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Report No.:UNIA2018113011FR-01

FCC RADIO TEST REPORT

FCC ID: YKBFBT1-035

Product : Wireless TWS earphones Trade Name : N/A Model Name : Melomania 1 Serial Model : N/A Report No. : UNIA2018113011FR-01

Prepared for

Audio Partnership PLC

Gallery Court, Hankey Place, London, SE1 4BB, United Kingdom

Prepared by

Shenzhen United Testing Technology Co., Ltd.

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深圳市优耐检测技术有限公司 Shenzhen United Testing Technology Co.,Ltd. United Testing Technology(Hong Kong) Limited

TEST RESULT CERTIFICATION

Applicant's name:	Audio Partnership PLC
Address:	Gallery Court, Hankey Place, London, SE1 4BB, United Kingdom
Manufacture's Name	Audio Partnership PLC
Address	Gallery Court, Hankey Place, London, SE1 4BB, United Kingdom
Product description	
Product name:	Wireless TWS earphones
Trade Mark:	N/A
Model and/or type reference :	Melomania 1
Difference	N/A

Standards FCC Rules and Regulations Part 15 Subpart C Section 15.247 ANSI C63.10: 2013

This device described above has been tested by Shenzhen United Testing Technology Co., Ltd., and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test	
Date (s) of performance of tests	
Date of Issue	
Test Result	

Nov. 26, 2018 ~Dec. 6, 2018 Dec. 7, 2018 Pass

Prepared by:

Reviewer:

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11. TEST SUMMARY

1.1 TEST PROCEDURES AND RESULTS

DESCRIPTION OF TEST CONDUCTED EMISSIONS TEST RADIATED EMISSION TEST BAND EDGE OCCUPIED BANDWIDTH MEASUREMENT MAXIMUM PEAK OUTPUT POWER FREQUENCY SEPARATION CONDUCTED BANDEGE MEASUREMENT SPURIOUS RF CONDUCTED EMISSION NUMBER OF HOPPING FREQUENCY TIME OF OCCUPANCY(DWELL TIME) ANTENNA REQUIREMENT RESULT COMPLIANT COMPLIANT COMPLIANT COMPLIANT COMPLIANT COMPLIANT COMPLIANT COMPLIANT COMPLIANT

1.2 TEST FACILITY

Test Firm : Shenzhen United Testing Technology Co., Ltd.

Address

: 2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.The testing quality system of our laboratory meets with ISO/IEC-17025 requirements, which is approved by CNAS. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

CNAS-LAB Code: L6494

The EMC Laboratory has been assessed and in compliance with CNAS-CL01 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2017 General Requirements) for the Competence of testing Laboratories.

Designation Number: CN1227

Test Firm Registration Number: 674885

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files.

1.3 MEASUREMENT UNCERTAINTY

Measurement Uncertainty

Conducted Emission Expanded Uncertainty

Radiated emission expanded uncertainty(9kHz-30MHz)

Radiated emission expanded uncertainty(30MHz-1000MHz)

Radiated emission expanded uncertainty(Above 1GHz)

=	2.23dB,	k=2
=	3.08dB,	k=2

= 4.42dB, k=2

= 4.06dB, k=2



22. GENERAL INFORMATION

2.1 2.1 GENERAL DESCRIPTION OF EUT

Equipment	Wireless TWS earphones	
Trade Mark	N/A	
Model Name	Melomania 1	
Serial No.	N/A	
Model Difference	N/A	
FCC ID	YKBFBT1-035	
Antenna Type	Internal Antenna	
Antenna Gain	1.4dBi	
Frequency Range	2402-2480MHz	
Number of Channels	79CH	
Modulation Type	GFSK, π/4 DQPSK, 8DPSK	
Battery	Model: M1254S3-A 3.7V+55mAh	
Power Source DC 3.7V from Battery or DC 5V from PC with AC 120(240)V/60Hz		

Note:

- 1. The EUT consists of a pair of headphones, divided into left and right headphone. The software and electric circuit of the two headphones are the same.
- 2. This report shows the right headphone.

Table for auxiliary equipment:

Equipment Description	quipment Description Manufacturer		Calibration Due Date	
Notebook	Lenovo	Lenovo G475	GB14477457	



2.22.2 Carrier Frequency of Channels

			Chann	el List			S
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	21	2423	42	2444	63	2465
01	2403	22	2424	43	2445	64	2466
02	2404	23	2425	44	2446	65	2467
03	2405	24	2426	45	2447	66	2468
04	2406	25	2427	46	2448	67	2469
05	2407	26	2428	47	2449	68	2470
06	2408	27	2429	48	2450	69	2471
07	2409	28	2430	49	2451	70	2472
08	2410	29	2431	50	2452	71	2473
09	2411	30	2432	51	2453	72	2474
10	2412	31	2433	52	2454	73	2475
11	2413	32	2434	53	2455	74	2476
12	2414	33	2435	54	2456	75	2477
13	2415	34	2436	55	2457	76	2478
14	2416	35	2437	56	2458	77	2479
15	2417	36	2438	57	2459	78	2480
16	2418	37	2439	58	2460	1	
17	2419	38	2440	59	2461		20
18	2420	39	2441	60	2462		
19	2421	40	2442	61	2463		
20	2422	41	2443	62	2464		1

2.3 2.3 Operation of EUT during testing

Operating Mode

The mode is used: Transmitting mode Low Channel: 2402MHz Middle Channel: 2441MHz High Channel: 2480MHz Test SW Version: InstallBlueSuiteCda_3_1_3_637

2.4 2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during Conducted testing:



EUT

Operation of EUT during Radiation testing:

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2.5 2.5 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
		CONDUCTED	EMISSIONS TEST	-	
1	AMN	Schwarzbeck	NNLK8121	8121370	2019.9.9
2	AMN	ETS	3810/2	00020199	2019.9.9
3	EMI TEST RECEIVER	Rohde&Schwarz	ESCI	101210	2019.9.9
4	AAN	TESEQ	T8-Cat6	38888	2019.9.9
é.		RADIATED	EMISSION TEST		
1	Horn Antenna	Sunol	DRH-118	A101415	2019.9.29
2	BicoNILog Antenna	Sunol	JB1 Antenna	A090215	2019.9.29
3	PREAMP	HP	8449B	2008A00160	2019.9.9
4	PREAMP	HP	8447D	2944A07999	2019.9.9
5	EMI TEST RECEIVER	Rohde&Schwarz	ESR3	101891	2019.9.9
6	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	2019.9.28
7	Signal Generator	Agilent	E4421B	MY4335105	2019.9.28
8	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2019.9.28
9	MXA Signal Analyzer	Agilent	N9020A	MY51110104	2019.9.9
10	ANT Tower&Turn table Controller	Champro	EM 1000	60764	2019.9.28
11	Anechoic Chamber	Taihe Maorui	9m*6m*6m	966A0001	2019.9.9
12	Shielding Room	Taihe Maorui	6.4m*4m*3m	643A0001	2019.9.9
13	RF Power sensor	DARE	RPR3006W	15100041SNO88	2019.3.14
14	RF Power sensor	DARE	RPR3006W	15100041SNO89	2019.3.14
15	RF power divider	Anritsu	K241B	992289	2019.9.28
16	Wideband radio communication tester	Rohde&Schwarz	CMW500	154987	2019.9.28
17	Biconical antenna	Schwarzbeck	VHA 9103	91032360	2019.9.8
18	Biconical antenna	Schwarzbeck	VHA 9103	91032361	2019.9.8
19	Broadband Hybrid Antennas	Schwarzbeck	VULB9163	VULB9163#958	2019.9.8
20	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1680	2019.1.12
21	Active Receive Loop Antenna	Schwarzbeck	FMZB 1919B	00023	2019.11.02
22	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170651	2019.03.14
23	Microwave Broadband Preamplifier	Schwarzbeck	BBV 9721	100472	2019.10.24
24	Active Loop Antenna	Com-Power	AL-130R	10160009	2019.05.10
25	Power Meter	KEYSIGHT	N1911A	MY50520168	2019.05.10
26	Frequency Meter	VICTOR	VC2000	997406086	2019.05.10
27	DC Power Source	HYELEC	HY5020E	055161818	2019.05.10
		Tes	t software		-
1	E3	Audix	6.101223a	N/A	N/A

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33. CONDUCTED EMISSIONS TEST

3.1 Conducted Power Line Emission Limit

For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following

		Maximum RF Lii	ne Voltage(dBµV)	2
Frequency	CLASS A		CLASS B	
(MHz)	Q.P.	Ave.	Q.P.	Ave.
0.15~0.50	79	66	66~56*	56~46*
0.50~5.00	73	60	56	46
5.00~30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

3.2 Test Setup



3.3 Test Procedure

- 1, The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10.
- 2, Support equipment, if needed, was placed as per ANSI C63.10.
- 3, All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
- 4, If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5, All support equipments received AC power from a second LISN, if any.
- 6, The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7, Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.

3.4 Test Result

Pass

Remark:

All modes were tested at AC 120V and 240V, only the worst result of AC 120V was reported.
 All modes of Low, Middle, and High channel were tested, only the worst result of High Channel was reported as below:

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Temperature:	26°C	Relative Humidity:	48%		
Test Date:	Dec. 4, 2018	Pressure:	1010hPa		
Test Voltage:	AC 120V, 60Hz	Phase:	Line		
Test Mode:	Transmitting mode of GFSK 2480MHz				



		Read	LISN	Cable		Limit	Over	
	Freq	Level	Factor	Loss	Level	Line	Limit	Remark
7	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.16	22.73	9.69	0.24	32.66	55.43	-22.77	Average
2	0.16	35.34	9.69	0.24	45.27	65.43	-20.16	QP
3	0.19	25.35	9.65	0.24	35.24	53.84	-18.60	Average
4	0.19	40.11	9.65	0.24	50.00	63.84	-13.84	QP
5	0.29	23.73	9.62	0.25	33.60	50.46	-16.86	Average
6	0.29	37.12	9.62	0.25	46.99	60.46	-13.47	QP
7	0.39	17.05	9.60	0.25	26.90	47.99	-21.09	Average
8	0.39	36.22	9.60	0.25	46.07	57.99	-11.92	QP
9	0.49	19.16	9.58	0.25	28.99	46.14	-17.15	Average
10	0.49	31.56	9.58	0.25	41.39	56.14	-14.75	QP
11	1.12	18.08	9.59	0.26	27.93	46.00	-18.07	Average
12	1.12	25.73	9.59	0.26	35.58	56.00	-20.42	QP

Remark: Factor = Insertion Loss + Cable Loss, Result = Reading + Factor, Margin = Result - Limit.

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	Read	LISN	Cable		Limit	Over	
Freq	Level	Factor	Loss	Level	Line	Limit	Remark
MHz	dBuV	dB	dB	dBuV	dBuV	dB	3
0.16	20.91	9.49	0.24	30.64	55.30	-24.66	Average
0.16	38.51	9.49	0.24	48.24	65.30	-17.06	QP
0.20	23.67	9.56	0.25	33.48	53.71	-20.23	Average
0.20	41.20	9.56	0.25	51.01	63.71	-12.70	QP
0.30	21.32	9.58	0.25	31.15	50.28	-19.13	Average
0.30	37.25	9.58	0.25	47.08	60.28	-13.20	QP
0.40	21.51	9.59	0.25	31.35	47.90	-16.55	Average
0.40	34.23	9.59	0.25	44.07	57.90	-13.83	QP
0.50	18.28	9.59	0.25	28.12	46.01	-17.89	Average
0.50	33.20	9.59	0.25	43.04	56.01	-12.97	QP
1.55	16.82	9.58	0.27	26.67	46.00	-19.33	Average
1.55	28.82	9.58	0.27	38.67	56.00	-17.33	QP
	Freq MHz 0.16 0.20 0.20 0.30 0.30 0.40 0.40 0.40 0.50 0.50 1.55 1.55	Read Freq Level MHz dBuV 0.16 20.91 0.16 38.51 0.20 23.67 0.20 41.20 0.30 21.32 0.30 37.25 0.40 21.51 0.40 34.23 0.50 18.28 0.50 33.20 1.55 16.82 1.55 28.82	Read LISN Freq Level Factor MHz dBuV dB 0.16 20.91 9.49 0.16 38.51 9.49 0.20 23.67 9.56 0.20 41.20 9.56 0.30 21.32 9.58 0.40 21.51 9.59 0.40 34.23 9.59 0.50 18.28 9.59 0.50 33.20 9.59 1.55 16.82 9.58 1.55 28.82 9.58	Read LISN Cable Freq Level Factor Loss MHz dBuV dB dB 0.16 20.91 9.49 0.24 0.16 38.51 9.49 0.24 0.20 23.67 9.56 0.25 0.20 41.20 9.56 0.25 0.30 21.32 9.58 0.25 0.30 37.25 9.58 0.25 0.40 21.51 9.59 0.25 0.40 34.23 9.59 0.25 0.50 18.28 9.59 0.25 0.50 33.20 9.59 0.25 1.55 16.82 9.58 0.27 1.55 28.82 9.58 0.27	Read LISN Cable Freq Level Factor Loss Level MHz dBuV dB dB dBuV 0.16 20.91 9.49 0.24 30.64 0.16 38.51 9.49 0.24 48.24 0.20 23.67 9.56 0.25 33.48 0.20 41.20 9.56 0.25 51.01 0.30 21.32 9.58 0.25 31.15 0.30 37.25 9.58 0.25 47.08 0.40 21.51 9.59 0.25 44.07 0.50 18.28 9.59 0.25 28.12 0.50 33.20 9.59 0.25 43.04 1.55 16.82 9.58 0.27 26.67 1.55 28.82 9.58 0.27 38.67	Read LISN Cable Limit Freq Level Factor Loss Level Line MHz dBuV dB dB dBuV dBuV 0.16 20.91 9.49 0.24 30.64 55.30 0.16 38.51 9.49 0.24 48.24 65.30 0.20 23.67 9.56 0.25 33.48 53.71 0.20 41.20 9.56 0.25 51.01 63.71 0.30 21.32 9.58 0.25 31.15 50.28 0.30 37.25 9.58 0.25 31.35 47.90 0.40 21.51 9.59 0.25 31.35 47.90 0.40 34.23 9.59 0.25 28.12 46.01 0.50 18.28 9.59 0.25 43.04 56.01 1.55 16.82 9.58 0.27 26.67 46.00 1.55 28.82 9.58 0.27 </td <td>Read LISN Cable Limit Over Freq Level Factor Loss Level Line Limit MHz dBuV dB dB dBuV dBuV dB 0.16 20.91 9.49 0.24 30.64 55.30 -24.66 0.16 38.51 9.49 0.24 48.24 65.30 -17.06 0.20 23.67 9.56 0.25 33.48 53.71 -20.23 0.20 41.20 9.56 0.25 51.01 63.71 -12.70 0.30 21.32 9.58 0.25 31.15 50.28 -19.13 0.30 37.25 9.58 0.25 47.08 60.28 -13.20 0.40 21.51 9.59 0.25 31.35 47.90 -16.55 0.40 34.23 9.59 0.25 28.12 46.01 -17.89 0.50 33.20 9.59 0.25 43.04 56.01</td>	Read LISN Cable Limit Over Freq Level Factor Loss Level Line Limit MHz dBuV dB dB dBuV dBuV dB 0.16 20.91 9.49 0.24 30.64 55.30 -24.66 0.16 38.51 9.49 0.24 48.24 65.30 -17.06 0.20 23.67 9.56 0.25 33.48 53.71 -20.23 0.20 41.20 9.56 0.25 51.01 63.71 -12.70 0.30 21.32 9.58 0.25 31.15 50.28 -19.13 0.30 37.25 9.58 0.25 47.08 60.28 -13.20 0.40 21.51 9.59 0.25 31.35 47.90 -16.55 0.40 34.23 9.59 0.25 28.12 46.01 -17.89 0.50 33.20 9.59 0.25 43.04 56.01

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4. RADIATED EMISSION TEST

4.1 Radiation Limit

For unintentional device, according to § 15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Distance (Meters)	Radiated (dBµV/m)	Radiated (µV/m)
30-88	3	40	100
88-216	3	43.5	150
216-960	3	46	200
Above 960	3	54	500

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

4.2 Test Setup

1. Radiated Emission Test-Up Frequency Below 30MHz



2. Radiated Emission Test-Up Frequency 30MHz~1GHz



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3. Radiated Emission Test-Up Frequency Above 1GHz



4.3 Test Procedure

- 1. Below 1GHz measurement the EUT is placed on turntable which is 0.8m above ground plane. And above 1GHz measurement EUT was placed on low permittivity and low tangent turn table which is 1.5m above ground plane.
- 2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 6. Repeat above procedures until the measurements for all frequencies are complete.
- 7. The test frequency range from 9KHz to 25GHz per FCC PART 15.33(a).
- 8. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Bilog Antenna	3
1GHz-18GHz	Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

Note:

For battery operated equipment, the equipment tests shall be performed using a new battery.

4.4 Test Result

PASS

Remark:

1. All modes of GFSK, $\pi/4$ DQPSK, 8DPSK were test at Low, Middle, and High channel, only the worst result of GFSK High Channel was reported for below 1GHz test.

2. For BT3.0 above 1GHz test all modes of GFSK, $\pi/4$ DQPSK, and 8DPSK were test at Low, Middle, and High channel, only the worst result of GFSK DH5 was reported.

3. By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "Z axis" position was the worst, and test data recorded in this report.

4. Radiated emission test from 9KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9KHz to 30MHz and not recorded in this report.

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Below 1GHz Test Results:

Temperature:	22°C	Relative Humidity:	48%				
Test Date:	Dec. 4, 2018	Pressure:	1010hPa				
Test Voltage:	AC 120V, 60Hz	Polarization:	Horizontal				
Test Mode:	le: Transmitting mode of GFSK 2480MHz						



		Read.	Antenna	Cable		Limit	Over	
	Freq	Level	Factor	Loss	Level	Line	Limit	Remark
,	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	31.18	36.88	14.30	0.31	20.09	40.00	-19.91	QP
2	38.48	45.09	13.30	0.16	27.19	40.00	-12.81	QP
3	44.90	39.80	13.24	0.12	21.76	40.00	-18.24	QP
4	50.06	39.57	13.00	0.12	21.31	40.00	-18.69	QP
5	137.42	37.22	14.87	0.23	21.12	43.50	-22.38	QP
6	146.89	38.27	15.38	0.23	22.65	43.50	-20.85	OP

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit Factor = Ant. Factor + Cable Loss – Pre-amplifier

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Temperature:	22℃	Relative Humidity:	48%				
Test Date:	Dec. 4, 2018	Pressure:	1010hPa				
Test Voltage:	AC 120V, 60Hz	Polarization:	Vertical				
Test Mode:	Transmitting mode of GFSK 2480MHz						



	ReadAntenna			Cable		Limit	Over	
	Freq	Level	Factor	Loss	Level	Line	Limit	Remark
-	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB	
1	35.62	40.12	12.89	0.22	21.86	40.00	-18.14	QP
2	43.20	44.05	13.33	0.13	26.12	40.00	-13.88	QP
3	47.99	46.92	13.09	0.12	28.74	40.00	-11.26	QP
4	56.20	44.60	12.30	0.13	25.67	40.00	-14.33	QP
5	144.33	39.76	15.32	0.23	24.08	43.50	-19.42	QP
6	244.23	42.28	12.25	0.40	23.98	46.00	-22.02	QP

Remark: Absolute Level = Reading Level + Factor, Margin = Absolute Level – Limit Factor = Ant. Factor + Cable Loss – Pre-amplifier

Remark:

- (1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHz was verified, and no any emission was found except system noise floor.
- (2) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (3) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.

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Above 1 GHz Test Results (GFSK Worst Case): CH Middle (2402MHz)

Horizontal:

		2				
Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2402	111.18	-5.81	105.37	114.00	-8.63	PK
2402	81.05	-5.83	75.22	94.00	-18.78	AV
4804	60.11	-3.62	56.49	74.00	-17.51	PK
4804	49.95	-3.62	46.33	54.00	-7.67	AV
7206	56.99	-0.98	56.01	74.00	-17.99	PK
7206	47.18	-0.98	46.20	54.00	-7.80	AV
Remark: Fact	or = Antenna	Factor + Cabl	e Loss – Pre-ampli	ifier. Margin =	Absolute Le	vel – Limit

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector			
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре			
2402	110.36	-5.81	104.55	114.00	-9.45	PK			
2402	81.21	-5.83	75.38	94.00	-18.62	AV			
4804	60.28	-3.62	56.66	74.00	-17.34	PK			
4804	50.63	-3.62	47.01	54.00	-6.99	AV			
7206	56.19	-0.98	55.21	74.00	-18.79	РК			
7206	46.85	-0.98	45.87	54.00	-8.13	AV			
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier Margin = Absolute Level – Limit									

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CH Middle (2441MHz)

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector	
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре	
2441	110.88	-5.81	105.07	114.00	-8.93	РК	
2441	81.17	-5.83	75.34	94.00	-18.66	AV	
4882	60.69	-3.62	57.07	74.00	-16.93	PK	
4882	49.82	-3.62	46.20	54.00	-7.80	AV	
7323	56.14	-0.98	55.16	74.00	-18.84	PK	
7323	46.33	-0.98	45.35	54.00	-8.65	AV	
Remark: Fact	emark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2441	110.35	-5.71	104.64	114.00	-9.36	PK
2441	82.05	-5.71	76.34	94.00	-17.66	AV
4882	61.18	-3.51	57.67	74.00	-16.33	PK
4882	50.22	-3.51	46.71	54.00	-7.29	AV
7323	56.21	-0.82	55.39	74.00	-18.61	PK
7323	45.99	-0.82	45.17	54.00	-8.83	AV
Remark: Fact	tor = Antenna	Factor + Cabl	e Loss – Pre-ampl	ifier. Margin =	Absolute Le	evel – Limit

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CH High (2480MHz) Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2480	111.81	-5.65	106.16	114.00	-7.84	PK
2480	82.11	-5.65	76.46	94.00	-17.54	AV
4960	60.23	-3.43	56.80	74.00	-17.20	PK
4960	49.62	-3.43	46.19	54.00	-7.81	AV
7440	56.33	-0.75	55.58	74.00	-18.42	PK
7440	46.99	-0.75	46.24	54.00	-7.76	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2480	111.08	-5.65	105.43	114.00	-8.57	PK
2480	81.77	-5.65	76.12	94.00	-17.88	AV
4960	60.63	-3.43	57.20	74.00	-16.80	РК
4960	49.25	-3.43	45.82	54.00	-8.18	AV
7440	56.18	-0.75	55.43	74.00	-18.57	PK
7440	47.32	-0.75	46.57	54.00	-7.43	AV

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier. Margin = Absolute Level – Limit

Remark :

(1) Measuring frequencies from 1 GHz to the 25 GHz.

(2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.

(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.

(4) Data of measurement within this frequency range shown "--- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for peak measurement with peak detector at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 10Hz for Average measurement with peak detection at frequency above 1GHz.

(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.

(7)All modes of operation were investigated and the worst-case emissions are reported.



5. BAND EDGE

5.1 Limits

FCC PART 15.247 Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

5.2 Test Procedure

The band edge compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW to 1MHz and VBM to 3MHz to measure the peak field strength and set RBW to 1MHz and VBW to 10kHz to measure the average radiated field strength. The conducted RF band edge was measured by using a spectrum analyzer. Set span wide enough to capture the highest in-band emission and the emission at the band edge. Set RBW to 100 KHz and VBW to 300 KHz, to measure the conducted peak band edge.

5.3 Test Result

PASS

Remark: All modes of GFSK, $\pi/4$ DQPSK, 8DPSK were tested, only the worst result of GFSK was reported as below:



Radiated Band Edge Test:

Worst case on GFSK

Operation Mode: TX CH Low (2402MHz)

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2310	56.24	-5.81	50.43	74	-23.57	PK
2310	49.24	-5.81	43.43	54	-10.57	AV
2390	56.04	-5.84	50.20	74	-23.80	PK
2390	49.65	-5.84	43.81	54	-10.19	AV
2400	57.46	-5.84	51.62	74	-22.38	PK
2400	49.84	-5.84	44.00	54	-10.00	AV
Remark: Fact	or = Antenna Facto	or + Cable Lo	oss – Pre-amplifier	i.	2	

Vertical:			1			-
Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2310	56.48	-5.81	50.67	74	-23.33	РК
2310	48.97	-5.81	43.16	54	-10.84	AV
2390	55.75	-5.84	49.91	74	-24.09	РК
2390	48.69	-5.84	42.85	54	-11.15	AV
2400	57.81	-5.84	51.97	74	-22.03	PK
2400	48.52	-5.84	42.68	54	11.32	AV
Remark: Fac	tor = Antenna Facto	or + Cable L	oss – Pre-amplifier			

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Operation Mode: TX CH High (2480MHz)

Horizontal :

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2483.5	56.41	-5.65	50.76	74.00	-23.24	РК
2483.5	48.54	-5.65	42.89	54	-11.11	AV
2500	55.85	-5.72	50.13	74.00	-23.87	PK
2500	48.47	-5.72	42.75	54	-11.25	AV
Remark: Fact	or = Antenna Facto	or + Cable I o	oss – Pre-amplifier	5		1

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:	U.		S		in i	
Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2483.5	57.22	-5.65	51.57	74.00	-22.43	PK
2483.5	49.24	-5.65	43.59	54	-10.41	AV
2500	56.99	-5.72	51.27	74.00	-22.73	PK
2500	49.05	-5.72	43.33	54	-10.67	AV
Remark: Fact	or = Antenna Facto	or + Cable L	oss – Pre-amplifier			

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6. OCCUPIED BANDWIDTH MEASUREMENT

- 6.1 Test Setup Same as Radiated Emission Measurement
- 6.2 Test Procedure
 - 1. The EUT was placed on a turn table which is 0.8m above ground plane.
 - 2. Set EUT as normal operation.
 - 3. Based on ANSI C63.10 section 6.9.2: RBW=30KHz, VBW=100KHz, Span=3MHz.
 - 4. The useful radiated emission from the EUT was detected by the spectrum analyser with peak detector.

6.3 Measurement Equipment Used

Same as Radiated Emission Measurement

6.4 Test Result

PASS

GFSK Modulation:

Frequency (MHz)	20dB Bandwidth (MHz)	Result
2402	0.945	PASS
2441	0.913	PASS
2480	0.920	PASS

CH: 2402MHz



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CH: 2441MHz



CH: 2480MHz



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π/4 DQPSK Modulation:

Frequency (MHz)	20dB Bandwidth (MHz)	Result
2402	1.302	PASS
2441	1.291	PASS
2480	1.291	PASS

CH: 2402MHz



CH: 2441MHz



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CH: 2480MHz



8DPSK Modulation:

Frequency (MHz)	20dB Bandwidth (MHz)	Result
2402	1.294	PASS
2441	1.291	PASS
2480	1.290	PASS

CH: 2402MHz



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CH: 2441MHz



CH: 2480MHz



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7. MAXIMUM PEAK OUTPUT POWER

7.1 Test Setup



7.2 Test Procedure

According to ANSI C63.10:2013 Maximum peak conducted output power for HFSS devices: The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.

The maximum Average conducted output power may be measured using a wideband RF power meter with a thermocouple derector or equivalent. The power meter shall have a video bandwidth that is greater than or equal to the HFSS bandwidth and shall utilize a fast-responding diode detector.

7.3 Limit

For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

7.4 Test Result

PASS

Туре	Channel	Peak Output power (dBm)	Limit (dBm)	Result
	Low	3.022		
GFSK	Mid	2.865	30	Pass
	High	2.987	7.	
6	Low	2.998		
π/4DQPSK	Mid	2.984	21	Pass
	High	2.965	1	
	Low	2.845		1
8DPSK	Mid	2.799	21	Pass
i.	High	2.892		

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8. FREQUENCY SEPARATION

8.1 Test Setup



8.2 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=30KHz and VBW=100KHz.

8.3 Limit

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

8.4 Test Result

PASS

Type/Modulation	СН	CH Frequency (MHz)	CH Separation (MHz)	Limit (MHz)	Result
	Low Channel	2402	1 000	0.045	pass
in the second se	Adjacency Channel	2403	1.000	0.945	
CH Separation GFSK	Mid Channel	2441	1.002	0.012	pass
	Adjacency Channel	2442	1.002	0.913	
	High Channel	2480	1.009	0.020	pass
	Adjacency Channel	2479	1.008	0.920	

CH: 2402MHz



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CH: 2441MHz



CH: 2480MHz



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Type/Modulation	СН	CH Frequency (MHz)	CH Separation (MHz)	Limit (MHz)	Result
5	Low Channel	2402	1.004	0.969	pass
	Adjacency Channel	2403	1.004	0.888	
CH Separation	Mid Channel	2441	0.002	0.901	pass
π/4DQPSK	Adjacency Channel	2442	0.992	0.001	
	High Channel	High Channel 2480		0.961	2000
	Adjacency Channel	2479	0.988	0.861	pass

CH: 2402MHz



CH: 2441MHz



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CH: 2480MHz



Type/Modulation	СН	CH Frequency (MHz)	CH Separation (MHz)	Limit (MHz)	Result	
1	Low Channel	2402	1.002	0.000	pass	
5	Adjacency Channel	2403	1.002	0.803		
CH Separation	Mid Channel	2441	0.002	0.961	0000	
8DPSK	Adjacency Channel	2442	0.992	0.001	pass	
	High Channel	2480	1.006	0.000	D000	
	Adjacency Channel	2479	1.006	0.860	pass	

CH: 2402MHz



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CH: 2441MHz



CH: 2480MHz



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9. CONDUCTED BANDEGE MEASUREMENT

9.1 Test Setup



9.2 Test Procedure

- 1. The EUT was placed on a turn table which is 0.8m above ground plane.
- 2. Set EUT as TX operation and connect directly to the spectrum analyzer.
- 3. Based on FCC Part15 C Section 15.247: RBW=100KHz, VBW=300KHz.
- 4. Set detected by the spectrum analyzer with peak detector.

9.3 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20dB.

9.4 Test Result

PASS

N	Modulation	Frequency Band	Delta Peak to band emission (dBc)	>Limit (dBc)	Result
1	Non honning	Left Band	53.10	20	Pass
CESK	Non-hopping	Right Band	58.51	20	Pass
GFSK	hanning	Left Band	56.11	20	Pass
nopping		Right Band	60.29	20	Pass
	Left Band	55.59	20	Pass	
	Non-hopping	Right Band	60.20	20	Pass
11/4DQP3K	-1	Left Band	51.32	20	Pass
	nopping	Right Band	59.72	20	Pass
		Left Band	52.65	20	Pass
8DPSK -	Non-nopping	Right Band	60.14	20	Pass
		Left Band	55.61	20	Pass
	nopping	Right Band	58.89	20	Pass

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Keyright Spectrum Analyzer - Swept SA R SENSE:INT ALIGN AUI R 50 Ω AC SENSE:INT ALIGN AUI Start Freq 2.310000000 GHz Tute: Ease Run Avg Type: Log-P	0 03:54:44 PM Dec 05, 2018 W TRACE 2 2 3 5 5 Frequency	Keyingh Spectrum Analyzer - Swept SA SENSE:1017 ALION AUTO 04:62:260 PMI B 50:00 Act SENSE:1017 ALION AUTO 04:62:260 PMI Start Freq 2.4755000000 GHz Takes Run Avg Type: Log-Pwr Takes	ec 05, 2018 2 2 3 4 5 6 Frequency
PRO: Fast Hig. ree can Avg/molic.= Jointo	Mkr1 2.404 0 GHz -0.565 dBm	PRO: Fast C mg. ree Kun IFGaint.ov Atten: 20 dB Mkr1 2.476 05 10 dBidiv Ref 10.00 dBm -1.73	0 GHz Auto Tune 3 dBm
	2.360000000 GHz		Center Freq 2.487500000 GHz
400	2.31000000 GHz		Start Freq 2.475000000 GHz
400 .700 .000	Stop Freq 2.41000000 GHz	800 Week at X an and the set of t	Stop Freq 2.50000000 GHz
Start 2.31000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep MRR MODE TRC; SCL X Y Function Function	Stop 2.41000 GHz 9.600 ms (1001 pts) THI FUNCTION VALUE THI FUNCTION VALUE	Start 2.47500 GHz Stop 2.500 #Res BW 100 kHz #VBW 300 kHz Sweep 2.400 ms (1 INR MODE TRC SCI x Y EVACTION EVACTOR MOTH FUNCTOR	00 GHz 001 pts) VALUE A
1 N 1 f 2.404.0 GHz -0.665 dBm 2 N 1 f 2.400.0 GHz -50.759 dBm 3	Freq Offset	1 N 1 f 2.476 959 GHz -1 733 dBm 2 N 1 f 2.483 500 GHz -57.985 dBm 3	Freq Offset 0 Hz
	Scale Type		Scale Type
MIGG STA	NTUS	ussa status	•
Hoping On		Hoping On	



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10. SPURIOUS RF CONDUCTED EMISSION

10.1 Test Limit

1. Below -20dB of the highest emission level in operating band.

2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

3.For below 30MHz,For 9KHz-150kHz,150K-10MHz,We use the RBW 1KHz,10KHz, So the limit need to calculated by "10lg(BW1/BW2)". for example For9KHz-150kHz,RBW 1KHz, The Limit= the highest emission level-20-10log(100/1)= the highest emission level-40.

10.2 Test Procedure

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013, For 9KHz-150kHz, Set RBW=1kHz and VBW= 3KHz; For 150KHz-10MHz, Set RBW=10kHz and VBW= 30KHz:For 10MHz-25GHz, Set RBW=100kHz and VBW= 300KHz in order to measure the peak field strength, and mwasure frequeny range from 9KHz to 25GHz.

10.3 Test Setup



10.4 Test Result

PASS

All modes of GFSK, $\pi/4$ DQPSK, 8DPSK were tested, only the worst result of GFSK was reported as below:

GFSK

CH: 2402MHz



Keysight Spectrum A	nalyzer - Swept SA							
Start Freq 30.	50 Ω AC .000000 MHz	PNO: Fast Trig: Fre	e Run) dB	Avg Type Avg Hold:	LIGN AUTO Log-Pwr >100/100	04:06:02 PM TRAC TYP DE	E 1 2 3 4 5 6 M WWWWWW T P N N N N	Frequency
10 dB/div Ref	10.00 dBm	I Guilleow				Mkr1 39. -58.0	70 MHz 89 dBm	Auto Tune
0.00								Center Freq 515.000000 MHz
-10.0							DL1-20.92-dBm	Start Free 30.000000 MHz
-30.0								Stop Fred 1.000000000 GH;
-50.0								CF Step 97.000000 MH: <u>Auto</u> Mar
-70.0	urman advantation	un maandad ar nijvelingerverkan	attenned and a state of the state of the	Month I what have a	yerpolytogen	linneriateteidfili	ntingenskilangh	Freq Offse 0 Hz
-00.0								Scale Type
Start 0.0300 G #Res BW 100 I	Hz kHz	#VBW 300 kHz			Sweep 9	Stop 1.0 2.73 ms (000 GHz 1001 pts)	Log <u>Lin</u>
MSG					STATU	S		

30MHz~1GHz

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🔤 Keysight Spectrum Analyzer - Swept SA 🛛 🔂	7 X
K RF 50 Ω AC SENSE:INT ALIGN AUTO 04:07:15 PM Dec 05, 2018 Frequen Start Freq 1.000000000 GHz Avg Type: Log-Pwr Trace II 2 34 5:01 Frequen PNO: Fast Trig: Free Run AvgIhold:>100/100 Type II 2 34 5:01 Frequen	су
IFGain:Low Atten: 20 dB Defendence Auto Mkr3 4.816 GHz -46.049 dBm Auto	Tune
Log 1 Center 0.00	r Freq 10 GHz
-30 0 2	t Freq 10 GHz
60.0 1 4 5 5 5 5 5 5 5 5 5 5 5 5 5 5 6 2 5 000000000000000000000000000000000000	Freq 0 GHz
Start 1.00 GHz Stop 25.00 GHz #Res BW 1.0 MHz #VBW 3.0 MHz Sweep 60.00 ms (1001 pts) MMR MODE TRC SCL X Y FUNCTION WIDTH FUNCTION VALUE AUTO	Step 10 GHz Man
I N I T 2.382 GHz -0.387 dBm 3 N 1 f 1.192 GHz -39.916 dBm Freq 0 3 N 1 f 4.816 GHz -46.049 dBm Freq 0 4 5 5 5 5 5 5 5	Offset 0 Hz
7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	Туре
	Lin
MSG STATUS	

1GHz~25GHz

GFSK

CH: 2441MHz



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Keysight Spectrum Analyzer - Swept SA					- 7 💌
RF 50 Ω AC tart Freq 30.000000 MHz	PNO: Fast IFGain:Low Atten: 20	Avg Tyj Run Avg Hol dB	ALIGN AUTO be: Log-Pwr d:>100/100	04:09:30 PM Dec 05, 2010 TRACE 1 2 3 4 5 TYPE M WWWW DET P NNNN	Frequency
dB/div Ref 10.00 dBm			N	1kr1 39.70 MH: -57.818 dBn	Auto Tune
.00					Center Free 515.000000 MH
D.0				DL1 -21.64 dBr	Start Free 30.000000 MH
0.0					Stop Fre 1.000000000 GH
D.0 1					CF Ste 97.000000 MH <u>Auto</u> Ma
0.0 merrinderselindersenter	Manalad <mark>a</mark> rikan Manalampiratash	an multi and douby		unanderselven-epositionsby	Freq Offse 0 H
0.0					Scale Type
tart 0.0300 GHz Res BW 100 kHz	#VBW 300 kHz		Sweep 9	Stop 1.0000 GHz 2.73 ms (1001 pts	Log <u>Lir</u>
G			STATUS		

30MHz~1GHz

Keysight Spectrum Analyzer - Swent SA					2	
RF 50 Ω AC tart Freq 1.000000000 Gl	Z PNO: Fast ⊂	SENSE:IN	T Avg 1 Avg H	ALIGN AUTO Type: Log-Pwr Iold:>100/100	04:10:20 PM Dec 05, 2018 TRACE 1 2 3 4 5 TYPE MWWWW DET P N N N N	Frequency
0 dB/div Ref 10.00 dBm	IFGain:Low	Atten: 20 dB		N	1kr3 4.888 GHz -46.385 dBm	Auto Tur
						Center Fre 13.000000000 GI
				مريديون بي ممكنية مريديون الم	and a set of the set	Start Fro 1.000000000 G
0.0 0.0 0.0	vhoqat _{an w} olyony <mark>i</mark> subse	and the second second				Stop Fr 25.000000000 G
art 1.00 GHz Res BW 1.0 MHz	#VBW	3.0 MHz		Sweep 6	Stop 25.00 GHz 0.00 ms (1001 pts)	CF Sto 2.400000000 G
R MODE TRC SCL X 1 N 1 f 2 2 N 1 f 2 2 N 1 f 1 1 1 1 3 N 1 f 4 4 4 4 5 6<	.440 GHz .216 GHz .888 GHz	Y -1.628 dBm -39.613 dBm -46.385 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	Freq Offs
7						Scale Ty Log <u>l</u>
G <mark>.</mark>				STATUS	,	

1GHz~25GHz

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GFSK

CH: 2480MHz



				100 C	
Keysight Spectrum Analyzer - Swept SA					
KF 50 Ω AC Start Freq 30.000000 MHz	PNO: Fast Trig: Free	SE:INT Avg Type Run Avg Hold:	ALIGN AUTO 04:1: : Log-Pwr >100/100	TRACE 1 2 3 4 5 6 TYPE MWWWW	Frequency
10 dB/div Ref 10.00 dBm	IFGain:Low Atten: 20	dB	Mkr1 -5	39.70 MHz 8.561 dBm	Auto Tune
0.00					Center Freq 515.000000 MHz
-20.0				041 -22417 dBm	Start Freq 30.000000 MHz
-30.0					Stop Freq 1.000000000 GHz
-50.0 1 -60.0					CF Step 97.000000 MHz <u>Auto</u> Man
-70.0	man manager and the second	known and an and the second	หางสาราชาชีชีชีชีอากูส	admentational the starranger	Freq Offset 0 Hz
					Scale Type
Start 0.0300 GHz #Res BW 100 kHz	#VBW 300 kHz		Sweep 92.73	o 1.0000 GHz ms (1001 pts)	
MSG			STATUS		

30MHz~1GHz

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					Second Second	
Keysight Spectrum Analyzer - Swept SA						- 7 ×
ເxα RF 50 Ω AC Start Freq 1.000000000 G	Hz PNO: Fast	SENSE:IN	Avg Avg	ALIGN AUTO Type: Log-Pwr Hold:>100/100	04:12:51 PM Dec 05, 2018 TRACE 1 2 3 4 5 TYPE M WWWW	Frequency
10 dB/dig Pef 10 00 dBm	IFGain:Low	Atten: 20 dB		N	Ikr3 4.960 GHz -46.644 dBm	Auto Tune
					DL1 -22.17 dBr	Center Freq 13.000000000 GHz
-30.0 2 3 3				ىرىنى «ۋە ^{رورورو} سامىلىيە تەرىرىدىد	and the second second	Start Freq 1.000000000 GHz
-60.0 -70.0	alter and a star and a star and a star a					Stop Freq 25.000000000 GHz
Start 1.00 GHz #Res BW 1.0 MHz	#VBW	/ 3.0 MHz		Sweep 6	Stop 25.00 GHz 0.00 ms (1001 pts	CF Step 2.400000000 GHz
MKR MODE TRC SCL X		Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	Adto
1 N 1 f 2 N 1 f 3 N 1 f 4	2.488 GHz 1.240 GHz 4.960 GHz	-2.133 dBm -38.881 dBm -46.644 dBm				Freq Offset 0 Hz
7 8 9 10						Scale Type
11						
MSG				STATUS		

1GHz~25GHz

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11. NUMBER OF HOPPING FREQUENCY

11.1 Test Limit

Frequency hopping systems in the 2400 - 2483.5MHz band shall use at least 15 channels.

11.2 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator.Set spectrum analyzer start 2400MHz to 2483.5MHz with RBW=1MHz and VBW=3MHz.

11.3 Test Setup



11.4 Test Result

PASS

Modulation	Number of Hopping Channel	Limit	Result
GFSK	79		U.
π/4DQPSK	79	≥15	Pass
8DPSK	79		

GFSK



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π/4DQPSK



8DPSK

🔤 Key	/sight Spe	ctrum Analy.	zer - Swe	pt SA										
<mark>IXI</mark> Star	t Erer	RF 1 2 400	50 Ω		17		SEI	ISE:INT	Avg Type	ALIGN AUTO	03:37:01 PI TRAC	M Dec 05, 2018	F	requency
ortar		1 2.400			PNO IFGai	:Fast ⊆ in:Low	Trig: Free Atten: 30	eRun IdB	Avg Hold	:>100/100	TYF Di			
10 dE	3/div	Ref 20	.00 d	Bm						ΔMkı	1 78.15 0	6 0 MHz .800 dB		Auto I une
10.0	X	በለፈላሊስ/	ህዚፈለ	ለሳቢሲል	NAM	ሲቢአለለስለ	ሲለብብክቢቢል	NN NA AI	ለበቤሌትላሊበ	vaananaa.	เ <i>โมโลก</i> ไป	102	2.4	Center Freq 1750000 GHz
0.00			- 0 0 9 9		η e γ	, , , , , 	7 TU V V V V V	μννταγγ	hénűzitez	0 1 1 1 1 1 1 1 1 1 1 1 1	<u>1999</u> 0980	P P = 10	2.40	Start Freq 00000000 GHz
-20.0	j k												2.48	Stop Freq 33500000 GHz
-40.0													<u>Auto</u>	CF Step 8.350000 MHz Man
-50.0 -60.0												1		Freq Offset 0 Hz
-70.0														Scale Type
Star #Res	t 2.40 s BW	000 GH 100 kHz	Z			#VBW	300 kHz			Sweep 8	Stop 2.43 3.000 ms (3350 GHz 1001 pts)	Log	Lin
MSG										STATU	s			

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12. TIME OF OCCUPANCY(DWELL TIME)

12.1 Test Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a pe-riod of 0.4 seconds multiplied by the number of hopping channels employed.

12.2 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with RBW=1MHz and VBW=3MHz,Span=0Hz.

12.3 Test Setup



12.4 Test Result

PASS

Туре	Modulation	СН	Pulse time(ms)	Dwell Time(ms)	Limit(ms)	Result
1	2	Low	2.98	317.867	400	Pass
Dwell Time	GFSK	Mid	2.94	313.600	400	Pass
		High	2.94	313.600	400	Pass

CH: 2402MHz

Keysight Spectrum Analyzer - Swept SA				- 5 -
Cepter Freq 2 402000000 GHz	SENSE:INT	ALIGN AUTO Avg Type: Log-Pwr	03:39:16 PM Dec 05, 2018 TRACE 1 2 3 4 5 6	Frequency
PNO: Fast ↔ IFGain:Low	Trig: Free Run Atten: 30 dB		DET P NNNN	
		Δ	Mkr1 2.983 ms	Auto Tune
10 dB/div Ref 20.00 dBm			-2.35 dB	
				Center Freq
10.0				2.402000000 GHz
0.00				
				Start Freq
-10.0				2.402000000 GHz
-20.0				Oten Ener
				2.402000000 GHz
-30.0				
-40.0				CF Step
				1.000000 MHz <u>Auto</u> Man
- 50.0 مريان به منه المالية المريان المالية المريان المالية المريان المالية المريان المالية المريان المالية الم	م م ال الما بالما م		μ 1Λ2 k	
-ee o	INT MATIN AND A CONTRACT		A MARINE R	Freq Offset
				0 Hz
-70.0				Scale Turne
				scale Type
Center 2.402000000 GHz	3.0 MHz	Sween 9	Span 0 Hz	Log <u>Lin</u>
MSG W NOTWINZ W W	5.0 14112	STATUS	555 ms (1001 pts)	

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LNi

CH: 2441MHz

weysight Spectrum Analyzer - Swept SA					- 7 -
RF 50 Ω AC	CH-	SENSE:INT	ALIGN AUTO	03:40:11 PM Dec 05, 2018 TRACE 1 2 3 4 5 6	Frequency
Center Freq 2.44 1000000	PNO: Fast +++	Trig: Free Run		TYPE WWWWWWW	
	IFGain:Low	Atten: 30 dB			Auto Tune
			2	10 22 dR	
Log				0.22 40	
					Center Freq
10.0					2.441000000 GHz
0.00	[]mmm-m				Start From
					2 44100000 GHz
-10.0					2.1111000000 0112
20.0					
-20.0					Stop Freq
-30.0					2.441000000 GHz
-40.0					CF Step
					Auto Man
-50.0					
\1 \1440.074_b&&&doctornells-arra14_06.0	rinX ₂		No and Alight	han ann an thair an an thair a	Erea Offect
+60.0					0 Hz
-70.0					Ocole Trme
					Scale Type
Center 2.441000000 GHz				Span 0 Hz	Log <u>Lin</u>
Res BW 1.0 MHz	#VBW	3.0 MHz	Sweep 8	3.333 ms (1001 pts)	
MSG			STATUS	3	

CH: 2480MHz

Keysight Spectr	um Analyzer - Sw	/ept SA									- 6 ×
L <mark>XI</mark>	RF 50 Ω	AC		SEN	ISE:INT		ALIGN AUTO	03:43:20 P	M Dec 05, 2018	F	requency
Center Fre	q 2.4800	00000	SHZ	Trig: Free	Run	Avg Type	: Log-Pwr	TRAC	DE WWWWWW		requeries
			IFGain:Low	Atten: 30	dB			DI	P NNNN		
								Mkr1 2	942 ms		Auto Tune
10 dB/div	Ref 20.00	dBm						-	2.66 dB		
Log	20.00										
											Center Freq
10.0										2.48	0000000 GHz
										_	
0.00											
						J. T.			· · · · · · · · · · · · · · · · · · ·		Start Freq
.10.0										2.48	80000000 GHz
10.0											
-20.0											Stop Freq
										2.48	80000000 GHz
-30.0											
h Mi u i											CE Stop
-40.0											1 000000 MHz
										Auto	Man
-50.0		و او او و							440		
the state of the s	We delike the	MAAN	1. MARINE	de l'arte de la constante de la	PUN MININY	X,					
-60.0	1		1	II a suble a	1.1.1.1						Freq Onser
											0 HZ
-70.0											
											Scale Type
Center 2.48	0000000 (GHz						u,	pan 0 Hz	Log	Lin
Res BW 1.0	MHz		#VBW	3.0 MHz			Sweep 8	3.333 ms (1001 pts)		
MSG							STATU	s			

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				2. C	
Modulation	СН	Pulse time(ms)	Dwell Time(ms)	Limit(ms)	Result
	Low	2.95	314.667	400	Pass
π/4DQPSK	Mid	2.96	315.733	400	Pass
	High	2.98	317.867	400	Pass
	Modulation π/4DQPSK	Modulation CH Low π/4DQPSK Mid High	ModulationCHPulse time(ms)Low2.95π/4DQPSKMid2.96High2.98	Modulation CH Pulse time(ms) Dwell Time(ms) μ Low 2.95 314.667 π/4DQPSK Mid 2.96 315.733 High 2.98 317.867	Modulation CH Pulse time(ms) Dwell Time(ms) Limit(ms) π/4DQPSK Low 2.95 314.667 400 π/4DQPSK Mid 2.96 315.733 400 High 2.98 317.867 400

CH: 2402MHz



CH: 2441MHz



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LNi

CH: 2480MHz

Keysight Spectrum Analyzer - Swept SA					- 5 -
K RF 50 Ω AC	SEN SEN	ISE:INT AVG TYPE	ALIGN AUTO 03:44:24 P : Log-Pwr TRAC	M Dec 05, 2018	Frequency
Center Freq 2.40000000 (PNO: Fast +++ Trig: Free	Run	TYI	PE WWWWWW T P N N N N N	
	IFGain:Low Atten: 30	ub	AMket 2	075 mo	Auto Tune
10 dB/div Pef 20 00 dBm				0.94 dB	
					Center Freq
10.0	ารางมีนุปสาขไข้สุดเสียงการไของเป็นปการไของไนป	(Hally Wards of the state of th			2.480000000 GHz
0.00					Start Fred
10.0					2.48000000 GHz
-10.0					
-20.0					
-20.0					Stop Freq
-30.0					2.48000000 GHz
-40.0					CF Step
					Auto Man
-50.0		142		<u>kı</u>	
while the strate of the front of the strate			KANGA NAMANANA MANANA	hite and the second	Fred Offset
-60.0				<u> </u>	0 Hz
-70.0					
					Scale Type
Center 2.480000000 GHz				pan 0 Hz	_og <u>Lin</u>
Res BW 1.0 MHz	#VBW 3.0 MHz		Sweep 8.333 ms ((1001 pts)	
MSG			STATUS		

Туре	Modulation	СН	Pulse time(ms)	Dwell Time(ms)	Limit(ms)	Result
	1	Low	2.92	315.733	400	Pass
Dwell Time	8DPSK	Mid	2.93	316.800	400	Pass
		High	2.95	316.800	400	Pass

CH: 2402MHz

🔤 Kej	ysight Spe	ctrum	Analyzer	- Swep	ot SA										
	tor Er	RF	2 4 0 1	50 Ω 2000		2117		SE	NSE:INT	Avg Type	LIGN AUTO	03:46:27 PI	M Dec 05, 2018	F	requency
Gen		eq	2.40	200	5000 K	PNO: F IFGain:	ast ↔ _ow_	Trig: Fre Atten: 30	e Run) dB			TYF Di			
10 dE	3/div	Re	f 20.()0 d	Bm						Δ	Mkr1 2	.917 ms 2.63 dB		Auto Tune
10.0														2.4	Center Freq
							, 1	1999, Angel 1999, 1999	all and the second s	Ned Andrew Angeles and a second	4			2.4	52000000 GH2
															Start Freq
														2.4	02000000 GHz
														2.4	Stop Freq 02000000 GHz
-30.0															
															CF Step 1.000000 MHz
												ļ.,		<u>Auto</u>	Man
	n <mark>n h</mark> ill	1	Marth	łł	hadatha	Hulp	₩2				1∆2 1 10 10 10 10 10 10 10 10 10 10 10 10 10	h hall half of the	rduhtynylyhy		Freq Offset
															0 Hz
															Scale Type
															could type
Cen Res	ter 2.4 BW 1	1020 .0 M	0000 Hz	0 GI	Hz		#VBW	/ 3.0 MHz			Sweep 8	.333 ms (pan 0 Hz 1001 pts)	Log	
MSG											STATUS	;			

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LNi

CH: 2441MHz

🔤 Keys	sight Spe	ctrum Analyzer - :	Swept SA								- 6 -
	or E	RF 50	Ω ΑC	211-7	SEN	ISE:INT	Ava	ALIGN AUTO	03:47:58 PM	Dec 05, 2018	Frequency
Gent	er Fr	eq 2.44 ft	500000	PNO: Fast ↔ IFGain:Low	, Trig: Free Atten: 30	Run dB		A	TYPE DET	925 ms	Auto Tune
10 dB Log	/div	Ref 20.00	dBm						-2	2.32 dB	
10.0											Center Freq
	,	hanna an hanna an h	hallen och allen	₩₩₩₩₩₩₩₩₩₩₩₩₩							2.441000000 0112
0.00										n aller w	Start Freq
-10.0											2.441000000 GHz
-20.0											Stop Freq
-30.0											2.441000000 GHz
-40.0											CF Step
											Auto Man
-50.0	WX 2				1 <u>∆2</u>	han hillingh	y lly guh	iyhtennetterheli	dividenality	M	Freq Offset
-60.0											0 Hz
-70.0											Scale Type
											ocale Type
Center Res I	er 2.4 BW 1	41000000 0 MHz	GHz	#VBV	V 3.0 MHz			Sweep_8	S 11.333 ms	oan 0 Hz 001 pts)	Log <u>Lin</u>
MSG								STATUS			

CH: 2480MHz

Keysight Spe	ctrum Analyzer - Sv	ept SA									
<mark>IXI</mark> Contor Er	RF 50 0			SEN	ISE:INT		ALIGN AUTO	03:48:45 PM	Dec 05, 2018	Fr	equency
Center Fr	eq 2.4600	JUUUU G	NO: Fast ++	Trig: Free	Run	A18 190		TYP			
		1	-Gain:Low	Atten: 30	dВ			Mired O	050 mag		Auto Tune
10 dB/div	Ref 20.00	dBm					Δ	- awiki 1 2.	950 ms 1.20 dB		
Log	1101 20.00										
										0	Center Freq
10.0										2.48	0000000 GHz
0.00			an a	e-ColoMate-Colo	Lander and Cartain	Color-Hereix Malare	1				
0.00			<u>п</u> ,		1.84. 1.94. I.	hall in the	l				Start Freq
-10.0										2.48	0000000 GHz
-20.0											Stop Fred
										2.48	0000000 GHz
-30.0											
											CE Sten
-40.0										1	1.000000 MHz
										<u>Auto</u>	Man
-00.0	and a star of the	المرابط والمراجع						1. William	al distant		
-60.0	a wat fitt i who.	all is seen in the	104741412				ייניאר איזיארי	a ha salkaka	ulli ani baika		Freq Offset
											0 Hz
-70.0											
											Scale Type
Center 2 /	80000000	2H7							nan () Hz	Log	Lin
Res BW 1	.0 MHz	4.812	#VBW	3.0 MHz			Sweep 8	.333 ms (1001 pts)		
MSG							STATUS				

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13. PSEUDORANDOM FREQUENCY HPPPING SEQUENCE

For 47 CFR Part 15C section 15.247 (a)(1) requirement

Frequency hopping systems shall have hopping channel carrier fre-quencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400 – 2483.5 MHz band may have hopping channel carrier fre-quencies

that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shal I hop

to chan-nel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping fre-quencies. Each frequency must be used equally on the average by each trans-mitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

TEUT Pseudorandom Frequency Hopping Sequence Requirement

The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the frist stage. The sequence begins with the frist one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

Number of shift register stages:9

Length of pseudo-random sequence:29-1=511 bits Longest sequence of zeros:8(non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An explame of pseudorandom frequency hopping sequence as follows:

0	2	4	6	62 64	78 1	73 75 77
						111

Each frequency used equally one the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

深圳市优耐的和ANTENNA REQUIREMENT

 Shenzhen United Testing Technology Co.,Ltd.
 2F, Annex Bldg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China

 United Testing Technology(Hong Kong) Limited
 深圳市宝安区西乡街道铁岗社区宝田一路365号嘉皇源科技园附楼2楼 邮编:518102 Tel:+86-755-86180996 Fax:+86-755-86180196

Standard Applicable:

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Connected Construction

The antenna used in this product is an Internal Antenna, The directional gains of antenna used for transmitting is 1.4dBi.

ANTENNA:



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15. PHOTOGRAPH OF TEST

15.1 Radiated Emission





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15.2 Conducted Emission



End of Report

深圳市优耐检测技术有限公司 Shenzhen United Testing Technology Co.,Ltd. United Testing Technology(Hong Kong) Limited