**Shenzhen Global Test Service Co.,Ltd.**
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road,
Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

# TEST REPORT

## ETSI EN 300 328 V2.2.2（2019-07）

| | |
|---|---|
| **Report Reference No**.....: | **GTS20240426022-1-16** |
| Compiled by<br>( position+printed name+signature) . : | File administrators Peter Xiao |
| Supervised by<br>( position+printed name+signature) . : | Test Engineer Evan Ouyang |
| Approved by<br>( position+printed name+signature) . : | Manager Jason Hu |
| Date of issue .....: | Jun.21, 2024 |
| **Test Laboratory Name** .....: | **Shenzhen Global Test Service Co.,Ltd.** |
| Address .....: | No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong |
| **Applicant's name**.....: | **Shenzhen Techtion Smart Electronics Co., Ltd** |
| Address .....: | Room 902, 8th Floor, Unit 1, Building No. 2, Xintianxia Chengyun Factory District, Vanke City Community, Bantian Street, Longgang District, Shenzhen, China |
| **Test specification**.....**:** | |
| Standard.....: | **ETSI EN 300 328 V2.2.2（2019-07）** |
| TRF Originator.....: | Shenzhen Global Test Service Co.,Ltd. |
| Master TRF .....: | Dated 2014-12 |



| | |
|---|---|
| **Test item description .....:** | **Outdoor Reflective Display Terminal** |
| Trade Mark.....: | N/A |
| Manufacturer .....: | Shenzhen Techtion Smart Electronics Co., Ltd |
| Model/Type reference .....: | TS-156PHD |
| List Model.....: | TS-780PHD, TS-101PHD, TS-105PHD, TS-133PHD, TS-215PHD, TS-286THD, TS-298THD, TS-280THD, TS-320PHD, TS-362THD, TS-401THD, TS-430PHD, TS-434THD, TS-500THD, TS-550PHD, TS-650THD, TS-750THD, TS-850THD, TS-860THD, TS-980THD, TS-XXXPHD, TS-XXXTHD(X=0-9,X=A-Z) |
| Modulation Type.....: | GFSK |
| Operation Frequency.....: | From 2402MHz to 2480MHz |
| Ratings .....: | DC 12.0V/4.0A by Adapter |
| Result .....: | **PASS** |

# T E S T  R E P O R T

| **Test Report No. :** | **GTS20240426022-1-16** | Jun. 21, 2024<br>Date of issue |
|---|---|---|

| | | |
|---|---|---|
| Equipment under Test | : | Outdoor Reflective Display Terminal |
| Model /Type | : | TS-156PHD |
| Listed Models | : | TS-780PHD, TS-101PHD, TS-105PHD, TS-133PHD, TS-215PHD, TS-286THD, TS-298THD, TS-280THD, TS-320PHD, TS-362THD, TS-401THD, TS-430PHD, TS-434THD, TS-500THD, TS-550PHD, TS-650THD, TS-750THD, TS-850THD, TS-860THD, TS-980THD, TS-XXXPHD, TS-XXXTHD(X=0-9,X=A-Z) |
| **Applicant** | : | **Shenzhen Techtion Smart Electronics Co., Ltd** |
| Address | : | Room 902, 8th Floor, Unit 1, Building No. 2, Xintianxia Chengyun Factory District, Vanke City Community, Bantian Street, Longgang District, Shenzhen, China |
| **Manufacturer** | : | **Shenzhen Techtion Smart Electronics Co., Ltd** |
| Address | : | Room 902, 8th Floor, Unit 1, Building No. 2, Xintianxia Chengyun Factory District, Vanke City Community, Bantian Street, Longgang District, Shenzhen, China |

| **Test Result**: | **PASS** |
|---|---|

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

# Contents

# 1. TEST STANDARDS

The tests were performed according to following standards:

ETSI EN 300 328 V2.2.2 (2019-07)–Wideband transmission systems;Data transmission equipment operating in the 2,4 GHz band;Harmonised Standard for access to radio spectrum

# 2. SUMMARY

## 2.1. General Remarks

| | | |
|---|---|---|
| Date of receipt of test sample | : | May. 10, 2024 |
| | | |
| Testing commenced on | : | May. 10, 2024 |
| | | |
| Testing concluded on | : | Jun. 20, 2024 |

## 2.2. Product Description

| | |
|---|---|
| Product Name: | Outdoor Reflective Display Terminal |
| Trade Mark: | N/A |
| Model/Type reference: | TS-156PHD |
| List Model: | TS-780PHD, TS-101PHD, TS-105PHD, TS-133PHD, TS-215PHD, TS-286THD, TS-298THD, TS-280THD, TS-320PHD, TS-362THD, TS-401THD, TS-430PHD, TS-434THD, TS-500THD, TS-550PHD, TS-650THD, TS-750THD, TS-850THD, TS-860THD, TS-980THD, TS-XXXPHD, TS-XXXTHD(X=0-9,X=A-Z) |
| Model Declaration | PCB board, structure and internal of these model(s) are the same, Only the model name different , So no additional models were tested. |
| Power supply: | DC 12.0V/4.0A by Adapter |
| Hardware Version | N/A |
| Software Version | N/A |
| Bluetooth | |
| Frequency Range | 2402MHz ~ 2480MHz |
| Channel Number | 79 channels for Bluetooth (DSS)<br>40 channels for Bluetooth (DTS) |
| Channel Spacing | 1MHz for Bluetooth (DSS)<br>2MHz for Bluetooth (DTS) |
| Modulation Type | GFSK, π/4-DQPSK, 8-DPSK for Bluetooth (DSS)<br>GFSK for Bluetooth (DTS) |
| 2.4GWLAN | |
| WLAN CE Operation frequency | IEEE 802.11b:2412-2472MHz<br>IEEE 802.11g:2412-2472MHz<br>IEEE 802.11n HT20:2412-2472MHz<br>IEEE 802.11n HT40:2422-2462MHz |
| WLAN CE Modulation Type | IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)<br>IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK)<br>IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK) |
| Channel number: | 13 Channel for IEEE 802.11b/g/n (HT20)<br>9 Channel for IEEE 802.11n (HT40) |
| Channel separation: | 5MHz |
| WIFI (5G Band) | |
| WLAN CE Operation frequency | 5180-5240MHz |
| WLAN CE Modulation Type | 802.11a/n/ac: OFDM |
| Channel number: | 4 Channels for 20MHz bandwidth(5180-5240MHz)<br>2 channels for 40MHz bandwidth(5190~5230MHz)<br>1 channels for 80MHz bandwidth(5210MHz) |
| SRD (5.8G Band) | |
| WLAN CE Operation frequency | 5745-5825MHz |

| | |
|---|---|
| WLAN CE Modulation Type | 802.11a/n/ac: OFDM |
| Channel Number | 5 channels for 20MHz bandwidth(5745-5825MHz)<br>2 channels for 40MHz bandwidth(5755~5795MHz)<br>1 channels for 80MHz bandwidth(5775MHz) |
| Antenna Description | Two External antenna respectively. WLAN not support 2*2MIMO technology.<br>ANT0 used for WIFI TX/RX, 2.0 dBi(Max.) for 2.4GWLAN;<br>ANT1 used for BT&WIFI TX/RX, 2.0 dBi(Max.) for BT and 2.0dBi (Max.) for 5GWLAN; |

## 2.3. Equipment Under Test

### Test Power supply

| | | | | | |
|---|---|---|---|---|---|
| Power supply voltage | : | ○ | 230V / 50 Hz | ○ | 120V / 60Hz |
| | | ● | 12 V DC | ○ | 24 V DC |
| | | ○ | Other (specified in blank below) | | |

DC 12.0V

### Description of the test mode

Bluetooth BLE used 40 channels and channel separation was 2MHz.

| Channel | Frequency(MHz) | Channel | Frequency(MHz) |
|---|---|---|---|
| 00 | 2402 | 20 | 2442 |
| 01 | 2404 | 21 | 2444 |
| 02 | 2406 | 22 | 2446 |
| -- | -- | -- | -- |
| -- | -- | -- | -- |
| 17 | 2436 | 37 | 2476 |
| 18 | 2438 | 38 | 2478 |
| 19 | 2440 | 39 | 2480 |

## 2.4. Description of the Equipment under Test (EUT)

| | |
|---|---|
| Reference documents: | Bluetooth® Core Specification |
| Special test descriptions: | None |
| Configuration descriptions: | TX tests: Channel 00(2402MHz),Channel 19(2440MHz),Channel 39(2480MHz) |
| | RX/Standby tests: BLE test mode enabled, scan enabled, TX Idle |
| Test mode: | ☐ Bluetooth Test mode loop back enabled (EUT is controlled over CBT/CMU) |
| | ☒ Special software is used. EUT is transmitting pseudo random data by itself |
| Bluetooth standard capabilities: | 40channels FHSS |
| | channel separation 2 MHz |
| | used freq. range 2402-2480 MHz |
| | Modulation types: GFSK |
| | Bandwidth appr. 1MHz for single hop frequency |

## 2.5. EUT Classification

| | | |
|---|---|---|
| Type of equipment: | ☒ | stand alone equipment |
| | ☐ | plug in radio equipment |
| | ☐ | combined equipment |
| Modulation types: | ☒ | Wide Band Modulation (None Hopping – e.g. DSSS, OFDM) |
| | ☐ | Frequency Hopping Spread Spectrum (FHSS) |
| Adaptive equipment: | ☒ | Yes, LBT-based |
| | ☐ | Yes, non-LBT-based |
| | ☐ | Yes (but can be disabled) |
| | ☐ | No |
| Antennas and transmit operating modes: | ☒ | Operating mode 1 (single antenna)<br>Equipment with 1 antenna,<br>Equipment with 2 diversity antennas operating in switched diversity mode by which at any moment in time only 1 antenna is used,<br>Smart antenna system with 2 or more transmit/receive chains, but operating in a mode where only 1 transmit/receive chain is used) |
| | ☐ | Operating mode 2 (multiple antennas, no beamforming)<br>Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously but without beamforming. |
| | ☐ | Operating mode 3 (multiple antennas, with beamforming)<br>Equipment operating in this mode contains a smart antenna system using two or more transmit/receive chains simultaneously with beamforming. In addition to the antenna assembly gain (G), the beamforming gain (Y) may have to be taken into account when performing the measurements. |

## 2.6. Test software

The system was configured for testing in a continuous transmits condition and change test channels by software (ADB Mode) provided by application.

## 2.7. EUT configuration

**The following peripheral devices and interface cables were connected during the measurement:**

● - supplied by the manufacturer

○ - supplied by the lab

| | | | |
|---|---|---|---|
| ● | Adapter | M/N: | ADP-48D12 |
| | | Manufacturer: | Hunan Dajing Technology Co., Ltd |
| ○ | PC | M/N: | DESKYOP-EUIVCNR |
| | | Manufacturer: | LENOVO |
| ○ | Display | M/N: | LE23CW-D |
| | | Manufacturer: | THTF |
| ○ | Keyboard | M/N: | T460S |
| | | Manufacturer: | LENOVO |
| ○ | Mouse | M/N: | Howard |
| | | Manufacturer: | LENOVO |
| ○ | Earphone | M/N: | MDR-XB550AP |
| | | Manufacturer: | SONY |
| ○ | USB flash disk | M/N: | U330 |
| | | Manufacturer: | aigo |

## 2.8. Modifications

No modifications were implemented to meet testing criteria.

# 3. TEST ENVIRONMENT

## 3.1. Address of the test laboratory

**Shenzhen Global Test Service Co.,Ltd.**
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

## 3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:
CNAS (No. CNAS L8169)
Shenzhen Global Test Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2019 General Requirements) for the Competence of Testing and Calibration Laboratories.
A2LA (Certificate No. 4758.01)
Shenzhen Global Test Service Co., Ltd. has been assessed by the American Association for Laboratory Accreditation (A2LA). Certificate No. 4758.01.
Industry Canada Registration Number. is 24189.
FCC Designation Number is CN1234.
FCC Registered Test Site Number is165725.

## 3.3. Environmental conditions

Normal Temperature: 25 °C
High Temperature: 45 °C
Low Temperature: -20 °C
Normal Voltage : DC 12.0V
High Voltage: DC 13.2V
Low Voltage: DC 10.8V
Relative Humidity: 55 %
Air Pressure: 989 hPa

## 3.4. Test Description

### 3.4.1 Main Terms

| | |
|---|---|
| Verdict | Verdict of each test cases. |
| Test Case | Test cases identification number and description in 3GPP test specification and ETSI specification. |

### 3.4.2 Terms used in Condition column

| | |
|---|---|
| NTC | Normal voltage, Normal Temperature |
| HV | High voltage, Normal Temperature |
| LV | Low voltage, Normal Temperature |
| HT | High Temperature, Normal voltage |
| LT | Low Temperature, Normal voltage |
| HTHV | High voltage, High Temperature |
| LTHV | High voltage, Low Temperature |
| HTLV | Low voltage, High Temperature |
| LTLV | Low voltage, Low Temperature |
| Vib | Vibration |

### 3.4.3 Terms used in Verdict column

| | |
|---|---|
| Pass | This test cases has been tested, and EUT is conformant to the applied standards in the given frequency band. |
| Fail | This test cases has been tested, but EUT is not conformant to the applied standards in the given frequency band. |
| N/A | This test case is either not required/not applicable in the specified band or is not applicable according to the specific PICS/PIXIT for the EUT. |
| Inc | Test case result is ambiguous in the given frequency band. |
| Decl | Declaration is received from the client to demonstrate the conformity to the relevant specification in the given frequency band. |
| BR | This test cases is not tested in the given frequency band, but this testcases was tested with pass result for the initial model in the given frequency band. |

**3.4.4 Summary of measurement results**

☒ **No deviations from the technical specifications were ascertained**
☐ **There were deviations from the technical specifications ascertained**

| Test Specification Clause | Test Case | Test Condition | Mode | Pass | Fail | N/A | NP | Remark |
|---|---|---|---|---|---|---|---|---|
| 5.4.2 | RF output power | NTC | GFSK | ☒ | ☐ | ☐ | ☐ | |
| | | LT | | ☒ | ☐ | ☐ | ☐ | |
| | | HT | | ☒ | ☐ | ☐ | ☐ | |
| 5.4.3 | Power Spectral Density | NTC | GFSK | ☒ | ☐ | ☐ | ☐ | |
| 5.4.2 | Duty Cycle, Tx-sequence, Tx-gap | NTC | GFSK | ☐ | ☐ | ☒ | ☐ | |
| 5.4.2 | Medium Utilisation (MU) factor | NTC | GFSK | ☐ | ☐ | ☒ | ☐ | |
| 5.4.6 | Adaptivity (adaptive equipment using modulations other than FHSS) | NTC | GFSK | ☐ | ☐ | ☒ | ☐ | |
| 5.4.7 | Occupied Channel Bandwidth | NTC | GFSK | ☒ | ☐ | ☐ | ☐ | |
| 5.4.8 | Transmitter unwanted emissions in the out-of-band domain | NTC | GFSK | ☒ | ☐ | ☐ | ☐ | |
| | | LT | | ☒ | ☐ | ☐ | ☐ | |
| | | HT | | ☒ | ☐ | ☐ | ☐ | |
| 5.4.9 | Transmitter unwanted emissions in the spurious domain (conducted & radiated) | NTC | GFSK | ☒ | ☐ | ☐ | ☐ | |
| 5.3.10 | Receiver spurious emissions (conducted & radiated) | NTC | GFSK | ☒ | ☐ | ☐ | ☐ | |
| 5.4.11 | Receiver Blocking | NTC | GFSK | ☒ | ☐ | ☐ | ☐ | |

Remark: The measurement uncertainty is not included in the test result.

## 3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the Shenzhen Global Test Service Co.,Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

| Test Items | Measurement Uncertainty | Notes |
|---|---|---|
| Frequency error | 25 Hz | (1) |
| Frequency range | 25 Hz | (1) |
| Transmitter power conducted | 0.57 dB | (1) |
| Transmitter power Radiated | 2.20 dB | (1) |
| Adjacent and alternate channel power Conducted | 1.20 dB | (1) |
| Conducted spurious emission | 1.60 dB | (1) |
| Radiated spurious emission | 2.20 dB | (1) |
| Intermodulation attenuation | 1.00 dB | (1) |
| Maximum useable receiver sensitivity | 2.80 dB | (1) |
| Co-channel rejection | 2.80 dB | (1) |
| Adjacent channel selectivity | 2.80 dB | (1) |
| Spurious response rejection | 2.80 dB | (1) |
| Intermodulation response rejection | 2.80 dB | (1) |
| Blcking or desensitization | 2.80 dB | (1) |

(1)This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 3.6. Equipments Used during the Test

| RF output power&PSD&OOB&OBW &Hoping &Duty Cycle, Tx-sequence, Tx-gap&Adaptively& ReceiverBlocking& Centre frequencies & TPC | | | | | | |
|---|---|---|---|---|---|---|
| Item | Test Equipment | Manufacturer | Model No. | Serial No. | Calibration Date | Calibration Due Date |
| 1 | Spectrum Analyzer | Agilent | N9020A | MY48010425 | 2023/09/08 | 2024/09/07 |
| 2 | Vector Signal generator | Agilent | N5181A | MY49060502 | 2023/07/13 | 2024/07/12 |
| 3 | Signal generator | Agilent | E4421B | 3610AO1069 | 2023/09/08 | 2024/09/07 |
| 4 | 4 Ch. Simultaneous Sampling 14 Bits 2 MS/s | Agilent | U2531A | TW53323507 | 2023/09/08 | 2024/09/07 |
| 5 | X-series USB Peak and Average Power Sensor | Agilent | U2021XA | MY5365004 | 2023/09/08 | 2024/09/07 |
| 6 | Climate Chamber | ESPEC | EL-10KA | A20120523 | 2023/09/08 | 2024/09/07 |
| 7 | Spectrum Analyzer | R&S | FSV40 | 100019 | 2023/07/13 | 2024/07/12 |
| 8 | Universal Radio Communication | Rohde&Schwarz | CMU200 | 114353 | 2023/09/08 | 2024/09/07 |
| 9 | Wireless Commnunication Tester | Rohde&Schwarz | CMW500 | 125408 | 2023/07/13 | 2024/07/12 |
| 10 | Test Control Unit | Tonscend | JS0806-1 | 178060067 | 2023/07/13 | 2024/07/12 |
| 11 | Automated filter bank | Tonscend | JS0806-F | 19F8060177 | 2023/07/13 | 2024/07/12 |
| 12 | EMI Test software | Tonscend | JS1120-1 | Ver 2.6.8.0518 | / | / |
| 13 | EMI Test software | Tonscend | JS1120-3 | Ver 2.5.77.0418 | / | / |

| Transmitter spurious emissions & Receiver spurious emissions | | | | | | |
|---|---|---|---|---|---|---|
| Item | Test Equipment | Manufacturer | Model No. | Serial No. | Calibration Date | Calibration Due Date |
| 1 | EMI Test Receiver | ROHDE & SCHWARZ | ESCI 7 | 101102 | 2023/09/08 | 2024/09/07 |
| 2 | Spectrum Analyzer | Agilent | N9020A | MY480 10425 | 2023/09/08 | 2024/09/07 |
| 3 | Spectrum Analyzer | R&S | FSV40 | 100019 | 2023/07/13 | 2024/07/12 |
| 4 | By-log Antenna | SCHWARZBECK | VULB9163 | 000976 | 2023/07/13 | 2024/07/12 |
| 5 | Double Ridged Horn Antenna (1~18GHz) | SCHWARZBECK | BBHA 9120D | 01622 | 2023/09/08 | 2024/09/07 |
| 6 | Horn Antenna (18GHz~40GHz) | Schwarzbeck | BBHA9170 | 791 | 2023/09/08 | 2024/09/07 |
| 7 | Amplifier (30MHz~1GHz) | Schwarzbeck | BBV 9743 | #202 | 2023/07/13 | 2024/07/12 |
| 8 | Amplifier (1GHz~18GHz) | Taiwan Chengyi | EMC051845 B | 980355 | 2023/07/13 | 2024/07/12 |
| 9 | Amplifier (26.5GHz~40GHz) | Schwarzbeck | BBV9179 | 9719-025 | 2023/07/13 | 2024/07/12 |
| 10 | High-Pass Filter | K&L | 9SH10-2700/X12750-O/O | KL142031 | 2023/07/13 | 2024/07/12 |
| 11 | High-Pass Filter | K&L | 41H10-1375/U12750-O/O | KL142032 | 2023/07/13 | 2024/07/12 |
| 12 | High pass filter | Compliance Direction systems | BSU-6 | 34202 | 2023/07/13 | 2024/07/12 |
| 13 | RF Cable | HUBER+SUHNER | RG214 | N/A | 2023/07/13 | 2024/07/12 |
| 14 | EMI Test software | Tonscend | JS32-RE | Ver 2.5.1.8 | / | / |

The calibration interval is 1 year.

# 4. TEST CONDITIONS AND RESULTS

## 4.1. ETSI EN 300 328 REQUIREMENTS

### 4.1.1. RF Output Power

**LIMIT**

**ETSI EN 300 328 Sub-clause 4.3.2.2.3**

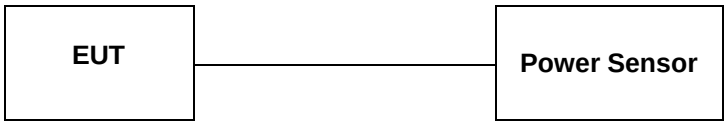
The RF output power for non-FHSS equipment shall be equal to or less than 20 dBm.

*NOTE: For Non-adaptive FHSS equipment, the manufacturer may have declared a reduced RF Output Power (see clause 5.4.1 m)) and associated Duty Cycle (see clause 5.4.1 e)) that will ensure that the equipment meets the requirement for the Medium Utilization (MU) factor further described in clause 4.3.2.5. This is verified by the conformance test referred to in clause 4.3.2.5.4.*

For non-adaptive non-FHSS equipment, where the manufacturer has declared an RF output power of less than 20 dBm e.i.r.p., the RF output power shall be equal to or less than that declared value.

This limit shall apply for any combination of power level and intended antenna assembly.

**TEST CONFIGURATION**




**TEST PROCEDURE**

**Please refer to ETSI EN 300 328 Sub-clause 5.4.2.2.1.2**

**Step 1:**

● Use a fast power sensor with a minimum sensitivity of -40 dBm and capable of minimum 1 MS/s.

● Use the following settings:

- Sample speed 1 MS/s or faster.
- The samples shall represent the RMS power of the signal.
- Measurement duration: For non-adaptive equipment: equal to the observation period defined in clause 4.3.1.3.2 or clause 4.3.2.4.2. For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) is captured.
- For adaptive equipment, to increase the measurement accuracy, a higher number of bursts may be used.

**Step 2:**

● For conducted measurements on devices with one transmit chain:

- 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.

● For conducted measurements on devices with multiple transmit chains:

- Connect one power sensor to each transmit port for a synchronous measurement on all transmit ports.
- Trigger the power sensors so that they start sampling at the same time. Make sure the time difference between the samples of all sensors is less than 500 ns.
- For each individual sampling point (time domain), sum the coincident power samples of all ports and store them. Use these summed samples as the new stored data set.

**Step 3:**

● Find the start and stop times of each burst in the stored measurement samples.
The start and stop times are defined as the points where the power is at least 30 dB below the highest value of the stored samples in step 2.
In case of insufficient sensitivity of the power sensor (e.g. in case of radiated measurements), the value of 30 dB may need to be reduced appropriately.

**Step 4:**

● Between the start and stop times of each individual burst calculate the RMS power over the burst using the formula below. The start and stop points shall be included. Save these Pburst values, as well as the start and stop times for each burst.

$$P_{burst} = \frac{1}{k}\sum_{n=1}^{k} P_{sample}(n)$$

with k being the total number of samples and n the actual sample number.

**Step 5:**

● The highest of all Pburst 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.

- case of smart antenna systems operating in mode with beamforming (see clause 5.3.2.2.4), add the additional beamforming gain Y in dB.
- If more than one antenna assembly is intended for this power setting, the maximum overall antenna gain (G or G + Y) shall be used.
- The RF Output Power (Pout) shall be calculated using the formula below:

$$P_{out} = A + G + Y$$

- This value, which shall comply with the limit given in clause 4.3.1.2.3 or clause 4.3.2.2.3, shall be recorded in the test report.

**EUT DESCRIPTION:**

| | |
|---|---|
| Mode: | BT Test mode |
| Test Channel | Channel 00(2402MHz),Channel 19(2440MHz),Channel 39(2480MHz) |
| Modulation: | GFSK |

**MEASUREMENT DESCRIPTION**

| | | |
|---|---|---|
| Instrument: | Power Meter measuring burst Power(RMS) of a least 10 packets | |
| Performed: | ☒ | Conducted |
| | ☐ | Radiated (only if no conducted sample is provided) |

**TEST RESULTS**

| **Test Method: Conducted** | | | | |
|---|---|---|---|---|
| **Modulation: GFSK** | | **Test Frequency: 2402 MHz** | | |
| **Test environmental** | | **Maximum conducted Burst Power in 15 measured Bursts (RMS) [dBm]** | | |
| **Temperature ( ℃ )** | **Voltage ( V )** | **Antenna Measured Power (dBm)** | **Antenna Gain(dBi)** | **EIRP(dBm)** |
| T Nor (25℃ ) | DC 12.0 | -0.71 | 2.00 | 1.29 |
| T min ( -20℃ ) | DC 12.0 | -0.44 | 2.00 | 1.56 |
| T Max ( +45℃ ) | DC 12.0 | -0.29 | 2.00 | 1.71 |
| **Result** | | **Pass** | | |
| **Limit** | | **20dBm** | | |

Note :1. Measured Power include the cable loss.

| **Test Method: Conducted** | | | | |
|---|---|---|---|---|
| **Modulation: GFSK** | | **Test Frequency: 2440 MHz** | | |
| **Test environmental** | | **Maximum conducted Burst Power in 15 measured Bursts (RMS) [dBm]** | | |
| **Temperature ( ℃ )** | **Voltage ( V )** | **Antenna Measured Power (dBm)** | **Antenna Gain(dBi)** | **EIRP(dBm)** |
| T Nor (25℃ ) | DC 12.0 | -0.97 | 2.00 | 1.03 |
| T min ( -20℃ ) | DC 12.0 | -0.76 | 2.00 | 1.24 |
| T Max ( +45℃ ) | DC 12.0 | -0.88 | 2.00 | 1.12 |
| **Result** | | **Pass** | | |
| **Limit** | | **20dBm** | | |

Note :1. Measured Power include the cable loss.

| **Test Method: Conducted** | | | | |
|---|---|---|---|---|
| **Modulation: GFSK** | | **Test Frequency: 2480 MHz** | | |
| **Test environmental** | | **Maximum conducted Burst Power in 15 measured Bursts (RMS) [dBm]** | | |
| **Temperature ( ℃ )** | **Voltage ( V )** | **Antenna Measured Power (dBm)** | **Antenna Gain(dBi)** | **EIRP(dBm)** |
| T Nor (25℃ ) | DC 12.0 | -0.63 | 2.00 | 1.37 |
| T min ( -20℃ ) | DC 12.0 | -0.36 | 2.00 | 1.64 |
| T Max ( +45℃ ) | DC 12.0 | -0.93 | 2.00 | 1.07 |
| **Result** | | **PASS** | | |
| **Limit** | | **20dBm** | | |

Note :1. Measured Power include the cable loss.

## 4.1.2. Duty Cycle,TX-sequence,TX-gap

**LIMIT**

**ETSI EN 300 328 Sub-clause 4.3.2.4.3**
Non-FHSS equipment shall comply with the following:
● The Duty Cycle shall be equal to or less than the maximum value declared by the manufacturer.
● The Tx-sequence time shall be equal to or less than 10 ms.
● The minimum Tx-gap time following a Tx-sequence shall be equal to the duration of that proceeding Tx-sequence with a minimum of 3,5 ms.
*NOTE: For Non-adaptive FHSS equipment, the manufacturer may have declared a reduced RF Output Power (see clause 5.4.1 m)) and associated Duty Cycle (see clause 5.4.1 e)) that will ensure that the equipment meets the requirement for the Medium Utilization (MU) factor further described in clause 4.3.2.5. This is verified by the conformance test referred to in clause 4.3.2.5.4.*

**TEST PROCEDURE**

**Please refer to ETSI EN 300 328 Sub-clause 5.4.2.2.1.3**
For systems using wide band modulations other than FHSS, the measurement shall be performed at the lowest, the middle, and the highest channel on which the equipment can operate. These frequencies shall be recorded.
The test procedure, which shall only be performed for non-adaptive systems and only to be performed at normal environmental conditions, shall be as follows:
**Step 1:**
● Use the same stored measurement samples from the procedure described in clause 5.4.2.2.1.2.
● The start and stop times are defined as the points where the power is at least 30 dB below the highest value of the stored samples. In case of insufficient sensitivity of the power sensor (e.g. in case of radiated measurements), the value of 30 dB may need to be reduced appropriately.
**Step 2:**
● Between the saved start and stop times of each individual burst, calculate the TxOn time. Save these TxOn values.
**Step 3:**
● Duty Cycle (DC) is the sum of all TxOn times between the end of the first gap (which is the start of the first burst within the observation period) and the start of the last burst (within this observation period) divided by the observation period. The observation period is defined in clause 4.3.1.3.2 or clause 4.3.2.4.2.
**Step 4:**
● For FHSS equipment using blacklisting, the TxOn time measured for a single (and active) hopping frequency shall be multiplied by the number of blacklisted frequencies. This value shall be added to the sum calculated in step 3 above. If the number of blacklisted frequencies cannot be determined, the minimum number of hopping frequencies (N) as defined in clause 4.3.1.4.3 shall be assumed.
● The calculated value for Duty Cycle (DC) shall be recorded in the test report. This value shall be equal to or less than the maximum value declared by the manufacturer.
**Step 5:**
● Use the same stored measurement samples from the procedure described in clause 5.4.2.2.1.2.
● Identify any TxOff time that is equal to or greater than the minimum Tx-gap time as defined in clause 4.3.1.3.3 or clause 4.3.2.4.3. These are the potential valid gap times to be further considered in this procedure.
● Starting from the second identified gap, calculate the time from the start of this gap to the end of the preceding gap. This time is the Tx-sequence time for this transmission. Repeat this procedure until the last identified gap within the observation period is reached.
● A combination of consecutive Tx-sequence times and Tx-gap times followed by a Tx-gap time, which is at least as long as the duration of this combination, may be considered as a single Tx-sequence time and in which case it shall comply with the limits defined in clause 4.3.1.3.3 or clause 4.3.2.4.3.
● It shall be noted in the test report whether the UUT complies with the limits for the maximum Tx-sequence time and minimum Tx-gap time as defined in clause 4.3.1.3.3 or clause 4.3.2.4.3.

**EUT DESCRIPTION:**

| | |
|---|---|
| Mode: | BT Test mode |
| Test Channel | Channel 00(2402MHz),Channel 19(2440MHz),Channel 39(2480MHz) |
| Modulation: | GFSK |

**MEASUREMENT DESCRIPTION**

| | | |
|---|---|---|
| Instrument: | Power Meter measuring average burst Power of a least 10 packets | |
| Performed: | ☒ | Conducted |
| | ☐ | Radiated (only if no conducted sample is provided) |

**TEST RESULTS**

This requirement do not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p. So this requirement do not apply for EUT.

## 4.1.3. Medium Utilisation (MU) factor

**LIMIT**

**ETSI EN 300 328 Sub-clause 4.3.2.5.3**
The maximum Medium Utilization factor for non-adaptive non-FHSS equipment shall be 10 %.

**TEST PROCEDURE**

**Please refer to ETSI EN 300 328 Sub-clause 5.4.2.2.1.4**

**Step 1:**
● Use the same stored measurement samples from the procedure described in clause 5.4.2.2.1.2.

**Step 2:**
● For each burst calculate the product of ($P_{burst}$/100 mW) and the TxOn time.
NOTE: Pburst is expressed in mW. TxOn time is expressed in ms.

**Step 3:**
● Medium Utilization is the sum of all these products divided by the observation period (expressed in ms) which is defined in clause 4.3.1.3.2 or clause 4.3.2.4.2. This value, which shall comply with the limit given in clause 4.3.1.6.3 or clause 4.3.2.5.3, shall be recorded in the test report.
● If, in case of FHSS equipment, operation without blacklisted frequencies is not possible, the power of the bursts on blacklisted hopping frequencies (for the calculation of the Medium Utilization) is assumed to be equal to the average value of the RMS power of the bursts on all active hopping frequencies.

**MEASUREMENT DESCRIPTION**

| | | |
|---|---|---|
| Instrument: | Power Meter measuring average burst Power of a least 10 packets | |
| Performed: | ☒ | Conducted |
| | ☐ | Radiated (only if no conducted sample is provided) |

**TEST RESULTS**

This requirement do not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p. So this requirement do not apply for EUT.

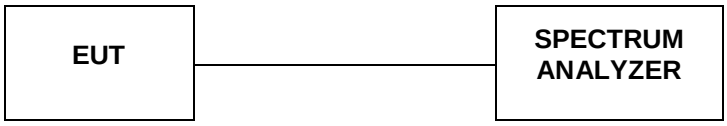
## 4.1.4. Power Spectral Density

**LIMIT**

**ETSI EN 300 328 Sub-clause 4.3.2.3.3**

The maximum Power Spectral Density for non-FHSS equipment is 10 dBm per MHz.

**TEST CONFIGURATION**




**TEST PROCEDURE**

**Please refer to ETSI EN 300 328 Sub-clause 5.4.3.2.1**
The transmitter shall be connected to a spectrum analyser and the Power Spectral Density as defined in clause 4.3.2.2 shall be measured and recorded.
**Step 1:**
Connect the UUT to the spectrum analyser and use the following settings:
● Start Frequency: 2 400 MHz
● Stop Frequency: 2 483,5 MHz
● Resolution BW: 10 kHz
● Video BW: 30 kHz
● Sweep Points: > 8 350
NOTE: For spectrum analysers not supporting this number of sweep points, the frequency band may be segmented.
● Detector: RMS
● Trace Mode: Max Hold
● Sweep time:
- For non-continuous transmissions: 2 × Channel Occupancy Time × number of sweep points(For non-adaptive equipment use the maximum TX-sequence time in the formula above instead of the Channel Occupancy Time).
- For continuous transmissions: 10 s; the sweep time may be increased further until a value where the sweep time has no further impact anymore on the RMS value of the signal
**Step 2:**
For conducted measurements on smart antenna systems using either operating mode 2 or operating mode 3 (see clause 5.3.2.2), repeat the measurement for each of the transmit ports. For each sampling point (frequency domain), add up the coincident power values (in mW) for the different transmit chains and use this as the new data set.
**Step 3:**
Add up the values for power for all the samples in the file using the formula below.

$$P_{Sum} = \sum_{n=1}^{k} P_{sample}(n)$$

with k being the total number of samples and n the actual sample number
**Step 4:**
Normalize the individual values for power (in dBm) so that the sum is equal to the RF Output Power (e.i.r.p.) measured in clause 5.4.2 and save the corrected data. The following formulas can be used:

$$C_{Corr} = P_{Sum} - P_{e.i.r.p.}$$

$$P_{Samplecorr}(n) = P_{Sample}(n) - C_{Corr}$$

with n being the actual sample number
**Step 5:**
Starting from the first sample $PS_{amplecorr}(n)$ (lowest frequency), add up the power (in mW) of the following samples representing a 1 MHz segment and record the results for power and position (i.e. sample #1 to sample #100). This is the Power Spectral Density (e.i.r.p.) for the first 1 MHz segment which shall be recorded.
**Step 6:**
Shift the start point of the samples added up in step 5 by one sample and repeat the procedure in step 5 (i.e. sample #2 to sample #101).
**Step 7:**
Repeat step 6 until the end of the data set and record the Power Spectral Density values for each of the 1 MHz segments.
From all the recorded results, the highest value is the maximum Power Spectral Density (PSD) for the UUT. This value, which shall comply with the limit given in clause 4.3.2.3.3, shall be recorded in the test report.

**EUT DESCRIPTION:**

| | |
|---|---|
| Mode: | BT Test mode |
| Test Channel | Channel 00(2402MHz),Channel 19(2440MHz),Channel 39(2480MHz) |
| Modulation: | GFSK |

**MEASUREMENT DESCRIPTION**

| | | |
|---|---|---|
| Instrument: | Spectrum Analyzer | |
| Detector: | RMS | |
| Sweep time: | auto | |
| Video bandwidth: | 30KHz | |
| Resolution bandwidth: | 10KHz | |
| Span: | 83.5MHz | |
| Frequency range | 2400-2483.5MHz | |
| Sweep Points | 15000 | |
| Performed: | ☒ | Conducted |
| | ☐ | Radiated (only if no conducted sample is provided) |

**TEST RESULTS**

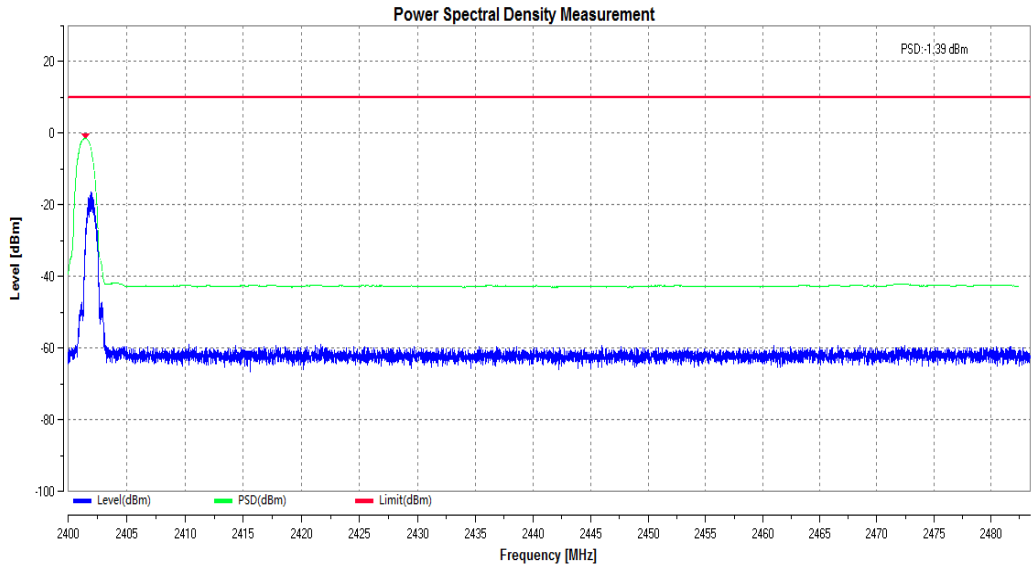
| **Test Mode:GFSK** | | |
|---|---|---|
| **Antenna Gain: 2.0 dBi** | | **Test Method: Conducted** |
| **Test Temperature: 25℃** | | **Test Voltage:DC 12.0** |
| **The Maximum Power Spectral Density** | | |
| **Test Channel Number** | **Test Frequency (MHz)** | **EIRP Density (dBm/MHz)** |
| 00 | 2402 | -1.39 |
| 19 | 2440 | -1.32 |
| 39 | 2480 | -2.04 |
| **Result** | | **PASS** |
| **Limit** | | **10dBm/MHz** |

Note :1. Measured Power include the cable loss&antenna gain.

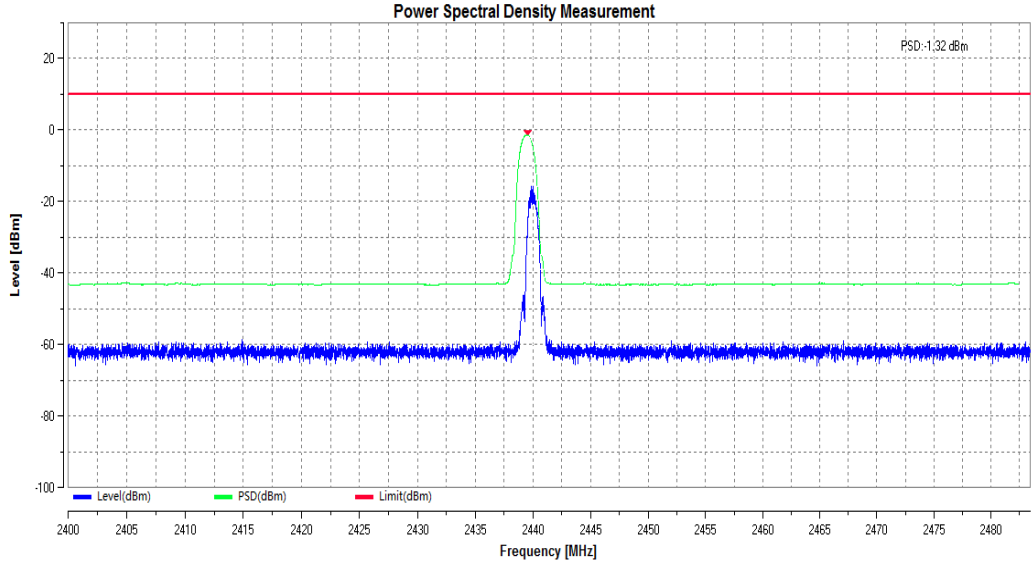
**Test plot as follows:**

GFSK

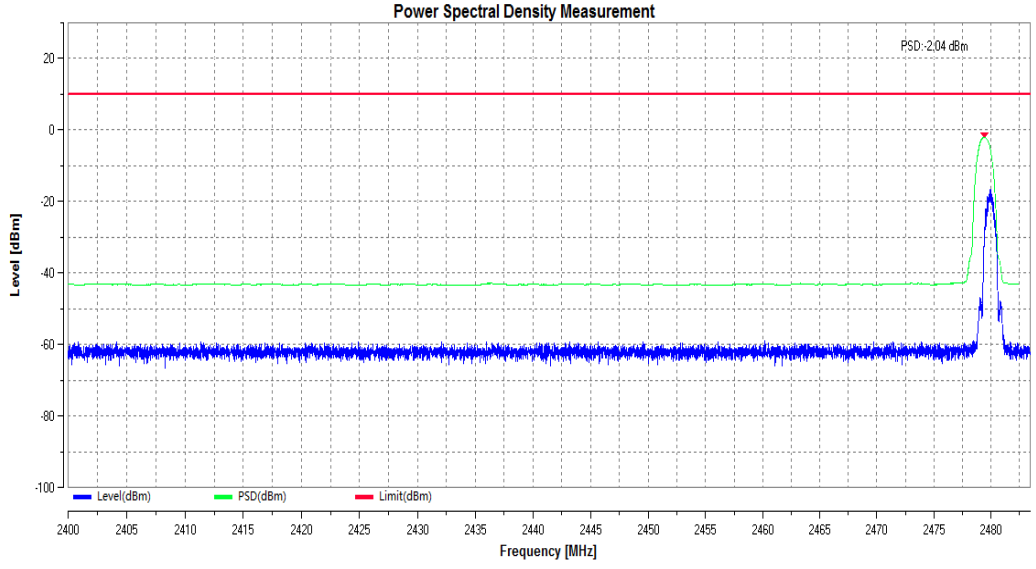
CH00




CH19




CH39



## 4.1.5. Adaptivity

**Requirements & Limits**

**ETSI EN 300 328 Sub-4.3.2.6**

**For Adaptive non-FHSS using DAA**

1) During normal operation, the equipment shall evaluate the presence of a signal on its current operating channel(s). If it is determined that a signal is present with a level above the detection threshold defined in step 5 that channel shall be marked as 'unavailable'.
2) The channel(s) shall remain unavailable for a minimum time equal to 1 s after which the channel may be considered again as an 'available' channel.
3) The total time during which an equipment has transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time. The Channel Occupancy Time shall be less than 40 ms. Each such transmission sequence shall be followed by an Idle Period (no transmissions) of minimum 5 % of the Channel Occupancy Time with a minimum of 100 µs. After this, the procedure as in step 1 needs to be repeated.
4) The detection threshold shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the detection threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the detection threshold level may be relaxed to:
$TL = -70\ dBm/MHz + 10 \times \log_{10}(100\ mW / P_{out})$ ($P_{out}$ in mW e.i.r.p.)
5) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in following table

| Wanted signal mean power from companion device (dBm) | Unwanted signal frequency (MHz) | Unwanted CW signal power (dBm) |
|---|---|---|
| -30 (see note 2) | 2 395 or 2 488,5 (see note 1) | -35 (see note 2) |
| NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1. | | |
| NOTE 2: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density in front of the UUT antenna. | | |

**For Adaptive non-FHSS using LBT (Frame Based Equipment):**

1) Before transmission, 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 18 µs. 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 during the next Frame Period. 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 equipment. See clause 4.3.2.6.1. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4.
3) The total time during which an equipment has transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time. The Channel Occupancy Time shall be in the range 1 ms to 10 ms followed by an Idle Period of at least 5 % of the Channel Occupancy Time used in the equipment for the current Frame Period.
4) An equipment, upon correct reception of a transmission which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames. A consecutive sequence of such transmissions by the equipment without a new CCA shall not exceed the maximum Channel Occupancy Time. 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 to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p. the CCA threshold level may be relaxed to:
$TL = -70\ dBm/MHz + 10 \times \log_{10}(100\ mW / P_{out})$ ($P_{out}$ in mW e.i.r.p.)

6) The equipment shall comply with the requirements defined in step 1 to step 4 in the present clause in the presence of an unwanted CW signal as defined in following table

| Wanted signal mean power from companion device | Unwanted signal frequency (MHz) | Unwanted signal power (dBm) |
|---|---|---|
| sufficient to maintain the link (see note 2) | 2 395 or 2 488,5 (see note 1) | -35 (see note 3) |
| NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1. | | |
| NOTE 2: A typical conducted value which can be used in most cases is -50 dBm/MHz. | | |
| NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density in front of the UUT antenna. | | |

**For Adaptive non-FHSS using LBT (Frame 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 18 µs. 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 also the next paragraph). The equipment shall perform an Extended CCA check in which the channel is observed for a random duration in the range between 18 µs and at least 160 µs. 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.

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 13 ms, after which the device shall perform a new CCA as described in step 1 above.

4) The equipment, upon correct reception of a transmission which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames. 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. 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.

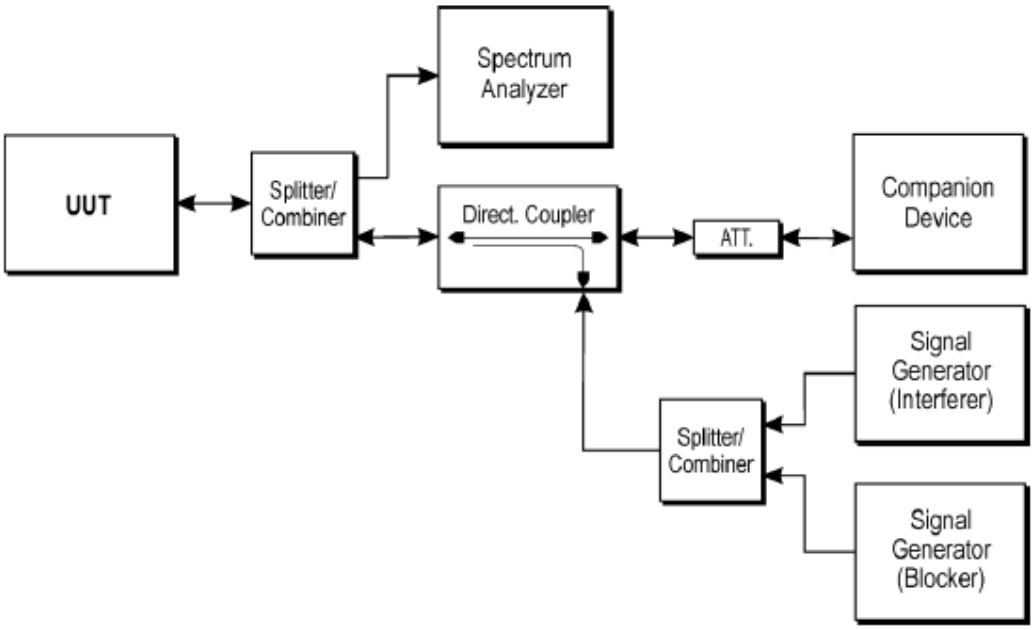
5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the CCA threshold level may be relaxed to:

$TL = -70\ \text{dBm/MHz} + 10 \times \log_{10}(100\ \text{mW} / P_{out})$ ($P_{out}$ in mW e.i.r.p.)

6) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in following table

| Wanted signal mean power from companion device | Unwanted signal frequency (MHz) | Unwanted signal power (dBm) |
|---|---|---|
| sufficient to maintain the link (see note 2) | 2 395 or 2 488,5 (see note 1) | -35 (see note 3) |
| NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1. | | |
| NOTE 2: A typical conducted value which can be used in most cases is -50 dBm/MHz. | | |
| NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna. | | |

**TEST CONFIGURATION:**




**TEST PROCEDURE**

1. Please refer to ETSI EN 300 328 Sub-clause 5.1 for the test conditions.
2. Please refer to ETSI EN 300 328 Sub-clause 5.4.6 for the measurement method.

   RBW: ⩾ Occupied Channel Bandwidth (if the analyser does not support this setting, the highest available setting shall be used) (10MHz)
   VBW: 3 × RBW (if the analyser does not support this setting, the highest available setting shall be used) (10MHz)
   Detector Mode: RMS
   Centre Frequency: Equal to the centre frequency of the operating channel
   Span: 0 Hz
   Sweep time: > Channel Occupancy Time of the UUT
   Trace Mode: Clear/Write

**TEST RESULTS**

This requirement do not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p. So this requirement do not apply for EUT.

## 4.1.6. Occupied Channel Bandwidth

**LIMIT**

**ETSI EN 300 328 Sub-clause 4.3.2.7.3**
The Occupied Channel Bandwidth shall be within the band given in following table.

| | Service frequency bands |
|---|---|
| Transmit | 2 400 MHz to 2 483,5 MHz |
| Receive | 2 400 MHz to 2 483,5 MHz |

In addition, for non-adaptive non-FHSS equipment with e.i.r.p. greater than 10 dBm, the Occupied Channel Bandwidth shall be equal to or less than 20 MHz.

**TEST PROCEDURE**

**Please refer to ETSI EN 300 328 Sub-clause 5.4.7.2.1**
**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 %
● Video BW: 3 × RBW
● Frequency Span: 2 × Occupied Channel Bandwidth (e.g. 40 MHz for a 20 MHz channel)
● 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.
NOTE: Make sure that the power envelope is sufficiently above the noise floor of the analyser to avoid the noise signals left and right from the power envelope being taken into account by this measurement.

**EUT DESCRIPTION:**

| | |
|---|---|
| Mode: | BT Test mode |
| Test Channel | Channel 00(2402MHz), Channel 39(2480MHz) |
| Modulation: | GFSK |

**MEASUREMENT DESCRIPTION**

| | | |
|---|---|---|
| Instrument: | Spectrum Analyzer | |
| Detector: | RMS | |
| Sweep time: | auto | |
| Video bandwidth: | 20KHz | |
| Resolution bandwidth: | 68KHz | |
| Span: | 2 MHz | |
| Center: | Transmit channel | |
| Trace: | Max hold | |
| Performed: | ☒ | Conducted |
| | ☐ | Radiated (only if no conducted sample is provided) |

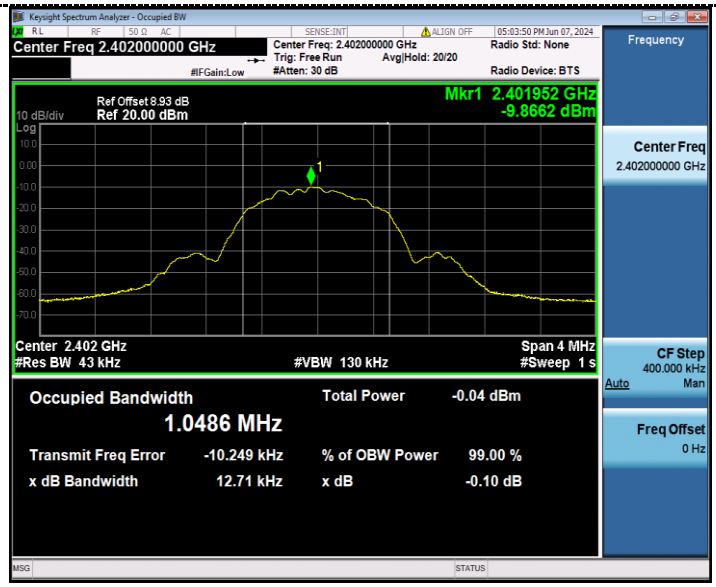
## TEST RESULTS

| Mode | Channel | Frequency (MHz) | 99% Bandwidth (MHz) | FL[MHz] | FH[MHz] | Limits (MHz) | Verdict |
|---|---|---|---|---|---|---|---|
| GFSK | 00 | 2402 | 1.0486 | 2401.4655 | 2402.5141 | 2400 to 2483.5 | PASS |
| | 39 | 2480 | 1.0515 | 2479.4611 | 2480.5126 | 2400 to 2483.5 | PASS |

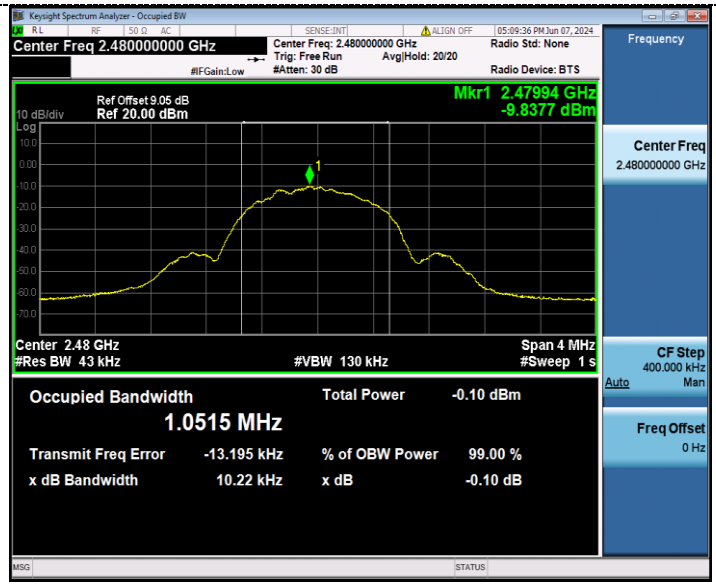
## Test plot as follows:

GFSK

CH00



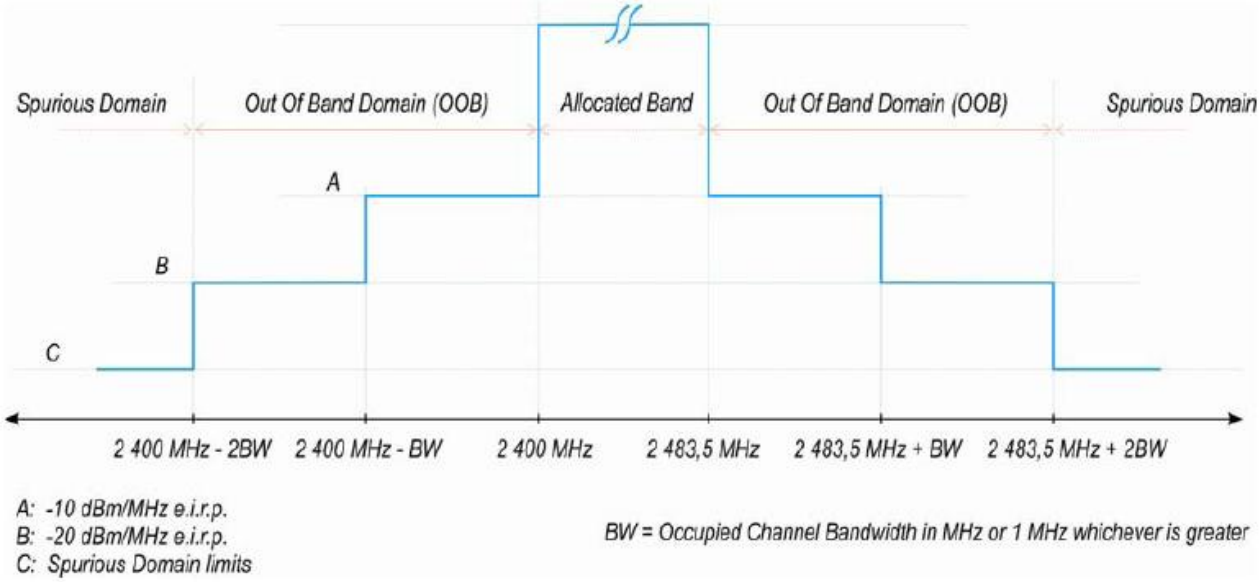

CH39



## 4.1.7. Transmitter unwanted emissions in the out-of-band domain

**LIMIT**

**ETSI EN 300 328 Sub-clause 4.3.2.8.3**
The transmitter unwanted emissions in the out-of-band domain shall not exceed the values provided by the mask in following figure




**TEST PROCEDURE**

**Please refer to ETSI EN 300 328 Sub-clause 5.4.8.2.1**
The Out-of-band emissions within the different horizontal segments of the mask provided in figures 1 and 3 shall be measured using the steps below. This method assumes the spectrum analyser is equipped with the Time Domain Power option.
**Step 1:**
Connect the UUT to the spectrum analyser and use the following settings:
- Measurement Mode: Time Domain Power
- Centre Frequency: 2 484 MHz
- Span: Zero Span
- Resolution BW: 1 MHz
- Filter mode: Channel filter
- Video BW: 3 MHz
- Detector Mode: RMS
- Trace Mode: Max Hold
- Sweep Mode: Single Sweep
- Sweep Points: Sweep time [µs] / (1 µs) with a maximum of 30 000
- Trigger Mode: Video
- 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)**
● The measurement shall be performed and repeated while the trigger level is increased until no triggering takes place.
● For FHSS 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 + 2 BW. 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 (which means this may partly overlap with the previous 1 MHz segment).

**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 - BW + 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

**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 - 2 BW 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 - 2 BW + 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

**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 figure 1 or figure 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 figure 1 or figure 3.
- Option 2: the limits provided by the mask given in figure 1 or figure 3 shall be reduced by 10 × log10(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: Ach refers to the number of active transmit chains.

**EUT DESCRIPTION:**

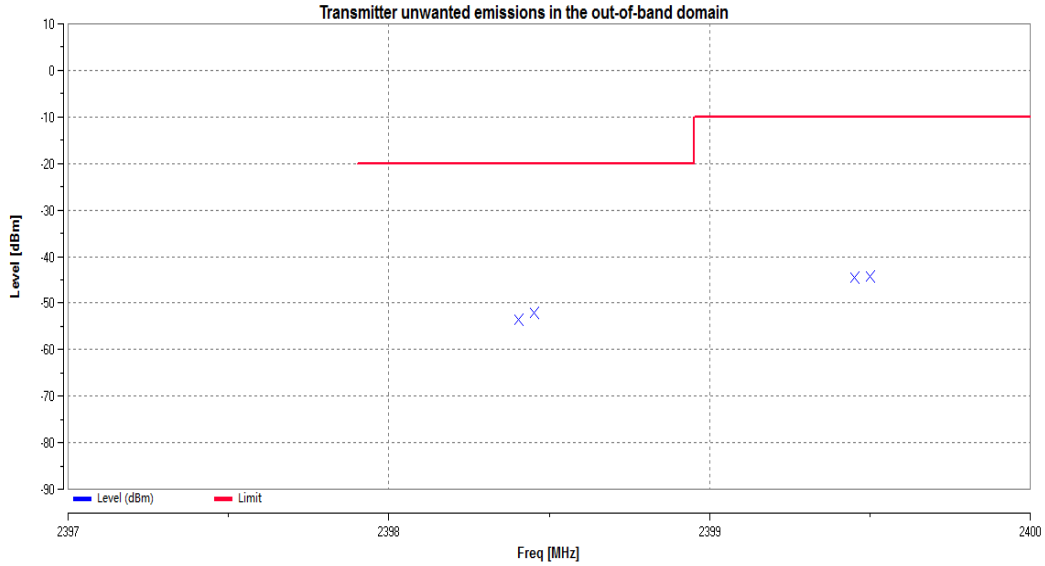
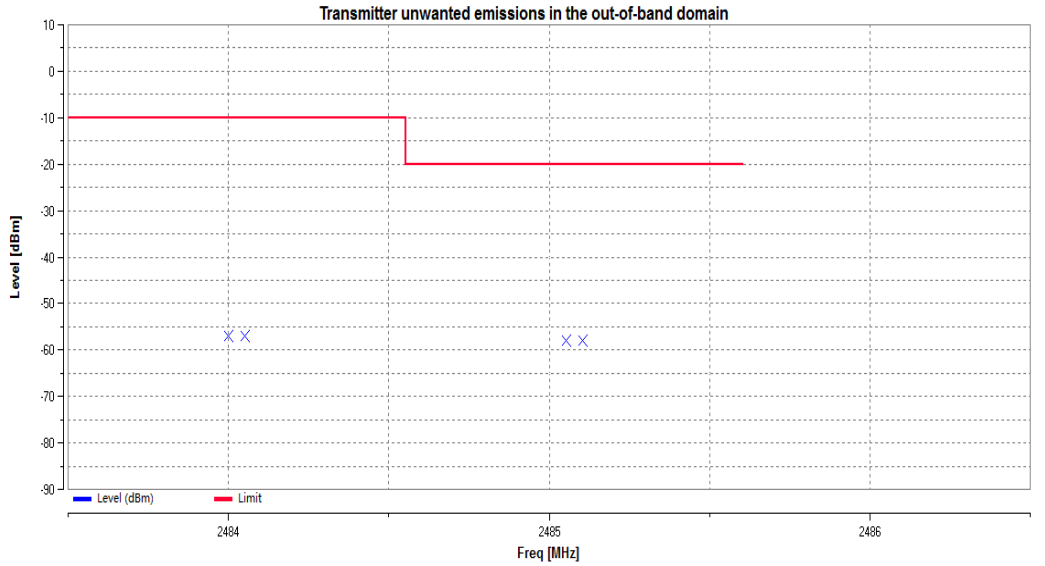
| | |
|---|---|
| Mode: | BT Test mode |
| Test Channel | Channel 00(2402MHz), Channel 39(2480MHz) |
| Modulation: | GFSK |

**MEASUREMENT DESCRIPTION**

| | | |
|---|---|---|
| Instrument: | Spectrum Analyzer | |
| Detector: | RMS | |
| Sweep time: | depending on packet length | |
| Video bandwidth: | 3MHz | |
| Resolution bandwidth: | 1MHz | |
| Span: | 0Hz | |
| Center: | fc (see result table) | |
| Trace: | Trigger to burst | |
| Sweep points: | 5000 | |
| Performed: | ☒ | Conducted |
| | ☐ | Radiated (only if no conducted sample is provided) |

**TEST RESULTS**

**Test plot as follows:**

| GFSK |
| --- |
|  |
| CH00(Left) |
|  |
| CH39(Right) |

## 4.1.8. Transmitter unwanted emissions in the spurious domain

**Limit**

**ETSI EN 300 328 Sub-clause 4.3.2.9.2**
The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 4

Table 4: Transmitter limits for spurious emissions

| Frequency range | Maximum power, e.r.p. (≤ 1 GHz) e.i.r.p. (> 1 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 694 MHz | -54 dBm | 100 kHz |
| 694 MHz to 1 GHz | -36 dBm | 100 kHz |
| 1 GHz to 12.75 GHz | -30 dBm | 1 MHz |

*Note: In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.*

**TEST PROCEDURE**

**Please refer to ETSI EN 300 328 Sub-clause 5.4.9.2.1 & 5.4.9.2.2**
In case of conducted measurements, the radio equipment shall be connected to the measuring equipment via a suitable attenuator.
The spectrum in the spurious domain (see figures 1 or 3) shall be searched for emissions that exceed the limit values given in tables 1 or 4 or that come to within 6 dB below these limits. Each occurrence shall be recorded.

**Pre-scan**
The test procedure below shall be used to identify potential unwanted emissions of the UUT.

**Step 1:**
The sensitivity of the measurement set-up should be such that the noise floor is at least 12 dB below the limits given in table 4 or table 12.

**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
● Filter type: 3 dB (Gaussian)
● Detector mode: Peak
● Trace Mode: Max Hold
● Sweep Points: ≥ 19 400; for spectrum analysers not supporting this high number of sweep points, the frequency band may 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, on any channel.
-For FHSS equipment operating in a normal operating (hopping not disabled) mode, the sweep time shall be further increased to capture multiple transmissions on any of the hopping frequencies.
-The above sweep time setting may result in long measuring times in case of FHSS equipment. To avoid such long measuring times, an FFT analyser may be used.

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 5.4.9.2.1.3 and compared to the limits given in table 4 or table 12.

**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
● Filter type: 3 dB (Gaussian)
● Detector mode: Peak
● Trace Mode: Max Hold
● Sweep Points: ≥ 23 500; for spectrum analysers not supporting this high number of sweep points, the frequency band may 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, on any channel.
- For FHSS equipment operating in a normal operating (hopping not disabled) mode, the sweep time shall be further increased to capture multiple transmissions on any of the hopping frequencies.
- The above sweep time setting may result in long measuring times in case of FHSS equipment. To avoid such long measuring times, an FFT analyser may be used.

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 5.4.9.2.1.3 and compared to the limits given in table 4 or table 12.

FHSS 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 5.4.9.2.1.3.

**Step 4:**
● In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), step 2 and step 3 need to be repeated for each of the active transmit chains (Ach).The limits used to identify emissions during this pre-scan need to be reduced by $10 \times \log_{10} (A_{ch})$..

**Measurement of the emissions identified during the pre-scan**
The procedure in step 1 to step 4 below shall be used to accurately measure the individual unwanted emissions identified during the pre-scan measurements above. This method assumes the spectrum analyser has a Time Domain Power function.

**Step 1:**
The level of the emissions shall be measured using the following spectrum analyser settings:
● Measurement Mode: Time Domain Power
● Centre Frequency: Frequency of the emission identified during the pre-scan
● Resolution Bandwidth: 100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
● Video Bandwidth: 300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
● Frequency Span: Zero Span
● Sweep Mode: Single Sweep
● Sweep Time: > 120 % of the duration of the longest burst detected during the measurement of the RF Output Power
● Sweep Points: Sweep time [µs] / (1 µs) with a maximum of 30 000
● Trigger Mode: Video (burst signals) or Manual (continuous signals)
● Detector Mode: RMS

**Step 2:**
Set a window where the start and stop indicators match the start and end of the burst with the highest level and record the value of the power measured within this window. If the spurious emission to be measured is a continuous transmission, the measurement window shall be set to match the start and stop times of the sweep.

**Step 3:**
In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), step 2 needs to be repeated for each of the active transmit chains ($A_{ch}$). Sum the measured power (within the observed window) for each of the active transmit chains.

**Step 4:**
The value defined in step 3 shall be compared to the limits defined in table 4 or table 12.

**EUT DESCRIPTION:**

| | |
|---|---|
| Mode: | BT Test mode |
| Test Channel | Channel 00(2402MHz), Channel 39(2480MHz) |
| Modulation: | GFSK |
| Assumed antenna gain: | 2.0 dBi |

**MEASUREMENT DESCRIPTION**

| | | |
|---|---|---|
| Instrument: | Spectrum Analyzer | |
| Detector: | Peak for prescan / RMS for emission retest | |
| Sweep time: | Auto | |
| Video bandwidth: | Below 1 GHz: 300 kHz / above 3MHz | |
| Resolution bandwidth: | Below 1 GHz: 100 kHz / above 1MHz | |
| Trace: | Max hold | |
| Sweep points: | 40001 | |
| Performed: | ☐ | Conducted |
| | ☒ | Radiated (only if no conducted sample is provided) |

**TEST RESULTS**

**Pass**

**Radioation Spurious Emissions**

| | |
|---|---|
| Measured Modulation | ☒**GFSK** |

**Radioation Spurious Emissions**

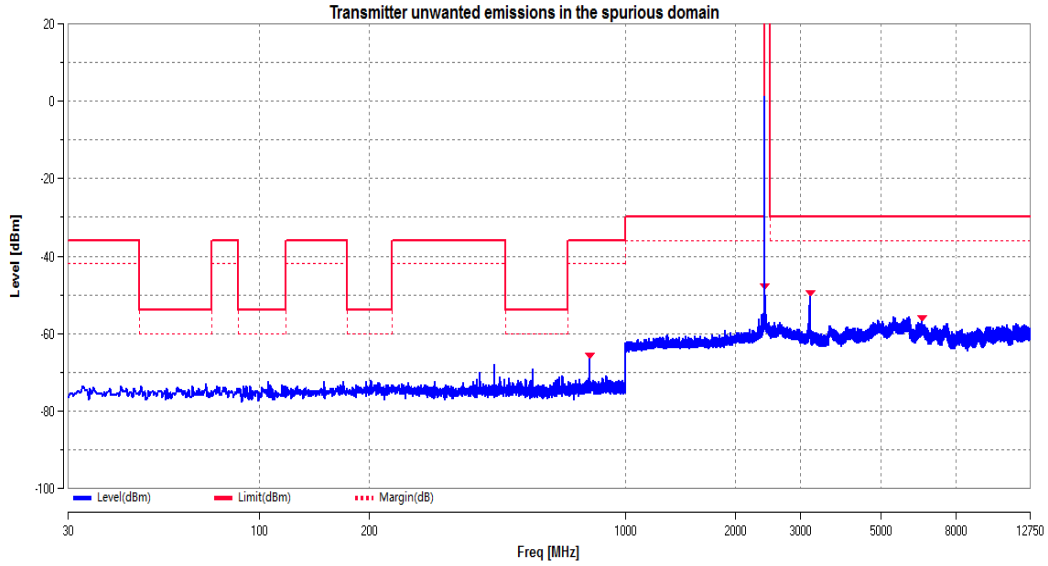
| Frequency (MHz) | Polarization (H/V) | Measure Level (dBm) | Limit (dBm) | Margin (dB) | Detector |
|---|---|---|---|---|---|
| Channel 0 (2402MHz) | | | | | |
| 419.50 | H | -47.68 | -36.00 | -11.68 | PK |
| 862.81 | V | -45.93 | -36.00 | -9.93 | PK |
| 865.95 | H | -48.10 | -36.00 | -12.10 | PK |
| 903.49 | V | -44.35 | -36.00 | -8.35 | PK |
| 1731.60 | H | -43.38 | -30.00 | -13.38 | PK |
| 4958.04 | V | -42.12 | -30.00 | -12.12 | PK |
| 7438.27 | H | -39.96 | -30.00 | -9.96 | PK |
| 7438.63 | V | -39.44 | -30.00 | -9.44 | PK |
| Channel 39 (2480MHz) | | | | | |
| 237.91 | H | -47.54 | -36.00 | -11.54 | PK |
| 254.67 | V | -52.53 | -36.00 | -16.53 | PK |
| 844.17 | H | -47.87 | -36.00 | -11.87 | PK |
| 825.03 | V | -49.42 | -36.00 | -13.42 | PK |
| 4961.09 | H | -42.92 | -30.00 | -12.92 | PK |
| 4961.06 | V | -41.53 | -30.00 | -11.53 | PK |
| 7439.92 | H | -44.27 | -30.00 | -14.27 | PK |
| 7440.28 | V | -42.04 | -30.00 | -12.04 | PK |

**Conducted Spurious Emissions**

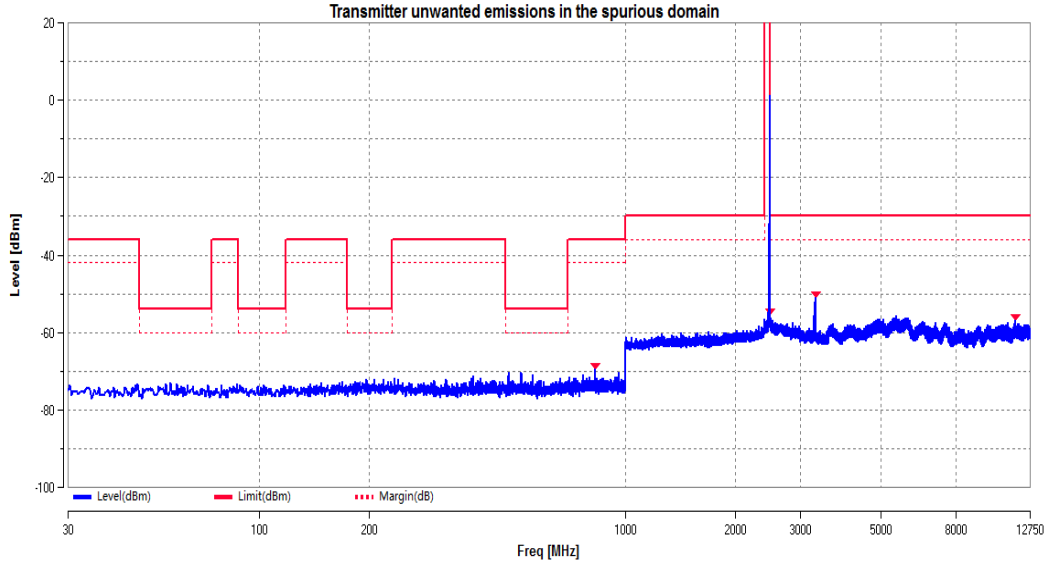
| Measured Modulation | ☒**GFSK** |
|---|---|

GFSK

CH00




CH39



## 4.1.9. Receiver spurious emissions

**LIMIT**

**ETSI EN 300 328 Sub-clause 4.3.2.10.3**

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

| Frequency range | Maximum power | Measurement bandwidth |
|---|---|---|
| 30 MHz to 1 GHz | -57 dBm | 100 kHz |
| 1 GHz to 12,75 GHz | -47 dBm | 1 MHz |

*Note: In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.*

**TEST PROCEDURE**

The same as described in section 4.1.8

**EUT DESCRIPTION:**

| | |
|---|---|
| Mode: | BT Test mode |
| Test Channel | Channel 00(2402MHz), Channel 39(2480MHz) |
| Modulation: | GFSK |
| Assumed antenna gain: | 2.0 dBi |

**MEASUREMENT DESCRIPTION**

| | | |
|---|---|---|
| Instrument: | Spectrum Analyzer | |
| Detector: | Peak for prescan / RMS for emission retest | |
| Sweep time: | Auto | |
| Video bandwidth: | Below 1 GHz: 300 kHz / above 3MHz | |
| Resolution bandwidth: | Below 1 GHz: 100 kHz / above 1MHz | |
| Trace: | Max hold | |
| Sweep points: | 40001 | |
| Performed: | ☐ | Conducted |
| | ☒ | Radiated (only if no conducted sample is provided) |

**TEST RESULTS**

**Pass**

**Radioation Spurious Emissions:**

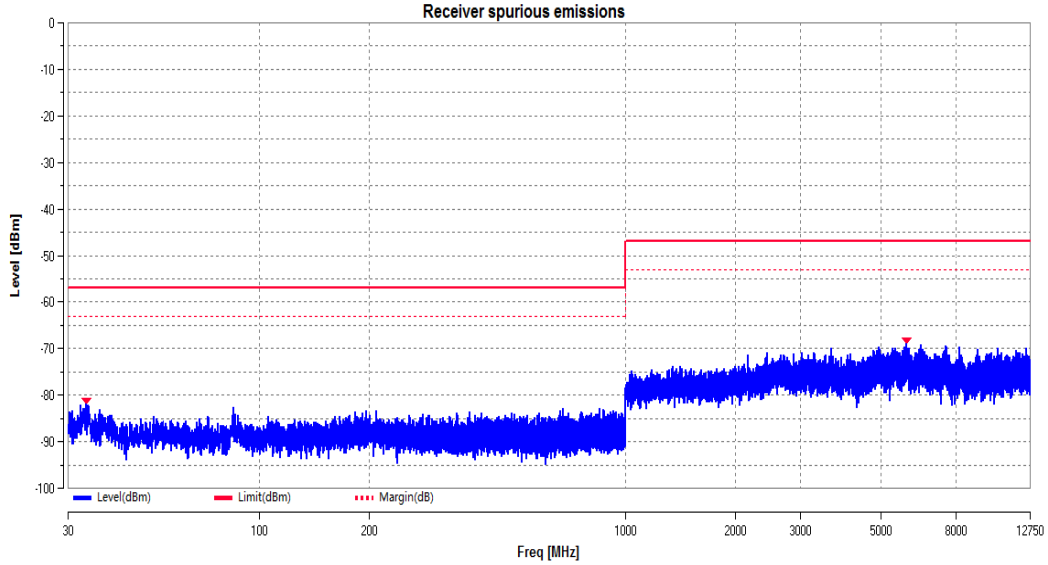
| Frequency (MHz) | Polarization (H/V) | Measure Level (dBm) | Limit (dBm) | Margin (dB) | Detector |
|---|---|---|---|---|---|
| Channel 0 (2402MHz) | | | | | |
| 216.67 | H | -70.85 | -57.00 | -13.85 | PK |
| 183.06 | V | -70.38 | -57.00 | -13.38 | PK |
| 887.24 | H | -70.60 | -57.00 | -13.60 | PK |
| 896.27 | V | -68.44 | -57.00 | -11.44 | PK |
| 1829.05 | H | -60.19 | -47.00 | -13.19 | PK |
| 1303.91 | V | -59.14 | -47.00 | -12.14 | PK |
| 2201.82 | H | -61.92 | -47.00 | -14.92 | PK |
| 2330.61 | V | -57.80 | -47.00 | -10.80 | PK |
| Channel 39 (2480MHz) | | | | | |
| 215.87 | H | -68.85 | -57.00 | -11.85 | PK |
| 179.71 | V | -67.59 | -57.00 | -10.59 | PK |
| 888.19 | H | -69.41 | -57.00 | -12.41 | PK |
| 896.71 | V | -69.28 | -57.00 | -12.28 | PK |
| 1829.45 | H | -58.79 | -47.00 | -11.79 | PK |
| 1300.50 | V | -57.05 | -47.00 | -10.05 | PK |
| 2201.72 | H | -62.72 | -47.00 | -15.72 | PK |
| 2330.51 | V | -59.28 | -47.00 | -12.28 | PK |

## Conducted Spurious Emissions

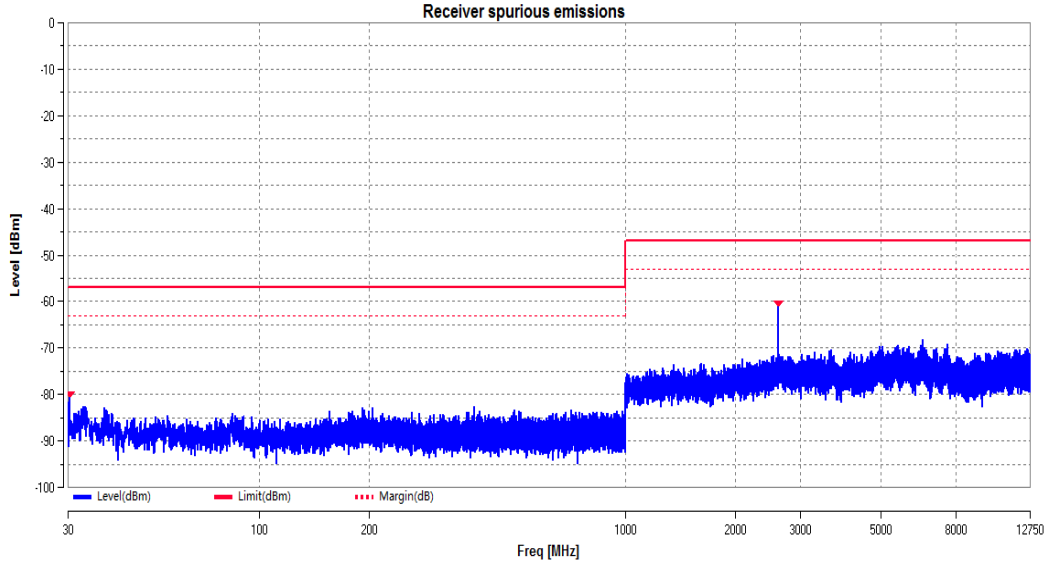
| Measured Modulation | ☒GFSK |
|---|---|

GFSK

CH00




CH39



## 4.1.10.Receiver Blocking

**Limits**

**ETSI EN 300 328 Sub-4.3.2.11.4**

**While maintaining the minimum performance criteria as defined in clause 4.3.2.11.4, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in follow**

**Receiver Category 1**

| Wanted signal mean power from companion device (dBm) (see notes 1 and 4) | Blocking signal frequency (MHz) | Blocking signal power (dBm) (see note 4) | Type of blocking signal |
|---|---|---|---|
| (-133 dBm + 10 × $\log_{10}$(OCBW)) or -68 dBm whichever is less (see note 2) | 2 380<br>2 504 | -34 | CW |
| (-139 dBm + 10 × $\log_{10}$(OCBW)) or -74 dBm whichever is less (see note 3) | 2 300<br>2 330<br>2 360<br>2 524<br>2 584<br>2 674 | | |

NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to $P_{min}$ + 26 dB where $P_{min}$ is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to $P_{min}$ + 20 dB where $P_{min}$ is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

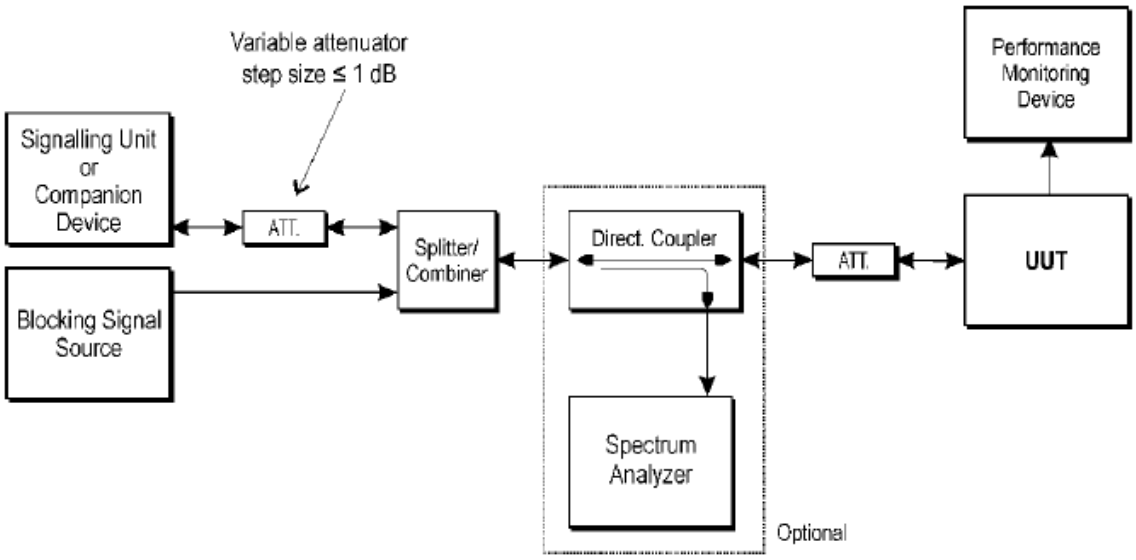
**Receiver Category 2**

| Wanted signal mean power from companion device (dBm) (see notes 1 and 3) | Blocking signal frequency (MHz) | Blocking signal power (dBm) (see note 3) | Type of blocking signal |
|---|---|---|---|
| (-139 dBm + 10 × $\log_{10}$(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2) | 2 380<br>2 504<br>2 300<br>2 584 | -34 | CW |
| NOTE 1: OCBW is in Hz.<br>NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to $P_{min}$ + 26 dB where $P_{min}$ is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.<br>NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2. | | | |

**Receiver Category 3**

| Wanted signal mean power from companion device (dBm) (see notes 1 and 3) | Blocking signal frequency (MHz) | Blocking signal power (dBm) (see note 3) | Type of blocking signal |
|---|---|---|---|
| (-139 dBm + 10 × $\log_{10}$(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2) | 2 380<br>2 504<br>2 300<br>2 584 | -34 | CW |
| NOTE 1: OCBW is in Hz.<br>NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to $P_{min}$ + 30 dB where $P_{min}$ is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.<br>NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2. | | | |

**TEST CONFIGURATION:**




**TEST PROCEDURE**

Please refer to ETSI EN 300 328 Sub-clause 5.4.11.2.1 for the measurement method..

**Step 1:**
● For non-FHSS equipment, the UUT shall be set to the lowest operating channel on which the blocking test has to be performed (see clause 5.4.11.1).

**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.
● Unless the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, the level of the wanted signal shall be set to the value provided in the table corresponding to the receiver category and type of equipment. The test procedure defined in clause 5.4.2, and more in particular clause 5.4.2.2.1.2, can be used to measure the (conducted) level of the wanted signal however no correction shall be made for antenna gain of the companion device (step 6 in clause 5.4.2.2.1.2 shall be ignored). This level may be measured directly at the output of the companion device and a correction is made for the coupling loss into the UUT. The actual level for the wanted signal shall be recorded in the test report.
● When the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, 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 $P_{min}$. This signal level ($P_{min}$) is increased by the value provided in note 2 of the applicable 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.
● If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 are met then proceed to step 6.

**Step 5**
● If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been increased with a value equal to the Occupied Channel Bandwidth except:
- For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by 3 dB.
- For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB.

● If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been decreased with a value equal to the Occupied Channel Bandwidth except:
- For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB.
- For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by 3 dB.
● If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, the UUT fails to comply with the Receiver Blocking requirement and step 6 and step 7 are no longer required.
● It shall be recorded in the test report whether the shift of blocking frequencies as described in the present step was used.

**Step 6:**
● Repeat step 4 and step 5 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 7:**
● For non-FHSS equipment, repeat step 2 to step 6 with the UUT operating at the highest operating channel on which the blocking test has to be performed (see clause 5.4.11.1).

**Step 8:**

● It shall be assessed and recorded in the test report whether the UUT complies with the Receiver Blocking requirement.

**TEST RESULTS**

According to Sub 4.2.3, The Power of the EUT is less than 10dB, so it belongs to Receiver category 3

| Test frequency | 2402MHz | | Test mode | Normal link | |
|---|---|---|---|---|---|
| Wanted signal mean power from companion device (dBm) | Blocking signal frequency (MHz) | Blocking signal power (dBm) | Limit(PER) | test value(PER) | Result |
| -139 dBm + 10 × log10(OCBW) +10dB | 2380 | -34 | 10% | 6% | PASS |
| | 2504 | -34 | 10% | 5% | PASS |
| | 2300 | -34 | 10% | 2% | PASS |
| | 2584 | -34 | 10% | 3% | PASS |

| Test frequency | 2480MHz | | Test mode | Normal link | |
|---|---|---|---|---|---|
| Wanted signal mean power from companion device (dBm) | Blocking signal frequency (MHz) | Blocking signal power (dBm) | Limit(PER) | test value(PER) | Result |
| -139 dBm + 10 × log10(OCBW) +10dB | 2380 | -34 | 10% | 7% | PASS |
| | 2504 | -34 | 10% | 4% | PASS |
| | 2300 | -34 | 10% | 3% | PASS |
| | 2584 | -34 | 10% | 4% | PASS |

**Note:Wanted signal mean power from companion device is -139 dBm + 10 × log10(OCBW) +10dB or -74 dBm+10dB whichever is less.**

## 5. TEST SETUP PHOTOS OF THE EUT

Reference to the test report No. **GTS20240426022-1-14.**

## 6. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

Reference to the test report No. **GTS20240426022-1-14.**

**.....End of Report.....**