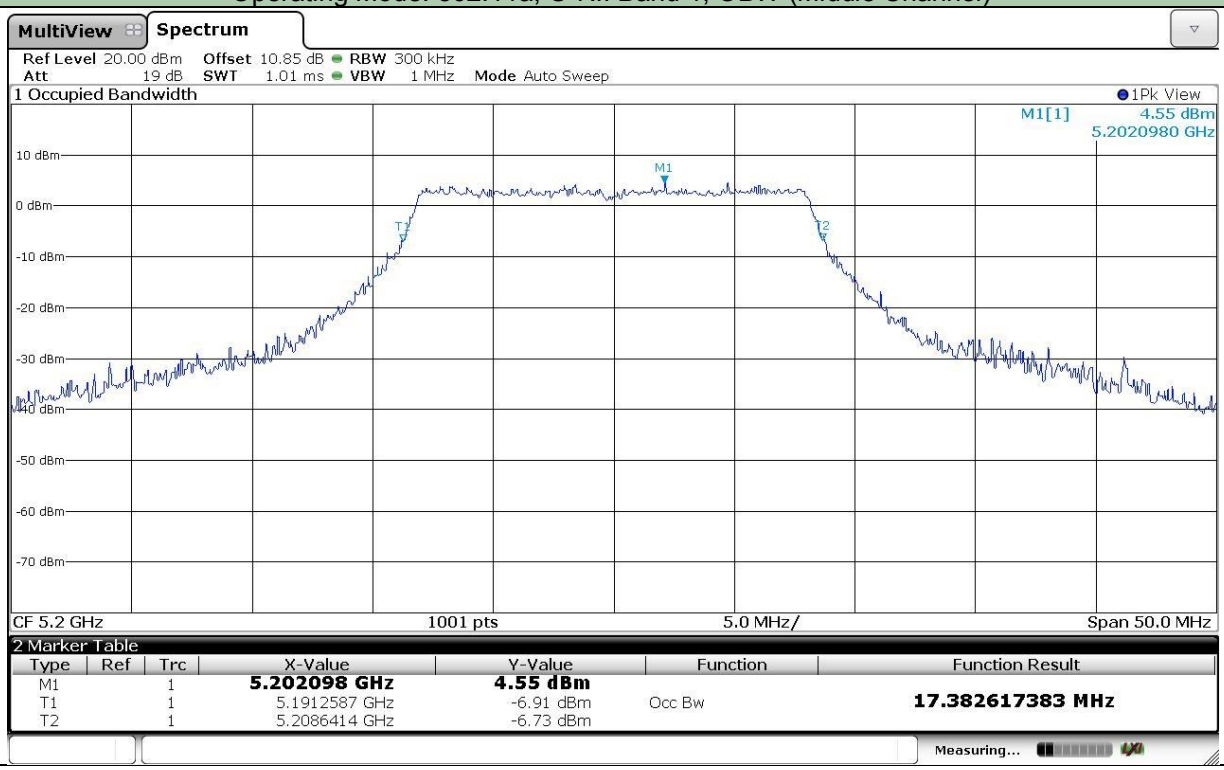
Operating Mode: 802.11a, U-NII Band 3, 26dB Bandwidth (High Channel)



Operating Mode: 802.11a, U-NII Band 1, OBW (Low Channel)

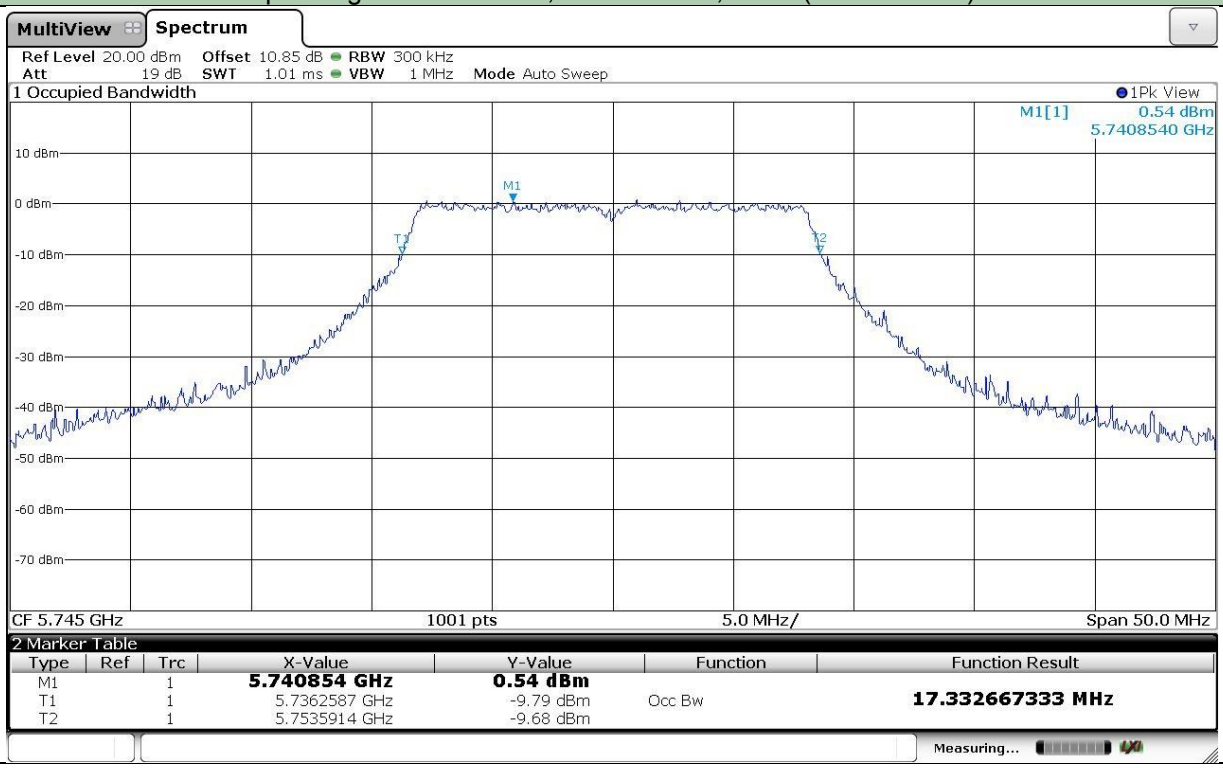


Operating Mode: 802.11a, U-NII Band 1, OBW (Middle Channel)

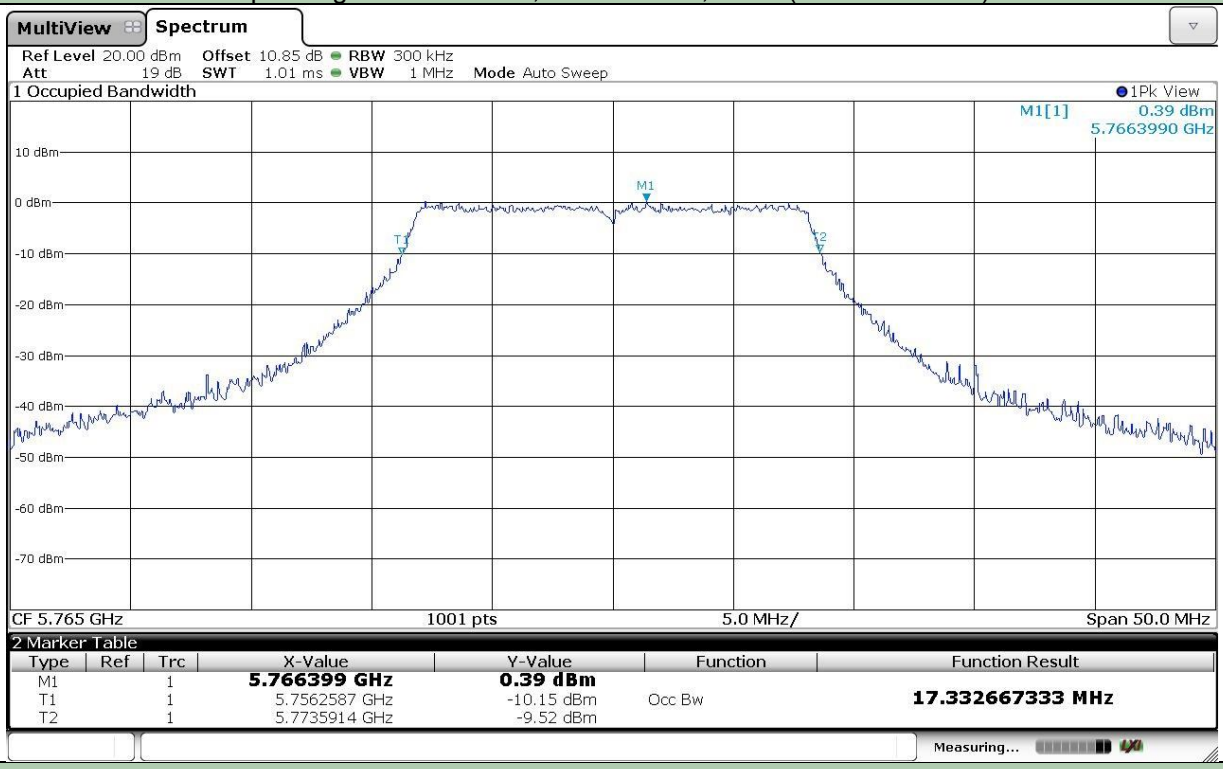


Operating Mode: 802.11a, U-NII Band 1, OBW (High Channel)

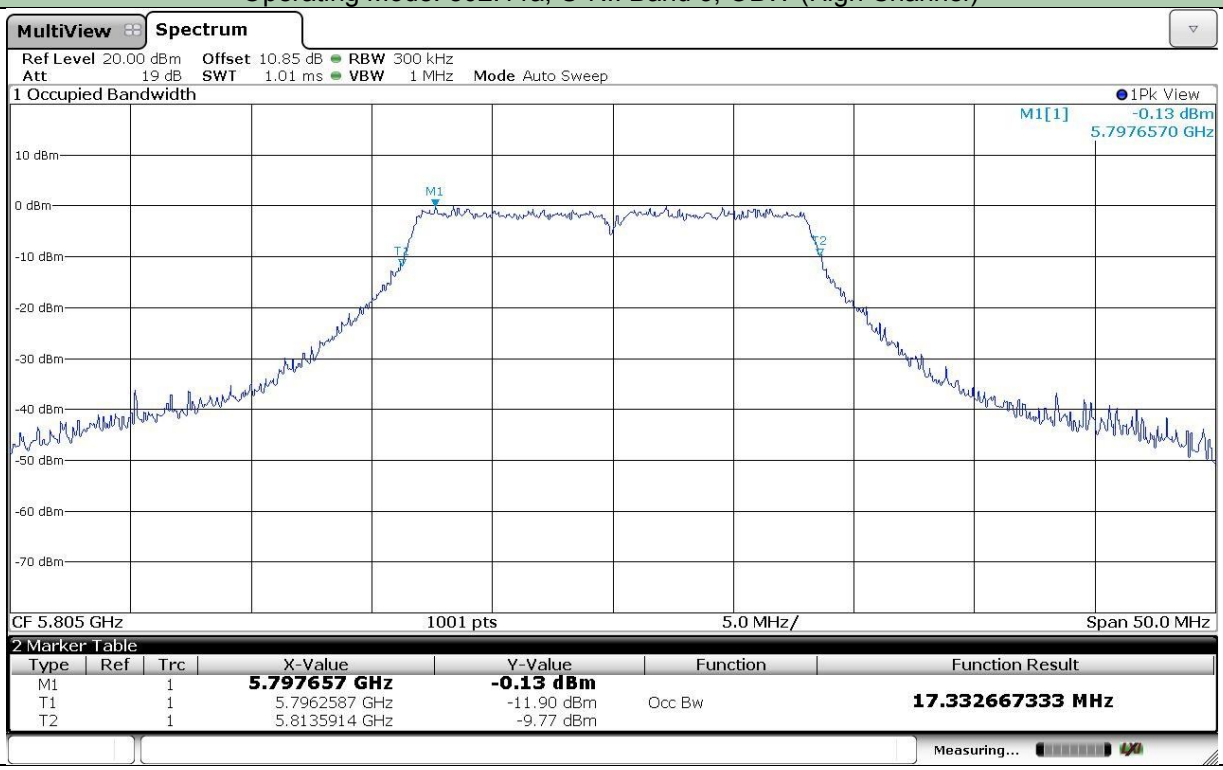
Operating Mode: 802.11a, U-NII Band 3, OBW (Low Channel)



Operating Mode: 802.11a, U-NII Band 3, OBW (Middle Channel)



Operating Mode: 802.11a, U-NII Band 3, OBW (High Channel)



5.2 6 dB BANDWIDTH

5.2.1 Limit

The minimum 6 dB bandwidth shall be at least 500 kHz within the (5.725 ~ 5.825) GHz band..

5.2.2 Method of Measurement

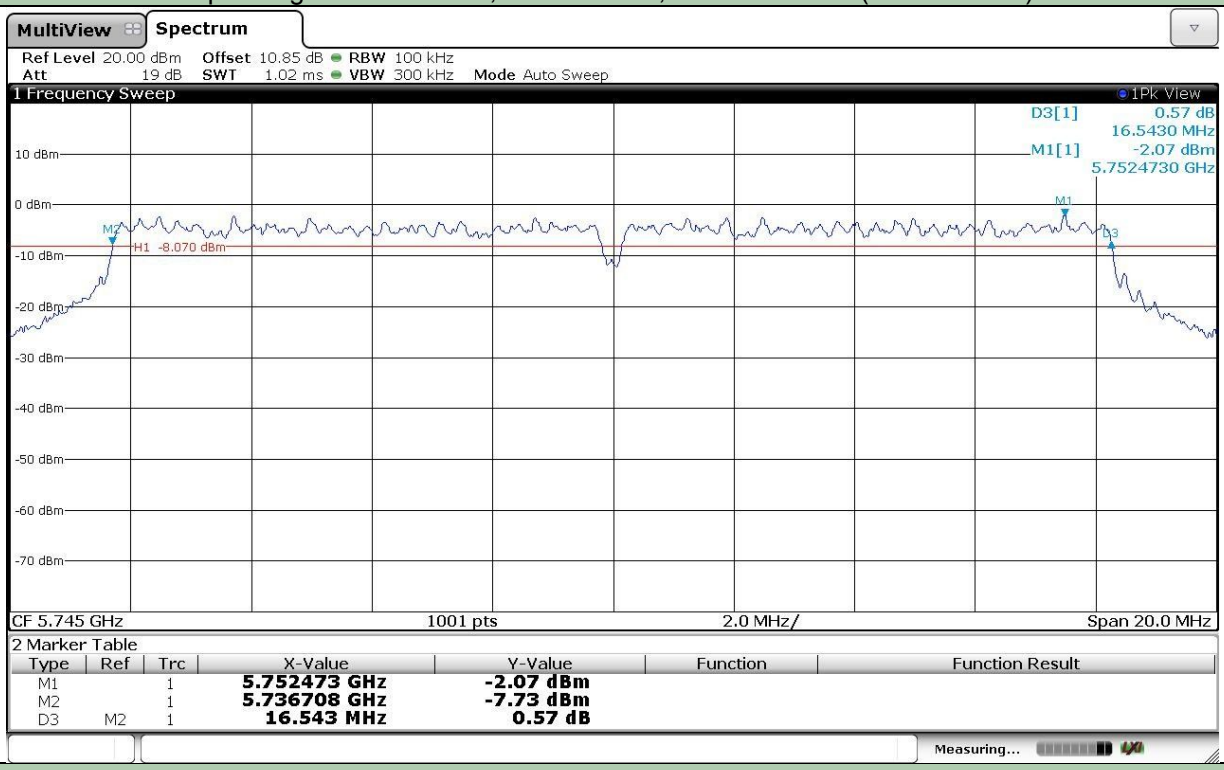
Reference to KDB 789033 D02 General UNII Test Procedures New Rules v01 Section C.2

5.2.3 Test Data for Output Power

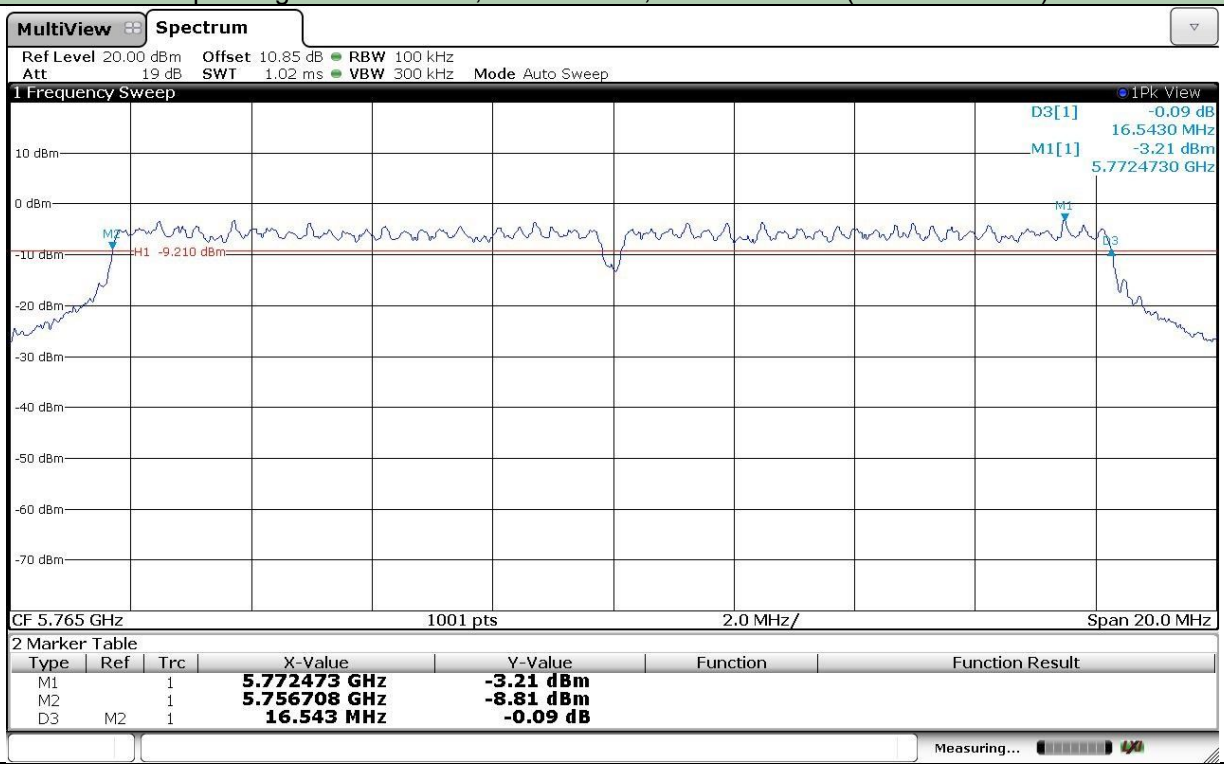
Test Date: Oct. 20, 2015		Tested by: S. M. Jang		
Operating Mode: U-NII Band 3				
Channel	Frequency (MHz)	Measured Value (dBm)	Limit (dBm)	Result
Low	5 745	16.54	≥ 0.5	PASS
Middle	5 765	16.54		PASS
High	5 805	16.54		PASS

5.2.4 Test Plots

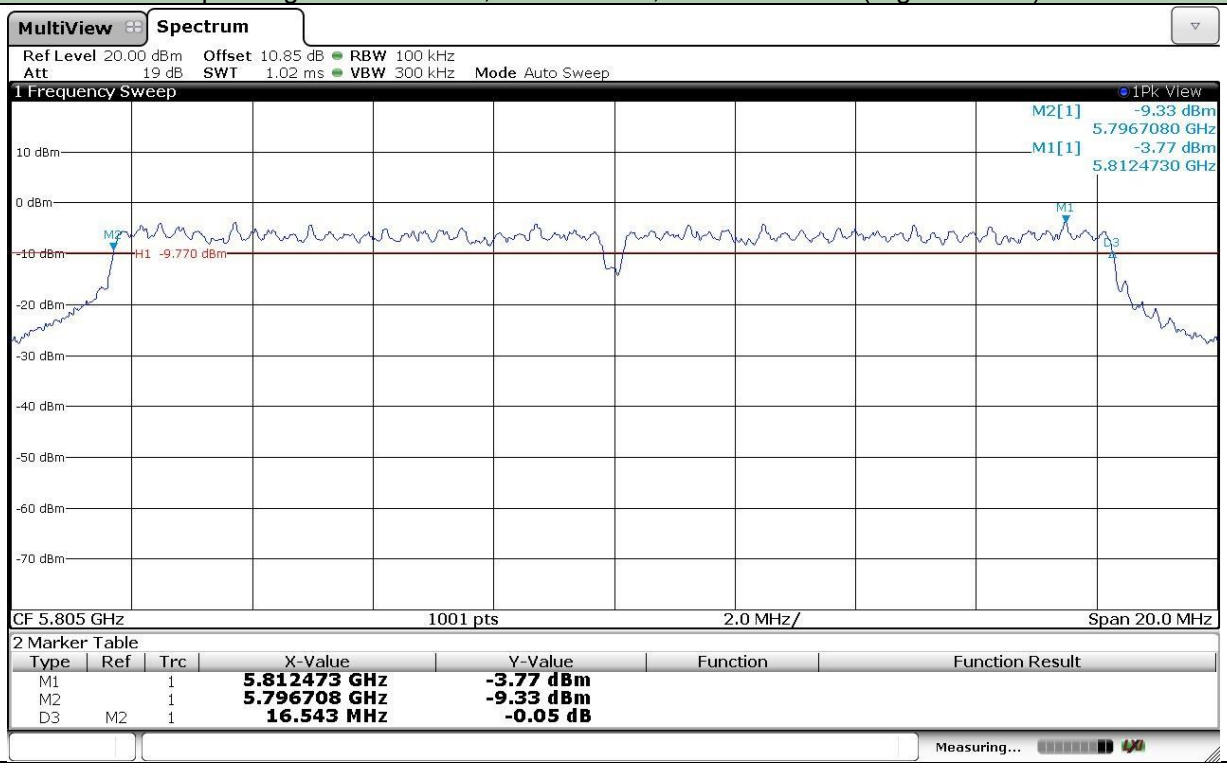
Operating Mode: 802.11a, U-NII Band 3, 6dB Bandwidth (Low Channel)



Operating Mode: 802.11a, U-NII Band 3, 6dB Bandwidth (Middle Channel)



Operating Mode: 802.11a, U-NII Band 1, 6 dB Bandwidth (High Channel)



5.3 OUTPUT POWER MEASUREMEENT

5.3.1 Limit

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 (30 dBm).

For the band (5.725 ~ 5.85) GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W (30 dBm).

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

5.3.2 Method of Measurement

Reference to KDB 789033 D02 General UNII Test Procedures New Rules v01: Section E)3)a) Method PM

5.3.3 Test Data

Test Date: Oct. 20, 2015				Tested by: S. M. Jang		
Operating Mode: U-NII Band 1						
Channel	Frequency (MHz)	Measured Value (dBm)	Duty Factor	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5 180	13.13	0.22	13.35	30	16.65
Middle	5 200	13.24	0.22	13.46	30	16.54
High	5 240	13.50	0.22	13.72	30	16.28
Operating Mode: U-NII Band 3						
Low	5 745	8.75	0.22	8.97	30	21.03
Middle	5 765	8.63	0.22	8.85	30	21.15
High	5 805	7.88	0.22	8.10	30	21.90

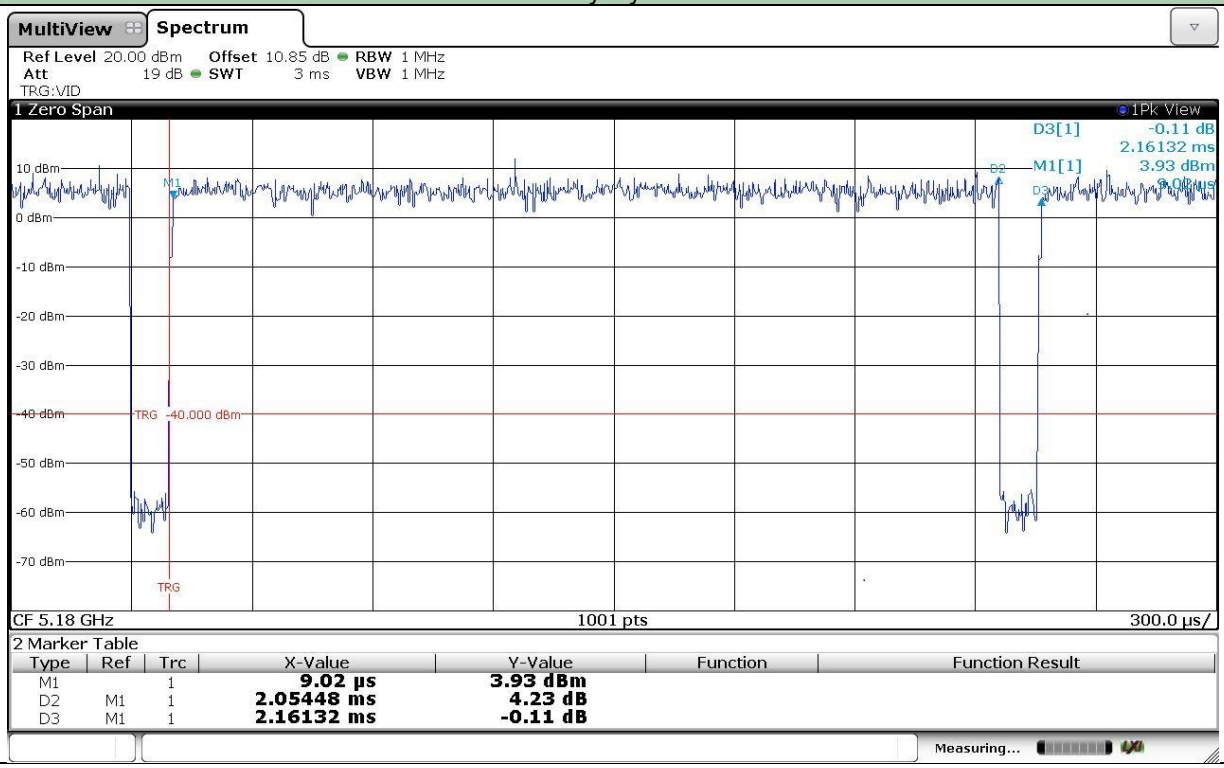
NOTE: Margin = Limit - Total Power
Total Power = Measured value + Duty factor
Duty cycle(X) : 0.95
Duty factor(10log/x) : 0.22

5.3.3.1 Duty Cycle

Operating Mode	On Time (ms)	On + Off Time (ms)	Duty Cycle (%)	Duty Factor
802.11a	2.054	2.161	95	0.22

5.3.3.1.1 Test Plot for Duty Cycle

Duty Cycle



5.4 POWER SPECTRAL DENSITY

5.4.1 Limit

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..

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

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

5.4.2 Method of Measurement

Reference to KDB 789033 D02 General UNII Test Procedures New Rules v01: Section F Maximum Power Spectral Density.

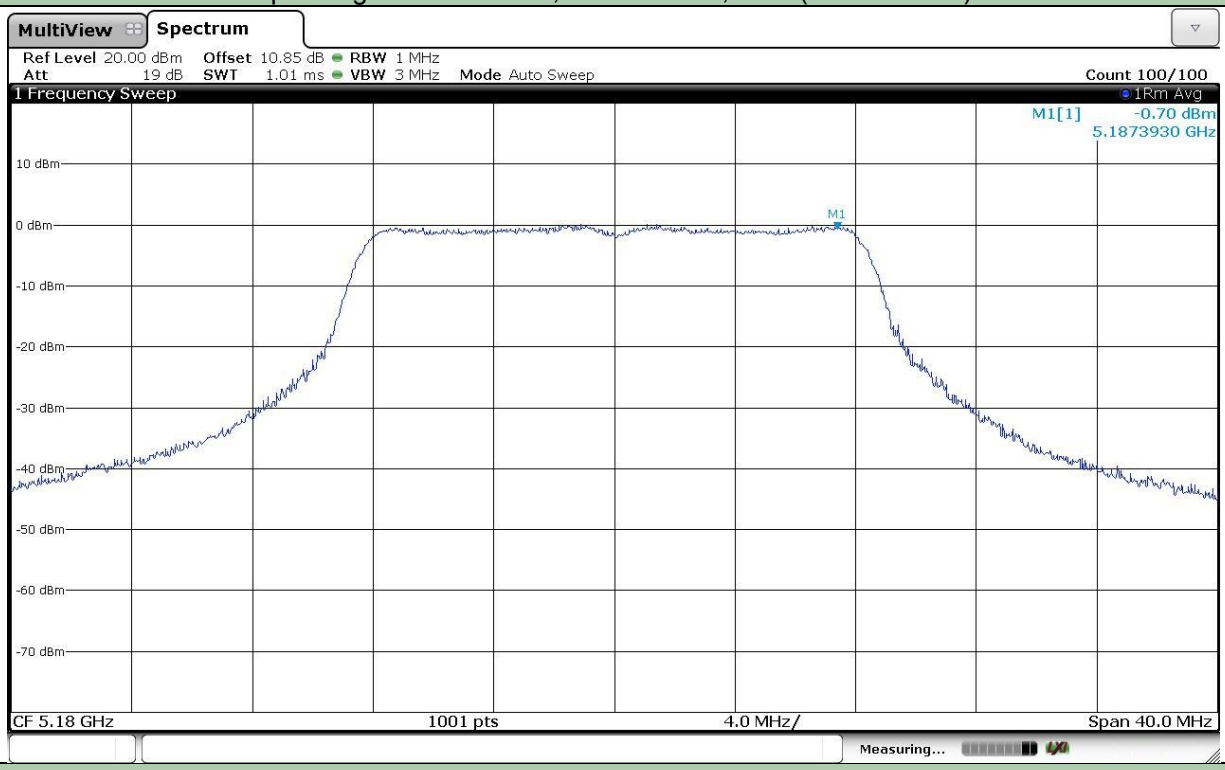
5.4.3 Test Data

Test Date: Oct. 20, 2015				Tested by: S. M. Jang		
Operating Mode: U-NII Band 1						
Channel	Frequency (MHz)	Measured Value (dBm/MHz)	Duty Factor	Total PSD (dBm/MHz)	Limit (dBm/MHz)	Margin (dB)
Low	5 180	-0.70	0.22	-0.48	≤17	17.48
Middle	5 200	-0.81	0.22	-0.59		17.59
High	5 240	0.35	0.22	0.57		17.57
Operating Mode: U-NII Band 3						
Channel	Frequency (MHz)	Measured Value (dBm/500 kHz)	Duty Factor	Total PSD (dBm/500 kHz)	Limit (dBm/500 kHz)	Margin (dB)
Low	5 745	-5.30	0.22	-5.08	≤30 dBm	35.08
Middle	5 765	-5.64	0.22	-5.42		35.42
High	5 805	-5.85	0.22	-5.63		35.63

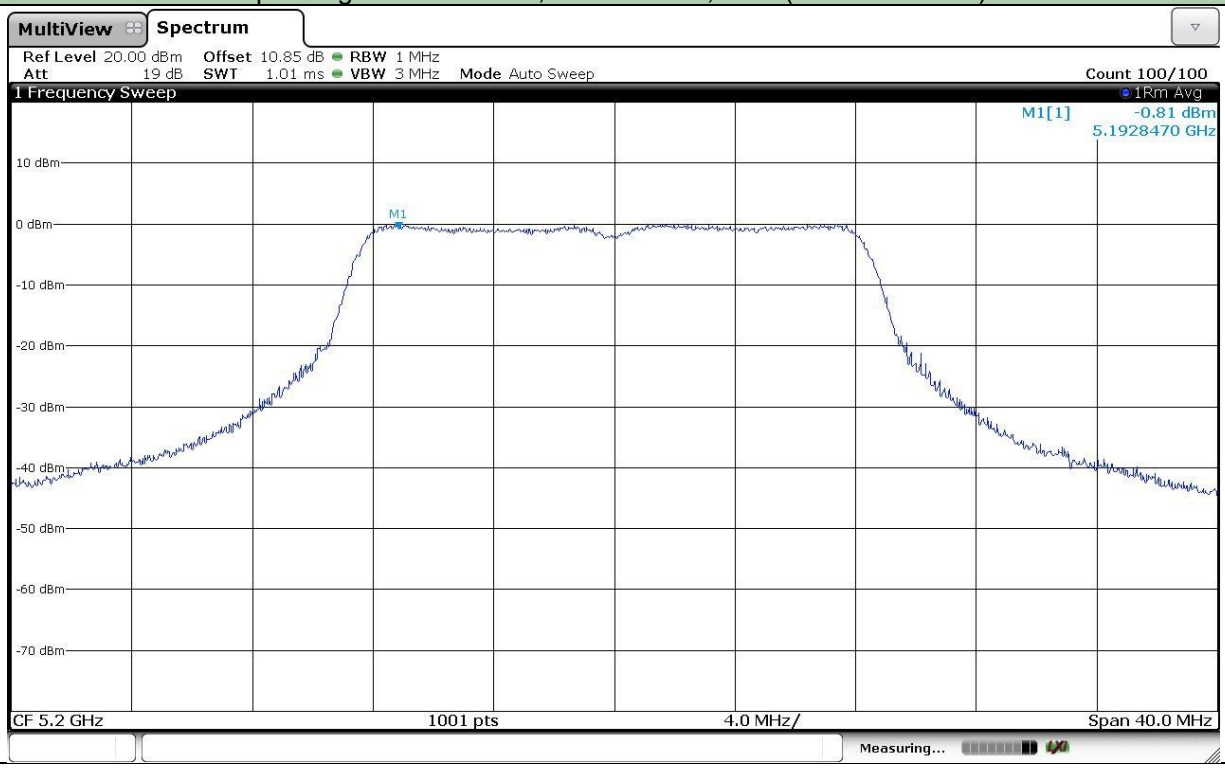
NOTE: Margin = Limit – Total PSD
Total PSD = Measured Value + Duty Factor
Duty cycle(X) : 0.95
Duty factor(10log/x) : 0.22

5.4.4 Test Plots

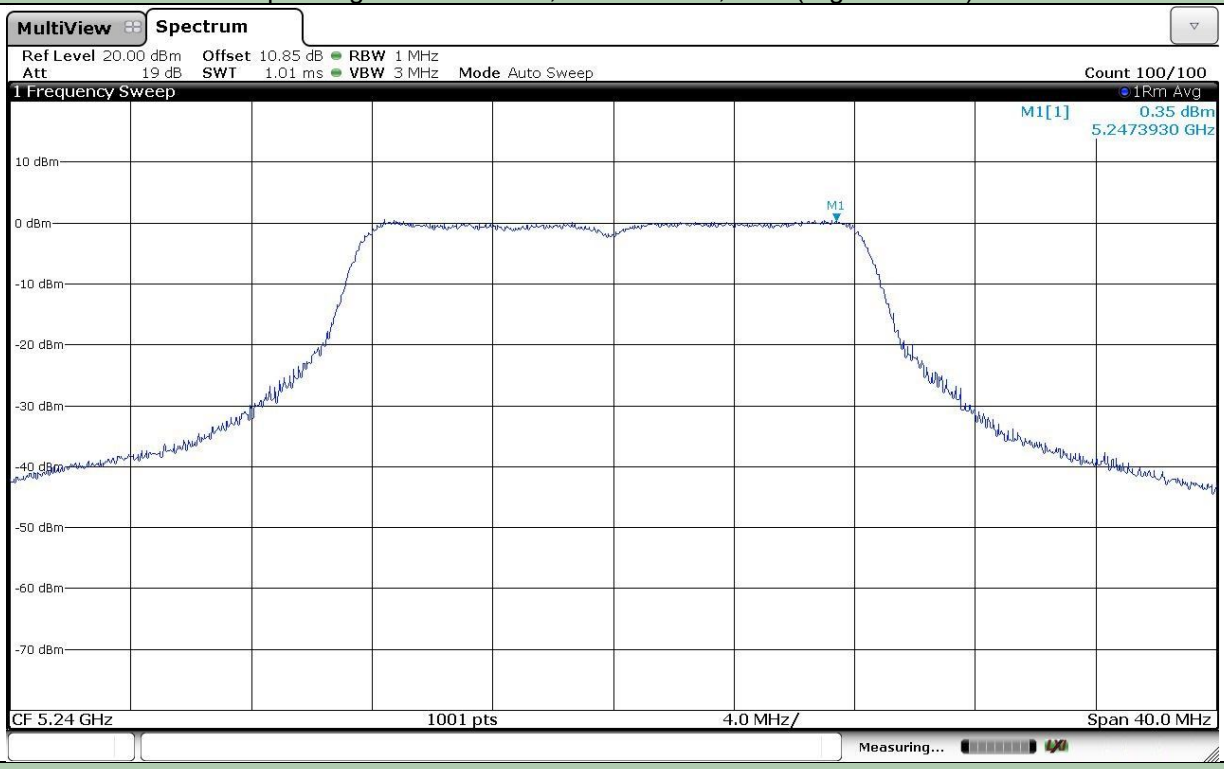
Operating Mode: 802.11a, U-NII Band 1, PSD (Low Channel)



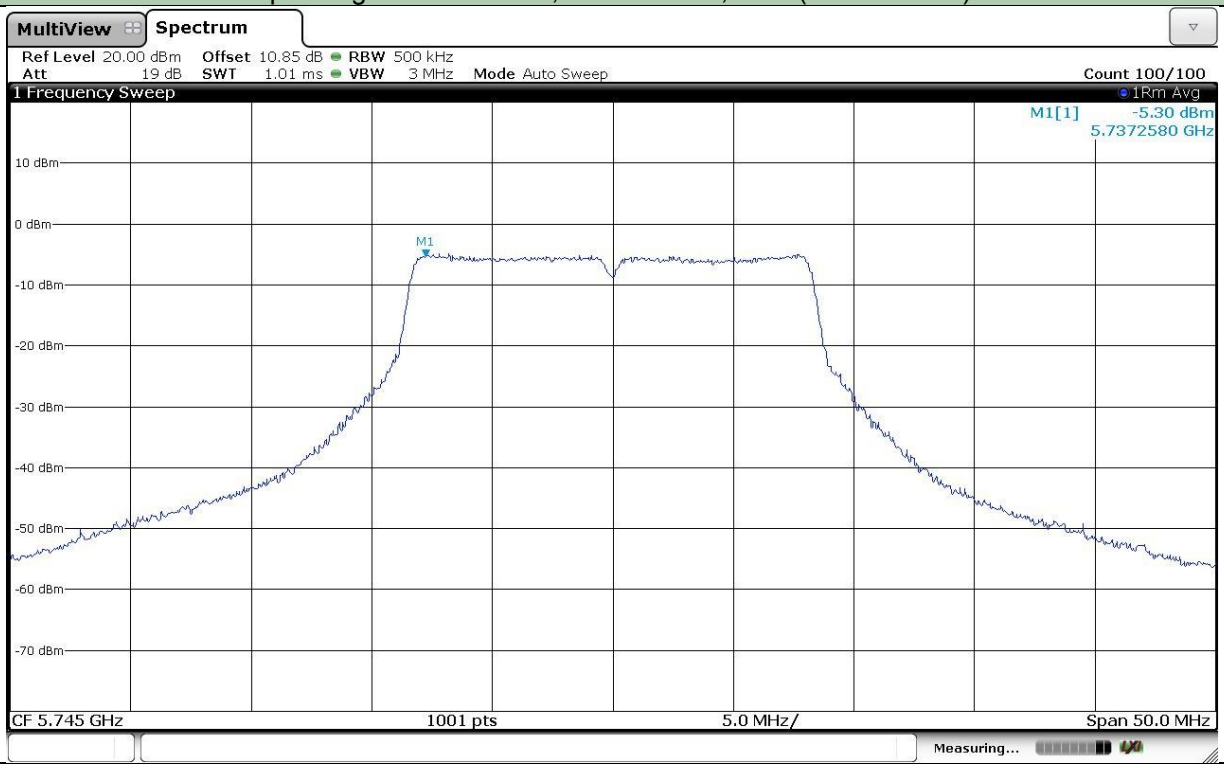
Operating Mode: 802.11a, U-NII Band 1, PSD (Middle Channel)



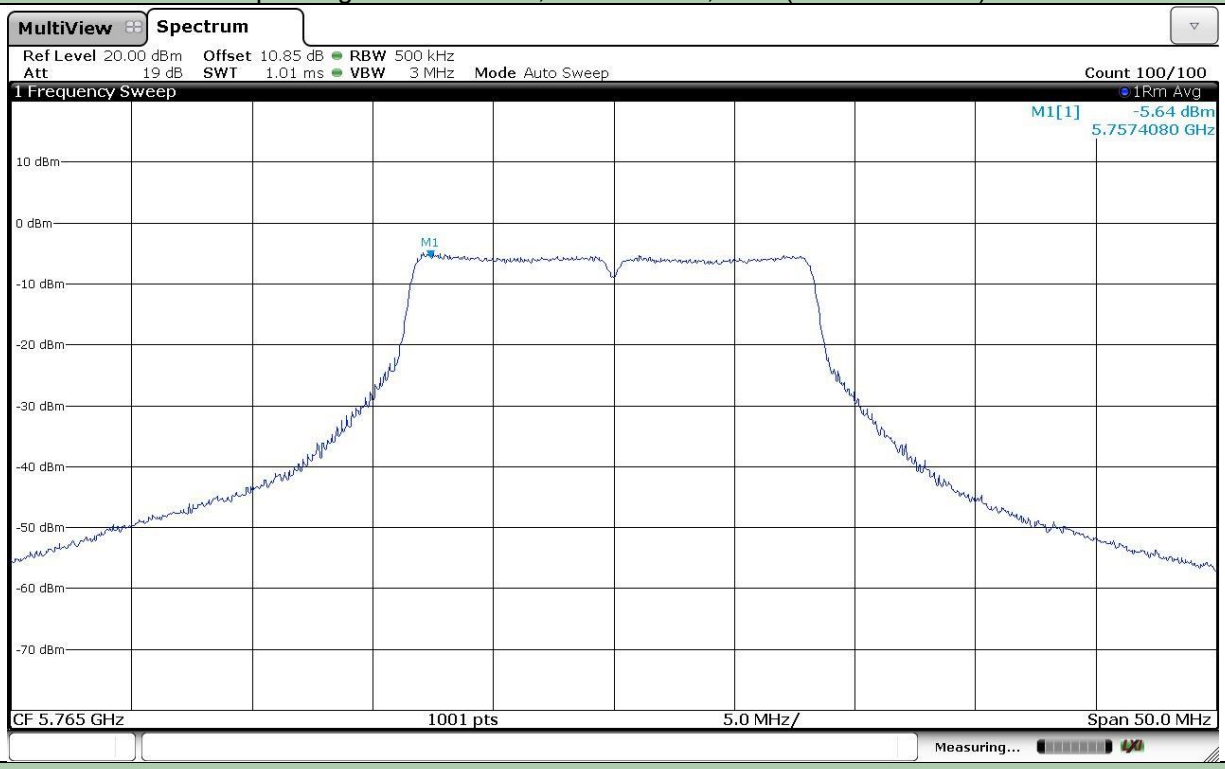
Operating Mode: 802.11a, U-NII Band 1, PSD (High Channel)



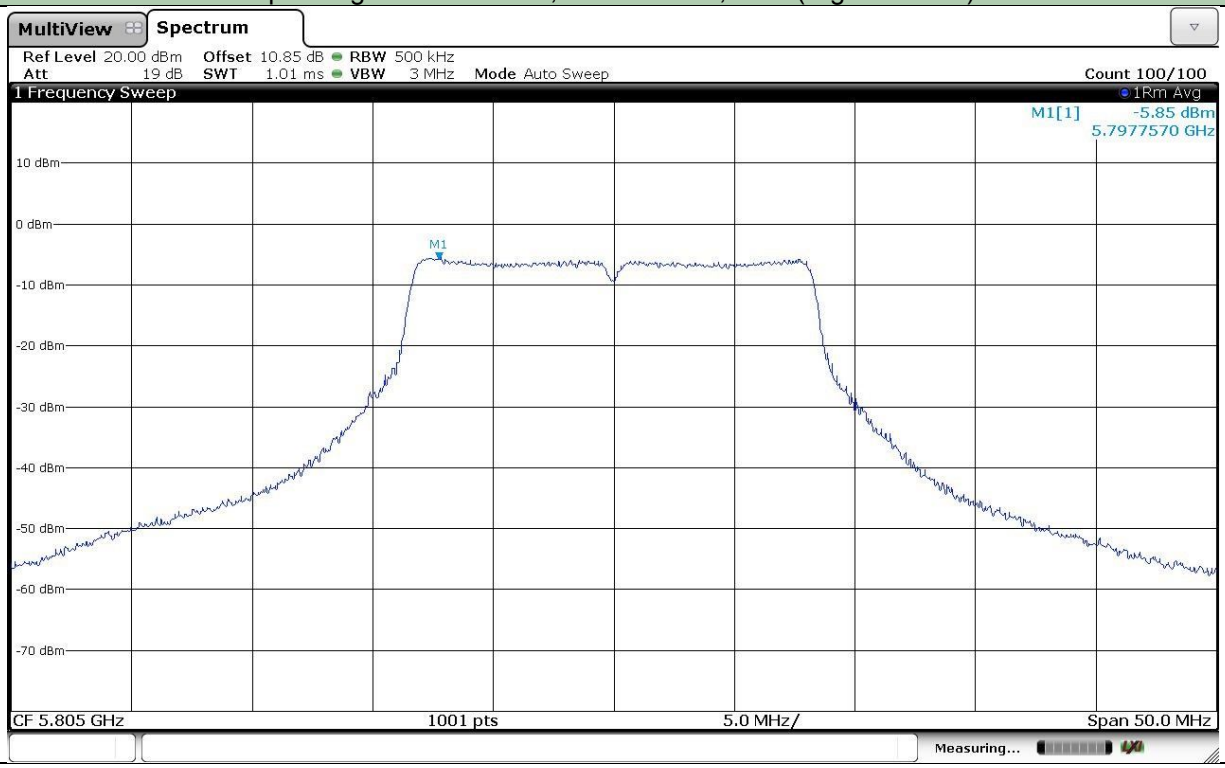
Operating Mode: 802.11a, U-NII Band 3, PSD (Low Channel)



Operating Mode: 802.11a, U-NII Band 3, PSD (Middle Channel)



Operating Mode: 802.11a, U-NII Band 3, PSD (High Channel)



5.5 FREQUENCY STABILITY

5.5.1 Limit

Acc. to section 15.407(g),

Measurements 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.

5.5.2 Method of Measurement

5.5.2.1 Frequency Stability Under Temperature Variation.

The EUT was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a spectrum analyzer. the EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency deviation and measure the frequency from the EUT at 20 ℃ operating frequency as reference frequency

Turn the EUT off and set the chamber temperature to highest. After the temperature stabilized for approximately 30 minutes record the frequency. Repeat step measure with 10 ℃ decreased per stage until the lowest temperature reached.

5.5.2.2 Frequency Stability Under Voltage Variations.

Set chamber temperature to 20 ℃. Use a variable AC or DC power supply to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer low enough to obtain the desired frequency resolution and record the frequency.

Reduce the input voltage to specify extreme voltage variation ± 15 % and end point and record the maximum frequency variation.

5.5.3 Test Data

Test Date: Oct. 25, 2015			Tested by: S. M. Jang		
Operating Mode: 802.11a, U-NII Band 1					
Voltage (%)	Input Power (DC)	Temperature (℃)	Frequency (Hz)	Freq. Devi. (Hz)	Deviation (%)
100	24 V	0	5 180 019 174	19174	0.0004
		10	5 180 011 678	11678	0.0002
		20	5 179 999 966	-34	0.0000
		30	5 179 988 820	-11180	-0.0002
		40	5 179 989 616	-10384	-0.0002
		50	5 179 993 271	-6729	-0.0001
		20	5 179 988 611	-11389	-0.0002
115	27.6 V	20	5 179 989 672	-10328	-0.0002
85	20.4 V	20	5 179 987 763	-12237	-0.0002
Operating Mode: 802.11a, U-NII Band 3					
Voltage (%)	Input Power (DC)	Temperature (℃)	Frequency (Hz)	Freq. Devi. (Hz)	Deviation (%)
100	24 V	0	5 785 023 229	23229	0.0004
		10	5 785 010 905	10905	0.0002
		20	5 785 002 730	2730	0.0000
		30	5 784 987 717	-12283	-0.0002
		40	5 784 990 244	-9756	-0.0002
		50	5 784 991 822	-8178	-0.0001
		20	5 784 994 148	-5852	-0.0001
115	27.6 V	20	5 784 987 668	-12332	-0.0002
85	20.4 V	20	5 784 994 148	-5852	-0.0001

5.6 Undesirable Emission

5.6.1 Limit

Acc. to section 15.205, 15.209, and 15.407(b)(1), (b)(4) following table shall be applied.

Frequency Range (MHz)		Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88		100	40
88 - 216		150	43.5
216 - 960		200	46
Above 960		500	54
Subpart E	(5.15 - 5.35) GHz (5.725-5.825) GHz	27 322	68.2 (-27 dBm/MHz)
	(5.725-5.825) GHz	122 188	78.2 (-17 dBm/MHz)

Acc. To section 15.407(b)(4):

For transmitters operating in the 5.725–5.825 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 EIRP of –17 dBm/MHz.

for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of –27 dBm/MHz.

NOTE: Emission Level (dBuV/m) = EIRP Level (dBm) - 95.2 @ 3 m measurement distance

5.6.2 Method of Measurement

Reference to KDB 789033 D02 General UNII Test Procedures New Rules v01 Section G.3 General Requirement for Unwanted Emissions Measurements.

The radiated emissions measurements were on 3 m, semi-anechoic chamber. The EUT and other support equipment were placed on a non-conductive table 80 cm above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

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

For measurement below 1 GHz, the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For peak emission measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth

is set to 3 MHz and for average measurement, resolution bandwidth is set to 1 MHz; and the video bandwidth is set to 10 Hz, when duty cycle is more than 98 %. If duty cycle is less than 98 %, the video bandwidth is set to ≥ 1/T, where T is 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.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

5.6.3 Measurement Uncertainty

Measurement uncertainties were not taken into account and following uncertainty levels have been estimated for tests performed on the apparatus.

Frequency Range	Uncertainty	Frequency Range	Uncertainty
9 kHz ~ 30 MHz	± 3.2 dB	30 MHz ~ 1 GHz	± 3.8 dB
1 GHz ~ 18 GHz	± 4.9 dB	18 GHz ~ 40 GHz	± 5.1 dB

5.6.4 Sample Calculated Example

At 80 MHz Limit = 40.0 dBuV/m

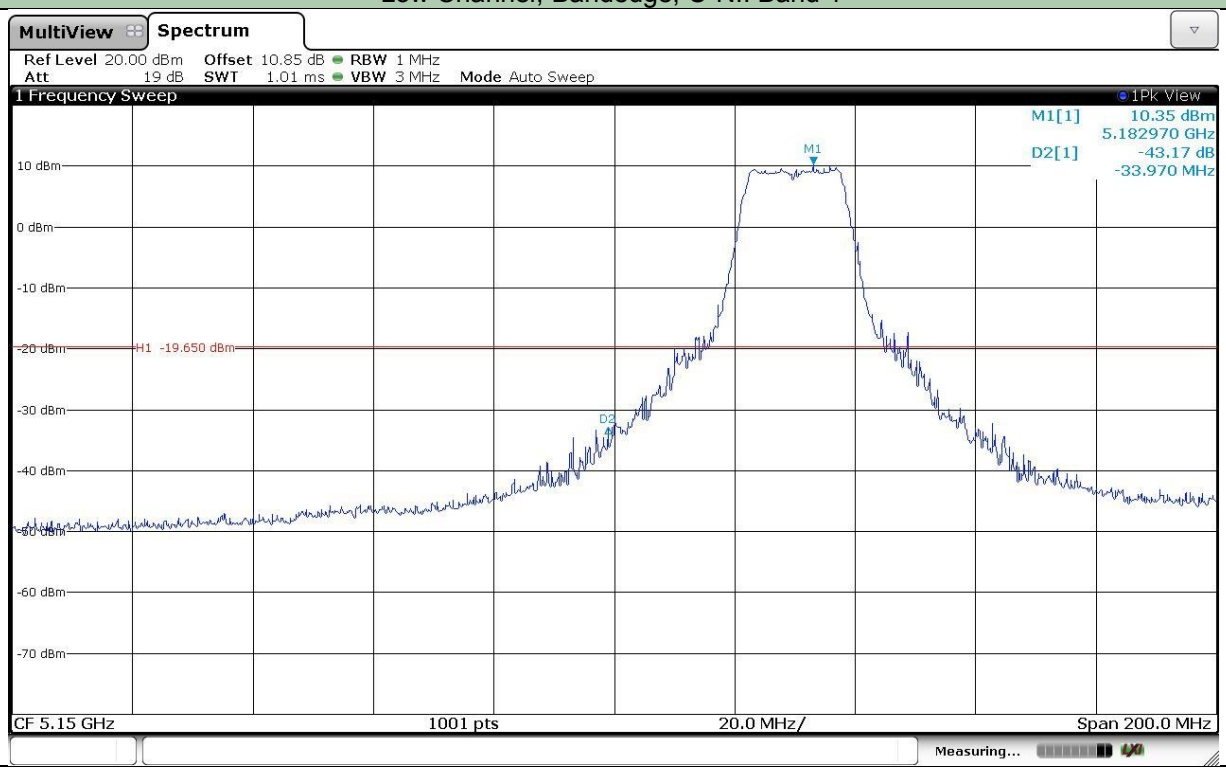
Result =Receiver reading value + Antenna Factor + Cable Loss - Pre-amplifier gain = 30 dBuV/m

Margin = Limit - Result = 40 - 30 = 10 so the EUT has 10.0 dB margin at 80 MHz

5.6.5 Test Data for Conducted spurious emission

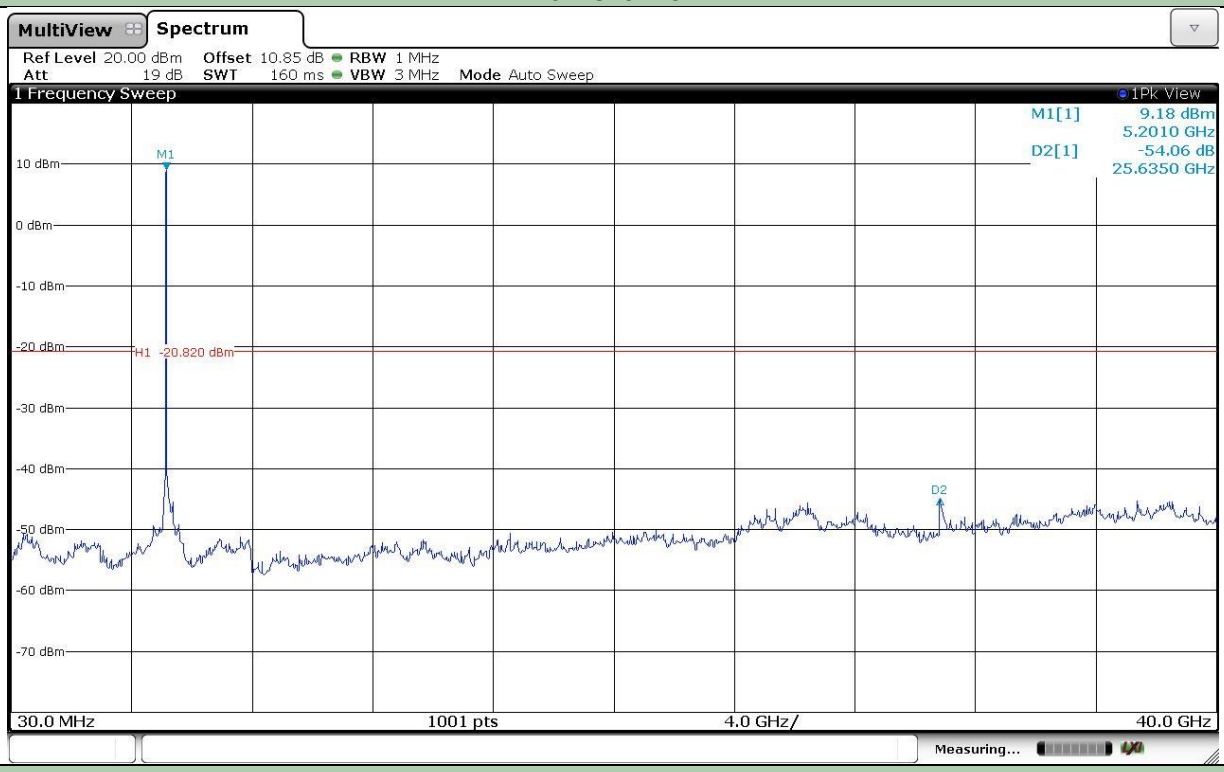
5.6.5.1 Operating Mode: U-NII Band 1

Test Date: Oct. 20, 2015	Tested by: S. M. Jang
Low Channel, Bandedge, U-NII Band 1	

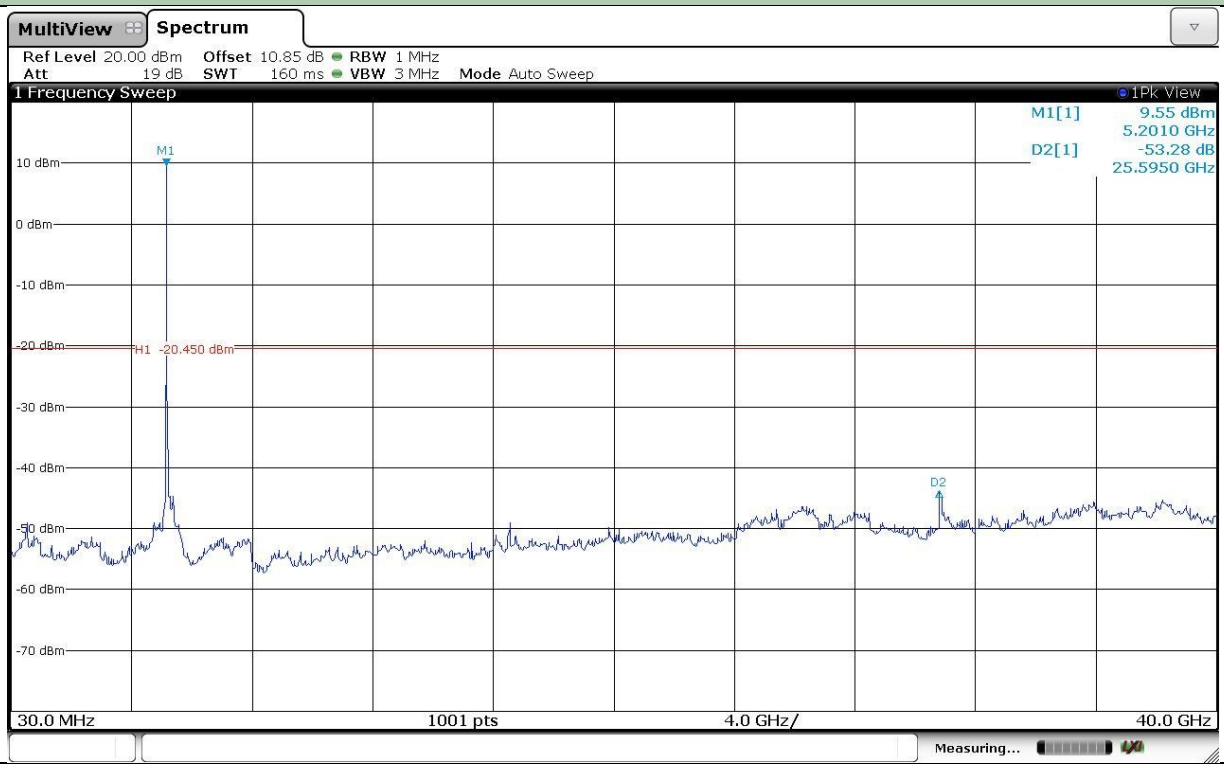


Out of Band Emission, U-NII Band 1

Low Channel

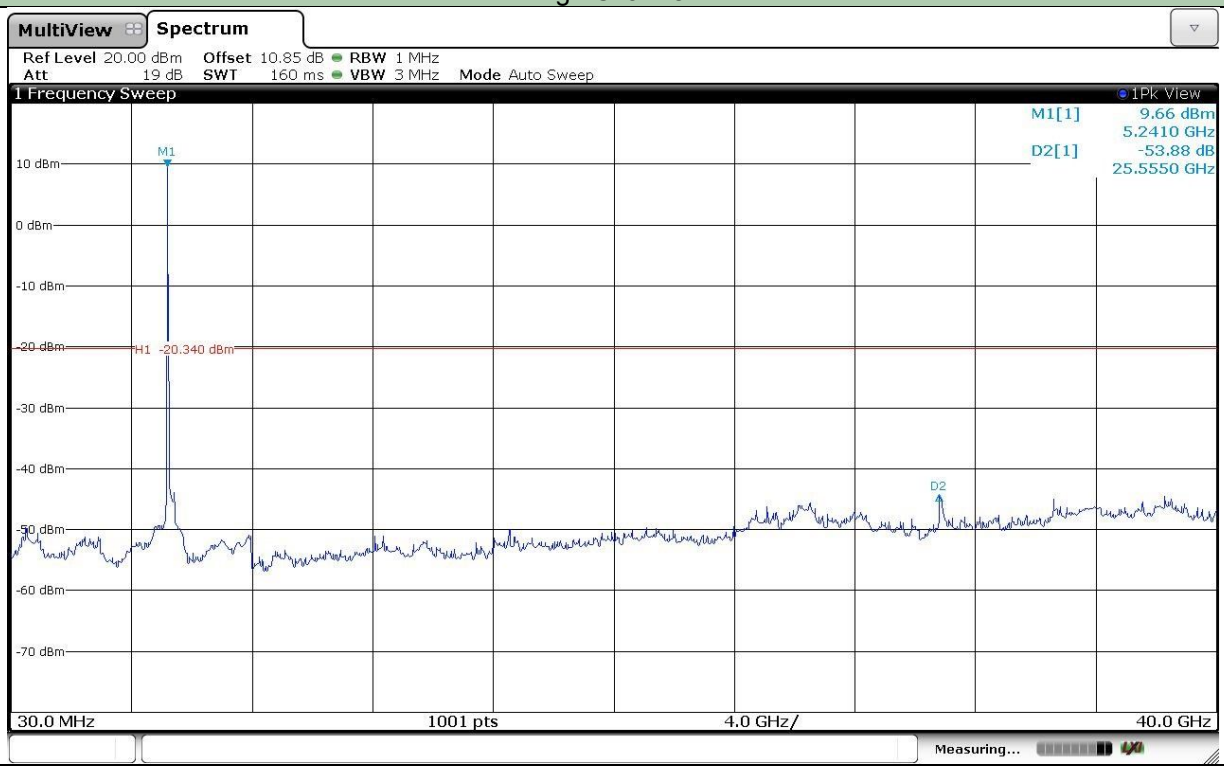


Middle Channel



Out of Band Emission, U-NII Band 1

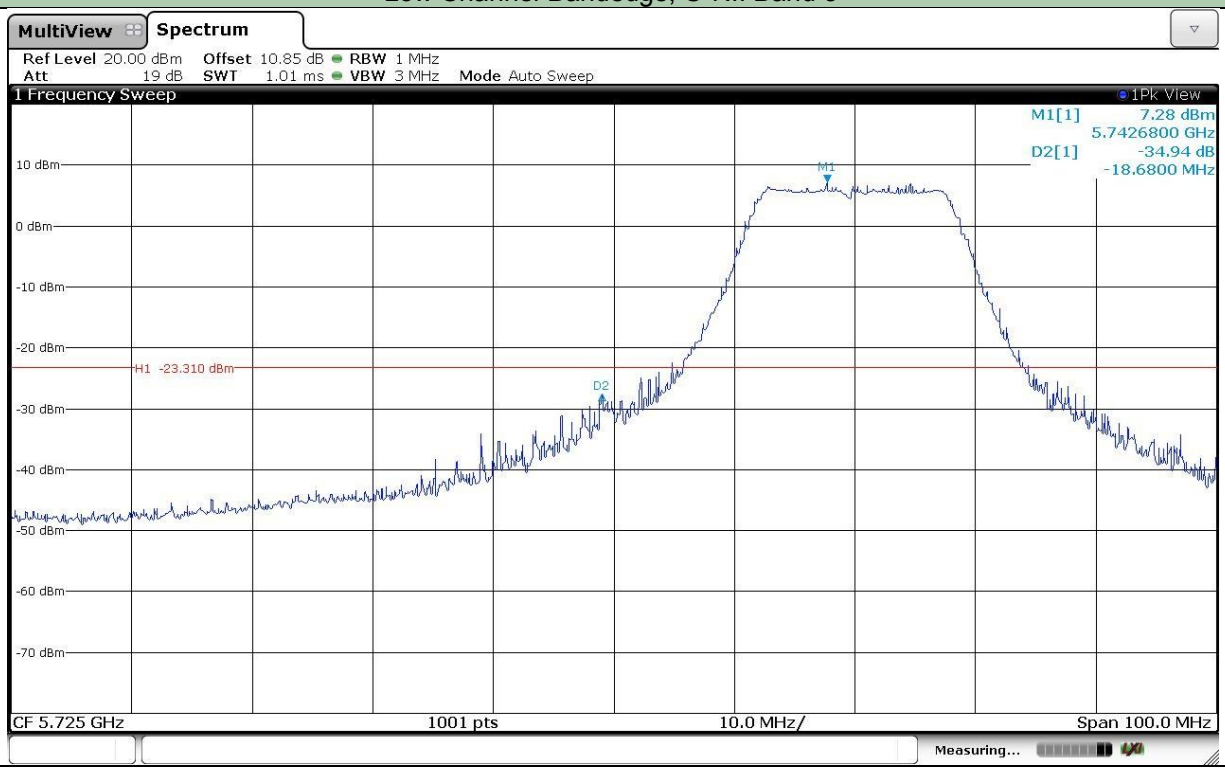
High Channel



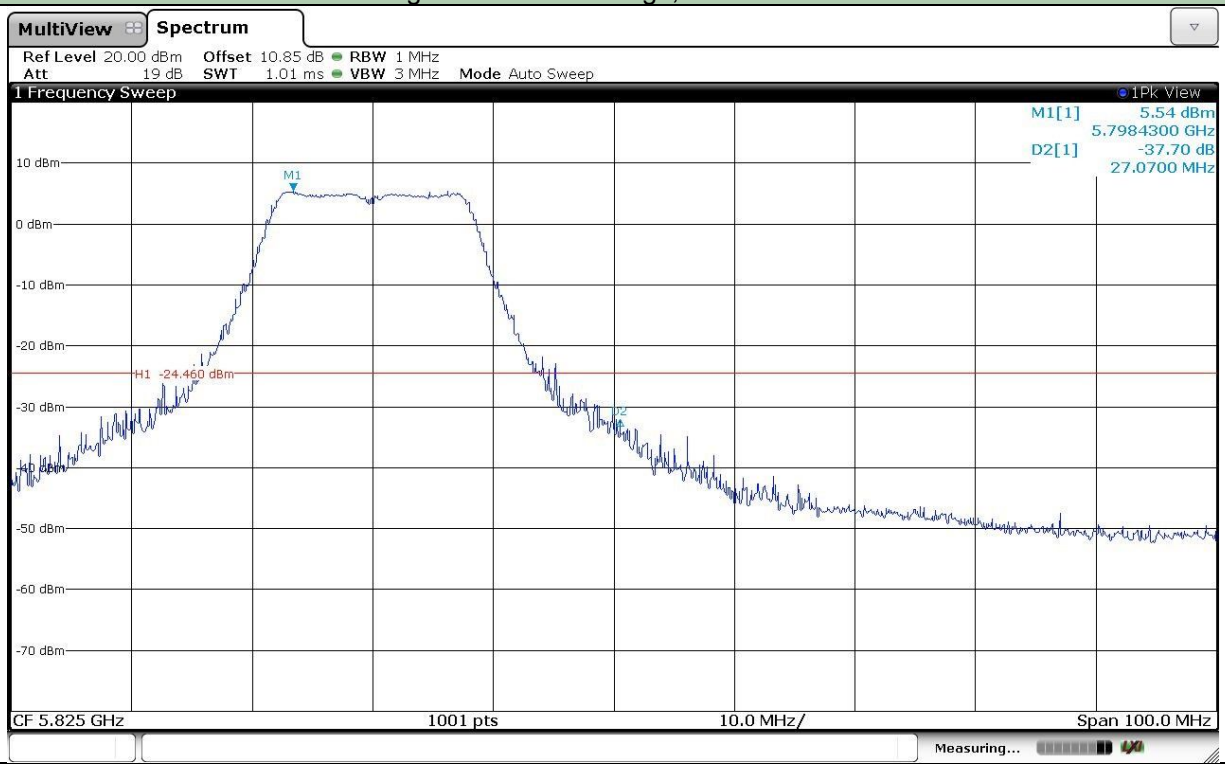
5.6.5.2 Operating Mode: U-NII Band 3

Test Date: Oct. 20, 2015	Tested by: S. M. Jang

Low Channel Bandedge, U-NII Band 3

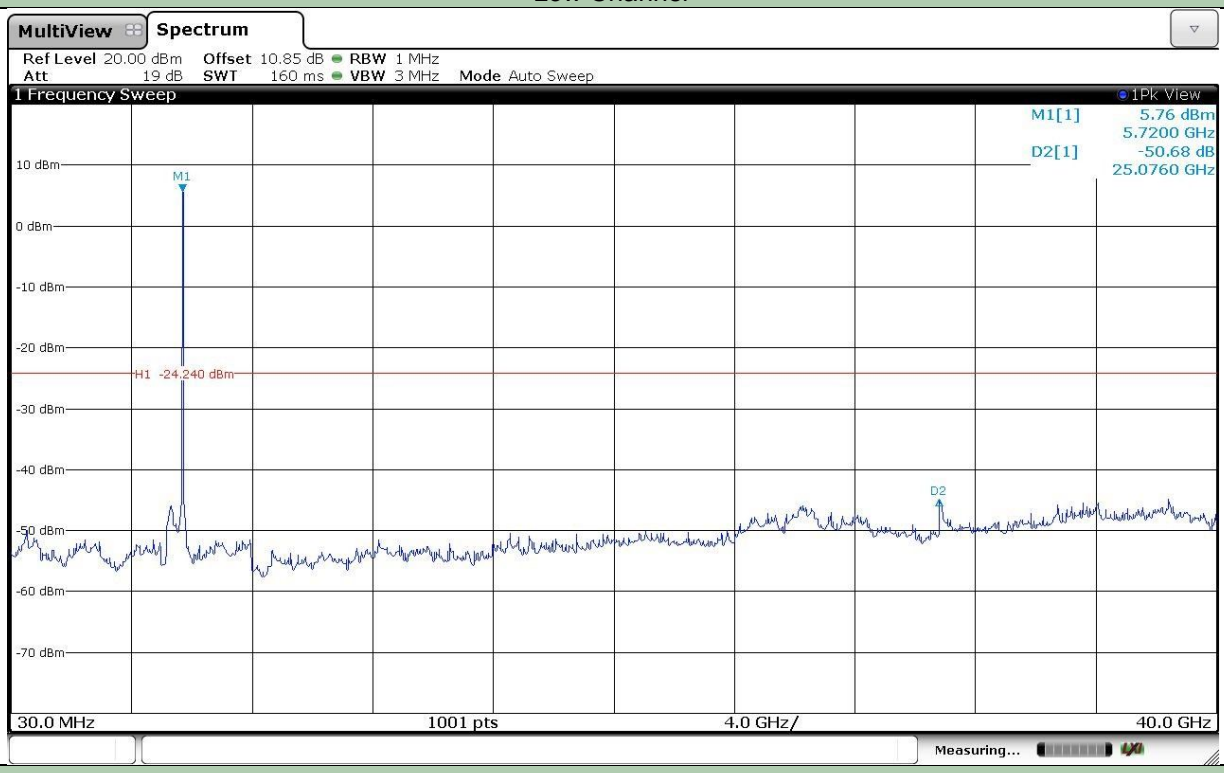


High Channel Bandedge, U-NII Band 3

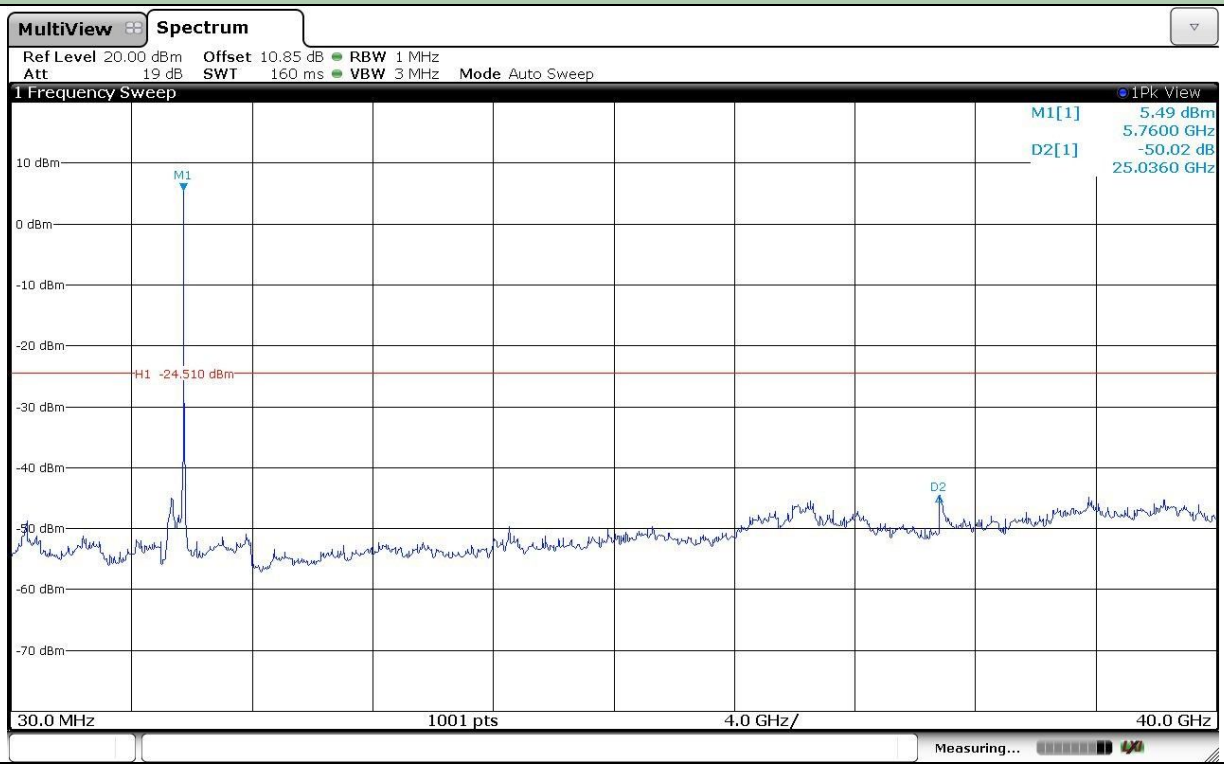


Out of Band Emission, U-NII Band 3

Low Channel

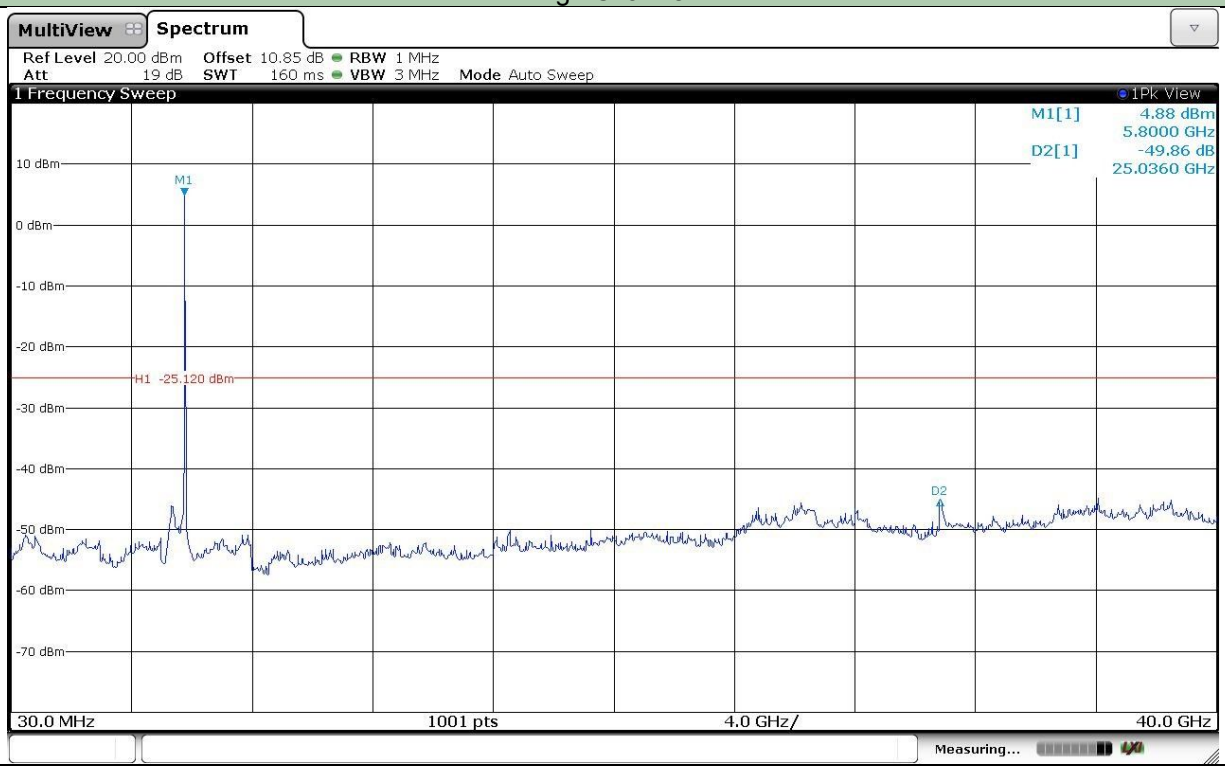


Middle Channel



Out of Band Emission, U-NII Band 3

High Channel



5.6.6 Test Data for Radiated spurious emission above 1 GHz

Test Date: Oct. 23, 2015		Tested by: S. M. Jang		
Operating Mode	On Time (ms)	On + Off Time (ms)	Duty Cycle (%)	Duty Factor
802.11a	2.054	2.161	95	0.22
T (ms)	1/T(kHz)	VBW Setting		
2.054	0.48685	1 kHz		

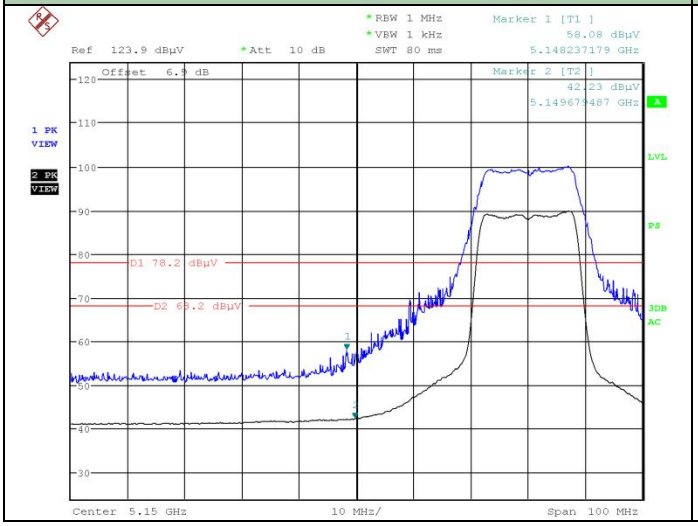
Note : Refer the plots for duty cycle at page 20.

5.6.6.1 Operating Mode: U-NII Band 1

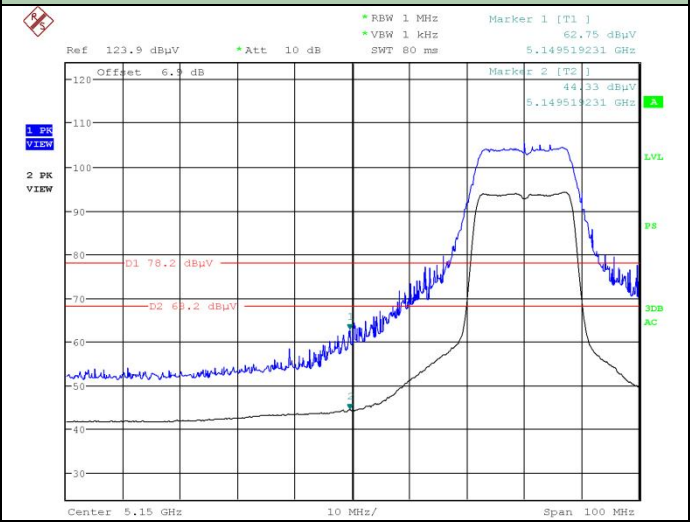
5.6.6.1.1 Test Plot for Band edge(Restricted band) @ 3 m

Graphical Test Data _ Low Channel

Horizontal



Vertical



Tabulated Test Data

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
5 148.2	51.48	Peak	H	33.9	27.3	58.08	68.2	10.1	150	60
5 149.6	35.63	Average	H	33.9	27.3	42.23	68.2	26.0	150	60
5 149.5	56.15	Peak	V	33.9	27.3	62.75	68.2	5.5	150	260
5 149.5	37.73	Average	V	33.9	27.3	44.33	68.2	23.9	150	260

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

5.6.6.1.2 Test Data for Harmonic & Spurious Emission

5.6.6.1.2.1 Low Channel

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
*5 148	54.6	Peak	V	34.0	27.1	61.5	74	12.5	100	359
*5 148	29.3	AV	V	34.0	27.1	36.2	54	17.8	100	359
13 291	47.0	Peak	H	38.6	23.2	62.4	74	11.6	100	255
14 277	21.8	AV	H	40.2	22.7	39.3	54	14.7	100	218
Emission was scanned up to 40 GHz; No emissions were detected above the noise floor which was at least 20 dB below the specification limit										

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

"*" indicates frequency in Band edge(Restricted band).

5.6.6.1.2.2 Middle Channel

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
12 917	38.2	Peak	V	38.2	23.3	61.5	74	12.5	100	216
12 905	38.2	AV	V	38.2	23.3	37.4	54	16.6	100	216
14 668	43.3	Peak	V	40.8	21.5	62.6	74	11.4	100	0
14 628	21.3	AV	V	40.8	21.5	40.6	54	13.4	100	0
Emission was scanned up to 40 GHz; No emissions were detected above the noise floor which was at least 20 dB below the specification limit										

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

"*" indicates frequency in Restricted band.

5.6.6.1.2.3 High Channel

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
*5 366	45.9	Peak	V	34.2	26.6	53.5	74	20.5	100	359
5 366	23.6	AV	V	34.2	26.6	31.2	54	22.8	100	359
11 098	42.9	Peak	H	37.4	22.4	57.9	74	16.1	100	359
11 191	19.8	AV	H	37.4	22.6	34.6	54	19.4	100	359
15 824	44.3	Peak	V	41.2	21.3	64.2	74	9.8	100	275
16 171	20.7	AV	V	41.5	21.3	40.9	54	13.1	100	275
Emission was scanned up to 40 GHz; No emissions were detected above the noise floor which was at least 20 dB below the specification limit										

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

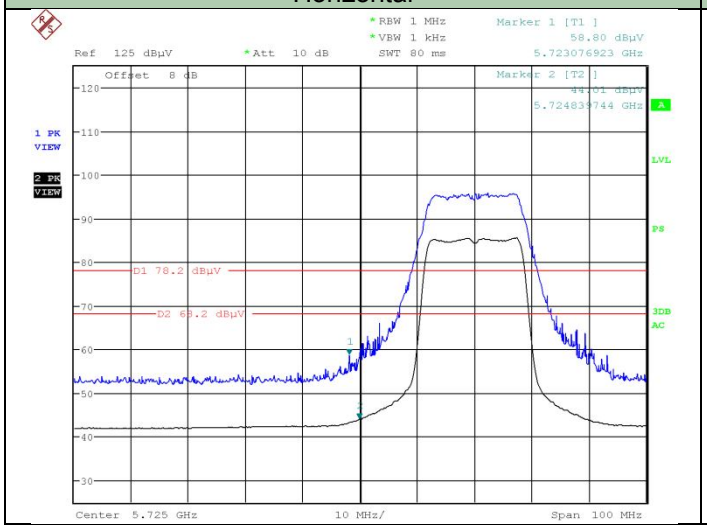
"*" indicates frequency in Restricted band.

5.6.6.2 Operating Mode: U-NII Band 3

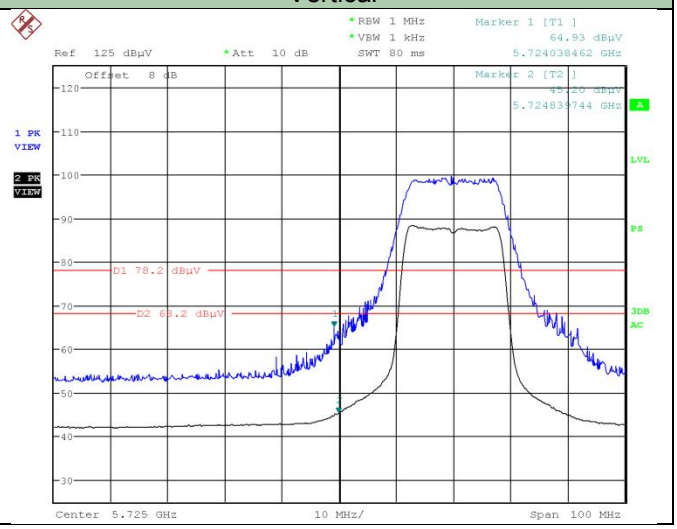
5.6.6.2.1 Test Data for Bandedge @ 3 m

Graphical Test Data _ Low Channel

Horizontal



Vertical



Tabulated Test Data

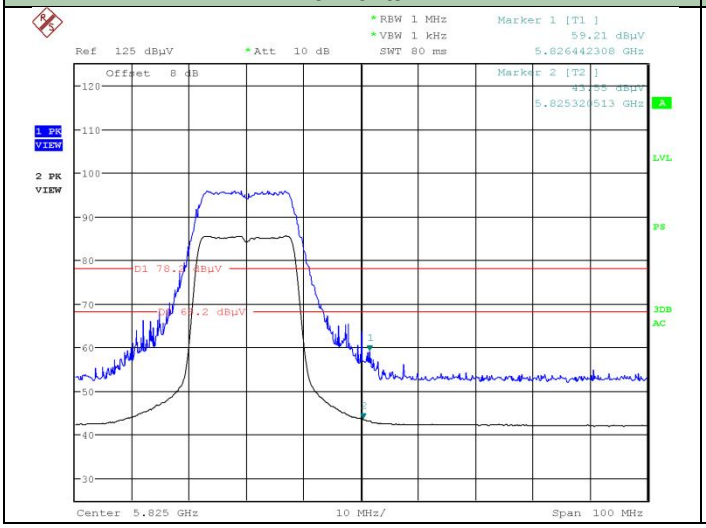
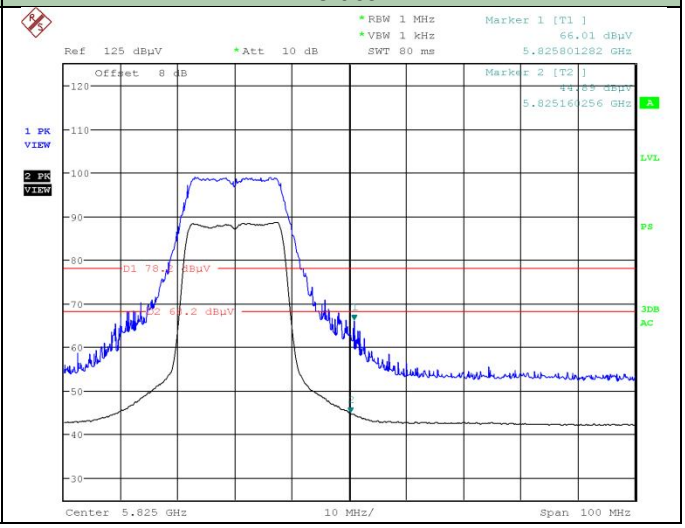
Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
5 723.0	50.70	Peak	H	34.4	26.3	58.80	78.2	19.4	150	300
5 724.8	35.91	Average	H	34.4	26.3	44.01	78.2	34.2	150	300
5 724.0	56.83	Peak	V	34.4	26.3	64.93	78.2	13.3	150	315
5 724.8	37.10	Average	V	34.4	26.3	45.20	78.2	33.0	150	315

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

Graphical Test Data _ High Channel	
Horizontal	Vertical
	

Tabulated Test Data										
Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
5 826.4	51.41	Peak	H	34.1	26.3	59.21	78.2	19.0	150	300
5 825.3	35.53	Average	H	34.1	26.3	43.33	78.2	34.9	150	300
5 825.8	58.21	Peak	V	34.1	26.3	66.01	78.2	12.2	150	310
5 825.1	37.09	Average	V	34.1	26.3	44.89	78.2	33.3	150	310

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

.

5.6.6.2.2 Test Data for Harmonic & Spurious Emission

5.6.6.2.2.1 Low Channel

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
12 254	44.7	Peak	H	37.8	22.8	-	59.7	74	14.3	100	359
13 172	21.1	AV	H	38.5	21.4	-	40.4	54	13.6	100	359
14 872	43.4	Peak	V	40.8	21.3	-	62.9	74	11.1	100	158
14 818	20.1	AV	V	40.7	21.4	-	39.4	54	14.6	100	158
Emission was scanned up to 40 GHz; No emissions were detected above the noise floor which was at least 20 dB below the specification limit											

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

"*" indicates frequency in Restricted band.

5.6.6.2.2.2 Middle Channel

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
13 359	45.6	Peak	V	38.7	23.1	-	61.2	74	12.8	100	0
13 300	22.7	AV	V	38.7	23.2	-	38.2	54	15.8	100	0
Emission was scanned up to 40 GHz; No emissions were detected above the noise floor which was at least 20 dB below the specification limit											

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

"*" indicates frequency in Restricted band.

5.6.6.2.2.3 High Channel

Frequency (MHz)	Receiver Reading (dBuV)	Detector Mode	Pol.	Ant. Factor (dB/m)	Corr. Factor(dB)	Duty Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Azimuth (Degree)
11 013	43.1	Peak	V	37.4	22.4	-	58.1	74	15.9	100	104
10 952	19.6	AV	V	37.4	22.5	-	34.5	54	19.5	100	104
16 198	44.0	Peak	H	41.5	21.3	-	64.2	74	9.8	100	359
16 371	20.8	AV	H	41.7	21.3	-	41.2	54	12.8	100	359
Emission was scanned up to 40 GHz; No emissions were detected above the noise floor which was at least 20 dB below the specification limit											

Note. "H" means Horizontal polarity, "V" means Vertical polarity.

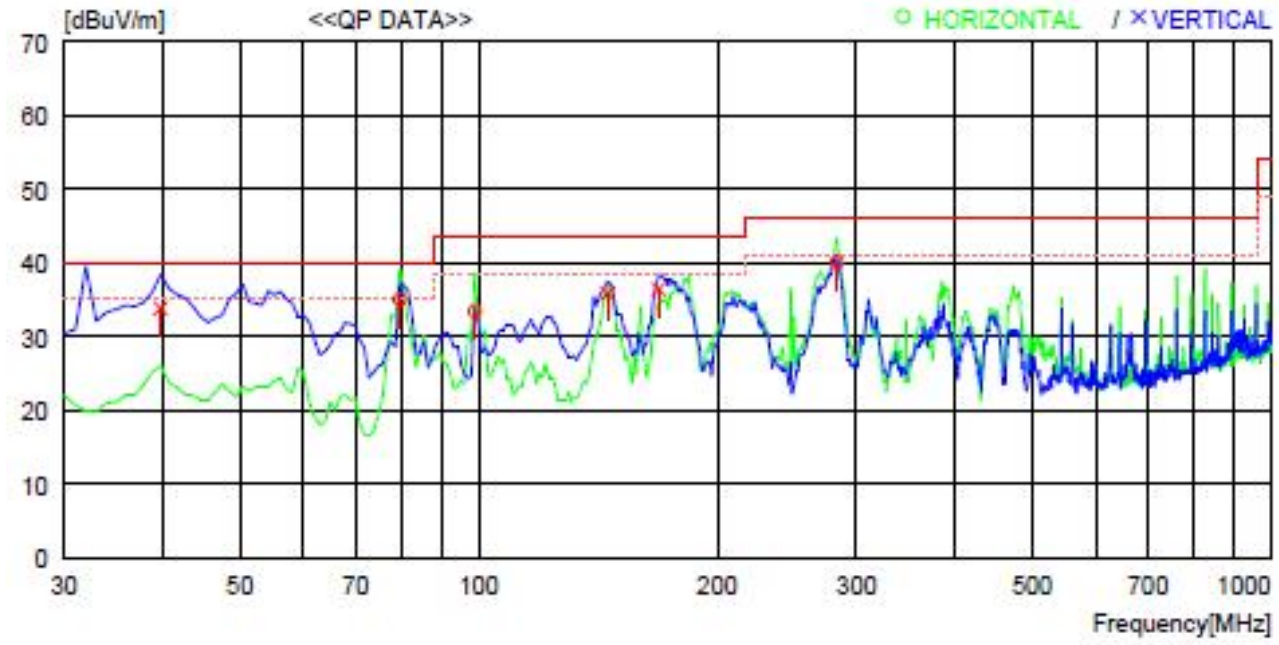
Corr. Factor (dB) = Pre-amplifier gain - Cable Loss

Result = Receiver Reading + Antenna Factor - Corr. Factor

Margin = Limit - Result

"*" indicates frequency in Restricted band.

5.6.7 Test Data below 1 GHz



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	79.470	51.7	8.4	7.6	32.7	35.0	40.0	5.0	200	359
2	98.870	46.2	12.1	7.8	32.7	33.4	43.5	10.1	400	292
3	283.170	50.3	12.8	9.5	32.5	40.1	46.0	5.9	100	0
----- Vertical -----										
4	39.700	45.9	15.4	7.2	32.7	35.8	40.0	6.2	100	138
5	145.430	51.7	8.4	8.4	32.7	35.8	43.5	7.7	100	228
6	168.710	51.4	9.1	8.5	32.6	36.4	43.5	7.1	100	243

5.7 AC Power Line Conducted Emission

5.7.1 Limit

Acc. to section 15.207 (a), following table shall be applied.

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

5.7.2 Method of Measurement

The EUT was placed on a wooden table, 0.8 m height above the horizontal ground plane and 40 cm from the vertical ground plane. 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.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

The test was performed for both Neutral and Hot lines.

5.7.3 Measurement Uncertainty

Measurement uncertainties were not taken into account and following uncertainty levels have been estimated for tests performed on the apparatus. The measurement uncertainties are given with at least 95 % confidence.

Frequency Range	Uncertainty	Frequency Range	Uncertainty
9 kHz ~ 150 kHz	± 2.07 dB	150 kHz ~ 30 MHz	± 2.07 dB

5.7.4 Sample Calculated Example

At 5.31 MHz QP Limit = 60.0 dBuV

Correction Factor (C. Factor) of LISN, Pulse Limiter and cable loss at 5.31 MHz = 9.7 dB

Q.P Reading from the Test receiver = 20.8 dBuV

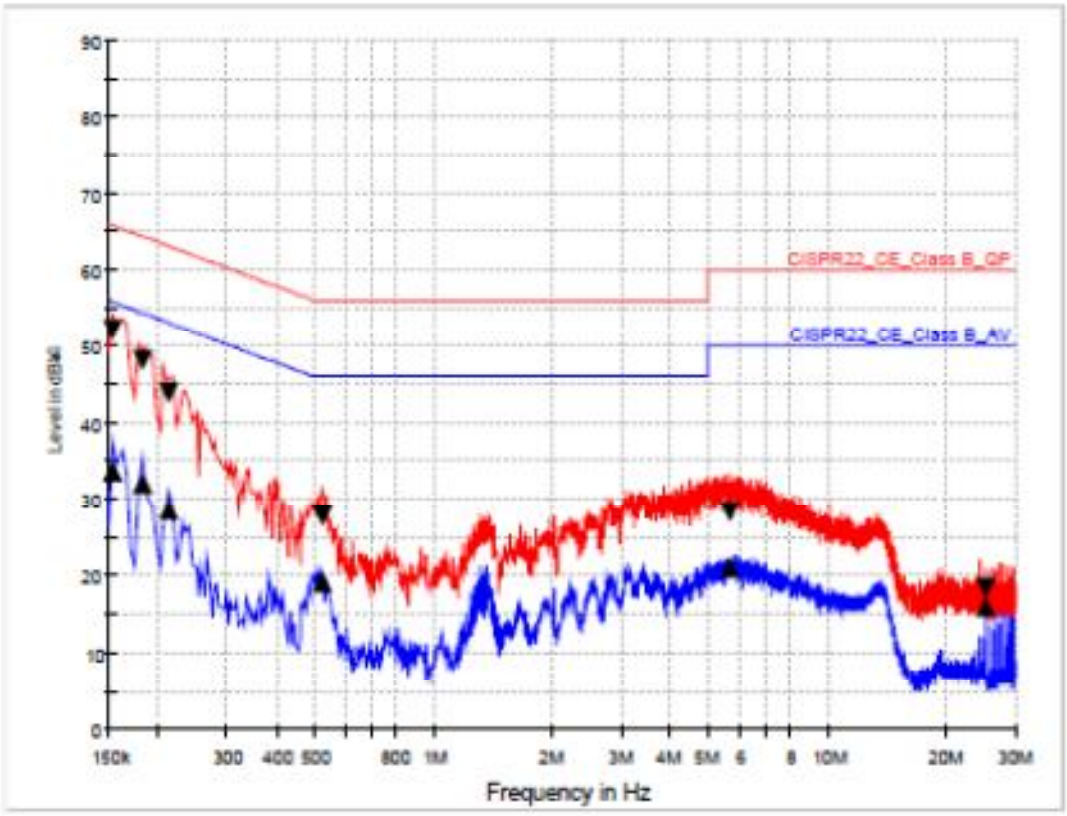
(Calculated value for system losses by software EMC32 manufactured by Rohde & Schwarz)

Therefore Q.P Margin = 60 - 20.8 = 39.2 so the EUT has 39.2 dB margin at 5.31 MHz

5.7.5 Worst Case Test Data

Test Date: Oct. 27, 2015	Tested by: S. M. Jang

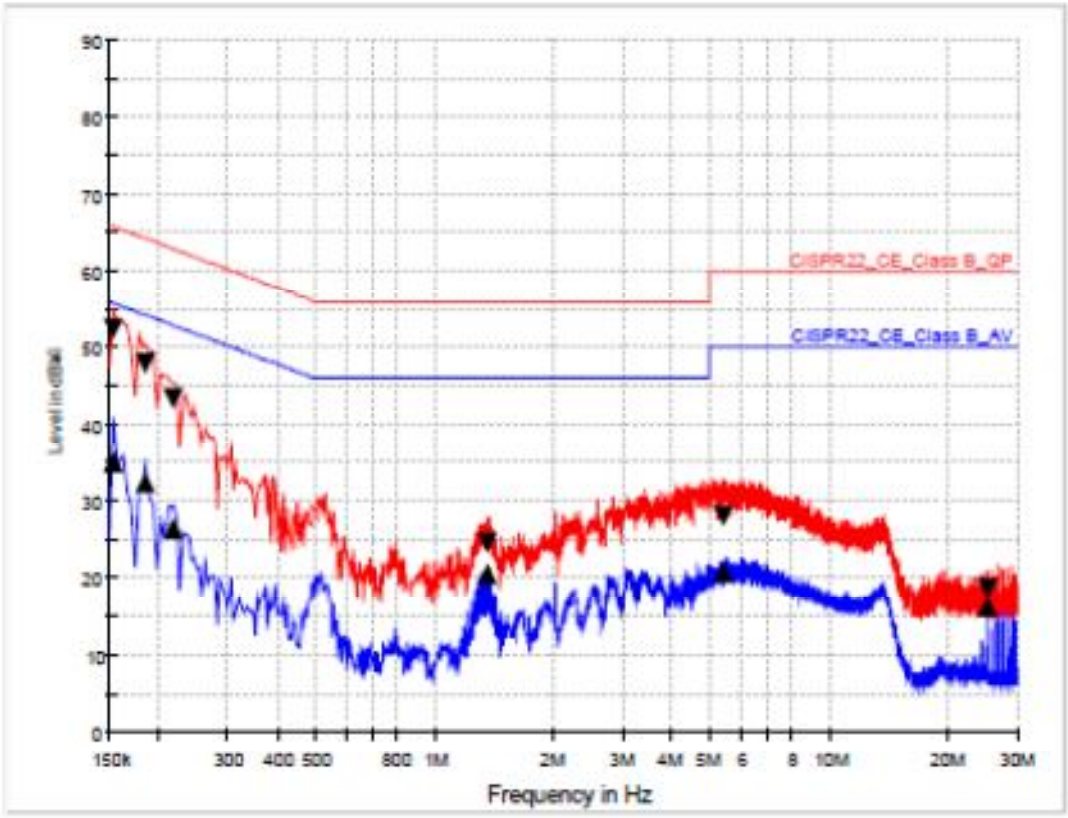
Hot Line



Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.154000	52.1	33.8	9.000	L1	9.6	13.6	65.8	21.9	55.8
0.182000	48.3	32.1	9.000	L1	9.6	16.1	64.4	22.3	54.4
0.214000	43.8	28.7	9.000	L1	9.6	19.2	63.0	24.4	53.0
0.522000	27.8	19.2	9.000	L1	9.6	28.2	56.0	26.8	46.0
5.670000	28.4	21.2	9.000	L1	9.7	31.6	60.0	28.8	50.0
25.058000	18.6	16.0	9.000	L1	10.0	41.4	60.0	34.0	50.0

Neutral Line



Limit and Margin1

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV)	Margin - CAV (dB)	Limit - CAV (dBµV)
0.154000	52.6	35.2	9.000	N	9.6	13.2	65.8	20.6	55.8
0.186000	48.0	32.5	9.000	N	9.6	16.2	64.2	21.7	54.2
0.218000	43.5	26.5	9.000	N	9.6	19.4	62.9	26.4	52.9
1.358000	24.7	20.6	9.000	N	9.6	31.3	56.0	25.4	46.0
5.366000	28.2	20.9	9.000	N	9.7	31.8	60.0	29.1	50.0
25.058000	18.8	16.3	9.000	N	10.1	41.2	60.0	33.7	50.0

Appendix I- Test Instrumentation

Description	Model No.	Serial No.	Manufacturer.	Due for Cal Date
TS8997 System				
Signal & Spectrum Analyzer	FSW 43	100578	Rohde & Schwarz	2016-05-06
Power Module	OSP 120	101389	Rohde & Schwarz	2016-05-06
Signal Generator	SMF100A	101441	Rohde & Schwarz	2016-05-06
Vector Signal Generator	SMBV100A	257560	Rohde & Schwarz	2016-05-06
DC Power Supply	E3610A	MY40005644	AGILENT	2016-05-06
SLIDACS	DSD-1005	M06-117	Digitek Power	N/A
Attenuator	56-10	58769	WEINSCHEL	2016-05-06
Attenuator	10dB	N/A	Rohde & Schwarz	2016-05-06
Temperature & Humidity Chamber	PR-3KP	14004209	Espec	2016-08-14
Test Receiver	ESU 26	100303	Rohde & Schwarz	2016-02-27
Loop Antenna	HFH2-Z2	100341	Rohde & Schwarz	2017-06-03
TRILOG Broadband Antenna	VULB9163	9163.770	Schwarzbeck	2017-02-08
Dipole Antenna	UHA9105	N/A	S/B	2017-07-17
Horn Antenna	HF 907	102426	Rohde & Schwarz	2017-01-15
DOPPEL STEG Horn Antenna	HF 906	100332	Rohde & Schwarz	2017-01-22
Attenuator	6dB	272.4110.50	Rohde & Schwarz	2016-05-05
Pre-Amplifier	310N	344015	Sonoma Instrument	2016-05-05
Turn Table	DT3000-3t	1310814	INNCO SYSTEM	N/A
Antenna Master	MA4000-EP	4600814	INNCO SYSTEM	N/A
Camera Controller	HDCon4102	6531445048	PONTIS	N/A
CO3000 Controller	Co3000-4Port	CO3000/806/ 34130814/L	INNCO SYSTEM	N/A
EMI Test Receiver	ESCI 7	100722	Rohde & Schwarz	2016-06-02
LISN	ENV216	100110	Rohde & Schwarz	2015-12-17
LISN	LS16C	16011403310	AFJ	2016-09-08

The measuring equipment utilized to perform the tests documented in this test report has been calibrated in accordance with manufacturer's recommendations, and is traceable to recognized national standards.