Supplemental "Transmit Simultaneously" Test Report

Report No.: RFBDUM-WTW-P22090716-3 R1

FCC ID: UXX-S5A246A

Test Model: S5A245A

Series Model: S5A246A

Received Date: 2022/10/11

Test Date: 2022/10/23 ~ 2022/11/25

Issued Date: 2023/3/27

Applicant: CRADLEPOINT, INC.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory

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FCC Registration / Designation Number: 723255 / TW2022

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Release Control Record

Issue No.	Description	Date Issued
RFBDUM-WTW-P22090716-3	Original release.	2022/12/9
RFBDUM-WTW-P22090716-3 R1	Modified the antenna list.	2023/3/27

1 Certificate of Conformity

Product: Semi-Ruggedized Router

Brand: cradlepoint

Test Model: S5A245A

Series Model: S5A246A

Sample Status: Engineering sample

Applicant: CRADLEPOINT, INC.

Test Date: 2022/10/23 ~ 2022/11/25

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 22 Subpart H
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:** **2023/3/27**
Vito Lung / Specialist

Approved by : , **Date:** **2023/3/27**
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 -9.14 dB at 0.34531 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 -6.3 dB at 42.1 MHz.
2.1053 27.53(g)	Radiated Spurious Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -48.8 dB at 3711.15 MHz, 3708.90 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	Semi-Ruggedized Router
Brand	cradlepoint
Test Model	S5A245A
Series Model:	S5A246A
Status of EUT	Engineering sample
Power Supply Rating	9 ~ 33 Vdc
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
Modulation Technology	**WLAN:** DSSS, OFDM, OFDMA
Transfer Rate	**WLAN:** 802.11b: up to 11 Mbps 802.11a/g: up to 54 Mbps 802.11n: up to 300 Mbps VHT: up to 400 Mbps 802.11ac: up to 866.7 Mbps 802.11ax: up to 573.5 Mbps 802.11ax: up to 1201.0 Mbps
Operating Frequency	**WLAN:** **2.4GHz:** 2.412 ~ 2.462GHz **5GHz:** 5.18 GHz ~ 5.24 GHz & 5.26 GHz ~ 5.32 GHz & 5.5 GHz ~ 5.72 GHz & 5.745 GHz ~ 5.825 GHz
Number of Channel	**WLAN:** **2.4GHz:** 802.11b, 802.11g, 802.11n (HT20), VHT20, 802.11ax (HE20):11 802.11n (HT40), VHT40, 802.11ax (HE40):7 **5GHz:** 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20):25 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40):12 802.11ac (VHT80), 802.11ax (HE80):6
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Refer to Note

Note:

1. The EUT has below model names which are identical to each other in all aspects except for the following table:

Product name	Brand	Product marketing name (PMN)	Model	Wi-Fi Function	Embedded radio (WWAN module)	Contains ID
Polaris	cradlepoint	S700-C4E	S5A245A	Yes	Quectel, EG25-G	XMR201903EG25G
		S700-C4D	S5A246A	Yes	Quectel, EC25-AF	XMR201808EC25AF
Note: From the above models, model: **S5A245A** was selected as representative model for the test and its data was recorded in this report.						

2. There are WWAN and WLAN (2.4 GHz & 5 GHz) technology used for the EUT.
3. The EUT has three radios as following table:

Radio 1	Radio 2	Radio 3
WLAN (2.4GHz + 5GHz)	WWAN (LTE + WCDMA+ GSM)	GPS

4. Simultaneously transmission condition.

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

5. The EUT uses following accessories.

GPIO Cable For DC Power		
Brand	Model	Specification
U-MEDIA	0573-1200090001	With DC Power supply Voltage Range : 9V-33V, 3A Cable : Unshielded, 2m
AC Adapter 1		
Brand	Model	Specification
APD	WA-36N12R	AC Input : 100-240V, 0.9A, 50-60Hz DC Output : 12V, 3A DC Output Cable : Unshielded, 1.5m
AC Adapter 2		
Brand	Model	Specification
Ktec	KSA-36W-120300D5	AC Input : 100-240V, 1A, 50-60Hz DC Output : 12V, 3A DC Output Cable : Unshielded, 1.5m
Note: For spurious emissions test, the worst case was found in **Adapter 1**. Therefore only the test data of the adapter was recorded in this report.		

6. The antenna information is listed as below.

For WLAN							
Ant. Set	RF Chain NO.	Brand	Model	Ant. Net Gain (dBi)	Frequency Range (GHz)	Ant. Type	Connector Type
1	Chain 0	M.gear	C732-510013-A	3.5	2.4~2.4835	Dipole	R-SMA
				4.5	5.15~5.85		
	Chain 1	M.gear	C732-510013-A	3.5	2.4~2.4835	Dipole	R-SMA
				4.5	5.15~5.85		
2	Chain 0	JOYMAX	TWX-151ARSXX-711	3.86	2.4~2.4835	Dipole	R-SMA
				3.58	5.15~5.85		
	Chain 1	JOYMAX	TWX-151ARSXX-711	3.86	2.4~2.4835	Dipole	R-SMA
				3.58	5.15~5.85		
3	Chain 0	WNC	08.22100.011	2.47	2.4~2.4835	Dipole	R-SMA
				2.47	5.15~5.85		
	Chain 1	WNC	08.22100.011	2.47	2.4~2.4835	Dipole	R-SMA
				2.47	5.15~5.85		
4	Chain 0	Cradlepoint	CP01	5.74	2.4~2.4835	Monopole	R-SMA
				5.60	5.15~5.85		
	Chain 1	Cradlepoint	CP01	5.74	2.4~2.4835	Monopole	R-SMA
				5.60	5.15~5.85		
5	Chain 0	TAOGLAS	MA1505.AK.001	1.4	2.4~2.4835	Monopole	R-SMA
				2.33	5.15~5.85		
	Chain 1	TAOGLAS	MA1505.AK.001	1.37	2.4~2.4835	Monopole	R-SMA
				2.55	5.15~5.85		

For WWAN							
Ant. Set	RF Chain NO.	Brand	Model	Antenna Net Gain (dBi)	Frequency Range (MHz)	Antenna Type	Connector Type
WWAN 1	Chain 0	JOYMAX	YWX-UM03SAX8-711B	0.94	615~703	Dipole	SMA
				0.31	703~748		
				0.24	748~885		
				0.71	885~915		
				1.1	915~960		
				0.6	1445~1515		
				0.37	1520~1640		
				1.24	1710~1785		
				1.43	1785~1920		
				1.5	1920~1980		
				2.63	1980~2500		
				2.5	2500~2570		
				2.41	2570~2620		
				2.34	2620~2700		
				3.34	3000~3300		
				4	3000~3400		
				4	3400~3570		
				2.9	2570~3700		
				4	3700~5000		
				4.39	5150~5925		
	Chain 1	JOYMAX	YWX-UM03SAX8-711B	0.94	615~703	Dipole	SMA
				0.31	703~748		
				0.24	748~885		
				0.71	885~915		
				1.1	915~960		
				0.6	1445~1515		
				0.37	1520~1640		
				1.24	1710~1785		
				1.43	1785~1920		
				1.5	1920~1980		
				2.63	1980~2500		
				2.5	2500~2570		
				2.41	2570~2620		
				2.34	2620~2700		
				3.34	3000~3300		
				4	3000~3400		
				4	3400~3570		
				2.9	2570~3700		
				4	3700~5000		
				4.39	5150~5925		

Ant. Set	RF Chain NO.	Brand	Model	Antenna Net Gain (dBi)	Frequency Range (MHz)	Antenna Type	Connector Type
WWAN 2	Chain 0	TAOGLAS	MA1505.AK.001	-0.08	617~698	Monopole	SMA
				1.04	698~806		
				2.03	824~960		
				2.94	1427~1518		
				4.55	1710~2200		
				4.96	2300~2690		
				5.82	3300~4200		
				5.90	5150~5925		
	Chain 1	TAOGLAS	MA1505.AK.001	-0.58	617~698	Monopole	SMA
				0.49	698~806		
				1.42	824~960		
				3.76	1427~1518		
				3.31	1710~2200		
				4.84	2300~2690		
				3.77	3300~4200		
				5.89	5150~5925		

For GPS

Ant. No.	Brand	Model	Antenna Net Gain (dBi)	Frequency Range (MHz)	Antenna Type	Connector Type
GPS	Unictron	H2MA803F104100	2.2	-	Castle patch	SMA

7. The EUT incorporates a MIMO function.

2.4 GHz Band		
Modulation Mode	**TX & RX Configuration**	
802.11b	2TX	2RX
802.11g	2TX	2RX
802.11n (HT20)	2TX	2RX
802.11n (HT40)	2TX	2RX
VHT20	2TX	2RX
VHT40	2TX	2RX
802.11ax (HE20)	2TX	2RX
802.11ax (HE40)	2TX	2RX
5 GHz 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

Note:
1. All of modulation mode support beamforming function except 802.11a/b/g modulation mode.

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	√	√	-	√	S5A246A (Dipole Set.1 + Dipole set WWAN 1)
2	√	√	√	-	S5A246A (Monopole Set.4 + Monopole set WWAN
3	√	√	-	√	S5A245A (Dipole Set.1 + Dipole set WWAN 1)
4	√	√	√	-	S5A245A (Monopole Set.4 + Monopole set WWAN

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
1-2	2.4GHz: 802.11ax (HE20) + 5GHz: 802.11ax (HE20) + LTE Band 5	1 to 11	6	OFDMA	BPSK
		36 to 48 52 to 64 100 to 116 149 to 165	40	OFDMA	BPSK
		20400 to 20649	20400	QPSK	-
3-4	2.4GHz: 802.11ax (HE20) + 5GHz: 802.11ax (HE20) + GSM850	1 to 11	6	OFDMA	BPSK
		36 to 48 52 to 64 100 to 116 149 to 165	40	OFDMA	BPSK
		824.2 to 848.8	824.2	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
1-2	2.4GHz: 802.11ax (HE20) + 5GHz: 802.11ax (HE20) + LTE Band 5	1 to 11	6	OFDMA	BPSK
		36 to 48 52 to 64 100 to 116 149 to 165	40	OFDMA	BPSK
		20400 to 20649	20400	QPSK	-
3-4	2.4GHz: 802.11ax (HE20) + 5GHz: 802.11ax (HE20) + GSM850	1 to 11	6	OFDMA	BPSK
		36 to 48 52 to 64 100 to 116 149 to 165	40	OFDMA	BPSK
		824.2 to 848.8	824.2	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
2	2.4GHz: 802.11ax (HE20) + 5GHz: 802.11ax (HE20) + LTE Band 5	1 to 11	6	OFDMA	BPSK
		36 to 48 52 to 64 100 to 116 149 to 165	40	OFDMA	BPSK
		20400 to 20649	20400	QPSK	-
4	2.4GHz: 802.11ax (HE20) + 5GHz: 802.11ax (HE20) + GSM850	1 to 11	6	OFDMA	BPSK
		36 to 48 52 to 64 100 to 116 149 to 165	40	OFDMA	BPSK
		824.2 to 848.8	824.2	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	2.4GHz: 802.11ax (HE20) + 5GHz: 802.11ax (HE20) + LTE Band 5	1 to 11	6	OFDMA	BPSK
		36 to 48 52 to 64 100 to 116 149 to 165	40	OFDMA	BPSK
		20400 to 20649	20400	QPSK	-
3	2.4GHz: 802.11ax (HE20) + 5GHz: 802.11ax (HE20) + GSM850	1 to 11	6	OFDMA	BPSK
		36 to 48 52 to 64 100 to 116 149 to 165	40	OFDMA	BPSK
		824.2 to 848.8	824.2	QPSK	-

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE≥1G	25deg. C, 75%RH 25deg. C, 76%RH	120Vac, 60Hz	Ryan Du Nelson Teng Carter Lin
RE<1G	20deg. C, 70%RH 25deg. C, 75%RH	120Vac, 60Hz	Ryan Du
PLC	25deg. C, 75%RH	120Vac, 60Hz	Ryan Du
OB	25deg. C, 60%RH	120Vac, 60Hz	Kevin Ko

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.

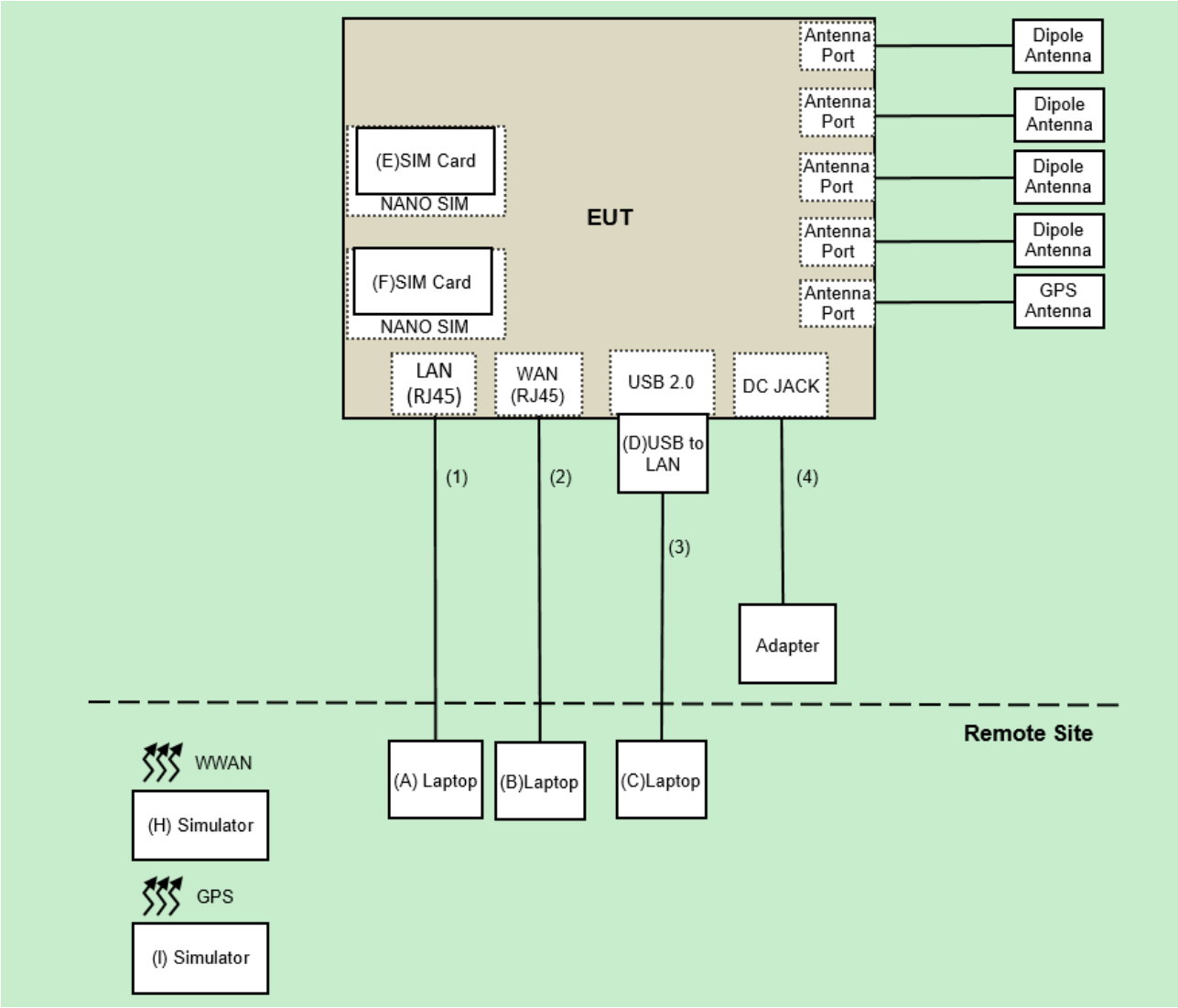
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Laptop	DELL	E6440	85HJXZ1	N/A	Provided by Lab
B	Laptop	Lenovo	81A4	YD02YN76	PD93165NGU	Provided by Lab
C	Laptop	Dell	Latitude 7430	8C19NN3	N/A	Provided by Lab
D	USB to LAN	i-gota	LAN-USBRJ45	N/A	N/A	Supplied by applicant
E	SIM Card	KeysSight	E7515-10910	N/A	N/A	Provided by Lab
F	SIM Card	R&S	CRT-Z3	N/A	N/A	Provided by Lab
G	Simulator	Anritsu	MT8820C	6201127458	N/A	Provided by Lab
H	Simulator	Keysight	E7515A	MY56030229	N/A	Provided by Lab
I	Simulator	LE Communication Co.,Ltd.	RLLS03W-P	77242	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	RJ-45	1	10	No	0	Provided by Lab
2	RJ-45	1	10	No	0	Provided by Lab
3	RJ-45	1	10	No	0	Provided by Lab
4	DC Cable	1	1.5	No	0	Supplied by applicant

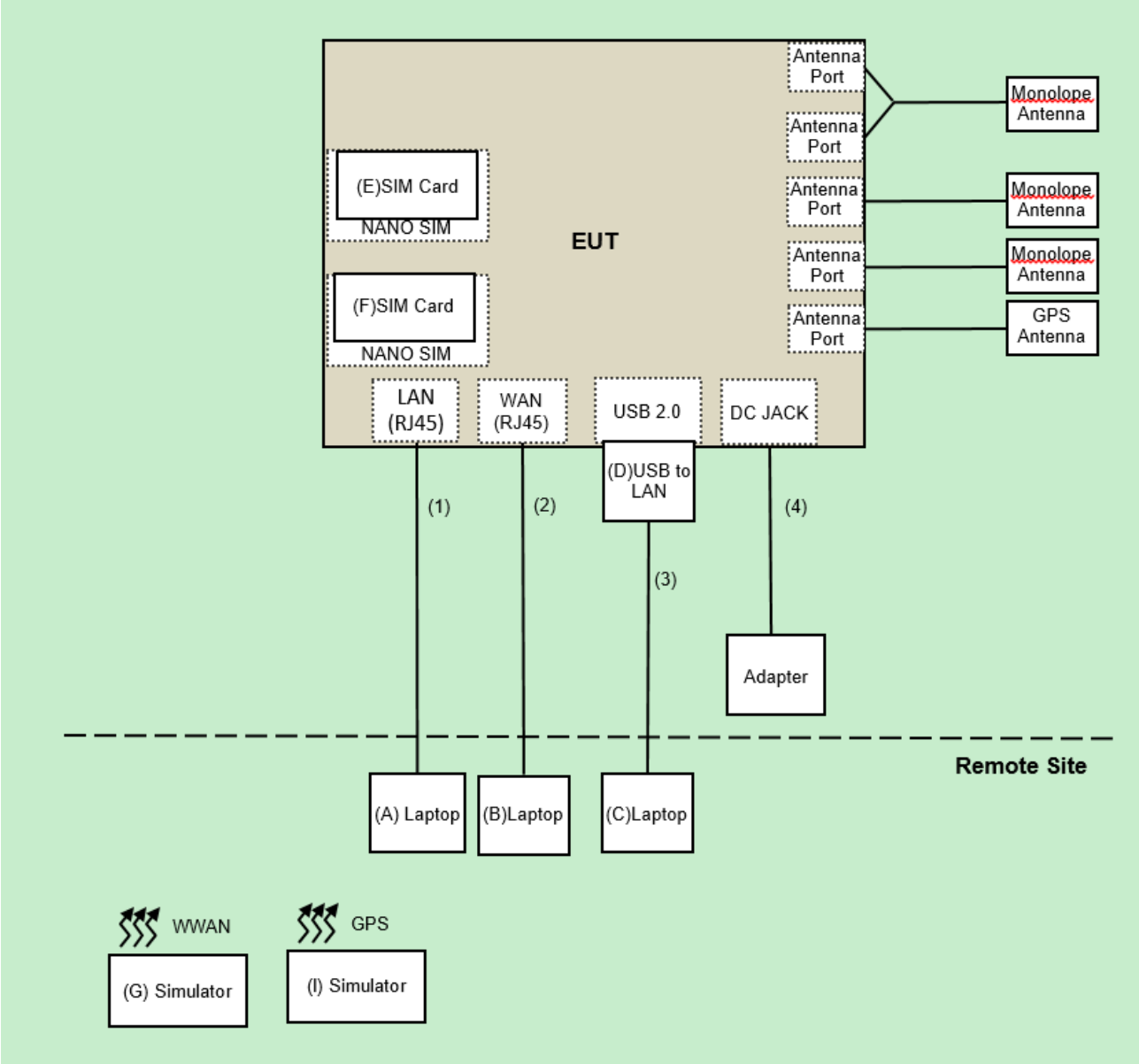
3.2.1 Configuration of System under Test

For Co-location

Mode 1, 3



Mode 2, 4



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 22:
The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

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	2022/10/4	2023/10/3
Trilog Broadband Antenna Schwarzbeck	VULB 9168	9168-361	2022/10/21	2023/10/20
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	2022/9/14	2023/9/13
Horn Antenna Schwarzbeck	BBHA9120-D	9120D-406	2021/11/14	2022/11/13
			2022/11/13	2023/11/14
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
			2022/11/13	2023/11/14
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: 2022/10/23 ~ 2022/11/25

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 22:

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.

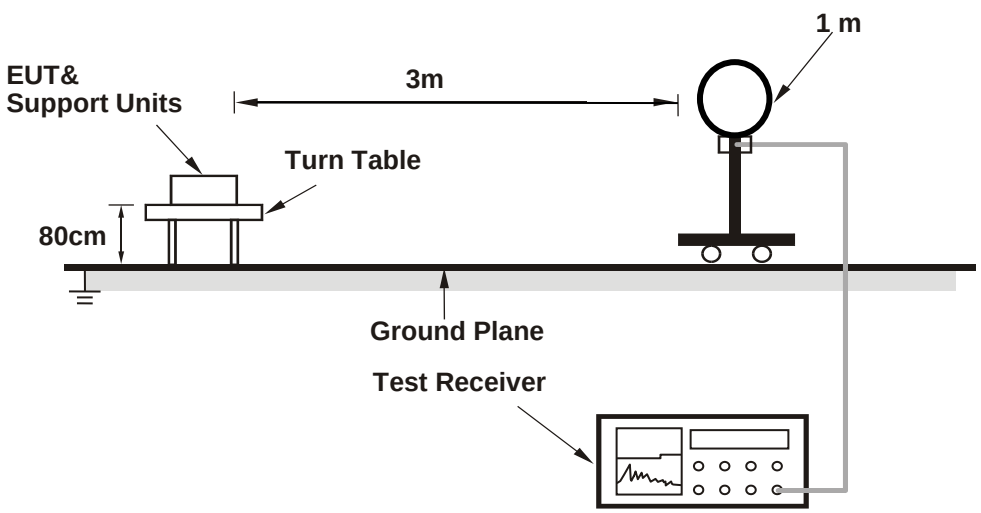
NOTE: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

4.1.4 Deviation from Test Standard

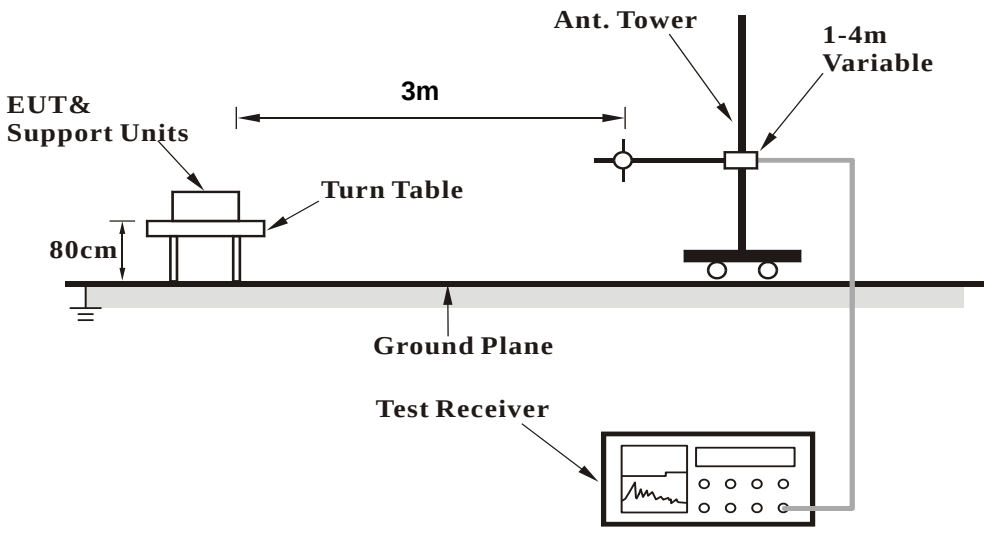
No deviation.

4.1.5 Test Setup

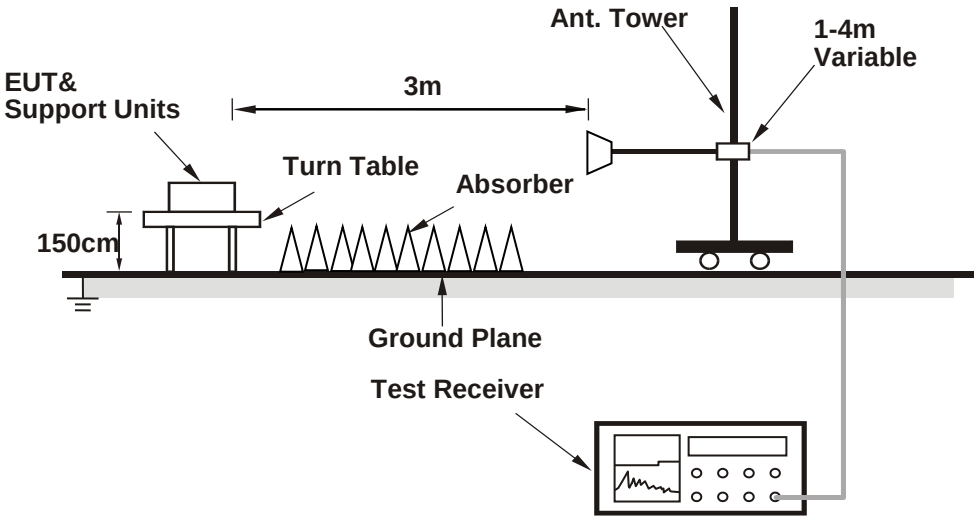
For Radiated emission below 30MHz



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 S5A245A_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

Dipole Antenna

Frequency Range	1 GHz ~ 40 GHz	**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	40.9 PK	74.0	-33.1	1.51 H	119	37.1	3.8
2	4874.00	30.6 AV	54.0	-23.4	1.51 H	119	26.8	3.8
3	7311.00	44.6 PK	74.0	-29.4	1.41 H	360	34.1	10.5
4	7311.00	34.7 AV	54.0	-19.3	1.41 H	360	24.2	10.5
5	#10400.00	50.8 PK	68.2	-17.4	1.28 H	75	36.5	14.3
6	15600.00	50.0 PK	74.0	-24.0	3.38 H	243	35.9	14.1
7	15600.00	38.1 AV	54.0	-15.9	3.38 H	243	24.0	14.1
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	4874.00	40.4 PK	74.0	-33.6	1.33 V	258	36.6	3.8
2	4874.00	30.6 AV	54.0	-23.4	1.33 V	258	26.8	3.8
3	7311.00	45.1 PK	74.0	-28.9	1.39 V	352	34.6	10.5
4	7311.00	34.7 AV	54.0	-19.3	1.39 V	352	24.2	10.5
5	#10400.00	50.3 PK	68.2	-17.9	3.31 V	115	36.0	14.3
6	15600.00	49.8 PK	74.0	-24.2	3.11 V	165	35.7	14.1
7	15600.00	38.2 AV	54.0	-15.8	3.11 V	165	24.1	14.1

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.

Dipole Antenna

Mode	TX channel 20400	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	1649.40	-63.3	-13.0	-50.3	1.59 H	39	36.0	-99.3
2	2061.75	-63.3	-13.0	-50.3	1.56 H	35	34.1	-97.3
3	2474.10	-62.6	-13.0	-49.6	2.09 H	159	33.6	-96.2
4	2886.45	-62.6	-13.0	-49.6	2.11 H	335	32.6	-95.2
5	3298.80	-63.5	-13.0	-50.5	1.23 H	286	31.5	-94.9
6	**3711.15**	**-61.8**	**-13.0**	**-48.8**	**1.45 H**	**61**	**32.0**	**-93.8**
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	1649.40	-63.8	-13.0	-50.8	1.09 V	58	35.5	-99.3
2	2061.75	-62.8	-13.0	-49.8	1.54 V	9	34.6	-97.3
3	2474.10	-62.6	-13.0	-49.6	1.28 V	134	33.6	-96.2
4	2886.45	-63.2	-13.0	-50.2	2.29 V	214	31.9	-95.2
5	3298.80	-62.9	-13.0	-49.9	3.62 V	343	32.1	-94.9
6	3711.15	-62.6	-13.0	-49.6	3.05 V	158	31.3	-93.8

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.

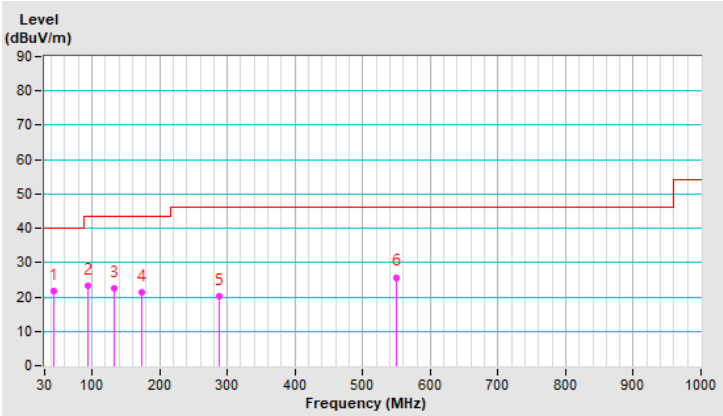
Below 1GHz Data:

Frequency Range	30 MHz ~ 1 GHz	Detector Function	(QP) RB = 120kHz

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	42.63	21.6 QP	40.0	-18.4	1.50 H	352	29.9	-8.3
2	93.52	23.4 QP	43.5	-20.1	1.00 H	42	37.1	-13.7
3	133.42	22.5 QP	43.5	-21.0	1.00 H	106	31.4	-8.9
4	172.89	21.4 QP	43.5	-22.1	1.00 H	35	30.5	-9.1
5	288.54	20.3 QP	46.0	-25.7	1.50 H	75	28.3	-8.0
6	549.20	25.7 QP	46.0	-20.3	1.50 H	124	27.6	-1.9

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.

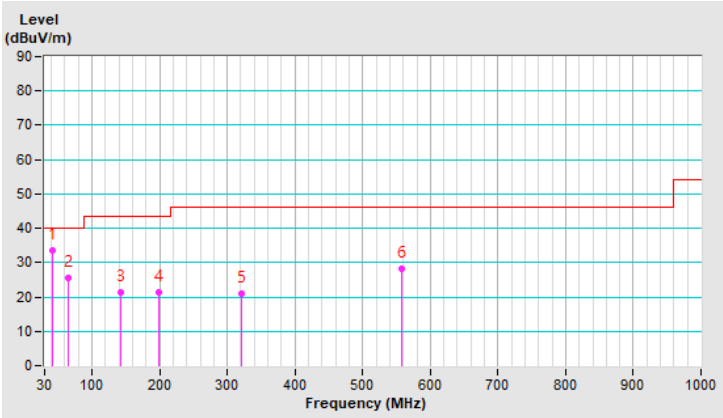


Frequency Range	30 MHz ~ 1 GHz	Detector Function	(QP) RB = 120kHz

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	41.32	33.5 QP	40.0	-6.5	1.50 V	239	42.0	-8.5
2	65.11	25.6 QP	40.0	-14.4	1.50 V	342	35.3	-9.7
3	142.99	21.5 QP	43.5	-22.0	1.50 V	142	29.7	-8.2
4	199.28	21.3 QP	43.5	-22.2	1.50 V	326	32.5	-11.2
5	320.36	21.1 QP	46.0	-24.9	1.50 V	284	27.9	-6.8
6	558.33	28.3 QP	46.0	-17.7	1.50 V	77	30.0	-1.7

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

Monopole Antenna

Frequency Range	1 GHz ~ 40 GHz	**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	40.9 PK	74.0	-33.1	1.53 H	104	37.1	3.8
2	4874.00	30.5 AV	54.0	-23.5	1.53 H	104	26.7	3.8
3	7311.00	44.0 PK	74.0	-30.0	1.48 H	352	33.5	10.5
4	7311.00	34.3 AV	54.0	-19.7	1.48 H	352	23.8	10.5
5	#10400.00	50.7 PK	68.2	-17.5	1.22 H	85	36.4	14.3
6	15600.00	49.7 PK	74.0	-24.3	3.37 H	256	35.6	14.1
7	15600.00	38.0 AV	54.0	-16.0	3.37 H	256	23.9	14.1
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	4874.00	39.9 PK	74.0	-34.1	1.35 V	249	36.1	3.8
2	4874.00	30.4 AV	54.0	-23.6	1.35 V	249	26.6	3.8
3	7311.00	45.0 PK	74.0	-29.0	1.44 V	339	34.5	10.5
4	7311.00	34.5 AV	54.0	-19.5	1.44 V	339	24.0	10.5
5	#10400.00	50.0 PK	68.2	-18.2	3.46 V	116	35.7	14.3
6	15600.00	49.4 PK	74.0	-24.6	3.12 V	169	35.3	14.1
7	15600.00	37.8 AV	54.0	-16.2	3.12 V	169	23.7	14.1

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.

Monopole Antenna

Mode	TX channel 20400	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	1649.40	-63.2	-13.0	-50.2	1.58 H	38	36.1	-99.3
2	2061.75	-63.1	-13.0	-50.1	1.55 H	34	34.2	-97.3
3	2474.10	-62.4	-13.0	-49.4	2.08 H	158	33.8	-96.2
4	2886.45	-62.4	-13.0	-49.4	2.09 H	333	32.7	-95.2
5	3298.80	-63.4	-13.0	-50.4	1.21 H	285	31.6	-94.9
6	3711.15	-61.7	-13.0	-48.7	1.44 H	63	32.2	-93.8
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	1649.40	-63.7	-13.0	-50.7	1.08 V	57	35.6	-99.3
2	2061.75	-62.6	-13.0	-49.6	1.53 V	8	34.7	-97.3
3	2474.10	-62.5	-13.0	-49.5	1.26 V	133	33.7	-96.2
4	2886.45	-63.1	-13.0	-50.1	2.28 V	213	32.1	-95.2
5	3298.80	-62.7	-13.0	-49.7	3.61 V	344	32.2	-94.9
6	3711.15	-62.4	-13.0	-49.4	3.03 V	156	31.4	-93.8

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.

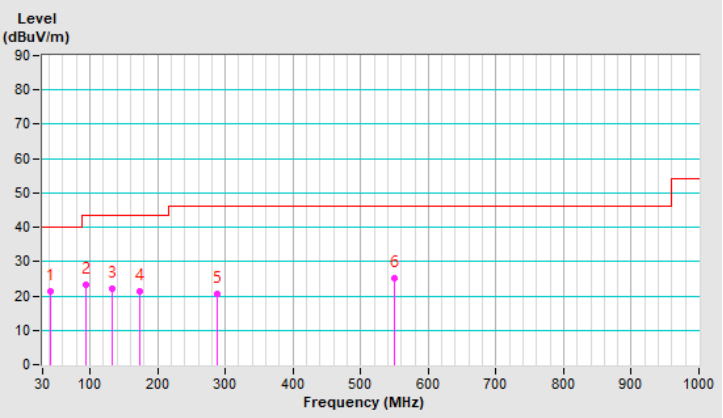
Below 1GHz Data:

Frequency Range	30 MHz ~ 1 GHz	Detector Function	(QP) RB = 120kHz

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	42.37	21.3 QP	40.0	-18.7	1.50 H	287	29.7	-8.4
2	93.12	23.3 QP	43.5	-20.2	1.00 H	62	37.1	-13.8
3	133.38	22.2 QP	43.5	-21.3	1.00 H	158	31.1	-8.9
4	172.65	21.5 QP	43.5	-22.0	1.00 H	49	30.6	-9.1
5	288.31	20.6 QP	46.0	-25.4	1.50 H	111	28.6	-8.0
6	549.17	25.3 QP	46.0	-20.7	1.50 H	127	27.2	-1.9

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.

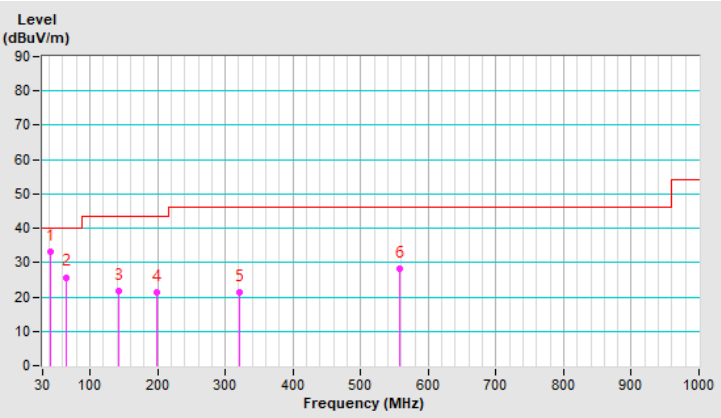


Frequency Range	30 MHz ~ 1 GHz	Detector Function	(QP) RB = 120kHz

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	41.24	33.2 QP	40.0	-6.8	1.50 V	263	41.7	-8.5
2	65.18	25.7 QP	40.0	-14.3	1.50 V	289	35.4	-9.7
3	143.11	21.6 QP	43.5	-21.9	1.50 V	147	29.8	-8.2
4	199.35	21.4 QP	43.5	-22.1	1.50 V	305	32.6	-11.2
5	320.63	21.5 QP	46.0	-24.5	1.50 V	297	28.3	-6.8
6	558.47	28.2 QP	46.0	-17.8	1.50 V	53	29.9	-1.7

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.



4.1.9 Test Results **(Mode 3)**

Above 1GHz Data

Dipole Antenna

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	4874.00	41.3 PK	74.0	-32.7	1.51 H	107	37.5	3.8
2	4874.00	30.8 AV	54.0	-23.2	1.51 H	107	27.0	3.8
3	7311.00	43.8 PK	74.0	-30.2	1.43 H	360	33.3	10.5
4	7311.00	33.9 AV	54.0	-20.1	1.43 H	360	23.4	10.5
5	#10400.00	50.8 PK	68.2	-17.4	1.28 H	75	36.5	14.3
6	15600.00	50.0 PK	74.0	-24.0	3.38 H	243	35.9	14.1
7	15600.00	38.1 AV	54.0	-15.9	3.38 H	243	24.0	14.1
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	4874.00	40.6 PK	74.0	-33.4	1.38 V	263	36.8	3.8
2	4874.00	30.7 AV	54.0	-23.3	1.38 V	263	26.9	3.8
3	7311.00	45.2 PK	74.0	-28.8	1.40 V	350	34.7	10.5
4	7311.00	34.6 AV	54.0	-19.4	1.40 V	350	24.1	10.5
5	#10400.00	50.4 PK	68.2	-17.8	3.36 V	107	36.1	14.3
6	15600.00	49.8 PK	74.0	-24.2	3.08 V	165	35.7	14.1
7	15600.00	38.1 AV	54.0	-15.9	3.08 V	165	24.0	14.1

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.

Dipole Antenna

Mode	TX channel 824.2	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	1648.40	-63.7	-13.0	-50.7	1.12 H	351	35.6	-99.3
2	2060.50	-63.3	-13.0	-50.3	1.43 H	357	34.1	-97.3
3	2472.60	-63.2	-13.0	-50.2	1.66 H	34	33.0	-96.2
4	2884.70	-63.2	-13.0	-50.2	2.56 H	211	32.0	-95.2
5	3296.80	-63.1	-13.0	-50.1	1.88 H	162	31.9	-94.9
6	3708.90	-62.1	-13.0	-49.1	2.28 H	22	31.8	-93.8
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	1648.40	-63.7	-13.0	-50.7	1.11 V	349	35.6	-99.3
2	2060.50	-63.3	-13.0	-50.3	1.42 V	358	34.0	-97.3
3	2472.60	-63.0	-13.0	-50.0	1.66 V	31	33.2	-96.2
4	2884.70	-62.9	-13.0	-49.9	2.53 V	212	32.3	-95.2
5	3296.80	-62.8	-13.0	-49.8	1.88 V	160	32.2	-94.9
6	**3708.90**	**-61.8**	**-13.0**	**-48.8**	**2.28 V**	**21**	**32.1**	**-93.8**

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.

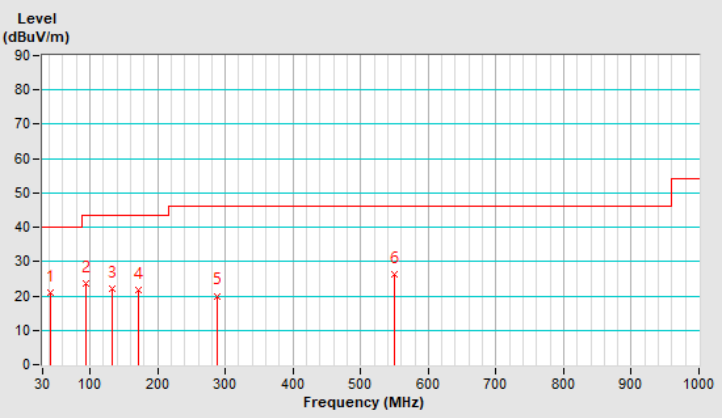
Below 1GHz Data:

Frequency Range	30 MHz ~ 1 GHz	Detector Function	(QP) RB = 120kHz

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	42.56	21.1 QP	40.0	-18.9	1.50 H	356	29.3	-8.2
2	93.23	23.6 QP	43.5	-19.9	1.00 H	39	37.2	-13.6
3	133.41	22.2 QP	43.5	-21.3	1.00 H	117	31.0	-8.8
4	172.42	21.7 QP	43.5	-21.8	1.00 H	33	30.7	-9.0
5	288.67	20.0 QP	46.0	-26.0	1.50 H	71	27.9	-7.9
6	549.49	26.2 QP	46.0	-19.8	1.50 H	137	28.1	-1.9

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.

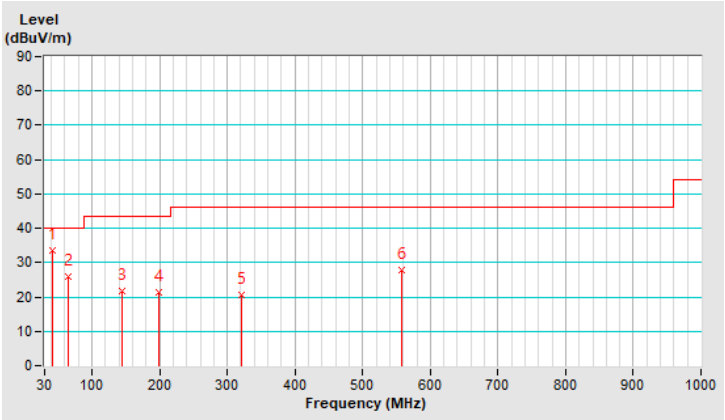


Frequency Range	30 MHz ~ 1 GHz	Detector Function	(QP) RB = 120kHz

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	41.59	33.6 QP	40.0	-6.4	1.50 V	235	41.9	-8.3
2	65.55	25.9 QP	40.0	-14.1	1.50 V	358	35.7	-9.8
3	143.49	21.7 QP	43.5	-21.8	1.50 V	137	29.8	-8.1
4	199.62	21.4 QP	43.5	-22.1	1.50 V	342	32.6	-11.2
5	320.35	20.7 QP	46.0	-25.3	1.50 V	292	27.5	-6.8
6	558.12	27.9 QP	46.0	-18.1	1.50 V	84	29.6	-1.7

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.



4.1.10 Test Results **(Mode 4)**

Above 1GHz Data

Monopole Antenna

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	4874.00	41.0 PK	74.0	-33.0	1.51 H	120	37.2	3.8
2	4874.00	30.5 AV	54.0	-23.5	1.51 H	120	26.7	3.8
3	7311.00	43.3 PK	74.0	-30.7	1.51 H	345	32.8	10.5
4	7311.00	33.8 AV	54.0	-20.2	1.51 H	345	23.3	10.5
5	#10400.00	51.0 PK	68.2	-17.2	1.22 H	96	36.7	14.3
6	15600.00	50.1 PK	74.0	-23.9	3.38 H	266	36.0	14.1
7	15600.00	38.4 AV	54.0	-15.6	3.38 H	266	24.3	14.1
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	4874.00	40.4 PK	74.0	-33.6	1.35 V	257	36.6	3.8
2	4874.00	30.6 AV	54.0	-23.4	1.35 V	257	26.8	3.8
3	7311.00	45.3 PK	74.0	-28.7	1.38 V	349	34.8	10.5
4	7311.00	34.9 AV	54.0	-19.1	1.38 V	349	24.4	10.5
5	#10400.00	49.8 PK	68.2	-18.4	3.41 V	108	35.5	14.3
6	15600.00	49.8 PK	74.0	-24.2	3.13 V	156	35.7	14.1
7	15600.00	38.1 AV	54.0	-15.9	3.13 V	156	24.0	14.1

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.

Monopole Antenna

Mode	TX channel 824.2	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	1648.40	-63.6	-13.0	-50.6	1.10 H	350	35.8	-99.3
2	2060.50	-63.1	-13.0	-50.1	1.41 H	359	34.2	-97.3
3	2472.60	-63.1	-13.0	-50.1	1.65 H	32	33.1	-96.2
4	2884.70	-63.0	-13.0	-50.0	2.54 H	213	32.1	-95.2
5	3296.80	-62.9	-13.0	-49.9	1.87 H	161	32.0	-94.9
6	3708.90	-61.9	-13.0	-48.9	2.27 H	20	31.9	-93.8
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	1648.40	-63.6	-13.0	-50.6	1.10 V	350	35.7	-99.3
2	2060.50	-63.2	-13.0	-50.2	1.43 V	357	34.2	-97.3
3	2472.60	-62.8	-13.0	-49.8	1.67 V	32	33.4	-96.2
4	2884.70	-63.0	-13.0	-50.0	2.54 V	211	32.1	-95.2
5	3296.80	-62.7	-13.0	-49.7	1.87 V	159	32.3	-94.9
6	**3708.90**	**-61.7**	**-13.0**	**-48.7**	**2.26 V**	**22**	**32.2**	**-93.8**

Remarks:

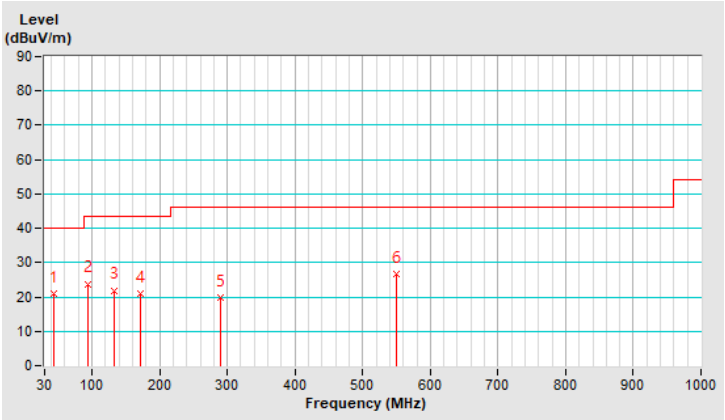
1. EIRP(dBm) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + 20log(D) – 104.8
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

Frequency Range	30 MHz ~ 1 GHz	Detector Function	(QP) RB = 120kHz

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	42.79	21.0 QP	40.0	-19.0	1.50 H	357	29.3	-8.3
2	93.47	23.8 QP	43.5	-19.7	1.00 H	37	37.3	-13.5
3	133.35	21.9 QP	43.5	-21.6	1.00 H	113	30.7	-8.8
4	172.30	21.1 QP	43.5	-22.4	1.00 H	18	30.1	-9.0
5	289.12	19.9 QP	46.0	-26.1	1.50 H	84	27.8	-7.9
6	549.25	26.8 QP	46.0	-19.2	1.50 H	127	28.7	-1.9

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.

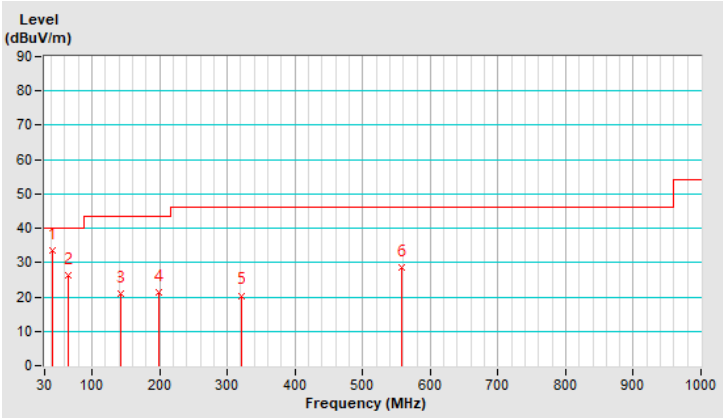


Frequency Range	30 MHz ~ 1 GHz	Detector Function	(QP) RB = 120kHz

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	**41.21**	**33.7 QP**	**40.0**	**-6.3**	**1.50 V**	**243**	**42.0**	**-8.3**
2	65.27	26.2 QP	40.0	-13.8	1.50 V	348	35.9	-9.7
3	143.27	21.0 QP	43.5	-22.5	1.50 V	141	29.1	-8.1
4	199.25	21.2 QP	43.5	-22.3	1.50 V	355	32.4	-11.2
5	320.72	20.4 QP	46.0	-25.6	1.50 V	302	27.2	-6.8
6	557.77	28.5 QP	46.0	-17.5	1.50 V	68	30.2	-1.7

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	2022/10/14	2023/10/13
LISN R&S	ESH3-Z5	848773/004	2022/10/18	2023/10/17
50 ohms Terminator NA	50	EMC-01	2022/9/27	2023/9/26
RF Coaxial Cable JYEBO	5D-FB	COCCAB-001	2022/8/24	2023/8/23
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: 2022/10/25 ~ 202211/25

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.

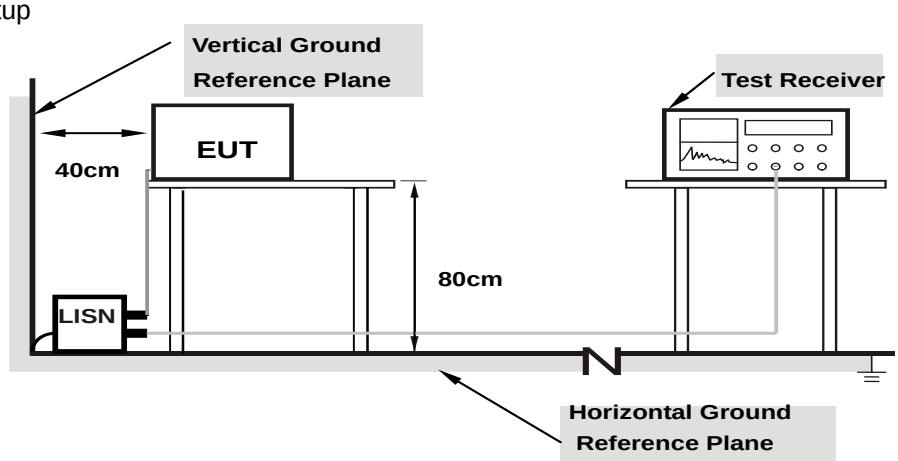
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.

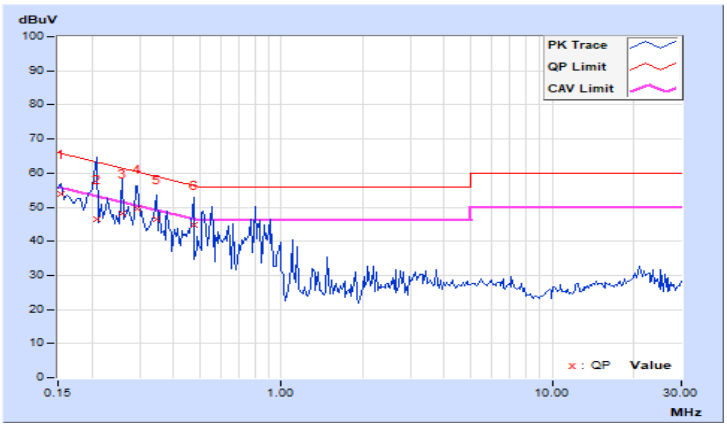
4.2.7 Test Results **(Mode 2)**

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	0.15391	9.94	43.90	23.79	53.84	33.73	65.79	55.79	-11.95	-22.06
2	0.20859	9.94	36.59	22.21	46.53	32.15	63.26	53.26	-16.73	-21.11
3	0.25938	9.94	38.23	22.42	48.17	32.36	61.45	51.45	-13.28	-19.09
4	0.29453	9.94	39.71	18.79	49.65	28.73	60.40	50.40	-10.75	-21.67
5	0.34531	9.95	36.54	29.85	46.49	39.80	59.07	49.07	-12.58	-9.27
6	0.47422	9.95	34.69	14.43	44.64	24.38	56.44	46.44	-11.80	-22.06

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

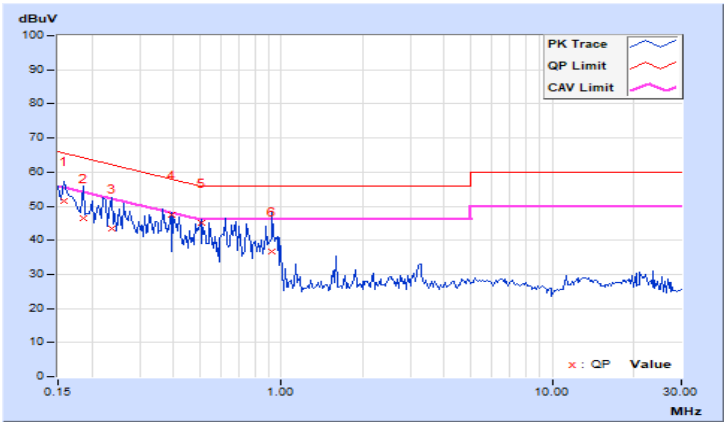


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	0.15781	10.00	41.41	24.69	51.41	34.69	65.58	55.58	-14.17	-20.89
2	0.18516	10.00	36.48	24.13	46.48	34.13	64.25	54.25	-17.77	-20.12
3	0.23594	10.00	33.57	18.31	43.57	28.31	62.24	52.24	-18.67	-23.93
4	0.39219	10.01	37.61	19.45	47.62	29.46	58.02	48.02	-10.40	-18.56
5	0.50547	10.02	35.13	14.59	45.15	24.61	56.00	46.00	-10.85	-21.39
6	0.92734	10.05	26.68	12.17	36.73	22.22	56.00	46.00	-19.27	-23.78

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



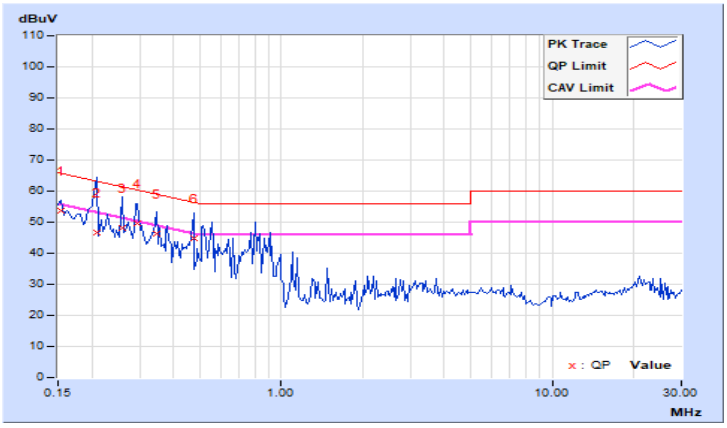
4.2.8 Test Results **(Mode 4)**

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	0.15391	9.94	43.94	23.84	53.88	33.78	65.79	55.79	-11.91	-22.01
2	0.20859	9.94	36.56	22.36	46.50	32.30	63.26	53.26	-16.76	-20.96
3	0.25938	9.94	38.16	22.52	48.10	32.46	61.45	51.45	-13.35	-18.99
4	0.29453	9.94	39.84	18.88	49.78	28.82	60.40	50.40	-10.62	-21.58
5	**0.34531**	**9.95**	**36.40**	**29.98**	**46.35**	**39.93**	**59.07**	**49.07**	**-12.72**	**-9.14**
6	0.47422	9.95	34.76	14.56	44.71	24.51	56.44	46.44	-11.73	-21.93

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

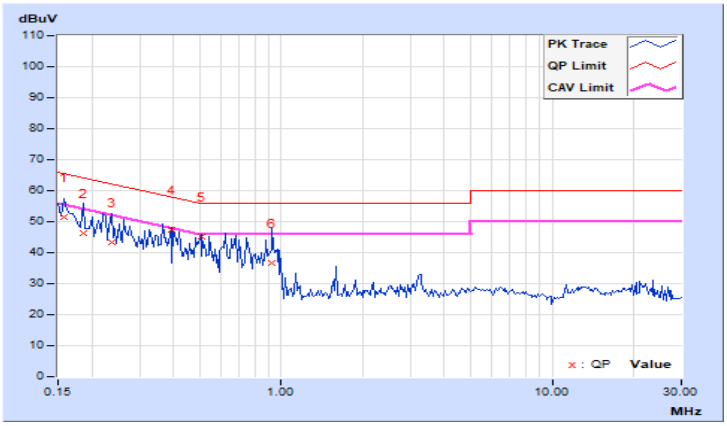


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	0.15781	10.00	41.44	24.56	51.44	34.56	65.58	55.58	-14.14	-21.02
2	0.18516	10.00	36.42	24.02	46.42	34.02	64.25	54.25	-17.83	-20.23
3	0.23594	10.00	33.50	18.42	43.50	28.42	62.24	52.24	-18.74	-23.82
4	0.39219	10.01	37.52	19.38	47.53	29.39	58.02	48.02	-10.49	-18.63
5	0.50547	10.02	35.04	14.64	45.06	24.66	56.00	46.00	-10.94	-21.34
6	0.92734	10.05	26.56	12.02	36.61	22.07	56.00	46.00	-19.39	-23.93

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

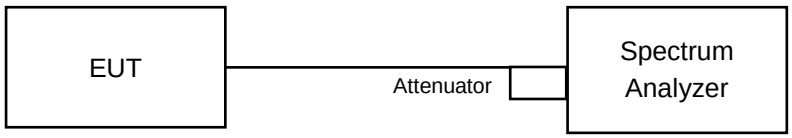


4.3 Conducted Out of Band Emission Measurement

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.

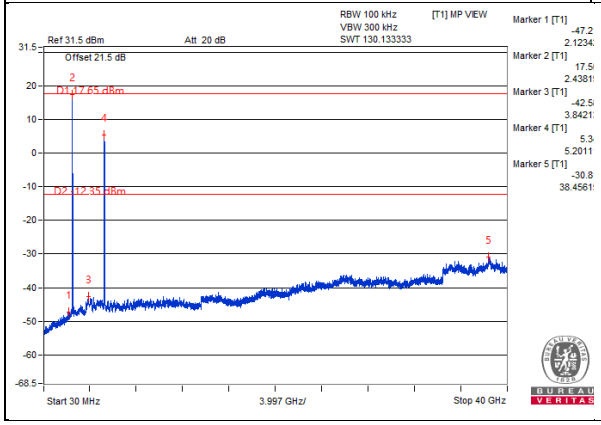
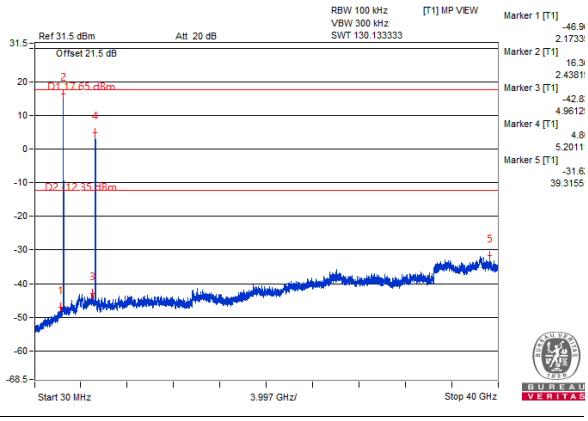
4.3.6 EUT Operating Conditions

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.

2.4GHz: 802.11ax (HE20) CH6 + 5GHz: 802.11ax (HE20) CH40

Chain 0	Chain 1
	

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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Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

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

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