

FCC Test Report

Report No.: RF150804C20A

FCC ID: HDCWLAN194XF2

Test Model: WLAN194XF2

Received Date: Aug. 04, 2015

Test Date: Aug. 31 ~ Sep. 10, 2015

Issued Date: Sep. 15, 2015

Applicant: Adtran

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

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Table of Contents

Release Control Record	4
1 Certificate of Conformity	5
2 Summary of Test Results	6
2.1 Measurement Uncertainty.....	6
2.2 Modification Record.....	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 Test Instruments.....	15
4.1.3 Test Procedures.....	16
4.1.4 Deviation from Test Standard.....	16
4.1.5 Test Set Up.....	17
4.1.6 EUT Operating Conditions.....	17
4.1.7 Test Results.....	18
4.2 Conducted Emission Measurement.....	54
4.2.1 Limits of Conducted Emission Measurement.....	54
4.2.2 Test Instruments.....	54
4.2.3 Test Procedures.....	55
4.2.4 Deviation from Test Standard.....	55
4.2.5 Test Setup.....	55
4.2.6 EUT Operating Conditions.....	55
4.2.7 Test Results.....	56
4.3 Transmit Power Measurement.....	58
4.3.1 Limits of Transmit Power Measurement.....	58
4.3.2 Test Setup.....	58
4.3.3 Test Instruments.....	58
4.3.4 Test Procedure.....	58
4.3.5 Deviation from Test Standard.....	58
4.3.6 EUT Operating Conditions.....	58
4.3.7 Test Result.....	59
4.4 Peak Power Spectral Density Measurement.....	67
4.4.1 Limits of Peak Power Spectral Density Measurement.....	67
4.4.2 Test Setup.....	67
4.4.3 Test Instruments.....	67
4.4.4 Test Procedures.....	67
4.4.5 Deviation from Test Standard.....	67
4.4.6 EUT Operating Conditions.....	67
4.4.7 Test Results.....	68
4.5 Frequency Stability.....	70
4.5.1 Limits of Frequency Stability Measurement.....	70
4.5.2 Test Setup.....	70
4.5.3 Test Instruments.....	70
4.5.4 Test Procedure.....	70
4.5.5 Deviation from Test Standard.....	70
4.5.6 EUT Operating Condition.....	70



4.5.7 Test Results 71

5 Pictures of Test Arrangements..... 72

Appendix – Information on the Testing Laboratories 73



A D T

Release Control Record

Issue No.	Description	Date Issued
RF150804C20A	Original release	Sep. 15, 2015

1 Certificate of Conformity

Product: 802.11 an PCIe Module

Brand: Adtran

Test Model: WLAN194XF2

Sample Status: ENGINEERING SAMPLE

Applicant: Adtran

Test Date: Aug. 31 ~ Sep. 10, 2015

Standards: 47 CFR FCC Part 15, Subpart E (Section 15.407)
ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by :  _____, **Date:** _____ Sep. 15, 2015
Pettie Chen / Senior Specialist

Approved by :  _____, **Date:** _____ Sep. 15, 2015
Ken Liu / Senior Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart E (Section 15.407)			
FCC Clause	Test Item	Result	Remarks
15.207 15.407(b)(6)	AC Power Conducted Emissions	Pass	Meet the requirement of limit. Minimum passing margin is -9.44dB at 0.52130MHz.
15.407(b) (1/2/3/4/6)	Radiated Emissions & Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -1.0dB at 500.42, 5350.00, 5400.00, 5470.00, 5725.00MHz.
15.407(a)(1/2 /3)	Max Average Transmit Power	Pass	Meet the requirement of limit.
15.407(a)(1/2 /3)	Peak Power Spectral Density	Pass	Meet the requirement of limit.
15.407(g)	Frequency Stability	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is MMCX not a standard connector.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.86 dB
	200MHz ~1000MHz	3.87 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	802.11 an PCIe Module
Brand	Adtran
Test Model	WLAN194XF2
Status of EUT	Engineering sample
Power Supply Rating	5Vdc (host)
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	5260 ~ 5320MHz, 5500 ~ 5700MHz
Number of Channel	5260 ~ 5320MHz: 4 for 802.11a, 802.11n (HT20) 2 for 802.11n (HT40) 5500 ~ 5700MHz: 8 for 802.11a, 802.11n (HT20) 3 for 802.11n (HT40)
Output Power	5260 ~ 5320MHz: 121.364mW 5500 ~ 5700MHz: 149.375mW
Antenna Type	Dipole antenna with 7dBi gain
Antenna Connector	MMCX
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. This report is prepared for FCC class II permissive change. The difference compared with the original report (BV ADT report no.: RF150804C20) is adding 5.26GHz to 5.32GHz and 5.50GHz to 5.70GHz by software.
2. The EUT incorporates a MIMO function. Physically, the EUT provides 3 completed transmitters and 3 receivers.

Modulation Mode	TX Function
802.11a	3TX
802.11n (HT20)	3TX
802.11n (HT40)	3TX

3.2 Description of Test Modes

For 5260 ~ 5320MHz

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

Channel	Frequency	Channel	Frequency
52	5260 MHz	60	5300 MHz
56	5280 MHz	64	5320 MHz

2 channels are provided for 802.11n (HT40):

Channel	Frequency	Channel	Frequency
54	5270 MHz	62	5310 MHz

For 5500 ~ 5700MHz

8 channels are provided for 802.11a, 802.11n (HT20):

Channel	Frequency	Channel	Frequency
100	5500 MHz	116	5580 MHz
104	5520 MHz	132	5660 MHz
108	5540 MHz	136	5680 MHz
112	5560 MHz	140	5700 MHz

3 channels are provided for 802.11n (HT40):

Channel	Frequency	Channel	Frequency
102	5510 MHz	134	5670 MHz
110	5550 MHz		

3.2.1 Test Mode Applicability and Tested Channel Detail

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

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

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

Radiated Emission Test (Above 1GHz):

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

EUT CONFIGURE MODE	MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	5260-5320	52 to 64	52, 60, 64	OFDM	BPSK	6.0
-	802.11n (HT20)		52 to 64	52, 60, 64	OFDM	BPSK	6.5
-	802.11n (HT40)		54 to 62	54, 62	OFDM	BPSK	13.5
-	802.11a	5500-5700	100 to 140	100, 116, 140	OFDM	BPSK	6.0
-	802.11n (HT20)		100 to 140	100, 116, 140	OFDM	BPSK	6.5
-	802.11n (HT40)		102 to 134	102, 110, 134	OFDM	BPSK	13.5

Radiated Emission Test (Below 1GHz):

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

EUT CONFIGURE MODE	MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11n (HT20)	5260-5320	52 to 64	100	OFDM	BPSK	6.5
		5500-5700	100 to 140		OFDM	BPSK	6.5

Power Line Conducted Emission Test:

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

EUT CONFIGURE MODE	MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11n (HT20)	5260-5320	52 to 64	100	OFDM	BPSK	6.5
		5500-5700	100 to 140		OFDM	BPSK	6.5

Antenna Port Conducted Measurement:

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

EUT CONFIGURE MODE	MODE	FREQ. BAND (MHz)	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11a	5260-5320	52 to 64	52, 60, 64	OFDM	BPSK	6.0
-	802.11n (HT20)		52 to 64	52, 60, 64	OFDM	BPSK	6.5
-	802.11n (HT40)		54 to 62	54, 62	OFDM	BPSK	13.5
-	802.11a	5500-5700	100 to 140	100, 116, 140	OFDM	BPSK	6.0
-	802.11n (HT20)		100 to 140	100, 116, 140	OFDM	BPSK	6.5
-	802.11n (HT40)		102 to 134	102, 110, 134	OFDM	BPSK	13.5

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE≥1G	20deg. C, 66%RH	120Vac, 60Hz	Jones Chang
RE<1G	18deg. C, 70%RH	120Vac, 60Hz	Jones Chang
PLC	25deg. C, 65%RH	120Vac, 60Hz	Bayu Chen
APCM	25deg. C, 60%RH	120Vac, 60Hz	Frank Liu

3.3 Duty Cycle of Test Signal

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

802.11a: Duty cycle = $1.357/1.422 = 0.954$, Duty factor = $10 * \log(1/0.954) = 0.20$

802.11n (HT20): Duty cycle = $1.268/1.333 = 0.951$, Duty factor = $10 * \log(1/0.951) = 0.22$

802.11n (HT40): Duty cycle = $0.623/0.675 = 0.923$, Duty factor = $10 * \log(1/0.923) = 0.35$



3.4 Description of Support Units

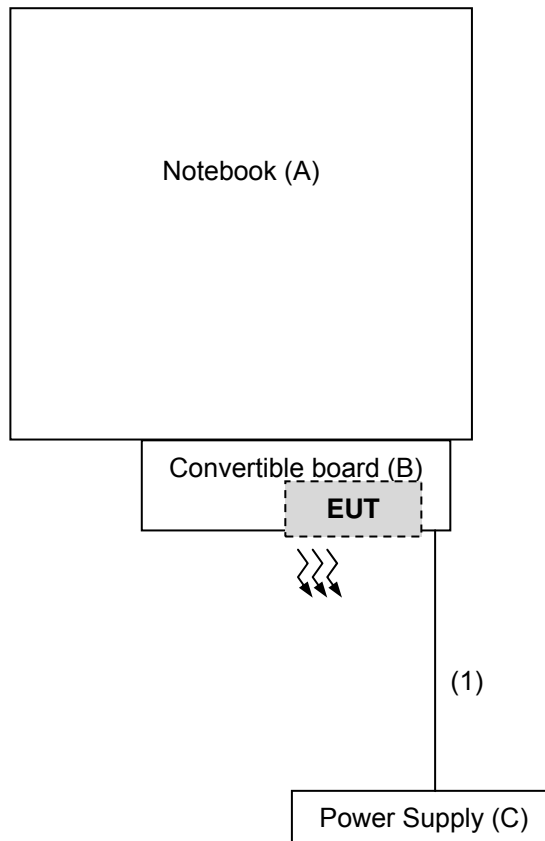
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5410	1HC2XM1	FCC DoC Approved	-
B.	Convertible board	NA	NA	NA	NA	Provided by client
C.	Power Supply	Topward	33010D	807748	NA	-

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Power	1	1.8	N	0	-

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart E (15.407)

789033 D02 General UNII Test Procedures New Rules v01

662911 D01 Multiple Transmitter Output v02r01

ANSI C63.10-2013

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

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

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

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

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

Note:

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

LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

Applicable To	Limit	
789033 D02 General UNII Test Procedures New Rules v01	FIELD STRENGTH AT 3m	
	PK:74 (dBµV/m)	AV:54 (dBµV/m)
Applicable To	EIRP Limit	Equivalent Field Strength at 3m
15.407(b)(1)	PK:-27 (dBm/MHz)	PK:68.2(dBµV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)	PK:-27 (dBm/MHz) ^{*1} PK:-17 (dBm/MHz) ^{*2}	PK: 68.2(dBµV/m) ^{*1} PK:78.2 (dBµV/m) ^{*2}

Note: ^{*1}beyond 10MHz of the band edge ^{*2}within 10 MHz of band edge

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

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
Test Receiver ROHDE & SCHWARZ	ESIB7	100187	Apr. 10, 2015	Apr. 09, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Jul. 08, 2015	Jul. 07, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Feb. 05, 2015	Feb. 04, 2016
HORN Antenna SCHWARZBECK	9120D	209	Feb. 09, 2015	Feb. 08, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Feb. 09, 2015	Feb. 08, 2016
Preamplifier Agilent	8447D	2944A10738	Oct. 18, 2014	Oct. 17, 2015
Preamplifier Agilent	8449B	3008A01964	Aug. 22, 2015	Aug. 21, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03(214 378)	Aug. 22, 2015	Aug. 21, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 106	Cable-CH3-03(309 224+12738)	Aug. 22, 2015	Aug. 21, 2016
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	NA	NA
26GHz ~ 40GHz Amplifier	EM26400	815221	Oct. 18, 2014	Oct. 17, 2015
High Speed Peak Power Meter	ML2495A	0824011	Jul. 09, 2015	Jul. 08, 2016
Power Sensor	MA2411B	0738171	Jul. 09, 2015	Jul. 08, 2016

- NOTE:**
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Chamber 9.
 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 215374.
 5. The IC Site Registration No. is IC 7450F-9.

4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

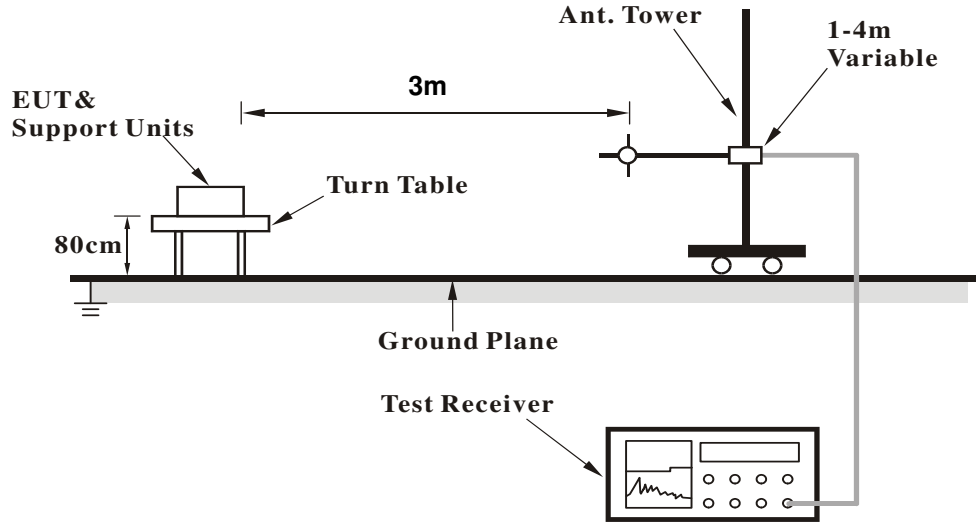
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.4 Deviation from Test Standard

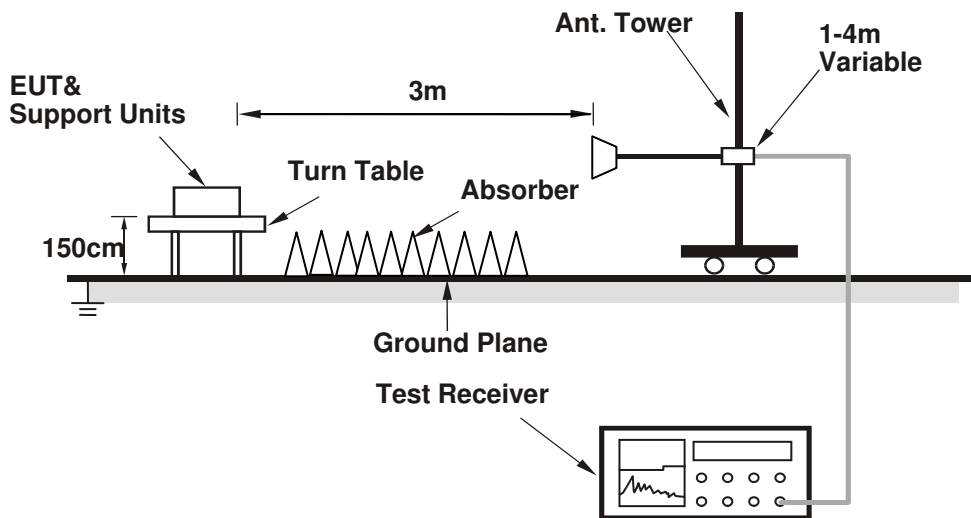
No deviation.

4.1.5 Test Set Up

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



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

4.1.6 EUT Operating Conditions

- a. Plugged the EUT into notebook via a convertible board and placed them on the testing table.
- b. The notebook system ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- c. The necessary accessories enable the system in full functions.

4.1.7 Test Results

Above 1GHz Data

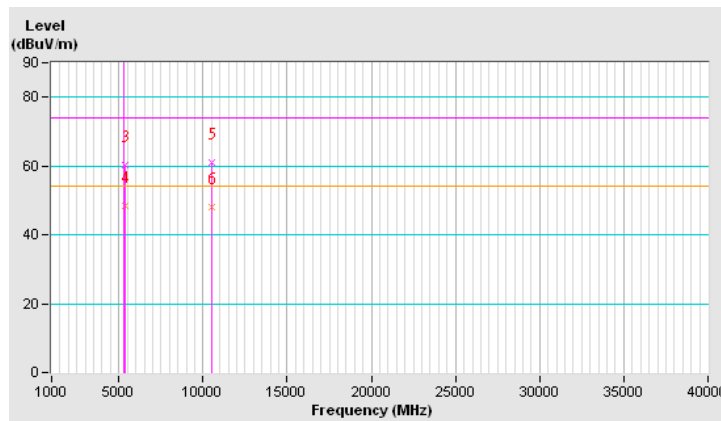
802.11a

CHANNEL	TX Channel 52	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5260.00	106.2 PK			2.06 H	21	66.50	39.70
2	*5260.00	97.3 AV			2.06 H	21	57.60	39.70
3	5400.00	60.1 PK	74.0	-13.9	1.80 H	135	53.40	6.70
4	5400.00	48.4 AV	54.0	-5.6	1.80 H	135	41.70	6.70
5	#10520.00	61.2 PK	74.0	-12.8	1.42 H	179	42.90	18.30
6	#10520.00	48.1 AV	54.0	-5.9	1.42 H	179	29.80	18.30

Remark:

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

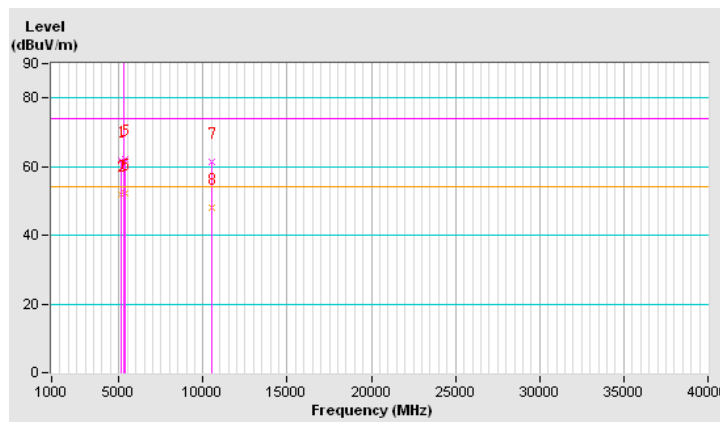


CHANNEL	TX Channel 52	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5120.00	61.9 PK	74.0	-12.1	1.75 V	25	55.70	6.20
2	5120.00	51.8 AV	54.0	-2.2	1.75 V	25	45.60	6.20
3	*5260.00	119.3 PK			1.82 V	60	79.60	39.70
4	*5260.00	111.7 AV			1.82 V	60	72.00	39.70
5	5400.00	62.0 PK	74.0	-12.0	1.79 V	54	55.30	6.70
6	5400.00	52.1 AV	54.0	-1.9	1.79 V	54	45.40	6.70
7	#10520.00	61.3 PK	74.0	-12.7	1.60 V	115	43.00	18.30
8	#10520.00	48.2 AV	54.0	-5.8	1.60 V	115	29.90	18.30

Remark:

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

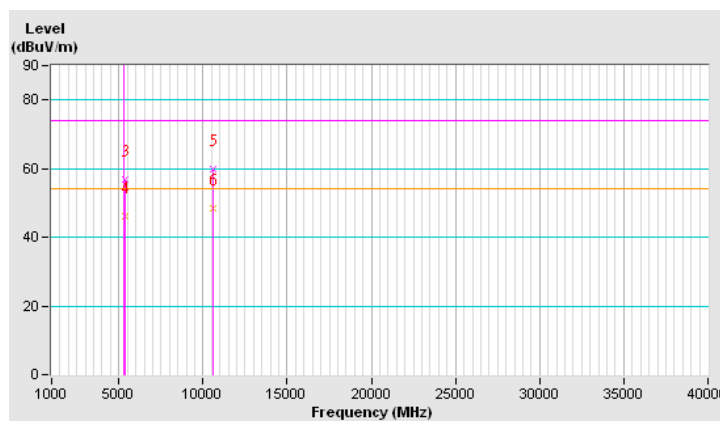


CHANNEL	TX Channel 60	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5300.00	106.7 PK			1.26 H	93	67.00	39.70
2	*5300.00	97.2 AV			1.26 H	93	57.50	39.70
3	5360.00	56.7 PK	74.0	-17.3	1.13 H	49	50.30	6.40
4	5360.00	46.2 AV	54.0	-7.8	1.13 H	49	39.80	6.40
5	10600.00	60.0 PK	74.0	-14.0	1.38 H	273	41.80	18.20
6	10600.00	48.3 AV	54.0	-5.7	1.38 H	273	30.10	18.20

Remark:

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

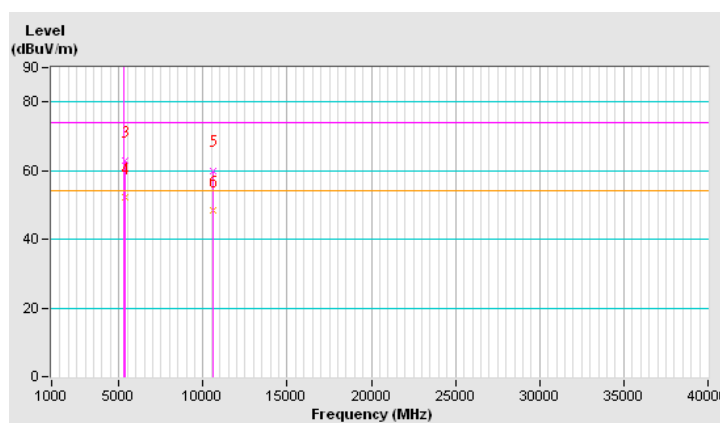


CHANNEL	TX Channel 60	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5300.00	119.6 PK			1.52 V	69	79.90	39.70
2	*5300.00	110.7 AV			1.52 V	69	71.00	39.70
3	5360.00	62.8 PK	74.0	-11.2	1.80 V	29	56.40	6.40
4	5360.00	52.3 AV	54.0	-1.7	1.80 V	29	45.90	6.40
5	10600.00	60.1 PK	74.0	-13.9	1.43 V	203	41.90	18.20
6	10600.00	48.3 AV	54.0	-5.7	1.43 V	203	30.10	18.20

Remark:

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

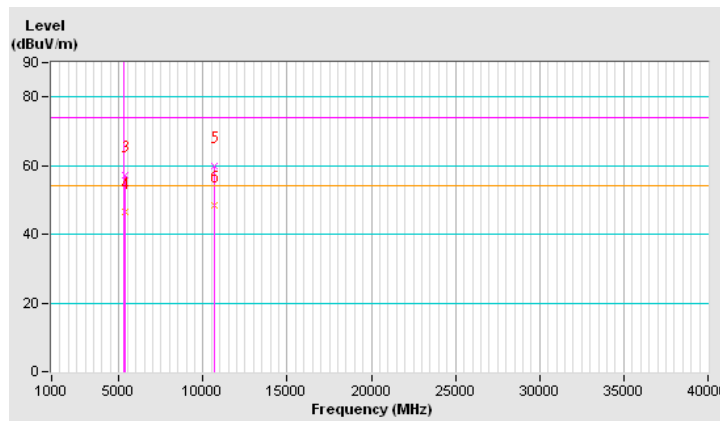


CHANNEL	TX Channel 64	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5320.00	107.4 PK			1.32 H	106	67.70	39.70
2	*5320.00	98.3 AV			1.32 H	106	58.60	39.70
3	5360.00	57.2 PK	74.0	-16.8	1.14 H	52	50.80	6.40
4	5360.00	46.5 AV	54.0	-7.5	1.14 H	52	40.10	6.40
5	10640.00	59.8 PK	74.0	-14.2	1.19 H	179	41.70	18.10
6	10640.00	48.4 AV	54.0	-5.6	1.19 H	179	30.30	18.10

Remark:

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

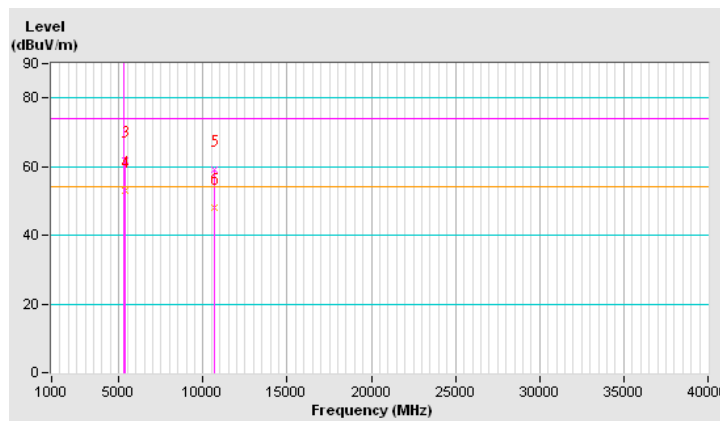


CHANNEL	TX Channel 64	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5320.00	119.3 PK			1.57 V	72	79.60	39.70
2	*5320.00	110.6 AV			1.57 V	72	70.90	39.70
3	5360.00	61.8 PK	74.0	-12.2	1.72 V	71	55.40	6.40
4	5360.00	52.9 AV	54.0	-1.1	1.72 V	71	46.50	6.40
5	10640.00	59.3 PK	74.0	-14.7	1.53 V	266	41.20	18.10
6	10640.00	48.2 AV	54.0	-5.8	1.53 V	266	30.10	18.10

Remark:

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

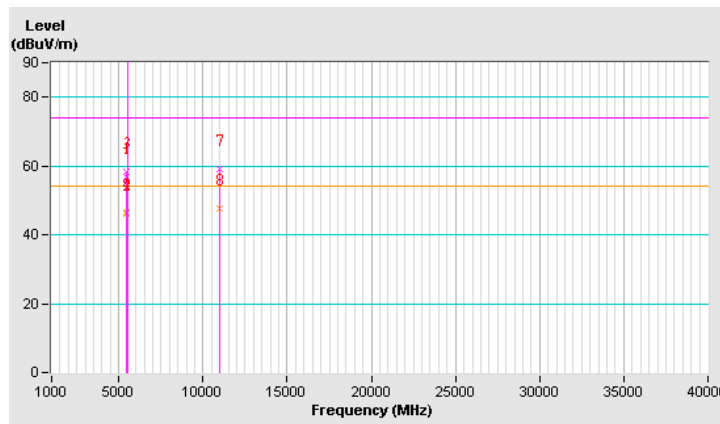


CHANNEL	TX Channel 100	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5425.00	57.0 PK	74.0	-17.0	1.25 H	342	50.30	6.70
2	5425.00	46.1 AV	54.0	-7.9	1.25 H	342	39.40	6.70
3	#5470.00	58.4 PK	74.0	-15.6	1.43 H	299	51.60	6.80
4	#5470.00	46.5 AV	54.0	-7.5	1.43 H	299	39.70	6.80
5	*5500.00	103.3 PK			1.39 H	118	63.30	40.00
6	*5500.00	94.1 AV			1.39 H	118	54.10	40.00
7	11000.00	59.0 PK	74.0	-15.0	1.07 H	233	39.90	19.10
8	11000.00	47.8 AV	54.0	-6.2	1.07 H	233	28.70	19.10

Remark:

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

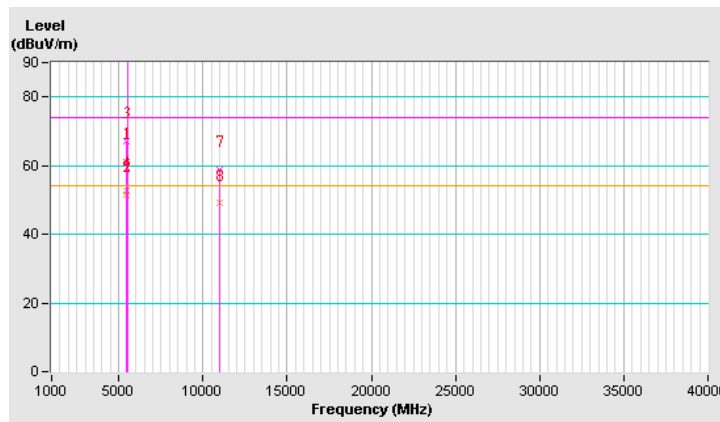


CHANNEL	TX Channel 100	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5425.00	61.1 PK	74.0	-12.9	1.85 V	80	54.40	6.70
2	5425.00	51.5 AV	54.0	-2.5	1.85 V	80	44.80	6.70
3	#5470.00	67.0 PK	74.0	-7.0	1.78 V	124	60.20	6.80
4	#5470.00	52.7 AV	54.0	-1.3	1.78 V	124	45.90	6.80
5	*5500.00	121.7 PK			1.90 V	103	81.70	40.00
6	*5500.00	112.8 AV			1.90 V	103	72.80	40.00
7	11000.00	58.7 PK	74.0	-15.3	1.56 V	283	39.60	19.10
8	11000.00	49.0 AV	54.0	-5.0	1.56 V	283	29.90	19.10

Remark:

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

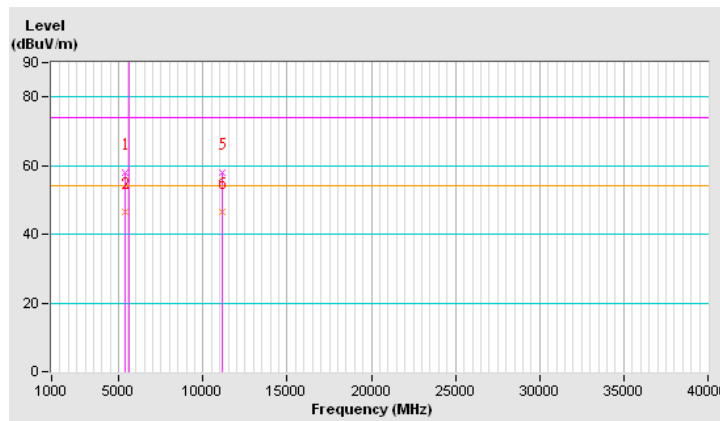


CHANNEL	TX Channel 116	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5400.00	58.1 PK	74.0	-15.9	1.22 H	64	51.40	6.70
2	5400.00	46.5 AV	54.0	-7.5	1.22 H	64	39.80	6.70
3	*5580.00	101.7 PK			1.45 H	97	61.60	40.10
4	*5580.00	92.6 AV			1.45 H	97	52.50	40.10
5	11160.00	58.1 PK	74.0	-15.9	1.07 H	44	39.40	18.70
6	11160.00	46.5 AV	54.0	-7.5	1.07 H	44	27.80	18.70

Remark:

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

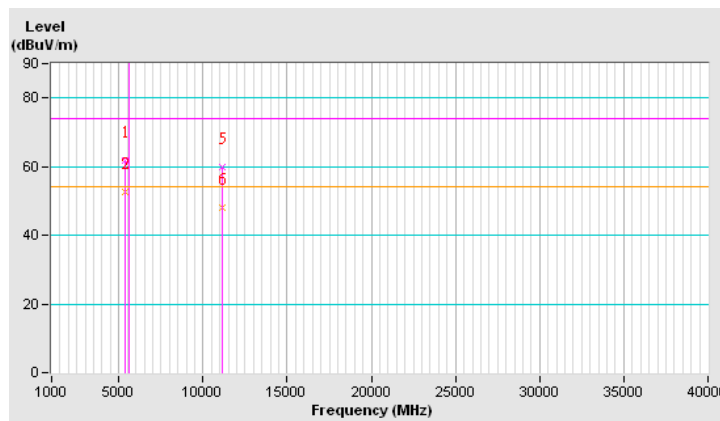


CHANNEL	TX Channel 116	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5400.00	61.7 PK	74.0	-12.3	1.75 V	58	55.00	6.70
2	5400.00	52.5 AV	54.0	-1.5	1.75 V	58	45.80	6.70
3	*5580.00	118.7 PK			1.91 V	94	78.60	40.10
4	*5580.00	110.8 AV			1.91 V	94	70.70	40.10
5	11160.00	59.9 PK	74.0	-14.1	1.95 V	88	41.20	18.70
6	11160.00	47.9 AV	54.0	-6.1	1.95 V	88	29.20	18.70

Remark:

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

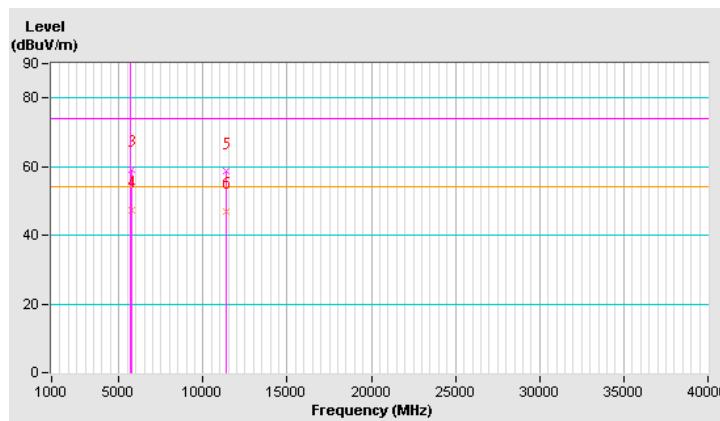


CHANNEL	TX Channel 140	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5700.00	101.7 PK			1.00 H	87	61.40	40.30
2	*5700.00	91.9 AV			1.00 H	87	51.60	40.30
3	#5725.00	59.0 PK	74.0	-15.0	1.11 H	70	51.80	7.20
4	#5725.00	47.3 AV	54.0	-6.7	1.11 H	70	40.10	7.20
5	11400.00	58.5 PK	74.0	-15.5	1.15 H	72	40.20	18.30
6	11400.00	47.0 AV	54.0	-7.0	1.15 H	72	28.70	18.30

Remark:

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

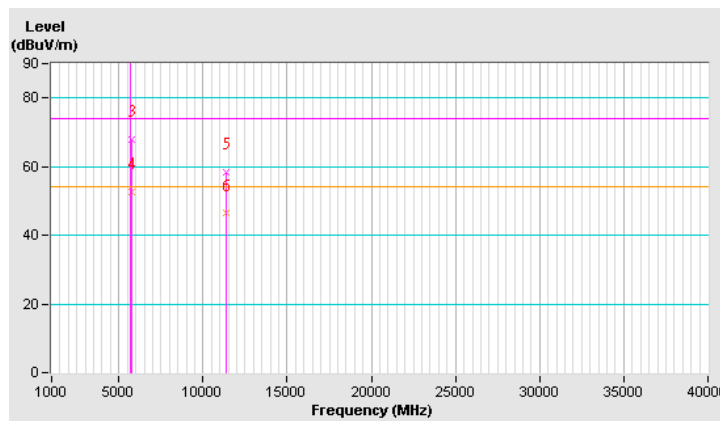


CHANNEL	TX Channel 140	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5700.00	117.0 PK			2.09 V	63	76.70	40.30
2	*5700.00	108.0 AV			2.09 V	63	67.70	40.30
3	#5725.00	67.9 PK	74.0	-6.1	2.13 V	62	60.70	7.20
4	#5725.00	52.6 AV	54.0	-1.4	2.13 V	62	45.40	7.20
5	11400.00	58.2 PK	74.0	-15.8	1.80 V	62	39.90	18.30
6	11400.00	46.3 AV	54.0	-7.7	1.80 V	62	28.00	18.30

Remark:

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



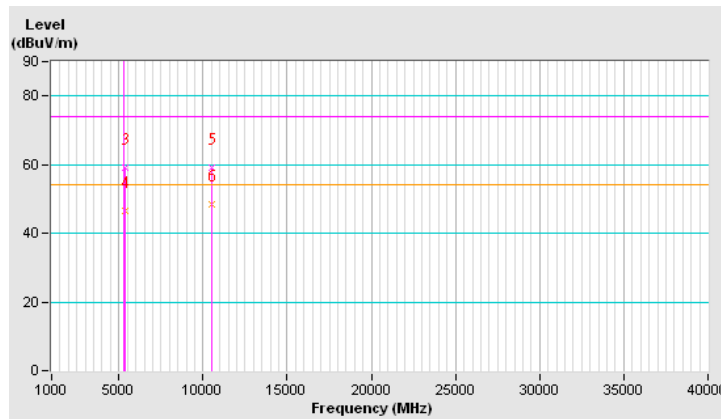
802.11n (HT20)

CHANNEL	TX Channel 52	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5260.00	107.1 PK			1.36 H	85	67.40	39.70
2	*5260.00	98.4 AV			1.36 H	85	58.70	39.70
3	5400.00	59.1 PK	74.0	-14.9	1.14 H	115	52.40	6.70
4	5400.00	46.6 AV	54.0	-7.4	1.14 H	115	39.90	6.70
5	#10520.00	59.1 PK	74.0	-14.9	1.00 H	135	40.80	18.30
6	#10520.00	48.4 AV	54.0	-5.6	1.00 H	135	30.10	18.30

Remark:

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

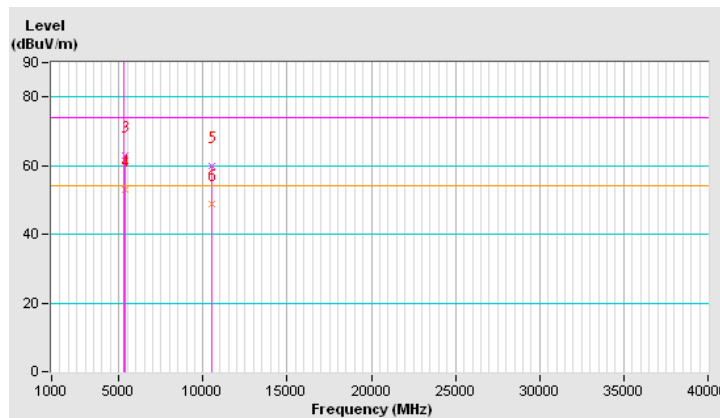


CHANNEL	TX Channel 52	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5260.00	119.1 PK			1.66 V	74	79.40	39.70
2	*5260.00	110.2 AV			1.66 V	74	70.50	39.70
3	5400.00	62.8 PK	74.0	-11.2	1.92 V	82	56.10	6.70
4	5400.00	53.0 AV	54.0	-1.0	1.92 V	82	46.30	6.70
5	#10520.00	60.0 PK	74.0	-14.0	1.48 V	14	41.70	18.30
6	#10520.00	48.7 AV	54.0	-5.3	1.48 V	14	30.40	18.30

Remark:

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

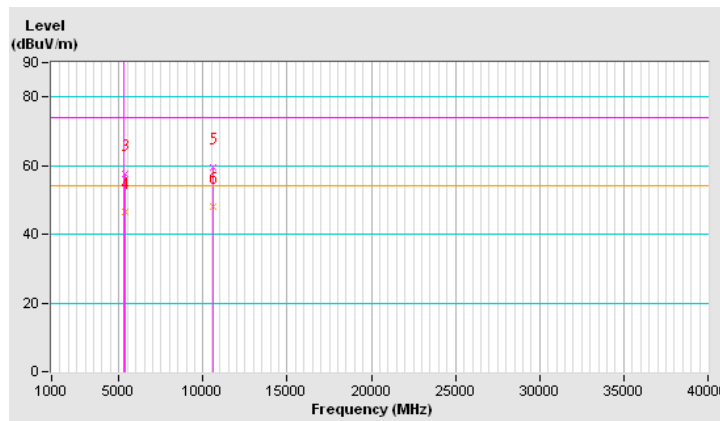


CHANNEL	TX Channel 60	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5300.00	106.8 PK			1.28 H	93	67.10	39.70
2	*5300.00	97.4 AV			1.28 H	93	57.70	39.70
3	5400.00	57.4 PK	74.0	-16.6	1.21 H	21	50.70	6.70
4	5400.00	46.6 AV	54.0	-7.4	1.21 H	21	39.90	6.70
5	10600.00	59.4 PK	74.0	-14.6	1.28 H	82	41.20	18.20
6	10600.00	48.0 AV	54.0	-6.0	1.28 H	82	29.80	18.20

Remark:

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

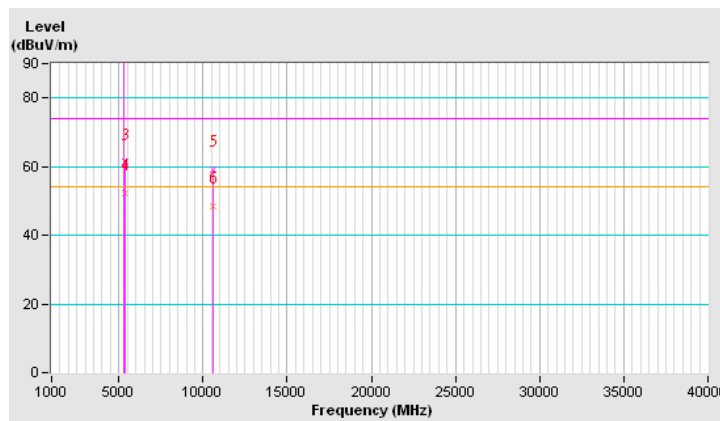


CHANNEL	TX Channel 60	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5300.00	119.2 PK			1.74 V	73	79.50	39.70
2	*5300.00	110.0 AV			1.74 V	73	70.30	39.70
3	5400.00	61.2 PK	74.0	-12.8	1.70 V	131	54.50	6.70
4	5400.00	52.4 AV	54.0	-1.6	1.70 V	131	45.70	6.70
5	10600.00	59.1 PK	74.0	-14.9	1.57 V	23	40.90	18.20
6	10600.00	48.3 AV	54.0	-5.7	1.57 V	23	30.10	18.20

Remark:

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

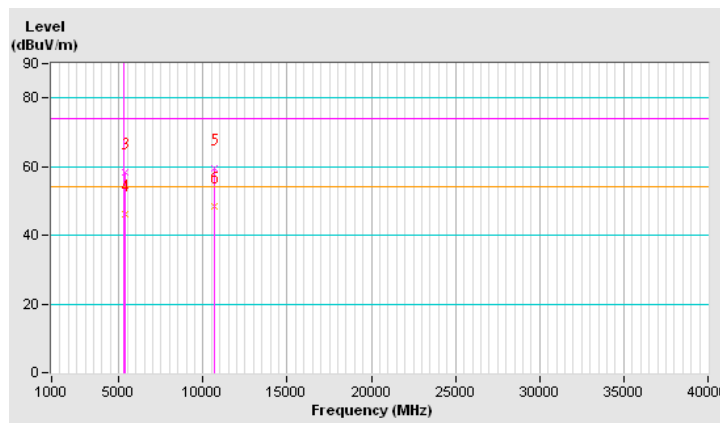


CHANNEL	TX Channel 64	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5320.00	106.1 PK			1.31 H	105	66.40	39.70
2	*5320.00	96.9 AV			1.31 H	105	57.20	39.70
3	5350.00	58.5 PK	74.0	-15.5	1.19 H	2	52.10	6.40
4	5350.00	46.2 AV	54.0	-7.8	1.19 H	2	39.80	6.40
5	10640.00	59.4 PK	74.0	-14.6	1.03 H	215	41.30	18.10
6	10640.00	48.5 AV	54.0	-5.5	1.03 H	215	30.40	18.10

Remark:

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

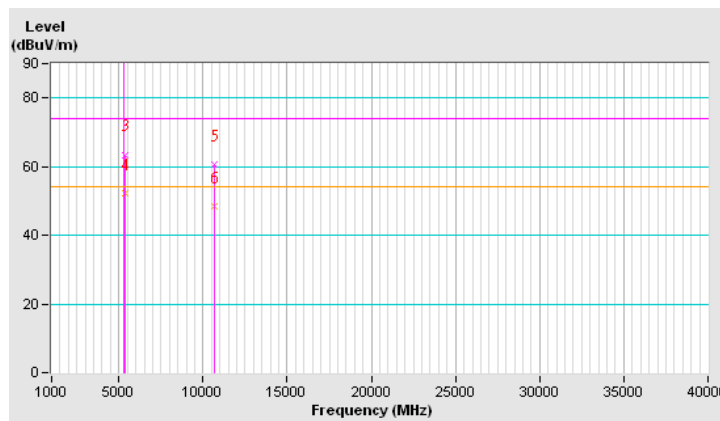


CHANNEL	TX Channel 64	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5320.00	119.7 PK			1.73 V	70	80.00	39.70
2	*5320.00	110.2 AV			1.73 V	70	70.50	39.70
3	5350.00	63.5 PK	74.0	-10.5	1.73 V	56	57.10	6.40
4	5350.00	52.2 AV	54.0	-1.8	1.73 V	56	45.80	6.40
5	10640.00	60.7 PK	74.0	-13.3	1.20 V	97	42.60	18.10
6	10640.00	48.6 AV	54.0	-5.4	1.20 V	97	30.50	18.10

Remark:

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

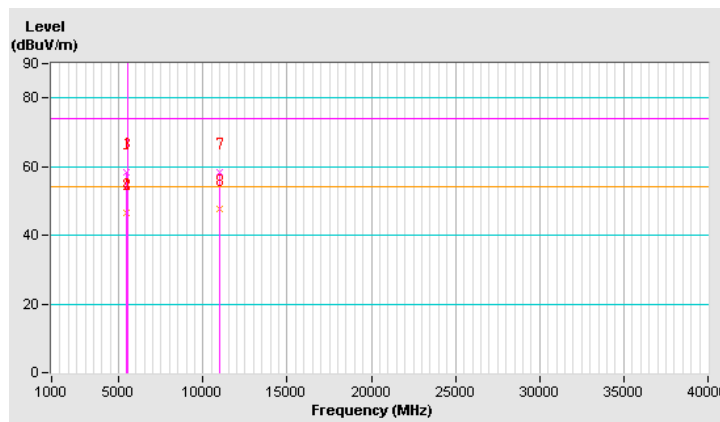


CHANNEL	TX Channel 100	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5460.00	58.3 PK	74.0	-15.7	1.18 H	103	51.50	6.80
2	5460.00	46.5 AV	54.0	-7.5	1.18 H	103	39.70	6.80
3	#5470.00	58.2 PK	74.0	-15.8	1.32 H	69	51.40	6.80
4	#5470.00	46.4 AV	54.0	-7.6	1.32 H	69	39.60	6.80
5	*5500.00	103.4 PK			1.39 H	117	63.40	40.00
6	*5500.00	93.8 AV			1.39 H	117	53.80	40.00
7	11000.00	58.5 PK	74.0	-15.5	1.06 H	252	39.40	19.10
8	11000.00	47.6 AV	54.0	-6.4	1.06 H	252	28.50	19.10

Remark:

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

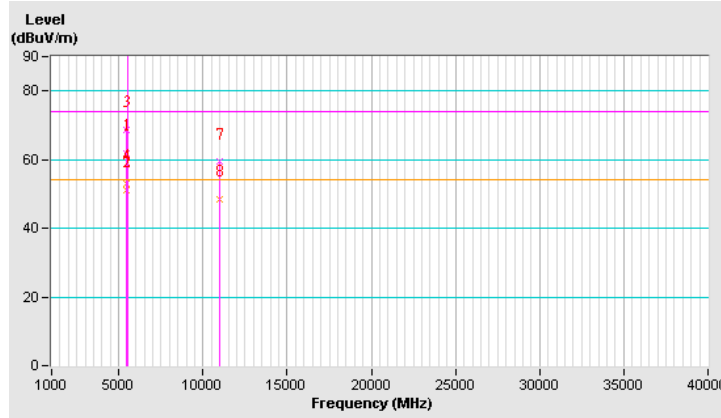


CHANNEL	TX Channel 100	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5420.00	61.8 PK	74.0	-12.2	1.85 V	93	55.10	6.70
2	5420.00	51.2 AV	54.0	-2.8	1.85 V	93	44.50	6.70
3	#5470.00	68.6 PK	74.0	-5.4	1.86 V	82	61.80	6.80
4	#5470.00	53.0 AV	54.0	-1.0	1.86 V	82	46.20	6.80
5	*5500.00	121.2 PK			1.87 V	92	81.20	40.00
6	*5500.00	112.1 AV			1.87 V	92	72.10	40.00
7	11000.00	59.3 PK	74.0	-14.7	1.72 V	100	40.20	19.10
8	11000.00	48.6 AV	54.0	-5.4	1.72 V	100	29.50	19.10

Remark:

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

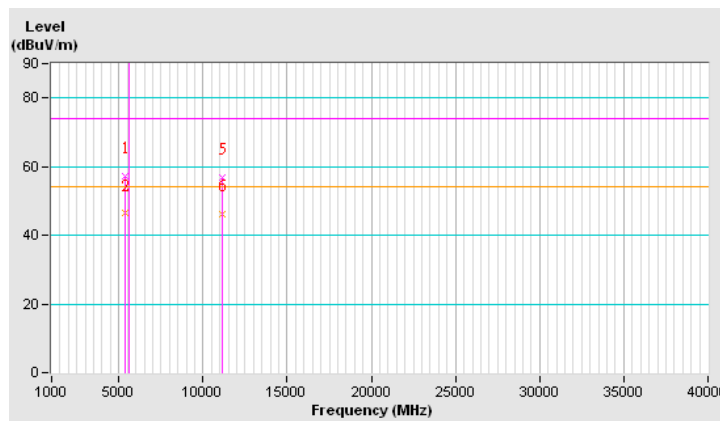


CHANNEL	TX Channel 116	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5400.00	57.3 PK	74.0	-16.7	1.02 H	53	50.60	6.70
2	5400.00	46.3 AV	54.0	-7.7	1.02 H	53	39.60	6.70
3	*5580.00	102.4 PK			1.46 H	95	62.30	40.10
4	*5580.00	92.1 AV			1.46 H	95	52.00	40.10
5	11160.00	56.7 PK	74.0	-17.3	1.18 H	69	38.00	18.70
6	11160.00	46.2 AV	54.0	-7.8	1.18 H	69	27.50	18.70

Remark:

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

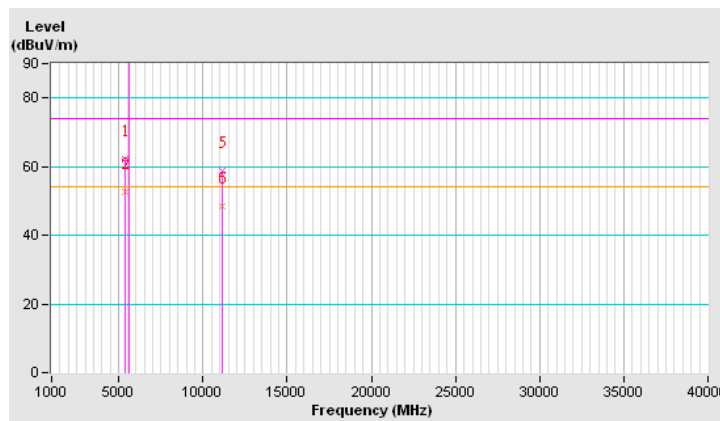


CHANNEL	TX Channel 116	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5400.00	62.3 PK	74.0	-11.7	1.77 V	81	55.60	6.70
2	5400.00	52.7 AV	54.0	-1.3	1.77 V	81	46.00	6.70
3	*5580.00	118.8 PK			1.89 V	93	78.70	40.10
4	*5580.00	109.4 AV			1.89 V	93	69.30	40.10
5	11160.00	58.8 PK	74.0	-15.2	1.88 V	87	40.10	18.70
6	11160.00	48.4 AV	54.0	-5.6	1.88 V	87	29.70	18.70

Remark:

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

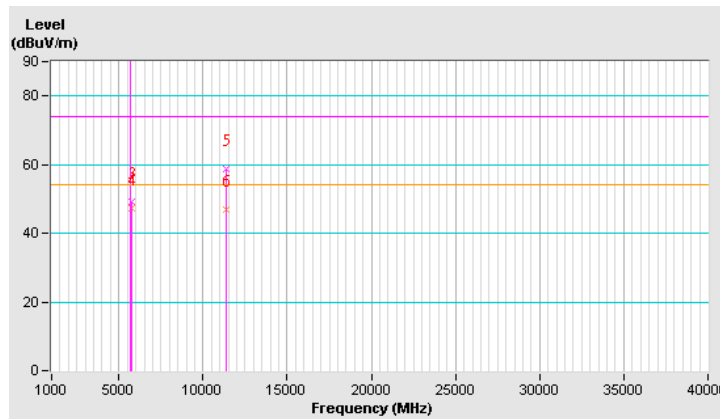


CHANNEL	TX Channel 140	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5700.00	101.4 PK			1.19 H	99	61.10	40.30
2	*5700.00	91.8 AV			1.19 H	99	51.50	40.30
3	#5725.00	49.1 PK	74.0	-24.9	1.00 H	62	41.90	7.20
4	#5725.00	47.2 AV	54.0	-6.8	1.00 H	62	40.00	7.20
5	11400.00	58.8 PK	74.0	-15.2	1.03 H	56	40.50	18.30
6	11400.00	46.8 AV	54.0	-7.2	1.03 H	56	28.50	18.30

Remark:

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

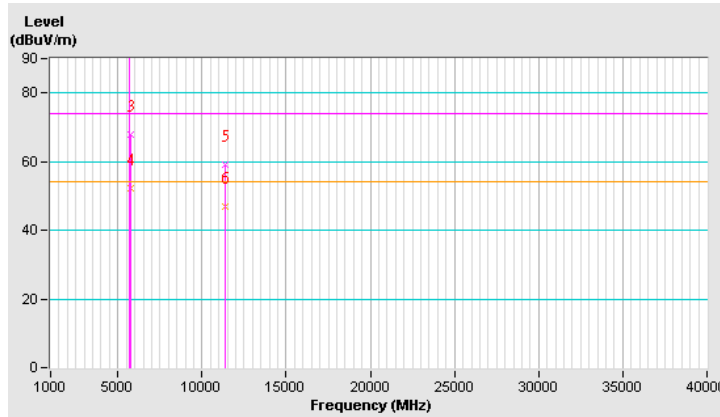


CHANNEL	TX Channel 140	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5700.00	115.8 PK			1.87 V	57	75.50	40.30
2	*5700.00	107.2 AV			1.87 V	57	66.90	40.30
3	#5725.00	67.9 PK	74.0	-6.1	2.04 V	104	60.70	7.20
4	#5725.00	52.2 AV	54.0	-1.8	2.04 V	104	45.00	7.20
5	11400.00	59.2 PK	74.0	-14.8	1.61 V	52	40.90	18.30
6	11400.00	47.0 AV	54.0	-7.0	1.61 V	52	28.70	18.30

Remark:

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



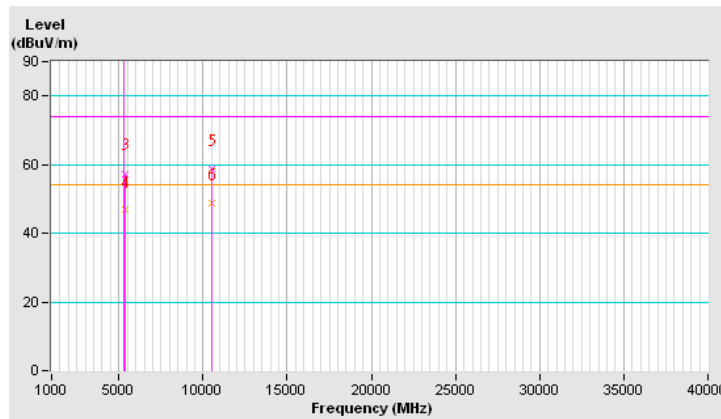
802.11n (HT40)

CHANNEL	TX Channel 54	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5270.00	105.6 PK			1.23 H	91	65.90	39.70
2	*5270.00	97.1 AV			1.23 H	91	57.40	39.70
3	5400.00	57.4 PK	74.0	-16.6	1.34 H	86	50.70	6.70
4	5400.00	46.7 AV	54.0	-7.3	1.34 H	86	40.00	6.70
5	#10540.00	58.6 PK	74.0	-15.4	1.22 H	82	40.20	18.40
6	#10540.00	48.8 AV	54.0	-5.2	1.22 H	82	30.40	18.40

Remark:

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

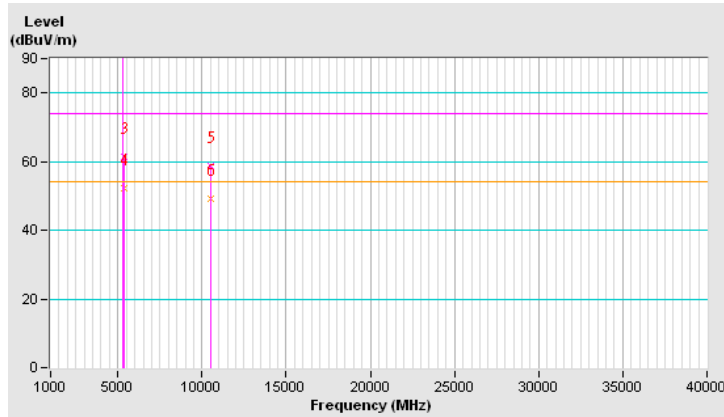


CHANNEL	TX Channel 54	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5270.00	119.7 PK			1.68 V	88	80.00	39.70
2	*5270.00	110.9 AV			1.68 V	88	71.20	39.70
3	5400.00	61.4 PK	74.0	-12.6	1.91 V	99	54.70	6.70
4	5400.00	52.4 AV	54.0	-1.6	1.91 V	99	45.70	6.70
5	#10540.00	58.9 PK	74.0	-15.1	1.60 V	22	40.50	18.40
6	#10540.00	49.1 AV	54.0	-4.9	1.60 V	22	30.70	18.40

Remark:

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

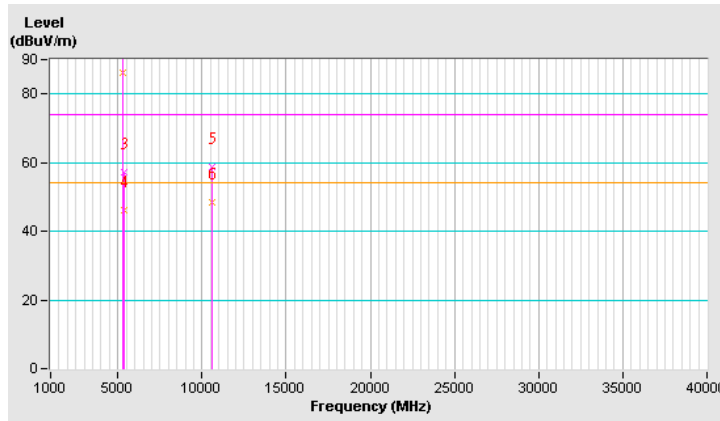


CHANNEL	TX Channel 62	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5310.00	95.1 PK			1.33 H	106	55.40	39.70
2	*5310.00	86.3 AV			1.33 H	106	46.60	39.70
3	5350.00	57.1 PK	74.0	-16.9	1.33 H	108	50.70	6.40
4	5350.00	46.2 AV	54.0	-7.8	1.33 H	108	39.80	6.40
5	10620.00	58.6 PK	74.0	-15.4	1.02 H	65	40.40	18.20
6	10620.00	48.4 AV	54.0	-5.6	1.02 H	65	30.20	18.20

Remark:

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

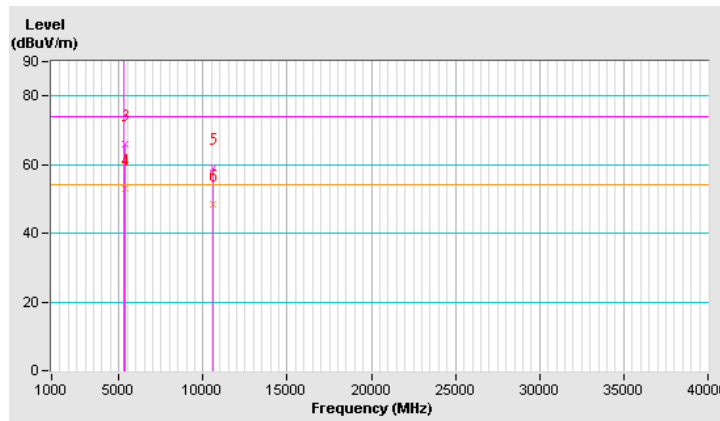


CHANNEL	TX Channel 62	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5310.00	110.7 PK			1.86 V	73	71.00	39.70
2	*5310.00	101.9 AV			1.86 V	73	62.20	39.70
3	5350.00	65.9 PK	74.0	-8.1	1.72 V	274	59.50	6.40
4	5350.00	53.0 AV	54.0	-1.0	1.72 V	274	46.60	6.40
5	10620.00	59.3 PK	74.0	-14.7	1.59 V	23	41.10	18.20
6	10620.00	48.6 AV	54.0	-5.4	1.59 V	23	30.40	18.20

Remark:

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

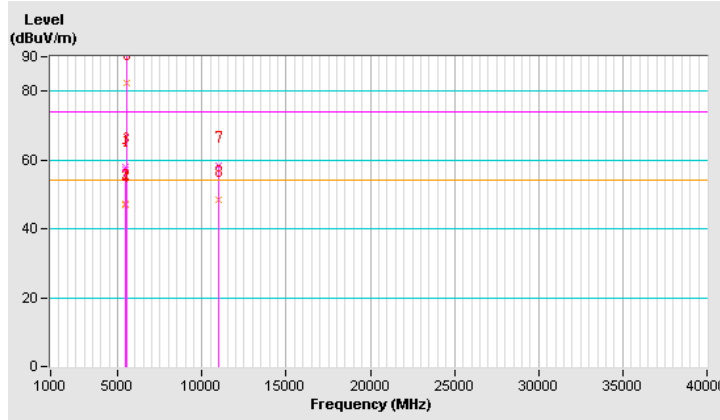


CHANNEL	TX Channel 102	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5460.00	57.3 PK	74.0	-16.7	1.15 H	161	50.50	6.80
2	5460.00	47.1 AV	54.0	-6.9	1.15 H	161	40.30	6.80
3	#5470.00	58.0 PK	74.0	-16.0	1.40 H	133	51.20	6.80
4	#5470.00	47.0 AV	54.0	-7.0	1.40 H	133	40.20	6.80
5	*5510.00	92.5 PK			1.30 H	99	52.50	40.00
6	*5510.00	82.4 AV			1.30 H	99	42.40	40.00
7	11020.00	58.3 PK	74.0	-15.7	1.11 H	82	39.30	19.00
8	11020.00	48.3 AV	54.0	-5.7	1.11 H	82	29.30	19.00

Remark:

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

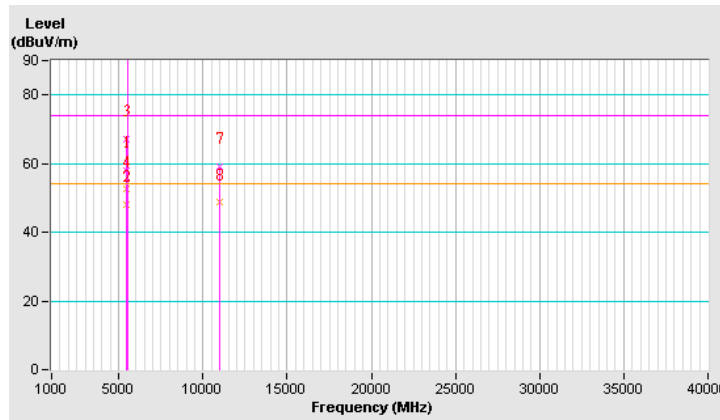


CHANNEL	TX Channel 102	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5460.00	57.9 PK	74.0	-16.1	1.78 V	78	51.10	6.80
2	5460.00	48.1 AV	54.0	-5.9	1.78 V	78	41.30	6.80
3	#5470.00	67.2 PK	74.0	-6.8	1.83 V	64	60.40	6.80
4	#5470.00	52.4 AV	54.0	-1.6	1.83 V	64	45.60	6.80
5	*5510.00	109.5 PK			1.81 V	71	69.50	40.00
6	*5510.00	100.7 AV			1.81 V	71	60.70	40.00
7	11020.00	59.2 PK	74.0	-14.8	1.69 V	69	40.20	19.00
8	11020.00	48.6 AV	54.0	-5.4	1.69 V	69	29.60	19.00

Remark:

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

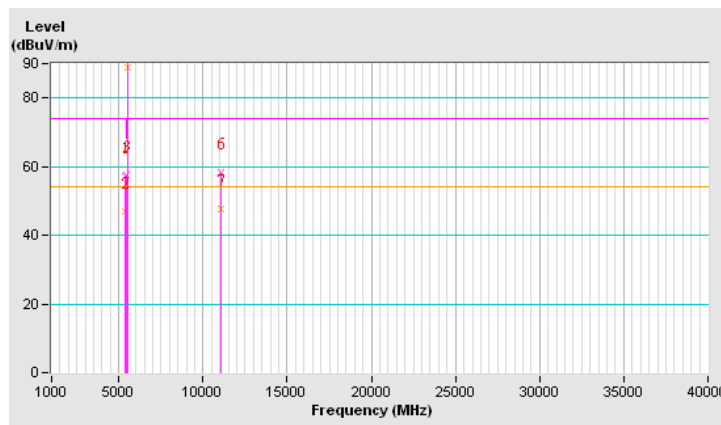


CHANNEL	TX Channel 110	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	5400.00	57.2 PK	74.0	-16.8	1.01 H	235	50.50	6.70
2	5400.00	47.0 AV	54.0	-7.0	1.01 H	235	40.30	6.70
3	#5470.00	57.6 PK	68.2	-10.6	1.11 H	100	50.80	6.80
4	*5550.00	97.4 PK			1.08 H	272	57.30	40.10
5	*5550.00	88.7 AV			1.08 H	272	48.60	40.10
6	11100.00	58.4 PK	74.0	-15.6	1.06 H	69	39.90	18.50
7	11100.00	47.7 AV	54.0	-6.3	1.06 H	69	29.20	18.50

Remark:

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

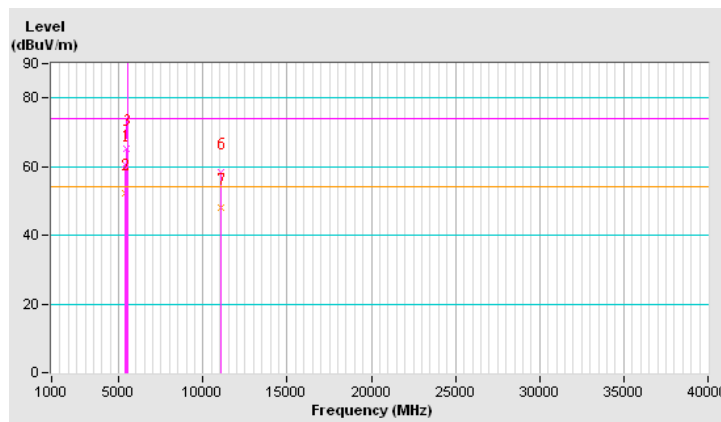


CHANNEL	TX Channel 110	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	5400.00	60.7 PK	74.0	-13.3	2.00 V	272	54.00	6.70
2	5400.00	52.2 AV	54.0	-1.8	2.00 V	272	45.50	6.70
3	#5470.00	65.1 PK	68.2	-3.1	1.98 V	271	58.30	6.80
4	*5550.00	118.2 PK			1.87 V	94	78.10	40.10
5	*5550.00	109.3 AV			1.87 V	94	69.20	40.10
6	11100.00	58.4 PK	74.0	-15.6	1.96 V	76	39.90	18.50
7	11100.00	48.2 AV	54.0	-5.8	1.96 V	76	29.70	18.50

Remark:

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

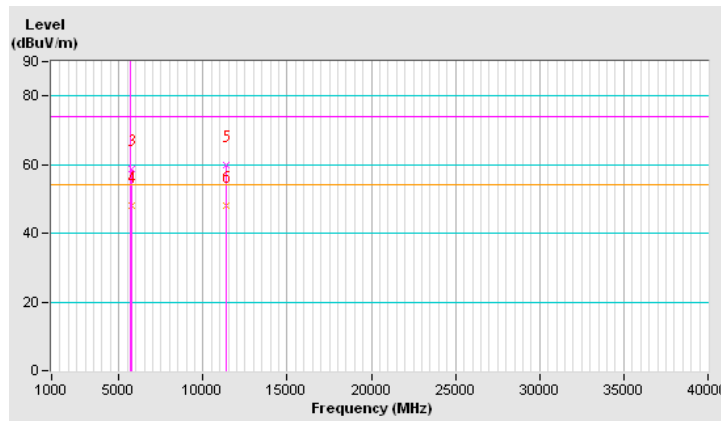


CHANNEL	TX Channel 134	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*5670.00	100.2 PK			1.38 H	87	60.00	40.20
2	*5670.00	91.3 AV			1.38 H	87	51.10	40.20
3	#5725.00	58.8 PK	74.0	-15.2	1.28 H	85	51.60	7.20
4	#5725.00	48.0 AV	54.0	-6.0	1.28 H	85	40.80	7.20
5	11340.00	60.0 PK	74.0	-14.0	1.03 H	87	41.30	18.70
6	11340.00	48.2 AV	54.0	-5.8	1.03 H	87	29.50	18.70

Remark:

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

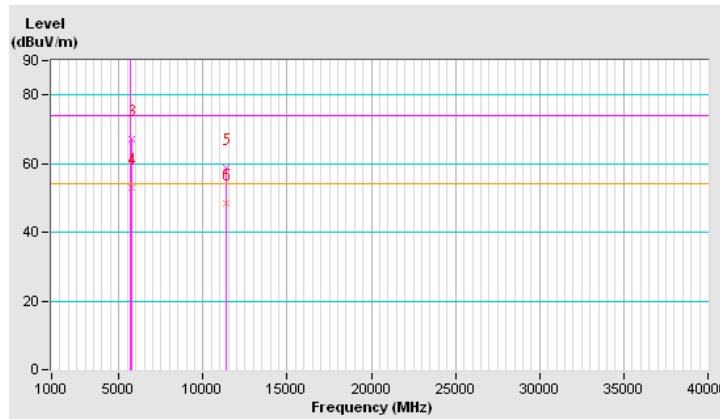


CHANNEL	TX Channel 134	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 40GHz		Average (AV)

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	*5670.00	116.5 PK			2.13 V	59	76.30	40.20
2	*5670.00	108.4 AV			2.13 V	59	68.20	40.20
3	#5725.00	67.3 PK	74.0	-6.7	2.08 V	127	60.10	7.20
4	#5725.00	53.0 AV	54.0	-1.0	2.08 V	127	45.80	7.20
5	11340.00	58.8 PK	74.0	-15.2	1.94 V	62	40.10	18.70
6	11340.00	48.3 AV	54.0	-5.7	1.94 V	62	29.60	18.70

Remark:

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



Below 1GHz worst-case data

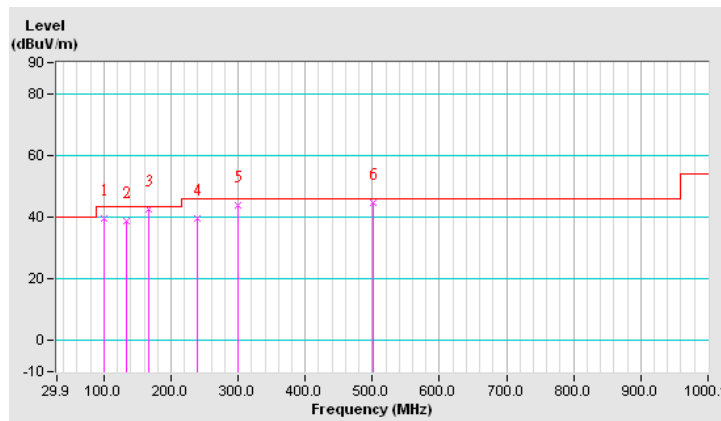
802.11n (HT20)

CHANNEL	TX Channel 100	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	99.89	39.6 QP	43.5	-3.9	2.00 H	36	58.50	-18.90
2	132.95	38.9 QP	43.5	-4.6	2.00 H	16	54.20	-15.30
3	166.00	42.4 QP	43.5	-1.1	1.50 H	34	56.60	-14.20
4	239.88	39.5 QP	46.0	-6.5	1.00 H	139	54.50	-15.00
5	300.16	43.7 QP	46.0	-2.3	1.00 H	133	56.10	-12.40
6	500.42	44.8 QP	46.0	-1.2	1.50 H	146	53.10	-8.30

Remark:

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

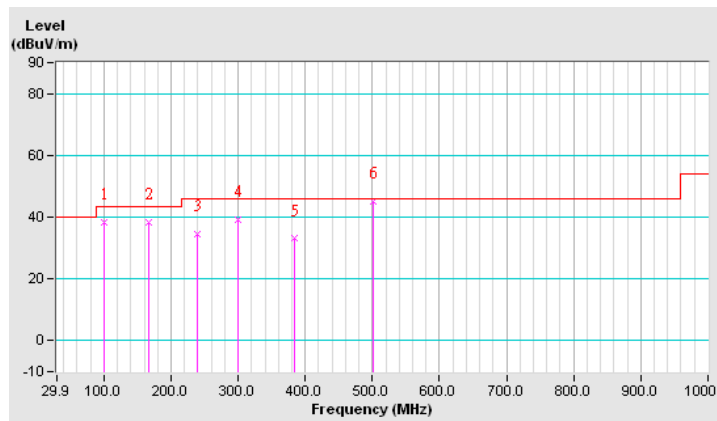


CHANNEL	TX Channel 100	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 1GHz		

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	99.89	38.1 QP	43.5	-5.4	1.00 V	95	57.00	-18.90
2	166.00	38.4 QP	43.5	-5.1	1.49 V	127	52.60	-14.20
3	239.88	34.3 QP	46.0	-11.7	1.99 V	172	49.30	-15.00
4	300.16	39.3 QP	46.0	-6.7	1.00 V	90	51.70	-12.40
5	383.76	33.0 QP	46.0	-13.0	1.00 V	250	43.80	-10.80
6	500.42	45.0 QP	46.0	-1.0	1.00 V	263	53.30	-8.30

Remark:

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



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

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

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

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 11, 2014	Nov. 10, 2015
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Dec. 26, 2014	Dec. 25, 2015
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Feb. 26, 2015	Feb. 25, 2016
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Jul. 24, 2015	Jul. 23, 2016
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

- Note:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Shielded Room 1.
 3. The VCCI Site Registration No. is C-2040.

4.2.3 Test Procedures

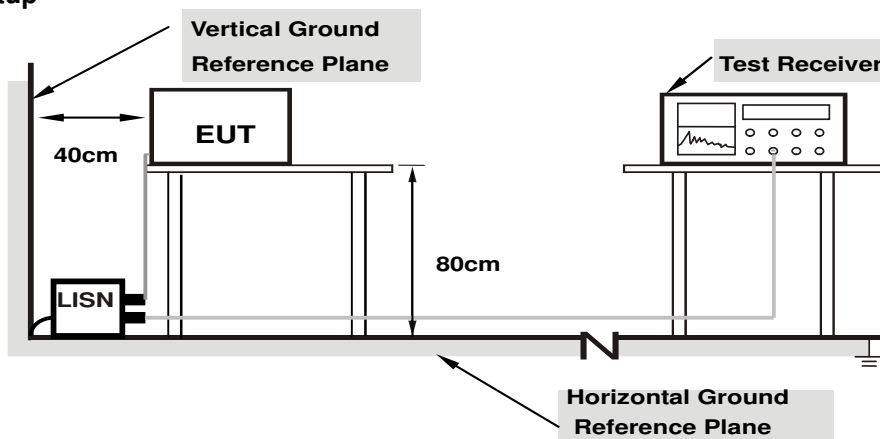
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



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

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

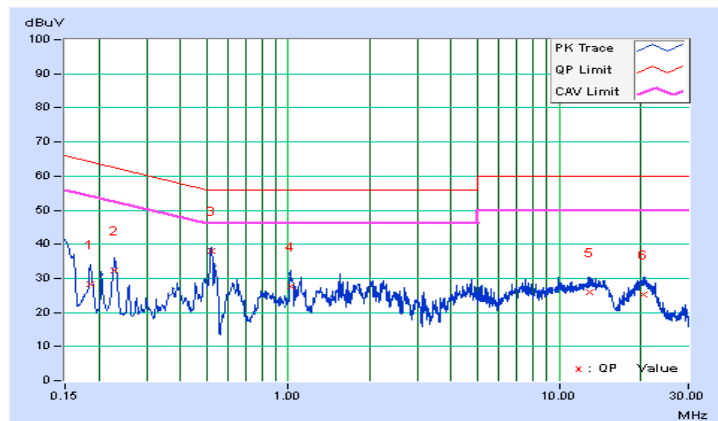
4.2.7 Test Results

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

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
			1	0.18519	9.83	18.40	6.57	28.23	16.40	64.25
2	0.22851	9.85	22.38	21.82	32.23	31.67	62.50	52.50	-30.28	-20.84
3	0.52130	9.89	28.13	26.67	38.02	36.56	56.00	46.00	-17.98	-9.44
4	1.01799	9.93	17.70	15.21	27.63	25.14	56.00	46.00	-28.37	-20.86
5	13.04518	10.69	15.10	7.82	25.79	18.51	60.00	50.00	-34.21	-31.49
6	20.49764	11.11	14.13	8.19	25.24	19.30	60.00	50.00	-34.76	-30.70

Remarks:

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

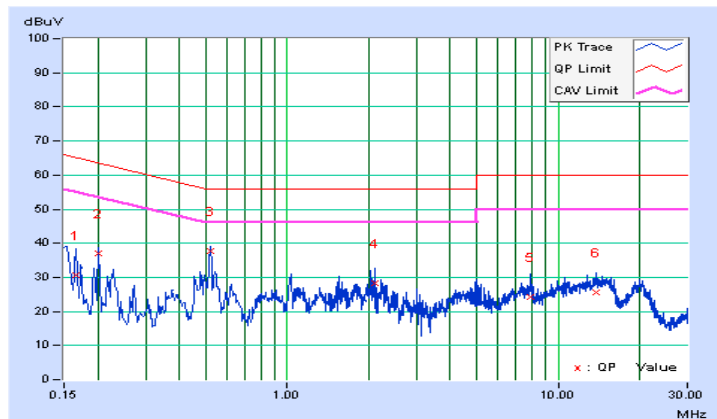


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
			1	0.16569	9.82	20.73	6.20	30.55	16.02	65.17
2	0.20084	9.83	27.31	6.80	37.14	16.63	63.58	53.58	-26.44	-36.95
3	0.52145	9.89	27.79	26.36	37.68	36.25	56.00	46.00	-18.32	-9.75
4	2.10891	10.00	18.19	9.82	28.19	19.82	56.00	46.00	-27.81	-26.18
5	7.92699	10.36	13.78	6.44	24.14	16.80	60.00	50.00	-35.86	-33.20
6	13.73725	10.65	14.89	8.24	25.54	18.89	60.00	50.00	-34.46	-31.11

Remarks:

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



4.3 Transmit Power Measurement

4.3.1 Limits of Transmit Power Measurement

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

*B is the 26 dB emission bandwidth in megahertz

Per KDB 662911 Method of conducted output power measurement on IEEE 802.11 devices,

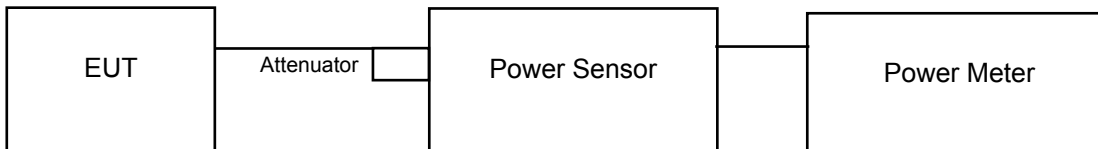
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

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

Array Gain = $5 \log(N_{ANT}/N_{SS})$ dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

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

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

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.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

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

4.3.7 Test Result

Power Output:

802.11a

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
52	5260	14.66	13.17	13.74	73.650	18.67	23.00	Pass
60	5300	14.73	13.52	14.03	77.501	18.89	23.00	Pass
64	5320	14.53	13.41	13.92	74.967	18.75	23.00	Pass
100	5500	14.02	15.31	14.51	87.447	19.42	23.00	Pass
116	5580	14.51	15.28	14.62	90.951	19.59	23.00	Pass
140	5700	13.48	14.97	15.28	87.418	19.42	23.00	Pass

*Gain: 7dBi > 6dBi, power limit shall be reduced to 24-(7-6) = 23.0dBm.

Note:

Chain 0

1. 11dBm + 10log(22.77)= 24.57>23dBm
2. 11dBm + 10log(22.69)= 24.56>23dBm
3. 11dBm + 10log(22.68)= 24.56>23dBm
4. 11dBm + 10log(23.05)= 24.63>23dBm
5. 11dBm + 10log(22.98)= 24.61>23dBm
6. 11dBm + 10log(22.64)= 24.55>23dBm

Chain 1

1. 11dBm + 10log(22.21)= 24.47>23dBm
2. 11dBm + 10log(21.85)= 24.39>23dBm
3. 11dBm + 10log(22.41)= 24.50>23dBm
4. 11dBm + 10log(21.33)= 24.29>23dBm
5. 11dBm + 10log(22.65)= 24.55>23dBm
6. 11dBm + 10log(22.28)= 24.48>23dBm

Chain 2

1. 11dBm + 10log(22.13)= 24.45>23dBm
2. 11dBm + 10log(21.95)= 24.41>23dBm
3. 11dBm + 10log(22.13)= 24.45>23dBm
4. 11dBm + 10log(22.45)= 24.51>23dBm
5. 11dBm + 10log(22.35)= 24.49>23dBm
6. 11dBm + 10log(21.70)= 24.36>23dBm

802.11n (HT20)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
52	5260	14.21	13.33	15.05	79.880	19.02	23.00	Pass
60	5300	14.62	13.59	14.39	79.308	18.99	23.00	Pass
64	5320	14.71	13.82	14.82	84.018	19.24	23.00	Pass
100	5500	15.13	15.34	14.72	96.430	19.84	23.00	Pass
116	5580	15.31	15.01	14.63	94.699	19.76	23.00	Pass
140	5700	13.94	14.06	15.08	82.453	19.16	23.00	Pass

*Gain: 7dBi > 6dBi, power limit shall be reduced to 24-(7-6) = 23.0dBm.

Note:

Chain 0

1. 11dBm + 10log(23.43)= 24.70>23dBm
2. 11dBm + 10log(23.71)= 24.75>23dBm
3. 11dBm + 10log(23.86)= 24.78>23dBm
4. 11dBm + 10log(23.61)= 24.73>23dBm
5. 11dBm + 10log(23.66)= 24.74>23dBm
6. 11dBm + 10log(23.20)= 24.65>23dBm

Chain 1

1. 11dBm + 10log(23.40)= 24.69>23dBm
2. 11dBm + 10log(23.73)= 24.75>23dBm
3. 11dBm + 10log(23.64)= 24.74>23dBm
4. 11dBm + 10log(21.82)= 24.39>23dBm
5. 11dBm + 10log(22.20)= 24.46>23dBm
6. 11dBm + 10log(23.83)= 24.77>23dBm

Chain 2

1. 11dBm + 10log(23.30)= 24.67>23dBm
2. 11dBm + 10log(23.37)= 24.69>23dBm
3. 11dBm + 10log(23.39)= 24.69>23dBm
4. 11dBm + 10log(22.99)= 24.62>23dBm
5. 11dBm + 10log(23.37)= 24.69>23dBm
6. 11dBm + 10log(23.24)= 24.66>23dBm

802.11n (HT40)

Channel	Channel Frequency (MHz)	Maximum Conducted Power (dBm)			Total Power (mW)	Total Power (dBm)	Power Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
54	5270	16.52	15.51	16.12	121.364	20.84	23.00	Pass
62	5310	10.40	8.26	9.44	26.454	14.22	23.00	Pass
102	5510	9.74	9.37	9.51	27.002	14.31	23.00	Pass
110	5550	16.95	16.11	16.53	135.355	21.31	23.00	Pass
134	5670	16.81	17.09	17.01	149.375	21.74	23.00	Pass

*Gain: 7dBi > 6dBi, power limit shall be reduced to 24-(7-6) = 23.0dBm.

Note:

Chain 0

1. 11dBm + 10log(50.13)= 28.00>23dBm
2. 11dBm + 10log(50.12)= 28.00>23dBm
3. 11dBm + 10log(48.34)= 27.84>23dBm
4. 11dBm + 10log(48.74)= 27.88>23dBm
5. 11dBm + 10log(49.50)= 27.95>23dBm

Chain 1

1. 11dBm + 10log(47.38)= 27.76>23dBm
2. 11dBm + 10log(47.06)= 27.73>23dBm
3. 11dBm + 10log(48.14)= 27.83>23dBm
4. 11dBm + 10log(47.92)= 27.81>23dBm
5. 11dBm + 10log(48.42)= 27.85>23dBm

Chain 2

1. 11dBm + 10log(48.30)= 27.84>23dBm
2. 11dBm + 10log(48.15)= 27.83>23dBm
3. 11dBm + 10log(48.11)= 27.82>23dBm
4. 11dBm + 10log(48.72)= 27.88>23dBm
5. 11dBm + 10log(46.90)= 27.71>23dBm

26dB Bandwidth:
802.11a

Channel	Channel Frequency (MHz)	26dBc Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
52	5260	22.77	22.21	22.13	Pass
60	5300	22.69	21.85	21.95	Pass
64	5320	22.68	22.41	22.13	Pass
100	5500	23.05	21.33	22.45	Pass
116	5580	22.98	22.65	22.35	Pass
140	5700	22.64	22.28	21.70	Pass

802.11n (HT20)

Channel	Channel Frequency (MHz)	26dBc Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
52	5260	23.43	23.40	23.30	Pass
60	5300	23.71	23.73	23.37	Pass
64	5320	23.86	23.64	23.39	Pass
100	5500	23.61	21.82	22.99	Pass
116	5580	23.66	22.20	23.37	Pass
140	5700	23.20	23.83	23.24	Pass

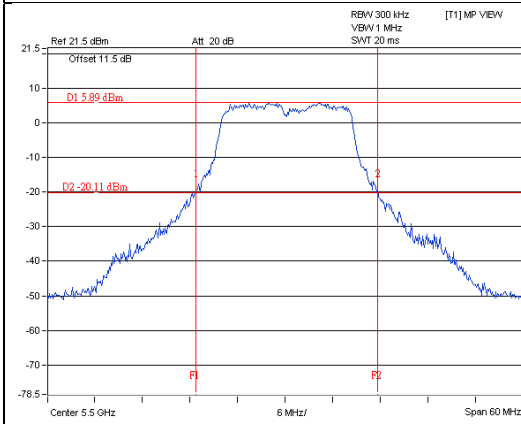
802.11n (HT40)

Channel	Channel Frequency (MHz)	26dBc Bandwidth (MHz)			Pass / Fail
		Chain 0	Chain 1	Chain 2	
54	5270	50.13	47.38	48.30	Pass
62	5310	50.12	47.06	48.15	Pass
102	5510	48.34	48.14	48.11	Pass
110	5550	48.74	47.92	48.72	Pass
134	5670	49.50	48.42	46.90	Pass

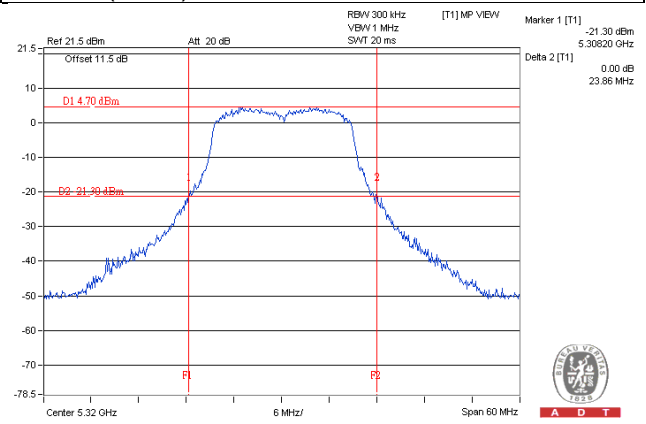
Spectrum Plot of Worst Value

802.11a

802.11n (HT20)

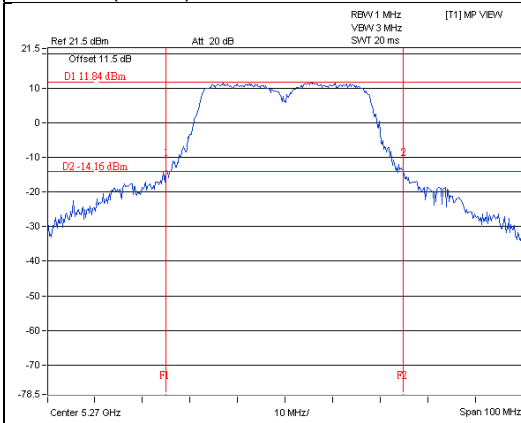


A D T



A D T

802.11n (HT40)



A D T

Occupied Bandwidth:
802.11a

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2
52	5260	16.92	16.56	16.68
60	5300	16.68	16.56	16.56
64	5320	16.56	16.56	16.68
100	5500	16.92	16.68	16.80
116	5580	16.80	16.56	16.80
140	5700	16.68	16.68	16.68

802.11n (HT20)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2
52	5260	17.88	18.00	17.88
60	5300	17.88	18.12	17.88
64	5320	17.64	17.88	17.76
100	5500	18.00	17.76	17.76
116	5580	17.88	17.52	17.88
140	5700	17.76	18.12	17.88

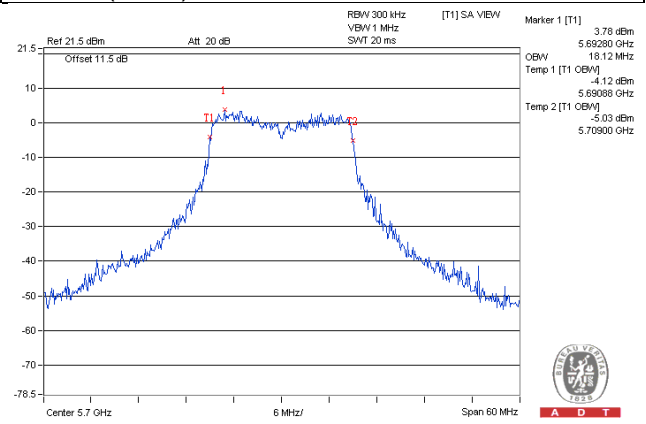
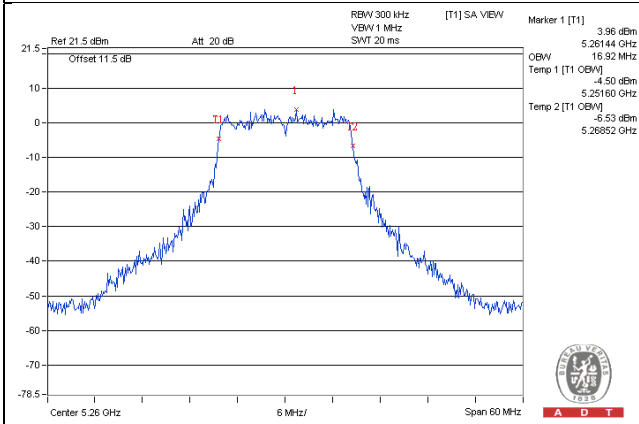
802.11n (HT40)

Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)		
		Chain 0	Chain 1	Chain 2
54	5270	36.72	36.72	36.72
62	5310	36.72	36.48	36.84
102	5510	36.60	36.48	36.84
110	5550	36.84	36.24	36.72
134	5670	36.84	36.72	36.60

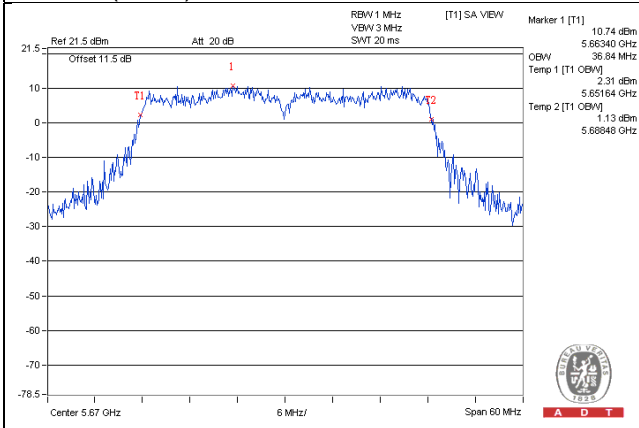
Spectrum Plot of Worst Value

802.11a

802.11n (HT20)



802.11n (HT40)



EUT MAXIMUM CONDUCTED POWER

802.11a

Frequency Band (MHz)	Max. Power	
	Output Power (mW)	Output Power (dBm)
5250~5350	77.501	18.89
5470~5725	90.951	19.59

Note: Manufacturer provides Transmit Power Control description to meet this requirement.

802.11n (HT20)

Frequency Band (MHz)	Max. Power	
	Output Power (mW)	Output Power (dBm)
5250~5350	84.018	19.24
5470~5725	96.430	19.84

Note: Manufacturer provides Transmit Power Control description to meet this requirement.

802.11n (HT40)

Frequency Band (MHz)	Max. Power	
	Output Power (mW)	Output Power (dBm)
5250~5350	121.364	20.84
5470~5725	149.375	21.74

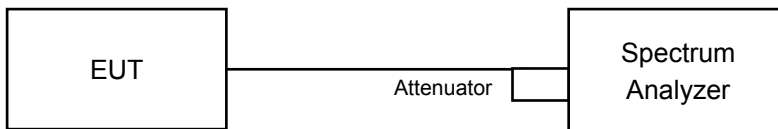
Note: Manufacturer provides Transmit Power Control description to meet this requirement.

4.4 Peak Power Spectral Density Measurement

4.4.1 Limits of Peak Power Spectral Density Measurement

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

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

Using method SA-2

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

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as Item 4.3.6.

4.4.7 Test Results

802.11a

Chan.	Frequency (MHz)	PSD (dBm/MHz)			Total PSD W/O Duty Factor (dBm/MHz)	Duty Factor	Total PSD With Duty Factor (dBm/MHz)	Maximum Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2					
52	5260	-0.48	-1.72	-1.40	3.61	0.20	3.81	5.23	Pass
60	5300	-0.84	-0.77	-1.70	3.69	0.20	3.89	5.23	Pass
64	5320	-0.62	0.13	-1.85	4.07	0.20	4.27	5.23	Pass
100	5500	0.62	0.18	-3.11	4.29	0.20	4.49	5.23	Pass
116	5580	-0.55	0.42	-1.51	4.30	0.20	4.50	5.23	Pass
140	5700	-0.07	0.20	0.40	4.96	0.20	5.16	5.23	Pass

Note:

- Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
- Directional gain = 7dBi + 10log(3) = 11.77dBi > 6dBi, so the power density limit shall be reduced to 11-(11.77-6) = 5.23dBm.
- Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT20)

Chan.	Frequency (MHz)	PSD (dBm/MHz)			Total PSD W/O Duty Factor (dBm/MHz)	Duty Factor	Total PSD With Duty Factor (dBm/MHz)	Maximum Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2					
52	5260	0.34	-0.86	-2.50	3.91	0.22	4.13	5.23	Pass
60	5300	-0.28	-1.43	-2.10	3.57	0.22	3.79	5.23	Pass
64	5320	-0.50	-1.80	-2.59	3.23	0.22	3.45	5.23	Pass
100	5500	-0.56	0.43	-1.97	4.18	0.22	4.40	5.23	Pass
116	5580	-0.02	0.64	-1.84	4.48	0.22	4.70	5.23	Pass
140	5700	0.51	-0.11	0.25	4.99	0.22	5.21	5.23	Pass

Note:

- Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
- Directional gain = 7dBi + 10log(3) = 11.77dBi > 6dBi, so the power density limit shall be reduced to 11-(11.77-6) = 5.23dBm.
- Refer to section 3.3 for duty cycle spectrum plot.

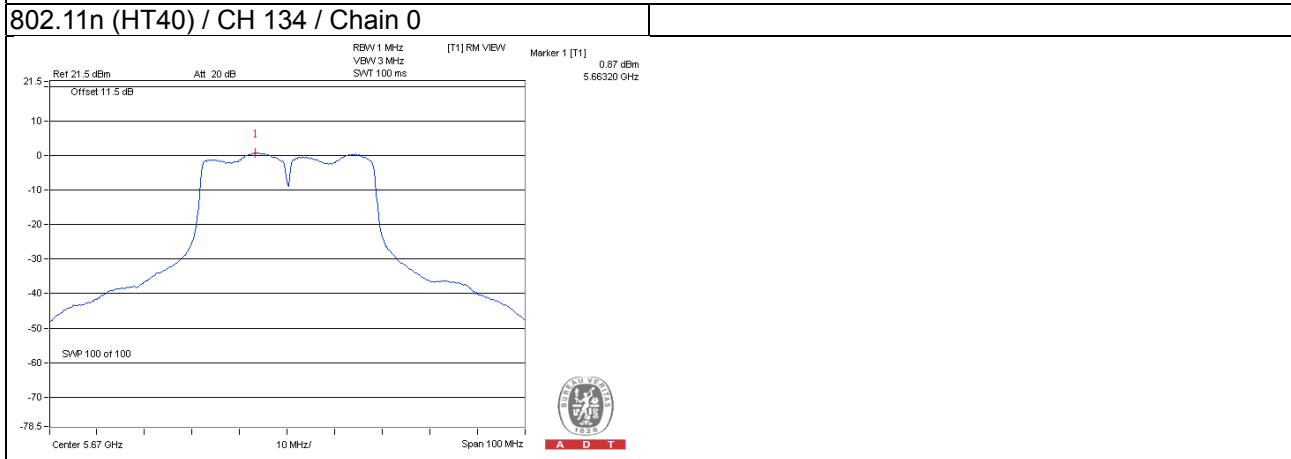
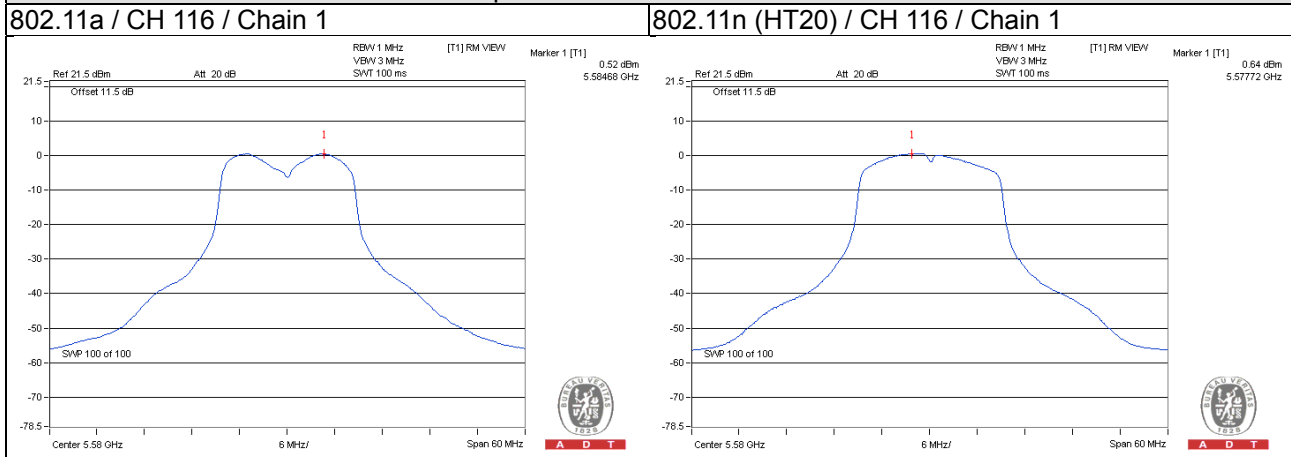
802.11n (HT40)

Chan.	Frequency (MHz)	PSD (dBm/MHz)			Total PSD W/O Duty Factor (dBm/MHz)	Duty Factor	Total PSD With Duty Factor (dBm/MHz)	Maximum Limit (dBm/MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2					
54	5270	0.10	-0.34	-0.39	4.56	0.35	4.91	5.23	Pass
62	5310	-6.07	-7.48	-7.60	-2.22	0.35	-1.87	5.23	Pass
102	5510	-6.77	-5.36	-9.62	-2.14	0.35	-1.79	5.23	Pass
110	5550	0.55	-0.34	-1.13	4.52	0.35	4.87	5.23	Pass
134	5670	0.56	-0.03	-0.30	4.86	0.35	5.21	5.23	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 = 7dBi + 10log(3) = 11.77dBi > 6dBi, so the power density limit shall be reduced to 11-(11.77-6) = 5.23dBm.
3. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value

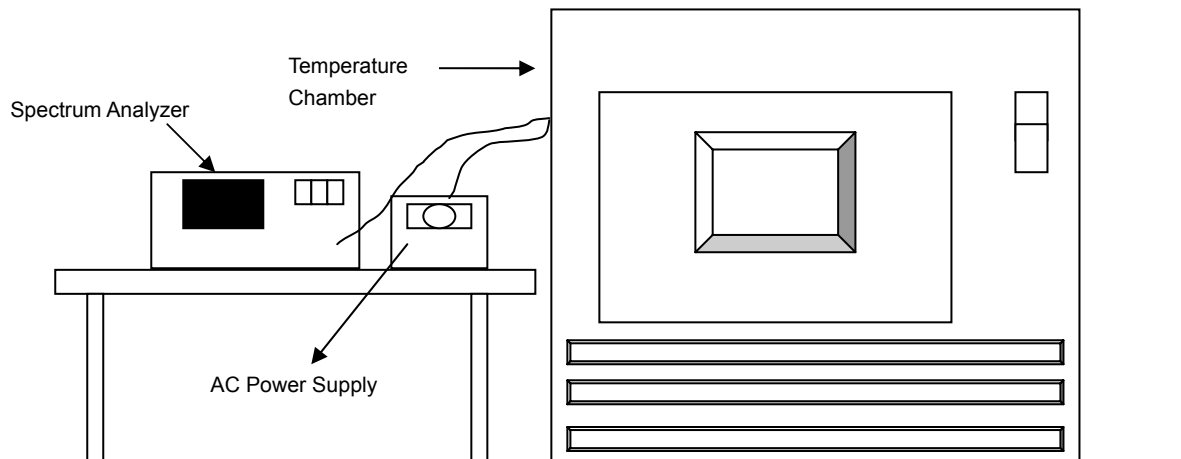


4.5 Frequency Stability

4.5.1 Limits of Frequency Stability Measurement

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

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

- a. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
- b. Turn the EUT on and couple its output to a spectrum analyzer.
- c. Turn the EUT off and set the chamber to the highest temperature specified.
- d. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
- e. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
- f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

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

4.5.7 Test Results

Frequency Stability Versus Temp.									
Operating Frequency: 5260MHz									
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 (%)
55	120	5259.9969	-0.00006	5259.9969	-0.00006	5259.9934	-0.00013	5259.9948	-0.00010
50	120	5259.9816	-0.00035	5259.9823	-0.00034	5259.9852	-0.00028	5259.9848	-0.00029
40	120	5260.0249	0.00047	5260.0253	0.00048	5260.0240	0.00046	5260.0262	0.00050
30	120	5259.9875	-0.00024	5259.9855	-0.00028	5259.9837	-0.00031	5259.9859	-0.00027
20	120	5259.9932	-0.00013	5259.9899	-0.00019	5259.9911	-0.00017	5259.9934	-0.00013
10	120	5259.9968	-0.00006	5259.9957	-0.00008	5259.9978	-0.00004	5259.9978	-0.00004
0	120	5260.0218	0.00041	5260.0217	0.00041	5260.0250	0.00048	5260.0251	0.00048
-10	120	5260.0276	0.00052	5260.0249	0.00047	5260.0252	0.00048	5260.0265	0.00050
-20	120	5260.0211	0.00040	5260.0226	0.00043	5260.0216	0.00041	5260.0198	0.00038

Frequency Stability Versus Temp.									
Operating Frequency: 5260MHz									
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	5259.9871	-0.00025	5259.9858	-0.00027	5259.9827	-0.00033	5259.9866	-0.00025
	120	5259.9875	-0.00024	5259.9855	-0.00028	5259.9837	-0.00031	5259.9859	-0.00027
	102	5259.9867	-0.00025	5259.9856	-0.00027	5259.9839	-0.00031	5259.9865	-0.00026



5 Pictures of Test Arrangements

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

Appendix – Information on the Testing Laboratories

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

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

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Web Site: www.bureauveritas-adt.com

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

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