



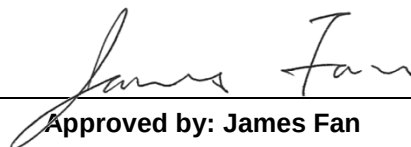
NCC RADIO TEST REPORT

Equipment : Active Loud Speaker
Brand Name : Marshall
Model Name : ACTON MULTI-ROOM
Applicant : 百滋國際股份有限公司
台北市松山區寶清街 17 號 5 樓之 1
Manufacturer : Zound Industries International AB
Room 411-412, 4th Floor, Main Building,
No. 99 Qiao Cheng East Road, Nanshan
District, Shenzhen City, China
Standard : NCC LP0002 (2018-01-10)

The product was received on May. 09, 2018, and testing was started from Jun. 28, 2018 and completed on Jul. 05, 2018. We, SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in NCC LP0002 (2018-01-10) and shown compliance with the applicable technical standards.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.


Approved by: James Fan

SPORTON INTERTIONAL INC. EMC & Wireless Communications Laboratory

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)



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History of this test report

Report No.	Version	Description	Issue Date
TR850940AC	01	Initial issue of report	Jul. 13, 2018

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	LP0002 3.10.1.6(2)(A)	6dB Bandwidth	Pass	-
3.1	-	99% Bandwidth	Pass	-
3.2	LP0002 3.10.1.2(1)(C)	Power Output Measurement	Pass	-
3.3	LP0002 3.10.1.6(2)(B)	Power Spectral Density	Pass	-
3.4	LP0002 3.10.1.5	Conducted Band Edges	Pass	-
		Conducted Spurious Emission	Pass	-
3.5	LP0002 3.10.1.5	Radiated Band Edges and Radiated Spurious Emission	Pass	Under limit -0.18 dB at 2390.00 MHz
3.6	LP0002 2.11	Receiver Radiated Emission	Pass	Under limit -5.59 dB at 934.12 MHz
3.7	LP0002 2.3	AC Conducted Emission	Pass	Under limit -15.34 dB at 0.276 MHz
3.8	LP0002 2.2 3.10.1.3 3.10.1.4	Antenna Requirement	Pass	-
3.9	LP0002 2.2 5.20.2	Maximum Power Density	Pass	-

Reviewed by: Along Chen

Report Producer: Jing Chen



1 General Description

1.1 Product Feature of Equipment Under Test

Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n, Wi-Fi 5GHz 802.11a/n/ac.

Product Specification subjective to this standard	
Antenna Type	WLAN: FPCB Antenna Bluetooth: FPCB Antenna

1.2 Modification of EUT

No modifications are made to the EUT during all test items.

1.3 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1190 and TW0007 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

Test Site No.	Sporton Site No.		
	TH05-HY	CO05-HY	03CH15-HY

Note: The test site complies with ANSI C63.4 2014 requirement.

1.4 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- NCC LP0002 (2018-01-10)
- FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
- ANSI C63.10-2013

Remark: All test items were verified and recorded according to the standards and without any deviation during the test.

2 Test Configuration of Equipment Under Test

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).
- b. AC power line Conducted Emission was tested under maximum output power.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

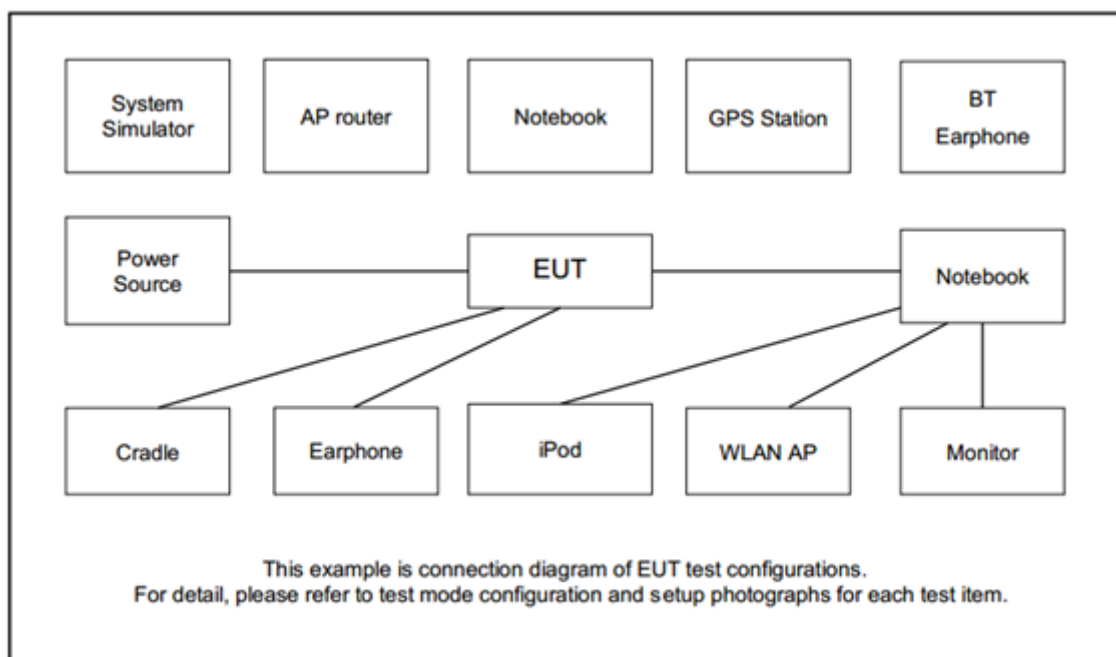
2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11b	1 Mbps
802.11g	6 Mbps
802.11n HT20	MCS0

Test Cases	
AC Conducted Emission	Mode 1: 802.11n HT20 Tx CH06_2437 MHz_MCS0 Mode 2: 802.11n HT20 Rx CH06_2437 MHz_MCS0
Receiver Radiated Emission	Mode 1: 802.11n HT20 Rx CH06_2437 MHz_MCS0

2.3 Connection Diagram of Test System



2.4 Support Unit used in test configuration and system

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	Notebook	DELL	Latitude E6430	FCC DoC	N/A	N/A
2.	iPod Nano	Apple	A1446	FCC DoC	Shielded, 1.5 m	N/A

Note: The support notebook is disconnected from EUT and removed from test table when EUT is set to transmit continuously.

2.5 EUT Operation Test Setup

The RF test items, utility "PuTTY" was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

2.6 Duty cycle

Mode	Duty Cycle (%)	Duty Cycle On (ms)	Duty Factor (dB)	VBW
802.11b	100.00%	100.00	0.00	10 Hz
802.11g	99.50%	1.46	0.02	1 kHz
802.11n HT20	99.80%	1.36	0.01	1 kHz

2.7 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Offset(dB) = RF cable loss(dB) + attenuator factor(dB).

= 4.2 + 10 = 14.2 (dB)

3 Test Result

3.1 6dB and 99% Bandwidth Measurement

3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

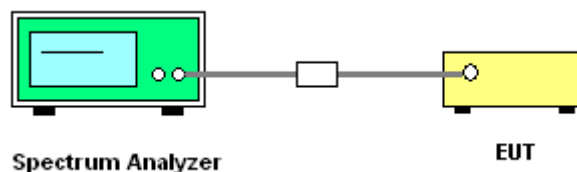
3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.1.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v04.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) = 200 kHz and set the Video bandwidth (VBW) = 1 MHz.
6. Measure and record the results in the test report.

3.1.4 Test Setup



3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4-2.4835GHz	-	-	-	-	-
802.11b_Nss1,(1Mbps)_1TX	10.145M	13.169M	13M2G1D	10.072M	13.097M
802.11g_Nss1,(6Mbps)_1TX	16.377M	16.643M	16M6D1D	16.377M	16.57M
802.11n HT20_Nss1,(MCS0)_1TX	17.609M	17.656M	17M7D1D	17.101M	17.583M

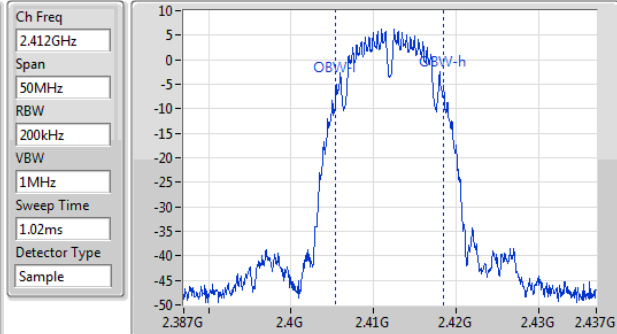
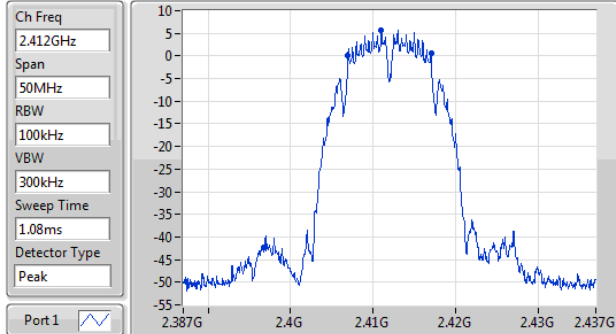
Max-N dB = Maximum 6dB down bandwidth; **Max-OBW** = Maximum 99% occupied bandwidth;

Min-N dB = Minimum 6dB down bandwidth; **Min-OBW** = Minimum 99% occupied bandwidth;

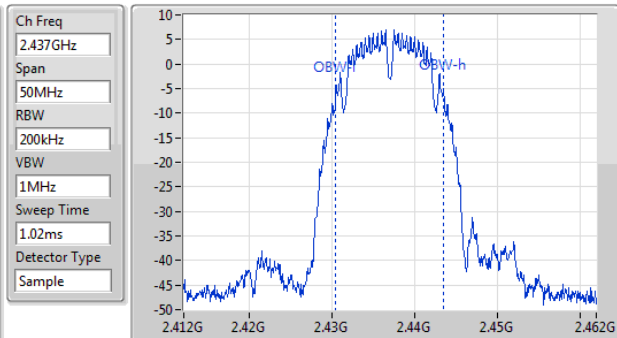
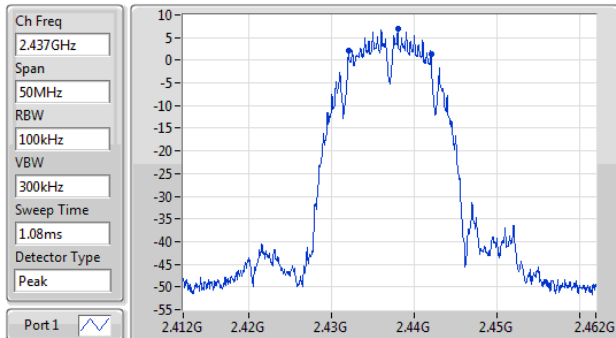
Result

Mode	Result	Limit (Hz)	Port 1-N dB (Hz)	Port 1-OBW (Hz)
802.11b_Nss1,(1Mbps)_1TX	-	-	-	-
2412MHz	Pass	500k	10.145M	13.097M
2437MHz	Pass	500k	10.072M	13.097M
2462MHz	Pass	500k	10.072M	13.169M
802.11g_Nss1,(6Mbps)_1TX	-	-	-	-
2412MHz	Pass	500k	16.377M	16.57M
2437MHz	Pass	500k	16.377M	16.643M
2462MHz	Pass	500k	16.377M	16.57M
802.11n HT20_Nss1,(MCS0)_1TX	-	-	-	-
2412MHz	Pass	500k	17.609M	17.583M
2437MHz	Pass	500k	17.536M	17.583M
2462MHz	Pass	500k	17.101M	17.656M

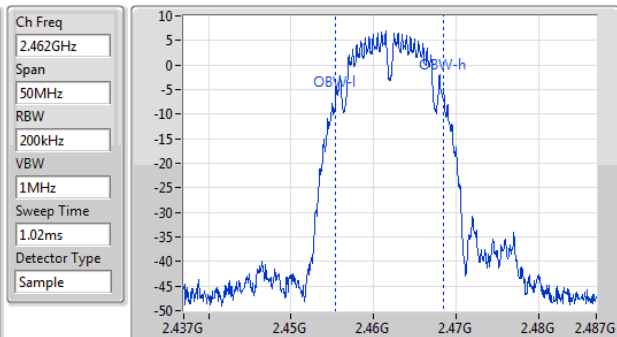
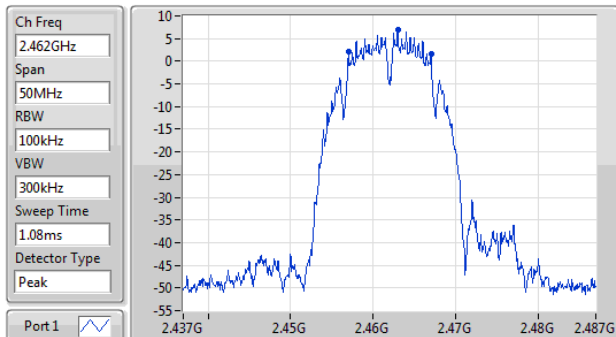
Port X-N dB = Port X 6dB down bandwidth; **Port X-OBW** = Port X 99% occupied bandwidth;

802.11b_Nss1,(1Mbps)_1TX
EBW
2412MHz


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
10.145M	2.406928G	2.417072G	13.097M	2.405415G	2.418512G	500k	1

802.11b_Nss1,(1Mbps)_1TX
EBW
2437MHz


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
10.072M	2.432G	2.442072G	13.097M	2.430415G	2.443512G	500k	1

802.11b_Nss1,(1Mbps)_1TX
EBW
2462MHz


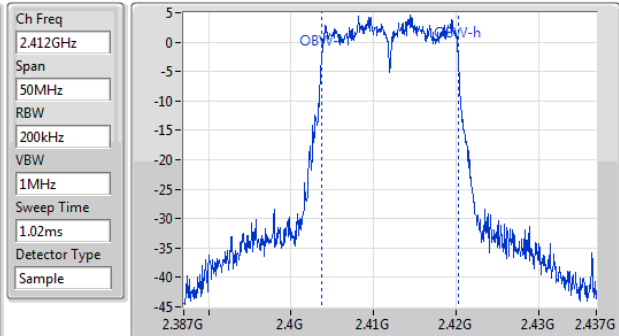
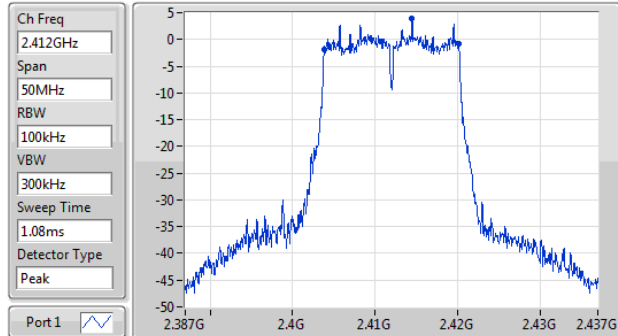
6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
10.072M	2.457G	2.467072G	13.169M	2.455343G	2.468512G	500k	1



802.11g_Nss1,(6Mbps)_1TX

EBW

2412MHz

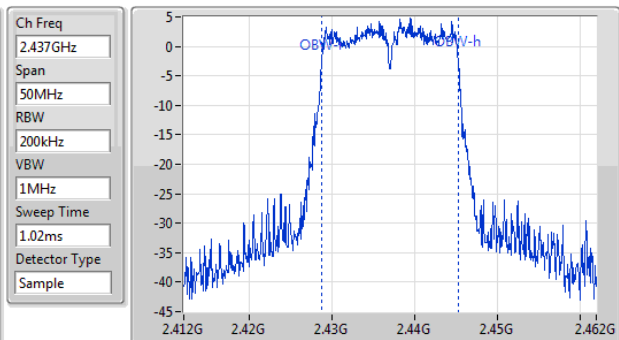
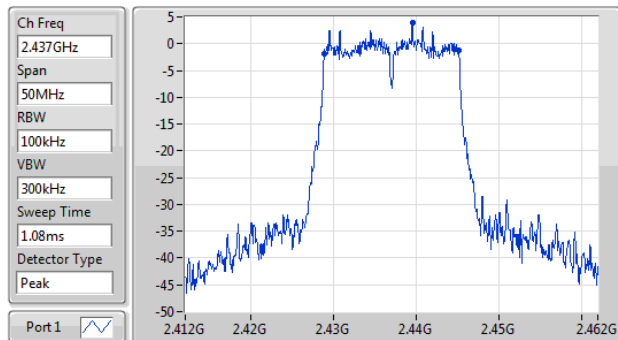


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
16.377M	2.403812G	2.420188G	16.57M	2.403679G	2.420249G	500k	1

802.11g_Nss1,(6Mbps)_1TX

EBW

2437MHz

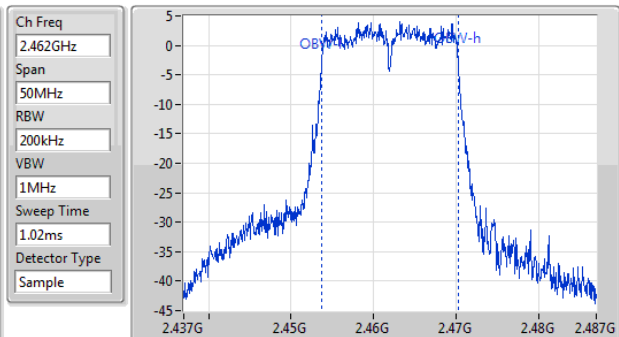
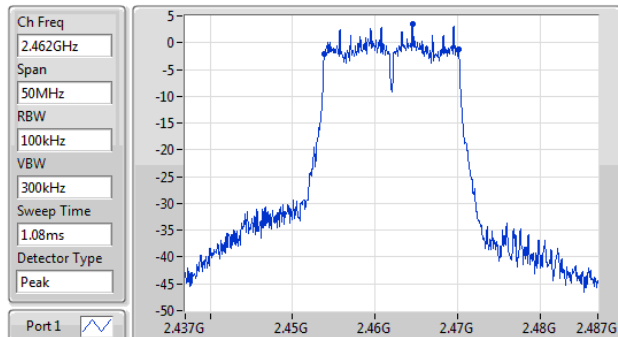


6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
16.377M	2.428812G	2.445188G	16.643M	2.428679G	2.445321G	500k	1

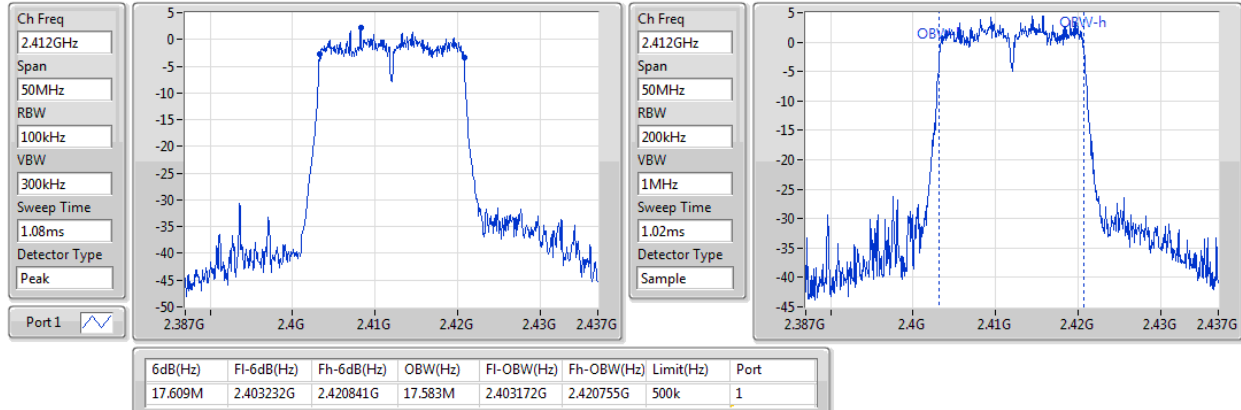
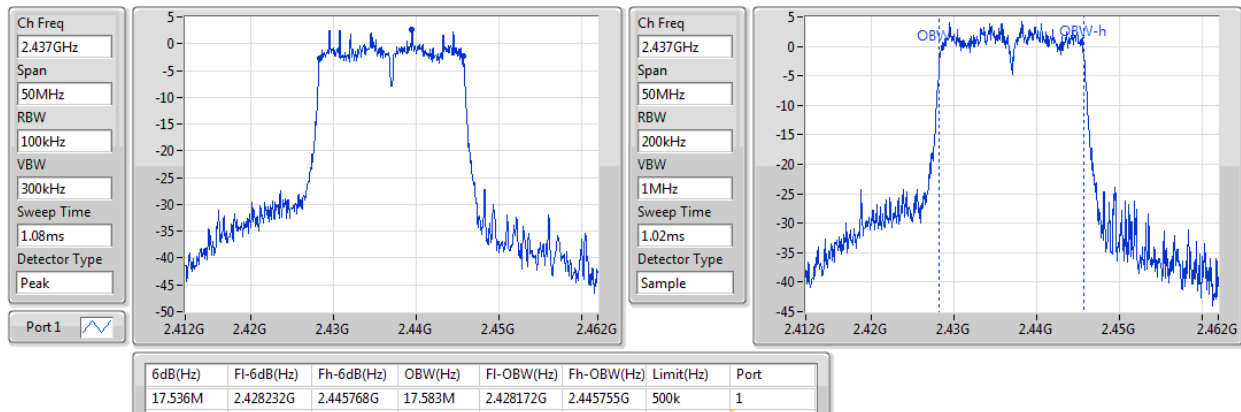
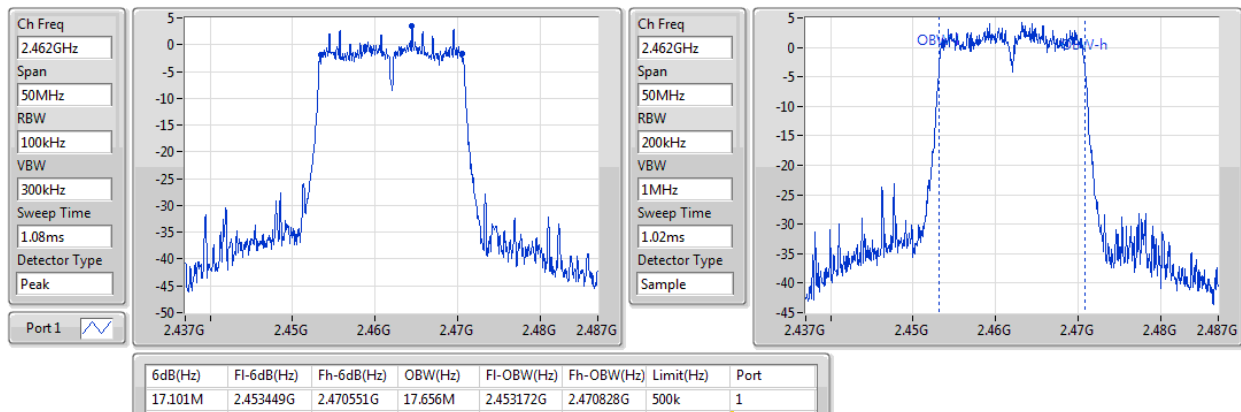
802.11g_Nss1,(6Mbps)_1TX

EBW

2462MHz



6dB(Hz)	Fl-6dB(Hz)	Fh-6dB(Hz)	OBW(Hz)	Fl-OBW(Hz)	Fh-OBW(Hz)	Limit(Hz)	Port
16.377M	2.453812G	2.470188G	16.57M	2.453679G	2.470249G	500k	1

802.11n HT20_Nss1,(MCS0)_1TX
EBW
2412MHz

802.11n HT20_Nss1,(MCS0)_1TX
EBW
2437MHz

802.11n HT20_Nss1,(MCS0)_1TX
EBW
2462MHz


3.2 Output Power Measurement

3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna with directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

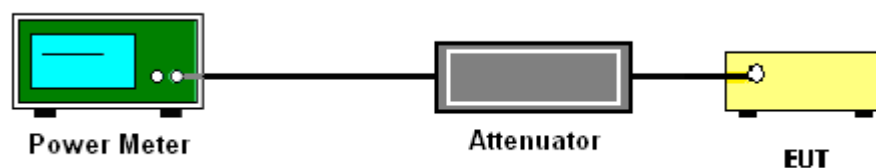
3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v04 section 9.1.2 PKPM1 Peak power meter method.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Peak Output Power

Summary

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
802.11b_Nss1,(1Mbps)_1TX	18.61	0.07261
802.11g_Nss1,(6Mbps)_1TX	23.89	0.24491
802.11n HT20_Nss1,(MCS0)_1TX	23.99	0.25061

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)
802.11b_Nss1,(1Mbps)_1TX	-	-	-	-	-	-	-
2412MHz	Pass	1.90	17.82	17.82	30.00	19.72	36.00
2437MHz	Pass	1.90	18.61	18.61	30.00	20.51	36.00
2462MHz	Pass	1.90	18.49	18.49	30.00	20.39	36.00
802.11g_Nss1,(6Mbps)_1TX	-	-	-	-	-	-	-
2412MHz	Pass	1.90	23.38	23.38	30.00	25.28	36.00
2437MHz	Pass	1.90	23.89	23.89	30.00	25.79	36.00
2462MHz	Pass	1.90	23.87	23.87	30.00	25.77	36.00
802.11n HT20_Nss1,(MCS0)_1TX	-	-	-	-	-	-	-
2412MHz	Pass	1.90	23.26	23.26	30.00	25.16	36.00
2437MHz	Pass	1.90	23.99	23.99	30.00	25.89	36.00
2462MHz	Pass	1.90	23.87	23.87	30.00	25.77	36.00

DG = Directional Gain; Port X = Port X output power

3.2.6 Test Result of Average output Power (Reporting Only)

Summary

Mode	Total Power (dBm)	Total Power (W)
2.4-2.4835GHz	-	-
802.11b_Nss1,(1Mbps)_1TX	15.63	0.03656
802.11g_Nss1,(6Mbps)_1TX	14.86	0.03062
802.11n HT20_Nss1,(MCS0)_1TX	14.74	0.02979

Result

Mode	Result	DG (dBi)	Port 1 (dBm)	Total Power (dBm)	Power Limit (dBm)	EIRP (dBm)	EIRP Limit (dBm)
802.11b_Nss1,(1Mbps)_1TX	-	-	-	-	-	-	-
2412MHz	Pass	1.90	14.75	14.75	30.00	16.65	
2437MHz	Pass	1.90	15.63	15.63	30.00	17.53	
2462MHz	Pass	1.90	15.48	15.48	30.00	17.38	
802.11g_Nss1,(6Mbps)_1TX	-	-	-	-	-	-	
2412MHz	Pass	1.90	14.5	14.50	30.00	16.40	
2437MHz	Pass	1.90	14.86	14.86	30.00	16.76	
2462MHz	Pass	1.90	14.72	14.72	30.00	16.62	
802.11n HT20_Nss1,(MCS0)_1TX	-	-	-	-	-	-	
2412MHz	Pass	1.90	14.43	14.43	30.00	16.33	
2437MHz	Pass	1.90	14.74	14.74	30.00	16.64	
2462MHz	Pass	1.90	14.65	14.65	30.00	16.55	

DG = Directional Gain; Port X = Port X output power

Note : Conducted average output power is for reference only

3.3 Power Spectral Density Measurement

3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

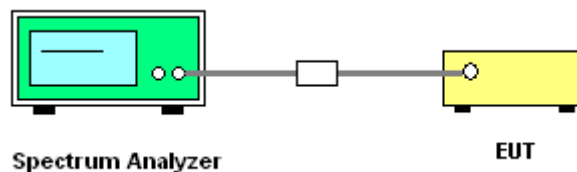
3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.3.3 Test Procedures

1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.

3.3.4 Test Setup



3.3.5 Test Result of Power Spectral Density

Summary

Mode	PD (dBm/RBW)
2.4-2.4835GHz	-
802.11b_Nss1,(1Mbps)_1TX	-7.70
802.11g_Nss1,(6Mbps)_1TX	-10.92
802.11n HT20_Nss1,(MCS0)_1TX	-10.56

RBW=3kHz.

Result

Mode	Result	DG (dBi)	Port 1 (dBm/RBW)	PD (dBm/RBW)	PD Limit (dBm/RBW)
802.11b_Nss1,(1Mbps)_1TX	-	-	-	-	-
2412MHz	Pass	1.90	-7.78	-7.78	8.00
2437MHz	Pass	1.90	-7.70	-7.70	8.00
2462MHz	Pass	1.90	-7.94	-7.94	8.00
802.11g_Nss1,(6Mbps)_1TX	-	-	-	-	-
2412MHz	Pass	1.90	-11.20	-11.20	8.00
2437MHz	Pass	1.90	-10.92	-10.92	8.00
2462MHz	Pass	1.90	-11.67	-11.67	8.00
802.11n HT20_Nss1,(MCS0)_1TX	-	-	-	-	-
2412MHz	Pass	1.90	-10.89	-10.89	8.00
2437MHz	Pass	1.90	-10.56	-10.56	8.00
2462MHz	Pass	1.90	-11.39	-11.39	8.00

DG = Directional Gain; RBW=3kHz;

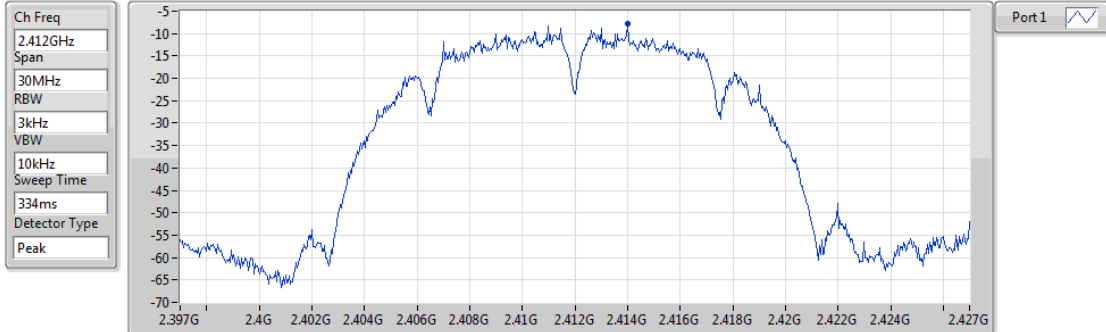
PD = trace bin-by-bin of each transmits port summing can be performed maximum power density; **Port X** = Port X power density;

Test results of each port are measured value with duty factor

802.11b_Nss1,(1Mbps)_1TX

PSD

2412MHz

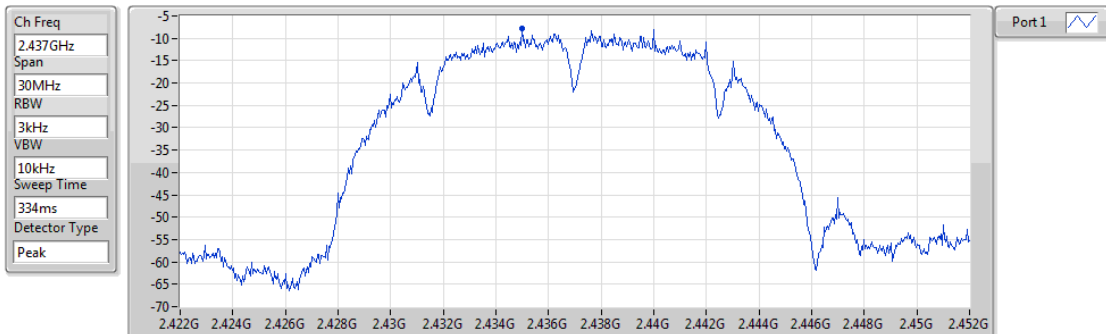


Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-7.78	-7.78	-7.78

802.11b_Nss1,(1Mbps)_1TX

PSD

2437MHz

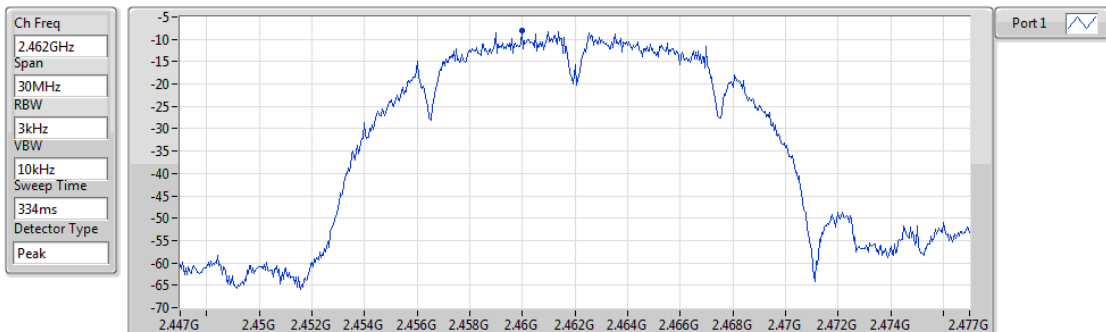


Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-7.70	-7.70	-7.70

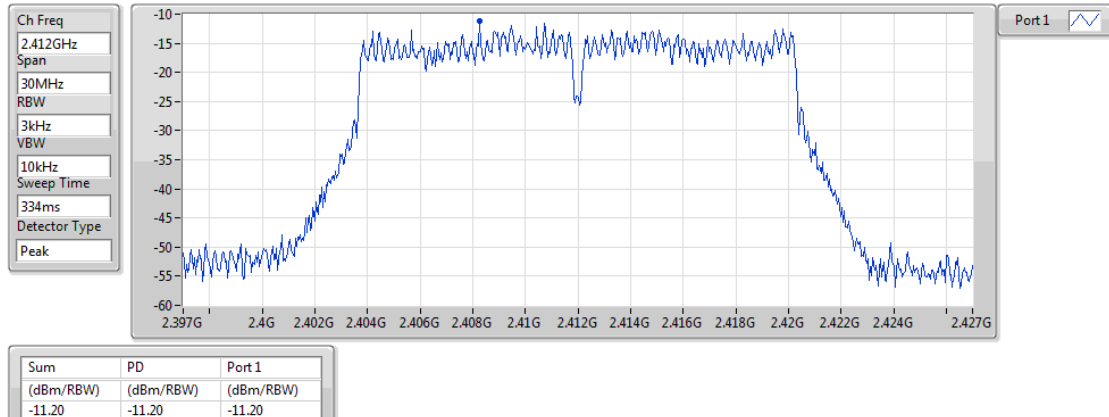
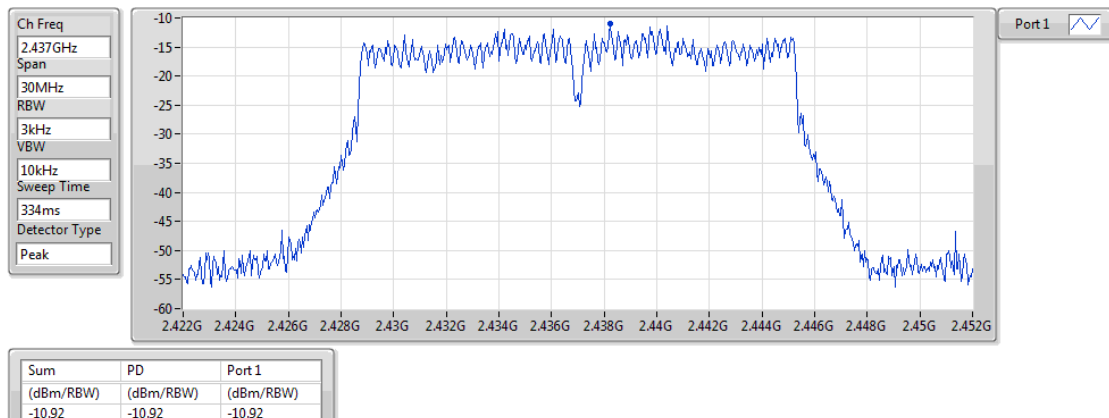
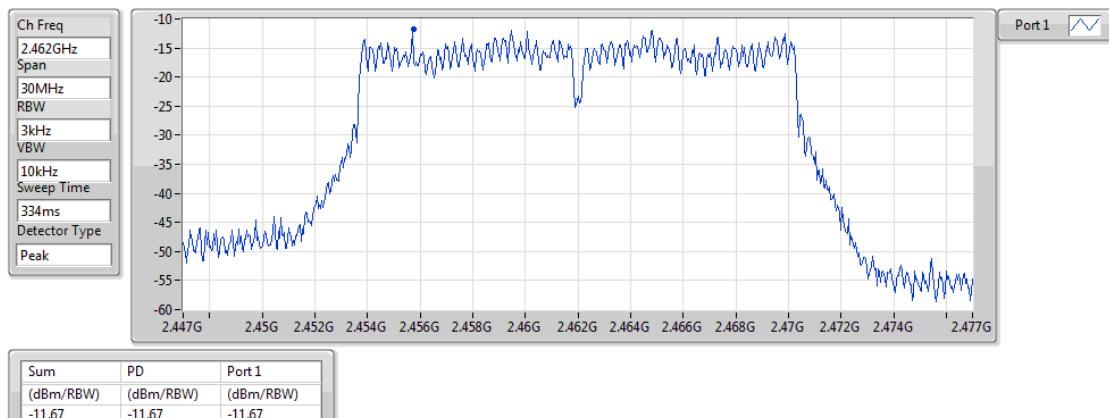
802.11b_Nss1,(1Mbps)_1TX

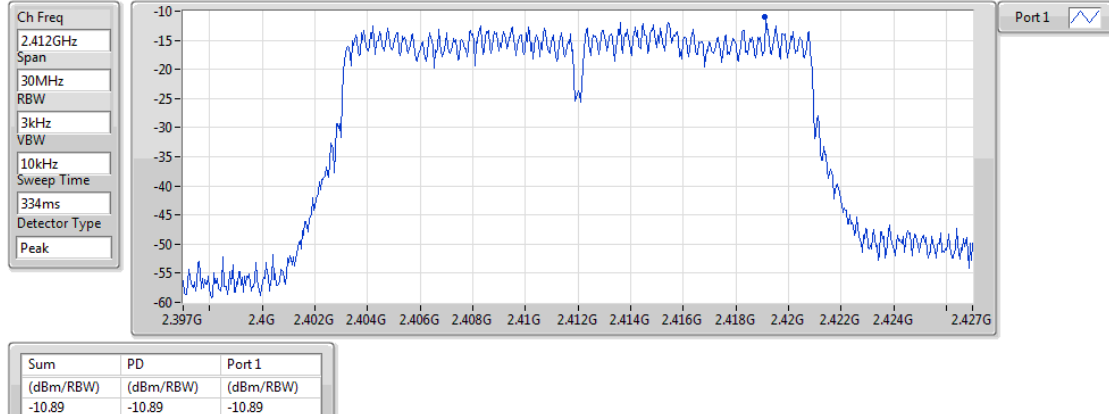
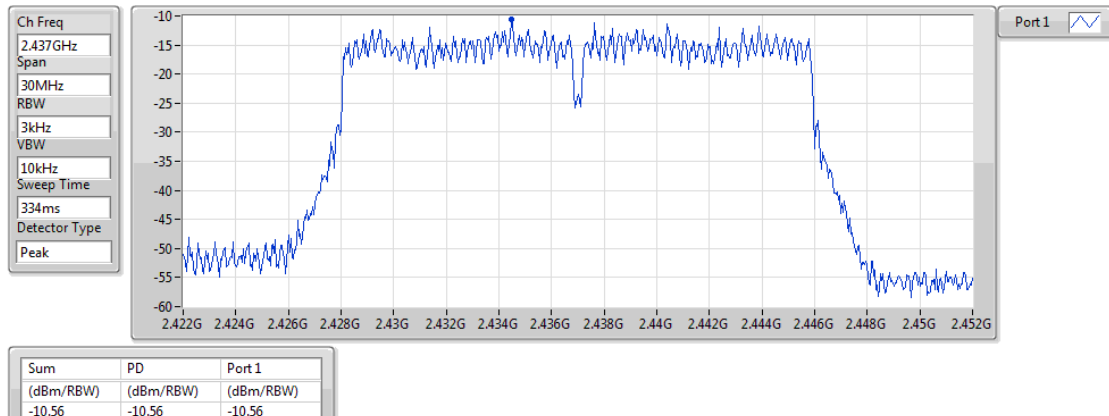
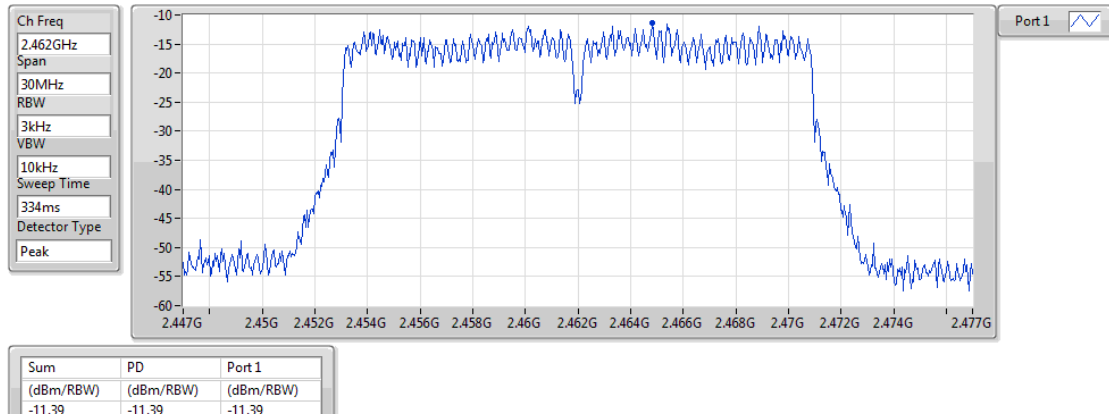
PSD

2462MHz



Sum	PD	Port 1
(dBm/RBW)	(dBm/RBW)	(dBm/RBW)
-7.94	-7.94	-7.94

802.11g_Nss1,(6Mbps)_1TX
PSD
2412MHz

802.11g_Nss1,(6Mbps)_1TX
PSD
2437MHz

802.11g_Nss1,(6Mbps)_1TX
PSD
2462MHz


802.11n HT20_Nss1,(MCS0)_1TX
PSD
2412MHz

802.11n HT20_Nss1,(MCS0)_1TX
PSD
2437MHz

802.11n HT20_Nss1,(MCS0)_1TX
PSD
2462MHz


3.4 Conducted Band Edges and Spurious Emission Measurement

3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions which fall in the restricted bands, as defined in NCC LP0002 section 2.7, must also comply with the radiated emission limits specified in NCC LP0002 section 2.8.

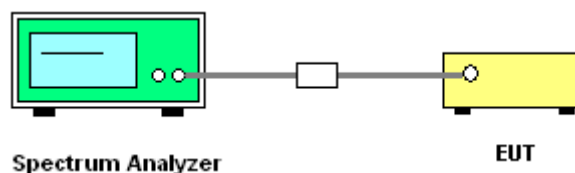
3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.4.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

3.4.4 Test Setup



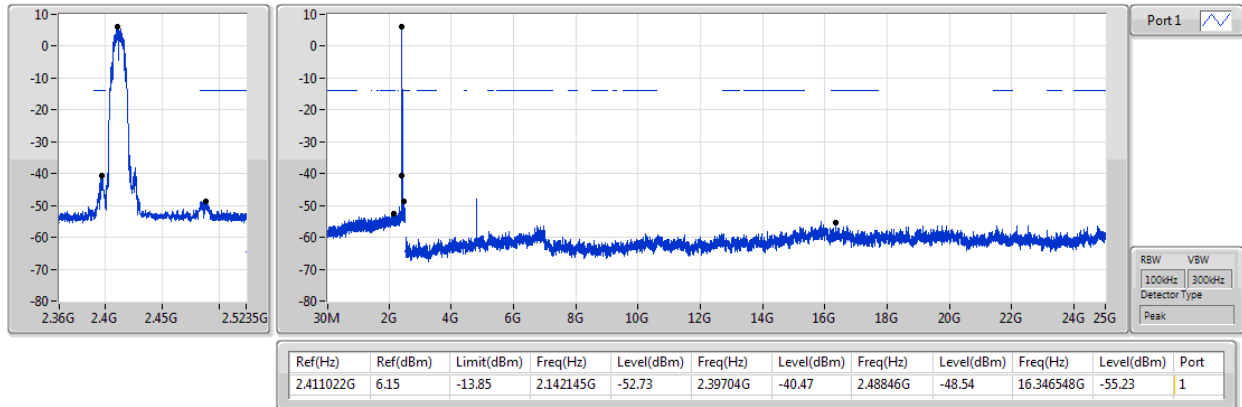
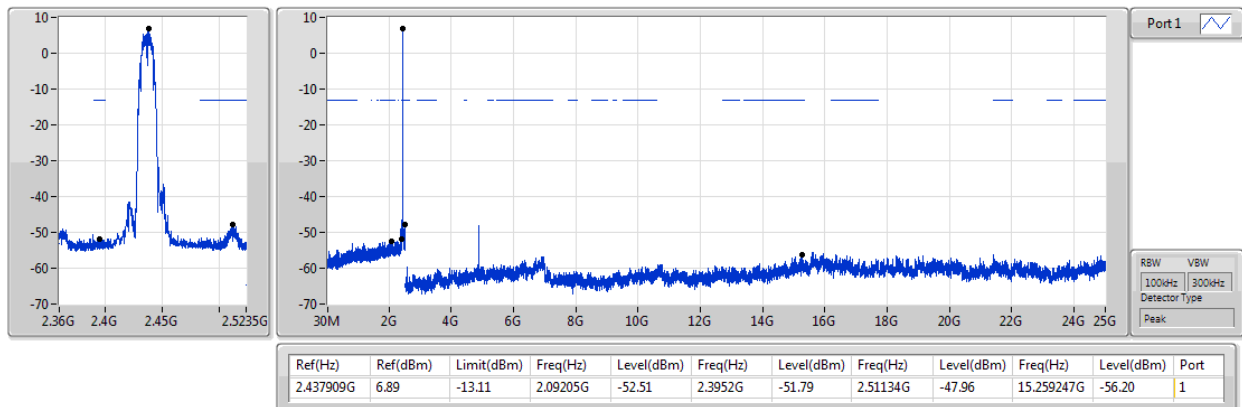
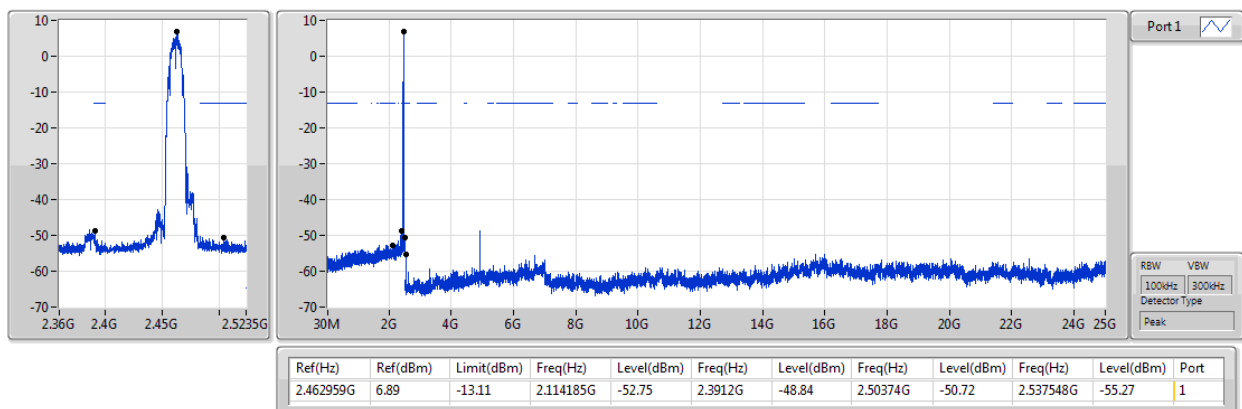
3.4.5 Test Result of Conducted Band Edges and Spurious Emission

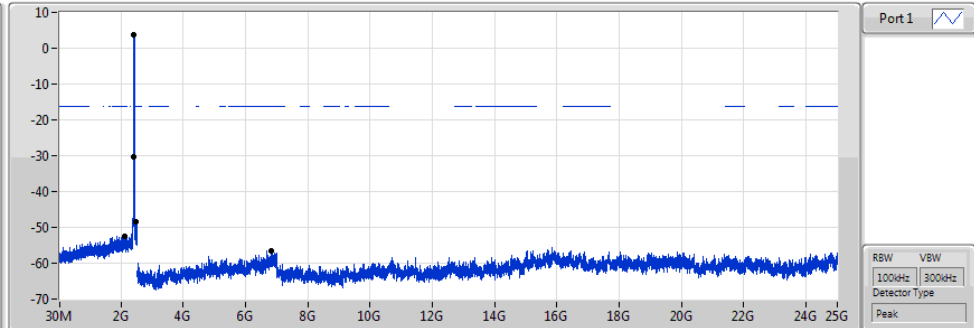
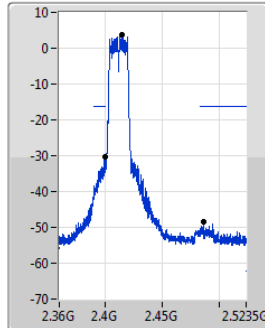
Summary

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
2.4-2.4835GHz	-	-	-	-	-	-	-	-	-	-	-	-	-
802.11b_Nss1,(1Mbps)_1TX	Pass	2.411022G	6.15	-13.85	2.142145G	-52.73	2.39704G	-40.47	2.48846G	-48.54	16.346548G	-55.23	1
802.11g_Nss1,(6Mbps)_1TX	Pass	2.414362G	3.65	-16.35	2.13166G	-52.46	2.39968G	-30.36	2.48638G	-48.39	6.836178G	-56.42	1
802.11n HT20_Nss1,(MCS0)_1TX	Pass	2.419372G	3.74	-16.26	2.132825G	-51.99	2.39352G	-27.89	2.48446G	-48.87	21.603239G	-56.50	1

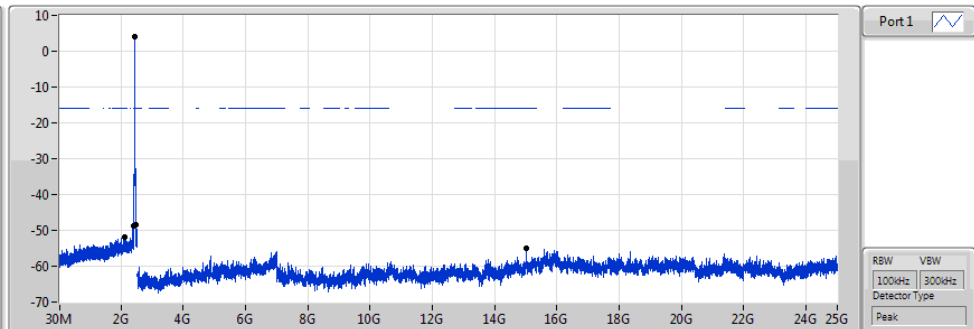
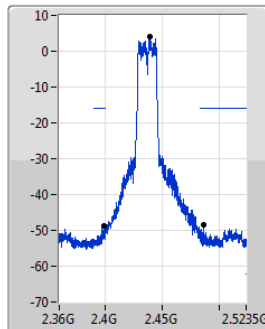
Result

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
802.11b_Nss1,(1Mbps)_1TX	-	-	-	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	2.411022G	6.15	-13.85	2.142145G	-52.73	2.39704G	-40.47	2.48846G	-48.54	16.346548G	-55.23	1
2437MHz	Pass	2.437909G	6.89	-13.11	2.09205G	-52.51	2.3952G	-51.79	2.51134G	-47.96	15.259247G	-56.20	1
2462MHz	Pass	2.462959G	6.89	-13.11	2.114185G	-52.75	2.3912G	-48.84	2.50374G	-50.72	2.537548G	-55.27	1
802.11g_Nss1,(6Mbps)_1TX	-	-	-	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	2.414362G	3.65	-16.35	2.13166G	-52.46	2.39968G	-30.36	2.48638G	-48.39	6.836178G	-56.42	1
2437MHz	Pass	2.439412G	3.97	-16.03	2.125835G	-51.87	2.39896G	-48.84	2.48638G	-48.41	15.009196G	-54.96	1
2462MHz	Pass	2.464462G	3.66	-16.34	1.883515G	-52.46	2.39312G	-50.48	2.48382G	-38.35	16.32969G	-54.59	1
802.11n HT20_Nss1,(MCS0)_1TX	-	-	-	-	-	-	-	-	-	-	-	-	-
2412MHz	Pass	2.419372G	3.74	-16.26	2.132825G	-51.99	2.39352G	-27.89	2.48446G	-48.87	21.603239G	-56.50	1
2437MHz	Pass	2.439412G	3.68	-16.32	1.904485G	-52.11	2.39776G	-50.36	2.5191G	-49.43	15.292962G	-56.07	1
2462MHz	Pass	2.464462G	3.68	-16.32	2.08972G	-52.62	2.39072G	-50.90	2.4851G	-33.48	2.534738G	-54.04	1

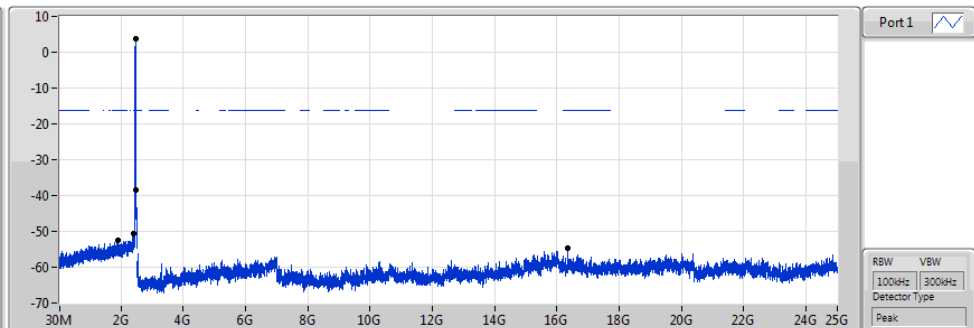
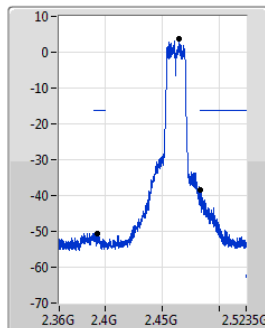
802.11b_Nss1,(1Mbps)_1TX
CSE NdB
2412MHz

802.11b_Nss1,(1Mbps)_1TX
CSE NdB
2437MHz

802.11b_Nss1,(1Mbps)_1TX
CSE NdB
2462MHz


802.11g_Nss1,(6Mbps)_1TX
CSE NdB
2412MHz


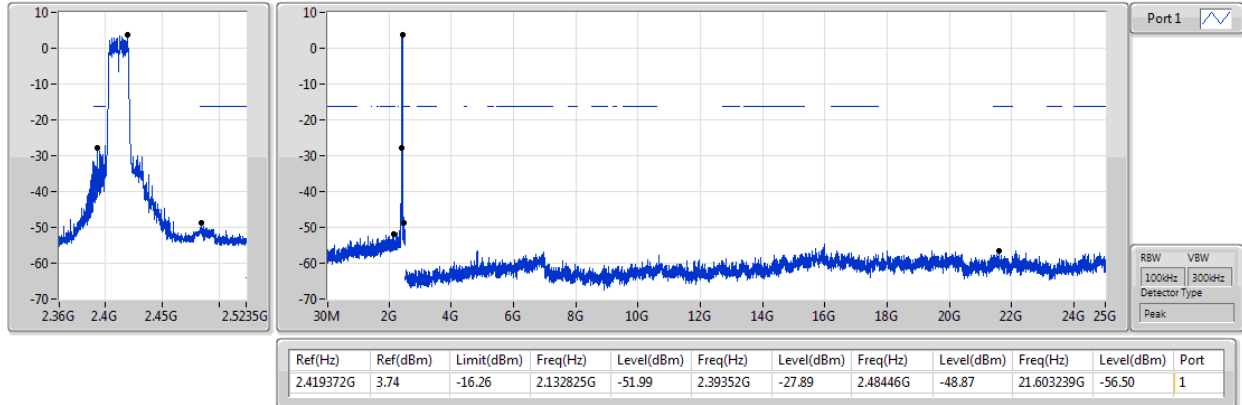
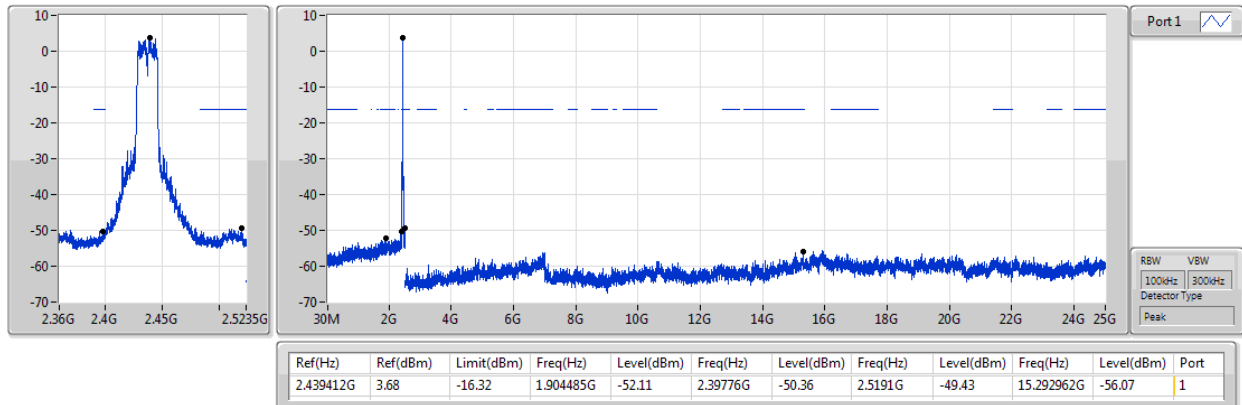
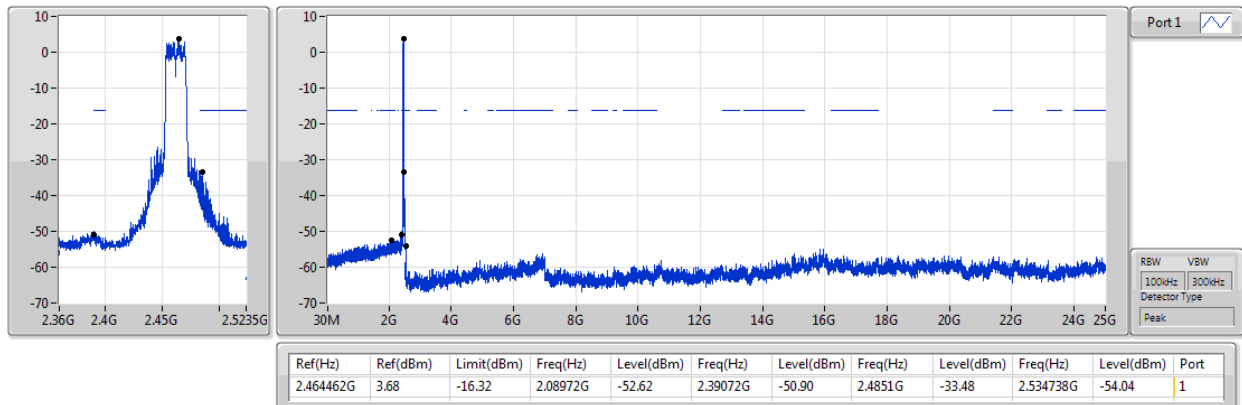
Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.414362G	3.65	-16.35	2.13166G	-52.46	2.39968G	-30.36	2.48638G	-48.39	6.836178G	-56.42	1

802.11g_Nss1,(6Mbps)_1TX
CSE NdB
2437MHz


Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.439412G	3.97	-16.03	2.125835G	-51.87	2.39896G	-48.84	2.48638G	-48.41	15.009196G	-54.96	1

802.11g_Nss1,(6Mbps)_1TX
CSE NdB
2462MHz


Ref(Hz)	Ref(dBm)	Limit(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Freq(Hz)	Level(dBm)	Port
2.464462G	3.66	-16.34	1.883515G	-52.46	2.39312G	-50.48	2.48382G	-38.35	16.32969G	-54.59	1

802.11n HT20_Nss1,(MCS0)_1TX
CSE NdB
2412MHz

802.11n HT20_Nss1,(MCS0)_1TX
CSE NdB
2437MHz

802.11n HT20_Nss1,(MCS0)_1TX
CSE NdB
2462MHz


3.5 Radiated Band Edges and Spurious Emission Measurement

3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the NCC LP0002 section 2.8 limits as below.

Frequency (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

3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

3.5.3 Test Procedures

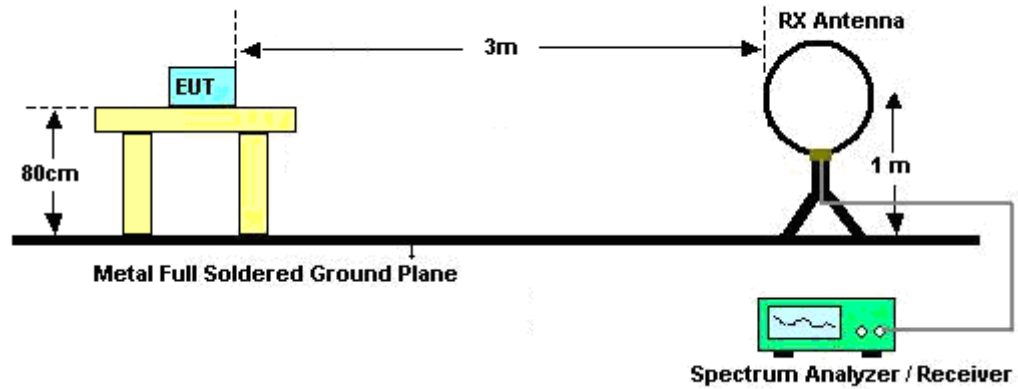
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
8. Use the following spectrum analyzer settings:
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Set RBW=100 kHz for $f < 1$ GHz; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold;
 - (3) Set RBW = 1 MHz, VBW= 3MHz for $f \geq 1$ GHz for peak measurement.

For average measurement:

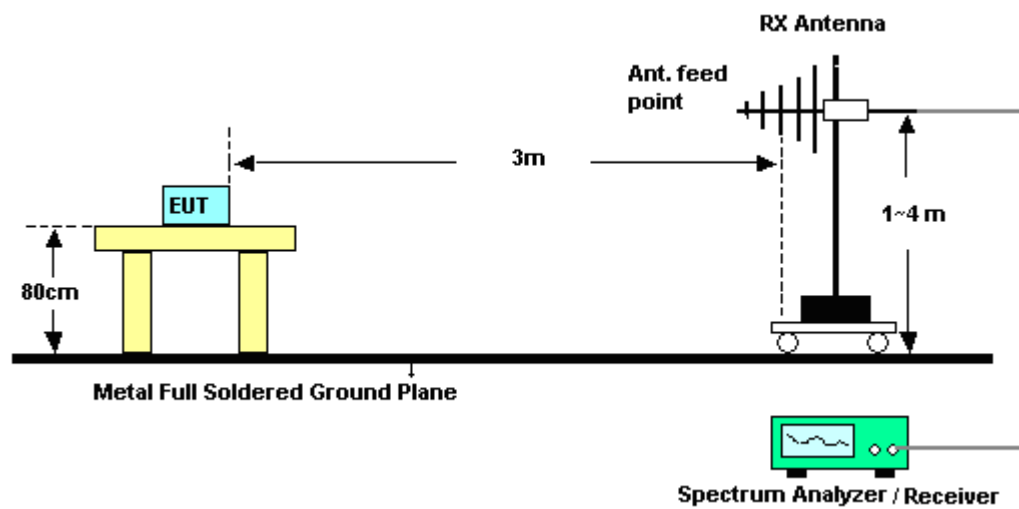
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW $\geq 1/T$, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

3.5.4 Test Setup

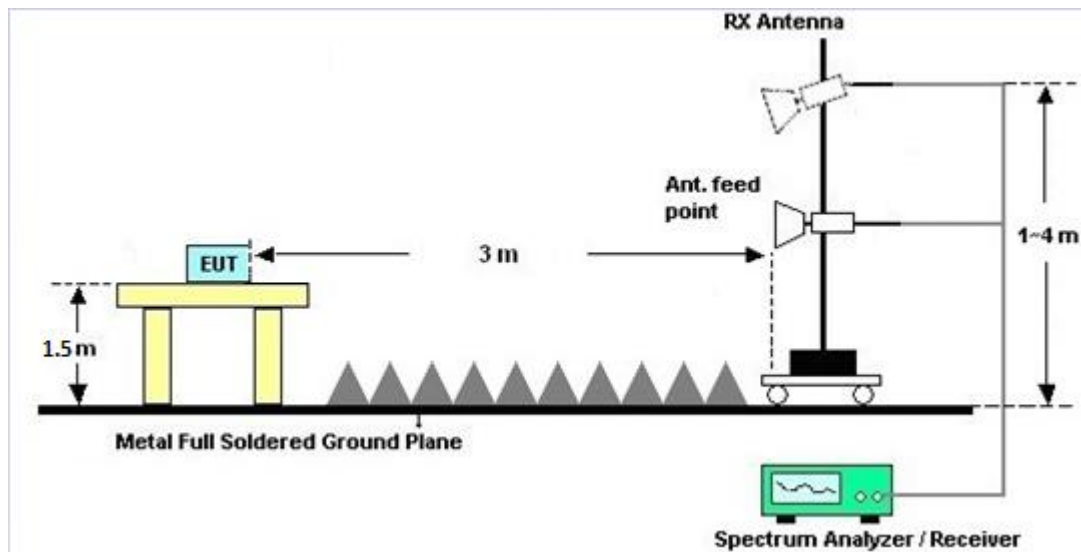
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz

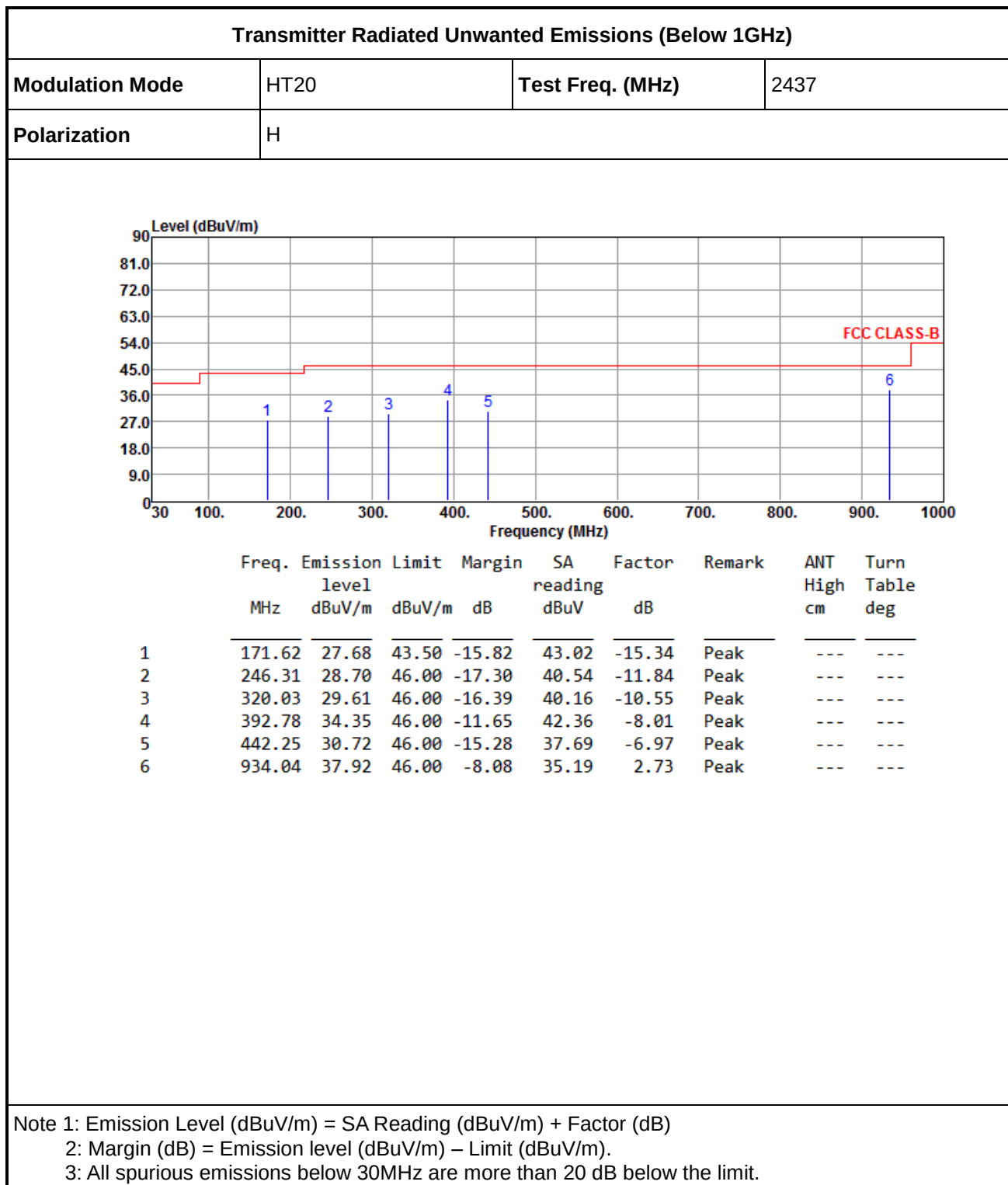


3.5.5 Test Results of Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per NCC LP0002 section 5.13 was not reported.

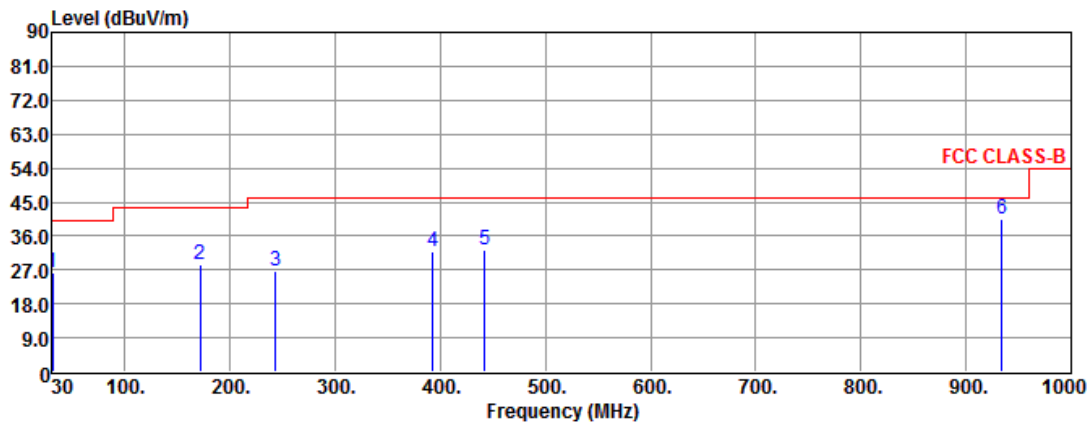
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.5.6 Test Result of Transmitter Radiated Unwanted Emissions (Below 1GHz)



Transmitter Radiated Unwanted Emissions (Below 1GHz)

Modulation Mode	HT20	Test Freq. (MHz)	2437
Polarization	V		



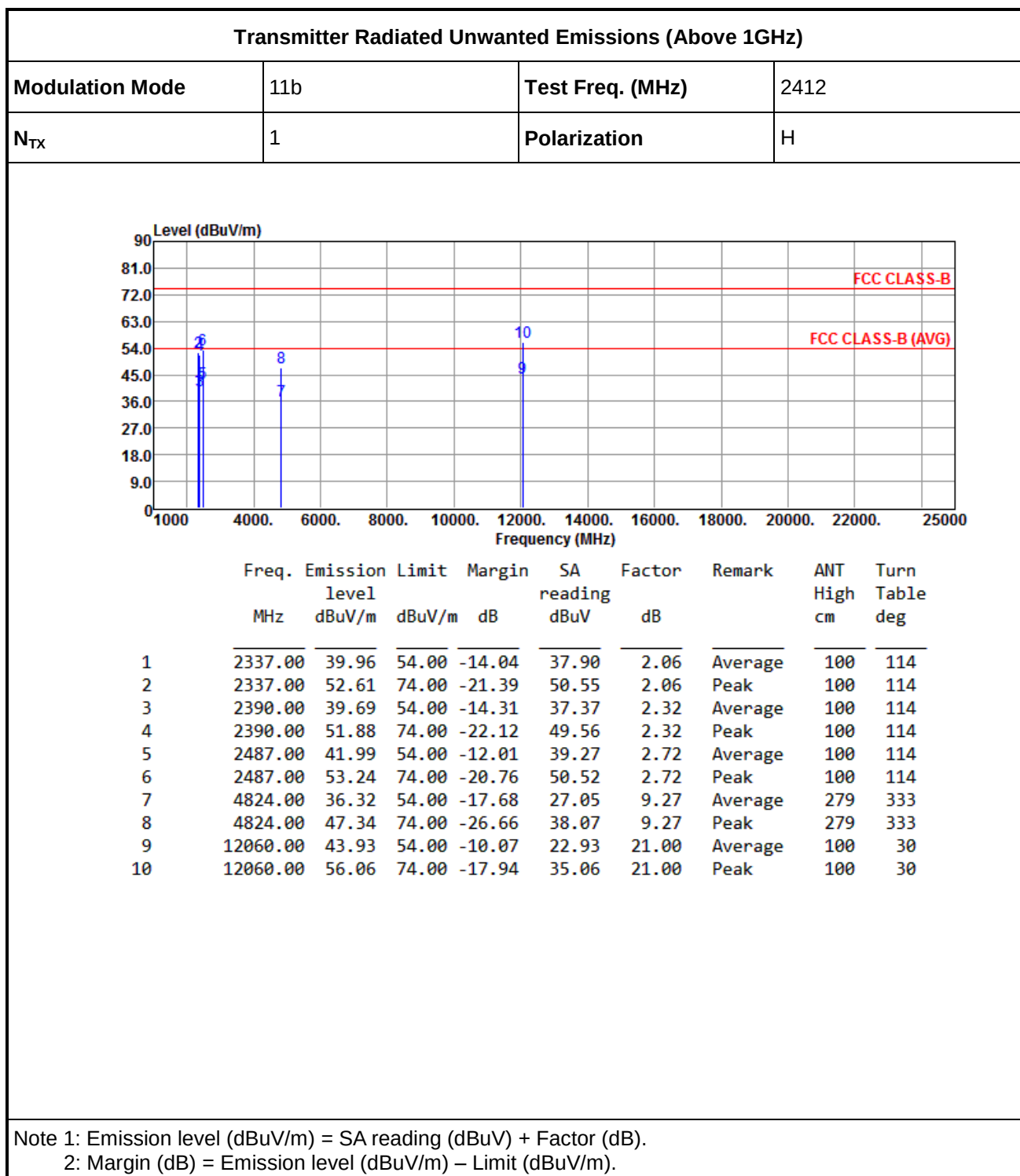
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	30.97	26.20	40.00	-13.80	34.26	-8.06	Peak	---	---
2	171.62	28.48	43.50	-15.02	43.82	-15.34	Peak	---	---
3	243.40	26.63	46.00	-19.37	38.56	-11.93	Peak	---	---
4	392.78	31.70	46.00	-14.30	39.71	-8.01	Peak	---	---
5	442.25	32.09	46.00	-13.91	39.06	-6.97	Peak	---	---
6	934.04	40.59	46.00	-5.41	37.86	2.73	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor (dB)

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

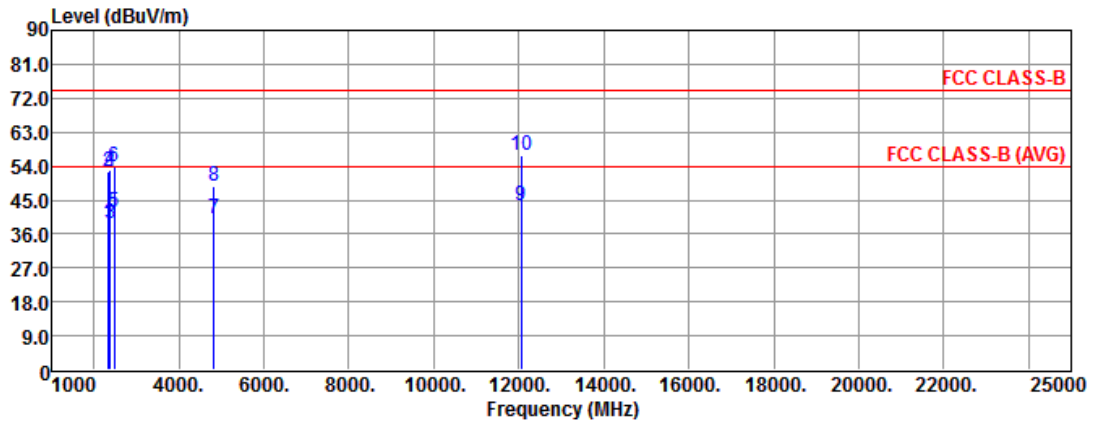
3: All spurious emissions below 30MHz are more than 20 dB below the limit.

3.5.7 Test Result of Transmitter Radiated Unwanted Emissions (Above 1GHz) for 11b



Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11b	Test Freq. (MHz)	2412
N_{TX}	1	Polarization	V



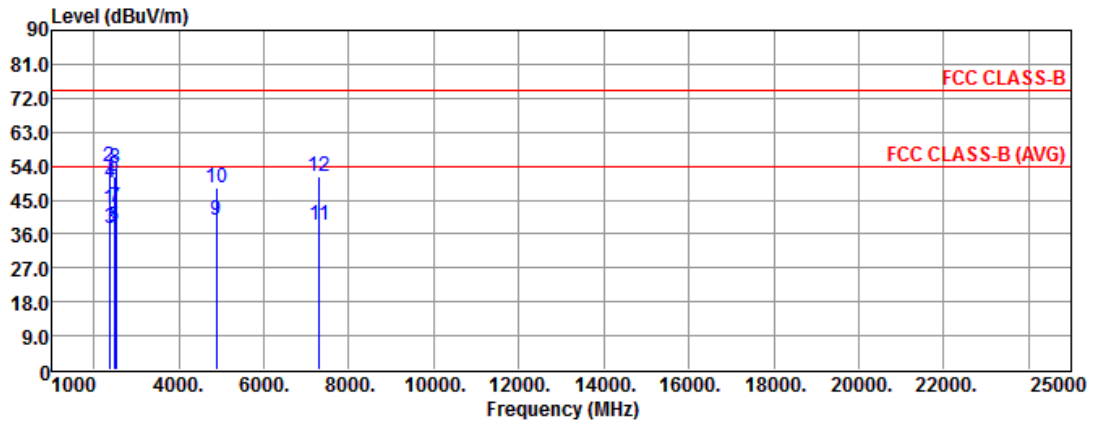
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2337.00	38.77	54.00	-15.23	36.71	2.06	Average	100	344
2	2337.00	52.53	74.00	-21.47	50.47	2.06	Peak	100	344
3	2390.00	38.87	54.00	-15.13	36.55	2.32	Average	100	344
4	2390.00	53.10	74.00	-20.90	50.78	2.32	Peak	100	344
5	2487.00	41.64	54.00	-12.36	38.92	2.72	Average	100	344
6	2487.00	53.85	74.00	-20.15	51.13	2.72	Peak	100	344
7	4824.00	39.89	54.00	-14.11	30.62	9.27	Average	100	36
8	4824.00	48.77	74.00	-25.23	39.50	9.27	Peak	100	36
9	12060.00	43.70	54.00	-10.30	22.70	21.00	Average	100	60
10	12060.00	56.65	74.00	-17.35	35.65	21.00	Peak	100	60

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11b	Test Freq. (MHz)	2437
N_{TX}	1	Polarization	H



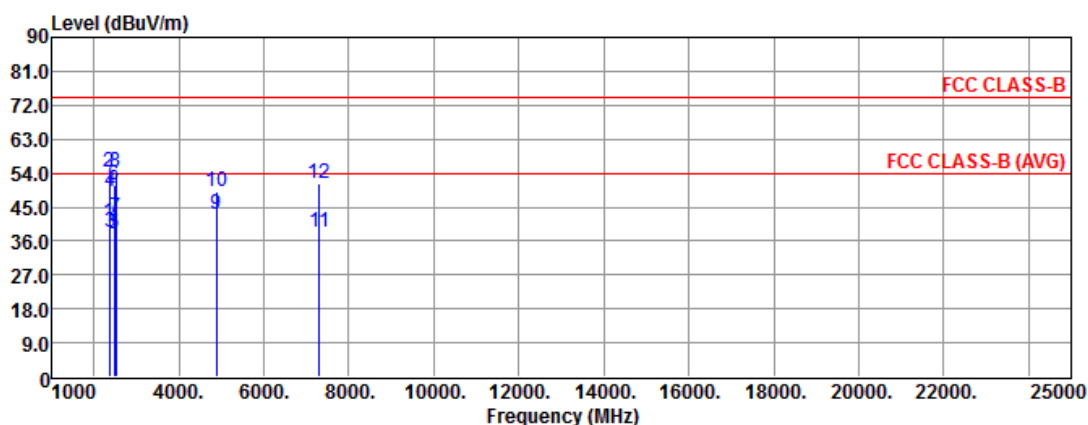
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2362.00	42.68	54.00	-11.32	40.54	2.14	Average	100	113
2	2362.00	53.92	74.00	-20.08	51.78	2.14	Peak	100	113
3	2390.00	37.65	54.00	-16.35	35.33	2.32	Average	100	113
4	2390.00	49.73	74.00	-24.27	47.41	2.32	Peak	100	113
5	2483.50	38.07	54.00	-15.93	35.35	2.72	Average	100	113
6	2483.50	51.19	74.00	-22.81	48.47	2.72	Peak	100	113
7	2512.00	42.95	54.00	-11.05	40.10	2.85	Average	100	113
8	2512.00	53.47	74.00	-20.53	50.62	2.85	Peak	100	113
9	4874.00	39.44	54.00	-14.56	29.91	9.53	Average	288	339
10	4874.00	48.19	74.00	-25.81	38.66	9.53	Peak	288	339
11	7311.00	38.39	54.00	-15.61	22.74	15.65	Average	100	20
12	7311.00	51.25	74.00	-22.75	35.60	15.65	Peak	100	20

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11b	Test Freq. (MHz)	2437
N_{TX}	1	Polarization	V



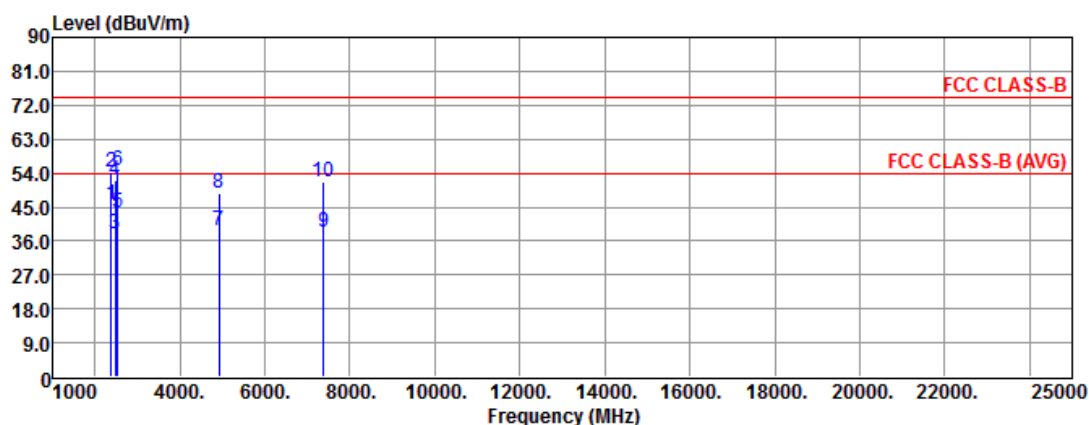
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2362.00	40.84	54.00	-13.16	38.70	2.14	Average	111	346
2	2362.00	54.30	74.00	-19.70	52.16	2.14	Peak	111	346
3	2390.00	38.29	54.00	-15.71	35.97	2.32	Average	111	346
4	2390.00	49.24	74.00	-24.76	46.92	2.32	Peak	111	346
5	2483.50	38.02	54.00	-15.98	35.30	2.72	Average	111	346
6	2483.50	50.73	74.00	-23.27	48.01	2.72	Peak	111	346
7	2512.00	42.10	54.00	-11.90	39.25	2.85	Average	111	346
8	2512.00	54.15	74.00	-19.85	51.30	2.85	Peak	111	346
9	4874.00	43.22	54.00	-10.78	33.69	9.53	Average	100	34
10	4874.00	49.22	74.00	-24.78	39.69	9.53	Peak	100	34
11	7311.00	38.42	54.00	-15.58	22.77	15.65	Average	100	50
12	7311.00	51.30	74.00	-22.70	35.65	15.65	Peak	100	50

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11b	Test Freq. (MHz)	2462
N_{TX}	1	Polarization	H



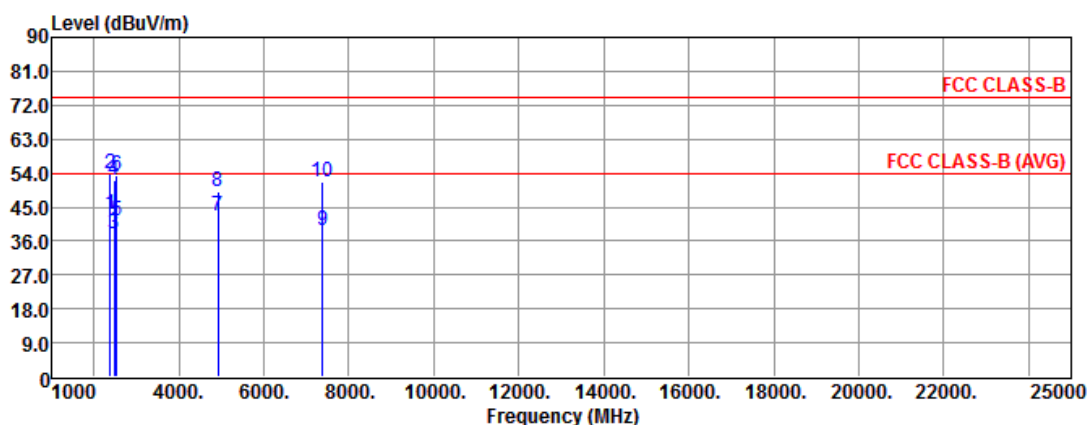
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2387.00	45.53	54.00	-8.47	43.23	2.30	Average	100	110
2	2387.00	54.36	74.00	-19.64	52.06	2.30	Peak	100	110
3	2483.50	38.09	54.00	-15.91	35.37	2.72	Average	100	110
4	2483.50	52.01	74.00	-21.99	49.29	2.72	Peak	100	110
5	2537.00	43.44	54.00	-10.56	40.54	2.90	Average	100	110
6	2537.00	54.51	74.00	-19.49	51.61	2.90	Peak	100	110
7	4924.00	38.61	54.00	-15.39	28.81	9.80	Average	275	336
8	4924.00	48.51	74.00	-25.49	38.71	9.80	Peak	275	336
9	7386.00	38.53	54.00	-15.47	22.67	15.86	Average	100	30
10	7386.00	51.59	74.00	-22.41	35.73	15.86	Peak	100	30

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11b	Test Freq. (MHz)	2462
N_{TX}	1	Polarization	V

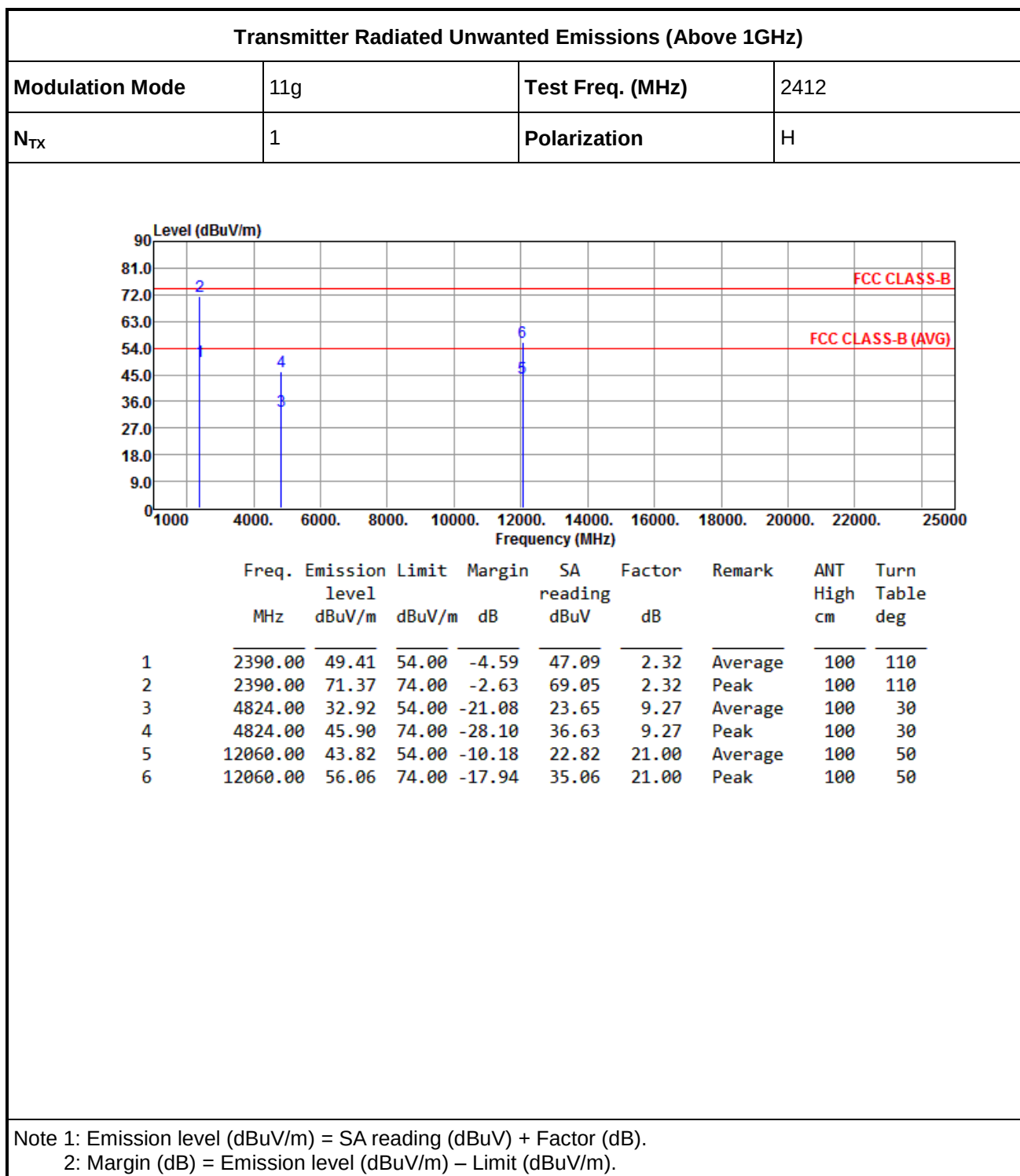


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2387.00	42.94	54.00	-11.06	40.64	2.30	Average	108	345
2	2387.00	54.00	74.00	-20.00	51.70	2.30	Peak	108	345
3	2483.50	38.08	54.00	-15.92	35.36	2.72	Average	108	345
4	2483.50	51.90	74.00	-22.10	49.18	2.72	Peak	108	345
5	2537.00	41.29	54.00	-12.71	38.39	2.90	Average	108	345
6	2537.00	53.21	74.00	-20.79	50.31	2.90	Peak	108	345
7	4924.00	42.79	54.00	-11.21	32.99	9.80	Average	100	35
8	4924.00	49.25	74.00	-24.75	39.45	9.80	Peak	100	35
9	7386.00	38.83	54.00	-15.17	22.97	15.86	Average	100	40
10	7386.00	51.55	74.00	-22.45	35.69	15.86	Peak	100	40

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

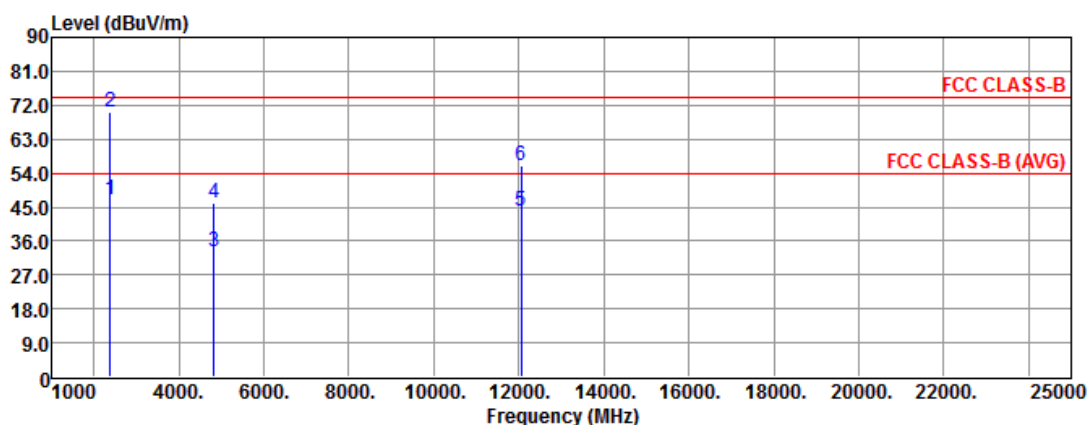
2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

3.5.8 Test Result of Transmitter Radiated Unwanted Emissions (Above 1GHz) for 11g



Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11g	Test Freq. (MHz)	2412
N_{TX}	1	Polarization	V



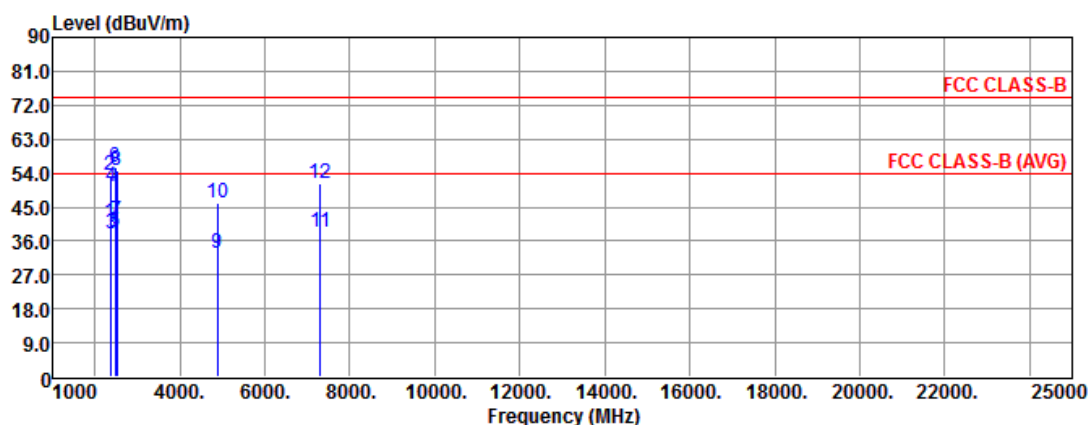
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	46.85	54.00	-7.15	44.53	2.32	Average	113	348
2	2390.00	70.02	74.00	-3.98	67.70	2.32	Peak	113	348
3	4824.00	33.13	54.00	-20.87	23.86	9.27	Average	100	60
4	4824.00	46.05	74.00	-27.95	36.78	9.27	Peak	100	60
5	12060.00	43.83	54.00	-10.17	22.83	21.00	Average	100	110
6	12060.00	56.14	74.00	-17.86	35.14	21.00	Peak	100	110

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11g	Test Freq. (MHz)	2437
N_{TX}	1	Polarization	H



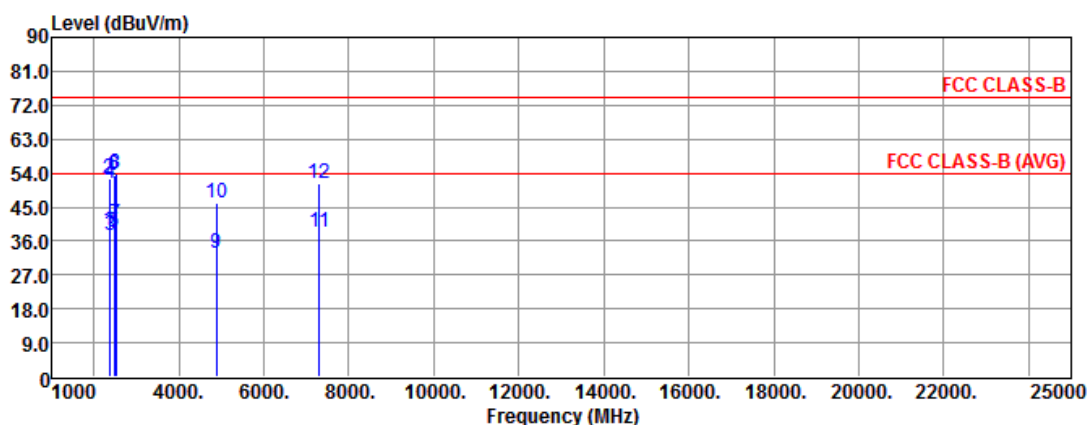
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2362.00	40.90	54.00	-13.10	38.76	2.14	Average	100	111
2	2362.00	53.55	74.00	-20.45	51.41	2.14	Peak	100	111
3	2390.00	37.71	54.00	-16.29	35.39	2.32	Average	100	111
4	2390.00	50.52	74.00	-23.48	48.20	2.32	Peak	100	111
5	2483.50	38.33	54.00	-15.67	35.61	2.72	Average	100	111
6	2483.50	55.55	74.00	-18.45	52.83	2.72	Peak	100	111
7	2512.00	41.23	54.00	-12.77	38.38	2.85	Average	100	111
8	2512.00	54.83	74.00	-19.17	51.98	2.85	Peak	100	111
9	4874.00	32.91	54.00	-21.09	23.38	9.53	Average	100	20
10	4874.00	46.21	74.00	-27.79	36.68	9.53	Peak	100	20
11	7311.00	38.39	54.00	-15.61	22.74	15.65	Average	100	90
12	7311.00	51.32	74.00	-22.68	35.67	15.65	Peak	100	90

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11g	Test Freq. (MHz)	2437
N_{TX}	1	Polarization	V



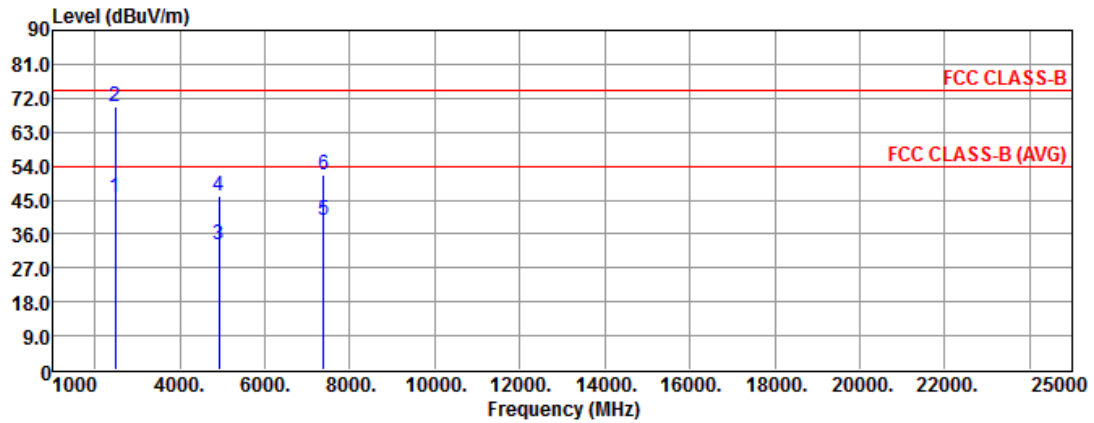
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2362.00	38.79	54.00	-15.21	36.65	2.14	Average	100	339
2	2362.00	52.47	74.00	-21.53	50.33	2.14	Peak	100	339
3	2390.00	37.64	54.00	-16.36	35.32	2.32	Average	100	339
4	2390.00	51.15	74.00	-22.85	48.83	2.32	Peak	100	339
5	2483.50	38.21	54.00	-15.79	35.49	2.72	Average	100	339
6	2483.50	53.36	74.00	-20.64	50.64	2.72	Peak	100	339
7	2512.00	40.35	54.00	-13.65	37.50	2.85	Average	100	339
8	2512.00	54.00	74.00	-20.00	51.15	2.85	Peak	100	339
9	4874.00	32.93	54.00	-21.07	23.40	9.53	Average	100	30
10	4874.00	46.02	74.00	-27.98	36.49	9.53	Peak	100	30
11	7311.00	38.32	54.00	-15.68	22.67	15.65	Average	100	60
12	7311.00	51.19	74.00	-22.81	35.54	15.65	Peak	100	60

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11g	Test Freq. (MHz)	2462
N_{TX}	1	Polarization	H



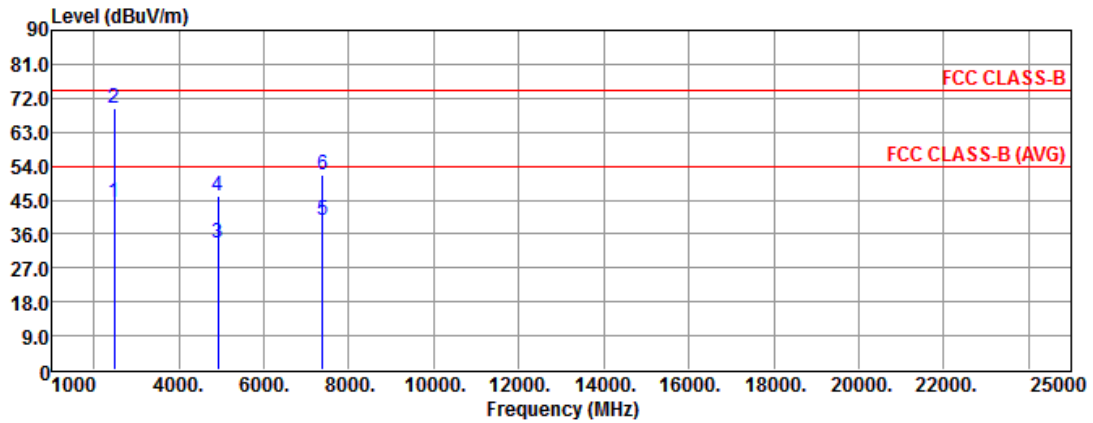
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	45.59	54.00	-8.41	42.87	2.72	Average	100	110
2	2483.50	69.95	74.00	-4.05	67.23	2.72	Peak	100	110
3	4924.00	33.21	54.00	-20.79	23.41	9.80	Average	100	80
4	4924.00	46.11	74.00	-27.89	36.31	9.80	Peak	100	80
5	7386.00	39.51	54.00	-14.49	23.65	15.86	Average	100	70
6	7386.00	51.68	74.00	-22.32	35.82	15.86	Peak	100	70

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	11g	Test Freq. (MHz)	2462
N_{TX}	1	Polarization	V

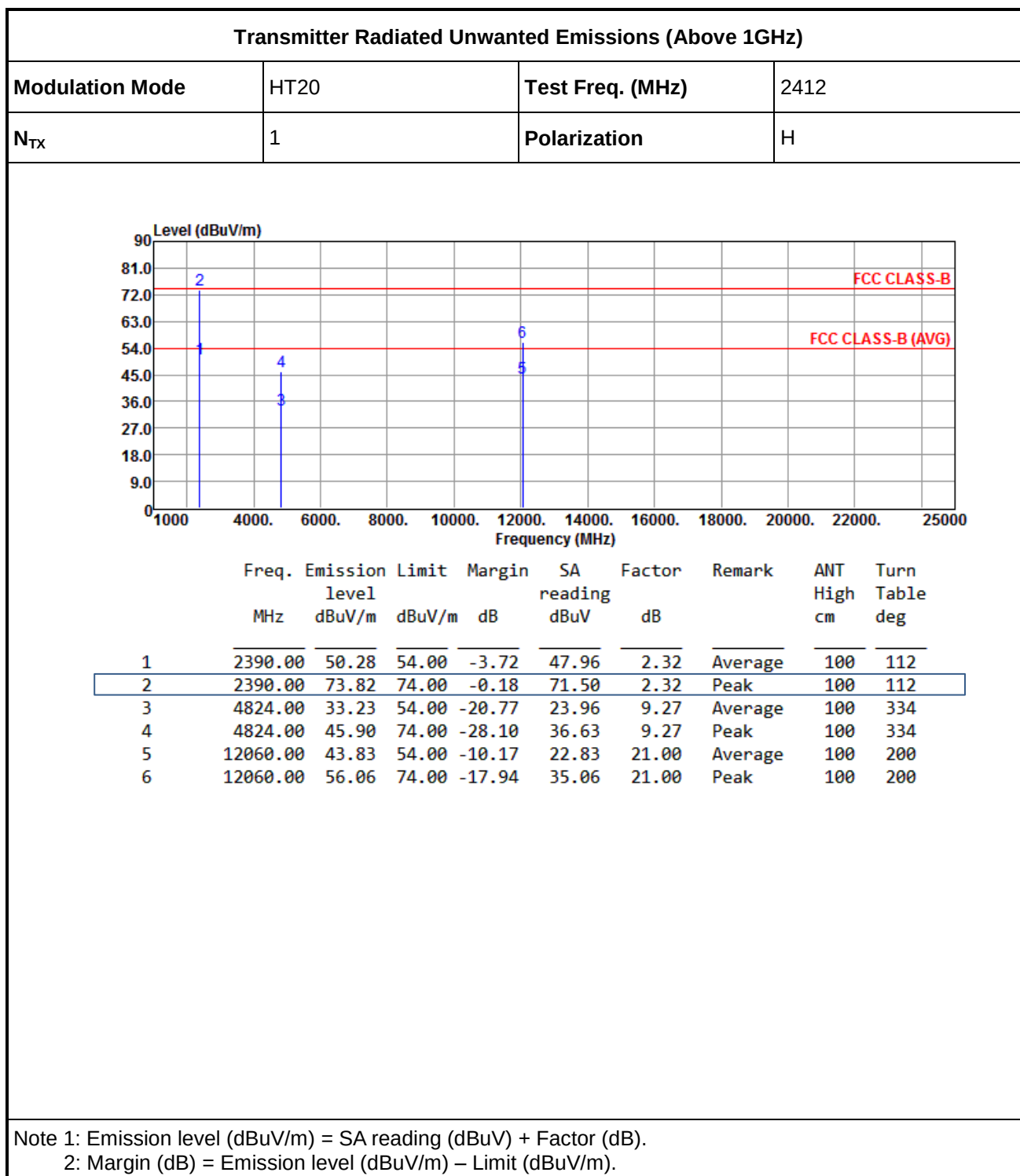


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	44.55	54.00	-9.45	41.83	2.72	Average	104	344
2	2483.50	69.43	74.00	-4.57	66.71	2.72	Peak	104	344
3	4924.00	33.41	54.00	-20.59	23.61	9.80	Average	100	60
4	4924.00	46.23	74.00	-27.77	36.43	9.80	Peak	100	60
5	7386.00	39.43	54.00	-14.57	23.57	15.86	Average	100	90
6	7386.00	51.75	74.00	-22.25	35.89	15.86	Peak	100	90

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

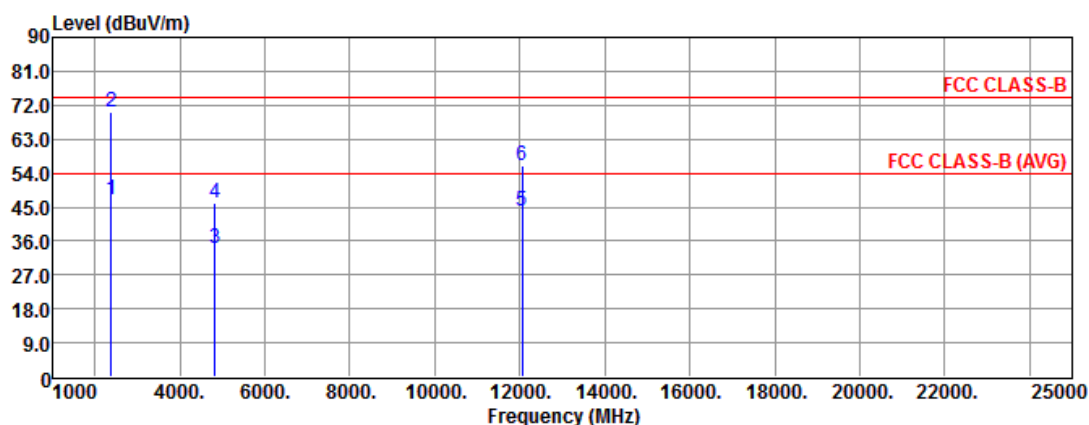
2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

3.5.9 Test Result of Transmitter Radiated Unwanted Emissions (Above 1GHz) for HT20



Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	HT20	Test Freq. (MHz)	2412
N_{TX}	1	Polarization	V



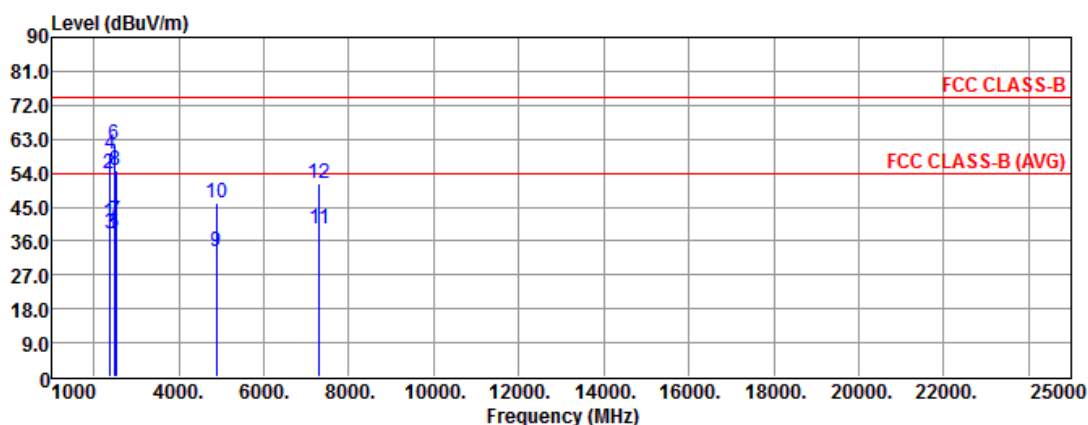
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2390.00	46.86	54.00	-7.14	44.54	2.32	Average	116	350
2	2390.00	70.21	74.00	-3.79	67.89	2.32	Peak	116	350
3	4824.00	33.82	54.00	-20.18	24.55	9.27	Average	100	34
4	4824.00	46.13	74.00	-27.87	36.86	9.27	Peak	100	34
5	12060.00	43.86	54.00	-10.14	22.86	21.00	Average	100	70
6	12060.00	56.16	74.00	-17.84	35.16	21.00	Peak	100	70

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	HT20	Test Freq. (MHz)	2437
N_{TX}	1	Polarization	H



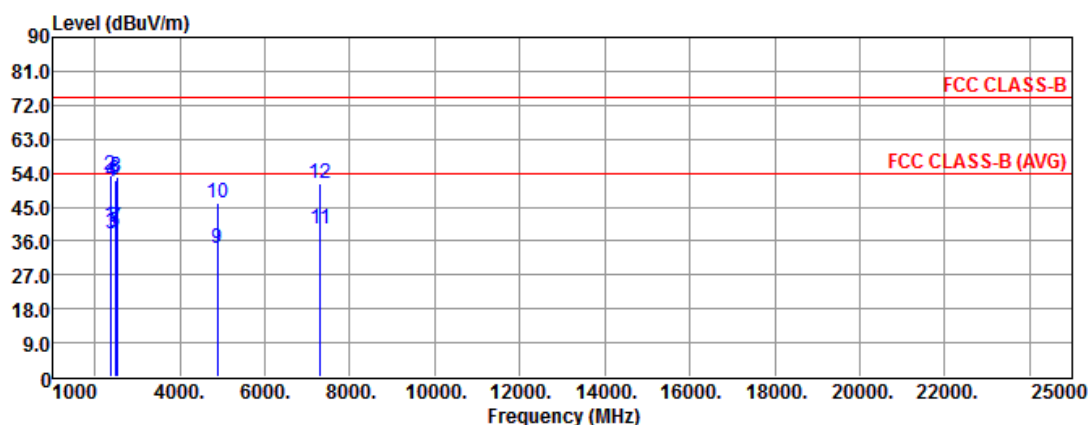
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2362.00	40.72	54.00	-13.28	38.58	2.14	Average	100	111
2	2362.00	54.01	74.00	-19.99	51.87	2.14	Peak	100	111
3	2390.00	37.97	54.00	-16.03	35.65	2.32	Average	100	111
4	2390.00	59.12	74.00	-14.88	56.80	2.32	Peak	100	111
5	2483.50	37.93	54.00	-16.07	35.21	2.72	Average	100	111
6	2483.50	61.68	74.00	-12.32	58.96	2.72	Peak	100	111
7	2512.00	41.28	54.00	-12.72	38.43	2.85	Average	100	111
8	2512.00	54.67	74.00	-19.33	51.82	2.85	Peak	100	111
9	4874.00	33.30	54.00	-20.70	23.77	9.53	Average	100	20
10	4874.00	46.20	74.00	-27.80	36.67	9.53	Peak	100	20
11	7311.00	39.10	54.00	-14.90	23.45	15.65	Average	100	50
12	7311.00	51.13	74.00	-22.87	35.48	15.65	Peak	100	50

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	HT20	Test Freq. (MHz)	2437
N_{TX}	1	Polarization	V



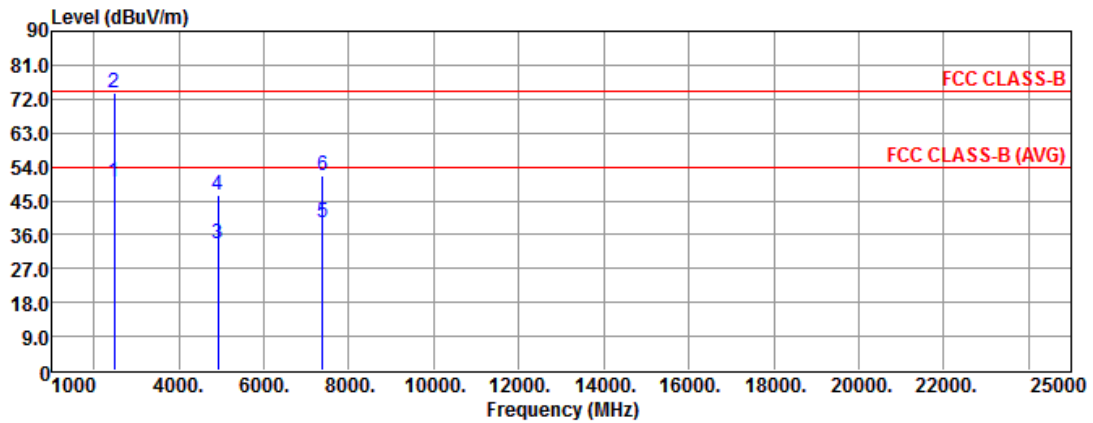
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2362.00	39.90	54.00	-14.10	37.76	2.14	Average	112	352
2	2362.00	53.37	74.00	-20.63	51.23	2.14	Peak	112	352
3	2390.00	37.94	54.00	-16.06	35.62	2.32	Average	112	352
4	2390.00	51.48	74.00	-22.52	49.16	2.32	Peak	112	352
5	2483.50	38.12	54.00	-15.88	35.40	2.72	Average	112	352
6	2483.50	51.99	74.00	-22.01	49.27	2.72	Peak	112	352
7	2512.00	39.47	54.00	-14.53	36.62	2.85	Average	112	352
8	2512.00	52.76	74.00	-21.24	49.91	2.85	Peak	112	352
9	4874.00	33.94	54.00	-20.06	24.41	9.53	Average	100	33
10	4874.00	46.20	74.00	-27.80	36.67	9.53	Peak	100	33
11	7311.00	39.13	54.00	-14.87	23.48	15.65	Average	100	50
12	7311.00	51.38	74.00	-22.62	35.73	15.65	Peak	100	50

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	HT20	Test Freq. (MHz)	2462
N_{TX}	1	Polarization	H



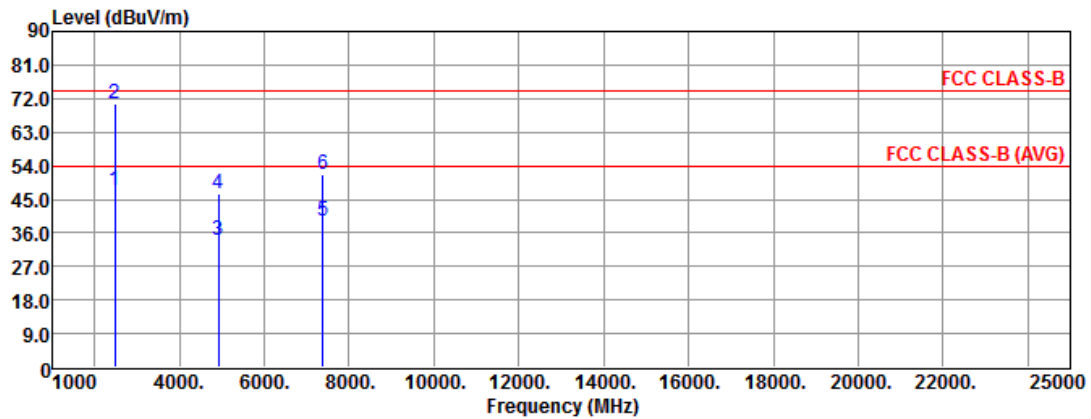
	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	49.96	54.00	-4.04	47.24	2.72	Average	100	111
2	2483.50	73.62	74.00	-0.38	70.90	2.72	Peak	100	111
3	4924.00	33.44	54.00	-20.56	23.64	9.80	Average	100	330
4	4924.00	46.43	74.00	-27.57	36.63	9.80	Peak	100	330
5	7386.00	39.39	54.00	-14.61	23.53	15.86	Average	100	60
6	7386.00	51.60	74.00	-22.40	35.74	15.86	Peak	100	60

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Transmitter Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	HT20	Test Freq. (MHz)	2462
N_{TX}	1	Polarization	V



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	2483.50	47.40	54.00	-6.60	44.68	2.72	Average	108	349
2	2483.50	70.69	74.00	-3.31	67.97	2.72	Peak	108	349
3	4924.00	34.07	54.00	-19.93	24.27	9.80	Average	100	35
4	4924.00	46.40	74.00	-27.60	36.60	9.80	Peak	100	35
5	7386.00	39.38	54.00	-14.62	23.52	15.86	Average	100	90
6	7386.00	51.65	74.00	-22.35	35.79	15.86	Peak	100	90

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

3.6 Test of Receiver Radiated Emission Measurement

3.6.1 Limit of Receiver Radiated Emission

Frequency (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

3.6.2 Measuring Instruments

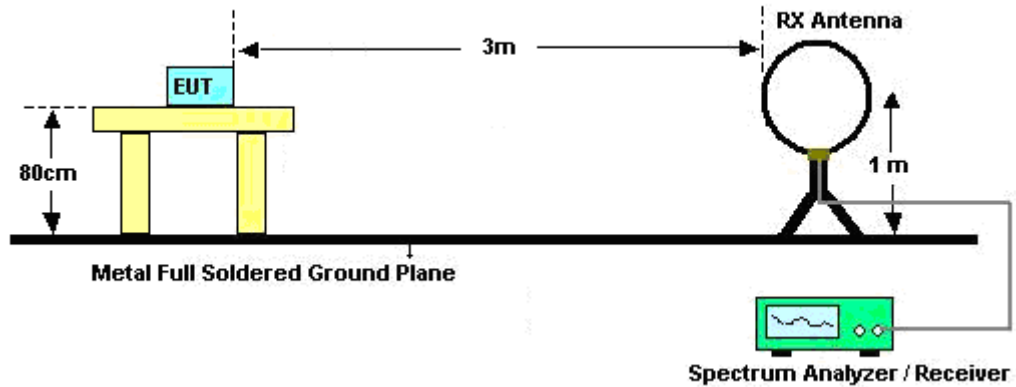
The measuring equipment is listed in the section 4 of this test report.

3.6.3 Test Procedures

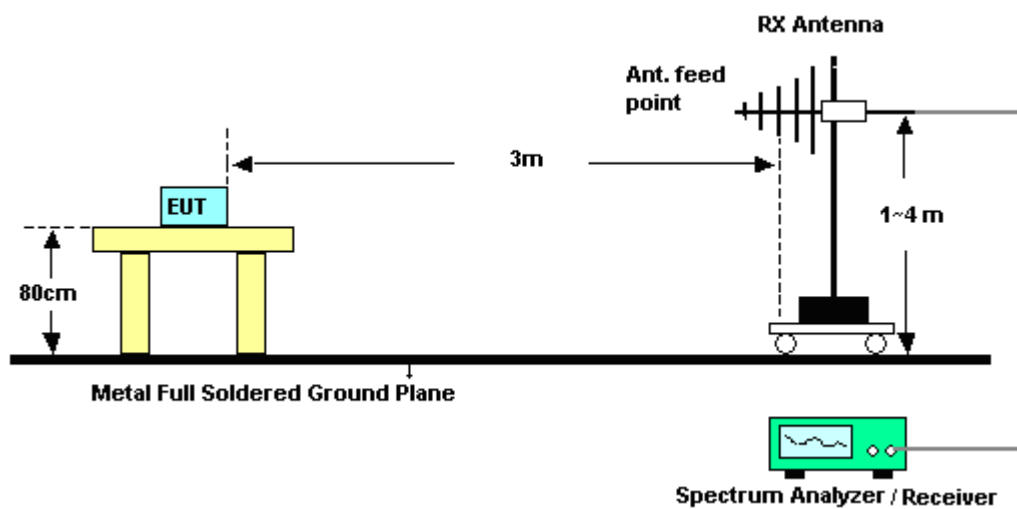
1. The EUT was placed on a turntable with 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The EUT was set 10 meters instead of 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower for frequency from 30MHz to 1GHz.
4. The table was rotated 360 degrees to determine the position of the highest radiation.
5. The antenna is a Bi-Log antenna and its height is adjusted between one to four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
6. For each suspected emission, the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
7. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode (RBW=120kHz/VBW=300kHz for frequency below 1GHz; RBW=1MHz VBW=3MHz (Peak), RBW=1MHz/VBW=10Hz (Average) for frequency above 1GHz).
8. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.
9. Emission level (dBμV/m) = 20 log Emission level (μV/m)
10. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

3.6.4 Test Setup

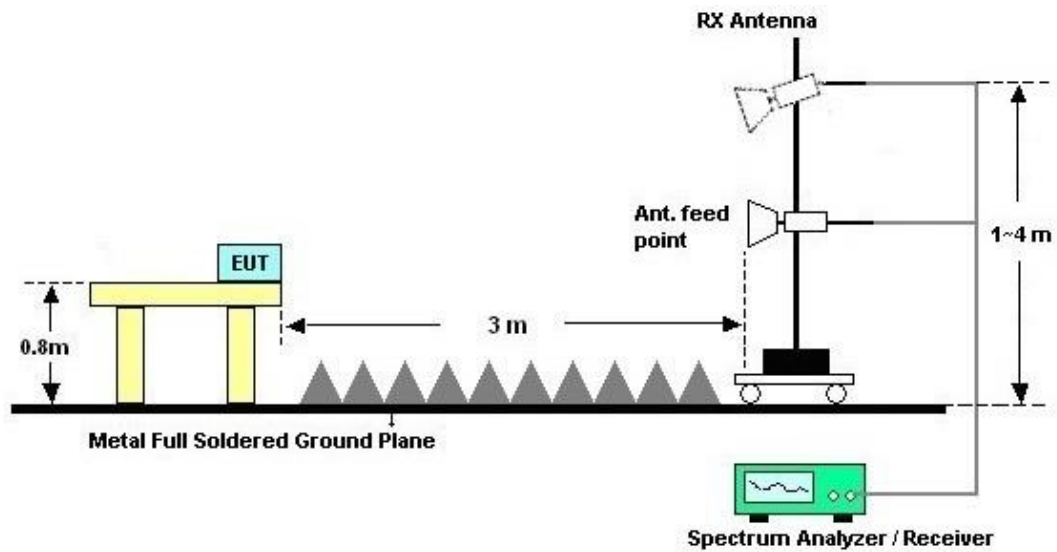
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz

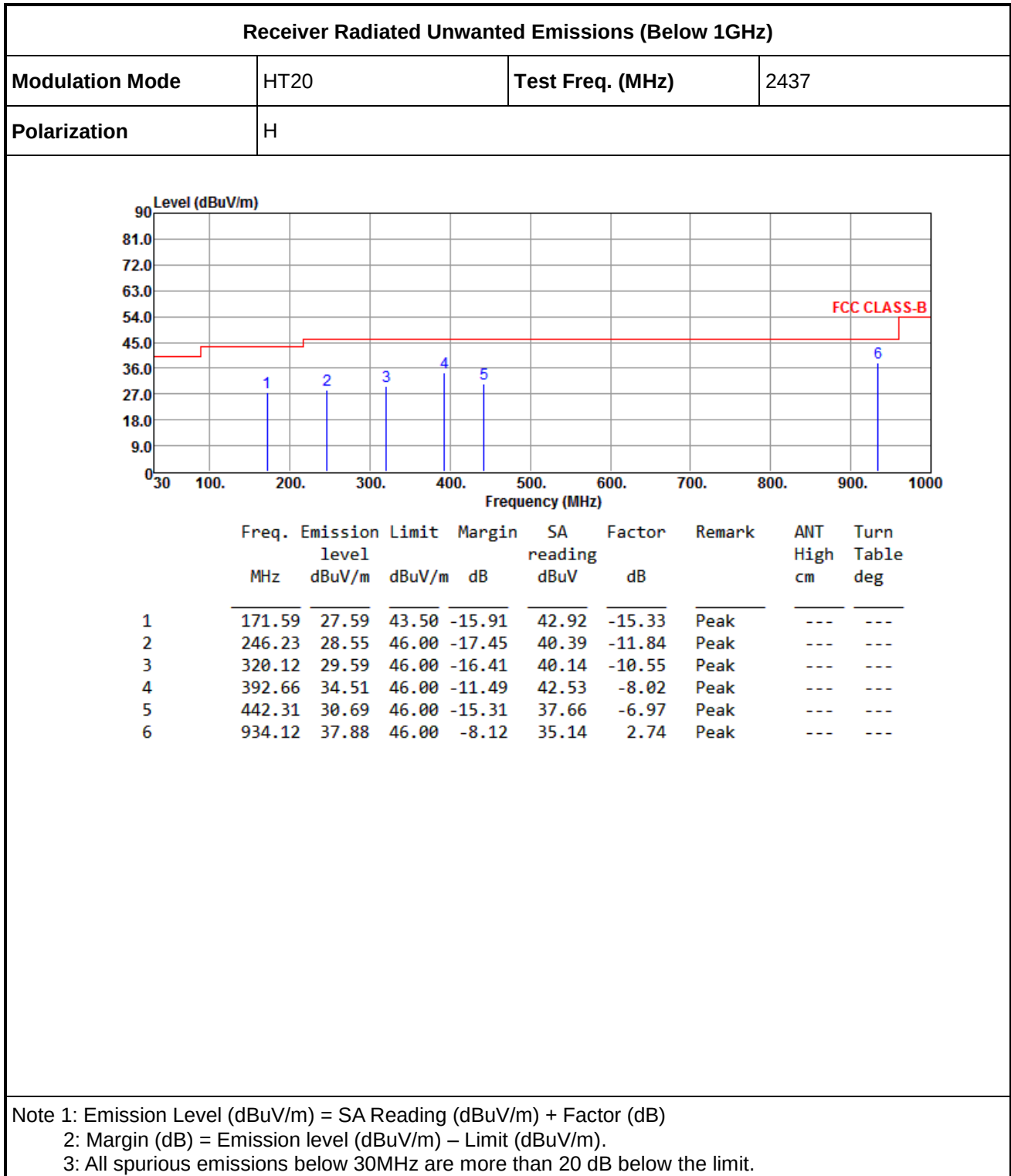


3.6.5 Test Result of Receiver Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per NCC LP0002 section 5.13 was not reported.

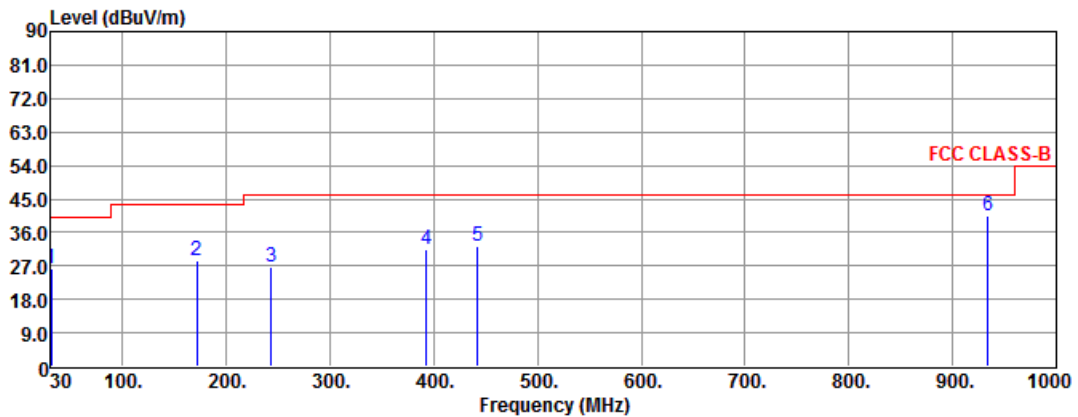
There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.6.6 Test Result of Receiver Radiated Unwanted Emissions (Below 1GHz)



Receiver Radiated Unwanted Emissions (Below 1GHz)

Modulation Mode	HT20	Test Freq. (MHz)	2437
Polarization	V		

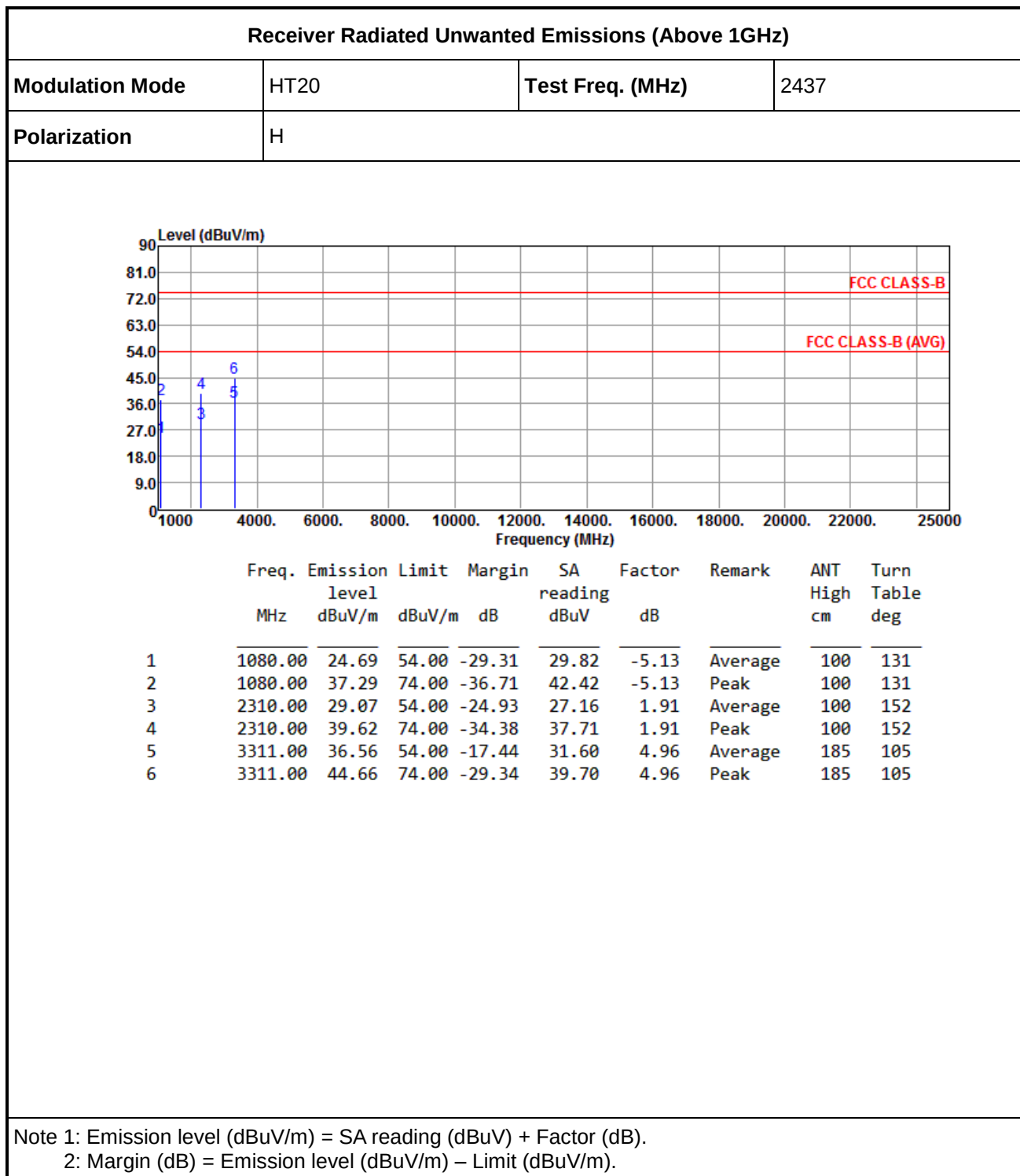


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	30.83	26.15	40.00	-13.85	34.15	-8.00	Peak	---	---
2	171.59	28.55	43.50	-14.95	43.88	-15.33	Peak	---	---
3	243.40	26.63	46.00	-19.37	38.56	-11.93	Peak	---	---
4	392.61	31.59	46.00	-14.41	39.61	-8.02	Peak	---	---
5	442.31	32.13	46.00	-13.87	39.10	-6.97	Peak	---	---
6	934.12	40.41	46.00	-5.59	37.67	2.74	Peak	---	---

Note 1: Emission Level (dBuV/m) = SA Reading (dBuV/m) + Factor (dB)

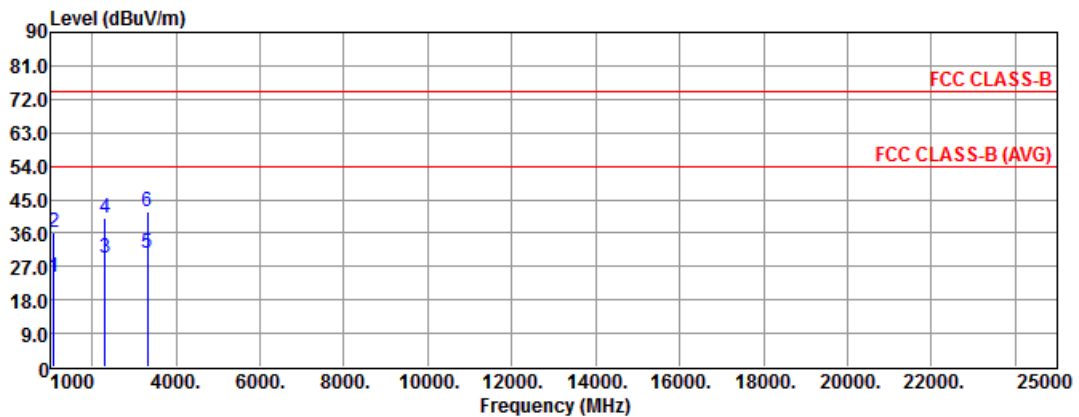
2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

3: All spurious emissions below 30MHz are more than 20 dB below the limit.

3.6.7 Test Result of Receiver Radiated Unwanted Emissions (Above 1GHz)


Receiver Radiated Unwanted Emissions (Above 1GHz)

Modulation Mode	HT20	Test Freq. (MHz)	2437
Polarization	V		



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1080.00	24.10	54.00	-29.90	29.23	-5.13	Average	100	235
2	1080.00	36.29	74.00	-37.71	41.42	-5.13	Peak	100	235
3	2310.00	29.29	54.00	-24.71	27.38	1.91	Average	100	315
4	2310.00	40.05	74.00	-33.95	38.14	1.91	Peak	100	315
5	3311.00	30.73	54.00	-23.27	25.77	4.96	Average	100	73
6	3311.00	41.62	74.00	-32.38	36.66	4.96	Peak	100	73

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).

2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

3.7 AC Conducted Emission Measurement

3.7.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

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

*Decreases with the logarithm of the frequency.

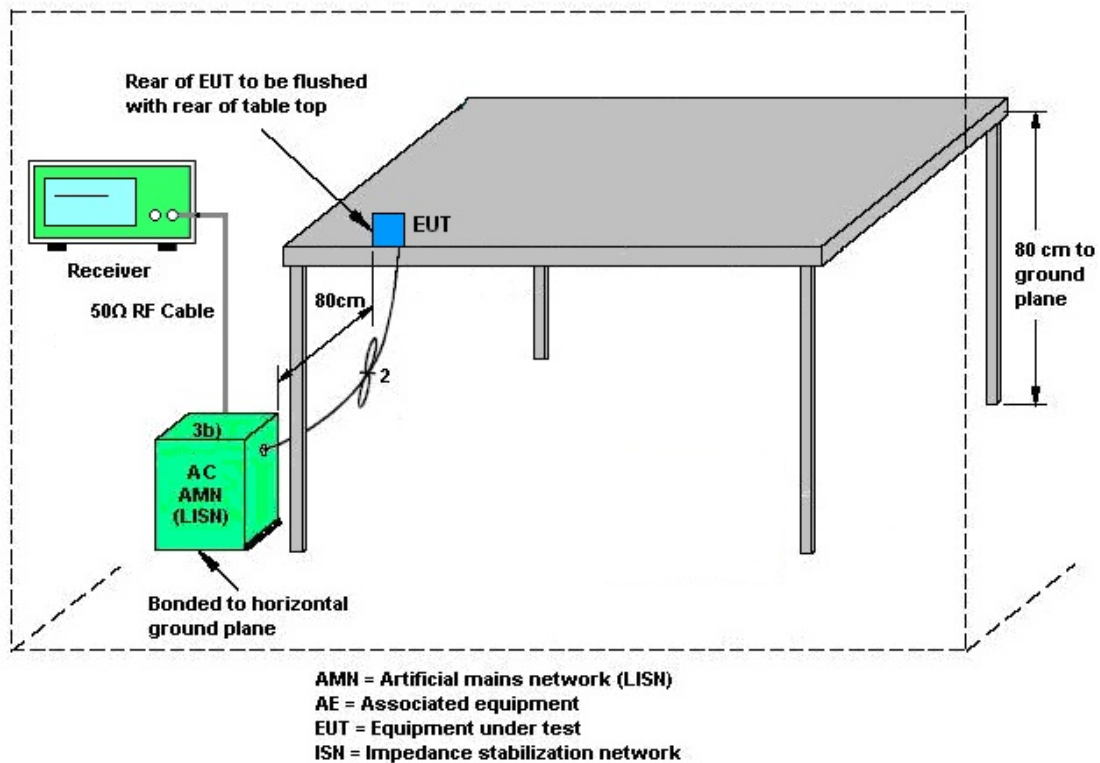
3.7.2 Measuring Instruments

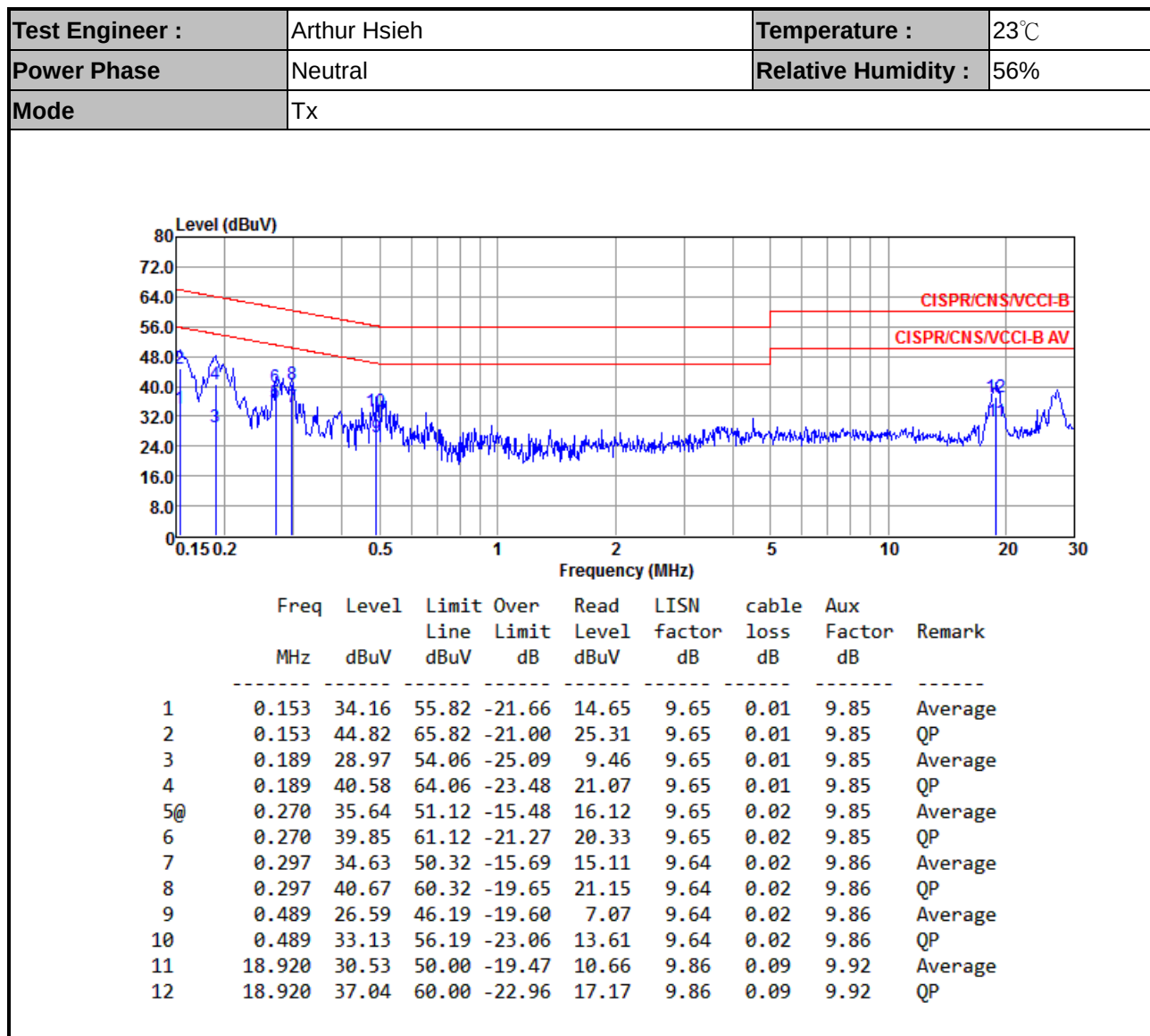
The measuring equipment is listed in the section 4 of this test report.

3.7.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.

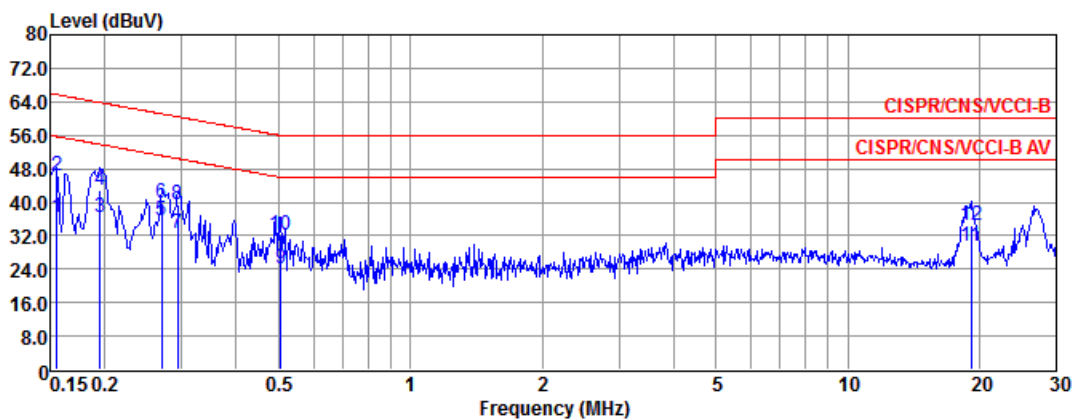
3.7.4 Test Setup



3.7.5 Test Result of AC Conducted Emission




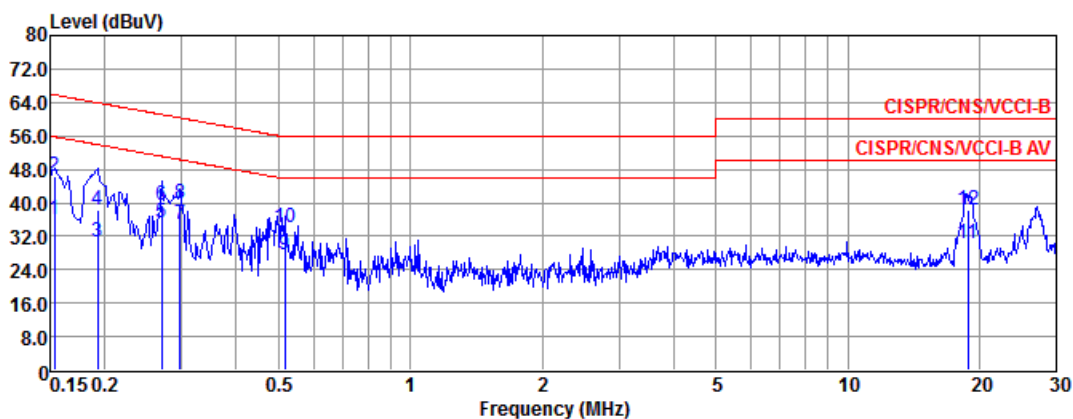
Test Engineer :	Arthur Hsieh	Temperature :	23°C
Power Phase	Line	Relative Humidity :	56%
Mode	Tx		



	Freq MHz	Level dBuV	Limit dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Aux Factor dB	Remark
1	0.156	36.31	55.69	-19.38	16.79	9.66	0.01	9.85	Average
2	0.156	46.17	65.69	-19.52	26.65	9.66	0.01	9.85	QP
3	0.195	36.46	53.80	-17.34	16.95	9.65	0.01	9.85	Average
4	0.195	42.84	63.80	-20.96	23.33	9.65	0.01	9.85	QP
5@	0.270	35.67	51.12	-15.45	16.15	9.65	0.02	9.85	Average
6	0.270	39.80	61.12	-21.32	20.28	9.65	0.02	9.85	QP
7	0.294	32.38	50.41	-18.03	12.85	9.65	0.02	9.86	Average
8	0.294	39.30	60.41	-21.11	19.77	9.65	0.02	9.86	QP
9	0.505	24.29	46.00	-21.71	4.76	9.65	0.02	9.86	Average
10	0.505	32.19	56.00	-23.81	12.66	9.65	0.02	9.86	QP
11	19.122	29.59	50.00	-20.41	9.79	9.78	0.10	9.92	Average
12	19.122	34.31	60.00	-25.69	14.51	9.78	0.10	9.92	QP



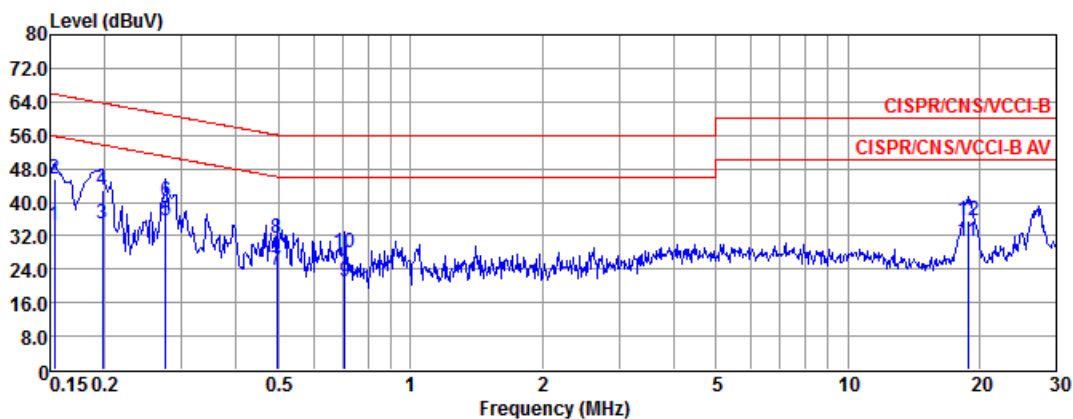
Test Engineer :	Arthur Hsieh	Temperature :	23°C
Power Phase	Neutral	Relative Humidity :	56%
Mode	Rx		



	Freq MHz	Level dBuV	Limit dBuV	Over Limit dB	Read Level dBuV	LISN factor dB	cable loss dB	Aux Factor dB	Remark
1	0.153	35.94	55.82	-19.88	16.43	9.65	0.01	9.85	Average
2	0.153	46.47	65.82	-19.35	26.96	9.65	0.01	9.85	QP
3	0.192	30.71	53.93	-23.22	11.20	9.65	0.01	9.85	Average
4	0.192	38.43	63.93	-25.50	18.92	9.65	0.01	9.85	QP
5	0.270	35.14	51.12	-15.98	15.62	9.65	0.02	9.85	Average
6	0.270	39.36	61.12	-21.76	19.84	9.65	0.02	9.85	QP
7@	0.297	34.76	50.32	-15.56	15.24	9.64	0.02	9.86	Average
8	0.297	39.74	60.32	-20.58	20.22	9.64	0.02	9.86	QP
9	0.516	27.42	46.00	-18.58	7.90	9.64	0.02	9.86	Average
10	0.516	34.25	56.00	-21.75	14.73	9.64	0.02	9.86	QP
11	18.820	30.13	50.00	-19.87	10.26	9.86	0.09	9.92	Average
12	18.820	38.25	60.00	-21.75	18.38	9.86	0.09	9.92	QP



Test Engineer :	Arthur Hsieh	Temperature :	23°C
Power Phase	Line	Relative Humidity :	56%
Mode	Rx		



	Freq	Level	Limit	Over	Read	LISN	cable	Aux	Remark
	MHz	dBuV	Line	Limit	Level	factor	loss	Factor	
			dBuV	dB	dBuV	dB	dB	dB	
1	0.153	34.35	55.82	-21.47	14.83	9.66	0.01	9.85	Average
2	0.153	45.55	65.82	-20.27	26.03	9.66	0.01	9.85	QP
3	0.198	34.67	53.71	-19.04	15.16	9.65	0.01	9.85	Average
4	0.198	42.86	63.71	-20.85	23.35	9.65	0.01	9.85	QP
5	0.276	35.60	50.94	-15.34	16.08	9.65	0.02	9.85	Average
6	0.276	40.31	60.94	-20.63	20.79	9.65	0.02	9.85	QP
7	0.494	23.68	46.10	-22.42	4.15	9.65	0.02	9.86	Average
8	0.494	31.31	56.10	-24.79	11.78	9.65	0.02	9.86	QP
9	0.708	21.05	46.00	-24.95	1.50	9.66	0.03	9.86	Average
10	0.708	27.77	56.00	-28.23	8.22	9.66	0.03	9.86	QP
11	18.820	30.56	50.00	-19.44	10.77	9.78	0.09	9.92	Average
12	18.820	35.61	60.00	-24.39	15.82	9.78	0.09	9.92	QP

3.8 Antenna Requirements

3.8.1 Standard Applicable

If directional gain of transmitting Antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached Antenna or of an Antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the LP0002 Section 2.2, Section 3.10.1.3, and Section 3.10.1.4.

3.8.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

3.8.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

3.9 Maximum Power Density

3.9.1 RF Exposure Limit Introduction

According to NCC LP0002, the criteria listed in Table shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §5.20.2.1 and §5.20.2.2.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1842/f	4.89/f	*(900/f ²)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna

3.9.2 Standalone Power Density Calculation

Frequency Range (MHz)	Maximum Conducted Power (dBm)	Rated Power (dBm)	Antenna Gain (dBi)	Distance (cm)	Power Density (mW/cm ²)	Limit (mW/cm ²)
2412~2462	15.63	16.00	1.9	20	0.012	1



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Nov. 23, 2017	Jun. 28, 2018 Jul. 01, 2018	Nov. 22, 2018	Radiation (03CH15-HY)
Preamplifier	Jet-Power	JPA00101800 -30-10P	160118000 2	1GHz~18GHz	Jul. 31, 2017	Jun. 28, 2018 Jul. 01, 2018	Jul. 30, 2018	Radiation (03CH15-HY)
Amplifier	SONOMA	310N	363440	9kHz~1GHz	Dec. 26, 2017	Jun. 28, 2018 Jul. 01, 2018	Dec. 25, 2018	Radiation (03CH15-HY)
Bilog Antenna	TESEQ	CBL6111D&0 0800N1D01N- 06	41912&05	30MHz to 1GHz	Jan. 10, 2018	Jun. 28, 2018 Jul. 01, 2018	Jan. 09, 2019	Radiation (03CH15-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY541300 85	20Hz ~ 8.4GHz	Oct. 31, 2017	Jun. 28, 2018 Jul. 01, 2018	Oct. 30, 2018	Radiation (03CH15-HY)
Horn Antenna	SCHWARZBE CK	BBHA 9120D	9120D-162 0	1G~18GHz	Oct. 03, 2017	Jun. 28, 2018 Jul. 01, 2018	Oct. 02, 2018	Radiation (03CH15-HY)
Hygrometer	TECPEL	DTM-303B	TP162976	N/A	Oct. 12, 2017	Jun. 28, 2018 Jul. 01, 2018	Oct. 11, 2018	Radiation (03CH15-HY)
Preamplifier	Keysight	83017A	MY532701 95	1GHz~26.5GHz	Aug. 21, 2017	Jun. 28, 2018 Jul. 01, 2018	Aug. 20, 2018	Radiation (03CH15-HY)
Spectrum Analyzer	Agilent	E4446A	MY501801 36	3Hz~44GHz	Apr. 25, 2018	Jun. 28, 2018 Jul. 01, 2018	Apr. 24, 2019	Radiation (03CH15-HY)
Controller	ChainTek	3000-1	N/A	Control Turn table & Ant Mast	N/A	Jun. 28, 2018 Jul. 01, 2018	N/A	Radiation (03CH15-HY)
Antenna Mast	ChainTek	MBS-520-1	N/A	1m~4m	N/A	Jun. 28, 2018 Jul. 01, 2018	N/A	Radiation (03CH15-HY)
Turn Table	ChainTek	T-200-S-1	N/A	0~360 Degree	N/A	Jun. 28, 2018 Jul. 01, 2018	N/A	Radiation (03CH15-HY)
SHF-EHF Horn Antenna	SCHWARZBE CK	BBHA 9170	BBHA9170 584	18GHz- 40GHz	Nov. 27, 2017	Jun. 28, 2018 Jul. 01, 2018	Nov. 26, 2018	Radiation (03CH15-HY)
Software	Audix	E3 6.2009-8-24	RK-00104 2	N/A	N/A	Jun. 28, 2018 Jul. 01, 2018	N/A	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER / MTJ Cooperation	SUCOFLEX 104 / 000000-MT18 A-100	MY36980/ 4, MY9838/4 PE, D3210	30MHz~1GHz	Mar. 15, 2018	Jun. 28, 2018 Jul. 01, 2018	Mar. 14, 2019	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER / MTJ Cooperation	SUCOFLEX 104 / 000000-MT18 A-100	MY36980/ 4, MY9838/4 PE, D3210	1GHz~18GHz	Mar. 15, 2018	Jun. 28, 2018 Jul. 01, 2018	Mar. 14, 2019	Radiation (03CH15-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	505134/2	30M~40GHz	Oct. 17, 2017	Jun. 28, 2018 Jul. 01, 2018	Oct. 16, 2018	Radiation (03CH15-HY)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Jul. 05, 2018	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102388	3.6GHz	Dec. 08, 2017	Jul. 05, 2018	Dec. 07, 2018	Conduction (CO05-HY)
Hygrometer	Testo	608-H1	34913912	N/A	Mar. 06, 2018	Jul. 05, 2018	Mar. 05, 2019	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 30, 2017	Jul. 05, 2018	Nov. 29, 2018	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Dec. 08, 2017	Jul. 05, 2018	Dec. 07, 2018	Conduction (CO05-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Jul. 05, 2018	N/A	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Jan. 03, 2018	Jul. 05, 2018	Jan. 02, 2019	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Jan. 03, 2018	Jul. 05, 2018	Jan. 02, 2019	Conduction (CO05-HY)



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Power Meter	Anritsu	ML2495A	1240001	N/A	Sep. 07, 2017	Jun. 02~Jul. 04, 2018	Sep. 06, 2018	Conducted (TH05-HY)
Power Sensor	Anritsu	MA2411B	1207349	300MHz~40GHz	Sep. 07, 2017	Jun. 02~Jul. 04, 2018	Sep. 06, 2018	Conducted (TH05-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP40	100057	9kHz-40GHz	Nov. 21, 2017	Jun. 02~Jul. 04, 2018	Nov. 20, 2018	Conducted (TH05-HY)
Switch Box & RF Cable	Burgeon	ETF-058	EC130048 4	N/A	Mar. 01, 2018	Jun. 02~Jul. 04, 2018	Feb. 28, 2019	Conducted (TH05-HY)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.70
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.20
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.00
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	5.20
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