

TEST REPORT

CERTIFICATE OF CONFORMITY

Standard: 47 CFR FCC Part 15, Subpart C (Section 15.249)

Report No.: RFBUIY-WTW-P26030171

FCC ID: XGB-MWAA0020

Product: Wireless Dongle

Brand: TURTLE BEACH

Model No.: MWAA0020

Received Date: 2026/3/5

Test Date: 2026/4/25 ~ 2026/4/30

Issued Date: 2026/5/19

Applicant: Voyetra Turtle Beach, Inc.

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

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FCC Registration / 198487 / TW2021

Designation Number:

Approved by: _____

Jeremy Lin

Jeremy Lin / Project Engineer

, Date: _____

2026/5/19

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Prepared by : Annie Chang / Senior Specialist



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Release Control Record

Issue No.	Description	Date Issued
RFBUUY-WTW-P26030171	Original release.	2026/5/19

1 Certificate

Product: Wireless Dongle

Brand: TURTLE BEACH

Test Model: MWAA0020

Sample Status: Engineering sample

Applicant: Voyetra Turtle Beach, Inc.

Test Date: 2026/4/25 ~ 2026/4/30

Standard: 47 CFR FCC Part 15, Subpart C (Section 15.249)

**Measurement
procedure:** ANSI C63.10-2020

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.

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.249)			
Standard / Clause	Test Item	Result	Remark
15.207	AC Power Conducted Emissions	Pass	Minimum passing margin is -12.50 dB at 4.86468 MHz
15.209 / 15.249(d)	Radiated Emissions below 1 GHz	Pass	Minimum passing margin is -5.8 dB at 46.49 MHz
15.209 / 15.249(a) / 15.249(d) / 15.249(e)	Radiated Emissions above 1 GHz	Pass	Minimum passing margin is -0.3 dB at 4958.00 MHz
15.215 (c)	20 dB 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	Specification	Expanded Uncertainty (k=2) (±)
AC Power Conducted Emissions	9 kHz ~ 30 MHz	3.24 dB
Radiated Emissions below 1 GHz	9 kHz ~ 30 MHz	2.55 dB
	30 MHz ~ 1 GHz	5.77 dB
Radiated Emissions above 1 GHz	1 GHz ~ 6 GHz	4.71 dB
	6 GHz ~ 18 GHz	5.3 dB
	18 GHz ~ 40 GHz	4.98 dB
20 dB Bandwidth	-	960 Hz

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.2 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

3 General Information

3.1 General Description

Product	Wireless Dongle
Brand	TURTLE BEACH
Test Model	MWAA0020
Status of EUT	Engineering sample
Power Supply Rating	5Vdc from host equipment
Modulation Type	GFSK
Transfer Rate	Up to 2 Mbps
Operating Frequency	2.404 GHz ~ 2.479 GHz
Number of Channel	9
Field Strength Of Fundamental	91.9 dBuV/m (Average) at 3 meters

Note:

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 Antenna Description of EUT

The antenna information is listed as below.

Gain(dBi)	Antenna Type	Connector Type
-1.35	Chip	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.

3.3 Channel List

9 channels are provided to this EUT:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2404	6	2442
2	2412	7	2450
3	2423	8	2462
4	2428	9	2479
5	2437		

3.4 Test Mode Applicability and Tested Channel Detail

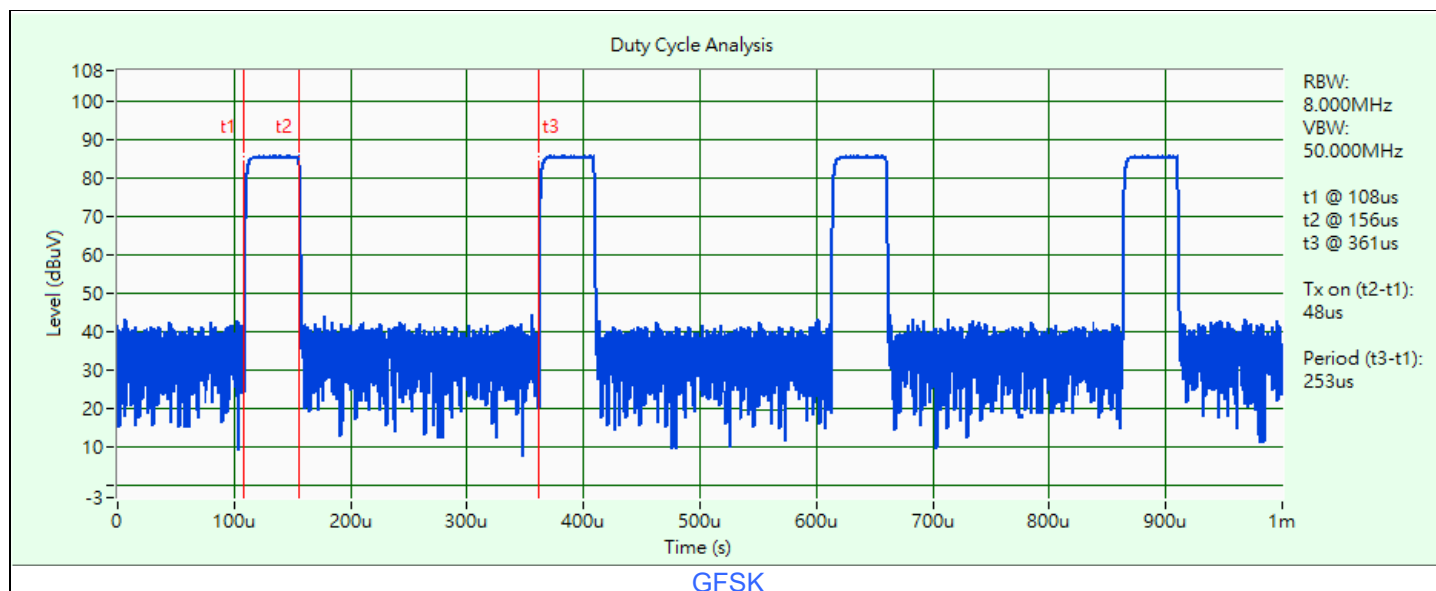
Pre-Scan:	1. EUT can be used in the following ways: X-axis/ Y-axis/ Z-axis. Pre-scan these ways and find the worst case as a representative test condition.
Worst Case:	1. X-axis/ Y-axis/ Z-axis Worst Condition: X-axis.

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

Test Item	Mode	Tested Channel	Modulation	Data Rate Parameter
AC Power Conducted Emissions	SRD 2M	5	GFSK	2Mb/s
Radiated Emissions below 1 GHz	SRD 2M	5	GFSK	2Mb/s
Radiated Emissions above 1 GHz	SRD 1M	1, 5, 9	GFSK	1Mb/s
	SRD 2M	1, 5, 9	GFSK	2Mb/s
20 dB Bandwidth	SRD 1M	1, 5, 9	GFSK	1Mb/s
	SRD 2M	1, 5, 9	GFSK	2Mb/s

3.5 Duty Cycle of Test Signal

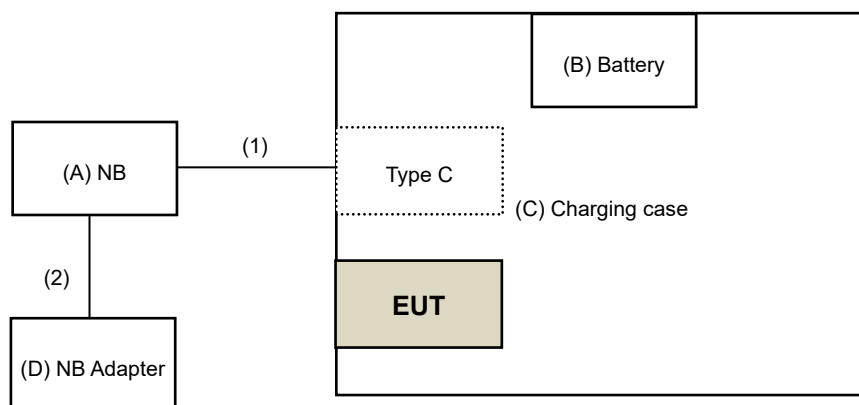
GFSK: Duty cycle = $0.048 \text{ ms} / 0.253 \text{ ms} \times 100\% = 19.0\%$



3.6 Test Program Used and Operation Descriptions

Controlling software (RF Test Tool-v1.0.1.0) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

3.7 Connection Diagram of EUT and Peripheral Devices



3.8 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	NB	Lenovo	IdeaPad 5 15ITL05	N/A	N/A	Provided by Lab
B	Battery	N/A	N/A	N/A	N/A	Supplied by applicant
C	Charging case	N/A	N/A	N/A	N/A	Supplied by applicant
D	NB Adapter	Lenovo	ADLX65CLGC2A	N/A	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	Type-A to C cable	1	1.8	Y	0	Supplied by applicant
2	DC Cable	1	1.9	N	0	Provided by Lab

4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.1 AC Power Conducted Emissions

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
50 ohm terminal resistance LYNICS	0900510	E1-01-300	2026/2/12	2027/2/11
		E1-01-301	2026/2/12	2027/2/11
		E1-011284	2025/9/18	2026/9/17
DC LISN R&S	ESH3-Z6	100219	2025/7/10	2026/7/9
		844950/018	2025/7/10	2026/7/9
Diode Pulse Limiter Schwarzbeck	VTSD 9561 F-N	01422	2025/5/2	2026/5/1
EMI Test Receiver R&S	ESR3	102413	2026/1/26	2027/1/25
		102414	2025/12/9	2026/12/8
Fixed Attenuator EMEC	EM-ATT30002602NN	N/A	2026/3/12	2027/3/11
High Pass Filter EMCI	150HPF-ME	114005	2025/5/2	2026/5/1
		114006	2025/5/2	2026/5/1
	150HPF-MF	113009	2025/5/2	2026/5/1
High Voltage Probe Schwarzbeck	TK9420	00982	2025/12/3	2026/12/2
LISN R&S	ENV216	101195	2025/7/18	2026/7/17
		101196	2026/3/3	2027/3/2
		101197	2025/7/4	2026/7/3
	ESH3-Z5	100220	2025/11/21	2026/11/20
LISN Schwarzbeck	NNLK 8121	8121-731	2025/6/10	2026/6/9
		8121-00759	2025/8/12	2026/8/11
	NNLK 8129	00624	2025/10/9	2026/10/8
		8129229	2025/10/14	2026/10/13
RF Coaxial Cable PEWC	5D-FB	Cable-CO3-01	2025/9/11	2026/9/10
Software BVADT	Cond_V7.4.1.0	N/A	N/A	N/A

Notes:

1. The test was performed in Linkou Conduction 3.
2. Tested Date: 2026/4/29

4.2 Radiated Emissions below 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Bi_Log Antenna Schwarzbeck	VULB 9168	137	2025/9/17	2026/9/16
Coupling / Decoupling Network Schwarzbeck	CDNE-M2	00097	2025/5/28	2026/5/27
	CDNE-M3	00091	2026/3/17	2027/3/16
MXE EMI Receiver Agilent	N9038A	MY51210114	2026/2/3	2027/2/2
Preamplifier Agilent	8447D	2944A11064	2026/2/13	2027/2/12
Radiating Loop Antenna TESEQ	RLA 6120-20	80002	2025/7/29	2026/7/28
RF Coaxial Cable Pacific	8D-FB	Cable-CH6-02	2025/6/24	2026/6/23
Signal Analyzer R&S	FSV40	101544	2025/7/1	2026/6/30
Software BVADT	Radiated_V7.7.1.1.1	N/A	N/A	N/A
Tower ADT	AT100	0306	N/A	N/A
Turn Table ADT	TT100	0306	N/A	N/A

Notes:

1. The test was performed in LK - 966 Chamber 6 (CH 6) (Linkou).
2. Tested Date: 2026/4/28

4.3 Radiated Emissions above 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Boresight antenna tower fixture BV	BAF-02	6	N/A	N/A
High Pass Filter Wainwright	WHK 3.1/18G-10SS	SN 8	2025/5/22	2026/5/21
Horn Antenna EMCO	3115	00028257	2025/11/9	2026/11/8
Horn Antenna ETS-Lindgren	3117-PA	00215857	2025/11/9	2026/11/8
Horn Antenna Schwarzbeck	BBHA 9170	212	2025/10/28	2026/10/27
		BBHA9170190	2025/11/9	2026/11/8
MXE EMI Receiver Agilent	N9038A	MY51210114	2026/2/3	2027/2/2
Notch Filter Micro-Tronics	BRC50703-01	010	2025/5/22	2026/5/21
	BRM17690	005	2025/5/22	2026/5/21
Preamplifier EMCI	EMC0126545	980076	2026/2/13	2027/2/12
	EMC184045B	980175	2025/8/23	2026/8/22
		980235	2026/2/13	2027/2/12
Preamplifier HP	8449B	3008A01201	2026/2/13	2027/2/12
RF Coaxial Cable EMCI	EMC104	190801	2025/7/4	2026/7/3
		190804	2025/7/4	2026/7/3
RF Coaxial Cable EMEC	EM102-KMKM-100	02	2025/7/4	2026/7/3
RF Coaxial Cable HUBER+SUHNER	SF-104	Cable-CH6-01	2025/7/4	2026/7/3
Signal Analyzer R&S	FSV40	101042	2025/9/19	2026/9/18
		101544	2025/7/1	2026/6/30
Software BVADT	Radiated_V7.7.1.1.1	N/A	N/A	N/A
Tower ADT	AT100	0306	N/A	N/A
Turn Table ADT	TT100	0306	N/A	N/A

Notes:

1. The test was performed in LK - 966 Chamber 6 (CH 6) (Linkou).
2. Tested Date: 2026/4/25 ~ 2026/4/30

4.4 20 dB Bandwidth

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Fixed Attenuator Woken	00800A1K01A-20	00800A1K01A-20-02	2025/5/23	2026/5/22
PXA Signal Analyzer Keysight	N9030A	MY54490260	2025/7/24	2026/7/23
Signal Analyzer R&S	FSV40	101544	2025/7/1	2026/6/30
Software	BVADT_RF_Test_Software V7.6.5.4	N/A	N/A	N/A

Notes:

1. The test was performed in LK - Oven (Linkou).
2. Tested Date: 2026/4/29

5 Limits of Test Items

5.1 AC Power Conducted Emissions

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

Notes:

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 0.50 MHz.

5.2 Radiated Emissions below 1 GHz

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

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

Notes:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).

5.3 Radiated Emissions above 1 GHz

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)
2400 ~ 2483.5 MHz	50	500

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)
Above 960	500	3

Notes:

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 1000 MHz, 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 20 dB under any condition of modulation.

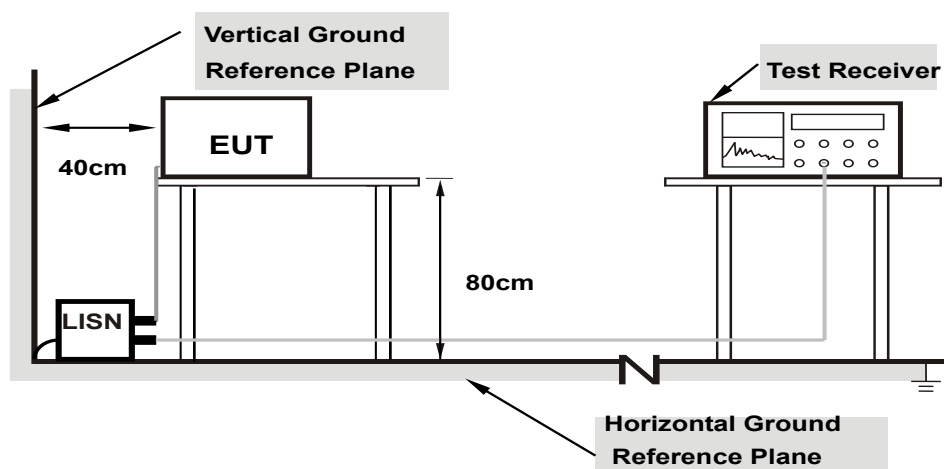
5.4 20 dB Bandwidth

The 20dB bandwidth shall be specified in operating frequency band.

6 Test Arrangements

6.1 AC Power Conducted Emissions

6.1.1 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).

6.1.2 Test Procedure

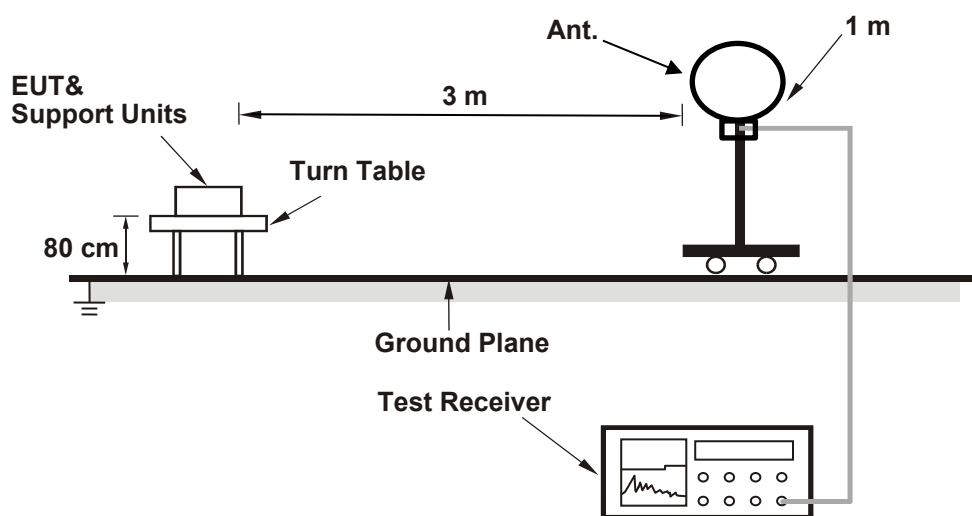
- Exploratory ac power-line conducted emission measurements: The EUT shall be operated on the mid channel and in the mode with highest output power unless the fundamental operates in the AC power-line emission test range then the EUT shall be operated in the range of typical modes of operation.
- The EUT was placed on a 0.8 meter to the top of table and 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/ 50 uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

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

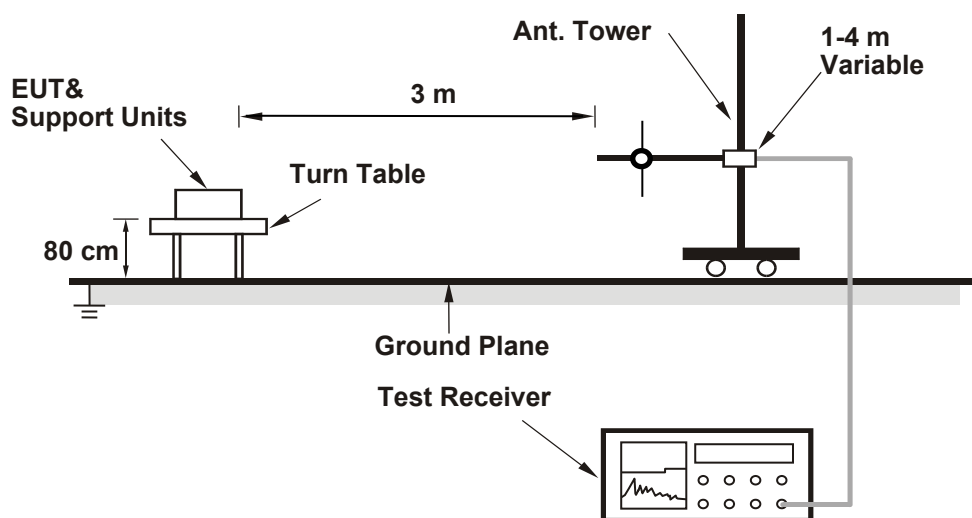
6.2 Radiated Emissions below 1 GHz

6.2.1 Test Setup

For Radiated emission below 30 MHz



For Radiated emission above 30 MHz



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

6.2.2 Test Procedure

For Radiated emission below 30 MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters 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. 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 (however, peak detector measurements may be used to determine compliance with QP requirements), except for the frequency band (9 kHz to 90 kHz and 110 kHz to 490 kHz) set to average detect function and peak detect function.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 200 Hz at frequency below 150 kHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz or 10 kHz at frequency (150 kHz to 30 MHz).
3. All modes of operation were investigated and the worst-case emissions are reported.

For Radiated emission above 30 MHz

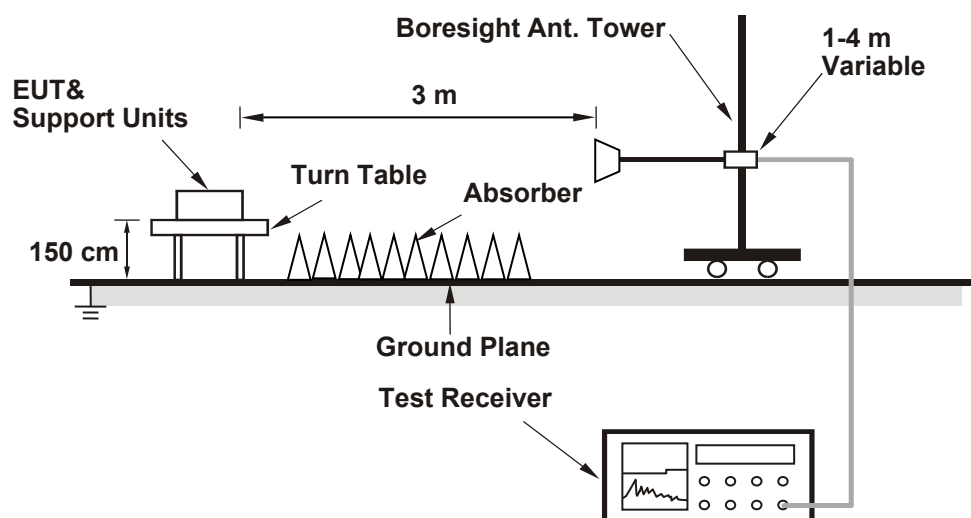
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the 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(QP) detect function, Average(AV) detect function, Peak(PK) detect function and specified bandwidth with maximum hold mode when the test frequencies less than or equal to 1 GHz.

Notes:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) at frequency below 1 GHz (however, peak detector measurements may be used to determine compliance with QP requirements).
2. All modes of operation were investigated and the worst-case emissions are reported.

6.3 Radiated Emissions above 1 GHz

6.3.1 Test Setup



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

6.3.2 Test Procedure

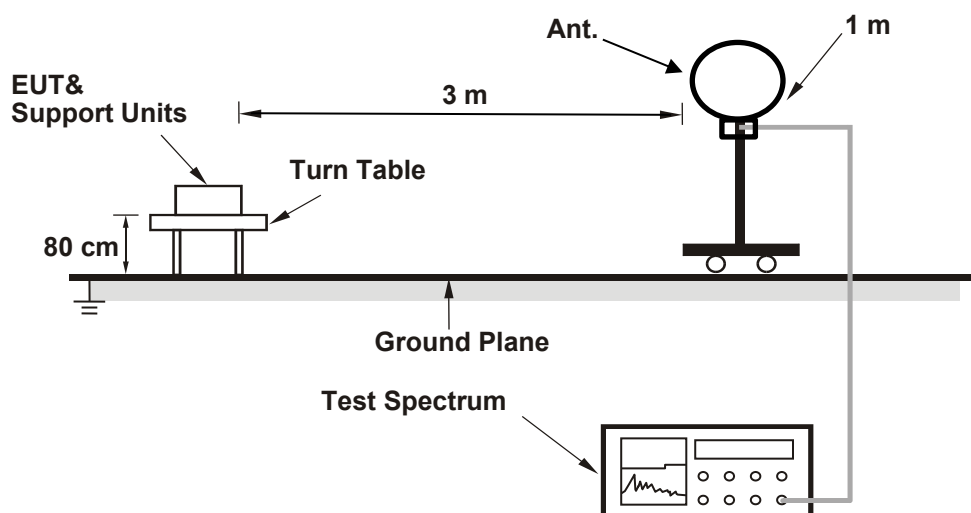
- The EUT was placed on the top of a rotating table 1.5 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- 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.
- 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.
- The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Notes:

- 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 (AV) at frequency above 1 GHz.
- According to ANSI C63.10 section 6.6.4 and 4.1.5.2.2. For fundamental and harmonic signal measurement, according to ANSI C63.10 section 7.5, the average value = peak value + duty cycle correction factor. For duty cycle correction factor values, see the Test Signal Duty Cycle section in this report.
- All modes of operation were investigated and the worst-case emissions are reported.

6.4 20 dB Bandwidth

6.4.1 Test Setup



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

6.4.2 Test Procedure

Radiated Measurement:

- The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- 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.
- The test-spectrum system was set to Peak Detect Function and Maximum Hold.
- Set resolution bandwidth (RBW) = 1% to 5% of the OBW.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than $[10 \log (OBW/RBW)]$ below the reference level.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

7 Test Results of Test Item

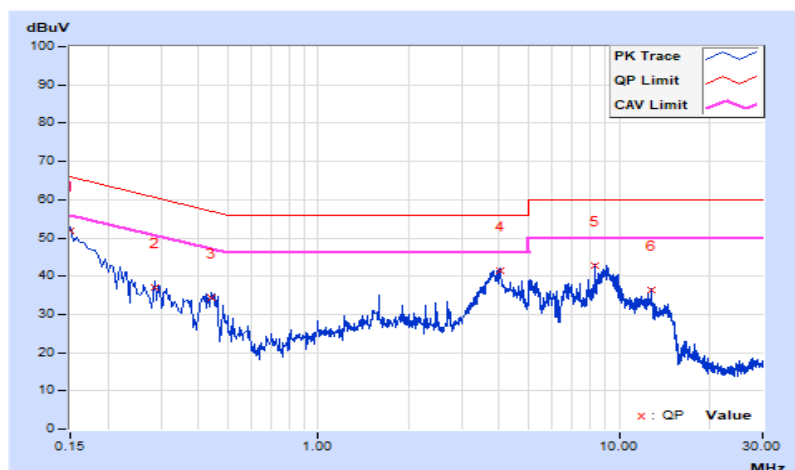
7.1 AC Power Conducted Emissions

RF Mode	GFSK-2M	Channel	CH 5 : 2437 MHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120 Vac, 60 Hz	Environmental Conditions	25 °C, 75% RH
Tested By	Jed Wu		

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	0.15000	9.54	42.16	24.01	51.70	33.55	66.00	56.00	-14.30	-22.45
2	0.28589	9.58	27.51	12.30	37.09	21.88	60.64	50.64	-23.55	-28.76
3	0.44248	9.59	24.85	14.27	34.44	23.86	57.02	47.02	-22.58	-23.16
4	4.01208	9.72	31.76	23.18	41.48	32.90	56.00	46.00	-14.52	-13.10
5	8.28915	9.84	33.01	25.23	42.85	35.07	60.00	50.00	-17.15	-14.93
6	12.78680	9.91	26.51	20.55	36.42	30.46	60.00	50.00	-23.58	-19.54

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

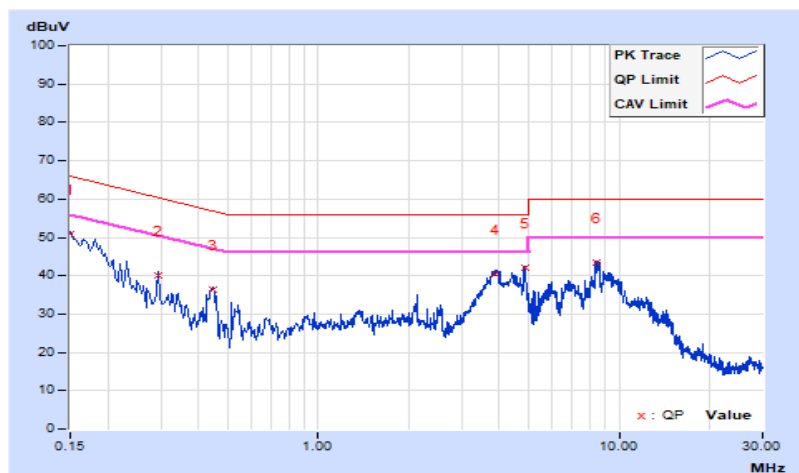


RF Mode	GFSK-2M	Channel	CH 5 : 2437 MHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power	120 Vac, 60 Hz	Environmental Conditions	25 °C, 75% RH
Tested By	Jed Wu		

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	9.34	41.37	21.29	50.71	30.63	66.00	56.00	-15.29	-25.37
2	0.29386	9.35	30.86	22.66	40.21	32.01	60.41	50.41	-20.20	-18.40
3	0.44626	9.37	27.12	20.70	36.49	30.07	56.94	46.94	-20.45	-16.87
4	3.86737	9.53	30.99	21.56	40.52	31.09	56.00	46.00	-15.48	-14.91
5	4.86468	9.56	32.56	23.94	42.12	33.50	56.00	46.00	-13.88	-12.50
6	8.40648	9.66	33.81	24.80	43.47	34.46	60.00	50.00	-16.53	-15.54

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



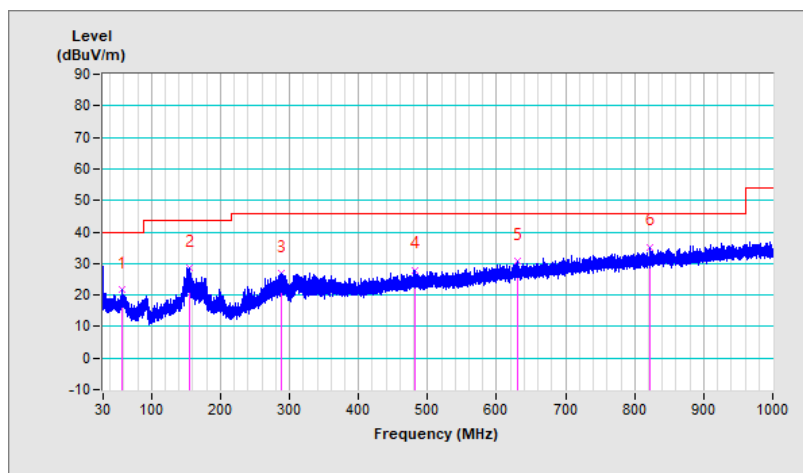
7.2 Radiated Emissions below 1 GHz

RF Mode	GFSK-2M	Channel	CH 5 : 2437 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 73.8% RH
Tested By	Ian Chang		

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	57.35	21.7 QP	40.0	-18.3	1.63 H	24	30.8	-9.1
2	155.95	28.7 QP	43.5	-14.8	1.52 H	227	36.7	-8.0
3	287.58	26.8 QP	46.0	-19.2	2.29 H	64	32.9	-6.1
4	481.05	28.0 QP	46.0	-18.0	1.84 H	134	29.5	-1.5
5	629.61	30.6 QP	46.0	-15.4	2.96 H	220	28.6	2.0
6	821.42	35.3 QP	46.0	-10.7	1.04 H	212	29.3	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 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.

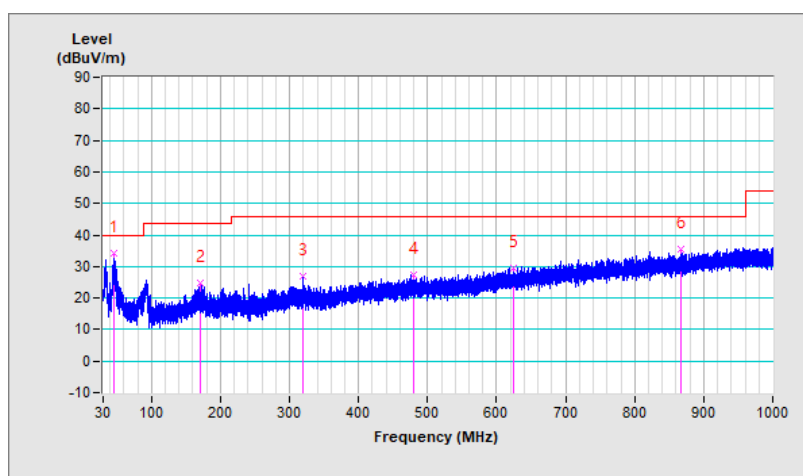


RF Mode	GFSK-2M	Channel	CH 5 : 2437 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120 kHz, DET=Quasi-Peak
Input Power	120 Vac, 60 Hz	Environmental Conditions	22 °C, 73.8% RH
Tested By	Ian Chang		

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	46.49	34.2 QP	40.0	-5.8	1.34 V	205	43.0	-8.8
2	170.50	24.9 QP	43.5	-18.6	1.89 V	287	33.1	-8.2
3	318.91	27.0 QP	46.0	-19.0	2.45 V	232	32.1	-5.1
4	478.96	27.5 QP	46.0	-18.5	2.81 V	196	29.1	-1.6
5	624.46	29.5 QP	46.0	-16.5	3.08 V	170	27.7	1.8
6	866.96	35.6 QP	46.0	-10.4	3.35 V	143	29.1	6.5

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 30 MHz ~ 1 GHz.
5. The frequency range 9 kHz ~ 30 MHz: all emissions are more than 20 dB below the limit, therefore do not be recorded in this report.



7.3 Radiated Emissions above 1 GHz

RF Mode	GFSK-1M	Channel	CH 1 : 2404 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	20.6 °C, 72.8% RH
Tested By	Ian Chang		

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	53.3 PK	74.0	-20.7	1.27 H	264	53.6	-0.3
2	2390.00	41.1 AV	54.0	-12.9	1.27 H	264	41.4	-0.3
3	2400.00	53.6 PK	74.0	-20.4	1.27 H	264	53.9	-0.3
4	2400.00	41.2 AV	54.0	-12.8	1.27 H	264	41.5	-0.3
5	*2404.00	103.2 PK	114.0	-10.8	1.27 H	264	103.5	-0.3
6	*2404.00	88.8 AV	94.0	-5.2	1.27 H	264	89.1	-0.3
7	4808.00	66.0 PK	74.0	-8.0	1.78 H	122	58.6	7.4
8	4808.00	51.6 AV	54.0	-2.4	1.78 H	122	44.2	7.4

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	51.9 PK	74.0	-22.1	2.88 V	234	52.2	-0.3
2	2390.00	40.0 AV	54.0	-14.0	2.88 V	234	40.3	-0.3
3	2400.00	52.5 PK	74.0	-21.5	2.88 V	234	52.8	-0.3
4	2400.00	40.6 AV	54.0	-13.4	2.88 V	234	40.9	-0.3
5	*2404.00	97.9 PK	114.0	-16.1	2.88 V	234	98.2	-0.3
6	*2404.00	83.5 AV	94.0	-10.5	2.88 V	234	83.8	-0.3
7	4808.00	64.5 PK	74.0	-9.5	1.86 V	211	57.1	7.4
8	4808.00	50.1 AV	54.0	-3.9	1.86 V	211	42.7	7.4

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:

$$20 \log(\text{Duty cycle}) = 20 \log(0.048 \text{ ms} / 0.253 \text{ ms}) = -14.4 \text{ dB}$$

RF Mode	GFSK-1M	Channel	CH 5 : 2437 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	20.6 °C, 72.8% RH
Tested By	Ian Chang		

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	*2437.00	106.1 PK	114.0	-7.9	1.39 H	265	106.2	-0.1
2	*2437.00	91.7 AV	94.0	-2.3	1.39 H	265	91.8	-0.1
3	4874.00	66.9 PK	74.0	-7.1	1.71 H	124	59.1	7.8
4	4874.00	52.5 AV	54.0	-1.5	1.71 H	124	44.7	7.8
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	*2437.00	101.2 PK	114.0	-12.8	2.85 V	229	101.3	-0.1
2	*2437.00	86.8 AV	94.0	-7.2	2.85 V	229	86.9	-0.1
3	4874.00	65.4 PK	74.0	-8.6	2.10 V	221	57.6	7.8
4	4874.00	51.0 AV	54.0	-3.0	2.10 V	221	43.2	7.8

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)
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:

$$20 \log(\text{Duty cycle}) = 20 \log(0.048 \text{ ms} / 0.253 \text{ ms}) = -14.4 \text{ dB}$$

RF Mode	GFSK-1M	Channel	CH 9 : 2479 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	20.6 °C, 72.8% RH
Tested By	Ian Chang		

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	*2479.00	102.6 PK	114.0	-11.4	1.37 H	261	102.4	0.2
2	*2479.00	88.2 AV	94.0	-5.8	1.37 H	261	88.0	0.2
3	2483.50	53.6 PK	74.0	-20.4	1.37 H	261	53.4	0.2
4	2483.50	41.5 AV	54.0	-12.5	1.37 H	261	41.3	0.2
5	4958.00	68.0 PK	74.0	-6.0	1.99 H	124	60.2	7.8
6	4958.00	53.6 AV	54.0	-0.4	1.99 H	124	45.8	7.8
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	*2479.00	97.7 PK	114.0	-16.3	2.89 V	230	97.5	0.2
2	*2479.00	83.3 AV	94.0	-10.7	2.89 V	230	83.1	0.2
3	2483.50	53.3 PK	74.0	-20.7	2.89 V	230	53.1	0.2
4	2483.50	41.2 AV	54.0	-12.8	2.89 V	230	41.0	0.2
5	4958.00	66.5 PK	74.0	-7.5	2.09 V	225	58.7	7.8
6	4958.00	52.1 AV	54.0	-1.9	2.09 V	225	44.3	7.8

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)
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:
 $20 \log(\text{Duty cycle}) = 20 \log(0.048 \text{ ms} / 0.253 \text{ ms}) = -14.4 \text{ dB}$

RF Mode	GFSK-2M	Channel	CH 1 : 2404 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	20.6 °C, 72.8% RH
Tested By	Ian Chang		

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	53.3 PK	74.0	-20.7	1.39 H	264	53.6	-0.3
2	2390.00	40.7 AV	54.0	-13.3	1.39 H	264	41.0	-0.3
3	2400.00	53.6 PK	74.0	-20.4	1.39 H	264	53.9	-0.3
4	2400.00	41.0 AV	54.0	-13.0	1.39 H	264	41.3	-0.3
5	*2404.00	103.8 PK	114.0	-10.2	1.39 H	264	104.1	-0.3
6	*2404.00	89.4 AV	94.0	-4.6	1.39 H	264	89.7	-0.3
7	4808.00	65.5 PK	74.0	-8.5	1.92 H	122	58.1	7.4
8	4808.00	51.1 AV	54.0	-2.9	1.92 H	122	43.7	7.4
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	52.7 PK	74.0	-21.3	2.86 V	227	53.0	-0.3
2	2390.00	40.1 AV	54.0	-13.9	2.86 V	227	40.4	-0.3
3	2400.00	52.9 PK	74.0	-21.1	2.86 V	227	53.2	-0.3
4	2400.00	40.4 AV	54.0	-13.6	2.86 V	227	40.7	-0.3
5	*2404.00	99.3 PK	114.0	-14.7	2.86 V	227	99.6	-0.3
6	*2404.00	84.9 AV	94.0	-9.1	2.86 V	227	85.2	-0.3
7	4808.00	63.6 PK	74.0	-10.4	2.06 V	219	56.2	7.4
8	4808.00	49.2 AV	54.0	-4.8	2.06 V	219	41.8	7.4

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:

$$20 \log(\text{Duty cycle}) = 20 \log(0.048 \text{ ms} / 0.253 \text{ ms}) = -14.4 \text{ dB}$$

RF Mode	GFSK-2M	Channel	CH 5 : 2437 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	20.6 °C, 72.8% RH
Tested By	Ian Chang		

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	*2437.00	106.3 PK	114.0	-7.7	1.39 H	264	106.4	-0.1
2	*2437.00	91.9 AV	94.0	-2.1	1.39 H	264	92.0	-0.1
3	4874.00	67.4 PK	74.0	-6.6	1.89 H	120	59.6	7.8
4	4874.00	53.0 AV	54.0	-1.0	1.89 H	120	45.2	7.8
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	*2437.00	101.4 PK	114.0	-12.6	2.85 V	220	101.5	-0.1
2	*2437.00	87.0 AV	94.0	-7.0	2.85 V	220	87.1	-0.1
3	4874.00	65.0 PK	74.0	-9.0	1.23 V	251	57.2	7.8
4	4874.00	50.6 AV	54.0	-3.4	1.23 V	251	42.8	7.8

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)
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:

$$20 \log(\text{Duty cycle}) = 20 \log(0.048 \text{ ms} / 0.253 \text{ ms}) = -14.4 \text{ dB}$$

RF Mode	GFSK-2M	Channel	CH 9 : 2479 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	120 Vac, 60 Hz	Environmental Conditions	20.6 °C, 72.8% RH
Tested By	Ian Chang		

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	*2479.00	103.2 PK	114.0	-10.8	1.39 H	263	103.0	0.2
2	*2479.00	88.8 AV	94.0	-5.2	1.39 H	263	88.6	0.2
3	2483.50	54.0 PK	74.0	-20.0	1.39 H	263	53.8	0.2
4	2483.50	41.3 AV	54.0	-12.7	1.39 H	263	41.1	0.2
5	4958.00	68.1 PK	74.0	-5.9	1.92 H	126	60.3	7.8
6	4958.00	53.7 AV	54.0	-0.3	1.92 H	126	45.9	7.8
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	*2479.00	98.8 PK	114.0	-15.2	2.91 V	223	98.6	0.2
2	*2479.00	84.4 AV	94.0	-9.6	2.91 V	223	84.2	0.2
3	2483.50	53.1 PK	74.0	-20.9	2.91 V	223	52.9	0.2
4	2483.50	40.6 AV	54.0	-13.4	2.91 V	223	40.4	0.2
5	4958.00	66.6 PK	74.0	-7.4	1.11 V	252	58.8	7.8
6	4958.00	52.2 AV	54.0	-1.8	1.11 V	252	44.4	7.8

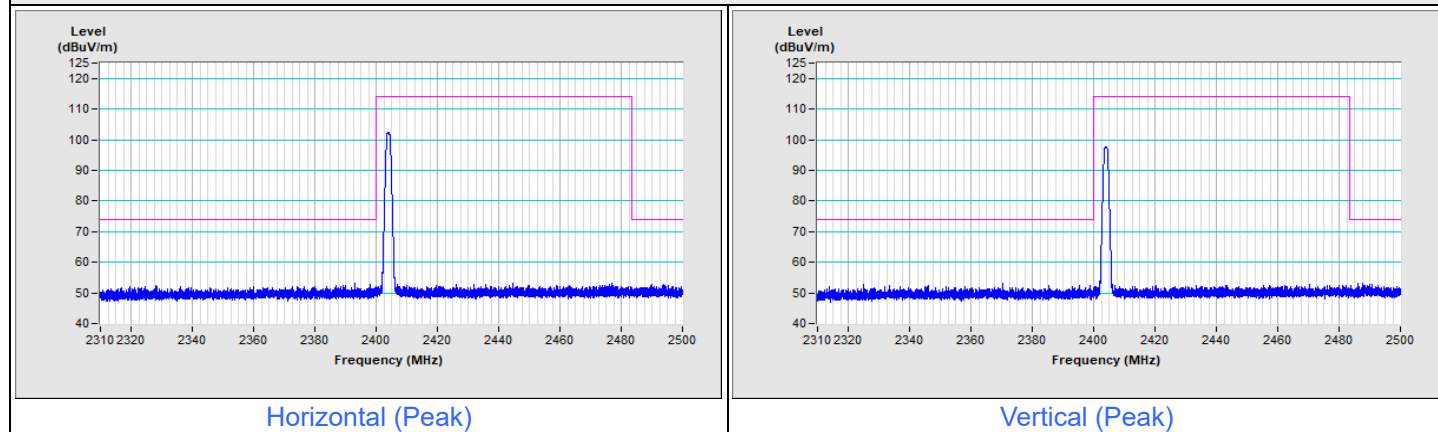
Remarks:

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)
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:
 $20 \log(\text{Duty cycle}) = 20 \log(0.048 \text{ ms} / 0.253 \text{ ms}) = -14.4 \text{ dB}$

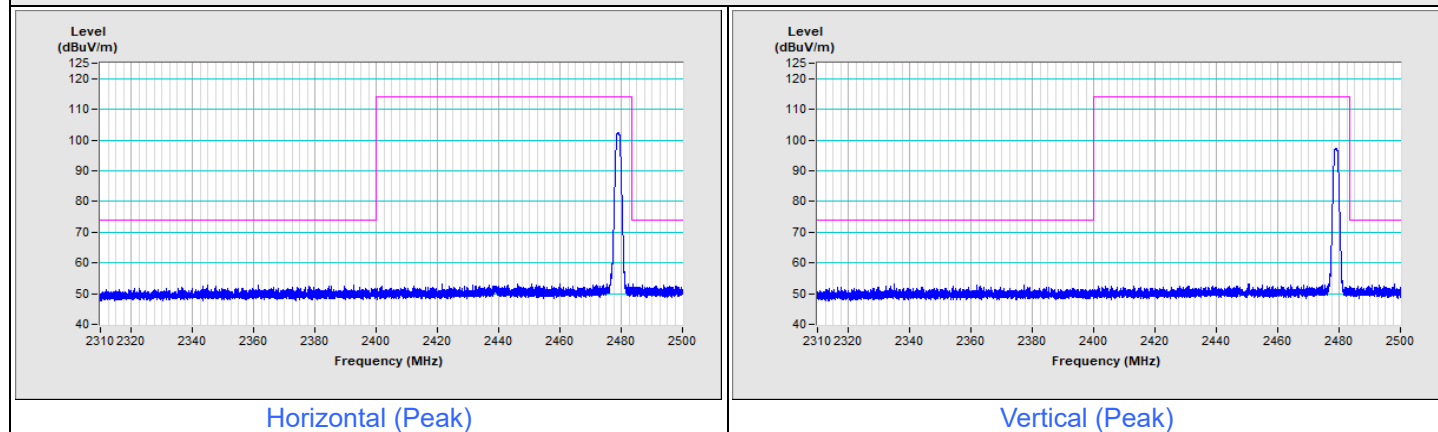
Plot of Band Edge

Frequency Range	2.31 GHz ~ 2.5 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak
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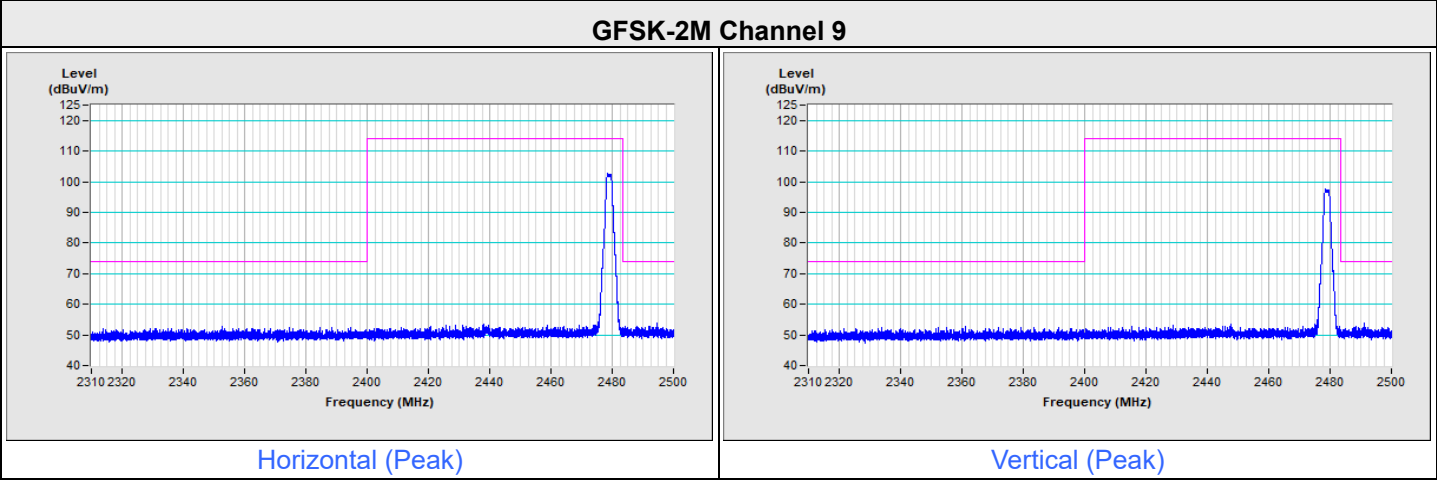
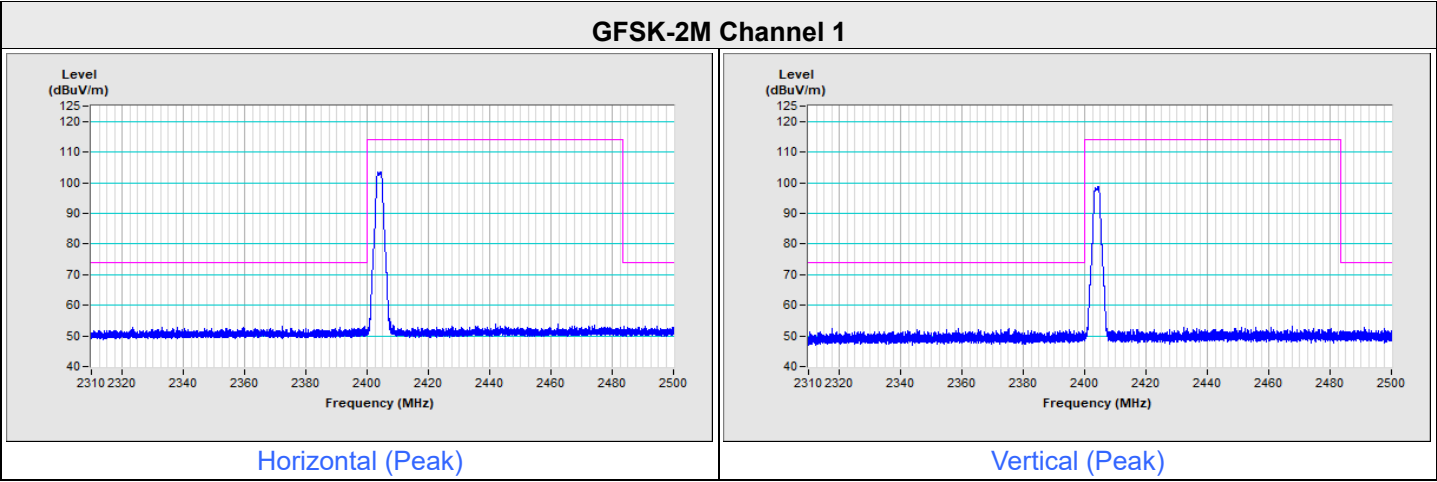
GFSK-1M Channel 1



GFSK-1M Channel 9

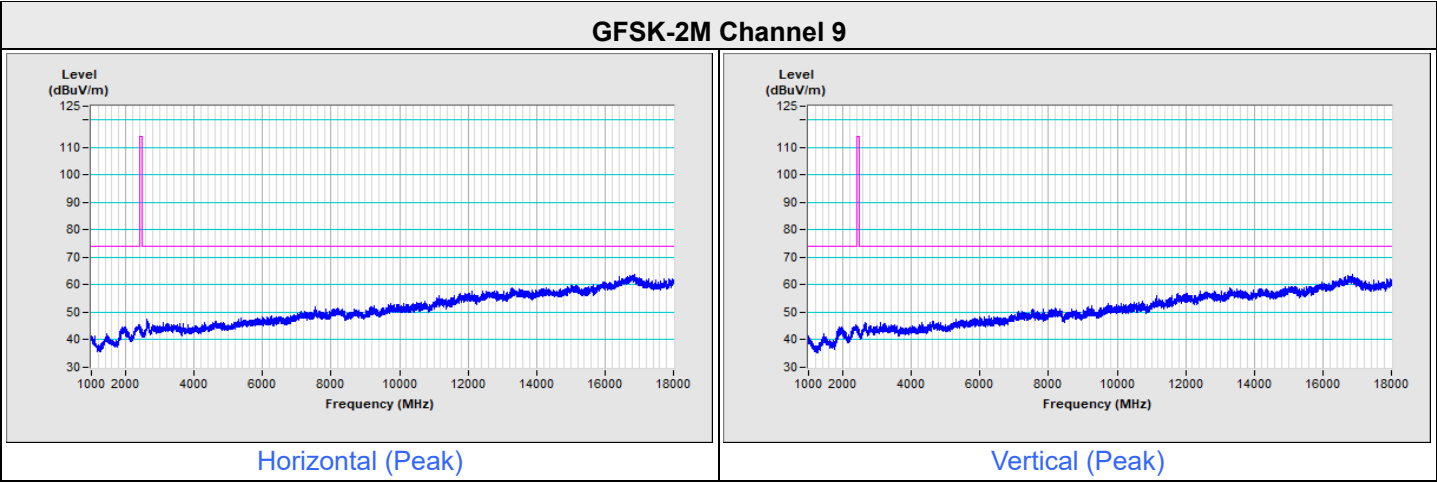


Frequency Range	2.31 GHz ~ 2.5 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak
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Plot of Other Emission

Frequency Range	1 GHz ~ 18 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak
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- Notes:
- For radiated emission test data, complete spectral plots shall be presented in the report only for the worst-case scenarios of each mode within each operating frequency band.
 - The frequency range 18 GHz ~ 25 GHz: After investigation, no any emissions were found to exist, therefore they are not recorded in this report.

7.4 20 dB Bandwidth

Input Power:	120 Vac, 60 Hz	Environmental Conditions:	25°C, 76% RH	Tested By:	Dalen Dai
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GFSK-1M

Channel	Channel Frequency (MHz)	20 dB Bandwidth (MHz)	Measured Frequencies		Operating Frequency Band (MHz)	Test Result
			FL (MHz)	FH (MHz)		
1	2404	1.2	2403.41	2404.61	2400 ~ 2483.5	Pass
5	2437	1.2	2436.41	2437.61		Pass
9	2479	1.19	2478.41	2479.6		Pass

Notes:

1. FL is the lowest frequency of the 20 dB bandwidth of power envelope.
2. FH is the highest frequency of the 20 dB bandwidth of power envelope.

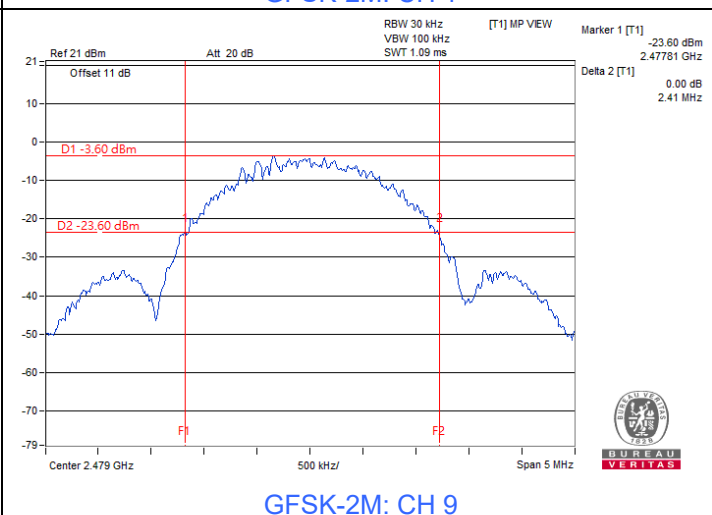
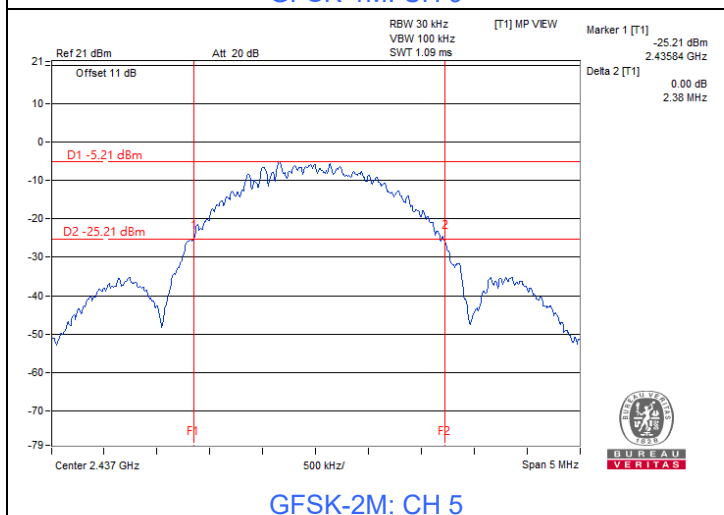
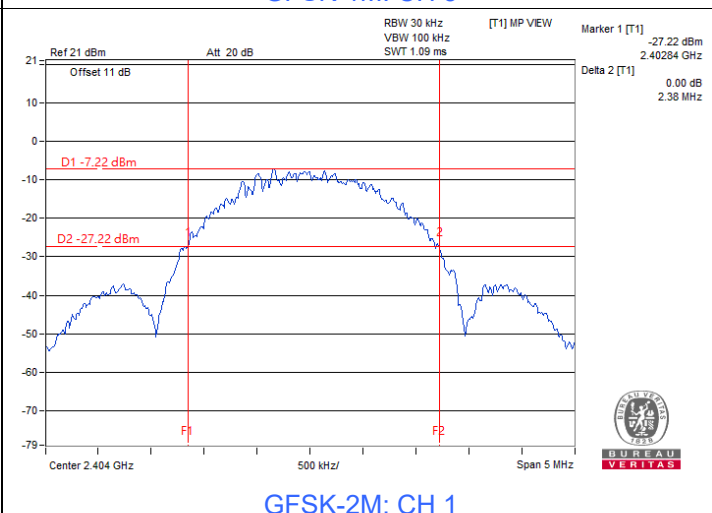
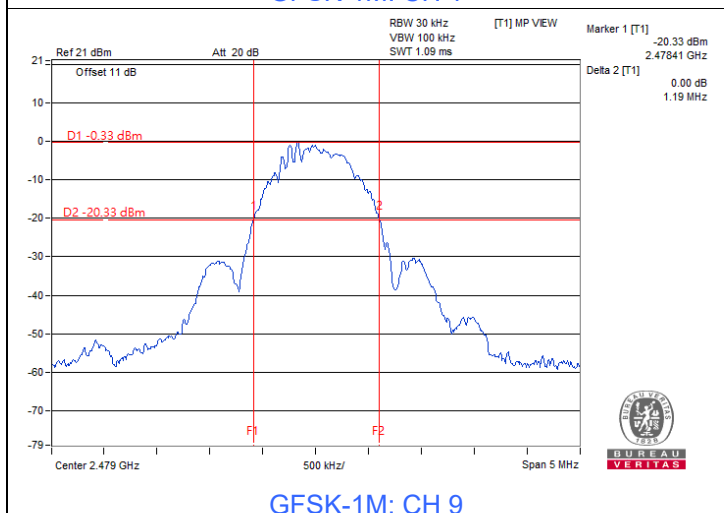
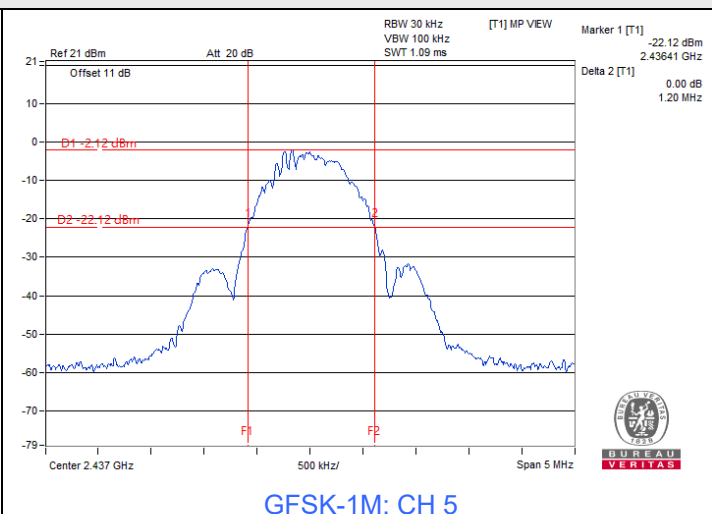
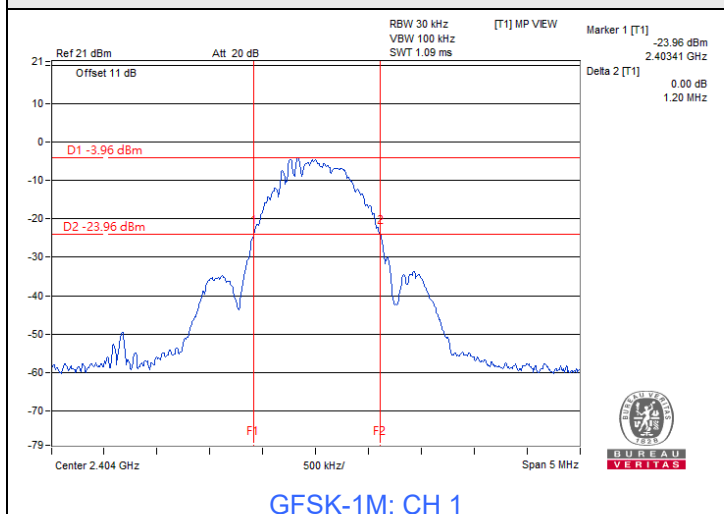
GFSK-2M

Channel	Channel Frequency (MHz)	20 dB Bandwidth (MHz)	Measured Frequencies		Operating Frequency Band (MHz)	Test Result
			FL (MHz)	FH (MHz)		
1	2404	2.38	2402.84	2405.22	2400 ~ 2483.5	Pass
5	2437	2.38	2435.84	2438.22		Pass
9	2479	2.41	2477.81	2480.22		Pass

Notes:

1. FL is the lowest frequency of the 20 dB bandwidth of power envelope.
2. FH is the highest frequency of the 20 dB bandwidth of power envelope.

Spectrum Plot



8 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo)

9 Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

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Email: service.adt@bureauveritas.com

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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