

TEST REPORT

CERTIFICATE OF CONFORMITY

Standard: 47 CFR FCC Part 15, Subpart C (Section 15.247)
Report No.: RFBDKG-WTW-P24050386
FCC ID: JNZF00014
Product: Stylus Pen
Brand: logitech
Model No.: F00014
Received Date: 2024/5/15
Test Date: 2024/5/27 ~ 2024/6/6
Issued Date: 2024/6/25

Applicant: Logitech Far East Ltd.

Address: #2 Creation Rd. 4, Science-Based Ind. Park Hsinchu Taiwan, R.O.C.

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

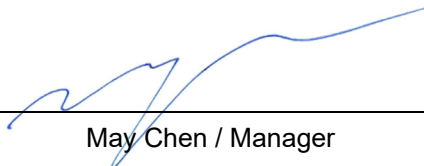
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Test Location: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan

FCC Registration / 723255 / TW2022

Designation Number:

Approved by: _____



May Chen / Manager

Date: _____

2024/6/25

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Prepared by : Phoenix Huang / Specialist

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Release Control Record

Issue No.	Description	Date Issued
RFBDKG-WTW-P24050386	Original release.	2024/6/25

1 Certificate

Product: Stylus Pen
Brand: logitech
Test Model: F00014
Sample Status: Engineering sample
Applicant: Logitech Far East Ltd.
Test Date: 2024/5/27 ~ 2024/6/6
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	Pass	Meet the requirement of limit.
15.247(d)	Conducted Out of Band Emissions	Pass	Meet the requirement of limit.
15.207	AC Power Conducted Emissions	Pass	Minimum passing margin is -14.81 dB at 0.43125 MHz
15.205 / 15.209 / 15.247(d)	Unwanted Emissions below 1 GHz	Pass	Minimum passing margin is -7.7 dB at 67.64 MHz
15.205 / 15.209 / 15.247(d)	Unwanted Emissions above 1 GHz	Pass	Minimum passing margin is -9.5 dB at 2390.00 and 2483.50 MHz
15.203	Antenna Requirement	Pass	Antenna connector is ipex(MHF) not a standard connector.

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:

Parameter	Specification	Uncertainty (±)
RF Output Power	-	1.1 dB
Power Spectral Density	-	1.3 dB
6 dB Bandwidth	-	1050.00 Hz
Conducted Out of Band Emissions	9 kHz ~ 40 GHz	2.6 dB
AC Power Conducted Emissions	150 kHz ~ 30 MHz	1.9 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	Stylus Pen
Brand	logitech
Test Model	F00014
Status of EUT	Engineering sample
Power Supply Rating	5 Vdc from USB-C interface or Cradle 3.7 Vdc from battery
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	2 Mbps
Operating Frequency	2.402 GHz ~ 2.478 GHz
Number of Channel	39
Output Power	5.321 mW (7.26 dBm)

Note:

1. The EUT may have a lot of colors for marketing requirement.
2. The EUT must be supplied with rechargeable battery as the following table:

Manufacturer	Model	Specification
SYNERGY	AHB390841TPLS	Power Rating : 3.7 Vdc, 122 mAh, 0.46 Wh

3. The EUT uses following accessory.

Item	Brand	Model
Cradle(optional)	logitech	Z00033

4. 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 Net Gain (dBi)	Frequency Range (GHz)	Antenna Type	Connector Type
1.24	2.4~2.4835	Dipole	ipex(MHF)

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

3.3 Channel List

39 channels are provided to this EUT:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460		

3.4 Test Mode Applicability and Tested Channel Detail

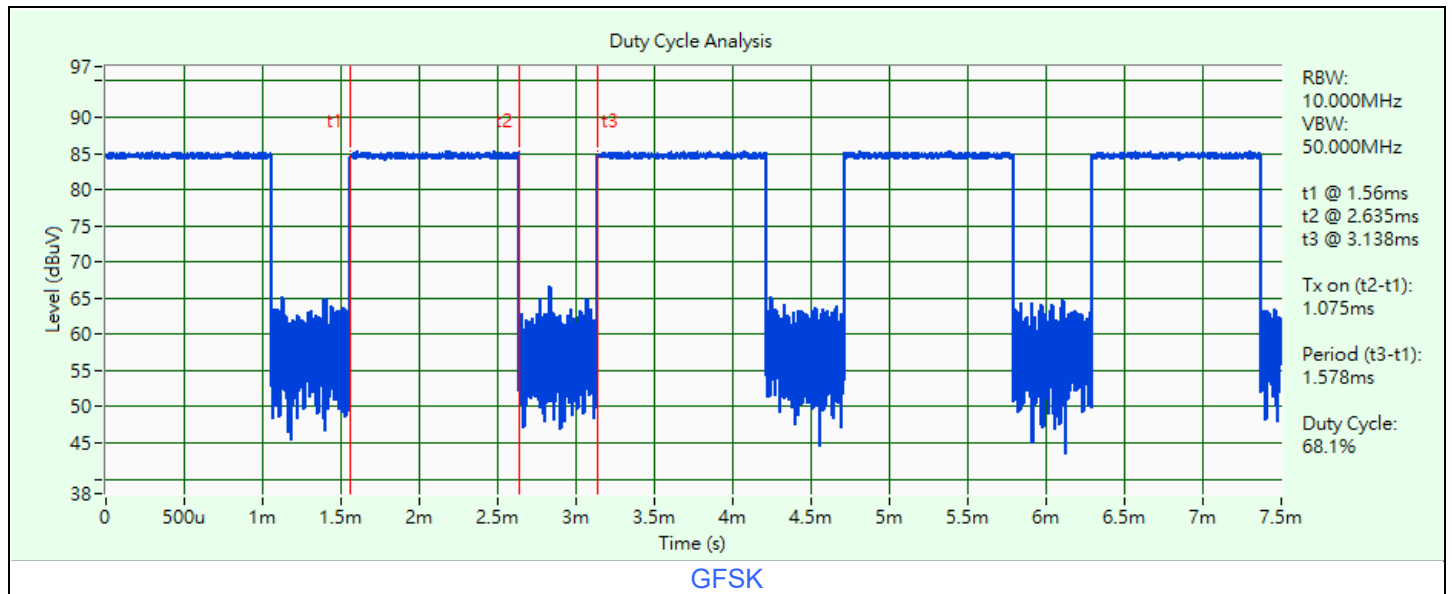
Pre-Scan:	<ol style="list-style-type: none"> 1. EUT can be used in the following ways: X-axis/ Y-axis/ Z-axis. Pre-scan these ways and find the worst case as a representative test condition. 2. For Unwanted Emissions below 1 GHz item: Battery/ AC Adapter/ Cradle. Pre-scan these modes and find the worst case as a representative test condition. 3. For AC power conducted emission item: AC Adapter/ Laptop/ Cradle. Pre-scan these modes and find the worst case as a representative test condition.
Worst Case:	<ol style="list-style-type: none"> 1. X-axis/ Y-axis/ Z-axis Worst Condition: X-axis 2. Unwanted Emissions below 1 GHz item the worst test condition: AC Adapter 3. AC power conducted emission item the worst test condition: Laptop

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

Test Item	Tested Channel	Modulation	Data Rate Parameter
RF Output Power	0, 19, 38	GFSK	2Mb/s
Power Spectral Density	0, 19, 38	GFSK	2Mb/s
6 dB Bandwidth	0, 19, 38	GFSK	2Mb/s
Conducted Out of Band Emissions	0, 19, 38	GFSK	2Mb/s
AC Power Conducted Emissions	0	GFSK	2Mb/s
Unwanted Emissions below 1 GHz	0	GFSK	2Mb/s
Unwanted Emissions above 1 GHz	0, 19, 38	GFSK	2Mb/s

3.5 Duty Cycle of Test Signal

GFSK: Duty cycle = 1.075 ms / 1.578 ms x 100% = 68.1%

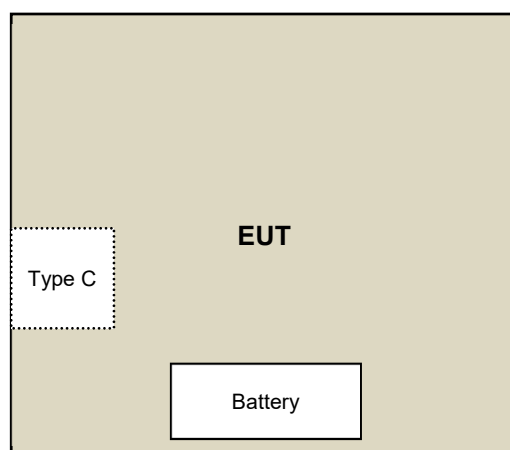


3.6 Test Program Used and Operation Descriptions

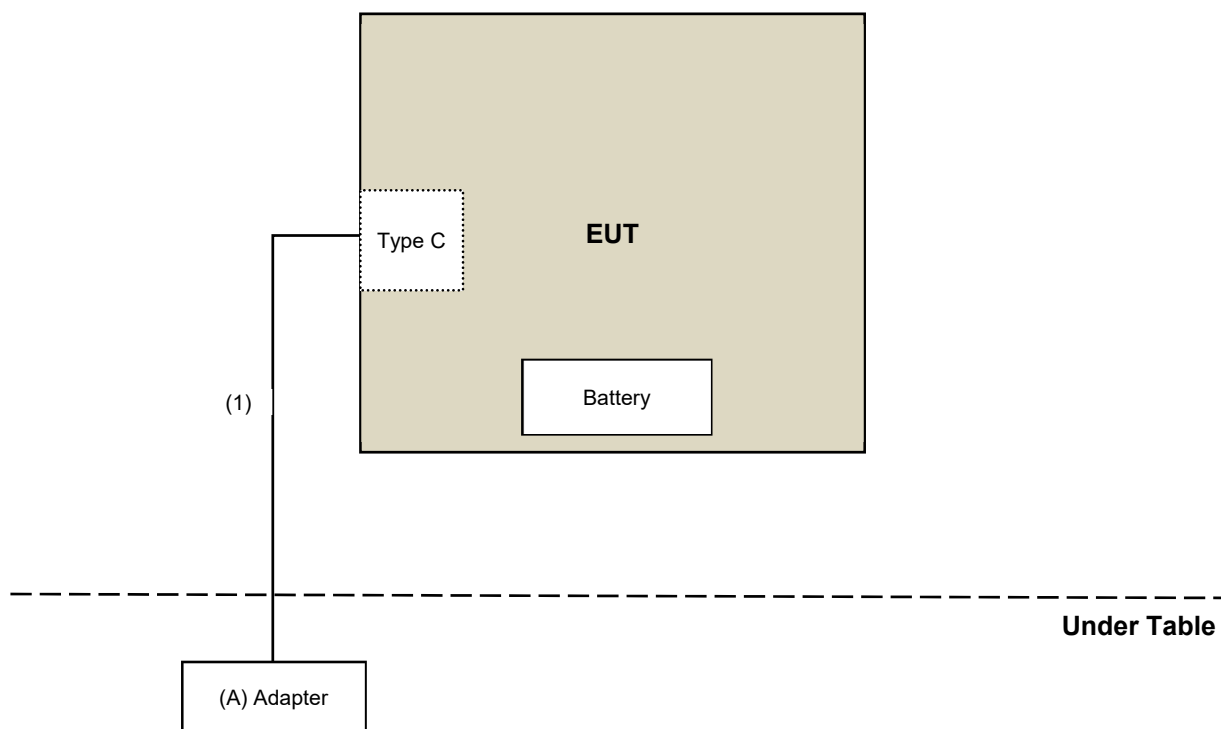
Controlling software (webhid app) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

3.7 Connection Diagram of EUT and Peripheral Devices

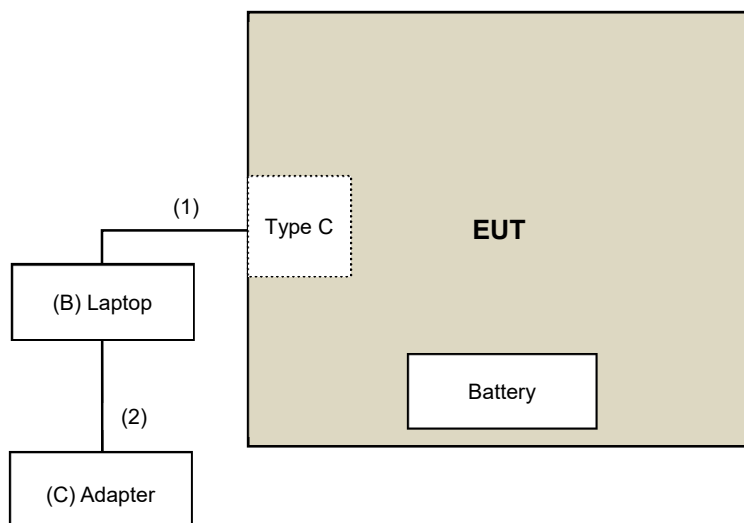
For Unwanted Emission (Above 1GHz) test:



For Unwanted Emission (Below 1GHz) test:



For AC Power Conducted Emission test:



3.8 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Adapter	UGREEN	CD244	N/A	N/A	Supplied by applicant
B	Laptop	Lenovo	81A4	YD02YN2A	PD93165NGU	Provided by Lab
C	Adapter	Lenovo	PA-1450-55LL	N/A	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	USB-C to USB-C cable	1	1.4	Yes	0	Supplied by applicant
2	DC cable	1	1.9	No	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 RF Output Power

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

Notes:

1. The test was performed in Oven room 2.
2. Tested Date: 2024/6/6

4.2 Power Spectral Density

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
MXA Signal Analyzer Keysight	N9020B	MY60112408	2024/3/7	2025/3/6
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: 2024/6/6

4.3 6 dB Bandwidth

Refer to section 4.2 to get information of the instruments.

4.4 Conducted Out of Band Emissions

Refer to section 4.2 to get information of the instruments.

4.5 AC Power Conducted Emissions

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
50 ohm terminal resistance Telegartner	50 ohm	3	2023/10/20	2024/10/19
EMI Test Receiver R&S	ESCS 30	847124/029	2023/10/18	2024/10/17
Fixed Attenuator STI	STI02-2200-10	005	2024/2/19	2025/2/18
LISN R&S	ESH3-Z5	835239/001	2024/4/3	2025/4/2
		848773/004	2023/10/13	2024/10/12
RF Coaxial Cable JYBAO	5D-FB	COCCAB-001	2024/2/19	2025/2/18
Software BVADT	BVADT_Cond_V7.3.7.4	N/A	N/A	N/A

Notes:

1. The test was performed in Conduction 1
2. Tested Date: 2024/5/28

4.6 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	2024/2/17	2025/2/16
Loop Antenna Electro-Metrics	EM-6879	264	2024/2/23	2025/2/22
MXE EMI Receiver Keysight	N9038A	MY59050100	2023/6/13	2024/6/12
Preamplifier EMCI	EMC330N	980852	2024/2/17	2025/2/16
	EMC001340	980142	2024/2/19	2025/2/18
RF Coaxial Cable JYEBAO	5D-FB	LOOPCAB-001	2024/2/19	2025/2/18
		LOOPCAB-002	2024/2/19	2025/2/18
RF Coaxial Cable PEWC	8D	001	2024/2/16	2025/2/15
		966-3-2	2024/2/16	2025/2/15
		966-3-3	2024/2/16	2025/2/15
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: 2024/5/28

4.7 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
Preamplifier EMCI	EMC12630SE	980384	2024/1/29	2025/1/28
	EMC184045SE	980387	2023/8/9	2024/8/8
PXA Signal Analyzer Keysight	N9030B	MY57142938	2024/3/20	2025/3/19
RF Coaxial Cable EMCI	EMC102-KM-KM-1200	160924	2024/1/29	2025/1/28
	EMC102-KM-KM-4000	200214	2024/1/29	2025/1/28
	EMC104-SM-SM-1500	180504	2024/1/29	2025/1/28
	EMC104-SM-SM-2000	180601	2024/1/29	2025/1/28
	EMC104-SM-SM-6000	210201	2024/1/29	2025/1/28
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: 2024/5/27 ~ 2024/5/28

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 6 dB Bandwidth

The minimum of 6 dB Bandwidth Measurement is 0.5 MHz.

5.4 Conducted Out of Band Emissions

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

5.5 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.

5.6 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).

5.7 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

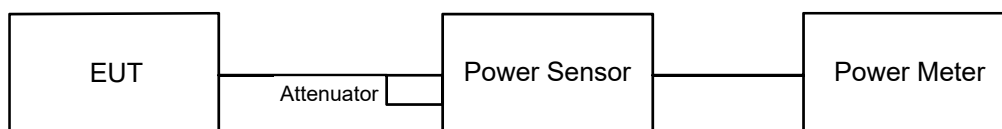
Notes:

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:

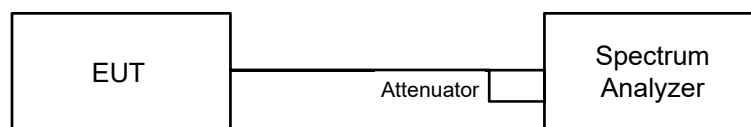
A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

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

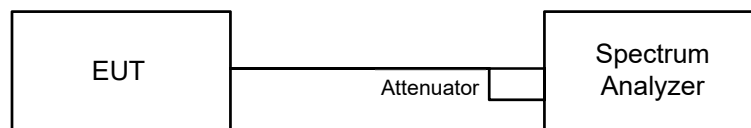


6.2.2 Test Procedure

- 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.
- d. Set the VBW $\geq 3 \times$ 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.

6.3 6 dB Bandwidth

6.3.1 Test Setup

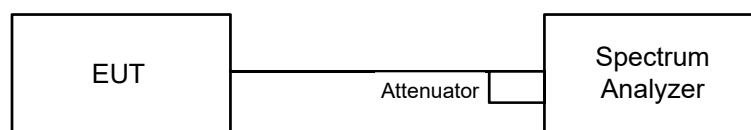


6.3.2 Test Procedure

- a. Set resolution bandwidth (RBW) = 100 kHz.
- b. Set the video bandwidth (VBW) $\geq 3 \times$ 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.

6.4 Conducted Out of Band Emissions

6.4.1 Test Setup



6.4.2 Test Procedure

MEASUREMENT PROCEDURE REF

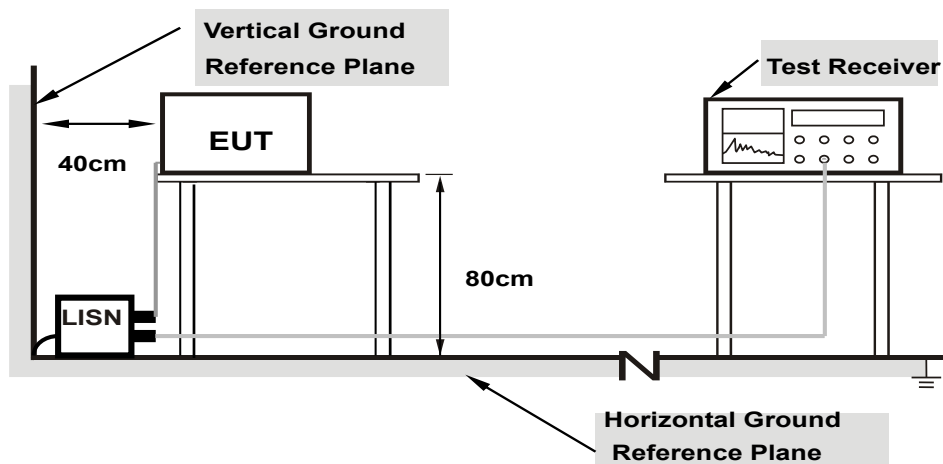
- a. Set the RBW = 100 kHz.
- b. Set the VBW ≥ 300 kHz.
- c. Detector = peak.
- d. Sweep time = auto couple.
- e. Trace mode = max hold.
- f. Allow trace to fully stabilize.
- g. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

- 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.

6.5 AC Power Conducted Emissions

6.5.1 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).

6.5.2 Test Procedure

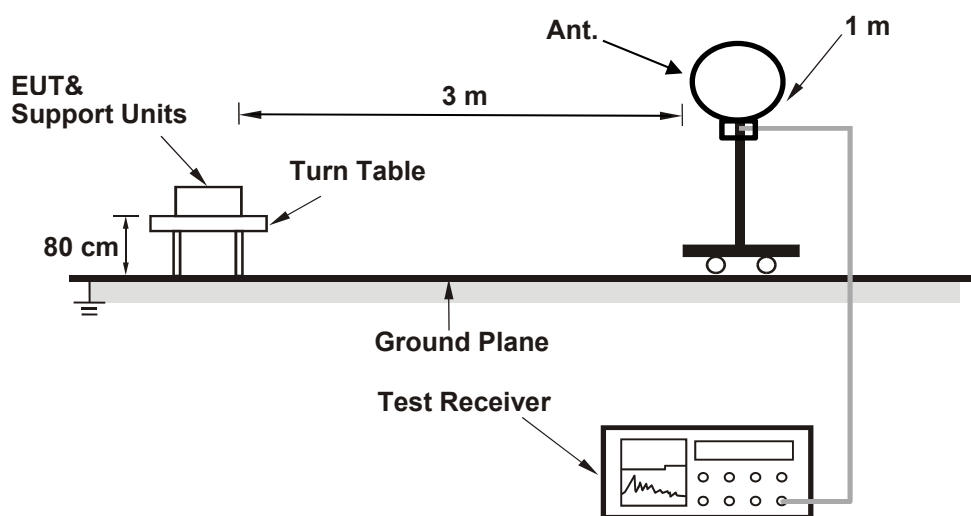
- The EUT was placed on a 0.8 meter to the top of table and placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The 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.

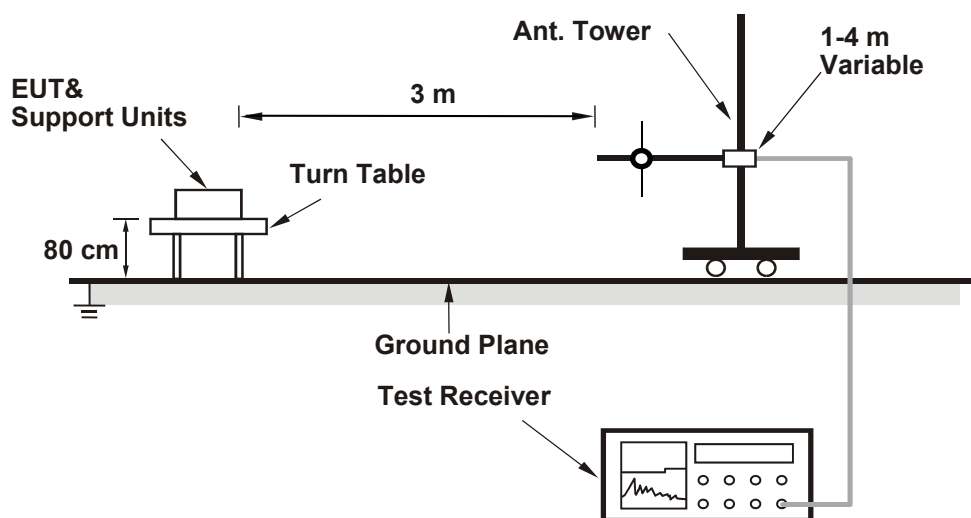
6.6 Unwanted Emissions below 1 GHz

6.6.1 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).

6.6.2 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

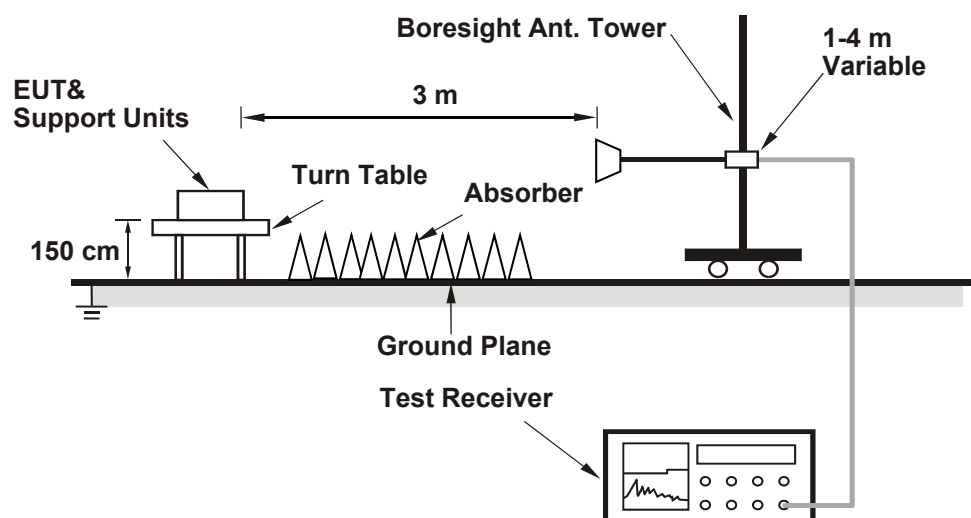
- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the 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.

6.7 Unwanted Emissions above 1 GHz

6.7.1 Test Setup



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

6.7.2 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 harmonic signal measurement, the resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is $\geq 1/T$ (Duty cycle $< 98\%$) or 10 Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1 GHz.
- 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:	3.7 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Dolly Chung
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For Peak Power

Chan.	Chan. Freq. (MHz)	Peak Power (mW)	Peak Power (dBm)	Power Limit (dBm)	Test Result
0	2402	5.321	7.26	30	Pass
19	2440	4.71	6.73	30	Pass
38	2478	4.227	6.26	30	Pass

Note: The antenna gain is 1.24 dBi < 6 dBi, so the output power limit shall not be reduced.

For Average Power

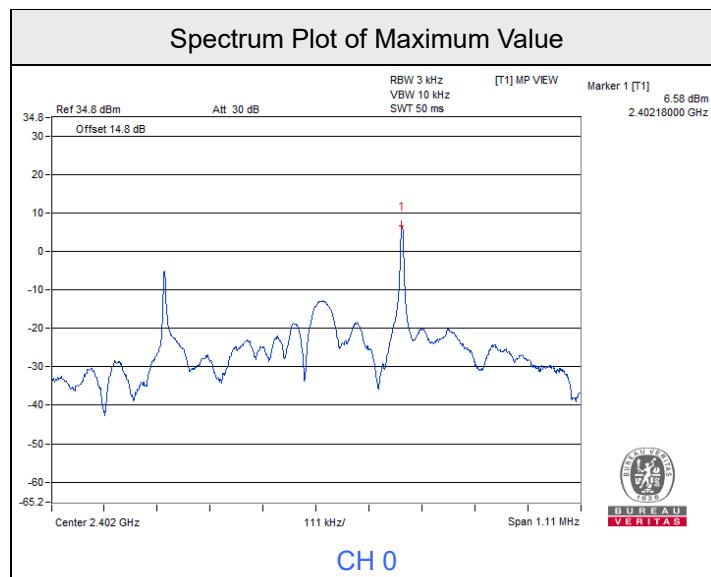
Chan.	Chan. Freq. (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	5.188	7.15
19	2440	4.592	6.62
38	2478	4.093	6.12

7.2 Power Spectral Density

Input Power:	3.7 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Dolly Chung
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Chan.	Chan. Freq. (MHz)	PSD (dBm/3kHz)	PSD Limit (dBm/3kHz)	Test Result
0	2402	6.58	8	Pass
19	2440	6.03	8	Pass
38	2478	5.46	8	Pass

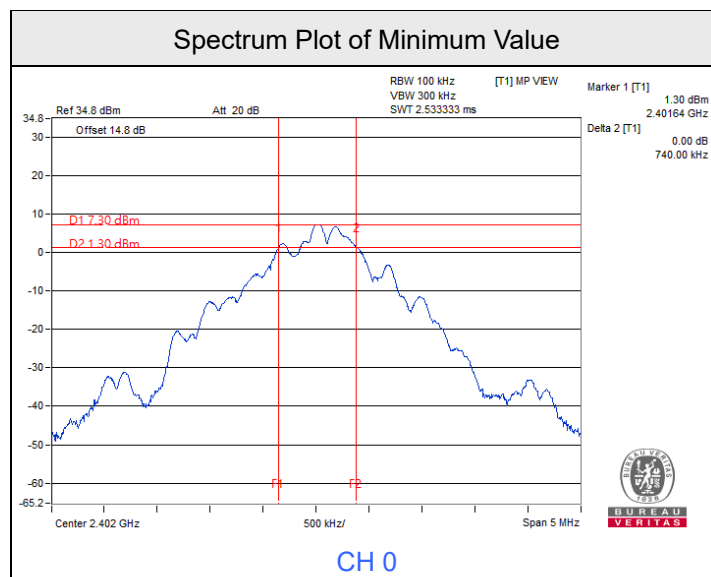
Note: The antenna gain is 1.24 dBi < 6 dBi, so the power density limit shall not be reduced.



7.3 6 dB Bandwidth

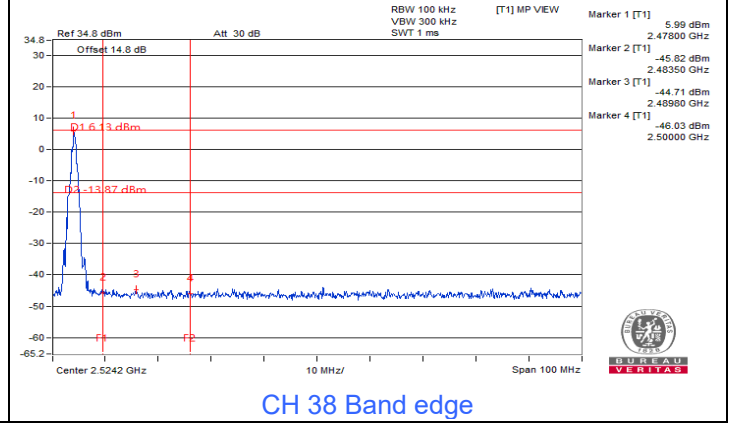
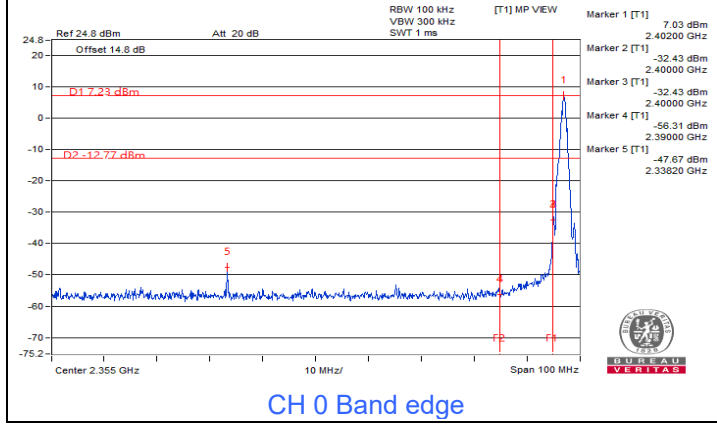
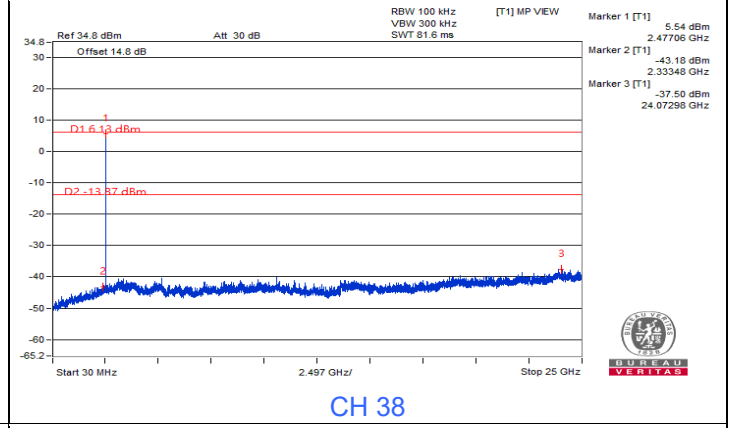
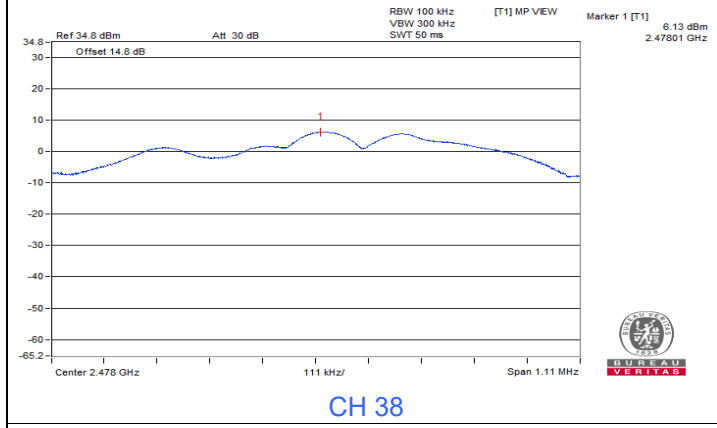
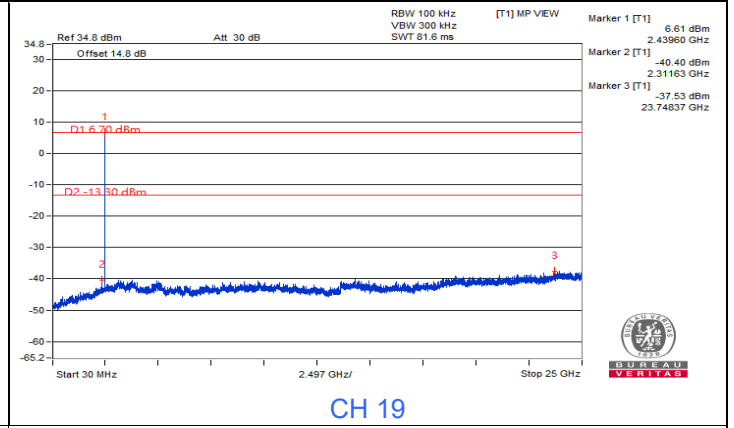
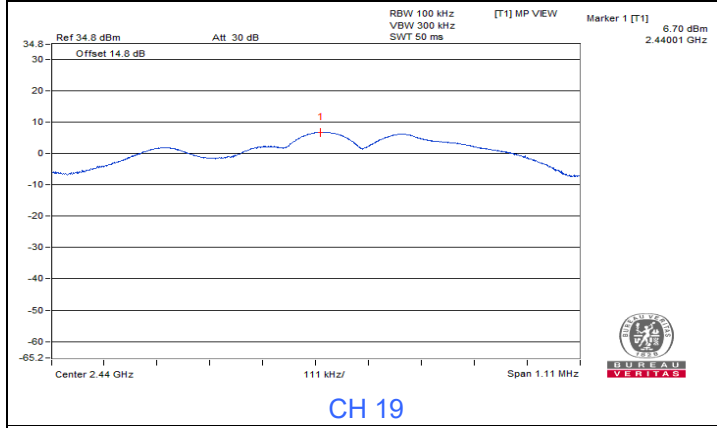
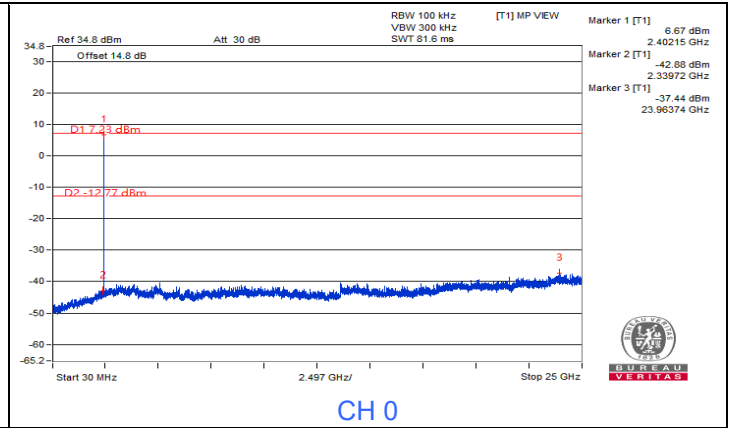
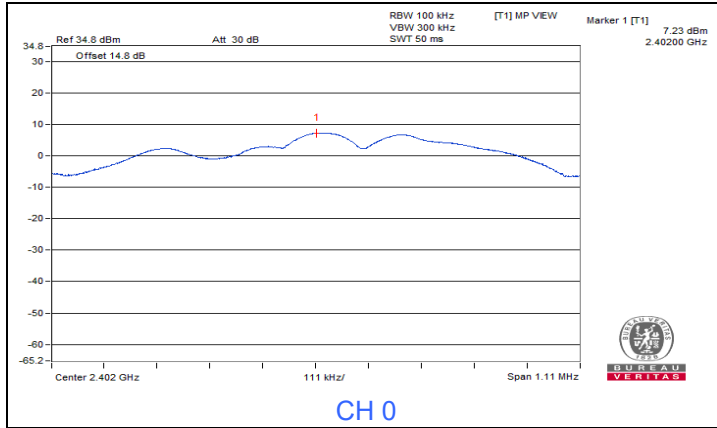
Input Power:	3.7 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Dolly Chung
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Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Test Result
0	2402	0.74	0.5	Pass
19	2440	0.74	0.5	Pass
38	2478	0.74	0.5	Pass



7.4 Conducted Out of Band Emissions

Input Power:	3.7 Vdc	Environmental Conditions:	25°C, 60% RH	Tested By:	Dolly Chung
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7.5 AC Power Conducted Emissions

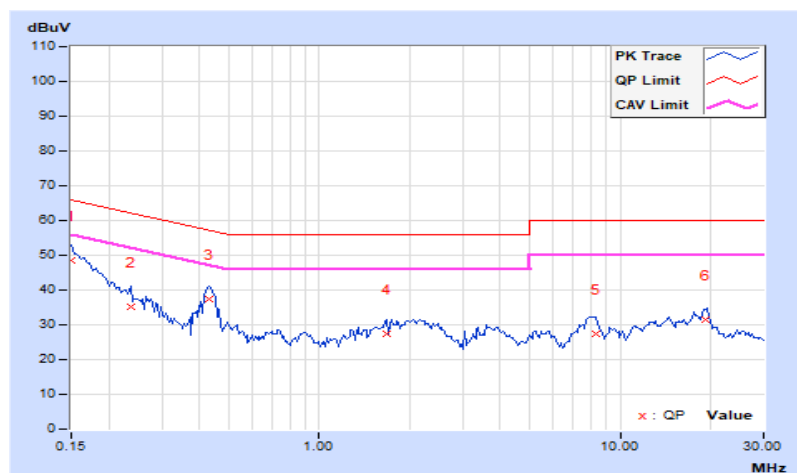
RF Mode	GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	22 °C, 60 % RH
Tested By	Louis Yang		

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	9.94	38.52	21.96	48.46	31.90	66.00	56.00	-17.54	-24.10
2	0.23594	9.95	25.15	11.59	35.10	21.54	62.24	52.24	-27.14	-30.70
3	0.43125	9.96	27.31	22.46	37.27	32.42	57.23	47.23	-19.96	-14.81
4	1.67188	10.04	17.23	12.76	27.27	22.80	56.00	46.00	-28.73	-23.20
5	8.26172	10.54	16.78	7.76	27.32	18.30	60.00	50.00	-32.68	-31.70
6	19.17969	11.14	20.46	16.31	31.60	27.45	60.00	50.00	-28.40	-22.55

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

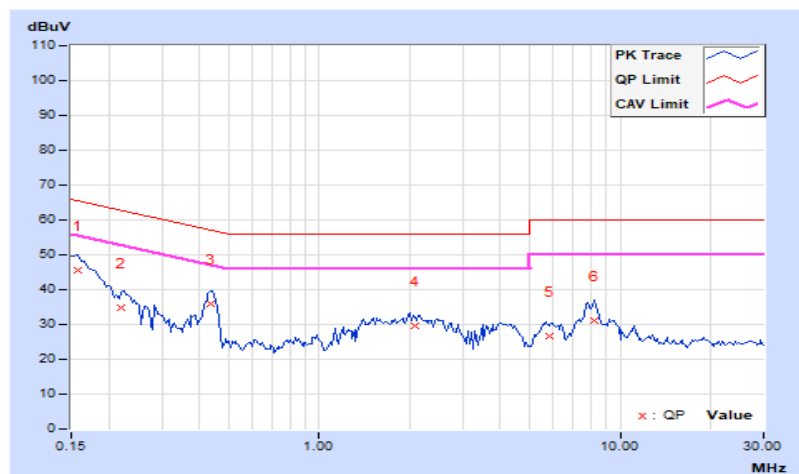


RF Mode	GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	150 kHz ~ 30 MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9 kHz
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	22 °C, 60 % RH
Tested By	Louis Yang		

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	0.15781	10.00	35.73	18.01	45.73	28.01	65.58	55.58	-19.85	-27.57
2	0.22031	10.01	24.77	10.29	34.78	20.30	62.81	52.81	-28.03	-32.51
3	0.43516	10.02	25.89	20.40	35.91	30.42	57.15	47.15	-21.24	-16.73
4	2.08203	10.10	19.38	14.83	29.48	24.93	56.00	46.00	-26.52	-21.07
5	5.85547	10.37	16.28	12.07	26.65	22.44	60.00	50.00	-33.35	-27.56
6	8.25000	10.52	20.46	13.02	30.98	23.54	60.00	50.00	-29.02	-26.46

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



7.6 Unwanted Emissions below 1 GHz

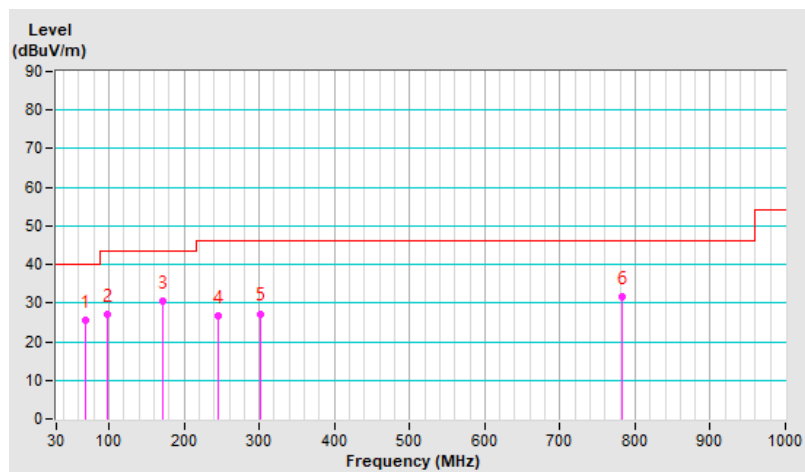
RF Mode	GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120kHz, DET=Quasi-Peak
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	22 °C, 64 % RH
Tested By	Louis Yang		

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	68.85	25.6 QP	40.0	-14.4	2.00 H	360	40.6	-15.0
2	98.55	26.9 QP	43.5	-16.6	1.50 H	200	44.1	-17.2
3	171.81	30.6 QP	43.5	-12.9	1.50 H	45	43.8	-13.2
4	245.70	26.6 QP	46.0	-19.4	1.50 H	29	40.1	-13.5
5	300.87	27.3 QP	46.0	-18.7	1.00 H	110	38.7	-11.4
6	781.92	31.6 QP	46.0	-14.4	1.00 H	328	32.6	-1.0

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.

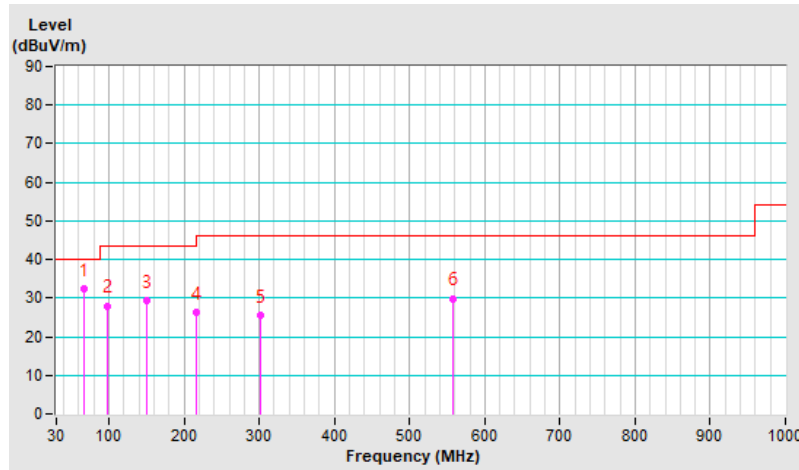


RF Mode	GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	QP: RB=120kHz, DET=Quasi-Peak
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	22 °C, 64 % RH
Tested By	Louis Yang		

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	67.64	32.3 QP	40.0	-7.7	1.00 V	62	46.8	-14.5
2	97.46	28.0 QP	43.5	-15.5	1.50 V	360	45.4	-17.4
3	150.21	29.4 QP	43.5	-14.1	1.50 V	360	41.8	-12.4
4	216.68	26.4 QP	46.0	-19.6	1.00 V	14	42.2	-15.8
5	301.82	25.5 QP	46.0	-20.5	1.00 V	41	36.9	-11.4
6	558.46	29.9 QP	46.0	-16.1	1.00 V	32	35.6	-5.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 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.



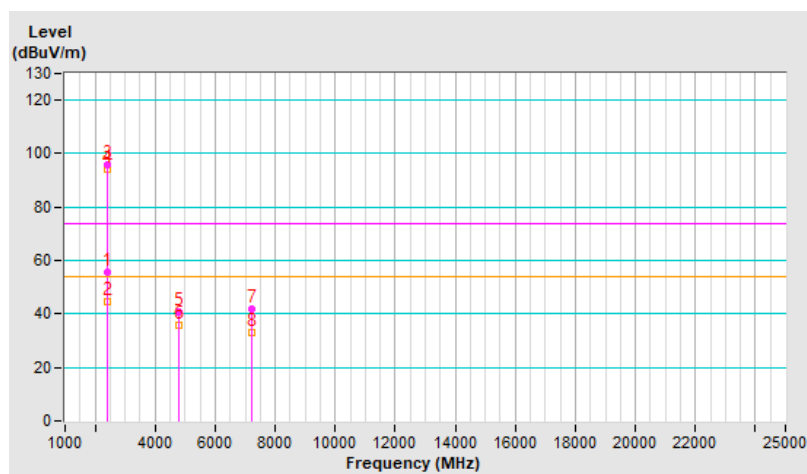
7.7 Unwanted Emissions above 1 GHz

RF Mode	GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=1 kHz, DET=Peak
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	24 °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	55.6 PK	74.0	-18.4	1.06 H	121	57.9	-2.3
2	2390.00	44.5 AV	54.0	-9.5	1.06 H	121	46.8	-2.3
3	*2402.00	95.7 PK			1.06 H	121	98.0	-2.3
4	*2402.00	94.4 AV			1.06 H	121	96.7	-2.3
5	4804.00	40.5 PK	74.0	-33.5	1.08 H	63	38.6	1.9
6	4804.00	35.7 AV	54.0	-18.3	1.08 H	63	33.8	1.9
7	#7206.00	41.8 PK			1.12 H	60	33.8	8.0
8	#7206.00	33.2 AV			1.12 H	60	25.2	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 radiated frequency is out of the restricted band, the limit was restricted at the Conducted Out of Band Emissions.



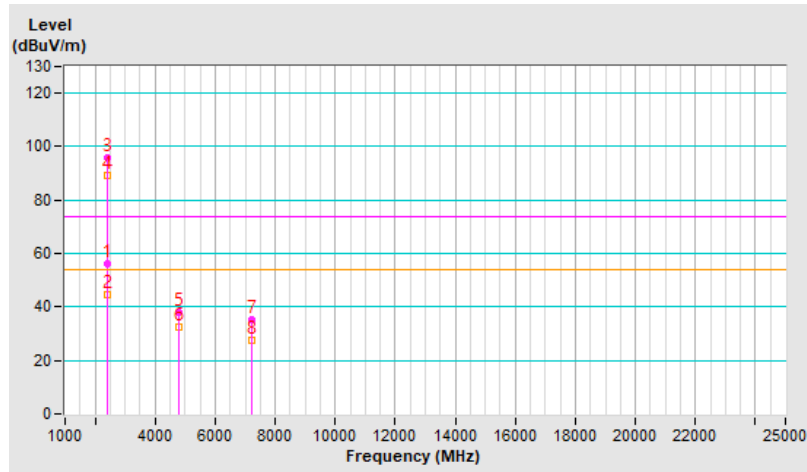


RF Mode	GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=1 kHz, DET=Peak
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	24 °C, 72 % RH
Tested By	Louis Yang		

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	3.81 V	205	58.6	-2.3
2	2390.00	44.5 AV	54.0	-9.5	3.81 V	205	46.8	-2.3
3	*2402.00	95.7 PK			3.81 V	205	98.0	-2.3
4	*2402.00	89.2 AV			3.81 V	205	91.5	-2.3
5	4804.00	38.2 PK	74.0	-35.8	1.20 V	330	36.3	1.9
6	4804.00	32.5 AV	54.0	-21.5	1.20 V	330	30.6	1.9
7	#7206.00	35.4 PK			1.00 V	245	27.4	8.0
8	#7206.00	27.6 AV			1.00 V	245	19.6	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 radiated frequency is out of the restricted band, the limit was restricted at the Conducted Out of Band Emissions.

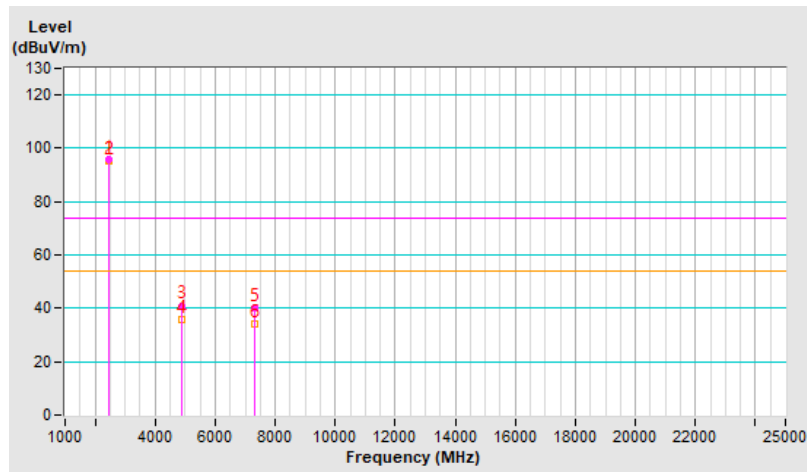


RF Mode	GFSK	Channel	CH 19 : 2440 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=1 kHz, DET=Peak
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	24 °C, 72 % RH
Tested By	Louis Yang		

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	*2440.00	96.0 PK			1.06 H	116	98.2	-2.2
2	*2440.00	95.5 AV			1.06 H	116	97.7	-2.2
3	4880.00	41.0 PK	74.0	-33.0	1.03 H	65	39.1	1.9
4	4880.00	36.0 AV	54.0	-18.0	1.03 H	65	34.1	1.9
5	7320.00	40.0 PK	74.0	-34.0	1.18 H	67	32.3	7.7
6	7320.00	34.1 AV	54.0	-19.9	1.18 H	67	26.4	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.

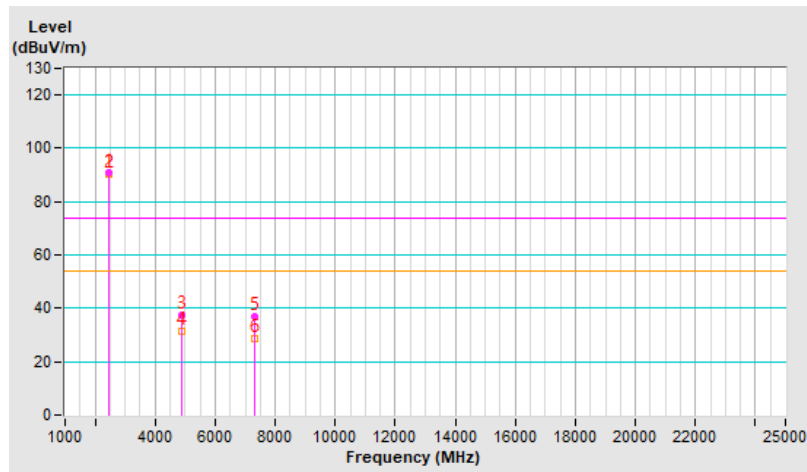


RF Mode	GFSK	Channel	CH 19 : 2440 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=1 kHz, DET=Peak
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	24 °C, 72 % RH
Tested By	Louis Yang		

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	*2440.00	91.0 PK			3.71 V	30	93.2	-2.2
2	*2440.00	90.4 AV			3.71 V	30	92.6	-2.2
3	4880.00	37.4 PK	74.0	-36.6	1.30 V	337	35.5	1.9
4	4880.00	31.5 AV	54.0	-22.5	1.30 V	337	29.6	1.9
5	7320.00	36.9 PK	74.0	-37.1	1.05 V	261	29.2	7.7
6	7320.00	28.4 AV	54.0	-25.6	1.05 V	261	20.7	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.

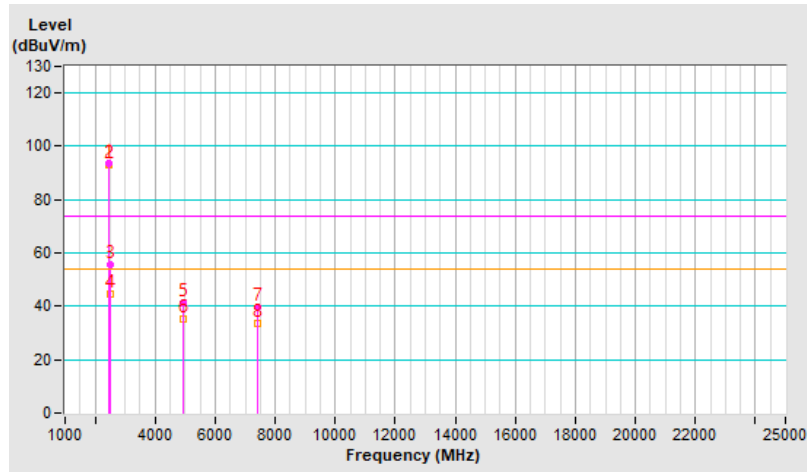


RF Mode	GFSK	Channel	CH 38 : 2478 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=1 kHz, DET=Peak
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	24 °C, 72 % RH
Tested By	Louis Yang		

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	*2478.00	93.7 PK			1.19 H	130	95.9	-2.2
2	*2478.00	93.1 AV			1.19 H	130	95.3	-2.2
3	2483.50	55.5 PK	74.0	-18.5	1.19 H	130	57.7	-2.2
4	2483.50	44.5 AV	54.0	-9.5	1.19 H	130	46.7	-2.2
5	4956.00	41.5 PK	74.0	-32.5	1.10 H	61	39.3	2.2
6	4956.00	35.2 AV	54.0	-18.8	1.10 H	61	33.0	2.2
7	7434.00	39.8 PK	74.0	-34.2	1.14 H	70	31.9	7.9
8	7434.00	33.7 AV	54.0	-20.3	1.14 H	70	25.8	7.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * " : Fundamental frequency, the limit was restricted at the RF Output Power.

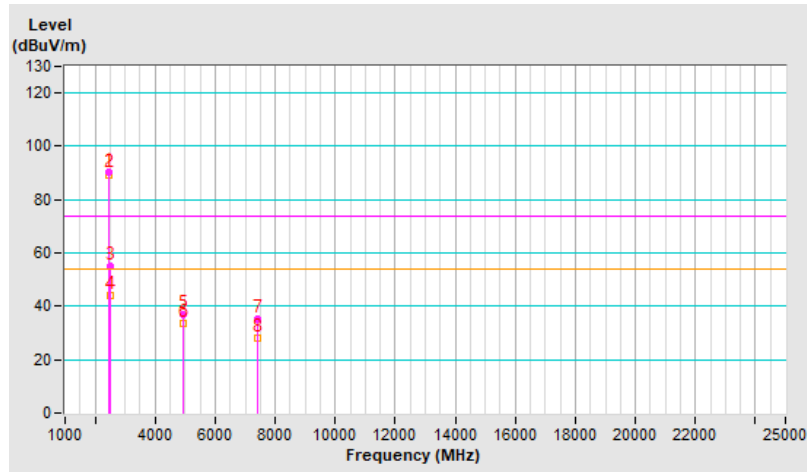


RF Mode	GFSK	Channel	CH 38 : 2478 MHz
Frequency Range	1 GHz ~ 25 GHz	Detector Function & Bandwidth	PK: RB=1 MHz, VB=3 MHz, DET=Peak AV: RB=1 MHz, VB=1 kHz, DET=Peak
Input Power (System)	120 Vac, 60 Hz	Environmental Conditions	24 °C, 72 % RH
Tested By	Louis Yang		

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	*2478.00	90.3 PK			4.00 V	36	92.5	-2.2
2	*2478.00	89.5 AV			4.00 V	36	91.7	-2.2
3	2483.50	55.3 PK	74.0	-18.7	4.00 V	36	57.5	-2.2
4	2483.50	44.0 AV	54.0	-10.0	4.00 V	36	46.2	-2.2
5	4956.00	36.8 PK	74.0	-37.2	1.28 V	333	34.6	2.2
6	4956.00	33.4 AV	54.0	-20.6	1.28 V	333	31.2	2.2
7	7434.00	35.3 PK	74.0	-38.7	1.06 V	250	27.4	7.9
8	7434.00	28.1 AV	54.0	-25.9	1.06 V	250	20.2	7.9

Remarks:

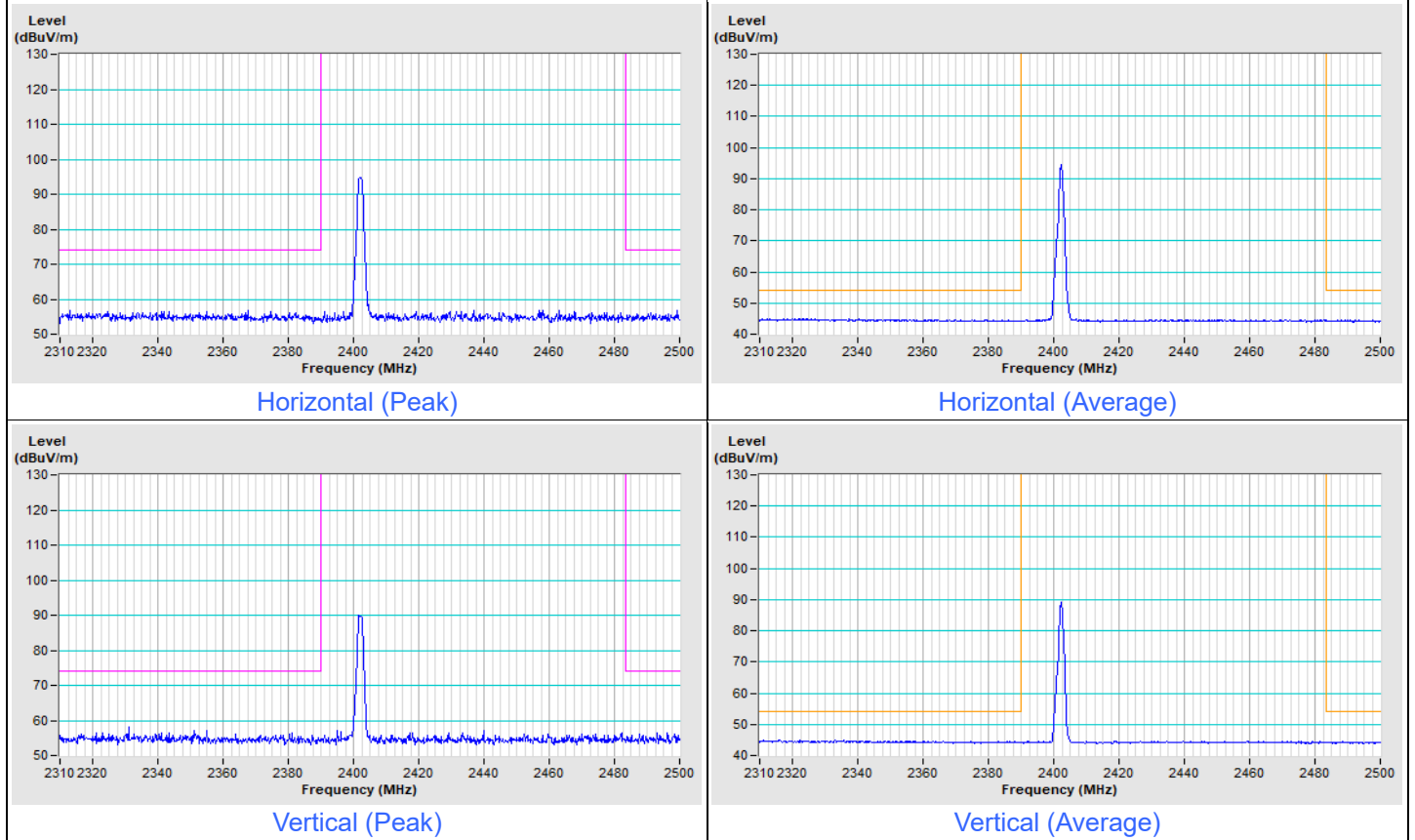
1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * " : Fundamental frequency, the limit was restricted at the RF Output Power.



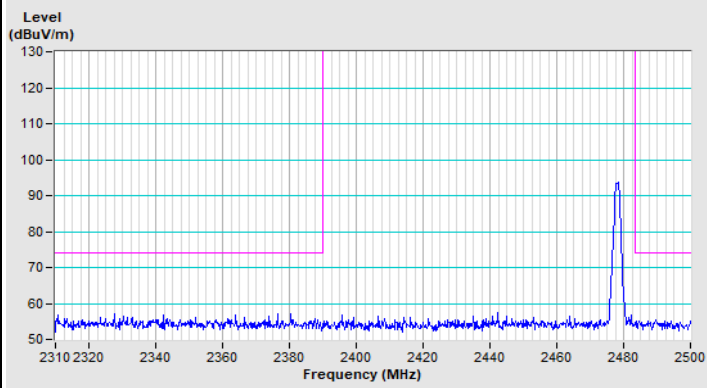
Plot of Band Edge

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=1 kHz, DET=Peak
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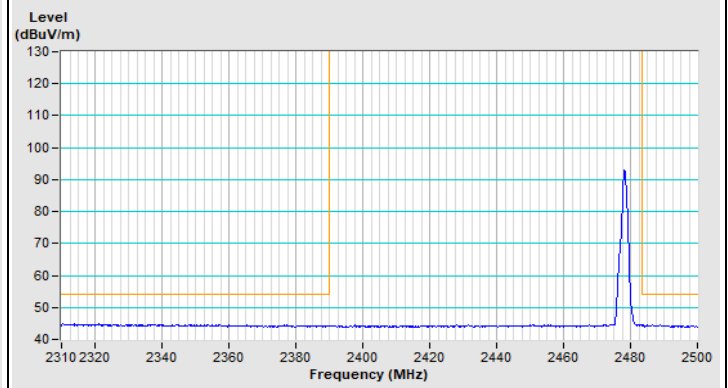
GFSK Channel 0



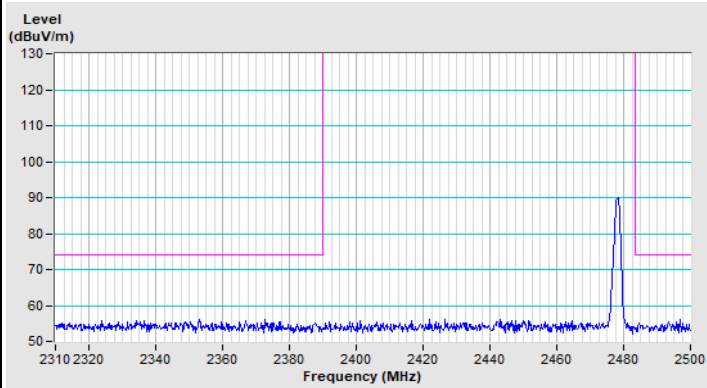
GFSK Channel 38



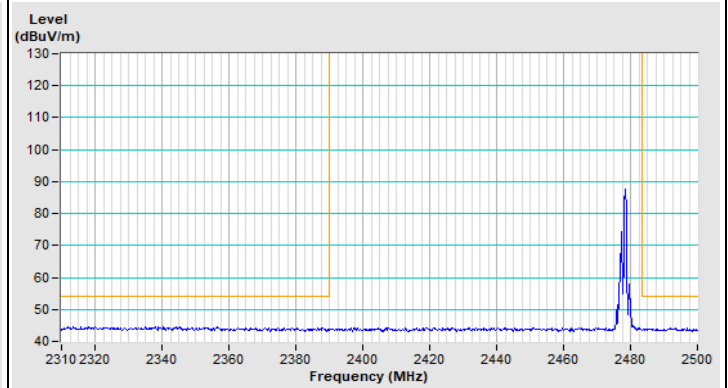
Horizontal (Peak)



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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