FCC Test Report

Report No.:	RFBDKG-WTW-P22050087
FCC ID:	JNZMR0100
Test Model:	MR0100
Received Date:	May 04, 2022
Test Date:	May 16 ~ May 20, 2022
Issued Date:	Jun. 10, 2022
Applicant:	Logitech Far East Ltd.
Address:	7700 Gateway Boulevard Newark California United States
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
Test Location(1):	No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
FCC Registration / Designation Number(1):	788550 / TW0003
Test Location(2):	No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)
FCC Registration / Designation Number (2):	281270 / TW0032

Testing Laboratory
2021

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Release Control Record

Issue No.	Description	Date Issued
RFBDKG-WTW-P22050087	Original release	Jun. 10, 2022

1 Certificate of Conformity

Product:	Wireless Mouse
Brand:	Logitech
Test Model:	MR0100
Sample Status:	Engineering sample
Applicant:	Logitech Far East Ltd.
Test Date:	May 16 ~ May 20, 2022
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) 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 : Pettie Chen , **Date:** Jun. 10, 2022

Pettie Chen / Senior Specialist

Approved by : Jeremy Lin , **Date:** Jun. 10, 2022

Jeremy Lin / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	NA	Power supply is 1.5Vdc from battery.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -7.0dB at 2390.0MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	Pass	Meet the requirement of limit.
15.247(b)	Conducted power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	No antenna connector is used.

Note:

1. For 2.4G band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A. Test Procedures refer to report 4.1.3.
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:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.00 dB
	30MHz ~ 200MHz	2.91 dB
	200MHz ~1000MHz	2.92 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	1.76 dB
	18GHz ~ 40GHz	1.77 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Wireless Mouse
Brand	Logitech
Test Model	MR0100
Sample Status	Engineering sample
Power Supply Rating	1.5Vdc from battery
Modulation Type	GFSK
Operating Frequency	2405 ~ 2474MHz
Number of Channel	70
Output Power	1.337mW
Antenna Type	Printed antenna with 2dBi gain
Antenna Connector	NA
Accessory Device	NA
Cable Supplied	NA

Note:

1. The EUT may have a lot of colors for marketing requirement.
2. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.
3. 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 Description of Test Modes

70 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
1	2405	22	2426	43	2447	64	2468
2	2406	23	2427	44	2448	65	2469
3	2407	24	2428	45	2449	66	2470
4	2408	25	2429	46	2450	67	2471
5	2409	26	2430	47	2451	68	2472
6	2410	27	2431	48	2452	69	2473
7	2411	28	2432	49	2453	70	2474
8	2412	29	2433	50	2454		
9	2413	30	2434	51	2455		
10	2414	31	2435	52	2456		
11	2415	32	2436	53	2457		
12	2416	33	2437	54	2458		
13	2417	34	2438	55	2459		
14	2418	35	2439	56	2460		
15	2419	36	2440	57	2461		
16	2420	37	2441	58	2462		
17	2421	38	2442	59	2463		
18	2422	39	2443	60	2464		
19	2423	40	2444	61	2465		
20	2424	41	2445	62	2466		
21	2425	42	2446	63	2467		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to				Description
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	Note	√	-

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

Note: No need to concern of Conducted Emission due to the EUT is powered by battery

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
-	1 to 70	1, 40, 70	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
-	1 to 70	1	GFSK

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.

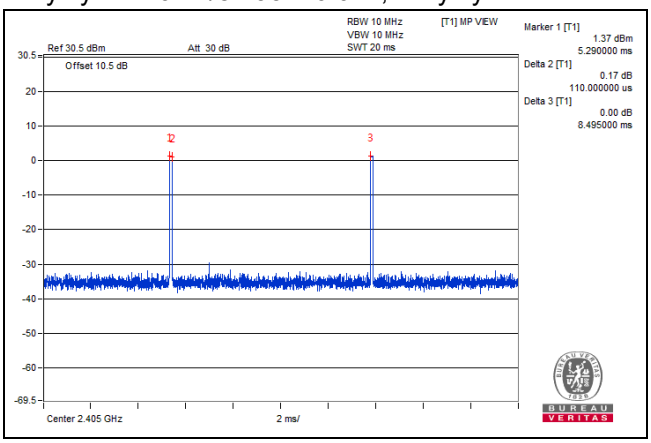
EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
-	1 to 70	1, 40, 70	GFSK

Test Condition:

Applicable to	Environmental Conditions	Input Power	Tested by
RE≥1G	23 deg. C, 67% RH	1.5Vdc	Edison Lee, Greg Lin
RE<1G	23 deg. C, 67% RH	1.5Vdc	Greg Lin
APCM	25 deg. C, 60% RH	1.5Vdc	Vincent Huang

3.3 Duty Cycle of Test Signal

Duty cycle = 0.11/8.495 = 0.014, Duty cycle correction factor = 20 * log (0.11/8.495) = -37.8



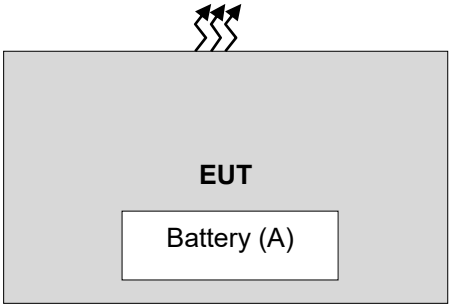
Note: This is highest operational duty cycle.

3.4 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.	Battery	Duracell	AA	NA	NA	Provided by lab

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards and References

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

Test standard:
FCC Part 15, Subpart C (15.247)
ANSI C63.10:2013

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

References Test Guidance:
KDB 558074 D01 15.247 Meas Guidance v05r02

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB 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

Note:

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

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038B	MY60180018	Feb. 18, 2022	Feb. 17, 2023
Spectrum Analyzer KEYSIGHT	N9020B	MY60110462	Dec. 21, 2021	Dec. 20, 2022
BILOG Antenna SCHWARZBECK	VULB9168	9168-995	Oct. 28, 2021	Oct. 27, 2022
HORN Antenna RF SPIN	DRH18-E	210104A18E	Nov. 14, 2021	Nov. 13, 2022
HORN Antenna SCHWARZBECK	BBHA 9170	9168-995	Nov. 14, 2021	Nov. 13, 2022
Loop Antenna EMCI	EM-6879	269	Sep. 16, 2021	Sep. 15, 2022
Loop Antenna TESEQ	HLA 6121	45745	Jul. 21, 2021	Jul. 20, 2022
Preamplifier EMCI	EMC330N	980783	Jan. 17, 2022	Jan. 16, 2023
Preamplifier EMCI	EMC118A45SE	980808	Dec. 30, 2021	Dec. 29, 2022
Preamplifier EMCI	EMC184045SE	980787	Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMC104-SM-SM-(9000+3000+2000+1000)	201230+ 201242+201238+ 210101	Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMCCFD400-NM-NM-(9000+3000+500+500)	201252+ 201250+201247+ 201245	Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMC101G-KM-KM-(5000+3000+2000)	201259+201256+201253	Jan. 17, 2022	Jan. 16, 2023
Software BV CPS	ADT_Radiated_V7.6.15.9.5	NA	NA	NA
Turn Table Max-Full	MFT-151SS-0.5T	NA	NA	NA
Turn Table Controller Max-Full	MF-7802BS	MF780208675	NA	NA
Antenna Tower KaiTuo	NA	NA	NA	NA
Antenna Tower Controller KaiTuo	KT-2000	NA	NA	NA
Wideband Power Sensor KEYSIGHT	N1923A	MY58020002	Jan. 17, 2022	Jan. 16, 2023
Peak Power Analyzer KEYSIGHT	8990B	MY51000485	Jan. 18, 2022	Jan. 17, 2023
Spectrum Analyzer ROHDE & SCHWARZ	FSV40	100979	Mar. 25, 2022	Mar. 24, 2023

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 WM Chamber 7.

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:

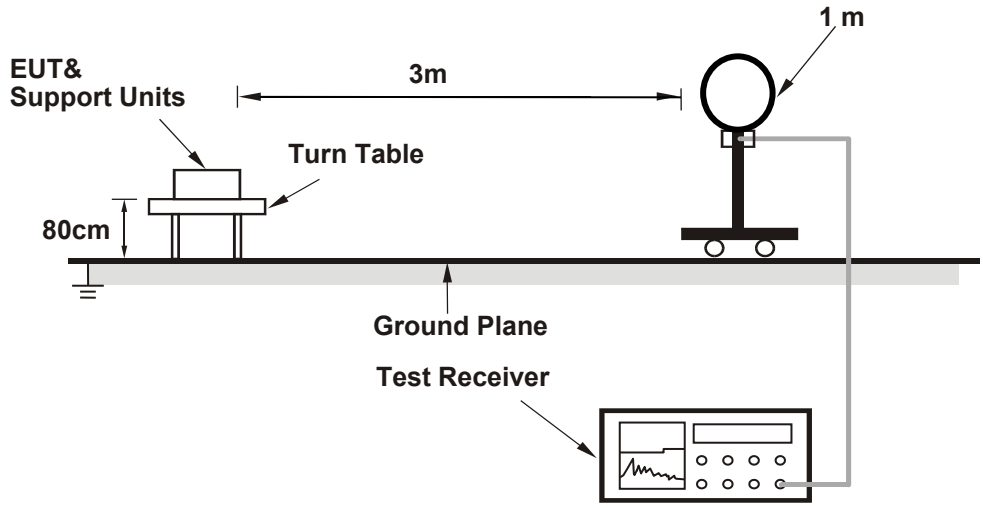
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection (AV) at frequency above 1GHz.
3. For Fundamental frequency and band edge & harmonic:
   The average value of fundamental frequency is average value = peak value + 20*log(Duty cycle) where the duty cycle correction factor is calculated from following formula:
   20*log(Duty cycle) = 20*log (0.11/8.495) =-37.8 dB, please refer to the plotted duty (see section 3.3)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

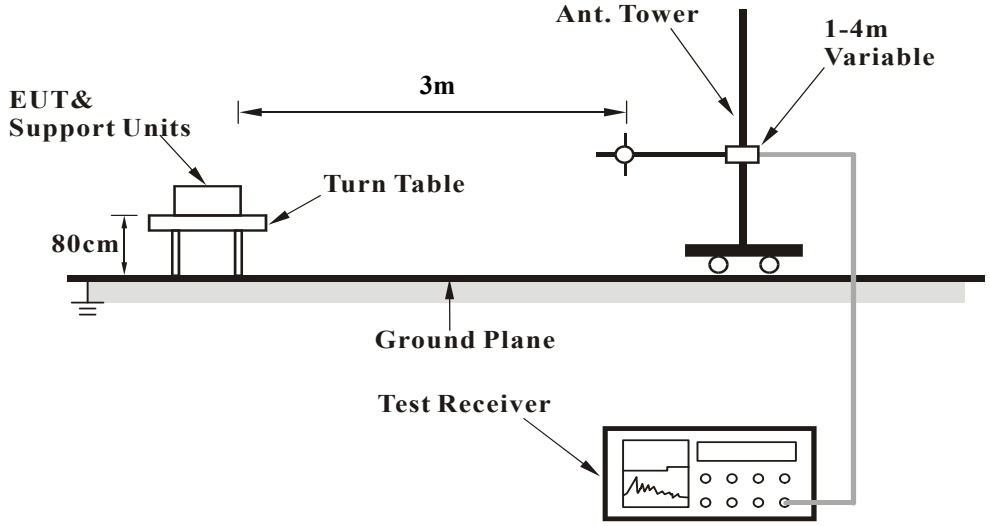
No deviation.

4.1.5 Test Setup

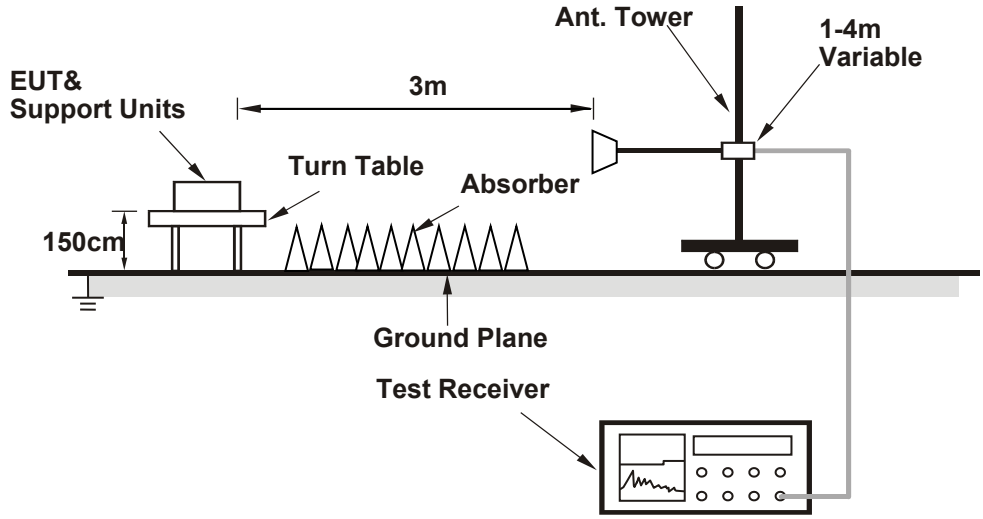
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

a. Placed the EUT on the testing table.

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

- UFY TX Modulated low duty cycle 2405MHz
- UFY TX Modulated low duty cycle 2444MHz
- UFY TX Modulated low duty cycle 2474MHz

4.1.7 Test Results

Above 1 GHz Data:

RF Mode	TX_GFSK	Channel	CH 1：2405 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	58.5 PK	74.0	-15.5	1.39 H	88	26.6	31.9
2	2390.00	46.9 AV	54.0	-7.1	1.39 H	88	15.0	31.9
3	*2405.00	99.4 PK			1.39 H	88	67.4	32.0
4	*2405.00	61.6 AV			1.39 H	88	29.6	32.0
5	4810.00	52.6 PK	74.0	-21.4	2.67 H	151	50.5	2.1
6	4810.00	14.8 AV	54.0	-39.2	2.67 H	151	12.7	2.1
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	58.0 PK	74.0	-16.0	3.67 V	142	26.1	31.9
2	**2390.00**	**47.0 AV**	**54.0**	**-7.0**	**3.67 V**	**142**	**15.1**	**31.9**
3	*2405.00	91.0 PK			3.67 V	142	59.0	32.0
4	*2405.00	53.2 AV			3.67 V	142	21.2	32.0
5	4810.00	49.9 PK	74.0	-24.1	1.10 V	185	47.8	2.1
6	4810.00	12.1 AV	54.0	-41.9	1.10 V	185	10.0	2.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. Margin value = Emission Level – Limit value.
4. The other emission levels were very low against the limit.
5. " * ": 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 (0.11/8.495) = -37.8 dB

RF Mode	TX_GFSK	Channel	CH 40：2444 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2444.00	99.9 PK			1.40 H	86	68.1	31.8
2	*2444.00	62.1 AV			1.40 H	86	30.3	31.8
3	4888.00	48.1 PK	74.0	-25.9	2.66 H	27	45.9	2.2
4	4888.00	10.3 AV	54.0	-43.7	2.66 H	27	8.1	2.2
5	7332.00	59.1 PK	74.0	-14.9	1.00 H	334	51.8	7.3
6	7332.00	21.3 AV	54.0	-32.7	1.00 H	334	14.0	7.3
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	90.2 PK			3.69 V	140	58.4	31.8
2	*2444.00	52.4 AV			3.69 V	140	20.6	31.8
3	4888.00	47.9 PK	74.0	-26.1	1.02 V	186	45.7	2.2
4	4888.00	10.1 AV	54.0	-43.9	1.02 V	186	7.9	2.2
5	7332.00	64.8 PK	74.0	-9.2	1.00 V	303	57.5	7.3
6	7332.00	27.0 AV	54.0	-27.0	1.00 V	303	19.7	7.3

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 (0.11/8.495) = -37.8 dB

RF Mode	TX_GFSK	Channel	CH 70：2474 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2474.00	99.8 PK			1.32 H	83	68.0	31.8
2	*2474.00	62.0 AV			1.32 H	83	30.2	31.8
3	2483.50	60.9 PK	74.0	-13.1	1.32 H	83	66.2	-5.3
4	2483.50	23.1 AV	54.0	-30.9	1.32 H	83	28.4	-5.3
5	4948.00	48.5 PK	74.0	-25.5	2.61 H	32	46.2	2.3
6	4948.00	10.7 AV	54.0	-43.3	2.61 H	32	8.4	2.3
7	7422.00	60.1 PK	74.0	-13.9	1.03 H	331	52.8	7.3
8	7422.00	22.3 AV	54.0	-31.7	1.03 H	331	15.0	7.3
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	90.6 PK			3.63 V	134	58.8	31.8
2	*2474.00	52.8 AV			3.63 V	134	21.0	31.8
3	2483.50	56.5 PK	74.0	-17.5	3.63 V	134	61.8	-5.3
4	2483.50	18.7 AV	54.0	-35.3	3.63 V	134	24.0	-5.3
5	4948.00	48.3 PK	74.0	-25.7	1.14 V	179	46.0	2.3
6	4948.00	10.5 AV	54.0	-43.5	1.14 V	179	8.2	2.3
7	7422.00	58.2 PK	74.0	-15.8	1.01 V	297	50.9	7.3
8	7422.00	20.4 AV	54.0	-33.6	1.01 V	297	13.1	7.3

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 (0.11/8.495) = -37.8 dB

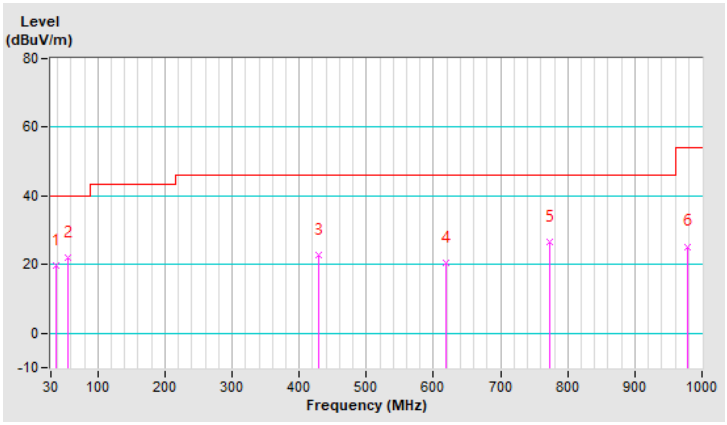
Below 1GHz worst-case data:

RF Mode	TX_GFSK	Channel	CH 1：2405 MHz
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	37.76	19.7 QP	40.0	-20.3	1.25 H	244	38.7	-19.0
2	55.22	22.0 QP	40.0	-18.0	1.50 H	16	40.6	-18.6
3	428.67	22.9 QP	46.0	-23.1	1.00 H	311	37.9	-15.0
4	617.82	20.5 QP	46.0	-25.5	1.25 H	307	31.5	-11.0
5	773.02	26.5 QP	46.0	-19.5	1.00 H	54	35.2	-8.7
6	977.69	25.3 QP	54.0	-28.7	1.00 H	10	31.3	-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. The other emission levels were very low against the limit of frequency range 30MHz ~ 1000MHz.
4. Margin value = Emission Level – Limit value.
5. The emission levels were very low against the limit of frequency range 9kHz ~ 30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

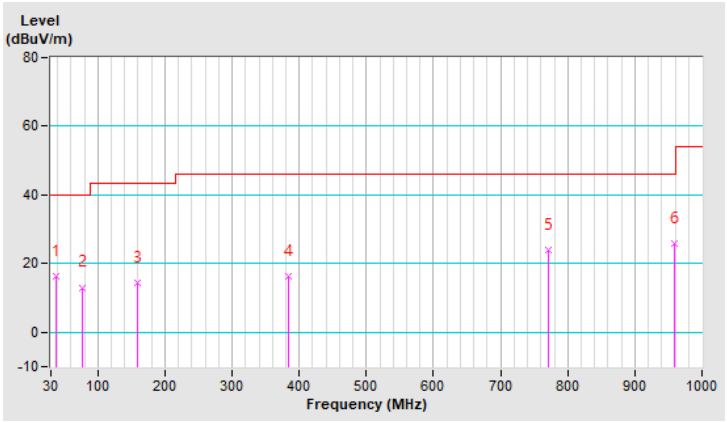


RF Mode	TX_GFSK	Channel	CH 1：2405 MHz
Frequency Range	30MHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	37.76	16.4 QP	40.0	-23.6	1.25 V	42	35.4	-19.0
2	76.56	13.1 QP	40.0	-26.9	1.00 V	293	35.8	-22.7
3	159.98	14.4 QP	43.5	-29.1	1.50 V	2	32.8	-18.4
4	384.05	16.4 QP	46.0	-29.6	1.00 V	321	32.5	-16.1
5	771.08	23.9 QP	46.0	-22.1	1.25 V	245	32.6	-8.7
6	958.29	25.9 QP	46.0	-20.1	1.00 V	282	32.1	-6.2

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

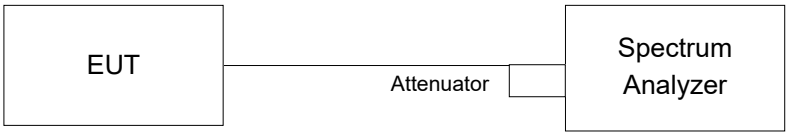


4.2 6dB Bandwidth Measurement

4.2.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 Test Procedure

a. Set resolution bandwidth (RBW) = 100kHz.

b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = peak.

c. Trace mode = max hold.

d. Sweep = auto couple.

e. 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 6 dB relative to the maximum level measured in the fundamental emission.

4.2.5 Deviation fromTest Standard

No deviation.

4.2.6 EUT Operating Conditions

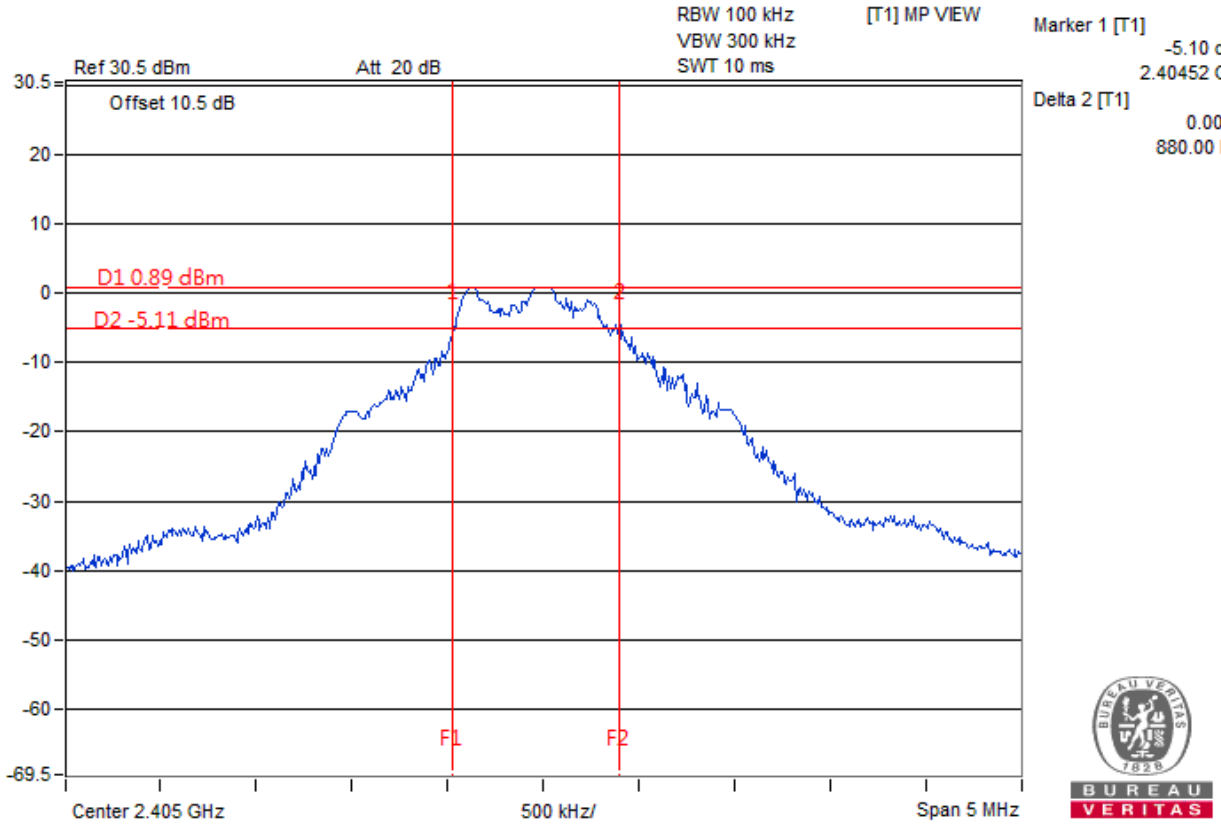
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

- UFY TX Modulated low duty cycle 2405MHz
- UFY TX Modulated low duty cycle 2444MHz
- UFY TX Modulated low duty cycle 2474MHz

4.2.7 Test Result

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2405	0.88	0.50	Pass
40	2444	0.90	0.50	Pass
70	2474	0.90	0.50	Pass

Spectrum Plot of Worst Value (CH 1)

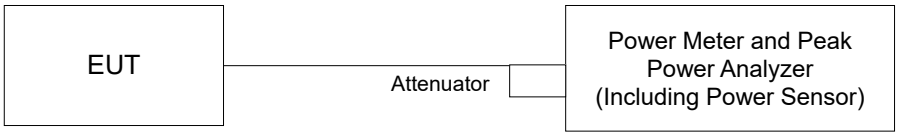


4.3 Conducted Output Power Measurement

4.3.1 Limits of Conducted Output Power Measurement

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

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedures

For 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.

For 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.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

- UFY TX Modulated low duty cycle 2405MHz
- UFY TX Modulated low duty cycle 2444MHz
- UFY TX Modulated low duty cycle 2474MHz

4.3.7 Test Results

For Peak Power

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2405	**1.337**	1.26	30.00	Pass
40	2444	1.327	1.23	30.00	Pass
70	2474	1.262	1.01	30.00	Pass

For Average Power

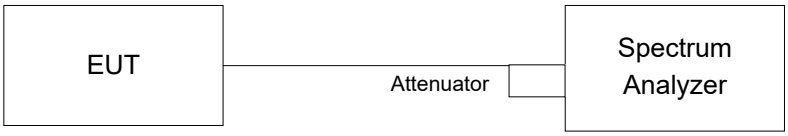
Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2405	1.279	1.07
40	2444	1.271	1.04
70	2474	1.191	0.76

4.4 Power Spectral Density Measurement

4.4.1 Limits of Power Spectral Density Measurement

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

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedure

a. Set analyzer center frequency to DTS channel center frequency.

b. Set the span to 1.5 times the DTS bandwidth.

c. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.

d. Set the VBW ≥ 3 × RBW.

e. Detector = peak.

f. Sweep time = auto couple.

g. Trace mode = max hold.

h. Allow trace to fully stabilize.

i. Use the peak marker function to determine the maximum amplitude level within the RBW.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Condition

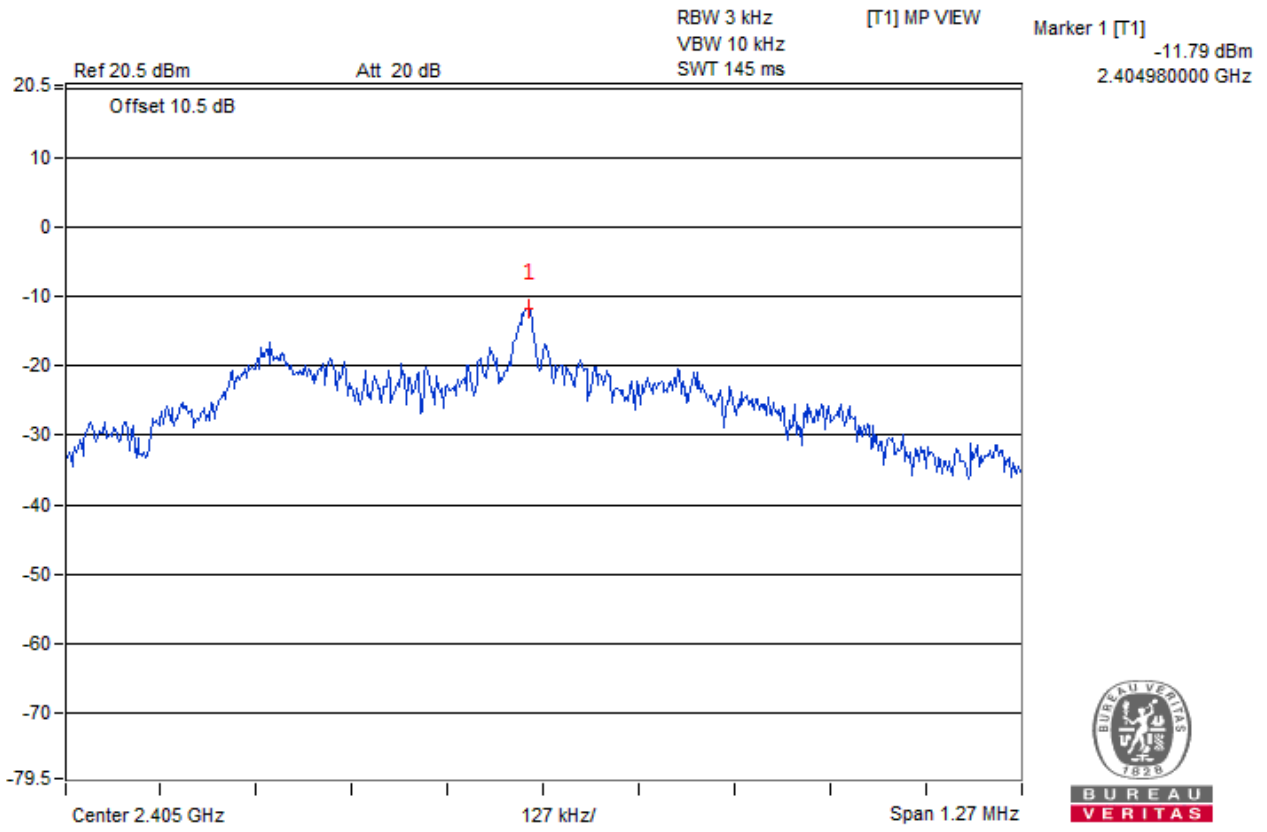
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

- UFY TX Modulated low duty cycle 2405MHz
- UFY TX Modulated low duty cycle 2444MHz
- UFY TX Modulated low duty cycle 2474MHz

4.4.7 Test Results

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
1	2405	-11.79	8.00	Pass
40	2444	-11.99	8.00	Pass
70	2474	-11.95	8.00	Pass

Spectrum Plot of Worst Value (CH 1)

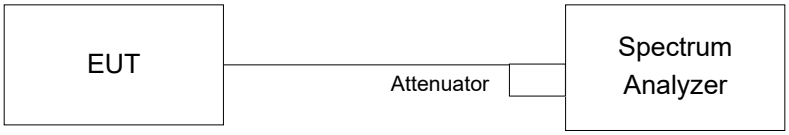


4.5 Conducted Out of Band Emission Measurement

4.5.1 Limits of Conducted Out of Band Emission Measurement

Below 20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

MEASUREMENT PROCEDURE REF

a. Set the RBW = 100 kHz.
b. Set the VBW ≥ 300 kHz.
c. Detector = peak.
d. Sweep time = auto couple.
e. Trace mode = max hold.
f. Allow trace to fully stabilize.
g. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOBE

a. Set RBW = 100 kHz.
b. Set VBW ≥ 300 kHz.
c. Detector = peak.
d. Sweep = auto couple.
e. Trace Mode = max hold.
f. Allow trace to fully stabilize.
g. Use the peak marker function to determine the maximum amplitude level.

4.5.5 Deviation from Test Standard

No deviation.

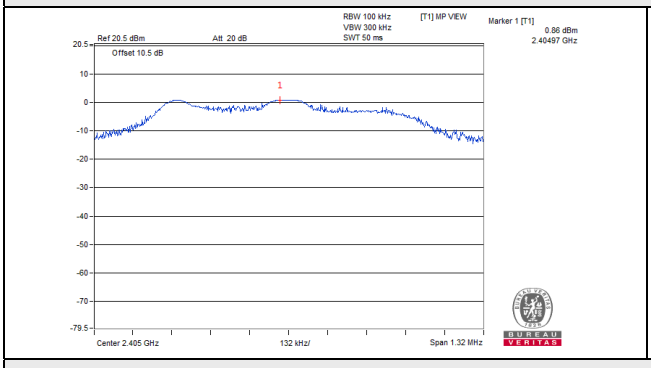
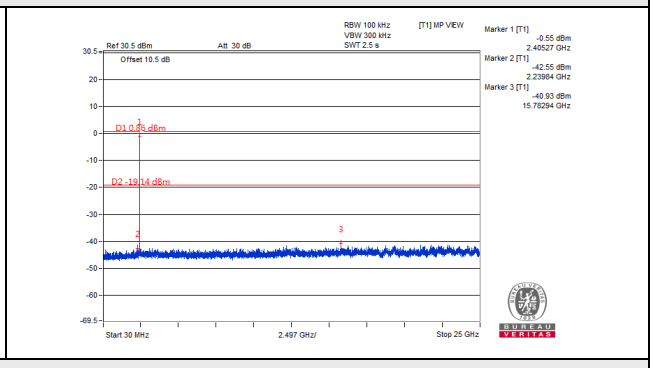
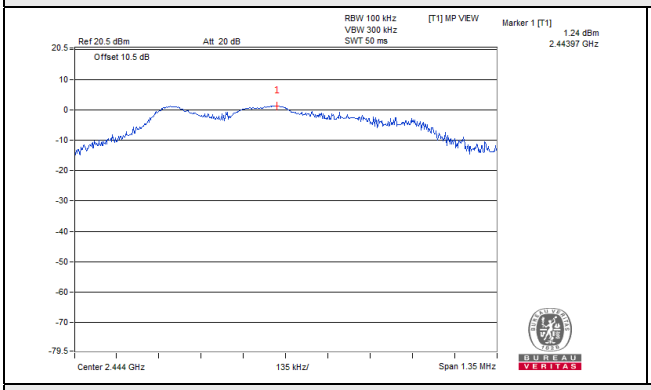
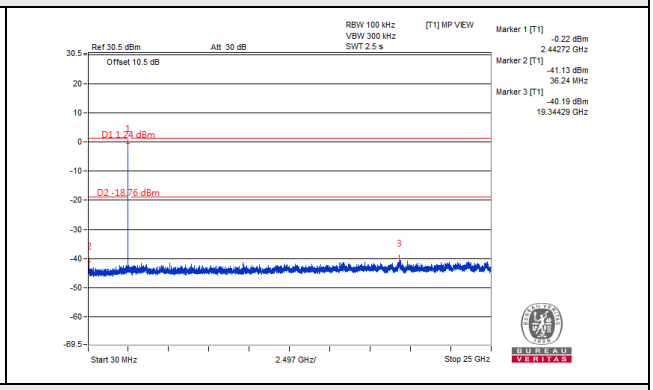
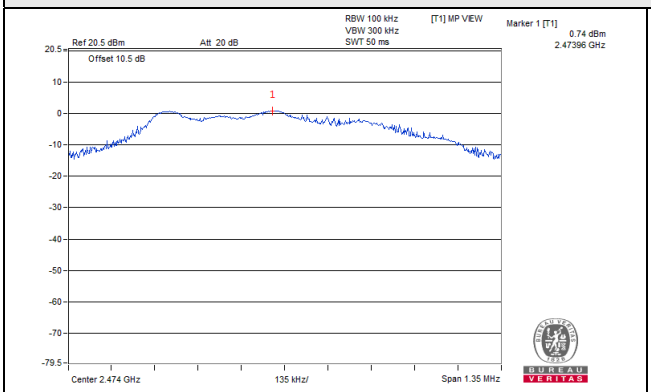
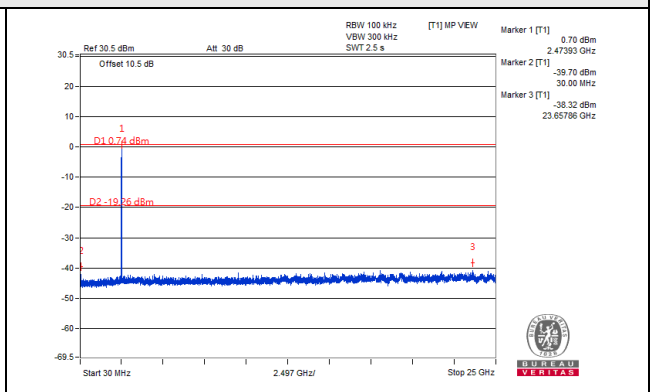
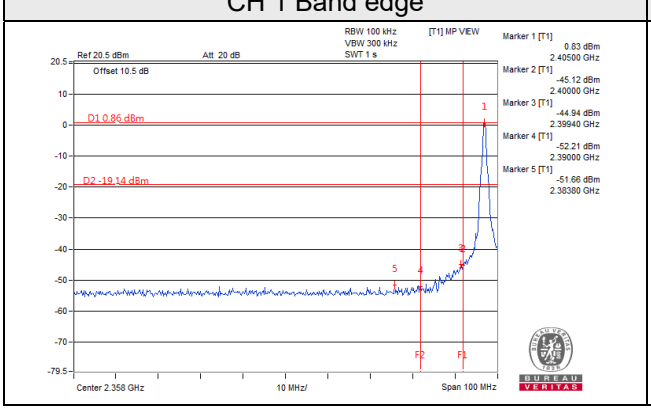
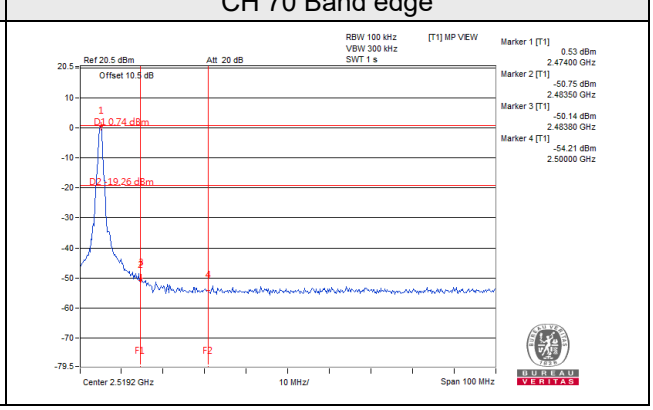
4.5.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

- UFY TX Modulated low duty cycle 2405MHz
- UFY TX Modulated low duty cycle 2444MHz
- UFY TX Modulated low duty cycle 2474MHz

4.5.7 Test Results

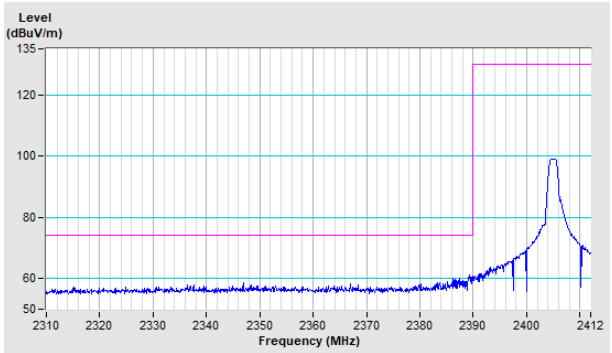
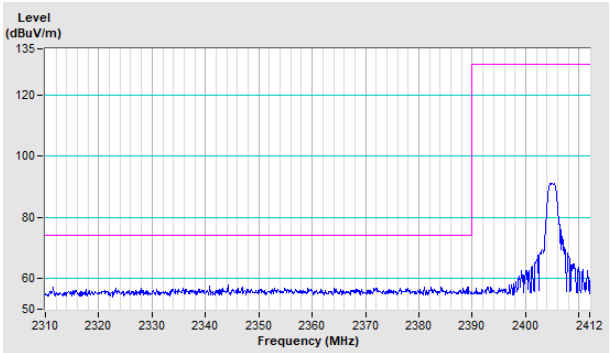
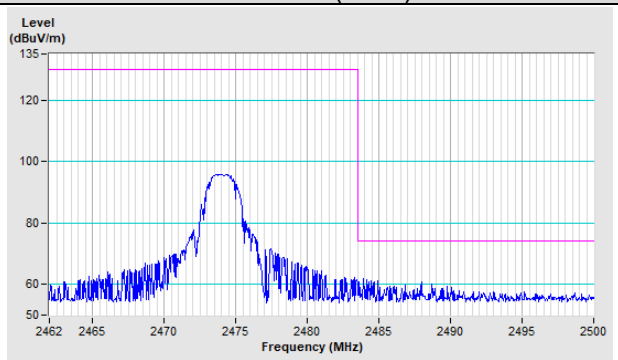
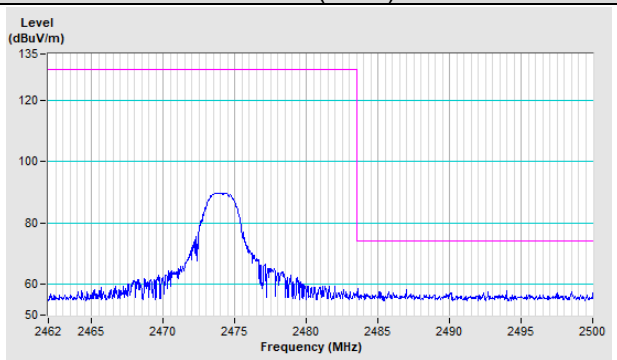
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

CH 1	
	
CH 40	
	
CH 70	
	
CH 1 Band edge	**CH 70 Band edge**
	

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Annex A - Band Edge Measurement

Channel 1	
Horizontal (Peak)	Vertical (Peak)
	
Channel 70	
Horizontal (Peak)	Vertical (Peak)
	

Appendix – Information of the Testing Laboratories

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

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

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Email: service.adt@tw.bureauveritas.com
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The address and road map of all our labs can be found in our web site also.

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