

# **RADIO TEST REPORT**

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# Report No:STS1811083W01

Issued for

Acuity Brands Lighting, Inc.

One Lithonia Way, Conyers, GA 30012, USA

Product Name:	4' Bluetooth Speaker Work Light		
Brand Name:	Lithonia Lighting		
Model Name:	SPSL 42IN 40K 80CRI BL		
Series Model:	SPSL 42IN 30K 80CRI BL, SPSL 42IN 50K 80CRI BL, SPSL 42IN 30K 90CRI BL, SPSL 42IN 40K 90CRI BL, SPSL 42IN 50K 90CRI BL		
FCC ID:	2ADCBSPSL42INB		
IC:	6715C-SPSL42INB		
Test Standard:-	FCC Part 15.247		
Test Standard.	RSS-247 Issue 2, February 2017		

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# **TEST RESULT CERTIFICATION**

Applicant'sname:	Acuity Brands Lighting, Inc.
Address	One Lithonia Way, Conyers, GA 30012,USA
Manufacture's Name:	Suzhou Powerhouse Co., Ltd
Address	No. 168 Yanshan West Rd, Town of Chengxiang, Taicang, Jiangsu Province, China
Product description	
Product Name:	4' Bluetooth Speaker Work Light
Brand Name:	Lithonia Lighting
Model Name:	SPSL 42IN 40K 80CRI BL
Series Model	SPSL 42IN 30K 80CRI BL, SPSL 42IN 50K 80CRI BL, SPSL 42IN 30K 90CRI BL, SPSL 42IN 40K 90CRI BL, SPSL 42IN 50K 90CRI BL
Test Standards	FCC Part15.247
	RSS-247 Issue 2, February 2017
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&IC 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 .: 14 Nov. 2018 ~16 Nov. 2018

Date of Issue ..... 20 Nov. 2018

Test Result ..... Pass

Testing Engineer : Technical Manager : Authorized Signatory : (Vita Li)

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#### **Revision History**

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	20 Nov. 2018	STS1811083W01	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 RSS-247 Issue 2				
Standard Section	Test Item	Judgment	Remark	
15.207 RSS-Gen Issue 5 April 2018	Conducted Emission	PASS		
15.247(a)(1) RSS-247 Issue 2, February 2017 (5.1)	Hopping Channel Separation	PASS		
15.247(a)(1)&(b)(1) RSS-247 Issue 2, February 2017 (5.1)	Output Power	PASS		
15.247(c) RSS-247 Issue 2, February 2017 (5.5)	Radiated Spurious Emission	PASS		
15.247(d) RSS-247 Issue 2, February 2017 (5.5)	Conducted Spurious & Band Edge Emission	PASS		
15.247(a)(iii) RSS-247 Issue 2, February 2017 (5.1)	Number of Hopping Frequency	PASS		
15.247(a)(iii) RSS-247 Issue 2, February 2017 (5.1)	Dwell Time	PASS		
15.247(a)(1) RSS-247 Issue 2, February 2017 (5.1)	Bandwidth	PASS		
15.205	Restricted Band Edge Emission	PASS		
Part 15.247(d)/part 15.209(a) RSS-247 Issue 2, February 2017 (5.5)	Band Edge Emission	PASS		
15.203 RSS-Gen Issue 5 April 2018	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** %.

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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

Shenzhen STS Test Services Co., Ltd.



# 2. GENERAL INFORMATION

# 2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	4' Bluetooth Speaker Work Light	
Trade Name	Lithonia Lighting	
Model Name	SPSL 42IN 40K 80CRI BL	
Series Model	SPSL 42IN 30K 80CRI BL, SPSL 42IN 50K 80CRI BL, SPSL 42IN 30K 90CRI BL, SPSL 42IN 40K 90CRI BL, SPSL 42IN 50K 90CRI BL	
Model Difference	30K,40K,50K is stand for color temperature; 80CRI, 90CRI is stand for Color Rendering Index	
Channel List	Please refer to the Note 2.	
Bluetooth	Frequency:2402 – 2480 MHz Modulation: GFSK(1Mbps), π/4-DQPSK(2Mbps)	
Adapter Power supply and ADP(rating): Input: AC 120V, 60Hz, 150mA Output: DC 5V, 1700mA		
Hardware version number	MLH_AC6925A4_DZBL-001-B2	
Software version number	RRD_8164_RSY6905C_(Lithonia SPSL)_F571_LQH_2018.06.09_NOFM.bin	
Radio Hardware version MPLY.LR9.W1444,MD.LWTG.MP.V79.P4		
Radio Software version	SC6531_W13.04.05_Release	
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.

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2.

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

#### 3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	Lithonia Lighting	SPSL 42IN 40K 80CRI BL	PCB Antenna	N/A	0	BT Antenna



#### 2.2 DESCRIPTION OF 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	100 2 Mbps/π/4-DQPSK	
Mode 5	TX CH39	2 Mbps/π/4-DQPSK	
Mode 6	TX CH78	2 Mbps/π/4-DQPSK	

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

#### For AC Conducted Emission

	Test Case
AC Conducted	Mode 7 : Keeping BT TX
Emission	

#### 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(1/2Mbps)	Power class: 1 M rate:4:27 2 M rate:11:183	Power class: 1 M rate:4:27 2 M rate:11:183	Power class: 1 M rate:4:27 2 M rate:11:183			

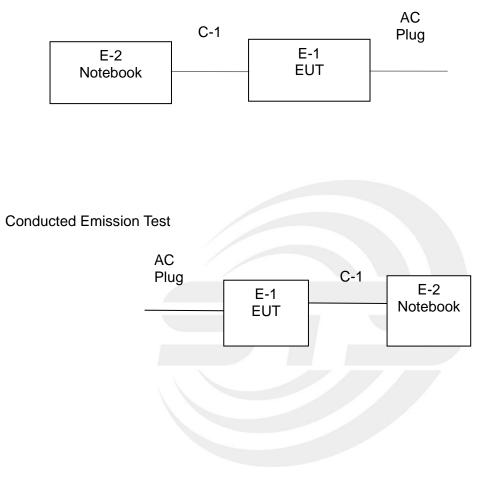


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#### 2.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

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 EmissionTest



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#### 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.

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

#### Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
E-2	Notebook	HP	500-320cx	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 <sup>r</sup>Length<sup>a</sup> column.
- (3) "YES" is means "shielded" "with core"; "NO" is means "unshielded" "without core".



# 2.6 EQUIPMENTS LIST FOR ALL TEST ITEMS

#### 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
Bilog Antenna	TESEQ	CBL6111D	34678	2017.11.02	2020.11.01
Horn Antenna	Schwarzbeck	BBHA 9120D(1201)	9120D-1343	2017.10.27	2020.10.26
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	N/A	2018.03.11	2021.03.10
Temperature & Humitidy	HH660	Mieo	N/A	2018.10.13	2019.10.12
Pre-mplifier (0.1M-3GHz)	EM	EM330	N/A	2018.03.09	2019.03.08
PreAmplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK201808090 1	2018.10.13	2019.10.12
Passive Loop (9K30MHz)	ZHINAN	ZN30900C	16035	2017.03.11	2020.03.10
Low frequency cable	EM	R01	N/A	2018.03.11	2019.03.10
Low frequency cable	EM	R06	N/A	2018.03.11	2019.03.10
High frequency cable	SCHWARZBECK	R04	N/A	2018.03.11	2019.03.10
High frequency cable	SCHWARZBECK	R02	N/A	2018.03.11	2019.03.10
Semi-anechoic chamber	Changling	966	N/A	2018.10.24	2020.10.23
turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A
Max-full Antenna Corp	MF	MFA-440H	N/A	N/A	N/A

## Conduction 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
LISN	R&S	ENV216	101242	2018.10.13	2019.10.12
conduction Cable	EM	C01	N/A	2018.03.11	2019.03.10
Temperature & Humitidy	Mieo	HH660	N/A	2018.10.13	2019.10.12



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#### **RF** Connected Test

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
USB RF power sensor	DARE	RPR3006W	15I00041SNO03	2018.10.13	2019.10.12
MXA Signal analyzer	Agilent	N9020A	MY51110105	2018.03.08	2019.03.07
MXA Signal analyzer	Agilent	N9020A	MY49100060	2018.10.13	2019.10.12



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## 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) and RSS-Gen Issue 5 April 2018 limit in the table below has to be followed.

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

Note:

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

The following table is the setting of the receiver

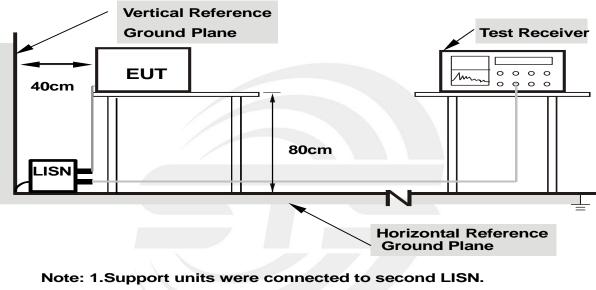
Receiver Parameters	Setting	
Attenuation	10 dB	
Start Frequency	0.15 MHz	
Stop Frequency	30 MHz	
IF Bandwidth	9 kHz	

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# 3.1.2 TEST PROCEDURE

- a. The EUT 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:	<b>25</b> ℃	Relative Humidity:	59%
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 7		

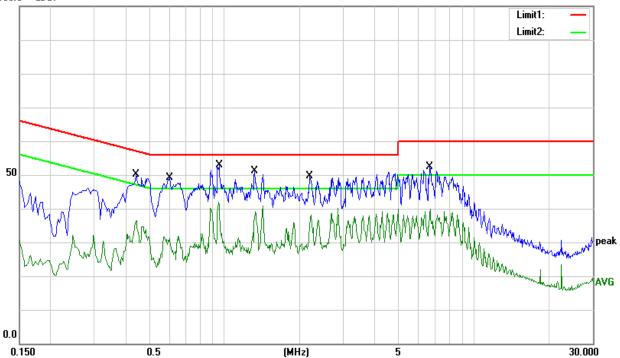
Frequency	Reading	Correct	Result	Limit	Margin	Demeril
(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	Remark
0.4420	29.66	20.49	50.15	57.02	-6.87	QP
0.4420	15.93	20.49	36.42	47.02	-10.60	AVG
0.6020	28.87	20.36	49.23	56.00	-6.77	QP
0.6020	11.45	20.36	31.81	46.00	-14.19	AVG
0.9500	32.79	20.18	52.97	56.00	-3.03	QP
0.9500	21.58	20.18	41.76	46.00	-4.24	AVG
1.3220	31.07	20.12	51.19	56.00	-4.81	QP
1.3220	20.73	20.12	40.85	46.00	-5.15	AVG
2.1980	29.50	20.04	49.54	56.00	-6.46	QP
2.1980	18.58	20.04	38.62	46.00	-7.38	AVG
6.6620	32.55	19.91	52.46	60.00	-7.54	QP
6.6620	19.92	19.91	39.83	50.00	-10.17	AVG

#### Remark:

1. All readings are Quasi-Peak and Average values.

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

100.0 dBu¥



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Temperature:	<b>25</b> ℃	Relative Humidity:	59%
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	Mode 7		

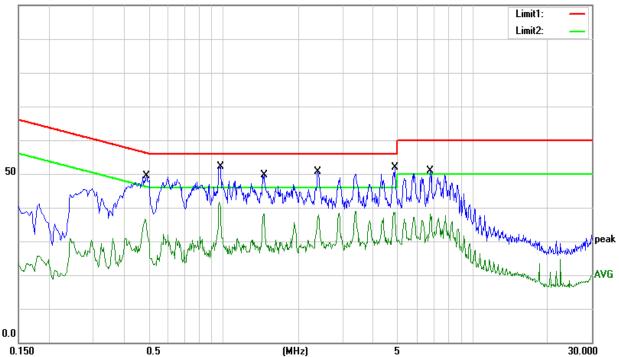
Frequency	Reading	Correct	Result	Limit	Margin	Remark
(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	Remark
0.4900	28.98	20.48	49.46	56.17	-6.71	QP
0.4900	16.12	20.48	36.60	46.17	-9.57	AVG
0.9700	31.96	20.17	52.13	56.00	-3.87	QP
0.9700	21.53	20.17	41.70	46.00	-4.30	AVG
1.4500	29.50	20.11	49.61	56.00	-6.39	QP
1.4500	18.10	20.11	38.21	46.00	-7.79	AVG
2.3860	30.62	20.03	50.65	56.00	-5.35	QP
2.3860	17.96	20.03	37.99	46.00	-8.01	AVG
4.8500	32.03	19.95	51.98	56.00	-4.02	QP
4.8500	18.74	19.95	38.69	46.00	-7.31	AVG
6.7580	30.95	19.91	50.86	60.00	-9.14	QP
6.7580	18.27	19.91	38.18	50.00	-11.82	AVG

#### Remark:

1. All readings are Quasi-Peak and Average values.

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

100.0 dBuV



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# 3.2 RADIATED EMISSION MEASUREMENT

# 3.2.1 RADIATED EMISSION LIMITS

20dBc 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) and RSS-247 Issue 2, February 2017 (5.5) 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).

#### 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

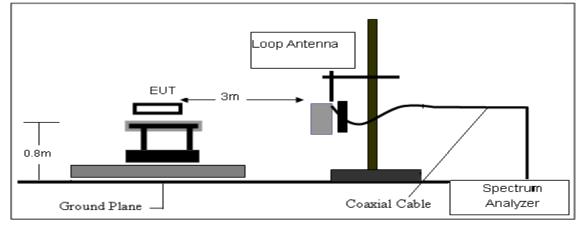
No deviation



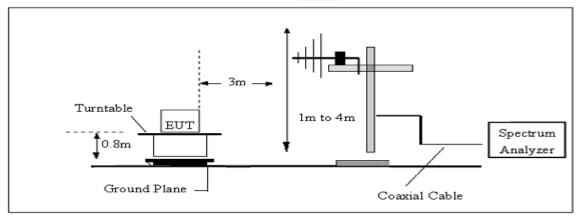


# 3.2.4 TESTSETUP

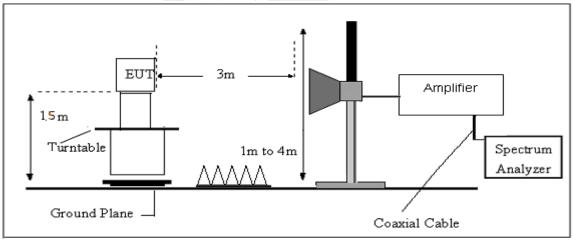
## (A) Radiated Emission Test-Up Frequency Below 30MHz



#### (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:	<b>24.5℃</b>	Relative Humidity:	51%
Test Voltage:	AC 120V/60Hz	Test Mode:	TX Mode

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





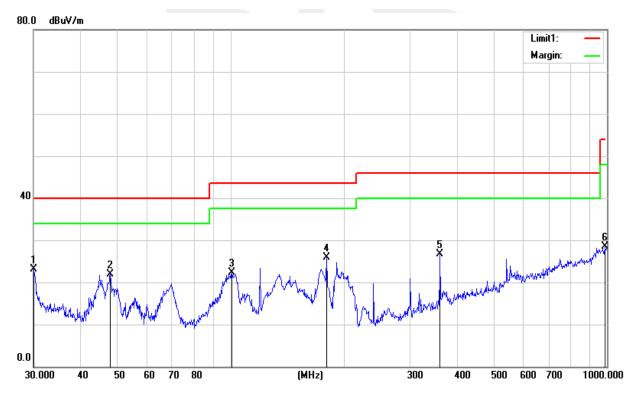
# (30MHz-1000MHz)

Temperature:	<b>24.5</b> ℃	Relative Humidity:	51%		
Test Voltage:	AC 120V/60Hz	Phase:	Horizontal		
Test Mode:	Mode 1/2/3/4/5/6 (Mode 5-2M worst mode)				

Frequency	Reading	Correct	Result	Limit	Margin	Remark
(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
30.1054	34.33	-11.24	23.09	40.00	-16.91	QP
47.9940	42.39	-20.45	21.94	40.00	-18.06	QP
100.9340	41.43	-19.12	22.31	43.50	-21.19	QP
180.0165	45.25	-19.44	25.81	43.50	-17.69	QP
360.4476	39.77	-13.12	26.65	46.00	-19.35	QP
986.0717	28.66	-0.12	28.54	54.00	-25.46	QP

#### Remark:

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



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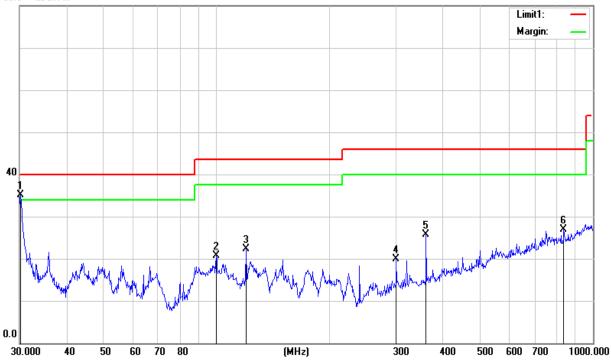
Temperature:	<b>24.5</b> ℃	Relative Humidity:	51%	
Test Voltage:	AC 120V/60Hz	Phase:	Vertical	
Test Mode:	Mode 1/2/3/4/5/6 (Mode 5-2M worst mode)			

Frequency	Reading	Correct	Result	Limit	Margin	Remark
(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
30.2111	46.43	-11.30	35.13	40.00	-4.87	QP
99.8777	39.93	-19.20	20.73	43.50	-22.77	QP
119.8556	40.01	-17.70	22.31	43.50	-21.19	QP
300.3672	34.66	-14.81	19.85	46.00	-26.15	QP
360.4476	38.77	-13.12	25.65	46.00	-20.35	QP
836.2443	29.78	-2.89	26.89	46.00	-19.11	QP

#### Remark:

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







# (1GHz~25GHz) Restricted band and Spurious emission Requirements

# **GFSK Low Channel**

				Antenna	Corrected	Emission				
Frequency	Reading	Amplifier	Loss	Factor	Factor	Level	Limits	Margin	Detector	Comment
(MHz)	(dBµV)	( <b>dB</b> )	( <b>dB</b> )	( <b>dB/m</b> )	( <b>dB</b> )	(dBµV/m)	(dBµV/m)	(dB)	Туре	
				Low	Channel (2402 I	//Hz)				
3264.87	61.32	44.70	6.70	28.20	-9.80	51.52	74.00	-22.48	PK	Vertical
3264.87	50.68	44.70	6.70	28.20	-9.80	40.88	54.00	-13.12	AV	Vertical
3264.77	61.63	44.70	6.70	28.20	-9.80	51.83	74.00	-22.17	PK	Horizontal
3264.77	50.30	44.70	6.70	28.20	-9.80	40.50	54.00	-13.50	AV	Horizontal
4804.36	59.36	44.20	9.04	31.60	-3.56	55.80	74.00	-18.20	PK	Vertical
4804.36	49.51	44.20	9.04	31.60	-3.56	45.95	54.00	-8.05	AV	Vertical
4804.40	58.74	44.20	9.04	31.60	-3.56	55.18	74.00	-18.82	PK	Horizontal
4804.40	50.56	44.20	9.04	31.60	-3.56	47.00	54.00	-7.00	AV	Horizontal
5359.62	49.17	44.20	9.86	32.00	-2.34	46.83	74.00	-27.17	PK	Vertical
5359.62	39.59	44.20	9.86	32.00	-2.34	37.25	54.00	-16.75	AV	Vertical
5359.69	47.66	44.20	9.86	32.00	-2.34	45.32	74.00	-28.68	PK	Horizontal
5359.69	38.43	44.20	9.86	32.00	-2.34	36.09	54.00	-17.91	AV	Horizontal
7205.72	53.64	43.50	11.40	35.50	3.40	57.04	74.00	-16.96	PK	Vertical
7205.72	43.58	43.50	11.40	35.50	3.40	46.98	54.00	-7.02	AV	Vertical
7205.90	53.86	43.50	11.40	35.50	3.40	57.26	74.00	-16.74	PK	Horizontal
7205.90	44.02	43.50	11.40	35.50	3.40	47.42	54.00	-6.58	AV	Horizontal

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# **GFSK Mid Channel**

				Antenna	Corrected	Emission				
Frequency	Reading	Amplifier	Loss	Factor	Factor	Level	Limits	Margin	Detector	
(MHz)	(dBµV)	( <b>dB</b> )	( <b>dB</b> )	( <b>dB/m</b> )	( <b>dB</b> )	(dBµV/m)	(dBµV/m)	(dB)	Туре	Comment
				Mid	Channel (2441 M	ИНz)				
3264.69	61.28	44.70	6.70	28.20	-9.80	51.48	74.00	-22.52	PK	Vertical
3264.69	50.12	44.70	6.70	28.20	-9.80	40.32	54.00	-13.68	AV	Vertical
3264.64	61.23	44.70	6.70	28.20	-9.80	51.43	74.00	-22.57	PK	Horizontal
3264.64	50.74	44.70	6.70	28.20	-9.80	40.94	54.00	-13.06	AV	Horizontal
4882.38	58.45	44.20	9.04	31.60	-3.56	54.89	74.00	-19.11	PK	Vertical
4882.38	50.56	44.20	9.04	31.60	-3.56	47.00	54.00	-7.00	AV	Vertical
4882.32	58.19	44.20	9.04	31.60	-3.56	54.63	74.00	-19.37	PK	Horizontal
4882.32	50.49	44.20	9.04	31.60	-3.56	46.93	54.00	-7.07	AV	Horizontal
5359.64	48.54	44.20	9.86	32.00	-2.34	46.20	74.00	-27.80	PK	Vertical
5359.64	39.56	44.20	9.86	32.00	-2.34	37.22	54.00	-16.78	AV	Vertical
5359.65	47.68	44.20	9.86	32.00	-2.34	45.34	74.00	-28.66	PK	Horizontal
5359.65	38.43	44.20	9.86	32.00	-2.34	36.09	54.00	-17.91	AV	Horizontal
7313.97	54.04	43.50	11.40	35.50	3.40	57.44	74.00	-16.56	PK	Vertical
7313.97	44.02	43.50	11.40	35.50	3.40	47.42	54.00	-6.58	AV	Vertical
7313.67	54.22	43.50	11.40	35.50	3.40	57.62	74.00	-16.38	PK	Horizontal
7313.67	44.37	43.50	11.40	35.50	3.40	47.77	54.00	-6.23	AV	Horizontal

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# **GFSK High Channel**

				Antenna	Corrected	Emission				
Frequency	Reading	Amplifier	Loss	Factor	Factor	Level	Limits	Margin	Detector	
(MHz)	(dBµV)	(dB)	( <b>dB</b> )	( <b>dB/m</b> )	( <b>dB</b> )	(dBµV/m)	(dBµV/m)	(dB)	Туре	Comment
				High	Channel (2480	MHz)				
3264.76	61.46	44.70	6.70	28.20	-9.80	51.66	74.00	-22.34	PK	Vertical
3264.76	50.74	44.70	6.70	28.20	-9.80	40.94	54.00	-13.06	AV	Vertical
3264.64	61.43	44.70	6.70	28.20	-9.80	51.63	74.00	-22.37	PK	Horizontal
3264.64	51.27	44.70	6.70	28.20	-9.80	41.47	54.00	-12.53	AV	Horizontal
4960.54	58.94	44.20	9.04	31.60	-3.56	55.38	74.00	-18.62	PK	Vertical
4960.54	50.28	44.20	9.04	31.60	-3.56	46.72	54.00	-7.28	AV	Vertical
4960.56	59.08	44.20	9.04	31.60	-3.56	55.52	74.00	-18.48	PK	Horizontal
4960.56	49.54	44.20	9.04	31.60	-3.56	45.98	54.00	-8.02	AV	Horizontal
5359.77	48.75	44.20	9.86	32.00	-2.34	46.41	74.00	-27.59	PK	Vertical
5359.77	40.15	44.20	9.86	32.00	-2.34	37.81	54.00	-16.19	AV	Vertical
5359.63	48.37	44.20	9.86	32.00	-2.34	46.03	74.00	-27.97	PK	Horizontal
5359.63	39.23	44.20	9.86	32.00	-2.34	36.89	54.00	-17.11	AV	Horizontal
7439.94	54.87	43.50	11.40	35.50	3.40	58.27	74.00	-15.73	PK	Vertical
7439.94	44.04	43.50	11.40	35.50	3.40	47.44	54.00	-6.56	AV	Vertical
7439.83	53.55	43.50	11.40	35.50	3.40	56.95	74.00	-17.05	PK	Horizontal
7439.83	44.92	43.50	11.40	35.50	3.40	48.32	54.00	-5.68	AV	Horizontal

Note:

3)

- 1) Scan with GFSK,  $\pi$ /4-DQPSK, 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.

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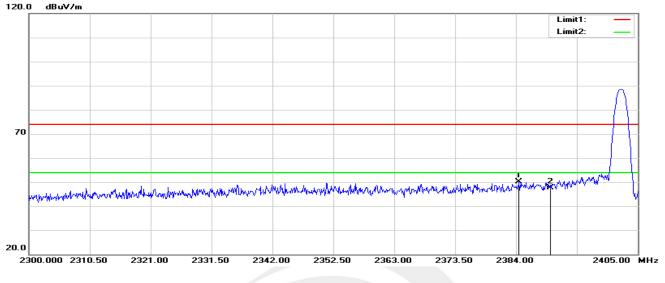
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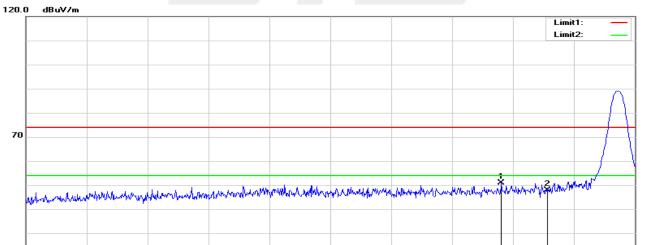
# Band edge Requirements

#### **GFSK-Low** Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2384.525	60.58	-10.51	50.07	74.00	-23.93	peak
2	2390.000	58.05	-10.48	47.57	74.00	-26.43	peak

Vertical



20.0

2300.000 2310.50 2321.00 2331.50 2342.00

2352.50 2363.00

2373.50

2384.00

2405.00 MHz

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2382.005	61.78	-10.81	50.97	74.00	-23.03	peak
2	2390.000	58.71	-10.75	47.96	74.00	-26.04	peak

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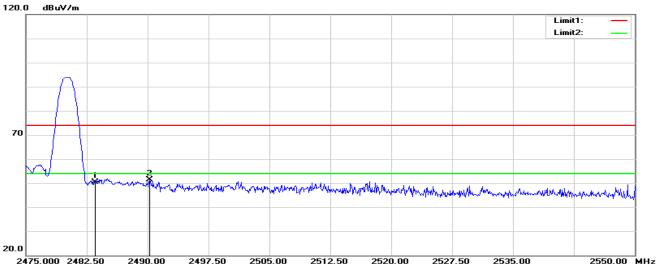
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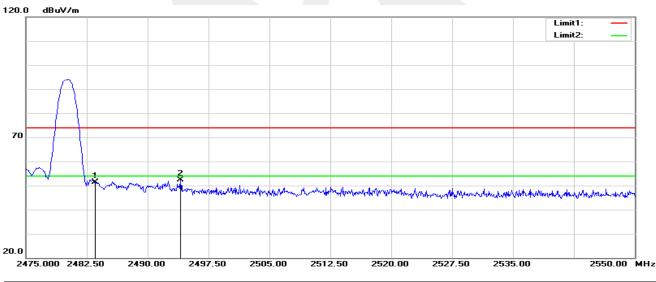
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## GFSK-High Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	60.33	-9.99	50.34	74.00	-23.66	peak
2	2490.225	61.26	-9.96	51.30	74.00	-22.70	peak

Vertical



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	61.32	-9.99	51.33	74.00	-22.67	peak
2	2494.050	62.24	-9.94	52.30	74.00	-21.70	peak

Note: GFSK,  $\pi/4$ -DQPSK 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 REQUIREMENT

According to FCC section 15.247(d) and RSS-247 Issue 2, February 2017 (5.5), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

#### 4.2 TEST PROCEDURE

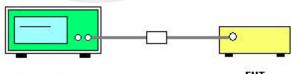
Spectrum Parameter	Setting
Detector	Peak
Start/Stop Frequency	30 MHz to 10th carrier harmonic
RB / VB (emission in restricted band)	100 KHz/300 KHz
Trace-Mode:	Max hold

For Band edge

Spectrum Parameter	Setting
Detector	Peak
Start/Stap Fraguanay	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

EUT

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

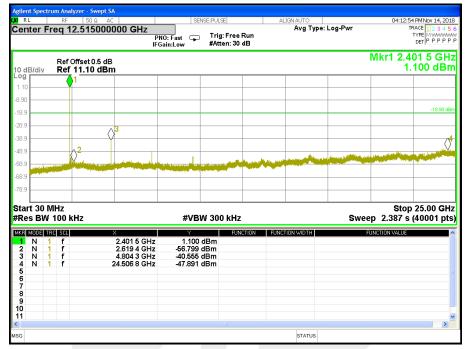
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



# 4.5 TEST RESULTS

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

## 00 CH



# 39 CH

RL			nalyzer - 5	omepto DΩ A			CE	NSE:PULSE			LIGNAUTO				P4-	16:03 0	MNov 14, 2
	er F				0000 GHz	PNO: Fa IFGain:L	st 🖵						Log-Pwr			TRAG	CE 1 2 3 4 PE MWWW ET P P P P
dB/o	div		ef Offset ef_9.61											1			0 9 GI 95 dB
9			<b>1</b>			_										_	
4																_	
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4				(	<b>∂</b> ³												
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	30 P BW		) kHz				#VB	W 300 k	Hz				s	wee	S 2.38	top 2 7 s (4	5.00 G 0001 p
N					× 2.440 9 GH		Y -0.395	dBm	FUNCTIO	N FUN	CTION WIDT	Ή		FU	NCTION VAL	UE	
N N N	1 1	1			3.174 3 GH 4.882 3 GH 24.228 4 GH	z -	57.266 38.173 46.809	dBm									

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# 78 CH

ilent Spect	<mark>rum Ana</mark> RF	lyzer - Swept S		SE	NSE:PULSE	AL	IGN AUTO			06 PMNov 14, 20
enter F	req 1	2.515000	P	'NO: Fast Gain:Low	Trig: Free #Atten: 30		Avg Type:	Log-Pwr		TYPE MWWW DET P P P P
) dB/div		Offset 0.5 dE 11.79 dBr								180 2 GH .787 dBi
.79	(	1								
21										-18.21 d
3.2			A3							
3.2		\ <u>2</u>								
3.2 July July						New York				
3.2										
art 30 I Res BW		<hz< td=""><td></td><td>#VB</td><td>W 300 kHz</td><td></td><td></td><td>Swe</td><td>Stoj ep 2.387 s</td><td>p 25.00 GH (40001 pt</td></hz<>		#VB	W 300 kHz			Swe	Stoj ep 2.387 s	p 25.00 GH (40001 pt
2 N 3 N 4 N	FC SCL 1 f 1 f 1 f 1 f		× 2.480 2 GHz 2.528 2 GHz 4.960 3 GHz 24.420 1 GHz	1.787 -53.830 -42.175 -47.672	dBm dBm dBm	CTION FUNC	TION WIDTH		FUNCTION VALUE	
5 5 7 3										
										>
i							STATUS			



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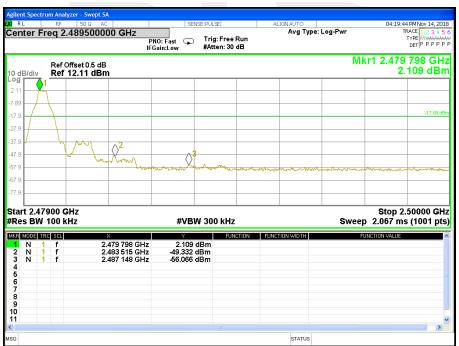


#### For Band edge

00 CH

Agilent Spectr										
IXI RL		50 Ω AC 1500000 G		SEI	VSE:PULSE	A	LIGNAUTO Avg Type:	Log-Pwr		PMNov 14, 2018 RACE 1 2 3 4 5 6
	leq 2.55	1500000 G	PNO: IFGair		Trig: Free #Atten: 30		ing type.	Logini		DET P P P P P
10 dB/div	Ref Offs Ref 11.	et 0.5 dB 47 dBm						M	kr1 2.401 ۱.۰	764 GHz 471 dBm
Log 1.47										$\bigcirc$
-8.53										
-18.5										-18-39/dBn
-28.5										
-38.5										
-48.5									<u>^2</u>	M
	wareyle made and and	and a start and a second	wardentestel	anger and a start of the	Manhaparation	and and and a start of the	www.www.www.www.	And property and the second	- and and and and	) (J~W '
-68.5										
-78.5										
Start 2.30 #Res BW				#VB	W 300 kHz	^		Swee	Stop 2. p 9.867 ms	40300 GHz (1001 pts)
MKR MODE T	RC SCL	×		Y		CTION FUN	CTION WIDTH	F	UNCTION VALUE	~
1 N 1 2 N 1 3 N 1 4		2.401 7 2.390 0 2.399 9	22 GHz	1.471 -59.425 -19.038	dBm					
4 5 6 7										
7										
8 9 10										
11										~
MSG							STATUS			
			~						_	

78 CH



Page 35 of 60

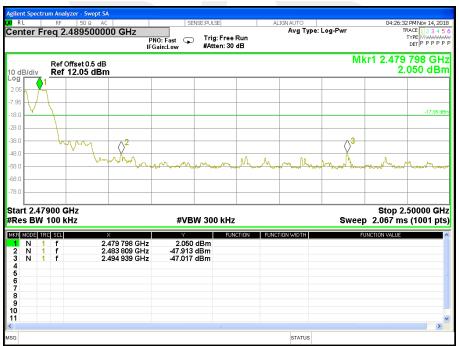


## For Hopping Band edge

00 CH

	rum Analyzer -							
enter F		ο Ω AC 500000 GHz	SE	NSE:PULSE	ALIGNAUTO Avg Type:	Log-Pwr	T	L PM Nov 14, 201 RACE 1 2 3 4 5
			PNO: Fast 🕞 IFGain:Low	Trig: Free Run #Atten: 30 dB				
dB/div	Ref Offse Ref 11.4					MI	(r1 2.401 1.	764 GH 492 dBr
49								
51								
.5								-18-51
.5								
.5								MWW
.5							<mark>2</mark>	
.5		tonen of many solo developments	and an	and the second	and the spectral and the second		And the second	
.5								
	0000 GHz 100 kHz		#VB	W 300 kHz		Sweep	Stop 2. 9.867 ms	40300 GH ; (1001 pt
R MODE T		×	Y	FUNCTION	FUNCTION WIDTH	FL	UNCTION VALUE	
N N	1 f 1 f 1 f	2.401 764 GH 2.390 022 GH 2.399 910 GH	iz -58.189					
								>
					STATUS			

78 CH





# Page 36 of 60

#### Report No.: STS1811083W01

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

Spectrum Analyzer - RF 50	D Q AC	SENSE:PULSE		ALIGNAUTO	04:51:43 PMNov 1
er Freq 12.51	5000000 GHz			Avg Type: Log-Pwr	TRACE 1 2
		10: Fast 😱 Trig: Fre Sain:Low #Atten:	e Kun 30 dB		DET P P
Ref Offset	0.5 dB				Mkr1 2.402 2
div Ref 9.19					-0.814 c
<b>1</b>					
					-20
	<mark>3</mark>				
	Y I				
^2					
L.Y.		and the second		and the second	
30 MHz BW 100 kHz		#\/D\W 200 kl	-	<b>.</b>	Stop 25.00
		#VBW 300 ki			veep 2.387 s (40001
ode tro scl N 1 f	2.402 2 GHz	-0.814 dBm	UNCTION FUN	ICTION WIDTH	FUNCTION VALUE
N 1 f N 1 f	3.074 5 GHz 4.804 3 GHz	-56.234 dBm -36.071 dBm			
N 1 f	24.147 3 GHz	-48.105 dBm			
				STATUS	
				STATUS	
		39			

#### 00 CH

39	CH
00	OIT

RL	-	RF	50 Ω	AC	SEN	ISE:PULSE	AL	.IGN AUTO		04:49:	25 PMNov 14, 20
ento	er F	req	12.5150	)00000 GHz	PNO: Fast 😱	Trig: Free R #Atten: 30 d		Avg Type:	Log-Pwr		TRACE 1 2 3 4 1 TYPE M WWWW DET P P P P I
dBi	/div		Offset 0.6								440 9 GH 138 dB
9 14			<b>\</b> 1								
36											
.9											-17.86 d
.9				A3							
.9 -				Y							0
9-			$\langle \rangle^2$						an a hubble		, in the second
9	Internet										
.9											
	30 P BW	VIHz 100	kHz		#VB\	V 300 kHz			Swe	Sto ep 2.387 s	p 25.00 Gl s (40001 pi
		RC  SCL		x	Y	FUNCT	ION FUNC	TION WIDTH		FUNCTION VALUE	
		f f		2.440 9 GHz 3.049 5 GHz 4.882 3 GHz 24.291 5 GHz	2.138 -56.343 -39.755 -46.454	dBm dBm					
i i r											
1											
8 9 10 11											1

Shenzhen STS Test Services Co., Ltd.



## 78 CH

RL	m Analyzer - S RF 50		SE	NSE:PULSE	A	LIGNAUTO			31 PMNov 14, 2
nter Fre	eq 12.515	5000000 GHz	PNO: Fast G IFGain:Low	) Trig: Free #Atten: 30		Avg Type:	Log-Pwr	Т	TYPE M WWW DET P P P P
	Ref Offset 0 Ref 11.08							Mkr1 2.4 1.	79 6 GI .083 dB
8	<sup>1</sup>								
2									-18.92
	.2		<b>∂</b> <sup>3</sup>						
9	Υ				and the second				
	Hz							Stor	25.00 G
urt 30 M es BW 1	100 kHz		#VB	W 300 kHz				ep 2.387 s	25.00 G (40001 p
rt 30 M es BW 1	100 kHz	× 2.479 6 GH 3.077 0 GF 7.439 8 GH 24.715 3 GH	Iz 1.083 Iz -56.858 Iz -51.540	dBm dBm dBm		TION WIDTH			
rt 30 Mi es BW 1 <u>NODE 1760</u> N 1 N 1 N 1	100 kHz f f f	2.479 6 GH 3.077 0 GH 7.439 8 GH	lz 1.083 lz -56.858 lz -51.540	dBm dBm dBm		TION WIDTH		ep 2.387 s	
nt 30 Mi es BW 1 MODE TRO N 1 N 1 N 1	100 kHz f f f	2.479 6 GH 3.077 0 GH 7.439 8 GH	lz 1.083 lz -56.858 lz -51.540	dBm dBm dBm		TION WIDTH		ep 2.387 s	



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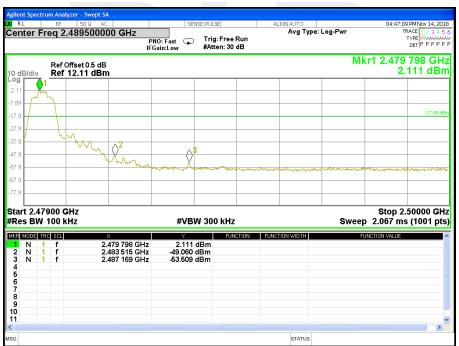


### For Band edge

00 CH

	um Analyzer						
enter F		50 Ω AC   1500000 GHz		ENSE:PULSE	ALIGNAUTO Avg T	rpe: Log-Pwr	04:52:21 PMNov 14, TRACE 1 2 3
			PNO: Fast G	Trig: Free Run #Atten: 30 dB			DET P P
dB/div	Ref Offse Ref 11.5					М	kr1 2.401 764 G 1.584 dE
58							
2							
4							-18.4
4							
.4							. N.
4				1			$(2)^2$
4 1000000	~~hjpy-h-e-we-wy	ell later and a start of the second	nunder () Benkingelik und President (/ Sp	and the many property in the second second	nalligered fredanskinskins	warmen and a second state of the	and the second
.4							
art 2 30	000 GHz						Stop 2.40300 G
	100 kHz		#VE	3W 300 kHz		Swee	p 9.867 ms (1001 j
R MODE TI		× 2.401 764 G	Y	EUNCTION 4 dBm	FUNCTION WIDTH		FUNCTION VALUE
N N	f	2.390 022 0	GHz -59.656	5 dBm			
		2.000 0 10 0	10.00	, abiii			
1							

78 CH



Page 39 of 60

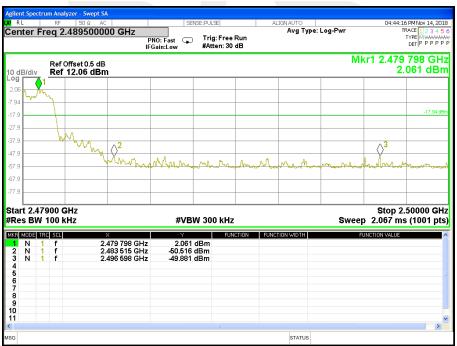


## For Hopping Band edge

00 CH

	rum Anal	yzer - Swept SA								
UX/RL	RF	50 Ω AC		SE	NSE:PULSE	AL	IGNAUTO Avg Type:	<b>.</b>		4 PM Nov 14, 2018 RACE 1 2 3 4 5 6
Center F	req 2.	35150000	F	PNO: Fast 🖵 Gain:Low	Trig: Free F #Atten: 30 c	Run 18	Avg Type:	Log-Pwr	I	TYPE MWWWWWW DET P P P P P P
10 dB/div		)ffset 0.5 dB 11.56 dBm	ı					М	kr1 2.402 1.	794 GHz 558 dBm
Log 1.56										1
-8.44										
-18.4										-18.44 dBm
-28.4										
-38.4										at dell
-48.4										jiwdd <sup>rwll</sup>
	ngil karawa	frank holy at the standard and	and a second	e-2100-0998-0-09-0-	en versent seen strang	rhannan anatar ang katalan		and the second	- Andrew Colored	
-68.4										
Start 2.30 #Res BW				#VB	W 300 kHz			Swee	Stop 2. p 9.867 ms	40300 GHz s (1001 pts)
MKR MODE T		;		Y	FUNC	TION FUNC	TION WIDTH		FUNCTION VALUE	^
		2.	402 794 GHz 390 022 GHz 399 910 GHz	1.558 -58.911 -19.026	dBm					
4 5 6 7										
7										
8 9 10										
11										~
<							07.07.00			>
ISG							STATUS			

78 CH





## 5. NUMBER OF HOPPING CHANNEL

## 5.1 LIMIT

FCC Part 15.247,Subpart C						
RSS-247 Issue 2						
Section	Test Item	Limit	FrequencyRange (MHz)	Result		
15.247(a)(1)(iii) RSS-247	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

EUT	SPECTRUM
	ANALYZER

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

## Number of Hopping Channel

79

## Hopping channel

RL	RF	50 Q AC	SENSE:PULS	E	ALIGN AUTO		04:21:49 PMNov 14, 20
enter F	req 2.4	41750000 GHz	NO: Fast Trig Gain:Low #Att	:Free Run en:30 dB	Avg Type: L	.og-Pwr	TRACE 1 2 3 4 TYPE M MMMMM DET P P P P
dB/div		set 0.5 dB 2.25 dBm				Mkr2 2	2.479 909 5 GH 2.07 dB
<sup>2g</sup> 25							2
75							
.8							
.8							
.8							
.8							
.8							
.8							
	0000 GH / 1.0 MH		#VBW 1.0	MHz		Sweep 7	Stop 2.48350 Gi 1.000 ms (1001 pi
2 N	TRO SOL 1 f 1 f	× 2.401 837 0 GHz 2.479 909 5 GHz	Y 1.55 dBm 2.07 dBm	FUNCTION	FUNCTION WIDTH	FUNC	TION VALUE
}   							
3							
, ) 							

Shenzhen STS Test Services Co., Ltd.



## 6. AVERAGE TIME OF OCCUPANCY

#### 6.1 LIMIT

	FCC Part 15.247,Subpart C						
RSS-247 Issue 2							
Section	Test Item	Limit	FrequencyRange (MHz)	Result			
15.247(a)(1)(iii) RSS-247	Average Time of Occupancy	0.4sec	2400-2483.5	PASS			

#### 6.2 TEST PROCEDURE

- a. The transmitter output (antenna port) was connected to the spectrum analyzer
- b. Set RBW =1MHz/VBW =3MHz.
- c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
- d. Sweep Time is more than once pulse time.
- Set the center frequency on any frequency would be measure and set the frequency span to e. zero span.
- f. Measure the maximum time duration of one single pulse.
- g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
- h. Measure the maximum time duration of one single pulse.
- i. DH5 Packet permit maximum 1600/ 79 / 6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). Sothe dwell time is the time duration of the pulse times 3.37 x 31.6 = 106.6 within 31.6 seconds.
- j. DH3 Packet permit maximum 1600 / 79 / 4 = 5.06 hops per second in each channel (3 time slots RX, 1 time slot TX). So he dwell time is the time duration of the pulse times  $5.06 \times 31.6 = 160$  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.



Report No.: STS1811083W01

## 6.5 TEST RESULTS

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

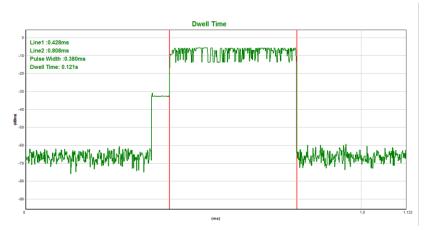
Data Packet	Frequency	Pulse Duration(ms)	Dwell Time(s)	Limits(s)
DH1	2441 MHz	0.380	0.122	0.4
DH3	2441 MHz	1.642	0.263	0.4
DH5	2441 MHz	2.890	0.308	0.4



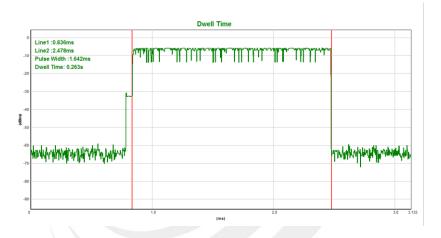
Shenzhen STS Test Services Co., Ltd.



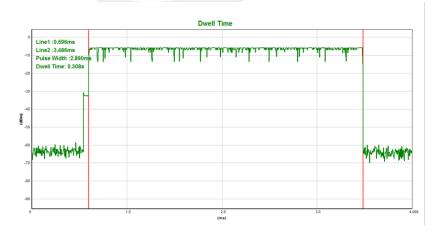
### CH39-DH1



## CH39-DH3



#### **CH39-DH5**



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Report No.: STS1811083W01

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

Data Packet	Frequency	Pulse Duration(ms)	Dwell Time(s)	Limits(s)
2DH1	2441 MHz	0.389	0.124	0.4
2DH3	2441 MHz	1.642	0.263	0.4
2DH5	2441 MHz	2.897	0.309	0.4



П

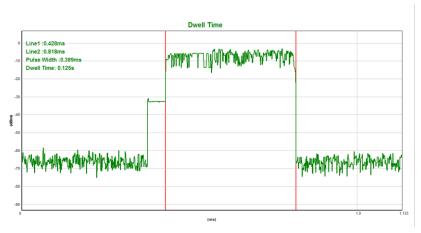
Shenzhen STS Test Services Co., Ltd.

 1/F., Building B, Zhuoke Science Park, No. 190, Chongqing Road, Fuyong Street, Bao'an District, Shenzhen, Guangdong, China

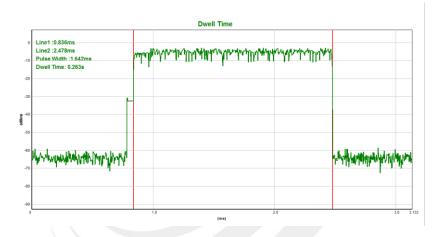
 Tel: + 86-755
 3688
 6277
 Http://www.stsapp.com
 E-mail: sts@stsapp.com



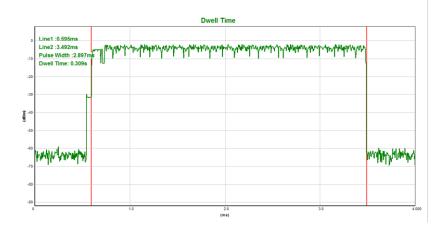
## CH39-2DH1



## CH39-2DH3



### CH39-2DH5







# 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.



Report No.: STS1811083W01

## 7.5 TEST RESULTS

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

Frequency	Ch. Separation (MHz)	Limit	Result
2402 MHz	0.999	0.874	Complies
2441 MHz	0.999	0.874	Complies
2480 MHz	0.999	0.873	Complies

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

RE RF	50Ω AC	SENSE:PULSE	ALIGNAUTO	04:14:06 PM Nov 14, 2
nter Freq 2.4	02500000 GHz PNO IFGa	: Wide 😱 Trig: Free Run in:Low #Atten: 30 dB	Avg Type: Log-P	WY TRACE 1 2 3 4 TYPE M WANN DET P P P
dB/div Ref 9.	set 0.5 dB .74 dBm			Mkr2 2.402 788 GI -0.237 dB
6			2	
3		m	m	
3	~~~~~	m		$\sim$
		~~~		Man 1
				hm
}				
3				
3				
nter 2.402500 es BW 30 kHz		#VBW 100 kHz		Span 3.000 M Sweep 3.200 ms (1001 p
MODE TRC SCL	X	Y FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
N 1 f	2.401 789 GHz 2.402 788 GHz	-0.26 dBm -0.24 dBm		
	2.402 100 0112	-0.24 dBiii		
				>

#### CH00 -1Mbps

Shenzhen STS Test Services Co., Ltd.



### CH39 -1Mbps

RF	50 Ω AC	SI	ENSE:PULSE	ALIGN AUTO		04:16:55 PM Nov 14
er Freq 2.44	1500000 GHz	PNO: Wide G IFGain:Low	⊃ Trig: Free Run #Atten: 30 dB	Avg Type:	Log-Pwr	TRACE 1 2 TYPE MWA DET P P
	et 0.5 dB .41 dBm				Mkr2	2.441 788 0 0.431 d
		<u>)</u> 1		<b>2</b>		
		now		Ann	$\sim$	
	~~~~		ma la		m -	
					- N	~
~~~	•					- <u>_</u>
er 2.441500 (	GHz					Span 3.000
BW 30 kHz		#VE	3W 100 kHz		Sweep 3	.200 ms (1001
DE TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH	FUNCT	ION VALUE
4 1 f 4 1 f	2.440 789 2.441 788		1 dBm 3 dBm			
• • •						

#### CH78 -1Mbps



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 E-mail: sts@stsapp.com



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Report No.: STS1811083W01

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

Frequency	Ch. Separation (MHz)	Limit	Result
2402 MHz	0.999	0.859	Complies
2441 MHz	1.002	0.859	Complies
2480 MHz	0.996	0.859	Complies

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

	RF		AC		SEN	ISE:PULSE			IAUTO		04	:53:24 PM Nov 1
ter Fi	req 2	2.402500	)000 GHz		ide 🖵 .ow	Trig: Free #Atten: 30			Avg Type	: Log-Pwr		TRACE 12 TYPE MM DET P P
3/div		Offset 0.5 9.77 dB								ľ	/lkr2 2.4	02 788 -0.117 c
				$\rangle^1$				2				
		m	m	$\sim$	$\sim$	$\sim$	$\sim$		$\sim \sim$	pm	$\sim$	
	1	×~	_									
$\sim$	کم _											h
			_									
	40250 30 ki	00 GHz Hz			#VBV	V 100 kH:	z			Swe		pan 3.000 ) ms (1001
10DE TE N 1	f		× 2.401 789		-0.17	dBm	NCTION	FUNCTION	N WIDTH		FUNCTION VA	LUE
N 1	f		2.402 788	GHz	-0.12	dBm						

## CH00 -2Mbps

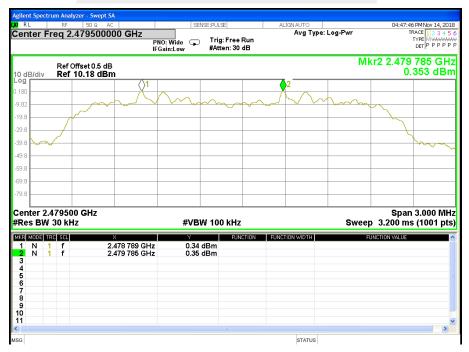
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#### CH39 -2Mbps

RF	50 Ω AC	SENSI	E:PULSE	ALIGNAUTO		04:50:08 PMNov 14,
er Freq 2.44	1500000 GHz	PNO: Wide 😱 FGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type:	Log-Pwr	TRACE 1 2 3 TYPE MWWW DET P P P
	et 0.5 dB .46 dBm				Mkr2	2.441 788 G 0.463 di
				<b>2</b>		
		And		$\sim$	2	
~		~~ [·				$\searrow$
1						M
~~~						
~~.						~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
er 2.441500 C	GHz					Span 3.000 M
BW 30 kHz		#VBW	100 kHz		Sweep 3	3.200 ms (1001
IODE TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH	FUNC	TION VALUE
N 1 f N 1 f	2.440 786 GHz 2.441 788 GHz					

#### CH78 -2Mbps



Shenzhen STS Test Services Co., Ltd.



# 8. BANDWIDTH TEST

## 8.1 LIMIT

FCC Part15 15.247,Subpart C RSS-247 Issue 2							
Section	Test Item Limit		FrequencyRange (MHz)	Result			
15.247(a)(1) RSS-247	20dB 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.



Report No.: STS1811083W01

8.5 TEST RESULTS

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

Frequency	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
2402 MHz	0.874	0.824	PASS
2441 MHz	0.874	0.822	PASS
2480 MHz	0.873	0.825	PASS

## CH00 -1Mbps





### CH39 -1Mbps



CH78 -1Mbps



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Report No.: STS1811083W01

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

Frequency	20dB Bandwidth (MHz)	99% Bandwidth (MHz)	Result
2402 MHz	1.288	1.174	PASS
2441 MHz	1.288	1.181	PASS
2480 MHz	1.288	1.175	PASS

## CH00 -2Mbps

RL RF 50 Q AC		ENSE:PULSE	ALIGNAUTO	07:47:17 AM Jan 21, 201
nter Freq 2.40200000	GHz	Center Freq: 2.402000		Radio Std: None
	#IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Hold:>10/10 Ext Gain: 2.00 dB	Radio Device: BTS
dB/div Ref 20.00 dBm				
0				
0				
0		Sm	$\sim$	
	$\sim$			
	¥			$M \setminus I$
) <b>****</b>				
0				
nter 2.402 GHz				Span 2 MH
es BW 30 kHz		#VBW 100 k	Hz	Sweep 2.733 m
Occupied Bandwidt	h	Total Power	7.42 dBm	
1.1	1735 MHz			
Transmit Freq Error	46.592 kHz	OBW Power	99.00 %	
k dB Bandwidth	1.288 MHz	x dB	-20.00 dB	
			STATUS	

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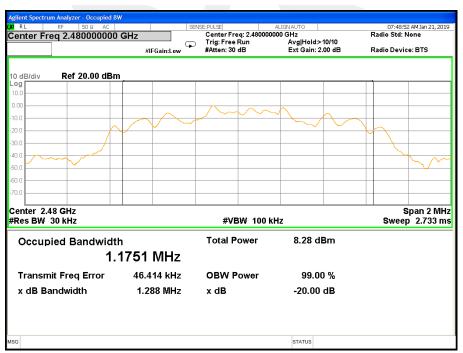
₩



#### CH39 -2Mbps



CH78 -2Mbps





# 9. OUTPUT POWER TEST

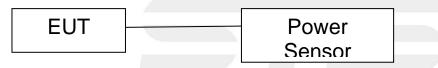
## 9.1 LIMIT

FCC Part 15.247,Subpart C						
		RSS-247 Issue 2				
Section	FrequencyRange (MHz)	Result				
15 247(a)(1)8(b)(1)	Output	1 W or 0.125W				
15.247(a)(1)&(b)(1) RSS-247	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



### 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.



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## 9.5 TEST RESULTS

Temperature:	25°C	Relative Humidity:	60%
Test Voltage:	AC 120V/60Hz		

GFSK(1Mbps)						
Test Channel	Frequency	Conducted	Output Power	LIMIT		
	(MHz)	Peak (dBm) AVG (dBm)		dBm		
CH00	2402	4.02	-0.24	30		
CH39	2441	4.05	-0.37	30		
CH78	2480	3.86	-0.56	30		

Note: the channel separation >20dB bandwidth

π/4QPSK(2Mbps)						
Test Channel	Frequency	Conducted	LIMIT			
Test Channel	(MHz)	Peak (dBm) AVG (dBm)		dBm		
CH00	2402	3.97	-0.43	20.97		
CH39	2441	4.16	-0.14	20.97		
CH78	2480	3.91	-0.63	20.97		

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

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## 10. ANTENNA REQUIREMENT

## **10.1 STANDARD REQUIREMENT**

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

## 10.2 EUT ANTENNA

The EUT antenna is PCB Antenna. It comply with the standard requirement.



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## **APPENDIX-PHOTOS OF TEST SETUP**

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

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