

RADIO TEST REPORT

For

Shantou Chaoyang District Shengtana Electronic Factory

Bluetooth headphone

Test Model: STN-16

Additional Model No.:

S450,S460,STN--019,STN-05,STN-07,STN-08,STN-10,STN-11,STN-12,STN-13,STN-16,STN-17,STN-18,STN-19,B60,B61,B62,B63,B64,B65,B74,B20,HPBT345,HPBT380,HPBT365,FBHP385

Prepared for : Shantou Chaoyang District Shengtana Electronic Factory
Electronic Factory
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Serial number : Prototype
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RADIO TEST REPORT
ETSI EN 300 328 V2.1.1 (2016-11)

Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques;
 Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

Report Reference No. : **LCS170718010AE**

Date of Issue : August 26,2017

Testing Laboratory Name : **Shenzhen LCS Compliance Testing Laboratory Ltd.**

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 Bao'an District, Shenzhen, Guangdong, China

Testing Location/ Procedure : Full application of Harmonised standards
 Partial application of Harmonised standards
 Other standard testing method

Applicant's Name..... : **Shantou Chaoyang District Shengtena Electronic Factory**

Address : Gounan Village Industrial Area, Gurao, Chaoyang District, Shantou
 City, China

Test Specification

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

Test Report Form No. : LCSEMC-1.0

TRF Originator..... : Shenzhen LCS Compliance Testing Laboratory Ltd.

Master TRF : Dated 2017-02

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Test Item Description. : Bluetooth headphone

Trade Mark..... : N/A

Test Model : STN-16

Ratings : DC 3.7V by battery (150mAh)
 Recharge Voltage: 5V $\overline{\sim}$, 0.5A

Result : **Positive**

Compiled by:

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Glin Lu

Glin Lu/ Technique principal

Approved by:



Gavin Hoang, Manager

Revision History

| Revision | Issue Date | Revisions | Revised By |
|----------|----------------|---------------|-------------|
| 00 | August 26,2017 | Initial Issue | Gavin Liang |
| | | | |
| | | | |

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1. GENERAL INFORMATION

1.1. Product Description for Equipment Under Test (EUT)

| | |
|---------------------|---|
| EUT | : Bluetooth headphone |
| Model Number | : S450,S460,STN--019,STN-05,STN-07,STN-08,STN-10,STN-11,STN-12,STN-13,STN-16,STN-17,STN-18,STN-19,B60,B61,B62,B63,B64,B65,B74,B20,HPBT345,HPBT380,HPBT365,FBHP385 |
| Model Declaration | : PCB board, structure and internal of these model(s) are the same, So no additional models were tested. |
| Test Model | : STN-16 |
| Power Supply | : DC 3.7V by battery (150mAh) Charging voltage: 5V ⁻ , 0.5A |
| Hardware Version | : V4.0 |
| Software Version | : V4.00 |
| Bluetooth | : |
| Frequency Range | : 2402.00-2480.00MHz |
| Channel Number | : 79 channels |
| Channel Spacing | : 1MHz |
| Modulation Type | : GFSK, $\pi/4$ -DQPSK, 8-DPSK |
| Bluetooth Version | : Bluetooth 4.2 |
| Antenna Description | : Internal Antenna, 1.2dBi(Max.) |

1.2. Objective

This Type approval report is prepared on behalf of **Shantou Chaoyang District Shengtana Electronic Factory** in accordance with ETSI EN 300 328 V2.1.1 (2016-11), Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.

The objective is to determine compliance with ETSI EN 300 328 V2.1.1 (2016-11).

1.3. Related Submittal(s)/Grant(s)

No Related Submittals.

1.4. Test Methodology

All measurements contained in this report were conducted with ETSI EN 300 328 V2.1.1 (2016-11).

1.5. Description of Test Facility

CNAS Registration Number. is L4595.
FCC Registration Number. is 899208.
Industry Canada Registration Number. is 9642A-1.
ESMD Registration Number. is ARCB0108.
UL Registration Number. is 100571-492.
TUV SUD Registration Number. is SCN1081.
TUV RH Registration Number. is UA 50296516-001

1.6. Support equipment List

| Manufacturer | Description | Model | Serial Number | Certificate |
|--------------|-------------|-------|---------------|-------------|
| -- | -- | -- | -- | -- |

1.7. External I/O

| I/O Port Description | Quantity | Cable |
|----------------------|----------|-------|
| Charge Interface | 1 | N/A |

1.8. List of Measuring Equipment

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Cal Date | Due Date |
|---|----------------|----------------------------------|--------------|--------------------|------------|------------|
| EMC Receiver | R&S | ESCS 30 | 100174 | 9kHz – 2.75GHz | 2017-06-18 | 2018-06-17 |
| Signal analyzer | Agilent | E4448A(External mixers to 40GHz) | US44300469 | 9kHz~40GHz | 2017-06-18 | 2018-06-17 |
| LISN | MESS Tec | NNB-2/16Z | 99079 | 9KHz-30MHz | 2017-06-18 | 2018-06-17 |
| LISN (Support Unit) | EMCO | 3819/2NM | 9703-1839 | 9KHz-30MHz | 2017-06-18 | 2018-06-17 |
| RF Cable-CON | UTIFLEX | 3102-26886-4 | CB049 | 9KHz-30MHz | 2017-06-18 | 2018-06-17 |
| ISN | SCHAFFNER | ISN ST08 | 21653 | 9KHz-30MHz | 2017-06-18 | 2018-06-17 |
| 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M | 03CH03-HY | 30M-18GHz | 2017-06-18 | 2018-06-17 |
| Amplifier | SCHAFFNER | COA9231A | 18667 | 9kHz-2GHz | 2017/04/18 | 2018/04/17 |
| Amplifier | Agilent | 8449B | 3008A02120 | 1GHz-26.5GHz | 2017/04/18 | 2018/04/17 |
| Amplifier | MITEQ | AMF-6F-260400 | 9121372 | 26.5GHz-40GHz | 2017/04/18 | 2018/04/17 |
| Loop Antenna | R&S | HFH2-Z2 | 860004/001 | 9k-30MHz | 2017/04/18 | 2018/04/17 |
| By-log Antenna | SCHWARZBECK | VULB9163 | 9163-470 | 30MHz-1GHz | 2017/04/18 | 2018/04/17 |
| Horn Antenna | EMCO | 3115 | 6741 | 1GHz-18GHz | 2017/04/18 | 2018/04/17 |
| Horn Antenna | SCHWARZBECK | BBHA9170 | BBHA9170154 | 15GHz-40GHz | 2017/04/18 | 2018/04/17 |
| RF Cable-R03m | Jye Bao | RG142 | CB021 | 30MHz-1GHz | 2017-06-18 | 2018-06-17 |
| RF Cable-HIGH | SUHNER | SUCOFLEX 106 | 03CH03-HY | 1GHz-40GHz | 2017-06-18 | 2018-06-17 |
| Power Meter | R&S | NRVS | 100444 | DC-40GHz | 2017-06-18 | 2018-06-17 |
| Power Sensor | R&S | NRV-Z51 | 100458 | DC-30GHz | 2017-06-18 | 2018-06-17 |
| Power Sensor | R&S | NRV-Z32 | 10057 | 30MHz-6GHz | 2017-06-18 | 2018-06-17 |
| AC Power Source | HPC | HPA-500E | HPA-9100024 | AC 0~300V | 2017-06-18 | 2018-06-17 |
| DC power Source | GW | GPC-6030D | C671845 | DC 1V-60V | 2017-06-18 | 2018-06-17 |
| Temp. and Humidity Chamber | Giant Force | GTH-225-20-S | MAB0103-00 | N/A | 2017-06-18 | 2018-06-17 |
| RF CABLE-1m | JYE Bao | RG142 | CB034-1m | 20MHz-7GHz | 2017-06-18 | 2018-06-17 |
| RF CABLE-2m | JYE Bao | RG142 | CB035-2m | 20MHz-1GHz | 2017-06-18 | 2018-06-17 |
| Signal Generator | R&S | SMR40 | 10016 | 10MHz~40GHz | 2017/07/16 | 2018/07/15 |
| Universal Radio Communication Tester | R&S | CMU200 | 112012 | N/A | 2016/10/27 | 2017/10/26 |
| Wideband Radio Communication Tester | R&S | CMW500 | 1201.0002K50 | N/A | 2016/11/19 | 2017/11/18 |
| MXG Vector Signal Generator | Agilent | N5182A | MY47071151 | 250KHz~6GHz | 2016/10/27 | 2017/10/26 |
| MXG Vector Signal Generator | Agilent | E4438C | MY42081396 | 250KHz~6GHz | 2016/10/27 | 2017/10/26 |
| PSG Analog Signal Generator | Agilent | N8257D | MY46520521 | 250KHz~20GHz | 2016/11/19 | 2017/11/18 |
| MXA Signal Analyzer | Agilent | N9020A | MY50510140 | 10Hz~26.5GHz | 2016/10/27 | 2017/10/26 |
| DC Power Supply | Agilent | E3642A | / | 0-8V,5A/0-20V,2.5A | 2016/05/20 | 2017/05/19 |
| RF Control Unit | Tonscend | JS0806-1 | / | / | 2016/11/19 | 2017/11/18 |
| LTE Test Software | Tonscend | JS1120-1 | / | Version: 2.5.7.0 | N/A | N/A |
| X-series USB Peak and Av | Agilent | U2021XA | MY54080022 | / | 2016/10/27 | 2017/10/26 |
| 4 Ch.Simultaneous Sampling 14 Bits 2 MS/s | Agilent | U2531A | MY54080016 | / | 2016/10/27 | 2017/10/26 |
| Test Software | Ascentest | AT890-SW | 20141230 | Version: 20160630 | N/A | N/A |
| Splitter/Combiner(Qty: 2) | Mini-Circuits | ZAPD-50W 4.2-6.0 GHz | NN256400424 | / | 2016/10/27 | 2017/10/26 |
| Splitter/Combine(Qty: 2) | MCLI | PS3-7 | 4463/4464 | / | 2016/10/27 | 2017/10/26 |
| ATT (Qty: 1) | Mini-Circuits | VAT-30+ | 30912 | / | 2016/10/27 | 2017/10/26 |

1.9. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| Parameter | Uncertainty |
|-----------------------------------|-------------|
| Occupied Channel Bandwidth | 5 % |
| RF output power, conducted | 1,5 dB |
| Power Spectral Density, conducted | 3 dB |
| Unwanted Emissions, conducted | 3 dB |
| All emissions, radiated | 6 dB |
| Temperature | 1 °C |
| Humidity | 5 % |
| DC and low frequency voltages | 3 % |
| Time | 5 % |
| Duty Cycle | 5 % |

1.10. Test Environment

| Items | Required (IEC 68-1) | Actual |
|----------------------------|---------------------|----------|
| Temperature (°C) | 15-35 | 21 |
| Humidity (%RH) | 25-75 | 50 |
| Barometric pressure (mbar) | 860-1060 | 950-1000 |

1.11. Description Of Test Modes

LCS has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

| Test Mode |
|--------------------------|
| Mode 1: Transmit by DH1 |
| Mode 2: Transmit by 2DH1 |
| Mode 3: Transmit by 3DH1 |
| Mode 4: Receive by DH1 |
| Mode 5: Receive by 2DH1 |
| Mode 4: Receive by 3DH1 |

Note:

- (1) For portable device, radiated spurious emission was verified over X, Y, Z Axis, and shown the worst case on this report.
- (2) Regards to the frequency band operation for systems using FHSS modulation: normal operation (hopping) was selected to test for conducted, and the lowest, highest frequency channel for radiation spurious test.
- (3) The extreme test condition for voltage and temperature were declared by the manufacturer.

2. SYSTEM TEST CONFIGURATION

2.1. Justification

The system was configured for testing in engineering mode.

2.2. EUT Exercise Software

N/A.

2.3. Special Accessories

N/A.

2.4. Block Diagram/Schematics

Please refer to the related document.

2.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

2.6. Configuration of Test Setup

Please refer to the test setup photo.

3. SUMMARY OF TEST RESULT

- No deviations from the test standards
 Deviations from the test standards as below description:

Technical requirements for Frequency Hopping equipment:

| Performed Test Item | Normative References | Test Performed | Result |
|--|----------------------------------|----------------|--------|
| RF Output Power & Receiver Category | ETSI EN 300 328 V2.1.1 (2016-11) | Yes | Pass |
| Duty cycle, Tx-Sequence, Tx-gap | ETSI EN 300 328 V2.1.1 (2016-11) | N/A | N/A |
| Accumulated Transmit Time, Frequency Occupation and Hopping Sequence | ETSI EN 300 328 V2.1.1 (2016-11) | Yes | Pass |
| Hopping Frequency Separation | ETSI EN 300 328 V2.1.1 (2016-11) | Yes | Pass |
| Medium Utilisation (MU) factor | ETSI EN 300 328 V2.1.1 (2016-11) | N/A | N/A |
| Adaptivity (Adaptive Frequency Hopping) | ETSI EN 300 328 V2.1.1 (2016-11) | N/A | N/A |
| Occupied Channel Bandwidth | ETSI EN 300 328 V2.1.1 (2016-11) | Yes | Pass |
| Transmitter unwanted emissions in the out-of-band domain | ETSI EN 300 328 V2.1.1 (2016-11) | Yes | Pass |
| Transmitter unwanted emissions in the spurious domain | ETSI EN 300 328 V2.1.1 (2016-11) | Yes | Pass |
| Receiver Spurious Emissions | ETSI EN 300 328 V2.1.1 (2016-11) | Yes | Pass |
| Receiver Blocking | ETSI EN 300 328 V2.1.1 (2016-11) | Yes | Pass |

Note:

The EUT can operate in an adaptive mode, and can't operate in a non-adaptive mode which is stated by the supplier.

4. RF OUTPUT POWER & Receiver Category

4.1. Limit

For non-adaptive frequency hopping systems

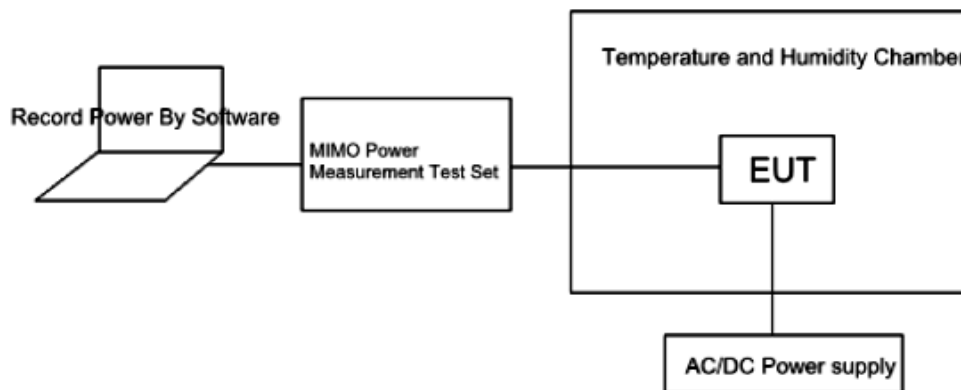
The maximum RF output power for non-adaptive Frequency Hopping equipment shall be declared by the supplier. The maximum RF output power for this equipment shall be equal to or less than the value declared by the supplier. This declared value shall be equal to or less than 20 dBm.

For adaptive frequency hopping systems

The maximum RF output power for adaptive Frequency Hopping equipment shall be equal to or less than 20 dBm.

4.2. Test Setup

For Conducted Measurement



4.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.2

Step 1:

- The fast power sensor use the following setting: Sample speed 1 MS/s.

Step 2:

- Connect the power sensor to the transmit port, sample the transmit signal and store the raw data. Use these stored samples in all following steps.

Step 3:

- Find the start and stop times of each burst in the stored measurement samples.

Step 4:

- Between the start and stop times of each individual burst calculate the RMS power over the burst. Save these P_{burst} values, as well as the start and stop times for each burst.

Step 5:

- The highest of all P_{burst} values (value "A" in dBm) will be used for maximum e.i.r.p. calculations.

Step 6:

- Add the (stated) antenna assembly gain "G" in dBi of the individual antenna.
- If applicable, add the additional beamforming gain "Y" in dB.

The RF Output Power (P) shall be calculated using the formula below:

$$P = A + G + Y$$

4.4. Test Result

Pass

***Note: 20 bursts had been captured for power measurement.

| | | |
|-----------|---|-------------------------|
| Product | : | bluetooth earphone |
| Test Item | : | RF Output Power |
| Test Mode | : | Mode 1: Transmit by DH1 |

| Test Conditions | | Frequency (MHz) | RF Output Power EIRP (dBm) | Limit (dBm) |
|-----------------|----------------|-----------------|----------------------------|-------------|
| Tnom (25°C) | Vnom (DC 3.7V) | 2402 | 3.22 | 20 |
| | | 2441 | 3.46 | |
| | | 2480 | 4.20 | |
| Tmax (45°C) | Vmax (DC 4.2V) | 2402 | 3.23 | 20 |
| | | 2441 | 3.62 | |
| | | 2480 | 4.18 | |
| Tmax (45°C) | Vmin (DC 3.3V) | 2402 | 3.29 | 20 |
| | | 2441 | 3.65 | |
| | | 2480 | 4.01 | |
| Tmin (-20°C) | Vmax (DC 4.2V) | 2402 | 3.27 | 20 |
| | | 2441 | 3.52 | |
| | | 2480 | 3.80 | |
| Tmin (-20°C) | Vmin (DC 3.3V) | 2402 | 3.31 | 20 |
| | | 2441 | 3.50 | |
| | | 2480 | 3.92 | |

| | | |
|-----------|---|--------------------------|
| Product | : | bluetooth earphone |
| Test Item | : | RF Output Power |
| Test Mode | : | Mode 2: Transmit by 2DH1 |

| Test Conditions | | Frequency (MHz) | RF Output Power EIRP (dBm) | Limit (dBm) |
|-----------------|----------------|-----------------|----------------------------|-------------|
| Tnom (25°C) | Vnom (DC 3.7V) | 2402 | 2.54 | 20 |
| | | 2441 | 2.79 | |
| | | 2480 | 3.54 | |
| Tmax (45°C) | Vmax (DC 4.2V) | 2402 | 2.59 | 20 |
| | | 2441 | 3.01 | |
| | | 2480 | 3.52 | |
| Tmax (45°C) | Vmin (DC 3.3V) | 2402 | 2.63 | 20 |
| | | 2441 | 3.04 | |
| | | 2480 | 3.46 | |
| Tmin (-20°C) | Vmax (DC 4.2V) | 2402 | 2.74 | 20 |
| | | 2441 | 2.90 | |
| | | 2480 | 3.19 | |
| Tmin (-20°C) | Vmin (DC 3.3V) | 2402 | 2.70 | 20 |
| | | 2441 | 2.89 | |
| | | 2480 | 3.34 | |

| | | |
|-----------|---|--------------------------|
| Product | : | bluetooth earphone |
| Test Item | : | RF Output Power |
| Test Mode | : | Mode 3: Transmit by 3DH1 |

| Test Conditions | | Frequency (MHz) | RF Output Power EIRP (dBm) | Limit (dBm) |
|-----------------|----------------|-----------------|----------------------------|-------------|
| Tnom (25°C) | Vnom (DC 3.7V) | 2402 | 2.61 | 20 |
| | | 2441 | 2.83 | |
| | | 2480 | 3.69 | |
| Tmax (45°C) | Vmax (DC 4.2V) | 2402 | 2.72 | 20 |
| | | 2441 | 3.03 | |
| | | 2480 | 3.55 | |
| Tmax (45°C) | Vmin (DC 3.3V) | 2402 | 2.77 | 20 |
| | | 2441 | 3.11 | |
| | | 2480 | 3.50 | |
| Tmin (-20°C) | Vmax (DC 4.2V) | 2402 | 2.72 | 20 |
| | | 2441 | 3.01 | |
| | | 2480 | 3.21 | |
| Tmin (-20°C) | Vmin (DC 3.3V) | 2402 | 2.79 | 20 |
| | | 2441 | 2.85 | |
| | | 2480 | 3.35 | |

4.5. Receiver Category

Receiver Category 1: Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p. shall be considered as receiver category 1 equipment.

Receiver Category 2: Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % or adaptive equipment with a maximum RF output power of 10 dBm e.i.r.p. shall be considered as receiver category 2 equipment.

Receiver Category 3: Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % or adaptive equipment with a maximum RF output power of 0 dBm e.i.r.p. shall be considered as receiver category 3 equipment.

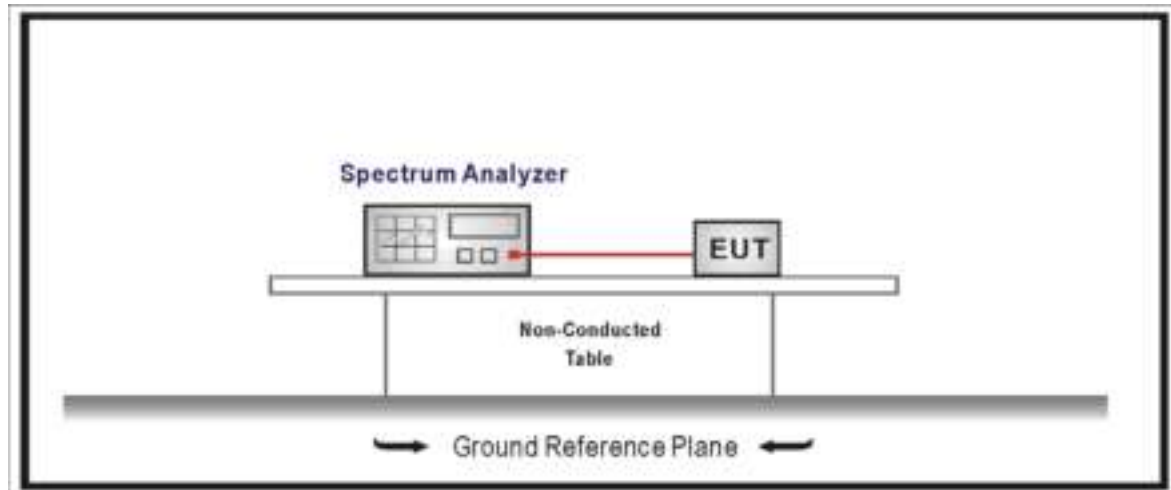
As this an adaptivity device with a maximum power of 3.01dBm, **it belongs to receiver category 2.**

5. DUTY CYCLE, TX-SEQUENCE, TX-GAP

5.1. Limit

For non-adaptive FHSS equipment, the Duty Cycle shall be equal to or less than the maximum value declared by the supplier. In addition, the maximum Tx-sequence time shall be 5 ms while the minimum Tx-gap time shall be 5 ms.

5.2. Test Setup



5.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.2

5.4. Test Result

These requirements apply to non-adaptive frequency hopping equipment or to adaptive frequency hopping equipment operating in a non-adaptive mode.

These requirements do not apply for equipment with a maximum declared RF Output power of less than 10dBm E.I.R.P. or for equipment when operating in a mode where the RF Output power is less than 10dBm E.I.R.P.

No applicable.

6. ACCUMULATED TRANSMIT TIME, FREQUENCY OCCUPATION AND HOPPING SEQUENCE

6.1. Limit

For non-adaptive frequency hopping systems

The Accumulated Transmit Time on any hopping frequency shall not be greater than 15 ms within any observation period of 15 ms 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 $((1 / U) \times 25 \%)$ and 77 % where U is the number of hopping frequencies in use.

The hopping sequence(s) shall contain at least N hopping frequencies where N is either 5 or the result of 15 MHz divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater.

For adaptive frequency hopping systems

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 400 ms within any observation period of 400 ms multiplied by the minimum number of hopping frequencies (N) that have to be used.

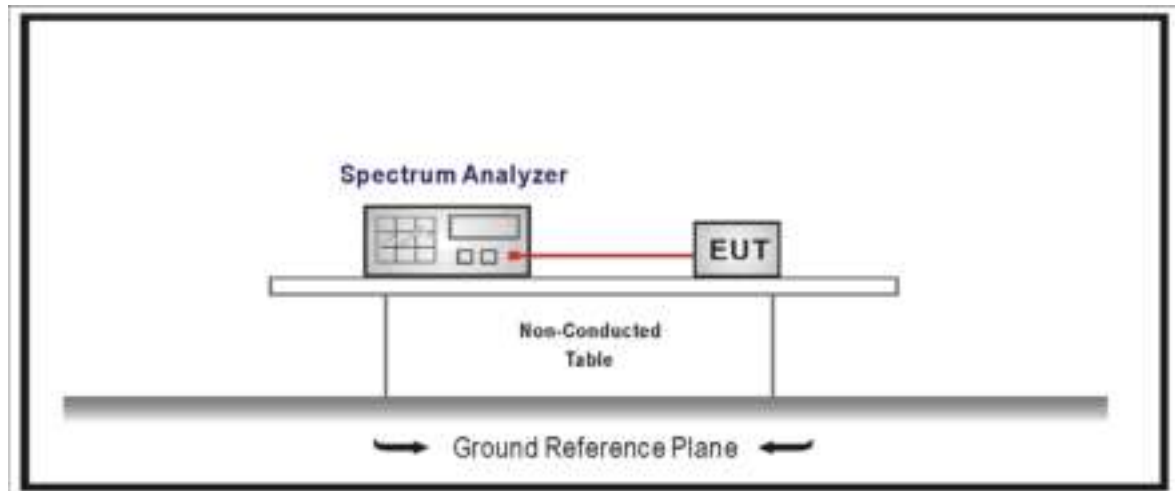
In order for the equipment to comply with the Frequency Occupation requirement, it shall meet either of the following two options:

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 $((1 / U) \times 25 \%)$ 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.

6.2. Test Setup



6.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.4

Step 1:

- The output of the transmitter shall be connected to a spectrum analyzer or equivalent.
- The analyzer shall be set as follows:
 - Centre Frequency: Equal to the hopping frequency being investigated
 - Frequency Span: 0 Hz
 - RBW: ~ 50 % of the Occupied Channel Bandwidth (we set RBW=500KHz)
 - VBW: \geq RBW (we set RBW=1500KHz)
 - Detector Mode: RMS
 - Sweep time: Equal to the applicable observation period (we set $400\text{ms} \times 79 = 31600\text{ms}$)
 - Number of sweep points: 30 000
 - Trace mode: Clear / Write
 - Trigger: Free Run

Step 2:

- Save the trace data to a file for further analysis by a computing device using an appropriate software application or program.

Step 3:

- Identify the data points related to the frequency being investigated by applying a threshold. The data points resulting from transmissions on the hopping frequency being investigated are assumed to have much higher levels compared to data points resulting from transmissions on adjacent hopping frequencies. If a clear determination between these transmissions is not possible, the RBW in step 1 shall be further reduced. In addition, a channel filter may be used.
- Count the number of data points identified as resulting from transmissions on the frequency being investigated and multiply this number by the time difference between two consecutive data points.

Step 4:

- The result in step 3 is the Accumulated Transmit Time which shall comply with the limit provided in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2 and which shall be recorded in the test report.

Step 5:

- Make the following changes on the analyzer and repeat steps 2 and 3.
Sweep time: $4 \times \text{Dwell Time} \times \text{Actual number of hopping frequencies in use}$
The hopping frequencies occupied by the equipment without having transmissions during the dwell time (blacklisted frequencies) should be taken into account in the actual number of hopping frequencies in use. If this number cannot be determined (number of blacklisted frequencies unknown) it shall be assumed that the equipment uses the maximum possible number of hopping frequencies.
- The result shall be compared to the limit for the Frequency Occupation defined in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2. The result of this comparison shall be recorded in the test report.

Step 6:

- Make the following changes on the analyzer:
 - Start Frequency: 2 400 MHz
 - Stop Frequency: 2 483,5 MHz
 - RBW: ~ 50 % of the Occupied Channel Bandwidth (single hop) (we set RBW=500KHz)
 - VBW: \geq RBW (we set RBW=1500KHz)
 - Detector Mode: RMS
 - Sweep time: 1s
 - Trace Mode: Max Hold
 - Trigger: Free Run
- Wait for the trace to stabilize. Identify the number of hopping frequencies used by the hopping sequence.
- The result shall be compared to the limit (value N) defined in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2. This value shall be recorded in the test report. For equipment with blacklisted frequencies, it might not be possible to verify the number of hopping frequencies in use. However they shall comply with the requirement for Accumulated Transmit Time and Frequency Occupation assuming the minimum number of hopping frequencies (N) defined in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2 is used.

Step 7:

- For adaptive equipment, using the lowest and highest -20 dB points from the total spectrum envelope obtained in step 6, it shall be verified whether the equipment uses 70 % of the band specified in clause 1. The result shall be recorded in the test report.

6.4. Test Result

| | | |
|-------------|---|---------------------|
| Product | : | Bluetooth headphone |
| Test Result | : | Pass |

Accumulated Transmit Time

| Packet | One Pulse time (ms) | Accumulated Dwell Time (ms) | Measure Time (ms) | Limit | Conclusion |
|--------|------------------------|--------------------------------|----------------------|--------|------------|
| DH1 | 0.50 | 122.15 | 31600 | <400ms | PASS |
| DH3 | 1.58 | 242.02 | | | |
| DH5 | 2.86 | 317.95 | | | |

Remark: Only record the worst data.

Min. Frequency Occupation Time

| Mode | Min. frequency occupation Time(ms) | Measure Time (ms) | Conclusion |
|------|---------------------------------------|----------------------|------------|
| DH1 | 0.30 | 119.97 | PASS |
| DH3 | 3.19 | 511.92 | PASS |
| DH5 | 11.46 | 899.90 | PASS |

Remark: Only record the worst data.

Hopping Channel & Hopping Sequence

| Mode | Number of hopping channel | Limit | Conclusion |
|------|---------------------------|-------|------------|
| GFSK | 79 | >15 | PASS |
| Mode | Hopping Sequence(%) | Limit | Conclusion |
| GFSK | 95.50% | >70% | PASS |

Remark: Only record the worst data.

7. HOPPING FREQUENCY SEPARATION

7.1. Limit

For non-adaptive equipment

For non-adaptive Frequency Hopping equipment, the Hopping Frequency Separation shall be equal or greater than the Occupied Channel Bandwidth, with a minimum separation of 100 kHz.

For equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for non-adaptive Frequency Hopping equipment operating in a mode where the RF Output power is less than 10 dBm e.i.r.p. only the minimum Hopping Frequency Separation of 100 kHz applies.

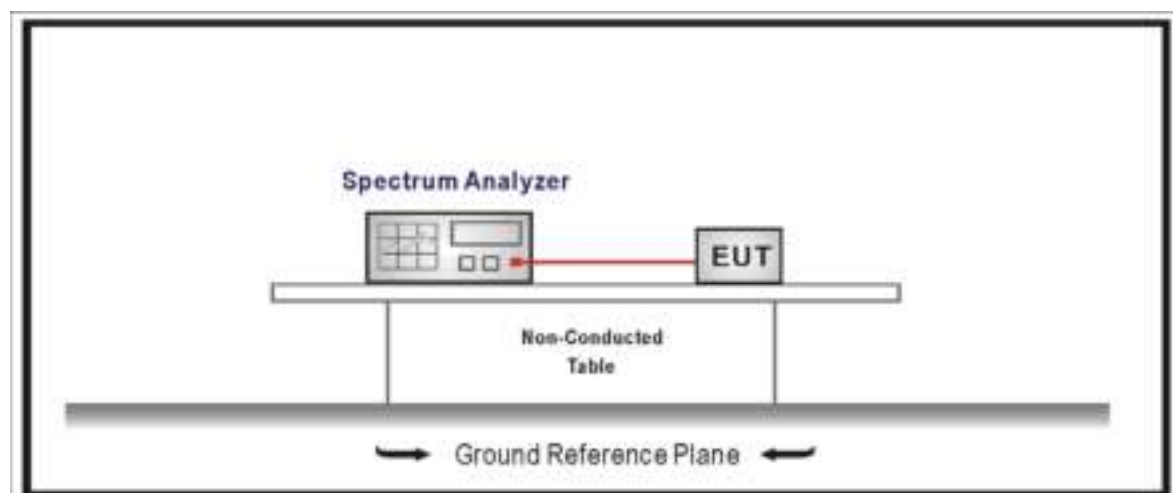
For adaptive equipment

For adaptive Frequency Hopping equipment, the minimum Hopping Frequency Separation shall be 100 kHz.

Adaptive Frequency Hopping equipment, which for one or more hopping frequencies, has switched to a non-adaptive mode because interference was detected on all these hopping positions with a level above the threshold level defined in clause 4.3.1.7.2.2 or clause 4.3.1.7.3.2, is allowed to continue to operate with a minimum Hopping Frequency Separation of 100 kHz on these hopping frequencies as long as the interference is present on these frequencies. The equipment shall continue to operate in an adaptive mode on other hopping frequencies.

Adaptive Frequency Hopping equipment which decided to operate in a non-adaptive mode on one or more hopping frequencies without the presence of interference, shall comply with the limit in clause 4.3.1.5.3.1 for these hopping frequencies as well as with all other requirements applicable to non-adaptive frequency hopping equipment.

7.2. Test Setup



7.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.5

The analyzer was setting as follow:

- Centre Frequency: Centre of the two adjacent hopping frequencies
- Frequency Span: Sufficient to see the complete power envelope of both hopping frequencies
- RBW: 1 % of the span (we set RBW=30KHz)
- VBW: 3 × RBW (we set VBW=100KHz)
- Detector Mode: RMS
- Trace Mode: Max Hold
- Sweep time: 1s

7.4. Test Result

| | | |
|-------------|---|------------------------------|
| Product | : | Bluetooth headphone |
| Test Item | : | Hopping Frequency Separation |
| Test Result | : | Pass |

| Mode | Result (MHz) | Limit (MHz) | Conclusion |
|------|--------------|-------------|------------|
| DH1 | 1.02 | ≥ 0.1 | PASS |
| 2DH1 | 1.02 | ≥ 0.1 | |
| 3DH1 | 1.02 | ≥ 0.1 | |

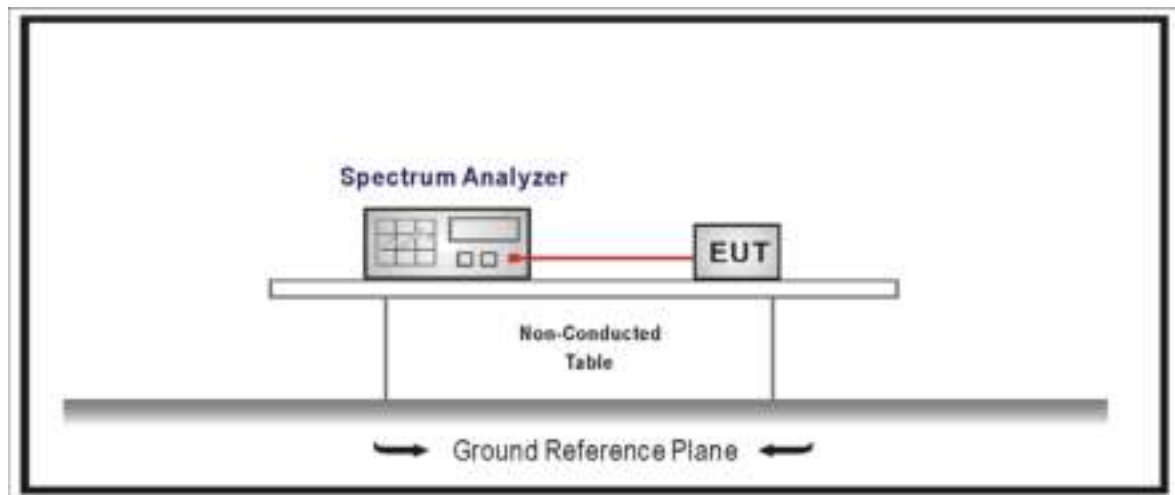
8. MEDIUM UTILISATION (MU) FACTOR

8.1. Limit

For non-adaptive equipment

The maximum Medium Utilization factor for non-adaptive Frequency Hopping equipment shall be 10 %.

8.2. Test Setup



8.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.2

8.4. Test Result

This requirement does not apply to adaptive equipment unless operating in a non-adaptive mode.

In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10dBm E.I.R.P. or for equipment when operating in a mode where the RF Output power is less than 10dBm E.I.R.P.

No applicable.

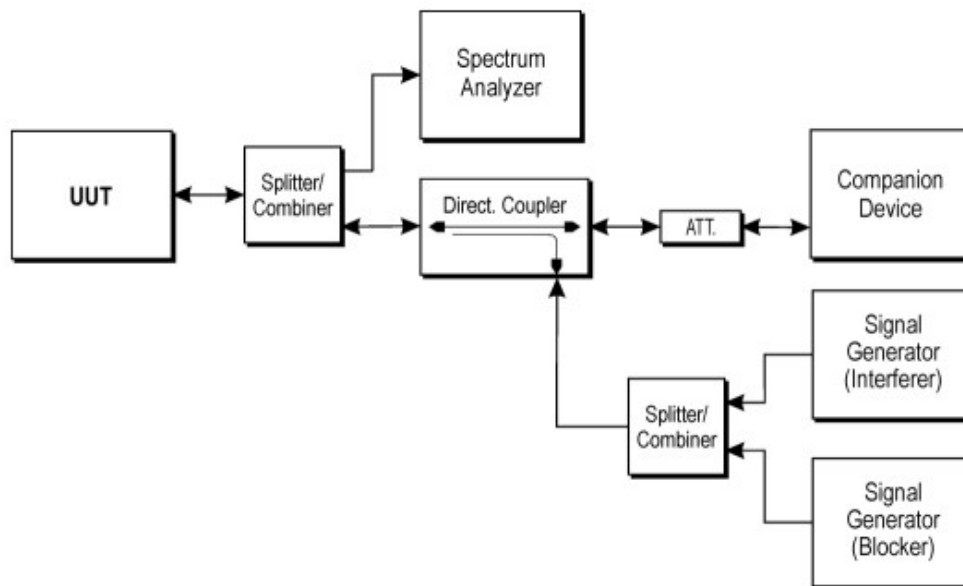
9. ADAPTIVITY (ADAPTIVE FREQUENCY HOPPING)

9.1. Limit

| Adaptivity Limit | |
|-------------------------------------|--|
| <input type="checkbox"/> | <p>LBT based Detect and Avoid</p> <p>--- The CCA observation time shall be not less than 0,2 % of the Channel Occupancy Time with a minimum of 18 μs.;</p> <p>--- COT ≤ 60 ms;</p> <p>--- Idle Period = 5% of COT with a minimum of 100 μs;</p> <p>--- Detection threshold level = -70 dBm/MHz + (20 dBm - Pout e.i.r.p)/1 MHz (Pout in dBm)</p> |
| <input checked="" type="checkbox"/> | <p>Non-LBT based Detect and Avoid</p> <p>--- The frequency shall remain unavailable for a minimum time equal to 1 second or 5 times the actual number of hopping frequencies in the current (adapted) channel map used by the equipment, multiplied with the Channel Occupancy Time whichever is the longest.</p> <p>--- COT ≤ 40 ms;</p> <p>--- For equipment using a dwell time > 40 ms that want to have other transmissions during the same hop (dwell time) an Idle Period (no transmissions) of minimum 5 % of the Channel Occupancy Period with a minimum of 100 μs shall be implemented.</p> <p>--- Detection threshold level = -70 dBm/MHz + (20 dBm - Pout e.i.r.p)/1 MHz (Pout in dBm)</p> |
| <input type="checkbox"/> | <p>Short Control Signalling Transmissions:</p> <p>--- Short Control Signalling Transmissions shall have a maximum TxOn / (TxOn + TxOff) ratio of 10 % within any observation period of 50 ms or within an observation period equal to the dwell time, whichever is the shorter.</p> |

9.2. Test Setup

Conducted measurements



9.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.6

9.4. Test Result

This requirement does not apply to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode providing the equipment complies with the requirements and/or restrictions applicable to non-adaptive equipment.

In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10dBm E.I.R.P. or for equipment when operating in a mode where the RF Output power is less than 10dBm E.I.R.P.

No applicable.

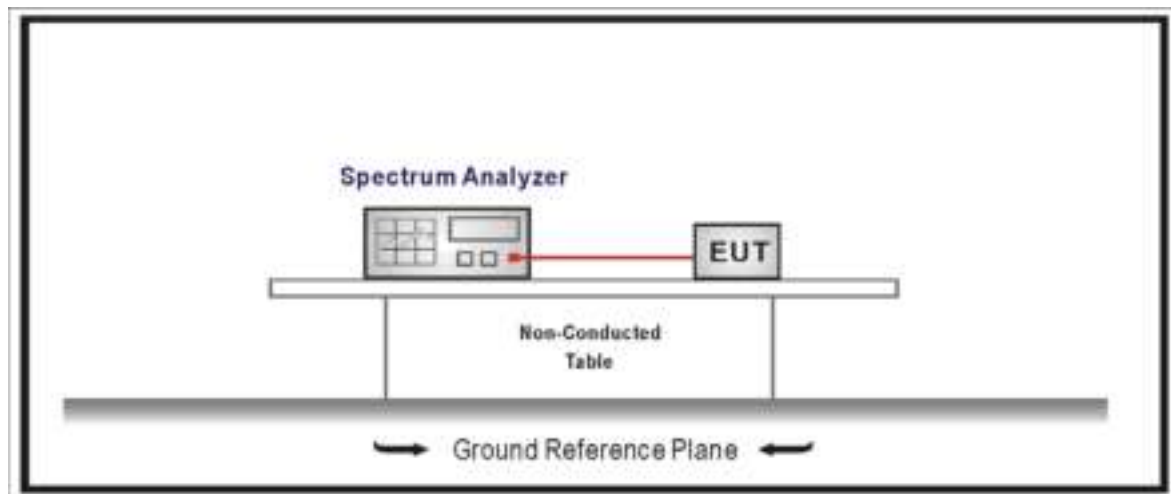
10. OCCUPIED CHANNEL BANDWIDTH

10.1. Limit

The Occupied Channel Bandwidth for each hopping frequency shall fall completely within the band 2.4GHz to 2.4835GHz.

For non-adaptive Frequency Hopping equipment with E.I.R.P greater than 10dBm, the Occupied Channel Bandwidth for every occupied hopping frequency shall be equal to or less than the value declared by the supplier. This declared value shall not be greater than 5 MHz.

10.2. Test Setup



10.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.7

Step 1:

Connect the UUT to the spectrum analyser and use the following settings:

- Centre Frequency: The centre frequency of the channel under test
- Resolution BW: ~ 1 % of the span without going below 1 % (We set RBW=20KHz)
- Video BW: $3 \times$ RBW (We set VBW=60KHz)
- Frequency Span: $2 \times$ Occupied Channel Bandwidth (We set Span=2MHz)
- Detector Mode: RMS
- Trace Mode: Max Hold

Step 2:

Wait until the trace is completed. Find the peak value of the trace and place the analyser marker on this peak.

Step 3:

Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded.

10.4. Test Result

| | | |
|-----------|---|----------------------------|
| Product | : | Bluetooth headphone |
| Test Item | : | Occupied Channel Bandwidth |
| Test Mode | : | Mode 1: Transmit by DH1 |

| Channel No. | Frequency (MHz) | 99% Bandwidth (MHz) | Limit |
|-------------|-----------------|---------------------|--|
| 00 | 2402 | 0.88 | Within the band 2400.0MHz~2483.5MHz |
| 79 | 2480 | 0.88 | |

| | | |
|-----------|---|----------------------------|
| Product | : | bluetooth earphone |
| Test Item | : | Occupied Channel Bandwidth |
| Test Mode | : | Mode 2: Transmit by 2DH1 |

| Channel No. | Frequency (MHz) | 99% Bandwidth (MHz) | Limit |
|-------------|-----------------|---------------------|--|
| 00 | 2402 | 1.12 | Within the band 2400.0MHz~2483.5MHz |
| 79 | 2480 | 1.12 | |

| | | |
|-----------|---|----------------------------|
| Product | : | bluetooth earphone |
| Test Item | : | Occupied Channel Bandwidth |
| Test Mode | : | Mode 3: Transmit by 3DH1 |

| Channel No. | Frequency (MHz) | 99% Bandwidth (MHz) | Limit |
|-------------|-----------------|---------------------|--|
| 00 | 2402 | 1.23 | Within the band 2400.0MHz~2483.5MHz |
| 79 | 2480 | 1.23 | |

| | | |
|-------------|---|------|
| Test Result | : | Pass |
|-------------|---|------|

11. TRANSMITTER UNWANTED EMISSIONS IN THE OUT-OF-BAND DOMAIN

11.1. Limit

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 1.

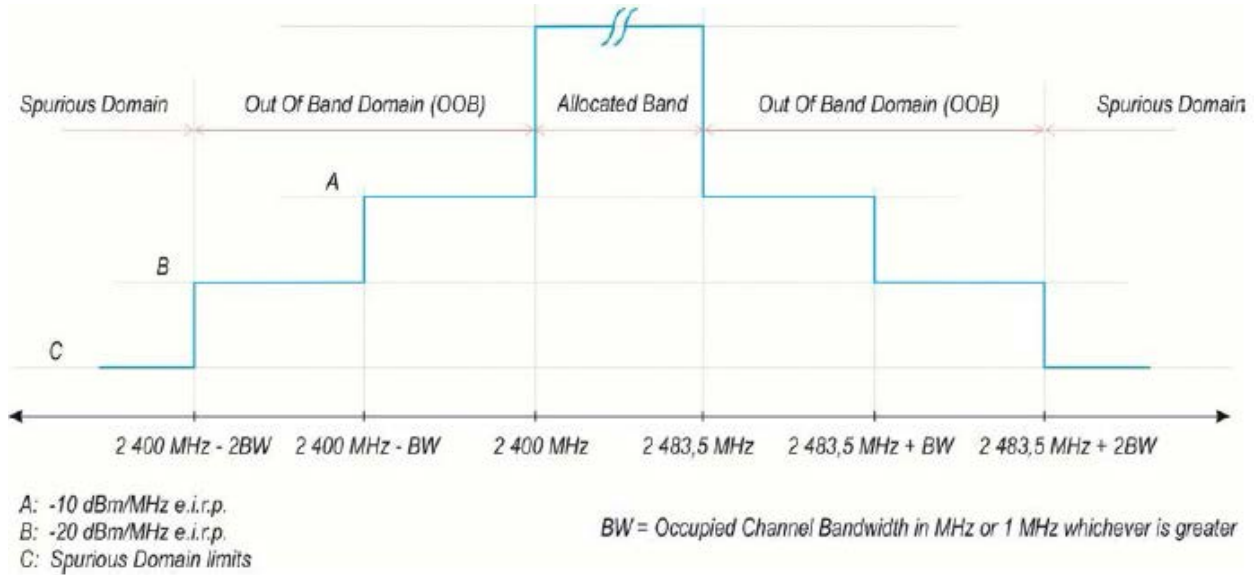
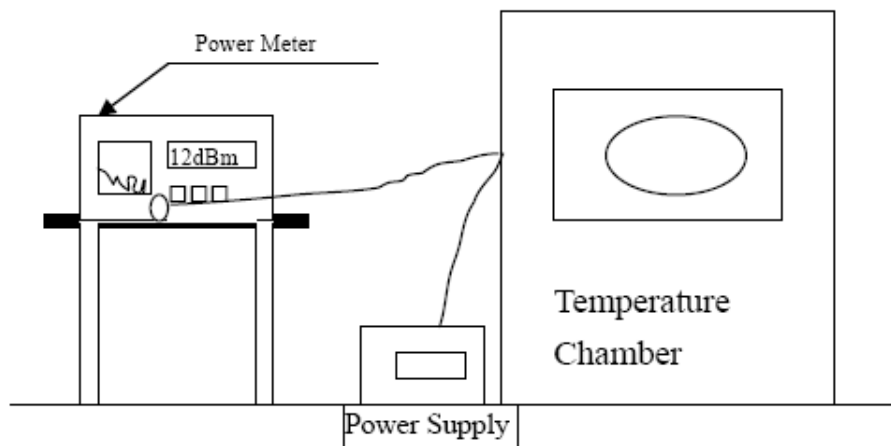


Figure 1: Transmit mask

11.2. Test Setup

For Conducted Measurement



11.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.8

Step 1:

- Connect the UUT to the spectrum analyser and use the following settings:
 - Centre Frequency: 2 484 MHz
 - Span: 0 Hz
 - Resolution BW: 1 MHz
 - Filter mode: Channel filter
 - Video BW: 3 MHz
 - Detector Mode: RMS
 - Trace Mode: Clear / Write
 - Sweep Mode: Continuous
 - Sweep Points: Sweep Time [s] / (1 μ s) or 5 000 whichever is greater
 - Trigger Mode: Video trigger

NOTE 1: In case video triggering is not possible, an external trigger source may be used.

- Sweep Time: > 120 % of the duration of the longest burst detected during the measurement of the RF Output Power

Step 2: (segment 2 483,5 MHz to 2 483,5 MHz + BW)

- Adjust the trigger level to select the transmissions with the highest power level.
- For frequency hopping equipment operating in a normal hopping mode, the different hops will result in signal bursts with different power levels. In this case the burst with the highest power level shall be selected.
- Set a window (start and stop lines) to match with the start and end of the burst and in which the RMS power shall be measured using the Time Domain Power function.
- Select RMS power to be measured within the selected window and note the result which is the RMS power within this 1 MHz segment (2 483,5 MHz to 2 484,5 MHz). Compare this value with the applicable limit provided by the mask.
- Increase the centre frequency in steps of 1 MHz and repeat this measurement for every 1 MHz segment within the range 2 483,5 MHz to 2 483,5 MHz + BW. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + BW - 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

Step 3: (segment 2 483,5 MHz + BW to 2 483,5 MHz + 2BW)

- Change the centre frequency of the analyser to 2 484 MHz + BW and perform the measurement for the first 1 MHz segment within range 2 483,5 MHz + BW to 2 483,5 MHz + 2BW. Increase the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + 2 BW - 0,5 MHz.

Step 4: (segment 2 400 MHz - BW to 2 400 MHz)

- Change the centre frequency of the analyser to 2 399,5 MHz and perform the measurement for the first 1 MHz segment within range 2 400 MHz - BW to 2 400 MHz. Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2BW + 0,5 MHz.

Step 5: (segment 2 400 MHz - 2BW to 2 400 MHz - BW)

- Change the centre frequency of the analyser to 2 399,5 MHz - BW and perform the measurement for the first 1 MHz segment within range 2 400 MHz - 2BW to 2 400 MHz - BW. Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2BW + 0,5 MHz.

Step 6:

- In case of conducted measurements on equipment with a single transmit chain, the declared antenna assembly gain "G" in dBi shall be added to the results for each of the 1 MHz segments and compared with the limits provided by the mask given in figures 1 or 3. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered.
- In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), the measurements need to be repeated for each of the active transmit chains. The declared antenna assembly gain "G" in dBi for a single antenna shall be added to these results. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered. Comparison with the applicable limits shall be done using any of the options given below:
 - Option 1: the results for each of the transmit chains for the corresponding 1 MHz segments shall be added. The additional beamforming gain "Y" in dB shall be added as well and the resulting values compared with the limits provided by the mask given in figures 1 or 3.
 - Option 2: the limits provided by the mask given in figures 1 or 3 shall be reduced by $10 \times \log_{10}(Ach)$ and the additional beamforming gain "Y" in dB. The results for each of the transmit chains shall be individually compared with these reduced limits.

NOTE 2: Ach refers to the number of active transmit chains.

It shall be recorded whether the equipment complies with the mask provided in figures 1 or 3.

11.5. Test Result

| | | |
|-------------------------------------|---|--|
| Product | : | Bluetooth headphone |
| Test Item | : | Transmitter unwanted emissions in the out-of-band domain |
| Test Mode | : | Mode 1: Transmit by DH1 |
| Remark: Only record the worst data. | | |

| Frequency (MHz) | Test Conditions (°C) | Max measured Values (dBm/MHz) | Limit (dBm/MHz) |
|--------------------------|----------------------|-------------------------------|-----------------|
| 2400-2BW~ 2400-BW | 25 | -66.21 | -20 |
| 2400-BW~2400 | 25 | -68.36 | -10 |
| 2483.5~ 2483.5+BW | 25 | -66.75 | -10 |
| 2483.5+BW~ 2483.5+2BW | 25 | -67.26 | -20 |

Note: All modulations of EUT have been tested and only record the worst data in the report.

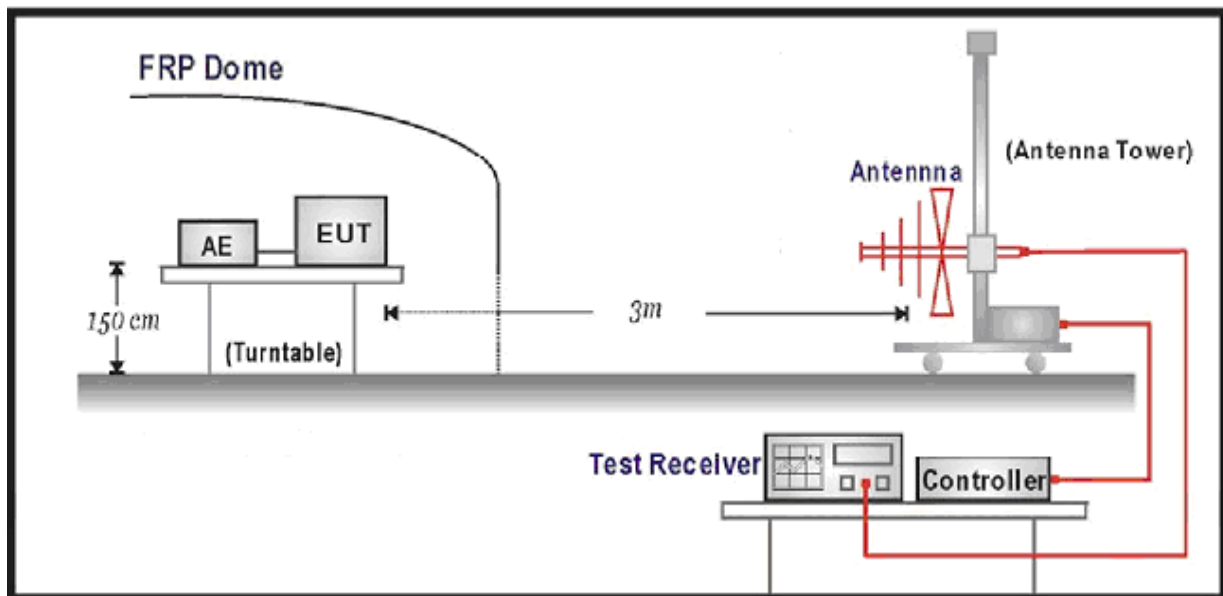
12. TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

12.1. Limit

| Transmitter Limits for Spurious Emissions | | |
|---|--|-----------|
| Frequency Range | Maximum power E.R.P. ($\leq 1\text{GHz}$) E.I.R.P. ($> 1\text{GHz}$) | Bandwidth |
| 30 MHz to 47 MHz | -36 dBm | 100 kHz |
| 47 MHz to 74 MHz | -54 dBm | 100 kHz |
| 74 MHz to 87,5 MHz | -36 dBm | 100 kHz |
| 87,5 MHz to 118 MHz | -54 dBm | 100 kHz |
| 118 MHz to 174 MHz | -36 dBm | 100 kHz |
| 174 MHz to 230 MHz | -54 dBm | 100 kHz |
| 230 MHz to 470 MHz | -36 dBm | 100 kHz |
| 470 MHz to 862 MHz | -54 dBm | 100 kHz |
| 862 MHz to 1 GHz | -36 dBm | 100 kHz |
| 1 GHz to 12,75 GHz | -30 dBm | 1 MHz |

12.2. Test Setup

For Radiated Measurement



12.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.9

Step 1:

The sensitivity of the spectrum analyser should be such that the noise floor is at least 12 dB below the limits given in tables 1 or 4.

Step 2:

The emissions over the range 30 MHz to 1 000 MHz shall be identified.

Spectrum analyser settings:

- Resolution bandwidth: 100 kHz
- Video bandwidth: 300 kHz
- Detector mode: Peak
- Trace Mode: Max Hold
- Sweep Points: ≥ 19400

NOTE 1: For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.

- Sweep time: For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 100 kHz frequency step, the measurement time is greater than two transmissions of the UUT. For Frequency Hopping equipment operating in a normal operating (hopping not disabled) mode, the sweep time shall be further increased to capture multiple transmissions on the same hopping frequency in different hopping sequences. Allow the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.3.10.2.1.3 and compared to the limits given in tables 1 or 4.

Step 3:

The emissions over the range 1 GHz to 12,75 GHz shall be identified.

Spectrum analyser settings:

- Resolution bandwidth: 1 MHz
- Video bandwidth: 3 MHz
- Detector mode: Peak
- Trace Mode: Max Hold
- Sweep Points: ≥ 23500

NOTE 2: For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.

- Sweep time: For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 1 MHz frequency step, the measurement time is greater than two transmissions of the UUT.

12.4. Test Result

| | | |
|-----------|---|--|
| Product | : | Bluetooth headphone |
| Test Item | : | Transmitter spurious emissions(Radiated Measurement) |
| Test Mode | : | Mode 1: Transmit by DH1 |

| Frequency (MHz) | Polarization (H/V) | Measure Level (dBm) | Limit (dBm) | Margin (dB) | Detector |
|----------------------|--------------------|---------------------|-------------|-------------|----------|
| Channel 0 (2402MHz) | | | | | |
| 245.39 | H | -50.81 | -36.00 | -14.81 | PK |
| 202.47 | V | -67.04 | -54.00 | -13.04 | PK |
| 911.50 | H | -49.55 | -36.00 | -13.55 | PK |
| 933.61 | V | -49.94 | -36.00 | -13.94 | PK |
| 4804.03 | H | -41.04 | -30.00 | -11.04 | PK |
| 4804.03 | V | -44.07 | -30.00 | -14.07 | PK |
| 7206.03 | H | -40.51 | -30.00 | -10.51 | PK |
| 7205.98 | V | -43.82 | -30.00 | -13.82 | PK |
| Channel 78 (2480MHz) | | | | | |
| 331.45 | H | -46.63 | -36.00 | -10.63 | PK |
| 223.54 | V | -66.22 | -54.00 | -12.22 | PK |
| 899.65 | H | -47.47 | -36.00 | -11.47 | PK |
| 807.48 | V | -66.54 | -54.00 | -12.54 | PK |
| 4960.02 | H | -40.88 | -30.00 | -10.88 | PK |
| 4960.03 | V | -40.99 | -30.00 | -10.99 | PK |
| 7440.02 | H | -43.61 | -30.00 | -13.61 | PK |
| 7440.00 | V | -43.44 | -30.00 | -13.44 | PK |

| | | |
|-----------|---|--|
| Product | : | Bluetooth headphone |
| Test Item | : | Transmitter spurious emissions (Conducted Measurement) |
| Test Mode | : | Mode 1: Transmit by DH1 |

| Frequency(MHz) | Measure Level(dBm) | Limit(dBm) | Margin(dB) | Detector |
|----------------------|--------------------|------------|------------|----------|
| Channel 0 (2402MHz) | | | | |
| 422.39 | -46.16 | -36.00 | -10.16 | PK |
| 887.69 | -46.05 | -36.00 | -10.05 | PK |
| 4804.01 | -40.23 | -30.00 | -10.23 | PK |
| 7206.03 | -40.31 | -30.00 | -10.31 | PK |
| Channel 78 (2480MHz) | | | | |
| 356.87 | -50.48 | -36.00 | -14.48 | PK |
| 899.69 | -49.54 | -36.00 | -13.54 | PK |
| 4960.00 | -41.90 | -30.00 | -11.90 | PK |
| 7439.99 | -42.67 | -30.00 | -12.67 | PK |

Note: All modulations of EUT have been tested and only record the worst data in the report.

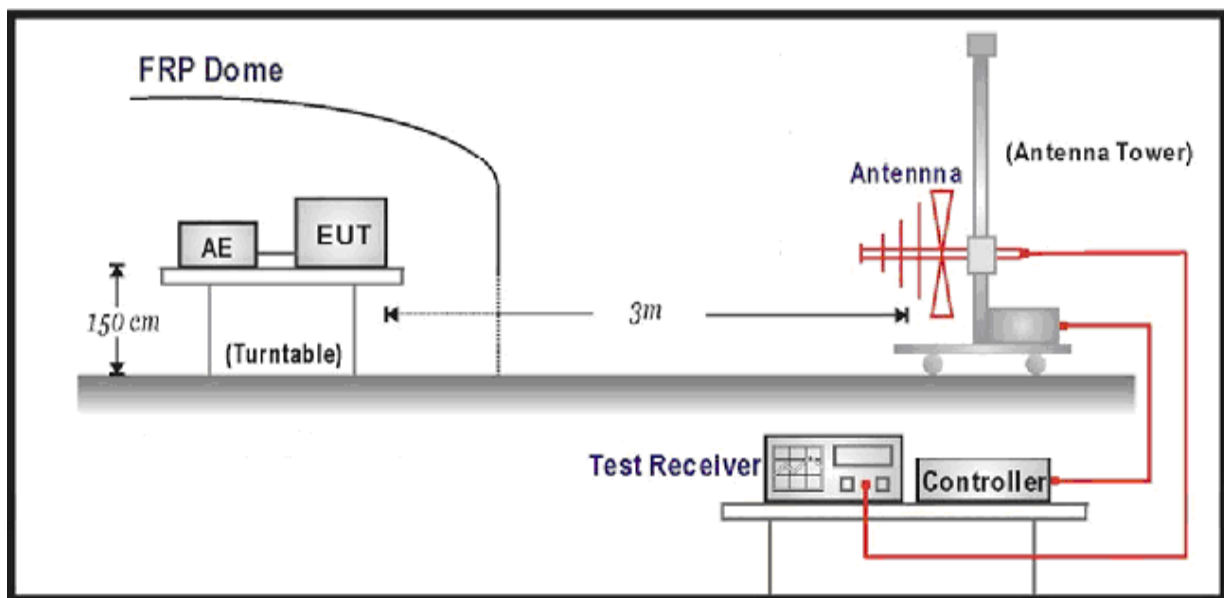
13. RECEIVER SPURIOUS EMISSIONS

13.1. Limit

| Spurious emissions limits for receivers | | |
|---|--|-----------------------|
| Frequency Range | Maximum power E.R.P. ($\leq 1\text{GHz}$) E.I.R.P. ($> 1\text{GHz}$) | Measurement bandwidth |
| 30 MHz to 1 GHz | -57 dBm | 100 kHz |
| 1 GHz to 12.75 GHz | -47 dBm | 1 MHz |

13.2. Test Setup

For Radiated Measurement



13.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.10

Step 1:

The sensitivity of the spectrum analyser should be such that the noise floor is at least 12 dB below the limits given in tables 2 or 5.

Step 2:

The emissions over the range 30 MHz to 1 000 MHz shall be identified.

Spectrum analyser settings:

- Resolution bandwidth: 100 kHz
- Video bandwidth: 300 kHz
- Detector mode: Peak
- Trace Mode: Max Hold
- Sweep Points: ≥ 19400
- Sweep time: Auto

Allow the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.4.10.2.1.3 and compared to the limits given in tables 2 or 5.

Step 3:

The emissions over the range 1 GHz to 12,75 GHz shall be identified.

Spectrum analyser settings:

- Resolution bandwidth: 1 MHz
- Video bandwidth: 3 MHz
- Detector mode: Peak
- Trace Mode: Max Hold
- Sweep Points: ≥ 23500
- Sweep time: Auto

Allow the trace to stabilize. Any emissions identified during the sweeps above that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.4.10.2.1.3 and compared to the limits given in tables 2 or 5. Frequency Hopping equipment may generate a block (or several blocks) of spurious emissions anywhere within the spurious domain. If this is the case, only the highest peak of each block of emissions shall be measured using the procedure in clause 5.4.10.2.1.3.

Step 4:

- In case of conducted measurements on smart antenna systems (equipment with multiple receive chains), the steps 2 and 3 need to be repeated for each of the active receive chains (Ach). The limits used to identify emissions during this pre-scan need to be reduced with $10 \times \log_{10}(\text{Ach})$ (number of active receive chains).

13.4. Test Result

| | | |
|-----------|---|--|
| Product | : | Bluetooth headphone |
| Test Item | : | Receiver spurious emissions (Radiated Measurement) |
| Test Mode | : | Mode 4: Receive by DH1 |

| Frequency (MHz) | Polarization (H/V) | Measure Level (dBm) | Limit (dBm) | Margin (dB) | Detector |
|----------------------|--------------------|---------------------|-------------|-------------|----------|
| Channel 0 (2402MHz) | | | | | |
| 186.35 | H | -69.86 | -57.00 | -12.86 | PK |
| 144.00 | V | -71.61 | -57.00 | -14.61 | PK |
| 977.73 | H | -68.21 | -57.00 | -11.21 | PK |
| 917.16 | V | -68.44 | -57.00 | -11.44 | PK |
| 1622.53 | H | -60.21 | -47.00 | -13.21 | PK |
| 1375.24 | V | -60.43 | -47.00 | -13.43 | PK |
| 2875.71 | H | -59.44 | -47.00 | -12.44 | PK |
| 2765.40 | V | -58.73 | -47.00 | -11.73 | PK |
| Channel 78 (2480MHz) | | | | | |
| 203.47 | H | -67.10 | -57.00 | -10.10 | PK |
| 201.06 | V | -70.63 | -57.00 | -13.63 | PK |
| 900.09 | H | -71.45 | -57.00 | -14.45 | PK |
| 820.92 | V | -70.03 | -57.00 | -13.03 | PK |
| 1408.21 | H | -60.49 | -47.00 | -13.49 | PK |
| 1338.53 | V | -61.37 | -47.00 | -14.37 | PK |
| 2676.93 | H | -61.99 | -47.00 | -14.99 | PK |
| 2628.05 | V | -60.41 | -47.00 | -13.41 | PK |

| | | |
|-----------|---|---|
| Product | : | bluetooth earphone |
| Test Item | : | Receiver spurious emissions (Conducted Measurement) |
| Test Mode | : | Mode 3: Receive by DH1 |

| Frequency(MHz) | Measure Level(dBm) | Limit(dBm) | Margin(dB) | Detector |
|----------------------|--------------------|------------|------------|----------|
| Channel 0 (2402MHz) | | | | |
| 258.21 | -70.95 | -57.00 | -13.95 | PK |
| 964.76 | -68.44 | -57.00 | -11.44 | PK |
| 1828.68 | -59.90 | -47.00 | -12.90 | PK |
| 2871.16 | -60.87 | -47.00 | -13.87 | PK |
| Channel 78 (2480MHz) | | | | |
| 133.30 | -70.09 | -57.00 | -13.09 | PK |
| 998.33 | -67.22 | -57.00 | -10.22 | PK |
| 1366.19 | -60.97 | -47.00 | -13.97 | PK |
| 2766.17 | -59.66 | -47.00 | -12.66 | PK |

Note: All modulations of EUT have been tested and only record the worst data in the report.

14. RECEIVER BLOCKING

14.1. Limit

Adaptive Frequency Hopping equipment shall comply with the requirements defined in clause 4.3.1.12.4. The minimum performance criterion shall be a PER less than or equal to 10 %.

Table 6: 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 wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 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 7: 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 4.3.1.12.3 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 8: Receiver Blocking parameters receiver category 3 equipment

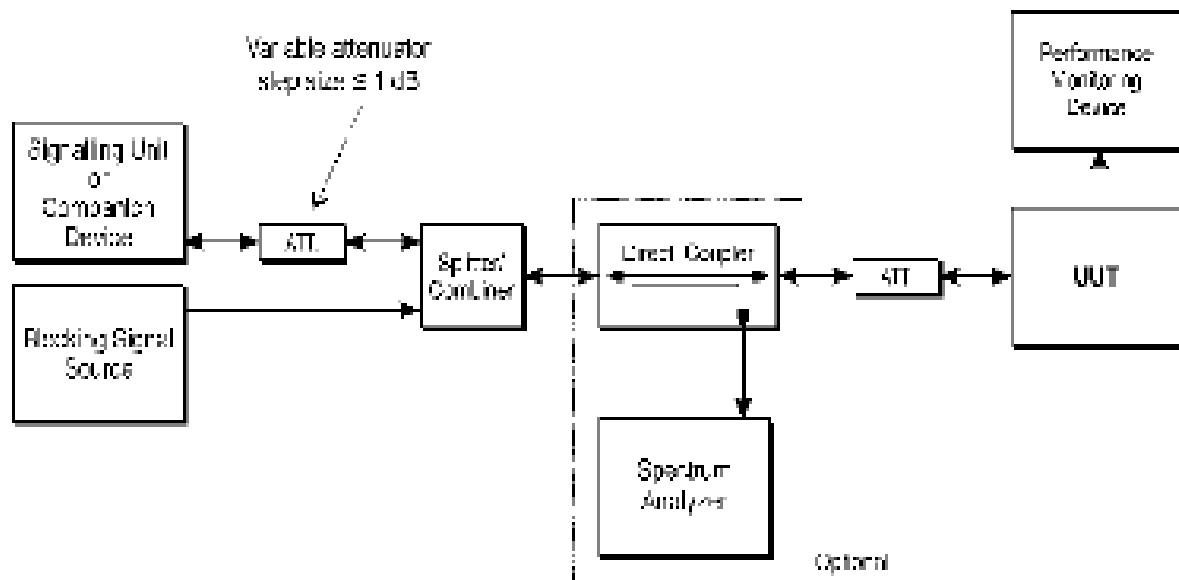
| Wanted signal mean power from companion device (dBm) | Blocking signal frequency (MHz) | Blocking signal power (dBm) (see note 2) | Type of blocking signal |
|--|---------------------------------|--|-------------------------|
| $P_{min} + 12$ dB | 2 380 2 503,5 | -57 | CW |
| $P_{min} + 12$ dB | 2 300 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 4.3.1.12.3 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.

14.2. Test Setup

Conducted measurements



14.3. Test Procedure

Step 1:

- For non-frequency hopping equipment, the UUT shall be set to the lowest operating channel.

Step 2:

- The blocking signal generator is set to the first frequency as defined in the appropriate table corresponding to the receiver category and type of equipment.

Step 3:

- With the blocking signal generator switched off, a communication link is established between the UUT and the associated companion device using the test setup shown in figure 6. The attenuation of the variable attenuator shall be increased in 1 dB steps to a value at which the minimum performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still met. The resulting level for the wanted signal at the input of the UUT is Pmin.
- This signal level (Pmin) is increased by the value provided in the table corresponding to the receiver category and type of equipment.

Step 4:

- The blocking signal at the UUT is set to the level provided in the table corresponding to the receiver category and type of equipment. It shall be verified and recorded in the test report that the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is met.

Step 5:

- Repeat step 4 for each remaining combination of frequency and level for the blocking signal as provided in the table corresponding to the receiver category and type of equipment.

Step 6:

- For non-frequency hopping equipment, repeat step 2 to step 5 with the UUT operating at the highest operating channel.

14.4. Test Result

| Test Condition | Test Mode | Test Channel | Ant | Pmin[dBm] | Wanted signal Level[dBm] (Pmin +6dB) | Blocking signal [dBm] | Freq [MHz] | CW Level [dBm] | PER [%] | Limit [%] | Verdict |
|----------------|-----------|--------------|------|-----------|--------------------------------------|-----------------------|------------|----------------|---------|-----------|---------|
| TNVN | DH1 | 2402 | Ant1 | -85.59 | -79.59 | -54.73 | 2380 | -57 | 5.65 | <=10 | PASS |
| TNVN | DH1 | 2402 | Ant1 | -85.59 | -79.59 | -54.62 | 2503.5 | -57 | 6.60 | <=10 | PASS |
| TNVN | DH1 | 2402 | Ant1 | -85.59 | -79.59 | -45.86 | 2583.5 | -47 | 5.34 | <=10 | PASS |
| TNVN | DH1 | 2402 | Ant1 | -85.59 | -79.59 | -45.33 | 2300 | -47 | 6.49 | <=10 | PASS |
| TNVN | DH1 | 2480 | Ant1 | -80.16 | -74.16 | -45.11 | 2300 | -47 | 3.99 | <=10 | PASS |
| TNVN | DH1 | 2480 | Ant1 | -80.16 | -74.16 | -54.17 | 2380 | -57 | 5.23 | <=10 | PASS |
| TNVN | DH1 | 2480 | Ant1 | -80.16 | -74.16 | -54.98 | 2503.5 | -57 | 4.59 | <=10 | PASS |
| TNVN | DH1 | 2480 | Ant1 | -80.16 | -74.16 | -45.11 | 2583.5 | -47 | 4.79 | <=10 | PASS |
| TNVN | 2DH1 | 2402 | Ant1 | -82.27 | -76.27 | -45.16 | 2583.5 | -47 | 8.38 | <=10 | PASS |
| TNVN | 2DH1 | 2402 | Ant1 | -82.27 | -76.27 | -45.28 | 2300 | -47 | 3.75 | <=10 | PASS |
| TNVN | 2DH1 | 2402 | Ant1 | -82.27 | -76.27 | -54.32 | 2380 | -57 | 4.94 | <=10 | PASS |
| TNVN | 2DH1 | 2402 | Ant1 | -82.27 | -76.27 | -54.06 | 2503.5 | -57 | 6.61 | <=10 | PASS |
| TNVN | 2DH1 | 2480 | Ant1 | -72.16 | -66.16 | -45.26 | 2583.5 | -47 | 2.26 | <=10 | PASS |

| | | | | | | | | | | | |
|------|------|------|------|--------|--------|--------|--------|-----|------|------|------|
| TNVN | 2DH1 | 2480 | Ant1 | -72.16 | -66.16 | -45.32 | 2300 | -47 | 3.06 | <=10 | PASS |
| TNVN | 2DH1 | 2480 | Ant1 | -72.16 | -66.16 | -54.33 | 2380 | -57 | 4.38 | <=10 | PASS |
| TNVN | 2DH1 | 2480 | Ant1 | -72.16 | -66.16 | -54.16 | 2503.5 | -57 | 2.90 | <=10 | PASS |
| TNVN | 3DH1 | 2402 | Ant1 | -74.25 | -68.25 | -54.11 | 2380 | -57 | 1.57 | <=10 | PASS |
| TNVN | 3DH1 | 2402 | Ant1 | -74.25 | -68.25 | -54.41 | 2503.5 | -57 | 1.78 | <=10 | PASS |
| TNVN | 3DH1 | 2402 | Ant1 | -74.25 | -68.25 | -45.02 | 2583.5 | -47 | 3.60 | <=10 | PASS |
| TNVN | 3DH1 | 2402 | Ant1 | -74.25 | -68.25 | -45.13 | 2300 | -47 | 3.51 | <=10 | PASS |
| TNVN | 3DH1 | 2480 | Ant1 | -75.34 | -69.34 | -45.16 | 2300 | -47 | 2.68 | <=10 | PASS |
| TNVN | 3DH1 | 2480 | Ant1 | -75.34 | -69.34 | -54.34 | 2380 | -57 | 1.73 | <=10 | PASS |
| TNVN | 3DH1 | 2480 | Ant1 | -75.34 | -69.34 | -54.46 | 2503.5 | -57 | 3.58 | <=10 | PASS |
| TNVN | 3DH1 | 2480 | Ant1 | -75.34 | -69.34 | -45.17 | 2583.5 | -47 | 1.41 | <=10 | PASS |

15.TEST SETUP PHOTOGRAPHS



Fig.1

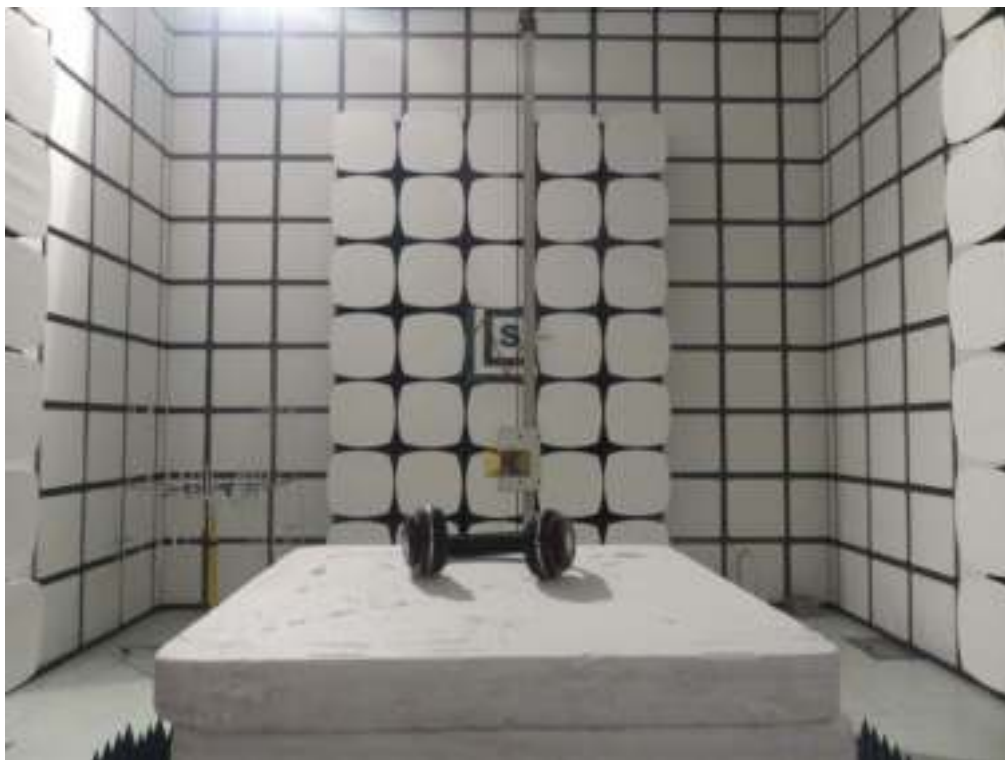


Fig.2

-----THE END OF TEST REPORT-----