

RADIO TEST REPORT

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Report No.: STS2106040W02

Issued for

Shenzhen Feng Jing Sheng Electronics Technology Co.,Ltd

501, building 5, No 36, Dafu Road, Zhangge community, Fucheng Street, Longhua District, Shenzhen City, Gunagdong China.

Product Name:	Bluetooth handsfree car kit		
Brand Name:	sunitec		
Model Name:	BC980		
Series Model:	BC980, BC980S, BC980SA, BC980P, BC980-G		
FCC ID:	2AWTE-BC980		
Test Standard:	FCC Part 15.247		

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TEST RESULT CERTIFICATION

Applicant's Name:	Shenzhen Feng Jing Sheng Electronics Technology Co.,Ltd
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Manufacturer's Name:	Shenzhen Feng Jing Sheng Electronics Technology Co.,Ltd
Address	501, building 5, No 36, Dafu Road, Zhangge community, Fucheng Street, Longhua District, Shenzhen City, Gunagdong China.
Product Description	
Product Name:	Bluetooth handsfree car kit
Brand Name:	sunitec
Model Name:	BC980
Series Model:	BC980, BC980S, BC980SA, BC980P, BC980-G
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:	08 June 2021

Date (s) of performance of tests .: 08 June 2021 ~ 11 June 2021

Date of Issue 11 June 2021

Test Result Pass

Testing Engineer : Technical Manager : Authorized Signatory : Chris Chen) Seem She (Sean she) Ministry States of the st

(Vita Li)

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	11 June 2021	STS2106040W02	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	N/A		
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 9K-30MHz	±2.84dB
4	All emissions, radiated 30M-1GHz	±4.39dB
5	All emissions, radiated 1G-6GHz	±5.10dB
6	All emissions, radiated>6G	±5.48dB
7	Conducted Emission (9KHz-150KHz)	±2.79dB
8	Conducted Emission (150KHz-30MHz)	±2.80dB



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Bluetooth handsfree car kit
Trade Name	sunitec
Model Name	BC980
Series Model	BC980, BC980S, BC980SA, BC980P, BC980-G
Model Difference	Only the model naming is different
Channel List	Please refer to the Note 2.
Bluetooth	Frequency:2402 – 2480 MHz Modulation: GFSK(1Mbps), π/4-DQPSK(2Mbps), 8DPSK(3Mbps)
Bluetooth Version	5.0
Bluetooth Configuration	BR+EDR
Antenna Type	Please refer to the Note 3.
Adapter	Input: DC 12-24V Output: DC 5V 500mA
Battery	Rated Voltage: 3.7V Charge Limit Voltage: 4.2V Capacity: 630mAh
Hardware version number	PCB_BC980S_V1.5
Software version number	98CB78ED_98DC2825
Connecting I/O Port(s)	Please refer to the Note 1.

Note:

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

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2.

	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	sunitec	BC980	PCB	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-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.

2.3 FREQUENCY HOPPING SYSTEM REQUIREMENTS

(1)Standard and Limit

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

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

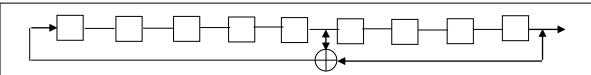
The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is permitted. The coordination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

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

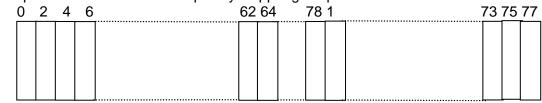
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Numver of shift register stages:9 Length of pseudo-random sequence:2⁹-1=511bits Longest sequence of zeros: 8(non-inverted signal)



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.



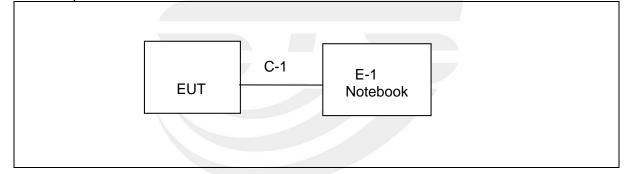
2.4 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

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	255,50	
BT	BR+EDR	π/4-DQPSK	0	255,50	BlueTest3
		8DPSK	0	255,50	

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





2.6 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

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

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

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-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	E	Z-EMC(Ver.STS	LAB-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
		U2021XA -	MY55520005	2020.10.10	2021.10.09
Power Sensor			MY55520006	2020.10.10	2021.10.09
Power Sensor	Keysight		MY56120038	2020.10.10	2021.10.09
			MY56280002	2020.10.10	2021.10.09
Signal Analyzer	Agilent	N9020A	MY51110105	2021.03.04	2022.03.03
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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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.

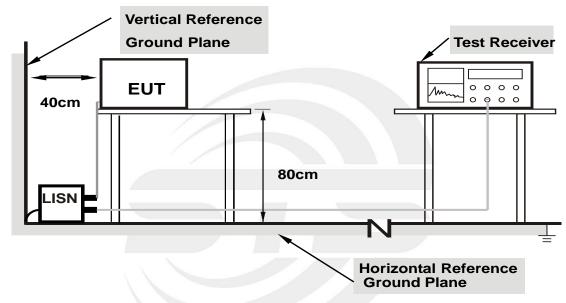
The following table is the setting of the receiver

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.



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3.1.5 TEST RESULT

Temperature:	26.0(C)	Relative Humidity:	58%RH
Test Voltage:		Phase:	L/N
Test Mode:			

Note: EUT is only power by battery, So it is not applicable for this test.



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3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS

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

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

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

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

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

Notes:

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

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

LIMITS OF RESTRICTED FREQUENCY BANDS

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

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For Radiated Emission

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

Spectrum Parameter	Setting	
Attenuation	Auto	
Detector	Peak/QP	
Start Frequency	30 MHz(Peak/QP)	
Stop Frequency	1000 MHz (Peak/QP)	
RB / VB (emission in restricted		
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	
Start/Stop Frequency	Lower Band Edge: 2310 to 2410 MHz	
	Upper Band Edge: 2476 to 2500 MHz	
	1 MHz / 3 MHz(Peak)	
RB / VB	1 MHz/1/T MHz(AVG)	

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

3.2.2 TEST PROCEDURE

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

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

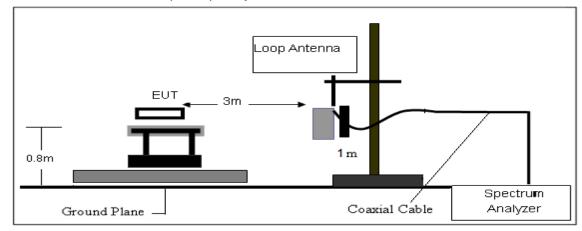
3.2.3 DEVIATION FROM TEST STANDARD

No deviation.

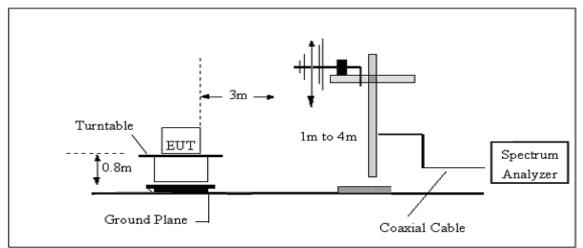


3.2.4 TESTSETUP

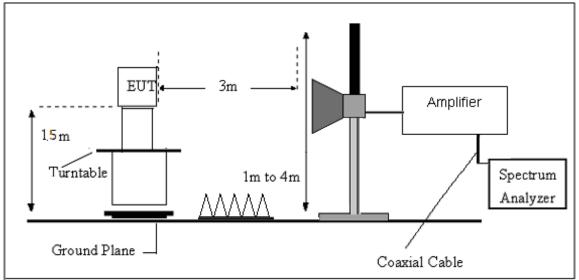
(A) Radiated Emission Test-Up Frequency Below 30MHz

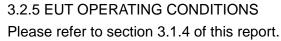


(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



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







3.2.6 FIELD STRENGTH CALCULATION

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

FS = RA + AF + CL - AGWhere FS = Field StrengthCL = Cable Attenuation Factor (Cable Loss)RA = Reading AmplitudeAG = Amplifier GainAF = Antenna Factor

For example

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

Factor=AF+CL-AG



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3.2.7 TEST RESULTS

(9KHz-30MHz)

Temperature:	23.1(C)	Relative Humidity:	60%RH
Test Voltage:	DC 3.7V	Test Mode:	TX Mode

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

Note:

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

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



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(30MHz-1000MHz)

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

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	79.4700	52.16	-23.11	29.05	40.00	-10.95	QP
2	303.5400	47.45	-14.69	32.76	46.00	-13.24	QP
3	551.8600	31.41	-5.72	25.69	46.00	-20.31	QP
4	733.2500	30.05	-2.35	27.70	46.00	-18.30	QP
5	911.7300	27.57	-0.16	27.41	46.00	-18.59	QP
6	979.6300	26.83	2.65	29.48	54.00	-24.52	QP

Remark:

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





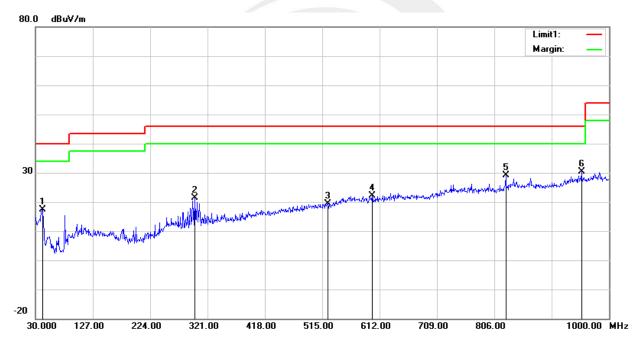
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Temperature:	23.1(C)	Relative Humidity:	60%RH		
Test Voltage:	DC 3.7V	Phase:	Vertical		
Test Mode:	Mode 1/2/3/4/5/6/7/8/9 (Mode 3 worst mode)				

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	41.6400	36.38	-18.93	17.45	40.00	-22.55	QP
2	299.6600	36.29	-14.82	21.47	46.00	-24.53	QP
3	524.7000	26.92	-7.65	19.27	46.00	-26.73	QP
4	599.3900	28.07	-5.84	22.23	46.00	-23.77	QP
5	825.4000	30.55	-1.31	29.24	46.00	-16.76	QP
6	953.4400	28.85	1.65	30.50	46.00	-15.50	QP

Remark:

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



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(1GHz~25GHz) Spurious emission Requirements

Frequency	Meter Reading	Amplifier	Loss	Antenna Factor	Corrected Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBµV)	(dB)	(dB)	(dB/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре	
				Low Ch	nannel (GFSK/2	2402 MHz)				
3264.80	61.35	44.70	6.70	28.20	-9.80	51.55	74.00	-22.45	PK	Vertical
3264.80	51.12	44.70	6.70	28.20	-9.80	41.32	54.00	-12.68	AV	Vertical
3264.75	61.78	44.70	6.70	28.20	-9.80	51.98	74.00	-22.02	PK	Horizontal
3264.75	49.95	44.70	6.70	28.20	-9.80	40.15	54.00	-13.85	AV	Horizontal
4804.54	58.40	44.20	9.04	31.60	-3.56	54.84	74.00	-19.16	PK	Vertical
4804.54	49.65	44.20	9.04	31.60	-3.56	46.09	54.00	-7.91	AV	Vertical
4804.38	58.18	44.20	9.04	31.60	-3.56	54.62	74.00	-19.38	PK	Horizontal
4804.38	49.53	44.20	9.04	31.60	-3.56	45.97	54.00	-8.03	AV	Horizontal
5359.77	48.17	44.20	9.86	32.00	-2.34	45.82	74.00	-28.18	PK	Vertical
5359.77	40.26	44.20	9.86	32.00	-2.34	37.92	54.00	-16.08	AV	Vertical
5359.85	47.20	44.20	9.86	32.00	-2.34	44.86	74.00	-29.14	PK	Horizontal
5359.85	39.31	44.20	9.86	32.00	-2.34	36.97	54.00	-17.03	AV	Horizontal
7205.80	54.89	43.50	11.40	35.50	3.40	58.29	74.00	-15.71	PK	Vertical
7205.80	44.18	43.50	11.40	35.50	3.40	47.58	54.00	-6.42	AV	Vertical
7205.96	54.01	43.50	11.40	35.50	3.40	57.41	74.00	-16.59	PK	Horizontal
7205.96	43.56	43.50	11.40	35.50	3.40	46.96	54.00	-7.04	AV	Horizontal
				Middle C	hannel (GFSK	/2441 MHz)				
3264.60	61.24	44.70	6.70	28.20	-9.80	51.44	74.00	-22.56	PK	Vertical
3264.60	49.92	44.70	6.70	28.20	-9.80	40.12	54.00	-13.88	AV	Vertical
3264.84	61.19	44.70	6.70	28.20	-9.80	51.39	74.00	-22.61	PK	Horizontal
3264.84	50.06	44.70	6.70	28.20	-9.80	40.26	54.00	-13.74	AV	Horizontal
4882.55	58.54	44.20	9.04	31.60	-3.56	54.98	74.00	-19.02	PK	Vertical
4882.55	49.55	44.20	9.04	31.60	-3.56	45.99	54.00	-8.01	AV	Vertical
4882.53	58.56	44.20	9.04	31.60	-3.56	55.00	74.00	-19.00	PK	Horizontal
4882.53	49.46	44.20	9.04	31.60	-3.56	45.90	54.00	-8.10	AV	Horizontal
5359.79	48.74	44.20	9.86	32.00	-2.34	46.40	74.00	-27.60	PK	Vertical
5359.79	40.37	44.20	9.86	32.00	-2.34	38.02	54.00	-15.98	AV	Vertical
5359.82	47.53	44.20	9.86	32.00	-2.34	45.18	74.00	-28.82	PK	Horizontal
5359.82	38.15	44.20	9.86	32.00	-2.34	35.80	54.00	-18.20	AV	Horizontal
7323.73	54.71	43.50	11.40	35.50	3.40	58.11	74.00	-15.89	PK	Vertical
7323.73	44.79	43.50	11.40	35.50	3.40	48.19	54.00	-5.81	AV	Vertical
7323.69	53.93	43.50	11.40	35.50	3.40	57.33	74.00	-16.67	PK	Horizontal
7323.69	44.30	43.50	11.40	35.50	3.40	47.70	54.00	-6.30	AV	Horizontal



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				High Char	nnel (GFSK/	2480 MHz)				
3264.78	61.34	44.70	6.70	28.20	-9.80	51.54	74.00	-22.46	PK	Vertical
3264.78	50.19	44.70	6.70	28.20	-9.80	40.39	54.00	-13.61	AV	Vertical
3264.85	62.13	44.70	6.70	28.20	-9.80	52.33	74.00	-21.67	PK	Horizontal
3264.85	50.06	44.70	6.70	28.20	-9.80	40.26	54.00	-13.74	AV	Horizontal
4960.49	59.10	44.20	9.04	31.60	-3.56	55.54	74.00	-18.46	PK	Vertical
4960.49	49.44	44.20	9.04	31.60	-3.56	45.88	54.00	-8.12	AV	Vertical
4960.42	58.34	44.20	9.04	31.60	-3.56	54.78	74.00	-19.22	PK	Horizontal
4960.42	49.16	44.20	9.04	31.60	-3.56	45.60	54.00	-8.40	AV	Horizontal
5359.70	49.00	44.20	9.86	32.00	-2.34	46.66	74.00	-27.34	PK	Vertical
5359.70	39.72	44.20	9.86	32.00	-2.34	37.38	54.00	-16.62	AV	Vertical
5359.72	47.23	44.20	9.86	32.00	-2.34	44.88	74.00	-29.12	PK	Horizontal
5359.72	38.17	44.20	9.86	32.00	-2.34	35.83	54.00	-18.17	AV	Horizontal
7439.95	54.72	43.50	11.40	35.50	3.40	58.12	74.00	-15.88	PK	Vertical
7439.95	43.96	43.50	11.40	35.50	3.40	47.36	54.00	-6.64	AV	Vertical
7439.77	53.64	43.50	11.40	35.50	3.40	57.04	74.00	-16.96	PK	Horizontal
7439.77	43.79	43.50	11.40	35.50	3.40	47.19	54.00	-6.81	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

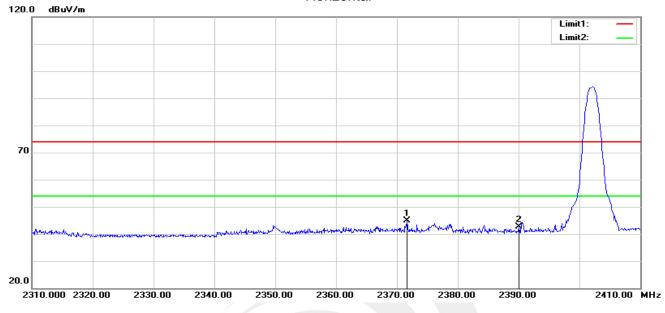
3) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.



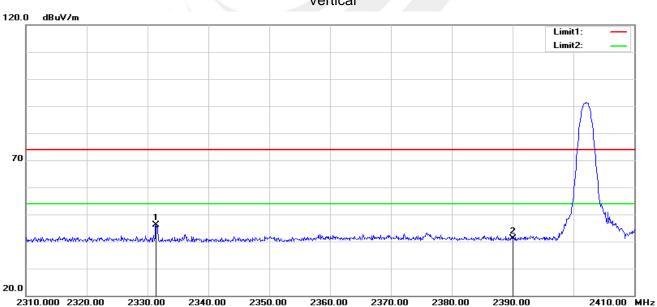


Restricted band Requirements

GFSK-Low Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2371.700	40.90	4.06	44.96	74.00	-29.04	peak
2	2390.000	38.31	4.34	42.65	74.00	-31.35	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2331.400	42.59	3.64	46.23	74.00	-27.77	peak
2	2390.000	36.89	4.34	41.23	74.00	-32.77	peak

Vertical

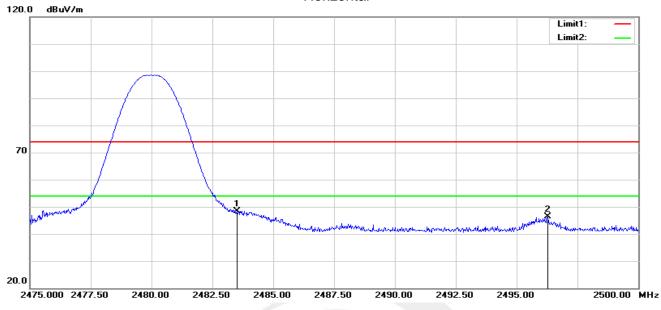
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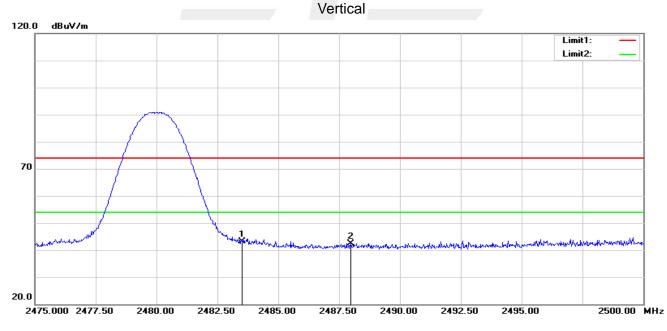
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GFSK-High Horizontal



No.	Frequency	Reading	Correct Result		esult Limit		Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	43.90	4.60	48.50	74.00	-25.50	peak
2	2496.275	41.74	4.64	46.38	74.00	-27.62	peak



No.	Frequency	Reading	U		Result Limit		Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	38.52	4.60	43.12	74.00	-30.88	peak
2	2487.975	37.80	4.62	42.42	74.00	-31.58	peak

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

Shenzhen STS Test Services Co., Ltd.





4. CONDUCTED SPURIOUS & BAND EDGE EMISSION

4.1 LIMIT

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

4.2 TEST PROCEDURE

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

For Band edge

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

For Hopping Band edge

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







The EUT is connected to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. Tune the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, the span is set to be greater than RBW.

4.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

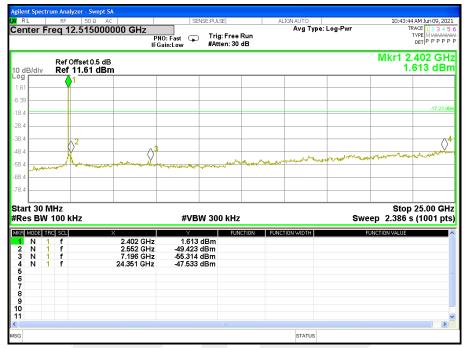




4.5 TEST RESULTS

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

00 CH



39 CH

Agilent Sp	bectrum /	Analyzer - S	wept SA						
U RL		RF 50		SENSE:PUL:	35	ALIGNAUTO			i AM Jun 09, 20
Cente	r Frec	12.515			: Free Run en: 30 dB	Avg Type:	Log-Pwr		RACE 1 2 3 4 1 TYPE MWMMM DET P P P P
I0 dB/d		ef Offset 0 ef 13.92							.452 GH 922 dBi
-og 3.92		1							
6.08									
16.1									-15.64 c
6.1		_							
6.1		2							
6.1						. N	when we we	monteros	mont
5.1 5.1	magan	Hell Marine	alour and the ball again and	manyan manakana	and a start of the	AN A			
6.1									
	80 MH2 3W 10			#VBW 30) kHz		Swe	Stop ep 2.386 s	25.00 G (1001 p
KR MOD	E TRC S		× 2.452 GHz	y 3.922 dBm	FUNCTION	FUNCTION WIDTH	ŀ	UNCTION VALUE	
2 N	1	f f	2.502 GHz	-50.224 dBm					
3 N 4 N		f f	5.374 GHz 24.476 GHz	-56.865 dBm -47.293 dBm					
5 6									
7 8									
9 0									
1									3

П



78 CH

	Swept SA	SENSE:PULSE		ALIGNAUTO		10:46:18 AM Jun 0	0.2
ter Freg 12.51		SENSE:PULSE		ALIGNAUTO Avg Type: I	og-Pwr	TRACE 1 2	
iter Freq 12.51			ree Run				100
	IFG	ain:Low #Atten	:30 dB			DET P	PF
Ref Offset	0.5 -10					Mkr1 2.477	G
Bidiv Ref 12.9						2.978 c	dΕ
<u></u> 1							-
2							
						-15	5.26
. 2							
		5			, the second	ليسرب المحر بالاردون الممالية المسالية والمد	nad
way way have had no	1 month months make	May make make	at any when	and the second second	Standard Contraction of the Standard	subtate :	
harding (and)							
rt 30 MHz						Stop 25.00	G
es BW 100 kHz		#VBW 300 k	Hz		Swee	ep 2.386 s (1001	
MODE TRC SCL	×	Y	FUNCTION FUI	NCTION WIDTH	FU	NCTION VALUE	
N 1 f	2.477 GHz	2.978 dBm					
N 1 f N 1 f	2.652 GHz 7.446 GHz	-53.784 dBm -54.480 dBm					
N 1 f	24.675 GHz	-47.329 dBm					
				STATUS			_



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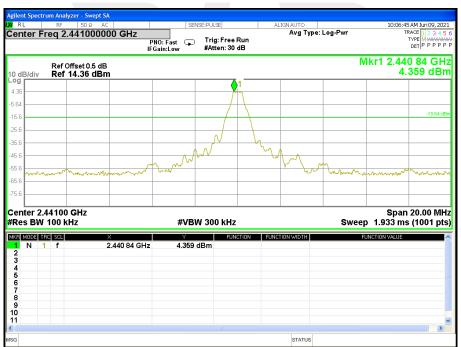


For Band edge(it's also the reference level for conducted spurious emission)

		nalyzer - Swept SA)							
Center	Fred	50 Ω AC 2.35350000		SE	NSE:PULSE	AL	IGNAUTO AVG Type:	Log-Pwr		AM Jun 09, 2021
Conter	noq	2.0000000	Р	NO: Fast 🖵 Gain:Low	Trig: Free F #Atten: 30 d		0 //	5		DET PPPPP
10 dB/div		f Offset 0.5 dB f 12.77 dBm	1					N		2 19 GHz 774 dBm
2.77										1
-7.23										ſ
-17.2										-17 23 dBm
-27.2										
-37.2										
-47.2					() ²					Ϋ́́, Ψ
-57.2	And the state of the	Unopermenter	mannen	الماسي المالية المحمد المالية الم	ward and when	Coperation and and a second	men Made	Merrow	honorienter	"№ " Қ
-67.2										
-77.2										
Start 2.3 #Res BV				#VB	W 300 kHz			Sweep	Stop 2. 0 10.27 ms	40700 GHz ; (1001 pts)
MKR MODE	TRC SC		2.402 19 GHz	¥ 2.774	dBm	TION FUNCT	TION WIDTH	Ħ	UNCTION VALUE	^
2 N 3 N	1 f	2	2.349 97 GHz 2.399 19 GHz	-51.365 -42.192	dBm					
4 N	1 f		.400 05 GHz	-40.220						
6										
5 6 7 8 9										
10										
11 <										~
MSG							STATUS			

00 CH

39 CH





78 CH

	rum Analyzer - S								
enter F	RF 50 req 2.4875	Ω AC 500000 GHz		SENSE:PULSE Trig: Fre #Atten: 3	e Run	ALIGNAUTO Avg Type:	Log-Pwr	TR	AM Jun 09, 2021 ACE 1 2 3 4 5 YPE MWAAAAA DET P P P P P
I0 dB/div	Ref Offset 0 Ref 14.74						MI	(r1 2.480 4.	025 GHz 741 dBm
4.74									
5.26 15.3		-/							-15.26 dB
5.3		$\overline{\mathbf{N}}$							
5.3	MAN		$\sqrt{1}$					4	
5.3	www.		- V V.X.	mmm	m Monand	-	manna	www.	hunn
5.3									
	2500 GHz			/BW 300 kH	z		Sweer	Stop 2.: 2.400 ms	50000 GH (1001 pts
Res BW	100 KHZ		<i>π</i> •						· ·
KR MODE 19 1 N 1 2 N 1 3 N 1 4 N 1 5	RC SCL f f f	× 2.480 025 2.483 500 2.484 050 2.496 000	GHz 4.74 GHz -55.83 GHz -51.57	41 dBm 30 dBm 11 dBm 46 dBm	JNCTION FUN	CTION WIDTH		UNCTION VALUE	
KR MODE TR 1 N 1 2 N 1 3 N 1	RC SCL f f f	2.480 025 2.483 500 2.484 050	GHz 4.74 GHz -55.83 GHz -51.57	41 dBm 30 dBm 11 dBm		CTION WIDTH			



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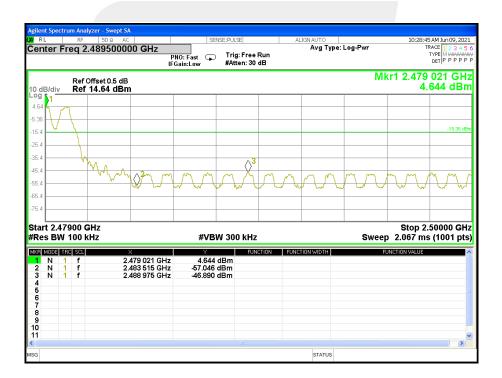




For Hopping Band edge

GFSK

e <mark>nt Spectru</mark> r R L		<mark>- Swept SA</mark> 50 Ω AC			SENS	E:PULSE	A	LIGN AUTO			10:26:33	AM Jun 09, 2
nter Fre	eq 2.35	150000		PNO: Fast FGain:Low		Trig: Free #Atten: 30		Avg Typ	e: Log-Pwr		TR ·	ACE 1 2 3 TYPE MWAA DET P P P F
B/div	Ref Offse Ref 13.3		1							Mkr1 2		000 G 389 dE
i												-16.61
5												(
											()2	N
	www.	www	wwww	MMM	www	MUM	10000000	wwww	MMMM	www	www	WWW
5 												
rt 2.300 es BW 1	00 GHz 00 kHz			#	#VBW	/ 300 kHz	1		Swe			40300 G (1001 p
MODE TRC			×		Y		CTION FUNC	TION WIDTH		FUNCTION	I VALUE	
N 1 N 1 N 1	f f f	2.3	403 000 GHz 390 022 GHz 400 013 GHz	-51	3.389 d .567 d .929 d	Bm						



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

	RF	50 Q A	NC	SENS	E:PULSE	ALIGN AUTO		10:48:52 AM	1 Jun 09
ter F			0000 GHz				: Log-Pwr	TRAC	E <mark>12</mark> 3 EMWW
				10: Fast 😱 Gain:Low	Trig: Free Run #Atten: 30 dB			DE	TPPF
	Pof	Offset 0.5 di	2					Mkr1 2.4	
3/div		4.94 dBm						-5.05	57 d
		1							
									-19.
		$\langle \rangle^2$	$\langle \rangle^3$			a	and making	mound	and of the
man	كلمقهمهما	Mart marker	- how was	manyagen	namental	Agenda managenes			
t 30 I	VIHz 100			#\/D\A	/ 300 kHz		Pu	Stop 25 (reep 2.386 s	
				#VDV			3W	FUNCTION VALUE	
N	RC SCL		2.402 GHz	-5.057 d	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
N ·	1 f		3.151 GHz 5.723 GHz	-56.456 d -56.607 d					
	f		24.301 GHz	-47.803 d	Bm				
N									
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N									
N									
N									
N									
N					III III	STATUS			
						STATUS			
					39 CH	STATUS			

00 CH

39	CH
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RL	RF	50 Q A	c i i	SENS	SE:PULSE		ALIGNAUTO		11:10:4	0 AM Jun 09, 20
nter F	req 1	2.515000	P	'NO: Fast 🖵 Gain:Low	Trig: Free I #Atten: 30		Avg Type:	Log-Pwr		RACE 1 2 3 4 TYPE MWMM DET P P P P
dB/div		0ffset 0.5 d⊟ 7.10 dBm								.452 GI .898 dB
g		1								
9										-17.15
9										
9										
9		<u>م2</u>	2							
			3				productor and allow	and	- Manuschand	moundan
a marine	mand	Mulaum	walk was allowed a show	mannen	and a start and a start with the start and t	~~~~~~	bolo about a contra			
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art 30 I es BW		kHz		#VBW	V 300 kHz			Swe	Stop ep 2.386	o 25.00 G s (1001 p
	RC SCL		×	Y		TION FUN	ICTION WIDTH	f	UNCTION VALUE	
N [·]	l f		2.452 GHz 3.201 GHz	-2.898 d -55.699 d						
	1 f 1 f		5.823 GHz 24.750 GHz	-56.476 d -48.075 d						
IN			24.750 GH2	-46.075 0	ы					
										3



78 CH

RL	RF	lyzer - Swept S		SE	NSE:PULSE	۵	LIGNAUTO		11:07:5	6 AM Jun 09, 202
nter F		2.515000	000 GHz	NO: Fast 🖵 Gain:Low		Run	Avg Type	: Log-Pwr		TYPE MWAAAAA DET P P P P
dB/div	Ref (Offset 0.5 dB 13.21 dBn	'n							.477 GH 211 dBi
g		1								
21										
'9 										
.8										-16.59 d
8										
8		2								
8		Σ	3							and the second
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8	· · · · ·	-								
.8										
art 30 I	MH7								Stor	25.00 GH
es BW		Hz		#VB	W 300 kHz			Sw	eep 2.386	
R MODE T			X	Y		ICTION FUNC	TION WIDTH		FUNCTION VALUE	
N N N	1 f 1 f 1 f 1 f		2.477 GHz 2.527 GHz 5.523 GHz 24.351 GHz	3.211 -49.105 -57.004 -48.185	dBm dBm					
										>
							STATUS			



Shenzhen STS Test Services Co., Ltd.

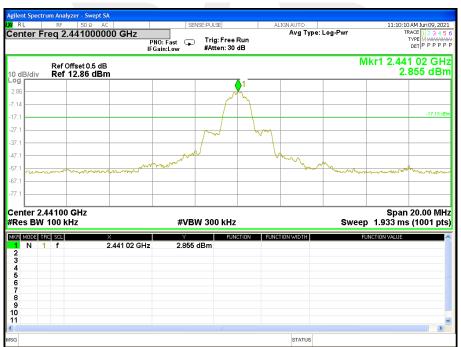


For Band edge(it's also the reference level for conducted spurious emission)

	rum Analyzer - Swept	SA						
Center F	RF 50 Ω	AC 000 GHz	SENSE:	PULSE	ALIGNAUTO Avg Typ	e: Log-Pwr	TR	AM Jun 09, 2021 ACE 1 2 3 4 5 6
e en ner r	100 2.000000	PI		Frig: Free Run #Atten: 30 dB		-	т	VPE MWWWWWW DET PPPPP
10 dB/div	Ref Offset 0.5 d Ref 10.09 dB						Mkr1 2.401 0.0	97 GHz 92 dBm
Log 0.090								1
-9.91								Λ
-19.9								-19,91 dBm
-29.9								
-39.9				<u>2</u>				4
-49.9								
00.0		have have a server	and and the second s	um Annenim	www.en.	and Maranishan	all the discourse and	-A- "\
-69.9								
-79.9								
Start 2.3 #Res BW	0000 GHz / 100 kHz		#VBW :	300 kHz		Swee	Stop 2.4 p 10.27 ms	10700 GHz (1001 pts)
MKR MODE T	irc scl 1 f	× 2.401 97 GHz	ү 0.092 dB		FUNCTION WIDTH		FUNCTION VALUE	_
	1 f 1 f	2.349 97 GHz 2.399 19 GHz	-53.669 dB -52.008 dB					
	1 f	2.400 05 GHz	-48.926 dB	m				
5 6 7								
8 9								
10								
<				Ш				
MSG					STATUS			

00 CH

39 CH





78 CH

	F 50 Ω AC		SENSE:PULSE		ALIGN AUTO	11:07:2	6 AM Jun 09, 202
nter Freq	2.48750000	PN	D: Fast 🖵 Trig: Fr ain:Low #Atten:		Avg Type: Log-f	⁹ wr	TYPE MWAAAAA DET P P P P
dB/div R	ef Offset 0.5 dB ef 13.41 dBm					Mkr1 2.480 3	025 GH 409 dBi
1	(1					
							-16.59 d
5							-10.550
6							
6	and and	Ump.	$\sqrt{2}^3$			Q ⁴	
in the second	-		Mundammer	mann		man h	- mar - m
5 5							
nt 2.47500						Otto = 0	60000 01
es BW 100			#VBW 300 k	Hz		Sweep 2.400 m	.50000 GI s (1001 pi
MODE TRC SC		× 480 025 GHz	Y 3.409 dBm	FUNCTION FUN	ICTION WIDTH	FUNCTION VALUE	
N 1 f	2.	483 500 GHz 484 025 GHz 496 100 GHz	-56.308 dBm -52.208 dBm -50.456 dBm				
N 1 f N 1 f N 1 f N 1 f	2.						
N 1 f N 1 f	2.						
N 1 f N 1 f	2.						
N 1 f N 1 f	2.						



Shenzhen STS Test Services Co., Ltd.

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For Hopping Band edge

π/4-DQPSK

	um Analyzer									
enter F	_R , req 2.35	50 Ω AC 5150000	0 GHz	PNO: Fast	NSE:PULSE Trig: Free #Atten: 30	Run	ALIGNAUTO Avg Type:	Log-Pwr	TR	AM Jun 09, 202 ACE 1 2 3 4 5 YPE MWWWW DET P P P P P
dB/div		et 0.5 dB .63 dBm	ı					М	kr1 2.403 0.6	000 GH 527 dBn
30										
37										(
.4										-19.37 d
.4										N
.4										
	unan	unuka	allanamhpui	manuter and		mahalan	manan	KARAMAN	mmm	www
.4										
3.4										
	000 GHz 100 kHz			#VB	W 300 kH:	z		Swee	Stop 2.4 p 9.867 ms	0300 GH (1001 pts
E MODE 11 N 1 2 N 1 3 N 1 4 5 5 7	f f	2. 2.	x 403 000 GHz 390 022 GHz 400 013 GHz	-53.079	dBm dBm	NCTION FUN	CTION WIDTH	F	UNCTION VALUE	
3 9 0 1										>
1							STATUS			

	RF 50 Ω		SE	NSE:PULSE	ALIGNAUTO Avg Type		11:39:30 AM Jun 09, 20
nter Fre	q 2.4895	00000 GHz	PNO: Fast 😱 IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type	: Log-Pwr	TRACE 1 2 3 4 TYPE M WAAAA DET P P P P
IB/div	Ref Offset 0. Ref 13.31					Mk	r1 2.479 021 GF 3.311 dB
1							
Ward							
							-16.69 c
	w						
		A 12			\\$`		
	v 1/1	WWW Show	hanna	when have	walk walk	when man	Mar Mar Marken
rt 2.479 es BW 1	00 GHz 00 kHz		#VBI	N 300 kHz		Sweep	Stop 2.50000 G 2.067 ms (1001 p
MODE TRC	SCL	×	Y	FUNCTION	FUNCTION WIDTH	FU	NCTION VALUE
N 1 N 1	f f	2.479 021 GH 2.483 515 GH					
N 1	f	2.492 020 GH					

Shenzhen STS Test Services Co., Ltd.



Page 43 of 74 Report No.: STS2106040W02

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

RL	RF	50 Q A	C		SENSE:PUL	SE	AL	IGN AUTO		11:41:	57 AM Jun 09, 202
enter l	Freq 1	2.515000		PNO: Fast FGain:Low		g: Free Run ten: 30 dB		Avg Type	≥: Log-Pwr		TRACE 1 2 3 4 5 TYPE MWWWW DET P P P P
dB/div		offset 0.5 dE 9.62 dBm									2.402 GH .384 dBi
38		1									
4											-19.68 d
4											-13.66.0
4											
4) ²	<u>3</u>							. Multi martini and	Land
4	Munuh	howard	marken	Mumadowe	ب سول جدا و مرد بو The	alles all all and a second	have	www.www.mu	and the second second		
4											
4											
art 30 es BV	MHz V 100 k	Hz		#	VBW 30	0 kHz			Sw	Stoj eep 2.386	p 25.00 GH s (1001 p1
	TRC SCL		× 2.402 GHz		Y 384 dBm	FUNCTION	FUNC	FION WIDTH		FUNCTION VALUE	
N N	1 f 1 f 1 f 1 f		2.402 GHz 2.552 GHz 5.923 GHz 24.326 GHz	z -53. z -55.	579 dBm 613 dBm 360 dBm						
											>

00 CH

39 CH

RL	RF	50 Q A	AC	SENSE:F	PULSE	ALIGNAUTO		11:46:54	AM Jun 09, 20
enter F	req ′	12.515000	PN		rig: Free Run Atten: 30 dB	Avg Typ	e: Log-Pwr	т	ACE 1 2 3 4 YPE MWAAAA DET P P P P
dB/div		Offset 0.5 di 9.47 dBm						Mkr1 2.4 -0.5	452 GI 535 dB
53	. () 1							
.5									-17.02
.5									
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.5		2	-						
.5		¥	3			harmont	mound	Harry Martin Martin and	and the second and
.5 motor	North Land Mile	1 Multimanaged	the hard the hard a server	man hand a series	maxime the print of all and all and all all all all all all all all all al				
.5									
.5									
art 30	MHz							Ston	25.00 G
les BW		kHz		#VBW 3	800 kHz		Swe	ep 2.386 s	(1001 p
R MODE	TRC SCL		x	Y	FUNCTION	FUNCTION WIDTH	ŀ	UNCTION VALUE	
N N	1 f 1 f		2.452 GHz 2.502 GHz	-0.535 dBr -50.642 dBr					
N	1 f		5.923 GHz	-57.022 dBr	n				
N	1 f		24.276 GHz	-47.769 dBr	n				

П



78 CH

Spectrum Analyzer - Sw	AC	SENSE:PULSE		ALIGN AUTO		11:44:25 A	M 1un 09
er Freq 12.515	000000 GHz PN		ree Run : 30 dB	Avg Type:	Log-Pwr	TRA TY	CE 1 2 3 PE MWW ET P P F
Ref Offset 0. Idiv Ref_11.82						Mkr1 2.4 1.8	77 C 15 d
1							
							-16.
2							
han	$\sqrt{3}$	and the second states	minum	and the second s	haven	renew when the my	Alexan and
welnet months							
: 30 MHz 8 BW 100 kHz		#VBW 300 I	ίHz		Sw	Stop 2 eep 2.386 s	
00E TRC SCL N 1 f N 1 f N 1 f N 1 f	× 2.477 GHz 2.552 GHz 5.998 GHz 24.725 GHz	1.815 dBm -49.930 dBm -56.752 dBm -47.406 dBm	FUNCTION FU	JNCTION WIDTH		FUNCTION VALUE	
)



Shenzhen STS Test Services Co., Ltd.



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

		yzer - Swept SA								
Center F	RF	50 Q AC	0 GHz	SE	NSE:PULSE		ALIGNAUTO Avg Typ	e: Log-Pwr	т	7 AM Jun 09, 2021 RACE 1 2 3 4 5 6
			Р	NO: Fast 😱 Gain:Low	Trig: Free #Atten: 30					DET PPPPP
10 dB/div) ffset 0.5 dB 10.32 dBm							Mkr1 2.40 0.	1 97 GHz 321 dBm
Log 0.320										1
-9.68										
-19.7										-19,68 dBm
-29.7										
-39.7										×4
-49.7					-			n		
	charghane	and the second of the	and the start where	ntratelycons ^{erv} errows	and a shipting and and		International Contractor	and for the second	may your work of the	~~ ^{/V} "\
-69.7										
Start 2.30 #Res BW				#VB	W 300 kHz			Swe	Stop 2. eep 10.27 m	.40700 GHz s (1001 pts)
MKR MODE T	RC SCL	×	.401 97 GHz	Y 0.321		CTION	FUNCTION WIDTH		FUNCTION VALUE	<u> </u>
2 N 1	1 f 1 f	2	.349 97 GHz .399 19 GHz	-54.552	dBm					
4 N 1	1 f		.400 05 GHz	-48.768						
5 6 7 8 9										
8										
10										
<										×
MSG							STATUS			

00 CH

39 CH





78 CH

ent Spectr	rum Analyze RF	e <mark>r - Swept SA</mark> 50 Ω AC			NSE:PULSE		ALIGNAUTO		11-10-5	M
		8750000		PNO: Fast		Run	ALIGNAUTU Avg Type:	Log-Pwr	Т	5 AM Jun 09, 20 RACE 1 2 3 4 TYPE M MANAN DET P P P P
dB/div		set 0.5 dB 3.56 dBm						M	kr1 2.479 3.	850 GH 559 dB
56			1 L							
.4										-16.44 c
.4		\sim	m						4	
4	www	<u>۷</u>		\mathcal{M}					- A	
.4 					antan an Carlo	er wynne	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		un un	harmans
.4										
	'500 GH 100 kH			#VB	W 300 kHz			Swee	Stop 2. p 2.400 ms	50000 G s (1001 p
MODE TR N 1 N 1 N 1 N 1	f f f	2.4 2.4 2.4	479 850 GHz 483 500 GHz 484 000 GHz 496 000 GHz	z -55.056 z -51.515	dBm dBm dBm	TION FUN	CTION WIDTH		FUNCTION VALUE	
))



Shenzhen STS Test Services Co., Ltd.

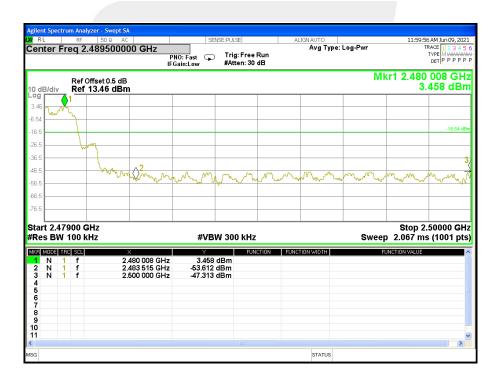




For Hopping Band edge

8DPSK

		yzer - Swept SA								
Center F	RF req 2.	50 Ω AC .35150000	00 GHz	PNO: Fast	NSE:PULSE	Run	Avg Type:	Log-Pwr	TI	5 AM Jun 09, 2021 RACE 1 2 3 4 5 6 TYPE M WWWWW
				Gain:Low	#Atten: 30	dB				DETPPPPP
10 dB/div)ffset 0.5 dB 11.31 dBm	ı					M		000 GHz 310 dBm
Log 1.31										1
-8.69										f.
-18.7										-18.69 dBm
-28.7										
-38.7									$\langle \rangle^2$	() ³
	<i>white</i>	Andrean	harmon		Margare Margare	hanna	mmm	Anna	himmen	Margard
-68.7			-							
-78.7										
Start 2.30									Stop 2.	40300 GHz
#Res BW	100 k	Hz		#VB	W 300 kHz			Swee	p 9.867 ms	s (1001 pts)
MKR MODE TH	ic scl		403 000 GHz	Y 1.310		CTION FUNC	TION WIDTH	F	UNCTION VALUE	^
2 N 1 3 N 1		2.	390 022 GHz 400 013 GHz	-53.621 -50.325						
4										
5 6 7										
8 9 10										
10 11										~
<										
MSG							STATUS			



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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:	DC 3.7V

Number of Hopping Channel

79

Hopping channel

RL			50 Ω AC	00 GHz			SE	NSE:PU	LSE			AL	IGN AU Au	TO g Typ	o: c	a-Pwa	r		10:2		AM Jun I	
enter	Free	1 Z.4 4	175000	JUGHZ	PN0 IFGa	D: Fast ain:Low	Ģ) Tr #A	ig: Fre tten: 3	e Rur 0 dB	ı		~*	41, 8	L.	-9 WI				Т	YPE MIS DET P F	لمتملم
dB/di			et 0.5 dB 73 dBm	n												1	Mkr	2 2	.480		0 0 84	
29 73	<u>}1</u>																					2
.73	WW	WW	mm	mm	M	nm	W	M	MM	ΛM	M	W	W	m	Υn	MW	WY	W	WW	W	IVYY	M
5.3																						
5.3																						
5.3																						4
5.3										-												
i.3 —										-												
5.3										+								1		-		
5.3										-								-		-		
		0 GHz 0 kHz				\$	¢VΒ	W 30	00 KH	z						s	wee	р 1	Stop .133 (2.4 ms	835) (100	0 GI 1 pt
(R MOD	E TRC	ICL.	;	×			Y		FL	INCTIO	N	FUNCT	rion w	IDTH			F	UNCT	ION VALU	JE		
1 N 2 N		f f		02 254 5 GH 30 160 0 GH				dBm														
3			2.40	50 160 0 Gr	72		4.04	авт														
4 5																						
6 7																						
8																						
9 0																						
1																						
																						>

Shenzhen STS Test Services Co., Ltd.

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6. AVERAGE TIME OF OCCUPANCY

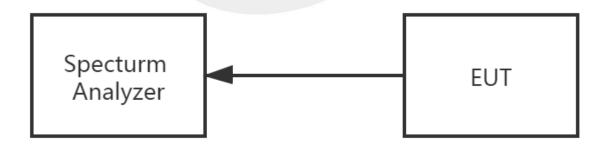
6.1 LIMIT

	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:	DC 3.7V

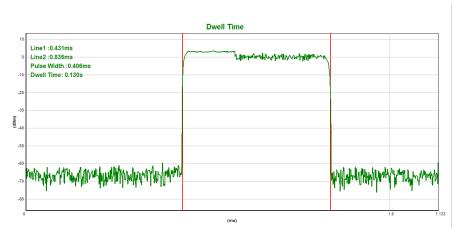
Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
DH1	middle	0.406	0.130	0.4
DH3	middle	1.656	0.265	0.4
DH5	middle	2.900	0.309	0.4



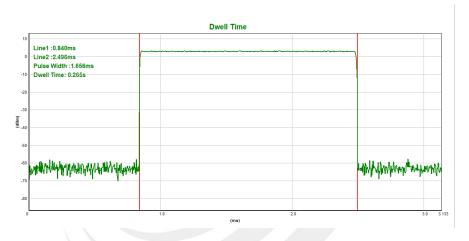
П



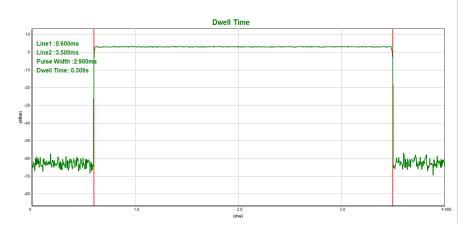
CH39-DH1



CH39-DH3







Shenzhen STS Test Services Co., Ltd.



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Temperature:	25 ℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps)– 2DH1/2DH3/2DH5	Test Voltage:	DC 3.7V

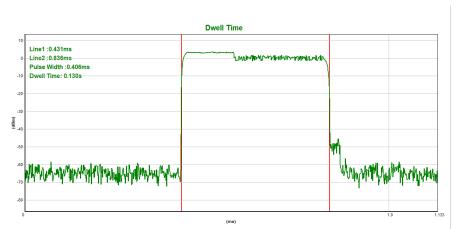
Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
2DH1	middle	0.406	0.130	0.4
2DH3	middle	1.658	0.265	0.4
2DH5	middle	2.908	0.310	0.4



Shenzhen STS Test Services Co., Ltd.



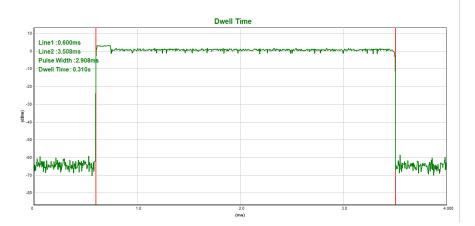
CH39-2DH1



CH39-2DH3



CH39-2DH5



Shenzhen STS Test Services Co., Ltd.



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Temperature:	25 ℃	Relative Humidity:	50%
Test Mode:	8DPSK(3Mbps)– 3DH1/3DH3/3DH5	Test Voltage:	DC 3.7V

Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
3DH1	middle	0.405	0.130	0.4
3DH3	middle	1.658	0.265	0.4
3DH5	middle	2.908	0.310	0.4



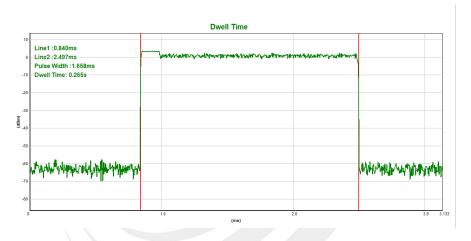
Shenzhen STS Test Services Co., Ltd.



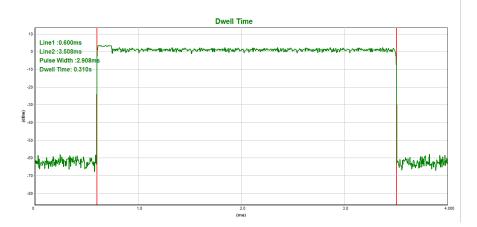
CH39-3DH1



CH39-3DH3



CH39-3DH5



Shenzhen STS Test Services Co., Ltd.



7. HOPPING CHANNEL SEPARATION MEASUREMEN

7.1 LIMIT

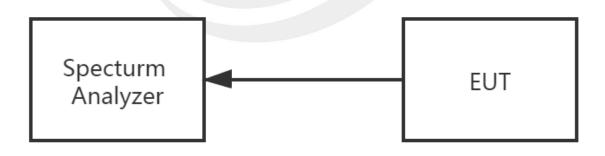
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that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

Spectrum Parameter	Setting			
Attenuation Auto				
Span Frequency > 20 dB Bandwidth or Channel Separation				
RB 30 kHz (20dB Bandwidth) / 30 kHz (Channel Separati				
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:	DC 3.7V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2402.002	2403.007	1.005	0.872	Complies
2441 MHz	2440.834	2441.998	1.164	0.866	Complies
2480 MHz	2479.008	2480.013	1.005	0.863	Complies

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

CH00 -1Mbps

RL RF	er - Swept SA 50 Ω AC	SENSE:PULSE	ALIGNAUTO		10:18:08 AM Jun 09, 202
	02500000 GHz	NO: Wide Trig: Fr Gain:Low #Atten:	Avg '	Type: Log-Pwr	TRACE 1 2 3 4 5 TYPE MWWW DET P P P P F
dB/div Ref 11	set 0.5 dB I. 60 dBm			Mkr	2 2.403 007 GH 2.309 dBr
g 60		1		2	
40	M	m	\sim	mon	N~
	~~~	h	- mm	- Maria	
.4	~~~~		N NA		~~~~
.4					
4					
.4 × m V					
4					
4					
.4					
enter 2.402500 Res BW 30 kHz	GHz	#VBW 100 ki		•	Span 3.000 MH 3.200 ms (1001 pt
R MODE TRC SCL	×		FUNCTION FUNCTION WIDT	H FUN	CTION VALUE
N 1 f	2.402 002 GHz 2.403 007 GHz	1.60 dBm 2.31 dBm			
	2.400 001 0112	2.01 0.011			
)					
)					
					>

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#### CH39 -1Mbps



#### CH78 -1Mbps



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Temperature:	25℃	Relative Humidity:	50%
	CH00 / CH39 / CH78 (π/4-DQPSK(2Mbps) Mode)	Test Voltage:	DC 3.7V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2402.005	2403.004	0.999	0.813	Complies
2441 MHz	2441.008	2442.007	0.999	0.814	Complies
2480 MHz	2479.014	2480.001	0.987	0.815	Complies

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

RL	RF 50 Ω	AC	SEN	SE:PULSE	ALIGNAUTO		11:16:46 AM Ju	109,202
enter F	req 2.40250	0000 GHz Pr	IO: Wide 😱 Gain:Low	Trig: Free Run #Atten: 30 dB	Avg Type	: Log-Pwr	TRACE 1	2345 WWWWW PPPF
dB/div	Ref Offset 0.5 Ref 9.59 dE					Mkr	2 2.403 004 0.798	
g			<u>\</u> 1		2			
.4		-	$\sim$	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	$-n^{\prime}$	m	m	$\sim$
4	~~~							
4								
4	- CH							
4								
.4								
.4								
	402500 GHz 30 kHz		#VBV	V 100 kHz		Sweep	Span 3.00 3.200 ms (10	0 MH 01 pt
R MODE T		× 2.402 005 GHz	Y -0.33 (	FUNCTION	FUNCTION WIDTH	FUN	CTION VALUE	
N 1		2.402 005 GHz 2.403 004 GHz	0.80 0	iBm				
i I								
:								
, 1								

#### CH00 -2Mbps

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#### CH39 -2Mbps

RF	50 Ω AC	SE	NSE:PULSE	ALIGNAUTO		11:30:21 AM Jun 09, 2
er Freq 2.4	41500000 GH			Avg Type: L	og-Pwr	TRACE 1 2 3 4 TYPE MWWW DET P P P F
	set 0.5 dB 1.86 dBm				Mkr2	2.442 007 G 2.282 dE
		()1		2		
ma a		n man	-	- 0 M	$\wedge$	- A
- V m	monter		m.m.	and have be	marth	which a
ter 2.441500	GHz					Span 3.000 M
s BW 30 kHz		#VB	W 100 kHz		Sweep 3.3	200 ms (1001 p
MODE TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH	FUNCTIO	N VALUE
N 1 f N 1 f	2.441 008		dBm			
N 1 f	2.442 007	GHZ 2.28	dBm			

#### CH78 -2Mbps



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Temperature:	25℃	Relative Humidity:	50%
	CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)	Test Voltage:	DC 3.7V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2402.008	2403.001	0.993	0.803	Complies
2441 MHz	2441.014	2442.004	0.990	0.805	Complies
2480 MHz	2479.005	2480.010	1.005	0.806	Complies

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

CH00 -3Mbps

RL	RF	50 Ω A		SENS	E:PULSE	AL	IGN AUTO			5 AM Jun 09, 202
enter	Freq 2	2.4025000	P	IO: Wide 😱 Gain:Low	Trig: Free Ru #Atten: 30 dB	n	Avg Type:	Log-Pwr		RACE 1 2 3 4 5 TYPE MWWWWW DET P P P P P
) dB/div		Offset 0.5 dE f 6.56 dBm						М	kr2 2.403 0.	001 GH 729 dBr
.44				21	~		~~~ ² ~	mmm		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
B.4		- Contraction	And A		~ hours	1.4 A M				
8.4		/								
3.4 <mark></mark>	Johnary									
3.4										
3.4										
	2.4025 W 30 k	00 GHz Hz		#VBW	100 kHz			Swee	Span p 3.200 ms	3.000 MH s (1001 pt
1 N	TRC SCL 1 f	2	× 2.402 008 GHz	0.42 di		N FUNCT	ION WIDTH		UNCTION VALUE	
3	1 1	4	2.403 001 GHz	0.73 d	вт					
5 5 7										
3 9										
1										>

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#### CH39 -3Mbps

RF	50 Ω AC	SENS	E:PULSE	ALIGN AUTO	11:5	1:03 AM Jun 09, 20
er Freq 2.44	1500000 GHz	PNO: Wide 😱 IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type: Lo	g-Pwr	TRACE 1 2 3 4 TYPE MWWW DET P P P P
Ref Offs B/div Ref 8.5	et 0.5 dB 6 dBm				Mkr2 2.44	l2 004 GH 2.410 dB
				2		
www	monter	mer have p	m	mar and an	mon	m run
ter 2.441500 ( s BW 30 kHz	SHZ	#VBW	100 kHz		Spa Sweep 3.200	an 3.000 Mi ms (1001 pt
MODE TRC SCL N 1 f	× 2.441 014 GH	r Iz 1.42 d	FUNCTION	FUNCTION WIDTH	FUNCTION VALU	E
N 1 f	2.442 004 GH					
						>

#### CH78 -3Mbps



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## 8. BANDWIDTH TEST

## 8.1 LIMIT

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

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

#### 8.2 TEST PROCEDURE

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

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

#### 8.3 TEST SETUP



### 8.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



### **8.5 TEST RESULTS**

Temperature:	25°C	Relative Humidity:	50%
	GFSK(1Mbps) CH00 / CH39 / C78	Test Voltage:	DC 3.7V

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	0.8723	PASS
2441 MHz	0.8664	PASS
2480 MHz	0.8625	PASS

#### CH00 -1Mbps

Agilent Spectrum Analyzer - Occupied B\	N			
X/RL   RF   50Ω AC		ENSE:PULSE Center Freg: 2.402000	ALIGNAUTO	10:42:36 AM Jun 09, 2021 Radio Std: None
Center Freq 2.402000000	GHZ	Trig: Free Run	Avg Hold:>10/10	Radio Sta: None
	#IFGain:Low	#Atten: 30 dB		Radio Device: BTS
10 dB/div Ref 20.00 dBm	۱ <u> </u>			
Log 10.0				
0.00				
-10.0		$\sim$		
-20.0				~
-30.0				
-40.0				hanne
-50.0				
-60.0				
-70.0				
Center 2.402 GHz				Span 2 MHz
#Res BW 30 kHz		#VBW 100 k	Hz	Sweep 2.733 ms
Occupied Bandwidt		Total Power	9.36 dBm	
		10101101101		
8	34.90 kHz			
Transmit Freg Error	874 Hz	OBW Power	99.00 %	
x dB Bandwidth	872.3 kHz	x dB	-20.00 dB	
	072.0 KHZ		-20.00 00	
MSG			STATUS	

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#### CH39 -1Mbps



CH78 -1Mbps





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Temperature:	25°C	Relative Humidity:	50%
	π/4-DQPSK(2Mbps) CH00 / CH39 / C78	Test Voltage:	DC 3.7V

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.219	PASS
2441 MHz	1.221	PASS
2480 MHz	1.223	PASS

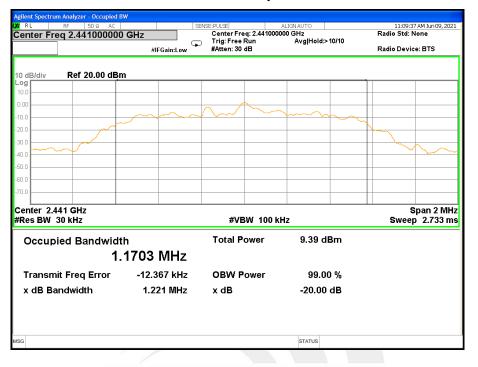
## CH00 -2Mbps



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#### CH39 -2Mbps



#### CH78 -2Mbps



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Temperature:	25°C	Relative Humidity:	50%
Test Mode:	8DPSK(3Mbps) CH00 / CH39 / CH78	Test Voltage:	DC 3.7V

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.205	PASS
2441 MHz	1.208	PASS
2480 MHz	1.209	PASS

## CH00 -3Mbps

Agilent Spectrum Analyzer - Occupied B		ENSE:PULSE	ALIGNAUTO	11:40:49 AM Jun 09, 2021
Center Freq 2.40200000	GHz	Center Freq: 2.402000		Radio Std: None
	#IFGain:Low	#Atten: 30 dB	Avginola.>10/10	Radio Device: BTS
10 dB/div Ref 20.00 dBn	n			
-og				
0.0				
0.0		$\sim$		
0.0	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		1 million	~
0.0				
0.0				
0.0				
0.0				
0.0				
Center 2.402 GHz Res BW 30 kHz		#VBW 100 k	Hz	Span 2 MHz Sweep 2.733 ms
Occupied Bandwidt	h	Total Power	7.10 dBm	
1.	1468 MHz			
Transmit Freq Error	15.051 kHz	OBW Power	99.00 %	
x dB Bandwidth	1.205 MHz	x dB	-20.00 dB	
G			STATUS	

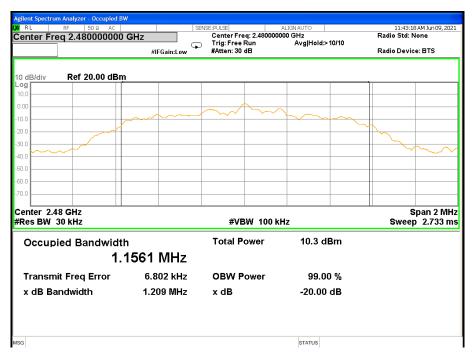
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#### CH39 -3Mbps



#### CH78 -3Mbps



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# 9. OUTPUT POWER TEST

#### 9.1 LIMIT

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

#### 9.2 TEST PROCEDURE

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

- a) Use the following spectrum analyzer settings:
- 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 2) RBW > 20 dB bandwidth of the emission being measured.
- 3) VBW  $\geq$  RBW.
- 4) Sweep: Auto.
- 5) Detector function: Peak.
- 6) Trace: Max hold.
- b) Allow trace to stabilize.
- c) Use the marker-to-peak function to set the marker to the peak of the emission.

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

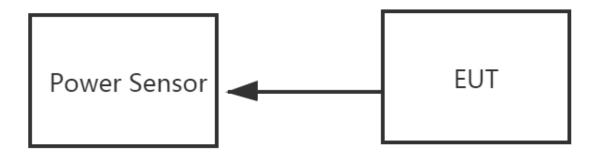
e) A plot of the test results and setup description shall be included in the test report.

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

PKPM1 Peak power meter method:

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

9.3 TEST SETUP



### 9.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

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#### 9.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Voltage:	DC 3.7V		

Mode Channel Number		Peak Power	Average Power	Limit	
	(MHz)	(dBm)	(dBm)	(dBm)	
	0	2402	3.79	-2.07	30.00
GFSK(1M)	39	2441	4.36	-0.76	30.00
	78	2480	4.83	-0.25	30.00

Note: the channel separation >20dB bandwidth

Mode Channel Number			Peak Power	Average Power	Limit
	(MHz)	(dBm)	(dBm)	(dBm)	
π/4-DQPSK( 2M)	0	2402	1.76	-4.99	20.97
	39	2441	3.60	-2.67	20.97
	78	2480	4.20	-1.94	20.97

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

Mode Channel Number		Peak Power	Average Power	Limit	
	(MHz)	(dBm)	(dBm)	(dBm)	
	0	2402	2.07	-4.99	20.97
8-DPSK(3M)	39	2441	3.76	-2.65	20.97
	78	2480	4.35	-1.92	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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