

FCC Test Report (15.407)

Report No.: RF141219C21-1

FCC ID: TE7C5V2

Test Model: Archer C5

Received Date: Dec. 19, 2014

Test Date: Jan. 05 ~ Mar. 10, 2015

Issued Date: Mar. 10, 2015

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A D T

Release Control Record

Issue No.	Description	Date Issued
RF141219C21-1	Original release.	Mar. 10, 2015

1 Certificate of Conformity

Product: AC1200 Wireless Dual Band Gigabit Router

Brand: TP-LINK

Test Model: Archer C5

Sample Status: Prototype

Applicant: TP-LINK TECHNOLOGIES CO., LTD.

Manufacturer: TP-LINK TECHNOLOGIES CO., LTD.

Test Date: Jan. 05 ~ Mar. 10, 2015

Standard: 47 CFR FCC Part 15, Subpart E (Section 15.407)
ANSI C63.10:2009

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Suntee Liu , **Date:** Mar. 10, 2015
Suntee Liu / Specialist

Approved by : Ken Liu , **Date:** Mar. 10, 2015
Ken Liu / Senior Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart E (SECTION 15.407)			
FCC Clause	Test Item	Result	Remarks
15.407(b)(6)	AC Power Conducted Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -6.11dB at 0.16562MHz.
15.407(b)(1/2/3/4/6)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -0.2dB at 5150.00MHz.
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 SMA reverse not a standard connector.

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	Expended Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.63 dB
	200MHz ~1000MHz	3.64 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	AC1200 Wireless Dual Band Gigabit Router
Brand	TP-LINK
Test Model	Archer C5
H/W	Archer C5
S/W	AC1200 Wireless Dual Band Gigabit Router
Status of EUT	Prototype
Power Supply Rating	12Vdc (adapter)
Modulation Type	256QAM, 64QAM, 16QAM, QPSK, BPSK
Modulation Technology	OFDM
Transfer Rate	802.11a: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 300Mbps 802.11ac: up to 866.6Mbps
Operating Frequency	5180 ~ 5240MHz
Number of Channel	802.11a, 802.11n (HT20), 802.11ac (VHT20): 4 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1
Output Power	171.408mW
Antenna Type	Omni directional antenna with 3dBi gain
Antenna Connector	SMA reverse
Accessory Device	Adapter
Data Cable Supplied	NA

Note:

1. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers. This device supports chip beamforming.

Modulation Mode	TX Function
802.11a	2TX
802.11n (HT20)	2TX
802.11n (HT40)	2TX
802.11ac (VHT20)	2TX
802.11ac (VHT40)	2TX
802.11ac (VHT80)	2TX

*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)

2. The EUT uses following adapter.

Brand	Ten Pao International Inc.
Model	S040EU1200250
Input Power	100-240Vac, 50/60Hz, 1.2A Max.
Output Power	12.0Vdc, 2500mA
Power Line	1.5m DC cable without core attached on adapter

3. The above EUT information is declared by 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 5180 ~ 5240MHz

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

Channel	Frequency	Channel	Frequency
36	5180 MHz	44	5220 MHz
40	5200 MHz	48	5240 MHz

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

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
42	5210MHz

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to				Description
	RE $\geq$ 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where RE $\geq$ 1G: Radiated Emission above 1GHz RE<1G: Radiated Emission below 1GHz
 PLC: Power Line Conducted Emission APCM: Antenna Port Conducted Measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on Z-plane.

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.

EUT Configure Mode	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Date Rate (Mbps)	TX Function
-	802.11a	5180-5240	36 to 48	36, 40, 48	OFDM	BPSK	6.0	2TX
-	802.11n (HT20)		36 to 48	36, 40, 48	OFDM	BPSK	7.2	2TX
-	802.11n (HT40)		38 to 46	38, 46	OFDM	BPSK	15.0	2TX
-	802.11ac (VHT80)		42	42	OFDM	BPSK	58.5	2TX

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.

EUT Configure Mode	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Date Rate (Mbps)	TX Function
-	802.11a	5180-5240	36 to 48	40	OFDM	BPSK	6.0	2TX

Power Line Conducted Emission Test:

- ☒ 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.

EUT Configure Mode	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Date Rate (Mbps)	TX Function
-	802.11a	5180-5240	36 to 48	40	OFDM	BPSK	6.0	2TX

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.

EUT Configure Mode	Mode	Frequency Band (MHz)	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Date Rate (Mbps)	TX Function
-	802.11a	5180-5240	36 to 48	36, 40, 48	OFDM	BPSK	6.0	2TX
-	802.11n (HT20)		36 to 48	36, 40, 48	OFDM	BPSK	7.2	2TX
-	802.11n (HT40)		38 to 46	38, 46	OFDM	BPSK	15.0	2TX
-	802.11ac (VHT80)		42	42	OFDM	BPSK	58.5	2TX

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE $\geq$ 1G	25 deg. C, 65% RH	120Vac, 60Hz	Ted Chang
RE<1G	18 deg. C, 70% RH	120Vac, 60Hz	Nick Hsu
PLC	22 deg. C, 70% RH	120Vac, 60Hz	Jones Chang
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Cedric Wu

3.3 Duty Cycle of Test Signal

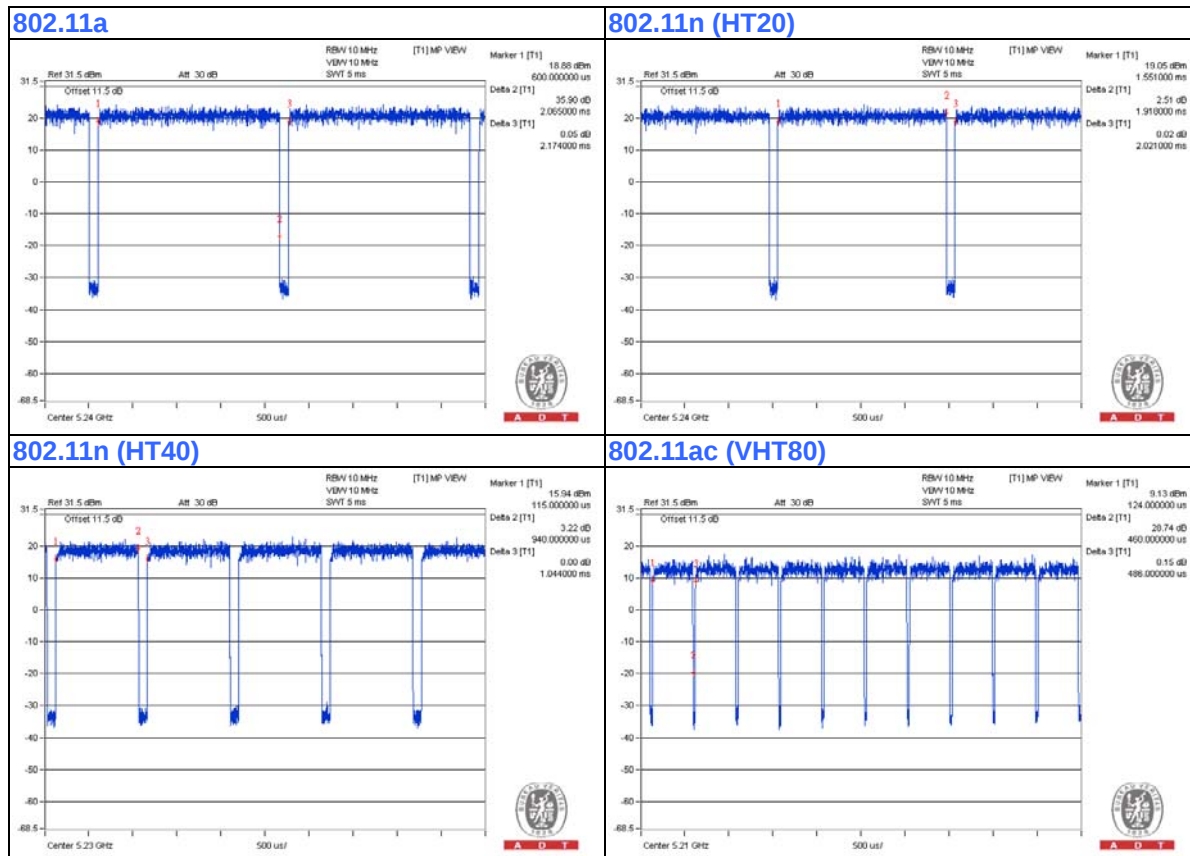
If duty cycle of test signal is < 98%, duty factor shall be considered.

802.11a: Duty cycle = $2.065/2.174 = 0.950$, Duty factor = $10 * \log(1/0.950) = 0.22$

802.11n (HT20): Duty cycle = $1.918/2.021 = 0.949$, Duty factor = $10 * \log(1/0.949) = 0.23$

802.11n (HT40): Duty cycle = $0.94/1.044 = 0.900$, Duty factor = $10 * \log(1/0.900) = 0.46$

802.11ac (VHT80): Duty cycle = $0.46/0.486 = 0.947$, Duty factor = $10 * \log(1/0.947) = 0.24$



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.

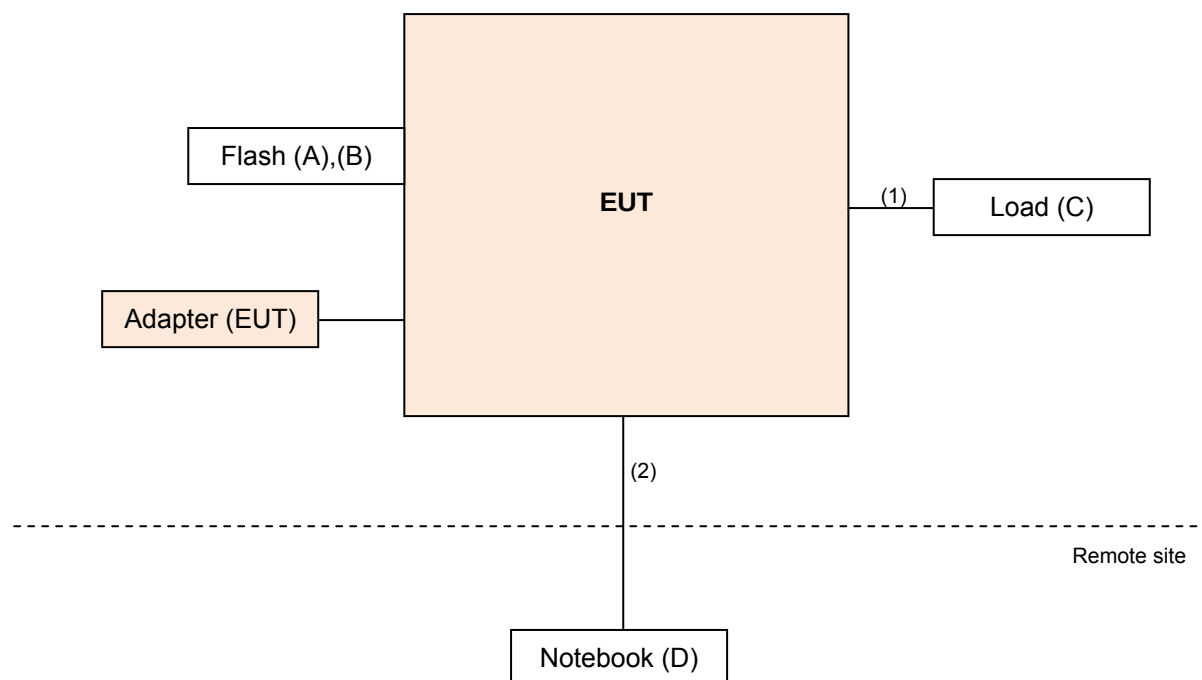
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	USB Flash Drive	Transcend	V85	569992-8209	FCC DoC Approved	-
B.	USB Flash Drive	Transcend	V85	538455 4488	FCC DoC Approved	-
C.	Load	NA	NA	NA	NA	-
D.	Notebook	DELL	D531	CN-0XM006-48643-81 U-2610	QDS-BRCM1020	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item D acted as a communication partner to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ45	4	1.8	N	0	-
2.	RJ45	1	3	N	0	-

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)

789033 D02 General UNII Test Procedure New Rules v01

662911 D01 Multiple Transmitter Output v02r01

ANSI C63.10:2009

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

NOTE: The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

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. Other emissions shall be at least 20dB below the highest level of the desired power:

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:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. 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 30dB 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) ^{*1} PK:-17 (dBm/MHz) ^{*2}	PK: 68.2(dBuV/m) ^{*1} PK:78.2 (dBuV/m) ^{*2}

NOTE: ^{*1} beyond 10MHz of the band edge ^{*2} 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

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCS30	100289	Dec. 01, 2014	Nov. 30, 2015
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	Feb. 11, 2014	Feb. 10, 2015
			Feb. 11, 2015	Feb. 10, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-156	Feb. 06, 2014	Feb. 05, 2015
			Feb. 06, 2015	Feb. 05, 2016
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Feb. 09, 2014	Feb. 08, 2015
			Feb. 09, 2015	Feb. 08, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Feb. 09, 2014	Feb. 08, 2015
			Feb. 09, 2015	Feb. 08, 2016
Preamplifier Agilent	8449B	3008A01911	Aug. 09, 2014	Aug. 08, 2015
Preamplifier Agilent	8447D	2944A10638	Aug. 09, 2014	Aug. 08, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	248780/4 309222/4 274092/4	Aug. 09, 2014	Aug. 08, 2015
RF signal cable Worken	8D-FB	Cable-CH9-01	Aug. 11, 2014	Aug. 10, 2015
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower & Turn Table Controller EMCO	2090	NA	NA	NA
26GHz ~ 40GHz Amplifier	EM26400	815221	Oct. 18, 2014	Oct. 17, 2015
High Speed Peak Power Meter	ML2495A	0824011	Jul. 26, 2014	Jul. 25, 2015
Power Sensor	MA2411B	0738171	Jul. 26, 2014	Jul. 25, 2015
WIT Standard Temperature And Humidity Chamber	TH-4S-C	W981030	Jun. 09, 2014	Jun. 08, 2015

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 loop antenna is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.

3. The test was performed in HwaYa Chamber 9.

4. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.

5. The FCC Site Registration No. is 215374.

6. The IC Site Registration No. is IC 7450F-9.

4.1.3 Test Procedure

- a. The EUT was placed on the top of a rotating table 0.8 meters 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:

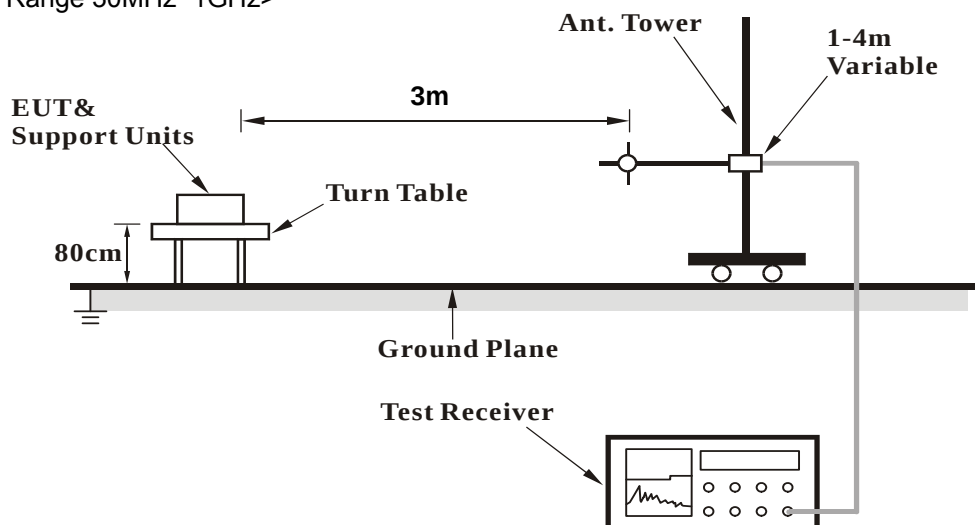
1. For emission measurements above 1 GHz, the EUT shall be placed at a height of 1.5 m above the ground at 3 meter chamber room for test
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
4. 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 ($10 \log(1/\text{duty cycle})$).
5. 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.
6. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

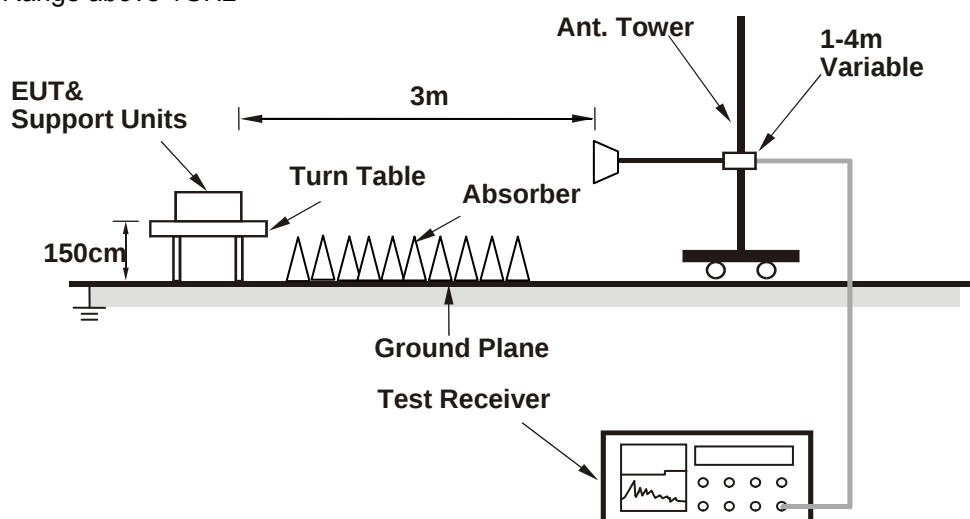
No deviation.

4.1.5 Test Setup

<Frequency Range 30MHz~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

- Placed the EUT on the testing table.
- Prepared a notebook to act as a communication partner and placed it outside of testing area.
- The communication partner connected with EUT via a RJ45 cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- The communication partner sent data to EUT by command "PING".
- The necessary accessories enable the system in full functions.

4.1.7 Test Results

Above 1GHz Data

802.11a

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	5100.00	58.6 PK	74.0	-15.4	1.00 H	210	56.70	1.90
2	5100.00	45.8 AV	54.0	-8.2	1.00 H	210	43.90	1.90
3	5150.00	55.9 PK	74.0	-18.1	1.00 H	214	53.90	2.00
4	5150.00	43.3 AV	54.0	-10.7	1.00 H	214	41.30	2.00
5	*5180.00	104.5 PK			1.12 H	76	64.50	40.00
6	*5180.00	94.7 AV			1.12 H	76	54.70	40.00
7	5420.00	59.0 PK	74.0	-15.0	1.02 H	34	56.90	2.10
8	5420.00	44.7 AV	54.0	-9.3	1.02 H	34	42.60	2.10
9	#10360.00	61.0 PK	74.0	-13.0	1.52 H	100	46.00	15.00
10	#10360.00	47.6 AV	54.0	-6.4	1.52 H	100	32.60	15.00
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	5100.00	63.9 PK	74.0	-10.1	1.00 V	305	62.00	1.90
2	5100.00	53.5 AV	54.0	-0.5	1.00 V	305	51.60	1.90
3	5150.00	61.0 PK	74.0	-13.0	1.02 V	36	59.00	2.00
4	5150.00	44.5 AV	54.0	-9.5	1.02 V	36	42.50	2.00
5	*5180.00	113.6 PK			1.00 V	76	73.60	40.00
6	*5180.00	104.1 AV			1.00 V	76	64.10	40.00
7	5420.00	60.6 PK	74.0	-13.4	1.00 V	245	58.50	2.10
8	5420.00	47.6 AV	54.0	-6.4	1.00 V	245	45.50	2.10
9	#10360.00	60.5 PK	74.0	-13.5	1.02 V	64	45.50	15.00
10	#10360.00	48.5 AV	54.0	-5.5	1.02 V	64	33.50	15.00

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.

CHANNEL	TX Channel 40	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	5120.00	61.8 PK	74.0	-12.2	1.05 H	64	59.90	1.90
2	5120.00	47.7 AV	54.0	-6.3	1.05 H	64	45.80	1.90
3	*5200.00	111.3 PK			1.00 H	77	71.20	40.10
4	*5200.00	102.0 AV			1.00 H	77	61.90	40.10
5	5350.00	59.5 PK	74.0	-14.5	1.05 H	64	57.50	2.00
6	5350.00	46.6 AV	54.0	-7.4	1.05 H	64	44.60	2.00
7	#10400.00	61.0 PK	74.0	-13.0	1.02 H	64	46.00	15.00
8	#10400.00	47.5 AV	54.0	-6.5	1.02 H	64	32.50	15.00
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	5120.00	65.0 PK	74.0	-9.0	1.00 V	77	63.10	1.90
2	5120.00	53.5 AV	54.0	-0.5	1.00 V	77	51.60	1.90
3	*5200.00	121.6 PK			1.00 V	310	81.50	40.10
4	*5200.00	111.5 AV			1.00 V	310	71.40	40.10
5	5350.00	61.5 PK	74.0	-12.5	1.00 V	7	59.50	2.00
6	5350.00	50.4 AV	54.0	-3.6	1.00 V	7	48.40	2.00
7	#10400.00	61.9 PK	74.0	-12.1	1.02 V	36	46.90	15.00
8	#10400.00	48.5 AV	54.0	-5.5	1.02 V	36	33.50	15.00

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.

CHANNEL	TX Channel 48	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	*5240.00	104.6 PK			1.00 H	78	64.50	40.10
2	*5240.00	95.1 AV			1.00 H	78	55.00	40.10
3	5350.00	58.9 PK	74.0	-15.1	1.05 H	58	56.90	2.00
4	5350.00	45.2 AV	54.0	-8.8	1.05 H	58	43.20	2.00
5	5400.00	63.3 PK	74.0	-10.7	1.05 H	159	61.20	2.10
6	5400.00	45.6 AV	54.0	-8.4	1.05 H	159	43.50	2.10
7	#10480.00	61.1 PK	74.0	-12.9	1.02 H	64	46.00	15.10
8	#10480.00	47.7 AV	54.0	-6.3	1.02 H	64	32.60	15.10
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	*5240.00	115.0 PK			1.12 V	358	74.90	40.10
2	*5240.00	105.8 AV			1.12 V	358	65.70	40.10
3	5350.00	58.7 PK	74.0	-15.3	1.05 V	48	56.70	2.00
4	5350.00	48.9 AV	54.0	-5.1	1.05 V	48	46.90	2.00
5	5400.00	64.8 PK	74.0	-9.2	1.00 V	2	62.70	2.10
6	5400.00	53.6 AV	54.0	-0.4	1.00 V	2	51.50	2.10
7	#10480.00	61.0 PK	74.0	-13.0	1.05 V	102	45.90	15.10
8	#10480.00	48.6 AV	54.0	-5.4	1.05 V	102	33.50	15.10

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.

802.11n (HT20)

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	5100.00	58.0 PK	74.0	-16.0	1.02 H	6	56.10	1.90
2	5100.00	45.4 AV	54.0	-8.6	1.02 H	6	43.50	1.90
3	5150.00	57.0 PK	74.0	-17.0	1.55 H	51	55.00	2.00
4	5150.00	43.5 AV	54.0	-10.5	1.55 H	51	41.50	2.00
5	*5180.00	104.0 PK			1.02 H	66	64.00	40.00
6	*5180.00	94.2 AV			1.02 H	66	54.20	40.00
7	5420.00	57.9 PK	74.0	-16.1	1.02 H	54	55.80	2.10
8	5420.00	44.4 AV	54.0	-9.6	1.02 H	54	42.30	2.10
9	#10360.00	61.0 PK	74.0	-13.0	1.52 H	48	46.00	15.00
10	#10360.00	47.4 AV	54.0	-6.6	1.52 H	48	32.40	15.00
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	5100.00	64.4 PK	74.0	-9.6	1.01 V	303	62.50	1.90
2	5100.00	53.5 AV	54.0	-0.5	1.01 V	303	51.60	1.90
3	5150.00	68.2 PK	74.0	-5.8	1.01 V	303	66.20	2.00
4	5150.00	47.9 AV	54.0	-6.1	1.01 V	303	45.90	2.00
5	*5180.00	113.9 PK			1.00 V	305	73.90	40.00
6	*5180.00	103.8 AV			1.00 V	305	63.80	40.00
7	5420.00	60.5 PK	74.0	-13.5	1.00 V	102	58.40	2.10
8	5420.00	48.0 AV	54.0	-6.0	1.00 V	102	45.90	2.10
9	#10360.00	61.0 PK	74.0	-13.0	1.05 V	64	46.00	15.00
10	#10360.00	48.5 AV	54.0	-5.5	1.05 V	64	33.50	15.00

REMARKS:

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

CHANNEL	TX Channel 40	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	5120.00	60.6 PK	74.0	-13.4	1.02 H	66	58.70	1.90
2	5120.00	47.4 AV	54.0	-6.6	1.02 H	66	45.50	1.90
3	*5200.00	110.7 PK			1.05 H	88	70.60	40.10
4	*5200.00	101.4 AV			1.05 H	88	61.30	40.10
5	5350.00	58.9 PK	74.0	-15.1	1.52 H	117	56.90	2.00
6	5350.00	46.1 AV	54.0	-7.9	1.52 H	117	44.10	2.00
7	#10400.00	60.6 PK	74.0	-13.4	1.00 H	247	45.60	15.00
8	#10400.00	47.1 AV	54.0	-6.9	1.00 H	247	32.10	15.00
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	5120.00	65.1 PK	74.0	-8.9	1.02 V	36	63.20	1.90
2	5120.00	53.6 AV	54.0	-0.4	1.02 V	36	51.70	1.90
3	*5200.00	121.4 PK			1.02 V	96	81.30	40.10
4	*5200.00	111.3 AV			1.02 V	96	71.20	40.10
5	5350.00	59.9 PK	74.0	-14.1	1.05 V	88	57.90	2.00
6	5350.00	50.1 AV	54.0	-3.9	1.05 V	88	48.10	2.00
7	#10400.00	61.5 PK	74.0	-12.5	1.20 V	325	46.50	15.00
8	#10400.00	48.1 AV	54.0	-5.9	1.20 V	325	33.10	15.00

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.

CHANNEL	TX Channel 48	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	*5240.00	104.4 PK			1.00 H	55	64.30	40.10
2	*5240.00	94.8 AV			1.00 H	55	54.70	40.10
3	5350.00	58.0 PK	74.0	-16.0	1.00 H	84	56.00	2.00
4	5350.00	44.8 AV	54.0	-9.2	1.00 H	84	42.80	2.00
5	5400.00	62.9 PK	74.0	-11.1	1.08 H	97	60.80	2.10
6	5400.00	45.1 AV	54.0	-8.9	1.08 H	97	43.00	2.10
7	#10480.00	60.3 PK	74.0	-13.7	1.25 H	354	45.20	15.10
8	#10480.00	47.3 AV	54.0	-6.7	1.25 H	354	32.20	15.10
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	*5240.00	114.6 PK			1.02 V	55	74.50	40.10
2	*5240.00	105.4 AV			1.02 V	55	65.30	40.10
3	5350.00	58.2 PK	74.0	-15.8	1.02 V	33	56.20	2.00
4	5350.00	48.5 AV	54.0	-5.5	1.02 V	33	46.50	2.00
5	5400.00	64.6 PK	74.0	-9.4	1.04 V	44	62.50	2.10
6	5400.00	53.3 AV	54.0	-0.7	1.04 V	44	51.20	2.10
7	#10480.00	60.3 PK	74.0	-13.7	1.02 V	225	45.20	15.10
8	#10480.00	48.3 AV	54.0	-5.7	1.02 V	225	33.20	15.10

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.

802.11n (HT40)

CHANNEL	TX Channel 38	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	5150.00	61.0 PK	74.0	-13.0	1.00 H	96	59.00	2.00
2	5150.00	46.5 AV	54.0	-7.5	1.00 H	96	44.50	2.00
3	*5190.00	100.1 PK			1.00 H	77	60.10	40.00
4	*5190.00	90.0 AV			1.00 H	77	50.00	40.00
5	5350.00	59.5 PK	74.0	-14.5	1.05 H	34	57.50	2.00
6	5350.00	45.6 AV	54.0	-8.4	1.05 H	34	43.60	2.00
7	#6920.00	52.9 PK	74.0	-21.1	1.02 H	63	45.30	7.60
8	#6920.00	43.1 AV	54.0	-10.9	1.02 H	63	35.50	7.60
9	#10380.00	60.9 PK	74.0	-13.1	1.02 H	25	45.90	15.00
10	#10380.00	47.5 AV	54.0	-6.5	1.02 H	25	32.50	15.00
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	5150.00	73.7 PK	74.0	-0.3	1.00 V	304	71.70	2.00
2	5150.00	51.6 AV	54.0	-2.4	1.00 V	304	49.60	2.00
3	*5190.00	109.6 PK			1.00 V	68	69.60	40.00
4	*5190.00	99.9 AV			1.00 V	68	59.90	40.00
5	5350.00	62.4 PK	74.0	-11.6	1.00 V	63	60.40	2.00
6	5350.00	50.8 AV	54.0	-3.2	1.00 V	63	48.80	2.00
7	#6920.00	55.9 PK	74.0	-18.1	1.08 V	254	48.30	7.60
8	#6920.00	46.4 AV	54.0	-7.6	1.08 V	254	38.80	7.60
9	#10380.00	60.7 PK	74.0	-13.3	1.00 V	36	45.70	15.00
10	#10380.00	48.2 AV	54.0	-5.8	1.00 V	36	33.20	15.00

REMARKS:

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

CHANNEL	TX Channel 46	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	5150.00	60.7 PK	74.0	-13.3	1.02 H	69	58.70	2.00
2	5150.00	48.5 AV	54.0	-5.5	1.02 H	69	46.50	2.00
3	*5230.00	102.0 PK			1.00 H	77	61.90	40.10
4	*5230.00	91.9 AV			1.00 H	77	51.80	40.10
5	5390.00	60.0 PK	74.0	-14.0	1.02 H	47	57.90	2.10
6	5390.00	45.7 AV	54.0	-8.3	1.02 H	47	43.60	2.10
7	#6100.00	49.4 PK	74.0	-24.6	1.02 H	34	45.70	3.70
8	#6100.00	37.2 AV	54.0	-16.8	1.02 H	34	33.50	3.70
9	#10460.00	60.9 PK	74.0	-13.1	1.02 H	34	45.90	15.00
10	#10460.00	47.2 AV	54.0	-6.8	1.02 H	34	32.20	15.00
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	5150.00	65.5 PK	74.0	-8.5	1.00 V	74	63.50	2.00
2	5150.00	53.8 AV	54.0	-0.2	1.00 V	74	51.80	2.00
3	*5230.00	112.4 PK			1.00 V	306	72.30	40.10
4	*5230.00	102.1 AV			1.00 V	306	62.00	40.10
5	5390.00	63.2 PK	74.0	-10.8	1.00 V	360	61.10	2.10
6	5390.00	51.3 AV	54.0	-2.7	1.00 V	360	49.20	2.10
7	#6100.00	49.9 PK	74.0	-24.1	1.00 V	262	46.20	3.70
8	#6100.00	39.7 AV	54.0	-14.3	1.00 V	262	36.00	3.70
9	#10460.00	62.0 PK	74.0	-12.0	1.05 V	34	47.00	15.00
10	#10460.00	48.2 AV	54.0	-5.8	1.05 V	34	33.20	15.00

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)

CHANNEL	TX Channel 42	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	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	5150.00	67.9 PK	74.0	-6.1	1.05 H	34	65.90	2.00
2	5150.00	46.5 AV	54.0	-7.5	1.05 H	34	44.50	2.00
3	*5210.00	95.6 PK			1.00 H	76	55.50	40.10
4	*5210.00	85.4 AV			1.00 H	76	45.30	40.10
5	#6946.00	53.2 PK	74.0	-20.8	1.02 H	34	45.50	7.70
6	#6946.00	41.3 AV	54.0	-12.7	1.02 H	34	33.60	7.70
7	#10420.00	61.0 PK	74.0	-13.0	1.02 H	34	46.00	15.00
8	#10420.00	48.5 AV	54.0	-5.5	1.02 H	34	33.50	15.00
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	5150.00	72.6 PK	74.0	-1.4	1.00 V	310	70.60	2.00
2	5150.00	53.5 AV	54.0	-0.5	1.00 V	310	51.50	2.00
3	*5210.00	106.7 PK			1.00 V	302	66.60	40.10
4	*5210.00	95.6 AV			1.00 V	302	55.50	40.10
5	#6946.00	55.6 PK	74.0	-18.4	1.00 V	230	47.90	7.70
6	#6946.00	46.6 AV	54.0	-7.4	1.00 V	230	38.90	7.70
7	#10420.00	61.0 PK	74.0	-13.0	1.02 V	34	46.00	15.00
8	#10420.00	47.6 AV	54.0	-6.4	1.02 V	34	32.60	15.00

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.

Below 1GHz Worst-Case Data

802.11a

CHANNEL	TX Channel 40	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

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	57.21	25.6 QP	40.0	-14.4	2.00 H	283	40.20	-14.60
2	99.98	24.4 QP	43.5	-19.1	1.51 H	275	43.10	-18.70
3	162.18	26.2 QP	43.5	-17.3	1.51 H	261	40.30	-14.10
4	199.12	30.7 QP	43.5	-12.8	2.00 H	133	47.60	-16.90
5	391.56	23.0 QP	46.0	-23.0	2.00 H	6	33.60	-10.60
6	675.37	30.6 QP	46.0	-15.4	1.01 H	229	35.60	-5.00
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	35.83	30.6 QP	40.0	-9.4	1.49 V	34	46.20	-15.60
2	58.22	33.8 QP	40.0	-6.2	1.00 V	359	48.50	-14.70
3	80.54	28.4 QP	40.0	-11.6	1.00 V	276	46.80	-18.40
4	158.30	23.9 QP	43.5	-19.6	1.00 V	155	37.90	-14.00
5	199.12	25.2 QP	43.5	-18.3	1.00 V	294	42.10	-16.90
6	836.71	29.8 QP	46.0	-16.2	1.00 V	294	31.70	-1.90

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

4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCS30	100288	Apr. 24, 2014	Apr. 23, 2015
RF signal cable Woken	5D-FB	Cable-HYCO2-01	Dec. 26, 2014	Dec. 25, 2015
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Dec. 30, 2014	Dec. 29, 2015
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Jul. 10, 2014	Jul. 09, 2015
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

Notes: 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 test was performed in HwaYa Shielded Room 2.

3. The VCCI Site Registration No. is C-2047.

4.2.3 Test Procedure

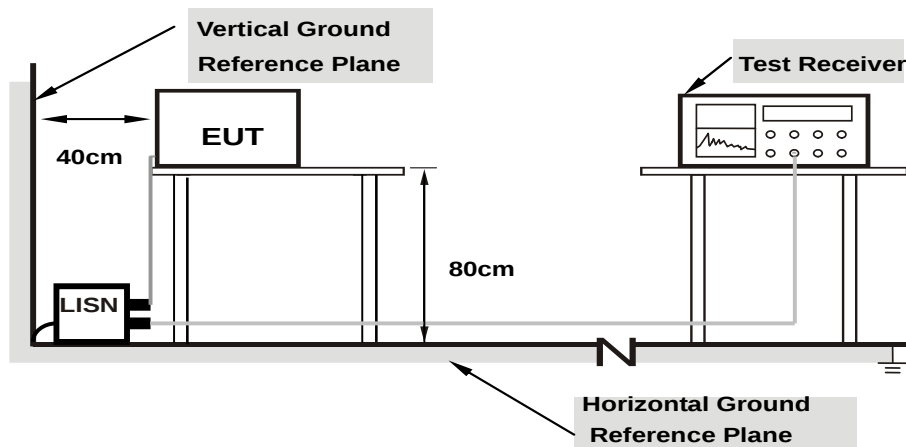
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 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

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

4.2.6 EUT Operating Condition

Same as 4.1.6.

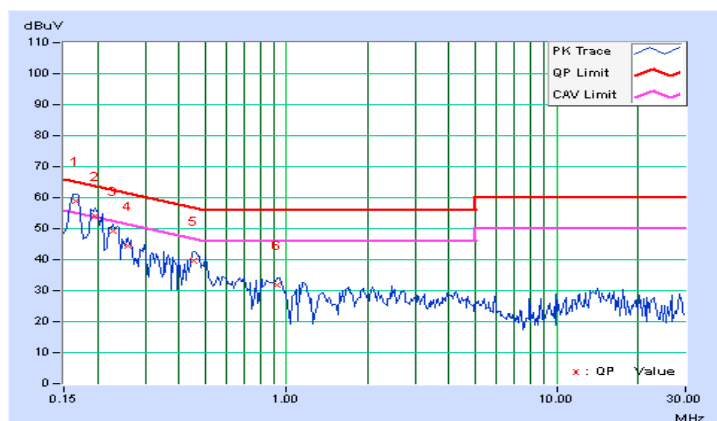
4.2.7 Test Results

PHASE	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16562	0.20	58.87	47.26	59.07	47.46	65.18	55.18	-6.11	-7.72
2	0.19687	0.20	53.84	42.65	54.04	42.85	63.74	53.74	-9.70	-10.89
3	0.22812	0.20	49.00	36.88	49.20	37.08	62.52	52.52	-13.32	-15.44
4	0.25938	0.20	44.11	30.41	44.31	30.61	61.45	51.45	-17.14	-20.84
5	0.45078	0.21	39.34	31.67	39.55	31.88	56.86	46.86	-17.31	-14.98
6	0.92734	0.29	31.44	24.38	31.73	24.67	56.00	46.00	-24.27	-21.33

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

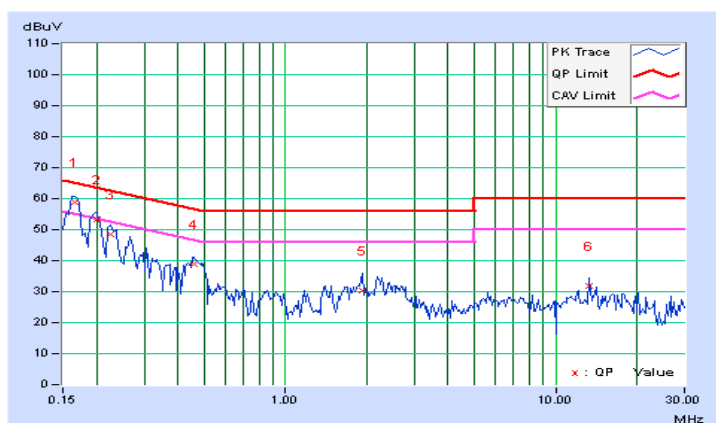


PHASE	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	-----------------------------------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16562	0.21	58.59	47.00	58.80	47.21	65.18	55.18	-6.38	-7.97
2	0.20078	0.22	53.01	40.28	53.23	40.50	63.58	53.58	-10.35	-13.08
3	0.22422	0.22	48.36	32.40	48.58	32.62	62.66	52.66	-14.08	-20.04
4	0.45859	0.26	38.50	32.09	38.76	32.35	56.72	46.72	-17.96	-14.37
5	1.92969	0.39	29.92	24.52	30.31	24.91	56.00	46.00	-25.69	-21.09
6	13.35695	0.66	31.30	28.92	31.96	29.58	60.00	50.00	-28.04	-20.42

REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.



4.3 Transmit Power Measurement

4.3.1 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

Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

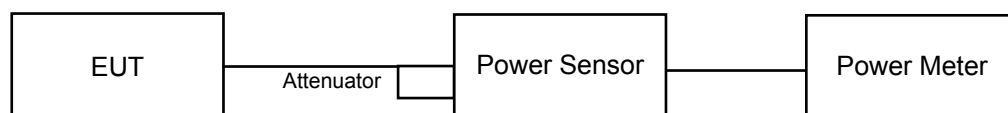
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;

Array Gain = $5 \log(N_{ANT}/N_{SS})$ dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = $10 \log(N_{ANT}/N_{SS})$ dB.

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

FOR AVERAGE POWER MEASUREMENT

For 802.11a, 802.11n (HT20), 802.11n (HT40)

789033 D02 General UNII Test Procedure New Rules v01

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.

For 802.11ac (VHT80)

789033 D02 General UNII Test Procedure New Rules v01

- 1) Set span to encompass the entire 26 dB EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
- 2) Set sweep trigger to "free run".
- 3) Set RBW = 1 MHz.
- 4) Set VBW $\geq$ 3 MHz
- 5) Number of points in sweep $\geq$ 2 Span / RBW.
- 6) Sweep time $\leq$ (number of points in sweep) * T
- 7) Detector = RMS.
- 8) Trace mode = max hold.
- 9) Allow max hold to run for at least 60 seconds, or longer as needed to allow the trace to stabilize.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Condition

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

4.3.7 Test Result

POWER OUTPUT:

802.11a

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
36	5180	18.51	18.56	142.737	21.55	30	PASS
40	5200	15.60	16.02	76.302	18.83	30	PASS
48	5240	18.65	18.61	145.893	21.64	30	PASS

802.11n (HT20)

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
36	5180	18.37	18.58	140.818	21.49	30	PASS
40	5200	15.50	15.90	74.386	18.71	30	PASS
48	5240	18.51	18.55	142.572	21.54	30	PASS

802.11n (HT40)

CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
38	5190	17.06	17.06	101.632	20.07	30	PASS
46	5230	19.33	19.33	171.408	22.34	30	PASS

802.11ac (VHT80)

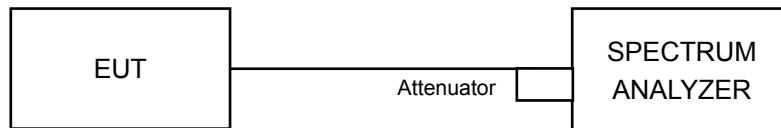
CHAN.	FREQ. (MHz)	MAXIMUM CONDUCTED POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1				
42	5210	16.53	16.94	94.409	19.75	30	PASS

4.4 Peak Power Spectral Density Measurement

4.4.1 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

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedure

789033 D02 General UNII Test Procedure New Rules v01

Using method SA-1 Duty cycle >98%

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz, Set VBW ≥ 3 MHz, Detector = RMS
3. Sweep time = auto, trigger set to “free run”.
4. Trace average at least 100 traces in power averaging mode.
5. Record the max value

Using method SA-2 Duty cycle <98%

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz, Set VBW ≥ 3 MHz, Detector = RMS
3. Sweep time = auto, trigger set to “free run”.
4. Trace average at least 100 traces in power averaging mode.
5. Record the max value and add 10 log (1/duty cycle)

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Condition

Same as item 4.3.6.

4.4.7 Test Results

802.11a

Chan.	Freq. (MHz)	PSD (dBm/MHz)		Total PSD w/o Duty Factor (dBm/MHz)	Duty Factor	Total PSD with Duty Factor (dBm/MHz)	Limit (dBm/MHz)	PASS / FAIL
		Chain 0	Chain 1					
36	5180	4.60	4.35	7.49	0.22	7.71	16.99	PASS
40	5200	2.02	1.56	4.81	0.22	5.03	16.99	PASS
48	5240	5.03	4.90	7.98	0.22	8.20	16.99	PASS

NOTE:

1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = $3\text{dBi} + 10\log(2) = 6.01\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $17-(6.01-6) = 16.99\text{dBm}$.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT20)

Chan.	Freq. (MHz)	PSD (dBm/MHz)		Total PSD w/o Duty Factor (dBm/MHz)	Duty Factor	Total PSD with Duty Factor (dBm/MHz)	Limit (dBm/MHz)	PASS / FAIL
		Chain 0	Chain 1					
36	5180	4.20	4.06	7.14	0.23	7.37	16.99	PASS
40	5200	1.66	1.23	4.46	0.23	4.69	16.99	PASS
48	5240	4.57	4.40	7.49	0.23	7.72	16.99	PASS

NOTE:

1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = $3\text{dBi} + 10\log(2) = 6.01\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $17-(6.01-6) = 16.99\text{dBm}$.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT40)

Chan.	Freq. (MHz)	PSD (dBm/MHz)		Total PSD w/o Duty Factor (dBm/MHz)	Duty Factor	Total PSD with Duty Factor (dBm/MHz)	Limit (dBm/MHz)	PASS / FAIL
		Chain 0	Chain 1					
38	5190	-0.39	-0.36	2.63	0.46	3.09	16.99	PASS
46	5230	2.18	2.01	5.10	0.46	5.56	16.99	PASS

NOTE:

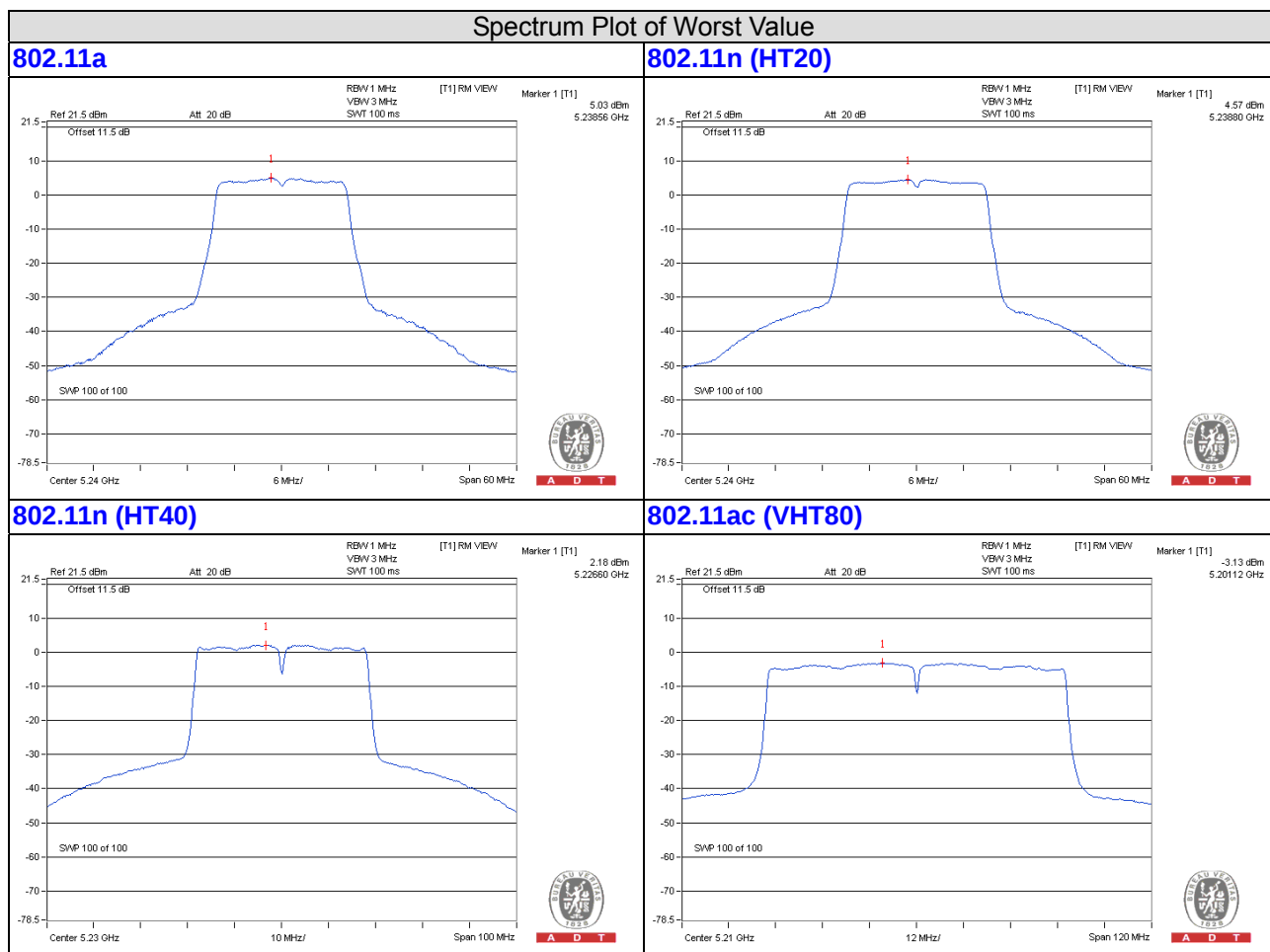
1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = $3\text{dBi} + 10\log(2) = 6.01\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $17-(6.01-6) = 16.99\text{dBm}$.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11ac (VHT80)

Chan.	Freq. (MHz)	PSD (dBm/MHz)		Total PSD w/o Duty Factor (dBm/MHz)	Duty Factor	Total PSD with Duty Factor (dBm/MHz)	Limit (dBm/MHz)	PASS / FAIL
		Chain 0	Chain 1					
42	5210	-3.13	-3.58	-0.34	0.24	-0.10	16.99	PASS

NOTE:

- Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
- Directional gain = $3\text{dBi} + 10\log(2) = 6.01\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $17 - (6.01 - 6) = 16.99\text{dBm}$.
- Refer to section 3.3 for duty cycle spectrum plot.

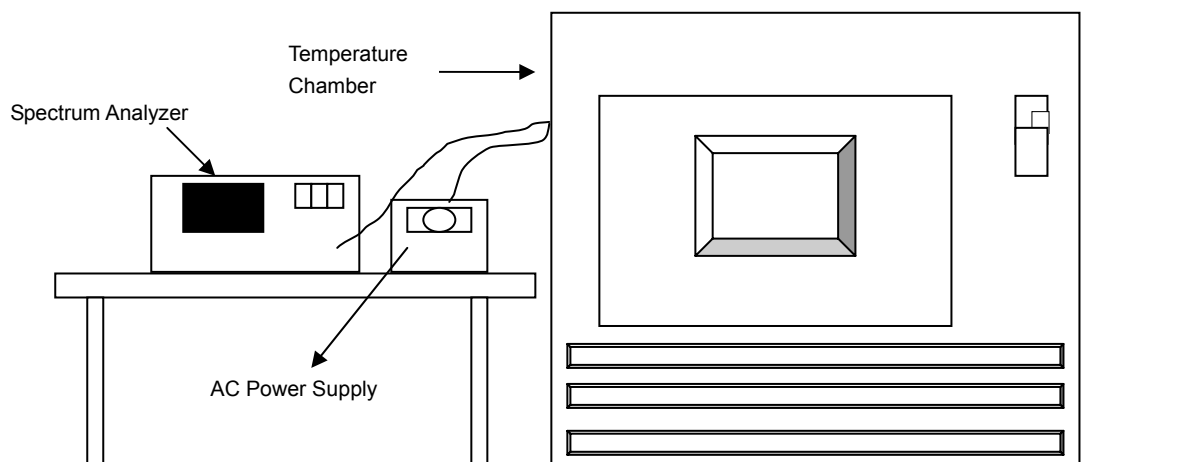


4.5 Frequency Stability Measurement

4.5.1 Limits of Frequency Stability Measurement

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

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

- 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.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

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

4.5.7 Test Results

Frequency Stability Versus Temp.									
Operating Frequency: 5240MHz									
Temp. (°C)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)
50	120	5239.9923	-0.00015	5239.993	-0.00013	5239.9888	-0.00021	5239.9904	-0.00018
40	120	5240.0142	0.00027	5240.0113	0.00022	5240.0099	0.00019	5240.013	0.00025
30	120	5240.0142	0.00027	5240.0128	0.00024	5240.012	0.00023	5240.0096	0.00018
20	120	5240.0014	0.00003	5240.0003	0.00001	5239.9995	-0.00001	5240.0012	0.00002
10	120	5240.0063	0.00012	5240.0059	0.00011	5240.008	0.00015	5240.0082	0.00016
0	120	5239.973	-0.00052	5239.9718	-0.00054	5239.9724	-0.00053	5239.9737	-0.00050
-10	120	5239.9787	-0.00041	5239.9776	-0.00043	5239.9778	-0.00042	5239.9764	-0.00045
-20	120	5240.0171	0.00033	5240.0213	0.00041	5240.0187	0.00036	5240.0203	0.00039
-30	120	5240.0228	0.00044	5240.023	0.00044	5240.023	0.00044	5240.0246	0.00047

Frequency Stability Versus Power Supply Voltage									
Operating Frequency: 5240MHz									
Temp. (°C)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)
20	138	5240.0004	0.00001	5239.9995	-0.00001	5239.9986	-0.00003	5240.0019	0.00004
	120	5240.0014	0.00003	5240.0003	0.00001	5239.9995	-0.00001	5240.0012	0.00002
	102	5240.0007	0.00001	5240.0006	0.00001	5240.0005	0.00001	5240.0007	0.00001

Note: Only the worst case (high channel) is recorded in the report.

5 Pictures of Test Arrangements

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

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:

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Hsin Chu EMC/RF Lab/Telecom Lab

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Web Site: 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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