

RADIO TEST REPORT

S T S

Report No.: STS2012300W02

Issued for

Human Things, Inc

2222 Felicia Ave, Rowland Heights, CA 91748, USA

Product Name:	GENKI AUDIO LITE		
Brand Name:	GENKI		
Model Name:	HTGL		
Series Model:	: N/A		
FCC ID:	2ARPBHTGL		
Test Standard:	FCC Part 15.247		

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TEST RESULT CERTIFICATION

Applicant's Name:	Human Things, Inc
Address	2222 Felicia Ave, Rowland Heights,CA 91748, USA
Manufacturer's Name:	Shenzhen I-Link Technology CO.,LTD
Address	Unit B, 2nd Floor, Building 1, Xifa District C, Yintian Industrial Park, Xixiang Street, Baoan District, Shenzhen, 518102
Product Description	
Product Name:	GENKI AUDIO LITE
Brand Name:	GENKI
Model Name:	HTGL
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:	01 Dec. 2020
Date (s) of performance of tests.:	01 Dec. 2020 ~ 09 Dec. 2020
Date of Issue	09 Dec. 2020
Test Result	Pass

 Testing Engineer
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 Chris Chen)

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 Technical Manager
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7. HOPPING CHANNEL SEPARATION MEASUREMEN

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	09 Dec. 2020	STS2012300W02	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.



1.1 TEST FACTORY

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

1.2 MEASUREMENT UNCERTAINTY

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

No.	Item	Uncertainty
1	RF output power, conducted	±0.68dB
2	Unwanted Emissions, conducted	±2.988dB
3	All emissions, radiated 30-1GHz	±5.6dB
4	All emissions, radiated 1G-6GHz	±5.5dB
5	All emissions, radiated>6G	±5.8dB
6	Conducted Emission (9KHz-150KHz)	±3.37dB
7	Conducted Emission (150KHz-30MHz)	±3.83dB

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2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	GENKI AUDIO LITE
Trade Name	GENKI
Model Name	HTGL
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	5.0
Bluetooth Configuration	BR+EDR
Antenna Type	Please refer to the Note 3.
Power Rating	Input: DC 5V (max 25mA)
Hardware version number	TYPE-C-VG
Software version number	Audio_TX_DUAL_LG_20201020_V1_6_8
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	PSA 華新科技股份有限公司 Walsin Technology Corporation		Ceramic	N/A	2dBi	BT Antenna



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	
Mode 13	Bluetooth connecting mode	

Note:

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

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.

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.

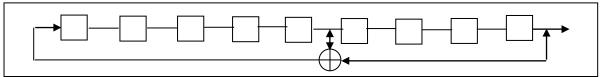
(2)The Pseudorandom sequence may be generated in a nin-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones: i.e. the shift register

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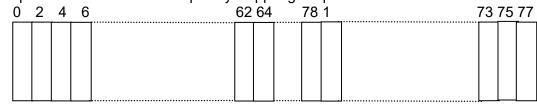


is initialized with nine ones.

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 th 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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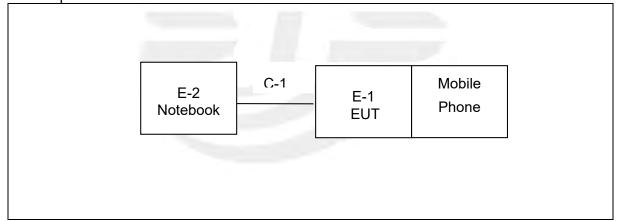
2.4 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

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	2	225 50	CSR
BT	BR+EDR	π/4-DQPSK	2	225 50	BlueSuite
		8DPSK	2	225 50	2.5.8

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





2.6 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

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

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

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-2	Notebook	LENOVO	ThinkPad E470	N/A	N/A
C-1	USB Cable	N/A	N/A	100cm	N/A
	Bluetooth speaker	N/A	N/A	N/A	N/A
	Mobile Phone	UNNECTO	U730	N/A	N/A

Note:

(1) For detachable type I/O cable should be specified the length in cm in ^rLength ^a column.



2.7 EQUIPMENTS LIST

Radiation Test equipment

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

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	
			MY55520005	2020.10.10	2021.10.09	
Power Sensor	Kovoicht	11202174	MY55520006	2020.10.10	2021.10.09	
Fower Serisor	Keysight	U2021XA	MY56120038	2020.10.10	2021.10.09	
			MY56280002	2020.10.10	2021.10.09	
Signal Analyzer	Agilent	N9020A	MY51110105	2020.03.05	2021.03.04	
Temperature & Humidity	HH660	Mieo	N/A	2020.10.13	2021.10.12	
MIMO Power measurement test Set	Keysight	U2021XA	MY55520005	2020.10.10	2021.10.09	
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

Tempe	erature:	23.1(C)		Relative Hu	Relative Humidity: 53		53%RH	
Test V	/oltage:	DC 5V		Phase:		L		
Test M	lode:	Mode 13						
00.0 dl	BuV			1				
						Limit1: Limit2:		
50 44	M. M	Munth many m		Multine March Martine		May Mun and Market Market	peak	
0.0		0.5					20.000	
0.150 No.	Frequency (MHz)		(MHz) Factor (dB)	Result (dBuV)	5 Limit (dBuV)	Margin (dB)	30.000 Detector	
1	0.1540	33.31	20.20	53.51	65.78	-12.27	QP	
2	0.1540	14.33	20.20	34.53	55.78	-21.25	AVG	
3	0.5740	14.94	20.38	35.32	56.00	-20.68	QP	
4	0.5740	5.22	20.38	25.60	46.00	-20.40	AVG	
5	1.4980	19.19	20.15	39.34	56.00	-16.66	QP	
6	1.4980	11.85	20.15	32.00	46.00	-14.00	AVG	
7	2.0660	20.45	20.14	40.59	56.00	-15.41	QP	
8	2.0660	11.51	20.14	31.65	46.00	-14.35	AVG	
9	4.7820	13.78	20.03	33.81	56.00	-22.19	QP	
	4.7820	0.81	20.03	20.84	46.00	-25.16	AVG	
10								
10 11	22.1820	10.90	20.64	31.54	60.00	-28.46	QP	

Remark:

- 1. All readings are Quasi-Peak and Average values.
- 2. Margin = Result (Result =Reading + Factor)–Limit

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Tempe	erature: 23.1(C)		Relative Humidity: 5		53%RH		
Test V	′oltage:	DC 5V		Phase: N		N	
Test M	lode:	Mode 13					
100.0 dE	Bu¥		l.			Limit1:	
						Limit2:	
50	hunner and	MM di Marana	ummer Market Mark	hydra hydra ywer ywer ywer ywer ywer ywer ywer ywer	M. M. M. Martin	understander ander and	peak
0.0		0.5	(MHz		5		30.000
No.	Frequency (MHz)		Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1580	34.34	20.21	54.55	65.57	-11.02	QP
2	0.1580	12.57	20.21	32.78	55.57	-22.79	AVG
3	0.5940	12.62	20.35	32.97	56.00	-23.03	QP
4	0.5940	3.16	20.35	23.51	46.00	-22.49	AVG
5	1.5940	17.91	20.15	38.06	56.00	-17.94	QP
	1.5940	10.44	20.15	30.59	46.00	-15.41	AVG
6	1.0040	10.11					
6 7	2.0660	18.71	20.14	38.85	56.00	-17.15	QP
				38.85 29.64	56.00 46.00	-17.15 -16.36	QP AVG
7	2.0660	18.71	20.14				
7 8	2.0660 2.0660	18.71 9.50	20.14 20.14	29.64	46.00	-16.36	AVG
7 8 9	2.0660 2.0660 4.9260	18.71 9.50 12.05	20.14 20.14 20.03	29.64 32.08	46.00 56.00	-16.36 -23.92	AVG QP

Remark:

- 1. All readings are Quasi-Peak and Average values.
- 2. Margin = Result (Result = Reading + Factor)-Limit



3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS

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

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

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

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

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

Notes:

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

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

LIMITS OF RESTRICTED FREQUENCY BANDS

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

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For Radiated Emission

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

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

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

For Restricted band

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

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

3.2.2 TEST PROCEDURE

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

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

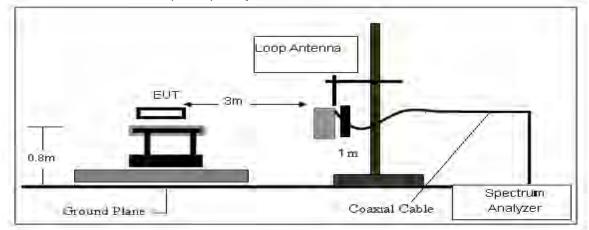
3.2.3 DEVIATION FROM TEST STANDARD

No deviation.

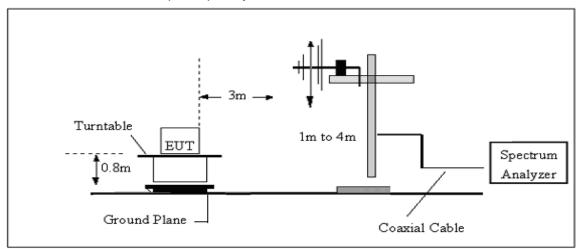


3.2.4 TESTSETUP

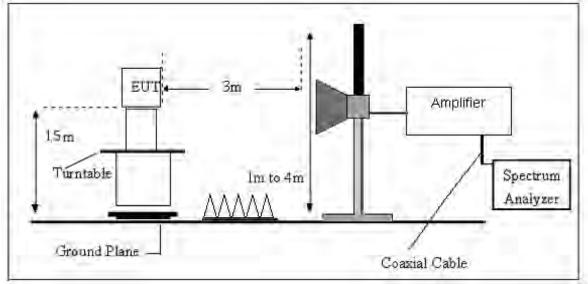
(A) Radiated Emission Test-Up Frequency Below 30MHz

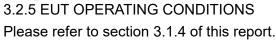


(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



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







3.2.6 FIELD STRENGTH CALCULATION

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

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

For example

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

Factor=AF+CL-AG



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3.2.7 TEST RESULTS

(9KHz-30MHz)

Temperature:	23.1(C)	Relative Humidity:	60%RH
Test Voltage:	DC 5V	Test Mode:	TX Mode

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

Note:

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

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



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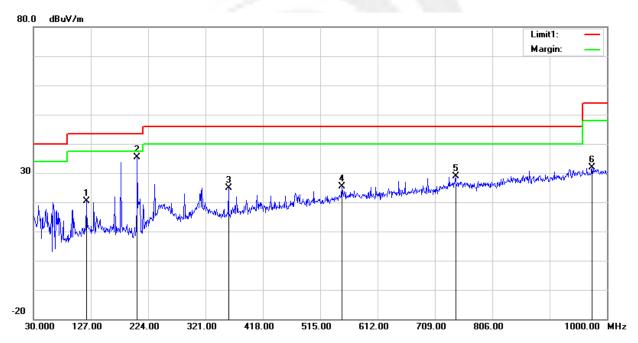
(30MHz-1000MHz)

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

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	119.2400	38.68	-18.38	20.30	43.50	-23.20	QP
2	205.5700	56.02	-20.72	35.30	43.50	-8.20	QP
3	359.8000	37.75	-12.87	24.88	46.00	-21.12	QP
4	551.8600	31.19	-5.72	25.47	46.00	-20.53	QP
5	743.9200	31.10	-2.13	28.97	46.00	-17.03	QP
6	974.7800	29.56	2.32	31.88	54.00	-22.12	QP

Remark:

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





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

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	63.9500	58.30	-25.64	32.66	40.00	-7.34	QP
2	312.2700	46.41	-14.36	32.05	46.00	-13.95	QP
3	359.8000	48.79	-12.87	35.92	46.00	-10.08	QP
4	696.3900	33.37	-4.23	29.14	46.00	-16.86	QP
5	915.6100	30.72	-0.09	30.63	46.00	-15.37	QP
6	988.3600	29.92	2.15	32.07	54.00	-21.93	QP

Remark:

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

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



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(1GHz~25GHz) 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)				
3264.89	61.41	44.70	6.70	28.20	-9.80	51.61	74.00	-22.39	PK	Vertical
3264.89	51.54	44.70	6.70	28.20	-9.80	41.74	54.00	-12.26	AV	Vertical
3264.63	62.08	44.70	6.70	28.20	-9.80	52.28	74.00	-21.72	PK	Horizontal
3264.63	51.30	44.70	6.70	28.20	-9.80	41.50	54.00	-12.50	AV	Horizontal
4804.54	59.04	44.20	9.04	31.60	-3.56	55.48	74.00	-18.52	PK	Vertical
4804.54	49.79	44.20	9.04	31.60	-3.56	46.23	54.00	-7.77	AV	Vertical
4804.41	58.55	44.20	9.04	31.60	-3.56	54.99	74.00	-19.01	PK	Horizontal
4804.41	49.68	44.20	9.04	31.60	-3.56	46.12	54.00	-7.88	AV	Horizontal
5359.72	48.14	44.20	9.86	32.00	-2.34	45.80	74.00	-28.20	PK	Vertical
5359.72	40.37	44.20	9.86	32.00	-2.34	38.03	54.00	-15.97	AV	Vertical
5359.80	47.18	44.20	9.86	32.00	-2.34	44.84	74.00	-29.16	PK	Horizontal
5359.80	38.94	44.20	9.86	32.00	-2.34	36.60	54.00	-17.40	AV	Horizontal
7205.87	53.92	43.50	11.40	35.50	3.40	57.32	74.00	-16.68	PK	Vertical
7205.87	44.52	43.50	11.40	35.50	3.40	47.92	54.00	-6.08	AV	Vertical
7205.88	54.53	43.50	11.40	35.50	3.40	57.93	74.00	-16.07	PK	Horizontal
7205.88	43.54	43.50	11.40	35.50	3.40	46.94	54.00	-7.06	AV	Horizontal
				Middle C	Channel (GFSK	(/2441 MHz)				
3264.70	60.82	44.70	6.70	28.20	-9.80	51.02	74.00	-22.98	PK	Vertical
3264.70	50.39	44.70	6.70	28.20	-9.80	40.59	54.00	-13.41	AV	Vertical
3264.64	61.06	44.70	6.70	28.20	-9.80	51.26	74.00	-22.74	PK	Horizontal
3264.64	50.69	44.70	6.70	28.20	-9.80	40.89	54.00	-13.11	AV	Horizontal
4882.39	58.62	44.20	9.04	31.60	-3.56	55.06	74.00	-18.94	PK	Vertical
4882.39	50.24	44.20	9.04	31.60	-3.56	46.68	54.00	-7.32	AV	Vertical
4882.32	59.09	44.20	9.04	31.60	-3.56	55.53	74.00	-18.47	PK	Horizontal
4882.32	49.14	44.20	9.04	31.60	-3.56	45.58	54.00	-8.42	AV	Horizontal
5359.85	49.28	44.20	9.86	32.00	-2.34	46.94	74.00	-27.06	PK	Vertical
5359.85	39.36	44.20	9.86	32.00	-2.34	37.02	54.00	-16.98	AV	Vertical
5359.86	48.21	44.20	9.86	32.00	-2.34	45.87	74.00	-28.13	PK	Horizontal
5359.86	38.67	44.20	9.86	32.00	-2.34	36.33	54.00	-17.67	AV	Horizontal
7323.96	54.65	43.50	11.40	35.50	3.40	58.05	74.00	-15.95	PK	Vertical
7323.96	44.97	43.50	11.40	35.50	3.40	48.37	54.00	-5.63	AV	Vertical
7323.71	54.19	43.50	11.40	35.50	3.40	57.59	74.00	-16.41	PK	Horizontal
7323.71	44.85	43.50	11.40	35.50	3.40	48.25	54.00	-5.75	AV	Horizontal



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				High Char	nnel (GFSK/	2480 MHz)				
3264.72	61.92	44.70	6.70	28.20	-9.80	52.12	74.00	-21.88	PK	Vertical
3264.72	51.25	44.70	6.70	28.20	-9.80	41.45	54.00	-12.55	AV	Vertical
3264.74	61.75	44.70	6.70	28.20	-9.80	51.95	74.00	-22.05	PK	Horizontal
3264.74	50.52	44.70	6.70	28.20	-9.80	40.72	54.00	-13.28	AV	Horizontal
4960.33	58.99	44.20	9.04	31.60	-3.56	55.43	74.00	-18.57	PK	Vertical
4960.33	50.25	44.20	9.04	31.60	-3.56	46.69	54.00	-7.31	AV	Vertical
4960.33	58.81	44.20	9.04	31.60	-3.56	55.25	74.00	-18.75	PK	Horizontal
4960.33	49.22	44.20	9.04	31.60	-3.56	45.66	54.00	-8.34	AV	Horizontal
5359.66	48.21	44.20	9.86	32.00	-2.34	45.87	74.00	-28.13	PK	Vertical
5359.66	40.03	44.20	9.86	32.00	-2.34	37.69	54.00	-16.31	AV	Vertical
5359.64	47.65	44.20	9.86	32.00	-2.34	45.31	74.00	-28.69	PK	Horizontal
5359.64	38.57	44.20	9.86	32.00	-2.34	36.23	54.00	-17.77	AV	Horizontal
7439.77	53.68	43.50	11.40	35.50	3.40	57.08	74.00	-16.92	PK	Vertical
7439.77	43.49	43.50	11.40	35.50	3.40	46.89	54.00	-7.11	AV	Vertical
7439.85	54.77	43.50	11.40	35.50	3.40	58.17	74.00	-15.83	PK	Horizontal
7439.85	43.83	43.50	11.40	35.50	3.40	47.23	54.00	-6.77	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

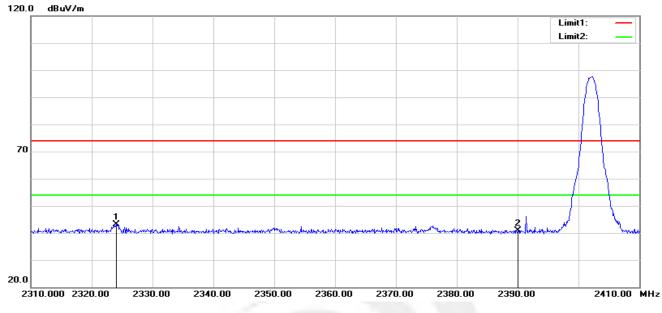
3) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.



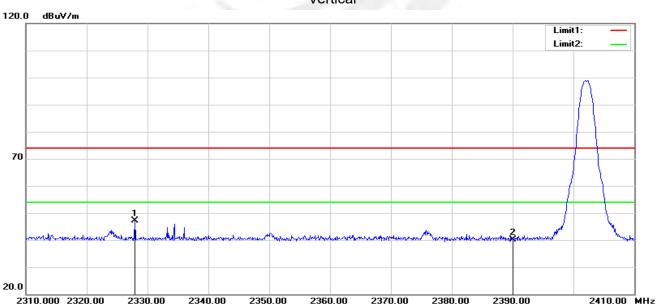
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Restricted band Requirements

GFSK-Low Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2324.100	66.62	-23.40	43.22	74.00	-30.78	peak
2	2390.000	63.70	-22.89	40.81	74.00	-33.19	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2327.900	70.49	-23.39	47.10	74.00	-26.90	peak
2	2390.000	63.06	-22.89	40.17	74.00	-33.83	peak

Vertical

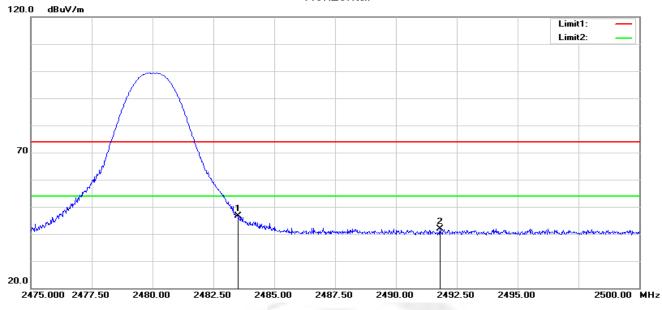
Shenzhen STS Test Services Co., Ltd.



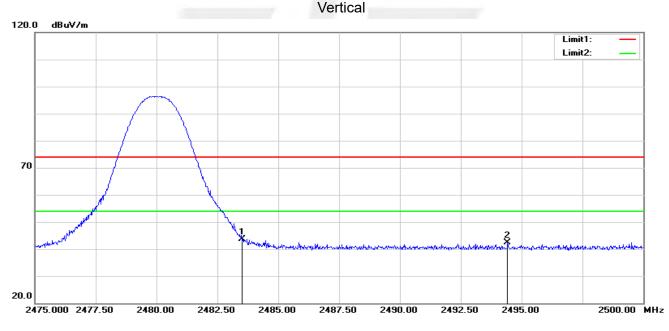
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GFSK-High Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	69.56	-22.94	46.62	74.00	-27.38	peak
2	2491.800	64.94	-22.94	42.00	74.00	-32.00	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	66.54	-22.94	43.60	74.00	-30.40	peak
2	2494.425	65.45	-22.95	42.50	74.00	-31.50	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

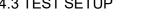
For Band edge

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







The EUT is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 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.



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4.5 TEST RESULTS

Temperature:	25 ℃	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps)-00/39/78 CH	Test Voltage:	DC 5V

00 CH

	ım Analyzer - Swe							
enter Fr	RF 50 Ω eq 12.5150	00000 GHz		nig: Free Run Atten: 30 dB	ALIGN AUTO Avg Typ	e: Log-Pwr		57 PM Dec 04, 21 TRACE 1 2 3 4 1 TYPE M WWW DET P P P P
) dB/div	Ref Offset 0.5 Ref 11.20 d							2.402 GH .202 dB
.20	1							
.80								-18.22 (
3.8								
3.8	2							
8.8					- manager	June mary	www.	mandelenandel
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B.8								
tart 30 M Res BW 1			#VBW 3	00 642			Stoj weep 2.39	p 25.00 GI
RENODE TRO		×	#VDW 3	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	s (1001 p
1 N 1 2 N 1 3 N 1 4 N 1 5	f f f f	2.402 GHz 2.502 GHz 7.995 GHz 24.551 GHz	1.202 dBm -46.436 dBm -55.313 dBm -48.721 dBm				FUNCTION VALUE	
6 7 8 9								
1								
G					STATUS			

39 CH

RL	RF	lyzer - Swept	AC		SENSE:INT		LIGNAUTO		03-23-5	7 PMDec 04, 2
			0000 GHz				Avg Type:	Log-Pwr	TF	RACE 1 2 3 4
			F	'NO: Fast 🕞 Gain:Low	Trig: Free I #Atten: 30	Run dB				DET P P P P
		Offset 0.5 d							Mkr1 2	.452 GI 380 dB
dB/div	Ref	11.38 dB	m							360 UE
38		<u>/</u>								
52										
.6			_							-16.20
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les BN	/ 100	KHZ		#VB	W 300 kHz				weep 2.39 s	s (1001 p
R MODE	TRC SCL		× 2.452 GHz	Y 1.380	FUNC	TION FUNC	CTION WIDTH		FUNCTION VALUE	
: N	1 f		3.526 GHz	-55.520	dBm					
	1 f 1 f		7.970 GHz 21.629 GHz	-55.989 -47.694						
	· ·		21.023 GHz	-47.034	ubiii					
							STATUS			



78 CH

RL RF 50 \$	veptSA Ω AC	SENSE:INT	ALIGN AUTO	03:2	6:41 PMDec 04, 20
enter Freq 12.515	000000 GHz	D: Fast 😱 Trig: Fre iin:Low #Atten: 3	Avg Type: e Run		TRACE 1 2 3 4 5 TYPE MWWW DET P P P P
Ref Offset 0 dB/div Ref 13.23					2.477 GH 3.234 dB
g 1					
77					
.8					-14.72
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o dian	ALL-ALL CONTRACTOR	A Contract of the second of th	and a state of the second state and	an mar and	a manunal
8					
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art 30 MHz tes BW 100 kHz		#VBW 300 kH	z	Sto Sweep 2.39	op 25.00 GI 9 s (1001 p
R MODE TRC SCL	×		NCTION FUNCTION WIDTH	FUNCTION VALUE	· ·
N 1 f N 1 f N 1 f N 1 f	2.477 GHz 2.577 GHz 5.224 GHz 24.401 GHz	3.234 dBm -49.594 dBm -56.190 dBm -48.715 dBm			
			STATUS		



Shenzhen STS Test Services Co., Ltd.





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

RL		Swept SA					
		OΩ AC	SENSE:II	TI	ALIGNAUTO Avg Type:	Log Dur	01:46:27 PMDec 04, TRACE 1 2 3
enter F	-req 2.353		PNO: Fast 🖵 Tris Gain:Low #At	g: Free Run ten: 30 dB	Avg Type.	Log-F wi	TYPE MWWW DET P P I
0 dB/div	Ref Offset Ref 11.7					N	1kr1 2.401 97 G 1.784 dE
og							<u> </u> 1
.78							l i i i i i i i i i i i i i i i i i i i
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	0000 GHz		#) (D) W 0.0	<u></u>		•	Stop 2.40700 G
tes BW	/ 100 kHz		#VBW 30	U KHZ			ep 10.3 ms (1001 p
R MODE T	TRC SCL	× 2.401 97 GHz	ĭ 1.784 dBm	FUNCTION	FUNCTION WIDTH	FU	INCTION VALUE
	1 f	2.324 08 GHz	-58.184 dBm				
			-55.025 dBm				
N	1 f 1 f	2.399 08 GHz 2.400 05 GHz					
N		2.399 08 GHz 2.400 05 GHz	-43.950 dBm				
8 N 4 N 5							
3 N							

00 CH

39 CH



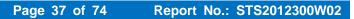


78 CH





Shenzhen STS Test Services Co., Ltd.

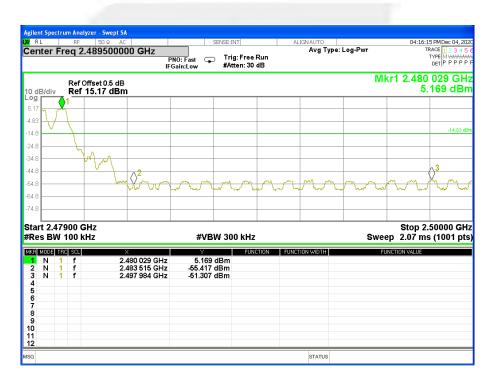




For Hopping Band edge

GFSK

	RF	50 Ω AC			SENSE:INT		ALI	GNAUTO				04:13:56	PMDec 04, 2
ente	r Freq 2	.35150000		PNO: Fast Gain:Low	⊃ Trig:Fro #Atten:	e Run 80 dB		Avg Ty	pe:Log	-Pwr		TR.	ACE 1 2 3 4 YPE M WWW DET P P P P
dB/d		Offset 0.5 dB 13.15 dBm	ı							N	/kr1 2		897 GH 146 dB
2g													
85													
.9													-16.85
.9											_		
.9						_							
.9												<u>2</u>	N
e AA	www	wwwww	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA		MAMAAA	NINAN	MM	MMMM	WWW	Mruu	www.h	wwww	mann
.9											-		
5.9 —											_		
art 2	2.30000 (3W 100 k			#VB	3W 300 KI	iz				Sw			0300 GI (1001 pi
art 2 ResE		(Hz 2.4	× 402 897 GHz 390 022 GHz	#VE 3.146 -56.101	dBm	IZ JNCTION	FUNCTI	ON WIDTH				.87 ms	
art 2 {es E N00 N 2 N 3 N	BW 100 k 1 f 1 f	(Hz 2. 2.	402 897 GHz	3.146	dBm dBm	-	FUNCTI	ON WIDTH			eep 9	.87 ms	
art 2 {es E N00 N 2 N 3 N	BW 100 k 1 f 1 f	(Hz 2. 2.	402 897 GHz 390 022 GHz	3.146 -56.101	dBm dBm	-	FUNCTI	ON WIDTH			eep 9	.87 ms	
art 2 Res E Res I N N N N N N N N N N N N N N N N N N N	BW 100 k 1 f 1 f	(Hz 2. 2.	402 897 GHz 390 022 GHz	3.146 -56.101	dBm dBm	-	FUNCTI	ON WIDTH			eep 9	.87 ms	
art 2 Res E N N N N N N N N	BW 100 k 1 f 1 f	(Hz 2. 2.	402 897 GHz 390 022 GHz	3.146 -56.101	dBm dBm	-	FUNCTI	ON WIDTH			eep 9	.87 ms	
art 2 Res E MOO N N N N N S N	BW 100 k 1 f 1 f	(Hz 2. 2.	402 897 GHz 390 022 GHz	3.146 -56.101	dBm dBm	-	FUNCTI	on width			eep 9	.87 ms	





Page 38 of 74 Report No.: STS2012300W02

Temperature:	25 ℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps)– 00/39/78 CH	Test Voltage:	DC 5V

00 CH

RL	RF	50 Ω AC		SENSE:INT		ALIGN AUTO		03:40):46 PM Dec 04, 21
enter F	req 12.	515000000 GH	IZ PNO: F IFGain:L		ree Run : 30 dB	Avg Type	: Log-Pwr		TRACE 1 2 3 4 TYPE M WWW DET P P P P
dB/div		set 0.5 dB 53 dBm							2.402 GF).471 dB
	1 (kei s								
5									
5									-18.19
5									
6	2								
5	Y		3			, sta whowing	and the stand and the state	and the second second	and the second
5	ساليساريهم	ang manufacture marting	whender	- man man and a second	and the state of t	when the state of	And the day and a		
5									
5									_
art 30 I es BW	MHz 100 kH	z		#VBW 300 F	(Hz		s	Sto weep 2.39	p 25.00 G s (1001 p
R MODE T	RC SCL	Х		Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
N	1 f 1 f	2.402 2.502	GHz	-0.471 dBm -46.906 dBm					
N	1 f 1 f	6.173 24.675		-55.537 dBm -47.907 dBm					
2									

39 CH

RL	um Analyzer - Sw RF 50 G	2 AC	SENSE:INT	ALI	IGN AUTO		03:43:21 PMDec 04, 20
		000000 GHz	0: Fast	ee Run	Avg Type: Lo		TRACE 1 2 3 4 5 TYPE MWWWW DET P P P P
dB/div	Ref Offset 0. Ref 12.47					Mk	r1 2.452 GH 2.471 dB
g 17	1						
3							
; —							-16.99
; 		3					
Nerveller-	marked agending	mathe and have a start	munip warman and	wanter and reaching of	man mark my a	and a stand of the	
5 							
5							
art 30 N es BW	/IHz 100 kHz		#VBW 300 ki	Hz			Stop 25.00 G 2.39 s (1001 p
MODE TR		×		UNCTION FUNCT	ION WIDTH	FUNCTION	ALUE
N 1 N 1 N 1	f	2.452 GHz 3.401 GHz 6.198 GHz 24.725 GHz	2.471 dBm -55.374 dBm -55.876 dBm -47.930 dBm				



78 CH

RL	RF 50 Ω	AC	SENSE:INT	ALIGN AUTO		03:46:04 PMDec 04, 2
enter F	req 12.5150	PN	0: Fast 🕞 Trig: Free F ain:Low #Atten: 30 d	Run	: Log-Pwr	TRACE 1 2 3 4 TYPE MWWW DET P P P
dB/div	Ref Offset 0.5 Ref 9.51 dE					Mkr1 2.477 GI -0.486 dB
49	1					
).5						-15.87
).5						
0.5						
0.5	<u>^2</u>					
).5	- the man	3	Man and the second and the second second	mented and a second and	manne	and a start and the start of th
).5 <mark></mark>	state and a state	Carlor of the second second	C. C			
0.5						
art 30 N Res BW	/IHz 100 kHz		#VBW 300 kHz		Swe	Stop 25.00 G ep 2.39 s (1001 p
(r Mode Tr	RC SCL	X	Y FUNC	TION FUNCTION WIDTH	FUN	CTION VALUE
1 N 1	f	2.477 GHz 2.577 GHz 5.548 GHz	-0.486 dBm -53.020 dBm -55.764 dBm			
B N 1 I N 1 5		24.625 GHz	-49.105 dBm			
3 N 1		24.625 GHz	-49.105 dBm			



Shenzhen STS Test Services Co., Ltd.





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

		lyzer - Swept SA								
RL	RF	50 Ω AC		S	ENSE:INT	AL	IGNAUTO AVG Type:	Lan Brin		6 PMDec 04, 20
Center H	-req 2	.35350000		PNO: Fast 😱 FGain:Low	Trig: Free R #Atten: 30 d		Avg Type:	Log-Pwr	1	RACE 1 2 3 4 5 TYPE MWWWM DET P P P P F
10 dB/div		Offset 0.5 dB 11.81 dBm						Ν	/kr1 2.40 1.	1 97 GH 813 dBr
Log										1
1.81										Å
8.19										-1819 dE
18.2										
-28.2										
38.2										<u>у</u> Г
48.2			$\langle \rangle^2$							
	ry~unlo	warden where and	met share was	alerentlymlanna	warmen had and	and a second	neekthinsteries	whenter	and the second	allan a
-68.2										
78.2										
Start 2.3 #Res BW				#VB\	V 300 kHz			Swe	Stop 2. ep 10.3 ms	40700 GH s (1001 pts
MKR MODE 1	TRCI SCLI	×		Y	FUNCT	ION FUNCT	ION WIDTH	E	UNCTION VALUE	
1 N 2 N 3 N	1 f 1 f 1 f	2 2 2	.401 97 GHz .323 97 GHz .399 40 GHz	1.813 c -57.385 c -44.801 c	iBm IBm IBm					
4 N 5	1 f	2	.400 05 GHz	-37.835 c	BIII					
6 7										
8										
10										
11 12										
12										

00 CH

39 CH



Shenzhen STS Test Services Co., Ltd.



78 CH





Shenzhen STS Test Services Co., Ltd.

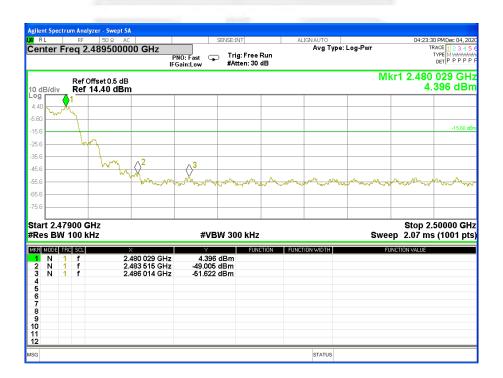




For Hopping Band edge

π/4-DQPSK

RL		Analyzer RF	- Swept 9				SENSE:	INT		ALI	GNAUTO					04:21:11	PMDec 04,
				000 GH	Р	NO: Fast Gain:Low	Tr	ig: Free tten: 30				ype: L	og-Pwr			TR. T	ACE 1 2 3 YPE M WAAA DET P P P
B/div			et 0.5 dE 29 dB											Mk	(r1 2.		000 G 288 dE
9																	
1							_										
-							_										-17.71
																	/
,																	
	InnAi	11000	المراجر	Annana	when	anga anga a	when	MAN.	why	ሌላሌ	www	Work	w.	wheaton		$\sqrt{2}$	a wall
		× •••											6.0	101-61-01	ALCOND.	0.000	to shaved
-							_										
		0 GHz	:														0300 G
		0 kHz				#V	'BW 30								· ·		(1001
MODE N		CL		× 2.403 000	GHz	2.2	38 dBm	FUN	CTION	FUNCTI	ON WIDTH			FU	NCTION V	ALUE	
N		f f		2.390 022			53 dBm 51 dBm										
					0.12	-10.21											



Shenzhen STS Test Services Co., Ltd.



Page 43 of 74 Report No.: STS2012300W02

Temperature:	25℃	Relative Humidity:	50%		
Test Mode:	8DPSK(3Mbps) -00/39/78 CH	Test Voltage:	DC 5V		

00 CH

RL	ectrum Ar Ri	alyzer - Swe 50 Ω		SENSE:INT		ALIGNAUTO		03:50:1	L2 PM Dec 04, 20
			00000 GHz	0: East Trig:	Free Run n: 30 dB	Avg Type:	Log-Pwr	т	TYPE MWWW DET P P P F
0 dB/di		f Offset 0.5 f 8.46 dB							.402 G⊦ 543 dB
og 1.54		1							
1.5									-18.29
1.5									
1.5		A2	- 2						
1.5	-	Jamer	Warman and	Regard and and the second	بلي المريد مريع م ويندم	ma and many and	and a stand and the second	war had have	William and the
1.5 1.5									
1.5									
	0 MHz W 100	kHz		#VBW 300	kHz		Sw	Stop eep 2.39	25.00 GI s (1001 p
	TRC SC		×	Y I	FUNCTION FU	NCTION WIDTH	FU	NCTION VALUE	
1 N 2 N 3 N 4 N 5	1 f 1 f 1 f 1 f		2.402 GHz 2.502 GHz 6.073 GHz 24.426 GHz	-1.543 dBm -50.008 dBm -56.076 dBm -47.905 dBm					
5 7									
в									
8 9 0 1 2									

39 CH

	rum Analyzer - Swep							
LXI RL	RF 50 Ω		SENSE:IN	Т	ALIGN AUTO			B PM Dec 04, 202
Center F	req 12.51500	PN		Free Run en: 30 dB	Avg Type	: Log-Pwr	TF	TYPE M WWWWW DET P P P P P
10 dB/div	Ref Offset 0.5 Ref 7.41 dB							452 GH: 592 dBn
-2.59	1							
-12.6								-17.02 dBr
-22.6								
-32.6	.2							A
-42.6	<u>v</u>	\Diamond^3			- Andrew	and the second second	man	and the second second
-62.6	monther	, mar and a second a second	an and a start and a second	here and here and here	and the state of t	(here the second se		
-72.6								
-82.6								
Start 30 I #Res BW			#VBW 300	kHz		Sv	Stop veep 2.39 s	25.00 GHz (1001 pts
MKR MODE T	RC SCL	× 2.452 GHz	-2.592 dBm	FUNCTION	FUNCTION WIDTH	F	UNCTION VALUE	
2 N 3 N	f f f	2.432 GHz 2.552 GHz 6.547 GHz 24.675 GHz	-50.526 dBm -55.593 dBm -48.082 dBm					
5								
7 8								
11 12								
MSG					STATUS			



78 CH

RL RF 50	Swept SA	SENSE:INT	ALIGN AUTO		03:56:34 PMDec 04, 20
enter Freq 12.51	5000000 GHz	0: Fast	Avg Type e Run	: Log-Pwr	TRACE 1 2 3 4 5 TYPE MWWWW DET P P P P F
Ref Offset dB/div Ref 13.24				MI	(r1 2.477 GF 3.243 dB
24					
76					
5.8					-15.72 (
i.8					
2					
8		HUML MAN AND MANY MANY	were and	hand with the second	when when the
.8					
.8					
art 30 MHz Res BW 100 kHz		#VBW 300 kH	lz	Sweep	Stop 25.00 Gi 2.39 s (1001 pi
R MODE TRC SCL	×	Y FI	UNCTION FUNCTION WIDTH	FUNCTION	
N 1 f N 1 f N 1 f N 1 f	2.477 GHz 2.577 GHz 7.022 GHz 24.700 GHz	3.243 dBm -50.670 dBm -55.780 dBm -48.468 dBm			



Shenzhen STS Test Services Co., Ltd.





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

	Spectru		alyzer - Swept S									
LXI RL		RF	50 Ω A			SENSE:INT		ALIGN			03	3:49:42 PM Dec 04, 2
Cente	ər Fr	eq 2	2.3535000	P	'NO: Fast Gain:Low	⊃ Trig: Fre #Atten: \$			Avg Type:	Log-Pwr		TRACE 1 2 3 4 TYPE M WAWA DET P P P P
10 dB <i>i</i> Log г	div		Offset 0.5 dB 11.71 dBr								Mkr1 2	.401 97 GH 1.714 dB
1.71 -												 1
-8.29 —												<u> </u>
-18.3												-18 29 0
-28.3 -												
-38.3 -												- 1 (Y L
-48.3 -												y
-58.3	المحدراهم		bermaterinomo	mithuman	halloun	n ordower and	manhles	Unowhered	- Almontalia	and a starter	http://www.strill.withle	aller to a fil
-78.3 -												
 Start	2 200	000	CU-								Ota	p 2.40700 Gł
#Res					#VB	W 300 kł	łz			Sw		p 2.40700 Gr 3 ms (1001 pt
MKR MC				X	Y		UNCTION	FUNCTION	WIDTH		FUNCTION VAL	LUE
1 N 2 N 3 N 5 6 7 8 9	1 1 1	f f f		2.401 97 GHz 2.324 08 GHz 2.399 40 GHz 2.400 05 GHz	1.714 -57.748 -44.499 -38.465	dBm						
5 6 7												
8												
10 11												
12												
MSG									STATUS			

00 CH

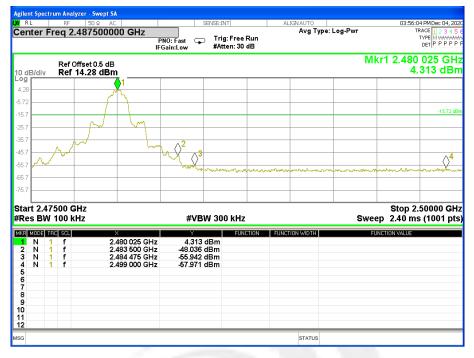
39 CH



Shenzhen STS Test Services Co., Ltd.



78 CH





Shenzhen STS Test Services Co., Ltd.

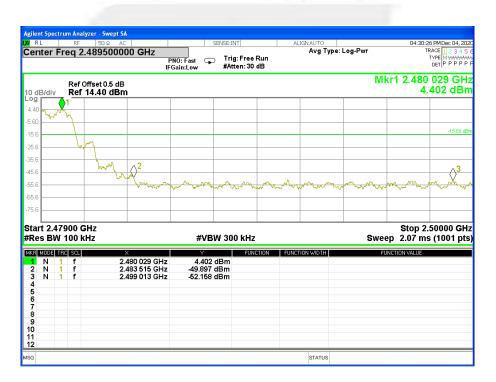




For Hopping Band edge

8DPSK

	RF	50 Ω AC			SENSE:INT	AL	IGN AUTO		04:28:08 P	MDec 04, 2
enter F	req 2.3	35150000		PNO: Fast Gain:Low	⊃ Trig: Free #Atten: 30	Run dB	Avg Type:	Log-Pwr	TYP	E 1 2 3 4 E M WWW T P P P P
dB/div		ffset 0.5 dB 2.33 dBm	1					М	kr1 2.403 0 2.3:	00 Gł 25 dB
33										
57										
.7										-17.68
.7										
.7										(
.7									^2	
7 ALA	AMMA	AVAMANA	ስለኤስሲካቢላሌ	MARAMAN	amanna	MAAAAAAAA	www.www	MM	wwwwwww	and the
7										
.7										
						_		Cura	Stop 2.40 ep 9.87 ms (
	0000 GI / 100 kH			#VB	SW 300 kHz	2		Swe	eh aroumet	
es BW	i 100 ki	Hz ×		Y	FUN	Z	ION WIDTH		unotion value	
es BW	/ 100 kl	Hz 2.4 2.3	403 000 GHz 390 022 GHz 400 013 GHz	Y	dBm dBm	_	ION WIDTH		• •	
es BW	/ 100 kH RC SCU 1 f 1 f	Hz 2.4 2.3	403 000 GHz 390 022 GHz	¥ 2.325 -58.087	dBm dBm	_	ION WIDTH		• •	
N N N N	/ 100 kH RC SCU 1 f 1 f	Hz 2.4 2.3	403 000 GHz 390 022 GHz	¥ 2.325 -58.087	dBm dBm	_	ION WIDTH		• •	
R MODE N 2 N 3 N 4 5 5 7 8	/ 100 kH RC SCU 1 f 1 f	Hz 2.4 2.3	403 000 GHz 390 022 GHz	¥ 2.325 -58.087	dBm dBm	_	ION WIDTH		• •	
es BW	/ 100 kH RC SCU 1 f 1 f	Hz 2.4 2.3	403 000 GHz 390 022 GHz	¥ 2.325 -58.087	dBm dBm	_	ION WIDTH		• •	
es BW	/ 100 kH RC SCU 1 f 1 f	Hz 2.4 2.3	403 000 GHz 390 022 GHz	¥ 2.325 -58.087	dBm dBm	_	ION WIDTH		• •	



Shenzhen STS Test Services Co., Ltd.



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.



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5.5 TEST RESULTS

Temperature:	25 ℃	Relative Humidity:	60%
Test Mode:	Hopping Mode -GFSK Mode	Test Voltage:	DC 5V

Number of Hopping Channel

gileni Spectrum Analyzer - Sw				
Center Freq 2.4417	50000 CH2	SENSE:INT	Avg Type: Log-Pwr	04:11:37 PMDec 04, 202
senter Freq 2.4417	PNO: IFGair	Fast Trig: Free Run #Low #Atten: 30 dB	Ang the cold at	DET P P P P P
Ref Offset 0. Ref 15.38	5 dB dBm		Mk	r2 2.480 160 0 GHz 5.38 dBm
				2
A DE ANY YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY	MAMMAN	ULTANI ALAAN AAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	(WYYYYYYYYYYYYYYYYYYYY	AAAAAAAAAAAAAAAA
146				
34.6				h.
44.5				
54.6				
64.6				
715				
	_			
Start 2.40000 GHz #Res BW 300 kHz		#VBW 300 kHz	Sw	Stop 2.48350 GH2 eep 1.13 ms (1001 pts
MXR MODE THE SEL	2.402 171 0 GHz	3.30 dBm	FUNCTION WIDTH	FUNCTION VALUE
1 N I F 2 N I F 3 4 5 6 6 7 8 9 9 10 11	2.402 171 0 GHz 2.480 160 0 GHz	5.38 dBm		
4				
6				
7 8				
9				
11				

Hopping channel



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(1Mbps)-DH1/DH3/DH5	Test Voltage:	DC 5V

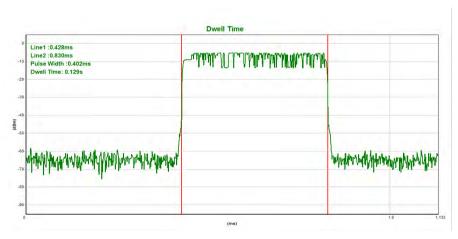
Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
DH1	middle	0.402	0.129	0.4
DH3	middle	1.662	0.266	0.4
DH5	middle	2.909	0.310	0.4



Shenzhen STS Test Services Co., Ltd.



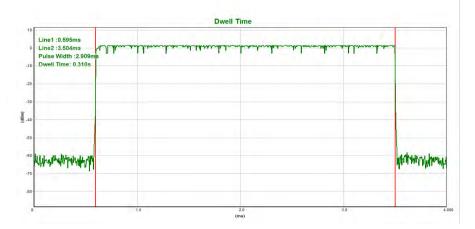
CH39-DH1



CH39-DH3



CH39-DH5



Shenzhen STS Test Services Co., Ltd.



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Temperature:	25 ℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps)– 2DH1/2DH3/2DH5	Test Voltage:	DC 5V

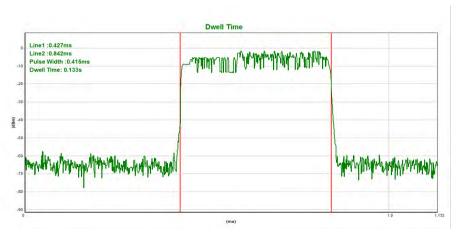
Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
2DH1	middle	0.415	0.133	0.4
2DH3	middle	1.671	0.267	0.4
2DH5	middle	2.921	0.312	0.4



Shenzhen STS Test Services Co., Ltd.



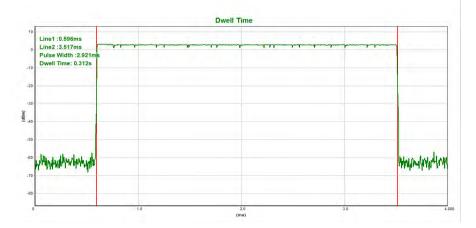
CH39-2DH1



CH39-2DH3



CH39-2DH5



Shenzhen STS Test Services Co., Ltd.



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Temperature:	25 ℃	Relative Humidity:	50%
	8DPSK(3Mbps)– 3DH1/3DH3/3DH5	Test Voltage:	DC 5V

Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
3DH1	middle	0.415	0.133	0.4
3DH3	middle	1.668	0.267	0.4
3DH5	middle	2.921	0.312	0.4



Shenzhen STS Test Services Co., Ltd.



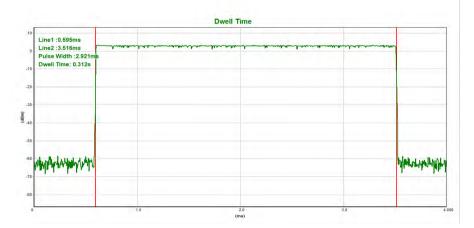
CH39-3DH1



CH39-3DH3



CH39-3DH5



Shenzhen STS Test Services Co., Ltd.



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%
	CH00 / CH39 / CH78 (GFSK(1Mbps) Mode)	Test Voltage:	DC 5V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2402.014	2403.013	0.999	0.864	Complies
2441 MHz	2441.017	2442.016	0.999	0.857	Complies
2480 MHz	2479.017	2480.019	1.002	0.857	Complies

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

CH00 -1Mbps



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CH39 -1Mbps



CH78 -1Mbps



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Temperature:	25℃	Relative Humidity:	50%
Test Mode:	CH00 / CH39 / CH78 (π/4-DQPSK(2Mbps) Mode)	Test Voltage:	DC 5V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2402.014	2403.016	1.002	0.813	Complies
2441 MHz	2441.017	2442.016	0.999	0.817	Complies
2480 MHz	2479.017	2480.013	0.996	0.817	Complies

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

RL	RF 50 Ω	AC AC	SENSE:INT	ALIGN AUTO	03:41:24 PMDec 04, 2
enter F	req 2.4025	00000 GHz PNO: V IFGain:		Avg Type: Log-Pwr	TRACE 1 2 3 4 TYPE M WAAA DET P P P P
dB/div	Ref Offset 0. Ref 11.28				Mkr2 2.403 016 GI 1.922 dB
28			⟩1	2	
72					~
	~		- man mar		
.7					
.7					
.7					
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	400500 011				0
	.402500 GHz ' 30 kHz		#VBW 100 kHz	s	Span 3.000 M weep 3.20 ms (1001 p
R MODE T	RC SCL	X	Y FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
	1 f 1 f	2.402 014 GHz 2.403 016 GHz	1.28 dBm 1.92 dBm		
	1 1	2.403 016 GH2	1.92 UDm		
i –					
;					
'					
•					
• •					

CH00 -2Mbps

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CH39 -2Mbps



CH78 -2Mbps



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Temperature:	25℃	Relative Humidity:	50%
Lest Minde.	CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)	Test Voltage:	DC 5V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2402.017	2403.016	0.999	0.814	Complies
2441 MHz	2441.017	2442.016	0.999	0.815	Complies
2480 MHz	2479.020	2480.019	0.999	0.815	Complies

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

CH00 -3Mbps

	50 Ω AC	SENSE:INT	ALIGN AUTO	03:50:53 PMDec 04, 20
enter Freq 2.	402500000 GHz	PNO: Wide Trig: Fre		g-Pwr TRACE 1 2 3 4 5 TYPE M WWW DET P P P P
	ffset 0.5 dB	IFGail.LUW Witten		Mkr2 2.403 016 GH 1.884 dBr
l0 dB/div Ref	11.28 dBm			1.004 UDI
1.28			2	
8.72				m
18.7				
				- my
28.7				
38.7				V
48.7				
58.7				
8.7				
78.7				
enter 2.40250				Span 3.000 MI
Center 2.402500 Res BW 30 kH		#VBW 100 kH		Sweep 3.20 ms (1001 pt
Center 2.402500 Res BW 30 kH	z ×	Y FL	Z	Span 3.000 Mł Sweep 3.20 ms (1001 pł FUNCTIONNALUE
enter 2.402500 Res BW 30 kH	z	Y FU z 1.28 dBm		Sweep 3.20 ms (1001 pt
enter 2.402500 Res BW 30 kH 1 N 1 f 2 N 1 f 3	z 2.402 017 GH	Y FU z 1.28 dBm		Sweep 3.20 ms (1001 pt
Center 2.402500 Res BW 30 kH 1 N 1 f 2 N 1 f 3 4	z 2.402 017 GH	Y FU z 1.28 dBm		Sweep 3.20 ms (1001 pt
Eenter 2.402500 Res BW 30 kH 1 N 1 f 2 N 1 f 3 4 5 6	z 2.402 017 GH	Y FU z 1.28 dBm		Sweep 3.20 ms (1001 pt
Center 2.402500 Res BW 30 kH 1 N 1 f 2 N 1 f 3 4 5 6 7	z 2.402 017 GH	Y FU z 1.28 dBm		Sweep 3.20 ms (1001 pt
Center 2.402500 Res BW 30 kH 1 N 1 f 2 N 1 f 3 4 5 6 7 8 9	z 2.402 017 GH	Y FU z 1.28 dBm		Sweep 3.20 ms (1001 pt
enter 2.402500 Res BW 30 kH: 1 N 1 f 2 N 1 f 3 4 5 5 6 7 8 9 9	z 2.402 017 GH	Y FU z 1.28 dBm		Sweep 3.20 ms (1001 pt
enter 2.402500 Res BW 30 kH 1 N 1 f 2 N 1 f 3 4 5 6 7 8 9	z 2.402 017 GH	Y FU z 1.28 dBm		Sweep 3.20 ms (1001 pt

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CH39 -3Mbps



CH78 -3Mbps



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8. BANDWIDTH TEST

8.1 LIMIT

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

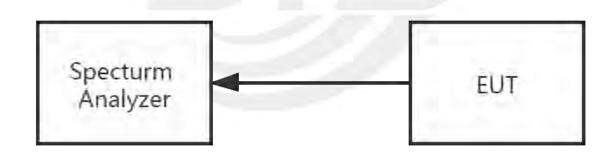
Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RB	30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)
VB	100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

8.2 TEST PROCEDURE

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

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

8.3 TEST SETUP



8.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



8.5 TEST RESULTS

Temperature:	25℃	Relative Humidity:	50%
Lest Minde.	GFSK(1Mbps) CH00 / CH39 / C78	Test Voltage:	DC 5V

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	0.8635	PASS
2441 MHz	0.8574	PASS
2480 MHz	0.8574	PASS

CH00 -1Mbps

gilent Spectrum Analyzer - Occupied B	N			
RL RF 50Ω AC		SENSE:INT Center Freg: 2.4020000	ALIGN AUTO	01:45:48 PMDec 04, 20 Radio Std: None
enter Freq 2.40200000		Trig: Free Run	Avg Hold:>10/10	Radio Sta. None
	#IFGain:Low	#Atten: 30 dB	-	Radio Device: BTS
Ref Offset 0.5 dB 0 dB/div Ref 20.00 dBm	1			
og				
0.0				
.00		\sim		
0.0				
				\sim
0.0				
0.0				
0.0				
enter 2.402 GHz Res BW 30 kHz		#VBW 100 ki	Hz	Span 2 MH Sweep 2.733 n
Occupied Bandwidt	h	Total Power	8.52 dBm	
8	37.86 kHz			
Transmit Freq Error	14.426 kHz	OBW Power	99.00 %	
x dB Bandwidth	863.5 kHz	x dB	-20.00 dB	
a			STATUS	

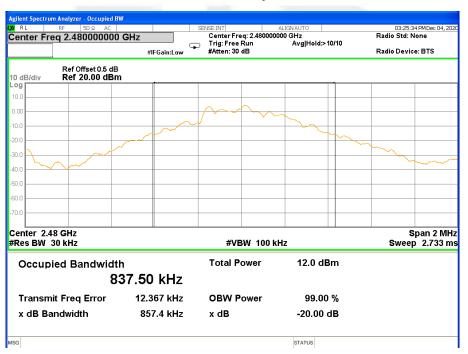
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CH39 -1Mbps



CH78 -1Mbps



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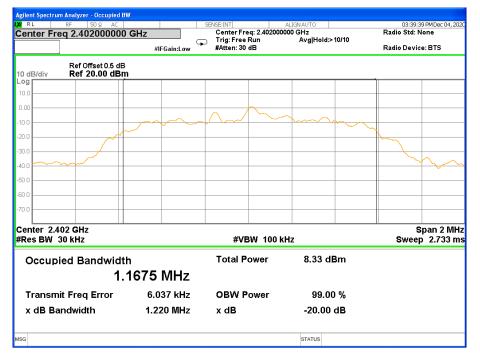


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Temperature:	25℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps) CH00 / CH39 / C78	Test Voltage:	DC 5V

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.22	PASS
2441 MHz	1.226	PASS
2480 MHz	1.225	PASS

CH00 -2Mbps



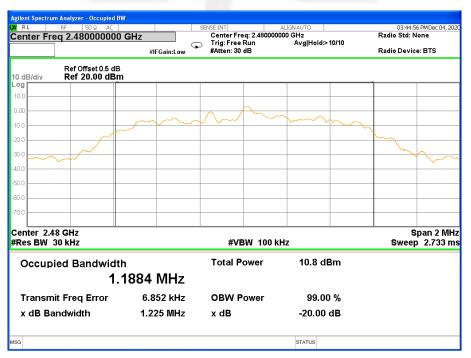
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CH39 -2Mbps



CH78 -2Mbps



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Temperature:	25℃	Relative Humidity:	50%
	8DPSK(3Mbps) CH00 / CH39 / CH78	Test Voltage:	DC 5V

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.221	PASS
2441 MHz	1.223	PASS
2480 MHz	1.222	PASS

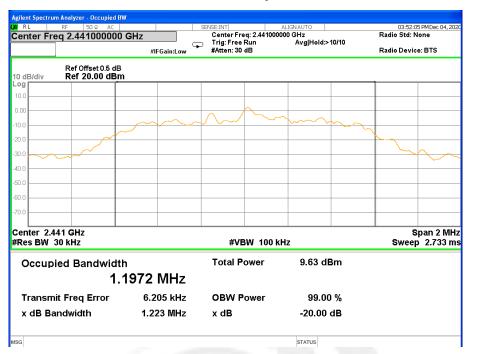
CH00 -3Mbps

gilent Spectrum Analyzer - Occupied BW	/			
RL RF 50 Ω AC	GHz	Center Freq: 2.402000		03:47:56 PMDec 04, 20 Radio Std: None
		➡ Trig: Free Run #Atten: 30 dB	Avg Hold:>10/10	Radio Device: BTS
Ref Offset 0.5 dB dB/div Ref 20.00 dBm				
og				
0.0				
.00				
			m	~
.0				- may -
.0				
.0				
.0				
0.0				
1.0				
enter 2.402 GHz Res BW 30 kHz		#VBW 100 k	Hz	Span 2 Mi Sweep 2.733 r
Occupied Bandwidth	1	Total Power	8.25 dBm	
1.1	1673 MHz			
Transmit Freq Error	6.382 kHz	OBW Power	99.00 %	
x dB Bandwidth	1.221 MHz	x dB	-20.00 dB	
6			STATUS	

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CH39 -3Mbps



CH78 -3Mbps



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9. OUTPUT POWER TEST

9.1 LIMIT

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

9.2 TEST PROCEDURE

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

a) Use the following spectrum analyzer settings:

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

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

3) VBW \geq RBW.

4) Sweep: Auto.

5) Detector function: Peak.

6) Trace: Max hold.

b) Allow trace to stabilize.

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

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

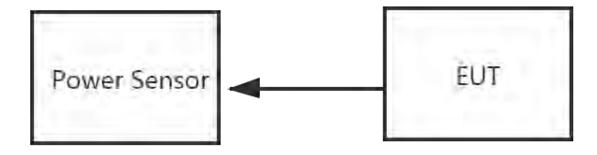
e) A plot of the test results and setup description shall be included in the test report.

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

PKPM1 Peak power meter method:

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DSS bandwidth and shall use a fast-responding diode detector.

9.3 TEST SETUP



9.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

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9.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Voltage:	DC 5V		

Mode		Peak Power	Average Power	Limit	
Mode	Number	(MHz)	(dBm)	(dBm)	(dBm)
	0	2402	3.21	-2.38	30.00
GFSK(1M)	39	2441	4.62	-1.08	30.00
	78	2480	5.44	-0.11	30.00

Note: the channel separation >20dB bandwidth

	Channel			Average Power	Limit
Mode	Number	(MHz)	(dBm)	(dBm)	(dBm)
	0	2402	2.58	-3.74	20.97
π/4-DQPSK(2M)	39	2441	3.95	-1.85	20.97
,	78	2480	4.91	-0.95	20.97

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

Mode Channel	Mode Channel Frequency	Peak Power	Average Power	Limit	
Mode		(MHz)	(dBm)	(dBm)	(dBm)
	0	2402	2.38	-4.24	20.97
8-DPSK(3M)	39	2441	3.81	-2.18	20.97
	78	2480	4.63	-1.44	20.97

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



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 Ceramic 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.



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