FCC Test Report

Report No.:	RF151030E03-1
FCC ID:	I88USG20W-VPN
Test Model:	USG20W-VPN
Received Date:	Oct. 30, 2015
Test Date:	Nov. 23 ~ Dec. 04, 2015
Issued Date:	Dec. 15, 2015
Applicant:	ZyXEL Communications Corporation
Address:	No. 2, Gongye E. 9th Road Hsinchu Science Park, Hsinchu, Taiwan (R.O.C.)
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan, R.O.C.
Lab Address:	No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)

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Release Control Record

Issue No.	Description	Date Issued
RF151030E03-1	Original release	Dec. 15, 2015

1 Certificate of Conformity

Product:	VPN Firewall
Brand:	ZyXEL
Test Model:	USG20W-VPN
Sample Status:	Engineering Sample
Applicant:	ZyXEL Communications Corporation
Test Date:	Nov. 23 ~ Dec. 04, 2015
Standards:	47 CFR FCC Part 15, Subpart E (Section 15.407) ANSI C63.10:2013

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:** Dec. 15, 2015

Celine Chou / Specialist

Approved by : Ken Liu , **Date:** Dec. 15, 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 -10.62dB at 0.36484MHz.
15.407(b) (1/2/3/4/6)	Radiated Emissions & Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -1.0dB at 5150.00MHz and 5714.90MHz.
15.407(a)(1/2/3)	Max Average Transmit Power	Pass	Meet the requirement of limit.
15.407(a)(1/2/3)	Peak Power Spectral Density	Pass	Meet the requirement of limit.
15.407(e)	6dB bandwidth	Pass	Meet the requirement of limit. (U-NII-3 Band only)
15.407(g)	Frequency Stability	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is 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	Expended 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	VPN Firewall
Brand	ZyXEL
Test Model	USG20W-VPN
Status of EUT	Engineering Sample
Power Supply Rating	12Vdc (adapter)
Modulation Type	256QAM, 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	OFDM
Transfer Rate	802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to 450Mbps 802.11ac: up to 1300Mbps
Operating Frequency	5180 ~ 5240MHz, 5745 ~ 5825MHz
Number of Channel	5180 ~ 5240MHz: 4 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80) 5745 ~ 5825MHz: 5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80)
Output Power	5180 ~ 5240MHz: 699.854mW 5745 ~ 5825MHz: 615.912mW
Antenna Type	Dipole antenna with 3dBi gain
Antenna Connector	i-pex(MHF)
Accessory Device	Adapter
Data Cable Supplied	0.9m non-shielded console cable without core

Note:

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

Modulation Mode	TX Function
802.11a	1TX (Diversity)
802.11n (HT20)	3TX
802.11n (HT40)	3TX
802.11ac (VHT80)	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)

* For 802.11a: ant. 1 was for the final test.

2. The EUT uses following adapter.

Brand	ASIAN POWER DEVICES INC.
Model	WA-24Q12R
Input Power	100-240Vac, 50-60Hz, 0.7A
Output Power	12Vdc, 2A
Power Line	1.5m cable without core attached on adapter

3. The power setting are list as below:

	802.11a	802.11n (HT20)		802.11n (HT40)		802.11ac (VHT80)
CH 36	20	16	CH 38	15	CH 42	13.5
CH 40	26	22.5	CH 46	22.5	CH 155	14.5
CH 48	26	26	CH 151	16.5		
CH 149	19.5	17.5	CH 159	21.5		
CH 157	30	30				
CH 159	26	22				

3.2 Description of Test Modes

For 5180 ~ 5240MHz

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

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

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

Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
42	5210MHz

For 5745 ~ 5825MHz:

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

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

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

Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

1 channel is provided for 802.11ac (VHT80):

Channel	Frequency
155	5775MHz

3.2.1 Test Mode Applicability and Tested Channel Detail

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

Where **RE≥1G:** Radiated Emission above 1GHz & 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 **X-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 (HT20)		36 to 48	36, 40, 48	OFDM	BPSK	7.2
-	802.11n (HT40)		38 to 46	38, 46	OFDM	BPSK	15.0
-	802.11ac (VHT80)		42	42	OFDM	BPSK	97.5
-	802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6.0
-	802.11n (HT20)		149 to 165	149, 157, 165	OFDM	BPSK	7.2
-	802.11n (HT40)		151 to 159	151, 159	OFDM	BPSK	15.0
-	802.11ac (VHT80)		155	155	OFDM	BPSK	97.5

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
	802.11a	5745-5825	149 to 165		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
	802.11a	5745-5825	149 to 165		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 (HT20)		36 to 48	36, 40, 48	OFDM	BPSK	7.2
-	802.11n (HT40)		38 to 46	38, 46	OFDM	BPSK	15.0
-	802.11ac (VHT80)		42	42	OFDM	BPSK	97.5
-	802.11a	5745-5825	149 to 165	149, 157, 165	OFDM	BPSK	6.0
-	802.11n (HT20)		149 to 165	149, 157, 165	OFDM	BPSK	7.2
-	802.11n (HT40)		151 to 159	151, 159	OFDM	BPSK	15.0
-	802.11ac (VHT80)		155	155	OFDM	BPSK	97.5

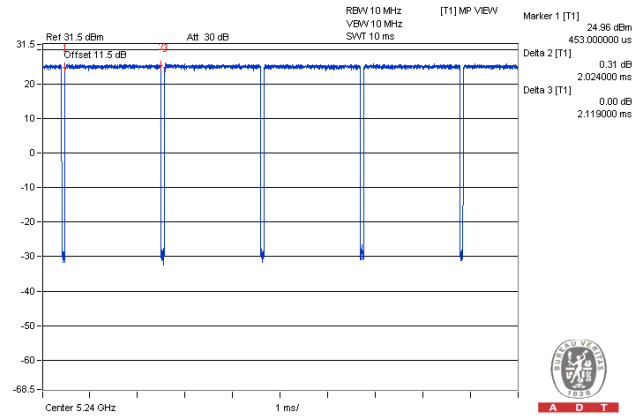
Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	24deg. C, 64%RH	120Vac, 60Hz	Alan Wu
RE<1G	26deg. C, 65%RH	120Vac, 60Hz	Alan Wu
PLC	25deg. C, 60%RH	120Vac, 60Hz	Tank Wu
APCM	25deg. C, 60%RH	120Vac, 60Hz	Leo Tsai

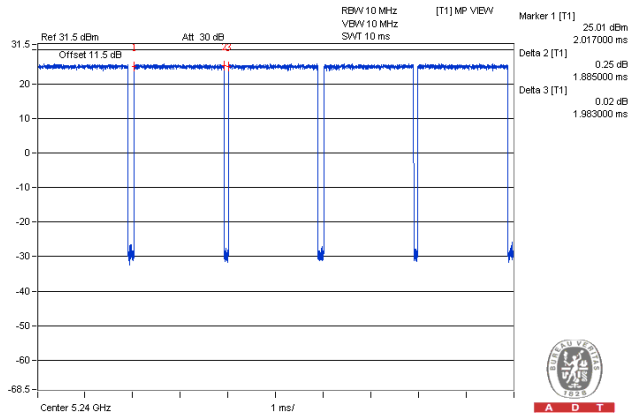
3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98 %, duty factor is required.
802.11a: Duty cycle = 2.024/2.119 = 0.955, Duty factor = 10 * log(1/0.955) = 0.20
802.11n (HT20): Duty cycle = 1.885/1.983 = 0.951, Duty factor = 10 * log(1/0.951) = 0.22
802.11n (HT40): Duty cycle = 0.925/1.000 = 0.925, Duty factor = 10 * log(1/0.925) = 0.34
802.11ac (VHT80): Duty cycle = 0.455/0.540 = 0.843, Duty factor = 10 * log(1/0.843) = 0.74

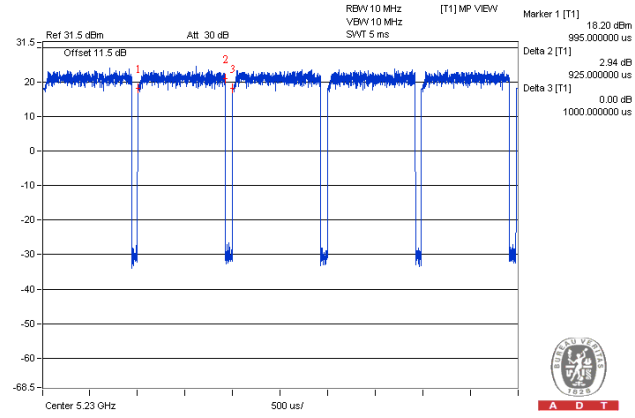
802.11a



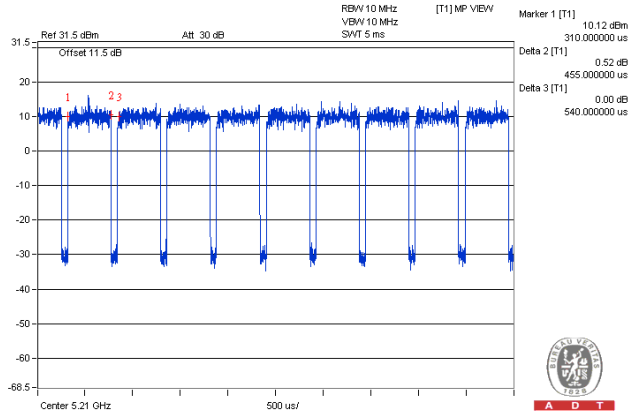
802.11n (HT20)



802.11n (HT40)



802.11ac (VHT80)



3.4 Description of Support Units

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

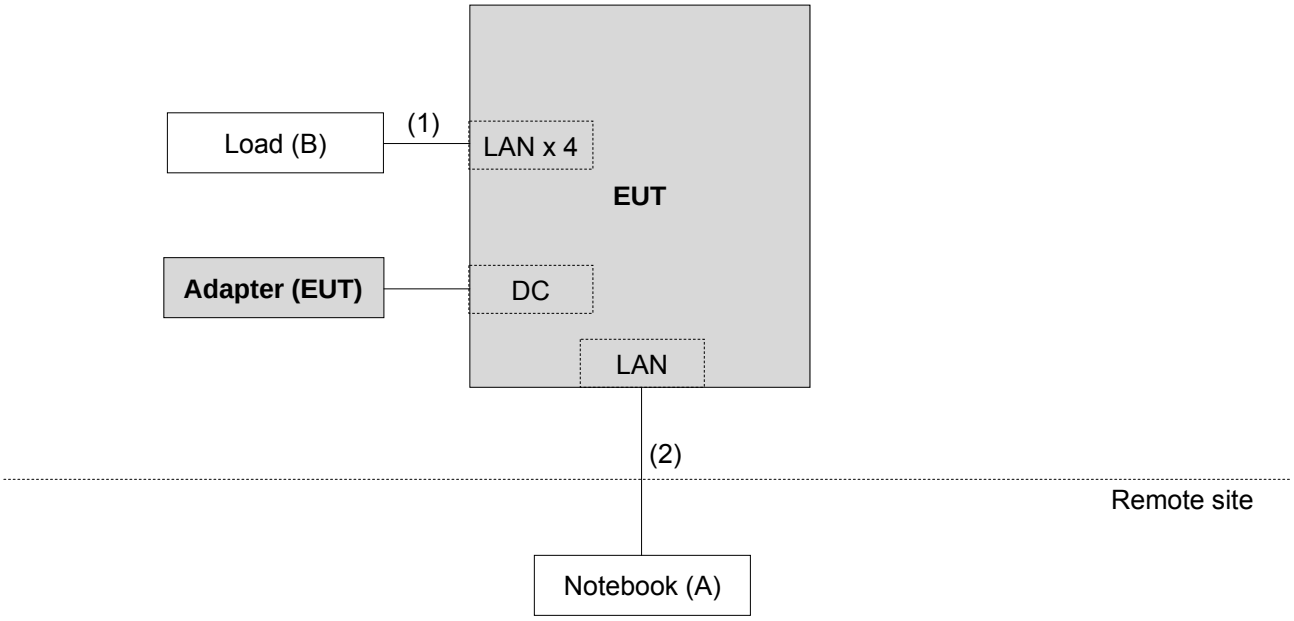
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5410	6RP2YM1	FCC DoC Approved	-
B.	Load	NA	NA	NA	NA	-

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Cat5e cable	4	1.8	N	0	-
2.	Cat5e cable	1	10	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 C63.10-2013

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.

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 (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:

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Oct. 12, 2015	Oct. 11, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Jul. 08, 2015	Jul. 07, 2016
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, 2015	Aug. 08, 2016
Preamplifier Agilent	8447D	2944A10631	Aug. 09, 2015	Aug. 08, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH4-02(295012+ 309220)	Aug. 09, 2015	Aug. 08, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH4-03(250724)	Aug. 09, 2015	Aug. 08, 2016
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, 2015	Oct. 17, 2016
High Speed Peak Power Meter	ML2495A	0824011	Jul. 09, 2015	Jul. 08, 2016
Power Sensor	MA2411B	0738171	Jul. 09, 2015	Jul. 08, 2016
WIT Standard Temperature And Humidity Chamber	TH-4S-C	W981030	Jun. 08, 2015	Jun. 07, 2016

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 4.
3. The horn antenna and 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 (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

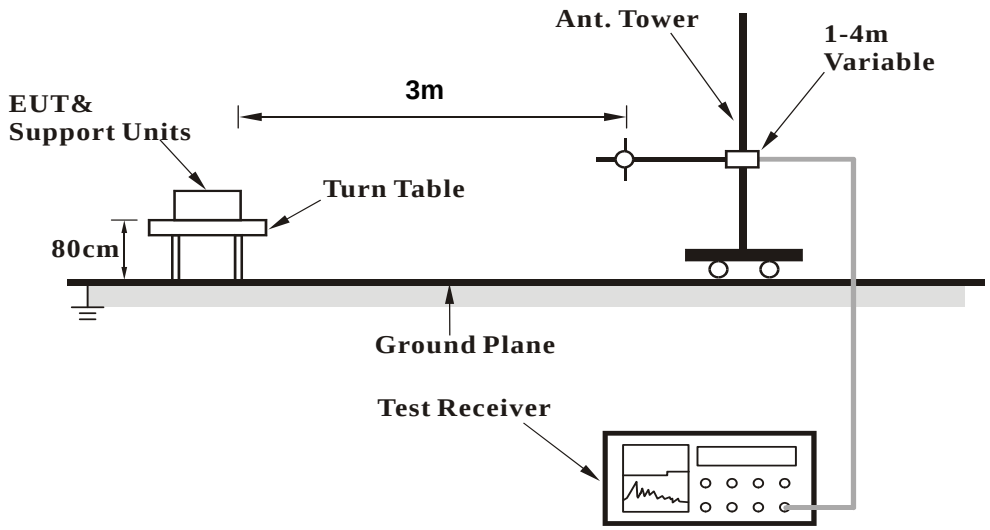
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.4 Deviation from Test Standard

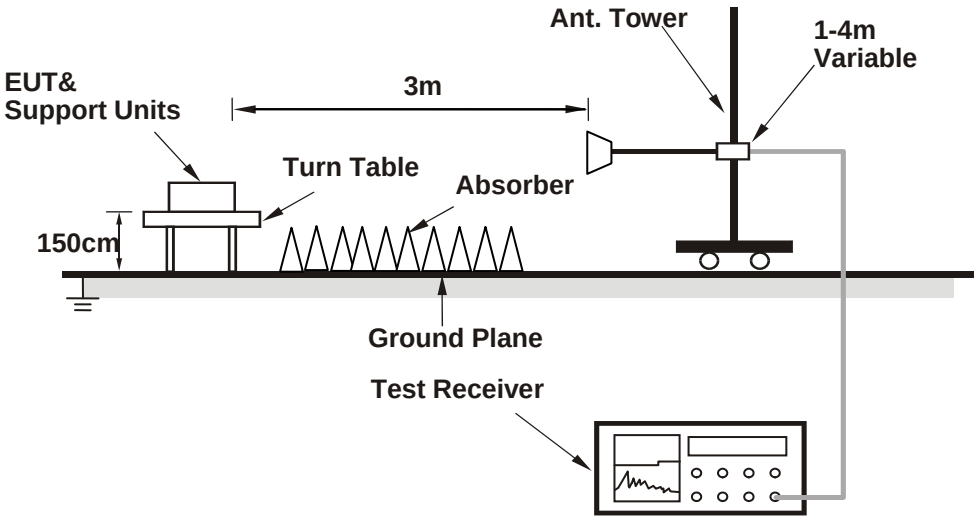
No deviation.

4.1.5 Test 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

a. Placed the EUT on the testing table.
b. Prepared notebook to act as communication partner and placed it outside of testing area.
c. 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.
d. The communication partner sent data to EUT by command "PING".
e. The necessary accessories enable the system in full functions.

4.1.7 Test Results

Above 1GHz Worst-Case Data:

802.11a

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	60.2 PK	74.0	-13.8	1.00 H	247	55.20	5.00
2	5150.00	47.7 AV	54.0	-6.3	1.00 H	247	42.70	5.00
3	*5180.00	104.1 PK			1.00 H	249	65.00	39.10
4	*5180.00	93.8 AV			1.00 H	249	54.70	39.10
5	#10360.00	61.5 PK	74.0	-12.5	1.00 H	132	44.40	17.10
6	#10360.00	48.1 AV	54.0	-5.9	1.00 H	132	31.00	17.10
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	68.8 PK	74.0	-5.2	2.23 V	247	63.80	5.00
2	5150.00	52.9 AV	54.0	-1.1	2.23 V	247	47.90	5.00
3	*5180.00	112.7 PK			2.29 V	247	73.60	39.10
4	*5180.00	102.4 AV			2.29 V	247	63.30	39.10
5	#10360.00	62.1 PK	74.0	-11.9	2.94 V	137	45.00	17.10
6	#10360.00	48.6 AV	54.0	-5.4	2.94 V	137	31.50	17.10

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
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) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

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	58.2 PK	74.0	-15.8	1.48 H	244	53.20	5.00
2	5150.00	45.2 AV	54.0	-8.8	1.48 H	244	40.20	5.00
3	*5200.00	108.4 PK			1.45 H	245	69.20	39.20
4	*5200.00	97.3 AV			1.45 H	245	58.10	39.20
5	#10400.00	61.7 PK	68.2	-6.5	1.00 H	130	44.40	17.30
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	68.7 PK	74.0	-5.3	1.96 V	235	63.70	5.00
2	5150.00	51.7 AV	54.0	-2.3	1.96 V	235	46.70	5.00
3	*5200.00	116.2 PK			1.96 V	237	77.00	39.20
4	*5200.00	105.0 AV			1.96 V	237	65.80	39.20
5	#10400.00	66.7 PK	68.2	-1.5	2.92 V	137	49.40	17.30

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) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

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	108.2 PK			1.43 H	248	69.00	39.20
2	*5240.00	97.2 AV			1.43 H	248	58.00	39.20
3	5350.00	60.4 PK	74.0	-13.6	1.42 H	246	55.00	5.40
4	5350.00	47.0 AV	54.0	-7.0	1.42 H	246	41.60	5.40
5	#10480.00	61.6 PK	68.2	-6.6	1.00 H	138	44.30	17.30
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	116.8 PK			2.10 V	192	77.60	39.20
2	*5240.00	105.6 AV			2.10 V	192	66.40	39.20
3	5350.00	60.9 PK	74.0	-13.1	2.06 V	190	55.50	5.40
4	5350.00	48.2 AV	54.0	-5.8	2.06 V	190	42.80	5.40
5	#10480.00	67.0 PK	68.2	-1.2	2.96 V	135	49.70	17.30

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 149	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

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	#5714.90	59.5 PK	74.0	-14.5	1.00 H	339	53.50	6.00
2	#5714.90	44.7 AV	54.0	-9.3	1.00 H	339	38.70	6.00
3	#5722.90	67.1 PK	78.2	-11.1	1.00 H	339	61.00	6.10
4	#5725.00	60.3 PK	78.2	-17.9	1.00 H	339	54.20	6.10
5	*5745.00	100.8 PK			1.00 H	335	60.50	40.30
6	*5745.00	90.7 AV			1.00 H	335	50.40	40.30
7	11490.00	59.8 PK	74.0	-14.2	1.00 H	137	42.20	17.60
8	11490.00	46.7 AV	54.0	-7.3	1.00 H	137	29.10	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	#5714.90	65.0 PK	74.0	-9.0	1.71 V	189	59.00	6.00
2	#5714.90	49.1 AV	54.0	-4.9	1.71 V	189	43.10	6.00
3	#5722.90	77.1 PK	78.2	-1.1	1.71 V	189	71.00	6.10
4	#5725.00	69.5 PK	78.2	-8.7	1.71 V	189	63.40	6.10
5	*5745.00	111.7 PK			1.75 V	188	71.40	40.30
6	*5745.00	101.4 AV			1.75 V	188	61.10	40.30
7	11490.00	60.5 PK	74.0	-13.5	1.00 V	220	42.90	17.60
8	11490.00	47.2 AV	54.0	-6.8	1.00 V	220	29.60	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.

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5785.00	105.9 PK			1.10 H	336	65.60	40.30
2	*5785.00	95.2 AV			1.10 H	336	54.90	40.30
3	11570.00	60.5 PK	74.0	-13.5	1.00 H	131	43.00	17.50
4	11570.00	47.3 AV	54.0	-6.7	1.00 H	131	29.80	17.50
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	*5785.00	116.0 PK			1.83 V	186	75.70	40.30
2	*5785.00	104.8 AV			1.83 V	186	64.50	40.30
3	11570.00	60.9 PK	74.0	-13.1	1.00 V	138	43.40	17.50
4	11570.00	47.8 AV	54.0	-6.2	1.00 V	138	30.30	17.50

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
5. " * ": Fundamental frequency.

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5825.00	103.9 PK			1.28 H	338	63.50	40.40
2	*5825.00	93.3 AV			1.28 H	338	52.90	40.40
3	#5850.00	56.6 PK	78.2	-21.6	1.20 H	335	50.20	6.40
4	#5852.10	67.2 PK	78.2	-11.0	1.20 H	335	60.80	6.40
5	#5860.10	59.3 PK	74.0	-14.7	1.20 H	335	52.90	6.40
6	#5860.10	46.5 AV	54.0	-7.5	1.20 H	335	40.10	6.40
7	11650.00	60.2 PK	74.0	-13.8	1.00 H	135	42.90	17.30
8	11650.00	47.1 AV	54.0	-6.9	1.00 H	135	29.80	17.30
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5825.00	113.7 PK			2.03 V	218	73.30	40.40
2	*5825.00	103.1 AV			2.03 V	218	62.70	40.40
3	#5850.00	66.6 PK	78.2	-11.6	2.08 V	212	60.20	6.40
4	#5852.10	76.9 PK	78.2	-1.3	2.08 V	212	70.50	6.40
5	#5860.10	68.0 PK	74.0	-6.0	2.08 V	212	61.60	6.40
6	#5860.10	51.9 AV	54.0	-2.1	2.08 V	212	45.50	6.40
7	11650.00	60.6 PK	74.0	-13.4	1.00 V	226	43.30	17.30
8	11650.00	47.4 AV	54.0	-6.6	1.00 V	226	30.10	17.30

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 (HT20)

CHANNEL	TX Channel 36	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

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	58.7 PK	74.0	-15.3	1.52 H	223	53.70	5.00
2	5150.00	45.8 AV	54.0	-8.2	1.52 H	223	40.80	5.00
3	*5180.00	106.1 PK			1.57 H	223	67.00	39.10
4	*5180.00	95.6 AV			1.57 H	223	56.50	39.10
5	#10360.00	61.1 PK	74.0	-12.9	1.00 H	241	44.00	17.10
6	#10360.00	48.1 AV	54.0	-5.9	1.00 H	241	31.00	17.10
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	69.9 PK	74.0	-4.1	2.40 V	180	64.90	5.00
2	**5150.00**	**53.0 AV**	**54.0**	**-1.0**	**2.40 V**	**180**	**48.00**	**5.00**
3	*5180.00	117.4 PK			2.42 V	188	78.30	39.10
4	*5180.00	107.3 AV			2.42 V	188	68.20	39.10
5	#10360.00	62.1 PK	74.0	-11.9	1.00 V	102	45.00	17.10
6	#10360.00	49.0 AV	54.0	-5.0	1.00 V	102	31.90	17.10

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB)
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) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

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	1.00 H	211	57.50	5.00
2	5150.00	48.0 AV	54.0	-6.0	1.00 H	211	43.00	5.00
3	*5200.00	108.9 PK			1.00 H	219	69.70	39.20
4	*5200.00	98.2 AV			1.00 H	219	59.00	39.20
5	#10400.00	61.7 PK	74.0	-12.3	1.00 H	245	44.40	17.30
6	#10400.00	48.6 AV	54.0	-5.4	1.00 H	245	31.30	17.30
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	69.6 PK	74.0	-4.4	2.05 V	355	64.60	5.00
2	5150.00	52.9 AV	54.0	-1.1	2.05 V	355	47.90	5.00
3	*5200.00	121.6 PK			2.09 V	9	82.40	39.20
4	*5200.00	110.9 AV			2.09 V	9	71.70	39.20
5	#10400.00	62.5 PK	74.0	-11.5	1.00 V	103	45.20	17.30
6	#10400.00	49.4 AV	54.0	-4.6	1.00 V	103	32.10	17.30

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) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

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	112.9 PK			1.38 H	240	73.70	39.20
2	*5240.00	102.1 AV			1.38 H	240	62.90	39.20
3	5350.00	63.8 PK	74.0	-10.2	1.32 H	237	58.40	5.40
4	5350.00	49.0 AV	54.0	-5.0	1.32 H	237	43.60	5.40
5	#10480.00	62.6 PK	68.2	-5.6	1.00 H	249	45.30	17.30
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	123.6 PK			2.44 V	190	84.40	39.20
2	*5240.00	112.3 AV			2.44 V	190	73.10	39.20
3	5350.00	64.4 PK	74.0	-9.6	2.43 V	253	59.00	5.40
4	5350.00	49.7 AV	54.0	-4.3	2.43 V	253	44.30	5.40
5	#10480.00	67.0 PK	68.2	-1.2	1.00 V	101	49.70	17.30

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 149	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

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	#5714.90	58.0 PK	74.0	-16.0	1.00 H	237	52.00	6.00
2	#5714.90	45.5 AV	54.0	-8.5	1.00 H	237	39.50	6.00
3	#5722.90	63.8 PK	78.2	-14.4	1.00 H	237	57.70	6.10
4	#5725.00	54.9 PK	78.2	-23.3	1.00 H	237	48.80	6.10
5	*5745.00	104.0 PK			1.00 H	231	63.70	40.30
6	*5745.00	93.9 AV			1.00 H	231	53.60	40.30
7	11490.00	61.0 PK	74.0	-13.0	1.00 H	247	43.40	17.60
8	11490.00	48.9 AV	54.0	-5.1	1.00 H	247	31.30	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	#5714.90	68.0 PK	74.0	-6.0	1.69 V	212	62.00	6.00
2	#5714.90	52.6 AV	54.0	-1.4	1.69 V	212	46.60	6.00
3	#5722.90	69.8 PK	78.2	-8.4	1.69 V	212	63.70	6.10
4	#5725.00	58.1 PK	78.2	-20.1	1.69 V	212	52.00	6.10
5	*5745.00	116.1 PK			1.77 V	190	75.80	40.30
6	*5745.00	106.2 AV			1.77 V	190	65.90	40.30
7	11490.00	61.3 PK	74.0	-12.7	1.00 V	138	43.70	17.60
8	11490.00	49.4 AV	54.0	-4.6	1.00 V	138	31.80	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.

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5785.00	111.2 PK			1.13 H	228	70.90	40.30
2	*5785.00	99.8 AV			1.13 H	228	59.50	40.30
3	11570.00	61.9 PK	74.0	-12.1	1.00 H	241	44.40	17.50
4	11570.00	49.4 AV	54.0	-4.6	1.00 H	241	31.90	17.50
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	*5785.00	121.7 PK			1.68 V	154	81.40	40.30
2	*5785.00	110.9 AV			1.68 V	154	70.60	40.30
3	11570.00	62.1 PK	74.0	-11.9	1.00 V	137	44.60	17.50
4	11570.00	50.0 AV	54.0	-4.0	1.00 V	137	32.50	17.50

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
5. " * ": Fundamental frequency.
6. " # ": The radiated frequency is out of the restricted band.

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5825.00	107.9 PK			1.26 H	227	67.50	40.40
2	*5825.00	97.4 AV			1.26 H	227	57.00	40.40
3	#5850.00	56.3 PK	78.2	-21.9	1.21 H	228	49.90	6.40
4	#5852.10	63.3 PK	78.2	-14.9	1.21 H	228	56.90	6.40
5	#5860.10	61.6 PK	74.0	-12.4	1.21 H	228	55.20	6.40
6	#5860.10	46.7 AV	54.0	-7.3	1.21 H	228	40.30	6.40
7	11650.00	61.6 PK	74.0	-12.4	1.00 H	249	44.30	17.30
8	11650.00	49.1 AV	54.0	-4.9	1.00 H	249	31.80	17.30
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5825.00	118.9 PK			1.74 V	184	78.50	40.40
2	*5825.00	108.6 AV			1.74 V	184	68.20	40.40
3	#5850.00	59.1 PK	78.2	-19.1	1.70 V	182	52.70	6.40
4	#5852.10	66.9 PK	78.2	-11.3	1.70 V	182	60.50	6.40
5	#5860.10	68.4 PK	74.0	-5.6	1.70 V	182	62.00	6.40
6	#5860.10	52.9 AV	54.0	-1.1	1.70 V	182	46.50	6.40
7	11650.00	61.7 PK	74.0	-12.3	1.00 V	132	44.40	17.30
8	11650.00	49.8 AV	54.0	-4.2	1.00 V	132	32.50	17.30

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 (HT40)

CHANNEL	TX Channel 38	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	60.9 PK	74.0	-13.1	1.00 H	232	55.90	5.00
2	5150.00	47.6 AV	54.0	-6.4	1.00 H	232	42.60	5.00
3	*5190.00	101.2 PK			1.06 H	230	62.10	39.10
4	*5190.00	91.1 AV			1.06 H	230	52.00	39.10
5	#10380.00	60.3 PK	74.0	-13.7	1.00 H	242	43.10	17.20
6	#10380.00	47.2 AV	54.0	-6.8	1.00 H	242	30.00	17.20
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	66.6 PK	74.0	-7.4	2.11 V	171	61.60	5.00
2	5150.00	52.6 AV	54.0	-1.4	2.11 V	171	47.60	5.00
3	*5190.00	110.9 PK			2.12 V	3	71.80	39.10
4	*5190.00	100.8 AV			2.12 V	3	61.70	39.10
5	#10380.00	61.9 PK	74.0	-12.1	1.00 V	105	44.70	17.20
6	#10380.00	48.5 AV	54.0	-5.5	1.00 V	105	31.30	17.20

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) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

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	57.3 PK	74.0	-16.7	1.17 H	231	52.30	5.00
2	5150.00	46.1 AV	54.0	-7.9	1.17 H	231	41.10	5.00
3	*5230.00	107.2 PK			1.16 H	231	68.00	39.20
4	*5230.00	97.0 AV			1.16 H	231	57.80	39.20
5	#10460.00	61.2 PK	74.0	-12.8	1.00 H	248	44.00	17.20
6	#10460.00	47.8 AV	54.0	-6.2	1.00 H	248	30.60	17.20
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	66.6 PK	74.0	-7.4	2.09 V	186	61.60	5.00
2	5150.00	52.9 AV	54.0	-1.1	2.09 V	186	47.90	5.00
3	*5230.00	116.6 PK			2.10 V	358	77.40	39.20
4	*5230.00	106.2 AV			2.10 V	358	67.00	39.20
5	#10460.00	62.2 PK	74.0	-11.8	1.00 V	109	45.00	17.20
6	#10460.00	49.2 AV	54.0	-4.8	1.00 V	109	32.00	17.20

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 151	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

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	#5714.90	59.1 PK	74.0	-14.9	1.20 H	234	53.10	6.00
2	#5714.90	45.4 AV	54.0	-8.6	1.20 H	234	39.40	6.00
3	#5722.90	59.9 PK	78.2	-18.3	1.20 H	234	53.80	6.10
4	#5725.00	54.8 PK	78.2	-23.4	1.20 H	234	48.70	6.10
5	*5755.00	99.5 PK			1.20 H	231	59.20	40.30
6	*5755.00	89.8 AV			1.20 H	231	49.50	40.30
7	11510.00	60.7 PK	74.0	-13.3	1.00 H	244	43.30	17.40
8	11510.00	48.7 AV	54.0	-5.3	1.00 H	244	31.30	17.40
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	#5714.90	67.9 PK	74.0	-6.1	2.24 V	3	61.90	6.00
2	#5714.90	52.7 AV	54.0	-1.3	2.24 V	3	46.70	6.00
3	#5722.90	70.3 PK	78.2	-7.9	2.24 V	3	64.20	6.10
4	#5725.00	64.6 PK	78.2	-13.6	2.24 V	3	58.50	6.10
5	*5755.00	111.3 PK			2.28 V	6	71.00	40.30
6	*5755.00	101.7 AV			2.28 V	6	61.40	40.30
7	11510.00	60.9 PK	74.0	-13.1	1.00 V	131	43.50	17.40
8	11510.00	49.0 AV	54.0	-5.0	1.00 V	131	31.60	17.40

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 159	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5795.00	105.2 PK			1.14 H	228	64.90	40.30
2	*5795.00	94.8 AV			1.14 H	228	54.50	40.30
3	#5850.00	53.9 PK	78.2	-24.3	1.10 H	221	47.50	6.40
4	#5852.10	58.6 PK	78.2	-19.6	1.10 H	221	52.20	6.40
5	#5860.10	59.4 PK	74.0	-14.6	1.10 H	221	53.00	6.40
6	#5860.10	46.1 AV	54.0	-7.9	1.10 H	221	39.70	6.40
7	11590.00	61.1 PK	74.0	-12.9	1.00 H	241	43.80	17.30
8	11590.00	48.9 AV	54.0	-5.1	1.00 H	241	31.60	17.30
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5795.00	116.2 PK			2.30 V	40	75.90	40.30
2	*5795.00	106.1 AV			2.30 V	40	65.80	40.30
3	#5850.00	62.4 PK	78.2	-15.8	2.33 V	327	56.00	6.40
4	#5852.10	67.7 PK	78.2	-10.5	2.33 V	327	61.30	6.40
5	#5860.10	68.1 PK	74.0	-5.9	2.33 V	327	61.70	6.40
6	#5860.10	52.6 AV	54.0	-1.4	2.33 V	327	46.20	6.40
7	11590.00	61.4 PK	74.0	-12.6	1.00 V	135	44.10	17.30
8	11590.00	49.3 AV	54.0	-4.7	1.00 V	135	32.00	17.30

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 (VHT80)

CHANNEL	TX Channel 42	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	61.9 PK	74.0	-12.1	1.17 H	223	56.90	5.00
2	5150.00	46.8 AV	54.0	-7.2	1.17 H	223	41.80	5.00
3	*5210.00	96.1 PK			1.18 H	229	56.90	39.20
4	*5210.00	85.5 AV			1.18 H	229	46.30	39.20
5	#10420.00	59.7 PK	74.0	-14.3	1.00 H	244	42.40	17.30
6	#10420.00	47.0 AV	54.0	-7.0	1.00 H	244	29.70	17.30
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	68.4 PK	74.0	-5.6	1.96 V	8	63.40	5.00
2	5150.00	52.7 AV	54.0	-1.3	1.96 V	8	47.70	5.00
3	*5210.00	106.4 PK			2.01 V	6	67.20	39.20
4	*5210.00	95.8 AV			2.01 V	6	56.60	39.20
5	#10420.00	61.6 PK	74.0	-12.4	1.00 V	109	44.30	17.30
6	#10420.00	48.3 AV	54.0	-5.7	1.00 V	109	31.00	17.30

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 155	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 40GHz		

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	#5714.90	60.9 PK	74.0	-13.1	1.00 H	224	54.90	6.00
2	#5714.90	46.6 AV	54.0	-7.4	1.00 H	224	40.60	6.00
3	#5722.90	62.0 PK	78.2	-16.2	1.00 H	224	55.90	6.10
4	#5725.00	55.3 PK	78.2	-22.9	1.00 H	224	49.20	6.10
5	*5775.00	93.6 PK			1.00 H	228	53.30	40.30
6	*5775.00	83.2 AV			1.00 H	228	42.90	40.30
7	11550.00	59.9 PK	74.0	-14.1	1.00 H	243	42.50	17.40
8	11550.00	48.5 AV	54.0	-5.5	1.00 H	243	31.10	17.40
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	#5714.90	67.9 PK	74.0	-6.1	1.90 V	51	61.90	6.00
2	**#5714.90**	**53.0 AV**	**54.0**	**-1.0**	**1.90 V**	**51**	**47.00**	**6.00**
3	#5722.90	69.8 PK	78.2	-8.4	1.90 V	51	63.70	6.10
4	#5725.00	64.7 PK	78.2	-13.5	1.90 V	51	58.60	6.10
5	*5775.00	108.7 PK			1.95 V	5	68.40	40.30
6	*5775.00	98.0 AV			1.95 V	5	57.70	40.30
7	11550.00	60.5 PK	74.0	-13.5	1.00 V	137	43.10	17.40
8	11550.00	48.8 AV	54.0	-5.2	1.00 V	137	31.40	17.40

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.

Below 1GHz Worst-Case 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	39.60	32.6 QP	40.0	-7.4	2.00 H	13	47.00	-14.40
2	185.13	32.5 QP	43.5	-11.0	1.25 H	241	48.20	-15.70
3	375.29	33.9 QP	46.0	-12.1	1.00 H	112	45.30	-11.40
4	499.48	33.4 QP	46.0	-12.6	2.00 H	235	42.70	-9.30
5	625.60	34.9 QP	46.0	-11.1	1.25 H	216	41.40	-6.50
6	875.91	34.7 QP	46.0	-11.3	2.00 H	118	36.80	-2.10
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	41.54	34.6 QP	40.0	-5.4	1.00 V	346	48.90	-14.30
2	60.95	35.0 QP	40.0	-5.0	1.50 V	301	49.60	-14.60
3	375.29	30.0 QP	46.0	-16.0	1.00 V	213	41.40	-11.40
4	499.48	33.1 QP	46.0	-12.9	1.25 V	106	42.40	-9.30
5	625.60	34.6 QP	46.0	-11.4	1.25 V	13	41.10	-6.50
6	875.91	35.2 QP	46.0	-10.8	1.00 V	168	37.30	-2.10

Remarks:

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

4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

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

Note: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCS 30	100288	Apr. 27, 2015	Apr. 26, 2016
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond2-01	Dec. 26, 2014	Dec. 25, 2015
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Dec. 30, 2014	Dec. 29, 2015
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Jul. 21, 2015	Jul. 20, 2016
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 2.
3. The VCCI Site Registration No. is C-2047.

4.2.3 Test Procedures

a. 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.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

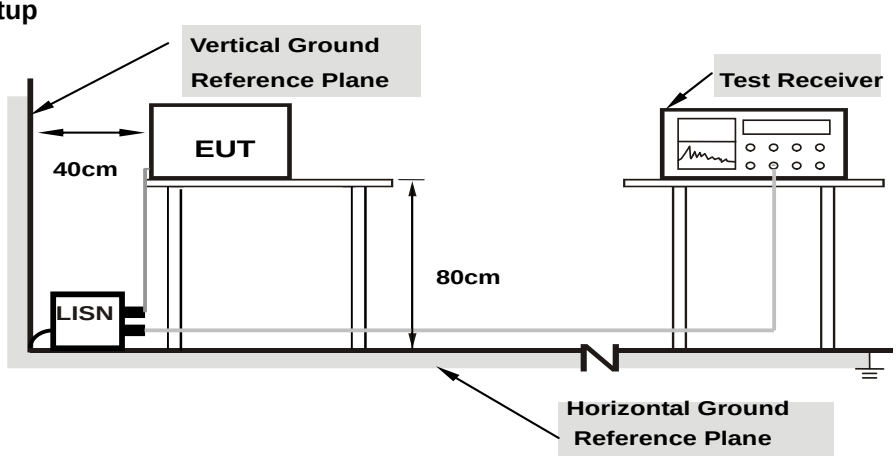
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.

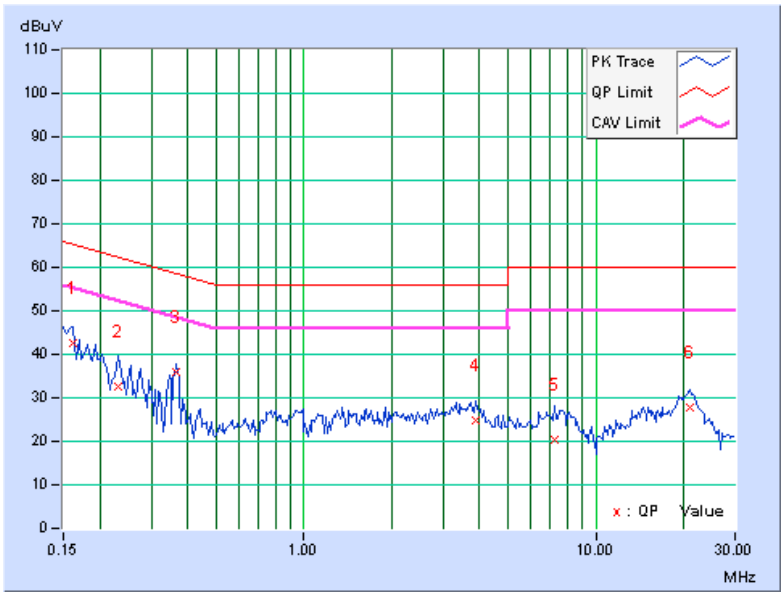
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	9.91	32.53	21.38	42.44	31.29	65.38	55.38	-22.93	-24.08
2	0.23203	9.92	22.81	14.57	32.73	24.49	62.38	52.38	-29.65	-27.89
3	0.36484	9.93	25.91	23.79	35.84	33.72	58.62	48.62	-22.78	-14.90
4	3.87500	10.18	14.62	7.11	24.80	17.29	56.00	46.00	-31.20	-28.71
5	7.22656	10.29	10.00	4.33	20.29	14.62	60.00	50.00	-39.71	-35.38
6	21.00000	10.59	17.19	11.29	27.78	21.88	60.00	50.00	-32.22	-28.12

Remarks:

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

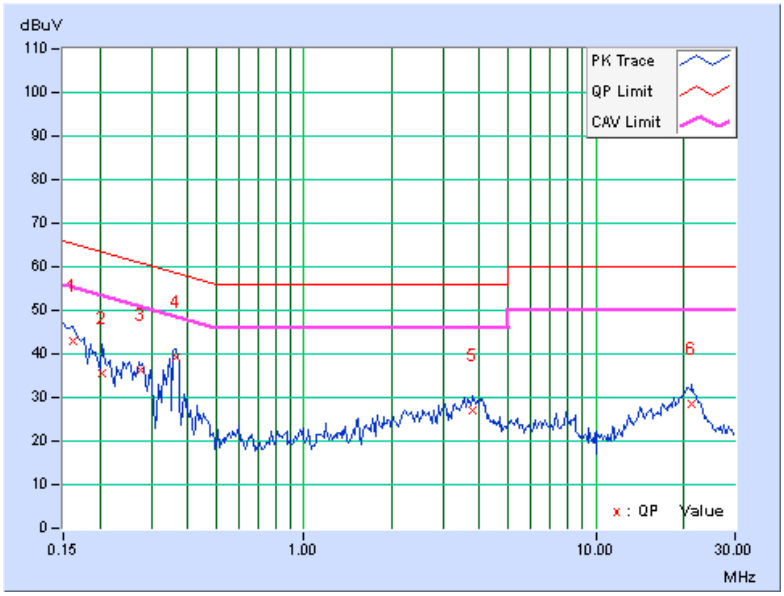


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	9.92	32.87	21.48	42.79	31.40	65.38	55.38	-22.58	-23.97
2	0.20469	9.93	25.57	17.11	35.50	27.04	63.42	53.42	-27.92	-26.38
3	0.27511	9.94	26.40	22.59	36.34	32.53	60.96	50.96	-24.63	-18.44
4	**0.36484**	**9.95**	**29.40**	**28.05**	**39.35**	**38.00**	**58.62**	**48.62**	**-19.27**	**-10.62**
5	3.80469	10.21	16.99	9.71	27.20	19.92	56.00	46.00	-28.80	-26.08
6	21.40234	10.74	17.76	12.09	28.50	22.83	60.00	50.00	-31.50	-27.17

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 Measurment

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 ≦ 125mW(21 dBm) at any elevation angle above 30 degrees as measured from the horizon)
		Fixed point-to-point Access Point	1 Watt (30 dBm)
	√	Indoor Access Point	1 Watt (30 dBm)
		Mobile and Portable client device	250mW (24 dBm)
U-NII-2A	---		250mW (24 dBm) or 11 dBm+10 log B*
U-NII-2C	---		250mW (24 dBm) or 11 dBm+10 log B*
U-NII-3	√		1 Watt (30 dBm)

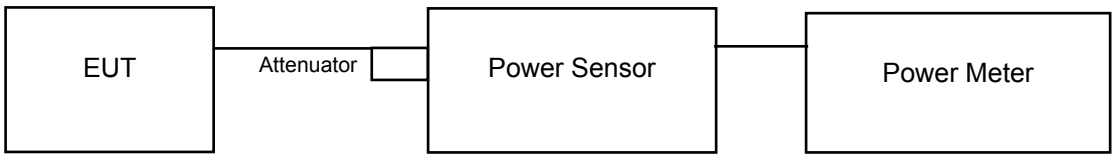
*B is the 26 dB emission bandwidth in megahertz

Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

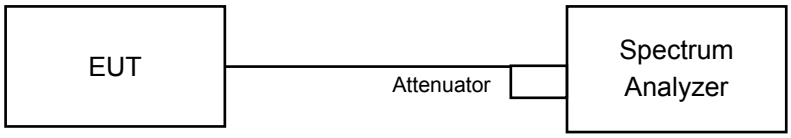
For power measurements on all other devices: Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

4.3.2 Test Setup

For 802.11a, 802.11n (HT20), 802.11n (HT40), 802.11ac (VHT20), 802.11ac (VHT40)



For 802.11ac (VHT80)



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

For Average Power Measurement

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

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

For 802.11ac (VHT80)

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 ≥ 3 MHz
e. Number of points in sweep ≥ 2 Span / RBW.
f. Sweep time ≤ (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.
k. Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’ s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

4.3.5 Deviation fromTest 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.	Freq. (MHz)	Maximum Conducted Power (mW)	Maximum Conducted Power (dBm)	Power Limit (dBm)	Pass / Fail
36	5180	151.705	21.81	30.00	Pass
40	5200	269.774	24.31	30.00	Pass
48	5240	266.686	24.26	30.00	Pass
149	5745	105.439	20.23	30.00	Pass
157	5785	223.872	23.50	30.00	Pass
165	5825	169.824	22.30	30.00	Pass

802.11n (HT20)

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	18.83	17.89	17.65	196.112	22.93	30.00	Pass
40	5200	22.92	22.42	22.75	558.831	27.47	30.00	Pass
48	5240	23.96	23.43	23.63	**699.854**	28.45	30.00	Pass
149	5745	18.55	17.44	17.02	177.427	22.49	30.00	Pass
157	5785	23.29	22.86	23.21	**615.912**	27.90	30.00	Pass
165	5825	20.34	19.46	20.27	302.865	24.81	30.00	Pass

802.11n (HT40)

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	15.82	15.00	15.14	102.476	20.11	30.00	Pass
46	5230	21.54	21.20	22.00	432.876	26.36	30.00	Pass
151	5755	16.37	15.64	15.17	112.880	20.53	30.00	Pass
159	5795	19.95	19.50	19.67	280.663	24.48	30.00	Pass

802.11ac (VHT80)

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	14.17	13.37	14.00	72.968	18.63	30.00	Pass
155	5775	14.35	13.76	14.06	76.463	18.83	30.00	Pass

26dB Bandwidth:

802.11a

Chan.	Freq. (MHz)	26dBc Bandwidth (MHz)	Pass / Fail
36	5180	36.55	Pass
40	5200	46.57	Pass
48	5240	45.82	Pass

802.11n (HT20)

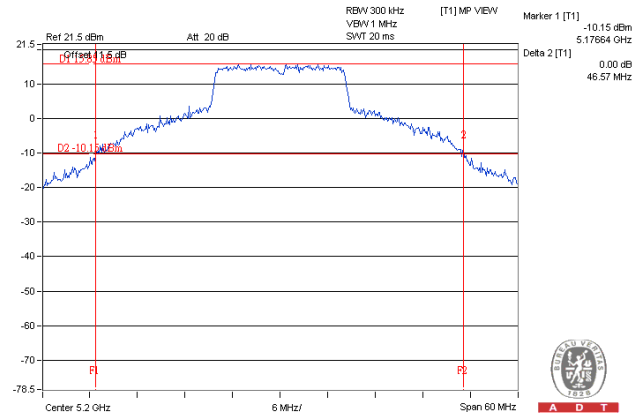
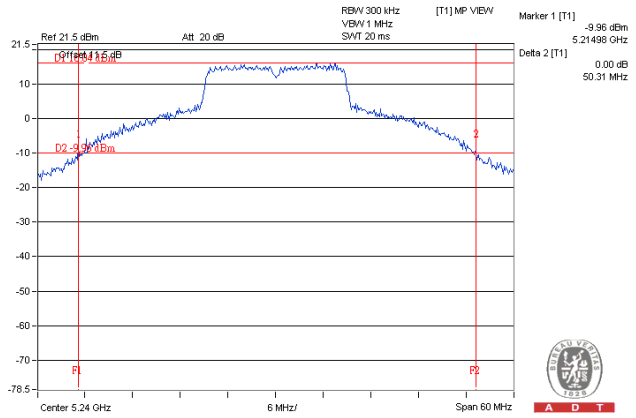
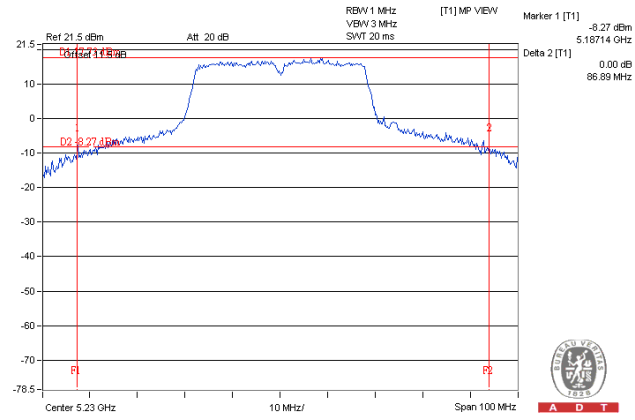
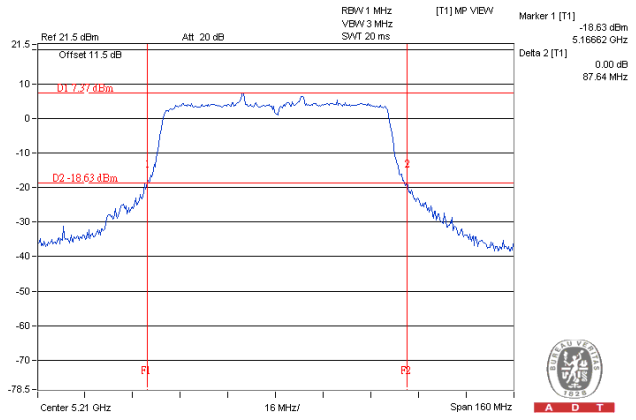
Chan.	Freq. (MHz)	26dBc Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
36	5180	24.09	23.94	23.18	Pass
40	5200	43.88	43.61	43.09	Pass
48	5240	48.65	48.46	50.31	Pass

802.11n (HT40)

Chan.	Freq. (MHz)	26dBc Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
38	5190	47.11	44.76	45.72	Pass
46	5230	83.87	75.30	86.89	Pass

802.11ac (VHT80)

Chan.	Freq. (MHz)	26dBc Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
42	5210	87.64	86.56	87.61	Pass

Spectrum Plot of Worst Value	
802.11a	802.11n (HT20)
	
802.11n (HT40)	802.11ac (VHT80)
	

Occupied Bandwidth:

802.11a

Chan.	Freq. (MHz)	Occupied Bandwidth (MHz)
36	5180	18.87
40	5200	31.68
48	5240	31.44
149	5745	17.65
157	5785	34.68
165	5825	27.36

802.11n (HT20)

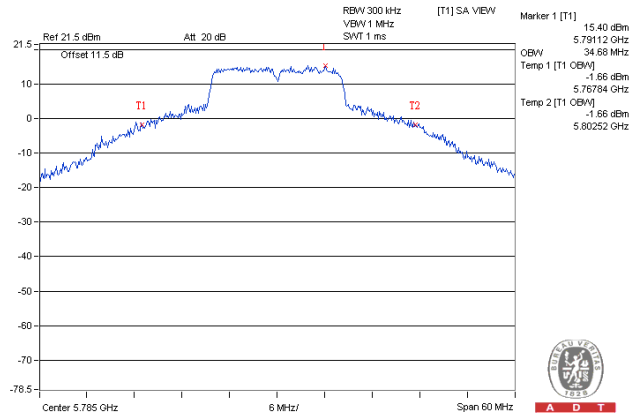
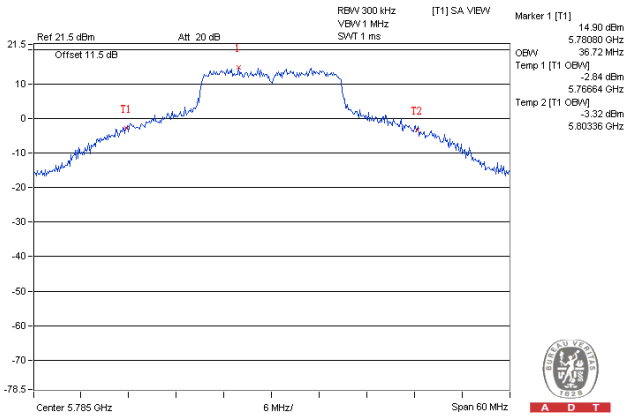
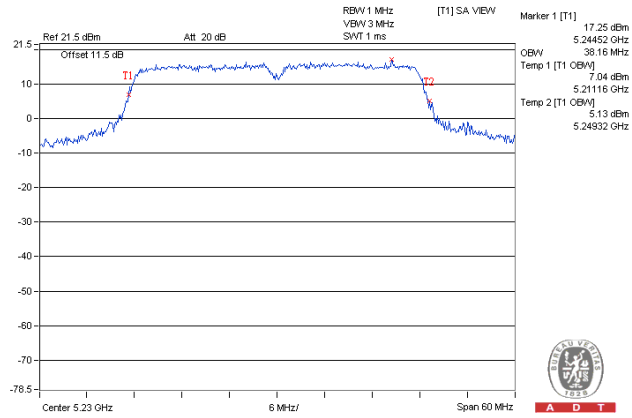
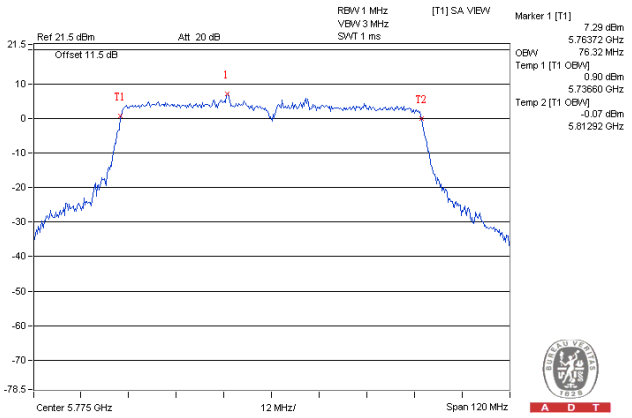
Chan.	Freq. (MHz)	Occupied Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2
36	5180	17.88	18.00	17.91
40	5200	25.56	24.60	25.68
48	5240	33.72	31.92	35.52
149	5745	18.12	18.00	17.83
157	5785	36.60	36.72	35.16
165	5825	19.08	18.48	18.84

802.11n (HT40)

Chan.	Freq. (MHz)	Occupied Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2
38	5190	36.96	36.72	36.84
46	5230	37.68	37.32	38.16
151	5755	36.96	36.96	37.20
159	5795	37.68	37.32	37.20

802.11ac (VHT80)

Chan.	Freq. (MHz)	Occupied Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2
42	5210	75.84	76.32	76.08
155	5775	76.32	76.32	76.08

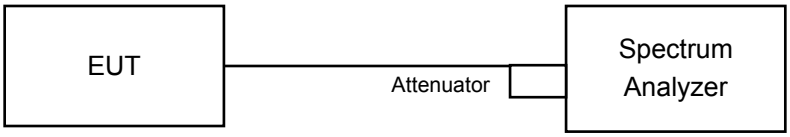
Spectrum Plot of Worst Value	
802.11a	802.11n (HT20)
	
802.11n (HT40)	802.11ac (VHT80)
	

4.4 Peak Power Spectral Density Measurement

4.4.1 Limits of Peak Power Spectral Density Measurement

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

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

For U-NII-1 band:
Using method SA-2

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

For U-NII-3 band:

a. Set span to encompass the entire emission bandwidth (EBW) of the signal.
b. Set RBW = 300 kHz, Set VBW ≥ 1 MHz, Detector = RMS
c. Use the peak marker function to determine the maximum power level in any 300 kHz band segment within the fundamental EBW.
d. Scale the observed power level to an equivalent value in 500 kHz by adjusting (reducing) the measured power by a bandwidth correction factor (BWCF) where BWCF = 10log(500 kHz/300kHz)
e. Sweep time = auto, trigger set to “free run”.
f. Trace average at least 100 traces in power averaging mode.
g. 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

For U-NII-1 Band

802.11a

Chan.	Freq. (MHz)	PSD w/o duty factor (dBm)	Duty factor	PSD with duty factor (dBm)	Max. Limit (dBm)	Pass / Fail
36	5180	9.02	0.20	9.22	17.00	Pass
40	5200	11.41	0.20	11.61	17.00	Pass
48	5240	11.43	0.20	11.63	17.00	Pass

Note: Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT20)

Chan.	Freq. (MHz)	PSD (dBm)			Total PSD w/o duty factor (dBm)	Duty factor	Total PSD with duty factor (dBm)	Max. Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2					
36	5180	5.62	5.03	4.13	9.74	0.22	9.96	15.23	Pass
40	5200	9.78	9.75	9.44	14.43	0.22	14.65	15.23	Pass
48	5240	10.34	9.91	10.15	14.91	0.22	15.13	15.23	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 = 3dBi + 10log(3) = 7.77dBi > 6dBi, so the power density limit shall be reduced to 17-(7.77-6) = 15.23dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT40)

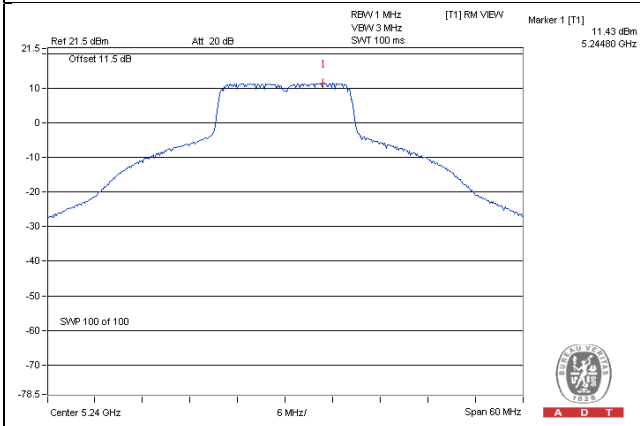
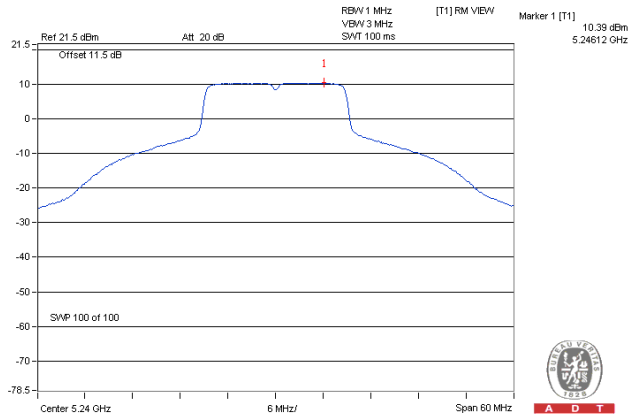
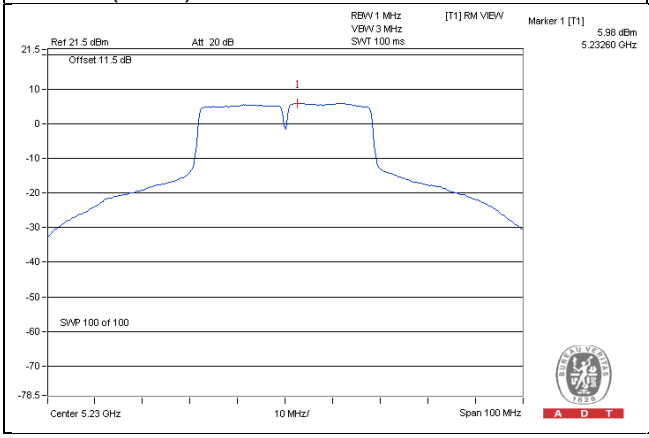
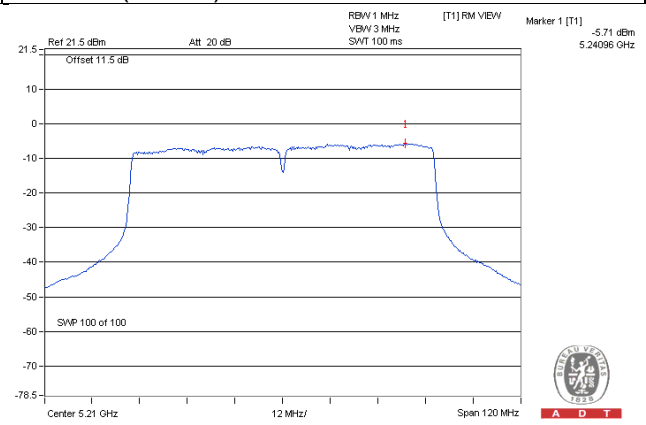
Chan.	Freq. (MHz)	PSD (dBm)			Total PSD w/o duty factor (dBm)	Duty factor	Total PSD with duty factor (dBm)	Max. Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2					
38	5190	-0.69	-2.20	-1.10	3.49	0.34	3.83	15.23	Pass
46	5230	5.34	4.99	5.95	10.21	0.34	10.55	15.23	Pass

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 = 3dBi + 10log(3) = 7.77dBi > 6dBi, so the power density limit shall be reduced to 17-(7.77-6) = 15.23dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11ac (VHT80)

Chan.	Freq. (MHz)	PSD (dBm)			Total PSD w/o duty factor (dBm)	Duty factor	Total PSD with duty factor (dBm)	Max. Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2					
42	5210	-6.20	-7.09	-6.17	-1.70	0.74	-0.96	15.23	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 = 3dBi + 10log(3) = 7.77dBi > 6dBi, so the power density limit shall be reduced to 17-(7.77-6) = 15.23dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value	
802.11a / Chain 0 / CH 48	802.11n (HT20) / Chain 0 / CH 48
	
802.11n (HT40) / Chain 2 / CH 46	802.11ac (VHT80) / Chain 2 / CH 42
	

For U-NII-3 Band

802.11a

Chan.	Freq. (MHz)	PSD (dBm/300k Hz)	PSD (dBm/500k Hz)	Duty factor	Total PSD (dBm/500k Hz)	Limit (dBm/500k Hz)	Pass / Fail
149	5745	-0.95	1.27	0.20	1.47	30.00	Pass
157	5785	2.18	4.40	0.20	4.60	30.00	Pass
165	5825	1.04	3.26	0.20	3.46	30.00	Pass

Note: Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT20)

TX chain	Chan.	Freq. (MHz)	PSD (dBm/300 kHz)	PSD (dBm/500 kHz)	10 log (N=3) dB	Duty factor	Total PSD (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	149	5745	-3.03	-0.81	4.77	0.22	4.18	28.23	Pass
	157	5785	1.79	4.01	4.77	0.22	9.00	28.23	Pass
	165	5825	-1.13	1.09	4.77	0.22	6.08	28.23	Pass
1	149	5745	-4.24	-2.02	4.77	0.22	2.97	28.23	Pass
	157	5785	1.17	3.39	4.77	0.22	8.38	28.23	Pass
	165	5825	-2.00	0.22	4.77	0.22	5.21	28.23	Pass
2	149	5745	-5.11	-2.89	4.77	0.22	2.10	28.23	Pass
	157	5785	1.33	3.55	4.77	0.22	8.54	28.23	Pass
	165	5825	-1.29	0.93	4.77	0.22	5.92	28.23	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 = 3dBi + 10log(3) = 7.77dBi > 6dBi, so the power density limit shall be reduced to 30-(7.77-6) = 28.23dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT40)

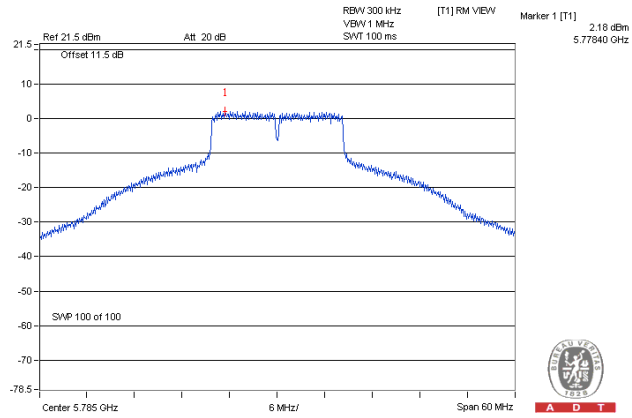
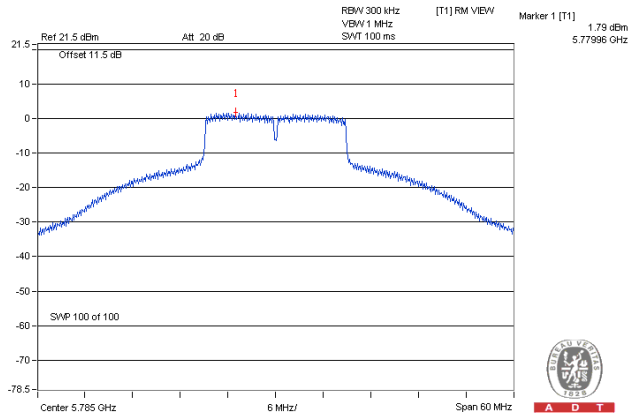
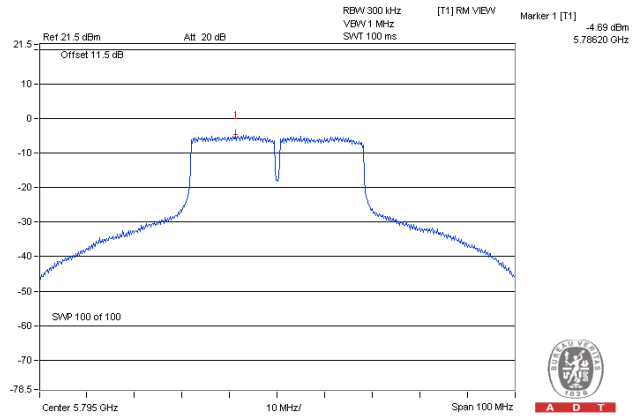
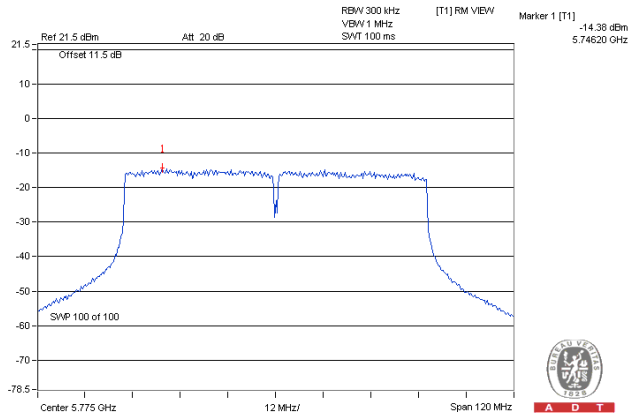
TX chain	Chan.	Freq. (MHz)	PSD (dBm/300 kHz)	PSD (dBm/500 kHz)	10 log (N=3) dB	Duty factor	Total PSD (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	151	5755	-8.71	-6.49	4.77	0.34	-1.38	28.23	Pass
	159	5795	-4.69	-2.47	4.77	0.34	2.64	28.23	Pass
1	151	5755	-9.91	-7.69	4.77	0.34	-2.58	28.23	Pass
	159	5795	-5.27	-3.05	4.77	0.34	2.06	28.23	Pass
2	151	5755	-10.11	-7.89	4.77	0.34	-2.78	28.23	Pass
	159	5795	-5.32	-3.10	4.77	0.34	2.01	28.23	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 = 3dBi + 10log(3) = 7.77dBi > 6dBi, so the power density limit shall be reduced to 30-(7.77-6) = 28.23dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11ac (VHT80)

TX chain	Chan.	Freq. (MHz)	PSD (dBm/300 kHz)	PSD (dBm/500 kHz)	10 log (N=3) dB	Duty factor	Total PSD (dBm/500 kHz)	Limit (dBm/500 kHz)	Pass / Fail
0	155	5775	-14.38	-12.16	4.77	0.74	-6.65	28.23	Pass
1	155	5775	-15.21	-12.99	4.77	0.74	-7.48	28.23	Pass
2	155	5775	-14.85	-12.63	4.77	0.74	-7.12	28.23	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 = 3dBi + 10log(3) = 7.77dBi > 6dBi, so the power density limit shall be reduced to 30-(7.77-6) = 28.23dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

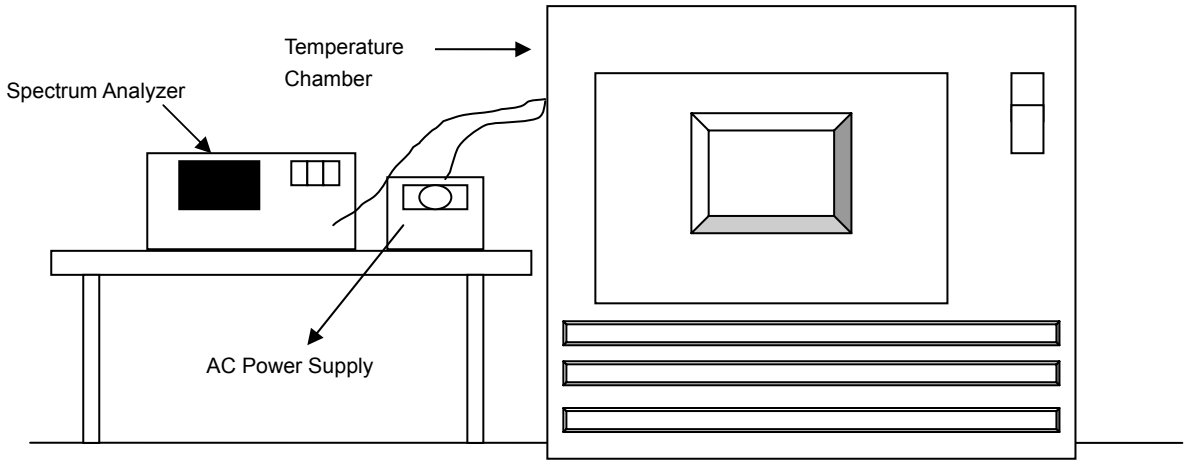
Spectrum Plot of Worst Value	
802.11a	802.11n (HT20)
	
802.11n (HT40)	802.11ac (VHT80)
	

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

a. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.

b. Turn the EUT on and couple its output to a spectrum analyzer.

c. Turn the EUT off and set the chamber to the highest temperature specified.

d. 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.

e. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.

f. 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

Frequemcy Stability Versus Temp.									
Operating Frequency: 5180MHz									
Temp. (℃)	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	5179.9991	-0.00002	5179.9994	-0.00001	5179.9998	0.00000	5180.0008	0.00002
40	120	5179.9995	-0.00001	5180.0002	0.00000	5179.999	-0.00002	5180.0026	0.00005
30	120	5179.9907	-0.00018	5179.9886	-0.00022	5179.9921	-0.00015	5179.9886	-0.00022
20	120	5179.9727	-0.00053	5179.9752	-0.00048	5179.9738	-0.00051	5179.9745	-0.00049
10	120	5179.9947	-0.00010	5179.9946	-0.00010	5179.9913	-0.00017	5179.9924	-0.00015
0	120	5179.9986	-0.00003	5179.9987	-0.00003	5179.998	-0.00004	5179.998	-0.00004
-10	120	5180.0069	0.00013	5180.0066	0.00013	5180.0078	0.00015	5180.007	0.00014
-20	120	5179.9892	-0.00021	5179.9855	-0.00028	5179.9873	-0.00025	5179.9888	-0.00022
-30	120	5179.989	-0.00021	5179.9846	-0.00030	5179.9854	-0.00028	5179.9847	-0.00030

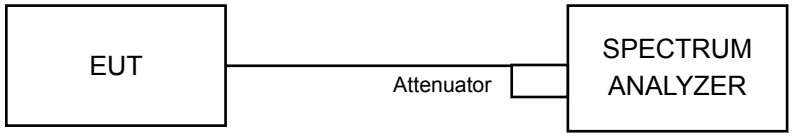
Frequemcy Stability Versus Voltage									
Operating Frequency: 5180MHz									
Temp. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)
20	138	5179.9719	-0.00054	5179.9758	-0.00047	5179.9736	-0.00051	5179.9743	-0.00050
	120	5179.9727	-0.00053	5179.9752	-0.00048	5179.9738	-0.00051	5179.9745	-0.00049
	102	5179.9722	-0.00054	5179.9758	-0.00047	5179.9733	-0.00052	5179.9753	-0.00048

4.6 6dB Bandwidth Measurment

4.6.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

a. Set resolution bandwidth (RBW) = 100kHz

b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.

c. Trace mode = max hold.

d. Sweep = auto couple.

e. Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

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

4.6.7 Test Results

802.11a

Chan.	Freq. (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
149	5745	16.38	0.5	Pass
157	5785	16.42	0.5	Pass
165	5825	16.40	0.5	Pass

802.11n (HT20)

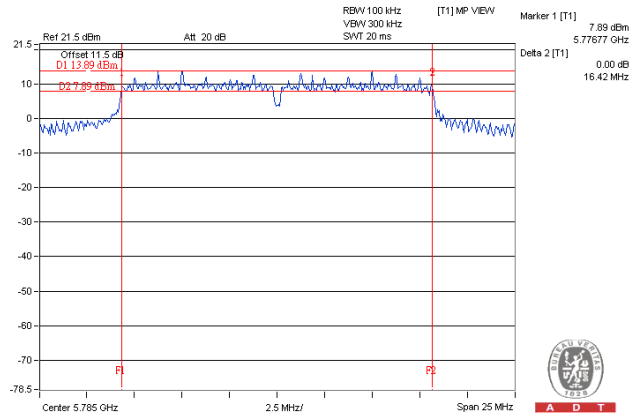
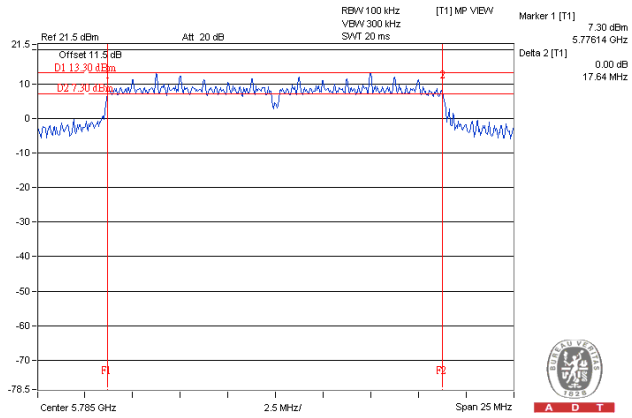
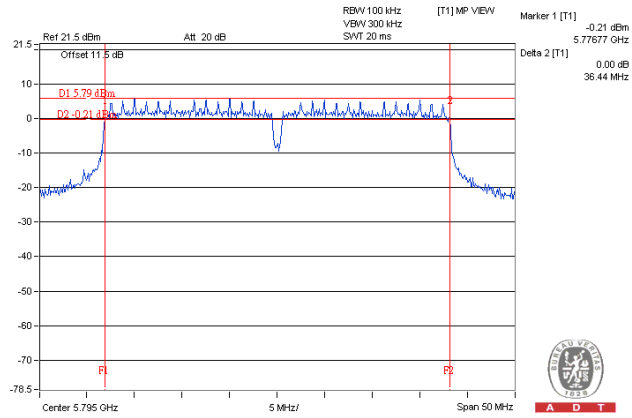
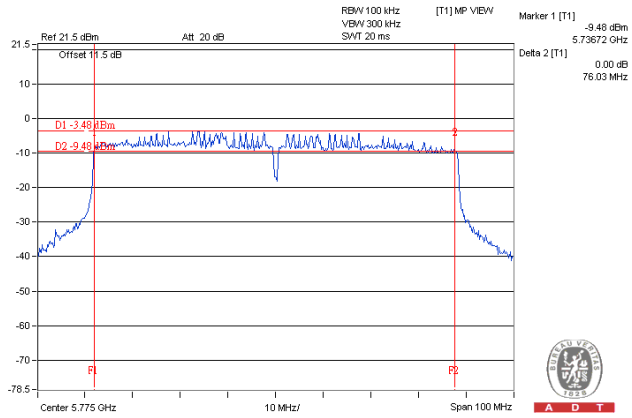
Chan.	Freq. (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
149	5745	17.61	17.61	17.62	0.5	Pass
157	5785	17.62	17.64	17.61	0.5	Pass
165	5825	17.62	17.62	17.62	0.5	Pass

802.11n (HT40)

Chan.	Freq. (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
151	5755	36.36	36.42	36.36	0.5	Pass
159	5795	36.18	36.13	36.44	0.5	Pass

802.11ac (VHT80)

Chan.	Freq. (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
155	5775	76.00	76.03	75.92	0.5	Pass

Spectrum Plot of Worst Value	
802.11a	802.11n (HT20)
	
802.11n (HT40)	802.11ac (VHT80)
	

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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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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