



FCC TEST REPORT (15.407)

REPORT NO.: RF130508C34B-1

MODEL NO.: C5

FCC ID: TE7C5

RECEIVED: May 08, 2013

TESTED: May 14 ~ May 21, 2013

ISSUED: Jun. 12, 2014

APPLICANT: TP-LINK TECHNOLOGIES CO., LTD.

ADDRESS: Building 24 (floors 1,3,4,5) and 28 (floors1-4)
Central Science and Technology Park, Shennan
Rd, Nanshan, Shenzhen, China

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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TABLE OF CONTENTS

RELEASE CONTROL RECORD.....	4
1. CERTIFICATION	5
2. SUMMARY OF TEST RESULTS.....	6
2.1 MEASUREMENT UNCERTAINTY	6
3. GENERAL INFORMATION.....	7
3.1 GENERAL DESCRIPTION OF EUT.....	7
3.2 DESCRIPTION OF TEST MODES.....	8
3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL	9
3.3 DUTY CYCLE OF TEST SIGNAL	11
3.4 DESCRIPTION OF SUPPORT UNITS.....	12
3.4.1 CONFIGURATION OF SYSTEM UNDER TEST.....	12
3.5 GENERAL DESCRIPTION OF APPLIED STANDARDS.....	13
4. TEST TYPES AND RESULTS.....	14
4.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT	14
4.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT	14
4.1.2 LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS	14
4.1.3 TEST INSTRUMENTS	15
4.1.4 TEST PROCEDURES	16
4.1.5 DEVIATION FROM TEST STANDARD	16
4.1.6 TEST SETUP.....	17
4.1.7 EUT OPERATING CONDITION	17
4.1.8 TEST RESULTS	18
4.2 CONDUCTED EMISSION MEASUREMENT.....	28
4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT	28
4.2.2 TEST INSTRUMENTS	28
4.2.3 TEST PROCEDURES.....	29
4.2.4 DEVIATION FROM TEST STANDARD	29
4.2.5 TEST SETUP.....	29
4.2.6 EUT OPERATING CONDITIONS.....	29
4.2.7 TEST RESULTS	30
4.3 PEAK TRANSMIT POWER MEASUREMENT.....	32
4.3.1 LIMITS OF PEAK TRANSMIT POWER MEASUREMENT	32
4.3.2 TEST SETUP.....	32
4.3.3 TEST INSTRUMENTS	33
4.3.4 TEST PROCEDURE	33
4.3.5 DEVIATION FROM TEST STANDARD	34
4.3.6 EUT OPERATING CONDITIONS.....	34
4.3.7 TEST RESULTS	35
4.4 PEAK POWER SPECTRAL DENSITY MEASUREMENT.....	37
4.4.1 LIMITS OF PEAK POWER SPECTRAL DENSITY MEASUREMENT	37
4.4.2 TEST SETUP.....	37
4.4.3 TEST INSTRUMENTS	37
4.4.4 TEST PROCEDURES.....	37
4.4.5 DEVIATION FROM TEST STANDARD	37
4.4.6 EUT OPERATING CONDITIONS.....	37
4.4.7 TEST RESULTS	38
4.5 PEAK POWER EXCURSION MEASUREMENT.....	40
4.5.1 LIMITS OF PEAK POWER EXCURSION MEASUREMENT	40
4.5.2 TEST SETUP.....	40
4.5.3 TEST INSTRUMENTS	40
4.5.4 TEST PROCEDURE	40
4.5.5 DEVIATION FROM TEST STANDARD	40
4.5.6 EUT OPERATING CONDITIONS.....	40
4.5.7 TEST RESULTS	41



4.6	FREQUENCY STABILITY	44
4.6.1	LIMITS OF FREQUENCY STABILITY MEASUREMENT	44
4.6.2	TEST SETUP.....	44
4.6.3	TEST INSTRUMENTS	44
4.6.4	TEST PROCEDURE	45
4.6.5	DEVIATION FROM TEST STANDARD	45
4.6.6	EUT OPERATING CONDITION	45
4.6.7	TEST RESULTS	46
4.7	20dBc BANDWIDTH MEASUREMENT	47
4.7.1	LIMITS OF PEAK TRANSMIT POWER MEASUREMENT	47
4.7.2	TEST SETUP.....	47
4.7.3	TEST INSTRUMENTS	47
4.7.4	TEST PROCEDURE	47
4.7.5	TEST RESULTS	48
5.	PHOTOGRAPHS OF THE TEST CONFIGURATION	52
6.	INFORMATION ON THE TESTING LABORATORIES.....	53
7.	APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB	54



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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF130508C34B-1	Original release	Jun. 12, 2014



1. CERTIFICATION

PRODUCT: AC1200 Wireless Dual Band Gigabit Router

MODEL: C5

BRAND: TP-LINK

APPLICANT: TP-LINK TECHNOLOGIES CO., LTD.


TESTED: May 14 ~ May 21, 2013

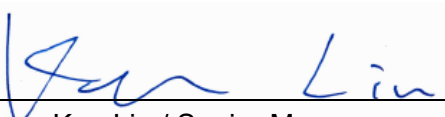
TEST SAMPLE: PROTOTYPE

STANDARDS: FCC Part 15, Subpart E (Section 15.407)

ANSI C63.10-2009

The above equipment (model: C5) 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 :** Jun. 12, 2014
Pettie Chen / Senior Specialist

APPROVED BY :  , **DATE :** Jun. 12, 2014
Ken Liu / Senior Manager

2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART E (SECTION 15.407)			
STANDARD SECTION	TEST TYPE	RESULT	REMARK
15.407(b)(6)	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -17.45dB at 0.15781MHz.
15.407(b/1/2/3)(b)(6)	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -2.8dB at 5350.00MHz.
15.407(a/1/2)	Max Average 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)	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 RP-SMA-F not a standard connector.
15.215	20dBc Bandwidth	PASS	Meet the requirement of limit.

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	2.93 dB
	200MHz ~ 1000MHz	2.95 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	AC1200 Wireless Dual Band Gigabit Router
MODEL NO.	C5
POWER SUPPLY	12Vdc (Adapter)
MODULATION TYPE	256QAM, 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 802.11ac: up to 1300.0Mbps
OPERATING FREQUENCY	5180.0 ~ 5240.0MHz
NUMBER OF CHANNEL	4 for 802.11a, 802.11n (20MHz) 2 for 802.11n (40MHz) 1 for 802.11ac (80MHz)
OUTPUT POWER	48.589mW
ANTENNA TYPE	Dipole antenna with 5.0dBi gain
ANTENNA CONNECTOR	RP-SMA-F
DATA CABLE	NA
I/O PORTS	Refer to user's manual
ACCESSORY DEVICES	Adapter

NOTE:

1. 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
802.11ac (80MHz)	3TX

2. The EUT consumes power from the following adapter.

BRAND:	Ten Pao International Inc.
MODEL:	S040EU1200250
INPUT:	100-240Vac, 50/60Hz, 1.2A Max
OUTPUT:	12Vdc, 2500mA
POWER LINE:	1.5m non-shielded cable without core

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

3.2 DESCRIPTION OF TEST MODES

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

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

CHANNEL	FREQUENCY
42	5210MHz

3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

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

Where **RE≥1G**: Radiated Emission above 1GHz **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	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6.0
-	802.11n (20MHz)	36 to 48	36, 40, 48	OFDM	BPSK	7.2
-	802.11n (40MHz)	38 to 46	38, 46	OFDM	BPSK	15.0
-	802.11ac (80MHz)	42	42	OFDM	BPSK	32.5

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	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	36 to 48	36	OFDM	BPSK	6.0

POWER LINE CONDUCTED EMISSION TEST:

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

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	36 to 48	36	OFDM	BPSK	6.0



ANTENNA PORT CONDUCTED MEASUREMENT:

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

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	36 to 48	36, 40, 48	OFDM	BPSK	6.0
-	802.11n (20MHz)	36 to 48	36, 40, 48	OFDM	BPSK	7.2
-	802.11n (40MHz)	38 to 46	38, 46	OFDM	BPSK	15.0
-	802.11ac (80MHz)	42	42	OFDM	BPSK	32.5

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25deg. C, 65%RH	120Vac, 60Hz	Chris Lin
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Ted Chang
PLC	25deg. C, 65%RH	120Vac, 60Hz	Alan Wu
APCM	24deg. C, 64%RH	120Vac, 60Hz	Nick Chen

3.3 DUTY CYCLE OF TEST SIGNAL

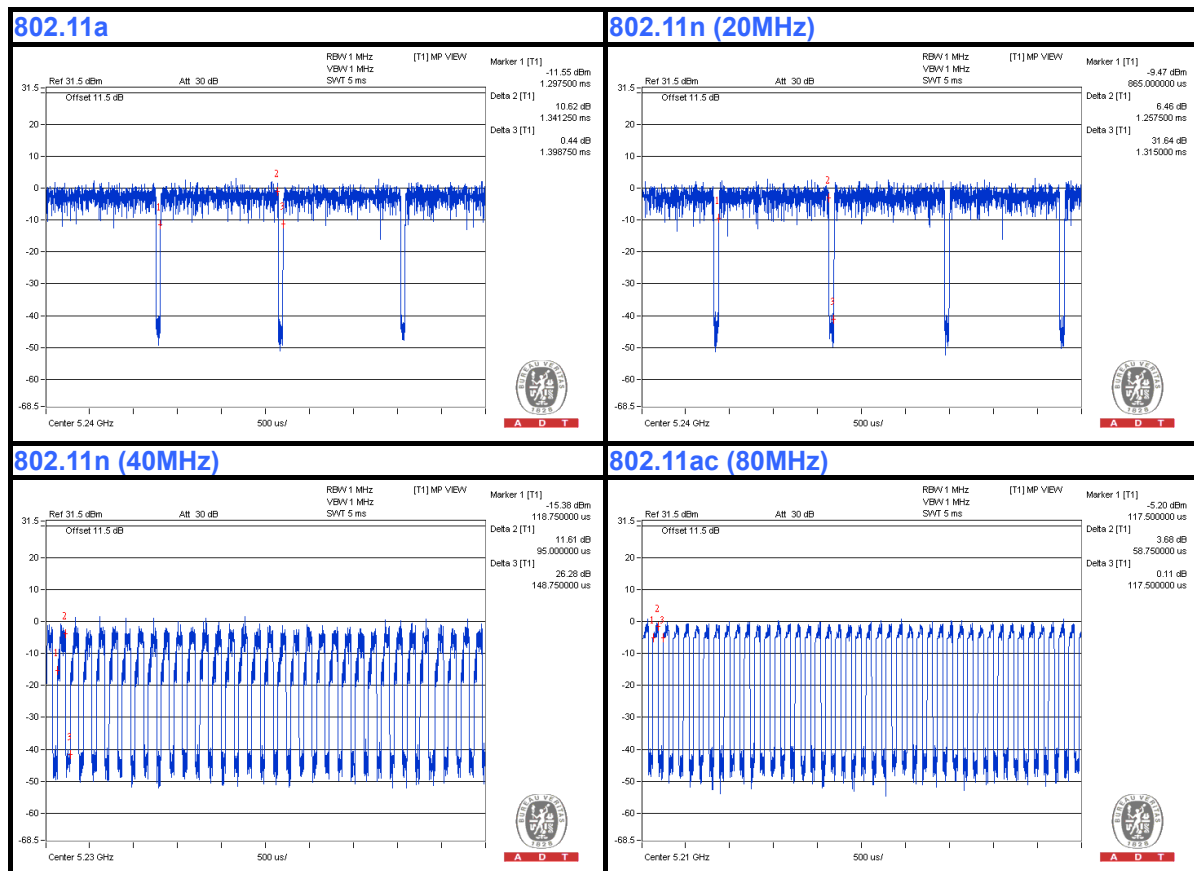
If duty cycle is < 98%, duty factor shall be considered.

802.11a: Duty cycle = 1.341/1.399 = 0.959, Duty factor = $10 * \log(1/0.959) = 0.18$

802.11n (20MHz): Duty cycle = 1.258/1.315 = 0.957, Duty factor = $10 * \log(1/0.957) = 0.20$

802.11n (40MHz): Duty cycle = 95.00/148.75 = 0.637, Duty factor = $10 * \log(1/0.637) = 1.95$

802.11ac (80MHz): Duty cycle = 58.75/117.50 = 0.500, Duty factor = $10 * \log(1/0.500) = 3.01$



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.

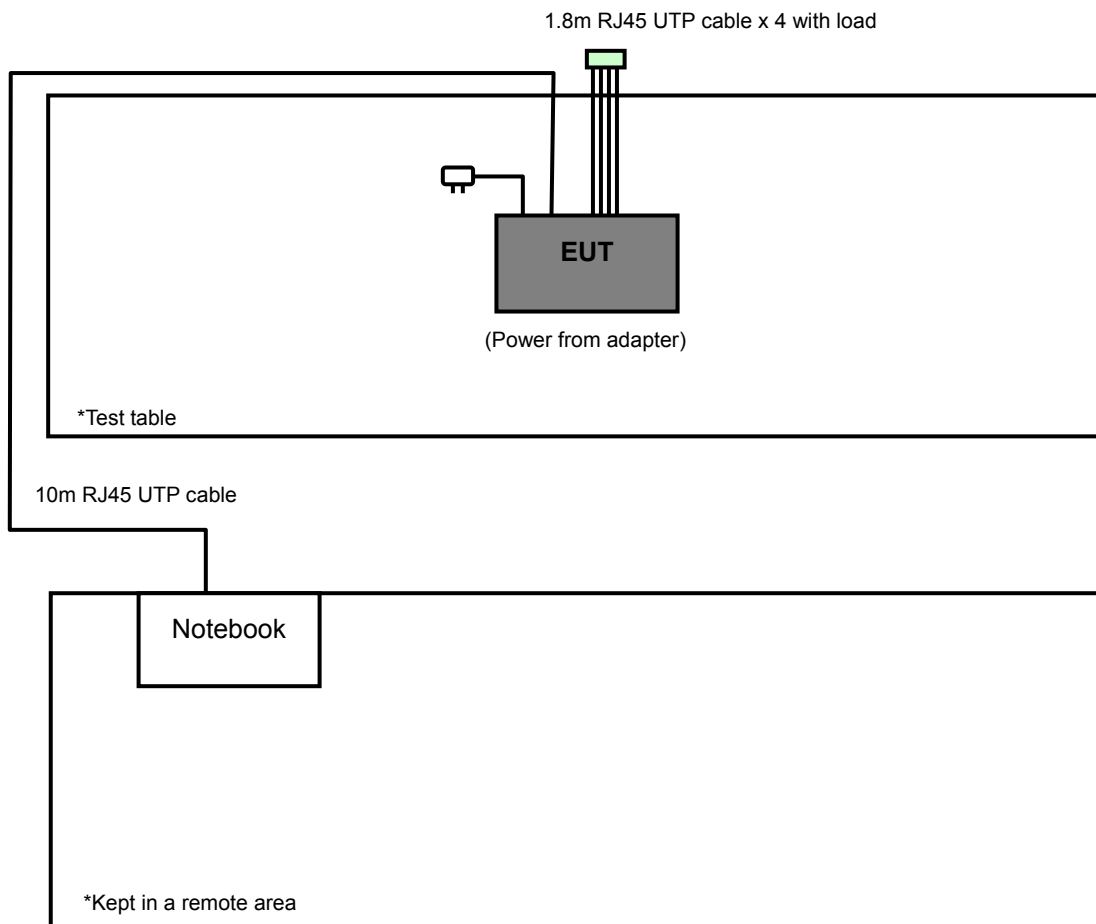
NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Notebook	DELL	E5420	33MLMQ1	FCC DoC Approved

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	10m RJ45 cable

NOTE:

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

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 D01 General UNII Test Procedures v01 r03

662911 D01 Multiple Transmitter Output v02

ANSI C63.10-2009

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

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

4. TEST TYPES AND RESULTS

4.1 RADIATED EMISSION AND BANDEDGE MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION AND BANDEDGE MEASUREMENT

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

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

APPLICABLE TO	LIMIT	
√	FIELD STRENGTH AT 3m (dBμV/m)	
	PK	AV
	74	54
	EIRP LIMIT (dBm)	EQUIVALENT FIELD STRENGTH AT 3m (dBμV/m)
	PK	PK
	-27	68.3

NOTE: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

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



4.1.3 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCS30	100289	Nov. 16, 2012	Nov. 15, 2013
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	Jan. 28, 2013	Jan. 27, 2014
BILOG Antenna SCHWARZBECK	VULB9168	9168-156	Mar. 22, 2013	Mar. 21, 2014
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-209	Sep. 03, 2012	Sep. 02, 2013
HORN Antenna SCHWARZBECK	BBHA 9170	148	Jul. 11, 2012	Jul. 10, 2013
Loop Antenna	HFH2-Z2	100070	Jan. 31, 2012	Jan. 30, 2014
Preamplifier Agilent	8449B	3008A01911	Oct. 25, 2012	Oct. 24, 2013
Preamplifier Agilent	8447D	2944A10638	Oct. 25, 2012	Oct. 24, 2013
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	295013/4 283403/4	Aug. 28, 2012	Aug. 27, 2013
RF signal cable Worken	8D-FB	Cable-HYCH9-01	Aug. 11, 2012	Aug. 10, 2013
Software BV ADT	ADT_Radiated_ V7.6.15.9.2	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower & Turn Table Controller EMCO	2090	NA	NA	NA
26GHz ~ 40GHz Amplifier	EM26400	815221	Oct. 25, 2012	Oct. 24, 2013
High Speed Peak Power Meter	ML2495A	0824012	Aug. 22, 2012	Aug. 21, 2013
Power Sensor	MA2411B	0738171	Jul. 30, 2012	Jul. 29, 2013
WIT Standard Temperature And Humidity Chamber	TH-4S-C	W981030	Jun. 13, 2012	Jun. 12, 2013

- NOTE:**
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The calibration interval of the loop antenna is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. The test was performed in HwaYa Chamber 9.
 4. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 5. The FCC Site Registration No. is 215374.
 6. The IC Site Registration No. is IC 7450F-9.

4.1.4 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 chamber. 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.

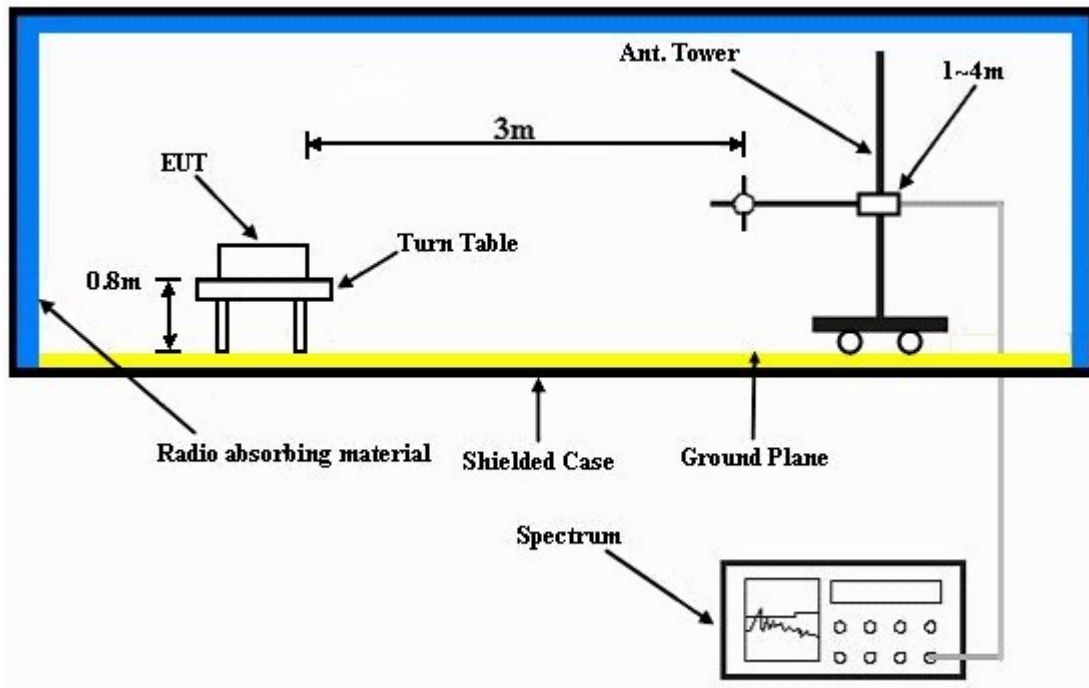
NOTE:

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

- Placed the EUT on the testing table.
- Prepared notebook to act as a communication partner and placed it outside of testing area.
- The communication partner connected with EUT via a RJ45 cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- The communication partner sent data to EUT by command "PING".
- The necessary accessories enabled 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	25deg. C, 65%RH	TESTED BY	Ted Chang

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	59.1 PK	74.0	-14.9	1.00 H	28	15.30	43.80
2	5150.00	46.4 AV	54.0	-7.6	1.00 H	28	2.60	43.80
3	*5180.00	97.9 PK			1.00 H	29	54.00	43.90
4	*5180.00	88.4 AV			1.00 H	29	44.50	43.90
5	#10360.00	55.6 PK	74.0	-18.4	1.45 H	168	4.70	50.90
6	#10360.00	43.9 AV	54.0	-10.1	1.45 H	168	-7.00	50.90

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	71.1 PK	74.0	-2.9	1.00 V	29	27.30	43.80
2	5150.00	49.3 AV	54.0	-4.7	1.00 V	29	5.50	43.80
3	*5180.00	112.1 PK			1.10 V	16	68.20	43.90
4	*5180.00	102.5 AV			1.10 V	16	58.60	43.90
5	#10360.00	58.1 PK	74.0	-15.9	1.07 V	74	7.20	50.90
6	#10360.00	45.6 AV	54.0	-8.4	1.07 V	74	-5.30	50.90

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
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.



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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	25deg. C, 65%RH	TESTED BY	Ted Chang

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	99.9 PK			1.13 H	154	56.00	43.90
2	*5200.00	89.3 AV			1.13 H	154	45.40	43.90
3	#10400.00	57.6 PK	74.0	-16.4	1.22 H	235	6.70	50.90
4	#10400.00	43.7 AV	54.0	-10.3	1.22 H	235	-7.20	50.90

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	111.6 PK			1.00 V	16	67.70	43.90
2	*5200.00	101.9 AV			1.00 V	16	58.00	43.90
3	#10400.00	60.2 PK	74.0	-13.8	1.54 V	261	9.30	50.90
4	#10400.00	47.1 AV	54.0	-6.9	1.54 V	261	-3.80	50.90

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
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.



A D T

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	25deg. C, 65%RH	TESTED BY	Ted Chang

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	98.2 PK			1.00 H	153	54.20	44.00
2	*5240.00	88.1 AV			1.00 H	153	44.10	44.00
3	5350.00	59.4 PK	74.0	-14.6	1.00 H	153	15.30	44.10
4	5350.00	46.6 AV	54.0	-7.4	1.00 H	153	2.50	44.10
5	#10480.00	57.3 PK	74.0	-16.7	1.67 H	136	6.10	51.20
6	#10480.00	45.2 AV	54.0	-8.8	1.67 H	136	-6.00	51.20

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	*5240.00	113.3 PK			1.14 V	70	69.30	44.00
2	*5240.00	102.8 AV			1.14 V	70	58.80	44.00
3	5350.00	62.1 PK	74.0	-11.9	1.14 V	68	18.00	44.10
4	5350.00	48.8 AV	54.0	-5.2	1.14 V	68	4.70	44.10
5	#10480.00	60.3 PK	74.0	-13.7	1.65 V	178	9.10	51.20
6	#10480.00	47.2 AV	54.0	-6.8	1.65 V	178	-4.00	51.20

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 the restricted band.



A D T

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	25deg. C, 65%RH	TESTED BY	Ted Chang

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	59.4 PK	74.0	-14.6	1.00 H	152	15.60	43.80
2	5150.00	46.3 AV	54.0	-7.7	1.00 H	152	2.50	43.80
3	*5180.00	100.5 PK			1.00 H	154	56.60	43.90
4	*5180.00	90.2 AV			1.00 H	154	46.30	43.90
5	#10360.00	55.5 PK	74.0	-18.5	1.52 H	166	4.60	50.90
6	#10360.00	44.0 AV	54.0	-10.0	1.52 H	166	-6.90	50.90

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5150.00	62.6 PK	74.0	-11.4	1.00 V	28	18.80	43.80
2	5150.00	49.2 AV	54.0	-4.8	1.00 V	28	5.40	43.80
3	*5180.00	111.8 PK			1.00 V	30	67.90	43.90
4	*5180.00	101.4 AV			1.00 V	30	57.50	43.90
5	#10360.00	57.3 PK	74.0	-16.7	1.04 V	265	6.40	50.90
6	#10360.00	46.1 AV	54.0	-7.9	1.04 V	265	-4.80	50.90

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
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.



A D T

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	25deg. C, 65%RH	TESTED BY	Ted Chang

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	98.4 PK			1.00 H	154	54.50	43.90
2	*5200.00	88.0 AV			1.00 H	154	44.10	43.90
3	#10400.00	55.6 PK	74.0	-18.4	1.87 H	198	4.70	50.90
4	#10400.00	44.1 AV	54.0	-9.9	1.87 H	198	-6.80	50.90

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	111.3 PK			1.09 V	30	67.40	43.90
2	*5200.00	101.1 AV			1.09 V	30	57.20	43.90
3	#10400.00	59.3 PK	74.0	-14.7	1.36 V	124	8.40	50.90
4	#10400.00	47.1 AV	54.0	-6.9	1.36 V	124	-3.80	50.90

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
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.



A D T

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	25deg. C, 65%RH	TESTED BY	Ted Chang

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	99.5 PK			1.00 H	152	55.50	44.00
2	*5240.00	89.6 AV			1.00 H	152	45.60	44.00
3	5350.00	58.6 PK	74.0	-15.4	1.00 H	148	14.50	44.10
4	5350.00	46.9 AV	54.0	-7.1	1.00 H	148	2.80	44.10
5	#10480.00	57.0 PK	74.0	-17.0	1.05 H	54	5.80	51.20
6	#10480.00	45.5 AV	54.0	-8.5	1.05 H	54	-5.70	51.20
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	*5240.00	112.7 PK			1.15 V	100	68.70	44.00
2	*5240.00	102.7 AV			1.15 V	100	58.70	44.00
3	5350.00	60.7 PK	74.0	-13.3	1.15 V	100	16.60	44.10
4	5350.00	48.1 AV	54.0	-5.9	1.15 V	100	4.00	44.10
5	#10480.00	60.4 PK	74.0	-13.6	1.46 V	157	9.20	51.20
6	#10480.00	48.4 AV	54.0	-5.6	1.46 V	157	-2.80	51.20

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 the restricted band.



A D T

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	25deg. C, 65%RH	TESTED BY	Ted Chang

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	58.3 PK	74.0	-15.7	1.00 H	148	14.50	43.80
2	5150.00	47.7 AV	54.0	-6.3	1.00 H	148	3.90	43.80
3	*5190.00	97.4 PK			1.00 H	151	53.50	43.90
4	*5190.00	87.0 AV			1.00 H	151	43.10	43.90
5	#10380.00	55.5 PK	74.0	-18.5	1.08 H	47	4.60	50.90
6	#10380.00	45.3 AV	54.0	-8.7	1.08 H	47	-5.60	50.90
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	60.6 PK	74.0	-13.4	1.00 V	15	16.80	43.80
2	5150.00	50.8 AV	54.0	-3.2	1.00 V	15	7.00	43.80
3	*5190.00	110.4 PK			1.00 V	18	66.50	43.90
4	*5190.00	99.3 AV			1.00 V	18	55.40	43.90
5	#10380.00	58.6 PK	74.0	-15.4	1.00 V	145	7.70	50.90
6	#10380.00	48.6 AV	54.0	-5.4	1.00 V	145	-2.30	50.90

REMARKS:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
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.



A D T

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	25deg. C, 65%RH	TESTED BY	Ted Chang

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	96.5 PK			1.00 H	153	52.60	43.90
2	*5230.00	87.9 AV			1.00 H	153	44.00	43.90
3	5350.00	58.5 PK	74.0	-15.5	1.00 H	148	14.40	44.10
4	5350.00	48.9 AV	54.0	-5.1	1.00 H	148	4.80	44.10
5	#10380.00	55.9 PK	74.0	-18.1	1.08 H	48	5.00	50.90
6	#10380.00	46.0 AV	54.0	-8.0	1.08 H	48	-4.90	50.90
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	109.0 PK			1.01 V	85	65.10	43.90
2	*5230.00	99.4 AV			1.01 V	85	55.50	43.90
3	5350.00	61.1 PK	74.0	-12.9	1.01 V	85	17.00	44.10
4	5350.00	51.2 AV	54.0	-2.8	1.01 V	85	7.10	44.10
5	#10460.00	59.0 PK	74.0	-15.0	1.54 V	165	7.90	51.10
6	#10460.00	49.1 AV	54.0	-4.9	1.54 V	165	-2.00	51.10

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.



A D T

802.11ac (80MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 42	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Ted Chang

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	59.1 PK	74.0	-14.9	1.64 H	321	15.30	43.80
2	#5150.00	47.8 AV	54.0	-6.2	1.64 H	321	4.00	43.80
3	*5210.00	87.3 PK			1.22 H	13	43.40	43.90
4	*5210.00	77.6 AV			1.22 H	13	33.70	43.90
5	#5350.00	60.3 PK	74.0	-13.7	1.08 H	235	16.20	44.10
6	#5350.00	47.5 AV	54.0	-6.5	1.08 H	235	3.40	44.10
7	#10420.00	55.8 PK	74.0	-18.2	1.35 H	147	4.80	51.00
8	#10420.00	46.1 AV	54.0	-7.9	1.35 H	147	-4.90	51.00
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	#5150.00	60.2 PK	74.0	-13.8	1.08 V	19	16.40	43.80
2	#5150.00	50.1 AV	54.0	-3.9	1.08 V	19	6.30	43.80
3	*5210.00	106.2 PK			1.08 V	19	62.30	43.90
4	*5210.00	97.0 AV			1.08 V	19	53.10	43.90
5	#5350.00	63.1 PK	74.0	-10.9	1.00 V	321	19.00	44.10
6	#5350.00	49.8 AV	54.0	-4.2	1.00 V	321	5.70	44.10
7	#10420.00	59.5 PK	74.0	-14.5	1.54 V	152	8.50	51.00
8	#10420.00	47.8 AV	54.0	-6.2	1.54 V	152	-3.20	51.00

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.



A D T

BELOW 1GHz WORST-CASE DATA : 802.11a

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 36	FREQUENCY RANGE	Below 1000MHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Chris Lin

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	159.98	39.9 QP	43.5	-3.6	1.24 H	348	26.20	13.70
2	249.22	28.9 QP	46.0	-17.1	1.00 H	332	16.10	12.80
3	375.32	34.9 QP	46.0	-11.1	1.50 H	317	18.30	16.60
4	625.58	38.0 QP	46.0	-8.0	1.00 H	157	15.30	22.70
5	749.74	33.1 QP	46.0	-12.9	1.24 H	138	8.60	24.50
6	875.84	34.9 QP	46.0	-11.1	1.50 H	147	8.40	26.50

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	64.92	31.8 QP	40.0	-8.2	1.24 V	113	19.90	11.90
2	159.98	38.1 QP	43.5	-5.4	1.00 V	195	24.40	13.70
3	375.32	36.6 QP	46.0	-9.4	1.00 V	195	20.00	16.60
4	499.48	35.4 QP	46.0	-10.6	1.50 V	264	15.60	19.80
5	625.58	39.7 QP	46.0	-6.3	1.00 V	45	17.00	22.70
6	961.20	36.7 QP	54.0	-17.3	1.24 V	197	9.30	27.40

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.

4.2 CONDUCTED EMISSION MEASUREMENT

4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	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	100288	Nov. 09, 2012	Nov. 08, 2013
RF signal cable Woken	5D-FB	Cable-HYCO2-01	Dec. 28, 2012	Dec. 27, 2013
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Dec. 21, 2012	Dec. 20, 2013
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 06, 2012	Jul. 05, 2013
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

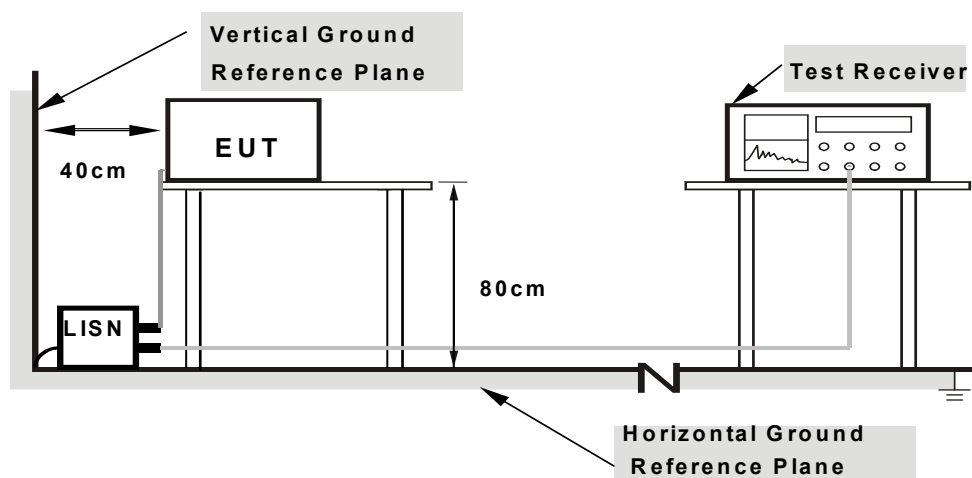
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling 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: 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 cm 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.



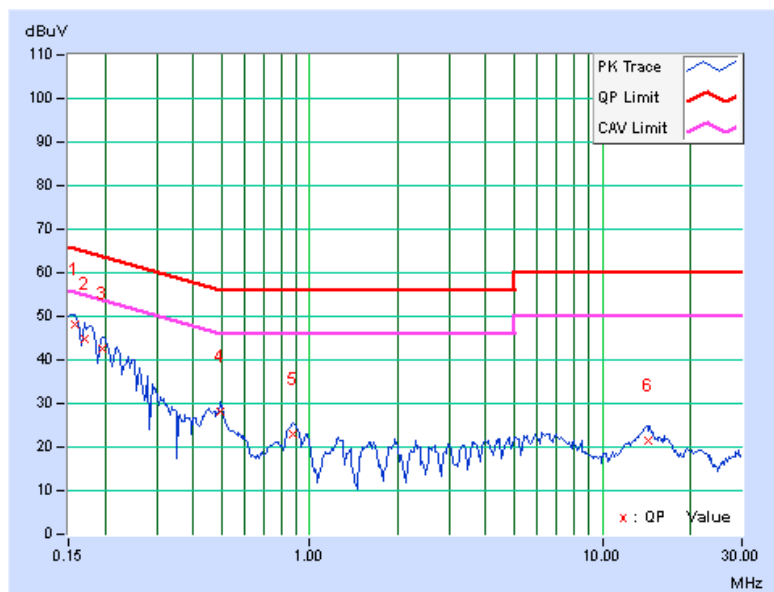
4.2.7 TEST RESULTS

CONDUCTED WORST-CASE DATA : 802.11a

PHASE	Line 1	6dB BANDWIDTH	9kHz
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15781	0.17	47.95	33.07	48.12	33.24	65.58	55.58	-17.45	-22.33
2	0.16953	0.17	44.54	26.58	44.71	26.75	64.98	54.98	-20.27	-28.23
3	0.19687	0.17	42.54	28.73	42.71	28.90	63.74	53.74	-21.03	-24.84
4	0.49766	0.22	28.11	22.20	28.33	22.42	56.04	46.04	-27.71	-23.62
5	0.87656	0.26	22.78	18.21	23.04	18.47	56.00	46.00	-32.96	-27.53
6	14.28516	0.52	20.91	16.07	21.43	16.59	60.00	50.00	-38.57	-33.41

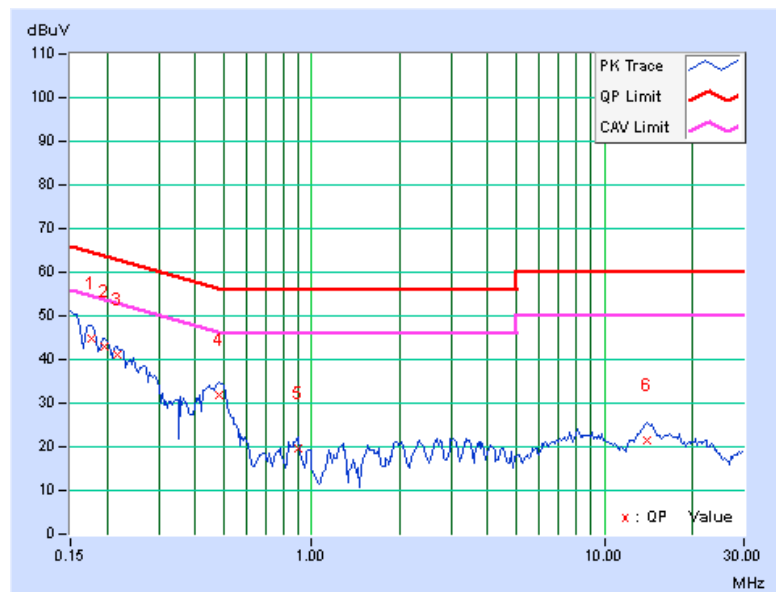
- REMARKS:**
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
 2. The emission levels of other frequencies were very low against the limit.
 3. Margin value = Emission level - Limit value
 4. Correction factor = Insertion loss + Cable loss
 5. Emission Level = Correction Factor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



PHASE	Line 2	6dB BANDWIDTH	9kHz
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17734	0.18	44.50	31.17	44.68	31.35	64.61	54.61	-19.93	-23.26
2	0.19687	0.18	42.91	29.33	43.09	29.51	63.74	53.74	-20.65	-24.23
3	0.21641	0.19	40.97	27.06	41.16	27.25	62.96	52.96	-21.80	-25.71
4	0.48203	0.25	31.62	25.24	31.87	25.49	56.30	46.30	-24.44	-20.82
5	0.90000	0.23	19.26	12.75	19.49	12.98	56.00	46.00	-36.51	-33.02
6	13.95313	0.58	20.94	14.94	21.52	15.52	60.00	50.00	-38.48	-34.48

- 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 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.

Per KDB 662911 D01 Multiple Transmitter Output v01r02 Method of conducted output power measurement on IEEE 802.11 devices,

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

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

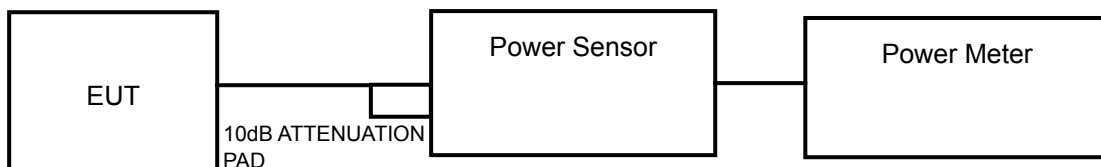
Array Gain = 5 log(NANT/NSS) dB or 3 dB, whichever is less for 20-MHz channel widths with NANT \geq 5.

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

4.3.2 TEST SETUP

FOR POWER OUTPUT MEASUREMENT

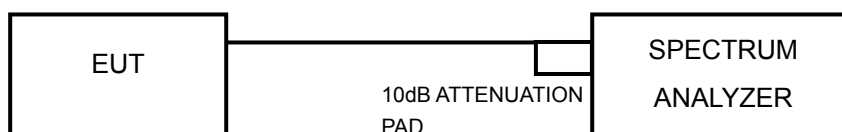
For 802.11a, 802.11n (20MHz), 802.11n (40MHz)



For 802.11ac (80MHz)



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

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

Using Method PM-G

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

For 802.11ac (80MHz)

Using Method SA-3

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

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)	AVERAGE POWER (dBm)			TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
36	5180	9.13	9.36	9.16	25.056	13.99	17	PASS
40	5200	8.57	9.01	8.96	23.026	13.62	17	PASS
48	5240	8.55	8.98	8.71	22.498	13.52	17	PASS

802.11n (20MHz)

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)			TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
36	5180	9.06	9.27	9.17	24.767	13.94	17	PASS
40	5200	8.97	9.34	9.11	24.626	13.91	17	PASS
48	5240	8.65	9.28	9.15	24.022	13.81	17	PASS

802.11n (40MHz)

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)			TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
38	5190	11.78	12.20	11.80	46.798	16.70	17	PASS
46	5230	12.05	12.34	11.88	48.589	16.87	17	PASS

802.11ac (80MHz)

CHAN.	CHAN. FREQ. (MHz)	AVERAGE POWER (dBm)			TOTAL POWER (mW)	TOTAL POWER (dBm)	POWER LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
42	5210	10.29	11.76	10.71	37.464	15.74	17	PASS

**26dB BANDWIDTH:****802.11a**

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)			PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2	
36	5180	23.58	23.24	22.00	PASS
40	5200	22.08	22.84	22.62	PASS
48	5240	22.33	22.59	22.94	PASS

802.11n (20MHz)

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)			PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2	
36	5180	22.75	23.38	23.48	PASS
40	5200	22.92	23.23	23.98	PASS
48	5240	23.81	22.91	23.55	PASS

802.11n (40MHz)

CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)			PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2	
38	5190	49.27	47.15	48.19	PASS
46	5230	49.30	50.48	47.17	PASS

802.11ac (80MHz)

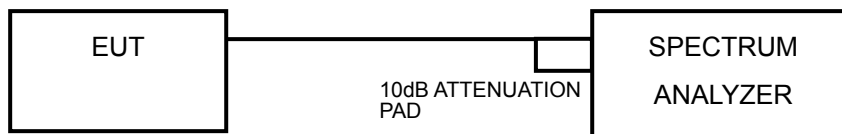
CHANNEL	CHANNEL FREQUENCY (MHz)	26dBc BANDWIDTH (MHz)			PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2	
42	5210	94.14	87.98	85.24	PASS

4.4 PEAK POWER SPECTRAL DENSITY MEASUREMENT

4.4.1 LIMITS OF PEAK POWER SPECTRAL DENSITY 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 PROCEDURES

Using method SA-2 alternative

- 1) Set span to encompass the entire emission bandwidth (EBW) of the signal.
- 2) Set RBW = 30 kHz, Set VBW \geq 1 MHz, Detector = RMS
- 3) Set Channel power measure = 1MHz
- 4) Sweep time = 30ms
- 5) Perform a single sweep.
- 6) 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 4.3.6.



4.4.7 TEST RESULTS

802.11a

CHAN.	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	-4.91	-4.63	-4.98	-0.07	0.18	0.11	0.23	PASS
40	5200	-5.43	-5.09	-4.82	-0.33	0.18	-0.15	0.23	PASS
48	5240	-5.40	-4.87	-4.73	-0.22	0.18	-0.04	0.23	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 = 5dBi + 10log(3) = 9.77dBi > 6dBi , so the power density limit shall be reduced to 4-(9.77-6) = 0.23dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (20MHz)

CHAN.	CHAN. FREQ. (MHz)	PSD (dBm)			TOTAL PSD W/O DUTY FACTOR (dBm)	DUTY FACTOR	TOTAL PSD WITH DUTY FACTOR (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2					
36	5180	-5.52	-4.74	-5.11	-0.34	0.20	-0.14	0.23	PASS
40	5200	-5.13	-4.28	-5.04	-0.03	0.20	0.17	0.23	PASS
48	5240	-5.02	-4.83	-4.65	-0.06	0.20	0.14	0.23	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 = 5dBi + 10log(3) = 9.77dBi > 6dBi , so the power density limit shall be reduced to 4-(9.77-6) = 0.23dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.



802.11n (40MHz)

CHAN.	CHAN. FREQ. (MHz)	PSD (dBm)			TOTAL PSD W/O DUTY FACTOR (dBm)	DUTY FACTOR	TOTAL PSD WITH DUTY FACTOR (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2					
38	5190	-8.80	-7.27	-7.29	-2.96	1.95	-1.01	0.23	PASS
46	5230	-7.63	-6.80	-7.68	-2.58	1.95	-0.63	0.23	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 = $5\text{dBi} + 10\log(3) = 9.77\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $4-(9.77-6) = 0.23\text{dBm}$.
- 3. Refer to section 3.3 for duty cycle spectrum plot.

802.11ac (80MHz)

CHAN.	CHAN. FREQ. (MHz)	PSD (dBm)			TOTAL PSD W/O DUTY FACTOR (dBm)	DUTY FACTOR	TOTAL PSD WITH DUTY FACTOR (dBm)	MAX. LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2					
42	5210	-12.89	-11.53	-12.31	-7.44	3.01	-4.43	0.23	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 = $5\text{dBi} + 10\log(3) = 9.77\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $4-(9.77-6) = 0.23\text{dBm}$.
- 3. Refer to section 3.3 for duty cycle spectrum plot.

4.5 PEAK POWER EXCURSION MEASUREMENT

4.5.1 LIMITS OF PEAK POWER EXCURSION 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 PROCEDURE

- 1) Set RBW = 1 MHz, VBW \geq 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

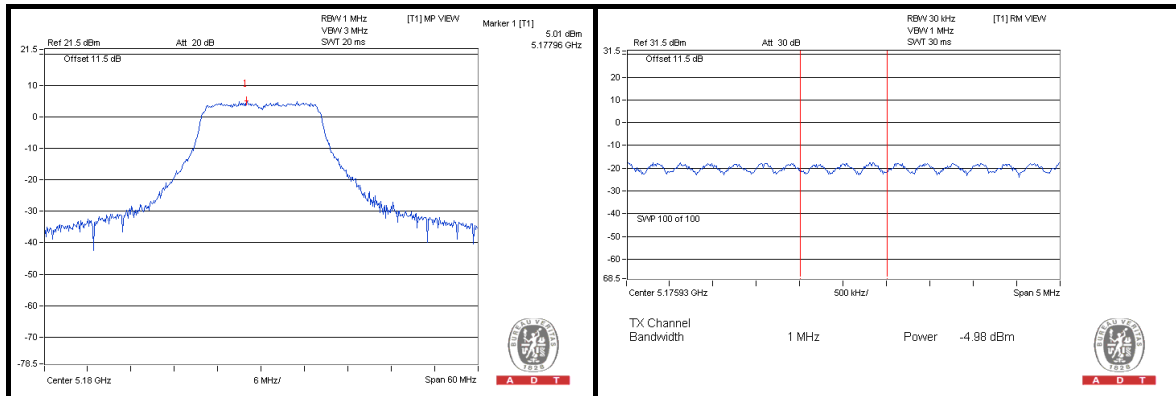
Same as 4.2.6



4.5.7 TEST RESULTS

802.11a

CHAN.	CHAN. FREQ. (MHz)	PEAK VALUE (dBm)			PPSD WITHOUT DUTY FACTOR (dBm)			PPSD WITH DUTY FACTOR (dBm)			PEAK EXCURSION (dB)			LIMIT (dB)	PASS/ FAIL
		CHAIN 0	CHAIN 1	CHAIN 2	CHAIN 0	CHAIN 1	CHAIN 2	CHAIN 0	CHAIN 1	CHAIN 2	CHAIN 0	CHAIN 1	CHAIN 2		
36	5180	4.30	4.85	5.01	-4.91	-4.63	-4.98	-4.73	-4.45	-4.80	9.03	9.30	9.81	13	PASS
40	5200	3.67	4.67	4.51	-5.43	-5.09	-4.82	-5.25	-4.91	-4.64	8.92	9.58	9.15	13	PASS
48	5240	4.09	4.59	4.89	-5.40	-4.87	-4.73	-5.22	-4.69	-4.55	9.31	9.28	9.44	13	PASS

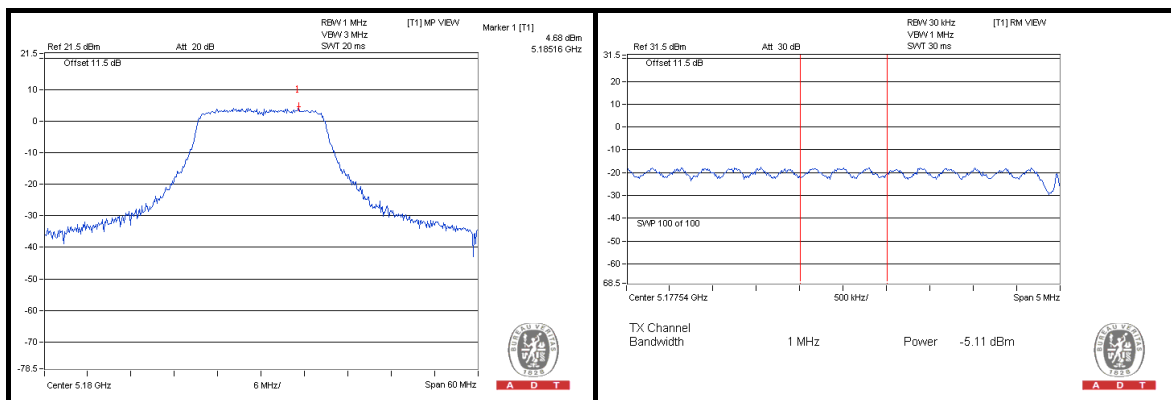




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802.11n (20MHz)

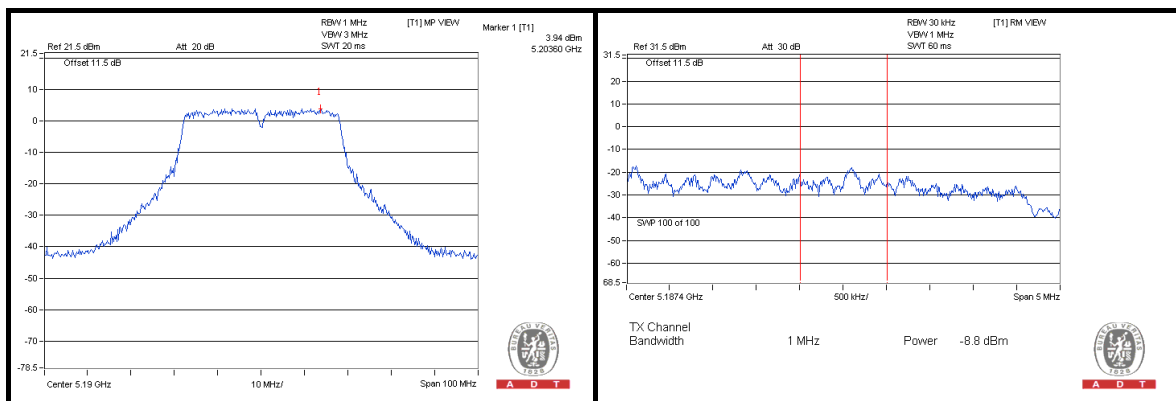
CHAN.	CHAN. FREQ. (MHz)	PEAK VALUE (dBm)			PPSD WITHOUT DUTY FACTOR (dBm)			PPSD WITH DUTY FACTOR (dBm)			PEAK EXCURSION (dB)			LIMIT (dB)	PASS/ FAIL
		CHAIN 0	CHAIN 1	CHAIN 2	CHAIN 0	CHAIN 1	CHAIN 2	CHAIN 0	CHAIN 1	CHAIN 2	CHAIN 0	CHAIN 1	CHAIN 2		
36	5180	3.81	4.01	4.68	-5.52	-4.74	-5.11	-5.32	-4.54	-4.91	9.13	8.55	9.59	13	PASS
40	5200	4.45	4.22	4.67	-5.13	-4.28	-5.04	-4.93	-4.08	-4.84	9.38	8.30	9.51	13	PASS
48	5240	4.19	3.85	4.16	-5.02	-4.83	-4.65	-4.82	-4.63	-4.45	9.01	8.48	8.61	13	PASS





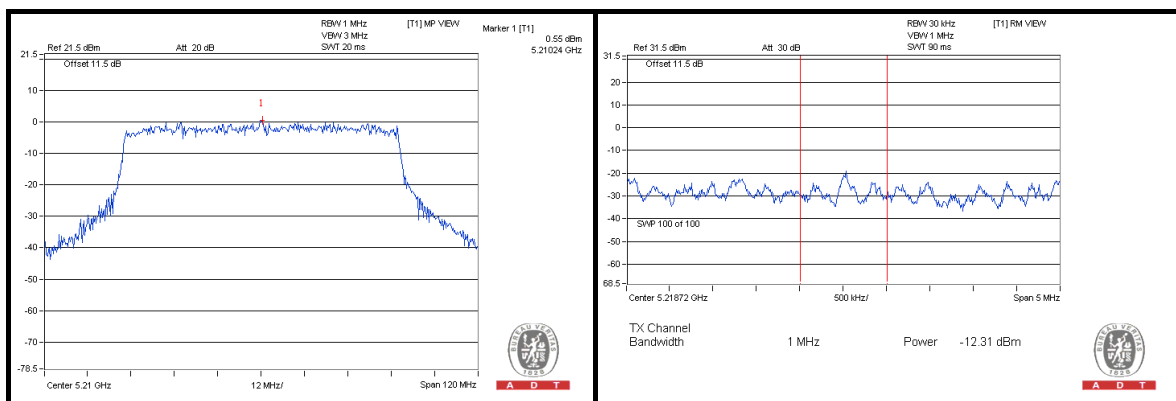
802.11n (40MHz)

CHAN.	CHAN. FREQ. (MHz)	PEAK VALUE (dBm)			PPSD WITHOUT DUTY FACTOR (dBm)			PPSD WITH DUTY FACTOR (dBm)			PEAK EXCURSION (dB)			LIMIT (dB)	PASS/FAIL
		CHAIN 0	CHAIN 1	CHAIN 2	CHAIN 0	CHAIN 1	CHAIN 2	CHAIN 0	CHAIN 1	CHAIN 2	CHAIN 0	CHAIN 1	CHAIN 2		
38	5190	3.94	5.18	5.30	-8.80	-7.27	-7.29	-6.85	-5.32	-5.34	10.79	10.50	10.64	13	PASS
46	5230	4.93	5.45	4.68	-7.63	-6.80	-7.68	-5.68	-4.85	-5.73	10.61	10.30	10.41	13	PASS



802.11ac (80MHz)

CHAN.	CHAN. FREQ. (MHz)	PEAK VALUE (dBm)			PPSD WITHOUT DUTY FACTOR (dBm)			PPSD WITH DUTY FACTOR (dBm)			PEAK EXCURSION (dB)			LIMIT (dB)	PASS/FAIL
		CHAIN 0	CHAIN 1	CHAIN 2	CHAIN 0	CHAIN 1	CHAIN 2	CHAIN 0	CHAIN 1	CHAIN 2	CHAIN 0	CHAIN 1	CHAIN 2		
42	5210	-0.17	1.05	0.55	-12.89	-11.53	-12.31	-9.88	-8.52	-9.30	9.71	9.57	9.85	13	PASS

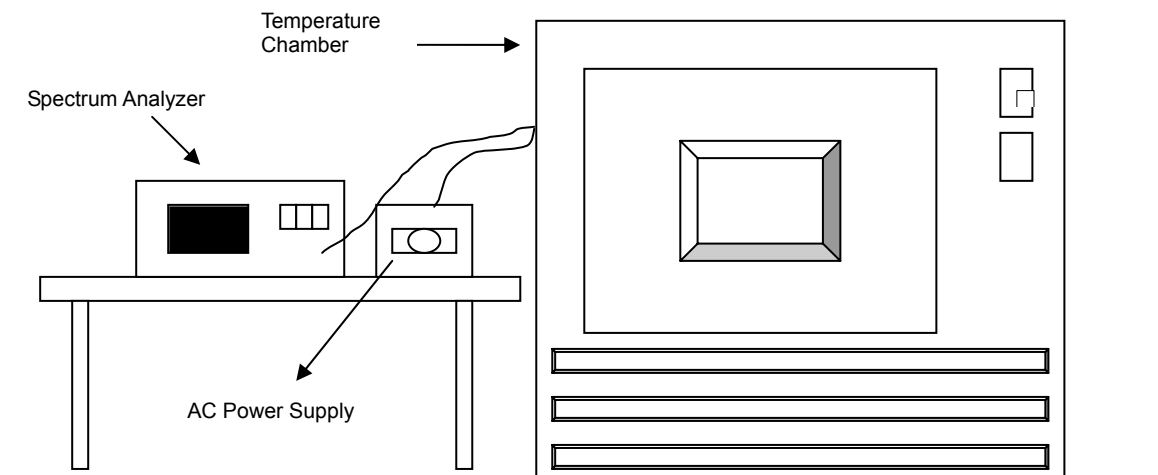


4.6 FREQUENCY STABILITY

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 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.

4.6.5 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

FREQUENCY STABILITY VERSUS TEMP.									
OPERATING FREQUENCY: 5180MHz									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)
60	120.0	5179.9755	-0.00047	5179.9872	-0.00025	5179.9816	-0.00036	5179.9879	-0.00023
50	120.0	5179.9837	-0.00031	5179.9874	-0.00024	5179.9893	-0.00021	5179.9875	-0.00024
40	120.0	5179.9950	-0.00010	5179.9967	-0.00006	5179.995	-0.00010	5179.9965	-0.00007
30	120.0	5180.0140	0.00027	5180.0117	0.00023	5180.0127	0.00025	5180.0143	0.00028
20	120.0	5179.9987	-0.00003	5180.0022	0.00004	5179.9978	-0.00004	5180.0007	0.00001
10	120.0	5180.0089	0.00017	5180.0065	0.00013	5180.0072	0.00014	5180.0061	0.00012
0	120.0	5179.9876	-0.00024	5179.9926	-0.00014	5179.9916	-0.00016	5179.9899	-0.00019
-10	120.0	5179.9864	-0.00026	5179.9867	-0.00026	5179.9819	-0.00035	5179.9848	-0.00029
-20	120.0	5179.9781	-0.00042	5179.9800	-0.00039	5179.9756	-0.00047	5179.9789	-0.00041
-30	120.0	5179.9794	-0.00040	5179.9853	-0.00028	5179.9848	-0.00029	5179.9858	-0.00027

FREQUENCY STABILITY VERSUS VOLTAGE									
OPERATING FREQUENCY: 5180MHz									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)	Measured Frequency (MHz)	Frequency Drift (%)
20	138	5179.9977	-0.00004	5180.0017	0.00003	5179.9989	-0.00002	5180.0019	0.00004
	120	5179.9987	-0.00003	5180.0022	0.00004	5179.9978	-0.00004	5180.0007	0.00001
	102	5179.9978	-0.00004	5180.0009	0.00002	5179.9988	-0.00002	5180.0010	0.00002

4.7 20dBc BANDWIDTH MEASUREMENT

4.7.1 LIMITS OF PEAK TRANSMIT POWER MEASUREMENT

20dBc point shall not overlap in 5150~5250MHz.

4.7.2 TEST SETUP



4.7.3 TEST INSTRUMENTS

Refer to section 4.1.3 to get information of above instrument.

4.7.4 TEST PROCEDURE

789033 D01 General UNII Test Procedures v01r03

Emission bandwidth

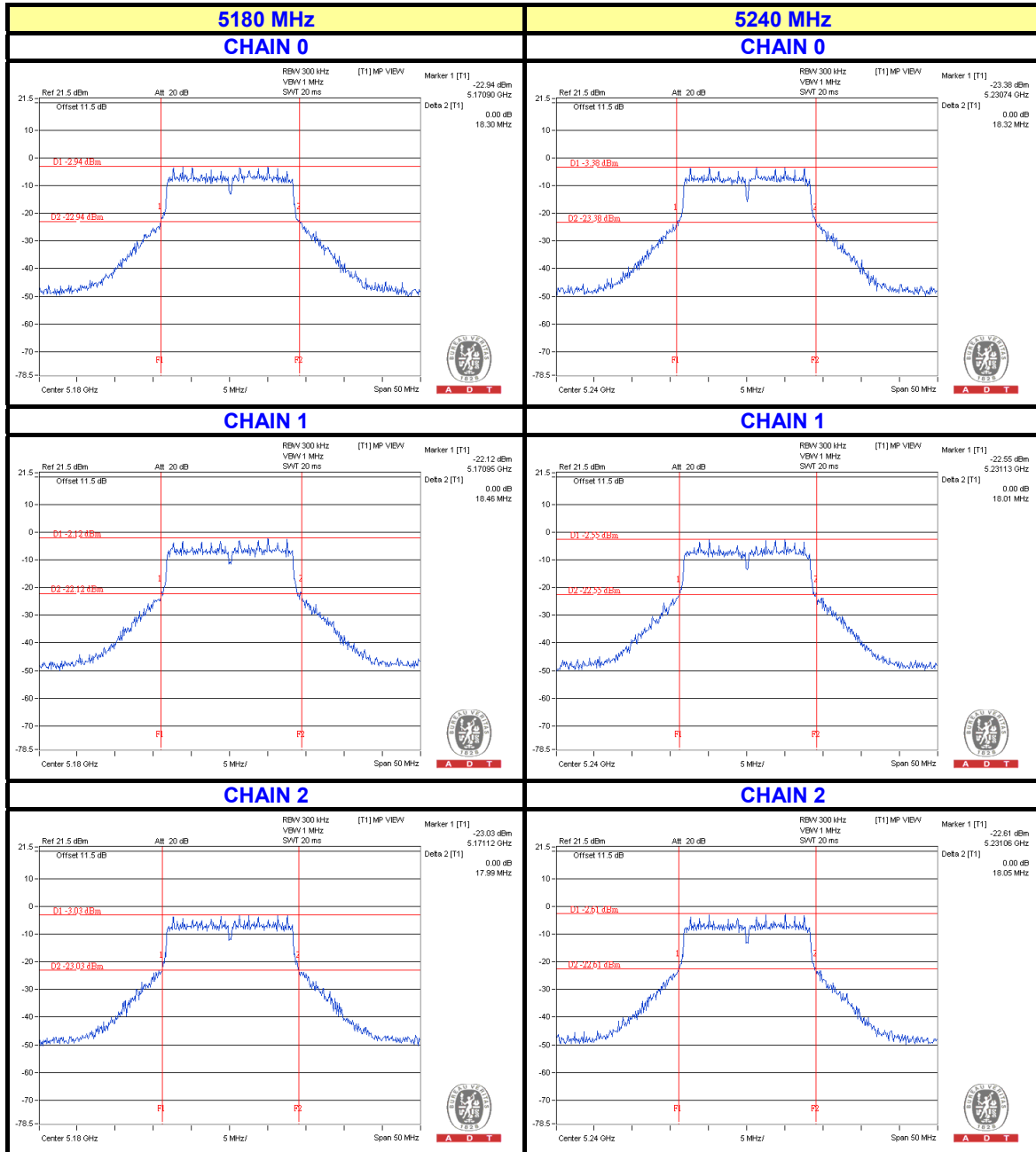
- 1) Set RBW = approximately 1% of the emission bandwidth.
- 2) Set the VBW > RBW.
- 3) Detector = Peak.
- 4) Trace mode = max hold.
- 5) Measure the maximum width of the emission that is 20 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.



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4.7.5 TEST RESULTS

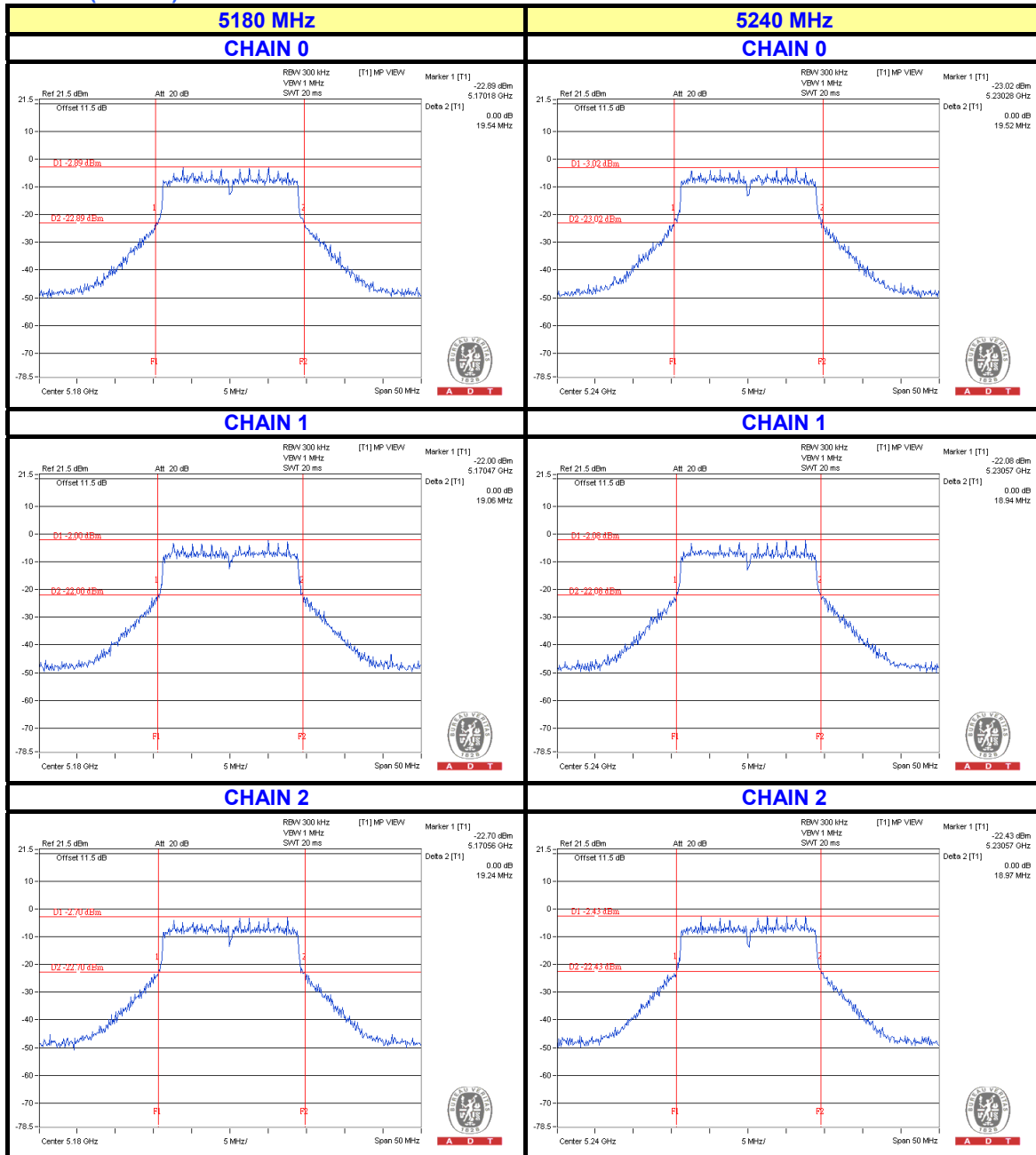
802.11a





A D T

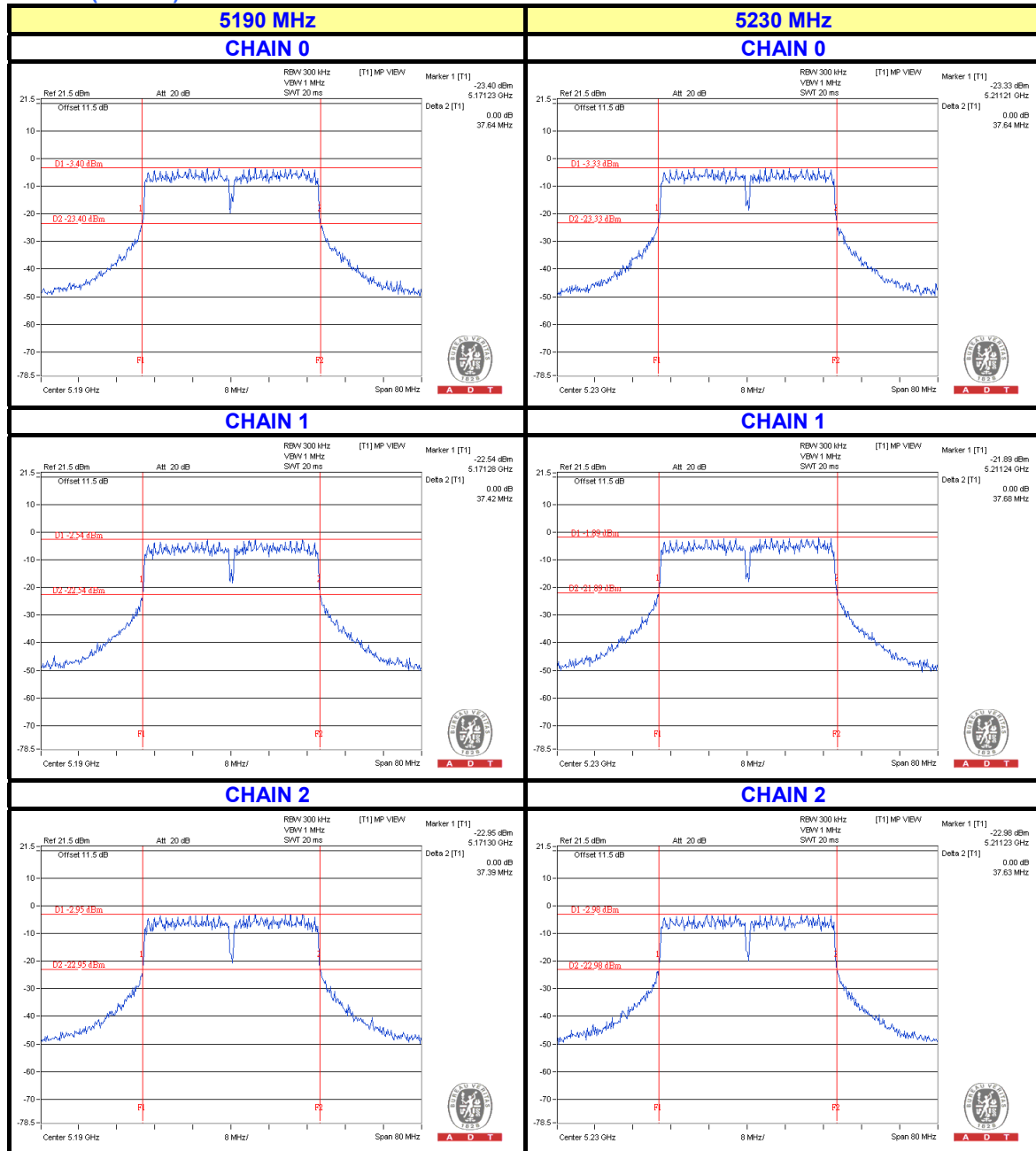
802.11n(20MHz)





A D T

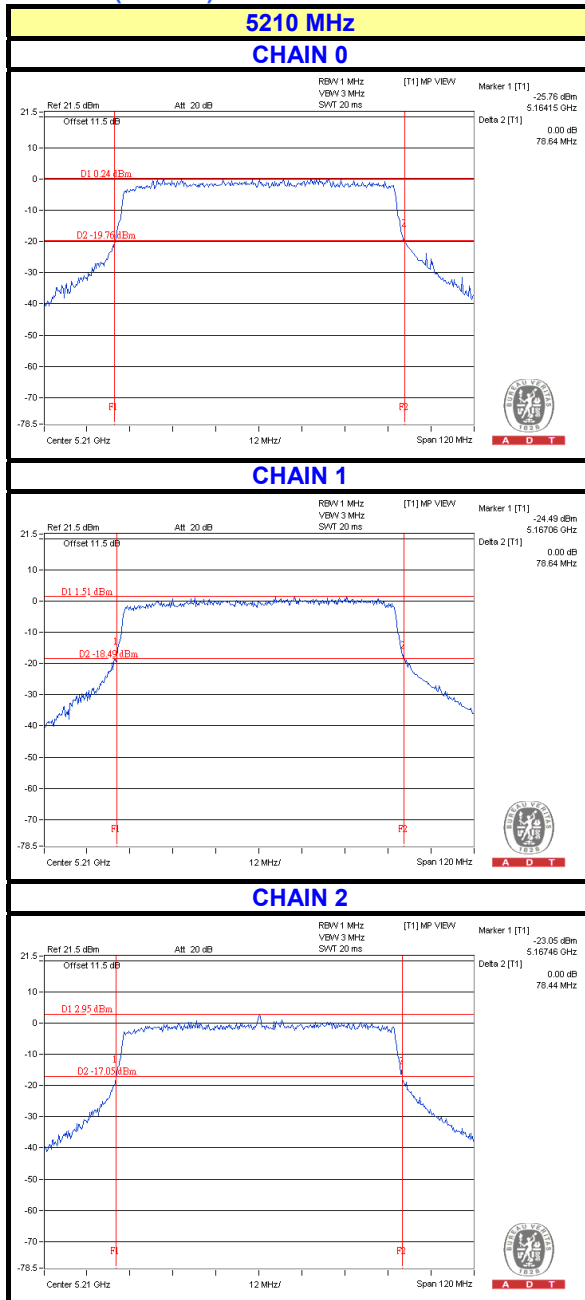
802.11n(40MHz)





A D T

802.11ac(80MHz)



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.

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

Hsin Chu EMC/RF Lab:

Tel: 886-3-5935343

Fax: 886-3-5935342

Hwa Ya EMC/RF/Safety Telecom Lab:

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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.

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