

FCC Test Report

Report No.: RF150326C26-1

FCC ID: TE7C3200

Test Model: Archer C3200

Received Date: Mar. 26, 2015

Test Date: Apr. 19 ~ May 11, 2015

Issued Date: May 14, 2015

Applicant: TP-LINK TECHNOLOGIES CO., LTD.

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Release Control Record

Issue No.	Description	Date Issued
RF150326C26-1	Original release	May 14, 2015

1 Certificate of Conformity

Product: AC3200 Wireless Tri-Band Gigabit Router

Brand: TP-LINK

Test Model: Archer C3200

Sample Status: Prototype

Applicant: TP-LINK TECHNOLOGIES CO., LTD.

Test Date: Apr. 19 ~ May 11, 2015

Standards: 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 : Celine Chou , **Date:** May 14, 2015
Celine Chou / Specialist

Approved by : Ken Liu , **Date:** May 14, 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
15.207 15.407(b)(6)	AC Power Conducted Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -15.52dB at 0.49064MHz.
15.407(b) (1/2/3/4/6)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.5dB at 10480.00MHz.
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(g)	Frequency Stability	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is i-pex MHF 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	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.59 dB
	200MHz ~1000MHz	3.60 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	AC3200 Wireless Tri-Band Gigabit Router
Brand	TP-LINK
Test Model	Archer C3200
Status of EUT	Prototype
Power Supply Rating	12Vdc from adapter
Modulation Type	256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	OFDM
Transfer Rate	802.11b:11.0/ 5.5/ 2.0/ 1.0Mbps 802.11g: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to 450.0Mbps 802.11ac: up to 1300Mbps
Operating Frequency	5180 ~ 5240MHz
Number of Channel	4 for 802.11a, 802.11n (20MHz), 802.11ac (20MHz) 2 for 802.11n (40MHz), 802.11ac (40MHz) 1 for 802.11ac (80MHz)
Output Power	460.764mW
Antenna Type	Omni-Directional antenna with 1.8dBi gain
Antenna Connector	i-pex MHF
Accessory Device	1.4m non-shielded AC power cable without core, adapter
Data Cable Supplied	N/A

Note:

1. The EUT incorporates a MIMO function. Physically, the EUT provides 3 completed transmitters and 3 receivers.

Modulation Mode	TX Function
802.11a	3TX
802.11n (20MHz)	3TX
802.11n (40MHz)	3TX
802.11ac (20MHz)	3TX
802.11ac (40MHz)	3TX
802.11ac (80MHz)	3TX

* 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.

Adapter	
Brand	Huntkey
Model	HKA06012050-7C
Input Power	100-240Vac, 1.5A, 50/60Hz
Output Power	12.0Vdc, 5A
Power Line	1.8m cable without core attached on adapter

3.2 Description of Test Modes

4 channels are provided for 802.11a, 802.11n (20MHz), 802.11ac (20MHz):

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

2 channels are provided for 802.11n (40MHz), 802.11ac (40MHz):

Channel	Frequency	Channel	Frequency
38	5190MHz	46	5230MHz

1 channel is provided for 802.11ac (80MHz):

Channel	Frequency
42	5210MHz

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 & Bandedge Measurement
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	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	5180-5240	36 to 48	36, 40, 48	OFDM	BPSK	6.0
-	802.11n (20MHz)		36 to 48	36, 40, 48	OFDM	BPSK	7.2
-	802.11n (40MHz)		38 to 46	38, 46	OFDM	BPSK	15.0
-	802.11ac (80MHz)		42	42	OFDM	BPSK	87.8

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	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	5180-5240	36 to 48	36	OFDM	BPSK	6.0

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	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	5180-5240	36 to 48	36	OFDM	BPSK	6.0

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	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	5180-5240	36 to 48	36, 40, 48	OFDM	BPSK	6.0
-	802.11n (20MHz)		36 to 48	36, 40, 48	OFDM	BPSK	7.2
-	802.11n (40MHz)		38 to 46	38, 46	OFDM	BPSK	15.0
-	802.11ac (80MHz)		42	42	OFDM	BPSK	87.8

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE $\geq$ 1G	25deg. C, 65%RH	120Vac, 60Hz	Chris Lin
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Chris Lin
PLC	22deg. C, 70%RH	120Vac, 60Hz	Jones Chang
APCM	25deg. C, 60%RH	120Vac, 60Hz	Antony Lee

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98 %, duty factor is required

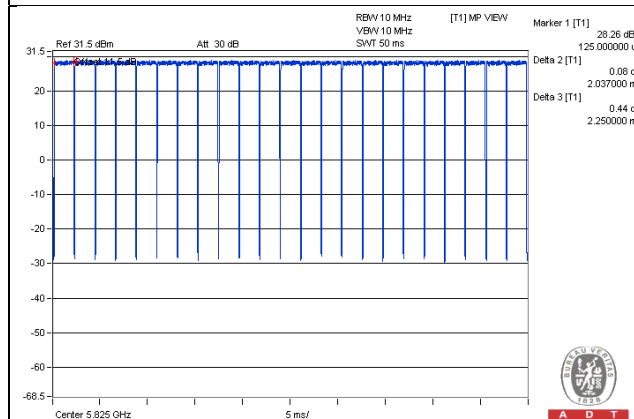
802.11a: Duty cycle = $2.037/2.250 = 0.905$, Duty factor = $10 * \log(1/0.905) = 0.43$

802.11n (20MHz): Duty cycle = $1.912/1.962 = 0.975$, Duty factor = $10 * \log(1/0.975) = 0.11$

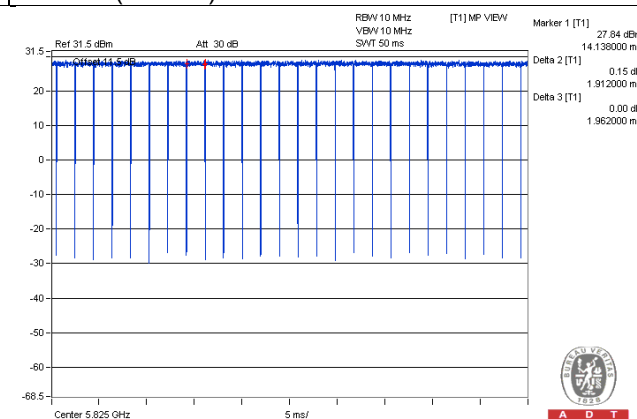
802.11n (40MHz): Duty cycle = $0.888/0.988 = 0.899$, Duty factor = $10 * \log(1/0.899) = 0.46$

802.11ac (80MHz): Duty cycle = $0.424/0.512 = 0.828$, Duty factor = $10 * \log(1/0.828) = 0.82$

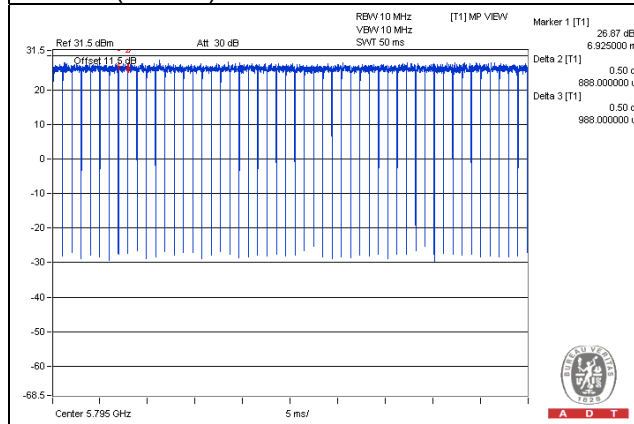
802.11a



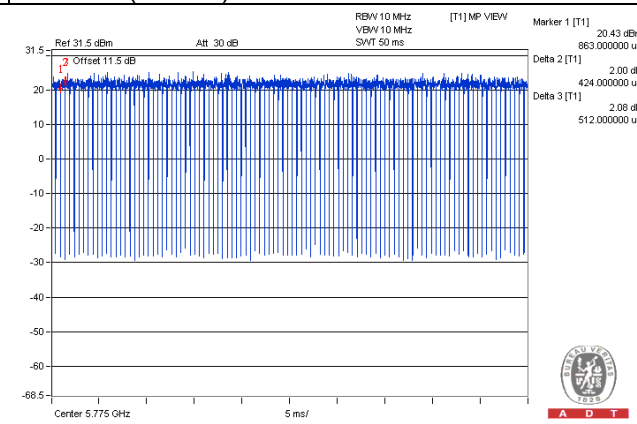
802.11n (20MHz)



802.11n (40MHz)



802.11ac (80MHz)



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.

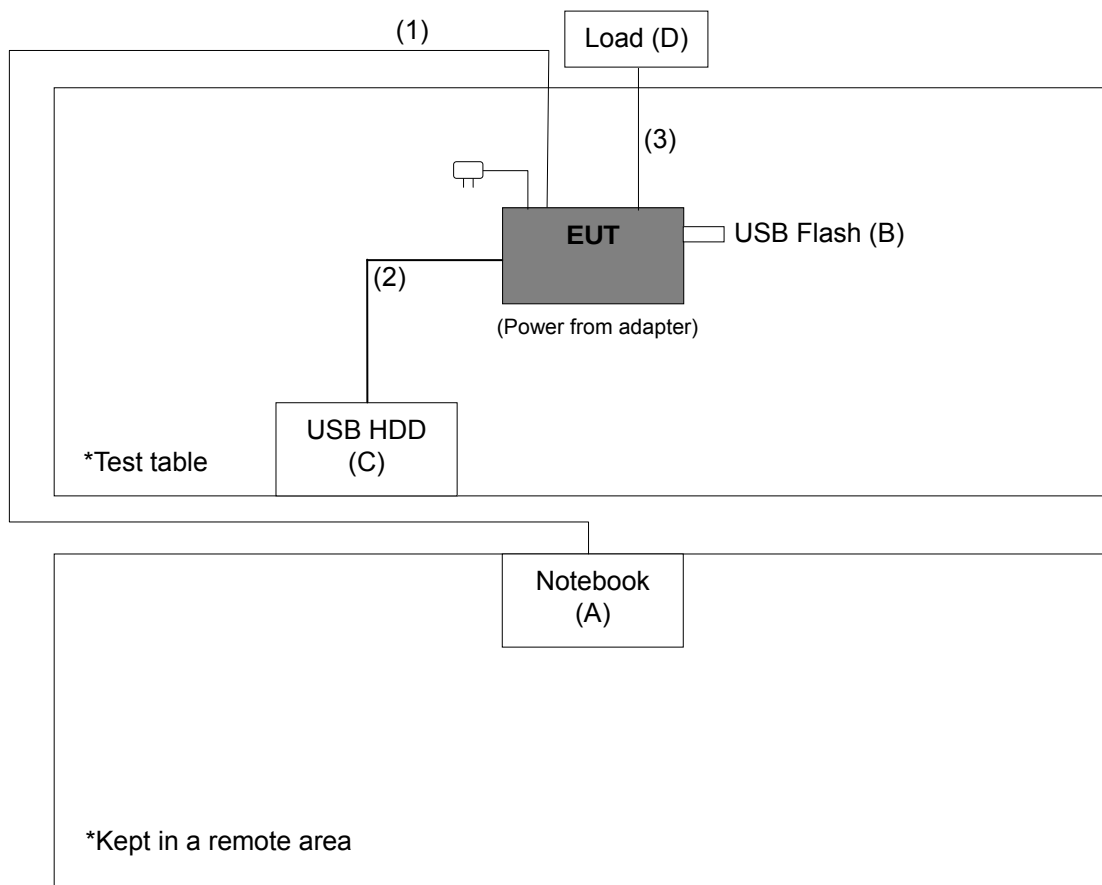
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5410	6RP2YM1	FCC DoC Approved	-
B.	USB Flash	Transcend	V85	538455 4489	FCC DoC Approved	-
C.	USB HDD	WD	WDBACY5000ABL	WX41A81P8576	FCC DoC Approved	-
D.	Load	NA	NA	NA	NA	-

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ 45	1	10	N	0	-
2.	USB	1	1.8	Y	0	-
3.	RJ 45	4	1.8	N	0	-

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

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 Procedures 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 20dB under any condition of modulation.

LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

APPLICABLE TO	LIMIT	
789033 D02 General UNII Test Procedures 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	ESCI	100424	Oct. 06, 2014	Oct. 05, 2015
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Jul. 25, 2014	Jul. 24, 2015
BILOG Antenna SCHWARZBECK	VULB9168	9168-155	Feb. 06, 2015	Feb. 05, 2016
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-1170	Feb. 05, 2015	Feb. 04, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Feb. 09, 2015	Feb. 08, 2016
Preamplifier Agilent	8449B	3008A01960	Aug. 09, 2014	Aug. 08, 2015
Preamplifier Agilent	8447D	2944A10631	Aug. 09, 2014	Aug. 08, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309220/4	Aug. 09, 2014	Aug. 08, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250724/4	Aug. 09, 2014	Aug. 08, 2015
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	295012/4	Aug. 09, 2014	Aug. 08, 2015
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	010303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021703	NA	NA
Turn Table BV ADT	TT100.	TT93021703	NA	NA
Turn Table Controller BV ADT	SC100.	SC93021703	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 test was performed in HwaYa Chamber 4.
 3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 4. The FCC Site Registration No. is 460141.
 5. The IC Site Registration No. is IC7450F-4.

4.1.3 Test Procedures

- 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:

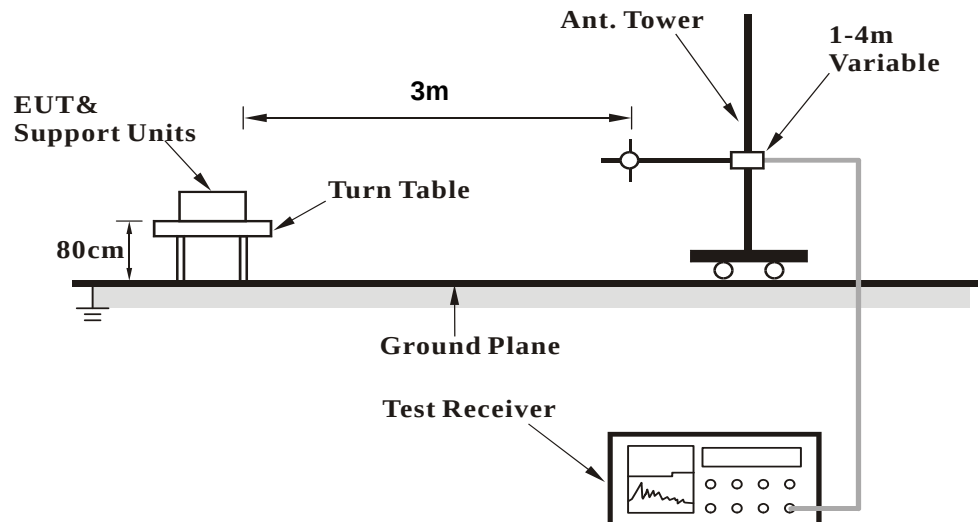
1. For emission measurements above 1 GHz, the EUT shall be placed at a height of 1.5 m above the ground at 3 meter chamber room for test. (Tracking Number 307455)
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 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

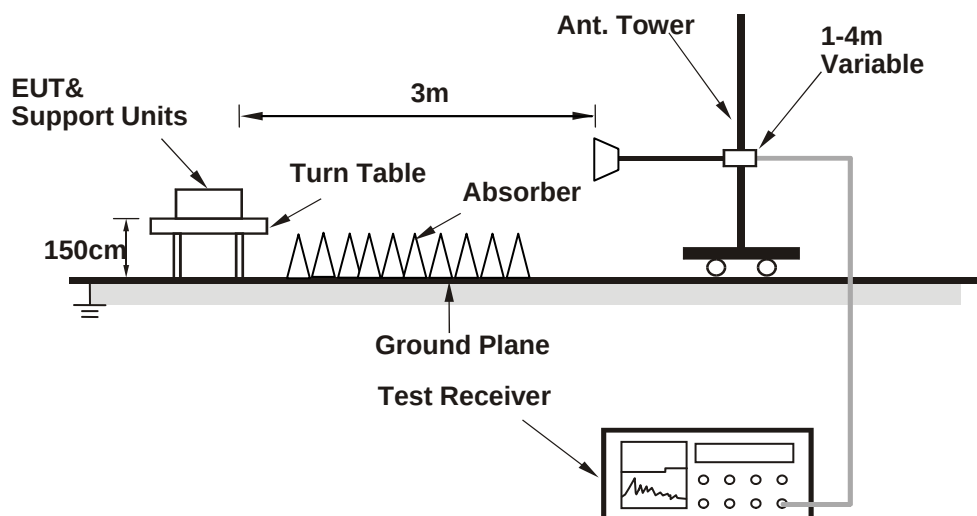
No deviation.

4.1.5 Test Set Up

<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 Conditions

- Placed the EUT on the testing table.
- Prepared a notebook to act as 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	5150.00	62.5 PK	74.0	-11.5	1.84 H	110	57.20	5.30
2	5150.00	46.8 AV	54.0	-7.2	1.84 H	110	41.50	5.30
3	*5180.00	117.2 PK			1.15 H	294	78.00	39.20
4	*5180.00	107.3 AV			1.15 H	294	68.10	39.20
5	#10360.00	66.5 PK	74.0	-7.5	1.00 H	58	48.10	18.40
6	#10360.00	53.4 AV	54.0	-0.6	1.00 H	58	35.00	18.40
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	56.0 PK	74.0	-18.0	1.10 V	266	50.70	5.30
2	5150.00	44.0 AV	54.0	-10.0	1.10 V	266	38.70	5.30
3	*5180.00	106.7 PK			1.00 V	307	67.50	39.20
4	*5180.00	97.1 AV			1.00 V	307	57.90	39.20
5	#10360.00	64.1 PK	74.0	-9.9	1.00 V	358	45.70	18.40
6	#10360.00	51.4 AV	54.0	-2.6	1.00 V	358	33.00	18.40

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)
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	*5200.00	119.8 PK			1.21 H	294	80.50	39.30
2	*5200.00	110.2 AV			1.21 H	294	70.90	39.30
3	#10400.00	69.7 PK	74.0	-4.3	1.26 H	57	51.50	18.20
4	#10400.00	53.3 AV	54.0	-0.7	1.26 H	57	35.10	18.20
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	*5200.00	108.3 PK			1.00 V	307	69.00	39.30
2	*5200.00	99.3 AV			1.00 V	307	60.00	39.30
3	#10400.00	65.6 PK	74.0	-8.4	1.00 V	329	47.40	18.20
4	#10400.00	51.6 AV	54.0	-2.4	1.00 V	329	33.40	18.20

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)
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	120.4 PK			1.51 H	291	81.10	39.30
2	*5240.00	110.7 AV			1.51 H	291	71.40	39.30
3	5350.00	55.9 PK	74.0	-18.1	1.51 H	300	50.30	5.60
4	5350.00	44.1 AV	54.0	-9.9	1.51 H	300	38.50	5.60
5	#10480.00	66.7 PK	74.0	-7.3	1.01 H	47	49.10	17.60
6	#10480.00	53.5 AV	54.0	-0.5	1.01 H	47	35.90	17.60
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	109.8 PK			1.00 V	341	70.50	39.30
2	*5240.00	99.3 AV			1.00 V	341	60.00	39.30
3	5350.00	55.1 PK	74.0	-18.9	1.60 V	85	49.50	5.60
4	5350.00	42.7 AV	54.0	-11.3	1.60 V	85	37.10	5.60
5	#10480.00	68.0 PK	74.0	-6.0	1.02 V	354	50.40	17.60
6	#10480.00	52.9 AV	54.0	-1.1	1.02 V	354	35.30	17.60

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)
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 (20MHz)

CHANNEL	TX Channel 36	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz	FUNCTION	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	64.3 PK	74.0	-9.7	1.70 H	301	59.00	5.30
2	5150.00	47.5 AV	54.0	-6.5	1.70 H	301	42.20	5.30
3	*5180.00	116.9 PK			1.60 H	294	77.70	39.20
4	*5180.00	106.9 AV			1.60 H	294	67.70	39.20
5	#10360.00	67.3 PK	74.0	-6.7	1.19 H	59	48.90	18.40
6	#10360.00	53.2 AV	54.0	-0.8	1.19 H	59	34.80	18.40
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	56.5 PK	74.0	-17.5	1.69 V	203	51.20	5.30
2	5150.00	43.1 AV	54.0	-10.9	1.69 V	203	37.80	5.30
3	*5180.00	106.9 PK			1.05 V	325	67.70	39.20
4	*5180.00	96.7 AV			1.05 V	325	57.50	39.20
5	#10360.00	61.4 PK	74.0	-12.6	1.10 V	3	43.00	18.40
6	#10360.00	48.9 AV	54.0	-5.1	1.10 V	3	30.50	18.40

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)
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	*5200.00	118.5 PK			1.08 H	297	79.20	39.30
2	*5200.00	108.4 AV			1.08 H	297	69.10	39.30
3	#10400.00	67.4 PK	74.0	-6.6	1.14 H	325	49.20	18.20
4	#10400.00	53.2 AV	54.0	-0.8	1.14 H	325	35.00	18.20
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	*5200.00	108.3 PK			1.59 V	328	69.00	39.30
2	*5200.00	99.7 AV			1.59 V	328	60.40	39.30
3	#10400.00	66.7 PK	74.0	-7.3	1.00 V	355	48.50	18.20
4	#10400.00	52.9 AV	54.0	-1.1	1.00 V	355	34.70	18.20

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)
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	120.3 PK			1.63 H	297	81.00	39.30
2	*5240.00	110.2 AV			1.63 H	297	70.90	39.30
3	5350.00	58.3 PK	74.0	-15.7	1.68 H	300	52.70	5.60
4	5350.00	48.0 AV	54.0	-6.0	1.68 H	300	42.40	5.60
5	#10480.00	67.2 PK	74.0	-6.8	1.02 H	53	49.60	17.60
6	#10480.00	53.5 AV	54.0	-0.5	1.02 H	53	35.90	17.60
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	110.0 PK			1.21 V	336	70.70	39.30
2	*5240.00	100.9 AV			1.21 V	336	61.60	39.30
3	5350.00	57.6 PK	74.0	-16.4	1.25 V	340	52.00	5.60
4	5350.00	47.1 AV	54.0	-6.9	1.25 V	340	41.50	5.60
5	#10480.00	65.2 PK	74.0	-8.8	1.00 V	352	47.60	17.60
6	#10480.00	52.6 AV	54.0	-1.4	1.00 V	352	35.00	17.60

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)
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 (40MHz)

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	73.4 PK	74.0	-0.6	1.63 H	294	68.10	5.30
2	5150.00	52.5 AV	54.0	-1.5	1.63 H	294	47.20	5.30
3	*5190.00	109.6 PK			1.63 H	292	70.40	39.20
4	*5190.00	99.7 AV			1.63 H	292	60.50	39.20
5	#10380.00	59.2 PK	74.0	-14.8	1.15 H	245	41.00	18.20
6	#10380.00	46.4 AV	54.0	-7.6	1.15 H	245	28.20	18.20
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	56.9 PK	74.0	-17.1	1.10 V	320	51.60	5.30
2	5150.00	45.4 AV	54.0	-8.6	1.10 V	320	40.10	5.30
3	*5190.00	101.5 PK			1.00 V	301	62.30	39.20
4	*5190.00	92.1 AV			1.00 V	301	52.90	39.20
5	#10380.00	59.2 PK	74.0	-14.8	1.07 V	23	41.00	18.20
6	#10380.00	46.1 AV	54.0	-7.9	1.07 V	23	27.90	18.20

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)
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 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	*5230.00	115.6 PK			1.00 H	293	76.30	39.30
2	*5230.00	106.1 AV			1.00 H	293	66.80	39.30
3	5350.00	57.0 PK	74.0	-17.0	1.60 H	85	51.40	5.60
4	5350.00	45.2 AV	54.0	-8.8	1.60 H	85	39.60	5.60
5	#10460.00	66.6 PK	74.0	-7.4	1.53 H	329	48.90	17.70
6	#10460.00	53.3 AV	54.0	-0.7	1.53 H	329	35.60	17.70
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	*5230.00	108.4 PK			1.15 V	336	69.10	39.30
2	*5230.00	98.6 AV			1.15 V	336	59.30	39.30
3	5350.00	55.5 PK	74.0	-18.5	1.02 V	36	49.90	5.60
4	5350.00	44.5 AV	54.0	-9.5	1.02 V	36	38.90	5.60
5	#10460.00	61.7 PK	74.0	-12.3	1.12 V	351	44.00	17.70
6	#10460.00	50.4 AV	54.0	-3.6	1.12 V	351	32.70	17.70

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)
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 (80MHz)

CHANNEL	TX Channel 42	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz	FUNCTION	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	69.0 PK	74.0	-5.0	1.93 H	293	63.70	5.30
2	5150.00	53.3 AV	54.0	-0.7	1.93 H	293	48.00	5.30
3	*5210.00	108.9 PK			1.57 H	294	69.60	39.30
4	*5210.00	97.9 AV			1.57 H	294	58.60	39.30
5	#10420.00	59.0 PK	74.0	-15.0	1.26 H	87	41.00	18.00
6	#10420.00	47.0 AV	54.0	-7.0	1.26 H	87	29.00	18.00
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	59.8 PK	74.0	-14.2	1.55 V	330	54.50	5.30
2	5150.00	45.6 AV	54.0	-8.4	1.55 V	330	40.30	5.30
3	*5210.00	98.5 PK			1.50 V	324	59.20	39.30
4	*5210.00	88.4 AV			1.50 V	324	49.10	39.30
5	#10420.00	58.2 PK	74.0	-15.8	1.55 V	223	40.20	18.00
6	#10420.00	45.6 AV	54.0	-8.4	1.55 V	223	27.60	18.00

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)
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 Data

802.11a

CHANNEL	TX Channel 36	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	64.83	29.5 QP	40.0	-10.5	1.99 H	255	44.70	-15.20
2	192.89	26.3 QP	43.5	-17.2	1.49 H	336	42.80	-16.50
3	350.07	30.1 QP	46.0	-15.9	1.00 H	19	41.90	-11.80
4	416.04	35.3 QP	46.0	-10.7	1.99 H	307	45.80	-10.50
5	800.24	27.7 QP	46.0	-18.3	1.00 H	208	30.90	-3.20
6	961.29	38.3 QP	54.0	-15.7	1.49 H	34	38.80	-0.50
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	33.78	39.0 QP	40.0	-1.0	1.01 V	77	54.40	-15.40
2	64.83	38.6 QP	40.0	-1.4	1.01 V	240	53.80	-15.20
3	416.04	33.6 QP	46.0	-12.4	1.01 V	12	44.10	-10.50
4	503.36	24.0 QP	46.0	-22.0	1.01 V	34	32.80	-8.80
5	780.83	27.7 QP	46.0	-18.3	2.00 V	211	31.00	-3.30
6	961.29	33.6 QP	54.0	-20.4	1.25 V	174	34.10	-0.50

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)
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.	Date Of Calibration	Due Date Of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100612	Sep. 30, 2014	Sep. 29, 2015
RF signal cable Woken	5D-FB	Cable-HYC01-01	Dec. 26, 2014	Dec. 25, 2015
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	847265/023	Oct. 21, 2014	Oct. 20, 2015
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 21, 2014	Jul. 20, 2015
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

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 test was performed in HwaYa Shielded Room 1.

3. The VCCI Site Registration No. is C-2040.

4.2.3 Test Procedures

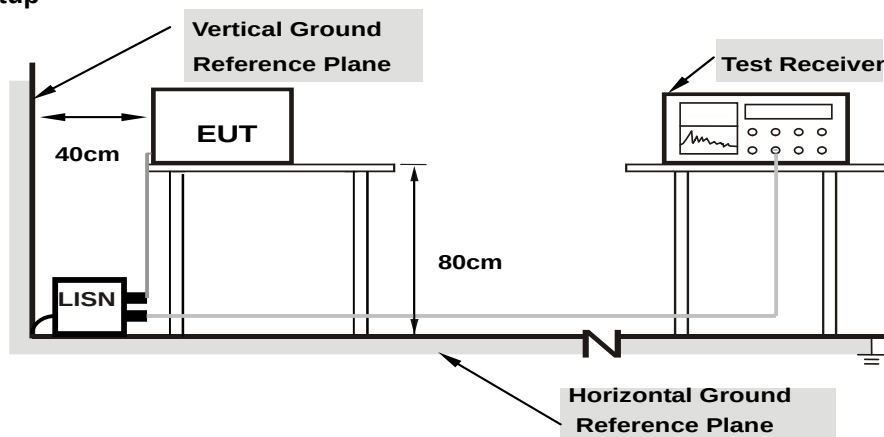
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance 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: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



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

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

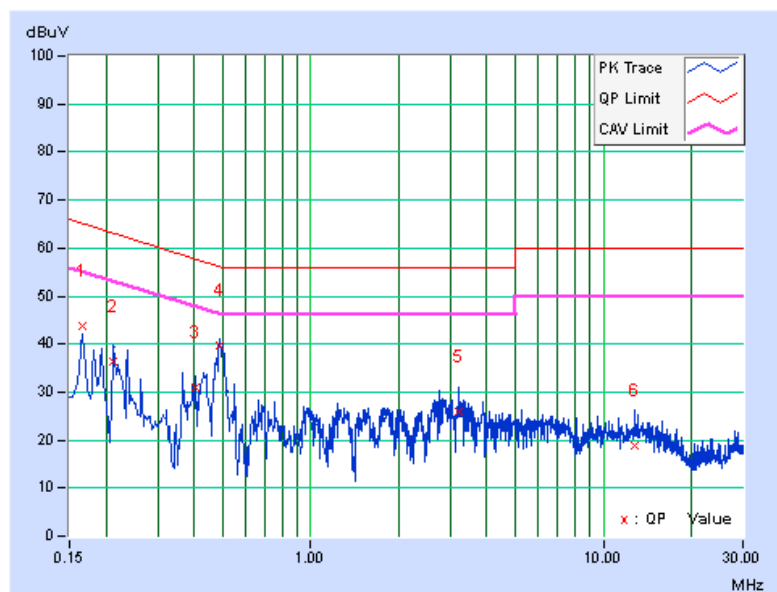
4.2.7 Test Results

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	0.16564	0.05	43.76	33.08	43.81	33.13	65.18	55.18	-21.36	-22.04
2	0.21256	0.06	36.22	24.34	36.28	24.40	63.10	53.10	-26.82	-28.70
3	0.40415	0.06	30.88	20.15	30.94	20.21	57.77	47.77	-26.83	-27.56
4	0.49017	0.06	39.74	30.21	39.80	30.27	56.16	46.16	-16.36	-15.89
5	3.21153	0.16	25.82	18.79	25.98	18.95	56.00	46.00	-30.02	-27.05
6	12.88487	0.58	18.43	12.17	19.01	12.75	60.00	50.00	-40.99	-37.25

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.

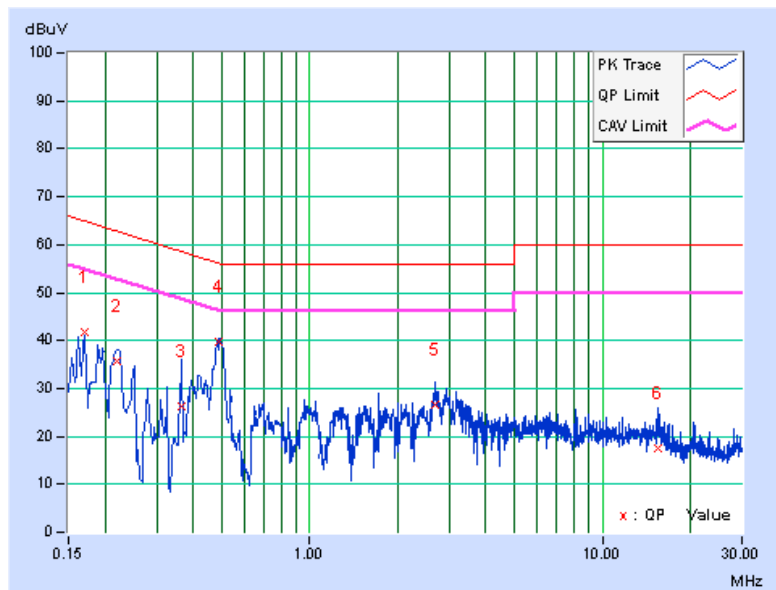


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16955	0.05	41.64	29.42	41.69	29.47	64.98	54.98	-23.29	-25.51
2	0.21851	0.05	35.72	27.58	35.77	27.63	62.88	52.88	-27.10	-25.24
3	0.36505	0.06	26.32	15.06	26.38	15.12	58.61	48.61	-32.23	-33.49
4	0.49064	0.06	39.62	30.57	39.68	30.63	56.16	46.16	-16.47	-15.52
5	2.69932	0.14	26.43	19.39	26.57	19.53	56.00	46.00	-29.43	-26.47
6	15.54758	0.59	16.84	9.87	17.43	10.46	60.00	50.00	-42.57	-39.54

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*

*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 $N_{ANT} \leq 4$;

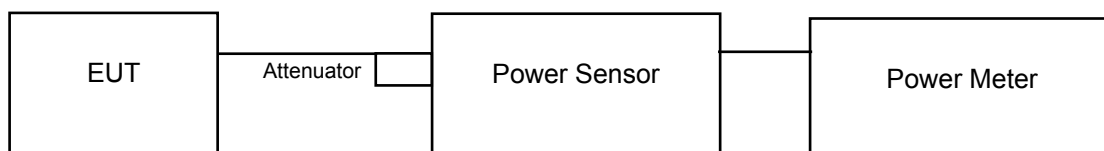
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;

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

For 802.11a, 802.11n (20MHz), 802.11n (40MHz), 802.11ac (20MHz), 802.11ac (40MHz)



For 802.11ac (80MHz)



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 (20MHz), 802.11n (40MHz), 802.11ac (20MHz), 802.11ac (40MHz)

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 (80MHz)

- a. Set span to encompass the entire 26 dB EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.
- b. Set sweep trigger to "free run".
- c. Set RBW = 1 MHz.
- d. Set VBW $\geq$ 3 MHz
- e. Number of points in sweep $\geq$ 2 Span / RBW.
- f. Sweep time $\leq$ (number of points in sweep) * T
- g. Using emission bandwidth to determine the frequency span for integration the channel bandwidth.
- h. Detector = RMS.
- i. Trace mode = max hold.
- j. 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 Conditions

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.	Chan. Freq. (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
36	5180	20.50	20.31	20.49	331.545	25.21	30	Pass
40	5200	20.92	20.33	20.81	351.994	25.47	30	Pass
48	5240	21.83	21.40	21.77	440.757	26.44	30	Pass

802.11n (20MHz)

Chan.	Chan. Freq. (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
36	5180	20.47	20.39	20.37	329.718	25.18	30	Pass
40	5200	20.91	20.43	20.79	353.668	25.49	30	Pass
48	5240	21.85	21.42	21.67	438.678	26.42	30	Pass

802.11n (40MHz)

Chan.	Chan. Freq. (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
38	5190	16.44	16.33	16.02	127.003	21.04	30	Pass
46	5230	21.97	21.61	22.00	460.764	26.63	30	Pass

802.11ac (80MHz)

Chan.	Chan. Freq. (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
42	5210	15.92	15.77	15.88	115.567	20.63	30	Pass

26dB Bandwidth:

802.11a

Channel	Channel Frequency (MHz)	26dBc Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
36	5180	28.42	21.40	25.01	Pass
40	5200	27.29	21.30	22.23	Pass
48	5240	25.79	21.47	24.86	Pass

802.11n (20MHz)

Channel	Channel Frequency (MHz)	26dBc Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
36	5180	31.30	21.19	29.87	Pass
40	5200	32.57	21.78	28.88	Pass
48	5240	30.01	21.88	29.46	Pass

802.11n (40MHz)

Channel	Channel Frequency (MHz)	26dBc Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
38	5180	41.21	41.15	40.87	Pass
46	5200	87.10	50.92	72.46	Pass

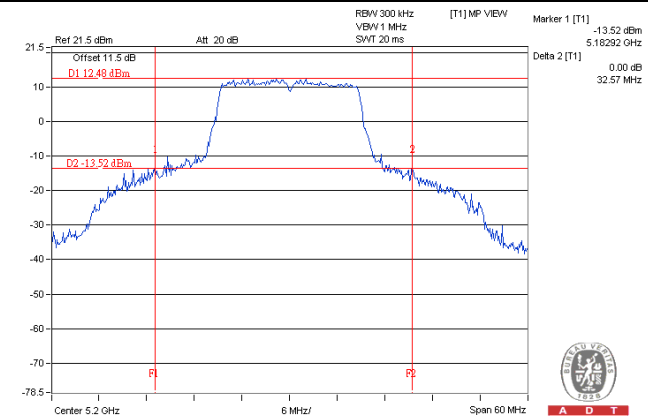
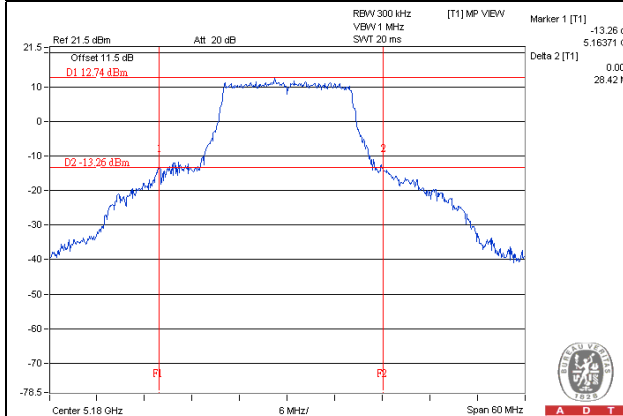
802.11ac (80MHz)

Channel	Channel Frequency (MHz)	26dBc Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
42	5210	82.51	81.97	81.49	Pass

Spectrum Plot of Worst Value

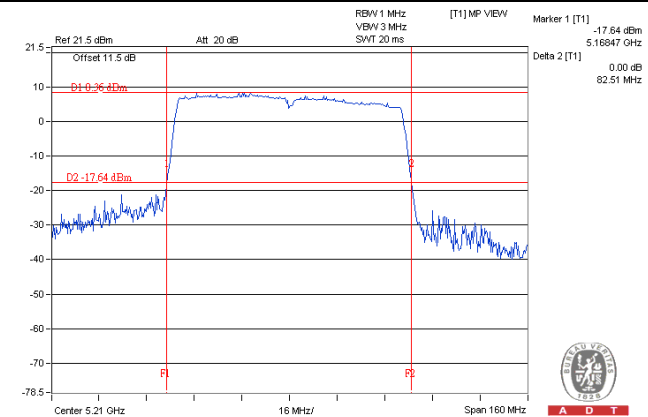
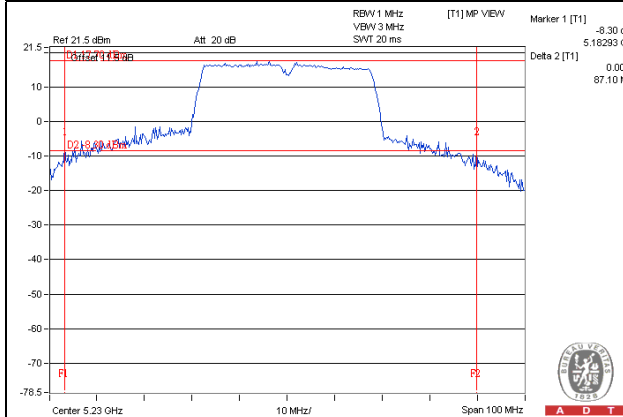
802.11a

802.11n (20MHz)



802.11n (40MHz)

802.11ac (80MHz)



For Occupied Bandwidth:

802.11a

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
36	5180	17.30	16.87	17.04	Pass
40	5200	17.28	16.92	17.04	Pass
48	5240	17.28	16.92	17.04	Pass

802.11n (20MHz)

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
36	5180	18.36	17.88	18.12	Pass
40	5200	18.24	17.88	18.12	Pass
48	5240	18.24	17.88	18.12	Pass

802.11n (40MHz)

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
38	5190	36.72	36.60	36.60	Pass
46	5230	37.44	36.84	37.08	Pass

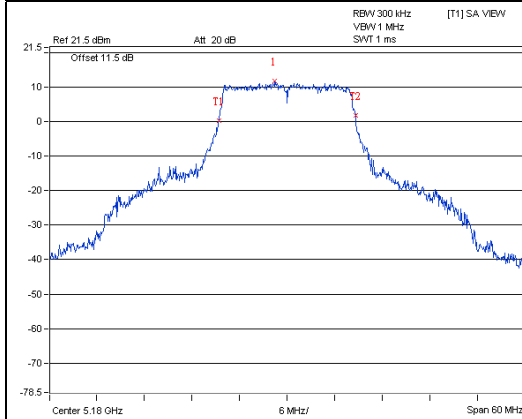
802.11ac (80MHz)

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
42	5210	75.84	75.84	75.60	Pass

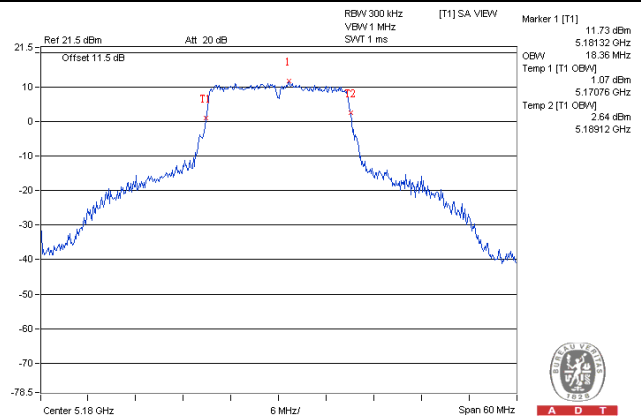
Spectrum Plot of Worst Value

802.11a

802.11n (20MHz)



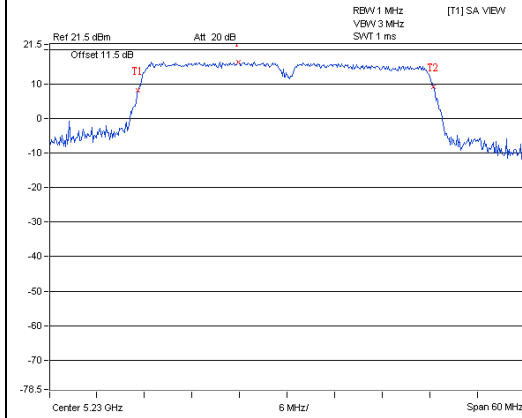
A D T



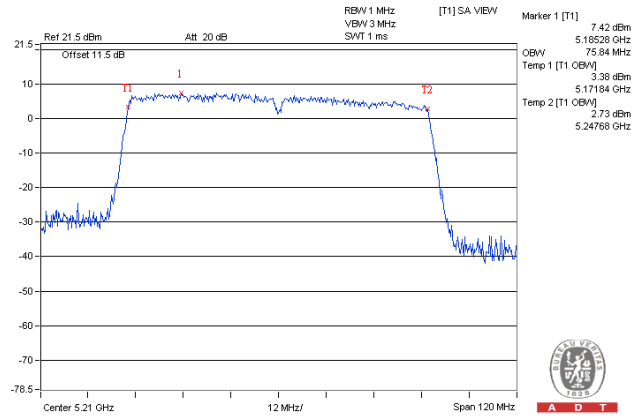
A D T

802.11n (40MHz)

802.11ac (80MHz)



A D T



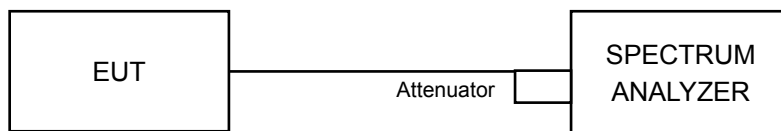
A D T

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

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 Procedures

Using method SA-2

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

Same as Item 4.3.6.

4.4.7 Test Results

802.11a

Chan.	Chan. Freq. (MHz)	PSD (dBm)			Total PSD W/O Duty Factor (dBm/MHz)	Duty Factor	Total PSD With Duty Factor (dBm/MHz)	Max. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2					
36	5180	7.14	6.65	6.88	11.67	0.43	12.10	16.43	Pass
40	5200	7.73	7.12	7.26	12.15	0.43	12.58	16.43	Pass
48	5240	9.06	8.08	8.55	13.36	0.43	13.79	16.43	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 = $1.8\text{dBi} + 10\log(3) = 6.57\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $17-(6.57-6) = 16.43\text{dBm}$.
- Refer to section 3.3 for duty cycle spectrum plot.

802.11n (20MHz)

Chan.	Chan. Freq. (MHz)	PSD (dBm)			Total PSD W/O Duty Factor (dBm/MHz)	Duty Factor	Total PSD With Duty Factor (dBm/MHz)	Max. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2					
36	5180	6.71	6.97	6.51	11.51	0.11	11.62	16.43	Pass
40	5200	7.35	7.37	7.27	12.10	0.11	12.21	16.43	Pass
48	5240	8.53	8.23	8.06	13.05	0.11	13.16	16.43	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 = $1.8\text{dBi} + 10\log(3) = 6.57\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $17-(6.57-6) = 16.43\text{dBm}$.
- Refer to section 3.3 for duty cycle spectrum plot.

802.11n (40MHz)

Chan.	Chan. Freq. (MHz)	PSD (dBm)			Total PSD W/O Duty Factor (dBm/MHz)	Duty Factor	Total PSD With Duty Factor (dBm/MHz)	Max. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2					
38	5190	-0.08	-0.59	-0.77	4.30	0.46	4.76	16.43	Pass
46	5230	5.89	5.39	5.46	10.36	0.46	10.82	16.43	Pass

Note:

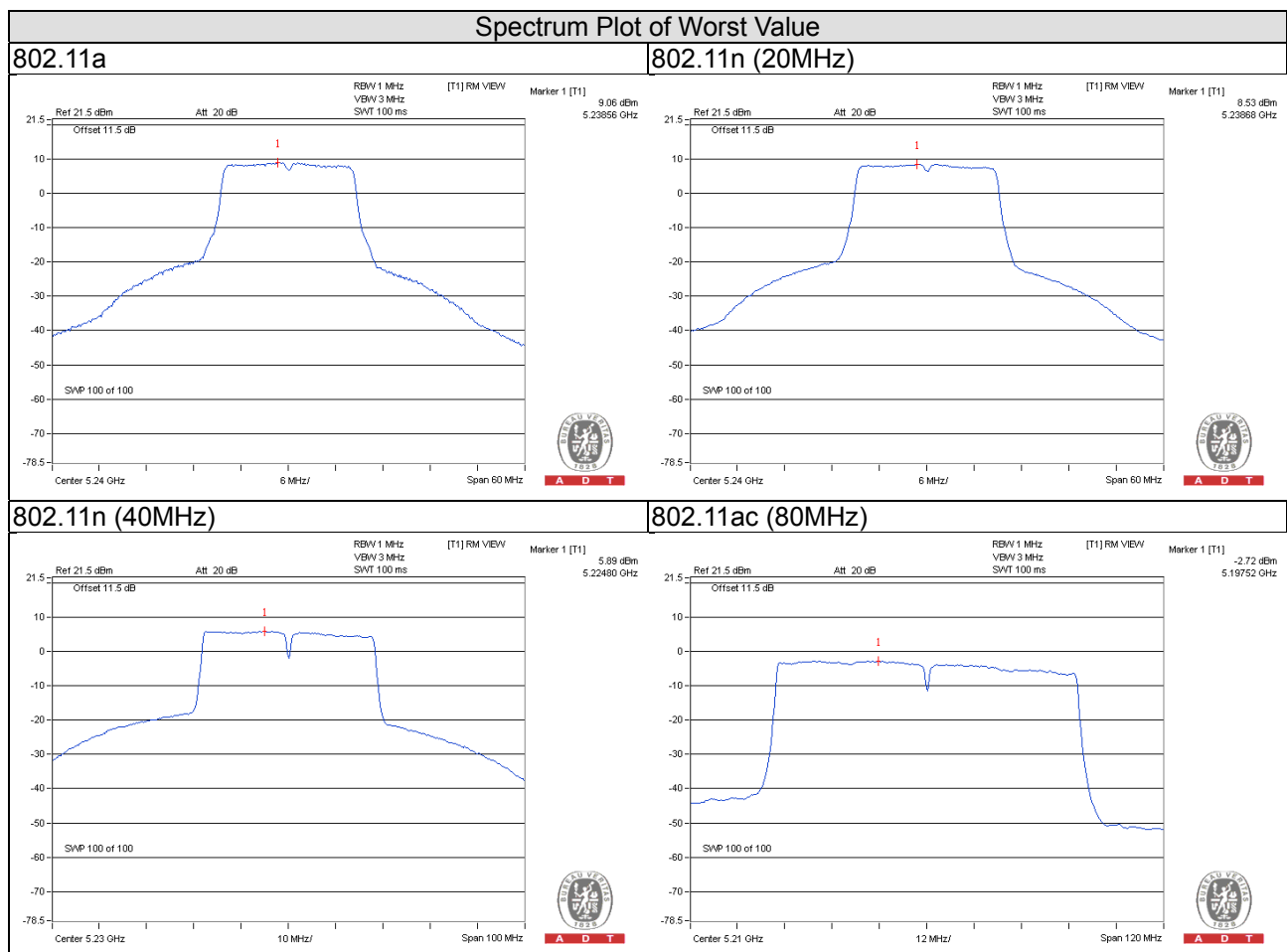
- Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
- Directional gain = $1.8\text{dBi} + 10\log(3) = 6.57\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $17-(6.57-6) = 16.43\text{dBm}$.
- Refer to section 3.3 for duty cycle spectrum plot.

802.11ac (80MHz)

Chan.	Chan. Freq. (MHz)	PSD (dBm)			Total PSD W/O Duty Factor (dBm/MHz)	Duty Factor	Total PSD With Duty Factor (dBm/MHz)	Max. Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2					
42	5210	-2.72	-3.14	-3.15	1.77	0.82	2.59	16.43	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 = $1.8\text{dBi} + 10\log(3) = 6.57\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $17 - (6.57 - 6) = 16.43\text{dBm}$.
3. Refer to section 3.3 for duty cycle spectrum plot.

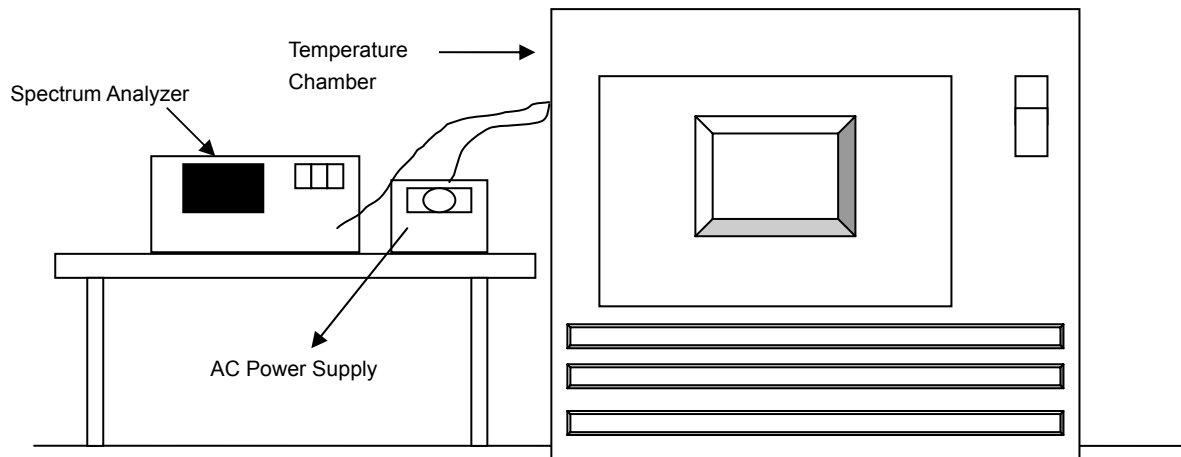


4.5 Frequency Stability

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	5240.0128	0.00024	5240.0155	0.00030	5240.0128	0.00024	5240.0136	0.00026
40	120	5239.99	-0.00019	5239.9877	-0.00023	5239.9881	-0.00023	5239.9906	-0.00018
30	120	5239.9889	-0.00021	5239.9898	-0.00019	5239.992	-0.00015	5239.9922	-0.00015
20	120	5239.9879	-0.00023	5239.9877	-0.00023	5239.9904	-0.00018	5239.989	-0.00021
10	120	5239.9762	-0.00045	5239.975	-0.00048	5239.9766	-0.00045	5239.9765	-0.00045
0	120	5240.0134	0.00026	5240.0135	0.00026	5240.014	0.00027	5240.0101	0.00019
-10	120	5240.0204	0.00039	5240.0213	0.00041	5240.0206	0.00039	5240.0177	0.00034
-20	120	5240.022	0.00042	5240.0224	0.00043	5240.0267	0.00051	5240.0257	0.00049
-30	120	5239.9844	-0.00030	5239.988	-0.00023	5239.9853	-0.00028	5239.9881	-0.00023

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 (%)
20	138	5239.9871	-0.00025	5239.9882	-0.00023	5239.9904	-0.00018	5239.9893	-0.00020
	120	5239.9879	-0.00023	5239.9877	-0.00023	5239.9904	-0.00018	5239.989	-0.00021
	102	5239.9884	-0.00022	5239.9883	-0.00022	5239.9913	-0.00017	5239.9881	-0.00023

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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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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