

TEST REPORT

CERTIFICATE OF CONFORMITY

Standard: 47 CFR FCC Part 15, Subpart C (Section 15.247)

Report No.: RFBDKG-WTW-P20100479A

FCC ID: JNZMR0037

Product: 2.4GHz Cordless Mouse

Brand: Logitech

Model No.: M-R0037

Received Date: 2024/1/1

Test Date: 2024/1/3 ~ 2024/1/11

Issued Date: 2024/3/6

Applicant: LOGITECH FAR EAST LTD.

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

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FCC Registration / 723255 / TW2022

Designation Number:

Approved by:  , Date: 2024/3/6

May Chen / Manager

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Prepared by : Vito Lung / Specialist



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Release Control Record

Issue No.	Description	Date Issued
RFBDKG-WTW-P20100479A	Original release.	2024/3/6

1 Certificate

Product: 2.4GHz Cordless Mouse
Brand: Logitech
Test Model: M-R0037
Sample Status: Engineering sample
Applicant: LOGITECH FAR EAST LTD.
Test Date: 2024/1/3 ~ 2024/1/11
Standard: 47 CFR FCC Part 15, Subpart C (Section 15.247)
Measurement procedure: ANSI C63.10-2013
KDB 558074 D01 15.247 Meas Guidance v05r02

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 15.247)			
Standard / Clause	Test Item	Result	Remark
15.247(b)	RF Output Power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.247(a)(2)	6 dB Bandwidth	NA	Refer to Note 1 below
15.247(d)	Conducted Out of Band Emissions	NA	Refer to Note 1 below
15.207	AC Power Conducted Emissions	NA	Refer to Note 1 below
15.205 / 15.209 / 15.247(d)	Unwanted Emissions below 1 GHz	Pass	Minimum passing margin is -12.8 dB at 32.06 MHz
15.205 / 15.209 / 15.247(d)	Unwanted Emissions above 1 GHz	Pass	Minimum passing margin is -6.8 dB at 2483.50 MHz
15.203	Antenna Requirement	Pass	No antenna connector is used.

Notes:

1. RF Output Power, Power Spectral Density, Unwanted Emissions test items were performed for this addendum. The others testing data refer to original test report.
2. 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:

Parameter	Specification	Uncertainty (±)
RF Output Power	-	1.1 dB
Power Spectral Density	-	1.3 dB
Unwanted Emissions below 1 GHz	9 kHz ~ 30 MHz	3.1 dB
	30 MHz ~ 1 GHz	5.4 dB
Unwanted Emissions above 1 GHz	1 GHz ~ 18 GHz	5.0 dB
	18 GHz ~ 40 GHz	5.3 dB

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	2.4GHz Cordless Mouse
Brand	Logitech
Test Model	M-R0037
Status of EUT	Engineering sample
Power Supply Rating	3 Vdc from batteries
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	2 Mbps
Operating Frequency	2.405 GHz ~ 2.474 GHz
Number of Channel	12
Output Power	0.3715 mW (-4.3 dBm)

Note:

1. This report is prepared for FCC Class II permissive change. The difference compared with the Report No.: RFBDKG-WTW-P20100479 design is as the following information:
 - ◆ RF components down size from 0402 to 0201 and change some component value(include L5 / L2 /L4 / C17 / C18 / L3/ C19/ C23), keep RF performance better, the change doesn't affect RF parameters.
 - ◆ Mount C24 component.
 - ◆ Antenna Gain change from 4.64dBi to 7.23dBi & rename antenna type.
2. According to above conditions, there are RF Output Power, Power Spectral Density and Unwanted Emissions needs to be performed. All data for meeting the requirement is verified.
3. The EUT may have a lot of colors for marketing requirement.
4. The product is supplied by alkaline batteries.
5. 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

1. The antenna information is listed as below.

Antenna Gain (dBi)	Frequency Range (GHz)	Antenna Type	Connector Type
7.23	2.4-2.4835	Dipole Antenna	None

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

3.3 Channel List

12 channels are provided to this EUT:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2405	7	2441
2	2408	8	2444
3	2414	9	2462
4	2417	10	2465
5	2432	11	2471
6	2435	12	2474

3.4 Test Mode Applicability and Tested Channel Detail

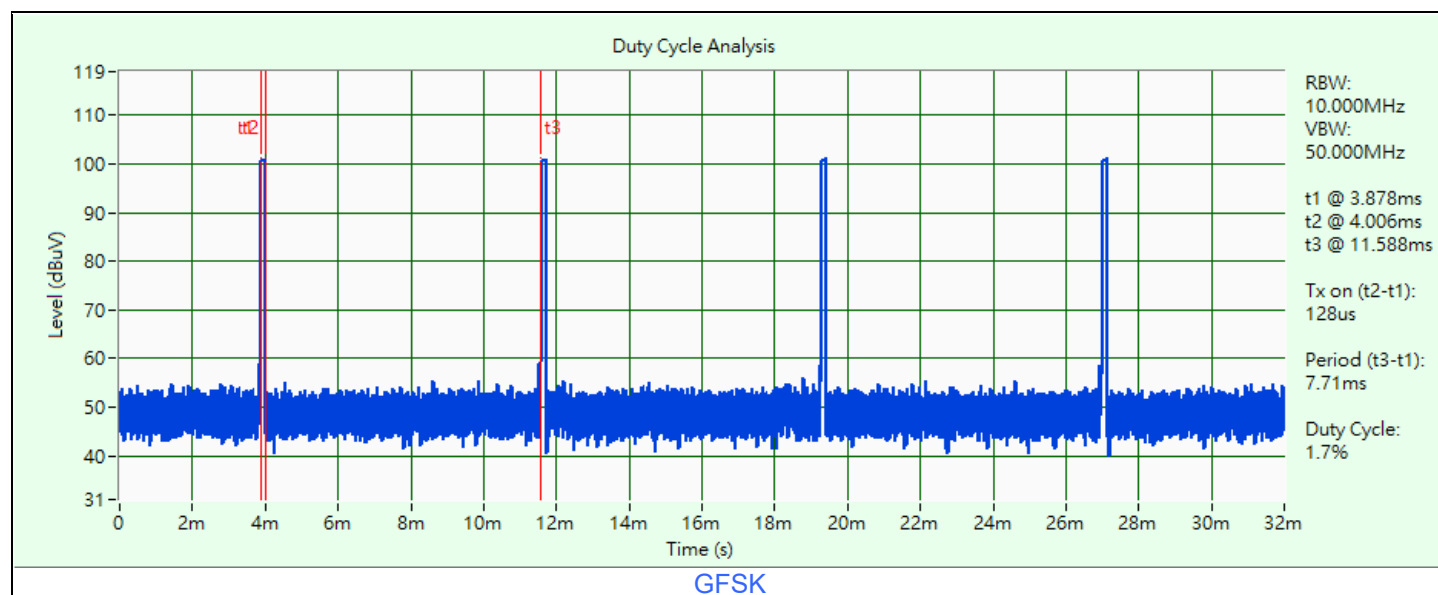
Pre-Scan:	1. Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
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Following channel(s) was (were) selected for the final test as listed below:

Test Item	Tested Channel	Modulation	Data Rate Parameter
RF Output Power	1, 8, 12	GFSK	2Mb/s
Power Spectral Density	1, 8, 12	GFSK	2Mb/s
Unwanted Emissions below 1 GHz	1	GFSK	2Mb/s
Unwanted Emissions above 1 GHz	1, 8, 12	GFSK	2Mb/s

3.5 Duty Cycle of Test Signal

GFSK: Duty cycle = $0.128 \text{ ms} / 7.71 \text{ ms} \times 100\% = 1.7\%$, duty factor = $10 * \log (1/\text{Duty cycle}) = 17.80 \text{ dB}$

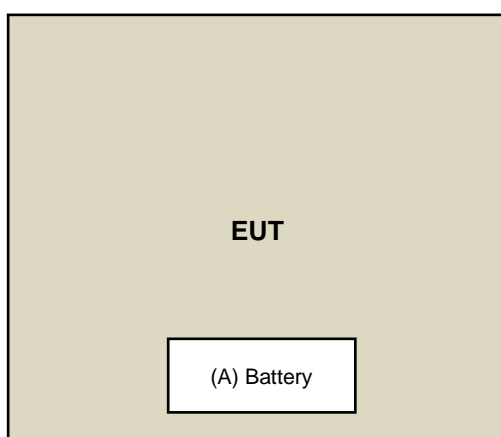


3.6 Test Program Used and Operation Descriptions

Controlling software (RF Sample with Receiver [Number Lock]) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

Test Item	Operation Description
RF Output Power	UFY TX Modulated low duty cycle 2405MHz
Power Spectral Density	UFY TX Modulated low duty cycle 2444MHz
Unwanted Emissions	UFY TX Modulated low duty cycle 2474MHz

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	Battery*2	Duracell	AA	N/A	N/A	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 RF Output Power

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Power Meter Anritsu	ML2495A	1529002	2023/6/17	2024/6/16
Pulse Power Sensor Anritsu	MA2411B	1726434	2023/6/19	2024/6/18

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2024/1/11

4.2 Power Spectral Density

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
MXA Signal Analyzer Keysight	N9020B	MY60112409	2023/2/18	2024/2/17
Software	ADT_RF Test Software V7.6.5.4	N/A	N/A	N/A

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2024/1/11

4.3 Unwanted Emissions below 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	N/A	N/A
Bi_Log Antenna Schwarzbeck	VULB 9168	9168-361	2023/10/13	2024/10/12
Fix tool for Boresight antenna tower BV	FBA-01	FBA_SIP01	N/A	N/A
Fixed Attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	2023/9/7	2024/9/6
Loop Antenna Electro-Metrics	EM-6879	264	2023/2/21	2024/2/20
MXE EMI Receiver Agilent	N9038A	MY50010156	2023/6/13	2024/6/12
Preamplifier EMCI	EMC330N	980852	2023/2/20	2024/2/19
	EMC001340	980142	2023/5/8	2024/5/7
RF Coaxial Cable JYEBAO	5D-FB	LOOPCAB-001	2023/12/12	2024/12/11
		LOOPCAB-002	2023/12/12	2024/12/11
RF Coaxial Cable PEWC	8D	966-3-2	2023/2/17	2024/2/16
		966-3-3	2023/2/17	2024/2/16
		966-4-1	2023/2/18	2024/2/17
Software	ADT_Radiated_V8.7.08	N/A	N/A	N/A

Notes:

1. The test was performed in 966 Chamber No. 3.
2. Tested Date: 2024/1/3

4.4 Unwanted Emissions above 1 GHz

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	N/A	N/A
Fix tool for Boresight antenna tower BV	FBA-01	FBA_SIP01	N/A	N/A
Horn Antenna Schwarzbeck	BBHA 9120D	9120D-406	2023/11/12	2024/11/11
	BBHA 9170	9170-739	2023/11/12	2024/11/11
MXE EMI Receiver Agilent	N9038A	MY50010156	2023/6/13	2024/6/12
Preamplifier EMCI	EMC12630SE	980384	2023/8/9	2024/8/8
	EMC184045SE	980387	2023/8/9	2024/8/8
PXA Signal Analyzer Keysight	N9030B	MY57142938	2023/4/6	2024/4/5
RF Coaxial Cable EMCI	EMC-KM-KM-4000	200214	2023/2/20	2024/2/19
	EMC102-KM-KM-1200	160924	2023/8/9	2024/8/8
	EMC104-SM-SM-1500	180504	2023/3/27	2024/3/26
	EMC104-SM-SM-2000	180601	2023/6/2	2024/6/1
	EMC104-SM-SM-6000	210201	2023/5/8	2024/5/7
Software	ADT_Radiated_V8.7.08	N/A	N/A	N/A

Notes:

1. The test was performed in 966 Chamber No. 3.
2. Tested Date: 2024/1/3 ~ 2024/1/11

5 Limits of Test Items

5.1 RF Output Power

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30 dBm)

5.2 Power Spectral Density

The Maximum of Power Spectral Density Measurement is 8 dBm in any 3 kHz.

5.3 Unwanted Emissions below 1 GHz

Radiated emissions up to 1 GHz which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

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).

5.4 Unwanted Emissions above 1 GHz

Radiated emissions above 1 GHz which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
Above 960	500	3

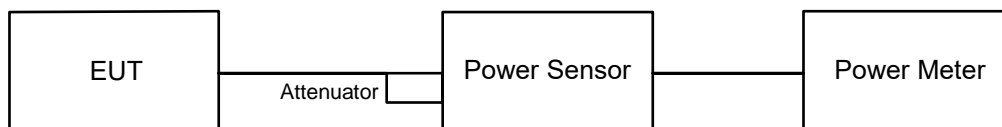
Notes:

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.

6 Test Arrangements

6.1 RF Output Power

6.1.1 Test Setup



6.1.2 Test Procedure

Peak Power:

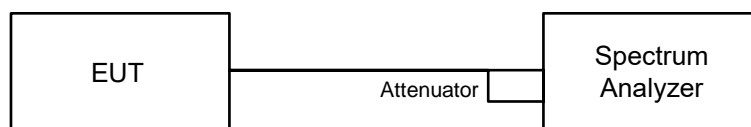
A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Average Power:

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

6.2 Power Spectral Density

6.2.1 Test Setup



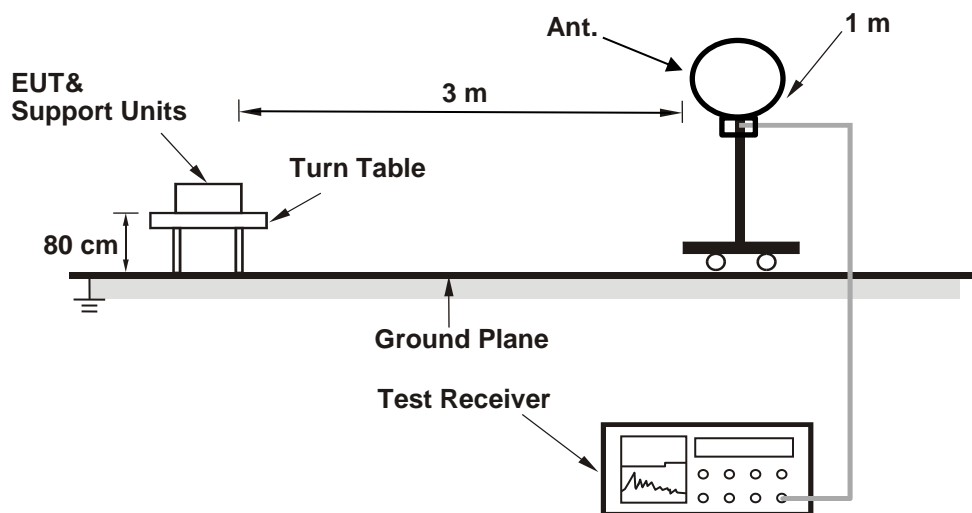
6.2.2 Test Procedure

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: 3 kHz.
- Set the VBW $\geq 3 \times$ RBW.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.

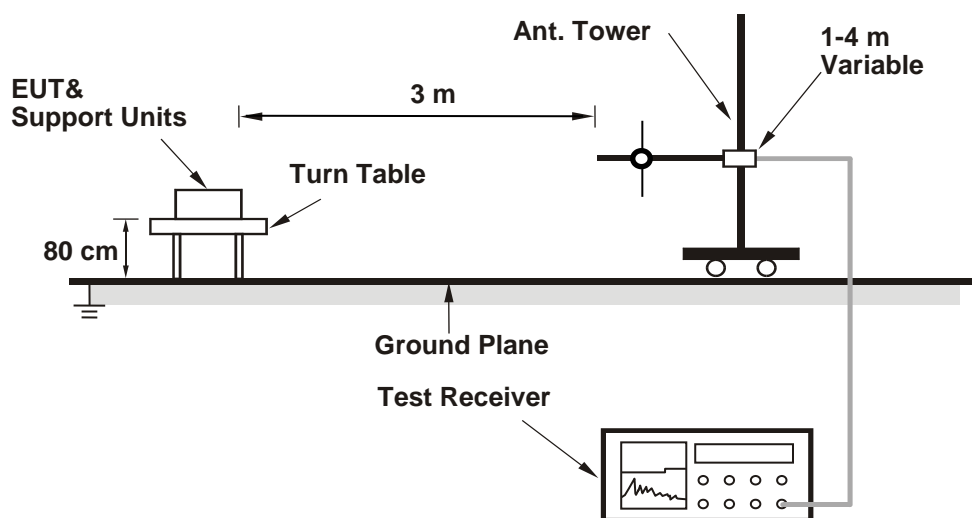
6.3 Unwanted Emissions below 1 GHz

6.3.1 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).

6.3.2 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, 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

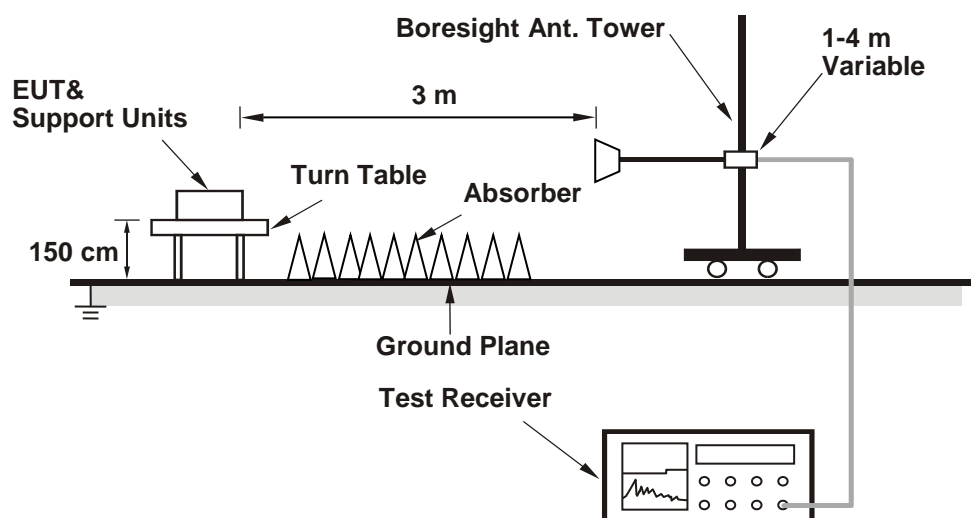
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the 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 detect function and specified bandwidth with maximum hold mode when the test frequency is below 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.
2. All modes of operation were investigated and the worst-case emissions are reported.

6.4 Unwanted Emissions above 1 GHz

6.4.1 Test Setup



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

6.4.2 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/spectrum analyzer 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.
- For fundamental and harmonic signal measurement, according to KDB 558074 D01 15.247 Meas Guidance v05r02 section 8.1(c)(3). The spectrum analyzer settings meet the requirements of 11.12.2.4 in ANSI C63.10 for making a Peak measurement, the average value = Peak value + duty cycle correction factor. The duty cycle measurement refers to FCC 47 CFR Part 15C section 15.35 (c). 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.

7 Test Results of Test Item

7.1 RF Output Power

Input Power:	3 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Louis Yang
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For Peak Power

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
1	2405	0.3715	-4.30	28.77	Pass
8	2444	0.3048	-5.16	28.77	Pass
12	2474	0.2576	-5.89	28.77	Pass

Note: The antenna gain is 7.23 dBi > 6 dBi, so the output power limit shall be reduced to $30 - (7.23 - 6) = 28.77$ dBm.

For Average Power

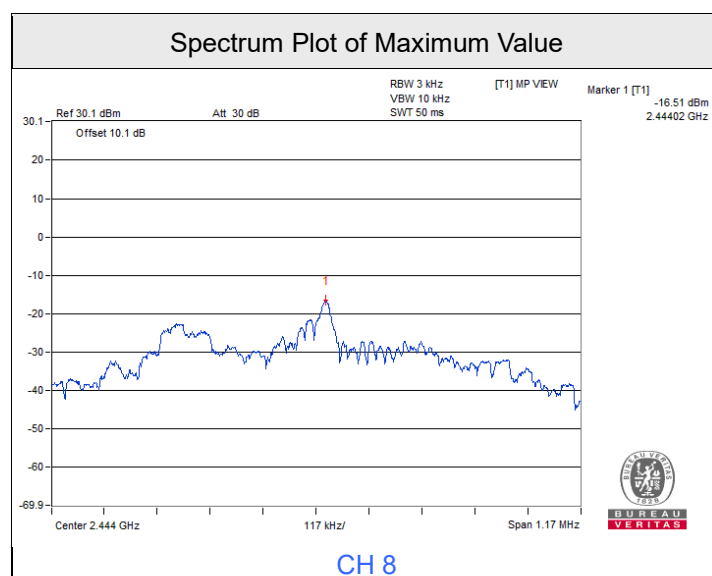
Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
1	2405	0.3631	-4.40
8	2444	0.2958	-5.29
12	2474	0.2518	-5.99

7.2 Power Spectral Density

Input Power:	3 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Louis Yang
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Chan.	Chan. Freq. (MHz)	PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Test Result
1	2405	-17.12	6.77	Pass
8	2444	-16.51	6.77	Pass
12	2474	-16.61	6.77	Pass

Note: The antenna gain is 7.23 dBi > 6 dBi, so the power density limit shall be reduced to $8 - (7.23 - 6) = 6.77$ dBm/3kHz.



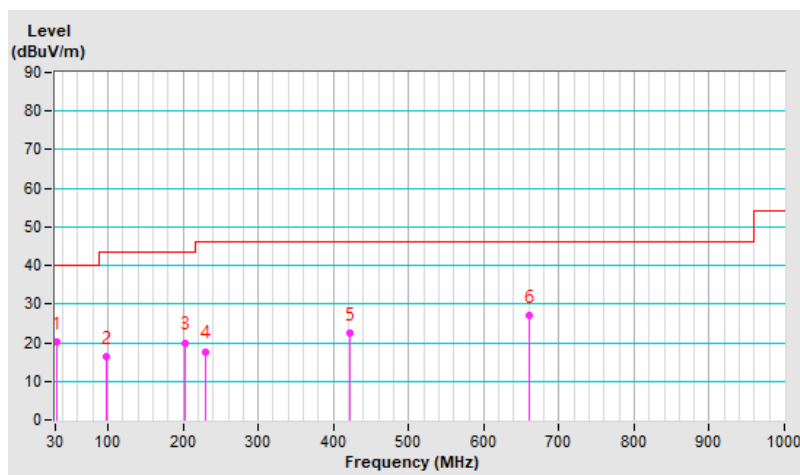
7.3 Unwanted Emissions below 1 GHz

RF Mode	GFSK	Channel	CH 1 : 2405 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120kHz, DET=Quasi-Peak
Input Power	3 Vdc	Environmental Conditions	22°C, 70% RH
Tested By	Louis Yang		

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	32.04	20.2 QP	40.0	-19.8	1.00 H	20	33.6	-13.4
2	98.51	16.5 QP	43.5	-27.0	1.50 H	158	33.7	-17.2
3	201.81	20.0 QP	43.5	-23.5	1.50 H	173	35.7	-15.7
4	229.07	17.7 QP	46.0	-28.3	2.00 H	272	33.0	-15.3
5	421.08	22.4 QP	46.0	-23.6	2.50 H	64	31.0	-8.6
6	660.43	27.0 QP	46.0	-19.0	2.50 H	360	30.4	-3.4

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

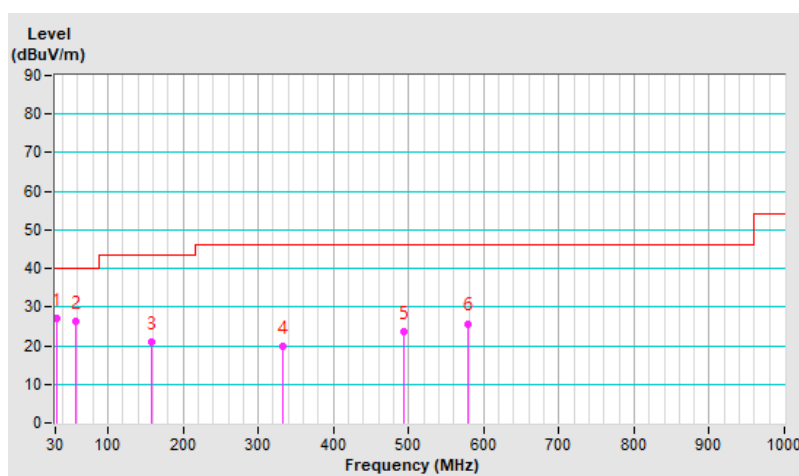


RF Mode	GFSK	Channel	CH 1 : 2405 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120kHz, DET=Quasi-Peak
Input Power	3 Vdc	Environmental Conditions	22°C, 70% RH
Tested By	Louis Yang		

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	32.06	27.2 QP	40.0	-12.8	1.00 V	308	40.6	-13.4
2	57.84	26.3 QP	40.0	-13.7	1.00 V	1	39.5	-13.2
3	157.51	20.8 QP	43.5	-22.7	1.50 V	6	33.3	-12.5
4	332.54	19.7 QP	46.0	-26.3	1.50 V	0	30.2	-10.5
5	493.25	23.6 QP	46.0	-22.4	2.00 V	360	30.4	-6.8
6	579.09	25.7 QP	46.0	-20.3	2.50 V	136	30.7	-5.0

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.



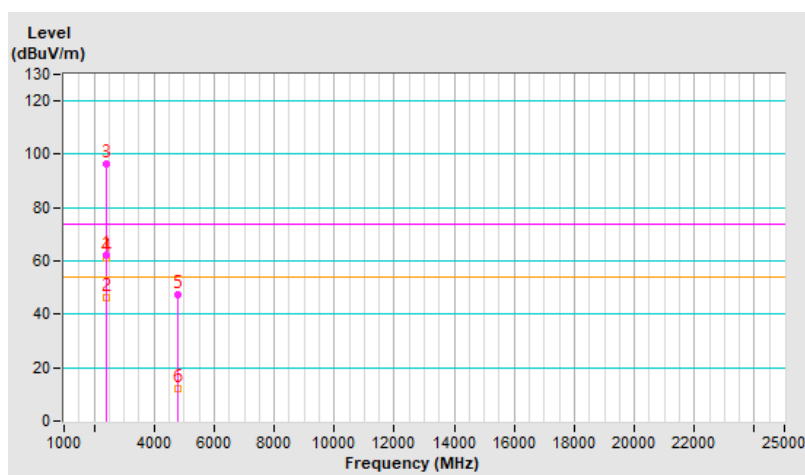
7.4 Unwanted Emissions above 1 GHz

RF Mode	GFSK	Channel	CH 1 : 2405 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	3 Vdc	Environmental Conditions	22°C, 72% RH
Tested By	Louis Yang		

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	62.1 PK	74.0	-11.9	1.50 H	172	64.4	-2.3
2	2390.00	46.5 AV	54.0	-7.5	1.50 H	172	48.8	-2.3
3	*2405.00	96.5 PK			1.50 H	172	98.8	-2.3
4	*2405.00	60.9 AV			1.50 H	172	63.2	-2.3
5	4810.00	47.5 PK	74.0	-26.5	1.04 H	199	45.3	2.2
6	4810.00	11.9 AV	54.0	-42.1	1.04 H	199	9.7	2.2

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.
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:
 $20 \log(\text{Duty cycle}) = 20 \log(0.128 \text{ ms} / 7.71 \text{ ms}) = -35.6 \text{ dB}$

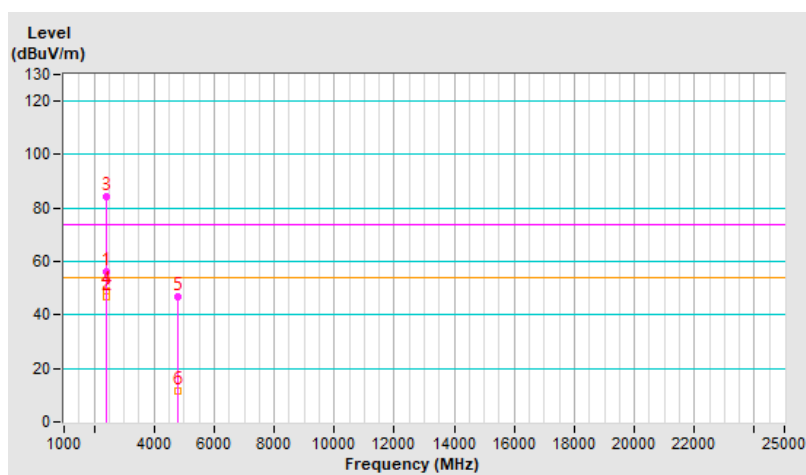


RF Mode	GFSK	Channel	CH 1 : 2405 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	3 Vdc	Environmental Conditions	22°C, 72% RH
Tested By	Louis Yang		

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	56.3 PK	74.0	-17.7	1.47 V	340	58.6	-2.3
2	2390.00	46.8 AV	54.0	-7.2	1.47 V	340	49.1	-2.3
3	*2405.00	84.5 PK			1.47 V	340	86.8	-2.3
4	*2405.00	48.9 AV			1.47 V	340	51.2	-2.3
5	4810.00	46.9 PK	74.0	-27.1	1.03 V	228	44.7	2.2
6	4810.00	11.3 AV	54.0	-42.7	1.03 V	228	9.1	2.2

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.
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:
 $20 \log(\text{Duty cycle}) = 20 \log(0.128 \text{ ms} / 7.71 \text{ ms}) = -35.6 \text{ dB}$

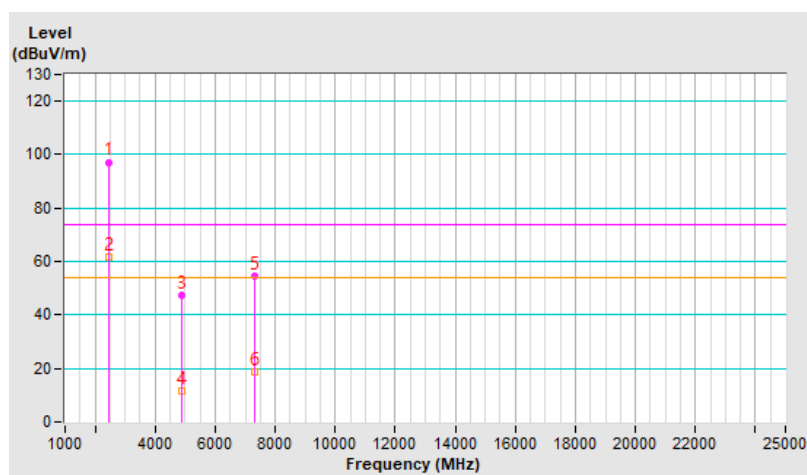


RF Mode	GFSK	Channel	CH 8 : 2444 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	3 Vdc	Environmental Conditions	22°C, 72% RH
Tested By	Louis Yang		

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	*2444.00	97.2 PK			3.37 H	188	99.4	-2.2
2	*2444.00	61.6 AV			3.37 H	188	63.8	-2.2
3	4888.00	47.1 PK	74.0	-26.9	1.05 H	202	45.1	2.0
4	4888.00	11.5 AV	54.0	-42.5	1.05 H	202	9.5	2.0
5	7332.00	54.3 PK	74.0	-19.7	1.00 H	210	46.6	7.7
6	7332.00	18.7 AV	54.0	-35.3	1.00 H	210	11.0	7.7

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, the limit was restricted at the RF Output Power.
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:
 $20 \log(\text{Duty cycle}) = 20 \log(0.128 \text{ ms} / 7.71 \text{ ms}) = -35.6 \text{ dB}$



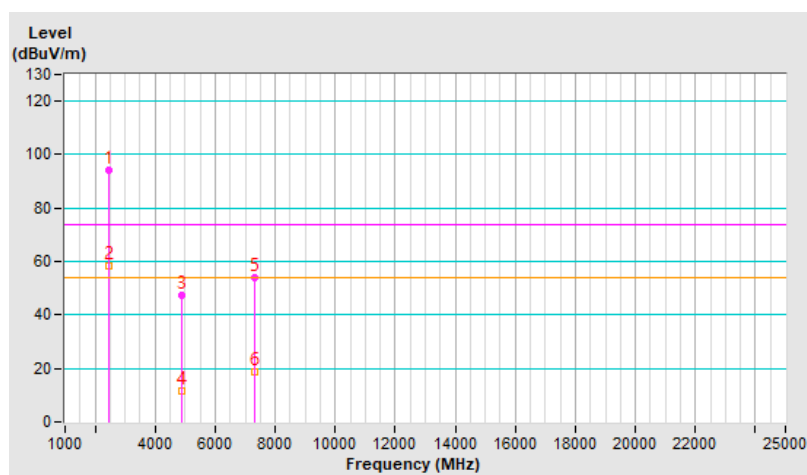
RF Mode	GFSK	Channel	CH 8 : 2444 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	3 Vdc	Environmental Conditions	22°C, 72% RH
Tested By	Louis Yang		

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	*2444.00	94.1 PK			3.69 V	45	96.3	-2.2
2	*2444.00	58.5 AV			3.69 V	45	60.7	-2.2
3	4888.00	47.3 PK	74.0	-26.7	1.00 V	215	45.3	2.0
4	4888.00	11.7 AV	54.0	-42.3	1.00 V	215	9.7	2.0
5	7332.00	54.2 PK	74.0	-19.8	1.03 V	209	46.5	7.7
6	7332.00	18.6 AV	54.0	-35.4	1.03 V	209	10.9	7.7

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, the limit was restricted at the RF Output Power.
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:

$$20 \log(\text{Duty cycle}) = 20 \log(0.128 \text{ ms} / 7.71 \text{ ms}) = -35.6 \text{ dB}$$



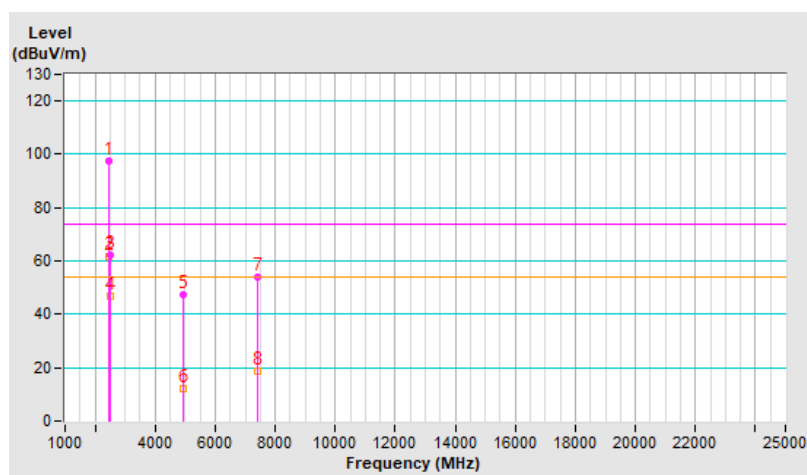
RF Mode	GFSK	Channel	CH 12 : 2474 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	3 Vdc	Environmental Conditions	22°C, 72% RH
Tested By	Louis Yang		

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	*2474.00	97.5 PK			2.12 H	167	99.7	-2.2
2	*2474.00	61.9 AV			2.12 H	167	64.1	-2.2
3	2483.50	62.3 PK	74.0	-11.7	2.12 H	167	64.6	-2.3
4	2483.50	47.0 AV	54.0	-7.0	2.12 H	167	49.3	-2.3
5	4948.00	47.6 PK	74.0	-26.4	1.10 H	216	45.4	2.2
6	4948.00	12.0 AV	54.0	-42.0	1.10 H	216	9.8	2.2
7	7422.00	54.2 PK	74.0	-19.8	1.02 H	198	46.2	8.0
8	7422.00	18.6 AV	54.0	-35.4	1.02 H	198	10.6	8.0

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.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.
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:

$$20 \log(\text{Duty cycle}) = 20 \log(0.128 \text{ ms} / 7.71 \text{ ms}) = -35.6 \text{ dB}$$



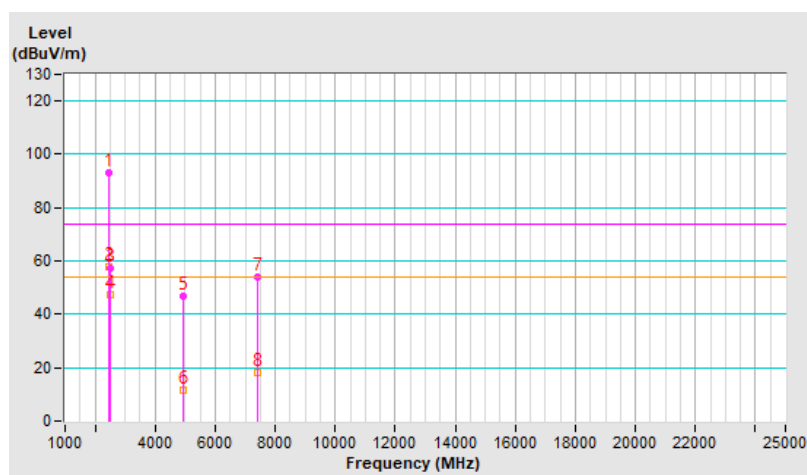
RF Mode	GFSK	Channel	CH 12 : 2474 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=3 MHz, DET=RMS
Input Power	3 Vdc	Environmental Conditions	22°C, 72% RH
Tested By	Louis Yang		

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	*2474.00	93.2 PK			4.00 V	248	95.4	-2.2
2	*2474.00	57.6 AV			4.00 V	248	59.8	-2.2
3	2483.50	57.5 PK	74.0	-16.5	4.00 V	248	59.8	-2.3
4	2483.50	47.2 AV	54.0	-6.8	4.00 V	248	49.5	-2.3
5	4948.00	47.0 PK	74.0	-27.0	1.00 V	205	44.8	2.2
6	4948.00	11.4 AV	54.0	-42.6	1.00 V	205	9.2	2.2
7	7422.00	53.9 PK	74.0	-20.1	1.02 V	203	45.9	8.0
8	7422.00	18.3 AV	54.0	-35.7	1.02 V	203	10.3	8.0

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.
5. " * ": Fundamental frequency, the limit was restricted at the RF Output Power.
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:

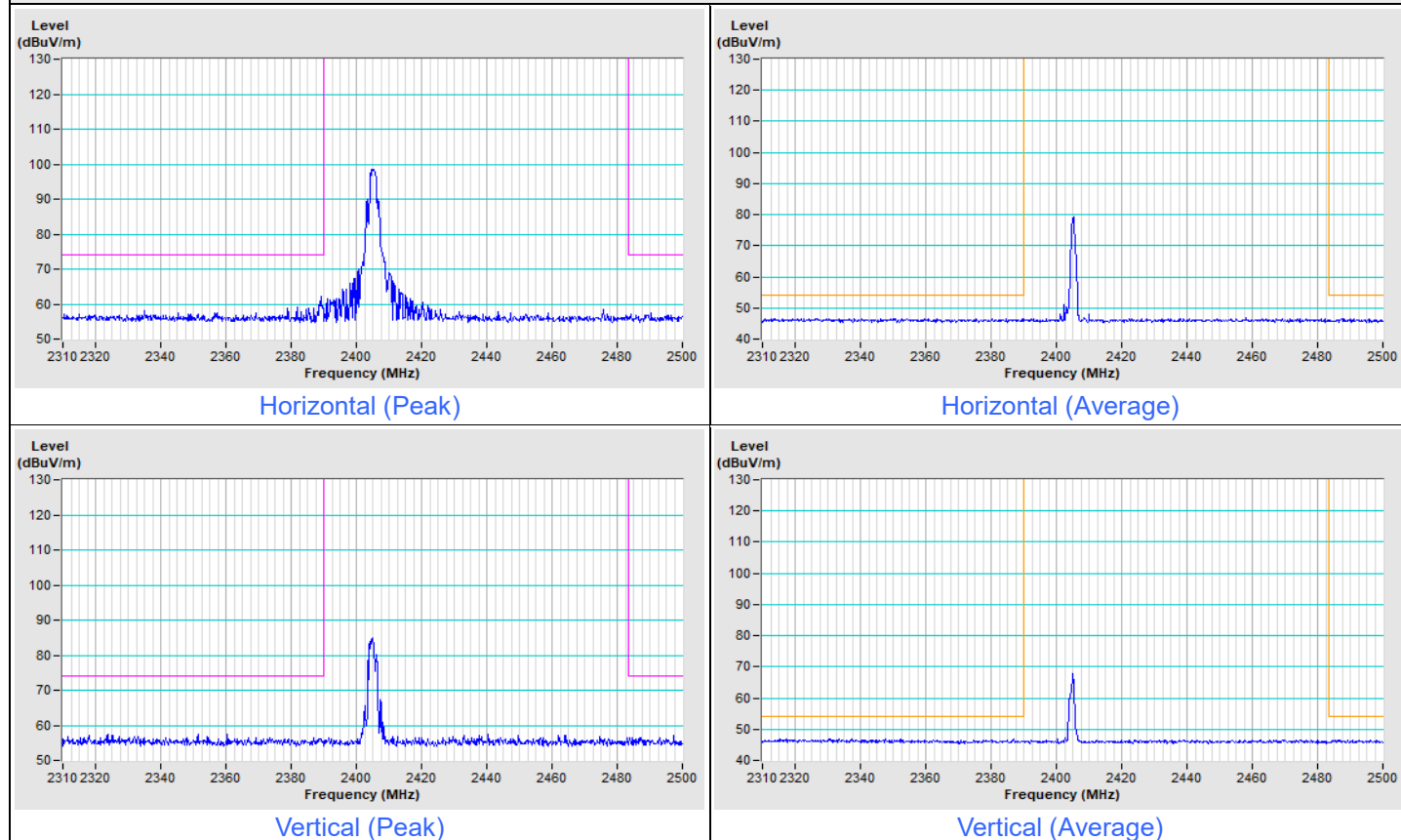
$$20 \log(\text{Duty cycle}) = 20 \log(0.128 \text{ ms} / 7.71 \text{ ms}) = -35.6 \text{ dB}$$



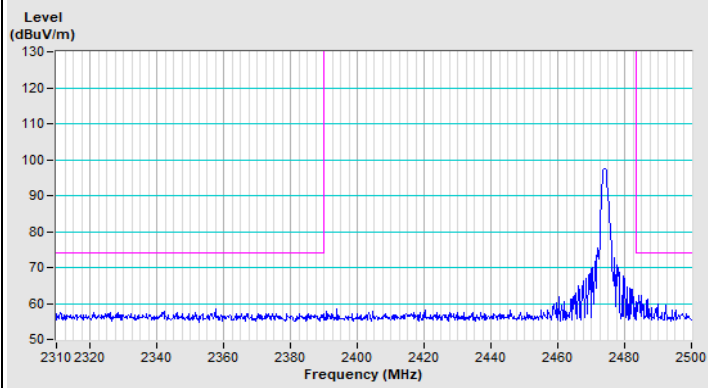
Plot of Band Edge

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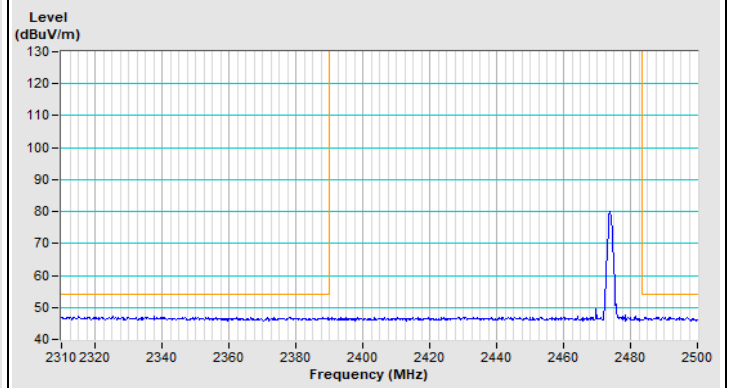
GFSK Channel 1



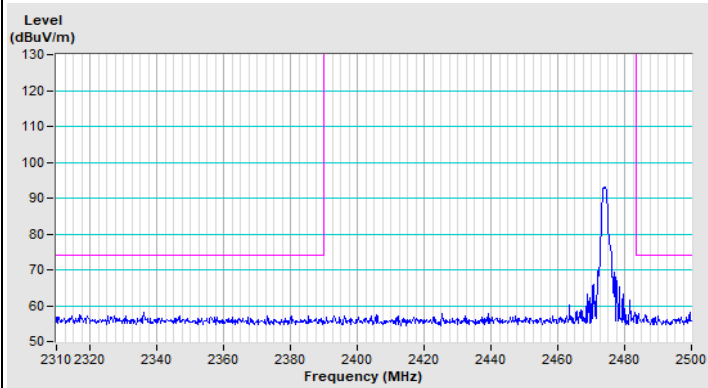
GFSK Channel 12



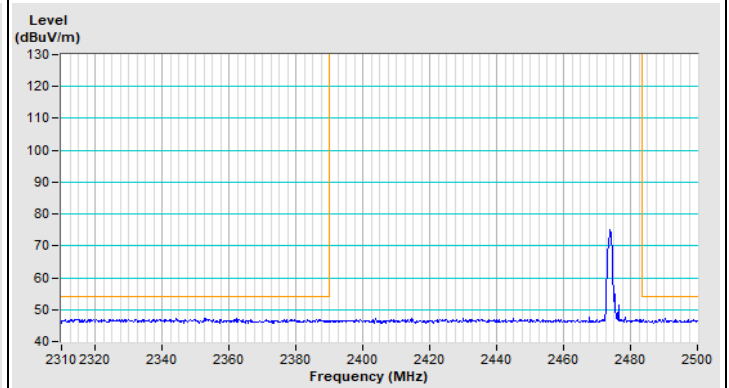
Horizontal (Peak)



Horizontal (Average)



Vertical (Peak)



Vertical (Average)

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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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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