Supplemental “Transmit Simultaneously” Test Report

Report No.:	RFBFBE-WTW-P22080834-4
FCC ID:	YAW529027-BEK-Z
Test Model:	PVS6
Received Date:	2022/8/24
Test Date:	2022/9/16 ~ 2022/9/19
Issued Date:	2022/10/4
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-P22080834-4	Original release.	2022/10/4

1 Certificate of Conformity

Product:	SunPower Monitoring System with PVS6
Brand:	SUNPOWER
Test Model:	PVS6
Sample Status:	Engineering sample
Applicant:	SunPower Corporation
Test Date:	2022/9/16 ~ 2022/9/19
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) 47 CFR FCC Part 15, Subpart E (Section 15.407) 47 CFR FCC Part 27 Subpart H 47 CFR FCC Part 2 ANSI C63.10: 2013 ANSI C63.26: 2015

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 : Vito Lung , **Date:** **2022/10/4**

Vito Lung / Specialist

Approved by : , **Date:** **2022/10/4**

May Chen / Manager

2 Summary of Test Results

FCC Part 15, Subpart C, E (SECTION 15.247, 15.407) FCC Part 27, Subpart H			
FCC Clause	Test Item	Result	Remarks
15.207 15.407(b)(6)	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -6.30 dB at 4.68359 MHz.
15.205 / 15.209 / 15.247(d) 15.407(b) (1/2/3/4(i/ii)/6)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -0.3 dB at 393.70 MHz.
2.1053 27.53(g)	Radiated Spurious Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -50.1 dB at 149.27 MHz, 2099.10 MHz.

Note:
1. 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	**WLAN:** CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode 1024QAM for OFDMA in 11ax mode **BT-EDR:** GFSK, π/4-DQPSK, 8DPSK **BT-LE:** GFSK
Modulation Technology	**WLAN:** DSSS, OFDM, OFDMA **BT-EDR:** FHSS **BT-LE:** DTS
Transfer Rate	**WLAN:** 802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n: up to 300Mbps 802.11ac: up to 866.7Mbps 802.11ax: up to 1201.0Mbps **BT-EDR:** Up to 3Mbps **BT-LE:** Up to 2Mbps
Operating Frequency	**WLAN:** **2.4GHz:** 2.412 ~ 2.462GHz **5GHz:** 5.18~ 5.24GHz, 5.745 ~ 5.825GHz **BT-EDR:** 2402MHz ~ 2480MHz **BT-LE:** 2402MHz ~ 2480MHz
Number of Channel	**WLAN:** **2.4GHz:** 802.11b, 802.11g, 802.11n (HT20),802.11ax (HE20): 11 **5GHz:** 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 9 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 4 802.11ac (VHT80), 802.11ax (HE80): 2 **BT-EDR:** 79 **BT-LE:** 40
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	- Hole Plugs x2 - Bracket x1

Note:

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

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

4. Simultaneously transmission condition.

Condition	Technology		
1	WLAN(2.4GHz)	BT	WWAN
2	WLAN(5GHz)	BT	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		

LTE						
Ant No.	Brand	Model	Antenna Gain (dBi)	Frequency rang (MHz)	Antenna type	Connector type
3	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
5GHz Band		
MODULATION MODE	**TX & RX CONFIGURATION**	
802.11a	2TX	2RX
802.11n (HT20)	2TX	2RX
802.11n (HT40)	2TX	2RX
802.11ac (VHT20)	2TX	2RX
802.11ac (VHT40)	2TX	2RX
802.11ac (VHT80)	2TX	2RX
802.11ax (HE20)	2TX	2RX
802.11ax (HE40)	2TX	2RX
802.11ax (HE80)	2TX	2RX

8. 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.
9. Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

3.1.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	OB	
1	√	√	√	√	Condition 1
2	√	√	√	√	Condition 2

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

PLC: Power Line Conducted Emission **OB:** Conducted Out-Band Emission Measurement

Radiated Emission Test (Above 1GHz):

☒ The tested configurations represent the worst-case mode from all possible combinations by the maximum power.

☒ 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
1	802.11b + BT-EDR + LTE	1 to 11	6	OFDM	BPSK
		0 to 78	78	FHSS	GFSK
		23010 to 23179	23010	QPSK	-
2	802.11ax (HE40) + BT-EDR + LTE	38 to 46 151 to 159	159	OFDMA	BPSK
		0 to 78	78	FHSS	GFSK
		23010 to 23179	23010	QPSK	-

Radiated Emission Test (Below 1GHz):

☒ The tested configurations represent the worst-case mode from all possible combinations by the maximum power.
☒ 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
1	802.11b + BT-EDR + LTE	1 to 11	6	OFDM	BPSK
		0 to 78	78	FHSS	GFSK
		23010 to 23179	23010	QPSK	-
2	802.11ax (HE40) + BT-EDR + LTE	38 to 46 151 to 159	159	OFDMA	BPSK
		0 to 78	78	FHSS	GFSK
		23010 to 23179	23010	QPSK	-

Power Line Conducted Emission Test:

☒ The tested configurations represent the worst-case mode from all possible combinations by the maximum power.
☒ 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
1	802.11b + BT-EDR + LTE	1 to 11	6	OFDM	BPSK
		0 to 78	78	FHSS	GFSK
		23010 to 23179	23010	QPSK	-
2	802.11ax (HE40) + BT-EDR + LTE	38 to 46 151 to 159	159	OFDMA	BPSK
		0 to 78	78	FHSS	GFSK
		23010 to 23179	23010	QPSK	-

Conducted Out-Band Emission Measurement:

☒ The tested configurations represent the worst-case mode from all possible combinations by the maximum power.

☒ 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
1	802.11b + BT-EDR	1 to 11	6	OFDM	BPSK
		0 to 78	78	FHSS	GFSK
2	802.11ax (HE40) + BT-EDR	38 to 46 151 to 159	159	OFDMA	BPSK
		0 to 78	78	FHSS	GFSK

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE≥1G	25deg. C, 65%RH	120Vac, 60Hz	Nelson Teng
RE<1G	25deg. C, 75%RH	120Vac, 60Hz	Nelson Teng
PLC	25deg. C, 75%RH	120Vac, 60Hz	Carter Lin
OB	25deg. C, 60%RH	120Vac, 60Hz	Rayn Du

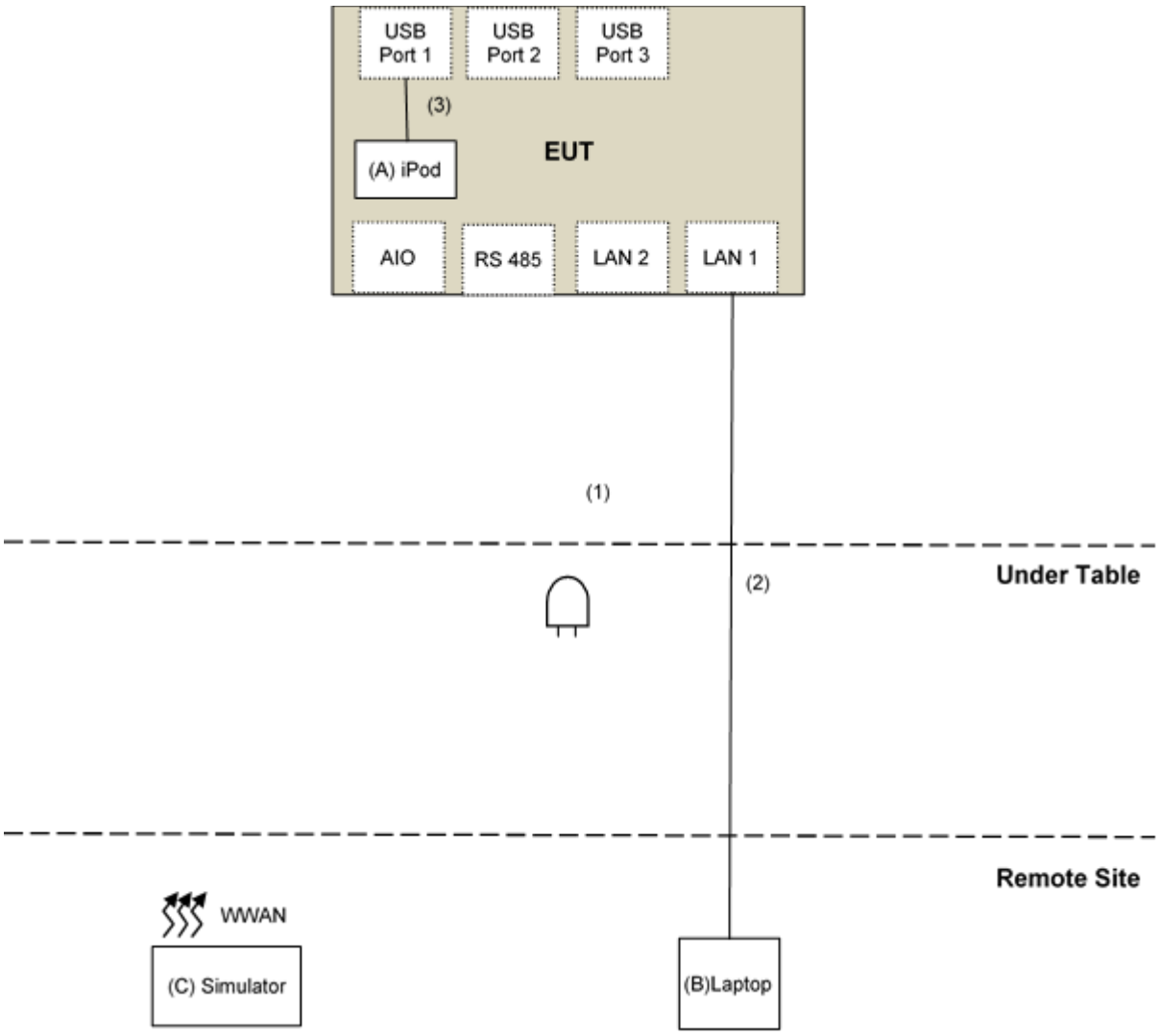
3.2 Description of Support Units

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
C.	Simulator	Keysight	E7515A	MY55340229	NA	Provided by Lab

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

3.2.1 Configuration of System under Test



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

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

For 47 CFR FCC Part 15:

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

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

Note:

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

Limits of unwanted emission out of the restricted bands

Applicable To		Limit	
789033 D02 General UNII Test Procedure New Rules v02r01		Field Strength at 3m	
		PK:74 (dBµV/m)	AV:54 (dBµV/m)
Frequency Band	Applicable To	EIRP Limit	Equivalent Field Strength at 3m
5150~5250 MHz	15.407(b)(1)	PK:-27 (dBm/MHz)	PK:68.2(dBµV/m)
5250~5350 MHz	15.407(b)(2)		
5470~5725 MHz	15.407(b)(3)		
5725~5850 MHz	15.407(b)(4)(i) 15.407(b)(4)(ii)	PK: -27 (dBm/MHz) *1 PK: 10 (dBm/MHz) *2 PK: 15.6 (dBm/MHz) *3 PK: 27 (dBm/MHz) *4	PK: 68.2(dBµV/m) *1 PK: 105.2 (dBµV/m) *2 PK: 110.8(dBµV/m) *3 PK: 122.2 (dBµV/m) *4

*1 beyond 75 MHz or more above of the band edge.

*2 below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.

*3 below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.

*4 from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Note:

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

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

FCC Part 27:

According to FCC 27.53(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver KEYSIGHT	N9038A	MY59050100	2022/6/20	2023/6/19
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Pre_Amplifier Agilent	8447D	2944A10636	2022/3/19	2023/3/18
LOOP ANTENNA Electro-Metrics	EM-6879	264	2022/3/18	2023/3/17
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-001	2022/1/6	2023/1/5
RF Coaxial Cable JYEBO	5D-FB	LOOPCAB-002	2022/1/6	2023/1/5
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	966-4-1	2022/3/8	2023/3/7
RF Coaxial Cable COMMATE/PEWC	8D	966-3-2	2022/2/26	2023/2/25
RF Coaxial Cable COMMATE/PEWC	8D	966-3-3	2022/2/26	2023/2/25
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	2022/1/10	2023/1/9
RF Coaxial Cable EMCI	EMC104-SM-SM-1500	180504	2022/4/25	2023/4/24
RF Coaxial Cable EMCI	EMC104-SM-SM-2000	180601	2022/6/6	2023/6/5
RF Cable EMCI	EMC104-SM-SM-6000	210201	2022/5/10	2023/5/9
Fix tool for Boresight antenna tower BV	FBA-01	FBA_SIP01	NA	NA
Spectrum Analyzer KEYSIGHT	N9030B	MY57142938	2022/4/26	2023/4/25
Pre_Amplifier EMCI	EMC184045SE	980387	2022/1/10	2023/1/9
Horn Antenna Schwarzbeck	BBHA 9170	9170-739	2021/11/14	2022/11/13
RF Cable-Frequency range: 1-40GHz EMCI	EMC102-KM-KM-1200	160924	2022/1/10	2023/1/9
RF Coaxial Cable EMCI	EMC-KM-KM-4000	200214	2022/3/8	2023/3/7

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: 2022/9/16 ~ 2022/9/19

4.1.3 Test Procedures

For FCC Part 15:

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) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

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

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

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

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

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

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 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.

FCC Part 27:

a. The field strength was measured with Spectrum Analyzer.

b. Measurement in the semi-anechoic chamber, EUT placed on the 1.5m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power. The “Read Value” is the field strength value via a spectrum reading obtained corrected for antenna factor, cable loss and pre-amplifier factor.

c. Perform a field strength measurement and then mathematically convert the measured field strength level to EIRP level.

d. Follow ANSI C63.26 section 5.2.7 d),

   E (dBμV/m) = Measured amplitude level (dBμV) + Cable Loss (dB) + Antenna Factor (dB/m).

   EIRP (dBm) = E (dBμV/m) + 20log(D) − 104.8; where D is the measurement distance (in the far field region) in m.

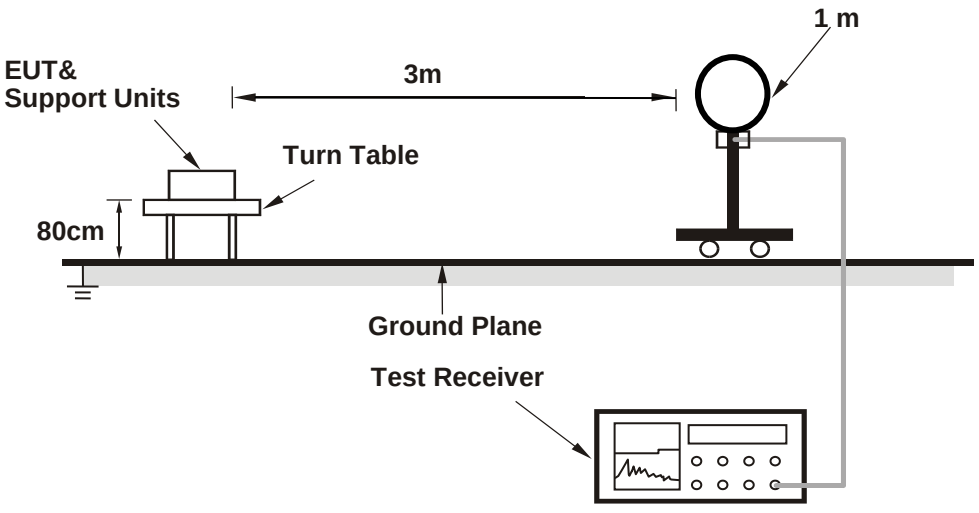
NOTE: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

4.1.4 Deviation from Test Standard

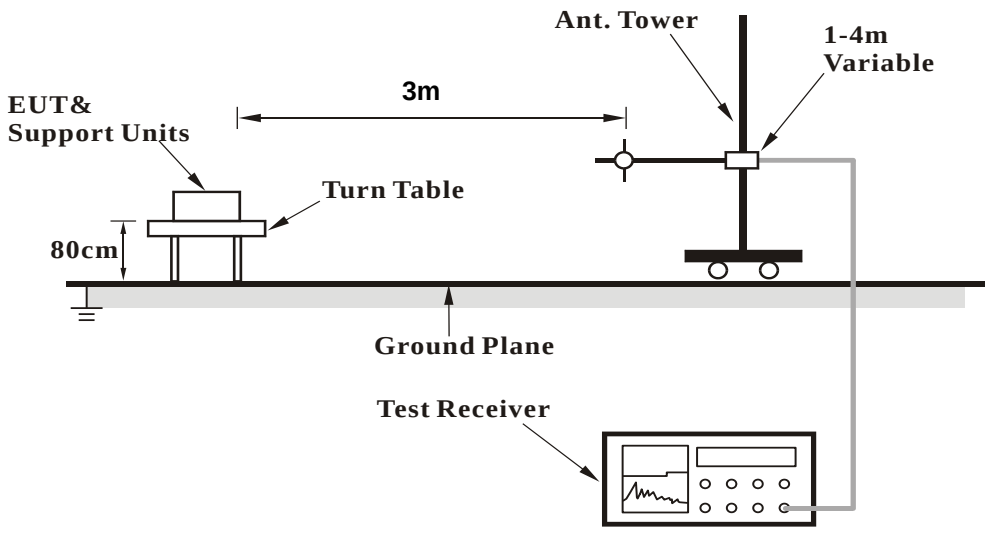
No deviation.

4.1.5 Test Setup

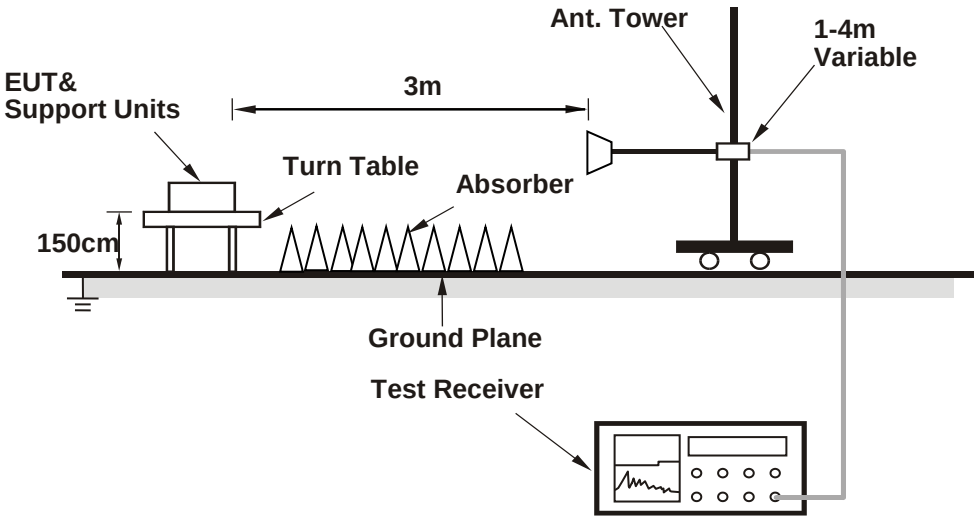
For Radiated emission below 30MHz



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. Placed the EUT on the testing table.

b. Controlling software (WLAN / Bluetooth: Run Putty.exe paste PVS6_WiFi+BT+BLE SOP.docx command ; WWAN: link Simulator) has been activated to set the EUT on specific status.

4.1.7 Test Results (Mode 1)

Above 1GHz Data

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	4874.00	52.7 PK	74.0	-21.3	1.42 H	294	48.7	4.0
2	4874.00	51.0 AV	54.0	-3.0	1.42 H	294	47.0	4.0
3	4960.00	41.0 PK	74.0	-33.0	2.51 H	256	37.0	4.0
4	4960.00	30.3 AV	54.0	-23.7	2.51 H	256	26.3	4.0
5	7311.00	52.4 PK	74.0	-21.6	2.10 H	263	42.2	10.2
6	7311.00	48.2 AV	54.0	-5.8	2.10 H	263	38.0	10.2
7	7440.00	45.8 PK	74.0	-28.2	1.78 H	145	35.3	10.5
8	7440.00	35.3 AV	54.0	-18.7	1.78 H	145	24.8	10.5
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	4874.00	48.7 PK	74.0	-25.3	2.34 V	19	44.7	4.0
2	4874.00	46.9 AV	54.0	-7.1	2.34 V	19	42.9	4.0
3	4960.00	43.2 PK	74.0	-30.8	1.07 V	16	39.2	4.0
4	4960.00	32.4 AV	54.0	-21.6	1.07 V	16	28.4	4.0
5	7311.00	51.5 PK	74.0	-22.5	1.03 V	328	41.3	10.2
6	7311.00	46.7 AV	54.0	-7.3	1.03 V	328	36.5	10.2
7	7440.00	45.6 PK	74.0	-28.4	2.66 V	94	35.1	10.5
8	7440.00	35.0 AV	54.0	-19.0	2.66 V	94	24.5	10.5

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.

Mode	TX channel 23010	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	**Frequency (MHz)**	**EIRP (dBm)**	**Limit (dBm)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	1399.40	-64.3	-13.0	-51.3	1.97 H	26	34.6	-98.9
2	1749.25	-63.3	-13.0	-50.3	2.33 H	2	35.6	-99.0
3	2099.10	-63.6	-13.0	-50.6	3.14 H	273	33.2	-96.8
4	2448.95	-64.1	-13.0	-51.1	1.58 H	358	32.1	-96.2
Antenna Polarity & Test Distance : Vertical at 3 m								
No	**Frequency (MHz)**	**EIRP (dBm)**	**Limit (dBm)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	1399.40	-68.6	-13.0	-55.6	1.33 V	130	30.3	-98.9
2	1749.25	-63.3	-13.0	-50.3	2.69 V	157	35.7	-99.0
3	**2099.10**	**-63.1**	**-13.0**	**-50.1**	**1.10 V**	**358**	**33.7**	**-96.8**
4	2448.95	-64.1	-13.0	-51.1	2.01 V	58	32.1	-96.2

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

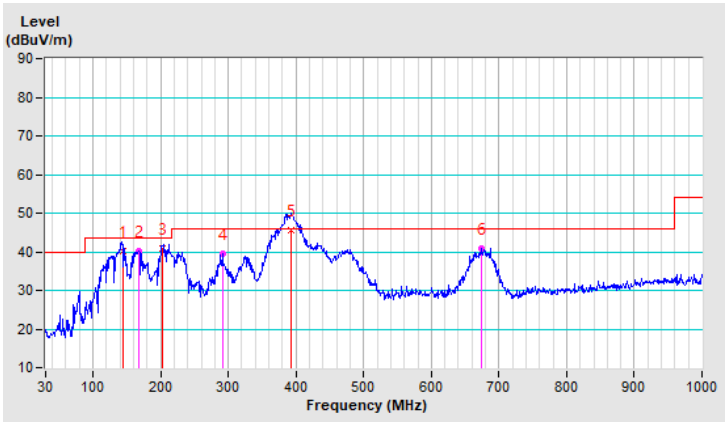
Below 1GHz Data:

Frequency Range	30 MHz ~ 1 GHz	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	144.35	40.2 QP	43.5	-3.3	2.00 H	261	48.3	-8.1
2	168.03	40.1 QP	43.5	-3.4	2.00 H	58	48.8	-8.7
3	203.08	41.0 QP	43.5	-2.5	2.00 H	282	52.3	-11.3
4	291.27	39.5 QP	46.0	-6.5	1.00 H	290	47.5	-8.0
5	**393.70**	**45.7 QP**	**46.0**	**-0.3**	**1.01 H**	**231**	**51.2**	**-5.5**
6	673.57	40.8 QP	46.0	-5.2	1.00 H	173	40.6	0.2

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 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

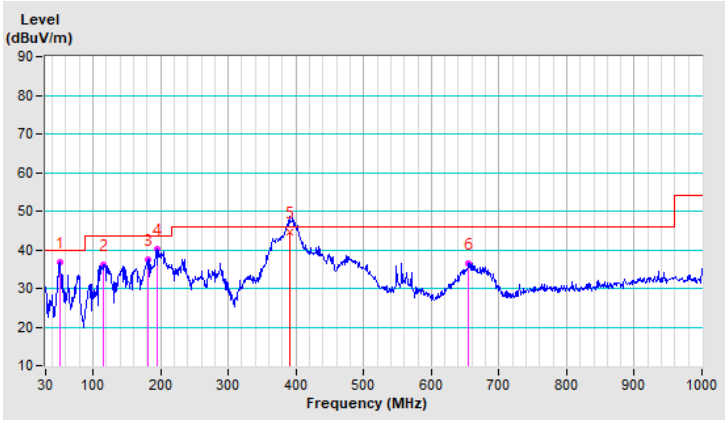


Frequency Range	30 MHz ~ 1 GHz	Detector Function	Quasi-Peak (QP)

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	50.88	36.8 QP	40.0	-3.2	1.00 V	360	45.1	-8.3
2	116.23	36.2 QP	43.5	-7.3	1.00 V	318	46.6	-10.4
3	180.71	37.6 QP	43.5	-5.9	1.00 V	248	47.5	-9.9
4	194.75	40.2 QP	43.5	-3.3	1.00 V	235	51.3	-11.1
5	391.59	44.5 QP	46.0	-1.5	2.00 V	0	50.1	-5.6
6	654.85	36.5 QP	46.0	-9.5	2.00 V	135	36.4	0.1

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 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.1.8 Test Results (Mode 2)

Above 1GHz Data

Frequency Range	1GHz ~ 40GHz	**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	4960.00	40.7 PK	74.0	-33.3	2.51 H	263	36.7	4.0
2	4960.00	29.9 AV	54.0	-24.1	2.51 H	263	25.9	4.0
3	7440.00	46.5 PK	74.0	-27.5	1.80 H	140	36.0	10.5
4	7440.00	35.7 AV	54.0	-18.3	1.80 H	140	25.2	10.5
5	11590.00	44.8 PK	74.0	-29.2	2.72 H	206	29.6	15.2
6	11590.00	32.1 AV	54.0	-21.9	2.72 H	206	16.9	15.2
7	#17385.00	42.3 PK	68.2	-25.9	1.28 H	94	23.2	19.1
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	4960.00	43.6 PK	74.0	-30.4	1.09 V	21	39.6	4.0
2	4960.00	32.6 AV	54.0	-21.4	1.09 V	21	28.6	4.0
3	7440.00	45.2 PK	74.0	-28.8	2.67 V	82	34.7	10.5
4	7440.00	34.9 AV	54.0	-19.1	2.67 V	82	24.4	10.5
5	11590.00	41.0 PK	74.0	-33.0	3.09 V	134	25.8	15.2
6	11590.00	30.4 AV	54.0	-23.6	3.09 V	134	15.2	15.2
7	#17385.00	40.7 PK	68.2	-27.5	2.68 V	307	21.6	19.1

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. " # ": The radiated frequency is out of the restricted band.

Mode	TX channel 23010	Frequency Range	Above 1000MHz

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	**Frequency (MHz)**	**EIRP (dBm)**	**Limit (dBm)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	1399.40	-64.1	-13.0	-51.1	1.83 H	27	34.8	-98.9
2	**1749.25**	**-63.1**	**-13.0**	**-50.1**	**2.56 H**	**4**	**35.8**	**-99.0**
3	2099.10	-63.3	-13.0	-50.3	3.05 H	270	33.5	-96.8
4	2448.95	-63.8	-13.0	-50.8	1.67 H	355	32.4	-96.2
Antenna Polarity & Test Distance : Vertical at 3 m								
No	**Frequency (MHz)**	**EIRP (dBm)**	**Limit (dBm)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	1399.40	-68.3	-13.0	-55.3	1.25 V	125	30.6	-98.9
2	1749.25	-63.7	-13.0	-50.7	2.64 V	154	35.3	-99.0
3	2099.10	-63.6	-13.0	-50.6	1.05 V	354	33.2	-96.8
4	2448.95	-64.3	-13.0	-51.3	2.05 V	56	31.9	-96.2

Remarks:

1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

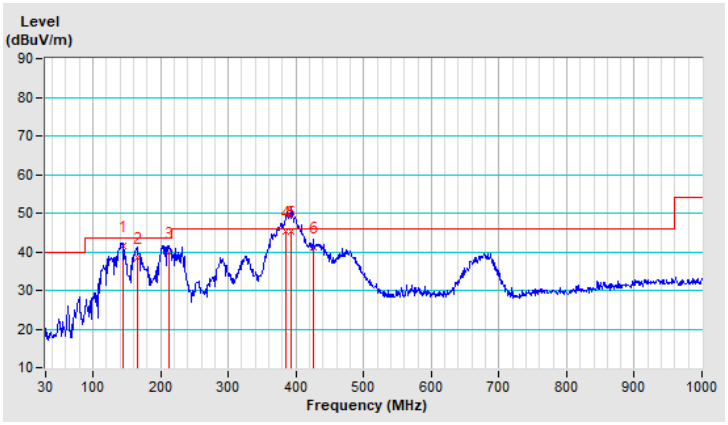
Below 1GHz Data:

Frequency Range	30 MHz ~ 1 GHz	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	144.29	41.6 QP	43.5	-1.9	2.00 H	277	49.7	-8.1
2	165.21	38.6 QP	43.5	-4.9	2.00 H	283	47.1	-8.5
3	212.92	39.9 QP	43.5	-3.6	1.01 H	286	51.1	-11.2
4	385.02	45.2 QP	46.0	-0.8	1.01 H	230	50.9	-5.7
5	393.02	45.2 QP	46.0	-0.8	1.01 H	233	50.7	-5.5
6	425.69	41.2 QP	46.0	-4.8	2.00 H	74	45.6	-4.4

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 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

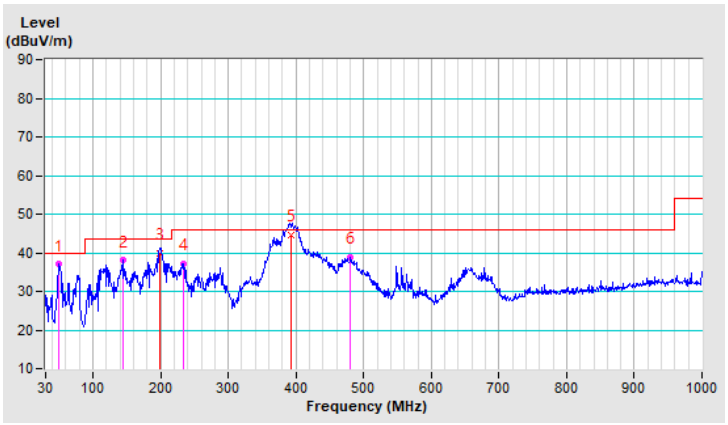


Frequency Range	30 MHz ~ 1 GHz	Detector Function	Quasi-Peak (QP)

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	50.10	37.0 QP	40.0	-3.0	1.00 V	203	45.2	-8.2
2	144.29	38.0 QP	43.5	-5.5	1.00 V	0	46.1	-8.1
3	198.86	39.8 QP	43.5	-3.7	1.01 V	244	51.0	-11.2
4	233.75	37.2 QP	46.0	-8.8	1.00 V	360	47.5	-10.3
5	392.99	44.7 QP	46.0	-1.3	2.04 V	1	50.2	-5.5
6	480.42	38.8 QP	46.0	-7.2	1.00 V	1	42.0	-3.2

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 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: 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
50 ohms Terminator NA	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	2022/8/24	2023/8/23
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: 2022/9/19

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.

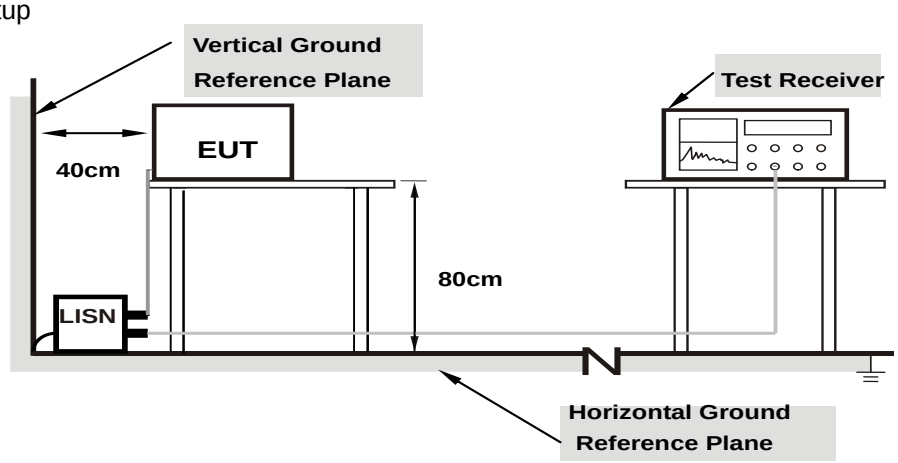
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.

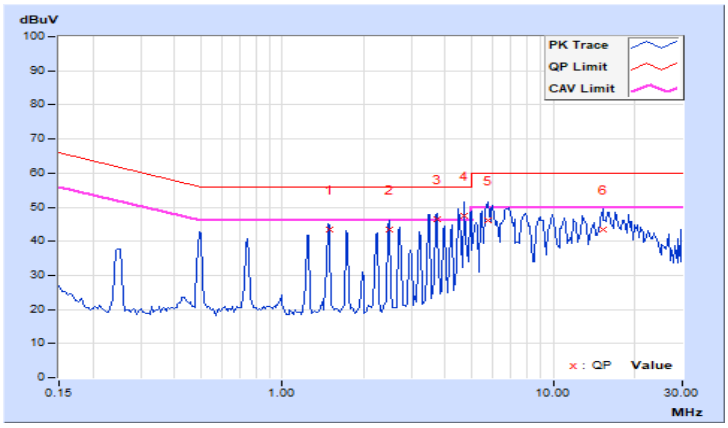
4.2.7 Test Results (Mode 1)

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	1.49609	10.02	33.37	26.06	43.39	36.08	56.00	46.00	-12.61	-9.92
2	2.48047	10.07	33.48	26.31	43.55	36.38	56.00	46.00	-12.45	-9.62
3	3.74609	10.14	36.25	25.69	46.39	35.83	56.00	46.00	-9.61	-10.17
4	4.68750	10.19	37.37	28.85	47.56	39.04	56.00	46.00	-8.44	-6.96
5	5.72266	10.25	35.71	24.68	45.96	34.93	60.00	50.00	-14.04	-15.07
6	15.22266	10.81	32.53	22.19	43.34	33.00	60.00	50.00	-16.66	-17.00

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

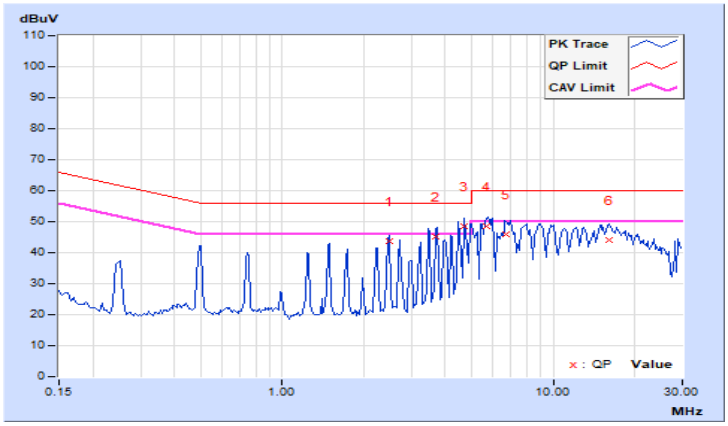


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	10.04	33.62	25.74	43.66	35.78	56.00	46.00	-12.34	-10.22
2	3.69922	10.09	35.14	26.59	45.23	36.68	56.00	46.00	-10.77	-9.32
3	**4.68359**	**10.13**	**38.21**	**29.57**	**48.34**	**39.70**	**56.00**	**46.00**	**-7.66**	**-6.30**
4	5.66797	10.18	38.18	29.57	48.36	39.75	60.00	50.00	-11.64	-10.25
5	6.73828	10.22	35.65	25.12	45.87	35.34	60.00	50.00	-14.13	-14.66
6	16.02344	10.65	33.37	24.26	44.02	34.91	60.00	50.00	-15.98	-15.09

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



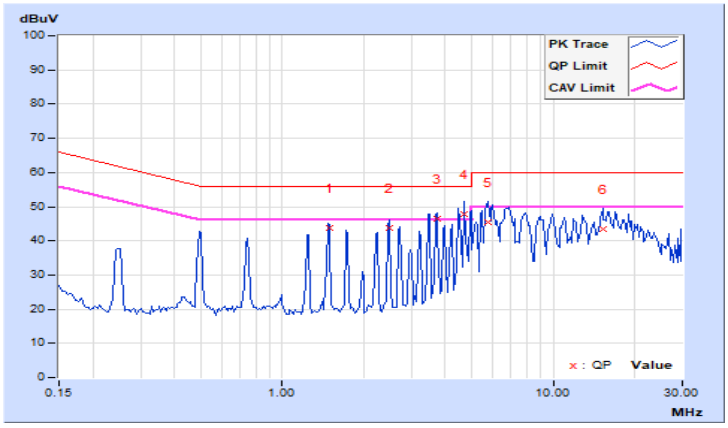
4.2.8 Test Results (Mode 2)

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	1.49609	10.02	33.86	26.37	43.88	36.39	56.00	46.00	-12.12	-9.61
2	2.48047	10.07	33.56	26.49	43.63	36.56	56.00	46.00	-12.37	-9.44
3	3.74609	10.14	36.25	25.69	46.39	35.83	56.00	46.00	-9.61	-10.17
4	4.68750	10.19	37.75	28.61	47.94	38.80	56.00	46.00	-8.06	-7.20
5	5.72266	10.25	35.28	24.37	45.53	34.62	60.00	50.00	-14.47	-15.38
6	15.22266	10.81	32.54	22.57	43.35	33.38	60.00	50.00	-16.65	-16.62

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

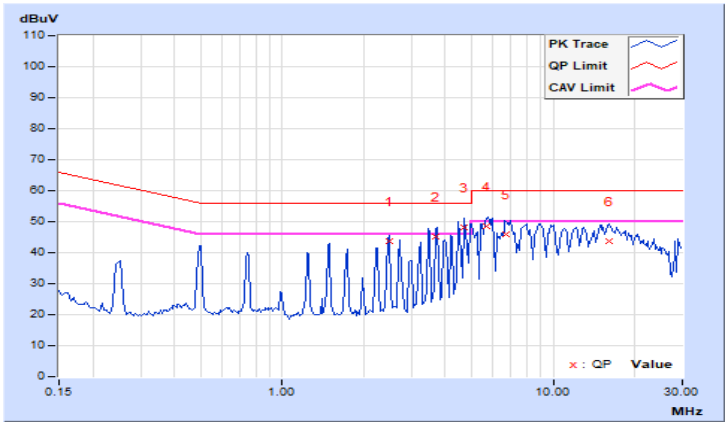


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	10.04	33.59	25.86	43.63	35.90	56.00	46.00	-12.37	-10.10
2	3.69922	10.09	35.08	26.65	45.17	36.74	56.00	46.00	-10.83	-9.26
3	4.68359	10.13	38.07	29.50	48.20	39.63	56.00	46.00	-7.80	-6.37
4	5.66797	10.18	38.26	29.69	48.44	39.87	60.00	50.00	-11.56	-10.13
5	6.73828	10.22	35.73	25.00	45.95	35.22	60.00	50.00	-14.05	-14.78
6	16.02344	10.65	33.02	24.07	43.67	34.72	60.00	50.00	-16.33	-15.28

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

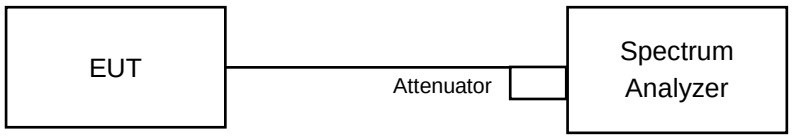


4.3 Conducted Out of Band Emission Measurement

4.3.1 Limits of Conducted Out of Band Emission Measurement

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

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 Procedures

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.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

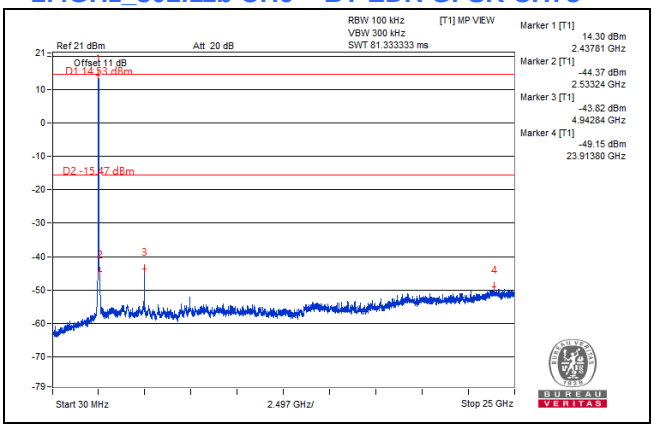
The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

4.3.7 Test Results

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

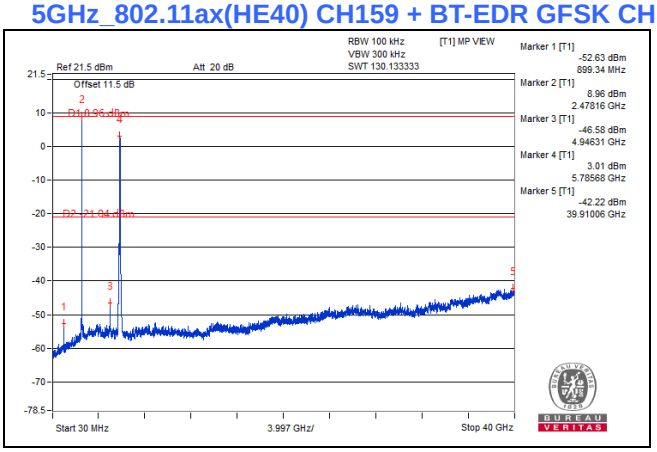
Mode 1:

2.4GHz_802.11b CH6 + BT-EDR GFSK CH78



Mode 2:

5GHz_802.11ax(HE40) CH159 + BT-EDR GFSK CH78



5 Pictures of Test Arrangements

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

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:

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

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