FCC TEST REPORT (15.407)

REPORT NO.:	RF111227C09-1
MODEL NO.:	APL22-09E
FCC ID:	QWU-09E
RECEIVED:	Dec. 27, 2011
TESTED:	Jan. 07 ~ Jan. 17, 2012
ISSUED:	Jan. 30, 2012

APPLICANT:	SonicWALL, Inc.
ADDRESS:	2001 Logic Drive San Jose, CA 95124, USA

ISSUED BY:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
LAB ADDRESS:	No. 47, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C)
TEST LOCATION:	No. 19, Hwa Ya 2nd Rd, Wen Hwa Tsuen, Kwei Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
Original release	N/A	Jan. 30, 2012

1. CERTIFICATION

PRODUCT:	Wireless 802.11 abgn Device
MODEL:	APL22-09E
BRAND:	SonicWALL
APPLICANT:	SonicWALL, Inc.
TESTED:	Jan. 07 ~ Jan. 17, 2012
TEST SAMPLE:	ENGINEERING SAMPLE
STANDARDS:	**FCC Part 15, Subpart E (Section 15.407)**
	ANSI C63.4-2003
	ANSI C63.10-2009

The above equipment (Model: APL22-09E) 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 : _____ , DATE : Jan. 30, 2012
Pettie Chen / Specialist

APPROVED BY : _____ DATE : Jan. 30, 2012
Gary Chang / Technical 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 AND LIMIT**	**RESULT**	**REMARK**
15.407(b)(5)	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -5.61dB at 29.057MHz.
15.407(b/1/2/3) (b)(5)	Electric Field Strength Spurious Emissions, 30MHz ~ 40000MHz	PASS	Meet the requirement of limit. Minimum passing margin is -1.3dB at 815.86MHz.
15.407(a/1/2/3)	Peak Transmit Power	PASS	Meet the requirement of limit.
15.407(a)(6)	Peak Power Excursion	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 RSMA 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	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.44 dB
Radiated emissions	30MHz ~ 200MHz	3.34 dB
	200MHz ~1000MHz	3.35 dB
	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

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

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

EUT	Wireless 802.11 abgn Device
MODEL NO.	APL22-09E
FCC ID	QWU-09E
POWER SUPPLY	12Vdc (Adapter)
MODULATION TYPE	64QAM, 16QAM, QPSK, BPSK
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 450.0Mbps
OPERATING FREQUENCY	5180.0 ~ 5240.0MHz
NUMBER OF CHANNEL	4 for 802.11a, 802.11n (20MHz) 2 for 802.11n (40MHz)
OUTPUT POWER	45.82mW
ANTENNA TYPE	PIFA antenna with 4dBi gain Dipole antenna with 4dBi gain
ANTENNA CONNECTOR	RSMA (For Dipole antenna)
DATA CABLE	1.9m non-shielded RJ45 cable without core
I/O PORTS	Refer to user's manual
ACCESSORY DEVICES	Adapter

NOTE:

1. The frequency bands used in this EUT are listed as follows:

Frequency Band (MHz)	2412~2462	5180~5240	5745~5825
802.11b	√		
802.11g	√		
802.11a		√	√
802.11n (20MHz)	√	√	√
802.11n (40MHz)	√	√	√

2. The EUT incorporates a MIMO function. Physically, the EUT provides three completed transmitters and three receivers.

MODULATION MODE	TX FUNCTION
802.11b	3TX
802.11g	3TX
802.11a	3TX
802.11n (20MHz)	3TX
802.11n (40MHz)	3TX

3. The EUT was powered by the following adapters:

Adapter 1	
BRAND:	SINO-AMERICAN
MODEL:	SA124C-12V
INPUT:	100-240Vac, 50-60Hz, 0.8A
OUTPUT:	12Vdc, 1.5A, 18W
POWER LINE:	DC: 1.5m non-shielded cable with one core AC: 1.8m non-shielded cable without core

Adapter 2	
BRAND:	Sunny
MODEL:	SYS1319-1812-T3
INPUT:	100-240Vac, 50-60Hz, 1.0 A Max
OUTPUT:	12Vdc, 1.5A, 18W Max
POWER LINE:	DC: 1.5m non-shielded cable with one core AC: 1.8m non-shielded cable without core

* Adapter 2 was the worst for the final tests.

4. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 DESCRIPTION OF TEST MODES

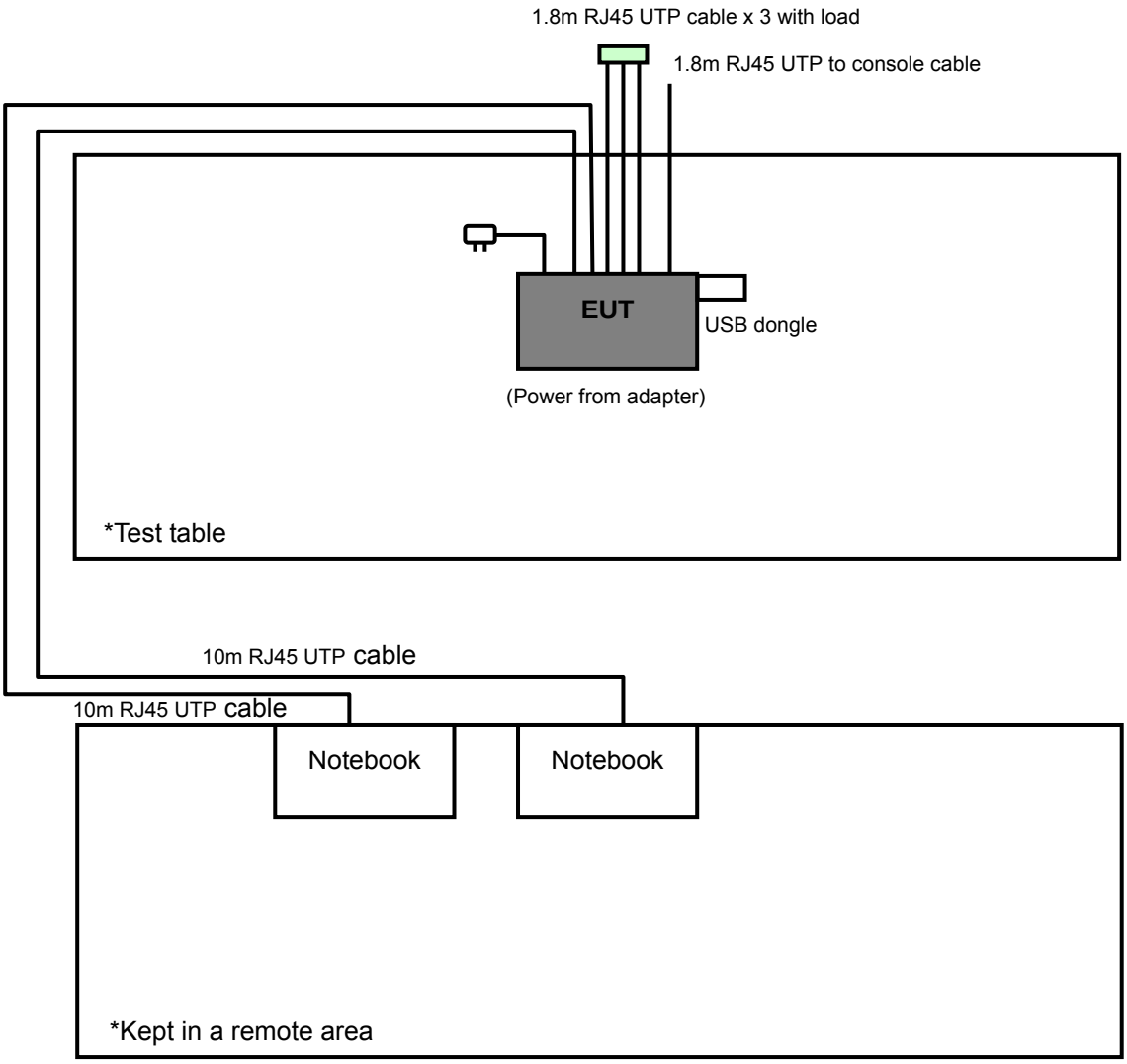
4 channels are provided for 802.11a, 802.11n (20MHz):

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

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

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
38	5190MHz	46	5230MHz

3.2.1 CONFIGURATION OF SYSTEM UNDER TEST



3.2.2 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

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

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

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, XYZ axis 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)	AXIS
802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6.0	Z
802.11n (20MHz)	36 to 48	36, 40, 48	OFDM	BPSK	7.2	Z
802.11n (40MHz)	38 to 46	38, 46	OFDM	BPSK	15.0	Z

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, XYZ axis 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)	AXIS
802.11n (40MHz)	38 to 46	38	OFDM	BPSK	15.0	Z

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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11n (40MHz)	38 to 46	38	OFDM	BPSK	15.0

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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)	AXIS
802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6.0	Z
802.11n (20MHz)	36 to 48	36, 40, 48	OFDM	BPSK	7.2	Z
802.11n (40MHz)	38 to 46	38, 46	OFDM	BPSK	15.0	Z

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	23deg. C, 65%RH	120Vac, 60Hz	Antony Lee
RE<1G	20deg. C, 65%RH	120Vac, 60Hz	Haru Yang
PLC	22deg. C, 65%RH	120Vac, 60Hz	Daniel Lin
APCM	23deg. C, 65%RH	120Vac, 60Hz	Antony 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)
ANSI C63.4-2003
ANSI C63.10-2009

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

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

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.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK	DELL	D531	CN-0XM006-48643-81U-2610	QDS-BRCM1020
2	NOTEBOOK	DELL	D531	CN-0XM006-48643-81U-2973	QDS-BRCM1020
3	USB DONGLE	Transcend	NA	NA	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	10m RJ45 UTP cable
2	10m RJ45 UTP cable
3	NA

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

4. TEST TYPES AND RESULTS

4.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

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. As shown in 15.35(b), 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

FREQUENCIES (MHz)	EIRP LIMIT (dBm)	EQUIVALENT FIELD STRENGTH AT 3m (dBμV/m) *NOTE 3
	PK	PK
5150 ~ 5250	-27	68.3

NOTE: 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).

4.1.3 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESIB7	100212	Aug. 02, 2011	Aug. 01, 2012
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100041	Jul. 21, 2011	Jul. 20, 2012
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Apr. 13, 2011	Apr. 12, 2012
HORN Antenna SCHWARZBECK	9120D	209	Aug. 25, 2011	Aug. 24, 2012
HORN Antenna SCHWARZBECK	BBHA 9170	148	Jul. 20, 2011	Jul. 19, 2012
Preamplifier Agilent	8447D	2944A10633	Oct. 29, 2011	Oct. 28, 2012
Preamplifier Agilent	8449B	3008A01964	Oct. 29, 2011	Oct. 28, 2012
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250723/4	Aug. 30, 2011	Aug. 29, 2012
RF signal cable HUBER+SUHNNER	SUCOFLEX 106	12738/6+309224/4	Aug. 30, 2011	Aug. 29, 2012
Software ADT.	ADT_Radiated_V7.6.15.9.2	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller inn-co GmbH	CO2000	017303	NA	NA
Turn Table ADT.	TT100	TT93021703	NA	NA
Turn Table Controller ADT.	SC100	SC93021703	NA	NA
High Speed Peak Power Meter	ML2495A	0842014	Apr. 26, 2011	Apr. 25, 2012
Power Sensor	MA2411B	0738404	Apr. 26, 2011	Apr. 25, 2012
26GHz ~ 40GHz Amplifier	EM26400	815221	Oct. 29, 2011	Oct. 28, 2012

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 3.
3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The FCC Site Registration No. is 988962.
5. The IC Site Registration No. is IC 7450F-3.

4.1.4 TEST PROCEDURES

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. 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 antenna is a broadband antenna, and its height 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 Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

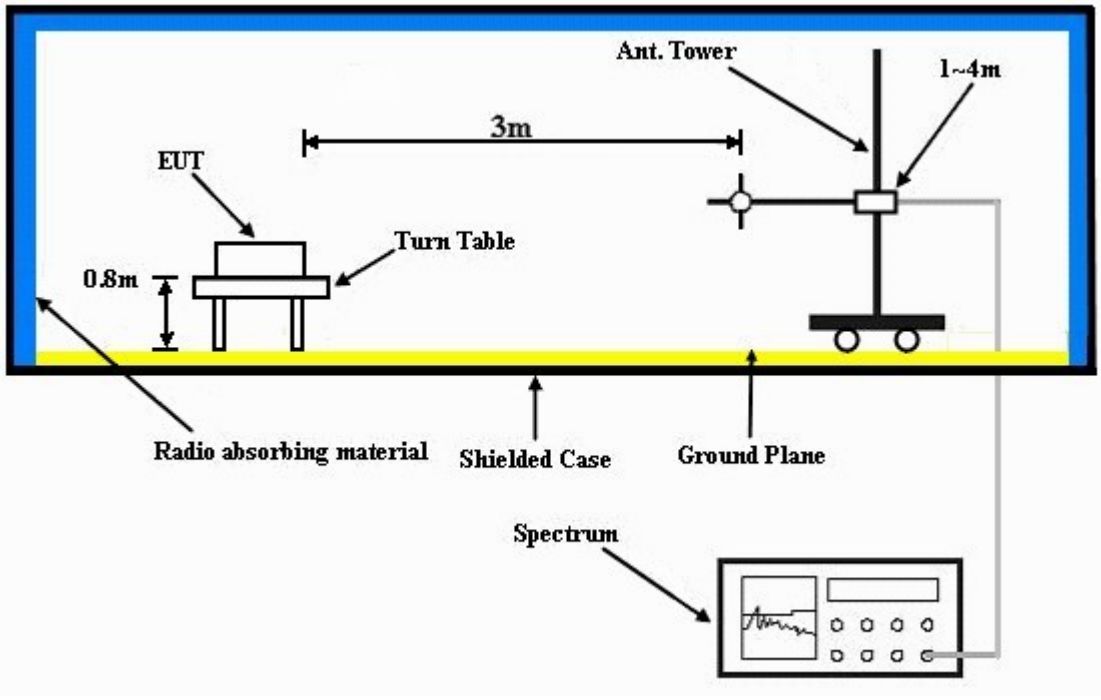
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 1kHz for Average detection (AV) at frequency above 1GHz.
4. 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



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

4.1.7 EUT OPERATING CONDITION

a. Placed the EUT on the testing table.
b. Prepared notebooks to act as communication partner and placed it outside of testing area.
c. The communication partner connected with EUT via a RJ45 cable and run 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.

4.1.8 TEST RESULTS

ABOVE 1GHz DATA：802.11a

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 36	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	23deg. C, 65%RH	TESTED BY	Antony Lee

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	46.5 PK	74.0	-27.5	1.02 H	309	8.00	38.50
2	5150.00	35.2 AV	54.0	-18.8	1.02 H	309	-3.30	38.50
3	*5180.00	98.3 PK			1.01 H	308	59.70	38.60
4	*5180.00	87.5 AV			1.01 H	308	48.90	38.60
5	#10360.00	57.3 PK	68.3	-11.0	1.00 H	59	7.80	49.50
6	15540.00	62.0 PK	74.0	-12.0	1.00 H	29	11.60	50.40
7	15540.00	48.6 AV	54.0	-5.4	1.00 H	29	-1.80	50.40
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	48.2 PK	74.0	-25.8	1.01 V	18	9.70	38.50
2	5150.00	37.8 AV	54.0	-16.2	1.01 V	18	-0.70	38.50
3	*5180.00	109.7 PK			1.00 V	360	71.10	38.60
4	*5180.00	98.2 AV			1.00 V	360	59.60	38.60
5	#10360.00	57.6 PK	68.3	-10.7	1.00 V	251	8.10	49.50
6	15540.00	61.1 PK	74.0	-12.9	1.00 V	15	10.70	50.40
7	15540.00	48.9 AV	54.0	-5.1	1.00 V	15	-1.50	50.40

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 the restricted band.

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 40	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	23deg. C, 65%RH	TESTED BY	Antony Lee

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5200.00	98.5 PK			4.00 H	0	59.90	38.60
2	*5200.00	87.6 AV			4.00 H	0	49.00	38.60
3	#10400.00	57.4 PK	68.3	-10.9	1.00 H	63	7.90	49.50
4	15600.00	61.5 PK	74.0	-12.5	1.00 H	33	11.20	50.30
5	15600.00	49.0 AV	54.0	-5.0	1.00 H	33	-1.30	50.30
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	*5200.00	108.9 PK			1.00 V	358	70.30	38.60
2	*5200.00	98.3 AV			1.00 V	358	59.70	38.60
3	#10400.00	57.0 PK	68.3	-11.3	1.00 V	255	7.50	49.50
4	15600.00	61.4 PK	74.0	-12.6	1.00 V	18	11.10	50.30
5	15600.00	48.5 AV	54.0	-5.5	1.00 V	18	-1.80	50.30

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 the restricted band.

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 48	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	23deg. C, 65%RH	TESTED BY	Antony Lee

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	98.1 PK			1.00 H	266	59.40	38.70
2	*5240.00	88.5 AV			1.00 H	266	49.80	38.70
3	5350.00	47.3 PK	74.0	-26.7	1.00 H	266	8.50	38.80
4	5350.00	33.8 AV	54.0	-20.2	1.00 H	266	-5.00	38.80
5	#10480.00	58.2 PK	68.3	-10.1	1.00 H	56	8.30	49.90
6	15720.00	61.5 PK	74.0	-12.5	1.00 H	32	11.50	50.00
7	15720.00	48.4 AV	54.0	-5.6	1.00 H	32	-1.60	50.00
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5240.00	109.3 PK			1.00 V	358	70.60	38.70
2	*5240.00	98.5 AV			1.00 V	358	59.80	38.70
3	5350.00	47.9 PK	74.0	-26.1	1.00 V	359	9.10	38.80
4	5350.00	35.3 AV	54.0	-18.7	1.00 V	359	-3.50	38.80
5	#10480.00	57.9 PK	68.3	-10.4	1.00 V	253	8.00	49.90
6	15720.00	61.3 PK	74.0	-12.7	1.00 V	15	11.30	50.00
7	15720.00	48.8 AV	54.0	-5.2	1.00 V	15	-1.20	50.00

REMARKS: 1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).

2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.
6. "#":The radiated frequency is out the restricted band.

802.11n (20MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 36	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	23deg. C, 65%RH	TESTED BY	Antony Lee

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	46.5 PK	74.0	-27.5	1.02 H	311	8.00	38.50
2	5150.00	35.4 AV	54.0	-18.6	1.02 H	311	-3.10	38.50
3	*5180.00	98.2 PK			1.02 H	310	59.60	38.60
4	*5180.00	87.4 AV			1.02 H	310	48.80	38.60
5	#10360.00	57.5 PK	68.3	-10.8	1.00 H	61	8.00	49.50
6	15540.00	62.3 PK	74.0	-11.7	1.00 H	32	11.90	50.40
7	15540.00	48.9 AV	54.0	-5.1	1.00 H	32	-1.50	50.40
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	50.4 PK	74.0	-23.6	1.00 V	339	11.90	38.50
2	5150.00	37.8 AV	54.0	-16.2	1.00 V	339	-0.70	38.50
3	*5180.00	109.2 PK			1.00 V	335	70.60	38.60
4	*5180.00	98.8 AV			1.00 V	335	60.20	38.60
5	#10360.00	56.8 PK	68.3	-11.5	1.00 V	255	7.30	49.50
6	15540.00	62.2 PK	74.0	-11.8	1.00 V	18	11.80	50.40
7	15540.00	49.3 AV	54.0	-4.7	1.00 V	18	-1.10	50.40

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 the restricted band.

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 40	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	23deg. C, 65%RH	TESTED BY	Antony Lee

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5200.00	98.2 PK			1.00 H	35	59.60	38.60
2	*5200.00	87.4 AV			1.00 H	35	48.80	38.60
3	#10400.00	57.6 PK	68.3	-10.7	1.00 H	65	8.10	49.50
4	15600.00	61.8 PK	74.0	-12.2	1.00 H	35	11.50	50.30
5	15600.00	49.5 AV	54.0	-4.5	1.00 H	35	-0.80	50.30
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	*5200.00	109.1 PK			1.00 V	360	70.50	38.60
2	*5200.00	98.4 AV			1.00 V	360	59.80	38.60
3	#10400.00	57.2 PK	68.3	-11.1	1.00 V	223	7.70	49.50
4	15600.00	61.6 PK	74.0	-12.4	1.00 V	21	11.30	50.30
5	15600.00	48.7 AV	54.0	-5.3	1.00 V	21	-1.60	50.30

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 the restricted band.

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 48	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	23deg. C, 65%RH	TESTED BY	Antony Lee

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	98.5 PK			1.00 H	263	59.80	38.70
2	*5240.00	88.6 AV			1.00 H	263	49.90	38.70
3	5350.00	47.6 PK	74.0	-26.4	1.00 H	265	8.80	38.80
4	5350.00	33.9 AV	54.0	-20.1	1.00 H	265	-4.90	38.80
5	#10480.00	58.6 PK	68.3	-9.7	1.00 H	59	8.70	49.90
6	15720.00	61.3 PK	74.0	-12.7	1.00 H	33	11.30	50.00
7	15720.00	48.7 AV	54.0	-5.3	1.00 H	33	-1.30	50.00
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5240.00	109.1 PK			1.00 V	359	70.40	38.70
2	*5240.00	98.4 AV			1.00 V	359	59.70	38.70
3	5350.00	48.2 PK	74.0	-25.8	1.00 V	359	9.40	38.80
4	5350.00	35.5 AV	54.0	-18.5	1.00 V	359	-3.30	38.80
5	#10480.00	58.2 PK	68.3	-10.1	1.00 V	255	8.30	49.90
6	15720.00	61.5 PK	74.0	-12.5	1.00 V	20	11.50	50.00
7	15720.00	48.9 AV	54.0	-5.1	1.00 V	20	-1.10	50.00

REMARKS: 1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).

2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. " * ": Fundamental frequency.
6. "#":The radiated frequency is out the restricted band.

802.11n (40MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 38	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	23deg. C, 65%RH	TESTED BY	Antony Lee

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	54.6 PK	74.0	-19.4	1.00 H	305	16.10	38.50
2	5150.00	38.0 AV	54.0	-16.0	1.00 H	305	-0.50	38.50
3	*5190.00	97.5 PK			1.01 H	306	58.90	38.60
4	*5190.00	86.1 AV			1.01 H	306	47.50	38.60
5	#10380.00	57.3 PK	68.3	-11.0	1.00 H	147	7.80	49.50
6	15570.00	61.9 PK	74.0	-12.1	1.00 H	41	11.60	50.30
7	15570.00	52.3 AV	54.0	-1.7	1.00 H	41	2.00	50.30
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	65.3 PK	74.0	-8.7	1.00 V	241	26.80	38.50
2	5150.00	50.5 AV	54.0	-3.5	1.00 V	241	12.00	38.50
3	*5190.00	107.6 PK			1.00 V	216	69.00	38.60
4	*5190.00	97.1 AV			1.00 V	216	58.50	38.60
5	#10380.00	57.2 PK	68.3	-11.1	1.00 V	25	7.70	49.50
6	15570.00	62.2 PK	74.0	-11.8	1.02 V	254	11.90	50.30
7	15570.00	48.8 AV	54.0	-5.2	1.02 V	254	-1.50	50.30

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 the restricted band.

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 46	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	23deg. C, 65%RH	TESTED BY	Antony Lee

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5230.00	98.2 PK			1.34 H	266	59.50	38.70
2	*5230.00	88.9 AV			1.34 H	266	50.20	38.70
3	5350.00	47.2 PK	74.0	-26.8	1.34 H	266	8.40	38.80
4	5350.00	34.1 AV	54.0	-19.9	1.34 H	266	-4.70	38.80
5	#10460.00	57.8 PK	68.3	-10.5	1.00 H	151	8.00	49.80
6	15690.00	61.8 PK	74.0	-12.2	1.00 H	49	11.70	50.10
7	15690.00	48.6 AV	54.0	-5.4	1.00 H	49	-1.50	50.10
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	*5230.00	108.9 PK			1.00 V	244	70.20	38.70
2	*5230.00	97.9 AV			1.00 V	244	59.20	38.70
3	5350.00	51.6 PK	74.0	-22.4	1.00 V	246	12.80	38.80
4	5350.00	38.5 AV	54.0	-15.5	1.00 V	246	-0.30	38.80
5	#10460.00	57.8 PK	68.3	-10.5	1.00 V	29	8.00	49.80
6	15690.00	61.2 PK	74.0	-12.8	1.01 V	248	11.10	50.10
7	15690.00	48.6 AV	54.0	-5.4	1.01 V	248	-1.50	50.10

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 the restricted band.

BELOW 1GHz WORST-CASE DATA：802.11n (40MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 38	FREQUENCY RANGE	Below 1000MHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	20deg. C, 65%RH	TESTED BY	Haru Yang

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	125.17	32.9 QP	43.5	-10.6	3.00 H	76	20.60	12.30
2	374.04	34.5 QP	46.0	-11.5	1.00 H	85	17.60	16.90
3	624.85	38.8 QP	46.0	-7.2	1.25 H	148	16.40	22.40
4	788.17	40.3 QP	46.0	-5.7	1.00 H	154	14.90	25.40
5	813.45	43.1 QP	46.0	-2.9	1.00 H	157	17.30	25.80
6	875.67	37.7 QP	46.0	-8.3	1.75 H	109	11.10	26.60
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	31.84	38.0 QP	40.0	-2.0	1.25 V	121	25.40	12.60
2	374.04	38.7 QP	46.0	-7.3	1.50 V	157	21.80	16.90
3	**815.86**	**44.7 QP**	**46.0**	**-1.3**	**1.20 V**	**314**	**18.80**	**25.90**
4	875.67	41.4 QP	46.0	-4.6	1.00 V	49	14.80	26.60
5	959.27	41.4 QP	46.0	-4.6	1.00 V	1	14.00	27.40
6	996.21	44.7 QP	54.0	-9.3	1.25 V	355	16.90	27.80

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 OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	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.

3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCS30	100289	Nov. 19, 2011	Nov. 18, 2012
RF signal cable Woken	5D-FB	Cable-HYCO2-01	Dec. 22, 2011	Dec. 21, 2012
LISN ROHDE & SCHWARZ	ESH2-Z5	100100	Dec. 30, 2011	Dec. 29, 2012
LISN ROHDE & SCHWARZ	ESH3-Z5	100312	Jul. 07, 2011	Jul. 06, 2012
V-LISN SCHWARZBECK	NNBL 8226-2	8226-142	Jun. 30, 2011	Jun. 29, 2012
LISN ROHDE & SCHWARZ	ENV216	100072	Jun. 10, 2011	Jun. 09, 2012
Software ADT	ADT_Cond_ V7.3.7	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.

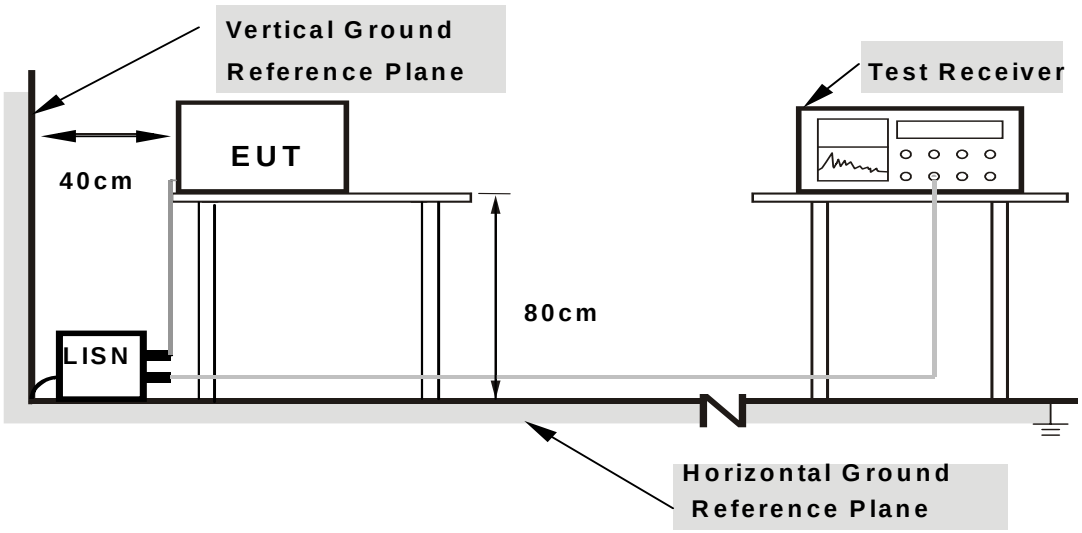
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

4.2.4 DEVIATION FROM TEST STANDARD

No deviation.

4.2.5 TEST SETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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

4.2.6 EUT OPERATING CONDITIONS

Same as 4.1.6.

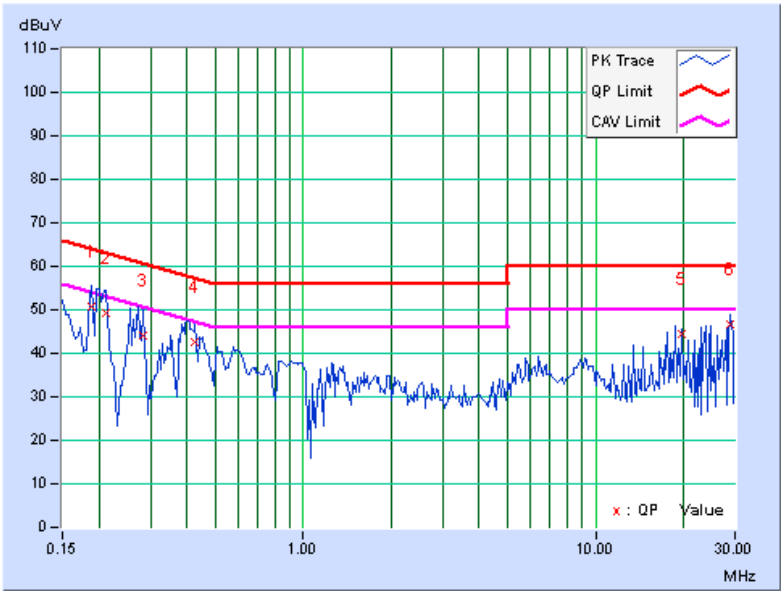
4.2.7 TEST RESULTS

CONDUCTED WORST-CASE DATA：802.11n (40MHz)

PHASE	Line 1	6dB BANDWIDTH	9kHz

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.189	0.15	50.71	30.81	50.86	30.96	64.08	54.08	-13.22	-23.12
2	0.213	0.15	49.24	30.30	49.39	30.45	63.11	53.11	-13.72	-22.66
3	0.283	0.16	43.83	28.08	43.99	28.24	60.73	50.73	-16.74	-22.49
4	0.427	0.17	42.35	26.12	42.52	26.29	57.30	47.30	-14.78	-21.01
5	19.727	0.62	43.73	40.81	44.35	41.43	60.00	50.00	-15.65	-8.57
6	29.055	0.52	46.32	37.75	46.84	38.27	60.00	50.00	-13.16	-11.73

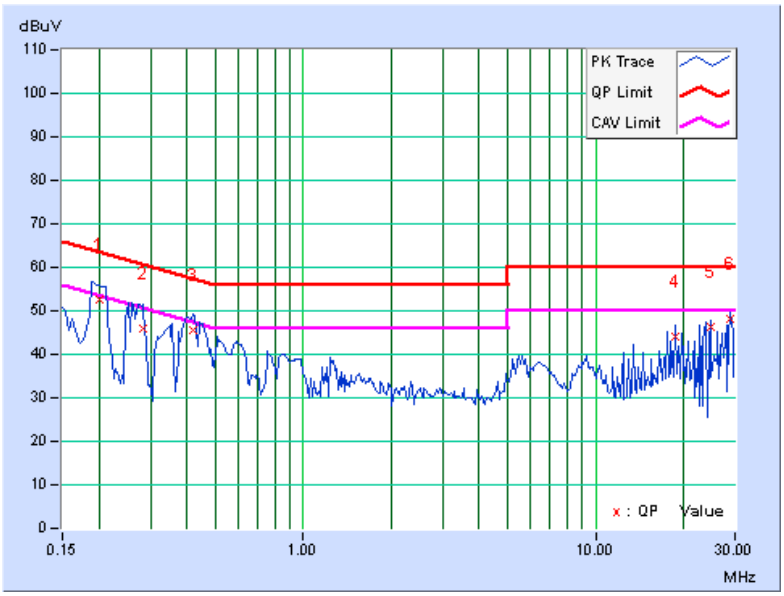
REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



PHASE	Line 2	6dB BANDWIDTH	9kHz

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.201	0.14	52.35	36.54	52.49	36.68	63.58	53.58	-11.09	-16.90
2	0.283	0.15	45.63	29.79	45.78	29.94	60.73	50.73	-14.95	-20.79
3	0.420	0.16	45.24	33.00	45.40	33.16	57.46	47.46	-12.06	-14.30
4	18.676	0.69	43.26	37.65	43.95	38.34	60.00	50.00	-16.05	-11.66
5	24.906	0.64	45.57	42.76	46.21	43.40	60.00	50.00	-13.79	-6.60
6	**29.057**	**0.55**	**47.48**	**43.84**	**48.03**	**44.39**	**60.00**	**50.00**	**-11.97**	**-5.61**

REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



4.3 PEAK TRANSMIT POWER MEASUREMENT

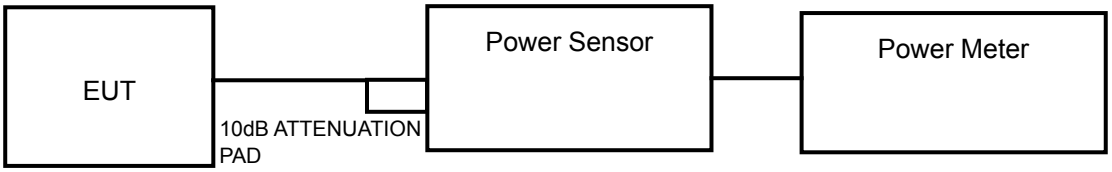
4.3.1 LIMITS OF PEAK TRANSMIT POWER MEASUREMENT

FREQUENCY BAND	LIMIT
5.15 ~ 5.25GHz	The lesser of 50mW (17dBm) or 4dBm + 10logB

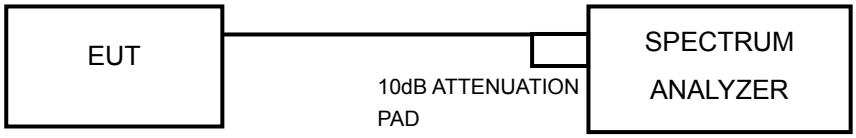
NOTE: Where B is the 26dB emission bandwidth in MHz.

4.3.2 TEST SETUP

FOR POWER OUTPUT MEASUREMENT



FOR 26dB BANDWIDTH



4.3.3 TEST INSTRUMENTS

Refer to section 4.1.3 to get information of above instrument.

4.3.4 TEST PROCEDURE

FOR AVERAGE POWER MEASUREMENT

A power sensor was used on the output port of the EUT. A power meter was used to read the response of the power sensor. Record the power level.

FOR 26dB 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%.

4.3.5 DEVIATION FROM TEST STANDARD

No deviation.

4.3.6 EUT OPERATING CONDITIONS

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

4.3.7 TEST RESULTS

POWER OUTPUT: 802.11a

CHAN.	CHAN. FREQ. (MHz)	POWER OUTPUT (dBm)			TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
36	5180	5.56	5.65	7.41	12.78	11.06	14.2	PASS
40	5200	5.62	5.32	7.26	12.37	10.92	14.2	PASS
48	5240	5.68	5.81	6.87	12.37	10.92	14.2	PASS

NOTE: Directional gain = 4dBi + 10log(3) = 8.8dBi > 6dBi, so the conducted power limit shall be reduced to 17-(8.8-6) = 14.2dBm.

802.11n (20MHz)

CHAN.	CHAN. FREQ. (MHz)	POWER OUTPUT (dBm)			TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
36	5180	8.51	8.82	10.62	26.25	14.19	17	PASS
40	5200	8.56	8.85	10.64	26.44	14.22	17	PASS
48	5240	8.65	8.96	10.75	27.08	14.33	17	PASS

802.11n (40MHz)

CHAN.	CHAN. FREQ. (MHz)	POWER OUTPUT (dBm)			TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
38	5190	11.18	11.22	12.89	**45.82**	16.61	17	PASS
46	5230	11.16	11.19	12.55	44.20	16.45	17	PASS

26dB OCCUPIED BANDWIDTH: 802.11a

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc OCCUPIED BANDWIDTH (MHz)			PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2	
36	5180	23.89	22.93	23.17	PASS
40	5200	24.06	23.13	23.09	PASS
48	5240	24.00	23.36	23.23	PASS

802.11n (20MHz)

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc OCCUPIED BANDWIDTH (MHz)			PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2	
36	5180	24.38	24.15	24.20	PASS
40	5200	24.75	24.44	24.59	PASS
48	5240	24.44	23.35	25.45	PASS

802.11n (40MHz)

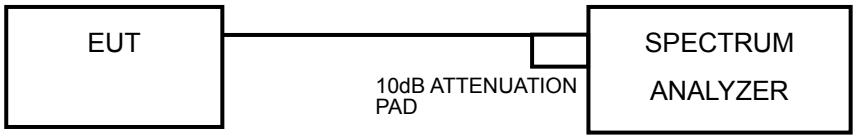
CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc OCCUPIED BANDWIDTH (MHz)			PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2	
38	5190	50.17	49.06	49.85	PASS
46	5230	50.05	48.87	48.08	PASS

4.4 PEAK POWER EXCURSION MEASUREMENT

4.4.1 LIMITS OF PEAK POWER EXCURSION MEASUREMENT

FREQUENCY BAND	LIMIT
5.15 ~ 5.25GHz	4dBm

4.4.2 TEST SETUP



4.4.3 TEST INSTRUMENTS

Refer to section 4.1.3 to get information of above instrument.

4.4.4 TEST PROCEDURE

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

4.4.5 DEVIATION FROM TEST STANDARD

No deviation.

4.4.6 EUT OPERATING CONDITIONS

Same as 4.2.6

4.4.7 TEST RESULTS

802.11a

CHAN.	CHAN. FREQ. (MHz)	PSD (dBm)			TOTAL POWER DENSITY (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2			
36	5180	-5.09	-4.93	-2.60	0.511	1.2	PASS
40	5200	-4.99	-5.35	-2.79	0.425	1.2	PASS
48	5240	-5.13	-4.63	-3.13	0.507	1.2	PASS

NOTE: 1. Directional gain = 4dBi + 10log(3) = 8.8dBi > 6dBi, so the power density limit shall be reduced to 4-(8.8-6) = 1.2dBm.

2. 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.

802.11n (20MHz)

CHAN.	CHAN. FREQ. (MHz)	PSD (dBm)			TOTAL POWER DENSITY (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2			
36	5180	-2.57	-1.36	-0.57	3.142	4	PASS
40	5200	-2.55	-1.31	-0.41	3.180	4	PASS
48	5240	-2.22	-1.11	-0.38	3.579	4	PASS

NOTE: Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.

802.11n (40MHz)

CHAN.	CHAN. FREQ. (MHz)	PSD (dBm)			TOTAL POWER DENSITY (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2			
38	5190	-3.07	-2.21	-1.29	2.518	4	PASS
46	5230	-2.85	-1.79	-2.42	2.287	4	PASS

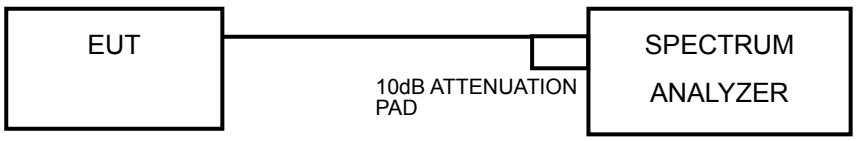
NOTE: Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.

4.5 PEAK POWER SPECTRAL DENSITY MEASUREMENT

4.5.1 LIMITS OF PEAK POWER SPECTRAL DENSITY MEASUREMENT

Shall not exceed 13 dB

4.5.2 TEST SETUP



4.5.3 TEST INSTRUMENTS

Refer to section 4.1.3 to get information of above instrument.

4.5.4 TEST PROCEDURES

1) Set RBW = 1 MHz, VBW ≤ 3 MHz, Detector = peak.
2) Trace mode = max-hold. Allow the sweeps to continue until the trace stabilizes.
3) Use the peak search function to find the peak of the spectrum.
4) Measure the PPSD.
5) Compute the ratio of the maximum of the peak-max-hold spectrum to the PPSD.

4.5.5 DEVIATION FROM TEST STANDARD

No deviation.

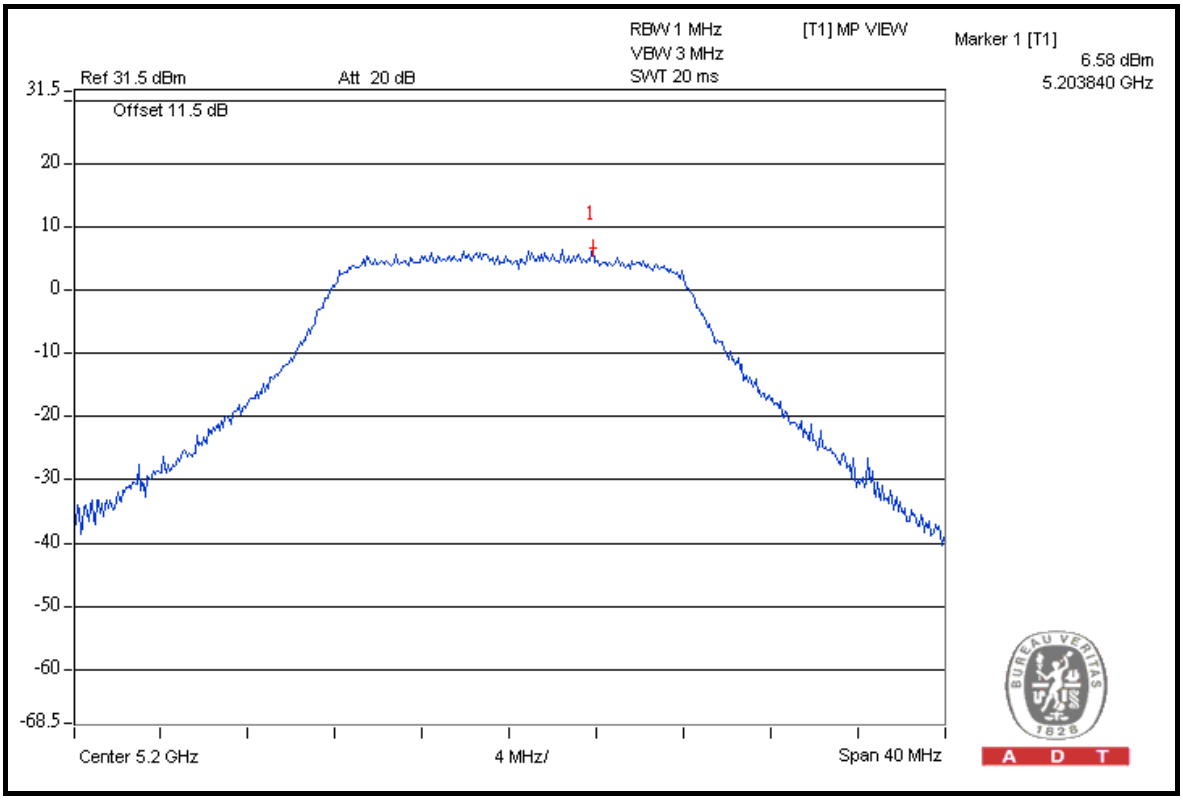
4.5.6 EUT OPERATING CONDITIONS

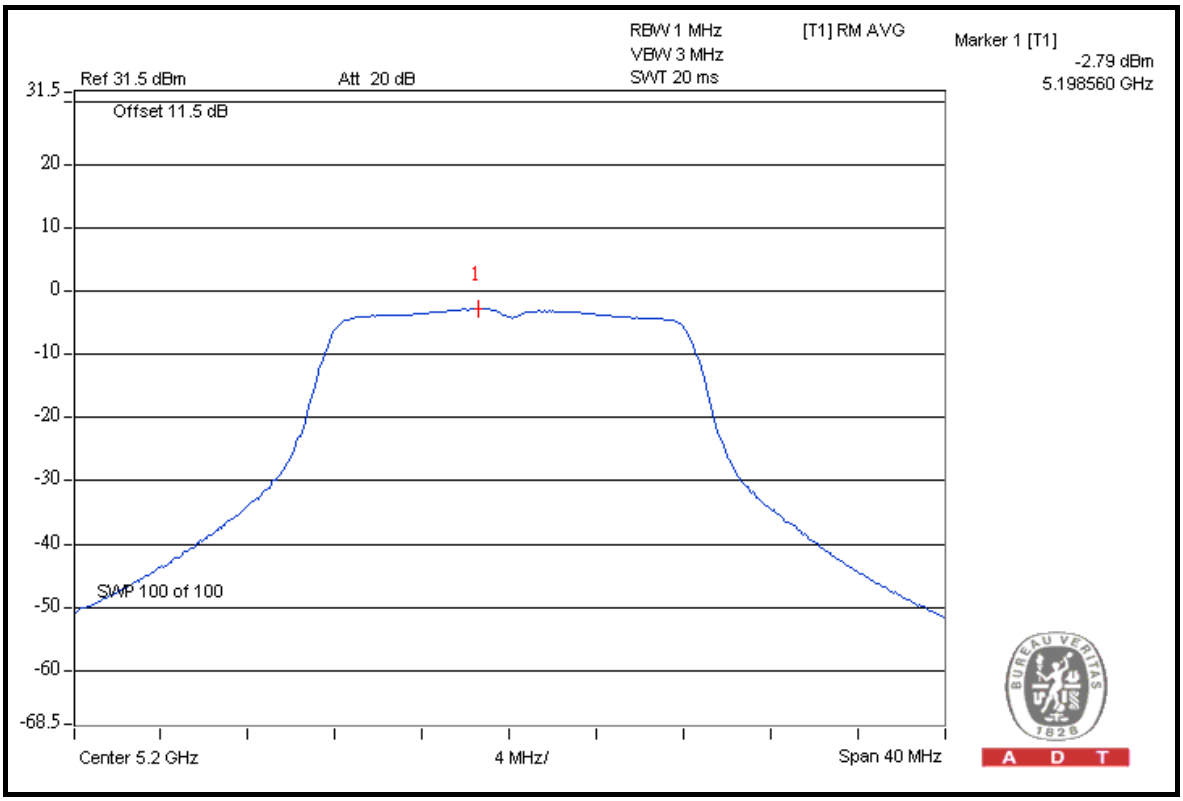
Same as 4.3.6.

4.5.7 TEST RESULTS

802.11a

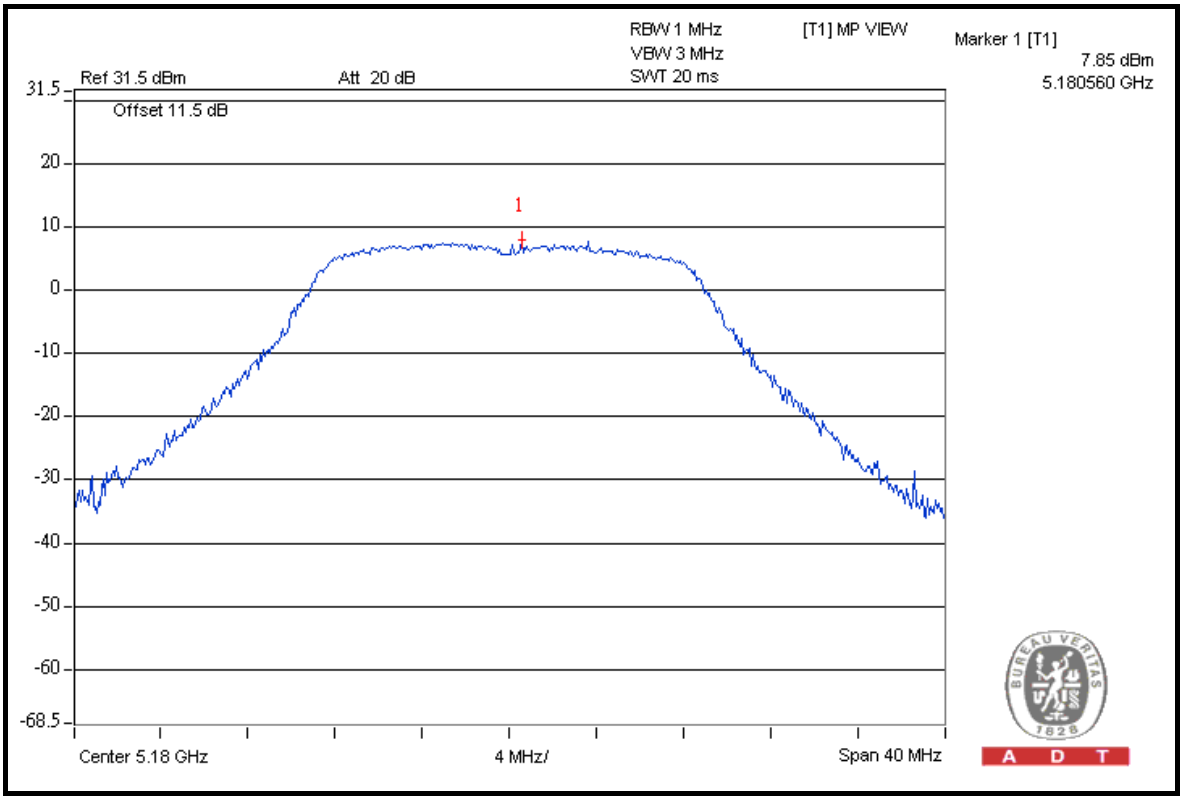
TX chain	CHAN.	CHANNEL FREQUENCY (MHz)	PEAK VALUE (dBm)	PPSD (dBm)	PEAK EXCURSION (dB)	LIMIT (dB)	PASS /FAIL
0	36	5180	4.03	-5.09	9.12	13	PASS
	40	5200	3.95	-4.99	8.94	13	PASS
	48	5240	3.99	-5.13	9.12	13	PASS
1	36	5180	3.65	-4.93	8.58	13	PASS
	40	5200	3.11	-5.35	8.46	13	PASS
	48	5240	3.82	-4.63	8.45	13	PASS
2	36	5180	6.76	-2.60	9.36	13	PASS
	40	5200	6.58	-2.79	9.37	13	PASS
	48	5240	6.01	-3.13	9.14	13	PASS

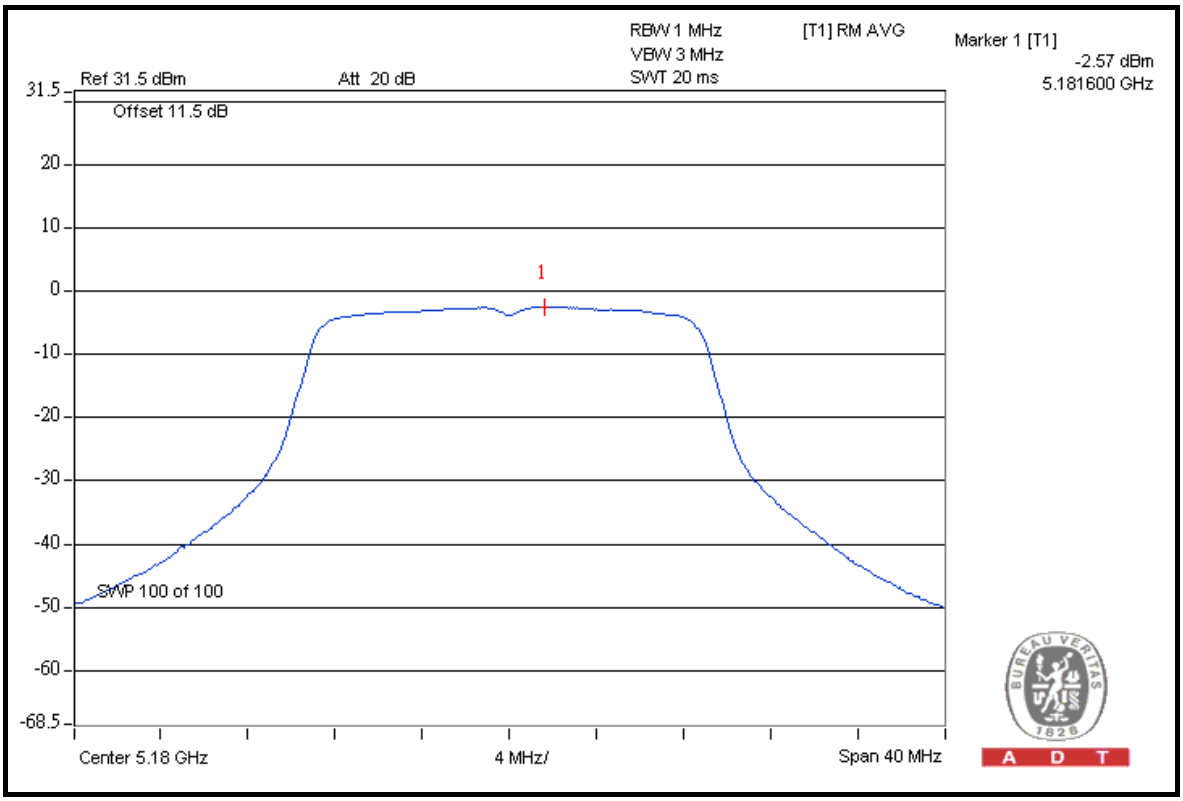

RBW 1 MHz
VBW 3 MHz
SWT 20 ms
[T1] MP VIEW
Marker 1 [T1]
6.58 dBm
5.203840 GHz
Ref 31.5 dBm
Att 20 dB
Offset 11.5 dB
31.5
20
10
0
-10
-20
-30
-40
-50
-60
-68.5
1
Center 5.2 GHz
4 MHz/
Span 40 MHz


RBW 1 MHz
VBW 3 MHz
SWT 20 ms
[T1] RM AVG
Marker 1 [T1]
-2.79 dBm
5.198560 GHz
Ref 31.5 dBm
Att 20 dB
Offset 11.5 dB
31.5
20
10
0
-10
-20
-30
-40
-50
-60
-68.5
1
SWP 100 of 100
Center 5.2 GHz
4 MHz/
Span 40 MHz

802.11n (20MHz)

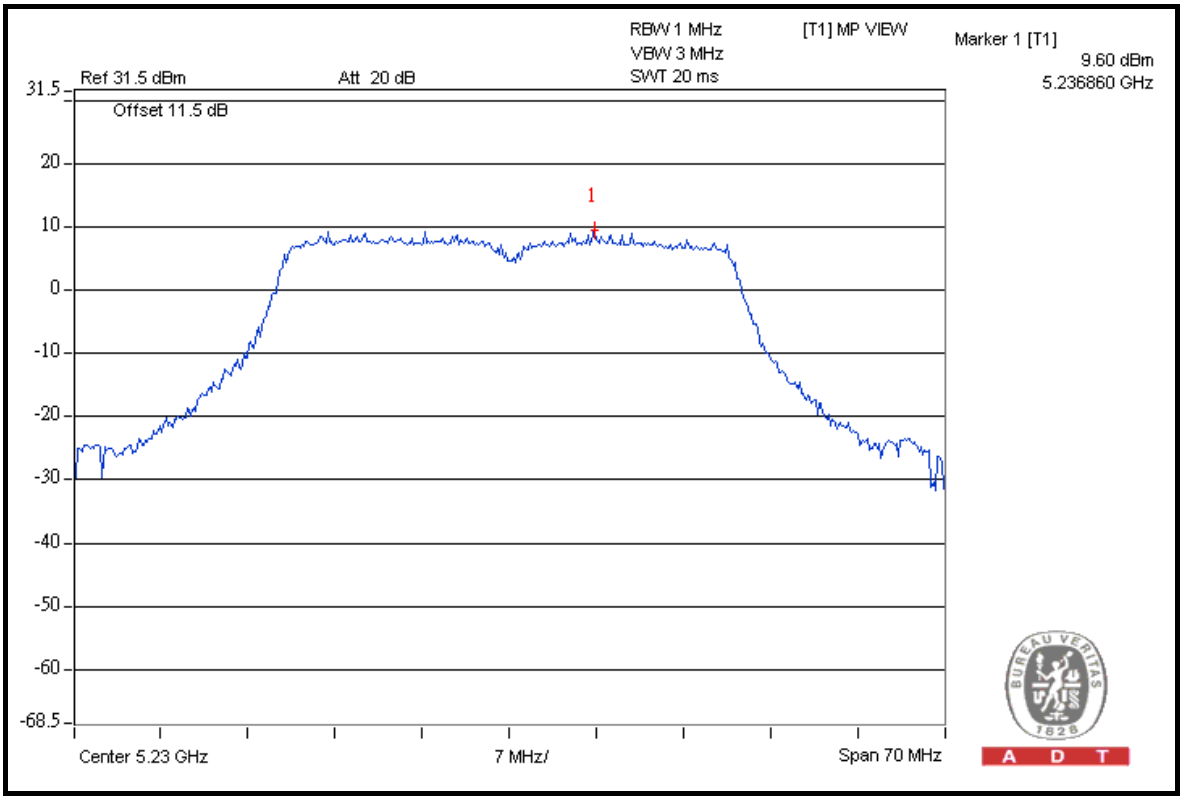
TX chain	CHAN.	CHANNEL FREQUENCY (MHz)	PEAK VALUE (dBm)	PPSD (dBm)	PEAK EXCURSION (dB)	LIMIT (dB)	PASS /FAIL
0	36	5180	7.85	-2.57	10.42	13	PASS
	40	5200	7.72	-2.55	10.27	13	PASS
	48	5240	7.80	-2.22	10.02	13	PASS
1	36	5180	7.95	-1.36	9.31	13	PASS
	40	5200	8.02	-1.31	9.33	13	PASS
	48	5240	8.23	-1.11	9.34	13	PASS
2	36	5180	9.62	-0.57	10.19	13	PASS
	40	5200	9.76	-0.41	10.17	13	PASS
	48	5240	9.92	-0.38	10.30	13	PASS

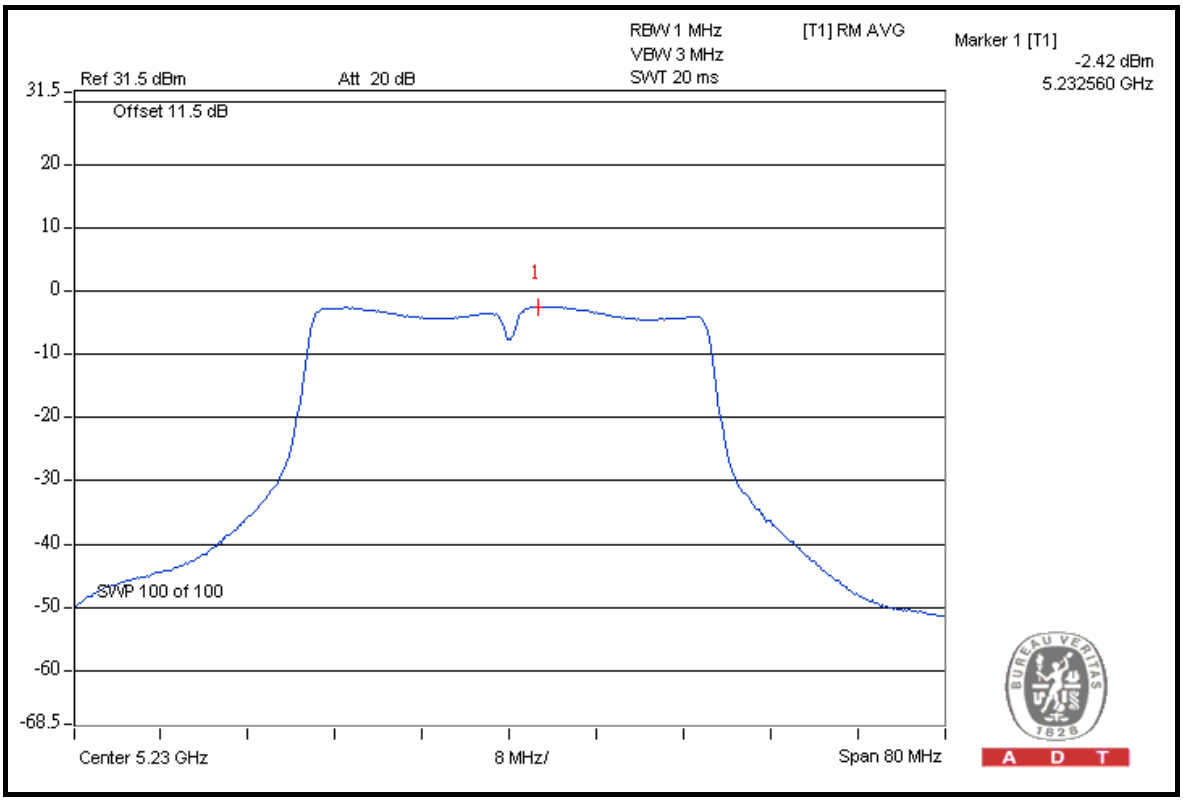

RBW 1 MHz
VBW 3 MHz
SWT 20 ms
[T1] MP VIEW
Marker 1 [T1]
7.85 dBm
5.180560 GHz
Ref 31.5 dBm
Att 20 dB
Offset 11.5 dB
31.5
20
10
0
-10
-20
-30
-40
-50
-60
-68.5
1
Center 5.18 GHz
4 MHz/
Span 40 MHz


RBW 1 MHz
VBW 3 MHz
SWT 20 ms
[T1] RM AVG
Marker 1 [T1]
-2.57 dBm
5.181600 GHz
Ref 31.5 dBm
Att 20 dB
Offset 11.5 dB
31.5
20
10
0
-10
-20
-30
-40
-50
-60
-68.5
1
SWP 100 of 100
Center 5.18 GHz
4 MHz/
Span 40 MHz

802.11n (40MHz)

TX chain	CHAN.	CHANNEL FREQUENCY (MHz)	PEAK VALUE (dBm)	PPSD (dBm)	PEAK EXCURSION (dB)	LIMIT (dB)	PASS /FAIL
0	38	5190	6.56	-3.07	9.63	13	PASS
	46	5230	6.65	-2.85	9.50	13	PASS
1	38	5190	7.17	-2.21	9.38	13	PASS
	46	5230	7.11	-1.79	8.90	13	PASS
2	38	5190	9.85	-1.29	11.14	13	PASS
	46	5230	9.60	-2.42	12.02	13	PASS


RBW 1 MHz
VBW 3 MHz
SWT 20 ms
[T1] MP VIEW
Marker 1 [T1]
9.60 dBm
5.236860 GHz
Ref 31.5 dBm
Att 20 dB
Offset 11.5 dB
31.5
20
10
0
-10
-20
-30
-40
-50
-60
-68.5
1
Center 5.23 GHz
7 MHz/
Span 70 MHz

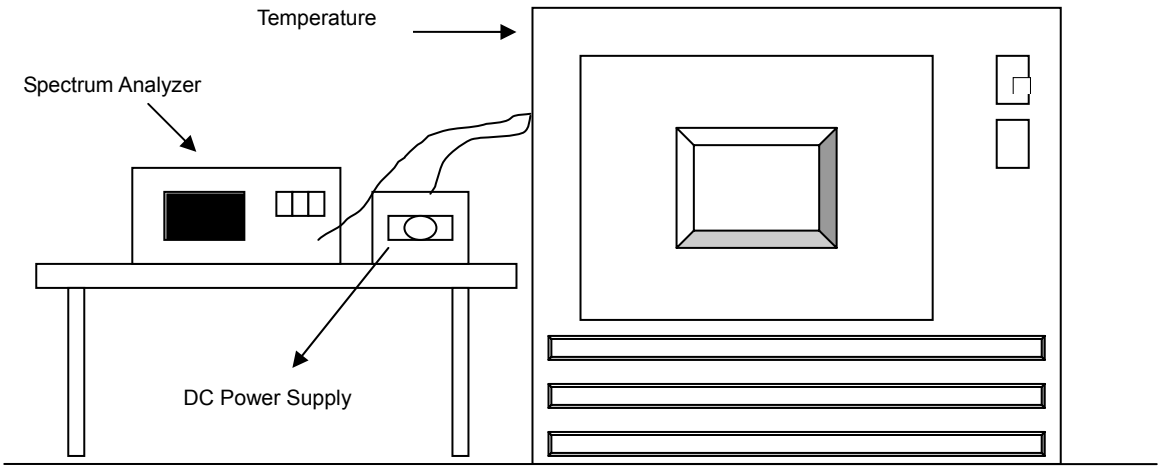

RBW 1 MHz
VBW 3 MHz
SWT 20 ms
[T1] RM AVG
Marker 1 [T1]
-2.42 dBm
5.232560 GHz
Ref 31.5 dBm
Att 20 dB
Offset 11.5 dB
31.5
20
10
0
-10
-20
-30
-40
-50
-60
-68.5
1
SWP 100 of 100
Center 5.23 GHz
8 MHz/
Span 80 MHz

4.6 FREQUENCY STABILITY

4.6.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

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

4.6.2 TEST SETUP



4.6.3 TEST INSTRUMENTS

Refer to section 4.1.3 to get information of above instrument.

4.6.4 TEST PROCEDURE

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

4.6.5 DEVIATION FROM TEST STANDARD

No deviation.

4.6.6 EUT OPERATING CONDITION

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

4.6.7 TEST RESULTS

FREQUEMCY STABILITY VERSUS TEMP.									
OPERATING FREQUENCY: 5200MHz									
TEMP. (℃)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
55	110.0	5199.989071	-2.102	5199.988869	-2.141	5199.988941	-2.127	5199.988674	-2.178
50	110.0	5199.988745	-2.164	5199.988641	-2.184	5199.988909	-2.133	5199.988875	-2.139
40	110.0	5199.989936	-1.935	5199.990032	-1.917	5199.989925	-1.937	5199.989686	-1.983
30	110.0	5199.991139	-1.704	5199.991181	-1.696	5199.991377	-1.658	5199.991286	-1.676
20	110.0	5199.992393	-1.463	5199.992856	-1.374	5199.992465	-1.449	5199.992672	-1.409
10	110.0	5199.991444	-1.645	5199.990911	-1.748	5199.990976	-1.735	5199.990615	-1.805
0	110.0	5199.989930	-1.937	5199.989627	-1.995	5199.990004	-1.922	5199.990298	-1.866
-10	110.0	5199.989480	-2.023	5199.989274	-2.063	5199.989371	-2.044	5199.989524	-2.015
-20	110.0	5199.988295	-2.251	5199.988556	-2.201	5199.988809	-2.152	5199.988591	-2.194
-30	110.0	5199.987770	-2.352	5199.988461	-2.219	5199.988040	-2.300	5199.988305	-2.249

FREQUEMCY STABILITY VERSUS VOLTAGE									
OPERATING FREQUENCY: 5200MHz									
TEMP. (℃)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)	Measured Frequency (MHz)	Frequency Drift (ppm)
20	93.5	5199.990966	-1.737	5199.991312	-1.671	5199.991555	-1.624	5199.991461	-1.642
	110.0	5199.992393	-1.463	5199.992856	-1.374	5199.992465	-1.449	5199.992672	-1.409
	126.5	5199.991345	-1.664	5199.991723	-1.592	5199.991693	-1.598	5199.991452	-1.644

5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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

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.

Copies of accreditation and authorization certificates of our laboratories obtained from approval agencies can be downloaded from our web site: www.adt.com.tw/index.5.phtml. If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab:
Tel: 886-2-26052180
Fax: 886-2-26051924

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Tel: 886-3-3183232
Fax: 886-3-3185050

Email: service.adt@tw.bureauveritas.com
Web Site: www.adt.com.tw

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

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---