FCC TEST REPORT FOR Shenzhen Linpa Technology Co.,Ltd Bluetooth Earphones Test Model: FDAPP2BT-W

Prepared for Address	:	Shenzhen Linpa Technology Co.,Ltd 114, C8, Flavor Commercial Street, Vanke Dream Town, Bantian, Longgang District, Shenzhen, Guangdong, 518102, China
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
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Data of reasint of test sample		April 06, 2017
Date of receipt of test sample	:	
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	April 06, 2017~April 19, 2017
Date of Report	:	April 19, 2017

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FCC	TEST	REPORT
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FCC CFR 47 PART 15 C(15.247)					
Report Reference No : LCS170406035AE					
Date of Issue	Date of Issue : April 19, 2017				
Festing Laboratory Name : Shenzhen LCS Compliance Testing Laboratory Ltd.					
	. 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 □ 				
Applicant's Name	: Shenzhen Linpa Technology Co.,Ltd				
Address	. : 114, C8, Flavor Commercial Street, Vanke Dream Town, Bantian, Longgang District, Shenzhen, Guangdong, 518102, China				
Test Specification					
Standard	. : FCC CFR 47 PART 15 C(15.247)				
Test Report Form No	. : LCSEMC-1.0				
TRF Originator	: Shenzhen LCS Compliance Testing Laboratory Ltd.				
Master TRF	. : Dated 2011-03				
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Test Item Description	: Bluetooth Earphones				
I rade Mark	.: iHip				
Trade Mark Model/ Type reference Ratings	. : FDAPP2BT-W				
Model/ Type reference	. : FDAPP2BT-W				
Model/ Type reference	. : FDAPP2BT-W . : DC 3.7V by battery(60mAh)				
Model/ Type reference	 FDAPP2BT-W DC 3.7V by battery(60mAh) Recharged by DC 5V/1A 				
Model/ Type reference Ratings Result	 FDAPP2BT-W DC 3.7V by battery(60mAh) Recharged by DC 5V/1A Positive 				

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FCC -- TEST REPORT

Ι

Test Report No. : LCS170406035AE		<u>April 19, 2017</u> Date of issue		
Type / Model	: FDAPP2BT-W			
EUT	: Bluetooth Earphones	Bluetooth Earphones		
Applicant	: Shenzhen Linpa Tech	nology Co.,Ltd		
Address	: 114,C8, Flavor Commercial Street, Vanke Dream Town, Bantian, Longgang District, Shenzhen, Guangdong, 518102, China			
Telephone	: /			
Fax	: /			
Manufacturer	: Shenzhen Linpa Tech	nology Co.,Ltd		
Address		rcial Street, Vanke Dream Town, Bantian, nzhen, Guangdong, 518102, China		
Telephone	:/			
Fax	: /			
Factory	: Shenzhen Linpa Tech	noloay CoLtd		
Address	: 114,C8, Flavor Comme	rcial Street, Vanke Dream Town, Bantian, nzhen, Guangdong, 518102, China		
Telephone	: /			
Fax	: /			

Test Result

Γ

Positive

The test report merely corresponds to the test sample.

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Revision History

Revision	Issue Date	Revisions	Revised By
00	2017-04-19	Initial Issue	Gavin Liang

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FCC ID: GTOLBS89

Report No.: LCS170406035AE

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1. GENERAL INFORMATION

: Bluetooth Earphones : FDAPP2BT-W
[:] DC 3.7V by battery(60mAh) Recharged by DC 5V/1A
: V1.0
: V1.0
: 2402MHz-2480MHz (Channel Frequency=2402+1(K-1), K=1, 2, 379) (DSS)
: V4.2+EDR
: 79 Channels
: GFSK, π/4-DQPSK , 8-DPSK
: PCB Antenna, 0dBi(Max.)

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
Mini USB Port	1	N/A

1.4 Description of Test Facility

CNAS Registration Number. is L4595. FCC Registration Number. is 899208. Industry Canada Registration Number. is 9642A-1. 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.

1.6 Measurement Uncertainty

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). 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 basic data rate feature, the data rates can be up to 1 Mb/s by modulating the RF carrier using GFSK techniques. The EUT works in the X-axis, Y-axis, Z-axis. 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	Frequency Range (MHz)	Data Rate (Mbps)	
	2402	1/2/3	
ВТ	2441	1/2/3	
	2480	1/2/3	
For Conducted Emission			
Test Mode		TX Mode	
For Radiated Emission			
Test Mode		TX 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).

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).

AC conducted emission test performed at both voltage AC 120V/60Hz and AC 240V/60Hz(Charge from PC).

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 normal operating mode for Hopping Numbers and Dwell Time test and a continuous transmits mode for other tests.

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 directly placed on the ground. 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 turntable, which is directly placed on the ground. 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

2.4. Test Sample

The application provides 2 samples to meet requirement;

Sample Number	Description
Sample 1	Engineer sample – continuous transmit
Sample 2	Normal sample – Intermittent transmit

3.1 Justification

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

3.2 EUT Exercise Software

The system was configured for testing in a continuous transmits condition and change test channels by software (Smart RF Control Kit) provided by application.

3.3 Special Accessories

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

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.

Applied Standard: FCC Part 15 Subpart C								
FCC Rules	Description of Test	Test Sample	Result					
§15.247(b)(1)	Maximum Conducted Output Power	Sample 1	Compliant					
§15.247(c)	Frequency Separation And 20 dB Bandwidth	Sample 1	Compliant					
§15.247(a)(1)(ii)	Number Of Hopping Frequency	Sample 2	Compliant					
§15.247(a)(1)(iii)	Time Of Occupancy (Dwell Time)	Sample 2	Compliant					
§15.209, §15.247(d)	Radiated and Conducted Spurious Emissions	Sample 1	Compliant					
§15.205	Emissions at Restricted Band	Sample 1	Compliant					
§15.207(a)	Conducted Emissions	Sample 1	Compliant					
§15.203	Antenna Requirements	Sample 1	Compliant					
§15.247(i)§2.1093	RF Exposure	N/A	Compliant					

5. SUMMARY OF TEST EQUIPMENT

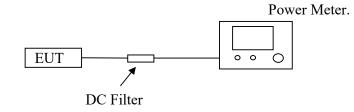
				0.111		
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1	Power Sensor	R&S	NRV-Z51	100458	2016-06-18	2017-06-17
2	Power Sensor	R&S	NRV-Z32	10057	2016-06-18	2017-06-17
3	Power Meter	R&S	NRVS	100444	2016-06-18	2017-06-17
4	DC Filter	MPE	23872C	N/A	2016-06-18	2017-06-17
5	RF Cable	Harbour Industries	1452	N/A	2016-06-18	2017-06-17
6	SMA Connector	Harbour Industries	9625	N/A	2016-06-18	2017-06-17
7	Spectrum Analyzer	Agilent	N9020A	MY50510140	2016-10-27	2017-10-26
8	Signal analyzer	Agilent	E4448A(Exter nal mixers to 40GHz)	US44300469	2016-06-16	2017-06-15
9	RF Cable	Hubersuhne	Sucoflex104	FP2RX2	2016-06-18	2017-06-17
10	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2016-06-18	2017-06-17
11	Amplifier	SCHAFFNER	COA9231A	18667	2016-06-18	2017-06-17
12	Amplifier	Agilent	8449B	3008A02120	2016-06-16	2017-06-15

13	Amplifier	MITEQ	AMF-6F-2604 00	9121372	2016-06-16	2017-06-15
14	Loop Antenna	R&S	HFH2-Z2	860004/001	2016-06-18	2017-06-17
15	By-log Antenna	SCHWARZBEC K	VULB9163	9163-470	2016-06-10	2017-06-09
16	Horn Antenna	EMCO	3115	6741	2016-06-10	2017-06-09
17	Horn Antenna	SCHWARZBEC K	BBHA9170	BBHA9170154	2016-06-10	2017-06-09
18	RF Cable-R03m	Jye Bao	RG142	CB021	2016-06-18	2017-06-17
19	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2016-06-18	2017-06-17
20	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	101142	2016-06-18	2017-06-17
21	Artificial Mains	ROHDE & SCHWARZ	ENV216	101288	2016-06-18	2017-06-17
22	EMI Test Software	AUDIX	E3	N/A	2016-06-18	2017-06-17

6. MEASUREMENT RESULTS

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: 1 watt. 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.

6.1.4 Test Results

Test Mode	Channel	Frequency (MHz)	Measured Maximum Peak Power (dBm)	Limits (dBm)	Verdict
	0	2402	0.35		
GFSK	39	2441	0.67	30	PASS
	78	2480	0.37		
	0	2402	-0.70		
π/4DQPSK	39	2441	-0.72	21	PASS
	78	2480	-0.13		
	0	2402	-0.14		
8DPSK	39	2441	-0.38	21	PASS
	78	2480	-0.46		

Remark:

1. Test results including cable loss;

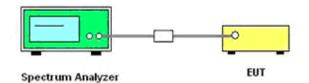
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6.2 Frequency Separation and 20 dB Bandwidth

6.2.1 Limit

According to §15.247(a) (1), 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.

6.2.2 Block Diagram of Test Setup



6.2.3 Test Procedure

Frequency separation test procedure:

1). Place the EUT on the table and set it in transmitting mode.

2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.

3). Set center frequency of Spectrum Analyzer = middle of hopping channel.

4). Set the Spectrum Analyzer as RBW = 100 kHz, VBW = 100 kHz, Span = wide enough to capture the peaks of two adjacent channels, Sweep = auto.

5). Max hold, mark 2 peaks of hopping channel and record the 2 peaks frequency.

20dB bandwidth test procedure:

1). Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel.

2). RBW ≥1% of the 20 dB bandwidth, VBW ≥RBW.

- 3). Detector function = peak.
- 4). Trace = max hold.

6.2.4 Test Results

Т	The Measurement Result With 1Mbps For GFSK Modulation								
Channel	20dB Bandwidth (MHz)	Channel Separation (MHz)	Limit (MHz)	Result					
Low	0.3817		0.3817	Pass					
Middle	0.3788	1.000	0.3788	Pass					
High	0.3776		0.3776	Pass					
The	Measurement Resul	t With 2Mbps For $\pi/4$	-DQPSK Modulati	on					
Channel	20dB Bandwidth (MHz)	Channel Separation (MHz)	Limit (MHz)	Result					
Low	1.102		0.735	Pass					
Middle	1.100	1.000	0.733	Pass					
High	1.062		0.708	Pass					
Tł	ne Measurement Res	ult With 3Mbps For 8	-DPSK Modulation	า					
Channel	20dB Bandwidth (MHz)	Channel Separation (MHz)	Limit (MHz)	Result					
Low	1.100		0.733	Pass					
Middle	1.101	1.000	0.734	Pass					
High	1.061		0.707	Pass					

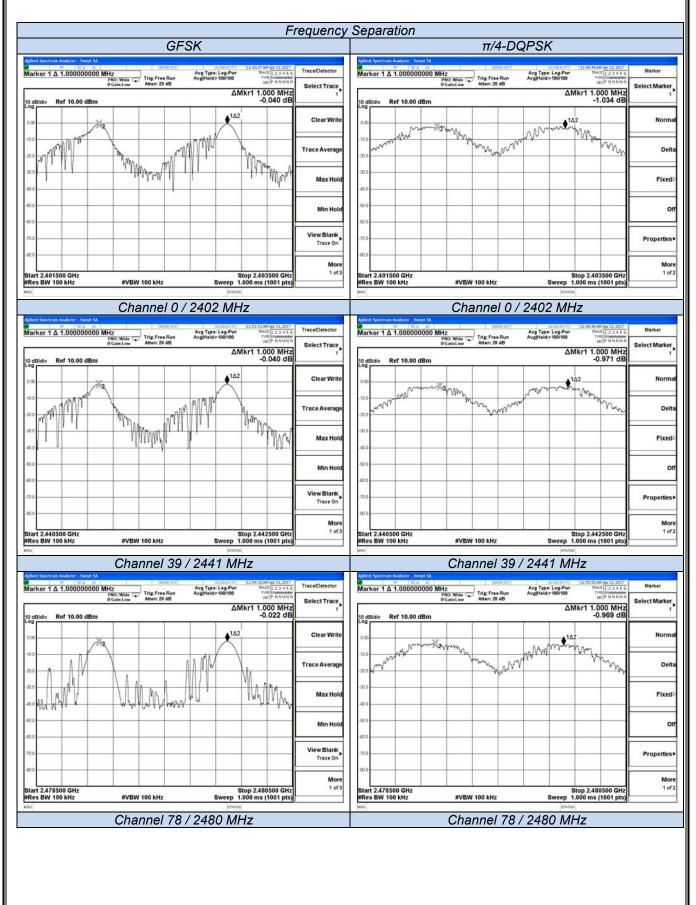
Remark:

1. Test results including cable loss;

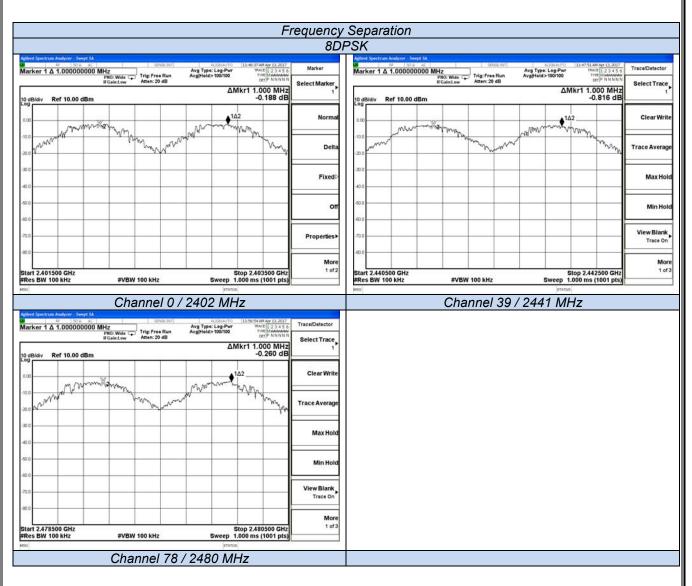
please refer to following plots;
 Measured at difference Packet Type for each mode and recorded worst case for each mode.

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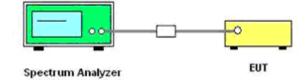
		Т	est Plot of	Test Result					
			8DI	PSK					
Int Spectrum Analyzer - Decopied BW FF 1500 #C enter Freq 2.402000000 GHz #F Gain:Low dB/div Ref 10.00 dBm	Center Freq: 2.402000000 GHz Trig: Free Run Avg Hold: #Atten: 20 dB	ALIONALTO OPERATE 22017 Radio Std: None >10/10 Radio Device: BTS	7 Trace/Detector	Aglent Spectrum Analyzer - Occupied th Center Freq 2.441000000 10 dB/div Ref 10.00 dBm	GHz Center F Trig: Free #Atten: 20	req: 2.441000000 GHz e Run Avg Hold 0 dB	Rad d>10/10	09:17PMApr 12, 2017 die Std: None die Device: BTS	Trace/Detector
dB/div Ref 10.00 dBm	m		Clear Write	10 dB/div Ref 10.00 dBm Log 0.00 -10.0 -20.0		m			ClearWri
10 mmmmmmm			Average	300 40.0 50.0			June	2 marine	Avera
			Max Hold	-60.0 -70.0 -80.0					Max H
enter 2.402 GHz tes BW 30 kHz	#VBW 100 kHz	Span 3 MHz Sweep 3.2 ms		Center 2.441 GHz #Res BW 30 kHz	#VE	SW 100 kHz		Span 3 MHz Sweep 3.2 ms	Min H
Occupied Bandwidth	Total Power	6.50 dBm		Occupied Bandwidth	h	Total Power	5.84 dB	m	800.00
962.56 kl Transmit Freq Error -7.807 x dB Bandwidth 1.100 M	kHz OBW Power	99.00 % -20.00 dB	Detector Peak► Auto <u>Man</u>	90 Transmit Freq Error x dB Bandwidth	61.62 kHz -10.357 kHz 1.101 MHz	OBW Power x dB	99.00 -20.00 c		Detec Pe Auto
							aran a		
Cha	annel 0 / 2402	2 MHz		MSG	Channel	39 / 244	status 41 MHz	2	
Cha erd Spectrum Analyzer - Orcepted BW mter Freq 2.480000000 GHz #FGaincl.ew	SUGE 211	2 MHz	7 Frequency	MIG	Channel	39 / 244		2	
Chrase	Center Freq: 2.480000000 GHz Trig: Free Run AvgiHoldz	2 MHz ALIONALTO OKORSS FM Agr 12, 2017 Radio Std: None	7 Frequency Center Freq 2.48000000 GHz	MSQ	Channel	39 / 244		2	
Inter Freq 2.480000000 GHz	Center 211	2 MHz ADVANTO Radio Std: None Radio Device: BTS Advantory Span 3 MHz	Center Freq 2.48000000 GHz	MEG	Channel	<u>39 / 244</u>		2	
Ind Spectrum Analyser: Occupied BW	Griter Freq: 2.48000000 GHz Center Freq: 2.4800000 GHz Trig: Free Run Avg Held: #Atten: 20 dB	2 MHz AUXIANO 040955MA4212,002 Radio Std: None Radio Device: BTS	Center Freq 2.48000000 GHz	MIG	Channel	<u>39 / 244</u>		2	
Characteria Autory - Occupied BY 10 500 Characteria Autory - Occupied BY 10 500 Characteria Autory - Alternative 10	Conter Fee 2 Addoction Offe Tray: Free State Atten: 20 dB #VBW 100 kHz Total Power	2 MHz ADDEADTO Radio Std: None Radio Device: BTS Span 3 MHz Sweep 3.2 ms	Center Freq 2.48000000 GHz 2.48000000 GHz 300.000 kHz 300.000 kHz Auto Man	MIG	Channel	39 / 244		2	
dSoctrue Analyzer : Occupied BW	Conter Free 2 46000000 OHe Tray: Free States Autor: 20 48 #VBW 100 kHz Total Power Hz	2 MHz ADVANTO Radio Std: None Radio Device: BTS Span 3 MHz Sweep 3.2 ms	Center Freq 2.48000000 GHz CF Step 300.000 Hz	MIG	Channel	39 / 244		2	
Chrase ref Sportner Audyrer, Deceded BW ref Tere 2.480000000 GHz ref Gaint.ew didaw Ref 10.00 dBm didaw ref 10.00 dBm didaw didaw Ref 10.00 dBm didaw didaw Ref 10.00 dBm didaw didaw didaw Ref 10.00 dBm didaw didaw didaw didaw Ref 10.00 dBm didaw di	Conter Free 2 Advances 0 OH2 Tray Free State AvgHeidz AvgHeidz #VBW 100 kHz Total Power HZ kHz OBW Power	2 MHz Radio Sté None Radio Device: BTS	Center Freq 2.48000000 GHz CF Step 300,000 kHz Auto Man Freq Offset	MIG	Channel	39 / 244		2	
ABJEWENTER ANALYSE - DOCUMENTER STATUS	Conter Free 2 Advances 0 OH2 Tray Free State AvgHeidz AvgHeidz #VBW 100 kHz Total Power HZ kHz OBW Power	2 MHz Radio Ste None Radio Device: BTS Radio Device: BTS Span 3 MHz Sweep 3.2 ms 5.06 dBm 99.00 %	Center Freq 2.48000000 GHz CF Step 300,000 kHz Auto Man Freq Offset	MIG	Channel	<u>' 39 / 244</u>		2	

6.3 Number of Hopping Frequency

6.3.1 Limit

According to §15.247(a)(1)(ii) or A8.1 (d), 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



6.3.3 Test Procedure

1). Place the EUT on the table and set it in transmitting mode.

2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.

3). Set Spectrum Analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.

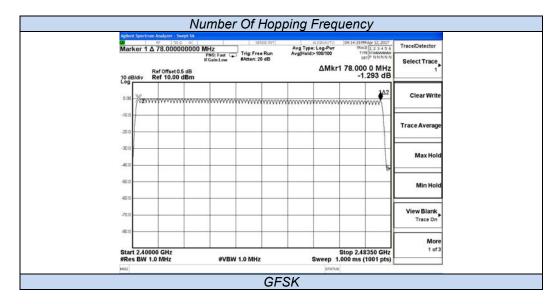
4). Set the Spectrum Analyzer as RBW, VBW=1MHz.

5). Max hold, view and count how many channel in the band.

6.3.4 Test Results

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

Note: The test data refer to the following page.



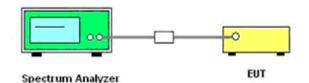
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6.4 Time of Occupancy (Dwell Time)

6.4.1 Limit

According to §15.247(a)(1)(iii) or A8.1 (d), 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



6.4.3 Test Procedure

1). Place the EUT on the table and set it in transmitting mode.

2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.

3). Set center frequency of Spectrum Analyzer = operating frequency.

4). Set the Spectrum Analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.

5). Repeat above procedures until all frequency measured was complete.

6.4.4 Test Results

The Dwell Time=Burst Width*Total Hops. The detailed calculations are showed as follows:

The duration for dwell time calculation: 0.4[s]*hopping number=0.4[s]*79[ch]=31.6[s*ch];

The burst width [ms/hop/ch], which is directly measured, refers to the duration on one channel hop.

The hops per second for all channels: The selected EUT Conf uses a slot type of 5-Tx&1-Rx and a hopping rate of 1600 [ch*hop/s] for all channels. So the final hopping rate for all channels is 1600/6=266.67 [ch*hop/s]

The hops per second on one channel: 266.67 [ch*hops/s]/79 [ch]=3.38 [hop/s];

The total hops for all channels within the dwell time calculation duration: 3.38 [hop/s]*31.6[s*ch]=106.67 [hop*ch];

The dwell time for all channels hopping: 106.67 [hop*ch]*Burst Width [ms/hop/ch].

Mode	Frequency (MHz)	Burst Type	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Verdict	
		DH1	0.384	0.123			
GFSK	2441	DH3	1.672	0.268	0.4	PASS	
		DH5	2.896	0.309			
		2DH1	0.380	0.122			
π/4-DQPSK	2441	2DH3	1.680	0.269	0.4	PASS	
		2DH5	2.912	0.311			
		3DH1	0.372	0.119			
8DPSK	2441	3DH3	1.648	0.264	0.4	PASS	
		3DH5	2.928	0.312			

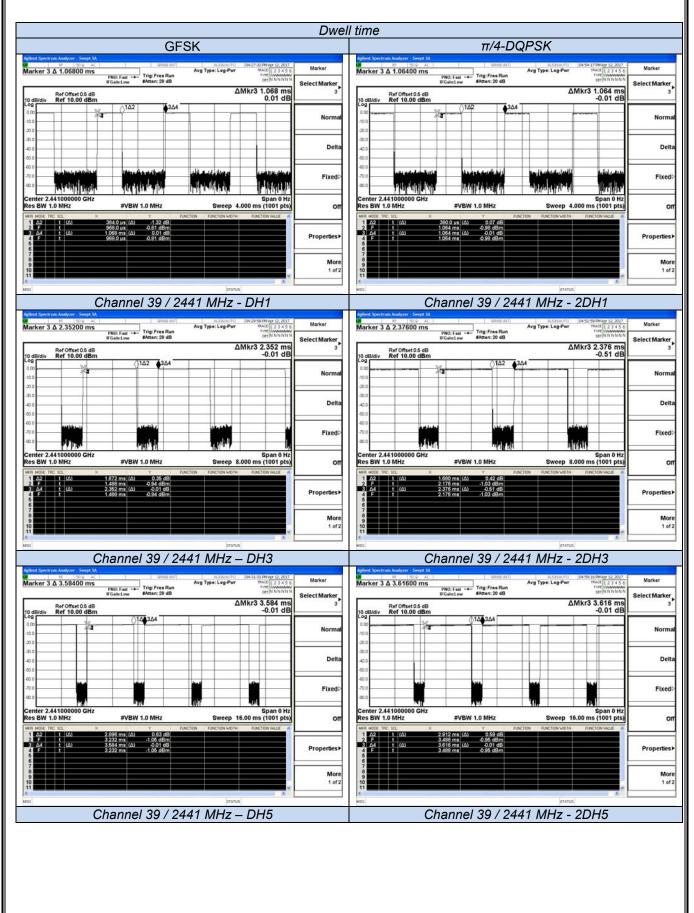
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Remark:

- 1. Test results including cable loss;
- 2. please refer to following plots;
- 3. Measured at difference Packet Type for each mode and recorded woest case for each mode.
- 4. Dwell Time Calculate formula: DH1: Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second DH3: Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second DH5: Dwell time=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second
- 5. Measured at low, middle and high channel, recorded worst at middle channel;

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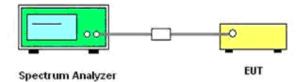
	Dwe	Il time	
		PSK	
Agilent Spectrum Analyzer - Swept SA 10 17 50 p. 44 10 10 10 00 00 00 00 00 00 00 00 00 00 0		Aglinit Spectrum Analyzer - Swept SA ## 50.0 ac selection 41,024,40170 05507,42 PM Apr 12, 2017	
Konstanti State and	Marker	Marker 3 ∆ 2.33600 ms PN0: Fast →→ Trig: Free Run PN0: Fast →→	Marker
Ref Offset 0.5 dB ΔMkr3 1.052 ms	Select Marker	Ref Offset 0.5 dB ΔMkr3 2.336 ms	Select Marker
10 dBlav Ref 10.00 dBm 0.54 dB	Normal	10 eB/div. Ref 10.00 dBm -0.01 dB 0.00 0100 0100 0100 0100 0100 0100 0100	Normal
-300 -400 -400	Deita	300 400 400	Delta
	Fixed⊳		Fixed⊳
Center 2.441000000 GHz Span 0 + tz Res BW 1.0 MHz #VBW 1.0 MHz Sweep 4.000 ms (1001 pts) WR HORE TG SG: × Y Function VILL Func	orr	Center 2.441000000 GHz Span 0 Hz Span 0 Hz Span 0 Hz Sweep 8.000 ms (1001 pts) Writ Moder W 1.0 MHz Y Factors water Pactors water Pactors water	orr
1 ΔΩ t (Δ) 372 0 μs (Δ) 0.61 dB 2. F t 1084 ms - 1.56 dBm 3. Δ4 t (Δ) 1054 ms (Δ) 0.54 dB 4. F t - 1.014 ms -1.56 dBm 6. F t - 1.014 ms -1.56 dBm	Properties▶	1 Δ2 t (Δ) 1.64 ms (Δ) 0.40 dB 2 F t 1.672 ms 0.96 dBm 3 Δ4 t (Δ) 2.338 ms (Δ) -0.01 dB 4 F t 1.872 ms -0.96 dBm 6 F t 1.872 ms -0.96 dBm 6 7 t -0.96 dBm 7 7	Properties►
8 9 10 11 11 4 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	More 1 of 2	8 9 10 11 11 4 4 5 4 5 5 5 5 5 5 5 5 5 5 5 5 5	More 1 of 2
Channel 39 / 2441 MHz - 3DH1		Channel 39 / 2441 MHz - 3DH3	
Name Sec Sec </td <td>Marker Select Marker</td> <td></td> <td></td>	Marker Select Marker		
	Normal		
	Delta		
	Fixed⊳		
Center 2.441000000 GHz Span 0 Hz Span 0 Hz Res BW 1.0 MHz #VBW 1.0 MHz Sweep 16:00 ms (100 Hpts) WR HOSE TR: SGL X Y Parchow Restorword H Parchow Restorword H	off		
1 Δ2 t (Δ) 2.220 ms (Δ) 1.22 dB 2 F t 3.308 ms - 1.67 dB 3 Δ4 t (Δ) 3.080 ms (Δ) 0.59 dB 4 F t 3.088 ms -1.67 dBm 6 F t 3.088 ms -1.67 dBm	Properties►		
	More 1 of 2		
Channel 39 / 2441 MHz – 3DH5			

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.

6.5.2 Block Diagram of Test Setup



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 26.5GHz 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 in this report. The test data refer to the following page.

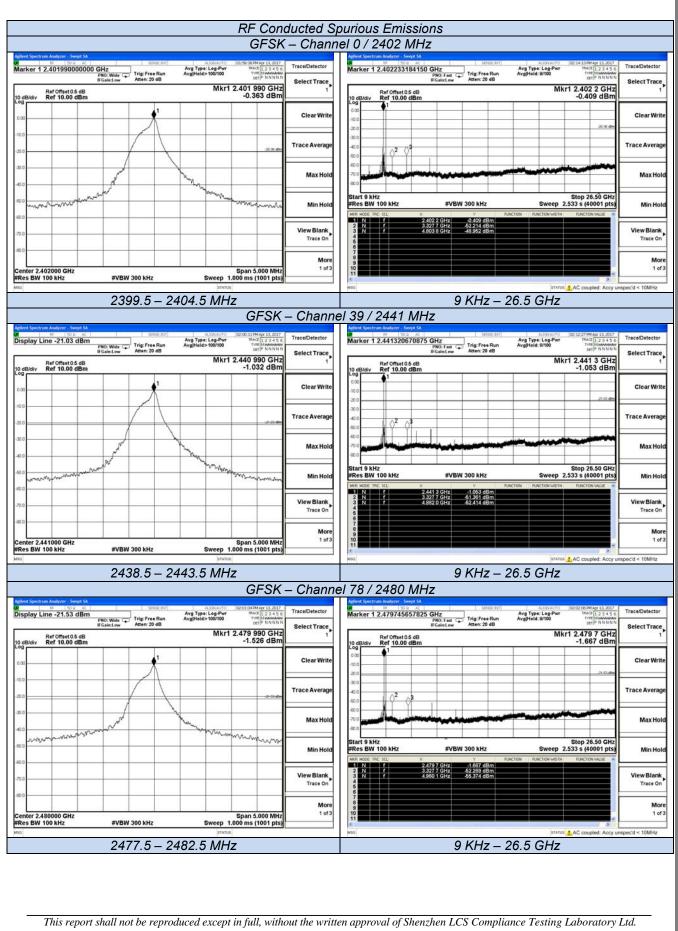
Test Mode	Channel	Frequency (MHz)	Spurious RF Conducted Emission (dBc)	Limits (dBc)	Verdict
	0	2402	<-20		
GFSK	39	2441	<-20	-20	PASS
	78	2480	<-20		
	0	2402	<-20		
π/4-DQPSK	39	2441	<-20	-20	PASS
	78	2480	<-20		
	0	2402	<-20		
8DPSK	39	2441	<-20	-20	PASS
	78	2480	<-20		

Remark:

- 1. Test results including cable loss;
- 2. please refer to following plots;
- 3. Measured at difference Packet Type for each mode and recorded worst case for each mode.

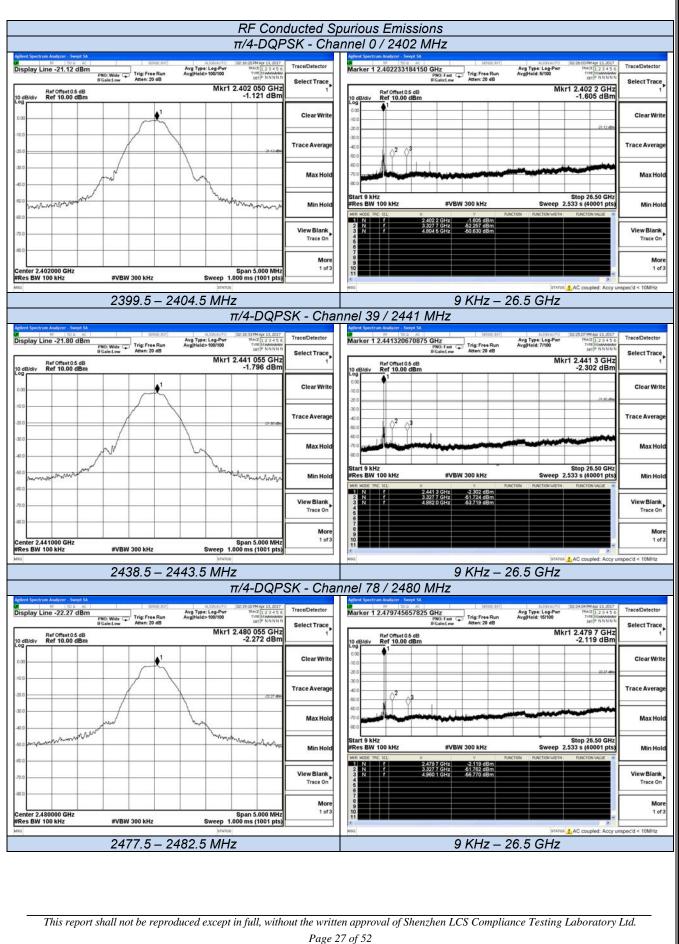
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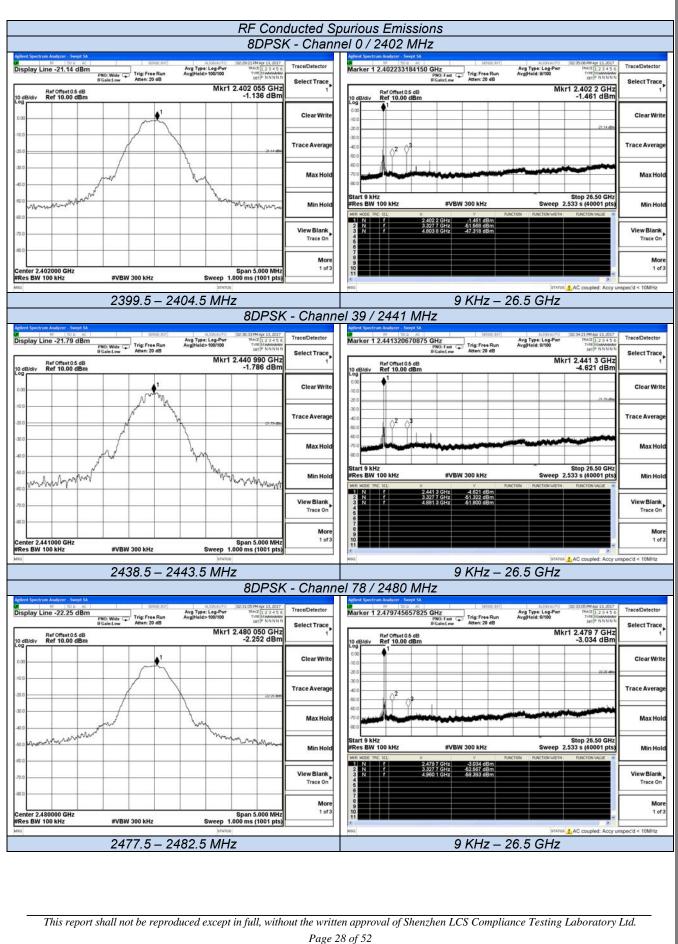


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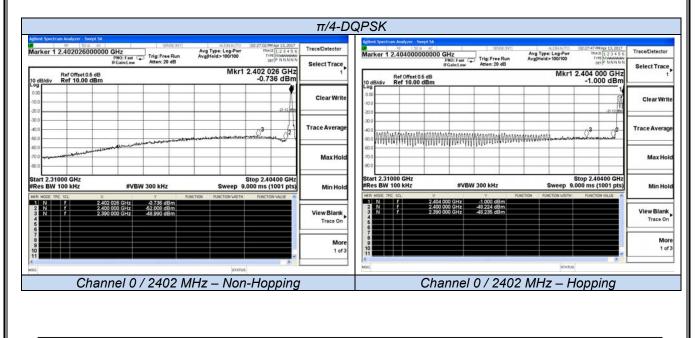




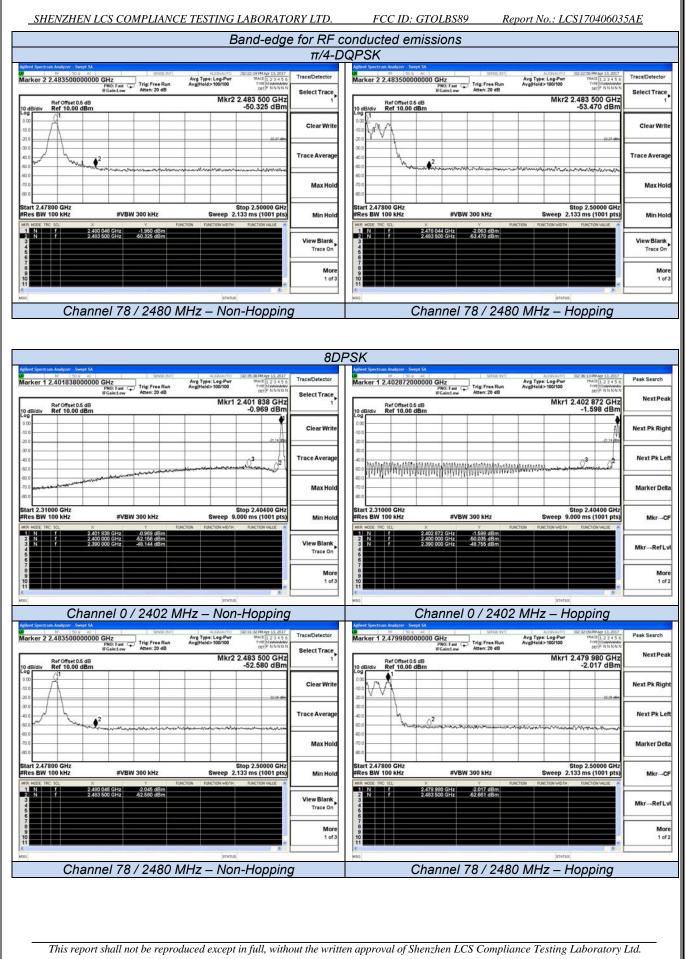




	GF	SK	
rit Sectors Addyn - Sergt M. se / Solo ac / I sector / Addyn - Sergt M. riker 1 2.402026000000 GHz - Trig: Free Run ArgTies Leg≀ Rikel [1.2 / 4.5 / PRO: Fast - Trig: Free Run ArgTies Leg≀ Rikel [1.2 / 4.5 / Fisicitant wr Atten: 20 dB		Agiled Syschum Andyzer, Swipt SA Bit Signature (Swipt SA) Bit Signat	ak Search
Ref Offset 0.5 dB Mkr1 2.402 026 GHz dB/div Ref 10.00 dBm -0.475 dBm	NextPeak	Ref Offset 0.5 dB Mkr1 2.402 026 GHz 10 dB/div Ref 10.00 dBm -0.397 dBm	NextPe
	Next Pk Right	20.0	xt Pk Ri
a construction of the second s	Next Pk Left	100 - 10 - 10 - 10 - 10 - 10 - 10 - 10	lext Pk I
0 Den ser and and a series of the series of	Marker Delta		larker D
art 2.31000 CHz Stop 2.40400 GHz es BW 100 kHz #VBW 300 kHz Sweep 9.000 ms (1001 pt) West ms so, x y naction narcinaveotm narcinaveotm	Mkr→CF	Start 2.31000 GHz Stop 2.40400 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 9.000 ms (1001 pts) Imm Acce the size x y runction runction worth runction worth 1 1 2.4020763 GHz -9.522 dBm runction worth runction worth runction worth	Mkr-
N Y 2402 (25: GHz - 0.475 dBm N Y 2400 (20: GHz - 6.1552 dBm N Y 2390 000 GHz - 449 520 dBm	Mkr→RefLvi	2 N f 2400,000 GHz 50,228 dBm	lkr→Re
	More 1 of 2		N 1
Channel 0 / 2402 MHz – Non-Hopping	v	Channel 0 / 2402 MHz – Hopping	
ent Spectrum Andyzer - Swept SA NF 50 p. AC SERVICE2011 AUXIVIAUTO (02502-06 PMAge 13, 2017		Agilent Spectrum Analyzer - Swept SA	
PRO: Fact Free Trig: Free Run Avg Type: Leg-Per Proc. Trig: Free Run PRO: Fact Trig: Free Run Avg Type: Leg-Per Trig: Free Run Ref Offset 0.5 dB Mkr2 2.483 500 GHz Trig: Free Run	Trace/Detector Select Trace	Marker 1 2.47800000000 GHz Avg Type: Leg-Par Not El 2 3 4 5 6 Floir Fait Avg Type: Leg-Par Not El 2 3 4 5 6 Frait C 2 3 4 5 6	ak Searci
51 401 dDm	1	Ref Offset 0.5 dB Mkr1 2.478 000 GHz	NextP
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Bildiv Ref 10.00 dBm -51.491 dBm	Clear Write	Ref Offset 05 dB Mkr1 2.478 000 GHz 10 dBkdly -1.638 dBm 10 dBkdly<	ext Pk R lext Pk
Bloker Ref 10.00 dBm -51.491 dBm -31.51.491 dBm -31	Clear Write Trace Average	Ref Offset0.6 dB Mkr1 2.478 000 GHz -1.638 dBm 10 dBidly Ref 10.00 dBm -1.638 dBm 000 -1.638 dBm Ne 000 Hz Step 2.50000 GHz VER MORE TR: 512 X Y Naction Wolf Naction Wolf	ext Pk R lext Pk larker D
Blodiv Ref 10.00 dBm -51.491 dBm -51.491 dBm -31046	Clear Write Trace Average Max Hold	Ref Offset0.5 dB Mkr1 2.478 000 GHz -1.638 dBm 10 dBidly Ref 10.00 dBm -1.638 dBm 000 -1.638 dBm Net 000	ext Pk R lext Pk larker D Mkr-
Bildiv Ref 10.00 dBm -51.491 dBm -51.491 dBm -31.5480 dBm rt 2.47800 GHz s BW 300 kHz s BW 300 kHz Sweep 2.133 ms (100 kHz) Sweep 2.133 ms (1	Clear Write Trace Average Max Hold Min Hold View Blank	Ref Offset0.5 dB Mkr1 2.478 000 GHz -1.638 dBm 10 dBidly Ref 10.00 dBm -1.638 dBm 000 -1.638 dBm Net 000	Next Pr xt Pk Ri lext Pk I Marker D Mkr



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6.6 Restricted Band Emission Limit

6.6.1. Standard Applicable

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\ Above 38.6

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (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

6.6.2. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

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

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

6.6.3. 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.

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 (± 45°) 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 (± 45°) 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:

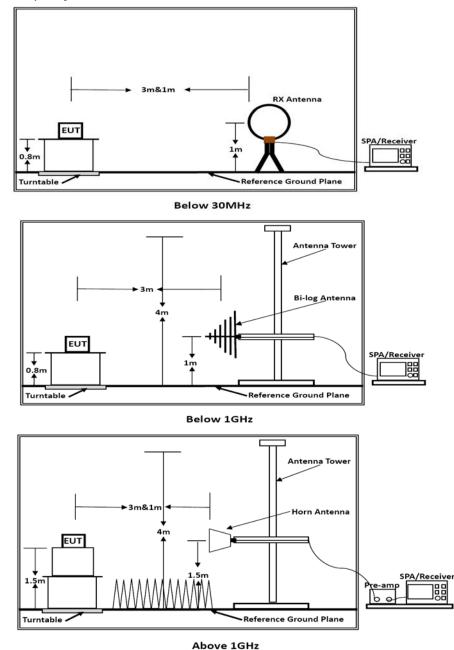
--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

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.

6.6.4. Test Setup Layout



Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1.5m.

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1.5m]) (dB); Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

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6.6.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.6.6. Results of Radiated Emissions (9 kHz~30MHz)

Temperature	25 ℃		Н	umidity	60%
Test Enginee	r Chaz	2	Configurations		BT
Freq. (MHz)	Level (dBuV)	Over L (dB)		Over Limit (dBuV)	it Remark
					See Note

Note:

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

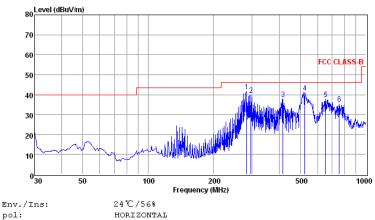
Distance extrapolation factor = 40 log (specific distance / test distance) (dB); Limit line = specific limits (dBuV) + distance extrapolation factor.

PASS.

Only record the worst test result in this report.

The test data please refer to following page.

Below 1GHz (Low Channel) DC 3.7V



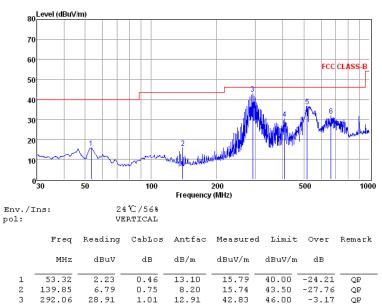
Freq Reading CabLos Antfac Measured Limit Over Remark

	MHz	dBuV	dB	dB/m	dBuV/m	dBuV/m	dB	
1	283.98	27.89	1.00	12.75	41.64	46.00	-4.36	QP
2	296.18	25.71	1.12	12.99	39.82	46.00	-6.18	QP
3	416.18	21.29	1.17	15.39	37.85	46.00	-8.15	QP
4	524.55	22.59	1.45	17.04	41.08	46.00	-4.92	QP
5	654.23	17.56	1.69	18.65	37.90	46.00	-8.10	QP
6	755.39	14.33	1.60	19.50	35.43	46.00	-10.57	QP

Note: 1. All readings are Quasi-peak values.

2. Measured= Reading + Antenna Factor + Cable Loss

3. The emission that ate 20db blow the offficial limit are not reported



1	53.32	2.23	0.46	13.10	15.79	40.00	-24.21	QP
2	139.85	6.79	0.75	8.20	15.74	43.50	-27.76	QP
3	292.06	28.91	1.01	12.91	42.83	46.00	-3.17	QP
4	408.95	13.74	1.28	15.24	30.26	46.00	-15.74	QP
5	519.06	18.28	1.47	16.94	36.69	46.00	-9.31	QP
6	665.80	11.63	1.55	18.69	31.87	46.00	-14.13	QP

Note: 1. All readings are Quasi-peak values.

Measured= Reading + Antenna Factor + Cable Loss
 The emission that ate 20db blow the offficial limit are not reported

***Note:

Pre-scan all mode and recorded the worst case results in this report (TX-Low Channel(1Mbps)). Emission level $(dBuV/m) = 20 \log Emission level (uV/m)$. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

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Above 1GHz

Note: All the modes have been tested and recorded worst mode in the report. The worst test result for GFSK, Channel 0 / 2402 MHz

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	60.05	33.06	35.04	3.94	62.01	74	-11.99	Peak	Horizontal
4804.00	42.31	33.06	35.04	3.94	44.27	54	-9.73	Average	Horizontal
4804.00	57.58	33.06	35.04	3.94	59.54	74	-14.46	Peak	Vertical
4804.00	44.55	33.06	35.04	3.94	46.51	54	-7.49	Average	Vertical
7206.00	50.04	34.25	36.11	4.45	52.63	74	-21.37	Peak	Horizontal
7206.00	37.10	34.25	36.11	4.45	39.69	54	-14.31	Average	Horizontal
7206.00	47.31	34.25	36.11	4.45	49.90	74	-24.10	Peak	Vertical
7206.00	37.46	34.25	36.11	4.45	40.05	54	-13.95	Average	Vertical
9608.00	48.71	35.14	37.23	4.62	51.24	74	-22.76	Peak	Horizontal
9608.00	38.88	35.14	37.23	4.62	41.41	54	-12.59	Average	Horizontal
9608.00	50.15	35.14	37.23	4.62	52.68	74	-21.32	Peak	Vertical
9608.00	41.44	35.14	37.23	4.62	43.97	54	-10.03	Average	Vertical
12010.00	46.45	36.11	38.14	5.21	49.63	74	-24.37	Peak	Horizontal
12010.00	37.48	36.11	38.14	5.21	40.66	54	-13.34	Average	Horizontal
12010.00	48.79	36.11	38.14	5.21	51.97	74	-22.03	Peak	Vertical
12010.00	37.05	36.11	38.14	5.21	40.23	54	-13.77	Average	Vertical
14412.00	45.99	37.18	39.21	5.59	49.55	74	-24.45	Peak	Horizontal
14412.00	33.88	37.18	39.21	5.59	37.44	54	-16.56	Average	Horizontal
14412.00	50.51	37.18	39.21	5.59	54.07	74	-19.93	Peak	Vertical
14412.00	35.43	37.18	39.21	5.59	38.99	54	-15.01	Average	Vertical
16814.00	47.73	38.22	40.17	5.91	51.69	74	-22.31	Peak	Horizontal
16814.00	34.43	38.22	40.17	5.91	38.39	54	-15.61	Average	Horizontal
16814.00	49.06	38.22	40.17	5.91	53.02	74	-20.98	Peak	Vertical
16814.00	35.70	38.22	40.17	5.91	39.66	54	-14.34	Average	Vertical

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The worst test result for GFSK, Channel 39 / 2441 MHz

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	58.28	33.16	35.15	3.96	60.25	74	-13.75	Peak	Horizontal
4882.00	43.57	33.16	35.15	3.96	45.54	54	-8.46	Average	Horizontal
4882.00	55.74	33.16	35.15	3.96	57.71	74	-16.29	Peak	Vertical
4882.00	42.39	33.16	35.15	3.96	44.36	54	-9.64	Average	Vertical
7323.00	52.88	34.32	36.19	4.48	55.49	74	-18.51	Peak	Horizontal
7323.00	38.10	34.32	36.19	4.48	40.71	54	-13.29	Average	Horizontal
7323.00	47.40	34.32	36.19	4.48	50.01	74	-23.99	Peak	Vertical
7323.00	35.95	34.32	36.19	4.48	38.56	54	-15.44	Average	Vertical
9764.00	50.97	35.23	37.31	4.65	53.54	74	-20.46	Peak	Horizontal
9764.00	38.20	35.23	37.31	4.65	40.77	54	-13.23	Average	Horizontal
9764.00	50.96	35.23	37.31	4.65	53.53	74	-20.47	Peak	Vertical
9764.00	35.72	35.23	37.31	4.65	38.29	54	-15.71	Average	Vertical
12205.00	50.31	36.19	38.26	5.26	53.50	74	-20.50	Peak	Horizontal
12205.00	34.92	36.19	38.26	5.26	38.11	54	-15.89	Average	Horizontal
12205.00	49.25	36.19	38.26	5.26	52.44	74	-21.56	Peak	Vertical
12205.00	38.85	36.19	38.26	5.26	42.04	54	-11.96	Average	Vertical
14646.00	50.29	37.27	39.29	5.63	53.90	74	-20.10	Peak	Horizontal
14646.00	34.63	37.27	39.29	5.63	38.24	54	-15.76	Average	Horizontal
14646.00	50.69	37.27	39.29	5.63	54.30	74	-19.70	Peak	Vertical
14646.00	36.06	37.27	39.29	5.63	39.67	54	-14.33	Average	Vertical
17087.00	50.45	38.30	40.25	5.95	54.45	74	-19.55	Peak	Horizontal
17087.00	37.73	38.30	40.25	5.95	41.73	54	-12.27	Average	Horizontal
17087.00	49.91	38.30	40.25	5.95	53.91	74	-20.09	Peak	Vertical
17087.00	35.30	38.30	40.25	5.95	39.30	54	-14.70	Average	Vertical

Freq. MHz	Reading dBuv	Ant. Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
4960.00	57.21	33.26	35.14	3.98	59.31	74	-14.69	Peak	Horizontal
4960.00	46.13	33.26	35.14	3.98	48.23	54	-5.77	Average	Horizontal
4960.00	55.68	33.26	35.14	3.98	57.78	74	-16.22	Peak	Vertical
4960.00	40.87	33.26	35.14	3.98	42.97	54	-11.03	Average	Vertical
7440.00	48.21	34.39	36.27	4.52	50.85	74	-23.15	Peak	Horizontal
7440.00	40.73	34.39	36.27	4.52	43.37	54	-10.63	Average	Horizontal
7440.00	47.73	34.39	36.27	4.52	50.37	74	-23.63	Peak	Vertical
7440.00	39.61	34.39	36.27	4.52	42.25	54	-11.75	Average	Vertical
9920.00	49.35	35.31	37.38	4.69	51.97	74	-22.03	Peak	Horizontal
9920.00	36.13	35.31	37.38	4.69	38.75	54	-15.25	Average	Horizontal
9920.00	48.02	35.31	37.38	4.69	50.64	74	-23.36	Peak	Vertical
9920.00	38.71	35.31	37.38	4.69	41.33	54	-12.67	Average	Vertical
12400.00	47.79	36.28	38.33	5.31	51.05	74	-22.95	Peak	Horizontal
12400.00	35.75	36.28	38.33	5.31	39.01	54	-14.99	Average	Horizontal
12400.00	47.78	36.28	38.33	5.31	51.04	74	-22.96	Peak	Vertical
12400.00	37.88	36.28	38.33	5.31	41.14	54	-12.86	Average	Vertical
14880.00	48.09	37.33	39.37	5.68	51.73	74	-22.27	Peak	Horizontal
14880.00	36.38	37.33	39.37	5.68	40.02	54	-13.98	Average	Horizontal
14880.00	48.75	37.33	39.37	5.68	52.39	74	-21.61	Peak	Vertical
14880.00	36.42	37.33	39.37	5.68	40.06	54	-13.94	Average	Vertical
17360.00	48.91	38.38	40.32	5.99	52.96	74	-21.04	Peak	Horizontal
17360.00	37.27	38.38	40.32	5.99	41.32	54	-12.68	Average	Horizontal
17360.00	47.16	38.38	40.32	5.99	51.21	74	-22.79	Peak	Vertical
17360.00	38.36	38.38	40.32	5.99	42.41	54	-11.59	Average	Vertical

The worst test result for GFSK, Channel 78 / 2480 MHz

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.

6.7. AC Power line conducted emissions

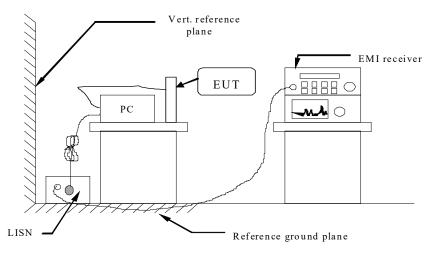
6.7.1 Standard Applicable

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				

* Decreasing linearly with the logarithm of the frequency

6.7.2 Block Diagram of Test Setup

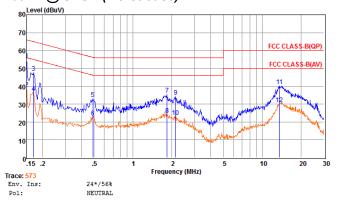


6.7.3 Test Results

PASS.

The test data please refer to following page.

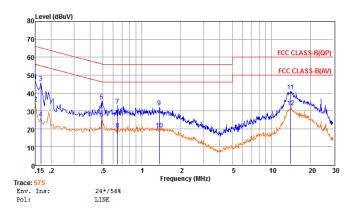
Test Results for AC 120V/60Hz @ GFSK (worst case)



Freq Reading LISNFac CabLos Aux2Fac Measured Limit Over Remark

	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.15	35.01	9.70	0.02	10.00	54.73	66.00	-11.27	QP
2	0.15	18.96	9.70	0.02	10.00	38.68	55.99	-17.31	Average
3	0.17	27.89	9.65	0.02	10.00	47.56	64.94	-17.38	QP
4	0.17	16.64	9.65	0.02	10.00	36.31	54.94	-18.63	Average
5	0.49	13.21	9.62	0.04	10.00	32.87	56.19	-23.32	QP
6	0.49	2.92	9.62	0.04	10.00	22.58	46.18	-23.60	Average
7	1.84	15.84	9.63	0.05	10.00	35.52	56.00	-20.48	QP
8	1.84	4.56	9.63	0.05	10.00	24.24	46.00	-21.76	Average
9	2.13	14.45	9.63	0.05	10.00	34.13	56.00	-21.87	QP
10	2.13	3.35	9.63	0.05	10.00	23.03	46.00	-22.97	Average
11	13.55	20.40	9.74	0.10	10.00	40.24	60.00	-19.76	QP
12	13.55	10.06	9.74	0.10	10.00	29.90	50.00	-20.10	Average

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac. 2. The emission levels that are 20dB below the official limit are not reported.

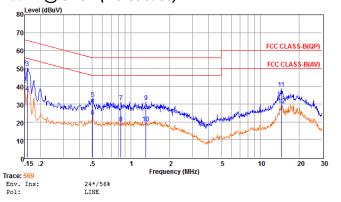


	Freq	Reading	LISNFac	CabLos	Aux2Fac	Measu	red Limit	; Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.15	27.02	9.57	0.02	10.00	46.61	66.00	-19.39	QP
2	0.15	14.66	9.57	0.02	10.00	34.25	55.99	-21.74	Average
3	0.17	26.09	9.59	0.02	10.00	45.70	65.16	-19.46	QP
4	0.17	6.25	9.59	0.02	10.00	25.86	55.16	-29.30	Average
5	0.49	15.78	9.62	0.04	10.00	35.44	56.19	-20.75	QP
6	0.49	6.18	9.62	0.04	10.00	25.84	46.18	-20.34	Average
7	0.65	13.21	9.64	0.04	10.00	32.89	56.00	-23.11	QP
8	0.65	-0.08	9.64	0.04	10.00	19.60	46.00	-26.40	Average
9	1.36	12.39	9.63	0.05	10.00	32.07	56.00	-23.93	QP
10	1.36	-0.09	9.63	0.05	10.00	19.59	46.00	-26.41	Average
11	13.99	21.11	9.71	0.10	10.00	40.92	60.00	-19.08	QP
12	13.99	12.31	9.71	0.10	10.00	32.12	50.00	-17.88	Average

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac. 2. The emission levels that are 20dB below the official limit are not reported.

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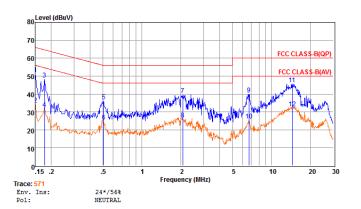
Test Results for AC 240V/60Hz @ GFSK (worst case)



Freq Reading LISNFac CabLos Aux2Fac Measured Limit Over Remark

	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.15	31.68	9.57	0.02	10.00	51.27	66.00	-14.73	QP
2	0.15	21.49	9.57	0.02	10.00	41.08	55.99	-14.91	Average
3	0.16	30.77	9.58	0.02	10.00	50.37	65.56	-15.19	QP
4	0.16	16.59	9.58	0.02	10.00	36.19	55.55	-19.36	Average
5	0.50	13.35	9.62	0.04	10.00	33.01	56.00	-22.99	QP
6	0.50	3.31	9.62	0.04	10.00	22.97	46.00	-23.03	Average
7	0.83	11.48	9.64	0.04	10.00	31.16	56.00	-24.84	QP
8	0.83	-0.28	9.64	0.04	10.00	19.40	46.00	-26.60	Average
9	1.30	11.43	9.63	0.05	10.00	31.11	56.00	-24.89	QP
10	1.30	-0.42	9.63	0.05	10.00	19.26	46.00	-26.74	Average
11	14.59	18.78	9.71	0.10	10.00	38.59	60.00	-21.41	QP
12	14.60	9.75	9.71	0.10	10.00	29.56	50.00	-20.44	Average

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac. 2. The emission levels that are 20dB below the official limit are not reported.



	Freq	Reading	LISNFac	CabLos	Aux2Fac	: Measur	red Limit	Over	Remark
	MHz	dBuV	dB	dB	dB	dB	dBuV	dBuV	dB
1	0.15	31.42	9.70	0.02	10.00	51.14	66.00	-14.86	QP
2	0.15	14.34	9.70	0.02	10.00	34.06	55.99	-21.93	Average
3	0.18	28.40	9.64	0.02	10.00	48.06	64.59	-16.53	QP
4	0.18	12.21	9.63	0.02	10.00	31.86	54.59	-22.73	Average
5	0.50	16.37	9.62	0.04	10.00	36.03	56.00	-19.97	QP
6	0.50	4.99	9.62	0.04	10.00	24.65	46.00	-21.35	Average
7	2.07	19.86	9.63	0.05	10.00	39.54	56.00	-16.46	QP
8	2.07	6.34	9.63	0.05	10.00	26.02	46.00	-19.98	Average
9	6.70	20.19	9.69	0.07	10.00	39.95	60.00	-20.05	QP
10	6.70	5.48	9.69	0.07	10.00	25.24	50.00	-24.76	Average
11	14.44	25.70	9.74	0.10	10.00	45.54	60.00	-14.46	QP
12	14.44	12.42	9.74	0.10	10.00	32.26	50.00	-17.74	Average

Remarks: 1. Measured = Reading +Cable Loss +Aux2 Fac.

 The emission levels that are 20dB below the official limit are not reported.

Note: Pre-scan all modes and recorded the worst case results in this report.

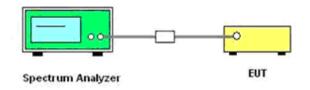
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6.8. Band-edge measurements for radiated emissions

6.8.1 Standard Applicable

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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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 in §15.209(a) (see §15.205(c)).

6.8.2. Test Setup Layout



6.8.3. Measuring Instruments and Setting

Please refer to section 6 of equipment list in this report. The following table is the setting of Spectrum Analyzer.

6.8.4. Test Procedures

According to KDB 412172 section 1.1 Field Strength Approach (linear terms):

 $eirp = p_t x g_t = (E x d)^2/30$

Where:

 p_t = transmitter output power in watts, \cdot

 g_t = numeric gain of the transmitting antenna (unitless), \cdot

E = electric field strength in V/m, \cdot

d = measurement distance in meters (m).

 $erp = eirp/1.64 = (E \times d)^2/(30 \times 1.64)$

Where all terms are as previously defined.

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
- Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=1/B for Peak detector.
- 4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- 5. Repeat above procedures until all measured frequencies were complete.
- 6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).

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- 7. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
- Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000
- 9. MbHz)evices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
- 10. Compare the resultant electric field strength level to the applicable regulatory limit.
- 11. Perform radiated spurious emission test duress until all measured frequencies were complete.

6.8.5. Test Results

		GFSH	(– Non-Hop	oing			
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
2310.000	-61.131	0.0	0.0	36.129	Peak	74.00	PASS
2310.000	-72.074	0.0	0.0	25.186	AV	54.00	PASS
2390.000	-37.151	0.0	0.0	60.109	Peak	74.00	PASS
2390.000	-56.697	0.0	0.0	40.563	AV	54.00	PASS
2483.500	-41.668	0.0	0.0	55.592	Peak	74.00	PASS
2483.500	-59.345	0.0	0.0	37.915	AV	54.00	PASS
2500.000	-42.208	0.0	0.0	55.052	Peak	74.00	PASS
2500.000	-60.427	0.0	0.0	36.833	AV	54.00	PASS

π/4DQPSK – Non-Hopping									
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict		
2310.000	-60.883	0.0	0.0	36.377	Peak	74.00	PASS		
2310.000	-72.164	0.0	0.0	25.096	AV	54.00	PASS		
2390.000	-39.501	0.0	0.0	57.759	Peak	74.00	PASS		
2390.000	-56.926	0.0	0.0	40.334	AV	54.00	PASS		
2483.500	-41.930	0.0	0.0	55.330	Peak	74.00	PASS		
2483.500	-59.969	0.0	0.0	37.291	AV	54.00	PASS		
2500.000	-41.613	0.0	0.0	55.647	Peak	74.00	PASS		
2500.000	-60.359	0.0	0.0	36.901	AV	54.00	PASS		

8DPSK – Non-Hopping										
Frequency (MHz)	Conducted Power (dBm)	Antenna Gain (dBi)	Ground Reflection Factor (dB)	Covert Radiated E Level At 3m (dBuV/m)	Detector	Limit (dBuV/m)	Verdict			
34.682	-60.578	0.0	0.0	36.682	Peak	74.00	PASS			
23.089	-72.171	0.0	0.0	25.089	AV	54.00	PASS			
59.226	-36.034	0.0	0.0	61.226	Peak	74.00	PASS			
37.899	-57.361	0.0	0.0	39.899	AV	54.00	PASS			
52.689	-42.571	0.0	0.0	54.689	Peak	74.00	PASS			
35.378	-59.882	0.0	0.0	37.378	AV	54.00	PASS			
51.741	-43.519	0.0	0.0	53.741	Peak	74.00	PASS			
34.792	-60.468	0.0	0.0	36.792	AV	54.00	PASS			

Remark:

- 1. Measured at difference Packet Type for each mode and recorded worst case for each mode.
- 2. Measured at Hopping and Non-Hopping mode, recorded worst at Non-Hopping mode.
- 3. The other emission levels were very low against the limit.
- 4. The average measurement was not performed when the peak measured data under the limit of average detection.
- 5. Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=330Hz/Sweep time=Auto/Detector=Peak;
- 6. Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.
- 7. Please refer to following test plots;

Band-edge me		nts for radiated emissions	
	GF	SK	
Applier Soutram Aubyzer - Sweg SA strate bit August / Soutram Aubyzer - Sweg SA W 500 # 500 # 500 # Marker 2 2.361606000000 GHz IPW0; Fast _ Chain _ Cha	6 Marker	Marker 2 2.488472000000 GHz BP00 # 40 StreePirt 41/31/8/10 01/50/51/8/4/13.2017 Marker 2 2.488472000000 GHz Frig: Free Run BP00 Feat Avg Type: Log Pur Trig: Free Run Atten: 20 dB Avg Type: Log Pur Avg Hold>100100 Trig: Free Run cell [®] NNNNN	Marker Select Marker
Ref offiset 0.5 dB Mkr2 2.361 606 GH: 10 dB/div Ref 10.00 dBm -38.642 dBn	2	Ref Offset0.5 dB Mkr2 2.488 472 GHz Log dB/dw Ref 10.00 dBm -39.713 dBm Log	2
	Normal		Normal
200 400 100 100 100 100 100 100 1	Delta	300 2 30 400 600	Delta
700	Fixed⊳	40.0	Fixed⊳
Start 2.31000 GHz Stop 2.40400 GHz #Res BW 1.0 MHz #VBW 3.0 MHz Sweep 1.000 ms (1001 pts stop 1.000 ms (1001 pts) of	Start 2.47800 GHz Stop 2.50000 GHz #Res BW 1.0 MHz #VBW 3.0 MHz Sweep 1.000 ms (1001 pts) WR HOD: FIG. SQL X Y Runchmer Machine M	Off
1 N f 2310 000 GHz -61.131 dBm 2 N f 2360 66 GHz -3842 dBm 3 N f 2380 000 GHz -37.151 dBm 6	Properties►	1 N f 2.483 500 CHz 41.669 dBm 2 N f 2.489 T2 CHz 33.713 dBm 3 N f 2.600 000 GHz 42.209 dBm 5 1 7 1 1 1 1 2 2 1 2 1 3 N f 2.600 000 GHz 42.209 dBm 4 2 1<	Properties►
	More 1 of 2		More 1 of 2
Channel 0 / 2402 MHz – Non-Hopping – I	Peak	Channel 78 / 2480 MHz – Non-Hopping – F	Peak
Anfleret, Spectrum Analyzer - Swept SA	π/4D	QPSK Agiled Spectrum Analyzer - Swept SA	
M FF SO Q AC SERVE INT AUXIMUTO 01:45:10 PM Apr 13, 2012 Marker 2 2.371100000000 GHz Avg Type: Log-Pwr TMACE [1 2 3 4 5	6 Trace/Detector	AF SD 0 AC SEPSE/NT ALISHAUTO OLS2:46 FMApr 13, 2017 Marker 2 2.489990000000 GHz Avg Type: Log-Pwr MARZE [1: 2: 3 4 5 6 The Even Pure MARZE [1: 2: 3 4 5 6	Trace/Detector
PHO: Fast Trig: Free Run If GainLow Avg Heid>100/100 Trig: Physical Physical Ref 0/fiset 0.5 dB Ref 0/fiset 0.5 dB 10 dB/div Mkr2 2.371 100 GH: -37.906 dBm -37.906 dBm	Select Trace	PRO Fast C Ing Prev Kun Kvgiprole kundo (ep Printing Broalect.ow Atten: 20 dB Mkr2 2.489 990 GHz 10 dB/div Ref 10.00 dBm -41.414 dBm	Select Trace
	Clear Write		Clear Write
200 22 33 22 33 200 200 200 200 200 200	Trace Average		Trace Average
700	Max Hold	48.0	Max Hold
Start 2.31000 GHz Stop 2.40400 GHz #Res BW 1.0 MHz #VBW 3.0 MHz Sweep 1.000 ms (1001 pts work) wai woot (rs sol) x y nunction nunction work) nunction work		MKR MODE TRC SCL X Y FUNCTION WOTH FUNCTION VALUE	Min Hold
1 N f 2310000 CHz 40.883 dBm 2 N f 237100 CHz 47306 dBm 3 N f 2390 000 CHz 399.501 dBm 6	View Blank Trace On	1 N f 2.483 500 GHz 41.930 dBm 2 N f 2.889 90 GHz 4.141 dBm 3 N f 2.660 000 GHz 41.613 dBm 6 6 6 6 6 6 6 7 4.1613 dBm 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 1.613 dBm 6 7 <th7< th=""> 7 7 7</th7<>	View Blank Trace On
	More 1 of 3		More 1 of 3
Channel 0 / 2402 MHz – Non-Hopping – I	Peak	Channel 78 / 2480 MHz – Non-Hopping – F	Peak
	8D)	PSK	
Agilent Spectrum Analyzer - Swept SA		Adient Spectrum Analyzer - Swept SA W RF 50.0 AC SPR6E.011 ALIGNAUTO 01:55:21 MM or 13, 2017	Trace/Detector
Marker 2 2.372698000000 GHz (10 m) CHar (12 m) Trig: Free Run Atten: 20 dB Arg Type: Leg-Par Arg Heid>100100 Trid: [12 m] Ref Offset 0.5 dB 10 dB/dw Ref Offset 0.5 dB Mkr2 2.372 698 GHI -366.430 dBm Mkr2 3.372 698 GHI	Select Marker	Marker 2 2.490364000000 GHz Trig: Free Run Avg Type: Leg-Pur Avg Hold>100/100 Trig: Calk of the free Run Avg Type: Leg-Pur Avg Hold>100/100 Trig: Calk of the free Run Ref Offset0.5 dB Mkr2 2.490 364 GHz Mkr2 2.490 364 GHz 10 dB/div Ref 10.00 dBm -41.740 dBm	Select Trace
	Normal	(Gg)	Clear Write
	Deita	200 300 400 400 400	Trace Average
400	Fixed	400	Max Hold
Start 2.31000 GHz Stop 2.40400 GH: #Res BW 1.0 MHz #VBW 3.0 MHz Sweep 1.000 ms (1001 pts) MRR MODE TRC SOL X Y Function Function Function	off	Start 2.47800 GHz Stop 2.50000 GHz #Res BW 1.0 MHz #VBW 3.0 MHz Sweep 1.000 ms (1001 pts) MMR_MODE_TRC_SQL x Y Function Function worthin Function worthin	Min Hold
1 N f 2.310 000 GHz 460.578 dBm 2 N f 2.379 690 GHz -364.30 dBm 3 N f 2.390 000 GHz -36.034 dBm 5	Properties►	1 N f 2483 500 GHz 422 571 dBm 2 2 N f 2480 4042 471 740 dBm 3 N f 2500 000 GHz 43 519 dBm 5	View Blank Trace On
	More 1 of 2		More 1 of 3
Channel 0 / 2402 MHz – Non-Hopping – I	Peak	Channel 78 / 2480 MHz – Non-Hopping – F	Paak

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SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD.	FCC ID: GTOLBS89	Report No.: LCS170406035AE

		Band-	edge mea			liated emissions		
				GF	SK			
Agilent Spectrum Analyzer - Swept SA					Agilent Spectrum Analyze	r - Swept SA		
Marker 2 2.3607600000	SERVE INT	Avg Type: Log-Pwr	04:22:32 PM Apr 12, 2017 TRACE 1 2 3 4 5 6	Marker	Marker 2 2.4856	34000000 GHz	ALIGNAUTO 01:50:03 PM Apr 13, 20 Avg Type: Log-Pwr TRACE 1 2 3 4 Avg[Hold>100/100 TVFE MWWW	Trace/Detector
	PNO: Fast Trig: Free Run IFGain:Low #Atten: 20 dB	Avg Hold>100/100	DET P N N N N N	Select Marker		PNO: Fast Trig: Free Run IFGain:Low Atten: 20 dB	Avg Type: Log-Pwr Avg[Hold>100/100 TyPE/MWWW oet/P NNN	Select Trace
Ref Offset 0.5 dB	1	Mkr2	2.360 760 GHz	2	Ref Offs	et 0.5 dB	Mkr2 2.485 634 GH	Z 1
10 dB/div Ref 10.00 dBm	() (i)	11 - 12 - 14 - 14 - 14 - 14 - 14 - 14 -	-59.157 dBm		10 dB/div Ref 10	.00 dBm	-57.370 dBi	n
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30.0			A	1000	-30.0			-
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70.0				Fixed	-70.0			Max Ho
					-00.0			
Start 2.31000 GHz	#VBW 330 Hz	C	Stop 2.40400 GHz 22.1 ms (1001 pts)		Start 2.47800 GH:		Stop 2.50000 GH	
Res BW 1.0 MHz		INCTION FUNCTION WOTH	22.1 ms (1001 pts)	off	#Res BW 1.0 MHz		Sweep 52.00 ms (1001 pt FUNCTION FUNCTION WIDTH FUNCTION VALUE	S) Min Hol
1 N f 23	70.074 40	Torcion wom	TURCTION TRUCK		1 N C		FUNCTION FUNCTION WOTH FUNCTION WEDE	1
2 N f 23	360 760 GHz -59.157 dBm 390 000 GHz -56.697 dBm			Bronartiesh	2 N f 3 N f	2,483 500 GHz 59,345 dBm 2,485 634 GHz 57,370 dBm 2,500 000 GHz 50,427 dBm		View Blank
6				Properties►	4			Trace On
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9				More	8			Mor
10				1 of 2	10			1 of
¢			2		<		>	
660		STATU	b.		MSG		STATUS	
Channe	el 0 / 2402 MHz	z – Non-H	oppina — J	AV	Ch	annel 78 / 2480 MI	Hz – Non-Hopping	–AV
							g	
				π/4D	QPSK			
gilent Spectrum Analyzer - Swept SA					Agilent Spectrum Analyze	r - Swept SA	and the second second part of the second sec	
RF 50.0 AC	SENSE: INT	Avg Type: Log-Pwr	04:23:39 PM Apr 12, 2017	Marker	Marker 2 2.4893	50.9 AC SPISE.NT	ALIGNAUTO 01:53:23 PMApr 13, 20 Avg Type: Log.Pwr TRACE 1, 2, 3, 4	Marker
Marker 2 2.3616060000	PNO: Fast Trig: Free Run	Avg/Hold: 65/100	TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P NNNNN		Marker 2 2.4095	PNO: Fast C Atten: 20 dB	Avg Type: Log-Pwr Avg Hold>100/100	WV IN
	IFGain:Low #Atten: 20 dB			Select Marker	1. C. M. C.		Mkr2 2.489 374 GH	Selectimarker
Ref Offset 0.5 dB 10 dB/div Ref 10.00 dBm		MKr2	2.361 606 GHz -58.994 dBm	2	10 dB/div Ref 0ffs	et 0.5 dB .00 dBm	-60.444 dBi	
Log			00.004 0.001		Log			
0.00				Normal	-10.0			Norma
-10.0					-20.0			1000.02
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50.0			3	-	-50.0			3
60.0	1 ²		Land		-60.0	Vul ↓2		4
70.0				Fixed	-70.0			Fixed
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Start 2.31000 GHz			Stop 2.40400 GHz		Start 2.47800 GH		Stop 2.50000 GH	IZ
#Res BW 1.0 MHz	#VBW 330 Hz	Sweep 2	22.1 ms (1001 pts)	off	#Res BW 1.0 MHz	#VBW 330 Hz	Sweep 52.00 ms (1001 pt	
MKR MODE TRC SOL X	y P 310 000 GHz -72.164 dBm	UNCTION FUNCTION WIDTH	FUNCTION VALUE		MKR MODE THE SEL	X Y	FUNCTION FUNCTION WIDTH FUNCTION VALUE	<u> </u>
	361 606 GHz -58.994 dBm				2 N f	2 483 500 GHz -59 969 dBm 2 489 374 GHz -60 444 dBm		
3 N f 23	390 000 GHz -56.926 dBm			Properties ►	3 N f	2.500 000 GHz -60.359 dBm		Properties
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8				More	7 8			
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03		STATU	1		MSG		STATUS	
Chann	el 0 / 2402 MH	7 Non H	lonning	41/	Ch	annal 78 / 2/20 M	Hz – Non-Hopping	
Chailin			opping –/	<i>۲ ۲</i>	Ch	annei 7072400 IVII		-AV
				20	PSK			
				00	-			
gilent Spectrum Analyzer - Swept SA	CENER-NUT	ALCON ALCO	01-47-58 PM Apr 13, 2017		Agilent Spectrum Analyze	50.9 AC SENSE:INT	ALIGNAUTO 01:54:24 PM Apr 13, 20	7
Marker 2 2.3652720000	00 GHz Trig: Free Run	Avg Type: Log-Pwr Avg Hold: 55/100	TRACE 1 2 3 4 5 6 TYPE MUMMUM DET P NNNN	Trace/Detector	Marker 2 2.4905		Avg Type: Log-Pwr TRACE 1 2 3 4 5	Marker
	PNO: Fast Trig: Free Run IFGain:Low Atten: 20 dB	watthing: coulde	DETPNNNNN	Select Trace		PNO: Fast Trig: Free Run IFGain:Low Atten: 20 dB	DETP NANA	Select Marker
Ref Offset 0.5 dB 0 dB/div Ref 10.00 dBm		Mkr2	2.365 272 GHz	1	Ref Offs	et 0.5 dB	Mkr2 2.490 540 GH -60.228 dB	Z 2
10 dB/div Ref 10.00 dBm			-56.251 dBm		10 dB/div Ref 10	.00 dBm	-60.228 dBi	"I
0.00				Clear Write	0.00			Norm
-10.0				Ciear write	-10.0			
20.0					-20.0			
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1555 Concerns of the second second				Max Hold	-80.0			-II Fixed
80.0								11
			Otom 0 10101 01					
80.0 Start 2.31000 GHz #Res BW 1.0 MHz	#VBW 330 Hz	Sweep 2	Stop 2.40400 GHz 22.1 ms (1001 pts)	Min Hold	Start 2.47800 GH: #Res BW 1.0 MHz	#VBW 330 Hz	Stop 2.50000 GF Sweep 52.00 ms (1001 pt	s) c

 Channel 0 / 2402 MHz – Non-Hopping –AV
 Channel 78 / 2480 MHz – Non-Hopping –AV

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View Blank Trace Or

> More 1 of 3

2 483 500 2 490 540 -59.882 dB -60.228 dB

Properties

More 1 of 2

-72.171 dBn -56.251 dBn -57.361 dBn

2.310 000 GHz 2.365 272 GHz 2.390 000 GHz

6.9. Pseudorandom frequency hopping sequence

6.9.1 Standard Applicable

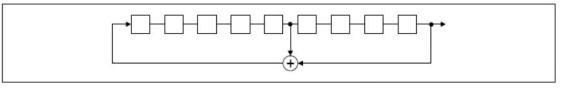
For 47 CFR Part 15C sections 15.247 (a) (1) requirement:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping 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. 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 hop-ping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

6.9.2 EUT Pseudorandom Frequency Hopping Sequence Requirement

The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th first stage. The sequence begins with the first one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros:8(non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of pseudorandom frequency hopping sequence as follows:

0	2	4	6		62 64	78	1	73	75 77
			Π					· · · · · · · · · · · · · · · · · · ·	
				1					

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

6.10. Antenna requirement

6.10.1 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.

6.10.2 Antenna Connected Construction

6.10.2.1. 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.

6.10.2.2. Antenna Connector Construction

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

6.10.2.3. 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.

Measurement parameters:

Measurement parameter						
Detector:	Peak					
Sweep time:	Auto					
Resolution bandwidth:	1 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		0.35	0.67	0.37
Radiated power [dBm] Measured with GFSK modulation		0.32	0.57	0.33
Gain [dBi] Calculated		i] Calculated -0.03		-0.04
Me	easurement unce	ertainty	± 1.6 dB (cond.)	/ ± 3.8 dB (rad.)

Result: -/-

-----THE END OF TEST REPORT------