

RADIO TEST REPORT

Report No.: STS2101080W01

Issued for

Ningbo Tonwel Audio Co., LTD

No. 28 Xiyi Road, Jiangshan Town, Yinzhou, Ningbo, China

Product Name:	ACTIVE SPEAKER	
Brand Name:	HARBINGER	
Model Name:	V2308	
Series Model:	V2310	
FCC ID:	2AIQW-V2310	
Test Standard:	FCC Part 15.247	

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TEST RESULT CERTIFICATION

Applicant's Name:	Ningbo Tonwel Audio Co., LTD
Address	No. 28 Xiyi Road, Jiangshan Town, Yinzhou, Ningbo, China
Manufacturer's Name:	Ningbo Tonwel Audio Co.,LTD
Address	No. 500 Qihang Road, Zhanqi Town, Yinzhou, Ningbo Zhejiang, China.
Product Description	
Product Name:	ACTIVE SPEAKER
Brand Name:	HARBINGER
Model Name:	V2308
Series Model:	V2310
Test Standards:	FCC Part15.247
Test Procedure:	ANSI C63.10-2013

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test.....:

Date of receipt of test item.....: 13 Jan. 2021

Date (s) of performance of tests .: 13 Jan. 2021 ~ 20 Jan. 2021

Date of Issue: 20 Jan. 2021

Test Result Pass

Testing Engineer

(Chris Chen)

Technical Manager

(Sean she)



Authorized Signatory :

(Vita Li)

Shenzhen STS Test Services Co., Ltd.

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	20 Jan. 2021	STS2101080W01	ALL	Initial Issue



Shenzhen STS Test Services Co., Ltd.



1. SUMMARY OF TEST RESULTS

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

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

NOTE:

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

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



1.1 TEST FACTORY

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

1.2 MEASUREMENT UNCERTAINTY

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

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



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

ACTIVE SPEAKER
HARBINGER
V2308
V2310
Both of models have the same circuit schematic, construction, PCB Lavout and critical components. The difference is horn size and lead to different power, function and configuration are different therefore model name is different.
Please refer to the Note 2.
Frequency:2402 – 2480 MHz Modulation: GFSK(1Mbps), π/4-DQPSK(2Mbps), 8DPSK(3Mbps)
5.0
BR+EDR
Please refer to the Note 3.
Input: AC 110-120V / AC 220-240V;4.0A;100W
N/A
N/A
Please refer to the Note 1.

Note:

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

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2.

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

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	HARBINGER	V2308	РСВ	N/A	0dBi	BT Antenna

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

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2.2 DESCRIPTION OF THE TEST MODES

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

Worst Mode	Description	Data Rate/Modulation
Mode 1	TX CH00	1Mbps/GFSK
Mode 2	TX CH39	1Mbps/GFSK
Mode 3	TX CH78	1Mbps/GFSK
Mode 4	TX CH00	2 Mbps/π/4-DQPSK
Mode 5	TX CH39	2 Mbps/π/4-DQPSK
Mode 6	TX CH78 2 Mbps/π/4-DQP	
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.



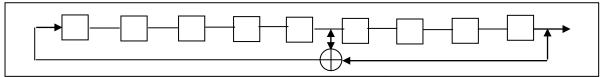
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The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping 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.

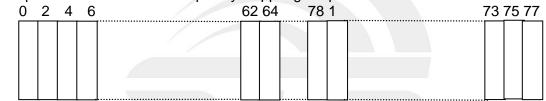
(2)The Pseudorandom sequence may be generated in a nin-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones: i.e. the shift register is initialized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



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.

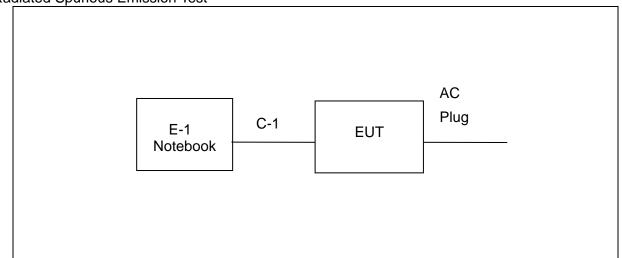
Test software Version	Test program: Bluetooth				
(Power control software) Parameters(1/2/3Mbps)	Power class: DH1 rate:4:27 2DH1 rate:20:54 3DH1 rate:24:83	Power class: DH3 rate:11:183 2DH3 rate:26:367 3DH3 rate:27:552	Power class: DH5 rate:15:339 2DH5 rate:30:679 3DH5 rate:31:1021		

RF Function	Туре	Mode Or Modulation type	ANT Gain(dBi)	Power Class	Software For Testing
		GFSK	0	7	
BT	BR+EDR	π/4-DQPSK	0	7	BT_Tool
		8DPSK	0	7	

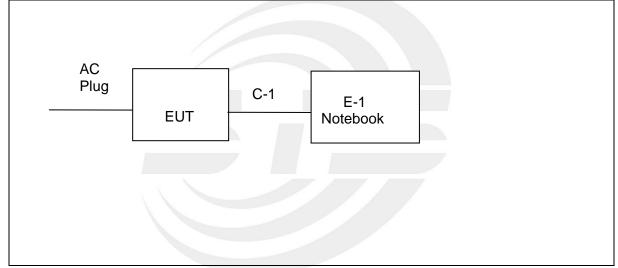




2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED Radiated Spurious Emission Test



Conducted Emission Test



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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-1	Notebook	LENOVO	ThinkPad E470	N/A	N/A
C-1	USB Cable	N/A	N/A	150cm	N/A

Note:

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



2.7 EQUIPMENTS LIST

Radiation Test equipment

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

Conduction Test equipment

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



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RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until		
		-	MY55520005	2020.10.10	2021.10.09		
Power Sensor	r Kovoight		MY55520006	2020.10.10	2021.10.09		
Fower Sensor	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	Kovoight	U2021XA	MY55520005	2020.10.10	2021.10.09		
measurement test Set	Keysight	0202174	WIT 00020000	2020.10.10	2021.10.09		
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)					



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3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

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

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

Note:

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

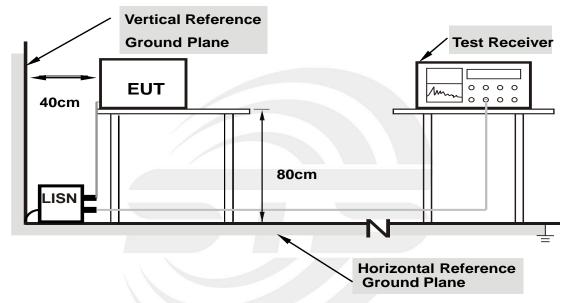
The following table is the setting of the receiver

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



3.1.2 TEST PROCEDURE

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



3.1.3 TEST SETUP

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

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

3.1.4 EUT OPERATING CONDITIONS

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



3.1.5 TEST RESULT

Temperature:	22.0(C)	Relative Humidity:	36%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 13		

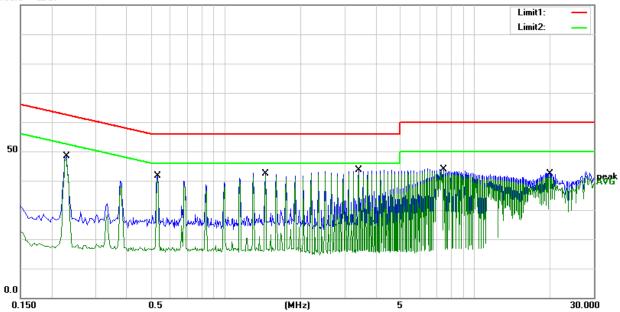
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.2300	27.98	20.44	48.42	62.45	-14.03	QP
2	0.2300	27.24	20.44	47.68	52.45	-4.77	AVG
3	0.5340	21.02	20.51	41.53	56.00	-14.47	QP
4	0.5340	19.85	20.51	40.36	46.00	-5.64	AVG
5	1.4420	22.15	20.30	42.45	56.00	-13.55	QP
6	1.4420	21.26	20.30	41.56	46.00	-4.44	AVG
7	3.4180	23.19	20.37	43.56	56.00	-12.44	QP
8	3.4180	22.36	20.37	42.73	46.00	-3.27	AVG
9	7.5180	23.31	20.68	43.99	60.00	-16.01	QP
10	7.5180	22.34	20.68	43.02	50.00	-6.98	AVG
11	19.7460	19.55	22.84	42.39	60.00	-17.61	QP
12	19.7460	18.42	22.84	41.26	50.00	-8.74	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:	22.0(C)	Relative Humidity:	36%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 13		

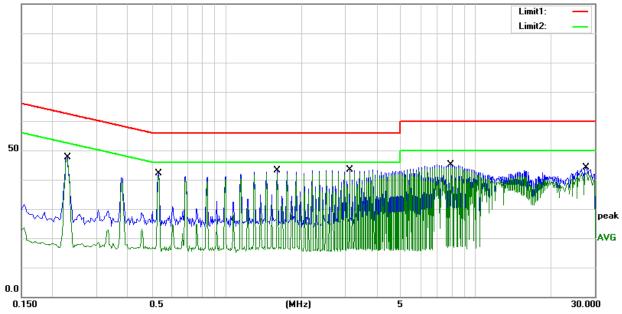
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.2300	27.24	20.44	47.68	62.45	-14.77	QP
2	0.2300	26.64	20.44	47.08	52.45	-5.37	AVG
3	0.5340	21.72	20.51	42.23	56.00	-13.77	QP
4	0.5340	20.57	20.51	41.08	46.00	-4.92	AVG
5	1.5940	22.80	20.30	43.10	56.00	-12.90	QP
6	1.5940	21.68	20.30	41.98	46.00	-4.02	AVG
7	3.1140	23.06	20.35	43.41	56.00	-12.59	QP
8	3.1140	21.91	20.35	42.26	46.00	-3.74	AVG
9	7.9020	24.33	20.76	45.09	60.00	-14.91	QP
10	7.9020	23.67	20.76	44.43	50.00	-5.57	AVG
11	27.5780	21.37	22.78	44.15	60.00	-15.85	QP
12	27.5780	19.58	22.78	42.36	50.00	-7.64	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)

	(dBuV/m) (at 3M)			
FREQUENCY (MHz)	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: 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.

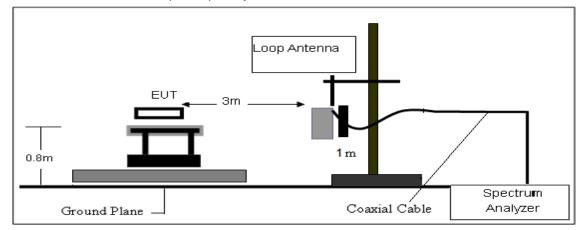
3.2.3 DEVIATION FROM TEST STANDARD

No deviation.

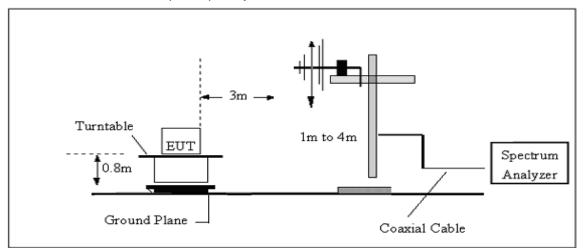


3.2.4 TESTSETUP

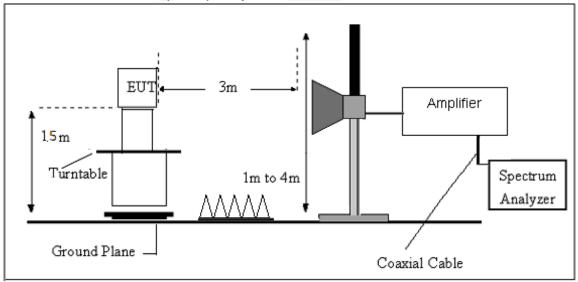
(A) Radiated Emission Test-Up Frequency Below 30MHz

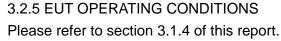


(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



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

For example

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

Factor=AF+CL-AG



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3.2.7 TEST RESULTS

(9KHz-30MHz)

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

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

Note:

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

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





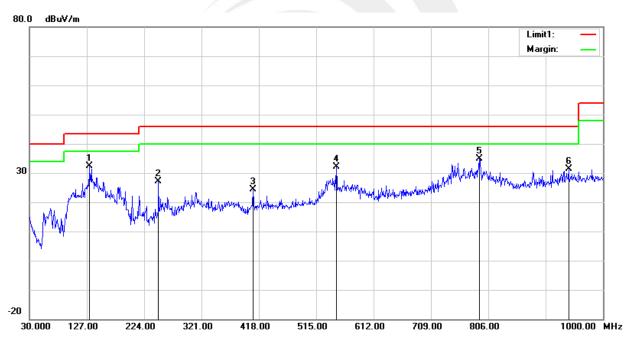
(30MHz-1000MHz)

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

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	131.8500	50.50	-18.20	32.30	43.50	-11.20	QP
2	248.2500	43.57	-16.43	27.14	46.00	-18.86	QP
3	408.3000	35.03	-10.66	24.37	46.00	-21.63	QP
4	548.9500	38.01	-5.88	32.13	46.00	-13.87	QP
5	790.4800	36.76	-1.97	34.79	46.00	-11.21	QP
6	941.8000	29.96	1.42	31.38	46.00	-14.62	QP

Remark:

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





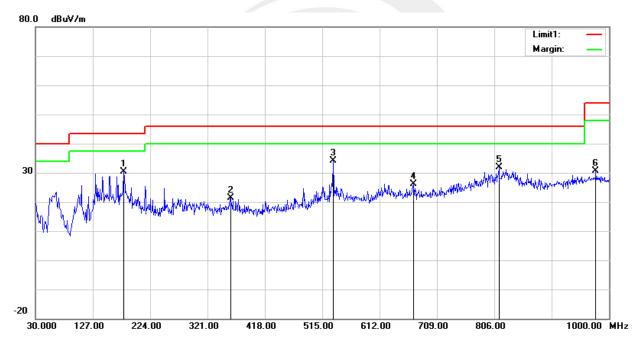
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Temperature:	23.1(C)	Relative Humidity:	60%RH		
Test Voltage:	AC 120V/60Hz	Phase:	Vertical		
Test Mode:	Mode 1/2/3/4/5/6/7/8/9(Mode 7 worst mode)				

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	179.3800	50.43	-20.02	30.41	43.50	-13.09	QP
2	359.8000	34.32	-12.87	21.45	46.00	-24.55	QP
3	533.4300	41.49	-7.25	34.24	46.00	-11.76	QP
4	669.2300	30.73	-4.60	26.13	46.00	-19.87	QP
5	813.7600	33.84	-1.98	31.86	46.00	-14.14	QP
6	977.6900	28.15	2.52	30.67	54.00	-23.33	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 Cha	annel (8-DPSK	/2402 MHz)				
3264.79	61.04	44.70	6.70	28.20	-9.80	51.24	74.00	-22.76	PK	Vertical
3264.79	50.52	44.70	6.70	28.20	-9.80	40.72	54.00	-13.28	AV	Vertical
3264.58	61.72	44.70	6.70	28.20	-9.80	51.92	74.00	-22.08	PK	Horizontal
3264.58	50.14	44.70	6.70	28.20	-9.80	40.34	54.00	-13.66	AV	Horizontal
4804.40	59.51	44.20	9.04	31.60	-3.56	55.95	74.00	-18.05	PK	Vertical
4804.40	49.39	44.20	9.04	31.60	-3.56	45.83	54.00	-8.17	AV	Vertical
4804.56	59.37	44.20	9.04	31.60	-3.56	55.81	74.00	-18.19	PK	Horizontal
4804.56	49.17	44.20	9.04	31.60	-3.56	45.61	54.00	-8.39	AV	Horizontal
5359.88	48.75	44.20	9.86	32.00	-2.34	46.41	74.00	-27.59	PK	Vertical
5359.88	40.29	44.20	9.86	32.00	-2.34	37.95	54.00	-16.05	AV	Vertical
5359.79	48.15	44.20	9.86	32.00	-2.34	45.81	74.00	-28.19	PK	Horizontal
5359.79	38.19	44.20	9.86	32.00	-2.34	35.85	54.00	-18.15	AV	Horizontal
7205.75	54.75	43.50	11.40	35.50	3.40	58.15	74.00	-15.85	PK	Vertical
7205.75	44.41	43.50	11.40	35.50	3.40	47.81	54.00	-6.19	AV	Vertical
7205.80	53.95	43.50	11.40	35.50	3.40	57.35	74.00	-16.65	PK	Horizontal
7205.80	44.33	43.50	11.40	35.50	3.40	47.73	54.00	-6.27	AV	Horizontal
				Middle Cl	hannel (8-DPS	K/2441 MHz)				
3264.65	61.35	44.70	6.70	28.20	-9.80	51.55	74.00	-22.45	PK	Vertical
3264.65	51.57	44.70	6.70	28.20	-9.80	41.77	54.00	-12.23	AV	Vertical
3264.78	61.13	44.70	6.70	28.20	-9.80	51.33	74.00	-22.67	PK	Horizontal
3264.78	51.21	44.70	6.70	28.20	-9.80	41.41	54.00	-12.59	AV	Horizontal
4882.48	59.25	44.20	9.04	31.60	-3.56	55.69	74.00	-18.31	PK	Vertical
4882.48	50.30	44.20	9.04	31.60	-3.56	46.74	54.00	-7.26	AV	Vertical
4882.35	58.77	44.20	9.04	31.60	-3.56	55.21	74.00	-18.79	PK	Horizontal
4882.35	49.18	44.20	9.04	31.60	-3.56	45.62	54.00	-8.38	AV	Horizontal
5359.69	49.32	44.20	9.86	32.00	-2.34	46.98	74.00	-27.02	PK	Vertical
5359.69	39.44	44.20	9.86	32.00	-2.34	37.10	54.00	-16.90	AV	Vertical
5359.79	47.33	44.20	9.86	32.00	-2.34	44.99	74.00	-29.01	PK	Horizontal
5359.79	38.84	44.20	9.86	32.00	-2.34	36.50	54.00	-17.50	AV	Horizontal
7323.88	54.17	43.50	11.40	35.50	3.40	57.57	74.00	-16.43	PK	Vertical
7323.88	43.82	43.50	11.40	35.50	3.40	47.22	54.00	-6.78	AV	Vertical
7323.77	54.93	43.50	11.40	35.50	3.40	58.33	74.00	-15.67	PK	Horizontal
7323.77	43.98	43.50	11.40	35.50	3.40	47.38	54.00	-6.62	AV	Horizontal



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				High Chan	nel (8-DPSK	/2480 MHz)				
3264.89	60.91	44.70	6.70	28.20	-9.80	51.11	74.00	-22.89	PK	Vertical
3264.89	51.69	44.70	6.70	28.20	-9.80	41.89	54.00	-12.11	AV	Vertical
3264.64	62.25	44.70	6.70	28.20	-9.80	52.45	74.00	-21.55	PK	Horizontal
3264.64	50.20	44.70	6.70	28.20	-9.80	40.40	54.00	-13.60	AV	Horizontal
4960.33	59.47	44.20	9.04	31.60	-3.56	55.91	74.00	-18.09	PK	Vertical
4960.33	50.17	44.20	9.04	31.60	-3.56	46.61	54.00	-7.39	AV	Vertical
4960.61	58.95	44.20	9.04	31.60	-3.56	55.39	74.00	-18.61	PK	Horizontal
4960.61	50.30	44.20	9.04	31.60	-3.56	46.74	54.00	-7.26	AV	Horizontal
5359.62	48.86	44.20	9.86	32.00	-2.34	46.52	74.00	-27.48	PK	Vertical
5359.62	40.12	44.20	9.86	32.00	-2.34	37.78	54.00	-16.22	AV	Vertical
5359.78	47.97	44.20	9.86	32.00	-2.34	45.63	74.00	-28.37	PK	Horizontal
5359.78	38.55	44.20	9.86	32.00	-2.34	36.21	54.00	-17.79	AV	Horizontal
7439.76	53.66	43.50	11.40	35.50	3.40	57.06	74.00	-16.94	PK	Vertical
7439.76	44.35	43.50	11.40	35.50	3.40	47.75	54.00	-6.25	AV	Vertical
7439.89	54.68	43.50	11.40	35.50	3.40	58.08	74.00	-15.92	PK	Horizontal
7439.89	43.63	43.50	11.40	35.50	3.40	47.03	54.00	-6.97	AV	Horizontal

Note:

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

Emission Level = Reading + Factor

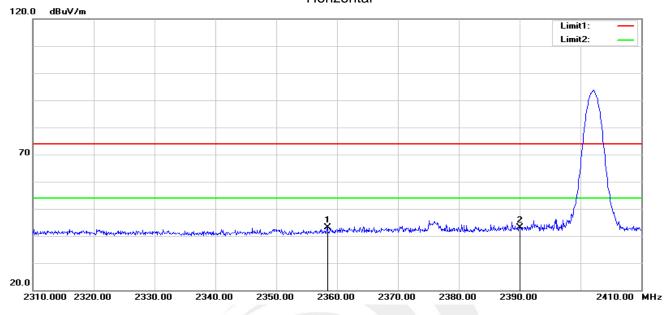
3) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.



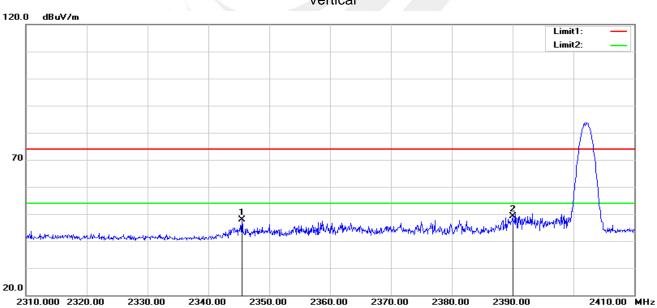


Restricted band Requirements

8DPSK-Low Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2358.400	39.26	3.87	43.13	74.00	-30.87	peak
2	2390.000	38.78	4.34	43.12	74.00	-30.88	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2345.500	44.26	3.71	47.97	74.00	-26.03	peak
2	2390.000	44.74	4.34	49.08	74.00	-24.92	peak

Vertical

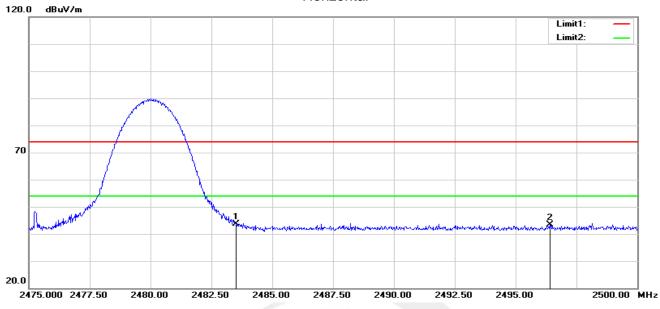
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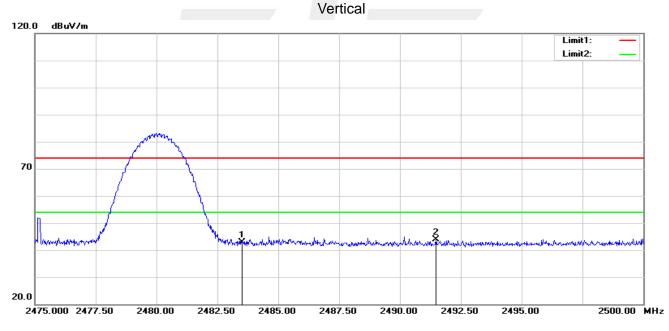
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8DPSK-High Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	38.99	4.60	43.59	74.00	-30.41	peak
2	2496.400	38.73	4.64	43.37	74.00	-30.63	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	38.31	4.60	42.91	74.00	-31.09	peak
2	2491.475	39.35	4.63	43.98	74.00	-30.02	peak

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

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 Eroquopov	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/Stap Eraguanav	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.



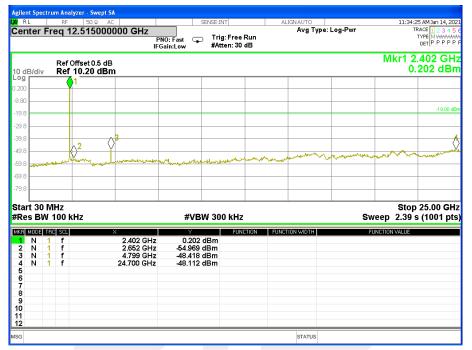
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4.5 TEST RESULTS

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

00 CH



39 CH

RL R	n <mark>alyzer - Swe</mark> pt F 50 Ω		SENSE:	INT	ALIGN AUTO		11:37:	41 AM Jan 14,
nter Freq		0000 GHz	NO: East Tr	ig: Free Run tten: 30 dB	Avg Type:	Log-Pwr		TYPE MWWW DET P P P
	f Offset 0.5 c f 4.16 dBr							.452 G .843 dE
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8								-20.68
8								
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MODE TRC SC	L	Х	Ŷ	FUNCTION	FUNCTION WIDTH	F	UNCTION VALUE	
N 1 f N 1 f N 1 f N 1 f		2.452 GHz 2.652 GHz 4.874 GHz 24.750 GHz	-5.843 dBm -55.980 dBm -52.277 dBm -47.671 dBm					

П



78 CH

RL	Analyzer - Swept RF 50 Ω		9	ENSE:INT	AL	IGN AUTO		11:40:	41 AM Jan 14, 2
nter Fred	12.51500	PI	NO: Fast 🖵 Gain:Low	Trig: Free F #Atten: 30 d	lun IB	Avg Type:	Log-Pwr		TYPE M WWWW DET P P P P
dB/div R	tef Offset 0.5 d tef 6.40 dBn								.477 GI 602 dB
g 50	↓ 1								
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art 30 MH: es BW 10			#VBI	N 300 kHz			S	Stop weep 2.39	25.00 G s (1001 p
R MODE TRC S		X	Y	FUNC	TION FUNCT	ION WIDTH		FUNCTION VALUE	
N 1	f f	2.477 GHz 3.201 GHz	-3.602 -55.961	dBm					
	f f	9.918 GHz 24.750 GHz	-51.289						
i									
1									



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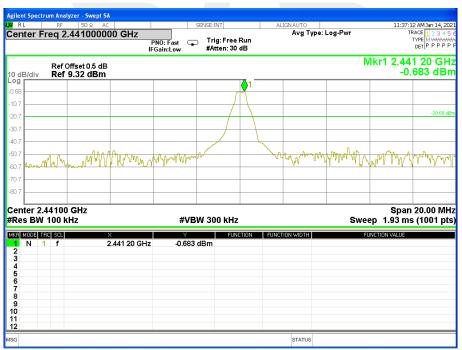


For Band edge(it's also the reference level for conducted spurious emission)

		yzer - Swept SA							
IXI RL	RF	50 Ω AC		SENSE:1	NT	ALIGN AUTO	/pe:Log-Pwr		5 AM Jan 14, 202 ACE 1 2 3 4 5
Center I	Freq 2.	.353500000 GH	IZ PNO: Fa IFGain:L		g: Free Run ten: 30 dB	Avg	/pe: Log-Pwr	1	DET P P P P P
10 dB/div)ffset 0.5 dB 11.00 dBm						Mkr1 2.40 1.	2 19 GH: 004 dBn
1.00									1
-9.00									
-19.0									-19,00 dB
-29.0									
-49.0					<u>2</u>				(Å ⁴)
-59.0		Hotman der and	land and the second second	the marked and	- Anna	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	when har her man	an marter and an and an and an	W Wh
-69.0									
-79.0									
Start 2.3 #Res BV				#VBW 30	0 kHz		Sw	Stop 2.4 eep 10.3 ms	10700 GH: (1001 pts
MKR MODE		×		Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
1 N 2 N 3 N 4 N	1 f 1 f 1 f 1 f	2.402 1 2.349 8 2.398 7 2.400 0	6 GHz - 6 GHz -	1.004 dBm 55.188 dBm 51.773 dBm 51.524 dBm					
5 6		2.400 0		UNIT ADM					
7 8 9									
10									
11 12									
MSG						STATUS			

00 CH

39 CH



Shenzhen STS Test Services Co., Ltd.



78 CH

SA	CENCE-THE	1			11:40:	12 AM Jan 14, 20
000 GHz	NO: Fast 😱 Trig:	Free Run		Log-Pwr		IZ AM Jan 14, 20 IRACE 1 2 3 4 1 TYPE M WMMM DET P P P P
3				N) 200 GH .333 dB
1						
$H \setminus \dots$						-21.33 0
						-21.33
- N	<u>2</u> /	~ <mark>3</mark>		A <u>4</u>		
The second se	~ Virmon w	hamman	man Marchen		nmmm	mulman
	#VBW 300	kHz		Sw	Stop 2 eep 2.40 m	.50000 G s (1001 p
×	Ÿ	FUNCTION FU	NCTION WIDTH		FUNCTION VALUE	
2.480 200 GHz 2.483 500 GHz 2.486 525 GHz 2.492 650 GHz	-1.333 dBm -59.914 dBm -58.537 dBm -58.441 dBm					
	C 000 GHz PI IFC 3 3 4 2.480 200 GHz 2.480 200 GHz 2.485 600 GHz 2.485 650 GHz	C SENSE:INT DO GHZ PNO: Fast IFGain:Low F #Atte 3 1 4 4 4 4 4 4 4 4 5 5 4 4 4 5 5 5 4 4 4 5 5 5 5 5 5 5 5 5 5 5 5 5	KC SENSE:INT DOD GHZ PNO: Fast IFGain:Low Trig: Free Run #Atten: 30 dB 3 1 1 4 <td>KC SERVELINT ALIGNAUTO DOD GHz PN0: Fast IFGain:Low Trig: Free Run #Atten: 30 dB Avg Type: 33 Trig: Alignation Trig: Free Run #Atten: 30 dB Avg Type: 34 Trig: Free Run #Atten: 30 dB Trig: Free Run #Atten: 30 dB 34 Trig: Free Run #Atten: 30 dB Trig: Free Run #Atten: 30 dB 34 Trig: Free Run #Atten: 30 dB Trig: Free Run #Atten: 30 dB 34 Trig: Free Run #Atten: 30 dB Trig: Free Run #Atten: 30 dB 34 Trig: Free Run #VBW 300 kHz Trig: Free Run #Atten: 30 dB 2480 200 GHz 2486 525 GHz 486 525 GHz </td> <td>KC SENSE:NT ALIGNAUTO 100 GHz PN0: Fast IFGain:Low Trig: Free Run #Atten: 30 dB Avg Type: Log-Pwr 3 7 1 1 4 2 3 4 4 2 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 5 4 4 5 5 4 4 5 5 4 4 5 5 4 4 5 5 4 4 5 5 4 5 5 7 4 5 5 7</td> <td>K SENSE:INT ALIGNAUTO 11:40; 100 GHz PN0: Fast Trig: Free Run #Atten: 30 dB Avg Type: Log-Pwr PN0: Fast Trig: Free Run #Atten: 30 dB Mkr1 2.480 -1 1 -1 2 -1</td>	KC SERVELINT ALIGNAUTO DOD GHz PN0: Fast IFGain:Low Trig: Free Run #Atten: 30 dB Avg Type: 33 Trig: Alignation Trig: Free Run #Atten: 30 dB Avg Type: 34 Trig: Free Run #Atten: 30 dB Trig: Free Run #Atten: 30 dB 34 Trig: Free Run #Atten: 30 dB Trig: Free Run #Atten: 30 dB 34 Trig: Free Run #Atten: 30 dB Trig: Free Run #Atten: 30 dB 34 Trig: Free Run #Atten: 30 dB Trig: Free Run #Atten: 30 dB 34 Trig: Free Run #VBW 300 kHz Trig: Free Run #Atten: 30 dB 2480 200 GHz 2486 525 GHz 486 525 GHz	KC SENSE:NT ALIGNAUTO 100 GHz PN0: Fast IFGain:Low Trig: Free Run #Atten: 30 dB Avg Type: Log-Pwr 3 7 1 1 4 2 3 4 4 2 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 5 4 4 5 5 4 4 5 5 4 4 5 5 4 4 5 5 4 4 5 5 4 5 5 7 4 5 5 7	K SENSE:INT ALIGNAUTO 11:40; 100 GHz PN0: Fast Trig: Free Run #Atten: 30 dB Avg Type: Log-Pwr PN0: Fast Trig: Free Run #Atten: 30 dB Mkr1 2.480 -1 1 -1 2 -1



Shenzhen STS Test Services Co., Ltd.

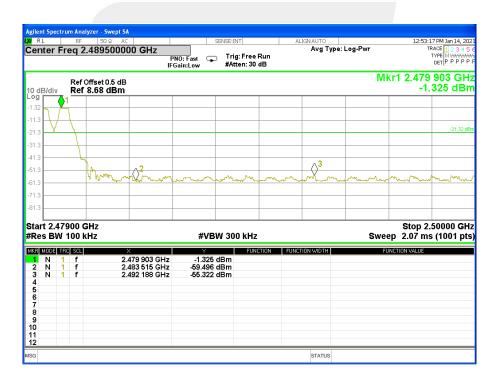




For Hopping Band edge

GFSK

	RF 50	IQ AC	SENS	E:INT	ALIGN AUTO			PM Jan 14, 2
enter F	req 2.351	500000 GHz PI IFC		Frig: Free Run Atten: 30 dB	Аvg Тур	e: Log-Pwr	TY	CE 1 2 3 4 PE MWWW ET P P P P
dB/div	Ref Offset (Ref 10.99					N	kr1 2.401 8 0.9	867 GH 93 dB
90								
01								
								-19.01
9.0								~
9.0							<mark>2</mark>	
0.0 <mark>ptategy</mark>	ar yes an	and a second second second	trapply and a star	mun	www.www.www.	www.www.	MUUUUUUUUUU	www
9.0								
9.0								
art 2 2							Stop 2.4 ep 9.87 ms	
Res BW	0000 GHz / 100 kHz		#VBW :				•	(1001 p
Res BW E 1009 N N N N N N N	100 kHz	× 2.401 867 GHz 2.390 022 GHz 2.400 013 GHz	#VBW 3 0.993 dBr -55.510 dBr -52.874 dBr	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	(1001 p
Res BW G MODE 1 1 N 2 N	V 100 kHz TRC SCL 1 f 1 f	2.401 867 GHz 2.390 022 GHz	0.993 dBr -55.510 dBr	FUNCTION	FUNCTION WIDTH		•	



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Page 40 of 76 Report No.: STS2101080W01

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

	ipectru		lyzer - Swept S	A							
LXI RL		RF	50Ω A			SENSE:INT		ALIGN AUTO			:32 PM Jan 14, 2021
Cente	er Fr	eq 1	2.515000	Р	NO: Fast Gain:Low	⊃ Trig: Free #Atten: 30	e Run D dB	Avg Ty	pe: Log-Pwr		TRACE 1 2 3 4 5 6 TYPE MWWWWA DET P P P P P
10 dB/e	div		Offset 0.5 dE 9.43 dBm								2.402 GHz).569 dBm
-0.57 -			1								
-10.6 —											-19.06 dBm
-20.6 =											13.00 0.00
-30.6											4
-40.0			⊘ ²	> ³				a and the should be a			and the second
-60.6 🔛	-	Contra la	mar and	netry restriction	Auropente	and the property is	mantager	monortenant	why have a comment	ment of the second	Magan Mondage Martin
-70.6 —											
-80.6 —											
Start∶ #Res			(Hz		#VE	W 300 kH	z		5		p 25.00 GHz s (1001 pts)
MKR MO				X	Y		NCTION	FUNCTION WIDTH		FUNCTION VALUE	
1 N 2 N 3 N 5 6 7 8 9	1 1	f f f		2.402 GHz 2.976 GHz 4.799 GHz 25.000 GHz	-0.569 -55.535 -52.752 -48.335	dBm dBm					
6 7 9 10 11 12											
MSG								STATUS			

00 CH

20	CI I
39	CH

	RF 50	OΩ AC	SENSE:INT		ALIGN AUTO		01:00:2	23 PM Jan 14,
nter F	req 12.51			Free Run n: 30 dB	Avg Type:	Log-Pwr		TYPE MWWW DET P P P
dB/div	Ref Offset Ref 9.21						Mkr1 2 -0.	.452 G 786 di
	 1							
3 								-20.7
								-20.1
3								-
		2 ^3						
3					and and the second second	monorme	and the second	and the second
3 	ont-new Working	have been and the second and the	munphettel	Contraction of the				
3								
+ 20	Dall-						Oton	25.00 0
	MHz / 100 kHz		#VBW 300	kHz		Sv	Stop veep 2.39	
es BW	/ 100 kHz	×	Y	kHz FUNCTION	FUNCTION WIDTH			
NODE T	/ 100 kHz	2.452 GHz	Y -0.786 dBm		FUNCTION WIDTH		veep 2.39	25.00 G s (1001
es BW N N N	/ 100 kHz 160 sou 1 f 1 f 1 f	2.452 GHz 3.301 GHz 4.874 GHz	-0.786 dBm -55.329 dBm -53.708 dBm		FUNCTION WIDTH		veep 2.39	
es BW N N N	I 100 kHz IRC SCL 1 f 1 f	2.452 GHz 3.301 GHz	-0.786 dBm -55.329 dBm		FUNCTION WIDTH		veep 2.39	
es BW N N N	/ 100 kHz 160 sou 1 f 1 f 1 f	2.452 GHz 3.301 GHz 4.874 GHz	-0.786 dBm -55.329 dBm -53.708 dBm		FUNCTION WIDTH		veep 2.39	
es BW N N N	/ 100 kHz 160 sou 1 f 1 f 1 f	2.452 GHz 3.301 GHz 4.874 GHz	-0.786 dBm -55.329 dBm -53.708 dBm		FUNCTION WIDTH		veep 2.39	
es BW N N N	/ 100 kHz 160 sou 1 f 1 f 1 f	2.452 GHz 3.301 GHz 4.874 GHz	-0.786 dBm -55.329 dBm -53.708 dBm		FUNCTION WIDTH		veep 2.39	
MODE T N N	/ 100 kHz 160 sou 1 f 1 f 1 f	2.452 GHz 3.301 GHz 4.874 GHz	-0.786 dBm -55.329 dBm -53.708 dBm		FUNCTION WIDTH		veep 2.39	
es BW N N N	/ 100 kHz 160 sou 1 f 1 f 1 f	2.452 GHz 3.301 GHz 4.874 GHz	-0.786 dBm -55.329 dBm -53.708 dBm		FUNCTION WIDTH		veep 2.39	

Shenzhen STS Test Services Co., Ltd.



78 CH

RL	RF	r - Swept SA 50 Ω AC			SENSE:INT		ALIGN AUTO		01:03:2	8 PM Jan 14, 2
nter Fi	req 12.5	5150000	100 GHz	PNO: Fast G	Trig: Fre #Atten: 3	e Run 0 dB	Avg Type	: Log-Pwr		ACE 1 2 3 4
dB/div		et 0.5 dB 01 dBm							Mkr1 2 -2.	.477 G 988 dE
9	1									
0										-21.34
					_					
0		$\langle \rangle^2$			3				m	بر
0 mene	monther	al and a start and a start and a start	ry all the stay day of	mananthan	and the second	on on the man				
.0										
0										
art 30 N es BW	/Hz 100 kHz	!		#VB	W 300 kH	z		S	Stop weep 2.39 s	25.00 G (1001 p
MODE TF		×		Y		NCTION FUN	ICTION WIDTH		FUNCTION VALUE	
N 1 N 1 N 1	f		2.477 GHz 3.301 GHz 9.918 GHz 24.750 GHz	-2.988 -54.693 -53.608 -48.377	dBm dBm					
IN I	-		24.750 GHZ	-46.311	ubiii					



Shenzhen STS Test Services Co., Ltd.



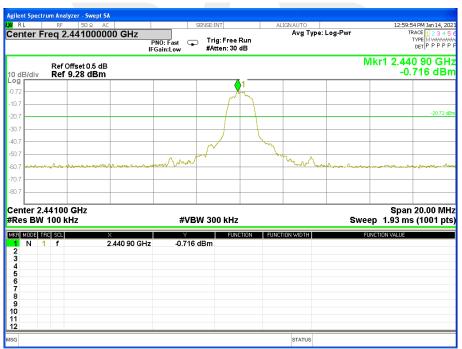


For Band edge(it's also the reference level for conducted spurious emission)

		zer - Swept SA					
KI RL	RF	50Ω AC		SENSE:INT	ALIGN AU	TO g Type: Log-Pwr	12:56:03 PM Jan 14, TRACE 1 2 3 4
Senter F	-req 2.3	353500000 GH:		➡ Trig: Free F #Atten: 30 d	Run	g Type: Log-Pwr	TYPE MWWW DET P P P
10 dB/div		fset 0.5 dB 0.94 dBm					Mkr1 2.401 86 G 0.938 dE
Log 0.940							1
-9.06							Λ I
-19.1							-19,06
-13.1							
39.1							
49.1				∧2			(),4
50.4				X		A	l l l
9.1	- Martinet	and a sublicity and a substrained a	and the second second second	and the second second	AND CONTRACTOR	annothing whether	nd und aussissing and an and an and an and an
79.1							
/ 3.1							
tart 2.3 Res BW			#V	BW 300 kHz		Si	Stop 2.40700 G weep 10.3 ms (1001 p
IKR MODE T		×	Y	FUNC	TION FUNCTION WI	DTH	FUNCTION VALUE
	1 f 1 f	2.401 86 2.349 86		8 dBm 0 dBm			
3 N	1 f 1 f	2.398 76 2.400 05	GHz -51.26	0 dBm 0 dBm			
5	1 1	2.400 05	GHZ -52.06	U dBm			
6							
7							
7 8							
0							
4 N 5 6 7 8 9 0 1 2							

00 CH

39 CH





78 CH

	RF 50 Ω A0		SENSE:INT		ALIGN AUTO			58 PM Jan 14, 2
nter Freq	2.4875000	P		ree Run n: 30 dB	Avg Type:	Log-Pwr	Т	RACE 1 2 3 4 TYPE MWWW DET P P P P
dB/div R	ef Offset 0.5 dB ef 8.65 dBm	-				М	kr1 2.479 -1.	900 GH .345 dB
5		1						
4	<i>۳</i>							
1								-21.34
4								
1		The second secon	A2		∧3 ∧4			
manal	mound	- Marine Contraction	w Roman man	halmongerun	moneran	how mark	N/~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	manan
.								
4								
urt 2.47500 es BW 100			#VBW 300 I	к Н 7		Swa	Stop 2 ep 2.40 m	.50000 G
MODE TRC SO		×	#*8473001		UNCTION WIDTH		UNCTION VALUE	5 (1001 p
N 1 f	2	.479 900 GHz .483 500 GHz	-1.345 dBm -59.120 dBm					
N 1 f	2	.489 850 GHz .491 625 GHz	-57.435 dBm -58.377 dBm					
14 1 1	2	.431 020 0112	-00.077 dBm					



Shenzhen STS Test Services Co., Ltd.

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For Hopping Band edge

π/4-DQPSK

gilent Spect	rum Analy RF	<mark>zer - Swept S</mark> 50 Ω A			ENSE:INT		IGNAUTO		01-25-53	PM Jan 14, 20
		3515000	00 GHz	PNO: Fast Gain:Low	Tuine Free	Run	Avg Type:	Log-Pwr	TRA T	PM Jan 14, 20 NCE 1 2 3 4 9 PE M WWW DET P P P P
) dB/div		ffset 0.5 dB 10.93 dBn						IV	ا 1kr1 2.401 0.§	867 GH 128 dBi
930										
07										-19.07 d
U1										
9.1						bee bloomb	Lunate	u . (Nalika	nhannad na	
.1	and a second second	encanyn fan Me	hayyonghodalaka	-tone-constitution	-and white and	ուլերերերեր	for waters and the second s	MATRACTICATION	U YANYA YA YANYA YANY	1 A ANY WAY
0.1										
art 2.30 Res BW				#VB	W 300 kHz			Swe	Stop 2.4 eep 9.87 ms	
R MODE T			× .401 867 GHz	Y 0.928		CTION FUNC	TION WIDTH		FUNCTION VALUE	
2 N 1		2	.401 887 GH2 .390 022 GHz .400 013 GHz	-55.665 -55.214	dBm					
2										

enter Freg 2	50 Ω AC		SEI	NSE:INT		IGN AUTO Avg Type	: Log-Pwr	01:	27:59 PM Jan 14, 2 TRACE 1 2 3 4
			NO: Fast 😱 Gain:Low	Trig: Free R #Atten: 30 dl					DET P P P
dB/div Ref	Offset 0.5 dB f 8.62 dBm						N		79 903 GI ·1.383 dE
4 marting									
4									-21.38
4									
1 1	1 10								
	The second	2					3	0	
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+									
1									
	сц.,						Sw		2.50000 G ms (1001 p
			#VBW	300 KHZ				00p 2.01	· ·
es BW 100	kHz	×	Y	FUNCT	ION FUNCT	ION WIDTH		FUNCTION VALU	· ·
NODE TRO SCI N 1 f N 1 f	kHz	.479 903 GHz .483 515 GHz	-1.383 di -58.717 di	FUNCT Bm Bm	ION FUNCT	ION WIDTH			· ·
NODE NEC SCI	kHz	.479 903 GHz	Y -1.383 di	FUNCT Bm Bm	ION FUNCT	ION WIDTH			· ·
es BW 100 MODE TRC SCI N 1 f N 1 f	kHz	.479 903 GHz .483 515 GHz	-1.383 di -58.717 di	FUNCT Bm Bm	ION FUNCT	ION WIDTH			· ·
N 1 f	kHz	.479 903 GHz .483 515 GHz	-1.383 di -58.717 di	FUNCT Bm Bm	ION FUNC	ION WIDTH			· ·
es BW 100 MODE TRC SCL N 1 f	kHz	.479 903 GHz .483 515 GHz	-1.383 di -58.717 di	FUNCT Bm Bm	ION FUNCT	ION WIDTH			· ·
es BW 100 MODE TRC SCL N 1 f	kHz	.479 903 GHz .483 515 GHz	-1.383 di -58.717 di	FUNCT Bm Bm		'ION WIDTH			· ·

Shenzhen STS Test Services Co., Ltd.



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

00 CH

RL		1C	SENSE:	INIT	ALIGN AUTO		01-25	:04 PM Jan 14, 20
enter Fred	RF 50 Ω A					e: Log-Pwr		TRACE 1 2 3 4
				g: Free Run tten: 30 dB				DET P P P P
	Ref Offset 0.5 dB Ref 10.02 dB							2.402 GH 0.020 dB
og 120	≬ 1							
.98								
0.0								-18.96
0.0								
0.0		л 3						
0.0	$\langle \rangle^2 \langle$	Υ			a i and we want	an manumber	montation	a some on the
).0 popernandered	and the second	frementer and and	Massandrandingle	All and a second	- Spendage			
0.0								
0.0								
tart 30 MHz			<i>"</i> »				Stop	p 25.00 G
tart 30 MHz Res BW 10	0 kHz		#VBW 30				weep 2.39	o 25.00 G s (1001 p
tart 30 MHz Res BW 10 83 M009 160 B	00 kHz scu	× 2.402 GHz	Y 0.020 dBm		FUNCTION WIDTH		Stop weep 2.39	p 25.00 GI s (1001 p
art 30 MHz Res BW 10 G MODE TRO B 1 N 1 2 N 1	0 kHz		Y		FUNCTION WIDTH		weep 2.39	o 25.00 Gi s (1001 p
tart 30 MHz Res BW 10 Res DW 10 R MODE TRO E 1 N 1 2 N 1 3 N 1 4 N 1	00 kHz SCL f f	2.402 GHz 3.276 GHz	0.020 dBm -55.636 dBm		FUNCTION WIDTH		weep 2.39	o 25.00 Gl s (1001 p
tart 30 MHz Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 10 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW 100 Res BW	10 kHz Sou f f f	2.402 GHz 3.276 GHz 4.799 GHz	0.020 dBm -55.636 dBm -52.377 dBm		FUNCTION WIDTH		weep 2.39	o 25.00 Gi s (1001 p
tart 30 MHz Res BW 10 37 MODE TRO 8 1 N 1 2 N 1 2 N 1 3 N 1 4 N 1 5 6 7 8	10 kHz Sou f f f	2.402 GHz 3.276 GHz 4.799 GHz	0.020 dBm -55.636 dBm -52.377 dBm		FUNCTION WIDTH		weep 2.39	o 25.00 G s (1001 p
tart 30 MHz Res BW 10 C 1000 He 10 C 1000 He 10 C 100	10 kHz Sou f f f	2.402 GHz 3.276 GHz 4.799 GHz	0.020 dBm -55.636 dBm -52.377 dBm		FUNCTION WIDTH		weep 2.39	5 25.00 Gi s (1001 p
tart 30 MHz Res BW 10 (1000 Free BW 1 N 1 2 N 1 3 N 1 3 N 1 5 6 7 8 9 0 1	10 kHz Sou f f f	2.402 GHz 3.276 GHz 4.799 GHz	0.020 dBm -55.636 dBm -52.377 dBm		FUNCTION WIDTH		weep 2.39	5 25.00 Gi s (1001 p
tart 30 MHz Res BW 10 1 N 1 2 N 1 3 N 1 4 N 1 5 6 6 7	10 kHz Sou f f f	2.402 GHz 3.276 GHz 4.799 GHz	0.020 dBm -55.636 dBm -52.377 dBm		FUNCTION WIDTH		weep 2.39	25.00 G s (1001 p

39 CH

RL	ectrur	n Ana RF	yzer - Swep							01.0	
	r Fre		50 Ω 2.51500	0000 GHz	PNO: Fast G	SENSE:INT Trig: Fre #Atten: 3	e Run 30 dB	ALIGN AUTO Avg Typ	e: Log-Pwr	01:3	D:19 PM Jan 14, 2 TRACE 1 2 3 4 TYPE M WAAAA DET P P P P
dB/di			offset 0.5 d 6.82 dBi								2.452 G 3.181 dB
18 —		-1)								
2		_									-20.65
2											
2				A3							
2				$\langle \rangle$				- All and the second	d a manage	Lan	when white
2	r	and	and house	al manufacture	whenter	mark wange and	later an any market	Mangan and Allander		* ··· ·	
2 —											
2											
art 3 es B			Hz		#VE	3W 300 kH	łz		s	Sto weep 2.39	p 25.00 G s (1001 p
N N	E TRC	SCL f		× 2.452 GHz 3.351 GHz		dBm	UNCTION	FUNCTION WIDTH		FUNCTION VALUE	
NN	1	f f		4.874 GHz 24.750 GHz	-50.263	dBm					



78 CH

L I	RF	zer - Swept 50 Ω /			ENSE:INT	AL	IGN AUTO		01:38	3:08 PM Jan 14,
	req 12		0000 GHz	NO: Fast 🖵 Gain:Low	Tuin Con Bu		Avg Type	: Log-Pwr		TRACE 1 2 3 TYPE MWW DET P P P
lB/div		fset 0.5 di 8.61 dBm								2.477 G I.391 dI
		1								
4										
4										-21.2
1				-	3					
4				Q	.		water	مەسىرىيەر يەلى	and a start of the	and the second second
مستبدد	returned ally	and the set	and a second s	~ the second second second	and a state of a state of the s	APPLATION AND A		· ·		
4										
art 30 N es BW		łz		#VB	N 300 kHz			ŝ	Sto Sweep 2.39	p 25.00 C s (1001
MODE TR			× 2.477 GHz	-1.391	FUNCTIO	N FUNCI	TION WIDTH		FUNCTION VALUE	
N 1	f		3.301 GHz	-54.940	dBm					
N 1 N 1	f		9.918 GHz 24.526 GHz	-52.248 -47.497						



Shenzhen STS Test Services Co., Ltd.



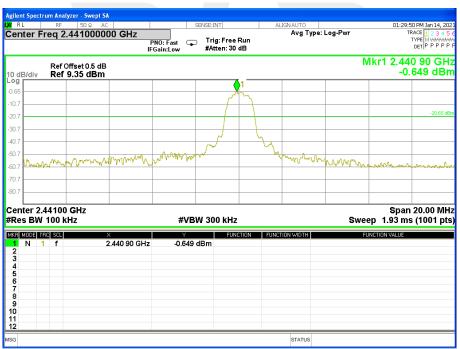


For Band edge(it's also the reference level for conducted spurious emission)

		alyzer - Swept SA								
LXI RL	RF			SEI	ISE:INT		ALIGN AUTO			:34 PM Jan 14, 202
Center	Freq 2	2.353500000	PI	NO: Fast 😱 Gain:Low	Trig: Free #Atten: 30	Run dB	Avg Typ	e: Log-Pwr		TRACE 1 2 3 4 5 TYPE M WWWWW DET P P P P P
10 dB/div		Offset 0.5 dB f 11.05 dBm							Mkr1 2.4	01 86 GH: .045 dBm
1.05										<u></u> 1
-8.95										+
-19.0								_		-18,96 dBr
-29.0										
-49.0					2					
-59.0	later grann	Mulman and some town allow	Manageranianthalla	handannerran	marken	-	hand and many and the sold	-	paratula munu	ment Ma
-69.0								_		
-79.0										
Start 2.: #Res B\				#VBW	300 kHz			Sv	Stop 2 veep 10.3 m	2.40700 GHz is (1001 pts
MKR MODE		X		Y	FUN	TION FL	INCTION WIDTH		FUNCTION VALUE	
1 N 2 N 3 N 4 N	1 f 1 f 1 f 1 f	2.34	01 86 GHz 19 86 GHz 98 76 GHz 90 05 GHz	1.045 df -55.161 df -51.220 df -50.151 df	3m 3m					
5 6 7 8 9										
9 10 11 12										
MSG							STATUS			

00 CH

39 CH





78 CH

	RF 50 Ω A		SENSE:INT	A	LIGNAUTO			39 PM Jan 14, 2
enter Fred	q 2.4875000	Р	NO: Fast 😱 Trig: Fi Sain:Low #Atten:	ree Run : 30 dB	Avg Type:	Log-Pwr	I	RACE 1 2 3 4 TYPE M WANN DET P P P P
dB/div R	tef Offset 0.5 dE Ref 8.71 dBm					N	1kr1 2.480 -1	050 GI 294 dB
29		0 1						
	ſ							
.3								-21.29
.3								
.3	ſ_	<u> </u>						
.3		- Maria	2	3		A <u>4</u>		
3 Whomm	har	· · ·	w Kommen		m muman	haven	mannam	mann
.3								
.3								
							Stop 2	.50000 G
art 2 4760				U -		Sw	eep 2.40 m	
art 2.4750 Res BW 10			#VBW 300 k	Π <u>Ζ</u>				
Res BW 10 R MODE TRC S	i0 kHz	×	Ŷ		CTION WIDTH		FUNCTION VALUE	
Res BW 10	10 kHz f 2	× 2.480 050 GHz 2.483 500 GHz			TION WIDTH		FUNCTION VALUE	
Res BW 10 Image: N 1 N 1 N 1 N 1 N 1 N 1 N 1	IO KHZ	2.480 050 GHz 2.483 500 GHz 2.488 150 GHz	-1.294 dBm -58.791 dBm -58.466 dBm		TION WIDTH		FUNCTION VALUE	
R X000 TEC E N 1 1 1 N 1 1 1 N 1 1 1 N 1 1 1 N 1 1 1	IO KHZ	2.480 050 GHz 2.483 500 GHz	-1.294 dBm -58.791 dBm		TION WIDTH		FUNCTION VALUE	
Res BW 10 R MODE TRG S N 1 2 N 1 3 N 1 4 N 1 5 5 5	IO KHZ	2.480 050 GHz 2.483 500 GHz 2.488 150 GHz	-1.294 dBm -58.791 dBm -58.466 dBm		CTION WIDTH		FUNCTION VALUE	
Res BW 10 R MODE TRG E N 1 2 N 1 3 N 1 4 N 1 5 7 3 3 3 1	IO KHZ	2.480 050 GHz 2.483 500 GHz 2.488 150 GHz	-1.294 dBm -58.791 dBm -58.466 dBm		TION WIDTH		FUNCTION VALUE	
Res BW 10 I N 1 2 N 1 3 N 1 5 5 7 3 0 0	IO KHZ	2.480 050 GHz 2.483 500 GHz 2.488 150 GHz	-1.294 dBm -58.791 dBm -58.466 dBm		TION WIDTH		FUNCTION VALUE	
N 1 N 1 2 N 3 N 4 N 5 - 6 - 8 -	IO KHZ	2.480 050 GHz 2.483 500 GHz 2.488 150 GHz	-1.294 dBm -58.791 dBm -58.466 dBm		CTION WIDTH		FUNCTION VALUE	



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For Hopping Band edge

8DPSK

				SENSE:INT		ALIGN AUTO			03:23:38 PM Jan 14, 2
enter Fr	eq 2.351	1500000 GHz	PNO: Fast IFGain:Low	Trig: Fre #Atten: \$	e Run 30 dB	Avg	Type: Log-Pwr		TRACE 1 2 3 4 TYPE M WAAWA DET P P P P
dB/div	Ref Offsel Ref 10.9							Mkr1 2.	401 867 GI 0.955 dB
g 50									
04									
.0									-19.04
.0					-				
.0					-				o2 //
.0									2
.0	another work	+hourse and a second contraction	ation of the second	ways and a strange with the	Maral Alasha	Salver of the		uru nurvan	LARRAN CONTRACTOR
.0									
.0									
	000 GHz 100 kHz		#V	/BW 300 kH	łz				op 2.40300 G 7 ms (1001 p
R MODE TR		×	Y		JNCTION	FUNCTION WIDT	1	FUNCTION V	ALUE
N 1 N 1 N 1		2.401 867 G 2.390 022 G 2.400 013 G	Hz -54.72	55 dBm 21 dBm 77 dBm					
		2.400 0 10 0		, apin					
))									
2									

TRACE 1 2 3	: Log-Pwr	ALIGN AUTO	IT	SENSE:II	50 Ω AC 89500000 GHz	RF
TYPE MWW DET P P P	Log-Fwi	018 I M	∣:Free Run :en:30 dB			-req 2.48
1 2.479 042 G -1.368 di	Mkr1				fset 0.5 dB .63 dBm	
						~
-21.3						
				3	^Δ Δ2	- North
mann	mumm	mam	mm		Nomman Long	
Stop 2.50000 C 2.07 ms (1001	Sweep) kHz	#VBW 30		7900 GHz V 100 kHz
TION VALUE	FUNCT	FUNCTION WIDTH	FUNCTION	¥	×	TRC SCL
				-1.368 dBm -58.405 dBm	2.479 042 GH 2.483 515 GH	1 f 1 f
				-55.462 dBm	2.486 896 GH	1 f

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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:	AC 120V/60Hz

Number of Hopping Channel

79

Hopping channel

	50 Ω AC	SENSE:INT	ALIGN AUTO	12:48:59 PM Jan 14, 20
Center Freq 2.4	441750000 GHz	PNO: Fast 😱 Trig: Free FGain:Low #Atten: 30	Avg Type: Log-Pwr e Run) dB	TRACE 1 2 3 4 1 TYPE M WWWW DET P P P P
10 dB/div Ref 1	fset 0.5 dB 1.03 dBm		Λ	1kr2 2.479 993 0 GF -1.06 dB
-og 1 1.03 ////////////////////////////////////	mmmmmm	mmmmm		
8.97				*********
29.0				
49.0				
59.0				
79.0				
tart 2.40000 GH		#VBW 300 kHz		Stop 2.48350 Gi weep 1.13 ms (1001 p
Res BW 300 kH	× 2.402 004 0 GHz	1.21 dBm	NCTION FUNCTION WIDTH	FUNCTION VALUE
Res BW 300 kH 1 N 1 f 2 N 1 f 3 4 5		1.21 dBm	FUNCTION FUNCTION WIDTH	FUNCTION VALUE
Res BW 300 kH 1 N 1 f 2 N 1 f 3 4	2.402 004 0 GHz	1.21 dBm	FUNCTION VIOTH	FUNCTION VALUE

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6. AVERAGE TIME OF OCCUPANCY

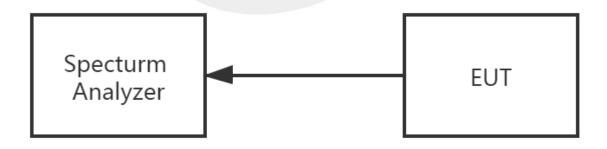
6.1 LIMIT

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(1Mbps)-DH1/DH3/DH5	Test Voltage:	AC 120V/60Hz

Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
DH1	middle	0.397	0.127	0.4
DH3	middle	1.655	0.265	0.4
DH5	middle	2.906	0.310	0.4



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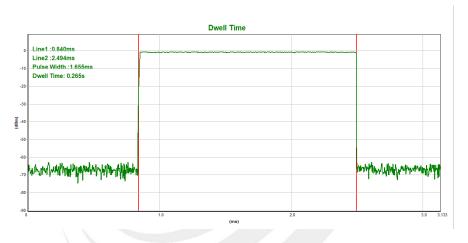
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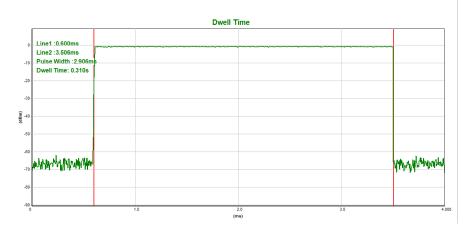
CH39-DH1



CH39-DH3







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

Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
2DH1	middle	0.406	0.130	0.4
2DH3	middle	1.658	0.265	0.4
2DH5	middle	2.908	0.310	0.4



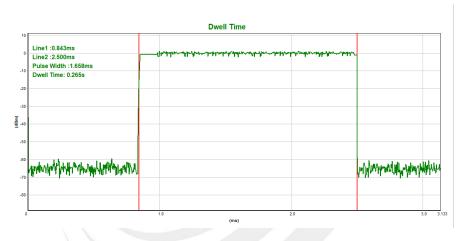
Shenzhen STS Test Services Co., Ltd.



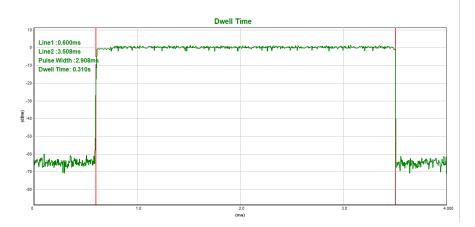
CH39-2DH1



CH39-2DH3



CH39-2DH5



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

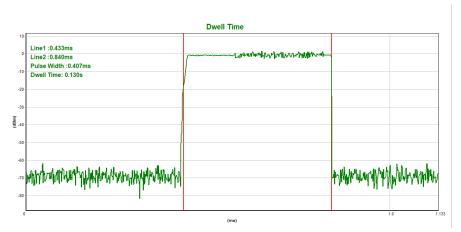
Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
3DH1	middle	0.407	0.130	0.4
3DH3	middle	1.658	0.265	0.4
3DH5	middle	2.912	0.311	0.4



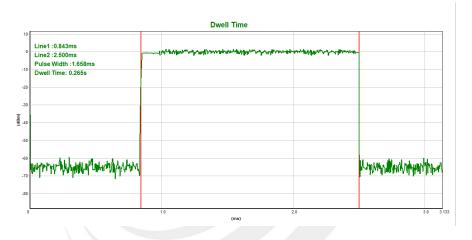
Shenzhen STS Test Services Co., Ltd.



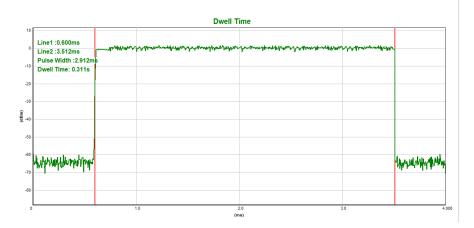
CH39-3DH1



CH39-3DH3



CH39-3DH5



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7. HOPPING CHANNEL SEPARATION MEASUREMEN

7.1 LIMIT

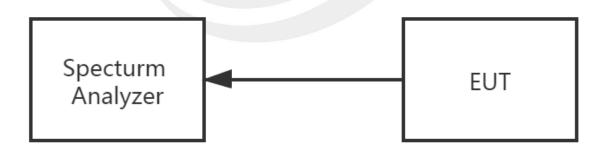
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

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

7.2 TEST PROCEDURE

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

7.3 TEST SETUP



7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.



7.5 TEST RESULTS

Temperature:	25℃	Relative Humidity:	50%
LOCT MINDAD.	CH00 / CH39 / CH78 (GFSK(1Mbps) Mode)	Test Voltage:	AC 120V/60Hz

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2401.885	2402.884	0.999	0.872	Complies
2441 MHz	2440.885	2441.887	1.002	0.872	Complies
2480 MHz	2478.885	2479.884	0.999	0.872	Complies

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

CH00 -1Mbps

RL	RF 50	DΩ AC	SENSE:INT	ALIGN AUTO	11:35:23 AM Jan 14, 2
nter F	req 2.402	500000 GHz PNO: IFGair		Avg Type: Log-Pwr	TRACE 1 2 3 4 TYPE M WAAA DET P P P P
dB/div	Ref Offset Ref 9.21				Mkr2 2.402 884 G -0.695 dE
9		()1		2	
		- M	\sim	m	
8			~~~		5
8		~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		- m
8	~ ~ /				- May
3 					
, <u> </u>					\
3					
es BW	.402500 GH / 30 kHz	łz	#VBW 100 kHz		Span 3.000 M weep 3.20 ms (1001 p
MODE 1		× 2.401 885 GHz	-0.65 dBm	N FUNCTION WIDTH	FUNCTION VALUE
	1 f 1 f	2.401 885 GHz 2.402 884 GHz	-0.65 dBm -0.69 dBm		

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CH39 -1Mbps



CH78 -1Mbps



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

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2401.882	2402.881	0.999	0.863	Complies
2441 MHz	2440.885	2441.884	0.999	0.863	Complies
2480 MHz	2478.888	2479.884	0.996	0.861	Complies

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

RL	RF 50	Ω AC	SENSE:INT	ALIGN AUTO	12:57:29 PM Jan 14, 2
enter F		500000 GHz PNO	Wide Trig: Free n:Low #Atten: 30	Avg Type: Run	
) dB/div	Ref Offset Ref 8.78				Mkr2 2.402 881 Gł -1.273 dB
.22		1	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	2	
.2			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~ home
	~	~~			
.2					
1.2	m				
.2					
.2					
1.2					
1.2					
	402500 GH 30 kHz	Z	#VBW 100 kH:	Z	Span 3.000 M Sweep 3.20 ms (1001 p
(R MODE T		×		NCTION FUNCTION WIDTH	FUNCTION VALUE
2 N '	1 f 1 f	2.401 882 GHz 2.402 881 GHz	-1.22 dBm -1.27 dBm		
3					
5					
,					
3 9					
7 B 9 D 1					

CH00 -2Mbps

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CH39 -2Mbps

RF 50 Ω AC	SENSE:INT	ALIGN AUTO	01:01:11 PM Jan 1
er Freq 2.441500000 GHz	Wide Trig: Free Run n:Low #Atten: 30 dB	Avg Type: Log-Pwr	TRACE 1 2 TYPE M₩ DET P P
Ref Offset 0.5 dB div Ref 7.09 dBm		М	kr2 2.441 884 (-2.932 c
()1		2	
	mmm	$\sim \sim \sim \sim$	ma
er 2.441500 GHz	20 (B14) 400 111-	-	Span 3.000
BW 30 kHz	#VBW 100 kHz		ep 3.20 ms (1001
IDE TRC SCL X	Y FUNCTION -2.91 dBm	FUNCTION WIDTH FI	JNCTION VALUE
N 1 f 2.440 885 GHz N 1 f 2.441 884 GHz	-2.91 dBm -2.93 dBm		

CH78 -2Mbps



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Temperature:	25℃	Relative Humidity:	50%
LOCT MINDAD.	CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)	Test Voltage:	AC 120V/60Hz

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2401.885	2402.887	1.002	0.809	Complies
2441 MHz	2440.888	2441.887	0.999	0.810	Complies
2480 MHz	2478.888	2479.887	0.999	0.811	Complies

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

CH00 -3Mbps

RL RF	50 Ω AC	SENSE:INT	ALIGN AUTO	01:36:02 PM Jan 14, 20
enter Freq 2	2.402500000 GHz	PNO: Wide Trig: Free IFGain:Low #Atten: 30	Avg Type: Log-Pw Run	
0 dB/div Ref	Offset 0.5 dB 7 10.39 dBm			Mkr2 2.402 887 GH 0.367 dBr
og		< <u>}</u> 1	2	
.390		Ann-	1	
9.61		- V - V~~~	have here here here here here here here he	2 miles
19.6				
29.6				\\
19.6	<u> </u>			
19.6				
9.6				
9.6				
79.6				
1				Span 3.000 MH
enter 2.40250 Res BW 30 kl		#VBW 100 kHz		Sweep 3.20 ms (1001 pt
Res BW 30 kł Krimode trej scu 1 n 1 f	Hz × 2.401 885 G	FUN Hz 0.41 dBm	CTION FUNCTION WIDTH	
Res BW/30 kH KR MODE TRO SCU 1 N 1 f 2 N 1 f 3	Hz	FUN Hz 0.41 dBm		Sweep 3.20 ms (1001 pt
Res BW 30 kH 1 N 1 f 2 N 1 f 3 4	Hz × 2.401 885 G	FUN Hz 0.41 dBm		Sweep 3.20 ms (1001 pt
Res BW 30 kl R Mode TRC SC 1 N 1 f 2 N 1 f 3 4 5 6	Hz × 2.401 885 G	FUN Hz 0.41 dBm		Sweep 3.20 ms (1001 pt
Res BW 30 kl 1 N 1 f 2 N 1 f 3 4 5 6 7 7 7 7	Hz × 2.401 885 G	FUN Hz 0.41 dBm		Sweep 3.20 ms (1001 pt
Res BW 30 kl 1 N 1 F 2 N 1 f 3 4 5 6 6 7 8 9	Hz × 2.401 885 G	FUN Hz 0.41 dBm		Sweep 3.20 ms (1001 pt
Res BW 30 kl 1 N 1 f 2 N 1 f 3 4 f 5 6 f 7 8 g 9 0 f	Hz × 2.401 885 G	FUN Hz 0.41 dBm		Sweep 3.20 ms (1001 pt
Res BW 30 kl 1 N 1 F 2 N 1 f 3 1 f 4 5 6 6 7 8 9 9 1	Hz × 2.401 885 G	FUN Hz 0.41 dBm		Sweep 3.20 ms (1001 pt

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CH39 -3Mbps

RF 50 Ω AC	SENSE:INT	ALIGN AUTO	01:32:36 PM Jan
r Freq 2.441500000 GHz PNO: IFGai	Wide Trig: Free Run 1:Low #Atten: 30 dB	Avg Type: Log-Pwr	TRACE 1 TYPE MI DET P F
Ref Offset 0.5 dB div Ref 8.55 dBm			Mkr2 2.441 887 -1.341
		2	
	\sim		
	· · horn	my v i h	
r 2.441500 GHz			Span 3.000
BW 30 kHz	#VBW 100 kHz	SI	veep 3.20 ms (100
DE TRC SCL X	Y FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1 f 2.440 888 GHz 1 f 2.441 887 GHz	-1.29 dBm -1.34 dBm		
2.441 007 0Hz	-1.34 0.011		

CH78 -3Mbps



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8. BANDWIDTH TEST

8.1 LIMIT

FCC Part15 15.247,Subpart C					
Section	on 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%
	GFSK(1Mbps) CH00 / CH39 / C78	Test Voltage:	AC 120V/60Hz

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	0.8718	PASS
2441 MHz	0.8720	PASS
2480 MHz	0.8715	PASS

CH00 -1Mbps



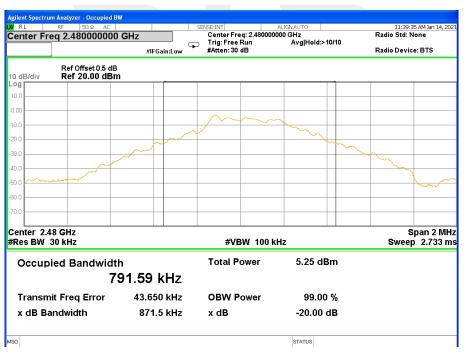
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CH39 -1Mbps



CH78 -1Mbps



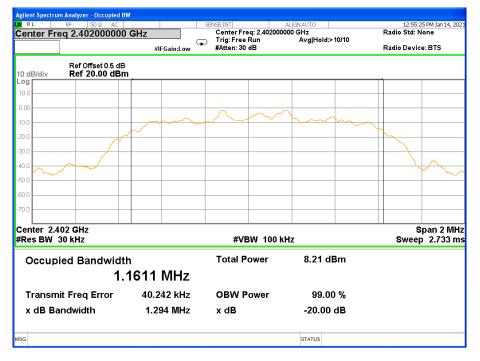


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Temperature:	25℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps) CH00 / CH39 / C78	Test Voltage:	AC 120V/60Hz

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.294	PASS
2441 MHz	1.295	PASS
2480 MHz	1.292	PASS

CH00 -2Mbps

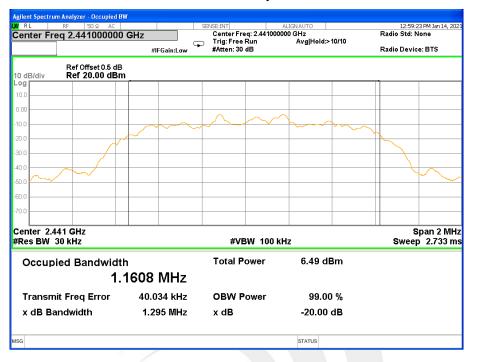


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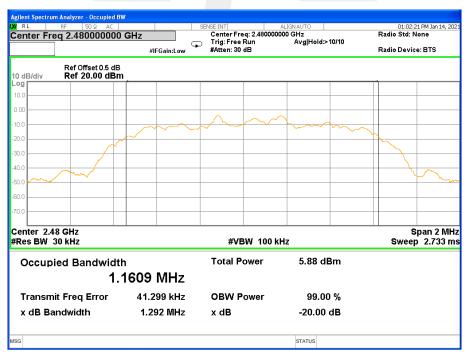
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CH39 -2Mbps



CH78 -2Mbps



Shenzhen STS Test Services Co., Ltd.



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

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.214	PASS
2441 MHz	1.215	PASS
2480 MHz	1.217	PASS

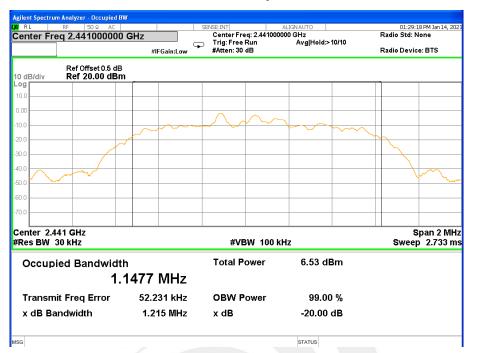
CH00 -3Mbps

Agilent Spectrum Analyzer - Oo				
Center Freq 2.4020	2 AC 00000 GHz	SENSE:INT Center Freq: 2.402000		01:33:57 PM Jan 14, 202: Radio Std: None
	#IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Hold:>10/10	Radio Device: BTS
Ref Offse 10 dB/div Ref 20.0				
Log				
10.0				
0.00		$\Lambda \sim$		
10.0				
20.0				
30.0				
40.0				- march
70.0				
70.0				
Center 2.402 GHz #Res BW 30 kHz		#VBW 100 k	ίΗz	Span 2 MHz Sweep 2.733 ms
Occupied Band	dwidth	Total Power	8.23 dBm	
-	1.1465 MHz			
Transmit Freq Er	ror 51.523 kHz	OBW Power	99.00 %	
x dB Bandwidth	1.214 MHz	x dB	-20.00 dB	
ISG			STATUS	

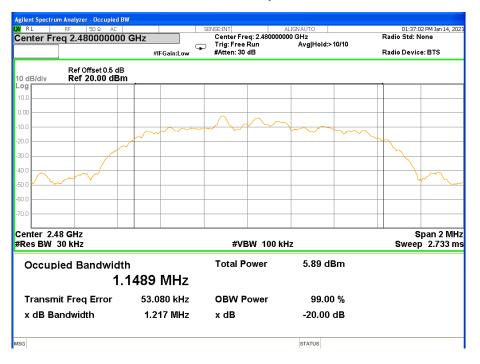
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CH39 -3Mbps



CH78 -3Mbps



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9. OUTPUT POWER TEST

9.1 LIMIT

FCC Part 15.247,Subpart C					
Section	on Test Item Limit Frequency Range (MHz) Resu				
		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.

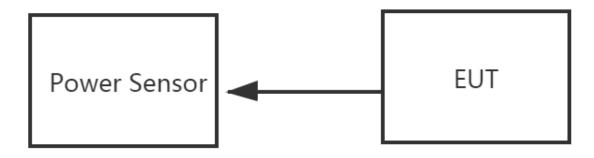
e) A plot of the test results and setup description shall be included in the test report.

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:	AC 120V/60Hz		

Mode Channel Number		Frequency	Peak Power	Average Power	Limit
	(MHz)	(dBm)	(dBm)	(dBm)	
	0	2402	1.02	-0.51	30.00
GFSK(1M)	39	2441	-0.20	-1.51	30.00
	78	2480	-0.98	-2.25	30.00

Note: the channel separation >20dB bandwidth

Mode Channel Number		Frequency		Peak Power	Average Power	Limit
	(MHz)	(dBm)	(dBm)	(dBm)		
	0	2402	3.75	-0.36	20.97	
π/4-DQPSK(2M)	39	2441	2.67	-1.37	20.97	
, ,	78	2480	1.37	-2.63	20.97	

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

Mode Channel Number		Frequency	1 2	Peak Power	Average Power	Limit
	(MHz)	(dBm)	(dBm)	(dBm)		
	0	2402	4.28	-0.36	20.97	
8-DPSK(3M)	39	2441	3.17	-1.36	20.97	
	78	2480	1.85	-2.63	20.97	

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

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10. ANTENNA REQUIREMENT

10.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

10.2 EUT ANTENNA

The EUT antenna is PCB 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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