

# **TEST REPORT**

## FCC PART 15 SUBPART C 15.247

Test report On Behalf of Shenzhen Wewo Tech co.,Ltd. For Calcini SweatPro 3 Model No.: EA07, EA17, EA27, EA37, EA57, EA67, EA77, EA87, EA97

FCC ID: 2AYH6-EA07

**Prepared For :** 

Shenzhen Wewo Tech co.,Ltd.

201, 6095-2 Baoan Avenue, Qiaotou Community, Fuhai Street, Baoan District, Shenzhen, China

Prepared By : Shenzhen HUAK Testing Technology Co., Ltd. 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

 Date of Test:
 Dec. 23, 2021 ~ Jan. 06, 2022

 Date of Report:
 Jan. 06, 2022

 Report Number:
 HK2112274991-1E

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## **TEST RESULT CERTIFICATION**

Applicant's name	Shenzhen Wewo Tech co.,Ltd.
Address:	201, 6095-2 Baoan Avenue, Qia Baoan District, Shenzhen,China
Manufacture's Name	Shenzhen Wewo Tech co.,Ltd.
Address	201, 6095-2 Baoan Avenue, Qia Baoan District, Shenzhen,China
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Baoan District, Shenzhen, China Shenzhen Wewo Tech co., Ltd.

, 6095-2 Baoan Avenue, Qiaotou Community, Fuhai Street,

201, 6095-2 Baoan Avenue, Qiaotou Community, Fuhai Street, Baoan District, Shenzhen, China

### Product description

Product name .....

Trade Mark:

TESTING	Cloni	C∧LCINI™	
Reavio	Coug	CVTCIN	RARVEL

Model and/or type reference :

Calcini SweatPro 3

: EA07, EA17, EA27, EA37, EA57, EA67, EA77, EA87, EA97

Standards.....

47 CFR FCC Part 15 Subpart C 15.247

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Date of Test .....

Date (s) of performance of tests.... Dec. 23, 2021 ~ Jan. 06, 2022 Date of Issue ...... Jan. 06, 2022

Test Result ..... Pass

Prepared by:

Project Engineer

Reviewed by:

Project Supervisor

Approved by:

asin Min

Technical Director

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**T** 591

#### \* Modified History \*\*

Revision	Description	Issued Data	Remark
Revision 1.0 Initial Test Report Release		Jan. 06, 2022	Jason Zhou
ING	Day Day	TING	G

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## 1. SUMMARY

## **1.1. TEST STANDARDS**

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

ANSI C63.10:2013 : American National Standard for Testing Unlicensed Wireless Devices

## **1.2. TEST DESCRIPTION**

FCC PART 15.247		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.215	20dB Bandwidth & 99% Bandwidth	PASS
FCC Part 15.247(d)	Spurious RF Conducted Emission	PASS
FCC Part 15.247(b)	Maximum Peak Output Power	PASS
FCC Part 15.247(a)(1)	Pseudorandom Frequency Hopping Sequence	PASS
FCC Part 15.247(a)(1)(iii)	Number of hopping frequency & Time of Occupancy	PASS
FCC Part 15.247(a)(1)	Frequency Separation	PASS
FCC Part 15.205/15.209	Radiated Emissions	PASS
FCC Part 15.247(d)	Band Edge Compliance of RF Emission	PASS

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## **1.3. INFORMATION OF THE TEST LABORATORY**

Shenzhen HUAK Testing Technology Co., Ltd. Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Testing Laboratory Authorization :

A2LA Accreditation Code is 4781.01. FCC Designation Number is CN1229. Canada IC CAB identifier is CN0045. CNAS Registration Number is L9589.

## **1.4. STATEMENT OF THE MEASUREMENT UNCERTAINTY**

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the Shenzhen HUAK Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for HUAK laboratory is reported:

Measurement Uncertainty	Notes
±0.37dB	(1)
±3.35dB	(1)
±2.20dB	(1)
±3.68%	(1)
±3.90dB	(1)
±4.28dB	(1)
±2.71dB	(1)
	Uncertainty ±0.37dB ±3.35dB ±2.20dB ±3.68% ±3.90dB ±4.28dB

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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## 2. GENERAL INFORMATION

## **2.1. ENVIRONMENTAL CONDITIONS**

During the measurement the environmental conditions were within the listed ranges:

Normal Temperature:		Normal Temperature: 25°C	
JUAK TEL	Relative Humidity:	55 %	- HUAK TE
Air Pressure:		101 kPa	0

## 2.2. GENERAL DESCRIPTION OF EUT

163	200 · · · · · · · · · · · · · · · · · ·		162
Product Name:	Calcini SweatPro 3		O HUAK IL
Model/Type reference:	EA07	MAKTESTING	
Series Model:	EA17, EA27, EA37, EA57, EA67, EA	.77, EA87, EA97	ING HUAKTESTING
Model Difference:	All model's the function, software and with a product color, appearance and sample model: EA07		-
Power supply:	DC 5V From Type-C or DC 3.7V Fror	n Battery	HUAK
Version:	Supported EDR	TING	
Modulation:	GFSK, π/4DQPSK, 8DPSK	HUAKTES	TESTING
Operation frequency:	2402MHz~2480MHz		C HUAN
Channel number:	79CH	OKTESTING	
Channel separation:	1MHz	D.m	ING
Antenna type:	Chip Antenna	HUAN	O HUM
Antenna gain:	2dBi		
Hardware Version:	V1.1		
Software Version:	V1.1	TESTING	TESTIN

Note: For more details, refer to the user's manual of the EUT.

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## 2.3. DESCRIPTION OF TEST MODES AND TEST FREQUENCY

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing.

There are 79 channels provided to the EUT and Channel 00/39/78 was selected for testing.

#### **Operation Frequency :**

**HUAK TESTING** 

Channel		Free	quency (N	/Hz)	
00			2402		
01	HUALTES	0.	2403	HUAKTES	
-smi		ST	NG .	<sup>(1)</sup>	
38	- 6	THE HUAK I	2440	- G	ING M
39			2441		
40	9. <del>.</del>		2442	W	
:			:		
77	TESTING	TESTING	2479	3	TESTING
78			2480		

Note: The line display in grey were the channel selected for testing.

Preliminary tests were performed in each mode and packet length of BT, and found worst case as bellow, finally test were conducted at those mode and recorded in this report.

Test Items	Worst case	
Conducted Emissions	DH5 High channel	
Radiated Emissions and Band Edge	DH5 Low channel	
Maximum Conducted Output Power	DH5/2DH5/3DH5	
20dB Bandwidth&99% Bandwidth	DH5/2DH5/3DH5	
Frequency Separation	DH5/2DH5/3DH5 Middle channel	
Number of hopping frequency	DH5/2DH5/3DH5	
Time of Occupancy (Dwell Time)	DH1/DH3/DH5 Middle channel 2DH1/2DH3/2DH5 Middle channel 3DH1/3DH3/3DH5 Middle channel	
Out-of-band Emissions	DH5/2DH5/3DH5	

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## 2.4. EQUIPMENTS USED DURING THE TEST

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1. NK TESTIN	L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Dec. 09, 2021	1 Year
2.	Receiver	R&S	ESCI 7	HKE-010	Dec. 09, 2021	1 Year
3.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 09, 2021	1 Year
4.	Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 09, 2021	1 Year
5.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 09, 2021	1 Year
6.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 09, 2021	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 09, 2021	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 09, 2021	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB 1519 B	WKE-014	Dec. 09, 2021	1 Year
10.	Horn Antenna	Schwarzbeck	9120D	HKE-013	Dec. 09, 2021	1 Year
11.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 09, 2021	1 Year
12.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 09, 2021	<sup>3</sup> 1 Year
13.	EMI Test Software EZ-EMC	Tonscend	JS1120-B Version	HKE-083	N/A	N/A
14.	Power Sensor	Agilent	E9300A	HKE-086	Dec. 09, 2021	1 Year
15.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 09, 2021	1 Year
16.	Signal generator	Agilent	N5182A	HKE-029	Dec. 09, 2021	1 Year
17.	Signal Generator	Agilent	83630A	HKE-028	Dec. 09, 2021	1 Year
18.	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 17, 2020	3 Year
19.	Power meter	Agilent	E4419B	HKE-085	Dec. 09, 2021	1 Year
20.	High gain antenna	Schwarzbeck	LB-180400 KF	HKE-054	Dec. 09, 2021	1 Year

The calibration interval was one year.

## 2.5. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

## 2.6. MODIFICATIONS

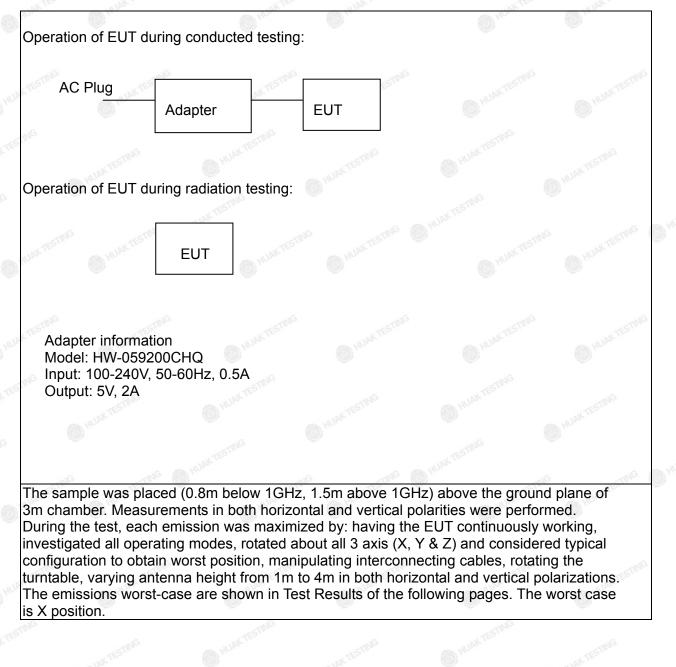
No modifications were implemented to meet testing criteria.

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## 2.7. DESCRIPTION OF TEST SETUP



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## 3. TEST CONDITIONS AND RESULTS

## 3.1. CONDUCTED EMISSIONS TEST

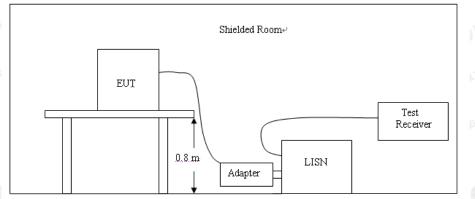
### <u>LIMIT</u>

According to FCC CFR Title 47 Part 15 Subpart C Section 15.207 and RSS Gen 8.8, AC Power Line Conducted Emissions Limits for License-Exempt Radio Apparatus as below:

	Limit (dBuV)		
Frequency range (MHz)	Quasi-peak	Average	
0.15-0.5	66 to 56*	56 to 46*	
0.5-5	56	46	
5-30	60	50	

\* Decreases with the logarithm of the frequency.

### **TEST CONFIGURATION**



### 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 C63.10:2013.
- 2. Support equipment, if needed, was placed as per ANSI C63.10:2013.
- 3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10:2013.
- The 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.
- 8. During the above scans, the emissions were maximized by cable manipulation.

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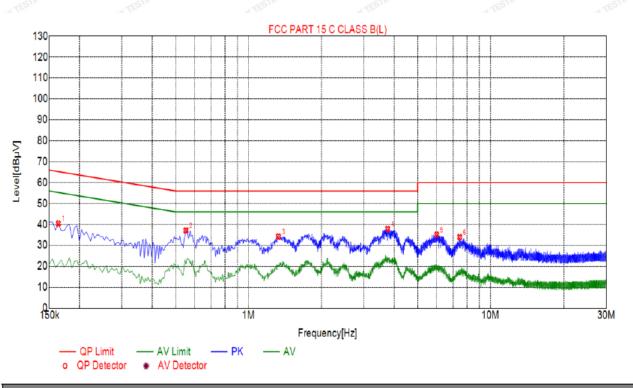
#### Page 12 of 52

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#### TEST RESULTS

Remark: All modes of GFSK, Pi/4 DQPSK, and 8DPSK were test at Low, Middle, and High channel; only the worst result of GFSK High Channel was reported as below:

Test Specification: Line



	Sus	spected	List						
10000	NO.	Freq. [MHz]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Reading [dBµV]	Detector	Туре
ż	1	0.1635	40.43	19.98	65.28	24.85	20.45	РК	L
	2	0.5505	37.13	20.06	56.00	18.87	17.07	РК	L
<	3	1.3290	34.19	20.10	56.00	21.81	14.09	РК	L
	4	3.7590	37.86	20.25	56.00	18.14	17.61	РК	L
	5	6.0000	35.07	20.23	60.00	24.93	14.84	PK	L
	6	7.4670	33.92	20.18	60.00	26.08	13.74	РК	L

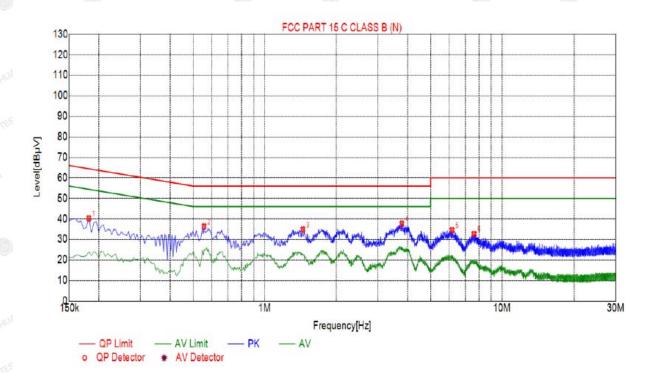
Remark: Margin = Limit – Level Correction factor = Cable lose + LISN insertion loss Level=Test receiver reading + correction factor

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Test Specification: Neutral

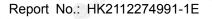


NO.	Freq. [MHz]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Reading [dBµV]	Detector	Туре				
1	0.1815	40.24	20.06	64.42	24.18	20.18	РК	N				
2	0.5550	36.30	20.06	56.00	19.70	16.24	PK	Ν				
3	1.4460	34.81	20.10	56.00	21.19	14.71	PK	N				
4	3.7860	37.63	20.25	56.00	18.37	17.38	PK	N				
5	6.1620	34.58	20.23	60.00	25.42	14.35	PK	N				
6	7.6290	32.71	20.17	60.00	27.29	12.54	PK	N				

Remark: Margin = Limit – Level Correction factor = Cable lose + LISN insertion loss Level=Test receiver reading + correction factor

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## 3.2. RADIATED EMISSIONS AND BAND EDGE

#### <u>Limit</u>

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.

In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Except when the requirements applicable to a given device state otherwise, emissions from license-exempt transmitters shall comply with the field strength limits shown in table below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

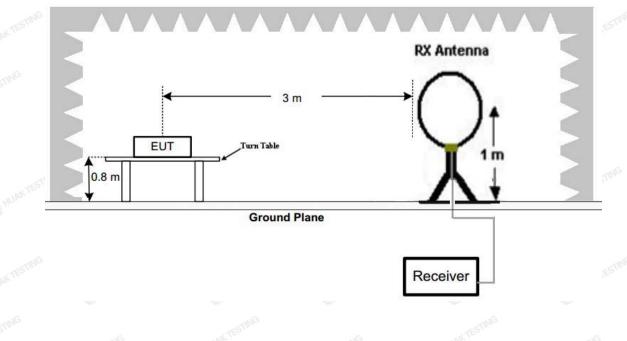
Unwanted emissions that fall into restricted bands shall comply with the limits specified in RSS-Gen; and Unwanted emissions that do not fall within the restricted frequency bands shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

	i nau		
Frequency (MHz)	Distance (Meters)	Radiated (dBµV/m)	Radiated (µV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	× <sup>10</sup> 3	54.0	500
All I All	47	19th	101-

Radiated emission limits

### **TEST CONFIGURATION**

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

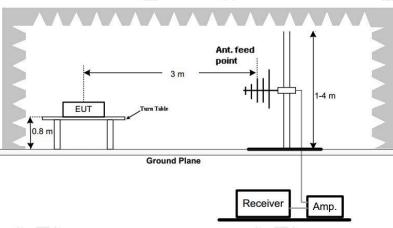


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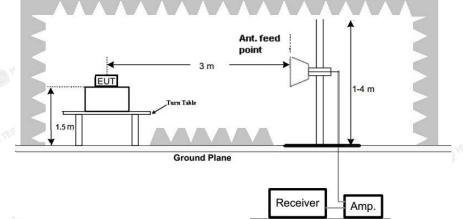
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(C) Radiated Emission Test Set-Up, Frequency above 1000MHz.



### Test Procedure

- The EUT was placed on turn table which is 0.8m above ground plane for below 1GHz test, and on a low permittivity and low loss tangent turn table which is 1.5m above ground plane for above 1GHz test.
- Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0°C to 360°C to acquire the highest emissions from EUT.
- 3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 4. Repeat above procedures until all frequency measurements have been completed.

### TEST RESULTS

Remark:

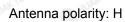
- Radiated Emission measured at GFSK, π/4 DQPSK and 8DPSK mode from 9 KHz to 10th harmonic of fundamental and recorded worst case at GFSK DH5 mode.
- 2. There is no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.
- 3. For below 1GHz testing recorded worst at GFSK DH5 low channel.

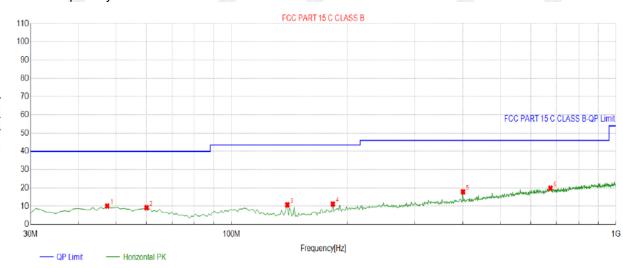
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#### Below 1GHz Test Results:





QP Detector

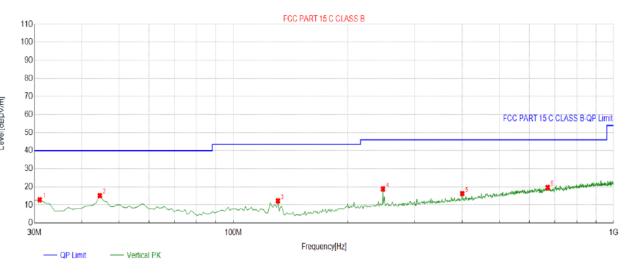
Suspe	ected List								
NO.	Freq.	Factor	Reading	Level	Limit	Margin	Height	Angle	Polarity
NO.	[MHz]	[dB]	[dBµV/m]	[dBµV/m]	[dBµV/m]	[dB]	[cm]	[°]	Polanty
1	47.4775	-13.65	23.75	10.10	40.00	29.90	100	50	Horizontal
2	60.1001	-15.19	24.31	9.12	40.00	30.88	100	1	Horizontal
3	139.7197	-19.16	29.86	10.70	43.50	32.80	100	360	Horizontal
4	183.4134	-16.57	27.78	11.21	43.50	32.29	100	71	Horizontal
5	399.9399	-10.41	28.32	17.91	46.00	28.09	100	69	Horizontal
6	675.6957	-4.75	24.66	19.91	46.00	26.09	100	132	Horizontal

Remark: Factor = Cable loss + Antenna factor - Preamplifier; Level = Reading + Factor; Margin = Limit - Level

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#### Antenna polarity: V



QP Detector

ð	Suspe	Suspected List										
	NO.	Freq.	Factor	Reading	Level	Limit	Margin	Height	Angle	Polarity		
		[MHz]	[dB]	[dBµV/m]	[dBµV/m]	[dBµV/m]	[dB]	[cm]	[°]			
	1	30.9710	-16.30	29.16	12.86	40.00	27.14	100	304	Vertical		
	2	44.5646	-13.73	28.90	15.17	40.00	24.83	100	97	Vertical		
	3	130.9810	-18.63	30.84	12.21	43.50	31.29	100	358	Vertical		
2	4	247.4975	-13.51	32.34	18.83	46.00	27.17	100	307	Vertical		
	5	399.9399	-10.41	26.69	16.28	46.00	29.72	100	120	Vertical		
	6	670.8408	-4.59	24.30	19.71	46.00	26.29	100	38	Vertical		

Remark: Factor = Cable loss + Antenna factor - Preamplifier; Level = Reading + Factor; Margin = Limit - Level

#### **Harmonics and Spurious Emissions**

#### Frequency Range (9kHz-30MHz)

	1>		L instit	
Frequency (MI	IZ)	Level@3m (dBµV/m)	LIMI	t@3m (dBµV/m)
-0		TESTING	KTESTIN	
TESTIN	HUM	TESTING	HOM.	TESTIN
HUM	Ŵ	HUM	-	HUM
	17	e	TING	
	HUNY TESTING			

Note: 1. Emission Level=Reading+ Cable loss+ Antenna factor-Amp factor.

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement.

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FICATION

### For 1GHz to 25GHz

CH Low (2402MHz)

Horizontal:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	O HUAN
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Detecto Type
4804.00	58.98	-3.65	55.33	74.00	-18.67	peak
4804.00	42.35	-3.65	38.70	54.00	-15.30	AVG
7206.00	56.32	-0.95	55.37	74.00	-18.63	peak
7206.00	41.28	-0.95	40.33	54.00	-13.67	AVG

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Detecto Type
4804.00	59.31	-3.65	55.66	74.00	-18.34	peak
4804.00	44.32	-3.65	40.67	54.00	-13.33	AVG
7206.00	56.82	-0.95	55.87	74.00	-18.13	peak
7206.00	44.39	-0.95	43.44	54.00	-10.56	AVG

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### CH Middle (2441MHz)

Horizontal:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Detector Type
4882.00	58.72	-3.54	55.18	74.00	-18.82	peak
4882.00	43.26	-3.54	39.72	54.00	-14.28	AVG
7323.00	56.19	-0.81	55.38	74.00	-18.62	peak
7323.00	43.67	-0.81	42.86	54.00	-11.14	AVG

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

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
4882.00	59.01	-3.54	55.47	74.00	-18.53	peak
4882.00	41.41	-3.54	37.87	54.00	-16.13	AVG
7323.00	56.34	-0.81	55.53	74.00	-18.47	peak
7323.00	43.93	-0.81	43.12	54.00	-10.88	AVG

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

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#### CH High (2480MHz)

Horizontal:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Detector Type
4960.00	58.36	-3.43	54.93	74.00	-19.07	peak
4960.00	45.62	-3.44	42.18	54.00	-11.82	AVG
7440.00	56.65	-0.77	55.88	74.00	-18.12	peak
7440.00	42.37	-0.77	41.60	54.00	-12.40	AVG

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

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Detector Type
4960.00	57.86	-3.43	54.43	74.00	-19.57	peak
4960.00	42.36	-3.44	38.92	54.00	-15.08	AVG
7440.00	54.99	-0.77	54.22	74.00	-19.78	peak
7440.00	41.28	-0.77	40.51	54.00	-13.49	AVG

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

#### 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) The emissions are attenuated more than 20dB below the permissible limits are not recorded in the report.

(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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## Radiated Band Edge Test:

## Hopping

## Horizontal (Worst case)

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector
<sub>。</sub> (MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2310.00	57.26	-5.81	51.45	74	-22.55	peak
2310.00	/	-5.81	O HUM	54	1 🔘 "	AVG
2390.00	57.39	-5.84	51.55	74	-22.45	peak
2390.00	JAK TESTING	-5.84	ESTING WAKTEST	54	TESTING	AVG

Vertical:

Meter Reading	Factor	Emission Level	Limits	Margin	Detector
(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
56.97	-5.81	51.16	74	-22.84	peak
/	-5.81	· /	54	/	AVG
57.14	-5.84	51.3	74	-22.7	peak
HUAR	-5.84	1 HUAN	54	HUAKTL	AVG
	Reading (dBµV) 56.97 /	Reading         Factor           (dBµV)         (dB)           56.97         -5.81           /         -5.81           57.14         -5.84	Reading         Factor         Emission Level           (dBµV)         (dB)         (dBµV/m)           56.97         -5.81         51.16           /         -5.81         /           57.14         -5.84         51.3	Reading         Factor         Emission Level         Limits           (dBµV)         (dB)         (dBµV/m)         (dBµV/m)           56.97         -5.81         51.16         74           /         -5.81         /         54           57.14         -5.84         51.3         74	Reading         Factor         Emission Level         Limits         Margin           (dBµV)         (dB)         (dBµV/m)         (dBµV/m)         (dB)           56.97         -5.81         51.16         74         -22.84           /         -5.81         /         54         /           57.14         -5.84         51.3         74         -22.7

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

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Horizontal	(Worst case)

eter Factor	Emission Level	Limits	Margin	Detector
				Detector
βμV) (dB)	(dBµV/m)	om <sup>©</sup> (dBμV/m)	(dB)	Туре
.28 -5.81	51.47	74	-22.53	peak
/ -5.81	۱ ۹	54	TING /	AVG
.34 -6.06	50.28	74	-23.72	peak
/ -6.06	<b></b>	54	10	AVG
	.28     -5.81       /     -5.81       .34     -6.06       /     -6.06	7.28     -5.81     51.47       /     -5.81     /       0.34     -6.06     50.28	1.28     -5.81     51.47     74       /     -5.81     /     54       0.34     -6.06     50.28     74       /     -6.06     /     54	7.28     -5.81     51.47     74     -22.53       /     -5.81     /     54     /       6.34     -6.06     50.28     74     -23.72       /     -6.06     /     54     /

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2483.50	57.16	-5.81	51.35	74	-22.65	peak
2483.50	1	-5.81	1	54	stands /	AVG
2500.00	56.34	-6.06	50.28	74	-23.72	peak
2500.00	/	-6.06	/	54 com <sup>6</sup>	1	AVG

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

Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.

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## NO hopping

Operation Mode: TX CH Low (2402MHz)

Horizontal (Worst case)

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2310.00	57.82	-5.81	52.01	74	-21.99	peak
2310.00	/	-5.81	/	54 msm <sup>6</sup>	1	AVG
2390.00	57.14	-5.84	51.3	74	-22.7	peak
2390.00	NAN-	-5.84	() HUM	54	HUAK	AVG

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

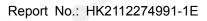
Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2310.00	56.28	-5.81	50.47	74	-23.53	peak
2310.00	1	-5.81	1	54	/	AVG
2390.00	57.14	-5.84	51.3	74	-22.7	peak
2390.00	/	-5.84	1	54	1	AVG

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

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ACATION



## Operation Mode: TX CH High (2480MHz)

Horizontal (Worst case)

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2483.50	57.19	-5.81	51.38	74	-22.62	peak
2483.50	STING /	-5.81	I	54	1	AVG
2500.00	56.34	-6.06	50.28	74	-23.72	peak
2500.00	/	-6.06	/	54	1	AVG
Remark: Facto	r = Antenna Fa	ctor + Cable L	.oss – Pre-amplifier.	° 0"	STING	TESTING

Vertical:

Frequency	Meter Reading	Factor	Emission Level	sm <sup>6</sup> Limits	Margin	Detector
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре
2483.50	57.19	-5.81	51.38	74	-22.62	peak
2483.50	TESTING /	-5.81	I AN TESTING	54	/	AVG
2500.00	56.29	-6.06	50.23	74	-23.77	peak
2500.00	1	-6.06	1	54	1	AVG
Demerly Feet	or - Antonno Fo	eter L Cabla L	Dro omplifior		TESTIC	AK TES

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

Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.

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## **3.3. MAXIMUM PEAK CONDUCTED OUTPUT POWER**

#### <u>Limit</u>

HUAK TESTING

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies 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 shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

### Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power sensor.

### Test Configuration



#### Test Results

Туре	Channel	Output power (dBm)	Limit (dBm)	Result
	00	6.41		
GFSK	39	6.3	21.00	Pass
	78	6.3 M <sup>100</sup>	HUAKTESTIN	HUAKTESTI
0	00	6.34	0	
π/4DQPSK	39	6.15	21.00	Pass
	78	6.33	HUM	TESTING
0.	00	6.35	TING O'	
8DPSK	39	6.26	21.00	Pass
	78	6.3	AKTESTING	MAK TESTING

Note: 1.The test results including the cable lose.

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## 3.4. 20DB BANDWIDTH

### Limit

For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwidth.

### 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 30 KHz RBW and 100 KHz VBW.

The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. The following procedure shall be used for measuring 99% power bandwidth:

RBW=1% to 5% of the OBW VBW=approximately 3 X RBW Detector=Peak

Trace Mode: Max Hold

Use the 99% power bandwidth function of the instrument to measure the Occupied Bandwidth and recoded.

#### Test Configuration



#### <u>Test Results</u>

Modulation	Channel	20dB bandwidth (MHz)	Result
	CH00	0.944	0.
GFSK	CH39	0.948	- Oline
	CH78	0.950	HUAKTESTIN
	CH00	1.220	
π/4DQPSK	CH39	1.272	Pass
	CH78	1.312	HUAKTES
	CH00	1.300	
8DPSK	CH39	1.298	
WAK TESTING	CH78	1.238	WAK TESTING

#### Test plot as follows:

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PR

### 20dB bandwidth



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CATIO

## 3.5. FREQUENCY SEPARATION

#### LIMIT

Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 KHz or the 2/3\*20dB bandwidth of the hopping channel, whichever is greater.

### **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 300 KHz RBW and 1000 KHz VBW.

#### **TEST CONFIGURATION**



#### TEST RESULTS

Modulation Channel GFSK Middle Channel		Channel Separation (MHz)	Limit(MHz)	Result
		1.000	2/3*20dB bandwidth	Pass
π/4DQPSK	Middle Channel	1.000	2/3*20dB bandwidth	Pass
8DPSK	Middle Channel	1.000	2/3*20dB bandwidth	Pass

Note: We have tested all mode at high, middle and low channel, and recorded worst case at middle.

### Test plot as follows:

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## 3.6. NUMBER OF HOPPING FREQUENCY

## Limit

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

### Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set spectrum analyzer start 2400MHz to 2483.5MHz.

## **Test Configuration**



### <u>Test Results</u>

CSTINE CS	The STINE	cs Thu	CSTINE
Modulation	Number of Hopping Channel	Limit	Result
GFSK	79	TNG	
π/4DQPSK	79	≥15	Pass
8DPSK	79		C HUAK IL

Test plot as follows:

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## 3.7. TIME OF OCCUPANCY (DWELL TIME)

### Limit

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

### Test Procedure

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

### Test Configuration



### Test Results

Modulation	Packet	Pulse time (ms)	Dwell time (second)	Limit (second)	Result
<b>TESTING</b>	DH1	0.37	0.118	TESTING	
GFSK DH3 DH5	DH3	1.62	0.259	0.40	PASS
	DH5	2.87	0.306		
π/4DQPSK	2-DH1	0.38	0.122	2	- 16 MH
	2-DH3	1.63	0.261	0.40	PASS
	2-DH5	2.88	0.307	O <sup>no</sup>	
8DPSK	3-DH1	0.38	0.122		
	3-DH3	1.63	0.261	0.40	PASS
	3-DH5	2.88	0.307	O HUM	O HUM

#### Note:

- 1. We have tested all mode at high, middle and low channel, and recoreded worst case at middle channel.
- Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second for DH1, 2-DH1, 3-DH1
   Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2-DH3, 3-DH3
   Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second for DH5, 2-DH5, 3-DH5

Test plot as follows:

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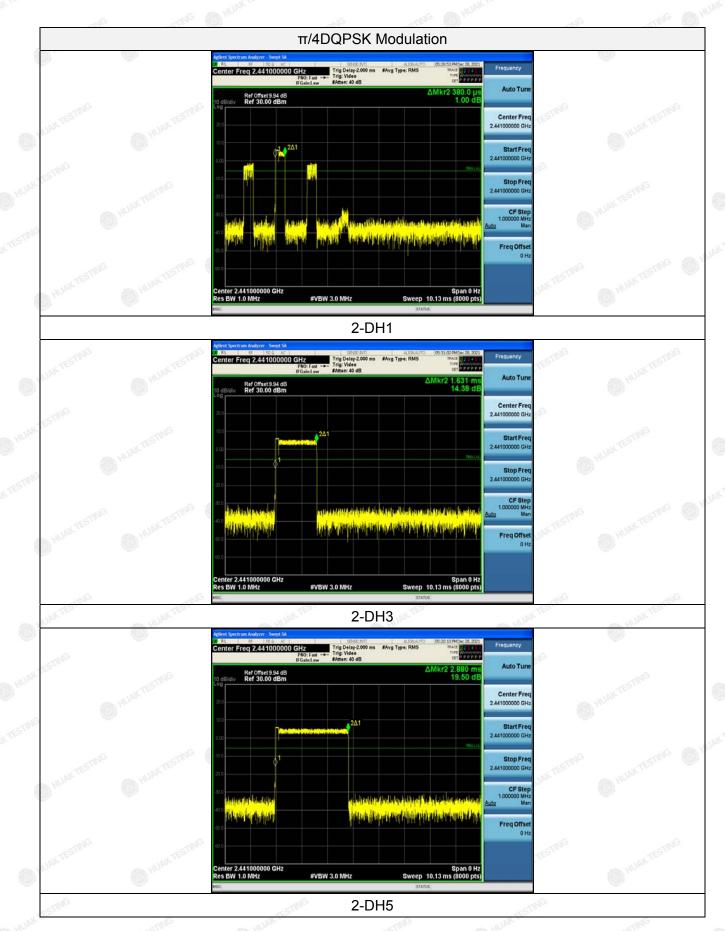


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# 3.8. OUT-OF-BAND EMISSIONS

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#### 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 con-ducted or a radiated measurement, pro-vided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter com-plies 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 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

#### Test Procedure

Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector, and max hold. Measurements utilizing these setting are made of the in-band reference level, band edge and out-of-band emissions.

#### Test Configuration



#### Test Results

Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandage measurement data.

We measured all conditions (DH1, DH3, DH5) and recorded worst case at DH5, 2DH5 and 3DH5.

Test plot as follows:

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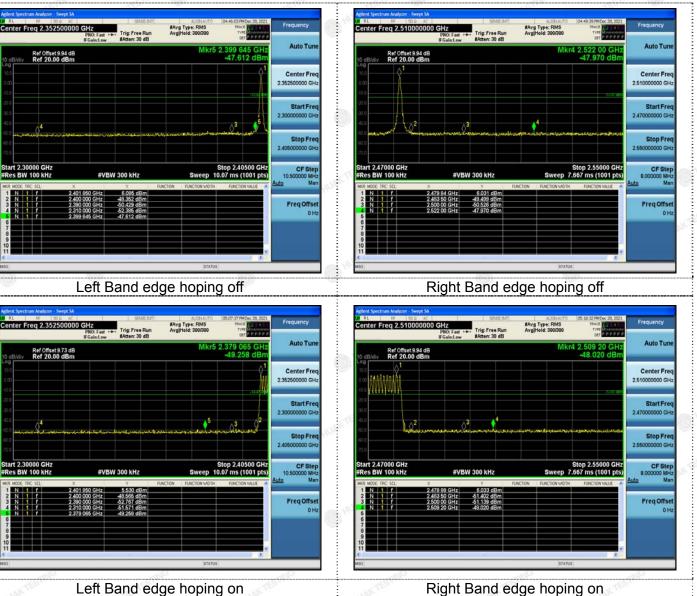
#### Report No.: HK2112274991-1E





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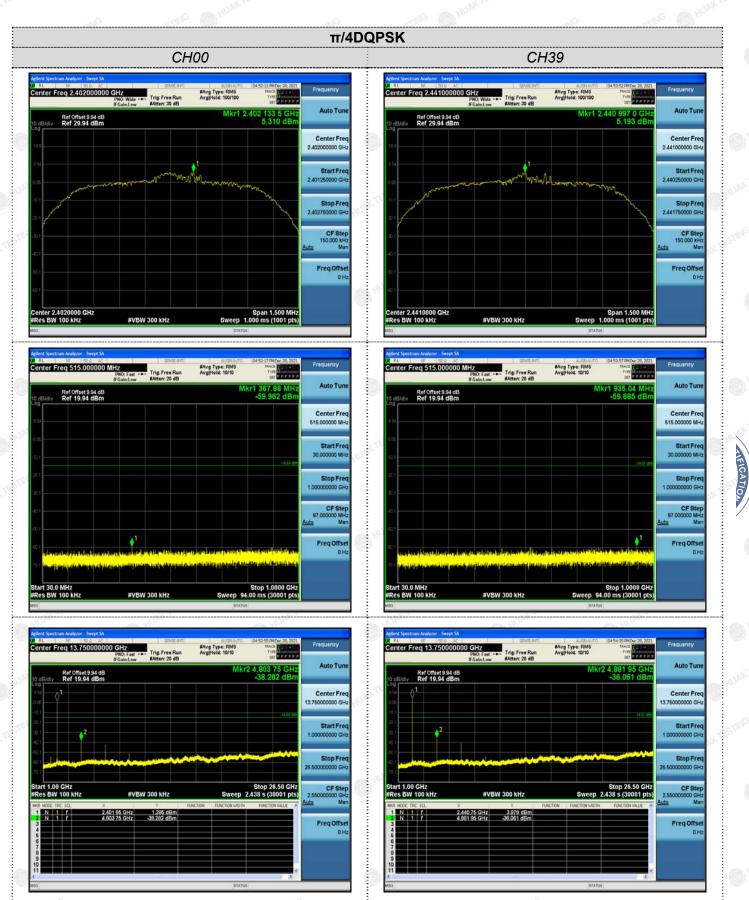
Left Band edge hoping on

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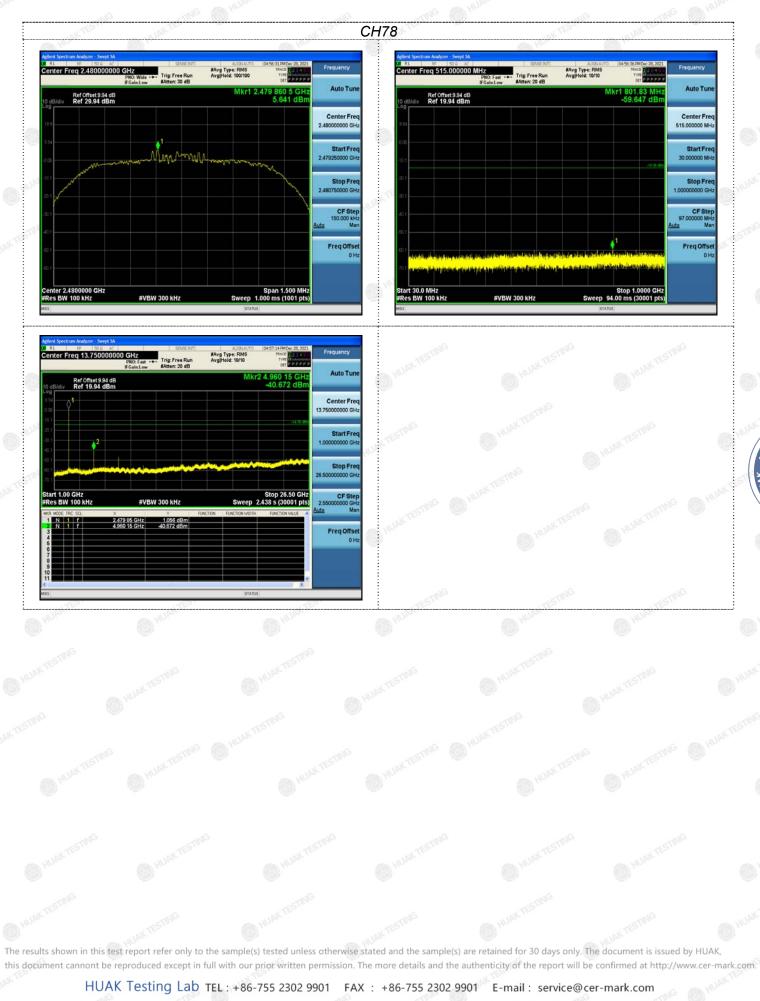
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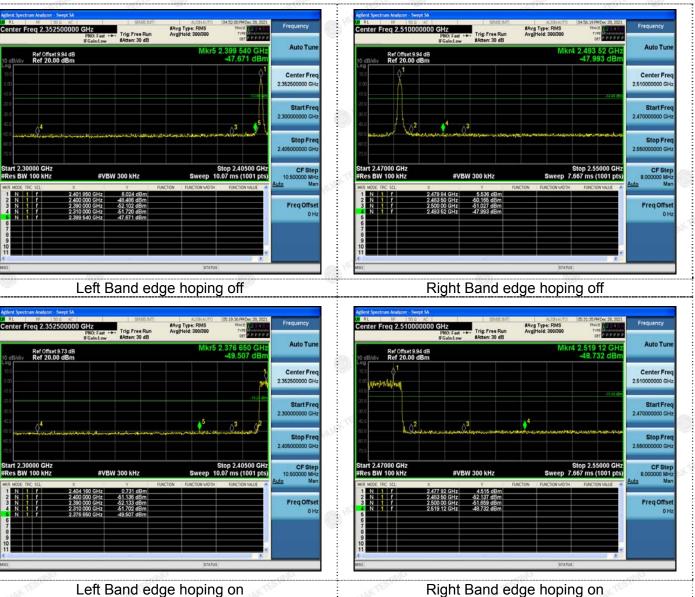
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#### Report No.: HK2112274991-1E

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Left Band edge hoping on

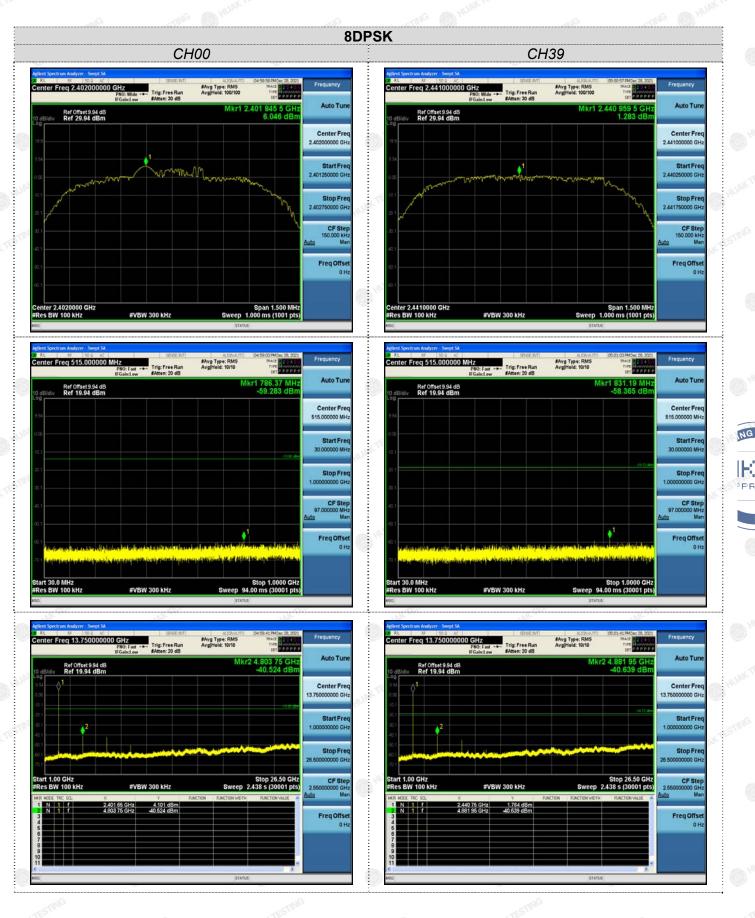
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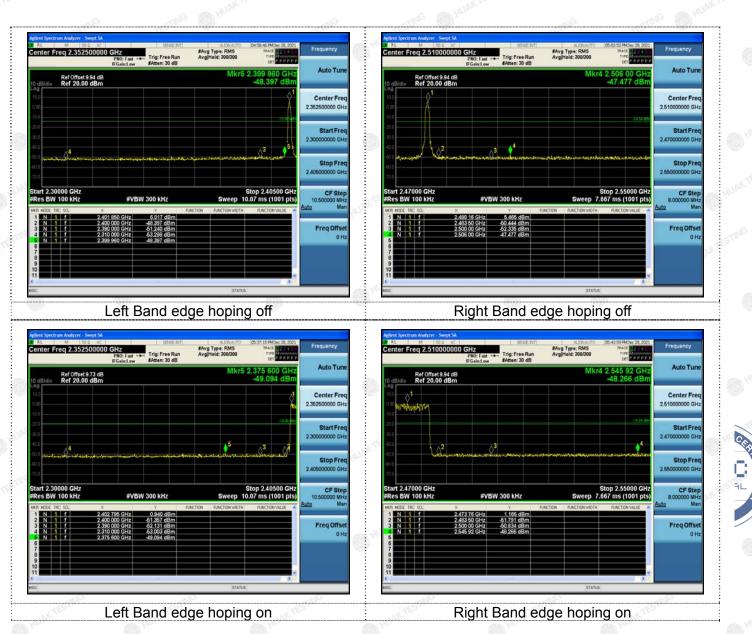


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CATION

### 3.9. PSEUDORANDOM FREQUENCY HOPPING SEQUENCE

#### TEST APPLICABLE

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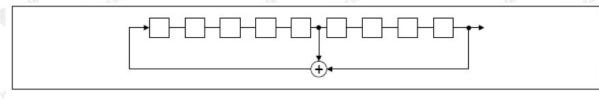
#### For 47 CFR Part 15C section 15.247 (a) (1):

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies 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 shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

#### EUT Pseudorandom Frequency Hopping Sequence Requirement

The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5<sup>th</sup> and 9<sup>th</sup> stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first 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

A	n ex	xam	ple	of p	seudorando	om freque	ncy ho	opping s	eque	ence as follows:			
	0	2	4	6		62	64	78	1		73	75 7	7
								1			T		٦
							L E	1					
								1					
								<del>ì</del>	<u> </u>		·		_

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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#### **3.10. 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. And according to FCC 47 CFR Section 15.247, if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

#### Refer to statement below for compliance.

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

#### **Antenna Connected Construction**

The antenna used in this product is a Chip Antenna, need professional installation. It conforms to the standard requirements. The directional gains of antenna used for transmitting is 2dBi.

#### ANTENNA

# 70 60 50 40 30 20 10 mm

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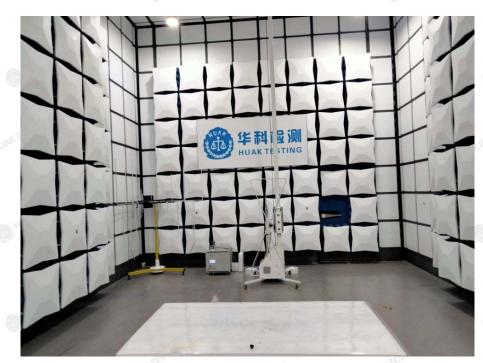


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# 4. TEST SETUP PHOTOS OF THE EUT

**Radiated Emissions** 





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#### Conducted Emission



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# 5. PHOTOS OF THE EUT

Reference to the report: ANNEX A of external photos and ANNEX B of internal photos.

-----End of test report-----

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