

FCC/IC - TEST REPORT

Report Number	:	68.950.20.0526.01		Date of Issue:	September 03, 2020	
Model	:	PI5R				
Product Type	:	In-ear True Wireles	ss Headpho	one		
Applicant	:	B&W Group Ltd.				
Address	•	Dale Road Worthin	g United K	ingdom BN11	2BH	
Factory	:	Charter Media (Do	ngguan) Co	o., Ltd.		_
Address	:	Dabandi Industrial	Zone, Dani	ing District, Hu	men Town,	
	•	523930 Dongguan	City, Guan	ngdong Provinc	е,	
	•	PEOPLE'S REPUE	BLC OF CH	IINA		
Test Result	:	Positive	□ Negati	ve		
Total pages including Appendices	:	64				

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
	Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District
	Shenzhen 518052
	P.R. China
Telephone:	86 755 8828 6998
Fax:	86 755 8288 5299
FCC Registration No.:	514049
ISED#:	10320A



3 Description of the Equipment Under Test

Product:	In-ear True Wireless Headphone
Model no/HVIN/PMN.:	PI5R
FVIN:	V1.0.X
FCC ID: IC:	2ACIX-PI5R 11946B-PI5R
Options and accessories:	Type-C Cable, Charging Case
Rating:	Earbud: 3.7VDC, 55mAh, 0.204Wh (Supplied by Built Li-ion battery)
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	79
Modulation:	GFSK, π/4-DQPSK, 8-DPSK
Antenna Type:	Mono pole antenna
Antenna Gain:	1.0dBi
Description of the EUT:	The Equipment Under Test (EUT) is an In-ear True Wireless Headphone support Bluetooth function.



4 Summary of Test Standards

	Test Standards
FCC Part 15 Subpart C	PART 15 - RADIO FREQUENCY DEVICES
10-1-2019 Edition	Subpart C - Intentional Radiators
RSS-Gen Issue 5, Amendment 1, March 2019	General Requirements for the Certification of Radio Apparatus
RSS-247 Issue 2 February 2017	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

All the test methods were according to Public Notice DA 00-705 -Frequency Hopper Spread Spectrum Test Procedure, KDB558074 D01 v05r02 and ANSI C63.10-2013.



5 Summary of Test Results

Technical Requirements					
FCC Part 15 Subp	oart C/ RSS-247 Issu	e 2/RSS-Gen Issue 5			
Test Condition			Pages	Test Result	Test Site
§15.207	RSS-GEN 8.8	Conducted emission AC power port		N/A	
§15.247(b)(1)	RSS-247 Clause 5.4(b)	Conducted peak output power	10	Pass	Site 1
§15.247(e)	RSS-247 Clause 5.2(b)	Power spectral density*		N/A	
§15.247(a)(2)	RSS-247 Clause 5.2(a)	6dB bandwidth		N/A	
§15.247(a)(1)	RSS-247 Clause 5.1(a) & RSS-Gen 6.7	20dB bandwidth and 99% Occupied Bandwidth	17	Pass	Site 1
§15.247(a)(1)	RSS-247 Clause 5.1(b)	Carrier frequency separation	27	Pass	Site 1
§15.247(a)(1)(iii)	RSS-247 Clause 5.1(d)	Number of hopping frequencies	30	Pass	Site 1
§15.247(a)(1)(iii)	RSS-247 Clause 5.1(d)	Dwell Time	32	Pass	Site 1
§15.247(d)	RSS-247 Clause 5.5	Spurious RF conducted emissions	37	Pass	Site 1
§15.247(d)	RSS-247 Clause 5.5	Band edge	48	Pass	Site 1
§15.247(d) & §15.209 & §15.205	RSS-247 Clause 5.5 & RSS-GEN 6.13 RSS-GEN 8.9 RSS-GEN 8.10	Spurious radiated emissions for transmitter and receiver	53	Pass	Site 1
§15.203	RSS-GEN 6.8	Antenna requirement	See note 2	Pass	

Note 1: N/A=Not Applicable.

Note 2: The EUT uses Mono pole antenna, which gain is 1.0dBi. In accordance to §15.203 and RSS-GEN 6.8, it is considered sufficiently to comply with the provisions of this section.



6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2ACIX-PI5R, IC: 11946B-PI5R complies with Section 15.205, 15.209, 15.247 of the FCC Part 15, Subpart and RSS-247 issue 2 and RSS-Gen issue 5 rules.

Note: The report is for BDR+EDR only.

SUMMARY:

All tests according to the regulations cited on page 5 were

- Performed
- □ Not Performed

The Equipment Under Test

- - Fulfills the general approval requirements.
- □ **Does not** fulfill the general approval requirements.

Sample Received Date:

August 3, 2020

August 3, 2020

Testing End Date:

Testing Start Date:

Reviewed by:

Johnshi

John Zhi EMC Project Manager

Prepared by:

August 31, 2020

Mark chen

Mark Chen EMC Project Engineer

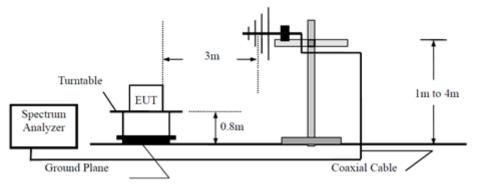
Tree them

Tree Zhan EMC Test Engineer

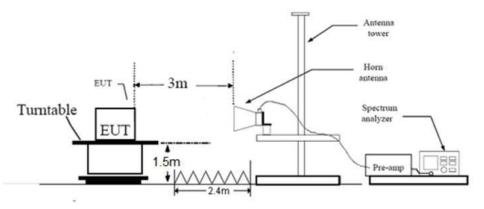
Tested by:

7 Test Setups

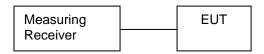
7.1 Radiated test setups Below 1GHz



Above 1GHz



7.2 Conducted RF test setups







8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
Notebook	Lenovo	X220	

Test software: Bluetooth 3 Test Tool, which used to control the EUT in continues transmitting mode

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status)

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

9 Technical Requirement

9.1 Conducted peak output power and e.i.r.p

Test Method

- Use the following spectrum analyzer settings: Span = approximately 5 times the 20dB bandwidth, centered on a hopping channel RBW > the 20dB bandwidth of the emission being measured, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2. Add a correction factor to the display.
- 3. 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

Limits

Conducted Peak Output Power:

	Frequency Range	Limit	Limit
	MHz	W	dBm
For e.i.r.p	2400-2483.5	≤1	≤30
	Frequency Range	Limit	Limit
	MHz	W	dBm
	2400-2483.5	≤4	≤36





Conducted peak output power

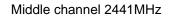
Bluetooth Mode GFSK modulation Test Result				
	Conducted Peak Output		Result	
Frequency	Peak Output	E.I.R.P	Result	
MHz	dBm	dBm		
Low channel 2402MHz	7.5	8.5	Pass	
Middle channel 2441MHz	7.56	8.56	Pass	
High channel 2480MHz	77	87	Pass	

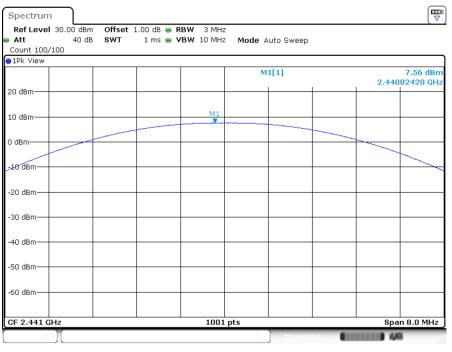
Spectrum Image: Construction of the second sec
20 dBm M1[1] 7.50 dB 10 dBm M1 2.40196800 GI 0 dBm M1 0 -20 dBm -20 dBm -20 dBm
20 dBm
10 dBm
0 dBm
-20 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 2.402 GHz 1001 pts Span 8.0 MH

Low channel 2402MHz

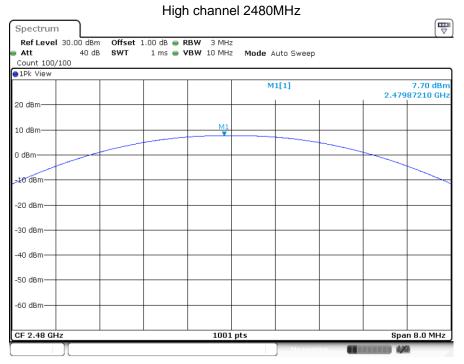
Date: 18.AUG.2020 14:23:38







Date: 18.AUG.2020 14:23:53



Date: 18.AUG.2020 14:24:14



Bluetooth Mode $\pi/4$ -DQPSK modulation Test Result Conducted

	Peak Output		Result
Frequency	Power	E.I.R.P	
MHz	dBm	dBm	
Low channel 2402MHz	7.52	8.52	Pass
Middle channel 2441MHz	7.54	8.54	Pass
High channel 2480MHz	7.64	8.64	Pass

		Low chan	nel 2402MHz		
Spectrum					
Count 100/100	dBm Offset 1. 0 dB SWT	00 dB 👄 RBW 31 1 ms 👄 VBW 101	/Hz /Hz Mode Auto Swee	D	
●1Pk View					7 50 10
			M1[1]		7.52 dBm 2.40198400 GHz
20 dBm				+ +	
			м		
10 dBm					
0 dBm					
-10 dBm					
-20 dBm					
-30 dBm					
oo abiii					
-40 dBm					
-50 dBm					
-60 dBm					
CF 2.402 GHz)01 pts		Span 8.0 MHz
Ĩ			Measu	ring	

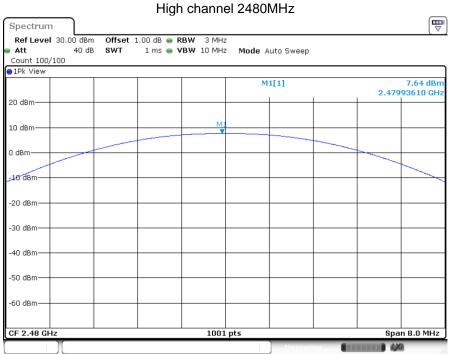
Date: 18.AUG.2020 14:24:40



Middle channel 2441MHz

Spectrum				
Ref Level 30.00 dBm	Offset 1.00 dB 👄 RB			
Att 40 dB Count 100/100	SWT 1 ms 👄 VB	W 10 MHZ Mode Au	uto Sweep	
1Pk View				
JIPK VIEW			141	7.54 dBr
		INI.	[1]	2.44099200 GH
20 dBm				
10 dBm		M1		
0 dBm				
-18 dBm				
-20 dBm				
-30 dBm				
-40 dBm				
-50 dBm				
-60 dBm				
ou doll				
CF 2.441 GHz		1001 pts		Span 8.0 MHz
1 I				AX4

Date: 18.AUG.2020 14:24:57



Date: 18.AUG.2020 14:25:07



Bluetooth Mode 8DPSK modulation Test Result Conducted

	Result		
Frequency	Power	E.I.R.P	
MHz	dBm	dBm	
Low channel 2402MHz	7.43	8.43	Pass
Middle channel 2441MHz	7.55	8.55	Pass
High channel 2480MHz	8.21	9.21	Pass

	L	ow channel	2402MHz		
Spectrum					
Ref Level 30.00 d	iBm Offset 1.00 dB	👄 RBW 3 MHz			
	dB SWT 1 ms	👄 VBW 10 MHz	Mode Auto Sweep		
Count 100/100					
IFK VIOW			M1[1]		7.43 dBm
20 dBm				2	.40196800 GHz
10 dBm		м			
0 dBm					
-10 dBm					
-20 dBm					
-30 dBm					
-40 dBm					
-50 dBm					
-60 dBm					
CF 2.402 GHz		1001 p	ts		Span 8.0 MHz
		•	Measuring		

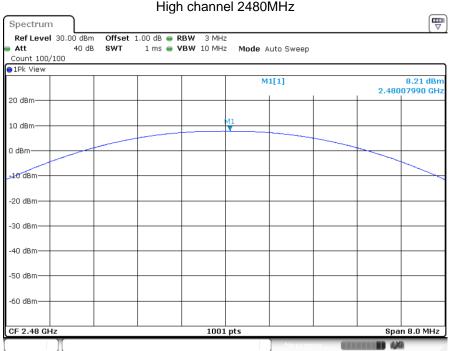
Date: 18.AUG.2020 14:25:38



Middle channel 2441MHz

Ref Level 30.00 dBm	Offset 1.00 dB 👄	RBW 3 MHz		
Att 40 dB	SWT 1 ms 👄	VBW 10 MHz r	Mode Auto Sweep	
Count 100/100				
1Pk View				
			M1[1]	7.55 dBr 2.44095200 GH
20 dBm				2.11050200 Gi
10 dBm		M		
0 dBm				
-10 dBm				
-20 dBm				
-30 dBm				
-40 dBm				
-50 dBm				
-60 dBm				
CF 2.441 GHz		1001 pts		Span 8.0 MHz
		1001 pts		

Date: 18.AUG.2020 14:25:53



High channel 2480MHz

Date: 18.AUG.2020 14:26:05



9.2 20 dB bandwidth and 99% Occupied Bandwidth

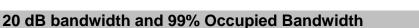
Test Method

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- 3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
- 4. Repeat above procedures until all frequencies measured were complete.

Limit

Limit [kHz]

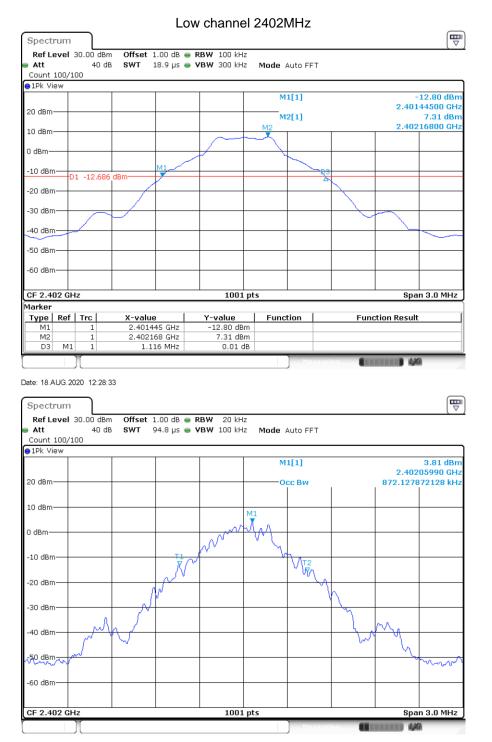
N/A





Bluetooth Mode GFSK Modulation test result

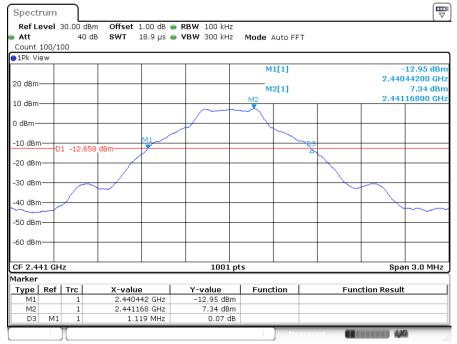
Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz	Result
 2402	1116	872		Pass
2441	1119	869		Pass
2480	1116	863		Pass



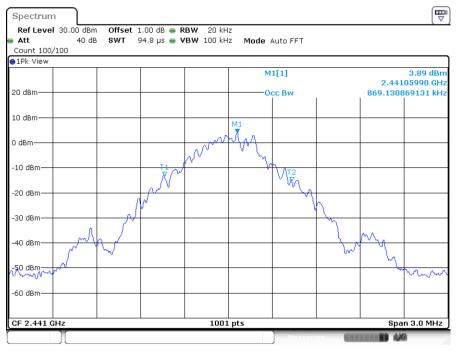
Date: 18.AUG.2020 12:28:44



Middle channel 2441MHz



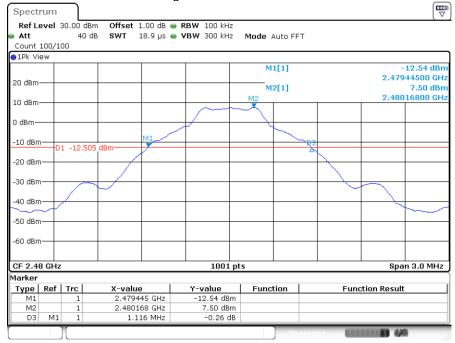
Date: 18.AUG.2020 12:30:13



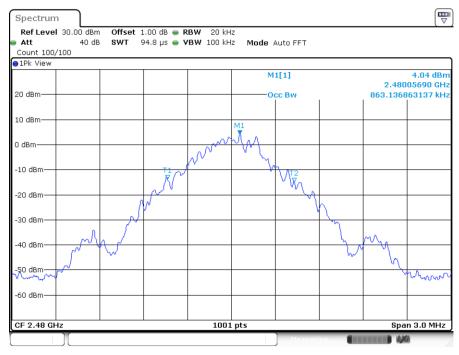
Date: 18.AUG.2020 12:30:23



High channel 2480MHz



Date: 18.AUG.2020 12:31:28



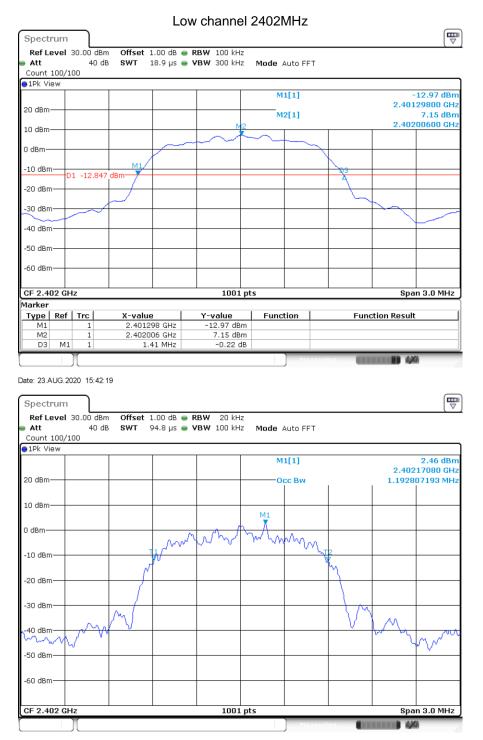
Date: 18.AUG.2020 12:31:39



20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode $\pi/4$ -DQPSK Modulation test result

	Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
_	MHz	kHz	kHz	kHz	
	2402	1410	1193		Pass
	2441	1410	1193		Pass
	2480	1410	1196		Pass



Date: 23.AUG.2020 15:42:30

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Middle channel 2441MHz



Date: 23.AUG.2020 15:43:04

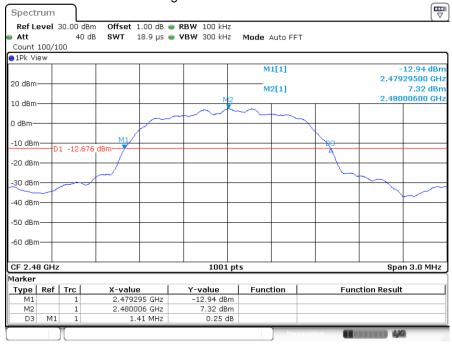


Date: 23.AUG.2020 15:43:14

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High channel 2480MHz



Date: 23.AUG.2020 15:44:21



Date: 23.AUG.2020 15:44:31

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20 dB bandwidth and 99% Occupied Bandwidth

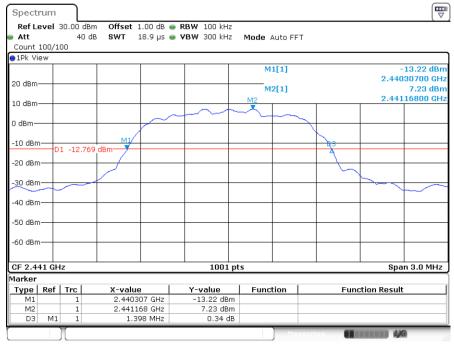
Bluetooth Mode 8DPSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz	Result
2402	1398	1190		Pass
2441	1398	1190		Pass
2480	1404	1190		Pass





Middle channel 2441MHz



Date: 23.AUG.2020 15:47:40

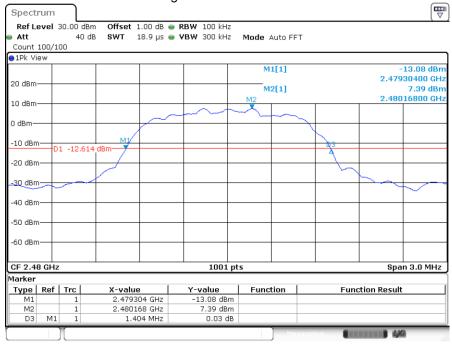


Date: 23.AUG.2020 15:47:51

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High channel 2480MHz



Date: 23.AUG.2020 15:48:25



Date: 23.AUG.2020 15:48:36

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9.3 Carrier Frequency Separation

Test Method

- Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
- 2. By using the Max-Hold function record the separation of two adjacent channels.
- 3. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function.
- 4. Repeat above procedures until all frequencies measured were complete.

Limit

Limit
kHz
≥25KHz or 2/3 of the 20 dB bandwidth which is greater

GFSK Modulation Limit

Test Mode	2/3 of 20 dB Bandwidth kHz
DH5	746
2DH5	940
3DH5	932





Carrier Frequency Separation

Test result: The measurement was performed with the typical configuration (normal hopping status), here GFSK modulation mode was used to show compliance.

GFSK Modulation test result

Test Mode	Carrier Frequency Separation kHz	Result
DH5	994	Pass
2DH5	997	Pass
3DH5	1017	Pass

	00 dB ● RBW 100 kHz 3.9 µs ● VBW 300 kHz	Mode Auto FFT	
Att 40 dB SWT 18 Count 100/100 1Pk View 20 dBm 10 dBm -10 dBm		Mode Auto FFT	
Count 100/100 1Pk View 20 dBm 10 dBm -10 dBm	3.9 µs 🖷 VBW 300 kHz	Mode Auto FFT	
1Pk View 20 dBm 10 dBm 0 dBm -10 dBm			
20 dBm			
10 dBm		M1[1]	7.11 dBm
10 dBm			2.44101304 GHz
0 dBm -10 dBm		D2[1]	0.24 dB
0 dBm		1 1	994.20 kHz
-10 dBm			02
-10 dBm	\sim		
			<u> </u>
20 dBm			
20 dBm			
-20 UBIII			
-30 dBm			
-40 dBm			
-50 dBm			
-60 dBm			
Start 2.4405 GHz	691 pt	ts	Stop 2.4425 GHz

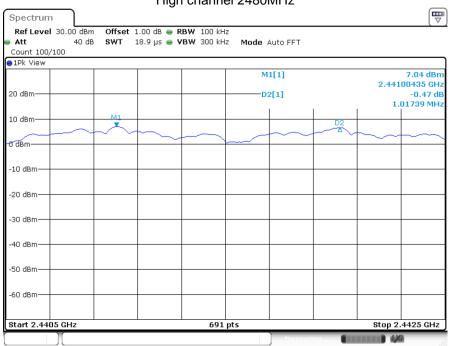
Date: 18.AUG.2020 13:18:14



T Spectrum Ref Level 30.00 dBm Offset 1.00 dB 👄 RBW 100 kHz 40 dB 18.9 µs 👄 **VBW** 300 kHz Att SWT Mode Auto FFT Count 100/100 ⊖1Pk View M1[1] 7.10 dBm 2.44116667 GHz 20 dBm· D2[1] -0.03 dB 997.10 kHz M1 10 dBm· T 0 dBm--10 dBm--20 dBm--30 dBm--40 dBm· -50 dBm--60 dBm· Start 2.4405 GHz 691 pts Stop 2.4425 GHz

Middle channel 2441MHz

Date: 23.AUG.2020 15:52:43



High channel 2480MHz

Date: 23.AUG.2020 15:56:35



9.4 Number of hopping frequencies

Test Method

- Use the following spectrum analyzer settings: Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
- 2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
- 3. Record all the signals from each channel until each one has been recorded.
- 4. Repeat above procedures until all frequencies measured were complete.

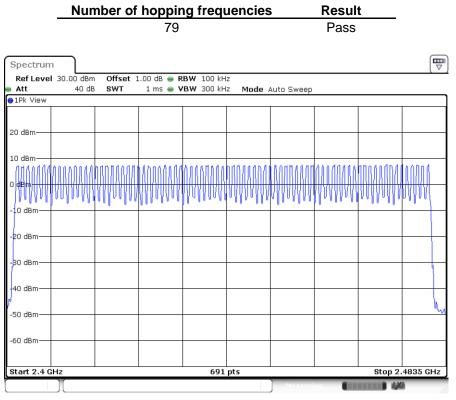
Limit

Limit number ≥ 15



Number of hopping frequencies

Test result: The measurement was performed with the typical configuration (normal hopping status), and the total hopping channels is constant for the all modulation mode according with the Bluetooth Core Specification. Here GFSK modulation mode was used to show compliance.



Date: 18.AUG.2020 13:19:09



9.5 Dwell Time

Test Method

- 1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable. Equipment mode: Spectrum analyzer
- 2. RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
- 3. Adjust the center frequency of spectrum analyzer on any frequency be measured.
- 4. Measure the Dwell Time by spectrum analyzer Marker function.
- 5. Repeat above procedures until all frequencies measured were complete.

Limit

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.



Dwell Time

Dwell time

The maximum dwell time shall be 0.4 s.

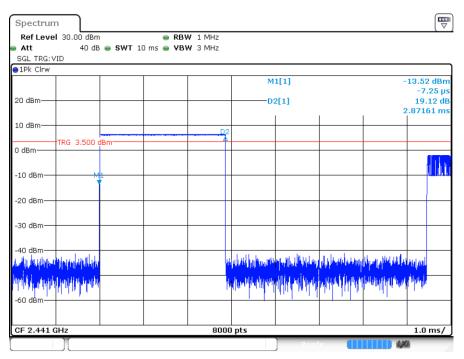
According to the Bluetooth Core Specification, the worse result (DH5 mode) was reported to show compliance.

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];

Test Result

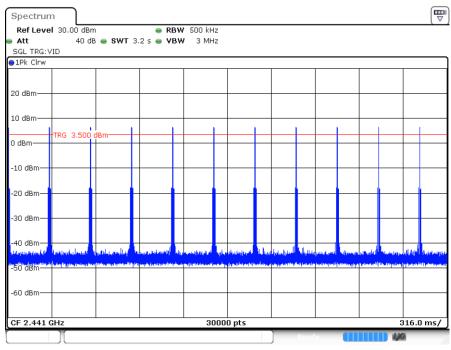
TestMode	Channel	BurstWidth	TotalHops	Result	Limit	Verdict
DH5	Нор	2.87	110	0.316	<=0.4	PASS
2DH5	Нор	2.88	110	0.317	<=0.4	PASS
3DH5	Нор	2.88	110	0.317	<=0.4	PASS

GFSK Modulation



Date: 18.AUG.2020 13:19:21

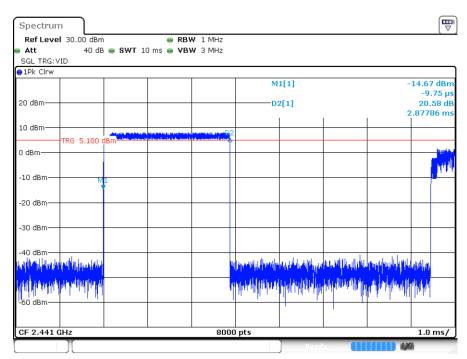




Date: 18.AUG.2020 13:19:26



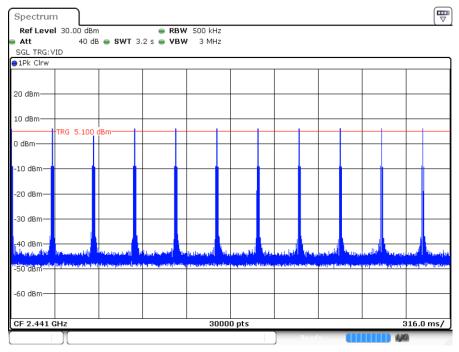
$\pi/4$ -DQPSK Modulation



Date: 23.AUG.2020 15:53:59

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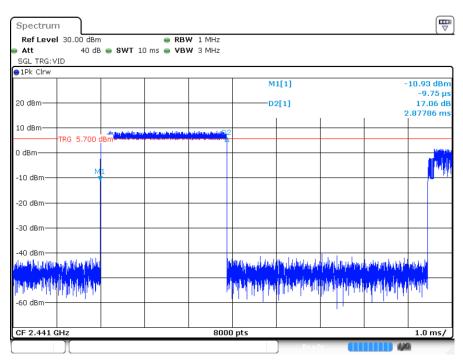




Date: 23.AUG.2020 15:54:04

2DH5

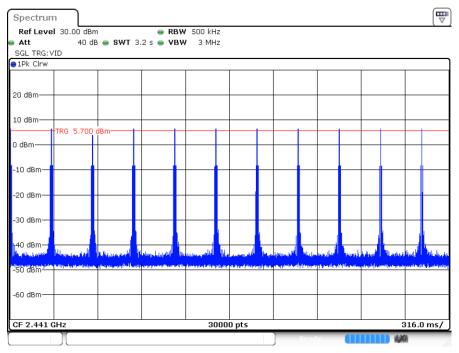
8-DPSK Modulation



Date: 23.AUG.2020 15:58:13

Report Number: 68.950.20.0526.01





Date: 23.AUG.2020 15:58:18

3DH5



9.6 Spurious RF conducted emissions

Test Method

- 1. Use the following spectrum analyzer settings:
 - 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 10th harmonic. Typically, several plots are required to cover this entire span. RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
- 3. The level displayed must comply with the limit specified in this Section. Submit these plots.
- 4. Repeat above procedures until all frequencies measured were complete.

Limit

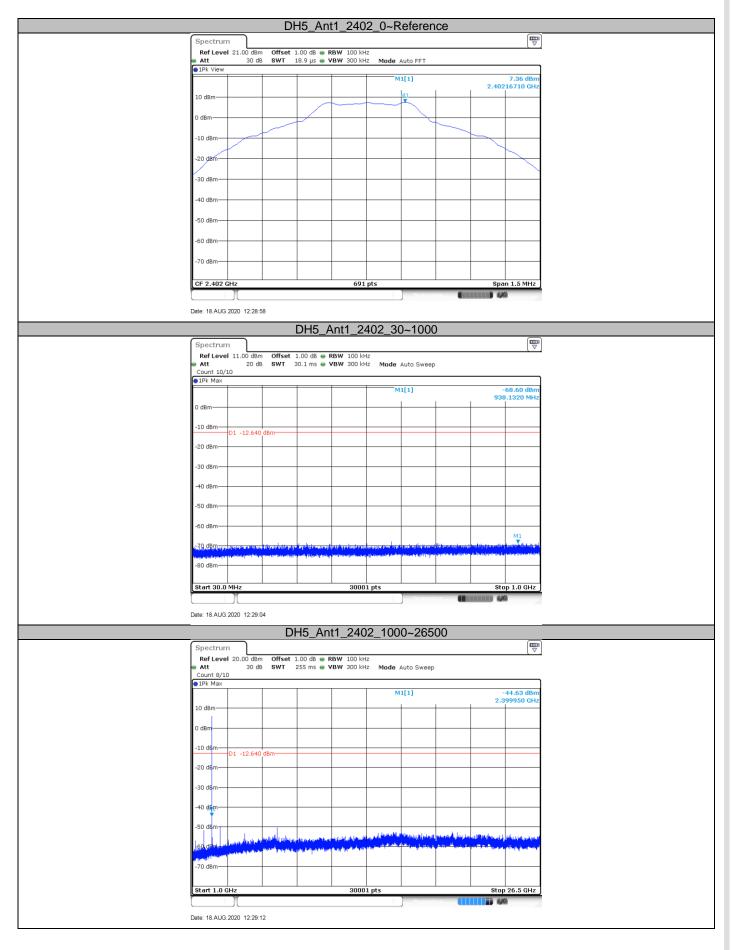
Frequency Range MHz	Limit (dBc)
30-25000	-20



Spurious RF conducted emissions

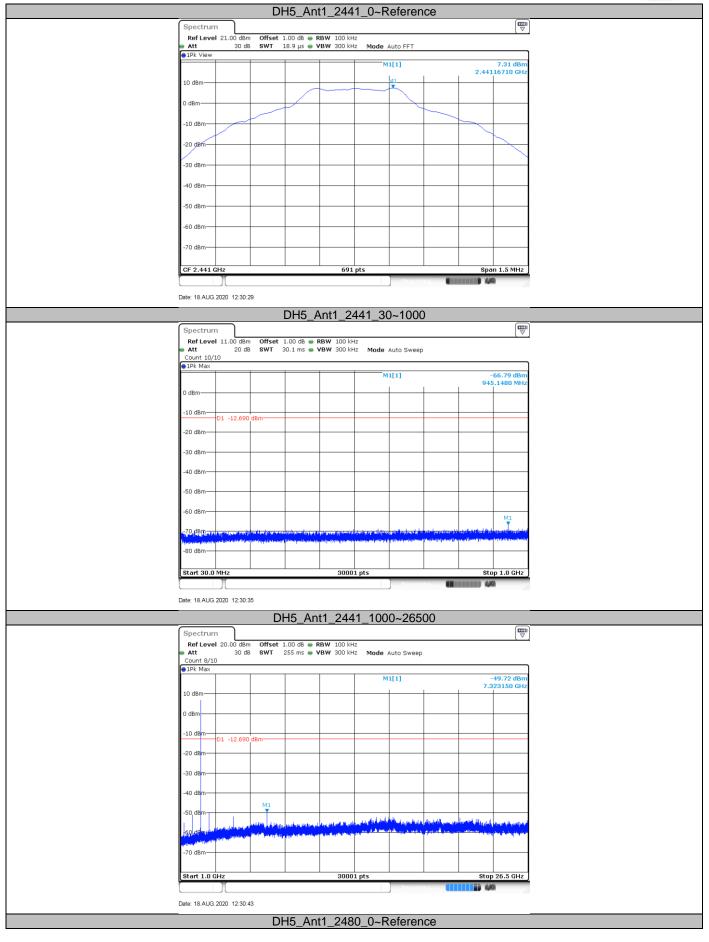
TestMode	Antenna	Channel(MHz)	FreqRange(MHz)	RefLevel(MHz)	Result(dBm)	Limit(dBm)	Verdict				
			Reference	7.36	7.36		PASS				
		2402	30~1000	30~1000	-68.6	<=-12.64	PASS				
			1000~26500	1000~26500	-44.63	<=-12.64	PASS				
			Reference	7.31	7.31		PASS				
DH5	Ant1	2441	30~1000	30~1000	-66.79	<=-12.69	PASS				
			1000~26500	1000~26500	-49.72	<=-12.69	PASS				
			Reference	7.51	7.51		PASS				
		2480	30~1000	30~1000	-68.35	<=-12.49	PASS				
			1000~26500	1000~26500	-48.67	<=-12.49	PASS				
			Reference	7.30	7.30		PASS				
		2402	30~1000	30~1000	-68.55	<=-12.7	PASS				
			1000~26500	1000~26500	-47.9	<=-12.7	PASS				
		2441	Reference	7.26	7.26		PASS				
2DH5	Ant1		30~1000	30~1000	-68.08	<=-12.74	PASS				
			/	, until	,		1000~26500	1000~26500	-47.5	<=-12.74	PASS
								Reference	7.49	7.49	
		2480	30~1000	30~1000	-67.49	<=-12.51	PASS				
			1000~26500	1000~26500	-46.31	<=-12.51	PASS				
			Reference	7.38	7.38		PASS				
		2402	30~1000	30~1000	-68.03	<=-12.62	PASS				
			1000~26500	1000~26500	-47.24	<=-12.62	PASS				
			Reference	7.41	7.41		PASS				
3DH5	3DH5 Ant1	2441	30~1000	30~1000	-67.59	<=-12.59	PASS				
			1000~26500	1000~26500	-47.33	<=-12.59	PASS				
			Reference	7.54	7.54		PASS				
		2480	30~1000	30~1000	-68.28	<=-12.46	PASS				
			1000~26500	1000~26500	-47.27	<=-12.46	PASS				





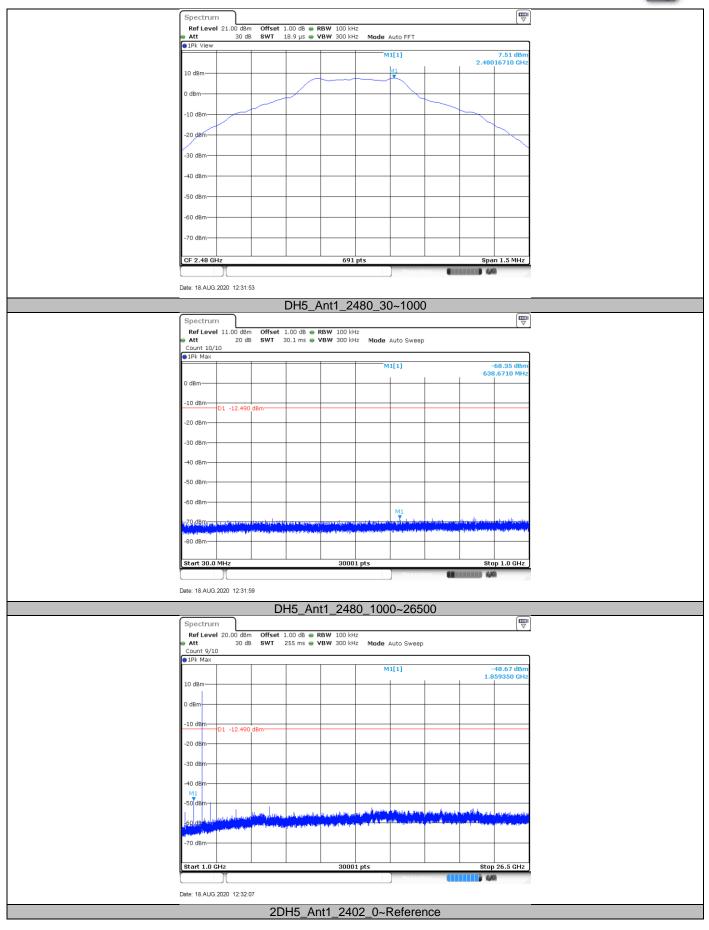
EMC_SZ_FR_21.00FCC Release 2014-03-20 TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District Shenzhen 518052, P.R. China Page 39 of 64





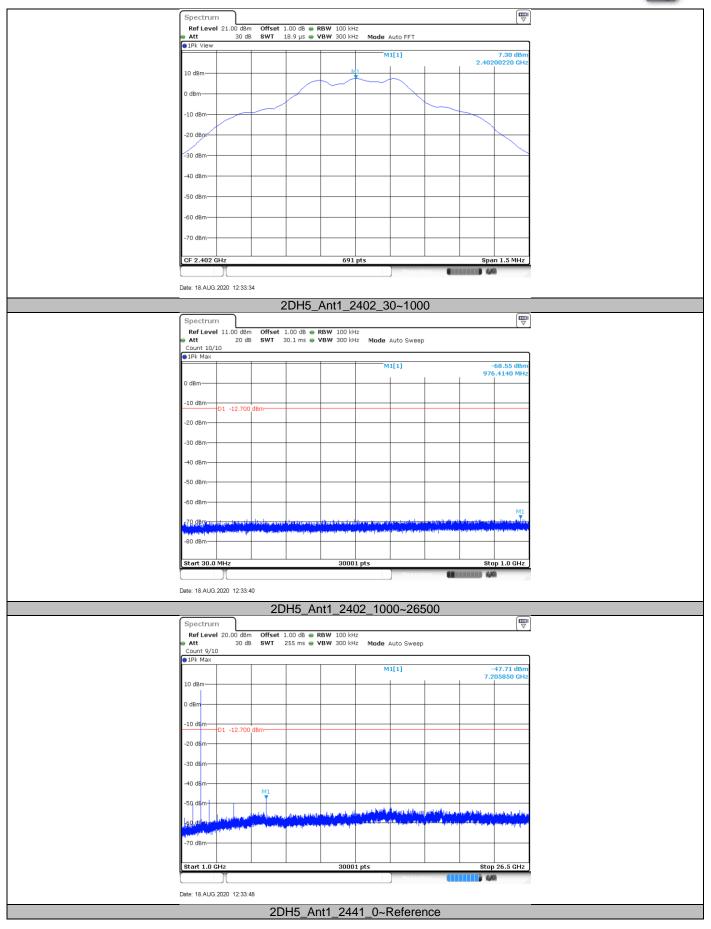
EMC_SZ_FR_21.00FCC Release 2014-03-20 TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District Shenzhen 518052, P.R. China Page 40 of 64





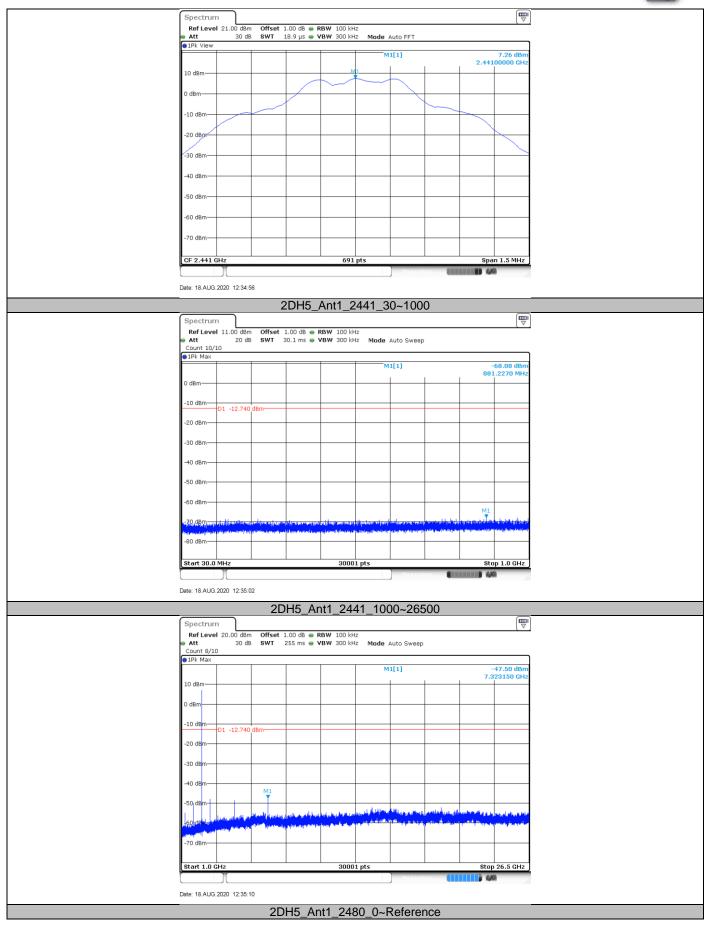
EMC_SZ_FR_21.00FCC Release 2014-03-20 TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District Shenzhen 518052, P.R. China Page 41 of 64





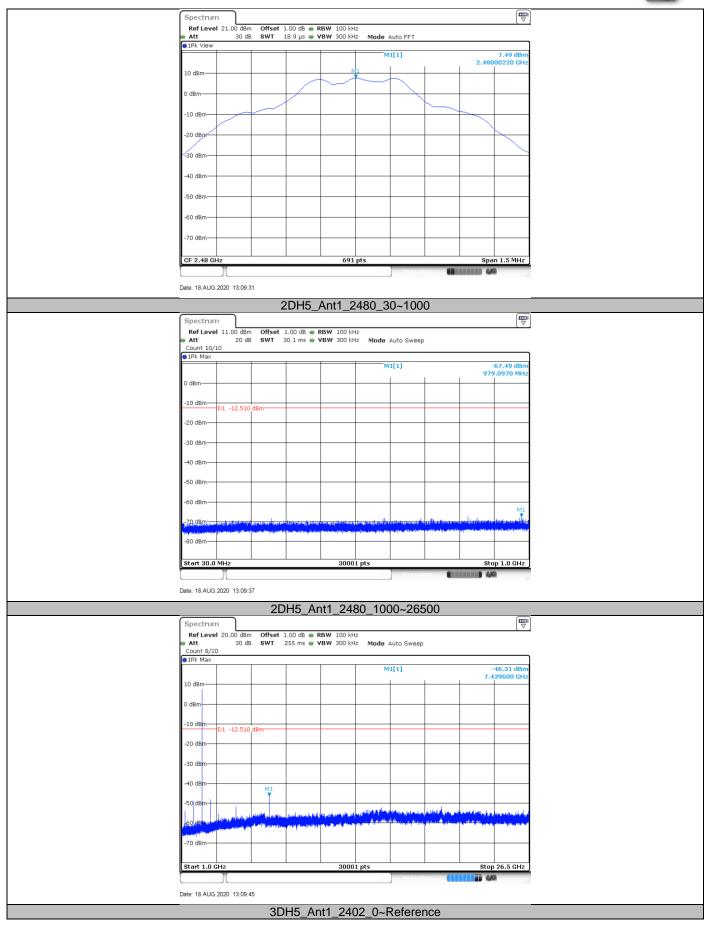
EMC_SZ_FR_21.00FCC Release 2014-03-20 TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District Shenzhen 518052, P.R. China





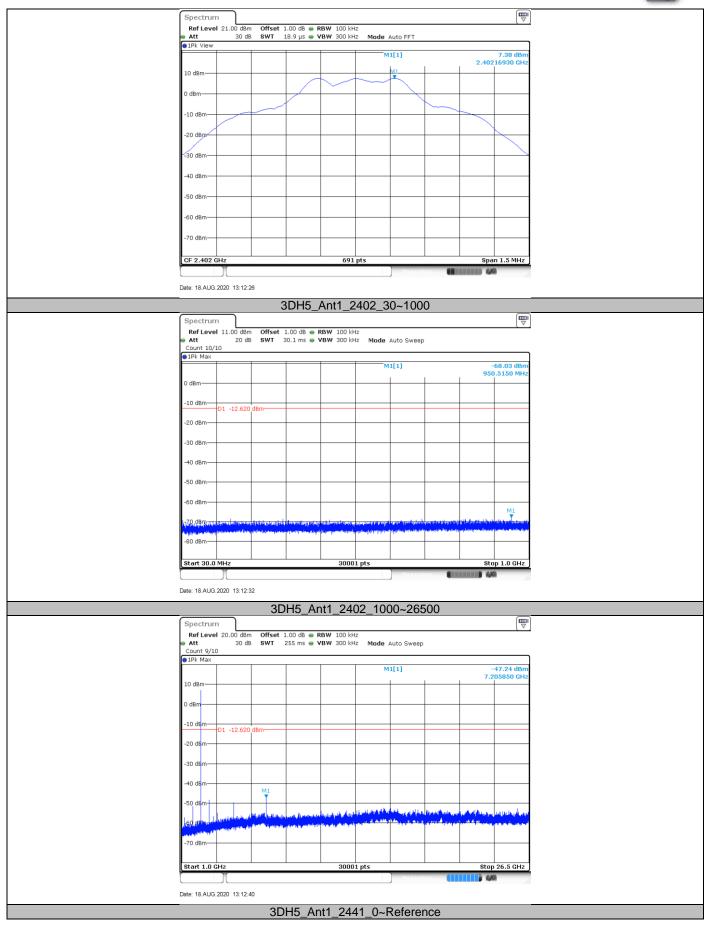
EMC_SZ_FR_21.00FCC Release 2014-03-20 TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District Shenzhen 518052, P.R. China Page 43 of 64





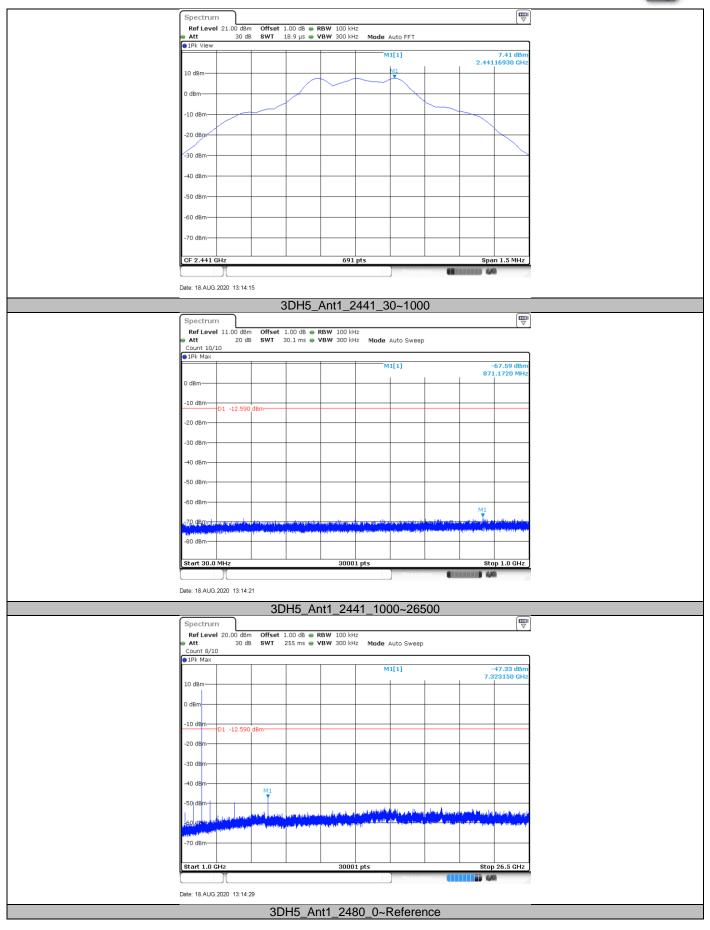
EMC_SZ_FR_21.00FCC Release 2014-03-20 TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District Shenzhen 518052, P.R. China Page 44 of 64





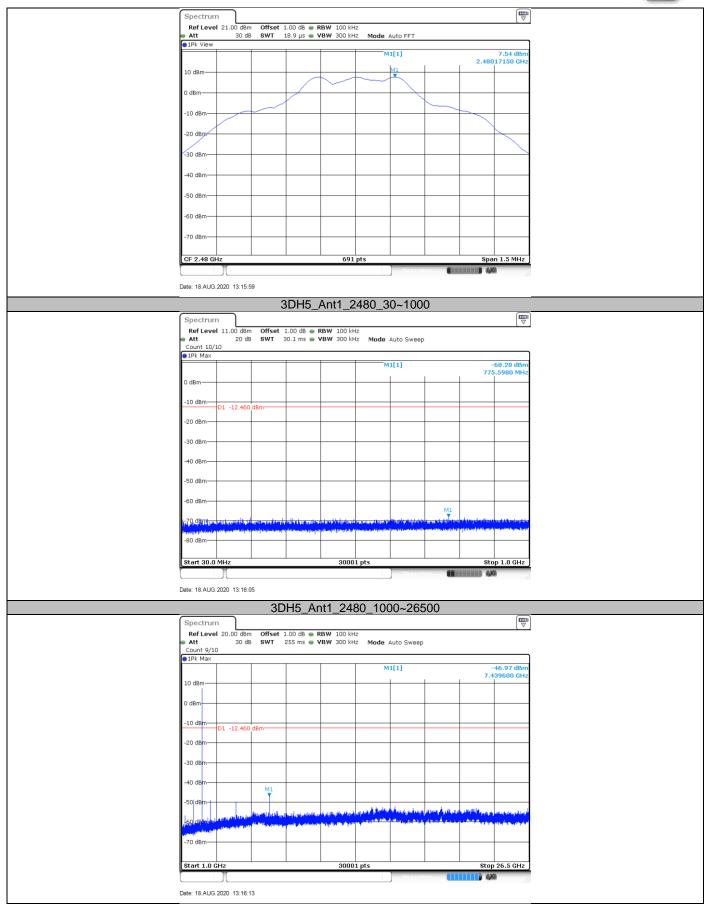
EMC_SZ_FR_21.00FCC Release 2014-03-20 TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District Shenzhen 518052, P.R. China Page 45 of 64





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9.7 Band edge testing

Test Method

- Use the following spectrum analyzer settings: Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 kHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section. .
- 4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

Limit:

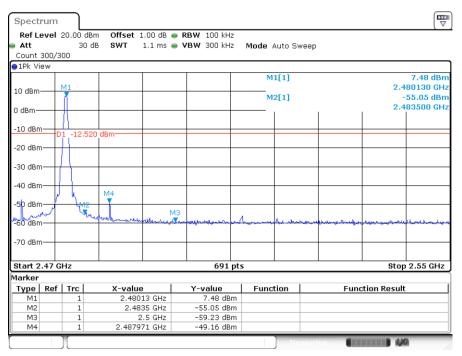
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits.



GFSK mode: Hopping off

Spectrum						
Ref Level Att	20.00 dB 30 (RBW 100 kHz VBW 300 kHz 	Mode Auto F	FT	× *
Count 300/3	300					
●1Pk View						
				M1[1]		7.24 dBn
10 dBm						2.401880 GH
				M2[1]		-49.31 d <mark>8</mark> r
0 dBm					1	2.400000 CH
-10 dBm	01 -12.76	i0_dBm				
-20 dBm						
20 abiii						
-30 dBm						
-40 dBm						
-50 dBm						M <u></u> # 4
-30 ubiii						
-60 dBm		ihungran Mary rolling	- Allentin allow the		the state is a March	M3
	and and	www.www.www.www.	~~ ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	- accounterations		
-70 dBm —						
Start 2.3 GH	lz		691 pt	s		Stop 2.405 GHz
Marker						
Type Ref	Trc	X-value	Y-value	Function	Fund	tion Result
M1	1	2.40188 GHz	7.24 dBm			
M2	1	2.4 GHz	-49.31 dBm			
M3	1	2.39 GHz	-61.49 dBm			
M4	1	2.399978 GHz	-50.61 dBm			
][Me	asuring	4,40

Date: 18.AUG.2020 12:28:53



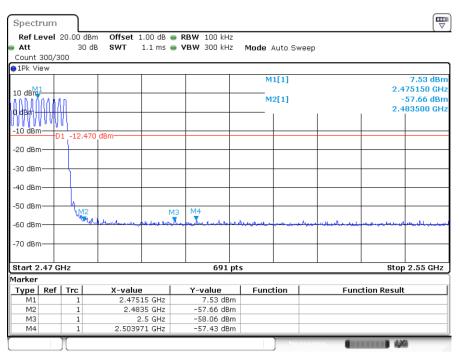
Date: 18.AUG.2020 12:31:48



GFSK mode: Hopping on

Spectrum							
Ref Level Att Count 300/	30 c		 RBW 100 kHz VBW 300 kHz 	Mode Auto F	FT		
1Pk View							
				M1[1]			6.24 dBr
10 dBm							103100 GH
				M2[1]			-55.12 dB
) dBm —					1	2.4	100000 c i
-10 dBm	D1 -13.76	0 dBm					
20 dBm	01 -10.00						
20 00111							
30 dBm-						_	
							1 (
40 dBm							
-50 dBm			M4				<u>M</u> ₽
60 dBm			_			, МЗ	1 wal
3202211 M	mynum	men un hours	- A Contraction of the second	and the second second	www.www.	underm	where
70 dBm						_	
Start 2.3 G	Hz		691 pts	I		Stop	2.405 GHz
1arker							
Type Ref	Trc	X-value	Y-value	Function	Fui	nction Result	t
M1	1	2.4031 GHz	6.24 dBm				
M2	1	2.4 GHz	-55.12 dBm				
MЗ	1	2.39 GHz	-62.09 dBm				
M4	1	2.349913 GHz	-58.70 dBm				

Date: 18.AUG.2020 13:17:26



Date: 18.AUG.2020 13:22:18



8DPSK mode: Hopping off

Ref Le	evel :	20.00 dB	m Offset 1	L.OO dB 🧉	RBW 100 kHz					(.
Att		30 0			VBW 300 kHz		Auto FF	т		
Count	300/3					nouo				
1Pk Vi	ew.									
						MI	l[1]			7.40 dBr
10 dBm·									2.	402190 🖬 H
to ubiii						M	2[1]			-53.76 d <mark>ø</mark> r
0 dBm—									2.	400000 GH
o doni										1 D
-10 dBm		1 -12.60	0 d0 m							1
		1 -12.60	U dBm							
-20 dBm					+					
20 40-										
-30 dBm										
-40 dBm										
-50 dBm					+					MAP
									M3	P
-60 dBm	limb	Hunn	morrowww	mound	hannar	multi	mound	manny	howwww	fampilie.
-70 dBm										
-70 ubii	'									
Start 2		-			691 p				Ctop	2.405 GHz
Aarker	.3 GH	2			091 þ				асор	2.403 GHZ
Type	Ref	Tro	X-value	1	Y-value	Funct	ion	E1	Inction Resul	+
M1	Ker	1	2.4021	9 GHZ	7.40 dBm				inction kesu	
M2		1		4 GHz	-53.76 dBm					
M3		1		9 GHz	-59.22 dBm					
M4		1	2.39906	5 GHz	-55.18 dBm					

Date: 18.AUG.2020 13:12:20

Specti	rum													
Ref Le Att Count 3		З	dBm O dB				₩ 100 kH ₩ 300 kH		Mode /	Auto S	weep			
😑 1Pk Vie	ew													
10 dBm-		м1								1[1] 2[1]				7.52 dBm 80130 GHz 56.29 dBm
0 dBm—		+				+							2.4	83500 GHz
-10 dBm		1 -12	400	dD ex										
-20 dBm			.480	uBIII										
-30 dBm	·+-	H												
-40 dBm	·//			M4										
-50 dBm -80 dBm	اكس	ł	12 ••••	muna		VI3		L	للمصغباتهم			بەتقا مەرىكەرىكى. سولەر مەرىكە	مر و ال ال ال	وبال والدي والدين والمراجع
-70 dBm														
70 abii														
Start 2	47.6	Hz					691	nts					Stor	2.55 GHz
Marker							0,71	pes					010	2100 0112
	Ref	Trc	1	X-value			Y-value	1	Fund	tion	1	Fund	tion Result	: 1
M1		1			13 GHz		7.52 dE	3m						
M2		1		2.48	35 GHz		-56.29 dB	3m						
M3		1		2	.5 GHz		-59.33 dB	3m						
M4		1		2.4879	71 GHz		-48.61 dB	Bm						
)[) Me	asuri	na		0

Date: 18.AUG.2020 13:15:53



8DPSK mode: Hopping on

Rofi	ovol 🤉	20.00 dB	m Offset 1	n db =	RBW 100 kHz					(·
Att	5961 2	30 c			VBW 300 kHz	Mode Auto	FET			
Count	300/30		0 0 1 240	.5 µ5 🖷	404 300 KHZ	Mode Auto	FFI			
1Pk Vi	<u> </u>									
						M1[1]				4.47 dB
10 - 10									2.4	04770 GI
10 dBm·						M2[1]				48.54 dB
0 dBm—									2.4	100000 GI
o ubiii-										1 ľ
-10 dBm										
	D;	1 -15.53	0 dBm							
-20 dBm					+					
-30 dBm					+ +					
-40 dBm	1									M2
-50 dBm										1
00 0011	·			M	4					U
-60 dBm				-	harry and the	And a set of the line of the			M3	An M
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Rodense	and the second		ri wa wango		- a constrained the second	mound	mapup	-0-00/0w	
-70 dBm			+		+					
Start 2	.3 GH	z			691 pt	s			Stop	2.405 GH
1arker										
Type	Ref	Trc	X-value	1	Y-value	Function	1	Func	tion Result	:
M1		1	2.40477	GHz	4.47 dBm					
M2		1	2.4		-48.54 dBm					
MЗ		1	2.39		-61.91 dBm					
M4		1	2.340783	GHz	-58.89 dBm					

Date: 23.AUG.2020 15:56:17

Spect	rum														
Ref L Att Count			10 dBm 30 dB				BW 100 k⊢ BW 300 k⊢	-	Mode /	Auto S	weep				
⊖1Pk V	iew														
10 dBm		м1								1[1]					7.39 dBm 80130 GHz
	hyrr	M				_			M	2[1]			I		50.18 dBm 83500 GHz
-10 dBr	n(	D1 -1	2.610	dBm									_		
-20 dBr	n-+	_				$\neg$							+		
-30 dBr	n-	$\uparrow$											+		
-40 dBr			ι M2										+		
-50 dBr			WT hu	Whenterson	1	ИЗ	M. Aluar	4							
-60 dBr	n-+			200 (Jake 1990)	ويهديه يحد مارمها	-2.04	alla allikadehaan	LIAN	بيدهمه فبيجره		م بالمحمد الم		****	*********	ومشاوية والمحاطرة وال
-70 dBr	n-+												+		
Start 2	2.47 0	GHz					691	pts						Stor	2.55 GHz
Marker								·							
Туре	Ref	Tre	c	X-value			Y-value		Func	tion		F	unction	Result	
M1			1		13 GHz		7.39 dE								
M2			1		35 GHz		-50.18 dE	_							
M3 M4			1		.5 GHz 51 GHz		-59.08 dE								
		1	1	2.3	DI GHZ		-37.00 UB			<u> </u>	1		_		-
		JL								, Me		10			

Date: 23.AUG.2020 16:00:32



# 9.8 Spurious radiated emissions for transmitter

### **Test Method**

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.

3: The height of antenna 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.

4: 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 and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

5: Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 100 KHz to 120KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW≥RBW for peak measurement ,Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious RBW = 1MHz, VBW=10Hz, Sweep = auto, Detector function = peak, Trace = max hold. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit.

If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correct factor, derived from the appropriate the duty cycle calculation.

The setting method can refer to DA00-705.



### Limit

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section15.205, must comply with the radiated emission limits specified in section 15.209.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Frequency	Field Strength	Field Strength	Detector
MHz	uV/m	dBµV/m	
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK



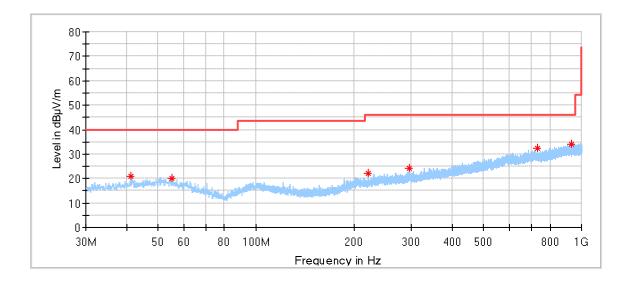
### Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worse case (which is subject to the maximum EIRP, GFSK mode) test result is listed in the report.

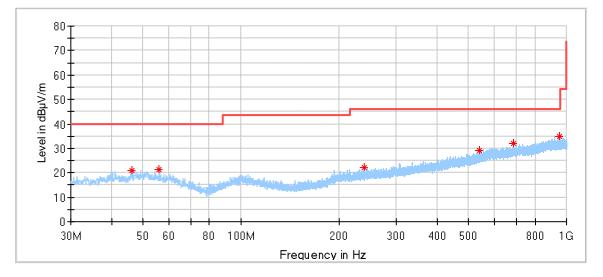
#### Transmitting spurious emission test result as below:

all of the modes were performed and the worst case GFSK was shown on the report.EUT:In-ear True Wireless HeadphoneM/N:PI5ROperating Condition:Tx 2402MHz, lowest Channel, Below 1GHz

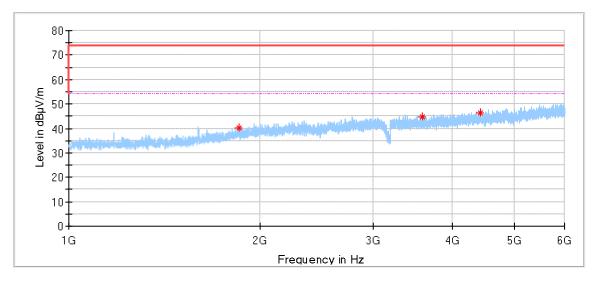


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
41.262778	21.00	40.00	19.00	150.0	н	313.0	13.7
55.004444	20.13	40.00	19.87	150.0	Н	228.0	14.2
221.359444	22.30	46.00	23.70	150.0	Н	228.0	12.9
295.887778	24.13	46.00	21.87	150.0	Н	265.0	14.9
733.465556	32.28	46.00	13.72	150.0	Н	126.0	22.6
934.686667	34.15	46.00	11.85	150.0	Н	194.0	25.2



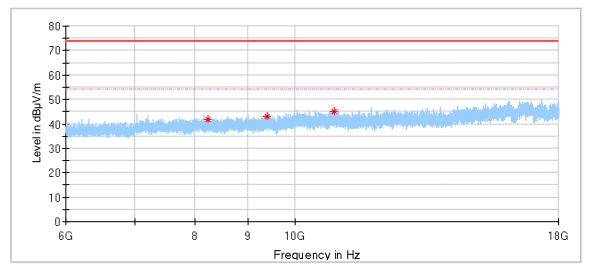


Frequency	MaxPeak	Limit	Margin	Height	Pol	Azimuth	Corr.
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(cm)		(deg)	(dB/m)
46.328333	21.09	40.00	18.91	150.0	V	350.0	14.4
56.136111	21.22	40.00	18.78	150.0	V	131.0	14.1
238.496111	22.30	46.00	23.70	150.0	V	247.0	13.8
538.818889	29.08	46.00	16.92	150.0	V	6.0	20.3
688.791667	31.82	46.00	14.18	150.0	V	271.0	22.1
948.643889	34.99	46.00	11.01	150.0	V	236.0	25.2

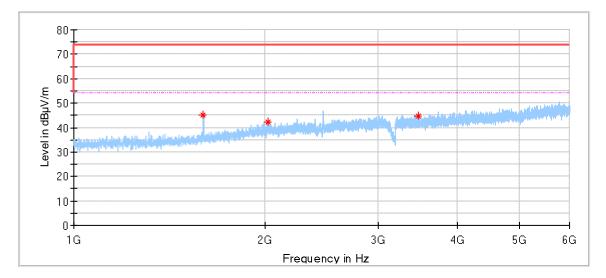


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1851.500000	40.01	74.00	33.99	150.0	Н	334.0	-5.3
3592.000000	44.52	74.00	29.48	150.0	Н	109.0	-0.1
4434.500000	46.17	74.00	27.83	150.0	Н	177.0	2.2



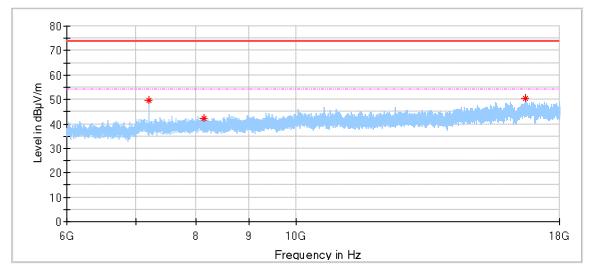


Frequency	MaxPeak	Limit	Margin	Height	Pol	Azimuth	Corr.
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(cm)		(deg)	(dB/m)
8237.000000	41.75	74.00	32.25	150.0	Н	140.0	6.2
9400.500000	42.93	74.00	31.07	150.0	Н	347.0	7.2
10909.500000	45.28	74.00	28.72	150.0	Н	163.0	8.5



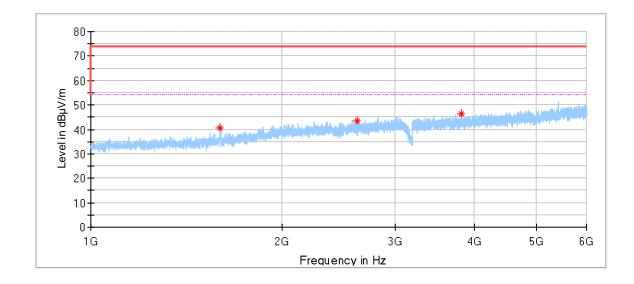
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1598.000000	45.29	74.00	28.71	150.0	v	0.0	-7.3
2019.500000	42.12	74.00	31.88	150.0	v	229.0	-4.2
3479.000000	44.90	74.00	29.10	150.0	V	206.0	-0.5





Frequency	MaxPeak	Limit	Margin	Height	Pol	Azimuth	Corr.
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(cm)		(deg)	(dB/m)
7205.500000	49.51	74.00	24.49	150.0	V	175.0	5.1
8138.500000	42.24	74.00	31.76	150.0	v	152.0	6.2
16683.500000	50.34	74.00	23.66	150.0	v	79.0	15.9

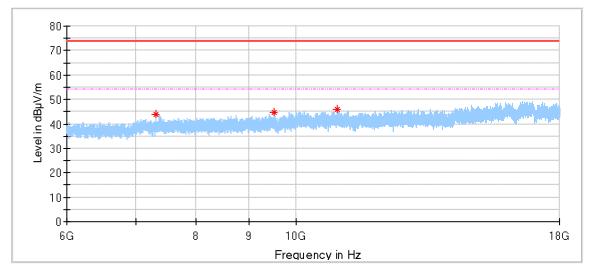
EUT:In-ear True Wireless HeadphoneM/N:PI5ROperating Condition:Tx 2441MHz, Middle Channel, 1GHz-18GHz



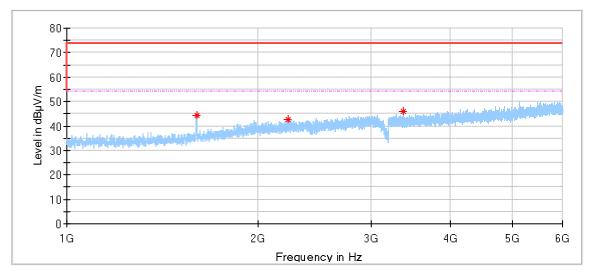
# **Critical_Freqs**

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1595.500000	40.58	74.00	33.42	150.0	Н	305.0	-7.3
2616.000000	43.51	74.00	30.49	150.0	Н	188.0	-2.5
3817.000000	46.27	74.00	27.73	150.0	Н	227.0	0.7



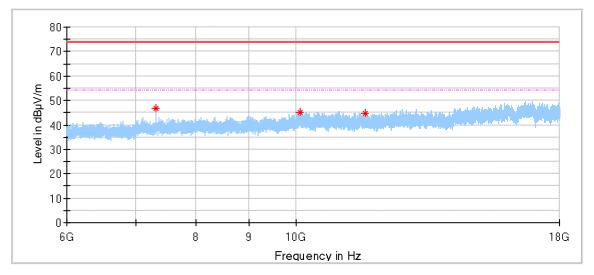


Frequency	MaxPeak	Limit	Margin	Height	Pol	Azimuth	Corr.
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(cm)		(deg)	(dB/m)
7323.000000	44.10	74.00	29.90	150.0	Н	81.0	5.3
9528.500000	44.87	74.00	29.13	150.0	Н	105.0	7.5
10968.000000	45.91	74.00	28.09	150.0	Н	0.0	8.5



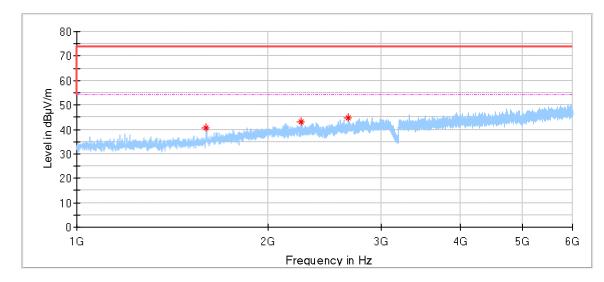
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1598.500000	44.38	74.00	29.62	150.0	v	13.0	-7.3
2224.000000	42.86	74.00	31.14	150.0	v	161.0	-3.6
3371.000000	45.77	74.00	28.23	150.0	v	21.0	-0.5





Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7323.500000	46.67	74.00	27.33	150.0	V	163.0	5.3
10089.500000	44.94	74.00	29.06	150.0	v	350.0	9.2
11676.000000	44.83	74.00	29.17	150.0	V	329.0	8.5

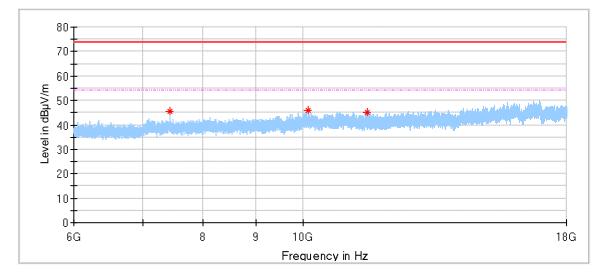
EUT:	In-ear True Wireless Headphone
M/N:	PI5R
Operating Condition:	Tx 2480MHz, High Channel, 1GHz-18GHz



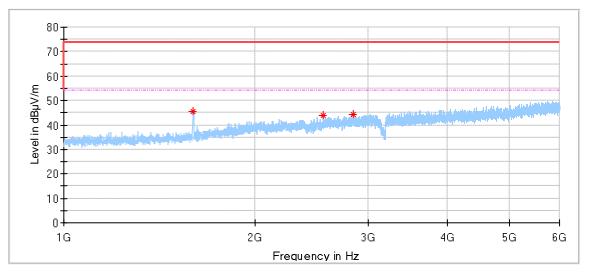
# **Critical_Freqs**

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1596.000000	40.58	74.00	33.42	150.0	Н	54.0	-7.3
2253.500000	43.07	74.00	30.93	150.0	Н	139.0	-3.5
2665.000000	44.60	74.00	29.40	150.0	Н	100.0	-2.4





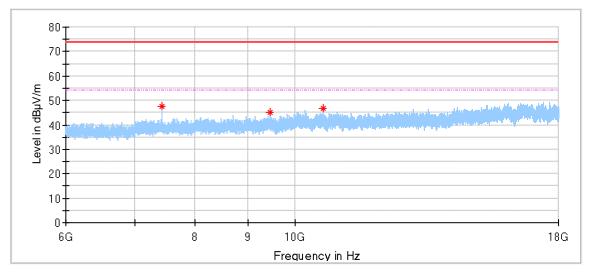
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7440.000000	45.72	74.00	28.28	150.0	Н	71.0	5.5
10114.000000	45.78	74.00	28.22	150.0	Н	279.0	9.2
11530.000000	45.19	74.00	28.81	150.0	Н	4.0	8.2



# Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1596.000000	45.42	74.00	28.58	150.0	v	30.0	-7.3
2556.000000	43.72	74.00	30.28	150.0	V	0.0	-2.7
2843.500000	44.20	74.00	29.80	150.0	v	15.0	-1.9





Frequency	MaxPeak	Limit	Margin	Height	Pol	Azimuth	Corr.
(MHz)	(dBµV/m)	(dBµV/m)	(dB)	(cm)		(deg)	(dB/m)
7440.500000	47.62	74.00	26.38	150.0	V	197.0	5.5
9471.500000	45.29	74.00	28.71	150.0	V	243.0	7.7
10643.000000	46.65	74.00	27.35	150.0	V	11.0	8.4

#### Remark:

- (1) Data of measurement within frequency range18-26GHz are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report.
- (2) Level=Reading Level + Correction Factor Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain Below 1GHz: Corrector factor = Antenna Factor + Cable Loss (The Reading Level is recorded by software which is not shown in the sheet)

# **10 Test Equipment List**

#### **Radiated Emission Test** Description Manufacturer Model no. Equipment ID Serial no. Calibration cal. due date interval (year) 68-4-74-14-EMI Test Receiver Rohde & Schwarz **ESR 26** 101269 1 2021-6-29 002 Trilog Super 68-4-80-19-Broadband Test Schwarzbeck VULB 9162 284 1 2021-2-24 003 Antenna Wave Guide 68-4-80-19-ETS 3117 1 2021-6-15 00218954 Antenna 001 2020-12-68-4-29-19-Pre-amplifier Rohde & Schwarz **SCU 18F** 100745 1 001 14 68-4-29-19-2020-12-Pre-amplifier Rohde & Schwarz SCU 08F2 08400018 1 14 004 Sideband Horn QWH-SL-68-4-80-14-Q-PAR 1 12827 2021-8-5 Antenna 18-40-K-SG 008 68-4-29-14-Pre-amplifier Rohde & Schwarz SCU 40A 100432 1 2021-7-30 002 2022-12-3m Semi-anechoic 68-4-90-19-3 TDK 9X6X6 ---chamber 006 29 68-4-90-19-Version10.35. Test software Rohde & Schwarz EMC32 N/A N/A 006-A01 02

### List of Test Instruments

#### **RF Conducted Test**

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Calibration interval (year)	cal. due date
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14- 004	101030	1	2021-6-21





# **11 System Measurement Uncertainty**

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty				
Test Items	Extended Uncertainty			
Radiated Spurious Emission 30MHz-1000MHz	Horizontal: 4.70dB; Vertical: 4.67dB;			
Radiated Spurious Emission 1000MHz-18000MHz	Horizontal: 4.65dB; Vertical: 4.63dB;			
Conducted RF test with TS 8997	RF Power Conducted: 1.16dB Frequency test involved: 0.6×10 ⁻⁷ or 1%			