Report No.: XXXXX **ULR No.** TC644621000001XXXF **Date of Issue:** 16/06/2021

Radio Test Report-2.4G BT
ETSI EN 300 328 V2.2.2 (2019-07)

Client Information:

Applicant Name:	XXXXXX
Applicant Address:	XXXXXX
Manufacturer's Name:	XXXXXX
Manufacturer's Address:	XXXXXX

Product Information:

Product Name:	Music Server
Model No.:	X14
Series Model:	NA
Ratings:	DC 24V/5A
Max RF Output Power(dBm):	3.32
Max e.i.r.p(dBm):	3.32
Reference standards:	**ETSI EN 300 328 V2.2.2 (2019-07)**
Brand Name:	Cocktail Audio
Report No.:	XXXXX
ULR:	TC644621000001XXXF
Date of Issue:	16/06/2021
Date of Receipt:	08/06/2021
Test Date:	08/06/2021 to 16/06/2021
Test laboratory:	**Alpha Test House** 198-199, MIE, Phase-1, Bahadurgarh, Haryana-124507 (India)

This device has been tested and found to comply with the stated standard(s), and tests results indicated in the test report and are applicable only to the tested sample identified in the report.

Tested by: *Mr.Deepak Kumar Singh* ***Approved by:*** *Mr. Sunil Kumar Yadav*

Contents

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1 Test Summary

1.1 Compliance with ETSI EN 300 328 V2.2.2 (2019-07)

No.	Description of Test Item	Basic Standard	Results
Transmitter Parameters			
1	RF Output Power	EN300328 clause 4.3.1.2	Pass
2	Accumulated Transmit Time	EN300328 clause 4.3.1.4	Pass
3	Frequency Occupation	EN300328 clause 4.3.1.4	Pass
4	Hopping Sequence	EN300328 clause 4.3.1.4	Pass
5	Hopping Frequency Separation	EN300328 clause 4.3.1.5	Pass
6	Occupied Channel Bandwidth	EN300328 clause 4.3.1.8	Pass
7	Transmitter unwanted emissions in the out-of-band domain	EN300328 clause 4.3.1.9	Pass
8	Transmitter unwanted emissions in the spurious domain	EN300328 clause 4.3.1.10	Pass
Receiver Parameters			
9	Receiver spurious emissions	EN300328 clause 4.3.1.11	Pass
10	Receiver Blocking	EN300328 clause 4.3.1.12	Pass
EN 300 328: the detail version is ETSI EN 300 328 V2.2.2 (2019-07) in the whole report.			
Tx: In this whole report Tx (or tx) means Transmitter. Rx: In this whole report Rx (or rx) means Receiver. RF: In this whole report RF means Radio Frequency.			

1.2 Measurement Uncertainty

No.	Item	Uncertainty
1	Conducted Emission Test	1.20dB
3	RF power,conducted	0.16dB
4	RF power density,conducted	0.24dB
5	Spurious emissions,conducted	0.21dB

2 Test Facility

The test facility is recognized, certified by NABL

2.1 Deviation from Standard

None

2.2 Abnormalities from Standard Conditions

None

3 General Information

3.1 General Description of EUT

Manufacturer:	XXXXXX
Manufacturer Address:	XXXXXX
EUT Name:	Music Server
Model No:	X14
Serial Model:	NA
Brand Name:	Cocktail Audio
Operation frequency:	2400 MHz to 2483.5 MHz
Modulation :	GFSK, π/4-DQPSK,8-DPSK
Modulation Type:	FHSS
Antenna Gain:	0dBi
Antenna Designation:	Internal Antenna
Bluetooth Version:	V5.0
Input Rating :	DC 24V/5A
Battery:	N/A
Note:	
1.	For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

4 Equipments List:

No	Test Equipment	Range and accuracy	Make	Model No	Cal. Date	Cal. Due Date
1	CMW500 Wideband Radio Communication Tester	100 MHz to 3.3 GHz	R&S	CMW500	02/07/2019	01/07/2021
2	FSV Signal Analyzer	10Hz to 30GHz, -154dBm to +30dBm, resolution bandwidth 1Hz to 10MHz	R&S	FSV30	01/07/2019	30/06/2021
3	SMBV100B Vector Signal Generator	8 kHz to 6 GHz	R&S	SMBV100B	08/08/2019	07/08/2021
4	SMF 100A Signal Generator	0.3 MHz to 22GHz	R&S	SMF 100A	04/06/2019	03/08/2021

Discipline:- Electronic Testing	**Group:- Miscellaneous Products**

5 Radio Technical Requirements Specification in EN 300 328

5.1 Transmitter Conditions

Item	***EUT Type***
1	*stand-alone radio equipment with or without their own control provisions;*
2	*plug-in radio devices intended for use with or within a variety of host systems, e.g. personal computers, hand-held terminals, etc.;*
3	*plug-in radio devices intended for use within combined equipment, e.g. cable modems, set-top boxes, access points, etc.;*
4	*Combined equipment or a combination of a plug-in radio device and a specific type of host equipment.*

Modulation
FHSS

EUT belongs to item 1 with FHSS modulation.

5.2 Test conditions

5.2.1 Normal conditions

Ambient:	*Temperature:*	*+15°C to +35°C*
	Relative humidity:	*20% to 75%*
	Press:	*1010 mbar*

5.2.2 Extreme conditions

	Temperature:	*-10°C to +55°C*
	Power Supply:	*24.0Vdc*

5.3 Test frequencies

EUT channels and frequencies list:

Description of Channel:					
Channel	*Frequency (MHz)*	*Channel*	*Frequency (MHz)*	*Channel*	*Frequency (MHz)*
00	*2402*	*27*	*2429*	*54*	*2456*
01	*2403*	*28*	*2430*	*55*	*2457*
02	*2404*	*29*	*2431*	*56*	*2458*
03	*2405*	*30*	*2432*	*57*	*2459*
04	*2406*	*31*	*2433*	*58*	*2460*
05	*2407*	*32*	*2434*	*59*	*2461*
06	*2408*	*33*	*2435*	*60*	*2462*
07	*2409*	*34*	*2436*	*61*	*2463*
08	*2410*	*35*	*2437*	*62*	*2464*
09	*2411*	*36*	*2438*	*63*	*2465*
10	*2412*	*37*	*2439*	*64*	*2466*
11	*2413*	*38*	*2440*	*65*	*2467*
12	*2414*	*39*	*2441*	*66*	*2468*
13	*2415*	*40*	*2442*	*67*	*2469*
14	*2416*	*41*	*2443*	*68*	*2470*
15	*2417*	*42*	*2444*	*69*	*2471*
16	*2418*	*43*	*2445*	*70*	*2472*
17	*2419*	*44*	*2446*	*71*	*2473*
18	*2420*	*45*	*2447*	*72*	*2474*
19	*2421*	*46*	*2448*	*73*	*2475*
20	*2422*	*47*	*2449*	*74*	*2476*
21	*2423*	*48*	*2450*	*75*	*2477*
22	*2424*	*49*	*2451*	*76*	*2478*
23	*2425*	*50*	*2452*	*77*	*2479*
24	*2426*	*51*	*2453*	*78*	*2480*
25	*2427*	*52*	*2454*	--	--
26	*2428*	*53*	*2455*	--	--

Test frequencies are the lowest channel: 0 channel(2402MHz), middle channel: 39 channel(2441 MHz) and highest channel: 78 channel(2480 MHz)

6 Transmitter Requirements

6.1 RF Output Power

6.1.1 *Limit(ETSI EN 300 328 V2.2.2 (2019-07)Clause 4.3.1.2.3)*

For non-adaptive frequency hopping systems

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

For adaptive frequency hopping systems

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

6.1.2 Test procedure

ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.2

1. *Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.*
2. *Use a fast power sensor suitable for 2, 4 GHz and capable of 1 MS/s.*
3. *Sample speed 1 MS/s or faster, and must represent the power of the signal.*
4. *For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) are captured.*
5. *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.
6. *For conducted measurements on devices with multiple transmit chains:*

   - Connect one power sensor to each transmit port for a synchronous measurement on all transmits 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 half the time between two samples.

   -For each instant in time, sum the power of the individual samples of all ports and store them. Use these stored samples in all following steps.
7. *Find the start and stop times of each burst in the stored measurement samples.*
8. *Between the start and stop times of each individual burst calculate the RMS power over the burst. Save these Pburst values, as well as the start and stop times for each burst.*

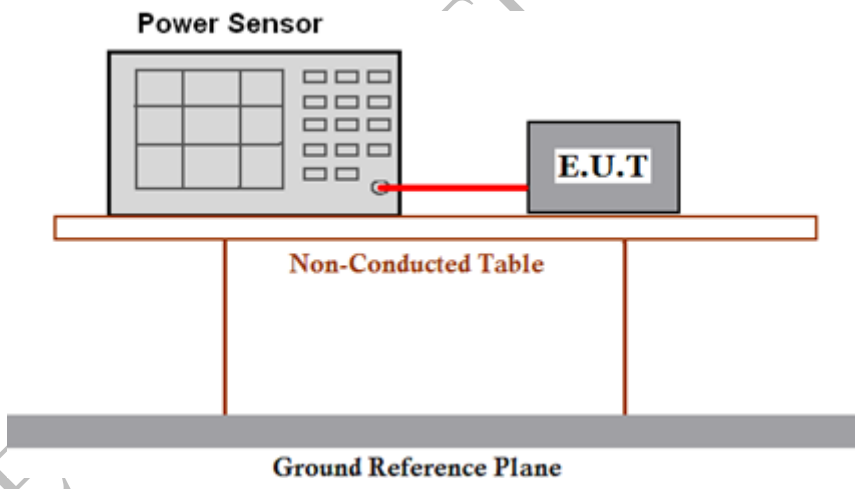
9. *The highest of all Pburst values (value "A" in dBm) will be used for maximum e.i.r.p. calculations.*
10. *Add the (stated) antenna assembly gain "G" in dBi of the individual antenna, If applicable, add the additional beamforming gain "Y" in dB.*
11. *If more than one antenna assembly is intended for this power setting, the maximum overall antenna gain (G or G + Y) shall be used.*
12. *The RF Output Power (P) shall be calculated using the formula below: P = A + G + Y*

Keep the EUT in transmitting at lowest, middle and highest channel individually. Record the max value.

EUT Operation

Status:	*Enter test mode for the product, keep EUT in continuously transmitting status with hoping on mode.* *Conducted measurement for this kind of products which be used for integral antenna equipment connect to the measuring equipment.* *Test the EUT in normal mode and EDR mode.* *Pre-test the EUT in AC mode and B/O mode, find worse case in B/O mode.*

6.1.3 TEST SETUP



6.1.4 Test record

Normal mode:

GFSK					
Measurement Conditions (in Normal & Extreme)		***Limit =20dBm***			
Temperature (°C)	***Voltage (V DC)***	***Test result (dBm)***			***Pass/Fail***
		2402 MHz	***2441 MHz***	***2480 MHz***	
T_{min} = -10	***V*** = 24	1.97	0.98	1.01	Pass
T_{nom} = +25	***V*** = 24	0.94	0.46	0.93	Pass
T_{max} = +55	***V*** = 24	0.83	0.87	0.92	Pass

EDR mode:

π/4-DQPSK					
Measurement Conditions (in Normal & Extreme)		***Limit =20dBm***			
Temperature (°C)	***Voltage (V DC)***	***Test result (dBm)***			***Pass/Fail***
		2402 MHz	***2441 MHz***	***2480 MHz***	
T_{min} = -10	***V*** = 24	1.49	1.61	1.79	Pass
T_{nom} = +25	***V*** = 24	1.65	0.57	1.98	Pass
T_{max} = +55	***V*** = 24	0.56	1.97	2.09	Pass

8-DPSK					
Measurement Conditions (in Normal & Extreme)		***Limit =20dBm***			
Temperature (°C)	***Voltage (V DC)***	***Test result (dBm)***			***Pass/Fail***
		2402 MHz	***2441 MHz***	***2480 MHz***	
T_{min} = -10	***V*** = 24	2.26	2.31	1.45	Pass
T_{nom} = +25	***V*** = 24	2.19	2.18	1.23	Pass
T_{max} = +55	***V*** = 24	3.32	1.98	2.54	Pass

6.2 Accumulated Transmit Time, Frequency Occupation and Hopping Sequence

6.2.1 *Limit(ETSI EN 300 328 V2.2.2 (2019-07)Clause 4.3.1.4.3)*

The maximum accumulated transmit time on any hopping frequency shall be 400 ms within any period of 400 ms multiplied by the minimum number of hopping frequencies (N) that have to be used.

6.2.2 Test procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.4

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

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 Dwell Time × Minimum number of hopping frequencies (N)

(see clause 4.3.1.4.2)

- Number of sweep points: 30 000

- Trace mode: Clear / Write

- Trigger: Free Run

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

3. Indentify 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.

4. The result in step 3 is the accumulated Transmit Time which shall comply with the limit provided in clauses 4.3.1.3.2.1 or 4.3.1.3.2.2 and which shall be recorded in the test report.

5. Make the following changes on the analyzer and repeat steps 2 and 3. Sweep time: 4 × Dwell Time × Actual number of hopping frequencies in use.

The hopping frequencies occupied by the system 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 can not be determined (number of blacklisted frequencies unknown) it shall be assumed that the equipment uses the minimum number of hopping frequencies as defined in clauses 4.3.1.4.2.1 or 4.3.1.4.2.2. The result shall be compared to the limit for the Minimum Frequency Occupation Time defined in clauses 4.3.1.3.2.1 or 4.3.1.3.2.2. This value shall be recorded in the test report.

6. Make the following changes on the analyzer:

- *Start Frequency: 2 400 MHz*
- *Stop Frequency: 2 483,5 MHz*
- *RBW: ~ 50 % of the Occupied Channel Bandwidth (single hop)*
- *VBW: ≥ RBW*
- *Detector Mode: RMS*
- *Sweep time: Auto*
- *Trace Mode: Max Hold*
- *Trigger: Free Run*

• *When the trace has completed, indentify the number of hopping frequencies used by the hopping sequence.*

• *The result shall be compared to the limit (value N) defined in clauses 4.3.1.3.2.1 or 4.3.1.3.2.2. 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 Minimum Frequency Occupation Time assuming the minimum number of hopping frequencies defined in clauses 4.3.1.3.2.1 or 4.3.1.3.2.2 are in use.

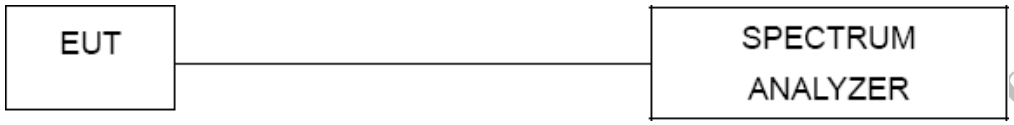
7. For adaptive systems, using the lowest and highest -20 dB points from the total spectrum envelope obtained in step 6, it shall be verified whether the system uses 70 % of the band specified in clause 1. The result shall be recorded in the test report.

Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). Repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s). An oscilloscope may be used instead of a spectrum analyzer.

EUT Operation:

Test Status: *Enter test mode for the product, keep EUT in continuously transmitting status with hoping on mode with different packages; find the worst case is GFSK & 8DPSK mode.*
Pre-test the EUT in AC mode and B/O mode, find worse case in B/O mode.

6.2.3 TEST SETUP



6.2.4 Test result

Measurement Data:

Accumulated Transmit Time:

Mode	*Frequency (MHz)*	*Packet*	*Accumulated Transmit Time (ms)*	*Burst Number*	*Sweep Time (ms)*	*Limit (ms)*	*Result*
GFSK	*2402*	*DH5*	*359.27*	*122*	*31600*	*400*	*Pass*
	2480	*DH5*	*336.34*	*114*	*31600*		*Pass*
∏/4-DQPSK	*2402*	*DH5*	*339.41*	*117*	*31600*		*Pass*
	2480	*DH5*	*356.23*	*123*	*31600*		*Pass*
8-DPSK	*2402*	*DH5*	*339.39*	*116*	*31600*		*Pass*
	2480	*DH5*	*356.83*	*124*	*31600*		*Pass*

The results are not greater than 0.4 seconds.

6.3 Frequency Occupation

6.3.1 *Limit(ETSI EN 300 328 V2.2.2 (2019-07)Clause 4.3.1.4)*

The Minimum Frequency Occupation Time shall be equal to one dwell time within a period not exceeding four times the product of the dwell time per hop and the number of hopping frequencies in use.

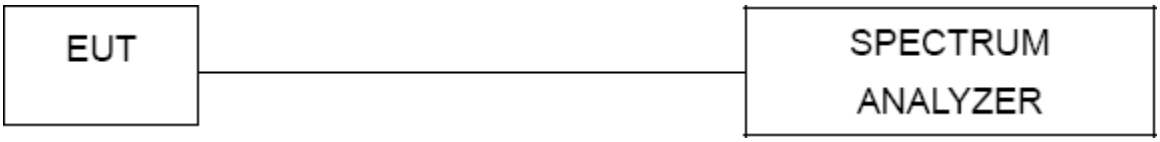
6.3.2 Test procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.4

EUT Operation:

Test Status: *Enter test mode for the product, keep EUT in continuously transmitting status with hoping on mode with different packages; find the worst case is 8DPSK mode. Pre-test the EUT in AC mode and B/O mode, find worse case in B/O mode.*

6.3.3 TEST SETUP



6.3.4 Test result

Channel (MHz)	*Packages*	*Dwell Time per hop (ms)*	*Testing period (ms)*	*Frequency Occupation period*	*Limit Dwell Times No.*	*Result*
2402.0	*DH5*	*2.9*	*916.4*	*1*	*≥ one dwell time*	*Pass*
2480.0	*DH5*	*17.4*	*5498.5*	*2*		*Pass*

Channel (MHz)	*Packages*	*Dwell Time per hop (ms)*	*Testing period (ms)*	*Frequency Occupation period*	*Limit Dwell Times No.*	*Result*
2402.0	*2DH5*	*2.7*	*853.2*	*2*	*≥ one dwell time*	*Pass*
2480.0	*2DH5*	*5.6*	*1769.5*	*4*		*Pass*

Channel (MHz)	*Packages*	*Dwell Time per hop (ms)*	*Testing period (ms)*	*Frequency Occupation period*	*Limit Dwell Times No.*	*Result*
2402.0	*3DH5*	*11.6*	*3665.6*	*1*	*≥ one dwell time*	*Pass*
2480.0	*3DH5*	*11.6*	*3665.6*	*2*		*Pass*

***Testing period**: 4 x Dwell time per hop x 79 Channels*

6.4 Hopping Sequence

6.4.1 *Limit(ETSI EN 300 328 V2.2.2 (2019-07)Clause 4.3.1.5.3)*

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

6.4.2 Test procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.4

EUT Operation:

Test Status: *Enter test mode for the product, keep EUT in continuously transmitting status with hoping on mode with different packages; find the worst case is 8DPSK mode. Pre-test the EUT in AC mode and B/O mode, find worse case in B/O mode.*

6.4.3 TEST SETUP

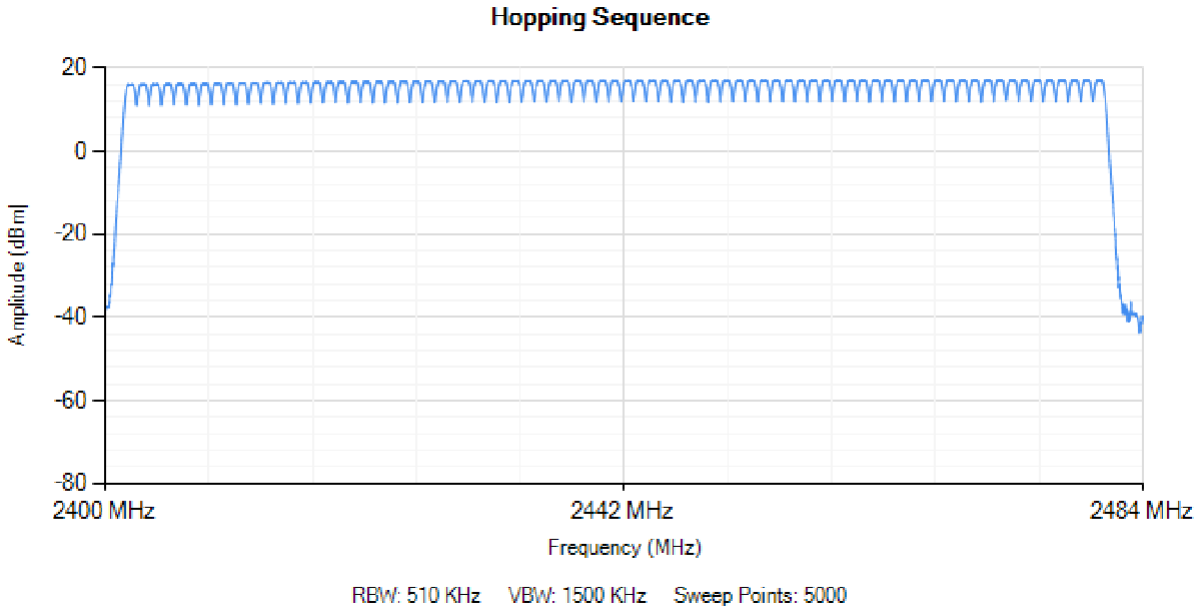
6.4.4 Test result

The unit does meet the requirements.

Hopping Sequence					
ISM band (MHz)	*Operation band (MHz)*	*20dB Down Bandwidth (%)*	*Limit (%)*	*Channel number*	*Limit (N)*
2400-2483.5	*2402-2480*	*94.96*	*≥70%*	*79*	*≥15*

Test graph as below:

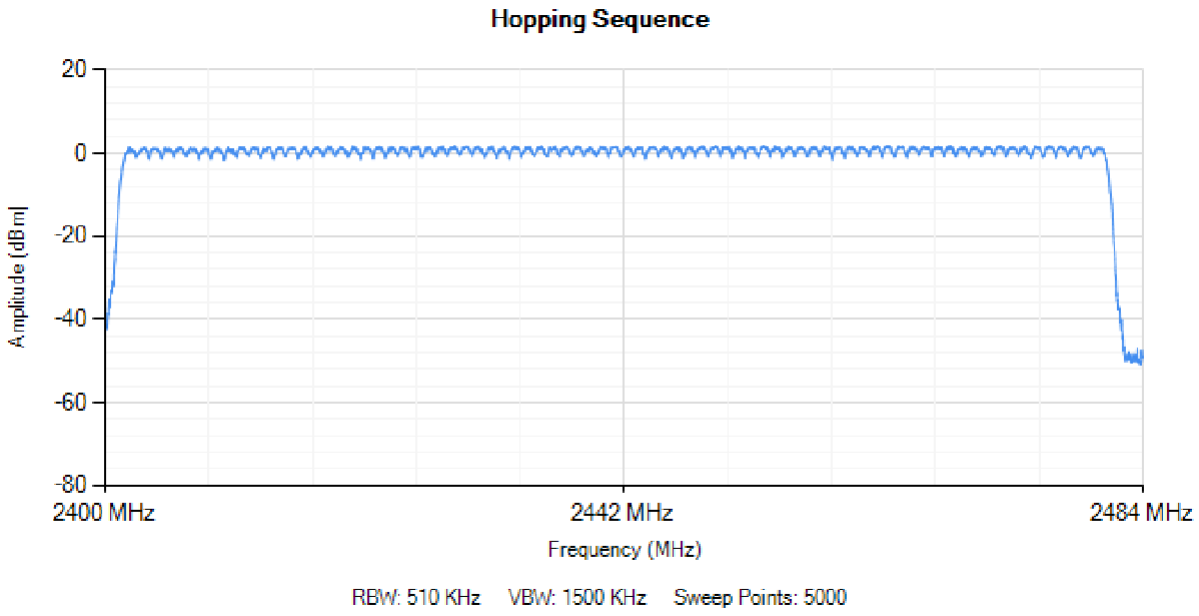
Normal mode: GFSK



Hopping Sequence					
ISM band (MHz)	*Operation band (MHz)*	*20dB Down Bandwidth (%)*	*Limit (%)*	*Channel number*	*Limit (N)*
2400-2483.5	*2402-2480*	*94.41*	*≥70%*	*79*	*≥15*

Test graph as below:

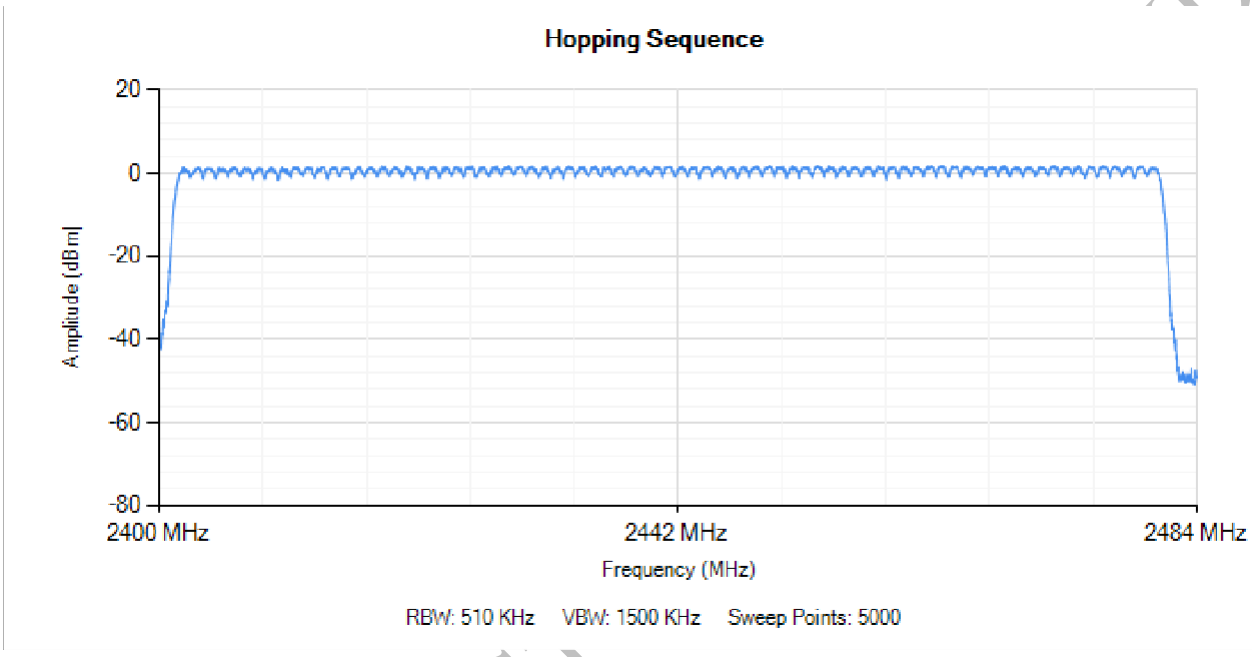
EDR mode: *∏/4-DQPSK*



Hopping Sequence					
ISM band (MHz)	*Operation band (MHz)*	*20dB Down Bandwidth (%)*	*Limit (%)*	*Channel number*	*Limit (N)*
2400-2483.5	*2402-2480*	*96.87*	*≥70%*	*79*	*≥15*

Test graph as below:

EDR mode: 8-DPSK



6.5 Hopping Frequency Separation

6.5.1 *Limit(ETSI EN 300 328 V2.2.2 (2019-07)Clause 4.3.1.5.3)*

Non-adaptive frequency hopping systems

The minimum Hopping Frequency Separation shall be equal to Occupied Channel Bandwidth (see clause 4.3.1.7) of a single hop, with a minimum separation of 100 kHz.

Adaptive frequency hopping systems

The minimum Hopping Frequency Separation shall be 100 kHz.

6.5.2 Test procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.5

Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.

The analyzer 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: RMS*
- *Trace Mode: Max Hold*
- *Sweep Time: Auto*

• Allow the trace to stabilize.

•Use the marker-delta function to determine the Hopping Frequency Separation between the peaks of the two adjacent hopping frequencies. This value shall be compared with the limits defined in clause 4.3.1.5.3 and shall be recorded in the test report.

EUT Operation:

Test Status: *Test the EUT in hopping mode.*

Pre-test the EUT in AC mode and B/O mode, find worse case in B/O mode.

6.5.3 TEST SETUP

6.5.4 Test result

Normal mode:

Test Channel	***Carrier Frequencies Separated*** *(MHz)*	***Pass/Fail***
Lower Channels (channel 0 and channel 1)	*0.83*	*Pass*
Upper Channels (channel 77 and channel 78)	*0.87*	*Pass*

EDR mode:

π/4-DQPSK

Test Channel	***Carrier Frequencies Separated*** *(MHz)*	***Pass/Fail***
Lower Channels (channel 0 and channel 1)	*0.95*	*Pass*
Upper Channels (channel 77 and channel 78)	*0.96*	*Pass*

8-DPSK

Test Channel	***Carrier Frequencies Separated*** *(MHz)*	***Pass/Fail***
Lower Channels (channel 0 and channel 1)	*0.94*	*Pass*
Upper Channels (channel 77 and channel 78)	*0.98*	*Pass*

6.6 Occupied Channel Bandwidth

6.6.1 *Limit (ETSI EN 300 328 V2.2.2 (2019-07)Clause 4.3.1.8.3)*

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

6.6.2 Test procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.7

1. *Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum 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*
2. *WAAEMT until the trace is completed, Find the peak value of the trace and place the analyser marker on this peak.*
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 Operation

Status: *Enter test mode for the product. Test in Channel lowest (2402MHz), highest (2480MHz), keep in continuously transmitting status on a single Hopping Frequency.*

Test the EUT in normal mode and EDR mode.

Pre-test the EUT in AC mode and B/O mode, find worse case in B/O mode.

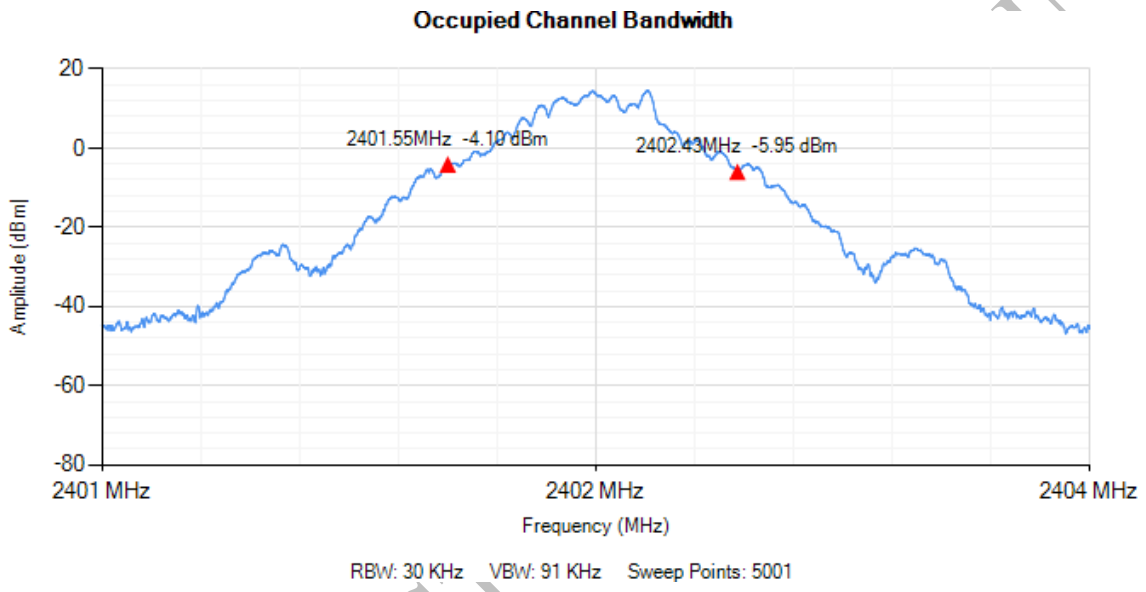
6.6.3 Test Setup

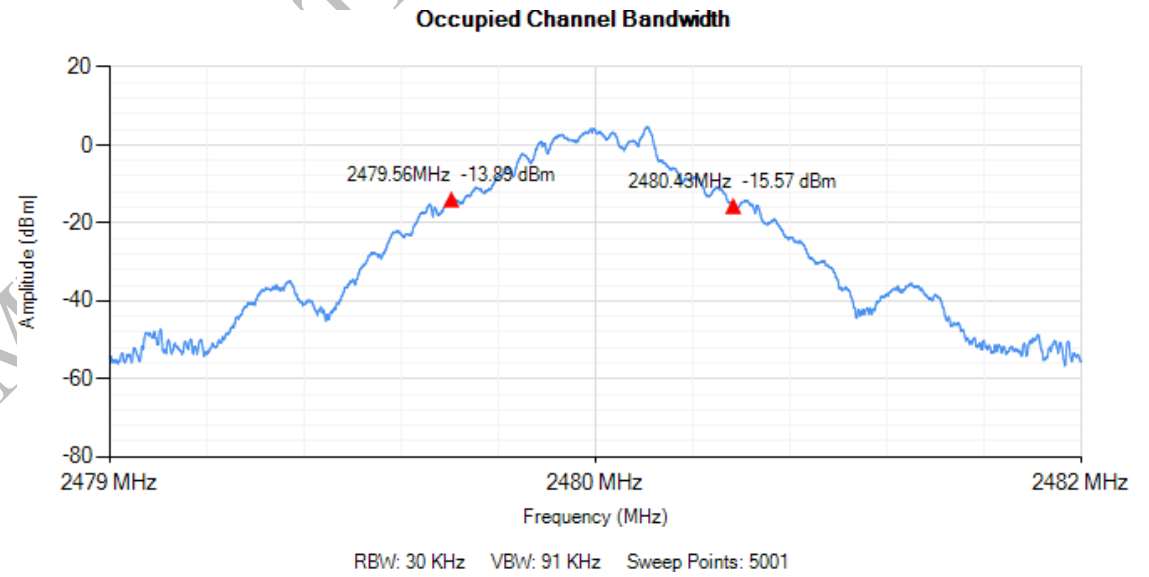
6.6.4 Test result

Remark: These measurements shall only be performed at normal test conditions.

Normal mode: GFSK

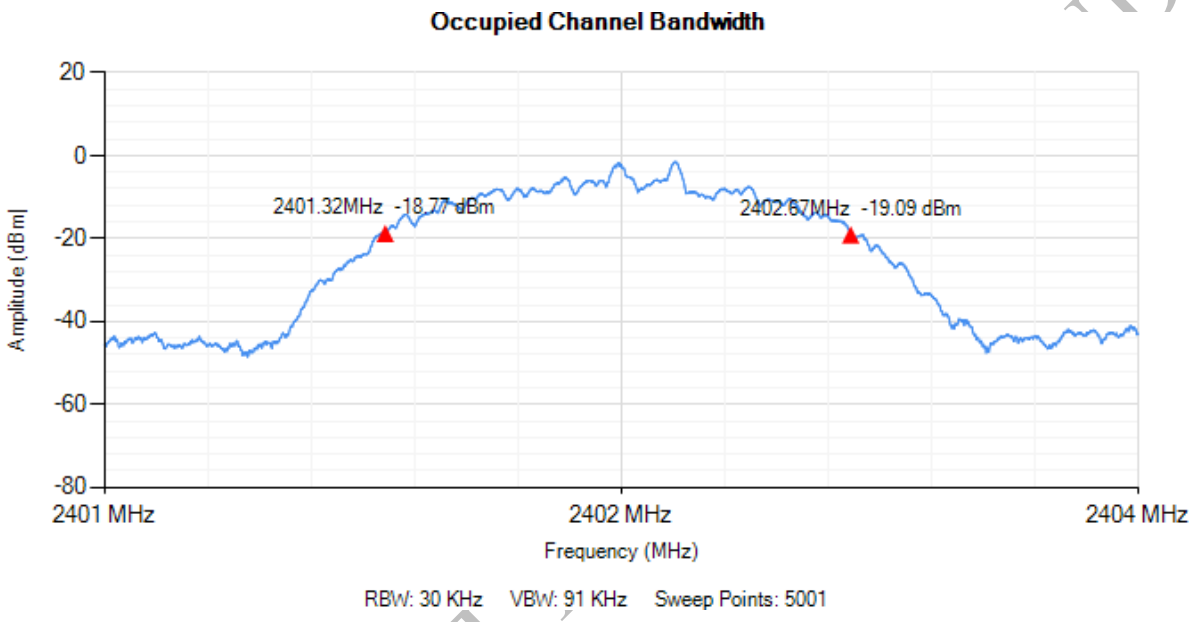
Test Channel	*Bandwidth 99%(MHz)*	*FL (MHz) or FH (MHz)*	*Lower Limit (MHz)*	*Higher Limit (MHz)*
Lowest	*0.868*	*2401.55*	*> 2400.0*	*N/A*
Highest	*0.870*	*2480.425*	*N/A*	*< 2483.5*

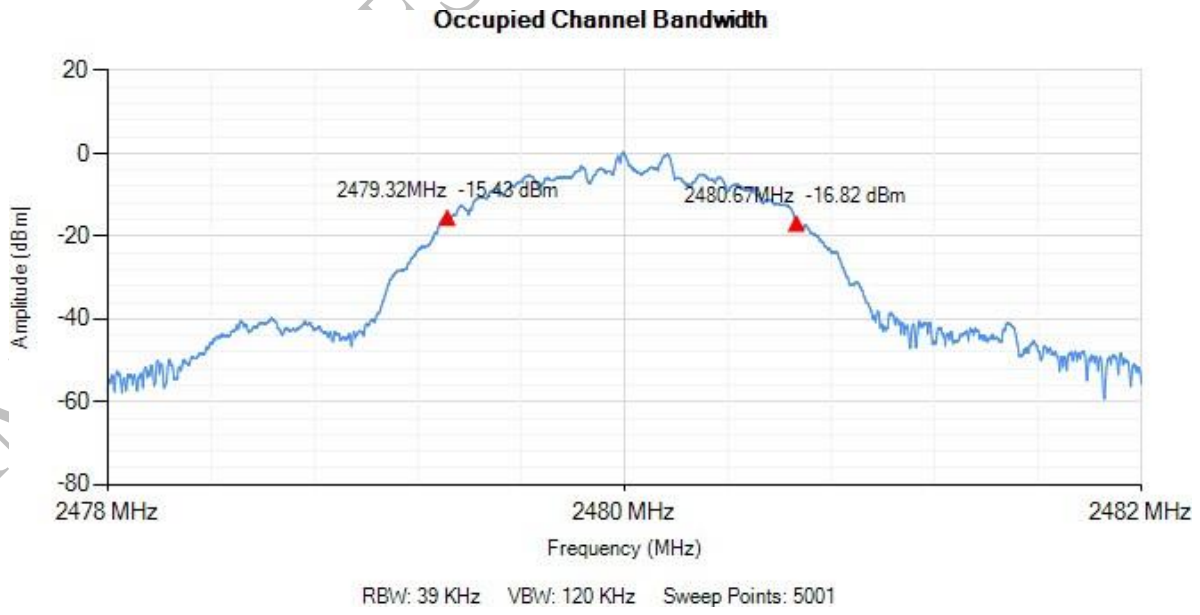




EDR mode: *π/4-DQPSK*

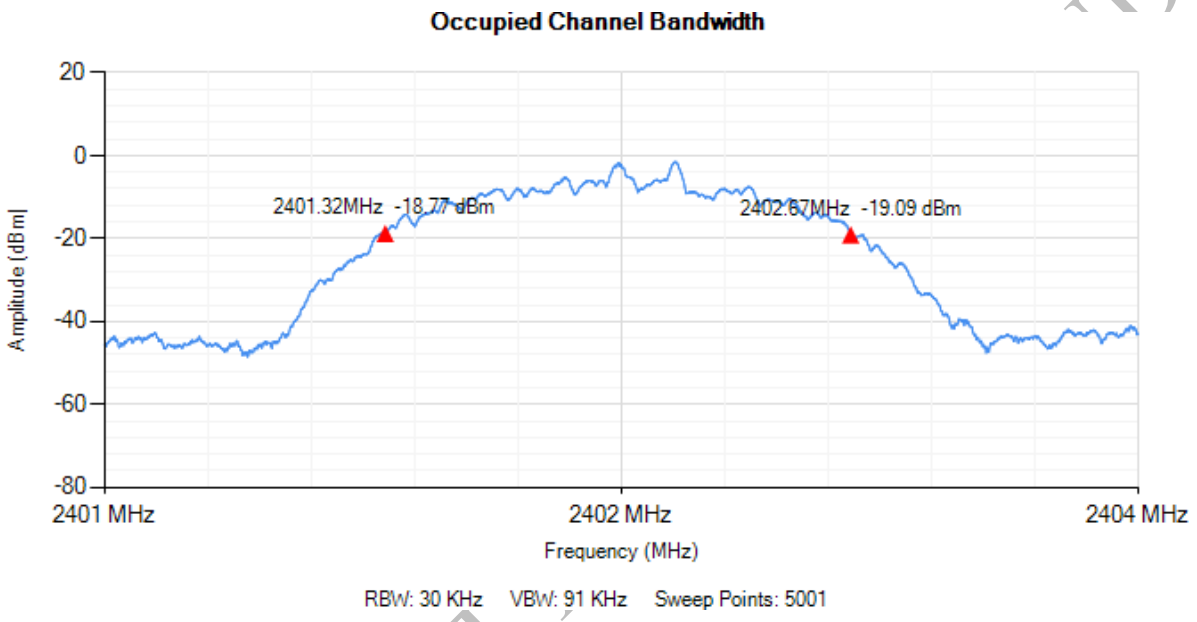
Test Channel	*Bandwidth 99%(MHz)*	*FL (MHz) or FH (MHz)*	*Lower Limit (MHz)*	*Higher Limit (MHz)*
Lowest	*1.348*	*2401.315*	*> 2400.0*	*N/A*
Highest	*1.350*	*2480.665*	*N/A*	*< 2483.5*

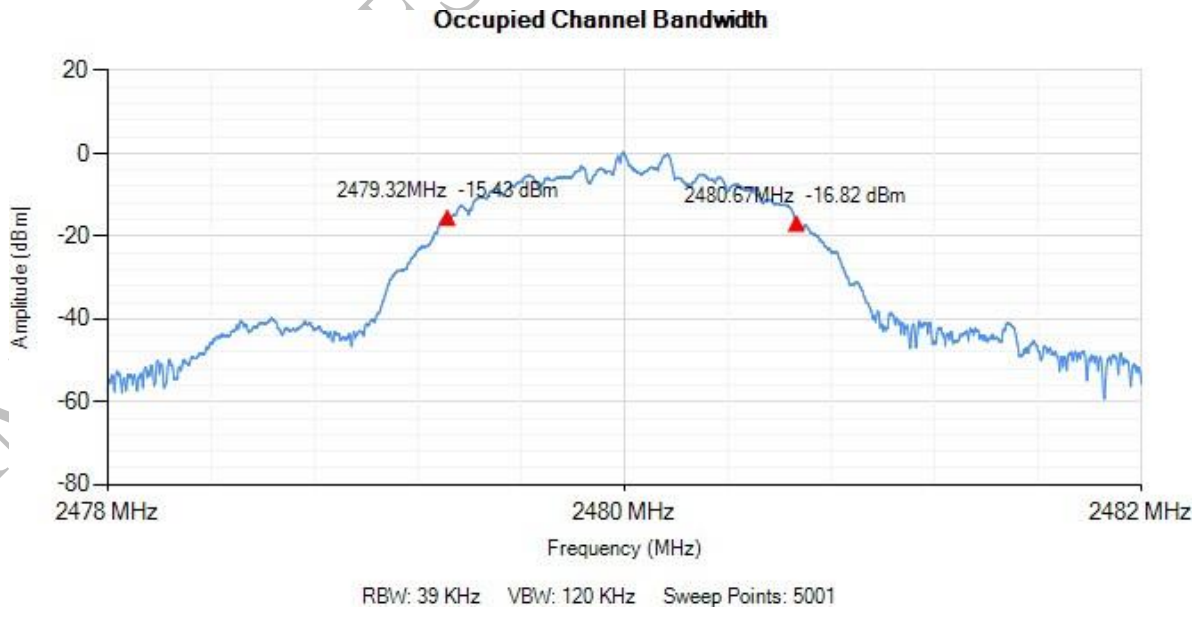




EDR mode: 8-DPSK

Test Channel	*Bandwidth 99%(MHz)*	*FL (MHz) or FH (MHz)*	*Lower Limit (MHz)*	*Higher Limit (MHz)*
Lowest	*1.352*	*2401.315*	*> 2400.0*	*N/A*
Highest	*1.350*	*2480.665*	*N/A*	*< 2483.5*

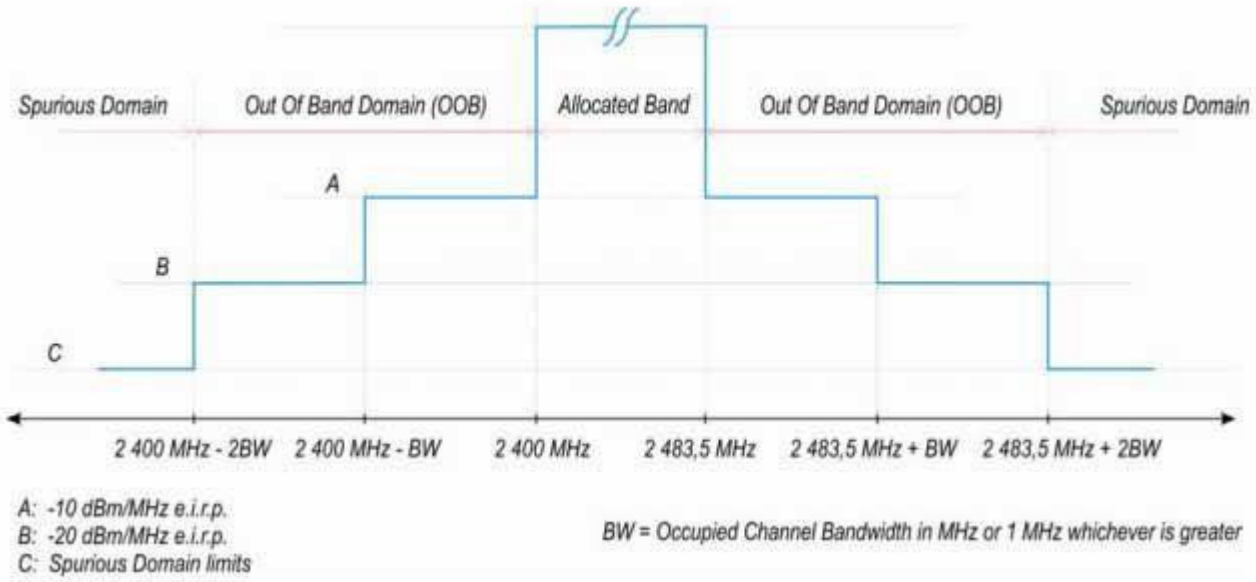




6.7 Transmitter unwanted emissions in the out-of-band domain

6.7.1 *Limit(ETSI EN 300 328 V2.2.2 (2019-07)Clause 4.3.1.9.3)*

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



6.7.2 Test procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.8

1. *Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum and use the following settings:*
   - *Centre Frequency: 2 484 MHz*
   - *Span: 0 Hz*
   - *Resolution BW: 1 MHz*
   - *Filter mode: Channel filter*
   - *Video BW: 3 MHz*
   - *Detector Mode: RMS*
   - *Trace Mode: Clear / Write*
   - *Sweep Mode: Continuous*
   - *Sweep Points: 5 000*
   - *Trigger Mode: Video trigger*

   NOTE 1: In case video triggering is not possible, an external trigger source may be used.
   - *Sweep Time: Suitable to capture one transmission burst*
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).

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.

4. *segment 2 400 MHz - BW to 2 400 MHz*

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

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.

6. *In case of conducted measurements on equipment with a single transmit chain, the declared antenna assembly gain "G" in dBi shall be added to the results for each of the 1 MHz segments and compared with the limits provided by the mask given in figures 1 or 3. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered.*

   •In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), the measurements need to be repeated for each of the active transmit chains. The declared antenna assembly gain "G" in dBi for a single antenna shall be added to these results. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered. Comparison with the applicable limits shall be done using any of the options given below:

   - Option 1: the results for each of the transmit chains for the corresponding 1 MHz segments shall be added. The additional beam forming gain "Y" in dB shall be added as well and the resulting values compared with the limits provided by the mask given in figures 1 or 3.

   - Option 2: the limits provided by the mask given in figures 1 or 3 shall be reduced by 10 x log 10(Ach) and the additional beam forming gain "Y" in dB. The results for each of the transmit chains shall be individually compared with these reduced limits.

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

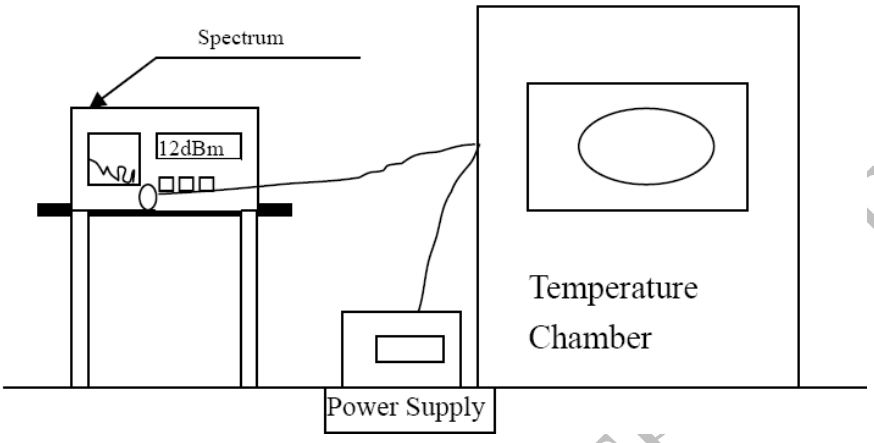
   It shall be recorded whether the equipment complies with the mask provided in figures 1 or 3.

EUT Operation

Status: *Enter test mode for the product, keep EUT in continuously transmitting status with hoping on mode with different packages; find the worst case is GFSK, 8DPSK mode.*
Pre-test the EUT in AC mode and B/O mode, find worse case in B/O mode.

6.7.3 Test Setup

For Conducted Measurement



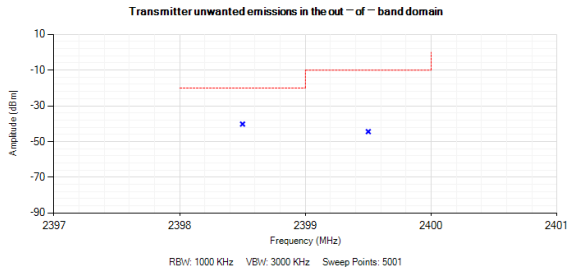
6.7.4 Test result

Modulation Type	*Test Condition*	*Test Channel*	*Frequency (MHz)*	*Level (dBm)*	*Limit (dBm)*
GFSK	*Normal*	*Lowest Channel*	*2399.5*	*-44.35*	*-10*
			2398.5	*-40.25*	*-20*
		Highest Channel	*2484*	*-54.64*	*-10*
			2485	*-56.54*	*-20*
Π/4-DQPSK	*Normal*	*Lowest Channel*	*2399.5*	*-45.65*	*-10*
			2399.15	*-49.88*	*-10*
			2398.15	*-52.34*	*-20*
			2397.8	*-52.36*	*-20*
		Highest Channel	*2484*	*-53.41*	*-10*
			2484.35	*-54.15*	*-10*
			2485.35	*-56.58*	*-20*
			2485.7	*-56.49*	*-20*
8-DPSK	*Normal*	*Lowest Channel*	*2399.5*	*-45.91*	*-10*
			2399.15	*-49.36*	*-10*
			2398.15	*-52.37*	*-20*
			2397.8	*-52.35*	*-20*
		Highest Channel	*2484*	*-53.69*	*-10*
			2484.35	*-54.31*	*-10*
			2485.35	*-56.57*	*-20*
			2485.7	*-56.55*	*-20*

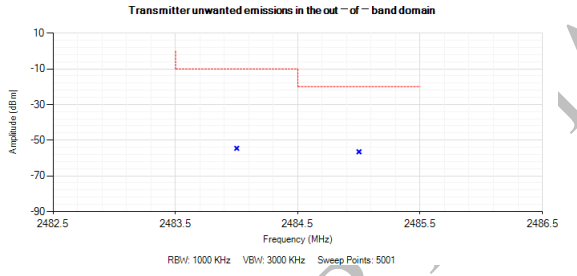
Test plots at normal condition:

Condition:	*Normal*

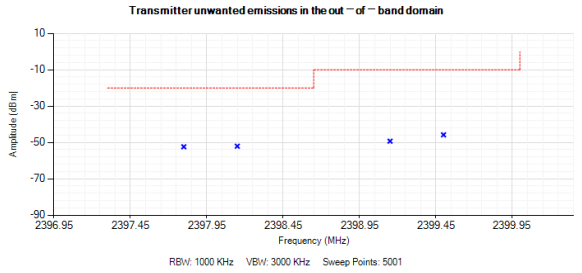
CH Low (Normal Temp) 1M



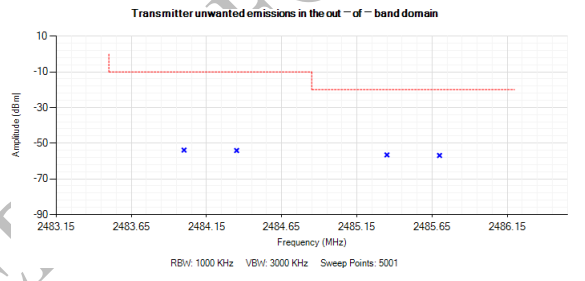
CH High (Normal Temp) 1M



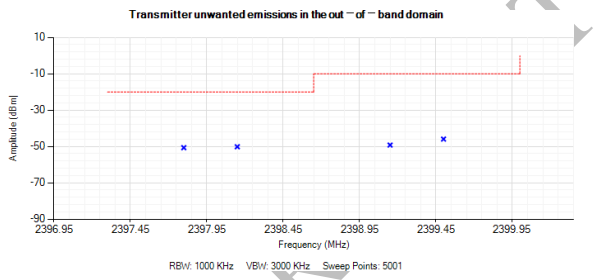
CH Low (Normal Temp) 2M



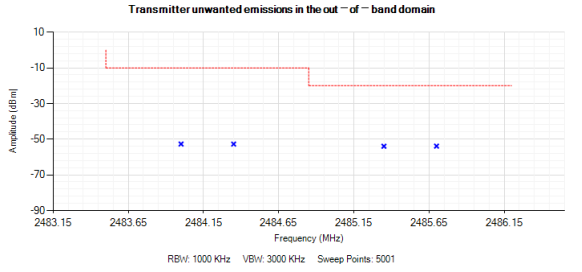
CH High (Normal Temp) 2M



CH Low (Normal Temp) 3M



CH High (Normal Temp) 3M



6.8 Transmitter unwanted emissions in the spurious domain

6.8.1 *Limit(ETSI EN 300 328 V2.2.2 (2019-07)Clause 4.3.1.10.3)*

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 1.

Table 1: Transmitter limits for spurious emissions

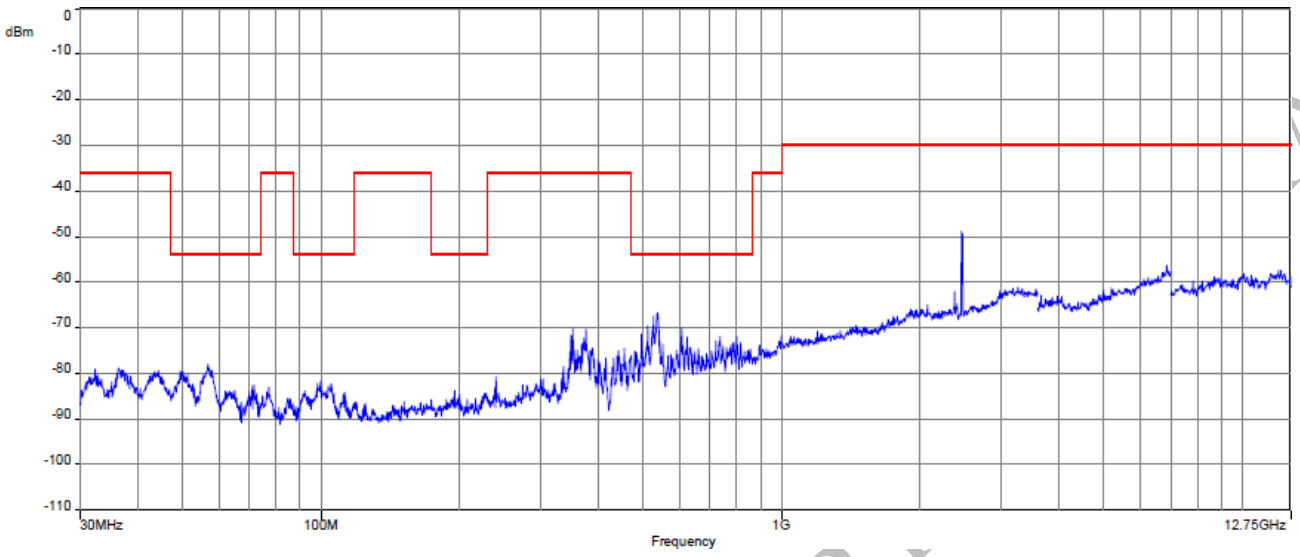
Frequency range	Maximum power	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 694 MHz	-54 dBm	100 kHz
694 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12,75 GHz	-30 dBm	1 MHz

6.8.2 Test procedure

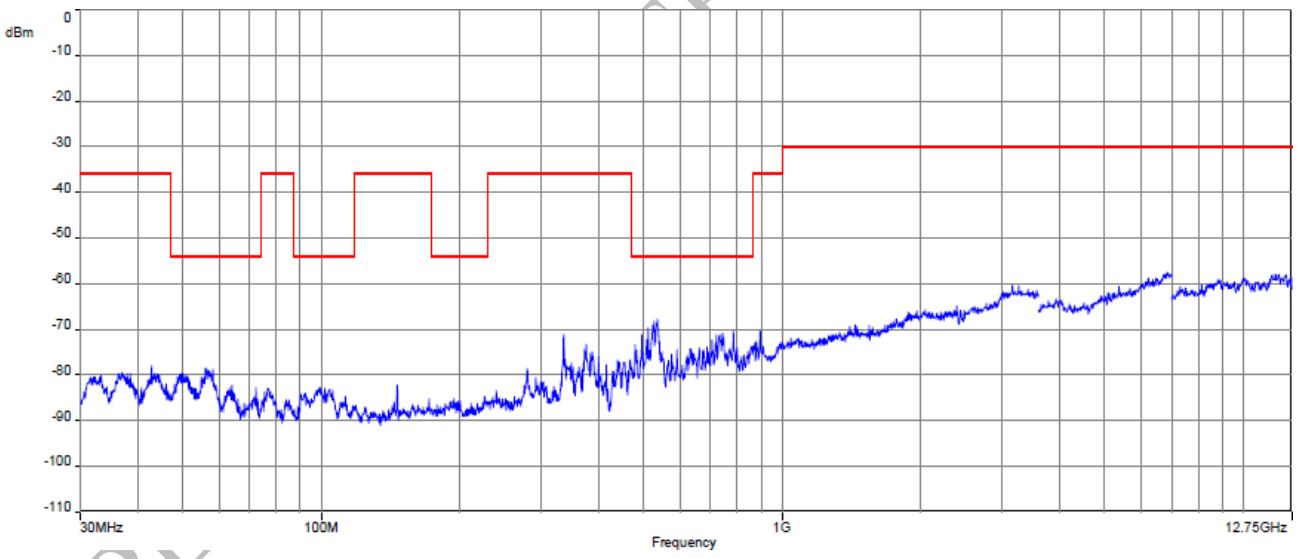
Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.9

6.8.3 *Test result(Conducted measurement)*

Low CH



High CH



6.9 Receiver spurious emissions

6.9.1 *Limit(ETSI EN 300 328 V2.2.2 (2019-07)Clause 4.3.1.11.3)*

The spurious emissions of the receiver shall not exceed the values given in table 2.

Spurious emission limits for receivers

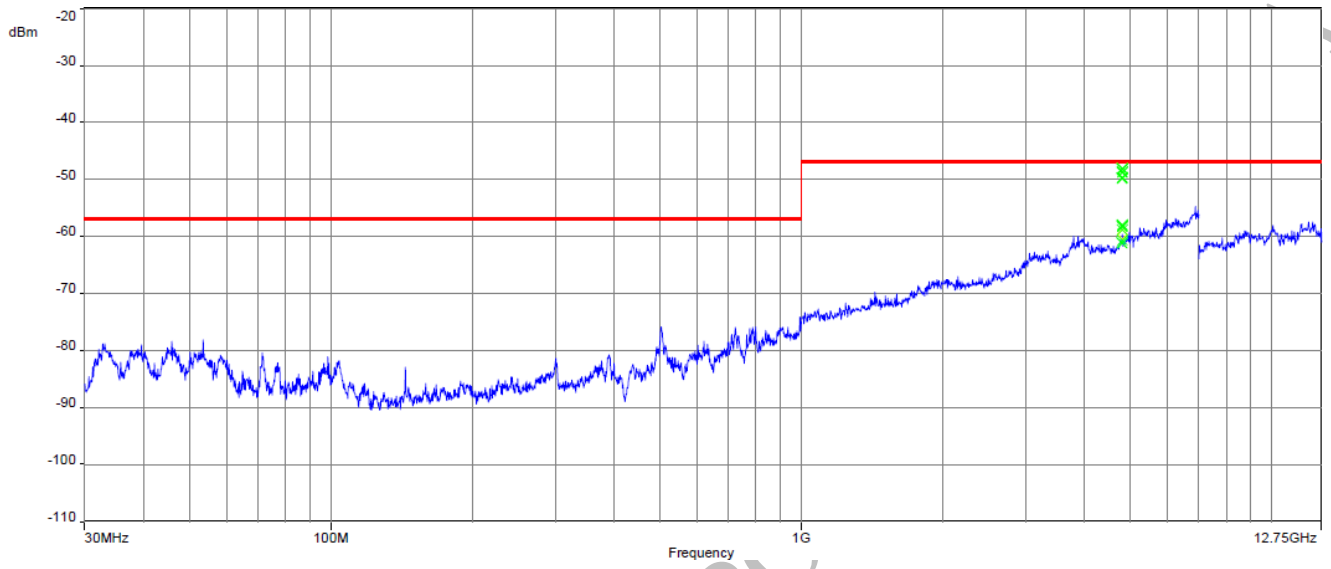
Frequency range	***Maximum power, e.r.p. (≤ 1 GHz) e.i.r.p. (> 1 GHz)***	***Bandwidth***
30 MHz to 1 GHz	*-57 dBm*	*100KHz*
1 GHz to 12,75 GHz	*-47 dBm*	*1MHz*

6.9.2 Test procedure

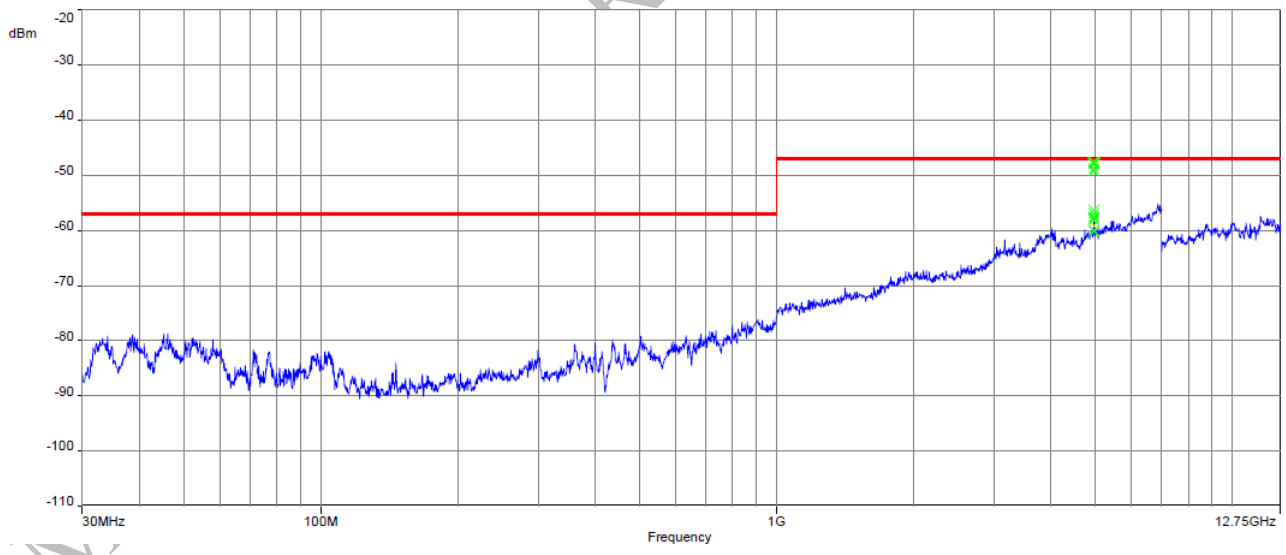
Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.10

6.9.3 Test result (Conducted measurement)

Low CH



High CH



6.10 Receiver Blocking

6.10.1*Limit (ETSI EN 300 328 V2.2.2 (2019-07)Clause 4.3.1.12.4)*

Receiver category 2

The following equipment shall be categorized as receiver category 2 equipment:

- non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % (irrespective of the maximum RF output power); or
- equipment (adaptive or non-adaptive) with a maximum RF output power greater than 0 dBm e.i.r.p. and less than or equal to 10 dBm e.i.r.p.

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 2 504	-34	CW
(-139 dBm + 10 × $\log_{10}$(OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 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 2 504 2 300 2 584	-34	CW

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: 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 2 504 2 300 2 584	-34	CW

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 the 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.

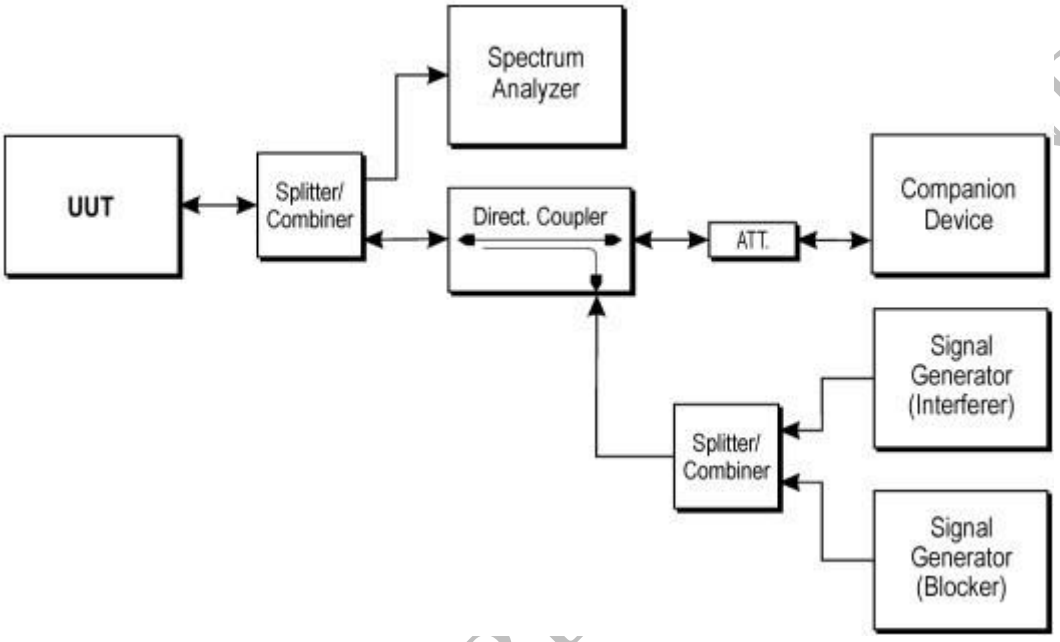
NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

6.10.2 Test procedure

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.11

6.10.3 Test Setup

Conducted measurements



6.10.4

Test result

Receiver blocking performance when operating at the lowest operating channel				
$OCBW_{min}$: 0.867 MHz			Antenna gain(G) : 0dBi	
The actual blocking signal power(Note1)			Modulation Mode-GFSK	
Note1: For the conducted measurements , the level shall be corrected as follows: the actual blocking signal power = blocking signal power + antenna gain				
Wanted signal mean power from companion device (dBm)	**Blocking signal frequency (MHz)**	**The actual blocking signal power (dBm)**	**PER(%)**	**Pass/Fail**
-69.63	2300	-34	0.74	PASS
	2380		0.56	PASS

Receiver blocking performance when operating at the Highest operating channel				
$OCBW_{min}$:0.871 MHz			Antenna gain(G) : 0dBi	
The actual blocking signal power(Note1)			Modulation Mode-GFSK	
Note1: For the conducted measurements , the level shall be corrected as follows: the actual blocking signal power = blocking signal power + antenna gain				
Wanted signal mean power from companion device (dBm)	**Blocking signal frequency (MHz)**	**The actual blocking signal power (dBm)**	**PER(%)**	**Pass/Fail**
-69.61	2504	-34	1.21	PASS
	2584		1.36	PASS

7 Photographs

SAMPLE VIEW 1

SAMPLE VIEW 2

End of report