Microtest
微测检测

Test Report

Report No.: MTi19070101-6E-1E

Date of issue: July 08, 2019

Sample Description:	3W Soundboom speaker
Model(s):	P328.23
Applicant:	
Address:	
Date of Test:	June 29, 2019 – July 08, 2019

Shenzhen Microtest Co., Ltd.
http://www.mtitest.com

MICROTEST CO., LTD. SHENZHEN MICROTEST AUTHORIZED

Tel:(86-755)88850135 Fax: (86-755) 88850136 Web: http://www.mtitest.com E-mail: mti@51mti.com
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Table of Contents

Test Result Certification

Applicant's name:

Address:

Manufacture's name:

Address:

Product name: 3W Soundboom speaker

Trademark: N/A

Model name: P328.23

Standards: EN 300 328 V2.1.1 (2016-11)

This device described above has been tested by Shenzhen Microtest Co., Ltd. and the test results show that the equipment under test (EUT) is in compliance with the Radio equipment requirements. And it is applicable only to the tested sample identified in the report.

Tested by: Jone.Lee

Jone Lee July 08, 2019

Reviewed by: Blue.Zheng

Blue Zheng July 08, 2019

Approved by: Smith Chen

Smith Chen July 08, 2019

1 Summary of Test Result

Item	Description of Test	Reference: Clause No	Result
1	RF Output Power	4.3.1.2 or 4.3.2.2	Pass
2	Accumulated Transmit time, Frequency Occupation & Hopping Sequence	4.3.1.4	Pass
3	Hopping Frequency Separation	4.3.1.5	Pass
4	Occupied Channel Bandwidth	4.3.1.8 or 4.3.2.7	Pass
5	Transmitter unwanted emissions in the OOB domain	4.3.1.9 or 4.3.2.8	Pass
6	Transmitter unwanted emissions in the spurious domain	4.3.1.10 or 4.3.2.9	Pass
7	Receiver spurious emissions	4.3.1.10 or 4.3.2.9	Pass
8	Adaptivity	4.3.1.7 or 4.3.2.6	N/A*
9	Receiver Blocking	4.3.1.12 or 4.3.2.11	Pass
10	Geo-location capability	4.3.1.13 or 4.3.2.12	N/A**

*Not applicable (the RF output power of EUT is less than 10dBm e.i.r.p.)

** Not applicable (the EUT has no geo-location capability)

2 General Description

2.1 Feature of equipment under test (EUT)

Product name:	3W Soundboom speaker
Model name:	P328.23
TX/RX frequency range:	TX: 2402MHz~2480MHz RX: 2402MHz~2480MHz
Bluetooth version:	V5.0
Modulation type:	GFSK, π/4-DQPSK
Power source:	DC 5V from adapter AC 230V/50Hz
Battery:	N/A
Adapter information:	N/A
Antenna designation:	PCB antenna (Antenna Gain: -0.58dBi)

2.2 Operation channel list

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

2.3 Test frequency channel

Low	2402MHz
Middle	2441MHz
High	2480MHz

2.4 EUT operation mode

During testing, the EUT is programed (provided by the manufacture) to control the Tx/Rx operation followed the test requirement.

2.5 Test conditions

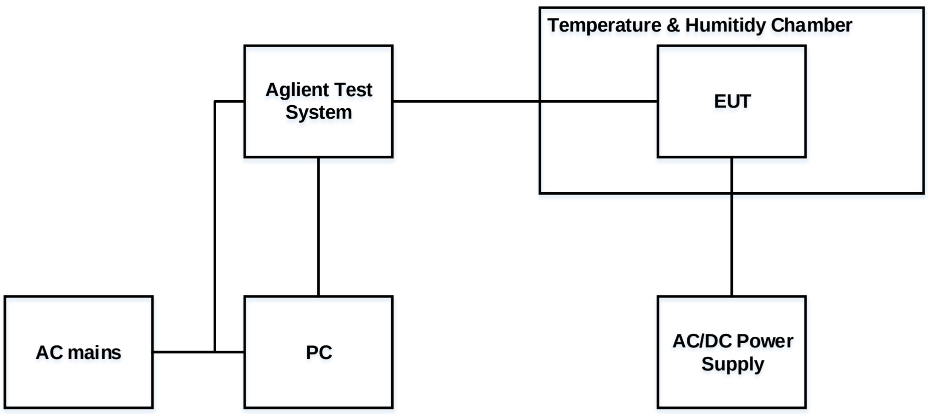
During the measurement the environmental conditions were within the listed ranges:

- Temperature: 15ºC~35ºC
- Humidity: 20%~75%
- Atmospheric pressure: 98kPa~101kPa

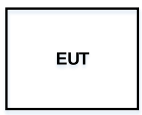
Test Conditions	Normal	N.V.L.T.	N.V.H.T.
Temperature (℃)	25	-10	40
Power supply (Vdc)	230		
Note1:The extreme temperatures are declared by manufacture. Note2:N.V.L.T. is the abbreviation of normal voltage lowest temperature; N.V.H.T. is the abbreviation of normal voltage highest temperature.			

2.6 EUT test setup

For RF Conducted test:



For Radiated test:



See photographs of the test setup in the report for the actual setup for test.

2.7 Ancillary equipment list

Equipment	Model	S/N	Manufacturer
Adapter	/	/	/

2.8 Measurement uncertainty

The following measurement uncertainty levels have been calculated for tests performed on the EUT as specified in ETSI TR 100 028-1/2.This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Parameter	Uncertainty Criterion	Measurement Uncertainty
Occupied Channel Bandwidth	±5%	4.0%
RF output power, conducted	±1.5dB	±1.13dB
Power Spectral Density, conducted	±3dB	±2.35dB
Unwanted Emissions, conducted	±3dB	±2.39dB
All emissions, radiated	±6dB	±4.60dB
Temperature	±3℃	±1.8℃
Supply voltages	±3%	±2.5%
Time	±5%	±4.2%

3 Testing Site

Test laboratory:	Shenzhen Microtest Co., Ltd.
Laboratory location:	No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China
CNAS Registration No.:	L5868
Telephone:	(86-755)88850135
Fax:	(86-755)88850136

Note: Instrument and equipment calibration laboratory:

Test laboratory:	Guangzhou Lisai Calibration and Testing Co.,LTD
Laboratory location:	No.8.South Street, Shi Ji Institute.Guangzhou.China
CNAS Registration No.:	L7127
Telephone:	(86-020) 31134076
Fax:	(86-020) 31134076

4 List of Test Equipment

Software Name: EMI Measurement Software
Manufacturer: Farad
Model: EZ-EMC

Equipment No.	Equipment Name	Manufacturer	Model	Serial No.	Calibration date	Due date
MTI-E001	Spectrum Analyzer	Agilent	E4407B	MY41441082	2018/09/18	2019/09/17
MTI-E004	EMI Test Receiver	Rohde&schwarz	ESPI	1000314	2018/09/18	2019/09/17
MTI-E006	Broadband antenna	schwarabeck	VULB9163	872	2018/09/18	2019/09/17
MTI-E007	Horn antenna	schwarabeck	BBHA9120D	1201	2018/09/18	2019/09/17
MTI-E014	amplifier	America	8447D	3113A06150	2018/09/18	2019/09/17
MTI-E015	Conduction Immunity Signal Generator	Schloder	CDG6000	126A1343/2015	2018/09/18	2019/09/17
MTI-E016	Coupled decoupling network	Schloder	CND M2/M3	A2210332/2015	2018/09/18	2019/09/17
MTI-E034	amplifier	Agilent	8449B	3008A02400	2018/09/18	2019/09/17
MTI-E040	Spectrum analyzer	Agilent	N9020A	MY49100060	2018/09/18	2019/09/17
MTI-E041	Signal generator	Agilent	N5182A	MY49060455	2018/09/18	2019/09/17
MTI-E042	Analog signal generator	Agilent	E4421B	GB40051240	2018/09/18	2019/09/17
MTI-E043	Power probe	Dare Instruments	RPR3006W	16I00054SNO16	2018/09/18	2019/09/17
MTI-E047	10dB attenuator	Mini-Circuits	UNAT-10+	15542	2018/09/18	2019/09/17
MTI-E049	spectrum analyzer	Rohde&schwarz	FSP-38	100019	2018/09/18	2019/09/17
MTI-E050	PSG Signal generator	Agilent	E8257D	MY46520873	2018/09/18	2019/09/17
MTI-E051	Active Loop Antenna 9kHz - 30MHz	Schwarzbeek	FMZB 1519 B	00044	2018/09/18	2019/09/17
MTI-E052	18-40GHz amplifier	Chengdu step Micro Technology	ZLNA-18-40G-21	1608001	2018/09/18	2019/09/17
MTI-E053	15-40G Antenna	Schwarzbeek	BBHA9170	BBHA9170582	2018/09/18	2019/09/17

Note: the calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

5 Test Result

5.1 RF output power

5.1.1 Definition

The RF output power is defined as the mean equivalent isotropically radiated power (e.i.r.p.) of the equipment during a transmission burst.

5.1.2 Limits

The maximum RF output power for adaptive Frequency Hopping equipment shall be equal to or less than 20 dBm.
This limit shall apply for any combination of power level and intended antenna assembly.

5.1.3 Test Procedures

Follow the test procedure as described in EN 300 328 V2.1.1 Clause 5.4.2 to measure the RF output power at normal and extreme conditions.

5.1.4 Test Result

Tel:(86-755)88850135 Fax: (86-755) 88850136 Web: http://www.mtitest.com E-mail: mti@51mti.com
Address: No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China

Test data

Note: E.I.R.P (dBm) = Max. Conducted power (dBm) + antenna gain (dBi)

Modulation	Test conditions	E.I.R.P (dBm)			Limit(dBm)	Result
		Low	Middle	High		
GFSK	Normal	0.241	0.202	0.027	20	Pass
	N.V.L.T.	0.189	0.102	0.245	20	Pass
	N.V.H.T.	0.175	0.165	0.265	20	Pass
π/4-DQPSK	Normal	0.855	0.982	0.785	20	Pass
	N.V.L.T.	0.712	0.851	0.681	20	Pass
	N.V.H.T.	0.733	0.842	0.624	20	Pass

5.2 Accumulated transmit time, frequency occupation & hopping sequence

5.2.1 Definition

The Accumulated Transmit Time is the total of the transmitter 'on' times, during an observation period, on a particular hopping frequency.

The Frequency Occupation is the number of times that each hopping frequency is occupied within a given period. A hopping frequency is considered to be occupied when the equipment selects that frequency from the hopping sequence. The equipment may be transmitting, receiving or stay idle during the Dwell Time spent on that hopping frequency.

The Hopping Sequence of frequency hopping equipment is the unrepeated pattern of the hopping frequencies used by the equipment.

5.2.2 Limits

Adaptive frequency hopping equipment

Adaptive Frequency Hopping systems shall be capable of operating over a minimum of 70% of the band.

The Accumulated Transmit Time on any hopping frequency shall not be greater than 400ms within any observation period of 400ms multiplied by the minimum number of hopping frequencies (N) that have to be used.

In order for the equipment to comply with the Frequency Occupation requirement, it shall meet either of the following two options:

Option 1: Each hopping frequency of the hopping sequence shall be occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use.

Option 2: The occupation probability for each frequency shall be between ((1 / U) × 25 %) and 77 % where U is the number of hopping frequencies in use.

The hopping sequence(s) shall contain at least N hopping frequencies at all times, where N is 15 or 15 divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater.

5.2.3 Test Procedures

Follow the test procedure as described in EN 300 328 V2.1.1 Clause 5.4.4 to measure the Accumulated Transmit time, Frequency Occupation & Hopping Sequence at normal condition.

5.2.4 Test Result

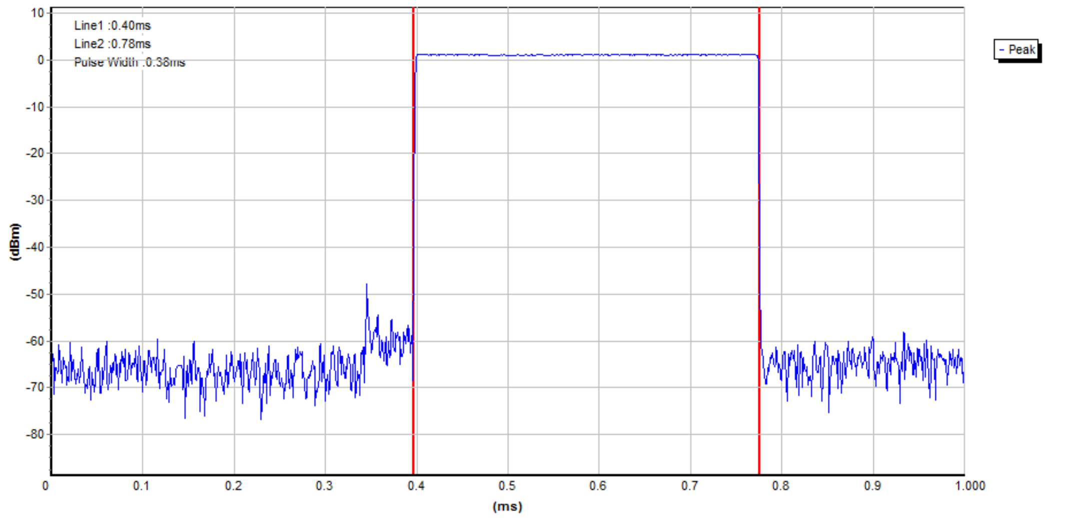
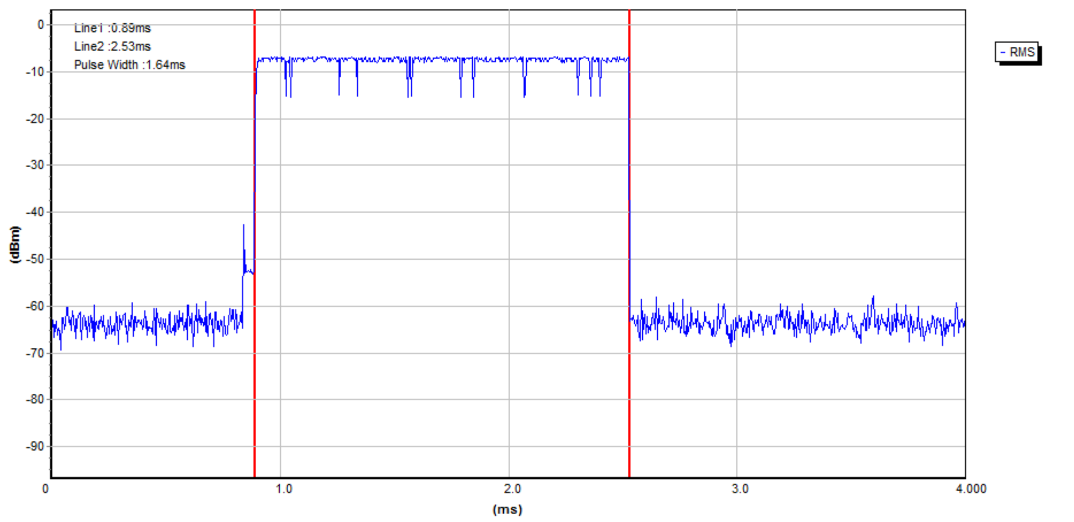
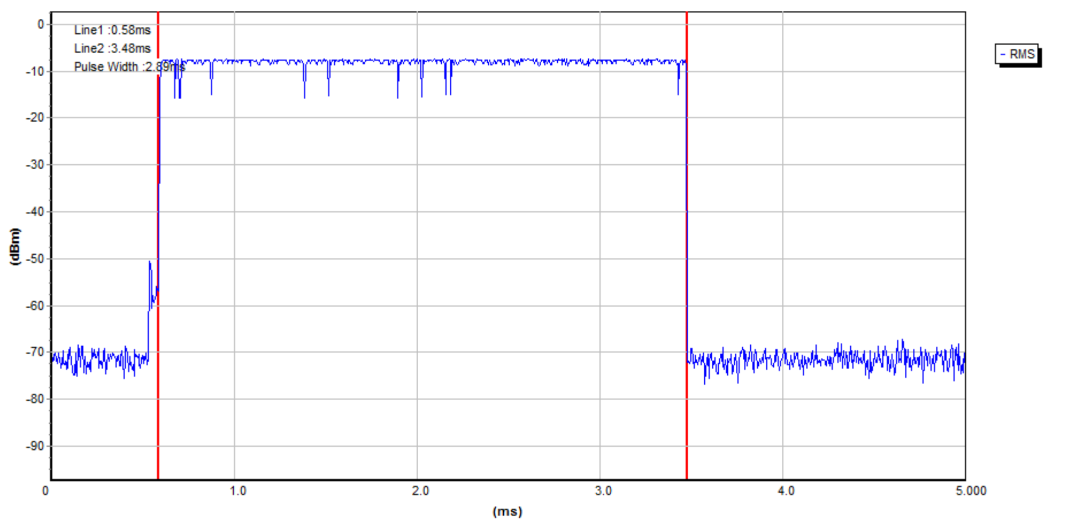
Test data

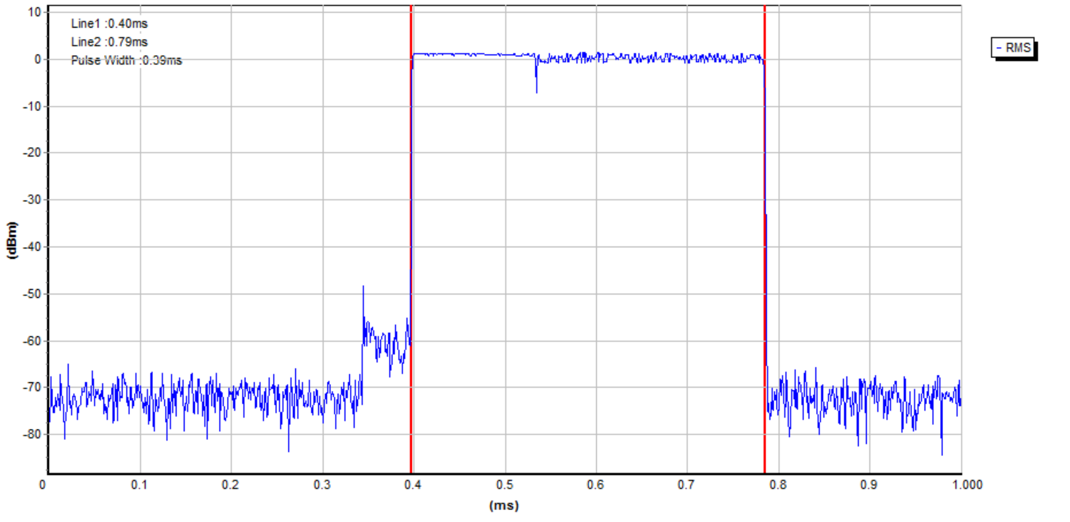
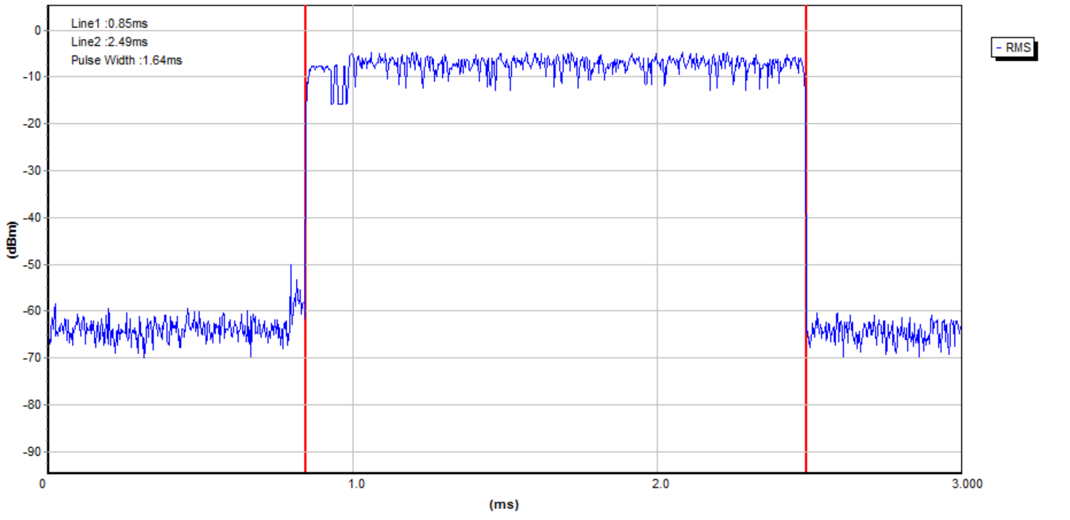
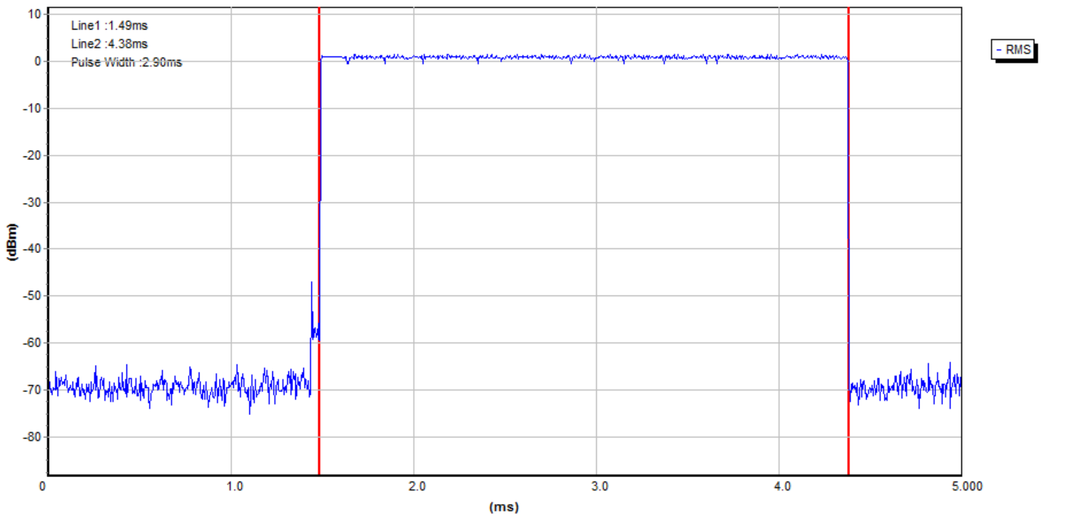
Accumulated Transmit time

Mode	Data Packet	Frequency (MHz)	Pulse Time (ms)	Minimum Frequency Occupation (ms)	Dwell Time (ms)	Limit(s)	Result
GFSK	DH1	2441	0.38	121.60	121.6	<0.4	Pass
	DH3	2441	1.64	262.40	262.4	<0.4	Pass
	DH5	2441	2.89	308.27	308.267	<0.4	Pass
π/4 DQPSK	2DH1	2441	0.39	124.80	124.8	<0.4	Pass
	2DH3	2441	1.64	262.40	262.4	<0.4	Pass
	2DH5	2441	2.9	309.33	309.333	<0.4	Pass

*Note1: A period time = 0.4 (s) * 79 = 31.6(s)*
Note2:
*DH1 time slot = Pulse Duration * (1600/(2*79)) * A period time*
*DH3 time slot = Pulse Duration * (1600/(4*79)) * A period time*
*DH5 time slot = Pulse Duration * (1600/(6*79)) * A period time*

Note3: For GFSK, π/4-DQPSK: The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

Modulation mode	GFSK mode
DH1	
DH3	
DH5	

Modulation mode	π/4-DQPSK
2-DH1	
2-DH3	
2-DH5	

Hopping Sequence

BT mode	Hopping number	Limit	Band allocation (%)	Limit (%)	Result
GFSK-DH5	79	>=15	93.31	>=70	Pass
π/4-DQPSK-2DH5	79	>=15	93.11	>=70	Pass

<table>
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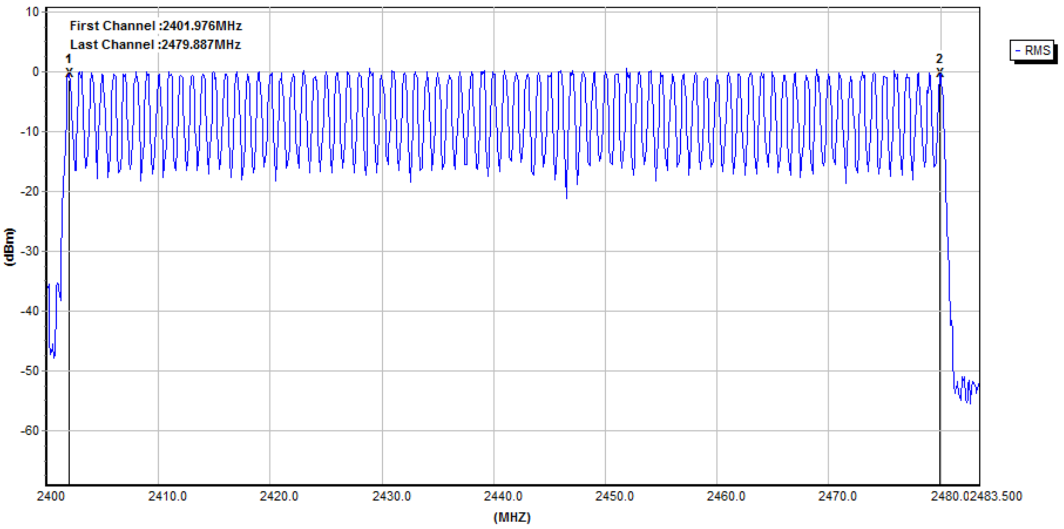
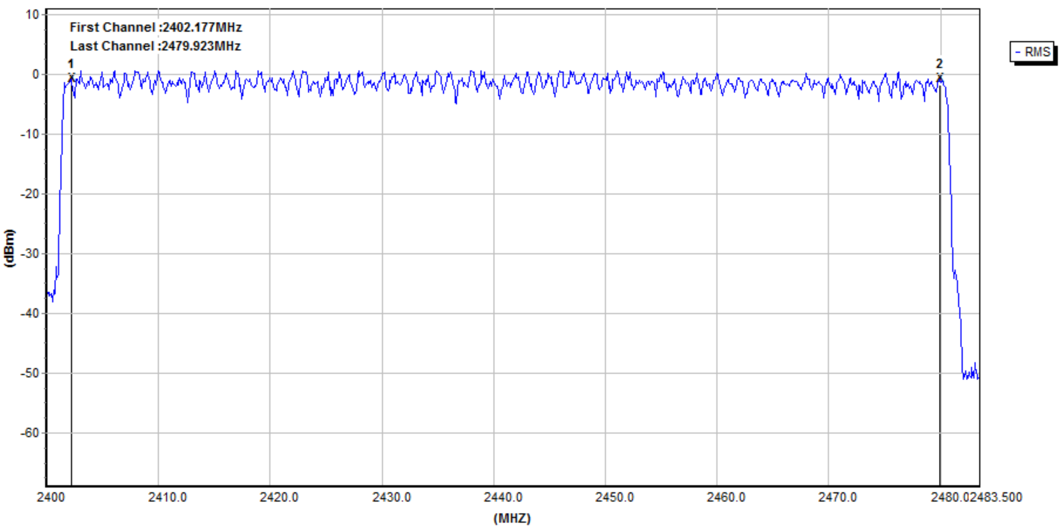
<tr><td>GFSK-DH5</td><td>
</td></tr>
<tr><td></td><td></td></tr>
<tr><td>π/4-DQPSK-2DH5</td><td>
</td></tr>
</table>

5.3 Hopping frequency separation

5.3.1 Definition

The Hopping Frequency Separation is the frequency separation between two adjacent hopping frequencies

5.3.2 Limits

Adaptive frequency hopping systems:

The minimum Hopping Frequency Separation shall be 100 kHz.

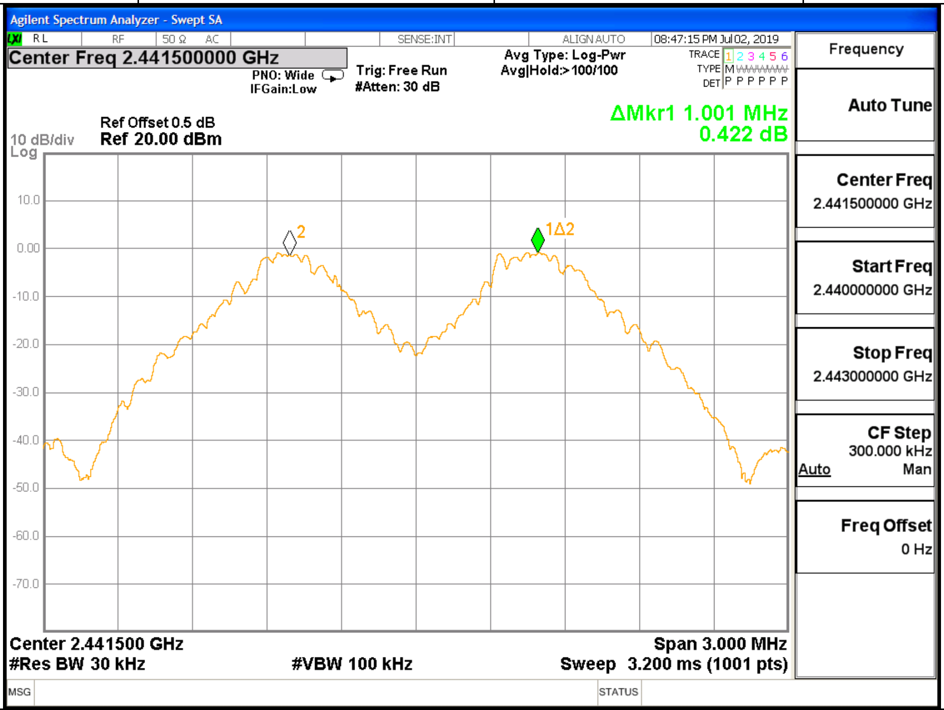
5.3.3 Test Procedures

Follow the test procedure as described in EN 300 328 V2.1.1 Clause 5.4.5 to measure the hopping frequency separation at normal condition.

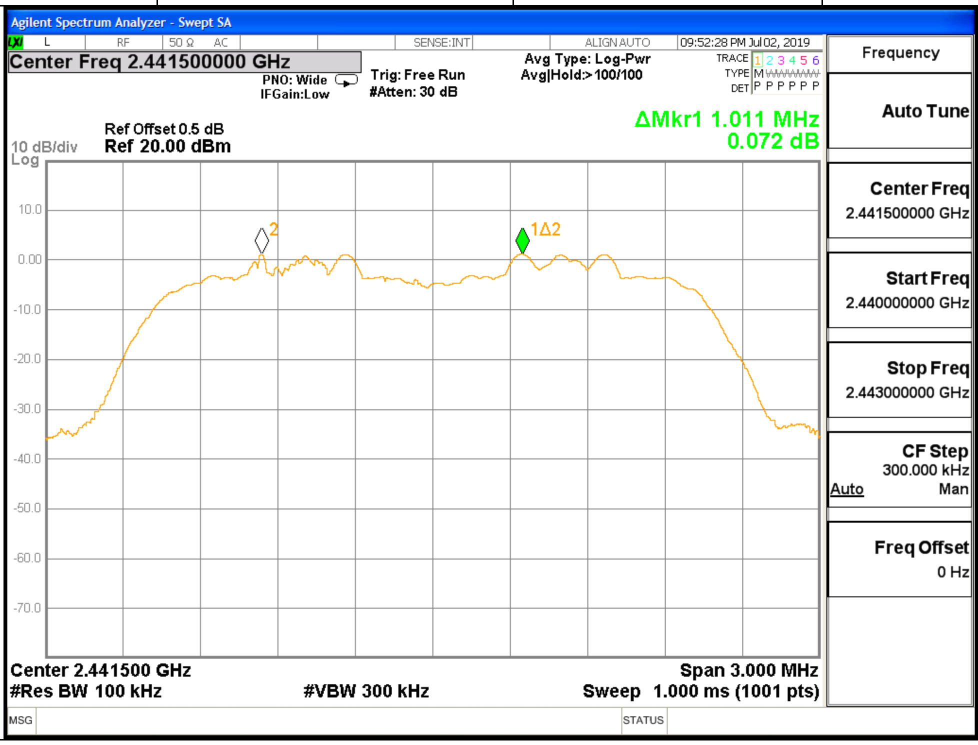
5.3.4 Test Result

Hopping frequency Separation:

BT mode	Hopping frequency separation (MHz)	Limit (MHz)	Result
GFSK	1.001	>=0.1	Pass



BT mode	Hopping frequency separation (MHz)	Limit (MHz)	Result
π/4-DQPSK	1.011	>=0.1	Pass



5.4 Occupied channel bandwidth

5.4.1 Definition

The Occupied Channel Bandwidth is the bandwidth that contains 99 % of the power of the signal hopping frequency.

5.4.2 Limits

The Occupied Channel Bandwidth for each hopping frequency shall fall completely within the specified band.

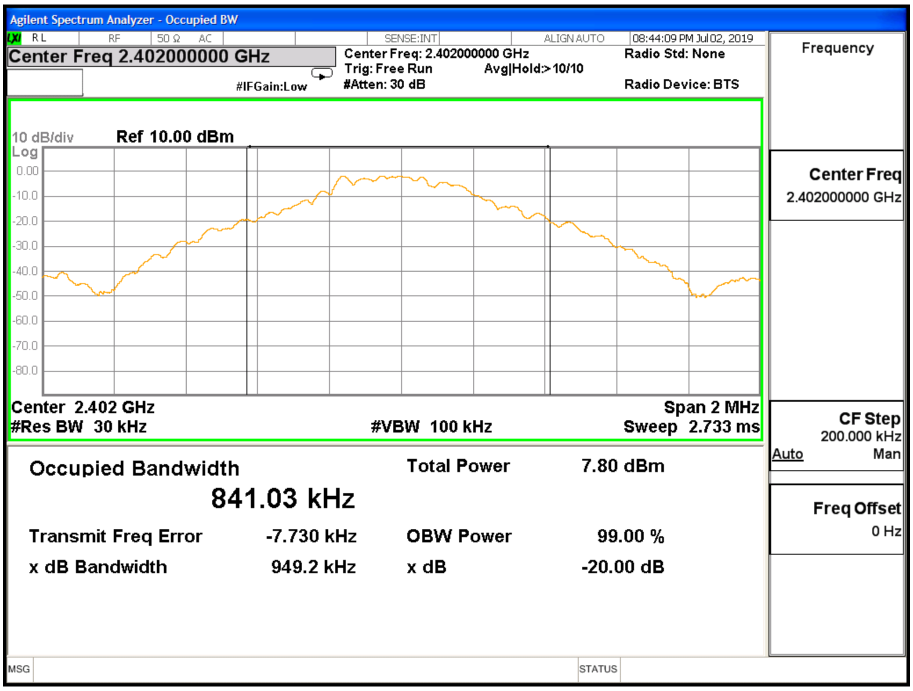
5.4.3 Test Procedures

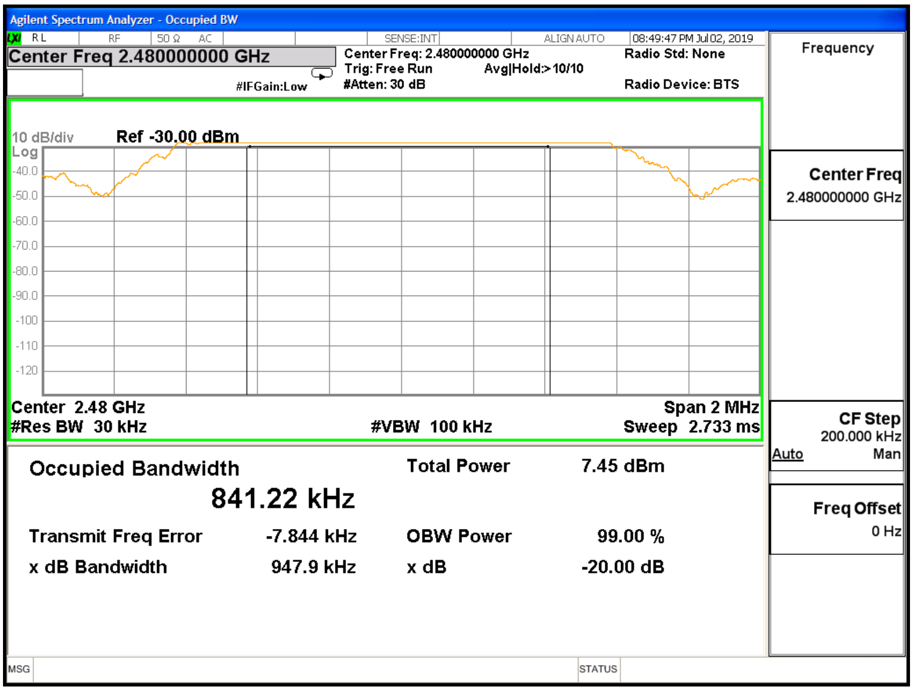
Follow the test procedure as described in EN 300 328 V2.1.1 Clause 5.4.7 to measure the occupied channel bandwidth at normal condition.

5.4.4 Test Result

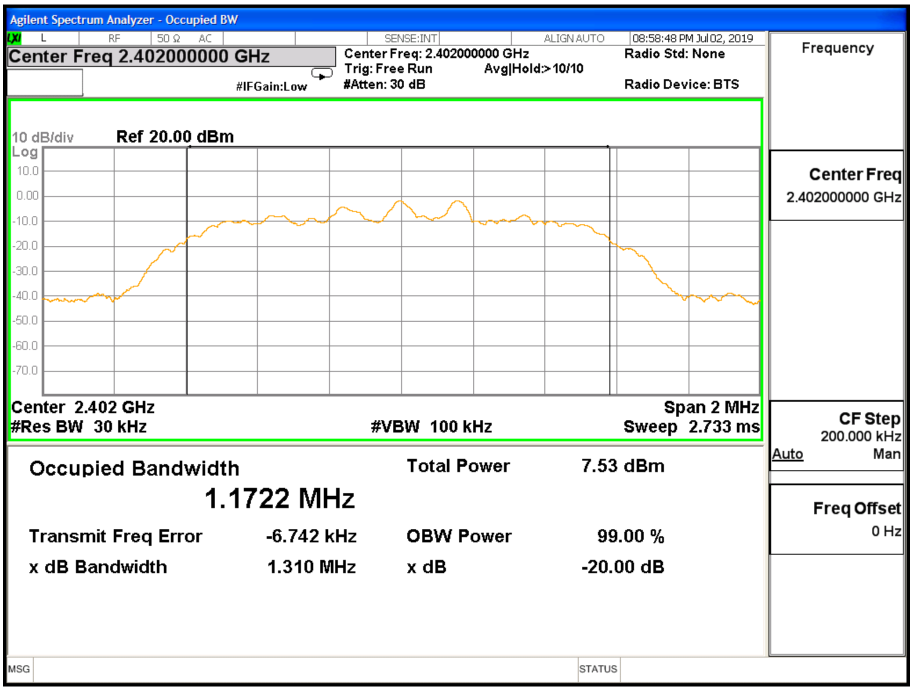
Test data

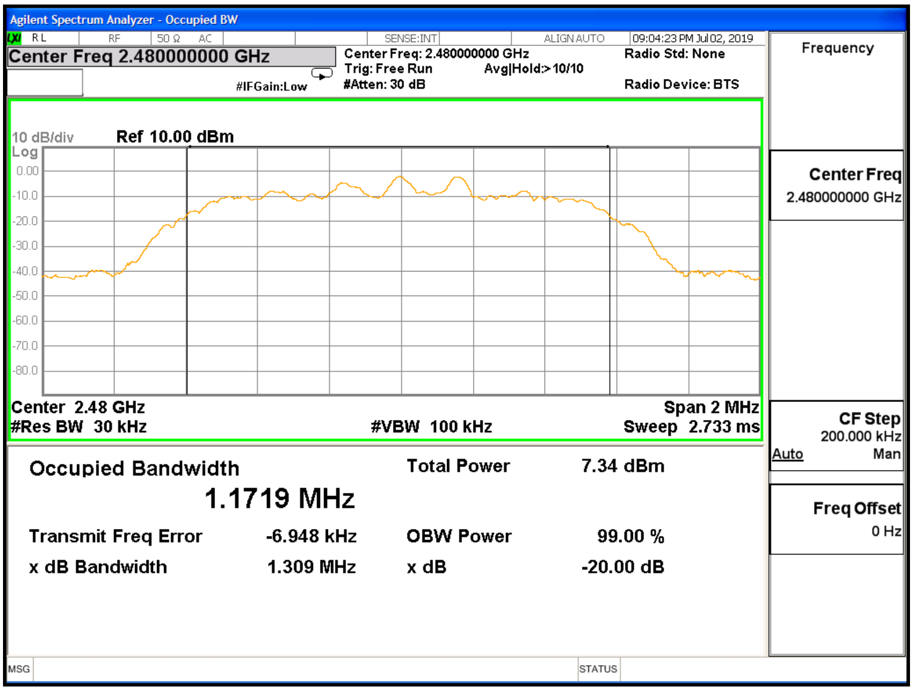
Test Mode	Frequency(MHz)	Occupied Channel Bandwidth(MHz)	Lower Band Edge(MHz)	Upper Band Edge(MHz)	Limit
GFSK	2402	0.84103	2401.5795	2402.4205	Within 2400-2483.5MHz
	2480	0.84122	2479.5794	2480.4206	





Test Mode	Frequency(MHz)	Occupied Channel Bandwidth(MHz)	Lower Band Edge(MHz)	Upper Band Edge(MHz)	Limit
π/4-DQPSK	2402	1.1722	2401.4139	2402.5861	Within 2400-2483.5MHz
	2480	1.1719	2479.4141	2480.5860	





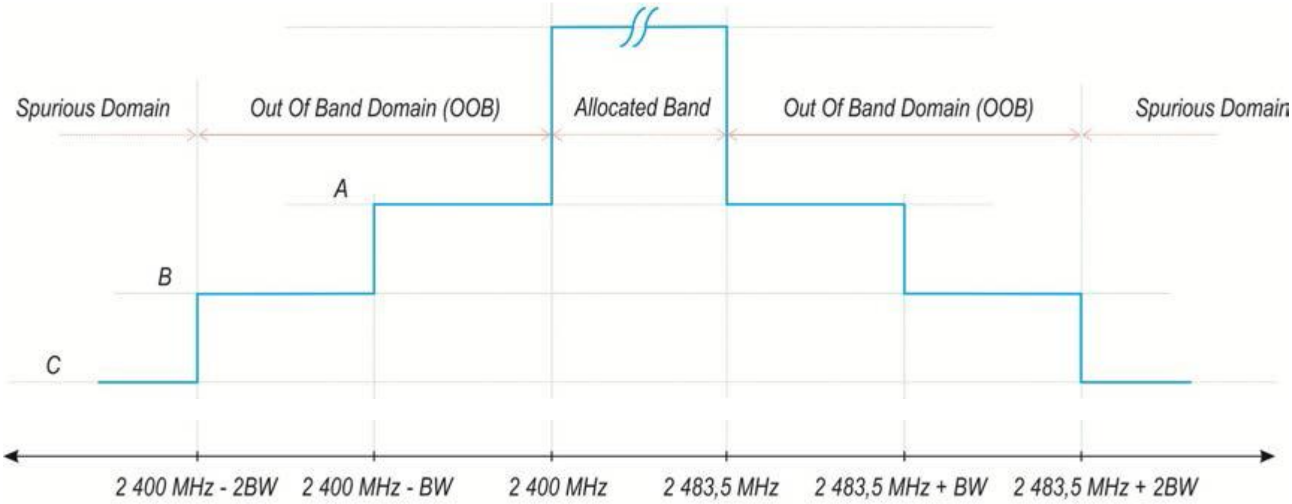
5.5 Transmitter unwanted emissions in the out-of-band domain

5.5.1 Definition

Transmitter unwanted emissions in the out-of-band domain are emissions when the equipment is in Transmit mode, on frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions.

5.5.2 Limits

The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in figure below.



A: -10 dBm/MHz e.i.r.p.
B: -20 dBm/MHz e.i.r.p.
C: Spurious Domain limits

BW = Occupied Channel Bandwidth in MHz or 1 MHz whichever is greater

5.5.3 Test Procedures

Follow the test procedure as described in EN 300 328 V2.1.1 Clause 5.4.8 to measure the transmitter unwanted emissions in the out-of-band domain at normal condition.

5.5.4 Test Result

Test data

BT mode	Transmitter unwanted emissions in the out-of-band domain (dBm/MHz e.i.r.p.)			
	2400MHz-BW	2400MHz-2BW	2483.5MHz+BW	2483.5MHz+2BW
GFSK	-40.338	-40.434	-49.049	-50.456
π/4-DQPSK	-35.598	-35.452	-50.220	-52.364
Limit	-10	-20	-10	-20
Max. Unwanted emission:		-35.452dBm/MHz		
Result		Pass		

5.6 Transmitter unwanted emissions in the spurious domain

5.6.1 Definition

Transmitter unwanted emissions in the spurious domain are emissions outside the allocated band and outside the out-of-band domain as the specified band when the equipment is in Transmit mode.

5.6.2 Limit

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table below.

Frequency range	Maximum power e.i.p. (≤ 1GHz) e.i.r.p. (>1GHz)	Bandwidth
30MHz to 47MHz	-36dBm	100kHz
47MHz to 74MHz	-54dBm	100kHz
74MHz to 87.5MHz	-36dBm	100kHz
87.5MHz to 118MHz	-54dBm	100kHz
118MHz to 174MHz	-36dBm	100kHz
174MHz to 230MHz	-54dBm	100kHz
230MHz to 470MHz	-36dBm	100kHz
470MHz to 862MHz	-54dBm	100kHz
862MHz to 1GHz	-36dBm	100kHz
1GHz to 12.75GHz	-30dBm	1MHz

5.6.3 Test procedures

Follow the test procedure as described in EN 300 328 V2.1.1 Clause 5.4.9 to measure the transmitter unwanted emissions in the spurious domain at normal condition.

5.6.4 Test result

Test data

30MHz-1GHz

EUT：	3W Soundboom speaker	Model Name：	P328.23
Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	1010hPa	Test Voltage：	DC 5V from USB port
Test Mode：	π/4-DQPSK(TX 2441MHz)		

Polar	Frequency	Reading Level	Factor	Emission Level	Limits	Margin	Detector Type
(H/V)	(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dB)	
V	35.4294	-76.24	11.26	-64.98	-36	-28.98	peak
V	53.4636	-74.48	10.2	-64.28	-54	-10.28	peak
V	114.7324	-71.79	12.22	-59.57	-54	-5.57	peak
V	153.2015	-63.49	13.34	-50.15	-36	-14.15	peak
V	299.4161	-70.19	7.64	-62.55	-36	-26.55	peak
V	463.9616	-72.86	5.6	-67.26	-54	-13.26	peak
H	43.9494	-73.57	9.81	-63.76	-36	-27.76	peak
H	62.6842	-74.29	12.15	-62.14	-54	-8.14	peak
H	126.6623	-74.02	12.85	-61.17	-36	-25.17	peak
H	189.1146	-76.18	10.96	-65.22	-54	-11.22	peak
H	247.8715	-78.07	10.09	-67.98	-36	-31.98	peak
H	484.2059	-77.85	5.33	-72.52	-54	-18.52	peak

Remark:
Emission Level= Reading Level+ Factor, Margin= Emission Level - Limit

1GHz-12.75G

EUT:	3W Soundboom speaker	Model Name:	P328.23
Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	1010hPa	Test Voltage:	DC 5V from USB port
Test Mode:	π/4-DQPSK (TX 2402/2441/2480MHz)		

Polar	Frequency	Reading Level	Factor	Emission Level	Limits	Margin	Detector Type
(H/V)	(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dB)	
operation frequency:2402							
V	4804.153	-47.84	8.90	-38.94	-30.00	-8.94	peak
V	7206.038	-53.31	4.57	-48.74	-30.00	-18.74	peak
H	4804.164	-49.52	8.90	-40.62	-30.00	-10.62	peak
H	7206.111	-50.59	4.57	-46.02	-30.00	-16.02	peak
operation frequency:2441							
V	4882.271	-49.51	9.34	-40.17	-30.00	-10.17	peak
V	7323.220	-52.28	4.45	-47.83	-30.00	-17.83	peak
H	4882.396	-52.42	9.34	-43.08	-30.00	-13.08	peak
H	7323.116	-51.50	4.45	-47.05	-30.00	-17.05	peak
operation frequency:2480							
V	4960.238	-45.52	9.77	-35.75	-30.00	-5.75	peak
V	7440.202	-54.44	4.33	-50.11	-30.00	-20.11	peak
H	4960.034	-47.94	9.77	-38.17	-30.00	-8.17	peak
H	7440.220	-51.06	4.33	-46.73	-30.00	-16.73	peak
Remark: Emission Level= Reading Level+ Factor, Margin= Emission Level - Limit							

Note: Worst mode is π/4-DQPSK, showing only the worst mode.

5.7 Receiver spurious emissions

5.7.1 Definition

Receiver spurious emissions are emissions at any frequency when the equipment is in receive mode.

5.7.2 Limits

The spurious emissions of the receiver shall not exceed the values given in table below.

Frequency range	Maximum power	Bandwidth
30MHz to 1GHz	-57dBm	100kHz
1GHz to 12.75GHz	-47dBm	1MHz

5.7.3 Test procedures

Follow the test procedure as described in EN 300 328 V2.1.1 Clause 5.3.11 to measure the receiver spurious emissions at normal condition.

5.7.4 Test result

Test data

30MHz-1GHz

EUT：	3W Soundboom speaker	Model Name：	P328.23
Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	1010hPa	Test Voltage：	DC 5V from USB port
Test Mode：	π/4-DQPSK (RX 2441MHz)		

Polar (H/V)	Frequency (MHz)	Reading Level (dBm)	Factor (dB)	Emission Level (dBm)	Limits (dBm)	Margin (dB)	Detector Type
V	34.5816	-88.86	11.29	-77.57	-57	-20.57	peak
V	177.1442	-90.03	12.07	-77.96	-57	-20.96	peak
V	236.1017	-87.46	10.55	-76.91	-57	-19.91	peak
V	378.7146	-93.64	7.03	-86.61	-57	-29.61	peak
V	525.4129	-93.52	5.62	-87.90	-57	-30.90	peak
V	757.7178	-96.53	3.38	-93.15	-57	-36.15	peak
H	47.2610	-90.19	9.7	-80.49	-57	-23.49	peak
H	186.5410	-94.43	11.05	-83.38	-57	-26.38	peak
H	276.2371	-96.69	8.3	-88.39	-57	-31.39	peak
H	391.1681	-92.71	6.76	-85.95	-57	-28.95	peak
H	479.5780	-94.21	5.37	-88.84	-57	-31.84	peak
H	626.0488	-97.33	5.05	-92.28	-57	-35.28	peak

Remark:
Emission Level= Reading Level+ Factor, Margin= Emission Level - Limit

EUT：	3W Soundboom speaker	Model Name：	P328.23
Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	1010hPa	Test Voltage：	DC 5V from USB port
Test Mode：	π/4-DQPSK (RX 2441MHz)		

Polar	Frequency	Reading Level	Factor	Emission Level	Limits	Margin	Detector Type
(H/V)	(MHz)	(dBm)	(dB)	(dBm)	(dBm)	(dB)	
V	1715.886	-58.88	3.76	-55.12	-47	-8.12	peak
V	2527.801	-59.99	3.97	-56.02	-47	-9.02	peak
V	3326.382	-61.64	4.77	-56.87	-47	-9.87	peak
V	6056.567	-65.58	7.37	-58.21	-47	-11.21	peak
V	7247.223	-68.78	4.53	-64.25	-47	-17.25	peak
V	8034.247	-69.09	3.62	-65.47	-47	-18.47	peak
H	1327.186	-59.60	3.05	-56.55	-47	-9.55	peak
H	2464.460	-65.09	4.13	-60.96	-47	-13.96	peak
H	4255.579	-62.46	5.76	-56.70	-47	-9.70	peak
H	5531.597	-62.00	6.92	-55.08	-47	-8.08	peak
H	7976.078	-67.79	3.7	-64.09	-47	-17.09	peak
H	9164.020	-72.13	1.82	-70.31	-47	-23.31	peak
Remark: Emission Level= Reading Level+ Factor, Margin= Emission Level - Limit							

Note: Worst mode is π/4-DQPSK, showing only the worst mode.

5.8 Adaptivity

5.8.1 Definition

Adaptive mode of LBT based Detect and Avoid is a mechanism by which equipment using wide band modulations other than FHSS, avoids transmissions in a channel in the presence of other transmissions in that channel.

5.8.2 Limits

Minimum set of requirements:

LBT based Detect and Avoid mechanism: Load Based Equipment.

1) Before a transmission or a burst of transmissions, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18μs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5) below. If the equipment finds the channel to be clear, it may transmit immediately

2) If the equipment finds the channel occupied, it shall not transmit on this channel (see note 2). The equipment shall perform an Extended CCA check in which the channel is observed for a random duration in the range between 18μs and at least 160μs. If the extended CCA check has determined the channel to be no longer occupied, the equipment may resume transmissions on this channel. If the Extended CCA time has determined the channel still to be occupied, it shall perform new Extended CCA checks until the channel is no longer occupied.

Note 1: The Idle Period in between transmissions is considered to be the CCA or the Extended CCA check as there are no transmissions during this period.

Note 2: The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive systems. Alternatively, the equipment is also allowed to continue transmissions on this channel providing it complies with the requirements.

3) The total time that an equipment makes use of a RF channel is defined as the Channel Occupancy Time. This Channel Occupancy Time shall be less than 13ms, after which the device shall perform a new CCA as described in step 1) above.

4) The equipment, upon correct reception of a packet which was intended for this equipment can skip CCA and immediately (see note 3) proceed with the transmission of management and control frames (e.g. ACK and Block ACK frames are allowed but data frames are not allowed). A consecutive sequence of transmissions by the equipment without a new CCA shall not exceed the maximum channel occupancy time as defined in step 3) above.

Note 3: For the purpose of multi-cast, the ACK transmissions (associated with the same data packet) of the individual devices are allowed to take place in a sequence.

5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal or less than -70 dBm/MHz at the input to the receiver (assuming a 0 dBi receive antenna). For power levels below 20 dBm e.i.r.p., the CCA threshold level may be relaxed to TL = -70 dBm/MHz + (20 dBm - Pout e.i.r.p.)/1 MHz (Pout in dBm).

Short Control Signalling Transmissions:

If implemented, Short Control Signalling Transmissions of adaptive equipment using wide band modulations other than FHSS shall have a maximum duty cycle of 10% within an observation period of 50ms.

5.8.3 Test Procedures

Follow the test procedure as described in EN 300 328 V2.1.1 Clause 5.4.6 to measure the Adaptivity & receiver blocking at normal condition.

5.8.4 Test Result

Not applicable.

5.9 Receiver blocking

5.9.1 Definition

Receiver blocking is a measure of the ability of the equipment to receive a wanted signal on its operating channel without exceeding a given degradation in the presence of an unwanted signal (blocking signal) at frequencies other than those of the operating band.

5.9.2 Limits

Table 14: Receiver Blocking parameters for Receiver Category 1 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380 2 503,5	-53	CW
P_{min} + 6 dB	2 300 2 330 2 360	-47	CW
P_{min} + 6 dB	2 523,5 2 553,5 2 583,5 2 613,5 2 643,5 2 673,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

Table 15: Receiver Blocking parameters receiver category 2 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380 2 503,5	-57	CW
P_{min} + 6 dB	2 300 2 583,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

Table 16: Receiver Blocking parameters receiver category 3 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 12 dB	2 380 2 503,5	-57	CW
P_{min} + 12 dB	2 300 2 583,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

5.9.3 Test Procedures

Follow the test procedure as described in EN 300 328 V2.1.1 Clause 5.4.11 to measure the receiver blocking at normal condition.

5.9.4 Test Result

Test data

Comply with receiver category 2 equipment.

When required minimum blocking signals injected, communication link between the UUT and the associated companion device remains, and the performance still meet the minimum performance criterion declared by manufacturer.

Frequency (MHz)	Mode	Data rate (Mbps)	Blocking Signal Frequency (MHz)	Wanted Signal(dBm) (Pmin+6dB)	Blocking Signal Level at Input Port (dBm)	PER(%)
2402	π/4-DQPSK	1	2380, 2503.5	-84.7+6	-57.58	0.36
2402	π/4-DQPSK	1	2 300 2 583,5	-84.7+6	-47.58	0.42
2480	π/4-DQPSK	1	2380, 2503.5	-84.7+6	-57.58	0.35
2480	π/4-DQPSK	1	2 300 2 583,5	-84.7+6	-47.58	0.39

Note: Worst mode is π/4-DQPSK, showing only the worst mode.

5.10 Geo-location capability

5.10.1 Definition

Geo-location capability is a feature of the equipment to determine its geographical location with the purpose to configure itself according to the regulatory requirements applicable at the geographical location where it operates.

The geo-location capability may be present in the equipment or in an external device (temporary) associated with the equipment operating at the same geographical location during the initial power up of the equipment. The geographical location may also be available in equipment already installed and operating at the same geographical location.

5.10.2 Limits

The geographical location determined by the equipment as defined in clause 4.3.2.12.2 shall not be accessible to the user.

5.10.3 Test Procedures

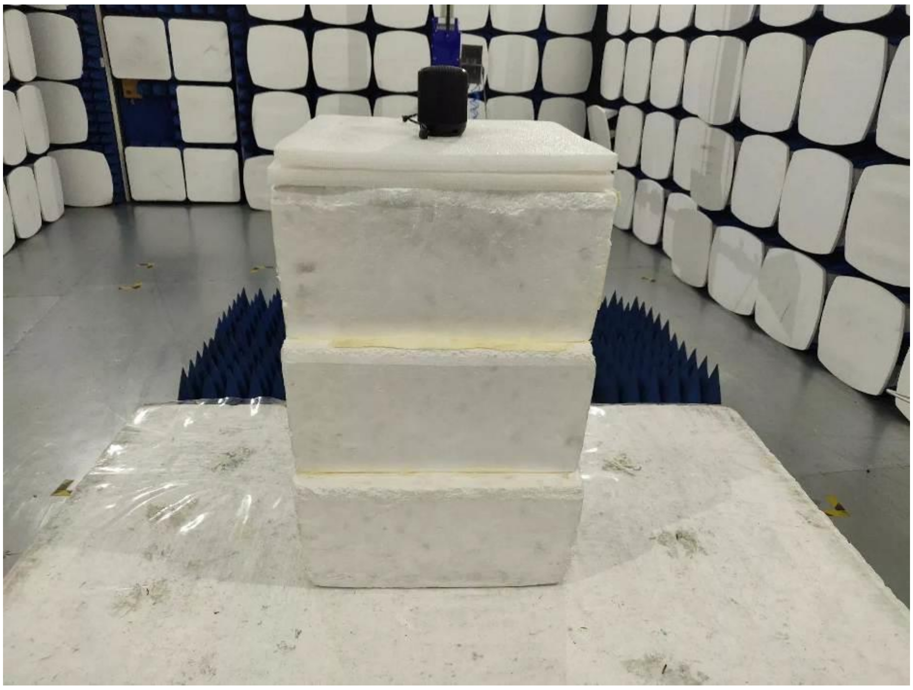
The geographical location determined by the equipment as defined in clause 4.3.1.13.2 shall not be accessible to the user.

5.10.4 Test Result

N/A
The EUT has no geo-location capability.

Photographs of the Test Setup

Radiated emission – below 1GHz

Radiated emission – above 1GHz


Annex A Information for Testing

a) The type of modulation used by the equipment:

☒ FHSS

☐ Other forms of modulation

b) In case of FHSS modulation:

- In case of non-Adaptive Frequency Hopping equipment:

The number of Hopping Frequencies:

- In case of Adaptive Frequency Hopping Equipment:

The maximum number of Hopping Frequencies: 79

The minimum number of Hopping Frequencies: 79

- The Dwell Time: ms
- The Minimum Channel Occupation Time:
- The (average) Dwell Time: ms

c) **Adaptive / non-adaptive equipment:**

☐ non-adaptive Equipment

☒ adaptive Equipment without the possibility to switch to a non-adaptive mode

☐ adaptive Equipment which can also operate in a non-adaptive mode

d) **In case of adaptive equipment:**

The Channel Occupancy Time implemented by the equipment:

☒ The equipment has implemented an LBT based DAA mechanism

- In case of equipment using modulation different from FHSS:

☐ The equipment is Frame Based equipment

☒ The equipment is Load Based equipment

☐ The equipment can switch dynamically between Frame Based and Load Based equipment

The CCA time implemented by the equipment:

☐ The equipment has implemented an non-LBT based DAA mechanism

☐ The equipment can operate in more than one adaptive mode

e) In case of non-adaptive Equipment:

The maximum RF Output Power (e.i.r.p.): 0.982dBm

The maximum (corresponding) Duty Cycle: 100%

Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):

f) The worst case operational mode for each of the following tests:

- RF Output Power: π/4-DQPSK
- Power Spectral Density:
- Duty cycle, Tx-Sequence, Tx-gap:
- Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment):
- Hopping Frequency Separation (only for FHSS equipment): π/4-DQPSK
- Medium Utilisation:
- Receiver Blocking: π/4-DQPSK
- Occupied Channel Bandwidth: π/4-DQPSK
- Transmitter unwanted emissions in the OOB domain: π/4-DQPSK
- Transmitter unwanted emissions in the spurious domain: π/4-DQPSK
- Receiver spurious emissions: π/4-DQPSK

g) The different transmit operating modes (tick all that apply):

☒ Operating mode 1: Single Antenna Equipment

☒ Equipment with only 1 antenna

☐ Equipment with 2 diversity antennas but only 1 antenna active at any moment in time

☐ Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)

☐ Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming

☐ Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)

☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1

☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2

NOTE: Add more lines if more channel bandwidths are supported.

☐ Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming

☐ Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)

☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1

☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2

NOTE: Add more lines if more channel bandwidths are supported.

h) **In case of Smart Antenna Systems:**

- The number of Receive chains:

- The number of Transmit chains:

  ☐ symmetrical power distribution

  ☐ asymmetrical power distribution

In case of beam forming, the maximum beam forming gain:

NOTE: Beam forming gain does not include the basic gain of a single antenna.

i) **Operating Frequency Range(s) of the equipment:**

- Operating Frequency Range 1: 2402MHz to 2480MHz
- Operating Frequency Range 2: MHz to MHz

NOTE: Add more lines if more Frequency Ranges are supported.

j) **Occupied Channel Bandwidth(s):**

- Occupied Channel Bandwidth 1: 1.1722MHz
- Occupied Channel Bandwidth 2: MHz

NOTE: Add more lines if more channel bandwidths are supported.

k) **Type of Equipment (stand-alone, combined, plug-in radio device, etc.):**

☒ Stand-alone

☐ Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)

☐ Plug-in radio device (Equipment intended for a variety of host systems)

☐ Other

l) **The extreme operating conditions that apply to the equipment:**

Operating temperature range: -10° C to 40° C

Details provided are for the: ☒ stand-alone equipment

☐ combined (or host) equipment

☐ test jig

m) **The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels:**

- Antenna Type:

  ☒ PCB Antenna

  Antenna Gain: -0.58dBi

Tel:(86-755)88850135 Fax: (86-755) 88850136 Web: http://www.mtitest.com E-mail: mti@51mti.com
Address: No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China

If applicable, additional beamforming gain (excluding basic antenna gain): dB

☐ Temporary RF connector provided

☐ No temporary RF connector provided

☐ Dedicated Antennas (equipment with antenna connector)

☐ Single power level with corresponding antenna(s)

☐ Multiple power settings and corresponding antenna(s)

Number of different Power Levels:

Power Level 1: dBm

Power Level 2: dBm

Power Level 3: dBm

NOTE 1: Add more lines in case the equipment has more power levels.

NOTE 2: These power levels are conducted power levels (at antenna connector).

- For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable

Power Level 1: dBm

Number of antenna assemblies provided for this power level:

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			
3			
4			

NOTE: Add more rows in case more antenna assemblies are supported for this power level.

Power Level 2: dBm

Number of antenna assemblies provided for this power level:

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			
3			
4			

NOTE: Add more rows in case more antenna assemblies are supported for this power level.

Power Level 3: dBm

Number of antenna assemblies provided for this power level:

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			
3			
4			

NOTE: Add more rows in case more antenna assemblies are supported for this power level.

n) **The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:**

Details provided are for the: ☒ stand-alone equipment

☐ combined (or host) equipment

☐ test jig

Supply Voltage ☒ AC mains State AC voltage 230V/50Hz

☐ DC State DC voltage

In case of DC, indicate the type of power source

☐ Internal Power Supply

☒ External Power Supply or AC/DC adapter

☒ Battery

☐ Other:

o) **Describe the test modes available which can facilitate testing:**

p) **The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):**

Bluetooth®

q) **Geo-location capability supported by the equipment:**

☐ Yes

☐ The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user.

☒ No

Photographs of the EUT

See the APPENDIX 1: EUT PHOTO in the report No.: MTi19070101-6E-1E-1.

----END OF REPORT----