

RADIO TEST REPORT

S T S

Report No.: STS2005229W07

Issued for

Chengdu XGIMI Technology Co., Ltd.

Building A4, Tianfu Software Park, High-tech zone, Chengdu, Sichuan, China

Product Name:	LED Projector
Brand Name:	XGIMI
Model Name:	XK13S
Series Model:	XK03S, XK04S, XK05S, XK06S, XK07S, XK08S, XK09S, XK10S, XK11S, XK12S, XK14S, XK15S, XK16S, XK17S, XK18S, XK19S, XK20S, XK21S, XK22S, XK23S, XK24S, XK25S, XK26S, XK27S, XK28S, XK29S, XK30S, XK31S, XK32S
FCC ID:	2AFENXK13S
Test Standard:	FCC Part 15.247

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TEST RESULT CERTIFICATION

Applicant's Name:	Chengdu XGIMI Technology Co., Ltd.
Address	Building A4, Tianfu Software Park, High-tech zone, Chengdu, Sichuan, China
Manufacture's Name:	Chengdu XGIMI Technology Co., Ltd.
Address	Building A4, Tianfu Software Park, High-tech zone, Chengdu, Sichuan, China
Product Description	
Product Name:	LED Projector
Brand Name:	XGIMI
Model Name:	XK13S
Series Model	XK03S, XK04S, XK05S, XK06S, XK07S, XK08S, XK09S, XK10S, XK11S, XK12S, XK14S, XK15S, XK16S, XK17S, XK18S, XK19S, XK20S, XK21S, XK22S, XK23S, XK24S, XK25S, XK26S, XK27S, XK28S, XK29S, XK30S, XK31S, XK32S
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	28 May 2020
Date (s) of performance of tests .:	28 May 2020 ~ 19 June 2020
Date of Issue	19 June 2020

Test Result Pass

Testing Engineer :	Chins cher
	(Chris Chen)
Technical Manager :	Sean She
	(Sean she)
Authorized Signatory :	Motarti Burgo . Notice
	(Vita Li)

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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	19 June 2020	2020 STS2005229W07 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	Lest Item					
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)(iii)	Number of Hopping Frequency	PASS				
15.247(a)(iii)	Dwell Time	PASS				
15.247(a)(1)	Bandwidth	PASS				
15.205	Restricted bands of operation	PASS				
Part 15.247(d)/part 15.209(a)	Band Edge Emission	PASS				
15.203	Antenna Requirement	PASS				

NOTE:

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

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

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1.1 TEST FACTORY

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

1.2 MEASUREMENT UNCERTAINTY

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

No.	Item	Uncertainty
1	RF output power, conducted	±0.68dB
2	Unwanted Emissions, conducted	±2.988dB
3	All emissions, radiated 30-1GHz	±6.7dB
4	All emissions, radiated 1G-6GHz	±5.5dB
5	All emissions, radiated>6G	±5.8dB
6	Conducted Emission (9KHz-150KHz)	±4.43dB
7	Conducted Emission (150KHz-30MHz)	±5dB

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2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF THE EUT

Product Name	LED Projector
Trade Name	XGIMI
Model Name	XK13S
Series Model	XK03S, XK04S, XK05S, XK06S, XK07S, XK08S, XK09S, XK10S, XK11S, XK12S, XK14S, XK15S, XK16S, XK17S, XK18S, XK19S, XK20S, XK21S, XK22S, XK23S, XK24S, XK25S, XK26S, XK27S, XK28S, XK29S, XK30S, XK31S, XK32S
Model Difference	Only the appearance color and model name are different, others are the same.
Channel List	Please refer to the Note 2.
Bluetooth	Frequency:2402 – 2480 MHz Modulation: GFSK(1Mbps), π/4-DQPSK(2Mbps), 8DPSK(3Mbps)
Bluetooth Version	5.0
BR+EDR	BR+EDR
Please see Note 3.	Please refer to the Note 3.
Adapter	Input: 100-240VAC 50/60Hz 1.5A Output: DC 19V,3.42A
Battery	Rated Voltage: 14.4V Charge Limit: 16.8V Capacity: 3100mAh
Hardware version number	V03
Software version number	V1.0.0
Connecting I/O Port(s)	Please refer to the Note 1.

Note:

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





2.

	Channel List						
Channel Frequency (MHz)		i i channei i		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	XGIMI	XK13S	PIFA	N/A	3.49 dBi	BT Antenna



2.2 DESCRIPTION OF THE TEST MODES

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

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

Note:

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

(2) We 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.

(3) The battery is full-charged during the radited and RF conducted test.

For AC Conducted Emission

	Test Case
AC Conducted Emission	Mode 13 : Keeping BT TX

2.3 FREQUENCY HOPPING SYSTEM REQUIREMENTS

(1)Standard and Limit

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

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



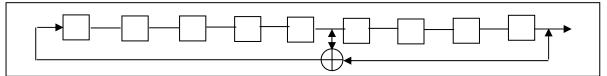
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The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping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

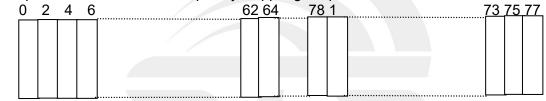
(2)The Pseudorandom sequence may be generated in a nin-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones: i.e. the shift register is initialized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

Numver of shift register stages:9

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



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



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

(3)Frequency Hopping System

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

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

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

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



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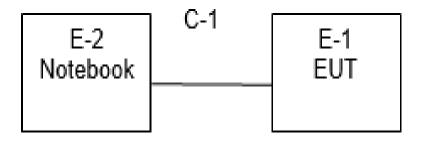
2.4 TABLE OF PARAMETERS OF TEST SOFTWARE SETTING

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

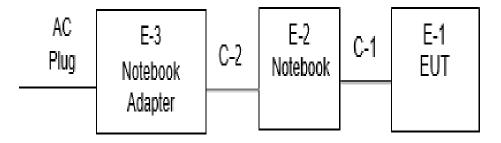
Test software Version	Test program: Bluetooth			
(Power control software) Parameters(1/2/3Mbps)	Power class: DH1 rate:4:27 2DH1 rate:20:54 3DH1 rate:24:83	Power class: DH3 rate:11:183 2DH3 rate:26:367 3DH3 rate:27:552	Power class: DH5 rate:15:339 2DH5 rate:30:679 3DH5 rate:31:1021	

RF Function	Туре	Mode Or Modulation type	Ant Gain(dBi)	Power Class	Software For Testing
		GFSK	3.49	7	
BT	BR+EDR	π/4-DQPSK	3.49	6	Combo_Tool
		8DPSK	3.49	6	

2.5 BLOCK DIGRAM 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.	Serial No.	Note			
N/A	N/A	N/A	N/A	N/A	N/A			

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
E-2	Notebook	Lenovo	ThinkPad E470	N/A	N/A
E-3	Notebook Adapter	HP	HSTNN-CA15	N/A	N/A
C-1	USB Cable	N/A	100cm	N/A	N/A
C-2	DC Cable	N/A	120cm	N/A	N/A

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in ^rLength ^l column.



2.7 EQUIPMENTS LIST

Radiation Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2019.07.29	2020.07.28
Signal Analyzer	Agilent	N9020A	MY51110105	2020.03.05	2021.03.04
Active loop Antenna	ZHINAN	ZN30900C	16035	2018.03.11	2021.03.10
Bilog Antenna	TESEQ	CBL6111D	34678	2017.11.02	2020.11.01
Horn Antenna	SCHWARZBECK	BBHA 9120D(1201)	9120D-1343	2018.10.19	2021.10.18
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2018.03.11	2021.03.10
Pre-Amplifier(0.1M-3G Hz)	EM	EM330	060665	2019.10.09	2020.10.08
Pre-Amplifier (1G-18GHz)	SKET	LNPA-01018G-45	SK201808090 1	2019.10.12	2020.10.11
Pre-Amplifier (18G-40G)	SKET	LNPA_1840-50	SK201810180 1	2019.10.22	2020.10.21
Temperature & Humidity	HH660	Mieo	N/A	2019.10.12	2020.10.11
Turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 RE)			

Conduction Test equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Test Receiver	R&S	ESCI	101427	2019.07.29	2020.07.28
LISN	R&S	ENV216	101242	2019.10.09	2020.10.08
LISN	EMCO	3810/2NM	23625	2019.10.09	2020.10.08
Temperature & Humidity	HH660	Mieo	N/A	2019.10.12	2020.10.11
Test SW	FARAD	EZ-EMC(Ver.STSLAB-03A1 CE)			

RF Connected Test

-					
Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
USB RF power sensor	DARE	RPR3006W	15100041SNO03	2019.10.09	2020.10.08
Signal Analyzer	Agilent	N9020A	MY49100060	2019.10.09	2020.10.08
Temperature & Humidity	HH660	Mieo	N/A	2019.10.12	2020.10.11
Test SW	FARAD		LZ-RF /L	zRf-3A3	

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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) limit in the table below has to be followed.

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

Note:

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

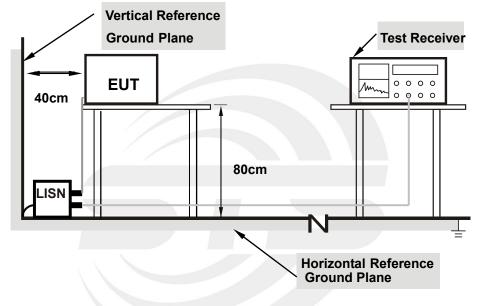
The following table is the setting of the receiver

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



3.1.2 TEST PROCEDURE

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



3.1.3 TEST SETUP

Note: 1.Support units were connected to second LISN. 2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.1.4 EUT OPERATING CONDITIONS

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



3.1.5 TEST RESULT

Temperature:	26.5(C)	Relative Humidity:	65%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	0.1780	32.00	20.23	52.23	64.58	-12.35	QP
2	0.1780	15.20	20.23	35.43	54.58	-19.15	AVG
3	0.3780	23.35	20.55	43.90	58.32	-14.42	QP
4	0.3780	11.30	20.55	31.85	48.32	-16.47	AVG
5	0.9860	16.67	20.16	36.83	56.00	-19.17	QP
6	0.9860	2.56	20.16	22.72	46.00	-23.28	AVG
7	3.0460	19.32	19.98	39.30	56.00	-16.70	QP
8	3.0460	5.87	19.98	25.85	46.00	-20.15	AVG
9	9.5740	16.92	20.11	37.03	60.00	-22.97	QP
10	9.5740	3.01	20.11	23.12	50.00	-26.88	AVG
11	22.7980	11.58	20.59	32.17	60.00	-27.83	QP
12	22.7980	-0.17	20.59	20.42	50.00	-29.58	AVG

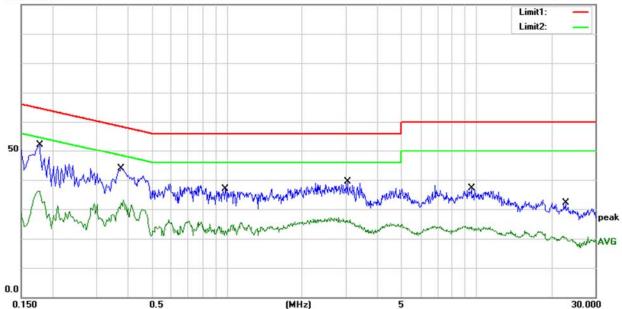
Remark:

1. All readings are Quasi-Peak and Average values

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

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

100.0 dBuV



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Temperature:	26.5(C)	Relative Humidity:	65%RH
Test Voltage:	AC 120V/60Hz	Phase:	Ν
Test Mode:	Mode 13		

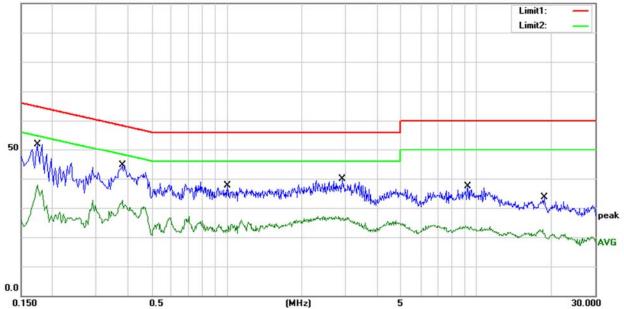
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB)	(dBuV)	(dBuV)	(dB)	
1	0.1740	31.65	20.26	51.91	64.77	-12.86	QP
2	0.1740	15.97	20.26	36.23	54.77	-18.54	AVG
3	0.3820	24.06	20.57	44.63	58.24	-13.61	QP
4	0.3820	11.29	20.57	31.86	48.24	-16.38	AVG
5	1.0060	17.44	20.16	37.60	56.00	-18.40	QP
6	1.0060	3.60	20.16	23.76	46.00	-22.24	AVG
7	2.9140	19.78	20.09	39.87	56.00	-16.13	QP
8	2.9140	6.17	20.09	26.26	46.00	-19.74	AVG
9	9.2700	17.47	19.87	37.34	60.00	-22.66	QP
10	9.2700	2.98	19.87	22.85	50.00	-27.15	AVG
11	18.8180	13.05	20.51	33.56	60.00	-26.44	QP
12	18.8180	0.82	20.51	21.33	50.00	-28.67	AVG

Remark:

1. All readings are Quasi-Peak and Average values

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

100.0 dBuV



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3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS

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

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

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

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

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

Notes:

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

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

LIMITS OF RESTRICTED FREQUENCY BANDS

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

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For Radiated Emission

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

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

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

For Restricted band

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

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

3.2.2 TEST PROCEDURE

- a. The measuring distance 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.

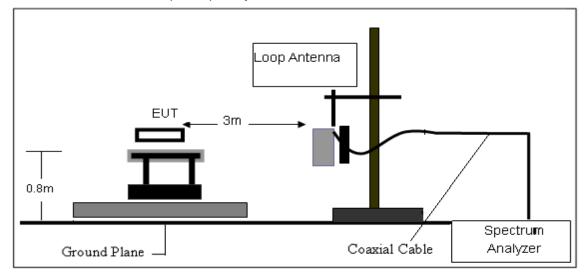
3.2.3 DEVIATION FROM TEST STANDARD

No deviation.

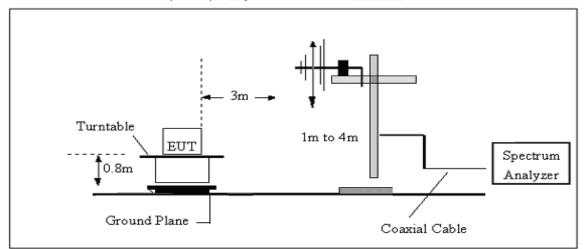


3.2.4 TESTSETUP

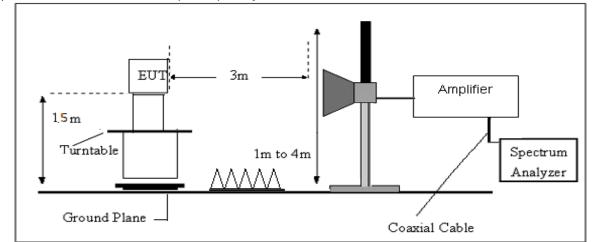
(A) Radiated Emission Test-Up Frequency Below 30MHz



(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 - AG Where 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





3.2.7 TEST RESULTS

(9KHz-30MHz)

Temperature:	23.5(C)	Relative Humidity:	49%RH
Test Voltage:	DC 14.4V	Test Mode:	TX Mode

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

Note:

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

Distance extrapolation factor =40 log (specific distance/test distance)(dB);

Limit line = specific limits (dBuv) + distance extrapolation factor.





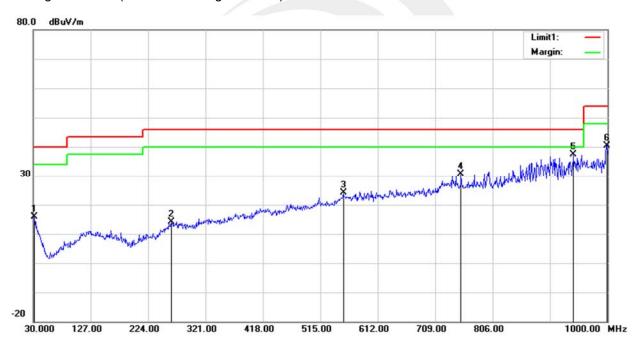
(30MHz-1000MHz)

Temperature:	23.5(C)	Relative Humidity:	49%RH			
Test Voltage:	DC 14.4V	Phase:	Horizontal			
Test Mode:	Mode 1/2/3/4/5/6/7/8/9(Mode 1 worst mode)					

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	31.9400	29.77	-13.86	15.91	40.00	-24.09	QP
2	262.8000	28.82	-14.76	14.06	46.00	-31.94	QP
3	553.8000	29.70	-5.67	24.03	46.00	-21.97	QP
4	752.6500	32.70	-2.16	30.54	46.00	-15.46	QP
5	942.7700	35.90	1.44	37.34	46.00	-8.66	QP
6	999.0300	38.25	2.04	40.29	54.00	-13.71	QP

Remark:

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



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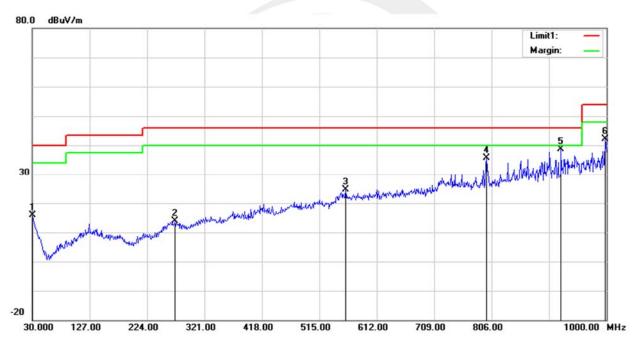


Temperature:	23.5(C)	Relative Humidity:	49%RH
Test Voltage:	DC 14.4V	Phase:	Vertical
Test Mode:	Mode 1/2/3/4/5/6/7/8/9(Mode	1 worst mode)	

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	30.0000	28.71	-12.85	15.86	40.00	-24.14	QP
2	271.5300	29.21	-15.37	13.84	46.00	-32.16	QP
3	559.6200	30.16	-5.50	24.66	46.00	-21.34	QP
4	797.2700	37.72	-2.03	35.69	46.00	-10.31	QP
5	923.3700	38.41	0.18	38.59	46.00	-7.41	QP
6	998.0600	39.98	2.04	42.02	54.00	-11.98	QP

Remark:

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



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(1GHz~25GHz) #Spurious emission Requirements

Frequency	Meter Reading	Amplifier	Loss	Antenna Factor	Orrected Factor	Emission Level	Limits	Margin	Detector	Comment
(MHz)	(dBµV)	(dB)	(dB)	(dB/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	Туре	
				Low Char	nnel (GFSK/24	402 MHz)				
3264.86	61.03	44.70	6.70	28.20	-9.80	51.23	74.00	-22.77	PK	Vertical
3264.86	51.07	44.70	6.70	28.20	-9.80	41.27	54.00	-12.73	AV	Vertical
3264.75	62.13	44.70	6.70	28.20	-9.80	52.33	74.00	-21.67	PK	Horizontal
3264.75	50.20	44.70	6.70	28.20	-9.80	40.40	54.00	-13.60	AV	Horizontal
4804.55	59.48	44.20	9.04	31.60	-3.56	55.92	74.00	-18.08	PK	Vertical
4804.55	50.04	44.20	9.04	31.60	-3.56	46.48	54.00	-7.52	AV	Vertical
4804.49	58.48	44.20	9.04	31.60	-3.56	54.92	74.00	-19.08	PK	Horizontal
4804.49	49.80	44.20	9.04	31.60	-3.56	46.24	54.00	-7.76	AV	Horizontal
5359.81	48.46	44.20	9.86	32.00	-2.34	46.11	74.00	-27.89	PK	Vertical
5359.81	39.38	44.20	9.86	32.00	-2.34	37.04	54.00	-16.96	AV	Vertical
5359.84	48.42	44.20	9.86	32.00	-2.34	46.07	74.00	-27.93	PK	Horizontal
5359.84	39.08	44.20	9.86	32.00	-2.34	36.73	54.00	-17.27	AV	Horizontal
7205.98	54.27	43.50	11.40	35.50	3.40	57.67	74.00	-16.33	PK	Vertical
7205.98	44.80	43.50	11.40	35.50	3.40	48.20	54.00	-5.80	AV	Vertical
7205.90	54.26	43.50	11.40	35.50	3.40	57.66	74.00	-16.34	PK	Horizontal
7205.90	43.69	43.50	11.40	35.50	3.40	47.09	54.00	-6.91	AV	Horizontal
			/	Middle Cha	annel (GFSK/	2441 MHz)			•	
3264.81	61.94	44.70	6.70	28.20	-9.80	52.14	74.00	-21.86	PK	Vertical
3264.81	50.78	44.70	6.70	28.20	-9.80	40.98	54.00	-13.02	AV	Vertical
3264.66	61.86	44.70	6.70	28.20	-9.80	52.06	74.00	-21.94	PK	Horizontal
3264.66	51.30	44.70	6.70	28.20	-9.80	41.50	54.00	-12.50	AV	Horizontal
4882.39	58.71	44.20	9.04	31.60	-3.56	55.15	74.00	-18.85	PK	Vertical
4882.39	49.30	44.20	9.04	31.60	-3.56	45.74	54.00	-8.26	AV	Vertical
4882.32	59.48	44.20	9.04	31.60	-3.56	55.92	74.00	-18.08	PK	Horizontal
4882.32	49.17	44.20	9.04	31.60	-3.56	45.61	54.00	-8.39	AV	Horizontal
5359.74	48.93	44.20	9.86	32.00	-2.34	46.59	74.00	-27.41	PK	Vertical
5359.74	40.31	44.20	9.86	32.00	-2.34	37.96	54.00	-16.04	AV	Vertical
5359.82	47.30	44.20	9.86	32.00	-2.34	44.96	74.00	-29.04	PK	Horizontal
5359.82	38.11	44.20	9.86	32.00	-2.34	35.76	54.00	-18.24	AV	Horizontal
7323.75	54.18	43.50	11.40	35.50	3.40	57.58	74.00	-16.42	PK	Vertical
7323.75	43.85	43.50	11.40	35.50	3.40	47.25	54.00	-6.75	AV	Vertical
7323.80	53.99	43.50	11.40	35.50	3.40	57.39	74.00	-16.61	PK	Horizontal
7323.80	44.96	43.50	11.40	35.50	3.40	48.36	54.00	-5.64	AV	Horizontal



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				High Char	nel (GFSK/	2480 MHz)				
3264.71	60.85	44.70	6.70	28.20	-9.80	51.05	74.00	-22.95	PK	Vertical
3264.71	50.84	44.70	6.70	28.20	-9.80	41.04	54.00	-12.96	AV	Vertical
3264.83	61.13	44.70	6.70	28.20	-9.80	51.33	74.00	-22.67	PK	Horizontal
3264.83	50.82	44.70	6.70	28.20	-9.80	41.02	54.00	-12.98	AV	Horizontal
4960.44	58.80	44.20	9.04	31.60	-3.56	55.24	74.00	-18.76	PK	Vertical
4960.44	49.44	44.20	9.04	31.60	-3.56	45.88	54.00	-8.12	AV	Vertical
4960.37	58.17	44.20	9.04	31.60	-3.56	54.61	74.00	-19.39	PK	Horizontal
4960.37	49.33	44.20	9.04	31.60	-3.56	45.77	54.00	-8.23	AV	Horizontal
5359.81	49.17	44.20	9.86	32.00	-2.34	46.82	74.00	-27.18	PK	Vertical
5359.81	40.16	44.20	9.86	32.00	-2.34	37.82	54.00	-16.18	AV	Vertical
5359.66	47.92	44.20	9.86	32.00	-2.34	45.57	74.00	-28.43	PK	Horizontal
5359.66	38.95	44.20	9.86	32.00	-2.34	36.60	54.00	-17.40	AV	Horizontal
7439.75	54.17	43.50	11.40	35.50	3.40	57.57	74.00	-16.43	PK	Vertical
7439.75	44.33	43.50	11.40	35.50	3.40	47.73	54.00	-6.27	AV	Vertical
7439.72	54.15	43.50	11.40	35.50	3.40	57.55	74.00	-16.45	PK	Horizontal
7439.72	44.14	43.50	11.40	35.50	3.40	47.54	54.00	-6.46	AV	Horizontal

Note:

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

Emission Level = Reading + Factor

3) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency

emission is mainly from the environment noise.



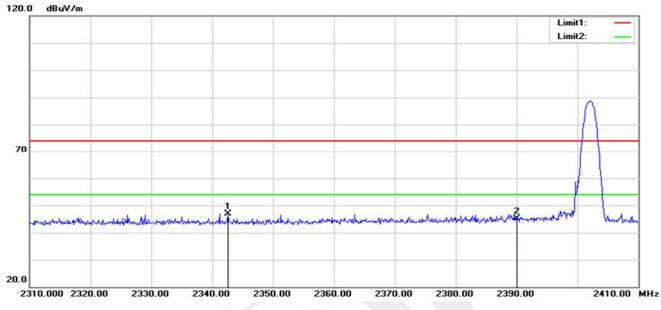
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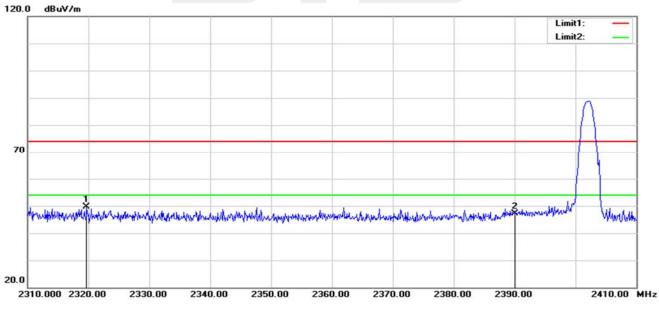
Restricted band Requirements

GFSK-Low Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2342.600	43.16	3.70	46.86	74.00	-27.14	peak
2	2390.000	40.77	4.34	45.11	74.00	-28.89	peak

Vertical



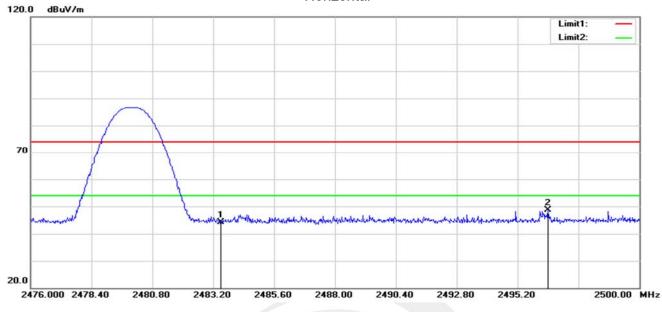
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2319.700	46.10	3.58	49.68	74.00	-24.32	peak
2	2390.000	42.87	4.34	47.21	74.00	-26.79	peak



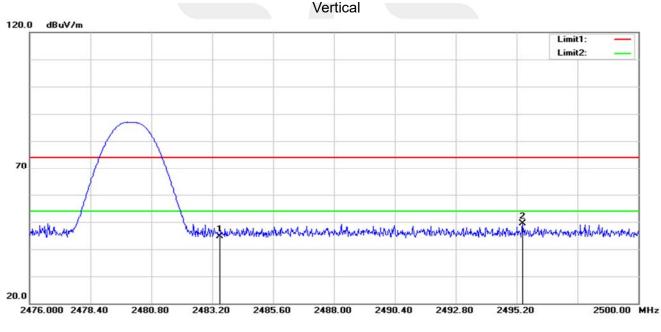
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GFSK-High Horizontal



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	39.55	4.60	44.15	74.00	-29.85	peak
2	2496.400	44.08	4.64	48.72	74.00	-25.28	peak



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	2483.500	40.10	4.60	44.70	74.00	-29.30	peak
2	2495.440	44.74	4.63	49.37	74.00	-24.63	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				
Start/Stan Fraguenay	Lower Band Edge: 2300 – 2407 MHz				
Start/Stop Frequency	Upper Band Edge: 2475 – 2500 MHz				
RB / VB (emission in restricted band)	100 KHz/300 KHz				
Trace-Mode:	Max hold				
For Hopping Band edge					

Spectrum Parameter	Setting				
Detector	Peak				
Start/Stan Fraguenay	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				

4.3 TEST SETUP



The EUT is connected 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.

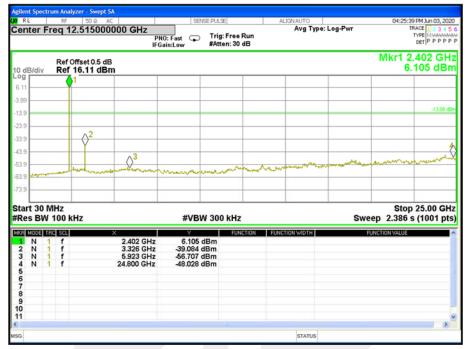
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4.5 TEST RESULTS

Temperature:	25 ℃	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps)-00/39/78 CH	Test Voltage:	DC 14.4V

00 CH



39 CH

		RF	50 Q	AC	SENSE:PULSE		ALIGNAUTO		04:41:03 PM Jun 03, 20
lark	er 1	2.45	2090000	000 GHz PNC		ree Run : 30 dB	Avg Type: Lo	g-Pwr	TRACE 1 2 3 4 TYPE MUMANN DET P P P P
0 dBi	/div		Offset 0.5 d 20.50 dB					N	lkr1 2.452 GF 6.252 dB
^{og}			1						
00									
50 -									-13.25
.5 -									
1.5 -			\Diamond^2						
1.5 -			Ť						0
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	30 N BW	1Hz 100 I	kHz		#VBW 300 F	Hz		Sweep	Stop 25.00 G 2.386 s (1001 p
	nnel Tr	C SCL		×	Y I	FUNCTION	UNCTION WIDTH		ON VALUE
				2.452 GHz 3.326 GHz	6.252 dBm -38.614 dBm				
		f		5.773 GHz 24.326 GHz	-57.130 dBm -47.097 dBm				
		f		5.773 GHz	-57.130 dBm				
		f		5.773 GHz	-57.130 dBm				\$

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78 CH

lent Spectrum Analyzer - Sw							
RL RF 50 Ω enter Freq 12.5150	PNC	SENSE:PULSE Trig: Fre in:Low #Atten:	e Run	ALIGN AUTO Avg Type: l	.og-Pwr	TI	7 PM Jun 03, 20 RACE 1 2 3 4 TYPE MWWW DET P P P P
Ref Offset 0. dB/div Ref_15.28							.477 GH 279 dB
28							
1.7							-14.51 c
1.7 2							
1.7							Q.
1.7 martine	men human	-	mandur	a mart and	Harry Contractory	and and the	mante
1.7							
art 30 MHz Res BW 100 kHz		#VBW 300 kH	łz		Swe	Stop ep 2.386 s	25.00 Gi (1001 p
R MODE TRC SCL N 1 f 2 N 1 f 3 N 1 f 4 N 1 f	X 2.477 GHz 3.326 GHz 5.448 GHz 24.176 GHz	Y 5 5.279 dBm -38.720 dBm -55.758 dBm -47.531 dBm	UNCTION FUI	NCTION WIDTH	FI	UNCTION VALUE	
N 1 f							
24				STATUS			



Shenzhen STS Test Services Co., Ltd.



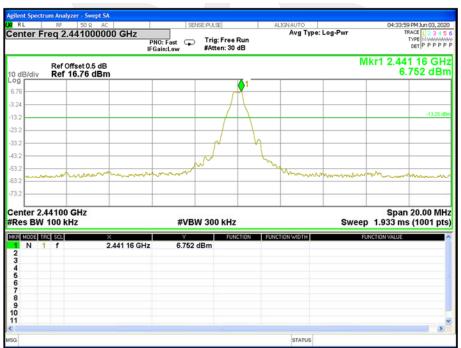


For Band edge(it's also the reference level for conducted spurious emission)

RL	RF 50	Ω AC	SENSE:PUL	SE	ALIGNAUTO		04:25:09 PM Jun 03, 20
enter F	req 2.3535	00000 GHz PN IFG	D: Fast 🖵 Tris ain:Low #At	g: Free Run ten: 30 dB	Avg Type	Log-Pwr	TYPE MUMM DET P P P
dB/div	Ref Offset 0 Ref 16.92					М	kr1 2.402 19 GH 6.917 dB
92							∮ 1
08							
ĩ							-1308
1							
1							
1							4
.1			2				Q ³ Y
1	-		- Interesting	monum	and the second second second	A approximate	and the state of t
1							
	000 GHz 100 kHz		#VBW 30	0 kHz		Sweep	Stop 2.40700 G 10.27 ms (1001 p
N 1	RC SCL	× 2.402 19 GHz	Y 6,917 dBm	FUNCTION	FUNCTION WIDTH	FU	ICTION VALUE
N 1 N 1	f f f	2.336 27 GHz 2.397 69 GHz 2.400 05 GHz	-58.186 dBm -55.525 dBm -48.875 dBm				

00 CH

39 CH





78 CH

lent Spectrum Analyzer - Swept SA			
	NO: Fast Fast Additional Sense: PULSE Trig: Free Run #Atten: 30 dB	ALIGNAUTO Avg Type: Log-Pwr	04:43:26 PM Jun 03, 20 TRACE 1 2 3 4 5 TYPE MUMUM DET P P P F
Ref Offset 0.5 dB dB/div Ref 15.49 dBm		N	kr1 2.479 850 GH 5.488 dBr
49			
51			-14.51 d
.5			
.5			
5 mmmmmm		manna 4	marine marine marine
5			
art 2.47500 GHz es BW 100 kHz	#VBW 300 kHz	Swee	Stop 2.50000 GF p 2.400 ms (1001 pt
N 1 f 2.479 850 GHz N 1 f 2.483 500 GHz N 1 f 2.483 500 GHz N 1 f 2.486 375 GHz N 1 f 2.491 725 GHz	5,489 dBm -57,418 dBm -56,865 dBm -57,052 dBm	FUNCTION WIDTH	FUNCTION VALUE
			>
		STATUS	



Shenzhen STS Test Services Co., Ltd.

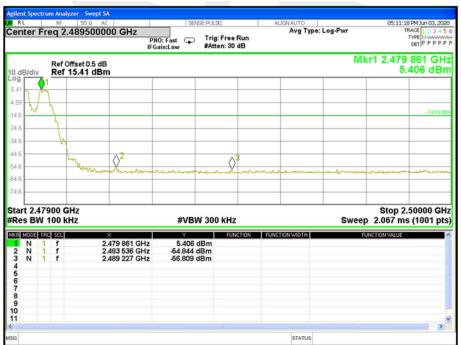


For Hopping Band edge

00 CH

		ctrur	n Anal	lyzer - Swept SA									
UXU R			RF	50 Q AC			SENSE:PULS	Æ	ALI	IGNAUTO			PM Jun 03, 2020
Cen	ter	Fre	eq 2	.351500000 (PN	10: Fast Sain:Low		: Free Run en: 30 dB		Avg Type:	Log-Pwr		ACE 123456 TYPE MUMMMM DET PPPPPP
	B/div			Offset 0.5 dB 17.05 dBm							М	kr1 2.402 7.	176 GHz 051 dBm
Log 7.05													
-2.95							_						A
-13.0	\vdash												-12.95 dBm
-23.0	\vdash						_						
-33.0	\vdash												
-43.0	\vdash												$\langle \rangle^3$
-53.0							manne	man			mmagan	man	unnul
-63.0 -73.0													
Stai #Re	t 2.3 s BV					#\	/BW 300) kHz			Swee	Stop 2. p 9.867 ms	40300 GHz (1001 pts)
MKR	MODE	TRC	SCL	×		١		FUNCTION	FUNCT	ION WIDTH		FUNCTION VALUE	~
1 2 3	NNN	1 1 1	f f f	2.390	176 GHz 022 GHz 910 GHz	-59.1	51 dBm 94 dBm 46 dBm						
4 5 6 7 8 9													
7													
9 10													
10													~
MSG										STATUS			

78 CH



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Page 37 of 73 Report No.: STS2005229W07

Temperature:	25 ℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps)– 00/39/78 CH	Test Voltage:	DC 14.4V

Ref Offset 0.5 d Ref 6.28 dBn	PN0 IFGa	D: Fast Trig: I in:Low #Atter	Free Run n: 30 dB	Avg Type: Log-Pwr	TRACE TYPE DET
	IFGa		n: 30 dB		DET
	IB.				
					Mkr1 2.40
<u> </u>					-0.81
V 1					
	3				
and and and a second	undana and	and a Man with all	when the	and and the man and the	and the second s
V 100 kHz TRC SCL 1 f 1 f 1 f 1 f	X 2.402 GHz 3.326 GHz 5.898 GHz 24.451 GHz	#VBW 300 -0.817 dBm -42.320 dBm -55.868 dBm -47.297 dBm		SUNCTION WIDTH	Sweep 2.386's (1) FUNCTION VALUE
				STATUS	

00 CH

39	CH
00	0

	RF	50 Q AC		SENSE:PULS	E	ALIGN AUTO		09:52:5	4 PM Jun 03, 202
enter	Freq ′	12.515000000	PNO	: Fast 😱 Trig n:Low #Atte	: Free Run en: 30 dB	Avg Type	: Log-Pwr	т	TYPE MWWWW DET P P P F
) dB/div		Offset 0.5 dB 5 8.54 dBm							.452 GH 458 dBr
46	(1							
1.5									-17.31 d
1.5									
.5		2							
.5		ΓY	A3						
.5					Anna and	marchan	جاديسه للمسلموس المارادي	warmouth was	and and a second second
.5		and a state of the	mara million	mannah	Area Latter				
.5								-	-
5									
art 30	MHz							Stor	25.00 GH
Res BV		kHz		#VBW 300) kHz		Swe	eep 2.386	s (1001 p
R MODE	TRC SCL			Y.	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
N	1 f		.452 GHz .326 GHz	-1.458 dBm -42.153 dBm					
	1 f	7	.471 GHz	-56.222 dBm					
		24	.800 GHz	-47.894 dBm					
N	1 f								
3 N 4 N	1 f								
3 N 4 N 5 7 8	1 f								
3 N 4 N 5	1 f								
NN	1 f								



78 CH

ilent Spectrum An								
enter Freq		000 GHz): Fast in:Low	EPULSE Trig: Free Run #Atten: 30 dB	ALIGNAUTO Avg Typ	pe: Log-Pwr		19 PM Jun 03, 20 TRACE 1 2 3 4 1 TYPE WWWWW DET P P P P
	Offset 0.5 dB f 9.20 dBm							2.477 GH 2.34 dBi
80	^ 1							
0.8								-18.55 d
).8								
								0
0.8 0.8	\mathcal{A}^2	1 and 3		us man	here have been and the	unaman	a the second white	mit mark
0.8 0.8				dates h			-	
0.8								
art 30 MHz Res BW 100	kHz		#VBW	300 kHz		Sw	Stop veep 2.386	o 25.00 GH s (1001 pt
R MODE TRC SCL N 1 f 2 N 1 f		× 2.477 GHz 3.151 GHz	-2.34 di -59.28 di		FUNCTION WIDTH		FUNCTION VALUE	
3 N 1 f		7.546 GHz 24.276 GHz	-59.68 di -48.83 di	3m				
4 N 1 f 5 7 8 9								
3 9 0								
								>
					STATUS			100



Shenzhen STS Test Services Co., Ltd.



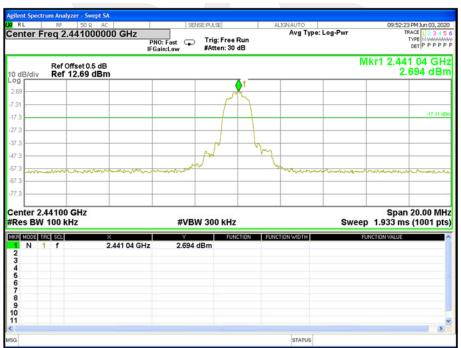


For Band edge(it's also the reference level for conducted spurious emission)

Center Freq 2.353500000 GHz Trig: Free Run If GainLow Avg Type: Log-Pwr Trice Trice Trice PN0: Fast If GainLow Trig: Free Run #Atten: 30 dB Mkr1 2.401 8 3.133 10 dB/div Ref 0ffset 0.5 dB Mkr1 2.401 8 3.133 313									er - Swept SA		ctrur		
Trig: Free Run #Atten: 30 dB Trig: Free Run #Atten: 30 dB Mkr1 2.4018 3.13: 10 dB/div 10 d	-		aul an Pur			SE:PULSE	SEP		50 Q AC	RF	-		
100 dB/div Ref 13.13 dBm 3.13 1313 313 313 6.67 3.13 169 3.13 369 3.13 369 3.13 369 3.13 369 3.13 369 3.13 369 3.13 369 3.13 369 3.13 369 3.13 369 3.13 369 3.13 369 3.13 369 3.13 3769 3.13 380 3.13 380 3.13 380 3.13 399 3.13 3100 GR 10.2 3110 1.1 3111 1.1 11 1.1 12 2.11 48 GHz 58.420 dBm 3 1.1 1.1 11 1.1 1.2.319 GHz 53.921 dBm 12 1.1 1.1 1.1 1.1 12.400 05 GHz 53.921 dBm 1.1 <th>CE 1 2 3 4 5 PE MUMMM ET P P P P P</th> <th>TYP</th> <th>e: Log-Pwr</th> <th>Avg Type.</th> <th></th> <th></th> <th>0:Fast 🖵 ain:Low</th> <th>PN</th> <th>5350000</th> <th>eq 2.3</th> <th>Fre</th> <th>iter</th> <th>Cer</th>	CE 1 2 3 4 5 PE MUMMM ET P P P P P	TYP	e: Log-Pwr	Avg Type.			0:Fast 🖵 ain:Low	PN	5350000	eq 2.3	Fre	iter	Cer
313 313 <th>86 GH: 33 dBn</th> <th></th> <th>I</th> <th></th> <th></th> <th></th> <th></th> <th>1</th> <th></th> <th></th> <th></th> <th></th> <th></th>	86 GH: 33 dBn		I					1					
6.67	1												-
169 1 1 2 369 369 369 469 369 469 369 569 3133 dBm 57042 dBm 3133 dBm 57042 dBm 319 67 39 8 300 dBm 9 300 dBm	Λ												
26.9 26.9 20.0	-16 87 dB												
46.9 2 46.9 3 66.9 2 4 4 76.9 3 5 5 Start 2.30000 GHz Res BW 100 KHz #VBW 300 KHz Stop 2.407 Sweep 10.27 ms (1) 1 N 1 f 2.401 86 GHz 2.3133 dBm 58.420 dBm 2 N 1 f 2.3133 dBm 58.420 dBm 3 N 1 f 2.307 48 GHz 4.00 05 GHz -57.042 dBm 53.921 dBm 5 6 6 6 6 6 6 7 8 9 9 9 6 6													
66.9 2 2 3 3 4 4 5 7 6 9 7 7 7 7 7 7 7 7 8 9 9 1 7 7 1 7 1 7 1 7 2 3 9 1 1 1 1													36.9
E66 9 Ministry Stop 2.407 Start 2.30000 GHz Stop 2.407 Res BW 100 KHz #VBW 300 KHz Stop 2.407	3/4								- 2				46.9
King King <th< td=""><td>Ŋ Ĺ</td><td>Q</td><td>an di sa man kata kata kat</td><td>the of each starts</td><td>a bat astron</td><td></td><td></td><td>allow and it are</td><td>$\langle \rangle^2$</td><td>_</td><td></td><td></td><td>56.9</td></th<>	Ŋ Ĺ	Q	an di sa man kata kata kat	the of each starts	a bat astron			allow and it are	$\langle \rangle^2$	_			56.9
Start 2.30000 GHz #VBW 300 kHz Stop 2.407 Res BW 100 kHz #VBW 300 kHz Sweep 10.27 ms (11) N 1 f 2.401 86 GHz 3.133 dBm 2 N 1 f 2.314 98 GHz -58.420 dBm 3 N 1 f 2.300 05 GHz -53.921 dBm 6 - - 7 - 8 - -									and the second				66.9
KR MODE TRUNCTION FUNCTION FUNC			_										76.9
N 1 f 2.401 86 GHz 3.133 dBm 2 N 1 f 2.314 98 GHz -58.420 dBm 3 N 1 f 2.397 49 GHz -57.042 dBm 4 N 1 f 2.400 05 GHz -53.921 dBm 6 - - - - - 7 - - - - - 8 - - - - -	0700 GH 1001 pts	Stop 2.40 ep 10.27 ms (1	Swee			V 300 kH	#VB\						
2 N 1 f 2.314 98 GHz 58.420 dBm 3 N 1 f 2.397 48 GHz 57.042 dBm 4 N 1 f 2.400 05 GHz 57.042 dBm 5 6 7 8 9		FUNCTION VALUE		TION WIDTH	ION FUN					SCL	TRC		IKR
4 N 1 f 2.400 05 GHz -53.921 dBm 5 6 7 8						Bm	-58.420	2.314 98 GHz	2		1	N	23
5 6 7 8 9											1	N	4
7													6
9													78
													9 10
11													11
50 STATUS	>			STATUS									80

00 CH

39 CH





78 CH

RL	RF	50 Q AC		SEN	ISE:PULSE	ALIGNAUTO		09:49:43 PM Jun 03, 20
nter Fre	eq 2.4	8750000	F	PNO: Fast 😱 Gain:Low	Trig: Free Run #Atten: 30 dB	Avg Type: L	.og-Pwr	TRACE 1 2 3 4 TYPE MWWW DET P P P P
dB/div		set 0.5 dB 1.45 dBm					Mk	r1 2.479 850 GI 1.450 dB
5			1 \					
5								-18.55
5 								
		~	m	A2/13				
mm	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	N	how	and the	Arrow Martine Company	-	·····	manner
6								
rt 2.475 es BW 1				#VBV	V 300 kHz		Sweep	Stop 2.50000 G 2.400 ms (1001 p
MODE TRO	SCL	×		Y	FUNCTION	FUNCTION WIDTH	FU	NCTION VALUE
	f f f	2.4	79 850 GHz 183 500 GHz 184 075 GHz 191 900 GHz	1.450 -59.109 -57.309 -58.358	dBm dBm			



Shenzhen STS Test Services Co., Ltd.

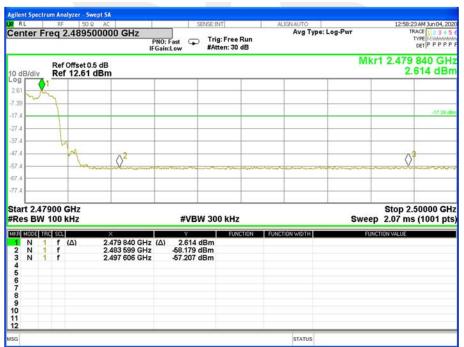


For Hopping Band edge

00 CH

RL	RF			9	ENSE:INT	ALIGNAUTO		3 AM Jun 04, 20
enter F	req	2.35150		NO: Fast 🖵 Gain:Low	Trig: Free Run #Atten: 30 dB	Avg Type: Lo		ACE 2345 TYPE MWWW DET P P P P F
dB/div		Offset 0.5 13.27 d					Mkr1 2.401 3.	867 GH 273 dB
27								
73								-16.73 d
.7								
.7								
.7		-					^2	03
7	and the second	hinadelle	when the second second second second	man	contraction of the second	and a second and a second as a second a	man human hu	mal
6.7								_
art 2.30 Res BW				#VB\	N 300 kHz		Stop 2. Sweep 9.87 ms	40300 GH (1001 pt
R MODE T			×	Y		FUNCTION WIDTH	FUNCTION VALUE	
1 N 2 N 3 N	1 f 1 f	(Δ)	2.401 867 GHz 2.390 022 GHz 2.398 880 GHz	(Δ) 3.273 -59.291 -57.199	dBm			
4 5 7 3 9								
5 9 0								
1								

78 CH



Shenzhen STS Test Services Co., Ltd.

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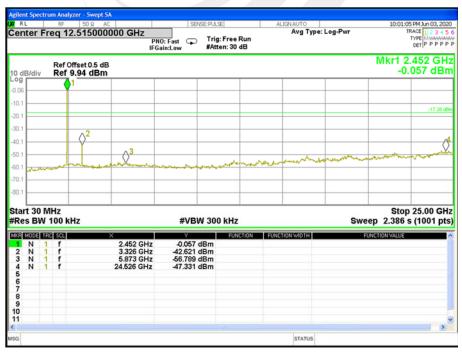
Page 42 of 73 Report No.: STS2005229W07

Temperature:	25 ℃	Relative Humidity:	50%
Test Mode:	8DPSK(3Mbps) -00/39/78 CH	Test Voltage:	DC 14.4V

	RF	50 Q	AC		SENSE:PULSE		AL	IGNAUTO		09	:59:42 PM Jun 03, 20
Fre	eq 1	2.51500						Ауд Тур	e: Log-Pwr		TRACE 1 2 3 4 TYPE WWWWWW DET P P P P
										Mkr	1 2.402 GH -3.11 dB
		1									
	-								_		-16.76 c
					-						-10100
		- 2	.3								\Diamond
		S ²	and and and	Museus	and also double	menter	han	markey	man	mainan	werner
MP	Mot .		_	and here a	ALC PRIMA				-		
	_				-					_	
		Hz		#V	BW 300	kHz			s		top 25.00 G 86 s (1001 p
TRC	_		X 402 CH	Y	1.dDm	FUNCTION	FUNCT	ION WIDTH		FUNCTION VA	LUE
1	f		3.051 GHz	-58.2	28 dBm						
1	f										
											>
) MI W 1	Ref C Ref	Ref Offset 0.5 d Ref 10.23 dE 1 1 MHz N 100 kHz 1 1 1 1 1 1 1 1 1 1 1 1 1	Ref Offset 0.5 dB Ref 10.23 dBm 1 1 1 1 1 1 1 1 1 1 1 1 1	PRO: Fast C IFGain:Low Ref Offset 0.5 dB Ref 10.23 dBm 1 1 MHz N 100 kHz #V 1 f 2.402 GHz 3. 1 1 f 3.051 GHz 4.523 CHz 5.76 4.523 CHz 5.76 5.752 CHz 5.752 5.752 CHz 5.752 5.	PR0: Fast IFGainLow Trig: I Ref Offset 0.5 dB Ref 10.23 dBm 1 1 1 1 1 1 1 1 1 1 1 1 1	PRO: Fast IFGain:Low Trig: Free Run #Atten: 30 dB Ref Offset 0.5 dB Ref 10.23 dBm 1 1 1 2 3 3 4 4 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	PN0: Fast IFGain:Low Trig: Free Run #Atten: 30 dB Ref Offset 0.5 dB Ref 10.23 dBm 1 1 1 2 3 3 4 4 5 4 5 4 5 4 5 4 5 4 5 4 5 4	PRO: Fast IFGain:Low Trig: Free Run #Atten: 30 dB Ref 00ffset 0.5 dB 1 1 1 2 3 3 4 4 4 1 1	PRO: Fast IFGain:Low Trig: Free Run #Atten: 30 dB Ref Offset 0.5 dB Image: Comparison of the second secon	Interference PND: Fast IFGalin:Low Trig: Free Run #Atten: 30 dB Ref 0ffset 0.5 dB Mkr 1 1

00 CH

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78 CH

ilent Spectrum Analyzer -					
RL RF 50 enter Freq 12.51	5000000 GHz	SENSE:PULSE		GN AUTO Avg Type: Log-Pw	
	PN	0: Fast 😱 Trig: Fre ain:Low #Atten: 3			DET P P P F
Ref Offset 0 dB/div Ref 11.3					Mkr1 2.477 GH 1.387 dBr
•g					
.61					
8.6					-18.49 d
3.6	2				
8.6	. 2				
3.6	$\sqrt{3}$		man	and the manufacture	malen and and malanting
3.6					
8.6					
tart 30 MHz Res BW 100 kHz		#VBW 300 kH			Stop 25.00 GH Sweep 2.386 s (1001 pt
R MODE TRC SCL	*			ON WIDTH	FUNCTION VALUE
N 1 f 2 N 1 f 3 N 1 f	2.477 GHz 3.326 GHz 5.723 GHz 24.725 GHz	1.387 dBm -42.066 dBm -56.520 dBm -47.077 dBm			
4 N 1 f 5 6 7 8 9					
0					
1					



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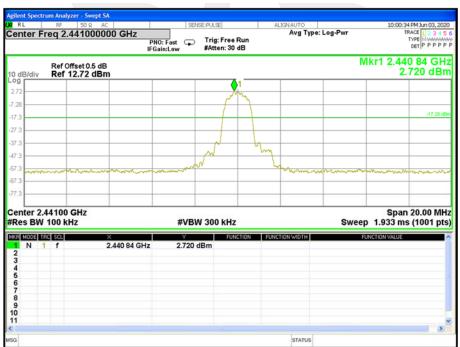


For Band edge(it's also the reference level for conducted spurious emission)

	rum Analyzer - Sw							
RL		AC CLL	SENSE:PULS	E	ALIGNAUTO	e: Log-Pwr		PM Jun 03, 2020
Center F	req 2.35350	PNC		: Free Run en: 30 dB	Avg Type	: Log-Pwr		DET P P P P P
10 dB/div	Ref Offset 0.6 Ref 13.24						0 Wkr1 2.40 3.1	2 08 GH: 242 dBr
3.24								0 1
6.76								
16.8								-16 76 dB
26.8								
6.8								
46.8		2						<mark>∕3</mark> 4 1
56.8	and the second second	man man	Anth-more mana	and and a second s	an man and and and and	monum	- commenter	my h
56.8								
76.8								
	0000 GHz 100 kHz		#VBW 300) kHz		Swee	Stop 2. p 10.27 ms	40700 GH (1001 pts
KR MODE T	RC SCL	×	Y	FUNCTION	FUNCTION WIDTH		FUNCTION VALUE	
1 N 1 2 N 1	1	2.402 08 GHz 2.327 18 GHz	3.242 dBm -58.290 dBm					
3 N 4 N	f	2.399 40 GHz 2.400 05 GHz	-57.080 dBm -52.496 dBm					
5 6								
7 8								
2 N 3 N 4 N 6 7 8 9								
11								2
G					STATUS			1521

00 CH

39 CH





78 CH

L	RF	l yzer - Swept S/ 50 ຄ AC		SE	NSE:PULSE	AL	IGNAUTO			PMJun 03,
ter F	req 2	2.48750000	P	NO: Fast 😱 Gain:Low	Trig: Free Run #Atten: 30 dB		Avg Type:	Log-Pwr		DET P P P
B/div		Offset 0.5 dB 11.51 dBm						М	kr1 2.479 1.	850 G 511 di
			1							
<u> </u>		ſ	<u>}</u>							
										-18.49
		M	m							4
~~~~~	Mature	m	him	-	-	Anna Anna		and and and a second	X	
-										
t 2.47 s BW				#VB	W 300 kHz			Swee	Stop 2. p 2.400 ms	
MODE T			×	Y	FUNCTION	FUNCT	ION WIDTH		FUNCTION VALUE	
	f f f	2.	479 850 GHz 483 500 GHz 489 475 GHz 497 325 GHz	1.511 -59.523 -57.593 -57.716	dBm dBm					
										-



Shenzhen STS Test Services Co., Ltd.





## For Hopping Band edge

00 CH

RL	RF 5	OΩ AC	9	ENSE:INT	ALIGNAUTO	01	1:03:17 AM Jun 04, 20
nter F	req 2.351		PNO: Fast 🗣 FGain:Low	Trig: Free Run #Atten: 30 dB	Avg Type: Lo	g-Pwr	TYPE MWWW DET P P P P
dB/div	Ref Offset Ref 13.4					Mkr1 2.4	02 794 GH 3.436 dB
g 44							
6							
6							-16.56
6							
6							
6							$\wedge^2$
6 min	minementer	and water and a stand of the second	a magning		the stand and the stand of the	where the manufacture is the second	
6							
6							
	0000 GHz 100 kHz		#VBI	W 300 kHz		Sto Sweep 9.87	p 2.40300 G ms (1001 p
MODE T	rice Scl.	×	Y Y	FUNCTION	FUNCTION WIDTH	FUNCTION VAL	UE
ZZZ	1 f (Δ) 1 f 1 f	2.402 794 GHz 2.390 022 GHz 2.399 910 GHz	-58.894	dBm dBm			

78 CH



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# 5. NUMBER OF HOPPING CHANNEL

### 5.1 LIMIT

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

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating FrequencyRange
RB	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

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:	DC 14.4V

# Number of Hopping Channel

#### 79

# Hopping channel

RL RF 50 Q AC	SENSE:PULSE	ALIGNAUTO	05:06:37 PM Jun 03, 202
Center Freq 2.441750000 GHz	NO: Fast Trig: Free I Sain:Low #Atten: 30	Avg Type: Log-Pwr Run dB	TRACE 1 2 3 4 5 TYPE MWWWW DET P P P P P
Ref Offset 0.5 dB 10 dB/div Ref 17.22 dBm		м	kr2 2.480 160 0 GH 5.85 dBn
•9 7.22 7.8		www.www.www.	2 ////////////////////////////////////
12.8			
22.8			
12.8			
2.8			
72.8			
tart 2.40000 GHz Res BW 300 kHz	#VBW 300 kHz	Sw	Stop 2.48350 GH eep 1.133 ms (1001 pt
KR MODE TRC SCL X		CTION FUNCTION WIDTH	FUNCTION VALUE
1 N 1 f 2.402 254 5 GHz 2 N 1 f 2.480 160 0 GHz 3 4	7.04 dBm 5.85 dBm		
5 6 7 8 9 0			
8 9			
11			

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# 6. AVERAGE TIME OF OCCUPANCY

#### 6.1 LIMIT

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

#### 6.2 TEST PROCEDURE

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

#### 6.3 TEST SETUP



#### 6.4 EUT OPERATION CONDITIONS

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



## 6.5 TEST RESULTS

Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps)-DH1/DH3/DH5	Test Voltage:	DC 14.4V

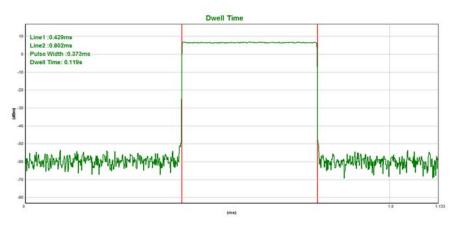
Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
DH1	middle	0.373	0.119	0.4
DH3	middle	1.631	0.261	0.4
DH5	middle	2.876	0.307	0.4



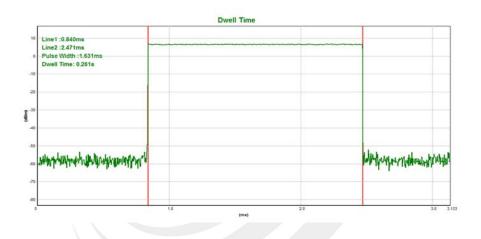
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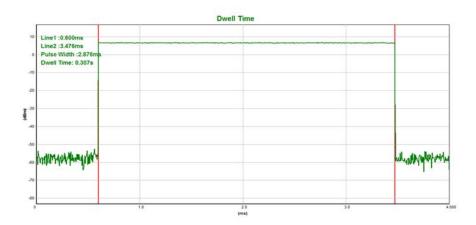
## CH39-DH1



### CH39-DH3







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Temperature:	<b>25</b> ℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps)– 2DH1/2DH3/2DH5	Test Voltage:	DC 14.4V

Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
2DH1	middle	0.380	0.122	0.4
2DH3	middle	1.632	0.261	0.4
2DH5	middle	2.886	0.308	0.4

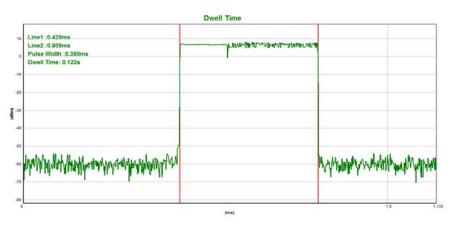


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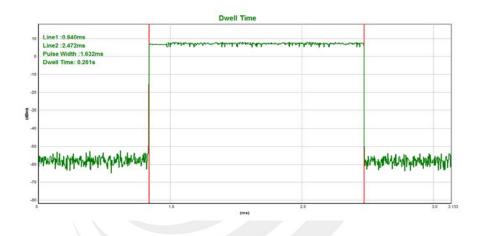


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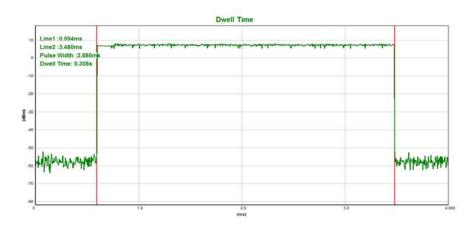
## CH39-2DH1



## CH39-2DH3







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Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Test Mode:	8DPSK(3Mbps)– 3DH1/3DH3/3DH5	Test Voltage:	DC 14.4V

Data Packet	Channel	pulse time(ms)	Dwell Time(s)	Limits(s)
3DH1	middle	0.381	0.122	0.4
3DH3	middle	1.633	0.261	0.4
3DH5	middle	2.888	0.308	0.4



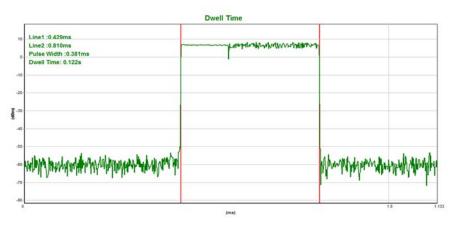
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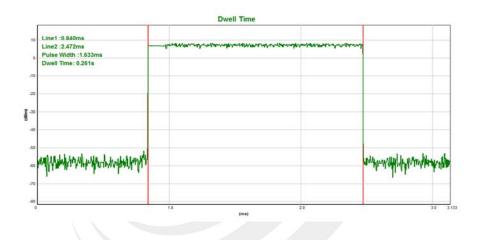


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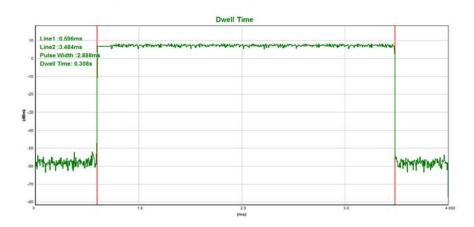
## CH39-3DH1



### CH39-3DH3







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# 7. HOPPING CHANNEL SEPARATION MEASUREMEN

7.1 LIMIT

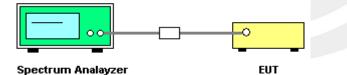
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that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

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

#### 7.2 TEST PROCEDURE

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

#### 7.3 TEST SETUP



## 7.4 EUT OPERATION CONDITIONS

The EUT was programmed to be in continuously transmitting mode.



## 7.5 TEST RESULTS

Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Lest Minde.	CH00 / CH39 / CH78 (GFSK(1Mbps) Mode)	Test Voltage:	DC 14.4V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2401.834	2402.830	0.996	0.889	Complies
2441 MHz	2440.831	2441.830	0.999	0.890	Complies
2480 MHz	2478.828	2479.827	0.999	0.890	Complies

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

### CH00 -1Mbps

RL	RF 50	Ω AC	SENSE:INT	ALIGN AUTO		02:30:35 AM Jun 04, 20
nter F	req 2.4025			Avg Free Run m: 30 dB	Type: Log-Pwr	TYPE MUMMUM DET P P P P F
dB/div	Ref Offset 0 Ref 16.50				Mkr	2 2.402 830 GH 5.185 dBr
50		21	~~~~	2	m	
.5			Z		Z	
5	/					2
5	A					1
5~~	~					m
5						
	402500 GH 30 kHz	z	#VBW 100	kHz	Sweep	Span 3.000 M 3.20 ms (1001 p
NODE T	f (Δ) f	× 2.401 834 GHz(/ 2.402 830 GHz	Δ) 4.63 dBm 5.18 dBm	FUNCTION FUNCTION WIDT	TH FUNC	TION VALUE

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#### CH39 -1Mbps



#### CH78 -1Mbps



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Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Test Mode:	CH00 / CH39 / CH78 (π/4-DQPSK(2Mbps) Mode)	Test Voltage:	DC 14.4V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2401.831	2402.833	1.002	0.841	Complies
2441 MHz	2440.831	2441.833	1.002	0.840	Complies
2480 MHz	2478.825	2479.827	1.002	0.841	Complies

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

RL	RF 50 1	R AC	SENSE:PULS		ALIGNAUTO	05:59	:31 PM Jun 03, 2020
enter F		00000 GHz PNO:	Mide Trig:	Free Run n: 30 dB	Avg Type: Log-Pv		TRACE 1 2 3 4 5 TYPE MWWWW DET P P P P P
0 dB/div	Ref Offset 0 Ref 13.73					Mkr2 2.40	2 833 GH: 5.475 dBn
og 3.73					2		
6.3				$\sim$		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
5.3							
.3 👡							home
5.3							
5.3							
6.3							
	402500 GHz	2	#VBW 100	kHz		Spa Sweep 3.200 n	n 3.000 MH ns (1001 pts
KR MODE T		×	Y	FUNCTION FU	NCTION WIDTH	FUNCTION VALUE	
1 N 2 N 3	1 1	2.401 831 GHz 2.402 833 GHz	5.50 dBm 5.48 dBm				
4							
5 6 7							
9							
0							
							>

#### CH00 -2Mbps

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#### CH39 -2Mbps

RF 50 Q AC	SENSE:PULSE	ALIGNAUTO	06:11:51 PM Jun 0
	): Wide 😱 Trig: Free Run ain:Low #Atten: 30 dB	Avg Type: Log-Pwr	TRACE 1 2 TYPE MH DET P P
Ref Offset 0.5 dB		Mk	r2 2.441 833 5.262
<u></u> 1		2	
man	mmm	m	~~
			~
www.			$\sim$
2.441500 GHz			Span 3.000
SW 30 kHz	#VBW 100 kHz	Sweep	3.200 ms (100
E TRC SCL X		UNCTION WIDTH FU	NCTION VALUE
1 f 2.440 831 GHz 1 f 2.441 833 GHz	5.34 dBm 5.26 dBm		

#### CH78 -2Mbps



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Temperature:	<b>25</b> ℃	Relative Humidity:	50%
Lest Minde.	CH00 / CH39 / CH78 (8DPSK(3Mbps)Mode)	Test Voltage:	DC 14.4V

Frequency	Mark1 Frequency (MHz)	Mark2 Frequency (MHz)	Ch. Separation (MHz)	Limit (MHz)	Result
2402 MHz	2401.825	2402.827	1.002	0.845	Complies
2441 MHz	2440.825	2441.827	1.002	0.845	Complies
2480 MHz	2478.828	2479.827	0.999	0.846	Complies

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

CH00 -3Mbps

RL	RF	50 Q AC	SENSE:P	ULSE	ALIGNAUTO		07:08:47 PM Jun 03, 202
enter F		2500000 GHz	NO: Mide T	rig: Free Run Atten: 30 dB	Avg Type: L	og-Pwr	TRACE 12345 TYPE MWWWW DET P P P P P
dB/div		et 0.5 dB 86 dBm				Mkr2	2.402 827 GH 3.849 dBr
.86		<u></u> 1	0.5.5		2		
14		m		$\sim$	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	$\sim\sim\sim\sim$	
5.1		C					<u> </u>
.1	_/						\
	~~~						$\sim$
a 🚽							
ε 1							
.1							
i.1							
enter 2	402500 0	SH7					Span 3.000 MH
	30 kHz		#VBW 1	00 kHz		Sweep 3.3	200 ms (1001 pt
R MODE T		×	Y		FUNCTION WIDTH	FUNCTIO	N VALUE
	f	2.401 825 GHz 2.402 827 GHz		n n			
3							
5							
3							
0							
							2



CH39 -3Mbps

RF 50 Ω AC	SENSE:PULSE	ALIGNAUTO	07:12:57 PM Jun 03,
	PNO: Wide 🖵 Trig: Free Run FGain:Low #Atten: 30 dB	Avg Type: Log-Pwr	TRACE 1 2 3 TYPE MWW DET P P P
Ref Offset 0.5 dB 3/div Ref 13.43 dBm		MI	(r2 2.441 827 G 3.606 dl
		2	
	m	mmmm	
			m has a second s
mm			\sim
ter 2.441500 GHz			Span 3.000 M
s BW 30 kHz	#VBW 100 kHz	Swee	3.200 ms (1001
NDDE TRC SCL X	Y FUNCTION	FUNCTION WIDTH F	UNCTION VALUE
N 1 f 2.440 825 GHz N 1 f 2.441 827 GHz			
N 1 1 2.441 627 GH	5.61 dBm		
			17
		STATUS	

CH78 -3Mbps



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8. BANDWIDTH TEST

8.1 LIMIT

FCC Part15 15.247,Subpart C					
Section	Test Item	Limit	FrequencyRange (MHz)	Result	
15.247 (a)(1)	Bandwidth	(20dB bandwidth)	2400-2483.5	PASS	

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

8.2 TEST PROCEDURE

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

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

8.3 TEST SETUP

EUT	SPECTRUM
	ANALYZER

8.4 EUT OPERATION CONDITIONS

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



8.5 TEST RESULTS

Temperature:	25 ℃	Relative Humidity:	50%
Test Mode:	GFSK(1Mbps) CH00 / CH39 / C78	Test Voltage:	DC 14.4V

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	0.8887	PASS
2441 MHz	0.8897	PASS
2480 MHz	0.8899	PASS

CH00 -1Mbps

	im Analyzer - Occupied B				
Center Fr	RF 50 R AC eq 2.40200000		Center Freq: 2.402000		04:24:23 PM Jun 03, 2020 Radio Std: None
]	#IFGain:Low	Trig: Free Run #Atten: 30 dB	Avg Hold>10/10	Radio Device: BTS
10 dB/div	Ref 20.00 dBn	n			
Log 10.0					
0.00			\sim		
-10.0					
-20.0		~~~~~		- m	_
-30.0					
-40.0					
-50.0					
-60.0					
-70.0					
Center 2.4 #Res BW			#VBW 100 k		Span 2 MHz Sweep 2.733 ms
#RES DW	30 KH2				Sweep 2.733 IIIS
Occup	ied Bandwidt	h	Total Power	13.5 dBm	
	8	30.76 kHz			
Transm	nit Freq Error	-10.169 kHz	OBW Power	99.00 %	
x dB Ba	andwidth	888.7 kHz	x dB	-20.00 dB	
MSG				STATUS	

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CH39 -1Mbps



CH78 -1Mbps



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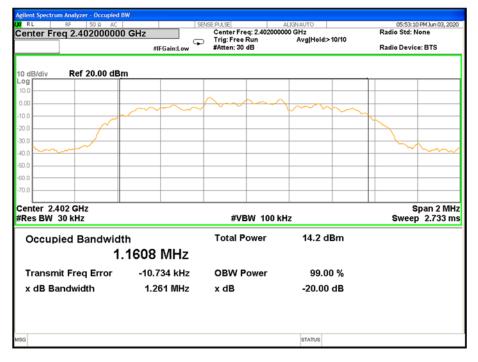


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Temperature:	25 ℃	Relative Humidity:	50%
	π/4-DQPSK(2Mbps) CH00 / CH39 / C78	Test Voltage:	DC 14.4V

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.2610	PASS
2441 MHz	1.2600	PASS
2480 MHz	1.2620	PASS

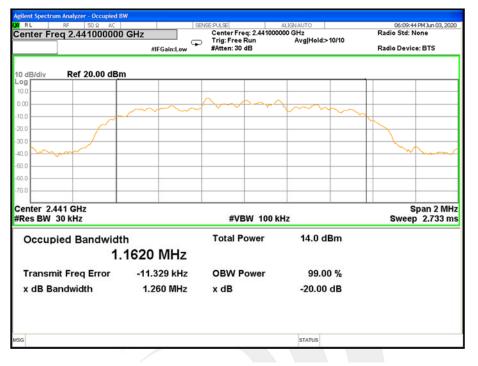
CH00 -2Mbps



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CH39 -2Mbps



CH78 -2Mbps



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Temperature:	25 ℃	Relative Humidity:	50%
	8DPSK(3Mbps) CH00 / CH39 / CH78	Test Voltage:	DC 14.4V

Frequency	20dB Bandwidth (MHz)	Result
2402 MHz	1.2670	PASS
2441 MHz	1.2670	PASS
2480 MHz	1.2690	PASS

CH00 -3Mbps

ilent Spectrum Analyzer - Occupied BV RL RF 50 Ω AC			ALIGNAUTO	07:06:36 PM Jun 03, 2020
enter Freq 2.40200000		Center Freq: 2.4020000 Trig: Free Run	000 GHz Avg Hold:>10/10	Radio Std: None
	#IFGain:Low	#Atten: 30 dB	Avginola>10/10	Radio Device: BTS
dB/div Ref 20.00 dBm	I			
99				
00				
0	$\sim\sim\sim\sim\sim$		man and a second	
0				
0				
enter 2.402 GHz				Span 2 MH
tes BW 30 kHz		#VBW 100 k	Hz	Sweep 2.733 m
Occupied Bandwidth	1	Total Power	13.7 dBm	
	1598 MHz			
Transmit Freq Error	-3.789 kHz	OBW Power	99.00 %	
x dB Bandwidth	1.267 MHz	x dB	-20.00 dB	
			20.00 40	
			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	FrequencyRange (MHz)	Result		
15.247	5.247 Output	1 W or 0.125W				
	Power	if channel separation > 2/3 bandwidthprovided thesystems operatewith an output power no greater than125 mW(20.97dBm)	2400-2483.5	PASS		

9.2 TEST PROCEDURE

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

a) Use the following spectrum analyzer settings:

1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.

2) RBW > 20 dB bandwidth of the emission being measured.

3) VBW \geq RBW.

4) Sweep: Auto.

5) Detector function: Peak.

6) Trace: Max hold.

b) Allow trace to stabilize.

c) Use the marker-to-peak function to set the marker to the peak of the emission.

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

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

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

PKPM1 Peak power meter method:

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

9.3 TEST SETUP

EUT -		Power sensor		PC
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9.4 EUT OPERATION CONDITIONS

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



9.5 TEST RESULTS

Temperature:	25℃	Relative Humidity:	60%
Test Voltage:	DC 14.4V		

Mode Channel Number	Channel	Frequency (MHz)	Peak Power	Average Power	Limit
	Number		(dBm)	(dBm)	(dBm)
GFSK(1M)	0	2402	7.83	5.05	30.00
	39	2441	7.48	4.68	30.00
	78	2480	6.60	3.81	30.00

Note: the channel separation >20dB bandwidth

	Channel	Frequency	Peak Power	Average Power	Limit
	Number	(MHz)	(dBm)	(dBm)	(dBm)
π/4-DQPSK(2M)	0	2402	6.20	0.95	20.97
	39	2441	5.60	0.39	20.97
	78	2480	4.72	-0.46	20.97

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

NIODA	Channel		Peak Power	Average Power	Limit
	Number		(dBm)	(dBm)	(dBm)
	0	2402	6.57	0.96	20.97
8-DPSK(3M)	39	2441	5.97	0.41	20.97
	78	2480	5.12	-0.46	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 PIFA Antenna. It comply with the standard requirement.



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APPENDIX-PHOTOS OF TEST SETUP

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

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



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