

# **RADIO TEST REPORT**

S T S

# Report No.: STS2107185W01

Issued for

BLU Products, Inc.

10814 NW 33rd St # 100 Doral, FL 33172, USA

Product Name: Speaker		
Brand Name:	BOLD	
Model Name:	BOLD ARIA Z	
Series Model:	N/A	
FCC ID:	YHLBLUARIAZ	
Test Standard:	FCC Part 15.247	

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## **TEST RESULT CERTIFICATION**

Applicant's Name	BLU Products, Inc.
Address	10814 NW 33rd St # 100 Doral, FL 33172, USA
Manufacturer's Name	BLU Products, Inc.
Address	10814 NW 33rd St # 100 Doral, FL 33172, USA
Product Description	
Product Name	Speaker
Brand Name	BOLD
Model Name:	BOLD ARIA Z
Series Model	N/A
Test Standards	FCC Part15.247
Test Procedure	ANSI C63.10-2013

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

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Date of Test.....

Date of receipt of test item:	26 July 2021
Date (s) of performance of tests :	26 July 2021~ 06 Aug. 2021

Date of Issue:	06 Aug. 2021

Test Result ..... Pass

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

(Vita Li)

Page 3 of 75 Report No.: STS2107185W01



Table of Contents	Page
1. SUMMARY OF TEST RESULTS	6
1.1 TEST FACTORY	7
1.2 MEASUREMENT UNCERTAINTY	7
2. GENERAL INFORMATION	8
2.1 GENERAL DESCRIPTION OF THE EUT	8
2.2 DESCRIPTION OF THE TEST MODES	10
2.3 FREQUENCY HOPPING SYSTEM REQUIREMENTS	10
2.4 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING	12
2.5 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	) 12
2.6 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS	13
2.7 EQUIPMENTS LIST	14
3. EMC EMISSION TEST	16
3.1 CONDUCTED EMISSION MEASUREMENT	16
3.2 RADIATED EMISSION MEASUREMENT	20
4. CONDUCTED SPURIOUS & BAND EDGE EMISSION	32
4.1 LIMIT	32
4.2 TEST PROCEDURE	32
4.3 TEST SETUP	33
4.4 EUT OPERATION CONDITIONS	33
4.5 TEST RESULTS	34
5. NUMBER OF HOPPING CHANNEL	49
5.1 LIMIT	49
5.2 TEST PROCEDURE	49
5.3 TEST SETUP	49
5.4 EUT OPERATION CONDITIONS	49
5.5 TEST RESULTS	50
6. AVERAGE TIME OF OCCUPANCY	51
6.1 LIMIT	51
6.2 TEST PROCEDURE	51
6.3 TEST SETUP	51
6.4 EUT OPERATION CONDITIONS	51
6.5 TEST RESULTS	52
7. HOPPING CHANNEL SEPARATION MEASUREMEN	58

Page 4 of 75 Report No.: STS2107185W01



Table of Contents	Page
7.1 LIMIT	58
7.2 TEST PROCEDURE	58
7.3 TEST SETUP	58
7.4 EUT OPERATION CONDITIONS	58
7.5 TEST RESULTS	59
8. BANDWIDTH TEST	65
8.1 LIMIT	65
8.2 TEST PROCEDURE	65
8.3 TEST SETUP	65
8.4 EUT OPERATION CONDITIONS	65
8.5 TEST RESULTS	66
9. OUTPUT POWER TEST	72
9.1 LIMIT	72
9.2 TEST PROCEDURE	72
9.3 TEST SETUP	72
9.4 EUT OPERATION CONDITIONS	72
9.5 TEST RESULTS	73
10. ANTENNA REQUIREMENT	74
10.1 STANDARD REQUIREMENT	74
10.2 EUT ANTENNA	74

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Page 5 of 75 Report No.: STS2107185W01

# **Revision History**

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	06 Aug. 2021 STS2107185W0		ALL	Initial Issue



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# 1. SUMMARY OF TEST RESULTS

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

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

NOTE:

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

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



#### 1.1 TEST FACTORY

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

#### 1.2 MEASUREMENT UNCERTAINTY

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

No.	Item	Uncertainty
1	RF output power, conducted	±0.68dB
2	Unwanted Emissions, conducted	±2.988dB
3	All emissions, radiated 9K-30MHz	±2.84dB
4	All emissions, radiated 30M-1GHz	±4.39dB
5	All emissions, radiated 1G-6GHz	±5.10dB
6	All emissions, radiated>6G	±5.48dB
7	Conducted Emission (9KHz-150KHz)	±2.79dB
8	Conducted Emission (150KHz-30MHz)	±2.80dB



# 2. GENERAL INFORMATION

# 2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	Speaker
Trade Name	BOLD
Model Name	BOLD ARIA Z
Series Model	N/A
Model Difference	N/A
Channel List	Please refer to the Note 2.
Bluetooth	Frequency:2402 – 2480 MHz Modulation: GFSK(1Mbps), π/4-DQPSK(2Mbps), 8DPSK(3Mbps)
Bluetooth Version	5.1
Bluetooth Configuration	BR+EDR
Antenna Type	Please refer to the Note 3.
Rating	Input: 5V, 500mA
Battery	Rated Voltage:3.7V Charge Limit Voltage:4.2V Capacity:400mAh
Hardware version number	V3
Software version number	V3
Connecting I/O Port(s)	Please refer to the Note 1.

Note:

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

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2.

Channel	Frequency	Channel List Channel Frequenc		Channel	Frequency	
	(MHz)		(MHz)		(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	BOLD	BOLD ARIA Z	PCB	N/A	2dBi	BT Antenna	

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

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# 2.2 DESCRIPTION OF THE TEST MODES

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

Worst Mode	Description	Data Rate/Modulation
Mode 1	TX CH00	1Mbps/GFSK
Mode 2	TX CH39	1Mbps/GFSK
Mode 3	TX CH78	1Mbps/GFSK
Mode 4	TX CH00	2 Mbps/π/4-DQPSK
Mode 5	TX CH39	2 Mbps/π/4-DQPSK
Mode 6	TX CH78	2 Mbps/π/4-DQPSK
Mode7	TX CH00	3 Mbps/8DPSK
Mode 8	TX CH39	3 Mbps/8DPSK
Mode 9	TX CH78	3 Mbps/8DPSK
Mode 10	Hopping	GFSK
Mode 11	Hopping	π/4-DQPSK
Mode 12	Hopping	8DPSK

Note:

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

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

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

For AC Conducted Emission

Test Case		
AC Conducted Emission	Mode 13 : Keeping BT TX	

#### 2.3 FREQUENCY HOPPING SYSTEM REQUIREMENTS

(1)Standard and Limit

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

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



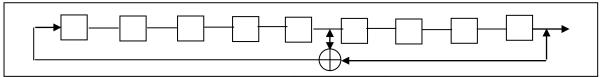
Page 11 of 75 Report No.: STS2107185W01

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

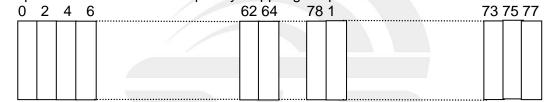
(2)The Pseudorandom sequence may be generated in a nin-stage shift register whose 5<sup>th</sup> and 9<sup>th</sup> stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones: i.e. the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

Numver of shift register stages:9

Length of pseudo-random sequence:2<sup>9</sup>-1=511bits Longest sequence of zeros: 8(non-inverted signal)



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



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

(3) Frequency Hopping System

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

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

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

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



Page 12 of 75 Report No.: STS2107185W01

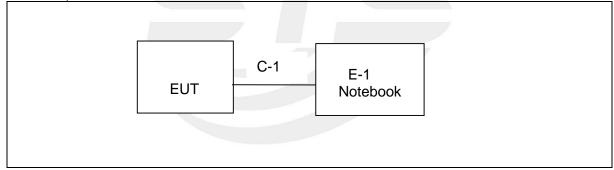
# 2.4 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

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

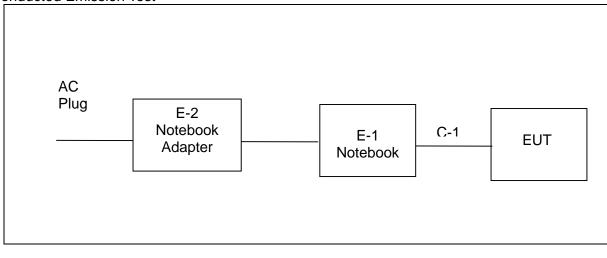
Test software Version	Test program: Bluetooth			
(Power control software) Parameters(1/2/3Mbps)	Power class: DH1 rate:4:27 2DH1 rate:20:54 3DH1 rate:24:83	Power class: DH3 rate:11:183 2DH3 rate:26:367 3DH3 rate:27:552	Power class: DH5 rate:15:339 2DH5 rate:30:679 3DH5 rate:31:1021	

RF Function	Туре	Mode Or Modulation type	ANT Gain(dBi)	Power Class	Software For Testing
		GFSK	2	10	
BT	BR+EDR	π/4-DQPSK	2	10	FCC_assist_1.0.2.2
		8DPSK	2	10	

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



# Conducted Emission Test



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# 2.6 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

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

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

#### Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Length	Note
E-2	Notebook Adapter	LENOVO	ADLX45DLC3A	N/A	N/A
E-1	Notebook	LENOVO	ThinkPad E470	N/A	N/A
C-1	USB Cable	N/A	N/A	150cm	N/A

Note:

(1) For detachable type I/O cable should be specified the length in cm in  $\[$ <sup> $\Gamma$ </sup>Length  $\]$  column.

(2) "YES" is means "with core"; "NO" is means "without core".



# 2.7 EQUIPMENTS LIST

#### Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2020.10.12	2021.10.11
Signal Analyzer	R&S	FSV 40-N	101823	2020.10.10	2021.10.09
Active loop Antenna	ZHINAN	ZN30900C	16035	2021.04.11	2022.04.10
Bilog Antenna	TESEQ	CBL6111D	34678	2020.10.12	2022.10.11
Horn Antenna	SCHWARZBECK	BBHA 9120D	02014	2019.10.15	2021.10.14
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2020.10.12	2022.10.11
Pre-Amplifier (0.1M-3GHz)	EM	EM330	060665	2020.10.12	2021.10.11
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK2018080901	2020.10.12	2021.10.11
Pre-Amplifier (18G-40GHz)	SKET	LNPA-1840-50	SK2018101801	2020.10.10	2021.10.09
Temperature & Humidity	HH660	Mieo	N/A	2020.10.13	2021.10.12
Turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A
Test SW	FARAD	E	Z-EMC(Ver.STS	LAB-03A1 RE)	

# Conduction Test equipment

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



Page 15 of 75 Report No.: STS2107185W01

#### **RF** Connected Test

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	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until		
ſ			_	MY55520005	2020.10.10	2021.10.09		
	Power Sensor	Keysight U2021XA		MY55520006	2020.10.10	2021.10.09		
	Power Sensor		MY56120038 MY56280002	U2U21XA		MY56120038	2020.10.10	2021.10.09
					2020.10.10	2021.10.09		
	Signal Analyzer	Agilent	N9020A	MY51110105	2021.03.04	2022.03.03		
	Temperature & Humidity	HH660	Mieo	N/A	2020.10.13	2021.10.12		
	Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)					



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# 3. EMC EMISSION TEST

# 3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

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

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

Note:

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

#### The following table is the setting of the receiver

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



# 3.1.2 TEST PROCEDURE

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

#### 3.1.3 TEST SETUP

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

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

#### 3.1.4 EUT OPERATING CONDITIONS

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



# 3.1.5 TEST RESULT

Temperature:	27.5(C)	Relative Humidity:	66%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	Mode 13		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1540	15.24	20.33	35.57	65.78	-30.21	QP
2	0.1540	2.26	20.33	22.59	55.78	-33.19	AVG
3	0.4660	18.46	20.54	39.00	56.58	-17.58	QP
4	0.4660	11.56	20.54	32.10	46.58	-14.48	AVG
5	0.9140	14.14	20.31	34.45	56.00	-21.55	QP
6	0.9140	2.56	20.31	22.87	46.00	-23.13	AVG
7	2.5340	10.01	20.33	30.34	56.00	-25.66	QP
8	2.5340	0.27	20.33	20.60	46.00	-25.40	AVG
9	6.8700	12.93	20.57	33.50	60.00	-26.50	QP
10	6.8700	2.83	20.57	23.40	50.00	-26.60	AVG
11	18.0980	10.62	22.46	33.08	60.00	-26.92	QP
12	18.0980	-1.72	22.46	20.74	50.00	-29.26	AVG

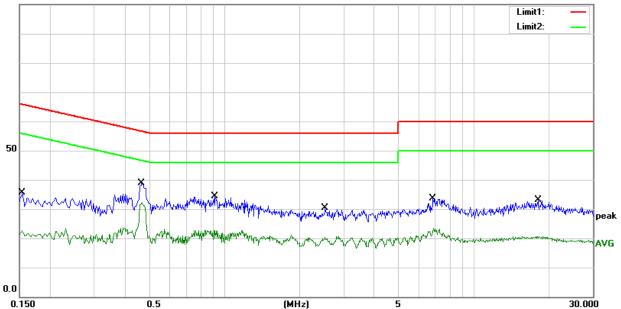
#### Remark:

1. All readings are Quasi-Peak and Average values

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

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







Page 19 of 75 Report No.: STS2107185W01

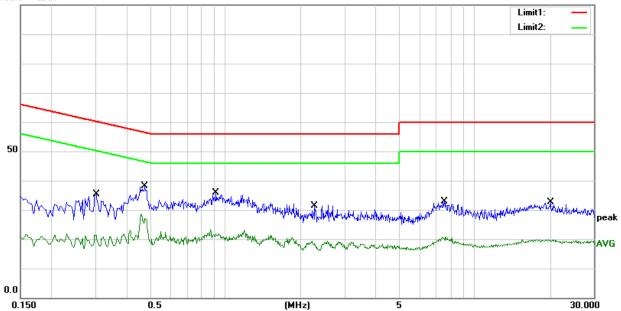
Temperature:	27.5(C)	Relative Humidity:	66%RH
Test Voltage:	AC 120V/60Hz	Phase:	Ν
Test Mode:	Mode 13		

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.2860	12.89	20.69	33.58	60.64	-27.06	QP
2	0.2860	0.60	20.69	21.29	50.64	-29.35	AVG
3	0.4740	17.86	20.54	38.40	56.44	-18.04	QP
4	0.4740	6.98	20.54	27.52	46.44	-18.92	AVG
5	0.9180	15.80	20.31	36.11	56.00	-19.89	QP
6	0.9180	1.73	20.31	22.04	46.00	-23.96	AVG
7	3.0980	10.72	20.35	31.07	56.00	-24.93	QP
8	3.0980	-1.49	20.35	18.86	46.00	-27.14	AVG
9	7.4260	13.57	20.66	34.23	60.00	-25.77	QP
10	7.4260	-0.24	20.66	20.42	50.00	-29.58	AVG
11	18.4300	9.31	22.53	31.84	60.00	-28.16	QP
12	18.4300	-2.62	22.53	19.91	50.00	-30.09	AVG

#### Remark:

1. All readings are Quasi-Peak and Average values

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





## 3.2 RADIATED EMISSION MEASUREMENT

#### 3.2.1 RADIATED EMISSION LIMITS

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

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

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

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

FREQUENCY (MHz)	(dBuV/m) (at 3M)		
PEAK AVER/	AGE		
Above 1000 74 54	ļ		

Notes:

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

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

# LIMITS OF RESTRICTED FREQUENCY BANDS

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

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Page 21 of 75 Report No.: STS2107185W01

For Radiated Emission

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

Spectrum Parameter	Setting	
Attenuation	Auto	
Detector	Peak/QP	
Start Frequency	30 MHz(Peak/QP)	
Stop Frequency	1000 MHz (Peak/QP)	
RB / VB (emission in restricted		
band)	120 KHz / 300 KHz	

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

For Restricted band

Spectrum Parameter	Setting		
Detector	Peak/AV		
Start/Stap Eraguapay	Lower Band Edge: 2310 to 2410 MHz		
Start/Stop Frequency	Upper Band Edge: 2476 to 2500 MHz		
	1 MHz / 3 MHz(Peak)		
RB / VB	1 MHz/1/T MHz(AVG)		

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Page 22 of 75 Report No.: STS2107185W01

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

#### 3.2.2 TEST PROCEDURE

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

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

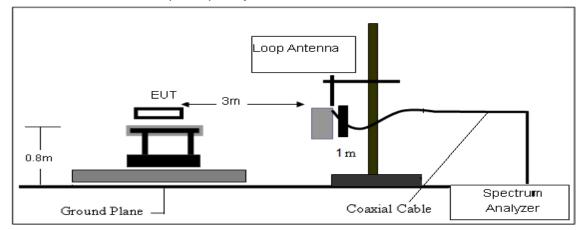
# 3.2.3 DEVIATION FROM TEST STANDARD

No deviation.

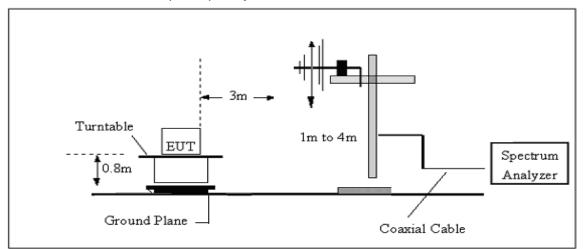


# 3.2.4 TESTSETUP

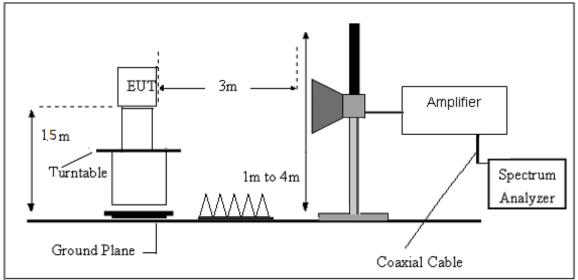
(A) Radiated Emission Test-Up Frequency Below 30MHz

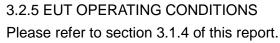


# (B) Radiated Emission Test-Up Frequency 30MHz~1GHz



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







# 3.2.6 FIELD STRENGTH CALCULATION

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

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

For example

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

Factor=AF+CL-AG



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# 3.2.7 TEST RESULTS

(9KHz-30MHz)

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

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

Note:

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

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



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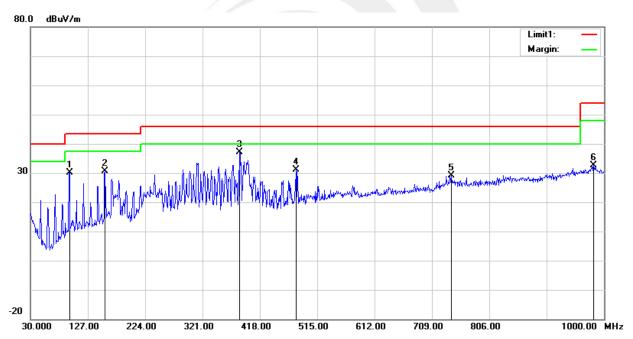
(30MHz-1000MHz)

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

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	95.9600	50.87	-20.67	30.20	43.50	-13.30	QP
2	156.1000	49.37	-18.66	30.71	43.50	-12.79	QP
3	383.0800	49.30	-12.06	37.24	46.00	-8.76	QP
4	479.1100	39.81	-8.68	31.13	46.00	-14.87	QP
5	741.9800	31.20	-2.12	29.08	46.00	-16.92	QP
6	982.5400	30.12	2.52	32.64	54.00	-21.36	QP

Remark:

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





Page 27 of 75 Report No.: STS2107185W01

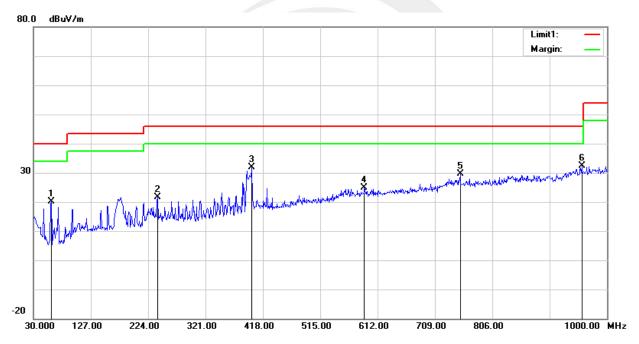
Temperature:	23.1(C)	Relative Humidity:	60%RH				
Test Voltage:	DC 3.7V	Phase:	Vertical				
Test Mode:	Mode 1/2/3/4/5/6/7/8/9(Mode 9 worst mode)						

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	60.0700	46.08	-25.86	20.22	40.00	-19.78	QP
2	240.4900	39.51	-17.93	21.58	46.00	-24.42	QP
3	399.5700	43.05	-11.16	31.89	46.00	-14.11	QP
4	589.6900	30.77	-5.83	24.94	46.00	-21.06	QP
5	751.6800	31.69	-2.17	29.52	46.00	-16.48	QP
6	957.3200	30.73	1.72	32.45	46.00	-13.55	QP

Remark:

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

2. Factor= Antenna factor+Cable attenuation factor(cable loss)-Amplifier gain



Page 28 of 75 Report No.: STS2107185W01



# (1GHz~25GHz) Spurious emission Requirements

Frequency	Meter Reading	Amplifier	Loss	Antenna Factor	Corrected Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBµV)	(dB)	(dB)	(dB/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре	
				Low Ch	annel (8DPSK/	/2402 MHz)				
3264.90	61.12	44.70	6.70	28.20	-9.80	51.32	74.00	-22.68	PK	Vertical
3264.90	51.06	44.70	6.70	28.20	-9.80	41.26	54.00	-12.74	AV	Vertical
3264.66	62.24	44.70	6.70	28.20	-9.80	52.44	74.00	-21.56	PK	Horizontal
3264.66	49.97	44.70	6.70	28.20	-9.80	40.17	54.00	-13.83	AV	Horizontal
4804.54	59.58	44.20	9.04	31.60	-3.56	56.02	74.00	-17.98	PK	Vertical
4804.54	50.21	44.20	9.04	31.60	-3.56	46.65	54.00	-7.35	AV	Vertical
4804.61	58.39	44.20	9.04	31.60	-3.56	54.83	74.00	-19.17	PK	Horizontal
4804.61	50.11	44.20	9.04	31.60	-3.56	46.55	54.00	-7.45	AV	Horizontal
5359.83	49.00	44.20	9.86	32.00	-2.34	46.66	74.00	-27.34	PK	Vertical
5359.83	40.23	44.20	9.86	32.00	-2.34	37.89	54.00	-16.11	AV	Vertical
5359.68	47.15	44.20	9.86	32.00	-2.34	44.81	74.00	-29.19	PK	Horizontal
5359.68	38.07	44.20	9.86	32.00	-2.34	35.73	54.00	-18.27	AV	Horizontal
7205.96	54.65	43.50	11.40	35.50	3.40	58.05	74.00	-15.95	PK	Vertical
7205.96	44.34	43.50	11.40	35.50	3.40	47.74	54.00	-6.26	AV	Vertical
7205.90	54.48	43.50	11.40	35.50	3.40	57.88	74.00	-16.12	PK	Horizontal
7205.90	43.54	43.50	11.40	35.50	3.40	46.94	54.00	-7.06	AV	Horizontal
				Middle C	hannel (8DPSł	2441 MHz)</td <td></td> <td></td> <td></td> <td></td>				
3264.87	61.60	44.70	6.70	28.20	-9.80	51.80	74.00	-22.20	PK	Vertical
3264.87	49.95	44.70	6.70	28.20	-9.80	40.15	54.00	-13.85	AV	Vertical
3264.68	61.38	44.70	6.70	28.20	-9.80	51.58	74.00	-22.42	PK	Horizontal
3264.68	51.15	44.70	6.70	28.20	-9.80	41.35	54.00	-12.65	AV	Horizontal
4882.46	59.59	44.20	9.04	31.60	-3.56	56.03	74.00	-17.97	PK	Vertical
4882.46	49.91	44.20	9.04	31.60	-3.56	46.35	54.00	-7.65	AV	Vertical
4882.45	58.23	44.20	9.04	31.60	-3.56	54.67	74.00	-19.33	PK	Horizontal
4882.45	49.28	44.20	9.04	31.60	-3.56	45.72	54.00	-8.28	AV	Horizontal
5359.88	48.36	44.20	9.86	32.00	-2.34	46.02	74.00	-27.98	PK	Vertical
5359.88	39.60	44.20	9.86	32.00	-2.34	37.26	54.00	-16.74	AV	Vertical
5359.72	47.93	44.20	9.86	32.00	-2.34	45.59	74.00	-28.41	PK	Horizontal
5359.72	38.51	44.20	9.86	32.00	-2.34	36.17	54.00	-17.83	AV	Horizontal
7323.74	53.61	43.50	11.40	35.50	3.40	57.01	74.00	-16.99	PK	Vertical
7323.74	43.54	43.50	11.40	35.50	3.40	46.94	54.00	-7.06	AV	Vertical
7323.73	54.77	43.50	11.40	35.50	3.40	58.17	74.00	-15.83	PK	Horizontal
7323.73	43.72	43.50	11.40	35.50	3.40	47.12	54.00	-6.88	AV	Horizontal



# Page 29 of 75 Report No.: STS2107185W01

				High Chan	nel (8DPSK	/2480 MHz)				
3264.80	61.71	44.70	6.70	28.20	-9.80	51.91	74.00	-22.09	PK	Vertical
3264.80	51.51	44.70	6.70	28.20	-9.80	41.71	54.00	-12.29	AV	Vertical
3264.80	61.43	44.70	6.70	28.20	-9.80	51.63	74.00	-22.37	PK	Horizontal
3264.80	50.68	44.70	6.70	28.20	-9.80	40.88	54.00	-13.12	AV	Horizontal
4960.45	59.29	44.20	9.04	31.60	-3.56	55.73	74.00	-18.27	PK	Vertical
4960.45	49.17	44.20	9.04	31.60	-3.56	45.61	54.00	-8.39	AV	Vertical
4960.56	59.42	44.20	9.04	31.60	-3.56	55.86	74.00	-18.14	PK	Horizontal
4960.56	49.67	44.20	9.04	31.60	-3.56	46.11	54.00	-7.89	AV	Horizontal
5359.85	48.77	44.20	9.86	32.00	-2.34	46.43	74.00	-27.57	PK	Vertical
5359.85	40.13	44.20	9.86	32.00	-2.34	37.79	54.00	-16.21	AV	Vertical
5359.83	47.44	44.20	9.86	32.00	-2.34	45.10	74.00	-28.90	PK	Horizontal
5359.83	39.40	44.20	9.86	32.00	-2.34	37.06	54.00	-16.94	AV	Horizontal
7439.80	53.57	43.50	11.40	35.50	3.40	56.97	74.00	-17.03	PK	Vertical
7439.80	43.70	43.50	11.40	35.50	3.40	47.10	54.00	-6.90	AV	Vertical
7439.74	54.01	43.50	11.40	35.50	3.40	57.41	74.00	-16.59	PK	Horizontal
7439.74	44.10	43.50	11.40	35.50	3.40	47.50	54.00	-6.50	AV	Horizontal

Note:

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

Emission Level = Reading + Factor

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



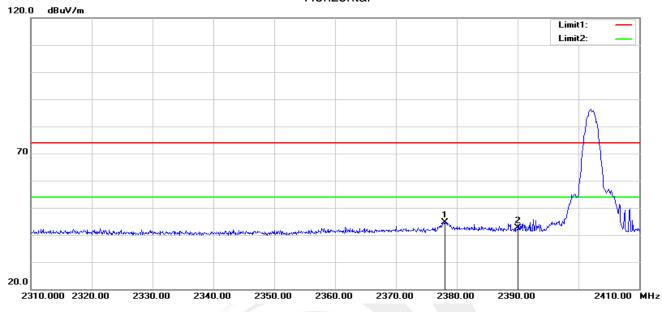
Page 30 of 75

Report No.: STS2107185W01

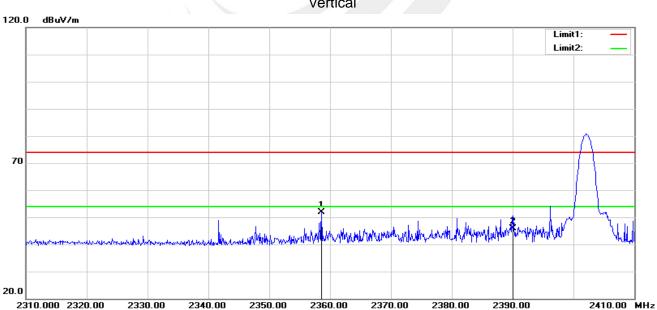


#### **Restricted band Requirements**

#### **8DPSK-Low** Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2378.000	40.40	4.16	44.56	74.00	-29.44	peak
2	2390.000	38.23	4.34	42.57	74.00	-31.43	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2358.600	48.04	3.87	51.91	74.00	-22.09	peak
2	2390.000	41.49	4.34	45.83	74.00	-28.17	peak

Vertical

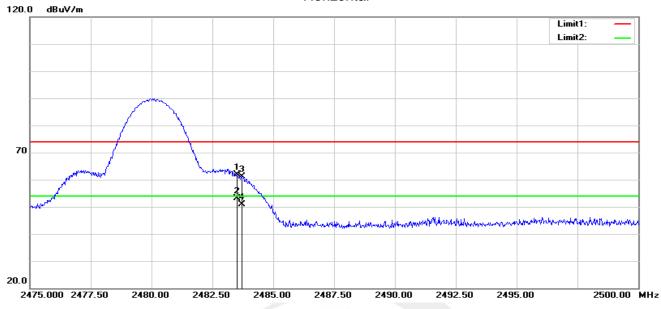
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Page 31 of 75

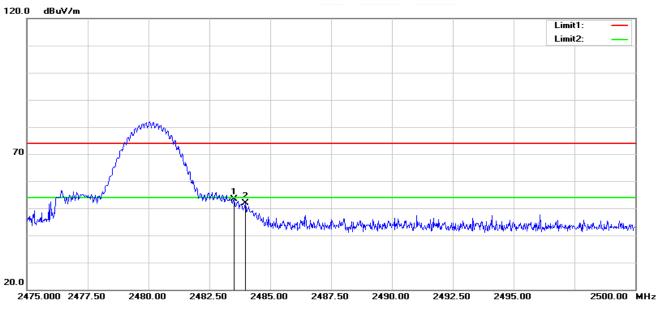
Report No.: STS2107185W01

#### 8DPSK-High Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	57.16	4.60	61.76	74.00	-12.24	peak
2	2483.500	48.52	4.60	53.12	54.00	-0.88	AVG
3	2483.725	56.44	4.60	61.04	74.00	-12.96	peak
4	2483.725	46.30	4.60	50.90	54.00	-3.10	AVG

Vertical



	No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
		(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
ſ	1	2483.500	48.90	4.60	53.50	74.00	-20.50	peak
	2	2483.975	47.37	4.61	51.98	74.00	-22.02	peak

Note: GFSK,  $\pi/4$ -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 – 2407 MHz		
Start/Stop Frequency	Upper Band Edge: 2475 – 2500 MHz		
RB / VB (emission in restricted band)	100 KHz/300 KHz		
Trace-Mode:	Max hold		

#### For Hopping Band edge

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







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

#### 4.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

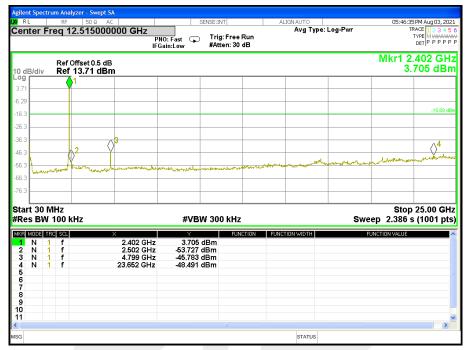




# 4.5 TEST RESULTS

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

## 00 CH



# 39 CH

	pectru	m Ana	lyzer - Swept SA	1							
RL		RF	50 Ω AC			SENSE:INT	A	IGNAUTO			57 PM Aug 03, 20
ente	er Fro	eq 1	2.5150000	Р	'NO: Fast 😱 Gain:Low	Trig: Free #Atten: 30		Avg Type:	Log-Pwr		TYPE MWWWWW DET P P P P
0 dB/	div		Offset 0.5 dB 13.62 dBm	1							.452 G⊦ .623 dB
<sup>og</sup> 3.62			1								
.82											
											-15.47 c
5.4											
5.4											
5.4 —			2	$\bigcirc$	5						∆4
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5.4 —											
5.4											
	30 M BW 1		(Hz		#VBI	N 300 kHz		1	Sw	Stop eep 2.386	o 25.00 GI s (1001 p
R MO	DE TRO	SCL f		2.452 GHz	¥ 3.623		CTION FUNC	TION WIDTH		FUNCTION VALUE	
2 N	i 1	f		2.527 GHz	-53.518	dBm					
3 N 1 N		f		7.321 GHz 24.051 GHz	-45.113						
5											
5 7											
3											
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# 78 CH

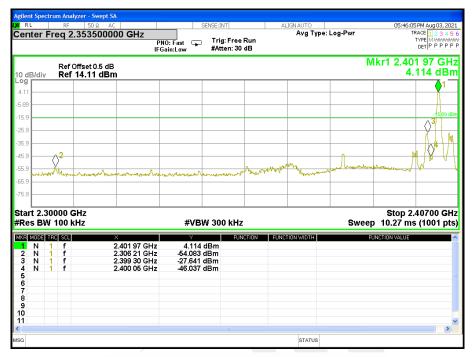
nt Spectrum Analyzer - Swept SA			
RL RF 50 Ω AC nter Freq 12.515000000 (	SENSE:INT SHZ PNO: Fast Trig: Free Run	ALIGNAUTO Avg Type: Log-Pwr	11:28:33 PM Aug 03, 20 TRACE 1 2 3 4 TYPE MWWW
	IFGain:Low #Atten: 30 dB		DETPPP
Ref Offset 0.5 dB B/div Ref 14.03 dBm			Mkr1 2.477 GF 4.030 dB
7			
)			-15.30
)			
2			
		. whe we want to	an rennow more
how were the the work of the second	administration and a second and a	and the second sec	
rt 30 MHz			Stop 25.00 G
es BW 100 kHz	#VBW 300 kHz	Swe	ep 2.386 s (1001 p
MODE TRC SCL X	Y FUNCTION 77 GHz 4.030 dBm	FUNCTION WIDTH F	UNCTION VALUE
N 1 f 2.5	02 GHz -44.903 dBm 18 GHz -42.308 dBm		
	26 GHz -48.296 dBm		



Shenzhen STS Test Services Co., Ltd.



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



#### 00 CH

39 CH





## 78 CH

L RF	alyzer - Swept SA			ENSE:INT		.IGN AUTO		11:20:03	PM Aug 03, 20
	2.48750000	F	PNO: Fast 🖵 Gain:Low	Trig: Free R #Atten: 30 d	un	Avg Type:	-	TF	ACE 1 2 3 4 TYPE MWWW DET P P P P
Bidiv Re	Offset 0.5 dB f 14.70 dBm						М	kr1 2.479 4.	950 GH 702 dB
)	<b></b>	1 T							
									-15.30 c
		h	mg	⊘ <b>3</b>					
www.	wh	had		$\dot{\wedge}$		- 1	man well and	- 2ª	mm
-									
rt 2.47500 s BW 100			#VBI	N 300 kHz			Swee	Stop 2. p 2.400 ms	50000 GI (1001 pi
MODE TRC SCL			Y	FUNC	FION FUNC	TION WIDTH	F	UNCTION VALUE	
N 1 f N 1 f N 1 f N 1 f	2.4	79 950 GHz 83 500 GHz 85 300 GHz 96 425 GHz	4.702 -37.993 -43.698 -52.543	dBm dBm					
						STATUS			



Shenzhen STS Test Services Co., Ltd.

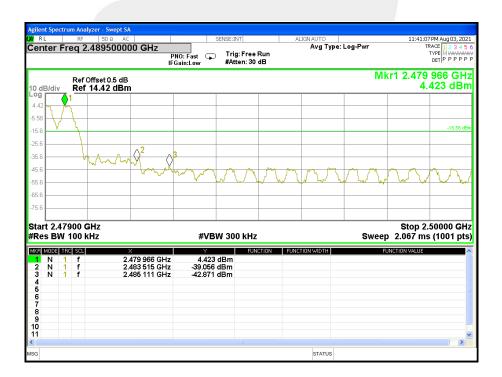




### For Hopping Band edge

GFSK

lent Spectr	rum Analy RE	<mark>yzer - Swept SA</mark> 50 Ω AC							11.00.5	- PM 4
		50 Ω AC .35150000	P	NO: Fast 🖵 Gain:Low	SENSE:INT Trig: Free #Atten: 30	Run	ALIGNAUTO Avg Type:	Log-Pwr	Т	5PM Aug 03, 20 RACE 1 2 3 4 1 TYPE MWWWW DET P P P P
dB/div		0ffset 0.5 dB 13.50 dBm	1					M	kr1 2.402 3.	176 GH 498 dB
g 50										
.5										-16.50 d
.5										
.5								ለሰበስ		na aliante
.5	Muth.	www.www	muhhhhhl	Whitehold	and when	ለኢትዮሌላታታላሉ	ሌሌ <mark>ሌሌሌሌ</mark> ሌሌ	ANNAL VII VI	MAMMAA	VVV
.5										
art 2.30 es BW				#VB	W 300 kHz	:		Swee	Stop 2. p 9.867 ms	40300 GI s (1001 p1
R MODE T	f	2.	402 176 GHz	3.498	dBm	ICTION FUN	CTION WIDTH	ŀ	UNCTION VALUE	
N N			390 022 GHz 400 013 GHz	-46.092 -29.304						
: 										
										>
							STATUS			



П



## Page 39 of 75 Report No.: STS2107185W01

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

RL	trum Ana	alyzer - Swept 1 50 Ω A		CEN	SE:INT	ALIGNA	TO		44:51 PM Aug 03, 20
		12.515000	0000 GHz	) · Fast	Trig: Free Run #Atten: 30 dB		vg Type: Log-P\		TRACE 1 2 3 4 TYPE MWMMM DET P P P P
dB/div		Offset 0.5 df f <b>10.17 dB</b>						Mkr	2.402 GF 0.169 dB
		1							
3									-16.25 o
3									10.230
3									
		2	∧ <mark>3</mark>						
3 <b></b>		Y	V				والمدادية والمستعم والمستاد	der and when the	malestonghing
	Water and	week week we	have a start the second second	ing-good and good and	And provided by the second				
rt 30 es BW	MHz ≬100	kHz		#VBW	300 kHz			S Sweep 2.38	top 25.00 <b>Gi</b> 36 s (1001 pi
N N N	TRC SCL 1 f 1 f 1 f 1 f		* 2.402 GHz 2.502 GHz 4.799 GHz 23.976 GHz	V 0.169 dE -50.412 dE -49.338 dE -48.498 dE	lm Im	FUNCTION W	ADTH	FUNCTION VAL	UE
									>

### 00 CH

39	CH
00	OIT

RL	RF	50 Q AC		9	SENSE:INT	A	LIGNAUTO			7 PM Aug 03, 2
enter F	req ′	12.515000	PN	IO: Fast 😱 Jain:Low	Trig: Free Ri #Atten: 30 di		Avg Type:	Log-Pwr	1	TYPE MWAAA DET P P P P
dB/div		Offset 0.5 dB 10.51 dBn								.452 GI .507 dB
g	(	1								
19										-15.76
.5										
5										
.5		.2			3					1
5		Ø <sup>-</sup>		Y					the manual and	- and and a starter
	-	window window	والمحمد والمعالمة والمعالمة وساعاتهم	manun	and a second and a second second	happen and have	man	ananakana pana sa ka	human	
5										
5										
5										
art 30 I es BW		kHz		#VB	N 300 kHz			Swe	Stop ep 2.386	o 25.00 G s (1001 p
	RC SCL		×	Y	FUNCT	ION FUNC	TION WIDTH	F	UNCTION VALUE	
N N	1 f 1 f		2.452 GHz 2.527 GHz	0.507 -51.740						
N <sup>1</sup>	1 f 1 f		9.768 GHz	-48.161	dBm					
N	1 1		24.376 GHz	-48.853	авт					



## 78 CH

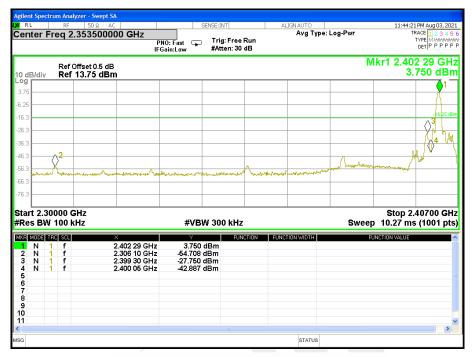
	0.5	0004000.001			14-50-50 PM A 00, 00
RL RF 50 Ω Inter Freg 12.5150		SENSE:INT	AL	IGNAUTO Avg Type: Log-Pv	11:50:53 PM Aug 03, 20
iller Frey 12.3130	PN		ee Run		TYPE M WAARAA DET P P P P
	IFG	ain:Low #Atten:	30 dB		DETIPPPP
Ref Offset 0.5	i dB				Mkr1 2.477 GH
dB/div Ref 13.83 c					3.828 dB
<sup>0</sup> 1					
33					
7					
2					-15.31 c
2					
2					
2 <b>2</b>		$\bigcirc$			
TK ß				a serie a star bar	mader and the second a
2 Longeneral monteriore	normandermandre	mound when and when when	un the man should be	March Harrison and Charlow and	
2					
2					
					Stop 25.00 Gl
		#VDW 200 k			
art 30 MHz es BW 100 kHz		#VBW 300 k			• • •
es BW 100 kHz	×	Y		ION WIDTH	Sweep 2.386 s (1001 pt
es BW 100 kHz Mode TRC SCL	2.477 GHz			ION WIDTH	•
es BW 100 kHz N 1 f N 1 f N 1 f	2.477 GHz 2.502 GHz 9.918 GHz	3.828 dBm -47.509 dBm -46.012 dBm		ION WIDTH	•
es BW 100 kHz MODE TRC SCL N 1 f N 1 f	2.477 GHz 2.502 GHz	3.828 dBm -47.509 dBm		ION WIDTH	• • •
es BW 100 kHz N 1 f N 1 f N 1 f	2.477 GHz 2.502 GHz 9.918 GHz	3.828 dBm -47.509 dBm -46.012 dBm		ION WIDTH	•
es BW 100 kHz N 1 f N 1 f N 1 f	2.477 GHz 2.502 GHz 9.918 GHz	3.828 dBm -47.509 dBm -46.012 dBm		ION WIDTH	•
es BW 100 kHz N 1 f N 1 f N 1 f	2.477 GHz 2.502 GHz 9.918 GHz	3.828 dBm -47.509 dBm -46.012 dBm		ION WIDTH	•
es BW 100 kHz N 1 f N 1 f N 1 f	2.477 GHz 2.502 GHz 9.918 GHz	3.828 dBm -47.509 dBm -46.012 dBm		ION WIDTH	• • •
es BW 100 kHz N 1 f N 1 f N 1 f	2.477 GHz 2.502 GHz 9.918 GHz	3.828 dBm -47.509 dBm -46.012 dBm		ION WIDTH	Sweep 2.386 s (1001 pt



Shenzhen STS Test Services Co., Ltd.



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



#### 00 CH

39 CH





## 78 CH

RL R	nalyzer - Swept S/ F 50 Ω AC		9	NSE:INT	ALIGNAUTO		11:50	:23 PM Aug 03, 20
	2.4875000	00 GHz	NO: Fast Gain:Low	Trig: Free Run #Atten: 30 dB		be: Log-Pwr	11:50	TRACE 1 2 3 4 TYPE MWWW DET P P P P
dB/div Re	ef Offset 0.5 dB ef 14.69 dBn					N	/kr1 2.47 2	9 950 GH I.693 dB
9 		1 /~						
3								-15.31 c
3	m. M	- Vm	$\wedge$	- 2				
3	- W	have	when a	hand				
3				W Cr. Where	and a second	por house of	and the second sec	n n n n n n n n n n n n n n n n n n n
3								
art 2.47500 es BW 100			#VBW	/ 300 kHz		Swe	Stop: ep 2.400 m	2.50000 G ns (1001 p
MODE TRC SC N 1 f N 1 f N 1 f N 1 f	2.	× .479 950 GHz .483 500 GHz .486 925 GHz .493 000 GHz	4.693 d -37.583 d -43.940 d -51.701 d	Bm Bm	FUNCTION WIDTH		FUNCTION VALUE	
					STATUS			



Shenzhen STS Test Services Co., Ltd.

Page 43 of 75 Report No.: STS2107185W01



## For Hopping Band edge

### $\pi/4$ -DQPSK

RL	rum Analyz RF	e <mark>r - Swept S/</mark> 50 Ω AC			SENSE:	INT	AI	IGNAUTO		12:02:01	. AM Aug 04, 203
		5150000		PNO: Fas IFGain:Lo	E GP Iri	g: Free Run tten: 30 dB		Avg Type:	Log-Pwr	TF	ACE 1 2 3 4 5 TYPE MWWWW DET P P P P
dB/div		set0.5 dB 1.81 dBm	1						. M	kr1 2.402 1.	073 GH 813 dBr
81											
19											-18.19 d
.2											-16.13 0
.2										^2	, Mr
2				<u> </u>					- MAN	mont	what
2 alterative	when the	hannal	nother	allhalm	withing	Munny	www.	www.	nn Inn		
.2				_							
.2											
	0000 GH 100 kH				#VBW 30	0 kHz		^	Swee	Stop 2. p 9.867 ms	40300 GH (1001 pt
R MODE T			×		Y 1 0 1 0 1 B	FUNCTION	FUNC	TION WIDTH		FUNCTION VALUE	
N N N		2.	402 073 GH 390 022 GH 400 013 GH	z -4	1.813 dBm 6.714 dBm 2.959 dBm						
i i											
											>

	RF	50 Ω AC			SENSE:INT		ALIGN AU	ro   g Type: Lo			12 AM Aug 04, 20 TRACE 1 2 3 4
ter Fi	req 2.	4895000	I	PNO: Fast 🖵 Gain:Low	Trig: Fr #Atten:		Avi	д туре: со	g-rwr		TYPE MWAAAAA DET P P P P
IB/div		)ffset 0.5 dB 14.62 dBn							MI		9 273 GH .616 dB
	~										
	7										
<u> </u>											-15.38 d
	- 7	m .	2								
		high	1 Min	$\bigcirc^3$							
			1 March	man	m	- Marvin	mym	man	marsh	and a second	- mon - how
L	0000										
rt 2.47 es BW				#VB	W 300 ki	lz			Swee	ວ 2.067 m	2.50000 GH Is (1001 pt
MODE TH			x	Y		UNCTION	FUNCTION WI	отн	;	UNCTION VALUE	
N 1 N 1	f		.479 273 GHz .483 515 GHz	-38.481							
N 1	f	2	.486 896 GHz	-44.008	dBm						



Page 44 of 75 Report No.: STS2107185W01

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

# 00 CH

		nalyzer - Swe							
RL	Fred		AC 00000 GHz	S	ENSE:INT	ALIGNAUTO Avg Type	: Loa-Pwr		AM Aug 04, 202 ACE 1 2 3 4 5
TILOT	1104	12.3130	Р	NO: Fast 🖵 Gain:Low	Trig: Free Run #Atten: 30 dB		<b></b>	Т	VPE MWWWW DET P P P P F
dB/div		f Offset 0.5 ef 9.40 di						Mkr1 2. -0.6	402 GH 601 dBi
60		<b>0</b> 1							
).6									
0.6									-16.12 d
).6									
.6		2	3						
).6		Y				water the sound the second	and and a strate of the state	- And have been	mand
).6		1 million	and a star way and a start of the	addena for the service of the servic	ومرد فالمليم بالمعمر مهاهر إستجماعه	welfing a second second second			
).6									
).6									
	0 MHz W 100	kHz		#VBV	V 300 kHz		Swe	Stop ep 2.386 s	25.00 GH (1001 pt
R MODE	TRC SC	L	× 2.402 GHz	-0.601 (	FUNCTION	FUNCTION WIDTH	F	UNCTION VALUE	
2 N 3 N 4 N	1 f 1 f 1 f		2.502 GHz 4.799 GHz 24.351 GHz	-50.298 ( -47.805 ( -48.347 (	dBm dBm				
5									
3									
) 1									
									>

## 39 CH

BL	pectrun	n Analy:	zer - Swept S	A							
		RF	50 Q AC		SE	INSE:INT	Al	.IGN AUTO			43 AM Aug 04, 2
enter	r Fre	eq 12	.515000		NO: Fast 🖵 Gain:Low	Trig: Free Ru #Atten: 30 dB	n	Avg Type	: Log-Pwr		TYPE MWMMM DET P P P P
0 dB/di			fset 0.5 dB 1.17 dBn								2.452 GH 1.172 dB
.17		<b>(</b> 1									
.83 -											-15.88 (
3.8		-									
1.8											
1.8		Ø	2	$\bigcirc^3$							
			with the second second	www.wooday.ww	and the state of the	-	er abolic and the	and and the second	and the property and the second second	ware for deran	Jan your and and
.8					1						
.8											
art 3 Res B		iz 00 kH	lz		#VBW	/ 300 kHz			Swe	Sto eep 2.386	p 25.00 G s (1001 p
R MOD	e Trc 1	SCL f		× 2.452 GHz	1.172 c	FUNCTIO	IN FUNC	TION WIDTH		FUNCTION VALUE	
	1	f f		2.527 GHz 5.773 GHz	-49.578 d -48.967 d	Bm					
3 N											
N	1	f		25.000 GHz	-49.351 d	Bm					
		f			-49.351 d	Bm					
3 N 4 N 5 7 8		f			-49.351 d	Bm					
3 N		f			-49.351 d	IBm					3



## 78 CH

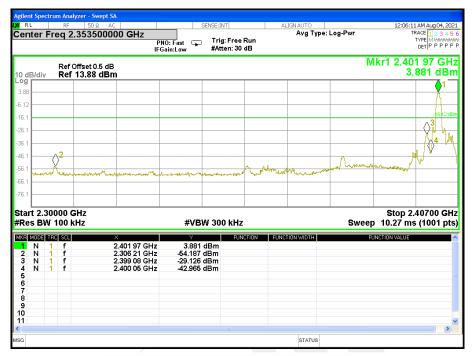
L RF 50.Ω	AC	SENSE:INT		ALIGNAUTO		12:11:40 AM Aug 04, 3
ter Freq 12.5150	000000 GHz		Free Run	Avg Type: Lo	og-Pwr	TRACE 1 2 3
	PN IFG:		n: 30 dB			DETPPP
Ref Offset 0. B/div Ref 12.84					N	/kr1 2.477 G 2.836 dE
1						
						-15.29
		A 3				
2		Q°				/
X X				man and the standard and	طرر مرار میں	mannen
here after and the war	monor the segment of the	man and and and and and and and and and a	warman warman	and the state of t		<u> </u>
rt 30 MHz		#VBW 300	kHz		Sweep	Stop 25.00 G 2.386 s (1001 p
		#4044.300				
S BW 100 kHz	×	Y	FUNCTION FL	INCTION WIDTH	FUNCT	ON VALUE
es BW 100 kHz MODE TRC SQL N 1 f N 1 f	2.477 GHz 2.502 GHz	2.836 dBm -46.922 dBm	FUNCTION FU	INCTION WIDTH	FUNCTI	ON VALUE
es BW 100 kHz Mode Tec SCL N 1 f	2.477 GHz	Y 2.836 dBm	FUNCTION FU	INCTION WIDTH	FUNCTI	ON VALUE
25 BW 100 kHz N 1 f N 1 f N 1 f	2.477 GHz 2.502 GHz 9.918 GHz	2.836 dBm -46.922 dBm -40.884 dBm	Function Fi	INCTION WIDTH	FUNCTI	ON VALUE
es BW 100 kHz N 1 f N 1 f N 1 f	2.477 GHz 2.502 GHz 9.918 GHz	2.836 dBm -46.922 dBm -40.884 dBm	FUNCTION F	INCTION WIDTH	FUNCTI	ON VALUE
es BW 100 kHz N 1 f N 1 f N 1 f	2.477 GHz 2.502 GHz 9.918 GHz	2.836 dBm -46.922 dBm -40.884 dBm	FUNCTION FU	INCTION WIDTH	FUNCT	ON VALUE
25 BW 100 kHz N 1 f N 1 f N 1 f	2.477 GHz 2.502 GHz 9.918 GHz	2.836 dBm .46.922 dBm .40.884 dBm .49.075 dBm	FUNCTION FU	INCTION WIDTH	FUNCT	ON VALUE



Shenzhen STS Test Services Co., Ltd.



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



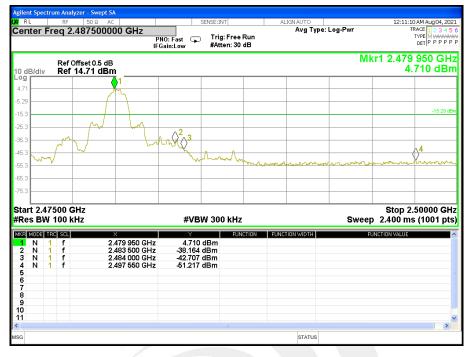
#### 00 CH

39 CH





### 78 CH





Shenzhen STS Test Services Co., Ltd.

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## For Hopping Band edge

8DPSK

ilent Spec R L	trum Ana	<mark>lyzer - Swept SA</mark> 50 Ω AC			SENSE:INT		ALIGN AUTO		12:24:2	7 AM Aug 04, 20
		.35150000	00 GHz	'NO: Fast 🖵 Gain:Low	Talas Farra			e: Log-Pwr	Т	RACE 1 2 3 4 TYPE MWWW DET P P P P
dB/div		Offset 0.5 dB 13.03 dBm	ı					N	1kr1 2.403 3.	000 GH 028 dB
.03										
97										
.0										-16.97 c
.0										N I
									$\langle \rangle^2$	Dala
.0	ton mlu	in weller	manhow	march	madur	mon	manpuna	Wynamed Mary	montante	1000000
.0	-N TWEE					· · · ·				
	0000 ( V 100			#VB	W 300 kHz			Swe	Stop 2 ep 9.867 m	.40300 GI s (1001 pi
R MODE	TRC SCL		< 403 000 GHz	¥ 3.028		CTION	FUNCTION WIDTH		FUNCTION VALUE	
N N	1 f 1 f		390 022 GHz 400 013 GHz	-46.420 -30.788						
1										
					111					
							STATUS			

RACE 1 2 3 4	12:26:3	e: Log-Pwr		T	SENSE: IN		50 Ω AC 8950000	RF	r Erd
DET P P P P				: Free Run en: 30 dB		PN	0930000	9 <b>4</b> 2.4	
105 GI 428 dB	0 Wkr1 2.479 4.	Μ					fset 0.5 dB 4.43 dBm		
									v m
-15.57									
							Δ.		
. 2						۵ <mark>2</mark>			
						Maria	m		
and a grand	My Marine	Margar and	and have been	Angen Annum	Marken Marken	W W			
.50000 G	Stop 2							00 GH	
s (1001 p	eep 2.067 m	Swee		) kHz	#VBW 300		Z	00 kH	3W 1
	FUNCTION VALUE		FUNCTION WIDTH	FUNCTION	⊻ 4.428 dBm	× 479 105 GHz	>	SCL f	DE TRC
					-38.786 dBm	.483 515 GHz	2.4	f	1
					-44.165 dBm	.498 257 GHz	2.4	f	1
>									



## 5. NUMBER OF HOPPING CHANNEL

5.1 LIMIT

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

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

### 5.2 TEST PROCEDURE

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



## 5.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



### 5.5 TEST RESULTS

Temperature:	<b>25</b> ℃	Relative Humidity:	60%
Test Mode:	Hopping Mode -GFSK Mode	Test Voltage:	DC 3.7V

## Number of Hopping Channel

#### 79

## Hopping channel

RL			AC		SENSE:INT	AL	IGNAUTO			4PM Aug 03, 20
enter	Freq	2.441750	F	PNO: Fast 🕞 Gain:Low	Trig: Free #Atten: 30	Run dB	Avg Type:	Log-Pwr		RACE 1 2 3 4 TYPE MWAAAA DET P P P P
) dB/di		ef Offset 0.5 d ef 14.93 dB						Mkr2	2.480 0	76 5 GF 4.93 dBi
.93	)¹ VVVV	mmm	www	mmmm	mmm		www	www	VYYYYYYY	
.07										
5.1										h
5.1										
5.1										
5.1									<b>0</b> 4 0	10050 01
	40000 W 300			#VB	W 300 kHz			Sweep	1.133 m	.48350 GI s (1001 pi
1 N	TRC SC 1 f	2.	× 402 087 5 GHz		dBm	CTION FUNC	TION WIDTH	FL	NCTION VALUE	
2 N 3 4	1 f	2.	480 076 5 GHz	4.93	dBm					
5 6 7										
8 9										
0										>
з							STATUS			

Shenzhen STS Test Services Co., Ltd.

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## 6. AVERAGE TIME OF OCCUPANCY

### 6.1 LIMIT

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

#### 6.2 TEST PROCEDURE

- a. The transmitter output (antenna port) was connected to the spectrum analyzer.
- b. Set RBW =1MHz/VBW =3MHz.
- c. Use a video trigger with the trigger level set to enable triggering only on full pulses.
- d. Sweep Time is more than once pulse time.
- Set the center frequency on any frequency would be measure and set the frequency span to e. zero span.
- f. Measure the maximum time duration of one single pulse.
- g. Set the EUT for DH5, DH3 and DH1 packet transmitting.
- h. Measure the maximum time duration of one single pulse.
- i. DH5 Packet permit maximum 1600/ 79 / 6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is  $3.37 \times 31.6 = 106.6$ .
- j. DH3 Packet permit maximum 1600 / 79 / 4 = 5.06 hops per second in each channel (3 time slots RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is  $5.06 \times 31.6 = 160$ .
- k. DH1 Packet permit maximum 1600 / 79 / 2 = 10.12 hops per second in each channel (1 time slot RX, 1 time slot TX). So the number of pulses in the observation period of 31.6 seconds is 10.12 x 31.6 = 320.

6.3 TEST SETUP



#### 6.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



## 6.5 TEST RESULTS

Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps)-DH1/DH3/DH5	Test Voltage:	DC 3.7V

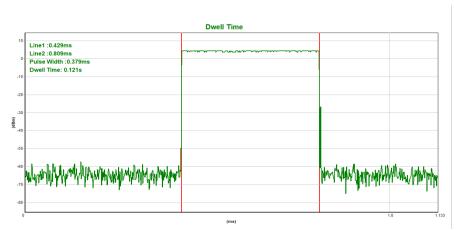
Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
DH1	middle	0.379	0.121	0.4
DH3	middle	1.638	0.262	0.4
DH5	middle	2.885	0.308	0.4



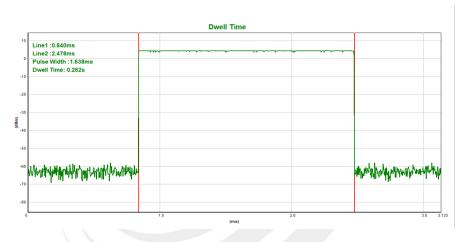
П



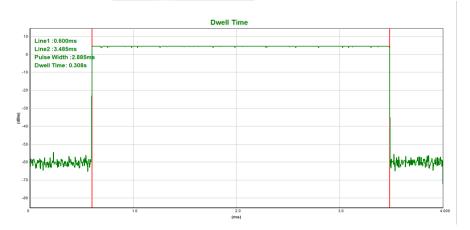
### CH39-DH1



### CH39-DH3







Shenzhen STS Test Services Co., Ltd.



Page 54 of 75 Report No.: STS2107185W01

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

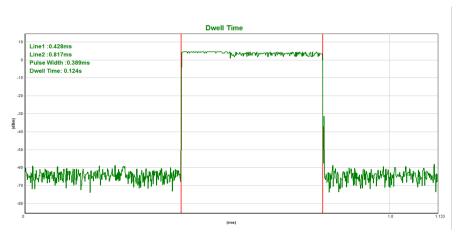
Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
2DH1	middle	0.389	0.124	0.4
2DH3	middle	1.643	0.263	0.4
2DH5	middle	2.891	0.308	0.4



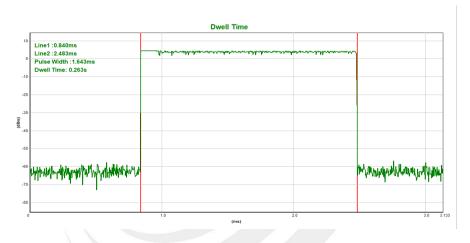
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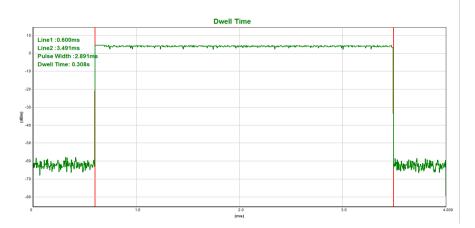
#### CH39-2DH1



### CH39-2DH3



#### CH39-2DH5



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Page 56 of 75 Report No.: STS2107185W01

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

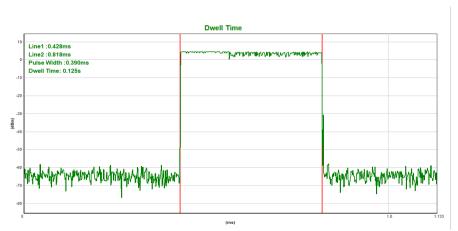
Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
3DH1	middle	0.390	0.125	0.4
3DH3	middle	1.642	0.263	0.4
3DH5	middle	2.893	0.309	0.4



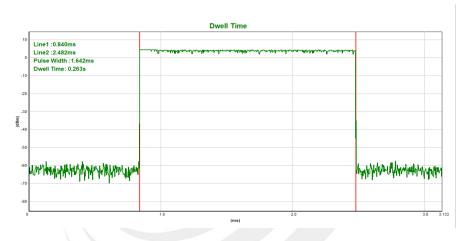
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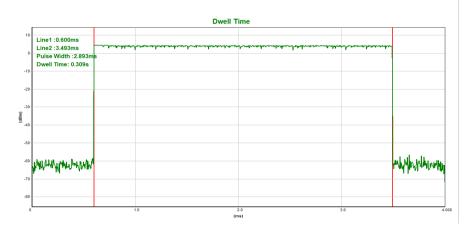
### CH39-3DH1



### CH39-3DH3



#### CH39-3DH5



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#### Report No.: STS2107185W01

## 7. HOPPING CHANNEL SEPARATION MEASUREMEN

7.1 LIMIT

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

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

#### 7.2 TEST PROCEDURE

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

#### 7.3 TEST SETUP



### 7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.



### 7.5 TEST RESULTS

Temperature:	25℃	Relative Humidity:	50%
	CH00 / CH39 / CH78 (GFSK(1Mbps) Mode)	Test Voltage:	DC 3.7V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2402.089	2403.088	0.999	0.952	Complies
2441 MHz	2441.092	2442.112	1.020	0.953	Complies
2480 MHz	2479.089	2480.091	1.002	0.953	Complies

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

### CH00 -1Mbps

RL	RF 50	IQ AC	SENSE:INT	A	LIGNAUTO	11:33:00 PM Aug 03, 20
iter F		500000 GHz	): Wide 🕞 Trig: F	ree Run : 30 dB	Avg Type: Log-Pwr	TRACE 1 2 3 4 TYPE M WWWW DET P P P P
B/div	Ref Offset Ref 11.6				N	/kr2 2.403 088 GF 1.695 dB
			<u>\</u>		2	
<u> </u>			· · ·		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~
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	. 1	/				- my
	$\overline{\nabla}$					
<u> </u>						
	102500 GH 30 kHz	Iz	#VBW 100 H	۲	Swe	Span 3.000 M ep   3.200 ms (1001 pt
MODE TH		× 2.402 089 GHz	Y 1.65 dBm	FUNCTION FUNC	TION WIDTH	FUNCTION VALUE
N 1		2.402 089 GHz 2.403 088 GHz	1.66 dBm 1.70 dBm			
						>

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#### CH39 -1Mbps



### CH78 -1Mbps





Page 61 of 75 Report No.: STS2107185W01

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

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2402.092	2403.091	0.999	0.881	Complies
2441 MHz	2441.095	2442.094	0.999	0.895	Complies
2480 MHz	2479.092	2480.094	1.002	0.893	Complies

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

RL	RF	50 Ω AC			SENSE:INT		ALIGN AUTO		11:55:3	5 PM Aug 03, 202
enter F	req 2.4	025000	00 GHz P	NO: Wide 🍙 Gain:Low	Tulur France F			: Log-Pwr	Т	RACE 1 2 3 4 5 TYPE MWWWW DET P P P P
dB/div		fset 0.5 dB 1.28 dBn						Mł	r2 2.403 1.	091 GH 669 dBr
28				$\sum_{i=1}^{1}$	~			2		
72			$\sim\sim$	$\sim$ $\sim$	1 mm	~~~~	$\sim$	$\sim$ $\sim$	m	
.7									<u> </u>	~~~
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.7										
	402500 30 kHz			#VB	W 100 kHz			Sweep	Span 3.200 ms	3.000 MH s (1001 pt
r Mode t N	RC SCL		× 402 092 GHz	Y 1.60	dBm	TION FU	NCTION WIDTH	FL	INCTION VALUE	
	f		403 091 GHz		dBm					
,   										
3										
)										
										>

### CH00 -2Mbps

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#### CH39 -2Mbps



#### CH78 -2Mbps





Page 63 of 75 Report No.: STS2107185W01

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

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2402.089	2403.088	0.999	0.867	Complies
2441 MHz	2441.092	2442.091	0.999	0.877	Complies
2480 MHz	2479.092	2480.094	1.002	0.879	Complies

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

CH00 -3Mbps

RL RF	50 Ω AC	SENSE:INT	ALIGN AUTO	12:16:25 AM Aug 04, 202
enter Freq 2.4	102500000 GHz PN IFC	0: Wide 🕞 Trig: Free F ain:Low #Atten: 30 d	Avg Type: Log-Pwr Run dB	TRACE 12345 TYPE MWWWM DET P P P P
dB/div Ref 1	fset 0.5 dB 1.66 dBm		Ν	1kr2 2.403 088 GH 1.657 dBr
.66		()1	2	
34		m	m	
3.3				- m
1.3	<u>/</u>			
13 mm				^
.3				
.3				
.3				
.3				
enter 2.402500 Res BW 30 kHz		#VBW 100 kHz	Swe	Span 3.000 MH ep   3.200 ms (1001 pt
R MODE TRC SCL	×		TION FUNCTION WIDTH	FUNCTION VALUE
1 N 1 f 2 N 1 f	2.402 089 GHz 2.403 088 GHz	1.66 dBm 1.66 dBm		
3				
5				
7				
3				
) ) 				

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#### CH39 -3Mbps

RF	50Ω AC		SENSE:INT	ALIGNAUTO	12	:18:17 AM Aug 04
er Freq 2.4	141500000 GHz	PNO: Wide 🖵 IFGain:Low	) Trig: Free Run #Atten: 30 dB	Avg Type: Lo	og-Pwr	TRACE 1 2 3 TYPE MWW DET P P F
Ref Of Idiv Ref 1	ffset 0.5 dB 2.07 dBm				Mkr2 2.4	42 091 0 2.084 d
		1		<u> </u>	2	
		$\sim$	man	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	man	
	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			<u> </u>		m
m						
er 2.441500	CH7				S	pan 3.000 l
BW 30 kHz		#VB	W 100 kHz		Sweep 3.200	
DDE TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VA	LUE
N 1 f N 1 f	2.441 092 0 2.442 091 0		dBm dBm			
N 1 T	2.442 091 0	3HZ 2.08	abm			

#### CH78 -3Mbps



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## 8. BANDWIDTH TEST

## 8.1 LIMIT

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

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

### 8.2 TEST PROCEDURE

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

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

#### 8.3 TEST SETUP



### 8.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.



### **8.5 TEST RESULTS**

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

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	0.9522	PASS
2441 MHz	0.9531	PASS
2480 MHz	0.9529	PASS

#### CH00 -1Mbps

Agilent Spectrun	n Analyzer - Occupied B	N			
XIRL	RF 50 Ω AC			ALIGNAUTO	05:45:26 PM Aug 03, 2021 Radio Std: None
Center Fre	eq 2.402000000	GHz	Center Freq: 2.402000 Trig: Free Run	Avg Hold:>10/10	Radio Sta: None
		#IFGain:Low	#Atten: 30 dB	5.	Radio Device: BTS
10 dB/div Log	Ref 20.00 dBm	<u> </u>			
10.0					
0.00					
-10.0				- market	
-20.0					~
		~~~			The second secon
-30.0	-				
-40.0					
-50.0					~
-60.0					
-70.0					
Center 2.4	02 GHz				Span 2 MHz
#Res BW 3			#VBW 100 k	Hz	Sweep 2.733 ms
Occupi	ied Bandwidt	h	Total Power	11.0 dBm	
occup.		 52.13 kHz			
	8:	52.15 KHZ			
Transmi	it Freq Error	90.263 kHz	OBW Power	99.00 %	
x dB Ba	ndwidth	952.2 kHz	x dB	-20.00 dB	
MSG				STATUS	

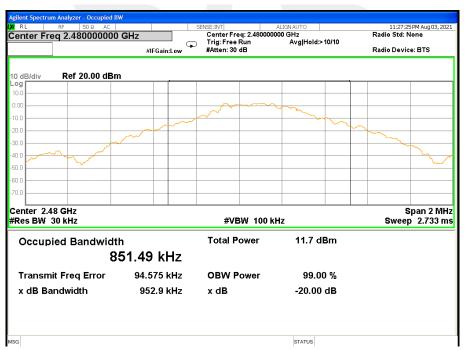
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#### CH39 -1Mbps



#### CH78 -1Mbps



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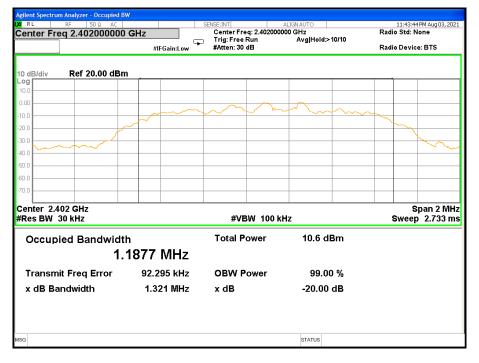


Page 68 of 75 Report No.: STS2107185W01

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	1.321	PASS
2441 MHz	1.343	PASS
2480 MHz	1.339	PASS

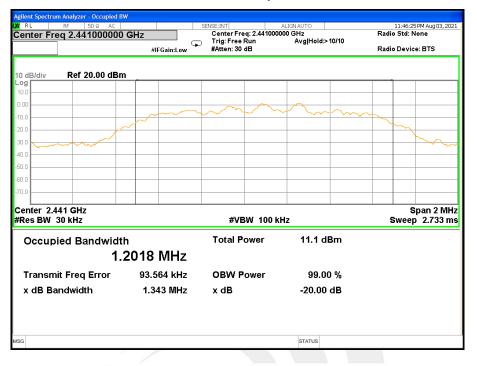
### CH00 -2Mbps



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#### CH39 -2Mbps



#### CH78 -2Mbps



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Page 70 of 75 Report No.: STS2107185W01

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

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.301	PASS
2441 MHz	1.316	PASS
2480 MHz	1.318	PASS

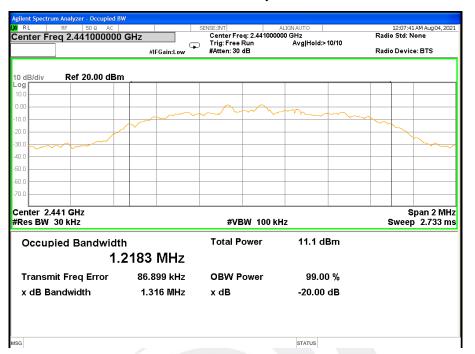
### CH00 -3Mbps

<mark>gilent Spectrum Analyzer - Occupied E</mark> RL RF 50 Ω AC			ALIGNAUTO	12:05:33 AM Aug 04, 2021
enter Freq 2.40200000	) GHz	Center Freq: 2.4020000 Trig: Free Run	000 GHz Avg Hold:>10/10	Radio Std: None
	#IFGain:Low	#Atten: 30 dB		Radio Device: BTS
0 dB/div Ref 20.00 dBr	n			
og				
0.0				
00				
0.0				
.0				
0.0				
).0				
0.0				
enter 2.402 GHz				Span 2 MH:
Res BW 30 kHz		#VBW 100 k	Hz	Sweep 2.733 m
Occupied Bandwidt	th	Total Power	10.6 dBm	
1.	2038 MHz			
Transmit Freq Error	87.154 kHz	OBW Power	99.00 %	
x dB Bandwidth	1.301 MHz	x dB	-20.00 dB	
3			STATUS	

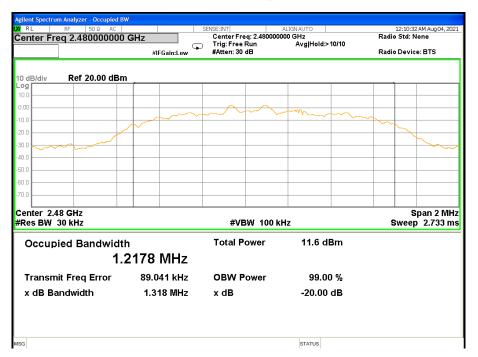
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#### CH39 -3Mbps



CH78 -3Mbps



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# 9. OUTPUT POWER TEST

### 9.1 LIMIT

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

### 9.2 TEST PROCEDURE

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

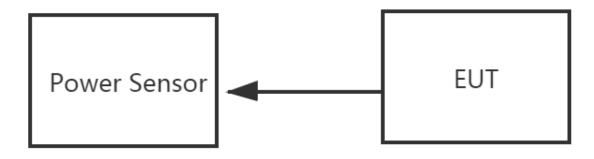
- a) Use the following spectrum analyzer settings:
- 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 2) RBW > 20 dB bandwidth of the emission being measured.
- 3) VBW  $\geq$  RBW.
- 4) Sweep: Auto.
- 5) Detector function: Peak.
- 6) Trace: Max hold.
- b) Allow trace to stabilize.
- c) Use the marker-to-peak function to set the marker to the peak of the emission.
- d) The indicated level is the peak output power, after any corrections for external attenuators and cables.
- e) A plot of the test results and setup description shall be included in the test report.

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

PKPM1 Peak power meter method:

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

9.3 TEST SETUP



### 9.4 EUT OPERATION CONDITIONS

Please refer to section 3.1.4 of this report.

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### 9.5 TEST RESULTS

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

Mode	Channel Frequenc Number (MHz)	Frequency	Peak Power	Average Power	Limit
		(MHz)	(dBm)	(dBm)	(dBm)
GFSK(1M)	0	2402	4.43	3.16	30.00
	39	2441	4.99	3.70	30.00
	78	2480	5.33	4.10	30.00

Note: the channel separation >20dB bandwidth

Mode	Channel Frequenc Number (MHz)	Frequency	Peak Power	Average Power	Limit
		(MHz)	(dBm)	(dBm)	(dBm)
π/4-DQPSK( 2M)	0	2402	4.88	2.02	20.97
	39	2441	5.35	2.76	20.97
	78	2480	5.70	3.08	20.97

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

Mode	Channel Frequency Number (MHz)	Frequency	Peak Power	Average Power	Limit
		(MHz)	(dBm)	(dBm)	(dBm)
8-DPSK(3M)	0	2402	4.98	1.96	20.97
	39	2441	5.45	2.75	20.97
	78	2480	5.80	3.13	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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