FCC Test Report

Report No: FCS202103021W01

Issued for

Shenzhen Huimei Shangpin Technology Co., Ltd.

201, Block A, Huafeng Smart Innovation Port, Gushu 2nd Road, Gushu Community, Xixiang Street, Baoan District, Shenzhen

Product Name:	Wifi Camera
Brand Name:	Casoda
Model Name:	CSD-500
Series Model:	CSD-510, CSD-520, CSD-530, CSD-540, CSD-550, CSD-560, CSD-570, CSD-580, CSD-590, CSD-600, CSD-610, CSD-620, CSD-630, CSD-640, CSD-650, CSD-660, CSD-670, CSD-680, CSD-690, CSD-700, CSD-710
FCC ID:	2A2BP-CSD

Issued By: Flux Compliance Service Laboratory
Add: Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan
Tel: 769-27280901 Fax:769-27280901 http://www.FCS-lab.com

TEST RESULT CERTIFICATION

Applicant's Name .....:	Shenzhen Huimei Shangpin Technology Co., Ltd.
Address.....:	201, Block A, Huafeng Smart Innovation Port, Gushu 2nd Road, Gushu Community, Xixiang Street, Baoan District, Shenzhen
Manufacture's Name .....:	Shenzhen Huimei Shangpin Technology Co., Ltd.
Address.....:	201, Block A, Huafeng Smart Innovation Port, Gushu 2nd Road, Gushu Community, Xixiang Street, Baoan District, Shenzhen

Product Description

Product Name.....:	Wifi Camera
Model Name.....:	CSD-500
Series Model.....:	CSD-510, CSD-520, CSD-530, CSD-540, CSD-550, CSD-560, CSD-570, CSD-580, CSD-590, CSD-600, CSD-610, CSD-620,
Test Standards.....:	CFR 47 FCC Part15E section 15.407
Test Procedure.....:	ANSI C63.10-2013 KDB 789033 D02 General UNII Test procedures New Rules 02 KDB558074 D01 Meas Guidance v05

This device described above has been tested by Flux Compliance Service Laboratory, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.
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Date of Test..... :

Date (s) of performance of tests :	May. 08, 2021 to June. 03, 2021
Date of Issue..... :	June. 03, 2021
Test Result ..... :	Pass

Tested by : Scott shen
(Scott Shen)

Reviewed by : Duke Qian
(Duke Qian)

Approved by : Kaa
(Kait Chen)

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	June. 03, 2021	FCS202103021W01	ALL	Initial Issue

1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

Standard Section	Test Item	Judgment	Remark
FCC 15.407 (e)	6/26db Bandwidth and 99% Bandwidth	PASS	--
FCC 15.407 (a)	Maximum Conducted Output Power	PASS	--
FCC 15.407 (a)	Power Spectral Density	PASS	--
FCC 15.407 (g)	Frequency Stability Measurement	PASS	
FCC 15.407 (a) FCC 15.209 FCC 15.205	Emissions in restricted frequency bands	PASS	
FCC 15.407 (a) FCC 15.209 FCC 15.205	Band Edge Compliance	PASS	
FCC 15.207	Power Line Conducted Emission	N/A	
FCC 15.203	Antenna requirement	PASS	--

1.1 TEST FACTORY

Company Name:	Flux Compliance Service Laboratory
Address:	Room 105 Floor Bao hao Technology Building 1 NO.15 Gong ye West Road Hi-Tech Industrial, Song shan lake Dongguan
Telephone:	+86-769-27280901
Fax:	+86-769-27280901
FCC Test Firm Registration Number: 514908 Designation number: CN0127 A2LA accreditation number：5545.01	

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y** ±**U**, where expended uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k=2**, providing a level of confidence of approximately **95** %.

No.	Item	Uncertainty
1	RF output power, conducted	±0.71dB
2	Unwanted Emissions, conducted	±2.988 dB
3	Conducted Emission (9KHz-150KHz)	±4.13 dB
4	Conducted Emission (150KHz-30MHz)	±4.74 dB
5	All emissions,radiated(<1G) 30MHz-1000MHz	±5.2 dB
6	All emissions,radiated 1GHz -18GHz	±4.66 dB
7	All emissions,radiated 18GHz -40GHz	±4.31 dB

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Wifi Camera
Trade Name	Casoda
Model Name	CSD-500
Series Model	CSD-510, CSD-520, CSD-530, CSD-540, CSD-550, CSD-560, CSD-570, CSD-580, CSD-590, CSD-600, CSD-610, CSD-620, CSD-630, CSD-640, CSD-650, CSD-660, CSD-670, CSD-680, CSD-690, CSD-700, CSD-710
Model Difference	The electrical circuit design, layout, components used and internal wiring for above models are identical, only different in model name and appearance color
Channel List	Please refer to the Note 2.2.
Operation frequency	IEEE 802.11a/n(HT20/40)/ac(HT20/40/80): U-NII-1 5150MHZ-5250 MHz IEEE 802.11a/n(HT20/40)/ac(HT20/40/80): U-NII-3 5725MHZ-5850 MHz
Number of channel	5150MHZ-5250 MHz (7CH) 5725MHZ-5850 MHz (8CH)
Modulation:	OFDM
Power supply	DC 12V by adapter
Hardware version number	V1.0
Software version number	V1.0
Sample type	Fixed equipment
Connecting I/O Port(s)	Please refer to the User's Manual

Note:

1. For a more detailed features description, please refer to the manufacturer’s specifications or the User's Manual.

2. Channel list

U-NII-1 (5.15-5.25GHz)		U-NII-3 (5.725-5.85GHz)	
channel	Frequency(MHz)	channel	Frequency(MHz)
36	5180	149	5745
38	5190	151	5755
40	5200	153	5765
42	5210	155	5775
44	5220	157	5785
46	5230	159	5795
48	5240	161	5805
		165	5825

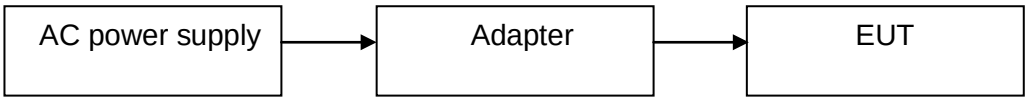
3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	KCC	KCC	External antenna	N/A	1.0 dBi	Antenna

2.2 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Block diagram of EUT configuration for test



Test software: the QA tool
The test softeware was used to control EUT work in continuous TX mode, and select test channel,

For 802.11a/n(HT20)/ac(HT20)

channel	Frequency(MHz)	channel	Frequency(MHz)
36	5180	149	5745
40	5200	157	5785
48	5240	165	5825

For 802.11n(HT40)/ac(HT40)

channel	Frequency(MHz)	channel	Frequency(MHz)
38	5190	151	5755
46	5230	159	5795

For 802.11 ac(HT80)

channel	Frequency(MHz)	channel	Frequency(MHz)
42	5210	155	5775

2.3 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

(3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.

2.4 EQUIPMENTS LIST

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESRP 3	FCS-E001	2020. 06.26	2021. 06.25
Signal Analyzer	R&S	FSV40-N	FCS-E012	2020.08.09	2021.08.10
Active loop Antenna	ZHINAN	ZN30900C	FCS-E013	2020.08.09	2021.08.10
Bilog Antenna	SCHWARZBECK	VULB 9168	FCS-E002	2020.08.26	2021.08.25
Horn Antenna	SCHWARZBECK	BBHA 9120D	FCS-E003	2020.08.26	2021.08.25
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	FCS-E018	2020.06.26	2021.06.25
Pre-Amplifier(0.1M-3GHz)	EMCI	EM330N	FCS-E004	2020.06.26	2021.06.25
Pre-Amplifier (1G-18GHz)	N/A	TSAMP-0518SE	FCS-E014	2020.08.09	2021.08.10
Pre-Amplifier (18G-40GHz)	TERA-MW	TRLA-0400	FCS-E019	2020.08.08	2021.08.07
Temperature & Humidity	HTC-1	victor	FCS-E005	2020.08.26	2021.08.25

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
EMI Test Receiver	R&S	ESCI	FCS-E020	2020.08.09	2021.08.10
LISN	R&S	ENV216	FCS-E007	2020.08.08	2021.08.07
LISN	ETS	3810/2NM	FCS-E009	2020.08.09	2021.08.10
Temperature & Humidity	HTC-1	victor	FCS-E008	2020.08.08	2021.08.07

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Company No.	Last calibration	Calibrated until
MXA SIGNAL Analyzer	Keysight	N9020A	FCS-E015	2020.08.09	2021.08.10
Spectrum Analyzer	Agilent	E4447A	MY50180039	2020.08.08	2021.08.07
Spectrum Analyzer	R&S	FSV-40	101499	2020.08.26	2021.08.25
Power meter	Agilent	U2021XA	MY50150389	2020.08.26	2021.08.25

3. 26dB Bandwidth, 6dB Bandwidth and 99% Bandwidth

3.1 Limit

FCC Part15, Subpart E		
Test Item	Limit	Frequency Range (MHz)
Bandwidth	26 dB Bandwidth	5150-5250
	26 dB Bandwidth	5250-5350
	26 dB Bandwidth	For FCC:5470-5725 For IC:5470-5600 5650-5725
	Minimum 500kHz 6dB Bandwidth	5725-5850

3.2 Test Procedure

(1) Connect EUT's antenna output to spectrum analyzer by RF cable.

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	For 6dB Bandwidth: RBW=100kHz For 26dB Bandwidth: approximately 1% of the emission bandwidth.
VBW	For 6dB Bandwidth: VBW=300kHz For 26dB Bandwidth: >3RBW
Trace	Max hold
Sweep	Auto couple

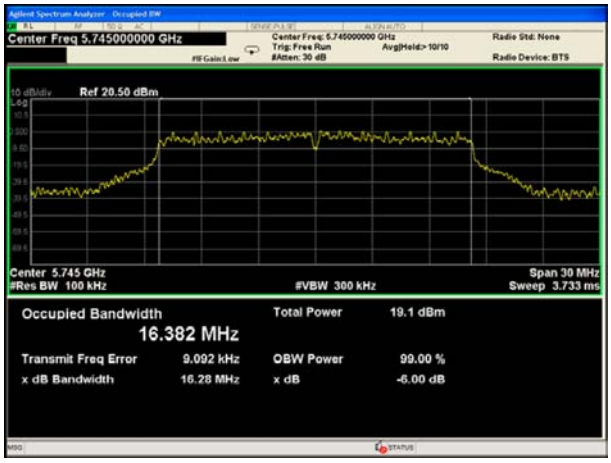
(2) Allow the trace to stabilize, measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 26dB and 6dB relative to the maximum level measured in the fundamental emission.

3.3 Test setup

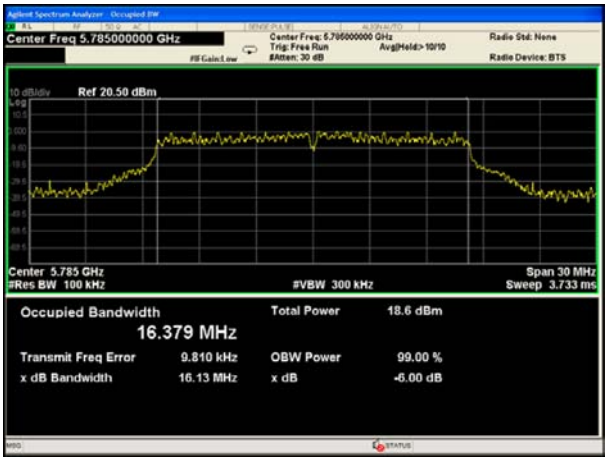
3.4 Test results

Band	Operation mode	6 dB Bandwidth (MHz)		
		Low	Middle	High
U-NII-3	802.11a	16.28	16.13	16.26
	802.11n(HT20)	17.69	17.65	17.59
	802.11n(HT40)	36.35	/	36.40
	802.11ac(HT20)	17.53	17.66	17.61
	802.11ac(HT40)	36.01	/	36.16
	802.11ac(HT80)	76.05	/	/

802.11a Low CH

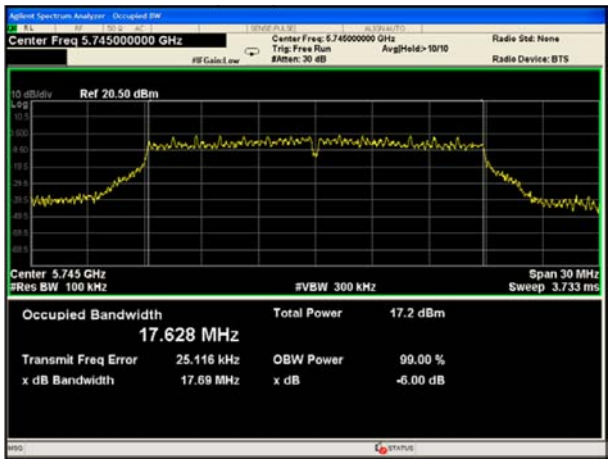


802.11a Middle CH



802.11a High CH

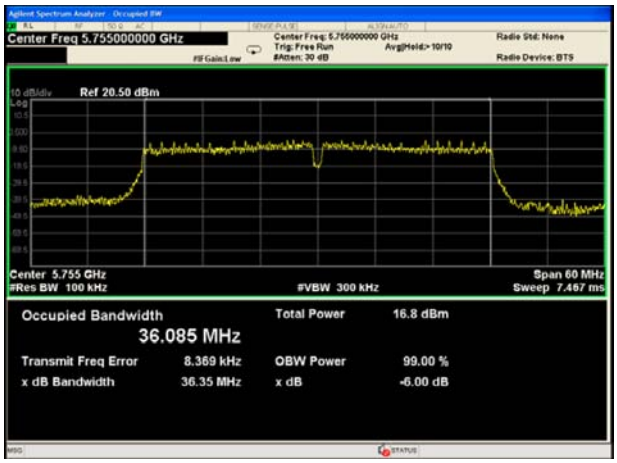
802.11n(HT20)Low CH



802.11n(HT20)Middle CH

802.11n(HT20) High CH

802.11n(HT40)Low CH



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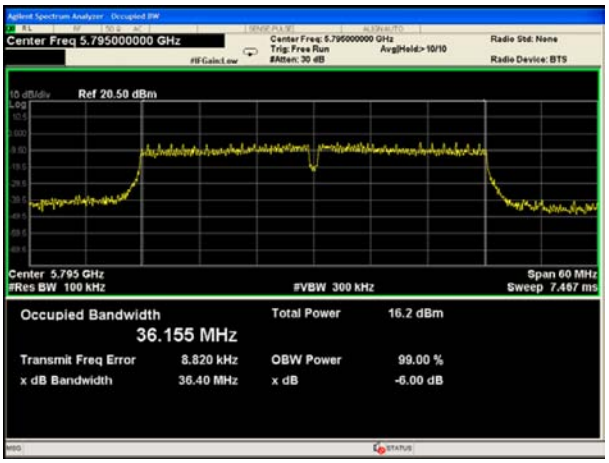
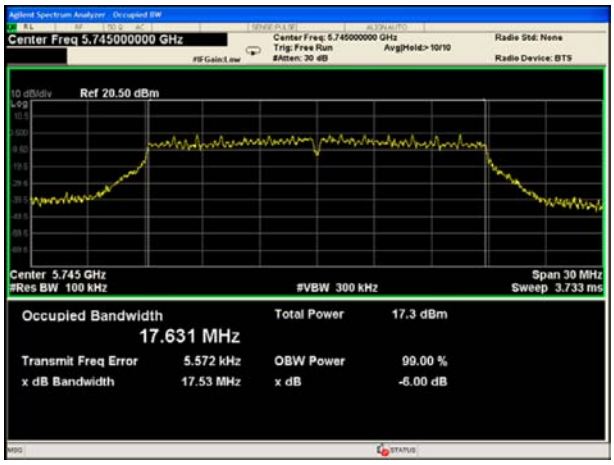
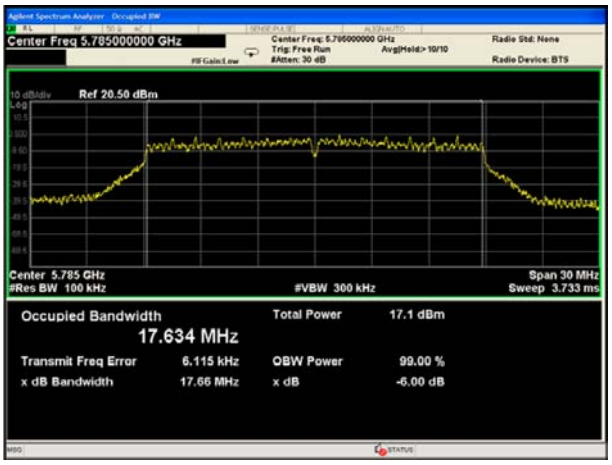


802.11ac(HT20)Low CH



802.11ac(HT20)Middle CH



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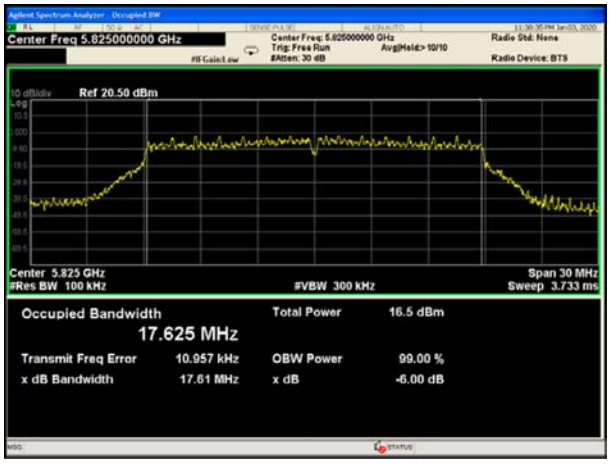
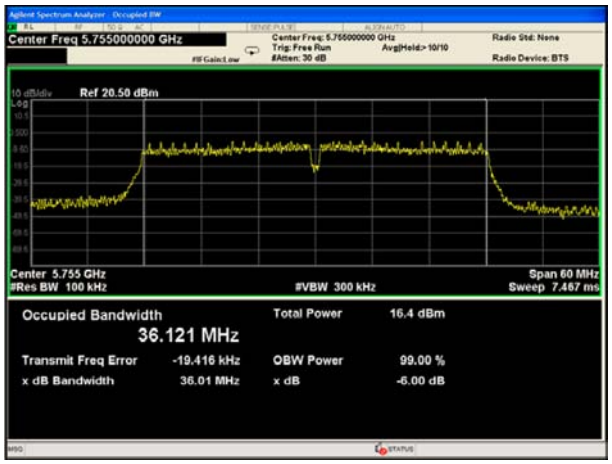
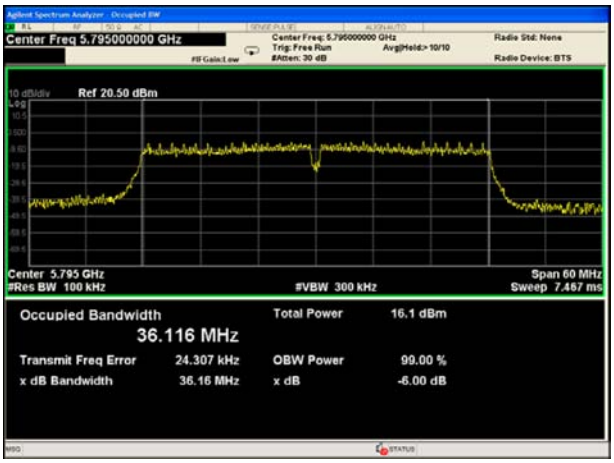


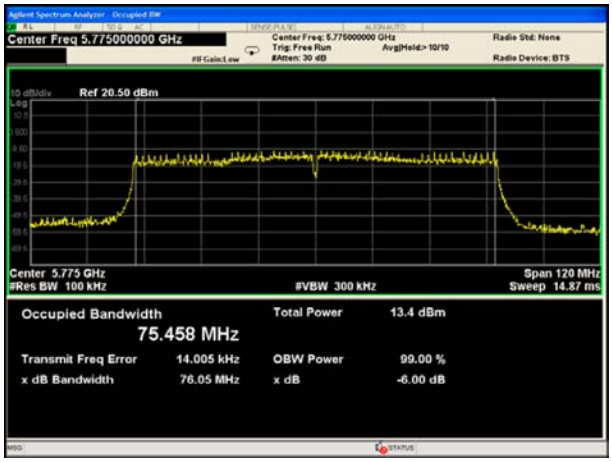
802.11ac(HT40)Low CH



802.11ac(HT40)High CH



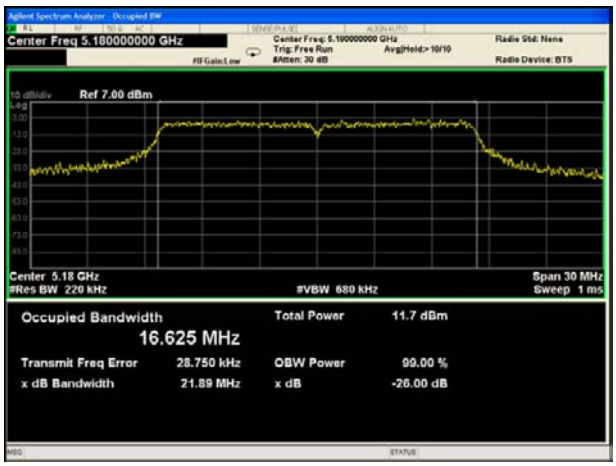
802.11ac(HT80) Low CH



26dB Bandwidth &99% Bandwidth Test result.

Band	Operation mode	26 dB Bandwidth (MHz)			99% Bandwidth (MHz)		
		Low	Middle	High	Low	Middle	High
U-NII-1	802.11a	21.89	21.80	22.25	16.625	16.643	16.626
	802.11n(HT20)	23.71	25.95	21.20	17.710	17.717	17.678
	802.11n(HT40)	41.60	/	58.32	36.246	/	36.294
	802.11ac(HT20)	22.28	26.16	21.09	17.711	17.760	17.678
	802.11ac(HT40)	41.70	/	54.68	36.230	/	36.362
	802.11ac(HT80)	80.91	/	/	75.487	/	/
U-NII-3	802.11a	20.54	20.47	20.26	16.567	16.574	16.579
	802.11n(HT20)	21.82	20.99	20.89	17.670	17.675	17.646
	802.11n(HT40)	40.18	/	40.54	36.034	/	36.037
	802.11ac(HT20)	21.50	21.20	20.95	17.659	17.668	17.651
	802.11ac(HT40)	40.44	/	40.19	36.052	/	36.045
	802.11ac(HT80)	79.01	/	/	75.369	/	/

802.11a U-NII-1 Low CH



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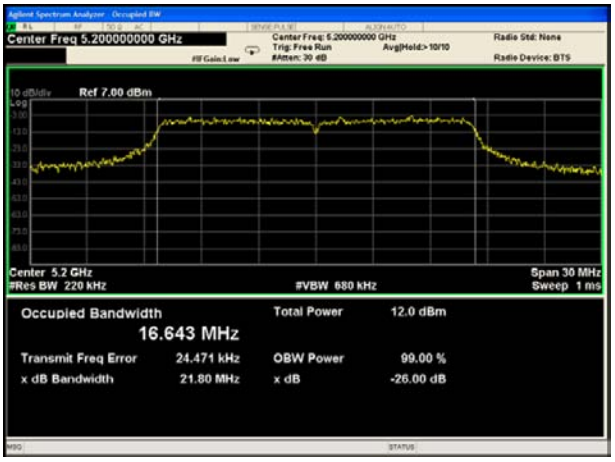
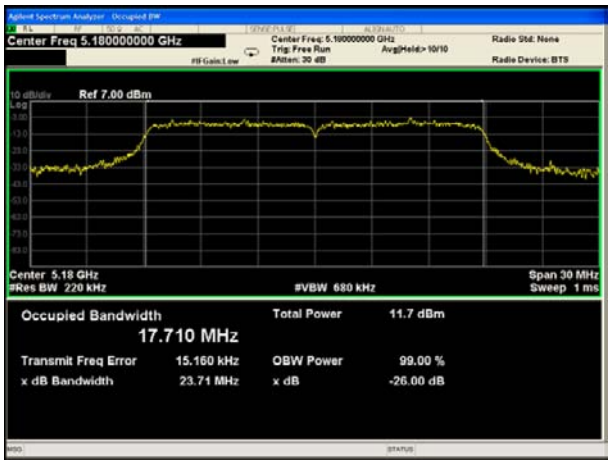


802.11a U-NII-1 High CH

802.11n(H20) U-NII-1 Low CH



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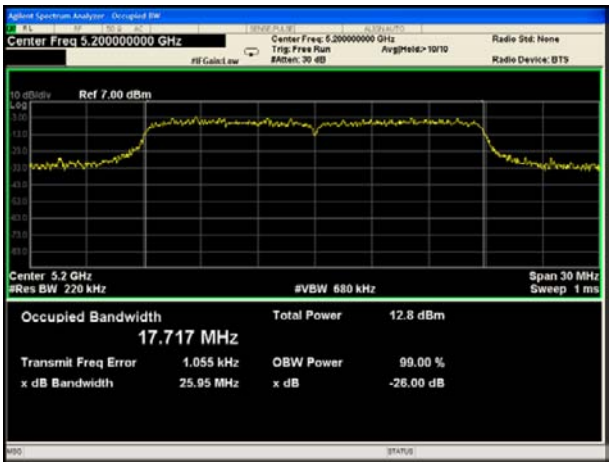

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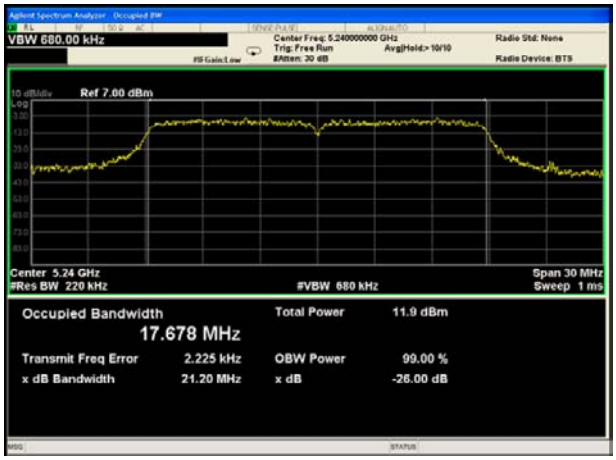

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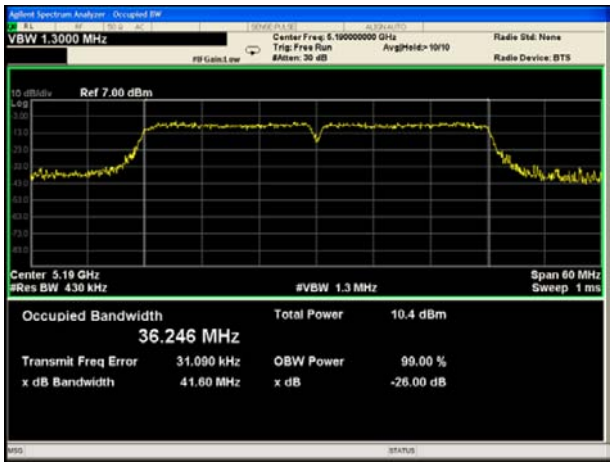

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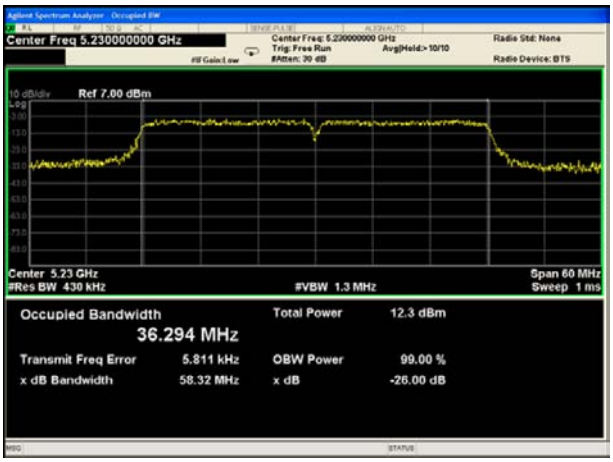
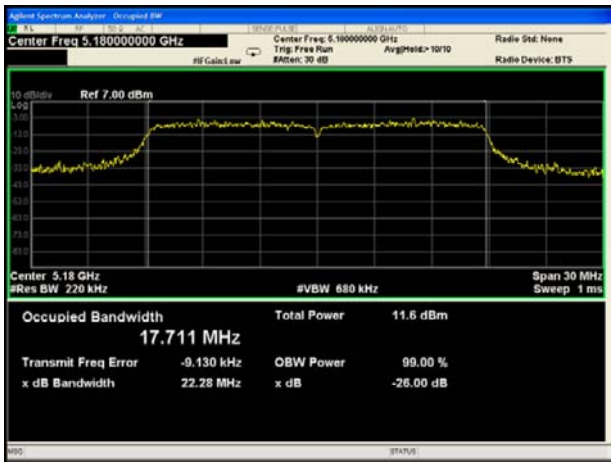


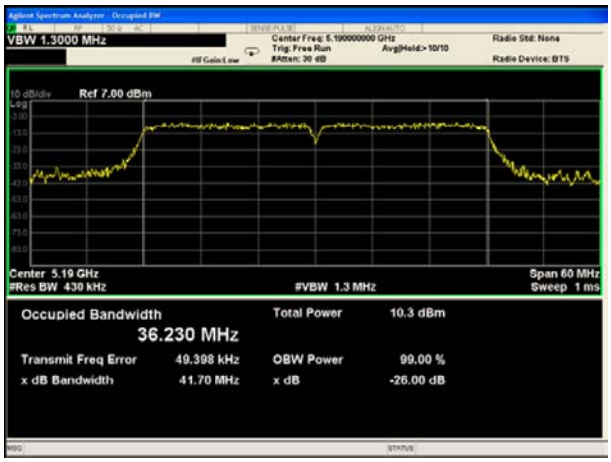
802.11ac(H20) U-NII-1 Low CH



802.11 ac(H20) U-NII-1 Middle CH

802.11 ac(H20) U-NII-1 High CH

802.11ac(H40) U-NII-1 Low CH



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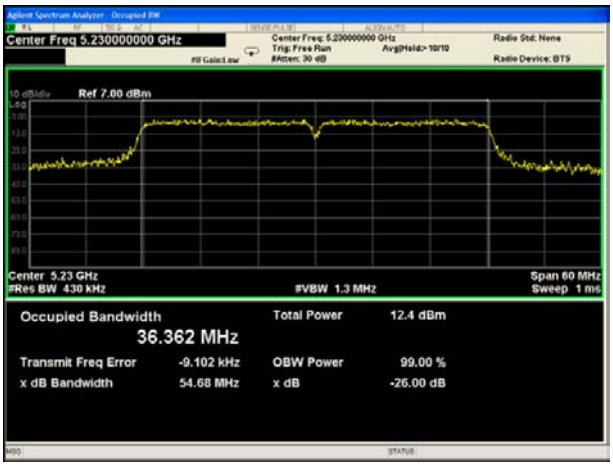
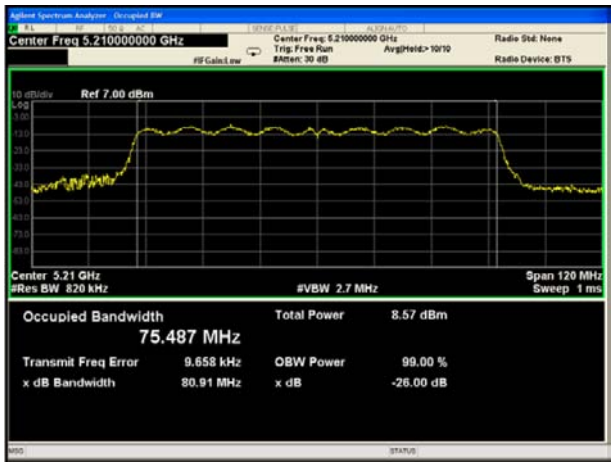
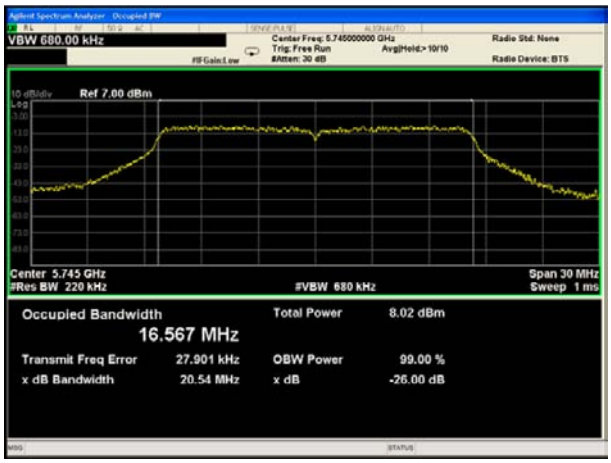


802.11ac(H80) U-NII-1 Low CH



802.11a U-NII-3 Low CH



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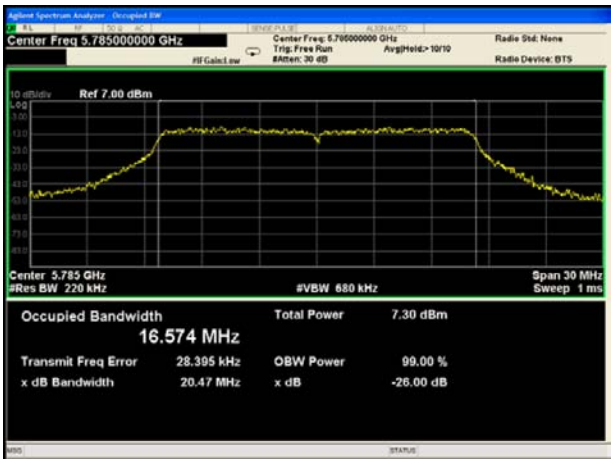
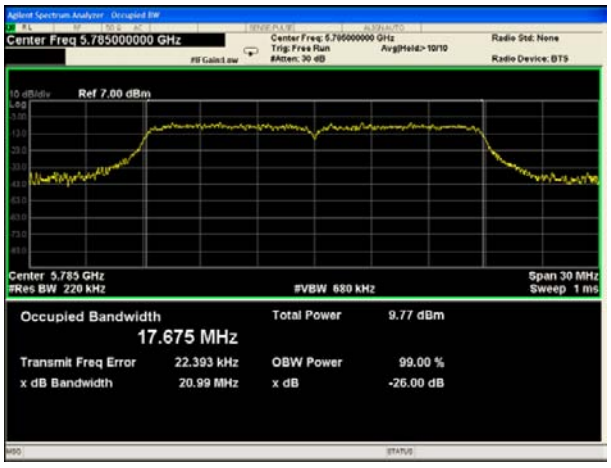


802.11a U-NII-3 High CH

802.11n(H20) U-NII-3 Low CH

802.11a(H20) U-NII-3 Middle CH



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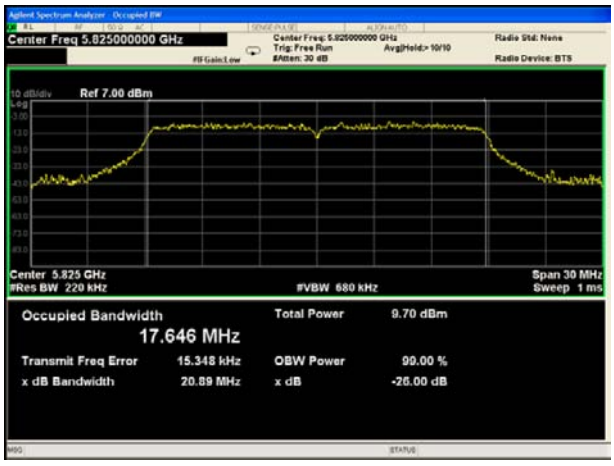
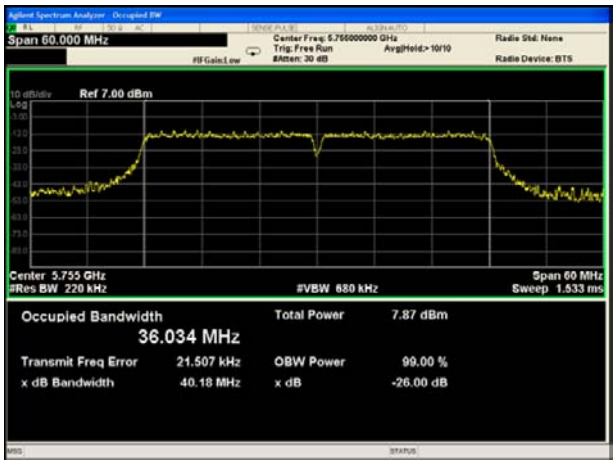
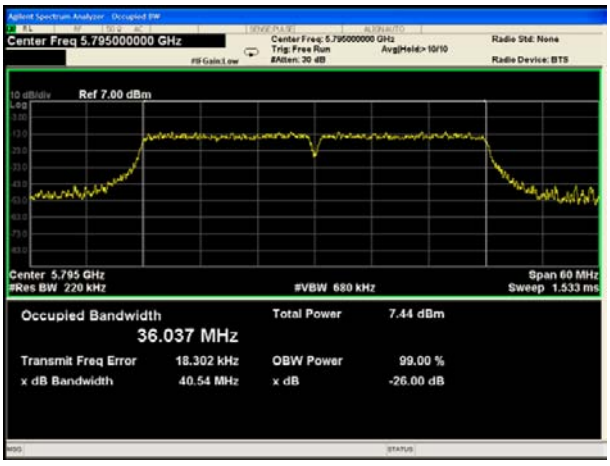


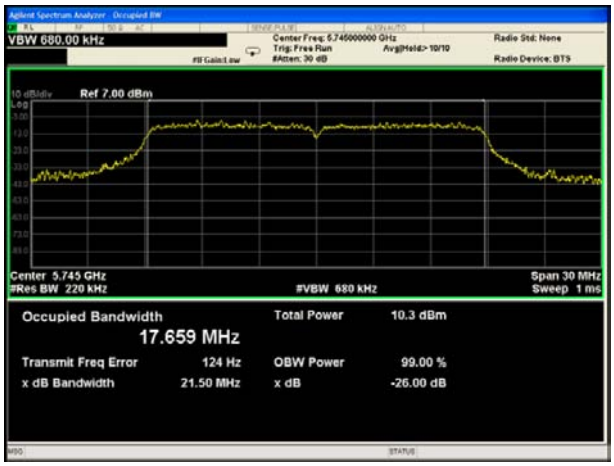
802.11n(H40) U-NII-3 Low CH



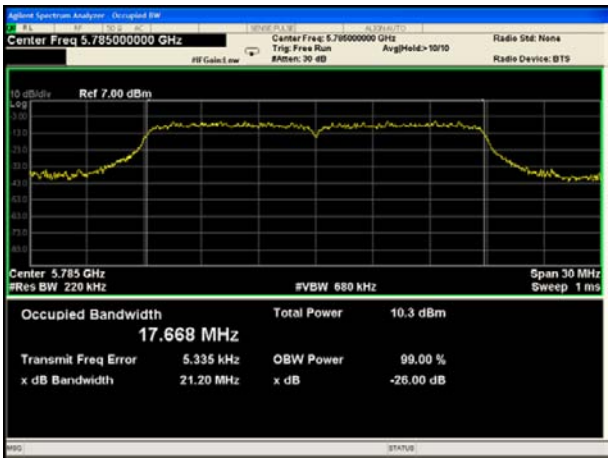
802.11n(H40) U-NII-3 High CH



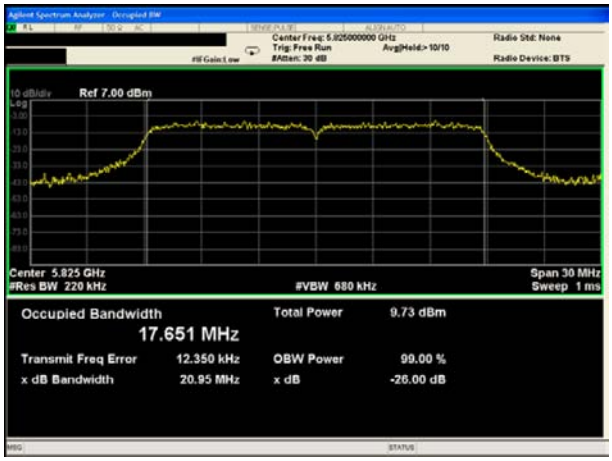
802.11ac(H20) U-NII-3 Low CH



802.11ac(H20) U-NII-3 Middle CH



802.11ac(H20) U-NII-3 High CH



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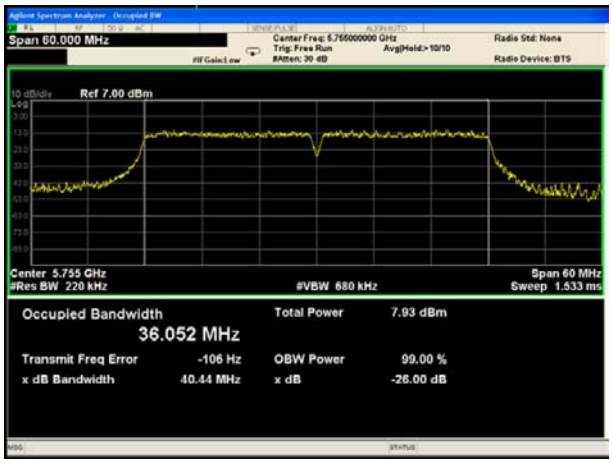
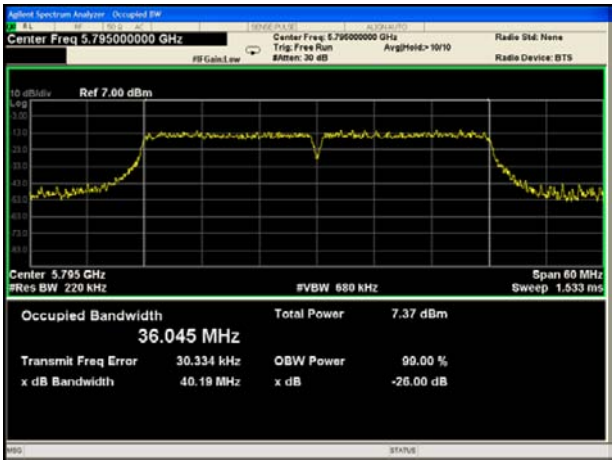
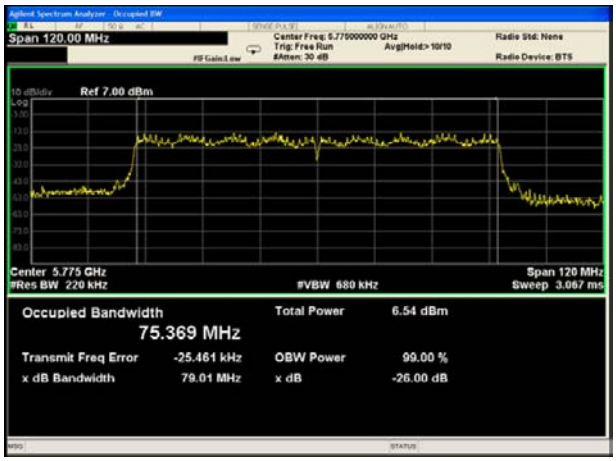


802.11ac(H40) U-NII-3 High CH



802.11ac(H80) U-NII-3 Low CH



4 CONDUCTED OUTPUT POWER

4.1 limit

FCC Part15, Subpart E/ RSS-247		
Test Item	Limit	Frequency Range (MHz)
Conducted Output Power	For FCC client devices: 250mW (24dBm)	5150-5250
	For RSS: e.i.r.p. power: not exceed 200 mW(23dBm) or 10 + 10 log10 B	
	250mW (24dBm) or 11 + 10 log10 B	5250-5350
	250mW (24dBm) or 11 + 10 log10 B	For FCC:5470-5725 For IC:5470-5600 5650-5725
	1 Watt (30dBm)	5725-5850
Note: For ISED: B=99% bandwidth.		

4.2 test procedure

a. Connect each EUT's antenna output to power meter by RF cable and attenuator

b. Get each antenna port's output power of EUT.

4.3 TEST SETUP

4.4 test results

Band	Operation mode	Conducted Output Power (dBm)		
		Low	Middle	High
U-NII-1	802.11a	11.52	11.50	11.00
	802.11n(HT20)	11.47	11.84	10.48
	802.11n(HT40)	10.52	/	10.36
	802.11ac(HT20)	11.54	**12.21**	10.70
	802.11ac(HT40)	10.21	/	10.15
	802.11ac(HT80)	8.35	/	/
U-NII-3	802.11a	6.71	5.97	5.61
	802.11n(HT20)	8.80	8.65	8.57
	802.11n(HT40)	7.14	/	6.27
	802.11ac(HT20)	**8.81**	8.34	8.27
	802.11ac(HT40)	7.37	/	6.58
	802.11ac(HT80)	5.78	/	/

* All transmit signals are completely uncorrelated with each other, Directional gain = G_{ANT} which is less than 6dBi. So the limit does not be reduced.

5. POWER SPECTRAL DENSITY

5.1 LIMIT

FCC Part15, Subpart E/ RSS-247		
Test Item	Limit	Frequency Range (MHz)
Power Spectral Density	For FCC: Other than Mobile and portable:17dBm/MHz Mobile and portable:11dBm/MHz	5150-5250
	For RSS eirp:10dBm/MHz	
	11dBm/MHz	5250-5350
	11dBm/MHz	For FCC:5470-5725 For IC:5470-5600 5650-5725
	30dBm/500kHz	5725-5850

5.2 TEST PROCEDURE

The transmitter output was connected to a spectrum analyzer. Power density was measured by spectrum analyzer with 1MHz RBW and 3MHz VBW.

Connect the UUT to the spectrum analyser and use the following settings:

5725MHz-5850MHz

Center Frequency	The centre frequency of the channel under test
Detector	RMS
RBW	500kHz
VBW	≥3 × RBW
Span	Encompass the entire emissions bandwidth (EBW) of the signal
Trace	Max hold
Sweep time	Auto

Note:

1. For UNII-3, according to KDB publication 789033 D02 General UNII Test Procedures New Rules v01, section II.F.5., it is acceptable to set RBW at 1MHz and VBW at 3MHz if the spectrum analyzer does not have 500kHz RBW.

2. The value measured with RBW=1MHz is to be added with 10log(500kHz/1MHz) which is - 3dB. For example, if the measured value is +10dBm using RBW=1MHz (that is +10dBm/MHz), then the converted value will be +7dBm/500kHz.

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.

5.3 TEST SETUP

5.4 TEST RESULTS

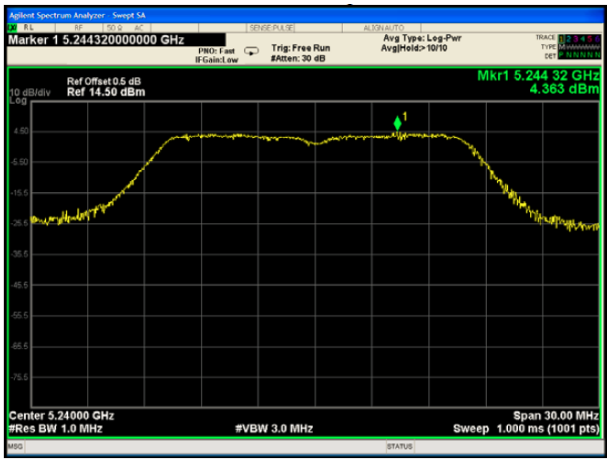
Band	Operation mode	Power Spectral Density (dBm/MHz)		
		Low	Middle	High
U-NII-1	802.11a	4.359	2.844	4.363
	802.11n(HT20)	3.135	4.648	3.333
	802.11n(HT40)	0.027	/	2.390
	802.11ac(HT20)	3.076	4.106	4.914
	802.11ac(HT40)	-0.032	/	1.904
	802.11ac(HT80)	-3.968	/	/
	Limit	≤11.00dBm/MHz		

Band	Operation mode	Power Spectral Density (dBm/MHz)		
		Low	Middle	High
U-NII-3	802.11a	-0.022	-0.862	-1.416
	802.11n(HT20)	2.166	1.154	0.860
	802.11n(HT40)	-3.238	/	-3.671
	802.11ac(HT20)	1.483	0.271	0.205
	802.11ac(HT40)	-2.973	/	-4.070
	802.11ac(HT80)	-6.255	/	/
	Limit	≤30.00dBm/500kHz		

802.11a U-NII-1 Low CH

802.11a U-NII-1 Middle CH

802.11a U-NII-1 High CH



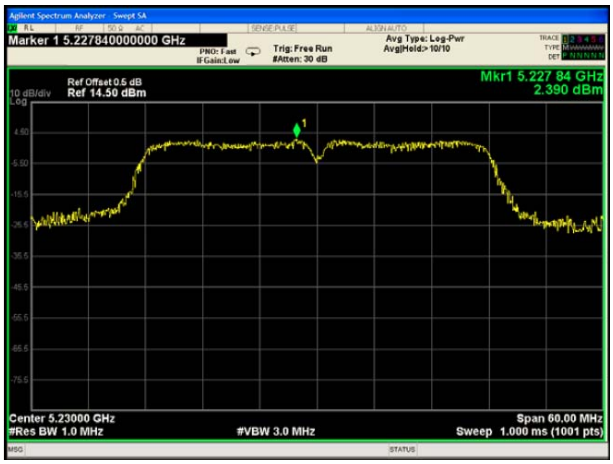
802.11n(HT20)U-NII-1 Low CH

802.11n(HT20)U-NII-1 Middle CH

802.11n(HT20)U-NII-1 High CH

802.11n(HT40)U-NII-1 Low CH

802.11n(HT40)U-NII-1 High CH



802.11ac(HT20)U-NII-1 Low CH

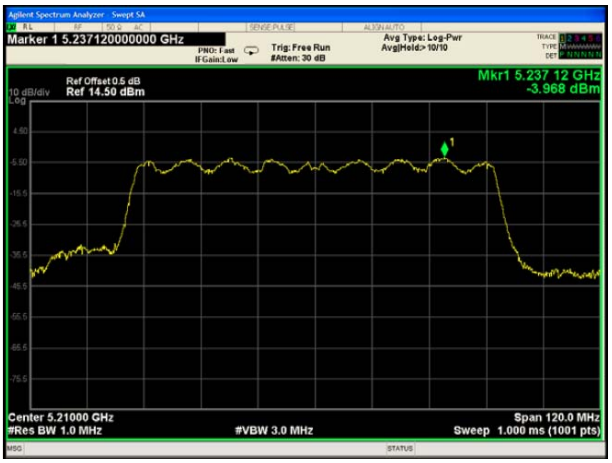
802.11ac(HT20)U-NII-1 Middle CH

802.11ac(HT20)U-NII-1 High CH

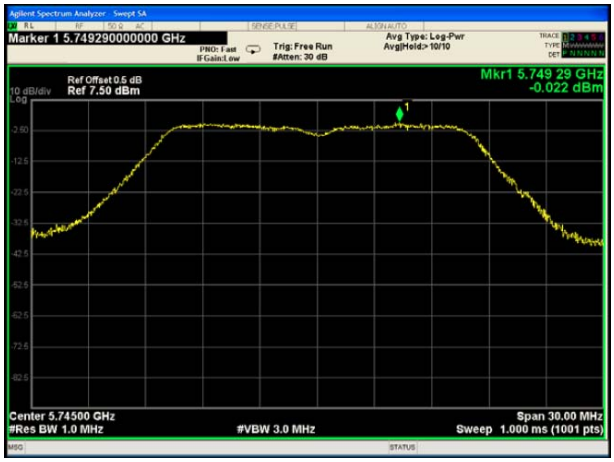
802.11ac(HT40)U-NII-1 Low CH

802.11ac(HT40)U-NII-1 High CH

802.11ac(HT80)U-NII-1 Low CH



802.11a U-NII-3 Low CH



802.11a U-NII-3 Middle CH

802.11a U-NII-3 High CH

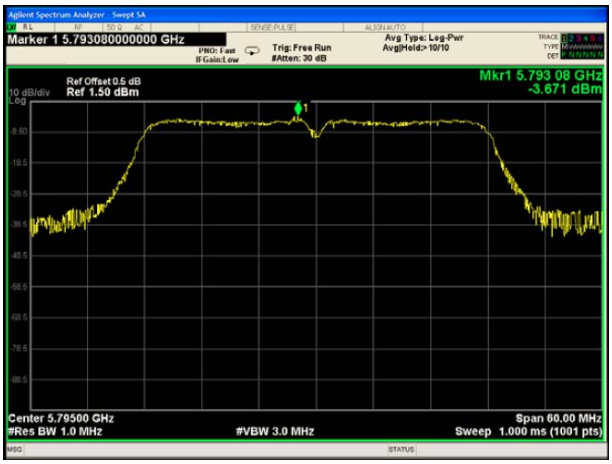
802.11n(HT20) U-NII-3 Low CH

802.11n(HT20) U-NII-3 Middle CH

802.11n(HT20) U-NII-3 High CH

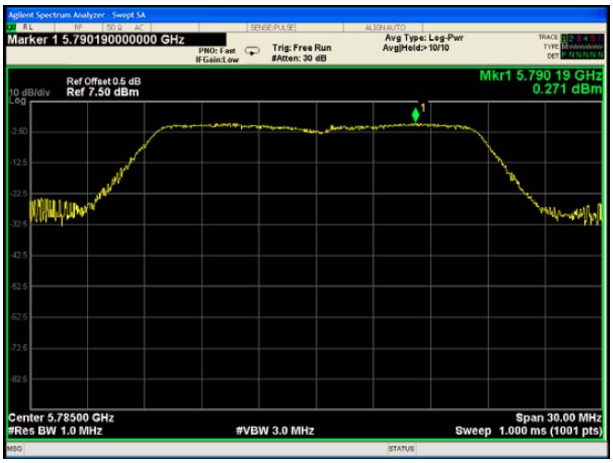
802.11n(HT40) U-NII-3 Low CH

802.11n(HT40) U-NII-3 High CH

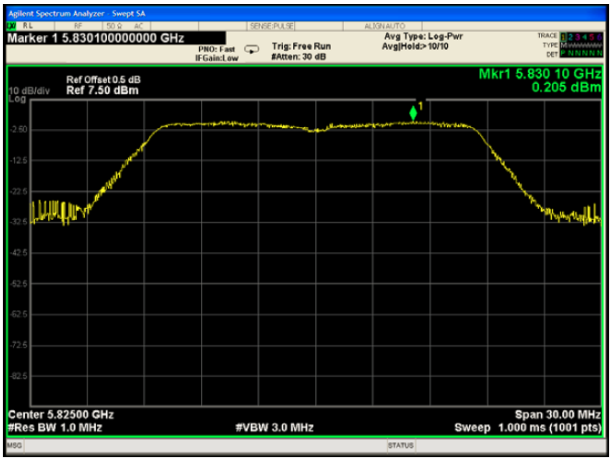


802.11ac(HT20) U-NII-3 Low CH

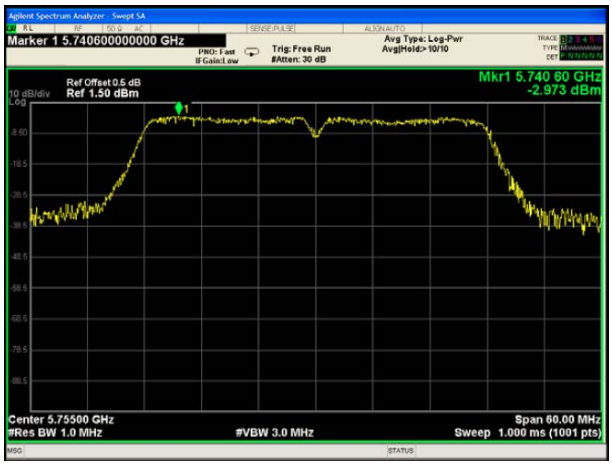
802.11ac(HT20) U-NII-3 Middle CH



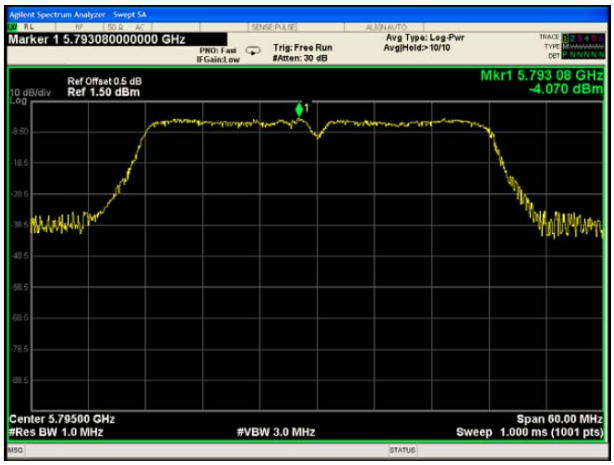
802.11ac(HT20) U-NII-3 High CH



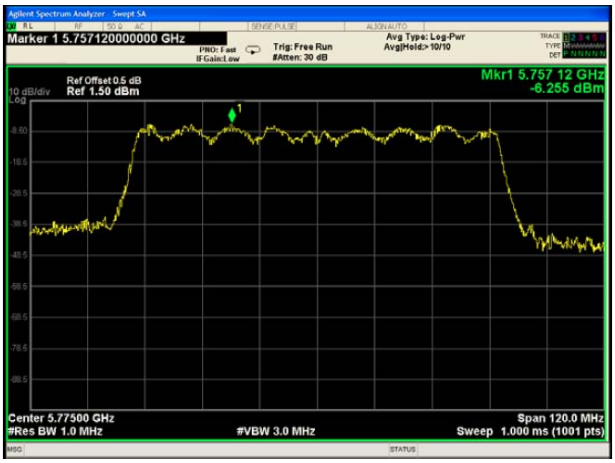
802.11ac(HT40) U-NII-3 Low CH



802.11ac(HT40) U-NII-3 High CH



802.11ac(HT80) U-NII-3 Low CH



6. FREQUENCY STABILITY MEASUREMENT

6.1 LIMIT

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

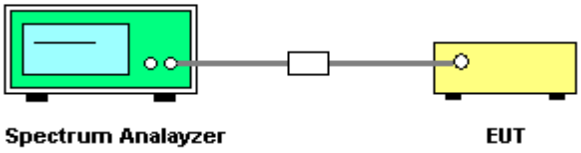
6.2 TEST PROCEDURE

(1) To ensure emission at the band edge is maintained within the authorized band, those values shall be measured by radiation emissions at upper and lower frequency points, and finally compensated by frequency deviation as procedures below.

(2) The EUT was operated at the maximum output power, and connected to the spectrum analyzer, which is set to maximum hold function and peak detector. The peak value of the power envelope was measured and noted. The upper and lower frequency points were respectively measured relatively 10dB lower than the measured peak value.

(3) The frequency deviation was calculated by adding the upper frequency point and the lower frequency point divided by two. Those detailed values of frequency deviation are provided in table below.

6.3 TEST SETUP



6.4 TEST RESULTS

U-NII-1 Test Frequency:5180MHz				
Temperature (℃)	Power Supply (DC V)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	12	/	/	/
45		1807	2.1599	20
30		1800	2.1516	20
20		1806	2.1587	20
10		1800	2.1516	20
0		1803	2.1552	20
-10		1800	2.1516	20
-15		1809	2.1623	20
-30		/	/	/
20	10.8	1810	2.1635	20
20	13.2	1798	2.1492	20

U-NII-3 Test Frequency:5785MHz				
Temperature (℃)	Power Supply (DC V)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	12	/	/	/
45		1919	2.2938	20
30		1911	2.2842	20
20		1915	2.2890	20
10		1923	2.2986	20
0		1907	2.2795	20
-10		1908	2.2807	20
-15		1914	2.2878	20
-30		/	/	/
20	10.8	1918	2.2926	20
20	13.2	1906	2.2783	20

7. Band edge

7.1 LIMIT

For transmitters operating in the 5.15-5.25 GHz and 5.725-5.85G band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27 dBm/MHz.

-27 dBm/MHz Limit=95.2+EIRP[dBm]=95.2-27=68.2 dBμV/m

7.2 TEST PROCEDURE

(1) EUT height should be 0.8m for below 1GHz at a semi□ anechoic chamber while EUT height should be 1.5m for above 1GHz at full chamber or semi□ anechoic chamber ground with absorbers

(2) Test antenna was located 3m from the EUT on an adjustable mast, and the antenna used as below table.

Test frequency range	Test antenna used	Test distance
9kHz-30MHz	Active Loop antenna	3m
30MHz-1GHz	Trilog Broadband Antenna	3m
1GHz-18GHz	Double Ridged Horn Antenna(1GHz-18GHz)	3m
18GHz-40GHz	Horn Antenna(18GHz-40GHz)	1m

According ANSI C63.10:2013 clause 6.4.4.2 and 6,5.3, for measurements below 30 MHz, the loop antenna was positioned with its plane vertical from the EUT and rotated about its vertical axis for maximum response at each azimuth position around the EUT. And the loop antenna also be positioned with its plane horizontal at the specified distance from the EUT. The center of the loop is 1 m above the ground. for measurement above 30MHz, the Trilog Broadband Antenna or Horn Antenna was located 3m from EUT, Measurements were made with the antenna positioned in both the horizontal and vertical planes of Polarization, and the measurement antenna was varied from 1 m to 4 m. in height above the reference ground plane to obtain the maximum signal strength.

(4) Below pre-scan procedure was first performed in order to find prominent frequency spectrum radiated emissions from 9kHz to 40GHz:

(a) Scanning the peak frequency spectrum with the antenna specified in step (3), and the EUT was rotated 360 degree, the antenna height was varied from 1m to 4m (Except loop antenna, it’s fixed 1m above ground.)

(b) Change work frequency or channel of device if practicable.

(c) Change modulation type of device if practicable.

(d) Change power supply range from 85% to 115% of the rated supply voltage

(e) Rotated EUT though three orthogonal axes to determine the attitude of EUT arrangement produces highest emissions.

Spectrum frequency from 9kHz to 40GHz (tenth harmonic of fundamental frequency) was investigated, and no any obvious emission were detected from 9kHz to 30MHz and 18GHz to 40GHz, so below final test was performed with frequency range from 30MHz to 18GHz.

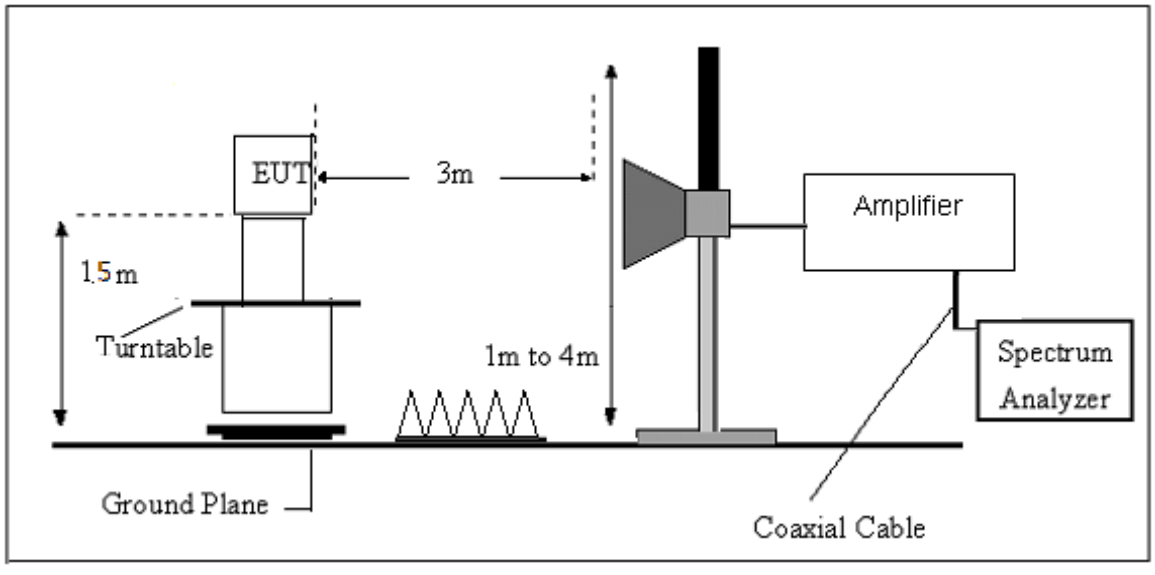
(6) The emissions from 9kHz to 1GHz were measured based on CISPR QP detector except for the frequency bands 9-90kHz, 110-490kHz, for emissions from 9kHz-90kHz,110kHz-490kHz and above 1GHz were measured based on average detector, for emissions above 1GHz, peak emissions also be measured and need comply with Peak limit

(7) The emissions from 9kHz to 1GHz, QP or average values were measured with EMI receiver with below RBW

Frequency band	RBW
9kHz-150kHz	200Hz
150kHz-30MHz	9kHz
30MHz-1GHz	120kHz

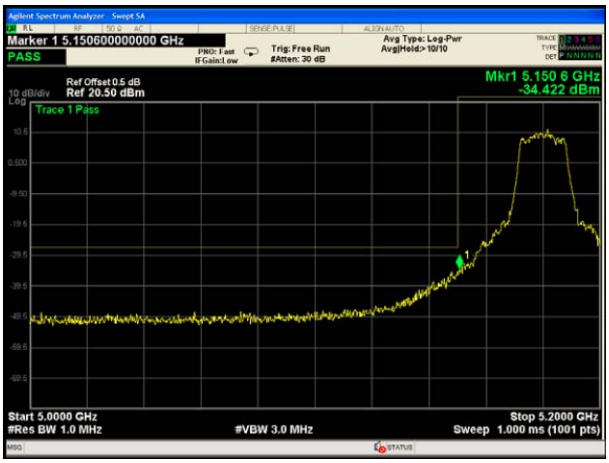
(8) For emissions above 1GHz, both Peak and Average level were measured with Spectrum Analyzer, and the RBW is set at 1MHz, VBW is set at 3MHz, Peak detector for Peak measure, RMS detector for AV value

7.3 TEST SETUP



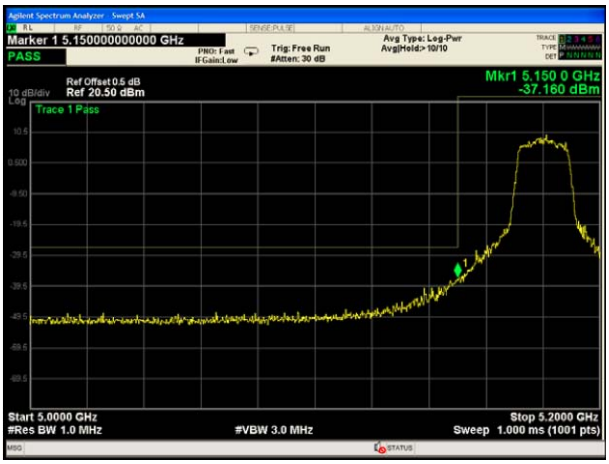
7.5 TEST RESULTS

802.11 a UNII-1 Band edge-left side

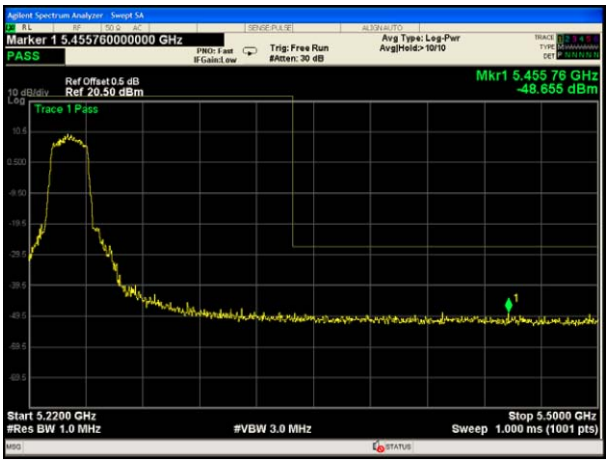


802.11 a UNII-1 Band edge-right side

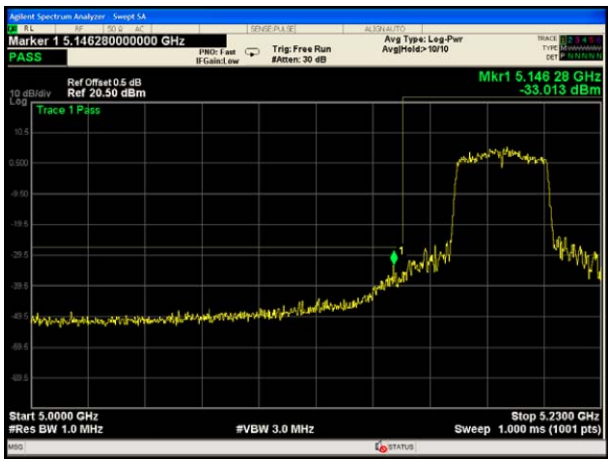
802.11 n(HT20)UNII-1 Band edge-left side



802.11n(HT20)UNII-1 Band edge-right side

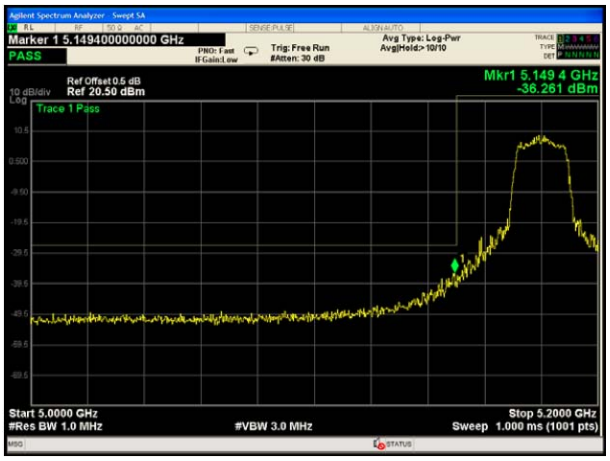


802.11 n(HT40)UNII-1 Band edge-left side

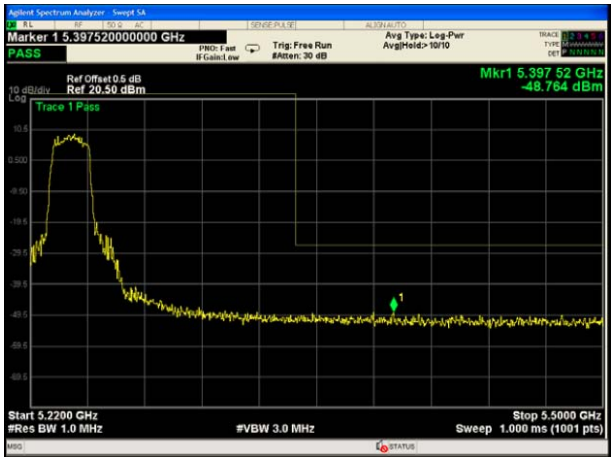


802.11n(HT40)UNII-1 Band edge-right side

802.11 ac(HT20)UNII-1 Band edge-left side



802.11 ac(HT20)UNII-1 Band edge-right side



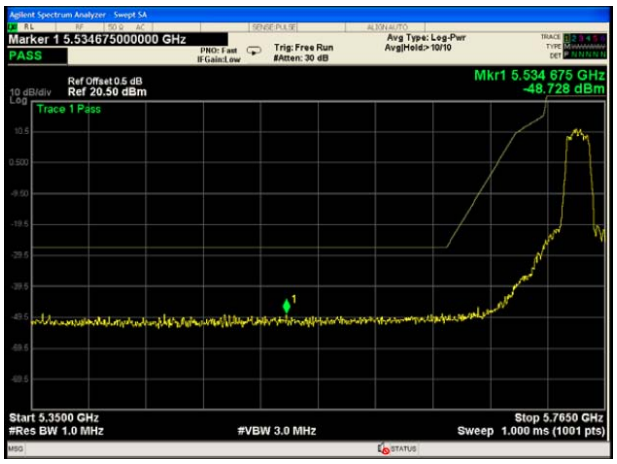
802.11 ac(HT40)UNII-1 Band edge-left side

802.11 ac(HT40)UNII-1 Band edge-right side

802.11 ac(HT80)UNII-1 Band edge-left side

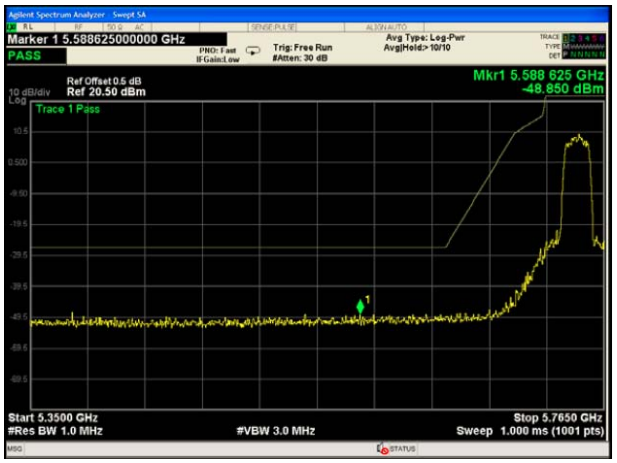
802.11 ac(HT80)UNII-1 Band edge-right side

802.11 a UNII-3 Band edge-left side



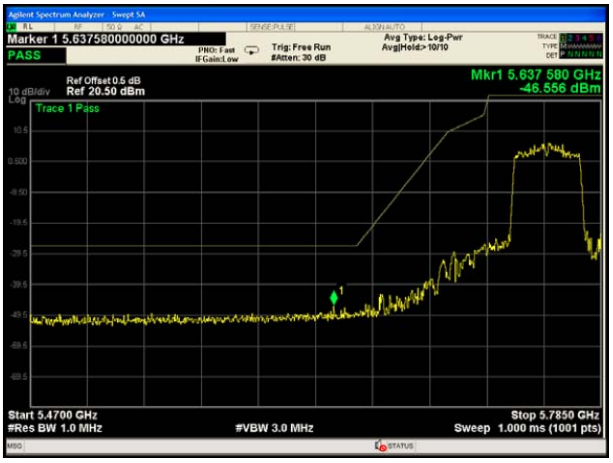
802.11 a UNII-3 Band edge- right side

802.11 n(HT20)UNII-3 Band edge-left side



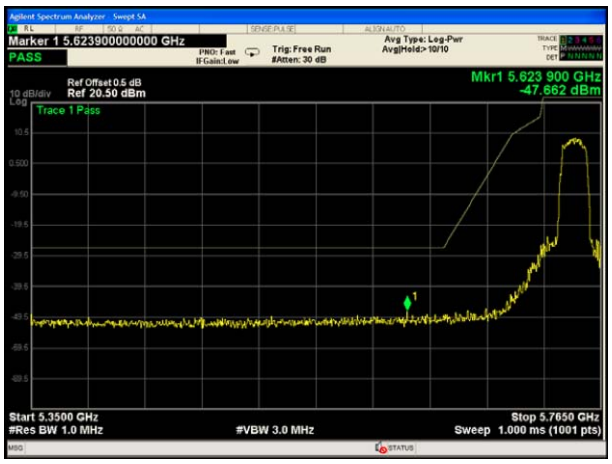
802.11n(HT20)UNII-3 Band edge- right side

802.11 n(HT40)UNII-3 Band edge-left side

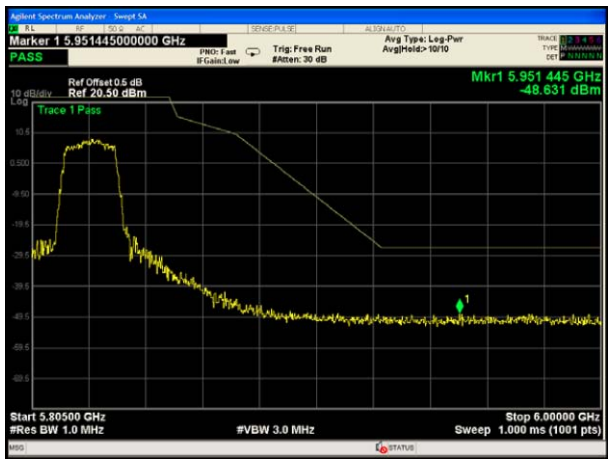


802.11n(HT40)UNII-3 Band edge- right side

802.11ac(HT20)UNII-3 Band edge-left side



802.11 ac (HT20)UNII-3 Band edge- right side

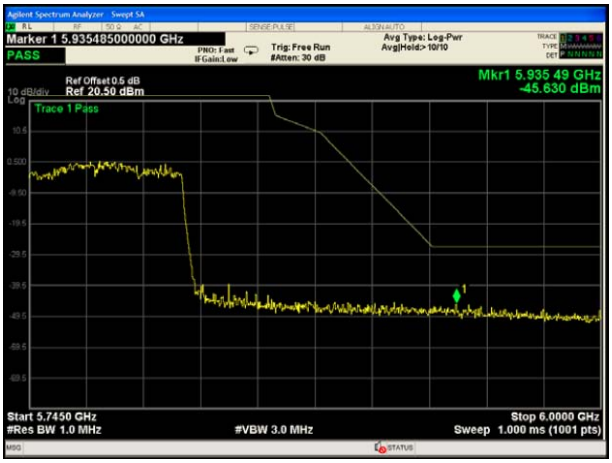


802.11ac(HT40)UNII-3 Band edge-left side

802.11 ac (HT40)UNII-3 Band edge- right side

802.11ac(HT80)UNII-3 Band edge-left side

802.11 ac (HT80)UNII-3 Band edge- right side



8. Duty Cycle

8.1 TEST REQUIREMENT

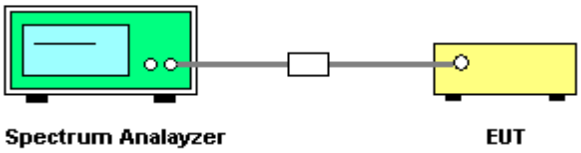
47 CFR Part 15C 15.407 and 789033 D02 General UNII Test Procedures New Rules v02r01(December 14, 2017), Section (B)

ANSI C63.10: 2013

8.2 TEST PROCEDURE

(1) Connect EUT's antenna output to spectrum analyzer by RF cable.

7.3 TEST SETUP



8.4 TEST RESULTS

UNII-1 a Mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
Low CH	100	100	100
Middle CH	100	100	100
High Ch	100	100	100

UNII-1 n(HT20) Mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
Low CH	100	100	100
Middle CH	100	100	100
High CH	100	100	100

UNII-1 n(HT40) Mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
Low CH	100	100	100
High CH	100	100	100

UNII-1 ac(HT20) Mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
Low CH	100	100	100
Middle CH	100	100	100
High CH	100	100	100

UNII-1 ac(HT40) Mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
Low CH	100	100	100
High CH	100	100	100

UNII-1 ac(HT80) Mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
Low CH	100	100	100

UNII-3 a Mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
Low CH	100	100	100
Middle CH	100	100	100
High Ch	100	100	100

UNII-3 n(HT20) Mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
Low CH	100	100	100
Middle CH	100	100	100
High CH	100	100	100
UNII-3 n(HT40) Mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
Low CH	100	100	100
High CH	100	100	100

UNII-3 ac(HT20) Mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
Low CH	100	100	100
Middle CH	100	100	100
High CH	100	100	100

UNII-3 ac(HT40) Mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
Low CH	100	100	100
High CH	100	100	100
UNII-3 ac(HT80) Mode			
channel	On time(ms)	Period(ms)	Duty Cycle(%)
Low CH	100	100	100

9 RADIATED EMISSION MEASUREMENT

9.1 RADIATED EMISSION LIMITS

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

For Radiated Emission

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/AV
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier hamonic(Peak/AV)
RB / VB (emission in restricted band)	PK=1MHz / 1MHz, AV=1 MHz /10 Hz

9.2 TEST PROCEDURE

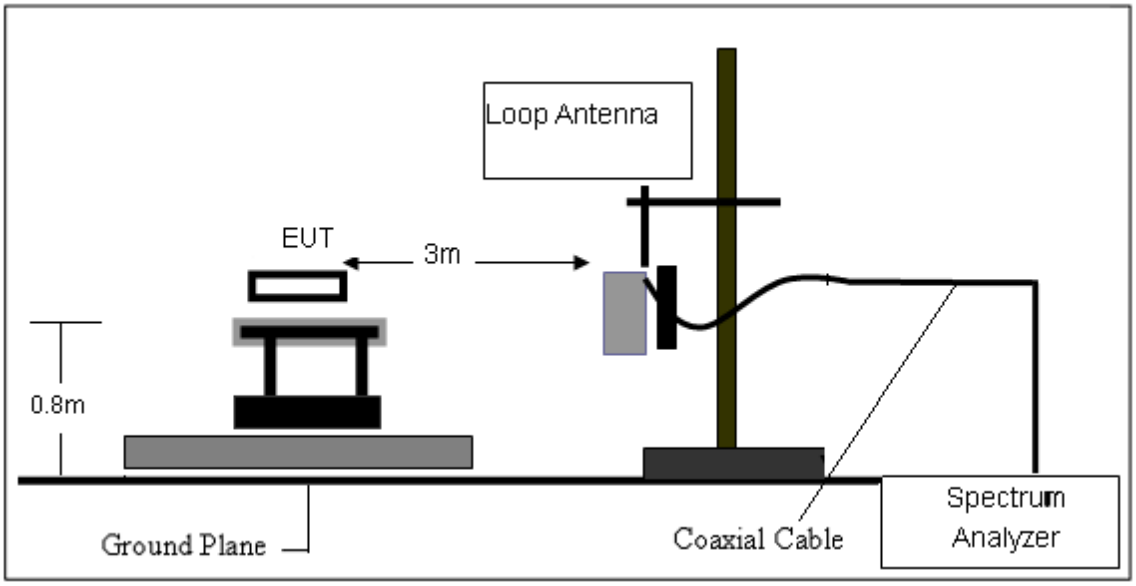
a. The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz,and above 1GHz.
b. The EUT was placed on the top of a rotating table 0.8 meters (above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment shall be 0.8 m(above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. horizontal and vertical polarizations of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then QuasiPeak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

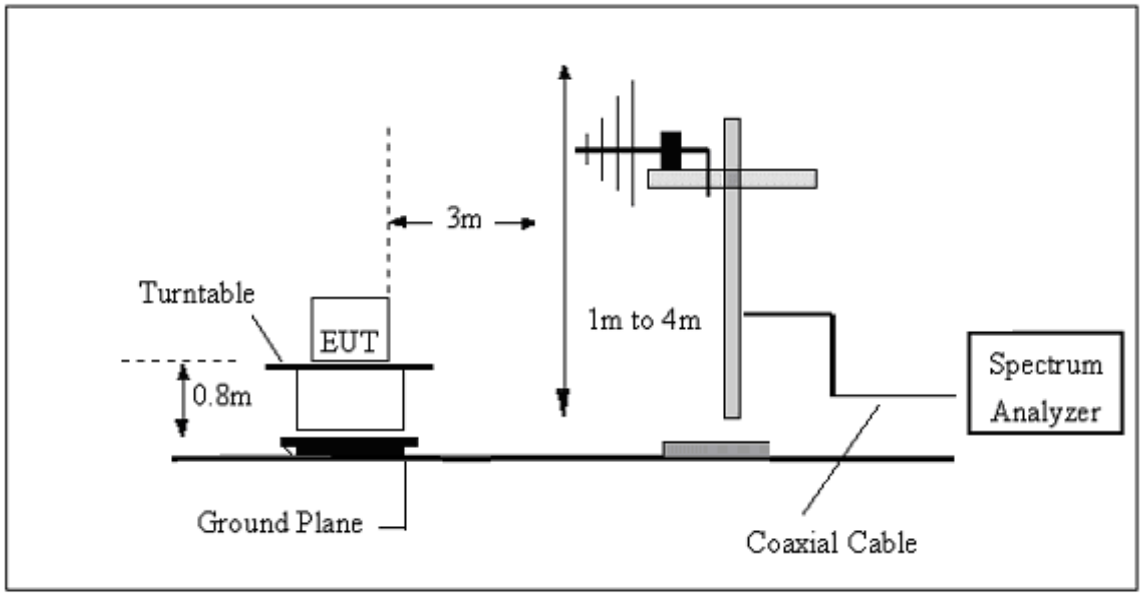
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

9.3 TESTSETUP

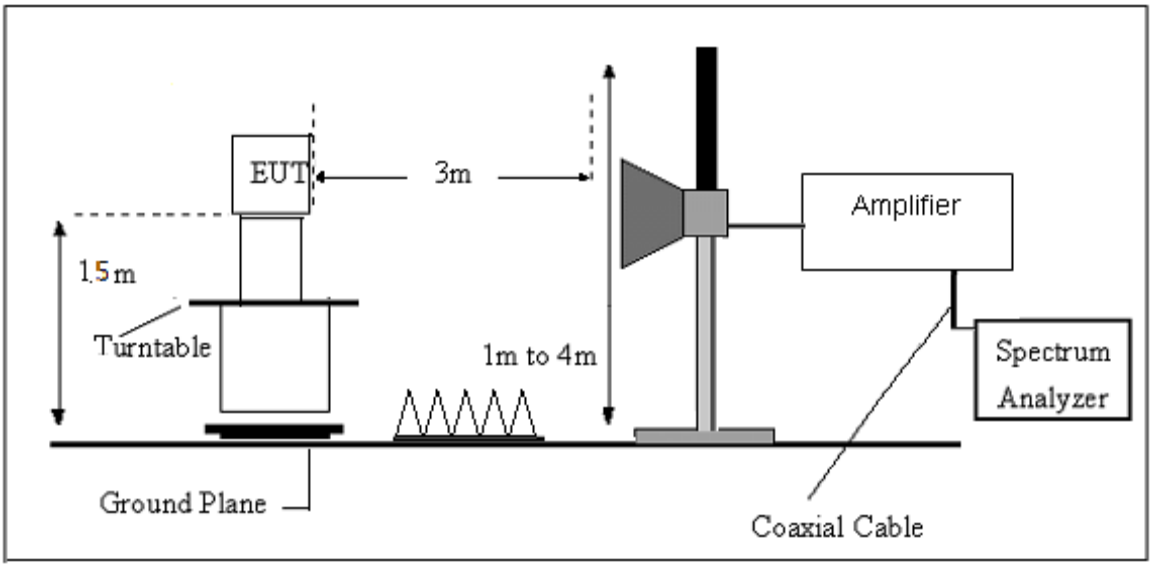
（A）Radiated Emission Test-Up Frequency Below 30MHz



（B）Radiated Emission Test-Up Frequency 30MHz~1GHz



（C）Radiated Emission Test-Up Frequency Above 1GHz



9.4. TEST RESULTS

(9KHz-30MHz)

Temperature:	22.7℃	Relative Humidity:	61%
Test Voltage:	DC 12V	Test Mode:	/

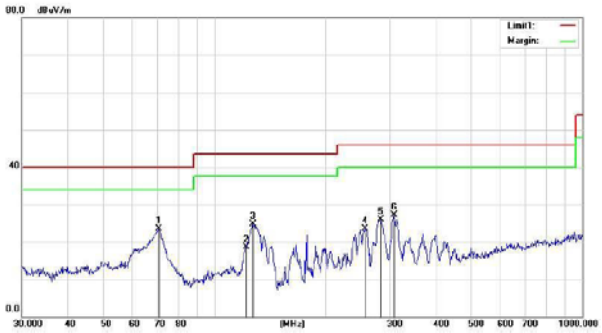
Note:
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

.

(30MHz-1000MHz)

All models are tested. Only show worst data on report, the worst data is UNII-1 a Low CH Mode

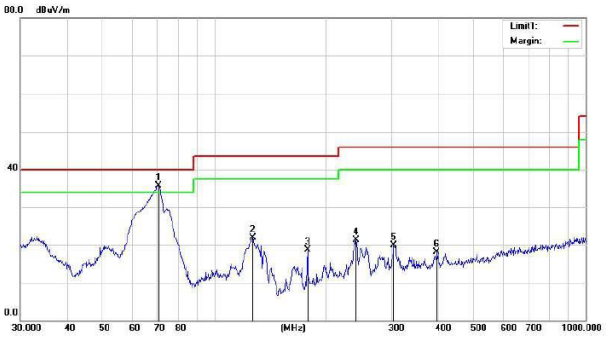
Hor.



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	70.5836	44.12	-20.53	23.59	40.00	-16.41	QP
2	122.4040	39.40	-20.98	18.42	43.50	-25.08	QP
3	127.2176	46.45	-21.65	24.80	43.50	-18.70	QP
4	256.5211	40.99	-17.52	23.47	46.00	-22.53	QP
5	282.9852	42.44	-16.62	25.82	46.00	-20.18	QP
6	307.8313	42.95	-15.87	27.08	46.00	-18.92	QP

Remark:
1. Margin = Result (Result =Reading + Factor)–Limit

Ver.



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	70.5836	75.96	-40.24	35.72	40.00	-4.28	QP
2	126.7723	62.17	-40.24	21.93	43.50	-21.57	QP
3	178.1327	59.04	-40.24	18.80	43.50	-24.70	QP
4	240.8304	61.53	-40.24	21.29	46.00	-24.71	QP
5	304.6100	60.13	-40.24	19.89	46.00	-26.11	QP
6	397.6334	58.26	-40.24	18.02	46.00	-27.98	QP

Remark:
1. Margin = Result (Result =Reading + Factor)–Limit

(1000MHz~40GHz) Restricted band and Spurious emission Requirements

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
802.11a U-NII-1 Low Channel 5180MHz									
4511.94	51.02	PK	6	1.2	H	-2.03	48.99	74.00	-25.01
4511.94	45.76	Ave	6	1.2	H	-2.03	43.73	54.00	-10.27
5148.65	53.26	PK	116	1.6	H	-1.02	52.24	74.00	-21.76
5148.65	47.58	Ave	116	1.6	H	-1.02	46.56	54.00	-7.44
10360.00	41.67	PK	194	1.5	H	5.33	47.00	74.00	-27.00
10360.00	38.16	Ave	194	1.5	H	5.33	43.49	54.00	-10.51
802.11a U-NII-1 Middle channel 5200MHz									
4502.78	52.02	PK	188	1.4	H	-1.94	50.08	74.00	-23.92
4502.78	44.27	Ave	188	1.4	H	-1.94	42.33	54.00	-11.67
5135.42	53.01	PK	31	1.1	H	-1.06	51.95	74.00	-22.05
5135.42	47.98	Ave	31	1.1	H	-1.06	46.92	54.00	-7.08
10400.00	42.38	PK	186	1.3	H	5.21	47.59	74.00	-26.41
10400.00	37.91	Ave	186	1.3	H	5.21	43.12	54.00	-10.88
802.11a U-NII-1 High channel 5240MHz									
4537.16	44.80	Ave	242	1.8	H	-2.24	42.56	54.00	-11.44
5145.04	54.65	PK	211	1.5	H	-1.09	53.56	74.00	-20.44
5145.04	49.39	Ave	211	1.5	H	-1.09	48.30	54.00	-5.70
10480.00	41.19	PK	337	1.1	H	5.14	46.33	74.00	-27.67
10480.00	39.49	Ave	337	1.1	H	5.14	44.63	54.00	-9.37

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.407/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
802.11a U-NII-3 Low Channel 5745MHz									
4532.62	50.61	PK	6	1.4	H	-2.06	48.55	74.00	-25.45
4532.62	46.18	Ave	6	1.4	H	-2.06	44.12	54.00	-9.88
11490.00	41.55	PK	271	1.9	H	5.93	47.48	68.20	-20.72
11490.00	39.43	Ave	271	1.9	H	5.93	45.36	54.00	-8.64
5385.82	46.90	PK	97	1.8	H	-1.25	45.65	74.00	-28.35
5385.82	38.68	Ave	97	1.8	H	-1.25	37.43	54.00	-16.57
802.11a U-NII-3 middle channel 5785MHz									
4503.12	50.86	PK	38	1.9	H	-2.03	48.83	74.00	-25.17
4503.12	45.11	Ave	38	1.9	H	-2.03	43.08	54.00	-10.92
11570.00	41.74	PK	234	1.7	H	5.81	47.55	68.20	-20.65
11570.00	39.56	Ave	234	1.7	H	5.81	45.37	54.00	-8.63
5380.67	45.96	PK	171	1.4	H	-1.22	44.74	74.00	-29.26
5380.67	39.61	Ave	171	1.4	H	-1.22	38.39	54.00	-15.61
802.11a U-NII-3 High channel 5825MHz									
4524.23	50.46	PK	251	1.2	H	-1.84	48.62	74.00	-25.38
4524.23	44.17	Ave	251	1.2	H	-1.84	42.33	54.00	-11.67
11650.00	41.36	PK	268	1.5	H	5.84	47.20	68.20	-21.00
11650.00	39.64	Ave	268	1.5	H	5.84	45.48	54.00	-8.52
5386.92	45.16	PK	59	1.1	H	-1.30	43.86	74.00	-30.14
5386.92	39.67	Ave	59	1.1	H	-1.30	38.37	54.00	-15.63

Note:
All model are tested. Only show worst data on report

10 CONDUCTED EMISSION TEST

10.1.1 POWER LINE CONDUCTED EMISSION LIMITS

Operating frequency band. In case the emission fall within the restricted band specified on Part 207(a) limit in the table below has to be followed.

FREQUENCY (MHz)	Conducted Emissionlimit (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

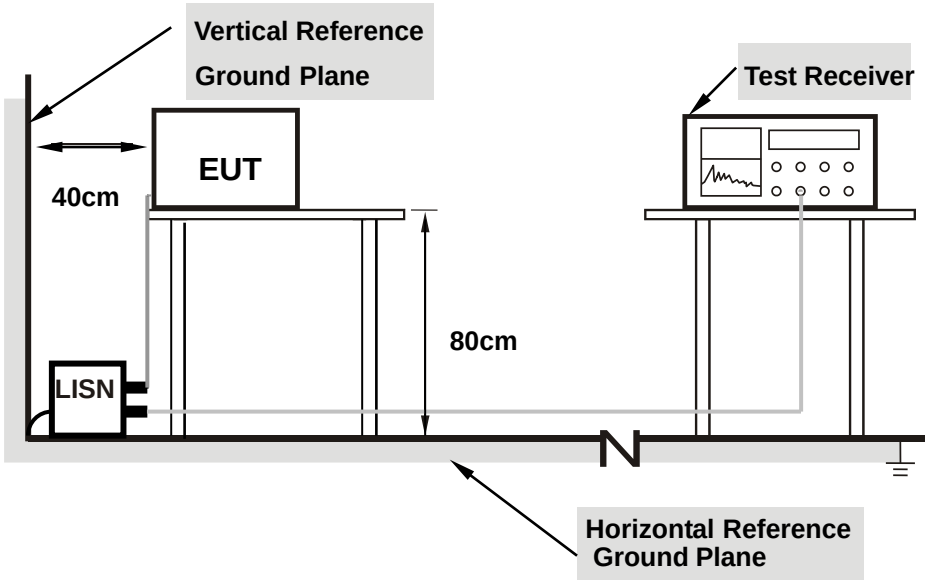
The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

10.2 TEST PROCEDURE

a. The EUT was 0.8 meters from the horizontal ground plane and 0.4 meters from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN at least 80 cm from nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

10.3 TEST SETUP



Note: 1.Support units were connected to second LISN.

2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

10 .4 TEST RESULT

Temperature:	22.1 ℃	Relative Humidity:	56%
Test Voltage:	DC 12V	Phase:	L/N
Test Mode:	NA		
Test Result:	NA		

11. ANTENNA REQUIREMENT

11.1 STANDARD REQUIREMENT

For intentional device, according to FCC 47 CFR 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

11.2 RESULT

The antennas used for this product are external antenna and no other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is 1.0.dBi.

※※※※※END OF THE REPORT※※※※※