

## FCC Test Report

**Report No.:** RF131203E01B-1

**FCC ID:** TX2-RTL8821AU

**Test Model:** RTL8821AU

**Received Date:** Dec. 21, 2015

**Test Date:** Dec. 25 to 29, 2015 and Jan. 06, 2016

**Issued Date:** Feb. 03, 2016

**Applicant:** Realtek Semiconductor Corp.

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### Release Control Record

Issue No.	Description	Date Issued
RF131203E01B-1	Original release.	Feb. 03, 2016



## 2 Summary of Test Results

47 CFR FCC Part 15, Subpart E (SECTION 15.407)			
FCC Clause	Test Item	Result	Remarks
15.407(b) (1/2/3/4/6)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -1.6dB at 5715.00MHz.
15.407(a)(1/2 /3)	Max Average Transmit Power	PASS	Meet the requirement of limit.
15.407(a)(1/2 /3)	Peak Power Spectral Density	PASS	Meet the requirement of limit.
15.407(e)	6dB bandwidth	PASS	Meet the requirement of limit. (U-NII-3 Band only)
15.407(g)	Frequency Stability	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	Antenna connector is IPEX not a standard connector.

**NOTE:** 1. Upgraded the standard to section 15.407 under new rule.

### 2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.19 dB
Radiated Emissions above 1 GHz	1GHz ~6GHz	3.43 dB
	6GHz ~ 18GHz	3.49 dB
	18GHz ~ 40GHz	4.11 dB

### 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT (WLAN)

Product	802.11a/b/g/n/ac RTL8821AU Combo module
Brand	Realtek
Test Model	RTL8821AU
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	DC 3.3V from host equipment
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode only
Modulation Technology	DSSS, OFDM, DTS
Transfer Rate	802.11b: up to 11Mbps 802.11a / g: up to 54Mbps 802.11n: up to 150Mbps 802.11ac: up to 433.4Mbps
Operating Frequency	<b>For 15.407</b> 5.18 ~ 5.24GHz, 5.26 ~ 5.32GHz, 5.50 ~ 5.58GHz, 5.66GHz ~ 5.70GHz & 5.745 ~ 5.825GHz <b>For 15.247</b> 2.412 ~ 2.462GHz
Number of Channel	<b>For 15.407</b> 21 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 9 for 802.11n (HT40), 802.11ac (VHT40) 4 for 802.11ac (VHT80) <b>For 15.247</b> 11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40)
Output Power	<b>For 15.407(U-NII-3 band)</b> 802.11a: 67.764mW 802.11ac (VHT20): 68.077mW 802.11ac (VHT40): 65.464mW 802.11ac (VHT80): 13.49mW <b>For 15.407 (U-NII-1, U-NII-2A and U-NII-2C Bands)</b> 802.11a: 69.823mW 802.11ac (VHT20): 69.343mW 802.11ac (VHT40): 71.285mW 802.11ac (VHT80): 20.701mW <b>For 15.247 (2.4GHz)</b> 802.11b: 123.310mW 802.11g: 293.765mW 802.11n (HT20): 264.850mW 802.11n (HT40): 213.304mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x 1
Data Cable Supplied	NA

**Note:**

1. This report is prepared for FCC class II permissive change. The difference compared with the Report No.: RF131203E01-1 design is as the following:
  - ◆ Upgraded the standard to section 15.407 under new rule.
  - ◆ Changed product name.
2. For U-NII-1, U-NII-2A and 2C Bands: There is no increase in authorized power level, so RF test refer original test report (Report No.: RF131203E01-1).
3. According to above conditions, therefor only U-NII-3 band and DFS need to be performed (except for Conducted Emission test item). And all data was verified to meet the requirements.
4. There are Bluetooth technology and WLAN technology used for the EUT.
5. For WLAN: 2.4GHz and 5GHz technology cannot transmit at same time.
6. The antennas provided to the EUT, please refer to the following table:

No.	Brand	Model	Antenna Type	Peak gain with cable loss (dBi) (2.4GHz)	Peak gain with cable loss(dBi) (5GHz)	Cable Loss (dB) (2.4GHz)	Cable Loss (dB) (5GHz)	Connector Type
1	LYNwave	ALA110-222050-300010 (Main) ALA110-222050-300010 (Aux)	PIFA	3.5 3.5	5 5	NA NA	NA NA	IPEX
2	WGT	SKA91WMPB02+A (Tx1) SKA91WMPB01+A (Tx2)	PIFA	0.82 -2.23	0.94 2.18	-1.32 -0.75	-2.04 -1.17	IPEX
3	JEM	1510-0122-0027 (Tx1) 1510-0122-0027 (Tx2)	PIFA	3.23 2.31	4.89 1.89	NA NA	NA NA	RF
4	FVC	K05007014501(6-23-7W25H-010) (Tx1) K05007014501(6-23-7W25H-010) (Tx2)	PIFA	2.85 1.59	2.46 2.91	NA NA	NA NA	IPEX
5	JEM	1510-0122-0022(IA-120073) (Tx1) 1510-0122-0022(IA-120073) (Tx2)	PIFA	2.23 2.21	1.69 1.84	NA NA	NA NA	RF
6	WGT	SK81WMPB01+A (Tx1) SK81WMPB02+A (Tx2)	PIFA	1.79 0.66	1.49 -0.40	-1.88 -2.95	-3.17 -4.96	IPEX
7	WGT	SKW2UWMPB01+A (Tx1) SKW2UWMPB01+A (Tx2)	PIFA	1.36 2.88	1.92 3.16	NA NA	NA NA	IPEX
8	WGT	SKW25WMPB01+A (Tx1) SKW25WMPB01+A (Tx2)	PIFA	0.72 0.49	-0.72 -0.71	-1.41 -1.39	-2.18 -2.15	IPEX
9	WGT	SK549WMPB01+A (Tx1) SK549WMPB02+A (Tx2)	PIFA	-0.17 -2.24	-0.13 0.03	-1.04 -0.88	-1.94 -1.64	IPEX
10	WGT	SK110WMPB01+A (Tx1) SK110WMPB02+A (Tx2)	PIFA	1.05 -0.41	1.08 2.32	-0.98 -0.99	-1.52 -1.54	IPEX
11	WGT	SKW31WMPB01+A (Tx1) SKW31WMPB01+A (Tx2)	PIFA	1.85 3.14	1.74 2.10	NA NA	NA NA	IPEX
12	FVC	6-23-7B51M-031 (Tx1) 6-23-7B51M-031 (Tx2)	PIFA	1.58 1.75	2.54 2.24	NA NA	NA NA	IPEX
13	FVC	6-23-7E51Q-011 (Tx1) 6-23-7E51Q-011 (Tx2)	PIFA	2.70 2.19	1.57 2.94	NA NA	NA NA	IPEX
14	FVC	6-23-7B710-022 (WM1) 6-23-7B710-022 (WM2)	PIFA	1.51 2.04	2.99 3.02	NA NA	NA NA	IPEX
15	WGT	SKM11WMPB03+A (Tx1) SKM11WMPB02+D (Tx2)	PIFA	-1.84 -2.93	0.44 1.35	1.17 0.89	2.02 1.54	IPEX
16	WGT	SKW23WMPB01+A (Tx1) SKW23WMPB02+A (Tx2)	PIFA	-1.61 -2.84	-0.14 -0.96	-2.10 -2.07	-3.25 -3.20	IPEX



No.	Brand	Model	Antenna Type	Peak gain with cable loss (dBi) (2.4GHz)	Peak gain with cable loss(dBi) (5GHz)	Cable Loss (dB) (2.4GHz)	Cable Loss (dB) (5GHz)	Connector Type
17	WGT	SKW24WMPB01+B (WM1) SKW24WMPB01+B (WM2)	PIFA	1.25 3.17	1.95 2.42	NA	NA	IPEX
18	FVC	K05007015501(6-23-7W244-020-1) (Tx1) K05007015501(6-23-7W244-020-1) (Tx2)	PIFA	2.53 2.28	2.86 2.97	NA	NA	IPEX
19	FVC	K05007014201(6-23-7W25P-020) (Tx1) K05007014201(6-23-7W25P-020) (Tx2)	PIFA	3.00 1.52	2.82 2.21	NA	NA	IPEX
20	WGT	SKW10WMPB01+A (Tx1) SKW10WMPB02+A (Tx2)	PIFA	0.85 0.44	0.75 1.24	-1.56 -1.53	-2.42 -2.36	IPEX
21	WGT	SKCZTWMPB01+A (Tx1) SKCZTWMPB02+A (Tx2)	PIFA	0.46 -0.79	2.80 1.03	-1.56 -1.53	-2.42 -2.36	IPEX
22	JEM	IA-120266 (Tx1) IA-120267 (Tx2)	PIFA	2.60 0.53	2.61 2.60	2.12 1.76	3.48 2.87	IPEX
23	WGT	SK547WMPB01+A (Tx1) SK549WMPB02+A (Tx2)	PIFA	-0.66 0.78	-0.19 2.06	-1.42 -1.43	-2.20 -2.21	IPEX
24	WGT	SK555WMPB01+B (Tx1) SK555WMPB02+B (Tx2)	PIFA	0.76 0.09	1.97 0.56	-1.83 -1.80	-2.83 -2.78	IPEX
25	WGT	SK65EWMPB01+A (Tx1) SK650WMPB02+A (Tx2)	PIFA	0.42 -0.13	0.11 1.27	-1.56 -0.61	-2.41 -0.94	IPEX
26	WGT	SK670WMPB01+A (Tx1) SK670WMPB02+A (Tx2)	PIFA	1.48 1.15	-0.44 0.42	-2.47 -1.93	-3.82 -2.99	IPEX
27	WGT	SK740WMPB01+A (Tx1) SK740WMPB02+A (Tx2)	PIFA	-0.93 0.20	0.96 0.86	-1.39 -1.26	-2.16 -1.95	IPEX
28	WGT	SK840WMPB01+B_SN (Tx1) SK840WMPB01+B_SN (Tx2)	PIFA	3.03 0.55	4.16 0.90	-1.12 -1.20	-1.74 -1.86	IPEX
29	WGT	SK94SWMPB01+B (TX1) SK94SWMPB01+B (TX2)	PIFA	0.76 0.46	1.12 1.44	-0.32 -0.44	-0.50 -0.68	IPEX
30	WGT	SK94TWMPB01+B (TX1) SK94TWMPB01+B (TX2)	PIFA	1.32 1.86	2.59 1.57	-0.59 -0.71	-0.91 -1.10	IPEX
31	WGT	SK50SWMPB01+A (TX1) SK50SWMPB02+A (TX2)	PIFA	-0.03 -0.13	1.25 2.13	-0.86 -0.72	-1.32 -1.12	IPEX
32	WGT	SK94TWMPB01+D (TX1) SK94TWMPB01+D (TX2)	PIFA	1.32 1.86	2.59 1.57	-0.59 -0.71	-0.91 -1.10	IPEX
33	WGT	SKC45WMPB03+B (WM1) SKC45WMPB03+B (WM2)	PIFA	2.46 2.91	2.90 2.67	NA	NA	IPEX
34	FVC	K05007015801 (WM1) K05007015901 (WM2)	PIFA	3.12 1.01	3.51 1.93	NA	NA	RF
35	WGT	SK345WMPB01+A (WM1) SK345WMPB02+A (WM2)	PIFA	0.86 2.51	2.94 3.25	NA	NA	IPEX

No.	Brand	Model	Antenna Type	Peak gain with cable loss (dBi) (2.4GHz)	Peak gain with cable loss(dBi) (5GHz)	Cable Loss (dB) (2.4GHz)	Cable Loss (dB) (5GHz)	Connector Type
36	FVC	K05007014901 (WM1) K05007015001 (WM2)	PIFA	1.85 1.94	1.35 1.99	NA	NA	IPEX
37	WGT	SKX51WMPB01+C (WM1) SKX51WMPB02+C (WM2)	PIFA	3.2 2.76	2.28 2.51	NA	NA	IPEX
38	INPAQ	WA-P-LB-02-122 (Main) WA-P-LB-01-072 (Aux)	PIFA	-1.41 -0.33	-2.44 -3.87	1.23 1.86	2.06 3.12	IPEX
39	Smart Approach	SE-ECZ50-001 (Tx1) SE-ECZ50-002 (Tx2)	PIFA	-1.37 -2.17	1.83 1.86	0.96 1.45	1.73 2.62	IPEX
40	INPAQ	WA-P-LB-02-121 (Main) WA-P-LB-01-071 (Aux)	PIFA	-2.26 -4.63	-2.87 -2.49	1.32 1.95	2.22 3.28	IPEX
41	Smart Approach	SE-ECZ70-001 (Tx1) SE-ECZ70-002 (Tx2)	PIFA	-0.65 -2.39	1.52 0.58	1.03 1.52	1.87 2.76	IPEX

**Note:** The **Antenna 1** was chosen for final test. The worst case was found in Aux. Therefore only the test data of the mode was recorded in this report.

7. The EUT incorporates a SISO function.

2.4GHz Band			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11b	1 ~ 11Mbps	1Tx (Diversity)	1Rx (Diversity)
802.11g	6 ~ 54Mbps	1Tx (Diversity)	1Rx (Diversity)
802.11n (HT20)	MCS 0~7	1Tx (Diversity)	1Rx (Diversity)
802.11n (HT40)	MCS 0~7	1Tx (Diversity)	1Rx (Diversity)
5GHz Band			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11a	6 ~ 54Mbps	1Tx (Diversity)	1Rx (Diversity)
802.11n (HT20)	MCS 0~7	1Tx (Diversity)	1Rx (Diversity)
802.11n (HT40)	MCS 0~7	1Tx (Diversity)	1Rx (Diversity)
802.11ac (VHT20)	MCS 0~8	1Tx (Diversity)	1Rx (Diversity)
802.11ac (VHT40)	MCS 0~9	1Tx (Diversity)	1Rx (Diversity)
802.11ac (VHT80)	MCS 0~9	1Tx (Diversity)	1Rx (Diversity)

The modulation and bandwidth are similar for 802.11n mode for 20MHz (40MHz) and 802.11ac mode for 20MHz (40MHz), therefore investigated worst case to representative mode in test report. (Final test mode refer section 3.2.1)

8. The above EUT information was declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

### 3.2 Description of Test Modes

#### FOR 5745 ~ 5825MHz:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

Channel	Frequency	Channel	Frequency
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz		

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775MHz

**3.2.1 Test Mode Applicability and Tested Channel Detail**

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	-	√	-

Where **RE≥1G**: Radiated Emission above 1GHz      **RE<1G**: Radiated Emission below 1GHz  
**PLC**: Power Line Conducted Emission      **APCM**: Antenna Port Conducted Measurement

**NOTE:**

1. "-" means no effect..

**Radiated Emission Test (Above 1GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6
802.11ac (VHT20)		149 to 165	149, 157, 165	OFDM	BPSK	6.5
802.11ac (VHT40)		151 to 159	151, 159	OFDM	BPSK	13.5
802.11ac (VHT80)		155	155	OFDM	BPSK	29.3

**Radiated Emission Test (Below 1GHz):**

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11ac (VHT20)	5745-5825	149 to 165	165	OFDM	BPSK	6

**Antenna Port Conducted Measurement:**

- This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6
802.11ac (VHT20)		149 to 165	149, 157, 165	OFDM	BPSK	6.5
802.11ac (VHT40)		151 to 159	151, 159	OFDM	BPSK	13.5
802.11ac (VHT80)		155	155	OFDM	BPSK	29.3

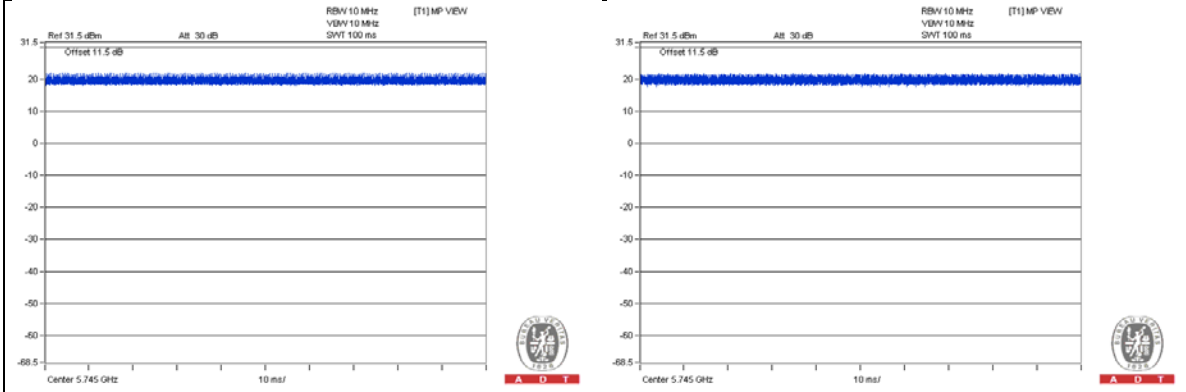
**Test Condition:**

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE $\geq$ 1G	23deg. C, 63%RH	120Vac, 60Hz	Jyunchun Lin
RE $<$ 1G	25deg. C, 62%RH	120Vac, 60Hz	Jyunchun Lin
APCM	25deg. C, 60%RH	120Vac, 60Hz	Gary Cheng

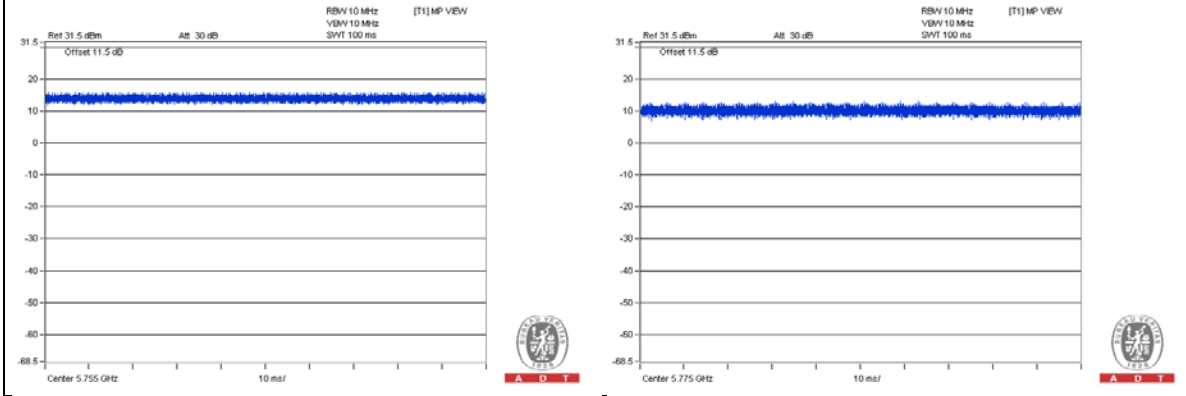
### 3.3 Duty Cycle of Test Signal

Duty cycle of test signal is 100 %, duty factor is not required.

**802.11a** **802.11ac (VHT20)**



**802.11ac (VHT40)** **802.11ac (VHT80)**



### 3.4 Description of Support Units

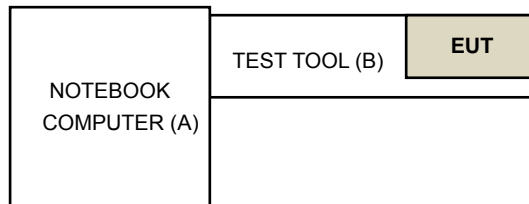
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook Computer	DELL	E5430	HYV4VY1	FCC DoC	Provided by Lab
B.	Test Tool	NA	NA	NA	NA	Supplied by Client

Note:

1. All power cords of the above support units are non-shielded (1.8m).

#### 3.4.1 Configuration of System under Test



### 3.5 General Description of Applied Standard

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart E (15.407)**

**KDB 789033 D02 General UNII Test Procedure New Rules v01**

ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.



## 4 Test Types and Results

### 4.1 Radiated Emission and Bandedge Measurement

#### 4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table.

Frequencies (MHz)	Field Strength (microvolts/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

#### NOTE:

- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = 20 log Emission level (uV/m).
- For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

#### LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

APPLICABLE TO	LIMIT	
789033 D02 General UNII Test Procedure New Rules v01	FIELD STRENGTH AT 3m	
	PK:74 (dBuV/m)	AV:54 (dBuV/m)
APPLICABLE TO	EIRP LIMIT	EQUIVALENT FIELD STRENGTH AT 3m
15.407(b)(1)	PK:-27 (dBm/MHz)	PK:68.2(dBuV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)	PK:-27 (dBm/MHz) <sup>*1</sup> PK:-17 (dBm/MHz) <sup>*2</sup>	PK: 68.2(dBuV/m) <sup>*1</sup> PK:78.2 (dBuV/m) <sup>*2</sup>

**NOTE:** <sup>\*1</sup> beyond 10MHz of the band edge <sup>\*2</sup> within 10 MHz of band edge

The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts).$$

**4.1.2 Test Instruments**

<b>DESCRIPTION &amp; MANUFACTURER</b>	<b>MODEL NO.</b>	<b>SERIAL NO.</b>	<b>CALIBRATED DATE</b>	<b>CALIBRATED UNTIL</b>
Test Receiver Agilent	N9038A	MY54450088	July 24, 2015	July 23, 2016
Pre-Amplifier <sup>(*)</sup> EMCI	EMC001340	980142	Jan. 13, 2014	Jan. 12, 2016
Loop Antenna <sup>(*)</sup> Electro-Metrics	EM-6879	264	Dec. 16, 2014	Dec. 15, 2016
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 18, 2015	Jan. 17, 2016
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-06	Nov. 11, 2015	Nov. 10, 2016
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Feb. 03, 2015	Feb. 02, 2016
RF Cable	8D	966-4-1 966-4-2 966-4-3	Apr. 03, 2015	Apr. 02, 2016
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Feb. 06, 2015	Feb. 05, 2016
Pre-Amplifier Agilent	8449B	3008A01922	Sep. 19, 2015	Sep. 18, 2016
RF Cable	EMC104-SM- SM-2000 EMC104-SM- SM-5000 EMC104-SM- SM-5000	150318 150323 150324	Mar. 31, 2015	Mar. 30, 2016
Pre-Amplifier EMCI	EMC184045	980143	Jan. 16, 2015	Jan. 15, 2016
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Feb. 05, 2015	Feb. 04, 2016
RF Cable	SUCOFLEX 102	36432/2 36441/2	Jan. 17, 2015	Jan. 16, 2016
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA
Power Meter Anritsu	ML2495A	1014008	Apr. 28, 2015	Apr. 27, 2016
Power Sensor Anritsu	MA2411B	0917122	Apr. 28, 2015	Apr. 27, 2016
Spectrum Analyzer R&S	FSP40	100060	May 08, 2015	May 07, 2016
Temperature & Humidity Chamber GIANTFORCE	GTH-150-40-S P-AR	MAA0812-008	Jan. 12, 2015	Jan. 11, 2016

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  2. \*The calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
  3. Loop antenna was used for all emissions below 30 MHz.
  4. The test was performed in 966 Chamber No. 4.
  5. The FCC Site Registration No. is 292998
  6. The CANADA Site Registration No. is 20331-2
- Tested Date: Dec. 25 to 29, 2015 and Jan. 06, 2016

#### 4.1.3 Test Procedure

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

**Note:**

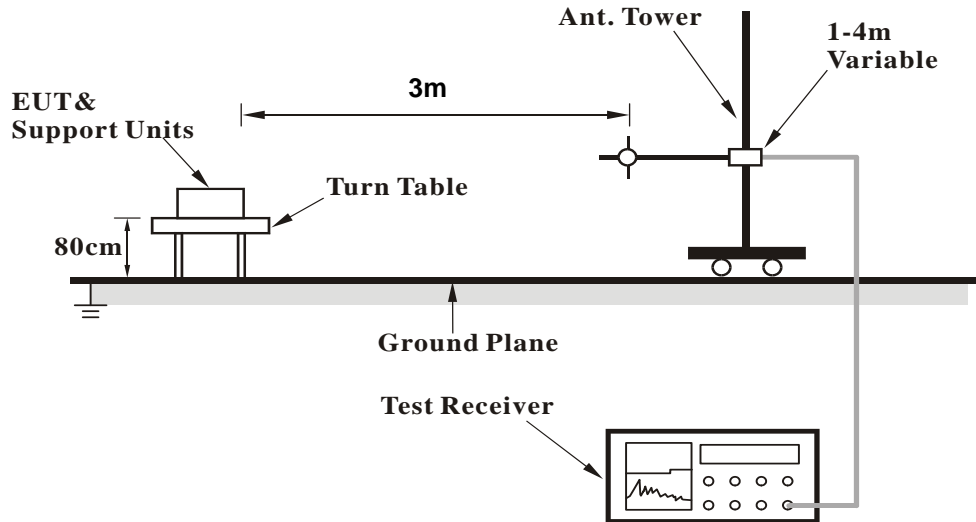
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ( $10 \log(1/\text{duty cycle})$ ).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle  $\geq 98\%$ ) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

#### 4.1.4 Deviation from Test Standard

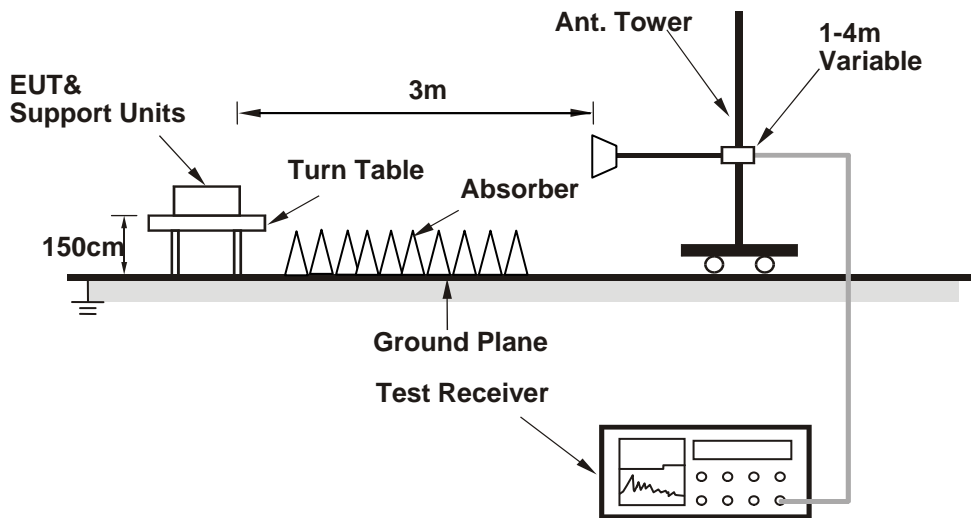
No deviation.

#### 4.1.5 Test Setup

##### <Frequency Range below 1GHz>



##### <Frequency Range above 1GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

#### 4.1.6 EUT Operating Condition

1. Connect the EUT with the support unit 1 (Notebook Computer) which is placed on a testing table.
2. The communication partner run test program "MP Kit RTL11ac 8821AU" to enable EUT under transmission/receiving condition continuously at specific channel frequency.

#### 4.1.7 Test Results

#### Above 1GHz Data:

#### 802.11a

<b>CHANNEL</b>	TX Channel 149	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 40GHz		Average (AV)

#### ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5715.00	57.5 PK	74.0	-16.5	2.18 H	97	50.12	7.38
2	#5715.00	42.1 AV	54.0	-11.9	2.18 H	97	34.72	7.38
<b>3</b>	<b>#5725.00</b>	<b>76.6 PK</b>	<b>78.2</b>	<b>-1.6</b>	<b>2.18 H</b>	<b>97</b>	<b>69.22</b>	<b>7.38</b>
4	*5745.00	106.4 PK			2.18 H	97	99.02	7.38
5	*5745.00	97.3 AV			2.18 H	97	89.92	7.38
6	11490.00	54.5 PK	74.0	-19.5	1.91 H	207	39.98	14.52
7	11490.00	42.5 AV	54.0	-11.5	1.91 H	207	27.98	14.52
8	#17235.00	56.7 PK	74.0	-17.3	2.02 H	213	32.94	23.76
9	#17235.00	45.3 AV	54.0	-8.7	2.02 H	213	21.54	23.76

#### ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5715.00	52.9 PK	74.0	-21.1	3.23 V	142	45.52	7.38
2	#5715.00	39.9 AV	54.0	-14.1	3.23 V	142	32.52	7.38
3	#5725.00	66.9 PK	78.2	-11.3	3.23 V	142	59.52	7.38
4	*5745.00	100.6 PK			3.23 V	142	93.22	7.38
5	*5745.00	91.5 AV			3.23 V	142	84.12	7.38
6	11490.00	53.9 PK	74.0	-20.1	1.42 V	192	39.38	14.52
7	11490.00	42.4 AV	54.0	-11.6	1.42 V	192	27.88	14.52
8	#17235.00	56.9 PK	74.0	-17.1	1.57 V	183	33.14	23.76
9	#17235.00	44.5 AV	54.0	-9.5	1.57 V	183	20.74	23.76

#### REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

<b>CHANNEL</b>	TX Channel 157	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 40GHz		Average (AV)

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5785.00	108.3 PK			2.15 H	101	100.92	7.38
2	*5785.00	98.4 AV			2.15 H	101	91.02	7.38
3	11570.00	54.1 PK	74.0	-19.9	1.90 H	222	39.53	14.57
4	11570.00	42.3 AV	54.0	-11.7	1.90 H	222	27.73	14.57
5	#17355.00	56.9 PK	74.0	-17.1	1.96 H	208	32.84	24.06
6	#17355.00	45.2 AV	54.0	-8.8	1.96 H	208	21.14	24.06

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5785.00	102.5 PK			3.25 V	148	95.12	7.38
2	*5785.00	92.6 AV			3.25 V	148	85.22	7.38
3	11570.00	53.6 PK	74.0	-20.4	1.41 V	177	39.03	14.57
4	11570.00	42.0 AV	54.0	-12.0	1.41 V	177	27.43	14.57
5	#17355.00	57.2 PK	74.0	-16.8	1.55 V	192	33.14	24.06
6	#17355.00	45.0 AV	54.0	-9.0	1.55 V	192	20.94	24.06

**REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

<b>CHANNEL</b>	TX Channel 165	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 40GHz		Average (AV)

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5825.00	108.4 PK			2.17 H	99	101.09	7.31
2	*5825.00	98.6 AV			2.17 H	99	91.29	7.31
3	#5850.00	60.9 PK	78.2	-17.3	2.17 H	99	53.65	7.25
4	#5860.00	55.7 PK	74.0	-18.3	2.17 H	99	48.48	7.22
5	#5860.00	42.4 AV	54.0	-11.6	2.17 H	99	35.18	7.22
6	11650.00	54.4 PK	74.0	-19.6	1.88 H	234	39.73	14.67
7	11650.00	42.7 AV	54.0	-11.3	1.88 H	234	28.03	14.67
8	#17475.00	56.7 PK	74.0	-17.3	1.93 H	198	32.68	24.02
9	#17475.00	44.9 AV	54.0	-9.1	1.93 H	198	20.88	24.02

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5825.00	102.6 PK			3.26 V	157	95.29	7.31
2	*5825.00	92.8 AV			3.26 V	157	85.49	7.31
3	#5850.00	53.4 PK	78.2	-24.8	3.26 V	157	46.15	7.25
4	#5860.00	53.1 PK	74.0	-20.9	3.26 V	157	45.88	7.22
5	#5860.00	40.2 AV	54.0	-13.8	3.26 V	157	32.98	7.22
6	11650.00	54.1 PK	74.0	-19.9	1.41 V	162	39.43	14.67
7	11650.00	42.4 AV	54.0	-11.6	1.41 V	162	27.73	14.67
8	#17475.00	57.3 PK	74.0	-16.7	1.51 V	187	33.28	24.02
9	#17475.00	45.3 AV	54.0	-8.7	1.51 V	187	21.28	24.02

**REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.



**802.11ac (VHT20)**

<b>CHANNEL</b>	TX Channel 149	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 40GHz		Average (AV)

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5715.00	57.5 PK	74.0	-16.5	2.17 H	111	50.12	7.38
2	#5715.00	42.5 AV	54.0	-11.5	2.17 H	111	35.12	7.38
3	#5725.00	76.0 PK	78.2	-2.2	2.17 H	111	68.62	7.38
4	*5745.00	105.4 PK			2.17 H	111	98.02	7.38
5	*5745.00	96.6 AV			2.17 H	111	89.22	7.38
6	11490.00	54.5 PK	74.0	-19.5	1.94 H	235	39.98	14.52
7	11490.00	42.5 AV	54.0	-11.5	1.94 H	235	27.98	14.52
8	#17235.00	57.2 PK	74.0	-16.8	1.91 H	200	33.44	23.76
9	#17235.00	45.5 AV	54.0	-8.5	1.91 H	200	21.74	23.76

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5715.00	53.3 PK	74.0	-20.7	3.18 V	135	45.92	7.38
2	#5715.00	39.4 AV	54.0	-14.6	3.18 V	135	32.02	7.38
3	#5725.00	66.3 PK	78.2	-11.9	3.18 V	135	58.92	7.38
4	*5745.00	99.6 PK			3.18 V	135	92.22	7.38
5	*5745.00	90.8 AV			3.18 V	135	83.42	7.38
6	11490.00	53.2 PK	74.0	-20.8	1.42 V	167	38.68	14.52
7	11490.00	41.7 AV	54.0	-12.3	1.42 V	167	27.18	14.52
8	#17235.00	57.1 PK	74.0	-16.9	1.51 V	191	33.34	23.76
9	#17235.00	45.0 AV	54.0	-9.0	1.51 V	191	21.24	23.76

**REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

<b>CHANNEL</b>	TX Channel 157	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 40GHz		Average (AV)

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5785.00	108.1 PK			2.17 H	102	100.72	7.38
2	*5785.00	98.1 AV			2.17 H	102	90.72	7.38
3	11570.00	54.6 PK	74.0	-19.4	1.85 H	216	40.03	14.57
4	11570.00	42.5 AV	54.0	-11.5	1.85 H	216	27.93	14.57
5	#17355.00	56.7 PK	74.0	-17.3	2.01 H	209	32.64	24.06
6	#17355.00	45.3 AV	54.0	-8.7	2.01 H	209	21.24	24.06

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5785.00	102.3 PK			3.24 V	152	94.92	7.38
2	*5785.00	92.2 AV			3.24 V	152	84.82	7.38
3	11570.00	54.3 PK	74.0	-19.7	1.45 V	164	39.73	14.57
4	11570.00	42.4 AV	54.0	-11.6	1.45 V	164	27.83	14.57
5	#17355.00	57.8 PK	74.0	-16.2	1.52 V	186	33.74	24.06
6	#17355.00	45.4 AV	54.0	-8.6	1.52 V	186	21.34	24.06

**REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

<b>CHANNEL</b>	TX Channel 165	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 40GHz		Average (AV)

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5825.00	107.5 PK			2.15 H	106	100.19	7.31
2	*5825.00	98.3 AV			2.15 H	106	90.99	7.31
3	#5850.00	69.1 PK	78.2	-9.1	2.15 H	106	61.85	7.25
4	#5860.00	58.9 PK	74.0	-15.1	2.15 H	106	51.68	7.22
5	#5860.00	44.8 AV	54.0	-9.2	2.15 H	106	37.58	7.22
6	11650.00	54.1 PK	74.0	-19.9	1.92 H	211	39.43	14.67
7	11650.00	42.6 AV	54.0	-11.4	1.92 H	211	27.93	14.67
8	#17475.00	56.6 PK	74.0	-17.4	1.92 H	213	32.58	24.02
9	#17475.00	45.1 AV	54.0	-8.9	1.92 H	213	21.08	24.02

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5825.00	101.7 PK			3.18 V	153	94.39	7.31
2	*5825.00	92.5 AV			3.18 V	153	85.19	7.31
3	#5850.00	53.5 PK	78.2	-24.7	3.18 V	153	46.25	7.25
4	#5860.00	55.1 PK	74.0	-18.9	3.18 V	153	47.88	7.22
5	#5860.00	40.1 AV	54.0	-13.9	3.18 V	153	32.88	7.22
6	11650.00	52.9 PK	74.0	-21.1	1.41 V	162	38.23	14.67
7	11650.00	41.5 AV	54.0	-12.5	1.41 V	162	26.83	14.67
8	#17475.00	57.2 PK	74.0	-16.8	1.58 V	189	33.18	24.02
9	#17475.00	44.9 AV	54.0	-9.1	1.58 V	189	20.88	24.02

**REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

**802.11ac (VHT40)**

<b>CHANNEL</b>	TX Channel 151	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 40GHz		Average (AV)

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5715.00	67.5 PK	74.0	-6.5	2.17 H	265	60.12	7.38
2	#5715.00	52.4 AV	54.0	-1.6	2.17 H	265	45.02	7.38
3	#5725.00	69.1 PK	78.2	-9.1	2.17 H	265	61.72	7.38
4	*5755.00	100.3 PK			2.17 H	265	92.92	7.38
5	*5755.00	90.7 AV			2.17 H	265	83.32	7.38
6	11510.00	54.5 PK	74.0	-19.5	1.85 H	230	40.00	14.50
7	11510.00	42.5 AV	54.0	-11.5	1.85 H	230	28.00	14.50
8	#17265.00	57.6 PK	74.0	-16.4	2.00 H	205	34.08	23.52
9	#17265.00	45.7 AV	54.0	-8.3	2.00 H	205	22.18	23.52

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5715.00	62.4 PK	74.0	-11.6	3.18 V	164	55.02	7.38
2	#5715.00	47.3 AV	54.0	-6.7	3.18 V	164	39.92	7.38
3	#5725.00	60.2 PK	78.2	-18.0	3.18 V	164	52.82	7.38
4	*5755.00	94.5 PK			3.18 V	164	87.12	7.38
5	*5755.00	85.1 AV			3.18 V	164	77.72	7.38
6	11510.00	54.7 PK	74.0	-19.3	1.51 V	159	40.20	14.50
7	11510.00	42.9 AV	54.0	-11.1	1.51 V	159	28.40	14.50
8	#17265.00	57.7 PK	74.0	-16.3	1.48 V	186	34.18	23.52
9	#17265.00	45.6 AV	54.0	-8.4	1.48 V	186	22.08	23.52

**REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

<b>CHANNEL</b>	TX Channel 159	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 40GHz		Average (AV)

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5795.00	105.9 PK			2.17 H	101	98.52	7.38
2	*5795.00	95.8 AV			2.17 H	101	88.42	7.38
3	#5850.00	62.3 PK	78.2	-15.9	2.17 H	101	55.05	7.25
4	#5860.00	59.8 PK	74.0	-14.2	2.17 H	101	52.58	7.22
5	#5860.00	44.2 AV	54.0	-9.8	2.17 H	101	36.98	7.22
6	11590.00	54.3 PK	74.0	-19.7	1.88 H	214	39.69	14.61
7	11590.00	42.4 AV	54.0	-11.6	1.88 H	214	27.79	14.61
8	#17385.00	57.6 PK	74.0	-16.4	1.95 H	207	33.11	24.49
9	#17385.00	45.6 AV	54.0	-8.4	1.95 H	207	21.11	24.49

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5795.00	100.1 PK			3.20 V	168	92.72	7.38
2	*5795.00	90.3 AV			3.20 V	168	82.92	7.38
3	#5850.00	53.3 PK	78.2	-24.9	3.20 V	168	46.05	7.25
4	#5860.00	55.6 PK	74.0	-18.4	3.20 V	168	48.38	7.22
5	#5860.00	40.2 AV	54.0	-13.8	3.20 V	168	32.98	7.22
6	11590.00	54.6 PK	74.0	-19.4	1.48 V	178	39.99	14.61
7	11590.00	42.6 AV	54.0	-11.4	1.48 V	178	27.99	14.61
8	#17385.00	58.1 PK	74.0	-15.9	1.57 V	201	33.61	24.49
9	#17385.00	45.6 AV	54.0	-8.4	1.57 V	201	21.11	24.49

**REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

**802.11ac (VHT80)**

<b>CHANNEL</b>	TX Channel 155	<b>DETECTOR FUNCTION</b>	Peak (PK)
<b>FREQUENCY RANGE</b>	1GHz ~ 40GHz		Average (AV)

**ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5715.00	66.8 PK	74.0	-7.2	2.17 H	296	59.42	7.38
2	#5715.00	<b>52.4 AV</b>	<b>54.0</b>	<b>-1.6</b>	<b>2.17 H</b>	<b>296</b>	<b>45.02</b>	<b>7.38</b>
3	#5725.00	68.9 PK	78.2	-9.3	2.17 H	296	61.52	7.38
4	*5775.00	96.8 PK			2.17 H	296	89.42	7.38
5	*5775.00	87.3 AV			2.17 H	296	79.92	7.38
6	#5850.00	63.5 PK	78.2	-14.7	2.17 H	296	56.25	7.25
7	#5860.00	61.9 PK	74.0	-12.1	2.17 H	296	54.68	7.22
8	#5860.00	47.5 AV	54.0	-6.5	2.17 H	296	40.28	7.22
9	11550.00	54.5 PK	74.0	-19.5	1.85 H	220	39.95	14.55
10	11550.00	42.6 AV	54.0	-11.4	1.85 H	220	28.05	14.55
11	#17325.00	57.0 PK	74.0	-17.0	2.01 H	221	33.38	23.62
12	#17325.00	45.2 AV	54.0	-8.8	2.01 H	221	21.58	23.62

**ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M**

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5715.00	61.7 PK	74.0	-12.3	3.24 V	149	54.32	7.38
2	#5715.00	47.6 AV	54.0	-6.4	3.24 V	149	40.22	7.38
3	#5725.00	64.1 PK	78.2	-14.1	3.24 V	149	56.72	7.38
4	*5775.00	91.0 PK			3.24 V	149	83.62	7.38
5	*5775.00	81.8 AV			3.24 V	149	74.42	7.38
6	#5850.00	58.3 PK	78.2	-19.9	3.24 V	149	51.05	7.25
7	#5860.00	56.9 PK	74.0	-17.1	3.24 V	149	49.68	7.22
8	#5860.00	42.6 AV	54.0	-11.4	3.24 V	149	35.38	7.22
9	11550.00	54.3 PK	74.0	-19.7	1.45 V	159	39.75	14.55
10	11550.00	42.1 AV	54.0	-11.9	1.45 V	159	27.55	14.55
11	#17325.00	57.5 PK	74.0	-16.5	1.55 V	179	33.88	23.62
12	#17325.00	45.4 AV	54.0	-8.6	1.55 V	179	21.78	23.62

**REMARKS:**

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " \* ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

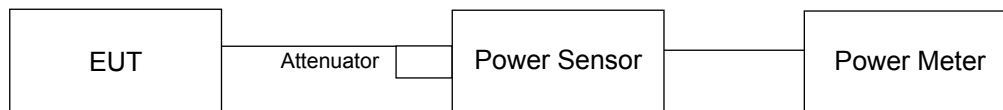
## 4.2 Transmit Power Measurement

### 4.2.1 Limits of Transmit Power Measurement

Operation Band	EUT Category		LIMIT
U-NII-1		Outdoor Access Point	1 Watt (30 dBm) (Max. e.i.r.p $\leq$ 125mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon)
		Fixed point-to-point Access Point	1 Watt (30 dBm)
		Indoor Access Point	1 Watt (30 dBm)
		Mobile and Portable client device	250mW (24 dBm)
U-NII-2A			250mW (24 dBm) or 11 dBm+10 log B*
U-NII-2C			250mW (24 dBm) or 11 dBm+10 log B*
U-NII-3	√		1 Watt (30 dBm)

\*B is the 26 dB emission bandwidth in megahertz

### 4.2.2 Test Setup



### 4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.2.4 Test Procedure

Method PM is used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

### 4.2.5 Deviation from Test Standard

No deviation.

### 4.2.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

#### 4.2.7 Test Result

#### POWER OUTPUT:

##### 802.11a

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
149	5745	66.374	18.22	30	Pass
157	5785	67.764	18.31	30	Pass
165	5825	65.615	18.17	30	Pass

##### 802.11ac (VHT20)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
149	5745	35.645	15.52	30	Pass
157	5785	67.92	18.32	30	Pass
165	5825	68.077	18.33	30	Pass

##### 802.11ac (VHT40)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
151	5755	17.906	12.53	30	Pass
159	5795	65.464	18.16	30	Pass

##### 802.11ac (VHT80)

Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
155	5775	13.49	11.30	30	Pass

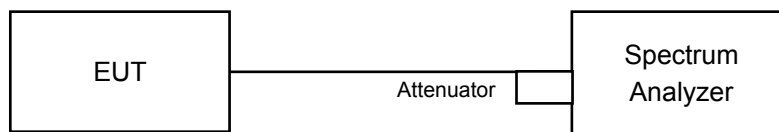


### 4.3 Peak Power Spectral Density Measurement

#### 4.3.1 Limits of Peak Power Spectral Density Measurement

Operation Band	EUT Category		LIMIT
U-NII-1		Outdoor Access Point	17dBm/ MHz
		Fixed point-to-point Access Point	
		Indoor Access Point	
		Mobile and Portable client device	11dBm/ MHz
U-NII-2A			11dBm/ MHz
U-NII-2C			11dBm/ MHz
U-NII-3		√	30dBm/ 500kHz

#### 4.3.2 Test Setup



#### 4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

#### 4.3.4 Test Procedure

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 300 kHz, Set VBW ≥ 1 MHz, Detector = RMS
3. Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
4. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where  $BWCF = 10\log(500\text{ kHz}/300\text{kHz})$
5. Sweep time = auto, trigger set to "free run".
6. Trace average at least 100 traces in power averaging mode.
7. Record the max value

#### 4.3.5 Deviation from Test Standard

No deviation.

#### 4.3.6 EUT Operating Condition

Same as Item 4.3.6.

**4.3.7 Test Results  
For U-NII-1 Band**
**802.11a**

Chan.	Chan. Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	Limit (dBm/500kHz)	Pass /Fail
149	5745	-4.31	-2.09	30	Pass
157	5785	-3.13	-0.91	30	Pass
165	5825	-3.56	-1.34	30	Pass

**802.11ac (VHT20)**

Chan.	Chan. Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	Limit (dBm/500kHz)	Pass /Fail
149	5745	-5.97	-3.75	30	Pass
157	5785	-3.57	-1.35	30	Pass
165	5825	-3.29	-1.07	30	Pass

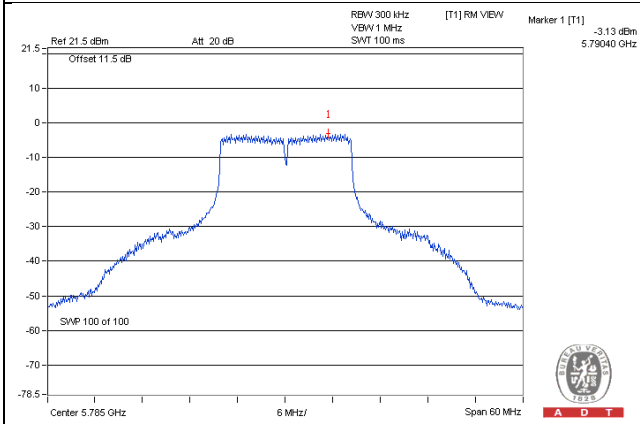
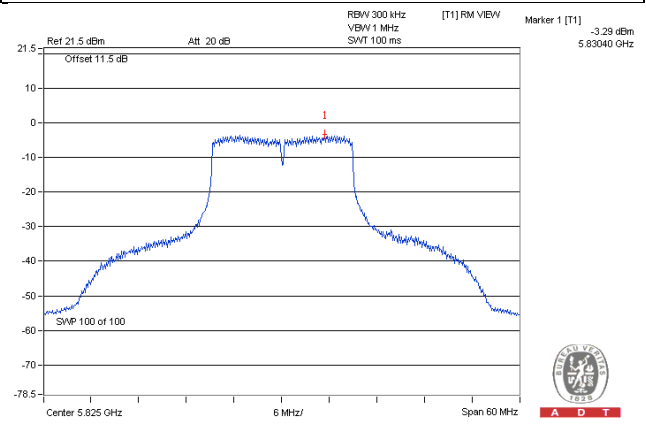
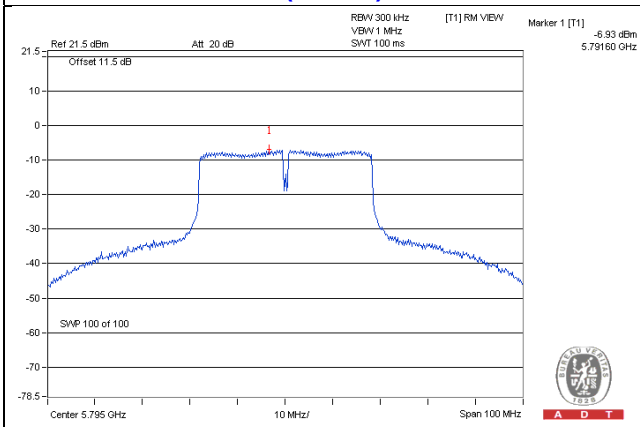
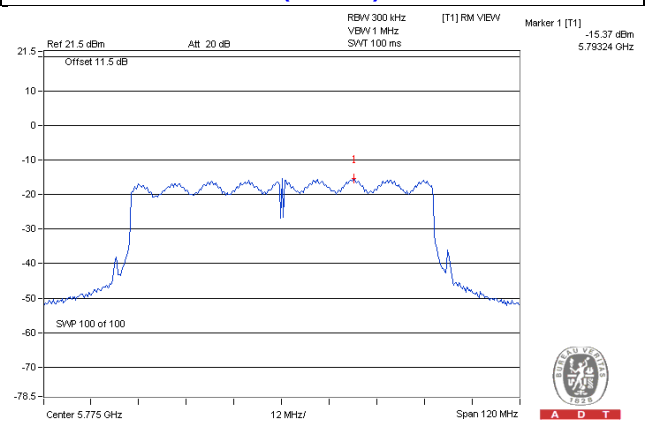
**802.11ac (VHT40)**

Chan.	Chan. Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	Limit (dBm/500kHz)	Pass /Fail
151	5755	-11.89	-9.67	30	Pass
159	5795	-6.93	-4.71	30	Pass

**802.11ac (VHT80)**

Chan.	Chan. Freq. (MHz)	PSD (dBm/300kHz)	PSD (dBm/500kHz)	Limit (dBm/500kHz)	Pass /Fail
155	5775	-15.37	-13.15	30	Pass

### Spectrum Plot of Worst Value

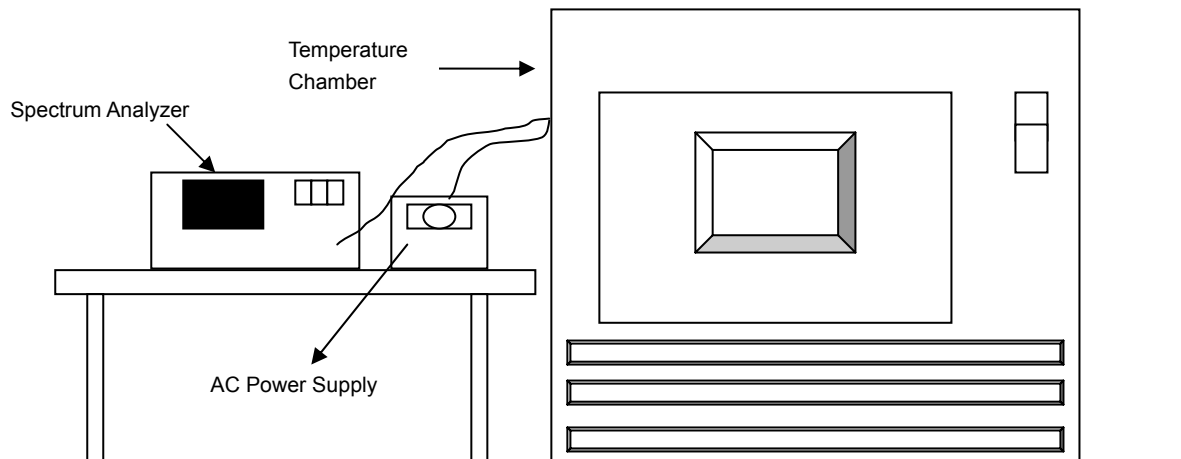
**802.11a: CH157****802.11ac (VHT20): CH165****802.11ac (VHT40): CH159****802.11ac (VHT80): CH155**

## 4.4 Frequency Stability Measurement

### 4.4.1 Limits of Frequency Stability Measurement

The frequency of the carrier signal shall be maintained within band of operation

### 4.4.2 Test Setup



### 4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.4.4 Test Procedure

- The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
- Turn the EUT on and couple its output to a spectrum analyzer.
- Turn the EUT off and set the chamber to the highest temperature specified.
- Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
- Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
- The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

### 4.4.5 Deviation from Test Standard

No deviation.

### 4.4.6 EUT Operating Condition

Set the EUT transmit at un-modulation mode to test frequency stability.

**4.4.7 Test Results**

<b>FREQUENCY STABILITY VERSUS TEMP.</b>									
<b>OPERATING FREQUENCY: 5745MHz</b>									
<b>TEMP. (°C)</b>	<b>POWER SUPPLY (Vac)</b>	<b>0 MINUTE</b>		<b>2 MINUTE</b>		<b>5 MINUTE</b>		<b>10 MINUTE</b>	
		<b>Measured Frequency (MHz)</b>	<b>Frequency Drift (%)</b>	<b>Measured Frequency (MHz)</b>	<b>Frequency Drift (%)</b>	<b>Measured Frequency (MHz)</b>	<b>Frequency Drift (%)</b>	<b>Measured Frequency (MHz)</b>	<b>Frequency Drift (%)</b>
50	120	5745.0213	0.00037	5745.0178	0.00031	5745.019	0.00033	5745.019	0.00033
40	120	5744.9905	-0.00017	5744.9887	-0.00020	5744.993	-0.00012	5744.989	-0.00019
30	120	5745.0175	0.00030	5745.0159	0.00028	5745.0135	0.00023	5745.0142	0.00025
20	120	5745.0175	0.00030	5745.0201	0.00035	5745.0176	0.00031	5745.017	0.00030
10	120	5745.0044	0.00008	5745.0044	0.00008	5745.004	0.00007	5745.005	0.00009
0	120	5745.0109	0.00019	5745.0094	0.00016	5745.0093	0.00016	5745.0116	0.00020
-10	120	5745.0053	0.00009	5745.0058	0.00010	5745.0052	0.00009	5745.0106	0.00018
-20	120	5745.0116	0.00020	5745.0131	0.00023	5745.012	0.00021	5745.0129	0.00022
-30	120	5744.9758	-0.00042	5744.9736	-0.00046	5744.9737	-0.00046	5744.9739	-0.00045

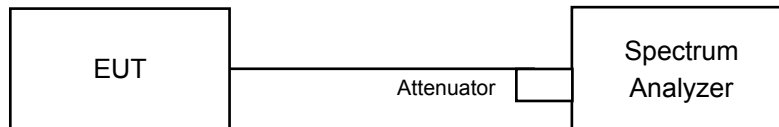
<b>FREQUENCY STABILITY VERSUS VOLTAGE</b>									
<b>OPERATING FREQUENCY: 5745MHz</b>									
<b>TEMP. (°C)</b>	<b>POWER SUPPLY (Vac)</b>	<b>0 MINUTE</b>		<b>2 MINUTE</b>		<b>5 MINUTE</b>		<b>10 MINUTE</b>	
		<b>Measured Frequency (MHz)</b>	<b>Frequency Drift (%)</b>	<b>Measured Frequency (MHz)</b>	<b>Frequency Drift (%)</b>	<b>Measured Frequency (MHz)</b>	<b>Frequency Drift (%)</b>	<b>Measured Frequency (MHz)</b>	<b>Frequency Drift (%)</b>
20	138	5745.0165	0.00029	5745.0209	0.00036	5745.0181	0.00032	5745.0178	0.00031
	120	5745.0175	0.00030	5745.0201	0.00035	5745.0176	0.00031	5745.017	0.00030
	102	5745.017	0.00030	5745.0196	0.00034	5745.0173	0.00030	5745.0159	0.00028

## 4.5 6dB Bandwidth Measurement

### 4.5.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

### 4.5.2 Test Setup



### 4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

### 4.5.4 Test Procedure

#### MEASUREMENT PROCEDURE REF

- a. Set resolution bandwidth (RBW) = 100kHz
- b. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW, Detector = Peak.
- c. Trace mode = max hold.
- d. Sweep = auto couple.
- e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

### 4.5.5 Deviation from Test Standard

No deviation.

### 4.5.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

#### 4.5.7 Test Results

##### 802.11a

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
149	5745	16.58	0.5	Pass
157	5785	16.58	0.5	Pass
165	5825	16.58	0.5	Pass

##### 802.11ac (VHT20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
149	5745	17.81	0.5	Pass
157	5785	17.81	0.5	Pass
165	5825	17.86	0.5	Pass

##### 802.11ac (VHT40)

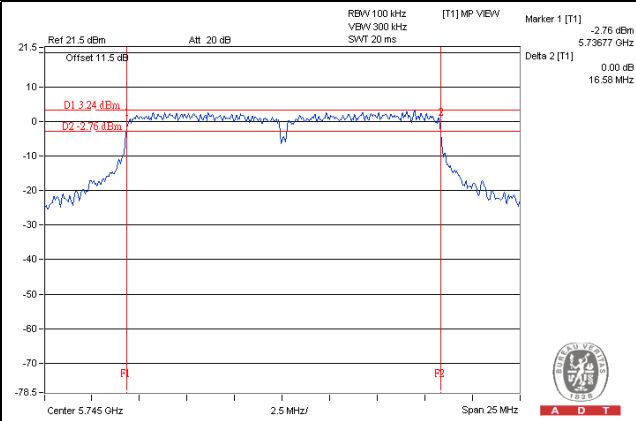
Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
151	5755	36.61	0.5	Pass
159	5795	36.64	0.5	Pass

##### 802.11ac (VHT80)

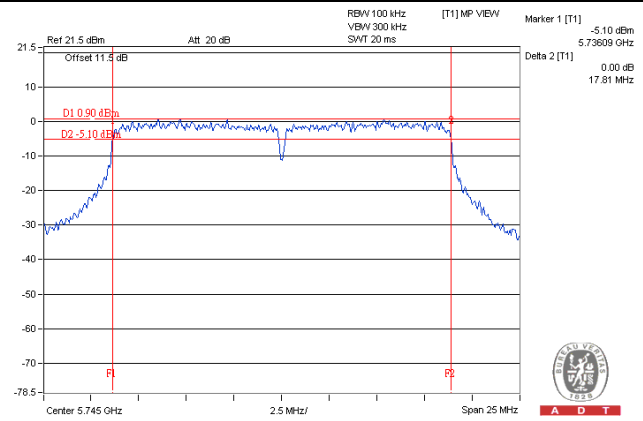
Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
155	5775	76.68	0.5	Pass

Spectrum Plot of Worst Value

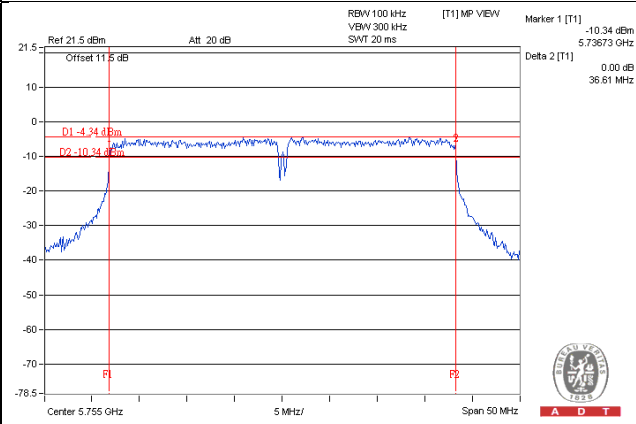
802.11a: CH149



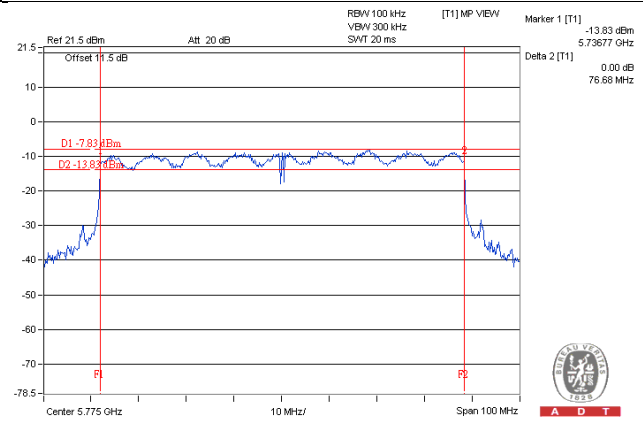
802.11ac (VHT20): CH149



802.11ac (VHT40): CH151



802.11ac (VHT80): CH155





## 5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).



A D T

## Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

**Linko EMC/RF Lab**

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Fax: 886-2-26051924

**Hsin Chu EMC/RF Lab/Telecom Lab**

Tel: 886-3-6668565

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**Hwa Ya EMC/RF/Safety Lab**

Tel: 886-3-3183232

Fax: 886-3-3270892

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**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

The address and road map of all our labs can be found in our web site also.

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