

FCC Test Report

Report No.: RFCEPG-WTW-P23010436

FCC ID: VECMP131

Test Model: MP131/HP, MP131-3B

Series Model: MP131-3, MP131, MP131-3/HP

Received Date: 2023/1/17

Test Date: 2023/2/13 ~ 2023/5/17

Issued Date: 2023/5/31

Applicant: ST Electronics (Satcom & Sensor Systems) Pte Ltd

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

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Test Location(1): No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City
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**FCC Registration /
Designation Number(1):** 788550 / TW0003

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

**FCC Registration /
Designation Number(2):** 281270 / TW0032



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Release Control Record

Issue No.	Description	Date Issued
RFCEPG-WTW-P23010436	Original release.	2023/5/31

1 Certificate of Conformity

Product: K-band motion detector

Brand: ST Engineering Electronics Ltd.

Test Model: MP131/HP, MP131-3B

Series Model: MP131-3, MP131, MP131-3/HP

Sample Status: Engineering sample

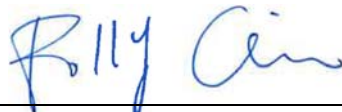
Applicant: ST Electronics (Satcom & Sensor Systems) Pte Ltd

Test Date: 2023/2/13 ~ 2023/5/17

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.249)
ANSI C63.10-2013

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

Prepared by :



Date:

2023/5/31

Polly Chien / Specialist

Approved by :



Date:

2023/5/31

Jeremy Lin / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.249)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -19.85 dB at 0.69000 MHz.
15.209 15.249 15.249 (d)	Radiated Emission Test Band Edge Measurement Limit: 50dB less than the peak value of fundamental frequency or meet radiated emission limit in section 15.209	Pass	Meet the requirement of limit. Minimum passing margin is -5.5 dB at 33.88 MHz.
15.215	Channel Bandwidth	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	No antenna connector is used.

Note: 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) (\pm)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.79 dB
Radiated Emissions	9kHz ~ 30MHz	3.00 dB
	30MHz ~ 200MHz	2.91 dB
	200MHz ~ 1000MHz	2.92 dB
	1GHz ~ 18GHz	1.76 dB
	18GHz ~ 40GHz	1.77 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	K-band motion detector
Brand	ST Engineering Electronics Ltd.
Test Model	MP131/HP, MP131-3B
Series Model	MP131-3, MP131, MP131-3/HP
Model Difference	Refer to Note
Status of EUT	Engineering sample
Power Supply Rating	3 Vdc / 5 Vdc
Modulation Type	CW/Pulse
Operating Frequency	8kHz Pulse: 24.06795 GHz 1kHz Pulse: 24.18825 GHz CW: 24.17778 GHz
Field Strength	8kHz Pulse: 78.3 dBuV/m (Average) at 3m 1kHz Pulse: 79.2 dBuV/m (Average) at 3m CW: 85.9 dBuV/m (Average) at 3m
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. All models are listed as below. The model of the MP131/HP, MP131-3B were chosen for final test.

Model	Difference	Test Mode			Remark
		A (8kHz pulse)	B (1kHz pulse)	C (CW)	
MP131-3	+3VDC VIN, selectable 55/70 dB gain, 1kHz pulse /CW		O	O	These models are electrically and mechanically identical. The intention of these models is only for the purpose of adapting to various types of motion and mainboard voltage levels.
MP131-3B	+3VDC VIN, selectable 55/70 dB gain, 8kHz pulse /CW	O		O (worst case)	
MP131	+5VDC VIN, selectable 55/70 dB gain, 1kHz pulse /CW		O	O	
MP131/HP	+5VDC VIN, fixed 70 dB gain, 1kHz pulse		O (worst case)		
MP131-3/HP	+3VDC VIN, fixed 70 dB gain, 1kHz pulse		O		

2. The antenna information is listed as below.

Antenna Gain (dBi)	Frequency Range (GHz)	Antenna Type	Connector Type
11	24~24.25	Patch Array	None

*Due to radiated measurements are made and the antenna gain is already accounted for this device, so provide an antenna datasheet and/or antenna measurement report is not required. The antenna dimensions and pictures (include antenna wire length if have) are stated in EUT photo exhibit.

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

3.2 Description of Test Modes

8kHz Pules

1 channel is provided for test:

Channel	Frequency (GHz)
1	24.06795

1kHz Pules

1 channel is provided for test:

Channel	Frequency (GHz)
1	24.18825

CW

1 channel is provided for test:

Channel	Frequency (GHz)
1	24.17778

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to				Description	
	RE \geq 1G	RE $<$ 1G	PLC	BW	Model	Modulation Type
A	√	√	√	√	MP131-3B	8kHz Pulse
B	√	√	√	√	MP131/HP	1kHz Pulse
C	√	√	√	√	MP131-3B	CW

Where **RE \geq 1G**: Radiated Emission above 1GHz & Bandedge Measurement
RE $<$ 1G: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission
BW: 20dB Bandwidth Measurement

Pre-Scan:	1. EUT can be used in the following ways: X-axis / Y-axis / Z-axis. Pre-scan these ways and find the worst case as a representative test condition. 2. For EUT the Input Voltage condition: 3 Vdc / 5 Vdc. Pre-scan these conditions and find the worst case as a representative test condition. 3. For EUT the IF-Amplifier condition: selectable: 55/70 dB and fixed 70 dB. Pre-scan these conditions and find the worst case as a representative test condition.
Worst Case:	1. X-axis/ Y-axis/ Z-axis Worst Condition: Y-axis 2. For EUT Input Voltage worst condition: For MP131-3, MP131-3B: 3 Vdc, for MP131/HP: 5 Vdc 3. For EUT The IF-Amplifier worst condition: 70 dB

Radiated Emission Test (Above 1GHz):

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

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

EUT Configure Mode	Frequency (GHz)	Modulation Type
A	24.06795	8kHz Pulse
B	24.18825	1kHz Pulse
C	24.17778	CW

Radiated Emission Test (Below 1GHz):

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

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

EUT Configure Mode	Frequency (GHz)	Modulation Type
A	24.06795	8kHz Pulse
B	24.18825	1kHz Pulse
C	24.17778	CW

Power Line Conducted Emission Test:

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

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

EUT Configure Mode	Frequency (GHz)	Modulation Type
A	24.06795	8kHz Pulse
B	24.18825	1kHz Pulse
C	24.17778	CW

20dB Bandwidth Measurement:

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

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

EUT Configure Mode	Frequency (GHz)	Modulation Type
A	24.06795	8kHz Pulse
B	24.18825	1kHz Pulse
C	24.17778	CW

Test Condition:

Applicable to	Environmental Conditions	Input Power	Tested by
RE\geq1G	24deg. C, 67%RH 22deg. C, 67%RH 23deg. C, 68%RH 22deg. C, 69%RH 21deg. C, 67%RH 22deg. C, 68%RH	3Vdc/5Vdc	Wade Huang
RE<1G	25deg. C, 65%RH	3Vdc/5Vdc	Wade Huang
PLC	25deg. C, 75%RH	3Vdc/5Vdc	Wade Huang, Greg Lin
BW	25deg. C, 60%RH	3Vdc/5Vdc	Wade Huang

3.3 Description of Support Units

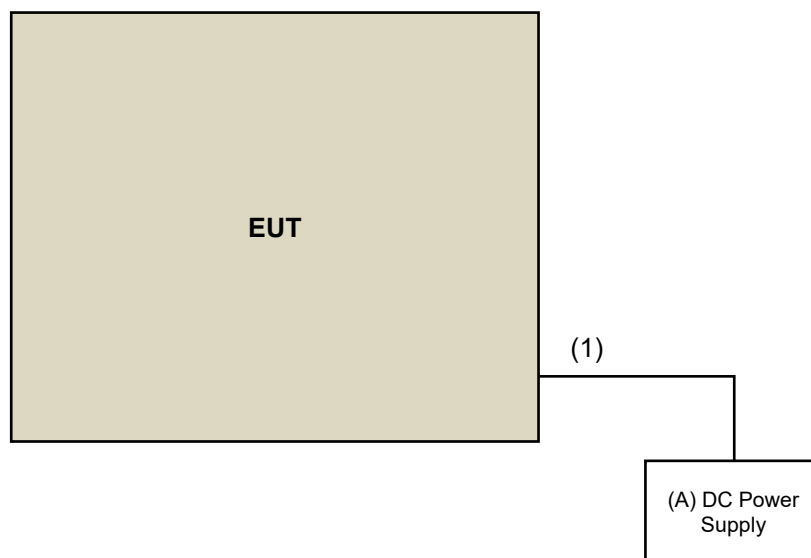
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
1.	DC power supply	Keysight	U8002A	NA	NA	Provided by Lab

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	DC cable	1	1	No	0	Provided by Lab

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.249)

ANSI C63.10-2013

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

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902 ~ 928 MHz	50	500
2400 ~ 2483.5 MHz	50	500
5725 ~ 5875 MHz	50	500
24 ~ 24.25 GHz	250	2500

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits as below table, whichever is the lesser attenuation

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

Note:

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date Of Calibration	Due Date Of Calibration
Test Receiver KEYSIGHT	N9038B	MY60180018	Feb. 07, 2022	Feb. 06, 2024
BILOG Antenna SCHWARZBECK	VULB9168	9168-995	Oct. 20, 2022	Oct. 19, 2023
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-404	Nov. 13, 2022	Nov. 12, 2023
Loop Antenna EMCI	HLA 6121	45745	Jul. 27, 2022	Jul. 26, 2023
Preamplifier EMCI	EMC330N	980783	Jan. 16, 2023	Jan. 15, 2024
Preamplifier EMCI	EMC330N	980783	Jan. 16, 2023	Jan. 15, 2024
Preamplifier EMCI	EMC118A45SE	980810	Dec. 29, 2022	Dec. 28, 2023
Preamplifier EMCI	EMC184045SE	980787	Jan. 16, 2023	Jan. 15, 2024
RF signal cable EMCI	EMC104-SM-SM-(900 0+2000+1000)	201230+ 201242+ 210101	Jan. 16, 2023	Jan. 15, 2024
RF signal cable EMCI	EMCCFD400-NM-NM -(9000+300+500)	201252+ 201250+ 201245	Jan. 16, 2023	Jan. 15, 2024
RF signal cable EMCI	EMC101G-KM-KM-(5 000+3000+2000)	201261+201258+ 201249	Jan. 16, 2023	Jan. 15, 2024
Software BV CPS	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Turn Table Max-Full	MFT-151SS-0.5T	NA	NA	NA
Turn Table Controller Max-Full	MF-7802BS	MF780208675	NA	NA
Antenna Tower KaiTuo	NA	NA	NA	NA
Antenna Tower Controller KaiTuo	KT-2000	NA	NA	NA
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY5 5190004/MY55190 007/MY55210005	Jul. 13, 2022	Jul. 12, 2023
Antenna_Horn oxe89 QUINSTAR	QWH-QPRR00	QWH-QPRR00-1	Feb. 11, 2021	Feb. 10, 2024
Antenna_Horn Conical Keysight	WR15CH-Conical	RCHO15RL-1	Feb. 11, 2021	Feb. 10, 2024
RF cable Anritsu	LL403	2019010240001	Jan. 07, 2023	Jan. 06, 2024
Spectrum Analyzer Keysight	N9042B+V3050A	US60360159	Jan. 07, 2023	Jan. 06, 2024
Antenna_Horn Conical Keysight	WR10CH-Conical	RCHO10RL-1	Feb. 11, 2021	Feb. 10, 2024

NOTE:

1. The calibration interval of the above test instruments is 12/24/36 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in WM Chamber 7.
3. Tested date: 2023/2/13 ~ 2023/5/17

4.1.3 Test Procedures

For Radiated emission: Below 30MHz

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

Note:

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

For Radiated emission: 30MHz ~ 100GHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The distance at which limits are typically specified is 3 meter; however, closer measurement distances may be utilized.
- c. Begin handheld measurements with the test antenna (horn) at a distance of 1 meter from the EUT, in a horizontally polarized position. Slowly adjust its position, entirely covering the plane 1 meter from the EUT.
- d. Repeat (b) with the horn in a vertically polarized position.
- e. 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.
- f. 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.
- g. 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.
- h. 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:

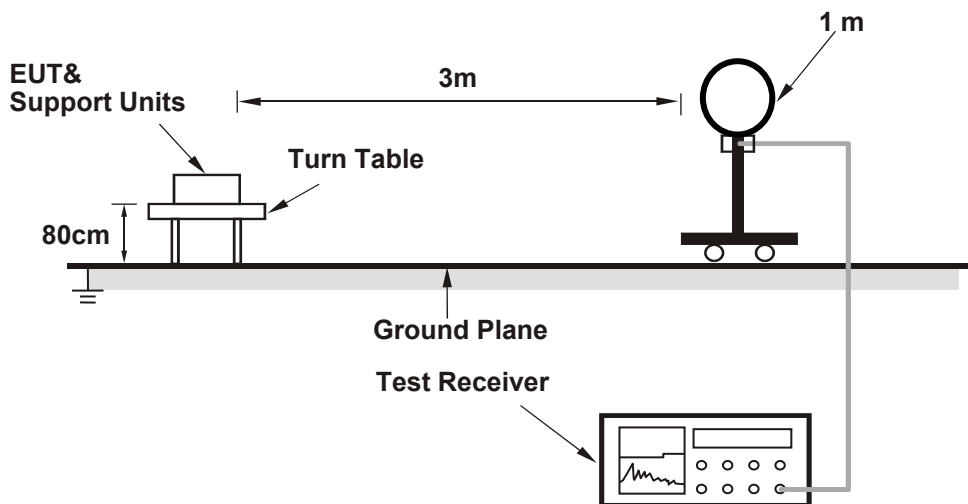
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection (PK) at frequency above 1GHz.
3. For Fundamental frequency and band edge & harmonic: The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle).
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

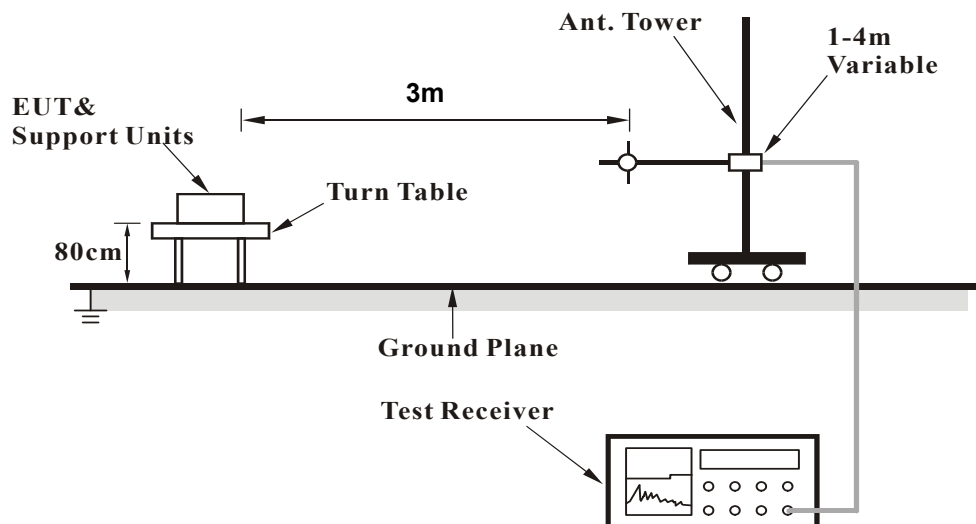
No deviation.

4.1.5 Test Setup

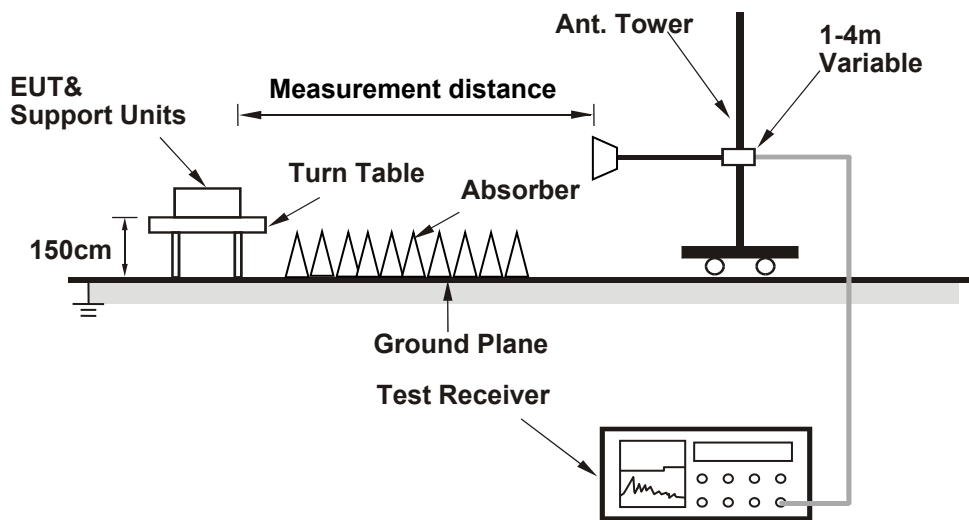
For Radiated emission below 30MHz



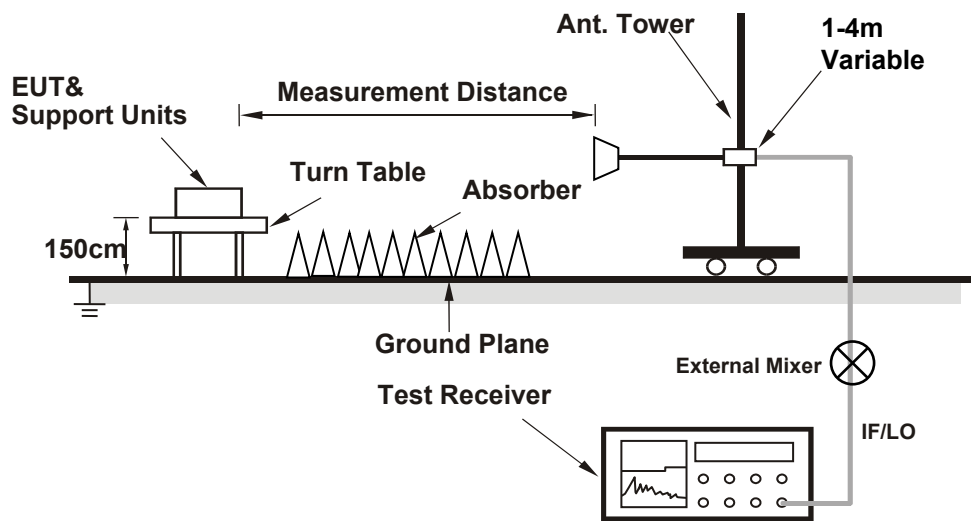
For Radiated emission 30MHz to 1GHz



For Radiated emission 1GHz ~ 40GHz



For Radiated emission above 40GHz



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. Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Mode A

For 1~18 GHz Data:

RF Mode	TX	Channel	CH 1 : 24.06795 GHz
Frequency Range	1GHz ~ 18GHz	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	16769.39	44.8 PK	74.0	-29.2	1.03 H	151	43.9	0.9
2	16769.39	32.9 AV	54.0	-21.1	1.03 H	151	32.0	0.9
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	16769.39	45.1 PK	74.0	-28.9	1.71 V	43	44.2	0.9
2	16769.39	33.2 AV	54.0	-20.8	1.71 V	43	32.3	0.9

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) + Distance Factor
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. Field strength limits are specified at a distance of 3 meters

The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) +20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).

For 18~40 GHz Data:

RF Mode	TX	Channel	CH 1 : 24.06795 GHz
Frequency Range	18GHz ~ 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	*24067.95	82.7 PK	128.0	-45.3	1.21 H	34	36.0	46.7
2	*24067.95	54.1 AV	108.0	-53.9	1.21 H	34	7.4	46.7
3	39509.00	56.4 PK	74.0	-17.6	1.74 H	255	57.2	-0.8
4	39509.00	44.7 AV	54.0	-9.3	1.74 H	255	45.5	-0.8
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	*24067.95	106.9 PK	128.0	-21.1	1.41 V	2	60.2	46.7
2	*24067.95	78.3 AV	108.0	-29.7	1.41 V	2	31.6	46.7
3	39509.00	56.6 PK	74.0	-17.4	1.26 V	21	57.4	-0.8
4	39509.00	44.9 AV	54.0	-9.1	1.26 V	21	45.7	-0.8

Remarks:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) +Distance Factor
- Margin value = Emission Level – Limit value
- The other emission levels were very low against the limit.
- The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20\log((0.037*1)/1) = -28.6\text{dB}$
 Please see page 22 for plotted duty.
- Field strength limits are specified at a distance of 3 meters
 The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) +20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).

Above 40GHz Data:

RF Mode	TX	Channel	CH 1 : 24.06795 GHz
Frequency Range	40GHz ~ 50GHz	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	48135.90	68.2 PK	88.0	-19.8	2.18 H	65	71.0	-2.8
2	48135.90	39.6 AV	68.0	-28.4	2.18 H	65	42.4	-2.8

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	48376.50	66.4 PK	88.0	-21.6	1.51 V	186	69.2	-2.8
2	48376.50	37.8 AV	68.0	-30.2	1.51 V	186	40.6	-2.8

Remarks:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
- Margin value = Emission Level – Limit value
- The other emission levels were very low against the limit.
- The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log ((0.037 * 1) / 1) = -28.6 \text{ dB}$
 Please see page 22 for plotted duty.
- Field strength limits are specified at a distance of 3 meters
 The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) + 20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).

RF Mode	TX	Channel	CH 1 : 24.06795 GHz
Frequency Range	50GHz ~ 75GHz	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	72203.85	69.4 PK	88.0	-18.6	1.28 H	350	73.5	-4.1
2	72203.85	40.8 AV	68.0	-27.2	1.28 H	350	44.9	-4.1

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	72203.85	63.0 PK	88.0	-25.0	1.41 V	307	67.1	-4.1
2	72203.85	34.4 AV	68.0	-33.6	1.41 V	307	38.5	-4.1

Remarks:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
- Margin value = Emission Level – Limit value
- The other emission levels were very low against the limit.
- The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log ((0.037 * 1) / 1) = -28.6 \text{ dB}$
 Please see page 22 for plotted duty.
- Field strength limits are specified at a distance of 3 meters
 The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) +20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).

RF Mode	TX	Channel	CH 1 : 24.06795 GHz
Frequency Range	75GHz ~ 100GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m

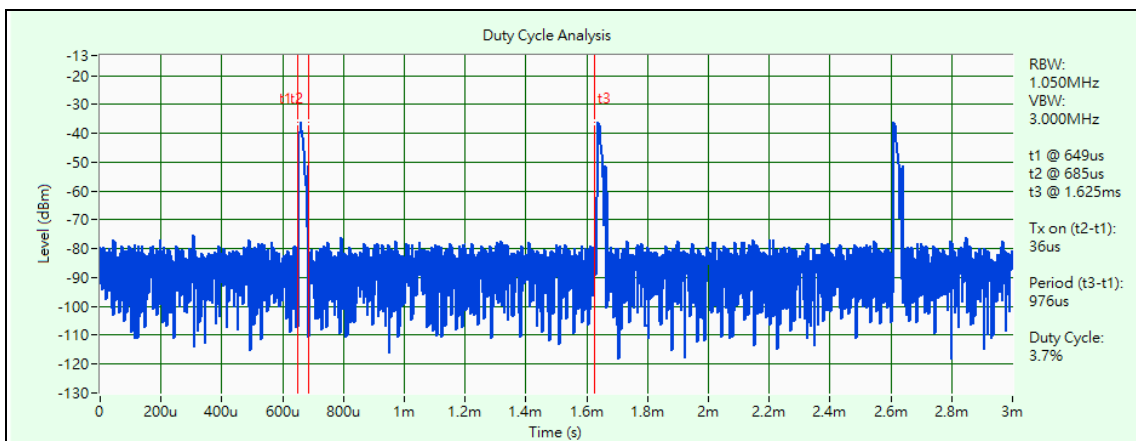
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	96271.80	69.2 PK	88.0	-18.8	1.42 H	64	55.5	13.7
2	96271.80	40.6 AV	68.0	-27.4	1.42 H	64	26.9	13.7

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	96271.80	71.1 PK	88.0	-16.9	1.42 V	352	57.4	13.7
2	96271.80	42.5 AV	68.0	-25.5	1.42 V	352	28.8	13.7

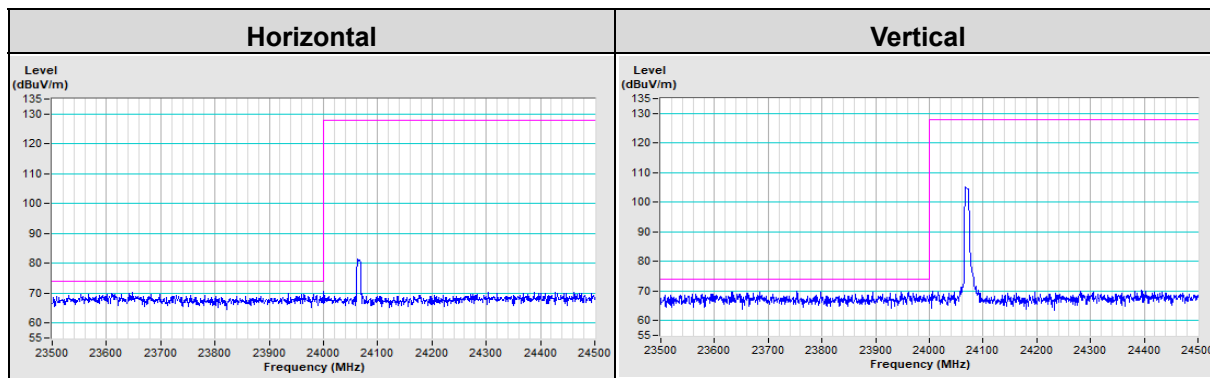
Remarks:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
- Margin value = Emission Level – Limit value
- The other emission levels were very low against the limit.
- The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log ((0.037 * 1) / 1) = -28.6 \text{ dB}$
 Please see page 22 for plotted duty.
- Field strength limits are specified at a distance of 3 meters
 The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) + 20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).



$$20 \log (\text{Duty cycle}) = 20 \log ((0.037 * 1) / 1) = -28.6 \text{ dB}$$

Plot of Band Edge



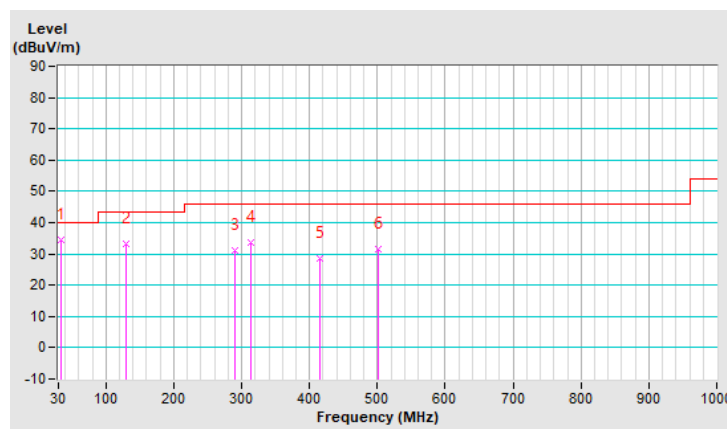
Below 1GHz Data:

RF Mode	TX	Channel	CH 1 : 24.06795 GHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	33.88	34.5 QP	40.0	-5.5	1.00 H	8	48.8	-14.3
2	129.91	33.1 QP	43.5	-10.4	1.00 H	36	47.8	-14.7
3	289.96	31.1 QP	46.0	-14.9	1.50 H	202	44.6	-13.5
4	314.21	33.8 QP	46.0	-12.2	1.00 H	161	46.6	-12.8
5	415.09	28.4 QP	46.0	-17.6	2.00 H	199	38.9	-10.5
6	500.45	31.6 QP	46.0	-14.4	1.50 H	319	40.3	-8.7

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 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



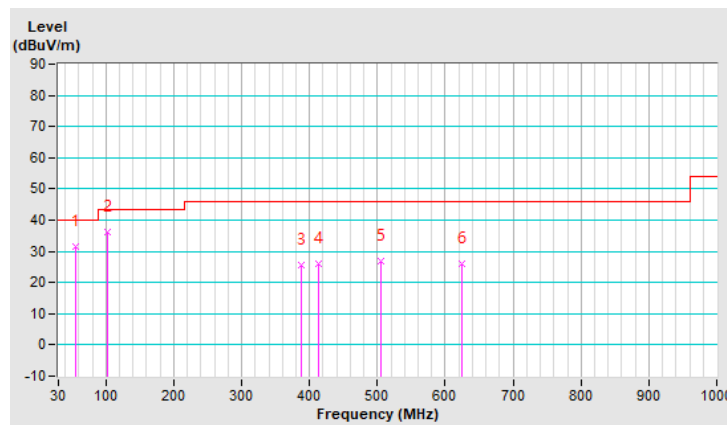
RF Mode	TX	Channel	CH 1 : 24.06795 GHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m

No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	56.19	31.6 QP	40.0	-8.4	1.00 V	69	45.5	-13.9
2	101.78	36.0 QP	43.5	-7.5	1.00 V	11	53.8	-17.8
3	386.96	25.7 QP	46.0	-20.3	2.00 V	301	36.8	-11.1
4	413.15	26.1 QP	46.0	-19.9	1.50 V	216	36.6	-10.5
5	505.30	26.9 QP	46.0	-19.1	1.00 V	103	35.4	-8.5
6	623.64	26.2 QP	46.0	-19.8	1.50 V	211	32.3	-6.1

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 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



Mode B

For 1~18 GHz Data:

RF Mode	TX	Channel	CH 1 : 24.18825 GHz
Frequency Range	1GHz ~ 18GHz	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	17617.50	45.1 PK	74.0	-28.9	1.65 H	121	44.3	0.8
2	17617.50	34.0 AV	54.0	-20.0	1.65 H	121	33.2	0.8

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	17617.50	45.3 PK	74.0	-28.7	1.77 V	203	44.5	0.8
2	17617.50	34.2 AV	54.0	-19.8	1.77 V	203	33.4	0.8

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) + Distance Factor
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. Field strength limits are specified at a distance of 3 meters

The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) +20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).

For 18~40 GHz Data:

RF Mode	TX	Channel	CH 1 : 24.18825 GHz
Frequency Range	18GHz ~ 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	*24188.25	84.7 PK	128.0	-43.3	1.41 H	50	38.1	46.6
2	*24188.25	58.0 AV	108.0	-50.0	1.41 H	50	11.4	46.6
3	37649.00	57.0 PK	74.0	-17.0	1.95 H	204	58.6	-1.6
4	37649.00	44.4 AV	54.0	-9.6	1.95 H	204	46.0	-1.6
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*24188.25	105.9 PK	128.0	-22.1	1.41 V	5	59.3	46.6
2	*24188.25	79.2 AV	108.0	-28.8	1.41 V	5	32.6	46.6
3	37649.00	57.4 PK	74.0	-16.6	1.04 V	67	59.0	-1.6
4	37649.00	44.6 AV	54.0	-9.4	1.04 V	67	46.2	-1.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log ((0.046 * 1) / 1) = -26.7 \text{ dB}$
 Please see page 30 for plotted duty.
6. Field strength limits are specified at a distance of 3 meters
 The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) + 20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).

Above 40GHz Data:

RF Mode	TX	Channel	CH 1 : 24.18825 GHz
Frequency Range	40GHz ~ 50GHz	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	48376.50	70.0 PK	88.0	-18.0	1.72 H	10	72.8	-2.8
2	48376.50	43.3 AV	68.0	-24.7	1.72 H	10	46.1	-2.8

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	48376.50	66.4 PK	88.0	-21.6	1.51 V	186	69.2	-2.8
2	48376.50	39.7 AV	68.0	-28.3	1.51 V	186	42.5	-2.8

Remarks:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
- Margin value = Emission Level – Limit value
- The other emission levels were very low against the limit.
- The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log ((0.046 * 1) / 1) = -26.7 \text{ dB}$
 Please see page 30 for plotted duty.
- Field strength limits are specified at a distance of 3 meters
 The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) + 20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).

RF Mode	TX	Channel	CH 1 : 24.18825 GHz
Frequency Range	50GHz ~ 75GHz	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	72564.75	62.8 PK	88.0	-25.2	1.33 H	31	66.8	-4.0
2	72564.75	36.1 AV	68.0	-31.9	1.33 H	31	40.1	-4.0

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	72564.75	56.2 PK	88.0	-31.8	1.40 V	333	60.2	-4.0
2	72564.75	29.5 AV	68.0	-38.5	1.40 V	333	33.5	-4.0

Remarks:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
- Margin value = Emission Level – Limit value
- The other emission levels were very low against the limit.
- The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log ((0.046 * 1) / 1) = -26.7 \text{ dB}$
 Please see page 30 for plotted duty.
- Field strength limits are specified at a distance of 3 meters
 The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) + 20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).

RF Mode	TX	Channel	CH 1 : 24.18825 GHz
Frequency Range	75GHz ~ 100GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m

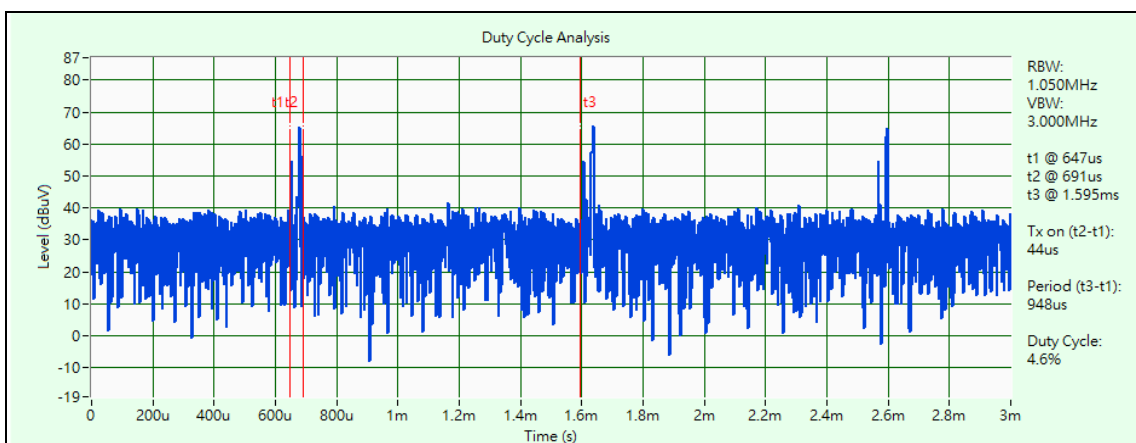
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	96753.00	70.2 PK	88.0	-17.8	1.49 H	315	56.5	13.7
2	96753.00	43.5 AV	68.0	-24.5	1.49 H	315	29.8	13.7

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	96753.00	67.1 PK	88.0	-20.9	1.42 V	355	53.4	13.7
2	96753.00	40.4 AV	68.0	-27.6	1.42 V	355	26.7	13.7

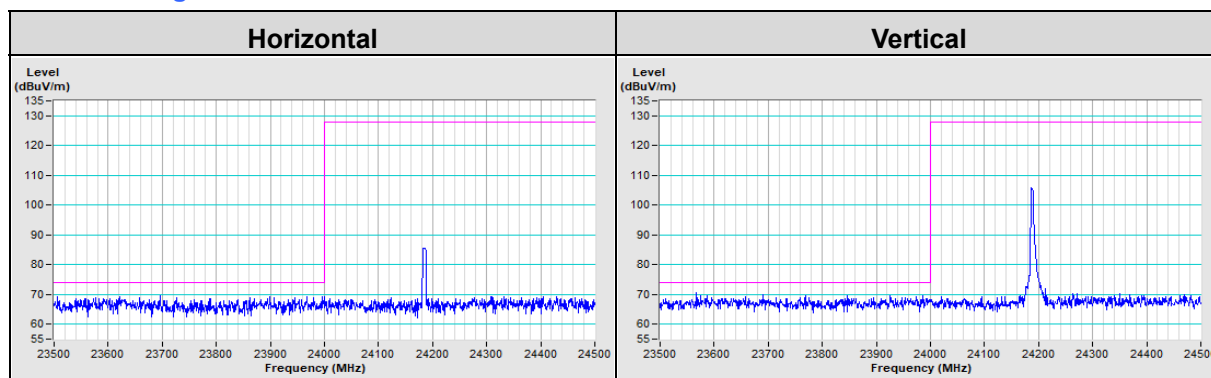
Remarks:

- Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
- Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
- Margin value = Emission Level – Limit value
- The other emission levels were very low against the limit.
- The average value of fundamental frequency is: Average = Peak value + 20log(Duty cycle) Where the duty factor is calculated from following formula:
 $20 \log (\text{Duty cycle}) = 20 \log ((0.046 * 1) / 1) = -26.7 \text{ dB}$
 Please see page 30 for plotted duty.
- Field strength limits are specified at a distance of 3 meters
 The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) +20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).



$$20 \log (\text{Duty cycle}) = 20 \log ((0.046 * 1) / 1) = -26.7 \text{ dB}$$

Plot of Band Edge



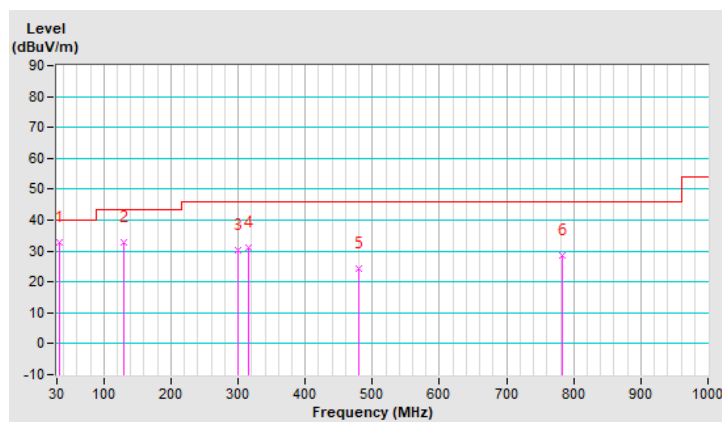
Below 1GHz Data:

RF Mode	TX	Channel	CH 1 : 24.18825 GHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	33.88	32.8 QP	40.0	-7.2	1.00 H	119	47.1	-14.3
2	128.94	32.7 QP	43.5	-10.8	1.00 H	99	47.6	-14.9
3	300.63	30.4 QP	46.0	-15.6	1.50 H	49	43.7	-13.3
4	315.18	31.3 QP	46.0	-14.7	1.50 H	203	44.1	-12.8
5	480.08	24.5 QP	46.0	-21.5	2.00 H	114	33.5	-9.0
6	783.69	28.6 QP	46.0	-17.4	1.00 H	80	32.1	-3.5

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 of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



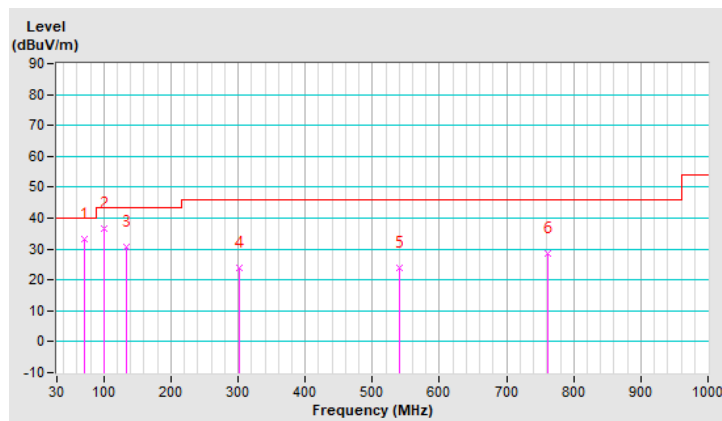
RF Mode	TX	Channel	CH 1 : 24.18825 GHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m

No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	71.71	33.1 QP	40.0	-6.9	1.00 V	2	49.5	-16.4
2	99.84	36.8 QP	43.5	-6.7	1.00 V	111	54.9	-18.1
3	132.82	30.5 QP	43.5	-13.0	1.50 V	206	45.0	-14.5
4	302.57	23.9 QP	46.0	-22.1	2.00 V	151	37.2	-13.3
5	541.19	24.1 QP	46.0	-21.9	1.50 V	23	32.0	-7.9
6	762.35	28.6 QP	46.0	-17.4	1.00 V	75	32.2	-3.6

Remarks:

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



Mode C

For 1~18 GHz Data:

RF Mode	TX	Channel	CH 1 : 24.17778 GHz
Frequency Range	1GHz ~ 18GHz	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	17235.00	45.6 PK	74.0	-28.4	1.50 H	2	45.0	0.6
2	17235.00	34.6 AV	54.0	-19.4	1.50 H	2	34.0	0.6
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	17235.00	45.2 PK	74.0	-28.8	1.78 V	201	44.6	0.6
2	17235.00	33.8 AV	54.0	-20.2	1.50 V	2	33.2	0.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. Field strength limits are specified at a distance of 3 meters

The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) +20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).

For 18~40 GHz Data:

RF Mode	TX	Channel	CH 1 : 24.17778 GHz
Frequency Range	18GHz ~ 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	*24177.78	75.8 PK	128.0	-52.2	1.24 H	27	28.8	47.0
2	*24177.78	75.8 AV	108.0	-32.2	1.24 H	27	28.8	47.0
3	39511.00	56.5 PK	74.0	-17.5	1.77 H	202	57.3	-0.8
4	39511.00	44.3 AV	54.0	-9.7	1.77 H	202	45.1	-0.8

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	*24177.78	85.9 PK	128.0	-42.1	1.25 V	0	38.9	47.0
2	*24177.78	85.9 AV	108.0	-22.1	1.25 V	0	38.9	47.0
3	39511.00	56.7 PK	74.0	-17.3	1.31 V	49	57.5	-0.8
4	39511.00	44.6 AV	54.0	-9.4	1.31 V	49	45.4	-0.8

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) +Distance Factor
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. Field strength limits are specified at a distance of 3 meters

The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) +20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).

Above 40GHz Data:

RF Mode	TX	Channel	CH 1 : 24.17778 GHz
Frequency Range	40GHz ~ 50GHz	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	48355.56	49.4 PK	88.0	-38.6	1.73 H	348	52.2	-2.8
2	48355.56	49.4 AV	68.0	-18.6	1.73 H	348	52.2	-2.8
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	48355.56	52.4 PK	88.0	-35.6	1.38 V	350	55.2	-2.8
2	48355.56	52.4 AV	68.0	-15.6	1.38 V	350	55.2	-2.8

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) + Distance Factor
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. Field strength limits are specified at a distance of 3 meters

The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) +20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).

RF Mode	TX	Channel	CH 1 : 24.17778 GHz
Frequency Range	50GHz ~ 75GHz	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	72533.34	47.7 PK	88.0	-40.3	1.75 H	349	51.7	-4.0
2	72533.34	47.7 AV	68.0	-20.3	1.75 H	349	51.7	-4.0

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	72533.34	48.0 PK	88.0	-40.0	1.38 V	352	52.0	-4.0
2	72533.34	48.0 AV	68.0	-20.0	1.38 V	352	52.0	-4.0

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) + Distance Factor
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. Field strength limits are specified at a distance of 3 meters

The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) +20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).

RF Mode	TX	Channel	CH 1 : 24.17778 GHz
Frequency Range	75GHz ~ 100GHz	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	96711.12	59.8 PK	88.0	-28.2	1.73 H	345	46.1	13.7
2	96711.12	59.8 AV	68.0	-8.2	1.73 H	345	46.1	13.7

Antenna Polarity & Test Distance : Vertical at 3 m

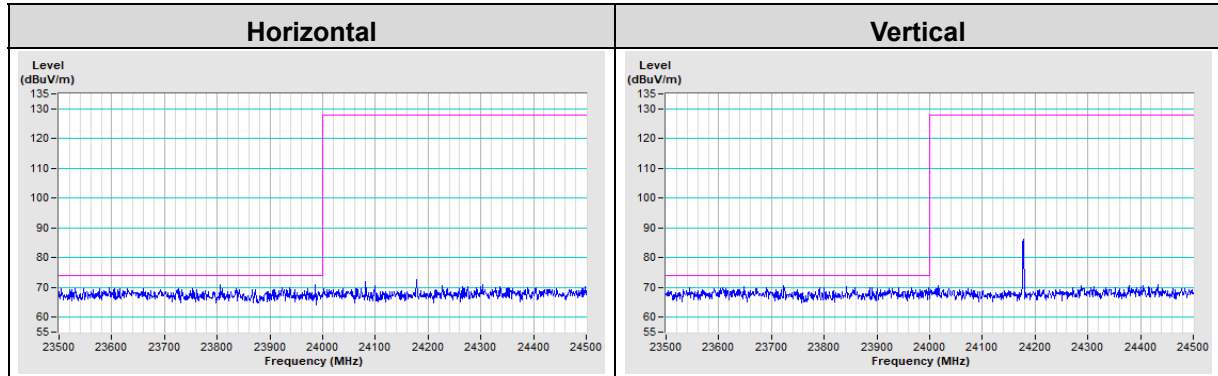
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	96711.12	60.1 PK	88.0	-27.9	1.40 V	349	46.4	13.7
2	96711.12	60.1 AV	68.0	-7.9	1.40 V	349	46.4	13.7

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) +Distance Factor
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. Field strength limits are specified at a distance of 3 meters

The measurements made at 1 meter distance. The data obtained at 1-meter distance was extrapolate results to the 3-m distance: Test value at 3-meter distance (dBuV) = Test value at 1 meter distance (dBuV) +20log(1/3)(dB) = Test value at 1 meter distance (dBuV) -9.5(dB).

Plot of Band Edge



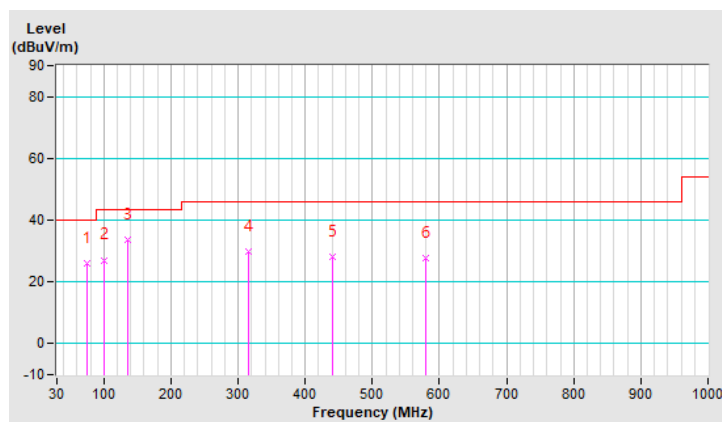
Below 1GHz Data:

RF Mode	TX	Channel	CH 1 : 24.17778 GHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	75.59	26.0 QP	40.0	-14.0	2.00 H	253	43.0	-17.0
2	100.81	27.1 QP	43.5	-16.4	2.00 H	252	44.4	-17.3
3	135.73	33.6 QP	43.5	-9.9	1.51 H	2	47.4	-13.8
4	315.18	29.9 QP	46.0	-16.1	1.01 H	277	42.0	-12.1
5	440.31	28.2 QP	46.0	-17.8	2.00 H	233	37.1	-8.9
6	579.02	27.8 QP	46.0	-18.2	1.51 H	178	33.8	-6.0

Remarks:

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



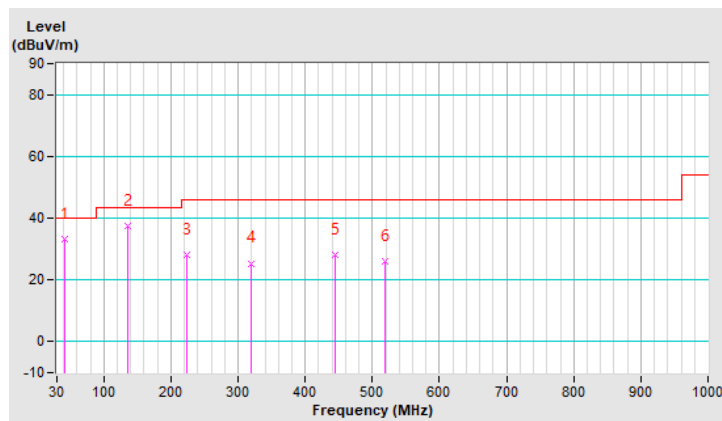
RF Mode	TX	Channel	CH 1 : 24.17778 GHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m

No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	42.61	33.1 QP	40.0	-6.9	1.50 V	208	46.5	-13.4
2	135.73	37.6 QP	43.5	-5.9	1.00 V	69	51.4	-13.8
3	223.03	28.0 QP	46.0	-18.0	1.00 V	2	44.6	-16.6
4	320.03	25.4 QP	46.0	-20.6	1.00 V	111	37.4	-12.0
5	445.16	28.1 QP	46.0	-17.9	2.00 V	272	36.9	-8.8
6	519.85	26.2 QP	46.0	-19.8	1.00 V	183	33.7	-7.5

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 of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

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

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

Mode B

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Test Receiver ROHDE & SCHWARZ	ESR3	102412	Dec. 21, 2022	Dec. 20, 2023
RF signal cable Woken	5D-FB	Cable-cond1-01	Jan. 07, 2023	Jan. 06, 2024
LISN ROHDE & SCHWARZ (EUT)	ENV216	101196	May 24, 2022	May 23, 2023
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Sep. 22, 2022	Sep. 21, 2023
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in HwaYa Shielded Room 2 (Conduction 2).

3. The VCCI Site Registration No. is C-12047.

4. Test Date: 2023/2/28

Mode A, C

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 05, 2022	Dec. 04, 2023
RF signal cable Woken	5D-FB	Cable-cond1-01	Jan. 07, 2023	Jan. 06, 2024
LISN ROHDE & SCHWARZ (EUT)	ENV216	101826	Mar. 14, 2022	Mar. 13, 2023
			Mar. 23, 2023	Mar. 22, 2024
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Sep. 12, 2022	Sep. 11, 2023
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	NA	NA

- Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Shielded Room 1 (Conduction 1).
 3. The VCCI Site Registration No. is C-12040.
 4. Test Date: 2023/2/28 & 2023/5/11

4.2.3 Test Procedures

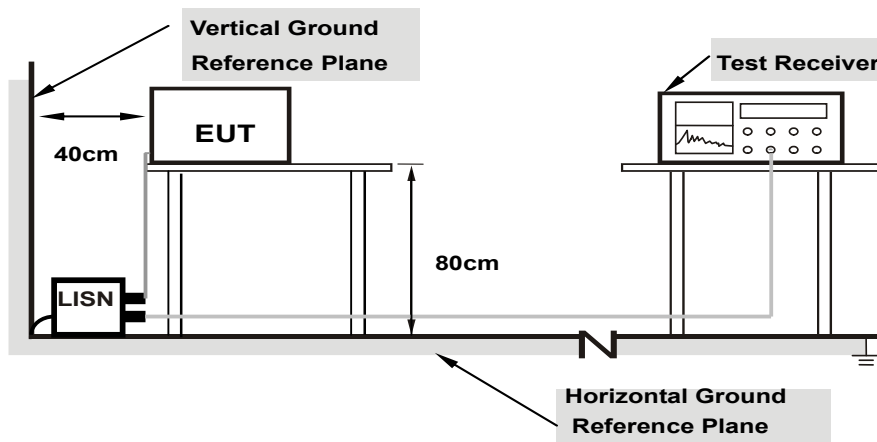
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling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

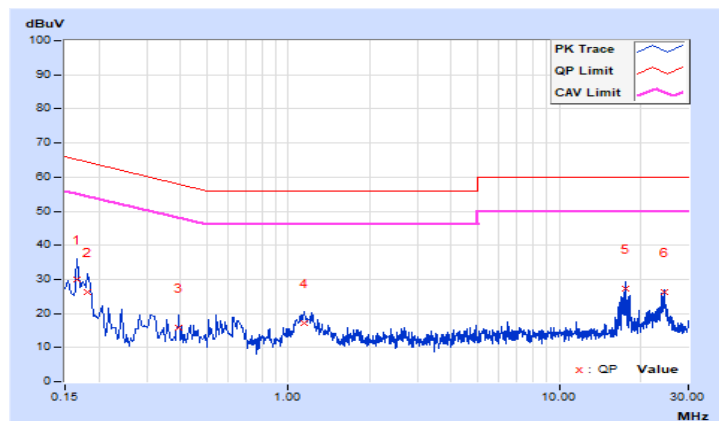
Mode A

RF Mode	TX	Channel	CH 1 : 24.06795 GHz
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	0.16600	10.12	19.78	6.95	29.90	17.07	65.16	55.16	-35.26	-38.09
2	0.18180	10.12	16.16	5.61	26.28	15.73	64.40	54.40	-38.12	-38.67
3	0.39400	10.13	5.74	2.38	15.87	12.51	57.98	47.98	-42.11	-35.47
4	1.14200	10.14	7.10	0.78	17.24	10.92	56.00	46.00	-38.76	-35.08
5	17.57000	10.84	16.48	11.83	27.32	22.67	60.00	50.00	-32.68	-27.33
6	24.35000	10.97	15.24	9.80	26.21	20.77	60.00	50.00	-33.79	-29.23

Remarks:

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

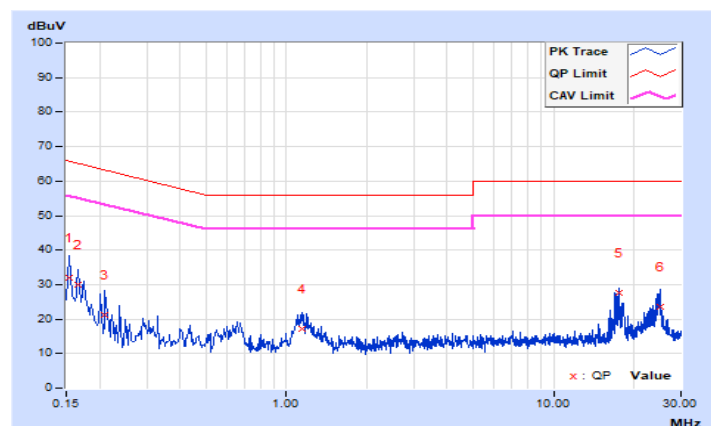


RF Mode	TX	Channel	CH 1 : 24.06795 GHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	0.15400	10.14	21.97	15.20	32.11	25.34	65.78	55.78	-33.67	-30.44
2	0.16600	10.15	19.95	7.54	30.10	17.69	65.16	55.16	-35.06	-37.47
3	0.21000	10.16	10.99	5.02	21.15	15.18	63.21	53.21	-42.06	-38.03
4	1.14200	10.18	7.04	3.83	17.22	14.01	56.00	46.00	-38.78	-31.99
5	17.57000	10.64	16.84	12.19	27.48	22.83	60.00	50.00	-32.52	-27.17
6	25.15000	10.68	12.98	5.10	23.66	15.78	60.00	50.00	-36.34	-34.22

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



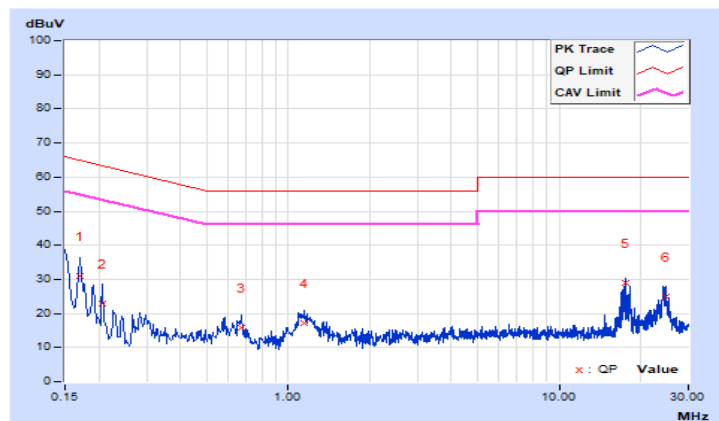
Mode B

RF Mode	TX	Channel	CH 1 : 24.18825 GHz
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	0.17000	10.12	20.81	9.48	30.93	19.60	64.96	54.96	-34.03	-35.36
2	0.20600	10.13	12.81	3.11	22.94	13.24	63.37	53.37	-40.43	-40.13
3	0.66987	10.13	5.77	2.48	15.90	12.61	56.00	46.00	-40.10	-33.39
4	1.15000	10.14	7.00	1.31	17.14	11.45	56.00	46.00	-38.86	-34.55
5	17.69400	10.84	18.27	14.71	29.11	25.55	60.00	50.00	-30.89	-24.45
6	24.79000	10.97	14.07	9.26	25.04	20.23	60.00	50.00	-34.96	-29.77

Remarks:

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

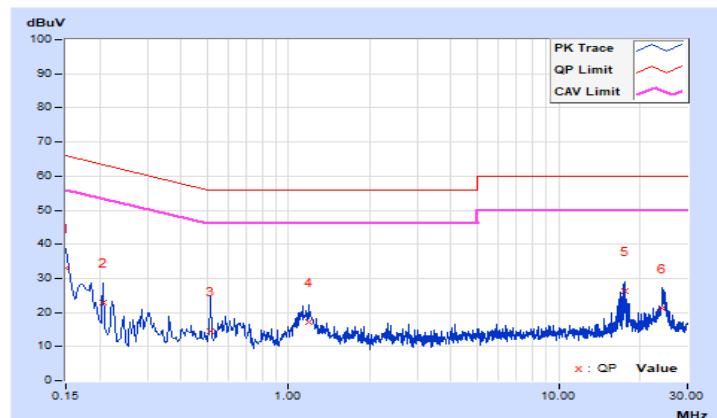


RF Mode	TX	Channel	CH 1 : 24.18825 GHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	0.15000	10.14	22.77	12.78	32.91	22.92	66.00	56.00	-33.09	-33.08
2	0.20600	10.16	12.84	3.11	23.00	13.27	63.37	53.37	-40.37	-40.10
3	0.51400	10.17	4.35	1.43	14.52	11.60	56.00	46.00	-41.48	-34.40
4	1.19000	10.18	6.85	0.53	17.03	10.71	56.00	46.00	-38.97	-35.29
5	17.57000	10.64	15.74	11.22	26.38	21.86	60.00	50.00	-33.62	-28.14
6	24.14600	10.68	10.55	0.25	21.23	10.93	60.00	50.00	-38.77	-39.07

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



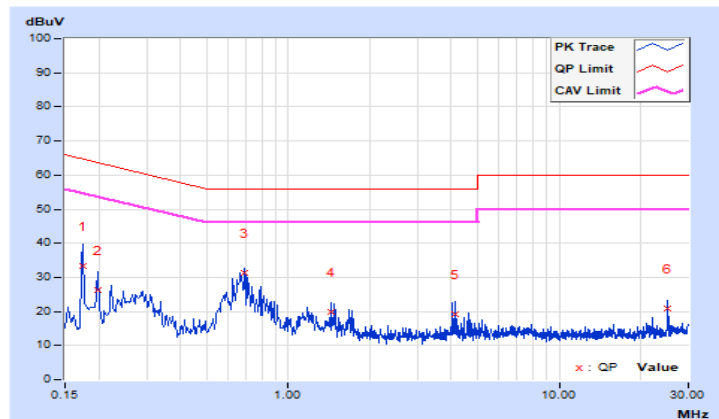
Mode C

RF Mode	TX	Channel	CH 1 : 24.17778 GHz
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	0.17400	9.63	23.59	17.54	33.22	27.17	64.77	54.77	-31.55	-27.60
2	0.19800	9.64	16.77	12.64	26.41	22.28	63.69	53.69	-37.28	-31.41
3	0.69000	9.68	21.60	16.47	31.28	26.15	56.00	46.00	-24.72	-19.85
4	1.44200	9.70	10.05	3.32	19.75	13.02	56.00	46.00	-36.25	-32.98
5	4.15000	9.74	9.59	2.01	19.33	11.75	56.00	46.00	-36.67	-34.25
6	25.17000	9.75	11.26	8.01	21.01	17.76	60.00	50.00	-38.99	-32.24

Remarks:

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

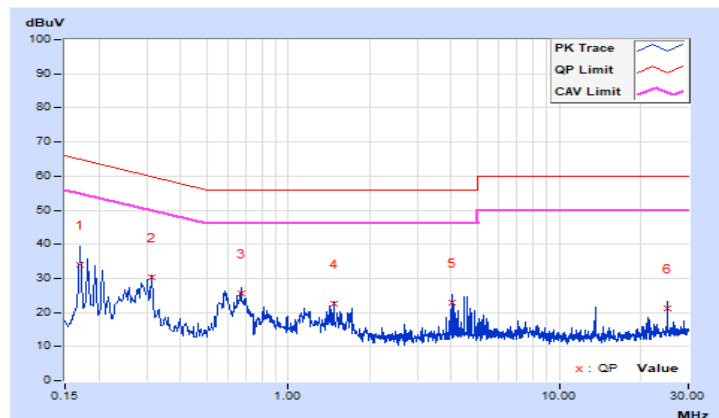


RF Mode	TX	Channel	CH 1 : 24.17778 GHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	0.17000	9.63	24.26	15.04	33.89	24.67	64.96	54.96	-31.07	-30.29
2	0.31400	9.66	20.70	14.22	30.36	23.88	59.86	49.86	-29.50	-25.98
3	0.67000	9.68	15.77	10.16	25.45	19.84	56.00	46.00	-30.55	-26.16
4	1.47400	9.71	13.00	8.02	22.71	17.73	56.00	46.00	-33.29	-28.27
5	4.05000	9.75	13.23	7.30	22.98	17.05	56.00	46.00	-33.02	-28.95
6	25.16600	9.88	11.47	8.23	21.35	18.11	60.00	50.00	-38.65	-31.89

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 20dB Bandwidth Measurement

4.3.1 Limits of 20dB bandwidth Measurement

According to 15.215(c), the requirement is to ensure the 20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified, is contained within the frequency band designated in the rule section under which the equipment is operated.

4.3.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

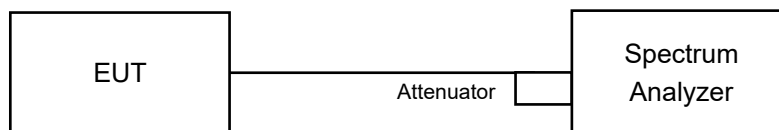
4.3.3 Test Procedures

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100kHz RBW (for mode A, B), 200Hz RBW (for mode C) and 300kHz VBW (for mode A, B), 620Hz VBW (for mode C). The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

4.3.4 Deviation from Test Standard

No deviation

4.3.5 Test Setup

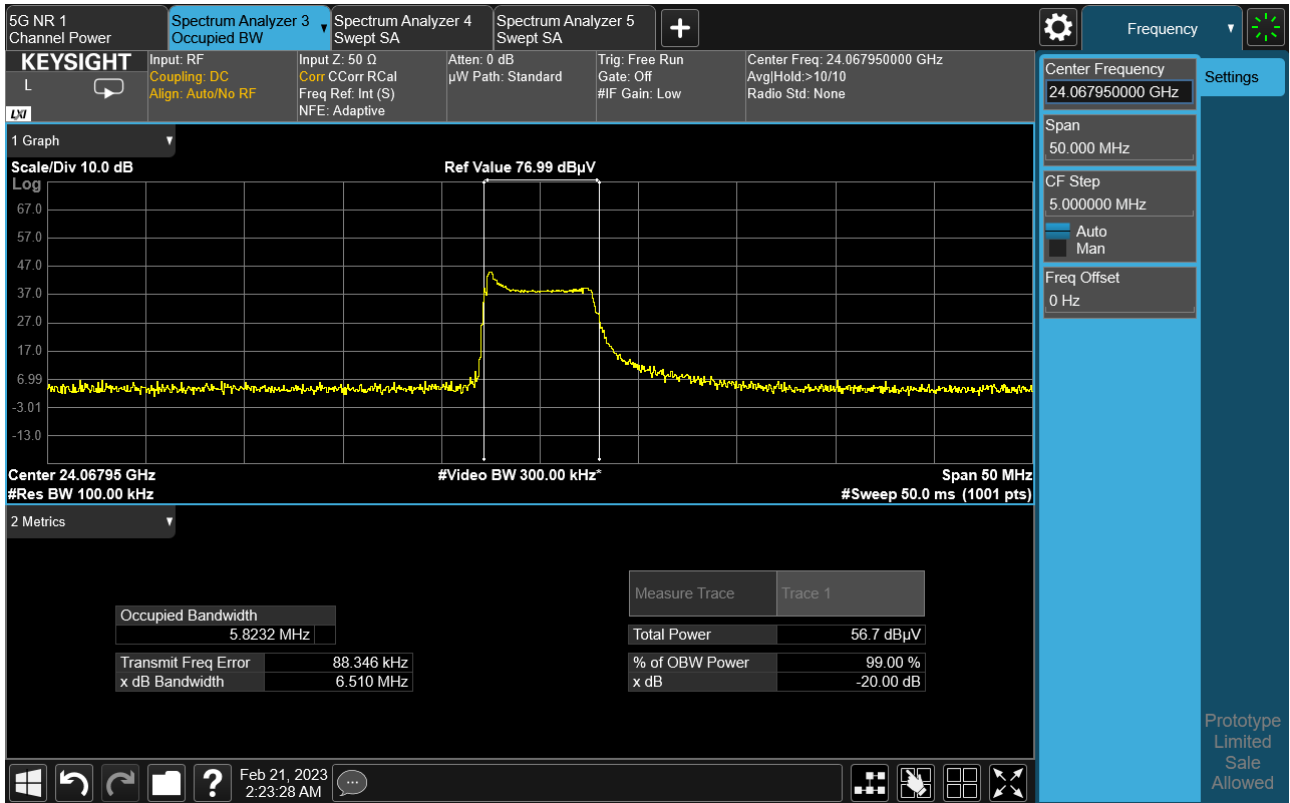


4.3.6 EUT Operating Conditions

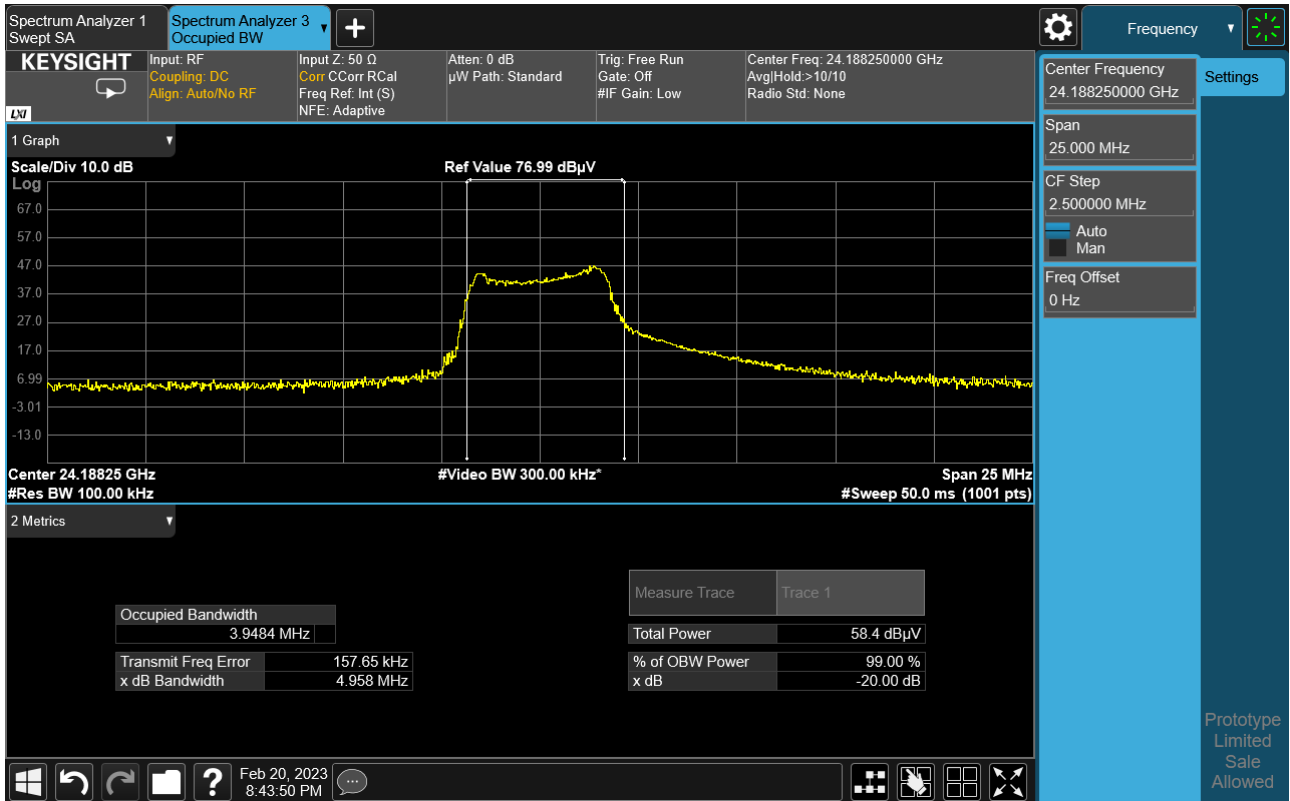
The software provided by client to enable the EUT under transmission condition continuously.

4.3.7 Test Results

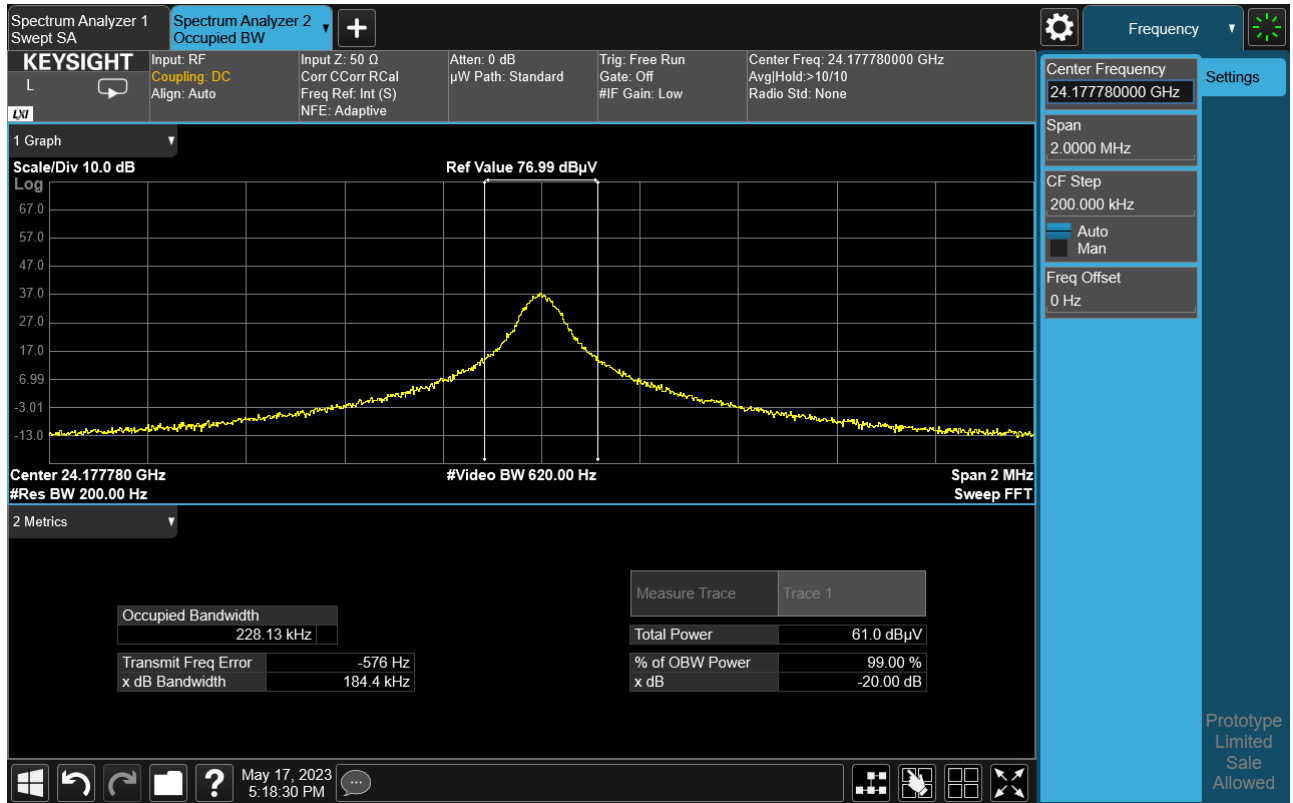
Mode A



Mode B



Mode C



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 and approved according to ISO/IEC 17025.

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

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Web Site: <http://ee.bureauveritas.com.tw>

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

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