

RADIO TEST REPORT

Product : USB dongle

Model Name : UD2403

Test Regulation : Article 2 paragraph 1 item 19, MIC notice 88 Appendix 43
ARIB STD-T66

Received Date : 2023/3/3

Test Date : 2023/3/3 ~ 2023/3/8

Issued Date : 2023/3/23

Applicant : Luxshare Precision Industry Co., Ltd.
Floor 2,Block A,Sanyo New Industrial Area, West Haoyi
Community,Shajing Subdistrict Office, Bao an District
Shenzhen, P. R. China

Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd.,
Zhudong Township, Hsinchu County, Taiwan

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Underwriters Laboratories Taiwan Co., Ltd.

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Doc No: Form-ULID-004802 (17-EM-F0967) / 4.1

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1. Attestation of Test Results

APPLICANT: Luxshare Precision Industry Co., Ltd.
Floor 2,Block A,Sanyo New Industrial Area, West Haoyi
Community,Shajing Subdistrict Office, Bao an District Shenzhen, P.
R. China

MANUFACTURER: Luxshare Precision Industry Co., Ltd.
2nd floor,A building,Sanyo New Industrial Area,West of
Maoyi,Shajing Street,Ban'an District,Shenzhen City,Guangdong
Province,China

EUT DESCRIPTION: USB dongle

BRAND: Dell

MODEL: UD2403

SAMPLE STAGE: Engineering Verification Test sample

DATE of TESTED: 2023/3/3 ~ 2023/3/8


APPLICABLE STANDARDS

STANDARD	Test Results
Article 2 paragraph 1 item 19, MIC notice 88 Appendix 43	PASS
ARIB STD-T66	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:



Cindy Hsin
Project Handler

Date : 2023/3/23

Approved and Authorized By:



Kent Liu
Senior Laboratory Engineer

Date : 2023/3/23

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2. Summary of Test Results

Summary of Test Results		
Test Items	MIC Notice	Test Result
Frequency Tolerance	MIC Notice No. 88 Appendix No. 43	PASS
Occupied Bandwidth (99% channel power bandwidth)		PASS
Spreading Bandwidth (90% channel power bandwidth)		PASS
Spurious Emission Transmitter		PASS
Antenna Power		PASS
Spurious Emission Receiver		PASS
Interference Prevention Function		PASS

3. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with Article 2 paragraph 1 item 19, MIC notice 88 Appendix 43.

4. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.

5. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

Determining compliance based on the results of the compliance measurement, not considering measurement instrumentation uncertainty.

Parameter	Uncertainty
Occupied Bandwidth	± 0.12 %
Spurious emissions	± 2.4 dB
Output power density	± 2.6 dB
Out of band radiated power	± 2.4 dB
Frequency Tolerance	± 0.12 %

6. General Information

6.1. General Description of EUT

Product	USB dongle
Brand	Dell
Model Name	UD2403
Sample ID	Conducted Test: 5847946 Radiated Test: 5847949
Radio Technology	Bluetooth LE
Operating Frequency	Bluetooth: 2402 ~ 2480 MHz
Modulation	GFSK for Bluetooth LE
Transfer Rate	Bluetooth LE: 1Mbps / 2Mbps
Nominal Voltage	5Vdc from host
Number of Channel	40
Rated RF Output Power Density	Refer to Note
Conducted RF Output Power Density	Refer to Note
Radiated RF Output Power Density	Refer to Note
Antenna Specification	Refer to item 6.4

Note:

1. The power table as below:

	Total Conducted RF Output Power Density (mW)	Rated Power (mW)	Radiated RF Output Power Density (mW)
Bluetooth LE			
BT LE_1Mbps	7.16	7.16	8.36
BT LE_2Mbps	3.56	3.56	4.15

2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3. Test Environment:

Measurement temperature : 21 °C ~ 25 °C

Measurement humidity : 52% ~ 66%

4. Test Personnel: Rex Chen

6.2. Description of test mode

Bluetooth LE:

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

NOTE 1: By means of test software provided by manufacture, the power levels during the tests were set according to the following codes:

Modulation type: BLE 1Mbps		Modulation type: BLE 2Mbps	
Channel	Power Setting	Channel	Power Setting
0	54	1	54
19	54	19	54
39	54	38	54

6.3. Test Condition

Test Conditions	Voltage (Vdc)
Vnormal	5

Note: Since the input voltage to receiver RF circuit varies below $\pm 1\%$ when the input voltage from the external power supply to the receiver varies $\pm 10\%$, therefore only execute normal condition test.

6.4. Description of Available Antennas

6.4.1. Antenna Specification

Ant. No.	Brand Name	Model Name	Antenna Type	Connector Type	Antenna Gain(dBi)
1	Toplink	24000858	Monopole	N/A	0.67

The above information was provided from customer and for more detailed features description, please refer to the customer's specifications, the laboratory shall not be held responsible.

6.4.2. Antenna Pattern

Please refer to the manufacturer's antenna report.

7. Test Instruments

Description	Manufacturer	Model No.	Serial No.	Calibration Authority	Cal. Method	Cal. Date	Expired date
Spectrum Analyzer	Rohde & Schwarz	FSV40	101490	Electronics Testing Center	c)	2022/9/12	2023/9/11
Power meter	Anritsu	MA2411B	1531202	Electronics Testing Center	c)	2023/1/4	2024/1/3
Power sensor	Anritsu	ML2495A	1645002	Electronics Testing Center	c)	2023/1/4	2024/1/3
Signal Generator	Keysight	N5182B	MY56200244	Electronics Testing Center	c)	2023/1/6	2024/1/5

Note: Calibration Method

- a) : Calibration conducted by the National Institute of Information and Communications Technology ~ NICT ~ or a designated calibration agency under Article 102-18 paragraph (1) ~ TELEC Engineering Center, Intertek Japan K.K., Keysight Technologies, Inc ~.
- b) : Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992) ~ Japan Calibration Service System ~.
- c) : Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1) ~ TELEC Engineering Center, Intertek Japan K.K., Keysight Technologies, Inc ~.
- d) : Calibration conducted by using other equipment that listed above from a) to c).

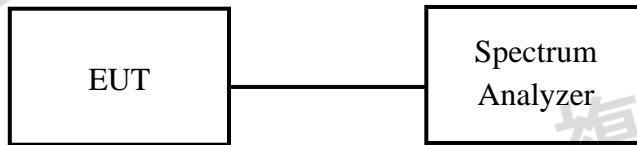
8. Test Results (Bluetooth LE)

8.1. Frequency Tolerance

8.1.1 Requirements

The limitation of Frequency Tolerance is less than or equal to ± 50 ppm.

8.1.2 Test Setup



8.1.3 Test Results

Test Voltage	Result
NV	PASS

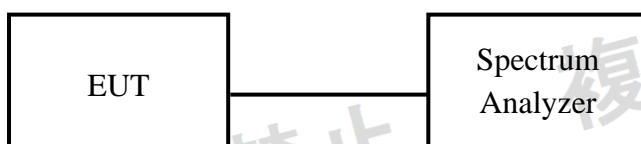
Mode	CH	Freq (MHz)	Carrier Frequency (MHz)	Frequency Tolerance (ppm)	Limit (ppm)
BT LE(1Mbps)	0	2402	2401.968	13.21	50
	19	2440	2439.967	13.64	50
	39	2480	2479.968	12.88	50
BT LE(2Mbps)	1	2404	2403.965	14.43	50
	19	2440	2439.964	14.79	50
	38	2478	2477.963	14.79	50

8.2. Occupied Bandwidth (99% Channel Power Bandwidth)

8.2.1 Requirements

Item	Limits
Occupied Bandwidth	FH, FH+DS, FH+OFDM: $\leq 83.5\text{MHz}$ Others: $\leq 26\text{MHz}$ OFDM1: $\leq 26\text{MHz}$ OFDM2: $26\text{MHz} < \text{BW} \leq 40\text{MHz}$

8.2.2 Test Setup

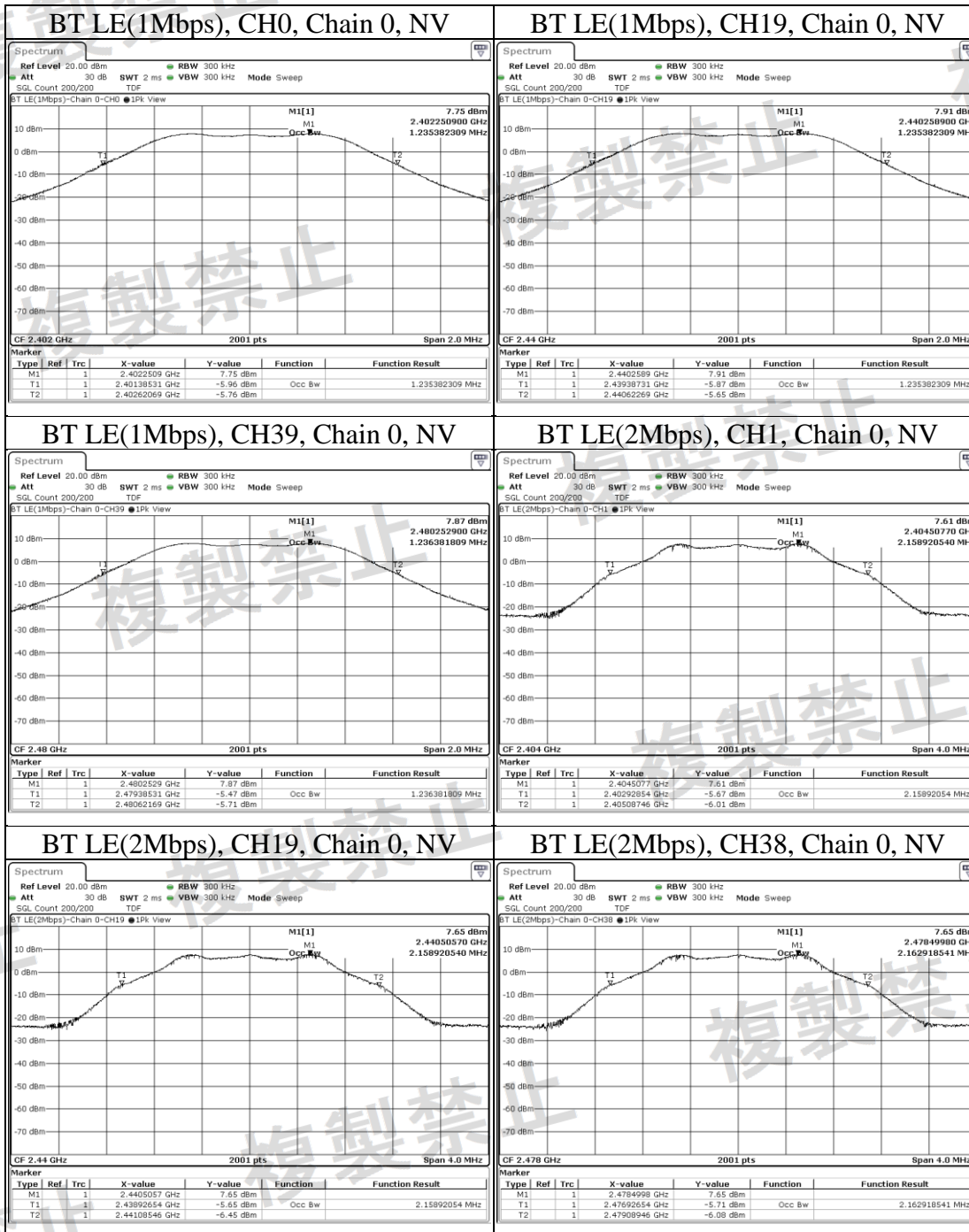


8.2.3 Test Results

Bluetooth LE

Test Voltage	Result
NV	PASS

Mode	CH	Freq (MHz)	OBW (MHz)	Limit (MHz)
BT LE(1Mbps)	0	2402	1.235	26
	19	2440	1.235	26
	39	2480	1.236	26
BT LE(2Mbps)	1	2404	2.159	26
	19	2440	2.159	26
	38	2478	2.163	26

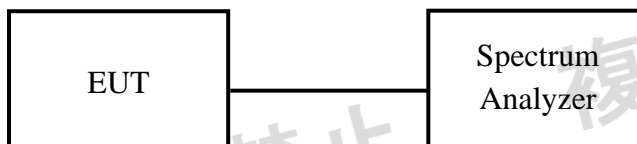


8.3. Spreading Bandwidth (90% Channel Power Bandwidth)

8.3.1 Requirements

Item	Limit	Remark
Spreading Bandwidth	≥ 500 kHz	(For DSSS, FHSS)
Spreading Factor	≥ 5	Operating frequency 2400 to 2483.5 MHz

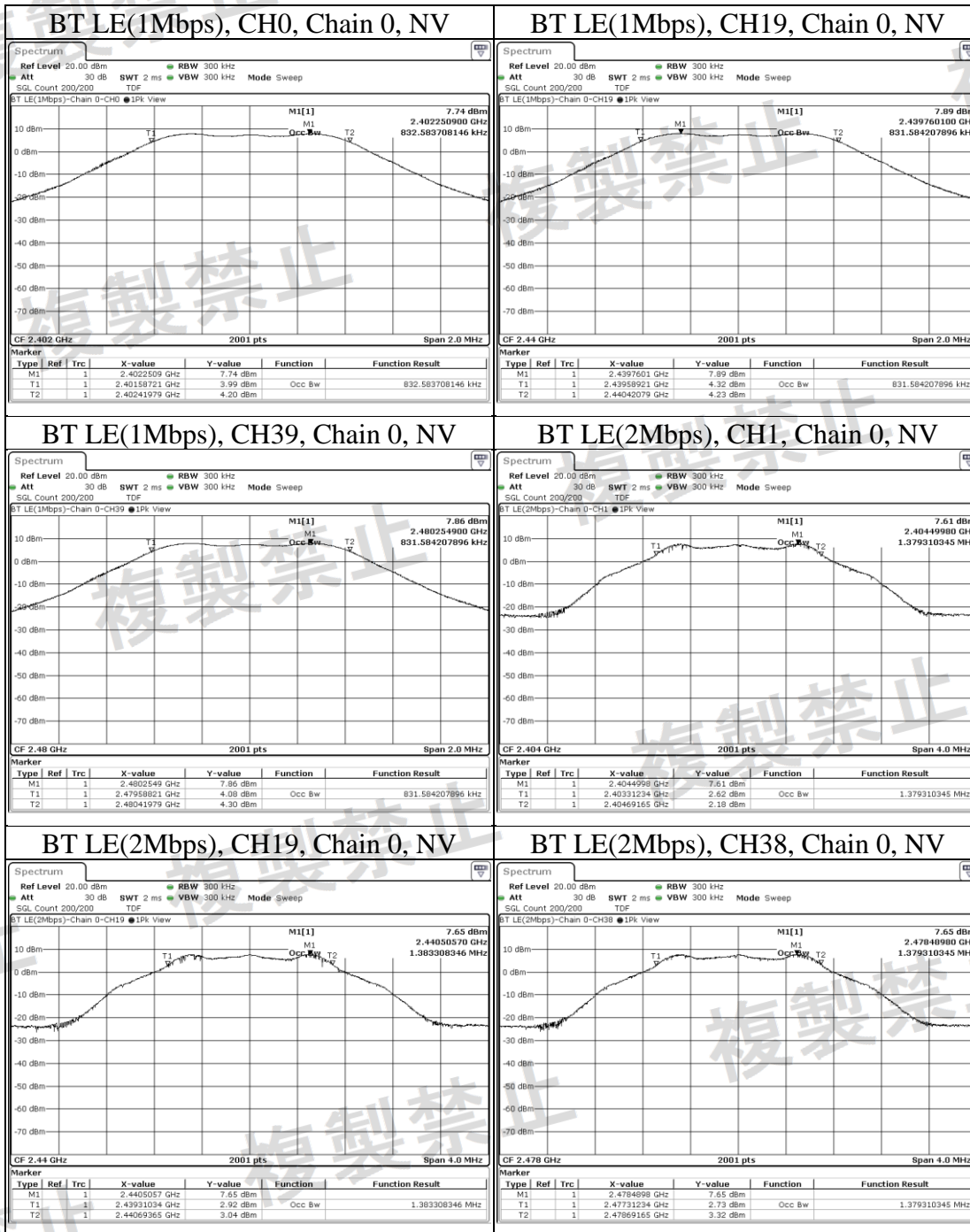
8.3.2 Test Setup



8.3.3 Test Results

Test Voltage	Result
NV	PASS

Mode	CH	Freq (MHz)	SBW (MHz)	Limit (MHz)	Spreading Factor	Limit
BT LE(1Mbps)	0	2402	0.833	0.5	13.321	5
	19	2440	0.832	0.5	13.305	5
	39	2480	0.832	0.5	13.305	5
BT LE(2Mbps)	1	2404	1.379	0.5	22.069	5
	19	2440	1.383	0.5	22.133	5
	38	2478	1.379	0.5	22.069	5



8.4. Spurious Emissions for Transmitter

8.4.1 Requirements

Frequencies	Limits	
30MHz-1GHz	$\leq 0.25 \mu\text{W}/100\text{kHz}$	$\leq -36\text{dBm} / 100\text{kHz}$
1GHz-2.387GHz	$\leq 2.5 \mu\text{W}/\text{MHz}$	$\leq -26\text{dBm} / \text{MHz}$
2.387GHz-2.4GHz	$\leq 25 \mu\text{W}/\text{MHz}$	$\leq -16\text{dBm} / \text{MHz}$
2.4835GHz-2.4965GHz	$\leq 25 \mu\text{W}/\text{MHz}$	$\leq -16\text{dBm} / \text{MHz}$
2.4965GHz -12.5GHz	$\leq 2.5 \mu\text{W}/\text{MHz}$	$\leq -26\text{dBm} / \text{MHz}$

8.4.2 Test Setup

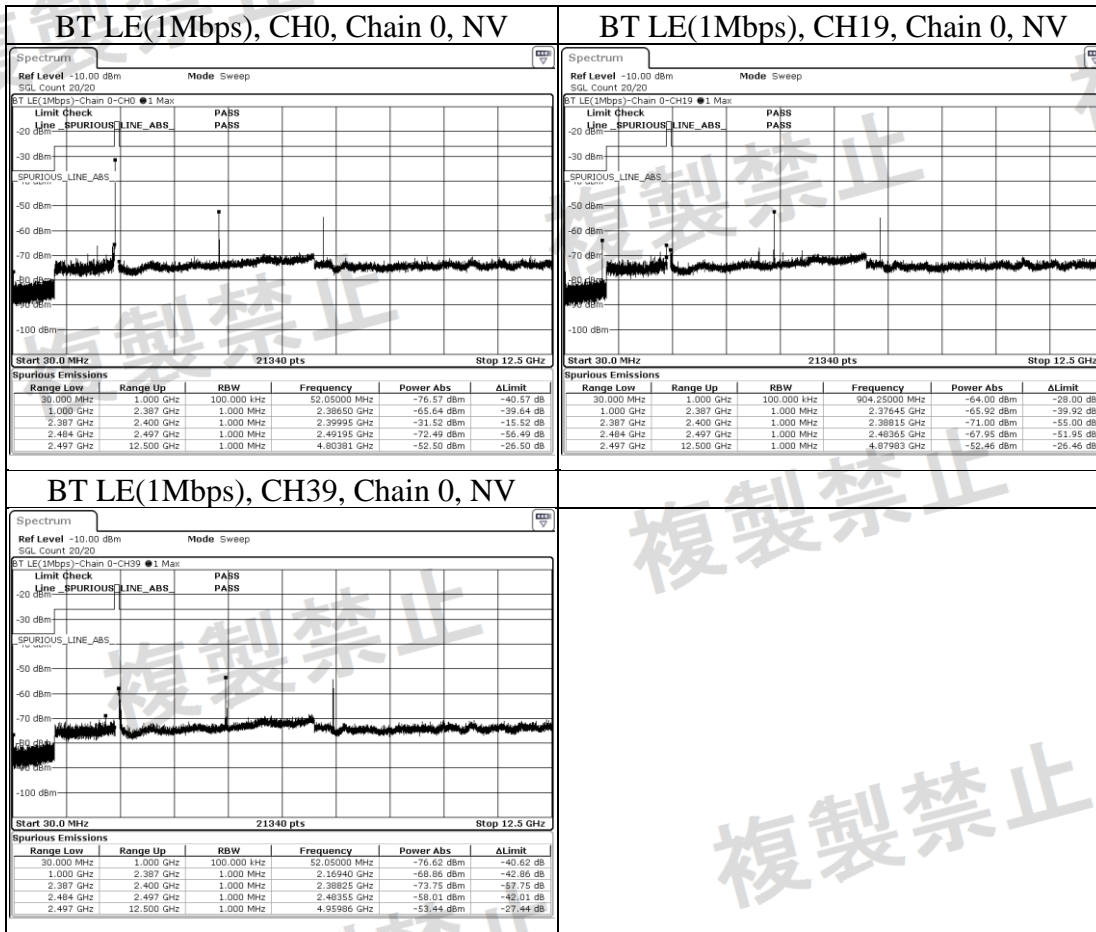


8.4.3 Test Results

Mode	Test Voltage	Result
BT LE(1Mbps)	NV	PASS

CH	Freq Range Low	Freq Range Up	Chain 0 Freq	Chain 0 Level	Worst +10*log(N)	Limit
0	30M	1G	52.05M	-76.57	-76.57	-36.00
	1G	2.387G	2.387G	-65.64	-65.64	-26.00
	2.387G	2.4G	2.4G	-31.52	-31.52	-16.00
	2.4835G	2.4965G	2.492G	-72.49	-72.49	-16.00
	2.4965G	12.5G	4.804G	-52.50	-52.50	-26.00
19	30M	1G	904.25M	-64.00	-64.00	-36.00
	1G	2.387G	2.376G	-65.92	-65.92	-26.00
	2.387G	2.4G	2.388G	-71.00	-71.00	-16.00
	2.4835G	2.4965G	2.484G	-67.95	-67.95	-16.00
	2.4965G	12.5G	4.88G	-52.46	-52.46	-26.00
39	30M	1G	52.05M	-76.62	-76.62	-36.00
	1G	2.387G	2.169G	-68.86	-68.86	-26.00
	2.387G	2.4G	2.388G	-73.75	-73.75	-16.00
	2.4835G	2.4965G	2.484G	-58.01	-58.01	-16.00
	2.4965G	12.5G	4.96G	-53.44	-53.44	-26.00

Note: For frequency unit (Freq) is "Hz", for Level & Limit above 1GHz unit is "dBm/MHz", for Level & Limit below 1GHz unit is "dBm/100kHz".

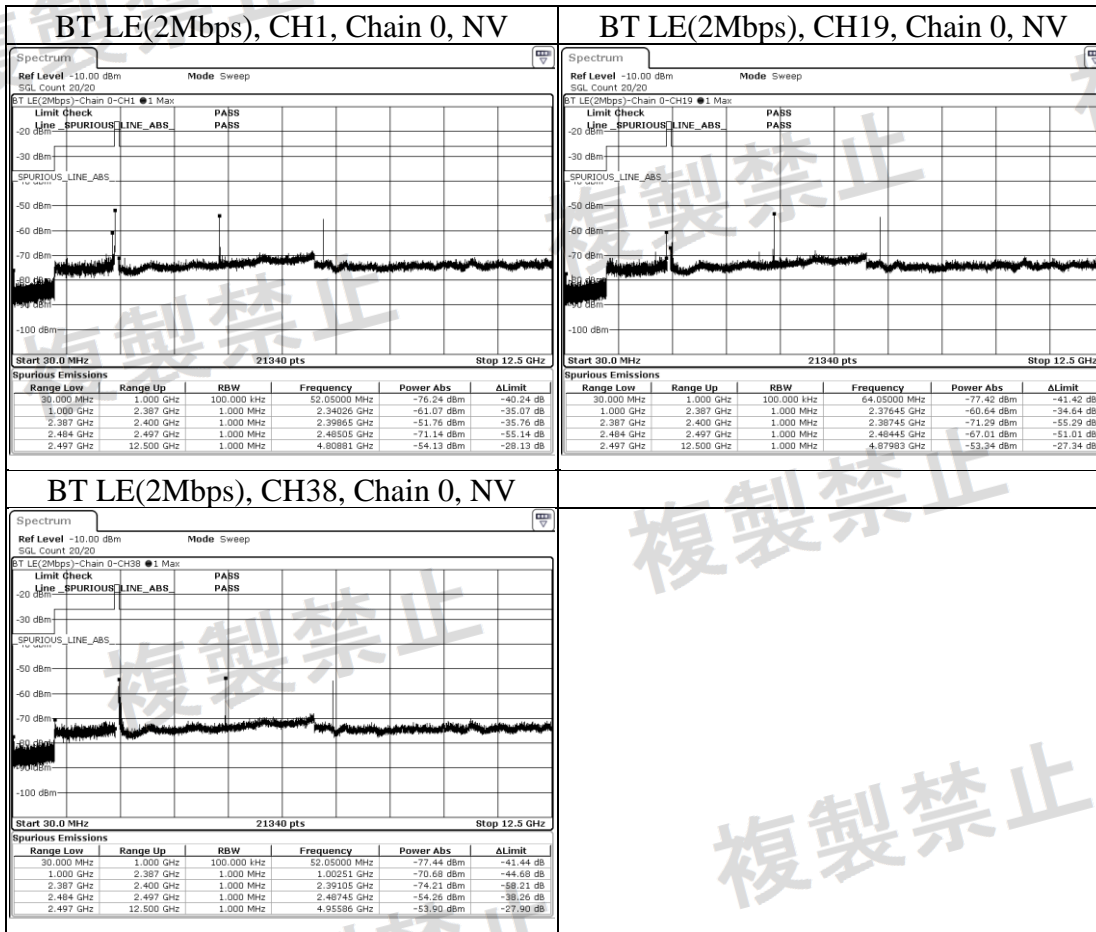


In the above test plot, frequency point that does not meet the limit line, enter the second measure by zero span emission power measurement, following test result as below:

Mode	Test Voltage	Result
BT LE(2Mbps)	NV	PASS

CH	Freq Range Low	Freq Range Up	Chain 0 Freq	Chain 0 Level	Worst +10*log(N)	Limit
1	30M	1G	52.05M	-76.24	-76.24	-36.00
	1G	2.387G	2.34G	-61.07	-61.07	-26.00
	2.387G	2.4G	2.399G	-51.76	-51.76	-16.00
	2.4835G	2.4965G	2.485G	-71.14	-71.14	-16.00
	2.4965G	12.5G	4.809G	-54.13	-54.13	-26.00
19	30M	1G	64.05M	-77.42	-77.42	-36.00
	1G	2.387G	2.376G	-60.64	-60.64	-26.00
	2.387G	2.4G	2.387G	-71.29	-71.29	-16.00
	2.4835G	2.4965G	2.484G	-67.01	-67.01	-16.00
	2.4965G	12.5G	4.88G	-53.34	-53.34	-26.00
38	30M	1G	52.05M	-77.44	-77.44	-36.00
	1G	2.387G	1.003G	-70.68	-70.68	-26.00
	2.387G	2.4G	2.391G	-74.21	-74.21	-16.00
	2.4835G	2.4965G	2.487G	-54.26	-54.26	-16.00
	2.4965G	12.5G	4.956G	-53.90	-53.90	-26.00

Note: For frequency unit (Freq) is "Hz", for Level & Limit above 1GHz unit is "dBm/MHz", for Level & Limit below 1GHz unit is "dBm/100kHz".



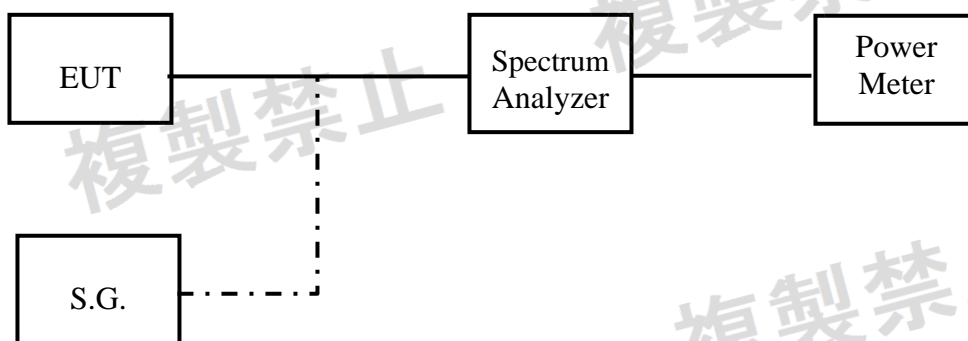
In the above test plot, frequency point that does not meet the limit line, enter the second measure by zero span emission power measurement, following test result as below:

8.5. Antenna Power

8.5.1 Requirements

Item	Limits
Antenna Power Density	$\leq 3 \text{ mW/MHz}$ (2427~2470.75MHz)
	DS: $\leq 10 \text{ mW/MHz}$
	OFDM: $\leq 10 \text{ mW/MHz}$ (Bandwidth $\leq 26\text{MHz}$)
	OFDM: $\leq 5 \text{ mW/MHz}$ ($26\text{MHz} < \text{Bandwidth} \leq 40\text{MHz}$)
	Others: $\leq 10 \text{ mW}$

8.5.2 Test Setup



8.5.3 Test Results

Bluetooth LE

BT LE_1Mbps

Normal Voltage

Channel	Antenna Power (mW)	Antenna Power Limit (mW)	Rated Power (mW)	Antenna Power Tolerance (%)	Tolerance Range Limit (%)	Antenna Gain (dBi)	EIRP Antenna Power (mW)	EIRP Antenna Power Limit (mW)
0	7.16	10.00	7.16	0.00	+20% ~ -80%	0.67	8.36	16.37
19	6.93	10.00	7.16	-3.21	+20% ~ -80%	0.67	8.09	16.37
39	6.95	10.00	7.16	-2.93	+20% ~ -80%	0.67	8.11	16.37

Note:

1. Antenna Power Tolerance (%) = $\{(\text{Conducted Antenna Power} - \text{Rated power}) / \text{Rated power} * 100\}$.
2. EIRP Antenna Power = Conducted Antenna Power + Antenna gain.

BT LE_2Mbps

Normal Voltage

Channel	Antenna Power (mW)	Antenna Power Limit (mW)	Rated Power (mW)	Antenna Power Tolerance (%)	Tolerance Range Limit (%)	Antenna Gain (dBi)	EIRP Antenna Power (mW)	EIRP Antenna Power Limit (mW)
1	3.44	10.00	3.56	-3.37	+20% ~ -80%	0.67	4.01	16.37
19	3.56	10.00	3.56	0.00	+20% ~ -80%	0.67	4.15	16.37
38	3.48	10.00	3.56	-2.25	+20% ~ -80%	0.67	4.06	16.37

Note:

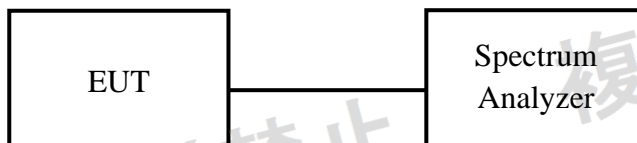
1. Antenna Power Tolerance (%) = $\{(\text{Conducted Antenna Power} - \text{Rated power}) / \text{Rated power} * 100\}$.
2. EIRP Antenna Power = Conducted Antenna Power + Antenna gain.

8.6. Spurious Emissions for Receiver

8.6.1 Requirements

Frequencies (MHz)	Limit
Below 1 GHz	≤ 4 nW (-54 dBm)
Above 1 GHz	≤ 20 nW (-47 dBm)

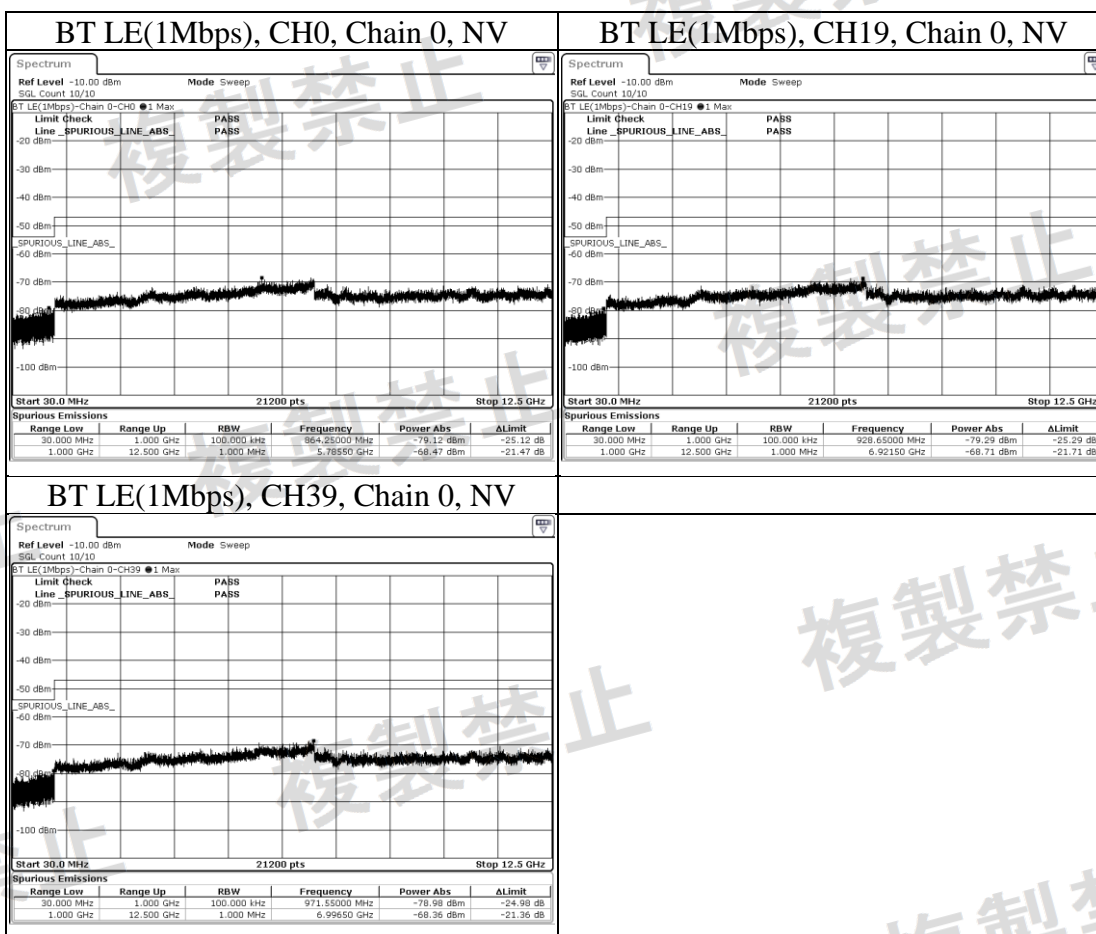
8.6.2 Test Setup



8.6.3 Test Results

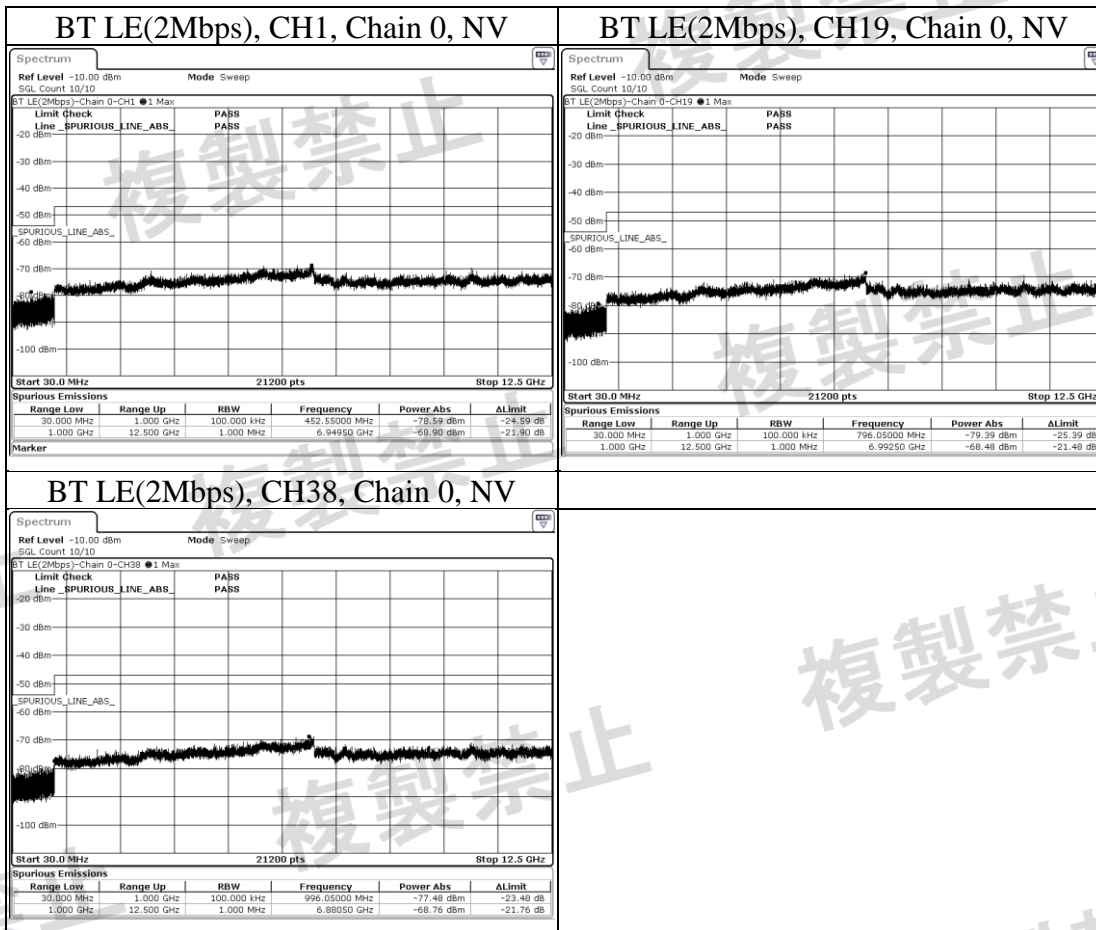
Mode	Test Voltage	Result
BT LE(1Mbps)	NV	PASS

CH	Freq Range Low	Freq Range Up	Chain 0 Freq	Chain 0 Level (dBm)	Sum (dBm)	Limit (dBm)
0	30M	1G	864.25M	-79.12	-79.12	-54.00
	1G	12.5G	5.786G	-68.47	-68.47	-47.00
19	30M	1G	928.65M	-79.29	-79.29	-54.00
	1G	12.5G	6.922G	-68.71	-68.71	-47.00
39	30M	1G	971.55M	-78.98	-78.98	-54.00
	1G	12.5G	6.997G	-68.36	-68.36	-47.00



Mode	Test Voltage	Result
BT LE(2Mbps)	NV	PASS

CH	Freq Range Low	Freq Range Up	Chain 0 Freq	Chain 0 Level (dBm)	Sum (dBm)	Limit (dBm)
1	30M	1G	452.55M	-78.59	-78.59	-54.00
	1G	12.5G	6.95G	-68.90	-68.90	-47.00
19	30M	1G	796.05M	-79.39	-79.39	-54.00
	1G	12.5G	6.993G	-68.48	-68.48	-47.00
38	30M	1G	996.05M	-77.48	-77.48	-54.00
	1G	12.5G	6.881G	-68.76	-68.76	-47.00

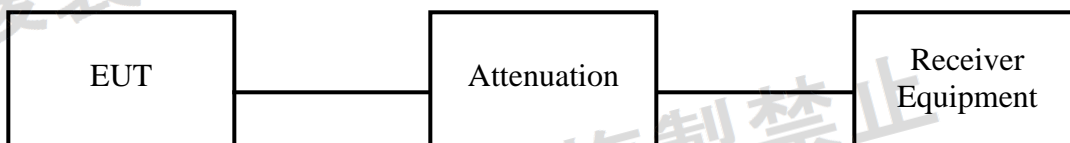


8.7. Interference Prevention Function

8.7.1 Requirements

Radio equipment used mainly on the same premises and automatically transmits or receives identification code.

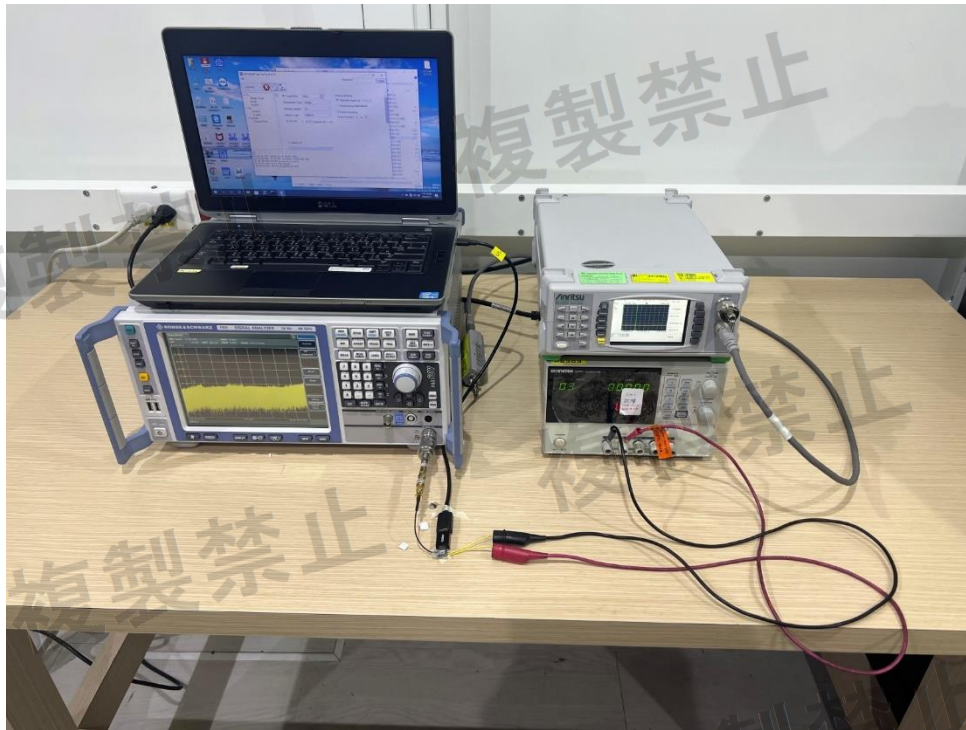
8.7.2 Test Setup



8.7.3 Test Results

Link Mode	Test Result
Bluetooth LE	PASS

9. Conducted Emission Measurement Setup Configurations



END OF REPORT

Underwriters Laboratories Taiwan Co., Ltd.

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