

RADIO TEST REPORT

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Report No.: STS2009272W01

Issued for

DTEN Inc

97 E Brokaw Road suite 180 San Jose CA 95112

Product Name:	DTEN ME			
Brand Name:	DTEN			
Model Name:	DBA0027			
Series Model:	N/A			
FCC ID:	2AQ7Q-DBA0027			
Test Standard:	FCC Part 15.247			

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TEST RESULT CERTIFICATION

Applicant's Name	DTEN Inc
Address	97 E Brokaw Road suite 180 San Jose CA 95112
Manufacturer's Name	DTEN Inc
Address	97 E Brokaw Road suite 180 San Jose CA 95112
Product Description	
Product Name	DTEN ME
Brand Name	DTEN
Model Name	DBA0027
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:	23 Sept. 2020
Date (s) of performance of tests :	23 Sept. 2020 ~ 30 Oct. 2020
Date of Issue:	30 Oct. 2020
	_

Test Result Pass

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

(Vita Li)

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7. HOPPING CHANNEL SEPARATION MEASUREMEN

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	30 Oct. 2020	STS2009272W01	ALL	Initial Issue



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1. SUMMARY OF TEST RESULTS

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

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

NOTE:

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

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

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1.1 TEST FACTORY

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

1.2 MEASUREMENT UNCERTAINTY

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

No.	Item	Uncertainty
1	RF output power, conducted	±0.68dB
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	DTEN ME
Trade Name	DTEN
Model Name	DBA0027
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.
Adapter	Input: AC 100-240V 50/60Hz 2.5A Output: 19V4.73A
Hardware version number	DBO0427-OPS-A311D-MAIN Rev P4
Software version number	S1a_A311D_dten_s27_S1-004-0.2.0.0-20200702
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	DTEN	DBA0027	PIFA	N/A	3.88 dBi	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	

Note:

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

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

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

For AC Conducted Emission

Test Case		
AC Conducted Emission	Mode 13 : Keeping BT TX	

2.3 FREQUENCY HOPPING SYSTEM REQUIREMENTS

(1)Standard and Limit

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

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



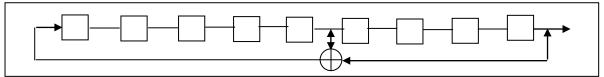
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The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping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

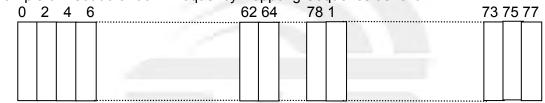
(2)The Pseudorandom sequence may be generated in a nin-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones: i.e. the shift register is initialized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

Numver of shift register stages:9

Length of pseudo-random sequence:2⁹-1=511bits Longest sequence of zeros: 8(non-inverted signal)



Liner Feedback Shift Register for Generator of the PRBS sequence An example of Pseudorandom Frequency Hoppong Sequence as follow:



Each frequency used equally on the average by each transmitter. The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies ini synchronization with the transmitted signals.

(3)Frequency Hopping System

This transmitter device is frequency hopping device, and complies with FCC part 15.247 rule.

This device uses Bluetooth radio which operates in 2400-2483.5 MHz band. Bluetooth uses a radio technology called frequency-hopping spread spectrum, which chops up the data being sent and transmits chunks of it on up to 79 bands (1 MHz each; centred from 2402 to 2480 MHz) in the range 2,400-2,483.5MHz. The transmitter switches hop frequencies 1,600 times per second to assure a high degree of data security. All Bluetooth devices participating in a given piconet are synchronized to the frequency-hopping channel for the piconet. The frequency hopping sequence is determined by the master's device address and the phase of the hopping sequence (the frequency to hop at a specific time) is determined by the master's internal clock. Therefore, all slaves in a piconet must know the master's device address and must synchronize their clocks with the master's clock.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its piconet to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

This device was tested with a bluetooth system receiver to check that the device maintained hopping synchronization, and the device complied with these requirements FCC Part 15.247 rule.

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2.4 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS.

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

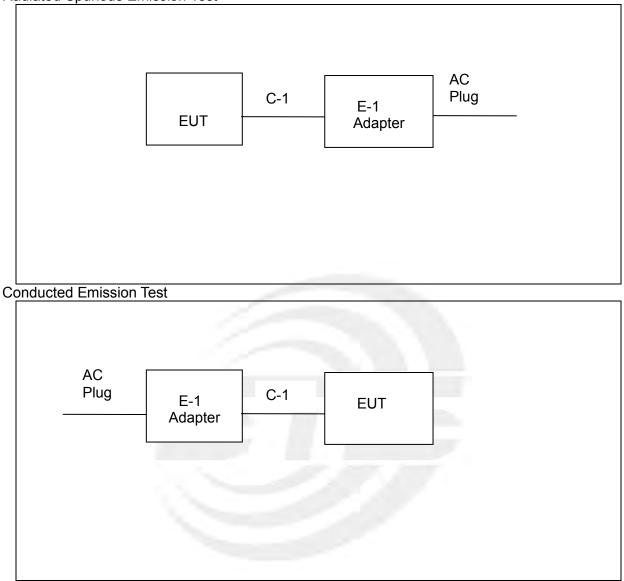
RF Function	Туре	Mode Or Modulation type	Ant Gain(dBi)	Power Class
		GFSK	3.88	Default
BT	BR+EDR	π/4-DQPSK	3.88	Default
		8DPSK	3.88	Default



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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	Ifr/Brand Model/Type No. Length		Note
E-1	Adapter	DTEN	DAP01	N/A	N/A
C-1	Power Cord	N/A	N/A	200cm	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
N/A	N/A	N/A	N/A	N/A	N/A
		0			

Note:

(1) For detachable type I/O cable should be specified the length in cm in ^CLength₂ 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	2022.10.11	
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	2022.10.11
LISN	R&S	ENV216	101242	2020.10.12	2022.10.11
LISN	EMCO	3810/2NM	23625	2020.10.12	2022.10.11
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		
MIMO Power measurement test Set	Keysight	U2021XA	MY55520005	2020.10.10	2021.10.09		
			MY55520006	2020.10.10	2021.10.09		
			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)					



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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		

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3.1.2 TEST PROCEDURE

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

3.1.3 TEST SETUP

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

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

3.1.4 EUT OPERATING CONDITIONS

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



3.1.5 TEST RESULT

Temperature:	27.5(C)	Relative Humidity:	69%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 13		

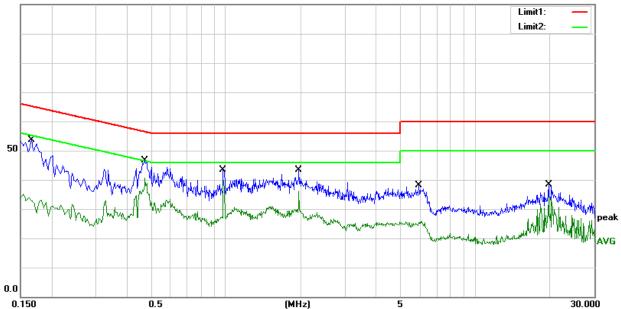
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1660	33.29	20.23	53.52	65.16	-11.64	QP
2	0.1660	14.96	20.23	35.19	55.16	-19.97	AVG
3	0.4740	26.23	20.48	46.71	56.44	-9.73	QP
4	0.4740	20.26	20.48	40.74	46.44	-5.70	AVG
5	0.9780	23.19	20.16	43.35	56.00	-12.65	QP
6	0.9780	19.70	20.16	39.86	46.00	-6.14	AVG
7	1.9620	23.32	20.06	43.38	56.00	-12.62	QP
8	1.9620	16.10	20.06	36.16	46.00	-9.84	AVG
9	5.9540	18.26	19.89	38.15	60.00	-21.85	QP
10	5.9540	6.06	19.89	25.95	50.00	-24.05	AVG
11	19.7100	17.69	20.62	38.31	60.00	-21.69	QP
12	19.7100	13.54	20.62	34.16	50.00	-15.84	AVG

Remark:

1. All readings are Quasi-Peak and Average values

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

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



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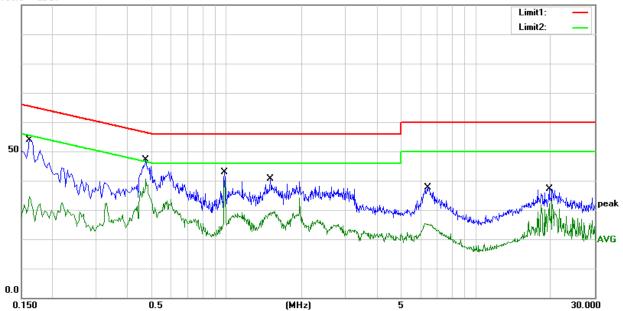
Temperature:	27.5(C)	Relative Humidity:	69%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 13		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1620	33.71	20.23	53.94	65.36	-11.42	QP
2	0.1620	14.28	20.23	34.51	55.36	-20.85	AVG
3	0.4740	26.72	20.48	47.20	56.44	-9.24	QP
4	0.4740	20.23	20.48	40.71	46.44	-5.73	AVG
5	0.9820	22.82	20.16	42.98	56.00	-13.02	QP
6	0.9820	19.89	20.16	40.05	46.00	-5.95	AVG
7	1.5020	20.41	20.11	40.52	56.00	-15.48	QP
8	1.5020	13.99	20.11	34.10	46.00	-11.90	AVG
9	6.4140	17.73	19.89	37.62	60.00	-22.38	QP
10	6.4140	5.58	19.89	25.47	50.00	-24.53	AVG
11	19.7100	16.57	20.62	37.19	60.00	-22.81	QP
12	19.7100	12.49	20.62	33.11	50.00	-16.89	AVG

Remark:

1. All readings are Quasi-Peak and Average values

- 2. Margin = Result (Result = Reading + Factor)–Limit
- 3. Factor=LISN factor+Cable loss+Limiter (10dB)
- 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)

1	
Field Strength	Measurement Distance
(micorvolts/meter)	(meters)
2400/F(KHz)	300
24000/F(KHz)	30
30	30
100	3
150	3
200	3
500	3
	(micorvolts/meter) 2400/F(KHz) 24000/F(KHz) 30 100 150 200

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)	120 KH2 / 300 KH2	

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

For Restricted band

Spectrum Parameter	Setting	
Detector	Peak/AV	
Start/Stop Frequency	Lower Band Edge: 2310 to 2410 MHz	
	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.

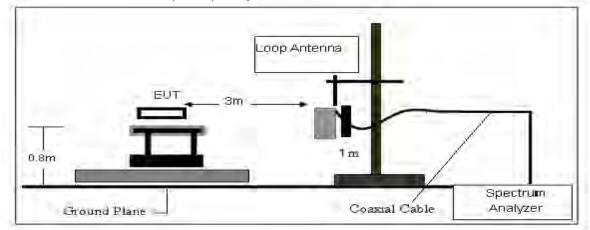
3.2.3 DEVIATION FROM TEST STANDARD

No deviation.

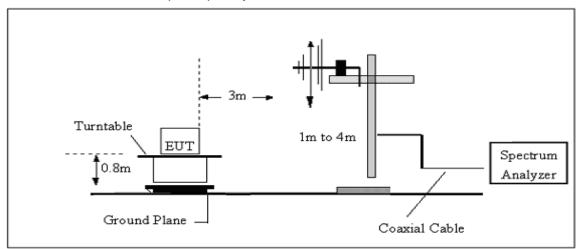


3.2.4 TESTSETUP

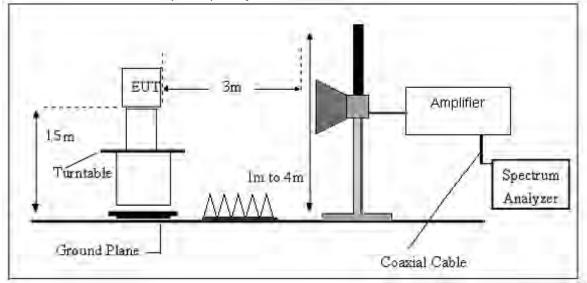
(A) Radiated Emission Test-Up Frequency Below 30MHz

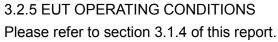


(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(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

AF CL AG Frequency FS RA Factor (MHz) (dBµV/m) (dBµV/m) (dB) (dB) (dB) (dB) 40 58.1 12.2 31.9 300 1.6 -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	Test Result
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F	
					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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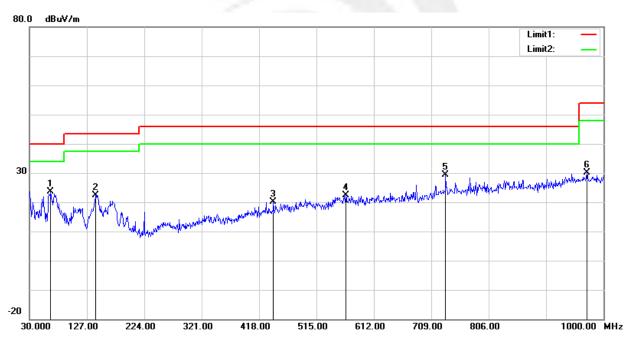
(30MHz-1000MHz)

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

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	65.8900	49.26	-25.60	23.66	40.00	-16.34	QP
2	141.5500	40.58	-18.11	22.47	43.50	-21.03	QP
3	442.2500	30.15	-9.99	20.16	46.00	-25.84	QP
4	564.4700	27.86	-5.54	22.32	46.00	-23.68	QP
5	733.2500	31.83	-2.35	29.48	46.00	-16.52	QP
6	971.8700	28.05	2.13	30.18	54.00	-23.82	QP

Remark:

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





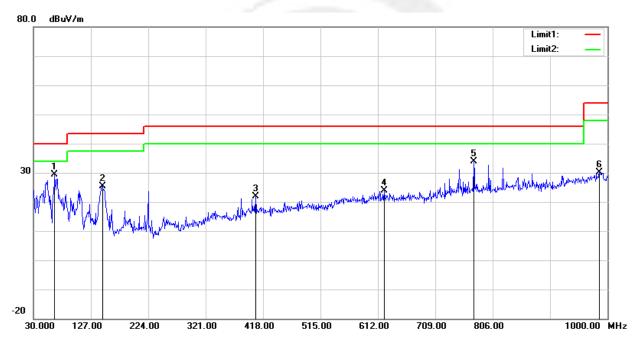
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Temperature:	23.1(C)	Relative Humidity:	60%RH	
Test Voltage:	AC 120V/60Hz	Phase:	Vertical	
Test Mode:	Mode 1/2/3/4/5/6/7/8/9(Mode 3 worst mode)			

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	65.8900	55.06	-25.60	29.46	40.00	-10.54	QP
2	146.4000	43.88	-18.38	25.50	43.50	-18.00	QP
3	405.3900	32.79	-10.83	21.96	46.00	-24.04	QP
4	622.6700	29.37	-5.37	24.00	46.00	-22.00	QP
5	773.9900	36.26	-2.29	33.97	46.00	-12.03	QP
6	986.4200	27.94	2.27	30.21	54.00	-23.79	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	Orrected Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBµV)	(dB)	(dB)	(dB/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре	
				Low Char	nnel (GFSK/2	402 MHz)				
3264.90	61.04	44.70	6.70	28.20	-9.80	51.24	74.00	-22.76	PK	Vertical
3264.90	50.62	44.70	6.70	28.20	-9.80	40.82	54.00	-13.18	AV	Vertical
3264.83	62.03	44.70	6.70	28.20	-9.80	52.23	74.00	-21.77	PK	Horizontal
3264.83	50.05	44.70	6.70	28.20	-9.80	40.25	54.00	-13.75	AV	Horizontal
4804.34	58.11	44.20	9.04	31.60	-3.56	54.55	74.00	-19.45	PK	Vertical
4804.34	49.37	44.20	9.04	31.60	-3.56	45.81	54.00	-8.19	AV	Vertical
4804.56	59.57	44.20	9.04	31.60	-3.56	56.01	74.00	-17.99	PK	Horizontal
4804.56	50.33	44.20	9.04	31.60	-3.56	46.77	54.00	-7.23	AV	Horizontal
5359.59	49.13	44.20	9.86	32.00	-2.34	46.79	74.00	-27.21	PK	Vertical
5359.59	39.50	44.20	9.86	32.00	-2.34	37.16	54.00	-16.84	AV	Vertical
5359.72	47.40	44.20	9.86	32.00	-2.34	45.06	74.00	-28.94	PK	Horizontal
5359.72	39.52	44.20	9.86	32.00	-2.34	37.18	54.00	-16.82	AV	Horizontal
7205.75	54.46	43.50	11.40	35.50	3.40	57.86	74.00	-16.14	PK	Vertical
7205.75	44.83	43.50	11.40	35.50	3.40	48.23	54.00	-5.77	AV	Vertical
7205.91	54.43	43.50	11.40	35.50	3.40	57.83	74.00	-16.17	PK	Horizontal
7205.91	43.91	43.50	11.40	35.50	3.40	47.31	54.00	-6.69	AV	Horizontal
	•			Middle Cha	annel (GFSK/	2441 MHz)		•		•
3264.68	62.03	44.70	6.70	28.20	-9.80	52.23	74.00	-21.77	PK	Vertical
3264.68	51.54	44.70	6.70	28.20	-9.80	41.74	54.00	-12.26	AV	Vertical
3264.85	60.91	44.70	6.70	28.20	-9.80	51.11	74.00	-22.89	PK	Horizontal
3264.85	50.50	44.70	6.70	28.20	-9.80	40.70	54.00	-13.30	AV	Horizontal
4882.44	59.46	44.20	9.04	31.60	-3.56	55.90	74.00	-18.10	PK	Vertical
4882.44	49.73	44.20	9.04	31.60	-3.56	46.17	54.00	-7.83	AV	Vertical
4882.44	58.83	44.20	9.04	31.60	-3.56	55.27	74.00	-18.73	PK	Horizontal
4882.44	50.16	44.20	9.04	31.60	-3.56	46.60	54.00	-7.40	AV	Horizontal
5359.74	49.13	44.20	9.86	32.00	-2.34	46.79	74.00	-27.21	PK	Vertical
5359.74	40.14	44.20	9.86	32.00	-2.34	37.80	54.00	-16.20	AV	Vertical
5359.68	48.51	44.20	9.86	32.00	-2.34	46.17	74.00	-27.83	PK	Horizontal
5359.68	39.25	44.20	9.86	32.00	-2.34	36.91	54.00	-17.09	AV	Horizontal
7323.73	53.95	43.50	11.40	35.50	3.40	57.35	74.00	-16.65	PK	Vertical
7323.73	43.50	43.50	11.40	35.50	3.40	46.90	54.00	-7.10	AV	Vertical
7323.86	54.68	43.50	11.40	35.50	3.40	58.08	74.00	-15.92	PK	Horizontal
7323.86	44.07	43.50	11.40	35.50	3.40	47.47	54.00	-6.53	AV	Horizontal



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				High Char	nnel (GFSK/	2480 MHz)				
3264.78	61.97	44.70	6.70	28.20	-9.80	52.17	74.00	-21.83	PK	Vertical
3264.78	50.86	44.70	6.70	28.20	-9.80	41.06	54.00	-12.94	AV	Vertical
3264.63	61.84	44.70	6.70	28.20	-9.80	52.04	74.00	-21.96	PK	Horizontal
3264.63	50.66	44.70	6.70	28.20	-9.80	40.86	54.00	-13.14	AV	Horizontal
4960.45	59.44	44.20	9.04	31.60	-3.56	55.88	74.00	-18.12	PK	Vertical
4960.45	49.49	44.20	9.04	31.60	-3.56	45.93	54.00	-8.07	AV	Vertical
4960.36	58.62	44.20	9.04	31.60	-3.56	55.06	74.00	-18.94	PK	Horizontal
4960.36	50.25	44.20	9.04	31.60	-3.56	46.69	54.00	-7.31	AV	Horizontal
5359.67	47.95	44.20	9.86	32.00	-2.34	45.61	74.00	-28.39	PK	Vertical
5359.67	40.37	44.20	9.86	32.00	-2.34	38.03	54.00	-15.97	AV	Vertical
5359.63	47.34	44.20	9.86	32.00	-2.34	45.00	74.00	-29.00	PK	Horizontal
5359.63	39.09	44.20	9.86	32.00	-2.34	36.75	54.00	-17.25	AV	Horizontal
7439.83	54.82	43.50	11.40	35.50	3.40	58.22	74.00	-15.78	PK	Vertical
7439.83	43.54	43.50	11.40	35.50	3.40	46.94	54.00	-7.06	AV	Vertical
7439.77	53.58	43.50	11.40	35.50	3.40	56.98	74.00	-17.02	PK	Horizontal
7439.77	43.48	43.50	11.40	35.50	3.40	46.88	54.00	-7.12	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.



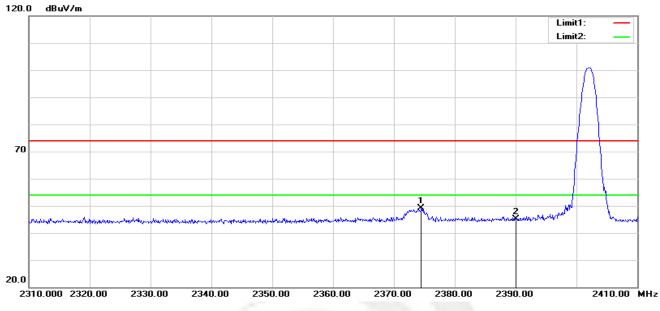
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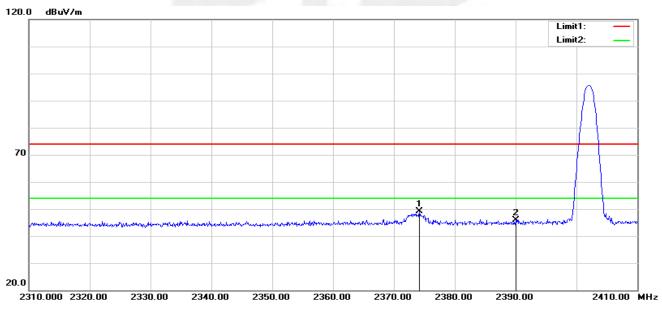
Restricted band Requirements

GFSK-Low Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2374.500	45.08	4.10	49.18	74.00	-24.82	peak
2	2390.000	40.90	4.34	45.24	74.00	-28.76	peak

Vertical



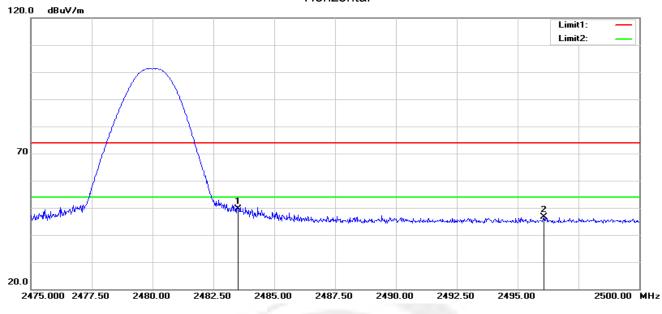
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2374.200	45.02	4.10	49.12	74.00	-24.88	peak
2	2390.000	41.45	4.34	45.79	74.00	-28.21	peak



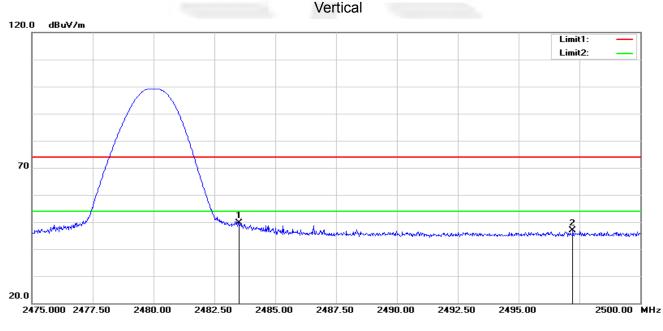
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GFSK-High Horizontal



No.	Frequency	Reading	Reading Correct		Result Limit		Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	45.12	4.60	49.72	74.00	-24.28	peak
2	2496.075	42.10	4.64	46.74	74.00	-27.26	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	45.13	4.60	49.73	74.00	-24.27	peak
2	2497.225	42.19	4.64	46.83	74.00	-27.17	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.

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4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

4.1 LIMIT

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

4.2 TEST PROCEDURE

Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

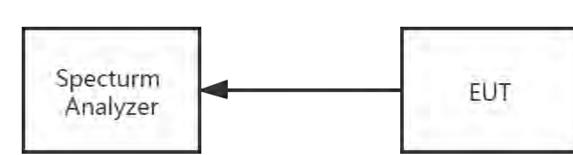
For Band edge

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

For Hopping Band edge

Spectrum Parameter	Setting			
Detector	Peak			
Start/Stap Eraguapay	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.



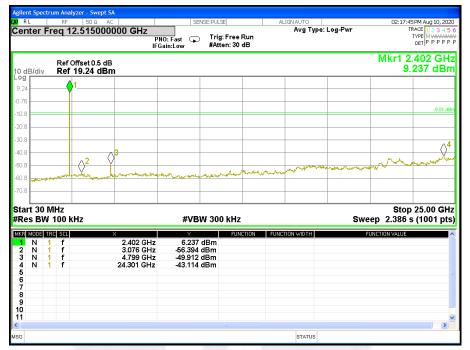
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4.5 TEST RESULTS

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

00 CH



39 CH

		dyzer - Swept S								
LXI RL Center	RF	50 Ω AC			SENSE:INT		ALIGNAUTO Avg Type	: Log-Pwr		7 PM Oct 20, 202
Center	Fied	12.313000	P	PNO: Fast Gain:Low	Trig: Free #Atten: 30					DET P P P P P
10 dB/div		Offset 0.5 dB 16.40 dBn								.452 GH: 401 dBn
6.40	(1								
-3.60										-12.70 dB
-13.6										
-33.6										
-43.6		²	(3			and a second second	لللصلات بد	- Mar	and the second second
	aphlan we	homen ward	- warne warden warden with	Munan	man warden war	halender Vision				
-73.6										
Start 30 #Res BV		kHz		#VB	W 300 kHz			Sw	Stop veep 2.39 s	25.00 GH: 6 (1001 pts
MKR MODE	TRC SCL		×	Ŷ	FUN	CTION FUI	NCTION WIDTH	FL	JNCTION VALUE	
1 N 2 N 3 N 4 N 5	1 f 1 f 1 f 1 f		2.452 GHz 3.900 GHz 7.446 GHz 25.000 GHz	6.401 -50.215 -55.825 -48.067	dBm dBm					
5 6 7 8 9										
10 11 12										
MSG							STATUS			



78 CH

RL RF	lyzer - Swept SA 50 Ω AC		SENSE:	INT	ALIGNA	UTO I		07:59:5	2 PM Oct 20, 2
nter Freq 1	2.515000000	GHz PNO: I IFGain:] Fast ⊊ Tr	ig: Free Run tten: 30 dB		vg Type:	Log-Pwr	TF	ACE 1 2 3 4
dB/div Ref	Offset 0.5 dB 16.43 dBm							Mkr1 2. 6.	477 GI 426 dB
43	1								
57									-12.49 (
.6									
6									
6		\ <mark>3</mark>				and a		. Martin	
6	worther and the second	- monteres	Anorem Classic and a	and water and	Warner Barrer				- nel and ar
.6									
art 30 MHz es BW 100 k	Hz		#VBW 30	00 kHz			Sw	Stop reep 2.39 s	25.00 G
R MODE TRC SCL	Х		Y	FUNCTION	FUNCTION V	VIDTH		INCTION VALUE	
N 1 f N 1 f	3.	477 GHz 975 GHz	6.426 dBm -50.146 dBm						
8 N 1 f I N 1 f		446 GHz 750 GHz	-56.101 dBm -48.655 dBm						
i									
3									
7 3 9 0									

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

Rt RF 10.0 AC SENSE:INT ALIGNAUTO 07:54:110M Center Freq 2.35350000 GHz PN0: Fast IFGain:Low Trig: Free Run #Atten: 30 dB Aug Type: Log-Pwr Trace Type: Type: Log-Pwr Ref Offset 0.5 dB Ref 17.81 dBm Mkr1 2.401 8 Ref Mkr1 2.401 8 Ref 219						er - Swept SA 50 Ω AC		IM An RF	ctru		
Ref 17.81 dBm 7.80 Og 7.81 Og 7.81 7.81 Stop 2.407 7.80 7.80 Stop 2.407 7.80 81 7.80 Stop 2.41 7.80	Trig: Free Run TYPE		Trig		Р				Fre		
Org Org <th></th>											
2.19 12.2 22.407 23.050 dBm 23.050 dBm 25.2 27.8 23.050 dBm 25.2 27.8	7.00					.81 aBm	er 17.	Rei	/	3/div	
12.2 22.2							_				.81
22 23 24 24 25 26 27 <											.19
22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 22 23 24 24 25 25 26 26 27 1 1 1 28 1 29 1 30 1 31 1 32 1 32 1 33 1 34 1 35 1 36 1 37 1 38 1 39 1 30 1 31 1 32 1 33 1 34 1 35 1 36 1 37 1 38 1 37 3							_				2.2
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Image: Stop 2 Image: S			_								2.2
Stop 2.407 Stop 2.407 Res BW 100 KHz Y BW 300 KHz Stop 2.407 Stop 2.407 Stop 2.407 Res BW 100 KHz Y BW 300 KHz Stop 2.407 Stop 2.407 Stop 2.407 Stop 2.40005 Stop 2.407 Stop 2.40005 Stop 2.407 Stop 2.407 Stop 2.407 Stop 2.40005 Stop 2.407 <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td>_</td><td></td><td></td><td></td><td>2.2</td></th<>							_				2.2
X22 X30000 GHz Stop 2.407 Res BW 100 kHz #VBW 300 kHz Stop 2.407 Stop 2.407 Sweep 10.3 ms (1) RM00E free Sci X Y FUNCTION FUNCTION WIDTH FUNCTION WIDTH FUNCTION VALUE In 1 f 2.401 86 GHz 7.808 dBm 4.01 FUNCTION VIDTH FUNCTION VIDTH FUNCTION VIDTH 2 N 1 f 2.400 86 GHz -37.838 dBm -33.050 dBm	want Y						<u>2</u>				2.2
Ant 2.30000 GHz Stop 2.407 Res BW 100 kHz #VBW 300 kHz Stop 2.407 R Model FRC Sci Y FUNCTION FUNCTION WIDTH FUNCTION VALUE I N 1 f 2.401 86 GHz -58.473 dBm -	un an	wohne who	enon	when an and	a alangeralana	+ Automation	nhene		www	mun	2.2
Image: Stop 2,407 Stop 2,407 Res BW 100 kHz #VBW 300 kHz Stop 2,407 Stop 2,407 Sweep 10.3 ms (11 Res BW 100 kHz Y FUNCTION FUNCTION WIDTH FUNCTION VALUE I N 1 f 2,401 86 GHz -58,473 dBm -											2.2
Res BW 100 kHz #VBW 300 kHz Sweep 10.3 ms (100 kHz) Model FRC Set. X FUNCTION FUNCTION WIDTH FUNCTION VALUE N 1 f 2.311 24 GHz 7.803 dBm FUNCTION VALUE FUNCTION VALUE N 1 f 2.339 40 GHz 37.835 dBm FUNCTION VALUE FUNCTION VALUE A N 1 f 2.309 40 GHz -33.050 dBm FUNCTION VALUE FUNCTION VALUE 5 F F 2.400 05 GHz -33.050 dBm F F 6 F F F F F F F 7 F F F F F F F 6 F F F F F F F 7 F <											
N 1 f 2.401 86 GHz 7.808 dBm 2 N 1 f 2.311 24 GHz -58.473 dBm 3 N 1 f 2.399 40 GHz -37.835 dBm 4 N 1 f 2.400 05 GHz -33.050 dBm 5 - - - - - 6 - - - - - 7 - - - - - - 8 - - - - - - - 9 - </td <td></td> <td>кНz</td> <td>BW 300</td> <td>#VE</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>		кНz	BW 300	#VE							
2 N 1 f 2.311 24 GHz -58,473 dBm 3 N 1 f 2.399 40 GHz -37,836 dBm 4 N 1 f 2.400 05 GHz -33,050 dBm 5		FUNCTION		Y			L	C SCL	TRC		(R)
	35 dBm		5 dBm	-37.835	399 40 GHz	2		f	1	N	3
	50 dBm		0 dBm	-33.050	400 05 GHz	2		f	1	N	
											3
)
											2

00 CH

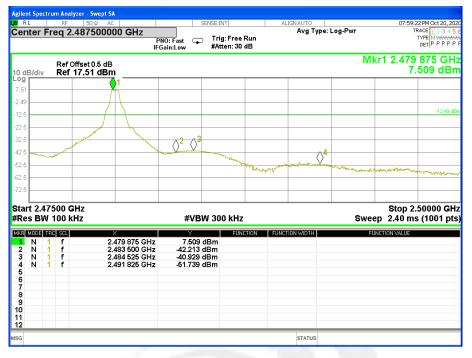
39 CH



Shenzhen STS Test Services Co., Ltd.



78 CH





Shenzhen STS Test Services Co., Ltd.





For Hopping Band edge

GFSK

	RF 50 Ω	AC	SENSE:INT		ALIGN AUTO		08:06:08 PM (Det 20, 20
enter l	Freq 2.35150	PI	NO: Fast 🍙 Trig: I Gain:Low #Atter	Free Run n: 30 dB	Avg Type: L	.og-Pwr	TYPE	12345 MWWW PPPPF
) dB/div	Ref Offset 0. Ref 17.17					Mkr	1 2.402 89 7.16	
ng								
.83								
2.8								-12.84 d
2.8								
2.8								
2.8							<u>^2</u>	Trouble
2.8							Jane M	1.1
2.8	Same and the second	where the second second	had a construction of the second s	man and a second		and and a second and a second and a second as a se	Annuel	
2.8								
ant 2 3	30000 GHz						Stop 2.403	00 CF
	V 100 kHz		#VBW 300	kHz		Sweep	9.87 ms (10	
	TRC SCL	×	Ŷ	FUNCTION FI	UNCTION WIDTH	FUNC	CTION VALUE	
		2.402 897 GHz	7.165 dBm					
1 N 2 N 3 N 4	1 f 1 f 1 f	2.390 022 GHz 2.400 013 GHz	-52.340 dBm -40.314 dBm					
1 N 2 N 3 N 4 5 5 7 3 9	1 f							
1 N 2 N	1 f							

		2 AC		SENSE:	INT	ALIGN AUTO			28 PM Oct 20, 20
ter Fre	q 2.4895	00000 GHz	PNO: Fas IFGain:Lov		ig: Free Run tten: 30 dB	Avg T	/pe: Log-Pwr		TYPE MWWW DET P P P P
B/div	Ref Offset 0 Ref 17.47						N	lkr1 2.479 7	9 861 GH .471 dB
AA									
	\								-12.53
<u> </u>	<u>h.</u>								
	- MArm		<mark>3</mark>						
<u> </u>	V V	and he particular de	www.raw	(han					
				. I Way	washing and a second	᠁ᢛ᠋ᡎᢦᡀᡊᡀᡏᡟᢔᠰᢆᠬᠼᡢ	www.	of an and the second	mm
rt 2.4790 s BW 10				#VBW 30	00 kHz		Swe	Stop 2 ep 2.07 m	.50000 G s (1001 p
MODE TRC		×		Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
N 1 N 1	f f	2.479 861 (2.483 515 (GHz -4	7.471 dBm 1.261 dBm					
N 1	f	2.485 153 (SHz -4	1.760 dBm					



Page 40 of 76 Report No.: STS2009272W01

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

00 CH

	RF 50 Ω	AC	SENSE:INT		ALIGN AUTO		10:34:	04 AM Oct 21, 20
enter F	Freq 12.5150	PN	IO: Fast 😱 Trig: F ain:Low #Atter	Free Run n: 30 dB	Avg Type:	Log-Pwr	ſ	RACE 1 2 3 4 5 TYPE MWWW DET P P P P
0 dB/div	Ref Offset 0.5 Ref 11.83 d							.402 GH .829 dBi
.83								
.03								
3.2								-17.69 (
1.2								
3.2								
3.2	2	3						102
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.2								
art 30	MHz						Stop) 25.00 GI
	V 100 kHz		#VBW 300				weep 2.39	s (1001 pi
Res BW E MODE N 2 N 3 N 4 N	V 100 kHz	× 2.402 GHz 2.502 GHz 4.000 GHz 10.018 GHz	#VBW 300 1.829 dBm -56.727 dBm -59.487 dBm -57.318 dBm		FUNCTION WIDTH			
Res BW R MODE N N 2 N 3 N	V 100 kHz 160 sol 1 f 1 f 1 f	2.402 GHz 2.502 GHz 4.000 GHz	1.829 dBm -56.727 dBm -59.487 dBm		FUNCTION WIDTH		weep 2.39	

39 CH

RL	RF 50 Ω	2 AC	SENSE:INT	0	.IGN AUTO		10:37:42 AN	Oct 21, 20
		000000 GHz	SENSE.INT	AL	Avg Type:	Log-Pwr	TRACE	12345
	109 12.5150	PN	0: Fast 😱 Trig: Fr				TYPE	PPPPF
		IFG	ain:Low #Atten:	30 dB				
	Ref Offset 0.5	5 dB					Mkr1 2.45	
0 dB/div	Ref 10.48 (0.48	1 dB
og	0 1							
480								
.52								-17.27
9.5								
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		w						
9.5								
9.5								
art 30 f	VILI-7						Stop 25	00.0
	100 kHz		#VBW 300 kl	Hz		Swee	ep 2.39 s (1	
tes BW	100 KHZ							
Res BW		×	Y F	UNCTION FUNC	TION WIDTH	FUNC	TION VALUE	
ir Mode t	RC SCL 1 f	2.452 GHz	0.481 dBm	FUNCTION FUNC	TION WIDTH	FUNC	TION VALUE	
R MODE T N 2 N	RC SCL 1 f 1 f	2.452 GHz 3.900 GHz	0.481 dBm -49.685 dBm	UNCTION FUNC	FION WIDTH	FUNC	TION VALUE	
R MODE T N 2 N 3 N	RC SCL 1 f	2.452 GHz	0.481 dBm	UNCTION FUNC	TION WIDTH	FUNC	TION VALUE	
R MODE T N 2 N 3 N	RC SCL 1 f 1 f 1 f	2.452 GHz 3.900 GHz 5.199 GHz	0.481 dBm -49.685 dBm -55.433 dBm	UNCTION FUNC	TION WIDTH	FUNC	TION VALUE	
R MODE T N 2 N 3 N 4 N 5 5 7	RC SCL 1 f 1 f 1 f	2.452 GHz 3.900 GHz 5.199 GHz	0.481 dBm -49.685 dBm -55.433 dBm	UNCTION FUNC	TION WIDTH	FUNC	TION VALUE	
F MODE 11 1 N 7 2 N 7 3 N 7 4 N 7 5 5 7 3	RC SCL 1 f 1 f 1 f	2.452 GHz 3.900 GHz 5.199 GHz	0.481 dBm -49.685 dBm -55.433 dBm	FUNCTION FUNC	TION WIDTH	FUNC	TION VALUE	
MODE T 1 N 2 2 N 2 3 N 2 4 N 2 5 5 5 6 5 5 7 3 3 9 0 0	RC SCL 1 f 1 f 1 f	2.452 GHz 3.900 GHz 5.199 GHz	0.481 dBm -49.685 dBm -55.433 dBm	FUNCTION FUNCT	TION WIDTH	FUNC	TION VALUE	
E MODE T 1 N 2 N 3 N 4 N 5 5 7 3 9 9 1 1 1 1 1 1 1 1 1 1	RC SCL 1 f 1 f 1 f	2.452 GHz 3.900 GHz 5.199 GHz	0.481 dBm -49.685 dBm -55.433 dBm	FUNCTION FUNCT	TION WIDTH	FUNC	TION VALUE	
B MODE T N 2 N 4 N 4 N 4 N 4 N 4 N 4 N 4 N 4 N 4 N 4	RC SCL 1 f 1 f 1 f	2.452 GHz 3.900 GHz 5.199 GHz	0.481 dBm -49.685 dBm -55.433 dBm	FUNCTION FUNC	STATUS	FUNC	TION VALUE	



78 CH

RL RF	50 Ω AC	SENSE:INT	ALIGN AUTO	10:41:25 AM Oct 21, 2
enter Freq 12	.515000000 GHz	NO: Fast 😱 Trig: Free Gain:Low #Atten: 30		
dB/div Ref 1	fset 0.5 dB 2.75 dBm			Mkr1 2.477 GI 2.747 dB
75				
25				-17.00
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	^2			
1.3	$-\gamma$ \wedge^3		- more a	man and and the man and a man
.3 mennehic worker	and the second and a second as the second as	and a second s		
7.3				
art 30 MHz tes BW 100 kH	lz	#VBW 300 kH	z	Stop 25.00 G Sweep 2.39 s (1001 p
R MODE TRC SCL	×		NCTION FUNCTION WIDTH	FUNCTION VALUE
N 1 f 2 N 1 f 3 N 1 f 4 N 1 f	2.477 GHz 3.975 GHz 6.947 GHz 24.950 GHz	2.747 dBm -49.818 dBm -55.861 dBm -47.886 dBm		
3				
1				
2				



Shenzhen STS Test Services Co., Ltd.



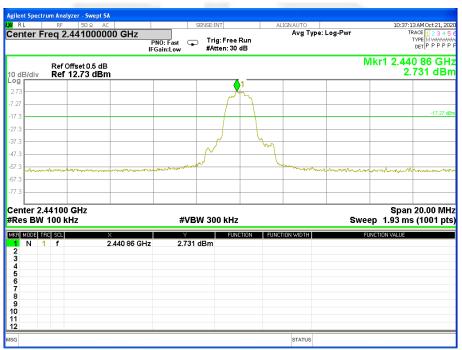


For Band edge(it's also the reference level for conducted spurious emission)

		lyzer - Swept SA								
nter F	req 2	50 Ω AC 2.35350000	0 GHz	PNO: Fast Gain:Low	ENSE:INT Trig: Free I #Atten: 30		ALIGN AUTO Avg Typ	e: Log-Pwr	Т	SAMOct 21, RACE 1 2 3 4 TYPE MWWW DET P P P
dB/div		Offset 0.5 dB 12.31 dBm	1						Mkr1 2.40 2.	1 86 G 305 dE
										1
										Δ
,										-176
7										
7										
7					<mark>2</mark>					4
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7	- and a second			and the second second second	and an and the second of the second se		Alexander of a second from a first		a determine of the set	
7										
urt 2.30									0 4am 0	40700 6
es BW				#VB	W 300 kHz			Sw	eep 10.3 m	40700 C s (1001
MODE T		×		Y	FUNC	TION	FUNCTION WIDTH		FUNCTION VALUE	
N	1 f 1 f 1 f 1 f	2	2.401 86 GHz 2.349 11 GHz 2.393 63 GHz 2.400 05 GHz	2.305 -58.247 -57.958 -56.757	dBm dBm					
							STATUS			

00 CH

39 CH



Shenzhen STS Test Services Co., Ltd.



78 CH

RL	RF	yzer - Swept SA 50 Ω AC		SEI	NSE:INT	4	LIGNAUTO		10:40	:55 AM Oct 21, 20
enter l	req 2	.48750000	F	PNO: Fast 😱 Gain:Low	Trig: Free #Atten: 30		Avg Type:	-		TRACE 1 2 3 4 1 TYPE M WAAAAA DET P P P P I
dB/div		offset 0.5 dB 13.00 dBm						ſ	Vkr1 2.479 3	9 875 GH .001 dB
00			1							
00		<i>س</i> ر	<u>\</u>							
										-17.00
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7.0					اور کاری روار می اور اور اور کاری روا		mplay and the we	and the second	landantentente	
	7500 G / 100 k			#VBW	300 kHz			Sw	Stop 2 veep 2.40 m	2.50000 GI Is (1001 pi
R MODE	TRC SCL		×	Y		CTION FUNC	CTION WIDTH		FUNCTION VALUE	
1 N 2 N	1 f 1 f		479 875 GHz 483 500 GHz	3.001 dl -59.714 dl						
3 N	1 f	2.	488 400 GHz	-57.957 di	Зm					
4 N	1 f	2.	492 400 GHz	-58.070 di	Зm					
5										
7										
7										
7 3 9 0 1										
7 3 9 0							STATUS			



Shenzhen STS Test Services Co., Ltd.





For Hopping Band edge

$\pi/4$ -DQPSK

nt Spectr	r <mark>um An</mark> a RF	a <mark>lyzer - Swe</mark> p 50 Ω			SENSE:INT		ALIGN AUTO		08:30:	33 PM Oct 20,
nter F	req 2	2.351500	0000 GHz	PNO: Fast C IFGain:Low	Trig: Fre #Atten: 3	e Run 10 dB	Аvg Тур	e: Log-Pwr		TYPE MWWW DET P P P
IB/div		Offset 0.5 12.23 d						IV	lkr1 2.402 2	794 G 234 dE
										-17.7
-										
									~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	and
1	man man	contra more	mannanan	un den annound all	en an	when any all a	T-phylor fra transford an	whether the set	and the second sec	www.manal
rt 2.30 es BW				#V	BW 300 kH	lz		Swe	Stop 2 eep 9.87 m	.40300 G s (1001 j
MODE T	ic scl f		× 2.402 794 G	Ja 2.23	4 dBm	INCTION	FUNCTION WIDTH		FUNCTION VALUE	
N 1 N 1	f		2.402 794 G 2.390 022 G 2.400 013 G	-lz -58.03	8 dBm 2 dBm					

RL	RF		AC	SE	NSE:INT		ALIGN AUTO		08	:32:51 PM Oct 20, 2
enter F	req 2	2.489500		PNO: Fast 🖵 Gain:Low	Trig: Free #Atten: 30		Avg Typ	e: Log-Pwr		TRACE 1 2 3 4 TYPE MWAAA DET P P P P
dB/div		Offset 0.5 ( 12.91 dB						IV	1kr1 2.4	79 861 GI 2.905 dB
91	1									
J9	·~~									
.1	$\rightarrow$									-17.10
.1	\ _v	1							_	
.1		m	$-\Delta^2 - \Delta$	3						
.1		- Winner	-A-A-a-a-a-a-a-a-a-a-a-a-a-a-a-a-a-a-a-	M Manalas						
.1				Mary Mary and	-Brok School and	-www.	or the construction	mon	- marina and and	mm
.1										
.1										
art 2.47 tes BW				#VBW	300 kHz	<u>.</u>		Sw		o 2.50000 G ms (1001 p
R MODE T			×	Y		CTION FU	NCTION WIDTH		FUNCTION VALU	JE
N S	1 f 1 f		2.479 861 GHz 2.483 515 GHz	2.905 dl -46.765 dl	3m					
N	1 f		2.485 111 GHz	-46.467 di	Зm					
1										
1 1										
1										
·										

Shenzhen STS Test Services Co., Ltd.



Page 45 of 76 Report No.: STS2009272W01

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

		ctru		lyzer - Swept S/	A							
<b>XI</b> F	-		RF	50 Q AC		SE	NSE:PULSE		ALIGNAUTO			50 AM Oct 21, 2020
Cei	nter	Fre	eq 1	2.515000	P	'NO: Fast 😱 Gain:Low	Trig: Free F #Atten: 30 c		Avg Typ	e: Log-Pwr		RACE 1 2 3 4 5 6 TYPE MWMMMM DET P P P P P P
				Offset 0.5 dB								.402 GHz
10 c Log	B/div	/	Ref	13.53 dBn	1						<b>.</b>	.530 dBm
3.5				71								
-6.47												-10.58 dBm
-16.5												10.00 000
-26.5	1											
-36.5	1											4
-46.5					3						-	
-56.5	1			V ² Y				and the and the set	mon	summer in	and a w	e mart
-66.5	Jul .	4	ng ng ng ng	and a start of the start of the	weren her and a second of the	and a share and	Man Longer Plan, 1 - VIIP					
-76.5	1											
10.5												
	rt 30 es B			kHz		#VB	W 300 kHz			Sw	Stop eep 2.386	25.00 GHz s (1001 pts)
	MODE	TRC			x	Y	FUNC	TION FUN	ICTION WIDTH		FUNCTION VALUE	^
1	N	1	f		2.402 GHz 3.151 GHz	3.530 -57.152						
3	N N	1	f		4.799 GHz 24.875 GHz	-51.501 -44.094						
4 5 7 8 9	IN				24.070 0HZ	-44.034	ubili					
6												
8												
10												
11												×
ISG									STATUS			

# 00 CH

39	CH
00	UL1

RL	m Analyzer - Sv RF 50:	Ω AC	SENSE:INT		ALIGNAUTO		10:59:33 AM Oct 21, 2
		000000 GHz	PNO: Fast Trig: F	ree Run : 30 dB	Avg Type: L	.og-Pwr	TRACE 1 2 3 4 TYPE MWWW DET P P P P
IB/div	Ref Offset 0 Ref 12.46					Μ	lkr1 2.452 GI 2.455 dB
	<b>1</b>						
							-17.39
		$\gamma^2$ $\sigma^3$					
and the second	Lemen	1 2 2 3	and the state of t	aman a	monenter	mensurand	mannen
what			- weither -				
rt 30 M s BW 1	Hz 100 kHz		#VBW 300 I	(Hz		Sweep	Stop 25.00 G 2.39 s (1001 p
NODE TRO N 1 N 1 N 1 N 1	f f f f f	× 2.452 GHz 3.900 GHz 5.399 GHz 24.426 GHz	-49.644 dBm -55.648 dBm	FUNCTION	UNCTION WIDTH	FUNCTIO	N VALUE



# 78 CH

RL		RF	zer - Swept 50 Ω		9	ENSE:INT		ALIGN AUTO		11:0	2:09 AM Oct 21, 2
nter	Fre	eq 12	.51500	0000 GHz P	NO: Fast 😱 Gain:Low	Trig: Free #Atten: 30	Run dB	Avg Type	: Log-Pwr		TRACE 1 2 3 4 TYPE MWWW DET P P P P
dB/di			fset 0.5 d .89 dBn								2.477 G ).792 dE
g		<b>\</b>									
.1 —											-16.93
.1											-10.00
.1											
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.1											
art 30 tes B		lz 00 k⊦	lz		#VBI	N 300 kHz	<u>'</u>			Sto Sweep 2.39	p 25.00 G s (1001 p
r  Mode	TRC	SCL		X	Y		ICTION FU	NCTION WIDTH		FUNCTION VALUE	· ·
N	1	f		2.477 GHz 2.502 GHz	0.792						
N	1	f		6.972 GHz 24.750 GHz	-55.069						
				24.700 0112	-41.401						
: 											
1											
2											



Shenzhen STS Test Services Co., Ltd.



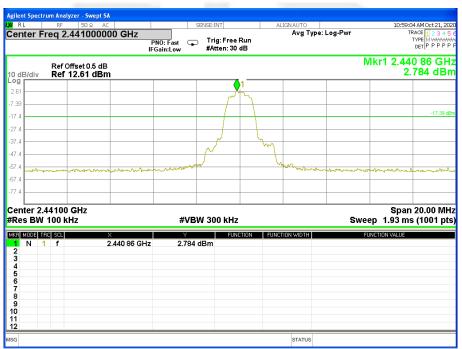


### For Band edge(it's also the reference level for conducted spurious emission)

		lyzer - Swept S								
enter F	RF Freq 2	50 Q A		SE	INSE:INT		Avg Type:	Log-Pwr	TF	1 AM Oct 21, 1 ACE 1 2 3 4
				PNO: Fast 🖵 Gain:Low	Trig: Free Ri #Atten: 30 di					
dB/div		Offset 0.5 dB 12.38 dB						N	/lkr1 2.40 2.	1 86 G 378 dE
38										<b>0</b> 1
38 52										Å
										-17 6
6										
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6					$\wedge^2$				0	3 _∫4
	Mound	where a second	and the second	mennenterterter	and the second second	how the share of the state of the	vielannen anderen	مستعميرا والمحمد والمعادمة	den more marked	haven
6										
6										
art 2.30 es BW				#\/D\/	/ 300 kHz			Curo	Stop 2. ep 10.3 ms	
				#VBV			TION WIDTH		•	(1001
	1 f		× 2.401 86 GHz	2.378 d	Bm	UN FUNC	TIUN WIDTH	i	JNCTION VALUE	
N	1 f 1 f		2.347 72 GHz 2.395 55 GHz	-58.012 d -57.900 d						
N	1 f		2.400 05 GHz	-56.217 d						
N										

#### 00 CH

39 CH





# 78 CH

		RF	50 Ω A0		SE	NSE:INT	AL	.IGN AUTO		11:01	:40 AM Oct 21, 20
enter	Fre	q 2.4	875000	F	PNO: Fast 😱 Gain:Low	Trig: Free   #Atten: 30	Run dB	Avg Type:	-		TRACE 1 2 3 4 5 TYPE MWWWW DET P P P P
dB/div			fset 0.5 dB 3.07 dBn						М	kr1 2.47 3	9 875 GH .070 dB
.07				1							
93			ſ	<u>}</u>							
5.9											-16.93 (
5.9 <b>—</b>											
6.9				m							
5.9			1'		2	3					
	v	- And	~~	<u>~~</u> ~~	mount		have hours	-	mound	where we have	monte
6.9											
5.9											
tart 2.4 Res Bl					#VBN	/ 300 kHz	-		Swe	Stop 2 ep 2.40 m	2.50000 GH Is (1001 pt
KR MODE	TRC	SCL		x	Y		TION FUNC	TION WIDTH		UNCTION VALUE	
1 N 2 N	1	f f		.479 875 GHz .483 500 GHz	3.070 d -59.061 d						
	1	f	2	485 825 GHz 498 750 GHz	-57.982 d -57.824 d	Bm					
3 N	-	·	2.	.496 750 GHZ	-07.824 u	5111					
3 N 4 N 5											
3 N 4 N 5 6 7											
3 N											
3 N 4 N 5 6 7											
3 N 4 N 5 6 7 8 9 0											



Shenzhen STS Test Services Co., Ltd.





# For Hopping Band edge

8DPSK

	50 Ω AC	SENSE: IN	Г	ALIGN AUTO	08:37:26 PM Oct 20,
nter Freq 2.3		NO: Fast 😱 Trig Sain:Low #Atte	Free Run en: 30 dB	Avg Type: Log	-Pwr TRACE 123 TYPE MWWW DET PPPF
dB/div Ref 12	set 0.5 dB 2.16 dBm				Mkr1 2.401 867 G 2.159 dE
6					
4					
8					-17.84
8					
3					
3					2 margaril
-	and have many and second the wheeld	wennes marge	handeredations and the test services	and many multimenter and	wellestation and the second second
8					
3					
art 2.30000 GH		#VBW 300	kHz		Stop 2.40300 G Sweep 9.87 ms (1001 p
es BW 100 kH					
MODE TRC SCL	2 401 957 CH7	Y 2.150 dBm	FUNCTION FL	INCTION WIDTH	FUNCTION VALUE
MODE TRC SCL N 1 f	× 2.401 867 GHz 2.390 022 GHz 2.400 013 GHz	2.159 dBm -57.633 dBm -38.869 dBm	Function FU	INCTION WIDTH	FUNCTION VALUE
Mode TRC SCL N 1 f N 1 f	2.401 867 GHz 2.390 022 GHz	2.159 dBm -57.633 dBm	FUNCTION FU	INCTION WIDTH	FUNCTION VALUE
MODE TRC SCL N 1 f N 1 f N 1 f	2.401 867 GHz 2.390 022 GHz	2.159 dBm -57.633 dBm	FUNCTION FU		FUNCTION VALUE
MODE TRC SCL N 1 f N 1 f N 1 f	2.401 867 GHz 2.390 022 GHz	2.159 dBm -57.633 dBm	Function Fu		FUNCTION VALUE
Mode TRC SCL N 1 f N 1 f	2.401 867 GHz 2.390 022 GHz	2.159 dBm -57.633 dBm	FUNCTION FU	INCTION WIDTH	FUNCTION VALUE

		Ω AC		SENSE:INT	ALIGN AUTO		08:39:46 PM Oct 20, 2
r Fr	eq 2.489	500000 GHz	PNO: Fast G	⊃ Trig: Free Run #Atten: 30 dB	Avg Type:	Log-Pwr	TRACE 1 2 3 4 TYPE M WWW DET P P P P
div	Ref Offset ( Ref 12.94					Mk	r1 2.479 861 GI 2.936 dB
	1						
San .	M						
							-17.06
	Mag		_				
	. Why	hor warmy					
	'	A	Mannur	Lanan Anna phaing	plynet Awythernetter		h_mming
	900 GHz 100 kHz		#VE	300 kHz		Sweel	
s BW	100 kHz	×	Y	FUNCTION	FUNCTION WIDTH		Stop 2.50000 G 2.07 ms (1001 p CTION VALUE
SBW 1003 116 N 1	100 kHz c scl f f	2.479 861 G 2.483 515 G	Hz 2.936 Hz -46.822	FUNCTION dBm dBm	FUNCTION WIDTH		o 2.07 ms (1001 p
s BW 1009 11	100 kHz c scl f f	2.479 861 G	Hz 2.936 Hz -46.822	FUNCTION dBm dBm	FUNCTION WIDTH		o 2.07 ms (1001 p
SBW 1003 116 N 1	100 kHz c scl f f	2.479 861 G 2.483 515 G	Hz 2.936 Hz -46.822	FUNCTION dBm dBm	FUNCTION WIDTH		o 2.07 ms (1001 p
SBW 1003 116 N 1	100 kHz c scl f f	2.479 861 G 2.483 515 G	Hz 2.936 Hz -46.822	FUNCTION dBm dBm	FUNCTION WIDTH		o 2.07 ms (1001 p
SBW 1003 116 N 1	100 kHz c sci f f	2.479 861 G 2.483 515 G	Hz 2.936 Hz -46.822	FUNCTION dBm dBm	FUNCTION WIDTH		o 2.07 ms (1001 p



# 5. NUMBER OF HOPPING CHANNEL

5.1 LIMIT

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

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating FrequencyRange
RB	300KHz
VB	300KHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

### **5.2 TEST PROCEDURE**

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Spectrum Setting: RBW= 300KHz, VBW=300KHz, Sweep time = Auto.

### 5.3 TEST SETUP



5.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



### 5.5 TEST RESULTS

Temperature:	<b>25</b> ℃	Relative Humidity:	60%
Test Mode:	Hopping Mode -GFSK Mode	Test Voltage:	AC 120V/60Hz

# Number of Hopping Channel

### 79

# Hopping channel

Center Freq 2.44	PNO	: Fast Trig: Free Ru n:Low #Atten: 30 df	AUGUAUTO Avg Type: In B	Log-Pwr	DB:03:49 PM Oct 20, 203 TRACE TYPE DET P P P P
10 dB/div Ref 0ffs				Mkr	2 2.479 909 5 GH 7.67 dBn
100 110 1767 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 1787 178	YYYYYYYYYYYYYYYYY	YYTYYYYYYYYYYY	TYYYYYYYYYYYYYY	YYYYYYYY	YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
Start 2.40000 GHz Res BW 300 kHz WS W025 fttt SC 1 N 1 f 2 N 1 f 3 4	2.402 171 0 GHz 2.479 909 5 GHz	#VBW 300 kHz 7.33 dBm 7.67 dBm	on [Function worth]		Stop 2.48350 GH ep 1.13 ms (1001 pt: menonweau)
4 5 6 7 8 9 10 11 12			STATUS		

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# 6. AVERAGE TIME OF OCCUPANCY

### 6.1 LIMIT

	F	CC Part 15.247,Subpart	С	
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.
- 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). Sothe dwell time is the time duration of the pulse times 3.37 x 31.6 = 106.6 within 31.6 seconds.
- 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 he dwell time is the time duration of the pulse times 5.06 x 31.6 = 160 within 31.6 seconds.
- 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 dwell time is the time duration of the pulse times 10.12 x 31.6 = 320 within 31.6 seconds.

6.3 TEST SETUP



# 6.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



# 6.5 TEST RESULTS

Temperature:	<b>25℃</b>	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps)-DH1/DH3/DH5	Test Voltage:	AC 120V/60Hz

Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
DH1	middle	0.380	0.122	0.4
DH3	middle	1.648	0.264	0.4
DH5	middle	2.889	0.308	0.4



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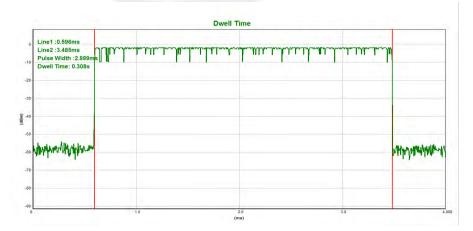
### CH39-DH1



# CH39-DH3



### CH39-DH5



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Temperature:	<b>25</b> ℃	Relative Humidity:	50%
	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	0.392	0.125	0.4
2DH3	middle	1.645	0.263	0.4
2DH5	middle	2.891	0.308	0.4



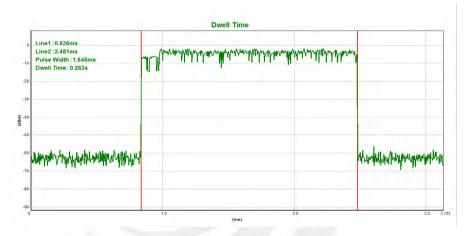
Shenzhen STS Test Services Co., Ltd.



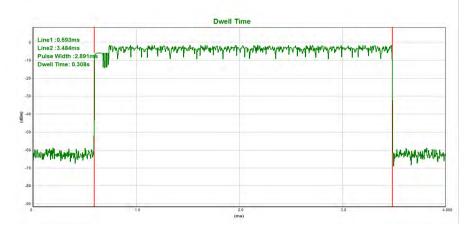
### CH39-2DH1











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Temperature:	<b>25</b> ℃	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	0.385	0.123	0.4
3DH3	middle	1.645	0.263	0.4
3DH5	middle	2.896	0.309	0.4



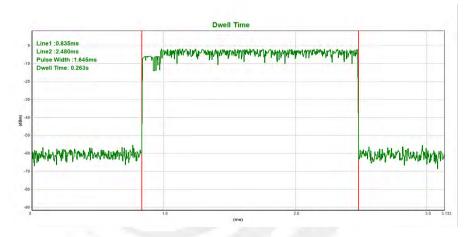
Shenzhen STS Test Services Co., Ltd.



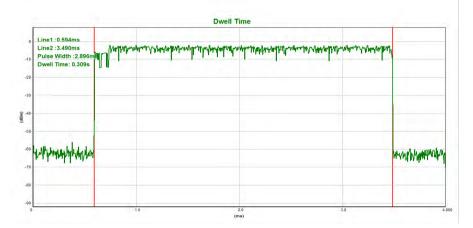
### CH39-3DH1



# 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%
	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	2401.855	2402.845	0.990	0.695	Complies
2441 MHz	2440.858	2441.857	0.999	0.703	Complies
2480 MHz	2478.861	2479.857	0.996	0.703	Complies

For GFSK: Ch. Separation Limits: > two-thirds 20dB bandwidth

### CH00 -1Mbps

RL	RF 50	DΩ AC	SENSE:INT	ALI	GNAUTO	07:55:25 PM Oct 20, 2
nter F	req 2.402		): Wide 🍙 Trig: Fi jin:Low #Atten:	ree Run 30 dB	Avg Type: Log-Pwr	TRACE 1234 TYPE M WANA DET P P P
dB/div	Ref Offset Ref 15.2	0.5 dB 2 dBm				Mkr2 2.402 845 GI 4.492 dB
		\1			<b>2</b>	
			$\sim\sim$	/	m	
			N.		~	
	~	m				
m	and a					
	402500 GH 30 kHz	łz	#VBW 100 k	Hz	Si	Span 3.000 M weep 3.20 ms (1001 p
MODE T	RC SCL	×		FUNCTION FUNCTI	ON WIDTH	FUNCTION VALUE
N 1	f	2.401 855 GHz 2.402 845 GHz	5.26 dBm 4.49 dBm			
IN I		2.402 845 9Hz	4.49 UDIII			

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#### CH39 -1Mbps

RF 50 Ω AC	SENSE:INT	ALIGN AUTO	07:57:55 PM Oct 2
ter Freq 2.441500000 GHz	PNO: Wide Trig: Free Run IFGain:Low #Atten: 30 dB	Avg Type: Log-Pwr	TRACE 1 2 3 TYPE MW DET P P F
Ref Offset 0.5 dB B/div Ref 14.65 dBm		Μ	kr2 2.441 857 0 4.604 d
	)1	2	
		- Com	
m			
hanner			
ter 2.441500 GHz s BW 30 kHz	#VBW 100 kHz	Swe	Span 3.000 ep 3.20 ms (1001
HODE TRC SCL X	Y FUNCTION		UNCTION VALUE
N 1 f 2.440 858 GHz N 1 f 2.441 857 GHz			

#### CH78 -1Mbps



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Temperature:	25°C	Relative Humidity:	50%
Test Mode:	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	2401.852	2402.848	0.996	0.903	Complies
2441 MHz	2440.858	2441.851	0.993	0.901	Complies
2480 MHz	2478.868	2479.857	0.989	0.902	Complies

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

RL	RF 50	Q AC	SENSE:IN		ALIGN AUTO		10:35:43 AM Oct 21, 20
enter F		500000 GHz PN0	Mide Trig:	Free Run en: 30 dB	Avg Type: L	₋og-Pwr	TRACE 1 2 3 4 5 TYPE M WANNA DET P P P F
0 dB/div	Ref Offset Ref 9.44					Mkr2	2.402 848 GH -0.289 dBr
0.56							
0.6		m r	~~~	$\sim$		m	$\sim$
0.6							~~~~~
0.6							
1.6	~						
0.6							
0.6							
0.6							
	.402500 GH / 30 kHz	Z	#VBW 100	kHz		Sweep	Span 3.000 Mi 3.20 ms (1001 pt
KR MODE T		×	Y	FUNCTION	FUNCTION WIDTH	FUNCT	ON VALUE
2 N '	1 f 1 f	2.401 852 GHz 2.402 848 GHz	-0.28 dBm -0.29 dBm				
3 4							
5							
7 8							
6 7 8 9 0							
7 8 9							

#### CH00 -2Mbps

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#### CH39 -2Mbps

RF 50 Ω AC	SENSE:INT	ALIGN AUTO	10:38:53 AM Oct
	): Wide 😱 Trig: Free I ain:Low #Atten: 30	Avg Type: Log-P Run dB	WT TRACE 1 2 TYPE M U DET P F
Ref Offset 0.5 dB			Mkr2 2.441 851
div Ref 10.11 dBm			0.145
	- v~ m m		
			\ \
r 2.441500 GHz			Span 3.000
BW 30 kHz	#VBW 100 kHz		Sweep 3.20 ms (100
DE TRC SCL X		TION FUNCTION WIDTH	FUNCTION VALUE
1 f 2.440 858 GHz 1 f 2.441 851 GHz	0.11 dBm 0.15 dBm		
2.441 001 0112	0.10 0.01		

#### CH78 -2Mbps



Shenzhen STS Test Services Co., Ltd.



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Temperature:	25℃	Relative Humidity:	50%
	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	2401.855	2402.848	0.993	0.902	Complies
2441 MHz	2440.843	2441.851	1.008	0.901	Complies
2480 MHz	2478.858	2479.857	0.999	0.903	Complies

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

CH00 -3Mbps

	50 Ω AC	SENSE:INT	ALIGN AUTO	10:57:27 AM Oct 21, 2
RL RF Center Freq 2.4	02500000 GHz PNO:	Wide Trig: Free F n:Low #Atten: 30 d	Avg Type: Log-Pw Run	
0 dB/div Ref 9.	set 0.5 dB <b>78 dBm</b>			Mkr2 2.402 848 GH -0.280 dB
og 0.22 10.2	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	mm	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
10.2				
0.2				¥
0.2				
enter 2.402500 Res BW 30 kHz	GHz	#VBW 100 kHz		Span 3.000 M Sweep 3.20 ms (1001 p
KB MODE TRG SCL 1 N 1 f 2 N 1 f 3 4	× 2.401 855 GHz 2.402 848 GHz	-0.18 dBm -0.28 dBm	TION FUNCTION WIDTH	FUNCTION VALUE
5 6 7 8				
9				

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#### CH39 -3Mbps

RF 50 Ω AC	SENSE:INT	ALIGN AUTO	11:00:16 AM Oct
	PNO: Wide 🍙 Trig: Free Ru FGain:Low #Atten: 30 dE	Avg Type: Log-Pwr un 3	TRACE 1 TYPE MI DET P F
Ref Offset 0.5 dB div Ref 9.86 dBm			Mkr2 2.441 851 0.094
	m mmm		$\sim$
			- m
ww			
r 2.441500 GHz			Span 3.00
BW 30 kHz	#VBW 100 kHz	Si	weep 3.20 ms (100
DE TRC SCL X 1 f 2.440 843 GHz	-0.14 dBm	ON FUNCTION WIDTH	FUNCTION VALUE
1 f 2.440 843 GHz	0.09 dBm		

#### CH78 -3Mbps



Shenzhen STS Test Services Co., Ltd.



# 8. BANDWIDTH TEST

# 8.1 LIMIT

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

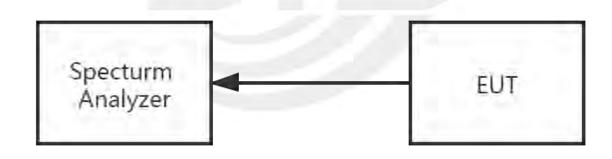
Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RB	30 kHz (20dB Bandwidth) / 30 kHz (Channel Separation)
VB	100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

#### **8.2 TEST PROCEDURE**

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

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

8.3 TEST SETUP



# 8.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



# **8.5 TEST RESULTS**

Temperature:	25℃	Relative Humidity:	50%
	GFSK(1Mbps) CH00 / CH39 / C78	Test Voltage:	AC 120V/60Hz

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.0430	PASS
2441 MHz	1.0550	PASS
2480 MHz	1.0540	PASS

#### CH00 -1Mbps



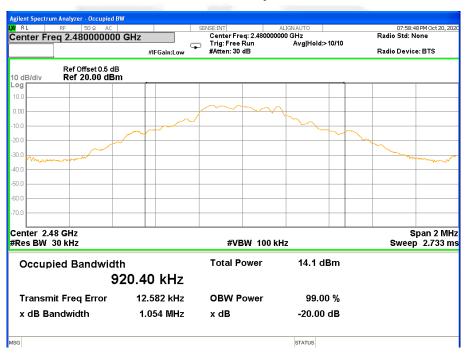
Shenzhen STS Test Services Co., Ltd.



### CH39 -1Mbps



CH78 -1Mbps



Shenzhen STS Test Services Co., Ltd.

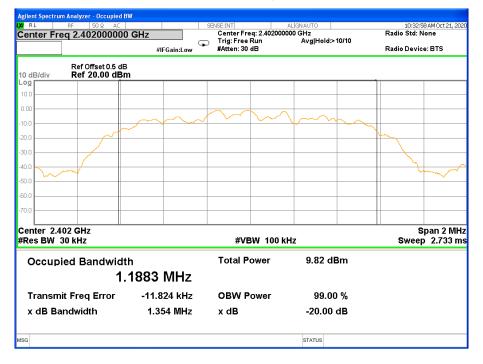


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Temperature:	25°C	Relative Humidity:	50%
LEST MINDE	π/4-DQPSK(2Mbps) CH00 / CH39 / C78	Test Voltage:	AC 120V/60Hz

Frequency	20dB Bandwidth (MHz) Result	
2402 MHz	1.354	PASS
2441 MHz	1.352	PASS
2480 MHz	1.353	PASS

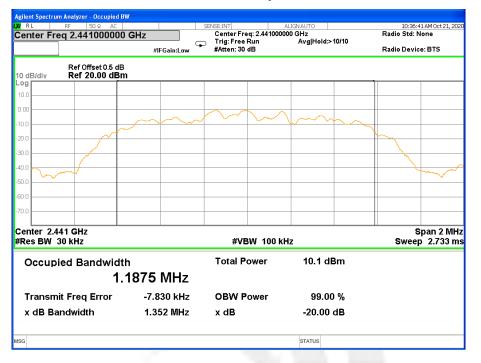
#### CH00 -2Mbps



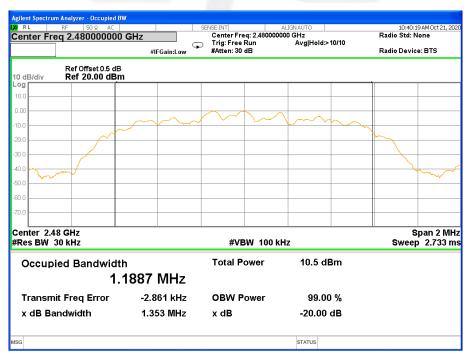
Shenzhen STS Test Services Co., Ltd.



#### CH39 -2Mbps



#### CH78 -2Mbps



Shenzhen STS Test Services Co., Ltd.

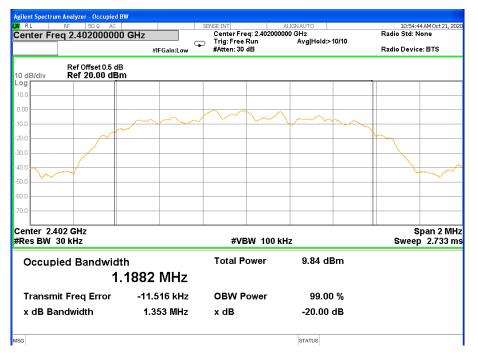


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Temperature:	25°C	Relative Humidity:	50%
LOST MICHO?	8DPSK(3Mbps) CH00 / CH39 / CH78	Test Voltage:	AC 120V/60Hz

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.353	PASS
2441 MHz	1.352	PASS
2480 MHz	1.354	PASS

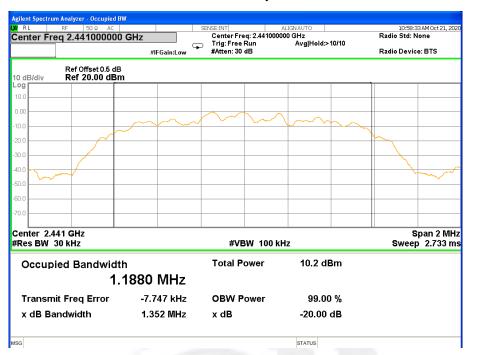
# CH00 -3Mbps



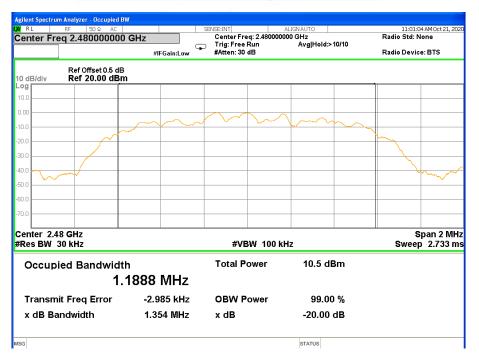
Shenzhen STS Test Services Co., Ltd.



### CH39 -3Mbps



CH78 -3Mbps



Shenzhen STS Test Services Co., Ltd.



# 9. OUTPUT POWER TEST

# 9.1 LIMIT

FCC Part 15.247,Subpart C						
Section	Test Item	tem Limit FrequencyRange (MHz) Res				
		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.

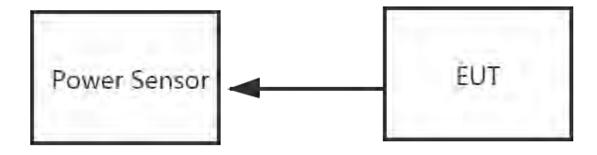
e) A plot of the test results and setup description shall be included in the test report.

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℃	Relative Humidity:	60%
Test Voltage:	AC 120V/60Hz		

Mode	Channel		Peak Power	Average Power	Limit
	Number (MHz)	(dBm)	(dBm)	(dBm)	
	0	2402	7.01	1.73	20.97
GFSK(1M)	39	2441	7.71	2.52	20.97
	78	2480	8.32	3.01	20.97

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

Mode	Channel		Peak Power	Average Power	Limit
	Number (MHz)	(dBm)	(dBm)	(dBm)	
π/4-DQPSK( 2M)	0	2402	5.13	-2.68	20.97
	39	2441	5.82	-1.96	20.97
	78	2480	6.55	-1.13	20.97

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

Mode		Frequency		Average Power	Limit
	Number	r (MHz)	(dBm)	(dBm)	(dBm)
	0	2402	5.26	-2.46	20.97
8-DPSK(3M)	39	2441	5.91	-1.77	20.97
	78	2480	6.72	-0.98	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 PIFA Antenna. It comply with the standard requirement.



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# **APPENDIX-PHOTOS OF TEST SETUP**

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

* * * * * END OF THE REPORT * * * * *



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