

# FCC Test Report

Part 15 subpart C

# **Client Information:**

Applicant:	Applicant:		Elec Technologies Group Limited		
Applicant ad	d.:	NO.11 Lianfeng Road, Dali Industrial Park, Qingxi Town, Dongguan City			
Product Informa	tion:				
Product Nam	ne:	Ear Bluetooth earp	ohone		
Model No.:		EH023, 7198-06, <sup>2</sup>	108306		
Brand Name	:	Elec Technologies	Group Limited		
FCC ID:		2ANED7198-06			
Standards:		CFR 47 FCC PAR	T 15 SUBPART	C:2017 section 15.247	
Prepared By	:				
	[	Dongguan Yaxu (A	iT) Technology	y Limited	
	Add.: 1	No.22, Jinqianling T Dongguan, Guangdo	hird Street, Jitig ong, China	gang, Huangjiang,	
Date of Receipt:	Jun. 01, 2	2017	Date of Test:	Jun. 01~22, 2017	
Date of Issue:	Jun. 24, 2	2017	Test Result:	Pass	

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

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Reviewed by: Seal-Chen

Approved by:



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# 2 Test Summary

# 2.1 Compliance with FCC Part 15 subpart C

Test		Test Requirement	Standard Paragraph	Result
Antenna	Requirement	FCC Part 15 C:2017	Section 15.247(c)	PASS
Conductio	on Emissions	FCC Part 15 C:2017	Section 15.207(a)	N/A
Radiate	d Emissions	FCC Part 15 C:2017	Section 15.247(d)	PASS
Carrier Frequencies Separated		FCC Part 15 C:2017	Section 15.247(a)(1)	PASS
Hopping Channel Number		FCC Part 15 C:2017	Section 15.247(a)(1) (iii)	PASS
Pseudorandom Frequency Hopping Sequence		FCC Part 15 C:2017	FCC PART 15 C section 15.247(a)(1), (g), (h)	PASS
Dwe	II Time	FCC Part 15 C:2017	Section 15.247(a)(1) (iii)	PASS
Maximum Pe	eak Output Power	FCC Part 15 C:2017	Section 15.247(b)	PASS
Band edge		FCC Part 15 C:2017	Section 15.247(d)	PASS
Conducted Spurious Emissions		FCC Part 15 C:2017	Section 15.247(d)	PASS
Note:				
(	1) Reference to the	e ANSI C63.10:2013.		

# 2.2 Test Location

All tests were performed at:

Dongguan Yaxu (AiT) Technology Limited No.22, Jinqianling Third Street, Jitigang, Huangjiang,Dongguan, Guangdong, China Tel.: +86.769.82020499 Fax.: +86.769.82020495



# 2.3 Measurement Uncertainty

All measurements involve certain levels of uncertainties, the maximum value of the uncertainty as below:

No.	Item	Uncertainty
1	Conducted Emission Test	1.20dB
2	Radiated Emission Test	3.30dB
3	RF power,conducted	0.16dB
4	RF power density, conducted	0.24dB
5	Spurious emissions, conducted	0.21dB
6	All emissions,radiated(<1G)	4.68dB
7	All emissions,radiated(>1G)	4.89dB



# 3 Test Facility

# The test facility is recognized, certified or accredited by the following organizations:

# .CNAS- Registration No: L6177

Dongguan Yaxu (AiT) technology Limited is accredited to ISO/IEC 17025:2005 general Requirements for the competence of testing and calibration laboratories (CNAS-CL01 Accreditation Criteria for the competence of testing and calibration laboratories) on Apr. 18, 2013

# .FCC- Registration No: 248337

The 3m Semi-Anechoic Chamber, 3m/10m Open Area Test Site and Shielding Room of Dongguan Yaxu (AiT) Technology Limited have been registered by Federal Communications Commission (FCC) on Aug.29, 2014.

# .Industry Canada(IC)-Registration No: IC6819A-1

The 3m Semi-Anechoic Chamber and 3m/10m Open Area Test Site of Dongguan Yaxu (AiT) Technology Limited have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing on Oct. 12, 2014.

# 3.1 Deviation from standard

None

# 3.2 Abnormalities from standard conditions

None



# 4 General Information

# 4.1 General Description of EUT

Manufacturer:	Elec Technologies Group Limited
Manufacturer Address:	NO.11 Lianfeng Road, Dali Industrial Park, Qingxi Town, Dongguan City.
EUT Name:	Ear Bluetooth earphone
Model No:	EH023
Derivative model No .:	7198-06, 108306
Brand Name:	Elec Technologies Group Limited
Serial No:	N/A
Operation frequency:	2402 MHz to 2480 MHz
NUMBER OF CHANNEL:	79
Modulation Technology:	GFSK, π/4-DQPSK, 8DPSK(1/2/3Mbps)
Bluetooth version:	4.2 (Without BLE)
H/W No.:	V1.0
S/W No.:	V1.0
Antenna Type:	PCB antenna
Antenna Gain:	Maximum 1.2dBi
Power Supply Range:	USB DC 5V or DC 3.7V from battery
Power Supply:	The same as above.
Power Cord:	N/A
	1Mbps: 4.23dBm
Output power (max) :	2Mbps: 4.21dBm
	3Mbps: 4.28dBm
Note:	
1.	For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2.	Model EH023, 7198-06, 108306 are identical except the model number.



		Descriptior	n of Channel:		
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	27	2429	54	2456
01	2403	28	2430	55	2457
02	2404	29	2431	56	2458
03	2405	30	2432	57	2459
04	2406	31	2433	58	2460
05	2407	32	2434	59	2461
06	2408	33	2435	60	2462
07	2409	34	2436	61	2463
08	2410	35	2437	62	2464
09	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		



# 4.2 Description of Test conditions

# (1) EUT was tested in normal configuration (Please See following Block diagram)



- 1. The EUT was used fully-charged battery and programmed to be in continuously transmitting mode with fully-charged battery and the transmit duty cycle is not less than 98%.
- 2. Using the notebook and the transform board to control the fixed transmitting frequency and other test mode. After finishing the test setting, the notebook and the transform board will be removed during measurements.
- (2) E.U.T. test conditions:

15.31(e): For intentional radiators, measurements of the variation of the input power or the adiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

(3) Test frequencies:

According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and. If required reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over	Number of	Location in	
which device operates	frequencies	the range of operation	
1 MHz or less	1	Middle	
1 to 10 MHz	2	1 near top and 1 near bottom	
More then 10 MHz	2	1 near top, 1 near middle and	
More than 10 MHz	5	1 near bottom	

(4) Frequency range of radiated measurements: According to the 15.33, the test range will be up to the tenth harmonic of the highest fundamental frequency.

(5) Pre-test the EUT in all transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data packet and conducted to determine the worst-case mode, only the worst-case results(1Mbps/3Mbps) are recorded in this report.



# 4.3 Test Peripheral List

No.	Equipment	Manufacturer	EMC Compliance	Model No.	Serial No.	Power cord	signal cable
1	Notebook	ASUS	N/A	X401A	X16- 9607 2	N/A	N/A
2	USB line	N/A	N/A	N/A	N/A	0.3m/unshielded /detachable	N/A
3	Transform board	N/A	N/A	N/A	N/A	N/A	N/A

# 4.4 EUT Peripheral List

No.	Equipment	Manufacturer	EMC Compliance	Model No.	Serial No.	Power cord	Remark
1	USB line	N/A	N/A	N/A	N/A	0.3m/unshielded /detachable	N/A



# 5 Equipments List for All Test Items

No	Test Equipment	Manufacturer	Model No	Serial No	Cal. Date	Cal. Due Date
1	SIGNAL ANALYZER	R&S	FSV40	101470	2017.06.29	2018.06.29
2	EMI Measuring Receiver	R&S	ESR	101660	2017.06.29	2018.06.29
3	Low Noise Pre Amplifier	Tsj	MLA-10K01-B01-27	1205323	2017.06.29	2018.06.29
4	Low Noise Pre Amplifier	Tsj	MLA-0120-A02-34	2648A04738	2017.06.29	2018.06.29
5	TRILOG Super Broadband test Antenna	SCHWARZBECK	VULB9160	9160-3206	2017.06.29	2018.06.29
6	Broadband Horn Antenna	SCHWARZBECK	BBHA9120D	452	2017.06.29	2018.06.29
7	SHF-EHF Horn	SCHWARZBECK	BBHA9170	BBHA9170367	2017.06.29	2018.06.29
8	$50\Omega$ Coaxial Switch	Anritsu	MP59B	6200264416	2017.06.29	2018.06.29
9	EMI Test Receiver	R&S	ESCI	100124	2017.06.29	2018.06.29
10	LISN	Kyoritsu	KNW-242	8-837-4	2017.06.29	2018.06.29
11	LISN	Kyoritsu	KNW-407	8-1789-3	2017.06.29	2018.06.29
12	$50\Omega$ Coaxial Switch	Anritsu	MP59B	6200264417	2017.06.29	2018.06.29
13	Loop Antenna	ETS	6512	00165355	2017.06.29	2018.06.29
14	Radiated Cable 1# (30MHz-1GHz)	FUJIKURA	5D-2W	01	2016.12.25	2017.12.24
15	Radiated Cable 2# (1GHz -25GHz)	FUJIKURA	10D2W	02	2016.12.25	2017.12.24
16	Conducted Cable 1#(9KHz-30MHz)	FUJIKURA	1D-2W	01	2016.12.25	2017.12.24
17	SMA Antenna connector	Dosin	Dosin-SMA	N/A	N/A	N/A
Note:	The SMA antenna connector is listed in the e	ctor is soldered on t equipment list.	he PCB board in orde	r to perform cond	ucted tests and t	his SMA antenna



# 6 Test Result

# 6.1 Antenna Requirement

# 6.1.1 Standard requirement

15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

15.247(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

# 6.1.2 EUT Antenna

The antenna is PCB antenna and no consideration of replacement. Antenna gain is Max. 1.2 dBi from 2.4GHz to 2.5GHz.

Antenna





# 6.2 Conduction Emissions Measurement

# 6.2.1 Applied procedures / Limit

Frequency of Emission (MHz)	Conducted Limit (dBµV)				
	Quasi-peak	Average			
0.15-0.5	66 to 56 *	56 to 46 *			
0.5-5	56	46			
5-30	60	50			

Note: Decreases with the logarithm of the frequency.

# 6.2.2 Test procedure

EUT was placed upon a wooden test table 0.8m above the horizontal metal reference plane and 0.4m from the vertical ground plane, and it was connected to an AMN. The closest distance between the boundary of the EUT and the surface of the AMN is 0.8m. All peripherals were connected to another AMN, and placed at a distance of 10cm from each other. A spectrum and receiver was connected to the RF output port of the AMN. Both average and quasi-peak value were detected.

# 6.2.3 Test setup





# 6.2.4 Test results

Remark: Because the EUT employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Measurements to demonstrate compliance with the conducted limits are not required for devices.

During the charging procedure, the Bluetooth function of this device is inactive.



# 6.3 Radiated Emissions Measurement

# 6.3.1 Applied procedures / Limit

15.247(d) 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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

	Field Strer	ngth	Measurement
Frequency of Emission (MHz)	μV/m	dBµV/m	Distance (meters)
0.009-0.49	2400/F(kHz)		300
0.49-1.705	24000/F(kHz)		30
1.705-30	30		30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3



# 6.3.2 Test setup

### **Test Configuration:**

1) 9 kHz to 30 MHz emissions:



2) 30 MHz to 1 GHz emissions:





### 3) 1 GHz to 25 GHz emissions:





# 6.3.3 Test procedure

- a. The EUT was placed on the top of a wooden table 0.8 meters (for measurement at frequency below 1GHz) and a wooden table 1.5 meters (for measurement at frequency above 1GHz) above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter, for the test frequency of above 1GHz, horn antenna opening in the test would have been facing the EUT when rise or fall) and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. The resolution bandwidth and video bandwidth of the test receiver was 1MHz and 1MHz for Peak detection at frequency above 1GHz.
- g. Test the EUT in the lowest channel (2402MHz), the middle channel (2440MHz), the Highest channel (2480MHz)
- h. Repeat above procedures until all frequencies measured was complete.

For measurement at frequency above 1GHz

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

In 18GHz to 25GHz, The EUT was checked by Horn ANT. But the test result at least have 20dB margin.The EUT was tested in Chamber Site.



# 6.3.4 Test Result

# Radiated Emissions Test Data Below 30MHz

EUT:	Ear Bluetooth earphone	Model Name :	EH023			
Temperature:	<b>25</b> ℃	Test Data	2017-06-20			
Pressure:	1005 hPa	Relative Humidity:	60%			
Test Mode :	ТХ	Test Voltage :	DC 3.7V from battery			
Measurement Distance	3 m	Frenqucy Range	9KHz to 30MHz			
RBW/VBW	)KHz~150KHz/RB 200Hz for QP, 150KHz~30MHz/RB 9KHz for QP					

No emission found between lowest internal used/generated frequencies to 30MHz.



### Radiated Emissions Test Data Below 1GHz

EUT:	Ear Bluetooth earphone	Model Name :	EH023		
Temperature:	<b>25</b> ℃	Test Data	2017-06-20		
Pressure:	1010 hPa	Relative Humidity:	60%		
Test Mode :	TX (1Mbps) CH00 (worst case)	Test Voltage :	DC 3.7V from battery		
Measurement Distance	3 m	Frenqucy Range	30MHz to 1GHz		
RBW/VBW	100KHz / 300KHz for spectrum, RBW=120KHz for receiver.				



Remark: Factor = Factor= Ant Factor + Cable Loss - Pre-amplifier.

No.	Mk	. Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		37.6798	35.37	-16.70	18.67	40.00	-21.33	QP
2		68.3908	33.27	-19.06	14.21	40.00	-25.79	QP
3		107.1337	30.68	-13.48	17.20	43.50	-26.30	QP
4		291.0360	31.01	-10.20	20.81	46.00	-25.19	QP
5		724.2611	31.76	-0.46	31.30	46.00	-14.70	QP
6	*	881.4067	31.12	2.48	33.60	46.00	-12.40	QP

Dongguan Yaxu (AiT) Technology Limited No.22, Jinqianling Third Street, Jitigang, Huangjiang,Dongguan, Guangdong, China

#### Horizontal



6

1000.000

33.07

### Vertical



5.10

38.17

54.00

-15.83

QP



### **Radiated Emissions Test Data Above 1GHz**

EUT:	Ear Bluetooth earphone	Model Name :	EH023		
Temperature:	<b>25</b> ℃	Test Data	2017-06-20		
Pressure:	1010 hPa	Relative Humidity:	60%		
Test Mode :	1Mbps	Test Voltage :	DC 3.7V from battery		
Measurement Distance	3 m	Frenqucy Range	1GHz to 25GHz		
RBW/VBW	1MHz/1MHz for Peak, 1MHz/10Hz for Average.				

### (a) Antenna polarization: Horizontal

Frequency	Reading	Correct	Measure	Limit	Margin	Detector
(MHz)	Level	Factor	Level	(dBuV/m)	(dB)	Туре
	(dBuV)	(dB)	(dBuV/m)			
4804.000	47.53	5.06	52.59	74.00	-21.41	PEAK
4804.000	36.46	5.06	41.52	54.00	-12.48	AVERAGE
7206.000	54.98	7.03	62.01	74.00	-11.99	PEAK
7206.000	44.51	7.03	51.54	54.00	-2.46	AVERAGE
9608.000	37.45	10.63	48.08	74.00	-25.92	PEAK
9608.000	28.14	10.63	38.77	54.00	-15.23	AVERAGE

#### 97.0 dBuV/m





# (b) Antenna polarization: Vertical

Frequency	Reading	Correct	Measure	Limit	Margin	Detector
(MHz)	Level	Factor	Level	(dBuV/m)	(dB)	Туре
	(dBuV)	(dB)	(dBuV/m)			
4804.000	46.88	5.06	51.94	74.00	-22.06	PEAK
4804.000	35.22	5.06	40.28	54.00	-13.72	AVERAGE
7206.000	52.11	7.03	59.14	74.00	-14.86	PEAK
7206.000	42.42	7.03	49.45	54.00	-4.55	AVERAGE
9608.000	35.12	10.63	45.75	74.00	-28.25	PEAK
9608.000	26.31	10.63	36.94	54.00	-17.06	AVERAGE

97.0 dBuV/m



Note:

### 10~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor Remark: Factor = Antenna Factor + Cable Loss - Pre-amplifier Lowest channel: 2402 MHz Data rate: 1Mbps



### (a) Antenna polarization: Horizontal

Frequency	Reading	Correct	Measure	Limit	Margin	Detector
(MHz)	Level	Factor	Level	(dBuV/m)	(dB)	Туре
	(dBuV)	(dB)	(dBuV/m)			
4882.000	47.19	5.14	52.33	74.00	-21.67	PEAK
4882.000	36.36	5.14	41.50	54.00	-12.50	AVERAGE
7323.000	53.88	7.54	61.42	74.00	-12.58	PEAK
7323.000	42.85	7.54	50.39	54.00	-3.61	AVERAGE
9764.000	38.21	11.39	49.60	74.00	-24.40	PEAK
9764.000	27.12	11.39	38.51	54.00	-15.49	AVERAGE

97.0 dBuV/m





# (b) Antenna polarization: Vertical

Frequency	Reading	Correct	Measure	Limit	Margin	Detector
(MHz)	Level	Factor	Level	(dBuV/m)	(dB)	Туре
	(dBuV)	(dB)	(dBuV/m)			
4882.000	46.32	5.14	51.46	74.00	-22.54	PEAK
4882.000	35.28	5.14	40.42	54.00	-13.58	AVERAGE
7323.000	51.43	7.54	58.97	74.00	-15.03	PEAK
7323.000	40.66	7.54	48.20	54.00	-5.80	AVERAGE
9764.000	36.87	11.39	48.26	74.00	-25.74	PEAK
9764.000	27.22	11.39	38.61	54.00	-15.39	AVERAGE

97.0 dBuV/m



# 10~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor

Remark: Factor = Antenna Factor + Cable Loss - Pre-amplifier

Middle Channel: 2441 MHz

Data rate: 1Mbps



# (a) Antenna polarization: Horizontal

Frequency	Reading	Correct	Measure	Limit	Margin	Detector
(MHz)	Level	Factor	Level	(dBuV/m)	(dB)	Туре
	(dBuV)	(dB)	(dBuV/m)			
4960.000	46.96	5.22	52.18	74.00	-21.82	PEAK
4960.000	35.11	5.22	40.33	54.00	-13.67	AVERAGE
7440.000	52.61	8.06	60.67	74.00	-13.33	PEAK
7440.000	42.33	8.06	50.39	54.00	-3.61	AVERAGE
9992.000	36.18	12.29	48.47	74.00	-25.53	PEAK
9992.000	26.16	12.29	38.45	54.00	-15.55	AVERAGE

97.0 dBu¥/m





# (b) Antenna polarization: Vertical

Frequency	Reading	Correct	Measure	Limit	Margin	Detector
(MHz)	Level	Factor	Level	(dBuV/m)	(dB)	Туре
	(dBuV)	(dB)	(dBuV/m)			
4960.000	47.60	5.22	52.82	74.00	-21.18	PEAK
4960.000	35.31	5.22	40.53	54.00	-13.47	AVERAGE
7440.000	51.22	8.06	59.28	74.00	-14.72	PEAK
7440.000	40.68	8.06	48.74	54.00	-5.26	AVERAGE
9920.000	36.01	12.10	48.11	74.00	-25.89	PEAK
9920.000	27.22	12.10	39.32	54.00	-14.68	AVERAGE

97.0 dBuV/m



Note:

### 10~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor Remark: Factor = Antenna Factor + Cable Loss - Pre-amplifier Highest Channel: 2480 MHz

Data rate: 1Mbps



EUT:	Ear Bluetooth earphone	Model Name :	EH023		
Temperature:	<b>25</b> ℃	Test Data	2017-06-20		
Pressure:	1010 hPa	Relative Humidity:	60%		
Test Mode :	3Mbps	Test Voltage :	DC 3.7V from battery		
Measurement Distance	3 m	Frenqucy Range	1GHz to 25GHz		
RBW/VBW	1MHz/1MHz for Peak, 1MHz/10Hz for Average.				

### (a) Antenna polarization: Horizontal

Frequency	Reading	Correct	Measure	Limit	Margin	Detector
(MHz)	Level	Factor	Level	(dBuV/m)	(dB)	Туре
	(dBuV)	(dB)	(dBuV/m)			
4804.000	46.82	5.06	51.88	74.00	-22.12	PEAK
4804.000	35.16	5.06	40.22	54.00	-13.78	AVERAGE
7206.000	52.23	7.03	59.26	74.00	-14.74	PEAK
7206.000	41.88	7.03	48.91	54.00	-5.09	AVERAGE
9608.000	36.42	10.63	47.05	74.00	-26.95	PEAK
9608.000	27.84	10.63	38.47	54.00	-15.53	AVERAGE

#### 97.0 dBu¥/m





# (b) Antenna polarization: Vertical

Frequency	Reading	Correct	Measure	Limit	Margin	Detector
(MHz)	Level	Factor	Level	(dBuV/m)	(dB)	Туре
	(dBuV)	(dB)	(dBuV/m)			
4804.000	45.72	5.06	50.78	74.00	-23.22	PEAK
4804.000	34.16	5.06	39.22	54.00	-14.78	AVERAGE
7206.000	52.78	7.03	59.81	74.00	-14.19	PEAK
7206.000	41.92	7.03	48.95	54.00	-5.05	AVERAGE
9608.000	35.48	10.63	46.11	74.00	-27.89	PEAK
9608.000	26.19	10.63	36.82	54.00	-17.18	AVERAGE

#### 97.0 dBuV/m



Note:

### 10~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor Remark: Factor = Antenna Factor + Cable Loss - Pre-amplifier Lowest Channel: 2402 MHz Data rate: 3Mbps



### (a) Antenna polarization: Horizontal

Frequency	Reading	Correct	Measure	Limit	Margin	Detector
(MHz)	Level	Factor	Level	(dBuV/m)	(dB)	Туре
	(dBuV)	(dB)	(dBuV/m)			
4882.000	46.75	5.14	51.89	74.00	-22.11	PEAK
4882.000	35.23	5.14	40.37	54.00	-13.63	AVERAGE
7323.000	52.37	7.54	59.91	74.00	-14.09	PEAK
7323.000	41.84	7.54	49.38	54.00	-4.62	AVERAGE
9764.000	37.24	11.39	48.63	74.00	-25.37	PEAK
9764.000	28.68	11.39	40.07	54.00	-13.93	AVERAGE

#### 97.0 dBu¥/m





# (b) Antenna polarization: Vertical

Frequency	Reading	Correct	Measure	Limit	Margin	Detector	
(MHz)	Level	Factor	Level	(dBuV/m)	(dB)	Туре	
	(dBuV)	(dBuV) (dB) (dBuV/m)	(dBuV) (dB)				
4882.000	45.37	5.14	50.51	74.00	-23.49	PEAK	
4882.000	36.02	5.14	41.16	54.00	-12.84	AVERAGE	
7323.000	51.94	7.54	59.48	74.00	-14.52	PEAK	
7323.000	40.88	7.54	48.42	54.00	-5.58	AVERAGE	
9764.000	36.49	11.39	47.88	74.00	-26.12	PEAK	
9764.000	28.74	11.39	40.13	54.00	-13.87	AVERAGE	

#### 97.0 dBuV/m



Note:

### 10~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor Remark: Factor = Antenna Factor + Cable Loss - Pre-amplifier Middle Channel: 2441 MHz Data rate: 3Mbps



### (a) Antenna polarization: Horizontal

Frequency	Reading	Correct	Measure	Limit	Margin	Detector
(MHz)	Level	Factor	Level	(dBuV/m)	(dB)	Туре
	(dBuV)	(dB)	(dBuV/m)			
4960.000	47.16	5.22	52.38	74.00	-21.62	PEAK
4960.000	37.19	5.22	42.41	54.00	-11.59	AVERAGE
7440.000	53.01	8.06	61.07	74.00	-12.93	PEAK
7440.000	42.36	8.06	50.42	54.00	-3.58	AVERAGE
9920.000	36.52	12.10	48.62	74.00	-25.38	PEAK
9920.000	25.59	12.10	37.69	54.00	-16.31	AVERAGE

#### 97.0 dBuV/m





# (b) Antenna polarization: Vertical

Frequency	Reading	Correct	Measure	Limit	Margin	Detector
(MHz)	Level	Factor	Level	(dBuV/m)	(dB)	Туре
	(dBuV)	(dB)	(dBuV/m)			
4960.000	45.92	5.22	51.14	74.00	-22.86	PEAK
4960.000	36.48	5.22	41.70	54.00	-12.30	AVERAGE
7440.000	52.75	8.06	60.81	74.00	-13.19	PEAK
7440.000	41.89	8.06	49.95	54.00	-4.05	AVERAGE
9920.000	34.86	12.10	46.96	74.00	-27.04	PEAK
9920.000	26.77	12.10	38.87	54.00	-15.13	AVERAGE

#### 97.0 dBuV/m



Note:

### 10~25GHz at least have 20dB margin. No recording in the test report.

Measurement Level = Reading Level + Factor Remark: Factor = Antenna Factor + Cable Loss - Pre-amplifier Highest channel: 2480 MHz Data rate: 3Mbps



# 6.3.5 TEST RESULTS (Restricted Bands Requirements)

EUT:	Ear Bluetooth earphone	Model Name :	EH023				
Temperature:	<b>25</b> ℃	Test Data	2017-06-20				
Pressure:	1010 hPa	Relative Humidity:	60%				
Test Mode :	TX 1Mbps/3Mbps	Test Voltage :	DC 3.7V from battery				
Note:	1. The transmitter was setup to transmit at the lowest channel. Then the field strength						
	was measured at 2310-2390 MHz.						
	2. The transmitter was setup to transmit at the highest channel. Then the field strength						
	was measured at 2483.5-2500 MHz.						
	3. The data of 2390MHz and 2483.5MH	Iz was the worst.					

Teet	Ant Pol Fred		Reading		Ant/CE	Act		Limit	
Mode		гтец. (МЦ-)	Peak	AV		Peak	AV	Peak	AV
Mode	11/ V		(dBuv)	(dBuv)		(dBuv/m)	(dBuv/m)	(dBuv/m)	(dBuv/m)
	V	2390.00	38.05	24.19	-5.79	32.26	18.40	74.00	54.00
Data rate 1Mbps	Н	2390.00	40.09	24.25	-5.79	34.30	18.46	74.00	54.00
	V	2483.50	41.76	32.85	-4.98	36.78	27.87	74.00	54.00
	Н	2483.50	46.34	35.15	-4.98	41.36	30.17	74.00	54.00
	V	2390.00	37.97	24.73	-5.79	32.18	18.94	74.00	54.00
Data rate 3Mbps	Н	2390.00	39.20	26.29	-5.79	33.41	20.5	74.00	54.00
	V	2483.50	45.12	31.65	-4.98	40.14	26.67	74.00	54.00
	Н	2483.50	51.15	35.93	-4.98	46.17	30.95	74.00	54.00

### Remark:

- (1) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode.
- (2) During the measurements above 1 GHz it is taken care of that the EUT is always within the 3 dB cone of radiation BW of the used antenna
- (3) Corr.Factor = Antenna Factor + Cable Loss Pre-amplifier.



10.0

2310.000

#### 90.0 dBuV/m



(MHz)

2410.000



#### 90.0 dBuV/m



#### 90.0 dBuV/m




50

10.0

2310.000

#### 90.0 dBuV/m



(MHz)

Dongguan Yaxu (AiT) Technology Limited No.22, Jinqianling Third Street, Jitigang, Huangjiang,Dongguan, Guangdong, China

1 X

2410.000



#### 90.0 dBuV/m



#### 90.0 dBuV/m





# 6.4 BANDWIDTH TEST

## 6.4.1 Applied procedures / Limit

For frequency hopping system operating in the 2400-2483.5MHz, If the 20dB bandwidth of hopping channel is greater than 25kHz, two-thirds 20dBbandwidth of hopping channel shell be a minimum limit for the hopping channel separation.

## 6.4.2 Test procedure

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel RBW ≥ 1% of the 20 dB bandwidth, VBW ≥ RBW, Sweep = auto, Detector function = peak Trace = max hold

## 6.4.3 Deviation from standard

No deviation.

## 6.4.4 Test setup





# 6.4.5 Test results

EUT:	Ear Bluetooth earphone	Model Name :	EH023
Temperature:	<b>26</b> ℃	Relative Humidity:	53%
Pressure:	1010 hPa	Test Power :	DC 3.7V from battery
Test Mode :	TX 1Mbps/ 3Mbps		

Channel		Channel frenqucy (MHz)	20dB bandwidth (MHz)	Limit (MHz)	Conclusion
	Low	2402	1.04446	N/A	Pass
1Mbps	Middle	2441	1.03537	N/A	Pass
	High	2480	1.04850	N/A	Pass
	Low	2402	1.29422	N/A	Pass
2Mbps	Middle	2441	1.29206	N/A	Pass
	High	2480	1.28606	N/A	Pass
	Low	2402	1.31728	N/A	Pass
3Mbps	Middle	2441	1.35806	N/A	Pass
	High	2480	1.36350	N/A	Pass



#### CH00-1Mbps



#### CH 39-1Mbps





#### CH 78-1Mbps



#### CH 00-2Mbps





### CH 39-2Mbps



#### CH 78-2Mbps





#### CH 00-3Mbps



#### CH 39-3Mbps





## CH 78-3Mbps





# 6.5 Carrier Frequencies Separated

## 6.5.1 Applied procedures / Limit

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.

## 6.5.2 Test procedure

- (1) Connected the antenna port to the Spectrum Analyzer, set the Spectrum Analyzer as Span = wide enough to capture the peaks of two adjacent channels, Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span, Video (or Average) Bandwidth (VBW) ≥ RBW Sweep = auto, Detector function = peak, Trace = max hold
- (2) The EUT should be transmitting at its maximum data rate. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.
- (3) The above procedure shall be repeated at the lowest, the middle, and the highest frequency of the stated frequency range with modulated mode. also shall be performed at different modes of operation.

## 6.5.3 Deviation from standard

No deviation.

## 6.5.4 Test setup





# 6.5.5 Test results

EUT:	Ear Bluetooth earphone	Model Name :	EH023
Temperature:	<b>26</b> ℃	Relative Humidity:	53%
Pressure:	1010 hPa	Test Power :	DC 3.7V from battery
Test Mode :	TX 1Mbps/ 3Mbps		

Channel		Channel frenqucy (MHz)	Channel Separation (MHz)	Conclusion
	Low	2402	1.000875	Pass
1Mbps	Middle	2441	1.000406	Pass
	Highest	2480	1.00050	Pass
	Low	2402	0.999656	Pass
3Mbps	Middle	2441	0.999656	Pass
	Highest	2480	0.999563	Pass

Ch. Separation >2/3(20dB bandwidth)















# 6.6 Pseudorandom Frequency Hopping Sequence

## 6.6.1 Standard requirement

## 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 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. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.



# 6.6.2 Other requirements Frequency Hopping Spread Spectrum System

#### Test Requirement:

47 CFR Part 15C Section 15.247 (a)(1), (h) requirement:

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

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

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

## Compliance for section 15.247(a)(1)

According to Bluetooth Core Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage

outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- 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 follow:



## Compliance for section 15.247(g)

According to Bluetooth Core Specification, the Bluetooth system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

#### Compliance for section 15.247(h)

According to Bluetooth Core specification, the Bluetooth system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

According to the Bluetooth Core specification, the Bluetooth system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.



# 6.7 Hopping Channel Number

# 6.7.1 Applied procedures / Limit

15.247(a) (1) (iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

## 6.7.2 Test procedure

- (1) Connected the antenna port to the Spectrum Analyzer , set the Spectrum Analyzer as Span = the frequency band of operation, RBW ≥ 1% of the span, VBW ≥ RBW Sweep = auto Detector function = peak, Trace = max hold
- (2) The EUT should be have its hopping function enabled. Maxhold and record hopping channels It may prove necessary to break the span up to sections, in order to clearly show all of the hopping frequencies.

## 6.7.3 Deviation from standard

No deviation.

## 6.7.4 Test setup





# 6.7.5 Test result

Hopping Channel Number result				
Operating Mode: 1Mbps/ 3Mbps Mode Test date:2017-06-20				
Result	Limi	t	Conclusion	
79	79 15		Pass	



Marker

EUT:	Ear Bluetooth earphone	Model Name :	EH023
Temperature:	<b>26</b> ℃	Relative Humidity:	53%
Pressure:	1010 hPa	Test Power :	DC 3.7V from battery
Test Mode :	TX 1Mbps/3Mbps		



## 1Mbps



# 6.8 Dwell time

# 6.8.1 Applied procedures / Limit

15.247(a) (1) (iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

## 6.8.2 Test procedure

- (1) Place the EUT on the table in the chamber or connect the antenna port of the EUT to spectrum analyzer and set it in transmitting mode.
- (2) Set RBW of spectrum analyzer to 1MHz, VBW  $\geq$  RBW
- (3) Use a video trigger with the trigger level set to enable triggering only on full pulses.
- (4) Sweep Time is more than once pulse time.
- (5) Set the center frequency on any frequency would be measure and set the frequency span to zero span.
- (6) Measure the maximum time duration of one single pulse.
- (7) Set the EUT for DH5, DH3 and DH1 packet transmitting.
- (8) Measure the maximum time duration of one single pulse.
- (9) A Period Time = 79\*0.4=31.6 S
  - DH1 Time Slot: Reading \* (1600/2)\*31.6/79
  - DH3 Time Slot: Reading \* (1600/4)\*31.6/79
  - DH5 Time Slot: Reading \* (1600/6)\*31.6/79

## 6.8.3 Deviation from standard

No deviation.

## 6.8.4 Test setup





# 6.8.5 Test result

EUT:	Ear Bluetooth earphone	Model Name :	EH023
Temperature:	<b>26</b> ℃	Relative Humidity:	53%
Pressure:	1010 hPa	Test Power :	DC 3.7V from battery
Test Mode :	CH00-DH1/DH3/DH5 (1Mbps Mode)		

Data Packet	Frequency	Pulse Duration (ms)	Dwell Time (ms)	Limits (s)
DH1	2402 MHz	0.426	136.32	0.4000
DH3	2402 MHz	1.671	267.36	0.4000
DH5	2402 MHz	2.921	311.5733	0.4000





CH 00- DH3



i l'ultilit	T						own hund the faith of the faith
CF 2.4	02 GH	z		32000 p	its		400.0 µs/
Marker							
Туре	Ref	Trc	X-value	Y-value	Functio	on	Function Result
M1		1	305.385 µs	-72.13 dBm			
D2	M1	1	2.920591 ms	-4.64 dB			



EUT:	Ear Bluetooth earphone	Model Name :	EH023		
Temperature:	<b>26</b> ℃	Relative Humidity:	53%		
Pressure:	1010 hPa	Test Power :	DC 3.7V from battery		
Test Mode :	CH00-3DH1/3DH3/3DH5 (3Mbps Mode)				

Data Packet	Frequency	Pulse Duration (ms)	Dwell Time (ms)	Limits (s)
3DH1	2402 MHz	0.437	139.84	0.4000
3DH3	2402 MHz	1.684	269.44	0.4000
3DH5	2402 MHz	2.934	312.96	0.4000

Spectru	m						
Ref Lev	el 20.00 dBr	n 🖷 I	RBW 1 MHz				
🗕 Att	30 d	B 👄 SWT 4 ms 👄 🖲	BW 1 MHz				
SGL							
●1AP Clrw	'						
				M1[1]		-	65.47 dBm
10 dBm—	_			00[1]			802.025 µs
				D2[1]		_	-5.10 UB
0 dBm							107.201 µ3
-10 dBm—							
20 dBm-							
-20 ubiii-							
-30 dBm—							
-40 dBm—							
-50 dBm—	a dut			han an a	a constant		- tall
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Markor	CF 2:402 GHZ 32000 µCS 400.0 µS						
	ef   Trc	X-value	Y-value	Eunction	Fund	tion Recult	. 1
M1	1	802.025 µs	-65.47 dBm	ranction	i une	Alon Kesul	
D2	M1 1	437.264 µs	-5.10 dB				

## CH 00- DH1



CH 00- DH3





# 6.9 Maximum Peak Output Power

# 6.9.1 Applied procedures / Limit

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.

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

## 6.9.2 Test procedure

- (1) Connected the antenna port to the Spectrum Analyzer, set the Spectrum Analyzer as
- (2) Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
- (3) RBW > the 20 dB bandwidth of the emission being measured, VBW  $\ge$  RBW, Sweep = auto
- (4) Detector function = peak, Trace = max hold
- (5) The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.
- (6) The above procedure shall be repeated at the lowest, the middle, and the highest frequency of the stated frequency range with modulated mode. Also shall be performed at different modes of operation.

## 6.9.3 Deviation from standard

No deviation.

## 6.9.4 Test setup





# 6.9.5 Test results

EUT:	Ear Bluetooth earphone	Model Name :	EH023			
Temperature:	<b>26</b> ℃	Relative Humidity:	60%			
Pressure:	1010 hPa	Test Voltage :	DC 3.7V from battery			
Test Mode :	ТХ					
Note: All the data rates have be tested and the worst-case as the table below.						

Test Mode	Frequency	Peak Output Power (dBm)	Limit (dBm)	Result
	2402 MHz	4.23	21	Pass
Data rate 1Mbps	2441 MHz	3.87	21	Pass
	2480 MHz	3.08	21	Pass
	2402 MHz	4.21	21	Pass
Data rate 2Mbps	2441 MHz	3.91	21	Pass
	2480 MHz	3.14	21	Pass
	2402 MHz	4.28	21	Pass
Data rate 3Mbps	2441 MHz	3.85	21	Pass
	2480 MHz	3.18	21	Pass



#### CH 00-1Mbps



#### CH 39-1Mbps





## CH 78-1Mbps



#### CH 00-2Mbps





## CH 39-2Mbps



#### CH 78-2Mbps





## CH 00-3Mbps



#### CH 39-3Mbps





## CH 78-3Mbps





# 6.10 Band edge

# 6.10.1 Applied procedures / Limit

15.247(d) 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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.205(c)).

## 6.10.2 Test procedure

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation, RBW ≥ 1% of the span, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold

## 6.10.3 Deviation from standard

No deviation.

## 6.10.4 Test setup





# 6.10.5Test results



## CH00 (Lower) Data rate 1Mbps









## CH00 (Lower) Data rate 3Mbps









## CH00 (Lower) Data rate 1Mbps



CH 78 (Upper) Data rate 1Mbps






#### CH00 (Lower) Data rate 3Mbps







# 6.11 Conducted Spurious Emissions

# 6.11.1 Applied procedures / Limit

15.247(d) 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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

# 6.11.2 Test procedure

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below.
- b. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10<sup>th</sup> harmonic. Typically, several plots are required to cover this entire span. RBW = 100 kHz VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold sweep points ≥ investigated frequency range/RBW.

# 6.11.3 Deviation from standard

No deviation.

### 6.11.4 Test setup





# 6.11.5Test results

Spectrur	n								
Ref Leve	el 20.00 dBm	l	🖷 RBV	✔ 100 kHz					
🛢 Att	30 dB	SWT 1.1	ms 👄 VBV	<b>V</b> 300 kHz	Mode Aut	O FFT			
⊖1Pk Max									
					М	1[1]		812	58.47 dBm .8050 MHz
10 dBm									
0 dBm									
-10 dBm—	-D1 -15.650	dBm							
-20 dBm—	51 15.555								
-30 dBm—									
-40 dBm—									
-50 dBm—							1	11	
-60 dBm	and a line of the set	anter angeterre	akalidinindi dana p	ten al-dalitik dagi	relie-e-allered free	April 1 and 1 a	<ul> <li>Mallapines.teel</li> </ul>	n digging sidening in	angan ini tani <sup>kal</sup> anga bara Kal
-70 dBm—	ayahanyalahasedyerethe	an a	haanaa haa	na hlatan ay an dua	allia ang ang ang ang ang ang ang ang ang an	ունդուլիցյին <sup>ով</sup> ից	a and a start of the second	n i na sente da sente	مريم وسقوري وأعمل مقاتب
Start 30.0	MHz			3200	) pts			Sto	p 1.0 GHz
Marker									
Type Ro	ef Trc	X-value 812.80	5 MHz	Y-value	Funct	tion	Func	tion Result	
		012,00	2.0016	50. m ub					

CH00 Data rate 1Mbps

#### CH00 Data rate 1Mbps







#### CH00 Data rate 1Mbps



### CH00 Data rate 1Mbps







Spectru	ım											
Ref Lev	<b>/el</b> 20	0.00 dBm		😑 F	<b>RBW</b> 100 kH	Iz						
🗕 Att		30 dB	SWT 1.	1 ms 😑 🎙	<b>VBW</b> 300 kH	lz M	ode Aut	to FFT				
😑 1Pk Max	:											
							M	1[1]				-57.05 dBm
10 dBm—	_										95	0.4540 MHz
0 dBm	_											
-10 dBm—	_											
20 d9m-	-D1	-16.010	dBm									
-20 0600-												
-30 dBm—												
-40 dBm—	_											
-50 dBm—	_											M1
read the second	) <sup>III</sup> to da	जन्म जन्म (किस)	ander <mark>Staarsela</mark> n		Anter a the first of the first	վրուներ	ավատերու	induly at a post	(mining)	a la tra para la la	No. Martine Internet	
-70 dBm-	1 <sup>0</sup> 11-0	er an the state of	Herent Charleshough	odali) tostym	the spin of a sub-	n a patri patri par	dina padahaja		tendere 1	on heigen ten	I Included	a na ana ana ana ana ana ana ana ana an
, 0 0011												
Start 30.	.0 MH	Iz	I	1	32	000 pt	ts	1			St	op 1.0 GHz
Marker												
Type F	Ref 📋	Trc	X-value	,	Y-valu	e	Func	tion		Fun	ction Resul	t
M1		1	950.4	54 MHz	-57.05	dBm						

#### CH39 Data rate 1Mbps









Spectr	um											
Ref Le	evel	20.00 dB	m	👄 F	RBW	100 kHz						
Att		30 0	B SWT 10	0 ms 😑 🕻	/BW	300 kHz	Mode	Auto Sv	/еер			
⊖1Pk Ma	ax -		_									
								M1[1]			-	19.12 dBm
10 dBm-											7.3	19530 GHz
0 dBm—												
-10 dBm												
		1 -16.01	0_dBm			41						
-20 dBm	+					Ĭ						
-30 dBm	-											
-40 dBm	_											
-50 dBm	_											
فيناب والمراجع	العميد	and a local track	أالم اعليك والمرا المعالية و	المراجعة (المرجعية) المراجع المرجعية (المرجعية)		and the second state	ومرادر المالأليان	and the second	المحم مستعينات	A State of the sta	الأمرية أراقه أناف الأرساريا. ومريد المريد المالية	
product production	and put	and the second se	And the second s	Total Inc.	- <b>^</b>	and the second second	halfs	and a second second	and a mach and possible	THE WE'S SHOW		died over Alleria
-70 dBm	_											
Start 3.	.0 GH	lz				3200	0 pts				Stop	13.0 GHz
Marker												
Туре	Ref	Trc	X-value	,	Y	value	- Fi	unction		Fund	ction Result	
M1		1	7.319	53 GHz		·19.12 dB	m					

#### CH39 Data rate 1Mbps









### CH78 Data rate 1Mbps

Spectrum											₩
Ref Level	20.00	dBm	•	RBW	/ 100 kHz						`
Att	30	dB SW1	1.1 ms 😑	VBW	/ 300 kHz	Mode Aut	o FFT				
●1Pk Max		1									
						M	1[1]				58.52 dBm
10 dBm										951	.5450 MHZ
0 dBm											
-10 dBm			_								
-20 dBm	D1 -16.7	790 dBm									
-30 dBm											
-40 dBm											
-50 dBm—											M1
-60 dBm	(laha), dan		a ta di ca bidi ji da	alsheda	المدادا والمراد والمراد	an are that that	"hafleliviev	and the state	enation <sup>te</sup>		the state
New Joseph Lands	Suples and	Transporter, Afric	dagay ya Direksin	n Huhr	halaparti del (st. e. k	datah tarih pro	Jaganaha	-day Moder	(Hitel)	and the second physical	manda de <sup>les</sup> ta des
-70 0811											
Start 30.0	MHz				3200	) pts				Sto	p 1.0 GHz
Marker											
Type Ret	Trc	<u>X-v</u>	alue		Y-value	Func	tion		Fund	tion Result	
M1	1	95	1.545 MHz		-58.52 dB	m					

# CH78 Data rate 1Mbps

Spectrum	ī					
Ref Level Att	l 20.00 dBi 30 d	m 🛛 👄 B <b>SWT</b> 32 ms 👄	RBW         100 kHz           VBW         300 kHz         M	1ode Auto Swee	эр	
●1Pk Max						
				M1[1]		3.21 dBm 2.4798440 GHz
10 dBm					M1	
0 dBm						
-10 dBm						
-20 dBm	D1 -16.79	D dBm				
-30 dBm						
-40 dBm						
-50 dBm						
ւ <sub>≂6</sub> ը,dβm <del>…,</del>	क्रम्बिन्द्राल्य नेत च्या	unpleasing the second second		Land the second s	a il su a de la	المتحدية الإيرية العلى إلى الألم ويروم من الأربي وتروية على ال ويحمد المراجع ويروم الأربية والمراجع المراجع ويروم من الأربي وتروية والمراجع
-70 dBm	a de para porte en cardela de c					
Start 1.0 G	Hz		32000	pts		Stop 3.0 GHz
Marker						
Type Re M1	f Trc	X-value 2.479844 GHz	Y-value 3.21 dBm	Function	Fund	tion Result





#### CH78 Data rate 1Mbps



#### CH78 Data rate 1Mbps

Spectrum										
Ref Level Att	20.00 dBm 30 dB	) SWT 120	e RB1 ) ms e VB1	₩ 100 kHz ₩ 300 kHz	Mode Au	to Swei	эр			
😑 1Pk Max										
					М	1[1]			- 20.0	49.11 dBm 92560 GHz
10 dBm										
0 dBm										
-10 dBm										
-20 dBm	D1 -16.790	dBm								
-30 dBm										
-40 dBm					мı					
-50 dBm	an John Jahr In alle		logitilit, genetic lite	en faster fasteren fan		Marked.	we will have been	and contact	المرجابان والدوا	Junit and Market
loopiblood in marced	n ya alin ya a Ya alin ya alin	ing and the second s	in di la peresente de 14	an come construine.	and a sector	hilite, and a	in a faile first of a second	and the state of the	اللار يعاقر ما هم الله ا	a an
-70 dBm										
Start 13.0 (	GHz			3200	) pts	I			Stop	25.0 GHz
Marker										
Type Ref	Trc 1	X-value 20.0925	i6 GHz	Y-value -49.11 dB	Func m	tion		Func	tion Result	





#### Spectrum Ref Level 20.00 dBm 🔵 RBW 100 kHz 30 dB SWT 1.1 ms 🖷 VBW 300 kHz Att Mode Auto FFT ●1Pk Max -58.19 dBm 797.7400 MHz M1[1] 10 dBm-0 dBm--10 dBm-D1 -15.610 dBm--20 dBm--30 dBm--40 dBm--50 dBm M: -60 dBm--տերերերե to the base of the n Cule a faalining de personalite het de արդանո երենին դենդին։ Դիներին դենդին na and providely -70 dBm----Start 30.0 MHz 32000 pts Stop 1.0 GHz Marker TypeRefTrcM11 X-value 797.74 MHz **Y-value** -58.19 dBm Function Result Function

#### CH00 Data rate 3Mbps

#### CH00 Data rate 3Mbps

Spectrun	ı )								
Ref Leve	I 20.00 dB	m	e RB	<b>W</b> 100 kHz					
🛢 Att	30 d	ів <b>swt</b> 32	ms 👄 VB	<b>W</b> 300 kHz	Mode Auto	Sweep			
●1Pk Max									
					M	1[1]		2.40	4.39 dBm 19688 GHz
10 dBm						ſ	1		
0 dBm									
-10 dBm									
-20 dBm	D1 -15.61	0 dBm							
-30 dBm									
-40 dBm									
-50 dBm									
L-60.dBm	hallman a la bear a la			بالبين المصيف		بها العمالية سيلب	وواريا والمائية أستنا	مراسط أخلطهم	al demonstration
-70 dBm—		n at a banna at a sella a bina an					i h <sub>an</sub> an light and a game	n de secolet de la fonce des d	
Start 1.0 C	Hz			32000	) pts			Sto	p 3.0 GHz
Marker									
Type Re	f Trc	X-value		Y-value	Funct	tion	Fund	ction Result	
M1	1	2.401968	37 GHz	4.39 dB	m				





#### Spectrum Ref Level 20.00 dBm 🔵 RBW 100 kHz 30 dB SWT 100 ms 🖷 VBW 300 kHz Att Mode Auto Sweep ●1Pk Max -19.18 dBm 7.206090 GHz M1[1] 10 dBm-0 dBm--10 dBm м1 D1 -15.610 dBm--20 dBm-Ŷ -30 dBm -40 dBm--50 dBm -70 dBm-32000 pts Stop 13.0 GHz Start 3.0 GHz Marker TypeRefTrcM11 X-value 7.20609 GHz **Y-value** -19.18 dBm Function Result Function

#### CH00 Data rate 3Mbps



Spectrur	n	٦								
Ref Leve	<b>el</b> 20	.00 dBm		🖷 R	<b>BW</b> 100 kHz					
🔵 Att		30 dB	SWT 120	D ms 👄 🛛	<b>BW</b> 300 kHz	Mode Au	to Swee	р		
●1Pk Max										
						м	1[1]		- 20.1	49.40 dBm 13190 GHz
10 dBm										
0 dBm										
-10 dBm—										
-20 dBm—	-D1	-15.610	dBm							
-30 dBm—										
-40 dBm—						MI				
-50 dBm—		التأرير أنتأر وم	aritaden, effilië	and the former that	and go band following of	Part Service	N <sup>a</sup> lashina	وللعنس فاختر بريس اللغاسة إ	aty <mark>he athan t</mark>	the state of the s
anness anness	ارور معام <mark>ر</mark>	na anta atri	hipping and the feature of the featu	يعدا ورائشان	and the second sec	and the state of	alling and the second s	an a third a start of the second s	i dite sendi kayaktı padate	to a local graduation of the second
-70 dBm—										
Start 13.0	   GHz	,			3200	nnts			Ston	25.0 GHz
Marker		-			0200				0.0P	
Type R	ef   T	rc	X-value		Y-value	Func	tion	Func	tion Result	[
M1		1	20.113:	19 GHz	-49.40 dB	m				





#### CH39 Data rate 3Mbps

Spectrum											
Ref Level	20.00	dBm		👄 RB1	₩ 100 kHz						
e Att	3	0 dB	SWT 1.1	. ms 👄 🛛 🗷 🖲	₩ 300 kHz	Mode Aut	O FFT				
●1Pk Max											
						M	1[1]			-	57.78 dBm
10 dBm		_								951	.6670 MHz
0 dBm											
-10 dBm											
-20 dBm	D1 -15.	980	dBm								
-30 dBm		_									
-40 dBm											
-50 dBm											M1
-60 dBm	Maria	ارتعاليل	n <sup>iner</sup> <sup>2</sup> theler (1)	polition depictu	and fighter and the last	արժութներ	, <sup>d</sup> avana, dari	<b>Manu</b>	भाषा है के स्वतृहत्ता <sup>स्थ</sup>		entitere Versing
-70 dBm	and a later the	a haran	alitical <u>substration</u> ed	an a faith an	1000 belaktions	net lagranticity are us	արտովիս	te al la	attent for the dealers	a statistica a statistica	a a di ali di di la di a
, o abiii											
Start 30.0	MHz				3200	) pts		I		Sto	p 1.0 GHz
Marker											
Type Ref	i   Trc		X-value	.	Y-value	Func	tion		Func	tion Result	
M1	1		951.66	67 MHz	-57.78 dB	m					

# CH39 Data rate 3Mbps

Spectrun	ī									
Ref Leve Att	20.00 ( 30	dBm ) dB <b>SWT</b> 32	e RBW ms e VBV	/ 100 kHz / 300 kHz /	Mode Auto	) Sweep	1			
●1Pk Max										
					M	1[1]			2.44	4.02 dBm 10310 GHz
10 dBm							M	1		
0 dBm										
-10 dBm										
-20 dBm	D1 -15.9	980 dBm								
-30 dBm										
-40 dBm										
-50 dBm										
-60 d8m	hand and an an all	temetripolitical en positiv	a training and the	al a facilitati di stato da		and the late	- Maria	and diamondate		an disara bahamb
-70 dBm	ogiideoogoogood	an a faire an an a stair a stai	Sanda ( Sandina a buy tay tai k 🦷							
Start 1.0 C	Hz			32000	pts				Sto	p 3.0 GHz
Marker										
Type Re M1	f Trc	X-value 2.44103	B1 GHz	Y-value 4.02 dBn	Funct	tion		Func	tion Result	





#### CH39 Data rate 3Mbps



#### CH39 Data rate 3Mbps

, , , , , , , , , , , , , , , , , , ,
]
-48.49 dBm 20.107560 GHz
المراجعة والمراجع
nation with the lattice of the second by a static second static ballotter
Stop 25.0 GHz
unction Result





### CH78 Data rate 3Mbps

Spectrum												
Ref Level	20.00	dBm			⊜ RB¥	♥ 100 kHz						
Att	3	0 dB	SWT	1.1 ms	● VB1	♥ 300 kHz	Mode Au	to FFT				
●1Pk Max												
							M	1[1]			-	57.41 dBm
10 dBm											949	.2110 MHZ
0 dBm												
-10 dBm				_								
-20 dBm	D1 -16	.800 a	IBm									
-30 dBm												
-40 dBm												
-50 dBm												M1
-60 dBm - n	andrate	on Althy	inst <sup>ell</sup> tentri	del caple (tri	տնդացնել	(nately contenant)	wheeled and	- Andrews	, Magaeria	lange dagar in		र त्यून्त्रीय विकास
-70 dBm	- Andrea (Angle	o talaja	e di Centre	the laboration	as flowing t	production of the second	na fealign and p	- Marine (1)	daragter.	. A MARINA PARA	I addression of the second	a alternation of the second
-/0 0.0111												
Start 30.0	MHz			-		3200	0 pts	1			Sto	p 1.0 GHz
Marker												
Type Ref	Trc		X-val	ue		Y-value	Func	tion		Func	tion Result	
M1	1		949	.211 MF	Iz	-57.41 dB	Sm					

# CH78 Data rate 3Mbps

Spectrum	'n								
Ref Level	20.00 di	Bm (	<b>RBW</b> 100 kHz						
🖷 Att	30	dB <b>SWT</b> 32 ms (	🔵 <b>VBW</b> 300 kHz	Mode Auto	o Sweep				
●1Pk Max									
				M1[1] 3.20 dE 2.4799690 G					
10 dBm				M1					
0 dBm									
-10 dBm									
-20 dBm	D1 -16.8	DO dBm							
-30 dBm									
-40 dBm									
-50 dBm									
.₀6ΩıdBm <del>oolo</del>					ann a talan <mark>i</mark> t	Lutul Quality		يافي (اروغنورون بايران الرويون). بالاسترسان معرفين مسويتين م	
-70 dBm									
Start 1.0 G	Hz		3200	 )0 pts			Sto	p 3.0 GHz	
Marker									
Type Ref	f Trc	X-value	Y-value	Func	Function		Function Result		
M1	1	2.479969 Gł	Hz 3.20 d	Bm					





### CH78 Data rate 3Mbps

Spectrur	n	)											
Ref Leve	<b>l</b> 20.0	dBrr			■ RB1	<b>W</b> 10	)O kHz						
Att		30 dB	SWT	100 ms	● VB	<b>W</b> 30	)O kHz	Mode 4	uto Swe	еер			
●1Pk Max													
								M1[1] -24.3			24.25 dBm		
10 dBm												7.4	39840 GHZ
0 dBm									_				
-10 dBm—				_					_				
-20 dBm—	D1 -1	6.800	dBm			17	11						
-30 dBm—													
-40 dBm—													
-50 dBm—				<u> </u>							NL,		La contra
اللعا وأورا والراحد وجروار	a la Lora Li	مهايدريد	الأسرار ويحربه ومراجع	<b>Jurg and an of p</b>		البيهاد	distant <sup>er</sup> tat	المطالبين الطبيا	إلال والمتحلقي أشاق	التدييط	and the second second	Refer to see the sector of the	an a
and a start of the	n den al la co	لام بساريدية	فأنامي ومرادفهما	and the second second		(hun)	ar thing are a	<sup>n de</sup> dependente		hater en de de la	The state of the s	Julian Internetion	
-70 dBm—				_									
Start 3.0 GHz         32000 pts         Stop 13.0 GHz													
Marker													
Type Re	ef Tro	<u> </u>	X-val	ue	Y-value			Function Function Result					
M1		1	7.4	3984 GH:	z	-24	4.25 dB	m					

# CH78 Data rate 3Mbps

Spectrun	ι							
Ref Leve Att	l 20.00 dBr 30 d	n e B <b>SWT</b> 120 ms e	RBW 100 kHz VBW 300 kHz (	Mode Auto Swe	ер			
●1Pk Max								
				M1[1] -50.02 18.32444				
10 dBm								
0 dBm								
-10 dBm								
-20 dBm	D1 -16.800	) dBm						
-30 dBm								
-40 dBm			M1					
-50 dBm	الايروليان ويلامي <sup>وي</sup> ا	and the second	And the other particulation of the	There are a special	and the spectra provide the second	and a structure of the state of		
ىلىمىيە <mark>ر بە<sup>رىم</sup>ارىسا</mark>	<del>فيرينان<sub>ي ل</sub>يس<sub>ا</sub>يني</del>	<mark>a a shirayi sa sa shirayi sa </mark>	<mark>a sana alin da alini yan kuna sani dina</mark> Alini yang kuna sani dina	alitika alihan di <mark>banduka di banduka d </mark>	and the second	a na antara panta a santa a santa a santa da sa		
-70 dBm								
Start 13.0 GHz         32000 pts         Stop 25.0 GHz								
Marker								
Type Re	f Trc	10 22444 CU2	Y-value	Function	Function Result			
	1	10.52444 GHz	U2_UBIII					



# 7 Photographs

# 7.1 Radiated Emission Test Setup



Above 1G





# 7.2 EUT Constructional Details











Dongguan Yaxu (AiT) Technology Limited No.22, Jinqianling Third Street, Jitigang, Huangjiang,Dongguan, Guangdong, China











Dongguan Yaxu (AiT) Technology Limited No.22, Jinqianling Third Street, Jitigang, Huangjiang,Dongguan, Guangdong, China











\*\* End of report \*\*

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