Microtest
微测检测

# Test Report

Report No.: MTi19070101-3E1

Date of issue: July 10, 2019

| | |
|---|---|
| Sample Description: | 6W Soundboom speaker |
| Model(s): | P328.24 |
| Applicant: | |
| Address: | |
| Date of Test: | July 01, 2019 –July 10, 2019 |

Shenzhen Microtest Co., Ltd.
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# Test Result Certification

| | |
|---|---|
| Applicant's name: | |
| Address: | |
| Manufacture's name: | |
| Address: | |
| Product name: | 6W Soundboom speaker |
| Trademark: | N/A |
| Model name: | P328.24 |
| 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 | July 10, 2019 |
| Reviewed by: | Blue Zheng | July 10, 2019 |
| Approved by: | Smith Chen | July 10, 2019 |

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Address: No.102A & 302A, East Block, Hengfang Industrial Park, Xingye Road, Xixiang, Bao'an District, Shenzhen, Guangdong, China

# 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.)<br>** Not applicable (the EUT has no geo-location capability) | | | |

# 2 General Description

## 2.1 Feature of equipment under test (EUT)

| | |
|---|---|
| Product name: | 6W Soundboom speaker |
| Model name: | P328.24 |
| TX/RX frequency range: | TX: 2402MHz~2480MHz<br>RX: 2402MHz~2480MHz |
| Bluetooth version: | V5.0 |
| Modulation type: | GFSK, π/4-DQPSK |
| Power source: | DC 5V from adapter AC 230V/50Hz or DC 3.7V from battery |
| Battery: | DC 3.7V 1200mAh |
| 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

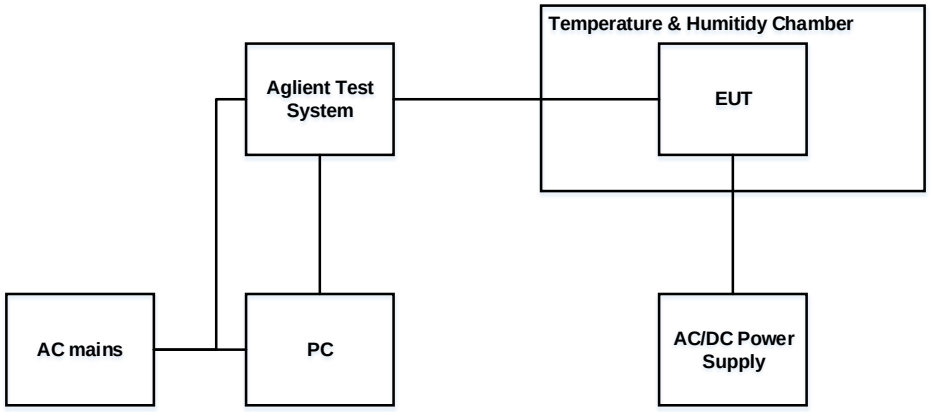
During the measurement the environmental conditions were within the listed ranges:

- 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) | 3.7 | | |
| Note1:The extreme temperatures are declared by manufacture.<br>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 |
|---|---|---|---|
| / | / | / | / |

## 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-E002 | CMU 200 universal radio communication tester | Rohde&schwarz | CMU 200 | 114587 | 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

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 | 0.097 | 0.226 | -0.102 | 20 | Pass |
| | N.V.L.T. | 0.026 | 0.222 | -0.104 | 20 | Pass |
| | N.V.H.T. | 0.080 | 0.209 | -0.171 | 20 | Pass |
| π/4-DQPSK | Normal | 0.788 | 0.782 | 0.568 | 20 | Pass |
| | N.V.L.T. | 0.683 | 0.755 | 0.532 | 20 | Pass |
| | N.V.H.T. | 0.701 | 0.773 | 0.496 | 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

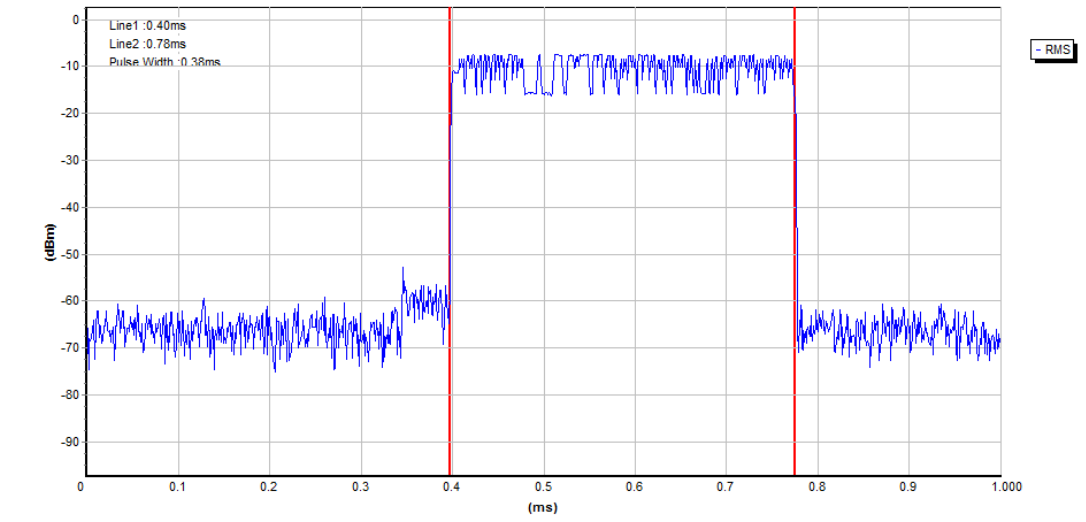
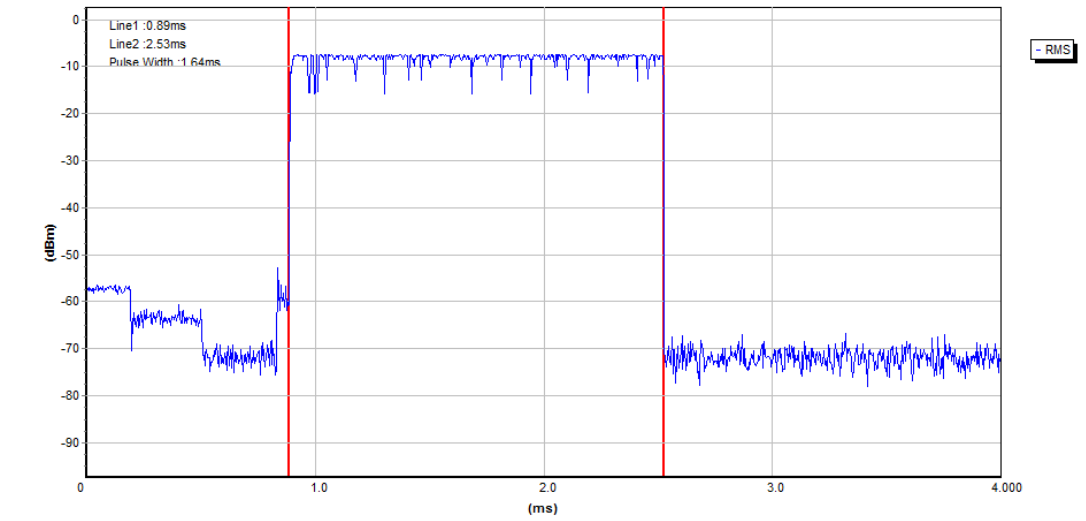
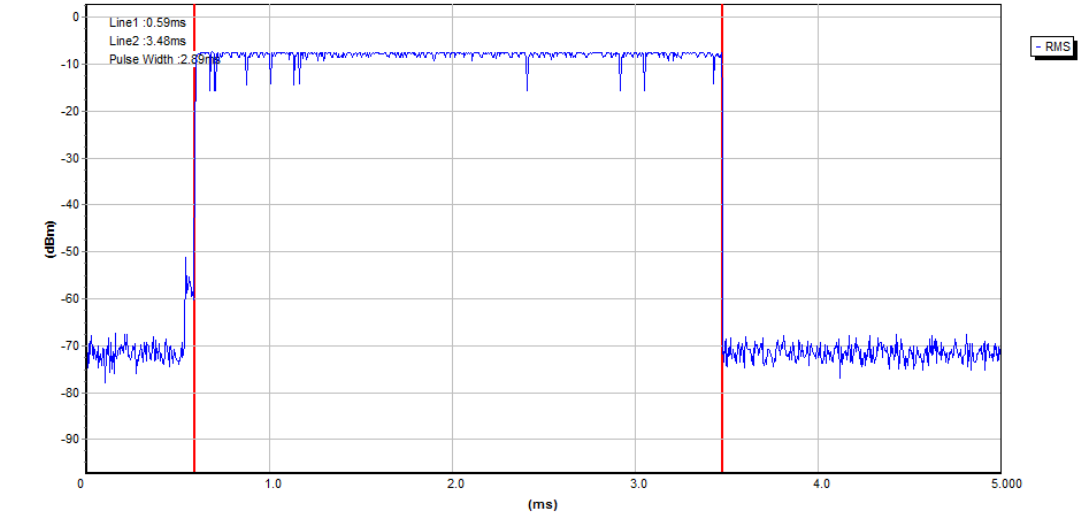
Test data

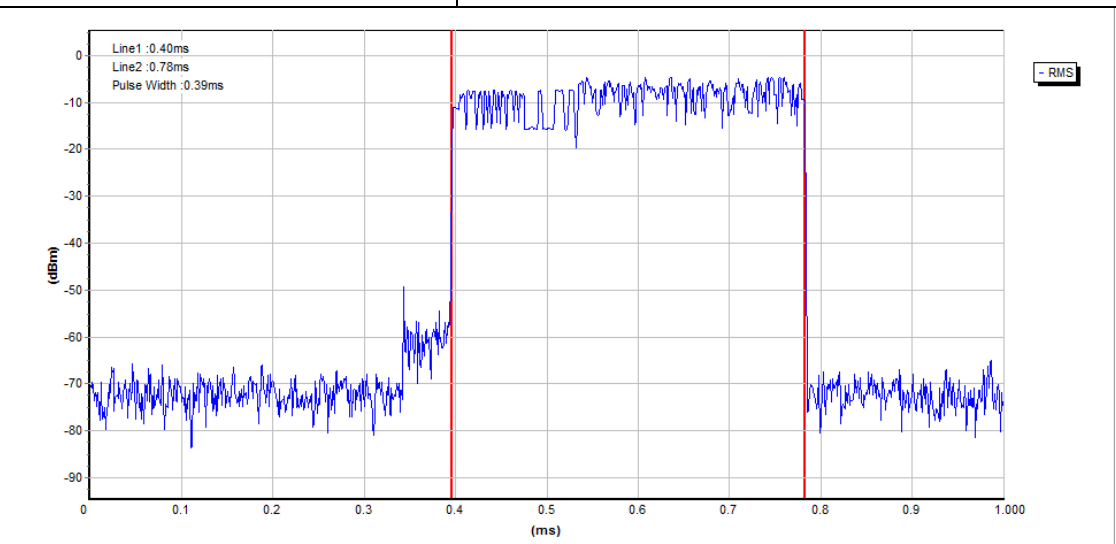
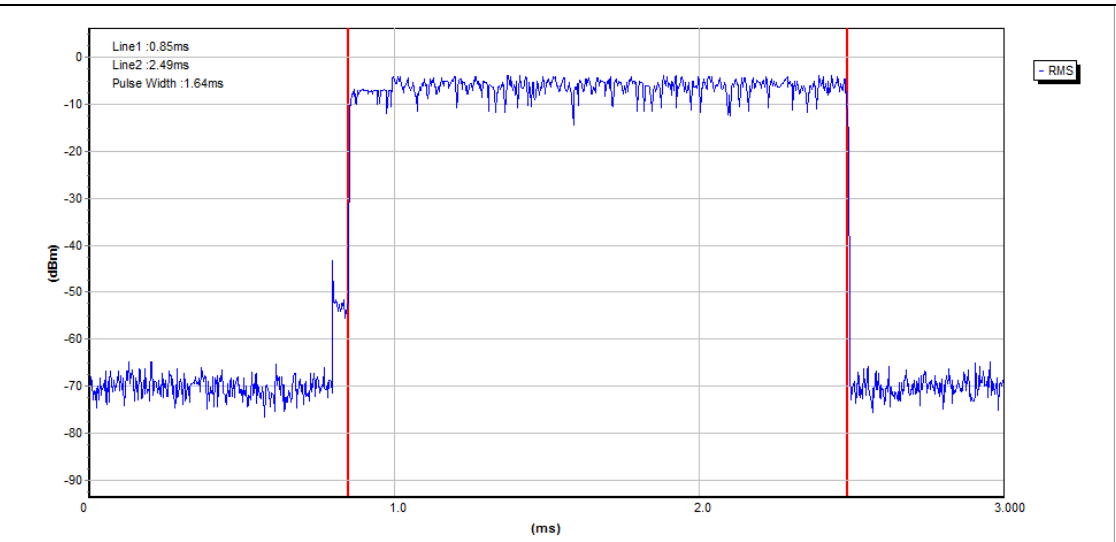
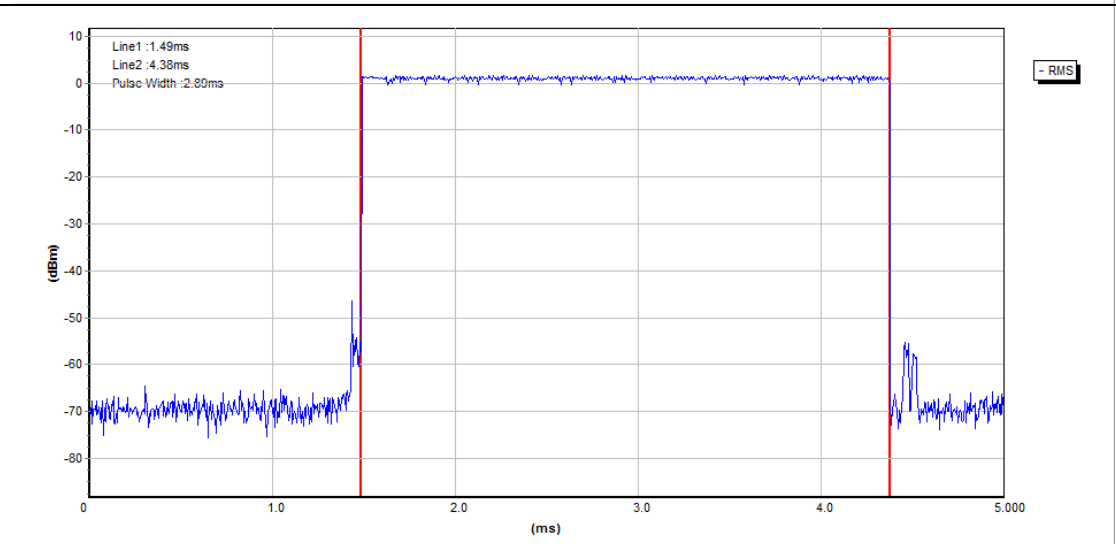
Accumulated Transmit time

| Mode | Data Packet | Frequency (MHz) | Pulse Time (ms) | Minimum Frequency Occupation (ms) | Dwell Time (ms) | Limit(s) | Result |
|---|---|---|---|---|---|---|---|
| GFSK | DH1 | 2441 | 1.38 | 2.76 | 441.60 | <0.4 | Pass |
| | DH3 | 2441 | 1.64 | 3.28 | 262.40 | <0.4 | Pass |
| | DH5 | 2441 | 2.89 | 5.78 | 308.27 | <0.4 | Pass |
| π/4 DQPSK | 2DH1 | 2441 | 0.39 | 0.78 | 124.80 | <0.4 | Pass |
| | 2DH3 | 2441 | 1.64 | 3.28 | 262.40 | <0.4 | Pass |
| | 2DH5 | 2441 | 2.89 | 5.78 | 308.27 | <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*

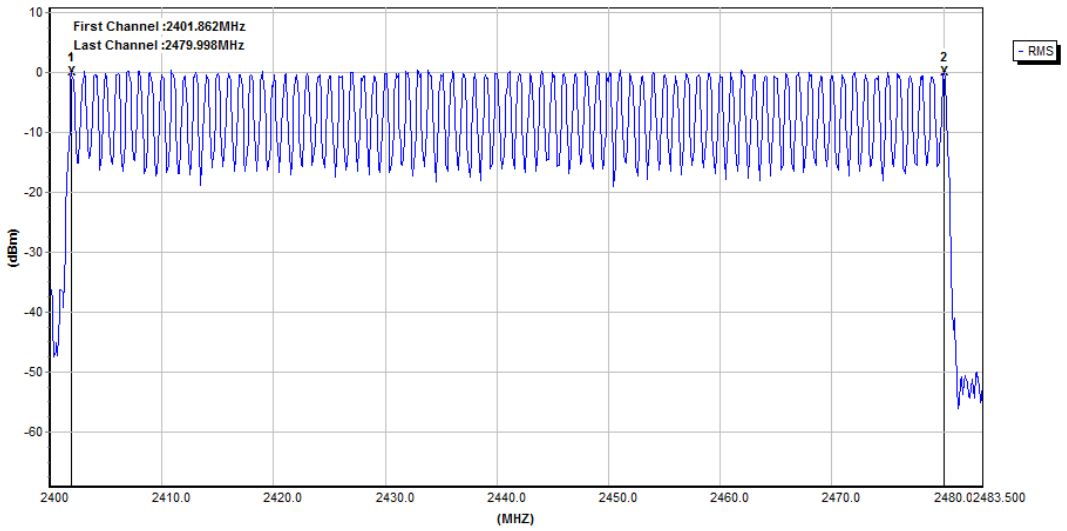
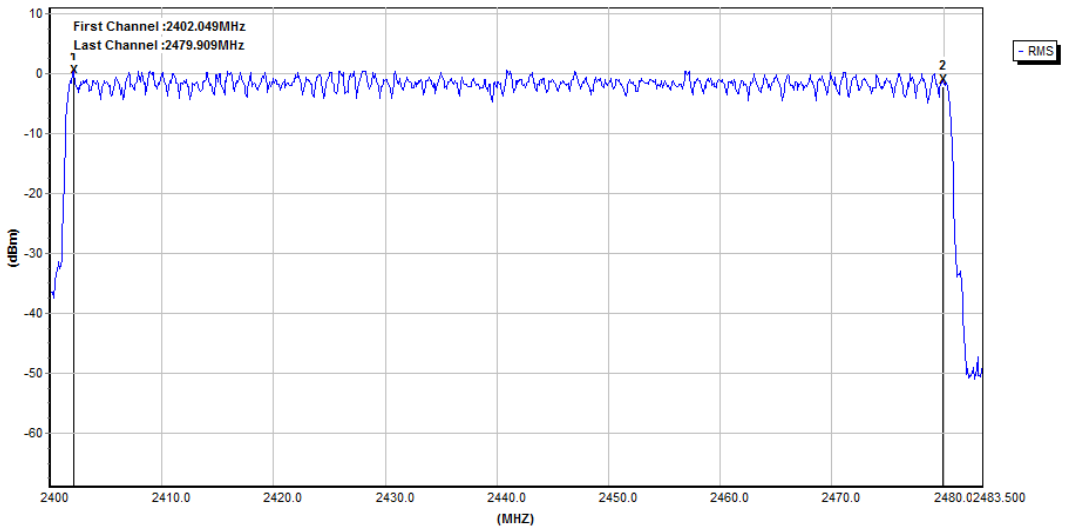
*Note3: For GFSK, π/4-DQPSK: The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s*

| 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 | 93.58 | >=70 | Pass |
| π/4-DQPSK-2DH5 | 79 | >=15 | 93.25 | >=70 | Pass |

| **Hopping Number for GFSK** | 79 |
|---|---|
| GFSK-DH5 |  |
| | |
| π/4-DQPSK-2DH5 |  |

## 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.

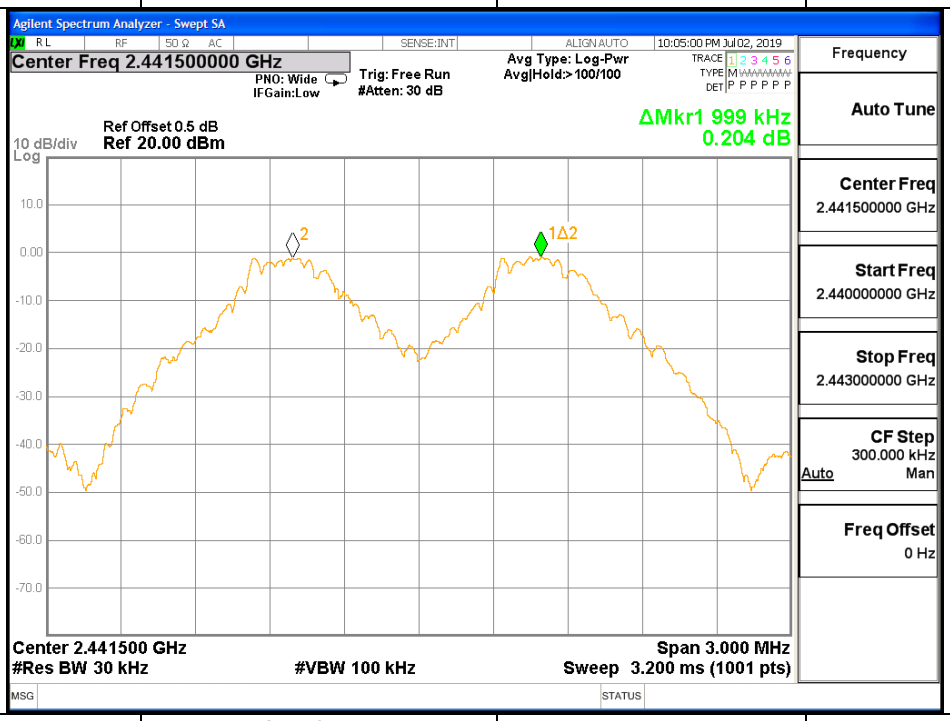
5.3.3 Test Procedures

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.

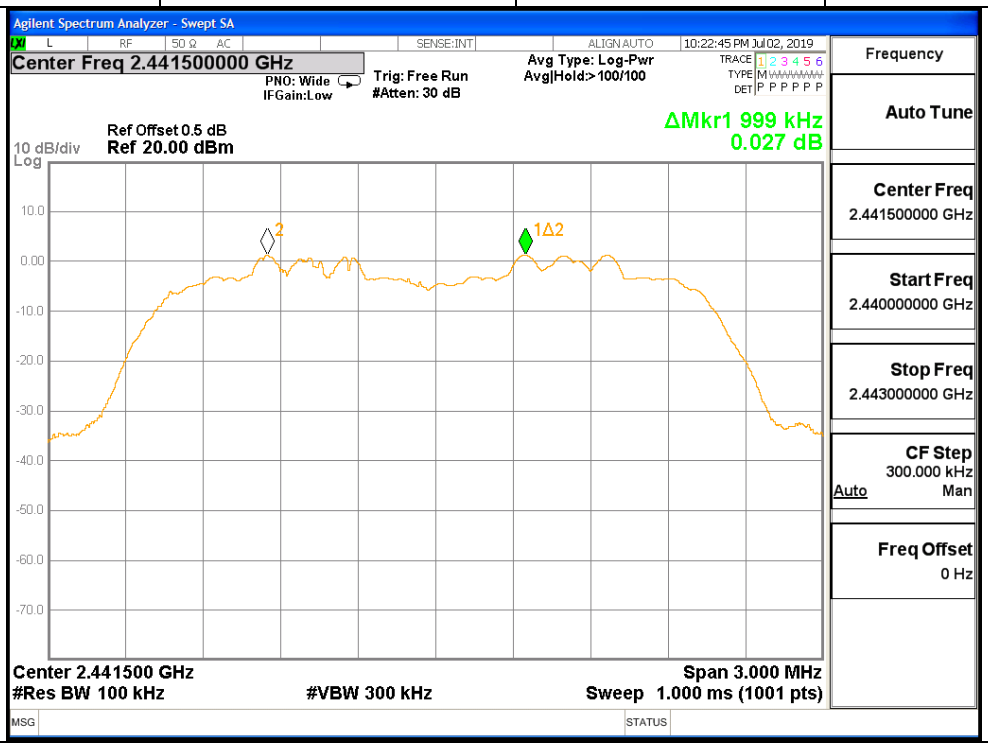
5.3.4 Test Result

Hopping frequency Separation:

| BT mode | Hopping frequency separation (MHz) | Limit (MHz) | Result |
|---|---|---|---|
| GFSK | 0.999 | >=0.1 | Pass |




| BT mode | Hopping frequency separation (MHz) | Limit (MHz) | Result |
|---|---|---|---|
| π/4-DQPSK | 0.999 | >=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.

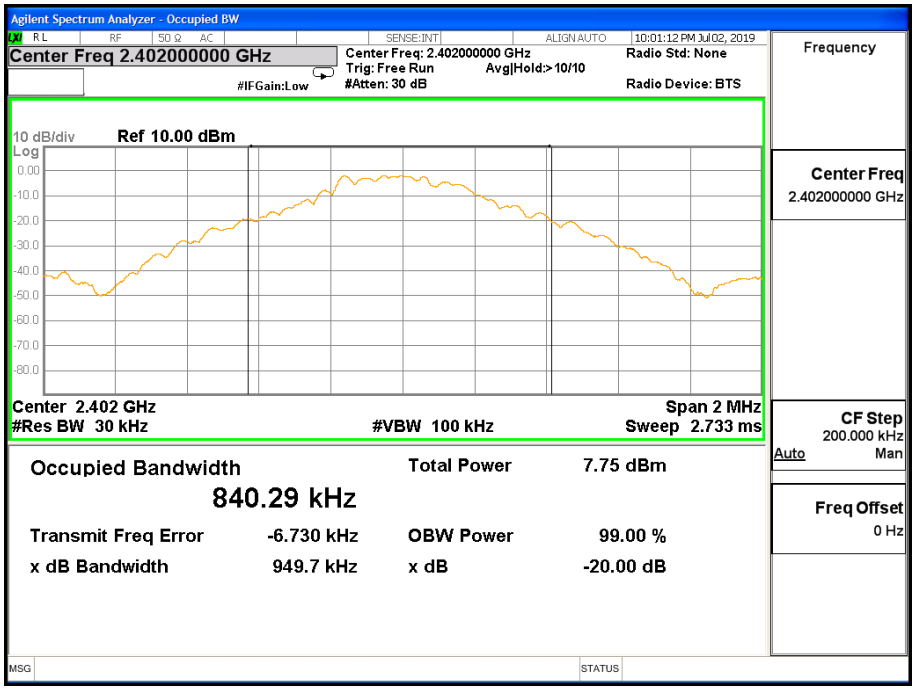
5.4.3 Test Procedures

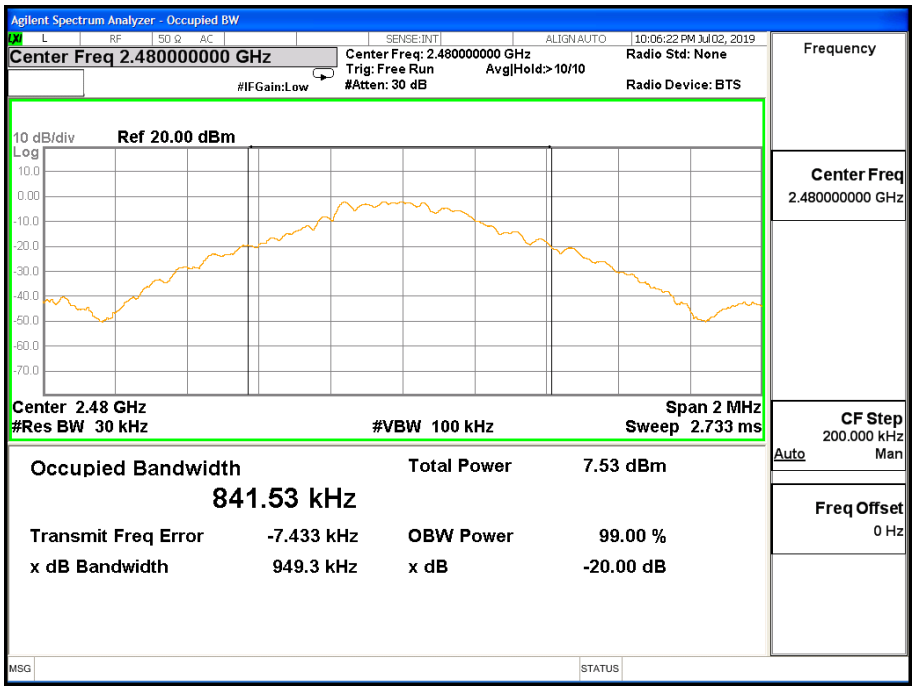
Follow the test procedure as described in EN 300 328 V2.1.1 Clause 5.4.7 to measure the occupied channel bandwidth at normal condition.

5.4.4 Test Result

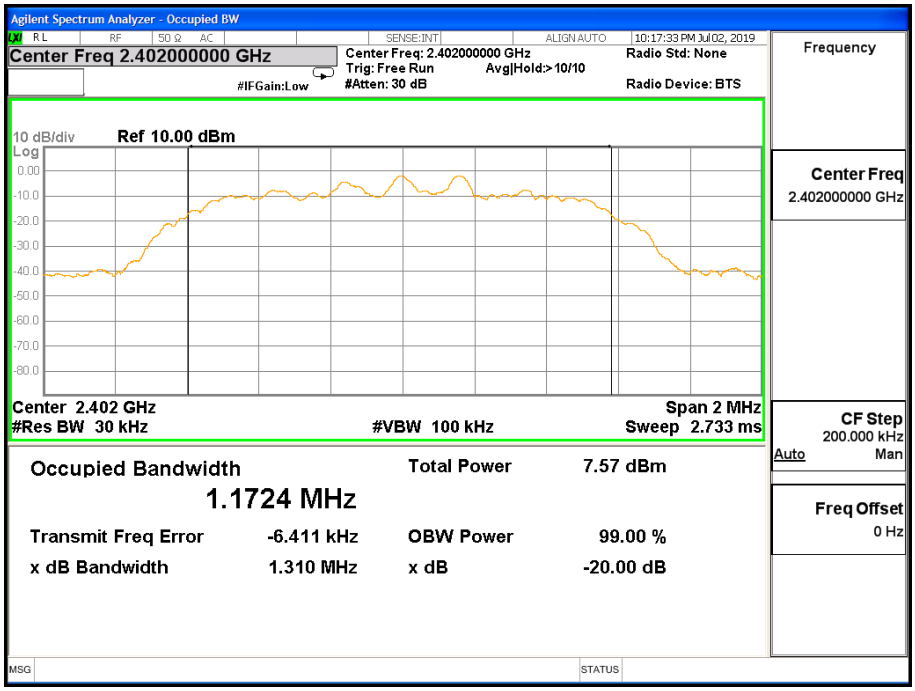
Test data

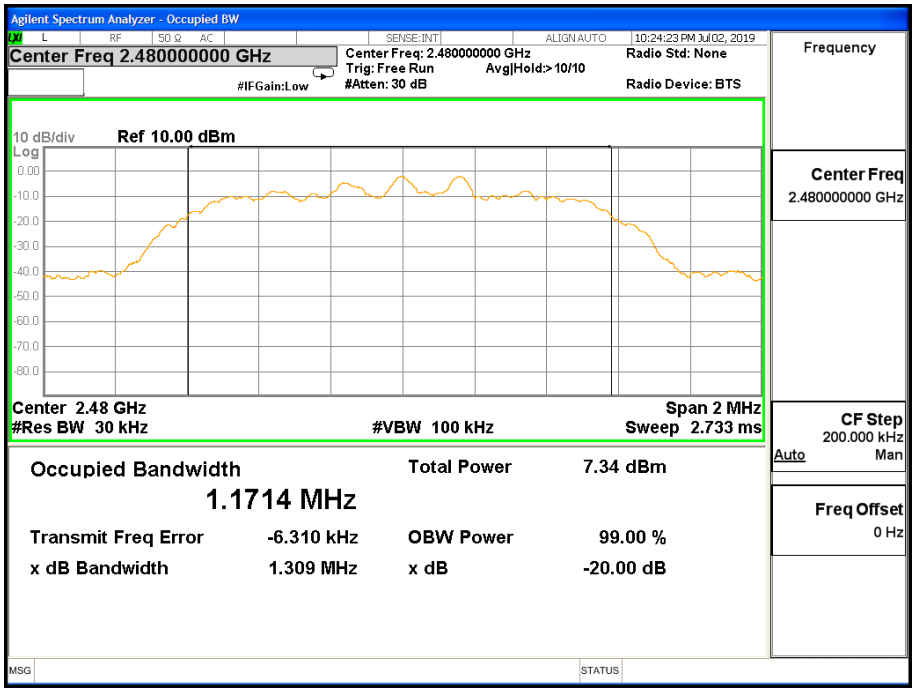
| Test Mode | Frequency(MHz) | Occupied Channel Bandwidth(MHz) | Lower Band Edge(MHz) | Upper Band Edge(MHz) | Limit |
|---|---|---|---|---|---|
| GFSK | 2402 | 0.84029 | 2401.5799 | 2402.4201 | Within 2400-2483.5MHz |
| | 2480 | 0.84153 | 2479.5792 | 2480.4208 | |



| Test Mode | Frequency(MHz) | Occupied Channel Bandwidth(MHz) | Lower Band Edge(MHz) | Upper Band Edge(MHz) | Limit |
|---|---|---|---|---|---|
| π/4-DQPSK | 2402 | 1.1724 | 2401.4138 | 2402.5862 | Within 2400-2483.5MHz |
| | 2480 | 1.1714 | 2479.4143 | 2480.5857 | |



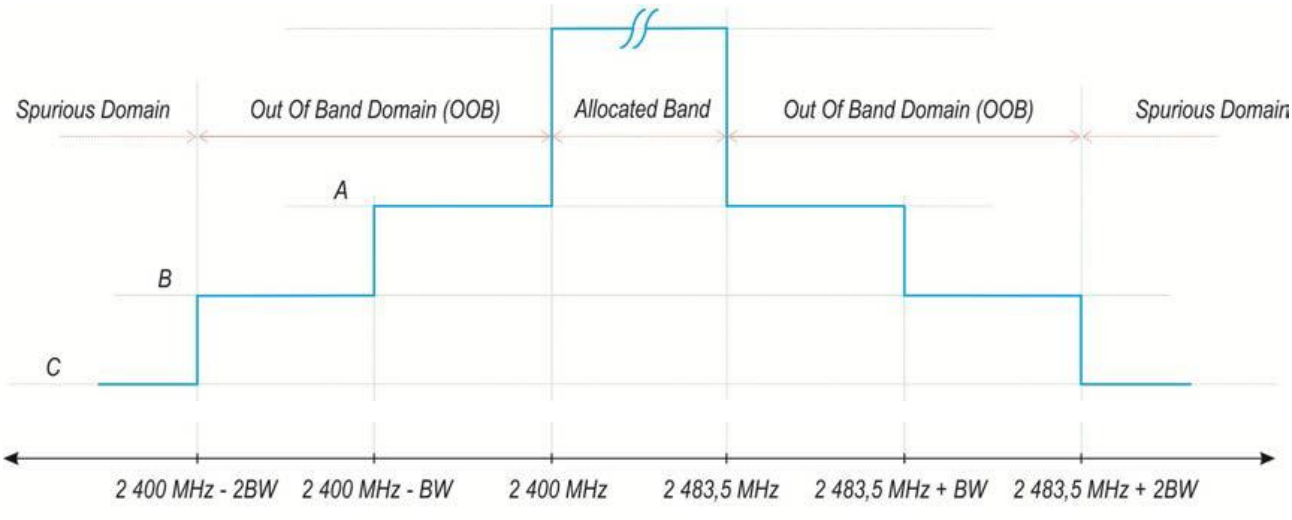
## 5.5 Transmitter unwanted emissions in the out-of-band domain

### 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 | -39.351 | -40.144 | -49.101 | -50.456 |
| π/4-DQPSK | -35.462 | -35.489 | -50.328 | -51.364 |
| Limit | -10 | -20 | -10 | -20 |
| Max. Unwanted emission: | | -35.462dBm/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： | 6W Soundboom speaker | Model Name： | P328.24 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010hPa | Test Voltage： | DC 3.7V |
| Test Mode： | π/4 DQPSK (TX 2402MHz) | | |

| Polar | Frequency | Reading Level | Factor | Emission Level | Limits | Margin | Detector Type |
|---|---|---|---|---|---|---|---|
| (H/V) | (MHz) | (dBm) | (dB) | (dBm) | (dBm) | (dB) | |
| V | 35.1405 | -76.80 | 11.26 | -65.54 | -36 | -29.54 | peak |
| V | 54.0772 | -74.37 | 10.2 | -64.17 | -54 | -10.17 | peak |
| V | 116.1749 | -72.77 | 12.22 | -60.55 | -54 | -6.55 | peak |
| V | 152.4140 | -63.83 | 13.34 | -50.49 | -36 | -14.49 | peak |
| V | 299.8829 | -70.30 | 7.64 | -62.66 | -36 | -26.66 | peak |
| V | 463.3299 | -73.65 | 5.6 | -68.05 | -54 | -14.05 | peak |
| H | 44.6649 | -73.67 | 9.81 | -63.86 | -36 | -27.86 | peak |
| H | 62.7789 | -74.22 | 12.15 | -62.07 | -54 | -8.07 | peak |
| H | 125.0364 | -75.97 | 12.85 | -63.12 | -36 | -27.12 | peak |
| H | 188.4035 | -76.00 | 10.96 | -65.04 | -54 | -11.04 | peak |
| H | 248.3002 | -78.07 | 10.09 | -67.98 | -36 | -31.98 | peak |
| H | 484.3505 | -77.28 | 5.33 | -71.95 | -54 | -17.95 | peak |

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

**1GHz-12.75G**

| | | | |
|---|---|---|---|
| EUT： | 6W Soundboom speaker | Model Name： | P328.24 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010hPa | Test Voltage： | DC 3.7V |
| Test Mode： | π/4 DQPSK (TX 2402/2441/2480MHz) | | |

| Polar (H/V) | Frequency (MHz) | Reading Level (dBm) | Factor (dB) | Emission Level (dBm) | Limits (dBm) | Margin (dB) | Detector Type |
|---|---|---|---|---|---|---|---|
| **operation frequency:2402** | | | | | | | |
| V | 4804.168 | -47.66 | 8.90 | -38.76 | -30.00 | -8.76 | peak |
| V | 7206.039 | -53.48 | 4.57 | -48.91 | -30.00 | -18.91 | peak |
| H | 4804.169 | -51.08 | 8.90 | -42.18 | -30.00 | -12.18 | peak |
| H | 7206.116 | -50.85 | 4.57 | -46.28 | -30.00 | -16.28 | peak |
| **operation frequency:2441** | | | | | | | |
| V | 4882.262 | -47.60 | 9.34 | -38.26 | -30.00 | -8.26 | peak |
| V | 7323.217 | -52.21 | 4.45 | -47.76 | -30.00 | -17.76 | peak |
| H | 4882.399 | -52.66 | 9.34 | -43.32 | -30.00 | -13.32 | peak |
| H | 7323.117 | -51.62 | 4.45 | -47.17 | -30.00 | -17.17 | peak |
| **operation frequency:2480** | | | | | | | |
| V | 4960.234 | -45.26 | 9.77 | -35.49 | -30.00 | -5.49 | peak |
| V | 7440.190 | -54.72 | 4.33 | -50.39 | -30.00 | -20.39 | peak |
| H | 4960.039 | -47.39 | 9.77 | -37.62 | -30.00 | -7.62 | peak |
| H | 7440.222 | -51.09 | 4.33 | -46.76 | -30.00 | -16.76 | 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： | 6W Soundboom speaker | Model Name： | P328.24 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010hPa | Test Voltage： | DC 3.7V |
| 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 | 35.7221 | -89.29 | 11.29 | -78.00 | -57 | -21.00 | peak |
| V | 176.2026 | -90.17 | 12.07 | -78.10 | -57 | -21.10 | peak |
| V | 236.1871 | -87.33 | 10.55 | -76.78 | -57 | -19.78 | peak |
| V | 378.2122 | -93.68 | 7.03 | -86.65 | -57 | -29.65 | peak |
| V | 525.8481 | -93.24 | 5.62 | -87.62 | -57 | -30.62 | peak |
| V | 759.6960 | -95.52 | 3.38 | -92.14 | -57 | -35.14 | peak |
| H | 45.7905 | -90.82 | 9.7 | -81.12 | -57 | -24.12 | peak |
| H | 187.4526 | -95.09 | 11.05 | -84.04 | -57 | -27.04 | peak |
| H | 277.3353 | -96.71 | 8.3 | -88.41 | -57 | -31.41 | peak |
| H | 389.8124 | -93.28 | 6.76 | -86.52 | -57 | -29.52 | peak |
| H | 478.7043 | -95.52 | 5.37 | -90.15 | -57 | -33.15 | peak |
| H | 625.4951 | -96.16 | 5.05 | -91.11 | -57 | -34.11 | peak |

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

| | | | |
|---|---|---|---|
| EUT： | 6W Soundboom speaker | Model Name： | P328.24 |
| Temperature： | 26 ℃ | Relative Humidity： | 54% |
| Pressure： | 1010hPa | Test Voltage： | DC 3.7V |
| 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 | 1714.968 | -58.39 | 3.76 | -54.63 | -47 | -7.63 | peak |
| V | 2528.208 | -59.54 | 3.97 | -55.57 | -47 | -8.57 | peak |
| V | 3327.448 | -60.90 | 4.77 | -56.13 | -47 | -9.13 | peak |
| V | 6056.149 | -65.49 | 7.37 | -58.12 | -47 | -11.12 | peak |
| V | 7248.267 | -69.48 | 4.53 | -64.95 | -47 | -17.95 | peak |
| V | 8033.790 | -69.44 | 3.62 | -65.82 | -47 | -18.82 | peak |
| H | 1326.896 | -59.05 | 3.05 | -56.00 | -47 | -9.00 | peak |
| H | 2464.683 | -65.30 | 4.13 | -61.17 | -47 | -14.17 | peak |
| H | 4255.453 | -61.45 | 5.76 | -55.69 | -47 | -8.69 | peak |
| H | 5531.064 | -61.08 | 6.92 | -54.16 | -47 | -7.16 | peak |
| H | 7975.965 | -68.58 | 3.7 | -64.88 | -47 | -17.88 | peak |
| H | 9164.591 | -70.89 | 1.82 | -69.07 | -47 | -22.07 | 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<br>2 503,5 | -53 | CW |
| $P_{min}$ + 6 dB | 2 300<br>2 330<br>2 360 | -47 | CW |
| $P_{min}$ + 6 dB | 2 523,5<br>2 553,5<br>2 583,5<br>2 613,5<br>2 643,5<br>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.<br>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<br>2 503,5 | -57 | CW |
| $P_{min}$ + 6 dB | 2 300<br>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.<br>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<br>2 503,5 | -57 | CW |
| $P_{min}$ + 12 dB | 2 300<br>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.<br>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 | 0.35 |
| 2480 | π/4-DQPSK | 1 | 2380, 2503.5 | -84.7+6 | -57.58 | 0.33 |
| 2480 | π/4-DQPSK | 1 | 2 300 2 583,5 | -84.7+6 | -47.58 | 0.30 |

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.

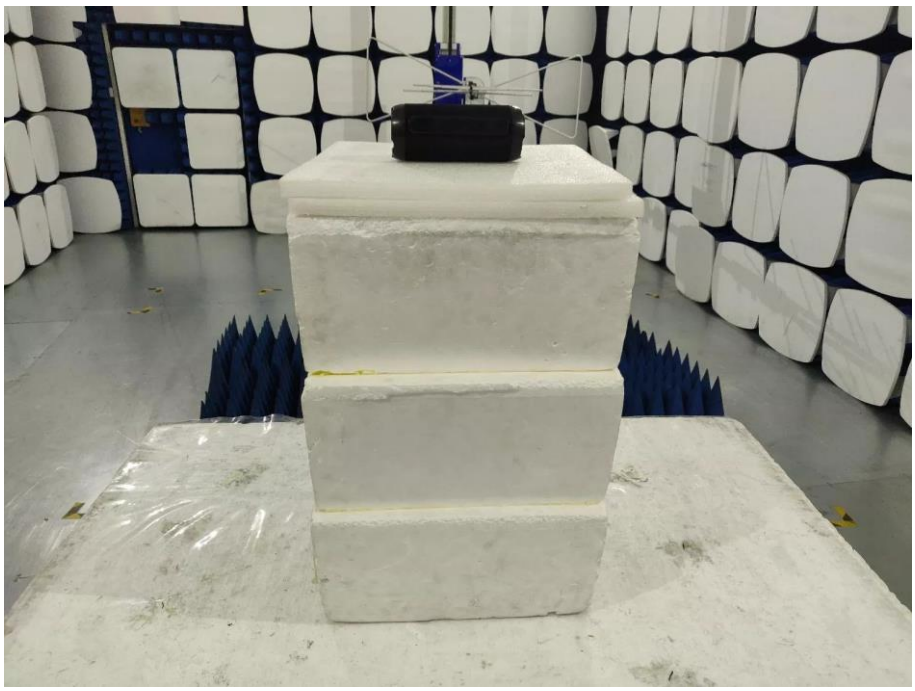
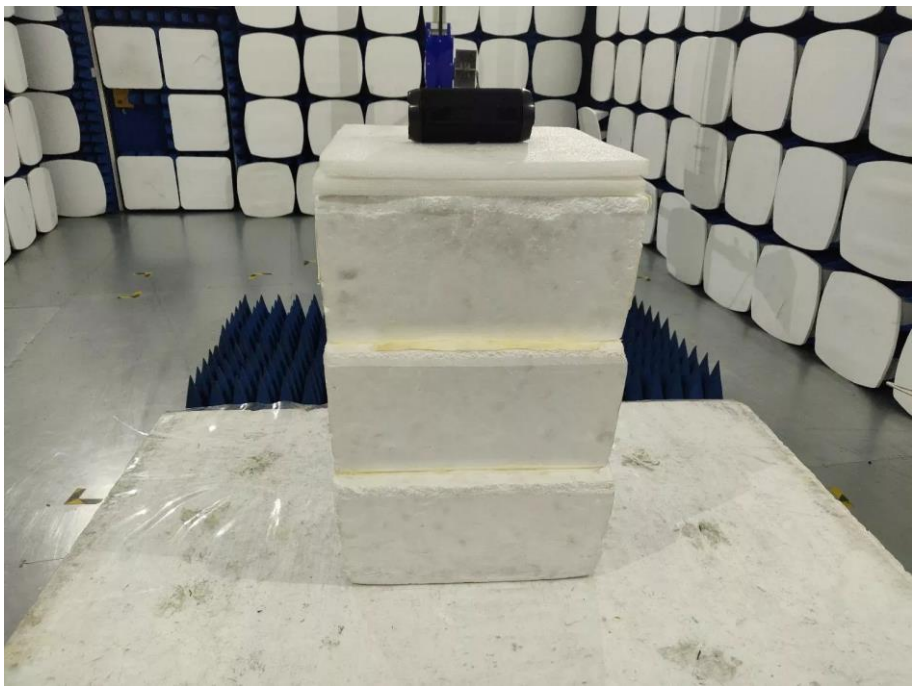
5.10.3 Test Procedures

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.): 0.778dBm

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: 1.1724MHz
- 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

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 3.7V

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.: MTi19070101-3E1-1.

**----END OF REPORT----**