

FCC Test Report

Report No.: RFBHWX-WTW-P21060926-1

FCC ID: SBVRM037

Test Model: S37

Received Date: Dec. 28, 2021

Test Date: Jan. 20 ~ Feb. 03, 2022

Issued Date: Mar. 28, 2022

Applicant: Sonos, Inc.

Address: 614 Chapala Street, Santa Barbara, California 93101

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

Lab Address: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

Test Location (1): No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City
33383, Taiwan

FCC Registration /
Designation Number: 788550 / TW0003

Test Location (2): No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan

FCC Registration /
Designation Number: 281270 / TW0032



This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification.

Table of Contents

Release Control Record	4
1 Certificate of Conformity	5
2 Summary of Test Results.....	6
2.1 Measurement Uncertainty.....	6
2.2 Modification Record	6
3 General Information	7
3.1 General Description of EUT	7
3.2 Description of Test Modes.....	8
3.2.1 Test Mode Applicability and Tested Channel Detail.....	9
3.3 Duty Cycle of Test Signal	11
3.4 Description of Support Units	12
3.4.1 Configuration of System under Test	12
3.5 General Description of Applied Standards and References	12
4 Test Types and Results	13
4.1 Radiated Emission and Bandedge Measurement	13
4.1.1 Limits of Radiated Emission and Bandedge Measurement	13
4.1.2 Test Instruments	14
4.1.3 Test Procedures.....	15
4.1.4 Deviation from Test Standard	15
4.1.5 Test Set Up	16
4.1.6 EUT Operating Conditions.....	17
4.1.7 Test Results	18
4.2 Conducted Emission Measurement.....	29
4.2.1 Limits of Conducted Emission Measurement	29
4.2.2 Test Instruments	29
4.2.3 Test Procedures.....	30
4.2.4 Deviation from Test Standard	30
4.2.5 Test Setup.....	30
4.2.6 EUT Operating Conditions.....	30
4.2.7 Test Results	31
4.3 6 dB Bandwidth Measurement.....	33
4.3.1 Limits of 6 dB Bandwidth Measurement.....	33
4.3.2 Test Setup.....	33
4.3.3 Test Instruments	33
4.3.4 Test Procedure	33
4.3.5 Deviation from Test Standard	33
4.3.6 EUT Operating Conditions.....	33
4.3.7 Test Results	34
4.4 Occupied Bandwidth Measurement.....	36
4.4.1 Test Setup.....	36
4.4.2 Test Instruments	36
4.4.3 Test Procedure	36
4.4.4 Deviation from Test Standard	36
4.4.5 EUT Operating Conditions.....	36
4.4.6 Test Results	37
4.5 Conducted Output Power Measurement	39
4.5.1 Limits of Conducted Output Power Measurement.....	39
4.5.2 Test Setup.....	39
4.5.3 Test Instruments	39
4.5.4 Test Procedures.....	39
4.5.5 Deviation from Test Standard	39
4.5.6 EUT Operating Conditions.....	39
4.5.7 Test Results	40

4.6	Power Spectral Density Measurement	41
4.6.1	Limits of Power Spectral Density Measurement.....	41
4.6.2	Test Setup.....	41
4.6.3	Test Instruments	41
4.6.4	Test Procedure	41
4.6.5	Deviation from Test Standard	41
4.6.6	EUT Operating Condition	41
4.6.7	Test Results	42
4.7	Conducted Out of Band Emission Measurement	44
4.7.1	Limits of Conducted Out of Band Emission Measurement.....	44
4.7.2	Test Setup.....	44
4.7.3	Test Instruments	44
4.7.4	Test Procedure	44
4.7.5	Deviation from Test Standard	44
4.7.6	EUT Operating Condition	44
4.7.7	Test Results	45
5	Pictures of Test Arrangements.....	51
	Annex A- Band Edge Measurement	52
	Appendix – Information of the Testing Laboratories	55

Release Control Record

Issue No.	Description	Date Issued
RFBHWX-WTW-P21060926-1	Original Release	Mar. 28, 2022

1 Certificate of Conformity

Product: Wireless Smart Speaker

Brand: Sonos

Test Model: S37

Sample Status: Engineering Sample

Applicant: Sonos, Inc.

Test Date: Jan. 20 ~ Feb. 03, 2022

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2013

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

Prepared by : Gina Liu, **Date:** Mar. 28, 2022
Gina Liu / Specialist

Approved by : Jeremy Lin, **Date:** Mar. 28, 2022
Jeremy Lin / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -6.99 dB at 2.22116 MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.72 dB at 2390.00 MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6 dB Bandwidth	Pass	Meet the requirement of limit.
---	Occupied Bandwidth Measurement	Pass	Reference only
15.247(b)	Conducted power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is IPEX micro-coax not a standard connector.

Note:

- For 2.4G band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A. Test Procedures refer to report 4.1.3.
- Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.79 dB
Radiated Emissions up to 1 GHz	9 kHz ~ 30 MHz	3.00 dB
	30 MHz ~ 200 MHz	2.91 dB
	200 MHz ~ 1000 MHz	2.93 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	1.76 dB
	18 GHz ~ 40 GHz	1.77 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Wireless Smart Speaker
Brand	Sonos
Test Model	S37
Status of EUT	Engineering Sample
Power Supply Rating	120 Vac
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: 11.0 / 5.5 / 2.0 / 1.0 Mbps 802.11g: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n: up to 144.4 Mbps
Operating Frequency	2412 ~ 2462 MHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20)
Output Power	154.899 mW
Antenna Type	Refer to Note as below
Antenna Connector	Refer to Note as below
Accessory Device	Refer to Note as below
Data Cable Supplied	N/A

Note:

- The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

Modulation Mode	Tx Function
802.11b	2TX
802.11g	2TX
802.11n (HT20)	2TX

- The EUT contains following accessory devices.

Product	Brand	Model	Description
Power cord	Well Shin	112-00426	Non-shielded with 2 core

- The following antennas were provided to the EUT.

Chain.	Model Name	Antenna Type	Antenna Connector	Peak Gain (dBi)								
				2412 MHz	2450 MHz	2470 MHz	5200 MHz	5300 MHz	5500 MHz	5600 MHz	5700 MHz	5800 MHz
Front Antenna	105-00194	Vertically-Polarized Dipole PCB Antenna	IPEX micro-coax	2.9	3.1	3.1	4.0	5.4	4.2	4.4	3.5	3.6
Rear Antenna	105-00195			4.8	4.9	4.7	4.8	4.7	4.6	5.1	4.2	4.3

- The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.
- The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.
- The product does not support co-located.

3.2 Description of Test Modes

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20):

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE $\geq$ 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

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

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.
NOTE: “-” means no effect.

Radiated Emission Test (Above 1 GHz):

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

Radiated Emission Test (Below 1 GHz):

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11g	1 to 11	1	OFDM	BPSK	6.0

Power Line Conducted Emission Test:

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11g	1 to 11	1	OFDM	BPSK	6.0

Bandedge Measurement:

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 11	OFDM	BPSK	6.5

Antenna Port Conducted Measurement:

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE $\geq$ 1G	25 deg. C, 70 % RH	120 Vac, 60 Hz	Hans Wu
RE<1G	25 deg. C, 70 % RH	120 Vac, 60 Hz	Raymond Lee
PLC	24 deg. C, 68 % RH	120 Vac, 60 Hz	Raymond Lee
APCM	25 deg. C, 60 % RH	120 Vac, 60 Hz	Jisyong Wang

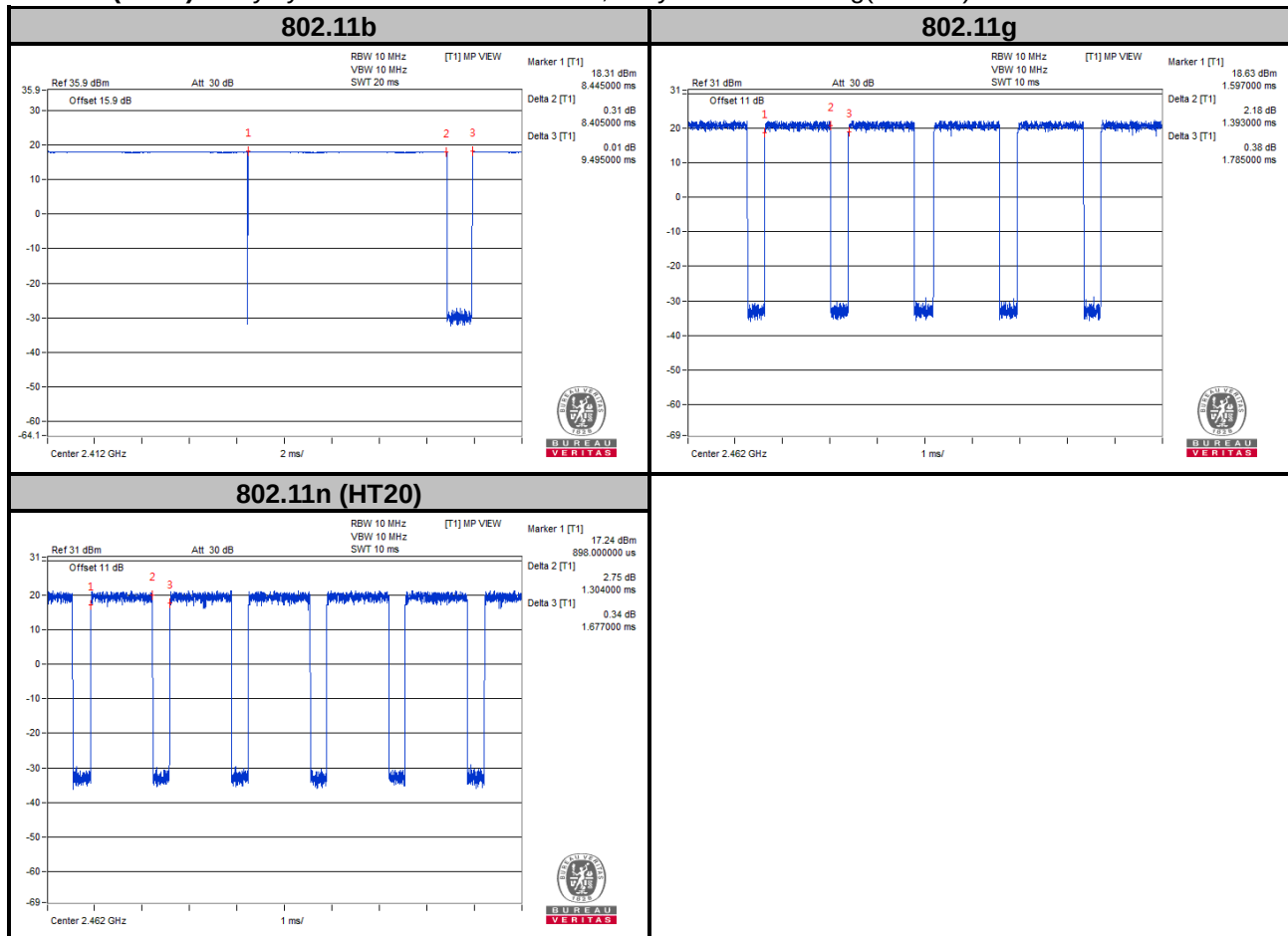
3.3 Duty Cycle of Test Signal

Duty cycle of test signal is < 98 %, duty factor shall be considered.

802.11b: Duty cycle = $8.405/9.495 = 0.885$, Duty factor = $10 * \log(1/0.885) = 0.53$

802.11g: Duty cycle = $1.393/1.785 = 0.780$, Duty factor = $10 * \log(1/0.780) = 1.08$

802.11n (HT20): Duty cycle = $1.304/1.677 = 0.778$, Duty factor = $10 * \log(1/0.778) = 1.09$



3.4 Description of Support Units

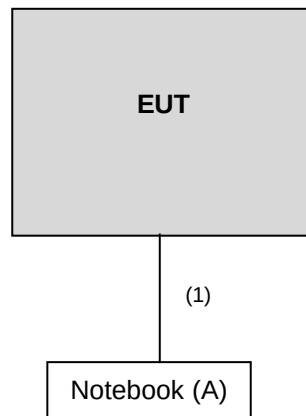
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	Dell	E5420	CN-0H5TG2-75900-1B 3-01UT-A01	N/A	-

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	LAN cable	1	10	N	0	-

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards and References

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

Test Standard:

FCC Part 15, Subpart C (15.247)

ANSI C63.10-2013

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

References Test Guidance:

KDB 558074 D01 Meas Guidance v05r02

KDB 662911 D01 Multiple Transmitter Output v02r01

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

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

NOTE:

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver Rohde & Schwarz	ESR3	102783	Dec. 21, 2021	Dec. 20, 2022
Spectrum Analyzer KEYSIGHT	N9020B	MY60110513	Dec. 24, 2021	Dec. 23, 2022
BILOG Antenna SCHWARZBECK	VULB9168	9168-1214	Oct. 27, 2021	Oct. 26, 2022
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1170	Nov. 14, 2021	Nov. 13, 2022
HORN Antenna SCHWARZBECK	BBHA 9170	9170-995	Nov. 14, 2021	Nov. 13, 2022
Loop Antenna EMCI	EM-6879	269	Sep. 16, 2021	Sep. 15, 2022
Loop Antenna TESEQ	HLA 6121	45745	Jul. 21, 2021	Jul. 20, 2022
Preamplifier EMCI	EMC330N	980798	Jan. 17, 2022	Jan. 16, 2023
Preamplifier EMCI	EMC118A45SE	980809	Dec. 30, 2021	Dec. 29, 2022
Preamplifier EMCI	EMC184045SE	980786	Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMC104-SM-SM-(9 000+2000+1000)	201244+ 201232+ 210103	Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMCCFD400-NM-N M-(9000+300+500)	201251+ 201249+ 201248	Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMC101G-KM-KM- (5000+3000+2000)	201261+201258+20124 9	Jan. 17, 2022	Jan. 16, 2023
Software BV ADT	ADT_Radiated_V7. 6.15.9.5	NA	NA	NA
Antenna Tower Max-Full	MFA-515BSN	NA	NA	NA
Turn Table Max-Full	MFT-201SS	NA	NA	NA
Turn Table Controller Max-Full	MF-7802BS	MF780208676	NA	NA
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004 /MY55190007/MY5521000 5	Jul. 12, 2021	Jul. 11, 2022

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in WM Chamber 9.

4.1.3 Test Procedures

For Radiated Emission below 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.

For Radiated Emission above 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30 MHz ~ 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

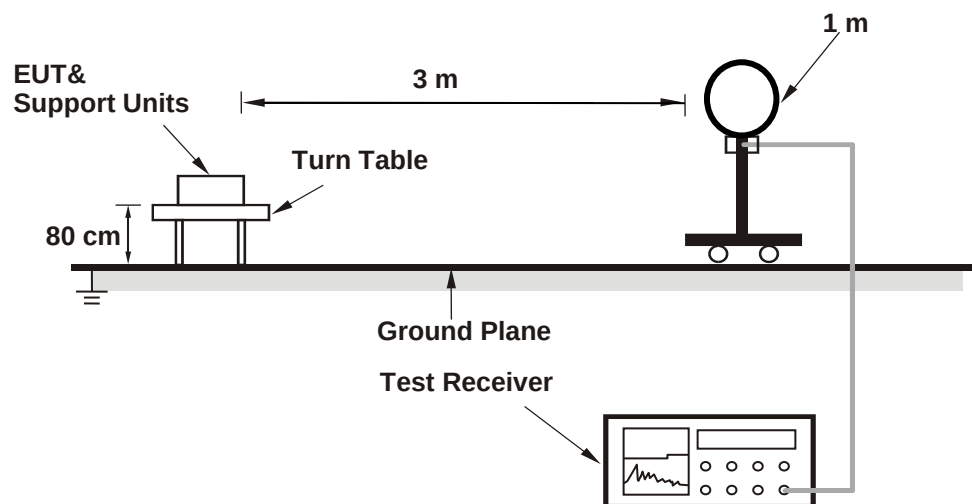
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle $< 98\%$) or 10 Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1 GHz.
(11b: RBW = 1 MHz, VBW = 1 kHz ; 11g: RBW = 1 MHz, VBW = 1 kHz ; 11n (HT20): RBW = 1 MHz, VBW = 1 kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

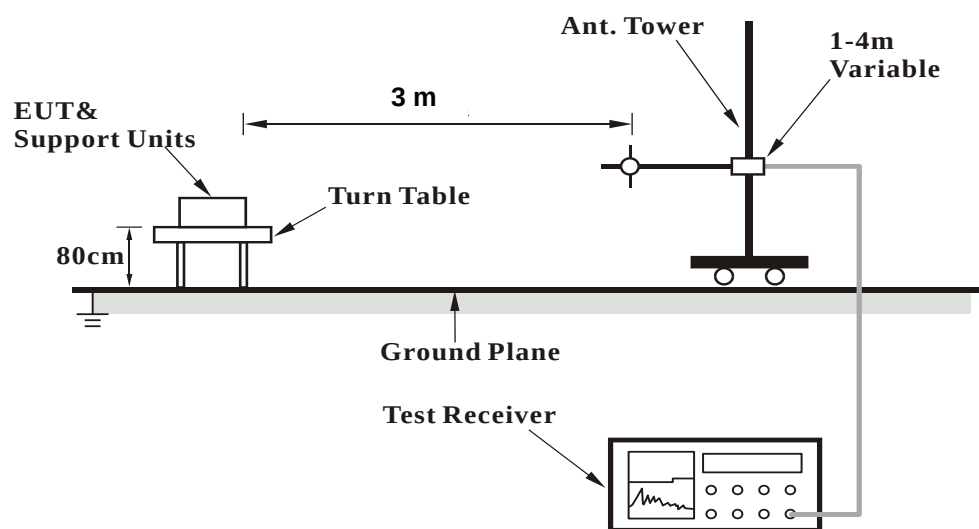
No deviation.

4.1.5 Test Set Up

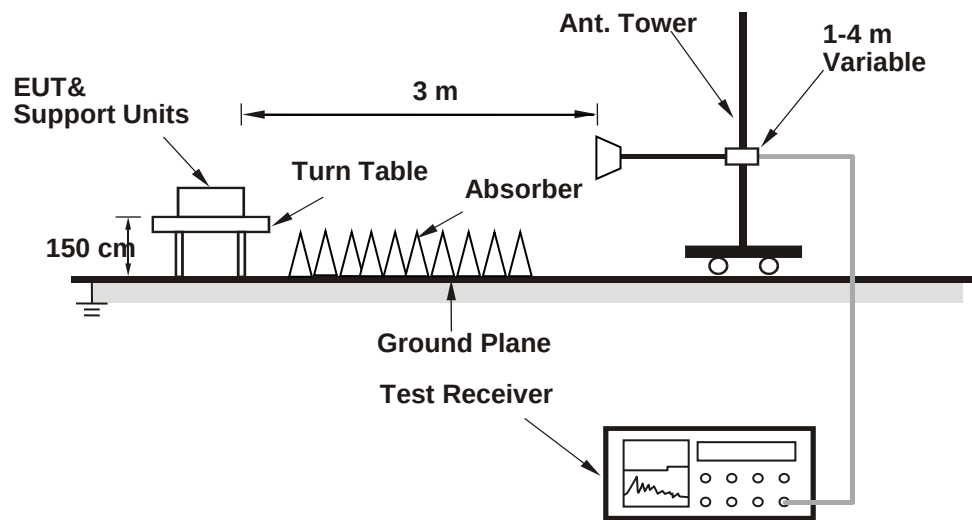
<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



<Radiated Emission above 1 GHz>



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

4.1.6 EUT Operating Conditions

- Placed the EUT on a testing table.
- Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1 GHz Data :

RF Mode	TX 802.11b	Channel	CH 1 : 2412 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	56.37 PK	74.00	-17.63	2.05 H	45	24.33	32.04
2	2390.00	44.11 AV	54.00	-9.89	2.05 H	45	12.07	32.04
3	*2412.00	106.50 PK			2.05 H	45	74.49	32.01
4	*2412.00	104.24 AV			2.05 H	45	72.23	32.01
5	4824.00	49.50 PK	74.00	-24.50	1.50 H	353	46.34	3.16
6	4824.00	45.32 AV	54.00	-8.68	1.50 H	353	42.16	3.16
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	57.08 PK	74.00	-16.92	1.98 V	218	25.04	32.04
2	2390.00	46.34 AV	54.00	-7.66	1.98 V	218	14.30	32.04
3	*2412.00	114.89 PK			1.98 V	218	82.88	32.01
4	*2412.00	112.35 AV			1.98 V	218	80.34	32.01
5	4824.00	55.59 PK	74.00	-18.41	2.08 V	219	52.43	3.16
6	4824.00	51.98 AV	54.00	-2.02	2.08 V	219	48.82	3.16

Remarks:

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

RF Mode	TX 802.11b	Channel	CH 6 : 2437 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2437.00	105.64 PK			2.99 H	58	73.68	31.96
2	*2437.00	103.52 AV			2.99 H	58	71.56	31.96
3	4874.00	47.49 PK	74.00	-26.51	1.50 H	189	44.28	3.21
4	4874.00	43.25 AV	54.00	-10.75	1.50 H	189	40.04	3.21
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2437.00	114.17 PK			1.52 V	278	82.21	31.96
2	*2437.00	111.58 AV			1.52 V	278	79.62	31.96
3	4874.00	53.58 PK	74.00	-20.42	2.06 V	213	50.37	3.21
4	4874.00	51.40 AV	54.00	-2.60	2.06 V	213	48.19	3.21

Remarks:

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

RF Mode	TX 802.11b	Channel	CH 11 : 2462 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2462.00	108.59 PK			2.03 H	47	76.63	31.96
2	*2462.00	106.19 AV			2.03 H	47	74.23	31.96
3	2483.50	58.02 PK	74.00	-15.98	2.03 H	47	26.01	32.01
4	2483.50	44.81 AV	54.00	-9.19	2.03 H	47	12.80	32.01
5	4924.00	49.08 PK	74.00	-24.92	1.62 H	344	45.84	3.24
6	4924.00	45.03 AV	54.00	-8.97	1.62 H	344	41.79	3.24
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2462.00	115.25 PK			1.98 V	214	83.29	31.96
2	*2462.00	112.78 AV			1.98 V	214	80.82	31.96
3	2483.50	58.76 PK	74.00	-15.24	1.98 V	214	26.75	32.01
4	2483.50	47.01 AV	54.00	-6.99	1.98 V	214	15.00	32.01
5	4924.00	52.07 PK	74.00	-21.93	2.12 V	210	48.83	3.24
6	4924.00	49.08 AV	54.00	-4.92	2.12 V	210	45.84	3.24

Remarks:

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

RF Mode	TX 802.11g	Channel	CH 1 : 2412 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	64.13 PK	74.00	-9.87	2.09 H	49	32.09	32.04
2	2390.00	49.76 AV	54.00	-4.24	2.09 H	49	17.72	32.04
3	*2412.00	109.46 PK			2.09 H	49	77.45	32.01
4	*2412.00	100.22 AV			2.09 H	49	68.21	32.01
5	4824.00	46.95 PK	74.00	-27.05	1.75 H	19	43.79	3.16
6	4824.00	35.72 AV	54.00	-18.28	1.75 H	19	32.56	3.16
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	70.19 PK	74.00	-3.81	1.33 V	87	38.15	32.04
2	2390.00	53.28 AV	54.00	-0.72	1.33 V	87	21.24	32.04
3	*2412.00	116.78 PK			1.33 V	87	84.77	32.01
4	*2412.00	106.97 AV			1.33 V	87	74.96	32.01
5	4824.00	50.33 PK	74.00	-23.67	2.13 V	217	47.17	3.16
6	4824.00	38.62 AV	54.00	-15.38	2.13 V	217	35.46	3.16

Remarks:

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

RF Mode	TX 802.11g	Channel	CH 6 : 2437 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2437.00	109.03 PK			1.92 H	56	77.07	31.96
2	*2437.00	99.85 AV			1.92 H	56	67.89	31.96
3	4874.00	47.73 PK	74.00	-26.27	1.80 H	21	44.52	3.21
4	4874.00	36.34 AV	54.00	-17.66	1.80 H	21	33.13	3.21
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2437.00	116.44 PK			1.52 V	84	84.48	31.96
2	*2437.00	107.09 AV			1.52 V	84	75.13	31.96
3	4874.00	50.83 PK	74.00	-23.17	2.10 V	226	47.62	3.21
4	4874.00	39.33 AV	54.00	-14.67	2.10 V	226	36.12	3.21

Remarks:

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

RF Mode	TX 802.11g	Channel	CH 11 : 2462 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2462.00	108.39 PK			1.99 H	51	76.43	31.96
2	*2462.00	99.41 AV			1.99 H	51	67.45	31.96
3	2483.50	64.10 PK	74.00	-9.90	1.99 H	51	32.09	32.01
4	2483.50	48.91 AV	54.00	-5.09	1.99 H	51	16.90	32.01
5	4924.00	46.75 PK	74.00	-27.25	1.73 H	20	43.51	3.24
6	4924.00	35.92 AV	54.00	-18.08	1.73 H	20	32.68	3.24
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2462.00	115.48 PK			1.40 V	92	83.52	31.96
2	*2462.00	105.97 AV			1.40 V	92	74.01	31.96
3	2483.50	69.04 PK	74.00	-4.96	1.40 V	92	37.03	32.01
4	2483.50	53.24 AV	54.00	-0.76	1.40 V	92	21.23	32.01
5	4924.00	50.92 PK	74.00	-23.08	2.02 V	215	47.68	3.24
6	4924.00	39.95 AV	54.00	-14.05	2.02 V	215	36.71	3.24

Remarks:

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

RF Mode	TX 802.11n (HT20)	Channel	CH 1 : 2412 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	66.55 PK	74.00	-7.45	2.09 H	46	34.51	32.04
2	2390.00	47.61 AV	54.00	-6.39	2.09 H	46	15.57	32.04
3	*2412.00	107.30 PK			2.09 H	46	75.29	32.01
4	*2412.00	97.89 AV			2.09 H	46	65.88	32.01
5	4824.00	49.71 PK	74.00	-24.29	2.11 H	168	46.55	3.16
6	4824.00	37.99 AV	54.00	-16.01	2.11 H	168	34.83	3.16
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2389.00	73.20 PK	74.00	-0.80	1.40 V	85	41.16	32.04
2	2389.00	52.87 AV	54.00	-1.13	1.40 V	85	20.83	32.04
3	*2412.00	114.87 PK			1.40 V	85	82.86	32.01
4	*2412.00	105.34 AV			1.40 V	85	73.33	32.01
5	4824.00	50.18 PK	74.00	-23.82	2.02 V	238	47.02	3.16
6	4824.00	38.35 AV	54.00	-15.65	2.02 V	238	35.19	3.16

Remarks:

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

RF Mode	TX 802.11n (HT20)	Channel	CH 6 : 2437 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2437.00	109.43 PK			2.04 H	53	77.47	31.96
2	*2437.00	100.17 AV			2.04 H	53	68.21	31.96
3	4874.00	50.89 PK	74.00	-23.11	2.62 H	170	47.68	3.21
4	4874.00	39.11 AV	54.00	-14.89	2.62 H	170	35.90	3.21
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2437.00	116.64 PK			1.34 V	84	84.68	31.96
2	*2437.00	106.71 AV			1.34 V	84	74.75	31.96
3	4874.00	51.30 PK	74.00	-22.70	2.11 V	254	48.09	3.21
4	4874.00	39.42 AV	54.00	-14.58	2.11 V	254	36.21	3.21

Remarks:

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

RF Mode	TX 802.11n (HT20)	Channel	CH 11 : 2462 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2462.00	105.94 PK			2.02 H	58	73.98	31.96
2	*2462.00	96.75 AV			2.02 H	58	64.79	31.96
3	2485.00	66.92 PK	74.00	-7.08	2.02 H	59	34.90	32.02
4	2485.00	46.62 AV	54.00	-7.38	2.02 H	59	14.60	32.02
5	4924.00	48.99 PK	74.00	-25.01	2.00 H	195	45.75	3.24
6	4924.00	37.44 AV	54.00	-16.56	2.00 H	195	34.20	3.24
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2462.00	113.93 PK			1.34 V	91	81.97	31.96
2	*2462.00	103.92 AV			1.34 V	91	71.96	31.96
3	2485.00	73.19 PK	74.00	-0.81	1.34 V	91	41.17	32.02
4	2485.00	49.33 AV	54.00	-4.67	1.34 V	91	17.31	32.02
5	4924.00	49.79 PK	74.00	-24.21	2.13 V	225	46.55	3.24
6	4924.00	37.94 AV	54.00	-16.06	2.13 V	225	34.70	3.24

Remarks:

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

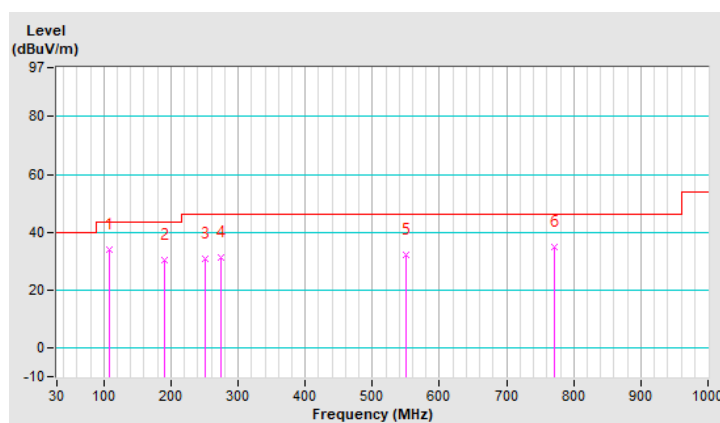
9 kHz ~ 1 GHz Worst-Case Data:

RF Mode	TX 802.11g	Channel	CH 1 : 2412 MHz
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	108.57	33.99 QP	43.50	-9.51	1.99 H	260	55.28	-21.29
2	190.05	30.14 QP	43.50	-13.36	1.49 H	249	50.97	-20.83
3	250.19	30.95 QP	46.00	-15.05	1.00 H	228	50.08	-19.13
4	275.41	31.20 QP	46.00	-14.80	1.00 H	218	49.22	-18.02
5	549.92	32.11 QP	46.00	-13.89	1.49 H	319	44.07	-11.96
6	772.05	34.98 QP	46.00	-11.02	1.99 H	132	42.96	-7.98

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

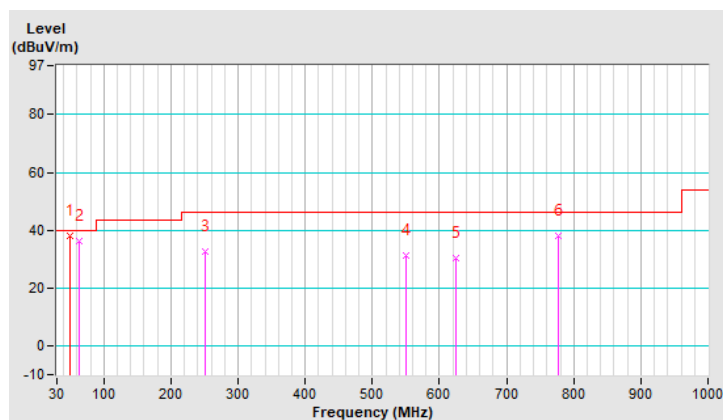


RF Mode	TX 802.11g	Channel	CH 1 : 2412 MHz
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	50.44	38.02 QP	40.00	-1.98	1.49 V	16	56.02	-18.00
2	62.98	36.09 QP	40.00	-3.91	1.00 V	188	55.25	-19.16
3	250.19	32.73 QP	46.00	-13.27	1.99 V	149	51.86	-19.13
4	549.92	31.18 QP	46.00	-14.82	1.99 V	192	43.14	-11.96
5	624.61	30.35 QP	46.00	-15.65	1.99 V	95	40.30	-9.95
6	777.87	38.28 QP	46.00	-7.72	1.99 V	89	46.18	-7.90

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

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

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

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 03, 2021	Dec. 02, 2022
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Jan. 15, 2022	Jan. 14, 2023
LISN/AMN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 25, 2021	Feb. 24, 2022
LISN/AMN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Sep. 07, 2021	Sep. 06, 2022
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Shielded Room 1 (Conduction 1).
 3. The VCCI Site Registration No. is C-12040.

4.2.3 Test Procedures

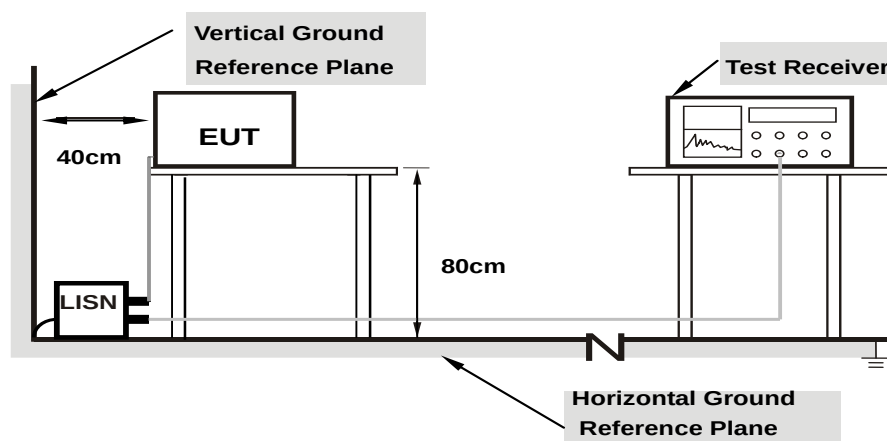
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling impedance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

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



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

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

4.2.6 EUT Operating Conditions

- Placed the EUT on a testing table.
- Use the software to control the EUT under transmission condition continuously at specific channel frequency.

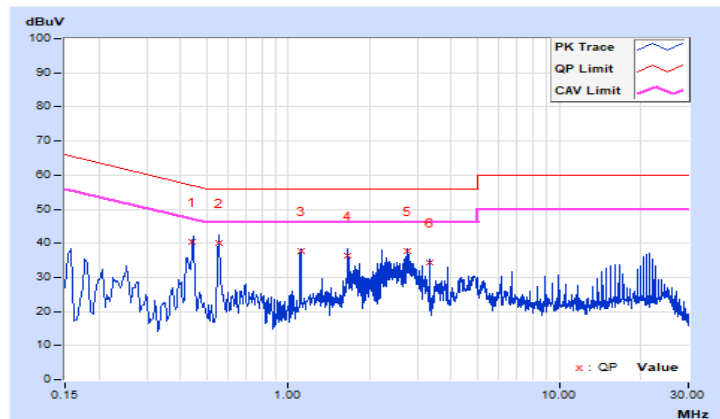
4.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	24 °C, 68% RH
Tested by	Raymond Lee	Test Date	2022/1/25

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.44293	9.87	30.62	17.35	40.49	27.22	57.01	47.01	-16.52	-19.79
2	0.55265	9.88	30.11	27.16	39.99	37.04	56.00	46.00	-16.01	-8.96
3	1.11400	9.92	27.80	23.32	37.72	33.24	56.00	46.00	-18.28	-12.76
4	1.66234	9.95	26.58	25.02	36.53	34.97	56.00	46.00	-19.47	-11.03
5	2.77000	9.99	27.56	16.40	37.55	26.39	56.00	46.00	-18.45	-19.61
6	3.33000	10.00	24.28	24.26	34.28	34.26	56.00	46.00	-21.72	-11.74

Remarks:

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

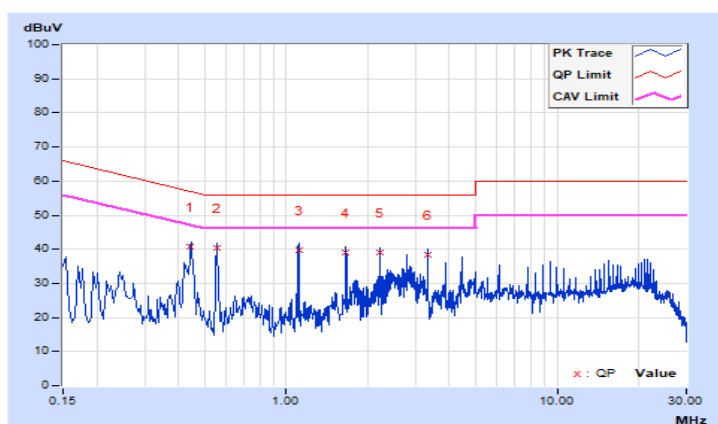


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	24 °C, 68% RH
Tested by	Raymond Lee	Test Date	2022/1/25

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.44177	9.94	30.68	15.67	40.62	25.61	57.03	47.03	-16.41	-21.42
2	0.55400	9.95	30.44	27.54	40.39	37.49	56.00	46.00	-15.61	-8.51
3	1.11000	10.00	29.67	28.92	39.67	38.92	56.00	46.00	-16.33	-7.08
4	1.66234	10.02	28.93	27.87	38.95	37.89	56.00	46.00	-17.05	-8.11
5	2.22116	10.05	29.14	28.96	39.19	39.01	56.00	46.00	-16.81	-6.99
6	3.33000	10.07	28.20	26.23	38.27	36.30	56.00	46.00	-17.73	-9.70

Remarks:

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

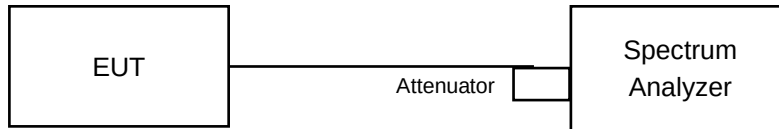


4.3 6 dB Bandwidth Measurement

4.3.1 Limits of 6 dB Bandwidth Measurement

The minimum of 6 dB Bandwidth Measurement is 0.5 MHz.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

- Set resolution bandwidth (RBW) = 100 kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

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

4.3.7 Test Results

802.11b

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	9.10	9.14	0.5	Pass
6	2437	9.10	9.02	0.5	Pass
11	2462	8.60	9.09	0.5	Pass

802.11g

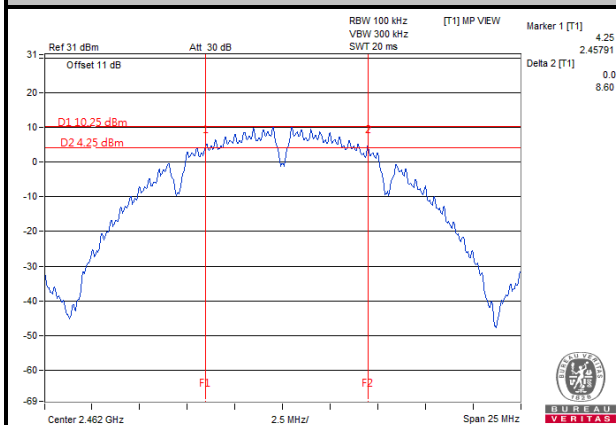
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	15.20	15.17	0.5	Pass
6	2437	15.19	15.18	0.5	Pass
11	2462	15.20	15.20	0.5	Pass

802.11n (HT20)

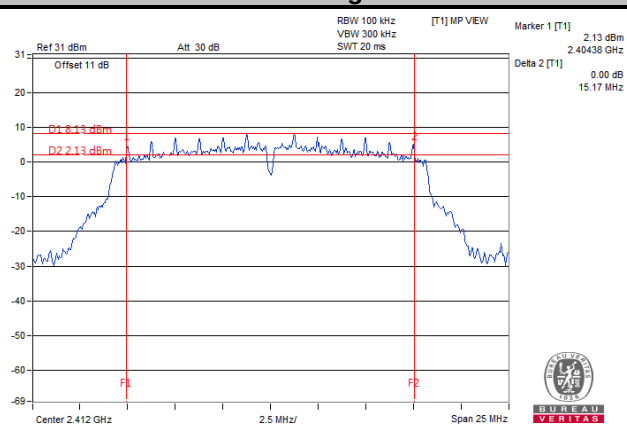
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	15.18	15.16	0.5	Pass
6	2437	15.17	15.18	0.5	Pass
11	2462	15.20	15.18	0.5	Pass

Spectrum Plot of Worst Value

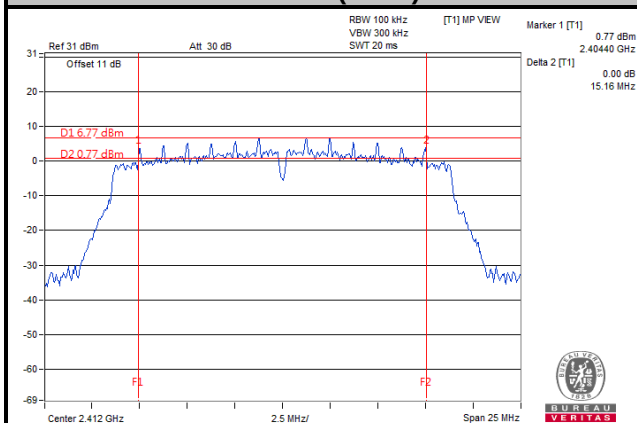
802.11b



802.11g

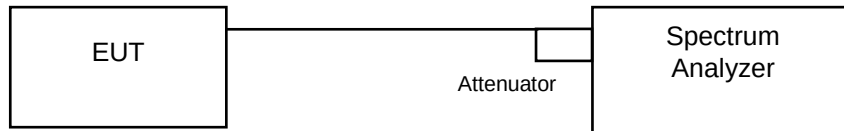


802.11n (HT20)



4.4 Occupied Bandwidth Measurement

4.4.1 Test Setup



4.4.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1 % to 5 % of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to sampling. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

4.4.4 Deviation from Test Standard

No deviation.

4.4.5 EUT Operating Conditions

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

4.4.6 Test Results

802.11b

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
1	2412	14.04	13.92	Pass
6	2437	13.80	13.44	Pass
11	2462	13.92	13.80	Pass

802.11g

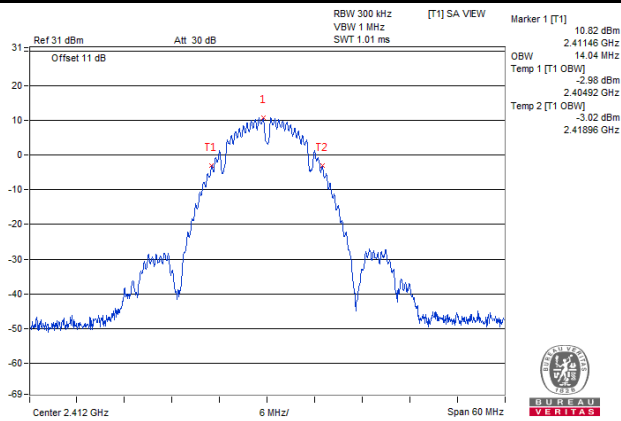
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
1	2412	16.80	16.68	Pass
6	2437	16.56	16.56	Pass
11	2462	16.80	16.68	Pass

802.11n (HT20)

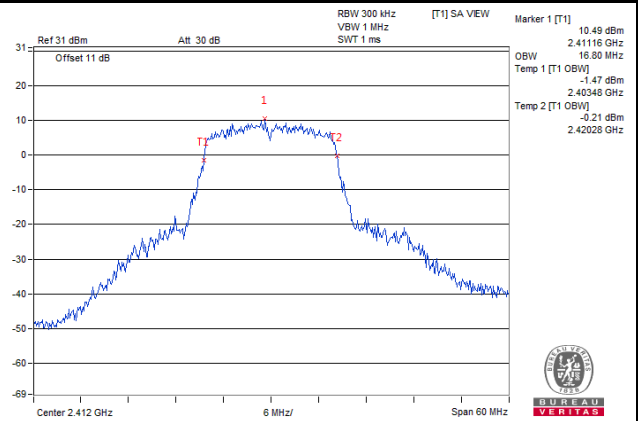
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
1	2412	17.64	17.64	Pass
6	2437	17.64	17.76	Pass
11	2462	17.76	17.64	Pass

Spectrum Plot of Worst Value

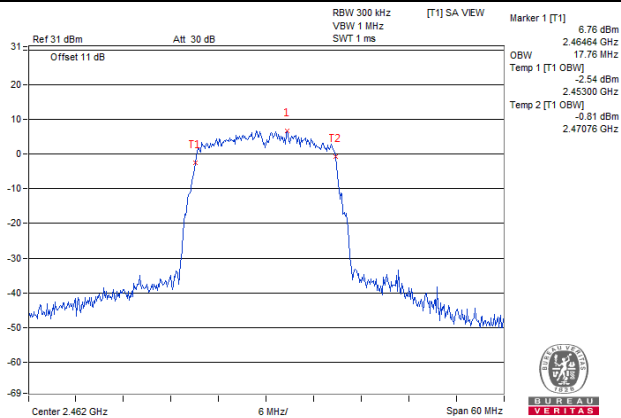
802.11b



802.11g



802.11n (HT20)



4.5 Conducted Output Power Measurement

4.5.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30 dBm)

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

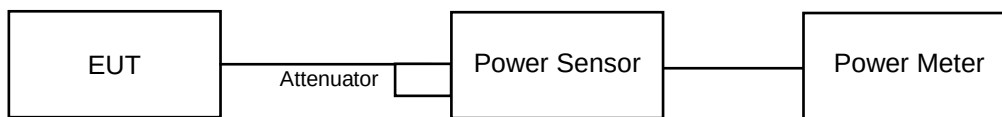
Array Gain = 0 dB (i.e., no array gain) for $NANT \leq 4$;

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

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

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

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedures

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

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Conditions

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

4.5.7 Test Results

802.11b

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	18.85	18.73	151.381	21.80	30	Pass
6	2437	17.89	17.82	122.052	20.87	30	Pass
11	2462	18.80	18.68	149.648	21.75	30	Pass

802.11g

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	18.36	18.30	136.157	21.34	30	Pass
6	2437	18.83	18.78	151.893	21.82	30	Pass
11	2462	16.78	16.79	95.396	19.80	30	Pass

802.11n (HT20)

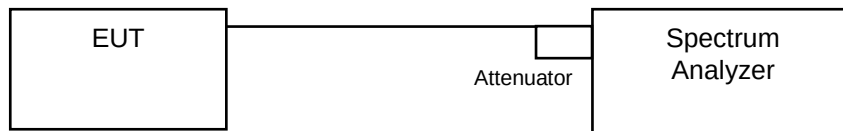
Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	16.45	16.38	87.608	19.43	30	Pass
6	2437	18.93	18.85	154.899	21.90	30	Pass
11	2462	14.89	14.80	61.031	17.86	30	Pass

4.6 Power Spectral Density Measurement

4.6.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8 dBm in any 3 kHz band during any time interval of continuous transmission.

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

For Average Power (Duty cycle < 98%)

- a. Measure the duty cycle (x).
- b. Set instrument center frequency to DTS channel center frequency.
- c. Set span to at least 1.5 times the OBW.
- d. Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- e. Set VBW $\geq 3 \times \text{RBW}$.
- f. Detector = power averaging (RMS) or sample detector (when RMS not available).
- g. Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span/RBW}$.
- h. Sweep time = auto couple.
- i. Do not use sweep triggering. Allow sweep to "free run".
- j. Employ trace averaging (RMS) mode over a minimum of 100 traces.
- k. Use the peak marker function to determine the maximum amplitude level.
- l. Add $10 \log (1/x)$, where x is the duty cycle measured in step (a), to the measured PSD to compute the average PSD during the actual transmission time.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

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

4.6.7 Test Results

802.11b

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Duty Factor (dB)	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-12.88	3.01	0.53	-9.34	6.94	Pass
	6	2437	-13.7	3.01	0.53	-10.16	6.94	Pass
	11	2462	-12.79	3.01	0.53	-9.25	6.94	Pass
1	1	2412	-13.24	3.01	0.53	-9.7	6.94	Pass
	6	2437	-14.05	3.01	0.53	-10.51	6.94	Pass
	11	2462	-13.2	3.01	0.53	-9.66	6.94	Pass

NOTE:

- Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] = 7.06 \text{ dBi} > 6 \text{ dBi}$, so the power density limit shall be reduced to $8 - (7.06 - 6) = 6.94 \text{ dBm}$.
- Method 2) C) of power density measurement of KDB 662911 is using for calculating total power density.

802.11g

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Duty Factor (dB)	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-16.06	3.01	1.08	-11.97	6.94	Pass
	6	2437	-15.39	3.01	1.08	-11.3	6.94	Pass
	11	2462	-16.95	3.01	1.08	-12.86	6.94	Pass
1	1	2412	-16.3	3.01	1.08	-12.21	6.94	Pass
	6	2437	-15.63	3.01	1.08	-11.54	6.94	Pass
	11	2462	-17.02	3.01	1.08	-12.93	6.94	Pass

NOTE:

- Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] = 7.06 \text{ dBi} > 6 \text{ dBi}$, so the power density limit shall be reduced to $8 - (7.06 - 6) = 6.94 \text{ dBm}$.
- Method E) 2) c) of power density measurement of KDB 662911 is using for calculating total power density.

802.11n (HT20)

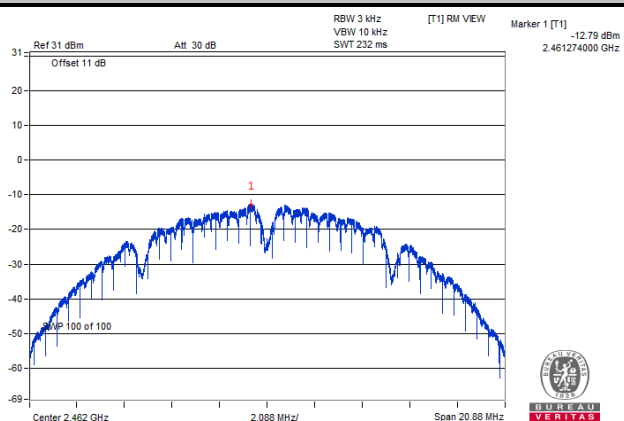
TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Duty Factor (dB)	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-18.02	3.01	1.09	-13.92	6.94	Pass
	6	2437	-15.19	3.01	1.09	-11.09	6.94	Pass
	11	2462	-19.91	3.01	1.09	-15.81	6.94	Pass
1	1	2412	-18.5	3.01	1.09	-14.4	6.94	Pass
	6	2437	-15.38	3.01	1.09	-11.28	6.94	Pass
	11	2462	-20.38	3.01	1.09	-16.28	6.94	Pass

NOTE:

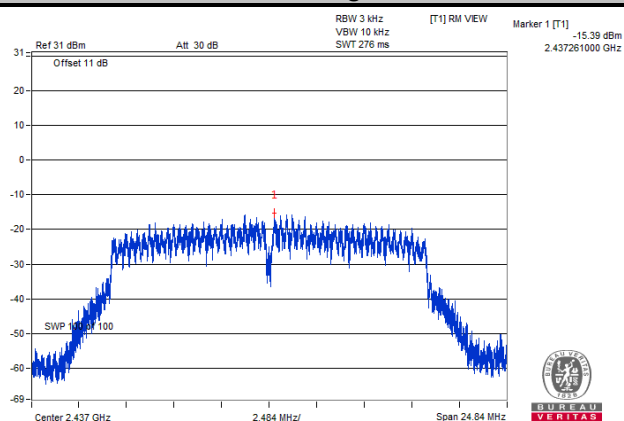
- Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] = 7.06 \text{ dBi} > 6 \text{ dBi}$, so the power density limit shall be reduced to $8 - (7.06 - 6) = 6.94 \text{ dBm}$.
- Method E) 2) c) of power density measurement of KDB 662911 is using for calculating total power density.

Spectrum Plot of Worst Value

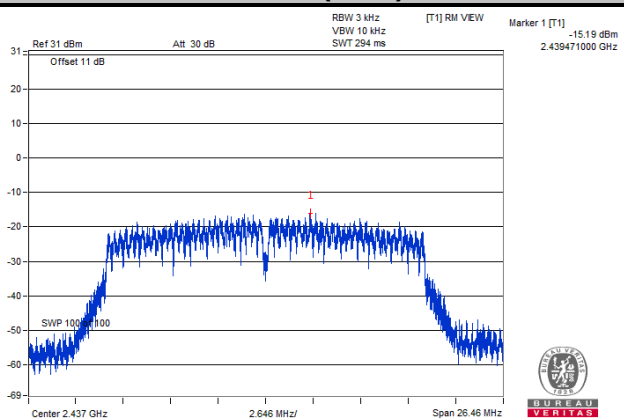
802.11b



802.11g



802.11n (HT20)

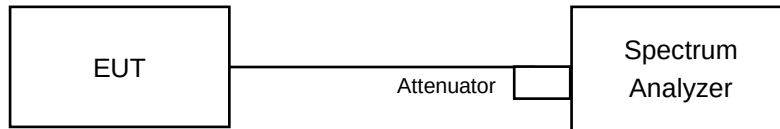


4.7 Conducted Out of Band Emission Measurement

4.7.1 Limits of Conducted Out of Band Emission Measurement

Below 30 dB of the highest emission level of operating band (in 100 kHz Resolution Bandwidth).

4.7.2 Test Setup



4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.7.4 Test Procedure

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

1. Set RBW = 100 kHz.
2. Set VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

4.7.5 Deviation from Test Standard

No deviation.

4.7.6 EUT Operating Condition

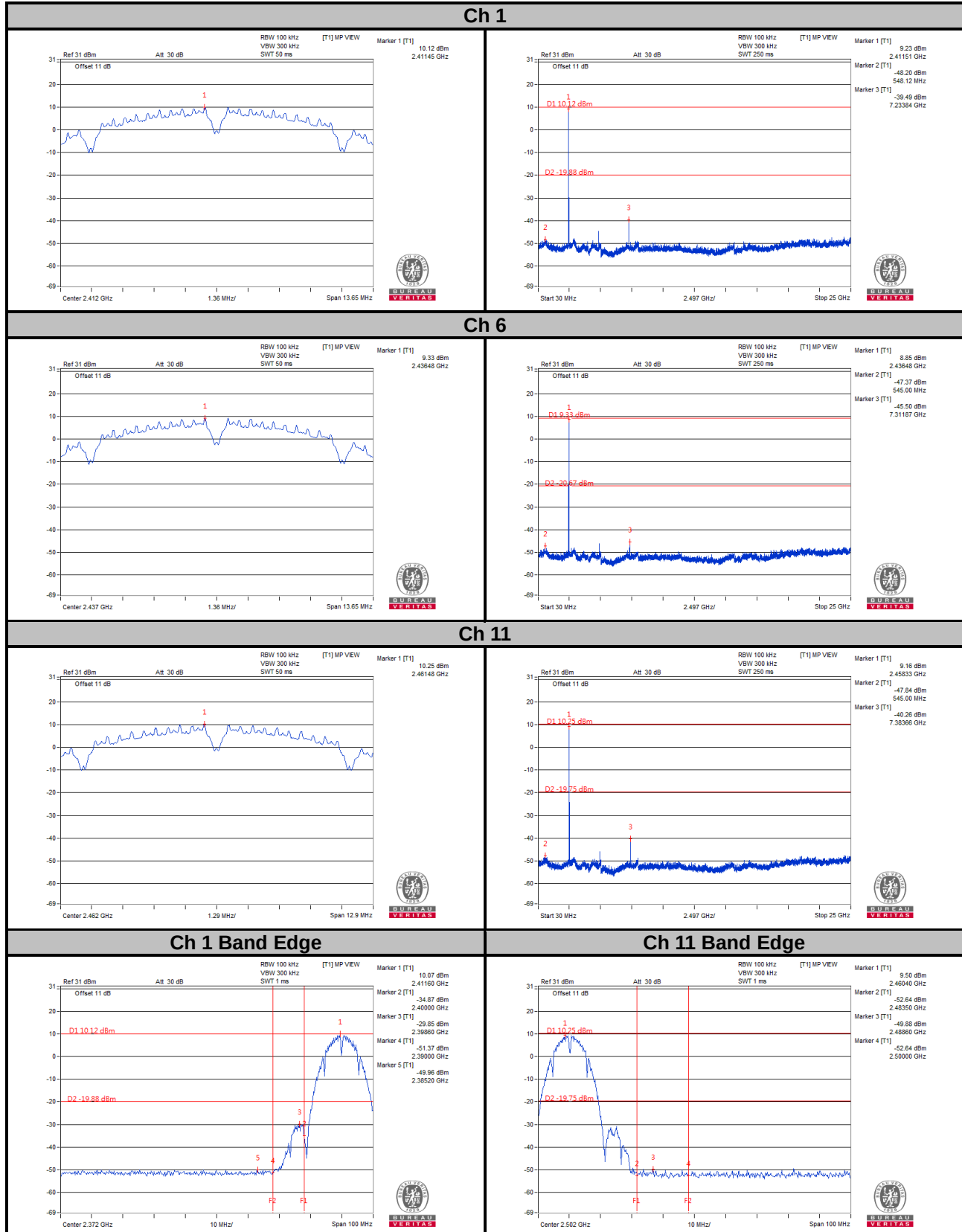
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.7.7 Test Results

The spectrum plots are attached on the following images. D1 line indicates the highest level, and D2 line indicates the 30 dB offset below D1. It shows compliance with the requirement.

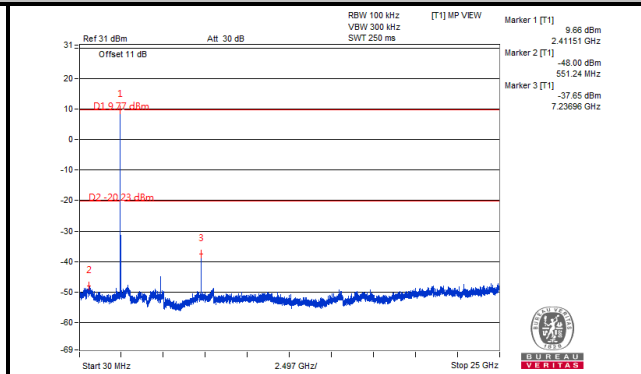
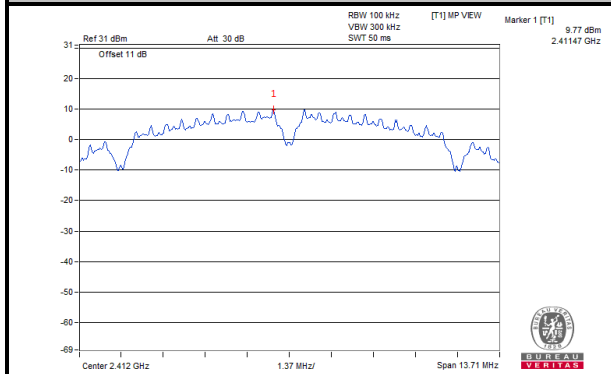
802.11b

CHAIN 0

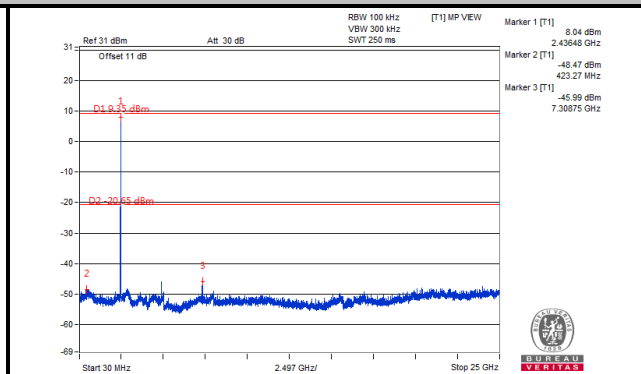
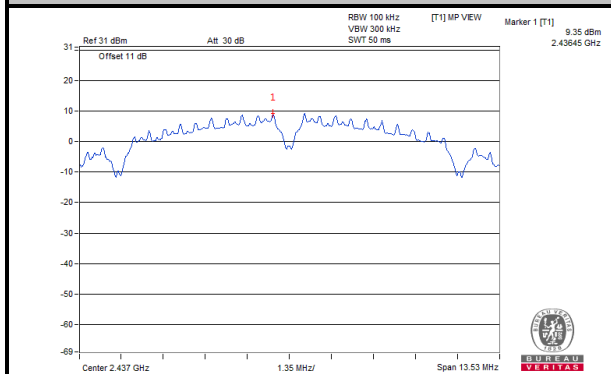


CHAIN 1

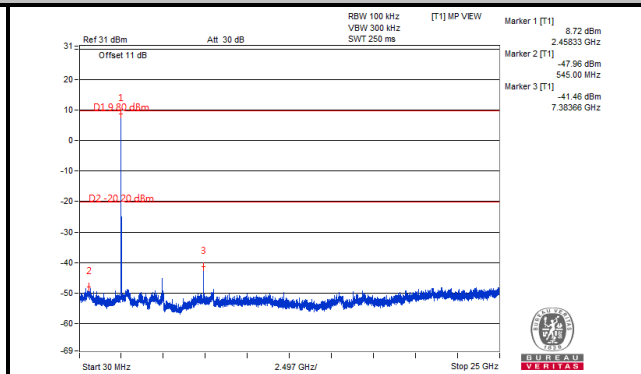
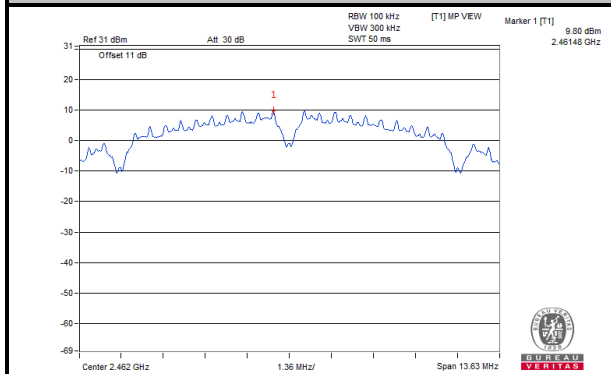
Ch 1



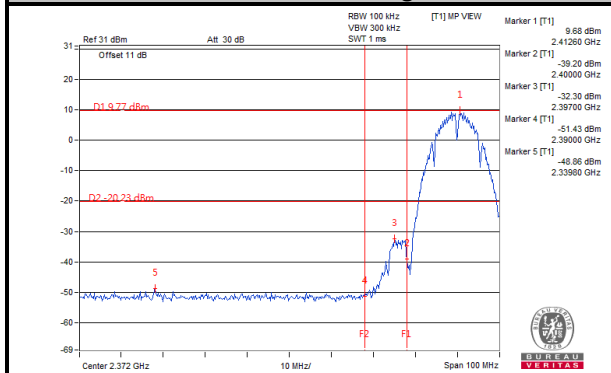
Ch 6



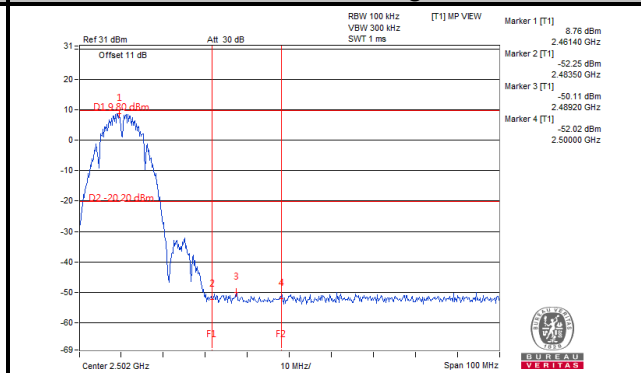
Ch 11



Ch 1 Band Edge

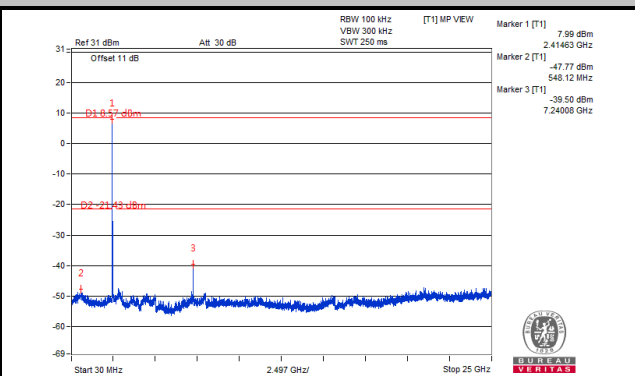
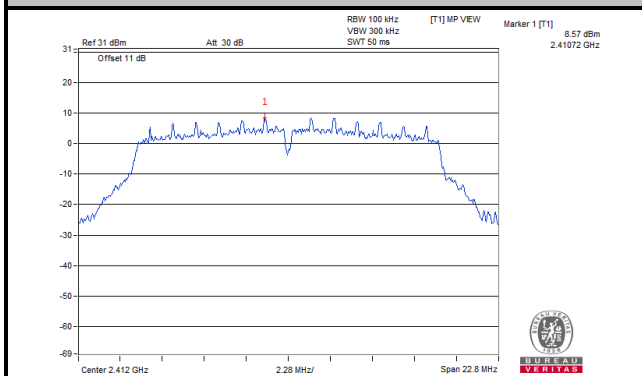


Ch 11 Band Edge

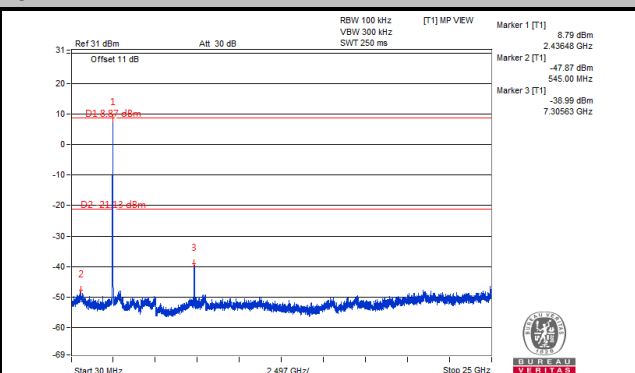
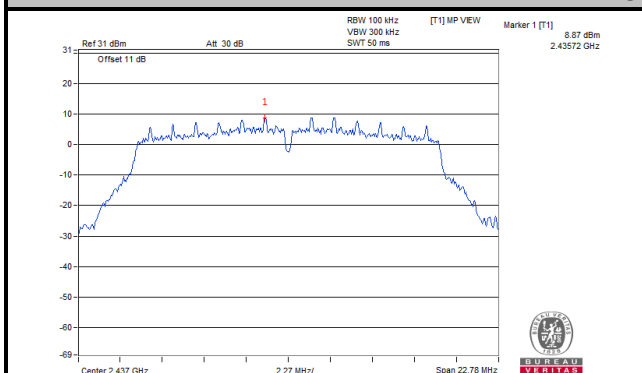


802.11g CHAIN 0

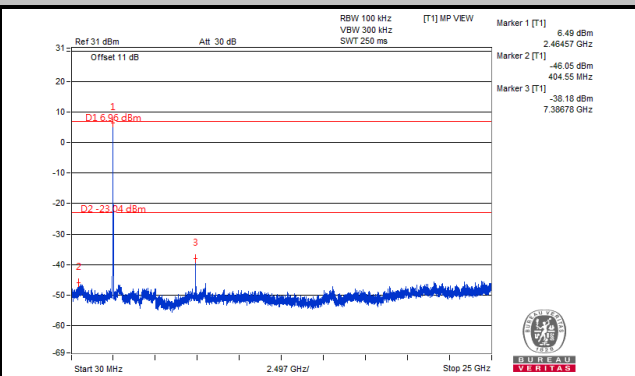
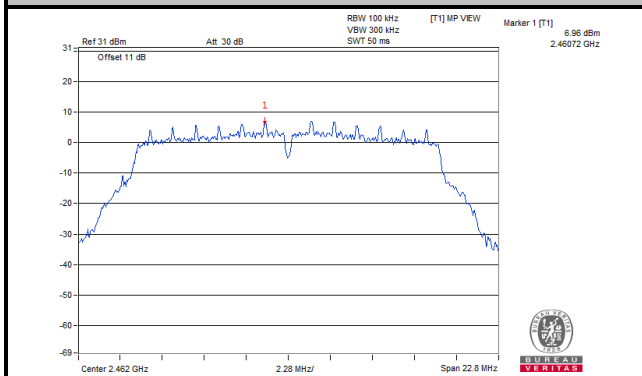
Ch 1



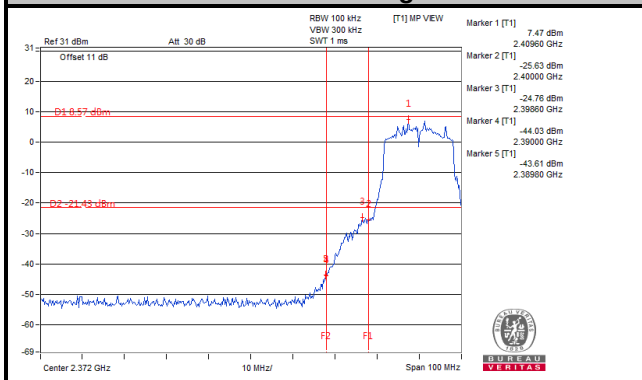
Ch 6



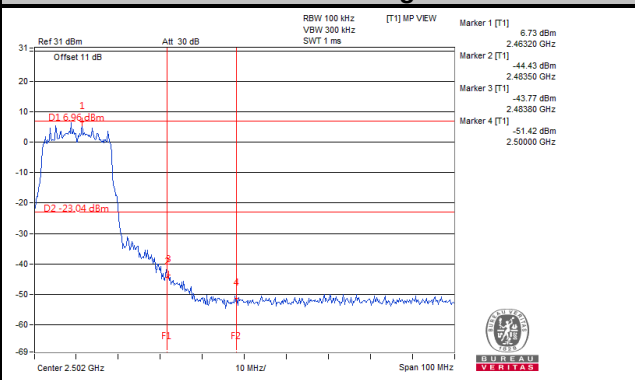
Ch 11



Ch 1 Band Edge

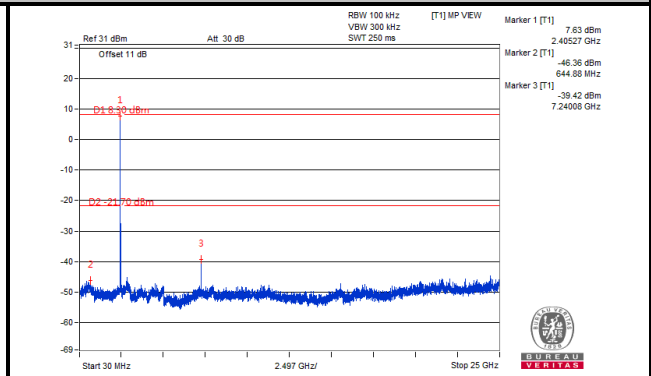
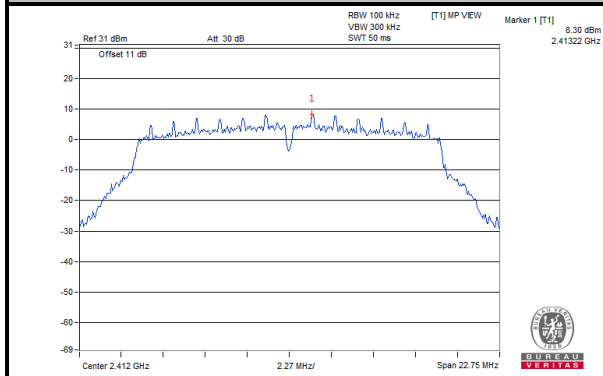


Ch 11 Band Edge

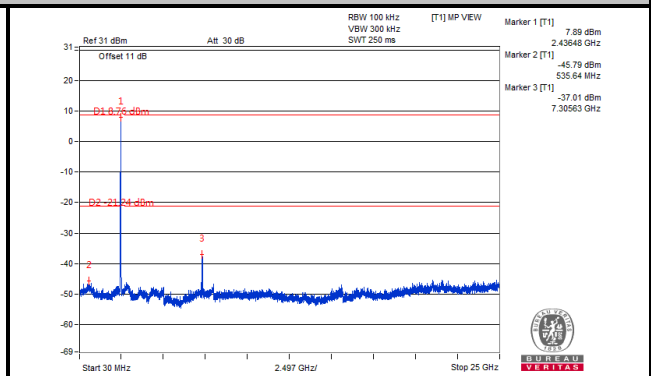
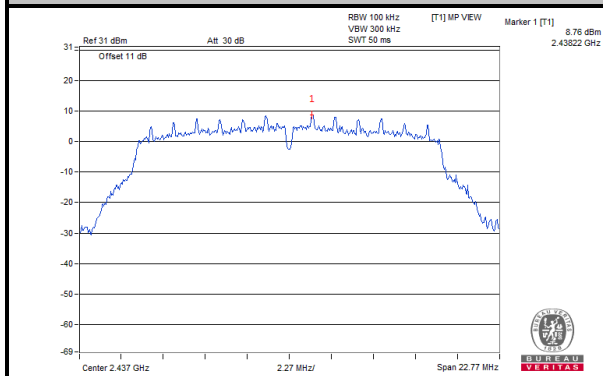


CHAIN 1

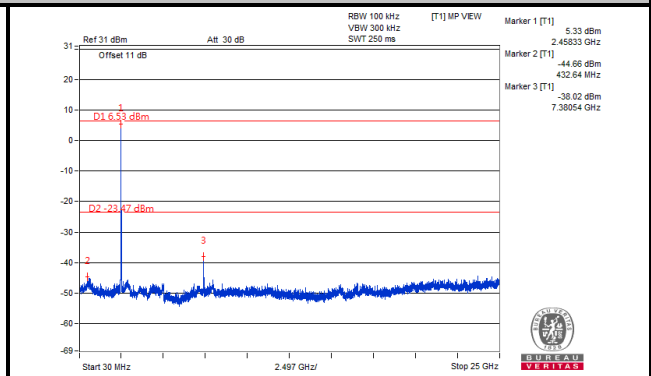
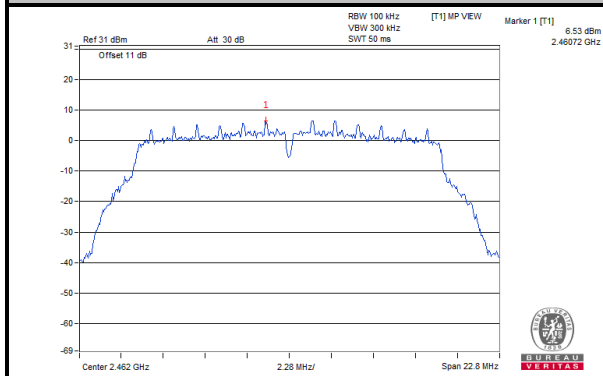
Ch 1



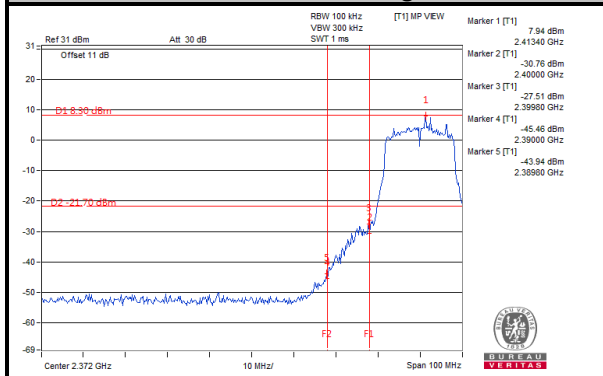
Ch 6



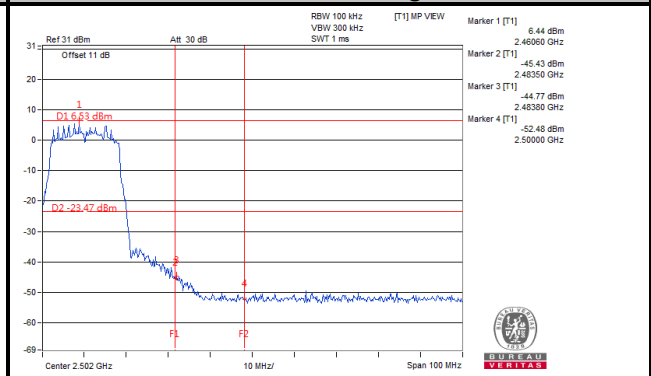
Ch 11



Ch 1 Band Edge

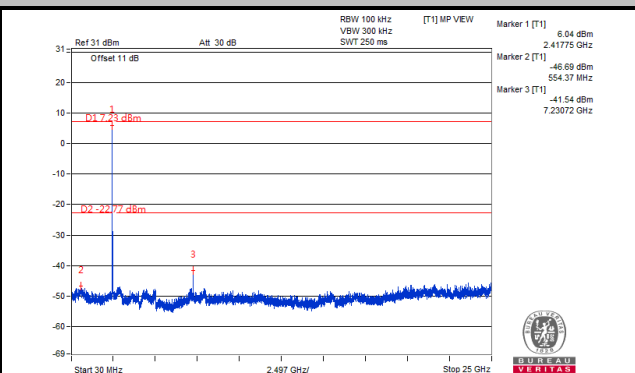
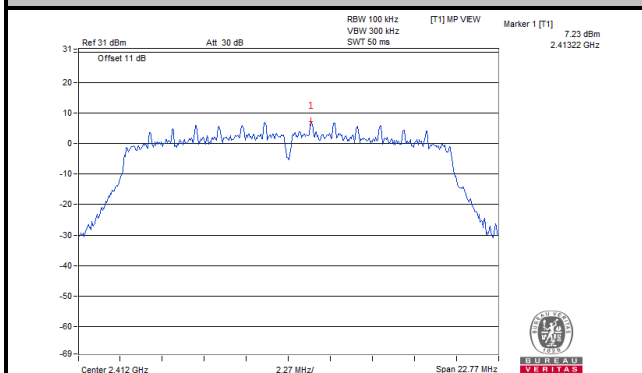


Ch 11 Band Edge

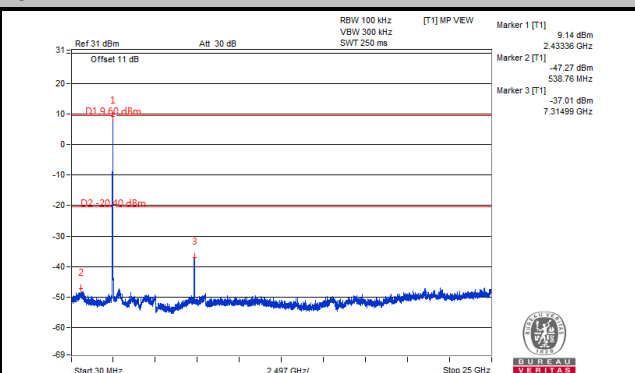
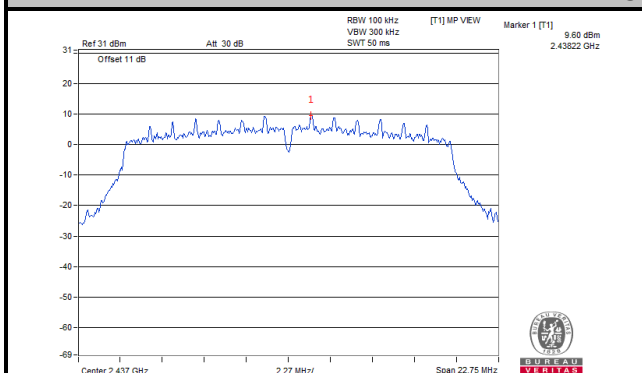


802.11n (HT20) CHAIN 0

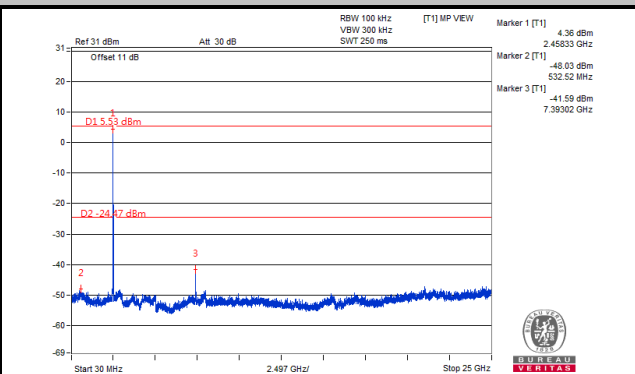
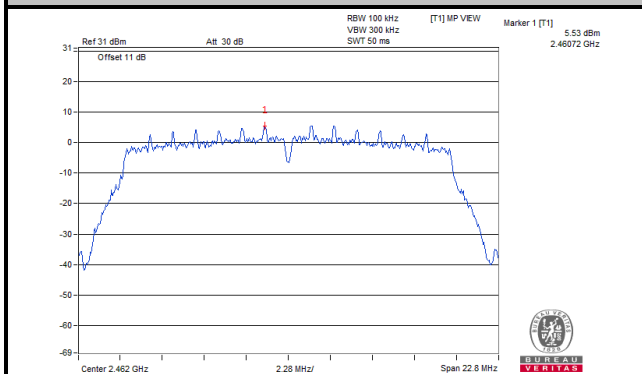
Ch 1



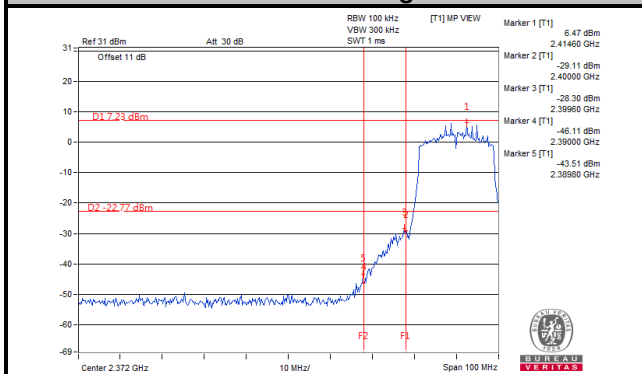
Ch 6



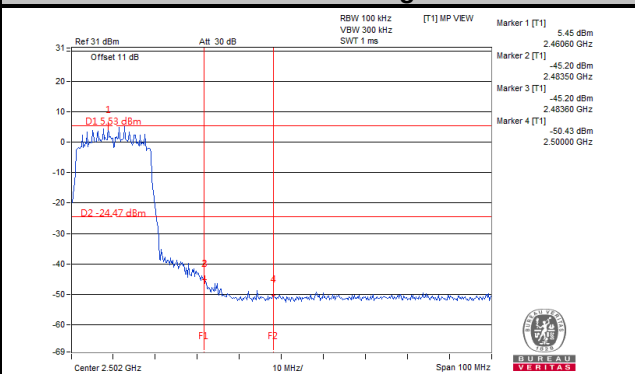
Ch 11



Ch 1 Band Edge

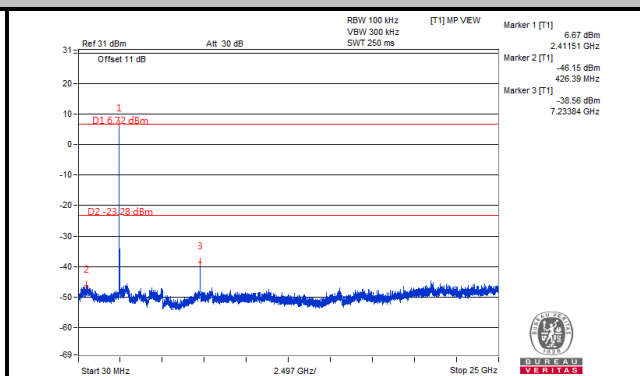
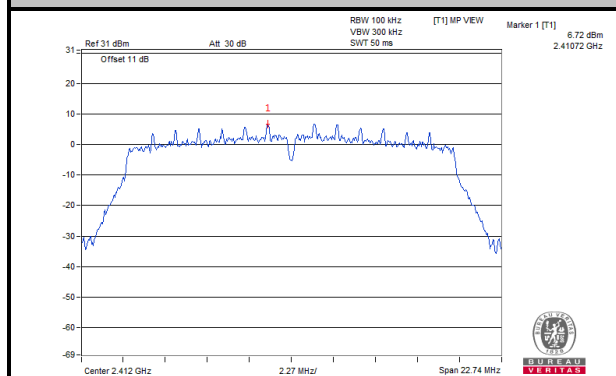


Ch 11 Band Edge

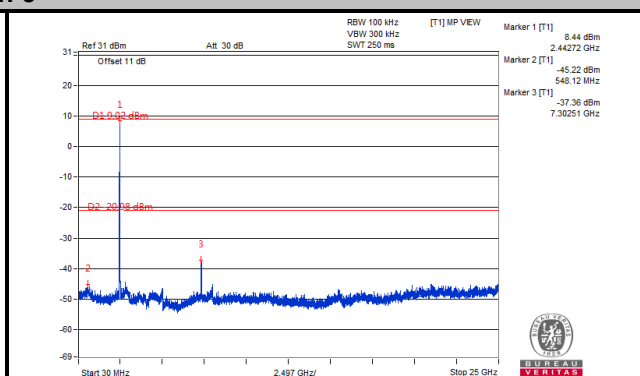
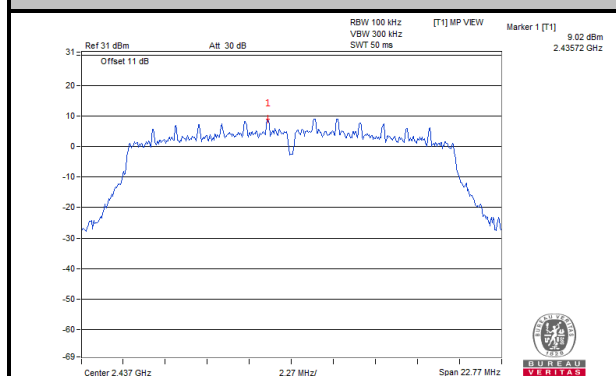


CHAIN 1

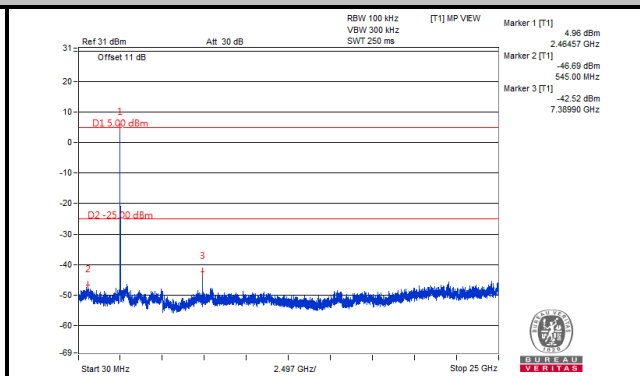
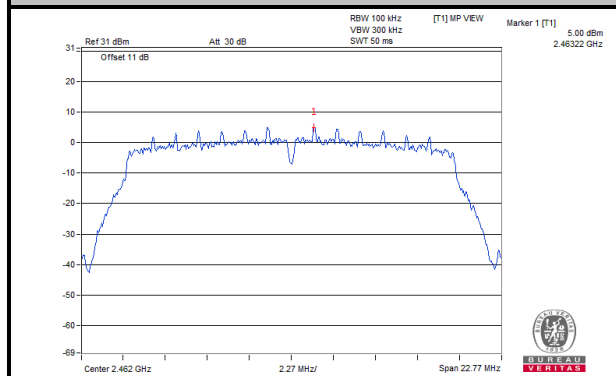
Ch 1



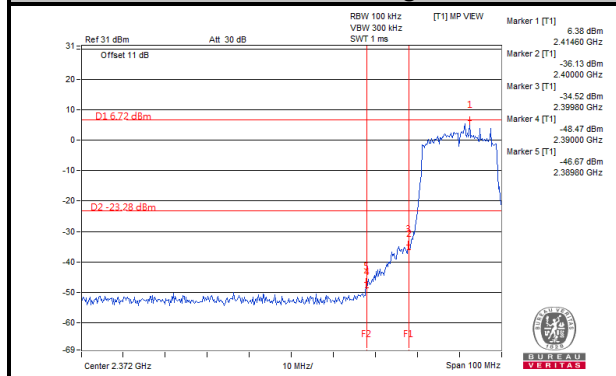
Ch 6



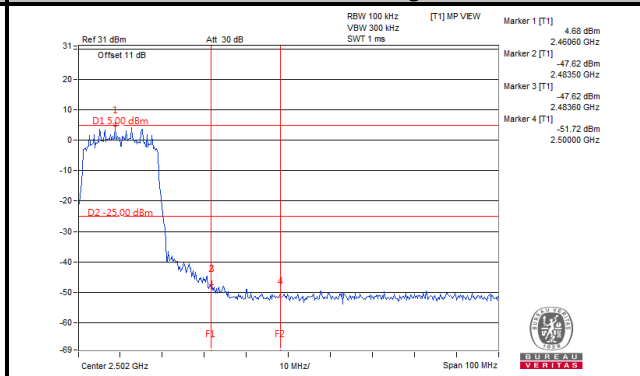
Ch 11



Ch 1 Band Edge



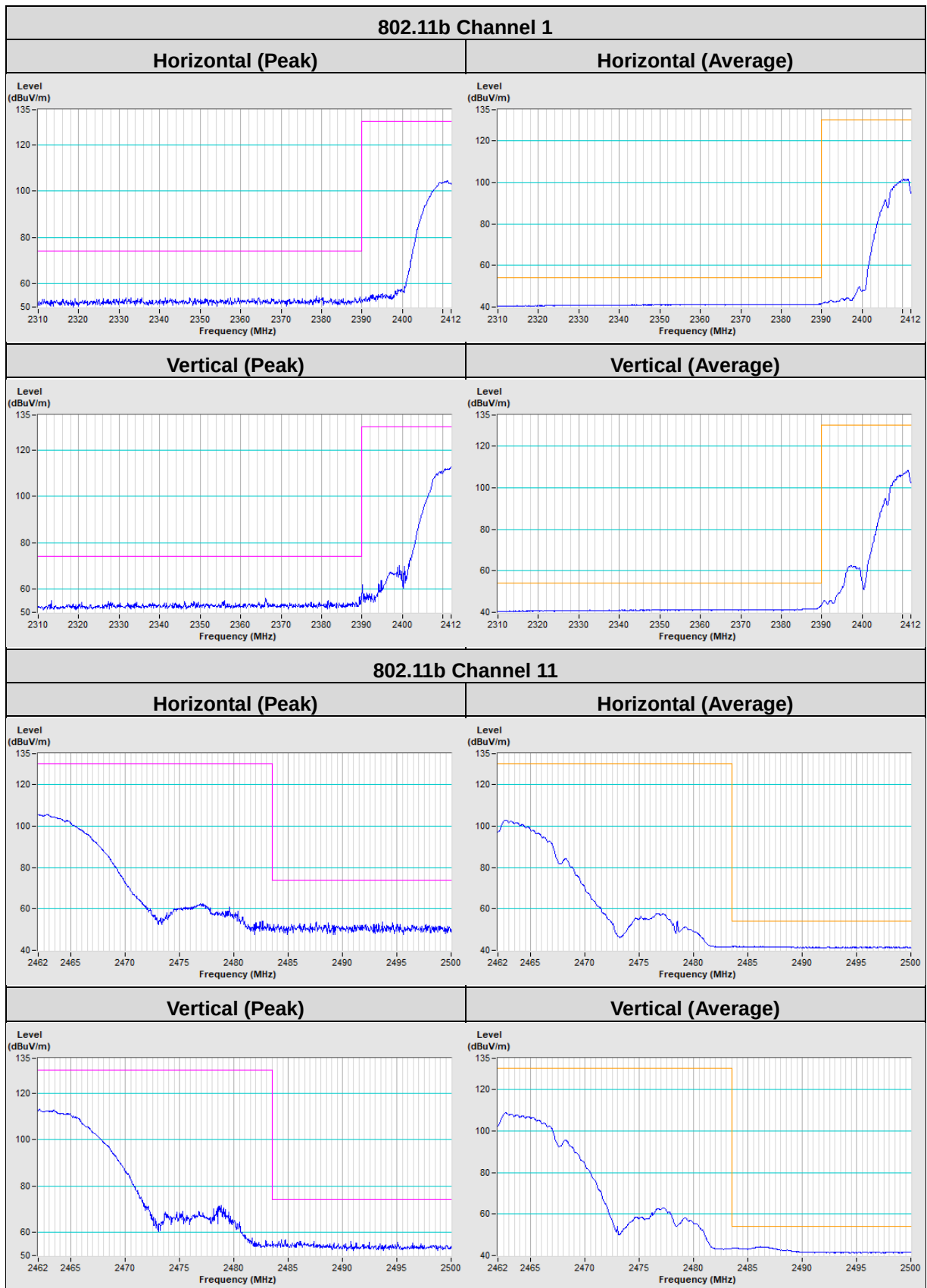
Ch 11 Band Edge

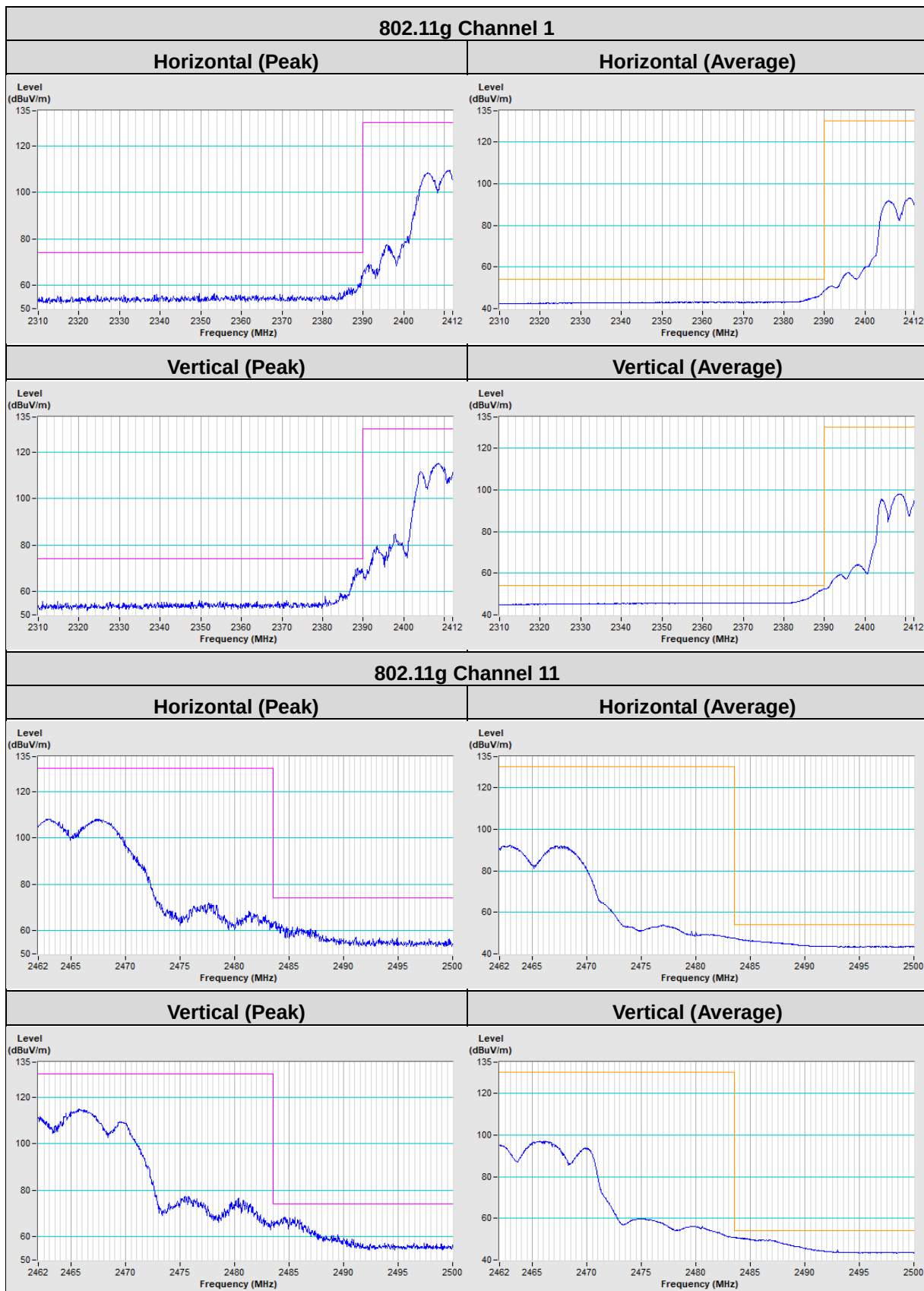


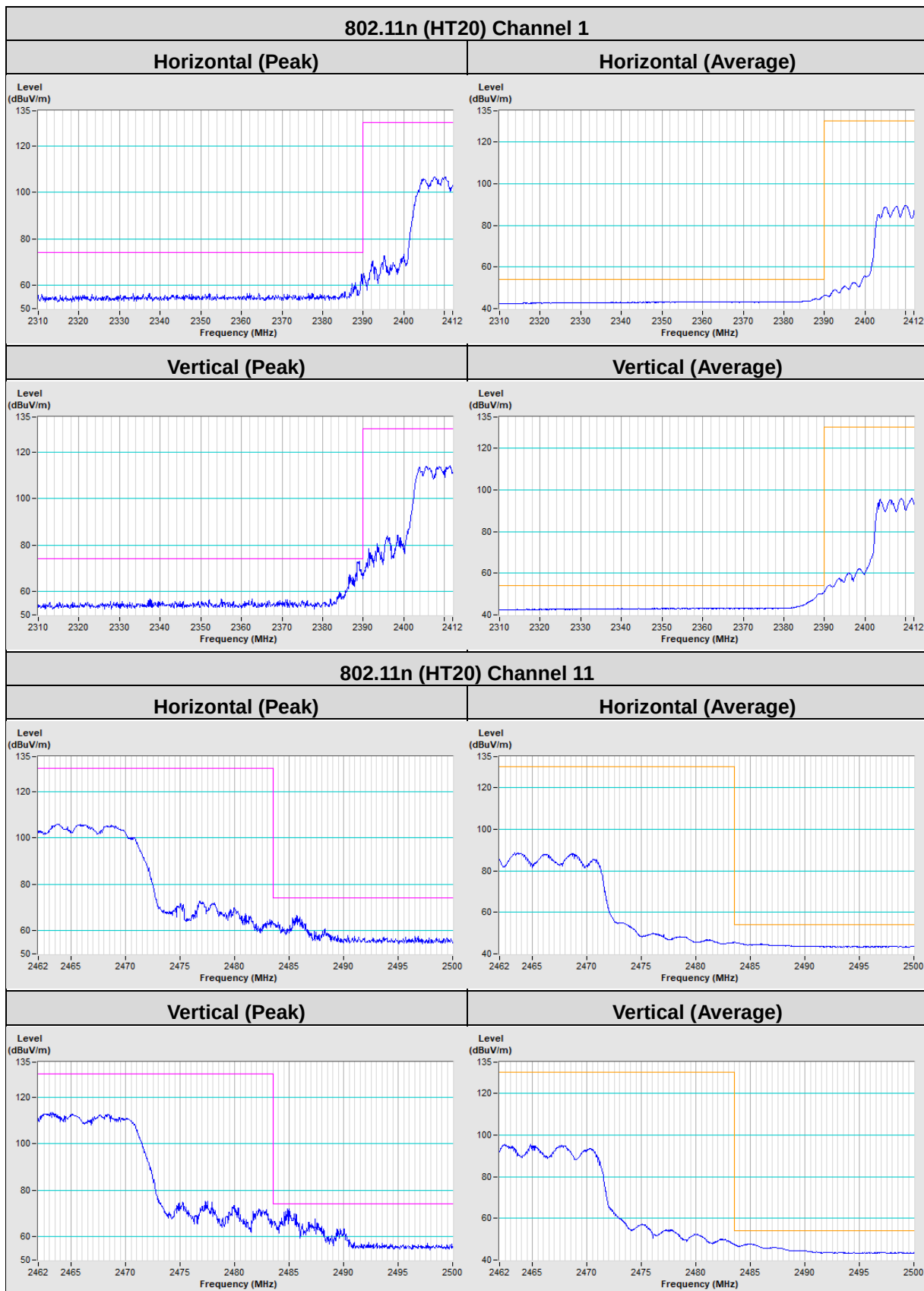
5 Pictures of Test Arrangements

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

Annex A- Band Edge Measurement







Appendix – Information of the Testing Laboratories

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

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

Lin Kou EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

--- END ---