FCC Test Report

Report No.:	RFBFBE-WTW-P21118016
FCC ID:	YAW539848
Test Model:	PVS6
Received Date:	2021/11/30
Test Date:	2021/11/30 ~ 2022/1/2
Issued Date:	2022/6/15
Applicant:	SunPower Corporation
Address:	1414 Harbour Way South Suite 1901, Richmond, CA 94804, USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
Test Location:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
FCC Registration / Designation Number:	723255 / TW2022

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Release Control Record

Issue No.	Description	Date Issued
RFBFBE-WTW-P21118016	Original release.	2022/6/15

1 Certificate of Conformity

Product:	SunPower Monitoring System with PVS6
Brand:	SUNPOWER
Test Model:	PVS6
Sample Status:	Engineering sample
Applicant:	SunPower Corporation
Test Date:	2021/11/30 ~ 2022/1/2
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 EMC characteristics under the conditions specified in this report.

Prepared by : Cherry Chuo , **Date:** 2022/6/15

Cherry Chuo / Specialist

Approved by : , **Date:** 2022/6/15

May Chen / Manager

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 -5.37 dB at 4.73047 MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.5 dB at 2390.00 MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	Pass	Meet the requirement of limit.
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 i-pex not a standard connector.

Note:
1. For 2.4 GHz band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A.
2. 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	150kHz ~ 30MHz	1.9 dB
Conducted emissions	-	2.5 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.1 dB
	30MHz ~ 1GHz	5.4 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.0 dB
	18GHz ~ 40GHz	5.3 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	SunPower Monitoring System with PVS6
Brand	SUNPOWER
Test Model	PVS6
Status of EUT	Engineering sample
Power Supply Rating	AC100-240V, 0.75A , 50/60Hz
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 1024QAM for OFDMA in 11ax HE mode
Modulation Technology	DSSS, OFDM, OFDMA
Transfer Rate	802.11b: up to 11 Mbps 802.11g: up to 54 Mbps 802.11n: up to 144.4 Mbps 802.11ax: up to 286.8 Mbps
Operating Frequency	2.412 ~ 2.462 GHz
Number of Channel	802.11b, 802.11g, 802.11n (HT20), 802.11ax (HE20): 11
Output Power	625.58 mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	-Hole Plugs x2 -Ethernet Cable x1: non-shielded, 1.5m -Bracket x1

Note:

1. The EUT contains certified WWAN module which FCC ID: XMR2020BG95M1 (Brand: Quectel; Model: BG95-M1)
2. There are WLAN, Bluetooth, ZigBee and WWAN technology used for the EUT.
3. The EUT has three radios as following table:

Radio 1	Radio 2	Radio 3
WLAN (2.4GHz+5GHz)+ BT	ZigBee	WWAN (LTE)

4. Simultaneously transmission condition.

Condition	Technology			
1	WLAN(2.4GHz)	BT	ZigBee	WWAN
2	WLAN(5GHz)	BT	ZigBee	WWAN
Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.				

5. The EUT needs to be supplied from an Internal power supply, the information is as below table:

Brand	Model No.	Spec.
WLAN WELL	IRM-30-12	AC Input: 100-240V, 0.75A , 50/60Hz DC Output: 12V, 2.5A

6. The antennas provided to the EUT, please refer to the following table:

WLAN / Bluetooth							
Ant No.	Chain No.	Brand	Model	Antenna Net Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type
1	Chain 0 (Including BT)	airgain	65-031-212002B	2.2	2.4~2.4835	PCB	I-PEX
				3.8	5.15~5.25		
				4.2	5.725~5.85		
2	Chain 1 (WLAN use only)	airgain	65-031-212003B	4.2	2.4~2.4835	PCB	I-PEX
				4.1	5.15~5.25		
				4.8	5.725~5.85		

ZigBee						
Ant No.	Brand	Model	Antenna Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type
3	airgain	65-031-212004B	4.8	2.4~2.4835	PCB	I-PEX

LTE						
Ant No.	Brand	Model	Antenna Gain (dBi)	Frequency rang (MHz)	Antenna type	Connector type
4	airgain	65-031-212001B	2.7	1850~1910	PCB	I-PEX
				1710~1755		
				698~716		

7. The EUT incorporates a MIMO function:

2.4GHz Band		
MODULATION MODE	**TX & RX CONFIGURATION**	
802.11b	2TX	2RX
802.11g	2TX	2RX
802.11n (HT20)	2TX	2RX
802.11ax (HE20)	2TX	2RX
Note: The modulation and bandwidth are similar for 802.11n mode for 20MHz and 802.11ax mode for 20MHz, therefore the manufacturer will control the power for 802.11n mode is the same as the 802.11ax mode or more lower than it and investigated worst case to representative mode in test report.		

8. The power setting are list as below:

802.11b		802.11g		802.11n (HT20)		802.11ax (HE20)	
Fre. (MHz)	**Power Setting**	**Fre. (MHz)**	**Power Setting**	**Fre. (MHz)**	**Power Setting**	**Fre. (MHz)**	**Power Setting**
2412	74	2412	64	2412	63	2412	63
2437	92	2437	77	2437	76	2437	76
2462	74	2462	63	2462	60	2462	60

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

10. 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.

3.2 Description of Test Modes

11 channels are provided for 802.11b, 802.11g, 802.11n (HT20), 802.11ax (HE20):

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

3.2.1 Test Mode Applicability and Tested Channel Detail

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

Where **RE≥1G:** Radiated Emission above 1GHz & Bandedge Measurement **RE<1G:** Radiated Emission below 1GHz

PLC: Power Line Conducted Emission **APCM:** Antenna Port Conducted Measurement

Radiated Emission Test (Above 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate Parameter
802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1Mb/s
802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6Mb/s
802.11ax (HE20)	1 to 11	1, 6, 11	OFDMA	BPSK	MCS0

Radiated Emission Test (Below 1GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate Parameter
802.11b	1 to 11	6	DSSS	DBPSK	1Mb/s

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.

Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate Parameter
802.11b	1 to 11	6	DSSS	DBPSK	1Mb/s

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.

Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate Parameter
802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1Mb/s
802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6Mb/s
802.11n (HT20) (output power only)	1 to 11	1, 6, 11	OFDM	BPSK	MCS0
802.11ax (HE20)	1 to 11	1, 6, 11	OFDMA	BPSK	MCS0

Test Condition:

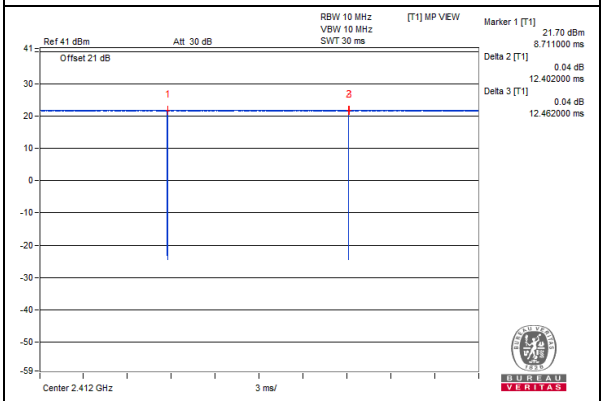
Applicable To	Environmental Conditions	Input Power	Tested By
RE≥1G	22deg. C, 70%RH	120Vac, 60Hz	Sampson Chen
RE<1G	22deg. C, 70%RH	120Vac, 60Hz	Ryan Du
PLC	25deg. C, 68%RH	120Vac, 60Hz	Sampson Chen
APCM	25deg. C, 60%RH	120Vac, 60Hz	Leon Dai

3.3 Duty Cycle of Test Signal

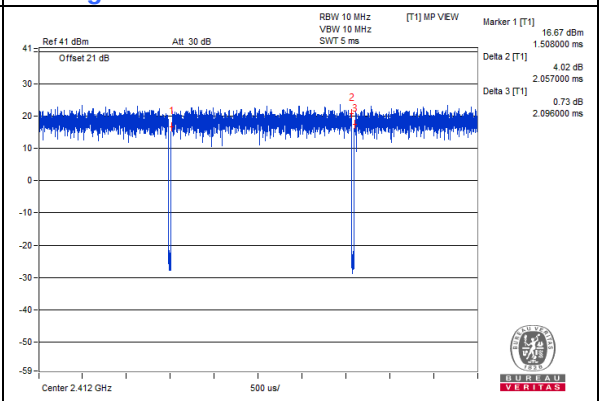
Duty cycle of test signal is ≥ 98 %, duty factor is not required.

802.11b: Duty cycle = 12.402 ms/12.462 ms = 0.995
802.11g: Duty cycle = 2.057 ms/2.096 ms = 0.981
802.11ax (HE20): Duty cycle = 1.483 ms/1.509 ms = 0.983

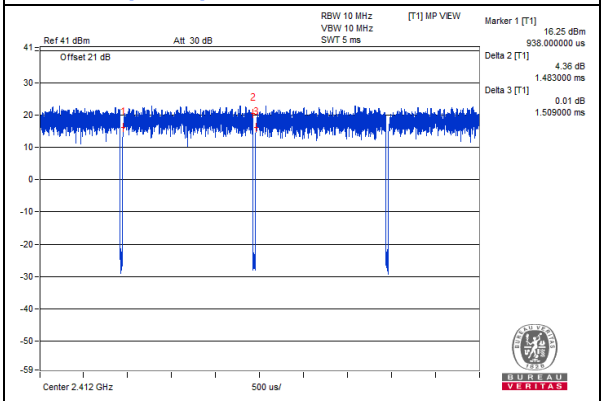
802.11b



802.11g



802.11ax (HE20)



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.

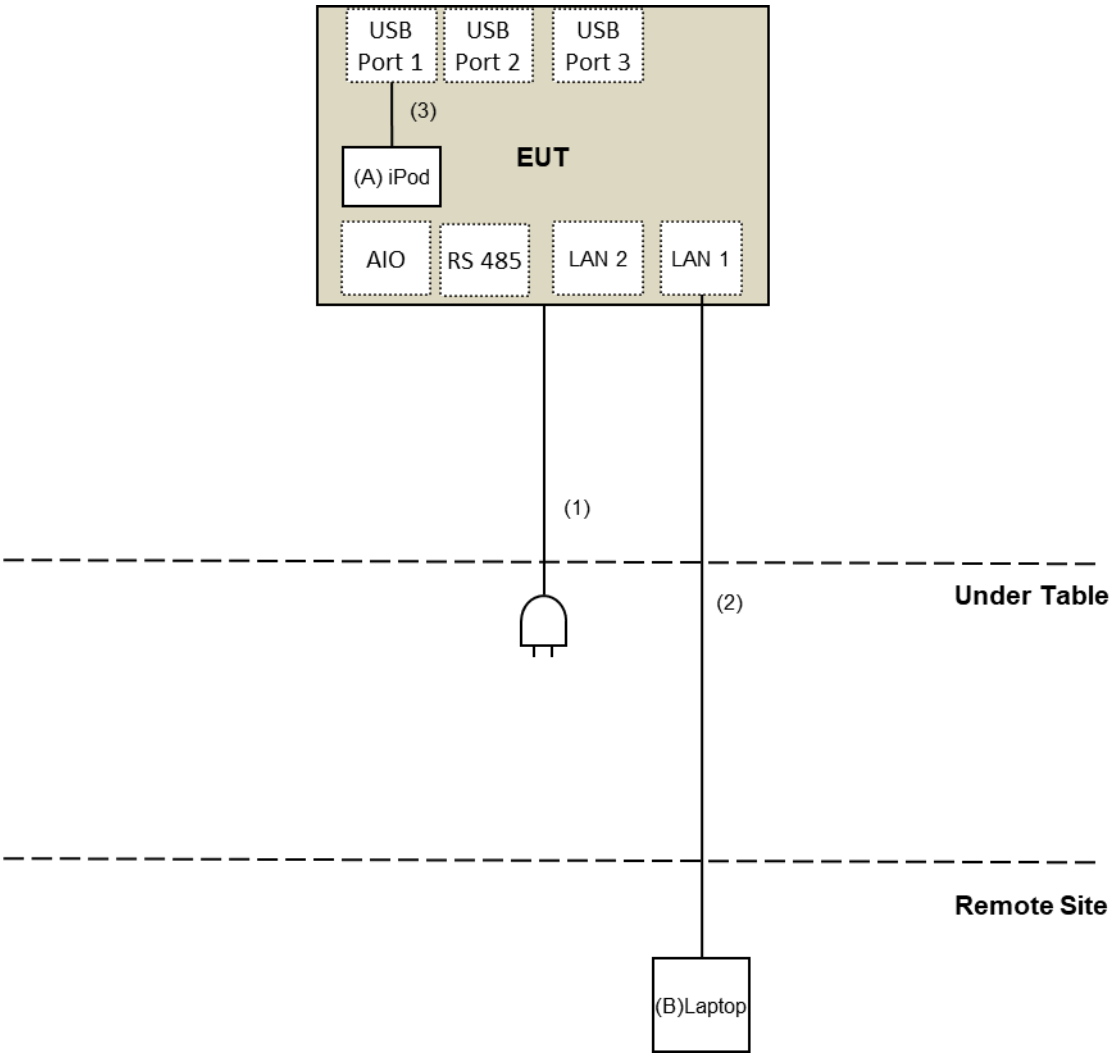
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	iPod	Apple	MC749TA/A	CC4DMFJUDFDM	NA	Provided by Lab
B.	Laptop	Lenovo	20U5S01X00 L14	PF-28LKK7	NA	Provided by Lab

Note:

1. 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.	AC Cable	1	1.8	No	0	Supplied by Applicant
2.	RJ-45 Cable	1	10	No	0	Provided by Lab
3.	USB Cable	1	0.1	Yes	0	Provided by Lab

3.4.1 Configuration of System under Test



Note: The test configuration was defined by the applicant requirement.

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 15.247 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 30dB 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 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

4.1.2 Test Instruments

For Radiated emission & Bandedge test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010156	2021/7/22	2022/7/21
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Pre_Amplifier EMCI	EMC001340	980142	2021/5/24	2022/5/23
LOOP ANTENNA Electro-Metrics	EM-6879	264	2021/3/5	2022/3/4
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-001	2021/1/7	2022/1/6
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-002	2021/1/7	2022/1/6
Pre_Amplifier Mini-Circuits	ZFL-1000VH2	QA0838008	2021/10/19	2022/10/18
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	2021/10/26	2022/10/25
RF Coaxial Cable COMMATE/PEWC	8D	966-3-1	2021/3/16	2022/3/15
RF Coaxial Cable COMMATE/PEWC	8D	966-3-2	2021/3/16	2022/3/15
RF Coaxial Cable COMMATE/PEWC	8D	966-3-3	2021/3/16	2022/3/15
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	2021/9/23	2022/9/22
Horn Antenna Schwarzbeck	BBHA9120-D	9120D-406	2021/11/14	2022/11/13
Pre_Amplifier EMCI	EMC12630SE	980384	2021/1/11	2022/1/10
RF Coaxial Cable EMCI	EMC104-SM-SM-1500	180504	2021/4/26	2022/4/25
RF Coaxial Cable EMCI	EMC104-SM-SM-2000	180601	2021/6/8	2022/6/7
RF Coaxial Cable EMCI	EMC104-SM-SM-6000	210201	2021/5/13	2022/5/12
Fix tool for Boresight antenna tower LIOW GUU	FBA-01	FBA_SIP01	NA	NA
Spectrum Analyzer Keysight	N9030A	MY54490679	2021/7/9	2022/7/8
Pre_Amplifier EMCI	EMC184045SE	980387	2021/1/11	2022/1/10
Horn Antenna Schwarzbeck	BBHA 9170	BBHA9170519	2021/11/14	2022/11/13
RF Cable-Frequency range: 1-40GHz EMCI	EMC102-KM-KM-1200	160924	2021/1/11	2022/1/10
RF cable (40GHz) EMCI	EMC-KM-KM-4000	200214	2021/3/10	2022/3/9

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 966 Chamber No. 3.
3. Tested Date: 2021/11/30 ~ 2021/12/24

For other test items test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSV40	101516	2021/3/8	2022/3/7
Power Meter Anritsu	ML2495A	1529002	2021/6/21	2022/6/20
Pulse Power Sensor Anritsu	MA2411B	1339443	2021/5/31	2022/5/30
Attenuator WOKEN	MDCS18N-10	MDCS18N-10-01	2021/4/13	2022/4/12
Software	ADT_RF Test Software V6.6.5.4	NA	NA	NA

NOTE: 1. The test was performed in Oven room 2.
2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. Tested Date: 2022/1/2

4.1.3 Test Procedures

For Radiated emission below 30MHz

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 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

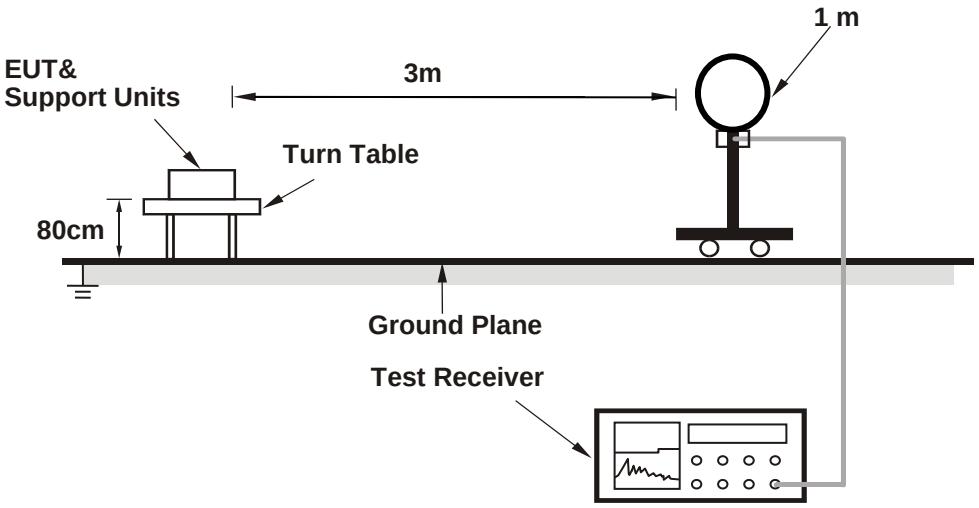
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

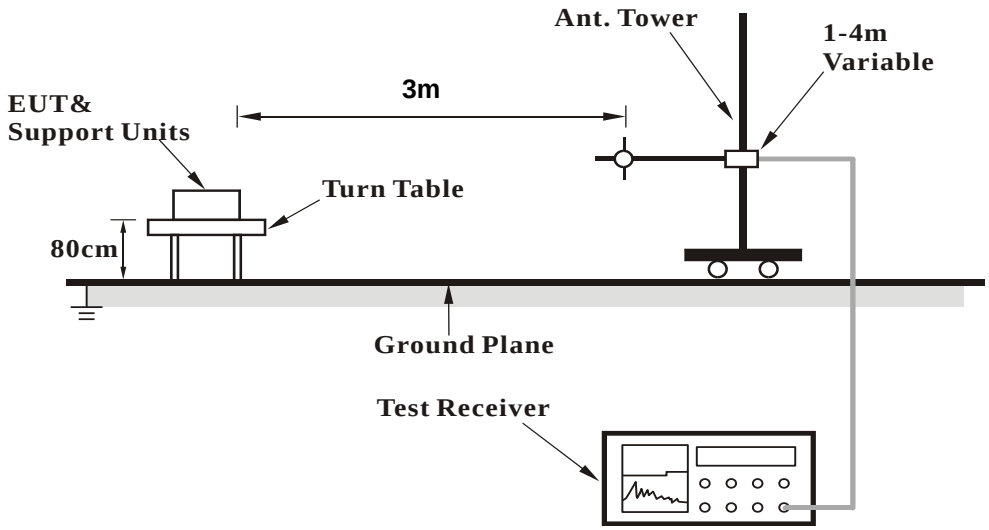
No deviation.

4.1.5 Test Setup

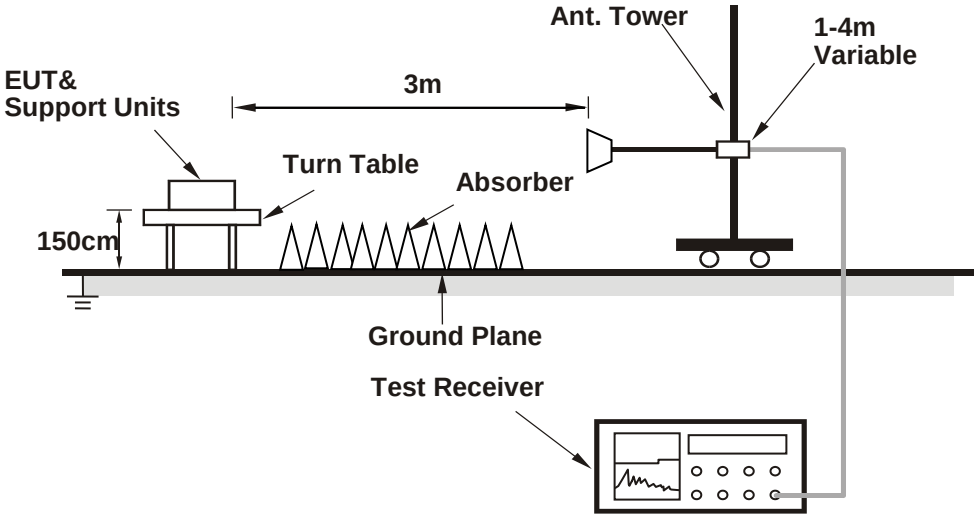
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

a. Connected the EUT with the Laptop Computer which is placed on remote site.
b. Controlling software (ssh paste PVS6_WiFi+Zigbee+BT+BLE+RB SOP.docx command) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz 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	60.0 PK	74.0	-14.0	1.16 H	51	61.2	-1.2
2	2390.00	53.2 AV	54.0	-0.8	1.16 H	51	54.4	-1.2
3	*2412.00	112.1 PK			1.16 H	51	113.4	-1.3
4	*2412.00	109.9 AV			1.16 H	51	111.2	-1.3
5	4824.00	43.9 PK	74.0	-30.1	1.48 H	279	40.5	3.4
6	4824.00	40.9 AV	54.0	-13.1	1.48 H	279	37.5	3.4
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	59.5 PK	74.0	-14.5	1.22 V	7	60.7	-1.2
2	2390.00	51.7 AV	54.0	-2.3	1.22 V	7	52.9	-1.2
3	*2412.00	110.5 PK			1.22 V	7	111.8	-1.3
4	*2412.00	108.1 AV			1.22 V	7	109.4	-1.3
5	4824.00	46.8 PK	74.0	-27.2	1.45 V	187	43.4	3.4
6	4824.00	45.3 AV	54.0	-8.7	1.45 V	187	41.9	3.4

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	2390.00	57.7 PK	74.0	-16.3	1.78 H	83	58.9	-1.2
2	2390.00	48.3 AV	54.0	-5.7	1.78 H	83	49.5	-1.2
3	*2437.00	115.0 PK			1.78 H	83	116.3	-1.3
4	*2437.00	112.8 AV			1.78 H	83	114.1	-1.3
5	2483.50	59.7 PK	74.0	-14.3	1.78 H	83	61.1	-1.4
6	2483.50	48.8 AV	54.0	-5.2	1.78 H	83	50.2	-1.4
7	4874.00	43.2 PK	74.0	-30.8	1.50 H	278	39.8	3.4
8	4874.00	40.5 AV	54.0	-13.5	1.50 H	278	37.1	3.4
9	7311.00	48.7 PK	74.0	-25.3	1.89 H	222	39.2	9.5
10	7311.00	44.0 AV	54.0	-10.0	1.89 H	222	34.5	9.5
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	56.1 PK	74.0	-17.9	1.32 V	15	57.3	-1.2
2	2390.00	46.9 AV	54.0	-7.1	1.32 V	15	48.1	-1.2
3	*2437.00	113.6 PK			1.32 V	15	114.9	-1.3
4	*2437.00	111.2 AV			1.32 V	15	112.5	-1.3
5	2483.50	58.4 PK	74.0	-15.6	1.32 V	15	59.8	-1.4
6	2483.50	47.2 AV	54.0	-6.8	1.32 V	15	48.6	-1.4
7	4874.00	47.2 PK	74.0	-26.8	1.50 V	172	43.8	3.4
8	4874.00	45.7 AV	54.0	-8.3	1.50 V	172	42.3	3.4
9	7311.00	46.2 PK	74.0	-27.8	1.41 V	330	36.7	9.5
10	7311.00	38.1 AV	54.0	-15.9	1.41 V	330	28.6	9.5

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	110.9 PK			1.50 H	315	112.3	-1.4
2	*2462.00	108.7 AV			1.50 H	315	110.1	-1.4
3	2487.70	62.8 PK	74.0	-11.2	1.50 H	315	64.2	-1.4
4	2487.70	53.3 AV	54.0	-0.7	1.50 H	315	54.7	-1.4
5	4924.00	42.5 PK	74.0	-31.5	1.43 H	129	39.0	3.5
6	4924.00	38.4 AV	54.0	-15.6	1.43 H	129	34.9	3.5
7	7386.00	47.2 PK	74.0	-26.8	1.00 H	46	37.6	9.6
8	7386.00	40.9 AV	54.0	-13.1	1.00 H	46	31.3	9.6
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	109.2 PK			1.49 V	21	110.6	-1.4
2	*2462.00	107.2 AV			1.49 V	21	108.6	-1.4
3	2484.70	60.0 PK	74.0	-14.0	1.49 V	21	61.4	-1.4
4	2484.70	51.9 AV	54.0	-2.1	1.49 V	21	53.3	-1.4
5	4924.00	42.6 PK	74.0	-31.4	1.01 V	179	39.1	3.5
6	4924.00	40.5 AV	54.0	-13.5	1.01 V	179	37.0	3.5
7	7386.00	44.8 PK	74.0	-29.2	1.56 V	270	35.2	9.6
8	7386.00	37.4 AV	54.0	-16.6	1.56 V	270	27.8	9.6

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	71.6 PK	74.0	-2.4	1.51 H	48	72.8	-1.2
2	2390.00	53.3 AV	54.0	-0.7	1.51 H	48	54.5	-1.2
3	*2412.00	109.8 PK			1.51 H	48	111.1	-1.3
4	*2412.00	100.0 AV			1.51 H	48	101.3	-1.3
5	4824.00	43.0 PK	74.0	-31.0	1.43 H	127	39.6	3.4
6	4824.00	38.7 AV	54.0	-15.3	1.43 H	127	35.3	3.4
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	2388.00	66.8 PK	74.0	-7.2	2.16 V	353	68.0	-1.2
2	2388.00	51.5 AV	54.0	-2.5	2.16 V	353	52.7	-1.2
3	*2412.00	110.8 PK			2.16 V	353	112.1	-1.3
4	*2412.00	101.5 AV			2.16 V	353	102.8	-1.3
5	4824.00	44.1 PK	74.0	-29.9	1.00 V	172	40.7	3.4
6	4824.00	38.8 AV	54.0	-15.2	1.00 V	172	35.4	3.4

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	2390.00	69.7 PK	74.0	-4.3	1.30 H	46	70.9	-1.2
2	2390.00	50.4 AV	54.0	-3.6	1.30 H	46	51.6	-1.2
3	*2437.00	114.5 PK			1.30 H	46	115.8	-1.3
4	*2437.00	104.3 AV			1.30 H	46	105.6	-1.3
5	2483.50	70.4 PK	74.0	-3.6	1.30 H	46	71.8	-1.4
6	2483.50	51.8 AV	54.0	-2.2	1.30 H	46	53.2	-1.4
7	4874.00	42.8 PK	74.0	-31.2	1.53 H	98	39.4	3.4
8	4874.00	37.7 AV	54.0	-16.3	1.53 H	98	34.3	3.4
9	7311.00	48.4 PK	74.0	-25.6	1.14 H	49	38.9	9.5
10	7311.00	36.8 AV	54.0	-17.2	1.14 H	49	27.3	9.5
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	67.8 PK	74.0	-6.2	2.60 V	321	69.0	-1.2
2	2390.00	48.8 AV	54.0	-5.2	2.60 V	321	50.0	-1.2
3	*2437.00	114.1 PK			2.60 V	321	115.4	-1.3
4	*2437.00	103.8 AV			2.60 V	321	105.1	-1.3
5	2483.50	68.4 PK	74.0	-5.6	2.60 V	321	69.8	-1.4
6	2483.50	49.5 AV	54.0	-4.5	2.60 V	321	50.9	-1.4
7	4874.00	43.8 PK	74.0	-30.2	1.06 V	186	40.4	3.4
8	4874.00	38.4 AV	54.0	-15.6	1.06 V	186	35.0	3.4
9	7311.00	43.7 PK	74.0	-30.3	1.53 V	262	34.2	9.5
10	7311.00	34.8 AV	54.0	-19.2	1.53 V	262	25.3	9.5

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	109.5 PK			1.36 H	314	110.9	-1.4
2	*2462.00	100.2 AV			1.36 H	314	101.6	-1.4
3	2483.50	71.5 PK	74.0	-2.5	1.36 H	314	72.9	-1.4
4	2483.50	53.3 AV	54.0	-0.7	1.36 H	314	54.7	-1.4
5	4924.00	43.3 PK	74.0	-30.7	1.56 H	99	39.8	3.5
6	4924.00	38.0 AV	54.0	-16.0	1.56 H	99	34.5	3.5
7	7386.00	47.9 PK	74.0	-26.1	1.19 H	54	38.3	9.6
8	7386.00	36.3 AV	54.0	-17.7	1.19 H	54	26.7	9.6
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	110.4 PK			3.22 V	345	111.8	-1.4
2	*2462.00	100.6 AV			3.22 V	345	102.0	-1.4
3	2483.50	72.2 PK	74.0	-1.8	3.22 V	345	73.6	-1.4
4	2483.50	52.6 AV	54.0	-1.4	3.22 V	345	54.0	-1.4
5	4924.00	44.1 PK	74.0	-29.9	1.11 V	196	40.6	3.5
6	4924.00	38.4 AV	54.0	-15.6	1.11 V	196	34.9	3.5
7	7386.00	43.8 PK	74.0	-30.2	1.50 V	270	34.2	9.6
8	7386.00	35.1 AV	54.0	-18.9	1.50 V	270	25.5	9.6

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 802.11ax (HE20)	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	70.3 PK	74.0	-3.7	1.17 H	52	71.5	-1.2
2	**2390.00**	**53.5 AV**	**54.0**	**-0.5**	**1.17 H**	**52**	**54.7**	**-1.2**
3	*2412.00	111.8 PK			1.17 H	52	113.1	-1.3
4	*2412.00	101.2 AV			1.17 H	52	102.5	-1.3
5	4824.00	42.7 PK	74.0	-31.3	1.51 H	88	39.3	3.4
6	4824.00	37.5 AV	54.0	-16.5	1.51 H	88	34.1	3.4
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	2388.00	67.8 PK	74.0	-6.2	2.12 V	347	69.0	-1.2
2	2388.00	52.6 AV	54.0	-1.4	2.12 V	347	53.8	-1.2
3	*2412.00	110.9 PK			2.12 V	347	112.2	-1.3
4	*2412.00	100.9 AV			2.12 V	347	102.2	-1.3
5	4824.00	43.8 PK	74.0	-30.2	1.02 V	190	40.4	3.4
6	4824.00	38.3 AV	54.0	-15.7	1.02 V	190	34.9	3.4

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 802.11ax (HE20)	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	2390.00	67.3 PK	74.0	-6.7	1.32 H	48	68.5	-1.2
2	2390.00	51.3 AV	54.0	-2.7	1.32 H	48	52.5	-1.2
3	*2437.00	115.3 PK			1.32 H	48	116.6	-1.3
4	*2437.00	104.2 AV			1.32 H	48	105.5	-1.3
5	2483.50	70.6 PK	74.0	-3.4	1.32 H	48	72.0	-1.4
6	2483.50	52.9 AV	54.0	-1.1	1.32 H	48	54.3	-1.4
7	4874.00	43.2 PK	74.0	-30.8	1.57 H	107	39.8	3.4
8	4874.00	38.0 AV	54.0	-16.0	1.57 H	107	34.6	3.4
9	7311.00	48.8 PK	74.0	-25.2	1.11 H	58	39.3	9.5
10	7311.00	37.1 AV	54.0	-16.9	1.11 H	58	27.6	9.5
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	65.8 PK	74.0	-8.2	2.58 V	322	67.0	-1.2
2	2390.00	50.8 AV	54.0	-3.2	2.58 V	322	52.0	-1.2
3	*2437.00	115.0 PK			2.58 V	322	116.3	-1.3
4	*2437.00	103.8 AV			2.58 V	322	105.1	-1.3
5	2483.50	68.9 PK	74.0	-5.1	2.58 V	322	70.3	-1.4
6	2483.50	51.8 AV	54.0	-2.2	2.58 V	322	53.2	-1.4
7	4874.00	43.7 PK	74.0	-30.3	1.11 V	191	40.3	3.4
8	4874.00	38.2 AV	54.0	-15.8	1.11 V	191	34.8	3.4
9	7311.00	43.4 PK	74.0	-30.6	1.56 V	257	33.9	9.5
10	7311.00	34.8 AV	54.0	-19.2	1.56 V	257	25.3	9.5

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 802.11ax (HE20)	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	108.6 PK			1.38 H	317	110.0	-1.4
2	*2462.00	99.3 AV			1.38 H	317	100.7	-1.4
3	2483.50	72.1 PK	74.0	-1.9	1.38 H	317	73.5	-1.4
4	2483.50	53.2 AV	54.0	-0.8	1.38 H	317	54.6	-1.4
5	4924.00	42.7 PK	74.0	-31.3	1.48 H	112	39.2	3.5
6	4924.00	37.8 AV	54.0	-16.2	1.48 H	112	34.3	3.5
7	7386.00	48.3 PK	74.0	-25.7	1.09 H	48	38.7	9.6
8	7386.00	36.5 AV	54.0	-17.5	1.09 H	48	26.9	9.6
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	109.2 PK			3.13 V	350	110.6	-1.4
2	*2462.00	99.9 AV			3.13 V	350	101.3	-1.4
3	2483.50	72.2 PK	74.0	-1.8	3.13 V	350	73.6	-1.4
4	2483.50	52.8 AV	54.0	-1.2	3.13 V	350	54.2	-1.4
5	4924.00	43.9 PK	74.0	-30.1	1.01 V	187	40.4	3.5
6	4924.00	38.2 AV	54.0	-15.8	1.01 V	187	34.7	3.5
7	7386.00	43.4 PK	74.0	-30.6	1.58 V	254	33.8	9.6
8	7386.00	34.5 AV	54.0	-19.5	1.58 V	254	24.9	9.6

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.

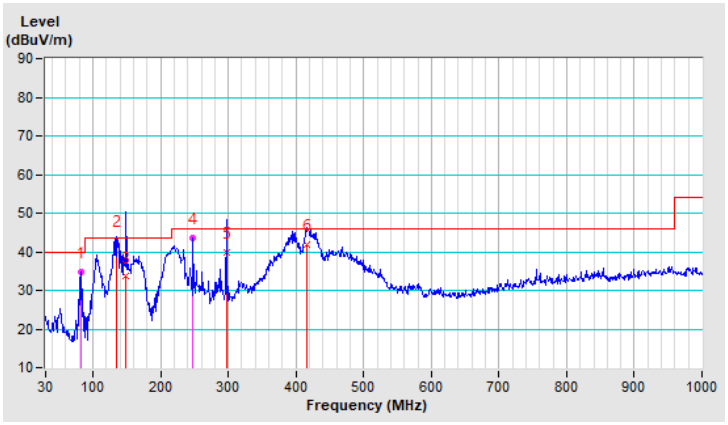
Below 1GHz Data:

RF Mode	TX 802.11b	Channel	CH 6：2437 MHz
Frequency Range	9kHz ~ 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	82.11	34.9 QP	40.0	-5.1	2.00 H	57	48.1	-13.2
2	134.11	42.8 QP	43.5	-0.7	1.50 H	127	51.1	-8.3
3	148.51	33.6 QP	43.5	-9.9	2.00 H	114	41.2	-7.6
4	247.52	43.7 QP	46.0	-2.3	2.00 H	65	52.4	-8.7
5	297.02	39.9 QP	46.0	-6.1	2.00 H	0	46.6	-6.7
6	415.24	41.8 QP	46.0	-4.2	2.00 H	212	45.2	-3.4

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.

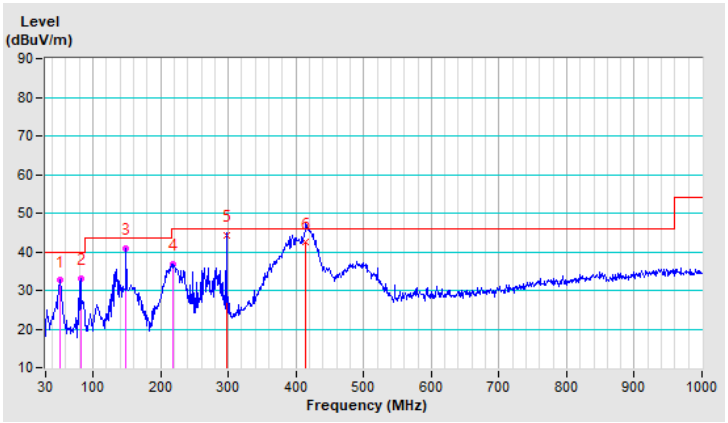


RF Mode	TX 802.11b	Channel	CH 6：2437 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

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	50.42	32.6 QP	40.0	-7.4	1.50 V	360	40.7	-8.1
2	82.14	33.1 QP	40.0	-6.9	1.50 V	323	46.3	-13.2
3	148.53	41.0 QP	43.5	-2.5	1.50 V	321	48.6	-7.6
4	218.96	36.8 QP	46.0	-9.2	1.50 V	46	47.2	-10.4
5	297.02	44.2 QP	46.0	-1.8	1.50 V	321	50.9	-6.7
6	414.31	42.4 QP	46.0	-3.6	2.00 V	273	45.8	-3.4

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 0.50MHz.

4.2.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	2021/10/13	2022/10/12
LISN R&S	ESH3-Z5	848773/004	2021/10/29	2022/10/28
LISN R & S	ESH3-Z5	835239/001	2021/3/26	2022/3/25
50 ohms Terminator	50	3	2021/10/27	2022/10/26
RF Coaxial Cable JYEBO	5D-FB	COCCAB-001	2021/9/25	2022/9/24
Fixed attenuator STI	STI02-2200-10	005	2021/8/27	2022/8/26
Software BVADT	BVADT_Cond_V7.3.7.4	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conduction 1.
3 Tested Date: 2021/12/17

4.2.3 Test Procedures

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

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

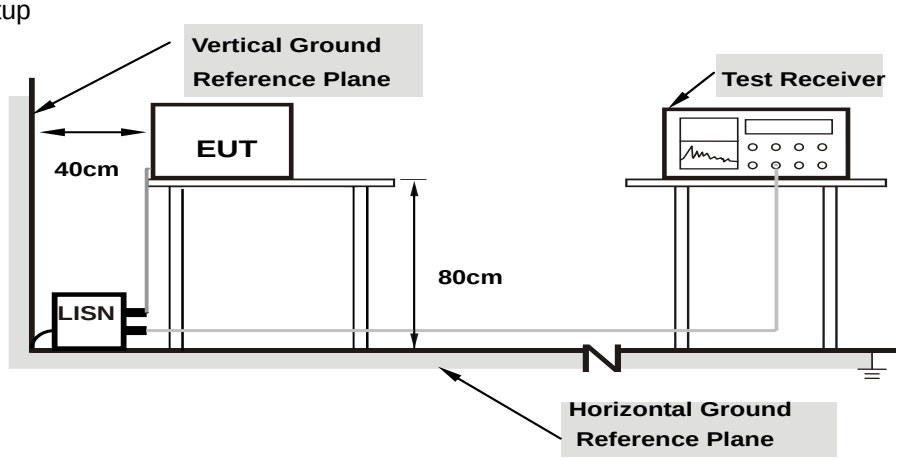
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



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

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

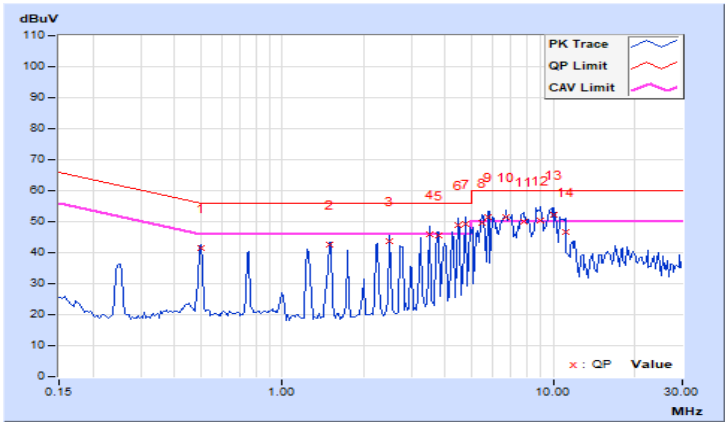
4.2.7 Test Results

RF Mode	TX 802.11b	Channel	CH 6：2437 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	0.50156	10.07	31.41	29.41	41.48	39.48	56.00	46.00	-14.52	-6.52
2	1.50000	10.13	32.43	26.01	42.56	36.14	56.00	46.00	-13.44	-9.86
3	2.48047	10.18	33.64	24.40	43.82	34.58	56.00	46.00	-12.18	-11.42
4	3.50000	10.23	35.68	27.98	45.91	38.21	56.00	46.00	-10.09	-7.79
5	3.77344	10.25	35.38	24.40	45.63	34.65	56.00	46.00	-10.37	-11.35
6	4.47266	10.29	38.75	29.33	49.04	39.62	56.00	46.00	-6.96	-6.38
7	**4.73047**	**10.30**	**38.85**	**30.33**	**49.15**	**40.63**	**56.00**	**46.00**	**-6.85**	**-5.37**
8	5.46484	10.34	39.21	28.67	49.55	39.01	60.00	50.00	-10.45	-10.99
9	5.72266	10.36	40.97	30.70	51.33	41.06	60.00	50.00	-8.67	-8.94
10	6.72266	10.42	41.02	30.93	51.44	41.35	60.00	50.00	-8.56	-8.65
11	7.75391	10.48	39.64	30.63	50.12	41.11	60.00	50.00	-9.88	-8.89
12	9.00000	10.55	39.80	30.39	50.35	40.94	60.00	50.00	-9.65	-9.06
13	10.00781	10.61	41.45	31.20	52.06	41.81	60.00	50.00	-7.94	-8.19
14	11.07422	10.68	36.05	23.21	46.73	33.89	60.00	50.00	-13.27	-16.11

Remarks:

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

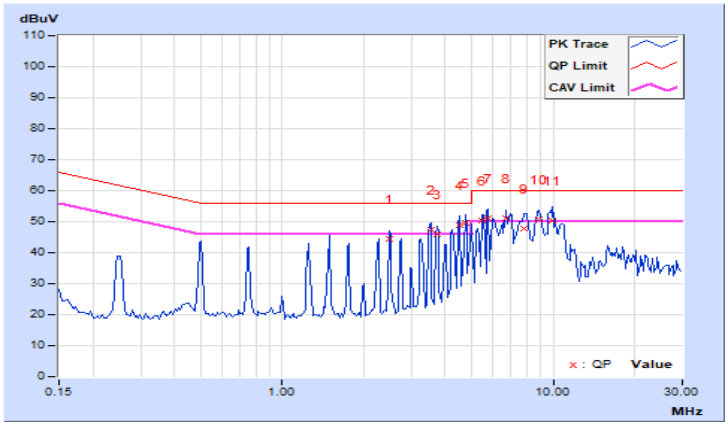


RF Mode	TX 802.11b	Channel	CH 6：2437 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	2.48047	10.15	34.11	24.34	44.26	34.49	56.00	46.00	-11.74	-11.51
2	3.52734	10.19	37.21	24.94	47.40	35.13	56.00	46.00	-8.60	-10.87
3	3.73828	10.20	35.74	26.84	45.94	37.04	56.00	46.00	-10.06	-8.96
4	4.52734	10.23	38.72	27.41	48.95	37.64	56.00	46.00	-7.05	-8.36
5	4.73438	10.24	39.23	30.24	49.47	40.48	56.00	46.00	-6.53	-5.52
6	5.48047	10.28	40.00	30.66	50.28	40.94	60.00	50.00	-9.72	-9.06
7	5.73047	10.29	40.71	31.16	51.00	41.45	60.00	50.00	-9.00	-8.55
8	6.72266	10.34	40.74	30.33	51.08	40.67	60.00	50.00	-8.92	-9.33
9	7.77344	10.39	37.36	28.44	47.75	38.83	60.00	50.00	-12.25	-11.17
10	8.81250	10.43	40.16	28.51	50.59	38.94	60.00	50.00	-9.41	-11.06
11	9.94531	10.49	40.04	29.54	50.53	40.03	60.00	50.00	-9.47	-9.97

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

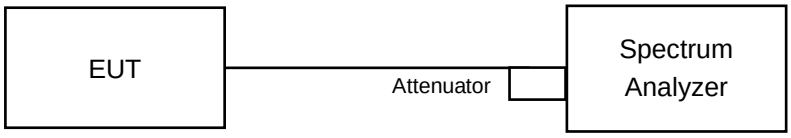


4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB 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

a. Set resolution bandwidth (RBW) = 100kHz
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = Peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. 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. In order to obtain results more easily, change max hold to view. It has no effect on the result

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

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

4.3.7 Test Result

802.11b

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	7.6	7.6	0.5	Pass
6	2437	8.07	8.07	0.5	Pass
11	2462	7.6	8.06	0.5	Pass

802.11g

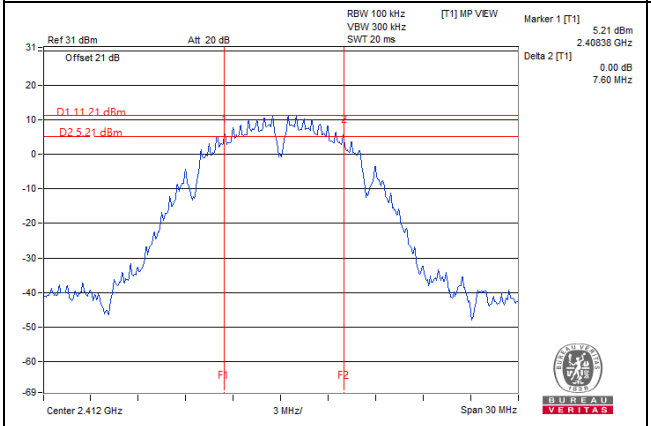
Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	16.39	16.4	0.5	Pass
6	2437	16.4	16.4	0.5	Pass
11	2462	16.39	16.4	0.5	Pass

802.11ax (HE20)

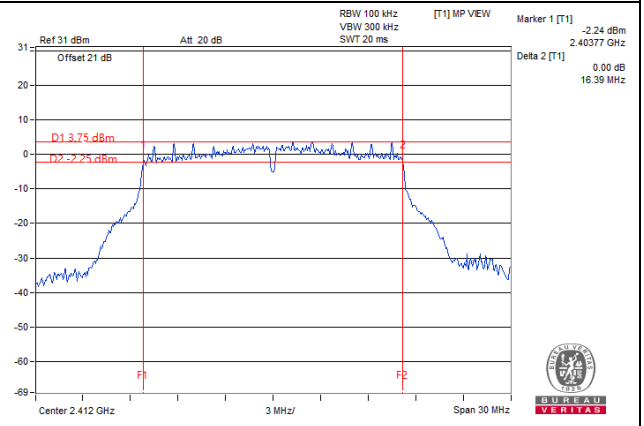
Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	18.84	18.74	0.5	Pass
6	2437	18.85	18.93	0.5	Pass
11	2462	18.65	18.67	0.5	Pass

Spectrum Plot of Worst Value

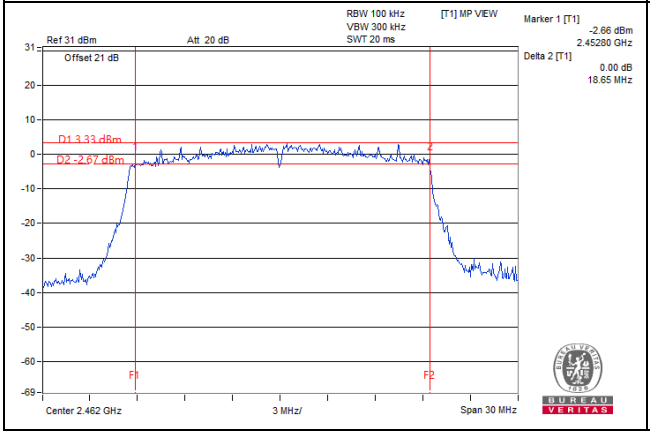
802.11b_Chain 0 / CH1



802.11g_Chain 0 / CH1



802.11ax (HE20)_Chain 0 / CH11



4.4 Conducted Output Power Measurement

4.4.1 Limits of Conducted Output Power Measurement

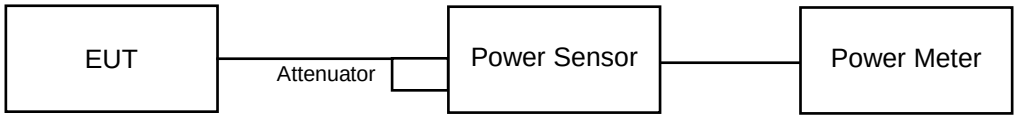
For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

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 $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT};
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

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

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

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.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as Item 4.3.6.

4.4.7 Test Results

Peak Power

802.11b

Chan.	Chan. Freq. (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Test Result
		Chain 0	Chain 1				
1	2412	21.27	21.23	266.707	24.26	30	Pass
6	2437	24.46	24.89	587.573	27.69	30	Pass
11	2462	21.37	21.66	283.643	24.53	30	Pass

802.11g

Chan.	Chan. Freq. (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Test Result
		Chain 0	Chain 1				
1	2412	23.52	23.93	472.078	26.74	30	Pass
6	2437	24.61	25.27	625.58	27.96	30	Pass
11	2462	23.32	23.70	449.206	26.52	30	Pass

802.11n (HT20)

Chan.	Chan. Freq. (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Test Result
		Chain 0	Chain 1				
1	2412	23.36	23.68	450.116	26.53	30	Pass
6	2437	24.35	24.83	576.359	27.61	30	Pass
11	2462	22.87	22.94	390.431	25.92	30	Pass

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Test Result
		Chain 0	Chain 1				
1	2412	23.59	23.89	473.466	26.75	30	Pass
6	2437	24.58	25.11	611.418	27.86	30	Pass
11	2462	23.13	23.19	414.038	26.17	30	Pass

Average Power

802.11b

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Average Power (mW)	Total Average Power (dBm)
		Chain 0	Chain 1		
1	2412	18.82	18.64	149.322	21.74
6	2437	22.44	22.58	356.522	25.52
11	2462	18.77	18.89	152.782	21.84

802.11g

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Average Power (mW)	Total Average Power (dBm)
		Chain 0	Chain 1		
1	2412	15.47	16.06	75.602	18.79
6	2437	19.42	19.72	181.255	22.58
11	2462	15.34	16.05	74.47	18.72

802.11n (HT20)

Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Average Power (mW)	Total Average Power (dBm)
		Chain 0	Chain 1		
1	2412	15.17	15.75	70.469	18.48
6	2437	18.94	19.28	163.066	22.12
11	2462	14.60	15.16	61.65	17.90

802.11ax (HE20)

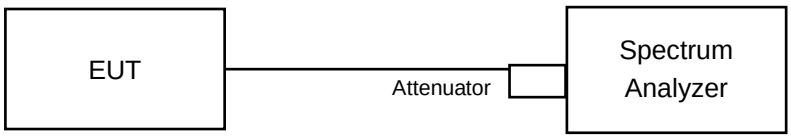
Chan.	Chan. Freq. (MHz)	Average Power (dBm)		Total Average Power (mW)	Total Average Power (dBm)
		Chain 0	Chain 1		
1	2412	15.45	16.03	75.162	18.76
6	2437	19.22	19.54	173.51	22.39
11	2462	14.81	15.45	65.344	18.15

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

a. Set analyzer center frequency to DTS channel center frequency.
b. Set the span to 1.5 times the DTS bandwidth.
c. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d. Set the VBW ≥ 3 × RBW.
e. Detector = peak.
f. Sweep time = auto couple.
g. Trace mode = max hold.
h. Allow trace to fully stabilize.
i. Use the peak marker function to determine the maximum amplitude level within the RBW.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

Same as Item 4.3.6

4.5.7 Test Results

802.11b

Chan.	Chan. Freq. (MHz)	PSD (dBm/3kHz)		Total PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Test Result
		Chain 0	Chain 1			
1	2412	-2.81	-3.37	-0.07	7.73	Pass
6	2437	1.05	0.31	3.71	7.73	Pass
11	2462	-2.90	-2.11	0.52	7.73	Pass

Note: 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.
2. The directional gain = 10 log[$(10^{G0/20} + 10^{G1/20})^2$ / 2] = 6.27 dBi > 6 dBi, so the power density limit shall be reduced to 8-(6.27-6) = 7.73 dBm/3kHz.

802.11g

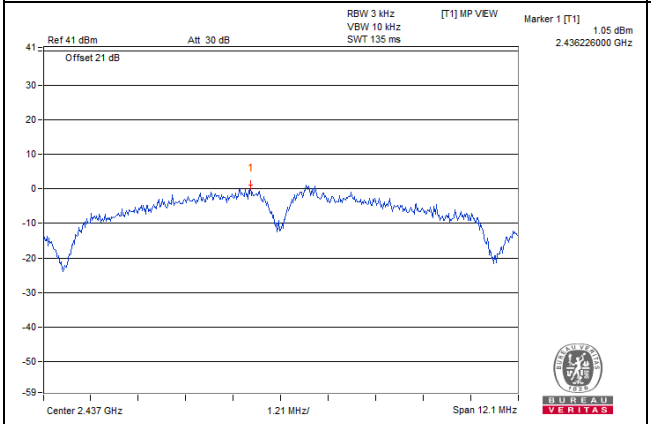
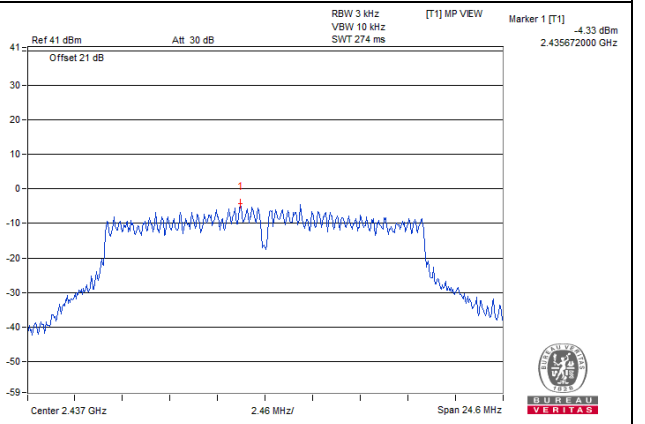
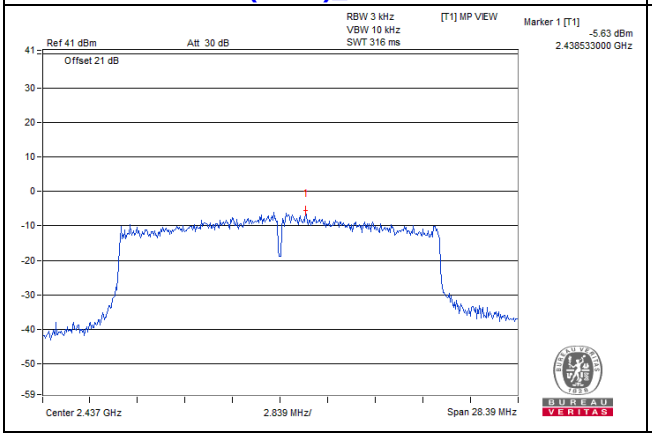
Chan.	Chan. Freq. (MHz)	PSD (dBm/3kHz)		Total PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Test Result
		Chain 0	Chain 1			
1	2412	-8.31	-8.37	-5.33	7.73	Pass
6	2437	-4.94	-4.33	-1.61	7.73	Pass
11	2462	-8.49	-7.95	-5.20	7.73	Pass

Note: 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.
2. The directional gain = 10 log[$(10^{G0/20} + 10^{G1/20})^2$ / 2] = 6.27 dBi > 6 dBi, so the power density limit shall be reduced to 8-(6.27-6) = 7.73 dBm/3kHz.

802.11ax (HE20)

Chan.	Chan. Freq. (MHz)	PSD (dBm/3kHz)		Total PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Test Result
		Chain 0	Chain 1			
1	2412	-8.57	-8.94	-5.74	7.73	Pass
6	2437	-6.51	-5.63	-3.04	7.73	Pass
11	2462	-9.38	-8.66	-5.99	7.73	Pass

Note: 1. Method b) Measure and sum spectral maxima across the outputs of KDB 662911 is using for calculating total power density.
2. The directional gain = 10 log[$(10^{G0/20} + 10^{G1/20})^2$ / 2] = 6.27 dBi > 6 dBi, so the power density limit shall be reduced to 8-(6.27-6) = 7.73 dBm/3kHz.

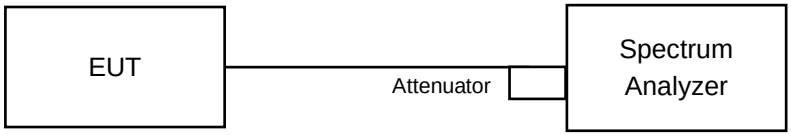
Spectrum Plot of Worst Value	
802.11b_Chain 0 / CH6	**802.11g_Chain 1 / CH6**
	
802.11ax (HE20)_Chain 1 / CH6	
	

4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

Below 20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

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

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 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 OOBE

1. Set RBW = 100 kHz.
2. Set VBW ≥ 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.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

Same as Item 4.3.6

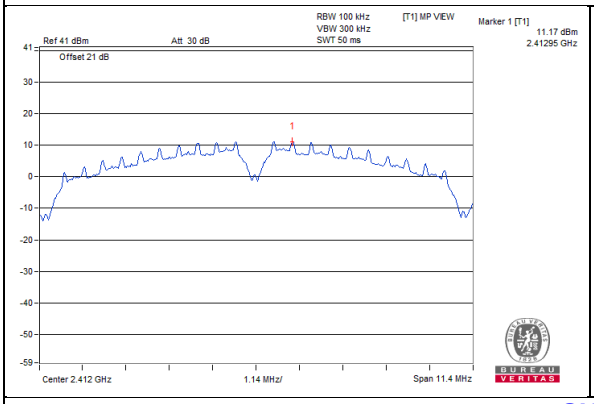
4.6.7 Test Results

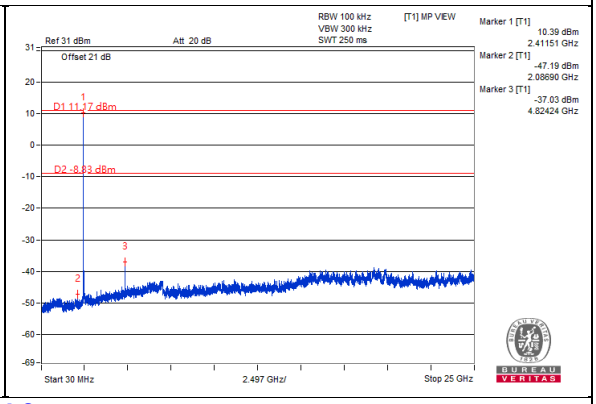
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

802.11b

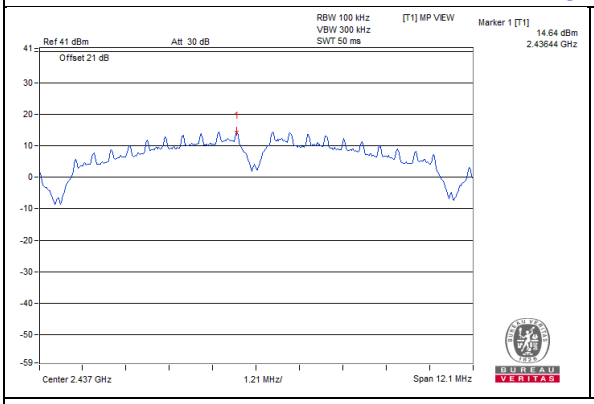
Chain 0

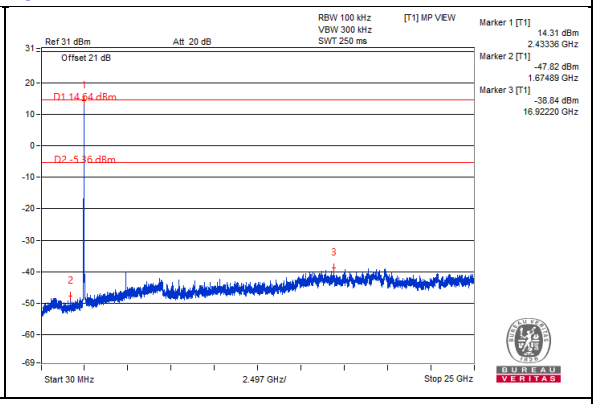
CH 1



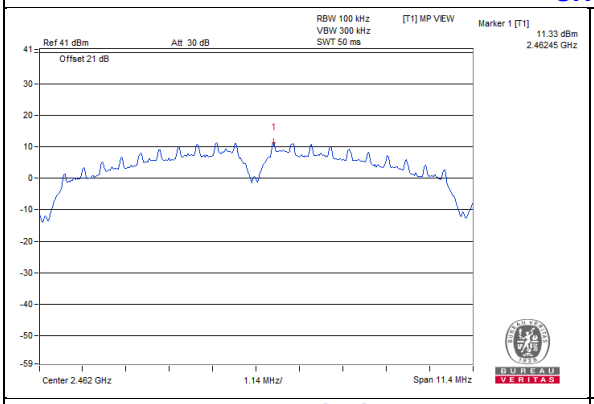


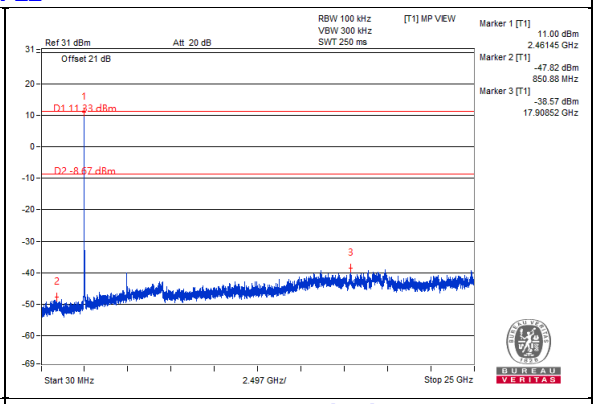
CH 6



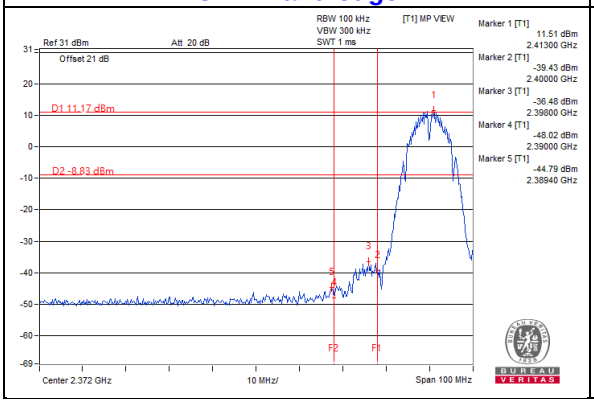


CH 11

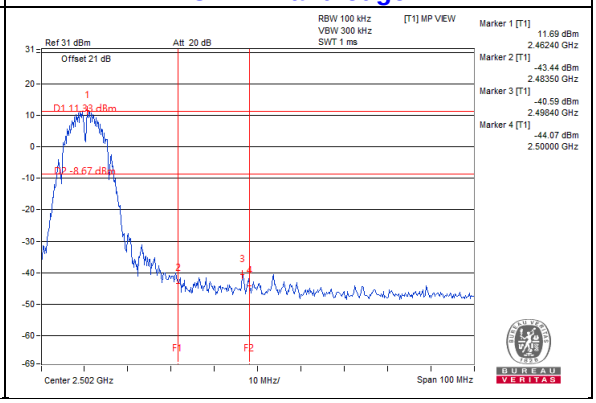




CH 1 Band edge

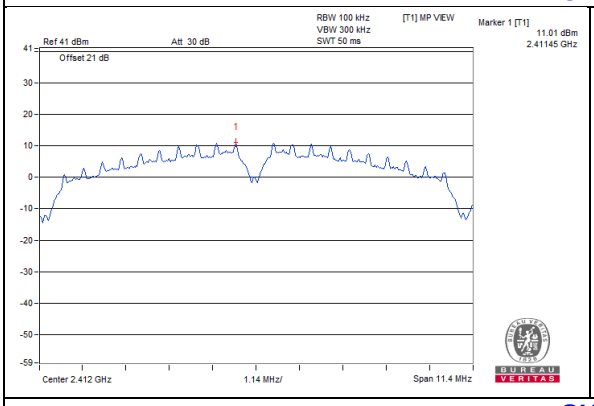


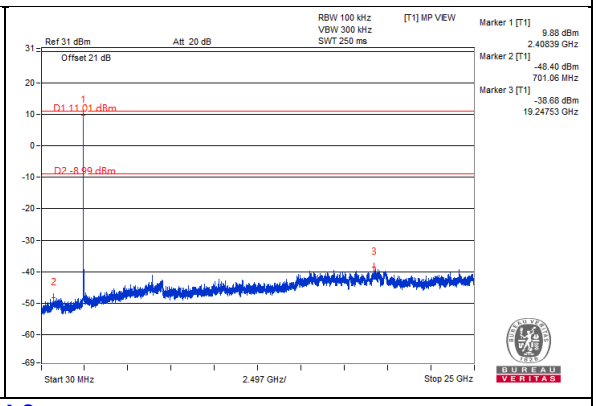
CH 11 Band edge



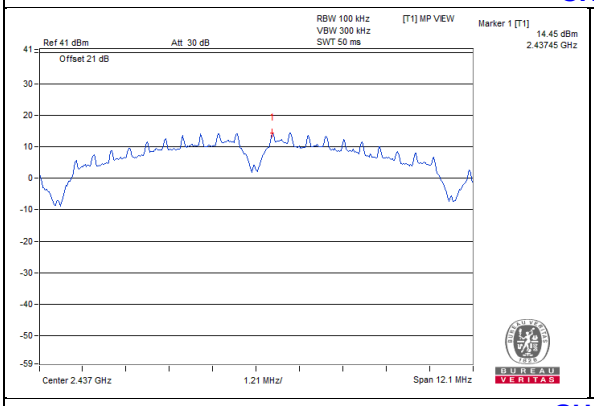
Chain 1

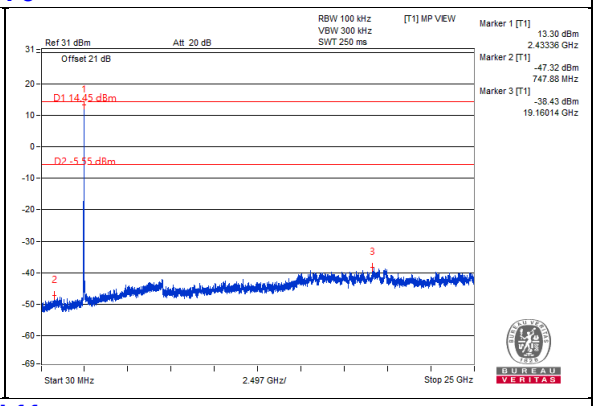
CH 1



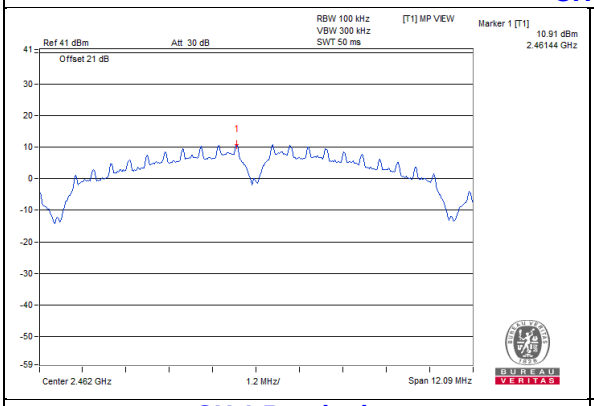


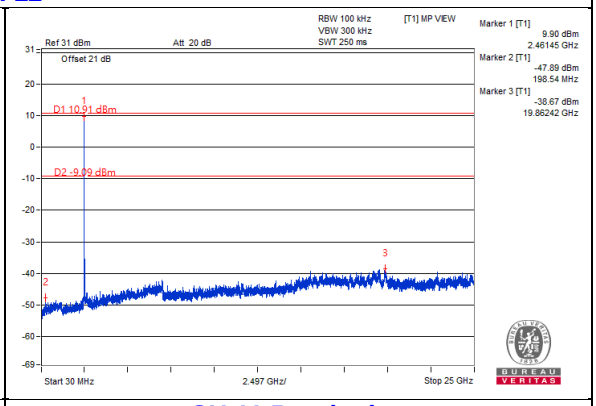
CH 6



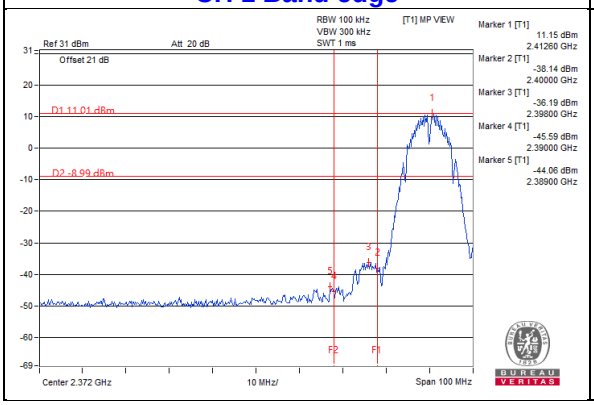


CH 11

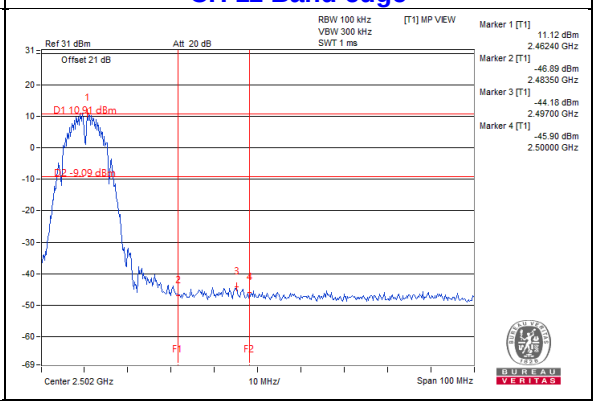




CH 1 Band edge



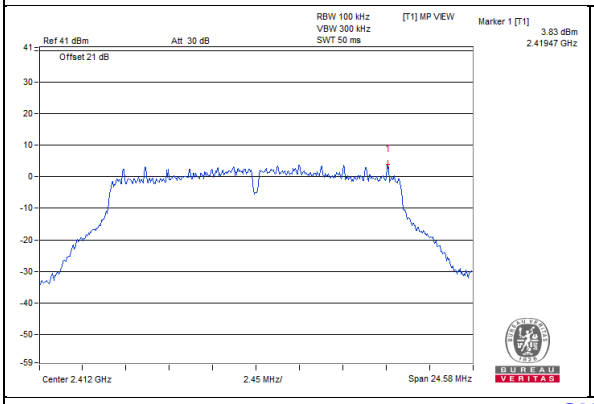
CH 11 Band edge

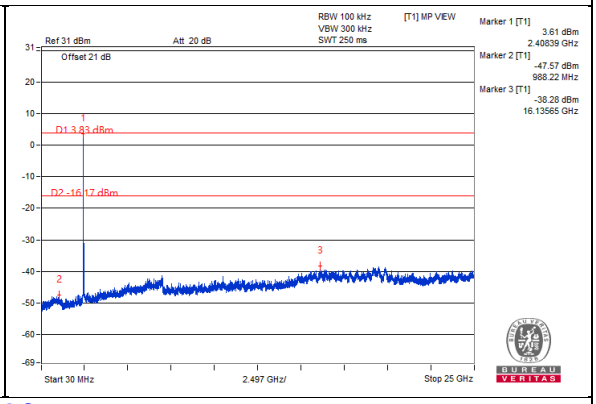


802.11g

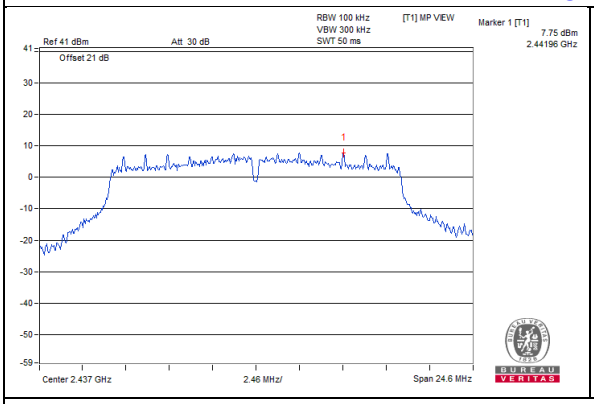
Chain 0

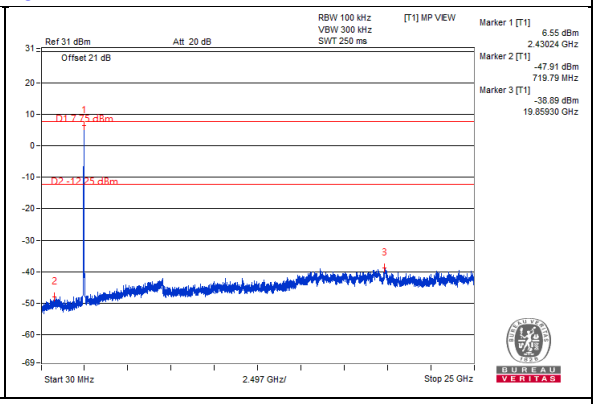
CH 1



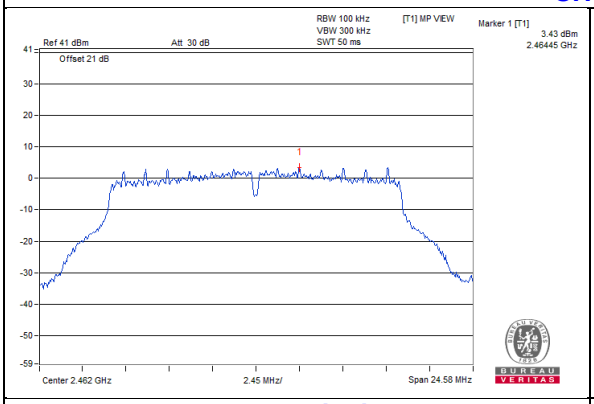


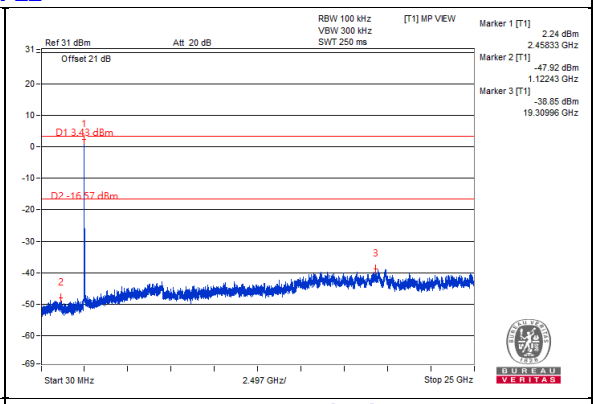
CH 6



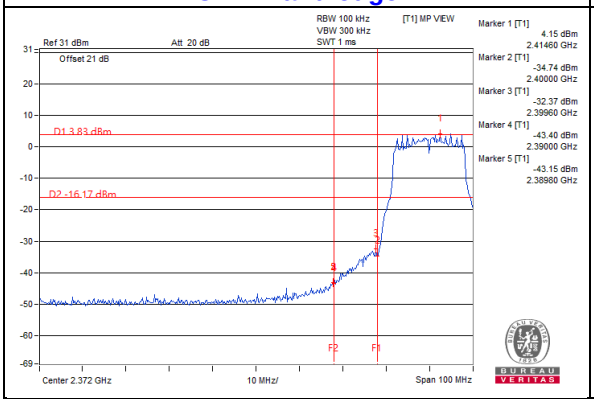


CH 11

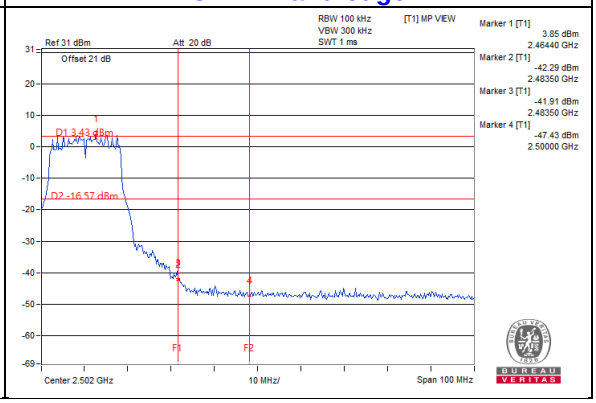




CH 1 Band edge

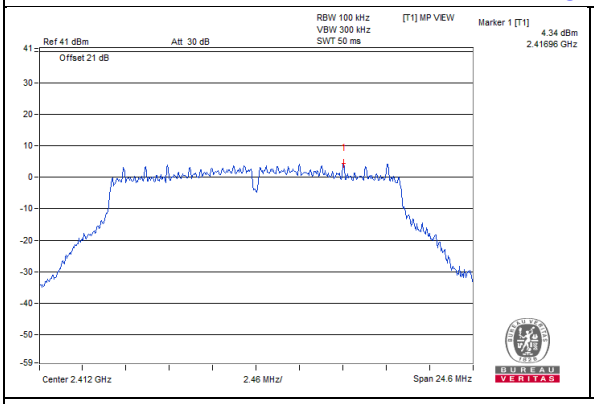


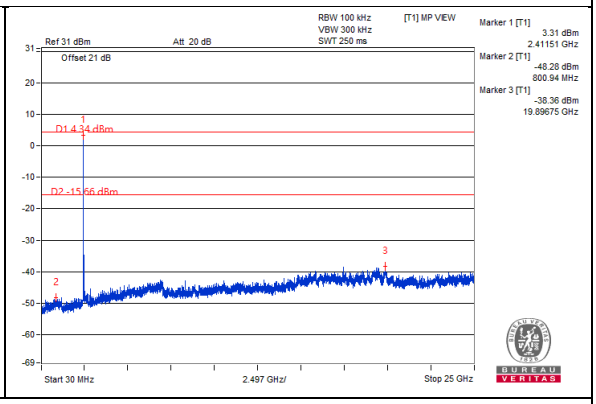
CH 11 Band edge



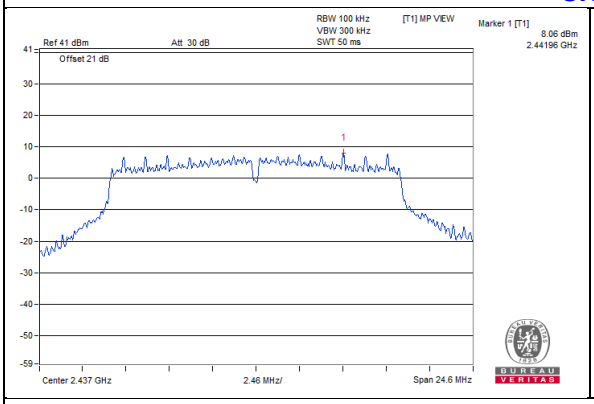
Chain 1

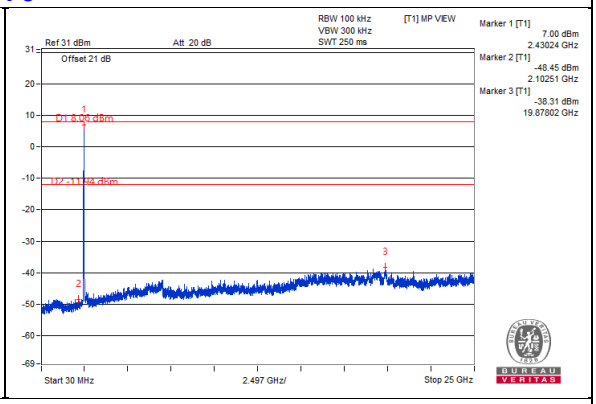
CH 1



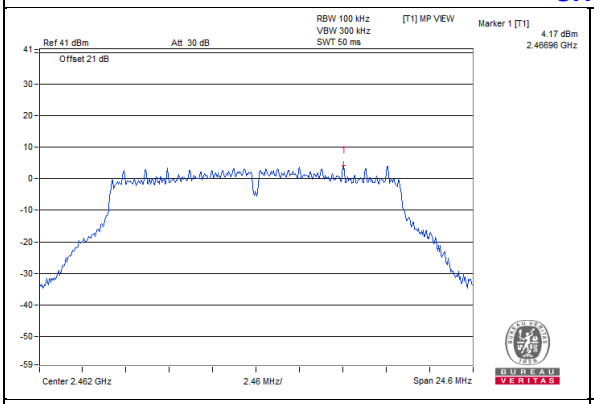


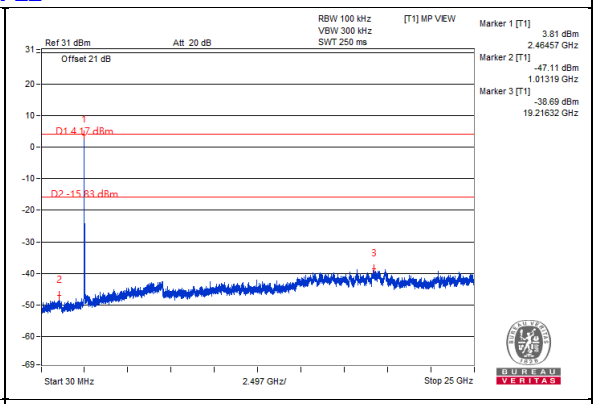
CH 6



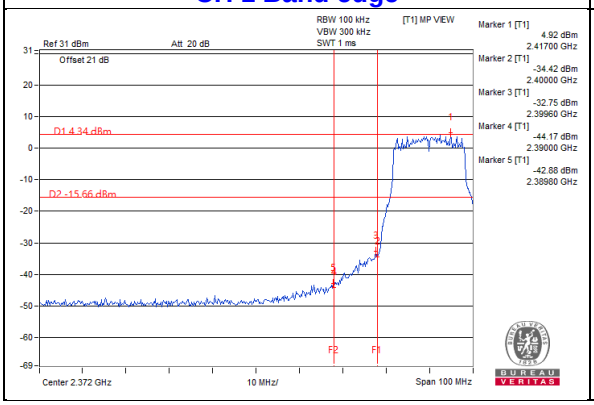


CH 11

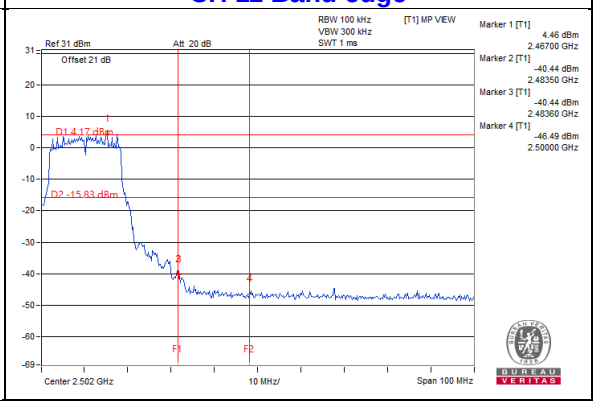




CH 1 Band edge



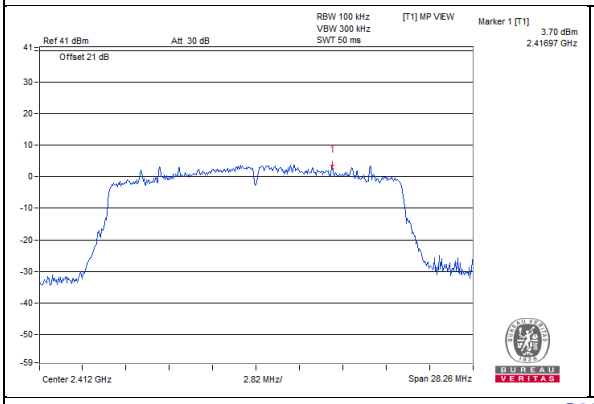
CH 11 Band edge

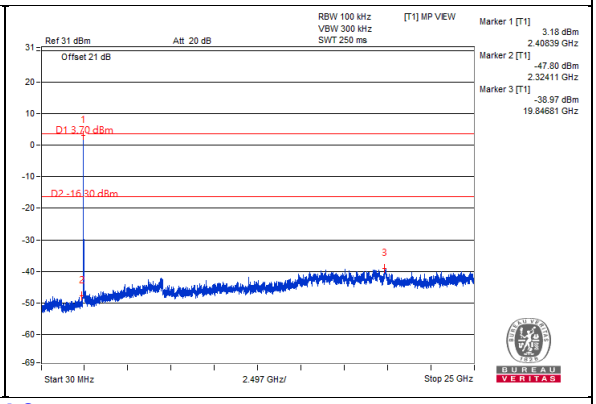


802.11ax (HE20)

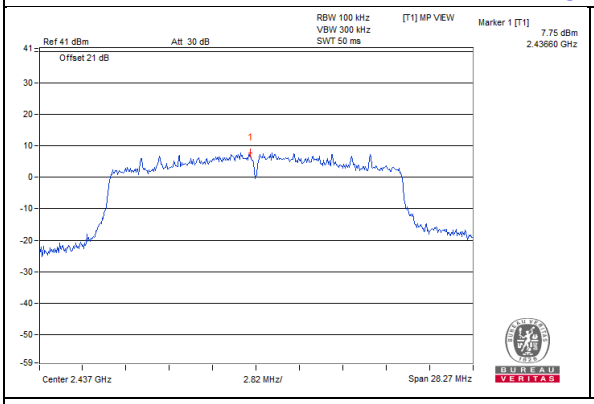
Chain 0

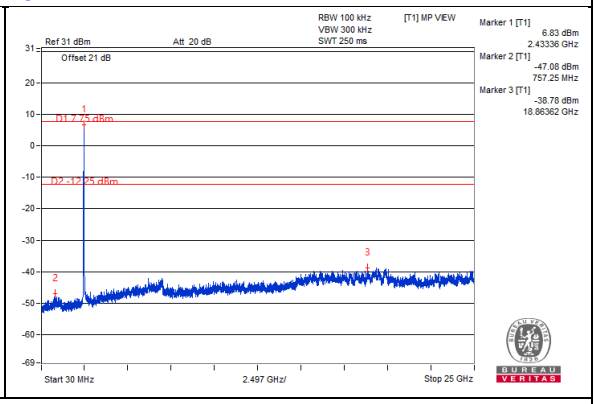
CH 1



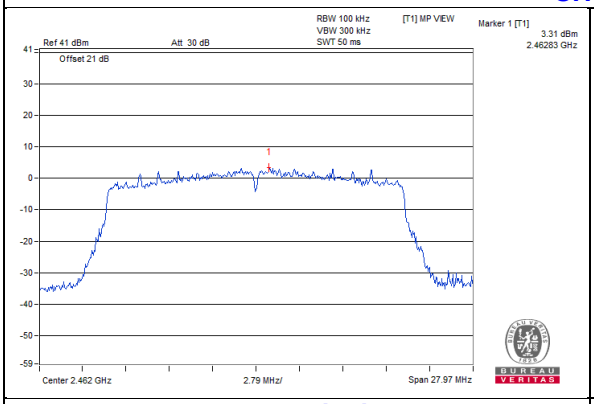


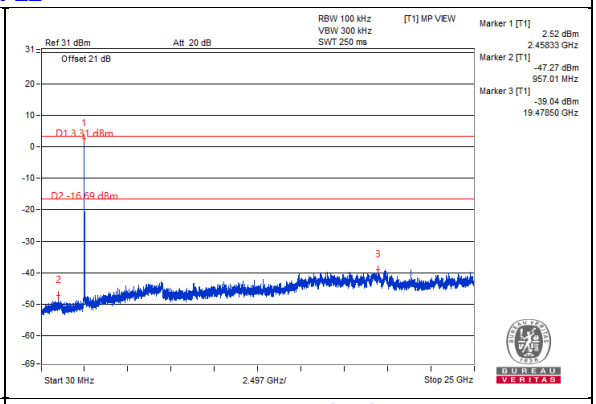
CH 6



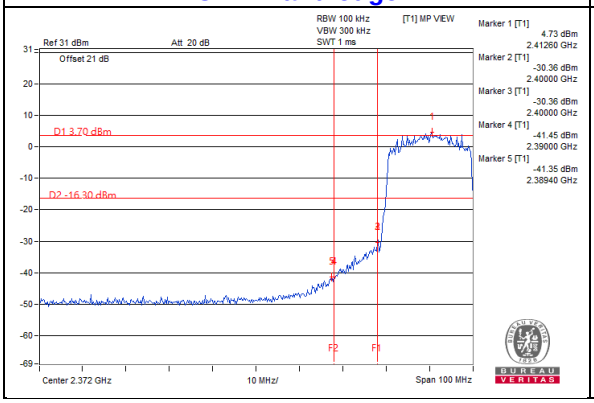


CH 11

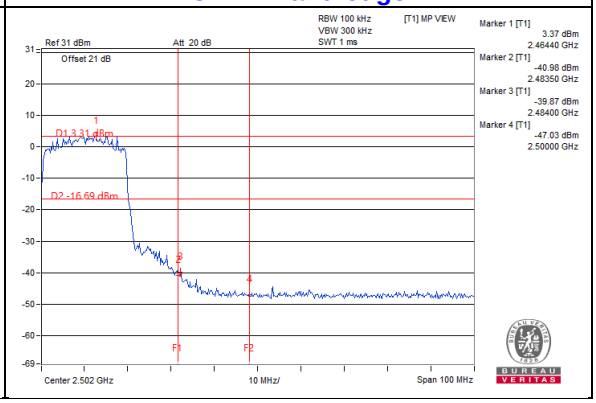




CH 1 Band edge

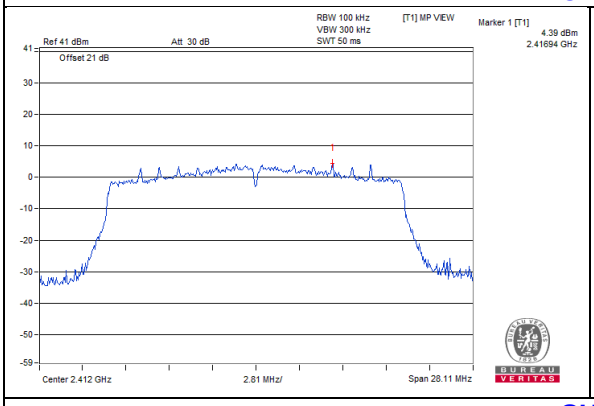


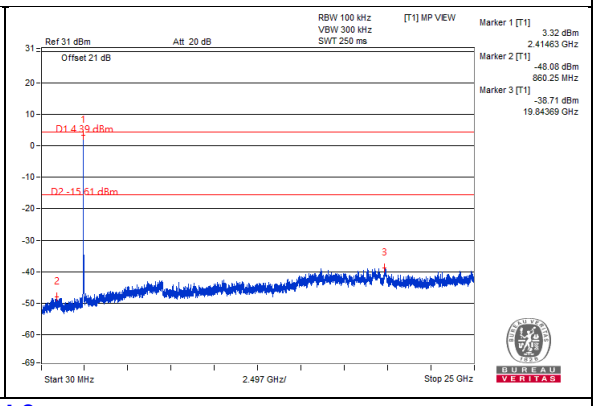
CH 11 Band edge



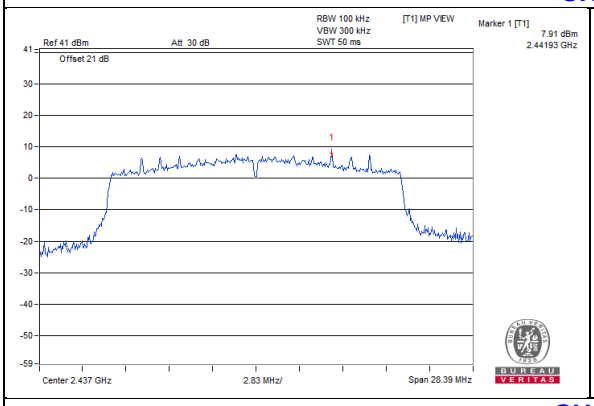
Chain 1

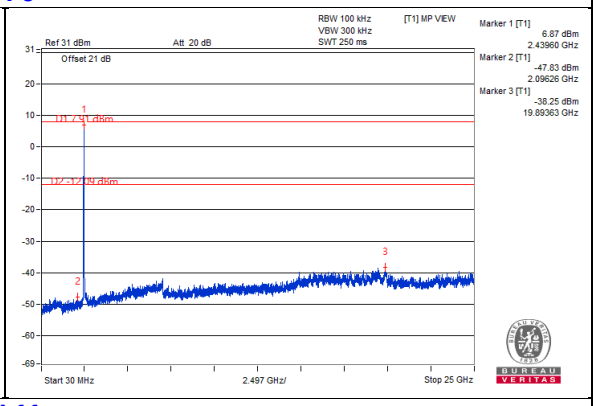
CH 1



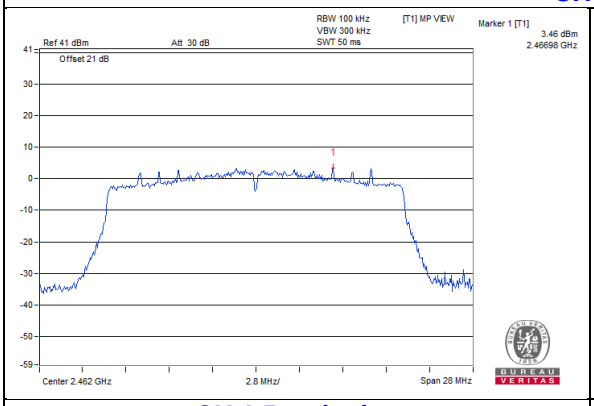


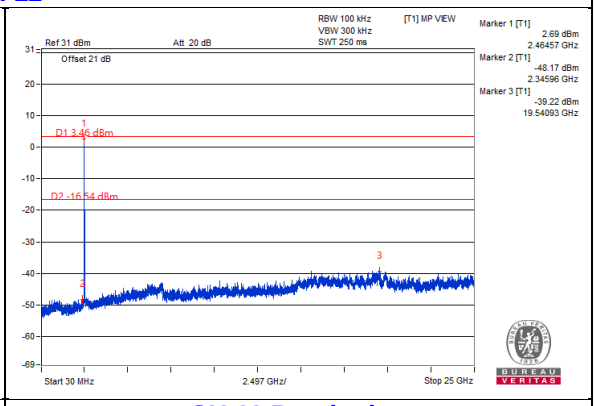
CH 6



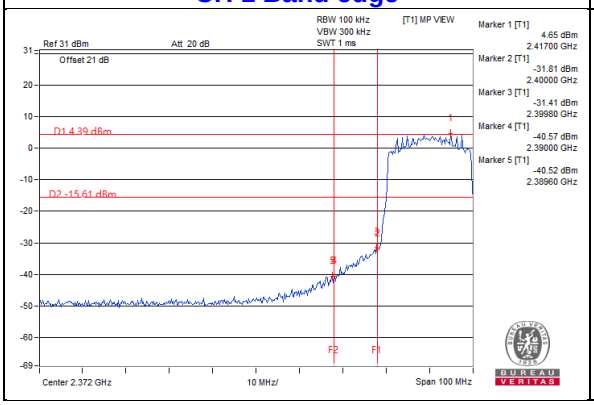


CH 11

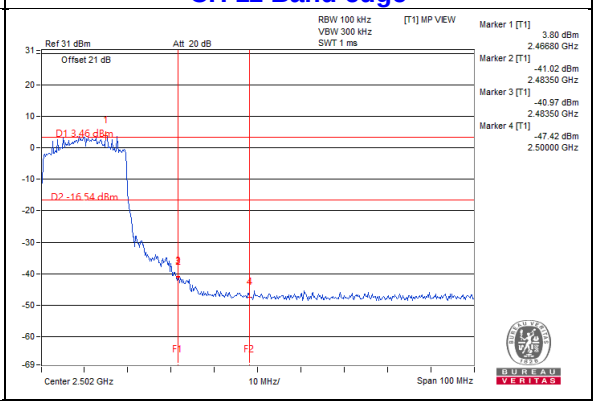




CH 1 Band edge



CH 11 Band edge



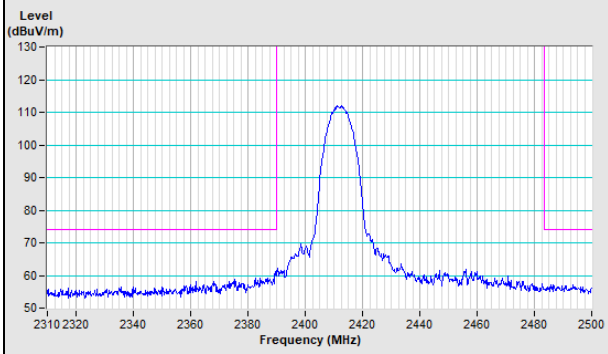
5 Pictures of Test Arrangements

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

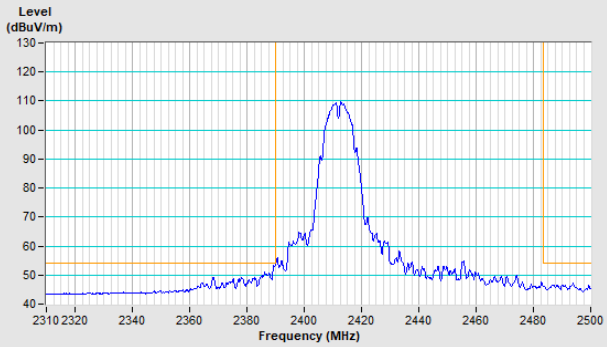
Annex A - Band-Edge Measurement

802.11b Channel 1

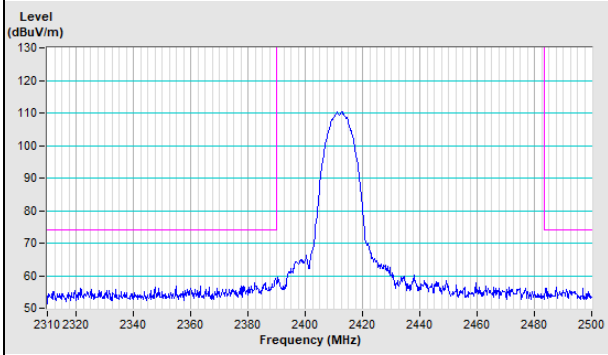
Horizontal (Peak)



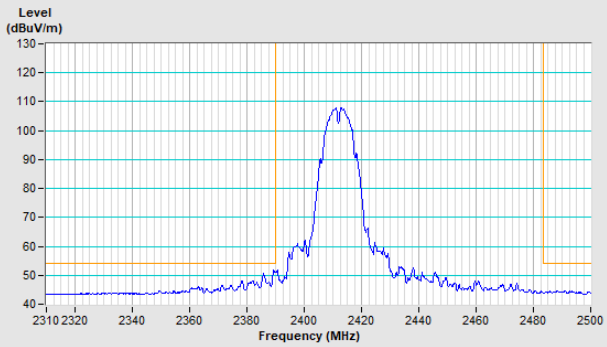
Horizontal (Average)



Vertical (Peak)

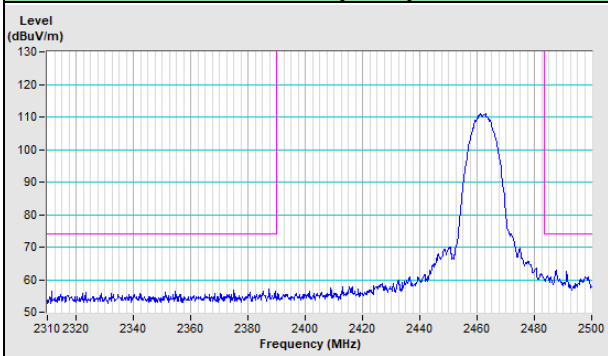


Vertical (Average)

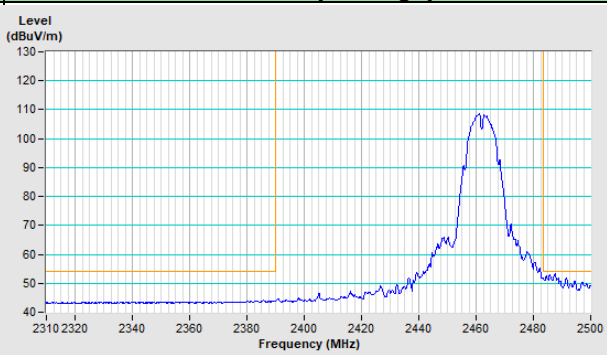


802.11b Channel 11

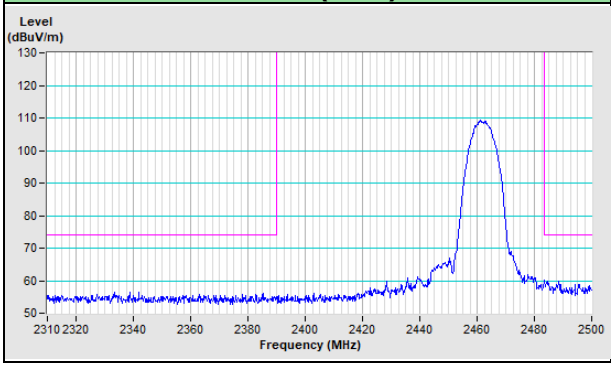
Horizontal (Peak)



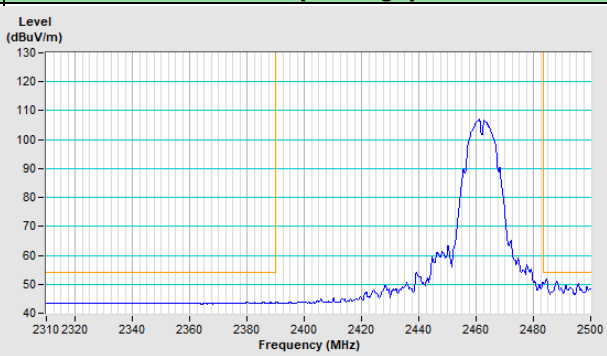
Horizontal (Average)



Vertical (Peak)

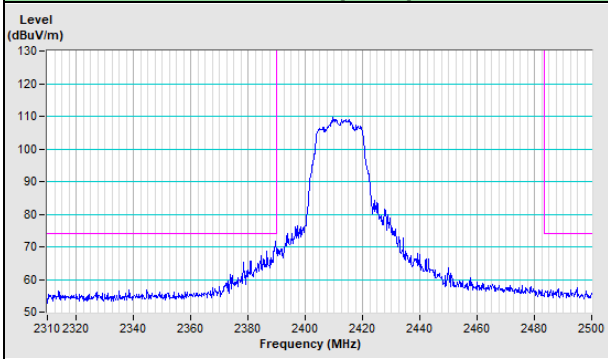


Vertical (Average)

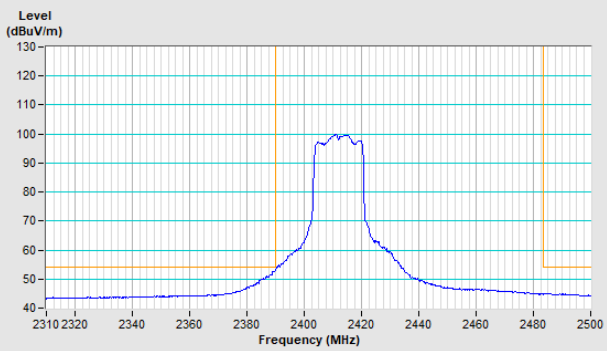


802.11g Channel 1

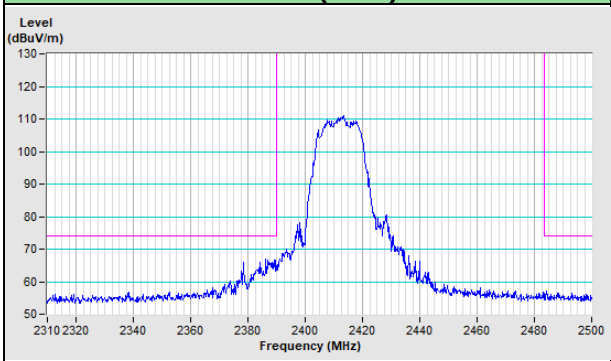
Horizontal (Peak)



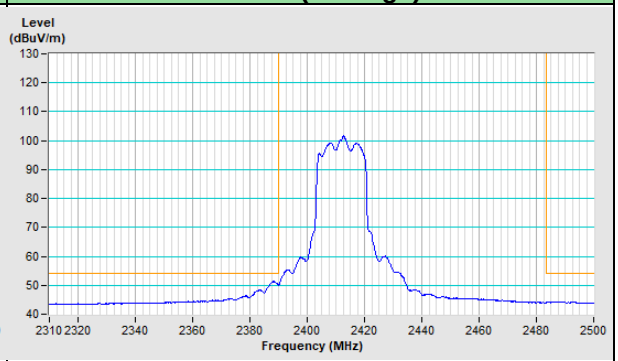
Horizontal (Average)



Vertical (Peak)

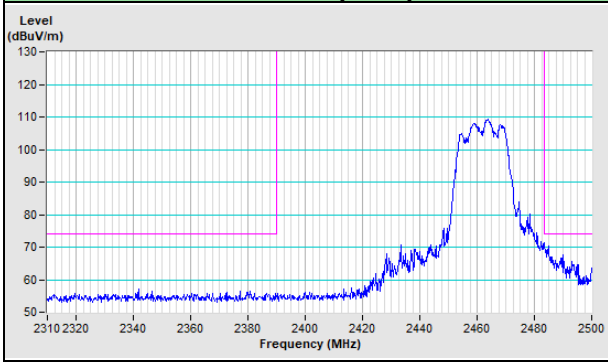


Vertical (Average)

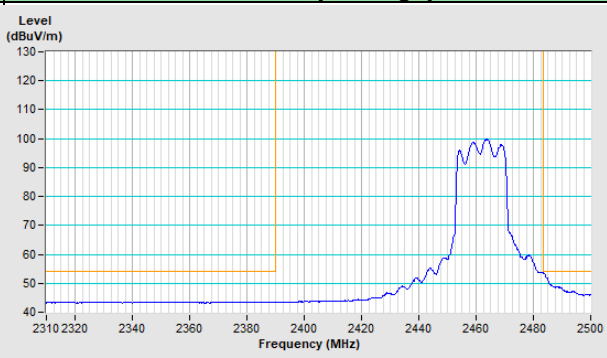


802.11g Channel 11

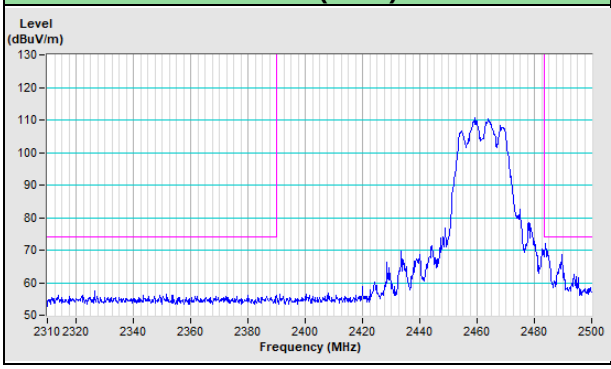
Horizontal (Peak)



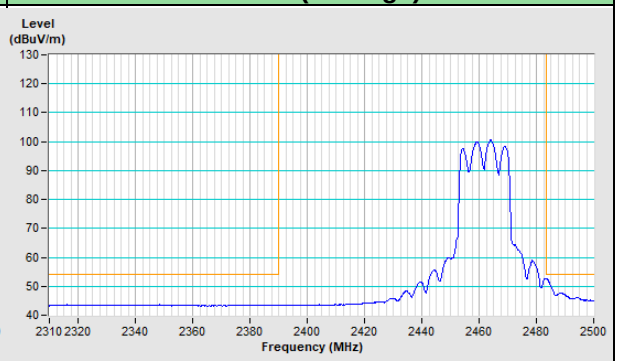
Horizontal (Average)



Vertical (Peak)

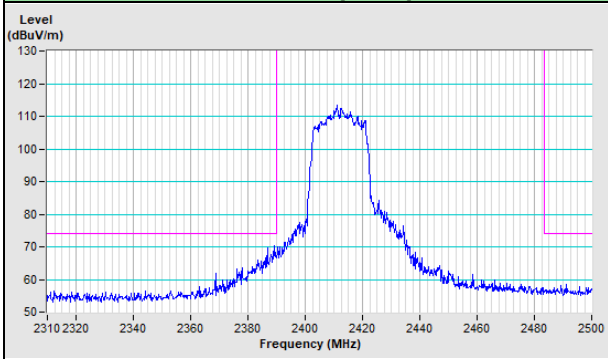


Vertical (Average)

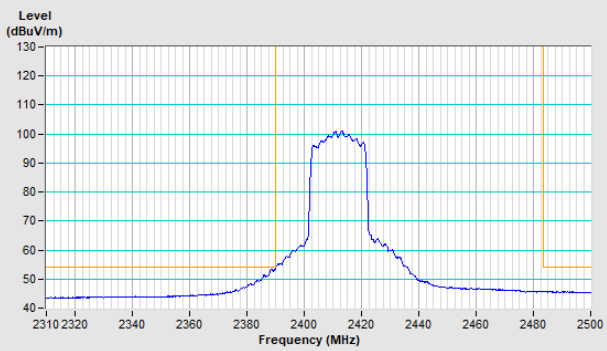


802.11ax (HE20) Channel 1

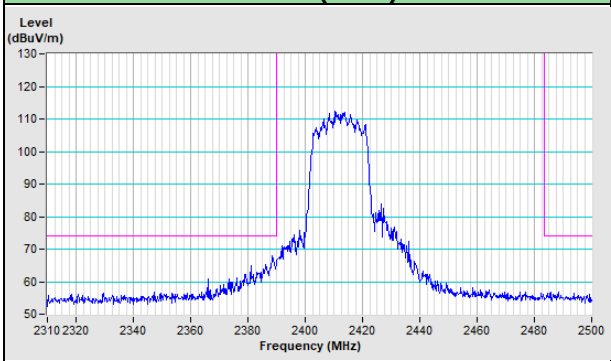
Horizontal (Peak)



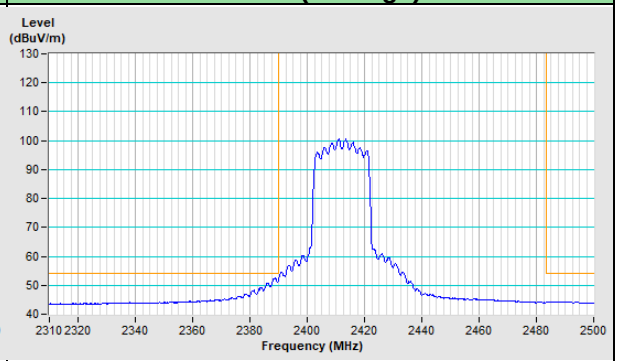
Horizontal (Average)



Vertical (Peak)

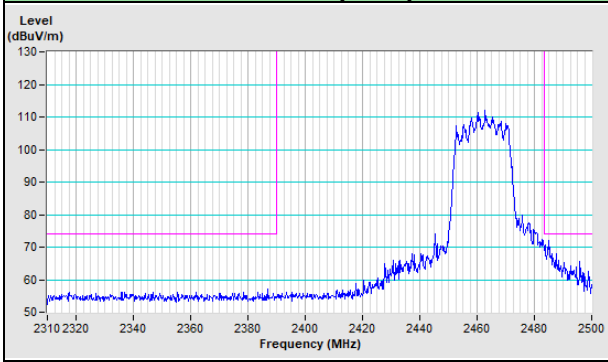


Vertical (Average)

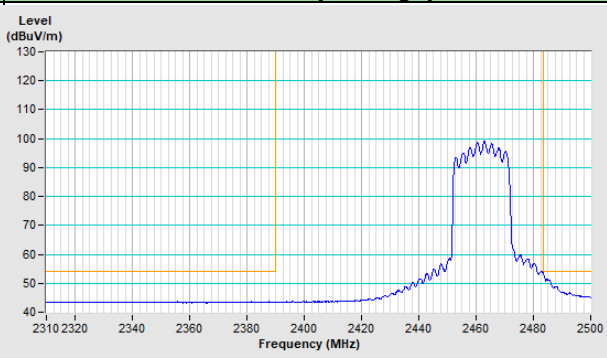


802.11ax (HE20) Channel 11

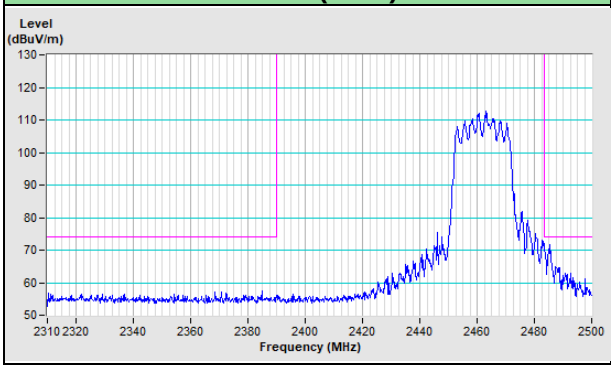
Horizontal (Peak)



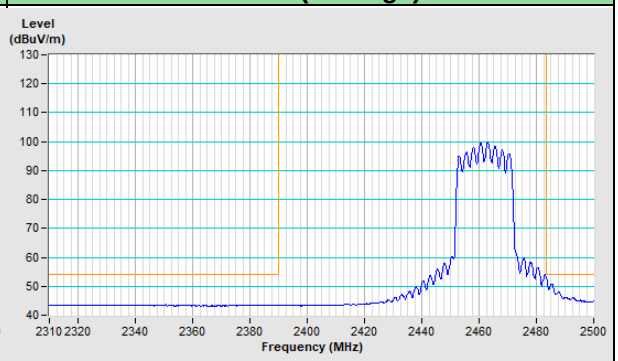
Horizontal (Average)



Vertical (Peak)



Vertical (Average)



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.

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Web Site: www.bureauveritas-adt.com

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

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