

RADIO TEST REPORT

S T S

Report No.: STS2112087W01

Issued for

Shenzhen TwoMonkeys Technology Co.,Ltd.

1201, 12/F, Dachong Building(Shangmei Keji), Yuehai Street, Nanshan District, Shenzhen, China

Product Name:	Dosmono Scanning Pen	
Brand Name:	N/A	
Model Name:	C505H	
Series Model:	C505A, C505B, C505C, C505D	
FCC ID:	2A33K-C505H	
Test Standard:	FCC Part 15.247	

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APPROVA

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00TEST RESULT CERTIFICATION

Applicant's Name:	Shenzhen TwoMonkeys Technology Co.,Ltd.
Address	1201, 12/F, Dachong Building(Shangmei Keji), Yuehai Street, Nanshan District, Shenzhen, China
Manufacturer's Name:	Shenzhen TwoMonkeys Technology Co.,Ltd.
Address	1201, 12/F, Dachong Building(Shangmei Keji), Yuehai Street, Nanshan District, Shenzhen, China
Product Description	
Product Name:	Dosmono Scanning Pen
Brand Name:	N/A
Model Name:	C505H
Series Model	C505A, C505B, C505C, C505D
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:	13 Dec. 2021
Date (s) of performance of tests :	13 Dec. 2021 ~ 22 Dec. 2021
Date of Issue:	22 Dec. 2021

Test Result Pass

Testing Engineer (Chris Chen) **Technical Manager** (Sean she) Authorized Signatory :

(Vita Li)

Page 3 of 73 Report No.: STS2112087W01



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
7. HOPPING CHANNEL SEPARATION MEASUREMEN	56

7. HOPPING CHANNEL SEPARATION MEASUREMEN

Page 4 of 73 Report No.: STS2112087W01



Table of Contents	Page
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

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Page 5 of 73 Report No.: STS2112087W01

Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	22 Dec. 2021	STS2112087W01	ALL	Initial Issue



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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.

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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

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2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Dosmono Scanning Pen
Trade Name	N/A
Model Name	C505H
Series Model	C505A, C505B, C505C, C505D
Model Difference	Only the product model is different
Channel List	Please refer to the Note 2.
Bluetooth	Frequency:2402 – 2480 MHz Modulation: GFSK(1Mbps), π/4-DQPSK(2Mbps), 8DPSK(3Mbps)
Bluetooth Version	4.2
Bluetooth Configuration	BR+EDR
Antenna Type	Please refer to the Note 3.
Rating	Input: DC 5V1A
Battery	Rated Voltage:3.8V Charge Limit Voltage:4.35V Capacity: 1200mAh
Hardware version number	V1.1
Software version number	c505h_1+8_eng
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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2.

		Chanr	nel 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	N/A	C505H	PIFA	N/A	0.5dBi	BT Antenna

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



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.



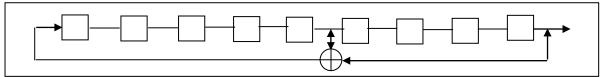
Page 11 of 73 Report No.: STS2112087W01

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.

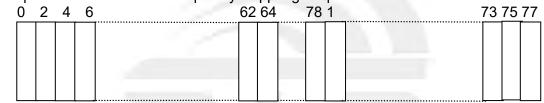
(2)The Pseudorandom sequence may be generated in a nin-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones: i.e. the shift register is initialized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

Numver of shift register stages:9

Length of pseudo-random sequence:2⁹-1=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.

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Page 12 of 73 Report No.: STS2112087W01

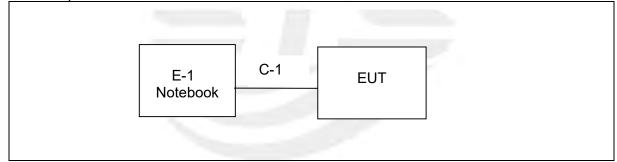
2.4 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

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.

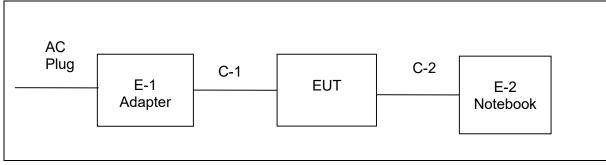
Test software Version	Test program: Bluetooth				
(Power control software) Parameters(1/2/3Mbps)	Power class: DH1 rate:4:27 2DH1 rate:20:54 3DH1 rate:24:83	Power class: DH3 rate:11:183 2DH3 rate:26:367 3DH3 rate:27:552	Power class: DH5 rate:15:339 2DH5 rate:30:679 3DH5 rate:31:1021		

RF Function	Туре	Mode Or Modulation type	ANT Gain(dBi)	Power Class	Software For Testing
		GFSK	0.5	default	
BT	BR+EDR	π/4-DQPSK	0.5	default	Engineering mode
		8DPSK	0.5	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.

	Necessary accessories							
Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note			
N/A	N/A	N/A	N/A N/A		N/A			

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-1	Adapter	HUAWEI	HW-050450C00	N/A	N/A
C-1	DC Cable	N/A	N/A	110cm	N/A
E-2	Notebook	LENOVO	ThinkPad E470	N/A	N/A
C-2	USB Cable	N/A	N/A	150cm	N/A

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	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 2022.10.0				
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)				



Page 15 of 73 Report No.: STS2112087W01

RF Connected Test

<u></u>								
	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until		
			U2021XA	MY55520005	2021.09.30	2022.09.29		
	Power Sensor	Keysight		MY55520006	2021.09.30	2022.09.29		
				MY56120038	2021.09.30	2022.09.29		
				MY56280002	2021.09.30	2022.09.29		
ſ	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)					





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

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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.
 - Vertical Reference Ground Plane EUT 40cm EUT 80cm N Horizontal Reference Ground Plane

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

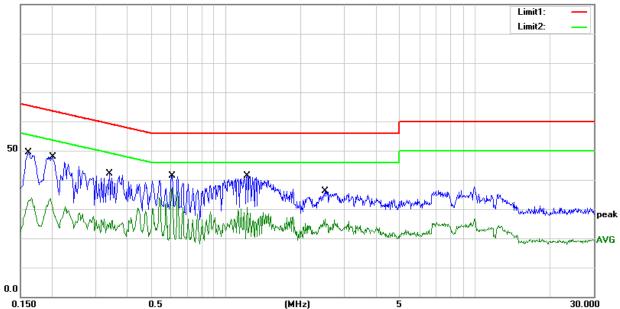
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1620	29.05	20.33	49.38	65.36	-15.98	QP
2	0.1620	13.48	20.33	33.81	55.36	-21.55	AVG
3	0.2020	27.57	20.32	47.89	63.53	-15.64	QP
4	0.2020	13.34	20.32	33.66	53.53	-19.87	AVG
5	0.3420	21.40	20.66	42.06	59.15	-17.09	QP
6	0.3420	5.55	20.66	26.21	49.15	-22.94	AVG
7	0.6100	21.03	20.44	41.47	56.00	-14.53	QP
8	0.6100	16.90	20.44	37.34	46.00	-8.66	AVG
9	1.2220	21.13	20.30	41.43	56.00	-14.57	QP
10	1.2220	10.30	20.30	30.60	46.00	-15.40	AVG
11	2.5060	15.88	20.33	36.21	56.00	-19.79	QP
12	2.5060	6.23	20.33	26.56	46.00	-19.44	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)



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Page 19 of 73 Report No.: STS2112087W01

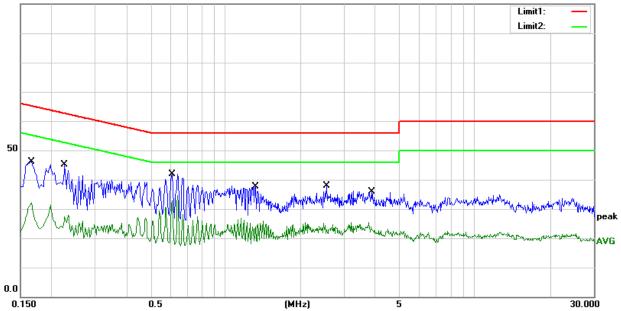
Temperature:	25.1(C)	Relative Humidity:	44%RH
Test Voltage:	AC 120V/60Hz	Phase:	Ν
Test Mode:	Mode 13		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1660	25.74	20.33	46.07	65.16	-19.09	QP
2	0.1660	11.75	20.33	32.08	55.16	-23.08	AVG
3	0.2260	24.82	20.43	45.25	62.60	-17.35	QP
4	0.2260	7.33	20.43	27.76	52.60	-24.84	AVG
5	0.6100	21.47	20.44	41.91	56.00	-14.09	QP
6	0.6100	14.22	20.44	34.66	46.00	-11.34	AVG
7	1.3180	17.39	20.30	37.69	56.00	-18.31	QP
8	1.3180	5.54	20.30	25.84	46.00	-20.16	AVG
9	2.5420	17.57	20.33	37.90	56.00	-18.10	QP
10	2.5420	4.72	20.33	25.05	46.00	-20.95	AVG
11	3.8660	15.48	20.40	35.88	56.00	-20.12	QP
12	3.8660	4.98	20.40	25.38	46.00	-20.62	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 dBu¥



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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 Fraguenay	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.: STS2112087W01

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.

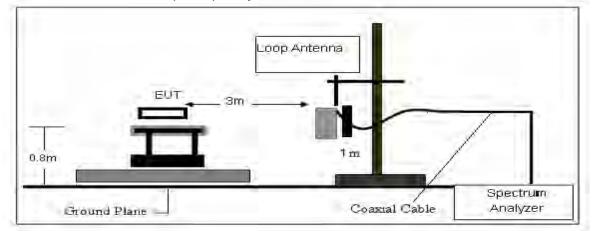
3.2.3 DEVIATION FROM TEST STANDARD

No deviation.

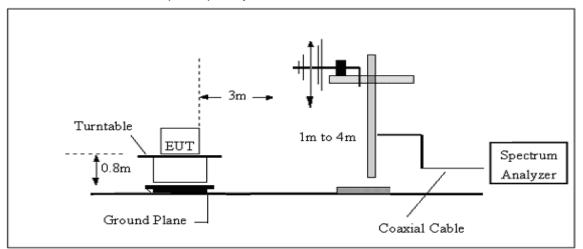


3.2.4 TESTSETUP

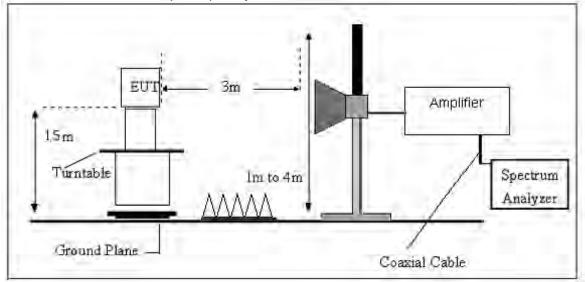
(A) Radiated Emission Test-Up Frequency Below 30MHz

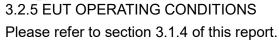


(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(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:	DC 3.8V	Test Mode:	TX Mode

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



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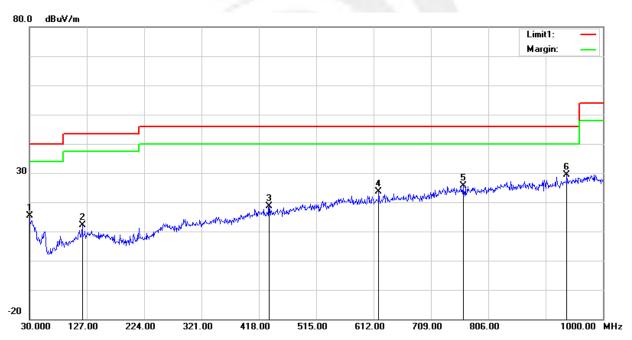
(30MHz-1000MHz)

Temperature:	23.1(C)	Relative Humidity:	60%RH		
Test Voltage:	DC 3.8V	Phase:	Horizontal		
Test Mode:	Mode 1/2/3/4/5/6/7/8/9(Mode 5 worst mode)				

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	30.0000	28.33	-12.85	15.48	40.00	-24.52	QP
2	119.2400	30.46	-18.38	12.08	43.50	-31.42	QP
3	435.4600	28.78	-10.12	18.66	46.00	-27.34	QP
4	620.7300	28.99	-5.46	23.53	46.00	-22.47	QP
5	763.3200	27.92	-2.22	25.70	46.00	-20.30	QP
6	938.8900	28.02	1.29	29.31	46.00	-16.69	QP

Remark:

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





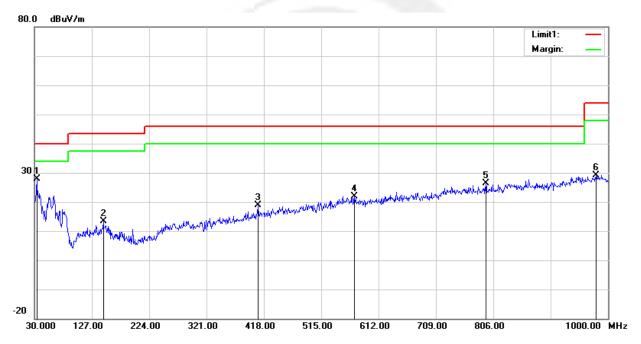
Page 27 of 73 Report No.: STS2112087W01

Temperature:	23.1(C)	Relative Humidity:	60%RH		
Test Voltage:	DC 3.8V	Phase:	Vertical		
Test Mode:	Mode 1/2/3/4/5/6/7/8/9(Mode 5 worst mode)				

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	33.8800	42.66	-14.80	27.86	40.00	-12.14	QP
2	146.4000	31.70	-18.38	13.32	43.50	-30.18	QP
3	408.3000	29.54	-10.66	18.88	46.00	-27.12	QP
4	571.2600	27.57	-5.62	21.95	46.00	-24.05	QP
5	793.3900	28.35	-1.99	26.36	46.00	-19.64	QP
6	979.6300	26.57	2.65	29.22	54.00	-24.78	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.: STS2112087W01



(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 Chan	nel (π/4-DQPS	6K/2402 MHz)				
3264.66	62.04	44.70	6.70	28.20	-9.80	52.24	74.00	-21.76	PK	Vertical
3264.66	51.62	44.70	6.70	28.20	-9.80	41.82	54.00	-12.18	AV	Vertical
3264.81	61.92	44.70	6.70	28.20	-9.80	52.12	74.00	-21.88	PK	Horizontal
3264.81	51.22	44.70	6.70	28.20	-9.80	41.42	54.00	-12.58	AV	Horizontal
4804.30	58.22	44.20	9.04	31.60	-3.56	54.66	74.00	-19.34	PK	Vertical
4804.30	50.53	44.20	9.04	31.60	-3.56	46.97	54.00	-7.03	AV	Vertical
4804.41	58.35	44.20	9.04	31.60	-3.56	54.79	74.00	-19.21	PK	Horizontal
4804.41	50.55	44.20	9.04	31.60	-3.56	46.99	54.00	-7.01	AV	Horizontal
5359.75	49.25	44.20	9.86	32.00	-2.34	46.91	74.00	-27.09	PK	Vertical
5359.75	39.76	44.20	9.86	32.00	-2.34	37.42	54.00	-16.58	AV	Vertical
5359.68	47.46	44.20	9.86	32.00	-2.34	45.11	74.00	-28.89	PK	Horizontal
5359.68	38.34	44.20	9.86	32.00	-2.34	36.00	54.00	-18.00	AV	Horizontal
7205.86	54.70	43.50	11.40	35.50	3.40	58.10	74.00	-15.90	PK	Vertical
7205.86	44.71	43.50	11.40	35.50	3.40	48.11	54.00	-5.89	AV	Vertical
7205.81	54.42	43.50	11.40	35.50	3.40	57.82	74.00	-16.18	PK	Horizontal
7205.81	44.25	43.50	11.40	35.50	3.40	47.65	54.00	-6.35	AV	Horizontal
	•			Middle Cha	innel (π/4-DQP	SK/2441 MHz)	•		
3264.78	61.54	44.70	6.70	28.20	-9.80	51.74	74.00	-22.26	PK	Vertical
3264.78	51.70	44.70	6.70	28.20	-9.80	41.90	54.00	-12.10	AV	Vertical
3264.73	61.29	44.70	6.70	28.20	-9.80	51.49	74.00	-22.51	PK	Horizontal
3264.73	50.46	44.70	6.70	28.20	-9.80	40.66	54.00	-13.34	AV	Horizontal
4882.40	58.79	44.20	9.04	31.60	-3.56	55.23	74.00	-18.77	PK	Vertical
4882.40	49.79	44.20	9.04	31.60	-3.56	46.23	54.00	-7.77	AV	Vertical
4882.38	59.53	44.20	9.04	31.60	-3.56	55.97	74.00	-18.03	PK	Horizontal
4882.38	50.31	44.20	9.04	31.60	-3.56	46.75	54.00	-7.25	AV	Horizontal
5359.60	48.09	44.20	9.86	32.00	-2.34	45.75	74.00	-28.25	PK	Vertical
5359.60	39.17	44.20	9.86	32.00	-2.34	36.82	54.00	-17.18	AV	Vertical
5359.69	47.50	44.20	9.86	32.00	-2.34	45.16	74.00	-28.84	PK	Horizontal
5359.69	38.51	44.20	9.86	32.00	-2.34	36.17	54.00	-17.83	AV	Horizontal
7323.98	54.70	43.50	11.40	35.50	3.40	58.10	74.00	-15.90	PK	Vertical
7323.98	43.58	43.50	11.40	35.50	3.40	46.98	54.00	-7.02	AV	Vertical
7323.78	54.97	43.50	11.40	35.50	3.40	58.37	74.00	-15.63	PK	Horizontal
7323.78	44.00	43.50	11.40	35.50	3.40	47.40	54.00	-6.60	AV	Horizontal



Page 29 of 73Report No.: STS2112087W01

				High Channe	l (π/4-DQPS	6K/2480 MHz)			
3264.82	61.28	44.70	6.70	28.20	-9.80	51.48	74.00	-22.52	PK	Vertical
3264.82	49.98	44.70	6.70	28.20	-9.80	40.18	54.00	-13.82	AV	Vertical
3264.66	62.08	44.70	6.70	28.20	-9.80	52.28	74.00	-21.72	PK	Horizontal
3264.66	50.22	44.70	6.70	28.20	-9.80	40.42	54.00	-13.58	AV	Horizontal
4960.38	58.98	44.20	9.04	31.60	-3.56	55.42	74.00	-18.58	PK	Vertical
4960.38	49.30	44.20	9.04	31.60	-3.56	45.74	54.00	-8.26	AV	Vertical
4960.58	58.52	44.20	9.04	31.60	-3.56	54.96	74.00	-19.04	PK	Horizontal
4960.58	49.86	44.20	9.04	31.60	-3.56	46.30	54.00	-7.70	AV	Horizontal
5359.87	48.75	44.20	9.86	32.00	-2.34	46.41	74.00	-27.59	PK	Vertical
5359.87	39.29	44.20	9.86	32.00	-2.34	36.94	54.00	-17.06	AV	Vertical
5359.83	47.39	44.20	9.86	32.00	-2.34	45.04	74.00	-28.96	PK	Horizontal
5359.83	39.42	44.20	9.86	32.00	-2.34	37.08	54.00	-16.92	AV	Horizontal
7439.69	54.63	43.50	11.40	35.50	3.40	58.03	74.00	-15.97	PK	Vertical
7439.69	43.99	43.50	11.40	35.50	3.40	47.39	54.00	-6.61	AV	Vertical
7439.68	54.05	43.50	11.40	35.50	3.40	57.45	74.00	-16.55	PK	Horizontal
7439.68	43.62	43.50	11.40	35.50	3.40	47.02	54.00	-6.98	AV	Horizontal

Note:

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

Emission Level = Reading + Factor

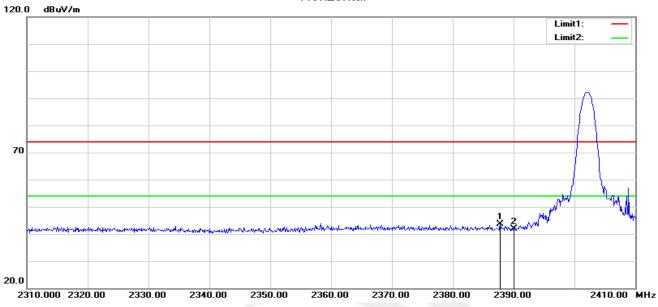
3) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.



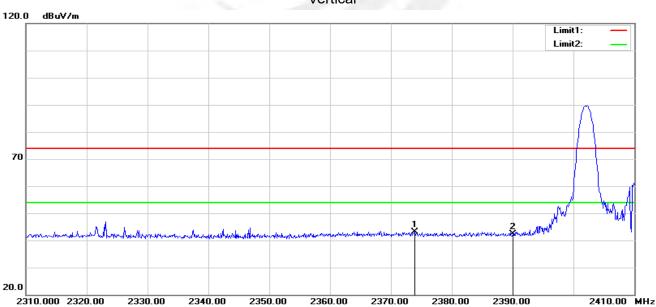
Page 30 of 73



Restricted band Requirements



Reading Correct Limit No. Frequency Result Margin Remark Factor(dB/m) (MHz) (dBuV) (dBuV/m) (dBuV/m) (dB) 2387.800 39.24 4.31 43.55 74.00 -30.45 1 peak 2 37.43 4.34 74.00 -32.23 2390.000 41.77 peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2373.900	39.01	4.10	43.11	74.00	-30.89	peak
2	2390.000	38.03	4.34	42.37	74.00	-31.63	peak

Vertical

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π/4-DQPSK-Low Horizontal



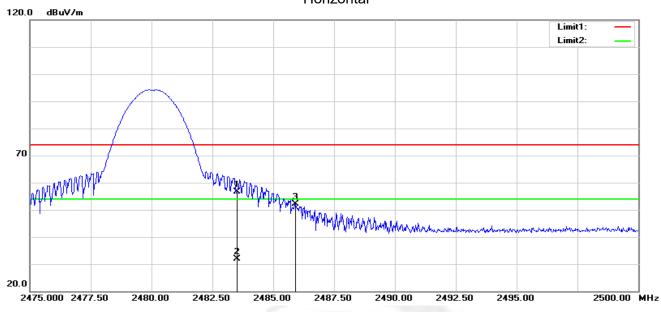
Report No.: STS2112087W01



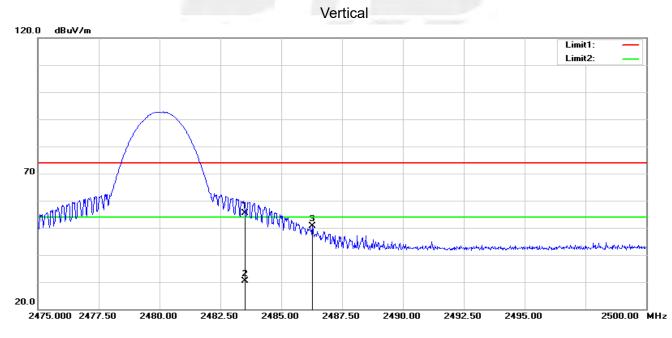
Page 31 of 73

Report No.: STS2112087W01

$\pi/4$ -DQPSK-High Horizontal



No.	Frequency	Reading	leading Correct		Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	52.14	4.60	56.74	74.00	-17.26	peak
2	2483.500	27.16	4.60	31.76	54.00	-22.24	AVG
3	2485.900	47.46	4.61	52.07	74.00	-21.93	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	50.76	4.60	55.36	74.00	-18.64	peak
2	2483.500	25.78	4.60	30.38	54.00	-23.62	AVG
3	2486.275	45.94	4.61	50.55	74.00	-23.45	peak

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

Shenzhen STS Test Services Co., Ltd.

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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 Eraguapay	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 Eraguanay	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 500hm; 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.

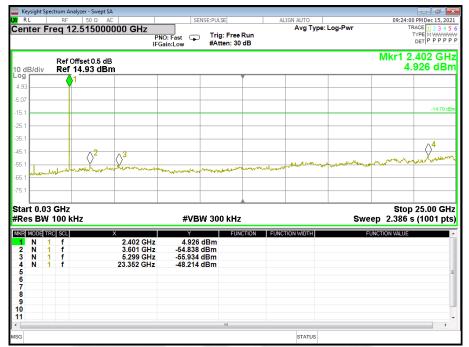




4.5 TEST RESULTS

Temperature:	25 ℃	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps)-00/39/78 CH	Test Voltage:	DC 3.8V

00 CH



39 CH

		t Spect		analyzer - Swept SA									
IXI R		_	RF	50 Ω AC		SE	NSE:PULSE		ALIG	AVg Type:	Law Down		4 PM Dec 15, 2021 RACE 1 2 3 4 5 6
Cer	iter	Fre	ed 1	2.515000		PNO: Fast	Trig: Free	Run		Avg Type:	Log-Pwr		TYPE M WWWWW
					IF	Gain:Low	#Atten: 30	0 dB					DET PPPPF
	Ref Offset 0.5 dB Mkr1 2.452 GH												.452 GHz
	0 dB/div Ref 14.12 dBm 4.118 dBn												.118 dBm
Log			(1									
4.12													
-5.88													-14.80 dBm
-15.9	F												-14.00 0011
-25.9													
-35.9													
-45.9				~2	. 2								0
-55.9				∇	$\langle \rangle$					have been and	mannen	month and the	monor
-65.9	1	nhm	Jend	have been the	Markenmarker	My you have a starty	and when the search when the s	al and a	hush				
-75.9	I												
-75.9													
Sta	rt 0.	.03 (GHz	:								Stop	25.00 GHz
#Re	s B	W 1	00	kHz		#VB	W 300 kH;	z			SW	eep 2.386	s (1001 pts)
MKR	MODE	TRC	SCL		x	Y	FUI	NCTION	FUNCTION	DN WIDTH		FUNCTION VALUE	•
1 2	N N	1	f		2.452 GHz 3.651 GHz	4.118							
23	N	1	f		5.099 GHz	-55.980	dBm						
4	Ν	1	f		24.750 GHz	-48.264	dBm						
6													=
7 8													
9													
10 11													
•													
MSG										STATUS			



78 CH

	ectrum Analyz									
RL	RF	50 Ω AC		SENS	E:PULSE	AL	IGN AUTO Avg Type:	Les Dur		41 PM Dec 15, 20
enter F	req 12.	515000		NO: Fast 😱 Gain:Low	Trig: Free Ru #Atten: 30 dE		Avg Type:	Log-Pwr		TYPE MWWW DET PPPP
dB/div		set 0.5 dB 1.95 dBn								2.477 GH I.318 dBi
95	1									
05 5.1										-14.55 d
i.1										
5.1 5.1		<u>,</u>								
6.1	mark war	L	-	المراجع والمراجع	the way of the way	r-m-lasteration	a destroy and a start with of	The market war	and and the	mannon
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it										
art 0.03	3 GHz / 100 kHz	2		#VBW	300 kHz			Sw	Sto veep 2.386	
art 0.03 Res BW	100 kHz	-	X	Y	FUNCTION	DN FUNCT				
art 0.03 Res BW MODE 10 N 1 N 1 N 1 N 1	100 kHz	-	× 2.477 GHz 3.726 GHz 6.198 GHz 24.750 GHz	#VBW 4.318 dl -56.375 dl -56.633 dl -47.838 dl	FUNCTION Bm Bm Bm	DN FUNCT	ION WIDTH		reep 2.386	
art 0.03 tes BW 8 MODE 10 8 N 1 9 N 1 1 9 N 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	100 kHz RC SCL 1 f 1 f 1 f	-	2.477 GHz 3.726 GHz 6.198 GHz	4.318 dl -56.375 dl -56.633 dl	FUNCTION Bm Bm Bm	DN FUNCT	ION WIDTH		reep 2.386	
art 0.03 Res BW MODE 17 N 1 2 N 1 3 N 1 4 N 1 5 5 7 8 9 9	100 kHz RC SCL 1 f 1 f 1 f	-	2.477 GHz 3.726 GHz 6.198 GHz	4.318 dl -56.375 dl -56.633 dl	FUNCTION Bm Bm Bm	DN FUNCT	ION WIDTH		reep 2.386	
TR MODE TR 1 N 1 2 N 1 3 N 1	100 kHz RC SCL 1 f 1 f 1 f	-	2.477 GHz 3.726 GHz 6.198 GHz	4.318 dl -56.375 dl -56.633 dl	FUNCTION Bm Bm Bm	DN FUNCT	ION WIDTH		reep 2.386	p 25.00 GF s (1001 pt



Shenzhen STS Test Services Co., Ltd.

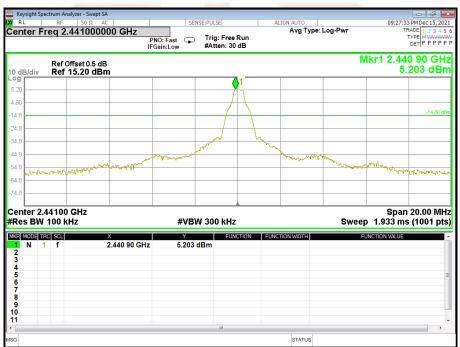


For Band edge(it's also the reference level for conducted spurious emission)

				zer - Swept S	A									
I <mark>XI</mark> RL			RF		iC .		SE	NSE:PULS		AL	IGN AUTO			29 PM Dec 15, 2021
Cent	ter I	Frec	2.3	535000	000 GHz	PNO: IFGair			Free Run en: 30 dB		Avg Typ	e: Log-Pwr		TYPE MWWWW DET P P P P P
													02 19 GHz .211 dBm	
Log 5.21														1
-4.79														
-14.8														-1479 dBm
-24.8														
-34.8														(2) ⁴
-44.8						_		2						W h
-54.8	man	ynne		homenod	munorma	warden	maria	markawateren	and man and			Netrendenson	mannerent	N'
-64.8														
-74.8														
			0 GH 0 kH:				#VB	W 300	kHz			Swe	Stop 2 ep 10.27 m	2.40700 GHz s (1001 pts)
		TRC S	CL		х		Y		FUNCTION	FUNC	TION WIDTH		FUNCTION VALUE	-
	N N	1			2.402 19 G 2.344 73 G	Hz	5.211 -58.255	dBm						
4	N N	1			2.399 19 G 2.400 05 G		-43.373 -45.001							
5 6														E
5 6 7 8 9														
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11 ∢														
SG											STATUS			

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Shenzhen STS Test Services Co., Ltd.





For Hopping Band edge

GFSK

R L	t Spect	trum Ar RF	alyzer - Swep 50 Ω	t SA AC		SEN	ISE:PULSE		ALIG	N AUTO			00		Dec 15, 20
	Fre			0000 GH	PNC	D: Fast 😱	Trig: Free #Atten: 30	Run) dB	ALIG		e: Log-Pw	/r		TRACE	1 2 3 4 1 MWWW P P P P P
dB/di)ffset 0.5 1 5.00 d l									Mk	r1 2.4		67 GH 13 dBr
- 00								<u> </u>							(
											_				
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i.o															0
														\wedge^2	M
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i.o —															
art 2. tes B						#VB\	N 300 kH;	<u>.</u>			5	Sweep	Sto 9.867	p 2.40 ms (1	300 GH 001 pt
R MODE		SCL		× 2.401 867	CHA	Y 5,003		ICTION	FUNCTIO	ON WIDTH		FL	INCTION VA	LUE	
N N	1	f		2.401 807 2.390 022 2.400 013	GHz	-58.866 -45.564	dBm								
5 7 3															
9															
							m								

	nt Spect		nalyzer - Swept SA							
enter	r Fre	RF eq 2	50 Ω AC 2.48950000	00 GHz	NO: Fast Gain:Low	Trig: Free Run #Atten: 30 dB	ALIGN AUTO Avg Type	: Log-Pwr	TF	ACE 1 2 3 4 TYPE MWWW DET P P P P
dB/di	iv		Offset 0.5 dB 15.29 dBn					М	kr1 2.479 5.	924 GH 290 dBi
29	0 1									
71	Ľ									
.7	v	+								-14.71 d
.7 –		1								
.7		~								
7			MANNAN	$\sqrt{2}$	3					
7			1 11	MAN BALLANN	Wmuna	M. M. Martin	mm	mannem	Manhan	m
7										
	470								0 1 0	
art 2 les B					#VB	W 300 kHz		Swee	5.00 Z. p 2.067 ms	50000 GI 5 (1001 pi
R MOD	DE TRO			X	Y	FUNCTION	FUNCTION WIDTH	F	UNCTION VALUE	
N	1	f	2	479 924 GHz 483 515 GHz	-53.889					
N	1	f	2.	485 237 GHz	-54.026	dBm				
						m				•

Shenzhen STS Test Services Co., Ltd.



Page 39 of 73 Report No.: STS2112087W01

Temperature:	25 ℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps)– 00/39/78 CH	Test Voltage:	DC 3.8V

							ectrum A	
09:44:52 PM Dec 15, 20		ALIGN AUTO	ULSE	SENSE		50 Ω AC	RF	L
TRACE 1 2 3 4 TYPE M WWW DET P P P P	: Log-Pwr	Avg Type:	rig: Free Run Atten: 30 dB	O: Fast 😱 ain:Low	PN	2.515000	req 1	iter F
Mkr1 2.402 GH					L	Offset 0.5 dB	Ref	
-0.171 dB						9.83 dBm		B/div
			Ť			1		
								I
-15.55 c								
								-
and and and an and and					<u>3</u>	<mark>2</mark>		
Man Martin Contraction of	- anonnen a	ague advertures	- Burnon week	and	and a second and a second	monthem	mound	L
							la su a	- March
Stop 25.00 G							3 GHz	
veep 2.386 s (1001 pt	Swe		00 kHz	#VBW		kHz	/ 100 H	s B₩
		FUNCTION WIDTH	FUNCTION	Y	Х		RC SCL	
FUNCTION VALUE			•	-0.171 dE	2.402 GHz		1 f 1 f	N
FUNCTION VALUE			1	-57.002 dE -56.789 dE	3.601 GHz 5.199 GHz		1 f	N
FUNCTION VALUE			1					N
FUNCTION VALUE			1	-56.789 dE	5.199 GHz		1 f	N
FUNCTION VALUE			1	-56.789 dE	5.199 GHz		1 f	N
FUNCTION VALUE			1	-56.789 dE	5.199 GHz		1 f	N
FUNCTION VALUE			1	-56.789 dE	5.199 GHz		1 f	N
FUNCTION VALUE			1	-56.789 dE	5.199 GHz		1 f	N

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39	CH

		nalyzer - Swept SA							
RL	RF	50 Ω AC		SEN	SE:PULSE	ALIGN AUTO			PM Dec 15, 20
nter F	req 1	2.515000	P	NO: Fast Gain:Low	Trig: Free Run #Atten: 30 dB	Avg Typ	e: Log-Pwr	1	ACE 1 2 3 4 YPE MWWW DET P P P P
dB/div		Offset 0.5 dB 12.26 dBn						Mkr1 2. 2.:	452 GH 262 dB
	(1			Ť				
26									
4									
7									-15.65 (
7									
_									
/ <u> </u>		$\langle \rangle^2$	\wedge^3					any mary	mm
	-	have have my	and have	have an area light	thousand a second	where and the man	and the second s	yar wr	
Not and									
rt 0.03 es BW				#VBV	V 300 kHz		Swe	Stop eep 2.386 s	25.00 G (1001 p
MODE T			X	Y	FUNCTION	FUNCTION WIDTH	i	UNCTION VALUE	
N 1	1 f 1 f		2.452 GHz 3.601 GHz	2.262					
N 1			5.873 GHz	-56.579 0					
	1 f								
N 1	1 f 1 f		24.725 GHz	-48.486 0					
N 1									
N 1									
N 1									
N 1									
N 1					1Bm				
N 1						STATUS			

Shenzhen STS Test Services Co., Ltd.



78 CH

	Swept SA						
	Ω AC	SENSE:PULSE	ALI	GN AUTO Avg Type: L	on Dur		2 PM Dec 15, 20
enter Freq 12.51	PN	O: Fast 🕞 Trig: Fro ain:Low #Atten:		Avg Type: L	-og-Pwr		TYPE MWWWA DET P P P P
Ref Offset dB/div Ref 14.20							.477 GF 202 dB
20							
5.8							-15.40 c
.8							
i.8							(
i.8 2	u and	And any for any part of a surger of a	1 mar shared wards	mummer	يوسه مسلما الماري	- marke	- and man
i.8		And the second					
art 0.03 GHz		#VBW 300 kł	łz		Swe	Stop ep 2.386 s	
art 0.03 GHz Res BW 100 kHz	×	Y F		ION WIDTH			
art 0.03 GHz Res BW 100 kHz R Mode TEG SCI N 1 f N 1 f N 1 f N 1 f	X 2.477 GHz 2.652 GHz 6.198 GHz 24.576 GHz			ION WIDTH		ep 2.386 s	
art 0.03 GHz les BW 100 kHz N 1 f N 1 f N 1 f N 1 f N 1 f	2.477 GHz 2.652 GHz 6.198 GHz	Y F 4.202 dBm -56.232 dBm -55.662 dBm		ION WIDTH		ep 2.386 s	
art 0.03 GHz Res BW 100 kHz MODE IFC Scl N 1 f N 1 f N 1 f	2.477 GHz 2.652 GHz 6.198 GHz	Y F 4.202 dBm -56.232 dBm -55.662 dBm		ION WIDTH		ep 2.386 s	
2 N 1 f 3 N 1 f	2.477 GHz 2.652 GHz 6.198 GHz	Y F 4.202 dBm -56.232 dBm -55.662 dBm		ION MDTH		ep 2.386 s	25.00 GF



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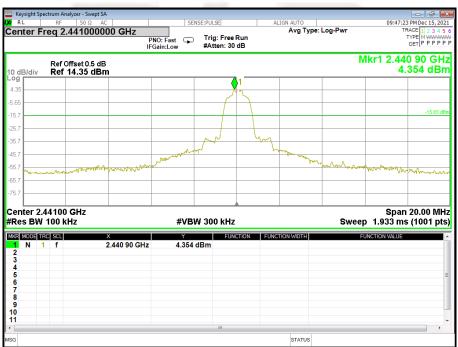


For Band edge(it's also the reference level for conducted spurious emission)

	ht Spect		nalyzer - Swept SA									
LXI RL		RF	50 Ω AC		SE	NSE:PULSE		ALIGN AUT				1 PM Dec 15, 2021
Cente	r Fre	q 2	.35350000				-	Avg	g Type: Lo	g-Pwr	т	RACE 1 2 3 4 5 6
					PNO: Fast 🔾	Trig: Free #Atten: 3						DET P P P P P P
					FGain:Low	#Atten: 3	, ub					,
		Ref	Offset 0.5 dB							N	1kr1 2.40	1 86 GHz
10 dB/c			14.45 dBm	1							4.	.451 dBm
4.45							<u> </u>					
-5.55												
-15.6												-15 55 dBm
-25.6												
-35.6												Nh
-45.6												4
-55.6					() ²							N V
-65.6	dun gal	en me	hear and the second	and the second states of the s	mehaphahrun	ne-deservestances	of all the local	MANNAM	antionate	mentumpen (MAR)	german and and and and and	
-75.6												
10.0							1					
Start 2	2.300	00 (GHz								Stop 2	.40700 GHz
#Res I	BW 1	00 I	KHZ		#VB	W 300 kH;	z			Sweep		s (1001 pts)
MKR MOI	DEL TRO	sci		x	I Y	ELV	ICTION	FUNCTION WIL	тн	F	UNCTION VALUE	
1 N		f		2.401 86 GHz		dBm	ionon	- Chonon on the			Sitement Miller	
2 N	1	f	2	2.337 66 GHz	-58.169	dBm						
3 N		f		2.398 65 GHz								
4 N	1	f	2	2.400 05 GHz	-49.613	dBm						
6												
5 6 7 8 9												
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11												-
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39 CH





78 CH





Shenzhen STS Test Services Co., Ltd.

Page 43 of 73 Report No.: STS2112087W01



For Hopping Band edge

π/4-DQPSK

		nalyzer - Swept SA		1	_				1		
	req 2	50 Ω AC .3515000	00 GHz	PNO: Fast	SENSE:PULS	Free Run en: 30 dB	AL	IGN AUTO Avg Typ	e: Log-Pwr	10:46	12 PM Dec 15, 202 TRACE 1 2 3 4 5 TYPE M WWWM DET P P P P P
) dB/div		Dffset 0.5 dB 13.91 dBn	n							Mkr1 2.40	3 000 GH 3.913 dBr
.91											
09											_
6.1					_						-16.09 d
5.1											
5.1 					_						1
6.1										Λ	2
	with	- see and see and	-	maganing	whomanhour	maration	handlager and	مەسىمەسىمىلى ھىل	www.	ma marine	munter
5.1 5.1											
art 2.30 Res BW				#\	/BW 300	kHz			Swe	Stop eep 9.867 n	2.40300 GH ns (1001 pt
R MODE T			x	Y		FUNCTION	FUNCT	TION WIDTH		FUNCTION VALU	
1 N 2 N 3 N 4 5	1 f 1 f 1 f	2	403 000 GH; 390 022 GH; 400 013 GH;	z -59.0	13 dBm 58 dBm 76 dBm						
6											
8 9											
B						m					

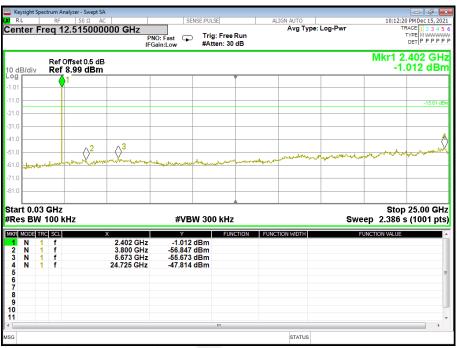
		nalyzer - Swept SA							
nter Fi	_R , eq 2	50 Ω AC .48950000	DO GHZ	NO: Fast Gain:Low	Trig: Free Run #Atten: 30 dB	ALIGN AUTO Avg Type	e: Log-Pwr	TF	ACE 1 2 3 4 TYPE MWWW DET P P P P
dB/div		Offset 0.5 dB 14.45 dBm	1				М	kr1 2.479 4.	210 GH 453 dB
5	n l								
s 	\rightarrow								-15.55
i				3					
		Mimula		Ŷ					
		10 11 11 11	Wowwww	white mark the	Mannennan		-	-	monohan
i									
;									
rt 2.47 es BW				#VBW	300 kHz		Swee	Stop 2. p 2.067 ms	50000 G ; (1001 p
MODE TR	C SCL		× 479 210 GHz	Y 4,453 di	FUNCTION	FUNCTION WIDTH	f	FUNCTION VALUE	
N 1 N 1	f	2.	479 210 GHz 483 515 GHz 487 337 GHz	-58.373 dE -39.846 dE	Bm				
					m				•

Shenzhen STS Test Services Co., Ltd.



Page 44 of 73 Report No.: STS2112087W01

Temperature:	25 ℃	Relative Humidity:	50%
Test Mode:	8DPSK(3Mbps) -00/39/78 CH	Test Voltage:	DC 3.8V



00 CH

	sight S	Spect		nalyzer - Swep											
RL			RF	50 Ω			SEN	SE:PULSE		ALIGN A					PM Dec 15, 20
ent	er	Fre	eq 1	2.5150	00000 GH	Z PNO: Fas IFGain:Lo		Trig: Free F #Atten: 30		A	vg Type:	Log-Pwr		т	ACE 1 2 3 4 5 YPE M WWW DET P P P P
			Ref	Offset 0.5	dB								M		452 GH
dB g r	3/div			8.95 dB										1.0)54 dBi
9 05				1											
.1															
1															-15.67 c
1															
1															
.1 -				^2	3										
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1	Level A		fr-r	Chevron Pred		and the second	mound	W ANNE WAR							
.1															
.1															
L arf	t 0.0	03.0	GHz											Stop	25.00 GH
			00 H	Hz			#VBV	V 300 kHz				S	weep 2		(1001 pt
R M	IODE	TRC	SCL		x		Y	FUNC	TION	FUNCTION V	VIDTH		FUNCTION	VALUE	
	N N	1	f		2.452 3.701		-1.054 d								
3	N	1	f		5.773	GHz -6	6.336 d	IBm							
	N	1	f		24.725	GHZ -4	8.412 d	IBm							
3															
)															
1	_														
		_						III			TATUS				,



78 CH

RL RF 50	wept SA				
RL RF 50		SENSE:PULSE	ALIGN	AUTO Avg Type: Log-Pwr	10:18:38 PM Dec 15 TRACE 1 2 3
enter Freq 12.515	PN	D: Fast Trig: Fr ain:Low #Atten:	ee Run	kvg Type. Log-Pwr	TYPE MWW DET P P
Ref Offset 0 dB/div Ref 13.88					Mkr1 2.477 0 3.879 d
² g					
12					-15
.1					
6.1					
1	Unand the Party of the State of	The said more than the second state	all marcher march with the speet	ر العالم ومر العالم العالم العالم	we have been been been been been been been be
		#VBW 300 ki	Hz.	Sv	Stop 25.00 veep 2.386 s (1001
tes BW 100 kHz	x				
N 1 f N 1 f N 1 f N 1 f N 1 f	X 2.477 GHz 3.226 GHz 6.198 GHz 24.750 GHz				veep 2.386 s (1001
tes BW 100 kHz R MODE Irc SC N 1 f f N 1 f f N 1 f f N 1 f f N 1 f f S 1 f f	2.477 GHz 3.226 GHz 6.198 GHz	Y F 3.879 dBm -56.726 dBm -54.303 dBm			veep 2.386 s (1001
2 N 1 f 3 N 1 f	2.477 GHz 3.226 GHz 6.198 GHz	Y F 3.879 dBm -56.726 dBm -54.303 dBm			veep 2.386 s (1001

Shenzhen STS Test Services Co., Ltd.



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

				lyzer - Swept S/								
X RL			RF	50 Ω A		SE	NSE:PULSE		ALIGN AUTO	be: Log-Pwr		19 PM Dec 15, 2021
Cent	er i	-rec	Z.	3535000		PNO: Fast 😱 FGain:Low	Trig: Free #Atten: 30		Avgiy	Je. Log-Fwi		
10 dB	3/div			ffset 0.5 dB 14.39 dBr							Mkr1 2.40 4)2 19 GHz .406 dBm
4.39												1
-5.61												<u> </u>
-15.6			_									-15,61 dBm
-25.6			_									
-35.6			-									
-45.6			-		\Diamond^2							N h
-55.6	erena.	ليترسنها	m	PQ_444+->->4-4	menne	an all the second	um that	unger.	malanteres	Montana	www.	w ⁽⁴)
-65.6 -75.6												
L												
Stari #Res						#VB	W 300 kHz			Swe	Stop 2 ep 10.27 m	.40700 GHz s (1001 pts)
MKR M	IODE N	TRC S	CL		x 2.402 19 GHz	Y 4,406		CTION	FUNCTION WIDTH		FUNCTION VALUE	A
2	N N N		f f		2.328 57 GHz 2.399 30 GHz	-58.411	dBm					
4	N		f		2.399 30 GHZ 2.400 05 GHZ	-45.220 -47.023						
6												
5 6 7 8 9												
10												
11 < 📃							m					
ISG									STATUS			

00 CH

39 CH



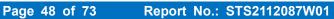


78 CH





Shenzhen STS Test Services Co., Ltd.





For Hopping Band edge

8DPSK

Keysight S R L	Spectr	um Anaļ RF	/zer - Swept S 50 Ω A			SENSE:PI	JI SE		ALIGN AUTO		10:35:06	- 🗇 🗐
	Fre			00 GHz	PNO: Fast IFGain:Low		rig: Free Ru Atten: 30 di	ın		: Log-Pwr	TF	ACE 1 2 3 4 5 TYPE M WWW DET P P P P
dB/div			fset 0.5 dE 2.24 dB							N	lkr1 2.402 2.	897 GH 242 dBr
24												
76												
.8												-17.76 d
.8												Ņ
.8												.0
				N-A-A-Mattera	man des sett	a cont first at tal		a der reintere			$\langle \rangle^2$	alphill P
.8												
.8												
art 2.3 es BV						#VBW 3	00 kHz			Swee	Stop 2. ep 9.867 ms	40300 GH ; (1001 pt
R MODE	TRC			× 402 897 GH		Y 2.242 dBm	FUNCT	ION FUN	CTION WIDTH		FUNCTION VALUE	
N N	1 1 1	f f f		2.402 897 GH 2.390 022 GH 2.400 013 GH	z -58	2.242 dBm 3.978 dBm 3.319 dBm	1					
							III					۱.
									STATUS			

Keysight Spe R L	ectrum An RF	nalyzer - Swept 50 Ω	SA AC	5	NSE:PULSE		ALIGN AUTO	1	10.37	18 PM Dec 15, 20
		.4895000	000 GHz	PNO: Fast				e: Log-Pwr		TRACE 1 2 3 4 TYPE MWWW DET P P P P
dB/div		Offset 0.5 d 14.64 dB						M	kr1 2.48	0 218 GH I.644 dB
64 36	<mark>۲</mark>									
.4										-15.36 c
.4	h	w^								
4		WWW	2 2	0 ³ .						
4			· · Մենովուներ	Monan	havenne	man	manalenaler	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	wayner	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
.4										
art 2.47 es BW				#VB	W 300 kH	z		Swee	Stop 2 p 2.067 m	2.50000 G Is (1001 p
MODE TR N 1 N 1	f		X 2.480 218 GHz 2.483 515 GHz	4.644 -49.038	dBm	NCTION	FUNCTION WIDTH		FUNCTION VALUE	
N 1	f		2.485 426 GHz	-52.282	dBm					
										•
							STATUS			



5. NUMBER OF HOPPING CHANNEL

5.1 LIMIT

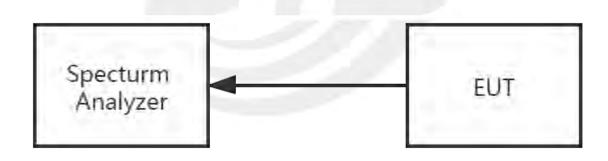
FCC Part 15.247,Subpart C									
Section	Test Item	Limit	FrequencyRange (MHz)	Result					
15.247 (a)(1)(iii)	Number of Hopping Channel	≥15	2400-2483.5	PASS					

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:	25℃	Relative Humidity:	60%
Test Mode:	Hopping Mode -GFSK Mode	Test Voltage:	DC 3.8V

Number of Hopping Channel

79

Hopping channel

RL RF 30.0	AC	SENSE PULSE	ALIGN AUTO		09:37:06 PM D	
enter Freq 2.44175	PNO: Fast IFGain:Low	Trig: Free Ru #Atten: 30 dl	Avg Type: B	Log-Pwr	TRACE TYPE / DET	P P P P
Ref Offset 0.5 dB/div Ref 15.74 d				Mkr2	2.480 243 5.75	5 GH i dBr
		******	YYYYYYYYYYYYYYY	YYYYYYYY	(TYYYYYYYYYYYY	
a,3)						-
24.3						-
(A.3)						1
54.3 74.3						
tart 2.40000 GHz Res BW 300 kHz	-	VBW 300 kHz		Sweep	Stop 2.483 1.133 ms (10	50 GH
2 N f f		Y FUNCT 5.51 dBm 5.75 dBm	ION FUNCTION WOTH	FU	ICTION VALUE	
3 4 5 6 7 8 9 0						
i						

Shenzhen STS Test Services Co., Ltd.



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

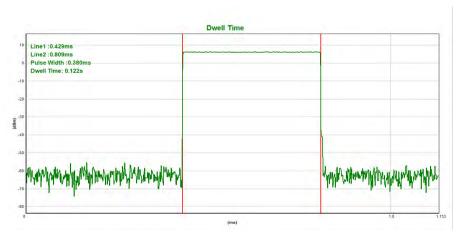
Temperature:	25℃	Relative Humidity:	50%
Test Mode:	GFSK/ π/4-DQPSK/ 8DPSK	Test Voltage:	DC 3.8V

Modulation	Pocket Type	Frequency (MHz)	Single Pulse Time (ms)	Dwell Time (s)	Limit (s)	Result
	DH1	2441	0.380	0.122	0.4	Pass
GFSK	DH3	2441	1.636	0.262	0.4	Pass
	DH5	2441	2.884	0.308	0.4	Pass
	2DH1	2441	0.388	0.124	0.4	Pass
π/4DQPSK	2DH3	2441	1.643	0.263	0.4	Pass
	2DH5	2441	2.889	0.308	0.4	Pass
	3DH1	2441	0.386	0.124	0.4	Pass
8DPSK	3DH3	2441	1.636	0.262	0.4	Pass
	3DH5	2441	2.890	0.308	0.4	Pass

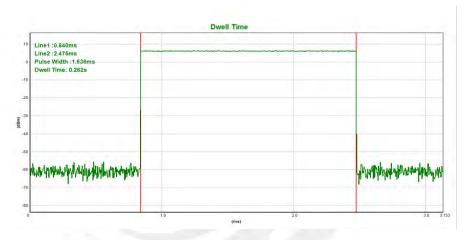
Shenzhen STS Test Services Co., Ltd.



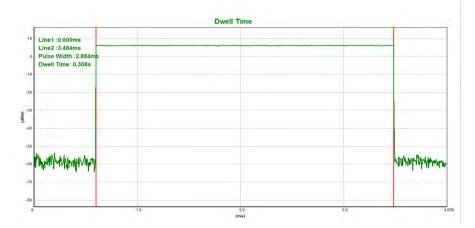
CH39-DH1



CH39-DH3



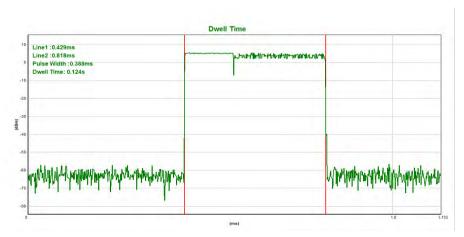
CH39-DH5



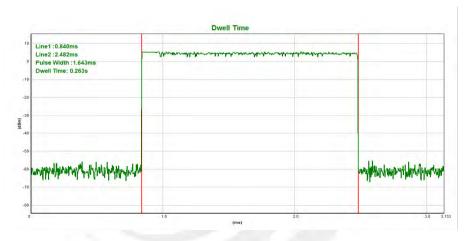
Shenzhen STS Test Services Co., Ltd.



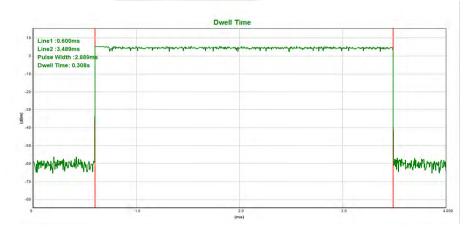
CH39-2DH1



CH39-2DH3



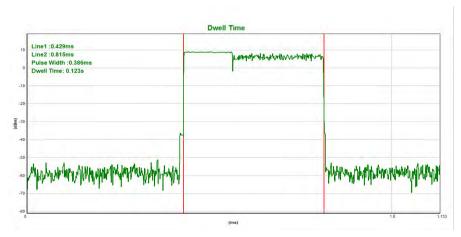
CH39-2DH5



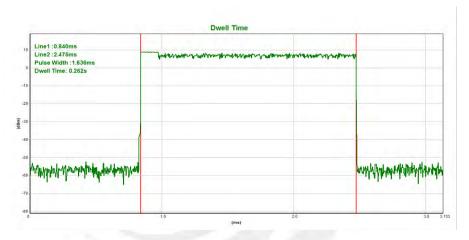
Shenzhen STS Test Services Co., Ltd.



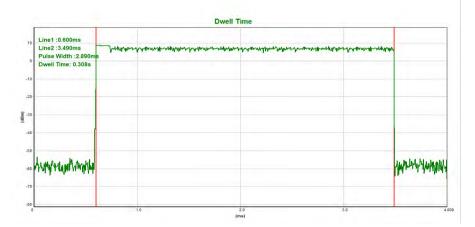
CH39-3DH1



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°C	Relative Humidity:	50%
Test Mode:	GFSK/π/4-DQPSK/8DPSK	Test Voltage:	DC 3.8V

Modulation	Frequency (MHz)	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
	2402	2402.011	2403.055	1.044	0.687	Pass
GFSK	2441	2441.059	2442.013	0.954	0.683	Pass
	2480	2479.056	2480.013	0.957	0.684	Pass
	2402	2402.062	2403.058	0.996	0.856	Pass
π/4DQPSK	2441	2441.203	2442.211	1.008	0.855	Pass
	2480	2479.047	2480.055	1.008	0.855	Pass
	2402	2402.224	2403.223	0.999	0.855	Pass
8DPSK	2441	2441.224	2442.223	0.999	0.855	Pass
	2480	2479.068	2480.058	0.990	0.855	Pass





CH00 -1Mbps



CH39 -1Mbps



Shenzhen STS Test Services Co., Ltd.



CH78 -1Mbps



CH00 -2Mbps





CH39 -2Mbps

Keysight Spectrum Analyze	er - Swept SA 50 Ω AC	SENSE:PULS	r I	ALIGN AUTO		10:00:2	B PM Dec 15, 20
enter Freq 2.44	1500000 GHz		⊧ : Free Run en: 30 dB	Aug Type: I	_og-Pwr	TF	TYPE M WWW DET P P P P
Ref Offs dB/div Ref 10.	et 0.5 dB . 24 dBm				М	kr2 2.442 0.	211 GH 711 dBi
40		1			2		
76 Marchan	man	month	mm	mhom	www	m	m
.8							
.8							
.8							
.8							
8							
.8							
enter 2.441500 G tes BW 30 kHz	3Hz	#VBW 100) kHz		Swee	Span p 3.200 ms	3.000 MH ; (1001 pt
R MODE TRC SCL N 1 f N 1 f	x 2.441 203 GHz 2.442 211 GHz	1.00 dBm 0.71 dBm	FUNCTION	UNCTION WIDTH	F	UNCTION VALUE	
	2.442 211 GHZ	0.71 dBm					
L							
,							
8							
)							
			m				

CH78 -2Mbps





CH00 -3Mbps

Page 61 of 73

Keysight Spe R L	ectrum Analyzer - RF 5	Swept SA 0 Ω AC						10.00	
		500000 GH		Trig: Free #Atten: 30	Run	LIGN AUTO Avg Type: I	Log-Pwr	TR	PM Dec 15, 20 ACE 1 2 3 4 TYPE M WWW DET P P P P
dB/div	Ref Offset Ref 9.86						М	kr2 2.403 2.	205 GI 063 dB
14			- A. ~~~	()1 /1		1. MM	2 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		~ ^ ^
.1		5 min		- Water Market				man	~~~~~
.1									
.1 <mark>- ^ - ^</mark>									
.1									
.1									
	402500 GH	47						Snan	3.000 M
les BW	30 kHz	12	#V	BW 100 kHz				p 3.200 ms	
R MODE TE N 1 N 1	f	× 2.402 191 2.403 205		7 dBm 6 dBm	NCTION FUNC	TION WIDTH		UNCTION VALUE	
)									
				m					,
iG						STATUS			

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 Ltd. Tel: +86-755 3688 6288 Fax:+86-755 3688 6277 Http://www.stsapp.com E-mail: sts@stsapp.com



CH78 -3Mbps

		nalyzer - Swept SA								
RL	RF	50 Ω AC		S	ENSE:PULSE		ALIGN AUTO Avg Type:	Law Down		3 PM Dec 15, 202
enter I	-req 2	.4795000		PNO: Wide G	⊃ Trig: Free #Atten: 30	Run dB	Avg Type:	Log-Pwr		TYPE MWWW DET PPPPP
) dB/div		Offset 0.5 dB 10.34 dBn						М	kr2 2.480 0.	058 GH 852 dBr
40	_			1				2		
56 ~~~		mm	m	mon	hum	m	-mm/	m	m	
.7										
.7										\setminus
.7										Jun
.7										
7										
.7										
	47050	00 GHz				L			0.0.0.0	3.000 MH
	.47950 V 30 ki			#VE	3W 100 kHz			Swee	span p 3.200 ms	
R MODE	TRC SCL		x .479 068 GHz	Y 0.2	FUN 6 dBm	CTION FU	NCTION WIDTH		FUNCTION VALUE	
2 N	1 f		480 058 GHz		5 dBm					
3										
0										

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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			

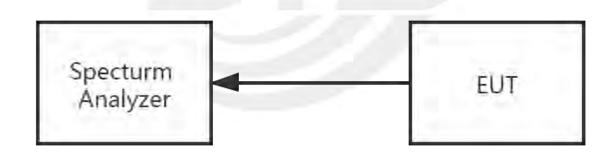
Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RB	30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)
VB	100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

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:	25℃	Relative Humidity:	50%
Test Mode:	GFSK/π/4-DQPSK/8DPSK	Test Voltage:	DC 3.8V

Modulation	Frequency (MHz)	-20 dB Bandwidth (MHz)	Result
	2402	1.0300	Pass
GFSK	2441	1.0240	Pass
	2480	1.0260	Pass
	2402	1.284	Pass
π/4DQPSK	2441	1.282	Pass
	2480	1.283	Pass
	2402	1.282	Pass
8DPSK	2441	1.283	Pass
	2480	1.283	Pass



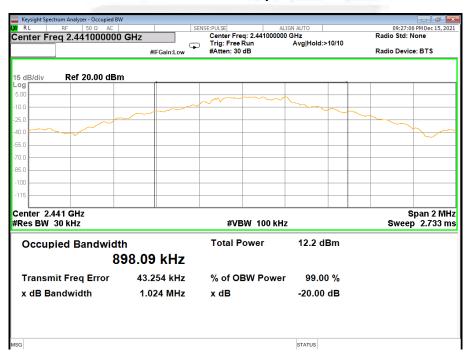
Shenzhen STS Test Services Co., Ltd.



CH00 -1Mbps

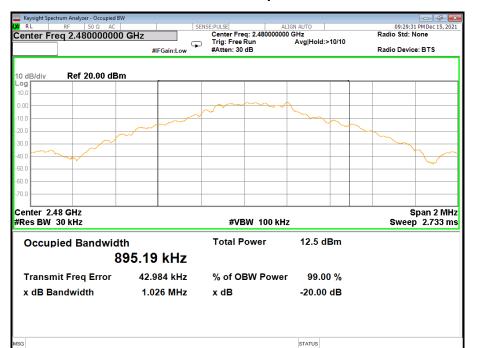


CH39 -1Mbps

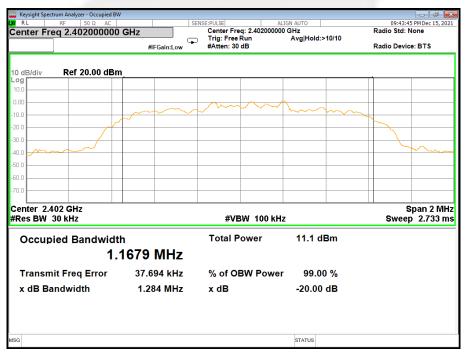




CH78 -1Mbps



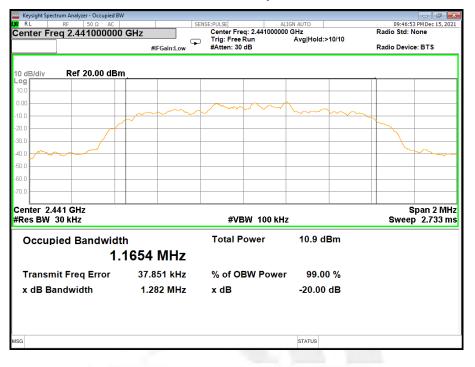
CH00 -2Mbps



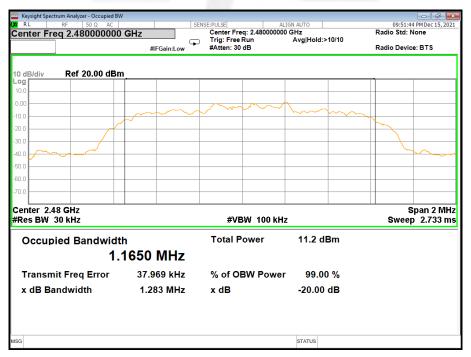
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CH39 -2Mbps



CH78 -2Mbps



Shenzhen STS Test Services Co., Ltd.

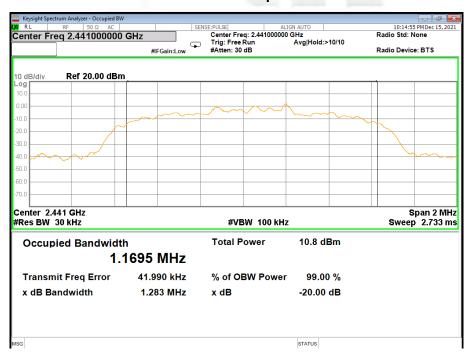


CH00 -3Mbps

	ectrum Analyzer - Occupied BW							
LXIRL	RF 50 Ω AC		ENSE:PULSE Center Freq: 2.4020000	ALIGN AUTO	10:11:12 PM Dec 15, 2021 Radio Std: None			
Center F	req 2.402000000	GHZ	Trig: Free Run	Avg Hold:>10/10				
		#IFGain:Low	#Atten: 30 dB		Radio Device: BTS			
15 dB/div	Ref 20.00 dBm	I						
Log								
5.00				hann.				
-10.0	~							
-25.0								
-40.0	~~~							
-55.0								
-70.0								
-85.0								
-100								
-115								
	.402 GHz				Span 2 MHz			
#Res BW	30 kHz		#VBW 100 kł	lz	Sweep 2.733 ms			
000	pied Bandwidt	h	Total Power	10.8 dBm				
Occu	-			TO.O GBII				
1.1717 MHz								
Trans	mit Freq Error	40.939 kHz	% of OBW Powe	er 99.00 %				
	Bandwidth	1.282 MHz	x dB	-20.00 dB				
	sanuwiuth		X UD	-20.00 08				
1								

CH39 -3Mbps

STATUS





CH78 -3Mbps



Shenzhen STS Test Services Co., Ltd.



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.

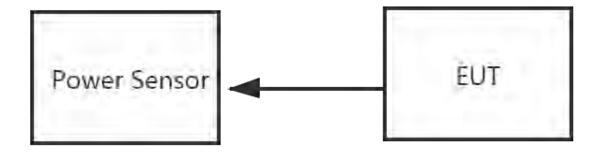
e) A plot of the test results and setup description shall be included in the test report.

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.

Shenzhen STS Test Services Co., Ltd.



9.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Voltage:	DC 3.8V		

Modulation	Frequency (MHz)	Peak Power (dBm)	Average Power (dBm)	Limit (dBm)
	2402	6.87	5.45	20.97
GFSK (1M)	2441	6.85	5.43	20.97
	2480	6.72	5.34	20.97
	2402	6.52	2.85	20.97
π/4-DQPSK (2M)	2441	7.05	2.90	20.97
	2480	6.52	2.83	20.97
	2402	6.53	2.82	20.97
8-DPSK (3M)	2441	7.03	2.87	20.97
	2480	6.75	3.16	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 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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