FCC TEST REPORT

FOR

Steren Electronics International LLC

Little Wing

Model No.: 750-905-BK-JHE

Additional Model No.: Please refer to page 6

Prepared for Address	:	Steren Electronics International LLC 6920 Carroll RoadSan Diego, CA 92121
Prepared by Address	:	Shenzhen LCS Compliance Testing Laboratory Ltd. 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an
	•	District, Shenzhen, Guangdong, China
Tel	:	(+86)755-82591330
Fax	:	(+86)755-82591332
Web	:	www.LCS-cert.com
Mail	:	webmaster@LCS-cert.com
Data of reasint of test comple		April 05, 2016
		April 05, 2016
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	April 05, 2016 – April 19, 2016
Date of Report	:	May 24, 2016

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FCC TEST REPORT		
FCC CFR 47 PART 15 C(15.247): 2015		
Report Reference No:: LCS1604050231E		
Date of Issue :	April 19, 2016	
Testing Laboratory Name: : Shenzhen LCS Compliance Testing Laboratory Ltd.		
Address :	1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China	
Testing Location/ Procedure :	Full application of Harmonised standards	
	Partial application of Harmonised standards	
	Other standard testing method \Box	
Applicant's Name: :	Steren Electronics International LLC	
Address :	6920 Carroll RoadSan Diego, CA 92121	
Test Specification		
Standard :	FCC CFR 47 PART 15 C(15.247): 2015	
Test Report Form No:	LCSEMC-1.0	
TRF Originator :	Shenzhen LCS Compliance Testing Laboratory Ltd.	
Master TRF:	Dated 2011-03	
	a Laboratory I to All makes record	

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Test Item Description: :	Little Wing
Trade Mark:	N/A
Model/ Type reference :	750-905-BK-JHE
Ratings:	DC 3.7V by battery(600mAh)
Result:	Positive

Compiled by:

Aking lin

Aking Jin/ File administrators

Supervised by:

Glin Lu/ Technique principal

Approved by:

(Jains Ping

Gavin Liang/ Manager

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FCC -- TEST REPORT

Test Report No. : LCS1604050231E

April 19, 2016 Date of issue

Type / Model	: 750-905-BK-JHE
EUT	: Little Wing
Applicant	: Steren Electronics International LLC
	: 6920 Carroll RoadSan Diego, CA 92121
Telephone	:/
Fax	:/
M	· Sharahan Orangen Development Ca. 141
	: Shenzhen Opower Development Co., Ltd
Address	: 6F, I Building, ChengDexuan Science and Technology Park, The
	Second Industrial City, LiSonglang Community, GongMing,
	GuangMing New District, ShenZhen, China.
Telephone	
Fax	:/
Factory	: Shenzhen Opower Development Co., Ltd
Address	
	: Second Industrial City, LiSonglang Community, GongMing,
	GuangMing New District, ShenZhen, China.
Telephone	:/
Fax	:/

Test Result	Positive
The test report merely corresponds to the test sample	

The test report merely corresponds to the test sample. It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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Revision History

Revision	Issue Date	Revisions	Revised By
00	2016-04-19	Initial Issue	Gavin Liang
01	2016-05-24	Change FCC ID	Gavin Liang

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1. GENERAL INFORMATION 1.1 Description of Device (EUT)

EUT	: Little Wing
Model No.	: 750-905-BK-JHE
Frequency Range	: 2.402-2.480GHz
Channel Number	: 79 channels
Channel frequency	: 2402.00-2480.00MHz (Channel Number: 79, Channel Frequency=2402+1(K-1), K=1, 2, 379);
Channel Spacing	: 1MHz
Modulation Type	: GFSK, π/4-DQPSK, 8-DPSK
Bluetooth Version	: V2.1+EDR
Antenna Gain	: Internal antenna, 0dBi (Max.)
Input Voltage	: DC 3.7V by battery(600mAh)

Additional models No.			
750-905-WD-JHE			
Remark: PCB board, str	ructure and internal of th	ese model(s) are the same	e, So no additional
models were tested			

1.2 Support equipment List

Manufacturer	Description	Model	Serial Number	Certificate
Lenovo	PC	B470		DOC
Lenovo	AC/DC ADAPTER	ADP-90DDB		DOC

1.3 External I/O Cable

I/O Port Description	Quantity	Cable
USB	1	N/A

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1.4 Description of Test Facility

Site Description	
EMC Lab.	: CNAS Registration Number. is L4595.
	FCC Registration Number. is 899208.
	Industry Canada Registration Number. is 9642A-1.
	VCCI Registration Number. is C-4260 and R-3804.
	ESMD Registration Number. is ARCB0108.
	UL Registration Number. is 100571-492.
	TUV SUD Registration Number. is SCN1081.
	TUV RH Registration Number. is UA 50296516-001

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

1.5 Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 - 4 "Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements" and is documented in the LCS quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Test Item		Frequency Range	Uncertainty	Note
		9KHz~30MHz	3.10dB	(1)
		30MHz~200MHz	2.96dB	(1)
Radiation Uncertainty	:	200MHz~1000MHz	3.10dB	(1)
		1GHz~26.5GHz	3.80dB	(1)
		26.5GHz~40GHz	3.90dB	(1)
Conduction Uncertainty	••	150kHz~30MHz	1.63dB	(1)
Power disturbance	••	30MHz~300MHz	1.60dB	(1)

1.6 Measurement Uncertainty

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7 Description of Test Modes

Bluetooth operates in the unlicensed ISM Band at 2.4GHz. With the introduction of the enhanced data rate (EDR) feature, the data rates can be up to 2 Mb/s. An increase in the peak data rate beyond the basic rate of 1 Mb/s is achieved by modulating the RF carrier using GFSK techniques, resulting in an increase of two to three times the number of bits per symbol. The 2 Mb/s EDR packets use a π /4-DQPSK modulation. X, Y, Z position have been tested. The following operating modes were applied for the related test items. All test modes were tested, only the result of the worst case was recorded in the report.

Mode of Operations	Freque	ncy Range	Data Rate
	(N	/Hz)	(Mbps)
	2	402	1
GFSK	2	441	1
	2	480	1
	2	402	2
$\pi/4$ DQPSK	2	441	2
	2	480	2
	2	402	3
8-DPSK	2	441	3
	2	480	3
1	For Conduct	ed Emission	
Test Mode		Т	'X Mode
	For Radiate	d Emission	
Test Mode		Т	X Mode

Worst-case mode and channel used for 150 kHz-30 MHz power line conducted emissions was the mode and channel with the highest output power, that was determined to be TX (1Mbps- Low Channel).

Worst-case mode and channel used for 9kHz-1000 MHz radiated emissions was the mode and channel with the highest output power, that was determined to be TX(1Mbps---Low Channel).

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR PART 15C 15.207, 15.209, 15.247 and DA 00-705.

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209, 15.247 under the FCC Rules Part 15 Subpart C.

2.3 General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table 0.8 meter above ground for below 1GHz and 1.5m for above 1GHz. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013

3. SYSTEM TEST CONFIGURATION

3.1 Justification

The system was configured for testing in a continuous transmits condition.

3.2 EUT Exercise Software

N/A.

3.3 Special Accessories

N/A.

3.4 Block Diagram/Schematics

Please refer to the related document.

3.5 Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6 Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULTS

A	Applied Standard: FCC Part 15 Subpart C	
FCC Rules	Description of Test	Result
§15.247(a)	Maximum Conducted Output Power	Compliant
§15.247(c)	Frequency Separation And 20 dB Bandwidth	Compliant
§15.247(a)(1)(ii)	Number Of Hopping Frequency	Compliant
§15.247(a)(1)(iii)	Time Of Occupancy (Dwell Time)	Compliant
§15.209, §15.205	Conducted Spurious Emissions and Band Edges Test	Compliant
§15.209, §15.247(d)	Radiated and Conducted Spurious Emissions	Compliant
§15.205	Emissions at Restricted Band	Compliant
§15.207(a)	Conducted Emissions	Compliant
§15.203	Antenna Requirements	Compliant
§15.247(i)§2.1093	RF Exposure	Compliant

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5. SUMMARY OF TEST EQUIPMENT

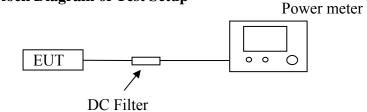
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1	Power Sensor	R&S	NRV-Z51	100458	2015-06-18	2016-06-17
2	Power Sensor	R&S	NRV-Z32	10057	2015-06-18	2016-06-17
3	Power Meter	R&S	NRVS	100444	2015-06-18	2016-06-17
4	DC Filter	MPE	23872C	N/A	2015-06-18	2016-06-17
5	RF Cable	Harbour Industries	1452	N/A	2015-06-18	2016-06-17
6	SMA Connector	Harbour Industries	9625	N/A	2015-06-18	2016-06-17
7	Spectrum Analyzer	Agilent	N9020A	MY50510140	2015-10-27	2016-10-26
8	Signal analyzer	Agilent	E4448A(Exte rnal mixers to 40GHz)	US44300469	2015-06-16	2016-06-15
9	RF Cable	Hubersuhne	Sucoflex104	FP2RX2	2015-06-18	2016-06-17
10	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2015-06-18	2016-06-17
11	Amplifier	SCHAFFNER	COA9231A	18667	2015-06-18	2016-06-17
12	Amplifier	Agilent	8449B	3008A02120	2015-06-16	2016-06-15
13	Amplifier	MITEQ	AMF-6F-260 400	9121372	2015-06-16	2016-06-15
14	Loop Antenna	R&S	HFH2-Z2	860004/001	2015-06-18	2016-06-17
15	By-log Antenna	SCHWARZBE CK	VULB9163	9163-470	2015-06-10	2016-06-09
16	Horn Antenna	EMCO	3115	6741	2015-06-10	2016-06-09
17	Horn Antenna	SCHWARZBE CK	BBHA9170	BBHA9170154	2015-06-10	2016-06-09
18	RF Cable-R03m	Jye Bao	RG142	CB021	2015-06-18	2016-06-17
19	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2015-06-18	2016-06-17
20	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	101142	2015-06-18	2016-06-17
21	EMI Test Receiver	ROHDE & SCHWARZ	ESPI	101840	2015-06-18	2016-06-17
22	Artificial Mains	ROHDE & SCHWARZ	ENV216	101288	2015-06-18	2016-06-17
23	EMI Test Software	AUDIX	E3	N/A	2015-06-18	2016-06-17

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6. ANTENNA PORT MEASUREMENT

6.1 Peak Power

6.1.1 Block Diagram of Test Setup



6.1.2 Limit

According to §15.247(b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

6.1.3 Test Procedure

The transmitter output is connected to the Power Meter.

Channel	Frequency (MHz)	Peak Output Power (dBm)	Peak Output Power (mW)	Limit (mW)	Result
2402		0.098	1.0228	1000	Pass
GFSK	2441	-0.209	0.9530	1000	Pass
	2480	-0.405	0.9110	1000	Pass
	2402	0.198	1.0466	125	Pass
$\pi/4$ -DQPSK	2441	-0.075	0.9829	125	Pass
	2480	-0.739	0.8435	125	Pass
8-DPSK	2402	0.126	1.0294	125	Pass
	2441	-0.267	0.9404	125	Pass
	2480	-0.758	0.8398	125	Pass

6.1.4 Test Results

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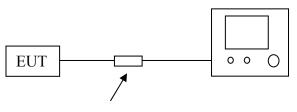
6.2 Frequency Separation and 20 dB Bandwidth

6.2.1 Limit

According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in15.209(a).

6.2.2 Block Diagram of Test Setup

Spectrum Analyzer



DC Filter

6.2.3 Test Procedure

Frequency separation test procedure:

- A. Place the EUT on the table and set it in transmitting mode.
- B. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.
- C. Set center frequency of Spectrum Analyzer = middle of hopping channel.
- D. Set the Spectrum Analyzer as RBW = 100 kHz, VBW = 300 kHz, Span = wide enough to capture the peaks of two adjacent channels, Sweep = auto.
- E. Max hold, mark 2 peaks of hopping channel and record the 2 peaks frequency.

20dB bandwidth test procedure:

- A. Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel.
- B. RBW $\geq 1\%$ of the 20 dB bandwidth, VBW \geq RBW.
- C. Detector function = peak.
- D. Trace = max hold.

6.2.4 Test	6.2.4 Test Results											
Th	The Measurement Result With 1Mbps For GFSK Modulation											
Channel	20dB Bandwidth (KHz)	Channel Separation (MHz)	Limit (MHz)	Result								
Low	859.7		>=25 KHz or 20 dB BW	Pass								
Middle	853.7	1.000	>=25 KHz or 20 dB BW	Pass								
High	862.1		>=25 KHz or 20 dB BW	Pass								

The N	The Measurement Result With 2Mbps For $\pi/4$ DQPSK Modulation										
Channel	20dB Bandwidth (MHz)	Channel Separation (MHz)	Limit (MHz)	Result							
Low	1.229		>=25 KHz or 2/3 20 dB BW	Pass							
Middle	1.237	1.000	>=25 KHz or 2/3 20 dB BW	Pass							
High	1.234		>=25 KHz or 2/3 20 dB BW	Pass							

The	The Measurement Result With 3Mbps For 8-DPSK Modulation										
Channel	20dB Bandwidth (MHz)	Channel Separation (MHz)	Limit (MHz)	Result							
Low	1.214	1.000	>=25 KHz or 2/3 20 dB BW	Pass							
Middle	1.215		>=25 KHz or 2/3 20 dB BW	Pass							
High	1.215		>=25 KHz or 2/3 20 dB BW	Pass							

The test data refer to the following page.

Manhan	02:07:22 PM Apr 19, 2016	ALIGN AUTO	ULSE	SENSE		AC	RF 50 Ω			
Marker Select Marke	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	g Type: Log-Pwr Hold:>100/100		Trig: Free Atten: 20	Iz PNO: Wide 😱 FGain:Low	PM	1.00000	arker 1		
Select Marke	ΔMkr1 1.000 MHz 0.269 dB									
Norn	<u> </u>	1Δ2			www.	m X2	. ^~	00		
De	WILL WAR	Mario Con Con	profession	M North			A MAN -	0.0		
Fixe										
).0).0		
								.0		
Propertie								.0		
M c 1 c	ton 3 402500 CU-						500 GHz	.0		
	top 2.403500 GHz .000 ms (1001 pts)	Sweep 1.		100 kHz	#VBW			art 2.40 les BW		

Test Plot of Frequency Separation (1Mbps)

Test Plot of Frequency Separation (2Mbps)

Marker	02:06:10 PM Apr 19, 2016		ALIGN AUT		PULSE	SENSE		AC	RF 50 Ω		u
Select Marke	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N		e: Log-Pw ⊳100/100		Run dB	Trig: Free Atten: 20	Z 10: Wide 😱 Gain:Low		1.000000	ker1Δ	lar
	r1 1.000 MHz -0.036 dB	Mk	Z					IBm	ef 10.00 (i/div R	0 dE
Norm	Mr how have -	Δ2 ~~~~	<u> </u>	~~~			WY MUN				
	an your from a second		~		www.www.w	- Arden	and a		mm	᠋ᡔᢇᠬᠬ	10.0
Del		_									0.0
Fixe		+									0.0
		_			0						0.0
c		+									0.0
		-			-						0.0
Properties		+									0.0
		+									0.0
Mo 1 o	p 2.403500 GHz 00 ms (1001 pts)	Sto	Swoon			100 kHz	#\/B\//			2.4015 BW 10	
	50 ms (1001 pts)		Sweep			100 KHZ	#VDVV			5 DVV 10	G

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RF 50 Ω AC	SENSE:PULSE	ALIGNAUTO	02:08:38 PM Apr 19, 2016	Marker
rker 1 Δ 1.000000000 MHz PNO: Wide IFGain:Lov		Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	Select Marker
dB/div Ref 10.00 dBm		ΔM	lkr1 1.000 MHz -0.086 dB	Select Marker
			wy With man and	Norm
ommer white the	markal man have a	Mund he	muntur	
0				De
0				Fixe
0				T IXC
0				(
0				
0				Propertie
0				Ma
Art 2.401500 GHz es BW 100 kHz #V	BW 100 kHz		top 2.403500 GHz 000 ms (1001 pts)	1 c
	DW TOO KII2	STATUS	000 m3 (1001 pt3)	

Test Plot of Frequency Separation (3Mbps)

Measurement of 20dB Bandwidth

Test frequency: 2402MHz (1Mbps)

RF 50 Ω AC	S	ENSE:PULSE	ALIGN AUTO	11:21:32 AM Apr 19	,2016	
enter Freq 2.402000000	Trig:	er Freq: 2.4020000 Free Run n: 20 dB	00 GHz Avg Hold:>10/10	Radio Std: None Radio Device: B1		e/Detector
0 dB/div Ref 10.00 dBm 9 00 0.0						Clear Wri
						Avera
1.0 1.0 1.0						Max Ho
enter 2.402 GHz Res BW 30 kHz	#	¢VBW 100 kH	2	Span 3 I Sweep 3.2		Min Ho
Occupied Bandwidtl	n	Total Pov	ver 8.2 ⁴	1 dBm		
87	79.22 kHz					Detect
Transmit Freq Error	11.863 kHz	OBW Pov	wer 99	9.00 %	Auto	M
x dB Bandwidth	859.7 kHz	x dB	-20.	00 d B		
G			STATU	c		

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Test frequency: 2441MHz (1Mbps)

RF 50 Ω AC		SENSE: PULSE enter Freg: 2.441000	ALIGN A	UTO 11:31:10 A Radio Std	M Apr 19, 2016	Trac	e/Detector
enter Freq 2.44100000		rig: Free Run Atten: 20 dB	Radio Std Radio Dev				
dB/div Ref 10.00 dB	m						
00		mm					Clear Wri
0	m	·	man -				
			<u> </u>				Avera
J							
0							Max Ho
enter 2.441 GHz es BW 30 kHz		#VBW 100 k	Hz		an 3 MHz p 3.2 ms		Min Ho
Occupied Bandwid	th	Total Po	ower	6.80 dBm			
3	880.25 kHz						Detect Peal
Transmit Freq Error	11.987 kHz	OBW P	ower	99.00 %		Auto	M
x dB Bandwidth	853.7 kHz	x dB	÷.	-20.00 dB			
			5	STATUS			

Test frequency: 2480MHz (1Mbps)

RF 50 Ω AC enter Freg 2.480000000		INSE:PULSE r Freq: 2.480000000 GHz		31:49 AM Apr 19, 2016	Trace/Detector
	Trig: F	ree Run Avg Hold : 20 dB	1:>10/10	lio Device: BTS	
0 dB/div Ref 10.00 dBm	<u> </u>				
.00					Clear Wri
				Lugar manage	Avera
0.0 0.0 1.0					Max Ho
enter 2.48 GHz Res BW 30 kHz	#	VBW 100 kHz	s	Span 3 MHz Sweep 3.2 ms	Min Ho
Occupied Bandwidth		Total Power	4.99 dB	m .	
88	32.08 kHz				Detect Peal
Transmit Freq Error	12.113 kHz	OBW Power	99.00	%	Auto <u>Ma</u>
x dB Bandwidth	862.1 kHz	x dB	-20.00 c	в	

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Test frequency: 2402MHz (2Mbps)

Agilent Spectrun	n Analyzer - Occupied BW									
Center Fre	RF 50 Ω AC	GHz #IFGain:Low				ALIGN AUTO >10/10	11:49:57 A Radio Std Radio Dev		Trac	e/Detector
10 dB/div	Ref 10.00 dBm									
Log 0.00 -10.0			_^_J	~~~~	m					Clear Write
-20.0 -30.0 -40.0 -50.0						N.	~~~			Average
-60.0 -70.0 -80.0										Max Hole
Center 2.4 #Res BW 3			#VE	3W 100 k	Hz			oan 3 MHz ep 3.2 ms		Min Hol
Occupi	ied Bandwidth 1.2	₀ 2699 MH	17	Total P	ower	7.15	ö dBm			Detecto
	it Freq Error Indwidth	7.500 k 1.229 M	Hz	OBW P x dB	ower		9.00 % 00 dB		Auto	Peakl <u>Mar</u>
MSG						STATUS	3			

Test frequency: 2441MHz (2Mbps)

Agilent Spectrum Analyzer - Occu								0	
Center Freq 2.44100	AC 0000 GHz #IFGain:Low	Center Fre Trig: Free F #Atten: 20	q: 2.4410000 Run		LIGNAUTO	Radio Std Radio Dev		Trac	e/Detector
10 dB/div Ref 10.00	dBm								
-10.0		~~~	~~~~	m					Clear Write
-20.0 -30.0 -40.0 -50.0	~~~				~~	~~~~	~~~~		Average
-50.0 -60.0 -70.0 -80.0									Max Hold
Center 2.441 GHz #Res BW 30 kHz		#VBV	№ 100 kH	Iz			an 3 MHz p 3.2 ms		Min Hold
Occupied Bandy	width 1.2601 M		Total Po	wer	7.00	dBm			Detector
Transmit Freq Erro x dB Bandwidth	or 8.459 1.237 M		OBW Po x dB	wer		.00 % 00 dB		Auto	Peak▶ <u>Man</u>
MSG					STATUS				

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Test frequency: 2480MHz (2Mbps)

gilent Spectrum Analyzer - Occupied B RF 50 Ω AC	w	SENSE:PULSE	AL	.IGN AUTO	11:40:57 8	M Apr 19, 2016	1	
enter Freq 2.48000000		Center Freq: 2.48000 Trig: Free Run		100000	Radio Std	None	Trac	e/Detector
	#IFGain:Low #	Atten: 20 dB			Radio Dev	rice: BTS		
0 dB/div Ref 10.00 dBn	n .			_				
.og 0.00								
10.0	_	\sim	ma -				9	Clear Writ
20.0		~ ~	- m	N-				
30.0	1			Jun				
40.0				``_				Averag
50.0								
0.0								
0.0								Max Hol
Center 2.48 GHz Res BW 30 kHz		#VBW 100	Hz			an 3 MHz p 3.2 ms		Min Hol
Occupied Bandwidt	h	Total P	ower	4.33	dBm			
	 2415 MHz	7						Detecto
								Detecto Peak
Transmit Freq Error	8.202 kH	Z OBW P	ower	99	0.00 %		Auto	Ma
x dB Bandwidth	1.234 MH	z xdB		-20.	00 dB			
G				STATUS				

Test frequency: 2402MHz (3Mbps)

	m Analyzer - Occupied									
Center Fre	RF 50 Ω AC eq 2.40200000					ALIGN AUTO	01:42:40 P Radio Std Radio Dev		Trac	e/Detector
10 dB/div	Ref 10.00 dB	m								
Log 0.00 -10.0 -20.0			_~~/	5	- marine					Clear Write
20.0						hora	~~~	\sim		Average
-60.0 -70.0 -80.0				2						Max Hold
Center 2.4 #Res BW			#VB	W 100 k	Hz			an 3 MHz ep 3.2 ms		Min Hold
Occup	ied Bandwid 1	^{lth} .2328 MH	lz	Total P	ower	7.5	1 dBm			Detector Peak▶
	iit Freq Error andwidth	11.986 k 1.214 M		OBW P x dB	ower		9.00 % .00 dB		Auto	Man_
MSG						STATU	s			

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Test frequency: 2441MHz (3Mbps)

gilent Spectrum Analyzer - Occupied B	W						
RF 50 Ω AC Center Freq 2.441000000		SENSE:PULSE nter Freq: 2.441000000 g: Free Run Av	ALIGNAUTO GHz g Hold:>10/10	01:43:37 P Radio Std	MApr 19, 2016 : None	Trac	e/Detector
		ten: 20 dB		Radio Dev	vice: BTS		
0 dB/div Ref 10.00 dBn	1 <u> </u>		<i></i>				
.og 0.00						,	Clear Writ
0.0	m		m				
0.0	m		5				
			m				Averag
0.0							
1.0							Max Hol
1.0							Maxilo
enter 2.441 GHz Res BW 30 kHz		#VBW 100 kHz			an 3 MHz p 3.2 ms		
					P 012 1115		Min Hol
Occupied Bandwidt		Total Powe	r 6.02	2 dBm			
	2190 MHz						Detecto Peak
Transmit Freq Error	12.590 kHz	OBW Powe	-	9.00 %		Auto	Ma
x dB Bandwidth	1.215 MHz	x dB	-20.	00 dB			
_							
G			STATU	S			

Test frequency: 2480MHz (3Mbps)

Agilent Spectrum A											
Center Freq			IZ Gain:Low				ALIGN AUTO	01:52:19 P Radio Std Radio Dev		Trac	e/Detector
10 dB/div	Ref 10.00	dBm									
Log 0.00 -10.0 -20.0			~~~	_~~	~~~~		~				Clear Write
-30.0	m	~~	-				hom		~~~		Average
-60.0 -70.0 -80.0											Max Hold
Center 2.48 #Res BW 30) kHz			#VE	3W 100 k			Swee	an 3 MHz p 3.2 ms		Min Hold
	d Bandv	1.20	92 Mł		Total P) dBm			Detector Peak▶
Transmit x dB Ban	Freq Erro dwidth	or	15.464 H 1.215 N		OBW P x dB	ower		9.00 % 00 dB		Auto	<u>Man</u>
MSG							STATU	5			

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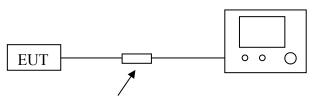
6.3 Number of Hopping Frequency

6.3.1 Limit

According to § 15.247(a)(1)(ii), Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

6.3.2 Block Diagram of Test Setup

Spectrum Analyzer



DC Filter

6.3.3 Test Procedure

- A. Place the EUT on the table and set it in transmitting mode.
- B. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.
- C. Set Spectrum Analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
- D. Set the Spectrum Analyzer as RBW, VBW=1MHz.
- E. Max hold, view and count how many channel in the band.

6.3.4 Test Results

The Measurement Result With The Worst Case of 1Mbps For GFSK Modulation								
Total No. of	Measurement Result (No. of Ch)	Limit (MHz)	Result					
Hopping Channel	79	≥15	Pass					

The test data refer to the following page.

Test Plot- Number of Hopping Channel

RF 50 Ω AC	SENSE:PULSE	ALIGN AUTO	02:02:29 PM Apr 19, 2016	
arker 2 2.480000000000 GHz PNO: Fat	st 🕞 Trig: Free Run	Avg Type: Log-Pwr Avg Hold:>100/100	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N	Marker
IFGain:Lo dB/div Ref 10.00 dBm	Atten: 20 dB	Mkr2 2.	480 000 0 GHz -2.662 dBm	Select Marker
	****	······································	2	Norma
				Delta
.0				Fixed
1.0				0
.0				Properties
.0				Mor
art 2.40000 GHz Res BW 1.0 MHz #	VBW 1.0 MHz	Sweep 1.	Stop 2.48350 GHz 000 ms (1001 pts)	1 of 2

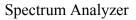
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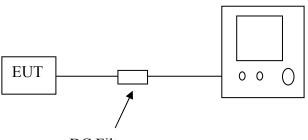
6.4 Time of Occupancy (Dwell Time)

6.4.1 Limit

According to \$15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

6.4.2 Block Diagram of Test Setup





DC Filter

6.4.3 Test Procedure

- A. Place the EUT on the table and set it in transmitting mode.
- B. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.
- C. Set center frequency of Spectrum Analyzer = operating frequency.
- D. Set the Spectrum Analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.
- E. Repeat above procedures until all frequency measured were complete.

The Measurement Result With The Worst Case of 1Mbps For GFSK Modulation									
Channel	Time of Pulse for DH5 (ms)	Sweep Time (ms)	Limit (ms)						
Low	2.90	31.6	309.3	400					
Middle	2.92	31.6	311.5	400					
High	2.91	31.6	310.4	400					

6.4.4 Test Results

Low Channel

2.90*(1600/6)/79*31.6=309.3ms

Middle Channel

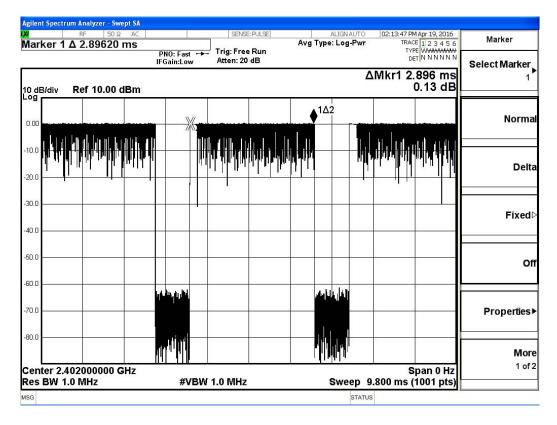
2.92*(1600/6)/79*31.6=311.5ms

High Channel

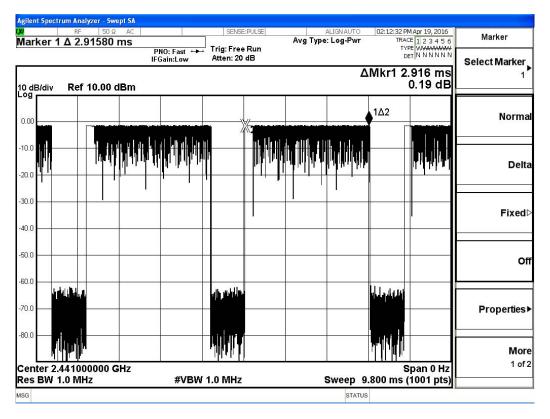
2.91*(1600/6)/79*31.6=310.4ms

The test data refer to the following:

Low Channel

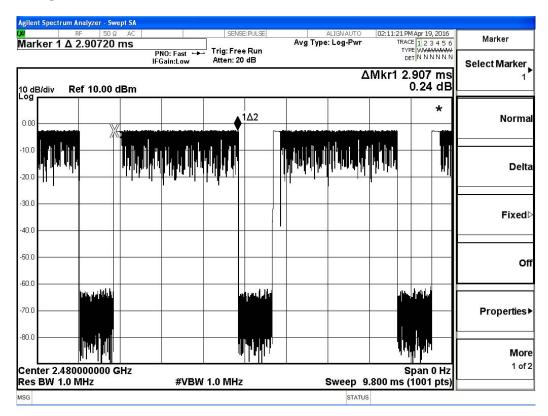


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Middle Channel

High Channel



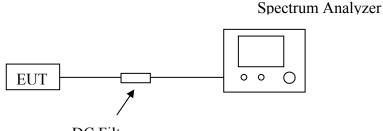
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6.5 Conducted Spurious Emissions and Band Edges Test

6.5.1 Limit

In any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.205(a).

6.5.2 Block Diagram of Test Setup



DC Filter

6.5.3 Test Procedure

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 300 KHz.

Measurements are made over the 9 kHz to 25GHz range with the transmitter set to the lowest, middle, and highest channels

6.5.4 Test Results of Conducted Spurious Emissions

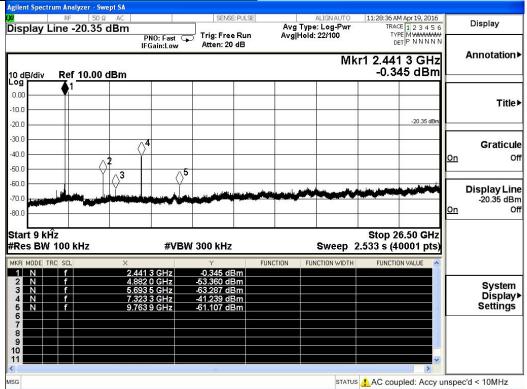
No non-compliance noted. Only record the worst test result (TX-GFSK) in this report. The test data refer to the following page.

Test Plot

lent Spectrum Analyzer Swept SA 11:26:42 AM Apr 19, 2016 E:PULSE GN AL Display TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N Avg Type: Log-Pwr Avg|Hold: 24/100 Display Line -18.99 dBm Trig: Free Run PNO: Fast 🖵 IFGain:Low Atten: 20 dB Annotation) Mkr1 2.402 2 GHz 1.005 dBm Ref 10.00 dBm 10 dB/div Log 0.00 Title -10.0 -18.99 dE -20.0 -30.0 Graticule -40.0 <u>On</u> Of (-50.0 -60.0 Display Line -18.99 dBm 70 On Off -80.0 Start 9 kHz Stop 26.50 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.533 s (40001 pts) FUNCTION FUNCTION WIDTH MKR MODE TH FUNCTION VALU 1 N -51.074 dBm -38.137 dBm 2345678 Hz Hz System Display▶ Settings -57.373 dBm Ν f 3 2 GHz 10 11 STATUS AC coupled: Accy unspec'd < 10MHz ASG

9KHz-25GHz Low Channel (GFSK)

9KHz-25GHz Middle Channel (GFSK)



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9KHz-25GHz High Channel (GFSK)

Agilent Spectrum Analyzer - Sv	wept SA				
RF 50 1		SENSE:PULSE	ALIGNAUTO	11:35:30 AM Apr 19, 2016	Display
Display Line -22.14		Trig: Free Run	Avg Type: Log-Pwr Avg Hold: 17/100	TRACE 1 2 3 4 5 6 TYPE MWWWW	Display
	PNO: Fast IFGain:Low	Atten: 20 dB	Avginola. 17100	DET PNNNN	
	II Gam.cow				Annotation
			MH	(r1 2.479 7 GHz	
10 dB/div Ref 10.00	dBm			-2.139 dBm	
- ^{og}					
0.00					Title
-10.0					Title
-20.0				-22.14 dBm	
-30.0	∆4				Graticul
-40.0	Y Y				
-50.0	<u>^</u> 2	∿2			<u>On</u> Of
-50.0	Ý <mark>\ 3</mark>	Ý			
-60.0	HY			والمراقع الارباد والمرام والمرام	Display Line
-70.0	A STATE OF THE STA				-22.14 dBn
-80.0			1. Disarrana di dia		On Of
-80.0					
Start 9 kHz				Stop 26.50 GHz	
Res BW 100 kHz	43.7	300 kHz	Sween	2.533 s (40001 pts)	
Res DW TOUKIZ	#¥		Sweep	2.555 S (40001 pts)	
MKR MODE TRC SCL	X	Y	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	
1 N f	2.479 7 GHz	-2.139 dBm			
2 N f 3 N f	4.960 1 GHz 5.694 9 GHz	<u>-54.955 dBm</u> -61.388 dBm			System
3 N f 4 N f	7.440 5 GHz	-37.342 dBm			Display
5 N f	9.920 3 GHz	-54.659 dBm		100	Settings
6					
8					
9					
10					
11				×	
<				>	
SG			STATU	s 🔥 AC coupled: Accy u	nspec'd < 10MHz

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6.5.5 Test Results of Band Edges Test

No non-compliance noted. Only record the worst test result in this report. The test data refer to the following page.

Test Plot

Hopping On - (GFSK) Agilent Spectrum Analyzer - Swept SA 7:46 PM Apr 19, 2016 TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N Display Display Line -20.03 dBm Avg Type: Log-Pwr Avg|Hold:>100/100 Trig: Free Run PNO: Fast IFGain:Low 0 Atten: 20 dB **Annotation** Mkr1 2.402 055 GHz -0.032 dBm 10 dB/div Log Ref 10.00 dBm 0.00 Title► -10.0 20.02 -20.0 30.0 Graticule 40.0 On Off -50.0 ∧3 -60.0 apple with the Display Line -20.03 dBm ann wrang mar Marth and a said a s and the provident of the second LUNN WINS -70.0 On Off 80. Start 2.31000 GHz Stop 2.40500 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 9.133 ms (1001 pts) MKR FUNCTION FUNCTION WIDTH FUNCTION VALUE -0.032 dBm -35.495 dBm -60.616 dBm 1 GHz System Display≯ Settings f 23 0 GHz 567 9 10 11 MSG STATUS

Display	56	6 PM Apr 19, 20 RACE 1 2 3 4 TYPE MWWW	TRA/	ALIGNAUTO pe: Log-Pwr d:>100/100	Avg	SENSE:PUL		PNO: Fas	AC	alyzer - Swe 50 Ω -22.50 (RF	
Annotation	IZ	022 GH 496 dB	2.478 0	Mkr1		tten: 20 dB		IFGain:Lo	dBm	f 10.00 c	Re	B/div
Title										.	$\frac{1}{\sqrt{2}}$	ł
Graticul n Of								,2 A		my my		
Display Line -22.50 dBn n Of	110	^J ogAcALand	Parylonalyw]19Ray	¹⁶ ไร่งารคำนางใหม่เปล่า	u.liww.dy.lilma	Mr.W.M.M.	rjil _{rvalu}	Thun Mar				
		.50000 Gi s (1001 pi		Sweep 2.		0 kHz	VBW :	#			7800 V 100	
System Display Settings		CTION VALUE	FUNCTI	UNCTION WIDTH	FUNCTION	Y 2.496 dBm 9.451 dBm		8 022 GHz 3 500 GHz			TRC SCL f f	MODE N N
	×	>				ш						
				STATUS								

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Hopping Off - (GFSK)

Agilent S		alyzer - Swep	t SA									
w Displa	ay Line	50 Ω -18.84 d	AC BM		SENSE:			ALIGNAUTO Type: Log-Pwr Hold:>100/100	TRA	M Apr 19, 2016 CE 1 2 3 4 5 6 PE M WWWWWW		Display
10 dB/d	div Ref	f 10.00 dE	IFGa	D: Fast 🕞 nin:Low	Atten: 20				2.402 0	er PNNNNN 055 GHz 61 dBm		Annotation►
-10.0 -												Title►
-30.0 — -40.0 —											<u>On</u>	Graticule Off
co. 0	_{ากก} ระโสโซ ¹ าราชสูงไฟ	-41/Wardenterter	Wymallalaydd	Arm wan	himmen and through	Lookya-n.o	esterne and	upl-rene land	3 3 3 3		<u>On</u>	Display Line -18.84 dBm Off
	2.31000 BW 100			#VBN	/ 300 kHz			Sweep 9		0500 GHz (1001 pts)		
1 N 2 N 3 N 4 5 6	f		× 2.402 055 2.400 000 2.390 000	GHz	Y 1.161 dB -27.994 dB -62.021 dB	m m	ICTION	FUNCTION WIDTH	FUNCTI	ON VALUE		System Display▶ Settings
7 8 9 10 11 <					uli -			STATU		×		

									nalyzer - Swe		Agilent
Display	4 Apr 19, 2016 E 1 2 3 4 5 6 E M WWMMM	TRAC	ALIGNAUTO		E:PULSE	200 02		dBm	-21.89 c	lay Line	w Disp
Annotation►	PNNNNN	DI 2.480 1	d:>100/100 Mkr1	AVgiH		Trig: Free Atten: 20	NO: Fast 🕞 Gain:Low	IFC	ef 10.00 c	udiv R	10 dE
Title▶	-21.89 dBm										Log 0.00 -10.0 -20.0
Graticule n Off								2 2	5	\mathcal{A}	-30.0 -40.0 -50.0
Display Line -21.89 dBm n Off	wmmnrond (na walanan	<u></u>	Caterophine	Mumeru	mar and					-60.0 -70.0 -80.0
		Stop 2.50 .133 ms (Sweep 2			300 kHz	#VBW			2.47800 BW 100	
	IN VALUE	FUNCTIO	UNCTION WIDTH	INCTION		Y		×	L	IODE TRC SI	
System Display▶ Settings						-1.890 dl -42.420 dl	0 GHZ	2.480 15 2.483 50		N f	3 4 5
											6 7 8 9 10
	>					ш					11
		\$	STATUS								MSG

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Hopping On - (π/4 DOPSK)

Agilent S	ipectru		er - Swept S/										
L)XI		RF	50 Ω AC			SENSE	:PULSE		ALIGN AUTO		M Apr 19, 2016		Display
Displa	ay Li	ne -20	.10 dBr				-		e: Log-Pwr	TRA	CE 1 2 3 4 5 6 PE MWWWWW		Display
): Fast 🖵 in:Low	Trig: Free Atten: 20		Avgihoid	l:>100/100	D			Annotation►
10 dB/	div	Ref 10).00 dBn	n					Mkr1		98 GHz		Annotation
Log 0.00													
-10.0 —		-									MA		Title►
-20.0 -30.0											-20.10 dBm / 12		
-30.0											Ň	_	Graticule Off
-50.0 —									-	3	, M	<u>On</u>	01
-60.0 —		المراجع المرا	a nonighthem	10. Juli - 900	nall be contened for a	a Lave In March			ANA ANA ANA	Whaterwo	, ^{pru}		Display Line
-70.0 ••	10-20-20-20-20-20-20-20-20-20-20-20-20-20	ermer parez	A1241 - 1641	ale sel al an		wy + pon						<u>On</u>	-20.10 dBm Off
Start : #Res		000 GH 100 kH			#VBW	300 kHz			Sweep 9	Stop 2.4 .133 ms (0500 GHz 1001 pts)		
MKR MO	200 / 10 / 10 / 10 / 10 / 10 / 10 / 10 /			×	~	Y		CTION FL	NCTION WIDTH	FUNCTI	ON VALUE		
1 N 2 N		f		.404 050		-0.098 dE						-	
3 N 4 5 6		f		.390 000 (-60.087 dE							System Display▶ Settings
7 8 9													
10 11											~		
MSG									STATUS		>		

Agilent Spectru	ım Analyzer - Swe	ept SA									
🕅 Display Li	RF 50 Ω			SENSE:			ALIGNAUTO ype: Log-Pwr bld:>100/100	TRA	MApr 19, 2016 2E 1 2 3 4 5 6 PE MWWWWW		Display
10 dB/div	Ref 10.00 (IFGa): Fast 🕞 iin:Low	Atten: 20		Avgine	and the state	D 2.480 0	24 GHz 77 dBm		Annotation►
0.00 -10.0 ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	1 								-22.58 dBm		Title►
-30.0 -40.0 -50.0	- huntung									<u>On</u>	Graticule Off
-60.0 -70.0 -80.0		10 M W W	V. Marillow	Murph	whenwhich	n)rann	www.mwmmh	Laurtheory	mpthing	<u>On</u>	Display Line -22.58 dBm Off
Start 2.473 #Res BW			#VBW	/ 300 kHz			Sweep 2		0000 GH z 1001 pts)		
MKR MODE TR 1 N 2 N 3 4 5	f f	× 2.480 024 2.483 500		Y -2.577 dB -45.427 dB	m	CTION	FUNCTION WIDTH	FUNCTI			System Display▶ Settings
6 7 8 9 10 11											2000 1994 A. A. Sood 🥌 K
MSG				ШÛ			STATU	3	>		

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Hopping Off - (π/4 DQPSK)

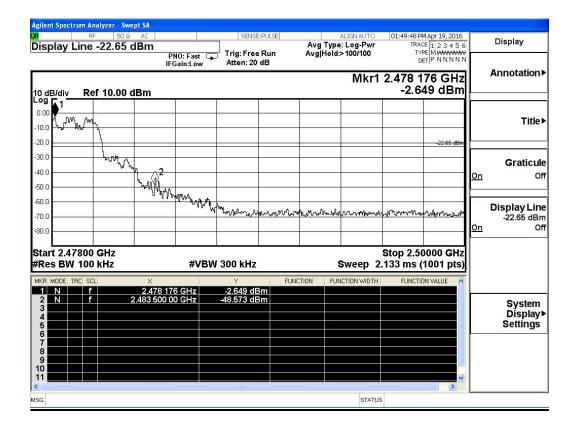
Agilent Spectrum Analyzer - Swept SA				
Display Line -20.15 dBm	SENSE:PU	ALIGNAUTO Avg Type: Log-Pwr	11:53:32 AM Apr 19, 2016 TRACE 1 2 3 4 5 6	Display
	PNO: Fast IFGain:Low Atten: 20 dB	un Avg[Hold:>100/100	Det P NNNN 2.402 055 GHz	Annotation
10 dB/div Ref 10.00 dBm			-0.052 dBm	
-20.0			-20,1 5 dBm	Title
-30.0			() the h	
			pr h	Graticule
-40.0			1	<u>On</u> Of
-50.0			3	
-60.0 -70.0 undates and under the second	arrively was and the former	have a set of the set	and the second sec	Display Line -20.15 dBm On Of
Start 2.31000 GHz #Res BW 100 kHz	#VBW 300 kHz		Stop 2.40500 GHz 133 ms (1001 pts)	
MKR MODE TRC SCL X	Y	FUNCTION FUNCTION WIDTH	FUNCTION VALUE	
2 N f 2.400	2 055 GHz -0.052 dBm 0 000 GHz -28.989 dBm 0 000 GHz -62.941 dBm			System Display Settings
6 7 8 9 10				
<			×	
MSG		STATUS		

Agilent Spectrum Analyzer - Swe						
KF 50 Ω Display Line -21.94 d	AC BM			ALIGNAUTO Type: Log-Pwr	11:38:43 AM Apr 19, 2016 TRACE 1 2 3 4 5	6 Display
10 dB/div Ref 10.00 d	PNO: Fast IFGain:Lov			Hold:>100/100 Mkr1	2.480 024 GHz -1.944 dBm	N Annotation►
Log 0.00 -10.0 -20.0					-21.94 dBn	Title▶
-30.0 -40.0 -50.0						Graticule On Off
-60.0 -70.0 -80.0		Varnam	Weber Monson	Muhmuni	www.wy.m.h.Aumaharryh	Display Line -21.94 dBm On Off
Start 2.47800 GHz #Res BW 100 kHz	#V	/BW 300 kHz		Sweep 2	Stop 2.50000 GHz 133 ms (1001 pts	
MKR MODE TRC SCL	× 2.480 024 GHz	۲ -1.944 dE	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	
2 N f 3 4 5	2.483 500 GHz	-1.344 dE -42.228 dE				System Display▶ Settings
6 7 8 9 9 10 11						
<		Ш				2
MSG				STATU	S	

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Hopping On - (8-DPSK)

gilent Spectrum Analyzer - Swept SA								
RF 50 Ω AC isplay Line -20.04 dBm	PNO: Fast	SENSE:PUL	Avg	ALIGNAUTO Fype: Log-Pwr Iold:>100/100	TRAC	MApr 19, 2016 E 1 2 3 4 5 6 PE MWWWWW		Display
0 dB/div Ref 10.00 dBm	IFGain:Low	Atten: 20 dB			2.403 0	05 GHz		Annotation
og 0.00						-20.04 dBm		Title
20.0 30.0 40.0							<u>0n</u>	Graticule Off
0.0 0.0 0.0 arthornanyakasikankasinankaki 0.0	๛สารปี าร ไรงจากโรงจาะไห้ไ	mannaman	<i>በአ</i> ኒክሌላቢቀዪብሪ	WWWWWW	up ^{er a} vor ^{us}	, "М ^{ин} "	<u>On</u>	Display Line -20.04 dBm Off
tart 2.31000 GHz Res BW 100 kHz	#VBW	300 kHz		Sweep 9	Stop 2.40 .133 ms (0500 GHz 1001 pts)		
2 N f 2.400 3 N f 2.390 4 5	8 005 GHz 0 000 GHz 0 000 GHz	Y -0.044 dBm -29.114 dBm -58.325 dBm	FUNCTION	FUNCTION WIDTH	FUNCTIO	DN VALUE		System Display≯ Settings
6 7 8 9 10 11								
sg				STATUS	5			



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Hopping Off - (8-DPSK)

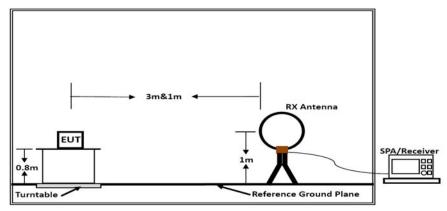
Agilent Spectrum Analyzer - Sv					
Display Line -20.01	dBm	SENSE:PULSE	ALIGN AUTO Avg Type: Log-Pw	r TRACE 1 2 3 4 5 6	Display
10 dB/div Ref 10.00	PNO: Fast IFGain:Low dBm		Avg Hold:>100/100	r1 2.402 055 GHz -0.008 dBm	Annotation
- 09 0.00 - 10.0 - 20.0				-20.04 dBm	Title
-40.0				AF IN	Graticul On O
-60.0 -70.0	paget and a second a	marine Musicipalities	Manapara and a second	A B B B B B B B B B B B B B B B B B B B	Display Lin -20.01 dBr <u>On</u> 0
Start 2.31000 GHz Res BW 100 kHz	#V	BW 300 kHz	Sweep	Stop 2.40500 GHz 9.133 ms (1001 pts)	
MKR MODE TRC SCL 1 N F 2 N F 3 N F 4 F 5 C F 6 C F 8 C F 9 C F 10 C F 11 C F	× 2.402 055 GHz 2.400 000 GHz 2.390 000 GHz	Y	FUNCTION FUNCTION WID	TH FUNCTION VALUE	System Display Settings
				-	

Agilent Spectrum Analyzer - Swep							
₩ RF 50 Ω Display Line -22.27 d		SENSE:PUI	Avg	ALIGNAUTO	TRAC	1Apr 19, 2016 E 1 2 3 4 5 6	Display
	PNO: Fast IFGain:Low			oid:>100/100 Mkr1			Annotation►
10 dB/div Ref 10.00 dl	Bm					1 dBm	
							T :41- N
-10.0		X					Title►
-20.0						22.27 dBm	
-30.0 -30.0 -40.0	2						Graticule
-40.0	W						<u>On</u> Off
-60.0	N. S. C.			_			Disalardia
-70.0		and monant worked way	Land and a second se	- and the form of	๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛๛	yolululu analasat	Display Line -22.27 dBm On Off
Start 2.47800 GHz #Res BW 100 kHz	#V	BW 300 kHz		Sweep 2	Stop 2.50 .133 ms (*		
MKR MODE TRC SCL	×	Y	FUNCTION	FUNCTION WIDTH	FUNCTIO	N VALUE	
3 4	2.480 002 GHz 483 500 00 GHz	-2.271 dBm -43.549 dBm					System Display≯ Settings
5 6 7							Settings
8							
10							
<		iii				>	
MSG				STATUS	3		

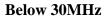
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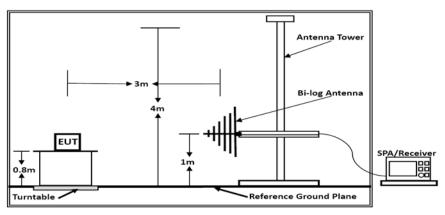
7. RADIATED MEASUREMENT

7.1 Block Diagram of Test Setup

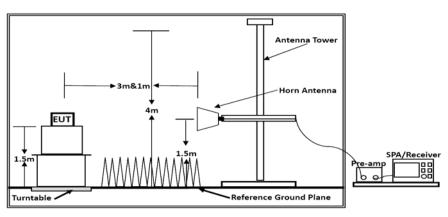


Below 30MHz





Below 1GHz



Above 1GHz

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7.2 Radiated Emission Limit

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 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	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

2 B000 38.6

Part 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector.

Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

Part 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (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

7.3 Instruments Setting

The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/Average
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/Average
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

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7.4 Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 0.8 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

- --- The turntable rotates from 0° to 315° using 45° steps.
- --- The antenna is polarized vertical and horizontal.
- --- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position $(\pm 45^{\circ})$ and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ($\pm 45^{\circ}$) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

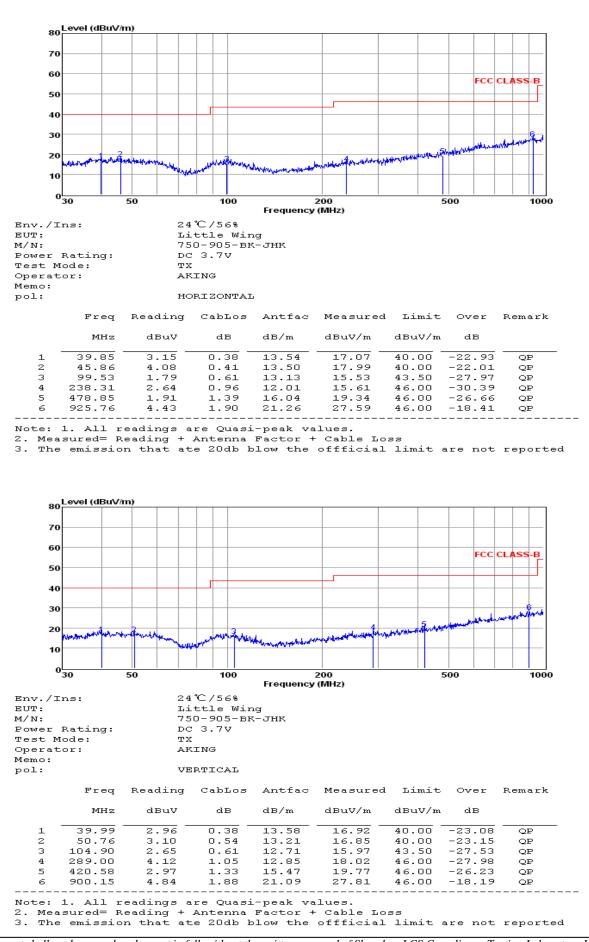
--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

7.5 Results for Radiated Emissions

PASS.

Only record the worst test result in this report. The test data please refer to following page:

Below 1GHz (Low Channel)



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Above 1GHz

The worst test result for GFSK, Tx-Low Channel:

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4804.00	54.47	33.06	35.04	3.94	56.43	74	-17.57	Peak	Horizontal
4804.00	29.52	33.06	35.04	3.94	31.48	54	-22.52	Average	Horizontal
4804.00	49.04	33.06	35.04	3.94	51.00	74	-23.00	Peak	Vertical
4804.00	37.25	33.06	35.04	3.94	39.21	54	-14.79	Average	Vertical

The worst test result for GFSK, Tx-Middle Channel:

Freq. MHz	Reading Dbuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4882.00	52.20	33.16	35.15	3.96	54.17	74	-19.83	Peak	Horizontal
4882.00	27.04	33.16	35.15	3.96	29.01	54	-24.99	Average	Horizontal
4882.00	48.45	33.16	35.15	3.96	50.42	74	-23.58	Peak	Vertical
4882.00	32.60	33.16	35.15	3.96	34.57	54	-19.43	Average	Vertical

The worst test result for GFSK, Tx-High Channel:

Freq. MHz	Reading DBuv	Ant. Fac dB/m	Pre. Fac dB	Cab. Los dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4960.00	51.58	33.26	35.14	3.98	53.68	74	-20.32	Peak	Horizontal
4960.00	29.07	33.26	35.14	3.98	31.17	54	-22.83	Average	Horizontal
4960.00	45.11	33.26	35.14	3.98	47.21	74	-26.79	Peak	Vertical
4960.00	29.98	33.26	35.14	3.98	32.08	54	-21.92	Average	Vertical
7	1.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4.4								

Notes:

1. Measuring frequencies from 9k~10th harmonic (ex. 26GHz), No emission found between lowest internal used/generated frequency to 30 MHz.

2. Radiated emissions measured in frequency range from 9k~10th harmonic (ex. 26GHz) were made with an instrument using Peak detector mode.

3. 18~25GHz at least have 20dB margin. No recording in the test report.

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7.6 Results for Band edge Testing (Radiated)

Only record the worst test case (Tx, GFSK, Non-hopping) as following:

	1 1-2402	, ursk,	Non-nop						
Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2385.00	49.22	32.89	35.16	3.51	50.46	74	-23.54	Peak	Horizontal
2385.00	37.59	32.89	35.16	3.51	38.84	54	-15.16	Average	Horizontal
2400.00	54.74	32.92	35.16	3.54	56.04	74	-17.96	Peak	Horizontal
2400.00	35.59	32.92	35.16	3.54	36.89	54	-17.11	Average	Horizontal
2385.00	53.03	32.89	35.16	3.51	54.30	74	-19.70	Peak	Vertical
2385.00	37.13	32.89	35.16	3.51	38.40	54	-15.60	Average	Vertical
2400.00	43.69	32.92	35.16	3.54	44.96	74	-29.04	Peak	Vertical
2400.00	33.95	32.92	35.16	3.54	35.23	54	-18.77	Average	Vertical

Tx-2402, GFSK, Non-hopping

Tx-2480, GFSK, Non-hopping

Freq. MHz	Reading Level dBuV	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2483.50	50.88	33.06	35.18	3.60	52.36	74	-21.64	Peak	Horizontal
2483.50	36.28	33.06	35.18	3.60	37.76	54	-16.24	Average	Horizontal
2483.50	50.91	33.06	35.18	3.60	52.39	74	-21.61	Peak	Vertical
2483.50	37.95	33.06	35.18	3.60	39.43	54	-14.57	Average	Vertical

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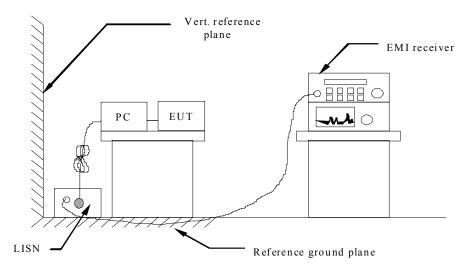
7.7. Power line conducted emissions

7.7.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range		Limits (dBµV)		
(MHz)	Quasi-peak	Average		
0.15 to 0.50	66 to 56	56 to 46		
0.50 to 5	56	46		
5 to 30	60	50		

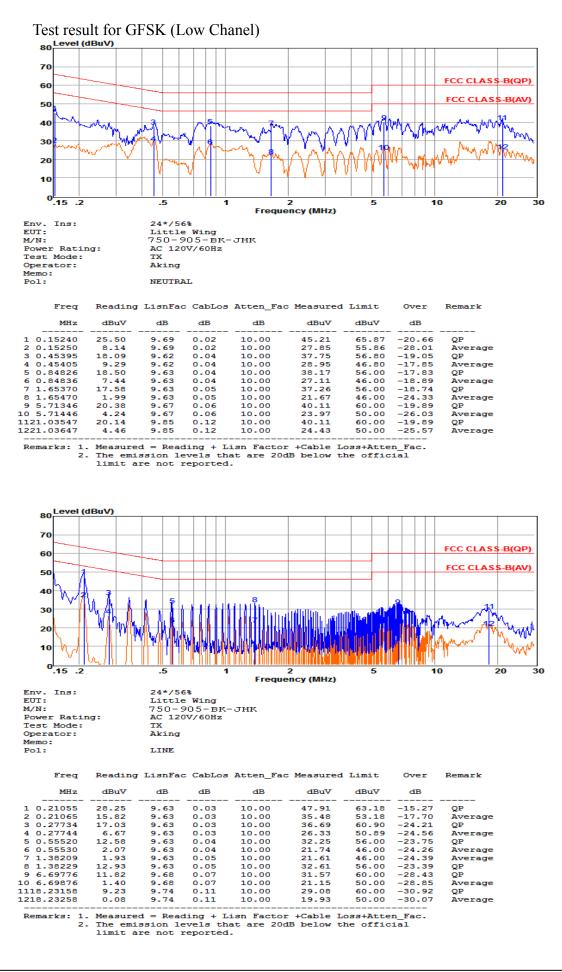
7.7.2 Block Diagram of Test Setup



7.7.3 Test Results

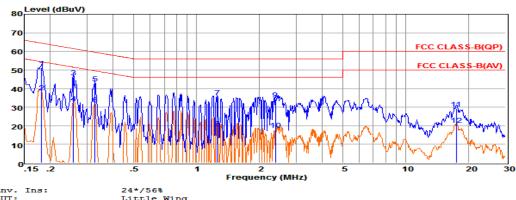
PASS.

The test data please refer to following page.



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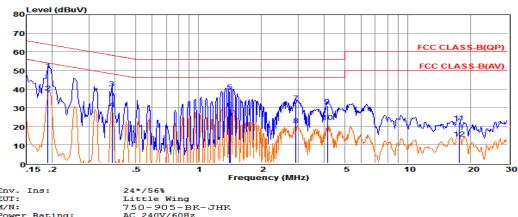


	F
Env. Ins:	24*/56%
EUT:	Little Wing
M/N:	750-905-вк-јнк
Power Rating:	AC 240V/60Hz
Test Mode:	TX
Operator:	Aking
Memo:	
Pol:	LINE

Freq Reading LisnFac CabLos Atten_Fac Measured Limit Over Rema

MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1 0.18152	31.38	9.61	0.02	10.00	51.01	64.42	-13.41	QP
2 0.18162	18.54	9.61	0.02	10.00	38.17	54.41	-16.24	Average
3 0.25751	26.40	9.63	0.03	10.00	46.06	61.51	-15.45	QP
4 0.25761	12.43	9.63	0.03	10.00	32.09	51.51	-19.42	Average
5 0.32685	23.12	9.62	0.03	10.00	42.77	59.53	-16.76	QP
6 0.32695	11.85	9.62	0.03	10.00	31.50	49.53	-18.03	Average
7 1.25546	15.71	9.63	0.05	10.00	35.39	56.00	-20.61	QP
8 1.25646	-1.02	9.63	0.05	10.00	18.66	46.00	-27.34	Average
9 2.38358	14.61	9.64	0.05	10.00	34.30	56.00	-21.70	QP
10 2.38458	-1.99	9.64	0.05	10.00	17.70	46.00	-28.30	Average
1117.47496	9.28	9.74	0.11	10.00	29.13	60.00	-30.87	QP
1217.47596	0.80	9.74	0.11	10.00	20.65	50.00	-29.35	Average
Remarks: 1	Measure	d = Read	ding +	Lisp Factor	+Cable L		n Fac	

emarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac. 2. The emission levels that are 20dB below the official limit are not reported.



Env. Ins:	24*/56%
EUT:	Little Wing
M/N:	750-905-в
Power Rating:	AC 240V/60H:
Test Mode:	TX
Operator:	Aking
Memo:	
Pol:	NEUTRAL

	Freq	Reading	LisnFac	CabLos	Atten_Fac	Measured	Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.19039	30.57	9.61	0.02	10.00	50.20	64.02	-13.82	QP
2	0.19049	18.47	9.61	0.02	10.00	38.10	54.02	-15.92	Average
3	0.38519	20.91	9.61	0.04	10.00	40.56	58.17	-17.61	QP
4	0.38529	9.54	9.61	0.04	10.00	29.19	48.16	-18.97	Average
5	1.41068	19.10	9.63	0.05	10.00	38.78	56.00	-17.22	QP
6	1.41168	9.47	9.63	0.05	10.00	29.15	46.00	-16.85	Average
7	2.91520	13.02	9.64	0.06	10.00	32.72	56.00	-23.28	QP
8	2.91620	0.79	9.64	0.06	10.00	20.49	46.00	-25.51	Average
9	4.13558	11.16	9.65	0.06	10.00	30.87	56.00	-25.13	QP
10	4.13658	2.50	9.65	0.06	10.00	22.21	46.00	-23.79	Average
111	17.56779	2.18	9.79	0.11	10.00	22.08	60.00	-37.92	QP
121	17.56879	-6.43	9.79	0.11	10.00	13.47	50.00	-36.53	Average
Remarks: 1. Measured = Reading + Lisn Factor +Cable Loss+Atten_Fac. 2. The emission levels that are 20dB below the official limit are not reported.									

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8. ANTENNA REQUIREMENT

8.1 Standard Applicable

According to antenna requirement of §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

8.2 Antenna Connected Construction

8.2.1. Standard Applicable

According to § 15.203 & RSS-Gen, 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.

8.2.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 0dBi, and the antenna is connect to PCB board and no consideration of replacement. Please see EUT photo for details.

8.2.3. Results: Compliance.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

Conducted power refers ANSI C63.10:2013 Output power test procedure for frequency-hopping spread-spectrum (FHSS) devices.

Radiated power refers to ANSI C63.10:2013 Radiated emissions tests.

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Measurement parameters:

Measurement parameter				
Detector:	Peak			
Sweep time:	Auto			
Resolution bandwidth:	3 MHz			
Video bandwidth:	3 MHz			
Trace-Mode:	Max hold			

Note: The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module. For normal Bluetooth devices, the GFSK mode is used.

Limits:

FCC	IC	
Antenna Gain		
6.0dBi		

Tnom Vnom		lowest channel 2402 MHz	middle channel 2441 MHz	highest channel 2480 MHz	
Conducted power [dBm] Measured with GFSK modulation Radiated power [dBm] Measured with GFSK modulation		0.12	-0.31	-0.46	
		-2.23	-1.55	-2.91	
Gain [dBi] Calculated		-2.35	-1.24	-2.45	
Measurement uncertainty			± 1.6 dB (cond.) / ± 3.8 dB (rad.)		

Result: -/-

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