

TEST REPORT

Application No.: SHEM1812001548CR
FCC ID HD5-HAQ
IC 1693B-HAQ
Applicant: Honeywell International Inc.
Address of Applicant: 9680 OLD BAILES Road, FORT MILL, SC 29707-7539 UNITED STATES
Manufacturer: Honeywell International Inc.
Address of Manufacturer: 9680 OLD BAILES Road, FORT MILL, SC 29707-7539 UNITED STATES
Factory: Metro (Suzhou) Technologies Co., Ltd
Address of Factory: No.221 Xinghai Street, China-Singapore Suzhou Industrial Park, Suzhou 215021, Jiangsu, China

Equipment Under Test (EUT):

EUT Name: Indoor Air Quality Monitor
Model No.: HAQSPA_R
Trade mark: Honeywell
Standard(s) : 47 CFR Part 15, Subpart C 15.247
 RSS-247 Issue 2, February 2017
Date of Receipt: 2018-12-04
Date of Test: 2018-12-05 to 2018-12-06
Date of Issue: 2018-12-13

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.

Parlam Zhan

Parlam Zhan
E&E Section Manager

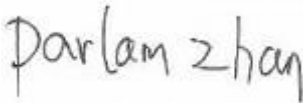
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Revision Record			
Version	Description	Date	Remark
00	Update tests	2018-12-13	Base on SHEM180100090102

Authorized for issue by:				
				
		<hr/>		
		Bill Wu / Project Engineer		
				
		<hr/>		
		Parlam Zhan / Reviewer		

2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(c)	See Note 1

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	See Note 1
Minimum 6dB Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.8.1	47 CFR Part 15, Subpart C 15.247a(2)	See Note 1
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(3)	Pass
Power Spectrum Density	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 11.10.2	47 CFR Part 15, Subpart C 15.247(e)	See Note 1
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.6	47 CFR Part 15, Subpart C 15.247(d)	See Note 1
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.8	47 CFR Part 15, Subpart C 15.247(d)	See Note 1
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.4	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass
99% Bandwidth	RSS-247 Issue 2, February 2017	ANSI C63.10 Section 6.9.3	RSS-Gen Section 6.6	See Note 1
Frequency Stability	RSS-Gen April 2018	RSS-Gen Section 6.11	RSS-Gen Section 8.11	See Note 2

Note 1: Base on SHEM180100090102.

Note 2: Frequency stability requested in RSS GEN S8.11 has been complied since the result of band edge can demonstrate.



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4 General Information

4.1 Details of E.U.T.

Power supply:	DC 3.7V, rechargeable Li-ion battery
Test voltage:	AC 120V,60Hz
Cable:	DC Cable 1m
Antenna Gain	1.9dBi
Antenna Type	Chip Antenna
Channel Spacing	5MHz
Modulation Type	802.11b: DSSS (CCK, DQPSK, DBPSK);802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK);802.11n(HT20)
Number of Channels	802.11b/g/n(HT20):11
Operation Frequency	802.11b/g/n(HT20): 2412MHz to 2462MHz

4.2 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
Laptop	LENOVO	R400	/
Serial port adapter plate	/	Test Plate 3	/

4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.25 x 10-8
2	Timeout	2s
3	Duty cycle	0.37%
4	Occupied Bandwidth	3%
5	RF conducted power	0.75dB
6	RF power density	2.84dB
7	Conducted Spurious emissions	0.75dB
8	RF Radiated power	4.5dB (Below 1GHz)
		4.8dB (Above 1GHz)
9	Radiated Spurious emission test	4.2dB (Below 30MHz)
		4.4dB (30MHz-1GHz)
		4.6dB (1GHz-18GHz)
		5.2dB (Above 18GHz)
10	Temperature test	1°C
11	Humidity test	3%
12	Supply voltages	1.5%
13	Time	3%

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

4.4 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd. Shanghai Branch

588 West Jindu Road, Xinqiao, Songjiang, 201612 Shanghai, China

Tel: +86 21 6191 5666

Fax: +86 21 6191 5678

No tests were sub-contracted.

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L0599)**

CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **NVLAP (Certificate No. 201034-0)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). Certificate No. 201034-0.

- **FCC –Designation Number: CN5033**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been recognized as an accredited testing laboratory.

Designation Number: CN5033. Test Firm Registration Number: 479755.

- **Industry Canada (IC) – IC Assigned Code: 8617A**

The 3m Semi-anechoic chamber of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 8617A-1.

- **VCCI (Member No.: 3061)**

The 3m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-3868,C-4336,T-12221,G-10830 respectively.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None

5 Equipment List

Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Conducted Test					
Spectrum Analyzer	R&S	FSP-30	SHEM002-1	2017-12-20	2018-12-19
Spectrum Analyzer	Agilent	N9020A	SHEM181-1	2018-08-13	2019-08-12
Signal Generator	R&S	SMR20	SHEM006-1	2018-08-13	2019-08-12
Signal Generator	Agilent	N5182A	SHEM182-1	2018-08-13	2019-08-12
Communication Tester	R&S	CMW270	SHEM183-1	2018-08-13	2019-08-12
Switcher	Tonscend	JS0806	SHEM184-1	2018-08-13	2019-08-12
Power Sensor	Keysight	U2021XA * 4	SHEM184-1	2018-08-13	2019-08-12
Splitter	Anritsu	MA1612A	SHEM185-1	/	/
Coupler	e-meca	803-S-1	SHEM186-1	/	/
High-low Temp Cabinet	Suzhou Zhihe	TL-40	SHEM087-1	2017-09-25	2020-09-24
AC Power Stabilizer	WOCEN	6100	SHEM045-1	2017-12-26	2018-12-25
DC Power Supply	QJE	QJ30003SII	SHEM046-1	2017-12-26	2018-12-25
Conducted test Cable	/	RF01~RF04	/	2017-12-26	2018-12-25
Radiated Test					
EMI test Receiver	R&S	ESU40	SHEM051-1	2017-12-20	2018-12-19
Spectrum Analyzer	R&S	FSP-30	SHEM002-1	2017-12-20	2018-12-19
Loop Antenna (9kHz-30MHz)	Schwarzbeck	FMZB1519	SHEM135-1	2017-04-10	2020-04-09
Antenna (25MHz-2GHz)	Schwarzbeck	VULB9168	SHEM048-1	2017-02-28	2020-02-27
Antenna (25MHz-3GHz)	Schwarzbeck	HL562	SHEM010-1	2017-02-28	2020-02-27
Horn Antenna (1-8GHz)	Schwarzbeck	HF906	SHEM009-1	2017-10-24	2020-10-23
Horn Antenna (1-18GHz)	Schwarzbeck	BBHA9120D	SHEM050-1	2017-01-14	2020-01-13
Horn Antenna (14-40GHz)	Schwarzbeck	BBHA 9170	SHEM049-1	2017-12-03	2020-12-02
Pre-amplifier (9KHz-2GHz)	CLAVIIO	BDLNA-0001	SHEM164-1	2018-08-13	2019-08-12
Pre-amplifier (1-18GHz)	CLAVIIO	BDLNA-0118	SHEM050-2	2018-08-13	2019-08-12
High-amplifier (14-40GHz)	Schwarzbeck	10001	SHEM049-2	2017-12-20	2018-12-19
Signal Generator	R&S	SMR40	SHEM058-1	2018-08-13	2019-08-12
Band Filter	LORCH	9BRX-875/X150	SHEM156-1	/	/
Band Filter	LORCH	13BRX-1950/X500	SHEM083-2	/	/
Band Filter	LORCH	5BRX-2400/X200	SHEM155-1	/	/
Band Filter	LORCH	5BRX-5500/X1000	SHEM157-2	/	/
High pass Filter	Wainwright	WHK3.0/18G	SHEM157-1	/	/
High pass Filter	Wainwright	WHKS1700	SHEM157-3	/	/
Semi/Fully Anechoic	ST	11*6*6M	SHEM078-2	2017-07-22	2020-07-21
RE test Cable	/	RE01, RE02, RE06	/	2017-12-26	2018-12-25

6 Radio Spectrum Technical Requirement

6.1 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)

Test Method: ANSI C63.10 (2013) Section 7.8.5

Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥ 50 hopping channels
	0.25 for $25 \leq$ hopping channels < 50
	1 for digital modulation
2400-2483.5	1 for ≥ 75 non-overlapping hopping channels
	0.125 for all other frequency hopping systems
	1 for digital modulation
5725-5850	1 for frequency hopping systems and digital modulation

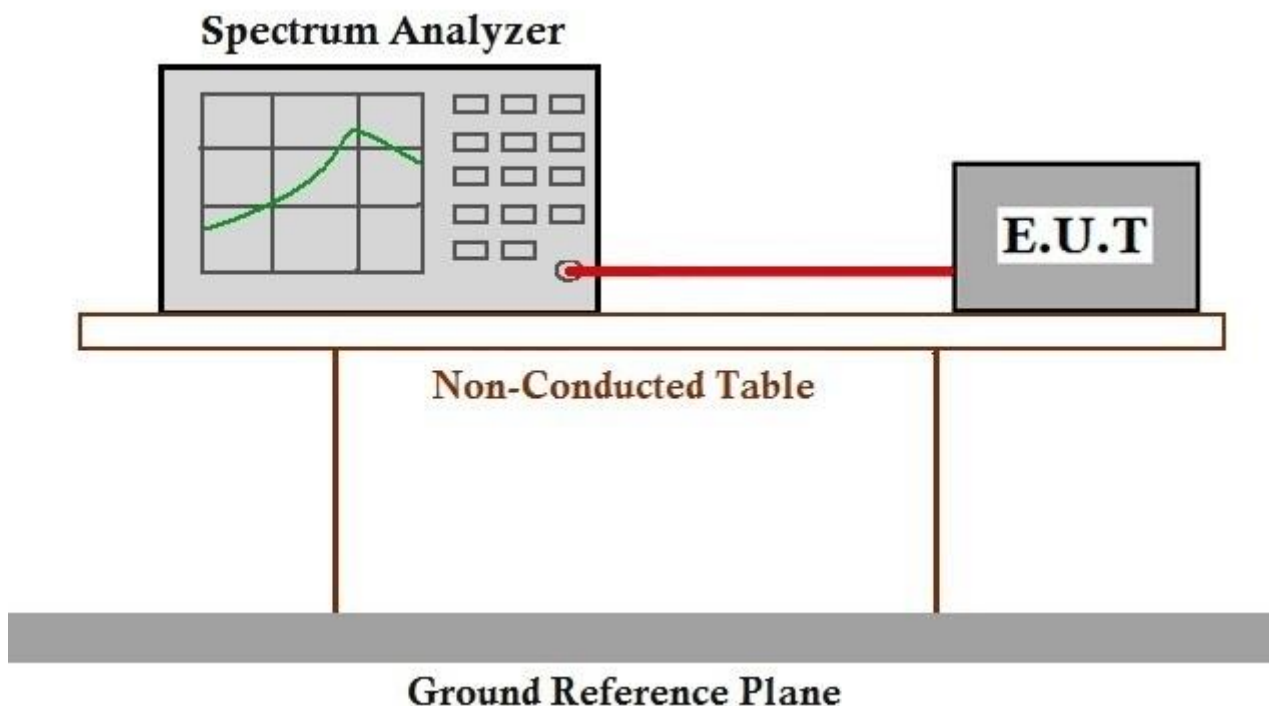
6.1.1 E.U.T. Operation

Operating Environment:

Temperature: 21 °C Humidity: 45 % RH Atmospheric Pressure: 1010 mbar

Test mode c:TX mode:Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20). Only the data of worst case is recorded in the report.

6.1.2 Test Setup Diagram

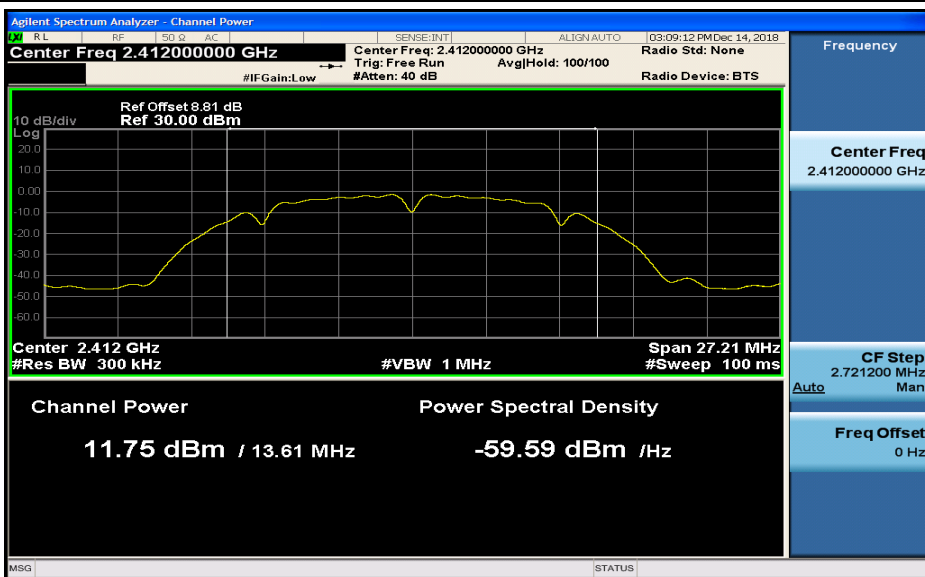


6.1.3 Measurement Procedure and Data

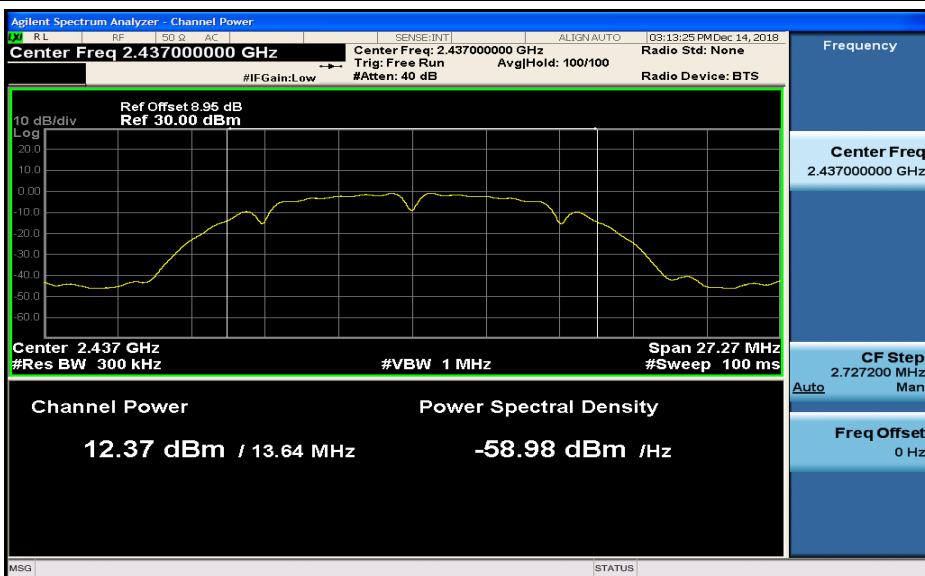
Maximum conducted (average) output power

Test Mode	Test Channel	Ant	Level [dBm]	10log(1/x) Factor[dB]	Power [dBm]	Limit [dBm]	Verdict
11B	2412	Ant1	11.75	0.05	11.80	30	PASS
11B	2437	Ant1	12.37	0.04	12.41	30	PASS
11B	2462	Ant1	12.74	0.04	12.78	30	PASS
11G	2412	Ant1	6.97	0.31	7.28	30	PASS
11G	2437	Ant1	11.11	0.22	11.33	30	PASS
11G	2462	Ant1	7.53	0.29	7.82	30	PASS
11N20SISO	2412	Ant1	6.86	0.28	7.14	30	PASS
11N20SISO	2437	Ant1	10.61	0.26	10.87	30	PASS
11N20SISO	2462	Ant1	7.48	0.26	7.74	30	PASS

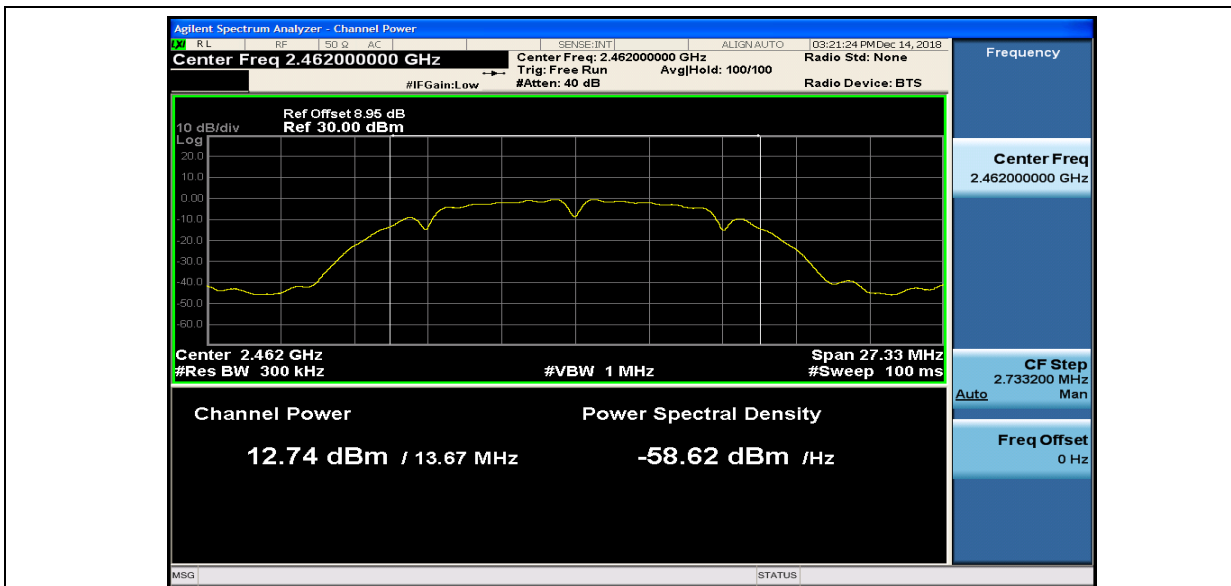
Maximum conducted (average) output power_11B_2412_Ant1



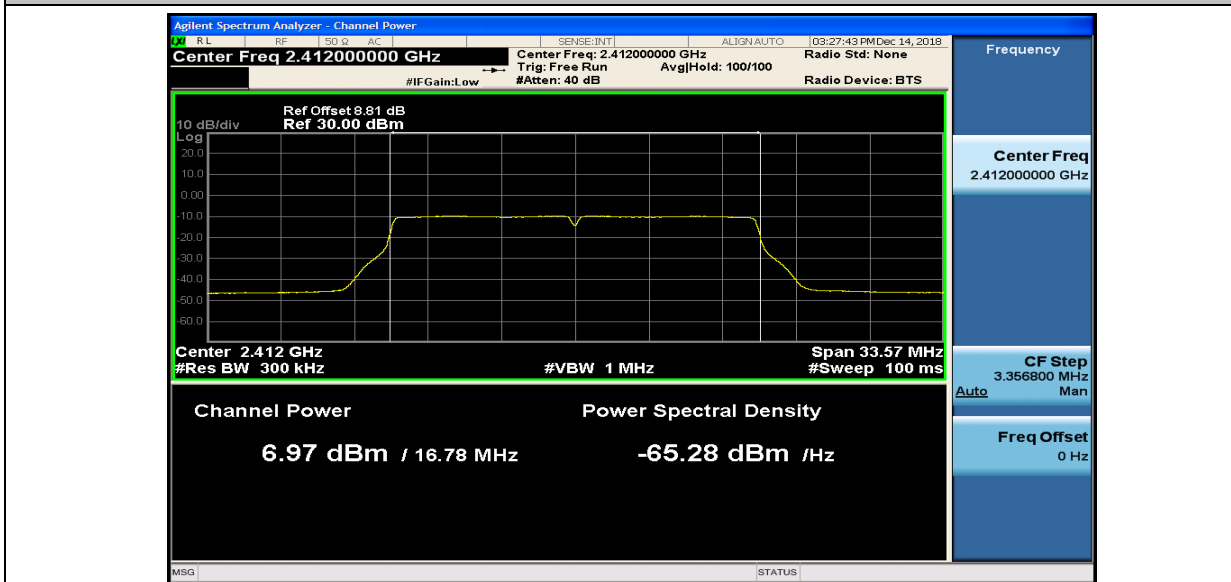
Maximum conducted (average) output power_11B_2437_Ant1



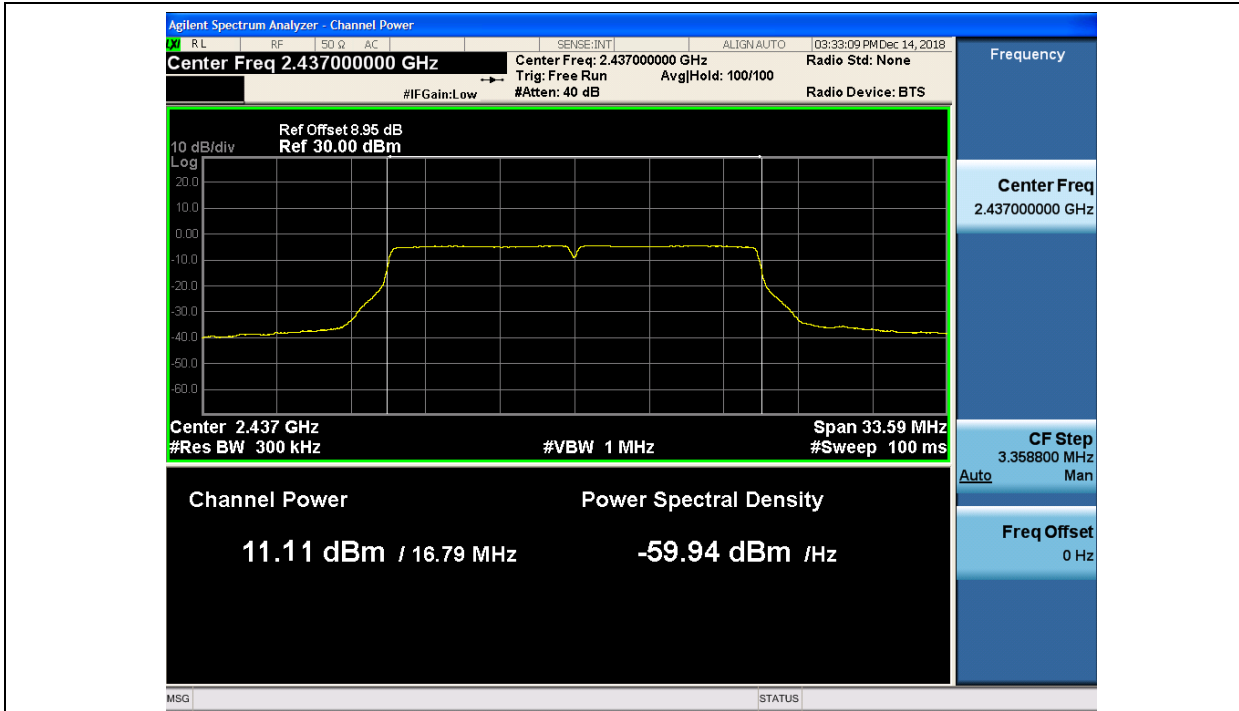
Maximum conducted (average) output power_11B_2462_Ant1



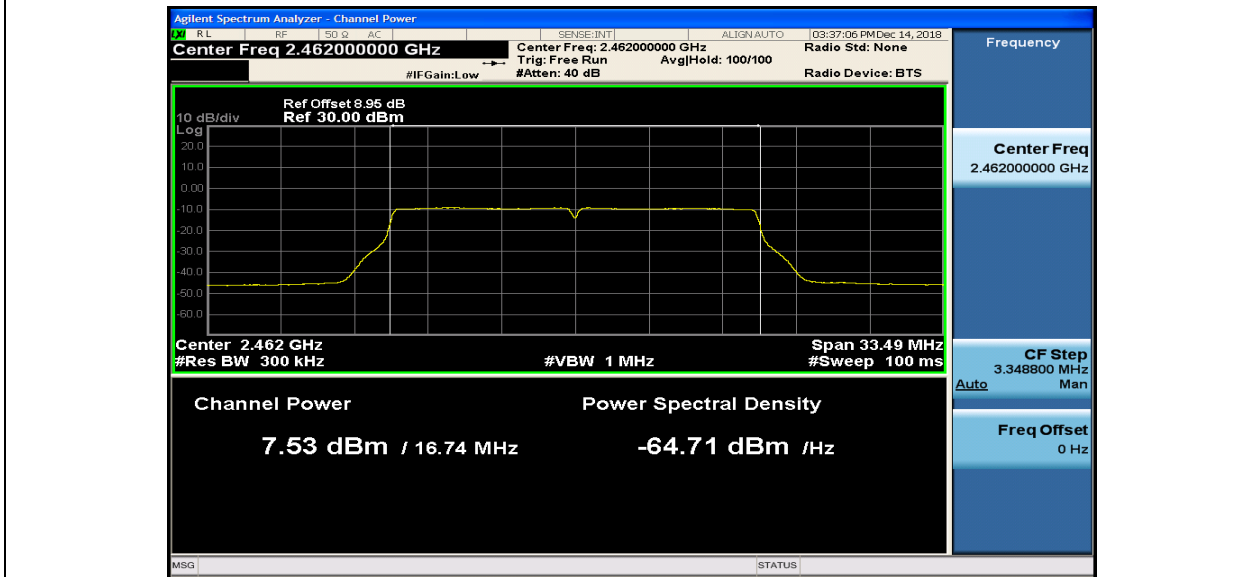
Maximum conducted (average) output power_11G_2412_Ant1



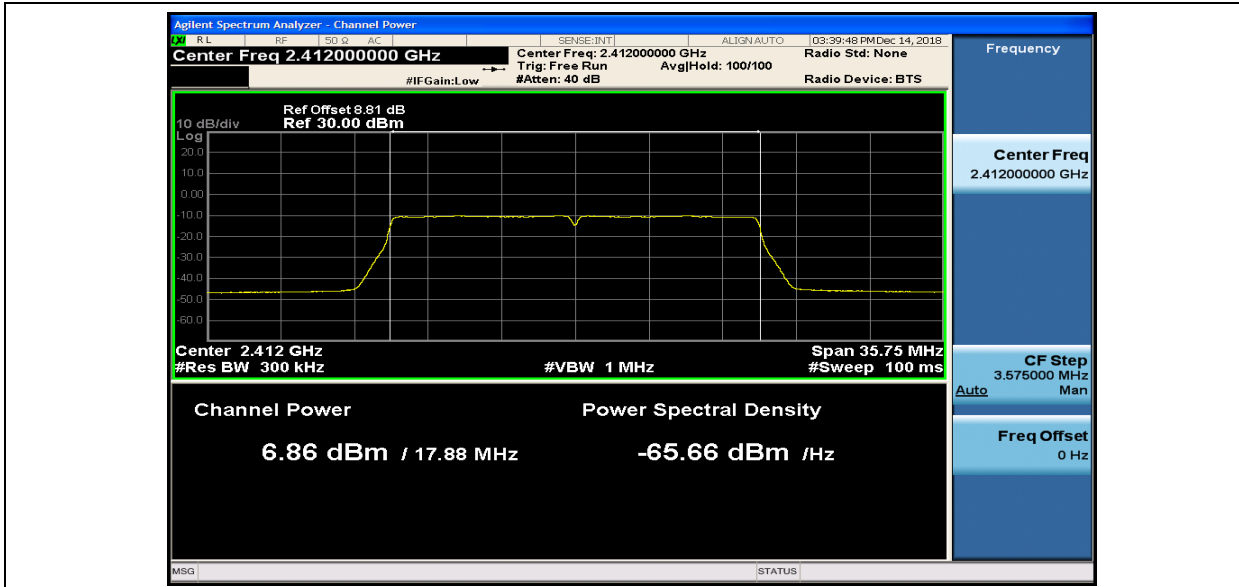
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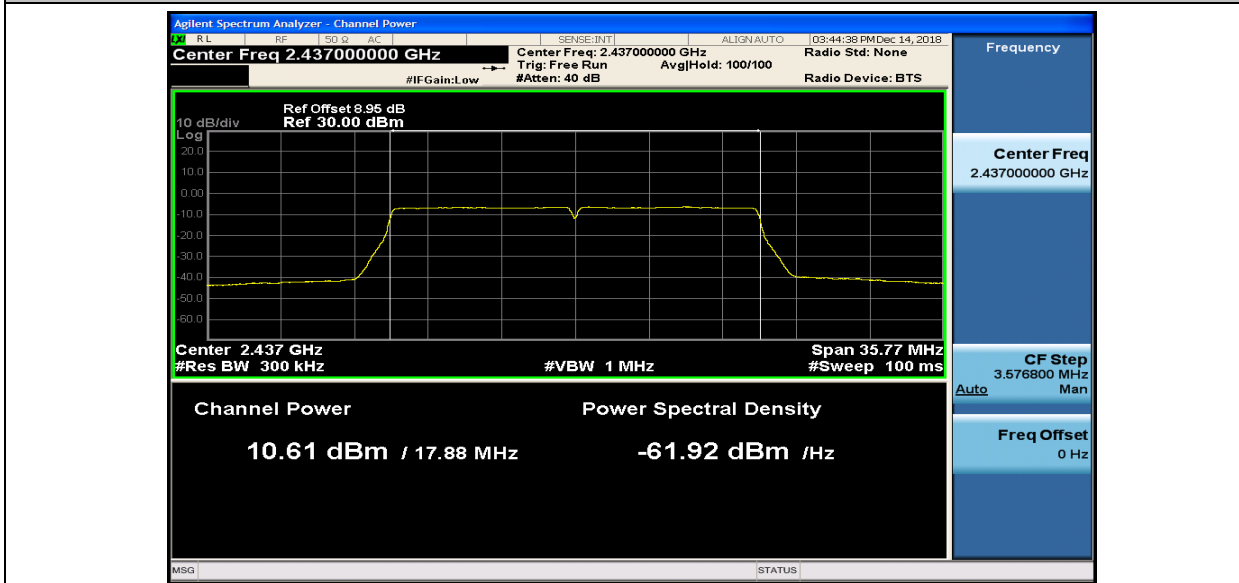
Maximum conducted (average) output power_11G_2462_Ant1



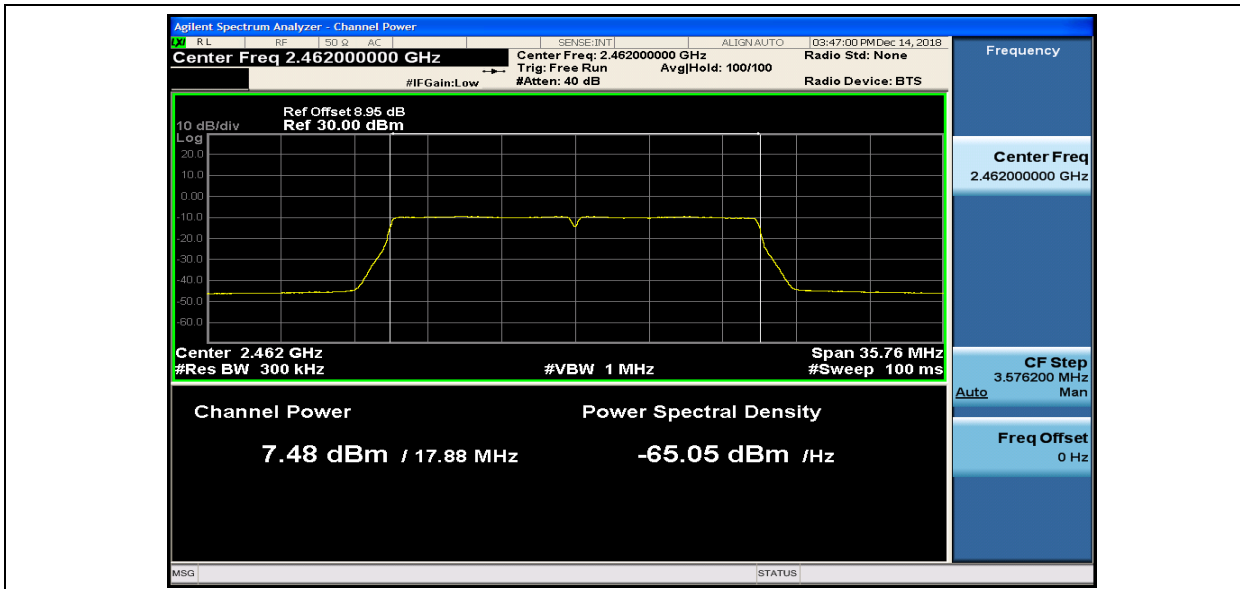
Maximum conducted (average) output power_11N20SISO_2412_Ant1



Maximum conducted (average) output power_11N20SISO_2437_Ant1



Maximum conducted (average) output power_11N20SISO_2462_Ant1



6.2 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.247(d)

Test Method: ANSI C63.10 (2013) Section 6.10.5

Limit:

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

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

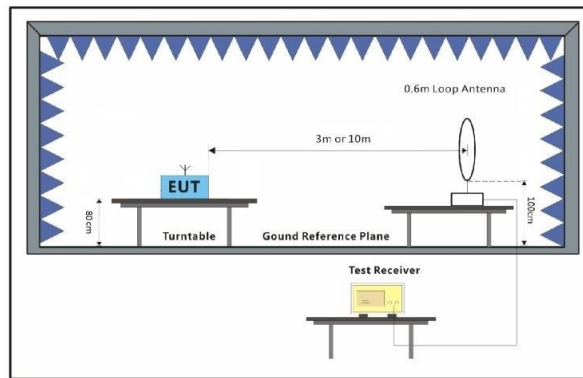
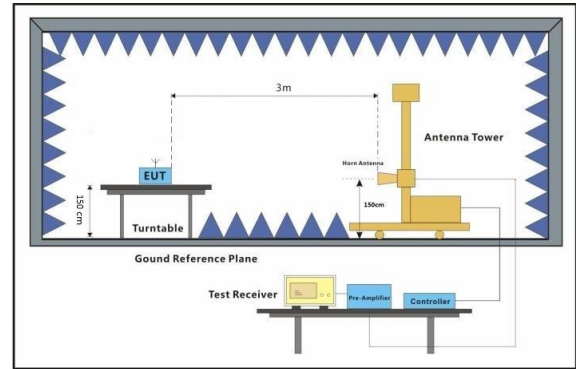
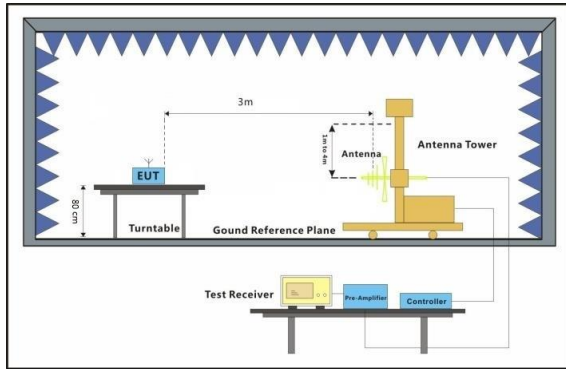
6.2.1 E.U.T. Operation

Operating Environment:

Temperature: 21 °C Humidity: 45 % RH Atmospheric Pressure: 1010 mbar

Test mode c:TX mode:Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20). Only the data of worst case is recorded in the report.

6.2.2 Test Setup Diagram



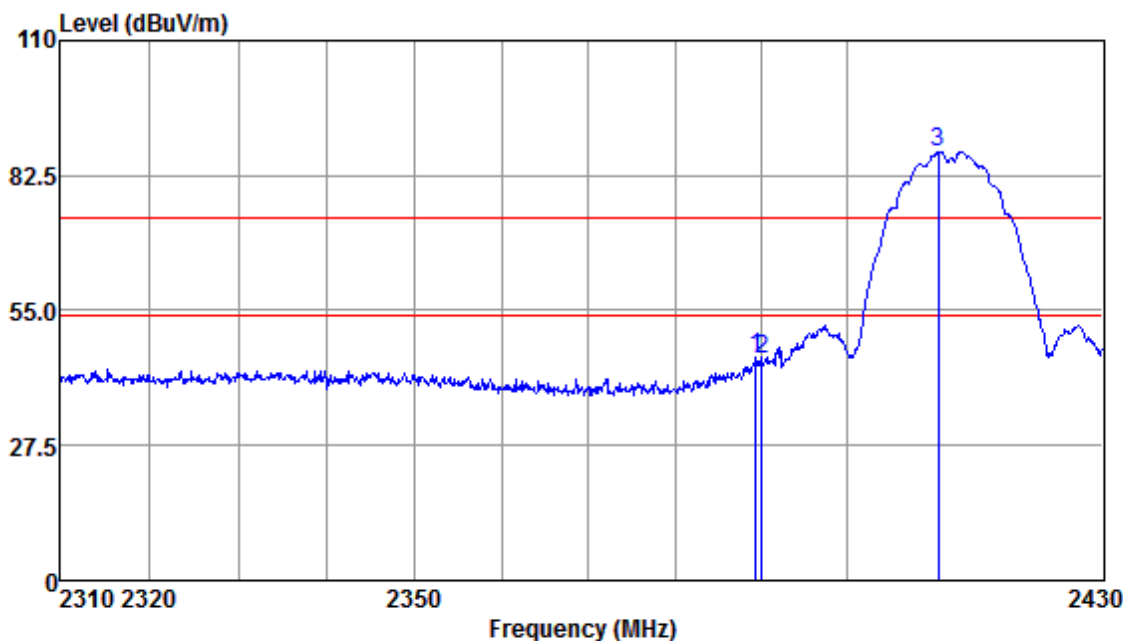
6.2.3 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark 1: $\text{Level} = \text{Read Level} + \text{Cable Loss} + \text{Antenna Factor} - \text{Preamp Factor}$

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Mode:c; Polarization:Horizontal; Modulation:b; bandwidth:20MHz; Channel:Low

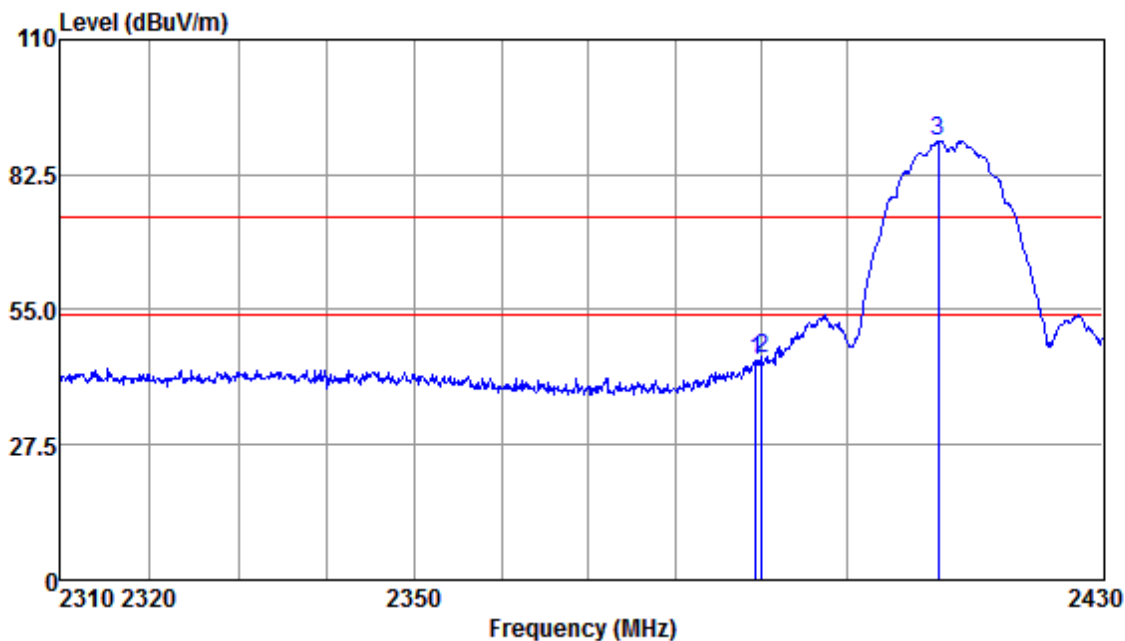


Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2389.36	50.37	26.03	6.47	37.36	45.51	74.00	-28.49	Peak
2390.00	49.80	26.03	6.47	37.36	44.94	74.00	-29.06	Peak
2410.63	92.13	26.06	6.50	37.35	87.34	74.00	13.34	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:c; Polarization:Vertical; Modulation:b; bandwidth:20MHz; Channel:Low

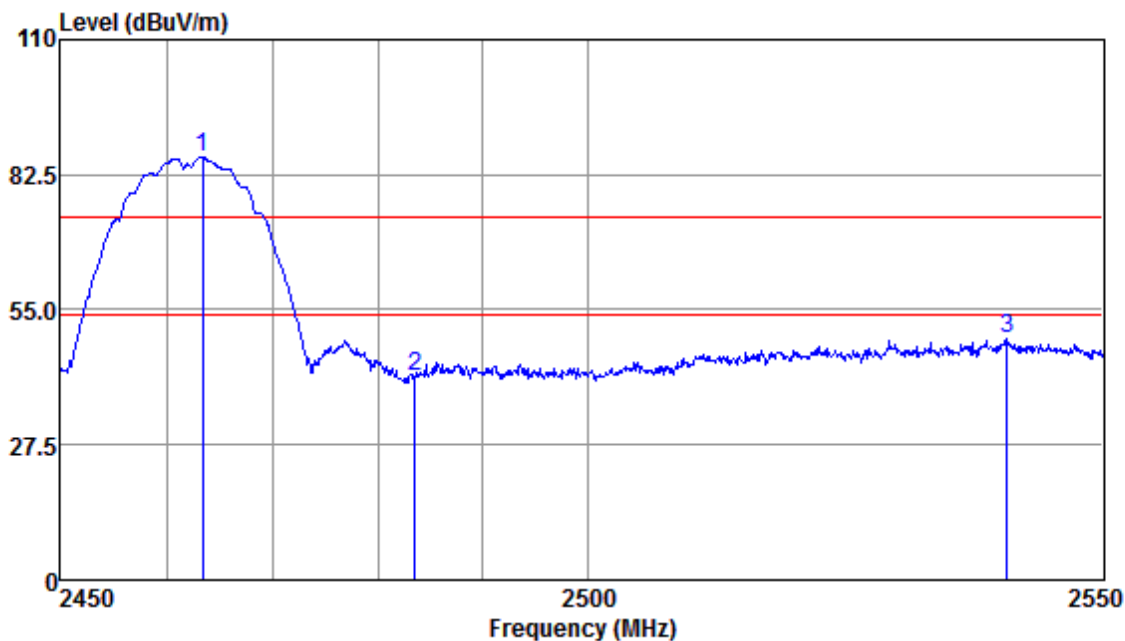


Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2389.36	49.37	26.03	6.47	37.36	44.51	74.00	-29.49	Peak
2390.00	49.80	26.03	6.47	37.36	44.94	74.00	-29.06	Peak
2410.63	94.13	26.06	6.50	37.35	89.34	74.00	15.34	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:c; Polarization:Horizontal; Modulation:b; bandwidth:20MHz; Channel:High

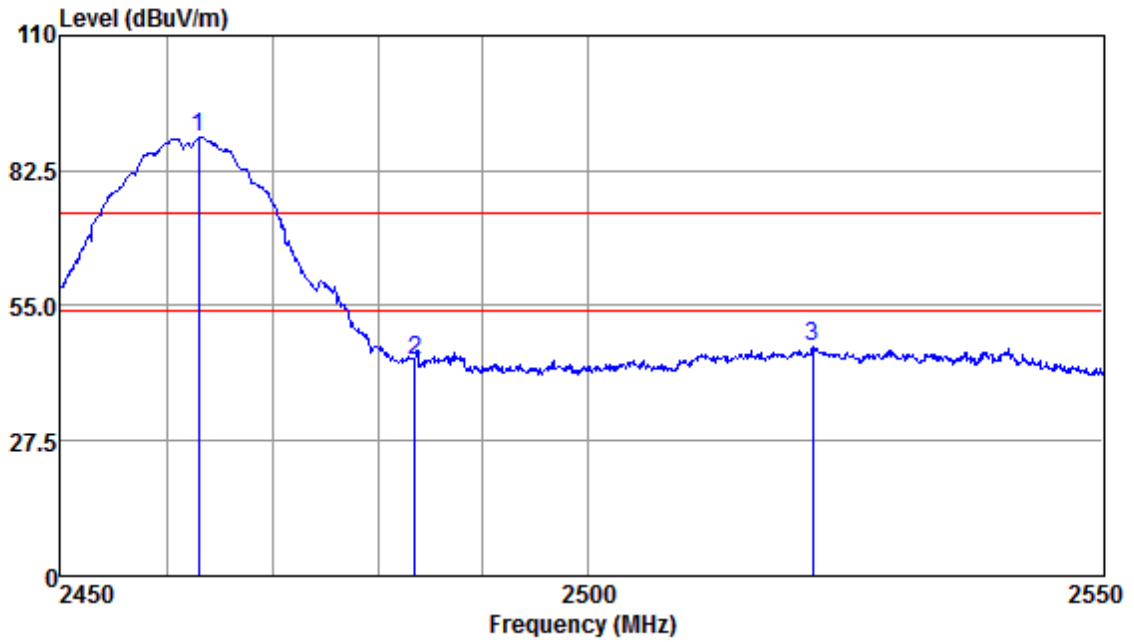


Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2463.37	90.71	26.15	6.68	37.46	86.08	74.00	12.08	Peak
2483.50	45.95	26.18	6.80	37.51	41.42	74.00	-32.58	Peak
2540.63	53.43	26.33	7.01	37.60	49.17	74.00	-24.83	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:c; Polarization:Vertical; Modulation:b; bandwidth:20MHz; Channel:High

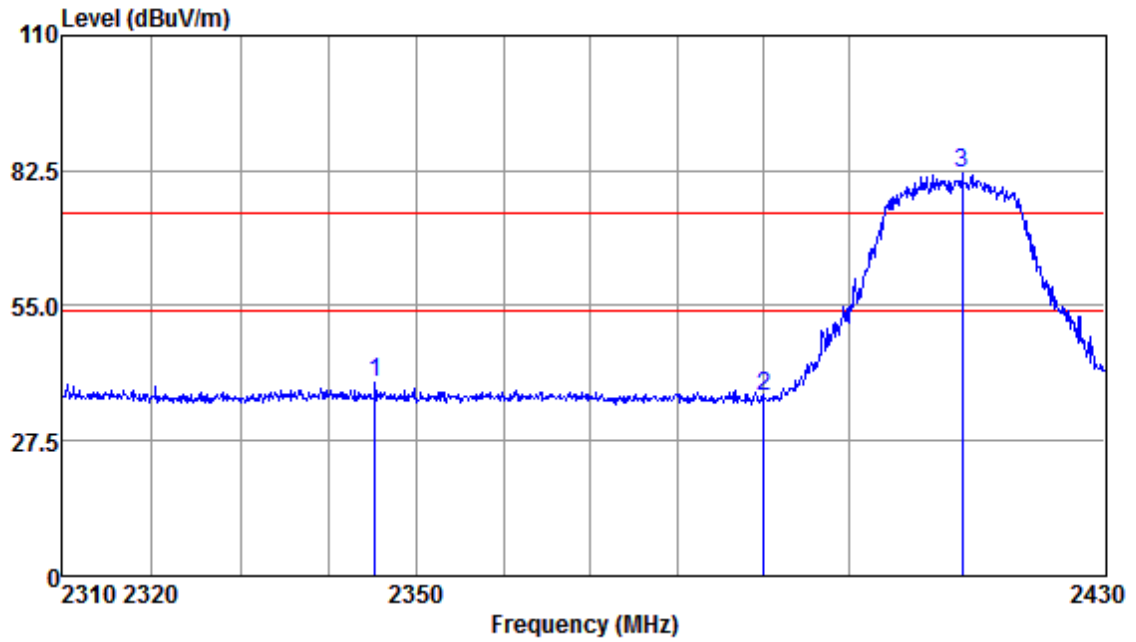


Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2462.97	93.87	26.15	6.68	37.46	89.24	74.00	15.24	Peak
2483.50	48.49	26.18	6.80	37.51	43.96	74.00	-30.04	Peak
2521.70	50.89	26.27	6.94	37.58	46.52	74.00	-27.48	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:c; Polarization:Horizontal; Modulation:g; bandwidth:20MHz; Channel:Low

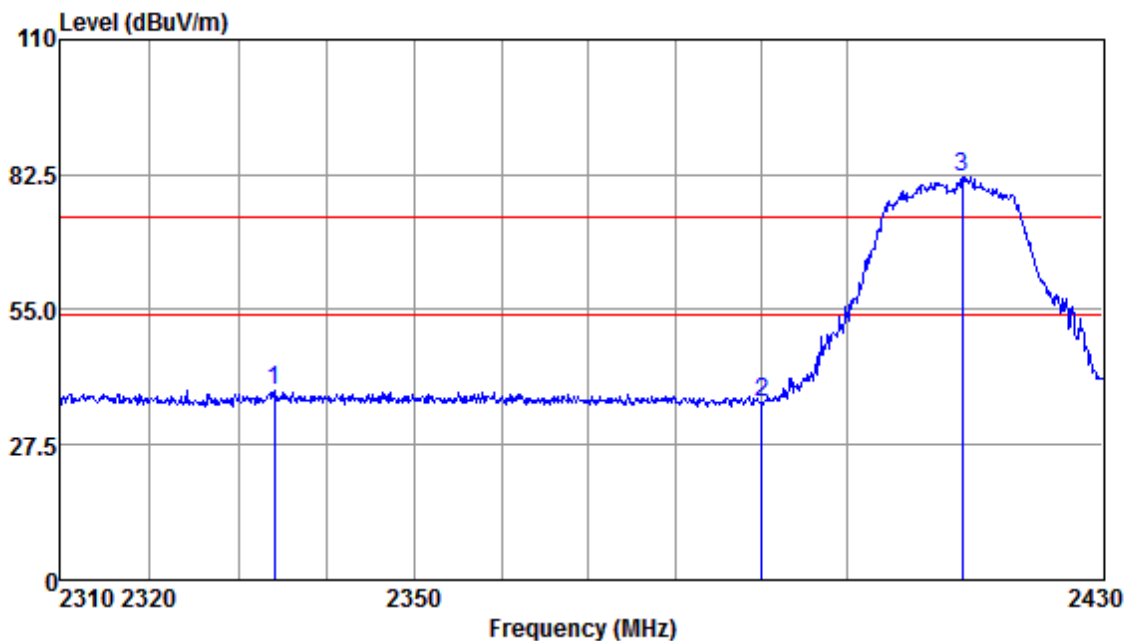


Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2345.36	44.37	25.97	6.40	37.37	39.37	74.00	-34.63	Peak
2390.00	41.33	26.03	6.47	37.36	36.47	74.00	-37.53	Peak
2413.20	86.78	26.08	6.50	37.36	82.00	74.00	8.00	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:c; Polarization:Vertical; Modulation:g; bandwidth:20MHz; Channel:Low

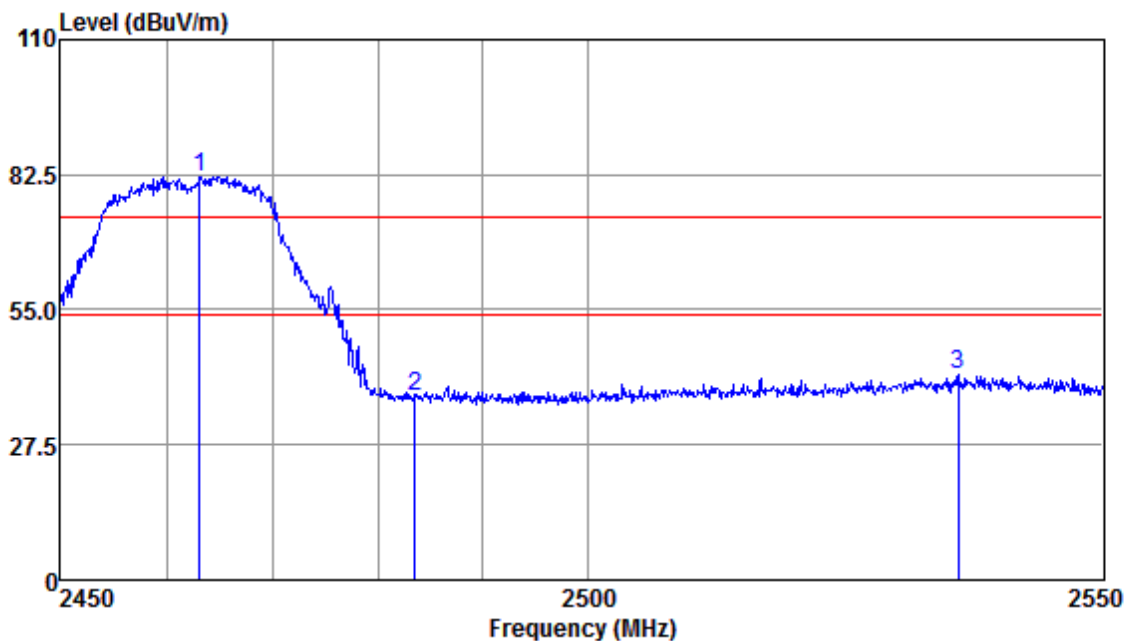


Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2334.11	43.47	25.95	6.37	37.37	38.42	74.00	-35.58	Peak
2390.00	40.83	26.03	6.47	37.36	35.97	74.00	-38.03	Peak
2413.44	86.75	26.08	6.50	37.36	81.97	74.00	7.97	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:c; Polarization:Horizontal; Modulation:g; bandwidth:20MHz; Channel:High

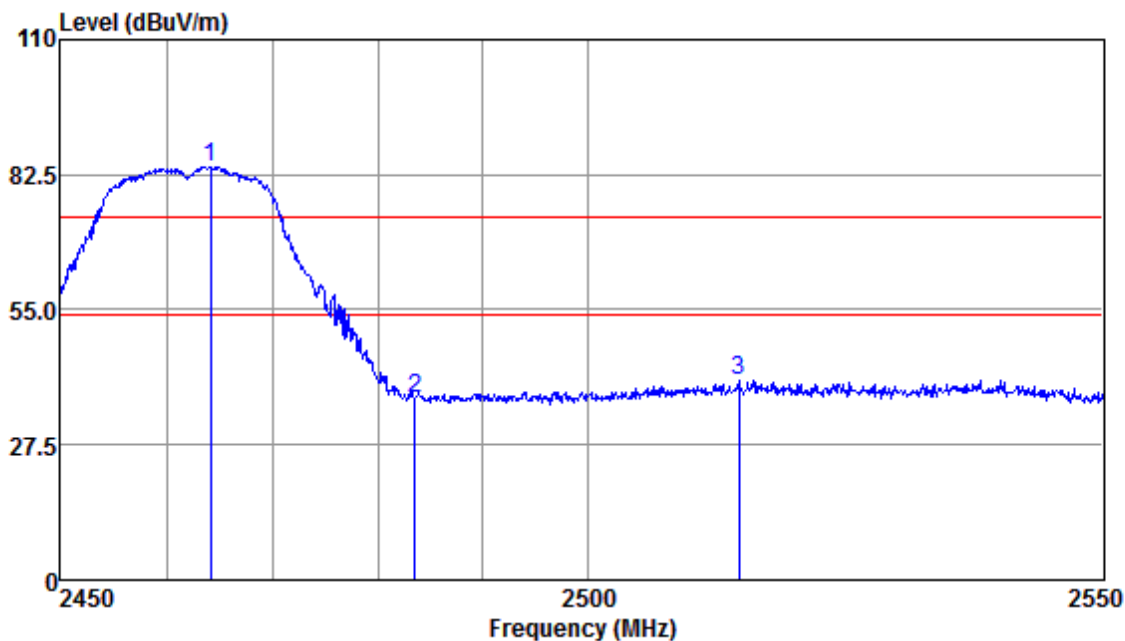


Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2463.07	86.81	26.15	6.68	37.46	82.18	74.00	8.18	Peak
2483.50	42.05	26.18	6.80	37.51	37.52	74.00	-36.48	Peak
2535.86	46.02	26.31	7.01	37.59	41.75	74.00	-32.25	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:c; Polarization:Vertical; Modulation:g; bandwidth:20MHz; Channel:High

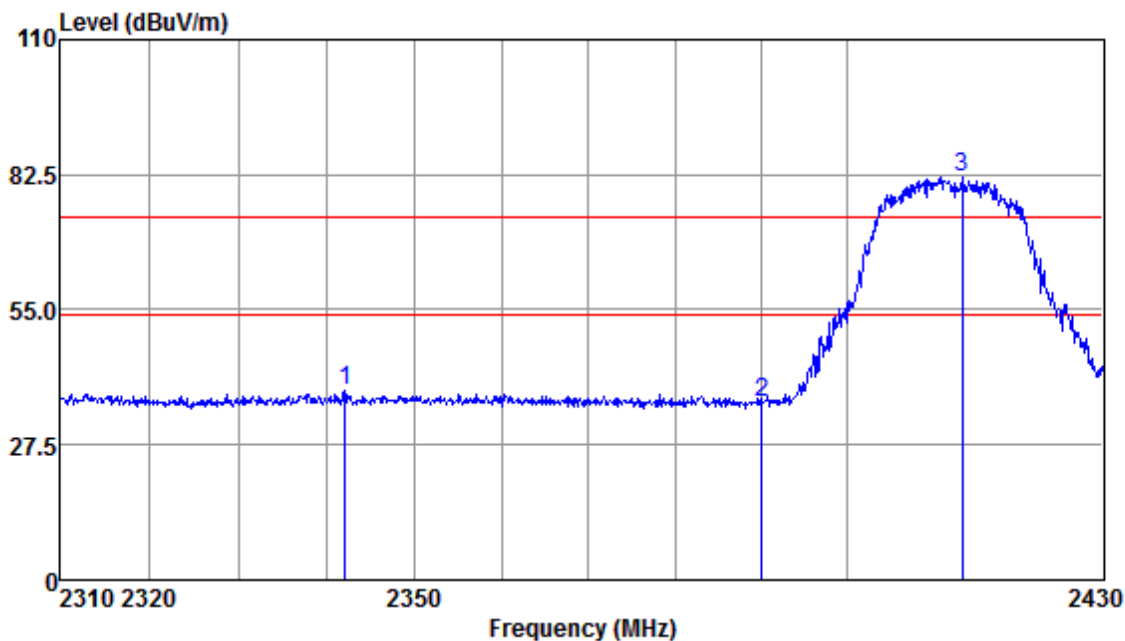


Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2464.16	88.85	26.15	6.68	37.46	84.22	74.00	10.22	Peak
2483.50	41.48	26.18	6.80	37.51	36.95	74.00	-37.05	Peak
2514.65	45.25	26.24	6.86	37.56	40.79	74.00	-33.21	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:c; Polarization:Horizontal; Modulation:n; bandwidth:20MHz; Channel:Low

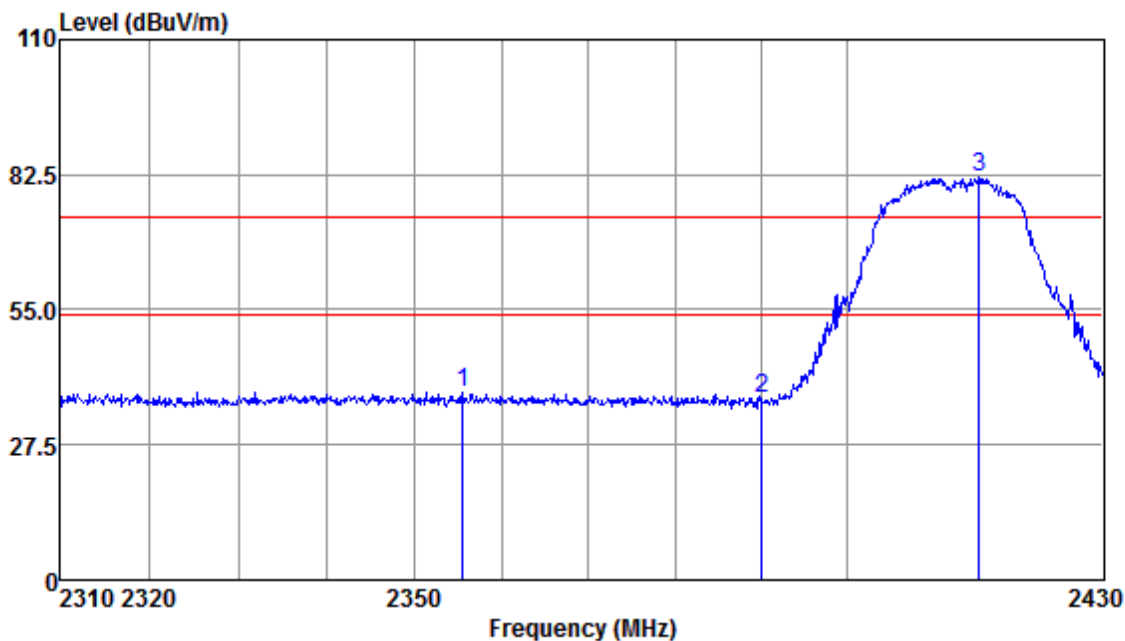


Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2342.16	43.47	25.96	6.40	37.37	38.46	74.00	-35.54	Peak
2390.00	40.90	26.03	6.47	37.36	36.04	74.00	-37.96	Peak
2413.44	86.78	26.08	6.50	37.36	82.00	74.00	8.00	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:c; Polarization:Vertical; Modulation:n; bandwidth:20MHz; Channel:Low

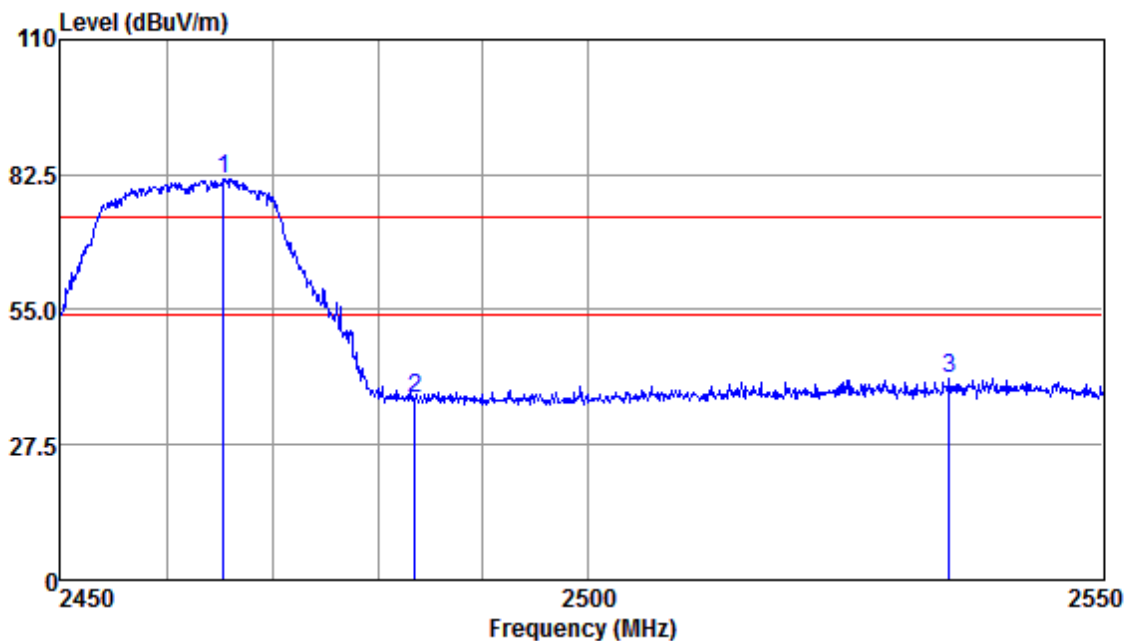


Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2355.60	43.14	25.98	6.42	37.36	38.18	74.00	-35.82	Peak
2390.00	41.93	26.03	6.47	37.36	37.07	74.00	-36.93	Peak
2415.40	86.60	26.08	6.56	37.36	81.88	74.00	7.88	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:c; Polarization:Horizontal; Modulation:n; bandwidth:20MHz; Channel:High

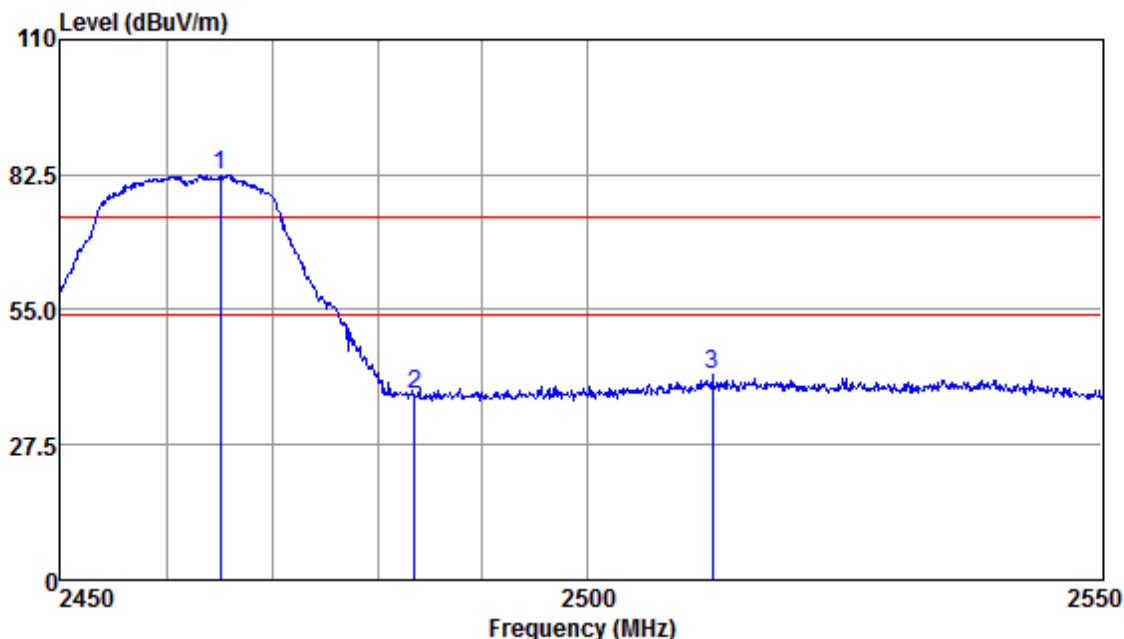


Antenna Polarity :HORIZONTAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2465.34	86.25	26.15	6.74	37.46	81.68	74.00	7.68	Peak
2483.50	41.31	26.18	6.80	37.51	36.78	74.00	-37.22	Peak
2534.95	45.43	26.31	7.01	37.59	41.16	74.00	-32.84	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:c; Polarization:Vertical; Modulation:n; bandwidth:20MHz; Channel:High



Antenna Polarity :VERTICAL

Freq	Read Level	Antenna Factor	Cable Loss	Preamp Factor	Emission Level	Limit Line	Over Limit	Remark
-----	-----	-----	-----	-----	-----	-----	-----	-----
MHz	dBuv	dB/m	dB	dB	dBuv/m	dBuv/m	dB	
2465.04	87.01	26.15	6.74	37.46	82.44	74.00	8.44	Peak
2483.50	42.36	26.18	6.80	37.51	37.83	74.00	-36.17	Peak
2512.13	46.31	26.24	6.86	37.56	41.85	74.00	-32.15	Peak

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

6.3 Radiated Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.247(d)

Test Method: ANSI C63.10 (2013) Section 6.10.4

Limit:

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

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

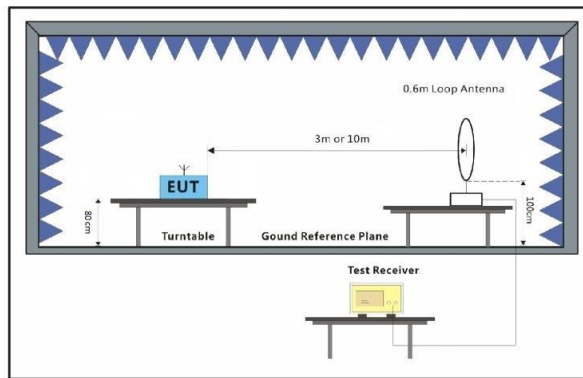
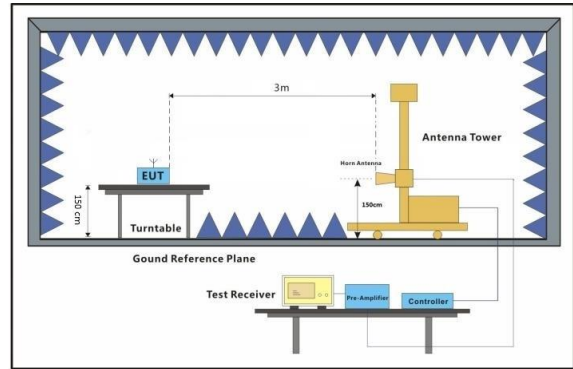
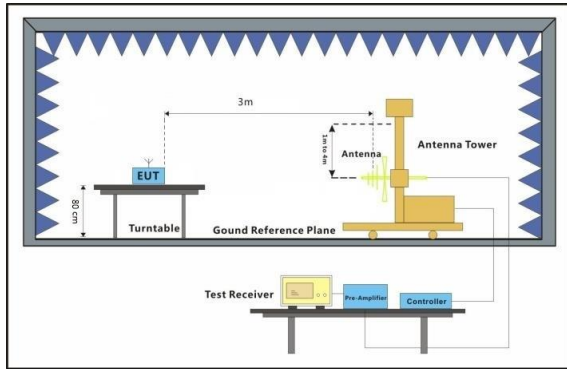
6.3.1 E.U.T. Operation

Operating Environment:

Temperature: 21 °C Humidity: 45 % RH Atmospheric Pressure: 1010 mbar

Test mode c:TX mode:Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20). Only the data of worst case is recorded in the report.

6.3.2 Test Setup Diagram



6.3.3 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- e. 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark:

- 1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
- 3) Scan from 9kHz to 25GHz, the disturbance above 18GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown



Mode:c; Polarization:Horizontal; Modulation:b; bandwidth:20MHz; Channel:Low

Frequency MHz	RX_R dBuV	Factor dB	Emission dBuV/m	Limit dBuV/m	Over Limit dB	Detector
4824	44.14	6.40	50.54	54	-3.46	peak
7236	41.49	10.76	52.25	54	-1.75	peak
9648	35.14	14.37	49.51	54	-4.49	peak

Mode:c; Polarization:Vertical; Modulation:b; bandwidth:20MHz; Channel:Low

Frequency MHz	RX_R dBuV	Factor dB	Emission dBuV/m	Limit dBuV/m	Over Limit dB	Detector
4824	43.22	6.40	49.62	54	-4.38	peak
7236	35.85	10.76	46.61	54	-7.39	peak
9648	33.81	14.37	48.18	54	-5.82	peak

Mode:c; Polarization:Horizontal; Modulation:b; bandwidth:20MHz; Channel:middle

Frequency MHz	RX_R dBuV	Factor dB	Emission dBuV/m	Limit dBuV/m	Over Limit dB	Detector
4874	42.98	6.92	49.90	54	-4.10	peak
7311	36.69	11.08	47.77	54	-6.23	peak
9748	31.68	14.36	46.04	54	-7.96	peak

Mode:c; Polarization:Vertical; Modulation:b; bandwidth:20MHz; Channel:middle

Frequency MHz	RX_R dBuV	Factor dB	Emission dBuV/m	Limit dBuV/m	Over Limit dB	Detector
4874	38.19	6.92	45.11	54	-8.89	peak
7311	37.96	11.08	49.04	54	-4.96	peak
9748	31.72	14.36	46.08	54	-7.92	peak

Mode:c; Polarization:Horizontal; Modulation:b; bandwidth:20MHz; Channel:High

Frequency MHz	RX_R dBuV	Factor dB	Emission dBuV/m	Limit dBuV/m	Over Limit dB	Detector
4924	38.22	7.31	45.53	54	-8.47	peak
7386	34.94	11.41	46.35	54	-7.65	peak
9848	33.75	14.38	48.13	54	-5.87	peak

Mode:c; Polarization:Vertical; Modulation:b; bandwidth:20MHz; Channel:High

Frequency MHz	RX_R dBuV	Factor dB	Emission dBuV/m	Limit dBuV/m	Over Limit dB	Detector
4924	42.15	7.31	49.46	54	-4.54	peak
7386	38.54	11.41	49.95	54	-4.05	peak
9848	36.03	14.38	50.41	54	-3.59	peak



Mode:c; Polarization:Horizontal; Modulation:g; bandwidth:20MHz; Channel:Low

Frequency	RX_R	Factor	Emission	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
4824	40.24	6.40	46.64	54	-7.36	peak
7236	39.03	10.76	49.79	54	-4.21	peak
9648	35.35	14.37	49.72	54	-4.28	peak

Mode:c; Polarization:Vertical; Modulation:g; bandwidth:20MHz; Channel:Low

Frequency	RX_R	Factor	Emission	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
4824	39.97	6.40	46.37	54	-7.63	peak
7236	39.10	10.76	49.86	54	-4.14	peak
9648	34.54	14.37	48.91	54	-5.09	peak

Mode:c; Polarization:Horizontal; Modulation:g; bandwidth:20MHz; Channel:middle

Frequency	RX_R	Factor	Emission	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
4874	39.75	6.92	46.67	54	-7.33	peak
7311	35.88	11.08	46.96	54	-7.04	peak
9748	35.58	14.36	49.94	54	-4.06	peak

Mode:c; Polarization:Vertical; Modulation:g; bandwidth:20MHz; Channel:middle

Frequency	RX_R	Factor	Emission	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
4874	42.72	6.92	49.64	54	-4.36	peak
7311	35.37	11.08	46.45	54	-7.55	peak
9748	32.38	14.36	46.74	54	-7.26	peak

Mode:c; Polarization:Horizontal; Modulation:g; bandwidth:20MHz; Channel:High

Frequency	RX_R	Factor	Emission	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
4924	42.36	7.31	49.67	54	-4.33	peak
7386	35.06	11.41	46.47	54	-7.53	peak
9848	33.62	14.38	48.00	54	-6.00	peak

Mode:c; Polarization:Vertical; Modulation:g; bandwidth:20MHz; Channel:High

Frequency	RX_R	Factor	Emission	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
4924	38.95	7.31	46.26	54	-7.74	peak
7386	34.15	11.41	45.56	54	-8.44	peak
9848	34.61	14.38	48.99	54	-5.01	peak



Mode:c; Polarization:Horizontal; Modulation:n; bandwidth:20MHz; Channel:Low

Frequency	RX_R	Factor	Emission	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
4824	39.31	6.40	45.71	54	-8.29	peak
7236	36.37	10.76	47.13	54	-6.87	peak
9648	35.69	14.37	50.06	54	-3.94	peak

Mode:c; Polarization:Vertical; Modulation:n; bandwidth:20MHz; Channel:Low

Frequency	RX_R	Factor	Emission	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
4824	38.49	6.40	44.89	54	-9.11	peak
7236	38.77	10.76	49.53	54	-4.47	peak
9648	33.85	14.37	48.22	54	-5.78	peak

Mode:c; Polarization:Horizontal; Modulation:n; bandwidth:20MHz; Channel:middle

Frequency	RX_R	Factor	Emission	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
4874	43.31	6.92	50.23	54	-3.77	peak
7311	38.33	11.08	49.41	54	-4.59	peak
9748	36.09	14.36	50.45	54	-3.55	peak

Mode:c; Polarization:Vertical; Modulation:n; bandwidth:20MHz; Channel:middle

Frequency	RX_R	Factor	Emission	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
4874	39.03	6.92	45.95	54	-8.05	peak
7311	37.96	11.08	49.04	54	-4.96	peak
9748	32.39	14.36	46.75	54	-7.25	peak

Mode:c; Polarization:Horizontal; Modulation:n; bandwidth:20MHz; Channel:High

Frequency	RX_R	Factor	Emission	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
4924	40.85	7.31	48.16	54	-5.84	peak
7386	38.52	11.41	49.93	54	-4.07	peak
9848	33.86	14.38	48.24	54	-5.76	peak

Mode:c; Polarization:Vertical; Modulation:n; bandwidth:20MHz; Channel:High

Frequency	RX_R	Factor	Emission	Limit	Over Limit	Detector
MHz	dBuV	dB	dBuV/m	dBuV/m	dB	
4924	39.30	7.31	46.61	54	-7.39	peak
7386	35.73	11.41	47.14	54	-6.86	peak
9848	36.49	14.38	50.87	54	-3.13	peak



7 Test Setup Photographs

Refer to the < Test Setup photos-FCC>.

8 EUT Constructional Details

Refer to the < External Photos > & < Internal Photos >.

- End of the Report -