

FCC Test Report

Report No.: RFBKWC-WTW-P22030152

FCC ID: H4IUD2301T

Test Model: UD2301t1

Received Date: 2022/3/3

Test Date: 2022/3/8 ~ 2022/3/16

Issued Date: 2022/4/12

Applicant: LITE-ON Technology Corp.

Address: 16F, 392, Ruey Kuang Road, Neihu, Taipei 11492, Taiwan, R.O.C

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

Lab Address: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

**FCC Registration /
Designation Number:** 198487 / TW2021



This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specifically mentioned, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification.

Table of Contents

Release Control Record	3
1 Certificate of Conformity	4
2 Summary of Test Results	5
2.1 Measurement Uncertainty	5
2.2 Modification Record	5
3 General Information	6
3.1 General Description of EUT	6
3.2 Description of Test Modes	7
3.2.1 Test Mode Applicability and Tested Channel Detail	8
3.3 Duty Cycle of Test Signal	9
3.4 Description of Support Units	10
3.4.1 Configuration of System under Test	10
3.5 General Description of Applied Standards	10
4 Test Types and Results	11
4.1 Radiated Emission and Bandedge Measurement	11
4.1.1 Limits of Radiated Emission and Bandedge Measurement	11
4.1.2 Test Instruments	12
4.1.3 Test Procedures	14
4.1.4 Deviation from Test Standard	14
4.1.5 Test Setup	15
4.1.6 EUT Operating Conditions	16
4.1.7 Test Results	17
4.2 Conducted Emission Measurement	22
4.2.1 Limits of Conducted Emission Measurement	22
4.2.2 Test Instruments	22
4.2.3 Test Procedures	23
4.2.4 Deviation From Test Standard	23
4.2.5 Test Setup	23
4.2.6 EUT Operating Condition	23
4.2.7 Test Results	24
4.3 Channel Bandwidth	26
4.3.1 Test Setup	26
4.3.2 Test Instruments	26
4.3.3 Test Procedure	26
4.3.4 Deviation from Test Standard	26
4.3.5 EUT Operating Condition	26
4.3.6 Test Results	27
5 Pictures of Test Arrangements	28
Appendix – Information of the Testing Laboratories	29

Release Control Record

Issue No.	Description	Date Issued
RFBEKC-WTW-P22030152	Original release.	2022/4/12

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.249)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -16.91dB at 0.15000MHz.
15.215	Channel Bandwidth Measurement	PASS	Meet the requirement of limit.
15.209 15.249 15.249 (d)	Radiated Emission and Bandedge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -10.00dB at 2402.00MHz.
15.203	Antenna Requirement	PASS	No antenna connector is used.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (\pm)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.00 dB
Conducted Emissions	9kHz ~ 40GHz	2.63 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	2.38 dB
	30MHz ~ 1000MHz	5.62 dB
Radiated Emissions above 1 GHz	Above 1GHz	5.41 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Dongle
Brand	DELL
Test Model	UD2301t1
Status of EUT	Engineering sample
Power Supply Rating	5Vdc from host equipment
Modulation Type	GFSK
Operating Frequency	2402MHz ~ 2479MHz
Number of Channel	78
Field Strength	84.00 dBuV/m (3m)
Antenna Type	Chip antenna with -0.8dBi gain
Antenna Connector	N/A
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

1. 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.
2. 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

78 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460		
19	2421	39	2441	59	2461		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE \geq 1G	RE $<$ 1G	PLC	APCM	
-	√	√	√	√	-

Where **RE \geq 1G**: Radiated Emission above 1GHz & Bandedge Measurement

RE $<$ 1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

APCM: Antenna Port Conducted Measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

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
-	0 to 77	0, 38, 77	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
-	0 to 77	0	GFSK

Power Line Conducted Emission Test:

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

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
-	0 to 77	0	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.

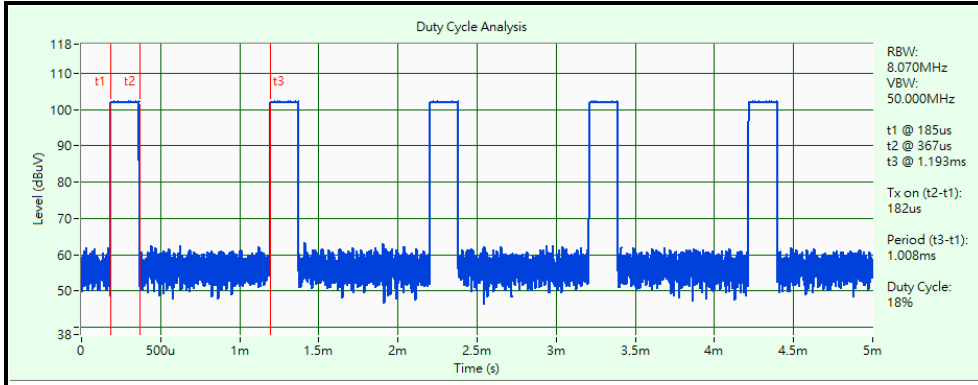
EUT Configure Mode	Available Channel	Tested Channel	Modulation Type
-	0 to 77	0, 38, 77	GFSK

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE\geq1G	19deg. C, 71%RH	120Vac, 60Hz (System)	Jed Wu
RE$<$1G	19deg. C, 71%RH	120Vac, 60Hz (System)	Jed Wu
PLC	25deg. C, 75%RH	120Vac, 60Hz (System)	Pirar Hsieh
APCM	25deg. C, 76%RH	120Vac, 60Hz (System)	Dalen Dai

3.3 Duty Cycle of Test Signal

Duty cycle correction factor = $20 \log(\text{Duty cycle}) = 20 \log(0.18) = -14.8\text{dB}$



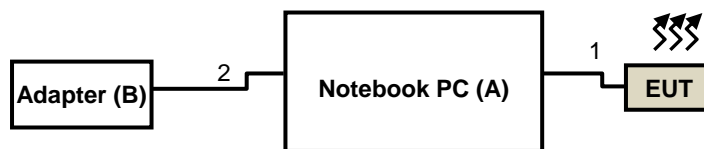
3.4 Description of Support Units

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.	Notebook	Lenovo	81A4	NA	NA	Provided by Lab
B.	Adapter	Lenovo	ADLX65CLGU2A	NA	NA	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB cable	1	1.0	Y	0	Provided by Lab
2.	DC cable	1	2.0	Y	0	Provided by Lab

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.249)

ANSI C63.10-2013

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

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

The field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902 ~ 928 MHz	50	500
2400 ~ 2483.5 MHz	50	500
5725 ~ 5875 MHz	50	500
24 ~ 24.25 GHz	250	2500

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits as below table, whichever is the lesser attenuation

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

NOTE:

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

4.1.2 Test Instruments

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until
Test Receiver Agilent	N9038A	MY51210129	2021/3/12	2022/3/11
Pre_Amplifier EMCI	EMC001340	980269	2021/6/29	2022/6/28
LOOP ANTENNA EMCI	LPA600	270	2021/9/2	2023/9/1
RF Coaxial Cable Pacific	8D-FB	Cable-CH6-02	2021/7/13	2022/7/12
Turn Table ADT	TT100	0306	NA	NA
Tower ADT	AT100	0306	NA	NA
Software BVADT	Radiated_V8.7.08	NA	NA	NA
Test Receiver Agilent	N9038A	MY51210129	2021/3/12	2022/3/11
Pre_Amplifier HP	8447D	2432A03504	2022/2/17	2023/2/16
Bi_Log Antenna Schwarzbeck	VULB 9168	137	2021/10/27	2022/10/26
RF Coaxial Cable Pacific	8D-FB	Cable-CH6-02	2021/7/13	2022/7/12
Coupling/Dcoupling Network Schwarzbeck	CDNE-M2	00097	2021/5/6	2022/5/5
Coupling/Dcoupling Network Schwarzbeck	CDNE-M3	00091	2021/5/6	2022/5/5
Turn Table ADT	TT100	0306	NA	NA
Tower ADT	AT100	0306	NA	NA
Software BVADT	Radiated_V8.7.08	NA	NA	NA
Spectrum Analyzer Agilent	E4446A	MY51100009	2021/6/29	2022/6/28
Spectrum Analyzer KEYSIGHT	N9030A	MY54490260	2021/7/23	2022/7/22
Test Receiver Agilent	N9038A	MY51210129	2021/3/12	2022/3/11
Spectrum Analyzer R&S	FSV40	101042	2021/9/9	2022/9/8
Pre-amplifier HP	8449B	3008A01201	2022/2/17	2023/2/16
Pre_Amplifier EMCI	EMC0126545	980076	2022/2/17	2023/2/16
Horn Antenna ETS-Lindgren	3117-PA	00215857	2021/11/14	2022/11/13
Horn Antenna EMCO	3115	00028257	2021/11/14	2022/11/13
Horn Antenna EMCO	3115	00027024	2021/11/14	2022/11/13
Pre-amplifier (18GHz-40GHz) EMC	EMC184045B	980175	2021/9/4	2022/9/3
Pre_Amplifier EMCI	EMC184045B	980235	2022/2/17	2023/2/16
Horn Antenna Schwarzbeck	BBHA 9170	212	2021/10/13	2022/10/12
RF Coaxial Cable HUBER SUHNER	SF-102	Cable-CH6-01	2021/7/8	2022/7/7
RF Coaxial Cable EM	EM102-KMKM-3.5+1M	EM102-KMKM-3.5+1M-01	2021/7/8	2022/7/7
BandPass Filter MICRO-TRONICS	BRM17690	005	2021/5/28	2022/5/27
Notch filter MICRO-TRONICS	BRC50703-01	010	2021/5/28	2022/5/27
Highpass filter Wainwright Instruments	WHK 3.1/18G-10SS	SN 8	2021/5/28	2022/5/27
RF Coaxial Cable WOKEN	WC01	Cable-CH10-03	2021/7/8	2022/7/7
RF Coaxial Cable Rosnol	K1K50-UP0279-K1K50-3000	Cable-CH10(3m)-04	2021/7/8	2022/7/7
Boresight antenna tower fixture BV	BAF-02	6	NA	NA
Turn Table ADT	TT100	0306	NA	NA
Tower ADT	AT100	0306	NA	NA
Software BVADT	Radiated_V8.7.08	NA	NA	NA

- NOTE:**
1. The calibration interval of the above test instruments is 12/24 months. And the calibrations are traceable to NML/ROC and NIST/USA.
 2. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 3. The test was performed in Linkou 966 Chamber 6 (CH 6).
 4. Tested Date: 2022/3/8

4.1.3 Test Procedures

For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

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

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

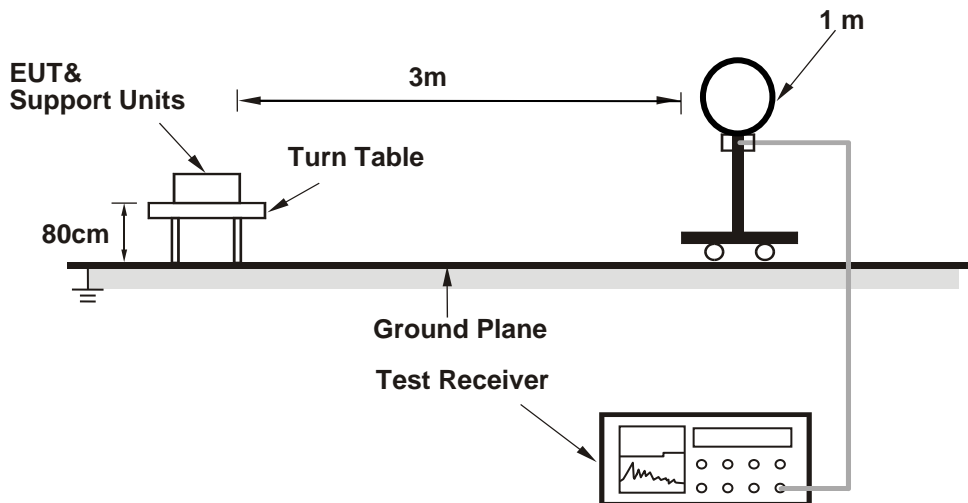
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection at frequency above 1GHz. For fundamental and harmonic signal measurement, according to ANSI C63.10 section 7.5, the average value = peak value + duty factor. The duty factor refer to Chapter 3.3 of this report.
3. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

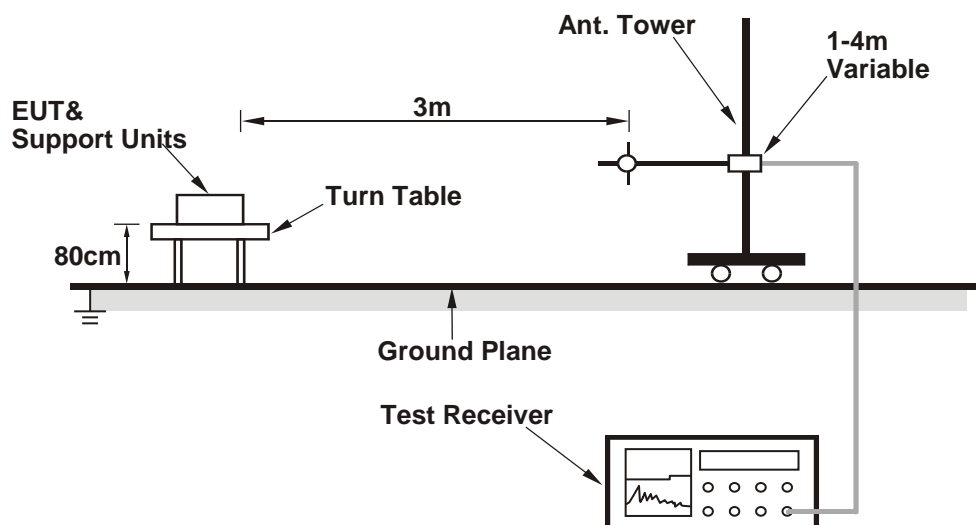
No deviation.

4.1.5 Test Setup

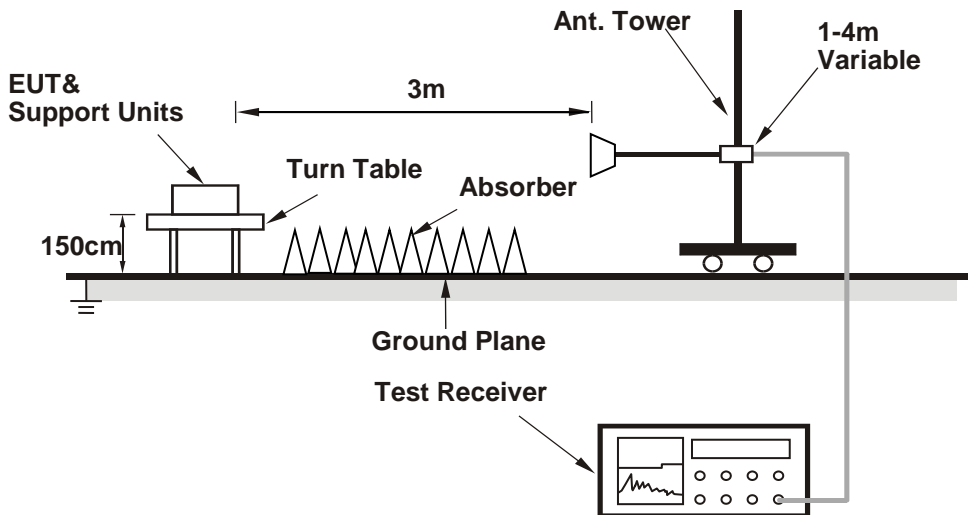
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

- a. Connected the EUT to Notebook PC.
- b. Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

ABOVE 1GHz DATA

RF Mode	TX GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function & Bandwidth	(PK) RB=1MHz, VB=3MHz (AV) 1M/3M detector RMS trace 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	51.80 PK	74.00	-22.20	1.61 H	238	54.11	-2.31
2	2390.00	38.04 AV	54.00	-15.96	1.61 H	238	40.35	-2.31
3	2400.00	55.45 PK	74.00	-18.55	1.61 H	238	57.75	-2.30
4	2400.00	40.65 AV	54.00	-13.35	1.61 H	238	42.95	-2.30
5	*2402.00	98.80 PK	114.00	-15.20	1.61 H	238	101.10	-2.30
6	*2402.00	84.00 AV	94.00	-10.00	1.61 H	238	86.30	-2.30
7	4804.00	46.04 PK	74.00	-27.96	1.62 H	133	40.58	5.46
8	4804.00	31.24 AV	54.00	-22.76	1.62 H	133	25.78	5.46

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2390.00	51.67 PK	74.00	-22.33	1.03 V	197	53.98	-2.31
2	2390.00	36.97 AV	54.00	-17.03	1.03 V	197	39.28	-2.31
3	2400.00	53.99 PK	74.00	-20.01	1.03 V	197	56.29	-2.30
4	2400.00	39.19 AV	54.00	-14.81	1.03 V	197	41.49	-2.30
5	*2402.00	97.38 PK	114.00	-16.62	1.03 V	197	99.68	-2.30
6	*2402.00	82.58 AV	94.00	-11.42	1.03 V	197	84.88	-2.30
7	4804.00	45.63 PK	74.00	-28.37	1.08 V	167	40.17	5.46
8	4804.00	30.83 AV	54.00	-23.17	1.08 V	167	25.37	5.46

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * " : Fundamental frequency.
6. The average value of fundamental and harmonic frequency is: Average = Peak value + 20 log(Duty cycle) Where the duty cycle correction factor is calculated from following formula:
 $20 \log(\text{Duty cycle}) = 20 \log(0.18) = -14.8\text{dB}$ for plotted duty.

RF Mode	TX GFSK	Channel	CH 38 : 2440 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function & Bandwidth	(PK) RB=1MHz, VB=3MHz (AV) 1M/3M detector RMS trace 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	*2440.00	98.46 PK	114.00	-15.54	1.00 H	254	100.67	-2.21
2	*2440.00	83.66 AV	94.00	-10.34	1.00 H	254	85.87	-2.21
3	4804.00	46.48 PK	74.00	-27.52	1.38 H	157	41.02	5.46
4	4804.00	31.68 AV	54.00	-22.32	1.38 H	157	26.22	5.46
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	95.90 PK	114.00	-18.10	2.05 V	235	98.11	-2.21
2	*2440.00	81.10 AV	94.00	-12.90	2.05 V	235	83.31	-2.21
3	4880.00	45.90 PK	74.00	-28.10	1.25 V	133	40.26	5.64
4	4880.00	31.10 AV	54.00	-22.90	1.25 V	133	25.46	5.64

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(0.18) = -14.8dB for plotted duty.

RF Mode	TX GFSK	Channel	CH 77 : 2479 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function & Bandwidth	(PK) RB=1MHz, VB=3MHz (AV) 1M/3M detector RMS trace 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	*2479.00	98.65 PK	114.00	-15.35	1.41 H	238	100.74	-2.09
2	*2479.00	83.85 AV	94.00	-10.15	1.41 H	238	85.94	-2.09
3	2483.50	53.42 PK	74.00	-20.58	1.41 H	238	55.50	-2.08
4	2483.50	38.62 AV	54.00	-15.38	1.41 H	238	40.70	-2.08
5	4958.00	46.75 PK	74.00	-27.25	1.36 H	149	41.07	5.68
6	4958.00	31.95 AV	54.00	-22.05	1.36 H	149	26.27	5.68

Antenna Polarity & Test Distance : Vertical at 3 m

No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2479.00	96.59 PK	114.00	-17.41	2.04 V	238	98.68	-2.09
2	*2479.00	81.79 AV	94.00	-12.21	2.04 V	238	83.88	-2.09
3	2483.50	51.73 PK	74.00	-22.27	2.04 V	238	53.81	-2.08
4	2483.50	36.93 AV	54.00	-17.07	2.04 V	238	39.01	-2.08
5	4958.00	46.03 PK	74.00	-27.97	1.86 V	115	40.35	5.68
6	4958.00	31.23 AV	54.00	-22.77	1.86 V	115	25.55	5.68

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(0.18) = -14.8dB for plotted duty.

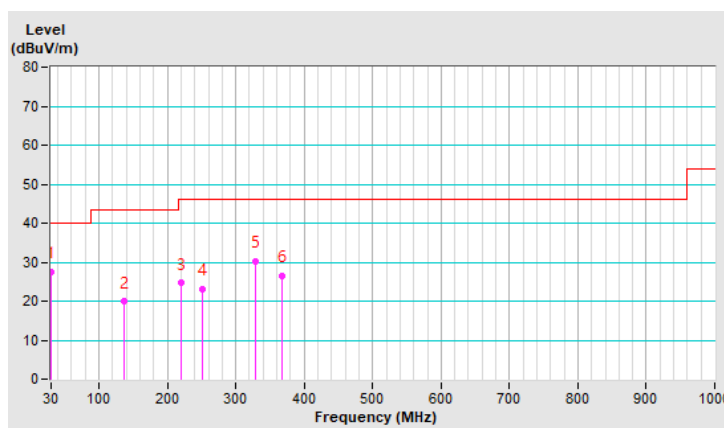
BELOW 1GHz WORST-CASE DATA

RF Mode	TX GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	30.15	27.41 QP	40.00	-12.59	1.25 H	32	37.67	-10.26
2	135.97	19.86 QP	43.50	-23.64	1.37 H	152	28.61	-8.75
3	219.15	24.59 QP	46.00	-21.41	1.88 H	254	34.60	-10.01
4	250.63	22.97 QP	46.00	-23.03	1.65 H	240	30.84	-7.87
5	328.57	30.25 QP	46.00	-15.75	1.42 H	249	35.20	-4.95
6	366.69	26.37 QP	46.00	-19.63	1.08 H	281	30.67	-4.30

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 30MHz~1000MHz.
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.

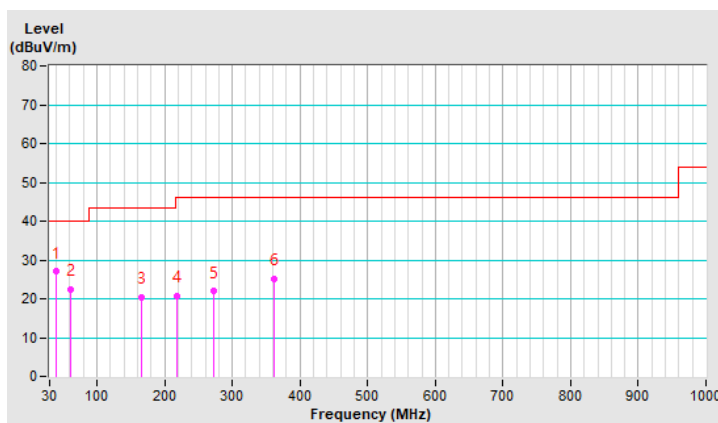


RF Mode	TX GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	9 kHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	40.48	26.99 QP	40.00	-13.01	1.77 V	239	36.13	-9.14
2	60.36	22.38 QP	40.00	-17.62	1.40 V	154	31.53	-9.15
3	166.43	20.31 QP	43.50	-23.19	1.35 V	66	28.36	-8.05
4	218.71	20.60 QP	46.00	-25.40	1.85 V	187	30.61	-10.01
5	272.45	21.89 QP	46.00	-24.11	1.28 V	360	28.48	-6.59
6	361.11	25.04 QP	46.00	-20.96	1.96 V	99	29.55	-4.51

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 30MHz~1000MHz.
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 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until
Test Receiver R&S	ESR3	102412	2022/1/22	2023/1/21
LISN Schwarzbeck	NSLK 8128	8128-244	2021/11/11	2022/11/10
LISN Schwarzbeck	NNLK8129	8129229	2021/5/20	2022/5/19
DC LISN Schwarzbeck	NNLK 8121	8121-808	2021/4/18	2022/4/17
LISN Schwarzbeck	NNLK 8121	8121-731	2021/4/28	2022/4/27
LISN R&S	ENV216	101196	2021/4/26	2022/4/25
LISN R&S	ESH3-Z5	100220	2021/11/25	2022/11/24
LISN R&S	ESH3-Z6	844950/018	2021/7/25	2022/7/24
DC LISN R&S	ESH3-Z6	100219	2021/7/25	2022/7/24
High Voltage Probe Schwarzbeck	TK9420	00982	2021/12/24	2022/12/23
RF Coaxial Cable Commate	5D-FB	Cable-CO5-01	2022/1/28	2023/1/27
Attenuator STI	STI02-2200-10	NO.4	2021/9/3	2022/9/2
50 Ohms Terminator LYNICS	0900510	E1-01-305	2022/2/9	2023/2/8
Isolation Transformer Erika Fiedler	D-65396	017	2021/9/9	2022/9/8
Software BVADT	Cond_V7.3.7.4	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. The test was performed in Linkou Conduction5

3. Tested Date: 2022/3/16

4.2.3 Test Procedures

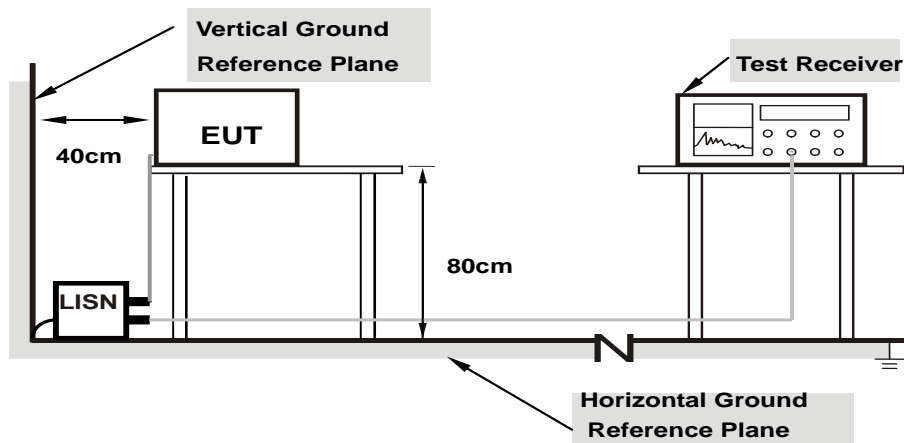
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

4.2.4 Deviation From Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

4.2.6 EUT Operating Condition

- Connected the EUT to Notebook PC.
- Set the EUT under transmission condition continuously at specific channel frequency.

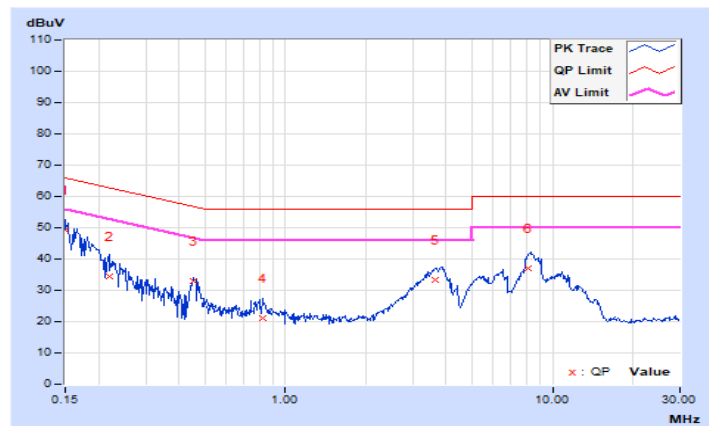
4.2.7 Test Results

RF Mode	TX GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	9.88	39.21	21.62	49.09	31.50	66.00	56.00	-16.91	-24.50
2	0.22031	9.89	24.71	10.21	34.60	20.10	62.81	52.81	-28.21	-32.71
3	0.45469	9.91	23.07	15.21	32.98	25.12	56.79	46.79	-23.81	-21.67
4	0.82578	9.95	11.24	5.66	21.19	15.61	56.00	46.00	-34.81	-30.39
5	3.62109	10.10	23.39	16.20	33.49	26.30	56.00	46.00	-22.51	-19.70
6	8.14453	10.31	26.89	20.93	37.20	31.24	60.00	50.00	-22.80	-18.76

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

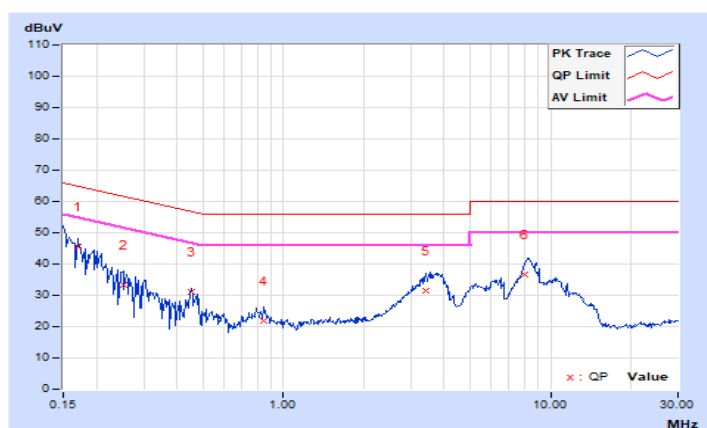


RF Mode	TX GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	0.16953	9.89	35.53	17.13	45.42	27.02	64.98	54.98	-19.56	-27.96
2	0.25156	9.91	23.44	7.69	33.35	17.60	61.71	51.71	-28.36	-34.11
3	0.45469	9.94	21.28	17.00	31.22	26.94	56.79	46.79	-25.57	-19.85
4	0.84531	9.96	11.76	4.94	21.72	14.90	56.00	46.00	-34.28	-31.10
5	3.42578	10.10	21.53	14.14	31.63	24.24	56.00	46.00	-24.37	-21.76
6	7.96484	10.30	26.45	19.88	36.75	30.18	60.00	50.00	-23.25	-19.82

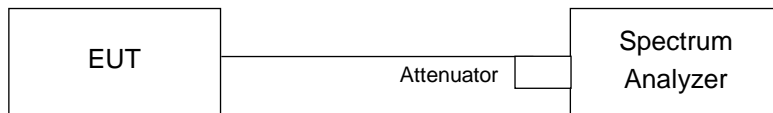
Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



4.3 Channel Bandwidth

4.3.1 Test Setup



4.3.2 Test Instruments

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until
Spectrum Analyzer R&S	FSV40	101544	2021/5/24	2022/5/23

- NOTE:**
1. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in LK - Oven
 2. Tested Date: 2022/3/9

4.3.3 Test Procedure

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

4.3.4 Deviation from Test Standard

No deviation.

4.3.5 EUT Operating Condition

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

5 Pictures of Test Arrangements

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

Appendix – Information of the Testing Laboratories

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

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

Lin Kou EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

--- END ---