

FCC TEST REPORT (15.407)

REPORT NO.: RF121205E03C-1

MODEL NO.: WMC-AC01

FCC ID: RRK2012060056-1

RECEIVED: June 27, 2014

TESTED: July 21 to 25, 2014

ISSUED: Aug. 07, 2014

APPLICANT: Alpha Networks Inc.

ADDRESS: No.8 Li-shing 7th Rd., Science-based
Industrial Park, Hsinchu, Taiwan, R.O.C.

ISSUED BY: Bureau Veritas Consumer Products Services
(H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory

LAB ADDRESS : No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen,
Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan,
R.O.C.

TEST LOCATION (1): No. 81-1, Lu Liao Keng, 9th Ling, Wu Lung Tsuen,
Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan,
R.O.C.

TEST LOCATION (2): No. 49, Ln. 206, Wende Rd., Shangshan Tsuen,
Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan,
R.O.C.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF121205E03C-1	Original release	Aug. 07, 2014

1. CERTIFICATION

PRODUCT: Wireless AC Module
BRAND NAME: Alpha
MODEL NO.: WMC-AC01
TEST SAMPLE: R&D SAMPLE
APPLICANT: Alpha Networks Inc.
TESTED: July 21 to 25, 2014
STANDARDS: FCC Part 15, Subpart E (Section 15.407)
ANSI C63.10-2009

The above equipment (Model: WMC-AC01) 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 : Midoli Peng, **DATE:** Aug. 07, 2014
(Midoli Peng, Specialist)

APPROVED BY : May Chen, **DATE:** Aug. 07, 2014
(May Chen, Manager)

2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART E (SECTION 15.407)			
STANDARD SECTION	TEST TYPE	RESULT	REMARK
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 5099.00MHz, 5113.30MHz & 5402.00MHz & 5150.00MHz.
15.407(a/1/2/3)	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 not a standard connector.

NOTE:

1. This report is prepared for FCC class II permissive change. Only Radiated Emissions & Band Edge Measurement, Transmit Power, Peak Power Spectral Density and Frequency Stability were presented in this test report.
2. The EUT was operating in 5.15~5.25GHz and 5.725~5.850GHz frequencies band. This report was recorded the RF parameters including 5.15~5.25GHz.

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:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

Measurement	Value
Radiated emissions (30MHz-1GHz)	5.43 dB
Radiated emissions (1GHz -6GHz)	5.37 dB
Radiated emissions (6GHz -18GHz)	3.65 dB
Radiated emissions (18GHz -40GHz)	3.88 dB

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

PRODUCT	Wireless AC Module
MODEL NO.	WMC-AC01
POWER SUPPLY	DC 3.3V or 5V from host equipment
MODULATION TYPE	64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode only.
MODULATION TECHNOLOGY	OFDM
TRANSFER RATE	802.11a / g: up to 54Mbps 802.11n: up to 450Mbps 802.11ac: up to 1300Mbps
OPERATING FREQUENCY	For 15.407 5.18 ~ 5.24GHz
	For 15.247 5.745 ~ 5.825GHz
NUMBER OF CHANNEL	For 15.407 4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80)
	For 15.247 5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80)
MAXIMUM OUTPUT POWER	For 5.15~5.25GHz 802.11a: 479.643mW 802.11ac (VHT20): 913.593mW 802.11ac (VHT40): 361.067mW 802.11ac (VHT80): 159.455mW
ANTENNA TYPE	Please see NOTE
DATA CABLE	NA
I/O PORTS	Refer to user's manual
ASSOCIATED DEVICES	NA

NOTE:

1. This report is prepared for FCC class II permissive change. The difference compared with the Report No.: RF121205E03-1 design is as the following information:

u Upgraded standard version.(For 5150~5250MHz only)

2. The antennas provided to the EUT, please refer to the following table:

Set 1								
Transmitter Circuit	Brand	Model name	Antenna Type	Gain (dBi) (Exclude cable loss)	Cable Loss (dB)	Net Gain (dBi)	Connector Type	Cable Length(mm)
Chain (0)	WHA YU	C037-511226-A	PCB	4	0.416	3.584	I-PEX	80
Chain (1)	WHA YU	C037-511226-A	PCB	4	0.416	3.584	I-PEX	80
Chain (2)	WHA YU	C037-511226-A	PCB	4	0.416	3.584	I-PEX	80
Set 2								
Transmitter Circuit	Brand	Model name	Antenna Type	Gain (dBi) (Exclude cable loss)	Cable Loss (dB)	Net Gain (dBi)	Connector Type	Cable Length(mm)
Chain (0)	WHA YU	C037-511225-A	PCB	4	0.572	3.428	I-PEX	110
Chain (1)	WHA YU	C037-511225-A	PCB	4	0.572	3.428	I-PEX	110
Chain (2)	WHA YU	C037-511225-A	PCB	4	0.572	3.428	I-PEX	110
Set 3								
Transmitter Circuit	Brand	Model name	Antenna Type	Gain (dBi) (Exclude cable loss)	Cable Loss (dB)	Net Gain (dBi)	Connector Type	Cable Length(mm)
Chain (0)	WHA YU	SSR-30247	PCB	4	0.18	3.82	I-PEX	50
Chain (1)	WHA YU	SSR-30247	PCB	4	0.18	3.82	I-PEX	50
Chain (2)	WHA YU	SSR-30247	PCB	4	0.18	3.82	I-PEX	50

Antenna (Set 3) was chosen for final test.

3. The EUT incorporates a MIMO function without beam forming.

MODULATION MODE	TX/RX FUNCTION
802.11a	3TX/3RX
802.11n (HT20)	3TX/3RX
802.11n (HT40)	3TX/3RX
802.11ac (VHT20)	3TX/3RX
802.11ac (VHT40)	3TX/3RX
802.11ac (VHT80)	3TX/3RX

Note: 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)

4. When the EUT operating in 802.11n, the software operation, which is defined by manufacturer, MCS (Modulation and Coding Schemes) from 0 to 23.
5. When the EUT operating in 802.11ac, the software operation, which is defined by manufacturer, MCS (Modulation and Coding Schemes) from 0 to 9.
6. The above EUT information was declared by the manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

3.2 DESCRIPTION OF TEST MODES

Operated in 5150 ~ 5250MHz band:

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

CHANNEL	FREQUENCY
36	5180 MHz
40	5200 MHz
44	5220 MHz
48	5240 MHz

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

CHANNEL	FREQUENCY
38	5190 MHz
46	5230 MHz

1 channels are provided for 802.11ac (VHT80):

CHANNEL	FREQUENCY
42	5210 MHz

3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO			DESCRIPTION
	RE < 1G	RE ³ 1G	APCM	
-	√	√	√	-

Where **RE < 1G**: Radiated Emission below 1GHz **RE ³ 1G**: Radiated Emission above 1GHz
APCM: Antenna Port Conducted Measurement

RADIATED EMISSION TEST (BELOW 1 GHz):

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11n (HT20)	36 to 48	48	OFDM	BPSK	19.5

RADIATED EMISSION TEST (ABOVE 1 GHz):

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (MBPS)
802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6
802.11ac (VHT20)	36 to 48	36, 40, 48	OFDM	BPSK	19.5
802.11ac (VHT40)	38 to 46	38, 46	OFDM	BPSK	40.5
802.11ac (VHT80)	42	42	OFDM	BPSK	87.8

ANTENNA PORT CONDUCTED MEASUREMENT:

- ☒ 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.

Network Radio					
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (MBPS)
802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6
802.11ac (VHT20)	36 to 48	36, 40, 48	OFDM	BPSK	19.5
802.11ac (VHT40)	38 to 46	38, 46	OFDM	BPSK	40.5
802.11ac (VHT80)	42	42	OFDM	BPSK	87.8

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE<1G	24deg. C, 68%RH	120Vac, 60Hz	Robert Cheng
RE ³ 1G	24deg. C, 68%RH	120Vac, 60Hz	Andy Ho
APCM	25deg. C, 60%RH	120Vac, 60Hz	Chilin Lee

3.3 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.

3.4 DUTY CYCLE OF TEST SIGNAL

If duty cycle of test signal is > 98 %, duty factor is not required.

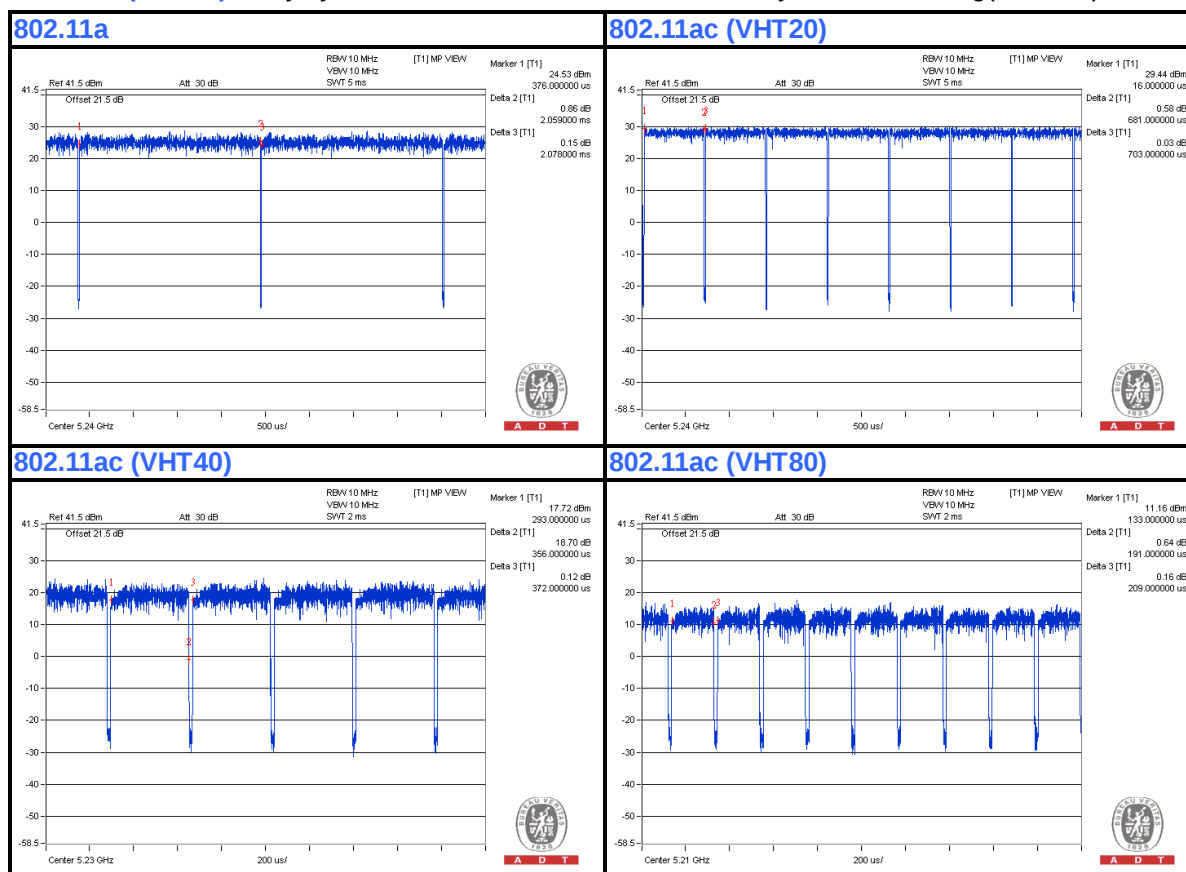
If duty cycle of test signal is < 98%, duty factor shall be considered.

802.11a: Duty cycle = 2.059 ms/2.078 ms = 0.991

802.11ac (VHT20): Duty cycle = 0.681 ms/0.703 ms = 0.969, Duty factor = $10 * \log(1/0.969) = 0.14$

802.11ac (VHT40): Duty cycle = 0.356 ms/0.372 ms = 0.957, Duty factor = $10 * \log(1/0.957) = 0.19$

802.11ac (VHT80): Duty cycle = 0.191 ms/0.209 ms = 0.914, Duty factor = $10 * \log(1/0.914) = 0.39$



3.5 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.

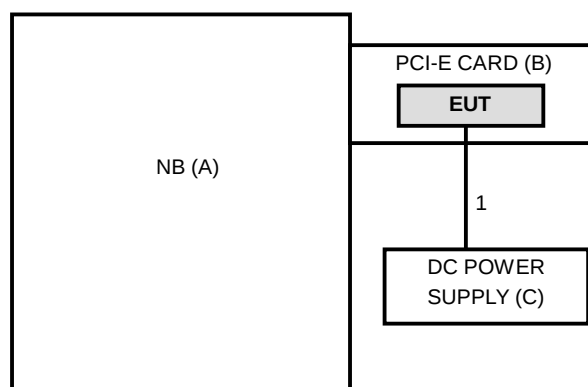
No.	Product	Brand	Model No.	Serial No.	FCC ID	Remark
A	NOTEBOOK COMPUTER	DELL	E5430	HYV4VY1	FCC DoC	Provided by Lab
B	PCI-E CARD	Alpha	NA	NA	NA	Supplied by client
C	DC POWER SUPPLY	Topward	6603D	795558	NA	Provided by Lab

NOTE:

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

No.	Cable	Qty.	Length (m)	Shielded (Yes/ No)	Cores (Number)	Remark
1	DC	1	1.8	No	0	Provided by Lab

3.6 CONFIGURATION OF SYSTEM UNDER TEST



4. TEST TYPES AND RESULTS

4.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

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

Frequencies (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:

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.

4.1.2 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 (dBμV/m)	AV:54 (dBμV/m)
APPLICABLE TO	EIRP LIMIT	EQUIVALENT FIELD STRENGTH AT 3m
15.407(b)(1)	PK:-27 (dBm/MHz)	PK:68.2(dBμV/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(dBμV/m) ^{*1} PK:78.2 (dBμV/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:

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

4.1.3 TEST INSTRUMENTS

Below 1GHz test

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY50010156	Jan. 15, 2014	Jan. 14, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 13, 2013	Nov. 12, 2014
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Feb. 27, 2014	Feb. 26, 2015
RF Cable	NA	CHHCAB_001	Oct. 06, 2013	Oct. 05, 2014
Spectrum Analyzer R&S	FSV40	100964	July 05, 2014	July 04, 2015
Horn_Antenna AISI	AIH.8018	0000220091110	Dec. 06, 2013	Dec. 05, 2014
Pre-Amplifier Agilent	8449B	3008A01923	Oct. 29, 2013	Oct. 28, 2014
RF Cable	NA	RF104-205 RF104-207 RF104-202	Dec. 12, 2013	Dec. 11, 2014
Spectrum Analyzer Agilent	E4446A	MY48250253	Aug. 28, 2013	Aug. 27, 2014
Pre-Amplifier SPACEK LABS	SLKKa-48-6	9K16	Nov. 13, 2013	Nov. 12, 2014
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Oct. 08, 2013	Oct. 07, 2014
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	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 horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
- 3 The test was performed in 966 Chamber No. H.
4. The FCC Site Registration No. is 797305.
- 5 The CANADA Site Registration No. is IC 7450H-3.
- 6 Tested Date: July 21, 2014



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Above 1GHz test

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
MXE EMI Receiver Agilent	N9038A	MY51210105	July 21, 2014	July 20, 2015
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-03	Nov. 13, 2013	Nov. 12, 2014
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-360	Feb. 26, 2014	Feb. 25, 2015
RF Cable	NA	CHGCAB_001	Oct. 05, 2013	Oct. 04, 2014
Spectrum Analyzer R&S	FSV40	100964	July 05, 2014	July 04, 2015
Horn_Antenna AISI	AIH.8018	0000320091110	Nov. 18, 2013	Nov. 17, 2014
Pre-Amplifier Agilent	8449B	3008A02578	June 24, 2014	June 23, 2015
RF Cable	NA	RF104-201 RF104-203 RF104-204	Dec. 12, 2013	Dec. 11, 2014
Spectrum Analyzer Agilent	E4446A	MY48250253	Aug. 28, 2013	Aug. 27, 2014
Pre-Amplifier SPACEK LABS	SLKKa-48-6	9K16	Nov. 13, 2013	Nov. 12, 2014
Horn_Antenna SCHWARZBECK	BBHA 9170	9170-424	Oct. 08, 2013	Oct. 07, 2014
Software	ADT_Radiated _V8.7.07	NA	NA	NA
Antenna Tower & Turn Table CT	NA	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 horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
- 3 The test was performed in 966 Chamber No. G.
4. The FCC Site Registration No. is 966073.
- 5 The VCCI Site Registration No. is G-137.
- 6 The CANADA Site Registration No. is IC 7450H-2.
- 7 Tested Date: July 21, 2014

4.1.4 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:

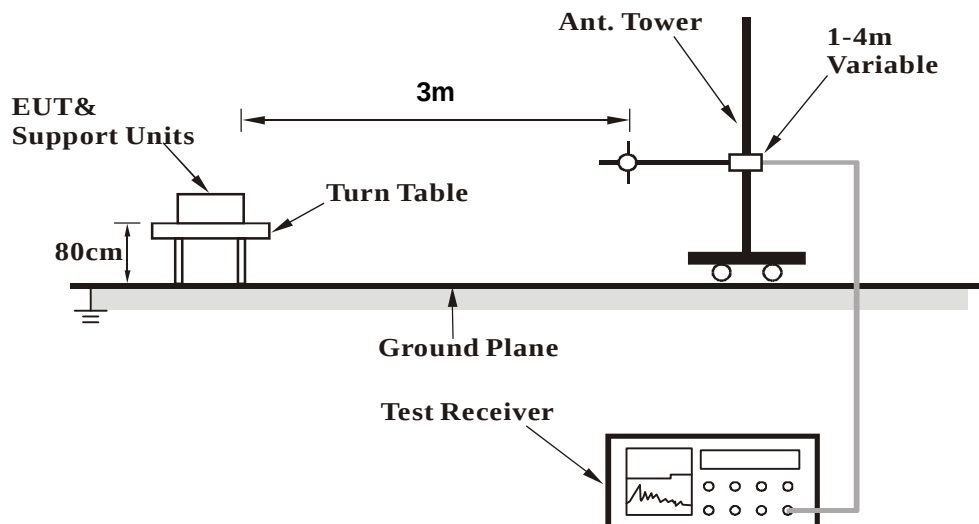
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.5 DEVIATION FROM TEST STANDARD

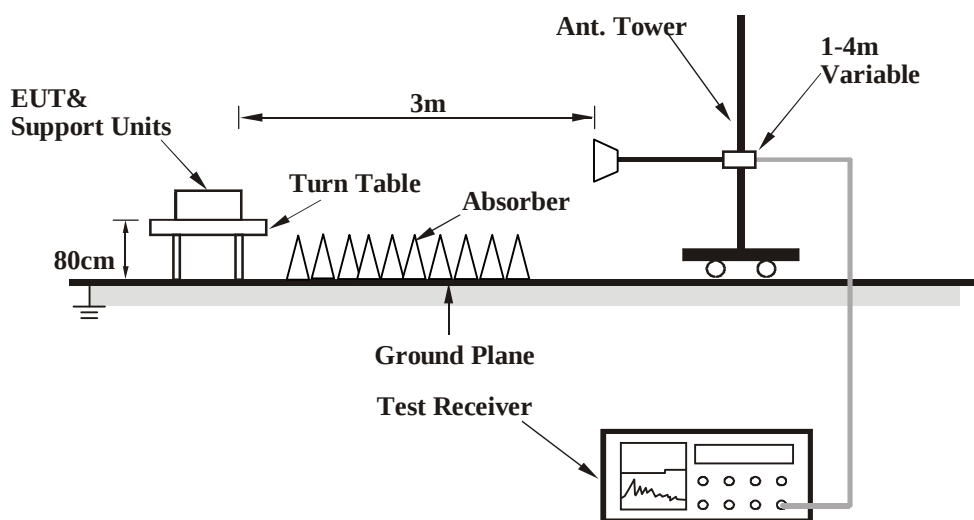
No deviation

4.1.6 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.



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4.1.7 EUT OPERATING CONDITION

1. Connect the EUT with the support unit 1 (Notebook Computer) which is placed on a testing table.
2. The communication partner run test program “Mtool 1.0.0.8” to enable EUT under transmission/receiving condition continuously at specific channel frequency.

4.1.8 TEST RESULTS

BELOW 1GHz WORST-CASE DATA

802.11ac (VHT20)

CHANNEL	TX Channel 48	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	Below 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	232.73	38.9 QP	46.0	-7.1	1.00 H	59	53.46	-14.55
2	240.01	42.0 QP	46.0	-4.0	1.50 H	76	55.83	-13.80
3	274.59	41.0 QP	46.0	-5.0	1.00 H	284	53.57	-12.61
4	305.53	37.2 QP	46.0	-8.8	1.00 H	83	48.68	-11.47
5	364.75	36.9 QP	46.0	-9.1	1.00 H	185	46.98	-10.07
6	697.17	39.7 QP	46.0	-6.4	1.00 H	79	42.82	-3.17
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	37.42	33.5 QP	40.0	-6.5	1.00 V	45	47.31	-13.77
2	232.78	35.4 QP	46.0	-10.6	1.00 V	100	49.96	-14.54
3	240.01	37.5 QP	46.0	-8.6	1.00 V	111	51.25	-13.80
4	698.43	37.4 QP	46.0	-8.6	2.00 V	68	40.55	-3.15
5	897.33	38.8 QP	46.0	-7.2	1.00 V	136	38.31	0.45
6	969.88	43.5 QP	54.0	-10.5	1.00 V	108	41.70	1.76

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value



A D T

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	5099.00	63.2 PK	74.0	-10.8	1.07 H	280	56.65	6.55
2	5099.00	53.8 AV	54.0	-0.2	1.07 H	280	47.25	6.55
3	*5180.00	115.8 PK			1.39 H	280	108.85	6.95
4	*5180.00	105.6 AV			1.39 H	280	98.65	6.95
5	#5827.40	56.5 PK	68.2	-11.7	1.77 H	67	47.90	8.60
6	#6906.70	62.3 PK	68.2	-5.9	1.76 H	70	49.65	12.65
7	#10360.00	55.6 PK	68.2	-12.6	1.00 H	241	42.49	13.11
8	15540.00	61.6 PK	74.0	-12.4	1.00 H	102	42.91	18.69
9	15540.00	48.3 AV	54.0	-5.7	1.00 H	102	29.61	18.69
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	5099.00	62.3 PK	74.0	-11.7	1.17 V	339	55.75	6.55
2	5099.00	52.9 AV	54.0	-1.1	1.17 V	339	46.35	6.55
3	*5180.00	113.9 PK			1.15 V	337	106.95	6.95
4	*5180.00	104.7 AV			1.15 V	337	97.75	6.95
5	#5827.40	54.0 PK	68.2	-14.2	1.33 V	225	45.40	8.60
6	#6906.70	54.5 PK	68.2	-13.7	1.15 V	100	41.85	12.65
7	#10360.00	55.3 PK	68.2	-12.9	1.00 V	211	42.19	13.11
8	15540.00	61.1 PK	74.0	-12.9	1.00 V	205	42.41	18.69
9	15540.00	48.3 AV	54.0	-5.7	1.00 V	205	29.61	18.69

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	5124.60	63.0 PK	74.0	-11.0	1.63 H	278	56.33	6.67
2	5124.60	53.5 AV	54.0	-0.5	1.63 H	278	46.83	6.67
3	*5200.00	115.8 PK			1.42 H	277	108.75	7.05
4	*5200.00	107.7 AV			1.42 H	277	100.65	7.05
5	#6933.30	61.1 PK	68.2	-7.1	1.41 H	62	48.35	12.75
6	#10400.00	55.9 PK	68.2	-12.3	1.00 H	245	42.68	13.22
7	15600.00	61.3 PK	74.0	-12.7	1.00 H	89	42.60	18.70
8	15600.00	48.1 AV	54.0	-5.9	1.00 H	89	29.40	18.70
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	5124.60	62.0 PK	74.0	-12.0	1.17 V	343	55.33	6.67
2	5124.60	52.9 AV	54.0	-1.1	1.17 V	343	46.23	6.67
3	*5200.00	114.9 PK			1.17 V	329	107.85	7.05
4	*5200.00	106.8 AV			1.17 V	329	99.75	7.05
5	#6933.30	54.1 PK	68.2	-14.1	1.12 V	97	41.35	12.75
6	#10400.00	55.3 PK	68.2	-12.9	1.03 V	203	42.08	13.22
7	15600.00	61.8 PK	74.0	-12.2	1.00 V	194	43.10	18.70
8	15600.00	48.8 AV	54.0	-5.2	1.00 V	194	30.10	18.70

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) – 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.



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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	5085.00	62.3 PK	74.0	-11.7	1.44 H	291	55.78	6.52
2	5085.00	50.5 AV	54.0	-3.5	1.44 H	291	43.98	6.52
3	*5240.00	123.5 PK			1.43 H	277	116.34	7.16
4	*5240.00	113.5 AV			1.43 H	277	106.34	7.16
5	5402.00	63.1 PK	74.0	-10.9	1.65 H	287	55.39	7.71
6	5402.00	53.8 AV	54.0	-0.2	1.65 H	287	46.09	7.71
7	#6986.70	61.8 PK	68.2	-6.4	1.39 H	225	48.86	12.94
8	#10480.00	56.3 PK	68.2	-11.9	1.64 H	269	43.14	13.16
9	15720.00	60.7 PK	74.0	-13.3	1.00 H	217	42.30	18.40
10	15720.00	48.5 AV	54.0	-5.5	1.00 H	217	30.10	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	5085.00	53.6 PK	74.0	-20.4	1.35 V	215	47.08	6.52
2	5085.00	49.6 AV	54.0	-4.4	1.35 V	215	43.08	6.52
3	*5240.00	122.4 PK			1.15 V	321	115.24	7.16
4	*5240.00	112.6 AV			1.15 V	321	105.44	7.16
5	5402.00	62.0 PK	74.0	-12.0	1.17 V	339	54.29	7.71
6	5402.00	52.6 AV	54.0	-1.4	1.17 V	339	44.89	7.71
7	#6986.70	54.9 PK	68.2	-13.3	1.15 V	107	41.96	12.94
8	#10480.00	58.2 PK	68.2	-10.0	1.53 V	224	45.04	13.16
9	15720.00	61.2 PK	74.0	-12.8	1.00 V	36	42.80	18.40
10	15720.00	48.7 AV	54.0	-5.3	1.00 V	36	30.30	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) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

802.11ac (VHT20)

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	5093.40	64.9 PK	74.0	-9.1	1.11 H	275	58.36	6.54
2	5093.40	53.7 AV	54.0	-0.3	1.11 H	275	47.16	6.54
3	*5180.00	116.4 PK			1.46 H	277	109.45	6.95
4	*5180.00	104.7 AV			1.46 H	277	97.75	6.95
5	#5611.60	55.5 PK	68.2	-12.7	1.69 H	277	47.27	8.23
6	#6906.60	60.2 PK	68.2	-8.0	1.62 H	273	47.55	12.65
7	#10360.00	55.8 PK	68.2	-12.4	1.04 H	231	42.69	13.11
8	15540.00	62.0 PK	74.0	-12.0	1.00 H	95	43.31	18.69
9	15540.00	48.7 AV	54.0	-5.3	1.00 H	95	30.01	18.69
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	5093.40	62.2 PK	74.0	-11.8	1.22 V	354	55.66	6.54
2	5093.40	52.8 AV	54.0	-1.2	1.22 V	354	46.26	6.54
3	*5180.00	115.2 PK			1.15 V	321	108.25	6.95
4	*5180.00	103.9 AV			1.15 V	321	96.95	6.95
5	#5611.60	54.4 PK	68.2	-13.8	1.11 V	114	46.17	8.23
6	#6906.60	53.2 PK	68.2	-15.0	1.37 V	210	40.55	12.65
7	#10360.00	55.3 PK	68.2	-12.9	1.00 V	215	42.19	13.11
8	15540.00	61.2 PK	74.0	-12.8	1.00 V	218	42.51	18.69
9	15540.00	48.3 AV	54.0	-5.7	1.00 V	218	29.61	18.69

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.



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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	5113.30	64.6 PK	74.0	-9.4	1.13 H	280	57.98	6.62
2	5113.30	53.8 AV	54.0	-0.2	1.13 H	280	47.18	6.62
3	*5200.00	118.2 PK			1.44 H	280	111.15	7.05
4	*5200.00	106.7 AV			1.44 H	280	99.65	7.05
5	5416.70	55.5 PK	74.0	-18.5	1.14 H	262	47.74	7.76
6	5416.70	50.2 AV	54.0	-3.8	1.14 H	262	42.44	7.76
7	#6933.30	61.9 PK	68.2	-6.3	1.37 H	259	49.15	12.75
8	#10400.00	56.0 PK	68.2	-12.2	1.00 H	230	42.78	13.22
9	15600.00	62.0 PK	74.0	-12.0	1.00 H	110	43.30	18.70
10	15600.00	48.8 AV	54.0	-5.2	1.00 H	110	30.10	18.70
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	5113.30	62.3 PK	74.0	-11.7	1.24 V	352	55.68	6.62
2	5113.30	53.0 AV	54.0	-1.0	1.24 V	352	46.38	6.62
3	*5200.00	116.8 PK			1.13 V	332	109.75	7.05
4	*5200.00	105.6 AV			1.13 V	332	98.55	7.05
5	5416.70	54.5 PK	74.0	-19.5	1.11 V	114	46.74	7.76
6	5416.70	49.6 AV	54.0	-4.4	1.11 V	114	41.84	7.76
7	#6933.30	54.5 PK	68.2	-13.7	1.00 V	210	41.75	12.75
8	#10400.00	55.5 PK	68.2	-12.7	1.00 V	199	42.28	13.22
9	15600.00	61.4 PK	74.0	-12.6	1.00 V	207	42.70	18.70
10	15600.00	48.3 AV	54.0	-5.7	1.00 V	207	29.60	18.70

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) – 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.



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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	5150.00	62.0 PK	74.0	-12.0	1.45 H	281	55.20	6.80
2	5150.00	49.0 AV	54.0	-5.0	1.45 H	281	42.20	6.80
3	*5240.00	122.8 PK			1.45 H	281	115.64	7.16
4	*5240.00	110.5 AV			1.45 H	281	103.34	7.16
5	5402.00	62.4 PK	74.0	-11.6	1.69 H	280	54.69	7.71
6	5402.00	53.7 AV	54.0	-0.3	1.69 H	280	45.99	7.71
7	#6986.70	60.2 PK	68.2	-8.0	1.40 H	226	47.26	12.94
8	#10480.00	55.6 PK	68.2	-12.6	1.00 H	230	42.44	13.16
9	15720.00	61.1 PK	74.0	-12.9	1.05 H	97	42.70	18.40
10	15720.00	47.8 AV	54.0	-6.2	1.05 H	97	29.40	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	62.5 PK	74.0	-11.5	1.27 V	345	55.70	6.80
2	5150.00	53.2 AV	54.0	-0.8	1.27 V	345	46.40	6.80
3	*5240.00	121.7 PK			1.10 V	310	114.54	7.16
4	*5240.00	109.1 AV			1.10 V	310	101.94	7.16
5	5402.00	61.4 PK	74.0	-12.6	1.16 V	126	53.69	7.71
6	5402.00	52.9 AV	54.0	-1.1	1.16 V	126	45.19	7.71
7	#6986.70	54.0 PK	68.2	-14.2	1.10 V	307	41.06	12.94
8	#10480.00	55.6 PK	68.2	-12.6	1.02 V	206	42.44	13.16
9	15720.00	60.7 PK	74.0	-13.3	1.00 V	231	42.30	18.40
10	15720.00	47.8 AV	54.0	-6.2	1.00 V	231	29.40	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) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

802.11ac (VHT40)

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	5113.60	68.7 PK	74.0	-5.3	1.72 H	280	62.08	6.62
2	5113.60	51.0 AV	54.0	-3.0	1.72 H	280	44.38	6.62
3	5150.00	73.8 PK	74.0	-0.2	1.46 H	278	67.00	6.80
4	5150.00	53.7 AV	54.0	-0.3	1.46 H	278	46.90	6.80
5	*5190.00	113.6 PK			1.46 H	278	106.60	7.00
6	*5190.00	103.0 AV			1.46 H	278	96.00	7.00
7	#5622.40	62.7 PK	68.2	-5.5	1.62 H	287	54.47	8.23
8	#6920.00	60.0 PK	68.2	-8.2	1.78 H	98	47.29	12.71
9	#10380.00	55.7 PK	68.2	-12.5	1.00 H	236	42.53	13.17
10	15570.00	61.6 PK	74.0	-12.4	1.00 H	123	42.91	18.69
11	15570.00	48.7 AV	54.0	-5.3	1.00 H	123	30.01	18.69
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	5113.60	66.6 PK	74.0	-7.4	1.14 V	112	59.98	6.62
2	5113.60	49.7 AV	54.0	-4.3	1.14 V	112	43.08	6.62
3	5150.00	61.9 PK	74.0	-12.1	1.22 V	360	55.10	6.80
4	5150.00	52.7 AV	54.0	-1.3	1.22 V	360	45.90	6.80
5	*5190.00	112.3 PK			1.10 V	326	105.30	7.00
6	*5190.00	101.7 AV			1.10 V	326	94.70	7.00
7	#5622.40	61.3 PK	68.2	-6.9	1.00 V	312	53.07	8.23
8	#6920.00	54.3 PK	68.2	-13.9	1.10 V	302	41.59	12.71
9	#10380.00	55.4 PK	68.2	-12.8	1.00 V	216	42.23	13.17
10	15570.00	60.6 PK	74.0	-13.4	1.01 V	212	41.91	18.69
11	15570.00	47.8 AV	54.0	-6.2	1.01 V	212	29.11	18.69

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.



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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	68.3 PK	74.0	-5.7	1.46 H	295	61.50	6.80
2	5150.00	53.6 AV	54.0	-0.4	1.46 H	295	46.80	6.80
3	*5230.00	116.5 PK			1.42 H	277	109.38	7.12
4	*5230.00	105.5 AV			1.42 H	277	98.38	7.12
5	5350.00	65.2 PK	74.0	-8.8	1.42 H	277	57.71	7.49
6	5350.00	50.7 AV	54.0	-3.3	1.42 H	277	43.21	7.49
7	#5665.80	60.9 PK	68.2	-7.3	1.32 H	288	52.60	8.30
8	#6973.20	62.2 PK	68.2	-6.0	1.34 H	265	49.30	12.90
9	#10460.00	55.6 PK	68.2	-12.6	1.00 H	241	42.42	13.18
10	15690.00	61.8 PK	74.0	-12.2	1.00 H	126	43.42	18.38
11	15690.00	48.7 AV	54.0	-5.3	1.00 H	126	30.32	18.38
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	5146.60	61.9 PK	74.0	-12.1	1.20 V	360	55.12	6.78
2	5146.60	52.4 AV	54.0	-1.6	1.20 V	360	45.62	6.78
3	*5230.00	115.3 PK			1.09 V	329	108.18	7.12
4	*5230.00	104.2 AV			1.09 V	329	97.08	7.12
5	5350.00	63.5 PK	74.0	-10.5	1.09 V	329	56.01	7.49
6	5350.00	48.9 AV	54.0	-5.1	1.09 V	329	41.41	7.49
7	#5665.80	54.8 PK	68.2	-13.4	1.08 V	104	46.50	8.30
8	#6973.20	54.1 PK	68.2	-14.1	1.00 V	215	41.20	12.90
9	#10460.00	55.1 PK	68.2	-13.1	1.00 V	213	41.92	13.18
10	15690.00	61.5 PK	74.0	-12.5	1.01 V	217	43.12	18.38
11	15690.00	48.4 AV	54.0	-5.6	1.01 V	217	30.02	18.38

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	73.4 PK	74.0	-0.6	1.41 H	265	66.60	6.80
2	5150.00	53.5 AV	54.0	-0.5	1.41 H	265	46.70	6.80
3	*5210.00	109.5 PK			1.41 H	265	102.44	7.06
4	*5210.00	97.3 AV			1.41 H	265	90.24	7.06
5	5350.00	70.4 PK	74.0	-3.6	1.32 H	252	62.91	7.49
6	5350.00	51.5 AV	54.0	-2.5	1.32 H	252	44.01	7.49
7	#5788.70	57.5 PK	68.2	-10.7	1.41 H	314	49.00	8.50
8	#6946.60	61.7 PK	68.2	-6.5	1.34 H	260	48.91	12.79
9	#10420.00	56.1 PK	68.2	-12.1	1.00 H	225	42.90	13.20
10	15630.00	61.5 PK	74.0	-12.5	1.00 H	97	42.90	18.60
11	15630.00	48.6 AV	54.0	-5.4	1.00 H	97	30.00	18.60
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	5150.00	62.7 PK	74.0	-11.3	1.16 V	359	55.90	6.80
2	5150.00	53.2 AV	54.0	-0.8	1.16 V	359	46.40	6.80
3	*5210.00	107.3 PK			1.15 V	335	100.24	7.06
4	*5210.00	95.9 AV			1.15 V	335	88.84	7.06
5	5350.00	69.5 PK	74.0	-4.5	1.15 V	335	62.01	7.49
6	5350.00	49.6 AV	54.0	-4.4	1.15 V	335	42.11	7.49
7	#5788.70	54.2 PK	68.2	-14.0	1.12 V	103	45.70	8.50
8	#6946.60	53.7 PK	68.2	-14.5	1.21 V	334	40.91	12.79
9	#10420.00	55.6 PK	68.2	-12.6	1.00 V	217	42.40	13.20
10	15630.00	61.7 PK	74.0	-12.3	1.00 V	223	43.10	18.60
11	15630.00	48.7 AV	54.0	-5.3	1.00 V	223	30.10	18.60

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) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

4.2 TRANSMIT POWER MEASUREMENT

4.2.1 LIMITS OF TRANSMIT POWER MEASUREMENT

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

Note: Where B is the 26dB emission bandwidth in MHz.

Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

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

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

Array Gain = $5 \log(NANT/NSS)$ dB or 3 dB, whichever is less for 20-MHz channel widths with $NANT \geq 5$.

For power measurements on all other devices: Array Gain = $10 \log(NANT/NSS)$ dB.

4.2.2 TEST INSTRUMENTS

FOR POWER OUTPUT MEASUREMENT

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Power meter Anritsu	ML2495A	1014008	Apr. 30, 2014	Apr. 29, 2015
Power sensor Anritsu	MA2411B	0917122	Apr. 30, 2014	Apr. 29, 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. Tested date : July 25, 2014

FOR 26dB OCCUPIED BANDWIDTH

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 05, 2014	July 04, 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. Tested date : July 25, 2014

4.2.3 TEST PROCEDURE

FOR POWER OUTPUT MEASUREMENT

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 26dB OCCUPIED BANDWIDTH

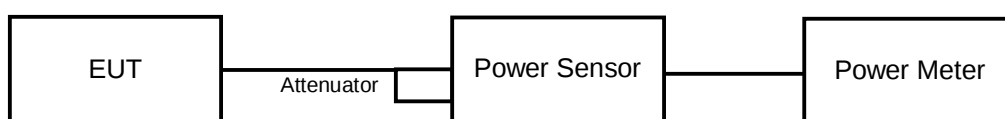
1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

4.2.4 DEVIATION FROM TEST STANDARD

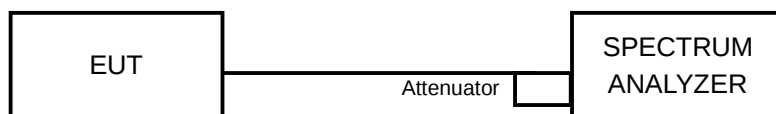
No deviation

4.2.5 TEST SETUP

FOR POWER OUTPUT MEASUREMENT



FOR 26dB OCCUPIED BANDWIDTH



4.2.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

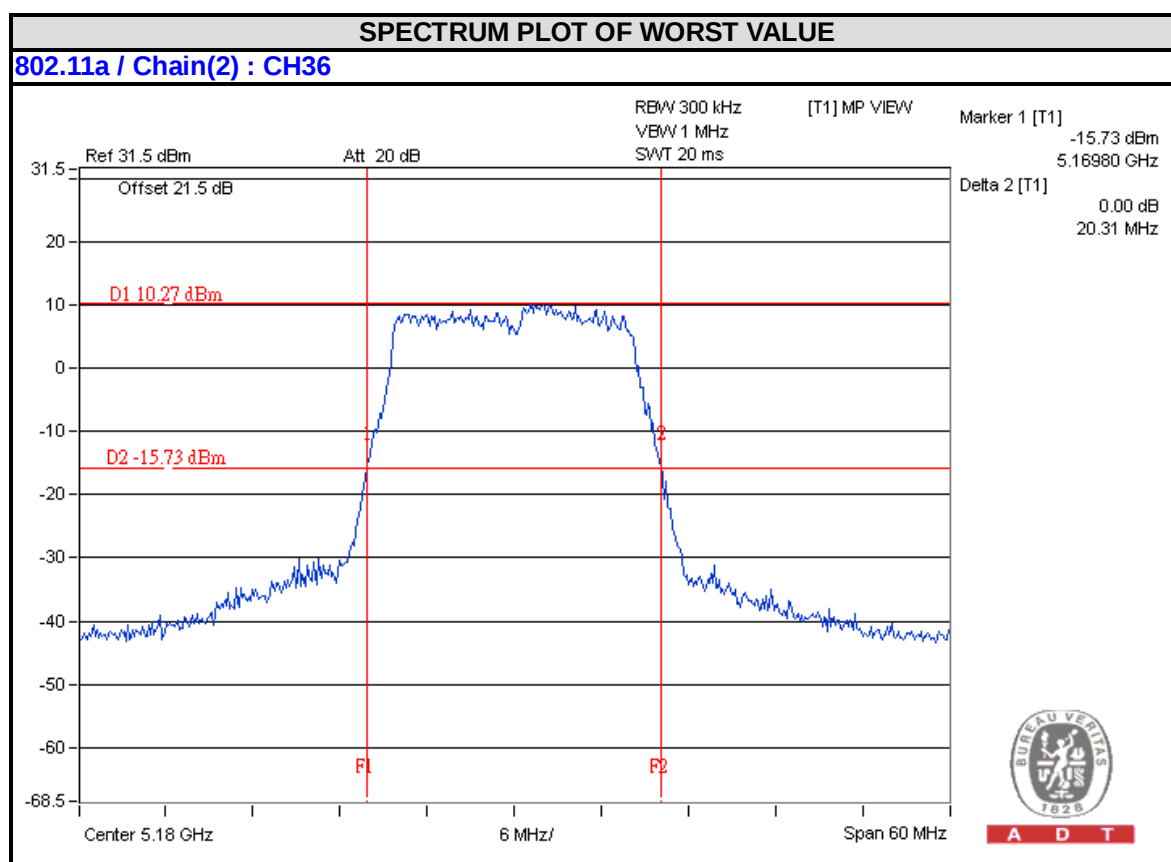
4.2.7 TEST RESULTS

802.11a

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)			TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
36	5180	16.38	16.73	16.91	139.64	21.45	30	PASS
40	5200	16.34	16.71	16.89	138.799	21.42	30	PASS
48	5240	22.21	21.52	22.34	479.643	26.81	30	PASS

26dB OCCUPIED BANDWIDTH:

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)		
		CHAIN 0	CHAIN 1	CHAIN 2
36	5180	20.40	20.48	20.31
40	5200	20.46	20.50	20.46
48	5240	28.95	21.59	28.67

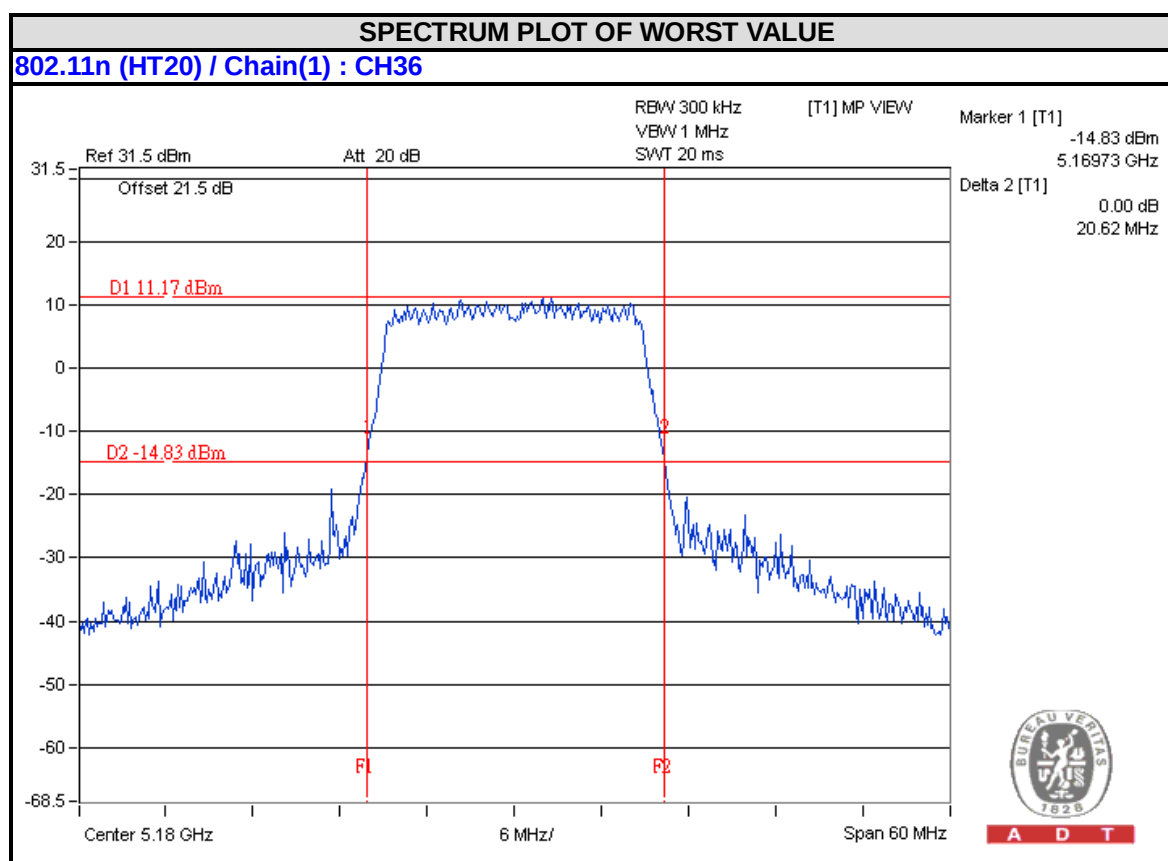


802.11ac (VHT20)

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)			TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
36	5180	17.74	17.71	17.99	181.4	22.59	30	PASS
40	5200	19.97	19.63	19.64	283.19	24.52	30	PASS
48	5240	25.36	24.02	25.02	913.593	29.61	30	PASS

26dB OCCUPIED BANDWIDTH:

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)		
		CHAIN 0	CHAIN 1	CHAIN 2
36	5180	20.85	20.62	20.69
40	5200	20.84	20.69	21.02
48	5240	48.63	38.22	42.85

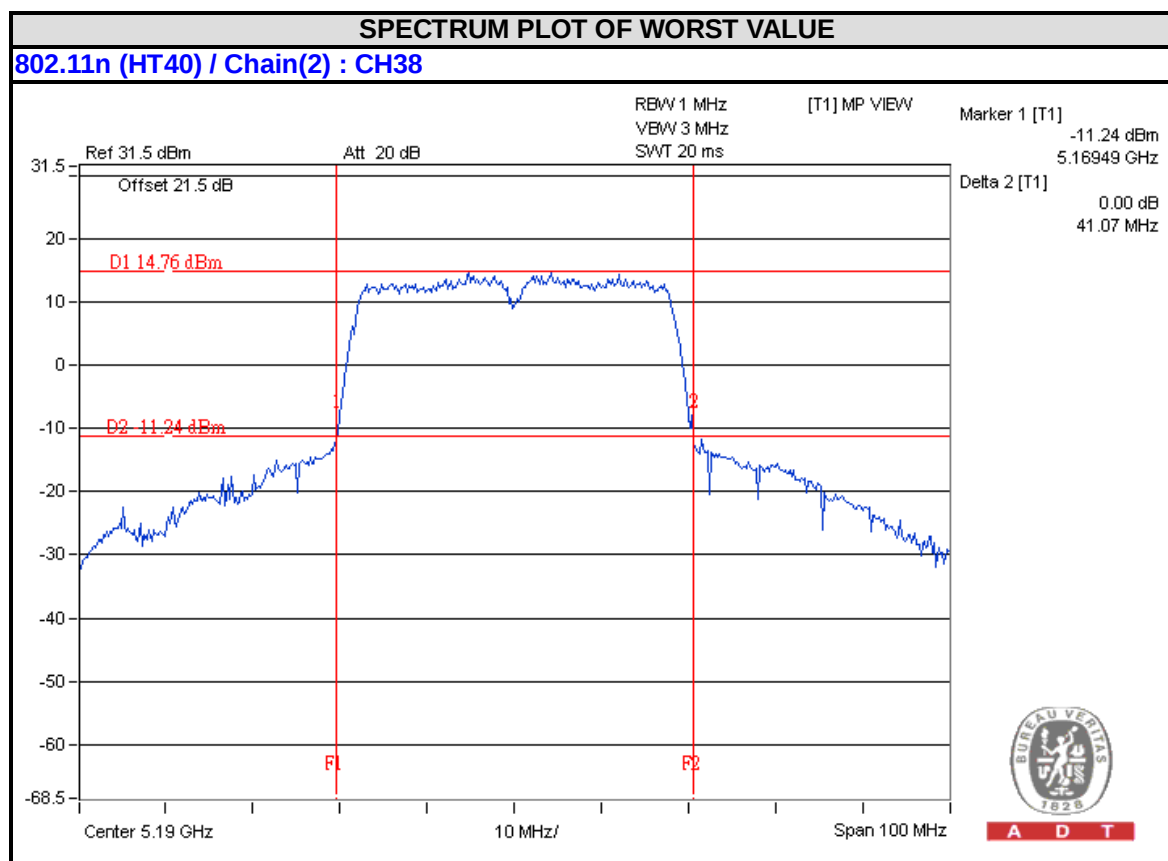


802.11ac (VHT40)

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)			TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
38	5190	18.16	18.16	18.56	202.707	23.07	30	PASS
46	5230	20.89	20.52	20.99	361.067	25.58	30	PASS

26dB OCCUPIED BANDWIDTH:

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)		
		CHAIN 0	CHAIN 1	CHAIN 2
38	5190	41.51	41.27	41.07
46	5230	51.61	46.30	53.80





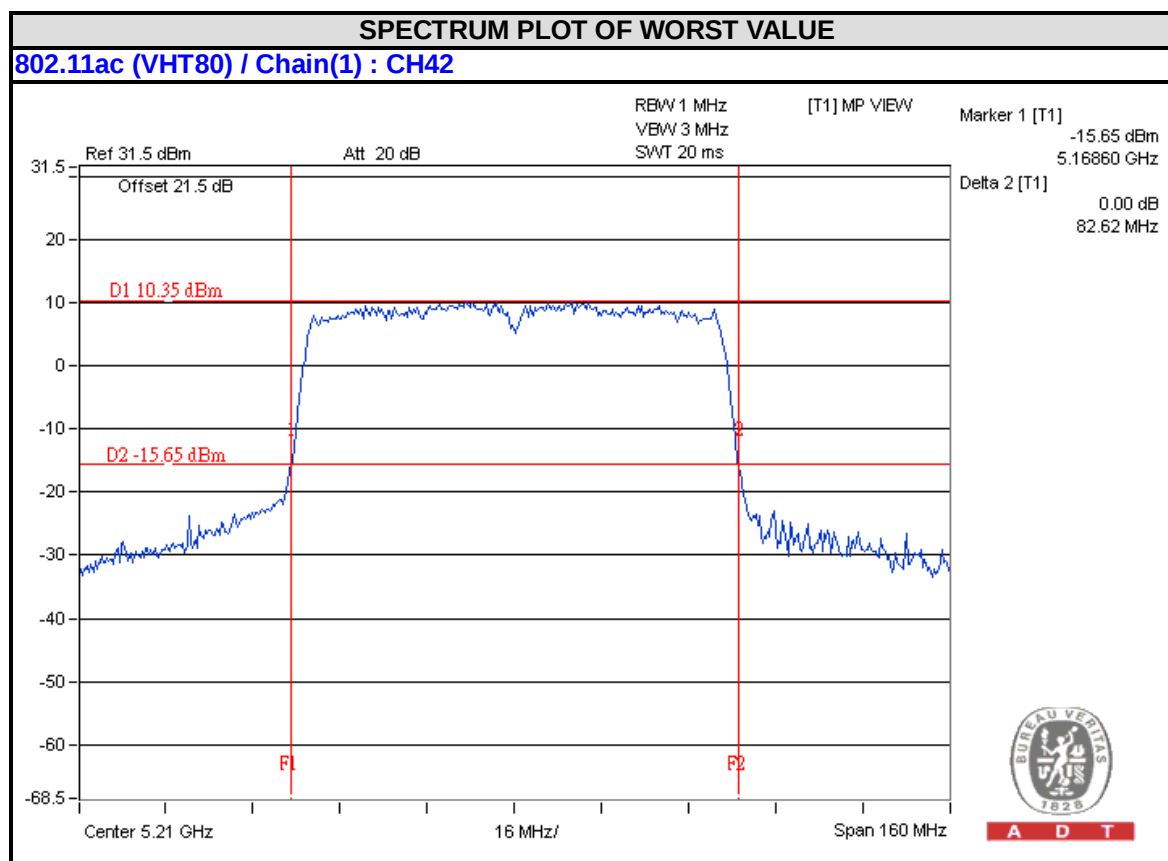
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802.11ac (VHT80)

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)			TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
38	5190	17.10	17.25	17.41	159.455	22.03	30	PASS

26dB OCCUPIED BANDWIDTH:

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)		
		CHAIN 0	CHAIN 1	CHAIN 2
42	5210	82.96	82.62	83.11



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4.3 PEAK POWER SPECTRAL DENSITY MEASUREMENT

4.3.1 LIMITS OF PEAK POWER SPECTRAL DENSITY MEASUREMENT

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

4.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 05, 2014	July 04, 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. Tested date : July 25, 2014

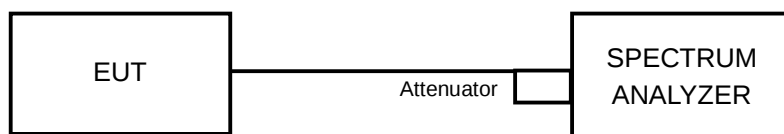
4.3.3 TEST PROCEDURES

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 1 MHz, Set VBW $\geq$ 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

4.3.4 DEVIATION FROM TEST STANDARD

No deviation

4.3.5 TEST SETUP



4.3.6 EUT OPERATING CONDITIONS

Same as 4.2.6

4.3.7 TEST RESULTS

802.11a

CHANNEL	CHANNEL FREQUENCY (MHz)	PSD (dBm)			TOTAL POWER DENSITY (dBm)	MAX. LIMIT (dBm)	PASS/FAIL
		CHAIN 0	CHAIN 1	CHAIN 2			
36	5180	3.70	4.03	4.88	9.00	14.41	PASS
40	5200	4.05	4.19	5.63	9.46	14.41	PASS
48	5240	9.70	8.35	10.06	14.20	14.41	PASS

NOTE: 1. Method a) 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. **5150~5250MHz:** Directional gain = $3.82\text{dBi} + 10\log(3) = 8.59\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $17 - (8.59 - 6) = 14.41\text{dBm}$.

802.11ac (VHT20)

CHANNEL	CHANNEL FREQUENCY (MHz)	PSD W/O DUTY FACTOR (dBm)			DUTY FACTOR (dB)	TOTAL PSD WITH DUTY FACTOR (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
36	5180	4.85	5.03	4.83	0.14	9.81	17	PASS
40	5200	7.25	7.02	7.40	0.14	12.13	17	PASS
48	5240	12.27	10.85	11.57	0.14	16.51	17	PASS

NOTE: 1. Method a) 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.

802.11ac (VHT40)

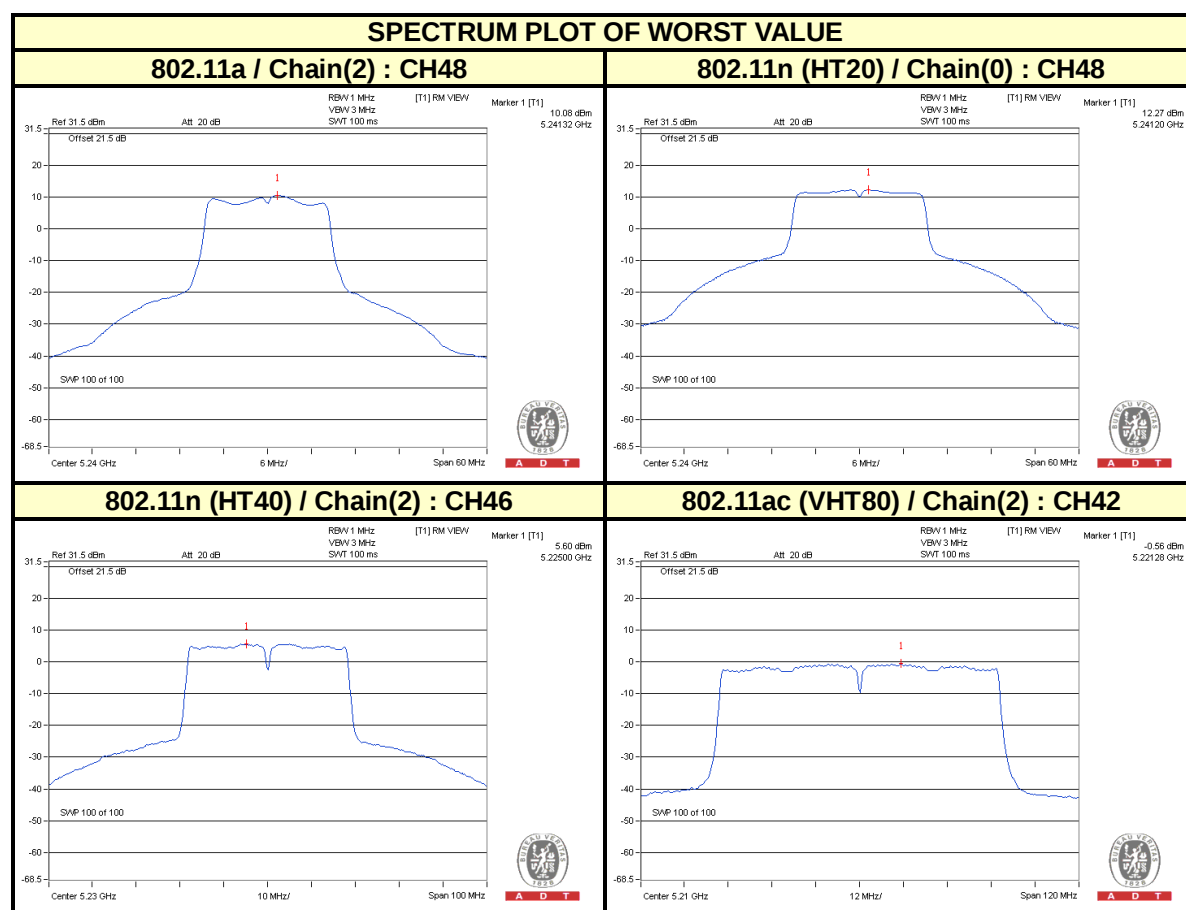
CHANNEL	CHANNEL FREQUENCY (MHz)	PSD W/O DUTY FACTOR (dBm)			DUTY FACTOR (dB)	TOTAL PSD WITH DUTY FACTOR (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
38	5190	2.50	2.62	2.79	0.19	7.60	17	PASS
46	5230	5.46	5.05	5.60	0.19	10.34	17	PASS

NOTE: 1. Method a) 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.

802.11ac (VHT80)

CHANNEL	CHANNEL FREQUENCY (MHz)	PSD W/O DUTY FACTOR (dBm)			DUTY FACTOR (dB)	TOTAL PSD WITH DUTY FACTOR (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
42	5210	-1.68	-1.21	-0.71	0.39	3.98	17	PASS

NOTE: 1. Method a) 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.





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4.4 FREQUENCY STABILITY

4.4.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

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

4.4.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 05, 2014	July 04, 2015
Temperature Humidity Chamber GIANTFORCE &	GTH-150-40-SP-AR	MAA0812-008	Jan. 13, 2014	Jan. 12, 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. Tested date : July 25, 2014

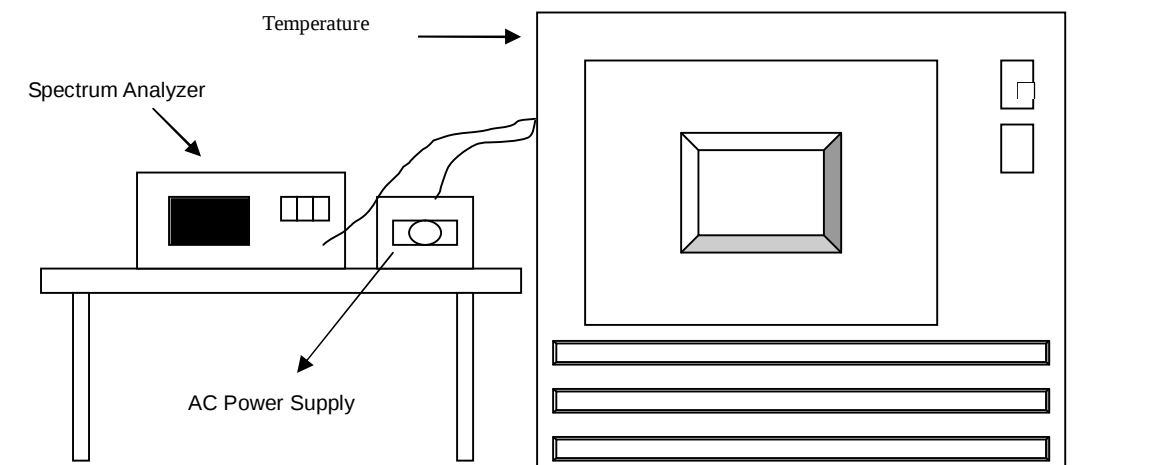
4.4.3 TEST PROCEDURE

1. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. 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.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

4.4.4 DEVIATION FROM TEST STANDARD

No deviation

4.4.5 TEST SETUP



4.4.6 EUT OPERATING CONDITION

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

4.4.7 TEST RESULTS

FREQUENCY STABILITY VERSUS TEMP.									
OPERATING FREQUENCY: 5240MHz									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
50	120	5239.9899	-0.00019	5239.9892	-0.00021	5239.9905	-0.00018	5239.9874	-0.00024
40	120	5240.0078	0.00015	5240.01	0.00019	5240.0103	0.00020	5240.0096	0.00018
30	120	5239.9776	-0.00043	5239.978	-0.00042	5239.9782	-0.00042	5239.9797	-0.00039
20	120	5239.9805	-0.00037	5239.9827	-0.00033	5239.9838	-0.00031	5239.9809	-0.00036
10	120	5239.9942	-0.00011	5239.9955	-0.00009	5239.9991	-0.00002	5239.9959	-0.00008
0	120	5240.0085	0.00016	5240.0101	0.00019	5240.0088	0.00017	5240.0068	0.00013
-10	120	5240.0244	0.00047	5240.0271	0.00052	5240.0225	0.00043	5240.0264	0.00050
-20	120	5240.0068	0.00013	5240.0075	0.00014	5240.006	0.00011	5240.0058	0.00011
-30	120	5240.0202	0.00039	5240.0189	0.00036	5240.0196	0.00037	5240.0206	0.00039

FREQUENCY STABILITY VERSUS VOLTAGE									
OPERATING FREQUENCY: 5240MHz									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
20	138	5239.9803	-0.00038	5239.9832	-0.00032	5239.9837	-0.00031	5239.9802	-0.00038
	120	5239.9805	-0.00037	5239.9827	-0.00033	5239.9838	-0.00031	5239.9809	-0.00036
	102	5239.9797	-0.00039	5239.9827	-0.00033	5239.9828	-0.00033	5239.9819	-0.00035

5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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



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6. INFORMATION ON THE TESTING LABORATORIES

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

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

Linko EMC/RF Lab:

Tel: 886-2-26052180

Fax: 886-2-26052943

Hsin Chu EMC/RF Lab:

Tel: 886-3-5935343

Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety/Telecom Lab:

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

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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7. APPENDIX A - MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No modifications were made to the EUT by the lab during the test.

--- END ---