

# **RADIO TEST REPORT**

S T S

# Report No.: STS2103086W07

Issued for

Chengdu XGIMI Technology Co., Ltd.

Building A4, Tianfu Software Park, High-tech zone, Chengdu, Sichuan, China

Product Name:	Projector			
Brand Name:	XGIMI			
Model Name:	ХКОЗК			
Series Model: XK04K,XK05K,XK06K,XK07K,XK08 XK09K,XK10K,XK11K,XK12K,XK13 XK14K,XK15K,XK16K,XK17K,XK18 XK19K,XK20K,XK21K,XK22K,XK23 XK24K,XK25K,XK26K,XK27K,XK28 XK29K,XK30K,XK31K,XK32K				
FCC ID:	2AFENXK03K			
Test Standard:	FCC Part 15.247			

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Shenzhen STS Test Services Co., Ltd. A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China TEL: +86-755 3688 6288 FAX: +86-755 3688 6277 E-mail:sts@stsapp.com APPROVAL 6



#### **TEST RESULT CERTIFICATION**

Applicant's Name:	Chengdu XGIMI Technology Co., Ltd.
Address	Building A4, Tianfu Software Park, High-tech zone, Chengdu, Sichuan, China
Manufacturer's Name:	Chengdu XGIMI Technology Co., Ltd.
Address	Building A4, Tianfu Software Park, High-tech zone, Chengdu, Sichuan, China
Product Description	
Product Name:	Projector
Brand Name:	XGIMI
Model Name:	XK03K
Series Model	XK04K,XK05K,XK06K,XK07K,XK08K,XK09K,XK10K,XK11K, XK12K,XK13K,XK14K,XK15K,XK16K,XK17K,XK18K,XK19K, XK20K,XK21K,XK22K,XK23K,XK24K,XK25K,XK26K,XK27K, XK28K,XK29K,XK30K,XK31K,XK32K
Test Standards	FCC Part15.247
Test Procedure	ANSI C63.10-2013

This device described above has been tested by STS, 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 of receipt of test item...... 29 Mar. 2021 Date (s) of performance of tests.: 29 Mar. 2021 ~ 13 May 2021

Date of Issue ..... 17 May 2021

Test Result ..... Pass

Testing Engineer : Technical Manager : Authorized Signatory : (Vita Li)

Shenzhen STS Test Services Co., Ltd.

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#### **Revision History**

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	17 May 2021	STS2103086W07	ALL	Initial Issue



Shenzhen STS Test Services Co., Ltd.



# 1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards: KDB 558074 D01 15.247 Meas Guidance v05r02.

FCC Part 15.247,Subpart C				
Standard Section	Test Item	Judgment	Remark	
15.207	Conducted Emission	PASS		
15.247(a)(1)	Hopping Channel Separation	PASS		
15.247(a)(1)&(b)(1)	Output Power	PASS		
15.209	Radiated Spurious Emission	PASS		
15.247(d)	Conducted Spurious & Band Edge Emission	PASS		
15.247(a)(1)(iii)	Number of Hopping Frequency	PASS		
15.247(a)(1)(iii)	Dwell Time	PASS		
15.247(a)(1)	Bandwidth	PASS		
15.205	Restricted bands of operation	PASS		
Part 15.247(d)/part 15.209(a)	Band Edge Emission PASS			
15.203	Antenna Requirement PASS			

NOTE:

(1) 'N/A' denotes test is not applicable in this Test Report.

(2) All tests are according to ANSI C63.10-2013.



#### 1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD Add. : A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China FCC test Firm Registration Number: 625569 IC test Firm Registration Number: 12108A A2LA Certificate No.: 4338.01

#### 1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	RF output power, conducted	±0.68dB
2	Unwanted Emissions, conducted	±2.988dB
3	All emissions, radiated 9K-30MHz	±2.84dB
4	All emissions, radiated 30M-1GHz	±4.39dB
5	All emissions, radiated 1G-6GHz	±5.10dB
6	All emissions, radiated>6G	±5.48dB
7	Conducted Emission (9KHz-150KHz)	±2.79dB
8	Conducted Emission (150KHz-30MHz)	±2.80dB



## 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Projector		
Trade Name	XGIMI		
Model Name	ХКОЗК		
Series Model	XK04K,XK05K,XK06K,XK07K,XK08K,XK09K,XK10K, XK11K,XK12K,XK13K,XK14K,XK15K,XK16K,XK17K, XK18K,XK19K,XK20K,XK21K,XK22K,XK23K,XK24K, XK25K,XK26K,XK27K,XK28K,XK29K,XK30K,XK31K, XK32K		
Model Difference	Only the appearance color and model name are different, others are exactly the same.		
Channel List	Please refer to the Note 2.		
Bluetooth	Frequency:2402 – 2480 MHz Modulation: GFSK(1Mbps), π/4-DQPSK(2Mbps), 8DPSK(3Mbps)		
Bluetooth Version	5.0		
Bluetooth Configuration	BR+EDR		
Antenna Type	Please refer to the Note 3.		
Adapter	Model: HKA250190A3-7D Input: 100-240V~ 50/60Hz 4.0A Output: 19VDC,13.16A, 250.04W		
Hardware version number	V03		
Software version number	V1.0.0		
Connecting I/O Port(s)	Please refer to the Note 1.		

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User Manual.





2.

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

#### 3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	XGIMI	XK03K	PIFA	N/A	3.49dBi	BT Antenna

Note: The antenna information refer the manufacturer provide report, applicable only to the tested sample identified in the report.

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#### 2.2 DESCRIPTION OF THE TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Worst Mode	Description	Data Rate/Modulation
Mode 1	TX CH00	1Mbps/GFSK
Mode 2	TX CH39	1Mbps/GFSK
Mode 3	TX CH78	1Mbps/GFSK
Mode 4	TX CH00	2 Mbps/π/4-DQPSK
Mode 5	TX CH39	2 Mbps/π/4-DQPSK
Mode 6	TX CH78	2 Mbps/π/4-DQPSK
Mode7	TX CH00	3 Mbps/8DPSK
Mode 8	TX CH39	3 Mbps/8DPSK
Mode 9	TX CH78	3 Mbps/8DPSK
Mode 10	Hopping	GFSK
Mode 11	Hopping π/4-DQPSK	
Mode 12	Hopping 8DPSK	

Note:

(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.

(2) We tested for all available U.S. voltage and frequencies (For 120V, 50/60Hz and 240V, 50/60Hz) for which the device is capable of operation, and the worst case of 120V/ 60Hz is shown in the report.

(3) The battery is fully-charged during the radiated and RF conducted test.

For AC Conducted Emission

	Test Case
AC Conducted Emission	Mode 13 : Keeping BT TX

#### 2.3 FREQUENCY HOPPING SYSTEM REQUIREMENTS

(1)Standard and Limit

According to FCC Part 15.247(a)(1), 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.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.



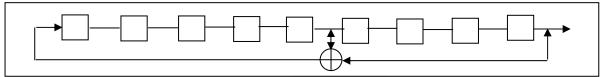
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The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

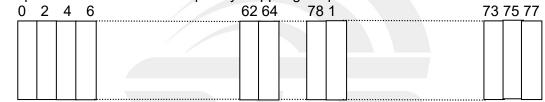
(2)The Pseudorandom sequence may be generated in a nin-stage shift register whose 5<sup>th</sup> and 9<sup>th</sup> stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones: i.e. the shift register is initialized with nine ones.

Numver of shift register stages:9

Length of pseudo-random sequence:2<sup>9</sup>-1=511bits Longest sequence of zeros: 8(non-inverted signal)



Liner Feedback Shift Register for Generator of the PRBS sequence An example of Pseudorandom Frequency Hoppong Sequence as follow:



Each frequency used equally on the average by each transmitter. The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies ini synchronization with the transmitted signals.

(3)Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

This device was tested with a bluetooth system receiver to check that the device maintained hopping synchronization, and the device complied with these requirements FCC Part 15.247 rule.



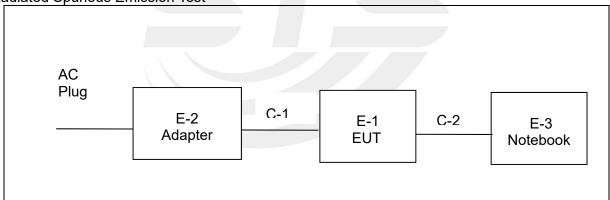
#### 2.4 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS.

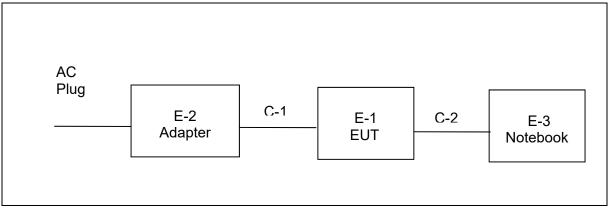
Test software Version	Test program: Bluetooth				
(Power control software) Parameters(1/2/3Mbps)	Power class: DH1 rate:4:27 2DH1 rate:20:54 3DH1 rate:24:83	Power class: DH3 rate:11:183 2DH3 rate:26:367 3DH3 rate:27:552	Power class: DH5 rate:15:339 2DH5 rate:30:679 3DH5 rate:31:1021		

RF Function	Туре	Mode Or Modulation type	ANT Gain(dBi)	Power Class	Software For Testing
		GFSK	3.49	7	
BT	BR+EDR	π/4-DQPSK	3.49	7	WCN_Combo_Tool
		8DPSK	3.49	7	

#### 2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED Radiated Spurious Emission Test



#### **Conducted Emission Test**





#### 2.6 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-2	Adapter	XGIMI	HKA250190A3-7D	N/A	N/A
C-1	DC Cable	N/A	N/A	120cm	YES
/	AC Cable	N/A	N/A	140cm	NO

#### Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-3	Notebook	DELL	Inspiron 13-3467	N/A	N/A
C-2	USB Cable	N/A	N/A	110cm	NO

Note:

- (1) For detachable type I/O cable should be specified the length in cm in  $\[$  Length  $\]$  column.
- (2) "YES" is means "with core"; "NO" is means "without core".



# 2.7 EQUIPMENTS LIST

#### Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	
Test Receiver	R&S	ESCI	101427	2020.10.12	2021.10.11	
Signal Analyzer	R&S	FSV 40-N	101823	2020.10.10	2021.10.09	
Active loop Antenna	ZHINAN	ZN30900C	16035	2019.07.11	2021.07.10	
Bilog Antenna	TESEQ	CBL6111D	34678	2020.10.12	2022.10.11	
Horn Antenna	SCHWARZBECK	BBHA 9120D	02014	2019.10.15	2021.10.14	
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2020.10.12	2022.10.11	
Pre-Amplifier (0.1M-3GHz)	EM	EM330	060665	2020.10.12	2021.10.11	
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2020.10.12	2021.10.11	
Pre-Amplifier (18G-40GHz)	SKET	LNPA-1840-50	SK2018101801	2020.10.10	2021.10.09	
Temperature & Humidity	HH660	Mieo	N/A	2020.10.13	2021.10.12	
Turn table	EM	SC100_1	60531	N/A	N/A	
Antenna mast	EM	SC100	N/A	N/A	N/A	
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)				

#### Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2020.10.12	2021.10.11
LISN	R&S	ENV216	101242	2020.10.12	2021.10.11
LISN	EMCO	3810/2NM	23625	2020.10.12	2021.10.11
Temperature & Humidity	HH660	Mieo	N/A	2020.10.13	2021.10.12
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			



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#### **RF** Connected Test

ī						
	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
				MY55520005	2020.10.10	2021.10.09
	Dewer Concer	Kayaisht	U2021XA -	MY55520006	2020.10.10	2021.10.09
	Power Sensor	Keysight		MY56120038	2020.10.10	2021.10.09
				MY56280002	2020.10.10	2021.10.09
ĺ	Signal Analyzer	Agilent	N9020A	MY51110105	2021.03.04	2022.03.03
	Temperature & Humidity	HH660	Mieo	N/A	2020.10.13	2021.10.12
ſ	Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			



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#### 3. EMC EMISSION TEST

## 3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table.

	Conducted Emissionlimit (dBuV)		
FREQUENCY (MHz)	Quasi-peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	
0.50 -5.0	56.00	46.00	
5.0 -30.0	60.00	50.00	

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of "\*" marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

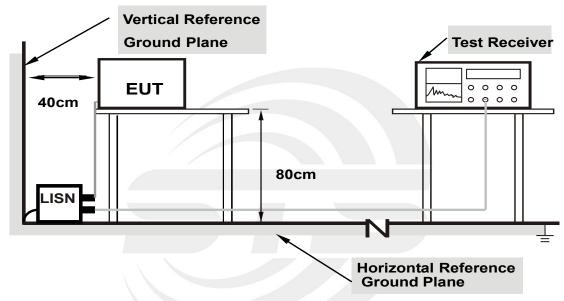
#### The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz



#### 3.1.2 TEST PROCEDURE

- a. The EUT is 0.8 m from the horizontal ground plane and 0.4 m from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments are powered from additional LISN(s). The LISN provides 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN is at least 80 cm from the nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item -EUT Test Photos.



#### 3.1.3 TEST SETUP

Note: 1. Support units were connected to second LISN.

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes support units.

#### 3.1.4 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



#### 3.1.5 TEST RESULT

Temperature:	26.8(C)	Relative Humidity:	66%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 13		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1580	31.33	20.21	51.54	65.57	-14.03	QP
2	0.1580	21.51	20.21	41.72	55.57	-13.85	AVG
3	0.4660	16.98	20.46	37.44	56.58	-19.14	QP
4	0.4660	5.41	20.46	25.87	46.58	-20.71	AVG
5	1.4140	12.65	20.16	32.81	56.00	-23.19	QP
6	1.4140	-0.15	20.16	20.01	46.00	-25.99	AVG
7	4.9940	11.58	20.02	31.60	56.00	-24.40	QP
8	4.9940	7.90	20.02	27.92	46.00	-18.08	AVG
9	12.6740	21.09	19.94	41.03	60.00	-18.97	QP
10	12.6740	15.54	19.94	35.48	50.00	-14.52	AVG
11	27.5380	30.57	20.84	51.41	60.00	-8.59	QP
12	27.5380	19.46	20.84	40.30	50.00	-9.70	AVG

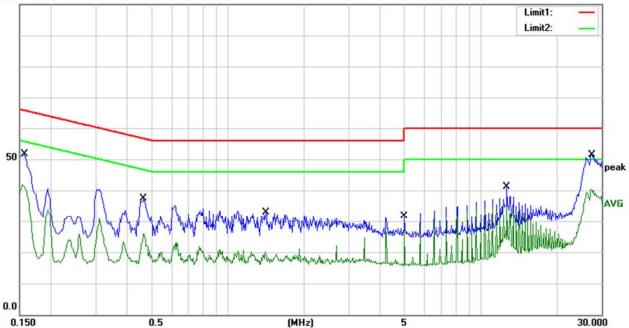
#### Remark:

1. All readings are Quasi-Peak and Average values

2. Margin = Result (Result = Reading + Factor )-Limit

3. Factor=LISN factor+Cable loss+Limiter (10dB)

100.0 dBuV





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Temperature:	26.8(C)	Relative Humidity:	66%RH
Test Voltage:	AC 120V/60Hz	Phase:	Ν
Test Mode:	Mode 13		

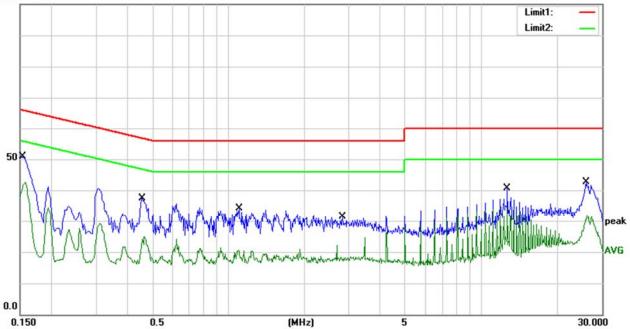
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1540	30.60	20.20	50.80	65.78	-14.98	QP
2	0.1540	22.47	20.20	42.67	55.78	-13.11	AVG
3	0.4580	16.98	20.47	37.45	56.73	-19.28	QP
4	0.4580	3.60	20.47	24.07	46.73	-22.66	AVG
5	1.1020	13.97	20.16	34.13	56.00	-21.87	QP
6	1.1020	0.54	20.16	20.70	46.00	-25.30	AVG
7	2.8380	11.24	20.10	31.34	56.00	-24.66	QP
8	2.8380	-1.75	20.10	18.35	46.00	-27.65	AVG
9	12.6700	20.62	19.94	40.56	60.00	-19.44	QP
10	12.6700	14.76	19.94	34.70	50.00	-15.30	AVG
11	25.9860	21.86	20.75	42.61	60.00	-17.39	QP
12	25.9860	11.10	20.75	31.85	50.00	-18.15	AVG

#### Remark:

1. All readings are Quasi-Peak and Average values

3. Factor=LISN factor+Cable loss+Limiter (10dB)

#### 100.0 dBuV



<sup>2.</sup> Margin = Result (Result = Reading + Factor )–Limit



#### 3.2 RADIATED EMISSION MEASUREMENT

#### **3.2.1 RADIATED EMISSION LIMITS**

In any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205 (a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed.

#### LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

Frequencies	Field Strength	Measurement Distance
(MHz)	(micorvolts/meter)	(meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (1GHz-25 GHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)			
	PEAK	AVERAGE		
Above 1000	74	54		

Notes:

(1) The limit for radiated test was performed according to FCC PART 15C.

- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

#### LIMITS OF RESTRICTED FREQUENCY BANDS

FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (MHz)	FREQUENCY (GHz)
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

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For Radiated Emission

Spectrum Parameter	Setting		
Attenuation	Auto		
Detector	Peak/QP/AV		
Start Frequency	9 KHz/150KHz(Peak/QP/AV)		
Stop Frequency	150KHz/30MHz(Peak/QP/AV)		
	200Hz (From 9kHz to 0.15MHz)/		
RB / VB (emission in restricted	9KHz (From 0.15MHz to 30MHz);		
band)	200Hz (From 9kHz to 0.15MHz)/		
	9KHz (From 0.15MHz to 30MHz)		

Spectrum Parameter	Setting	
Attenuation	Auto	
Detector	Peak/QP	
Start Frequency	30 MHz(Peak/QP)	
Stop Frequency	1000 MHz (Peak/QP)	
RB / VB (emission in restricted	120 KHz / 300 KHz	
band)		

Spectrum Parameter	Setting		
Attenuation	Auto		
Detector	Peak/AV		
Start Frequency	1000 MHz(Peak/AV)		
Stop Frequency	10th carrier hamonic(Peak/AV)		
RB / VB (emission in restricted	1 MHz / 3 MHz(Peak)		
band)	1 MHz/1/T MHz(AVG)		

For Restricted band

Spectrum Parameter	Setting		
Detector	Peak/AV		
Start/Stop Eroguopov	Lower Band Edge: 2310 to 2410 MHz		
Start/Stop Frequency	Upper Band Edge: 2475 to 2500 MHz		
	1 MHz / 3 MHz(Peak)		
RB / VB	1 MHz/1/T MHz(AVG)		

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Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

#### 3.2.2 TEST PROCEDURE

- a. The measuring distance at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
- b. The EUT was placed on the top of a rotating table 0.8 m (above 1GHz is 1.5 m) above the ground at a 3 m anechoic chamber test site. The table was rotated 360 degree to determine the position of the highest radiation.
- c. The height of the equipment shall be 0.8 m (above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. Horizontal and vertical polarization of the antenna are set to make the measurement.
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and QuasiPeak detector mode will be re-measured.
- e. If the Peak Mode measured value is compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and no additional QP Mode measurement was performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos. Note:

Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

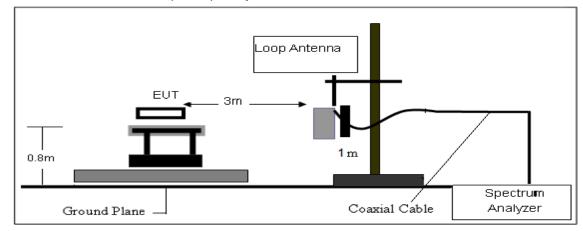
# 3.2.3 DEVIATION FROM TEST STANDARD

No deviation.

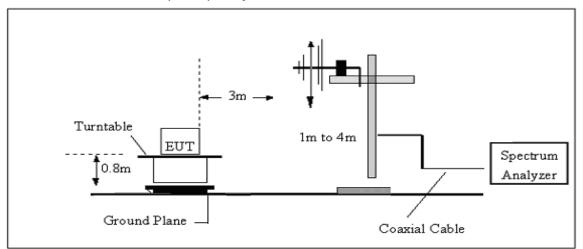


### 3.2.4 TESTSETUP

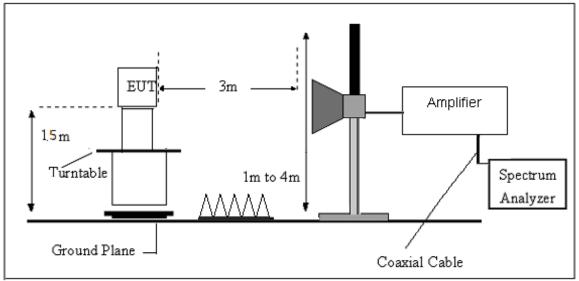
(A) Radiated Emission Test-Up Frequency Below 30MHz

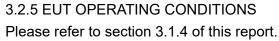


#### (B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz







#### 3.2.6 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG Where FS = Field Strength CL = Cable Attenuation Factor (Cable Loss) RA = Reading Amplitude AG = Amplifier Gain AF = Antenna Factor

For example

Frequency	FS	RA	AF	CL	AG	Factor
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(dB)	(dB)	(dB)
300	40	58.1	12.2	1.6	31.9	-18.1

Factor=AF+CL-AG



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#### 3.2.7 TEST RESULTS

(9KHz-30MHz)

Temperature:	23.1(C)	Relative Humidity:	60%RH
Test Voltage:	AC 120V/60Hz	Test Mode:	TX Mode

Freq.	Reading	Limit	Margin	State	Test Desult	
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F	Test Result	
					PASS	
					PASS	

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor =40 log (specific distance/test distance)(dB); Limit line = specific limits (dBuv) + distance extrapolation factor.





(30MHz-1000MHz)

Temperature:	23.1(C)	Relative Humidity:	60%RH			
Test Voltage:	AC 120V/60Hz	Phase:	Horizontal			
Test Mode:	Mode 1/2/3/4/5/6/7/8/9 (Mode	Mode 1/2/3/4/5/6/7/8/9 (Mode 7 worst mode)				

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	143.4900	53.67	-18.23	35.44	43.50	-8.06	QP
2	221.0900	56.73	-19.53	37.20	46.00	-8.80	QP
3	596.4800	43.25	-5.84	37.41	46.00	-8.59	QP
4	700.2700	38.76	-4.16	34.60	46.00	-11.40	QP
5	869.0500	39.09	-0.52	38.57	46.00	-7.43	QP
6	990.3000	40.00	2.05	42.05	54.00	-11.95	QP

Remark:

- 1. Margin = Result (Result = Reading + Factor )-Limit
- 2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain





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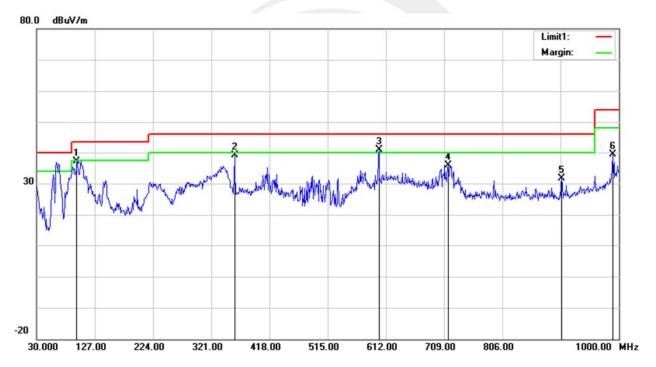
Temperature:	23.1(C)	Relative Humidity:	60%RH	
Test Voltage:	AC 120V/60Hz	Phase:	Vertical	
Test Mode:	Mode 1/2/3/4/5/6/7/8/9 (Mode 7 worst mode)			

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	96.9300	57.71	-20.57	37.14	43.50	-6.36	QP
2	359.8000	51.92	-12.87	39.05	46.00	-6.95	QP
3	600.3600	46.73	-5.84	40.89	46.00	-5.11	QP
4	715.7900	39.37	-3.51	35.86	46.00	-10.14	QP
5	904.9400	31.83	-0.32	31.51	46.00	-14.49	QP
6	990.3000	37.32	2.05	39.37	54.00	-14.63	QP

Remark:

1. Margin = Result (Result = Reading + Factor )–Limit

2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain



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#### (1GHz~25GHz) \$purious emission Requirements

Frequency	Meter Reading	Amplifier	Loss	Antenna Factor	Corrected Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBµV)	(dB)	(dB)	(dB/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре	
				Low Ch	annel (8DPSK/	2402 MHz)				
3264.68	61.46	44.70	6.70	28.20	-9.80	51.66	74.00	-22.34	PK	Vertical
3264.68	50.82	44.70	6.70	28.20	-9.80	41.02	54.00	-12.98	AV	Vertical
3264.78	61.73	44.70	6.70	28.20	-9.80	51.93	74.00	-22.07	PK	Horizontal
3264.78	50.69	44.70	6.70	28.20	-9.80	40.89	54.00	-13.11	AV	Horizontal
4804.53	58.84	44.20	9.04	31.60	-3.56	55.28	74.00	-18.72	PK	Vertical
4804.53	50.60	44.20	9.04	31.60	-3.56	47.04	54.00	-6.96	AV	Vertical
4804.60	58.60	44.20	9.04	31.60	-3.56	55.04	74.00	-18.96	PK	Horizontal
4804.60	49.76	44.20	9.04	31.60	-3.56	46.20	54.00	-7.80	AV	Horizontal
5359.89	48.25	44.20	9.86	32.00	-2.34	45.91	74.00	-28.09	PK	Vertical
5359.89	39.50	44.20	9.86	32.00	-2.34	37.16	54.00	-16.84	AV	Vertical
5359.80	47.84	44.20	9.86	32.00	-2.34	45.50	74.00	-28.50	PK	Horizontal
5359.80	39.00	44.20	9.86	32.00	-2.34	36.66	54.00	-17.34	AV	Horizontal
7205.88	54.19	43.50	11.40	35.50	3.40	57.59	74.00	-16.41	PK	Vertical
7205.88	43.64	43.50	11.40	35.50	3.40	47.04	54.00	-6.96	AV	Vertical
7205.85	54.41	43.50	11.40	35.50	3.40	57.81	74.00	-16.19	PK	Horizontal
7205.85	43.75	43.50	11.40	35.50	3.40	47.15	54.00	-6.85	AV	Horizontal
				Middle C	hannel (8DPSł	2441 MHz)</td <td></td> <td></td> <td></td> <td></td>				
3264.62	61.67	44.70	6.70	28.20	-9.80	51.87	74.00	-22.13	PK	Vertical
3264.62	50.63	44.70	6.70	28.20	-9.80	40.83	54.00	-13.17	AV	Vertical
3264.85	60.82	44.70	6.70	28.20	-9.80	51.02	74.00	-22.98	PK	Horizontal
3264.85	51.05	44.70	6.70	28.20	-9.80	41.25	54.00	-12.75	AV	Horizontal
4882.39	59.01	44.20	9.04	31.60	-3.56	55.45	74.00	-18.55	PK	Vertical
4882.39	50.28	44.20	9.04	31.60	-3.56	46.72	54.00	-7.28	AV	Vertical
4882.39	59.53	44.20	9.04	31.60	-3.56	55.97	74.00	-18.03	PK	Horizontal
4882.39	50.07	44.20	9.04	31.60	-3.56	46.51	54.00	-7.49	AV	Horizontal
5359.64	48.01	44.20	9.86	32.00	-2.34	45.67	74.00	-28.33	PK	Vertical
5359.64	40.38	44.20	9.86	32.00	-2.34	38.04	54.00	-15.96	AV	Vertical
5359.81	48.21	44.20	9.86	32.00	-2.34	45.87	74.00	-28.13	PK	Horizontal
5359.81	38.98	44.20	9.86	32.00	-2.34	36.64	54.00	-17.36	AV	Horizontal
7323.74	54.30	43.50	11.40	35.50	3.40	57.70	74.00	-16.30	PK	Vertical
7323.74	43.72	43.50	11.40	35.50	3.40	47.12	54.00	-6.88	AV	Vertical
7323.78	53.72	43.50	11.40	35.50	3.40	57.12	74.00	-16.88	PK	Horizontal
7323.78	44.25	43.50	11.40	35.50	3.40	47.65	54.00	-6.35	AV	Horizontal



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				High Chan	nel (8DPSK	/2480 MHz)				
3264.87	62.14	44.70	6.70	28.20	-9.80	52.34	74.00	-21.66	PK	Vertical
3264.87	51.17	44.70	6.70	28.20	-9.80	41.37	54.00	-12.63	AV	Vertical
3264.66	61.31	44.70	6.70	28.20	-9.80	51.51	74.00	-22.49	PK	Horizontal
3264.66	50.05	44.70	6.70	28.20	-9.80	40.25	54.00	-13.75	AV	Horizontal
4960.46	58.30	44.20	9.04	31.60	-3.56	54.74	74.00	-19.26	PK	Vertical
4960.46	49.21	44.20	9.04	31.60	-3.56	45.65	54.00	-8.35	AV	Vertical
4960.58	58.78	44.20	9.04	31.60	-3.56	55.22	74.00	-18.78	PK	Horizontal
4960.58	50.58	44.20	9.04	31.60	-3.56	47.02	54.00	-6.98	AV	Horizontal
5359.59	49.23	44.20	9.86	32.00	-2.34	46.89	74.00	-27.11	PK	Vertical
5359.59	40.19	44.20	9.86	32.00	-2.34	37.85	54.00	-16.15	AV	Vertical
5359.75	48.15	44.20	9.86	32.00	-2.34	45.81	74.00	-28.19	PK	Horizontal
5359.75	39.42	44.20	9.86	32.00	-2.34	37.08	54.00	-16.92	AV	Horizontal
7439.76	53.73	43.50	11.40	35.50	3.40	57.13	74.00	-16.87	PK	Vertical
7439.76	43.93	43.50	11.40	35.50	3.40	47.33	54.00	-6.67	AV	Vertical
7439.74	54.74	43.50	11.40	35.50	3.40	58.14	74.00	-15.86	PK	Horizontal
7439.74	44.95	43.50	11.40	35.50	3.40	48.35	54.00	-5.65	AV	Horizontal

Note:

- 1) Scan with GFSK,  $\pi$ /4-DQPSK, 8DPSK, the worst case is 8DPSK Mode.
- 2) Factor = Antenna Factor + Cable Loss Pre-amplifier.

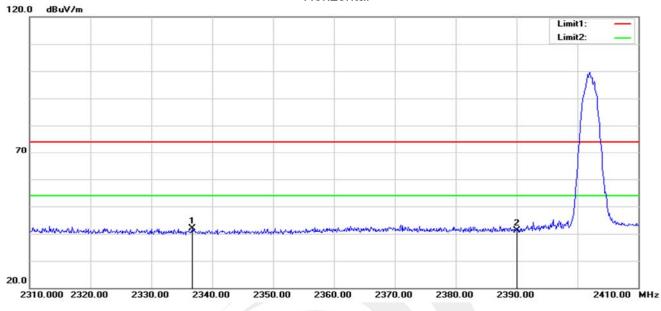
Emission Level = Reading + Factor

3) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.

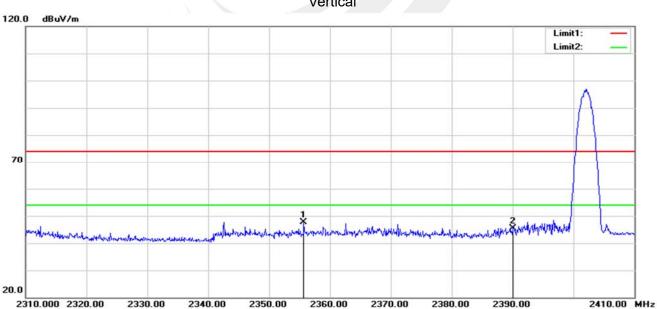


#### **Restricted band Requirements**

8DPSK-Low Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2336.700	38.32	3.66	41.98	74.00	-32.02	peak
2	2390.000	36.89	4.34	41.23	74.00	-32.77	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2355.700	43.81	3.83	47.64	74.00	-26.36	peak
2	2390.000	41.00	4.34	45.34	74.00	-28.66	peak

Vertical

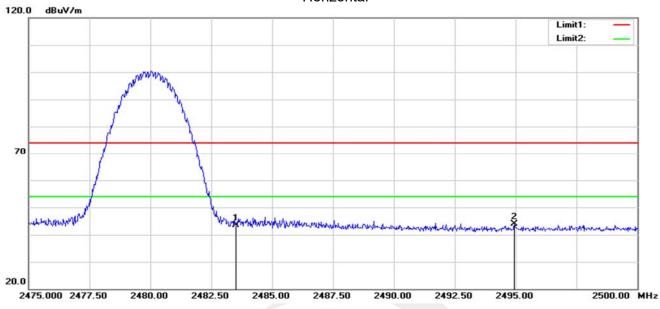
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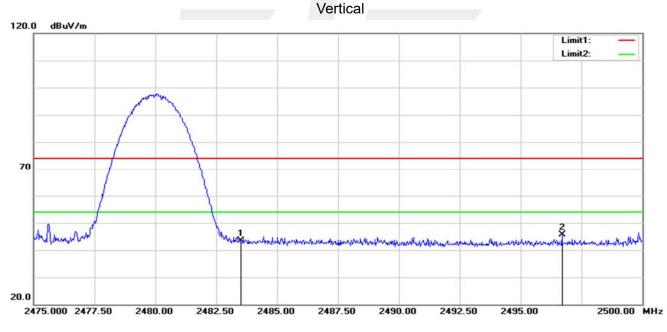
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#### 8DPSK-High Horizontal



No.	Frequency	y Reading Correct Result Limit Margin Remark			Remark		
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	38.90	4.60	43.50	74.00	-30.50	peak
2	2494.950	39.20	4.63	43.83	74.00	-30.17	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	38.70	4.60	43.30	74.00	-30.70	peak
2	2496.700	40.98	4.64	45.62	74.00	-28.38	peak

Note: GFSK,  $\pi$ /4-DQPSK, 8DPSK of the nohopping and hopping mode all have been test, the worst case is 8DPSK of the nohopping mode, this report only show the worst case.

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# 4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

# 4.1 LIMIT

According to FCC section 15.247(d), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

### 4.2 TEST PROCEDURE

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

#### For Band edge

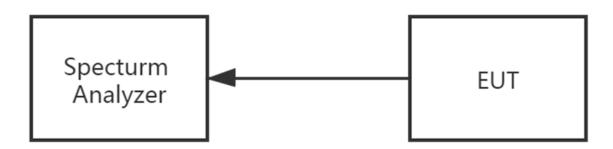
Spectrum Parameter	Setting
Detector	Peak
Start/Stap Eraguanay	Lower Band Edge: 2300 – 2407 MHz
Start/Stop Frequency	Upper Band Edge: 2475 – 2500 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

#### For Hopping Band edge

Spectrum Parameter	Setting			
Detector	Peak			
Start/Stop Eroguapov	Lower Band Edge: 2300– 2403 MHz			
Start/Stop Frequency	Upper Band Edge: 2479 – 2500 MHz			
RB / VB (emission in restricted band)	100 KHz/300 KHz			
Trace-Mode:	Max hold			







The EUT is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. Tune the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, the span is set to be greater than RBW.

#### 4.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

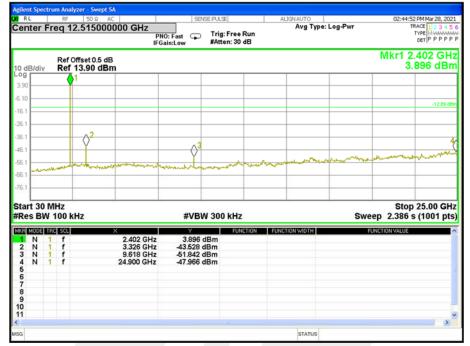




#### 4.5 TEST RESULTS

Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps)-00/39/78 CH	Test Voltage:	AC 120V/60Hz

# 00 CH



#### 39 CH

dB/div	eq 12.51500	PNC	): Fast 🖵 Trig: F in:Low #Atten	ree Run	Avg Type: I	.og-Pwr	т	RACE 1 2 3 4 5
dB/div				30 dB				DET P P P P
g	Ref 17.64 dE							.452 GH 641 dB
	41							
36								
4								-12.26
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4								
4		<mark>3</mark>			marthe Maran	and the second	ر چەتىمىمىيى بىر	man
4 selection	and the second		Warden ter March March 1	and the second				
4								
art 30 MH es BW 1			#VBW 300 k	Hz		Swe	Stop ep 2.386 s	25.00 G
R MODE TRC	SCL	×	Y	FUNCTION FU	NCTION WIDTH		UNCTION VALUE	<u> </u>
N 1 N 1 N 1	f f f	2.452 GHz 3.326 GHz 6.148 GHz 24.850 GHz	7.641 dBm -43.175 dBm -56.856 dBm -47.463 dBm					
								)

П



## 78 CH

lent Spectr	r <mark>um Anal</mark> RF	<mark>lyzer - Swept SA</mark> 50 Ω AC		SEN	ISE:PULSE		ALIGN AUTO		02:50:4	5 PM Mar 28, 20
enter F		2.5150000	00 GHz	0: Fast 😱	Trig: Free F #Atten: 30 d	Run	Avg Type:	Log-Pwr		TYPE MUMMM DET P P P P
dB/div		Offset 0.5 dB 16.53 dBm								.477 GH 532 dB
53		1								
47										-13.36 d
.5										
.5										
1.5		2 	3				andread	-	manul	munul
1.5	للسعروس	mark show a low	an resolution	menne	uhner t	anter a sera				
art 30 M										25.00 GI
tes BW		Hz			N 300 kHz				ep 2.386	s (1001 pi
R MODE TR N 1 2 N 1 3 N 1 4 N 1	f f f	6 	2.477 GHz 2.652 GHz 5.848 GHz 24.276 GHz	6.532 -56.526 -56.571 -48.333	dBm dBm	TION FUN	CTION WIDTH	ł	UNCTION VALUE	
5 7 8 9										
					34					>
							STATUS			



Shenzhen STS Test Services Co., Ltd.



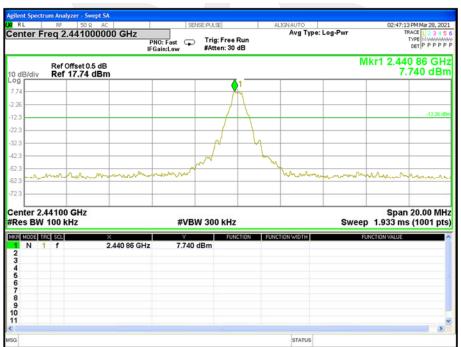


#### For Band edge(it's also the reference level for conducted spurious emission)

		Analyzer - Sw						
RL			AC AC	SENSE:PUL	Œ	ALIGNAUTO Avg Type	Les Dus	02:44:22 PM Mar 28, 20 TRACE 1 2 3 4
Senter I	Fred	q 2.3535	00000 GHz PNI IFGa		: Free Run en: 30 dB	Avg Type	Log-Pwr	TRACE 1 2 3 4 TYPE M MMMM DET P P P P
0 dB/div		Ref Offset 0. Ref 17.11					I	Mkr1 2.401 86 GF 7.105 dB
.og								1
2.89								
								-12,89 d
2.9								
22.9								
32.9								
12.9		2						
2.9		y Y	when the weather shows					marsh more that he had
2.9								
2.9								
tart 2.3 Res BV				#VBW 30	) kHz		Swee	Stop 2.40700 GF p 10.27 ms (1001 pt
KR MODE	TRC	SCL	×	Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE
1 N 2 N	1	f f	2.401 86 GHz 2.313 59 GHz	7.105 dBm -57.244 dBm				
3 N 4 N	1	f	2.398 98 GHz	-55.486 dBm				
4 N 5	1	T	2.400 05 GHz	-51.622 dBm				
6 7								
2 N 3 N 5 6 7 8 9								
0								
1								>
G						STATUS		11.000

#### 00 CH

39 CH





## 78 CH

ent Spectrum Analyzer	- Swept SA	SENSE:PULS	-	ALIGNAUTO	02/50/14	PM Mar 28, 200
nter Freq 2.487	7500000 GHz	NO: Fast Trig	Free Run n: 30 dB	Avg Type: Log-Pwr	TR. T	ACE 1 2 3 4 5 YPE MUMMUM DET P P P P F
Ref Offse dB/div Ref 16.6					Mkr1 2.479 6.6	850 GH 538 dBr
64						
36						-13.36 d
4						
.4		∧2 ∧ <sup>3</sup>				
14 minument	· ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	undane mon	man	montal		*
.4						
art 2.47500 GHz es BW 100 kHz		#VBW 300	kHz	Sv	Stop 2.5 veep 2.400 ms	i0000 GH (1001 pt
R MODE TRC SCL	×	Y	FUNCTION FU	INCTION WIDTH	FUNCTION VALUE	
N 1 f N 1 f N 1 f N 1 f	2.479 850 GHz 2.483 500 GHz 2.485 600 GHz 2.496 500 GHz	6.638 dBm -57.483 dBm -56.459 dBm -56.919 dBm				
				line al		>
				STATUS		



Shenzhen STS Test Services Co., Ltd.





## For Hopping Band edge

GFSK

nt Spectr	um Analyzer -	Swept SA	SE	NSE:PULSE	ALIGNAUTO		03:07:55	PM Mar 28,
nter Fi		1500000 GHz	PNO: Fast IFGain:Low		Аvg Туре	: Log-Pwr	TR/	ACE 1 2 3 YPE MWW DET P P P
B/div	Ref Offse Ref 17.1					N	lkr1 2.402 7.1	897 G 125 di
<u> </u>								
								-12.8
-								
							A2	(
	-		ummen		wanter mar and and a second		manula	mand
	000 GHz 100 kHz		#VB	W 300 kHz		Swee	Stop 2.4 p 9.867 ms	0300 C (1001 J
MODE TF		× 2.402 897 GH	z 7.125	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
N 1		2.390 022 GH 2.400 013 GH	z -59.056	dBm				
		2.000 010 010	-					
					STATUS			

RL	_	RF	50 Q AC		SEN	SE:PULSE	ALIGNAUTO		03:10:13 PM Mar 28, 20
enter	Fre	eq 2	.489500000 (		Fast 🖵 n:Low	Trig: Free Run #Atten: 30 dB	Avg Ty	pe: Log-Pwr	TRACE 1 2 3 4 9 TYPE M WWWW DET P P P P
dB/div			Offset 0.5 dB 16.54 dBm					М	kr1 2.479 861 GH 6.537 dBi
54	<b>\</b> 1								
6 A	M								
5 V		l.							-13.46 d
5		Y.							
5		1							
5		(V)							
5			my of	2					$\wedge^3$
5			manto	man	anner	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	roman de marana ana	monorm	
5									
×									
art 2. es B					#VBV	V 300 kHz		Swee	Stop 2.50000 GH p 2.067 ms (1001 pt
MODE	TRC		×		Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE
NNN	1	f f	2.483	861 GHz 515 GHz 782 GHz	6.537 c -58.974 c -55.799 c	IBm			
	-		2.430	102 0112		Iom			
									>



#### Page 39 of 75 Report No.: STS2103086W07

Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Test Mode:	π/4-DQPSK(2Mbps)– 00/39/78 CH	Test Voltage:	AC 120V/60Hz

	Ω AC	SENSE:PULS	E	ALIGNAUTO	02:59:20 PM
req 12.515			: Free Run en: 30 dB	Avg Type: Log-P	WY TRACE TYPE DET
Ref Offset 0 Ref 17.14					Mkr1 2.40 7.14
1					
$\diamond^2$					
	3				man and the second
- Annen		myuntorone	and the second second	~~	
/IHz 100 kHz		#VBW 300	kHz		Stop 25 Sweep 2.386 s (1
RC SCL	× 2.402 GHz	7,144 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1 1	3.326 GHz 5.673 GHz	-42.813 dBm -56.405 dBm			
1 f	24.301 GHz	-47.627 dBm			
				STATUS	

#### 00 CH

39	CH
	- · · ·

RL		r <mark>um An</mark> RF	50 Ω /	AC	SENSE:PUL!	Æ	ALIGN AUTO		03:33:3	0 PM Mar 28, 202
ente	er F	req ′	12.51500		): Fast 😱 Trig in:Low #Att	: Free Run en: 30 dB	Avg Type	: Log-Pwr	1	TYPE MUMANNA DET P P P P P
) dB/	div		Offset 0.5 d 15.76 dB							.452 GH .756 dBr
76			1							
24 -										
1.2										-12.05 d
2										
1.2 -									-	
2			2 <sup>2</sup>	$\wedge^3$				all arright	manume	-
2	an a	مسه	and a strangene	and the second and and and and and and and and and a	nountermo	me	man			
2			-					_	_	-
	30 I					70000			Stop	25.00 GH
	_	100			#VBW 300	) kHz			eep 2.386	s (1001 pi
E MO 2 N 3 N	4	RC SCL f	· · · · · ·	2.452 GHz 3.476 GHz	5.756 dBm -57.178 dBm	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
3 M 4 M	4	f f		5.923 GHz 24.326 GHz	-56.412 dBm -46.761 dBm					
5										
3										
)										
9 D 1										>



## 78 CH

ilent Spectrum Ana RL RF	50 Q AC		SENSE:PULS	E I	ALIGNAUTO		03:42:20 PM Mar 28, 2
enter Freq 1	2.51500000	) GHz PNO: F IFGain:I		: Free Run en: 30 dB	Avg Type:	Log-Pwr	TYPE MWWW DET P P P
	Offset 0.5 dB 11.85 dBm						Mkr1 2.477 G 1.845 dE
85	1						
15							-13.11
3.2							
3.2	2						
3.2	V	<del>3</del>					
3.2	-	war Lunderund	and a starter	man	have marked	and the second	Mar
3.2							
3.2							
art 30 MHz Res BW 100 I	Hz		#VBW 300	kHz	i.	Swee	Stop 25.00 G p 2.386 s (1001 p
R MODE TRC SCL	×		Y	FUNCTION	FUNCTION WIDTH	FUI	ICTION VALUE
N 1 f 2 N 1 f 3 N 1 f 4 N 1 f 5	i	2.477 GHz 3.326 GHz 5.372 GHz 1.975 GHz	1.845 dBm -43.192 dBm -56.685 dBm -47.778 dBm				
5 5 7 3 9							
2							
9 D 1							- ALCONTRACTOR OF A



Shenzhen STS Test Services Co., Ltd.





#### For Band edge(it's also the reference level for conducted spurious emission)

		Analyzer - Swept								
RL		RF 50 Q /		SENS	E:PULSE	ALIC	Avg Type:	Les Dus		9 PM Mar 28, 202 RACE 1 2 3 4 5
Center I	Frec	2.3535000	PN	0: Fast 😱 ain:Low	Trig: Free Run #Atten: 30 dB		Avg Type:	Log-Pwr		TYPE MHMMM DET P P P P P
0 dB/div		ef Offset 0.5 d ef 17.42 dB							Mkr1 2.40 7.	1 86 GH 424 dBn
.og										1
7.42										Å
2.58										-12 58 05
2.6										
22.6										
32.6										14
42.6										
52.6										19 H
62.6	,Laka	-Angle Works		a commenter ou	montering	and and a second	4	- the termine	مەرورلىرىلىرىلىرىلىرىلىرىلىرىلىرىلىرىلىرىكى ئىلىلارلىرىلىرىلىرىلىرىلىرىلىرىلىرىلىرىلى	
72.6										
tart 2.3 Res BV				#VBW	300 kHz			Swee	Stop 2 p 10.27 m	.40700 GH s (1001 pt
KR MODE	TRC	CL.	×	Y	FUNCTION	FUNCTION	DN WIDTH		FUNCTION VALUE	
1 N 2 N	1	f	2.401 86 GHz 2.317 23 GHz	7.424 d -58.733 d						
3 N	1	r -	2.399 40 GHz	-54.626 d	Bm					
4 N 5	1		2.400 05 GHz	-47.992 d	Bm					
6										
2 N 3 N 5 6 7 8 9										
10										
11										
sg							STATUS			1.1.2
3							annius			

#### 00 CH

39 CH





## 78 CH

ent Spectrum Ana R L RF	lyzer - Swept SA 50 Ω AC		SEN	SE:PULSE	ALIGNAUTO		03:41:50 PM M	¥ 28, 20
nter Freq 2	.48750000	PN	IO: Fast 😱	Trig: Free Run #Atten: 30 dB	Avg Type:	Log-Pwr	TRACE	
	Offset 0.5 dB 16.89 dBm					M	(r1 2.479 85) 6.886	
9	<b></b>	5						
1								-13.11 d
1								
1	pr -	m					- 4	
aman	n l	here and	minne	mm	www		·····	~~~
1								
art 2.47500 ( es BW 100			#VBV	V 300 kHz	10	Sweep	Stop 2.500 2.400 ms (10	
MODE TRC SCL	×		Y	FUNCTION	FUNCTION WIDTH	FL	UNCTION VALUE	
N 1 f N 1 f N 1 f N 1 f	2.4	79 850 GHz 83 500 GHz 84 125 GHz 97 750 GHz	6.886 c -57.353 c -56.244 c -57.569 c	iBm iBm				
								>



Shenzhen STS Test Services Co., Ltd.





### For Hopping Band edge

#### π/4-DQPSK

nt Spectru	m Analyzer - S	Swept SA	CE	NSE:PULSE	ALIGN AUTO		03-59-40	PM Mar 28, 20
		500000 GHz	PNO: Fast G		Avg Type:	Log-Pwr	TRA	VCE 1 2 3 4 VPE MUMMA DET P P P P
B/div	Ref Offset Ref 17.24						lkr1 2.402 ( 7.2	073 GI 42 dB
								-12.76
								(
a		warman and		and the second second	and the second design of the			alar and
	000 GHz 100 kHz		#VB	W 300 kHz		Swee	Stop 2.4 p 9.867 ms	
MODE TRO N 1 N 1	f f	× 2.402 073 GH 2.390 022 GH			FUNCTION WIDTH		FUNCTION VALUE	
N 1	f	2.400 013 GH						
				8				
					STATUS			



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Page 44 of 75 Report No.: STS2103086W07

Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Test Mode:	8DPSK(3Mbps) -00/39/78 CH	Test Voltage:	AC 120V/60Hz

R	L		RF	50 Ω	AC		SENSE:PULS	ε	AL	.IGN AUTO		04:27	14 PM Mar 28, 202
lar	ker	13	2.40	0215000	00000 GHz	PNO: Fast FGain:Low	Trig #Atte	: Free Run en: 30 dB		Avg Type	: Log-Pwr		TRACE 1 2 3 4 5 TYPE MUMMM DET P P P P P
D d	B/di			Offset 0.5 f <b>20.50</b> d									2.402 GH 1.653 dBn
og		· _	110	. 1									
0.5	$\vdash$			)'									
00	$\vdash$												
.50							_						-12:54 dt
9.5													
9.5							_						
9.5													
9.5				2	∆ <sup>3</sup>								$\bigcirc$
9.5				Q.	ľ.	anner		wayne	n	mananton	man and the second	new man	without
	me	mas					- Jonnon						
9.5													
		0 M W 1		kHz		#	VBW 300	kHz		A.	Sw		p 25.00 GH s (1001 pts
S.B.		TRO	SCL		×			FUNCTION	FUNC	TION WIDTH		FUNCTION VALUE	
1	NN	1	f		2.402 GHz 2.702 GHz	4.	553 dBm 297 dBm						
3	N	1	f		5.174 GHz	-52.0	641 dBm						
4	Ν	1	f		24.226 GHz	-48.6	524 dBm						
6													
7													
234567890													
0													
•													>

## 00 CH

## 39 CH

RL		RF	50 Q	AC	SENSE:	PULSE	ALIGN AUTO		04:21:5	57 PM Mar 28, 20
nter	Fre	eq 1	2.51500	00000 GHz		rig: Free Run Atten: 30 dB	Ауд Туре	: Log-Pwr		TYPE MUMAUM DET P P P P
dB/di	iv		Offset 0.5 12.09 d							2.452 GI .089 dB
			1							
9										-11.99
9										
1			<>2							
9			Ý	^3						
9							man man	man	and a second and	markent
9	-ser	and and	the second	stay to a hard and and and and and and and and and an	a and the second	and a property and and and and				
9										
9										
art 3 es B			Hz		#VBW 3	300 kHz		Sw	Stop eep 2.386	o 25.00 G s (1001 p
R MODI	E TRC			X	Y		FUNCTION WIDTH		FUNCTION VALUE	
	1 1 1	f f f		2.452 GHz 3.326 GHz 5.174 GHz 24.301 GHz	2.089 dBi -43.307 dBi -54.005 dBi -46.898 dBi	n n				
										3

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## 78 CH

nt Spectrum	Analyzer - Swej		SENSE:PULS	=	ALIGNAUTO		04:19:14	PM Mar 28,
		00000 GHz	Trig	: Free Run en: 30 dB	Avg Type: I	⊾og-Pwr	TR. T	ACE 1 2 3 YPE MWW DET P P P
	Ref Offset 0.5 Ref 14.42 d						Mkr1 2. 4.4	477 G 123 di
	<b>1</b>							
								-13.12
i								
	_							/
	2	()3				man	man	mener
	on the second	mensionalitication	manderson	man	March Constant Constant			
rt 30 MH es BW 10			#VBW 300	kHz		Swee	Stop 2.386 s	25.00 G (1001 p
MODE TRC		×	Y	FUNCTION	FUNCTION WIDTH	FU	NCTION VALUE	
N 1 N 1 N 1 N 1	f f f f	2.477 GHz 2.777 GHz 5.973 GHz 24.226 GHz	4.423 dBm -57.087 dBm -55.939 dBm -47.096 dBm					
								- 14
					STATUS			



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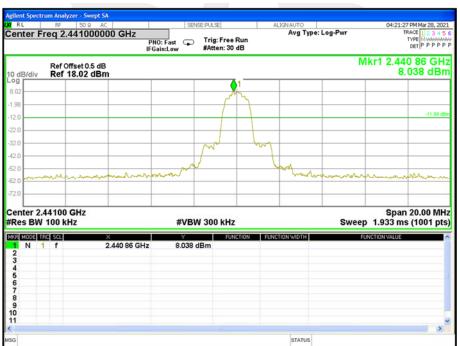


For Band edge(it's also the reference level for conducted spurious emission)

		er - Swept SA					
X RL	RF	50 Q AC	SENSE	PULSE	ALIGNAUTO		04:25:55 PM Mar 28, 202 TRACE 1 2 3 4 5
Center F	req 2.3	53500000 GHz	PNO: Fast 😱 Gain:Low	Trig: Free Run #Atten: 30 dB	Avg Type	e: Log-Pwr	TYPE MUMMM DET P P P P P
10 dB/div		fset 0.5 dB 7.46 dBm				Γ	Mkr1 2.401 86 GH: 7.457 dBn
Log							1
7.46							Λ I
-2.54							-12 54 dB
12.5							
-22.5							
-32.5							14
-42.5							
-62.5						man and a second	management by
.72.5							
Start 2.3 #Res BW			#VBW	300 kHz		Swee	Stop 2.40700 GH p 10.27 ms (1001 pts
MKR MODE 1	RC SCL	×	Y.	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE
1 N 2 N	1 f	2.401 86 GHz 2.329 85 GHz	7.457 dE				
2 N N N 5 6 7 8 9	1 f	2.399 40 GHz	-53.245 dE	3m			
4 N 5	1 1	2.400 05 GHz	-48.637 dE	sm			
6							
8							
10							
11							
ISG					STATUS		1991 - 1991 1991 - 1992

#### 00 CH

39 CH





## 78 CH

nter Freg 2.4875000	C 00 GHz	SENSE:PULSE		ALIGNAUTO Avg Type: Log		44 PM Mar 28, 2 TRACE 1 2 3 4
101 110 2.407 5000			Free Run m: 30 dB			DET P P P F
Ref Offset 0.5 dE					Mkr1 2.479 6	9 850 GI 6.879 dE
8	<u></u>					
1						-13.12
1						
m	m					
and the second	- Marine	$\beta^2$	3		4	
		Kunner	man	marmen AM	acht anna an Innen	, and and a second second
		#VBW 300	kH7		Stop 2 Sweep 2.400 m	2.50000 G is (1001 p
		#VBW 300	KIT L			
es BW 100 kHz Mode trac sol	x	Y		NCTION WIDTH	FUNCTION VALUE	
N 1 f 22 N 1 f 22 N 1 f 22	x 2.479 850 GHz 2.483 500 GHz 2.486 375 GHz 2.496 025 GHz			NCTION WIDTH	FUNCTION VALUE	
es BW 100 kHz N 1 f 2 N 1 f 2 N 1 f 2	2.479 850 GHz 2.483 500 GHz 2.486 375 GHz	4 6.879 dBm -58.564 dBm -56.094 dBm		NCTION WIDTH	FUNCTION VALUE	
es BW 100 kHz N 1 f 2 N 1 f 2 N 1 f 2	2.479 850 GHz 2.483 500 GHz 2.486 375 GHz	4 6.879 dBm -58.564 dBm -56.094 dBm		NCTION WIDTH	FUNCTION VALUE	



Shenzhen STS Test Services Co., Ltd.





## For Hopping Band edge

8DPSK

lent : R L	Spectr	um Anal RF	yzer - Swept S								
	er Fr		.3515000	00 GHz	PNO: Fast Gain:Low	Trig: Free #Atten: 30	Run dB	ALIGNAUTO Avg Type		TR. T	PM Mar 28, 20 ACE 1 2 3 4 YPE M WAAWA DET P P P P
dB/	div		offset 0.5 dE 16.20 dBr						N	lkr1 2.402 6.1	073 GH 198 dB
20 -											
80 -		_									-13.80 d
:8 :8 -											
.8											
8.8		_								^2	
3.8 3.8		-		horand market and the second	contrantiqueta	www.www.www.www.www.www.www.www.		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			www.
		000 G 100 k			#VE	SW 300 kHz	:		Swee	Stop 2.4 ep 9.867 ms	0300 GH (1001 pt
E M0			2	× 2.402 073 GHz 2.390 022 GHz	6.198 -58.290	3 dBm	ICTION	FUNCTION WIDTH		FUNCTION VALUE	
8 M	v 1	f		.400 013 GHz	-52.081						
5											
3											
, ) 1											
						1					>
3								STATUS			

nter Fr	RF	50 Q AC		SE	NSE:PULSE		ALI	Avg Type:	Log-Pwr	T	2 PM Mar 28, 20 RACE 1 2 3 4
			PN	10: Fast 🖵 ain:Low	Trig: F #Atten	ree Run : 30 dB					DET P P P P
B/div		fset 0.5 dB 6.61 dBn							N	1kr1 2.479 6.	021 GI 609 dB
1											
2.0	4										
											-13.39 (
	$\rightarrow$										
	۲v	η									
		V	2							0	3
		. Aller	Marson			mm	man	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	m		m
rt 2.47 s BW				#VB	W 300 H	HZ			SWe	stop 2. ep 2.067 ms	50000 G
MODE TR			×	~		FUNCTION		ON WIDTH	0110	FUNCTION VALUE	, 100 T P
N 1 N 1 N 1	f f f	2.	479 021 GHz 483 515 GHz 497 627 GHz	6.609 -58.475 -56.661	dBm	PONCTION	PONCI			PORCHON VALUE	



## 5. NUMBER OF HOPPING CHANNEL

5.1 LIMIT

	FCC Part 15.247,Subpart C											
Section	Test Item	Limit	FrequencyRange (MHz)	Result								
15.247 (a)(1)(iii)	Number of Hopping Channel	≥15	2400-2483.5	PASS								

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating FrequencyRange
RB	300KHz
VB	300KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

#### 5.2 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting: RBW= 300KHz, VBW=300KHz, Sweep time = Auto.
- 5.3 TEST SETUP



## 5.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



#### 5.5 TEST RESULTS

Temperature:	<b>25</b> ℃	Relative Humidity:	60%
Test Mode:	Hopping Mode -GFSK Mode	Test Voltage:	AC 120V/60Hz

## Number of Hopping Channel

#### 79

## Hopping channel

RL		RF	50 Q AC			SENSE:PULSE	E	A	.IGN AUTO		03:05	:36 PM Mar 28, 202
entei	r Fre	eq 2.	.441750000	F	NO: Fast Gain:Low		Free Run m: 30 dB		Avg Type	: Log-Pwr		TRACE 1 2 3 4 5 TYPE MUMUU DET P P P P
dB/d			Offset 0.5 dB 17.84 dBm							Mk	r2 2.479	909 5 GH 6.66 dBr
	<u>}1</u>											<b>2</b>
16	W	WY	mmm	mmm	WWW	YYYYYY	WWW	YWW	WWW	mmm	mmm	YWW
22												
2												
2												
2												
2												
2												-
2.2						_						_
	100										Otom	
art 2 Res E					#V	/BW 300	kHz			Swee	ep 1.133 n	2.48350 GH ns (1001 pt
KR MOD			X		Y		FUNCTION	FUNC	TION WIDTH		FUNCTION VALUE	
1 N 2 N	1	f f		920 5 GHz 909 5 GHz		20 dBm 66 dBm						
3 4												
5												
5												
8 9												
0												
												>

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## 6. AVERAGE TIME OF OCCUPANCY

### 6.1 LIMIT

	F	CC Part 15.247,Subpart	С	
Section	Test Item	Limit	FrequencyRange (MHz)	Result
15.247 (a)(1)(iii)	Average Time of Occupancy	0.4sec	2400-2483.5	PASS

#### 6.2 TEST PROCEDURE

- a. The transmitter output (antenna port) was connected to the spectrum analyzer.
- b. Set RBW =1MHz/VBW =3MHz.
- c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
- d. Sweep Time is more than once pulse time.
- Set the center frequency on any frequency would be measure and set the frequency span to e. zero span.
- f. Measure the maximum time duration of one single pulse.
- g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
- $\tilde{h}$ . Measure the maximum time duration of one single pulse.
- i. DH5 Packet permit maximum 1600/ 79 / 6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is 3.37 x 31.6 = 106.6.
- j. DH3 Packet permit maximum 1600 / 79 / 4 = 5.06 hops per second in each channel (3 time slots RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is 5.06 x 31.6 = 160.
- k. DH1 Packet permit maximum 1600 / 79 / 2 = 10.12 hops per second in each channel (1 time slot RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is 10.12 x 31.6 = 320.

6.3 TEST SETUP



#### 6.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



### 6.5 TEST RESULTS

Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps)-DH1/DH3/DH5	Test Voltage:	AC 120V/60Hz

Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
DH1	middle	0.374	0.120	0.4
DH3	middle	1.630	0.261	0.4
DH5	middle	2.876	0.307	0.4



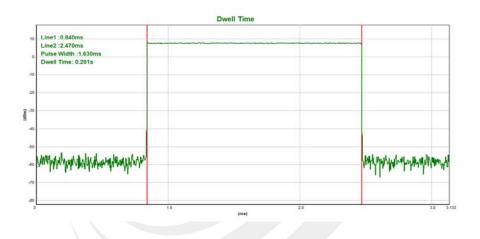


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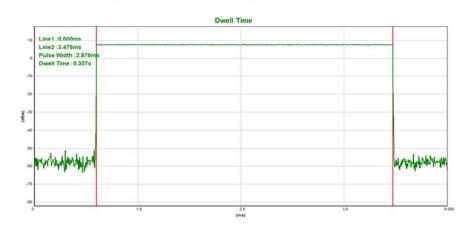
## CH39-DH1



### CH39-DH3







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Temperature:	<b>25</b> ℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps)– 2DH1/2DH3/2DH5	Test Voltage:	AC 120V/60Hz

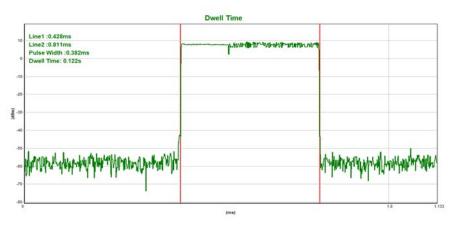
Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
2DH1	middle	0.382	0.122	0.4
2DH3	middle	1.634	0.261	0.4
2DH5	middle	2.880	0.307	0.4



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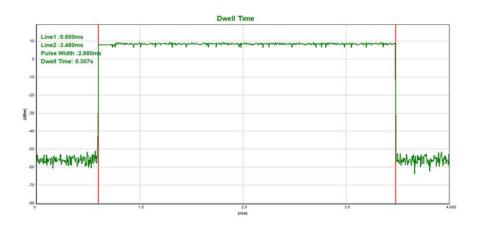
### CH39-2DH1



#### CH39-2DH3







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Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Test Mode:	8DPSK(3Mbps)– 3DH1/3DH3/3DH5	Test Voltage:	AC 120V/60Hz

Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
3DH1	middle	0.381	0.122	0.4
3DH3	middle	1.632	0.261	0.4
3DH5	middle	2.884	0.308	0.4

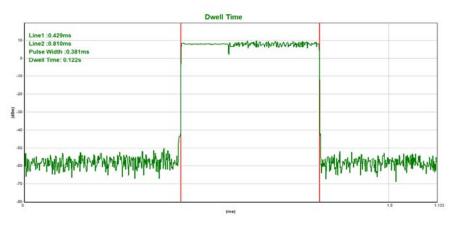


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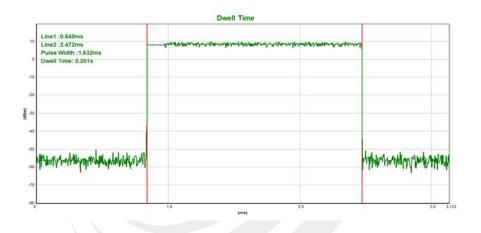


Report No.: STS2103086W07

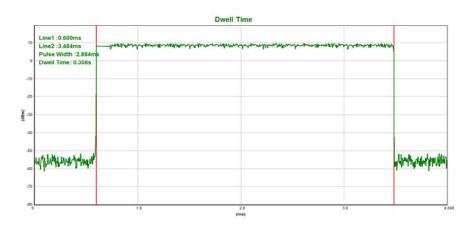
### CH39-3DH1



### CH39-3DH3







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## 7. HOPPING CHANNEL SEPARATION MEASUREMEN

7.1 LIMIT

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.

Spectrum Parameter	Setting		
Attenuation	Auto		
Span Frequency	> 20 dB Bandwidth or Channel Separation		
RB	30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)		
VB	100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation)		
Detector	Peak		
Trace	Max Hold		
Sweep Time	Auto		

#### 7.2 TEST PROCEDURE

- a. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
- b. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised for 20 dB bandwidth measurement.
- c. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised for channel separation measurement.

#### 7.3 TEST SETUP



### 7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.



### 7.5 TEST RESULTS

Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Lest Minde.	CH00 / CH39 / CH78 (GFSK(1Mbps) Mode)	Test Voltage:	AC 120V/60Hz

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2401.840	2402.839	0.999	0.823	Complies
2441 MHz	2440.987	2441.989	1.002	0.821	Complies
2480 MHz	2478.840	2479.839	0.999	0.822	Complies

For GFSK: Ch. Separation Limits: > 20dB bandwidth

### CH00 -1Mbps



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#### CH39 -1Mbps



#### CH78 -1Mbps





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Temperature:	<b>25</b> ℃	Relative Humidity:	50%
	CH00 / CH39 / CH78 (π/4-DQPSK(2Mbps) Mode)	Test Voltage:	AC 120V/60Hz

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2401.837	2402.836	0.999	0.741	Complies
2441 MHz	2440.843	2441.845	1.002	0.841	Complies
2480 MHz	2479.014	2480.001	0.987	0.841	Complies

## For $\pi$ /4-DQPSK(2Mbps): Ch. Separation Limits: > two-thirds 20dB bandwidth

RL	RF	50 Q AC		SE	NSE:PULSE	ALI	GNAUTO		03:44:57	PM Mar 28, 202
enter	Freq 2	.40250000	P	NO: Wide 🖵	Trig: Free R #Atten: 30 d	un B	Avg Type:	Log-Pwr	1	ACE 1 2 3 4 5 TYPE MUMMUM DET P P P P P
0 dB/div		Offset 0.5 dB 12.49 dBm						Mk	r2 2.402 5.5	836 GH: 579 dBn
og 2.49 7.51		m	m X	man	www	hund	22 Amr	m	$\sim \sim $	y. Am
7.5 7.5	and a	ſ								
7.5	~~~									
7.5										
	2.40250 N 30 kH			#VB	W 100 kHz	1		Sweep	Span 3.200 ms	3.000 MH (1001 pts
1 N 2 N 3	TRC SCL 1 f 1 f		× 401 837 GHz 402 836 GHz		dBm dBm	TION FUNCTI	ION WIDTH	FUN	ICTION VALUE	
4 5 6 7										
8 9 0 1										
										>

#### CH00 -2Mbps



#### CH39 -2Mbps



#### CH78 -2Mbps





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Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Lest Minde.	CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)	Test Voltage:	AC 120V/60Hz

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2401.834	2402.839	1.005	0.846	Complies
2441 MHz	2440.828	2441.839	1.011	0.848	Complies
2480 MHz	2478.840	2479.839	0.999	0.845	Complies

For 8DPSK(3Mbps):Ch. Separation Limits: > two-thirds 20dB bandwidth

CH00 -3Mbps

enter	Fre	RF Pq 2		): Wide Trig pin:Low #Att	⊭ Free Run en: 30 dB	ALIGNAUTO Avg Typ	e: Log-Pwr		I2 PM Mar 28, 202 IRACE 1 2 3 4 5 TYPE MWWWW DET P P P P P
0 dB/di	iv		Offset 0.5 dB 13.61 dBm				MI		839 GH 791 dBn
.og 3.61 6.39 16.4			- An	Vmm	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Mr Cont	Mr. Marine	m	$\gamma \sim 10^{-10}$
26.4 36.4	~	s d							
i6.4									
enter Res B			0 GHz Iz	#VBW 10	) kHz		Swee	Spar p 3.200 m	n 3.000 MH s (1001 pts
KR MOD	E TRO	SCL	× 2.401 834 GHz	y 3.89 dBm	FUNCTION	FUNCTION WIDTH	F	UNCTION VALUE	_
1 N 2 N 3 4 5 6 7	1	f	2.401 834 GHZ 2.402 839 GHz	3.89 dBm 3.79 dBm					
8 9									

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#### CH39 -3Mbps



#### CH78 -3Mbps



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## 8. BANDWIDTH TEST

## 8.1 LIMIT

	FCC Part15 15.247,Subpart C						
Section Test Item Limit FrequencyRange (MHz) Result							
15.247 (a)(1)	Bandwidth	N/A	2400-2483.5	PASS			

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RB	30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)
VB	100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

#### 8.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.

b. Spectrum Setting: RBW= 30KHz, VBW=100KHz, Sweep time = Auto.

8.3 TEST SETUP



### 8.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



### **8.5 TEST RESULTS**

Temperature:	<b>25</b> ℃	Relative Humidity:	50%
	GFSK(1Mbps) CH00 / CH39 / C78	Test Voltage:	AC 120V/60Hz

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	0.8233	PASS
2441 MHz	0.8213	PASS
2480 MHz	0.8221	PASS

#### CH00 -1Mbps

Agilent Spectrum Analyzer - Occupied BV	V			-
X RL RF 50 Ω AC Center Freq 2.402000000		ENSE:PULSE Center Freg: 2.4020000	ALIGN AUTO	02:43:44 PM Mar 28, 2021 Radio Std: None
	#IFGain:Low		Avg Hold>10/10	Radio Device: BTS
10 dB/div Ref 20.00 dBm				
10.0				
0.00		And	<b>\</b>	
-10.0			han	
-20.0	~/~		· · · · · · · · · · · · · · · · · · ·	
-30.0				
-40.0				
-50.0				
-60.0				
-70.0				
Center 2.402 GHz #Res BW 30 kHz		#VBW 100 k	Hz	Span 2 MHz Sweep 2.733 ms
Occupied Bandwidt	n	Total Power	12.8 dBm	
8	19.52 kHz			
Transmit Freq Error	-7.308 kHz	OBW Power	99.00 %	
x dB Bandwidth	823.3 kHz	x dB	-20.00 dB	
MSG			STATUS	

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#### CH39 -1Mbps



#### CH78 -1Mbps



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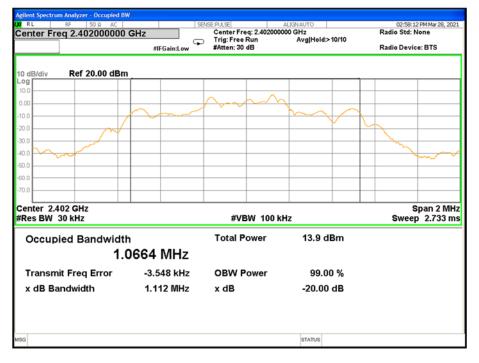


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Temperature:	<b>25</b> ℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps) CH00 / CH39 / C78	Test Voltage:	AC 120V/60Hz

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.112	PASS
2441 MHz	1.261	PASS
2480 MHz	1.261	PASS

## CH00 -2Mbps

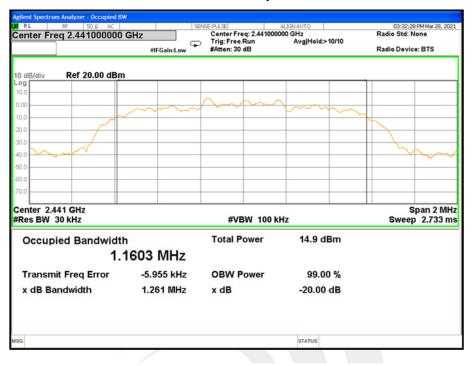


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#### CH39 -2Mbps



#### CH78 -2Mbps



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Temperature:	<b>25</b> ℃	Relative Humidity:	50%
	8DPSK(3Mbps) CH00 / CH39 / CH78	Test Voltage:	AC 120V/60Hz

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.269	PASS
2441 MHz	1.272	PASS
2480 MHz	1.268	PASS

## CH00 -3Mbps

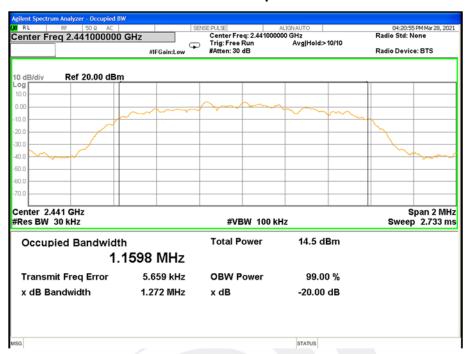
gilent Spectrum Analyzer - Occupied BV RL RF 50 Ω AC		ENSE:PULSE	ALIGNAUTO	04:25:17 PM Mar 28, 2021
enter Freq 2.40200000		Center Freq: 2.4020000	000 GHz	Radio Std: None
	#IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Hold:>10/10	Radio Device: BTS
dB/div Ref 20.00 dBm				
pg				
.00				
	~~~~~		how	
0.0				
0.0				
0.0				
1.0				
3.0				
enter 2.402 GHz Res BW 30 kHz		#VBW 100 k	Hz	Span 2 MH Sweep 2.733 m
Occupied Bandwidth	1	Total Power	13.9 dBm	
	1591 MHz			
Transmit Freq Error	5.835 kHz	<b>OBW Power</b>	99.00 %	
x dB Bandwidth	1.269 MHz	x dB	-20.00 dB	
3			STATUS	

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#### CH39 -3Mbps



#### CH78 -3Mbps





# 9. OUTPUT POWER TEST

### 9.1 LIMIT

FCC Part 15.247,Subpart C						
Section	Test Item	Limit	Frequency Range (MHz)	Result		
		1 W or 0.125W				
15.247 (a)(1)&(b)(1)	Output Power	if channel separation > 2/3 bandwidthprovided thesystems operatewith an output power no greater than125 mW(20.97dBm)	2400-2483.5	PASS		

### 9.2 TEST PROCEDURE

This is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:

a) Use the following spectrum analyzer settings:

1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.

2) RBW > 20 dB bandwidth of the emission being measured.

3) VBW  $\geq$  RBW.

4) Sweep: Auto.

5) Detector function: Peak.

6) Trace: Max hold.

b) Allow trace to stabilize.

c) Use the marker-to-peak function to set the marker to the peak of the emission.

d) The indicated level is the peak output power, after any corrections for external attenuators and cables.

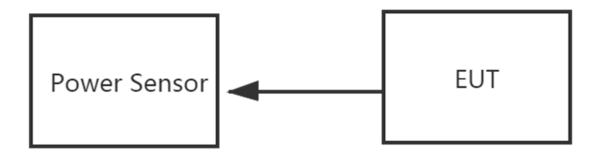
e) A plot of the test results and setup description shall be included in the test report.

NOTE—A peak responding power meter may be used, where the power meter and sensor system video bandwidth is greater than the occupied bandwidth of the unlicensed wireless device, rather than a spectrum analyzer.

PKPM1 Peak power meter method:

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 DSS bandwidth and shall use a fast-responding diode detector.

9.3 TEST SETUP



### 9.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

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#### 9.5 TEST RESULTS

Temperature:	<b>25℃</b>	Relative Humidity:	60%
Test Voltage:	AC 120V/60Hz		

Mode Channel Number	Channel	Frequency (MHz)	Peak Power	Average Power	Limit
	Number		(dBm)	(dBm)	(dBm)
GFSK(1M)	0	2402	8.04	5.29	30.00
	39	2441	8.12	5.38	30.00
	78	2480	7.35	4.61	30.00

Note: the channel separation >20dB bandwidth

Mode Channel Number		Frequency (MHz)	Peak Power	Average Power	Limit
	Number		(dBm)	(dBm)	(dBm)
π/4-DQPSK( 2M)	0	2402	10.51	5.23	20.97
	39	2441	10.49	5.30	20.97
	78	2480	9.71	4.52	20.97

Note: the channel separation >2/3 20dB bandwidth

Mode Channel Number	Channel	Frequency (MHz)	Peak Power	Average Power	Limit
	Number		(dBm)	(dBm)	(dBm)
8-DPSK(3M)	0	2402	10.85	5.22	20.97
	39	2441	10.82	5.29	20.97
	78	2480	10.02	4.52	20.97

Note: the channel separation >2/3 20dB bandwidth

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## 10. ANTENNA REQUIREMENT

#### **10.1 STANDARD REQUIREMENT**

15.203 requirement: For intentional device, according to 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.

#### 10.2 EUT ANTENNA

The EUT antenna is PIFA Antenna. It comply with the standard requirement.



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## **APPENDIX-PHOTOS OF TEST SETUP**

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

\*\*\*\*\*\*END OF THE REPORT\*\*\*\*\*



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