

FCC Test Report (BT-EDR)

Report No.: RFBDKG-WTW-P21050968

FCC ID: JNZB00040

Test Model: B00040

Received Date: May 28, 2021

Test Date: June 23, 2021

Issued Date: July 09, 2021

Applicant: LOGITECH FAR EAST LTD.

Address: 7700 Gateway Boulevard Newark California United States

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

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**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

Issue No.	Description	Date Issued
RFBDKG-WTW-P21050968	Original release.	July 09, 2021

1 Certificate of Conformity

Product: Wireless Earphones

Brand: ULTIMATE EARS

Test Model: B00040

Sample Status: ENGINEERING SAMPLE

Applicant: LOGITECH FAR EAST LTD.

Test Date: June 23, 2021

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 EMC characteristics under the conditions specified in this report.

Prepared by : Vivian Huang, **Date:** July 09, 2021
Vivian Huang / Specialist

Approved by : Clark Lin, **Date:** July 09, 2021
Clark Lin / Technical Manager

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 -25.59 dB at 3.79354 MHz.
15.247(a)(1)(iii)	Number of Hopping Frequency Used	NA	Refer to Note 1 below
15.247(a)(1)(iii)	Dwell Time on Each Channel	NA	Refer to Note 1 below
15.247(a)(1)	1. Hopping Channel Separation 2. Spectrum Bandwidth of a Frequency Hopping Sequence Spread Spectrum System	NA	Refer to Note 1 below
15.247(b)	Maximum Peak Output Power	NA	Refer to Note 1 below
15.205 & 209 & 15.247(d)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -4.1 dB at 4960.00 MHz.
15.247(d)	Antenna Port Emission	PASS	Meet the requirement of limit.
15.203	Antenna Requirement	PASS	No antenna connector is used.

Note:

1. AC Power Conducted Emission & Radiated Emissions & Band Edge Measurement were performed for this addendum. The others testing data refer to original test report.
2. For 2.4 GHz band compliance with rule 15.247(d) of the band-edge items, the test plots were recorded in Annex A.
3. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
4. This report is prepared for supplementary report.

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	1.9 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.1 dB
	30MHz ~ 1GHz	5.4 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.0 dB
	18GHz ~ 40GHz	5.3 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (BT-EDR)

Product	Wireless Earphones
Brand	ULTIMATE EARS
Test Model	B00040
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	Wireless earphone battery output is 3.7 Vdc, Wireless earphone inputs are (5Vdc/10mA to 5Vdc/60mA) each. Charging case output is 5Vdc, 60mA for each wireless earphone (5Vdc/120mA total).
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	Up to 3 Mbps
Operating Frequency	2.402 ~ 2.480 GHz
Number of Channel	79
Output Power	7.852 mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Charging case x 1
Data Cable Supplied	USB to type C cable x 1 (Unshielded, 0.6 m)

Note:

- This is a supplementary report of Report No.: RF200611E06. The differences between them are as below information:
 - ◆ Updated Grantee's company address.
 - ◆ Added 2nd source of Flash.
 - ◆ Added 2nd source antenna.

Original				
Earphone	Antenna Gain (dBi)	Frequency Range (GHz)	Antenna Type	Connector Type
Left	-1.02	2.4~2.4835	Chip	None
Right	-1.02	2.4~2.4835	Chip	None
Newly				
Earphone	Antenna Gain (dBi)	Frequency Range (GHz)	Antenna Type	Connector Type
Left	-1.97	2.4~2.4835	Chip	None
Right	-1.97	2.4~2.4835	Chip	None

- According to the applicant's requirements, only Conducted Emission, Radiated Emissions & Band Edge test items need to be performed. All data for meeting the requirement is verified.

3. The EUT (Wireless Earphones, Charging Case) power needs to be supplied from a battery, the information is as below table:

Wireless earphones battery		
Brand Name	Model No.	Spec.
VARTA or Logitech	CP1254 A3 or 533-000186	3.7Vdc, 60 mAh
Charging case		
Brand Name	Model No.	Spec.
ULTIMATE EARS	B00041	Input: 5 Vdc, 350 mA Output: 5 Vdc, 250 mA
Battery (For charging case used)		
Brand Name	Model No.	Spec.
Springpower Technology (Shenzhen) Co., Ltd. or Logitech	491032 or 533-000182 or 533-000193	3.8 Vdc, 135 mAh, 0.513 Wh

4. When charge case is open, wireless function will be operated, when charge case is close, wireless function will be not operated.

5. The EUT was pre-tested under the following modes:

AC Power Conducted Emission test	
Test Mode	Description
Mode A	EUT powered by Charge case (use USB adapter) (for new antenna)
Mode B	EUT powered by Charge case (use Laptop) (for new antenna)

Note: From the above modes, the worst case was found in **Mode A**. Therefore only the test data of the mode was recorded in this report.

6. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.
7. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.2 Description of Test Modes

79 channels are provided for BT-EDR mode:

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	78	2480
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	
-	√	√	√	-

Where **RE \geq 1G**: Radiated Emission above 1GHz **RE $<$ 1G**: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane (Below 1GHz) & Z-plane (Above 1GHz)**.

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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 to 78	0, 39, 78	FHSS	GFSK	DH5
0 to 78	0, 39, 78	FHSS	8DPSK	3DH5

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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 to 78	78	FHSS	GFSK	DH5

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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	PACKET TYPE
0 to 78	78	FHSS	GFSK	DH5

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE \geq 1G	25deg. C, 66%RH	120Vac, 60Hz (System)	Tom Yang
RE $<$ 1G	25deg. C, 66%RH	120Vac, 60Hz (System)	Tom Yang
PLC	25deg. C, 66%RH	120Vac, 60Hz (System)	Tom Yang

3.3 Description of Support Units

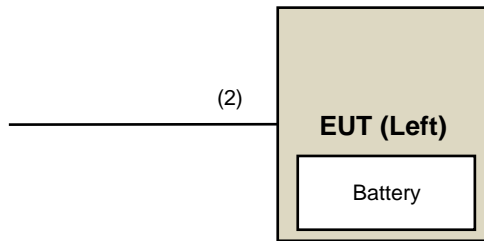
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	USB Adapter	ASUS	EXA1205UA	NA	NA	Provided by Lab

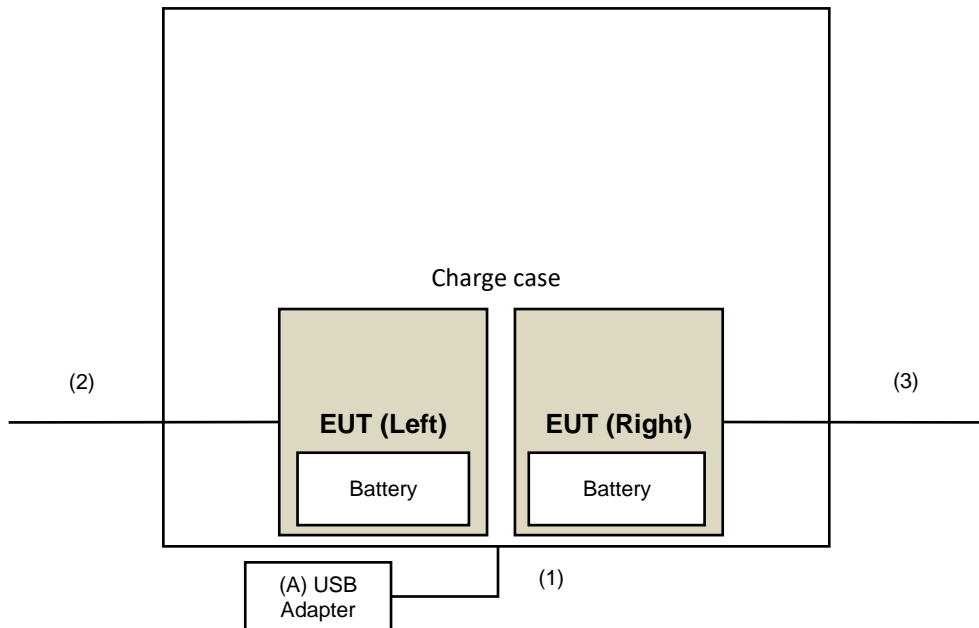
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB to type C Cable	1	0.6	No	0	Supplied by client
2.	Console Cable	1	0.03	No	0	Supplied by client (For RF Setup)
3.	Console Cable	1	0.03	No	0	Supplied by client (For RF Setup)

3.3.1 Configuration of System under Test

For Radiated Emission test:



For AC Power Conducted Emission test



3.4 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

For Radiated Emission test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Keysight	N9038A	MY54450088	July 06, 2020	July 05, 2021
Pre-Amplifier EMCI	EMC001340	980142	May 24, 2021	May 23, 2022
Loop Antenna Electro-Metrics	EM-6879	264	Mar. 05, 2021	Mar. 04, 2022
RF Cable	5D-FB	LOOPCAB-001	Jan. 07, 2021	Jan. 06, 2022
RF Cable	5D-FB	LOOPCAB-002	Jan. 07, 2021	Jan. 06, 2022
Pre-Amplifier Mini-Circuits	ZFL-1000VH2	QA0838008	Oct. 20, 2020	Oct. 19, 2021
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Nov. 05, 2020	Nov. 04, 2021
RF Cable	8D	966-3-1	Mar. 16, 2021	Mar. 15, 2022
RF Cable	8D	966-3-2	Mar. 16, 2021	Mar. 15, 2022
RF Cable	8D	966-3-3	Mar. 16, 2021	Mar. 15, 2022
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Sep. 24, 2020	Sep. 23, 2021
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Nov. 22, 2020	Nov. 21, 2021
Pre-Amplifier EMCI	EMC12630SE	980384	Jan. 11, 2021	Jan. 10, 2022
RF Cable	EMC104-SM-SM-1500	180504	Apr. 26, 2021	Apr. 25, 2022
RF Cable	EMC104-SM-SM-2000	180601	June 08, 2021	June 07, 2022
RF Cable	EMC104-SM-SM-6000	210201	May 13, 2021	May 12, 2022
Spectrum Analyzer Keysight	N9030A	MY54490679	July 13, 2020	July 12, 2021
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 11, 2021	Jan. 10, 2022
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 22, 2020	Nov. 21, 2021
RF Cable	EMC102-KM-KM-1200	160924	Jan. 11, 2021	Jan. 10, 2022
RF Cable	EMC-KM-KM-4000	200214	Mar. 10, 2021	Mar. 09, 2022
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	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 966 Chamber No. 3.
3. Tested Date: June 23, 2021

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:

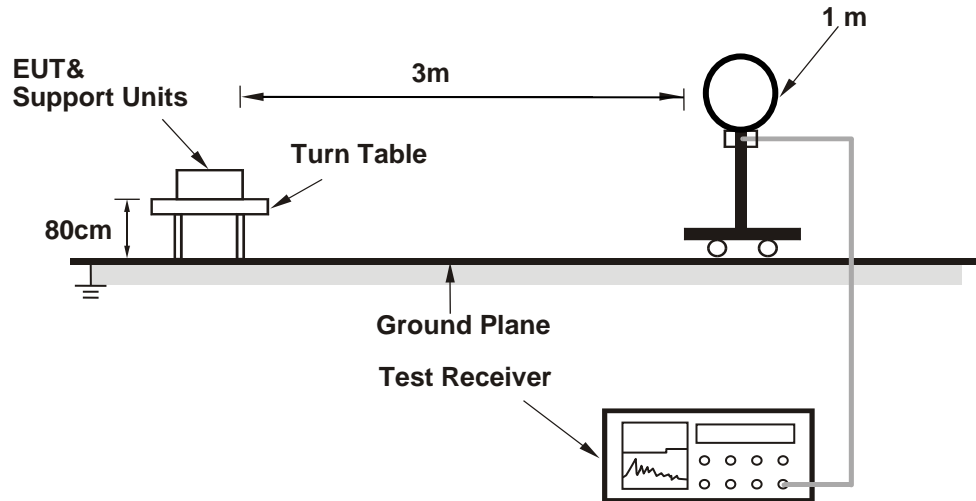
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

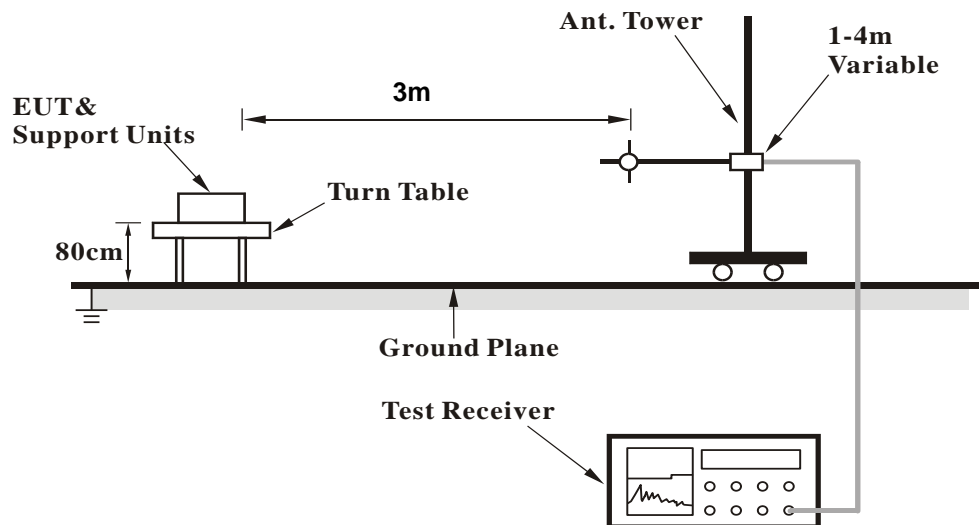
No deviation.

4.1.5 Test Setup

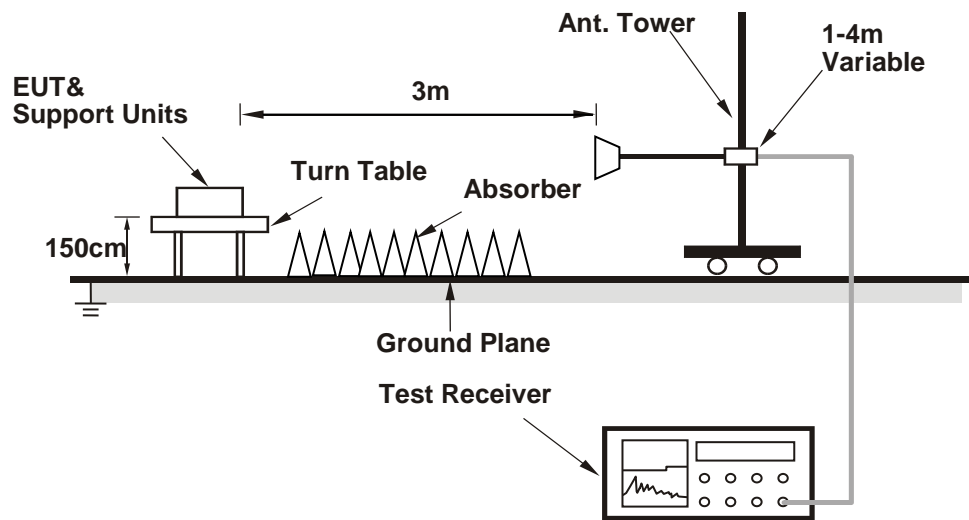
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

- a. Placed the EUT on the testing table.
- b. Controlling software (BlueTest3_3_2_2_144) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data:

RF Mode	TX BT_GFSK	Channel	CH 0 : 2402 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2379.00	56.1 PK	74.0	-17.9	3.02 H	318	57.3	-1.2
2	2379.00	43.6 AV	54.0	-10.4	3.02 H	318	44.8	-1.2
3	*2402.00	96.7 PK			3.02 H	318	97.9	-1.2
4	*2402.00	95.7 AV			3.02 H	318	96.9	-1.2
5	4804.00	49.7 PK	74.0	-24.3	1.12 H	109	45.9	3.8
6	4804.00	45.6 AV	54.0	-8.4	1.12 H	109	41.8	3.8
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	2353.50	56.4 PK	74.0	-17.6	1.19 V	225	57.5	-1.1
2	2353.50	43.6 AV	54.0	-10.4	1.19 V	225	44.7	-1.1
3	*2402.00	93.6 PK			1.19 V	225	94.8	-1.2
4	*2402.00	92.5 AV			1.19 V	225	93.7	-1.2
5	4804.00	45.6 PK	74.0	-28.4	1.03 V	254	41.8	3.8
6	4804.00	40.5 AV	54.0	-13.5	1.03 V	254	36.7	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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX BT_GFSK	Channel	CH 39 : 2441 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2441.00	97.3 PK			1.06 H	99	98.5	-1.2
2	*2441.00	96.5 AV			1.06 H	99	97.7	-1.2
3	4882.00	52.2 PK	74.0	-21.8	1.14 H	111	48.4	3.8
4	4882.00	48.1 AV	54.0	-5.9	1.14 H	111	44.3	3.8
5	7323.00	53.4 PK	74.0	-20.6	1.08 H	139	43.7	9.7
6	7323.00	47.5 AV	54.0	-6.5	1.08 H	139	37.8	9.7

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	*2441.00	93.6 PK			1.49 V	241	94.8	-1.2
2	*2441.00	92.9 AV			1.49 V	241	94.1	-1.2
3	4882.00	48.7 PK	74.0	-25.3	1.08 V	270	44.9	3.8
4	4882.00	44.9 AV	54.0	-9.1	1.08 V	270	41.1	3.8
5	7323.00	49.3 PK	74.0	-24.7	1.40 V	297	39.6	9.7
6	7323.00	39.7 AV	54.0	-14.3	1.40 V	297	30.0	9.7

Remarks:

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

RF Mode	TX BT_GFSK	Channel	CH 78 : 2480 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	98.5 PK			1.04 H	100	99.7	-1.2
2	*2480.00	97.7 AV			1.04 H	100	98.9	-1.2
3	2486.10	57.0 PK	74.0	-17.0	1.04 H	100	58.2	-1.2
4	2486.10	43.3 AV	54.0	-10.7	1.04 H	100	44.5	-1.2
5	4960.00	53.8 PK	74.0	-20.2	1.10 H	76	49.8	4.0
6	4960.00	49.9 AV	54.0	-4.1	1.10 H	76	45.9	4.0
7	7440.00	54.8 PK	74.0	-19.2	1.02 H	141	45.1	9.7
8	7440.00	48.5 AV	54.0	-5.5	1.02 H	141	38.8	9.7

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	*2480.00	94.2 PK			1.50 V	230	95.4	-1.2
2	*2480.00	93.4 AV			1.50 V	230	94.6	-1.2
3	2489.00	55.0 PK	74.0	-19.0	1.50 V	230	56.2	-1.2
4	2489.00	43.2 AV	54.0	-10.8	1.50 V	230	44.4	-1.2
5	4960.00	50.4 PK	74.0	-23.6	1.04 V	256	46.4	4.0
6	4960.00	46.1 AV	54.0	-7.9	1.04 V	256	42.1	4.0
7	7440.00	50.7 PK	74.0	-23.3	1.40 V	304	41.0	9.7
8	7440.00	41.0 AV	54.0	-13.0	1.40 V	304	31.3	9.7

Remarks:

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

RF Mode	TX BT_8DPSK	Channel	CH 0 : 2402 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2365.10	56.5 PK	74.0	-17.5	2.98 H	320	57.6	-1.1
2	2365.10	43.6 AV	54.0	-10.4	2.98 H	320	44.7	-1.1
3	*2402.00	98.5 PK			2.98 H	320	99.7	-1.2
4	*2402.00	93.9 AV			2.98 H	320	95.1	-1.2
5	4804.00	53.5 PK	74.0	-20.5	1.09 H	94	49.7	3.8
6	4804.00	47.0 AV	54.0	-7.0	1.09 H	94	43.2	3.8

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	2340.90	56.2 PK	74.0	-17.8	1.22 V	227	57.3	-1.1
2	2340.90	43.5 AV	54.0	-10.5	1.22 V	227	44.6	-1.1
3	*2402.00	94.7 PK			1.22 V	227	95.9	-1.2
4	*2402.00	90.2 AV			1.22 V	227	91.4	-1.2
5	4804.00	50.9 PK	74.0	-23.1	1.08 V	246	47.1	3.8
6	4804.00	44.1 AV	54.0	-9.9	1.08 V	246	40.3	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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

RF Mode	TX BT_8DPSK	Channel	CH 39 : 2441 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2441.00	99.8 PK			2.89 H	318	101.0	-1.2
2	*2441.00	94.3 AV			2.89 H	318	95.5	-1.2
3	4882.00	53.7 PK	74.0	-20.3	1.13 H	94	49.9	3.8
4	4882.00	47.9 AV	54.0	-6.1	1.13 H	94	44.1	3.8
5	7323.00	52.8 PK	74.0	-21.2	1.07 H	145	43.1	9.7
6	7323.00	43.8 AV	54.0	-10.2	1.07 H	145	34.1	9.7

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	*2441.00	94.9 PK			1.14 V	218	96.1	-1.2
2	*2441.00	90.2 AV			1.14 V	218	91.4	-1.2
3	4882.00	51.1 PK	74.0	-22.9	1.12 V	233	47.3	3.8
4	4882.00	44.7 AV	54.0	-9.3	1.12 V	233	40.9	3.8
5	7323.00	47.8 PK	74.0	-26.2	1.32 V	319	38.1	9.7
6	7323.00	36.2 AV	54.0	-17.8	1.32 V	319	26.5	9.7

Remarks:

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

RF Mode	TX BT_8DPSK	Channel	CH 78 : 2480 MHz
Frequency Range	1GHz ~ 25GHz	Detector Function	Peak (PK) Average (AV)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*2480.00	100.1 PK			1.00 H	104	101.3	-1.2
2	*2480.00	95.9 AV			1.00 H	104	97.1	-1.2
3	2483.50	56.7 PK	74.0	-17.3	1.00 H	104	57.9	-1.2
4	2483.50	44.2 AV	54.0	-9.8	1.00 H	104	45.4	-1.2
5	4960.00	54.8 PK	74.0	-19.2	1.10 H	78	50.8	4.0
6	4960.00	48.9 AV	54.0	-5.1	1.10 H	78	44.9	4.0
7	7440.00	52.9 PK	74.0	-21.1	1.04 H	142	43.2	9.7
8	7440.00	45.3 AV	54.0	-8.7	1.04 H	142	35.6	9.7

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	*2480.00	95.1 PK			1.16 V	227	96.3	-1.2
2	*2480.00	90.5 AV			1.16 V	227	91.7	-1.2
3	2487.10	56.2 PK	74.0	-17.8	1.16 V	227	57.4	-1.2
4	2487.10	43.5 AV	54.0	-10.5	1.16 V	227	44.7	-1.2
5	4960.00	51.2 PK	74.0	-22.8	1.09 V	247	47.2	4.0
6	4960.00	45.4 AV	54.0	-8.6	1.09 V	247	41.4	4.0
7	7440.00	48.2 PK	74.0	-25.8	1.38 V	316	38.5	9.7
8	7440.00	37.3 AV	54.0	-16.7	1.38 V	316	27.6	9.7

Remarks:

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

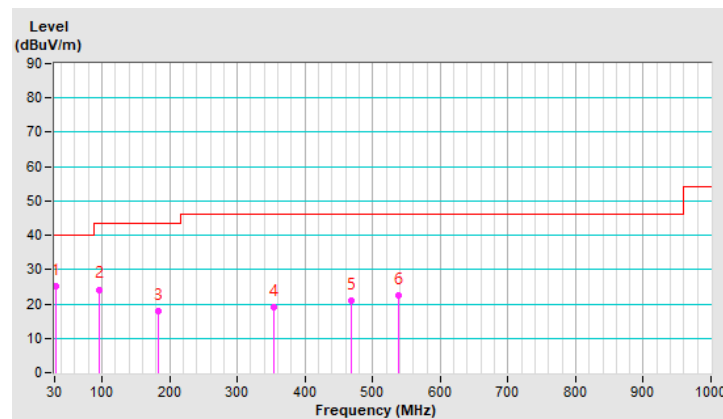
Below 1GHz Data:

RF Mode	TX BT_GFSK	Channel	CH 78 : 2480 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	31.02	25.2 QP	40.0	-14.8	1.00 H	300	34.7	-9.5
2	96.44	24.2 QP	43.5	-19.3	2.00 H	150	37.2	-13.0
3	183.00	17.9 QP	43.5	-25.6	2.00 H	296	27.4	-9.5
4	354.63	18.9 QP	46.0	-27.1	2.00 H	43	23.9	-5.0
5	468.90	21.0 QP	46.0	-25.0	2.00 H	360	22.7	-1.7
6	537.82	22.4 QP	46.0	-23.6	3.00 H	0	22.8	-0.4

Remarks:

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

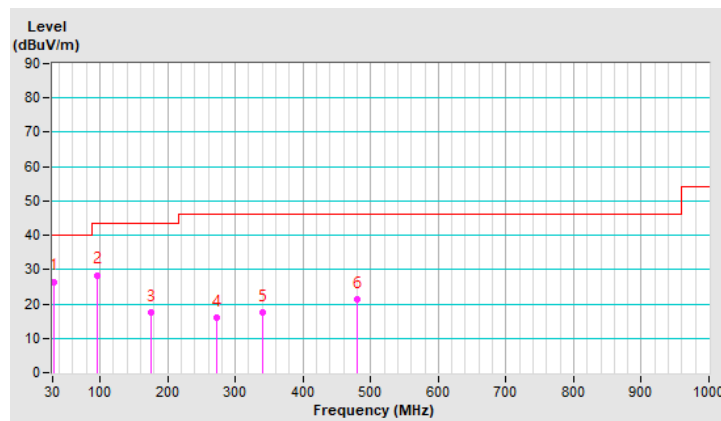


RF Mode	TX BT_GFSK	Channel	CH 78 : 2480 MHz
Frequency Range	9kHz ~ 1GHz	Detector Function	Quasi-Peak (QP)

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBUV/m)	Limit (dBUV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBUV)	Correction Factor (dB/m)
1	31.73	26.5 QP	40.0	-13.5	1.00 V	200	35.9	-9.4
2	95.61	28.4 QP	43.5	-15.1	1.00 V	300	41.5	-13.1
3	176.04	17.4 QP	43.5	-26.1	1.00 V	300	26.2	-8.8
4	271.54	16.0 QP	46.0	-30.0	1.50 V	300	23.6	-7.6
5	341.34	17.6 QP	46.0	-28.4	1.50 V	300	22.9	-5.3
6	480.64	21.5 QP	46.0	-24.5	1.50 V	300	23.0	-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 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	ESCS 30	847124/029	Oct. 20, 2020	Oct. 19, 2021
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 27, 2020	Oct. 26, 2021
Line-Impedance Stabilization Network (for Peripheral) R&S	ESH3-Z5	835239/001	Mar. 26, 2021	Mar. 25, 2022
50 ohms Terminator	50	3	Oct. 26, 2020	Oct. 25, 2021
RF Cable	5D-FB	COCCAB-001	Sep. 26, 2020	Sep. 25, 2021
Fixed attenuator EMCI	STI02-2200-10	005	Aug. 29, 2020	Aug. 28, 2021
Software BVADT	BVADT_Cond_V7.3.7.4	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conduction 1.
- 3 Tested Date: June 23, 2021

4.2.3 Test Procedures

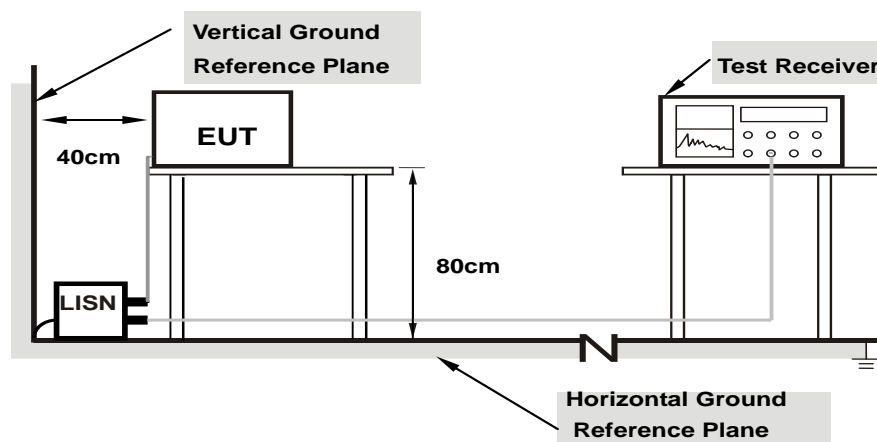
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

Same as 4.1.6.

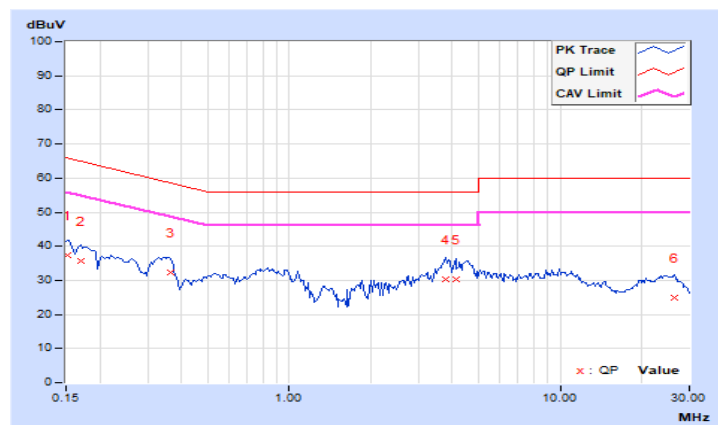
4.2.7 Test Results

RF Mode	TX BT_GFSK	Channel	CH 78 : 2480 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	0.15158	9.97	27.35	10.21	37.32	20.18	65.91	55.91	-28.59	-35.73
2	0.17093	9.98	25.71	12.21	35.69	22.19	64.92	54.92	-29.23	-32.73
3	0.36458	10.02	22.46	10.29	32.48	20.31	58.62	48.62	-26.14	-28.31
4	3.79354	10.25	20.16	4.11	30.41	14.36	56.00	46.00	-25.59	-31.64
5	4.14758	10.27	20.03	4.86	30.30	15.13	56.00	46.00	-25.70	-30.87
6	26.56171	11.66	13.37	0.53	25.03	12.19	60.00	50.00	-34.97	-37.81

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

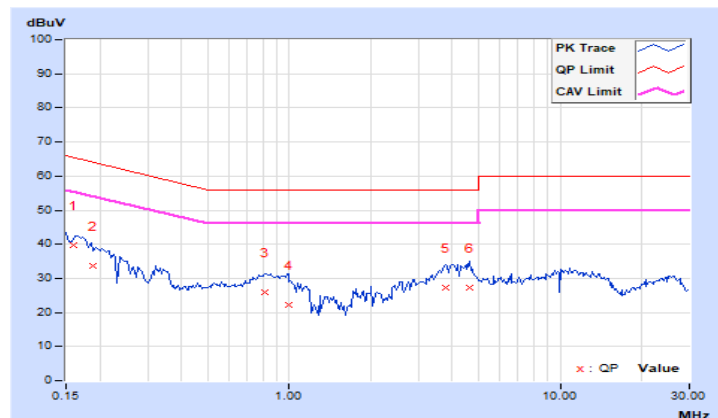


RF Mode	TX BT_GFSK	Channel	CH 78 : 2480 MHz
Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz

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	0.15963	9.96	29.75	12.09	39.71	22.05	65.48	55.48	-25.77	-33.43
2	0.18754	9.99	23.71	8.06	33.70	18.05	64.14	54.14	-30.44	-36.09
3	0.81659	10.05	15.87	0.01	25.92	10.06	56.00	46.00	-30.08	-35.94
4	0.99794	10.06	12.15	-3.03	22.21	7.03	56.00	46.00	-33.79	-38.97
5	3.77962	10.23	16.90	0.72	27.13	10.95	56.00	46.00	-28.87	-35.05
6	4.63075	10.28	17.11	1.26	27.39	11.54	56.00	46.00	-28.61	-34.46

Remarks:

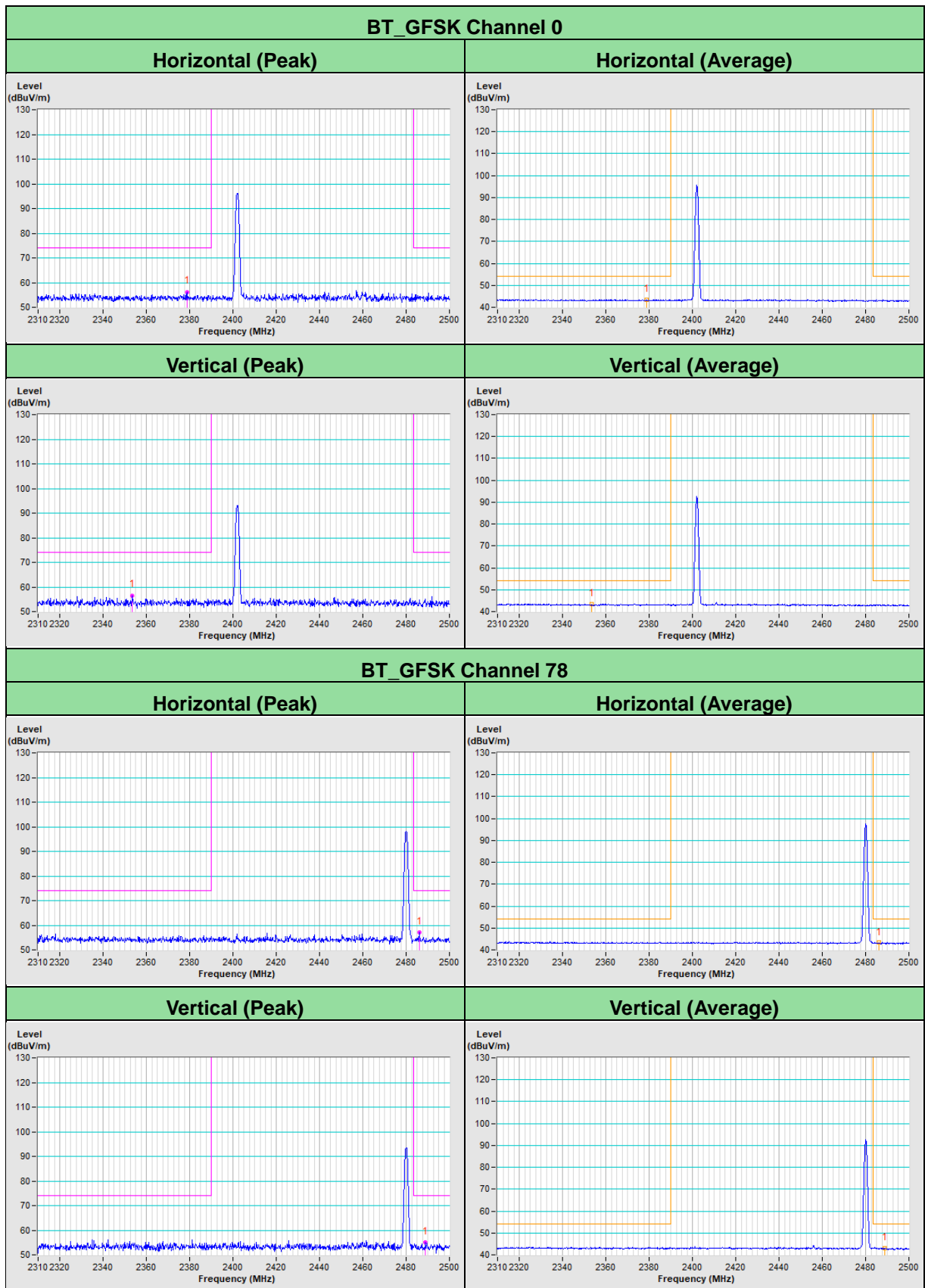
1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



5 Pictures of Test Arrangements

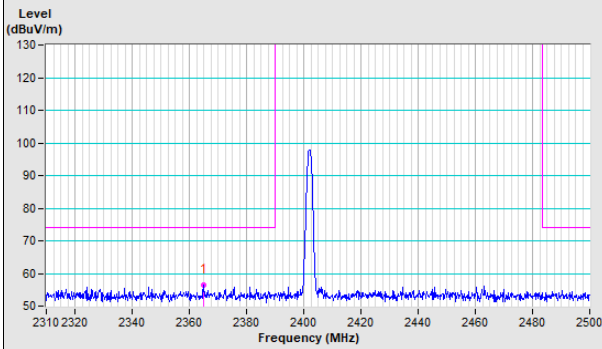
Please refer to the attached file (Test Setup Photo).

Annex A - Band-Edge Measurement

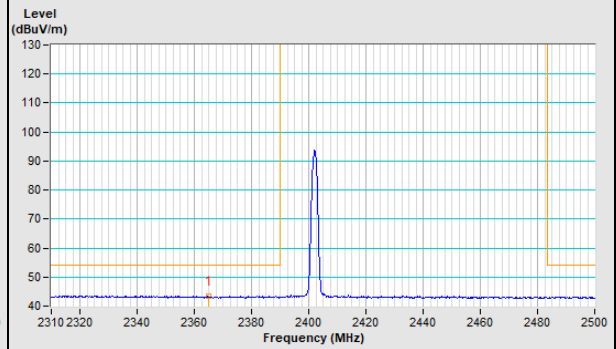


BT_8DPSK Channel 0

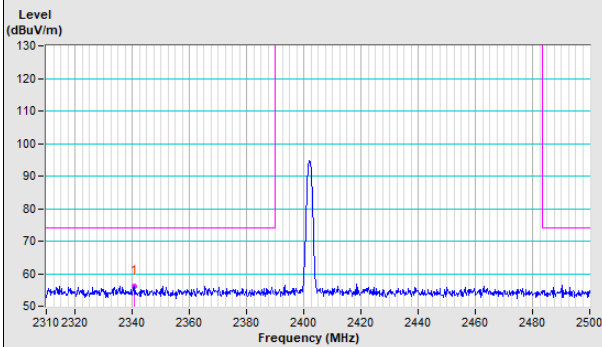
Horizontal (Peak)



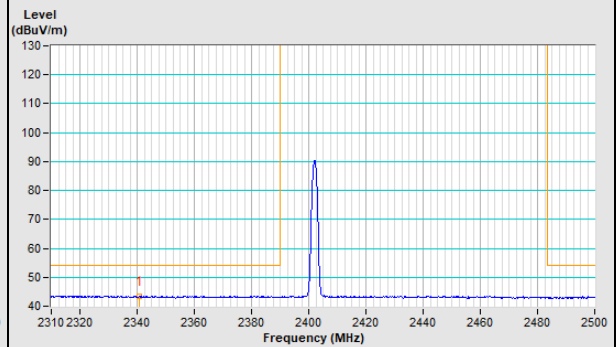
Horizontal (Average)



Vertical (Peak)

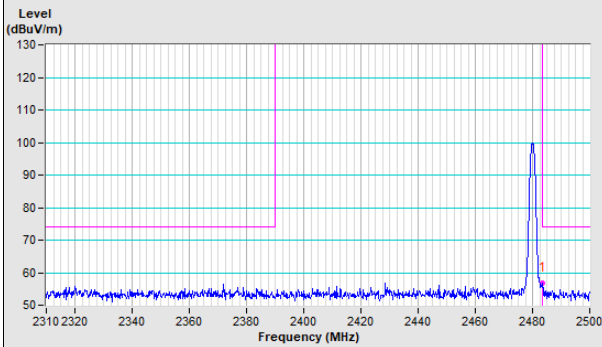


Vertical (Average)

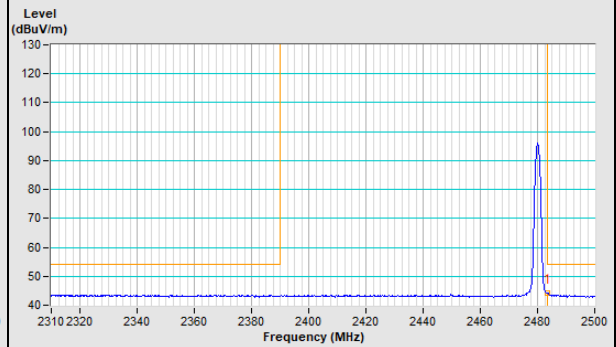


BT_8DPSK Channel 78

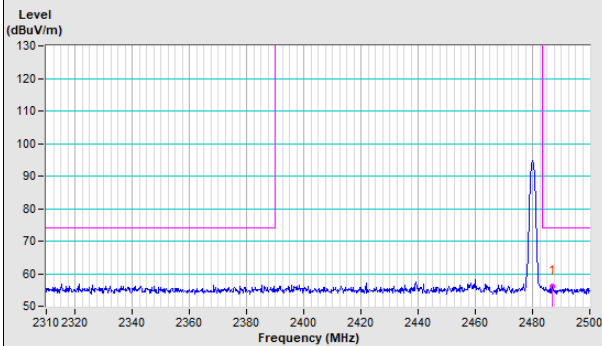
Horizontal (Peak)



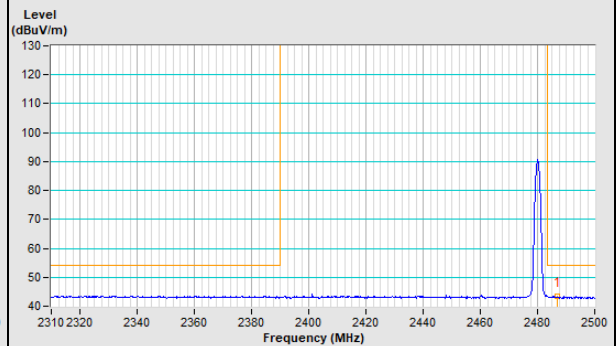
Horizontal (Average)



Vertical (Peak)



Vertical (Average)



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:

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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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