

RADIO TEST REPORT

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Report No.: STS2201225W03

Issued for

BLU Products, Inc.

10814 NW 33rd St # 100 Doral, FL 33172, USA

Product Name:	Mobile Phone
Brand Name:	BLU
Model Name:	STUDIO X5
Series Model:	N/A
FCC ID:	YHLBLUSTX5
Test Standard:	FCC Part 15.247

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TEST RESULT CERTIFICATION

Applicant's Name:	BLU Products, Inc.
Address	10814 NW 33rd St # 100 Doral, FL 33172, USA
Manufacturer's Name:	BLU Products, Inc.
Address	10814 NW 33rd St # 100 Doral, FL 33172, USA
Product Description	
Product Name:	Mobile Phone
Brand Name	BLU
Model Name:	STUDIO X5
Series Model	N/A
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.....: 27 Jan. 2022

Date (s) of performance of tests .: 27 Jan. 2022 ~ 28 Mar. 2022

Date of Issue 28 Mar. 2022

Testing Engineer

Test Result Pass

him che

(Chris Chen)

Technical Manager

APPROVAL

Authorized Signatory :

howy

(Sean she)

(Bovey Yang)

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7. HOPPING CHANNEL SEPARATION MEASUREMEN

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	28 Mar. 2022	STS2201225W03	ALL	Initial Issue



Shenzhen STS Test Services Co., Ltd.



1. SUMMARY OF TEST RESULTS

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

	FCC Part 15.247,Subpart C					
Standard Section	Test Item	Judgment	Remark			
15.207	Conducted Emission	PASS				
15.247(a)(1)	Hopping Channel Separation	PASS				
15.247(a)(1)&(b)(1)	Output Power	PASS				
15.209	Radiated Spurious Emission	PASS				
15.247(d)	Conducted Spurious & Band Edge Emission	PASS				
15.247(a)(1)(iii)	Number of Hopping Frequency	PASS				
15.247(a)(1)(iii)	Dwell Time	PASS				
15.247(a)(1)	Bandwidth	PASS				
15.205	Restricted bands of operation PA					
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	Mobile Phone
Trade Name	BLU
Model Name	STUDIO X5
Series Model	N/A
Model Difference	N/A
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.
Adapter	Input: AC 100-240V, 50/60Hz, 0.2A Output: DC 5V, 750mAh
Battery	Rated Voltage:3.7V Charge Limit Voltage:4.2V Capacity: 2000mAh
Hardware version number	HCT-M896MB-A2
Software version number	Bom3-cts-go-Blu-Latin_V1_S01_20220105_user_202 20105_temp
Connecting I/O Port(s)	Please refer to the Note 1.

Note:

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





2.

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

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	BLU	STUDIO X5	PIFA	N/A	0.41dBi	BT Antenna

Note: The antenna information refer the manufacturer provide report, applicable only to the tested sample identified in the report. Due to the incorrect antenna information, a series of problems such as the accuracy of the test results will be borne by the customer.



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-DQPS	
Mode7	TX CH00 3 Mbps/8DPSK	
Mode 8	TX CH39	3 Mbps/8DPSK
Mode 9	TX CH78	3 Mbps/8DPSK
Mode 10	Hopping	GFSK
Mode 11	Hopping π/4-DQPSK	
Mode 12	Hopping 8DPSK	

Note:

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

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

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

For AC Conducted Emission

	Test Case
AC Conducted Emission	Mode 13 : Keeping BT TX

2.3 FREQUENCY HOPPING SYSTEM REQUIREMENTS

(1)Standard and Limit

According to FCC Part 15.247(a)(1), The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

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



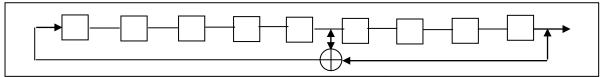
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The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping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

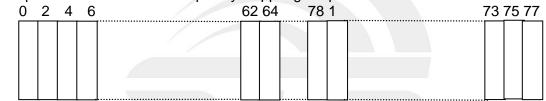
(2)The Pseudorandom sequence may be generated in a nin-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones: i.e. the shift register is initialized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

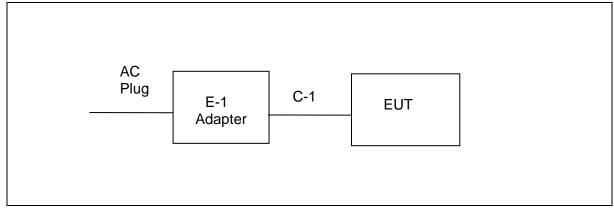
Test software Version	Test program: Bluetooth				
(Power control software) Parameters(1/2/3Mbps)	Power class: DH1 rate:4:27 2DH1 rate:20:54 3DH1 rate:24:83	Power class: DH3 rate:11:183 2DH3 rate:26:367 3DH3 rate:27:552	Power class: DH5 rate:15:339 2DH5 rate:30:679 3DH5 rate:31:1021		

RF Function	Туре	Mode Or Modulation type	ANT Gain(dBi)	Power Class	Software For Testing
		GFSK	0.41	Default	
BT	BR+EDR	π/4-DQPSK	0.41	Default	Engineering mode
		8DPSK	0.41	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
E-1	Adapter	BLU	US-HY-0750	N/A	N/A
C-1	DC Cable	N/A	N/A	100cm	NO

Support units

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

Note:

- (1) For detachable type I/O cable should be specified the length in cm in ^r Length ^a 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)			



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RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
			MY55520005	2021.09.30	2022.09.29
Power Sensor	Kovoight	U2021XA	MY55520006	2021.09.30	2022.09.29
Power Sensor	Power Sensor Keysight U		MY56120038	2021.09.30	2022.09.29
			MY56280002	2021.09.30	2022.09.29
Signal Analyzer	Agilent	N9020A	MY51110105	2022.03.01	2023.02.28
Temperature & Humidity	HH660	Mieo	N/A	2021.10.09	2022.10.08
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			



Shenzhen STS Test Services Co., Ltd.

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3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

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

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

Note:

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

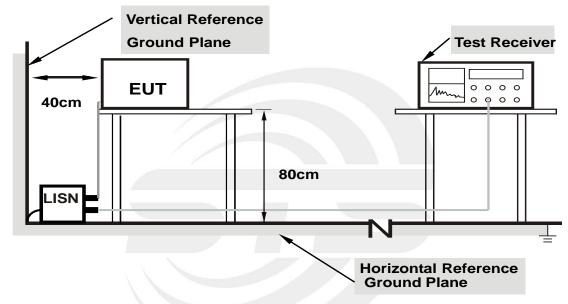
The following table is the setting of the receiver

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



3.1.2 TEST PROCEDURE

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



3.1.3 TEST SETUP

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

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

3.1.4 EUT OPERATING CONDITIONS

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



3.1.5 TEST RESULT

Temperature:	26.1(C)	Relative Humidity:	60%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 13		

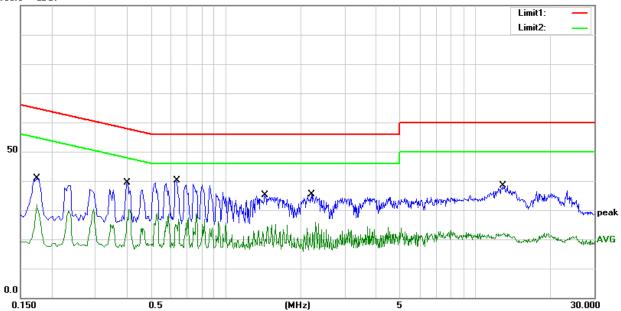
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1740	20.45	20.35	40.80	64.77	-23.97	QP
2	0.1740	11.44	20.35	31.79	54.77	-22.98	AVG
3	0.4020	18.83	20.57	39.40	57.81	-18.41	QP
4	0.4020	9.58	20.57	30.15	47.81	-17.66	AVG
5	0.6380	19.66	20.41	40.07	56.00	-15.93	QP
6	0.6380	8.20	20.41	28.61	46.00	-17.39	AVG
7	1.4380	14.84	20.34	35.18	56.00	-20.82	QP
8	1.4380	5.25	20.34	25.59	46.00	-20.41	AVG
9	2.2060	14.93	20.41	35.34	56.00	-20.66	QP
10	2.2060	5.45	20.41	25.86	46.00	-20.14	AVG
11	12.8740	17.09	21.29	38.38	60.00	-21.62	QP
12	12.8740	0.82	21.29	22.11	50.00	-27.89	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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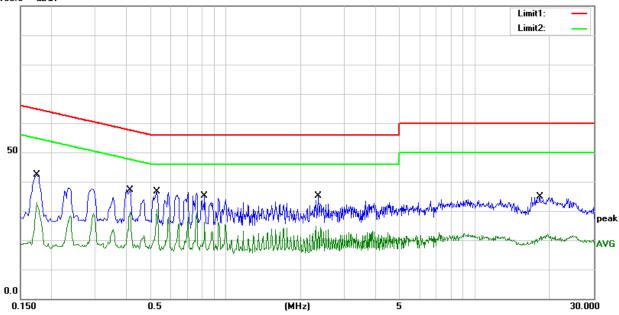
Temperature:	26.1(C)	Relative Humidity:	60%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 13		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1740	21.98	20.35	42.33	64.77	-22.44	QP
2	0.1740	12.63	20.35	32.98	54.77	-21.79	AVG
3	0.4140	16.63	20.56	37.19	57.57	-20.38	QP
4	0.4140	9.05	20.56	29.61	47.57	-17.96	AVG
5	0.5300	16.12	20.47	36.59	56.00	-19.41	QP
6	0.5300	10.27	20.47	30.74	46.00	-15.26	AVG
7	0.8260	14.89	20.34	35.23	56.00	-20.77	QP
8	0.8260	9.03	20.34	29.37	46.00	-16.63	AVG
9	2.3540	14.64	20.41	35.05	56.00	-20.95	QP
10	2.3540	4.46	20.41	24.87	46.00	-21.13	AVG
11	18.2460	12.33	22.44	34.77	60.00	-25.23	QP
12	18.2460	-0.28	22.44	22.16	50.00	-27.84	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¥





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		
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		
	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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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.

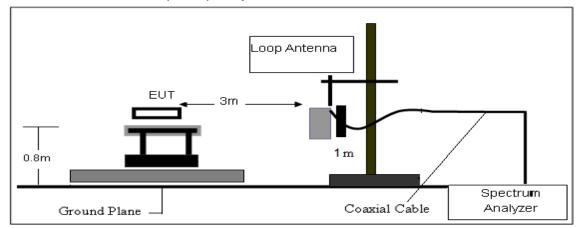
3.2.3 DEVIATION FROM TEST STANDARD

No deviation.

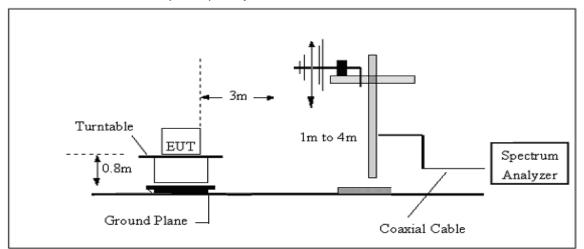


3.2.4 TESTSETUP

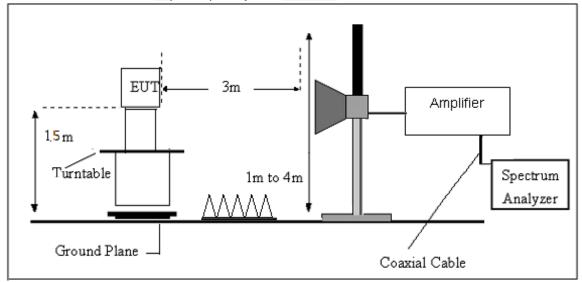
(A) Radiated Emission Test-Up Frequency Below 30MHz

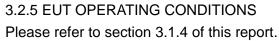


(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(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 3.7V	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.



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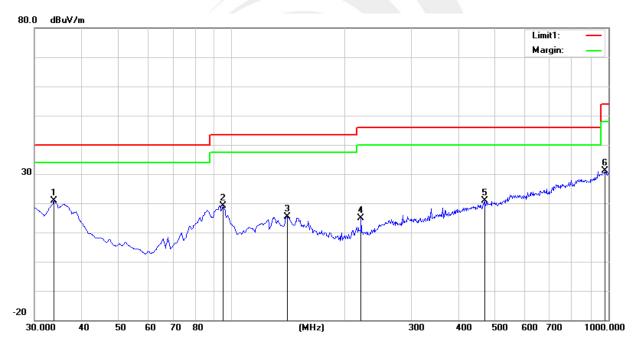
(30MHz-1000MHz)

Temperature:	23.1(C)	Relative Humidity:	60%RH		
Test Voltage:	DC 3.7V	Phase:	Horizontal		
Test Mode:	Mode 1/2/3/4/5/6/7/8/9(Mode 1 worst mode)				

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	33.8800	35.60	-14.80	20.80	40.00	-19.20	peak
2	94.9900	40.00	-20.78	19.22	43.50	-24.28	peak
3	140.5800	33.40	-18.05	15.35	43.50	-28.15	peak
4	221.0900	34.50	-19.53	14.97	46.00	-31.03	peak
5	469.4100	29.87	-9.03	20.84	46.00	-25.16	peak
6	979.6300	28.47	2.65	31.12	54.00	-22.88	peak

Remark:

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





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Temperature:	23.1(C)	Relative Humidity:	60%RH	
Test Voltage:	DC 3.7V	Phase:	Vertical	
Test Mode:	Mode 1/2/3/4/5/6/7/8/9(Mode 1 worst mode)			

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	33.8800	50.34	-14.80	35.54	40.00	-4.46	peak
2	79.4700	47.98	-23.11	24.87	40.00	-15.13	peak
3	140.5800	35.56	-18.05	17.51	43.50	-25.99	peak
4	205.5700	37.56	-20.72	16.84	43.50	-26.66	peak
5	616.8500	29.02	-5.49	23.53	46.00	-22.47	peak
6	983.5100	29.49	2.46	31.95	54.00	-22.05	peak

Remark:

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



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(1GHz~25GHz) 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)				
3264.84	60.90	44.70	6.70	28.20	-9.80	51.10	74.00	-22.90	PK	Vertical
3264.84	50.99	44.70	6.70	28.20	-9.80	41.19	54.00	-12.81	AV	Vertical
3264.65	61.31	44.70	6.70	28.20	-9.80	51.51	74.00	-22.49	PK	Horizontal
3264.65	49.90	44.70	6.70	28.20	-9.80	40.10	54.00	-13.90	AV	Horizontal
4804.35	59.42	44.20	9.04	31.60	-3.56	55.86	74.00	-18.14	PK	Vertical
4804.35	49.84	44.20	9.04	31.60	-3.56	46.28	54.00	-7.72	AV	Vertical
4804.60	58.95	44.20	9.04	31.60	-3.56	55.39	74.00	-18.61	PK	Horizontal
4804.60	49.79	44.20	9.04	31.60	-3.56	46.23	54.00	-7.77	AV	Horizontal
5359.84	48.85	44.20	9.86	32.00	-2.34	46.51	74.00	-27.49	PK	Vertical
5359.84	39.15	44.20	9.86	32.00	-2.34	36.81	54.00	-17.19	AV	Vertical
5359.79	47.59	44.20	9.86	32.00	-2.34	45.25	74.00	-28.75	PK	Horizontal
5359.79	38.92	44.20	9.86	32.00	-2.34	36.58	54.00	-17.42	AV	Horizontal
7205.77	54.10	43.50	11.40	35.50	3.40	57.50	74.00	-16.50	PK	Vertical
7205.77	43.87	43.50	11.40	35.50	3.40	47.27	54.00	-6.73	AV	Vertical
7205.78	54.84	43.50	11.40	35.50	3.40	58.24	74.00	-15.76	PK	Horizontal
7205.78	44.00	43.50	11.40	35.50	3.40	47.40	54.00	-6.60	AV	Horizontal
		•		Middle C	Channel (GFSK	/2441 MHz)			•	
3264.81	61.23	44.70	6.70	28.20	-9.80	51.43	74.00	-22.57	PK	Vertical
3264.81	51.23	44.70	6.70	28.20	-9.80	41.43	54.00	-12.57	AV	Vertical
3264.64	60.94	44.70	6.70	28.20	-9.80	51.14	74.00	-22.86	PK	Horizontal
3264.64	50.74	44.70	6.70	28.20	-9.80	40.94	54.00	-13.06	AV	Horizontal
4882.55	59.37	44.20	9.04	31.60	-3.56	55.81	74.00	-18.19	PK	Vertical
4882.55	50.47	44.20	9.04	31.60	-3.56	46.91	54.00	-7.09	AV	Vertical
4882.51	58.32	44.20	9.04	31.60	-3.56	54.76	74.00	-19.24	PK	Horizontal
4882.51	49.23	44.20	9.04	31.60	-3.56	45.67	54.00	-8.33	AV	Horizontal
5359.61	49.11	44.20	9.86	32.00	-2.34	46.77	74.00	-27.23	PK	Vertical
5359.61	39.02	44.20	9.86	32.00	-2.34	36.68	54.00	-17.32	AV	Vertical
5359.76	47.70	44.20	9.86	32.00	-2.34	45.36	74.00	-28.64	PK	Horizontal
5359.76	38.17	44.20	9.86	32.00	-2.34	35.83	54.00	-18.17	AV	Horizontal
7323.83	54.76	43.50	11.40	35.50	3.40	58.16	74.00	-15.84	PK	Vertical
7323.83	44.39	43.50	11.40	35.50	3.40	47.79	54.00	-6.21	AV	Vertical
7323.83	54.41	43.50	11.40	35.50	3.40	57.81	74.00	-16.19	PK	Horizontal
7323.83	44.24	43.50	11.40	35.50	3.40	47.64	54.00	-6.36	AV	Horizontal



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				High Char	nnel (GFSK/	2480 MHz)				
3264.75	61.15	44.70	6.70	28.20	-9.80	51.35	74.00	-22.65	PK	Vertical
3264.75	51.25	44.70	6.70	28.20	-9.80	41.45	54.00	-12.55	AV	Vertical
3264.82	61.58	44.70	6.70	28.20	-9.80	51.78	74.00	-22.22	PK	Horizontal
3264.82	51.08	44.70	6.70	28.20	-9.80	41.28	54.00	-12.72	AV	Horizontal
4960.48	59.37	44.20	9.04	31.60	-3.56	55.81	74.00	-18.19	PK	Vertical
4960.48	50.45	44.20	9.04	31.60	-3.56	46.89	54.00	-7.11	AV	Vertical
4960.47	58.46	44.20	9.04	31.60	-3.56	54.90	74.00	-19.10	PK	Horizontal
4960.47	49.58	44.20	9.04	31.60	-3.56	46.02	54.00	-7.98	AV	Horizontal
5359.80	48.74	44.20	9.86	32.00	-2.34	46.40	74.00	-27.60	PK	Vertical
5359.80	39.54	44.20	9.86	32.00	-2.34	37.20	54.00	-16.80	AV	Vertical
5359.68	47.55	44.20	9.86	32.00	-2.34	45.21	74.00	-28.79	PK	Horizontal
5359.68	38.47	44.20	9.86	32.00	-2.34	36.13	54.00	-17.87	AV	Horizontal
7439.94	53.57	43.50	11.40	35.50	3.40	56.97	74.00	-17.03	PK	Vertical
7439.94	44.16	43.50	11.40	35.50	3.40	47.56	54.00	-6.44	AV	Vertical
7439.92	53.87	43.50	11.40	35.50	3.40	57.27	74.00	-16.73	PK	Horizontal
7439.92	44.39	43.50	11.40	35.50	3.40	47.79	54.00	-6.21	AV	Horizontal

Note:

- 1) Scan with GFSK, π /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.



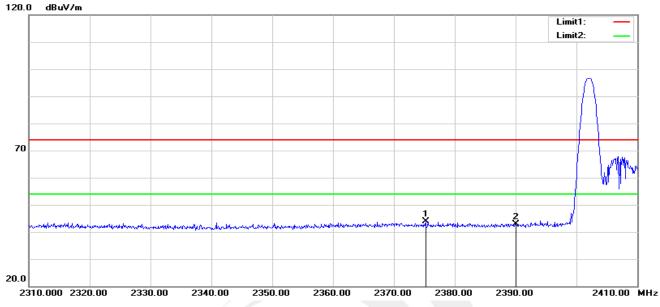
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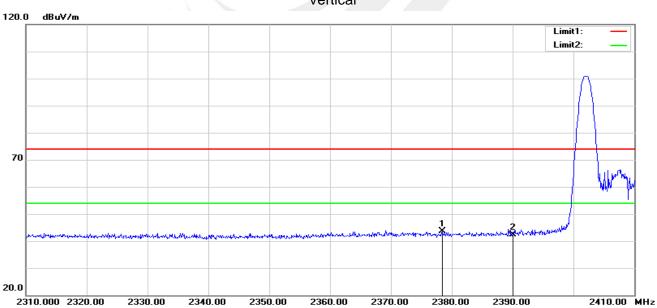


Restricted band Requirements

GFSK-Low Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2375.200	39.64	4.12	43.76	74.00	-30.24	peak
2	2390.000	38.60	4.34	42.94	74.00	-31.06	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2378.400	39.40	4.17	43.57	74.00	-30.43	peak
2	2390.000	38.01	4.34	42.35	74.00	-31.65	peak

Vertical

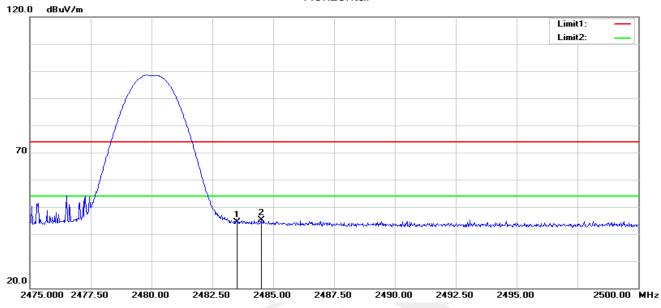
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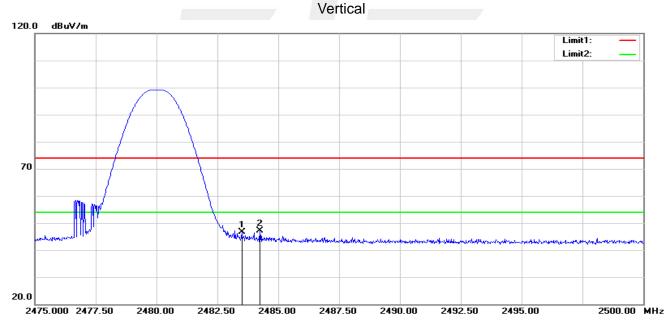
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GFSK-High Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	39.72	4.60	44.32	74.00	-29.68	peak
2	2484.500	40.52	4.61	45.13	74.00	-28.87	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	41.98	4.60	46.58	74.00	-27.42	peak
2	2484.250	42.53	4.61	47.14	74.00	-26.86	peak

Note: GFSK, π /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.

Shenzhen STS Test Services Co., Ltd.



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	
Stort/Stop Eroguopou	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				
Stort/Stop Eroquopov	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.



Shenzhen STS Test Services Co., Ltd.



4.5 TEST RESULTS

Temperature:	25 ℃	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps)-00/39/78 CH	Test Voltage:	DC 3.7V

	Spectri	um An	alyzer - Swept SA									
RL		RF	50 Ω AC			SENSE:PULS		AL	IGN AUTO			49 AM Mar 03, 202
enter	Fre	q 12	2.5150000	-	PNO: Fast Gain:Low		Free Run n: 30 dB		Avg Typ	e: Log-Pwr		TRACE 1 2 3 4 5 TYPE MWWWW DET P P P P P
0 dB/div			offset 0.5 dB 17.03 dBm	I								2.402 GH .028 dBn
°g			1									
.97												
3.0												-12.24 dB
3.0												
3.0												
3.0					3							4
3.0				Y						Strain Straighton Straighton	- Aundren -	manun
3.0	mh	hout	menterrele	Mar Marcale	anna an	ale manual	mark when	M/MA and and a	- Charles and	When the second	w	
3.0												
tart 0.0												p 25.00 GH
Res Bl	W 10	JO K	HZ		#	VBW 300	KHZ			SM	/eep 2.386	· ·
KR MODE 1 N 2 N	1	f f	>	2.402 GHz 3.626 GHz	-57.2	028 dBm 215 dBm	FUNCTION	FUNC	TION WIDTH		FUNCTION VALUE	
3 N 4 N 5	1	f		7.196 GHz 24.750 GHz		189 dBm 962 dBm						
5 7 8												
3												
5												
												Þ
6									STATUS			

00 CH

39 CH

	t Spectr		nalyzer - Swept SA										
RL		RF	50 Ω AC			SENSE:F	ULSE		ALI	GN AUTO			2 AM Mar 03, 202
enter	Fre	eq 1	2.5150000		PNO: Fast IFGain:Low		rig: Free Atten: 30			Avg Type:	Log-Pwr	Т	TYPE MWWWM DET PPPP
		Refí	Offset 0.5 dB										.452 GH
0 dB/div			16.83 dBn									6	.833 dBr
°g			1					1					
3.2													-12.45 dt
1.2													
3.2													
3.2			2	3									
1.2	ليعين		- And	mentionen	how were	an other	م مردس الرميدي	manut	more	monthemphon	workenner		and water
3.2 Jane	- and the second se	Mar.t.											
3.2													
art 0.	.03 C	SHz						A				Stor	25.00 GH
Res B			Hz		#	VBW 3	00 kHz				Sw	eep 2.386	s (1001 pt
R MODE	TRC	SCL		X		Y	FUN	CTION	FUNCT	ION WIDTH		FUNCTION VALUE	
N 2 N	1	f		2.452 GH 3.651 GH		.833 dBr 625 dBr							
8 N	1	f		5.823 GH	z -55	451 dBr	n						
N	1	f		24.775 GH	z -47	411 dBr	n						
j													
3													
9													
i													
3										STATUS			•
										314105			



78 CH

		nalyzer - Swept SA									
RL	RF	50 Ω AC			SENSE:PULSE		ALIG	AUTO		02:	11:30 AM Mar 03, 20
enter F	req 1	2.515000		PNO: Fast (FGain:Low	Trig: Fr #Atten:			Avg Type	: Log-Pwr		TRACE 1 2 3 4 TYPE MWWW DET P P P P
dB/div		Offset 0.5 dB								Mkr1	2.477 GH 7.108 dB
11	(1									
89											
.9						_					-12.21 c
.9											
			.3								
.9		<u>\</u> 2		1				لطروي وستعسر مراسر	A gul good and	worken were	مسعم المصلم المالك
اللاجمير و	فحمد والمهدام	Contrary Verson	de son an and	and the second shall be	man and and and	-De Manager	a non t		1		
.9											
art 0.0:				#\	/BW 300 k	Hz			Si		
art 0.03 es BW	100 I	kHz	×	Y		Hz	FUNCTIO	N WIDTH	SI		36 s (1001 pt
art 0.03 es BW Model N N N	100	kHz	x 2.477 GHz 3.676 GHz 4.949 GHz 24.800 GHz	7.1 -56.6 -54.5			FUNCTIO	N WIDTH	Si	weep 2.38	86 s (1001 p
art 0.03 es BW	7 100 RC SCL 1 f 1 f 1 f	kHz	2.477 GHz 3.676 GHz 4.949 GHz	7.1 -56.6 -54.5	08 dBm 75 dBm 17 dBm		FUNCTIO	N WDTH	S	weep 2.38	36 s (1001 p
art 0.03 es BW	7 100 RC SCL 1 f 1 f 1 f	kHz	2.477 GHz 3.676 GHz 4.949 GHz	7.1 -56.6 -54.5	08 dBm 75 dBm 17 dBm 69 dBm		FUNCTIO	NWIDTH	S	weep 2.38	36 s (1001 pt
N S	7 100 RC SCL 1 f 1 f 1 f	kHz	2.477 GHz 3.676 GHz 4.949 GHz	7.1 -56.6 -54.5	08 dBm 75 dBm 17 dBm		FUNCTIO	N WIDTH	S	weep 2.38	top 25.00 Gł 66 s (1001 pł UE



Shenzhen STS Test Services Co., Ltd.



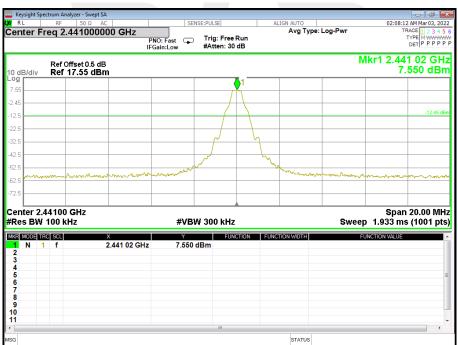


For Band edge(it's also the reference level for conducted spurious emission)

	ight Spe		nalyzer - Swept SA	4								
X RL		RF	50 Ω A			SENSE:PULSE		AL	IGN AUTO		02:05	:18 AM Mar 03, 202
Cente	er Fr	eq 2	.3535000	00 GHz					Avg Type	e: Log-Pwr		TRACE 1 2 3 4 5
					PNO: Fast G		Free Run n: 30 dB					DET P P P P P
					IFGain:Low	#Atte	n: 30 dB					,
		Def	Offset 0.5 dE								Mkr1 2.4	01 97 GH:
10 dB/	div		17.76 dBr									7.757 dBn
7.76												≬ 1
-2.24 -												-12 24 dBr
-12.2												- 2/24 001
-22.2												
-32.2												+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$
-42.2				2								<u>4</u> [
-52.2			() [·]	2								\ % \
-62.2	Jan	المرسمهم	marrow	- man - man	mannena	mmand	hunan	مهد للبلال	woh hand	rentertitor	monten	mount les
-72.2												
Start												2.40700 GH:
#Res	BW	100 k	(Hz		#VI	3W 300	kHz			Swee	ep 10.27 r	ns (1001 pts
MKR MO		C SCL		Х	Y		FUNCTION	FUNC	TION WIDTH		FUNCTION VALU	·
1 N 2 N		f		2.401 97 GH 2.319 26 GH		7 dBm 8 dBm						
3 1		f		2.399 40 GH		8 dBm						
4 1		f		2.400 05 GH		9 dBm						
5												
5 6 7												
6												
8 9												
10												
11												
•						п	1					Þ
ISG									STATUS			

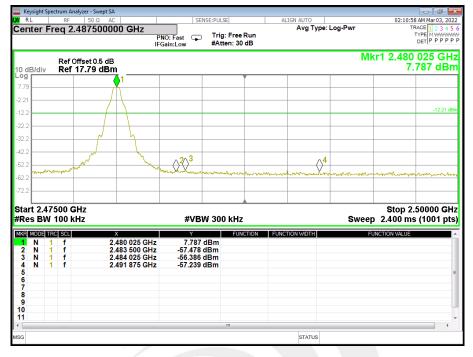
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78 CH





Shenzhen STS Test Services Co., Ltd.

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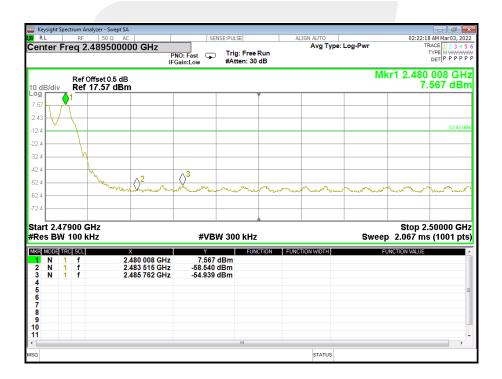




For Hopping Band edge

GFSK

	-		Swept SA		1	SENSE:			LIGN AUTO	1	02,20,08	B AM Mar 03, 202
enter	r Fred	q 2.351			PNO: Fast IFGain:Low		Frig: Free I #Atten: 30	Run		e: Log-Pwr	TR	RACE 1 2 3 4 5 TYPE MWWW DET P P P P
dB/di		Ref Offset								N	/kr1 2.403 7.	000 GH 418 dBr
.42												
58 -												
.6												-12.58 d
.6												
.6												- (
.6											^2	
2.6 —		manun	man	mm	unun	www	www	mann	mmm	man	www.wa	mm
2.6												
art 2.		00 GHz 00 kHz				#VBW :	300 kHz			Swe	Stop 2. ep 9.867 ms	40300 GH s (1001 pt
art 2. Res B	BW 10 ETRC S	00 kHz		03 000 GHz	2 7	#VBW (Y 7.418 dB 3.424 dB	FUNC	TION FUN	CTION WIDTH	Swe		
art 2. tes B N N N N	3W 10 E TRC E 1 1)0 kHz sci	2.40 2.39		2 7	Y 7.418 dB	FUNC m m	CTION FUNC	CTION WIDTH	Swe	ep 9.867 ms	
art 2. Res B N N N N	3W 10 E TRC E 1 1	00 kHz scl	2.40 2.39	0 022 GHz	2 7	Y 7.418 dB 8.424 dB	FUNC m m	CTION FUN	CTION WIDTH	Swe	ep 9.867 ms	
art 2. Res B R MODE N 2 N 3 N 4	3W 10 E TRC E 1 1	00 kHz scl	2.40 2.39	0 022 GHz	2 7	Y 7.418 dB 8.424 dB	FUNC m m	CTION FUN	CTION WIDTH	Swe	ep 9.867 ms	
art 2. Res B R MODE N 2 N 3 N 4 5 5 7	3W 10 E TRC E 1 1	00 kHz scl	2.40 2.39	0 022 GHz	2 7	Y 7.418 dB 8.424 dB	FUNC m m	CTION FUN	CTION WIDTH	Swe	ep 9.867 ms	
art 2. es B N N N	3W 10 E TRC E 1 1	00 kHz scl	2.40 2.39	0 022 GHz	2 7	Y 7.418 dB 8.424 dB	FUNC m m	CTION FUNG	CTION WIDTH	Swe	ep 9.867 ms	



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Page 39 of 73 Report No.: STS2201225W03

Temperature:	25 ℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps)– 00/39/78 CH	Test Voltage:	DC 3.7V

		lyzer - Swept SA								
RL	RF	50 Ω AC		SEN	ISE:PULSE	AL	IGN AUTO			5 AM Feb 23, 202
enter F	req 12	2.5150000			Trig: Free R	un	Avg Type:	Log-Pwr		RACE 1 2 3 4 5
				NO: Fast 🖵 Gain:Low	#Atten: 30 d					DET P P P P P
									Mkr1 2	.402 GH
0 dB/div		ffset 0.5 dB 13.02 dBm								015 dBn
		5.02 dbm			Y					
3.02	<u> </u>									
5.98										
7.0										-13.30 dt
7.0										
7.0			. 3							1
7.0	1	^ <mark>2</mark>	-						. mar	al man
7.0 	-	have how well	man	um margar	manner	Marry Marrien	نور «موط ¹⁴⁷ »»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»»	when and when	wall a d	~~~~
7.0										
7.0										
					k					
art 0.0:		_						_		25.00 GH
tes BW	100 kł	-IZ		#VB\	№ 300 kHz			Swe	ep 2.386	s (1001 pi
R MODE T		>		Y	FUNCT	TION FUNC	TION WIDTH	F	UNCTION VALUE	
1 N 2 N	1 f 1 f		2.402 GHz 2.802 GHz	3.015 -57.330						
3 N	1 f		7.196 GHz	-52.171	dBm					
	1 f		24.650 GHz	-48.204	dBm					
5										
7										
B										
9 0										
í										
					m		1			Þ
3							STATUS			
1						_				

00 CH

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Keysight R L	Spect		alyzer - Swept								
	Fre	RF eq 1:	50 Ω 2.515000	0000 GHz	PNO: Fast FGain:Low	NSE:PULSE Trig: Free R #Atten: 30 d	un	IGN AUTO Avg Type:	Log-Pwr	т	4 AM Feb 23, 20 RACE 1 2 3 4 TYPE M WWW DET P P P P
dB/div)ffset 0.5 d 11.31 dB								.452 GI .312 dB
			1								
;9 L											
7											-13.56
7											
				A.3							
7			$\langle \rangle^2$					mounder	a man and and	and	mon
· ····	North	hor all	Same and the second	way Martin May News	alway and a start of the	Mary Mary Survey Mary	per altra and a			-	
7											
urt 0. es Bi			Hz		#VB	W 300 kHz			Swe	Stop ep 2.386	25.00 G
MODE				X		FUNC	TION FUNC	TION WIDTH		UNCTION VALUE	- (· · · · P
Ν	1	f		2.452 GHz		dBm					
N	1	f		3.626 GHz 5.773 GHz	-56.414	dBm					
Ν	1	f		24.725 GHz	-48.007	dBm					
					1	III	ì	STATUS			,



78 CH

Keysight																		
RL		RF 50					SEN	NSE:PULS			AL	IGN AUT		Log-Pw	(r	03	3:48:13 / TRA	M Feb 23, 20
enter	Frec	12.515 ן	0000	00 GH2	PN	VO: Fast Gain:Lov			Free F en: 30 (Avg	Type:	Log-Pw	r.		TY	PE MWWW DET PPPP
dB/div		ef Offset 0 ef 16.47														Mkr	1 2.4 6.4	477 GH 72 dBi
47		1																
53																		-13.60 c
.5																		
.5																		
.5												and a gran	at which a	-	and and and	mark	ww	ward
5	الملسور	and the second	www.www	مر المواد مورد	~Web	man	mon	mone	and the	- and a grade and a grade and a	mante							
.5																		
.5		Hz 0 kHz					#VB\	N 300	kHz						Swe			
art 0.0 es Bl	N/10	0 kHz	×				Y		kHz EUNC	TION	FUNCT	FION WID	TH				86 s	
5 art 0.0 es Bl MODE N N N N	W 10	0 kHz		2.477 G 3.226 G 6.273 G 24.401 G	GHz GHz	-5 -5	#VB\ 6.472 6.953 6.705 8.709	dBm dBm dBm		TION	FUNC	FION WID	TH			ep 2.3	86 s	
5 es B) N N N N	W 10	0 kHz f f f		2.477 0 3.226 0 6.273 0	GHz GHz	-5 -5	Y 6.472 6.953 6.705	dBm dBm dBm		TION	EUNC	TION WID	TH			ep 2.3	86 s	
art 0.0 tes B1	W 10	0 kHz f f f		2.477 0 3.226 0 6.273 0	GHz GHz	-5 -5	Y 6.472 6.953 6.705	dBm dBm dBm dBm	FUNC	TION	EUNC	TION WID	TH _			ep 2.3	86 s	
art 0.0 Res Bl N N N N N N	W 10	0 kHz f f f		2.477 0 3.226 0 6.273 0	GHz GHz	-5 -5	Y 6.472 6.953 6.705	dBm dBm dBm dBm		TION	FUNC		TH			ep 2.3	86 s	25.00 GF (1001 pt



Shenzhen STS Test Services Co., Ltd.



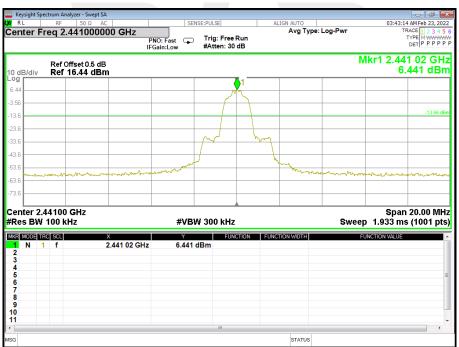


For Band edge(it's also the reference level for conducted spurious emission)

		Spectru		alyzer - Swept S								
XI RI	-	Fro	RF	50 Ω A 3535000		SE	NSE:PULSE		ALIGN AUTO	ype: Log-Pwr		3 AM Feb 23, 2022
Cell		FIE	4 2.	3333000		PNO: Fast	Trig: Fre #Atten: 3),		DET P P P P P
						IFGain:Low	#Atten: 3				111	,
	3/div)ffset 0.5 dE 16.70 dBi							Mkr1 2.40 6.	700 dBm
Log 6.70												1
-3.30												A
-3.30												-13 30 dBr
-23.3												
-23.3												Nh
-43.3												4
-43.3						²						1
63.3	um	andre.	m	where where	munne		Alerropuerre	nermo	ware have the	mound	un and a state of the second	and the
-73.3												
-73.3												
		3000 N 10				#VB	W 300 kH	z		Swe	Stop 2. ep 10.27 ms	40700 GHz 6 (1001 pts
MKR	MODE	TRC	5CL		x	Y	l FU	INCTION	FUNCTION WIDTH	1	FUNCTION VALUE	
1 2	N N	1	f f		2.401 97 GH		dBm					
3	N	1	f		2.399 40 GHz	z -53.954	dBm					
4 5	N	1	f		2.400 05 GHz	z -48.494	dBm					
5 6 7												
8 9												
10												
11 ∢							m					
SG									STATL	JS		

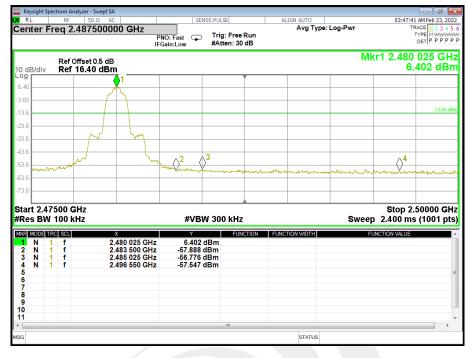
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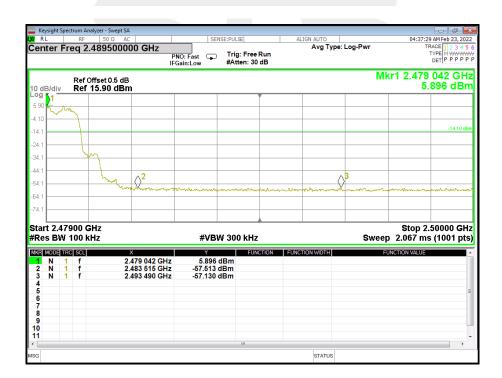




For Hopping Band edge

π/4-DQPSK

Keysight Sp R L	ectrum Anal RF	lyzer - Swept SA 50 Ω AC			ENSE:PULSE		ALIGN AUTO		04-25-17	👝 🖓 📕
		35150000	00 GHz	PNO: Fast Gain:Low	Tain Fas	eRun 0 dB	Avg Type:	Log-Pwr	TR/ T	AM Feb 23, 202 ACE 1 2 3 4 5 APE M WWWW DET P P P P P
dB/div		fset 0.5 dB 5.02 dBm	1					M	kr1 2.401 5.0	867 GH)22 dBn
02						<u> </u>				
98										-14.98 d
.0										-14.30 0
.0										h
									<u>^2</u>	() ³
i.0	menne	villionestores	materman	-malyana aparata	mangana	Lowman	and and a second second	howard	menun	wand
i.0										
	0000 GI 100 kH			#VB	W 300 kH:	z		Swee	Stop 2.4 p 9.867 ms	0300 GH (1001 pt
R MODE T			x	Y		NCTION FL	INCTION WIDTH	F	UNCTION VALUE	
N 1 2 N 1 3 N 1 5 6	1 f 1 f 1 f	2.	401 867 GHz 390 022 GHz 400 013 GHz	-56.846						
3 9 0										
1					m					



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Page 44 of 73 Report No.: STS2201225W03

Temperature:	25℃	Relative Humidity:	50%
Test Mode:	8DPSK(3Mbps) -00/39/78 CH	Test Voltage:	DC 3.7V

	ight Sp		Analyzer - Swept S	A							
X RL		RJ			SE	NSE:PULSE		ALIGN AUTO			46 AM Feb 23, 2022
Cent	er F	req	12.515000	P	NO: Fast 😱 Gain:Low	Trig: Free F #Atten: 30 (Avg Type	: Log-Pwr	1	TYPE M WWWWW DET P P P P P
10 dBi	/div		f Offset 0.5 dE								2.402 GHz .523 dBm
2.52			\ 1								
-7.48											-13.45 dBm
-17.5											
-27.5											
-47.5			2		3						Ó
-57.5		, malebri	- And -	and will be wanted	Manager and the Mathematica	and a shall an array of	with many the	person prover personal	A mar marker	and the state of t	many
-67.5	han an a										
-77.5 -											
Start #Res					#VB	W 300 kHz			Sw	Stop veep 2.386	o 25.00 GHz s (1001 pts)
MKR M			L	х	Y	FUNC	TION	UNCTION WIDTH		FUNCTION VALUE	A
2 1	N N N			2.402 GHz 3.626 GHz 7.196 GHz	2.523 -56.345 -52.378	dBm dBm					
	N 1	f		24.675 GHz	-48.242	dBm					E
5 6 7 8 9											
9 10											
11											-
ISG								STATUS			

00 CH

30	CH	
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Keysight	t Spect	rum An	alyzer - Swept	SA							
RL		RF		AC	SEI	NSE:PULSE		ALIGN AUTO			50 AM Feb 23, 20
enter	· Fre	eq 1:	2.51500		NO: Fast 😱 Gain:Low	Trig: Free #Atten: 30		Avg Typ	e: Log-Pwr		TYPE MWWW DET PPPP
dB/di)ffset 0.5 d 11.76 dB								2.452 GH I.205 dB
76		- (1				1				
24											
2											-13.70 c
2											
2											
			•		,						
2			$\langle \rangle^2$		•			a gran and many	and sugarthal ser	wowner	North Same
	and the second	Jan Hannaha	and the second	and a second	and an article	مر ورو مرابع مرابع المرابع الم	and the second second	And the second sec			
2											
.2											
art 0. tes B			Hz		#VBI	N 300 kHz			Sw	Sto eep 2.386	p 25.00 GI s (1001 pi
R MODE	E TRC	SCL f		× 2.452 GHz	¥		CTION	FUNCTION WIDTH		FUNCTION VALUE	
N	1	f		3.601 GHz 7.321 GHz	-57.119	dBm					
N	1	f		24.725 GHz	-48.332						
						m					•

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78 CH

Keysight Sp										
RL	RF	50 Ω A		SEN	SE:PULSE	A	LIGN AUTO Avg Type	l og Pwr		59 AM Feb 23, 20
nter F	req 1	2.515000	P	PNO: Fast 😱 Gain:Low	Trig: Free R #Atten: 30 d		Avg Type	. Log-Pwi		TYPE MWWW DET P P P P
dB/div		Offset 0.5 dE 12.81 dBr								2.477 GH .812 dBi
31	- (1								
9										-13.42 o
2		<u>2</u>	<u>3</u>							1 0
manul	- Martine	marken		ann hugh affra ta have	wales all and a	Destry	and when the second	May when the the	and the second of the	Mar Mar
rt 0.03		(Hz		#VBV	V 300 kHz			Sw	Stop reep 2.386	
2 es BW	100 k	(Hz	×	Y	FUNC	TION FUNC	TION WDTH			
nt 0.03 es BW	100 k RC SCL 1 f 1 f 1 f	(Hz	× 2.477 GHz 3.676 GHz 6.048 GHz 24.725 GHz	#VBV 2.812 c -55.867 c -56.621 c -48.861 c	FUNC IBm IBm IBm	FION FUNC	TION WIDTH		eep 2.386	
nt 0.03 es BW Mode na N 1 N 1 N 1	100 k RC SCL 1 f 1 f	(Hz	2.477 GHz 3.676 GHz 6.048 GHz	2.812 c -55.867 c -56.621 c	FUNC IBm IBm IBm	FUNC	TION MIDTH		eep 2.386	
nt 0.03 es BW Mode M N 1 N 1 N 1	100 k RC SCL 1 f 1 f	(Hz	2.477 GHz 3.676 GHz 6.048 GHz	2.812 c -55.867 c -56.621 c	FUNC IBm IBm IBm	TION FUNC	TION WIDTH		eep 2.386	o 25.00 GH s (1001 pt
nt 0.03 es BW Mode M N 1 N 1 N 1	100 k RC SCL 1 f 1 f	(Hz	2.477 GHz 3.676 GHz 6.048 GHz	2.812 c -55.867 c -56.621 c	FUNC IBm IBm IBm	FION FUNC	TION WIDTH		eep 2.386	



Shenzhen STS Test Services Co., Ltd.



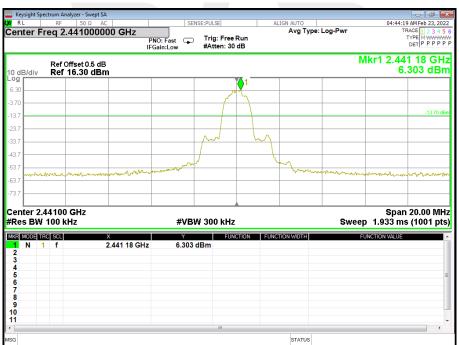


For Band edge(it's also the reference level for conducted spurious emission)

		nalyzer - Swept SA								
RL	RF	50 Ω AC		SE	NSE:PULSE	ALI	GN AUTO Avg Type:	Law Dum		AM Feb 23, 20
enter H	-req 2	.35350000	P	PNO: Fast 😱	Trig: Free Ru #Atten: 30 dE		Avg Type:	Log-Pwr		TYPE MWWW DET PPPP
) dB/div		Offset 0.5 dB 16.58 dBm	ı					N	lkr1 2.40 6.	2 19 GH 584 dBi
og 6.58										1
.42										-
3.4										-1345 d
3.4										
3.4										
.4				<mark>2</mark>						Ja y
4 hours	Manad	-	mennem	amaran	مەرىمەم ارىمىمىيەر مەر	1. Mary Manusch	manpharma	hourseman	and the second	nahard 1
1.4										
art 2.3	0000 C	2H7							Stop 2	40700 GH
Res BW				#VB	W 300 kHz			Sweep	0.00 2. 0 10.27 ms	
R MODE 1	TRC SCL		x 2.402 19 GHz	Y 6,584	FUNCTI dBm	ON FUNCT	ION WIDTH	FL	JNCTION VALUE	
2 N 5 N	1 f 1 f		2.337 56 GHz 2.399 40 GHz	-57.558 -52.466						
	1 f		2.400 05 GHz	-50.556	dBm					
1										
					m					•
							STATUS			

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39 CH





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78 CH

	ectrum Analyzer -										
RL	RF 50	0Ω AC	CH-		SENSE:PULSE		ALI	GN AUTO	: Log-Pwr	04:5	2:28 AM Feb 23, 202 TRACE 1 2 3 4 5
enterr	Teq 2.407	500000		PNO: Fast FGain:Low		ree Run : 30 dB					DET P P P P
0 dB/div	Ref Offset Ref 16.5								I		80 025 GH 6.579 dBn
.og		<u>0 u</u>									
6.58		77	\ \								
3.42											-13.42 dB
13.4											10.12 40
23.4		~									
33.4		<u>~</u> .	- mart								
43.4			- L.	^2 ∧	3						
i3.4 ~~~~~	man			monor	monte	manth	www	r.r.m.mbsrr.r.a	warm and a state	mount	manhan
3.4											
73.4											
/3.4	7500 GHz									Stop	2.50000 GH
73.4	7500 GHz 100 kHz			#\	/BW 300 I	(Hz			Swe	Stop eep 2.400	2.50000 GH ms (1001 pt
13.4 tart 2.47 Res BW	100 kHz			Y	(1	(Hz FUNCTION	FUNCTI	ON WIDTH	Swe	Stop eep 2.400	ms (1001 pt
3.4 tart 2.47 Res BW 1 N 1 2 N 1 3 N 1 4 N 1	100 kHz RC SCL 1 f 1 f 1 f	2.48 2.48 2.48	0 025 GHz 3 500 GHz 4 250 GHz 8 825 GHz	6.5 -55.4 -56.5			FUNCTI	ON WIDTH	Swe	ep 2.400	ms (1001 pt
3.4 tart 2.47 Res BW 1 N 1 2 N 1 3 N 1 4 N 1 5 6	100 kHz RC SCL 1 f 1 f 1 f	2.48 2.48 2.48	3 500 GHz 4 250 GHz	6.5 -55.4 -56.5	579 dBm 190 dBm 591 dBm		FUNCTI	ON WIDTH	Swe	ep 2.400	ms (1001 pt
3.4 tart 2.47 Res BW 1 N 1 2 N 1 3 N 1 4 N 1 5 6 7 8	100 kHz RC SCL 1 f 1 f 1 f	2.48 2.48 2.48	3 500 GHz 4 250 GHz	6.5 -55.4 -56.5	579 dBm 190 dBm 591 dBm		FUNCTI	ION WIDTH	Swe	ep 2.400	ms (1001 pt
3.4 tart 2.47 Res BW 1 N 1 2 N 1 3 N 1 4 N 1 5 6 7 7 8 9	100 kHz RC SCL 1 f 1 f 1 f	2.48 2.48 2.48	3 500 GHz 4 250 GHz	6.5 -55.4 -56.5	579 dBm 190 dBm 591 dBm		FUNCTI	ION WIDTH	Swe	ep 2.400	ms (1001 pt
3.4 tart 2.47 Res BW 1 N 1 2 N 1 3 N 1 4 N 1 5 6 7 8	100 kHz RC SCL 1 f 1 f 1 f	2.48 2.48 2.48	3 500 GHz 4 250 GHz	6.5 -55.4 -56.5	579 dBm 190 dBm 191 dBm 21 dBm	FUNCTION	FUNCTI	ON WIDTH	Swe	ep 2.400	ms (1001 pt
3.4 tart 2.47 Res BW S MODE IF 1 N 1 2 N 1 3 N 1 4 N 1 5 6 7 8 9 0	100 kHz RC SCL 1 f 1 f 1 f	2.48 2.48 2.48	3 500 GHz 4 250 GHz	6.5 -55.4 -56.5	579 dBm 190 dBm 591 dBm	FUNCTION	FUNCTI	ION WIDTH	Swe	ep 2.400	ms (1001 pt



Shenzhen STS Test Services Co., Ltd.





For Hopping Band edge

8DPSK

RL	RF	Analyzer - Swept SA 50 Ω AC		SE	NSE:PULSE	A	IGN AUTO		05:17:30	AM Feb 23, 202
enter	Freq	2.3515000	00 GHz	PNO: Fast Gain:Low	Trig: Free R #Atten: 30 d	un	Avg Type:	Log-Pwr	TR/ T	ACE 1 2 3 4 5 YPE M WWWW DET P P P P P
dB/di		f Offset 0.5 dB f 16.18 dBn						MI	kr1 2.402 6.1	176 GH 183 dBr
18										
82 —										
.8										-13.82 d
.8										
1.8										
1.8									2	- V
1.8 •••••	n fran mar frank	un un un manage	-	en montener	manger		monenter	manna	mounter	-lonear N
art 2.	.30000 W 100			#VB	W 300 kHz			Swee	Stop 2.4 p 9.867 ms	10300 G H (1001 pt:
art 2. Res B R MODE N 2 N	W 100	kHz 2 2	X 2.402 176 GHz 2.390 022 GHz	¥ 6.183 -59.506	dBm dBm	ION FUNC	TION WIDTH		Stop 2.4 p 9.867 ms unction value	0300 GH (1001 pt
art 2. Res B N N N N N N	W 100	kHz 2 2	.402 176 GHz	Y 6.183	dBm dBm	ION FUNC	TION WIDTH		9.867 ms	(1001 pt
art 2. Res B MODE N 2 N 3 N 4	W 100	kHz 2 2	.402 176 GHz .390 022 GHz	¥ 6.183 -59.506	dBm dBm	ion Func	TION WIDTH		9.867 ms	(1001 pt:
art 2. Res B MODE N N N N N N N N N N	W 100	kHz 2 2	.402 176 GHz .390 022 GHz	¥ 6.183 -59.506	dBm dBm	ion Func	TION WIDTH		9.867 ms	0300 GH (1001 pt:
art 2. Res B N N N N N N N N N N N N N N N N N N N	W 100	kHz 2 2	.402 176 GHz .390 022 GHz	¥ 6.183 -59.506	dBm dBm	ION FUNC	TION WIDTH		9.867 ms	(1001 pt:
art 2. Res B N N N N N N N	W 100	kHz 2 2	.402 176 GHz .390 022 GHz	¥ 6.183 -59.506	dBm dBm	ION FUNC	TION WIDTH		9.867 ms	(1001 pt

RL	RF	nalyzer - Swept SA 50 Ω AC		SE	NSE:PULSE	A	LIGN AUTO Avg Type:	Les Dum		42 AM Feb 23, 20
nter F	req 2	.4895000	F	PNO: Fast 🕞 Gain:Low	Trig: Free #Atten: 30		Avg Type:	Log-Pwr	1	TYPE MWWW DET PPPP
dB/div		Offset 0.5 dB 16.43 dBn						M	(r1 2.479 6	0 168 G⊦ .435 dB
	~					[
57										-13.57 c
6										
6	\\	1								
6										
6		man	a^2	5						
6					and a stranger and an and a	artuðrinningur meðandar		and have the stand of the		Un marine and
6										
art 2.47 es BW				#VB	W 300 kHz			Sweep	Stop 2 2.067 m	.50000 GI s (1001 pi
	RC SCL		x 479 168 GHz	6.435		CTION FUNC	CTION WIDTH	Fl	UNCTION VALUE	
N 1	f	2	.479 168 GHZ .483 515 GHZ .485 048 GHZ	-57.483	dBm					
		-	.400 040 0112	-01.001	ubiii					



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 3.7V

Number of Hopping Channel

79

Hopping channel

dB/d			offset 0.5 dB						Mk	r2 2.480	160 0 G 7.91 dl
	liv ()1	Ref	17.89 dBn	n			1				7.91 0
9	Ϋ₩	VVY	IVYYYYYY	VYYYYYYY	WWWW	YYYYYYY	YYYYYY	YYYYYYY	(VYVVYVV)	NYYYYYY	WWW
14											
1											
1											
		00 G 100 k			#VI	BW 300 kl	łz		Swe	Stop: ep 1.133 m	2.48350 C ns (1001
_	DE TRO	SCL		x	Y		UNCTION	FUNCTION WIDTH		FUNCTION VALUE	
	1	f		02 171 0 GHz 80 160 0 GHz	7.8 7.9	7 dBm 1 dBm					
MOI N N	1										
N	1										
N											
N											

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6. AVERAGE TIME OF OCCUPANCY

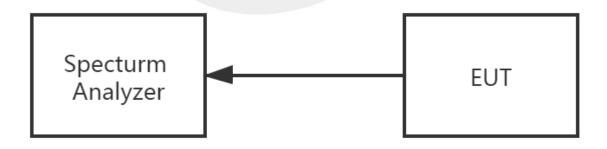
6.1 LIMIT

	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 $3.37 \times 31.6 = 106.6$.
- 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 $5.06 \times 31.6 = 160$.
- 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 3.7V

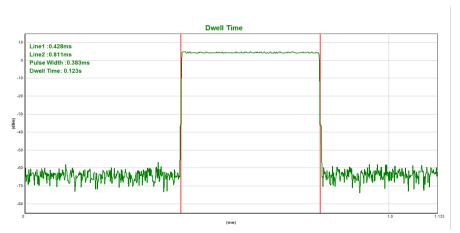
Modulation	Pocket Type	Frequency (MHz)	Single Pulse Time (ms)	Dwell Time (s)	Limit (s)	Result
	DH1	2441	0.383	0.123	0.4	Pass
GFSK	DH3	2441	1.636	0.262	0.4	Pass
	DH5	2441	2.887	0.308	0.4	Pass
	2DH1	2441	0.388	0.124	0.4	Pass
π/4DQPSK	2DH3	2441	1.642	0.263	0.4	Pass
	2DH5	2441	2.890	0.308	0.4	Pass
	3DH1	2441	0.390	0.125	0.4	Pass
8DPSK	3DH3	2441	1.640	0.262	0.4	Pass
	3DH5	2441	2.892	0.308	0.4	Pass

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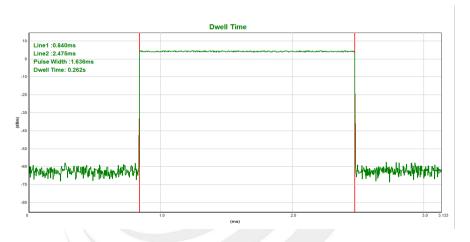


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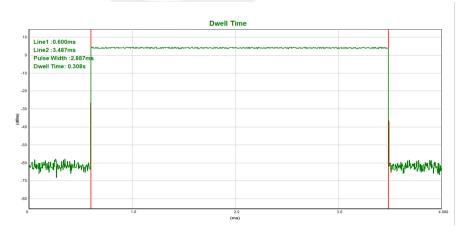
CH39-DH1



CH39-DH3





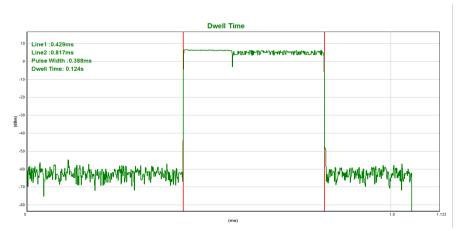


Shenzhen STS Test Services Co., Ltd.

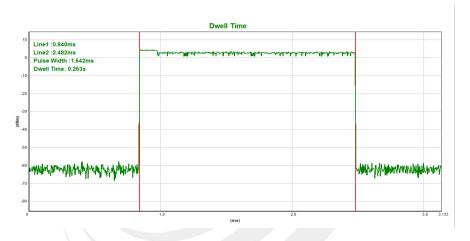


Page 54 of 73 Re

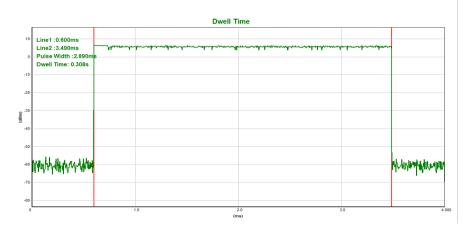
CH39-2DH1



CH39-2DH3



CH39-2DH5



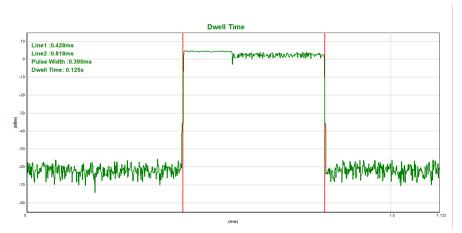
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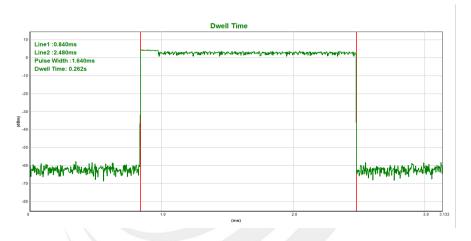
Page 55 of 73

Report No.: STS2201225W03

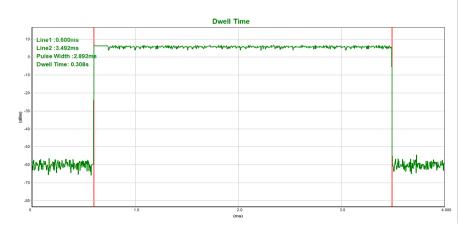
CH39-3DH1



CH39-3DH3



CH39-3DH5



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7. HOPPING CHANNEL SEPARATION MEASUREMEN

7.1 LIMIT

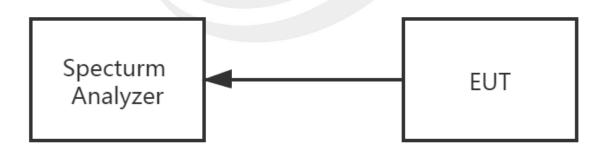
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that 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℃	Relative Humidity:	50%
Test Mode:	GFSK/π/4-DQPSK/8DPSK	Test Voltage:	DC 3.7V

Modulation	Frequency (MHz)	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)	Result
	2402	2402.005	2403.007	1.002	0.687	Pass
GFSK	2441	2440.972	2442.004	1.032	0.969	Pass
	2480	2478.969	2479.971	1.002	0.684	Pass
	2402	2402.164	2403.172	1.008	0.856	Pass
π/4DQPSK	2441	2441.023	2442.022	0.999	0.855	Pass
	2480	2479.164	2480.166	1.002	0.856	Pass
	2402	2402.167	2403.160	0.993	0.857	Pass
8DPSK	2441	2441.158	2442.160	1.002	0.859	Pass
	2480	2479.161	2480.172	1.011	0.859	Pass





CH00 -1Mbps



CH39 -1Mbps





CH78 -1Mbps



CH00 -2Mbps



Shenzhen STS Test Services Co., Ltd.



CH39 -2Mbps

Keysight Spectrum Analyzer - Swept SA RL RF 50 Ω AC	SENSE:PUL	SE ALIGN AUTO	04:22:15 AM Feb 23, 20
nter Freq 2.44150000	0 GHz		TRACE 1 2 3 4 TYPE MWWW DET P P P
Ref Offset 0.5 dB dB/div Ref 8.14 dBm			Mkr2 2.442 022 GF 2.214 dB
a hor	mar Martin	mmmmm	2 Amarian and a second
.9			
.9			
.9			
.9			
1.9			
enter 2.441500 GHz tes BW 30 kHz	#VBW 10	0 kHz	Span 3.000 MI Sweep 3.200 ms (1001 pt
N 1 f 2.4	41 023 GHz 2.09 dBm 42 022 GHz 2.21 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE
5 7 8			
		m	Þ
3		STATUS	

CH78 -2Mbps



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CH00 -3Mbps

	ectrum Analyze									
RL	RF	50 Ω AC		SEI	ISE:PULSE	AL	IGN AUTO Avg Type:			4 AM Feb 23, 202
enter F	req 2.40	250000		NO: Wide	Trig: Free Ru	in	Avg Type:	Log-Pwr		TYPE M WWW
			. i	Gain:Low	#Atten: 30 dB					DETPPPF
	Ref Offs	at 0.5 dB						М	kr2 2.403	160 GH
0 dB/div	Ref 9.0								4.	326 dBr
og			0		The second se			2		
).94		~~~	www	m V ls Wh	mmm	m	-~~~~^	how	mon	wwww
10.9	1									
20.9										
0.9										
.0.9 ~~~	~~~									
0.9										
0.9										
0.9										
0.9										
enter 2.	402500 0	SH7							Span	3.000 MI
Res BW	30 kHz			#VB\	N 100 kHz			Swee	p 3.200 m	
KR MODE T	RC SCL	x		Y	FUNCT	ON FUNCT	TION WIDTH	ł	UNCTION VALUE	
1 N 1 2 N 1	f		02 167 GHz 03 160 GHz	2.68 4.33						
2 N 3	T	2.4	03 160 GHZ	4.33	abm					
4 5										
6										
7 8										
9										
0										
					III					Þ
G							STATUS			
1										

CH39 -3Mbps

	Analyzer - Swept SA								
Center Freq	F 50 Ω AC		SEN	ISE:PULSE	AL	IGN AUTO Avg Type:	Log-Pwr		AM Feb 23, 2022
Center Freq	2.44150000	Р	NO: Wide 🖵	Trig: Free #Atten: 30	Run				
		IF	Gain:Low	#Atten: 30	dB				
	ef Offset 0.5 dB ef 14.08 dBm						MH		160 GHz 080 dBm
Log	er 14.08 ubiii		Δ1				<u>A</u> 2		
4.08			~ m			Amar	Å		
-5.92 ~~~ ~~ ~~ ~~~~~~~~~~~~~~~~~~~~~~~~~~	mon			www.ha	m	VIN VIV	horn	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	www.vw
-15.9									
-25.9									
-35.9									
-45.9									
-55.9									
-65.9									
-75.9									
Center 2.441 #Res BW 30			#VB\	N 100 kHz			Sweep		3.000 MHz (1001 pts)
MKR MODE TRC SO	L X		Y	FUN	CTION FUNC	TION WIDTH	FU	JNCTION VALUE	
1 N 1 f		41 158 GHz	1.95						
3 N 1 T	2.4	42 160 GHz	4.08	abm					
4									=
6									-
7 8									
9 10									
11									
<				III					- F
MSG						STATUS			

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



CH78 -3Mbps

Keysight Spectrum Analy						
RL RF	50 Ω AC	SENSE:PUL	SE	ALIGN AUTO Avg Type: Lo		12:31 AM Feb 23, 20 TRACE 1 2 3 4
enter Freq 2.4	79500000 GHz	PNO: Wide 😱 Trig	: Free Run	Avg Type. Lo	ig-rwi	TYPE M WANNAW
			ten: 30 dB			DET P P P P
					Mkr2 2 /	80 172 GH
	set 0.5 dB .75 dBm				WIN12 2.4	3.039 dBr
g Rei 9.		V1			2	
25	0 0 0	my man		honor	Å	
1.3	· markense.	. v man	m	way v.	month	
.3					0	m
.3						h
.3						- my
.3						
.3						
.3						
.3						
nter 2.479500	CH2				er	oan 3.000 MH
es BW 30 kHz	GHZ	#VBW 10	0 kHz		Sweep 3.200	ms (1001 nf
		"15 11 18			•	· ·
R MODE TRC SCL N 1 f	× 2.479 161 GH	z 4.33 dBm	FUNCTION	FUNCTION WIDTH	FUNCTION VA	LUE
N 1 f	2.473 101 GH					
				STATUS		
				STATUS		



Shenzhen STS Test Services Co., Ltd.



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

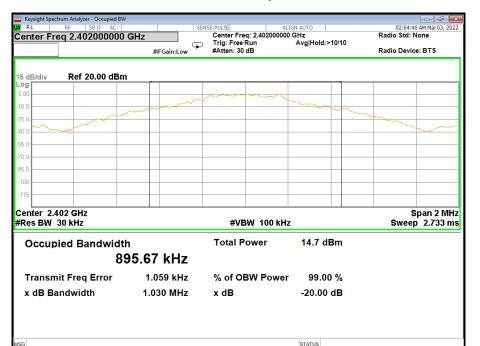
Temperature:	25℃	Relative Humidity:	50%
Test Mode:	GFSK/π/4-DQPSK/8DPSK	Test Voltage:	DC 3.7V

Modulation	Frequency (MHz)	-20 dB Bandwidth (MHz)	Result
	2402	1.0300	Pass
GFSK	2441	0.9689	Pass
	2480	1.0260	Pass
	2402	1.284	Pass
π/4DQPSK	2441	1.283	Pass
	2480	1.284	Pass
	2402	1.285	Pass
8DPSK	2441	1.289	Pass
	2480	1.289	Pass

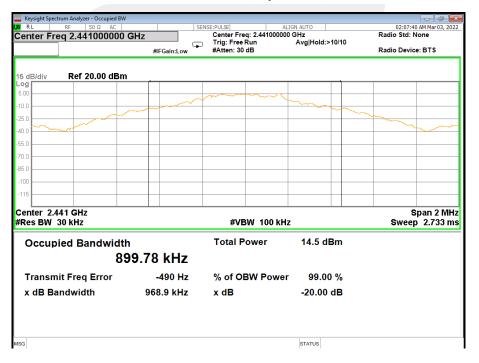




CH00 -1 Mbps



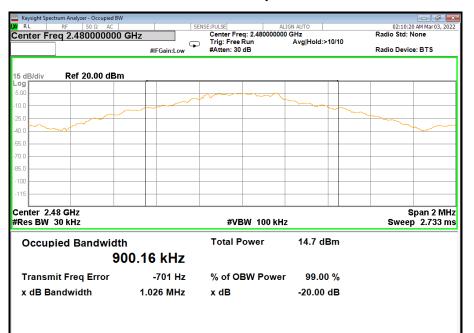
CH39 -1Mbps



Shenzhen STS Test Services Co., Ltd.

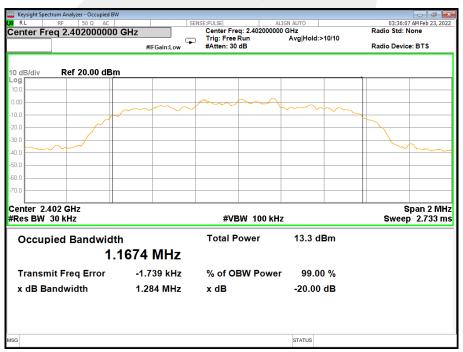


CH78 -1Mbps



CH00 -2Mbps

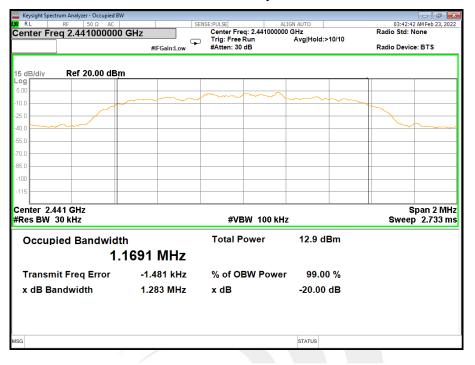
STATUS



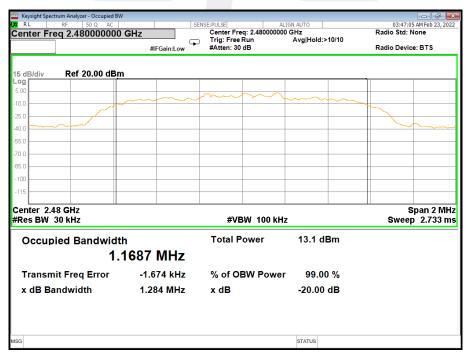
Shenzhen STS Test Services Co., Ltd.



CH39 -2Mbps



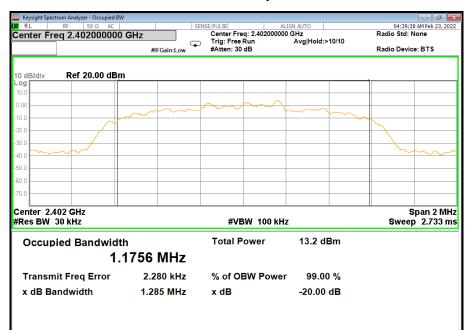
CH78 -2Mbps



Shenzhen STS Test Services Co., Ltd.



CH00 -3Mbps



CH39 -3Mbps

STATUS



Shenzhen STS Test Services Co., Ltd.



CH78 -3Mbps

sight Spectrum Analyzer - Occupied BW RF 50 Ω AC Cer Freq 2.480000000	SI	ENSE:PULSE	ALIGN AUTO	04:51:53 AM Feb 23, 20 Radio Std: None
er Freq 2.48000000	#IFGain:Low	The second second second	Avg Hold:>10/10	Radio Device: BTS
8/div Ref 20.00 dBm	<u> </u>			
er 2.48 GHz BW 30 kHz		#VBW 100 kF	łz	Span 2 M Sweep 2.733
ccupied Bandwidt	h	Total Power	13.0 dBm	
1.1	1773 MHz			
ansmit Freq Error	2.377 kHz	% of OBW Powe	er 99.00 %	
B Bandwidth	1.289 MHz	x dB	-20.00 dB	
			STATUS	

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			
15.247 (a)(1)&(b)(1)	Output Power	1 W or 0.125W		PASS			
		if channel separation > 2/3 bandwidthprovided thesystems operatewith an output power no greater than125 mW(20.97dBm)	2400-2483.5				

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.

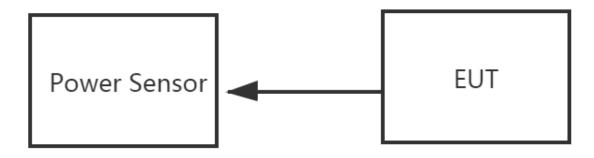
e) A plot of the test results and setup description shall be included in the test report.

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 3.7V		

Modulation	Frequency (MHz)	Peak Power (dBm)	Average Power (dBm)	Limit (dBm)
GFSK (1M)	2402	9.11	7.78	20.97
	2441	9.00	7.69	20.97
	2480	8.71	7.41	20.97
	2402	8.37	2.28	20.97
π/4-DQPSK (2M)	2441	8.30	2.26	20.97
	2480	8.02	1.99	20.97
	2402	9.11	4.96	20.97
8-DPSK (3M)	2441	9.05	4.94	20.97
	2480	8.75	4.67	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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