FCC TEST REPORT FOR

Shenzhen Linpa Technology Co.,Ltd

Bluetooth Headpphone

Model No.: SBT660

Series model : PBT660, LBT660

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.
Address	:	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
Date of receipt of test sample	:	August 20, 2017
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	August 20, 2017~ September 18, 2017
Date of Report	:	September 18, 2017

This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 1 of 61

FCC TEST REPORT		
FCC CFR 47 PART 15 C(15.247): 2016		
Report Reference No::	LCS170817067AE	
Date of Issue :	September 18, 2017	
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 □	
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): 2016	
Test Report Form No :	LCSEMC-1.0	
TRF Originator:	Shenzhen LCS Compliance Testing Laboratory Ltd.	
Master TRF :	Dated 2011-03	
Shenzhen LCS Compliance Testing Laboratory Ltd. All rights reserved.		
This publication may be reproduced i Shenzhen LCS Compliance Testing I	n whole or in part for non-commercial purposes as long as the _aboratory Ltd. is acknowledged as copyright owner and source of	

Shenzhen LCS Compliance Testing Laboratory Ltd. is acknowledged as copyright owner and source of the material. Shenzhen LCS Compliance Testing Laboratory Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

Test Item Description:	Bluetooth Headpphone
Trade Mark :	Sharper Image, Polaroid ,Limited Too
Test Model	SBT660
Ratings	DC 3.7V by battery
	Recharge Voltage: 5V,1A
Result	Positive

Compiled by:

Supervised by:

Approved by:

Are chai

Ace Chai/ File administrators

Glin Lu/ Technique principal

Gavin Liang/ Manager

This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 2 of 61

FCC -- TEST REPORT

Test Report No. : LCS170817067AE		<u>September 18, 2017</u> Date of issue		
Test Model	: SBT660			
EUT	: Bluetooth Headpphone			
Applicant	: Shenzhen Linpa Tech	nology Co.,Ltd		
Address	: 114,C8, Flavor Comme Longgang District, She	rcial Street, Vanke Dream Town, Bantian, nzhen, Guangdong, 518102, China		
Telephone	:/	:/		
Fax	: /			
Manufacturer	: Dongguan Linpa Elec	tronics Ltd		
Address	: 3F-C, B Building, Qiaoj Dongguan City	iaozhonglu 178; Shiguqiao;Tangxia County,		
Telephone	: /			
Fax	: /			
Factory	: Dongguan Linpa Elec	tronics Ltd		
Address	: 3F-C, B Building, Qiaoj Dongguan City	iaozhonglu 178; Shiguqiao;Tangxia County,		
Telephone	: /			
Fax	: /			

Test Result

Positive

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.

Revision History

Revision	Issue Date	Revisions	Revised By
00	September 18, 2017	Initial Issue	Gavin Liang

This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 4 of 61

TABLE OF CONTENTS

Description	Page
1. GENERAL INFORMATION	
1.1 Description of Device (EUT)	
1.2 Support equipment List	
1.3 External I/O Cable	
1.4 Description of Lest Facility	
1.5 Statement of the Measurement Uncertainty	
1.7 Description of Test Modes	
2. TEST METHODOLOGY/	
2 1 FUT Configuration	
2.2 EUT Exercise	
2.3 General Test Procedures	
2.4. Test Sample	
3. SYSTEM TEST CONFIGURATION	••••••
3.1 Justification	
3.2 EUT Exercise Software	
3.3 Special Accessories	
3.4 Block Diagram/Schematics	
3.6 Test Setun	
4. SUMMARY OF TEST RESULTS	
	1
	I
6. MEASUREMENT RESULTS	I
6.1 Peak Power	I 1
6.3 Number of Hopping Frequency	1 1
6.4 Time of Occupancy (Dwell Time)	$\frac{1}{2}$
6.5 Conducted Spurious Emissions and Band Edges Test	2
6.6 Restricted Band Emission Limit	3
6.7. AC Power line conducted emissions	4
6.8. Band-edge measurements for radiated emissions	4
6.10 Aptoppa requirement	
8.EXIERNAL AND INTERNAL PHOTOS OF THE EUT	5

1. GENERAL INFORMATION

1.1

Description of Device (EUT)	
EUT	: Bluetooth Headpphone
Test Model	: SBT660
List Model No.	: PBT660, LBT660
Model Declaration	: PCB board, structure and internal of these model(s) are the same, So no additional models were tested.
Power Supply	: DC 3.7V by battery Recharge Voltage: 5V ,1A
Hardware version	: V1.6
Software version	: V1.0
Bluetooth Operation frequency	2402MHz-2480MHz
Bluetooth Version	: 3.0+EDR
Bluetooth Channel Number	: 79 Channels
Bluetooth Modulation Type	: GFSK, π /4-DQPSK , 8-DPSK
Antenna Description	: Internal Antenna, 2dBi

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
Charge Interface	1	N/A

1.4 Description of Test Facility

CNAS Registration Number. is L4595.

FCC Registration Number. is CN5024.

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

NVLAP Registration Code is 600167-0

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10:2013 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 6 of 61

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
BT V 3.0	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).

Pre-test AC conducted emission at charge from PC mode, recorded worst case.

Pre-test AC conducted emission at both voltage AC 120V/60Hz and AC 240V/50Hz, recorded worst case.

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 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 the turntable, which is 0.8 m above ground plane. 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. SYSTEM TEST CONFIGURATION

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 (MP_kit_RF TOOL) 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.

4. SUMMARY OF TEST RESULTS

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)	47(a)(1)(ii) Number Of Hopping Frequency		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	§15.205 Emissions at Restricted Band		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

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
1	Power Sensor	R&S	NRV-Z51	100458	2017-06-18	2018-06-17
2	Power Sensor	R&S	NRV-Z32	10057	2017-06-18	2018-06-17
3	Power Meter	R&S	NRVS	100444	2017-06-18	2018-06-17
4	DC Filter	MPE	23872C	N/A	2017-06-18	2018-06-17
5	RF Cable	Harbour Industries	1452	N/A	2017-06-18	2018-06-17
6	SMA Connector	Harbour Industries	9625	N/A	2017-06-18	2018-06-17
7	Spectrum Analyzer	Agilent	N9020A	MY50510140	2016-10-27	2017-10-26
8	Signal analyzer	Agilent	E4448A(Exter nal mixers to 40GHz)	US44300469	2017-06-16	2018-06-15
9	RF Cable	Hubersuhne	Sucoflex104	FP2RX2	2017-06-18	2018-06-17
10	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2017-06-18	2018-06-17
11	Amplifier	SCHAFFNER	COA9231A	18667	2017-06-18	2018-06-17
12	Amplifier	Agilent	8449B	3008A02120	2017-06-16	2018-06-15
13	Amplifier	MITEQ	AMF-6F-2604 00	9121372	2017-06-16	2018-06-15
14	Loop Antenna	R&S	HFH2-Z2	860004/001	2017-06-18	2018-06-17
15	By-log Antenna	SCHWARZBEC K	VULB9163	9163-470	2017-06-10	2018-06-09
16	Horn Antenna	EMCO	3115	6741	2017-06-10	2018-06-09
17	Horn Antenna	SCHWARZBEC K	BBHA9170	BBHA9170154	2017-06-10	2018-06-09
18	RF Cable-R03m	Jye Bao	RG142	CB021	2017-06-18	2018-06-17
19	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2017-06-18	2018-06-17
20	EMI Test Receiver	ROHDE & SCHWARZ	ESCI	101142	2017-06-18	2018-06-17
21	Artificial Mains	ROHDE & SCHWARZ	ENV216	101288	2017-06-18	2018-06-17
22	EMI Test Software	AUDIX	E3	N/A	2017-06-18	2018-06-17

This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 11 of 61

6. MEASUREMENT RESULTS

- 6.1 Peak Power
- 6.1.1 Block Diagram of Test Setup



DC Filter

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

Temperature	26.6°C	Humidity	52.3%
Test Engineer	Jayden Zhuo	Configurations	BT

Test Mode	Channel	Frequency (MHz)	Measured Maximum Peak Power (dBm)	Limits (dBm)	Verdict
	0	2402	1.675		
GFSK	39	2441	1.104	30	PASS
	78	2480	0.697		
	0	2402	0.52		
π/4-DQPSK	39	2441	0.152	21	PASS
	78	2480	-0.28		
	0	2402	0.645		
8-DPSK	39	2441	0.254	21	PASS
	78	2480	-0.203		

Remark:

1. Test results including cable loss;

2. please refer to following plots;

3. Measured output power at difference Packet Type for each mode and recorded worst case for each mode.

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 = 300 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 \geq 1% of the 20 dB bandwidth, VBW \geq RBW.

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

6.2.4 Test Results

Temperature	26.6°C	Humidity	52.3%
Test Engineer	Jayden Zhuo	Configurations	BT

The Measurement Result With 1Mbps For GFSK Modulation							
Channel	20dB Bandwidth (KHz)	Channel Separation (MHz)	Limit (KHz)	Result			
Low	744.6		496.40	Pass			
Middle	829.3	1.000	552.87	Pass			
High	823.8		549.20	Pass			
The Measurement Result With 2Mbps For π /4-DQPSK Modulation							
Channel	20dB Bandwidth (KHz)	Channel Separation (MHz)	Limit (KHz)	Result			
Low	1117		744.67	Pass			
Middle	1115	1.000	743.33	Pass			
High	1117		744.67	Pass			
Th	e Measurement Res	ult With 3Mbps For 8	-DPSK Modulatior	า			
Channel	20dB Bandwidth (KHz)	Channel Separation (MHz)	Limit (KHz)	Result			
Low	1165		776.67	Pass			
Middle	1164	1.000	776.00	Pass			
High	1164		776.00	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.



This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 15 of 61

	Test Plot of Test Result								
			8-D	PSK					
Keysight Spectrum Advance - Swept SA P ² SO AC Image: Some Spectrum Advance - Swept SA Marker 1 Δ 1.00000000 MHz PNO: Wide IF Gain: Low Marker 1 Δ Ref Offset 0.5 dB Ref 20.0 dBm	SENSE:INT Avg Trig: Free Run Atten: 30 dB	ALIGN AUTO [06:56:22 PM Sep15,2017] TYPe: Log-Pwr TRACE [1 2 3 4 5 6 Hold:>100/100 TYPE MWWWWW DET [P NNNN ΔMkr1 1.000 0 MHz 0.231 dB	Marker Select Marker	Marker 1 Δ 1.00 Ref Off 10 dB/div Ref 21	zzer - Swept SA 50 Ω AC PNO: Wide IFGain:Low iset 0.5 dB 1.00 dBm	Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100	06:58:58 PM Sep 15, 2017 TRACE 12:34 5 6 TYPE MWWWW DET P NNNNN Ikr1 1.000 MHz 0.173 dB	Marker Select Marker
		1Δ2	Normal	10.0					Normal
-10.0			Delta	-10.0		<u> </u>			Delta
-30.0			Fixed⊳	-30.0					Fixed⊳
-40.0			Off	-40.0					Off
-70.0			Properties≯ More	-60.0					Properties⊁
Start 2.401500 GHz #Res BW 100 kHz #VE	300 kHz	Stop 2.403530 GHz Sweep 1.000 ms (1001 pts)	1 of 2	Start 2.440500 G #Res BW 100 kH	Hz z #VBV	V 300 kHz	Si Sweep 1. status	top 2.442500 GHz 000 ms (1001 pts)	1 of 2
Cł	nannel 0 / 24	02 MHz			Cha	nnel 39 /	/2441 MF	Ηz	
If: Fey sign 5 pectrum Analyzer - Swept 5A ID: FF 159.0 AC Marker 1 & 1.000000000 MHz PRO: Wide IFGainct.ow PRO: Wide IFGainct.ow 10 dB/div Ref 0ffset 0.5 dB Log PC0.00 dBm Log	SENSE:INT Avg Trig: Free Run Atten: 30 dB	ALION AUTO [07:01:22PM Sep15, 2017 Type: Log-Pwr TRACE [1:2:3:4:5:6 Hold:>100/100 Trate www.www.weip Mkr1 1.000 MHz 0.027 dB	Marker Select Marker 1						
10.0		1∆2	Normal						
-10.0	mp-/		Delta						
-30.0			Fixed⊳						
-60.0			Off						
-70.0			Properties► 						
Start 2.478500 GHz #Res BW 100 kHz #VE	300 kHz	Stop 2.480500 GHz Sweep 1.000 ms (1001 pts)	1 of 2						
Ch	annel 78 / 24	480 MHz							

SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD. FCC ID: GTOLBS86

Report No.: LCS170817067AE



This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 17 of 61

SHENZHEN LCS COMPLIANCE TESTING LABORATORY LTD. FCC ID: GTOLBS86

Report No.: LCS170817067AE

20dB Bandwidth						
	8-D	PSK				
Koyolpt Spectrum Analyzer - Occupied BW SSIGE-INIT ALLON AUTO 06-1218PH Sep15_2017 Center Freq 2.4020000000 GHz Center Freq 2.402000000 GHz Center Freq 2.40200000 GHz Radio Std: None #FGaintLow #FGaintLow Tdg: Free Run Avg Hold>-1010 Radio Device: BTS	Trace/Detector	Krysight Spectrum Analyzer-Occupied IW Serve::Ivi1 ALION AUTO 09:16:56 PM Sep15, 2017 Center Freq 2.441000000 GHz Center Freq::2.441000000 Hz Center Freq::2.441000000 Hz Trig: Free Run Avg Hold:>10/10 Radio Device: BTS				
10 dB/div Ref 20.00 dBm	ClearWrite	10 dB/div Ref 20.00 dB/m				
	Average	Average				
40.0	Max Hold	60.0 Max Hold				
Center 2.402 GHz Span 3 MHz #Res BW 30 kHz #VBW 100 kHz Sweep 3.2 ms	Min Hold	Center 2.441 GHz Span 3 MHz #Res BW 30 kHz #VBW 100 kHz Sweep 3.2 ms Min Hold				
Occupied Bandwidth Total Power 6.36 dBm 1.1042 MHz Transmit Freq Error -2.991 kHz OBW Power 99.00 % x dB Bandwidth 1.165 MHz x dB -20.00 dB	Detector Peak≯ Auto <u>Man</u>	Occupied Bandwidth Total Power 6.16 dBm 1.1053 MHz Detector Transmit Freq Error -3.577 kHz V dB Bandwidth 1.164 MHz x dB -20.00 dB				
Channel 0 / 2402 MHz		Channel 39 / 2441 MHz				
Bit Monte Addition Analysis of Control of C	Trace/Detector					
	Clear Write					
	Max Hold					
Center 2.48 GHz Span 3 MHz #Res BW 30 kHz #VBW 100 kHz Sweep 3.2 ms	Min Hold					
Occupied Bandwidth Total Power 6.73 dBm	Detector					
Transmit Freq Error -3.857 kHz OBW Power 99.00 %	Peak► Auto <u>Man</u>					
x dB Bandwidth 1.164 MHz x dB -20.00 dB						
MSG STATUS						
Channel 78 / 2480 MHz						

This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 18 of 61

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

Temperature	26.6°C	Humidity	52.3%
Test Engineer	Jayden Zhuo	Configurations	BT

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

Note: The test data refer to the following page.



This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 19 of 61

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].

Temperature	26.6°C	Humidity	52.3%
Test Engineer	Jayden Zhuo	Configurations	BT

Mode	Frequency (MHz)	Burst Type	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Verdict
GFSK	2441	DH1	0.37	0.118	0.4	PASS
		DH3	1.615	0.258		
		DH5	2.86	0.305		
π/4-DQPSK	2441	2DH1	0.375	0.120	0.4	PASS
		2DH3	1.62	0.259		
		2DH5	2.865	0.306		
8-DPSK	2441	3DH1	0.38	0.122	0.4	PASS
		3DH3	1.615	0.258		
		3DH5	2.865	0.306		

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;

This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 22 of 61

Dwell time GFSK π/4-DQPSK Marker 3 Δ 21 α RF 50 Ω ac Marker 3 Δ 1.25000 ms Units ALIGN Avg Type: Log Avg Type: Log PNO: Fast +++ Trig: Free Run IFGain:Low Atten: 30 dB PNO: Fast +++ Trig: Free Run IFGain:Low Atten: 30 dB DET N N N N N YPE WWWW Select Marker ΔMkr3 1.250 ms 0.01 dB ΔMkr3 1.245 ms -0.03 dB Ref Offset 0.5 dB Ref 20.00 dBm Ref Offset 0.5 dB Ref 20.00 dBm 1Δ2 3∆4 * 7 শ্র η____ Del Fixed Span 0 Hz Sweep 5.000 ms (1001 pts) 0000 GH Span 0 Hz Sweep 5.000 ms (1001 pts #VBW 3.0 MHz Of 1.0 MHz #VBW 3.0 MHz
 370.0 μs
 (Δ)
 0.24 dB

 2.740 ms
 0.73 dBm

 1.250 ms
 (Δ)
 0.01 dB

 2.740 ms
 0.73 dBm
 375.0 μs (Δ) -0.49 dB 1.995 ms -0.41 dBm 1.245 ms (Δ) -0.03 dB 1.995 ms -0.41 dBm t (A) t (A) Properties Mor 1 of 2 Channel 39 / 2441 MHz - DH1 Channel 39 / 2441 MHz - 2DH1 PM Sep 15, 201 4CE 1 2 3 4 5 4PE WWWWW DET N N N N N Marker 3 Δ 2.50000 ms Marker Marker 3 Δ 2.50500 ms Avg Type: Log-Pwr Avg Type: Log-Pwr Marke PNO: Fast +++ Trig: Free Run IFGain:Low Atten: 30 dB PNO: Fast +++ Trig: Free Run IEGain:Low Atten: 30 dB THE WWWW Select Marker Select Marke ΔMkr3 2.500 ms 0.00 dB ΔMkr3 2.505 ms -0.05 dB Ref Offset 0.5 dB Ref 20.00 dBm Ref Offset 0.5 dB Ref 20.00 dBm 1Δ2 3∆4 Norr Norm Del Delt Fixed Fixed TTT nter 2.44100000 Span 0 Hz Sweep 5.000 ms (1001 pts Span 0 Hz Sweep 5.000 ms (1001 pts) #VBW 3.0 MH; #VBW 3.0 MHz O 1.0 MHz Of -0.10 dB 0.95 dBm 0.00 dB 0.95 dBm 660.0 μs 2.505 ms (Δ) 660.0 μs -0.62 dB -0.18 dBn -0.05 dB .980 ms .500 ms (Δ) Properties Properties Mor More 1 of 2 1 of 2 Channel 39 / 2441 MHz – DH3 Channel 39 / 2441 MHz - 2DH3 Marker Marke arker 3 Δ 3.74500 ms ALIGN AUTO Marker 3 Δ 3.75000 ms ALIGN AUTO Avg Type: Log-Pwr PNO: Fast --- Trig: Free Run IEGain: Low Atten: 30 dB PNO: Fast +++ Trig: Free Run IFGain:Low Atten: 30 dB Select Marker Select Marker ΔMkr3 3.745 ms 0.06 dB ΔMkr3 3.750 ms -0.01 dB Ref Offset 0.5 dB Ref 20.00 dBm Ref Offset 0.5 dB Ref 20.00 dBm 1Δ2 34 Norm Norm ×21 Del Delt Fixed Fixed Span 0 Hz Sweep 5.000 ms (1001 pts) 00 GH: Sweep 5.000 ms (1001 pts) #VBW 3.0 MHz #VBW 3.0 MHz 1.0 MHz of 1.0 MHz Off 0.87 dBm 0.87 dBm 0.87 dBm 695.0 μs 3.745 ms (Δ) 1.140 ms 3.750 ms (Δ) -0.19 dBi -0.01 d Properties Properties More 1 of 2 More 1 of 2

Channel 39 / 2441 MHz – DH5

Channel 39 / 2441 MHz - 2DH5

This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 23 of 61

Dwell time					
8-DPSK					
Its Keysight Spectrum Analyzer - Swegt SA. SBIGS_2017 ALISN AUTO 67:42:52 PM Sep 15, 2017 Warker 3 & 1.255500 ms PNO: Fast - Frig: Free Run IFGanLow Trig: Free Run Atten: 30 dB Avg Type: Log-Pwr Trig: Trig: Trig: Tree Run Atten: 30 dB AVg Type: Log-Pwr Trig: Tree Run Atten: 30 dB	Marker Select Marker 3	Marker 3 Δ 2.50000 ms Strict free Run Atten: 30 dB Auton Autro 074-493 PM Sep 15, 2017 PHO: Fast ++- Trig: Free Run Atten: 30 dB Auton Autro 074-493 PM Sep 15, 2017 Tride [1 2 3 4 5 6 Tride [1 2 3 4 5 6 Tride [1 2 3 4 5 6] PHO: Fast ++- Trig: Free Run Atten: 30 dB Auton Autro 074-493 PM Sep 15, 2017 PHO: Fast ++- Trig: Free Run Atten: 30 dB Auton Autro 074-493 PM Sep 15, 2017 Deat Official D5 /R Auton Autro Auton Autro 074-493 PM Sep 15, 2017	Marker Select Marker 3		
10 des/div Ref 20.00 dBm -0.23 dB	Normal	10 delativ Ref 20.00 dBm 0.00 dB	Normal		
300 400 400 400 400 400 400 400 400 400	Delta Fixed⊳	300	Delta Fixed⊳		
Mark Mark Mark Mark Mark Mark Mark Space Mark Mark <t< td=""><td>Off</td><td>Center 2.441000000 GHz #VBW 3.0 MHz Span 0 Hz Res BW 01.10 MHz #VBW 3.0 MHz Sweep 5.000 ms (100 pts) MOR MODETRCI SCL X Y Function 1 A2 t (A) 1.95 ms (A) -0.85 dB 2 F t (A) 1.95 ms (A) -0.85 dB</td><td>Off</td></t<>	Off	Center 2.441000000 GHz #VBW 3.0 MHz Span 0 Hz Res BW 01.10 MHz #VBW 3.0 MHz Sweep 5.000 ms (100 pts) MOR MODETRCI SCL X Y Function 1 A2 t (A) 1.95 ms (A) -0.85 dB 2 F t (A) 1.95 ms (A) -0.85 dB	Off		
3 Δ4 t (Δ) 1.255 ms (Δ) -0.23 dB 4 F t 2.100 ms -0.16 dBm 6 7 - - - 7 - - - - 9 -	Properties► More 1 of 2	3) A4 t (Δ) 2.500 ms (Δ) 0.00 dB 4) F t 1.950 ms -0.42 dBm 6) - - - 7 - - - - 9 - - - - 10 - - - -	Properties► More 1 of 2		
Channel 39 / 2441 MHz - 3DH1		Channel 39 / 2441 MHz - 3DH3			
Bit Keysight Spectrum Analyzer - Swept SA SENSE:INT ALISN AUTO 07:45:21 PH Sep15, 2017 Warker 3 ∆ 3.74500 ms PN0: Fast Trig: Free Run IFGainLow Trig: Free Run Atten: 30 dB Avg Type: Log-Pwr Trig: Free Run Atten: 30 dB 07:45:21 PH Sep15, 2017 Ref Offset 0.5 dB Atten: 30 dB Atten: 30 dB AMKr3 3.745 ms 0 dA cHB	Marker Select Marker 3				
	Normal				
	Fixed⊳				
Center 2.441000000 GHz Res BW 1.0 MHz #VBW 3.0 MHz Sweep 5.000 ms (1001 pts) Sweep 5.000 ms (1001 pts)	Off				
α = 1 α = 1 (Δ) 2.886 ms (Δ) -0.08 dB Function Function </td <td>Properties►</td> <td></td> <td></td>	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.

Temperature	26.6°C	Humidity	52.3%
Test Engineer	Jayden Zhuo	Configurations	BT

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

Remark:

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.



This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 27 of 61



This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 28 of 61



This report shall not be reproduced except in full, without the written approval of Shenzhen LCS Compliance Testing Laboratory Ltd. Page 29 of 61