

RADIO TEST REPORT

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Report No:STS1812290W02

Issued for

Beijing Qunlitiancheng Network Technology Co., Ltd.

5/F No.14 Building, No.8 Yard, ZhenGuoSi North Street Fengtai District, Beijing China 100070

Product Name:	Bluetooth Headphones			
Brand Name:	dyplay			
Model Name:	Urban Traveller			
Series Model:	N/A			
FCC ID:	2ARFD-TRAVELLER			
Test Standard:	FCC Part 15.247			

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TEST RESULT CERTIFICATION

Applicant'sname:	Beijing Qunlitiancheng Network Technology Co., Ltd.
Address:	5/F No.14 Building, No.8 Yard, ZhenGuoSi North Street Fengtai District, Beijing China 100070
Manufacture's Name:	Beijing Qunlitiancheng Network Technology Co., Ltd.
Address	5/F No.14 Building, No.8 Yard, ZhenGuoSi North Street Fengtai District, Beijing China 100070
Product description	
Product Name:	Bluetooth Headphones
Brand Name:	dyplay
Model Name:	Urban Traveller
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 (s) of performance of tests .: 04 Jan. 2019 ~ 08 Jan. 2019

Date of Issue 16 Jan. 2019

Test Result Pass

Testing Engineer

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APPROVAL 6

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	16 Jan. 2019	STS1812290W02	ALL	Initial Issue



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1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards: DA 00-705

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			
15.247(c)	Radiated Spurious Emission	PASS			
15.247(d)	Conducted Spurious & Band Edge Emission	PASS			
15.247(a)(iii)	Number of Hopping Frequency	PASS			
15.247(a)(iii)	Dwell Time	PASS			
15.247(a)(1)	Bandwidth	PASS			
15.205	Restricted Band Edge Emission	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. : 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China FCC Registration No.: 625569 IC Registration No.: 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	±0.71dB
2	Unwanted Emissions, conducted	±0.63dB
3	All emissions, radiated 30-200MHz	±3.43dB
4	All emissions, radiated 200MHz-1GHz	±3.57dB
5	All emissions, radiated>1G	±4.13dB
6	Conducted Emission(9KHz-150KHz)	±3.18dB
7	Conducted Emission(150KHz-30MHz)	±2.70dB

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2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Bluetooth Headphones
Trade Name	dyplay
Model Name	Urban Traveller
Series Model	N/A
Model Difference	N/A
Channel List	Please refer to the Note 2.
Bluetooth	Frequency:2402 – 2480 MHz Modulation: GFSK(1Mbps), π/4-DQPSK(2Mbps), 8DPSK(3Mbps)
Bluetooth Version	4.1 BR+EDR
Adapter	N/A
Battery	Capacity:500 mAh Rated Voltage: DC 3.7V Charge Limit: DC 4.2V
Hardware version number	H032-CSR9835-V1.2
Software version number	H032 CSR8635 SW V01
Connecting I/O Port(s)	Please refer to the User's Manual

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's 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	dyplay	Urban Traveller	РСВ	N/A	0.11 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
Noto		

Note:

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

(2) We have be tested for all avaiable 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

2.3 TABLE OF PARAMETERS OF TEXT 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			
Frequency	2402 MHz 2441 MHz 2480 MHz			
(Power control software) Parameters(1/2/3Mbps)	Power class: 1 M rate:4:27 2 M rate:11:183 3 M rate:15:339	Power class: 1 M rate:4:27 2 M rate:11:183 3 M rate:15:339	Power class: 1 M rate:4:27 2 M rate:11:183 3 M rate:15:339	



2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

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

Radiated Spurious Emission Test



2.5 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.

Nacassary accessories

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

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
E-2	Notebook	DELL	VOSTRO.3800	N/A	N/A
C-1	USB Cable	N/A	100cm	N/A	N/A

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in ^rLength^a column.
- (3) "YES" is means "shielded" "with core"; "NO" is means "unshielded" "without core".

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2.6 EQUIPMENTS LIST

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2018.10.13	2019.10.12
Signal Analyzer	Agilent	N9020A	MY51110105	2018.03.08	2019.03.07
Active loop Antenna	ZHINAN	ZN30900C	16035	2018.03.11	2021.03.10
Bilog Antenna	TESEQ	CBL6111D	34678	2017.11.02	2020.11.1
Horn Antenna	SCHWARZBECK	BBHA 9120D(1201)	9120D-1343	2018.10.19	2021.10.18
SHF-EHF Horn Antenna (15G-40GHz)	A-INFO	LB-180400-KF	J211020657	2018.03.11	2019.03.10
Pre-mplifier(0.1M-3GH z)	EM	EM330	060665	2018.10.13	2019.10.12
PreAmplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK201808090 1	2018.10.13	2019.10.12
Temperature & Humitidy	HH660	Mieo	N/A	2018.10.11	2019.10.10
turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A

RF Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
USB RF power sensor	DARE	RPR3006W	15100041SNO03	2018.10.13	2019.10.12
Signal Analyzer	Agilent	N9020A	MY49100060	2018.10.13	2019.10.12
Temperature & Humitidy	HH660	Mieo	N/A	2018.10.11	2019.10.10



3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

Operating frequency band. In case the emission fall within the restricted band specified on Part 207(a) limit in the table below has to be followed.

	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.

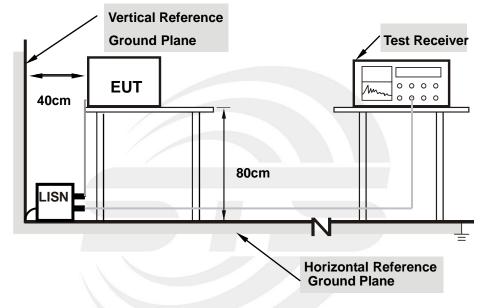
The following table is the setting of the receiver

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 was 0.8 meters from the horizontal ground plane and 0.4 meters from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 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 at least 80 cm from 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 from other units and other metal planes

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:	21.6°C	Relative Humidity:	69%
Test Voltage:	N/A	Phase:	L/N
Test Mode:	N/A		

Note: The BT function will be disabled (not transmitting) when the EUT is charging, the test is not available.



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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)

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

Notes:

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

(2) The tighter limit applies at the band edges.

(3) Emission level (dBuV/m)=20log Emission level (uV/m).

For Radiated Emission

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	
band)	PK=1MHz / 1MHz, AV=1 MHz /10 Hz

For Band edge

Spectrum Parameter	Setting
Detector	Peak/AV
	Lower Band Edge: 2300 to 2403 MHz
Start/Stop Frequency	Upper Band Edge: 2479 to 2500 MHz
RB / VB (emission in restricted band)	PK=1MHz / 1MHz, AV=1 MHz / 10 Hz

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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 of 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 meters(above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees 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 polarizations 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 then QuasiPeak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement 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

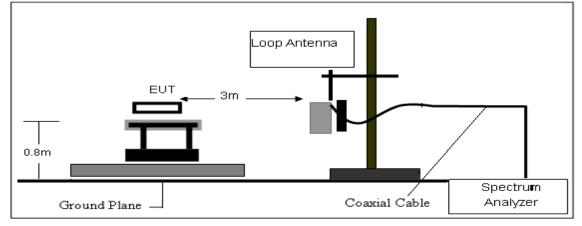
No deviation

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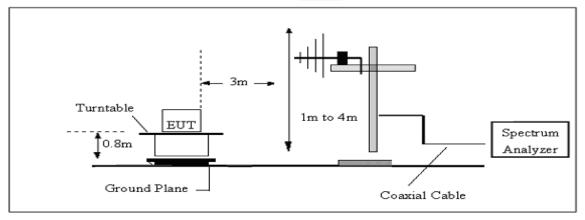


3.2.4 TESTSETUP

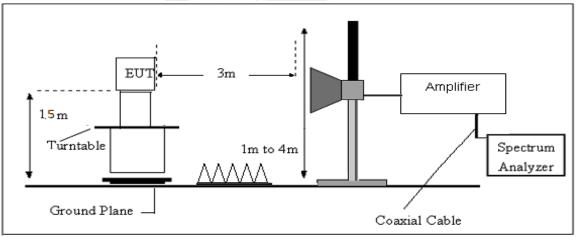
(A) Radiated Emission Test-Up Frequency Below 30MHz



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



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



3.2.5 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

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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:	22.5°C	Relative Humidity:	54%
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.





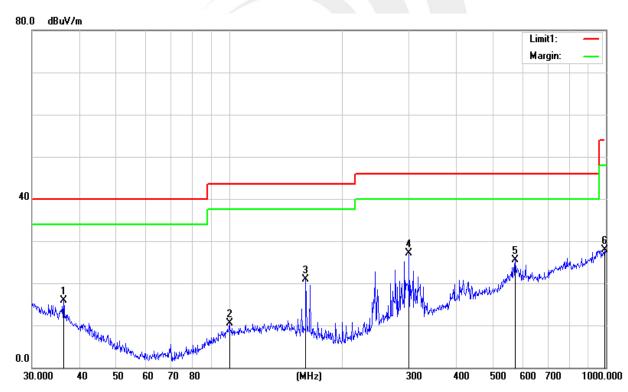
(30MHz-1000MHz)

Temperature:	22.5℃	Relative Humidity:	54%		
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	36.3814	30.31	-14.47	15.84	40.00	-24.16	QP
2	100.2286	29.75	-19.17	10.58	43.50	-32.92	QP
3	159.7844	39.49	-18.49	21.00	43.50	-22.50	QP
4	300.3672	41.83	-14.81	27.02	46.00	-18.98	QP
5	574.6258	32.12	-6.67	25.45	46.00	-20.55	QP
6	993.0114	28.09	-0.10	27.99	54.00	-26.01	QP

Remark:

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



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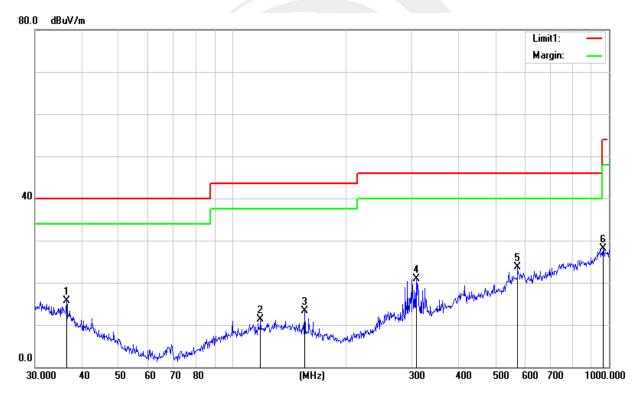


Temperature:	22.5℃	Relative Humidity:	54%		
Test Voltage:	DC 3.7V	Phase:	Vertical		
Test Mode:	Mode 1/2/3/4/5/6/7/8/9(Mode 3 worst mode)				

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	36.3814	30.23	-14.47	15.76	40.00	-24.24	QP
2	119.0180	28.99	-17.75	11.24	43.50	-32.26	QP
3	155.9101	31.55	-18.28	13.27	43.50	-30.23	QP
4	307.8313	35.47	-14.57	20.90	46.00	-25.10	QP
5	572.6144	30.37	-6.65	23.72	46.00	-22.28	QP
6	965.5421	28.21	-0.14	28.07	54.00	-25.93	QP

Remark:

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





(1GHz~25GHz) Restricted band and 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	Commone
				Low C	hannel (2402	2 MHz)				
3264.66	61.14	44.70	6.70	28.20	-9.80	51.34	74.00	-22.66	PK	Vertical
3264.66	51.25	44.70	6.70	28.20	-9.80	41.45	54.00	-12.55	AV	Vertical
3264.75	61.21	44.70	6.70	28.20	-9.80	51.41	74.00	-22.59	PK	Horizontal
3264.75	49.89	44.70	6.70	28.20	-9.80	40.09	54.00	-13.91	AV	Horizontal
4804.50	58.32	44.20	9.04	31.60	-3.56	54.76	74.00	-19.24	PK	Vertical
4804.50	49.12	44.20	9.04	31.60	-3.56	45.56	54.00	-8.44	AV	Vertical
4804.43	59.15	44.20	9.04	31.60	-3.56	55.59	74.00	-18.41	PK	Horizontal
4804.43	49.66	44.20	9.04	31.60	-3.56	46.10	54.00	-7.90	AV	Horizontal
5359.74	48.29	44.20	9.86	32.00	-2.34	45.95	74.00	-28.05	PK	Vertical
5359.74	39.12	44.20	9.86	32.00	-2.34	36.78	54.00	-17.22	AV	Vertical
5359.74	47.88	44.20	9.86	32.00	-2.34	45.54	74.00	-28.46	PK	Horizontal
5359.74	39.02	44.20	9.86	32.00	-2.34	36.68	54.00	-17.32	AV	Horizontal
7205.81	54.08	43.50	11.40	35.50	3.40	57.48	74.00	-16.52	PK	Vertical
7205.81	44.55	43.50	11.40	35.50	3.40	47.95	54.00	-6.05	AV	Vertical
7205.70	53.82	43.50	11.40	35.50	3.40	57.22	74.00	-16.78	PK	Horizontal
7205.70	43.42	43.50	11.40	35.50	3.40	46.82	54.00	-7.18	AV	Horizontal
				Middle	Channel (244	1 MHz)				
3264.71	61.77	44.70	6.70	28.20	-9.80	51.97	74.00	-22.03	PK	Vertical
3264.71	50.65	44.70	6.70	28.20	-9.80	40.85	54.00	-13.15	AV	Vertical
3264.81	60.93	44.70	6.70	28.20	-9.80	51.13	74.00	-22.87	PK	Horizontal
3264.81	51.17	44.70	6.70	28.20	-9.80	41.37	54.00	-12.63	AV	Horizontal
4882.39	58.64	44.20	9.04	31.60	-3.56	55.08	74.00	-18.92	PK	Vertical
4882.39	50.24	44.20	9.04	31.60	-3.56	46.68	54.00	-7.32	AV	Vertical
4882.50	59.30	44.20	9.04	31.60	-3.56	55.74	74.00	-18.26	PK	Horizontal
4882.50	50.21	44.20	9.04	31.60	-3.56	46.65	54.00	-7.35	AV	Horizontal
5359.70	48.59	44.20	9.86	32.00	-2.34	46.25	74.00	-27.75	PK	Vertical
5359.70	40.20	44.20	9.86	32.00	-2.34	37.86	54.00	-16.14	AV	Vertical
5359.84	47.86	44.20	9.86	32.00	-2.34	45.52	74.00	-28.48	PK	Horizontal
5359.84	38.35	44.20	9.86	32.00	-2.34	36.01	54.00	-17.99	AV	Horizontal
7323.74	54.62	43.50	11.40	35.50	3.40	58.02	74.00	-15.98	PK	Vertical
7323.74	44.72	43.50	11.40	35.50	3.40	48.12	54.00	-5.88	AV	Vertical
7323.81	53.88	43.50	11.40	35.50	3.40	57.28	74.00	-16.72	PK	Horizontal
7323.81	43.79	43.50	11.40	35.50	3.40	47.19	54.00	-6.81	AV	Horizontal

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				High C	hannel (248	0 MHz)				
3264.74	61.73	44.70	6.70	28.20	-9.80	51.93	74.00	-22.07	PK	Vertical
3264.74	50.73	44.70	6.70	28.20	-9.80	40.93	54.00	-13.07	AV	Vertical
3264.57	61.00	44.70	6.70	28.20	-9.80	51.20	74.00	-22.80	PK	Horizontal
3264.57	50.53	44.70	6.70	28.20	-9.80	40.73	54.00	-13.27	AV	Horizontal
4960.52	59.00	44.20	9.04	31.60	-3.56	55.44	74.00	-18.56	PK	Vertical
4960.52	50.13	44.20	9.04	31.60	-3.56	46.57	54.00	-7.43	AV	Vertical
4960.37	59.21	44.20	9.04	31.60	-3.56	55.65	74.00	-18.35	PK	Horizontal
4960.37	49.44	44.20	9.04	31.60	-3.56	45.88	54.00	-8.12	AV	Horizontal
5359.83	49.04	44.20	9.86	32.00	-2.34	46.70	74.00	-27.30	PK	Vertical
5359.83	39.12	44.20	9.86	32.00	-2.34	36.78	54.00	-17.22	AV	Vertical
5359.71	48.09	44.20	9.86	32.00	-2.34	45.75	74.00	-28.25	PK	Horizontal
5359.71	38.54	44.20	9.86	32.00	-2.34	36.20	54.00	-17.80	AV	Horizontal
7439.92	54.48	43.50	11.40	35.50	3.40	57.88	74.00	-16.12	PK	Vertical
7439.92	43.59	43.50	11.40	35.50	3.40	46.99	54.00	-7.01	AV	Vertical
7439.74	53.50	43.50	11.40	35.50	3.40	56.90	74.00	-17.10	PK	Horizontal
7439.74	44.28	43.50	11.40	35.50	3.40	47.68	54.00	-6.32	AV	Horizontal

Note:

1) Scan with GFSK, $\pi/4$ -DQPSK,8DPSK,the worst case is GFSK Mode

2) Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Emission Level = Reading + Factor

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.

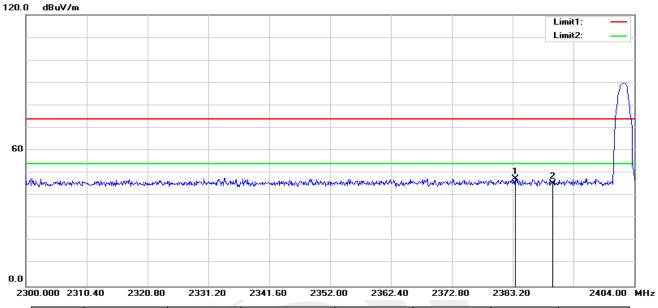
Shenzhen STS Test Services Co., Ltd.



Report No.: STS1812290W02

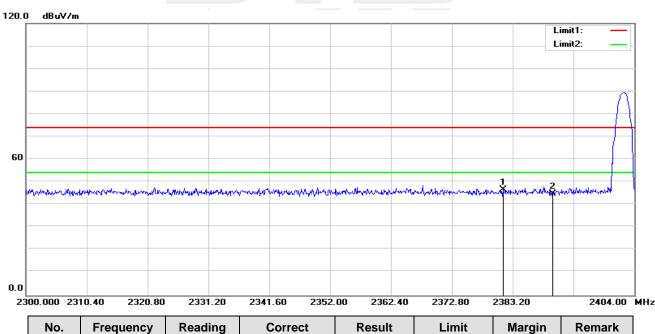
Restricted band Requirements

GFSK-Low Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2383.616	58.11	-10.52	47.59	74.00	-26.41	peak
2	2390.000	56.02	-10.48	45.54	74.00	-28.46	peak

Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2381.536	57.13	-10.54	46.59	74.00	-27.41	peak
2	2390.000	55.36	-10.48	44.88	74.00	-29.12	peak

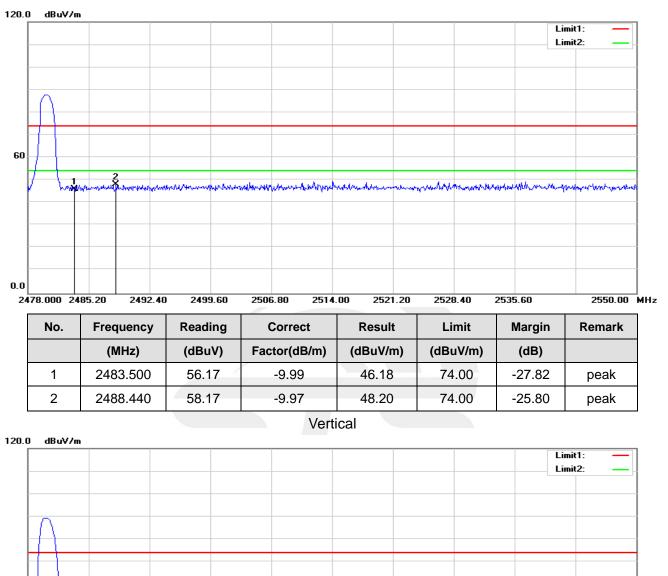
1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China Tel: + 86-755 3688 6288 Fax:+ 86-755 3688 6277 Http://www.stsapp.com E-mail: sts@stsapp.com

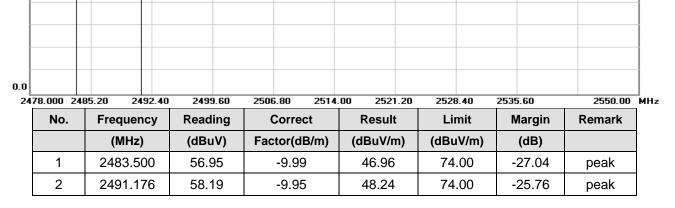


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Report No.: STS1812290W02

GFSK-High Horizontal





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

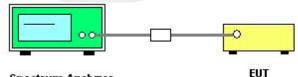
Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

For Band edge

Spectrum Parameter	Setting
Detector	Peak
Stort/Stop Eroguopou	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

Remark : Hopping on and Hopping off mode all have been tested, only worst case hopping off is reported.

4.3 TEST SETUP



Spectrum Analyzer

The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 500hm; the path loss as the factor is calibrated to correct the reading. Make the measurement with the spectrum analyzer's resolution bandwidth(RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

4.4 EUT OPERATION CONDITIONS

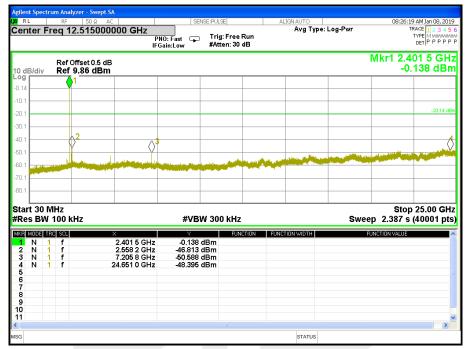
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



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

RL									
	RF 50 Ω Freq 12.5150	000000 GHz	SENSE:PL	use ig: Free Run	ALI	GNAUTO Avg Type:	Log-Pwr		D2 AM Jan 08, 2 TRACE 1 2 3 4 TYPE MWAAAA
				tten: 30 dB					DETPPP
) dB/div	Ref Offset 0. Ref_11.68							Mkr1 2.4 1	140 9 GI .683 dB
.68	1								
32									
3.3									-18.32
3.3			2						
3.3	2								
					فعريدة	in the second			
3.3									
3.3									
			#) (D)W 0/				0		
Res BV	V 100 kHz		#VBW 30					ep 2.387 s	
Res BV	V 100 kHz TEC SCL	× 2.440 9 GHz	Y 1.683 dBm	FUNCTION	FUNCT	ION WIDTH			o 25.00 G (40001 p
Res BV R MODE N N 2 N 3 N	V 100 kHz TRC SCL 1 f 1 f 1 f	2.440 9 GHz 2.545 1 GHz 7.322 5 GHz	1.683 dBm -51.877 dBm -45.254 dBm	FUNCTION	FUNCT	ION WIDTH		ep 2.387 s	
Res BV	V 100 kHz TRC SCL 1 f 1 f	2.440 9 GHz 2.545 1 GHz	1.683 dBm -51.877 dBm	FUNCTION	FUNCT	ION WIDTH		ep 2.387 s	
F MODE N 2 N 3 N 4 N 5 5 7	V 100 kHz TRC SCL 1 f 1 f 1 f	2.440 9 GHz 2.545 1 GHz 7.322 5 GHz	1.683 dBm -51.877 dBm -45.254 dBm	FUNCTION	FUNCT	ION WIDTH		ep 2.387 s	
Res BV R MODE N N N N N N N N N N N N N	V 100 kHz TRC SCL 1 f 1 f 1 f	2.440 9 GHz 2.545 1 GHz 7.322 5 GHz	1.683 dBm -51.877 dBm -45.254 dBm	FUNCTION	FUNCT	ION WIDTH		ep 2.387 s	
Res BV R MODE N 2 N 3 N 4 N 5 7 3	V 100 kHz TRC SCL 1 f 1 f 1 f	2.440 9 GHz 2.545 1 GHz 7.322 5 GHz	1.683 dBm -51.877 dBm -45.254 dBm	FUNCTION	FUNCT	ION WIDTH		ep 2.387 s	



78 CH

nt Spectri	um Anal RF	lyzer - Swept S		05					201051	
		50 Q A 2.515000	000 GHz	PNO: Fast Gain:Low	NSE:PULSE Trig: Free I #Atten: 30	Run	IGNAUTO Avg Type:	Log-Pwr		14 AM Jan 08, 2 TRACE 1 2 3 TYPE MWWM DET P P P
B/div		Offset 0.5 dE 13.19 dBi							Mkr1 2.4 3	180 2 G .193 di
		1								
										-16.81
		^ <u>2</u>		3						/
			Y						an de constations	a second
rt 30 N es BW		(Hz		#VB	W 300 kHz		1	Swe	Stop ep 2.387 s	o 25.00 G (40001 p
MODE TH	C SCL		× 2.480 2 GHz	Y 3.193		CTION FUNC	TION WIDTH		FUNCTION VALUE	
N 1 N 1 N 1	f f		2.636 2 GHz 7.439 2 GHz 24.280 2 GHz	-50.365 -43.378 -47.986	dBm dBm					
							STATUS			



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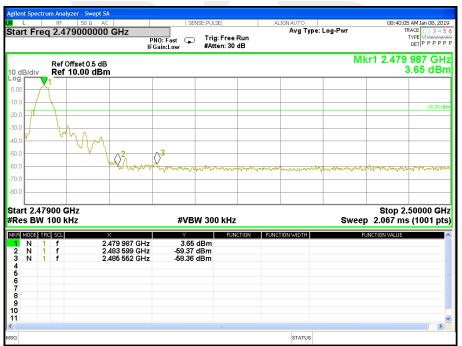


For Band edge

00 CH

ilent Spectr	rum Analyzer -										
art Fre	RF 50 9 2.30000	0 Ω AC		S PNO: Fast FGain:Low	D Trig: Fre #Atten: 3	e Run 10 dB	AL	IGNAUTO Avg Type:	Log-Pwr		8 AM Jan 08, 201 RACE 1 2 3 4 5 TYPE M WAMAAA DET P P P P F
dB/div	Ref Offset Ref 10.1								N	lkr1 2.401	970 GH 0.06 dBr
40											•
36											
.9											-19.94 di
.9											
.9											∆ 3
9 Junio	how make more thank	nd yter up bed	www.www.water	monthillement	-	mont	helpentra	manhantal		and the second second	Walter W
.9											
1.9											
	0000 GHz 100 kHz			#VE	SW 300 KH	z			Swee	Stop 2 p 9.867 m	.40300 GH s (1001 pt
R MODE T		×		Ÿ		UNCTION	FUNCT	ION WIDTH		FUNCTION VALUE	
N 1 N 1 N 1	f	2.3	01 970 GHz 90 022 GHz 99 189 GHz	-61.154							
1											
								STATUS			

78 CH





For Hopping Band edge

00 CH

	Analyzer - Swept RF 50 Ω							00:45:07	
	<u> 2.351500</u>		PNO: Fast FGain:Low	NSE:PULSE Trig: Free #Atten: 30	Run	LIGNAUTO Avg Type:	Log-Pwr	TF	5 AM Jan 08, 20: RACE 1 2 3 4 5 TYPE MWWW DET P P P P P
	ef Offset 0.5 d ef 9.24 dBr						M	kr1 2.402 -0.	897 GH 755 dBi
76									
.8									-20.75 d
8									
8									
8 ANTINAN	የትስ _{ለሰ} ታት ከስ	հի ուլ. Դիրաներ	uhi Jhamile , a	Marthe Landaha	A 610			2	
8 			L 20.0101 - Mrofin		and the state of the	ada suratification	, (and the second	and the second
.8									
art 2.30000 es BW 100			#VB	W 300 kHz			Swee	Stop 2. 9.867 ms	40300 GH ; (1001 pt
MODE TRC S		× 2,402 897 GHz	-0.755		CTION FUNC	CTION WIDTH	li	UNCTION VALUE	
N 1 1 N 1 1		2.390 022 GHz 2.399 910 GHz							

78 CH



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

RF 50	IQ AC	SENSE:PU	LSE	ALIGNAUTO		09:00:4	2 AM Jan
req 30.0000			g: Free Run	Avg Type:	Log-Pwr		TYPE M
			ten: 30 dB				DET
Ref Offset	0.5 -10					Mkr1 2.4	02 2
iv Ref 5.00						-5	.311
1							
<mark>0</mark> 2	.3					a standica	
- statement	3	and the second second second	and the stand	Constant of the local division of the local			
0 MHz						Stor	o 25.0
3W 100 kHz		#VBW 30	0 kHz		Sw	eep 2.387 s	
E TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	<u>`</u>
1 f	2.402 2 GHz	-5.311 dBm					
1 f 1 f	2.532 0 GHz 5.630 1 GHz	-54.407 dBm -59.757 dBm					
1 f	24.596 7 GHz	-49.891 dBm					
				STATUS			
			9 CH				

00 CH

39	CH
00	OIT

RL		RF		AC	SEN	SE:PULSE	AL	.IGN AUTO			37 AM Jan 08, 20
ento	er Fı	req 1	2.51500		NO: Fast 😱 Gain:Low	Trig: Free Run #Atten: 30 dB		Avg Type:	: Log-Pwr		TYPE MWWWW DET P P P P
dBi	/div		Offset 0.5 10.12 dl							Mkr1 2.4 0	140 9 GH .116 dB
g 20		(1								
38 -											
9											-19.88 (
9 -											
9			<u>∧</u> 2	<u>3</u>							\downarrow
9 - 9 -			Lange La	3	e la la compañía de l		and the second second	and Plan			
9 –											
9											
	30 N BW	/IHz 100	kHz		#VBV	V 300 kHz			Swe	Stoj ep 2.387 s	p 25.00 G (40001 p
	DDE TF			X	Y	FUNCTION	FUNC	TION WIDTH		FUNCTION VALUE	
Ì		f		2.440 9 GHz 2.596 9 GHz 5.793 7 GHz 24.245 9 GHz	0.116 c -52.502 c -56.113 c -46.539 c	lBm IBm					
											>

П



78 CH

		- Swept SA									
RL		50 Q AC	0 GHz	9	ENSE:PULSE		ALI	GNAUTO Avg Type	: Log-Pwr	09:0	5:59 AM Jan 08, 20 TRACE 1 2 3 4
	164 12.5	1500000	F	NO: Fast 🔾	☐ Trig: Fr #Atten:						DET P P P P
			IF	Gain:Low	#Atten:	30 aB					,
	Ref Offs										.480 2 GF -0.017 dB
dB/div	Ref 9.9	8 aBm									0.017 00
2	<u>Y</u> ·_										
·											
						_					-20.02
				-							
, <u> </u>	<mark>\2</mark>			3						and the second	
	<u> </u>	and the second second	hall a star and a	a a dia mandri a dia		Arrest	ألوارية				
1				The distance of the second							
rt 30 N	VIHZ 100 kHz			43.7	3W 300 k	U -			C 11		op 25.00 GI s (40001 p
									51	· ·	<u> </u>
MODE TE	RC SCL	× 2	480 2 GHz	-0.01	7 dBm	FUNCTION	FUNCT	ION WIDTH		FUNCTION VALU	JE
N 1	f	2.	635 6 GHz	-54.64	1 dBm						
			440 5 GHz 789 0 GHz	-54.18	3 dBm 2 dBm						
N 1 N 1	T	24.									
	T	24.									
	Т	24.									
		24.									
		24.									
		24.									



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1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China Tel: + 86-755 3688 6288 Fax:+ 86-755 3688 6277 Http://www.stsapp.com E-mail: sts@stsapp.com



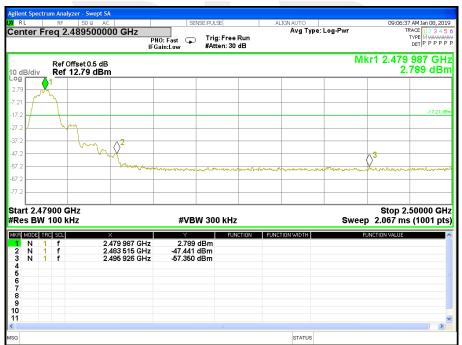
Page 34 of 66 Report No.: STS1812290W02

For Band edge

00 CH

RL	um Analyzer -							
			PNO: Fast	Trig: Free Run	ALIGNAUTO Avg Typ	e: Log-Pwr	09:01:21 AM Ja TRACE	23.
B/div	Ref Offset Ref 6.84	0.5 dB	-Gain:Low	#Atten: 30 dB		М	kr1 2.401 97(-3.162	0 G
	Rei 0.04							
								-23.1
<u> </u>								
								- /
	manulan	- stopp Mar Man Marson Mar and	Annonemp	-	munhenenenene	Marganstrandynamik	manner recorder to portion	ww
	000 GHz 100 kHz		#VBI	W 300 kHz		Swee	Stop 2.403 p 9.867 ms (10	
MODE TR		× 2.401 970 GHz	-3.162	FUNCTION	FUNCTION WIDTH	f	FUNCTION VALUE	
N 1	f	2.390 022 GHz 2.399 910 GHz	-59.886 -54.838	dBm				
N 1								
N 1								
N 1								
N 1								

78 CH



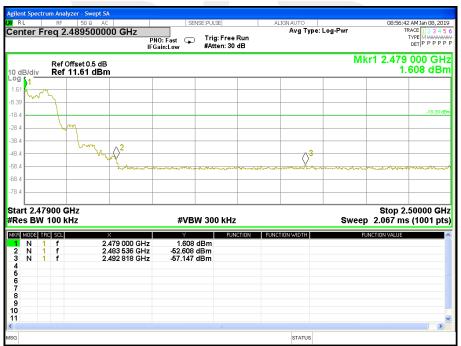


For Hopping Band edge

00 CH

nt Spectrum Analyze	50 Ω AC	SENS	E:PULSE	ALIGNAUTO		08:54:21	AM Jan 08, 20
iter Freq 2.3	51500000 GHz	PNO: Fast 😱 FGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type:	Log-Pwr	TR	ACE 1 2 3 4 YPE MWAAA DET P P P P
	set 0.5 dB 99 dBm				М	kr1 2.403 -3.0	000 GI 014 dB
							-23.01
							-20.01
andan n hav	MMMM						-
CARACTER AND A	MAN UUU UNIY VUY have a	Anger and the second	mul anning	د	and a state of source of a state	h la parte an and a second	40400 Barlon
rt 2.30000 GH s BW 100 kH		#VBW	300 kHz		Swee	-Stop 2.4 p 9.867 ms	
MODE TRC SCL N 1 f N 1 f N 1 f	× 2.403 000 GHz 2.390 022 GHz 2.398 880 GHz	-60.767 d	Bm	FUNCTION WIDTH		FUNCTION VALUE	

78 CH



П



Page 36 of 66 Report No.: STS1812290W02

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

13 AM Jan 08, 2019 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P P P P P Center Freq 12.515000000 GHz Avg Type: Log-Pwr PNO: Fast 🖵 IFGain:Low Trig: Free Run #Atten: 30 dB Mkr1 2.402 2 GHz -3.307 dBm Ref Offset 0.5 dB Ref 6.69 dBm 10 dB/div 23.3 -33.: ()4 43.3 \bigcirc^2 ()³ 63.3 83 -Stop 25.00 GHz Sweep 2.387 s (40001 pts) Start 30 MHz #Res BW 100 kHz #VBW 300 kHz MKR MODE TRC SCL FUNCTION VALUE T FUNCTION FUNCTION WIDTH -3.307 dBm -56.421 dBm -56.685 dBm -47.680 dBm 2.402 2 GHz 3.035 8 GHz 5.917 3 GHz 24.200 3 GHz 1 2 3 4 5 6 7 8 9 10 11 N N N f f f 1 STATUS

00 CH

39 CH

RL	r <mark>um Analyze</mark> RF	50 Q AC	SENSE:PUL	9E	ALIGNAUTO		09:12:39 AM Jan 08, 20
enter F		515000000 GHz	PNO East Tri	g: Free Run ten: 30 dB	Avg Type:	Log-Pwr	TRACE 1 2 3 4 TYPE MWAAA DET P P P P
) dB/div		et 0.5 dB)2 dBm				N	lkr1 2.440 9 GI -4.979 dB
.98	<u>1</u>						
i.o							-24.98
5.0 							
.0	<u>2</u>		3				
0				and the second		Anna All Maria	
0							
0							
art 30 ľ es BW	VIHz 100 kHz	:	#VBW 30	0 kHz		Sweep	Stop 25.00 G 2.387 s (40001 p
N N N	f	× 2.440 9 GHz 2.570 7 GHz	-56.141 dBm	FUNCTION	FUNCTION WIDTH	FUN	ICTION VALUE
	f f	7.323 1 GHz 24.380 7 GHz					
N ·)



78 CH

ent Spectrum Analyzer - Swept RL RF 50 Q		SENSE:PULSE	ALIGNAUTO	09:15:06 AM Jan 08, 2
nter Freq 12.51500		Trig: Free Run	Avg Type: Log	
Ref Offset 0.5 d				Mkr1 2.479 6 G 1.285 dE
9				
7				-18.71
7				
7	3			
7				
7				
rt 30 MHz es BW 100 kHz		#VBW 300 kHz		Stop 25.00 G Sweep 2.387 s (40001 p
MODE TRC SCL N 1 f N 1 f N 1 f N 1 f	2.636 2 GHz -5 4.959 7 GHz -5	Y FUNCTIO 1.285 dBm 5.600 dBm 3.600 dBm 5.681 dBm 5.831 dBm 5.831 dBm	N FUNCTION WIDTH	FUNCTION VALUE



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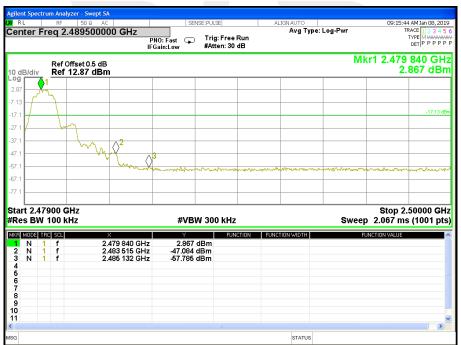
Page 38 of 66 Report No.: STS1812290W02

For Band edge

00 CH

	rum Analyzer -							
RL		50 Ω AC	SE	NSE:PULSE	ALIGNAUTO Avg Type:	Log-Pwr		AM Jan 08, 20 ACE 1 2 3 4 !
	109 2.00		PNO: Fast 🖵	Trig: Free Run #Atten: 30 dB	0 //	•	T	VPE M WAAAAAA DET P P P P I
			-Galil.LOW	Witten: 00 ab		MI	kr1 2.402	176 CH
dB/div	Ref Offse Ref 6.89							115 dB
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11								
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L1								-23.12 d
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8.1							\wedge^2	<u>)</u>
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3.1								
8.1								
							O t 0.4	
	0000 GHz		#VB	W 300 kHz		Sweer	stop 2.4 p 9.867 ms	0300 GH
R MODE T		×	<i></i>	FUNCTION	FUNCTION WIDTH	-	UNCTION VALUE	(1001 pt
1 N 1	1 f	2.402 176 GHz	-3.115	dBm	TORCHOR WIDTH			
	1 f 1 f	2.390 022 GHz 2.399 910 GHz						
1								
5								
7 3								
3								
								>

78 CH



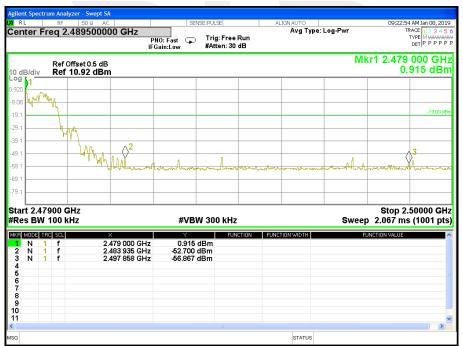


For Hopping Band edge

00 CH

R L	rum Analyzer - RF 5	50 Ω AC		ENSE:PULSE	01	IGNAUTO		09:20:32	AM Jan 08, 201
		1500000 GHz	PNO: Fast IFGain:Low		ın	Avg Type:	Log-Pwr	TRA T	ACE 1 2 3 4 5 YPE M WWWWW DET P P P P P
dB/div	Ref Offse Ref 7.03						M	kr1 2.403 (-2.9	000 GH 073 dBr
97									
.0									
.0									-22.97 d
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.0									
	0000 GHz 100 kHz		#VE	300 kHz			Swee	Stop 2.4 p 9.867 ms	0300 GH (1001 pts
R MODE T		× 2.403 000 G	Y SHz -2.973	FUNCT	ON FUNCT	ION WIDTH	ŀ	UNCTION VALUE	
N N	1 f 1 f	2.390 022 0 2.399 910 0							
									>

78 CH



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5. NUMBER OF HOPPING CHANNEL

5.1 LIMIT

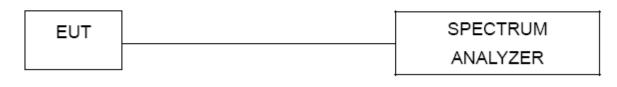
FCC Part 15.247,Subpart C						
Section	Test Item	Limit	FrequencyRange (MHz)	Result		
15.247 (a)(1)(iii)	Number of Hopping Channel	≥15	2400-2483.5	PASS		

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating FrequencyRange
RB	1MHz
VB	1MHz
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= 1MHz, VBW=1MHz, Sweep time = Auto.

5.3 TEST SETUP



5.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.



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

ilent Spectrum Analyz R L RF	50 Q AC	SENSE:PULSE	ALIGNAUTO	08 e: Log-Pwr	:43:13 AM Jan 08, 201 TRACE 1 2 3 4 5
art Freq 2.400	PN	IO: Fast 😱 Trig: Fre ain:Low #Atten: 3	e Run	2. Log-r wi	TYPE MWWWW DET P P P P
dB/div Ref 13	set 0.5 dB 3.67 dBm			Mkr2 2.48	0 160 0 GH 2.46 dBi
67 0 ¹					2
33					
6.3					
i.3					
i.3					
1.3					
5.3					
i.3					
i.3					
art 2.40000 GH	-			Ota	- 0 40050 OL
art 2.40000 GH Res BW 1.0 MH		#VBW 1.0 MH	z	Sweep 1.000	p 2.48350 GH ms (1001 pt
R MODE TRC SCL	×		INCTION FUNCTION WIDTH	FUNCTION VAL	LUE
1 N 1 f 2 N 1 f	2.402 171 0 GHz 2.480 160 0 GHz	-1.08 dBm 2.46 dBm			
3	2	2			
4 5					
5 7					
3					

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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). 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 $5.06 \times 31.6 = 160$ 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 $10.12 \times 31.6 = 320$ within 31.6 seconds.

6.3 TEST SETUP



6.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.



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	0.414	0.132	0.4
DH3	middle	1.671	0.267	0.4
DH5	middle	2.920	0.311	0.4



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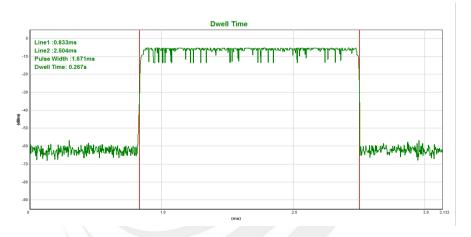
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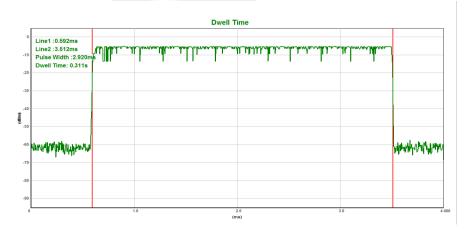
CH39-DH1

Line1 :0.421ms Line2 :0.835ms Pulse Width :0.414ms	<u></u>		
Dwell Time: 0.132s			
hte he was a second and the production of the second second		Man MANNA MAN	WANYMAAN
		1 1 11.4	4 v. t. 10 ft

CH39-DH3



CH39-DH5



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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	0.421	0.135	0.4
2DH3	middle	1.677	0.268	0.4
2DH5	middle	2.924	0.312	0.4



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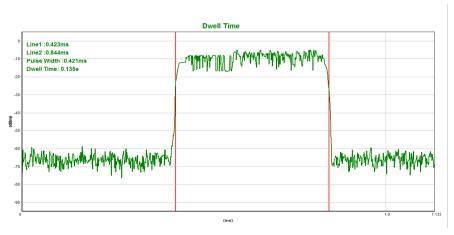
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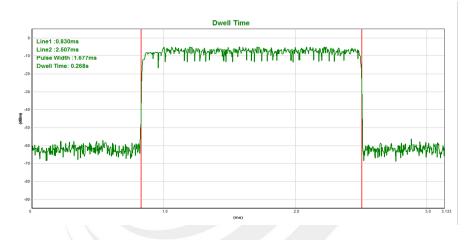


Report No.: STS1812290W02

CH39-2DH1



CH39-2DH3



CH39-2DH5





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

Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
3DH1	middle	0.420	0.134	0.4
3DH3	middle	1.673	0.268	0.4
3DH5	middle	2.928	0.312	0.4



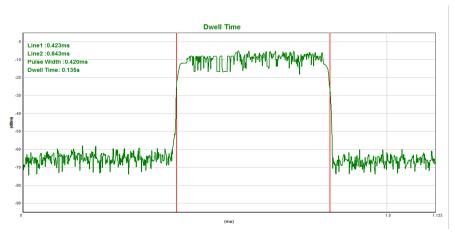
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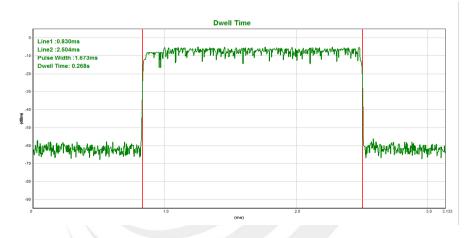
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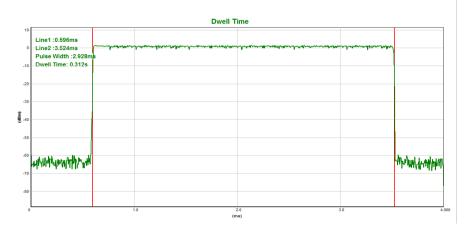
CH39-3DH1



CH39-3DH3







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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



Spectrum Analayzer

EUT

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	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	0.999	0.920	Complies
2441 MHz	0.999	0.904	Complies
2480 MHz	1.000	0.921	Complies

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

RL RF	50 Ω AC	SENSE:PULSE	ALIGNAUTO	08:28:53 AM Jan 08, 201
enter Freq 2.40	PNO:	Wide Trig: Free Run n:Low #Atten: 30 dB	Avg Type: Log-Pwr	TRACE 1 2 3 4 5 TYPE M MAAAAA DET P P P P F
dB/div Ref 8.9	et 0.5 dB 15 dBm			Mkr2 2.402 983 GH -0.140 dBi
anter 2.402500 C Res BW 30 kHz	GHz	#VBW 100 kHz		Span 3.000 MH eep 3.200 ms (1001 pt eunction value
	2.401 994 GHz 2.402 983 GHz	-1.04 dBm -0.14 dBm		
,) 				

CH00 -1Mbps

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CH39 -1Mbps



CH78 -1Mbps



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

Frequency	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	0.999	0.799	Complies
2441 MHz	1.002	0.812	Complies
2480 MHz	1.002	0.813	Complies

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

		IΩ AC		SE	NSE:PULSE	A	LIGNAUTO		09:01:57	
er Fr	eq 2.402	500000 G	PNO	: Wide 🖵 in:Low	Trig: Free F #Atten: 30 (Avg Type:	Log-Pwr	т	ACE 1 2 YPE MWA DET P P
8/div	Ref Offset Ref 6.22							Mk	r2 2.402 -2.2	983 (204 c
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or 7 /	102500 GH	17							Span	3 000
	30 kHz	12		#VB	W 100 kHz			Sweep	3.200 ms	(1001
IODE TR		×		Y		TION FUNC	TION WIDTH	FL	NCTION VALUE	
N 1 N 1		2.401 9		-3.71 -2.20						
										)

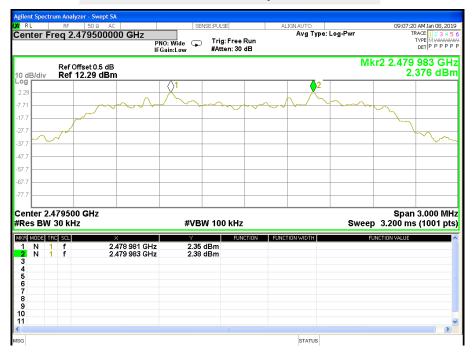
## CH00 -2Mbps



#### CH39 -2Mbps

	SENSE:PU	LSE	ALIGNAUTO	09:04:16 AM J
r Freq 2.441500000 GHz		ig: Free Run tten: 30 dB	Avg Type: Log-Pwr	TRACE TYPE DET
Ref Offset 0.5 dB iv Ref 10.82 dBm				Mkr2 2.441 98 0.914
	()1		2	
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		m		m
				- hy
				· · · · · · · · · · · · · · · · · · ·
2.441500 GHz				Span 3.0
	#VBW 10	00 kHz	S	weep 3.200 ms (10
SW 30 kHz		FUNCTION FUN	NCTION WIDTH	FUNCTION VALUE
E TRC SCL X	Y			
E TRC SCL X 1 f 2.440 981 G	Hz 0.83 dBm			
1 f 2.440 981 G	Hz 0.83 dBm			
E TRC SCL X 1 f 2.440 981 G	Hz 0.83 dBm			
E TRC SCL X 1 f 2.440 981 G	Hz 0.83 dBm			
E TRC SCL X 1 f 2.440 981 G	Hz 0.83 dBm			
E TRC SCL X 1 f 2.440 981 G	Hz 0.83 dBm			
E TRC SCL X 1 f 2.440 981 G	Hz 0.83 dBm			

#### CH78 -2Mbps



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

Frequency	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	0.999	0.803	Complies
2441 MHz	0.999	0.803	Complies
2480 MHz	1.002	0.805	Complies

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

		er - Swept SA								
RL	RF	50 Ω AC		SE	NSE:PULSE		ALIGNAUTO Avg Type	Log-Pwr		5 AM Jan 08, 20 RACE 1 2 3 4
	eq 2.4	0230000	Р	NO: Wide 😱 Gain:Low	Trig: Free F #Atten: 30 d	Run 18				DET P P P P
) dB/div		set 0.5 dB 30 <b>dB</b> m						М	kr2 2.402 -2.	983 GI 202 dB
^{pg}				<⟩1			2			
.70			$\sim$	$\sim$	~	0.000	$\sim$	~~~		
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3.7										1~
3.7	$\sim$									~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
3.7										
1.7										
.7										
3.7										
enter 2.4 Res BW		GHz		#VB	W 100 kHz			Swee	Spar p 3.200 m	1 3.000 M s (1001 p
R MODE TH		×		Y	FUNC	TION FUN	CTION WIDTH	F	UNCTION VALUE	
1 N 1 2 N 1	f		01 984 GHz 02 983 GHz	-3.70 -2.20						
3										
5										
5 7										
3										
D										
1										>
3							STATUS			

CH00 -3Mbps



#### CH39 -3Mbps

RF	50 Ω AC		ENSE:PULSE	ALIGN AUTO	(	19:13:17 AM Jan
Freq 2.44	1500000 GHz	: PNO: Wide IFGain:Low	⊃ Trig: Free Run #Atten: 30 dB	Avg Type: L	og-Pwr	TRACE 1 TYPE M DET P
	et 0.5 dB .83 dBm				Mkr2 2.	441 983 0.887
		()1		2		
		$\sim$			$\wedge$	
	m			~~	m	
					~	$\sim$
-A						$\sim$
~~~~						$\sim$
2.441500 (GH7					Span 3.00
W 30 kHz	0112	#VE	3W 100 kHz		Sweep 3.20	
TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH	FUNCTION	ALUE
1 f	2.440 984		3 dBm			
1 f	2.441 983	GHz 0.8	9 dBm			

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	(20dB bandwidth)	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

EUT	SPECTRUM
	ANALYZER

8.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.



8.5 TEST RESULTS

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

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	0.920	PASS
2441 MHz	0.904	PASS
2480 MHz	0.921	PASS

CH00 -1Mbps



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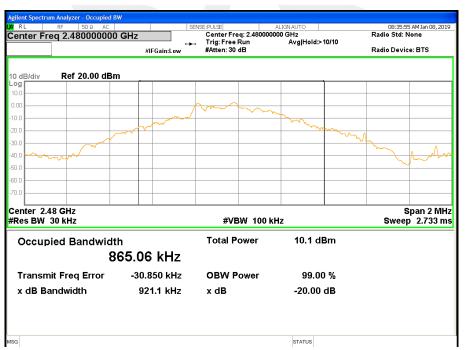
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CH39 -1Mbps



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	1.198	PASS
2441 MHz	1.218	PASS
2480 MHz	1.220	PASS

CH00 -2Mbps

	m Analyzer - Occupied B				
Center Fr	RF 50 Ω AC eq 2.402000000		NSE:PULSE Center Freq: 2.402000		08:58:24 AM Jan 08, 2019 Radio Std: None
]	#IEGain:Low	Trig: Free Run #Atten: 30 dB	Avg Hold:>10/10	Radio Device: BTS
		HI Gam.Low			
10 dB/div	Ref 20.00 dBm	n			
Log 10.0					
0.00					
-10.0					
-20.0		\sim		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
-30.0					
-40.0					
-50.0	~~~				
-60.0					
-70.0					
Center 2.4					Span 2 MHz
#Res BW			#VBW 100 k	Hz	Sweep 2.733 ms
Occup	ied Bandwidt		Total Power	3.32 dBm	
		 1555 MHz			
Transm	nit Freq Error	-21.362 kHz	OBW Power	99.00 %	
x dB Ba	andwidth	1.198 MHz	x dB	-20.00 dB	
MSG				STATUS	

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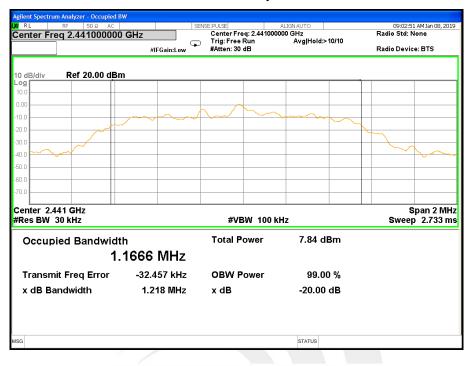
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CH39 -2Mbps



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	1.204	PASS
2441 MHz	1.205	PASS
2480 MHz	1.208	PASS

CH00 -3Mbps

RL RF 50 Ω AC		INSE:PULSE	ALIGNAUTO	09:08:27 AM Jan 08, 201
enter Freq 2.40200000	GHz	Center Freq: 2.402000	000 GHz	Radio Std: None
	#IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Hold:>10/10	Radio Device: BTS
dB/div Ref 20.00 dBm				
g				
0				
	~~~~		man 1	
in manual l				- m
)				
nter 2.402 GHz				0
es BW 30 kHz		#VBW 100 k	Hz	Span 2 MH Sweep   2.733 m
Occupied Bandwidtl	า	Total Power	3.63 dBm	
1.1	1432 MHz			
Fransmit Freq Error	-7.309 kHz	OBW Power	99.00 %	
k dB Bandwidth	1.204 MHz	x dB	-20.00 dB	
			STATUS	

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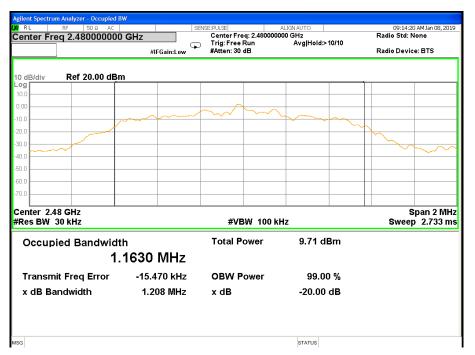
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#### CH39 -3Mbps



CH78 -3Mbps



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# 9. OUTPUT POWER TEST

# 9.1 LIMIT

FCC Part 15.247,Subpart C					
Section	Test Item	Limit	FrequencyRange (MHz)	Result	
15 247	Outout	1 W or 0.125W			
15.247 Output (a)(1)&(b)(1) 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

a. The EUT was directly connected to the Power Sensor&PC

#### 9.3 TEST SETUP

EUT	Power sensor		PC
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# 9.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.



9.5 TEST RESULTS

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

Mode Channel Number		Frequency	Frequency	Peak Power	Average Power	Limit
	(MHz) (dBm)	(dBm)	(dBm)	(dBm)		
	0	2402	2.72	-4.22	30.00	
GFSK	39	2441	4.46	-2.36	30.00	
	78	2480	5.33	-1.28	30.00	

Note: the channel separation >20dB bandwidth

	Channel Frequency		Peak Power	Average Power	Limit
	Number	(MHz)	(dBm)	(dBm)	(dBm)
π/4-DQPSK	0	2402	2.18	-4.86	20.97
	39	2441	3.16	-3.97	20.97
	78	2480	4.45	-2.41	20.97

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

Mode Channel Number		Frequency	Peak Power	Average Power	Limit
	(MHz) (dBm)	(dBm)	(dBm)	(dBm)	
	0	2402	2.44	-4.55	20.97
8-DPSK	39	2441	3.46	-3.40	20.97
	78	2480	4.59	-2.36	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 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.

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