

FCC AND IC RADIO TEST REPORT

FCC ID: 2AFWP-153100VA

IC: 21116-153100VA

Product : SONNET60, SONNET120

Trade Name :



153100-VA,153100-Vx,153102-VA, 153102-Vx The "x" **Model Name**: in the model reference can be any letter A – Z denoting non-safety related changes, e.g leather covering Report No. : UNIA19103018FR-01

Prepared for

Blackstar Amplification Ltd. Beckett House, 14 Billing Road Northampton, NN1 5AW

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:	Blackstar Amplification Ltd.
Address:	Beckett House, 14 Billing Road Northampton, NN1 5AW United Kingdom
Manufacture's Name:	Blackstar Amplification Ltd.
Address:	Beckett House, 14 Billing Road Northampton, NN1 5AW United Kingdom
Product description	
Product name:	SONNET60, SONNET120
Trade Mark:	Blackstar
Model and/or type reference .:	153100-VA,153100-Vx,153102-VA, 153102-Vx The "x" in the model reference can be any letter A – Z denoting non-safety related changes, e.g leather covering
Standards	FCC Rules and Regulations Part 15 Subpart C Section 15.247; RSS-247 Issue 2: February 2017; RSS-Gen Issue 5 April 2018; 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	Jul. 10 ~ 22,				
Date of Issue	Jul. 23, 2019				
Test Result	Pass				

Prepared by:

Reviewer:

Approved & Authorized Signer:

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

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Report No.: UNIA19103018FR-01

1. 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

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

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

SONNET60, SONNET120
Blackstar
153100-VA, 153102-VA
All models have same circuits diagram of Bluetooth module PCB, RF Chip construction; All models have the same enclosure and general appearance except the position of the I/O port. Also AC/DC Power board, control board and main board have minor difference which will not have influence on the RF features.
2AFWP-153100VA
21116-153100VA
PCB Antenna
0dBi
2402-2480MHz
79CH
GFSK, π/4 DQPSK, 8DPSK
AC 100-240V, 50/60Hz

Table for auxiliary equipment:

Equipment Description	Manufacturer	Model	Serial Number
Notebook	Lenovo	Lenovo G475	GB14477457



2.2 Carrier Frequency of Channels

			Channe	el List			0
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequenc (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		
17	2419	38	2440	59	2461	1.5	
18	2420	39	2441	60	2462	1.00	
19	2421	40	2442	61	2463		
20	2422	41	2443	62	2464		-

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: Install BlueSuite_2_5_8_667

2.4 DESCRIPTION OF TEST SETUP

Operation of EUT during Conducted testing:

AC 120V/60Hz EUT

Operation of EUT during Radiation testing:

AC 120V/60Hz

EUT

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2.5 MEASUREMENT INSTRUMENTS LIST

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated unti
	1-1	CONDUCTED	EMISSIONS TEST	-	
1	AMN	Schwarzbeck	NNLK8121	8121370	2020.09.06
2	AMN	ETS	3810/2	00020199	2020.09.06
3	EMI TEST RECEIVER	Rohde&Schwarz	ESCI	101210	2020.09.06
4	AAN	TESEQ	T8-Cat6	38888	2020.09.06
_		RADIATED	EMISSION TEST		
1	Horn Antenna	Sunol	DRH-118	A101415	2020.09.06
2	BicoNILog Antenna	Sunol	JB1 Antenna	A090215	2020.09.06
3	PREAMP	HP	8449B	3008A00160	2020.09.06
4	PREAMP	HP	8447D	2944A07999	2020.09.06
5	EMI TEST RECEIVER	Rohde&Schwarz	ESR3	101891	2020.09.06
6	VECTOR Signal Generator	Rohde&Schwarz	SMU200A	101521	2020.09.06
7	Signal Generator	Agilent	E4421B	MY4335105	2020.09.06
8	MXA Signal Analyzer	Agilent	N9020A	MY50510140	2020.09.06
9	MXA Signal Analyzer	Agilent	N9020A	MY51110104	2020.09.06
10	ANT Tower&Turn table Controller	Champro	EM 1000	60764	2020.09.06
11	Anechoic Chamber	Taihe Maorui	9m*6m*6m	966A0001	2020.09.06
12	Shielding Room	Taihe Maorui	6.4m*4m*3m	643A0001	2020.09.06
13	RF Power sensor	DARE	RPR3006W	15100041SNO88	2020.09.06
14	RF Power sensor	DARE	RPR3006W	15100041SNO89	2020.09.06
15	RF power divider	Anritsu	K241B	992289	2020.09.06
16	Wideband radio communication tester	Rohde&Schwarz	CMW500	154987	2020.09.06
17	Biconical antenna	Schwarzbeck	VHA 9103	91032360	2020.09.06
18	Biconical antenna	Schwarzbeck	VHA 9103	91032361	2020.09.06
19	Broadband Hybrid Antennas	Schwarzbeck	VULB9163	VULB9163#958	2020.09.06
20	Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1680	2020.09.06
21	Active Receive Loop Antenna	Schwarzbeck	FMZB 1919B	00023	2020.09.06
22	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170651	2020.09.06
23	Microwave Broadband Preamplifier	Schwarzbeck	BBV 9721	100472	2020.09.06
24	Active Loop Antenna	Com-Power	AL-130R	10160009	2020.09.06
25	Power Meter	KEYSIGHT	N1911A	MY50520168	2020.09.06
26	Frequency Meter	VICTOR	VC2000	997406086	2020.09.06
27	DC Power Source	HYELEC	HY5020E	055161818	2020.09.06
			software		64
1	E3	Audix	6.101223a	N/A	N/A

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3. CONDUCTED EMISSIONS TEST

3.1 Conducted Power Line Emission Limit

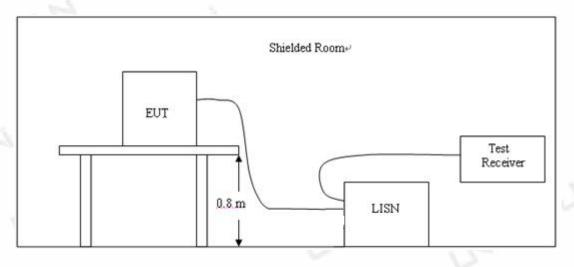
For unintentional device, according to § 15.107(a) & RSS-Gen [8.8] Line Conducted Emission Limits is as following

	Maximum RF Line Voltage(dBµV)					
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

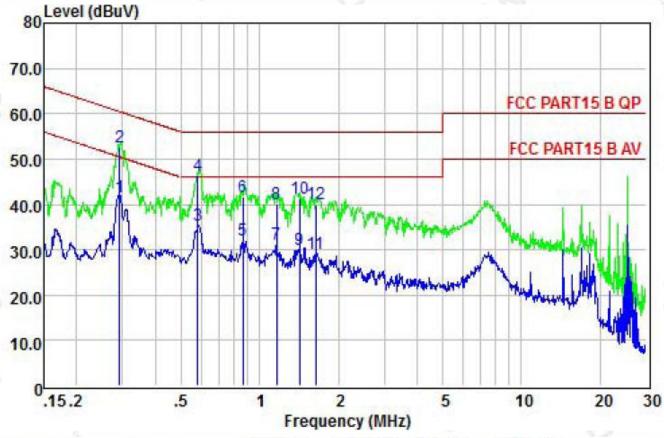
Remark:

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:



Temperature:	26℃	Relative Humidity:	48%
Model:	153100-VA	Pressure:	1010hPa
Test Voltage:	AC 120V, 60Hz	Phase:	Line
Test Mode:	Transmitting mode of GFSK 2480	MHz	S



Cable LISN Limit Over Freq Level Loss Factor Line Limit Remark

	MHz	dBuV	dB	dB	dBuV	dB	·	
1	0.29	41.72	0.25	9.62	50.46	-8.74	Average	
2	0.29	52.70	0.25	9.62	60.46	-7.76	QP	
3	0.58	35.52	0.25	9.59	46.00	-10.48	Average	
4	0.58	46.30	0.25	9.59	56.00	-9.70	QP	
5	0.86	32.03	0.26	9.60	46.00	-13.97	Average	
6	0.86	41.60	0.26	9.60	56.00	-14.40	QP	
7	1.17	31.11	0.27	9.59	46.00	-14.89	Average	
8	1.17	40.20	0.27	9.59	56.00	-15.80	QP	
9	1.42	29.99	0.27	9.60	46.00	-16.01	Average	
10	1.42	41.30	0.27	9.60	56.00	-14.70	QP	
11	1.64	29.27	0.27	9.60	46.00	-16.73	Average	
12	1.64	40.00	0.27	9.60	56.00	-16.00	QP	
	Remark: Factor = In	sertion Loss +	Cable Loss	Result = Read	ling + Factor	Margin = Res	sult – Limit	

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



Temperature:	26				Humidity:	48%	-
Model:		3100-VA		Pressure	:	1010hPa	15
Test Voltage:		C 120V, 60Hz		Phase:		Neutral	~
Test Mode:	Tra	ansmitting mod	de of GFSK 2	2480MHz			
80 Level (d	BuV)						
00							
0.0							
0.0							-
-	-					FCC P	ART15 B Q
0.0	-	~					
	3					FCC F	ART15 B A
0.0	A	4					
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0		.5		quency (MH	lz)		20
0 <mark>.15.2</mark>			Cable	quency (MH LISN	lz) Limit	Over	
0 <mark>.15.2</mark>	req	.5 Level	Cable	quency (MH	lz)	Over	20 Remark
0 <mark>.15.2</mark>		Level	Cable Loss	quency (MH LISN Factor	lz) Limit Line	Over Limit	
0 <mark>.15.2</mark>	Treq MHz		Cable	quency (MH LISN	lz) Limit	Over Limit	
0.15.2 E	MHz	Level dBuV	Cable Loss dB	quency (MH LISN Factor dB	lz) Limit Line dBuV	Over Limit dB	Remark
0.15.2 E	MHz	Level dBuV 43.03	Cable Loss dB 0.25	quency (MH LISN Factor dB 9.58	lz) Limit Line dBuV 50.50	Over Limit dB -7.47	Remark
0.15.2 E	MHz	Level dBuV	Cable Loss dB	quency (MH LISN Factor dB	lz) Limit Line dBuV	Over Limit dB -7.47	Remark
0.15.2 E	MHz	Level dBuV 43.03	Cable Loss dB 0.25	quency (MH LISN Factor dB 9.58	lz) Limit Line dBuV 50.50	Over Limit dB -7.47 -8.90	Remark
0.15.2 E	MHz).29).29	Level dBuV 43.03 51.60	Cable Loss dB 0.25 0.25	quency (MH LISN Factor dB 9.58 9.58	Limit Line dBuV 50.50 60.50	Over Limit dB -7.47 -8.90 -8.99	Remark Average QP Average
0.15.2 F	MHz).29).29).59	Level dBuV 43.03 51.60 37.01	Cable Loss dB 0.25 0.25 0.25	quency (MH LISN Factor dB 9.58 9.58 9.59	z) Limit Line dBuV 50.50 60.50 46.00 56.00	Over Limit dB -7.47 -8.90 -8.99	Remark Average QP Average QP
0.15.2	MHz).29).29).59).59	Level dBuV 43.03 51.60 37.01 46.50	Cable Loss dB 0.25 0.25 0.25 0.25	quency (MH LISN Factor dB 9.58 9.59 9.59 9.59	z) Limit Line dBuV 50.50 60.50 46.00 56.00 46.00	Over Limit dB -7.47 -8.90 -8.99 -9.50	Remark Average QP Average QP Average
0.15.2	MHz).29).29).59).59).88).88	Level dBuV 43.03 51.60 37.01 46.50 30.05 42.70	Cable Loss dB 0.25 0.25 0.25 0.25 0.26 0.26	quency (MH LISN Factor dB 9.58 9.58 9.59 9.59 9.60 9.60 9.60	z) Limit Line dBuV 50.50 60.50 46.00 56.00 56.00	Over Limit dB -7.47 -8.90 -8.99 -9.50 -15.95 -13.30	Remark Average QP Average QP Average QP
0.15.2 E	MHz).29).29).59).59).88).88).88	Level dBuV 43.03 51.60 37.01 46.50 30.05 42.70 31.55	Cable Loss dB 0.25 0.25 0.25 0.25 0.25 0.26 0.26 0.27	quency (MH LISN Factor dB 9.58 9.59 9.59 9.59 9.60 9.60 9.59	z) Limit Line dBuV 50.50 60.50 46.00 56.00 46.00 56.00 46.00	Over Limit dB -7.47 -8.90 -8.99 -9.50 -15.95 -13.30 -14.45	Remark Average QP Average QP Average QP Average
0.15.2	MHz).29).29).59).59).88).88).88).88	Level dBuV 43.03 51.60 37.01 46.50 30.05 42.70 31.55 41.50	Cable Loss dB 0.25 0.25 0.25 0.25 0.26 0.26 0.27 0.27	quency (MH LISN Factor dB 9.58 9.59 9.59 9.59 9.60 9.60 9.59 9.59 9.59	z) Limit Line dBuV 50.50 60.50 46.00 56.00 46.00 56.00 46.00 56.00	Over Limit dB -7.47 -8.90 -8.99 -9.50 -15.95 -13.30 -14.45 -14.50	Remark Average QP Average QP Average QP Average QP
0.15.2 F	MHz).29).29).59).59).88).88].15].15].15].40	Level dBuV 43.03 51.60 37.01 46.50 30.05 42.70 31.55 41.50 30.92	Cable Loss dB 0.25 0.25 0.25 0.25 0.26 0.26 0.27 0.27 0.27	quency (MH LISN Factor dB 9.58 9.59 9.59 9.60 9.60 9.60 9.59 9.59 9.59 9.59	z) Limit Line dBuV 50.50 60.50 46.00 56.00 46.00 56.00 46.00 56.00 46.00	Over Limit dB -7.47 -8.90 -8.99 -9.50 -15.95 -13.30 -14.45 -14.50 -15.08	Remark Average QP Average QP Average QP Average QP Average
0.15.2 F	MHz).29).29).59).59).88).88).88].15	Level dBuV 43.03 51.60 37.01 46.50 30.05 42.70 31.55 41.50	Cable Loss dB 0.25 0.25 0.25 0.25 0.26 0.26 0.27 0.27	quency (MH LISN Factor dB 9.58 9.59 9.59 9.59 9.60 9.60 9.59 9.59 9.59	z) Limit Line dBuV 50.50 60.50 46.00 56.00 46.00 56.00 46.00 56.00 46.00 56.00	Over Limit dB -7.47 -8.90 -8.99 -9.50 -15.95 -13.30 -14.45 -14.50	Remark Average QP Average QP Average QP Average QP Average QP

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

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Temperature:	26 ℃			Relative Hur	nidity: 48	3%	in the second se
Model:	15310)2-VA		Pressure:	10	10hPa	5
Fest Voltage:	AC 12	20V, 60Hz		Phase:	Liı	ne	
Test Mode:	Trans	mitting mode	of GFSK 248	0MHz		1	
80 Level (d	BuV)		2				
00							
0.0							
0.0						I I I I I I I I I I I I I I I I I I I	and where
0.0	-					FCC PAF	RT15 B QP
1.0	6 0	~				in the second	Sec. Land
50.0 2	-A-A	10 12				FCC PA	RT15 B AV
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	T PYIP	y 11	5.5			TNU IIII	
0.0	1111.1	MANA	more	Ample			A MARINE
	~ N NN	A RAA D		ANN	All and	my Lill	
0.0						MULLIN	
0.0						sdi	A.L. M. Chine
0.0							100
0.0							
45.2	1						
.15.2		.5	1	2	5	10	20
.15.2		.5	1 Frequ	2 ency (MHz)	-	10	20
.15.2		.5	1 Frequ Cable		-	10 Over	20
.15.2	Freq	.5 Level	71.0	ency (MHz)	2.50	Over	
.15.2	Freq		Cable	ency (MHz) LISN	Limit	Over	20 Remark
.15.2	Freq MHz		Cable	ency (MHz) LISN	Limit	Over Limit	
.15.2		Level	Cable Loss	ency (MHz) LISN Factor	Limit Line	Over Limit	
		Level	Cable Loss	ency (MHz) LISN Factor	Limit Line dBuV	Over Limit	Remark
1	MHz 0.17	Level dBuV	Cable Loss dB 0.24	ency (MHz) LISN Factor dB 9.67	Limit Line dBuV 54.99	Over Limit dB -18.54	Remark
1 2	MHz 0.17 0.17	Level dBuV 36.45	Cable Loss dB 0.24 0.24	ency (MHz) LISN Factor dB 9.67 9.67	Limit Line dBuV 54.99 64.99	Over Limit dB -18.54 -16.08	Remark Averag QP
1 2	MHz 0.17 0.17 0.23	Level dBuV 36.45 48.91 39.91	Cable Loss dB 0.24 0.25	ency (MHz) LISN Factor dB 9.67 9.67 9.63	Limit Line dBuV 54.99 64.99 52.39	Over Limit dB -18.54 -16.08 -12.48	Remark Averag QP Averag
1 2	MHz 0.17 0.17 0.23 0.23	Level dBuV 36.45 48.91 39.91 51.91	Cable Loss dB 0.24 0.25 0.25 0.25	ency (MHz) LISN Factor dB 9.67 9.67 9.63 9.63 9.63	Limit Line dBuV 54.99 64.99 52.39 62.39	Over Limit dB -18.54 -16.08 -12.48 -10.48	Remark Averag QP Averag QP
1 2 3 4 5	MHz 0.17 0.17 0.23 0.23 0.28	Level dBuV 36.45 48.91 39.91 51.91 42.42	Cable Loss dB 0.24 0.24 0.25 0.25 0.25	ency (MHz) LISN Factor dB 9.67 9.63 9.63 9.63 9.63 9.62	Limit Line dBuV 54.99 64.99 52.39 62.39 50.85	Over Limit dB -18.54 -16.08 -12.48 -10.48 -8.43	Remark Averag QP Averag QP Averag
1 2 3 4 5 6	MHz 0.17 0.17 0.23 0.23 0.28 0.28	Level dBuV 36.45 48.91 39.91 51.91 42.42 53.00	Cable Loss dB 0.24 0.25 0.25 0.25 0.25 0.25	ency (MHz) LISN Factor dB 9.67 9.63 9.63 9.63 9.62 9.62	Limit Line dBuV 54.99 64.99 52.39 62.39 50.85 60.85	Over Limit dB -18.54 -16.08 -12.48 -10.48 -8.43 -7.85	Remark Averag QP Averag QP Averag QP
1 2 3 4 5 6 7	MHz 0.17 0.17 0.23 0.23 0.28 0.28 0.28 0.34	Level dBuV 36.45 48.91 39.91 51.91 42.42 53.00 40.68	Cable Loss dB 0.24 0.25 0.25 0.25 0.25 0.25 0.25	ency (MHz) LISN Factor dB 9.67 9.63 9.63 9.63 9.62 9.62 9.62 9.60	Limit Line dBuV 54.99 64.99 52.39 62.39 50.85 60.85 49.13	Over Limit dB -18.54 -16.08 -12.48 -10.48 -8.43 -7.85 -8.45	Remark Averag QP Averag QP Averag QP Averag
1 2 3 4 5 6 7 8	MHz 0.17 0.17 0.23 0.23 0.28 0.28 0.28 0.34 0.34	Level dBuV 36.45 48.91 39.91 51.91 42.42 53.00 40.68 52.08	Cable Loss dB 0.24 0.25 0.25 0.25 0.25 0.25 0.25 0.25	ency (MHz) LISN Factor dB 9.67 9.63 9.63 9.63 9.62 9.62 9.60 9.60 9.60	Limit Line dBuV 54.99 64.99 52.39 62.39 50.85 60.85 49.13 59.13	Over Limit dB -18.54 -16.08 -12.48 -10.48 -8.43 -7.85 -8.45 -7.05	Remark Averag QP Averag QP Averag QP Averag QP
1 2 3 4 5 6 7 8 9	MHz 0.17 0.17 0.23 0.23 0.28 0.28 0.28 0.34 0.34 0.34 0.52	Level dBuV 36.45 48.91 39.91 51.91 42.42 53.00 40.68 52.08 35.86	Cable Loss dB 0.24 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.25	ency (MHz) LISN Factor dB 9.67 9.67 9.63 9.63 9.63 9.62 9.62 9.60 9.60 9.58	Limit Line dBuV 54.99 64.99 52.39 62.39 50.85 60.85 49.13 59.13 46.00	Over Limit dB -18.54 -16.08 -12.48 -10.48 -8.43 -7.85 -8.45 -7.05 -10.14	Remark Averag QP Averag QP Averag QP Averag QP Averag
1 2 3 4 5 6 7 8 9	MHz 0.17 0.17 0.23 0.23 0.28 0.28 0.28 0.34 0.34 0.34 0.52 0.52	Level dBuV 36.45 48.91 39.91 51.91 42.42 53.00 40.68 52.08 35.86 46.70	Cable Loss dB 0.24 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.25	ency (MHz) LISN Factor dB 9.67 9.63 9.63 9.63 9.63 9.62 9.62 9.62 9.60 9.60 9.58 9.58	Limit Line dBuV 54.99 64.99 52.39 62.39 50.85 60.85 49.13 59.13 46.00 56.00	Over Limit dB -18.54 -16.08 -12.48 -10.48 -8.43 -7.85 -8.45 -7.05 -10.14 -9.30	Remark Averag QP Averag QP Averag QP Averag QP Averag QP
1 2 3 4 5 6 7 8	MHz 0.17 0.17 0.23 0.23 0.28 0.28 0.28 0.34 0.34 0.34 0.52	Level dBuV 36.45 48.91 39.91 51.91 42.42 53.00 40.68 52.08 35.86	Cable Loss dB 0.24 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.25	ency (MHz) LISN Factor dB 9.67 9.63 9.63 9.63 9.63 9.62 9.62 9.62 9.60 9.60 9.58 9.58	Limit Line dBuV 54.99 64.99 52.39 62.39 50.85 60.85 49.13 59.13 46.00 56.00	Over Limit dB -18.54 -16.08 -12.48 -10.48 -8.43 -7.85 -8.45 -7.05 -10.14 -9.30 -10.54	Remark Averag QP Averag QP Averag QP Averag QP Averag QP Averag

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

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Femperature:	26℃		Relative Humidity:	48%	
Model:	153102-VA		Pressure:	1010hPa	1. 2. 2
Fest Voltage:	AC 120V, 60Hz		Phase:	Neutral	~
Fest Mode:	Transmitting mode	e of GFSK 2	480MHz	~	
80 Level (dBu	V)				
0.0				FCC PA	RT15 B QP
0.0 8 1	A 12 12	ANY	Antana la	FCC PA	RT15 B AV
0.0		MAAN	North	- MULLIN	
0.0 0.0 0.0	a Mana	Padada	- Martin artificanthing	where where the	
0.0					
0.15.2	.5	1	2 5 quency (MHz)	10	20 3

	rreq	rever	LOSS	ractor	Line	Limit	Remark	
	MHz	dBuV	dB	dB	dBuV	dB		
ı	0.17	36.16	0.24	9.50	54.94	-18.78	Average	
2	0.17	48.49	0.24	9.50	64.94	-16.45	QP	
3	0.23	41.17	0.25	9.57	52.44	-11.27	Average	
4	0.23	52.93	0.25	9.57	62.44	-9.51	QP	
5	0.28	41.87	0.25	9.58	50.81	-8.94	Average	
6	0.28	54.00	0.25	9.58	60.81	-6.81	QP	
7	0.35	40.23	0.25	9.58	49.00	-8.77	Average	
8	0.35	51.85	0.25	9.58	59.00	-7.15	QP	
9	0.50	36.41	0.25	9.59	46.00	-9.59	Average	
10	0.50	47.74	0.25	9.59	56.00	-8.26	QP	
11	0.69	36.24	0.26	9.60	46.00	-9.76	Average	
12	0.69	48.00	0.26	9.60	56.00	-8.00	QP	

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

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4. RADIATED EMISSION TEST

4.1 Radiation Limit

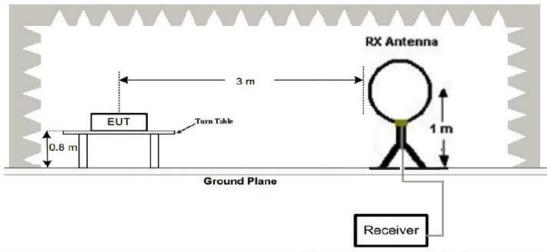
For unintentional device, according to § 15.109(a) & RSS-247 [5.5], except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

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

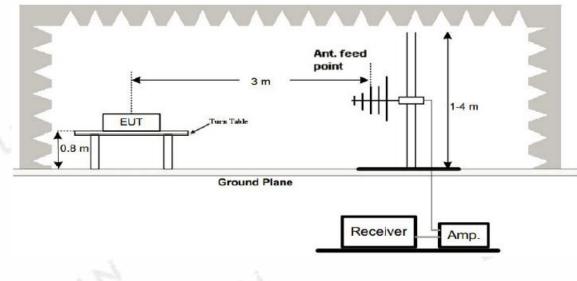
For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

4.2 Test Setup

1. Radiated Emission Test-Up Frequency Below 30MHz



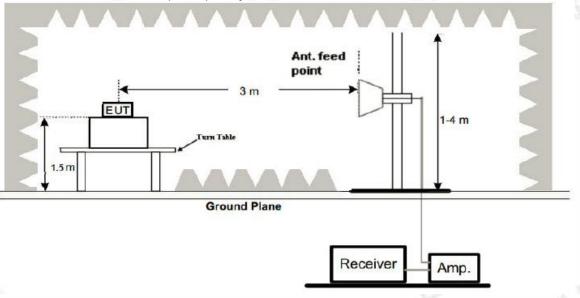
2. Radiated Emission Test-Up Frequency 30MHz~1GHz



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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 8DPSK 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 ℃		Re	lative Humidi	ty: 48%		
Model:	153100-VA	-2	Pre	essure:	1010hl	⊃a	
Test Voltage:	AC 120V, 60)Hz	Po	larization:	Horizo	ntal	
Test Mode:	Transmitting	mode of GFSk	C 2480MHz	<u>7</u>	~	2	1
80 Level (dB	uV/m)			1		1 1	
0.0	_						
0.0						FCC P	ART 15B
0.0	_			-			-6dB
0.0						_	
0.0		2.3.14	4 m	100		6	And the Market
D.O male mark	سيليه بالمريد		"HANK	4 Manun	windthe	al and the second	
0.0 halen made	menuly alphaba			44 Annan	were the second	Ale and the second	
	50	100 Fr	equency	200 (MHz)	and the second	500	100
0.0				The second second	Limit	500 Over	100
0.0	Read	Fr	equency	The second second	Limit	Over	100 Remark
0.0 0 30 Fre	Read	Fr Antenna Factor	Cable Loss	(MHz)	Line	Over	
0.0 0 30 Fre	Readi eq Level Hz dBuV	Fr Antenna Factor 	Cable Loss	(MHz) Level dBuV/m	Line dBuV/m	Over Limit	Remark
0.0 0 30 Fre Mi	Readi eq Level Hz dBuV 80 8.15	Fr Antenna Factor 	cable Loss dB 0.15 0.16	(MHz) Level dBuV/m 21.39 28.05	Line dBuV/m 40.00	Over Limit dB	Remark
0.0 030 Fre Mi 79.1 94.1 106.3	Readi eq Level Hz dBuV 80 8.15 43 16.05 39 16.90	Fr Antenna Factor dB/m 13.09 11.84 11.58	cable Loss dB 0.15 0.16 0.18	(MHz) Level dBuV/m 21.39 28.05 28.66	Line dBuV/m 40.00 43.50 43.50	Over Limit dB -18.61 -15.45 -14.84	QP QP QP QP
0.0 0 30 Fre 94.4 106.3 137.9	Readi eq Level Hz dBuV 80 8.15 43 16.05 39 16.90 90 15.47	Fr Antenna Factor dB/m 13.09 11.84 11.58 14.94	equency Cable Loss dB 0.15 0.16 0.18 0.23	(MHz) Level dBuV/m 21.39 28.05 28.66 30.64	Line dBuV/m 40.00 43.50 43.50 43.50	Over Limit dB -18.61 -15.45 -14.84 -12.86	Remark QP QP QP QP QP
0.0 030 Fre Mi 79.1 94.1 106.3	Readi eq Level Hz dBuV 80 8.15 43 16.05 39 16.90 90 15.47 62 11.55	Fr Antenna Factor dB/m 13.09 11.84 11.58	cable Loss dB 0.15 0.16 0.18	(MHz) Level dBuV/m 21.39 28.05 28.66 30.64	Line dBuV/m 40.00 43.50 43.50 43.50 43.50	Over Limit dB -18.61 -15.45 -14.84	Remark QP QP QP QP QP QP

Factor = Ant. Factor + Cable Loss

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Temperatu	ıre: 22	C		Relat	ive Humidity:	48%		100
Model:	15	3100-VA		Press	sure:	1010hPa	a	1
Test Voltag	ge: AC	2120V, 60H	Z	Polar	ization:	Vertical		
Test Mode	e: Tra	ansmitting m	ode of GFSK	2480MHz	S			
80 Leve	el (dBuV/m)	11			_		
70.0								
50.0						_	FCC PAR	T 15B
0.0					1450			-6dB
0.0								
0.0 1	-		5				6	a sub
0.0	- Let	34	Lundin	M.		الله	Mar Maria	and a start of the
20.0 -	halimatedalina	34		Manna	horsowhelenson	- Althouse and a second	here and here and	
20.0 - 1 10.0 0 30	50	34	100	100	00		500	1000
20.0 / 1	50		Fre	equency			500	1000
0.0	50 Freq			100		Limit Line	Over	1000 Remar
0.0			Fre Antenna Factor	Cable Loss	(MHz)	Limit Line	Over Limit	Remar
20.0 - N	Freq MHz	Level	Fre Antenna Factor dB/m	Cable Loss dB 0.27	(MHz) Level dBuV/m 25.24	Limit Line dBuV/m 40.00	Over Limit dB -14.76	Remar
0.0 0.0 0 30	Freq MHz 33.21 43.51	Level dBuV 11.49 13.69	Fre Antenna Factor dB/m 13.48 13.31	Cable Loss dB 0.27 0.13	(MHz) Level dBuV/m 25.24 27.13	Limit Line dBuV/m 40.00 40.00	Over Limit dB -14.76 -12.87	Remar QP QP
20.0	Freq MHz 33.21 43.51 65.34	Level dBuV 11.49 13.69 13.87	Fre Antenna Factor dB/m 13.48 13.31 11.85	Cable Loss dB 0.27 0.13 0.14	(MHz) Level dBuV/m 25.24 27.13 25.86	Limit Line dBuV/m 40.00 40.00 40.00	Over Limit dB -14.76 -12.87 -14.14	Remar QP QP QP
20.0 - 1 - 1 0.0 0 - 30	Freq MHz 33.21 43.51 65.34 72.59	Level dBuV 11.49 13.69 13.87 13.10	Fre Antenna Factor dB/m 13.48 13.31	Cable Loss dB 0.27 0.13 0.14 0.14	(MHz) Level dBuV/m 25.24 27.13	Limit Line dBuV/m 40.00 40.00 40.00 40.00	Over Limit dB -14.76 -12.87 -14.14 -15.14	Remar QP QP QP QP QP

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

17.38

Remark:

6

580.70

11.04

(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.

1.14

29.56

46.00 -16.44

OP

- (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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	http://www.uni-lah.htm



Femperature	e: 22	2°C		Rei	ative Humidit	y: 48%		100
Nodel:	15	53102-VA		Pre	ssure:	1010hF	⊃a	100
Fest Voltage	e: A	C 120V, 60H	Hz	Pol	arization:	Horizo	ntal	
Fest Mode:	Tr	ansmitting	mode of GFSI	K 2480MHz	2		S	
80 Level	(dBuV/n	1)		-				
0.0							_	
0.0							FCC P	ART 15E
0.0							TCC II	-6dE
0.0								
-	-	-		2 4	5			
0.0								
1	alu		2	when	and the second states	WILL		1 mourie marked
1	leget 19 Alter	water an a floor	white the second	why	white	Whitehho	un and a super	100 Marken Marke
0.0 0.0	in the second second	bolk/reacher	and	when	whenter	White	Hampen	and a start of the
0.0	50	ball rain bor	2 444444 100	julm.	200	White	500	1
0.0	50	bold rain from	121220200	requency	the state of the second second	White		
0.0	50	Read	121220200		the state of the second second	Limit		
0.0	50 Freq		F	requency	the state of the second second	Limit	500 Over	
0.0			Fi Antenna Factor	Cable Loss	(MHz)	Line	500 Over Limit	1(
0.0	Freq	Level	Fi Antenna Factor	Cable Loss	(MHz)	Line dBuV/m	500 Over Limit	1(Remar
	Freq MHz	Level dBuV	Fi Antenna Factor dB/m	Cable Loss dB	(MHz) Level dBuV/m	Line dBuV/m 40.00	500 Over Limit dB	1(Remar
0.0 0.0 0 30	Freq MHz 31.84 06.76 36.94	Level dBuV 10.15	Finished Antenna Factor dB/m 14.03 11.60 14.80	Cable Loss dB 0.30 0.18 0.23	(MHz) Level dBuV/m 24.48 25.64 27.68	Line dBuV/m 40.00 43.50 43.50	500 Over Limit dB -15.52 -17.86 -15.82	QP QP QP QP
	Freq MHz 31.84 06.76 36.94	Level dBuV 10.15 13.86 12.65 15.30	Fi Antenna Factor dB/m 14.03 11.60	Cable Loss dB 0.30 0.18 0.23 0.23	(MHz) Level dBuV/m 24.48 25.64 27.68 31.18	Line dBuV/m 40.00 43.50 43.50 43.50	500 Over Limit dB -15.52 -17.86 -15.82 -12.32	QP QP QP QP QP
0.0 0.0 0 30	Freq MHz 31.84 06.76 36.94	Level dBuV 10.15 13.86 12.65	Finished Antenna Factor dB/m 14.03 11.60 14.80	Cable Loss dB 0.30 0.18 0.23	(MHz) Level dBuV/m 24.48 25.64 27.68 31.18	Line dBuV/m 40.00 43.50 43.50 43.50 46.00	500 Over Limit dB -15.52 -17.86 -15.82	QP QP QP QP QP QP QP QP

Factor = Ant. Factor + Cable Loss

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Temp	perature:	22℃		INC	lative Humid	ity: 48%		100
Mode	el:	153102-VA		Pre	Pressure:		Pa	1
Test Voltage:		AC 120V, 60Hz		Po	Polarization:		al	V.
Test	Mode:	Transmitting	mode of GFS	K 2480MH	z	·	s	
80 <mark>1</mark>	Level (dBuV/	m)						
0.0								
0.0					_		FCC P	ART 15B
0.0					-			-6dB
0.0	3	_		6				
	8			ATTAL	11		I	1
0.0	No. MA		and W	n wh	the way way	W. LU	110 martin	Same and a state
0.0 0.0		have a which the	www.ww	r wh	handmin	nd ad ad a day had	alliname	www.u.d.
0.0	30 50	hand the set	100	/ "WA	200	nd of the state	500	100
0.0	30 50	han gaal Miking		requenc	and the second second	nd of the state	500	100
0.0	30 50				and the second second	Limit	500 Over	100
0.0	30 50 Freq	Read	F	requenc	and the second second	Limit	Over	100 Remark
0.0	Freq	Read! Level	F Antenna	Cable Loss	y (MHz) Level	Line	Over Limit	Remark
0.0	Freq	Read Level dBuV	F Antenna Factor dB/m	Cable Loss dB	y (MHz) Level dBuV/m	Line dBuV/m	Over Limit dB	Remark
0.0 0.0 0	Freq MHz 30.11 30.75	Read Level dBuV 20.72 20.44	Factor dB/m 14.75 14.48	Cable Loss dB 0.34 0.32	y (MHz) Level dBuV/m 35.81 35.24	Line dBuV/m 40.00 40.00	Over Limit dB -4.19 -4.76	Remark QP QP
0.0 0.0 0	Freq MHz 30.11 30.75 31.40	Read/ Level dBuV 20.72 20.44 20.56	Factor dB/m 14.75 14.48 14.21	Cable Loss dB 0.34 0.32 0.31	y (MHz) Level dBuV/m 35.81 35.24 35.08	Line dBuV/m 40.00 40.00 40.00	Over Limit dB -4.19 -4.76 -4.92	Remark QP QP QP
0.0 0.0 0;	Freq MHz 30.11 30.75 31.40 31.84	Read/ Level dBuV 20.72 20.44 20.56 18.74	Factor dB/m 14.75 14.48 14.21 14.03	Cable Loss dB 0.34 0.32 0.31 0.30	y (MHz) Level dBuV/m 35.81 35.24 35.08 33.07	Line dBuV/m 40.00 40.00 40.00 40.00	Over Limit dB -4.19 -4.76 -4.92 -6.93	Remark QP QP QP QP
0.0 0.0 0	Freq MHz 30.11 30.75 31.40	Read/ Level dBuV 20.72 20.44 20.56 18.74 18.50	Factor dB/m 14.75 14.48 14.21 14.03 13.38	Cable Loss dB 0.34 0.32 0.31 0.30 0.13	y (MHz) Level dBuV/m 35.81 35.24 35.08 33.07 32.01	Line dBuV/m 40.00 40.00 40.00 40.00 40.00	Over Limit dB -4.19 -4.76 -4.92 -6.93 -7.99	Remark QP QP QP QP QP QP

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

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.

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	2F, Annex Bidg, Jiahuangyuan Tech Park, #365 Baotian 1 Rd, Tiegang Community, Xixiang Str, Bao'an District, Shenzhen, China 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:+86-755-86180156
	http://www.mi-jab.bk



All model 153100-VA , 153102-VA were test, 153100-AV test results were the worst, the report only records the worst mode test results of the 153100-AV model.

Above 1 GHz Test Results (8DPSK Worst Case): CH Low (2402MHz)

Horizontal:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2402	111.11	-5.84	105.27	114.00	-8.73	PK
2402	83.14	-5.84	77.30	94.00	-16.70	AV
4804	62.34	-3.64	58.70	74.00	-15.30	PK
4804	51.27	-3.64	47.63	54.00	-6.37	AV
7206	58.25	-0.95	57.30	74.00	-16.70	PK
7206	48.72	-0.95	47.77	54.00	-6.23	AV

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2402	111.26	-5.84	105.42	114.00	-8.58	РК
2402	81.55	-5.84	75.71	94.00	-18.29	AV
4804	60.34	-3.64	56.70	74.00	-17.30	PK
4804	51.37	-3.64	47.73	54.00	-6.27	AV
7206	56.29	-0.95	55.34	74.00	-18.66	PK
7206	47.95	-0.95	47.00	54.00	-7.00	AV



CH Middle (2441MHz)

Horizontal:

LN

Reading Result	Factor	Emission Level	Limits	Margin	Detector
(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
112.05	-5.84	106.21	114.00	-7.79	PK
82.39	-5.84	76.55	94.00	-17.45	AV
62.51	-3.64	58.87	74.00	-15.13	PK
52.52	-3.64	48.88	54.00	-5.12	AV
56.48	-0.95	55.53	74.00	-18.47	PK
47.09	-0.95	46.14	54.00	-7.86	AV
	Result (dBµV) 112.05 82.39 62.51 52.52 56.48	Result Factor (dBµV) (dB) 112.05 -5.84 82.39 -5.84 62.51 -3.64 52.52 -3.64 56.48 -0.95	Result Pactor Emission Level (dBμV) (dB) (dBμV/m) 112.05 -5.84 106.21 82.39 -5.84 76.55 62.51 -3.64 58.87 52.52 -3.64 48.88 56.48 -0.95 55.53	Result Pactol Emission Level Emission Level (dBμV) (dB) (dBμV/m) (dBμV/m) 112.05 -5.84 106.21 114.00 82.39 -5.84 76.55 94.00 62.51 -3.64 58.87 74.00 52.52 -3.64 48.88 54.00 56.48 -0.95 55.53 74.00	ResultFactorEmission LevelLimitsMargin(dBμV)(dB)(dBμV/m)(dBμV/m)(dB)112.05-5.84106.21114.00-7.7982.39-5.8476.5594.00-17.4562.51-3.6458.8774.00-15.1352.52-3.6448.8854.00-5.1256.48-0.9555.5374.00-18.47

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2441	112.18	-5.71	106.47	114.00	-7.53	PK
2441	82.39	-5.71	76.68	94.00	-17.32	AV
4882	61.14	-3.51	57.63	74.00	-16.37	PK
4882	50.25	-3.51	46.74	54.00	-7.26	AV
7323	56.21	-0.82	55.39	74.00	-18.61	PK
7323	46.99	-0.82	46.17	54.00	-7.83	AV

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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	113.18	-5.65	107.53	114.00	-6.47	PK
2480	82.15	-5.65	76.50	94.00	-17.50	AV
4960	61.88	-3.43	58.45	74.00	-15.55	PK
4960	50.27	-3.43	46.84	54.00	-7.16	AV
7440	57.62	-0.75	56.87	74.00	-17.13	PK
7440	46.28	-0.75	45.53	54.00	-8.47	AV
Remark: Fact	or = Antenna	Factor + Cab	le Loss – Pre-ampli	, ifier. Margin =	Absolute Le	evel – Limit

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2480	113.25	-5.65	107.60	114.00	-6.40	РК
2480	82.44	-5.65	76.79	94.00	-17.21	AV
4960	61.42	-3.43	57.99	74.00	-16.01	PK
4960	50.26	-3.43	46.83	54.00	-7.17	AV
7440	57.61	-0.75	56.86	74.00	-17.14	РК
7440	46.75	-0.75	46.00	54.00	-8.00	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.

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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 $\pi/4$ DQPSK was reported as below.

All model 153100-VA , 153102-VA were test, 153100-AV test results were the worst, the report only records the worst mode test results of the 153100-AV model.

Radiated Band Edge Test:

Worst case on $\pi/4DQPSK$

Operation Mode: TX CH Low (2402MHz)

Horizontal:

Reading Result	Factor	Emission Level	Limits	Margin	Detector
(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
53.79	-5.81	47.98	74.00	-26.02	РК
1	-5.81	1	54.00	/	AV
53.31	-5.84	47.47	74.00	-26.53	РК
1	-5.84	/	54.00	/	AV
53.29	-5.84	47.45	74.00	-26.55	РК
1	-5.84	1	54.00	1	AV
	(dBµV) 53.79 / 53.31 /	(dBµV) (dB) 53.79 -5.81 / -5.81 53.31 -5.84 / -5.84 53.29 -5.84	(dBµV) (dB) (dBµV/m) 53.79 -5.81 47.98 / -5.81 / 53.31 -5.84 47.47 / -5.84 / 53.29 -5.84 47.45	(dBµV) (dB) (dBµV/m) (dBµV/m) 53.79 -5.81 47.98 74.00 / -5.81 / 54.00 53.31 -5.84 47.47 74.00 / -5.84 / 54.00 / -5.84 47.47 74.00 / -5.84 47.45 74.00	(dBµV) (dB) (dBµV/m) (dBµV/m) (dB) 53.79 -5.81 47.98 74.00 -26.02 / -5.81 / 54.00 / 53.31 -5.84 47.47 74.00 -26.53 / -5.84 47.47 74.00 -26.53 / -5.84 47.45 74.00 -26.55

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

Vertical.

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2310	52.85	-5.81	47.04	74.00	-26.96	PK
2310	1	-5.81	1	54.00	1	AV
2390	53.14	-5.81	47.33	74.00	-26.67	PK
2390	1	-5.84	1	54.00	Ι	AV
2400	53.22	-5.84	47.38	74.00	-26.62	PK
2400	1	-5.84	1	54.00	1	AV

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Operation Mode: TX CH High (2480MHz)

Horizontal :

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Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2483.5	53.43	-5.65	47.78	74.00	-26.22	PK
2483.5	1	-5.65	1	54.00	1	AV
2500	53.15	-5.72	47.43	74.00	-26.57	PK
2500	1	-5.72		54.00	1	AV
Remark: Fac	tor = Antenna Facto	or + Cable Lo	oss – Pre-amplifier	5	1	17.

Vertical:	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		S		4	
Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2483.5	52.38	-5.65	46.73	74.00	-27.27	РК
2483.5	1	-5.65	1	54.00	/	AV
2500	53.24	-5.72	47.52	74.00	-26.48	РК
2500	/	-5.72	1	54.00	1	AV

Remark: Factor = Antenna Factor + Cable Loss – 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)	99% Bandwidth (MHz)	Result
2402	0.908	0.843	PASS
2441	0.870	0.836	PASS
2480	0.868	0.836	PASS

CH: 2402MHz



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CH: 2441MHz

Keysight Spectrum Analyzer - Occupied BW INF 50 0 AC enter Freq 2.441000000	GHz Ce	sense mi nter Freq: 2.4410000 g: Free Run	ALIGN M 000 GHz Avg Hold:>10/10	Radio Std:	M Jul 13, 2019 None	Frequency
		tten: 20 dB		Radio Dev	ice: BTS	
dB/div Ref 20.00 dBm						
αο 	- mand	m				Center Fre 2.441000000 Gi
			Ju	~~~~^		
0						
5						
enter 2.441 GHz tes BW 30 kHz		#VBW 100 kH	z		an 3 MHz 4.133 ms	CF Sto 300.000 k
Occupied Bandwidtl	ո 36.27 kHz	Total Po	wer	2.3 dBm		Auto M Freg Offs
Transmit Freq Error x dB Bandwidth	-5.879 kHz 869.0 kHz	% of OB\ x dB		99.00 % 20.00 dB		0
				TATUS		

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CH: 2480MHz



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π/4 DQPSK Modulation:

Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
2402	1.198	1.159	PASS
2441	1.214	1.161	PASS
2480	1.216	1.161	PASS

CH: 2402MHz



CH: 2441MHz



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CH: 2480MHz



8DPSK Modulation:

Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
2402	1.205	1.147	PASS
2441	1.205	1.142	PASS
2480	1.206	1.145	PASS

CH: 2402MHz



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CH: 2441MHz

	09:40:37 AM Jul 13, 2019	ALIGN ALITO	SENSE	AC	ectrum Analyzer - Occupie RF 50 Q M
Frequency	Radio Std: None Radio Device: BTS	0000 GHz Avg Hold:>10/10	Center Freq Trig: Free R #Atten: 20 d	000 GHz #IFGain:Low ↔	req 2.4410000
				dBm	Ref 20.00 d
Center Fr 2.441000000 G		~~~~	~~^		
	·				v
	Span 3 MHz Sweep 4.133 ms	Hz	#VBW		.441 GHz 30 kHz
Auto M	0 dBm	ower 9.8		idth 1.1422 MH	pied Bandwi
Freq Offs 0	9.00 %	W Power 9			nit Freq Error
	.00 dB	-20	Hz x	1.205 M	andwidth

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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	3.358		
GFSK	Mid	3.541	30	Pass
	High	3.429	1.5	10. Te
	Low	3.625	1.00	
π/4DQPSK	Mid	3.358	21	Pass
	High	3.154	2	
	Low	3.365	2	100
8DPSK	Mid	3.255	21	Pass
100	High	3.321		

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Report No.: UNIA19103018FR-01

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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	1.004	0.908	pass
673	Adjacency Channel	2403	1.004		
CH Separation	Mid Channel	2441	1.004	0.070	pass
GFSK	Adjacency Channel	2442	1.004	a 0.870	
St.	High Channel	2480	0.000	0.969	pass
	Adjacency Channel	2479	0.988	0.868	

CH: 2402MHz



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CH: 2441MHz



CH: 2480MHz



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Report No.: UNIA19103018FR-01

Type/Modulation	СН	CH Frequency (MHz)	CH Separation (MHz)	Limit (MHz)	Result
CH Separation π/4DQPSK A	Low Channel	2402	1 000	0.799	pass
	Adjacency Channel	2403	1.000		
	Mid Channel	2441	0.004	0.809	D 000
	Adjacency Channel	2442	0.994		pass
	High Channel	2480	0.984	0.011	pass
	Adjacency Channel	2479	0.904	0.811	

CH: 2402MHz



CH: 2441MHz



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CH: 2480MHz



Type/Modulation	СН	CH Frequency (MHz)	CH Separation (MHz)	Limit (MHz)	Result
CH Separation 8DPSK	Low Channel	2402	4.000	0.803	
	Adjacency Channel	2403	1.000		pass
	Mid Channel	2441	1.000	0.803	pass
	Adjacency Channel	2442	1.002		
	High Channel	2480	1.000	0.004	
	Adjacency Channel	2479	1.000	0.804	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

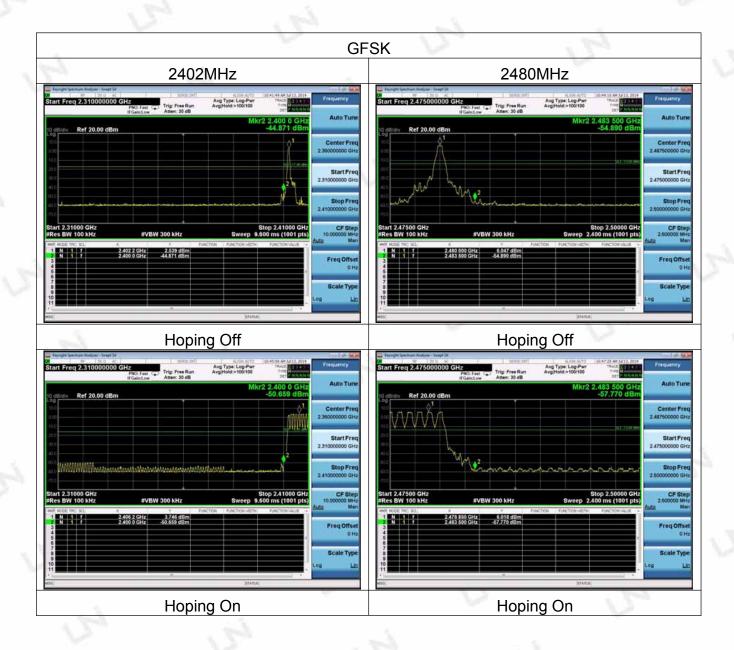
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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

17,66					
Mo	dulation	Frequency Band	Delta Peak to band emission (dBc)	>Limit (dBc)	Result
	Nen henning	Left Band	47.41	20	Pass
OFOK	Non-hopping	Right Band	60.94	20	Pass
GFSK	h a a a in a	Left Band	54.41	20	Pass
	hopping	Right Band	63.79	20	Pass
	Nam hanning	Left Band	46.23	20	Pass
	Non-hopping	Right Band	60.98	20	Pass
π/4DQPSK	h a n n in n	Left Band	48.70	20	Pass
S	hopping	Right Band	62.58	20	Pass
	New Accession	Left Band	46.90	20	Pass
	Non-hopping	Right Band	61.22	20	Pass
8DPSK	h e e e in e	Left Band	48.26	20	Pass
124	hopping	Right Band	64.30	20	Pass

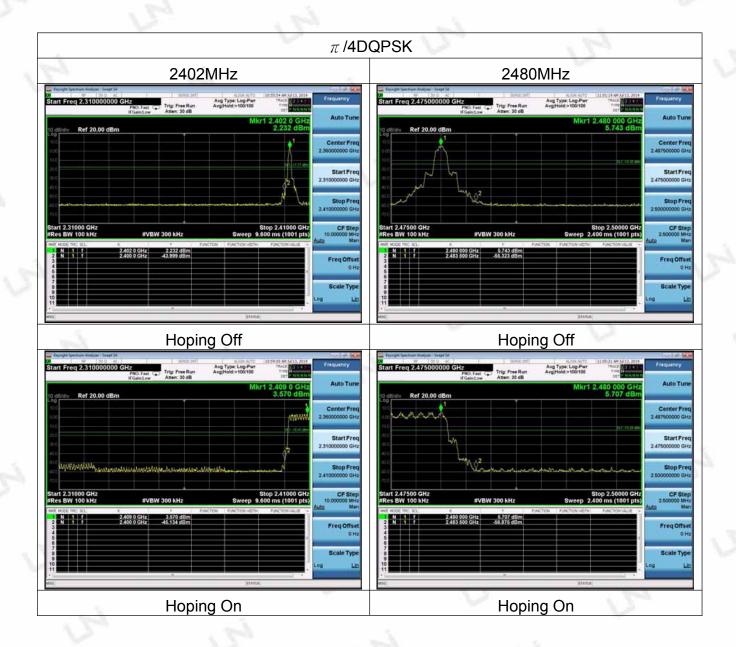
PASS

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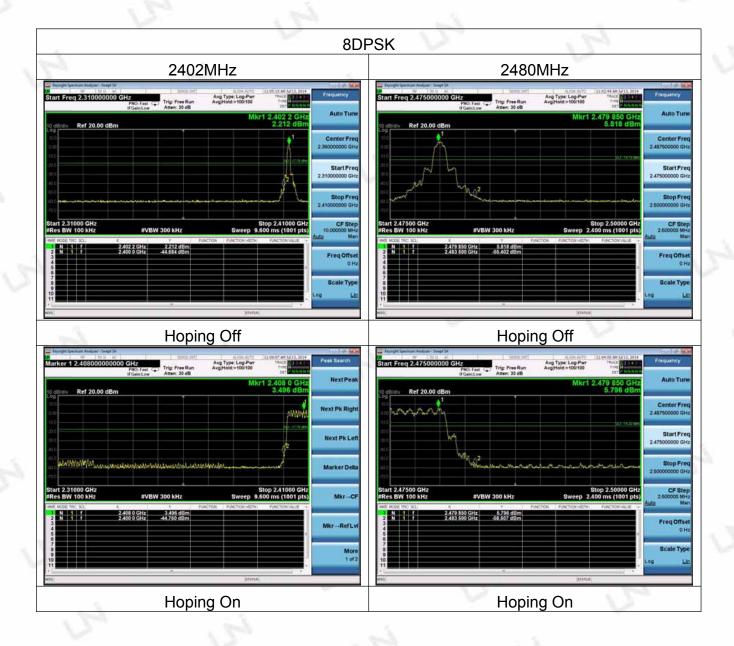
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10. SPURIOUS RF CONDUCTED EMISSION

10.1 Test Limit

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

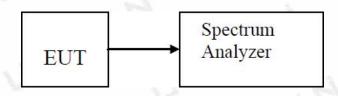
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

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

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



π/4DQPSK

CH: 2402MHz



tart Freq 30.000000 MHz	PNO: Fast	SENSE INT	Aug Type: Log-Pwr Avg Hold:>100/100	01:50:32 PMJul 13, 2019 TRACE 2 2 3 4 5 TYPE MWWWWWW DET P NNNNN	Frequency
0 dB/div Ref 20.00 dBm	T Galice on		M	kr1 362.71 MHz -50.114 dBm	Auto Tune
10.0					Center Free 515.000000 MH
10.0					Start Free 30.000000 MH
20.0				70,3 -17 23 d Gm	Stop Fre 1.000000000 GH
40.0					CF Step 97.000000 MH <u>Auto</u> Ma
22.2 Anternalistantication	nanarisadierradiener	iolon turniturges	instantion of the second	ensisteria terrematicipations	Freq Offse 0 H
70.0					Scale Type
start 0.0300 GHz Res BW 100 kHz	#VBW 3	00 kHz	Sweep 9	Stop 1.0000 GHz 2.73 ms (1001 pts)	Log <u>Li</u>

30MHz~1GHz

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

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0 0 0					19	Analyzer - Swept S	Spectru	ysight
Frequency	01:52:02 PM Jul 13, 2019	ALIGN AUTO		SENSE IN		€ <u>50 0</u> .00000000	1	
	TYPE MWWWWW DET P NNINNN	Type: Log-Pwr Hold:>100/100		Trig: Free Run Atten: 30 dB	PNO: Fast C IFGain:Low	.00000000	req1	t Fi
Auto Tune	r2 24.568 GHz -37.134 dBm	Mk			n	ef 20.00 dB	/ R	Bidiv
Center Free 13.000000000 GH:							¢1	
	51.1 -17.23 dim							
Start Fred 1.000000000 GH:								
	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	norman	m	monoral	a sharp and a sharp	vie in marge	a de	
Stop Free 25.00000000 GH:								
CF Step 2.400000000 GHz	Stop 25.00 GHz .00 ms (1001 pts)	Sweep 60		3.0 MHz	#VB	iz MHz	00 GI W 1.0	
<u>Auto</u> Mar	FUNCTION VALUE	FUNCTION WIDTH	FUNCTION	Y	X		TRC S	-
Freq Offse				2.771 dBm -37.134 dBm	2 392 GHz 24.568 GHz		1	NN
	1							
Scale Type								
Log <u>Lir</u>								
							_	_

1GHz~25GHz

π/4DQPSK

CH: 2441MHz

RF 50.0 AC		SENSE:INT	ALIGN AUTO	01:54:26 PM Jul 13, 2019	Francisco
enter Freq 2.4410000	PNO: Wide C	Trig: Free Run Atten: 30 dB	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 2 2 3 4 5 1 TYPE MWWWWWWW DET P NNNNN	Frequency
0 dB/div Ref 20.00 dBm	//////////////////////////////////////		Mkr1	2.440 838 GHz 3.447 dBm	Auto Tun
0.0					Center Fre 2.441000000 GH
0.00	$\int $			D(.1 - 15 56 aBm	Start Fre 2.439500000 GH
0.0	/				Stop Fre 2.442500000 GH
0.0					CF Ste 300.000 kF Auto Ma
					Freq Offs 0 H
0.0					Scale Typ
enter 2.441000 GHz Res BW 100 kHz	#VBW	300 kHz	Sweep 1	Span 3.000 MHz .000 ms (1001 pts)	Log L

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RF-	5 0 0 m 100		SENSE:INT	ALIGN AUTO	01:54:45 PM Jul 13, 2019	Frequency
Start Freq 30.	.000000 MHz	PNO: Fast	Trig: Free Run Atten: 30 dB	Avg Type: Log-Pwr Avg Hold: 89/100	TYPE NUMBER OF PARTY	
0 dB/div Ref	20.00 dBm			М	kr1 362.71 MHz -50.719 dBm	Auto Tun
10.0						Center Fre 515.000000 MH
10.0					5L1 -15.46 dBm	Start Fre 30.000000 MH
0.0					00,1 +15 56 cent	Stop Fre 1.000000000 GH
20		<b>1</b>				CF Ste 97.000000 MH Auto Ma
	annar ter talan sian	rivilen inder beriter	yik ku dar bill orker fri Austre ge	aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa	mantheman	Freq Offso 0 H
70.0						Scale Typ
tart 0.0300 G Res BW 100 I		#VBW	300 kHz	Sweep 9	Stop 1.0000 GHz 2.73 ms (1001 pts)	Log L

30MHz~1GHz

Keysight Spectrum Analyzer - Swept SA RF 50 Q AC		SENSE:INT		ALIGN AUTO	01:55:30 PM Jul 13,		04
tart Freq 1.000000000 G	PNO: Fast	Trig: Free Run Atten: 30 dB		Type: Log-Pwr Hold:>100/100	TRACE 2 TYPE MWW DET P NM		Frequency
0 dB/div Ref 20.00 dBm	VIN MARANALI			MI	(r2 24.544 G -37.886 d		Auto Tun
						13	Center Fre
					211-163		Start Fre 1.000000000 G⊦
Contractory of the second s		the second second second					
0 0	an a					25	a second s
0.0		V 3.0 MHz			Stop 25.00 ( 0.00 ms (1001	GHz pts) 2	Stop Fre 5.000000000 GH CF Ste 2.400000000 GH
tart 1.00 GHz Res BW 1.0 MHz RR MODE TRC SCL X	#VBW	V 3.0 MHz 3.910 dBm	FUNCTION.			GHz pts) 2	CF Ste
Image: Constraint of the second sec	#VBM	V 3.0 MHz		Sweep 6	0.00 ms (1001	GHz pts) 2	5.000000000 GF CF Ste 2.400000000 GF to Ma Freq Offse
tart 1.00 GHz Res BW 1.0 MHz RR MODE TRC SCL X	#VBW	V 3.0 MHz 3.910 dBm		Sweep 6	0.00 ms (1001	GHz pts) 2	CF Ste

1GHz~25GHz

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## π/4DQPSK

## CH: 2480MHz



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Keysight Spectrum Analyzer - Swept SA				0.4
tart Freq 30.000000 MHz	PNO: Fast Trig: Free Run EGain:Low Atten: 30 dB	Avg Type: Log-Pwr Avg Hold: 94/100	01:57:22 PM Jul 13, 2019 TRACE 1 2 3 4 5 TYPE M WWWWW DET P NN NN N	Frequency
) dB/div Ref 20.00 dBm	In Santa UW Present Of Sig	М	kr1 939.86 MHz -56.402 dBm	Auto Tun
00				Center Fre 515.000000 MH
a 0			DL1-1535 dBm	Start Fre 30.000000 MH
0.0				Stop Fre 1.000000000 GH
20				CF Ste 97.000000 MH Auto Ma
0.0 1.0	angerty Standard and a strange december	40.9765444141414444444444444	here was have been and	Freq Offse 0 H
				Scale Typ
tart 0.0300 GHz Res BW 100 kHz	#VBW 300 kHz	Sweep 9	Stop 1.0000 GHz 2.73 ms (1001 pts)	Log Li

30MHz~1GHz

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

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Mikr2 24.520 GH2           OBBIN         -37.806 dBm           OB         -37.806 dBm           OB         Center Fre           13.00000000 GH           OB         Center Fre           I3.00000000 GH           OB         Center Fre           I3.00000000 GH           Start Fre           I3.00000000 GH           Start Fre           I3.00000000 GH           Start Fre           I. 00 GHZ           Res BW 1.0 MHz         #VBW 3.0 MHz         Sweep 60.00 ms (1001 pts)           Auto         Mat           I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I <thi< th="">         I         <thi< th=""> <thi< th=""><th>Keysight Spectrum Analyzer - Swept SA</th><th></th><th></th><th></th><th></th><th></th><th>0 0 0</th></thi<></thi<></thi<>	Keysight Spectrum Analyzer - Swept SA						0 0 0
Mkr2 24.520 GHz       Auto Tun         000       -37.806 dBm       -37.806 dBm         1.000000000 GH       -37.806 dBm       -37.806 dBm         1.000000000 GH       -37.806 dBm       -37.806 dBm         1.1       1       24.88 GHz       4.934 dBm         1.1       1       24.88 GHz       4.934 dBm         1.1       1       24.820 GHz       37.806 d		PNO: Fast C	Trig: Free Run	Avg	Type: Log-Pwr	TRACE	Frequency
Center Fre Center Fre 13.00000000 GH Cut 13.00 GH Start Fre 1.00000000 GH Start Fre 1.00000000 GH Start Fre 1.00000000 GH Stop Fre 25.0000000 GH Stop Fre 25.0000000 GH CF Step 2.400000000 GH N 1 f 2.468 GHz N 1 f 2.468 GHz Stop Stop Stop Stop Stop Stop OGHZ Stop Stop Stop Stop Stop Stop Stop Stop	dBidiy Ref 20.00 dBm	Poinceow			Mk		Auto Tune
Clinitian         Clinitian         Start Free           0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0 </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Center Freq 13.000000000 GHz</td>							Center Freq 13.000000000 GHz
xt 1.00 GHz         Stop 25.00 GHz         Stop 25.00 GHz         Stop 25.00 GHz         CF Step 240000000 GH           MODE TRC SCL         x         Y         FUNCTION         FUNCTION WOTH         FUNCTION WALLE         Auto         Mate           N 1         f         24.6520 GHz         -37.805 dBm         FUNCTION         FUNCTION WOTH         FUNCTION WALLE         Freq Offsee         0 H           N         1         f         24.6520 GHz         -37.805 dBm         Scale Type         Cg         Log         Ling							Start Freq 1.000000000 GHz
SBW 1.0 MHz         #VBW 3.0 MHz         Sweep 60.00 ms (1001 pts)         2.40000000 GH           MODE TRCI SCL         X         Y         FUNCTION         FUNCTION WOTH         FUNCTION WALLE           N         1         f         2.488 GHz         4.934 dBm         FUNCTION         FUNCTION WOTH         FUNCTION WALLE         Freq Offse           N         1         f         24.620 GHz         -37.806 dBm         Freq Offse         0 H           Scale Type         Cog         Lite         Cog         Lite         Cog         Lite			Aring Aire of Areasta	and the second	Aran		Stop Freq 25.000000000 GHz
MODE TICS SCL X Y FUNCTION WIDTH FUNCTION WALLE N 1 f 2488 GHz 4934 dBm N 1 f 24.520 GHz 37.806 dBm Scale Type Log Li		#VB	W 3.0 MHz		Sweep 60		CF Step 2.400000000 GHz
N       1       f       24.620 GHz       -37.806 dBm       Freq Offse         0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0		2 499 CH-	Y 4 024 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE .	Auto Man
	N 1 7 2	4.520 GHz					Freq Offset 0 Hz
							Scale Type
							Log Lin

1GHz~25GHz

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## 11. NUMBER OF HOPPING FREQUENCY

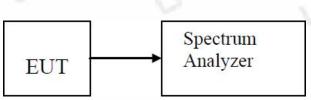
## 11.1 Test Limit

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	Limit	Result
Woodlation	Channel		rtooun
GFSK	79		
π/4DQPSK	79	≥15	Pass
8DPSK	79		

## GFSK

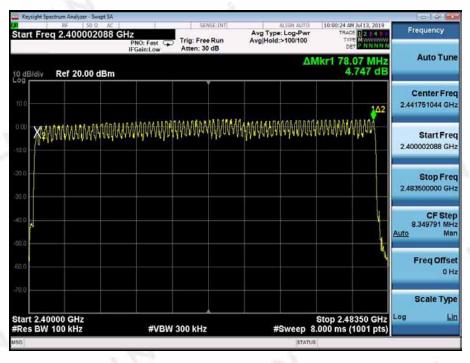
Keysight Spectrum Analyzer - Swept SA RF 50 Q AC		SENSE:DUT	ALIGN AUTO	09:53:40 AM Jul 13, 2019	Frequency
itart Freq 2.400000000	PNO: Fast	Trig: Free Run Atten: 30 dB	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 2 3 4 5 5 TYPE MWWWWWW DET P NNNNN	
0 dB/div Ref 20.00 dBm			ΔMkr	1 78.239 5 MHz 3.853 dB	Auto Tun
10.0				102	Center Fre 2.441750000 GH
					Start Fre 2.400000000 GH
0.0					Stop Fre 2.483500000 GH
au					CF Ste 8.350000 MH <u>Auto</u> Ma
50.0					Freq Offse 0 H
70.0					Scale Type
tart 2.40000 GHz Res BW 100 kHz	#VBW	300 kHz	#Sweep 8	Stop 2.48350 GHz .000 ms (1001 pts)	Log <u>Li</u>
50			STATUS		-

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#### $\pi/4DQPSK$

	SENSE:INT	ALIGN AUTO	09:58:33 AM Jul 13, 2019	
PNO: East		Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 2 3 4 5 1 TYPE MWWWWW DET P NNNN	Frequency
		ΔΝ	lkr1 78.15 MHz 3.687 dB	Auto Tune
			142	Center Fre 2.441751044 GH
MINNAMIN	wwwwww	MANAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	WWWWWW	Start Fre 2.400002088 GH
				Stop Fre 2.483500000 GH
				CF Ste 8.349791 MH Auto Ma
				Freq Offse 0 H
				Scale Typ
#VBW 3	00 kHz			Log <u>Li</u>
	IFGain:Low	PNO: Fast Trig: Free Run IFGain:Low Atten: 30 dB	Hz PRO: Fast Trig: Free Run Atten: 30 dB Atten: 30 dB Atten: 4 dB	Hz PNO: Fast.         Trig: Free Run Atten: 30 dB         Avg Type: Log-Pwr Avg Hold:>100/100         Trid: D 2 3355 Total 100/100           AMKr1 78.15 MHz 3.687 dB         3.687 dB         Avg Type: Log-Pwr Avg Hold:>100/100         Avg Type: Log-Pwr Det Internet Atten: 30 dB

8DPSK



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## 12. TIME OF OCCUPANCY(DWELL TIME)

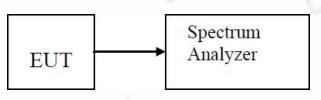
## 12.1 Test Limit

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
		Low	2.95	314.67	400	Pass
Dwell Time	GFSK	Mid	2.95	314.67	400	Pass
		High	2.93	312.53	400	Pass

## CH: 2402MHz

Keysight Spi	ectrum Analyzer - Swept SA		I HALING MART			0 0 0
enter F	req 2.40200000	PNO: Fast	Trig: Free Run Atten: 30 dB	Aug Type: Log-Pwr	10:29:32 AM Jul 13, 2019 TRACE 12 3 4 5 TYPE WWWWWWWWW DET P NNNNN	Frequency
0 dB/div	Ref 20.00 dBm	Poantitow		Δ	Mkr1 2.950 ms 1.70 dB	Auto Tune
10.0						Center Fred 2.402000000 GHz
0.80			л			Start Fred 2.402000000 GH;
20.0						Stop Free 2.402000000 GH:
						CF Step 1.000000 MH Auto Mar
50.0 60.0	nadatatan	handdhiannithd	William W		interditation	Freq Offse 0 H:
70.0						Scale Type
enter 2.4	402000000 GHz	#\/P\M	3.0 MHz	Swaan 9	Span 0 Hz .333 ms (1001 pts)	Log <u>Lir</u>
SG	.0 WI12	#9094	5.0 14112	Sweep 8	Contraction of the local division of the loc	

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## CH: 2441MHz

Keysight Spectrum Analyzer - Swept SA	I HALING STATE			0 0 0
enter Freq 2.441000000 GHz PNO: Fast IFGaint.ow	Trig: Free Run Atten: 30 dB	Avg Type: Log-Pwr	10:30:33 AM Jul 13, 2019 TRACE 1 2 3 4 5 0 TYPE WWWWWWW DET P. NN NN N	Frequency
dB/div Ref 20.00 dBm		ΔΙ	Wkr1 2.975 ms 4.14 dB	Auto Tun
00				Center Fre 2.441000000 GH
00 0 0	۵۱۱ م ۲۰ م			Start Fre 2.441000000 GH
00				Stop Fre 2.441000000 GH
		102	ł	CF Ste 1.000000 MH Auto Ma
**************************************		interferite production of the	when meaning the reacting of	Freq Offs 0 H
				Scale Typ
enter 2.441000000 GHz es BW 1.0 MHz #VE	3W 3.0 MHz	Sweep 8.	Span 0 Hz 333 ms (1001 pts)	Log L
G		STATUS		

## CH: 2480MHz

0	ectrum Analyzer - Swept SA RF 50 0 AC   req 2.480000000	GHz PNO: Fast IFGainclow Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr	10:31:45 AM Jul 13, 2019 TRACE 2 2 3 4 3 TYPE WWWWWWW DET P. N.N.N.N.N	Frequency
10 dB/div	Ref 20.00 dBm	Possilitory Privers of the	Δ.	Mkr1 2.950 ms 3.09 dB	Auto Tun
10.0					Center Fre 2.480000000 GH
0.80					Start Fre 2.480000000 GH
20.0					Stop Fre 2.480000000 GH
				162	CF Ste 1.000000 MH Auto Ma
50.0 60.0	nliteriko-nniko-nikologieko	Hundlindunal Hushira May 2		mander referente	Freq Offse 0 H
200	480000000 GHz			Snap 0.44	Scale Typ
Res BW 1		#VBW 3.0 MHz	Sweep 8	Span 0 Hz .333 ms (1001 pts)	
156		#VOIV 5/5 Miliz	STATUS		-

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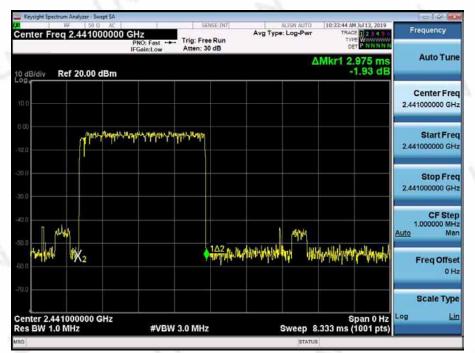
## Page 51 of 56

Туре	Modulation	СН	Pulse time(ms)	Dwell Time(ms)	Limit(ms)	Result
		Low	2.98	317.87	400	Pass
Dwell Time	π/4DQPSK	Mid	2.98	317.87	400	Pass
		High	2.96	315.73	400	Pass

#### CH: 2402MHz



#### CH: 2441MHz



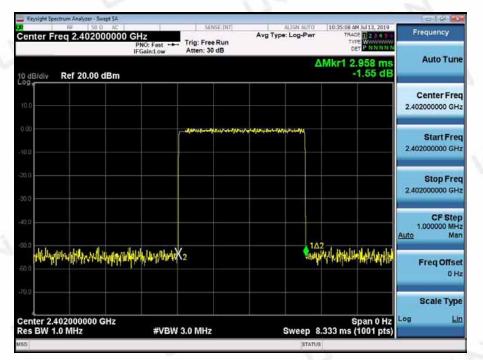
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## CH: 2480MHz

neysigne opr	ectrum Analyzer - Swept SA RF 50.0 AC		SENSE:INT	ALIGN AUTO	10:33:01 AM Jul 13, 2019	0 0 0
enter F	req 2.4800000	PNO: Fast	Trig: Free Run Atten: 30 dB	Avg Type: Log-Pwr	TRACE 2 2 4 4 5 0 TYPE WWWWWWW DET P NNNNN	Frequency
0 dB/div	Ref 20.00 dBm			Δ	Mkr1 2.958 ms -0.67 dB	Auto Tune
100						Center Free 2.480000000 GH
1.00			-Marinett	หมายการสาราชาชาชาชาชาชาชาชาชาชาชาชาชาชาชาชาชา	lluqqea	Start Free 2.480000000 GH;
0.0						Stop Free 2.480000000 GH
0.0						CF Ste 1.000000 MH <u>Auto</u> Ma
0.0 N/W/	<b>a</b> laphanalaideannan	y addaestic ally			Annual and the state	Freq Offse 0 H
0.0						Scale Type
enter 2.4 es BW 1	480000000 GHz .0 MHz	#VBW	3.0 MHz	Sweep 8	Span 0 Hz .333 ms (1001 pts)	Log <u>Li</u> r
sg				STATUS		

Туре	Modulation	СН	Pulse time(ms)	Dwell Time(ms)	Limit(ms)	Result
	1	Low	2.96	315.73	400	Pass
Dwell Time	Dwell 8DPSK	Mid	2.96	315.73	400	Pass
Time		High	2.96	315.73	400	Pass

## CH: 2402MHz



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## CH: 2441MHz

0.4	M Jul 13, 2019	10-25-45 4	ALIGN AUTO	SENSE:INT		ectrum Analyzer - Swept SA RF 50 Q AC	Conditional and the
Frequency	PE WARANA	TRAC	vg Type: Log-Pwr	rig: Free Run tten: 30 dB	CHZ PNO: Fast	req 2.44100000	enter F
Auto Tun	.958 ms 2.02 dB		Δ		1 canned	Ref 20.00 dBm	0 dB/div
Center Fre 2.441000000 GH							10.0
Start Free 2.441000000 GH		Maran Johnson	aby - biget and a state of the state of the	- Ayriot			0.00
Stop Fre 2.441000000 GH							0.0
CF Ste 1.000000 MH <u>Auto</u> Ma	142						0.0
Freq Offse 0 H	and a start			WARMAN X2	adalist Helpizathaa	all of the second s	so.o
Scale Type							10
10000	ipan 0 Hz (1001 pts)		Sweep 8	) MHz	#VBW 3	441000000 GHz I.0 MHz	enter 2. tes BW 1
-		5	STATUS				1G

#### CH: 2480MHz

XI Neys	ight Spectrum Analyzer - Swept S RF 50 Q A		SENSE ONT	ALIGN AUTO	10:36:34 AM Jul 13, 2019	
Cent	er Freq 2.4800000	PNO: Fast	Trig: Free Run Atten: 30 dB	Avg Type: Log-Pwr	TRACE 2 2 4 5 5 TYPE WWWWWW DET P NNNNN	Frequency
0 dB/	div Ref 20.00 dBr	n		Δ	Mkr1 2.958 ms -4.02 dB	Auto Tune
10.0	- Alson also also also also also also also also					Center Fre 2.480000000 GH
0.00 10.0						Start Fre 2.480000000 GH
0.0 0.0						Stop Fre 2.480000000 GH
0.0						CF Ste 1.000000 MF Auto Ma
- 0.0 	¥2	•1	<del>a</del> zyon <mark>hart</mark> hairthalaithe	Heel, logichy name lokel hydron	aletrifetruppine lead the service	Freq Offse 0 H
70.0						Scale Typ
	er 2.480000000 GHz 3W 1.0 MHz		3.0 MHz	Sweep 8	Span 0 Hz .333 ms (1001 pts)	Log Li
sg				STATUS		

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# LN

## 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

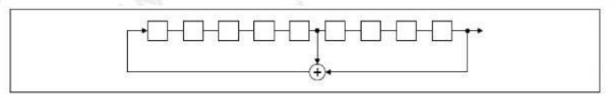
that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shal I hop

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

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
Т						
						111
						111
						i

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.

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## 14. ANTENNA REQUIREMENT

#### 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 PCB Antenna, The directional gains of antenna used for transmitting is 0dBi.

## **BT ANTENNA:**



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## 15. PHOTOGRAPH OF TEST



Radiated Emission (Below 1G)



Radiated Emission (Above 1G)



## ***End of Report***

**Conducted Emission** 

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