

# **TEST REPORT**

Product Name	Bluetooth Wireless LED Color Changing Speaker, Rechargeable Battery
Model Number	<ul> <li>iBT154, iBT154B, iBT154Q, iBT154R, iBT154X</li> <li>(X would be 1 or 2 alphabet(s) combination denote different cabinet color)</li> </ul>
FCC ID	: EMOIBT154A
Prepared for : Address :	SDI Technologies Inc. 1299, Main Street, Rahway, NJ 07065, U.S.A.
Prepared by : Address :	EMTEK (SHENZHEN) CO., LTD. Building 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China
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Report Number	:	ES200226005E
Date(s) of Tests	:	February 26, 2020 to March 20, 2020
Date of issue	:	March 20, 2020

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# **VERIFICATION OF COMPLIANCE**

Applicant:	SDI Technologies Inc 1299, Main Street, Rahway, NJ 07065, U.S.A.
Manufacturer:	SDI Technologies Inc 1299, Main Street, Rahway, NJ 07065, U.S.A.
Factory:	TOP TEAM IDEREK (SHAOGUAN) LIMITED GAOJILING, TAIPING TOWN, SHIXING COUNTY, SHAO GUAN CITY, GUANGDONG PROVINCE, CHINA, China
Product Description:	Bluetooth Wireless LED Color Changing Speaker, Rechargeable Battery
Trade Mark:	iHome
Model Number:	iBT154, iBT154B, iBT154Q, iBT154R, iBT154X (X would be 1 or 2 alphabet(s) combination denote different cabinet color) (note: The models are the same except color of appearance and model number, here we prepare iBT154 for the all test)

## 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	February 26, 2020 to March 20, 2020
Prepared by :	Loven Luo Loren Luo /Editor
Reviewer :	Tim Dong /Supervisor
Approved & Authorized Signer :	Lisa Wang /Manager ESTING

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# **Modified Information**

Version	Summary	Revision Date	Report No.
Ver.1.0	Original Report	1	ES200226005E
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# 1. GENERAL INFORMATION

#### 1.1 Product Description

Characteristics	Description	
Product Name	Bluetooth Wireless LED Color Changing Speaker, Rechargeable Battery	
Model number	iBT154, iBT154B, iBT154Q, iBT154R, iBT154X (X would be 1 or 2 alphabet(s) combination denote different cabinet color)	
Power Supply	DC 5V from adapter, 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)	2.43dBm(0.001750W)	
Antenna Type	Internal PCB antenna	
Antenna Gain	0dBi	

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#### 1.2 Test 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 2016.5.19 The Laboratory has been assessed according to the requirements ISO/IEC 17025.
	Accredited by FCC, August 03, 2017 Designation Number: CN1204 Test Firm Registration Number: 882943
	Accredited by Industry Canada, November 24, 2015 The Certificate Registration Number is 4480A.
	Accredited by A2LA, July 31, 2017 The Certificate Number is 4321.01.
Name of Firm :	EMTEK(SHENZHEN) CO., LTD.
Site Location :	Bldg 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



Table 2-1 Equipment Used in Tested System

Item	Equipment	Trademar k	Model No.	FCC ID	Note
1.	Bluetooth Wireless LED Color Changing Speaker, Rechargeable Battery	iHome	iBT154	EMOIBT154A	EUT
2	Adapter	N/A	Model:ASSA44A-050230 Input:100-240V 50/60Hz 0.5A Max Output:5V	N/A	Support Equipment

#### 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 Complia	
§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 Complian 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, 8DPSK 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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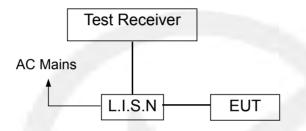


## 6. Conducted Emissions Test

#### 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 Test 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:

Operation Mode:	ТХ	Test Date :	March 11, 2020
Frequency Range:	0.15MHz~30MHz	Temperature :	<b>28</b> ℃
Test Result:	PASS	Humidity :	65 %
Test By:	Loren		

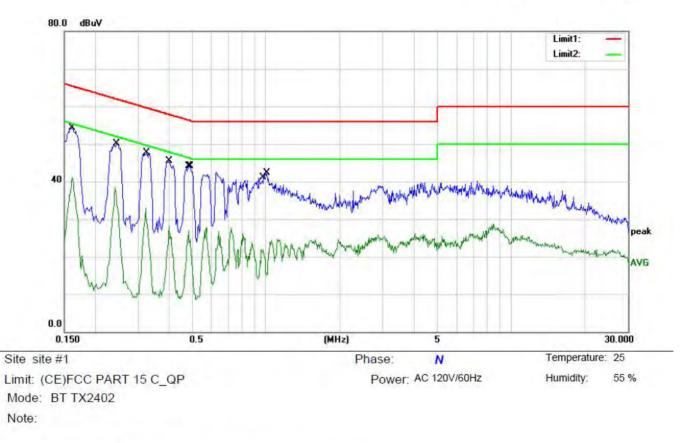
Pass.

Conducted emission at both 120V & 240V, and emission at 120V represents the worst case. All the modulation modes were tested the data of the worst mode (GFSK TX 2402MHz) are recorded in the following pages and the others modulation methods do not exceed the limits.

Please refer to the following data.

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No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	C. A.	<u>.</u>
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1620	44.23	10.02	54.25	65.36	-11.11	QP	
2		0.1620	31.18	10.02	41.20	55.36	-14.16	AVG	
3	1.1	0.2420	28.20	10.05	38.25	52.03	-13.78	AVG	
4		0.2442	40.05	10.06	50.11	61.95	-11.84	QP	
5		0.3220	22.79	10.09	32.88	49.66	-16.78	AVG	
6		0.3260	37.59	10.10	47.69	59.55	-11.86	QP	
7		0.4020	35.27	10.13	45.40	57.81	-12.41	QP	
8		0.4020	18.04	10.13	28.17	47.81	-19.64	AVG	
9		0.4820	16.64	10.17	26.81	46.30	-19.49	AVG	
10		0.4900	33.99	10.18	44.17	56.17	-12.00	QP	
11		0.9780	11.73	10.18	21.91	46.00	-24.09	AVG	
12		1.0180	30.69	10.18	40.87	56.00	-15.13	QP	

\*:Maximum data x:Over limit I:over n

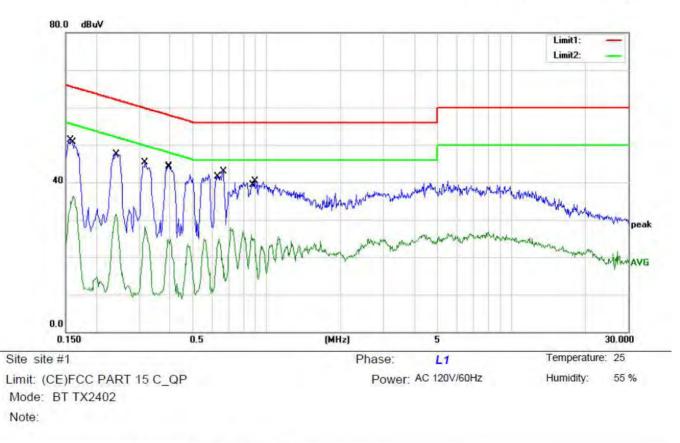
Lover margin

Comment: Factor build in receiver.

Operator: HU

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No. M	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	èr".	
	-	MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1564	41.21	10.01	51.22	65.65	-14.43	QP	
2		0.1620	26.38	10.02	36.40	55.36	-18.96	AVG	
3		0.2420	37.54	10.05	47.59	62.03	-14.44	QP	
4		0.2420	21.48	10.05	31.53	52.03	-20.50	AVG	
5	21	0.3180	35.13	10.09	45.22	59.76	-14.54	QP	
6		0.3180	17.99	10.09	28.08	49.76	-21.68	AVG	
7		0.3955	34.17	10.13	44.30	57.95	-13.65	QP	
8		0.4020	14.59	10.13	24.72	47.81	-23.09	AVG	
9		0.6340	14.68	10.18	24.86	46.00	-21.14	AVG	1
10 '	*	0.6620	32.68	10.18	42.86	56.00	-13.14	QP	
11		0.8660	15.86	10.18	26.04	46.00	-19.96	AVG	2
12		0.8900	30.18	10.18	40.36	56.00	-15.64	QP	

\*:Maximum data

x:Over limit I:over margin

Comment: Factor build in receiver. Operator: HU

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6.5 Conducted Measurement Photos:

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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:

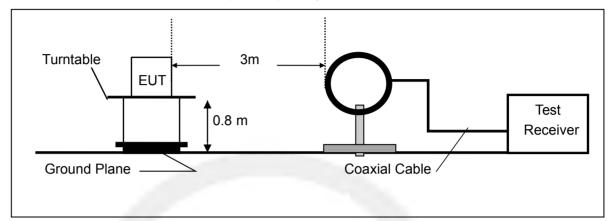
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	Average
Trace	Max hold

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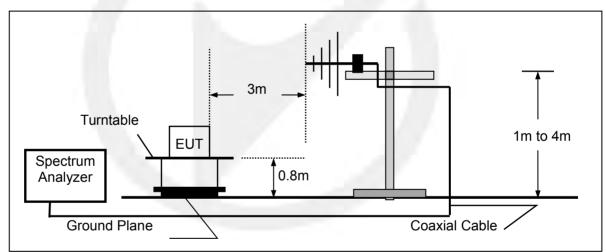


## 7.2 Test SET-UP (Block Diagram of Configuration)

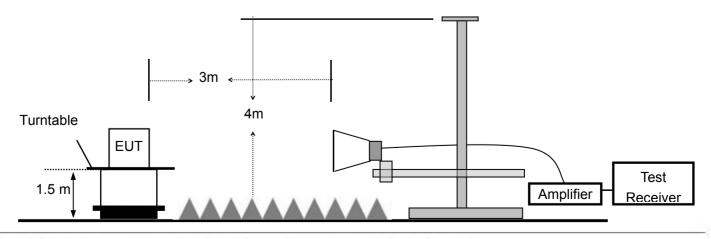
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



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



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



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Report No. ES200226005E



# 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
<sup>1</sup> 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  $\xi$  15.205, and the emissions located in restricted bands also comply with 15.209 limit.

#### 7.5 Measurement Result

Operation Mode:	ТХ	Test Date :	March 11, 2020
Test By:	Loren	Temperature :	<b>28</b> ℃
Test Result:	PASS	Humidity :	65 %
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:

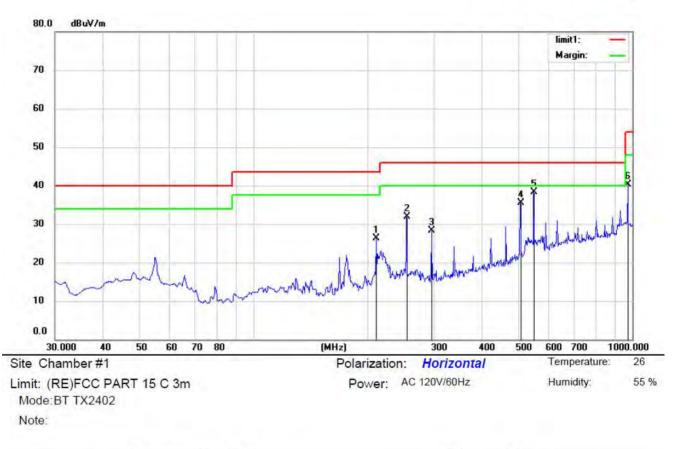
Pass.

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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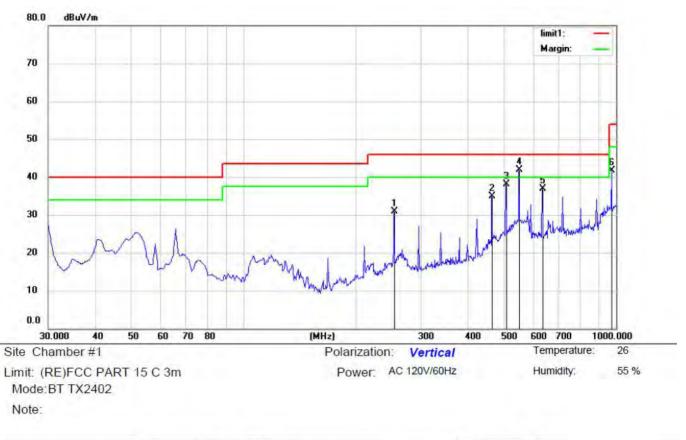
MHz 211.3900	dBuV ) 43,60	dB	dBuV/m	10.111					
211.3900	13.60			dBuV/m	dB	Detector	cm	degree	Comment
	45.00	-17.38	26.22	43.50	-17.28	QP			
254.0700	47.32	-15.51	31.81	46.00	-14.19	QP			
295.7800	42.07	-13.81	28.26	46.00	-17.74	QP			
508.2100	44.20	-8.71	35.49	46.00	-10.51	QP			
550.8900	46.00	-7.71	38.29	46.00	-7.71	QP			
	40 44	-0.09	40.35	54.00	-13.65	QP			
		550.890046.00974.780040.44							

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

Operator: HUANG

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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
	254.0700	46.43	-15.51	30.92	46.00	-15.08	QP			
	465.5300	44.67	-9.78	34.89	46.00	-11.11	QP			
6.2	508.2100	46.80	-8.71	38.09	46.00	-7.91	QP			
*	550.8900	49.70	-7.71	41.99	46.00	-4.01	QP	_		
	635.2800	42.30	-5.45	36.85	46.00	-9.15	QP			
	974.7800	41.79	-0.09	41.70	54.00	-12.30	QP			
	*	MHz 254.0700 465.5300 508.2100	Mk.         Freq.         Level           MHz         dBuV           254.0700         46.43           465.5300         44.67           508.2100         46.80           * 550.8900         49.70           635.2800         42.30	Mk.         Freq.         Level         Factor           MHz         dBuV         dB           254.0700         46.43         -15.51           465.5300         44.67         -9.78           508.2100         46.80         -8.71           * 550.8900         49.70         -7.71           635.2800         42.30         -5.45	Mk.         Freq.         Level         Factor         ment           MHz         dBuV         dB         dBuV/m           254.0700         46.43         -15.51         30.92           465.5300         44.67         -9.78         34.89           508.2100         46.80         -8.71         38.09           * 550.8900         49.70         -7.71         41.99           635.2800         42.30         -5.45         36.85	Mk.         Freq.         Level         Factor         ment         Limit           MHz         dBuV         dB         dBuV/m         dBuV/m           254.0700         46.43         -15.51         30.92         46.00           465.5300         44.67         -9.78         34.89         46.00           508.2100         46.80         -8.71         38.09         46.00           * 550.8900         49.70         -7.71         41.99         46.00           635.2800         42.30         -5.45         36.85         46.00	Mk.         Freq.         Level         Factor         ment         Limit         Over           MHz         dBuV         dB         dBuV/m         dBuV/m         dB           254.0700         46.43         -15.51         30.92         46.00         -15.08           465.5300         44.67         -9.78         34.89         46.00         -11.11           508.2100         46.80         -8.71         38.09         46.00         -7.91           * 550.8900         49.70         -7.71         41.99         46.00         -9.15           635.2800         42.30         -5.45         36.85         46.00         -9.15	Mk.         Freq.         Level         Factor         ment         Limit         Over           MHz         dBuV         dB         dBuV/m         dBuV/m         dB         Detector           254.0700         46.43         -15.51         30.92         46.00         -15.08         QP           465.5300         44.67         -9.78         34.89         46.00         -11.11         QP           508.2100         46.80         -8.71         38.09         46.00         -7.91         QP           * 550.8900         49.70         -7.71         41.99         46.00         -4.01         QP           635.2800         42.30         -5.45         36.85         46.00         -9.15         QP	Mk.         Freq.         Level         Factor         ment         Limit         Over         Height           MHz         dBuV         dB         dBuV/m         dBuV/m         dB         Detector         cm           254.0700         46.43         -15.51         30.92         46.00         -15.08         QP         -           465.5300         44.67         -9.78         34.89         46.00         -11.11         QP         -           508.2100         46.80         -8.71         38.09         46.00         -7.91         QP         -           * 550.8900         49.70         -7.71         41.99         46.00         -4.01         QP         -           635.2800         42.30         -5.45         36.85         46.00         -9.15         QP         -	Mk.         Freq.         Level         Factor         ment         Limit         Over         Height         Degree           MHz         dBuV         dB         dBuV/m         dBuV/m         dB         Detector         cm         degree           254.0700         46.43         -15.51         30.92         46.00         -15.08         QP         -         -           465.5300         44.67         -9.78         34.89         46.00         -11.11         QP         -         -           508.2100         46.80         -8.71         38.09         46.00         -7.91         QP         -         -           * 550.8900         49.70         -7.71         41.99         46.00         -9.15         QP         -         -           635.2800         42.30         -5.45         36.85         46.00         -9.15         QP         -         -

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

Operator: HUANG

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March 11, 2020

#### Above 1000MHz~10<sup>th</sup> Harmonics:

Operation Mode: GFSK (CH1: 2402MHz)

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.

Test Date :

Reading Correct Emission Limit Ant. Freq. Margin(dB) Pol. Level(dBuV/m) Factor Level(dBuV/m) 3m (MHz) H/V ΡK AV dB ΡK AV ΡK AV ΡK AV 4804 V 93.64 73.38 -32.3 61.34 41.08 74 54 -12.66 -12.92 7206 93.09 71.90 -37.2 55.89 34.70 74 -19.30 V 54 -18.11 -23.05 9608 V 91.78 70.75 -39.8 51.98 30.95 74 54 -22.02 12010 V 98.91 74.66 -40.5 58.41 34.16 74 54 -15.59 -19.84 V 71.33 -41.7 74 54 -17.84 -24.37 14412 97.86 56.16 29.63 74 16814 V 93.98 75.34 -40.0 53.98 35.34 54 -20.02 -18.66 4804 н 95.65 72.99 -31.6 64.05 41.39 74 54 -9.95 -12.61 74 7206 Н 96.67 70.65 -35.5 61.17 35.15 54 -12.83 -18.85 9608 97.66 72.53 -38.3 59.36 34.23 74 54 -14.64 -19.77 н 37.53 74 54 12010 Н 93.35 76.53 -39.0 54.35 -19.65 -16.47 14412 Н 92.91 75.37 -42.0 50.91 33.37 74 54 -23.09 -20.63 74 16814 н 94.76 70.99 -39.3 31.69 54 -18.54 -22.31 55.46

Operation Mode: GFSK (CH40: 2441MHz)

Test Date : March 11, 2020

Freq.	Ant.	Rea	ding	Correct	Emis	sion	Li	mit	Marg	in(dB)
	Pol.	Level(d	BuV/m)	Factor	Level(d	BuV/m)	3m(dE	3uV/m)		
(MHz)	H/V	ΡK	AV	dB	PK	AV	PK	AV	PK	AV
4880	V	93.13	70.02	-32.3	60.83	37.72	74	54	-13.17	-16.28
7320	V	94.30	70.69	-37.2	57.1	33.49	74	54	-16.90	-20.51
9760	V	91.97	76.40	-39.8	52.17	36.6	74	54	-21.83	-17.40
12200	V	91.79	76.92	-40.5	51.29	36.42	74	54	-22.71	-17.58
14640	V	96.34	74.26	-41.0	55.34	33.26	74	54	-18.66	-20.74
17080	V	92.08	76.92	-41.1	50.98	35.82	74	54	-23.02	-18.18
4880	н	94.78	73.76	-31.6	63.18	42.16	74	54	-10.82	-11.84
7320	Н	94.86	74.06	-35.5	59.36	38.56	74	54	-14.64	-15.44
9760	н	93.37	75.12	-38.3	55.07	36.82	74	54	-18.93	-17.18
12200	Н	91.63	70.91	-39.0	52.63	31.91	74	54	-21.37	-22.09
14640	н	98.65	72.05	-42.0	56.65	30.05	74	54	-17.35	-23.95
17080	н	93.23	76.62	-41.5	51.73	35.12	74	54	-22.27	-18.88

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Freq.	Ant.	Rea	ding	Correct	Emis	sion	Liı	mit	Marg	in(dB)
	Pol.	Level(d	BuV/m)	Factor	Level(dBuV/m)		IBuV/m) 3m(dBuV/m)			
(MHz)	H/V	PK	AV	dB	PK	AV	PK	AV	PK	AV
4960	V	92.73	70.16	-32.3	60.43	37.86	74	54	-13.57	-16.14
7440	V	97.64	70.41	-37.2	60.44	33.21	74	54	-13.56	-20.79
9920	V	92.57	72.86	-39.8	52.77	33.06	74	54	-21.23	-20.94
12400	V	96.21	72.63	-40.5	55.71	32.13	74	54	-18.29	-21.87
14880	V	93.48	71.01	-41.0	52.48	30.01	74	54	-21.52	-23.99
17360	V	97.82	76.47	-41.1	56.72	35.37	74	54	-17.28	-18.63
4960	Н	92.91	72.69	-31.6	61.31	41.09	74	54	-12.69	-12.91
7440	Н	96.06	76.35	-35.5	60.56	40.85	74	54	-13.44	-13.15
9920	Н	91.81	70.30	-38.3	53.51	32	74	54	-20.49	-22.00
12400	Н	96.44	73.75	-39.0	57.44	34.75	74	54	-16.56	-19.25
14880	Н	95.47	70.27	-42.0	53.47	28.27	74	54	-20.53	-25.73
17360	Н	97.83	70.93	-41.5	56.33	29.43	74	54	-17.67	-24.57

#### Operation Mode: GFSK (CH79: 2480MHz)

#### Test Date : March 11, 2020

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

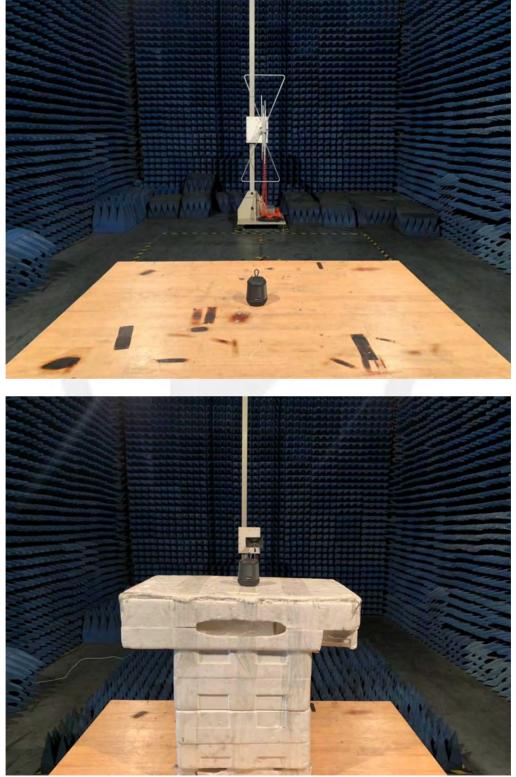
Note: (1) All Readings are Peak Value and AV.

- (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. ES200226005E



## 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:

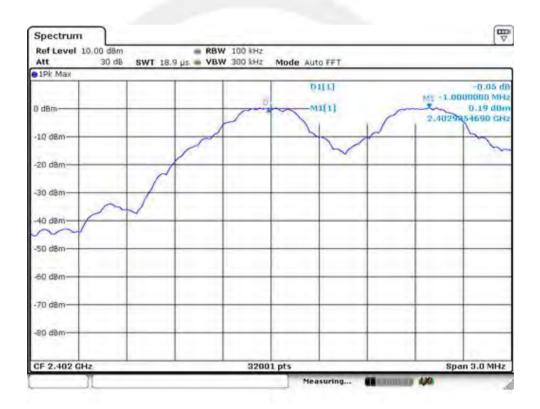
Refer to attached data chart.

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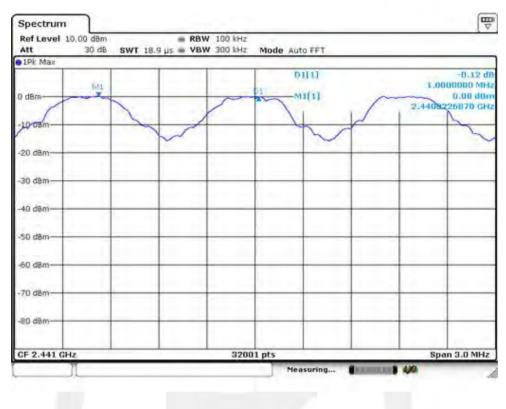


Spectrum Detector:	PK	Test Date :	March 11, 2020
Test By:	Loren	Temperature :	24℃
Test Result: Modulation:	PASS GFSK	Humidity :	53 %

Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1000	>787
40	2441	1000	>781
79	2480	1000	>781







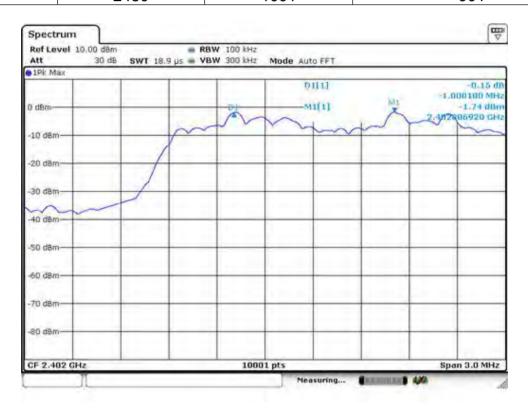


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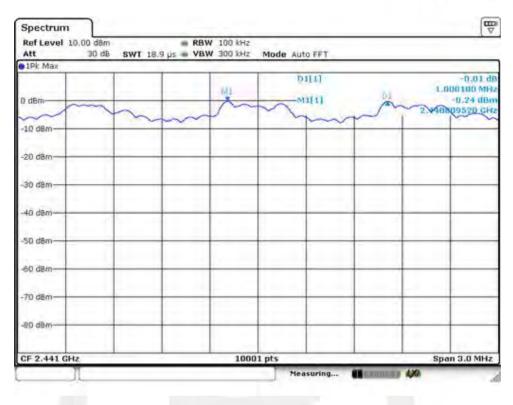
Report No. ES200226005E



Spectrum Detector: Test By:	PK Loren	Test Date : Temperature :	March 11, 2020 24℃
Test Result: Modulation:	PASS П/4-DQPSK	Humidity :	53 %
Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1000	>904
40	2441	1000	>896
79	2480	1001	>901







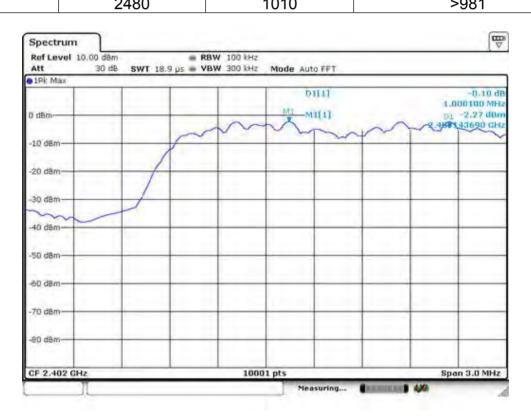


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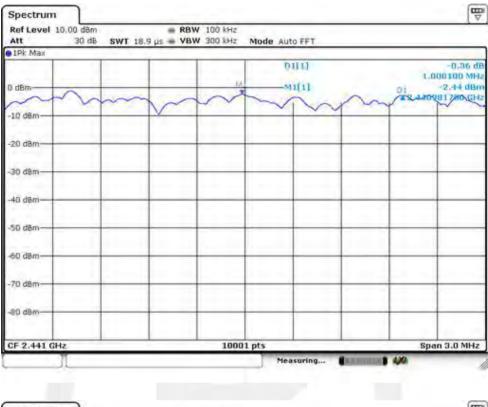
Report No. ES200226005E



Spectrum Detector: Test By: Test Result: Modulation:	PK Loren PASS 8DPSK	Test Date : Temperature : Humidity :	March 11, 2020 24℃ 53 %
Channel number	Channel frequency (MHz)	Separation Read Value (kHz)	Separation Limit 2/3 20dB Down BW(kHz)
1	2402	1000	>975
40	2441	1000	>978
79	2480	1010	>981









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Report No. ES200226005E



## 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 :	March 11, 2020
Test By:	Loren	Temperature :	<b>24</b> °C
Test Result:	PASS	Humidity :	53 %
Modulation:	GFSK		

Channel number	Channel frequency (MHz)	20dB Down BW(kHz)
1	2402	1181
40	2441	1172
79	2480	1172

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IPK Max         D.51 dBm           0 dBm         2.40212590 GH           -10 dBm         2.40212590 GH           -20 dBm         20.00 dB           -30 dBm         0 factor           -70 dBm         0 factor <t< th=""><th>Ref Level 1 Att</th><th>10.00 d8m 30 d8</th><th></th><th>/ 100 kHz / 300 kHz Mod</th><th>e Auto FFT</th><th></th><th></th></t<>	Ref Level 1 Att	10.00 d8m 30 d8		/ 100 kHz / 300 kHz Mod	e Auto FFT		
0 dBm         2.40212590 GH           -10 dBm         -10 dBm           -20 dBm         -21           -20 dBm         -20 dBm           -30 dBm         -20 dBm           -30 dBm         -20 dBm           -20 dBm         -20 dBm           -30 dBm         -20 dBm           -50 dBm         -20 dBm           -70 dBm         -20 d21259 GHz           -70 d1 d1         1           -70 d2259 GHz         -51 dBm           -70 d20 GHz         -11 100 MHz           -71 1         1         2.40	1Pk Max		and at period				
-10 d8m	0 dBm				nde		2.40212590 (20.00
-20 dBm -30 dBm -30 dBm -30 dBm -30 dBm -30 dBm -30 dBm -70	-10 dBm-	-	- /		Qlastor		
40 d8m         -30 d8m <th30 d8m<="" th="">         -30 d8m         <th< td=""><td>-20 dBm</td><td>-</td><td></td><td>-</td><td>1</td><td>The second secon</td><td></td></th<></th30>	-20 dBm	-		-	1	The second secon	
-50 dBm -50 dBm -70	-30 dBm	~				1	
60 dBm         691 pts         Span 3.0 MHz         Marker         70 dBm         71 dBm <th< td=""><td>40 dBm-</td><td>-</td><td></td><td></td><td></td><td>-</td><td>Jam</td></th<>	40 dBm-	-				-	Jam
-70 dBm -70 dBm -70 dBm -80 dBm -70	-50 d8m-	_				-	
S0 dBm         691 pts         Span 3.0 MHz           GF 2.402 GHz         691 pts         Span 3.0 MHz           Marker         Your Function         Function Result           M1         1         2.4021259 GHz         0.51 dBm         ndB down         1.1809 MHz           T1         1         2.4013661 GHz         -19.51 dBm         ndB down         20.00 dB	-60 d8m	_		-		-	-
CF 2.402 GHz         691 pts         Span 3.0 MHz           Marker         Yope         Ref         Trc         X-value         Y-value         Function         Function Result           M1         1         2.4021259 GHz         0.51 dBm         ndB down         1.1809 MHz           T1         1         2.4013661 GHz         -19.51 dBm         ndB         20.00 dB	-70 dBm-	_		-		-	_
Marker         Type         Ref         Trc         X-value         Y-value         Function         Function Result           M1         1         2.4021259 GHz         0.51 dBm         ndB down         1,1809 MHz           T1         1         2.4013661 GHz         -19.51 dBm         ndB         20.00 dB	-80 dBm	-		-		-	
Type         Ref         Trc         X-value         Y-value         Function         Function Result           M1         1         2.4021259 GHz         0.51 dBm         ndB down         1.1809 MHz           T1         1         2.4013661 GHz         -19.51 dBm         ndB         20.00 dB	CF 2.402 G	łz		691 pts			Span 3.0 M
M1         1         2.4021259 GHz         0.51 dBm         ndB down         1.1809 MHz           T1         1         2.4013661 GHz         -19.51 dBm         ndB         20.00 dB							out the second second
T1 1 2.4013661 GHz -19.51 dBm ndB 20.00 dB						Fun	
	T2	1		-19.37 d8m	Q factor		

Ref Level 1 Att	10.00 dBm 30 dB			100 kHz 300 kHz Mo	de Auto FFT		
1Pk Max							
0 dBm			/		ndo Bwi Q factor	-	0.30 dBn 2,44112590 GH 20.00 di 1,172200000 MH 2082,
-20 d8m		6		-		12	
-30 dBm	-					K	-
-40 dBm							
-50 d8m	_						
-60 dBm	-		-			-	-
-70 dBm				+ +	-		
-80 dBm					-	-	
CF 2.441 G	łz		_	691 pt	is .	-	Span 3.0 MHz
Marker							and have a
Type Ref		X-value		Y-value	Function	Fu	nction Result
M1 T1	1	2,441125		0.30 dBm -19.56 dBm	ndB down ndB	-	1,1722 MHz 20.00 d8
T2	1	2.441542		-19.73 dBm	Q factor		2082.5
	77				Measuring		

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Report No. ES200226005E



Ref Level Att	10.00 d8n 30 d8		W 100 kHz W 300 kHz Mod	e Auto FFT		
1Pk Max						
0 dBm			Mi	mi[1]		0.65 dBr 2.47995220 GH 20.00 d
-10 d8m-			1	QTactor		1.172200000 MH 2115,
-20 d8m-	-	-	-		440	
-30 dBm	~				1	
40.d8an						
-50 d8m-	_		-		-	
-60 d8m	_		-		-	
-70 dBm-	_		-	_	-	
-80 d8m	_		-			
CF 2.48 GH	z		691 pts			Span 3.0 MHz
Marker	1.0.1				-	
Type Ref M1	Trc 1	X-value 2.4799522 GHz	Y-value 0.65 dBm	Function ndB down	Fund	tion Result 1.1722 MHz
T1	1	2.4793705 GHz	-19.44 dBm	ndB		20.00 d8
T2	1	2.4805427 GHz	-19.41 dBm	Q factor		2115.6



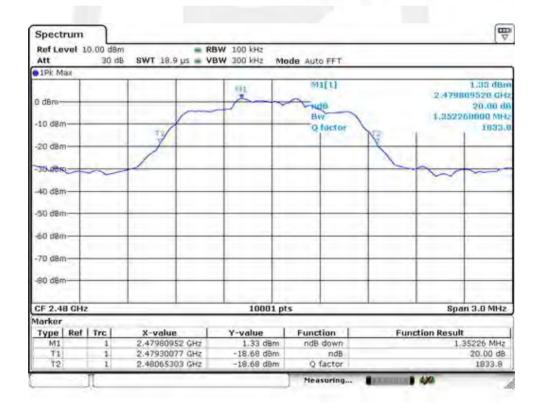
pectrum De est By: est Result: lodulation:	tector:	РК Loren PASS П/4-DQPSK	Ter Hui	t Date : nperature : midity :	Ma 24 <sup>°</sup> 53		2020
	Chanr	nel number		l frequency MHz)		B Down V(kHz)	
Γ		1	2	2402	1	356	
-		40		2441		345	
-		79		<u>441</u> 2480		1352	
L		19	2	400		1352	
Spect Ref Le Att	vel 10.00 dân 30 di		W 100 kHz W 300 kHz M	ode Auto FFT			E
0 dBm- -10 dBm -20 dBm			MI	MI ndB BW/ Q factor		-1.74 db/ 2.401010120 GF 20.00 d 1.356160000 MF 1771	
-30 dBm					6	~ ~	~
-40 dBm	-		+ +			~	~
-50 dBn	1		-	_			-
-60 d8n	-		-				
-70 dBm			-	_		-	_
-80 dBm							
CF 2.4	D2 GHz		10001 p	ts	-	Span :	3.0 MHz
Marker	0.00						
	Ref   Trc	X-value	Y-value	Function	Fund	tion Result	
M1 T1	1	2.40181012 GHz 2.40129567 GHz	-1.74 dBm -21.76 dBm	ndB down ndB	-		516 MHz
T2	1	2.40129567 GHz 2.40265183 GHz	-21.76 d8m	Q factor		4	1771.0
0	JI.			Measuring	ALC: NO.	430	, Ili

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Ref Level 1 Att	10.00 d8n 30 d8		W 100 kHz W 300 kHz Mc	de Auto FFT			
1Pk Max							-
0 dBm	_		MI	m1[1]		2.44001	0.34 dBn 8520 GH 20.00 di
-10 dBm	-			Q factor	100	1.34507	1814.
-20 d8m		1			Na		
-30 dBm-	~				1		~
-40 dBm-	-				-		
-50 d8m	_				-	-	
-60 d8m	-	-			1		_
-70 dBm			-		+	-	
-80 dBm	-		-		-		
CF 2.441 G	łz		10001 pt	s		Span	3.0 MHz
Marker Type   Ref	Trc	X-value	Y-value	Function	Eur	ction Result	
MI	1	2.44081852 GHz	-0.34 dBm	ndB down	- Cur		1507 MHz
T1 T2	1	2.44030527 GHz 2.44165033 GHz	-20.33 dBm	ndB Q factor			20.00 d8 1814.6
	TT	and the state	and a state of	Measuring	Statutes.	4.40	





Spectrum Detector:	PK	Test Date :	March 11, 2020
Test By:	Loren	Temperature :	24℃
Test Result: Modulation:	PASS 8DPSK	Humidity :	53 %

Channel number	Channel frequency	20dB Down
Channel humber	(MHz)	BW(kHz)
1	2402	1463
40	2441	1467
79	2480	1472

Ref Level Att	10.00 dBn 30 dB		W 100 kHz W 300 kHz Mod	e Auto FFT		
1Pk Max						
0 dBm				M1[1] ndB Bw Q factor	Y	-4.59 dBr 2.40204340 GH 20.00 d 1.463100000 MH 1641.
-20 dBm	~~~	Ju -			TE .	
-40 dBm			_			
-50 dBm	-	1				
-60 dBm	-					
-70 dBm						
-80 dBm					-	
CF 2.402 G	Hz		691 pts		-	Span 3.0 MHz
larker						
	Trc	X-value	Y-value	Function	Fun	ction Result
M1 T1	1	2.4020434 GHz 2.4012229 GHz	-4.59 dBm -24.49 dBm	ndB down ndB		1.4631 MHz 20.00 dB
T2	1	2.402686 GHz	-24.62 dBm	Q factor		1641.8



Ref Level : Att	10.00 dBm 30 dB		W 100 kHz W 300 kHz Mod	e Auto FFT		
1Pk Max	_					
0 dBm				M1[1]		-4,84 dBn 2,44091320 GH 20,00 dl 1,467400000 MH 1663,
-20 dBm				Q factor	100	
-30 dBm-	~~~~				5	
-40 dBm	-					
-50 dBm	-		-		-	
-60 dBm	-					
-70 dBm						-
-80 dBm						
CF 2.441 G	Iz	1 1	691 pts			Span 3.0 MHz
Marker						
Type   Ref		X-value	Y-value	Function	Fun	ction Result
M1 T1	1	2.4409132 GHz 2.4402142 GHz	-4.84 dBm -24.74 dBm	ndB down ndB		1.4674 MHz 20.00 dB
T2	1	2.4416816 GHz	-24.65 dBm	Q factor		1663.4
	11			Measuring	COLUMN 1	434

Att	10.00 dBm 30 dB			V 100 kHz V 300 kHz Mo	de Auto FFT		
1Pk Max							
0 dBm			~	11W	M1[1] ndB Bw Q factor	Y	-5.25 dBr 2.47991320 GH 20.00 dl 1.471800000 MH 1685.
-20 dBm		17	-			V2	
-30 dBm	~~	~					
-40 dBm	_					-	
-50 dBm	-	-	-			-	
-60 dBm		-		+ +		-	
-70 dBm		-	_	+ +			
-80 dBm			-				
CF 2.48 GH	z			691 pt	5		Span 3.0 MHz
larker							
Type   Ref	Trc	X-value		Y-value	Function	Fun	ction Result
M1	1	2.479913		-5.25 dBm	ndB down		1.4718 MHz
T1 T2	1	2.479214		-25.32 dBm -25.20 dBm	ndB Q factor		20.00 dB 1685.0



# **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 attache	d data chart
Worst Test Mode	GFSK
Test By:	Loren
Test Result:	PASS

Test Date : Temperature : Humidity : March 11, 2020 25 ℃ 50 %

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

	1 1				0	1111			-0.48 df
M3	алларала	hanandha	аллалала	плалала	аппалла	nnonndan	nonnonno	ÓRRANRAN	78.300,MHz
MAAAA	ANAAAAAA	<b>MANAAAAA</b>	And And A	MAANAAAA	<b>MANAAAAA</b>	MANAN	E WARMAN	<b>MANAA HA</b>	нихаросно
-10 d8m-	-						-		
-20 d8m	-		_	-		-			
30 dBm-	-								
-40 dBm				-			1 = 1		3
-S0 d8m	_						-	_	
-60 dBm				_	-				
-70 dBm	1			-			-		
-80 dBm									

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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 =  $1600 \text{ s}^{-1}$ 

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

- 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.

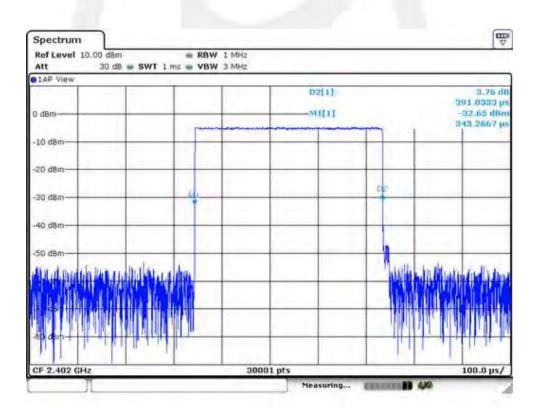
Modulation:	GFSK	Test Date :	March 11, 2020
Test By:	Loren	Temperature :	<b>25</b> ℃
Test Result:	PASS	Humidity :	50 %

#### 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	0.391	125.12	400
DH3	1600/(4*79) x 31.6 =160	1.647	263.52	400
DH5	1600/(6*79) x 31.6 =106.67	2.895	308.80	400

Remark: The results of worst cased was recorded.

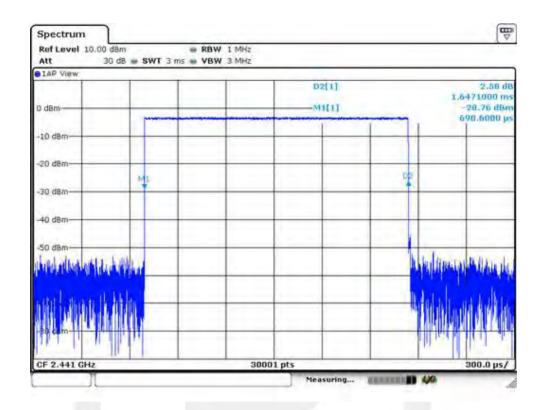
#### DH1:



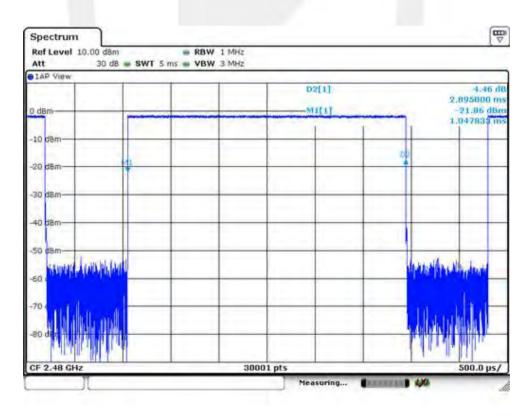
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DH3:



#### 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 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.

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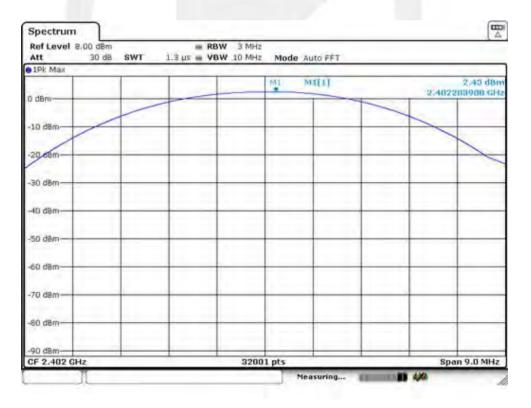


#### 12.4Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	March 11, 2020
Test By:	Loren	Temperature :	<b>25</b> ℃
Test Result:	PASS	Humidity :	50 %
Modulation:	GFSK	-	

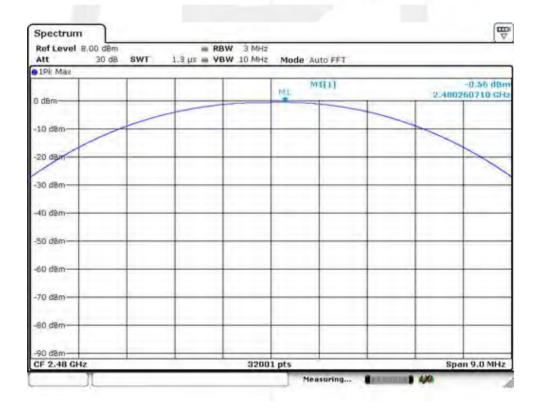
Channel number	Channel Frequency (MHz)	Peak Power output(dBm)	Peak Power output(mW)	Peak Power Limit(mW)	Pass/Fail
01	2402	2.43	1.750	1000	PASS
40	2441	1.03	1.268	1000	PASS
79	2480	-0.56	0.879	1000	PASS



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Ref Level 8.00 dBr Att 30 d		= Ri 1.3 μs = Vi		Node Auto FFT		
1Pk Max		ALC: NOT A		and share to t		
0 d8m			MI	M1[1]	_	1.03 dBm 2.441157780 GHz
a dan	-	-				
-10 dBm-		-				
20 dam-	-	-			-	
-30 dBm		-				
-40 dBm	_	-				
-50 d8m	_				-	
-60 d8m		-				
70 dBm	-				-	
-\$0 dBm	-	-			-	
-90 d8m			32001 pt			Span 9.0 MHz





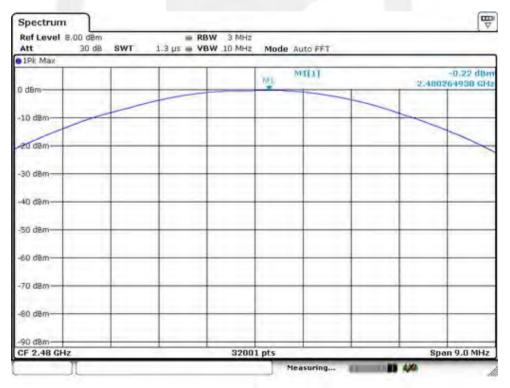
Spectrum Detector:	PK	Test Date :	March 11, 2020
Test By:	Loren	Temperature :	25 ℃
Test Result: Modulation:	PASS П/4-DQPSK	Humidity :	50 %

Channel number	Channel Frequency (MHz)	Peak Power output(dBm)	Peak Power output(mW)	Peak Power Limit(mW)	Pass/Fail
01	2402	-0.82	0.828	125	PASS
40	2441	1.32	1.355	125	PASS
79	2480	-0.22	0.951	125	PASS

Att 30 dB	SWT 1.3 µs = VBW 10 M	Hz Mode Auto FFT	
1		MIL	-0,82 dBn 2,4023260 GH
0 dBm			
10 dBm			
-20 d8m			
-30 dBm			
-40 d8m-			
- D GBM			
-S0 d8m			
-60 dBm			
-70 d8m			
TU UDIN			
-80 dBm-			
			1



fLevel 10.00 d8m RBW 3 MHz t 30 dB SWT 1.3 µs = VBW 10 MHz	Mode Auto FFT	
₽k Max		
Ma	M1[1]	1.32 dBn 2.4405440 GH
Bm		
dBm		
øðm		
d8m-		
d8m-		
dem		
dBm-		
dBm-		
GBm		
dBm		
2.441 GHz 69	11 pts	Span 9.0 MHz





Spectrum Detector:	PK	Test Date :	March 11, 2020
Test By:	Loren	Temperature :	25 ℃
Test Result: Modulation:	PASS 8DPSK	Humidity :	50 %

Channel number	Channel Frequency (MHz)	Peak Power output(dBm)	Peak Power output(mW)	Peak Power Limit(mW)	Pass/Fail
01	2402	-0.44	0.904	125	PASS
40	2441	1.5	1.413	125	PASS
79	2480	1.76	1.500	125	PASS

Ref Level 10.00 d8m Att 30 dB		BW 3 MHz BW 10 MHz Mod	de Auto FFT		
PiPk Max		bti	MILLI	-0 2.4016	44 dBm 220 GHz
0 dBm					_
-10 dBm		-	_		
20 d8pa		-			-
-30 d8m					1
	-				
-40 d8m					
-S0 d8m					
-60 d8m					
-70 dBm					
-SD dBm					
					.0 MHz



Spectrum							₩ V
Ref Level 10.0 Att		1.3 µs = VB	W 3 MHz W 10 MHz 7	Mode Auto FFT			
1Pk Max							201
	1. 1.			MI[1]		- 20	1.50 dBn
) dBm				Y	1	2.44	13390 GH
a deline					1		
10 dBm	1					~	
TO OBIN							
20_d8m							
30 d8m-							-
40 d8m			-		-		
	111				1.1.1		
SD d8m			-				
60 dBm-			-		-		
70 dBm		_	-		-	-	
	_						
SD dBm		_	-				
n	1		691	pts Measuring			
Spectrum Ref Level 10.0			₩ 3 MH2	Measuring	. Constant		
Spectrum Ref Level 10.0 Att		= RB\ 1.3 ps = VB	₩ 3 MH2		<b>(</b> (20010))		
Spectrum Ref Level 10.0 Att			₩ 3 MH2 ₩ 10 MH2 1	Measuring		490	.76 dBn
Spectrum Ref Level 10.0 Att p1Pk Max			₩ 3 MH2	Measuring	(Constant)	490	.76 dBn
Spectrum Ref Level 10.0 Att p1Pk Max			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum Ref Level 10.0 Att 1Pk Max			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum Ref Level 10.0 Att 1Pk Max			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum Ref Level 10.0 Att 10 dBm			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum Ref Level 10.0 Att 10 dBm			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum Ref Level 10.0 Att 119k Max 0 dBm 10 dBm 20.dBm			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum Ref Level 10.0 Att 119k Max 0 dBm 10 dBm 20.dBm			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum Ref Level 10.0 Att 10 dBm 10 dBm 20 dBm 30 dBm			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum Ref Level 10.0 Att 10 dBm 10 dBm 20 dBm 30 dBm			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum Ref Level 10.0 Att 10 dBm 10 dBm 20 dBm 30 dBm 40 dBm			W 3 MHz W 10 MHz 7	Measuring		490	1.76 dBr
Spectrum           Ref Level 10.0           Att           10 dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum           Ref Level 10.0           Att           10 dBm           10 dBm           20 dBm           30 dBm           30 dBm           50 dBm			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum           Ref Level 10.0           Att           10 dBm           10 dBm           20 dBm           30 dBm           40 dBm           50 dBm           60 dBm			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
CF 2.441 GHz			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum           Ref Level 10.0           Att           10/dBm           10/dBm           20/dBm           30/dBm           30/dBm           40/dBm           50/dBm           60/dBm           70/dBm			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum Ref Level 10.0 Att 10 dBm 10 dBm 20 dBm 30 dBm 40 dBm 50 dBm 60 dBm			W 3 MHz W 10 MHz 7	Measuring		490	.76 dBn
Spectrum           Ref Level 10.0           Att           10/dBm           10/dBm           20/dBm           30/dBm           40/dBm           50/dBm           60/dBm           70/dBm			W 3 MHz W 10 MHz 7	Measuring		490	1,76 dBn 96220 CH



# 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

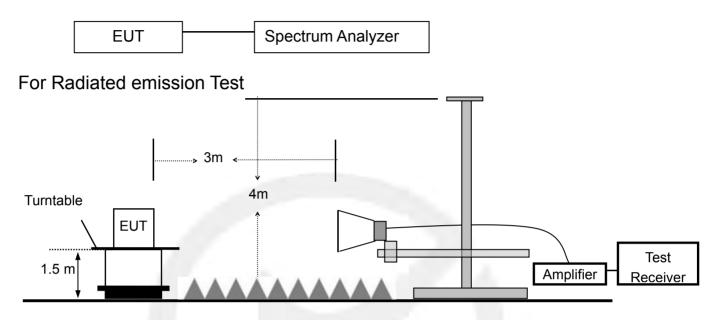
For Non-Restricted Band, When spectrum scanned above 1GHz setting resolution bandwidth 100KHz, video bandwidth 300KHz:

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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Report No. ES200226005E



## 13.4 Measurement Results:

Refer to attached data chart.

Spectrum Detector:	PK	Test Date :	March 11, 2020
Test By:	Loren	Temperature :	<b>25</b> ℃
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)
2401.82	GFSK	-4.42	50.20	>20dBc
2401.82	pi/4-DQPSK	-4.40	51.94	>20dBc
2401.82	8DPSK	-4.41	51.58	>20dBc
2479.82	GFSK	0.62	53.53	>20dBc
2479.82	pi/4-DQPSK	0.56	53.69	>20dBc
2479.82	8DPSK	0.57	53.84	>20dBc

## Test plots of GFSK

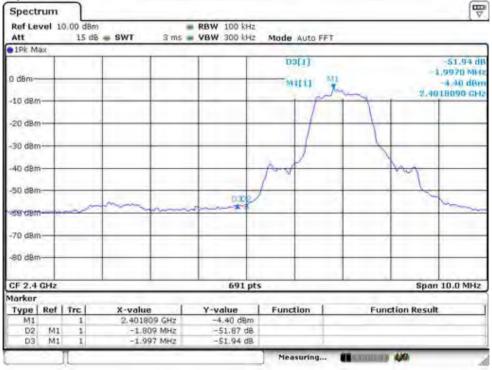
19k Max      0 dBm	-50.20 d -2,0260 MH -4,32 dB 2,4018090 GH
0 dBm MI[1] MI -10 dBm -20 dBm	-2,0260 MH -4,42 dBr
-20 dBm	
40.0m	
	_
-50 dem	The second
-68 dBm	~~~
-70 dBm	
-80 dBm-	
CF 2.4 GHz 691 pts S	pan 10.0 MHz
Marker	
Type Ref Trc X-value Y-value Function Function Re	sult
M1 1 2.401809 GHz -4.42 dBm	
D2 M1 1 -1.809 MHz -49.76 dB D3 M1 1 -2.026 MHz -50.20 dB	

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Ref Lev Att		0.00 d8m 15 d8	- SWT		RBW 100 VBW 300		Mode	Auto F	FT			
• 1Pk Ma	X											
0 dBm	1	T T						3[1]				-53.53 d 4.6090 MH 0.62 dB 798100 GH
-10 dBm	1	2										
-20 d8m	A	-	1	-	-	+-	_	-	-			+
1.1	1		1							- 1		
-30 dBm	-	_	1	1				1	-			1
40 dBm	_		1	-	_			-	_			
			1									
-50 d8m-	+		-	1	-	-	0	-	-		-	1
-60 d8m			1		m	the	~!	15	m	in	m	him
-ou dem-			1						-			
-70 dBm	-	_	-	-	-	-	_	-	-			-
-S0 dBm-	+	_		-	-	-	_	1	-			1
CF 2.48	DE CI	1.		-		91 pts	_				Ona	n 10.0 MHz
Marker	35 6	12		_	0.	ri pis		_	_	_	apa	H 10.0 MH2
Type	Ref	Trc	X-valu	e I	Y-value	1	Fund	tion		Func	tion Resu	lt
M1		1	2.47	981 GHz	0.62	dBm			-			
D2 D3	M1 M1	1		03 MHz 589 MHz	-56.6		_	_				
03	but	A.	4.0	10.4 10112	-95.5	5 UD	_	_	_			

## Test plots of pi/4-DQPSK

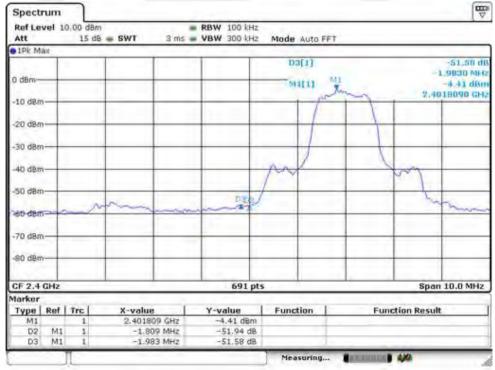


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Ref Lev Att		0.00 d8m 15 d8	. SWT		<ul> <li>RBW 100 kH</li> <li>VBW 300 kH</li> </ul>		uto FFT			
• 1Pk Ma	X									
0 dBm—	A	143 X				Mil D3[			-4,6 7	53.69 di 910 MH 1.56 dBn 100 GH
-10 dBm	7		1				-			
-20 d8m	1	_	11	-		-	_	-		
			15							
-58 d8m	-		V	1						
-40 dBm	-		-	1				-		
				1				-		
-50 d8m	-		1	120	mil	- Contraction	-			
-60 d8m	-	_	-	-		nd	-	him	m	
								1.0		
-70 dBm	1	-		-				-		
-80 d8m	-	_	-	-				-		
CF 2.48	35 GI	Hz	1		691 p	ts			Span 1	0.0 MHz
Marker					10.0					-
Туре	Ref		X-valu		Y-value	Functio	on	Fun	ction Result	-
M1 D2	MI	1		981 GHz 903 MHz	0.56 dBm -57.14 dB		-	-		-
02	MI	1		531 MHz	-57.14 de					
	-	17				1	ring	an annual sea	4.90	

## Test plots of 8DPSK



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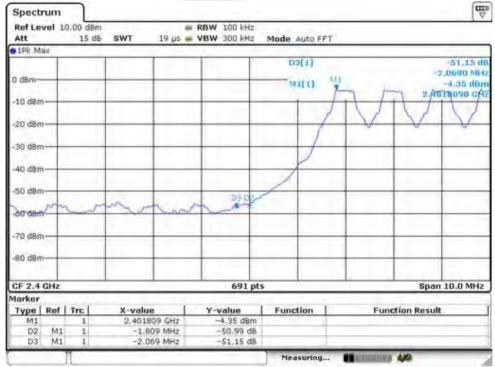
Ref Le Att	vel 1	0.00 d8n 15 d8	S - SWT		RBW 100 kHz VBW 300 kHz	Mode	uto FFT			
1Pk M	ax			_		Bal	-1			-
0 dBm—	M	M:				D3				-53.84 d .6749 MF 11.37 dBr
-10 dBm	++	_	A	_		1	_	1	2,47	98100 GH
-20 d8m	+	-	1	-	-		-	-		_
30 dB/r	+	-	hur	1	+ +			-		
40 dBm	-			1				-		
-50 d8n	-			100	mill	-	ma.			
60 d8a	-	-				~		Y		
70 dBm	+		-			-		1		
80 dBm	+									
CF 2.4	835 G	Hz	-	-	691 pt	s	_	-	Span	10.0 MH
tarker								-		
Type M1	Ref	Trc	X-value 2.4798		Y-value 0.57 dBm	Functi	on	Fun	ction Result	-
D2	M1	1		3 MHz	-56.95 dB	-				
D3	M1	1		4 MHz	-53.84 dB	-				



## For Hopping Mode:

Frequency (MHz)	Modulation	Peak Power Output(dBm)	Result of Band edge(dBc)	Band edge Limit(dBc)
2401.82	GFSK	-4.35	51.15	>20dBc
2401.82	pi/4-DQPSK	-4.57	41.13	>20dBc
2401.82	8DPSK	-4.42	37.92	>20dBc
2479.82	GFSK	0.23	53.74	>20dBc
2479.82	pi/4-DQPSK	0.36	53.86	>20dBc
2479.82	8DPSK	0.43	53.39	>20dBc

## Test plots of GFSK



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Ref Level 1 Att	0.00 d8m 15 d8	the second se	RBW 100 kHz VBW 300 kHz	Mode Auto FFT		
1Pk Max			1	D3[1]		-53,74
MI				00[1]		5,7450 MI
a dama	1			311[1]		0,23 dB
do dam					-	2.4789110 G
V	)	Den la				
-20 d8m	-		-		-	
-30 dBm					-	
40 d8m-						
HU GBIN						
-50 d8m-		-		102	-	
			house.	min	m	min
60 d8m			1 1 1 1	- Maria		- solar s
-70 dBm						
so dam	_				-	
CF 2.4835 G	Hz	<u> </u>	691 pts		-	Span 10.0 MH
tarker			- 10 C - 10 C - 10	1		17. 17. 18. 19. 19. 19. 19. 19. 19. 19. 19. 19. 19
Type   Ref		X-value	Y-value	Function	Fun	ction Result
M1	1	2.478811 GHz	0.23 dBm		-	
D2 M1 D3 M1	1	4.6889 MHz 5.745 MHz	-59.13 dB -53.74 dB			

# Test plots of pi/4-DQPSK

Ref Le	vel 10	0.00 d8m	- SWT		RBW 100 kHz VBW 300 kHz				[ <del>"</del>
PIPK M	ex.	15 00	ani	5 115	YOW SOU KHE	MODE AU	0 PF1		
0 dBm-						03[1] M1[1]		~~~~	-41,13 d -1,9680 MH -4,57 dBr -4,57 dBr
				-	1				
-20 dBm	-	_	1						
-30 dBm		-		_			-		
-40 dBm	-	-		-	DE	Smit		-	
-50 d8m	-								
s	~	~~	1 m	10		-		-	
-60 dBm	-				1		-		-
-70 dBm	+	-		_	-	-	-		_
-80 dBm	+	-					-		
CF 2.4	GHz	_		-	691 p	ts	-	-	Span 10.0 MHz
Marker		* 1				1			
Type M1	Ref	1	X-value 2.40180	0.697	-4.57 dBm	Function	-	Functio	n Result
D2 D3	M1 M1	1	-1.80	9 MHz	-40.56 dB -41.13 dB		1		
_	-	11				Measuri			0

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Ref Lev Att	el 10	0.00 d8m 15 d8	- SWT		RBW 100 k VBW 300 k		Mode Auto F	FT			
1Pk Ma	X										
0 gBm	-	~					D3[1]				-53.86 ( 5.6730 Mi 0.36 dB (99110 G)
-10 dBm-	-	_	1	-	-	-		-	1	2,47	89110 G
-20 d8m-	-	-	1	-	-	_	_	-	-	_	
-30 dBm-	+	-	Vo	1	-	-			+		
-40 dBm-	+	-		1	-	-		-	+	-	-
-50 d8m-	+	_	-	The		2	Us		-		1
-60 d8m-	+	-	-	-		~	~	m	min	min	
-70 dBm-	+		-	-		-		-	+	-	
-80 dBm-	+	-						-	+		
CF 2.48	35 GI	Hz	-	-	691	pts		_	_	Span	10.0 MH
tarker		* 1							-		
Type M1	Ref	Trc	X-valu 2 4799	B 11 GHz	Y-value 0.36 dB	705	Function		Functio	on Result	-
D2 D3	M1 M1	1	4.68	89 MHz 73 MHz	-57.65 (	.8t					
	-					-	Measuring.	-		1.01	_

# Test plots of 8DPSK

Spectru Ref Leve	1 10.0		- Loss		RBW 100 kHz	-	-			[œm
Att	_	15 dB	SWT	3 ms =	VBW 300 kHz	Mode	Auto FF	T		
1Pk Max		-								
0 dBm	-						1[1]	mou		-4.42 dBr 048050 GH -37.92 d 7-8046 AM
-10 d8m-	-						1	100	1	1
-20 d8m-	-	-		-	-			-	-	-
-30 d8m	+			-	-	-	d		-	
-40 d8m-	+	-		-	The second	N		-	-	-
-50 d8m-	-	~	~~~	h~		-	1	-	-	-
-60 d8m-	-	-				_		-	-	
-70 dBm-	-	-				_		-	-	
-80 dBm	-	-					-			
CF 2.4 G	-lz	-	-	-	691 pt	s		_	Spa	n 10.0 MHz
Marker										
Type R M1	et T	1	X-valu 2 4049	e IOS GHZ	Y-value -4.42 dBm	Fund	tion	Fu	nction Resu	it .
D2	M1 M1	1	-4.80	46 MHz 37 MHz	-37.92 dB -39.09 dB	-				_
	11	-				Mea	suring	Real Property lies	. 430	

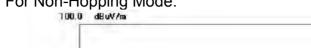
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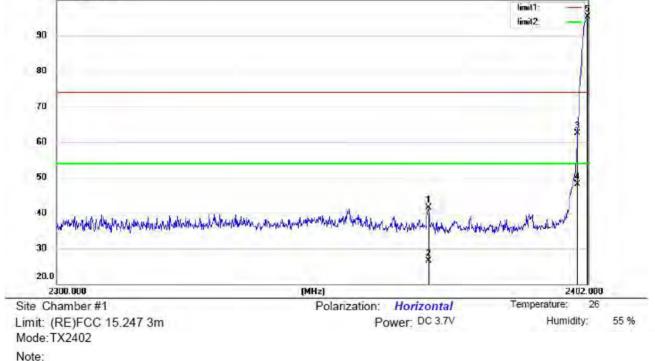


Ref Le	vel 1	0.00 d8n 15 d8	s wr		RBW 100 kHz VBW 300 kHz	Mode Auto	FFT			
1Pk Mi	эx									
0 dBm;	~~		-			D3[1]				-53.39 di ,7020 MH 0.48 dBn 98100 GH
-10 dBm	-	-	A	-		1	-	-		
-20 d8m	+	_	1	-	-	_		-	_	
-30 dBm	-		hard	1						
40 dBm	+		-	1				-	-	-
-50 dBm	-	_	-	In	man			-	-	
60 d8m	+	_	-				-	m	~~~	m
70 dBm	+		-	-	-	_	-	-	-	-
-80 dBm	+	-	-	-			-	-	-	
CF 2.4	135 G	Hz		-	691 pt	5		-	Span	10.0 MHz
Marker								-		
Type M1	Ref	Trc	X-valu 2 47	981 GHz	Y-value 0.43 dBm	Function	-	Functio	n Result	_
D2 D3	M1 M1	1	3.6	203 MHz 732 MHz	-53.91 d8 -53.39 dB	_	-			
-	-	11				Measuring			0	



#### 2. Radiated emission Test Worst test modulation 8DPSK For Non-Hopping Mode:





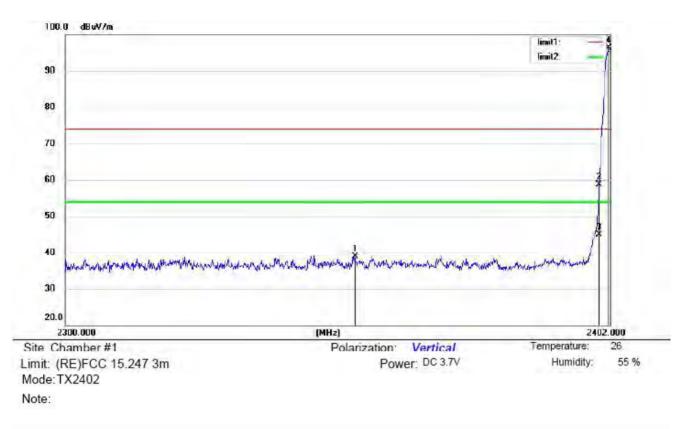
No.	Mk.	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	1	Antenna Height	Table Degree	
		MHz	dBu∀	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2370.992	60.21	-18.67	41.54	74.00	-32.46	peak		261	
2	}	2370.992	45.25	-18.67	26.58	54.00	-27.42	AVG			
3	į	2400.000	81.09	-18.50	62.59	74.00	-11.41	peak			
4		2400.000	66.58	-18.50	48.08	54.00	-5.92	AVG			
5	*	2401.796	113.73	-18.49	95.24	74.00	21.24	peak			

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

Operator: HU

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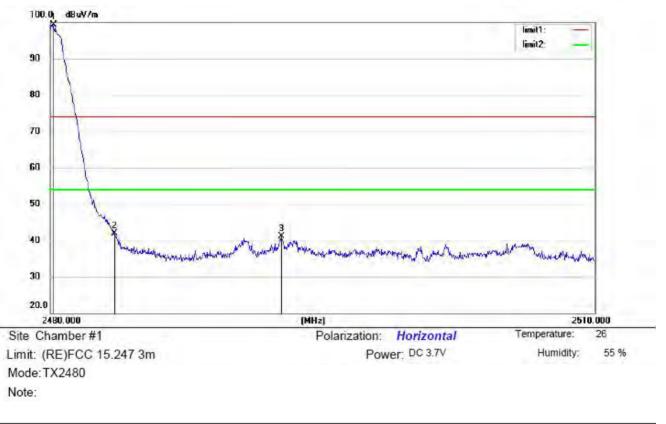
No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over			Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		2353.652	57.73	-18.77	38.96	74.00	-35.04	peak			
2		2400.000	77.14	-18.50	58.64	74.00	-15.36	peak			
3		2400.000	63.47	-18.50	44.97	54.00	-9.03	AVG			
4	*	2401.694	114.86	-18.49	96.37	74.00	22.37	peak			

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

Operator: HU

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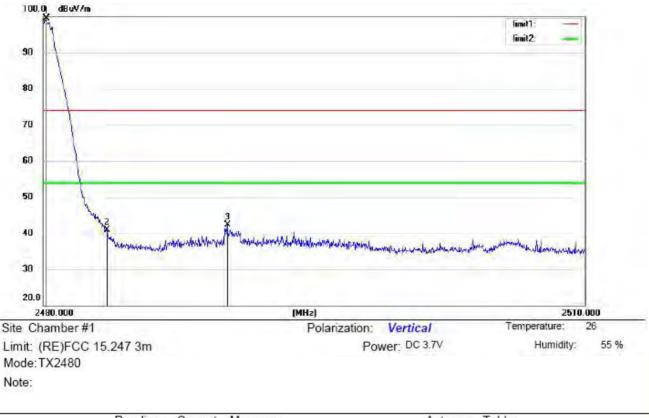
No.	Mk	. Freq.	Reading Level		Measure- ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBu∨	dB	dBuV/m	dBu∨/m	dB	Detector	cm	degree	Comment
1	*	2480.150	117.35	-18.03	99.32	74.00	25.32	peak			
2		2483.500	59.99	-18.01	41.98	74.00	-32.02	peak			
3		2492.690	58.98	-17.96	41.02	74.00	-32.98	peak			

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

Operator: HU

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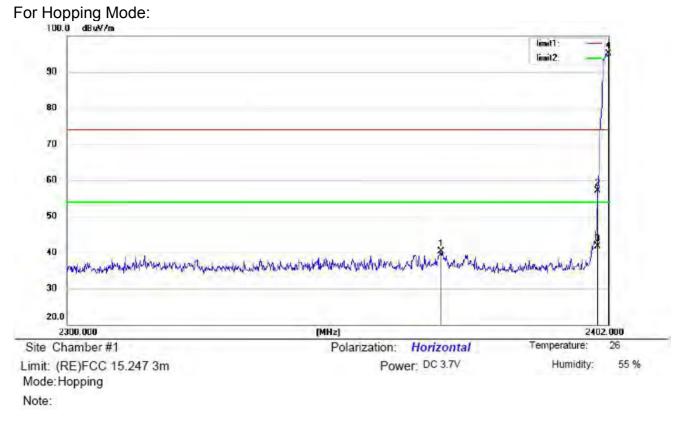
No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height		
		MHz	dBuV	dB	dBu∀/m	dBu\//m	dB	Detector	cm	degree	Comment
1	*	2480.150	117.53	-18.03	99.50	74.00	25.50	peak			
2	- 6	2483.500	58.94	-18.01	40.93	74.00	-33.07	peak			
3		2490.170	60.25	-17.97	42.28	74.00	-31.72	peak			

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

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No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	0	Antenna Height		
		MHz	dBu∨	dB	dBuV/m	dBu∀/m	dB	Detector	cm	degree	Comment
1		2369.972	58.88	-18.68	40.20	74.00	-33.80	peak			And a second of a second
2		2400.000	75.70	-18.50	57.20	74.00	-16.80	peak			
3		2400.000	60.20	-18.50	41.70	54.00	-12.30	AVG			
4	*	2402.000	113.65	-18.49	95.16	74.00	21.16	peak			

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

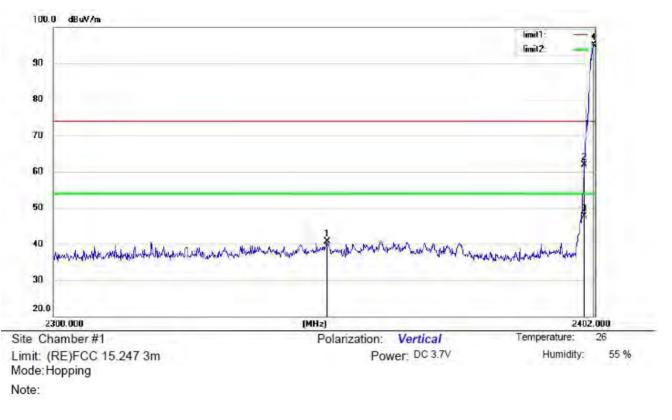
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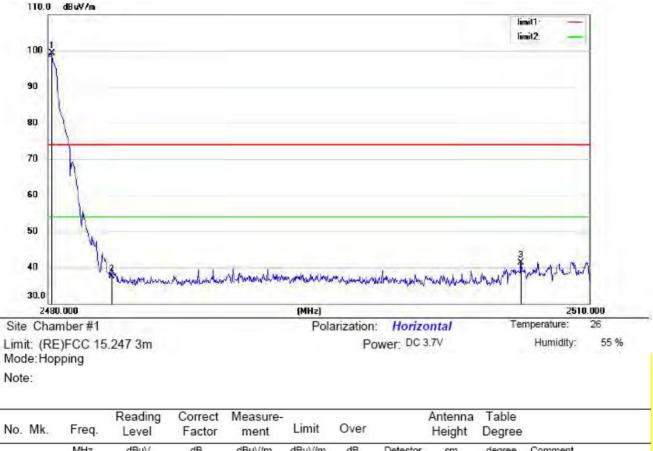
No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	0		Table Degree	
		MHz	dBuV	dB	dBuV/m	dBu∀/m	dB	Detector	cm	degree	Comment
1		2351.000	59.45	-18.78	40.67	74.00	-33.33	peak			
2		2400.000	80.42	-18.50	61.92	74.00	-12.08	peak			
3		2400.000	66.14	-18.50	47.64	54.00	-6.36	AVG			
4	*	2401.694	113.62	-18.49	95.13	74.00	21.13	peak			

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

Operator: HU

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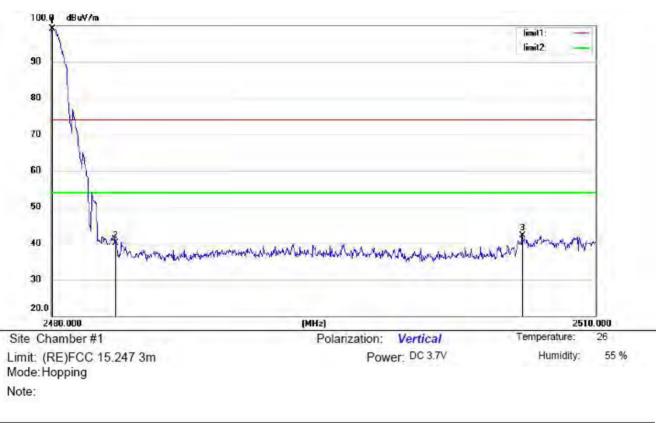
	-1873C - 1973CD 1973CD 197								3	
	MHz	dBuV	dB	dBu∀/m	dBuV/m	dB	Detector	cm	degree	Comment
1 *	2480.180	117.31	-18.03	99.28	74.00	25.28	peak			
2	2483.500	55.55	-18.01	37.54	74.00	-36.46	peak			
3	2506.190	59.10	-17.89	41.21	74.00	-32.79	peak			

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

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No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over		Antenna Height		
		MHz	dBu∀	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	2480.030	117.12	-18.03	99.09	74.00	25.09	peak		15	
2		2483.500	58.19	-18.01	40.18	74.00	-33.82	peak			
3		2505.950	59.98	-17.89	42.09	74.00	-31.91	peak			

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

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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.





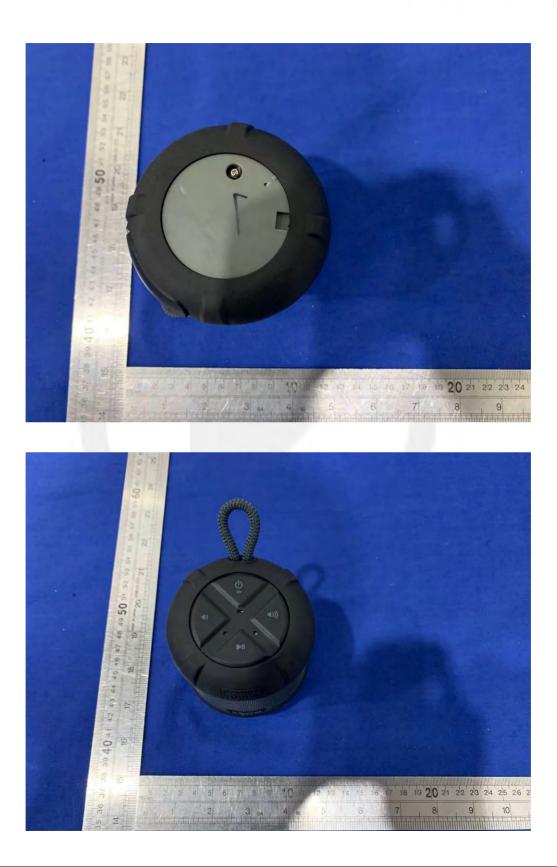
# 15. Photos of EUT





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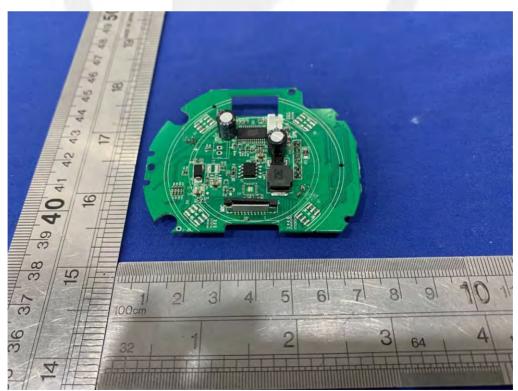


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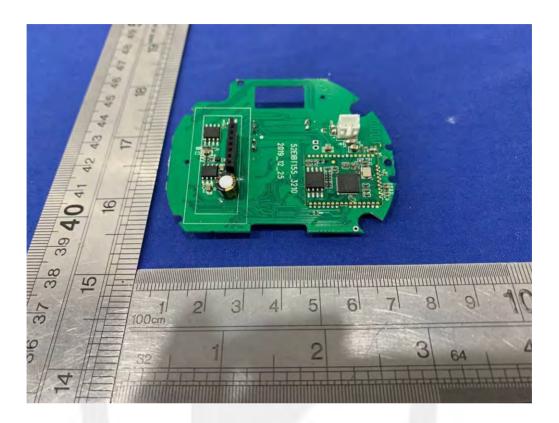
Report No. ES200226005E





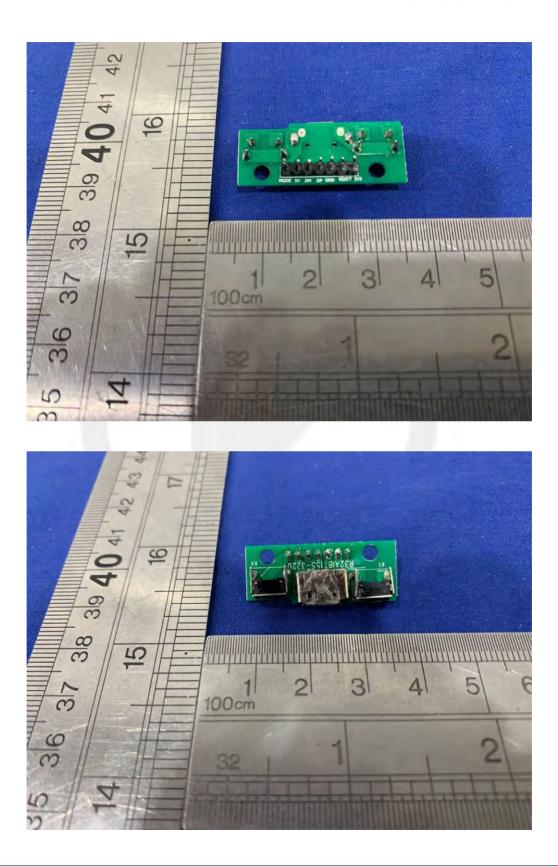








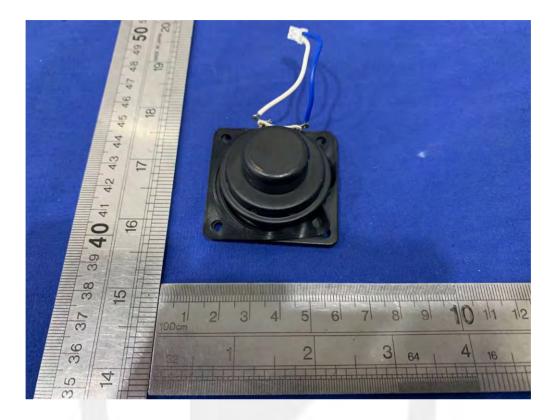




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Report No. ES200226005E







\*\*\* End of Report \*\*\*

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