

FCC Test Report

Report No.: RFBDTL-WTW-P20110545 R2

FCC ID: 2AEUPBHACT001

Model: 5AT3T6

Received Date: Nov. 05, 2020

Test Date: Aug. 19 ~ Sep. 13, 2021 (For all tests of BT LE 1M, BT LE 2M: Ch 17 except Radiated Emission below 1GHz)

Dec. 15 ~ Dec. 16, 2021 (For all tests of BT LE 2M: Ch 37, 39 except Radiated Emission below 1GHz)

Apr. 30, 2022 (For Radiated Emission below 1GHz)

Issued Date: Sep. 30, 2022

Applicant: Ring LLC

Address: 12515 Cerise Ave, Hawthorne, CA 90250, USA

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

Test Location (2): No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)

**FCC Registration /
Designation Number(1):** 788550 / TW0003

**FCC Registration /
Designation Number(2):** 281270 / TW0032



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Release Control Record

Issue No.	Description	Date Issued
RFBDTL-WTW-P20110545	Original release	Jan. 25, 2022
RFBDTL-WTW-P20110545 R1	Revise test result of Radiated Emission below 1GHz	May 04, 2022
RFBDTL-WTW-P20110545 R2	Revise product name	Sep. 30, 2022

1 Certificate of Conformity

Product: Mobile Connectivity Device

Brand: ring

Model: 5AT3T6

Sample Status: Engineering sample

Applicant: Ring LLC

Test Date: Aug. 19 ~ Sep. 13, 2021 (For all tests of BT LE 1M, BT LE 2M: Ch 17 except Radiated Emission below 1GHz)

Dec. 15 ~ Dec. 16, 2021 (For all tests of BT LE 2M: Ch 37, 39 except Radiated Emission below 1GHz)

Apr. 30, 2022 (For Radiated Emission below 1GHz)

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 Chan

Date:

Sep. 30, 2022

Pettie Chen / Senior Specialist

Approved by :

Jeremy Lin

Date:

Sep. 30, 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	Pass	Meet the requirement of limit. Minimum passing margin is -16.40dB at 0.41000MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -3.7dB at 718.48MHz.
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:

- 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.
- 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) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.79 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.00 dB
	30MHz ~ 200MHz	2.91 dB
	200MHz ~ 1000MHz	2.93 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	Mobile Connectivity Device
Brand	ring
Model	5AT3T6
Sample Status	Engineering sample
Power Supply Rating	12Vdc (Adapter)
Modulation Type	GFSK
Transfer Rate	BT LE 1M (Nordic), BT LE 1M (Dialog): 1Mbps BT LE 2M (Nordic): 2Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	40
Channel Spacing	2MHz
Output Power	BT LE 1M (Nordic): 6.152mW BT LE 1M (Dialog): 1.099mW BT LE 2M (Nordic): 5.321mW
Antenna Type	Refer to note
Antenna Connector	Refer to note
Accessory Device	NA
Cable Supplied	NA

Note:

1. The EUT was tested with the following adapter. (Support unit only)

Product	Brand	Model	Description
Adapter	PHIHONG	PPA24A-120	Input: 100-240Vac~1.5A , 50/60Hz Output: 12Vdc / 2A, 24W Power Line: 1.5m non-shielded cable without core

2. The Antenna information is listed as below.

Antenna No.	Brand	Gain(dBi)	Frequency range	Antenna Type	Connector Type
LoRa BLE2(Dialog)	HAITONG	LoRa: -3.16 / BLE2: 0.54	LoRa 902~928MHz / BLE2 2400~2500MHz	Monopole	none (like solder)
GPS BLE1(Nordic)	HAITONG	GPS: -1.5 / BLE1: 1.35	GPS 1575MHz / BLE1 2400~2500MHz	PIFA	none (like solder)
Microwave Sensor	PCB Vender VGT/YJ	4.15	5725~5890 MHz	PIFA	none (like solder)

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

3. BT LE 1M (Nordic), BT LE 1M (Dialog) and Microwave Sensor and LoRa can transmit at same time.

3.2 Description of Test Modes

40 channels are provided to this EUT:

Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)	Channel	Freq. (MHz)
37	2402	9	2422	18	2442	28	2462
0	2404	10	2424	19	2444	29	2464
1	2406	38	2426	20	2446	30	2466
2	2408	11	2428	21	2448	31	2468
3	2410	12	2430	22	2450	32	2470
4	2412	13	2432	23	2452	33	2472
5	2414	14	2434	24	2454	34	2474
6	2416	15	2436	25	2456	35	2476
7	2418	16	2438	26	2458	36	2478
8	2420	17	2440	27	2460	39	2480

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:

1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on X plane.
2. For radiated emission (below 1GHz) and power line conducted emission test items chosen the worst maximum fundamental emission level channel.

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	Data Rate (Mbps)
-	37 to 39	37, 17, 39	GFSK	1 (Nordic, Dialog)
-	37 to 39	37, 17, 39	GFSK	2 (Nordic)

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	Data Rate (Mbps)
-	37 to 39	37	GFSK	1 (Nordic)
-	37 to 39	39	GFSK	1 (Dialog)

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	Data Rate (Mbps)
-	37 to 39	37	GFSK	1 (Nordic)
-	37 to 39	39	GFSK	1 (Dialog)

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	Data Rate (Mbps)
-	37 to 39	37, 17, 39	GFSK	1 (Nordic, Dialog)
-	37 to 39	37, 17, 39	GFSK	2 (Nordic)

Test Condition:

Applicable to	Environmental Conditions	Input Power	Tested by
RE $\geq$ 1G	21 deg. C, 68% RH	120Vac, 60Hz	Rex Wang
RE<1G	23 deg. C, 69% RH	120Vac, 60Hz	Edison Lee
PLC	25 deg. C, 75% RH	120Vac, 60Hz	Edison Lee
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Alan Wu Gary Lin

3.3 Duty Cycle of Test Signal

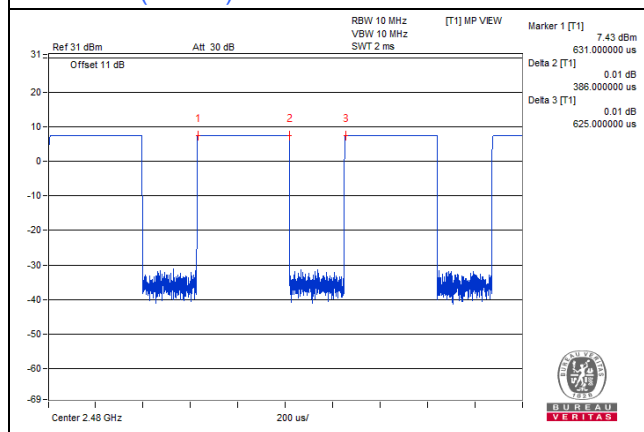
Duty cycle of test signal is < 98%, duty factor is required.

BT LE 1M (Nordic): Duty cycle = 0.386/0.625 = 0.618, Duty factor = $10 * \log(1/0.618) = 2.09$

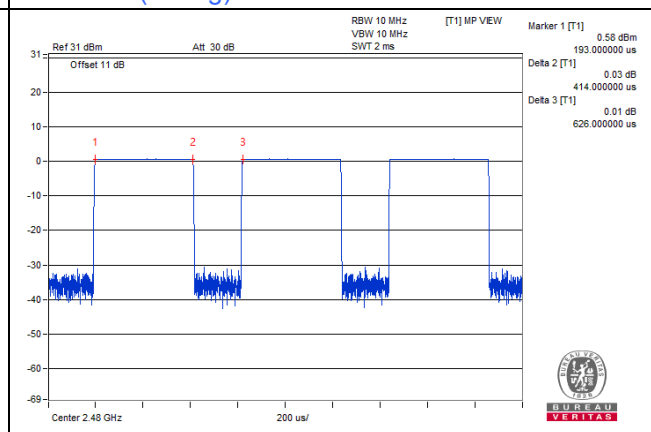
BT LE 1M (Dialog): Duty cycle = 0.414/0.626 = 0.661, Duty factor = $10 * \log(1/0.661) = 1.80$

BT LE 2M (Nordic): Duty cycle = 0.201/0.625 = 0.322, Duty factor = $10 * \log(1/0.322) = 4.93$

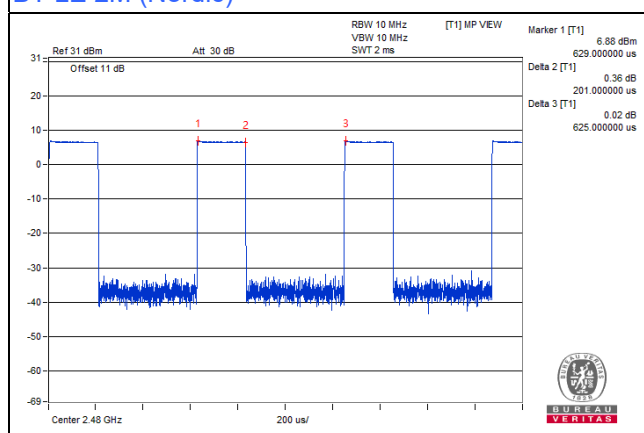
BT LE 1M (Nordic)



BT LE 1M (Dialog)



BT LE 2M (Nordic)



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.	Adapter	PHIHONG	PPA24A-120	NA	NA	Provided by client

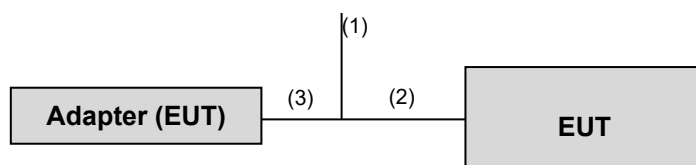
Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Cable	1	1.2	N	0	Provided by client
2.	OBD Cable	1	1.0	N	0	Provided by client
3.	AC Power cable	1	1.5	N	0	Provided by client

Note: The core(s) is(are) originally attached to the cable(s).

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

Test Date: Aug. 19 ~ Sep. 13, 2021

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver Rohde & Schwarz	ESR3	102783	Dec. 21, 2020	Dec. 20, 2021
Spectrum Analyzer KEYSIGHT	N9020B	MY60110513	Dec. 21, 2020	Dec. 20, 2021
BILOG Antenna SCHWARZBECK	VULB9168	1214	Nov. 04, 2020	Nov. 03, 2021
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1170	Nov. 22, 2020	Nov. 21, 2021
HORN Antenna SCHWARZBECK	BBHA 9170	995	Nov. 22, 2020	Nov. 21, 2021
Preamplifier EMCI	EMC330N	980798	Jan. 12, 2021	Jan. 11, 2022
Preamplifier EMCI	EMC118A45SE	980809	Jan. 12, 2021	Jan. 11, 2022
Preamplifier EMCI	EMC184045SE	980786	Jan. 12, 2021	Jan. 11, 2022
RF signal cable EMCI	EMC104-SM-SM-(9 000+2000+1000)	201244+ 201232+ 210103	Jan. 12, 2021	Jan. 11, 2022
RF signal cable EMCI	EMCCFD400-NM-N M-(9000+300+500)	201251+ 201249+ 201248	Jan. 12, 2021	Jan. 11, 2022
RF signal cable EMCI	EMC101G-KM-KM-(5000+3000+2000)	201261+201258+20 1249	Jan. 12, 2021	Jan. 11, 2022
Software BV ADT	ADT_Radiated_V7.6 .15.9.5	NA	NA	NA
Antenna Tower Max-Full	MFA-515BSN	NA	NA	NA
Turn Table Max-Full	MFT-201SS	NA	NA	NA
Turn Table Controller Max-Full	MF-7802BS	MF780208676	NA	NA
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190 004/MY55190007/MY5 5210005	Jul. 12, 2021	Jul. 11, 2022

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 9.

Test Date: Dec. 15 ~ Dec. 16, 2021

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver Rohde & Schwarz	ESR3	102783	Dec. 21, 2020	Dec. 20, 2021
Spectrum Analyzer KEYSIGHT	N9020B	MY60110513	Dec. 21, 2020	Dec. 20, 2021
BILOG Antenna SCHWARZBECK	VULB9168	1214	Oct. 28, 2021	Oct. 27, 2022
HORN Antenna RF SPIN	DRH18-E	210104A18E	Jan. 08, 2021	Jan. 07, 2022
HORN Antenna SCHWARZBECK	BBHA 9170	9170-1048	Nov. 14, 2021	Nov. 13, 2022
Preamplifier EMCI	EMC330N	980798	Jan. 12, 2021	Jan. 11, 2022
Preamplifier EMCI	EMC118A45SE	980809	Jan. 12, 2021	Jan. 11, 2022
Preamplifier EMCI	EMC184045SE	980786	Jan. 12, 2021	Jan. 11, 2022
RF signal cable EMCI	EMC104-SM-SM-(9 000+2000+1000)	201244+ 201232+ 210103	Jan. 12, 2021	Jan. 11, 2022
RF signal cable EMCI	EMCCFD400-NM-N M-(9000+300+500)	201251+ 201249+ 201248	Jan. 12, 2021	Jan. 11, 2022
RF signal cable EMCI	EMC101G-KM-KM-(5000+3000+2000)	201261+201258+20 1249	Jan. 12, 2021	Jan. 11, 2022
Software BV ADT	ADT_Radiated_V7.6 .15.9.5	NA	NA	NA
Antenna Tower Max-Full	MFA-515BSN	NA	NA	NA
Turn Table Max-Full	MFT-201SS	NA	NA	NA
Turn Table Controller Max-Full	MF-7802BS	MF780208676	NA	NA
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190 004/MY55190007/MY5 5210005	Jul. 12, 2021	Jul. 11, 2022

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 9.

Test Date: Apr. 30, 2022

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver Rohde & Schwarz	ESR3	102783	Dec. 21, 2021	Dec. 20, 2022
Spectrum Analyzer KEYSIGHT	N9020B	MY60110513	Dec. 24, 2021	Dec. 23, 2022
BILOG Antenna SCHWARZBECK	VULB9168	9168-1214	Oct. 27, 2021	Oct. 26, 2022
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1170	Nov. 14, 2021	Nov. 13, 2022
HORN Antenna SCHWARZBECK	BBHA 9170	9170-995	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	980798	Jan. 17, 2022	Jan. 16, 2023
Preamplifier EMCI	EMC118A45SE	980809	Dec. 30, 2021	Dec. 29, 2022
Preamplifier EMCI	EMC184045SE	980786	Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMC104-SM-SM-(9 000+2000+1000)	201244+ 201232+ 210103	Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMCCFD400-NM-N M-(9000+300+500)	201251+ 201249+ 201248	Jan. 17, 2022	Jan. 16, 2023
RF signal cable EMCI	EMC101G-KM-KM-(5000+3000+2000)	201261+201258+20 1249	Jan. 17, 2022	Jan. 16, 2023
Software BV ADT	ADT_Radiated_V7.6 .15.9.5	NA	NA	NA
Antenna Tower Max-Full	MFA-515BSN	NA	NA	NA
Turn Table Max-Full	MFT-201SS	NA	NA	NA
Turn Table Controller Max-Full	MF-7802BS	MF780208676	NA	NA
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190 004/MY55190007/MY5 5210005	Jul. 12, 2021	Jul. 11, 2022

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 9.

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:

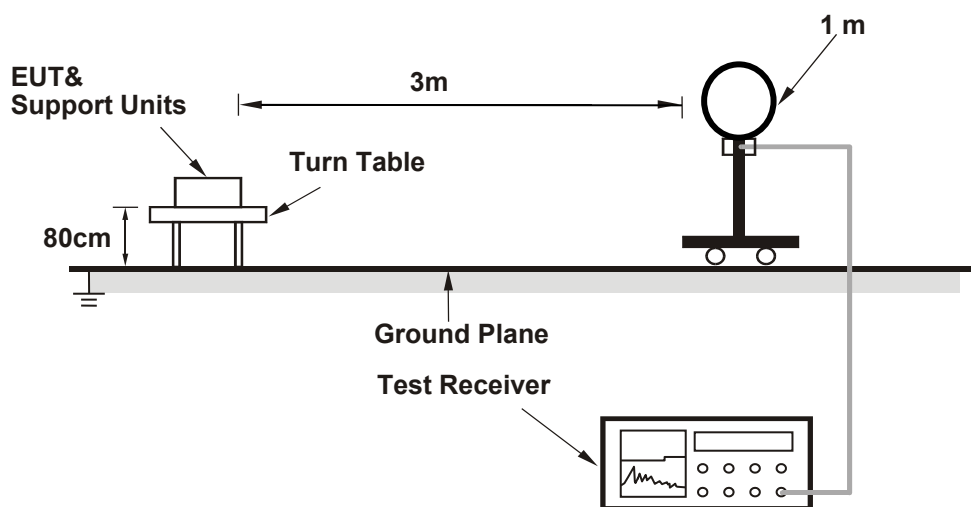
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle < 98%) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz. (BT LE 1M (Nordic), BT LE 1M (Dialog): RBW = 1MHz, VBW = 3kHz, BT LE 2M (Nordic): RBW = 1MHz, VBW = 10kHz)
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

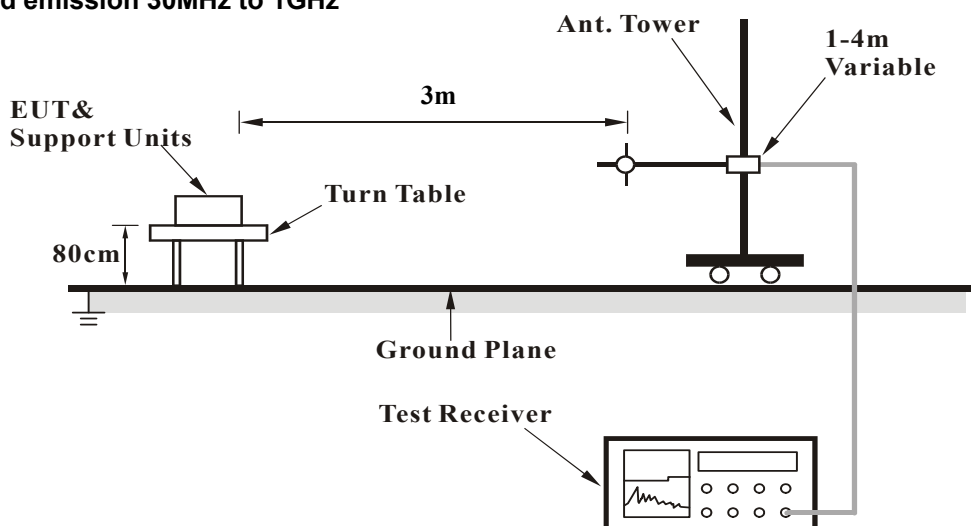
No deviation.

4.1.5 Test Setup

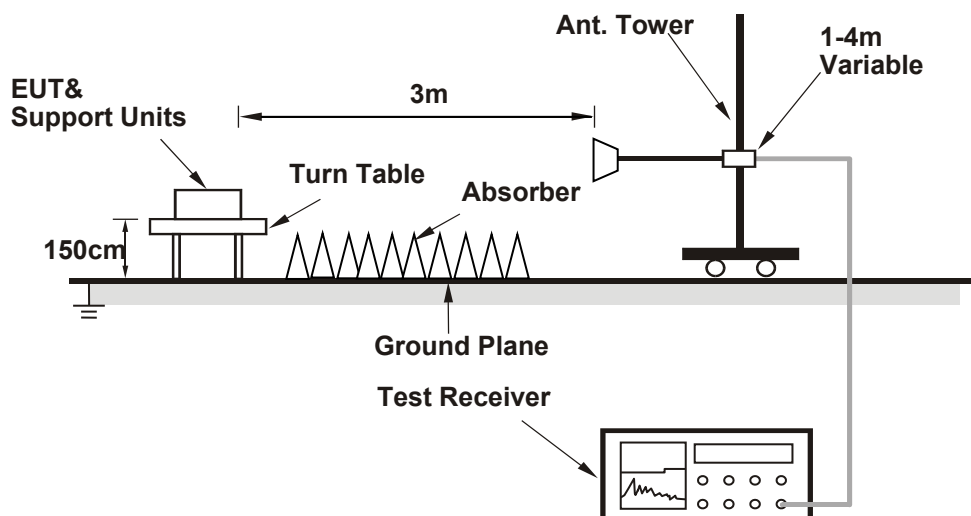
For Radiated emission below 30MHz



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

Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1 GHz Data:

BT LE 1M (Nordic)

CHANNEL	TX Channel 37	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	59.6 PK	74.0	-14.4	2.26 H	52	27.2	32.4
2	2390.00	47.0 AV	54.0	-7.0	2.26 H	52	14.6	32.4
3	*2402.00	104.6 PK			2.26 H	52	72.1	32.5
4	*2402.00	104.0 AV			2.26 H	52	71.5	32.5
5	4804.00	50.6 PK	74.0	-23.4	1.00 H	286	49.2	1.4
6	4804.00	42.2 AV	54.0	-11.8	1.00 H	286	40.8	1.4
Antenna Polarity & Test Distance : Vertical at 3m								
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	57.9 PK	74.0	-16.1	1.46 V	317	25.5	32.4
2	2390.00	45.6 AV	54.0	-8.4	1.46 V	317	13.2	32.4
3	*2402.00	97.0 PK			1.46 V	317	64.5	32.5
4	*2402.00	95.8 AV			1.46 V	317	63.3	32.5
5	4804.00	49.7 PK	74.0	-24.3	1.01 V	281	48.3	1.4
6	4804.00	40.6 AV	54.0	-13.4	1.01 V	281	39.2	1.4

Remarks:

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

CHANNEL	TX Channel 17	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	103.9 PK			3.12 H	64	71.4	32.5
2	*2440.00	102.9 AV			3.12 H	64	70.4	32.5
3	4880.00	48.7 PK	74.0	-25.3	1.00 H	284	47.2	1.5
4	4880.00	38.2 AV	54.0	-15.8	1.00 H	284	36.7	1.5
Antenna Polarity & Test Distance : Vertical at 3m								
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	98.5 PK			1.67 V	317	66.0	32.5
2	*2440.00	97.6 AV			1.67 V	317	65.1	32.5
3	4880.00	47.7 PK	74.0	-26.3	1.01 V	284	46.2	1.5
4	4880.00	38.0 AV	54.0	-16.0	1.01 V	284	36.5	1.5

Remarks:

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

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	*2480.00	103.4 PK			2.61 H	180	70.9	32.5
2	*2480.00	102.2 AV			2.61 H	180	69.7	32.5
3	2483.50	59.0 PK	74.0	-15.0	2.61 H	180	26.5	32.5
4	2483.50	46.9 AV	54.0	-7.1	2.61 H	180	14.4	32.5
5	4960.00	50.4 PK	74.0	-23.6	2.40 H	139	48.6	1.8
6	4960.00	40.4 AV	54.0	-13.6	2.40 H	139	38.6	1.8
Antenna Polarity & Test Distance : Vertical at 3m								
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	*2480.00	98.6 PK			2.92 V	345	66.1	32.5
2	*2480.00	97.4 AV			2.92 V	345	64.9	32.5
3	2483.50	57.7 PK	74.0	-16.3	2.92 V	345	25.2	32.5
4	2483.50	46.2 AV	54.0	-7.8	2.92 V	345	13.7	32.5
5	4960.00	48.3 PK	74.0	-25.7	1.00 V	292	46.5	1.8
6	4960.00	37.9 AV	54.0	-16.1	1.00 V	292	36.1	1.8

Remarks:

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

BT LE 1M (Dialog)

CHANNEL	TX Channel 37	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	57.6 PK	74.0	-16.4	1.07 H	135	25.2	32.4
2	2390.00	45.8 AV	54.0	-8.2	1.07 H	135	13.4	32.4
3	*2402.00	95.7 PK			1.07 H	135	63.2	32.5
4	*2402.00	95.0 AV			1.07 H	135	62.5	32.5
5	4804.00	46.3 PK	74.0	-27.7	1.12 H	293	44.9	1.4
6	4804.00	35.1 AV	54.0	-18.9	1.12 H	293	33.7	1.4
Antenna Polarity & Test Distance : Vertical at 3m								
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	57.9 PK	74.0	-16.1	1.12 V	158	25.5	32.4
2	2390.00	45.3 AV	54.0	-8.7	1.12 V	158	12.9	32.4
3	*2402.00	92.4 PK			1.12 V	158	59.9	32.5
4	*2402.00	91.4 AV			1.12 V	158	58.9	32.5
5	4804.00	46.2 PK	74.0	-27.8	1.05 V	282	44.8	1.4
6	4804.00	35.0 AV	54.0	-19.0	1.05 V	282	33.6	1.4

Remarks:

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

CHANNEL	TX Channel 17	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	96.1 PK			1.39 H	136	63.6	32.5
2	*2440.00	95.2 AV			1.39 H	136	62.7	32.5
3	4880.00	46.7 PK	74.0	-27.3	1.17 H	289	45.2	1.5
4	4880.00	35.3 AV	54.0	-18.7	1.17 H	289	33.8	1.5
Antenna Polarity & Test Distance : Vertical at 3m								
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	95.0 PK			1.22 V	159	62.5	32.5
2	*2440.00	93.8 AV			1.22 V	159	61.3	32.5
3	4880.00	46.3 PK	74.0	-27.7	1.03 V	284	44.8	1.5
4	4880.00	35.2 AV	54.0	-18.8	1.03 V	284	33.7	1.5

Remarks:

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

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	*2480.00	94.1 PK			1.40 H	200	61.6	32.5
2	*2480.00	93.1 AV			1.40 H	200	60.6	32.5
3	2483.50	58.3 PK	74.0	-15.7	1.40 H	200	25.8	32.5
4	2483.50	46.1 AV	54.0	-7.9	1.40 H	200	13.6	32.5
5	4960.00	47.4 PK	74.0	-26.6	1.17 H	290	45.6	1.8
6	4960.00	35.8 AV	54.0	-18.2	1.17 H	290	34.0	1.8
Antenna Polarity & Test Distance : Vertical at 3m								
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	*2480.00	92.8 PK			1.18 V	153	60.3	32.5
2	*2480.00	91.8 AV			1.18 V	153	59.3	32.5
3	2483.50	58.4 PK	74.0	-15.6	1.18 V	153	25.9	32.5
4	2483.50	46.4 AV	54.0	-7.6	1.18 V	153	13.9	32.5
5	4960.00	47.0 PK	74.0	-27.0	1.10 V	285	45.2	1.8
6	4960.00	35.5 AV	54.0	-18.5	1.10 V	285	33.7	1.8

Remarks:

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

BT LE 2M (Nordic)

CHANNEL	TX Channel 37	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	57.9 PK	74.0	-16.1	1.15 H	313	26.2	31.7
2	2390.00	48.8 AV	54.0	-5.2	1.15 H	313	17.1	31.7
3	*2402.00	99.0 PK			1.15 H	313	67.2	31.8
4	*2402.00	95.6 AV			1.15 H	313	63.8	31.8
5	4804.00	48.6 PK	74.0	-25.4	2.48 H	148	46.3	2.3
6	4804.00	38.9 AV	54.0	-15.1	2.48 H	148	36.6	2.3
Antenna Polarity & Test Distance : Vertical at 3m								
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	1.12 V	17	26.3	31.7
2	2390.00	47.9 AV	54.0	-6.1	1.12 V	17	16.2	31.7
3	*2402.00	85.1 PK			1.12 V	17	53.3	31.8
4	*2402.00	82.3 AV			1.12 V	17	50.5	31.8
5	4804.00	48.8 PK	74.0	-25.2	1.68 V	201	46.5	2.3
6	4804.00	39.0 AV	54.0	-15.0	1.68 V	201	36.7	2.3

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.

CHANNEL	TX Channel 17	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	97.2 PK			1.23 H	301	65.4	31.8
2	*2440.00	93.9 AV			1.23 H	301	62.1	31.8
3	4880.00	48.7 PK	74.0	-25.3	2.33 H	174	46.1	2.6
4	4880.00	39.2 AV	54.0	-14.8	2.33 H	174	36.6	2.6
Antenna Polarity & Test Distance : Vertical at 3m								
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	87.5 PK			1.03 V	27	55.7	31.8
2	*2440.00	84.3 AV			1.03 V	27	52.5	31.8
3	4880.00	48.9 PK	74.0	-25.1	1.66 V	214	46.3	2.6
4	4880.00	39.2 AV	54.0	-14.8	1.66 V	214	36.6	2.6

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.

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	*2480.00	96.8 PK			1.30 H	301	64.9	31.9
2	*2480.00	94.1 AV			1.30 H	301	62.2	31.9
3	2483.50	59.6 PK	74.0	-14.4	1.30 H	301	27.7	31.9
4	2483.50	48.4 AV	54.0	-5.6	1.30 H	301	16.5	31.9
5	4960.00	49.3 PK	74.0	-24.7	2.27 H	180	46.5	2.8
6	4960.00	39.4 AV	54.0	-14.6	2.27 H	180	36.6	2.8
Antenna Polarity & Test Distance : Vertical at 3m								
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	*2480.00	90.9 PK			1.00 V	25	59.0	31.9
2	*2480.00	87.5 AV			1.00 V	25	55.6	31.9
3	2483.50	58.3 PK	74.0	-15.7	1.00 V	25	26.4	31.9
4	2483.50	48.2 AV	54.0	-5.8	1.00 V	25	16.3	31.9
5	4960.00	49.0 PK	74.0	-25.0	1.58 V	211	46.2	2.8
6	4960.00	39.5 AV	54.0	-14.5	1.58 V	211	36.7	2.8

Remarks:

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

Below 1GHz worst-case data:

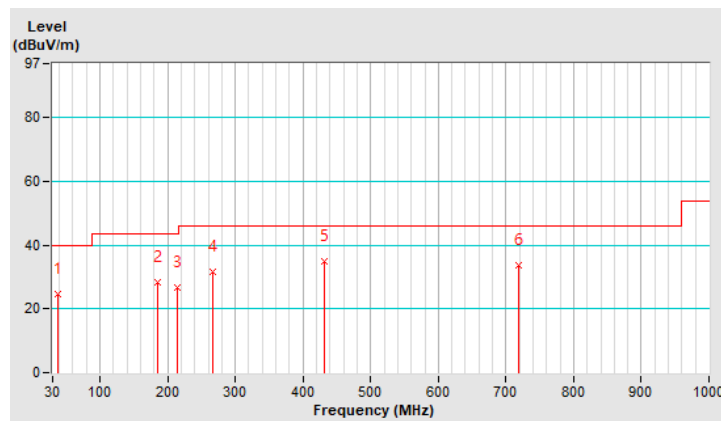
BT LE 1M (Nordic)

CHANNEL	TX Channel 37	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	38.48	24.8 QP	40.0	-15.2	1.52 H	144	38.5	-13.7
2	184.73	28.5 QP	43.5	-15.0	1.04 H	208	43.7	-15.2
3	214.73	26.9 QP	43.5	-16.6	1.37 H	194	43.2	-16.3
4	265.71	31.6 QP	46.0	-14.4	1.23 H	314	45.2	-13.6
5	431.86	35.1 QP	46.0	-10.9	1.76 H	254	44.3	-9.2
6	718.43	33.5 QP	46.0	-12.5	1.02 H	54	37.3	-3.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. 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.

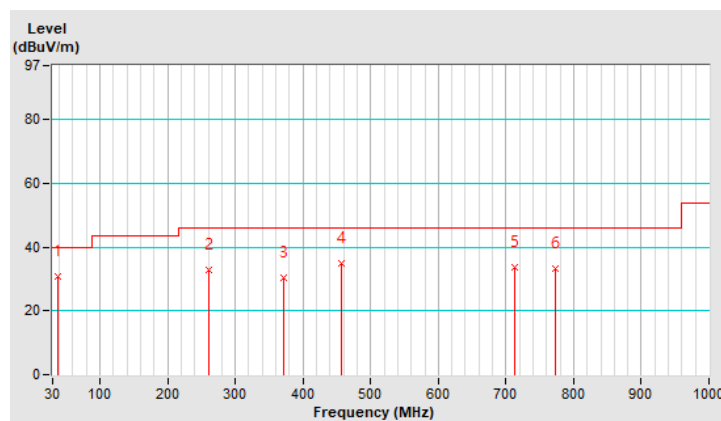


CHANNEL	TX Channel 37	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	37.54	30.8 QP	40.0	-9.2	1.23 V	145	44.5	-13.7
2	261.24	32.8 QP	46.0	-13.2	1.34 V	168	46.7	-13.9
3	370.50	30.5 QP	46.0	-15.5	1.66 V	214	41.2	-10.7
4	457.38	34.8 QP	46.0	-11.2	1.68 V	23	43.3	-8.5
5	713.24	33.8 QP	46.0	-12.2	1.02 V	53	37.6	-3.8
6	772.18	33.2 QP	46.0	-12.8	1.14 V	302	36.3	-3.1

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. 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.



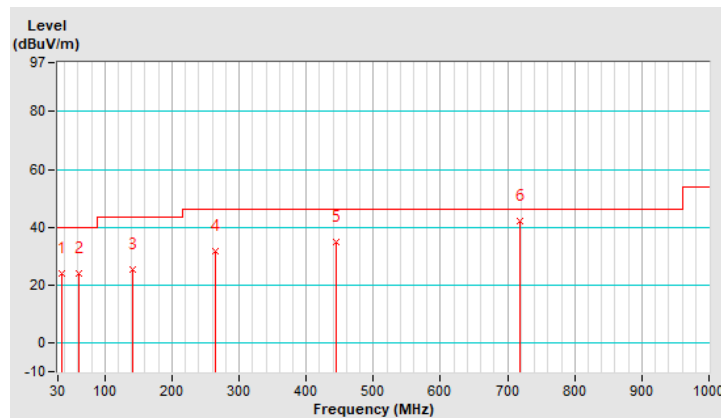
BT LE 1M (Dialog)

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	36.48	24.1 QP	40.0	-15.9	1.12 H	134	38.1	-14.0
2	61.27	24.1 QP	40.0	-15.9	1.02 H	107	38.1	-14.0
3	140.77	25.2 QP	43.5	-18.3	1.78 H	22	38.7	-13.5
4	265.18	31.6 QP	46.0	-14.4	1.02 H	5	45.2	-13.6
5	444.28	35.0 QP	46.0	-11.0	1.76 H	130	43.8	-8.8
6	718.48	42.3 QP	46.0	-3.7	1.88 H	161	46.1	-3.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m).
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB).
3. 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.

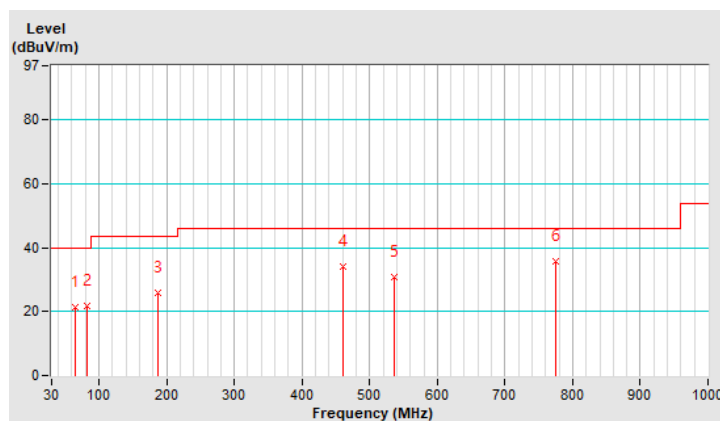


CHANNEL	TX Channel 39	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	65.43	21.4 QP	40.0	-18.6	1.63 V	182	36.1	-14.7
2	81.89	21.7 QP	40.0	-18.3	1.38 V	19	40.1	-18.4
3	187.42	25.7 QP	43.5	-17.8	2.03 V	305	41.2	-15.5
4	461.27	34.1 QP	46.0	-11.9	1.89 V	142	42.5	-8.4
5	535.81	30.9 QP	46.0	-15.1	1.46 V	241	38.2	-7.3
6	775.18	35.7 QP	46.0	-10.3	1.05 V	166	38.7	-3.0

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.



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

Test Date: Aug. 23, 2021

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Dec. 04, 2020	Dec. 03, 2021
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Jan. 16, 2021	Jan. 15, 2022
LISN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 25, 2021	Feb. 24, 2022
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 28, 2020	Aug. 27, 2021
Software ADT	BV ADT_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 HwaYa Shielded Room 1 (Conduction 1).

3. The VCCI Site Registration No. is C-12040.

4.2.3 Test Procedures

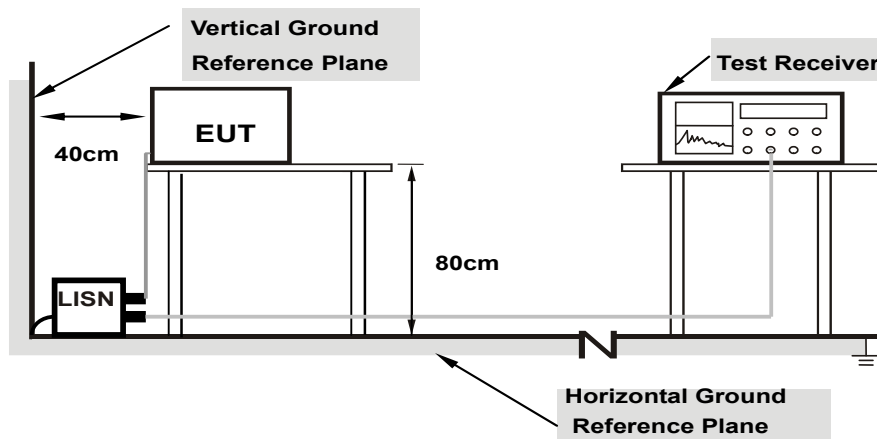
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance 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 Conditions

Same as 4.1.6.

4.2.7 Test Results

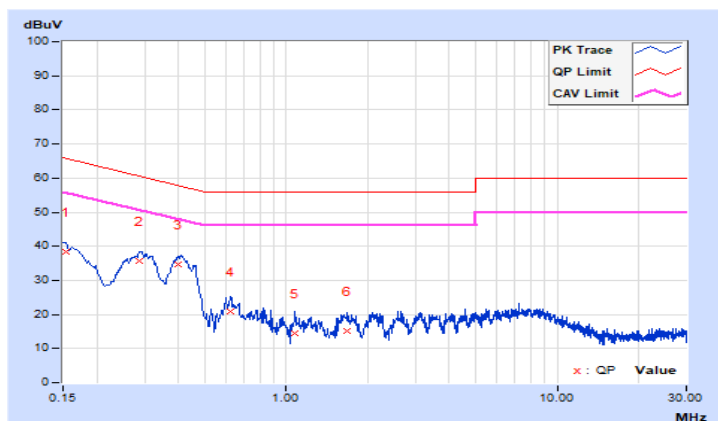
BT LE 1M (Nordic)

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15400	9.76	28.52	24.56	38.28	34.32	65.78	55.78	-27.50	-21.46
2	0.28600	9.80	25.92	22.21	35.72	32.01	60.64	50.64	-24.92	-18.63
3	0.39758	9.83	24.74	21.05	34.57	30.88	57.90	47.90	-23.33	-17.02
4	0.62200	9.86	10.88	7.32	20.74	17.18	56.00	46.00	-35.26	-28.82
5	1.07800	9.91	4.63	0.40	14.54	10.31	56.00	46.00	-41.46	-35.69
6	1.67800	9.93	5.09	1.34	15.02	11.27	56.00	46.00	-40.98	-34.73

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.

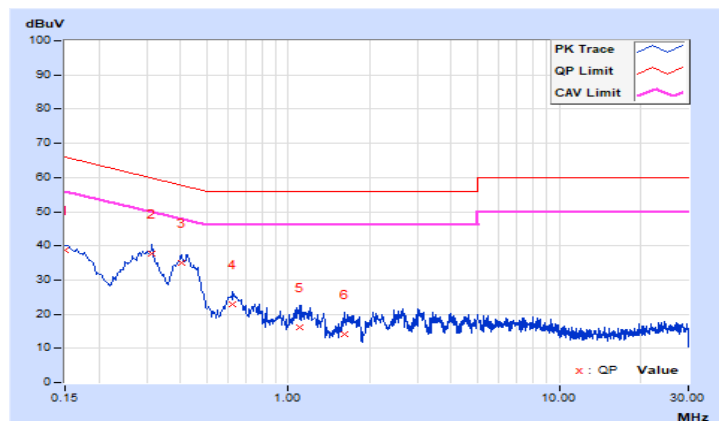


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.80	28.84	24.87	38.64	34.67	66.00	56.00	-27.36	-21.33
2	0.31365	9.87	27.84	20.86	37.71	30.73	59.87	49.87	-22.16	-19.14
3	0.40600	9.90	24.98	21.08	34.88	30.98	57.73	47.73	-22.85	-16.75
4	0.62600	9.92	12.90	9.42	22.82	19.34	56.00	46.00	-33.18	-26.66
5	1.09800	9.96	6.21	1.59	16.17	11.55	56.00	46.00	-39.83	-34.45
6	1.61400	9.98	4.23	0.61	14.21	10.59	56.00	46.00	-41.79	-35.41

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.



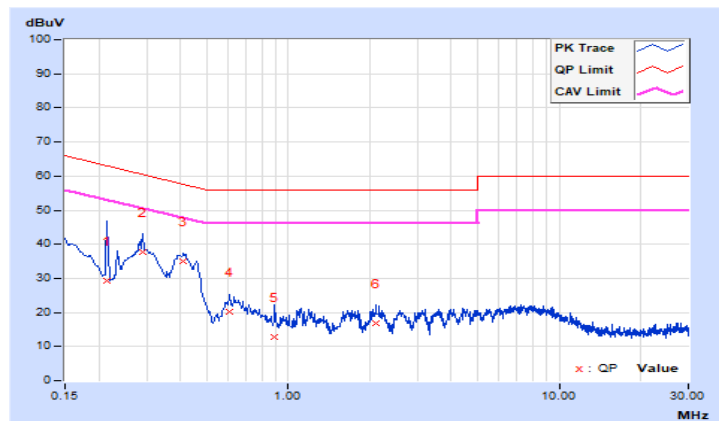
BT LE 1M (Dialog)

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.21400	9.77	19.44	13.78	29.21	23.55	63.05	53.05	-33.84	-29.50
2	0.28982	9.80	27.81	22.40	37.61	32.20	60.53	50.53	-22.92	-18.33
3	0.41000	9.83	25.15	21.42	34.98	31.25	57.65	47.65	-22.67	-16.40
4	0.61000	9.86	10.45	7.08	20.31	16.94	56.00	46.00	-35.69	-29.06
5	0.89400	9.90	2.97	0.60	12.87	10.50	56.00	46.00	-43.13	-35.50
6	2.11000	9.94	6.76	2.55	16.70	12.49	56.00	46.00	-39.30	-33.51

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.

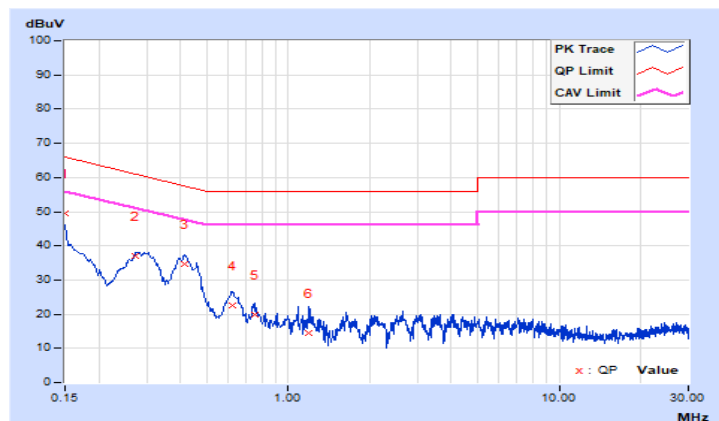


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.80	30.83	25.40	40.63	35.20	66.00	56.00	-25.37	-20.80
2	0.27400	9.86	27.10	21.44	36.96	31.30	61.00	51.00	-24.04	-19.70
3	0.41361	9.90	24.80	21.03	34.70	30.93	57.58	47.58	-22.88	-16.65
4	0.61894	9.92	12.60	9.30	22.52	19.22	56.00	46.00	-33.48	-26.78
5	0.75000	9.93	10.09	5.71	20.02	15.64	56.00	46.00	-35.98	-30.36
6	1.19000	9.97	4.50	0.04	14.47	10.01	56.00	46.00	-41.53	-35.99

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.

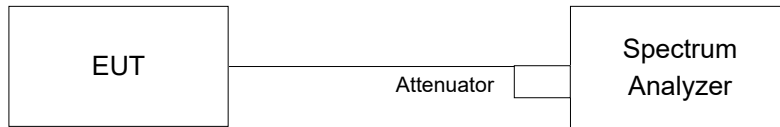


4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

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 Procedure

- Set resolution bandwidth (RBW) = 100kHz.
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

4.3.5 Deviation from Test Standard

No deviation.

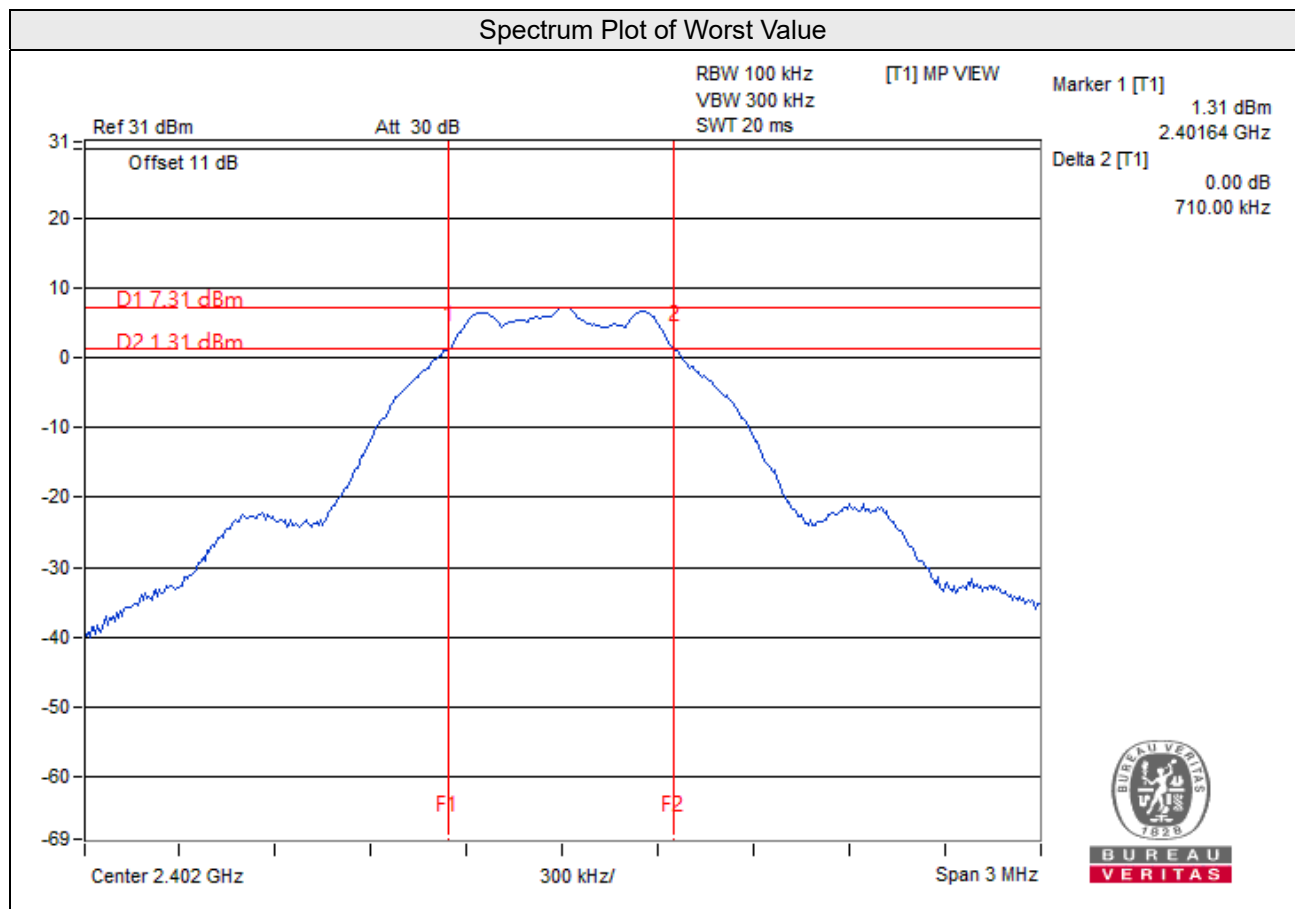
4.3.6 EUT Operating Conditions

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

4.3.7 Test Result

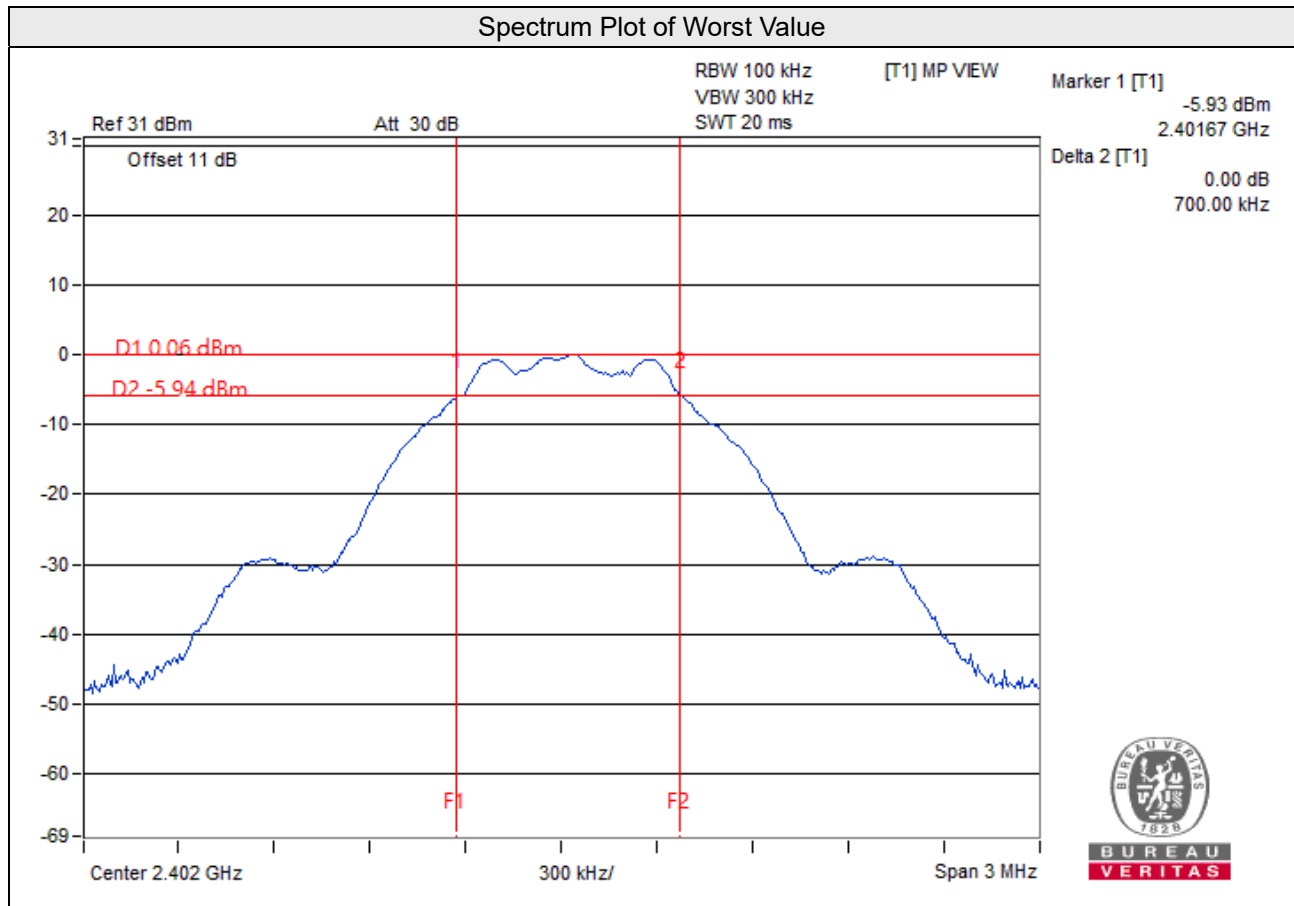
BT LE 1M (Nordic)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
37	2402	0.71	0.5	Pass
17	2440	0.72	0.5	Pass
39	2480	0.73	0.5	Pass



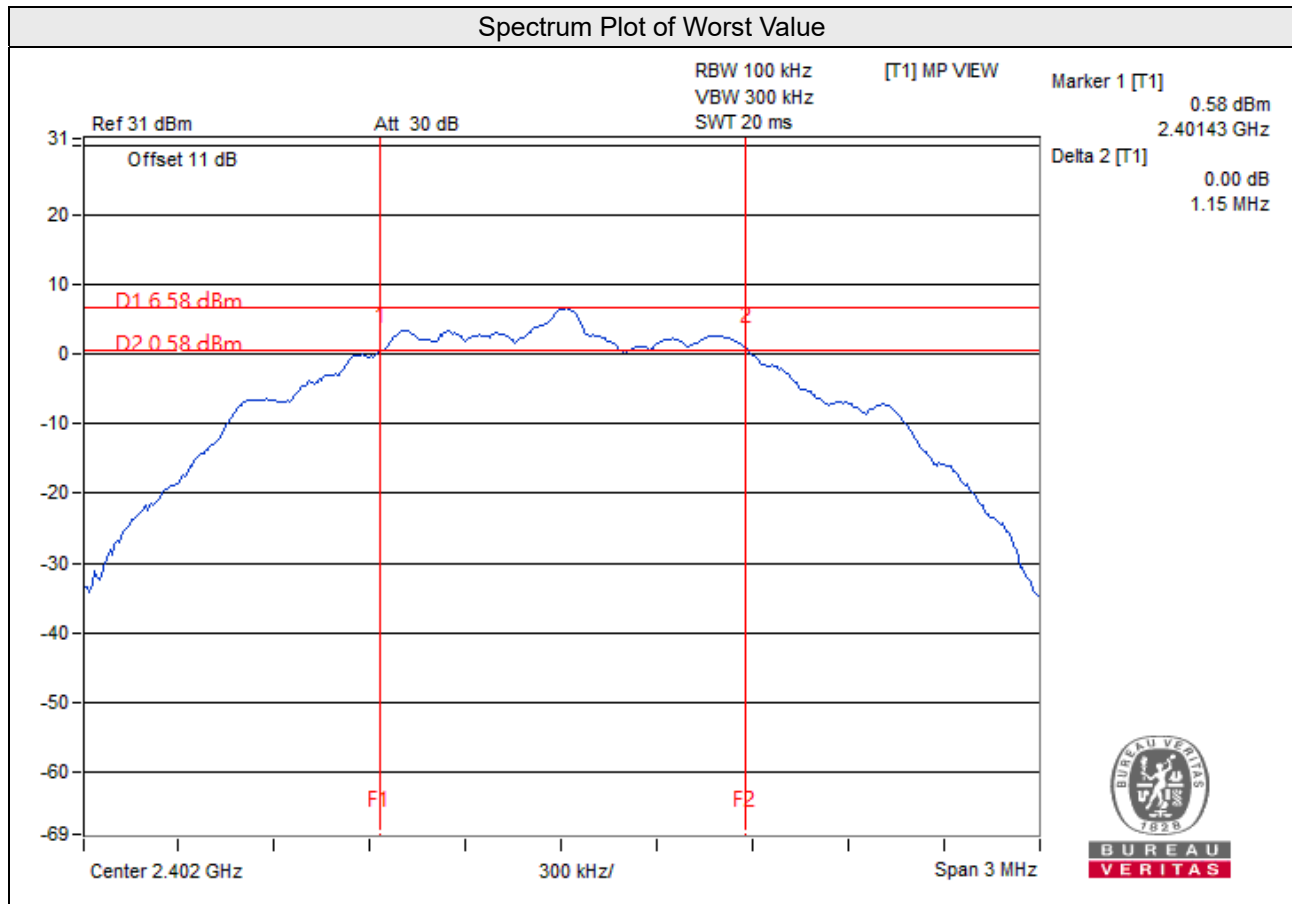
BT LE 1M (Dialog)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
37	2402	0.70	0.5	Pass
17	2440	0.71	0.5	Pass
39	2480	0.70	0.5	Pass



BT LE 2M (Nordic)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
37	2402	1.15	0.5	Pass
17	2440	1.20	0.5	Pass
39	2480	1.15	0.5	Pass

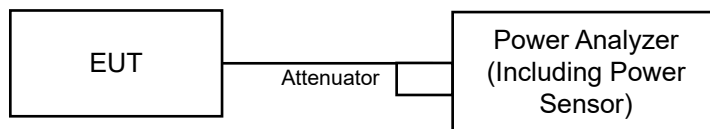


4.4 Conducted Output Power Measurement

4.4.1 Limits of Conducted Output Power Measurement

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

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 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.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as item 4.3.6.

4.4.7 Test Results

Peak Power

BT LE 1M (Nordic)

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
37	2402	6.152	7.89	30.00	Pass
17	2440	6.053	7.82	30.00	Pass
39	2480	6.039	7.81	30.00	Pass

BT LE 1M (Dialog)

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
37	2402	0.955	-0.20	30.00	Pass
17	2440	1.045	0.19	30.00	Pass
39	2480	1.099	0.41	30.00	Pass

BT LE 2M (Nordic)

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
37	2402	5.188	7.15	30.00	Pass
17	2440	5.224	7.18	30.00	Pass
39	2480	5.321	7.26	30.00	Pass

Average Power

BT LE 1M (Nordic)

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
37	2402	5.998	7.78
17	2440	5.943	7.74
39	2480	5.929	7.73

BT LE 1M (Dialog)

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
37	2402	0.942	-0.26
17	2440	1.035	0.15
39	2480	1.084	0.35

BT LE 2M (Nordic)

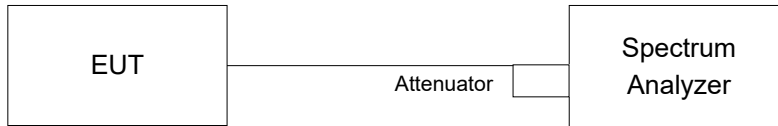
Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
37	2402	5.152	7.12
17	2440	5.200	7.16
39	2480	5.297	7.24

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

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

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

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set the VBW $\geq 3 \times \text{RBW}$.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.

4.5.5 Deviation from Test Standard

No deviation.

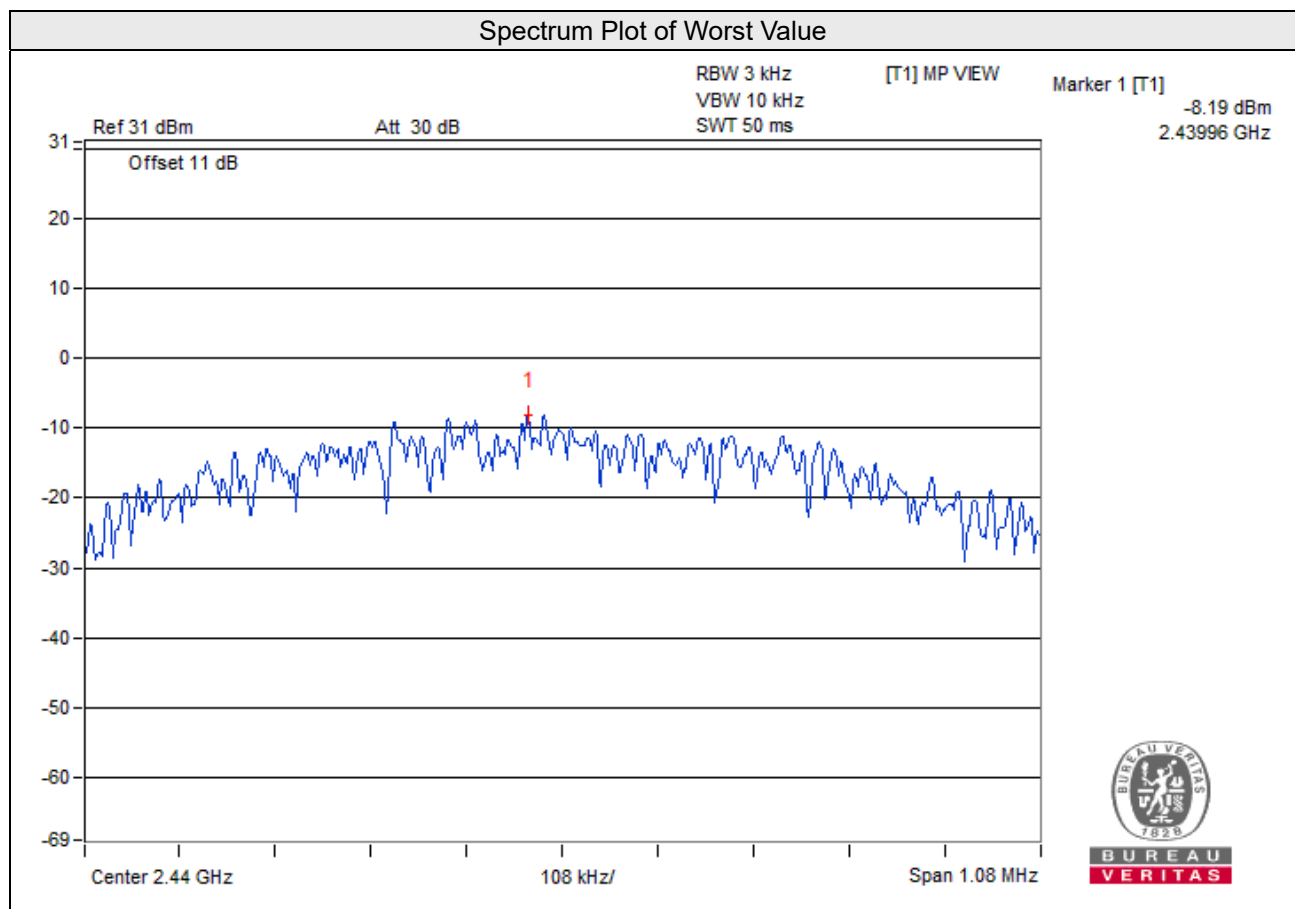
4.5.6 EUT Operating Condition

Same as item 4.3.6

4.5.7 Test Results

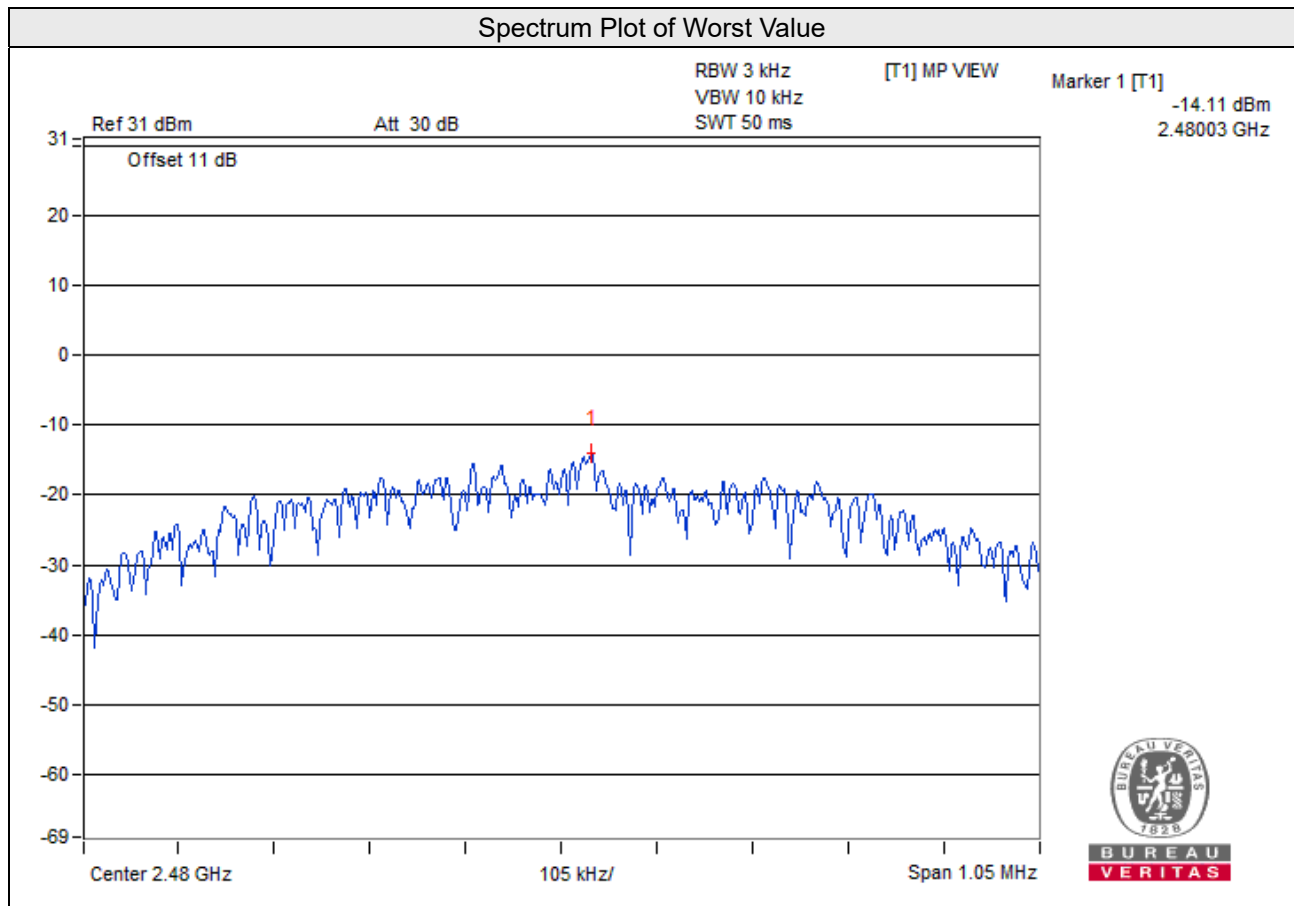
BT LE 1M (Nordic)

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
37	2402	-8.27	8.00	Pass
17	2440	-8.19	8.00	Pass
39	2480	-8.25	8.00	Pass



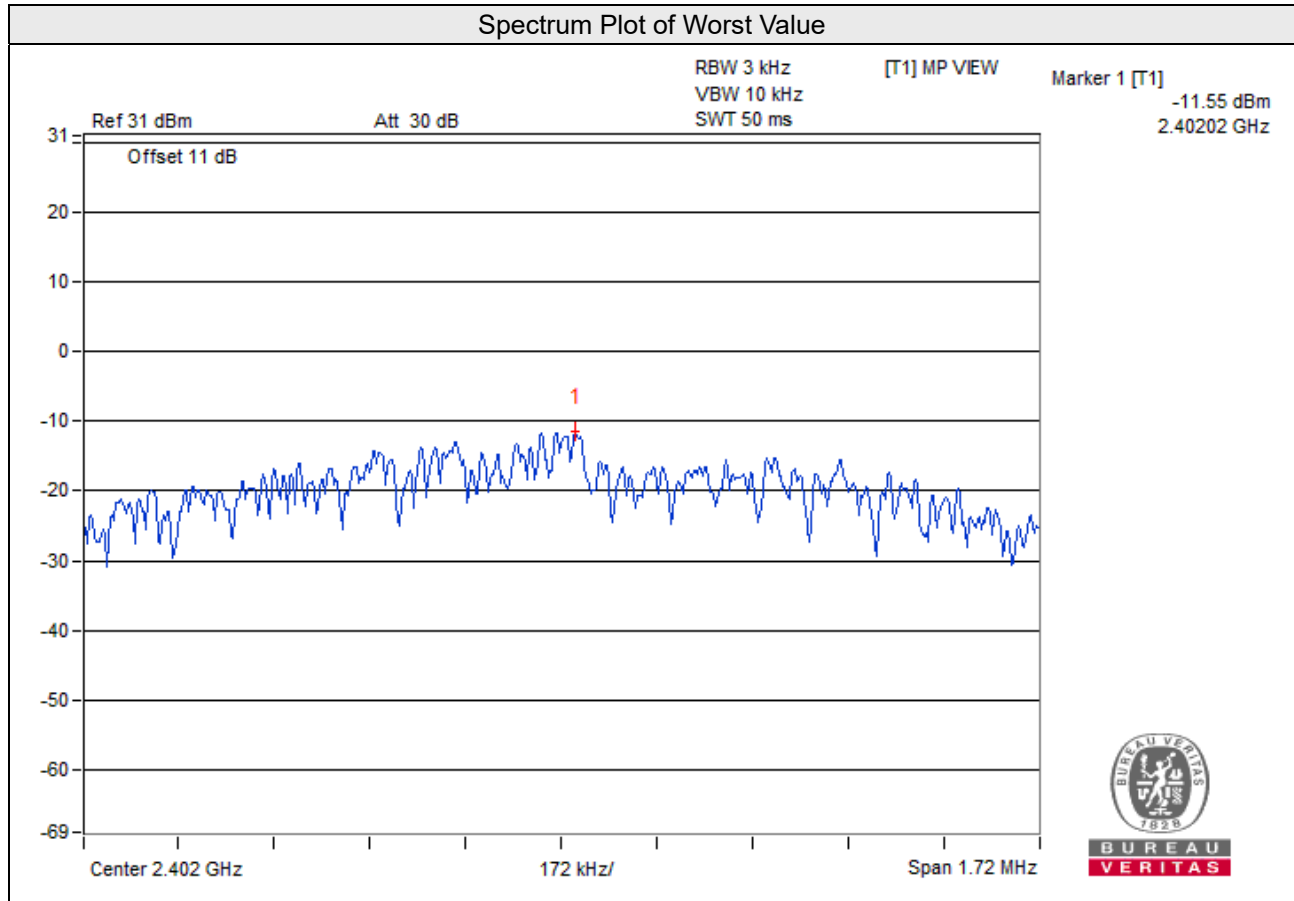
BT LE 1M (Dialog)

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
37	2402	-14.85	8.00	Pass
17	2440	-14.69	8.00	Pass
39	2480	-14.11	8.00	Pass



BT LE 2M (Nordic)

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass / Fail
37	2402	-11.55	8.00	Pass
17	2440	-12.72	8.00	Pass
39	2480	-11.65	8.00	Pass

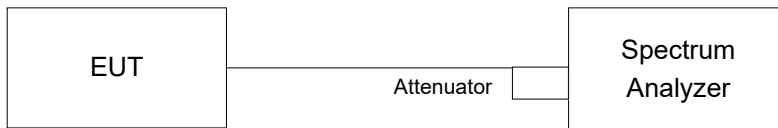


4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

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

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

- Set the RBW = 100 kHz.
- Set the VBW $\geq$ 300 kHz.
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

- Set RBW = 100 kHz.
- Set VBW $\geq$ 300 kHz.
- Detector = peak.
- Sweep = auto couple.
- Trace Mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

Same as item 4.3.6

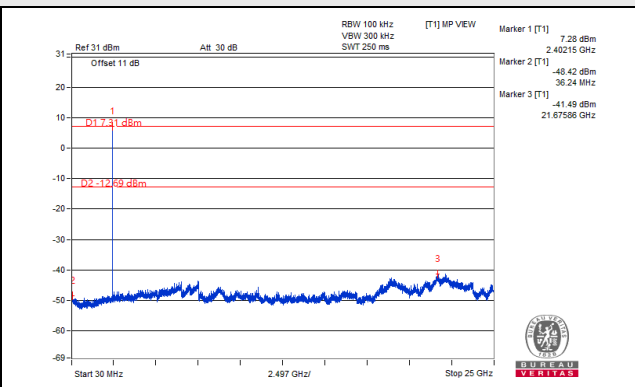
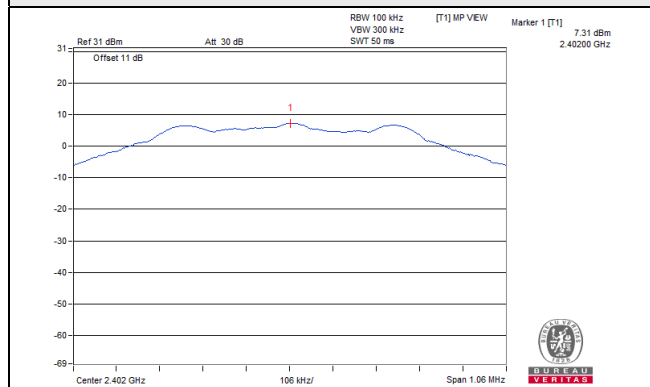
4.6.7 Test Results

The conducted emission test is performed on each TX port of operating mode without summing or adding 10log (N) since the limit is relative emission limit.

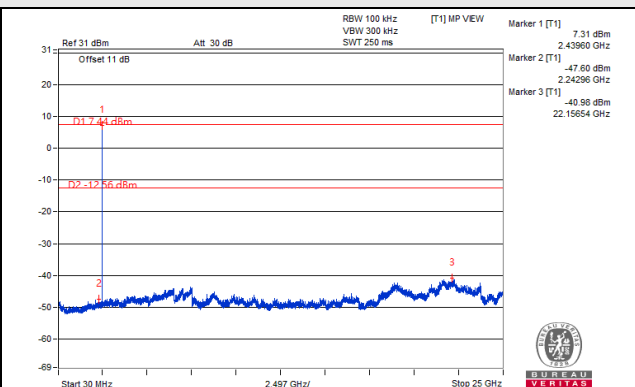
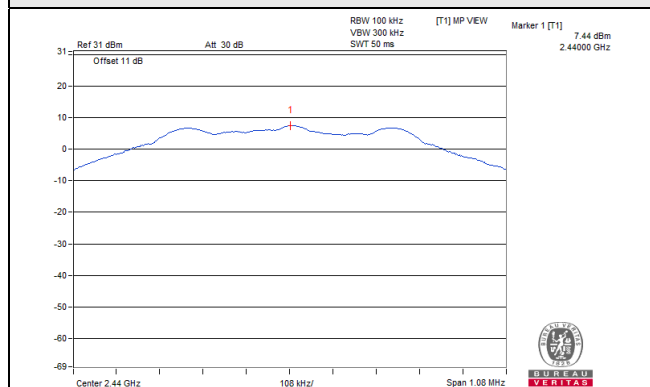
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

BT LE 1M (Nordic)

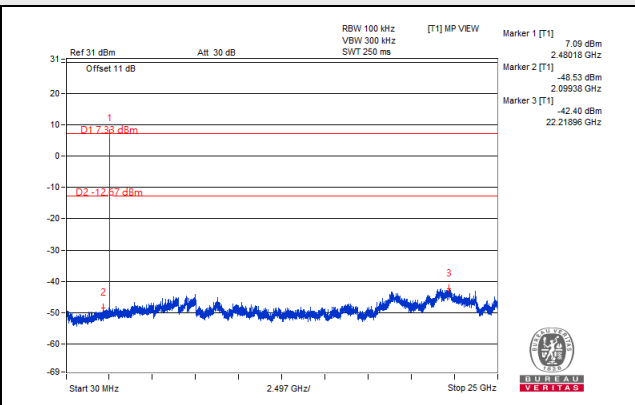
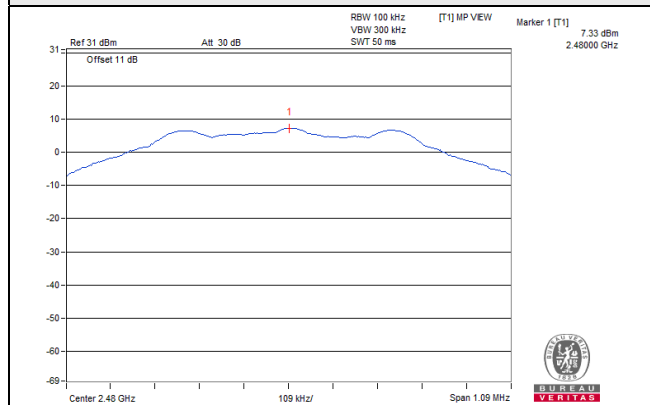
CH 37



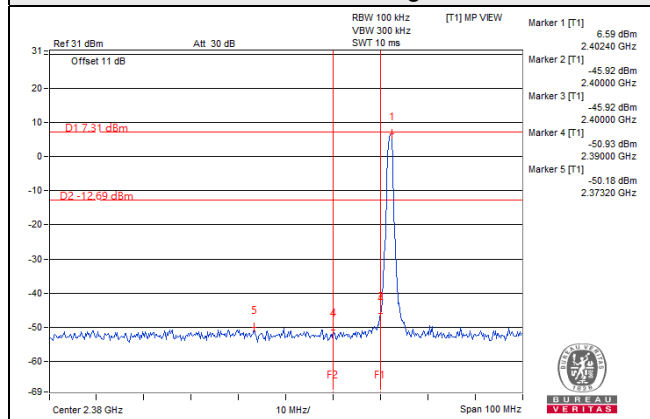
CH 17



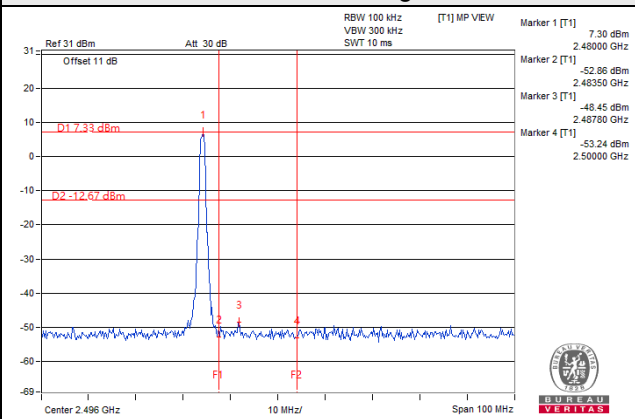
CH 39



CH 37 Band edge

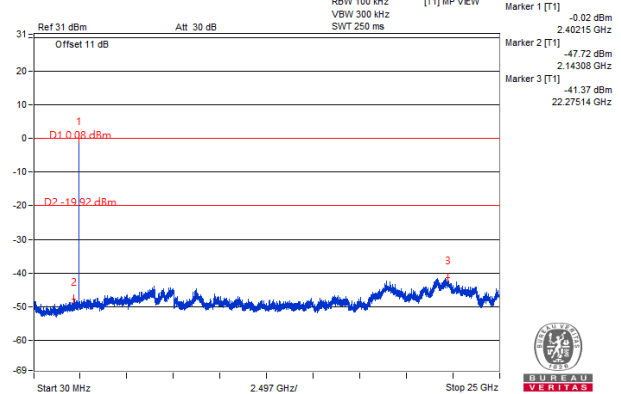
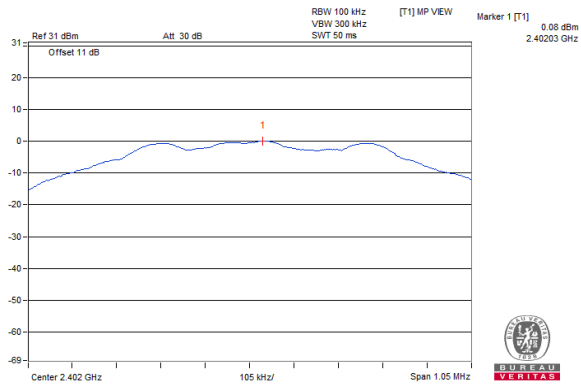


CH 39 Band edge

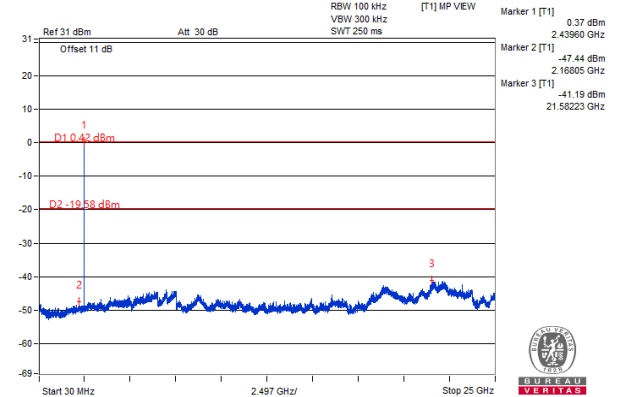
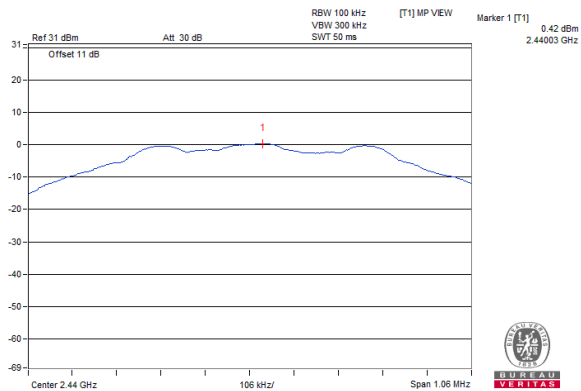


BT LE 1M (Dialog)

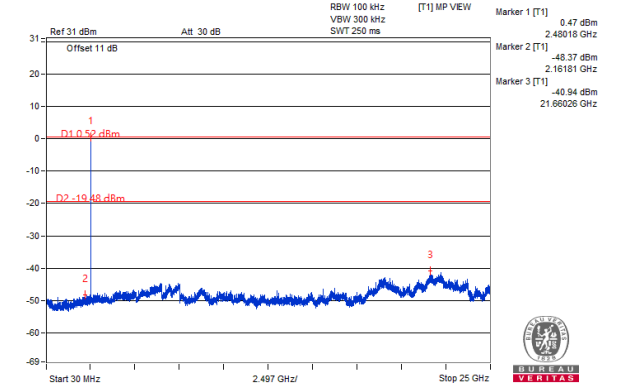
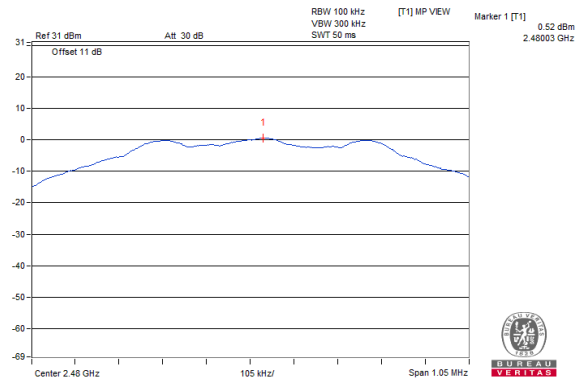
CH 37



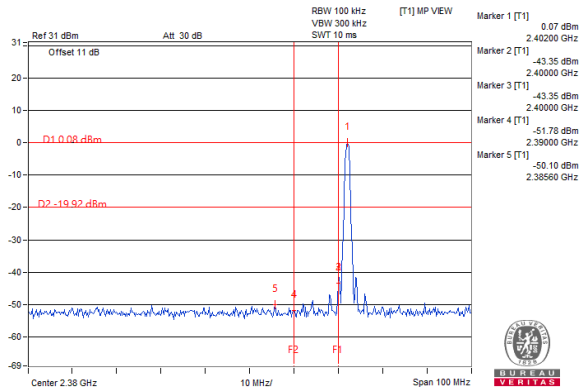
CH 17



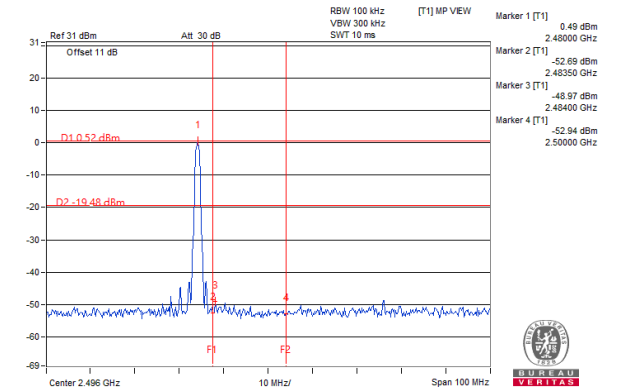
CH 39



CH 37 Band edge

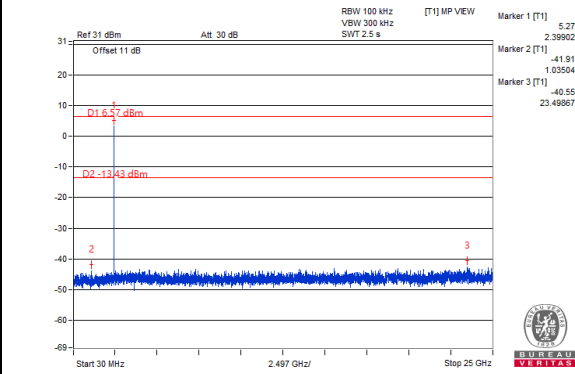
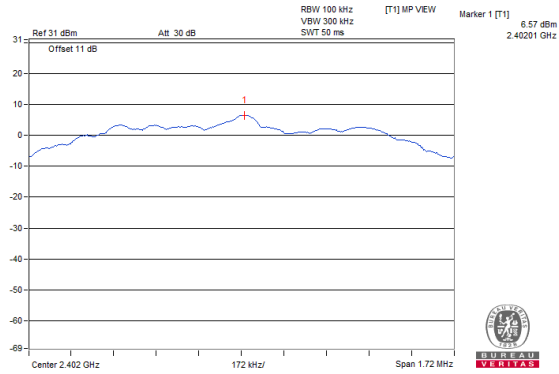


CH 39 Band edge

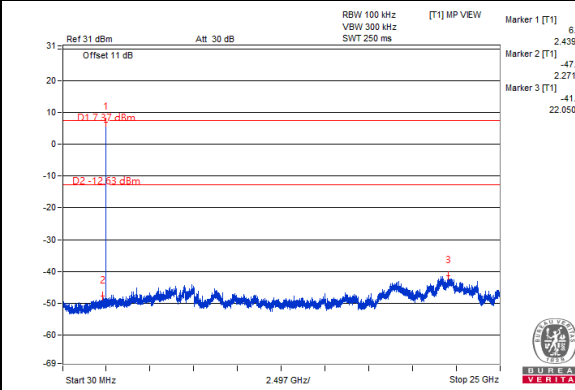
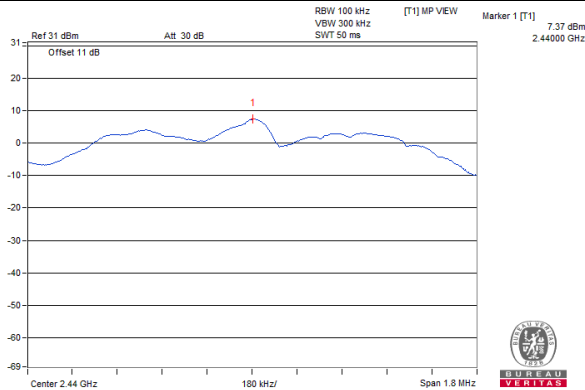


BT LE 2M (Nordic)

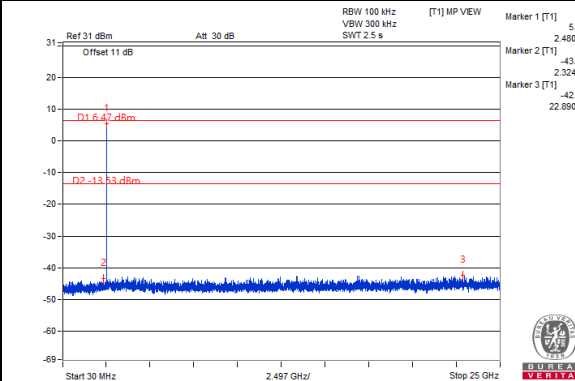
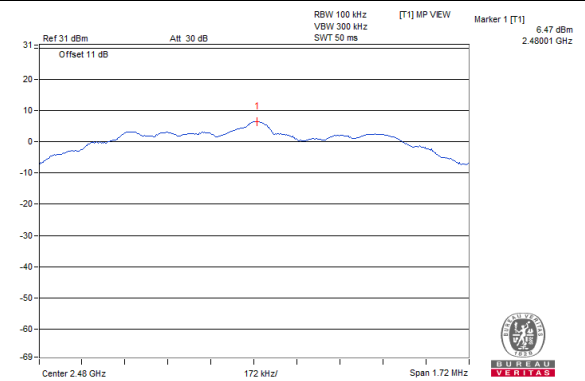
CH 37



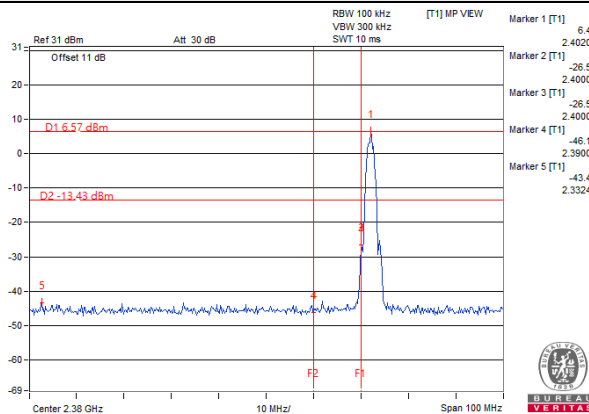
CH 17



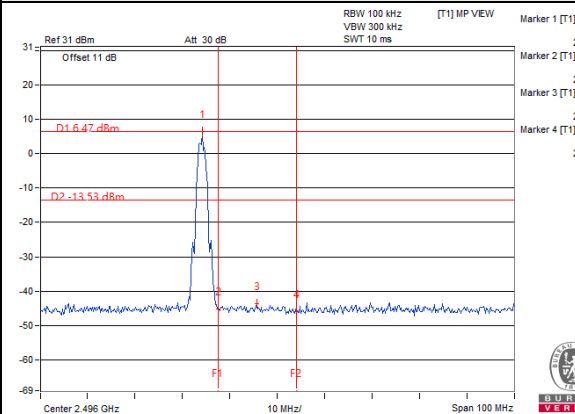
CH 39



CH 37 Band edge



CH 39 Band edge

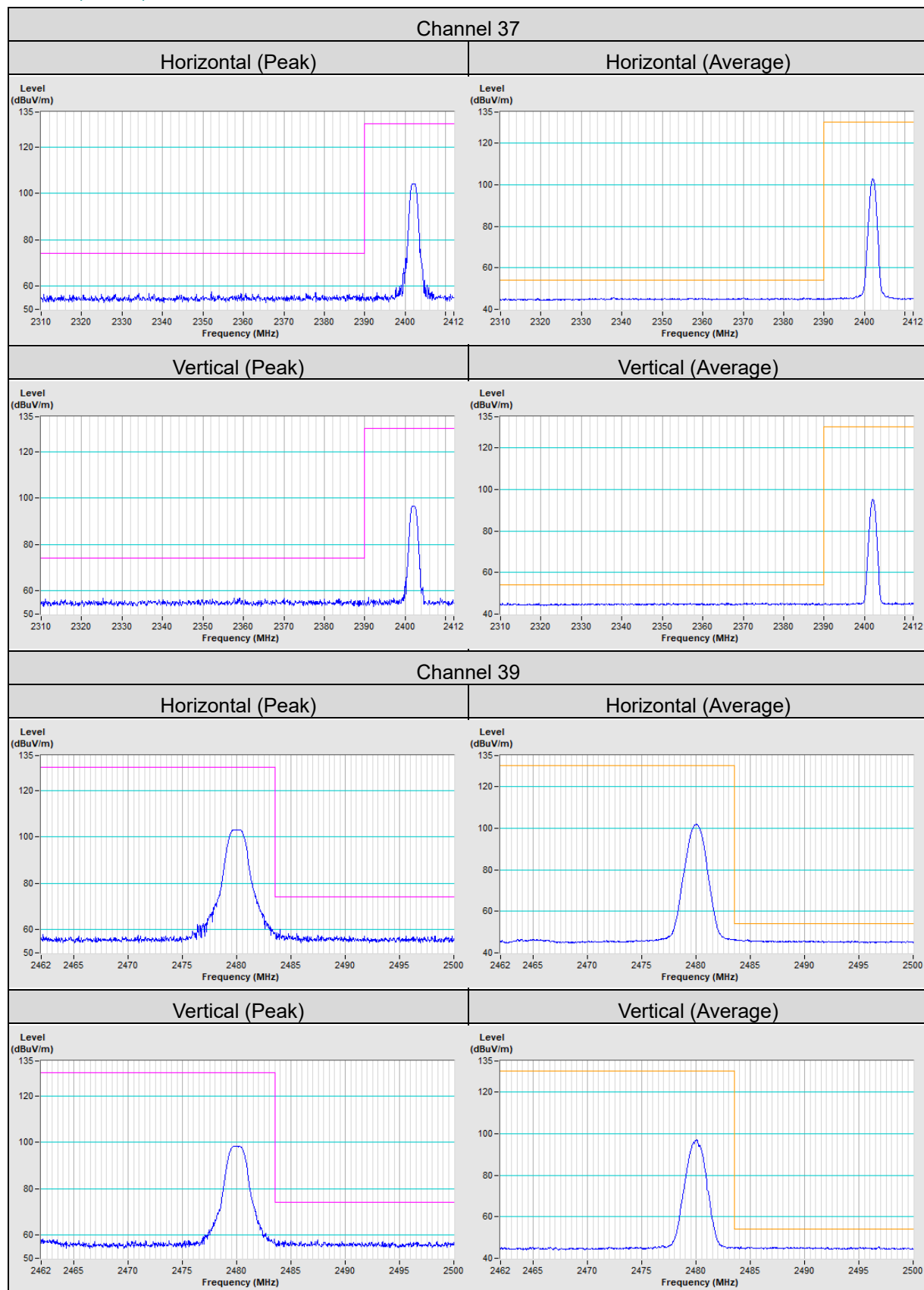


5 Pictures of Test Arrangements

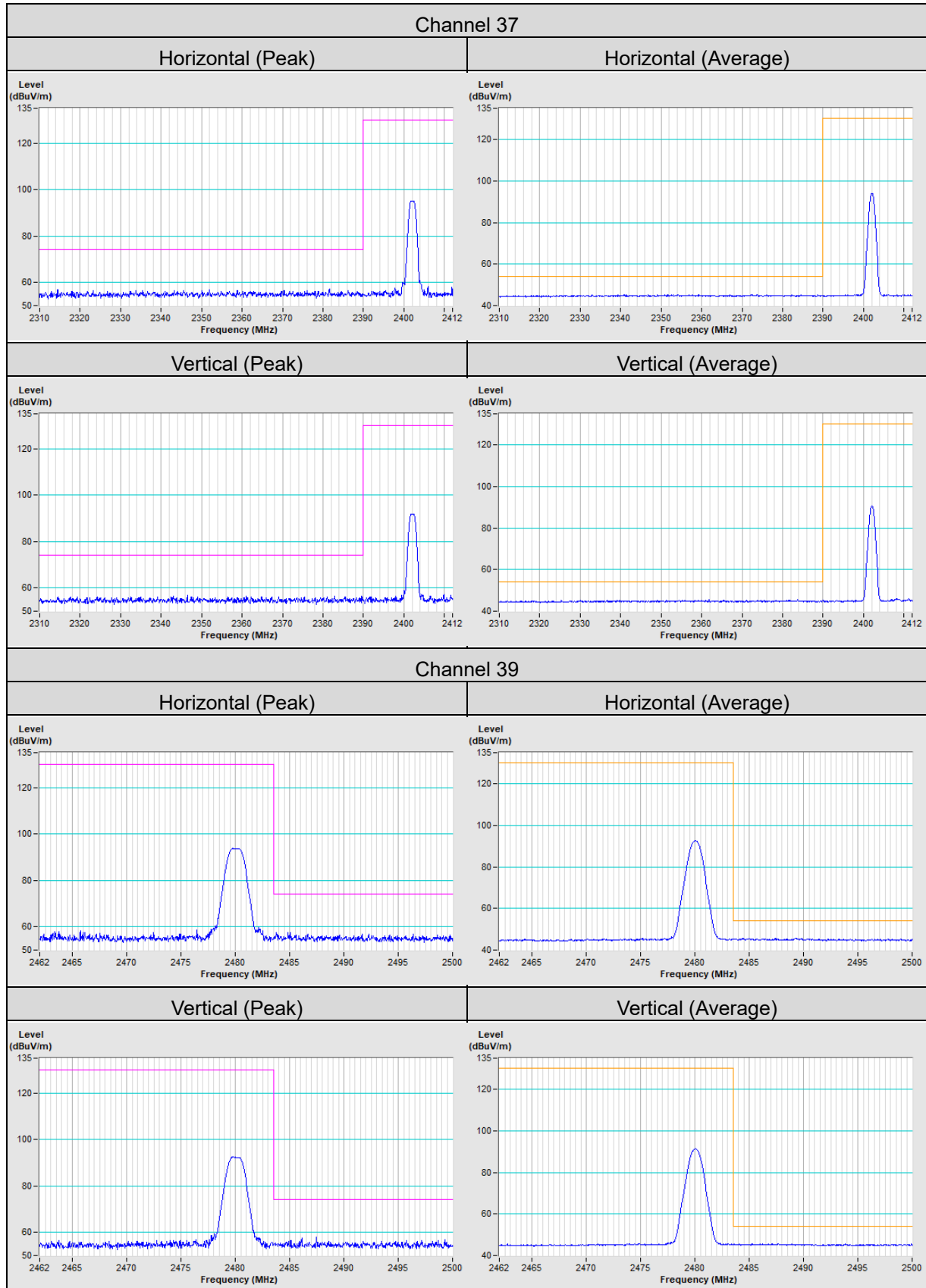
Please refer to the attached file (Test Setup Photo).

Annex A- Band Edge Measurement

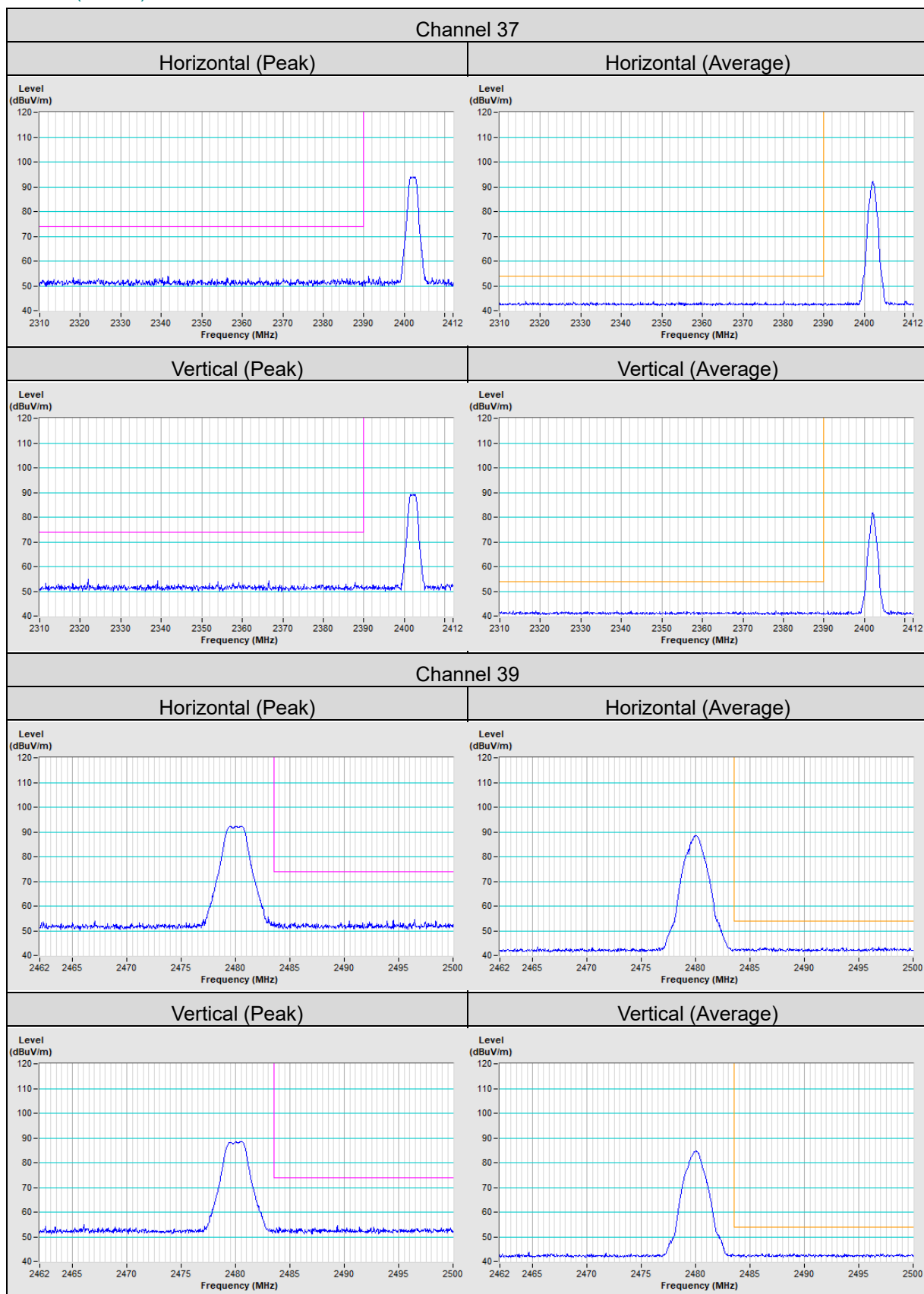
BT LE 1M (Nordic)



BT LE 1M (Dialog)



BT LE 2M (Nordic)



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:

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.

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