

TEST REPORT

Product Name	: TURE WIRELESS EARBUD
Model Number	: MZX637, MZX637-BLK-SA, MZX637-WHT-SA, 19TW05, MZX637-BLK, MZX637-WHT, MZX637-BLK-SA-6, MZX637-WHT-SA-6
FCC ID	: 2AKI8-MZX637
Prepared for : Address :	TOPWAY EM ENTERPRISE LIMITED 8F., Block B, Building 6, Baoneng Science and technology park, Qingxiang RD., Qinghu Industrial Park, Longhua New District, Shenzhen, GD, China
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Report Number	:	ES200508025W
Date(s) of Tests	:	May 08, 2020 to May 20, 2020
Date of issue	:	May 20, 2020

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VERIFICATION OF COMPLIANCE

Applicant:	TOPWAY EM ENTERPRISE LIMITED 8F., Block B, Building 6, Baoneng Science and technology park, Qingxiang RD., Qinghu Industrial Park, Longhua New District, Shenzhen, GD, China
Manufacturer:	TOPWAY EM ENTERPRISE LIMITED 8F., Block B, Building 6, Baoneng Science and technology park, Qingxiang RD., Qinghu Industrial Park, Longhua New District, Shenzhen, GD, China
Product Description:	TURE WIRELESS EARBUD
Trade Mark:	N/A
Model Number:	MZX637, MZX637-BLK-SA, MZX637-WHT-SA, 19TW05, MZX637-BLK, MZX637-WHT, MZX637-BLK-SA-6, MZX637-WHT-SA-6

We hereby certify that:

The above equipment was tested by EMTEK(SHENZHEN) CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10-2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247(2018).

Date of Test _	May 08, 2020 to May 20, 2020
Prepared by : _	Loren Luo Loren Luo /Editor
Reviewer : _	Tim Dong /SupervisorENZHEN
Approved & Authorized Signer : _	Lisa Wang /Manager ESTING

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Report No.ES200508025W



Modified Information

Version	Summary	Revision Date	Report No.
Ver.1.0	Original Report	/	ES200508025W

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1. GENERAL INFORMATION

1.1 Product Description

Characteristics	Description	
Product Name	TURE WIRELESS EARBUD	
Model number	MZX637, MZX637-BLK-SA, MZX637-WHT-SA, 19TW05, MZX637-BLK, MZX637-WHT, MZX637-BLK-SA-6, MZX637-WHT-SA-6 Note: The models are the same except color of appearance and model number, here we prepare MZX637 for the all test)	
Power Supply	DC 3.7V Battery	
Kind of Device	Bluetooth Ver.5.0	
Modulation	GFSK, π/4-DQPSK, 8DPSK	
Operating Frequency Range	2402-2480MHz	
Number of Channels	79	
Transmit Power Max(PK)	1.82dBm(0.001521W)	
Antenna Type	Internal antenna	
Antenna Gain	0dBi	

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1.2Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10-2013. Radiated testing was performed at an antenna to EUT distance 3 meters.



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1.3Test Facility

Site Description	
EMC Lab. :	Accredited by CNAS, 2016.10.24 The certificate is valid until 2022.10.28 The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2005) The Certificate Registration Number is L2291.
	Accredited by TUV Rheinland Shenzhen 2018.3.30 The Laboratory has been assessed according to the requirements ISO/IEC 17025.
	Accredited by FCC, August 06, 2018 The certificate is valid until August 07, 2020 Designation Number: CN1204 Test Firm Registration Number: 882943
Name of Firm :	Accredited by Industry Canada, November 09, 2018 The Conformity Assessment Body Identifier is CN0008 EMTEK(SHENZHEN) CO., LTD.
Site Location :	Building 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China

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2. System Test Configuration

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. The Tx frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode.

2.3.2 Radiated Emissions

Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of EUT was fixed in a particular direction according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013.

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2.4 Configuration of Tested System

Fig. 2-1 Configuration of Tested System

EUT

Table 2-1 Equipment Used in Tested System

Item	Equipment	Trademar k	Model No.	FCC ID	Note
1.	TURE WIRELESS EARBUD	N/A	MZX637	2AKI8-MZX637	EUT

Note:

(1) Unless otherwise denoted as EUT in Remark column , device(s) used in tested system is a support equipment.

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FCC Rules	Description Of Test	Result
§15.207	AC Power Conducted Emission	N/A
§15.247(d),§15.209	Radiated Emission	Compliant
§15.247(a)(1)	Channel Separation test	Compliant
§15.247(a)(1)	20dB Bandwidth	Compliant
§15.247(a)(1)(iii)	Quantity of Hopping Channel	Compliant
§15.247(a)(1)(iii)	Time of Occupancy(Dwell Compliant Time)	
§15.247(b)	Max Peak output Power test	Compliant
§15.247(d)	Band edge test	Compliant
§15.203	Antenna Requirement Compliant	

3. Summary of Test Results

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4. Description of test modes

The EUT has been tested under its typical operating condition and fully-charged battery for EUT tested alone. Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting. Only the worst case data were reported.

The EUT has been associated with peripherals pursuant to ANSI C63.10-2013 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation (9 KHz to the 10th harmonics of the highest fundamental frequency or to 40 GHz, whichever is lower).

The EUT has been tested under TX operating condition.

This EUT is a FHSS system, were conducted to determine the final configuration from all possible combinations. We use software control the EUT, Let EUT hopping on and transmit with highest power, all the modes GFSK, $\Pi/4$ -DQPSK have been tested. 79 Channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for test.

Channel	Frequency(MHz)
1	2402
40	2441
79	2480

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5. TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Radio Frequency	±1x10^-5
Maximum Peak Output Power Test	±1.0dB
Conducted Emissions Test	±2.0dB
Radiated Emission Test	±2.0dB
Power Density	±2.0dB
Occupied Bandwidth Test	±1.0dB
Band Edge Test	±3dB
All emission, radiated	±3dB
Antenna Port Emission	±3dB
Temperature	±0.5℃
Humidity	±3%

Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95%

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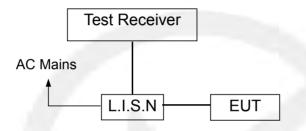


6. Conducted Emissions Test

6.1 Measurement Procedure:

- 1. The EUT was placed on a table, which is 0.8m above ground plane.
- 2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 3. Repeat above procedures until all frequency measured was complete.

6.2 Test SET-UP (Block Diagram of Configuration)



6.3 Measurement Equipment Used:

		Conducted	Emission Te	est Site	_	
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	Characteristics	Last Cal.	Due date
Test Receiver	Rohde & Schwarz	ESCS30	100018	9kHz~3GHz	05/23/2019	05/22/2020
L.I.S.N	Rohde & Schwarz	ENV216	100017	9KHz-300MHz	05/23/2019	05/22/2020
RF Switching Unit	CDS	RSU-M2	38401	9KHz-300MHz	05/23/2019	05/22/2020
Coaxial Cable	CDS	79254	46107086	9kHz~3GHz	05/23/2019	05/22/2020

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6.4 Measurement Result:

N/A.

Note: Bluetooth does not work while charging



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7. Radiated Emission Test

7.1 Measurement Procedure

- 1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10-2013.
- 2. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.
- 3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
- 4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
- 5. Set to the maximum power setting and enable the EUT transmit continuously.
- 6. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.
- 7. Test Procedure of measurement (For Above 1GHz):
 - 1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).
 - 2) Change the antenna polarization and repeat 1) with vertical polarization.
 - 3) Make a hardcopy of the spectrum.
 - 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
 - 5) Change the analyser mode to Clear/ Write and found the cone of emission.
 - 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.
 - 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.
 - 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.

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Use the following spectrum analyzer settings:

When spectrum scanned from 30MHz to 1GHz setting resolution bandwidth 120KHz and video bandwidth 300KHz:

EMI Test Receiver	Setting
Attenuation	Auto
RB	120KHz
VB	300KHz
Detector	QP
Trace	Max hold

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz:

EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	3MHz
Detector	Peak
Trace	Max hold

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 10Hz:

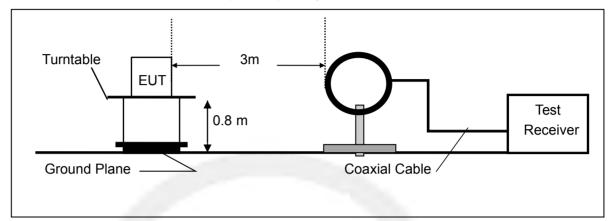
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	Average
Trace	Max hold

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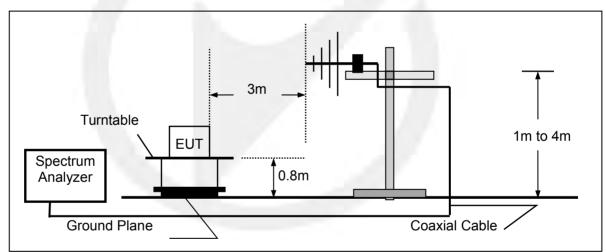


7.2 Test SET-UP (Block Diagram of Configuration)

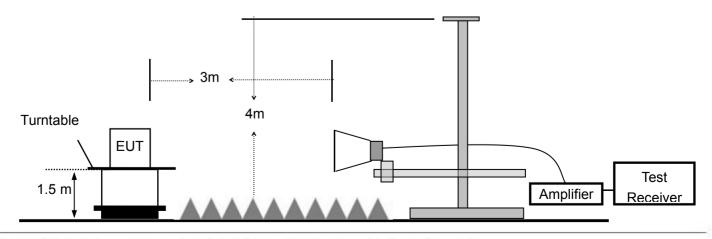
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



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7.3 Measurement Equipment Used:

Item	Equipment	Manufacturer	Model No.	Serial No.	Characteristics	Last Cal.	Cal. Interval
1.	Test Receiver	Rohde & Schwarz	ESCI	1166.5950.0 3	9KHz-3GHz	05/23/2019	1 Year
2.	Loop Antenna	Schwarzbeck	FMZB 1519	012	9 KHz -30MHz	05/23/2019	1 Year
3.	Bilog Antenna	Schwarzbeck	VULB9163	000141	25MHz-2GHz	05/23/2019	1 Year
4.	Power Amplifier	CDS	RSU-M352	818	1MHz-1GHz	05/23/2019	1 Year
5.	Power Amplifier	HP	8447F	OPT H64	1GHz-26.5GHz	05/23/2019	1 Year
6.	Color Monitor	SUNSPO	SP-140A	N/A		05/23/2019	1 Year
7.	Single Line Filter	JIANLI	XL-3	N/A		05/23/2019	1 Year
8.	Single Phase Power Line Filter	JIANLI	DL-2X100B	N/A		05/23/2019	1 Year
9.	3 Phase Power Line Filter	JIANLI	DL-4X100B	N/A		05/23/2019	1 Year
10.	DC Power Filter	JIANLI	DL-2X50B	N/A		05/23/2019	1 Year
11.	Cable	Schwarzbeck	PLF-100	549489	9KHz-3GHz	05/23/2019	1 Year
12.	Cable	Rosenberger	CIL02	A0783566	9KHz-3GHz	05/23/2019	1 Year
13.	Cable	Rosenberger	RG 233/U	525178	9KHz-3GHz	05/23/2019	1 Year
14.	Signal Analyzer	Rohde & Schwarz	FSV30	103040	9KHz-40GHz	05/23/2019	1 Year
15.	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1272	1GHz-18GHz	05/23/2019	1 Year
16.	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA91703 99	14GHz -26.5GHz	05/23/2019	1 Year
17.	Power Amplifier	LUNAR EM	LNA1G18-4 0	J101000000 81	1GHz-26.5GHz	05/23/2019	1 Year
18.	Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	05/23/2019	1 Year
19.	Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	05/23/2019	1 Year
20.	Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	05/23/2019	1 Year

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7.4 Radiated Emission Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table 15.209(a):

Frequencies	Field Strength	Measurement Distance
(MHz)	(micorvolts/meter)	(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

15.205 Restricted bands of operation

MHz	MHz	MHz	GHz	
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15	
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46	
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75	
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5	
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2	
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5	
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7	
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4	
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5	
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2	
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4	
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12	
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0	
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8	
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5	
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(2)	

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Remark 1. Emission level in dBuV/m=20 log (uV/m)

2. Measurement was performed at an antenna to the closed point of EUT distance of meters.

3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of ξ 15.205, and the emissions located in restricted bands also comply with 15.209 limit.

7.5 Measurement Result

Operation Mode:	ТХ	Test Date :	May 14, 2020
Test By:	Loren	Temperature :	27 ℃
Test Result:	PASS	Humidity :	63 %
Measured Distance:	3m		

Below 30MHz:

Freq.	Ant.Pol.	Emission	Limit 3m	Over
		Level		
(MHz)	H/V	(dBuV/m)	(dBuV/m)	(dB)

Note: The low frequency, which started from 9KHz-30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

Below 1000MHz:

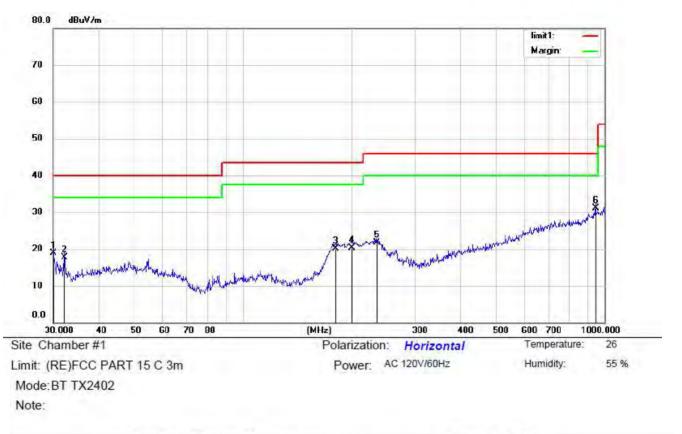
Pass.

All modulation modes have been tested, the worst mode is (GFSK TX 2402MHz), the data is recorded on the following page, other modulation modes do not exceed this limit.

Please refer to the following data.

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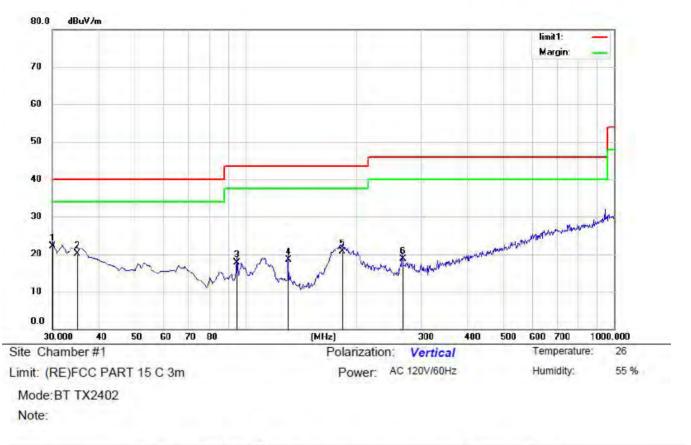
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	12	30.0000	37.58	-18.76	18.82	40.00	-21.18	QP			
2	-	32.2925	36.74	-19.00	17.74	40.00	-22.26	QP			
3		181.2834	39.50	-19.31	20.19	43.50	-23.31	QP			
4		199.9856	37.54	-17.25	20.29	43.50	-23.21	QP			
5	-	234.1684	37.80	-16.14	21.66	46.00	-24.34	QP			
6	*	945.4400	31.63	-0.62	31.01	46.00	-14.99	QP			

*:Maximum data x:Over limit I:over margin

Operator: Lian

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No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	30.0000	40.85	-18.76	22.09	40.00	-17.91	QP			
2		34.8823	38.65	-18.62	20.03	40.00	-19.97	QP			
3		94.9900	36.70	-18.98	17.72	43.50	-25.78	QP			
4	1	130.8800	39.84	-21.36	18.48	43.50	-25.02	QP			
5		183.2600	39.80	-19.13	20.67	43.50	-22.83	QP			
6		266.6800	33.65	-14.85	18.80	46.00	-27.20	QP			

*:Maximum data x:Over limit I:over margin

Operator: Lian

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Above 1000MHz~10th Harmonics:

All modulation modes have been tested, the worst mode is (GFSK), the data is recorded on the following page, other modulation modes do not exceed this limit.Please refer to the following data.

Operation Mode: GFSK (CH1: 2402MHz)	
-------------------------------------	--

Test Date : May 14, 2020

Freq.	Ant. Pol.	Rea Level(d	0	Correct Factor	Emis Level(d		Lim 3n		Margin(d	B)
(MHz)	H/V	PK	AV	dB	PK	AV	PK	AV	PK	AV
4804	V	92.60	76.85	-32.3	60.30	44.55	74	54	-13.70	-9.45
7206	V	96.16	73.62	-37.2	58.96	36.42	74	54	-15.04	-17.58
9608	V	97.99	72.04	-39.8	58.19	32.24	74	54	-15.81	-21.76
12010	V	97.98	71.44	-40.5	57.48	30.94	74	54	-16.52	-23.06
14412	V	96.15	71.61	-41.7	54.45	29.91	74	54	-19.55	-24.09
16814	V	92.90	72.66	-40.0	52.90	32.66	74	54	-21.10	-21.34
4804	Н	97.07	71.97	-31.6	65.47	40.37	74	54	-8.53	-13.63
7206	Н	96.93	76.52	-35.5	61.43	41.02	74	54	-12.57	-12.98
9608	Н	98.19	70.97	-38.3	59.89	32.67	74	54	-14.11	-21.33
12010	Н	96.24	76.19	-39.0	57.24	37.19	74	54	-16.76	-16.81
14412	Н	92.95	75.22	-42.0	50.95	33.22	74	54	-23.05	-20.78
16814	Н	97.43	76.12	-39.3	58.13	36.82	74	54	-15.87	-17.18

Operation Mode: GFSK (CH40: 2441MHz)

Test Date : May 14, 2020

							1			
Freq.	Ant.	Rea	ding	Correct	Emis	ssion	Lii	mit	Marg	in(dB)
	Pol.	Level(d	BuV/m)	Factor	Level(d	BuV/m)	3m(dE	3uV/m)		
(MHz)	H/V	PK	AV	dB	PK	AV	PK	AV	PK	AV
4882	V	94.77	76.76	-32.3	62.47	44.46	74	54	-11.53	-9.54
7323	V	96.69	71.22	-37.2	59.49	34.02	74	54	-14.51	-19.98
9764	V	91.41	73.89	-39.8	51.61	34.09	74	54	-22.39	-19.91
12205	V	93.47	73.30	-40.5	52.97	32.8	74	54	-21.03	-21.20
14646	V	94.36	73.94	-41.0	53.36	32.94	74	54	-20.64	-21.06
17087	V	93.49	75.08	-41.1	52.39	33.98	74	54	-21.61	-20.02
4882	Н	95.64	72.88	-31.6	64.04	41.28	74	54	-9.96	-12.72
7323	Н	96.18	76.31	-35.5	60.68	40.81	74	54	-13.32	-13.19
9764	н	97.63	76.47	-38.3	59.33	38.17	74	54	-14.67	-15.83
12205	н	98.34	74.93	-39.0	59.34	35.93	74	54	-14.66	-18.07
14646	Н	91.57	76.66	-42.0	49.57	34.66	74	54	-24.43	-19.34
17087	Н	97.96	71.41	-41.5	56.46	29.91	74	54	-17.54	-24.09

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Freq.	Ant.	Rea	ding	Correct	Correct Emission		Limit		Margin(dB)	
	Pol.	Level(d	BuV/m)	Factor	Level(d	BuV/m)	3m(dBuV/m)			
(MHz)	H/V	PK	AV	dB	PK	AV	PK	AV	PK	AV
4960	V	94.92	72.47	-32.3	62.62	40.17	74	54	-11.38	-13.83
7440	V	98.94	72.56	-37.2	61.74	35.36	74	54	-12.26	-18.64
9920	V	98.27	74.20	-39.8	58.47	34.4	74	54	-15.53	-19.60
12400	V	95.61	73.23	-40.5	55.11	32.73	74	54	-18.89	-21.27
14880	V	96.47	76.13	-41.0	55.47	35.13	74	54	-18.53	-18.87
17360	V	96.25	75.50	-41.1	55.15	34.4	74	54	-18.85	-19.60
4960	Н	95.96	76.61	-31.6	64.36	45.01	74	54	-9.64	-8.99
7440	Н	93.44	72.20	-35.5	57.94	36.7	74	54	-16.06	-17.30
9920	Н	97.11	72.65	-38.3	58.81	34.35	74	54	-15.19	-19.65
12400	Н	96.80	73.92	-39.0	57.8	34.92	74	54	-16.20	-19.08
14880	Н	93.94	71.20	-42.0	51.94	29.2	74	54	-22.06	-24.80
17360	Н	92.03	73.87	-41.5	50.53	32.37	74	54	-23.47	-21.63

Operation Mode: GFSK (CH79: 2480MHz)

Test Date : May 14, 2020

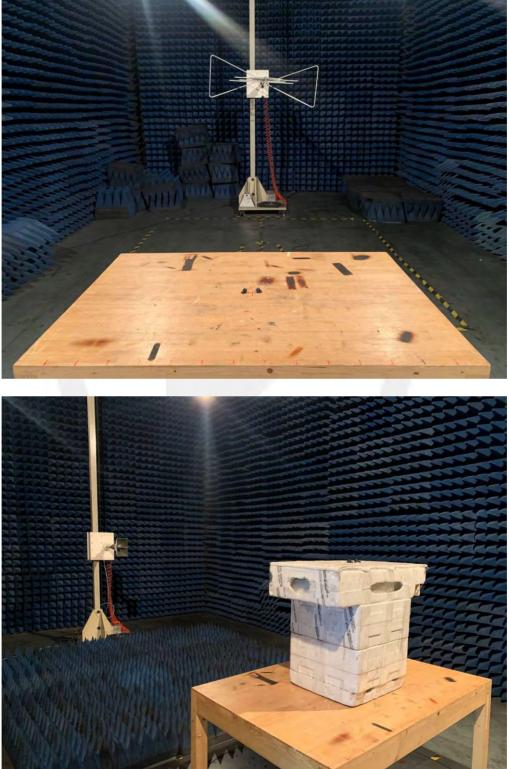
Other harmonics emissions are lower than 20dB below the allowable limit.

- **Note:** (1) All Readings are Peak Value and AV.
 - (2) Emission Level= Reading Level+ Probe Factor +Cable Loss.
 - (3) The average measurement was not performed when the peak measured data under the limit of average detection.
 - (4) Measuring frequencies from 1GHz to 25GHz.

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7.5 Radiated Measurement Photos:



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Report No.ES200508025W



8. Channel Separation test

8.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

8.2 Test SET-UP (Block Diagram of Configuration)

EUT Spectrum Analyzer

8.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	Characteristics	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	10Hz-30GHz	05/23/2019	05/22/2020
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	05/23/2019	05/22/2020
Antenna Connector	ARTHUR-YANG	2244-N1TG1	N/A	10Hz-30GHz	05/23/2019	05/22/2020

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

8.4 Measurement Results:

Refer to attached data chart.

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>750

.

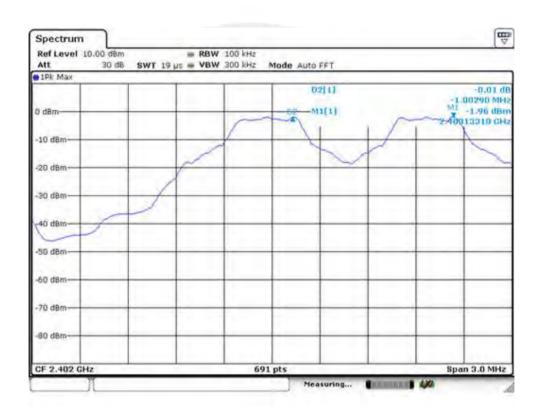
- -

Spectrum Detector: Test By: Test Result: Modulation:	PK Loren PASS GFSK	Test Date : Temperature : Humidity :	May 14, 2020 25℃ 55 %
Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1003	>750
40	2441	1003	>750

- . .

2480

79



1003

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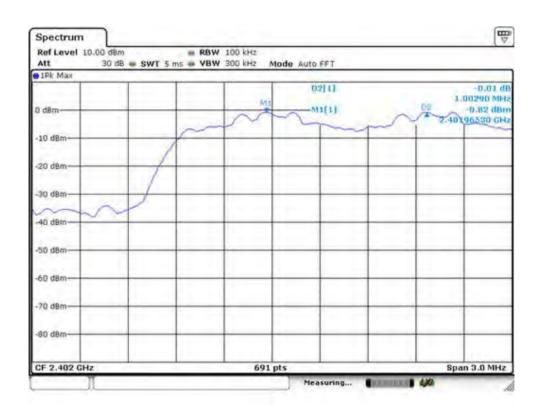
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Report No.ES200508025W

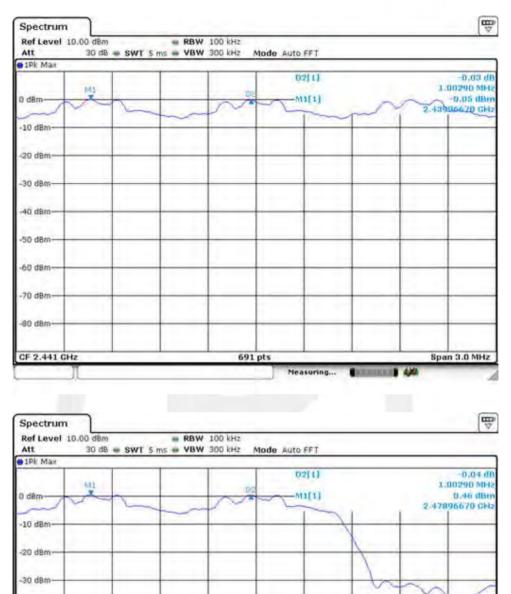


Spectrum Detector: Test By: Test Result: Modulation:	РК Loren PASS П/4-DQPSK	Test Date : Temperature : Humidity :	May 14, 2020 25℃ 55 %
Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1003	>915
40	2441	1003	>915
79	2480	1003	>915



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Report No.ES200508025W

-40 dBm

-50 d8m

-60 d8m

-70 dBm

-80 dBm

CF 2.48 GHz

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691 pts

Measuring...

STATISTICS.

430

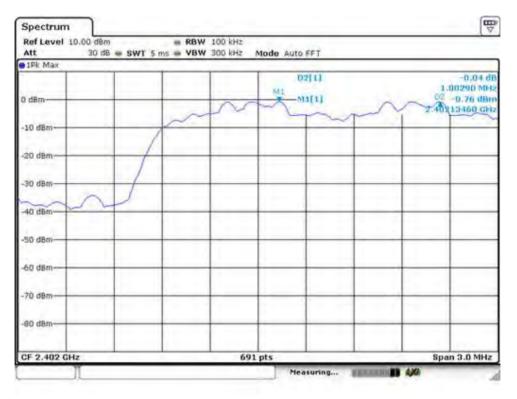
Span 3.0 MHz



Spectrum Detector:	PK	Test Date :
Test By:	Loren	Temperature :
Test Result: Modulation:	PASS 8DPSK	Humidity :

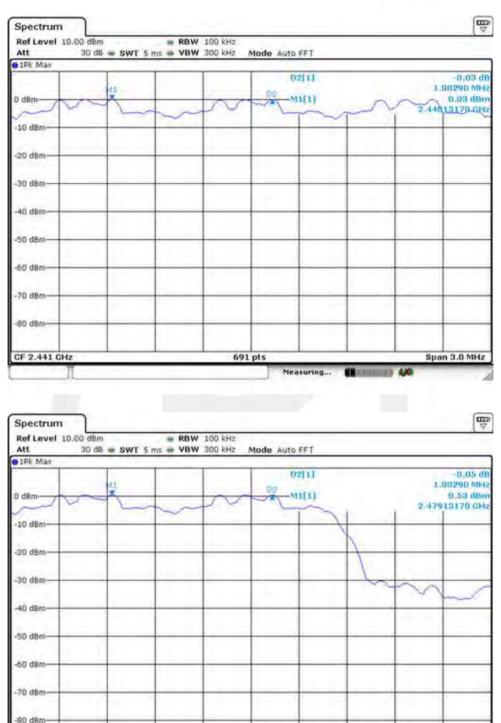
May 14, 2020 25℃ 55 %

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1003	>921
40	2441	1003	>917
79	2480	1003	>915



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CF 2.48 GHz

691 pts

Measuring...

STATISTICS.

430

Span 3.0 MHz



9. 20dB Bandwidth test

9.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

9.2 Test SET-UP (Block Diagram of Configuration)

EUT Spectrum Analyzer

9.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	Characteristics	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	10Hz-30GHz	05/23/2019	05/22/2020
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	05/23/2019	05/22/2020
Antenna Connector	ARTHUR-YANG	2244-N1TG1	N/A	10Hz-30GHz	05/23/2019	05/22/2020

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

9.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	May 14, 2020
Test By:	Loren	Temperature :	25 ℃
Test Result:	PASS	Humidity :	53 %
Modulation:	GFSK		

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	1125
40	2441	1125
79	2480	1125

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• IPk Max 1.35 dB 0 dBm 0.10 dBm 2.40213020 dF -10 dBm 9.50ctor 20.00 (-20 dBm 9.50ctor 2136 -20 dBm 9.50ctor 2136 -30 dBm -60 dBm -60 dBm -60 dBm -50 dBm -60 dBm -60 dBm -70 dBm -70 dBm -70 dBm -70 dBm -70 dBm -10 dBm -1.1245 MH -1.1245 MH -10 dBm -1.1245 MH 2.4021302 GHz -10 dBm -2.402 GHz 591 pts Span 3.0 MH	Spectrum Ref Level 1 Att	0.00 dBm 30 dB		100 kHz 300 kHz Mod	e Auto FFT	₩	
0 dBm 2.40213020 G 20.00 0 3.124500000 M 20.00 0 3.124500000 M 2136 20 dBm 2 20	1Pk Max						
-10 dBm -20 dBm -30 dBm -30 dBm -30 dBm -30 dBm -50 dBm -60 dBm -70	0 d8m	_			MY	-1.95 dBa 2.40219020 GH 20.00 db	
-20 dBm -30 dBm -40 dBm -50 dBm -50 dBm -60 dBm -70	-10 dBm				1	1.124500000 MH 2136,	
40 dBm 50 dBm 50 dBm 50 dBm 60 dBm<	-20 dBm	-	- The second		1		
-50 dBm -60 dBm -70	-30 dBm	-	1				
60 dBm 60 dBm -70 dBm -70 dBm -80 dBm -70 dBm -70 dBm -70 dBm -70 dBm -70 dBm M1 1 1 2.4014096 GHz -72.02 dBm ndB 20.00 d3	40 dBm	1					
-70 dBm -80 dBm -80 dBm -80 dBm -70 dBm -80 dBm -80 dBm -70 dBm -80 dBm -80 dBm -80 dBm -70 dBm -80 dBm -70 dBm -80	-S0 dBm-	_		-	-		
B0 dBm 691 pts Span 3.0 MH OF 2.402 GHz 691 pts Span 3.0 MH Marker Yourker Function Function Result M1 1 2.4021302 GHz -1.95 dBm ndB down 1.1245 MH T1 1 2.4014096 GHz -22.02 dBm ndB 20.00 dBm	-60 d8m	-		-			
CF 2.402 GHz 691 pts Span 3.0 MH Marker Your Ref Trc X-value Y-value Function Function Result M1 1 2.4021302 GHz -1.95 dBm ndB down 1.1245 MH. T1 1 2.4014096 GHz -22.02 dBm ndB 20.00 dBm	-70 d8m-	-					
Marker Yube Ref Trc X-value Y-value Function Function Result M1 1 2.4021302 GHz -1.95 dBm ndB down 1.1245 MH. T1 1 2.4014096 GHz -22.02 dBm ndB 20.00 dB	-80 d8m				-		
Type Ref Trc X-value Y-value Function Function Result M1 1 2.4021302 GHz -1.95 dBm ndB down 1.1245 MH. T1 1 2.4014096 GHz -22.02 dBm ndB 20.00 dB	CF 2.402 GH	łz		691 pts		Span 3.0 MHz	
M1 1 2.4021302 GHz -1.95 dBm ndB down 1.1245 MH. T1 1 2.4014096 GHz -22.02 dBm ndB 20.00 dB		Incl	Manakan I	Mushing 1	Furnition 1	Furnishing Resputs	
T1 1 2.4014096 GHz -22.02 dBm ndB 20.00 d						Function Result 1.1245 MHz	
T2 1 2.402534 GHz -21.84 dBm 0 factor 2136.3	T1	-				20.00 dB	
	T2	1	2.402534 GHz	-21.84 d8m	Q factor	2136.3	

10.00 dBn 30 dB		JS VBW	100 kHz 300 kHz Mt	de Auto FFT	_			
_								
		/		Mi ndb Bw Q-Locto	r and	-1.16 dBr 2.44113460 GH 20.00 d 1.124500000 MH 2170.		
		-			9			
-	1			-	1			
1		-			-			
	-	-	-					
-	-	-			-			
_	-	_				-		
	-							
Hz			691 p	ts	-	Span 3.0 MHz		
Trc	X-value		Y-value	Function		Function Result		
1	2.44113	and the second	-1.16 dBm			1.1245 MHz		
1	2.44040		-21.07 d8m	the Research of the Research o		20.00 dB 2170.9		

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Ref Level 1 Att	10.00 dBm 30 dB		BW 100 kHz BW 300 kHz Mo	de Auto FFT				
1Pk Max				· · · · · · · · · · · · · · · · · · ·				
0 d8m				M1 nd0		-0.65 dBo 2.48013460 GH 20.00 dt		
-10 d8m	_			C-Lactor		1.124500000 MH 2205.4		
-20 dBm	-	K		1	2			
-30 dBm	-				K			
40 dBm	5		_		-			
-S0 dBm-	_		_		-			
-60 d8m	_		-		-			
-70 dBm-	-							
-80 d8m-	-		_	_	-			
CF 2.48 GH	,		691 pt			Span 3.0 MHz		
Marker			ass pr			opun one ranc		
Type Ref	Trc	X-value	Y-value	Function	Fund	Function Result		
MI	1	2.4801346 GHz	-0.65 dBm	ndB down		1.1245 MHz		
T1	1	2.4794096 GHz	-20.77 d8m	ndB		20.00 dB		
T2	1	2.480534 GHz	-20.79 d8m	Q factor		2205.6		

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pectrum Detecto est By: est Result: lodulation:	or:	РК Loren PASS П/4-DQPSK	Ter Hu	st Date : mperature : midity :	2	/lay 14, 2 25℃ 53 %	020	
С		l number	()	el frequency MHz))dB Dowr 3W(kHz)	١	
		1		2402		1372		
	4	-0		2441		1372		
	79			2480		1372		
							_	
Spectrum Ref Level Att	10.00 dBm	SWT 5 ms WB	W 100 kHz W 300 kHz Mo	de Auto FFT			(W)	
• IPK Max	-		1	Mil[1]		-0	.82 dBm	
0 d8m			242			2.40196	530 GHz	
U GOM		-	ndo			20.00 d8 1.371900000 MHz		
-10 d8m				Q factor	-		1750,0	
-20 dBm-		W.	-		N2	-	-	
					1			
-30 dBm	-						1	
-40 dBm-	~						1	
-SD dBm			-				-	
-60 d8m	_		-		-			
-70 dBm			+ +		-			
-80 d8m								
CF 2.402 0	Hz		691 pt	s	-	Span 3	.0 MHz	
Marker								
Type Re		X-value	Y-value	Function	Fun	ction Result	10 6015	
MI	1	2.4019653 GHz 2.4012836 GHz	-0.82 dBm -20.81 dBm	ndB down ndB			19 MHz 0.00 dB	
T2	1	2.4026556 GHz	-20.97 d8m	Q factor			1750.8	
	N			Measuring	(in the	4,00	1	

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Ref Level 1 Att		- SWT 5 ms		100 kHz 300 kHz Mo	de Auto FFT		
• 1Pk Max	-		-				and the second second
0 d8m				NU	Mi[1]		-0.07 dBr 2.44096960 GH 20.00 d
-10 d8m		1	~		Bw Q factor	1	1.371900000 MH 1779.
-20 dBm		1		+ +		13	
-30 dBm						15	h 7
-40 dBm						-	
-SD dBm-	_					-	-
-60 dBm	-		-			-	-
-70 dBm	-		-	-			
-80 d8m-	-						
CF 2.441 G	-lz		_	691 pt	s	1	Span 3.0 MHz
Marker	Trc	X-value	1	Y-value	Function		nction Result
Type Ref M1	1	2.4409695 0	iH2	-0.07 dBm	ndB down	Fu	1.3719 MHz
T1 T2	1	2.4402836 G	Hz	-20.11 d8m -20.23 d8m	ndB Q factor		20.00 dB 1779.2
	19				Measuring.	. Shanaa	

PIPk Max						
0 d8m		V	Ma	Mi[1] ndb Bw Q factor	2,479969 20 1,3719000	0.00 d
-20 dBm-						/
-50 dBm						_
-70 dBm						
CF 2.48 GH	z		691 pt		Span 3.	0 MHz
Type Ref	Trc	X-value	Y-value	Function	Function Result	
M1	1	2.4799695 GHz	0.43 d8m	ndB down		9 MHz
T1	1	2.4792836 GHz	-19.53 d8m	ndB	20	00 dB
T2	1	2.4806556 GHz	-19.70 d8m	Q factor	1	807.7



Spectrum Detector:	PK	Test Date :	May 14, 2020
Test By:	Loren	Temperature :	25℃
Test Result: Modulation:	PASS 8DPSK	Humidity :	53 %

Channel number	Channel frequency	20dB Down
Charmer number	(MHz)	BW(kHz)
1	2402	1381
40	2441	1376
79	2480	1372

Att	10.00 dBn 30 dB	= RI	BW 100 kHz BW 300 kHz Mor	de Auto FFT		
1Pk Max						
0 d8m		~	~	MI[1] ndB Bw Q factor		-0.75 dBr 2.40210020 GH 20.00 d 1.380600000 MH 1739,
-20 dBm		1		-	As	
-40 dBm		2	_		~	
-S0 dBm	-		-	_	-	
-60 dBm						
-70 dBm						
						in the
CF 2.402 G	-lz		691 pt	5		Span 3.0 MHz
Type Ref	Trc	X-value	Y-value	Function	Fun	ction Result
M1 T1 T2	1	2.4021302 GHz 2.401288 GHz 2.4026686 GHz	-0.75 dBm -20.76 dBm -21.02 dBm	ndB down ndB Q factor		1.3806 MHz 20.00 dB 1739.9



Ref Level : Att				100 kHz 1 300 kHz Mi	de Auto FFT		
• 1Pk Max	_		_				1000
0 d8m	-		~	w	MI nd0		0.01 dB 2.44113460 G 20.00 1.376300000 M
-10 d8m		-			Q factor	here	1773
-20 dBm	-	1	-	+ +		A3	-
-30 dBm	_	1					
-40 dBm	~~~~						
-50 dBm	_				_	_	
-60 d8m	-		-			-	
-70 dBm	-	-		-		-	
-80 d8m						-	
CF 2.441 G	Hz		_	691 p	ts		Span 3.0 MH
Marker	Incl	M. contern		M under	I constant I	Pres	dation Process
Type Ref M1	Trc	X-value 2.441134	6 GHz	Y-value 0.01 dBm	Function ndB down	Fun	ction Result 1.3763 MH
T1	1	2.440292	and the second second	-19.94 d8m			20.00 di
T2	1	2.441668	6 GHz	-20.27 dam	Q factor		1773.7

Att 1Pk Max	30 dt	3 - SWT 5 ms - V	BW 300 kHz Mo	de Auto FFT		
0 d8m	-	-		Mi[1] I nd0 Bw O factor		0.49 dB/ 2.48015020 dF 20.00 d 1.373900000 MH 1807.
-20 dBm	_	¥.	_		Ne	
-30 dBm	-				16	
-40 dBm					-	
-S0 dBm	-	-	-		-	
60 d8m-	-	-	-		-	
-70 dBm	-		-		-	
-80 d8m			-	_	-	
CF 2.48 GH	2		691 pt	s	-	Span 3.0 MH
larker Type Ref	ITes	X-value	Y-value	Function	Free	ction Result
MI	1	2.4801302 GHz	0.49 d8m	ndB down	Fui	1.3719 MH.
T1	1	2.4792923 GHz	-19.28 d8m	ndB		20.00 de
T2	1	2.4806643 GHz	-19.21 d8m	Q factor		1807.8



10. Quantity of Hopping Channel Test

10.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

10.2Test SET-UP (Block Diagram of Configuration)

EUT Spectrum Analyzer

10.3Measurement Equipment Used:

EQUIPMENT	MFR	MODEL	SERIAL	Characteristics	LAST	CAL DUE.
TYPE		NUMBER	NUMBER		CAL.	
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	10Hz-30GHz	05/23/2019	05/22/2020
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	05/23/2019	05/22/2020
Antenna Connector	ARTHUR-YANG	2244-N1TG1	N/A	10Hz-30GHz	05/23/2019	05/22/2020

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

10.4 Measurement Results:

Refer to attached	l data chart
Worst Test Mode	GFSK
Test By:	Loren
Test Result:	PASS

Test Date : Temperature : Humidity :

May 14, 2020 25 ℃ 50 %

Hopping Channel	Quantity of Hopping	Quantity of Hopping
Frequency Range	Channel	Channel
2402-2480	79	>15

1Pk Max									
	1.7				Ď	2[1]			1.20 de 8.360 MHz
d dBm-		-	80005000	ABBAABBAA	bonagan	Athanna		cana hony	2.12 BB
INNIN	WANNA	WWWW	MWWW	WWWW	WWWW (ADALANDAA	WWWW	n n i n n i fitte	EXABLACED
-19 BBm+1	Hickory	hand	-H-th	the He	1.11.1	terthe at	tuto	titr.a	- m
-20 d8m-			_	-				_	
	1 1	1					1		
-30 dBm						-			
40 d8m-		1	_						N
TO GEN	D1	1000			1		1		
-50 d8m		-				-			
							1.000		
-60 dBm									
-70 dBm-	-	-	-	-	-	-	-	-	
				-	·				
-80 dBm									
	GHz				pts		at the factor		4835 GHz

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11. Time of Occupancy (Dwell Time) test

11.1 Test Description

The Equipment Under Test (EUT) was set up to perform the dwell time measurements. The EUT was connected to the spectrum analyzer via a short coax cable. The dwell time is calculated by:

Dwell time = time slot length * hop rate / number of hopping channels * 31.6s

with:

- hop rate = $1600 \times 1/s$ for DH1 packets = 1600 s^{-1}

- hop rate = 1600/3 * 1/s for DH3 packets = $533.33 s^{-1}$

- number of hopping channels = 79

- 31.6 s = 0.4 seconds multiplied by the number of hopping channels = 0.4 s * 79

The highest value of the dwell time is reported.

11.2 Test SET-UP (Block Diagram of Configuration)

EUT

Spectrum Analyzer

11.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	Characteristics	LAST CAL.	CAL DUE.
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	10Hz-30GHz	05/23/2019	05/22/2020
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	05/23/2019	05/22/2020
Antenna Connector	ARTHUR-YANG	2244-N1TG1	N/A	10Hz-30GHz	05/23/2019	05/22/2020

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

11.4 Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (a) (1) (iii)

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Since the Bluetooth technology uses 79 channels this period is calculated to be 31.6seconds. Refer to

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attached data chart.

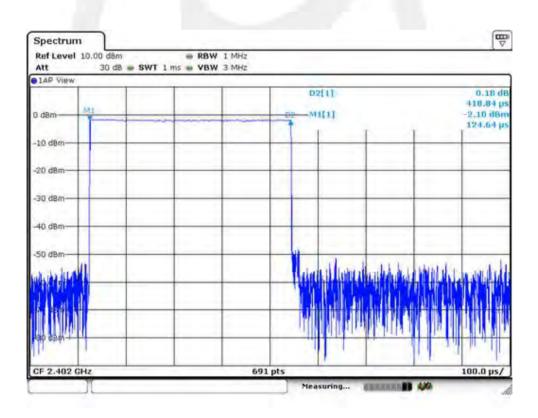
Modulation:	GFSK	Test Date :	May 14, 2020
Test By:	Loren	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %

11.5 Test result

Mode	Number of transmission in a 31.6(79 Hopping*0.4)	Length of transmissions time(msec)	Result (msec)	Limit (msec)
DH1	1600/(2*79) x 31.6 = 320	0.419	134.08	400
DH3	1600/(4*79) x 31.6 =160	1.678	268.48	400
DH5	1600/(6*79) x 31.6 =106.67	2.920	311.48	400

Remark: The results of worst cased was recorded.

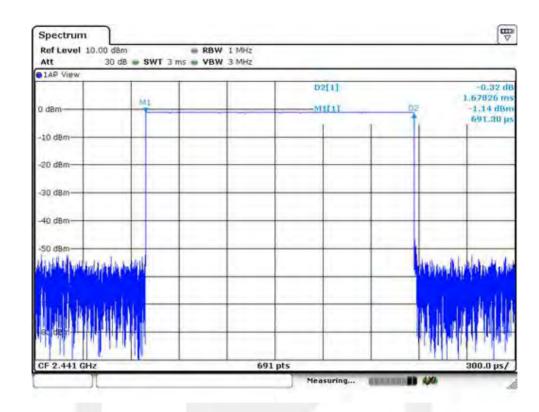
DH1:



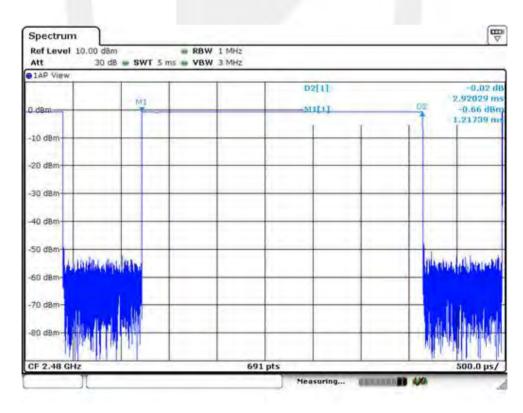
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DH3:



DH5:



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12. MAXIMUM PEAK OUTPUT POWER TEST

12.1 Measurement Procedure

a. Check the calibration of the measuring instrument(SA) using either an internal calibrator or a known signal from an external generator.

b. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

c. The center frequency of the spectrum analyzer is set to the fundamental frequency and using proper RBW and VBW setting.

d. Measure the captured power within the band and recording the plot.

e. Repeat above procedures until all frequencies required were complete.

12.2 Test SET-UP (Block Diagram of Configuration)



12.3 Measurement Equipment Used:

EQUIPMENT	MFR	MODEL	SERIAL	Characteristics	LAST	CAL DUE.
TYPE		NUMBER	NUMBER		CAL.	
Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	10Hz-30GHz	05/23/2019	05/22/2020
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	05/23/2019	05/22/2020
Antenna Connector	ARTHUR-YANG	2244-N1TG1	N/A	10Hz-30GHz	05/23/2019	05/22/2020

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

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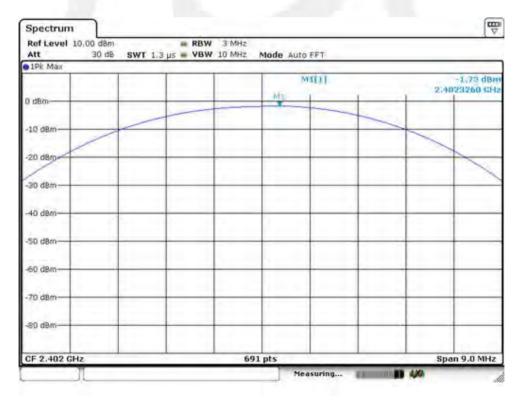


12.4Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	May 14, 2020
Test By:	Loren	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %
Modulation:	GFSK	-	

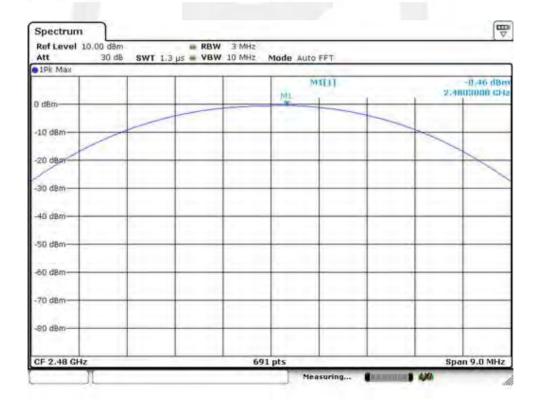
Channel number	Channel Frequency (MHz)	Peak Power output(dBm)	Peak Power output(mW)	Peak Power Limit(mW)	Pass/Fail
01	2402	-1.73	0.671	1000	PASS
40	2441	-0.95	0.804	1000	PASS
79	2480	-0.46	0.899	1000	PASS



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Spectrum Ref Level 10.00 di						₩ V
Att 30 1Pk Max	dB SWT 1.3 µs = VB	W 10 IMHZ MODE	Auto FFT			
		841	M1[1]			-0.95 dBm 12740 GHz
0 dBm		-		-		
-10 dBm			-		<	
-20 d8m						1
-30 dBm	-		-	-		
-40 dBm-			-	-		
-S0 d8m			-	-		
-60 dBm				-		
-70 dBm			-	-	_	
-SD dBm			_			
CF 2.441 GHz		691 pts			Spar	n 9.0 MHz
T			Measuring	annua an	the second s	



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Report No.ES200508025W



Spectrum Detector: Test By: Test Result: Modulation: РК Loren PASS П/4-DQPSK Test Date : Temperature : Humidity : May 14, 2020 25 ℃ 50 %

Channel number	Channel Frequency (MHz)	Peak Power output(dBm)	Peak Power output(mW)	Peak Power Limit(mW)	Pass/Fail
01	2402	0.49	1.119	125	PASS
40	2441	1.20	1.318	125	PASS
79	2480	1.67	1.469	125	PASS

1Pk Max						_
1			ME	M1[1]	2,402156	9 dBn 10 GH
0 dBm-						_
10 dBm		-	-			
28 0Bm		-		-		>
-30 dBm						
-40 dBm-						
-50 d8m	- 1.					_
-60 dBm			-			
-70 dBm						
-so dBm	-					

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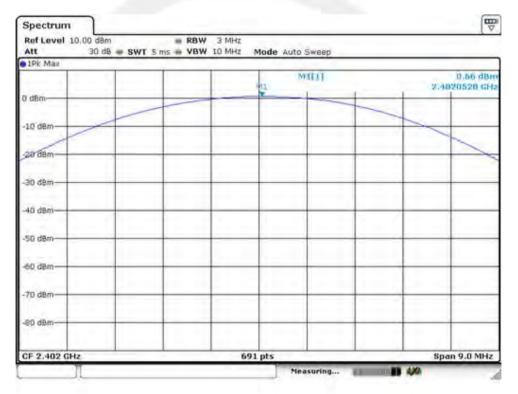
Spectrum								₩ V
Ref Level 1		Sad.	= RBW		and the second			
Att	30 dB	SWT 5	s mis 🖷 VBW	10 MHz 1	Mode Auto Sweep	-		
1Pk Max			-	-	North 1			1 nn dna
					MI		2.4	1,20 dBn 411690 GH:
0 dBm		-		-		-	1	1
		-	-					
10 dBm	/	-	-					
1				1				1
20 dBm-	_	-	-			_		
			1		1			
30 d8m-		1		1				-
SO GOM								
40 dBm								
40 dem	1	Sec. 11		1.1.1.1	1		(
				-		-		
S0 d8m								
60 dBm-								
		1.		1.			1.0	-
70 dBm								
1.2			-					
80 dBm			1	-			-	1
CF 2.441 GH	1					_		an 9.0 MHz
	л			691	l pts Measuring	. (1.1.111)		
Spectrum Ref Level 1)] 0.00 d8m		# RBW	3 MHz	Measuring.	. B anole		
Spectrum Ref Level 1 Att)] 0.00 d8m			3 MHz		. C armelia		
Spectrum Ref Level 1 Att)] 0.00 d8m			3 MHz	Measuring.	. P arantin		(The second seco
Spectrum Ref Level 1 Att)] 0.00 d8m			3 MHz	Measuring.	. Cannolin	1 440	1.67 dBr
Spectrum Ref Level 1 Att 1Pk Max)] 0.00 d8m			3 MHz	Measuring.		1 440	1.67 dBr
Spectrum Ref Level 1 Att 1Pk Max)] 0.00 d8m			3 MHz	Measuring.		1 440	1.67 dBr
Spectrum Ref Level 1 Att 1Pk Max)] 0.00 d8m			3 MHz	Measuring.		1 440	1.67 dBr
Spectrum Ref Level 1 Att 19k Max)] 0.00 d8m			3 MHz	Measuring.		1 440	1.67 dBr
Spectrum Ref Level 1 Att 19k Max I dBm 10 dBm)] 0.00 d8m			3 MHz	Measuring.		1 440	1.67 dBr
Spectrum Ref Level 1 Att 1Pk Max 1 dBm 10 dBm)] 0.00 d8m			3 MHz	Measuring.		1 440	
Spectrum Ref Level 1 Att 1Pk Max 1 dBm 10 dBm 20 dBm)] 0.00 d8m			3 MHz	Measuring.		1 440	
Spectrum Ref Level 1 Att 1Pk Max 1 dBm 10 dBm 20 dBm)] 0.00 d8m			3 MHz	Measuring.		1 440	
Spectrum Ref Level 1 Att 11Pk Max 0 dBm 10 dBm 20 dBm 30 dBm)] 0.00 d8m			3 MHz	Measuring.		1 440	1.67 dBr
Spectrum Ref Level 1 Att 11Pk Max 0 dBm 10 dBm 20 dBm 30 dBm)] 0.00 d8m			3 MHz	Measuring.		1 449	1.67 dBr
Spectrum Ref Level 1 Att 1Pk Max 1 dBm 10 dBm 20 dBm 30 dBm 40 dBm)] 0.00 d8m			3 MHz	Measuring.		1 449	
Spectrum Ref Level 1 Att 1Pk Max 1 dBm 10 dBm 20 dBm 30 dBm 40 dBm)] 0.00 d8m			3 MHz	Measuring.		1 449	
Spectrum Ref Level 1 Att 11Pk Max 10 dBm 10 dBm 20 dBm 30 dBm 40 dBm 50 dBm)] 0.00 d8m			3 MHz	Measuring.		1 449	
Spectrum Ref Level 1 Att 11Pk Max 10 dBm 10 dBm 20 dBm 30 dBm 40 dBm 50 dBm)] 0.00 d8m		t mis 🖶 VBW	3 MHz	Measuring.		1 449	
Spectrum Ref Level 1 Att 1Pk Max 10 dBm 10 dBm 20 dBm 30 dBm 40 dBm 60 dBm)] 0.00 d8m			3 MHz	Measuring.		1 449	
Spectrum)] 0.00 d8m		t mis 🖶 VBW	3 MHz	Measuring.		1 449	
Spectrum Ref Level 1 Att 1Pk Max 10 dBm 10 dBm 20 dBm 30 dBm 40 dBm 50 dBm 60 dBm 70 dBm)] 0.00 d8m		t mis a VBW	3 MHz	Measuring.		1 449	
Spectrum Ref Level 1 Att 10 dBm 10 dBm 20 dBm 30 dBm 40 dBm 60 dBm)] 0.00 d8m		t mis a VBW	3 MHz	Measuring.		1 449	1.67 dBn
Spectrum Ref Level 1 Att 1Pk Max 1 dBm 10 dBm 20 dBm 30 dBm 40 dBm 50 dBm 60 dBm 70 dBm)] 0.00 d8m		t mis a VBW	3 MHz	Measuring.		1 449	



Spectrum Detector:	ΡK
Test By:	Lore
Test Result:	PAS
Modulation:	8DF

K oren ASS DPSK Test Date : Temperature : Humidity : May 14, 2020 25 ℃ 50 %

Channel number	Channel Frequency (MHz)	Peak Power output(dBm)	Peak Power output(mW)	Peak Power Limit(mW)	Pass/Fail
01	2402	0.66	1.164	125	PASS
40	2441	1.35	1.365	125	PASS
79	2480	1.82	1.521	125	PASS



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Spectrum	-						u v v
Ref Level 10.0							
Att 1Pk Max	30 08 - SW	5 ms - VBW	10 MH2	Mode Auto Sweep			
LP & FIERD				MILL			1.35 dBn
				Ma		2.44	19970 GH
) dBm					-		
	-	-					
10 dBm			_				
	5						~
20 d8m							1
SCO GIDITI							
-							
30 dBm							
20.00					1.1		-
40 dBm					-		
-SD d8m-			-		-	-	
60 d8m-		_				-	
70 dBm		_	-		-	-	
			1				1
SD dBm						-	
op apin							
							0.00
	<u>ר</u>		69	1 pts Measuring	annun)		
Spectrum Ref Level 10.0		RBW	3 MHz	Measuring	anna a		
Spectrum Ref Level 10,0 Att			3 MHz		anna a		
Spectrum Ref Level 10,0 Att			3 MHz	Measuring Mode Auto Sweep	. Constant		(T
Spectrum			3 MHz	Measuring		490	n 9.0 MHz [↓ 1.82 dBn 99970 GH
Spectrum Ref Level 10.0 Att 1Pk Max			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10.0 Att p1Pk Max			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10,0 Att 1Pk Max			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10,0 Att 1Pk Max			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10.0 Att 10 dBm			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10.0 Att 10 dBm			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10.0 Att 11 dBm 10 dBm 20 dBm			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10.0 Att 11 dBm 10 dBm 20 dBm			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10.0 Att 11Pk Max 10 dBm 10 dBm 20 dBm 30 dBm			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10.0 Att 11Pk Max 10 dBm 10 dBm 20 dBm 30 dBm			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10.0 Att 10 dBm 10 dBm 20 dBm 30 dBm 40 dBm			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10.0 Att 10 dBm 10 dBm 20 dBm 30 dBm 40 dBm			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10.0 Att 10 dBm 10 dBm 20 dBm 30 dBm 40 dBm 50 dBm			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10.0 Att 10 dBm 10 dBm 20 dBm 30 dBm 40 dBm 50 dBm		r sms webw	3 MHz	Measuring		490	.82 dBn
Spectrum Ref Level 10.0 Att 10 dBm 10 dBm 20 dBm 30 dBm 30 dBm 50 dBm 60 dBm			3 MHz	Measuring Mode Auto Sweep		490	.82 dBn
Spectrum Ref Level 10.0 Att 1Pk Max 0 dBm 10 dBm 20 dBm 30 dBm		r sms webw	3 MHz	Measuring		490	.82 dBn
Spectrum Ref Level 10.0 Att 10 dBm 10 dBm 20 dBm 30 dBm 30 dBm 30 dBm 50 dBm 30 dBm 40 dBm 50 dBm 70 dBm		r sms webw	3 MHz	Measuring		490	.82 dBn
Spectrum Ref Level 10.0 Att 10 dBm 10 dBm 20 dBm 30 dBm 30 dBm 50 dBm 60 dBm		r sms webw	3 MHz	Measuring		2:47	.82 dBn
Spectrum Ref Level 10.0 Att 10 dBm 10 dBm 20 dBm 30 dBm 30 dBm 50 dBm 60 dBm 70 dBm		r sms webw	3 MHz	Measuring		490	.82 dBn



13. Band EDGE test

13.1 Measurement Procedure

For Conducted Test

- 1. The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100KHz. The video bandwidth is set to 300KHz.
- 2. The spectrum from 30MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

EMI Test Receiver	Setting
Attenuation	Auto
RBW	100KHz
VBW	300KHz
Detector	Peak
Trace	Max hold

For Radiated emission Test

The EUT was placed on a styrofoam table which is 1.5m above ground plane.

The measurement procedure at the ban edges was simplified by performing the measurement in just one plot. Both, the in-band-emission and the unwanted emission were be encompassed by the span. After trace stabilization, the maximum peak was be determined by a peak detector and the value was marked by an appropriate limit line. The second limit line, which is 20dB below the first, marks the limit for the emissions in the unrestricted band. A maximum-peak-detector marks the highest emission in the unrestricted band next to the band edge.

The measurements were performed at the lower end of the 2.4GHz band. Use the following spectrum analyzer settings:

For Restricted Band, When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz:

EMI Test Receiver	Setting
Attenuation	Auto
RBW	1MHz
VBW	3MHz
Detector	Peak
Trace	Max hold

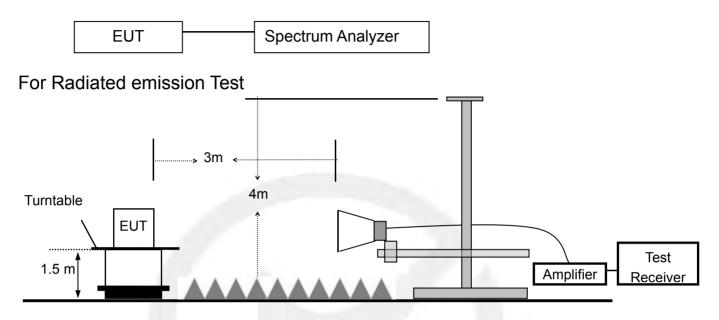
For Non-Restricted Band, When spectrum scanned above 1GHz setting resolution bandwidth 100KHz, video bandwidth 300KHz:

EMI Test Receiver	Setting
Attenuation	Auto
RBW	100KHz
VBW	300KHz
Detector	Peak
Trace	Max hold

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13.2 Test SET-UP (Block Diagram of Configuration) For Conducted Test



13.3 Measurement Equipment Used:

For Conducted Test

Γ	EQUIPMENT	MFR	MODEL	SERIAL	Characteristics	LAST	CAL DUE.
	TYPE		NUMBER	NUMBER		CAL.	
	Spectrum Analyzer	Rohde & Schwarz	FSV30	1321.3008K	10Hz-30GHz	05/23/2019	05/22/2020
	Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	05/23/2019	05/22/2020
	Antenna Connector	ARTHUR-YANG	2244-N1TG1	N/A	10Hz-30GHz	05/23/2019	05/22/2020

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list. For Radiated emission Test

Item	Equipment	Manufacturer	Model No.	Serial No.	Characteristics	Last Cal.	Cal. Interval
1	Signal Analyzer	Rohde & Schwarz	FSV30	103040	9KHz-40GHz	05/23/2019	1 Year
2	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-12 72	1GHz-18GHz	05/23/2019	1 Year
3	Power Amplifier	LUNAR EM	LNA1G18-40	J1010000 0081	1GHz-26.5GHz	05/23/2019	1 Year
4	Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	05/23/2019	1 Year
5	Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	05/23/2019	1 Year
6	Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	05/23/2019	1 Year

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13.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	May 14, 2020
Test By:	Loren	Temperature :	25 ℃
Test Result:	PASS	Humidity :	50 %

1. Conducted Test

For Non-Hopping Mode:

Frequency (MHz)	Modulation	Peak Power Output(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)
2397.32	GFSK	-3.98	50.9	>20dBc
2399.86	pi/4-DQPSK	-3.96	52.59	>20dBc
2399.8	8DPSK	-3.93	51.76	>20dBc
2484.56	GFSK	-0.97	52.79	>20dBc
2484.51	pi/4-DQPSK	-1.04	53.12	>20dBc
2484.56	8DPSK	-0.97	52.79	>20dBc

Test plots of GFSK

Att		15 dB	SWT 19 µs i	VBW 300 kHz	Mode Auto FF	т	
1Pk Ma	×						
0 dBm—	+				D3[1]	MI	-50.90 d -4,5010 MF -3,98 dB 2,4019230 GF
-10 dBm-				-			
-20 d8m-	+	-		-			
-30 dBm-	+	-		-			
-40 dBm-	+				X		
-50 d8m-	+	_	03	DE	1		
-50 USm-	+		1 man	m			5-0
-70 dBm-	+			-		-	_
-80 dBm-	+	-		-			
CF 2.4 (Hz			691 pt	s		Span 10.0 MH:
tarker		A			Function		ion Result
Type M1	Ket	1	X-value 2.401823 GHz	-3.98 dBm	Function	Funct	ION RESUIC
D2	MI	1	-1.8234 MHz	-50.44 dB			
D3	M1	1	-4.501 MHz	-50,90 dB			

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Ref Level Att	15 di	a strate a second of the		Mode Auto FFT		
PiPk Max	_			Balta		F. 1. 10
1.1.1	MI			D3[1]		-52.79 d -4.7020 MF
0 dBm	The			347[1]		-0.97 dB
	11			and a second		2.4798240 G
-10 d8m-	1	5				
-20 d8m-	-	4				
20 00111		N				
-30 d8m	_	1	-		-	
2						
-10 dem-	_		-		-	
-50 d8m-		1		03	1 1	
10.0			mile	and has		al an and
-60 dBm-	-					
-70 d8m-						
-/u ubiii						
-80 dBm-	_				-	
(
CF 2.4835	GHz	1 1	691 pts	1		Span 10.0 MH
Marker				A		
Type Ref	Trc	X-value	Y-value	Function	Fund	tion Result
M1	1	2.479824 GHz	-0.97 dBm		-	
D2 M	1 1	3.6758 MHz	-57.12 dB			

Test plots of pi/4-DQPSK

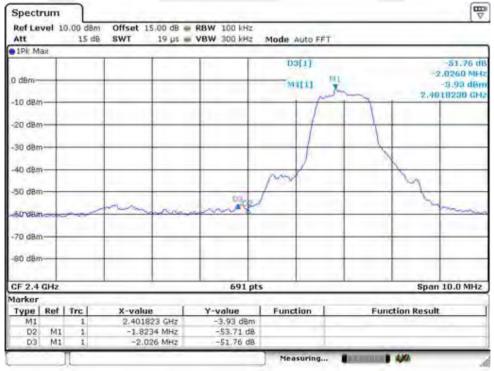
Ref Level 1 Att	0.00 dBm 15 dB		VBW 300 kHz	Mode Auto FFT	4	
1Pk Max						
0 dBm				D3[1]	MI Marine	-52,59 di -1,9680 MH -0,96 dBn 7,4018230 GH
-10 d8m-				1		
-20 d8m	-		-			
-30 d8m	-		-			
-40 d8m	-		+ +	not		~~
-50 d8m	_		DEC			
-60'd8m	-	man	month		-	m
-70 dBm					-	_
-80 dBm	-					
CF 2.4 GHz			691 pt	5		Span 10.0 MHz
Marker			10.0	1		
Type Ref	Trc	X-value	Y-value	Function	Funct	ion Result
MI	1	2.401823 GHz	-3.96 dBm			
D2 M1 D3 M1	1	-1.8234 MHz -1.968 MHz	-52.28 d8 -52.59 d8			

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Ref Leve Att	10.00 d8m 15 d8			Mode Auto FFT	4.
• 1Pk Max					
0 dBm	IN1			D3[1]	-53.12 (4.6090 Mi -1.04 dB 2.4798240 G
-10 d8m-	-	A		1	1 1 1
-20 d8m-		1			
-20 08117					
-30 d8m			-		
n/		1			
40 dBm-	-	1 mg	-		
-50 d8m-	-		-		
-20.0600-	1	Ser	0		
-60 d8m-	-		minis		Mangara and
		The second second	1		
-70 dBm-	-	-	-		
-90 dBm					
-ou upin					
CF 2.483	5 GHz	<u> </u>	691 pts		Span 10.0 MH
Marker				1	
Type R	ef Trc	X-value	Y-value	Function	Function Result
MI	1	2.479824 GHz	-1.04 dBm		
	M1 1 M1 1	3.6758 MHz 4.689 MHz	-57.21 dB -53.12 dB		
0.5		TOTAL PROPERTY OF	Voltage UD	Measuring	1

Test plots of 8DPSK



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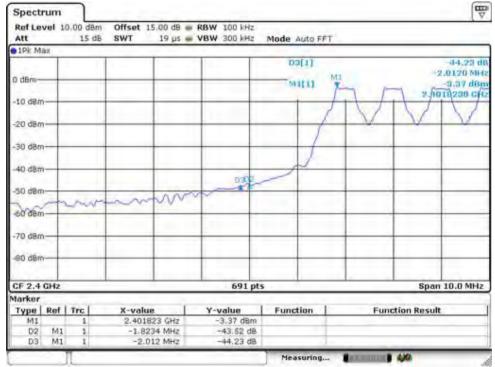
Att	_	15 di	SWT	19 µs 🖷	VBW 300 kHz	Mode Aut	to FFT			
0 d8m	T	MJ-1				D3[1 31(1		_		-52.79 di 4.7020 MH -0.97 dBn 798240 GH
-20 dBm -30 dBm -40 dBm-			E	1						
-50 d8m- -60 d8m- -70 d8m-					The state of the s		m		-	
-80 d8m-										
CF 2.48	35 G	Hz			691 pt	s		_	Spar	10.0 MHz
Marker Type M1 D2 D3	M1 M1	Trc 1 1	3.6	ue 0824 GHz 0758 MHz 0732 MHz	Y-value -0.97 dBm -56.60 dB -52.79 dB	Functio	n	Func	tion Resul	



For Hopping Mode:

Frequency (MHz)	Modulation	Peak Power Output(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)
2399.81	GFSK	-3.37	44.23	>20dBc
2398.84	pi/4-DQPSK	-4	51.93	>20dBc
2397.84	8DPSK	-3.98	51.26	>20dBc
2483.92	GFSK	-0.52	54.1	>20dBc
2484.5	pi/4-DQPSK	-1.08	53.81	>20dBc
2484.51	8DPSK	-1.08	54	>20dBc

Test plots of GFSK



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Att	_	15 dB	SWT	19 µs =	VBW 300 k	Hz	Mode Au	to FFT	·		
0 dam		h					nation of the second se			2.4	-54,10 d 4,0960 MF -0.52 dB 1798240 GF
-10 dBm	1	4				-	1			1	
-20 dBm	4		1	-	-	-	-		-	-	-
-30 dBm	+	_	1	-	-	-	_	_		-	-
-40 dBm	-	-	1		-	+				-	
-50 d8m	+	_	-	1	-		oa i		-	-	-
-60 d8m	-	_	-	-	m	and	m	2	m	m	-m
-70 dBm	+		-	-	-		-	_	-	-	-
-90 dBm	+	-		-	-	-	_		-	-	-
CF 2.48	135 G	Hz		-	691	L pts				Spa	in 10.0 MH:
Marker	not l	the l	X-valu		Y-value	-	Functio	. 1		nction Resu	
Type M1	REL	1		824 GHz	-0.52 d	Bmi	Functio	m	FU	nction kest	int.
D2	M1	1	3.6	758 MHz	-57.57	dB		-			
D3	M1	1	4,	096 MHz	-54.10	dB					

Test plots of pi/4-DQPSK

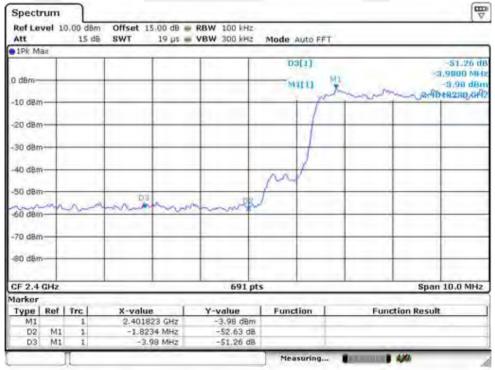
Att	/ei 10	0.00 d8m 15 d8	Offset 15.00 dB = SWT 19 µs =	RBW 100 kHz VBW 300 kHz	Mode Auto FFT	1	
• 1Pk Ma	3X						
0 dBm—					D3[1]	Jan m	51,93 di 2,9810 MH -4,00 dBn -4,00 dBn -4,00 dBn
-10 dBm							
-20 dBm	-	_		-			
-30 dBm	-	-		-			
-40 dBm	-	-			m	-	
-50 d8m	_	_			Jan	-	
-60 dBm	h	John	······································	2 minut			
-70 dBm	-			-		-	
-S0 dBm	-	-		-		-	
CF 2.4	GHz			691 pt	5		Span 10.0 MHz
Marker							
Type M1	Ref		2.401823 GHz	-4.00 dBm	Function	Fund	tion Result
D2	MI	1	-1.8234 MHz	-52.16 d8		-	
D3	MI	1	-2.981 MHz	-51,93 dB			

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Att	10.00 d8n 15 d		Contract and a second	Mode Auto FFT	1	
1Pk Max						
Mi	1			D3[1]		-53,81 c 5,6730 Mi
0 48m-	(Phone)			MILLI		-1.08 dB
10 100	-	1				2.4788260 G
-10 d8m-						
-20 d8m-		1				
20 0011						
-30 d8m-		1	-		+ +	
-40 dBm			-			
-50 d8m		hin	manie	DB		
-60 d8m	_		man	monin	mm	
-70 dBm-			-		-	
1.200.000						
-80 d8m						
1.			-		1. A	
CF 2.4835	GHz		691 pts			Span 10.0 MH
Marker						1110 C
Type Re MI	f Trc	2.478826 GHz	Y-value -1.08 dBm	Function	Funct	ion Result
	11 1	4.6744 MHz	-57.34 d8			
	11 1	5.673 MHz	-53.81 dB			

Test plots of 8DPSK



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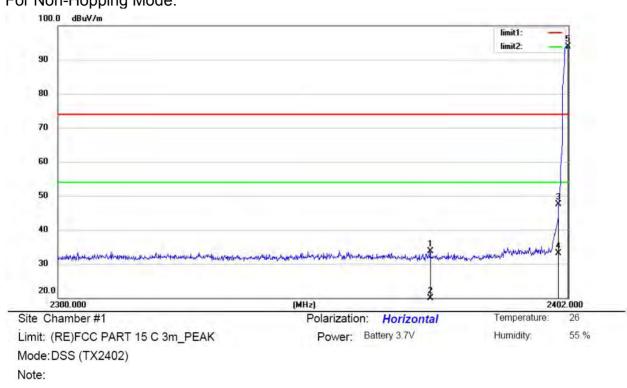
Att	A61 T	0.00 d8m 15 d8			RBW 100 kHz VBW 300 kHz	Mode	Auto FFT	c'		
• 1Pk M	ах			_						
0 dBm-	~	Mi	-				3[1]			-54.00 d 4,6090 MH -1,08 dBr 798240 GH
-10 dBm	-		A			-	1	1		A APR - IN MA
-20 d8m	+	-	1	_	-	_	-	-		-
-30 dBm	-	_	1	_						-
-40 d8m			has							
-50 d8n										
-60 dBn		1		his	mar	mar	in	in	m	m
-50 000									-	-
-70 dBn	-		-	-	+ +	-	-	-		
-S0 dBm	-	-			-	_	-			-
CF 2.4	835 G	Hz		-	691 pt	5		-	Spa	n 10.0 MHz
larker										
Туре	Ref		X-value		Y-value	Fund	tion	Fun	tion Resul	lt
D2	MI	1	3.675	8 MHz	-57.71 d8	_				
M1 D2 D3	MI MI	1			-1.08 dBm -57.71 dB -54.00 dB	1 10	asuring	-	430	-

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Report No.ES200508025W



2. Radiated emission Test Worst test modulation GFSK For Non-Hopping Mode:



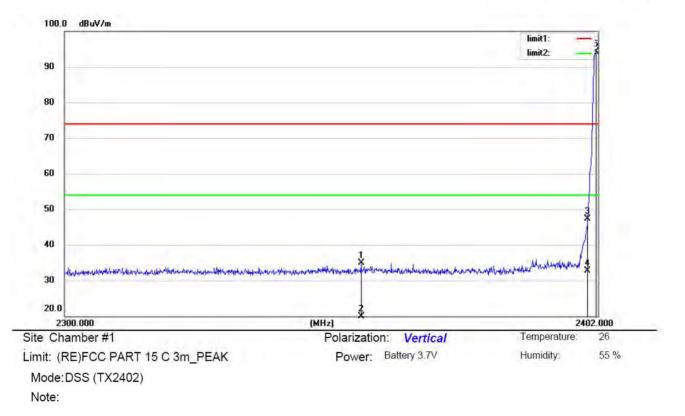
No.	Mk.	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2373.950	54.70	-21.00	33.70	74.00	-40.30	peak		0	
2		2373.950	38.54	-21.00	17.54	54.00	-36.46	AVG		0	
3	2	2400.000	68.52	-20.93	47.59	74.00	-26.41	peak		0	
4		2400.000	54.10	-20.93	33.17	54.00	-20.83	AVG		0	
5	*	2401.796	114.90	-20.93	93.97	74.00	19.97	peak		0	

*:Maximum data x:Over limit 1:over margin

Operator: Lian

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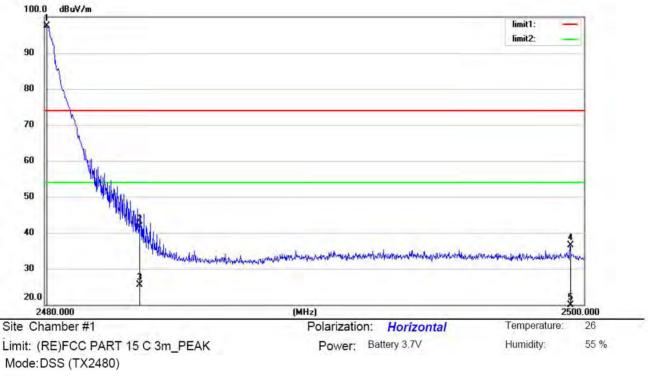
No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	:	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2356.202	54.98	-20.04	34.94	74.00	-39.06	peak		0	
2		2356.202	37.15	-20.04	17.11	54.00	-36.89	AVG		0	
3		2400.000	67.12	-19.77	47.35	74.00	-26.65	peak		0	
4		2400.000	52.44	-19.77	32.67	54.00	-21.33	AVG		0	
5	*	2401.592	114.03	-19.76	94.27	74.00	20.27	peak		0	

*:Maximum data x:Over limit !:over margin

Operator: Lian

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Note:

No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	2480.060	118.21	-20.71	97.50	74.00	23.50	peak		0	
2		2483.500	62.49	-20.72	41.77	74.00	-32.23	peak		0	
3		2483.500	46.25	-20.72	25.53	54.00	-28.47	AVG		0	
4		2499.480	57.22	-20.66	36.56	74.00	-37.44	peak		0	
5	3	2499.480	40.15	-20.66	19.49	54.00	-34.51	AVG		0	

*:Maximum data x:Over limit !:over margin

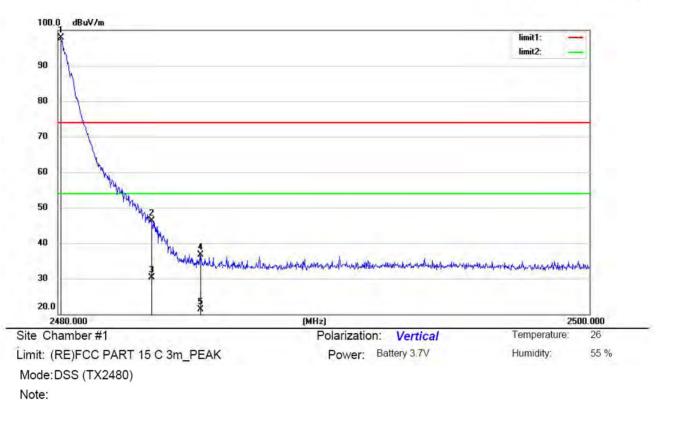
Operator: Lian

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No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	2480.100	117.22	-19.28	97.94	74.00	23.94	peak		0	
2		2483.500	65.64	-19.27	46.37	74.00	-27.63	peak		0	
3		2483.500	49.58	-19.27	30.31	54.00	-23.69	AVG		0	
4		2485.340	56.03	-19.25	36.78	74.00	-37.22	peak		0	
5	i i	2485.340	40.50	-19.25	21.25	54.00	-32.75	AVG		0	

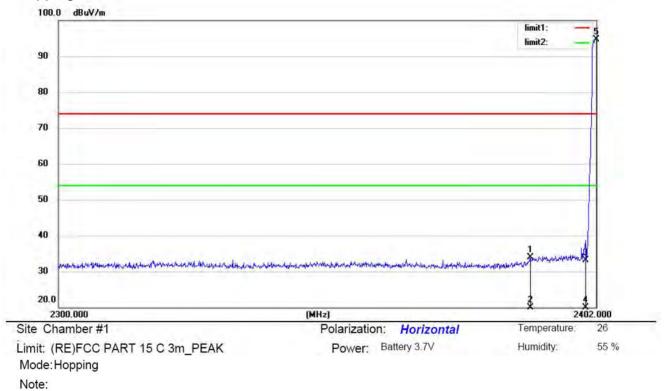
*:Maximum data x:Over limit 1:over margin

Operator: Lian

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For Hopping Mode:



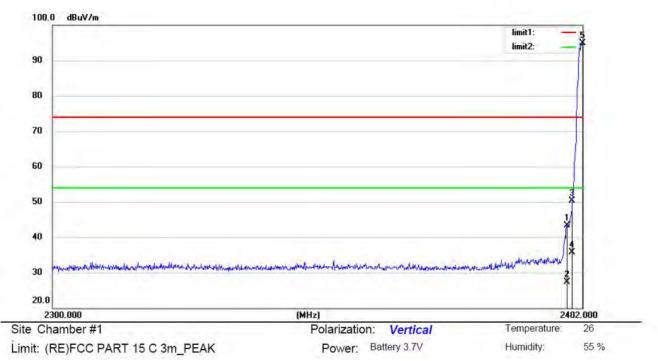
No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2389.250	54.77	-20.96	33.81	74.00	-40.19	peak		0	
2		2389.250	38.15	-20.96	17.19	54.00	-36.81	AVG		0	
3	ş	2400.000	54.05	-20.93	33.12	74.00	-40.88	peak		0	
4	8	2400.000	37.89	-20.93	16.96	54.00	-37.04	AVG		0	
5	*	2402.000	115.65	-20.93	94.72	74.00	20.72	peak		0	

*:Maximum data x:Over limit 1:over margin

Operator: Lian

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Mode:Hopping Note:

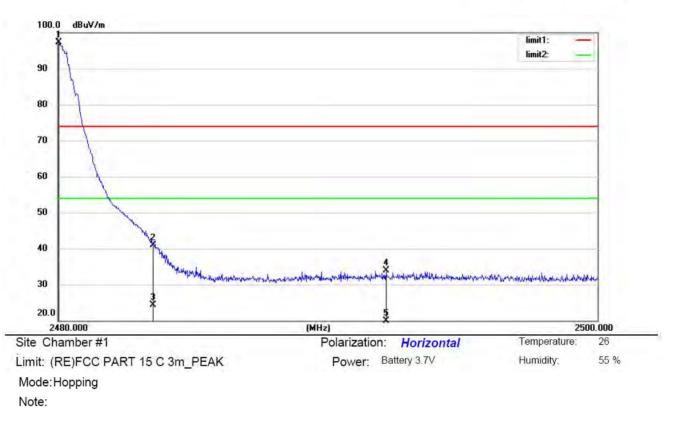
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2398.940	64.14	-20.93	43.21	74.00	-30.79	peak		0	
2		2398.940	48.15	-20.93	27.22	54.00	-26.78	AVG		0	
3		2400.000	71.15	-20.93	50.22	74.00	-23.78	peak		0	
4		2400.000	56.69	-20.93	35.76	54.00	-18.24	AVG		0	
5	*	2401.898	115.80	-20.93	94.87	74.00	20.87	peak		0	

*:Maximum data x:Over limit 1:over margin

Operator: Lian

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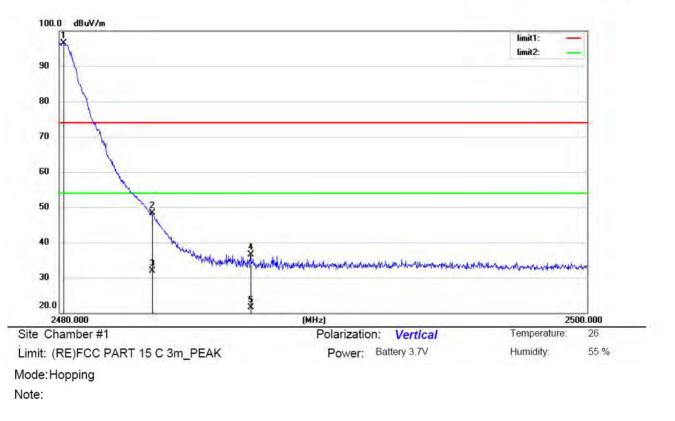
No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
(†		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	2480.020	117.97	-20.71	97.26	74.00	23.26	peak		0	
2		2483.500	61.72	-20.72	41.00	74.00	-33.00	peak		0	
3		2483.500	45.12	-20.72	24.40	54.00	-29.60	AVG		0	
4		2492.160	54.54	-20.69	33.85	74.00	-40.15	peak		0	
5		2492.160	38.14	-20.69	17.45	54.00	-36.55	AVG		0	

*:Maximum data x:Over limit I:over margin

Operator: Lian

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No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	2480.160	115.74	-19.28	96.46	74.00	22.46	peak		0	
2		2483.500	67.62	-19.27	48.35	74.00	-25.65	peak		0	
3		2483.500	51.20	-19.27	31.93	54.00	-22.07	AVG		0	
4		2487.240	55.65	-19.24	36.41	74.00	-37.59	peak		0	
5		2487.240	40.69	-19.24	21.45	54.00	-32.55	AVG		0	

*:Maximum data x:Over limit 1:over margin

Operator: Lian

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14. Antenna Application

14.1 Antenna requirement

The EUT'S antenna is met the requirement of FCC part 15C section 15.203 and 15.247.

FCC part 15C section 15.247 requirements:

Systems operating in the 2402-2480MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

14.2 Result

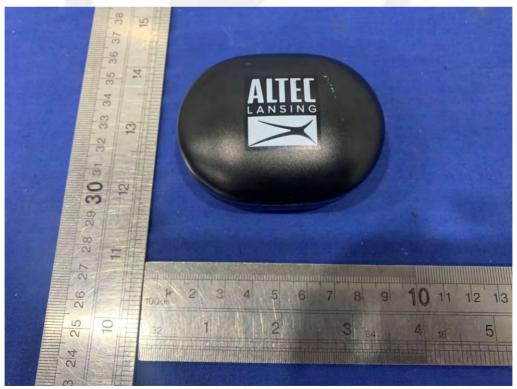
The EUT's antenna, permanent attached antenna, used a PCB antenna and integrated on PCB, The antenna's gain is 0 Bi and meets the requirement.





15. Photos of EUT





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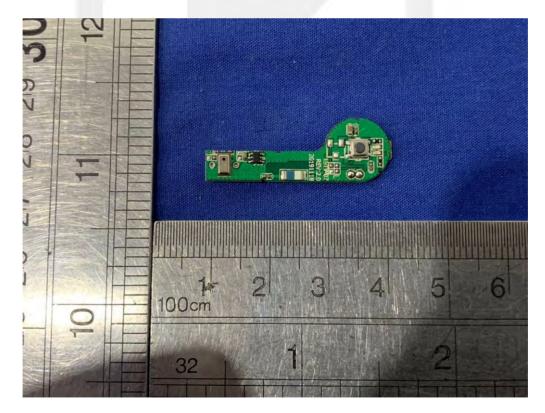
Report No.ES200508025W



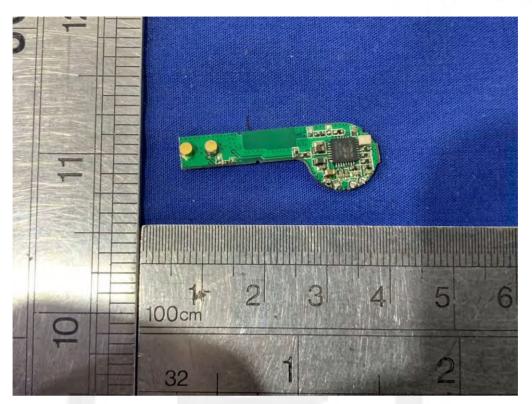


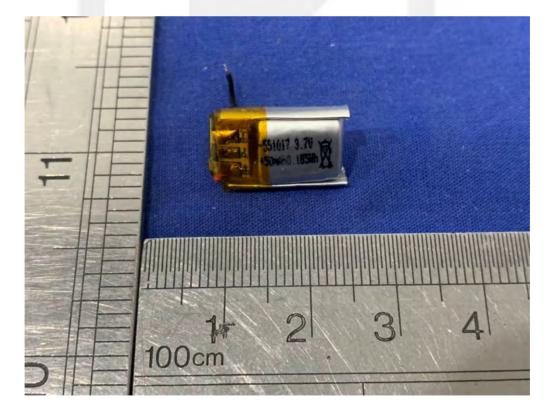
















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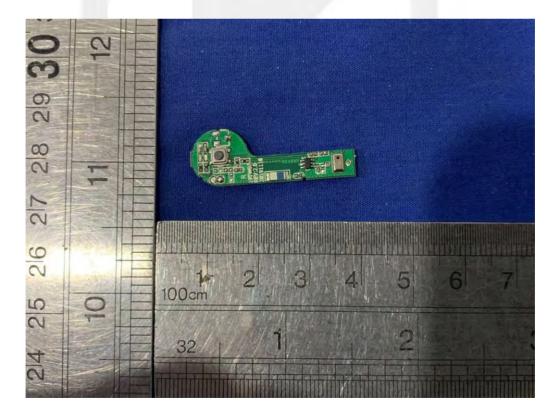
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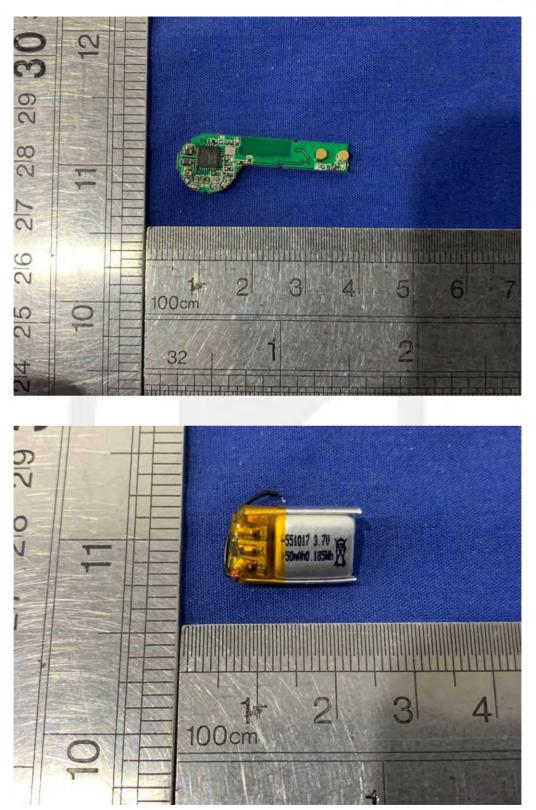












*** End of Report ***

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