ETSI EN 300 328 V2.1.1: 2016

TEST REPORT

FOR

Wireless business earbud

Model No.: P326.751, CT16236

Trademark: N/A

Report No.: ED170904030R

Issue Date: September 13, 2017

Prepared for

Prepared by

EMTEK(DONGGUAN) CO., LTD.
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1 TEST RESULT CERTIFICATION

Applicant :

Manufacturer :

EUT : Wireless business earbud

Model Name : P326.751, CT16236

Trademark : N/A

Measurement Procedure Used:

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
ETSI EN 300 328 V2.1.1: 2016	PASS

The device described above is tested by EMTEK (DONGGUAN) CO., LTD. to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and EMTEK (DONGGUAN) CO., LTD. is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the ETSI EN 300 328 V2.1.1: 2016 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of EMTEK (DONGGUAN) CO., LTD.

Date of Test : September 04, 2017 to September 12, 2017

Prepared by : Abby Li

Abby Li/Editor

Reviewer : Tomas Yang

Tomas Yang/Supervisor

Approve & Authorized Signer :

Sam Lv/Manager

EMTEK (DONGGUAN) CO.,LTD. TESTING

2 EUT DESCRIPTION

Product:	Wireless business earbud
Model Number:	P326.751, CT16236 (note: The models are the same except appearance and model number, so we prepare P326.751 for the Full test)
Trademark	N/A
Data Rate:	1Mbps for GFSK modulation 2Mbps for pi/4-DQPSK modulation 3Mbps for 8DPSK modulation
Modulation:	GFSK, π/4-DQPSK, 8DPSK
Operating Frequency:	2402-2480MHz
Number of Channels:	79 channels
Transmit Power Max:	-0.74dBm
Antenna Type:	PCB Antenna
Antenna Gain:	0dBi;
Power supply:	☒DC supply: Battery 3.7V
	☐AC 230V/50Hz for adapter
Temperature Range:	-20°C ~ +50°C

Note: for more details, please refer to the User’s manual of the EUT.

INFORMATION AS REQUIRED BY EN 300 328 V2.1.1

<table>
<tr><th>EN 300 328</th><th colspan="2">Information Is Provided By The Manufacturer</th></tr>
<tr><td>The Type Of Modulation Used By The Equipment</td><td colspan="2">☒ FHSS
☐ other forms of modulation</td></tr>
<tr><td>In Case Of FHSS

Modulation:</td><td colspan="2">☐ In case of non-Adaptive Frequency Hopping equipment
The number of Hopping Frequencies:

☒ In case of Adaptive Frequency Hopping Equipment
The maximum number of Hopping Frequencies:79
The minimum number of Hopping Frequencies: 79</td></tr>
<tr><td rowspan="11">The Worst Case Operational Mode For Each Of The Following Tests:</td><td>RF Output Power</td><td>-0.74 dBm</td></tr>
<tr><td>Power Spectral Density</td><td>N/A</td></tr>
<tr><td>Duty Cycle, Tx-Sequence, Tx-gap.</td><td>N/A</td></tr>
<tr><td>Accumulated Transmit time, Frequency Occupation & Hopping Sequence (only for FHSS equipment)</td><td>PASS</td></tr>
<tr><td>Hopping Frequency Separation (only for FHSS equipment)</td><td>1000KHz</td></tr>
<tr><td>Medium Utilisation.</td><td>N/A</td></tr>
<tr><td>Adaptivity & Receiver Blocking.</td><td>PASS</td></tr>
<tr><td>Nominal Channel Bandwidth</td><td>1.129MHz</td></tr>
<tr><td>Transmitter Unwanted Emissions in the OOB domain.</td><td>PASS</td></tr>
<tr><td>Transmitter Unwanted Emissions in the spurious domain</td><td>PASS</td></tr>
<tr><td>Receiver spurious emissions</td><td>PASS</td></tr>
<tr><td rowspan="2">The Different Transmit Operating Modes (Tick All That Apply):</td><td colspan="2">☒ Operating mode 1: Single Antenna Equipment
☒ Equipment with only 1 antenna
☐ Equipment with 2 diversity antennas but only 1 antenna active at any moment in time
☐ Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)</td></tr>
<tr><td colspan="2">☐ Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming
☐ Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)
☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1
☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2</td></tr>
</table>

	☐ Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming ☐ Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode) ☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1 ☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2
Operating Frequency Range(S) Of The Equipment:	Operating Frequency Range: 2402 MHz to 2480 MHz
Nominal Channel Bandwidth(s):	Occupied Channel Bandwidth: 1.129MHz
Type of Equipment (stand-alone, combined, plug-in radio device, etc.):	☒ Stand-alone ☐ Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment) ☐ Plug-in radio device (Equipment intended for a variety of host systems) ☐ Other
Describe the test modes available which can facilitate testing:	Modulation Mode: GFSK, π/4-DQPSK, 8DPSK Test Frequency: Low Frequency, Middle Frequency, High Frequency
The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):	Bluetooth Classical
NOTE: N/A means not applicable	

Modified History

Rev.	Summary	Date of Rev.	Report No.
V1.0	Original Report	/	ED170904030R

3 SUMMARY OF TEST RESULT

Clause (EN 300 328)	Test Parameter	Verdict	Remark
4.3.1.2	RF Output Power	PASS	
4.3.1.3	Duty Cycle and Tx-Sequence and Tx-Gap	N/A (See Note1)	Only applicable for non-adaptive equipment Output Power >10dBm
4.3.1.4	Accumulated Transmit Time, Frequency Occupation	PASS	
4.3.1.4	Hopping Frequency Sequence	PASS	
4.3.1.5	Hopping Frequency Separation	PASS	
4.3.1.6	Medium Utilisation Factor	N/A (See Note1)	Only applicable for non-adaptive equipment Output Power >10dBm
4.3.1.7	Adaptivity (Adaptive Frequency Hopping)	N/A	Only applicable for adaptive equipment Output Power >10dBm
4.3.1.8	Occupied Channel Bandwidth	PASS	
4.3.1.9	Transmitter Unwanted Emission in the out-of Band	PASS	
4.3.1.10	Transmitter Unwanted Emissions in the Spurious Domain	PASS	
4.3.1.11	Receiver Spurious Emissions	PASS	
4.3.1.12	Receiver Blocking	PASS	
4.3.1.13	Geo-location capability	N/A (See Note1)	Only applicable for have Geo-location function equipment
NOTE1: N/A means not applicable			

4 TEST METHODOLOGY

4.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards:

ETSI EN 300 328 –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

4.2 MEASUREMENT EQUIPMENT USED

For Spurious Emissions Test

Equipment Type	Manufacturer	Model No.	Serial Number	Last Cal.
EMI Test Receiver	Rohde & Schwarz	ESCI	101414	May 16, 2017
EMI Test Receiver	Rohde & Schwarz	FSV40	132.1-3008K39-100967-AP	May 16, 2017
Pre-Amplifier	LUNAR-EM	LNA30M3G-25	J10100000071	May 16, 2017
Pre-Amplifier	Lunar EM	LNA1G18-48	J1011131010001	May 16, 2017
Bilog Antenna	Schwarzbeck	VULB9163	660	May 17, 2017
Horn Antenna	Schwarzbeck	BBHA 9120	1178	May 17, 2017
Cable	H+B	NmSm-05-C15052	N/A	May 17, 2017
Cable	H+B	NmSm-2-C15201	N/A	May 17, 2017
Cable	H+B	NmNm-7-C15702	N/A	May 17, 2017
Cable	H+B	SAC-40G-1	414	May 17, 2017
Cable	H+B	SUCOFLEX104	MY14871/4	May 17, 2017
Cable	H+B	BLU18A-NmSm-6500	D8501	May 17, 2017
Band reject Filter(50dB)	WI/DE	WRCGV-2400(2400-2485MHz)	2	May 17, 2017
Remark: *Each piece of equipment is scheduled for calibration once a year.*				

For other test items:

Equipment Type	Manufacturer	Model No.	Serial Number	Last Cal.
Vector Signal Generater	Agilent	N5182B	My53050553	May 16, 2017
Analog Signal Generator	Agilent	N5171B	My53050878	May 16, 2017
Signal Analyzer	Agilent	N9010A	My53470879	May 16, 2017
Power Analyzer	Agilent	PS-X10-200	N/A	May 16, 2017
Test Accessories	Agilent	PS-X10-100	N/A	May 16, 2017
Temperature&Humidity test chamber	ESPEC	EL-02KA	12107166	May 16, 2017
Remark: *Each piece of equipment is scheduled for calibration once a year.*				

4.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.
The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.
The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (GFSK modulation; π/4-DQPSK modulation; 8DPSK modulation) were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Frequency and Channel list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	39	2441	…	…
1	2403	40	2442	76	2478
2	2404	41	2443	77	2479
…	…	…	…	78	2480
Note: fc=2402MHz+k×1MHz k=0 to 78					

Test Frequency and channe:

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	39	2441	78	2480

5 FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at:

EMTEK (DONGGUAN) CO., LTD.
Bldg 69, Majialong Industry Zone District, Nanshan District, Shenzhen, China
The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5.3 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description		
EMC Lab.	:	Accredited by CNAS, 2015.09.24 The certificate is valid until 2018.07.03 The Laboratory has been assessed and proved to be in compliance with CNAS/CL01:2006 The Certificate Registration Number is L3150 Registered on Industry Canada, January 13, 2017 The Certificate Number is 9444A
Name of Firm	:	EMTEK (DONGGUAN) CO., LTD.
Site Location	:	No.281, Guantai Road, Nancheng District, Dongguan, Guangdong, China.

6 TEST SYSTEM UNCERTAINTY

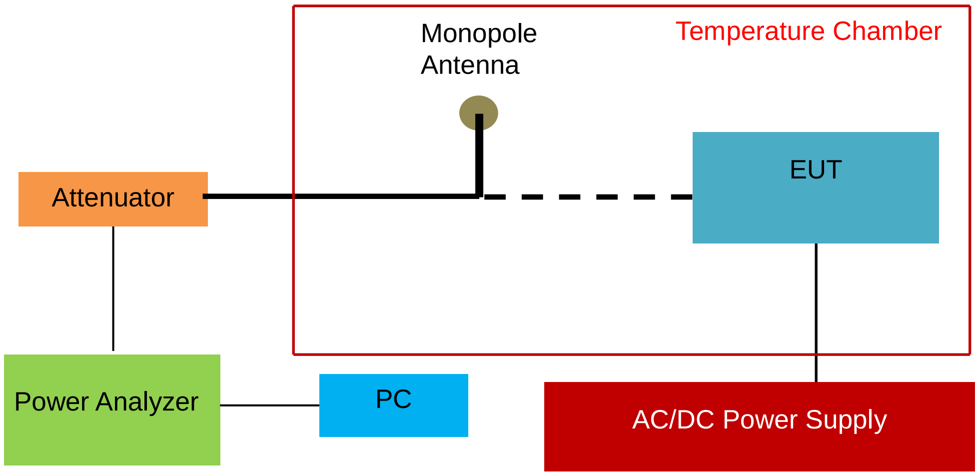
Maximum measurement uncertainty of the test system

Test Parameter	Measurement Uncertainty
RF Output Power	±1.0%
Duty Cycle and Tx-Sequence and Tx-Gap	±0.9%
Dwell Time and Minimum Frequency Occupation	±1.3%
Medium Utilisation Factor	±1.5%
Occupied Channel Bandwidth	±2.3%
Transmitter Unwanted Emission in the out-of Band	±1.2%
Transmitter Unwanted Emissions in the Spurious Domain	±2.7%
Receiver Spurious Emissions	±2.7%
Temperature	±3.2%
Humidity	±2.5%

7 SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

Conducted measurements configuration of EUT shall be as follows:

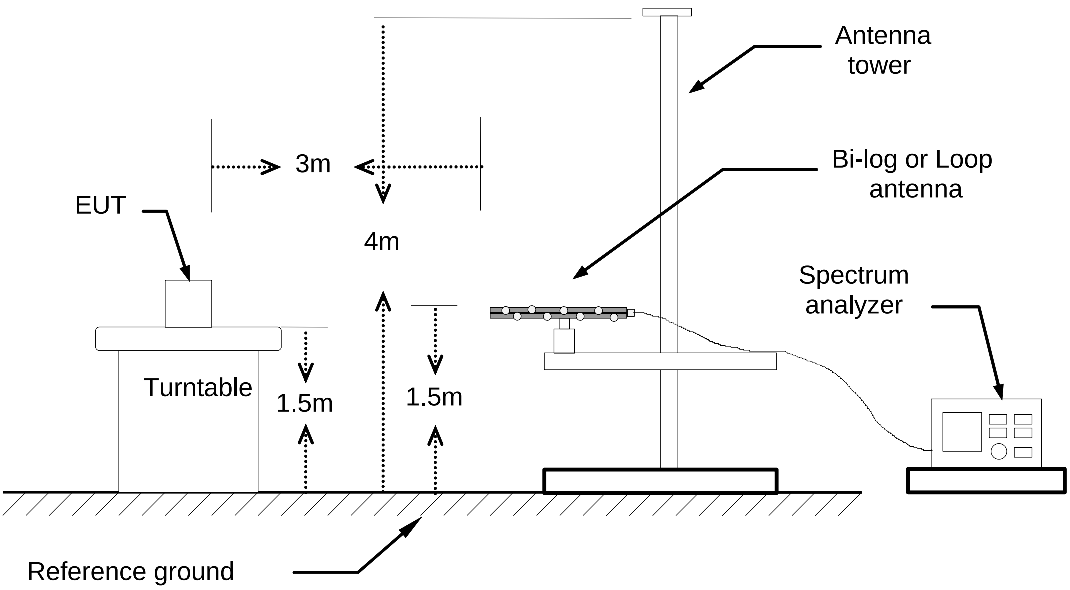


Remarks:

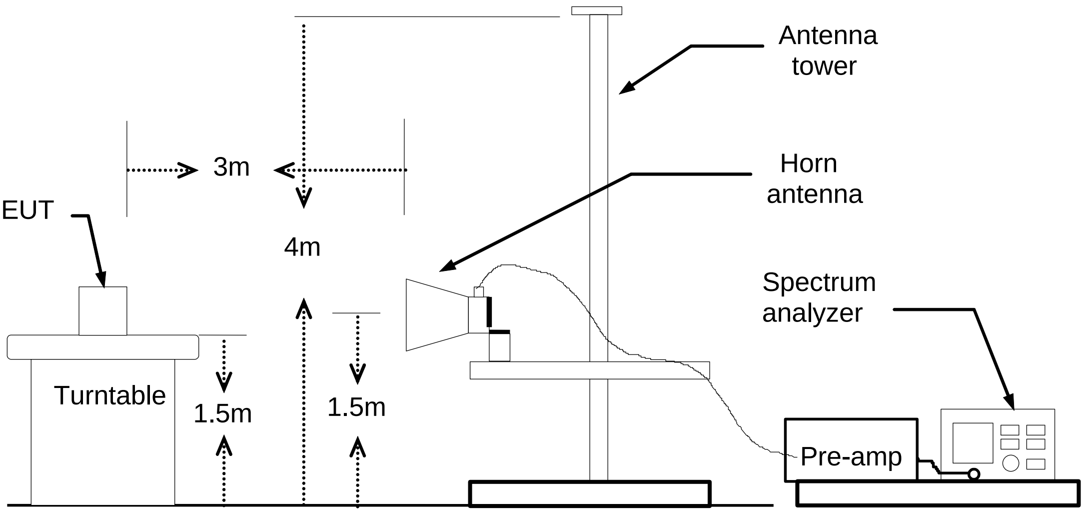
The Signal Analyzer could be connected to a monopole antenna or directly connected to the EUT, if the EUT has already employing an antenna connector.

Radiated measurements configuration of EUT shall be as follows:

Below 1GHz



Above 1GHz



7.2 SUPPORT EQUIPMENT

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
1.	N/A	N/A	N/A	N/A	

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

8 ETSI EN 300 328 REQUIREMENTS

8.1 RF OUTPUT POWER

8.1.1 Applicable standard

EN 300 328 Clause 4.3.1.2

8.1.2 Conformance Limit

The Maximum RF Output Power <= 100 mW (20 dBm) (EIRP) at both normal environmental conditions and at the extremes of the operating temperature range.

8.1.3 Test Configuration

The measurements for RF output power shall be performed at both normal environmental conditions and at the extremes of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s).

8.1.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.2.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.2.2 for the measurement method.

The test procedure shall be as follows:

■ Conducted measurements

Step 1:

• Use a fast power sensor suitable for 2,4 GHz 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) are 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 in all following steps.

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 dynamic range, 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. 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.

• If applicable, 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 (P) shall be calculated using the formula below: P = 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.

■ Radiated measurements

This method shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

When performing radiated measurements, the UUT shall be configured and antenna(s) positioned (including smart antenna systems and equipment capable of beamforming) for maximum e.i.r.p. towards the measuring antenna. This position shall be recorded.

A test site as described in annex B and applicable measurement procedures as described in annex C shall be used.

Taking into account the calibration factor from the measurement site, the test procedure for RF Output Power is further as described under clause 5.4.2.2.1.2, step 1 to step 5. The RF Output Power P is equal to the value A obtained in step 5. The test procedure for Duty Cycle, Tx-sequence, Tx-gap is further as described in clause 5.4.2.2.1.3 and the test procedure for Medium Utilization is further as described in clause 5.4.2.2.1.4.

8.1.5 Test Results

Operation Mode: ☒ GFSK ☒ pi/4-DQPSK ☒ 8DPSK

Temperature: Refer to the following table **Test Date:** September 11, 2017

Humidity: 55 % RH Tested by: KK

TEST CONDITIONS		TRANSMITTER POWER (dBm)		
		Temp (25)°C	Temp (-10)°C	Temp (55)°C
Data Rate	VOLT / POWER	3.7V	3.7V	3.7V
1Mbps	RMS	-1.05	**-0.74**	-2.04
2Mbps	RMS	-1.69	-1.25	-1.47
3Mbps	RMS	-2.41	-1.69	-1.01
Limit		<= 20dBm		
Verdict		PASS	PASS	PASS

8.2 ACCUMULATED TRANSMIT TIME, FREQUENCY OCCUPATION

8.2.1 Applicable standard

ETSI EN 300 328 clause 4.3.1.4

8.2.2 Conformance Limit

The requirement applies to all types of frequency hopping equipment.

- For non-adaptive frequency hopping system

  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) × 25 %) and 77 % where U is the number of hopping frequencies in use.

- For adaptive frequency hopping system

  Adaptive Frequency Hopping equipment shall be capable of operating over a minimum of 70 % of the band specified in clause 1.

  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) × 25 %) and 77 % where U is the number of hopping frequencies in use.

8.2.3 Test Configuration

The measurements for dwell time shall be performed at normal environmental conditions of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s).

8.2.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.4.1 for the test conditions.

2. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.4.2 for the measurement method.

The test procedure shall be as follows:

■ Conducted measurements

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
- VBW: ≥ RBW
- Detector Mode: RMS
- Sweep time: Equal to the applicable observation period (see clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2)
- 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:

This step is only applicable for equipment implementing Option 1 in clause 4.3.1.4.3.1 or Option 1 in clause 4.3.1.4.3.2 for complying with the Frequency Occupation requirement and the manufacturer decides to demonstrate compliance with this requirement via measurement.

• Make the following changes on the analyser and repeat step 2 and step 3.
Sweep time: 4 × Dwell Time × 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, Option 1 or clause 4.3.1.4.3.2, Option 1. 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 hopping frequency)
- VBW: ≥ RBW
- Detector Mode: RMS
- Sweep time: 1 s; this setting may result in long measuring times. To avoid such long measuring times, an FFT analyser may be used
- 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 frequency hopping equipment, it shall be verified whether the equipment uses 70 % of the band specified in table 1. This verification can be done using the lowest and highest -20 dB points from the total spectrum envelope obtained in step 6. The result shall be recorded in the test report.

■ Radiated measurements

A test site as described in annex B and applicable measurement procedures as described in annex C may be used. Alternatively, a test fixture may be used.

The test procedure is further as described under clause 5.4.4.2.1.

8.2.5 Test Results

Worst Case-Modulation Type: 8DPSK

Frequency (MHz)	Duty Cycle Data Packet	Dwell Time Per Hop (ms)	Minimun Number of Hop Frequency	400msX minimum number of hopping frequencies (s)	maximum accumulated dwell time (ms)	maximum dwell time limit (ms)	Result
Hopping mode	3DH1	2.92	79	31.6	321.01	400.0	Pass
Hopping mode	3DH3	2.92	79	31.6	319.41	400.0	Pass
Hopping mode	3DH5	2.91	79	31.6	311.3	400.0	Pass

Frequency (MHz)	Duty Cycle Data Packet	Dwell Time Per Hop (ms)	Actual Number of Hop Frequency (N)	[4*Dwell time per hop*N] (ms)	Number of hop in [4*Dwell time per hop*N]	Minimum Number of Hopping Limit in [4*Dwell time per hop*N] (ms)	Result
Hopping mode	3DH1	2.92	79	922.72	3	1	Pass
Hopping mode	3DH3	2.92	79	922.72	3	1	Pass
Hopping mode	3DH5	2.91	79	919.56	3	1	Pass

8.3 HOPPING FREQUENCY SEQUENCE

8.3.1 Applicable standard

ETSI EN 300 328 clause 4.3.1.4

8.3.2 Conformance Limit

The requirement applies to all types of frequency hopping equipment.

- For non-adaptive frequency hopping system
  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. According to clause 4.3.1.5.3.1 the minimum Hopping Frequency Separation for non-adaptive equipment is equal to the Occupied Channel Bandwidth with a minimum of 100 kHz.
- For adaptive frequency hopping system
  The hopping sequence(s) shall contain at least N hopping frequencies at all times, where N is either 15 or the result of 15 MHz divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater.

8.3.3 Test Configuration

The measurements for hopping sequences shall be performed at normal environmental conditions of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.
Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s).

8.3.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.4.1 for the test conditions.

2. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.4.2 for the measurement method.

The test procedure shall be as follows:

■ Conducted measurements

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
- VBW: ≥ RBW
- Detector Mode: RMS
- Sweep time: Equal to the applicable observation period (see clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2)
- 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:

This step is only applicable for equipment implementing Option 1 in clause 4.3.1.4.3.1 or Option 1 in clause 4.3.1.4.3.2 for complying with the Frequency Occupation requirement and the manufacturer decides to demonstrate compliance with this requirement via measurement.

• Make the following changes on the analyser and repeat step 2 and step 3.
Sweep time: 4 × Dwell Time × 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, Option 1 or clause 4.3.1.4.3.2, Option 1. 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 hopping frequency)
- VBW: ≥ RBW
- Detector Mode: RMS
- Sweep time: 1 s; this setting may result in long measuring times. To avoid such long measuring times, an FFT analyser may be used
- 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 frequency hopping equipment, it shall be verified whether the equipment uses 70 % of the band specified in table 1. This verification can be done using the lowest and highest -20 dB points from the total spectrum envelope obtained in step 6. The result shall be recorded in the test report.

■ Radiated measurements

A test site as described in annex B and applicable measurement procedures as described in annex C may be used. Alternatively, a test fixture may be used.

The test procedure is further as described under clause 5.4.4.2.1.

8.3.5 Test Results

Temperature:	25ºC	Test Date:	September 11, 2017
Humidity:	55 % RH	Tested by:	King Kong

Test Condition			Measured Data	Limited	Verdict
GFSK/DH5	1Mbps	Hopping Frequency Sequence	79	15-79	PASS
π/4-DQPSK/2DH5	2Mbps		79	15-79	PASS
8DPSK/3DH5	3Mbps		79	15-79	PASS
NOTE: N/A means not applicable					

8.4HOPPING FREQUENCY SEPARATION

8.4.1 Applicable standard

ETSI EN 300 328 clause 4.3.1.5

8.4.2 Conformance Limit

The requirement applies to all types of frequency hopping equipment.

- For non-adaptive frequency hopping system

  For non-adaptive Frequency Hopping equipment, the Hopping Frequency Separation shall be equal to or greater than the Occupied Channel Bandwidth (see clause 4.3.1.8), 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 frequency hopping system

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

  Adaptive Frequency Hopping equipment that switched to a non-adaptive mode for one or more hopping frequencies because interference was detected on these hopping frequencies with a level above the threshold level defined in clause 4.3.1.7.2.2, point 5 or clause 4.3.1.7.3.2, point 5, is allowed to continue to operate with a minimum Hopping Frequency Separation of 100 kHz as long as the interference remains present on these hopping 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 for Hopping Frequency Separation for non-adaptive equipment defined in clause 4.3.1.5.3.1 (first paragraph) for these hopping frequencies as well as with all other requirements applicable to non-adaptive frequency hopping equipment.

8.4.3 Test Configuration

The measurements for hopping frequency separation shall be performed at normal environmental conditions of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.
Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s).

8.4.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.5.1 for the test conditions.

2. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.5.2 for the measurement method.

The test procedure shall be as follows:

■ Conducted measurements

●Option 1

Step 1:

• The output of the transmitter shall be connected to a spectrum analyser or equivalent.

• The analyser shall be set as follows:

- 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
- VBW: 3 × RBW
- Detector Mode: Max Peak
- Trace Mode: Max Hold
- Sweep time: Auto

Step 2:

• Wait for the trace to stabilize.

• Use the marker function of the analyser to define the frequencies corresponding to the lower -20 dBr point and the upper -20 dBr point for both hopping frequencies F1 and F2. This will result in $F1_L$ and $F1_H$ for hopping frequency F1 and in $F2_L$ and $F2_H$ for hopping frequency F2. These values shall be recorded in the report.

Step 3:

• Calculate the centre frequencies $F1_C$ and $F2_C$ for both hopping frequencies using the formulas below. These values shall be recorded in the report.

$$F1_C = \frac{F1_L + F1_H}{2} \quad F2_C = \frac{F2_L + F2_H}{2}$$

• Calculate the Hopping Frequency Separation (F_{HS}) using the formula below. This value shall be recorded in the report.

$$F_{HS} = F2_C - F1_C$$

• Compare the measured Hopping Frequency Separation with the limit defined in clause 4.3.1.5.3. In addition, for non-Adaptive Frequency Hopping equipment, the Hopping Frequency Separation shall be equal to or greater than the Occupied Channel Bandwidth as defined in clause 4.3.1.8 or:

$F_{HS} \geqslant$ Occupied Channel Bandwidth

See figure 4:

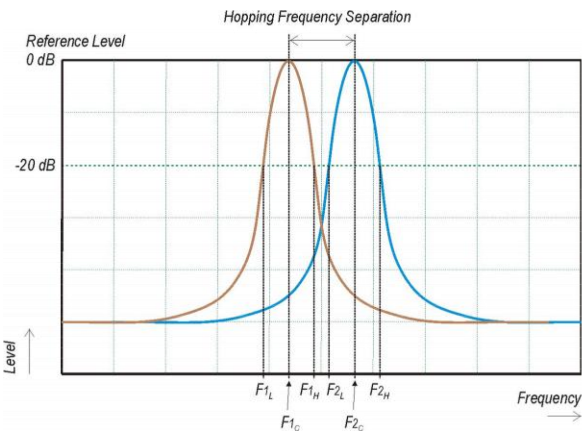


Figure 4: Hopping Frequency Separation

For adaptive equipment, in case of overlapping channels which prevents the definition of the -20 dBr reference points $F1_H$ and $F2_L$, a higher reference level (e.g. -10 dBr or -6 dBr) may be chosen to define the reference points $F1_L$; $F1_H$; $F2_L$ and $F2_H$.

Alternatively, special test software may be used to:

• force the UUT to hop or transmit on a single Hopping Frequency by which the -20 dBr reference points can be measured separately for the two adjacent Hopping Frequencies; and/or

• force the UUT to operate without modulation by which the centre frequencies $F1_C$ and $F2_C$ can be measured directly.

The method used to measure the Hopping Frequency Separation shall be documented in the test report.

●Option 2

Step 1:

• The output of the transmitter shall be connected to a spectrum analyser or equivalent.

• The analyser shall be set as follows:

- 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
- VBW: 3 × RBW
- Detector Mode: Max Peak
- Trace Mode: Max Hold
- Sweep Time: Auto

Step 2:

• Wait for the trace to stabilize.

• Use the marker-delta function to determine the Hopping Frequency Separation between the centres of the two adjacent hopping frequencies (e.g. by identifying peaks or notches at the centre of the power envelope for the two adjacent signals). This value shall be compared with the limits defined in clause 4.3.1.5.3 and shall be recorded in the test report.

■ Radiated measurements

A test site as described in annex B and applicable measurement procedures as described in annex C may be used.

Alternatively a test fixture may be used.

The test procedure is further as described under clause 5.4.5.2.1.

8.4.5 Test Results

Temperature:	24ºC	Test Date:	September 11, 2017	
Humidity:	53 % RH	Tested by:	King Kong	
TEST CONDITION		Measured Data (kHz)	Limited (kHz)	Verdict
GFSK/DH5	Hopping Frequency Separation	1000	>=100kHz	PASS
π/4-DQPSK/2DH5		1000	>=100kHz	PASS
8DPSK/3DH5		1000	>=100kHz	PASS
NOTE: N/A means not applicable				

8.5 OCCUPIED CHANNEL BANDWIDTH

8.5.1 Applicable standard

ETSI EN 300 328 clause 4.3.1.8

8.5.2 Conformance Limit

The Occupied Channel Bandwidth for each hopping frequency shall fall completely within the band 2400-2483.5MHz.
For non-adaptive Frequency Hopping equipment with e.i.r.p. greater than 10 dBm, the Occupied Channel Bandwidth for every occupied hopping frequency shall be equal to or less than the Nominal Channel Bandwidth declared by the manufacturer. See clause 5.4.1 j). This declared value shall not be greater than 5 MHz.

8.5.3 Test Configuration

The measurements for occupied channel bandwidth shall be performed at normal environmental conditions of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s).

8.5.4 Test Procedure

1. Please refer to ETSI EN 300 328(V2.1.1) clause 5.4.7.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.7.2 for the measurement method.

The measurement procedure shall be as follows:
■ Conducted measurement
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 × Nominal Channel Bandwidth
• Detector Mode: RMS
• Trace Mode: Max Hold
• Sweep time: 1 s
Step 2:
Wait for the trace to stabilize.
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.
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.
■ Radiated measurement
The test set up as described in annex B and the applicable measurement procedures described in annex C shall be used.
Alternatively, a test fixture may be used.
The test procedure is as described under clause 5.4.7.2.1.

8.5.5 The worst Test Results

Temperature:	24ºC	Tested by:		King Kong	
Humidity:	53 % RH	Test Date:		September 11, 2017	
Operation Mode	Frequency(MHz)	99%OBW(KHz)	Result (MHz)	Limited(MHz)	Verdict
8DPSK	2402 MHz	1124	2401.39	>2400.0	PASS
	2480 MHz	1129	2480.47	<2483.5	PASS

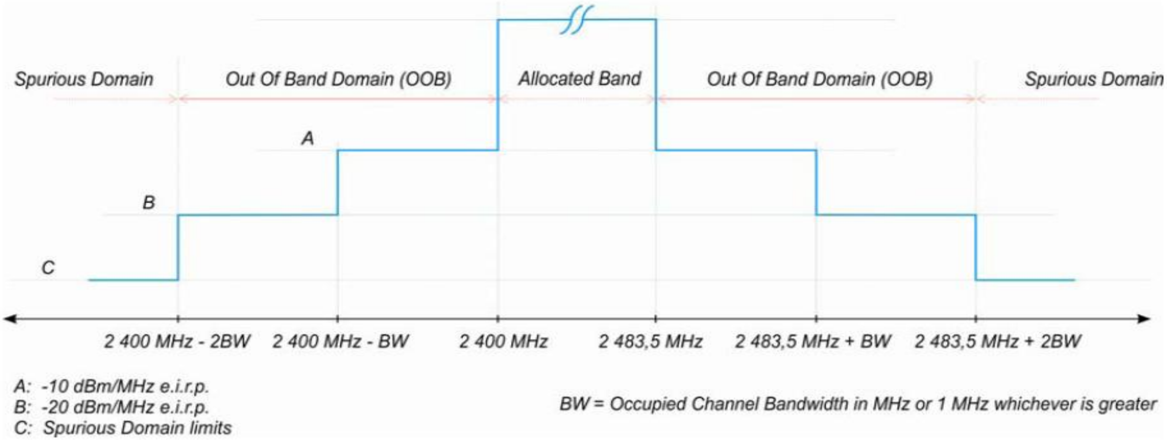
8.6TRANSMITTER UNWANTED EMISSION IN THE OUT-OF BAND

8.6.1 Applicable standard

ETSI EN 300 328 clause 4.3.1.9

8.6.2 Conformance Limit

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



8.6.3 Test Configuration

The measurements for emission in the out-of band shall be performed at both normal environmental conditions and at the extremes of the operating temperature range.

Radiated measurements shall only be used for integral antenna equipment that does not have a temporary antenna connector(s) provided.

Conducted measurements shall be used for antenna equipment provided a temporary antenna connector(s).

8.6.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.8.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.8.2 for the measurement method.

■ Conducted measurement

The applicable mask is defined by the measurement results from the tests performed under clause 5.4.7 (Occupied Channel Bandwidth).

The Out-of-band emissions within the different horizontal segments of the mask provided in figure 1 and figure 3 shall be measured using the procedure in step 1 to step 6 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:
- 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: Max Hold
- Sweep Mode: Continuous
- Sweep Points: Sweep Time [s] / (1 μs) or 5 000 whichever is greater
- Trigger Mode: Video trigger; 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 (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 - 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 (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.

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

■ Radiated measurement

The test set up as described in annex B and the applicable measurement procedures described in annex C shall be used. Alternatively a test fixture may be used.
The test procedure is as described under clause 5.4.8.2.1.

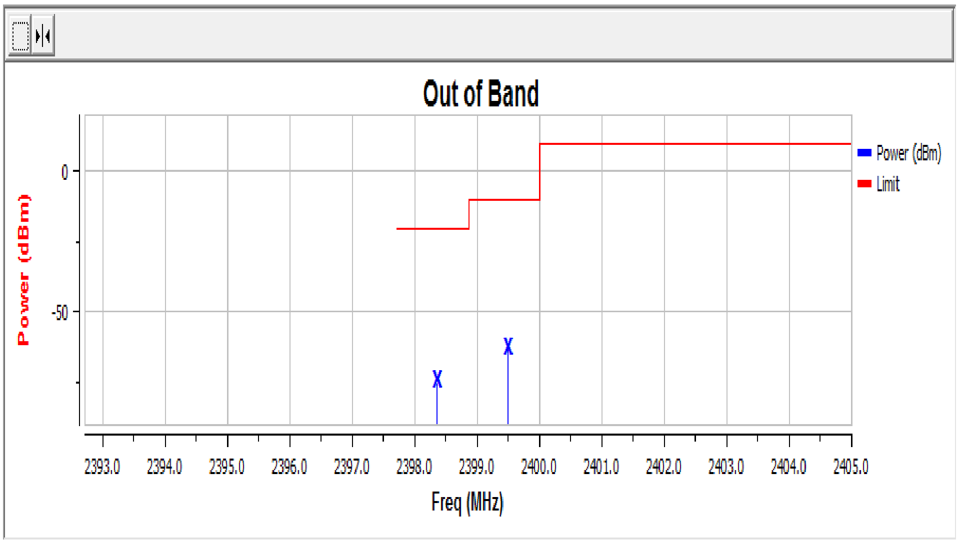
8.6.5 Test results

Pass

All the modulation modes were tested, the data of the worst mode are described in the following table

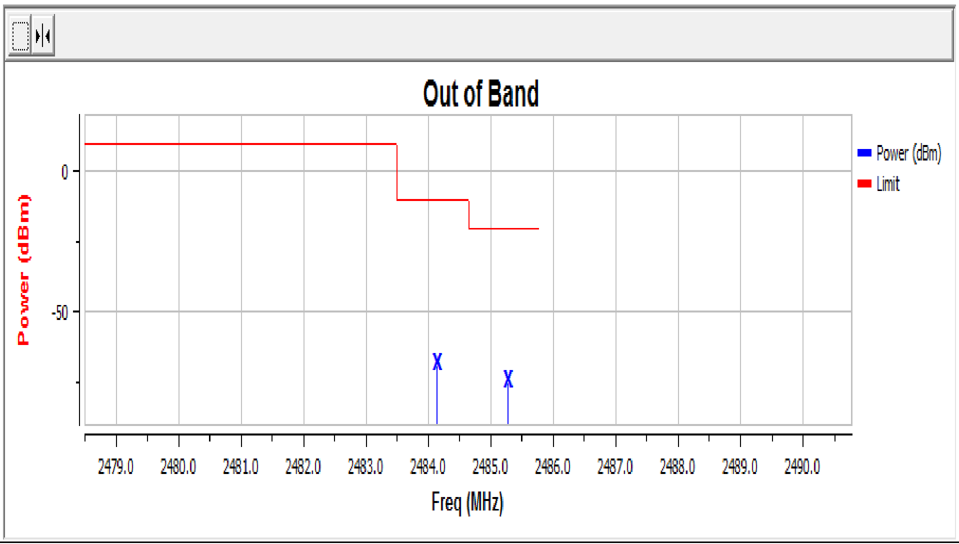
☒ GFSK	☐ pi/4-DQPSK	☐ 8DPSK	Hopping frequency

Channel	Antenna	Freq(MHz)	Level	Limit
CH Low-2402	Antenna 1	2399.5	-63.67	-10
CH Low-2402	Antenna 1	2398.357	-75.35	-20



☒ GFSK	☐ pi/4-DQPSK	☐ 8DPSK	Hopping frequency

Channel	Antenna	Freq(MHz)	Level	Limit
CH High-2480	Antenna 1	2484.139	-69.56	-10
CH High-2480	Antenna 1	2485.278	-75.6	-20



8.7 TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

8.7.1 Applicable standard

ETSI EN 300 328 clause 4.3.1.10

8.7.2 Conformance Limit

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in below.
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 e.i.r.p. for emissions above 1 GHz.

Frequency Range	Maximum power	bandwidth
30 MHz to 47 MHz	-36dBm	100kHz
47 MHz to 74 MHz	-54dBm	100kHz
74 MHz to 87.5 MHz	-36dBm	100kHz
87.5MHz to118 MHz	-54dBm	100kHz
118 MHz to174MHz	-36dBm	100kHz
174MHz to 230MHz	-54dBm	100kHz
230 MHz to 470 MHz	-36dBm	100kHz
470 MHz to 862 MHz	-54dBm	100kHz
862 MHz to1 GHz	-36dBm	100kHz
1GHz to12.75 GHz	-30dBm	1MHz

8.7.3 Test Configuration

The measurements for emissions in the spurious domain shall only be performed at normal test conditions.

Radiated measurements shall be used for equipment.

Conducted measurements shall be used for equipment.

8.7.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.9.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.9.2 for the measurement methods.

■ Conducted measurement

● Introduction

The spectrum in the spurious domain (see figure 1 or figure 3) shall be searched for emissions that exceed the limit values given in table 4 or table 12 or that come to within 6 dB below these limits. Each occurrence shall be recorded.

The measurement procedure contains 2 parts.

● 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 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, on any channel.
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 any of the hopping frequencies.
The above sweep time setting may result in long measuring times in case of frequency hopping equipment. To avoid such long measuring times, an FFT analyser could 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 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, on any channel.
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 any of the hopping frequencies.
The above sweep time setting may result in long measuring times in case of frequency hopping equipment. To avoid such long measuring times, an FFT analyser could 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.
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 5.4.9.2.1.3.
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 with 10 × log10 (Ach) (number of active transmit chains).
● 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: Video (burst signals) or Manual (continuous signals)
• Detector: 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 (Ach).

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.

■ Radiated measurement

The test site as described in annex B and applicable measurement procedures as described in annex C shall be used.

The test procedure is further as described under clause 5.4.9.2.1.

8.7.5 Test Results

Freq (MHz)	RMS Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
749.571	-74.73	-54.00	-20.73	Pass
825.945	-75.14	-54.00	-21.14	Pass
826.042	-75.09	-54.00	-21.09	Pass
840.441	-75.13	-54.00	-21.13	Pass
850.754	-75.28	-54.00	-21.28	Pass
857.078	-74.74	-54.00	-20.74	Pass

8.8 RECEIVER SPURIOUS EMISSIONS

8.8.1 Applicable standard

ETSI EN 300 328 clause 4.3.1.11

8.8.2 Conformance Limit

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

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 e.i.r.p. for emissions above 1 GHz.

Frequency Range	Maximum power	Measurement Width
30 MHz to 1 GHz	-57 dBm	100kHz
1 GHz to 12.75 GHz	-47 dBm	1MHz

8.8.3 Test Configuration

The measurements for emissions in the spurious domain shall only be performed at normal test conditions.

The measurements for emissions in the spurious domain shall only be performed at normal test conditions.

Radiated measurements shall be used for equipment.

Conducted measurements shall be used for equipment.

8.8.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.11.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.11.2 for the measurement methods.

■ Conducted measurement

● Introduction

The spectrum in the spurious domain (see figure 1 or figure 3) shall be searched for emissions that exceed the limit values given in table 4 or table 12 or that come to within 6 dB below these limits. Each occurrence shall be recorded.

The measurement procedure contains 2 parts.

● 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 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, on any channel.
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 any of the hopping frequencies.
The above sweep time setting may result in long measuring times in case of frequency hopping equipment. To avoid such long measuring times, an FFT analyser could 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 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, on any channel.
  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 any of the hopping frequencies.
  The above sweep time setting may result in long measuring times in case of frequency hopping equipment. To avoid such long measuring times, an FFT analyser could 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.

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 5.4.9.2.1.3.

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 with 10 × log10 (Ach) (number of active transmit chains).

- 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: Video (burst signals) or Manual (continuous signals)
- Detector: 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 (Ach).
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.

- Radiated measurement

The test site as described in annex B and applicable measurement procedures as described in annex C shall be used.
The test procedure is further as described under clause 5.4.9.2.1.

8.8.5 Test Results

Freq (MHz)	RMS Level (dBm)	Limit (dBm)	Over Limit (dB)	Status
439.112	-75.33	-57.00	-18.33	Pass
912.437	-75.01	-57.00	-18.01	Pass
916.329	-74.63	-57.00	-17.63	Pass
956.997	-75.01	-57.00	-18.01	Pass
957.094	-75.00	-57.00	-18.00	Pass
970.034	-74.63	-57.00	-17.63	Pass
5539.000	-62.33	-47.00	-15.33	Pass
5731.000	-62.10	-47.00	-15.10	Pass
5911.000	-62.29	-47.00	-15.29	Pass
5954.000	-62.27	-47.00	-15.27	Pass

8.9 ADAPTIVITY (ADAPTIVE FREQUENCY HOPPING)

8.9.1 Applicable standard

ETSI EN 300 328 clause 4.3.1.7

8.9.2 Conformance Limit

Only for adaptive equipment and RF output power >=10dBm(EIRP)

- Adaptive Frequency Hopping equipment using LBT based DAA shall comply with the following minimum set of requirements:

1) At the start of every dwell time, before transmission on a hopping frequency, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The CCA observation time shall be not less than 0,2 % of the Channel Occupancy Time with a minimum of 18 μs. If the equipment finds the hopping frequency to be clear, it may transmit immediately.
2) If it is determined that a signal is present with a level above the detection threshold defined in step 5 the hopping frequency shall be marked as 'unavailable'. Then the equipment may jump to the next frequency in the hopping scheme even before the end of the dwell time, but in that case the 'unavailable' channel cannot be considered as being 'occupied' and shall be disregarded with respect to the requirement of the minimum number of hopping frequencies as defined in clause 4.3.1.4.3.2. Alternatively, the equipment can remain on the frequency during the remainder of the dwell time. However, if the equipment remains on the frequency with the intention to transmit, it shall perform an Extended CCA check in which the (unavailable) channel is observed for a random duration between the value defined for the CCA observation time in step 1 and 5 % of the Channel Occupancy Time defined in step 3. If the Extended CCA check has determined the frequency to be no longer occupied, the hopping frequency becomes available again. 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 during which an equipment has transmissions on a given hopping frequency without re-evaluating the availability of that frequency is defined as the Channel Occupancy Time.
   The Channel Occupancy Time for a given hopping frequency, which starts immediately after a successful CCA, shall be less than 60 ms followed by an Idle Period of minimum 5 % of the Channel Occupancy Time with a minimum of 100 μs.
   After the Idle Period has expired, the procedure as in step 1 shall be repeated before having new transmissions on this hopping frequency during the same dwell time.
   EXAMPLE: An equipment with a dwell time of 400 ms can have 6 transmission sequences of 60 ms each, separated with an Idle Period of 3 ms. Each transmission sequence was preceded with a successful CCA check of 120 μs.
   For LBT based adaptive frequency hopping equipment with a dwell time < 60 ms, the maximum Channel Occupancy Time is limited by the dwell time.
4) 'Unavailable' channels may be removed from or may remain in the hopping sequence, but in any case:
   - apart from Short Control Signalling Transmissions referred to in clause 4.3.1.7.4, there shall be no transmissions on 'unavailable' channels;
   - a minimum of N hopping frequencies as defined in clause 4.3.1.4.3.2 shall always be maintained.
5) 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 × log10 (100 mW / Pout) (Pout 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 table 2.

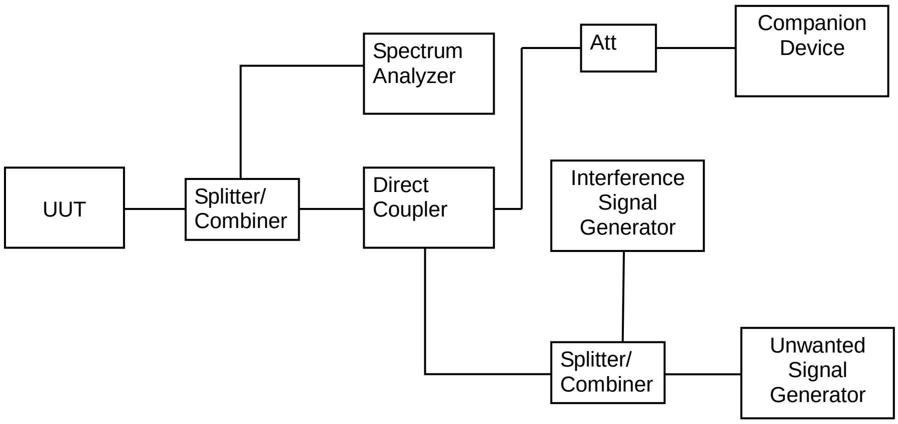
Unwanted Signal parameters

Wanted signal mean power from companion device	Unwanted signal frequency (MHz)	Unwanted CW 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 value which can be used in most cases is -50 dBm/MHz. NOTE 3: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.		

- Short control signaling transmissions

If implemented, 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 less.

8.9.3 Test Configuration



8.9.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.6.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.6.2 for the measurement method.

■ Conducted measurement

Adaptive Frequency Hopping equipment using DAA

●Step 1 to step 7 below define the procedure to verify the efficiency of the DAA based adaptive mechanisms for frequency hopping equipment. These mechanisms are described in clause 4.3.1.7. For systems using multiple receive chains only one chain (antenna port) need to be tested. All other receiver inputs shall be terminated.

Step 1:

• The UUT shall connect to a companion device during the test. The interference signal generator, the unwanted signal generator, the spectrum analyser, the UUT and the companion device are connected using a set-up equivalent to the example given by figure 5, although the interference and unwanted signal generators do not generate any signals at this point in time. The spectrum analyser is used to monitor the transmissions of both the UUT and the companion device and it should be possible to distinguish between either transmission. In addition, the spectrum analyser is used to monitor the transmissions of the UUT in response to the interfering and the unwanted signals.

• For the hopping frequency to be tested, adjust the received signal level (wanted signal from the companion device) at the UUT to the value defined in table 2 and table 3 (clause 4).
Testing of Unidirectional equipment does not require a link to be established with a companion device.

• The analyser shall be set as follows:

- RBW: use next available RBW setting below the measured Occupied Channel Bandwidth

- Filter type: Channel Filter
- VBW: ≥ RBW
- Detector Mode: RMS
- Centre Frequency: Equal to the hopping frequency to be tested
- Span: 0 Hz
- Sweep time: > Channel Occupancy Time of the UUT. If the Channel Occupancy Time is non-contiguous (non-LBT based equipment), the sweep time shall be sufficient to cover the period over which the Channel Occupancy Time is spread out
- Trace Mode: Clear/Write
- Trigger Mode: Video

Step 2:

• Configure the UUT for normal transmissions with a sufficiently high payload resulting in a minimum transmitter activity ratio (TxOn / (TxOn + TxOff)) of 0,3. Where this is not possible, the UUT shall be configured to the maximum payload possible.

• Using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that, for equipment with a dwell time greater than the maximum allowable Channel Occupancy Time, the UUT complies with the maximum Channel Occupancy Time and minimum Idle Period defined in clause 4.3.1.7.2.2 or clause 4.3.1.7.3.2. When measuring the Idle Period of the UUT, it shall not include the transmission time of the companion device.

Step 3: Adding the interference signal

• An interference signal as defined in clause B.7 is injected centred on the hopping frequency being tested. The power spectral density level (at the input of the UUT) of this interference signal shall be equal to the detection threshold defined in clause 4.3.1.7.2.2 or clause 4.3.1.7.3.2.

Step 4: Verification of reaction to the interference signal

• The spectrum analyser shall be used to monitor the transmissions of the UUT on the selected hopping frequency with the interfering signal injected. This may require the spectrum analyser sweep to be triggered by the start of the interfering signal.

• Using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that:

i) The UUT shall stop transmissions on the hopping frequency being tested.
The UUT is assumed to stop transmissions on this hopping frequency within a period equal to the maximum Channel Occupancy Time defined in clause 4.3.1.7.2.2 or clause 4.3.1.7.3.2. As stated in clause 4.3.1.7.3.2, step 3, the Channel Occupancy Time for non-LBT based frequency hopping equipment may be non-contiguous.

ii) For LBT based frequency hopping equipment, apart from Short Control Signalling Transmissions (see iii) below), there shall be no subsequent transmissions on this hopping frequency, as long as the interference signal remains present.
For non-LBT based frequency hopping equipment, apart from Short Control Signalling Transmissions (see iii) below), there shall be no subsequent transmissions on this hopping frequency for a (silent) period defined in clause 4.3.1.7.3.2, step 2. After that, the UUT may have normal transmissions again for the duration of a single Channel Occupancy Time period (which may be non-contiguous). Because the interference signal is still present, another silent period as defined in clause 4.3.1.7.3.2, step 2 needs to be included. This sequence is repeated as long as the interfering signal is present.
In case of overlapping channels, transmissions in adjacent channels may generate transmission bursts on the channel being investigated; however, they have a lower amplitude as on-channel transmissions. Care should be taken to only evaluate the on-channel transmissions. The Time Domain Power Option of the analyser may be used to measure the RMS power of the individual bursts to distinguish on-channel transmissions from transmissions on adjacent channels. In some cases, the RBW may need to be reduced.
To verify that the UUT is not resuming normal transmissions as long as the interference signal is present, the monitoring time may need to be 60 s or more. If transmissions are detected during this period, the settings of the analyser may need to be adjusted to allow an accurate assessment to verify the transmissions comply with the limits for Short Control Signalling Transmissions.

iii) The UUT may continue to have Short Control Signalling Transmissions on the hopping frequency being tested while the interference signal is present. These transmissions shall comply with the limits defined in clause 4.3.1.7.4.2. The verification of the Short Control Signalling transmissions may require the analyser settings to be changed (e.g. sweep time).

iv) Alternatively, the equipment may switch to a non-adaptive mode.

Step 5: Adding the unwanted signal

• With the interfering signal present, a 100 % duty cycle CW signal is inserted as the unwanted signal. The frequency and the level are provided in table 2 of clause 4.3.1.7.2.2, step 6 or table 3 of clause

4.3.1.7.3.2,
step 6.

• The spectrum analyser shall be used to monitor the transmissions of the UUT on the selected hopping frequency. This may require the spectrum analyser sweep to be triggered by the start of the unwanted signal.

• Using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that:

i) The UUT shall not resume normal transmissions on the hopping frequency being tested as long as both the interference and unwanted signals remain present.

To verify that the UUT is not resuming normal transmissions as long as the interference and unwanted signals are present, the monitoring time may need to be 60 s or more. If transmissions are detected during this period, the settings of the analyser may need to be adjusted to allow an accurate assessment to verify the transmissions comply with the limits for Short Control Signalling Transmissions.

ii) The UUT may continue to have Short Control Signalling Transmissions on the hopping frequency being tested while the interference and unwanted signals are present. These transmissions shall comply with the limits defined in clause 4.3.1.7.4.2.

The verification of the Short Control Signalling transmissions may require the analyser settings to be changed (e.g. sweep time).

Step 6: Removing the interference and unwanted signal

• On removal of the interference and unwanted signal, the UUT is allowed to re-include any channel previously marked as unavailable; however, for non-LBT based equipment, it shall be verified that this shall only be done after the period defined in clause 4.3.1.7.3.2, step 2.

Step 7:

• Step 2 to step 6 shall be repeated for each of the hopping frequencies to be tested.

8.9.5 Test Results

Mode	Output Power	Remarks	Pass/Fail
☒BT-CM	≤10dBm	Not Applicable	NA

8.10 RECEIVER BLOCKING

8.10.1 Applicable standard

ETSI EN 300 328 clause 4.3.1.12

8.10.2 Conformance Limit

The minimum performance criterion shall be a PER less than or equal to 10 %. The manufacturer may declare alternative performance criteria as long as that is appropriate for the intended use of the equipment (see clause 5.4.1.t)).

■ General

While maintaining the minimum performance criteria as defined in clause 4.3.1.12.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in below.

●Receiver Category 1

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
Pmin + 6 dB	2 380 2 503,5	-53	CW
Pmin + 6 dB	2 300 2 330 2 360	-47	CW
Pmin + 6 dB	2 523,5 2 553,5 2 583,5 2 613,5 2 643,5 2 673,5	-47	CW

NOTE 1: Pmin is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal.
NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.

●Receiver Category 2

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
Pmin + 6 dB	2 380 2 503,5	-57	CW
Pmin + 6 dB	2 300 2 583,5	-47	CW

NOTE 1: Pmin is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal.
NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.

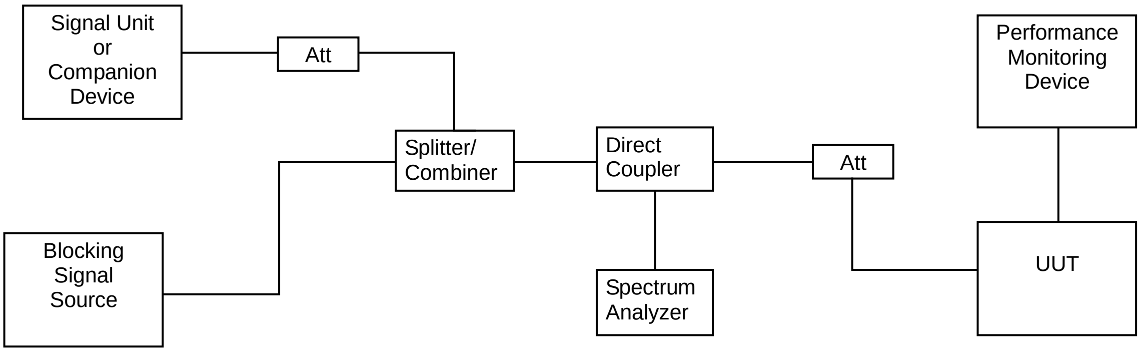
●Receiver Category 3

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
Pmin + 12 dB	2 380 2 503,5	-57	CW

Pmin + 12 dB	2 300 2 583,5	-47	CW
NOTE 1: Pmin is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

8.10.3 Test Configuration



8.10.4 Test Procedure

1. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.11.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V2.1.1) clause 5.4.11.2 for the measurement method.

■ Conducted measurement

Adaptive Frequency Hopping equipment using DAA

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.

■ Radiated measurements

When performing radiated measurements on equipment with dedicated antennas, measurements shall be repeated for each alternative dedicated antenna.

A test site as described in annex B and applicable measurement procedures as described in annex C shall be used.

The test procedure is further as described under clause 5.4.11.2.1.

The level of the blocking signal at the UUT referred to in step 4 is assumed to be the level in front of the UUT antenna(s). The UUT shall be positioned with its main beam pointing towards the antenna radiating the blocking signal. The position recorded in clause 5.4.2.2.2 can be used.

8.10.5 Test Results

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.
☐	Other Receiver category	Maximum RF Output Power less than 10 dBm e.i.r.p. No need to test Receiver Blocking

Operation Mode:	☒ GFSK	☐ π/4-DQPSK	☐ 8DPSK
Test Frequency:	☒2402MHz	☐2480MHz	
Temperature:	24ºC	Test Date:	September 11, 2017
Humidity:	53 % RH	Tested by:	King Kong

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm)	Type of blocking signal	PER(%)	Result
-72.14	2 380	-57	CW	1.59%	PASS
	2 503,5	-57	CW	0.85%	PASS
	2 300	-47	CW	1.96%	PASS
	2 583.5	-47	CW	0.69%	PASS
	☒Pout<=10dBm NOTE: N/A means not applicable				

END OF REPORT