

# **RADIO TEST REPORT**

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# Report No.: STS2202110W01

Issued for

Shenzhen EDUP Electronics Technology Co.,Ltd.

6 Floor, #6 Building, No.48, Kangzheng Road, Liantang Industrial Area, Buji Town, Longgang District, Shenzhen, China

Product Name:	Bluetooth PCI-E WiFi Card	
Brand Name:	EDUP, EDUP HOME, EDUP LOVE, WISE TIGER, EPSKY, Card-King, Rosewill	
Model Name:	EP-EP9651	
Series Model:	EP-9651S, EP-9651GS, EP-9651GS Pro, EP-AX210 Pro, EP-AX210GS, EP-AX210, WT-AX210, EP-AX210S, EH-9651, EH-9651S, EH-9651GS, EH-9651GS Pro, EH-AX210 Pro, EH-AX210GS, EH-AX210, EH-AX210S, WT-AX210, WT-9651, WT-9651S, WT-9651GS, WT-9651GS Pro, WT-AX210 Pro, WT-AX210GS, WT-AX210S, KW-9651, KW-9651, KW-9651GS, KW-9651GS-Pro, KW-AX210Pro, KW-AX210GS, KW-AX210, KW-AX210S, RNX-AX5400Pro, RNX-AX5400GS	
FCC ID:	DID: 2AHRD-EPEP9651	
Test Standard:	FCC Part 15.247	

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APPROVA

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## **TEST RESULT CERTIFICATION**

Applicant's Name:	Shenzhen EDUP Electronics Technology Co., Ltd.
Address	6 Floor, #6 Building, No.48, Kangzheng Road, Liantang Industrial Area, Buji Town, Longgang District, Shenzhen, China
Manufacturer's Name:	Shenzhen EDUP Electronics Technology Co.,Ltd.
Address	6 Floor, #6 Building, No.48, Kangzheng Road, Liantang Industrial Area, Buji Town, Longgang District, Shenzhen, China
Product Description	
Product Name:	Bluetooth PCI-E WiFi Card
Brand Name	EDUP, EDUP HOME, EDUP LOVE, WISE TIGER, EPSKY, Card-King, Rosewill
Model Name:	EP-EP9651
Series Model	EP-9651S, EP-9651GS, EP-9651GS Pro, EP-AX210 Pro, EP-AX210GS, EP-AX210, WT-AX210, EP-AX210S, EH-9651, EH-9651S, EH-9651GS, EH-9651GS Pro, EH-AX210 Pro, EH-AX210GS, EH-AX210, EH-AX210S, WT-AX210, WT-9651, WT-9651S, WT-9651GS, WT-9651GS Pro, WT-AX210 Pro, WT-AX210GS, WT-AX210S, KW-9651, KW-9651, KW-9651GS, KW-9651GS-Pro, KW-AX210Pro, KW-AX210GS, KW-AX210, KW-AX210S, RNX-AX5400Pro, RNX-AX5400GS
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...... 21 Feb. 2022

Date (s) of performance of tests .: 21 Feb. 2022 ~ 26 Feb. 2022

Date of Issue ..... 26 Feb. 2022

Test Result ..... Pass

Testing Engineer

(Chris Chen)

**Technical Manager** 

(Sean she)



Authorized Signatory :

## (Vita Li)

Shenzhen STS Test Services Co., Ltd.

Page 3 of 73 Report No.: STS2202110W01



Table of Contents	Page
1. SUMMARY OF TEST RESULTS	6
1.1 TEST FACTORY	7
1.2 MEASUREMENT UNCERTAINTY	7
2. GENERAL INFORMATION	8
2.1 GENERAL DESCRIPTION OF THE EUT	8
2.2 DESCRIPTION OF THE TEST MODES	10
2.3 FREQUENCY HOPPING SYSTEM REQUIREMENTS	10
2.4 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING	12
2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	12
2.6 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS	13
2.7 EQUIPMENTS LIST	14
3. EMC EMISSION TEST	16
3.1 CONDUCTED EMISSION MEASUREMENT	16
3.2 RADIATED EMISSION MEASUREMENT	20
4. CONDUCTED SPURIOUS & BAND EDGE EMISSION	32
4.1 LIMIT	32
4.2 TEST PROCEDURE	32
4.3 TEST SETUP	33
4.4 EUT OPERATION CONDITIONS	33
4.5 TEST RESULTS	34
5. NUMBER OF HOPPING CHANNEL	49
5.1 LIMIT	49
5.2 TEST PROCEDURE	49
5.3 TEST SETUP	49
5.4 EUT OPERATION CONDITIONS	49
5.5 TEST RESULTS	50
6. AVERAGE TIME OF OCCUPANCY	51
6.1 LIMIT	51
6.2 TEST PROCEDURE	51
6.3 TEST SETUP	51
6.4 EUT OPERATION CONDITIONS	51
6.5 TEST RESULTS	52

Page 4 of 73 Report No.: STS2202110W01



Table of Contents	Page
7. HOPPING CHANNEL SEPARATION MEASUREMEN	56
7.1 LIMIT	56
7.2 TEST PROCEDURE	56
7.3 TEST SETUP	56
7.4 EUT OPERATION CONDITIONS	56
7.5 TEST RESULTS	57
8. BANDWIDTH TEST	63
8.1 LIMIT	63
8.2 TEST PROCEDURE	63
8.3 TEST SETUP	63
8.4 EUT OPERATION CONDITIONS	63
8.5 TEST RESULTS	64
9. OUTPUT POWER TEST	70
9.1 LIMIT	70
9.2 TEST PROCEDURE	70
9.3 TEST SETUP	70
9.4 EUT OPERATION CONDITIONS	70
9.5 TEST RESULTS	71
10. ANTENNA REQUIREMENT	72
10.1 STANDARD REQUIREMENT	72
10.2 EUT ANTENNA	72



Page 5 of 73 Report No.: STS2202110W01

## **Revision History**

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	26 Feb. 2022	STS2202110W01	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	Radiated Spurious Emission PASS			
15.247(d)	Conducted Spurious & Band Edge 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	±0.87dB
2	Unwanted Emissions, conducted	±2.895dB
3	All emissions, radiated 9K-30MHz	±3.80dB
4	All emissions, radiated 30M-1GHz	±4.09dB
5	All emissions, radiated 1G-6GHz	±4.92dB
6	All emissions, radiated>6G	±5.49dB
7	Conducted Emission (9KHz-30MHz)	±2.73dB



## 2. GENERAL INFORMATION

## 2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Bluetooth PCI-E WiFi Card	
Trade Name	EDUP, EDUP HOME, EDUP LOVE, WISE TIGER, EPSKY, Card-King, Rosewill	
Model Name	EP-EP9651	
Series Model	EP-9651S, EP-9651GS, EP-9651GS Pro, EP-AX210 Pro, EP-AX210GS, EP-AX210, WT-AX210, EP-AX210S, EH-9651, EH-9651S, EH-9651GS, EH-9651GS Pro, EH-AX210 Pro, EH-AX210GS, EH-AX210, EH-AX210S, WT-AX210, WT-9651, WT-9651S, WT-9651GS, WT-9651GS Pro, WT-AX21 Pro, WT-AX210GS, WT-AX210S, KW-9651, KW-9651, KW-9651GS, KW-9651GS-Pro, KW-AX210Pro, KW-AX210GS, KW-AX210, KW-AX210S, RNX-AX5400Pro, RNX-AX5400GS	
Model Difference	Different appearance size and shape	
Channel List	Please refer to the Note 2.	
Bluetooth	Frequency:2402 – 2480 MHz Modulation: GFSK(1Mbps), π/4-DQPSK(2Mbps), 8DPSK(3Mbps)	
Bluetooth Version	5.2	
Bluetooth Configuration	BR+EDR	
Antenna Type	Please refer to the Note 3.	
Rating	Input: AC 120V/60Hz	
Hardware version number	V1.0	
Software version number	V22.0	
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.

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	1 <u> </u>	Chani	nel List		r _
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
ĺ		EDUP, EDUP					
		HOME, EDUP					BT
	1	LOVE, WISE	EP-EP9651	Dipole	N/A	5	
		TIGER, EPSKY,		-			Antenna
		Card-King					

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.



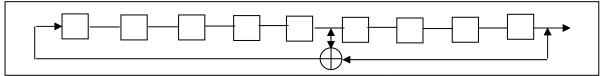
Page 11 of 73 Report No.: STS2202110W01

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.

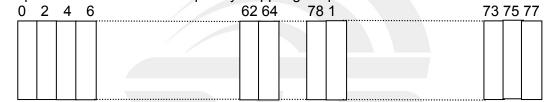
(2)The Pseudorandom sequence may be generated in a nin-stage shift register whose 5<sup>th</sup> and 9<sup>th</sup> stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones: i.e. the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



Page 12 of 73 Report No.: STS2202110W01

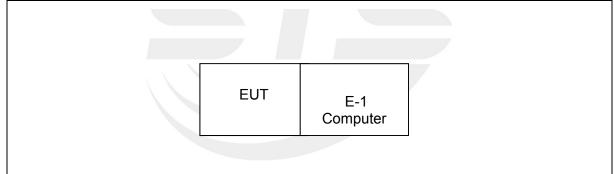
## 2.4 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

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.

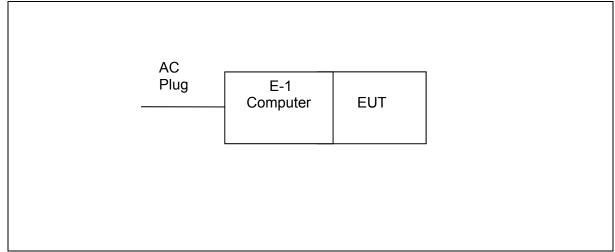
Test software Version	Test program: Bluetooth				
(Power control software) Parameters(1/2/3Mbps)	Power class: DH1 rate:4:27 2DH1 rate:20:54 3DH1 rate:24:83	Power class: DH3 rate:11:183 2DH3 rate:26:367 3DH3 rate:27:552	Power class: DH5 rate:15:339 2DH5 rate:30:679 3DH5 rate:31:1021		

RF Function	Туре	Mode Or Modulation type	ANT Gain(dBi)	Power Class	Software For Testing
		GFSK	5	Default	
BT	BR+EDR	π/4-DQPSK	5	Default	DRTU
		8DPSK	5	Default	

## 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
N/A	N/A	N/A	N/A	N/A	N/A

#### Necessary accessories

#### Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-1	Computer	HP	880-190cn	N/A	N/A

Note:

- (1) For detachable type I/O cable should be specified the length in cm in <sup>r</sup>Length <sup>a</sup> 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	2021.09.30	2022.09.29
Signal Analyzer	R&S	FSV 40-N	101823	2021.09.30	2022.09.29
Active loop Antenna	ZHINAN	ZN30900C	16035	2021.04.11	2023.04.10
Bilog Antenna	TESEQ	CBL6111D	34678	2020.10.12	2022.10.11
Horn Antenna	SCHWARZBECK	BBHA 9120D	02014	2021.10.11	2023.10.10
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	2021.10.08	2022.10.07
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2021.09.30	2022.09.29
Pre-Amplifier (18G-40GHz)	SKET	LNPA-1840-50	SK2018101801	2021.09.28	2022.09.27
Temperature & Humidity	HH660	Mieo	N/A	2021.10.09	2022.10.08
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	2021.09.30	2022.09.29
LISN	R&S	ENV216	101242	2021.09.30	2022.09.29
LISN	EMCO	3810/2NM	23625	2021.09.30	2022.09.29
Temperature & Humidity	HH660	Mieo	N/A	2021.10.09	2022.10.08
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			



Page 15 of 73 Report No.: STS2202110W01

#### **RF** Connected Test

Ē							
	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	
				MY55520005	2021.09.30	2022.09.29	
	Dewer Concer	Kayaisht	U2021XA	MY55520006	2021.09.30	2022.09.29	
	Power Sensor	Keysight		MY56120038	2021.09.30	2022.09.29	
				MY56280002	2021.09.30	2022.09.29	
	Signal Analyzer	Agilent	N9020A	MY51110105	2021.03.04	2022.03.03	
	Temperature & Humidity	HH660	Mieo	N/A	2021.10.09	2022.10.08	
	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 Emiss	sionlimit (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.

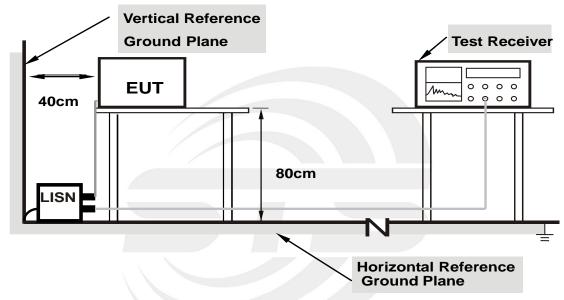
#### The following table is the setting of the receiver

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:	23.2(C)	Relative Humidity:	44%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	0.5940	23.83	20.45	44.28	56.00	-11.72	QP
2	0.5940	20.43	20.45	40.88	46.00	-5.12	AVG
3	0.7700	23.88	20.34	44.22	56.00	-11.78	QP
4	0.7700	22.01	20.34	42.35	46.00	-3.65	AVG
5	1.1020	23.44	20.30	43.74	56.00	-12.26	QP
6	1.1020	21.44	20.30	41.74	46.00	-4.26	AVG
7	1.2780	23.73	20.30	44.03	56.00	-11.97	QP
8	1.2780	21.36	20.30	41.66	46.00	-4.34	AVG
9	1.4540	23.76	20.30	44.06	56.00	-11.94	QP
10	1.4540	19.62	20.30	39.92	46.00	-6.08	AVG
11	1.6180	22.73	20.30	43.03	56.00	-12.97	QP
12	1.6180	19.56	20.30	39.86	46.00	-6.14	AVG

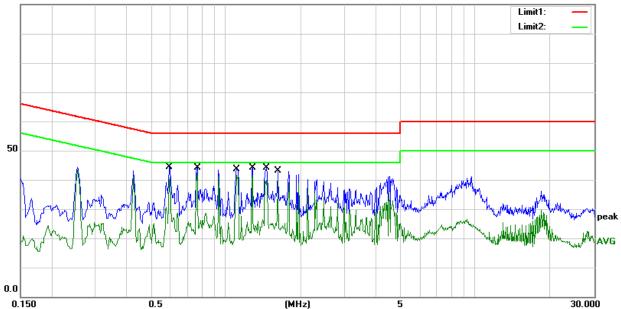
#### Remark:

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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Page 19 of 73 Report No.: STS2202110W01

Temperature:	23.2(C)	Relative Humidity:	44%RH
Test Voltage:	AC 120V/60Hz	Phase:	Ν
Test Mode:	Mode 13		

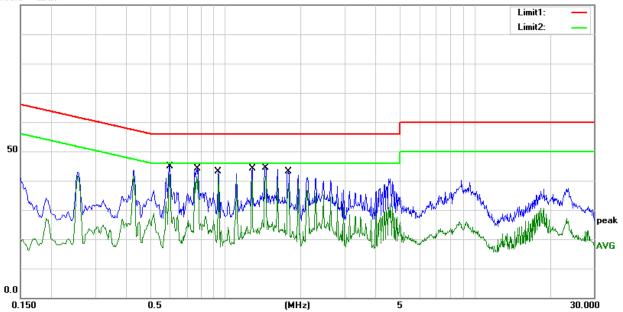
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.5980	24.46	20.45	44.91	56.00	-11.09	QP
2	0.5980	21.80	20.45	42.25	46.00	-3.75	AVG
3	0.7740	23.75	20.34	44.09	56.00	-11.91	QP
4	0.7740	21.05	20.34	41.39	46.00	-4.61	AVG
5	0.9380	22.78	20.31	43.09	56.00	-12.91	QP
6	0.9380	21.52	20.31	41.83	46.00	-4.17	AVG
7	1.2780	23.87	20.30	44.17	56.00	-11.83	QP
8	1.2780	20.19	20.30	40.49	46.00	-5.51	AVG
9	1.4460	24.01	20.30	44.31	56.00	-11.69	QP
10	1.4460	21.10	20.30	41.40	46.00	-4.60	AVG
11	1.7900	22.94	20.30	43.24	56.00	-12.76	QP
12	1.7900	18.82	20.30	39.12	46.00	-6.88	AVG

#### Remark:

1. All readings are Quasi-Peak and Average values

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

100.0 dBuV



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<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 (GHz)
16.42-16.423	399.9-410	4.5-5.15
16.69475-16.69525	608-614	5.35-5.46
16.80425-16.80475	960-1240	7.25-7.75
25.5-25.67	1300-1427	8.025-8.5
37.5-38.25	1435-1626.5	9.0-9.2
73-74.6	1645.5-1646.5	9.3-9.5
74.8-75.2	1660-1710	10.6-12.7
108-121.94	1718.8-1722.2	13.25-13.4
123-138	2200-2300	14.47-14.5
149.9-150.05	2310-2390	15.35-16.2
156.52475-156.52525	2483.5-2500	17.7-21.4
156.7-156.9	2690-2900	22.01-23.12
162.0125-167.17	3260-3267	23.6-24.0
167.72-173.2	3332-3339	31.2-31.8
240-285	3345.8-3358	36.43-36.5
322-335.4	3600-4400	Above 38.6
	16.42-16.423 16.69475-16.69525 16.80425-16.80475 25.5-25.67 37.5-38.25 73-74.6 74.8-75.2 108-121.94 123-138 149.9-150.05 156.52475-156.52525 156.7-156.9 162.0125-167.17 167.72-173.2 240-285	16.42-16.423399.9-41016.69475-16.69525608-61416.80425-16.80475960-124025.5-25.671300-142737.5-38.251435-1626.573-74.61645.5-1646.574.8-75.21660-1710108-121.941718.8-1722.2123-1382200-2300149.9-150.052310-2390156.52475-156.525252483.5-2500156.7-156.92690-2900162.0125-167.173260-3267167.72-173.23332-3339240-2853345.8-3358

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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		
band)	120 KHz / 300 KHz	

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 Fraguapay	Lower Band Edge: 2310 to 2410 MHz		
Start/Stop Frequency	Upper Band Edge: 2476 to 2500 MHz		
	1 MHz / 3 MHz(Peak)		
RB / VB	1 MHz/1/T MHz(AVG)		

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Page 22 of 73 Report No.: STS2202110W01

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.

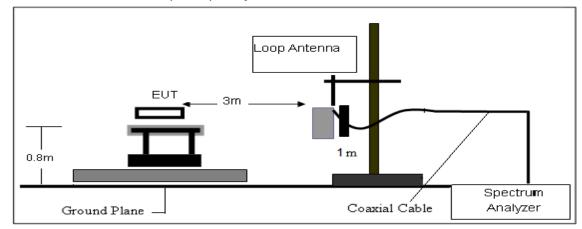
# 3.2.3 DEVIATION FROM TEST STANDARD

No deviation.

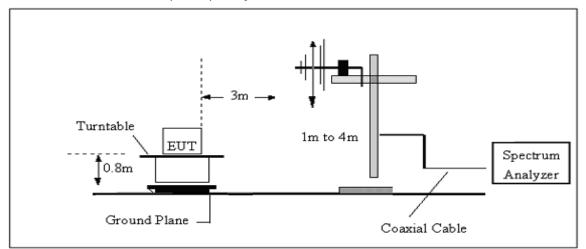


## 3.2.4 TESTSETUP

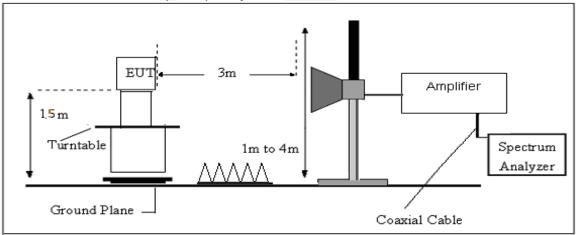
(A) Radiated Emission Test-Up Frequency Below 30MHz



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



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



3.2.5 EUT OPERATING CONDITIONS Please refer to section 3.1.4 of this report.



## 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	Toot Dooult	
(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.





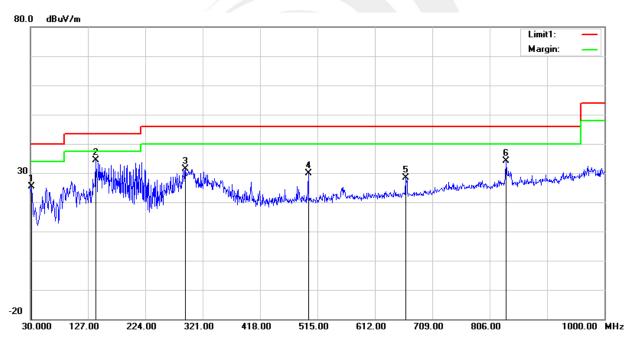
(30MHz-1000MHz)

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 3 worst mode)				

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	31.9400	39.22	-13.86	25.36	40.00	-14.64	QP
2	140.5800	52.48	-18.05	34.43	43.50	-9.07	QP
3	291.9000	46.51	-15.09	31.42	46.00	-14.58	QP
4	499.4800	37.96	-8.02	29.94	46.00	-16.06	QP
5	664.3800	33.05	-4.71	28.34	46.00	-17.66	QP
6	834.1300	34.61	-0.59	34.02	46.00	-11.98	QP

Remark:

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





Page 27 of 73 Report No.: STS2202110W01

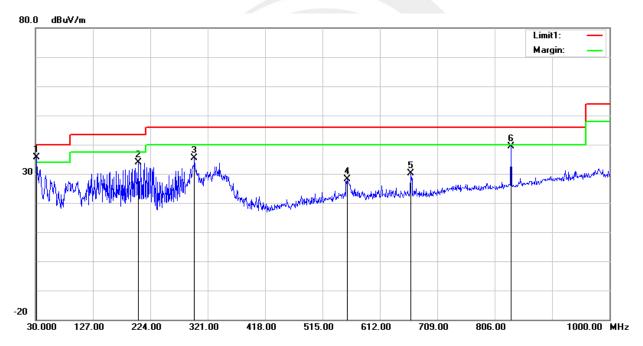
Temperature:	23.1(C)	Relative Humidity:	60%RH	
Test Voltage:	AC 120V/60Hz	Phase:	Vertical	
Test Mode:	Mode 1/2/3/4/5/6/7/8/9(Mode 3 worst mode)			

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	31.9400	49.58	-13.86	35.72	40.00	-4.28	QP
2	203.6300	54.67	-20.86	33.81	43.50	-9.69	QP
3	298.6900	50.17	-14.86	35.31	46.00	-10.69	QP
4	556.7100	33.62	-5.58	28.04	46.00	-17.96	QP
5	664.3800	34.86	-4.71	30.15	46.00	-15.85	QP
6	834.1300	40.01	-0.59	39.42	46.00	-6.58	QP

Remark:

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

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



Page 28 of 73 Report No.: STS2202110W01



## (1GHz~25GHz) Spurious 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	nannel (GFSK/2	2402 MHz)				
3264.80	60.82	44.70	6.70	28.20	-9.80	51.02	74.00	-22.98	PK	Vertical
3264.80	49.89	44.70	6.70	28.20	-9.80	40.09	54.00	-13.91	AV	Vertical
3264.75	62.05	44.70	6.70	28.20	-9.80	52.25	74.00	-21.75	PK	Horizontal
3264.75	50.01	44.70	6.70	28.20	-9.80	40.21	54.00	-13.79	AV	Horizontal
4804.32	58.42	44.20	9.04	31.60	-3.56	54.86	74.00	-19.14	PK	Vertical
4804.32	49.35	44.20	9.04	31.60	-3.56	45.79	54.00	-8.21	AV	Vertical
4804.35	59.60	44.20	9.04	31.60	-3.56	56.04	74.00	-17.96	PK	Horizontal
4804.35	49.23	44.20	9.04	31.60	-3.56	45.67	54.00	-8.33	AV	Horizontal
5359.59	48.96	44.20	9.86	32.00	-2.34	46.61	74.00	-27.39	PK	Vertical
5359.59	40.08	44.20	9.86	32.00	-2.34	37.74	54.00	-16.26	AV	Vertical
5359.60	47.33	44.20	9.86	32.00	-2.34	44.99	74.00	-29.01	PK	Horizontal
5359.60	38.64	44.20	9.86	32.00	-2.34	36.29	54.00	-17.71	AV	Horizontal
7205.96	54.59	43.50	11.40	35.50	3.40	57.99	74.00	-16.01	PK	Vertical
7205.96	43.83	43.50	11.40	35.50	3.40	47.23	54.00	-6.77	AV	Vertical
7205.78	54.21	43.50	11.40	35.50	3.40	57.61	74.00	-16.39	PK	Horizontal
7205.78	44.40	43.50	11.40	35.50	3.40	47.80	54.00	-6.20	AV	Horizontal
				Middle C	Channel (GFSK	/2441 MHz)				
3264.61	61.56	44.70	6.70	28.20	-9.80	51.76	74.00	-22.24	PK	Vertical
3264.61	51.73	44.70	6.70	28.20	-9.80	41.93	54.00	-12.07	AV	Vertical
3264.57	61.17	44.70	6.70	28.20	-9.80	51.37	74.00	-22.63	PK	Horizontal
3264.57	51.32	44.70	6.70	28.20	-9.80	41.52	54.00	-12.48	AV	Horizontal
4882.54	58.60	44.20	9.04	31.60	-3.56	55.04	74.00	-18.96	PK	Vertical
4882.54	50.50	44.20	9.04	31.60	-3.56	46.94	54.00	-7.06	AV	Vertical
4882.53	58.39	44.20	9.04	31.60	-3.56	54.83	74.00	-19.17	PK	Horizontal
4882.53	50.01	44.20	9.04	31.60	-3.56	46.45	54.00	-7.55	AV	Horizontal
5359.71	48.97	44.20	9.86	32.00	-2.34	46.62	74.00	-27.38	PK	Vertical
5359.71	40.39	44.20	9.86	32.00	-2.34	38.05	54.00	-15.95	AV	Vertical
5359.75	48.00	44.20	9.86	32.00	-2.34	45.66	74.00	-28.34	PK	Horizontal
5359.75	38.52	44.20	9.86	32.00	-2.34	36.17	54.00	-17.83	AV	Horizontal
7323.93	54.71	43.50	11.40	35.50	3.40	58.11	74.00	-15.89	PK	Vertical
7323.93	44.06	43.50	11.40	35.50	3.40	47.46	54.00	-6.54	AV	Vertical
7323.85	54.85	43.50	11.40	35.50	3.40	58.25	74.00	-15.75	PK	Horizontal
7323.85	44.69	43.50	11.40	35.50	3.40	48.09	54.00	-5.91	AV	Horizontal



## Page 29 of 73 Report No.: STS2202110W01

				High Char	nnel (GFSK/	2480 MHz)				
3264.77	61.03	44.70	6.70	28.20	-9.80	51.23	74.00	-22.77	PK	Vertical
3264.77	50.29	44.70	6.70	28.20	-9.80	40.49	54.00	-13.51	AV	Vertical
3264.70	61.18	44.70	6.70	28.20	-9.80	51.38	74.00	-22.62	PK	Horizontal
3264.70	50.33	44.70	6.70	28.20	-9.80	40.53	54.00	-13.47	AV	Horizontal
4960.36	58.97	44.20	9.04	31.60	-3.56	55.41	74.00	-18.59	PK	Vertical
4960.36	49.17	44.20	9.04	31.60	-3.56	45.61	54.00	-8.39	AV	Vertical
4960.45	59.58	44.20	9.04	31.60	-3.56	56.02	74.00	-17.98	PK	Horizontal
4960.45	50.41	44.20	9.04	31.60	-3.56	46.85	54.00	-7.15	AV	Horizontal
5359.83	48.76	44.20	9.86	32.00	-2.34	46.42	74.00	-27.58	PK	Vertical
5359.83	39.23	44.20	9.86	32.00	-2.34	36.89	54.00	-17.11	AV	Vertical
5359.66	48.03	44.20	9.86	32.00	-2.34	45.69	74.00	-28.31	PK	Horizontal
5359.66	38.83	44.20	9.86	32.00	-2.34	36.49	54.00	-17.51	AV	Horizontal
7439.71	54.83	43.50	11.40	35.50	3.40	58.23	74.00	-15.77	PK	Vertical
7439.71	43.84	43.50	11.40	35.50	3.40	47.24	54.00	-6.76	AV	Vertical
7439.91	54.34	43.50	11.40	35.50	3.40	57.74	74.00	-16.26	PK	Horizontal
7439.91	44.08	43.50	11.40	35.50	3.40	47.48	54.00	-6.52	AV	Horizontal

Note:

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

Emission Level = Reading + Factor

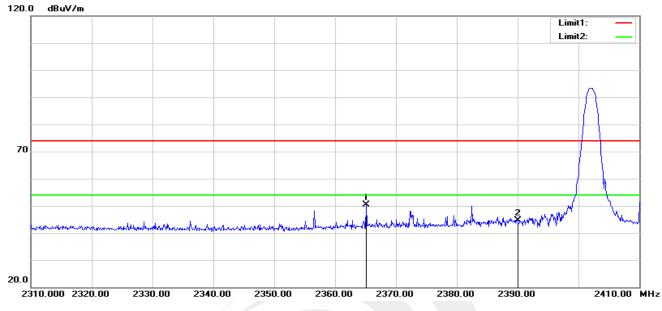
3) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.



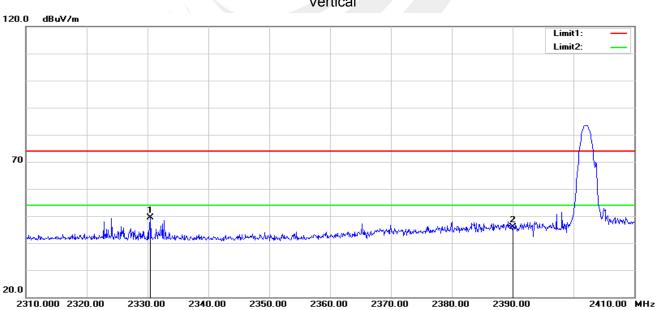
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## **Restricted band Requirements**

**GFSK-Low** Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2365.100	46.37	3.97	50.34	74.00	-23.66	peak
2	2390.000	40.18	4.34	44.52	74.00	-29.48	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2330.500	45.66	3.63	49.29	74.00	-24.71	peak
2	2390.000	41.45	4.34	45.79	74.00	-28.21	peak

Vertical

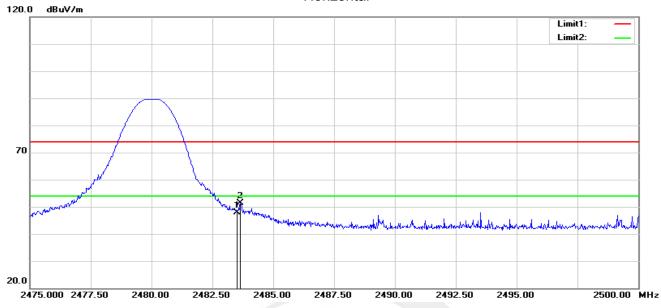
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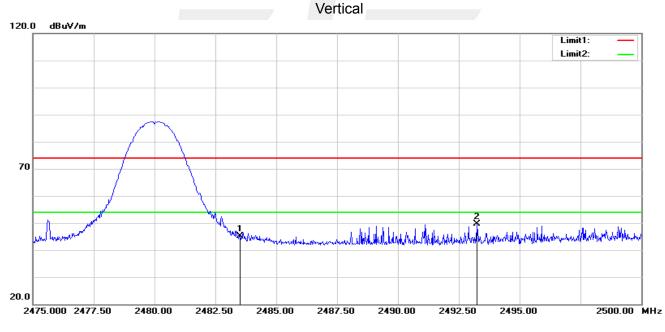
Page 31 of 73

Report No.: STS2202110W01

#### **GFSK-High** Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	43.17	4.60	47.77	74.00	-26.23	peak
2	2483.650	46.66	4.60	51.26	74.00	-22.74	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	40.52	4.60	45.12	74.00	-28.88	peak
2	2493.250	45.02	4.64	49.66	74.00	-24.34	peak

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

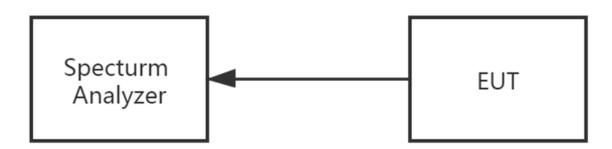
Spectrum Parameter	Setting
Detector	Peak
Start/Stop Eraguanay	Lower Band Edge: 2300 – 2407 MHz
Start/Stop Frequency	Upper Band Edge: 2475 – 2500 MHz
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

#### For Hopping Band edge

Spectrum Parameter	Setting			
Detector	Peak			
Start/Stop Frequency	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.

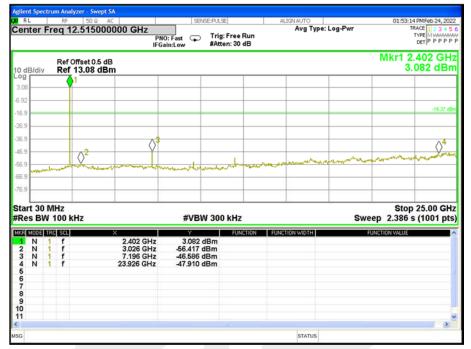




## 4.5 TEST RESULTS

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

## 00 CH



## 39 CH

	_	RF	50 Q AC		SENSE:PU	.SE	ALIGN AUTO		01:50:4	2 PMFeb 24, 202
enter	r Fre	eq 1	2.5150000	PNO		g: Free Run ten: 30 dB	Avg Type:	Log-Pwr	1	TYPE MUMM DET P P P P P
) dB/di	iv		Offset 0.5 dB <b>12.56 dBm</b>							.452 GH .563 dBr
2g		<	1							
.44		_								-16.32 d
										10.32 0
4				3						
4		-	<mark>2</mark>					L. Jollan	- monthing	anon the
4	ململح	لمعمس	and more and	- Marine Marine	were sound the standard and and	and and a server of	and the second			
4										
			íHz		#VBW 30	0 kHz		Swe	Stop 2.386	) 25.00 GH s (1001 pt
art 3 Res B	3W 1	100 k	:Hz ×		Y		FUNCTION WIDTH		Stop 2.386 UNCTION VALUE	o 25.00 GH s (1001 pt
Res E NOD N N N N N N	3W 1	OO K	×	2.452 GHz 3.101 GHz 7.321 GHz 12.215 GHz			FUNCTION WIDTH		eep 2.386	25.00 GI s (1001 pt
R MOO	SW 1	f f	×	2.452 GHz 3.101 GHz 7.321 GHz	2.563 dBm -56.630 dBm -46.924 dBm		FUNCTION WIDTH		eep 2.386	25.00 GF s (1001 pf
R MOD	SW 1	f f	×	2.452 GHz 3.101 GHz 7.321 GHz	2.563 dBm -56.630 dBm -46.924 dBm		FUNCTION WADTH		eep 2.386	25.00 Gł s (1001 pł

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## 78 CH

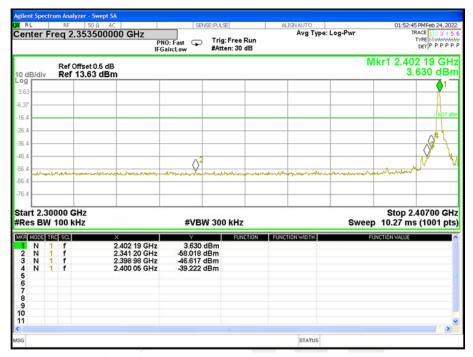
L RF 50 Q AC	SENSE:PULS			01:55:01 PMFeb 24,
ter Freq 12.515000000 GHz	PNO: Fast 🖵 Trig: FGain:Low #Atte	Avg T Free Run m:30 dB	Type: Log-Pwr	TRACE 1 2 3 TYPE MWM DET P P
Ref Offset 0.5 dB B/div Ref 13.32 dBm				Mkr1 2.477 G 3.323 d
1				
				-16.4
	3			
	Maryland marine	und and and and and and and and and and a	munderament	معمامهم معلوه معمور
t 30 MHz s BW 100 kHz	#VBW 300	kHz	Sweep	Stop 25.00 ( 2.386 s (1001
MODE TRC SCL X	Y III	FUNCTION FUNCTION WIDT	H FUNCT	TION VALUE
N 1 f 2.477 GHz N 1 f 2.677 GHz N 1 f 7.446 GHz N 1 f 24.326 GHz	-56.703 dBm -47.888 dBm			



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



#### 00 CH

39 CH





## 78 CH

ter Freq 2.4875000	PNO:		Free Run	ALIGNAUTO Avg Type:	Log-Pwr	01:54:31 PM TRAC TYP DE	
Ref Offset 0.5 dl		Low #Atte	en: 30 ab		М	kr1 2.480 0	
	1 1						
	4						-16.4
- And	- har	$\wedge^2 \wedge^3$					
mar	- hn	22			$\Delta^4$		
	_		- marker and	- marine	v sm	- Anno - An	~~~
t 2.47500 GHz s BW 100 kHz		#VBW 300	kHz		Swee	Stop 2.50	
MODE TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
N 1 f N 1 f	2.480 050 GHz 2.483 500 GHz 2.484 400 GHz 2.493 050 GHz	3.510 dBm -52.556 dBm -49.085 dBm -54.809 dBm					



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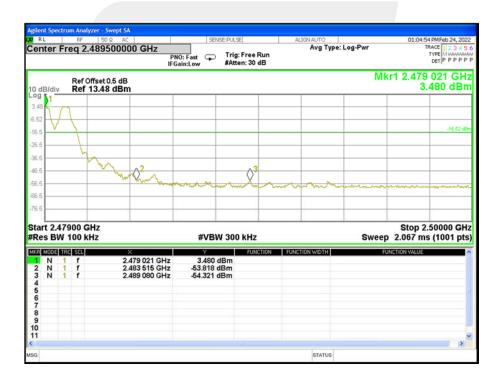




### For Hopping Band edge

GFSK

RL	rum Analyzer - RF 5	D R AC	SENS	E:PULSE	ALIGN AUTO		01:02:49	PMFeb 24, 20
enter F	req 2.351		NO: Fast 😱 Gain:Low	Trig: Free Run #Atten: 30 dB	Avg Type:	-		TYPE MWWWW DET P P P P
dB/div	Ref Offset Ref 13.4					N	1kr1 2.402 3.	073 GH 440 dB
44								
56								
6.6								-16.58 d
6.6								
6.6								0
.6							$\Diamond^2$	N
.6	minim	a have ghe ger and the work	eter and the second	and the state of t	and we are a set of the set of th		and when the second	ALAN Y
.6								
art 2 3(	0000 GHz						Stop 2	40300 GH
	100 kHz		#VBW	/ 300 kHz		Swee	ep 9.867 ms	
R MODE T		×	Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
N 1 2 N 1 3 N 1	f f f	2.402 073 GHz 2.390 022 GHz 2.400 013 GHz	3.440 d -55.786 d -44.788 d	Bm				
					STATUS			>



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#### Page 39 of 73 Report No.: STS2202110W01

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

RF 50 S	Ω AC	SENSE:PULS	E	ALIGN AUTO	01:59:42 PMFeb
r Freq 12.515	000000 GHz	0: Fast 🖵 Trig ain:Low #Atte	Free Run en: 30 dB	Avg Type: Log-P	
Ref Offset 0					Mkr1 2.402 -4.461
1					
A2	^3				
merelander	www.allaneero	man Madaman	mener	and the second of the second s	- St-Jan Land - and the second of the second
80 MHz BW 100 kHz		#VBW 300	kHz		Stop 25.0 Sweep 2.386 s (100
E TRC SCL 1 f 1 f 1 f 1 f 1 f	× 2.402 GHz 3.001 GHz 5.523 GHz 24.451 GHz	4.461 dBm -55.499 dBm -57.146 dBm -48.380 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
				STATUS	
			э сн		

### 00 CH

39	CH

RL		RF	50 Q A		SENSE:P	ULSE	ALIGN AUTO			08 PMFeb 24, 20
ente	er Fre	eq 1:	2.515000			rig: Free Run Atten: 30 dB	Аvg Туре	: Log-Pwr		TRACE 1 2 3 4 TYPE MWWWW DET P P P P
dB/c	div		offset 0.5 dB 6.94 dBm							2.452 GH 8.058 dB
٩Г		-	1							
16		ľ								-
1										-19.03 (
1										
1										
1					3					$\rightarrow$
			2	Y			mour		untration	and and the second
	m	w		al and the second second	manumente	anentiment	manie man and	and the second sec		
Ľ										
1									2	
L	30 M	Hz							Sto	p 25.00 G
art :		Hz 100 k	Hz		#VBW 3	300 kHz		Sw	Sto eep 2.386	p 25.00 G s (1001 p
art : es l	BW 1	100 k	Hz	×	Y	FUNCTION	FUNCTION WIDTH		Sto eep 2.386 FUNCTION WARDE	p 25.00 G s (1001 p
es I	BW 1	100 k SCL	Hz	× 2.452 GHz 2.476 CHz	-3.058 dBr	FUNCTION	FUNCTION WIDTH		eep 2.386	p 25.00 G s (1001 p
Int:	BW 1	100 k f f	Hz	3.176 GHz 7.321 GHz	-3.058 dBr -57.194 dBr -50.253 dBr	FUNCTION m m	FUNCTION WIDTH		eep 2.386	p 25.00 G s (1001 p
es I	BW 1	100 k SCU f	Hz	3.176 GHz	-3.058 dBr -57.194 dBr	FUNCTION m m	FUNCTION WIDTH		eep 2.386	p 25.00 G s (1001 p
art : es   N	BW 1	100 k f f	Hz	3.176 GHz 7.321 GHz	-3.058 dBr -57.194 dBr -50.253 dBr	FUNCTION m m	FUNCTION WIDTH		eep 2.386	p 25.00 G s (1001 p
Int:	BW 1	100 k f f	Hz	3.176 GHz 7.321 GHz	-3.058 dBr -57.194 dBr -50.253 dBr	FUNCTION m m	FUNCTION WIDTH		eep 2.386	p 25.00 G s (1001 p
Int:	BW 1	100 k f f	Hz	3.176 GHz 7.321 GHz	-3.058 dBr -57.194 dBr -50.253 dBr	FUNCTION m m	FUNCTION W/DTH		eep 2.386	p 25.00 G s (1001 p
Int : es   N	BW 1	100 k f f	Hz	3.176 GHz 7.321 GHz	-3.058 dBr -57.194 dBr -50.253 dBr	FUNCTION m m	FUNCTION WIDTH		eep 2.386	p 25.00 G s (1001 p
art : es   N	BW 1	100 k f f	Hz	3.176 GHz 7.321 GHz	-3.058 dBr -57.194 dBr -50.253 dBr	FUNCTION m m	FUNCTION WIDTH		eep 2.386	p 25.00 G s (1001 p

Shenzhen STS Test Services Co., Ltd.



# 78 CH

RL	RF	yzer - Swept 50 ຄ. /	IC I	SEI	NSE:PULSE	AL	IGNAUTO			0 PM Feb 24, 21
nter F	req 1	2.515000	0000 GHz	NO: Fast 😱 Gain:Low	Trig: Free Run #Atten: 30 dB		Avg Type:	Log-Pwr	т	RACE 1 2 3 4 TYPE MWWW DET P P P F
B/div		offset 0.5 dl 5.73 dBm							Mkr1 2 -4.	.477 G 272 dE
/		1								
-	_									-19.04
				•						0
3		) <sup>2</sup>	$\langle \rangle$	3					meren	and the second
فيلمهلم	hautant	manuels	unimered	Alter and a second	from the second	na la				
3		-	-							
3			-							
rt 30 M es BW		Hz		#VB	W 300 kHz			Swe	Stop ep 2.386	25.00 G s (1001 p
MODE T			×	Y	FUNCTION	FUNCT	ION WIDTH	ł	UNCTION VALUE	
	f f f		2.477 GHz 2.552 GHz 7.446 GHz 24.276 GHz	-4.272 -56.665 -54.021 -47.536	dBm dBm					
					U. C.		- Lineare L			)
							STATUS			



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

		alyzer - Swept SA					
K RL	RF		SENS	E:PULSE	ALIGN AUTO		2 PMFeb 24, 2022
Center F	req	2.353500000 GHz	PNO: Fast 🖵 IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type:		TYPE MWWWW DET P P P P P
10 dB/div		f Offset 0.5 dB f 10.93 dBm				Mkr1 2.40 0.	2 19 GHz 927 dBm
-og							<b>1</b>
.930							Á
9.07							-1907 dB
19.1							- oprob
29.1							
39.1							(A) <sup>3</sup> }
49.1							1
59.1	مرومهم	an and the second second	and the state of the	warment when	warman for said to have down of	and and a second and a second second	<i>V</i> *
69.1							-
79.1							
tart 2.3 Res BM			#VBW	300 kHz		Stop 2. Sweep 10.27 ms	40700 GH 6 (1001 pts
KR MODE	TRC SCI		Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	
1 N 2 N		2.402 19 0					
3 N 4 N	1 f	2.397 91 0	GHz -46.646 di	Bm			
4 N 5	1 1	2.400 05 0	GHz -38.644 dl	sm			
6							
2 N 3 N 5 6 7 8 9							
10							
11							
sg					STATUS		
					514105		

#### 00 CH

39 CH





# 78 CH

		50 R AC	0 GHz	56	NSE:PULSE		ALIGNAUTO Avg Type:	Log-Pwr		0 PMFeb 24, 2 RACE 1 2 3 4
			P	PNO: Fast Gain:Low	Trig: Free #Atten: 30	Run dB				DET P P P F
lB/div	Ref Offs Ref 10.	et 0.5 dB 96 dBm						N	/kr1 2.480 0.	175 G 994 dE
			1							
1 <u> </u>		-1								-19.04
	-	mond	- Vinne	. 2 /3						
m	www			why	Ant in			<b>∆</b> <sup>4</sup>		
								Service and a sure	man	
	500 GHz									50000 G
es BW 1	100 kHz				W 300 kHz			Swe	ep 2.400 ms	s (1001 p
	LISLL	2.4	80 175 GHz 83 500 GHz	0.994 -52.811	dBm dBm	ICTION	UNCTION WIDTH		FONCTION VALUE	
MODE TRI N 1 N 1 N 1 N 1	f f f	2.4	84 375 GHz 92 875 GHz	-49.466 -57.247						
MODE TRI N 1 N 1 N 1		2.4								
MODE TRI N 1 N 1 N 1	f f f	2.4								



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### For Hopping Band edge

### π/4-DQPSK

		lyzer - Swept SA								
RL Center F	<sup>RF</sup> req 2	.351500000 GI		Fast 😱	SE:PULSE Trig: Free Run #Atten: 30 dB	ALIGN AUT Avg	ro g Type: Log-f	wr	TR. T	PMFeb 24, 2022 ACE 1 2 3 4 5 YPE M 444444 DET P P P P P
0 dB/div		Offset 0.5 dB 10.82 dBm						Mk	(r1 2.403 0.8	000 GH: 322 dBn
820										1
9.18										{
9.2										-19.18 d
9.2										~~~~
9.2										
9.2									$\langle \rangle^2$	
9.2	Weap term	and the second	and the second second second	to an and the second		where the second	*******		and the second	and the second second
9.2										
tart 2.30 Res BW				#VBV	V 300 kHz			Sweep	Stop 2.4 9.867 ms	0300 GH (1001 pts
KR MODE T		×		Y	FUNCTION	FUNCTION WID	отн	FL	UNCTION VALUE	
1 N 1 2 N 1 3 N 1 5 6 7 8 9 0	f	2.403 00 2.390 02 2.400 01	2 GHz	0.822 -58.465 -41.146	dBm					
9 0 1										
G						ST	ATUS			



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Page 44 of 73 Report No.: STS2202110W01

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

#### eb 24, 202 22 PMH6 TRACE Center Freq 12.515000000 GHz Avg Type: Log-Pwr PNO: Fast G Trig: Free Run #Atten: 30 dB DET P P P P P Mkr1 2.402 GHz -3.501 dBm Ref Offset 0.5 dB Ref 6.50 dBm 10 dB/di 3.5 **∂**<sup>4</sup> 43. Ĉ $\langle \rangle^2$ 83 / Start 30 MHz #Res BW 100 kHz Stop 25.00 GHz Sweep 2.386 s (1001 pts) #VBW 300 kHz MKR MODE TRC SCL UNCTION VALUE FUNCTIO Т -3.501 dBm -56.571 dBm -50.712 dBm -48.561 dBm N N N N 2.402 GHz 3.026 GHz 7.196 GHz 24.201 GHz 1 2 3 4 5 6 7 8 9 10 11 f 1 STATUS

#### 00 CH

# 39 CH

RL		RE	50 g	AC	SENSE:PUL	£ I	ALIGN AUTO		02:05:22	2 PMFeb 24, 202
	er Fr			0000 GHz	East Trig	: Free Run en: 30 dB	Avg Type:	Log-Pwr	TF	TYPE MWWWW DET P P P P F
) dB/d	div		Offset 0.5 d							.452 GH 150 dBi
150		(	1							
85										
.9										-19.03 d
.9 -										
9.9				3						<
9		melinak	S.	e and a start		monen	have marked	and a second and a s	monter	man
.9	م. م							_		-
.9 -									2	
art 3 Res I		1Hz 100	kHz		#VBW 30	) kHz		Sw	Stop eep 2.386 s	25.00 GH (1001 pt
R MOR		C SCL		× 2.452 GHz	0.150 dBm	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
2 N 3 N 4 N	1	ff		3.076 GHz 6.797 GHz 24.551 GHz	-56.373 dBm -56.381 dBm -48.028 dBm					
5										
,										>
										2

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# 78 CH

r Freq 12.515		SENSE:PULS	E	ALIGNAUTO Avg Type:	Log-Pwr	02:07:18 PM TRACE	
1100 12.515	PN	D: Fast 😱 Trig: ain:Low #Atte	: Free Run en: 30 dB			TYPE	r P P
Ref Offset 0						Mkr1 2.47 -6.34	
<b>1</b>							
	3						
		مريعهم والمريح	man		male Barkers	an manufactory	س
30 MHz BW 100 kHz		#VBW 300	kHz		Sw	Stop 25 eep 2.386 s (1	
DE TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
	2.477 GHz 2.802 GHz 7.446 GHz 24.301 GHz	-6.344 dBm -56.496 dBm -50.218 dBm -48.023 dBm					



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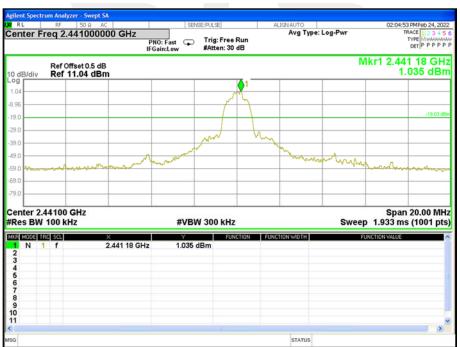


### For Band edge(it's also the reference level for conducted spurious emission)

	Spe	ctrur		lyzer - Swept SA						
X RL	_	_	RF	50 Q AC	SEF	VSE:PULSE		ALIGN AUTO	: Log-Pwr	02:02:52 PMFeb 24, 2022 TRACE 1 2 3 4 5 6
Cent	er	Fre	eq 2		PNO: Fast 😱 FGain:Low	Trig: Free #Atten: 30		Avg Type	: Log-Pwr	TRACE 1 2 3 4 5 6 TYPE M WWWWWW DET P P P P P
10 dB	/div			Offset 0.5 dB 10.80 dBm						Mkr1 2.402 08 GHz 0.884 dBm
										<b>1</b>
0.800 -										Å
-9.20										-1920 dBr
-19.2										
-29.2										
-39.2 -49.2										
				$\sqrt{2}$						M M
-59.2			- the state	and the second	and the second	and the second s		a roud and a star of points a los	and the second second	
-79.2										
13.2								0		
Start #Res					#VB	N 300 kHz	2		Swee	Stop 2.40700 GHz p 10.27 ms (1001 pts)
MKR M	ODE	TRC	SEL	×	Y		ICTION	FUNCTION WIDTH		FUNCTION VALUE
	N	1	f	2.402 08 GHz 2.320 97 GHz						
3 1	NN	1	f	2.397 80 GHz 2.400 05 GHz	-47.251	dBm				
	N	1	T	2.400 05 GHz	-39.467	авт				
5										
567										
56789										
5 6 7 8 9										
5 6 7 8 9 10 11										

#### 00 CH

39 CH





## 78 CH

	5q 2.4	875000	1	PNO: Fast 😱 Gain:Low	Trig: Free Rur #Atten: 30 dB		vg Type:	-		RACE 1 2 3 4 TYPE MWWW DET P P P P
B/div		set 0.5 dB ).96 dBn						N	1kr1 2.480 0.	175 GI 955 dB
			R.							
4										-19.05
		~	ha							
	- Marine - M	- J~.	- W	$M_{\rm m}^2$						
° 🔨	hand			maril	human	mana		2	-	-
·										
0										
rt 2.475 es BW 1				#VB	W 300 kHz			Swe	Stop 2 ep 2.400 m	.50000 G s (1001 p
MODE TRO	SCL		×	Y.	FUNCTIO	FUNCTION	WIDTH		FUNCTION VALUE	
N 1 N 1	f f f	2.	.480 175 GHz .483 500 GHz .484 525 GHz .493 075 GHz	0.955 -53.543 -47.129 -57.255	dBm dBm					
N 1										
N 1										
N 1 N 1										



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## For Hopping Band edge

8DPSK

		yzer - Swept SA								
enter f	<sub>R</sub> ⊧ Freq 2.	50 Ω AC .35150000	PN	IO: Fast	ISE:PULSE Trig: Free Ri #Atten: 30 di	ın	ALIGN AUTO Avg Type:		TF	PMFeb 24, 20 RACE 1 2 3 4 9 TYPE MMMMM DET P P P P
) dB/div		)ffset 0.5 dB 1 <b>0.93 dBm</b>						M	kr1 2.402 0.	176 GH 929 dB
30										
07										
0.1										-20.81.d
										$\diamond$
0.1									<u>2</u>	
0.1		And and an interest				hole-and the second	han an an an an	-a	Ver	and all the
	0000 G	Hz							Stop 2.	40300 GH
Res BW	V 100 k	Hz		#VB	N 300 kHz			Swee	p 9.867 ms	(1001 pt
E MODE 1 N 2 N 3 N	TRC SCL 1 f 1 f 1 f	2.3	02 176 GHz 90 022 GHz 00 013 GHz	0.929 -59.284 -41.146	dBm	ON FUN	CTION WIDTH		FUNCTION VALUE	
1	1 1	2.4	00 013 GHZ	-41.140	авт					
5										
3										
2										
										>

L		RF	50 Q		SE	NSE:PULSE	ALIGN AUTO	Type: Log-Pwr	01:39:32 PMFeb 24, TRACE 1 2 3
iter	Fre	q 2.	489500		PNO: Fast 😱 Gain:Low	Trig: Free Rur #Atten: 30 dB		Type. Log-Pwr	TYPE MWW DET P P P
B/div			ffset 0.5 d 10.80 dB					Ν	/kr1 2.479 189 G 0.800 dl
<b>0</b> 1									
ľ	J	η							
⊢		+							-19.2
$\vdash$		h							
$\vdash$		-	Ma Change						
$\vdash$			ومسرس						
$\vdash$		-			mana	waran waran waran waran wa sa wa	- manantin	- manager	
								-	
rt 2.4 s Bl					#VB	W 300 kHz		Swe	Stop 2.50000 ( ep 2.067 ms (1001
MODE	TRC			×	Y	FUNCTIO	N FUNCTION WIDT	н	FUNCTION VALUE
ZZZ	1 1 1	f f f		2.479 189 GHz 2.483 515 GHz 2.492 083 GHz	0.800 -55.695 -56.044	dBm			



# 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 5	ΩΩ AC	SENSE:PULSE	ALIGN A		01:00:43 PMFeb 24, 202
enter Freq 2.441		Fast Trig: Fre h:Low #Atten: 3	e Run	vg Type: Log-Pwr	TRACE 1 2 3 4 5 TYPE MUMUM DET P P P P F
Ref Offset 0 dB/div Ref 13.9				Mkr	2 2.480 243 5 GH 3.92 dBr
•9 1 3.95 4 3.05 6.1	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	44444 <b>4</b> 4444444	~~~~~	(44444444444444	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
6.1					
6.1					
tart 2.40000 GHz Res BW 300 kHz		#VBW 300 kH	z	Swee	Stop 2.48350 GF p 1.133 ms (1001 pt
26 M008 TRG SCL 1 N 1 f 2 N 1 f 3 4	× 2.402 004 0 GHz 2.480 243 5 GHz	3.86 dBm 3.92 dBm	INCTION FUNCTION	MDTH F	UNCTION VALUE
5 6 7 8 9					
0					>

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# 6. AVERAGE TIME OF OCCUPANCY

### 6.1 LIMIT

FCC Part 15.247,Subpart C								
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

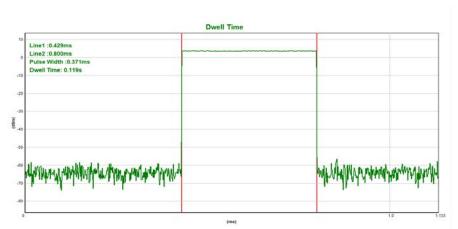
Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Test Mode:	GFSK/ π/4-DQPSK/ 8DPSK	Test Voltage:	AC 120V/60Hz

Modulation	Pocket Type	Frequency (MHz)	Single Pulse Time (ms)	Dwell Time (s)	Limit (s)	Result
	DH1	2441	0.371	0.119	0.4	Pass
GFSK	DH3	2441	1.626	0.260	0.4	Pass
	DH5	2441	2.876	0.307	0.4	Pass
	2DH1	2441	0.381	0.122	0.4	Pass
π/4DQPSK	2DH3	2441	1.633	0.261	0.4	Pass
	2DH5	2441	2.880	0.307	0.4	Pass
	3DH1	2441	0.381	0.122	0.4	Pass
8DPSK	3DH3	2441	1.635	0.262	0.4	Pass
	3DH5	2441	2.885	0.308	0.4	Pass

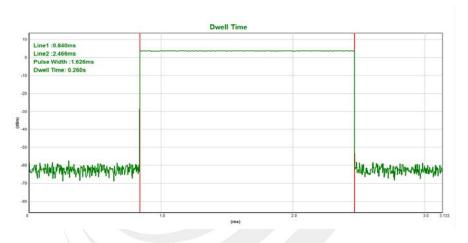
Shenzhen STS Test Services Co., Ltd.



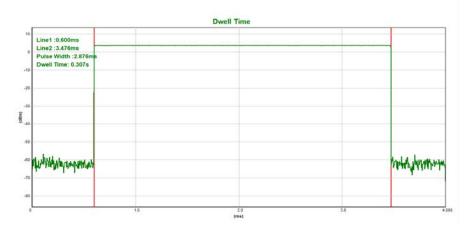
### CH39-DH1



### CH39-DH3





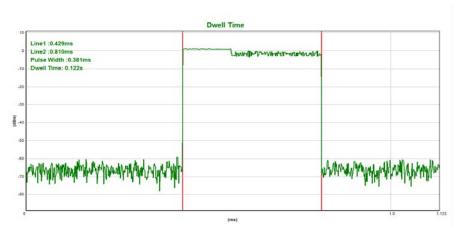


Shenzhen STS Test Services Co., Ltd.

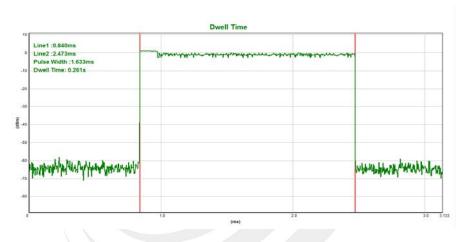
П



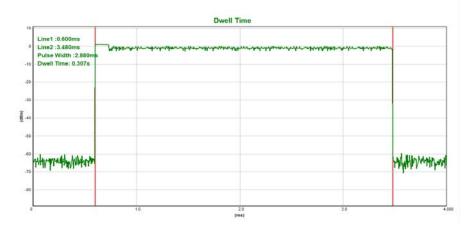
#### CH39-2DH1



### CH39-2DH3



#### CH39-2DH5

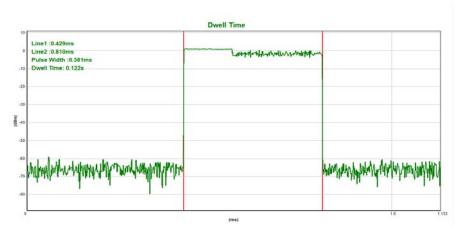


Shenzhen STS Test Services Co., Ltd.

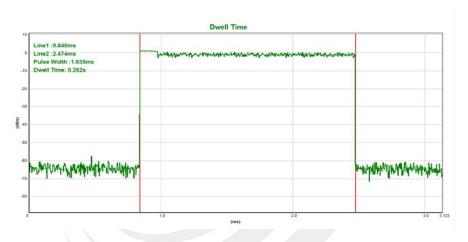
П



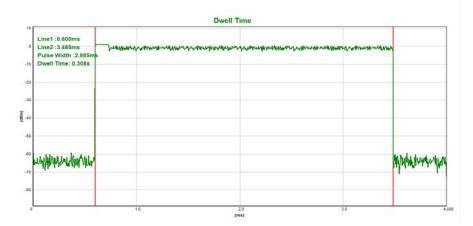
### CH39-3DH1



#### CH39-3DH3



#### CH39-3DH5



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### 7. HOPPING CHANNEL SEPARATION MEASUREMEN

7.1 LIMIT

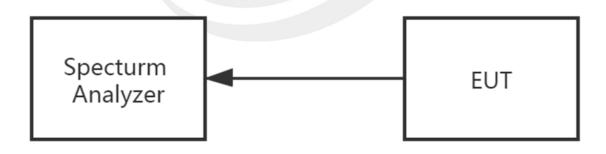
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that 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: 25%	ΰC	Relative Humidity:	50%
Test Mode: GFS	- SK/π/4-DQPSK/8DPSK	Test Voltage:	AC 120V/60Hz

Modulation	Frequency (MHz)	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
	2402	2402.032	2403.031	0.999	0.950	Pass
GFSK	2441	2441.032	2442.028	0.996	0.939	Pass
	2480	2478.990	2480.028	1.038	0.944	Pass
	2402	2402.020	2403.028	1.008	0.845	Pass
π/4DQPSK	2441	2441.017	2442.031	1.014	0.842	Pass
	2480	2479.011	2480.013	1.002	0.847	Pass
	2402	2402.020	2403.172	1.152	0.852	Pass
8DPSK	2441	2441.176	2442.175	0.999	0.845	Pass
	2480	2479.170	2480.178	1.008	0.852	Pass





#### CH00 -1Mbps



#### CH39 -1Mbps





#### CH78 -1Mbps



### CH00 -2Mbps





#### CH39 -2Mbps



#### CH78 -2Mbps





### CH00 -3Mbps

Page 61 of 73

R L	um Analy RF	zer - Swept SA 50 Ω AC			NSE:PULSE		LIGNAUTO		01-04-12	2 PMFeb 24, 2
		402500000	PN	0: Wide 🖵	Trig: Free F #Atten: 30	Run	Avg Type:	Log-Pwr	TI	TYPE MWWW DET P P P F
dB/div		ffset 0.5 dB 8 <b>.30 dBm</b>						MI	(r2 2.403 -1.	172 G 838 dE
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7										
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nter 2.4	102500								Snan	3.000 N
es BW	30 kH			#VB	W 100 kHz				3.200 ms	
N 1 N 1	f f		02 020 GHz 03 172 GHz	-1.69 -1.84	dBm	TION FUNC	CTION WIDTH	F	UNCTION VALUE	

#### CH39 -3Mbps



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 Http://www.stsapp.com E-mail: sts@stsapp.com

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# CH78 -3Mbps

RL RF 50Ω AC		SENSE:PULSE	ALIGN AUTO	01:33:23 PMFeb 24, 202
nter Freq 2.47950000	0 GHz PNO: Wide IFGain:Lov		Avg Type: Log-Pwr	TRACE 1 2 3 4 9 TYPE MWWWW DET P P P P
Ref Offset 0.5 dB dB/div Ref 2.53 dBm			N	lkr2 2.480 178 GH -1.857 dBr
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nter 2.479500 GHz es BW 30 kHz		#VBW 100 kHz	Swee	Span 3.000 MH p 3.200 ms (1001 pt
MODE TRC SCL X		Y FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
	79 170 GHz 80 178 GHz	-2.05 dBm -1.86 dBm		
				12



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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%
Test Mode:	GFSK/π/4-DQPSK/8DPSK	Test Voltage:	AC 120V/60Hz

Modulation	Frequency (MHz)	-20 dB Bandwidth (MHz)	Result
	2402	0.9503	Pass
GFSK	2441	0.9387	Pass
	2480	0.9442	Pass
	2402	1.268	Pass
π/4DQPSK	2441	1.263	Pass
	2480	1.271	Pass
	2402	1.278	Pass
8DPSK	2441	1.267	Pass
	2480	1.278	Pass



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#### CH00 -1Mbps



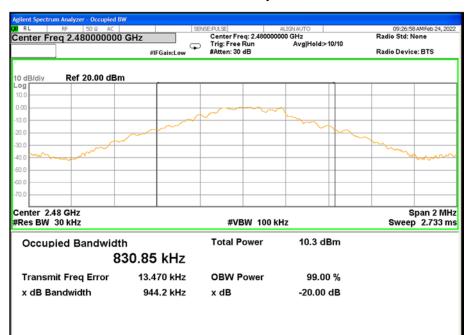
CH39 -1Mbps



Shenzhen STS Test Services Co., Ltd.

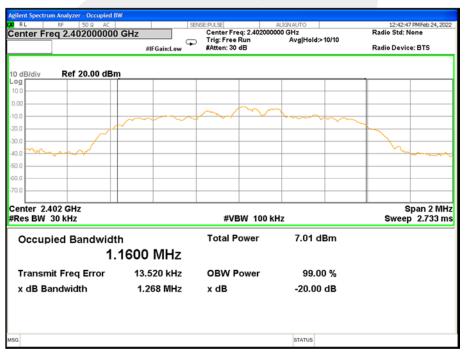


#### CH78 -1Mbps



CH00 -2Mbps

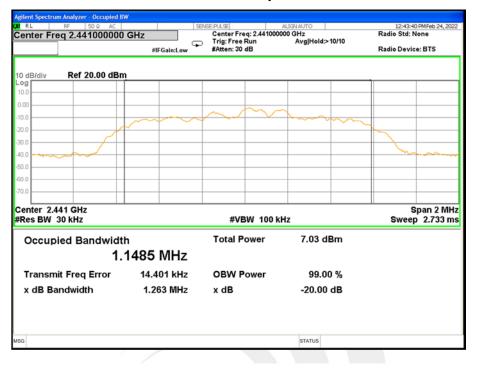
STATUS



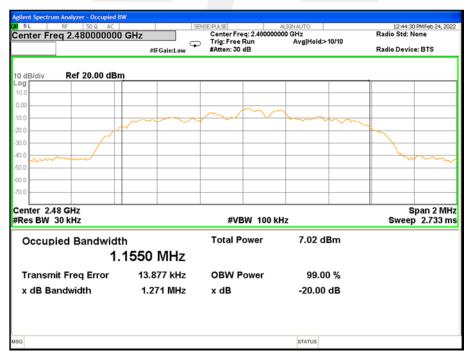
Shenzhen STS Test Services Co., Ltd. Tel: +86-755 3688 6288 Fax: +86-755 3688 6277 Http://www.stsapp.com E-mail: sts@stsapp.com



#### CH39 -2Mbps



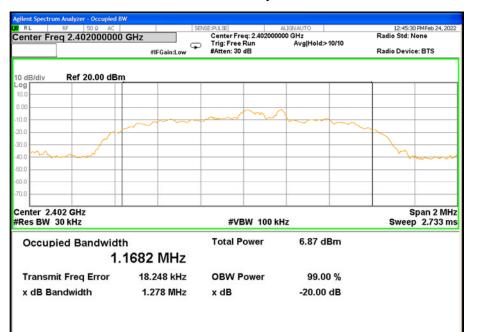
#### CH78 -2Mbps



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#### CH00 -3Mbps



#### CH39 -3Mbps

STATUS



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# CH78 -3Mbps

nt Spectrum Analyzer - Occupied BV IL RF 50 ຄ AC Iter Freq 2.480000000	S	Center Freq: 2.4800000	ALIGN AUTO 1000 GHz Avg Hold:>10/10	12:47:19 PMFeb 24, 202 Radio Std: None Radio Device: BTS
IB/div Ref 20.00 dBm	1			
		m	V	
	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			~
m				mun
iter 2.48 GHz s BW 30 kHz		#VBW 100 ki	Hz	Span 2 MH Sweep 2.733 m
occupied Bandwidt	n 1628 MHz	Total Power	6.87 dBm	
ransmit Freq Error	16.544 kHz	OBW Power	99.00 %	
dB Bandwidth	1.278 MHz	x dB	-20.00 dB	
			STATUS	



# 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.

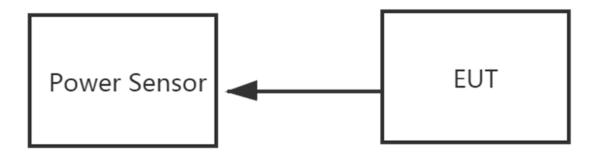
e) A plot of the test results and setup description shall be included in the test report.

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		

Modulation	Frequency (MHz)	Peak Power (dBm)	Average Power (dBm)	Limit (dBm)
GFSK (1M)	2402	3.78	2.64	20.97
	2441	3.85	2.72	20.97
	2480	3.90	2.77	20.97
π/4-DQPSK (2M)	2402	1.11	-2.81	20.97
	2441	1.17	-2.75	20.97
	2480	1.22	-2.70	20.97
8-DPSK (3M)	2402	1.40	-2.81	20.97
	2441	1.46	-2.76	20.97
	2480	1.52	-2.69	20.97

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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 Dipole 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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