FCC Test Report

Report No.:	RFBCFP-WTW-P22100652
FCC ID:	Q3V-MRS32B
Product:	MRS Tubular Motor
Test Model:	MRS-32B
Received Date:	2022/10/25
Test Date:	2022/11/16~2022/11/24
Issued Date:	2022/12/13
Applicant:	Nien Made Enterprise Co., Ltd.
Address:	23F.-1, No. 98, Shizheng N. 7th Rd., Xitun Dist.,Taichung City 407,Taiwan
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
FCC Registration / Designation Number:	198487 / TW2021

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RFBCFP-WTW-P22100652	Original release.	2022/12/13

1 Certificate of Conformity

Product: MRS Tubular Motor

Test Model: MRS-32B

Sample Status: Engineering sample

Applicant: Nien Made Enterprise Co., Ltd.

Test Date: 2022/11/16~2022/11/24

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 : Annie Chang , **Date:** 2022/12/13
Annie Chang / Senior Specialist

Approved by : Jeremy Lin , **Date:** 2022/12/13
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 -21.21dB at 0.42576MHz.
15.215	Channel Bandwidth Measurement	PASS	Meet the requirement of limit.
15.209 15.249 15.249 (d)	Radiated Emission and Bandedge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -9.8dB at 61.04MHz.
15.203	Antenna Requirement	PASS	IPEX 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) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.00 dB
Conducted Emissions	9kHz ~ 40GHz	2.63 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	2.38 dB
	30MHz ~ 1000MHz	5.70 dB
Radiated Emissions above 1 GHz	Above 1GHz	5.37 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	MRS Tubular Motor
Test Model	MRS-32B
Status of EUT	Engineering sample
Power Supply Rating	16.4Vdc from Power Chrager (PB-01S) or 24Vdc from Adapter via Power Chrager (PB-02) or 10.89Vdc /10.8Vdc from Internal Battery
Modulation Type	GFSK
Operating Frequency	2415MHz ~ 2459MHz
Number of Channel	3
Field Strength	71.7dBuV/m (3m)
Accessory Device	Refer to note as below
Data Cable Supplied	N/A

Note:

1. The EUT uses following accessories.

Item	Brand	Model	Specification
Battery 1	JHIH HONG	T20004-1	10.89Vdc, 2600mAh, 28.314Wh.
Battery 2	JHIH HONG	T20004-2	10.8Vdc, 3300mAh, 35.64Wh

2. The EUT uses following support unit.

Item	Brand	Model	Specification
Remote control	NienMade	RC-A01	-
36W Adapter	UNIFIVE	UHVUU3036-240015SA	AC I/P: 100-240V, 50/60Hz, 0.9A DC O/P: 24V, 1.5A, 36.0W Non-shielded DC cable (1.5m, 1 core)
36W Non-shielded DC extend cable	-	-	2m
Power Charger	NienMade	PB-01S	-
Power Charger	NienMade	PB-02	-

3. For Radiated Emissions test, the following modes were pre-tested:
   - ✧ Charging Mode (Powered from Power Chrager (PB-01S))
   - ✧ Charging Mode (Powered from Adapter via Power Chrager (PB-02))
   - ✧ Operating Mode (Powered from 3300mAh Battery)
   - ✧ Operating Mode (Powered from 2600mAh Battery)

   The worst emission level was found when the EUT tested under **Operating Mode (Powered from 2600mAh Battery),** therefore, only its test data was recorded in this report.
4. 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.

3.2 Antenna Description of EUT

The antenna information is listed as below.

Gain (dBi)	Antenna Type	Connector Type
0.52	Monopole	IPEX

Note: 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.

3.3 Description of Test Modes

3 channels are provided to this EUT:

Channel	Frequency (MHz)
1	2415
2	2439
3	2459

3.3.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE≥1G	RE<1G	PLC	APCM	
A	√	√	-	√	Operating Mode (Powered from Int. Battery)
B	-	√	√	-	Charging Mode (Powered from Adapter via Power Charger_PB-02)

Where **RE≥1G:** Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission
APCM: Antenna Port Conducted Measurement

Radiated Emission Test (Above 1GHz):

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

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A	1 to 3	1, 2, 3	GFSK

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	Available Channel	Tested Channel	Modulation Type
A	1 to 3	3	GFSK
B	-	-	-

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	Available Channel	Tested Channel	Modulation Type
B	-	-	-

Antenna Port Conducted Measurement:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

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

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

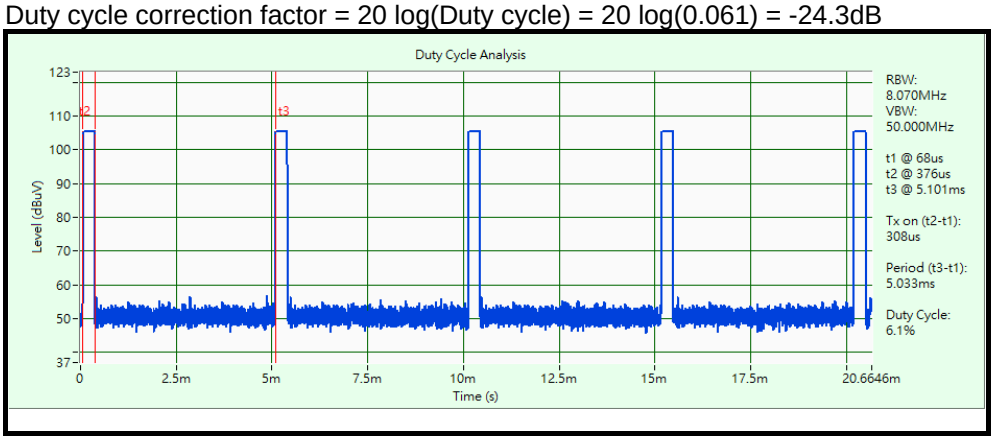
EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
A	1 to 3	1, 2, 3	GFSK

Test Condition:

Applicable To	EUT Configure Mode	Environmental Conditions	Input Power	Tested By
RE≥1G	A	16.3deg. C,62.7%RH	10.89Vdc	Jed Wu
RE<1G	A	23deg. C, 70%RH	10.89Vdc	Ian Chang
	B	23deg. C, 70%RH	120Vac, 60Hz	Ian Chang
PLC	B	25deg. C, 75%RH	120Vac, 60Hz	Pirar Hsieh
APCM	A	25deg. C, 76%RH	10.89Vdc	Dalen Dai

3.4 Duty Cycle of Test Signal

Duty cycle correction factor = 20 log(Duty cycle) = 20 log(0.061) = -24.3dB



3.5 Description of Support Units

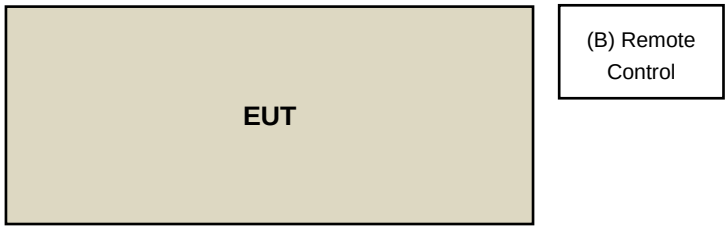
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	36W Adapter	UNIFIVE	UHVUU3036-240015SA	N/A	N/A	Supplied by applicant
B	Remote control	NienMade	RC-A01	N/A	N/A	Supplied by applicant
C	Power Charger	NienMade	PB-02	N/A	N/A	Supplied by applicant

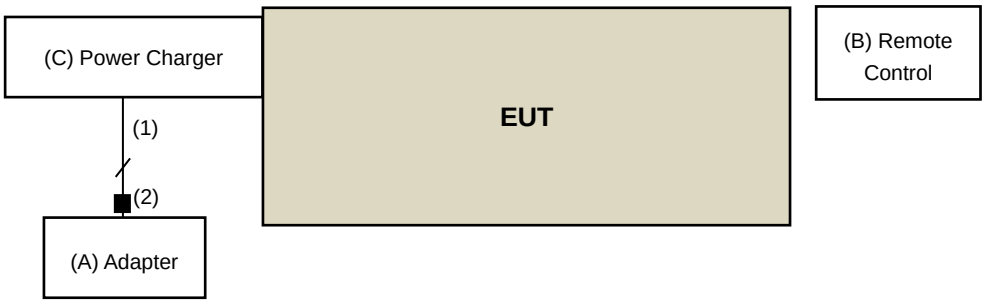
ID	Cable Descriptions	Qty.	Length(m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	DC extend Cable	1	2	N	0	Supplied by applicant
2	DC Cable	1	1.5	N	1	Supplied by applicant

3.5.1 Configuration of System under Test

Mode A



Mode B



3.6 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

Radiated Emissions up to 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Bi_Log Antenna Schwarzbeck	VULB 9168	137	2022/10/21	2023/10/20
Coupling/Dcoupling Network Schwarzbeck	CDNE-M2	00097	2022/6/1	2023/5/31
	CDNE-M3	00091	2022/6/1	2023/5/31
LOOP ANTENNA EMCI	LPA600	270	2021/9/2	2023/9/1
Pre_Amplifier EMCI	EMC001340	980269	2022/6/28	2023/6/27
Pre_Amplifier HP	8447D	2432A03504	2022/2/17	2023/2/16
RF Coaxial Cable Pacific	8D-FB	Cable-CH6-02	2022/6/30	2023/6/29
Software BVADT	Radiated_V8.7.08	N/A	N/A	N/A
Spectrum Analyzer R&S	FSV40	101544	2022/5/9	2023/5/8
Test Receiver Agilent	N9038A	MY51210129	2022/4/8	2023/4/7
		MY51210137	2022/6/9	2023/6/8
Tower ADT	AT100	0306	N/A	N/A
Turn Table ADT	TT100	0306	N/A	N/A

NOTE: 1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Linkou 966 Chamber 6 (CH 6).
3. Tested Date: 2022/11/24

Radiated Emissions above 1 GHz

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until
Spectrum Analyzer Agilent	E4446A	MY51100009	2022/6/27	2023/6/26
Spectrum Analyzer KEYSIGHT	N9030A	MY54490260	2022/7/14	2023/7/13
Test Receiver Agilent	N9038A	MY51210129	2022/4/8	2023/4/7
Test Receiver Agilent	N9038A	MY51210137	2022/6/9	2023/6/8
Spectrum Analyzer R&S	FSV40	101544	2022/5/9	2023/5/8
Spectrum Analyzer R&S	FSV40	101042	2022/9/5	2023/9/4
Pre-amplifier HP	8449B	3008A01201	2022/2/17	2023/2/16
Pre_Amplifier EMCI	EMC0126545	980076	2022/2/17	2023/2/16
Horn Antenna ETS-Lindgren	3117-PA	00215857	2022/11/13	2023/11/12
Horn Antenna EMCO	3115	00028257	2022/11/13	2023/11/12
Horn Antenna EMCO	3115	00027024	2022/11/13	2023/11/12
Pre-amplifier (18GHz-40GHz) EMCI	EMC184045B	980175	2022/9/3	2023/9/2
Pre_Amplifier EMCI	EMC184045B	980235	2022/2/17	2023/2/16
Horn Antenna Schwarzbeck	BBHA 9170	212	2022/10/20	2023/10/19
RF Coaxial Cable HUBER SUHNER	SF-104	Cable-CH6-01	2022/9/20	2023/9/19
RF Coaxial Cable EM	EM102-KMKM-3.5+1M	EM102-KMKM-3.5+1M-01	2022/7/7	2023/7/6
Band Pass Filter MICRO-TRONICS	BRM17690	005	2022/5/26	2023/5/25
Notch Filter MICRO-TRONICS	BRC50703-01	010	2022/5/26	2023/5/25
High Pass Filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	2022/5/26	2023/5/25
RF Coaxial Cable EM	EM102-KMKM-3.5+1M	EM102-KMKM-3.5+1M-01	2022/7/7	2023/7/6
Boresight antenna tower fixture BV	BAF-02	6	NA	NA
Turn Table ADT	TT100	0306	NA	NA
Tower ADT	AT100	0306	NA	NA
Software BVADT	Radiated_V8.7.08	NA	NA	NA
Software BVADT	Radiated_V7.7.1.1.1	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 Linkou 966 Chamber 6 (CH 6).
3. Tested Date: 2022/11/16

4.1.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

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

c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

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

For Radiated emission above 30MHz

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

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

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

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

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

f. The test-receiver system was set to peak and average 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) and Average detection at frequency above 1GHz. For fundamental and harmonic signal measurement, according to ANSI C63.10 section 7.5, the average value = peak value + duty factor. The duty factor refer to Chapter 3.3 of this report.

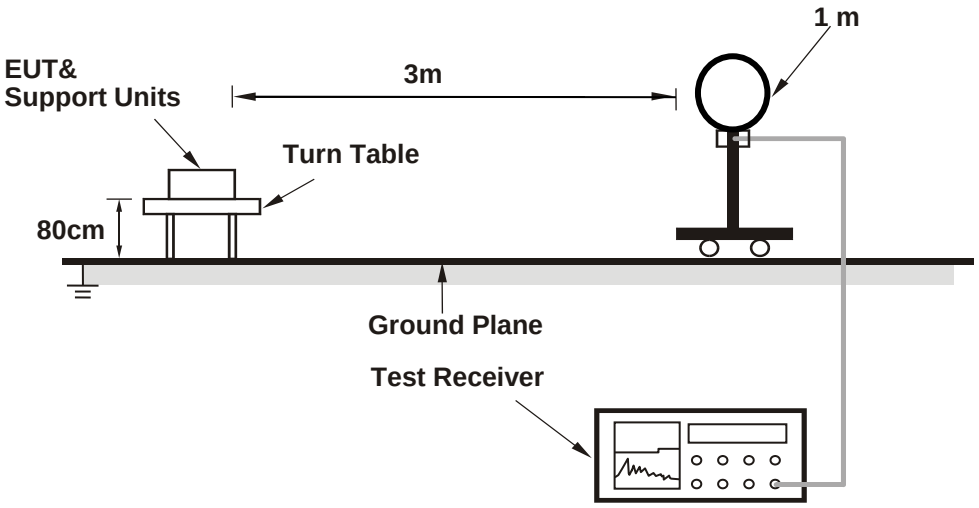
3. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

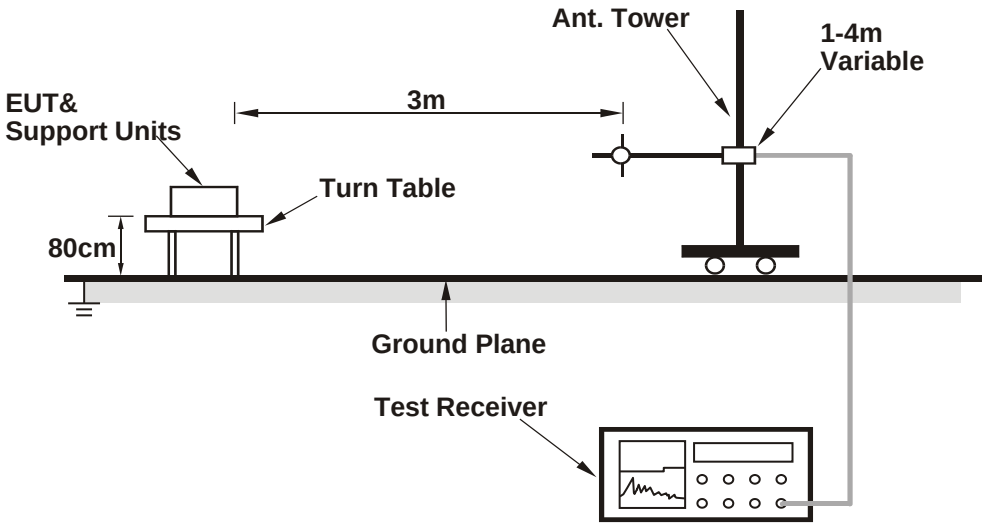
No deviation.

4.1.5 Test Setup

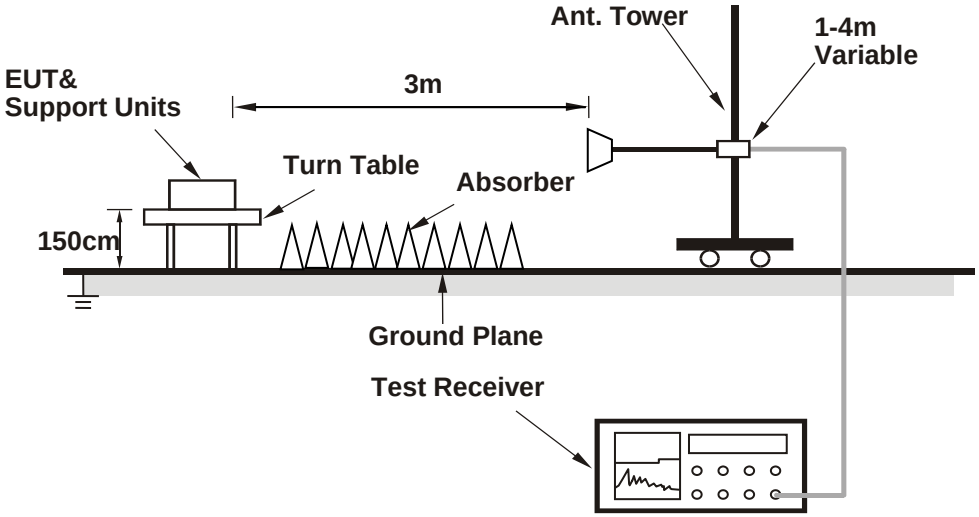
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

Mode A

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

Mode B

a. Connected the EUT to Adapter via Power Charger.
b. Set the EUT under charging condition.

4.1.7 Test Results

Mode A

ABOVE 1GHz DATA

RF Mode	GFSK	Channel	CH 1：2415 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz (AV) RB = 1 MHz, VB = 3 MHz (RMS)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	46.7 PK	74.0	-27.3	1.19 H	333	44.6	2.1
2	2390.00	39.2 AV	54.0	-14.8	1.19 H	333	37.1	2.1
3	2400.00	32.9 PK	74.0	-41.1	1.19 H	333	30.8	2.1
4	2400.00	8.6 AV	54.0	-45.4	1.19 H	333	6.5	2.1
5	*2415.00	95.2 PK	114.0	-18.8	1.19 H	333	93.0	2.2
6	*2415.00	70.9 AV	94.0	-23.1	1.19 H	333	68.7	2.2
7	4830.00	51.1 PK	74.0	-22.9	1.44 H	307	38.7	12.4
8	4830.00	26.8 AV	54.0	-27.2	1.44 H	307	14.4	12.4
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	45.6 PK	74.0	-28.4	3.01 V	172	43.5	2.1
2	2390.00	35.9 AV	54.0	-18.1	3.01 V	172	33.8	2.1
3	2400.00	32.3 PK	74.0	-41.7	3.01 V	172	30.2	2.1
4	2400.00	8.0 AV	54.0	-46.0	3.01 V	172	5.9	2.1
5	*2415.00	92.5 PK	114.0	-21.5	3.01 V	172	90.3	2.2
6	*2415.00	68.2 AV	94.0	-25.8	3.01 V	172	66.0	2.2
7	4830.00	50.6 PK	74.0	-23.4	3.69 V	254	38.2	12.4
8	4830.00	26.3 AV	54.0	-27.7	3.69 V	254	13.9	12.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:
   20 log(Duty cycle) = 20 log(0.308 ms / 5.033 ms) = -24.3 dB

RF Mode	GFSK	Channel	CH 2：2439 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz (AV) RB = 1 MHz, VB = 3 MHz (RMS)

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	*2439.00	95.8 PK	114.0	-18.2	1.02 H	332	93.6	2.2
2	*2439.00	71.5 AV	94.0	-22.5	1.02 H	332	69.3	2.2
3	4878.00	52.0 PK	74.0	-22.0	1.27 H	306	39.3	12.7
4	4878.00	27.7 AV	54.0	-26.3	1.27 H	306	15.0	12.7
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	*2439.00	93.1 PK	114.0	-20.9	2.84 V	171	90.9	2.2
2	*2439.00	68.8 AV	94.0	-25.2	2.84 V	171	66.6	2.2
3	4878.00	51.5 PK	74.0	-22.5	3.52 V	253	38.8	12.7
4	4878.00	27.2 AV	54.0	-26.8	3.52 V	253	14.5	12.7

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.
5. " * ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:
   20 log(Duty cycle) = 20 log(0.308 ms / 5.033 ms) = -24.3 dB

RF Mode	GFSK	Channel	CH 3：2459 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	(PK) RB = 1 MHz, VB = 3 MHz (AV) RB = 1 MHz, VB = 3 MHz (RMS)

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	*2459.00	96.0 PK	114.0	-18.0	1.16 H	332	93.7	2.3
2	*2459.00	71.7 AV	94.0	-22.3	1.16 H	332	69.4	2.3
3	2483.50	46.2 PK	74.0	-27.8	1.16 H	332	43.8	2.4
4	2483.50	21.9 AV	54.0	-32.1	1.16 H	332	19.5	2.4
5	4918.00	52.3 PK	74.0	-21.7	1.41 H	308	39.4	12.9
6	4918.00	28.0 AV	54.0	-26.0	1.41 H	308	15.1	12.9
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	*2459.00	93.4 PK	114.0	-20.6	2.98 V	173	91.1	2.3
2	*2459.00	69.1 AV	94.0	-24.9	2.98 V	173	66.8	2.3
3	2483.50	45.7 PK	74.0	-28.3	2.98 V	173	43.3	2.4
4	2483.50	21.4 AV	54.0	-32.6	2.98 V	173	19.0	2.4
5	4918.00	51.8 PK	74.0	-22.2	3.66 V	255	38.9	12.9
6	4918.00	27.5 AV	54.0	-26.5	3.66 V	255	14.6	12.9

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.
5. " * ": Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:
   20 log(Duty cycle) = 20 log(0.308 ms / 5.033 ms) = -24.3 dB

Mode A

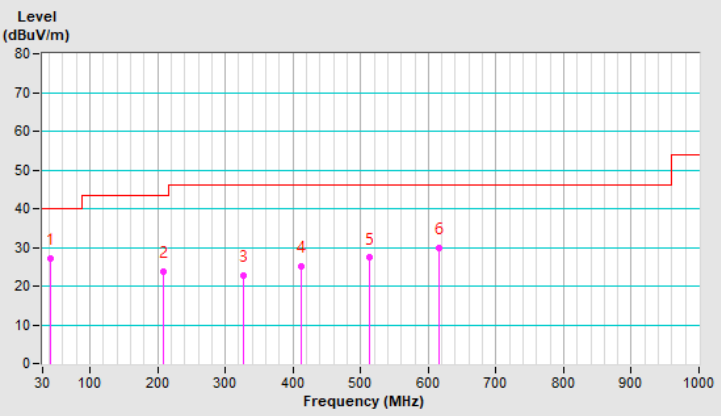
BELOW 1GHz WORST-CASE DATA

RF Mode	GFSK	Channel	CH 3：2459 MHz
Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	(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	41.64	27.1 QP	40.0	-12.9	1.89 H	164	36.1	-9.0
2	207.51	23.8 QP	43.5	-19.7	2.24 H	199	34.2	-10.4
3	326.82	22.7 QP	46.0	-23.3	2.72 H	246	27.7	-5.0
4	413.15	25.2 QP	46.0	-20.8	3.03 H	277	28.4	-3.2
5	514.03	27.3 QP	46.0	-18.7	3.25 H	299	28.2	-0.9
6	615.88	29.9 QP	46.0	-16.1	3.52 H	325	28.5	1.4

Remarks:

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

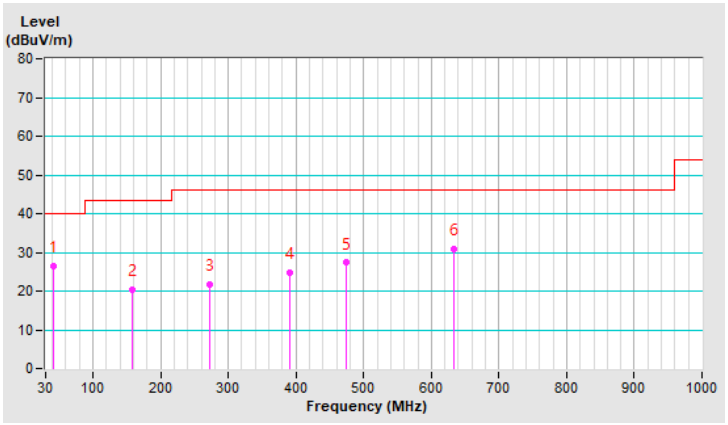


RF Mode	GFSK	Channel	CH 3：2459 MHz
Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz

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	41.64	26.5 QP	40.0	-13.5	3.25 V	224	35.5	-9.0
2	157.07	20.5 QP	43.5	-23.0	2.96 V	196	28.4	-7.9
3	272.50	21.7 QP	46.0	-24.3	2.44 V	144	28.3	-6.6
4	390.84	24.7 QP	46.0	-21.3	2.14 V	114	28.4	-3.7
5	474.26	27.3 QP	46.0	-18.7	1.97 V	97	29.0	-1.7
6	634.31	30.8 QP	46.0	-15.2	1.54 V	55	28.8	2.0

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 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.



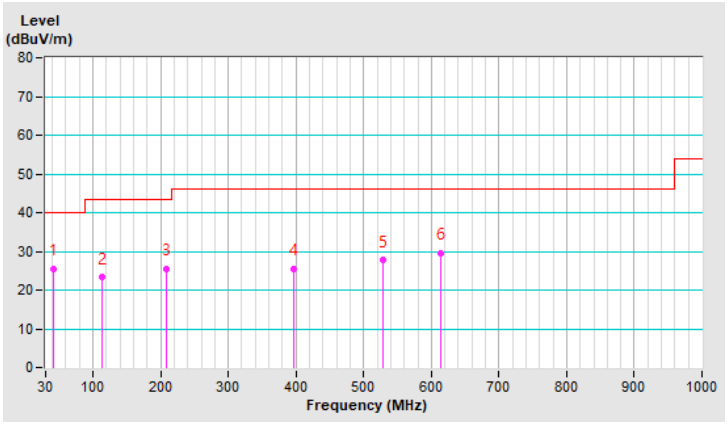
Mode B

Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	(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	41.64	25.4 QP	40.0	-14.6	2.35 H	140	34.4	-9.0
2	113.42	23.2 QP	43.5	-20.3	2.13 H	117	34.5	-11.3
3	208.48	25.6 QP	43.5	-17.9	1.78 H	83	36.0	-10.4
4	395.69	25.6 QP	46.0	-20.4	2.79 H	183	29.2	-3.6
5	529.55	27.7 QP	46.0	-18.3	3.08 H	211	28.5	-0.8
6	614.91	29.5 QP	46.0	-16.5	3.45 H	248	28.1	1.4

Remarks:

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

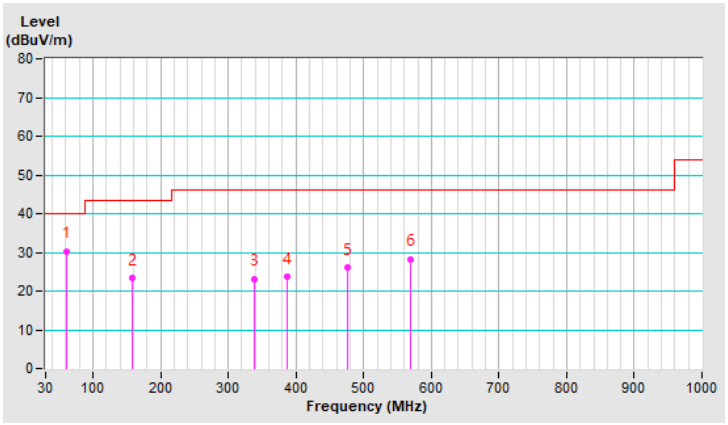


Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz

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	**61.04**	**30.2 QP**	**40.0**	**-9.8**	**2.11 V**	**186**	**39.5**	**-9.3**
2	158.04	23.2 QP	43.5	-20.3	1.51 V	127	31.1	-7.9
3	338.46	23.1 QP	46.0	-22.9	2.76 V	251	28.0	-4.9
4	385.99	23.6 QP	46.0	-22.4	3.02 V	277	27.3	-3.7
5	476.20	26.0 QP	46.0	-20.0	3.26 V	300	27.7	-1.7
6	569.32	28.1 QP	46.0	-17.9	3.60 V	334	28.1	0.0

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 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	ESR3	102412	2022/1/22	2023/1/21
LISN Schwarzbeck	NSLK 8128	8128-244	2022/11/8	2023/11/7
LISN Schwarzbeck	NNLK8129	8129229	2022/6/8	2023/6/7
DC LISN Schwarzbeck	NNLK 8121	8121-808	2022/4/29	2023/4/28
LISN Schwarzbeck	NNLK 8121	8121-731	2022/5/26	2023/5/25
LISN Schwarzbeck	NNLK 8121	8121-00759	2022/8/18	2023/8/17
LISN R&S	ENV216	101196	2022/5/24	2023/5/23
DC LISN R&S	ESH3-Z6	844950/018	2022/8/2	2023/8/1
DC LISN R&S	ESH3-Z6	100219	2022/8/2	2023/8/1
High Voltage Probe Schwarzbeck	TK9420	00982	2021/12/24	2022/12/23
RF Coaxial Cable Commate	5D-FB	Cable-CO5-01	2022/1/28	2023/1/27
Attenuator STI	STI02-2200-10	NO.4	2022/9/2	2023/9/1
50 Ohms Terminator LYNICS	0900510	E1-01-305	2022/2/9	2023/2/8
50 ohm terminal LYNICS	0900510	E1-011286	2022/9/19	2023/9/18
50 ohm terminal LYNICS	0900510	E1-011285	2022/9/19	2023/9/18
Isolation Transformer Erika Fiedler	D-65396	017	2022/9/8	2023/9/7

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 Linkou Conduction05
3. The VCCI Site Registration No. C-11093.
4. Tested Date: 2022/11/25

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.

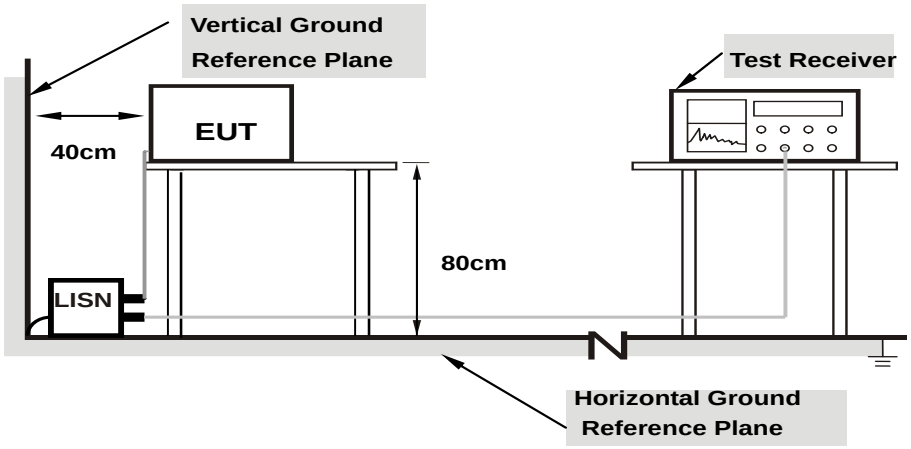
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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 Condition

Mode B

a. Connected the EUT to Adapter via Power Charger.

b. Set the EUT under charging condition.

4.2.7 Test Results

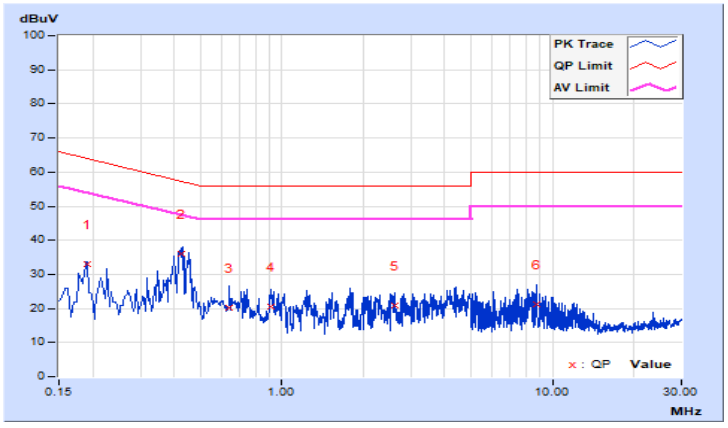
Mode B

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

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	0.18990	9.94	23.17	5.90	33.11	15.84	64.04	54.04	-30.93	-38.20
2	**0.42576**	**9.94**	**26.19**	**4.23**	**36.13**	**14.17**	**57.34**	**47.34**	**-21.21**	**-33.17**
3	0.63965	9.96	10.39	2.66	20.35	12.62	56.00	46.00	-35.65	-33.38
4	0.91496	9.97	10.67	2.38	20.64	12.35	56.00	46.00	-35.36	-33.65
5	2.61071	10.06	10.66	5.09	20.72	15.15	56.00	46.00	-35.28	-30.85
6	8.71469	10.32	11.06	5.73	21.38	16.05	60.00	50.00	-38.62	-33.95

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

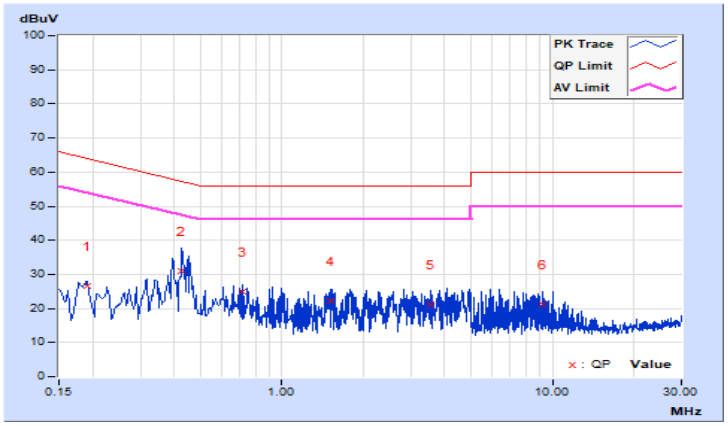


Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz

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	0.18990	9.95	16.60	4.41	26.55	14.36	64.04	54.04	-37.49	-39.68
2	0.42531	9.96	21.13	4.69	31.09	14.65	57.34	47.34	-26.25	-32.69
3	0.71147	9.98	14.91	2.98	24.89	12.96	56.00	46.00	-31.11	-33.04
4	1.52144	10.02	12.20	3.59	22.22	13.61	56.00	46.00	-33.78	-32.39
5	3.54437	10.11	11.16	5.20	21.27	15.31	56.00	46.00	-34.73	-30.69
6	9.23738	10.34	10.87	5.58	21.21	15.92	60.00	50.00	-38.79	-34.08

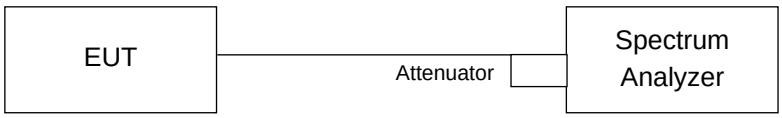
Remarks:

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 Channel Bandwidth

4.3.1 Test Setup



4.3.2 Test Instruments

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until
Spectrum Analyzer R&S	FSV40	101544	2022/5/9	2023/5/8

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 LK - Oven
2. Tested Date: 2021/11/16

4.3.3 Test Procedure

a. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
c. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
d. Repeat above procedures until all frequencies measured were complete.

4.3.4 Deviation from Test Standard

No deviation.

4.3.5 EUT Operating Condition

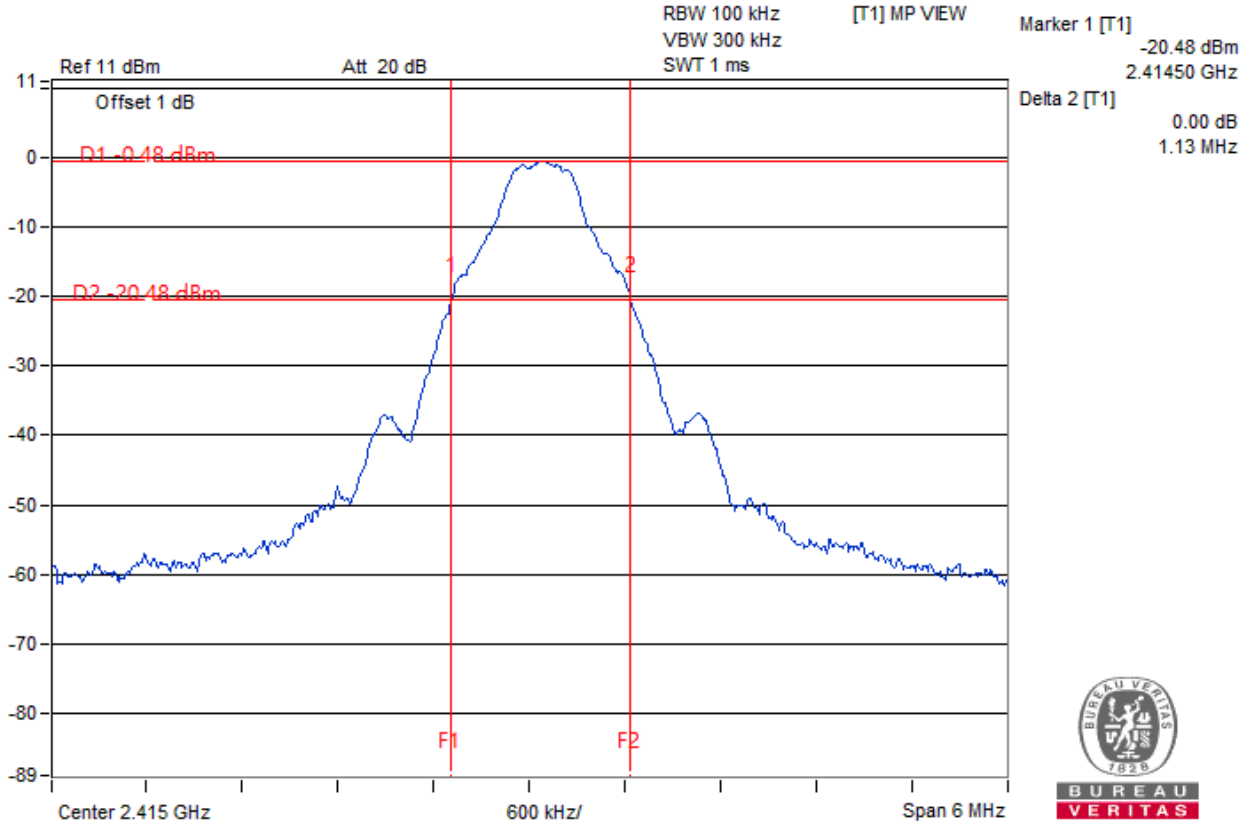
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.3.6 Test Results

Mode A

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
1	2415	1.13
2	2439	1.13
3	2459	1.13

SPECTRUM PLOT of WORST VALUE



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:

Lin Kou EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

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

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

--- END ---