Mini Clip
Retractable Headset

User Manual

Contents

Product Specifications

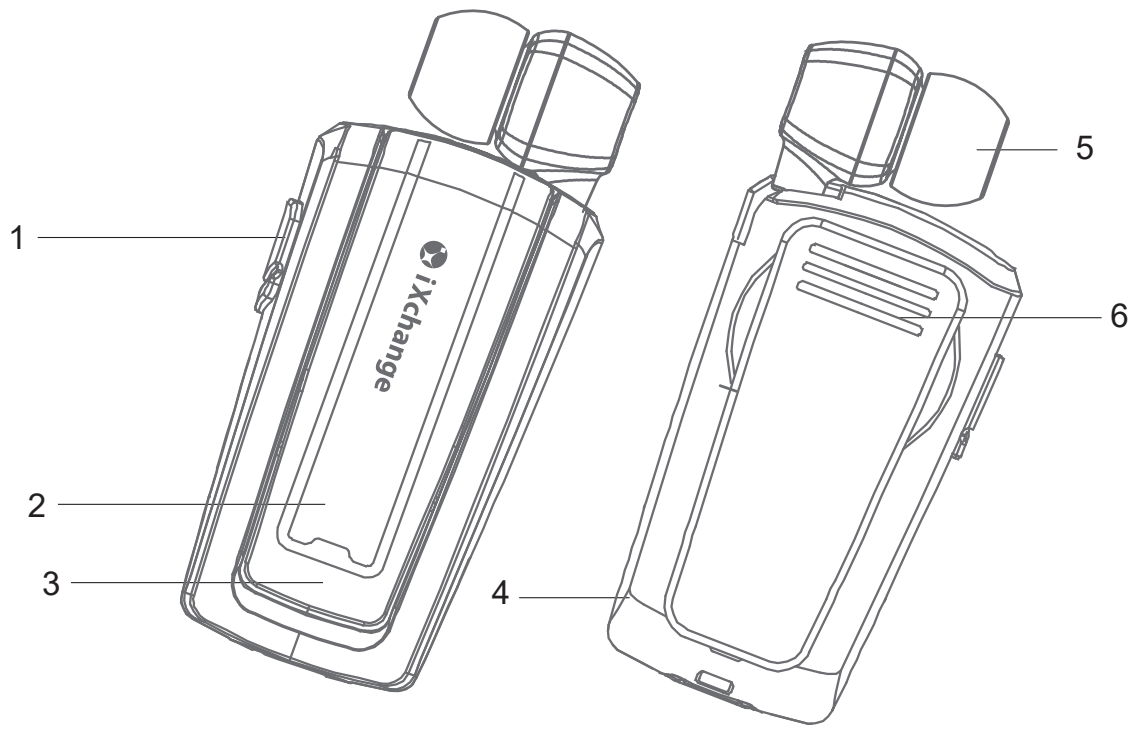
Bluetooth® Specification:	v5.3
Bluetooth® Profiles Supported:	HFP, HSP, A2DP, AVRCP
Operating Distance:	10 meters
Operating Temperature:	0-50 degree celsius
Charging Time:	Around 1.5-2 hours
Talk Time*:	Up to 7.5 hours
Music Time*:	Up to 10 hours
Standby Time*:	Up to 120 hours
Battery Type and Capacity:	Rechargeable Li-Polymer 65mAh
Dimension:	47(L) x 26(W) x 14.5(H) mm
Weight:	18g

*May be varied by mobile phone settings and operator

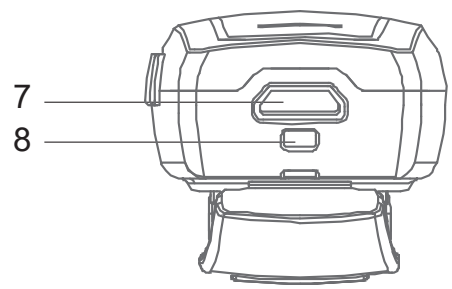
Components

Inside the package, you should find:
1x Retractable Headset
1x Micro USB Cable
1x User Manual
1x Neck Strap
2x Inear Cushion (L and S size each)

UA-26 Overview

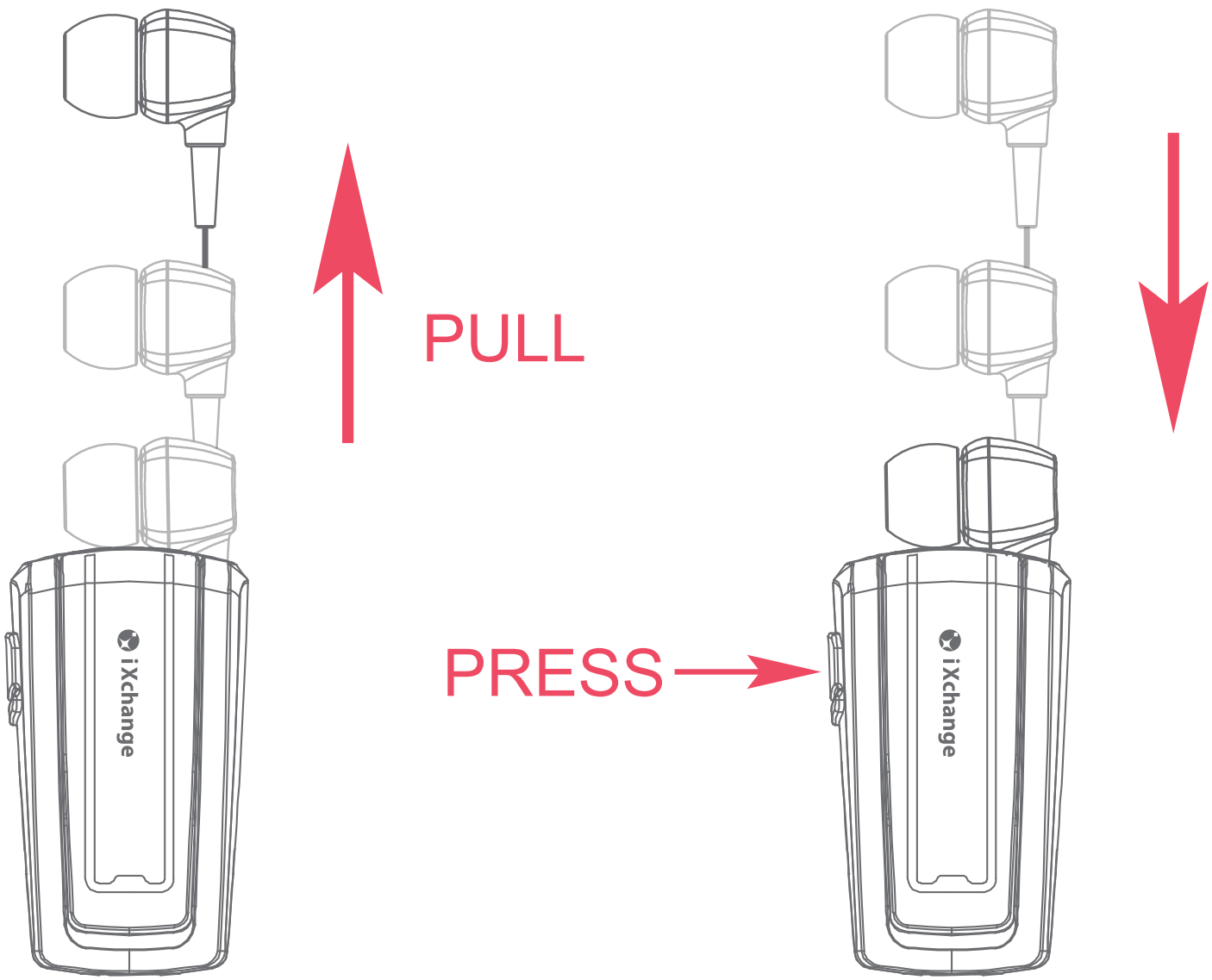


1. Rewind Button
2. Multi-function Button (MFB)
3. Status Indicator
4. Microphone
5. Speaker
6. Clip
7. Micro USB Charging Socket
8. Neck Strap Hole



Retractable Mechanism

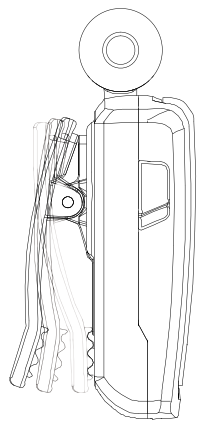
The earpiece cord can be extended by gently pulling on the cord. The cord can be retracted (shortened) by pressing the Rewind Button.

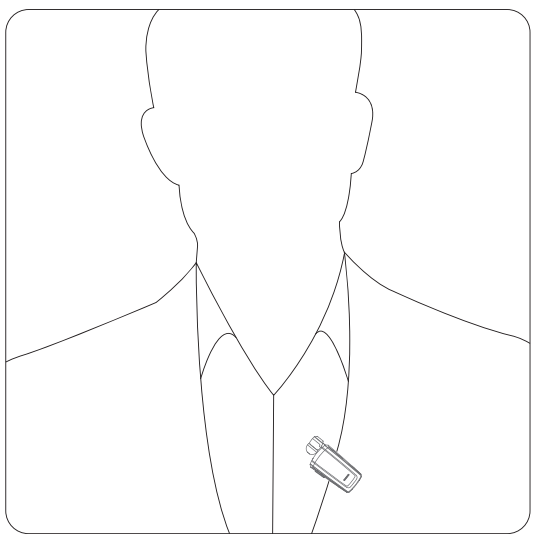


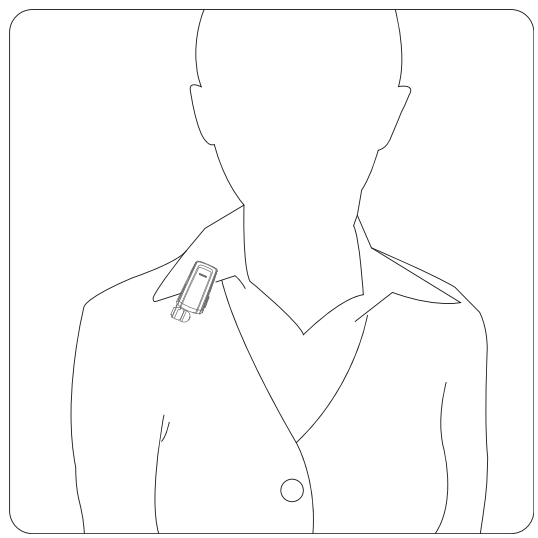
How to Wear Your Headset

UA-26 is designed,

A. to clip onto your clothing

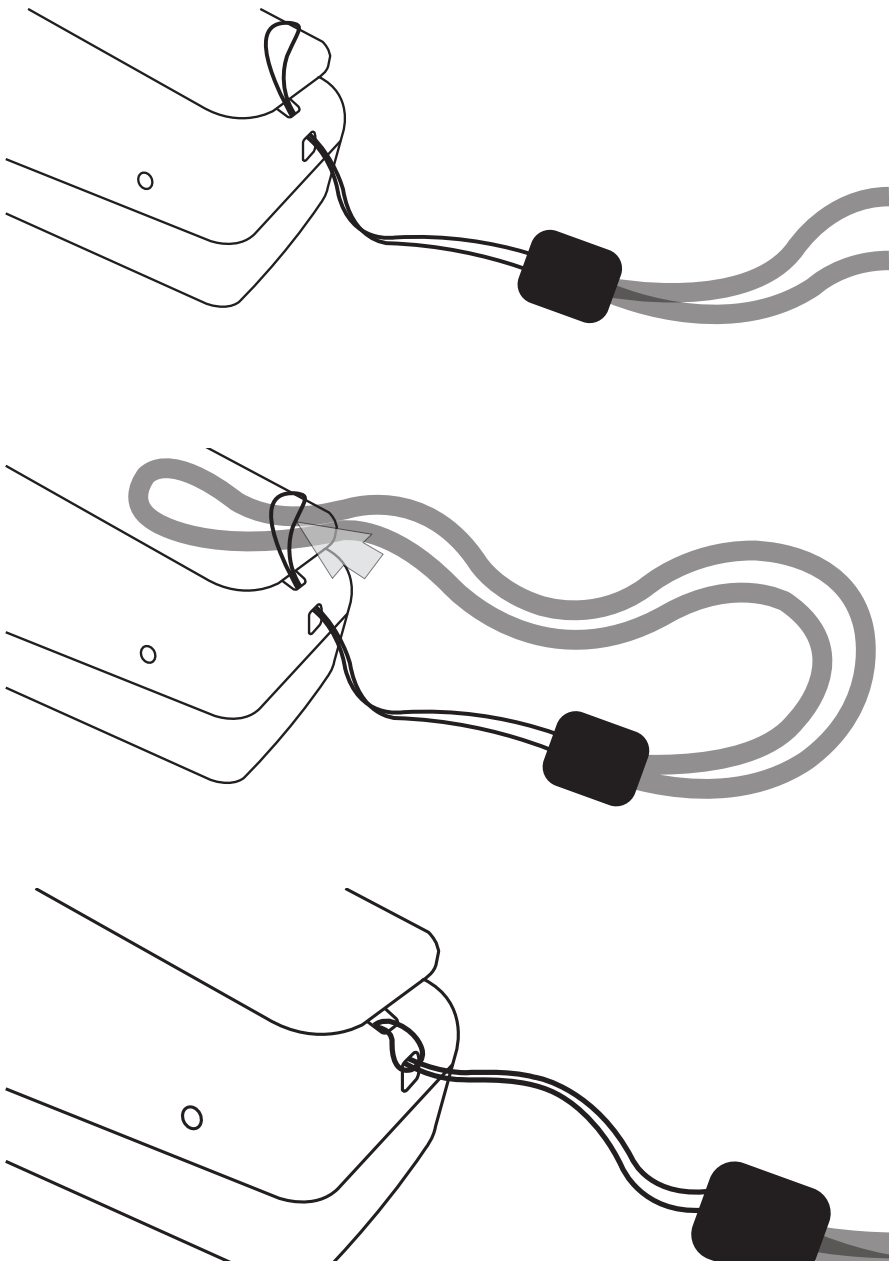






How to Wear Your Headset (cont'd)

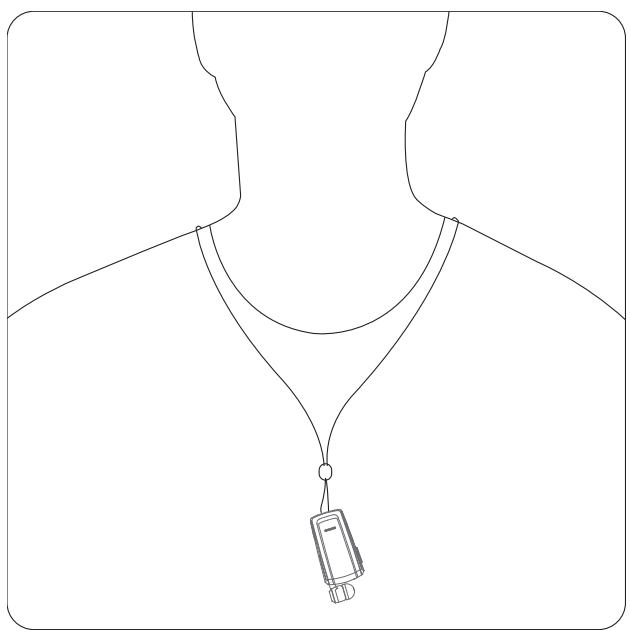
B. fasten by a neck strap to wear comfortably and securely around your neck



Step 1. Loop the thin end of the neck strap through the slot on the Headset.

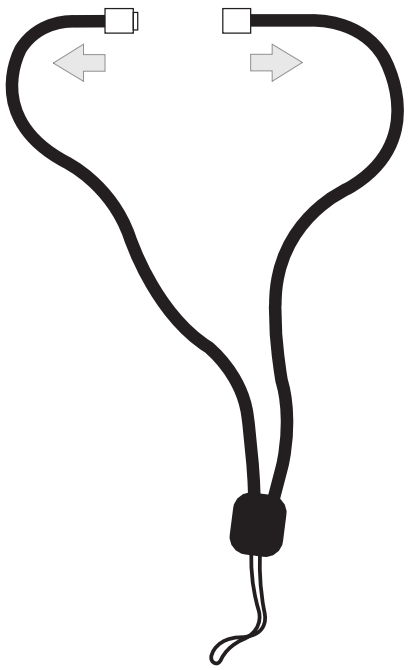
Step 2. Loop the thicker side of the neck strap through the loop created by the thin wire and pull until snug.

Step 3. Once pulled through, you can wear your Headset around your neck.



How to Wear Your Headset (cont'd)

B.



To release the strap, hold the strap and pull outwardly. (See the picture on left)

• Use the provided neck strap only.

• It may be necessort to bring the microphone closer to your mouth for lowering background noise.

Charging Your Headset

Before using your UA-26 (”Headset”) for the first time, please insert the charger into the power source and connect the other end to micro USB charging socket of headset to charge the battery fully.

Status	**Status Indicator**
1. Charging	Red light ON
2. Fully charged	OFF
3. Low battery	Red light for every 5 seconds
4. Out of battery	OFF

• To extend the battery life, re-charging the battery every 6 months.
• Charging indication will be delayed in a few seconds if the headset has not been used for a long period of time.

Getting Started

Turning Your Headset On and Off:

A. Turning on
Press and hold the MFB until the status indicator flashes blue.
B. Turning off
Press and hold the MFB until the status indicator flashes red.

Pairing Your Headset with a Bluetooth® wireless technology enabled phone

1. Turn on the Bluetooth® function in the mobile phone.
2. Place the headset and the phone where they are visible, within arm's length from each other.
3. Ensure the headset is OFF.
4. To activate the headset's pairing mode, press and hold the MFB until the blue LED on.
5. Search the headset, select "UA-26" and enter the passcode "0000 ". If your mobile phone supports "Simple Pairing" function, no code is required.
6. When the pairing is complete, the headset's status indicator will off.

Pairing Your Headset with two Bluetooth® wireless technology enabled phones (Multi-point)

Headset supports a Multi-point function to allow simultaneous its pairing with two mobile phones.

1. Pair the headset with the first phone (follow the step in "Pairing Your Headset with a Bluetooth mobile phone").
2. Turn off the headset and the bluetooth function of the first paired phone.
3. Pair the headset with the second phone (follow the step in "Pairing Your Headset with a Bluetooth mobile phone").
4. Activate the Bluetooth connection with the headset and the first paired phone on the phone's menu.

• For some phones, you may need to manual press "connect" to connect the headset.
• If the pairing cannot be completed within two minutes, the headset will automatically go to standby mode and then turn off after three minutes. Repeat steps to pair both devices again.

Reconnecting Your Headset

1. If the headset has powered off, it will be reconnected to the phone automatically after switching on the headset.

2. If the phone has powered off and headset is then disconnected you need to reconnect the headset from the bluetooth's menu when phone turns on again. Otherwise, the headset will switch off.

Using Your Headset

Function	**Button**	**Audio (Earpiece)**	**Status Indicator**
Incoming Call		Ringtone	Blue light flashes
Answer a Call	Press MFB once to accept.	--	During the call, blue light flashes
Call Reject	Press the MFB twice	--	--
• Reject a second call directly on the other connected phone during the call.			
End a Call	Press the MFB once	'Do' tone once	--
Voice Dail	Press and hold the MFB	'Do' tone once	--
Last Number Redial	Press the MFB twice	--	--

Using Your Headset (cont'd)

Function	Button	Audio (Earpiece)	Status Indicator
Out of range alert	--	--	Blue light flashing 2 times
• The headset will automatically reconnect within 5 minutes, otherwise it will off. If auto-connect is not supported, please reconnect from the Bluetooth's menu.			
Call Transfer (from headset to mobile phone / or vice versa)	During a conversation, press the MFB twice	--	Call by headset: Blue light flashing once Call by phone: Blue light flashing
Adjust Volume	Adjust from your mobile	'Do' tone	--
Standby mode with mobile connection	--	--	--
Reset (paired devices list)	Turn off headset, press and hold the MFB for 8 seconds	'Do' tone twice	Red light flashes once

Using Your Headset (cont'd)

Function	Button	Audio (Speaker)	Status Indicator
Standby mode without mobile connection	--	--	Blue light flashing 2 times

- UA-26 is designed to work with the mobile phones with Bluetooth Hands-free profiles (or Bluetooth devices), the compatibility of some features are not guaranteed for some phones in different operating system.

In order to have a better and clear reception, there should have no obstacle to the headset while talking.

Troubleshooting

I cannot adjust volume in my headset
- Please adjust the volume by your phone

I cannot pair with my mobile phone
- Ensure your headset is power on and fully charged
- Ensure the Bluetooth setting is activated on your phone
- Ensure the headset is at pairing mode (blue light on)
- Ensure the headset is not out of range of your phone
- Ensure your phone is visible to all nearby Bluetooth devices (when the headset is in easy pairing mode)
- Please wait a seconds for the searching the Bluetooth devices

If the above steps do not solve the problem, please turn off the headset and recharge the headset, and then try again.

I cannot hear the sound in my headset
- Ensure your headset is power on and fully charged
- Ensure your headset is paired and connected with your phone
- Ensure the conversation is not transferred to your phone
- Ensure the volume level is high enough

I cannot turn off the headset
Please press and hold the MFB for a longer time, otherwise, please recharge the headset for 2-3 seconds then disconnect the charger, the headset now turns off.

Troubleshooting (cont'd)

I cannot turn on the headset
Ensure your headset is power on and fully charged, otherwise, please charge the headset for 1-1.5 hours, and then turn on again.

My phone cannot be auto-reconnected with the headset
- Manually connect the headset from your mobile phone
- Turn off the mobile then turn on again
- Turn off the headset then turn on again

There is a "Beep" sound from the earpiece during the call, what happen?
Low battery alert, please charge your headset.

I hear some noise during the call, why?
There is an obstruction between the headset and your mobile, please remove it. Or please put your mobile on the table, don't hold it on hand.

Safety Precautions

1. Unintentional depression of the retractable button could result in an injury from the force of the earpiece cord retraction.
2. Be careful when retracting the length of the earphone. Keep a safe distance between your face and the headset.
3. If you must use the headset while driving, ensure your attention is fully focused on driving safety. Be a responsible driver and abide by the local laws.
4. Place in a children's unreachable area, never allows them to play with the headset. Small parts pose as a choking hazard.
5. Obey all designated areas such as hospitals, electronically restrictive and hazardous environment that require an electrical device be switched off.
6. Turn off your headset prior to boarding on an aircraft. Do not use it while being asked by the flight attendant.
7. Never mount or store your headset over any air bag deployment area as serious injury could result upon deployment.
8. Do not attempt to disassemble the headset as it does not contain serviceable components.
9. Headset builds with battery inside and should dispose of it according to local regulations, not as a household waste.

Maintenance

1. Do not yank or forcibly pull the earphone cord.
2. Consider turning your headset off before placing it in your pocket or bag. If the MFB is accidentally pushed, your mobile phone may place an unintended call.
3. Do not expose the headset to liquid or humidity, as it is not waterproof.
4. Do not use abrasive cleaning solvents to clean the headset.
5. Do not expose the headset to extremely high or low temperatures.
6. Do not expose your headset to contact with sharp objects as this will cause scratches and damage.
7. Do not stick anything inside the headset as this may damage internal components.
8. Do not attempt to replace the headset's battery. It is built-in and is not removable.

Declaration of Conformity

We, iXchange, declare that the following product:

Product Name: Mini Clip
Model Number: UA-26

is in conformity with the following essential requirements of Council Directive 1999/5/EC (referred to as R&TTE Directive): Article 3.1a, 3.1b and 3.2 and the product is manufactured in accordance with Annea II of the directive.

FCC Compliance Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1)This device may not cause harmful interference, and
(2)This device must accept any interference received, including interference that may cause undesired operation.

15.21
You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

FCC Compliance Statement (cont'd)

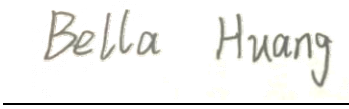
15.105(b)
This equipment has been tested and found to comply with the limits for Class B digital devices, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

Made in China

TEST REPORT
ETSI EN 300 328 V2.2.2 (2019-07)

Report Reference No.....	**HK2307102941-2ER**	
Compiled by (position+printed name+signature).....	Testing engineer Bella Huang	
Supervised by (position+printed name+signature).....	Technique principal Sliver Wan	
Approved by (position+printed name+signature).....	Manager Jason Zhou	
Date of issue.....	2023/07/19	

Testing Laboratory Name.....	Shenzhen HUAK Testing Technology Co., Ltd.
Address.....	1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Applicant's name	Channel Enterprises (HK) Ltd.
Address.....	Rm.6, 20/F., Lucida Ind. Building, 43-47 Wang Lung Street, Tsuen Wan, N.T., Hong Kong
Test specification.....	
Standard	ETSI EN 300 328 V2.2.2 (2019-07)
TRF Originator.....	Shenzhen HUAK Testing Technology Co., Ltd.
Master TRF.....	Dated 2019-07

Test item description	Bluetooth Headset
Trade Mark	iXchange
Model/Type reference.....	UA-25B1
List Model	UA-26B1, UA-25 v2.0, UA-26
Hardware Version.....	V2.0
Software Version	V2.0
Modulation Type	GFSK, π/4DQPSK
Operation Frequency.....	From 2402 MHz to 2480 MHz
Ratings.....	DC 5V From Micro USB or DC 3.7V From Battery
Result.....	**PASS**

TEST REPORT

Test Report No. :	HK2307102941-2ER	2023/07/19 Date of issue

Equipment under Test	:	Bluetooth Headset
Model /Type	:	UA-25B1
Listed Models	:	UA-26B1, UA-25 v2.0, UA-26
Applicant	:	Channel Enterprises (HK) Ltd.
Address	:	Rm.6, 20/F., Lucida Ind. Building, 43-47 Wang Lung Street, Tsuen Wan, N.T., Hong Kong
Manufacturer	:	Channel Enterprises (HK) Ltd.
Address	:	Rm.6, 20/F., Lucida Ind. Building, 43-47 Wang Lung Street, Tsuen Wan, N.T., Hong Kong

Test Result:	**PASS**

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

** Modified History **

Revision	Description	Issued Data	Remark
Revision 1.0	Initial Test Report Release	2023/07/19	Jason Zhou

Contents

1. TEST STANDARDS

The tests were performed according to following standards:

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

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	2023/07/10
Testing commenced on	:	2023/07/10
Testing concluded on	:	2023/07/19

2.2. Product Description

Name of EUT	Bluetooth Headset
Model(s) Number	UA-25B1
List Models	UA-26B1, UA-25 v2.0, UA-26
Difference description	All model's the function, software and electric circuit are the same, only with a product color and model named different. Test sample model: UA-25B1.
Hardware version	V2.0
Software version	V2.0
Antenna Type	PCB Antenna
Antenna Gain	0 dBi

2.3. Equipment Under Test

Power supply system utilised

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

DC 5V From Micro USB or DC 3.7V From Battery

Description of the test mode

Bluetooth 2.1 and EDR:79 channels are provided to the EUT.

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

2.4. Description of the Equipment under Test (EUT)

Reference documents:	Bluetooth® Core Specification
Special test descriptions:	None
Configuration descriptions:	TX tests: were performed with x-DH5 packets and static PRBS pattern payload.
	RX/Standby tests: BT test mode enabled, scan enabled, TX Idle
Test mode:	☒Bluetooth Test mode loop back enabled (EUT is controlled over CBT/CMU)
	☐Special software is used. EUT is transmitting pseudo random data by itself
Bluetooth standard capabilities:	79 channels FHSS
	channel separation 1 MHz
	used freq. range 2402-2480 MHz
	Modulation types: GFSK, π/4 DQPSK
	Bandwidth appr. 1MHz, 1,5 MHz, 1.5 MHz for single hop frequency
	number of hopping channels > 15 all the time
	more than 70% of band used with more than 20 channels

2.5. EUT Classification:

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

2.6. EUT configuration

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

● - supplied by the manufacturer

○ - supplied by the lab

●	Power Cable	Length (m) :	/
		Shield :	/
		Detachable :	/

○Adapter information
N/A

2.7. Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3.1. Information of the Test Laboratory

Shenzhen HUAK Testing Technology Co., Ltd.
1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Testing Laboratory Authorization：
A2LA Accreditation Code is 4781.01.
FCC Designation Number is CN1229.
Canada IC CAB identifier is CN0045.
CNAS Registration Number is L9589.

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2003) and CISPR Publication 22.

3.2. Environmental conditions

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

Normal Temperature: 15°C~35°C
High Temperature: 40℃
Low Temperature: -10℃
Normal Voltage: DC 3.7V
High Voltage: DC 4.255V
Low Voltage: DC 3.145V
Relative Humidity: 55 %
Air Pressure: 989 hPa

3.3. Test Description

3.4.1 Main Terms

Verdict	Verdict of each test cases.
Test Case	Test cases identification number and description in ETSI specification.

3.4.2 Terms used in Condition column

NTVNormal voltage, Normal Temperature
HTHVHigh voltage, High Temperature
LTHVHigh voltage, Low Temperature
HTLVLow voltage, High Temperature
LTLVLow voltage, Low Temperature

3.4.3 Terms used in Verdict column

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

3.4.4 Sumarry of measurement results

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

Test Specification Clause	Test Case	Test Condition	Mode	Pass	Fail	N/A	NP	Remark
5.4.2	RF output power	NTV	GFSK π/4 DQPSK	☒	☐	☐	☐	
		LT		☒	☐	☐	☐	
		HT		☒	☐	☐	☐	
5.4.2	Duty Cycle,Tx-sequence, Tx-gap	NTV	---	☐	☐	☒	☐	
5.4.4	Dwell time, min Freq.Occupation and Hopping sequence	NTV	GFSK π/4 DQPSK	☒	☐	☐	☐	
5.4.5	Hopping Separation	NTV	GFSK π/4 DQPSK	☒	☐	☐	☐	
5.4.2	Medium Utilisation	NTV	---	☐	☐	☒	☐	
5.4.6	Adaptivity, Short Control Signalling Transmissions	NTV	GFSK π/4 DQPSK	☐	☐	☒	☐	
5.4.7	Occupied Channel Bandwidth	NTV	GFSK π/4 DQPSK	☒	☐	☐	☐	
5.4.8	Transmitter unwanted emissions in the out-of-band domain	NTV	GFSK π/4 DQPSK	☒	☐	☐	☐	
		LT		☐	☐	☒	☐	
		HT		☐	☐	☒	☐	
5.4.9	Transmitter unwanted emissions in the spurious domain (conducted & radiated)	NTV	GFSK π/4 DQPSK	☒	☐	☐	☐	
5.4.10	Receiver spurious emissions (conducted & radiated)	NTV	GFSK π/4 DQPSK	☒	☐	☐	☐	
5.4.11	Receiver Blocking	NTV	----	☒	☐	☐	☐	

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

3.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities.The measurement uncertainty was calculated for all measurements listed in this test report acc. to ETSI TR 100 028-1 [1], ETSI TS 103 051 [2] and ETSI TS 103 052 [3] and shall correspond to anexpansion factor (coverage factor) k = 1,96 or k = 2 (which provide confidence levels of respectively 95 % and 95,45 %in the case where the distributions characterizing the actual measurement uncertainties are normal (Gaussian)).and is documented in the Shenzhen HUAK Testing Technology Co., Ltd.quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device

Hereafter the best measurement capability for Shenzhen HUAK Testing Technology Co., Ltd.is reported:

No.	Item	Uncertainty
1	Occupied Channel Bandwidth	±3.68%
2	RF power,conducted	±0.37dB
3	Power Spectral Density, conducted	±0.78dB
4	Unwanted Emissions, conducted	±2.71dB
5	All emissions, radiated	±4.28dB
6	Temperature	±0.5°C
7	Humidity	±2%
8	DC and low frequency voltages	±1.5%
9	Time	±1.0%
10	Duty Cycle	±3.0%

3.5. Equipment Used during the Test

RF output power & PSD & OOB & OBW & Hoping & Duty Cycle, Tx-sequence, Tx-gap & Adaptively&Blocking						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	Spectrum analyzer	Agilent	N9020A	HKE-048	2023/02/17	2024/02/16
2	Signal generator	Agilent	83630A	HKE-028	2023/02/17	2024/02/16
3	Signal generator	Agilent	N5182A	HKE-029	2023/02/17	2024/02/16
4	RF automatic control unit	Tonscend	JS0806-2	HKE-060	2023/02/17	2024/02/16

Transmitter spurious emissions & Receiver spurious emissions						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	2023/02/17	2024/02/16
2	Horn antenna	Schwarzbeck	9120D	HKE-013	2023/02/17	2024/02/16
3	Receiver	R&S	ESR-7	HKE-010	2023/02/17	2024/02/16
4	Position controller	Taiwan MF	MF7802	HKE-011	2023/02/17	2024/02/16
5	Preamplifier	EMCI	EMC051845SE	HKE-015	2023/02/17	2024/02/16
6	Preamplifier	Agilent	83051A	HKE-016	2023/02/17	2024/02/16
7	High pass filter unit	Tonscend	JS0806-F	HKE-055	2023/02/17	2024/02/16
8	Spectrum analyzer	Agilent	N9020A	HKE-048	2023/02/17	2024/02/16

The calibration interval is 1 year.

4. TEST CONDITIONS AND RESULTS

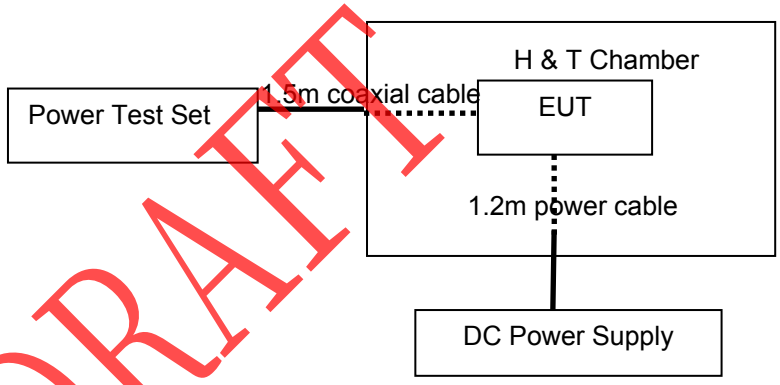
4.1. ETSI EN 300 328 REQUIREMENTS

4.1.1. RF Output Power

LIMIT

According to ETSI EN 300 328 V2.2.2 §4.3.1.2.3,
For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be20 dBm.
The maximum RF output power for non-adaptive equipment shall be declared by the supplier and shall not exceed20 dBm. See clause 5.4.1 m). For non-adaptive equipment using wide band modulations other than FHSS, themaximum RF output power shall be equal to or less than the value declared by the supplier.
This limit shall apply for any combination of power level and intended antenna assembly.

TEST CONFIGURATION



TEST PROCEDURE
According to ETSI EN 300 328 V2.2.2(2019-07) §5.4.2.2.1.2, conducted method..
Step 1:
•Use a fast power sensor with a minimum sensitivity of -40 dBm and capable of minimum 1 MS/s.
•Use the following settings:
- Sample speed 1 MS/s or faster.
- The samples shall represent the RMS power of the signal.
- Measurement duration: For non-adaptive equipment: equal to the observation period defined in clause 4.3.1.3.2 or clause 4.3.2.4.2. For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) is captured.
For adaptive equipment, to increase the measurement accuracy, a higher number of bursts may be used.
Step 2:
•For conducted measurements on devices with one transmit chain:
- Connect the power sensor to the transmit port, sample the transmit signal and store the raw data. Use these stored samples in all following steps.
•For conducted measurements on devices with multiple transmit chains:
- Connect one power sensor to each transmit port for a synchronous measurement on all transmit ports.
- Trigger the power sensors so that they start sampling at the same time. Make sure the time difference between the samples of all sensors is less than 500 ns.
- For each individual sampling point (time domain), sum the coincident power samples of all ports and store them. Use these summed samples as the new stored data set.
Step 3:
•Find the start and stop times of each burst in the stored measurement samples.
The start and stop times are defined as the points where the power is at least 30 dB below the highest value ofthe stored samples in step 2.
In case of insufficient sensitivity of the power sensor (e.g. in case of radiated measurements), the value of30 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 theformula below. The start and stop points shall be included. Save these Pburst values, as well as the start andstop 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.
•In case of smart antenna systems operating in mode with beamforming (see clause 5.3.2.2.4), add the additional beamforming gain Y in dB.
•If more than one antenna assembly is intended for this power setting, the maximum overall antenna gain (G orG + Y) shall be used.
•The RF Output Power (Pout) shall be calculated using the formula below:

Pout = 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 inthe test report.

EUT DESCRIPTION:

Mode:	BT Testmode
Hopping:	On
Packet Type:	Longest supported
Modulation:	GFSK, Π/4 DQPSK

MEASUREMENT DESCRIPTION

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

TEST RESULTS

Test environmental		Maximum conducted Burst Power in 15 measured Bursts (RMS) [dBm]		
Test Mode	**Test Condition**	**AntennaMeasuredPower (dBm)**	**EIRP(dBm)**	**Limit(dBm)**
GFSK	NTV	1.18	1.18	20
	LT/NV	-1.25	-1.25	20
	HT/NV	-2.35	-2.35	20
π/4DQPSK	NTV	0.83	0.83	20
	LT/NV	-2.59	-2.59	20
	HT/NV	-2.58	-2.58	20
Result		**Pass**		

Note :Cable loss and antenna gain was combined in the calculated result.

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

LIMIT

ETSI EN 300 328 (V2.2.2) Sub-clause 4.3.1.3.3
The Duty Cycle shall be equal to or less than the maximum value declared by the supplier.
The maximum Tx-sequence Time an d the minimum Tx-gap Time shall be according to the formula below:
Maximum Tx-Sequence Time = Minimum Tx-gap Time = M
where M is in the range of 3,5 ms to 10 ms.
Duty Cycle is defined as the ratio of the total transmitter 'on'-time to a 1 second observation period.
Tx-sequence is defined as a period in time during which a single or multiple transmissions may occur and which shall be followed by a Tx-gap.
Tx-gap is defined as a period in time during which no transmissions occur.
NOTE: The maximum Duty Cycle at which the equipment can operate, is declared by the supplier.
These requirements apply to non-adaptive equipment or to adaptive equipment when operating in a non-adaptive mode. The equipment is using wide band modulations other than FHSS.
These requirements do not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.
Medical devices requiring reverse compatibility with other medical devices placed on the market when earlier versions of the present document were harmonised, are allowed to have an operating mode in which they do not have to comply with the requirements for Duty Cycle, Tx-sequence and Tx-gap.

TEST PROCEDURE

Please refer to ETSI EN 300 328 (V2.2.2) Sub-clause5.4.2.2.1.3
For systems using wide band modulations other than FHSS, the measurement shall be performed at the lowest, the middle, and the highest channel on which the equipment can operate. These frequencies shall be recorded.
The test procedure, which shall only be performed for non-adaptive systems and only to be performed at normal environmental conditions, shall be as follows:

Step 1:
•Use the same stored measurement samples from the procedure described in clause 5.4.2.2.1.2.
•The start and stop times are defined as the points where the power is at least 30 dB below the highest value ofthe stored samples. In case of insufficient sensitivity of the power sensor (e.g. in case of radiated measurements), the value of 30 dB may need to be reduced appropriately.

Step 2:
•Between the saved start and stop times of each individual burst, calculate the TxOn time. Save these TxOn values.

Step 3:
•Duty Cycle (DC) is the sum of all TxOn times between the end of the first gap (which is the start of the first burst within the observation period) and the start of the last burst (within this observation period) divided by the observation period. The observation period is defined in clause 4.3.1.3.2 or clause 4.3.2.4.2.

Step 4:
•For FHSS equipment using blacklisting, the TxOn time measured for a single (and active) hopping frequency shall be multiplied by the number of blacklisted frequencies. This value shall be added to the sum calculated instep 3 above. If the number of blacklisted frequencies cannot be determined, the minimum number of hoppingfrequencies (N) as defined in clause 4.3.1.4.3 shall be assumed.
•The calculated value for Duty Cycle (DC) shall be recorded in the test report. This value shall be equal to or less than the maximum value declared by the manufacturer.

Step 5:
•Use the same stored measurement samples from the procedure described in clause 5.4.2.2.1.2.
•Identify any TxOff time that is equal to or greater than the minimum Tx-gap time as defined in clause 4.3.1.3.3or clause 4.3.2.4.3. These are the potential valid gap times to be further considered in this procedure.
•Starting from the second identified gap, calculate the time from the start of this gap to the end of the precedinggap. This time is the Tx-sequence time for this transmission. Repeat this procedure until the last identified gapwithin the observation period is reached.
•A combination of consecutive Tx-sequence times and Tx-gap times followed by a Tx-gap time, which is at least as long as the duration of this combination, may be considered as a single Tx-sequence time and in whichcase it shall comply with the limits defined in clause 4.3.1.3.3 or clause 4.3.2.4.3.
•It shall be noted in the test report whether the UUT complies with the limits for the maximum Tx-sequence time and minimum Tx-gap time as defined in clause 4.3.1.3.3 or clause 4.3.2.4.3.

EUT DESCRIPTION:

Mode:	BT Testmode
Test Channel	Channel 00(2402MHz),Channel 39(2441MHz),Channel 78(2480MHz)
Modulation:	GFSK, Π/4 DQPSK

MEASUREMENT DESCRIPTION

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

TEST RESULTS

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

4.1.3. Accumulated Transmit Time, Frequency Occupation and HoppingSequence

LIMIT

According to ETSI EN 300 328 V2.2.2 (2019-07) §4.3.1.4.3

DWELL TIME	
Condition	Limit
☐ Non-adaptive frequency hopping systems	≤ 15 ms in any [15 ms * the minimum number of hopping frequencies (N)] time domain
☒ Adaptive frequency hopping systems	≤ 400 ms in any [400 ms * the minimum number of hopping frequencies (N)] time domain
MINIMUM FREQUENCY OCCUPATION TIME	
Condition	Limit
☐ Non-adaptive frequency hopping systems	Option 1:Each hopping frequency of the hopping sequence shall be occupied at least once within a period notexceeding 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.
☒ Adaptive frequency hopping systems	
HOPPING SEQUENCE (S)	
Condition	Limit
☐ Non-adaptive frequency hopping systems	≥15 hopping frequencies or 15/minimumHopping Frequency Separation (MHz) whichever is greater.
☒ Adaptive frequency hopping systems	Operating over a minimum of 70% of the Operating in the band 2.4 GHz to 2.4835 GHz
	≥15 hopping frequencies or 15/minimum Hopping Frequency Separation (MHz) whichever is greater.

TEST PROCEDURE

According to ETSI EN 300 328 V2.2.2 (2019-07) §5.4.4.2.1 Conducted measurements.

Accumulated Transmit Time test procedure:

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: 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:

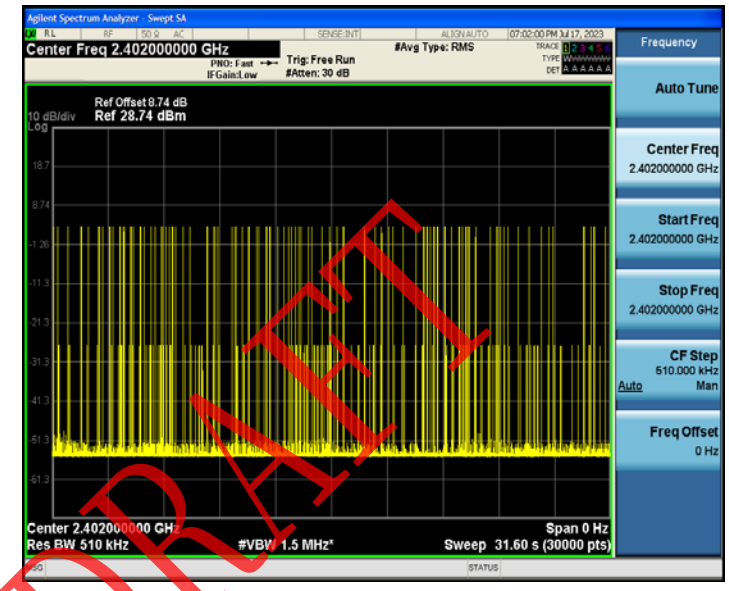
•Save the trace data to a file for further analysis by a computing device using an appropriate software application or program.

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 havemuch higher levels compared to data points resulting from transmissions on adjacent hopping frequencies. If aclear determination between these transmissions is not possible, the RBW in step 1 shall be further reduced. Inaddition, a channel filter may be used.
•Count the number of data points identified as resulting from transmissions on the frequency being investigatedand 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.
•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 1or 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 analyser:
- 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: Peak
- Sweep time: 1 s; this setting may result in long measuring times. To avoid such long measuring times, an FFT analyser may be used
- Number of sweep points: ~ 400 / Occupied Channel Bandwidth (MHz); the number of sweep points may need to be further increased in case of overlapping channels
- Trace Mode: Max Hold
- Trigger: Free Run
Step 7:
•For adaptive FHSS 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.

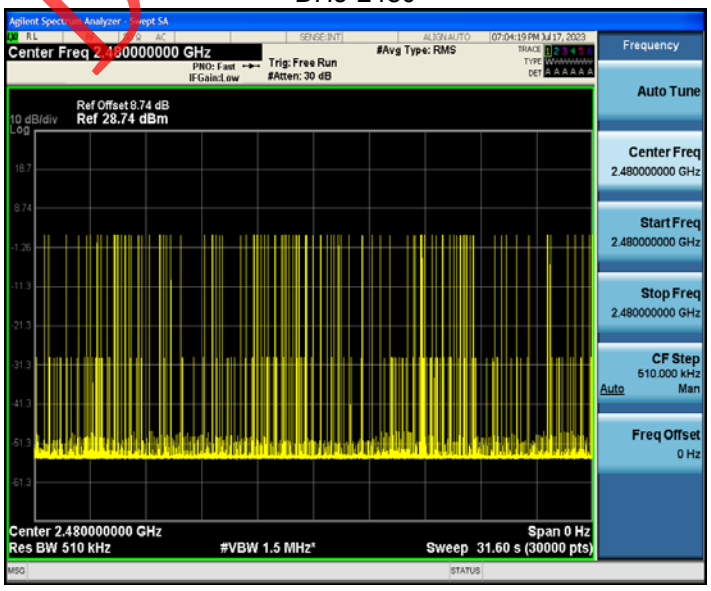
TEST RESULTS

Test Mode	Test Channel	Ant	Accumulated Dwell time [ms]	Limit [ms]	Result
DH5	2402	Ant1	312.860	<=400	PASS
DH5	2480	Ant1	299.166	<=400	PASS
2DH5	2402	Ant1	325.501	<=400	PASS
2DH5	2480	Ant1	326.554	<=400	PASS

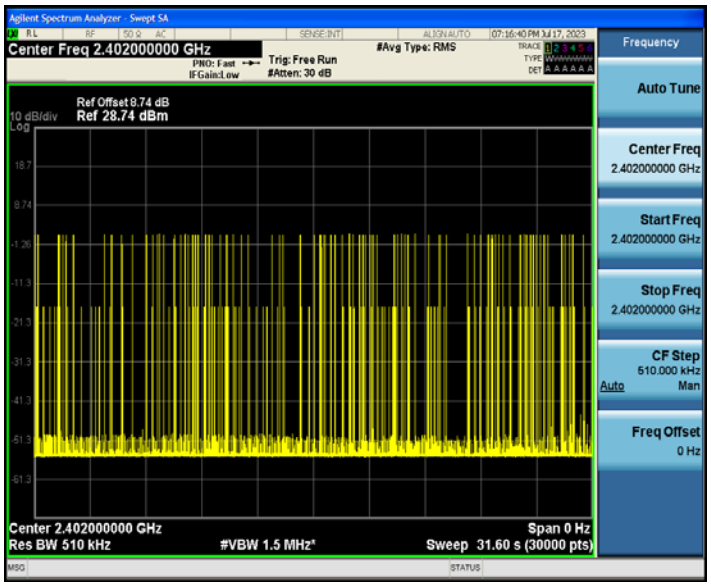
DH5-2402



DH5-2480



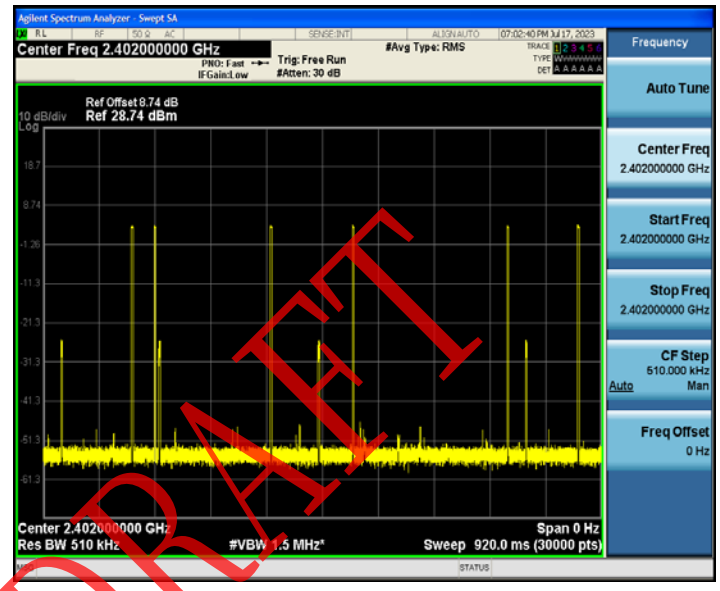
2DH5-2402



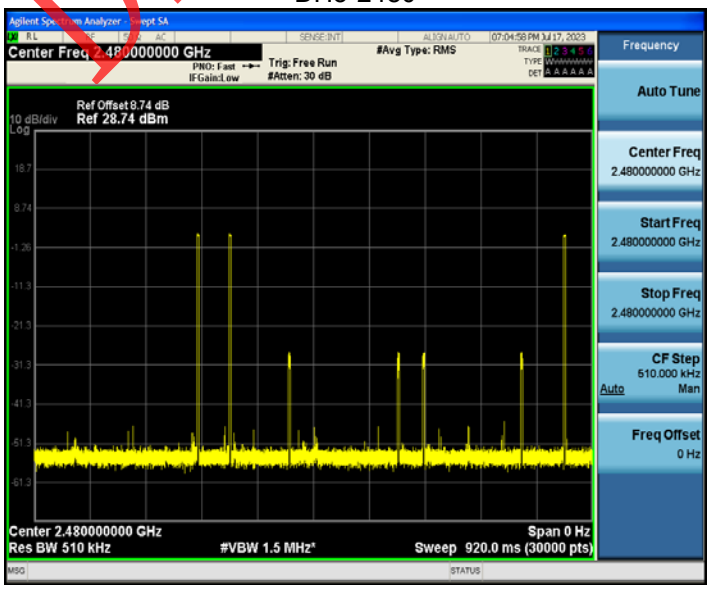
2DH5-2480

Test Mode	Test Channel	Ant	Frequency occupation times [N]	Limit [N]	Result
DH5	2402	Ant1	6	>=1	PASS
DH5	2480	Ant1	3	>=1	PASS
2DH5	2402	Ant1	5	>=1	PASS
2DH5	2480	Ant1	3	>=1	PASS

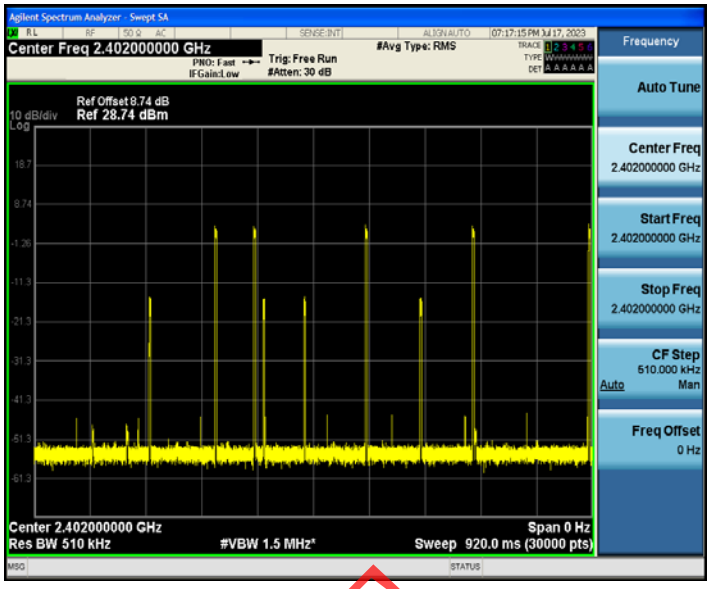
DH5-2402



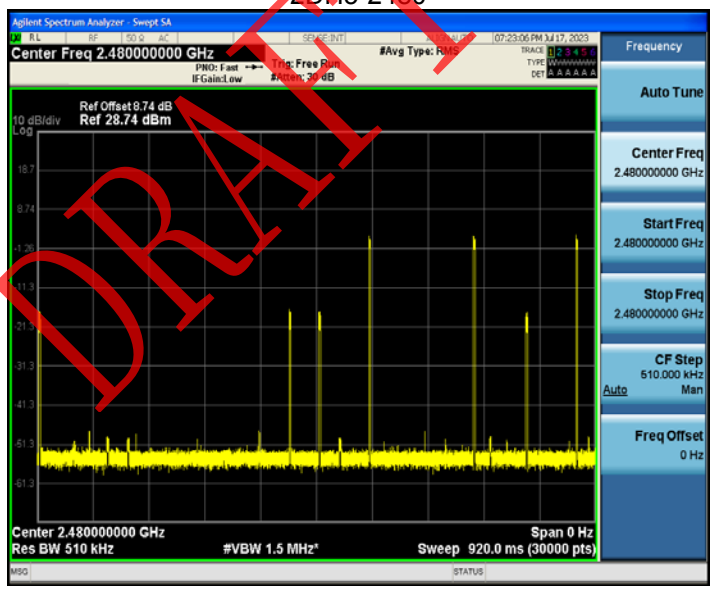
DH5-2480



2DH5-2402



2DH5-2480

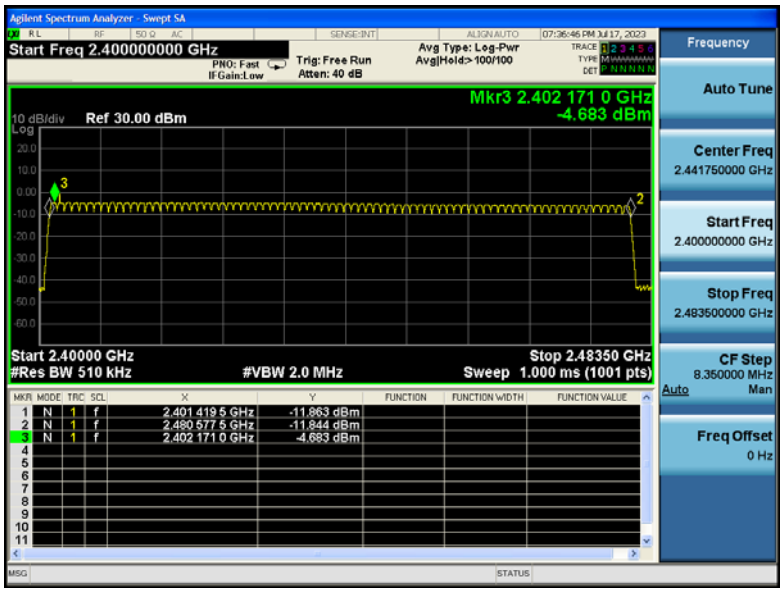


Note：*1, The Minimum frequency occupation time observe is a period of 4*Dwell time*Hopping frequency*
2, The Minimum Frequency Occupation Time shall be equal to one dwell time within a period not exceeding four timesthe product of the dwell time per hop and the number of hopping frequencies in use.

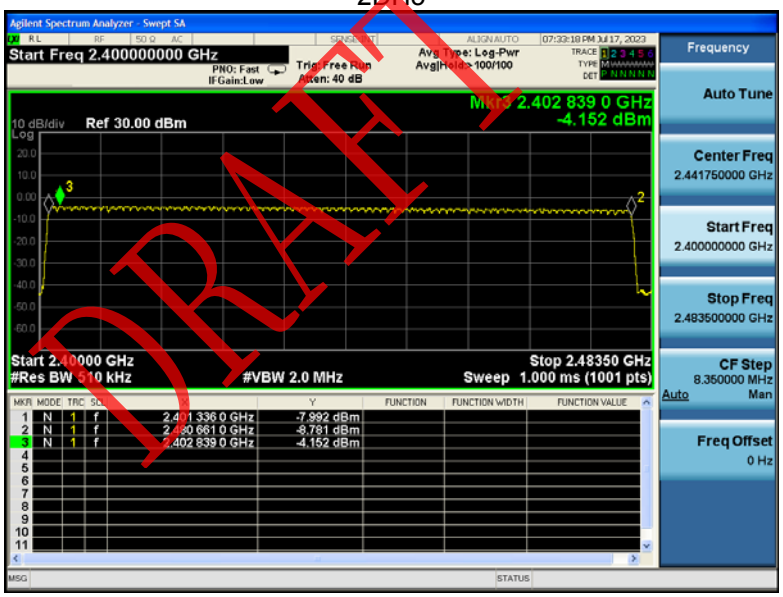
Hopping Sequence:

HOPPING SEQUENCE							
Hopping Mode	**Hopping Channel**	**Hopping Channel Limit**	**F_L 20Db**	**F_H 20Db**	**Hopping Range**	**Minimun Hopping Range Limit**	**Result**
DH5	79	15	2401.420	2480.578	94.80%	70%	Pass
2DH5	79	15	2401.336	2480.661	95.00%	70%	Pass

DH5



2DH5



4.1.4. Hopping Frequency Separation

LIMIT

ETSI EN 300 328 V2.2.2 (2019-07) 4.3.1.5.3:
Adaptive frequency hopping systemsThe minimum Hopping Frequency Separation shall be 100 kHz.

TEST PROCEDURE

According to ETSI EN 300 328 V2.2.2 (2019-07) §5.4.5.2.1.3,option 2, conducted method.

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 twoadjacent hopping frequencies (e.g. by identifying peaks or notches at the centre of the power envelope for thetwo 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.

EUT DESCRIPTION:

Mode:	BT Testmode
Hopping:	On
Packet Type:	Longest supported
Modulation:	GFSK, Π/4 DQPSK

MEASUREMENT DESCRIPTION

Instrument:	Spectrum Analyzer	
Detector:	Max Peak	
Sweep time:	auto	
Video bandwidth:	100KHz	
Resolution bandwidth:	30 KHz	
Span:	3 MHz	
Trace:	Max hold	
Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

BDR Mode (GFSK):

Channel Number	Frequency(MHz)	Ch. Separation (MHz)	Limit (MHz)	PASS/FAIL
			Minimum	
39	2441	1.000	0.100	PASS

EDR Mode (π/4-DQPSK):

Channel Number	Frequency(MHz)	Ch. Separation (MHz)	Limit (MHz)	PASS/FAIL
			Minimum	
39	2441	1.000	0.100	PASS

DH5

2DH5

4.1.5. Medium Utilisation (MU) factor

LIMIT

ETSI EN 300 328 V2.2.2(2019-07) Sub-clause 4.3.1.6.3
For non-adaptive equipment using wide band modulations other than FHSS, the maximum Medium Utilization factorshall be 10 %.
This requirement does not apply to adaptive equipment unless operating in a non-adaptive mode. In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

TEST PROCEDURE

Please refer to ETSI EN 300 328 V2.2.2(2019-07) Sub-clause 5.4.2.2.1.4
Step 1:
•Use the same stored measurement samples from the procedure described in clause 5.4.2.2.1.2.
Step 2:
•For each burst calculate the product of (Pburst / 100 mW) and the TxOn time. Pburst is expressed in mW. TxOn
time is expressed in ms.
Step 3:
•Medium Utilization is the sum of all these products divided by the observation period (expressed in ms) whichis defined in clause 4.3.1.3.2 or clause 4.3.2.4.2. This value, which shall comply with the limit given in clause 4.3.1.6.3 or clause 4.3.2.5.3, shall be recorded in the test report.

If, in case of FHSS equipment, operation without blacklisted frequencies is not possible, the power of the bursts on blacklisted hopping frequencies (for the calculation of the Medium Utilization) is assumed to be equal to the average value of the RMS power of the bursts on all active hopping frequencies.

EUT DESCRIPTION:

Mode:	BT Testmode
Test Channel	Channel 00(2402MHz),Channel 39(2441MHz),Channel 78(2480MHz)
Modulation:	GFSK, Π/4 DQPSK

MEASUREMENT DESCRIPTION

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

TEST RESULTS

Not Applicable according to ETSI EN 300 328 V2.2.2 (2019-07) Sub-clause 4.3.1.6.1

This requirement does not apply to adaptive equipment unless operating in a non-adaptive mode.
In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of lessthan 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

4.1.6. Adaptivity (Adaptive Frequency Hopping)

LIMIT

Requirement	Type	
	Adaptive Frequency Hopping using LBT based DAA	Adaptive Frequency Hopping using other forms of DAA (non-LBT based)
Minimum Clear Channel Assessment (CCA) Time	At least of Max(18 us, 0.2% of COT) (Note 1)	N/A
Maximum Channel Occupancy (COT) Time	2.0ms$_{note4}$ to 60ms/Dwell time (Note 3)	40 ms
Minimum Idle Period	5% of COT and should longer then 100us	At least 5% of COT and 100 μ s
Extended CCA check	(CCA, 5% of COT)	N/A
Short Control Signaling Transmissions	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. (Note 2)	
Note 1: The CCA time used by the equipment shall be declared by the supplier. Note 2: Adaptive equipment may or may not have Short Control Signaling Transmissions. Note 3: For LBT based adaptive frequency hopping equipment with a dwell time < 60 ms, the maximum ChannelOccupancy Time is limited by the dwell time. Note 4: acrroding to 4.3.1.7.2.2 3)of ETSI EN 300 328 V2.2.2, the 5% of COT should longer then 100us, so the minimum COT should longer then 2.0ms.		

Wanted signal mean powerfrom companion device:
TL = -70 dBm/MHz + 10 × log10 (100 mW / P_{out})(Pout in mW e.i.r.p.)

Unwanted Signal parameters

Wanted signal mean power from companion device	Maximum transmit power (PH) EIRP mW	Threshold Level (TL)
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 operatingchannels within the range 2 400 MHz to 2 442 MHz, while thelowest frequency shall be used for testing operating channelswithin 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 caseof conducted measurements, this level has to be corrected by theactual antenna assembly gain.		

TEST CONFIGURATION

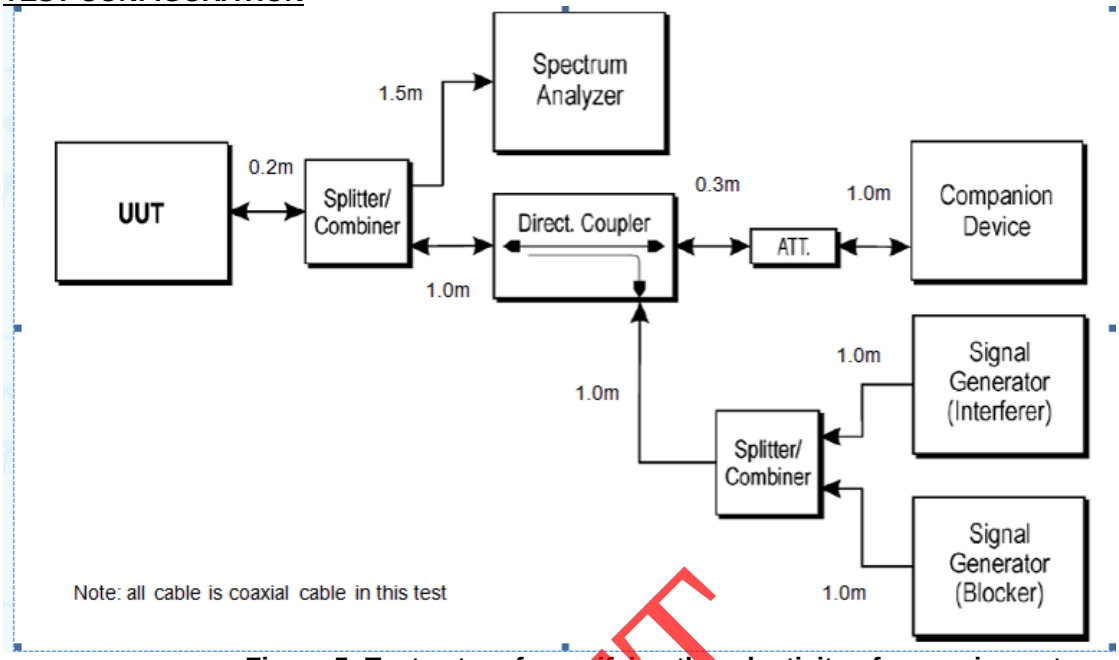


Figure 5: Test set-up for verifying the adaptivity of an equipment

MEASUREMENT DESCRIPTION

According to ETSI EN 300 328 V2.2.2(2019-07) §5.4.6.2.1.4, Conducted measurements

Step 1:

•The UUT shall connect to a companion device during the test. The interference signal generator, the unwantedsignal generator, the spectrum analyser, the UUT and the companion device are connected using a set-upequivalent to the example given by figure 5 although the interference and unwanted signal generator do notgenerate any signals at this point in time. The spectrum analyser is used to monitor the transmissions of boththe UUT and the companion device and it should be possible to distinguish between either transmission. Inaddition, the spectrum analyser is used to monitor the transmissions of the UUT in response to the interferingand the unwanted signals.

•Adjust the received signal level (wanted signal from the companion device) at the UUT to the value defined intable 10 (clause 4.3.2.6.3.2.2) for Frame Based Equipment or in table 11 (clause 4.3.2.6.3.2.3) for Load BasedEquipment.Testing of Unidirectional equipment does not require a link to be established with a companion device.

•The analyser shall be set as follows:

- RBW: ⩾ Occupied Channel Bandwidth (if the analyser does not support this setting, the highest available setting shall be used)
- VBW: 3 × RBW (if the analyser does not support this setting, the highest available setting shall be used)
- Detector Mode: RMS
- Centre Frequency: Equal to the centre frequency of the operating channel
- Span: 0 Hz
- Sweep time: > maximum Channel Occupancy Time
- 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.
•For Frame Based Equipment, using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that the UUT complies with the maximum Channel Occupancy Time and minimum Idle Period defined in clause 4.3.2.6.3.2.2, step 3. When measuring the Idle Period of the UUT, only transmissions from the UUT shall be considered.
•For Load Based equipment, using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that the UUTcomplies with the maximum Channel Occupancy Time and minimum Idle Period defined inclause 4.3.2.6.3.2.3, step 2 and step 3. When measuring the Idle Period of the UUT, only transmissions from the UUT shall be considered.
For the purpose of testing Load Based Equipment referred to in the first paragraph of clause 4.3.2.6.3.2.3(IEEE 802.11™ [i.3] or IEEE 802.15.4™ [i.4] equipment), the limits to be applied for the minimum IdlePeriod and the maximum Channel Occupancy Time are the same as defined for other types of Load BasedEquipment (see clause 4.3.2.6.3.2.3, step 2 and step 3). The Idle Period is considered to be equal to the CCA orExtended CCA time defined in clause 4.3.2.6.3.2.3, step 1 and step 2.
Step 3: Adding the interference signal
•An interference signal as defined in clause B.7 is injected on the current operating channel of the UUT. 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 4.3.2.6.3.2.2, step 5 (frame based equipment) or clause 4.3.2.6.3.2.3, step 5 (load based equipment).
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 operating channel 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 current operating channel.
The UUT is assumed to stop transmissions within a period equal to the maximum Channel Occupancy Time defined in clause 4.3.2.6.3.2.2 (frame based equipment) or clause 4.3.2.6.3.2.3 (load based equipment).
ii) Apart from Short Control Signalling Transmissions, there shall be no subsequent transmissions while the interfering signal is present.
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.
iii) The UUT may continue to have Short Control Signalling Transmissions on the operating channel while the interfering signal is present. These transmissions shall comply with the limits defined in clause 4.3.2.6.4.2.
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 10 (clause 4.3.2.6.3.2.2) for Frame Based Equipment or in table 11 (clause 4.3.2.6.3.2.3) for Load Based Equipment.
•The spectrum analyser shall be used to monitor the transmissions of the UUT on the selected operating channel. 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 current operating channel 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.
ii) The UUT may continue to have Short Control Signalling Transmissions on the operating channel while the interfering and unwanted signals are present. These transmissions shall comply with the limits defined in clause 4.3.2.6.4.2.
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 signals the UUT is allowed to start transmissions again on this channel; however, this is not a requirement and, therefore, does not require testing.
Step 7:
•Step 2 to step 6 shall be repeated for each of the frequencies to be tested.

MEASUREMENT DESCRIPTION

Instrument:	Spectrum Analyzer	
Detector:	RMS	
Sweep time:	> Channel Occupancy Time	
Video bandwidth:	≥ RBW	
Resolution bandwidth:	≥ Occupied Channel Bandwidth	
Span:	0 Hz	
Center:	Equal to the hopping freq. to be tested	
Trace:	clear/write video triggered	
Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)
	☐	Short Control Signalling Transmissions available

TEST RESULTS

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

4.1.7. Occupied Channel Bandwidth

LIMIT

According to ETSI EN 300 328 V2.2.2(2019-07) 4.3.2.7.3,
The Occupied Channel Bandwidth for each hopping frequency shall fall completely within the band given in clause 1.For non-adaptive Frequency Hopping equipment with e.i.r.p greater than 10 dBm, the Occupied Channel Bandwidth forevery occupied hopping frequency shall be equal to or less than the Nominal Channel Bandwidth declared by thesupplier. See clause 5.3.1 j). This declared value shall not be greater than 5 MHz.

TEST PROCEDURE

Please refer to ETSI EN 300 328 (V2.2.2) Sub-clause §5.4.7.2.1
According to ETSI EN 300 328 V2.2.2 (2019-07) § 5.4.7.2.1 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 andright from the power envelope being taken into account by this measurement.

EUT DESCRIPTION:

Mode:	BT Testmode
Hopping:	Off
Packet Type:	Longest supported
Modulation:	GFSK, Π/4 DQPSK

MEASUREMENT DESCRIPTION

Instrument:	Spectrum Analyzer	
Detector:	RMS	
Sweep time:	auto	
Video bandwidth:	100KHz	
Resolution bandwidth:	30KHz	
Span:	100KHz	
Center:	Transmit channel	
Trace:	Max hold	
Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

TEST RESULTS

Test Data

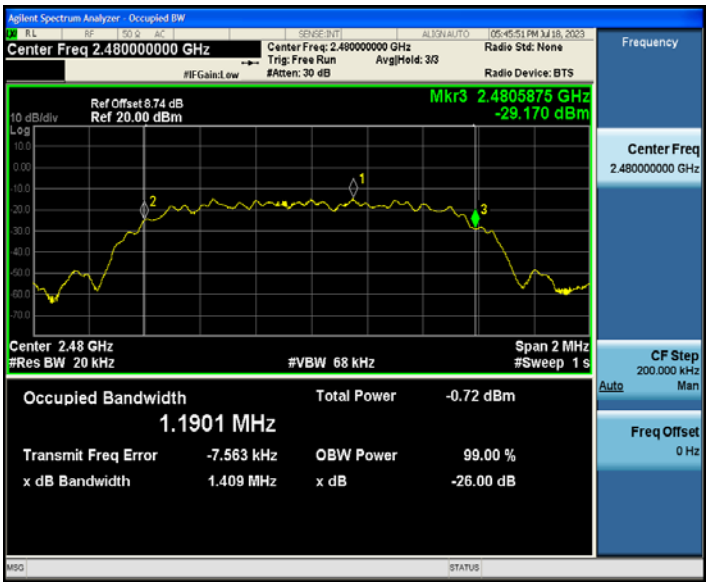
Type	CHANNEL	CHANNEL FREQUENCY (MHz)	OCCUPIED BANDWIDTH (MHz)	Measured frequencies		Limit	PASS /FAIL
				F_L (MHz)	F_H (MHz)		
1DH5	00	2402	0.874	2401.553	---	FL>2.4GHz and FH<2.4835 GHz	PASS
	78	2480	0.874	---	2480.426		PASS
2DH5	00	2402	1.189	2401.398	---	FL>2.4GHz and FH<2.4835 GHz	PASS
	78	2480	1.190	---	2480.588		PASS

DH5-2402

DH5-2480

2DH5-2402

2DH5-2480



4.1.8. Transmitter unwanted emissions in the out-of-band domain

LIMIT

ETSI EN 300 328 (V2.2.2) Sub-clause 4.3.2.8.3
The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in figure 3.
NOTE: Within the 2 400 MHz to 2 483,5 MHz band, the Out-of-band emissions are fulfilled by compliance with the Occupied Channel Bandwidth requirement in clause 4.3.2.7.

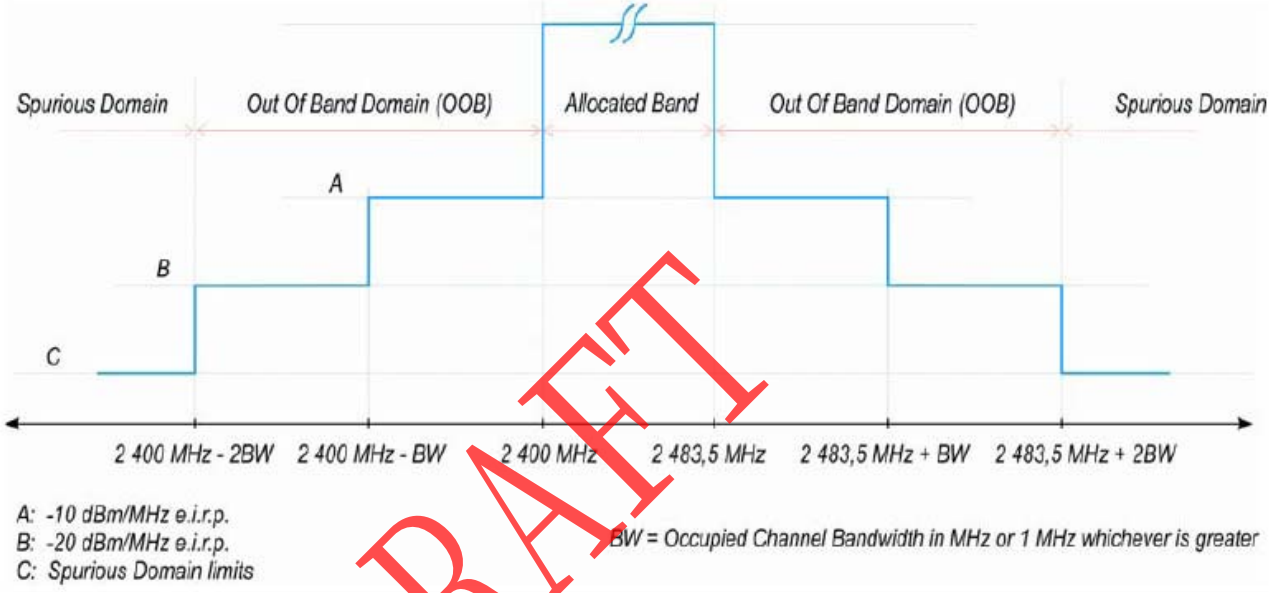
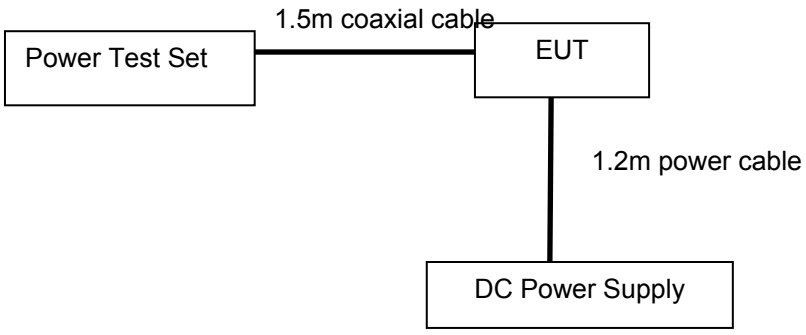


Figure 3: Transmit mask

Transmitter unwanted emissions in the out-of-band domain are emissions when the equipment is in Transmit mode, on frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious.
These measurements shall only be performed at normal test conditions.
For systems using FHSS modulation, the measurements shall be performed during normal operation (hopping).
For systems using wide band modulations other than FHSS, the measurement shall be performed at the lowest and the highest channel on which the equipment can operate. Theseoperating channels shall be recorded.
The equipment shall be configured to operate under its worst case situation with respect to output power.
If the equipment can operate with different Occupied Channel Bandwidths (e.g. 20 MHz and 40 MHz), than each channel bandwidth shall be tested separately.

TEST CONFIGURATION



TEST PROCEDURE

According to ETSI EN 300 328 V2.2.2(2019-07) §5.4.8.2.1, conducted method.

Step 1:

•Connect the UUT to the spectrum analyser and use the following settings:
- Measurement Mode: Time Domain Power
- Centre Frequency: 2 484 MHz
- Span: Zero Span
- Resolution BW: 1 MHz
- Filter mode: Channel filter
- Video BW: 3 MHz
- Detector Mode: RMS
- Trace Mode: Max Hold
- Sweep Mode: Single Sweep
- Sweep Points: Sweep time [µs] / (1 µs) with a maximum of 30 000
- Trigger Mode: Video
- Sweep Time: > 120 % of the duration of the longest burst detected during the measurement of the RF Output Power

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

•The measurement shall be performed and repeated while the trigger level is increased until no triggering takesplace.
•For FHSS equipment operating in a normal hopping mode, the different hops will result in signal bursts with different power levels. In this case the burst with the highest power level shall be selected.
•Set a window (start and stop lines) to match with the start and end of the burst and in which the RMS power shall be measured using the Time Domain Power function.
•Select RMS power to be measured within the selected window and note the result which is the RMS power within this 1 MHz segment (2 483,5 MHz to 2 484,5 MHz). Compare this value with the applicable limit provided by the mask.
•Increase the centre frequency in steps of 1 MHz and repeat this measurement for every 1 MHz segment withinthe range 2 483,5 MHz to 2 483,5 MHz + BW. The centre frequency of the last 1 MHz segment shall be set to2 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 + 2 BW):

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

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

•Change the centre frequency of the analyser to 2 399,5 MHz and perform the measurement for the first 1 MHzsegment within range 2 400 MHz - BW to 2 400 MHz Reduce the centre frequency in 1 MHz steps and repeatthe measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to2 400 MHz - BW + 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

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

•Change the centre frequency of the analyser to 2 399,5 MHz - BW and perform the measurement for the first 1 MHz segment within range 2 400 MHz - 2 BW to 2 400 MHz - BW. Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segmentshall be set to 2 400 MHz - 2 BW + 0,5 MHz (which means this may partly overlap with the previous 1 MHzsegment).

Step 6:

•In case of conducted measurements on equipment with a single transmit chain, the declared antenna assemblygain G in dBi shall be added to the results for each of the 1 MHz segments and compared with the limitsprovided by the mask given in figure 1 or figure 3. If more than one antenna assembly is intended for thispower setting, the antenna with the highest gain shall be considered.
•In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), themeasurements need to be repeated for each of the active transmit chains. The declared antenna assembly gainG in dBi for a single antenna shall be added to these results. If more than one antenna assembly is intended forthis power setting, the antenna with the highest gain shall be considered. Comparison with the applicable limitsshall 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.

EUT DESCRIPTION:

Mode:	BT Testmode
Hopping:	On
Packet Type:	Longest supported
Modulation:	GFSK, π/4 DQPSK

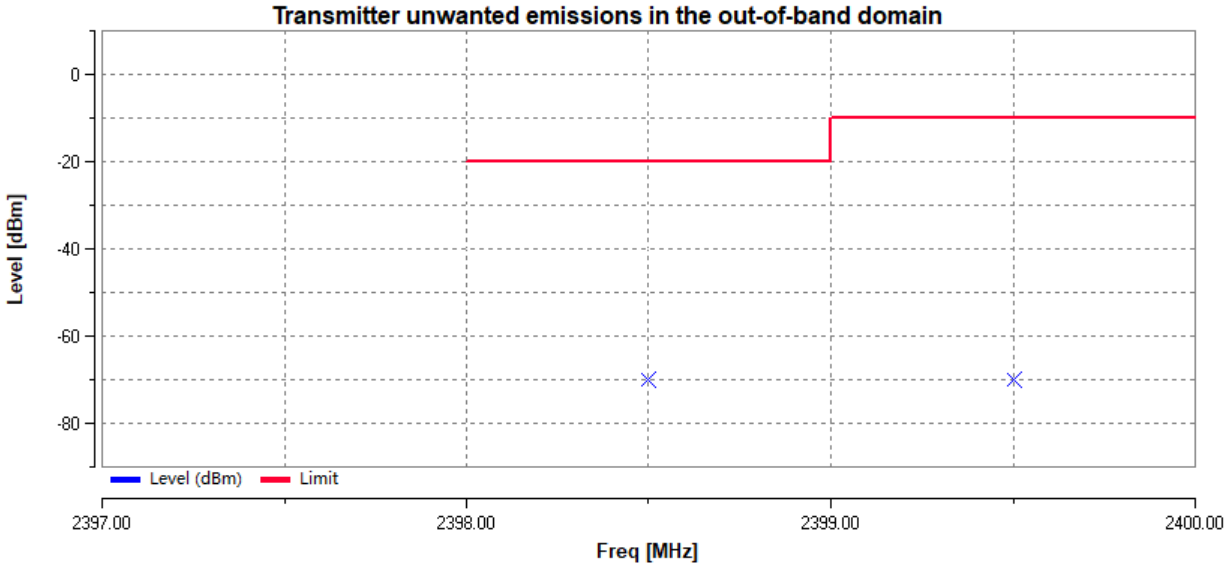
MEASUREMENT DESCRIPTION

Instrument:	Spectrum Analyzer	
Detector:	RMS	
Sweep time:	depending on packet length	
Video bandwidth:	3MHz	
Resolution bandwidth:	1MHz	
Span:	0Hz	
Center:	fc (see result table)	
Trigger Mode:	Video trigger	
Sweep points:	Sweep Time [s] / (1 µs) or 5,000 whichever is greater	
Performed:	☒	Conducted
	☐	Radiated (only if no conducted sample is provided)

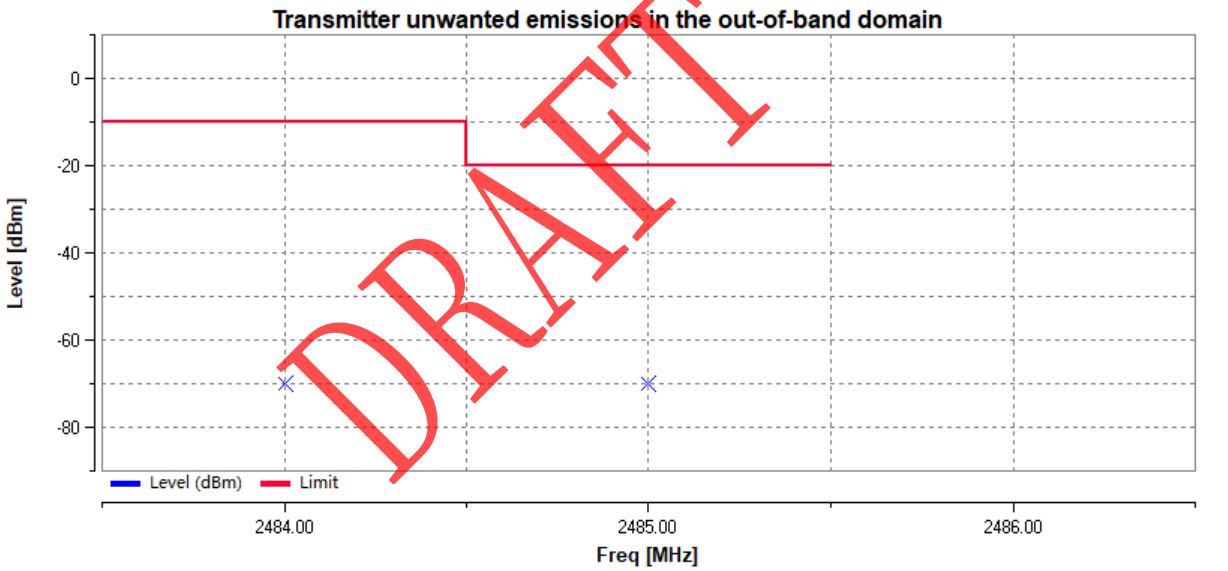
TEST RESULTS

Test Condition	Test Mode	Test Channel	Ant	Freq [MHz]	Result [dBm]	Limit [dBm]	Verdict
TNVN	DH5	2402	Ant1	2398.500	-61.85	<=-20	PASS
TNVN	DH5	2402	Ant1	2399.500	-62.04	<=-10	PASS
TNVN	DH5	2402	Ant1	2484.000	-50.48	<=-10	PASS
TNVN	DH5	2402	Ant1	2485.000	-51.85	<=-20	PASS
TNVN	DH5	2480	Ant1	2398.020	-50.21	<=-20	PASS
TNVN	DH5	2480	Ant1	2399.500	-43.05	<=-10	PASS
TNVN	DH5	2480	Ant1	2484.000	-48.63	<=-10	PASS
TNVN	DH5	2480	Ant1	2485.240	-48.61	<=-20	PASS
TNVN	2DH5	2402	Ant1	2398.300	-44.84	<=-20	PASS
TNVN	2DH5	2402	Ant1	2399.300	-39.41	<=-20	PASS
TNVN	2DH5	2402	Ant1	2484.000	-49.19	<=-10	PASS
TNVN	2DH5	2402	Ant1	2485.200	-49.48	<=-10	PASS
TNVN	2DH5	2480	Ant1	2387.000	-46.84	<=-10	PASS
TNVN	2DH5	2480	Ant1	2384.183	-47.76	<=-10	PASS
TNVN	2DH5	2480	Ant1	2485.183	-47.33	<=-20	PASS
TNVN	2DH5	2480	Ant1	2485.366	-46.63	<=-20	PASS

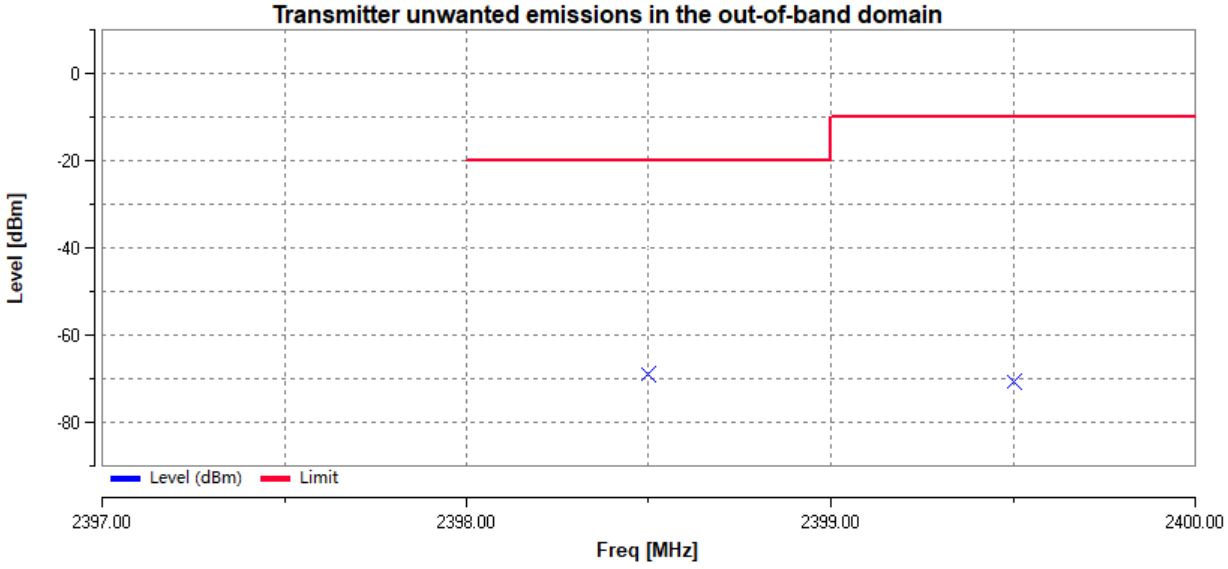
DH5_2402_Ant1_2400MHz-2BW to 2400MHz



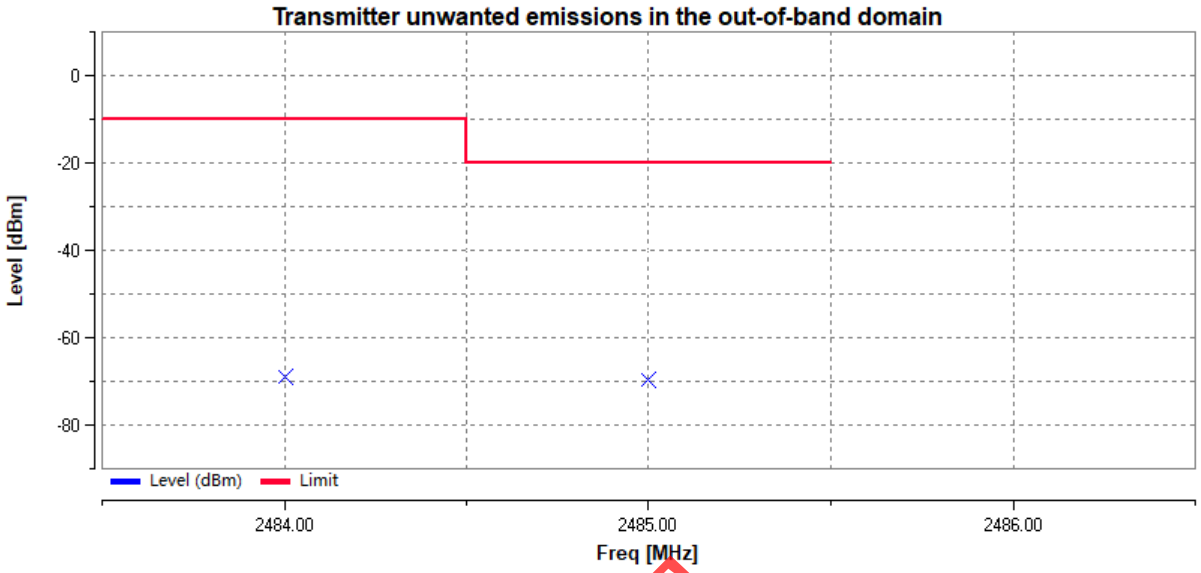
DH5_2402_Ant1_2483.5MHz to 2483.5MHz+2BW



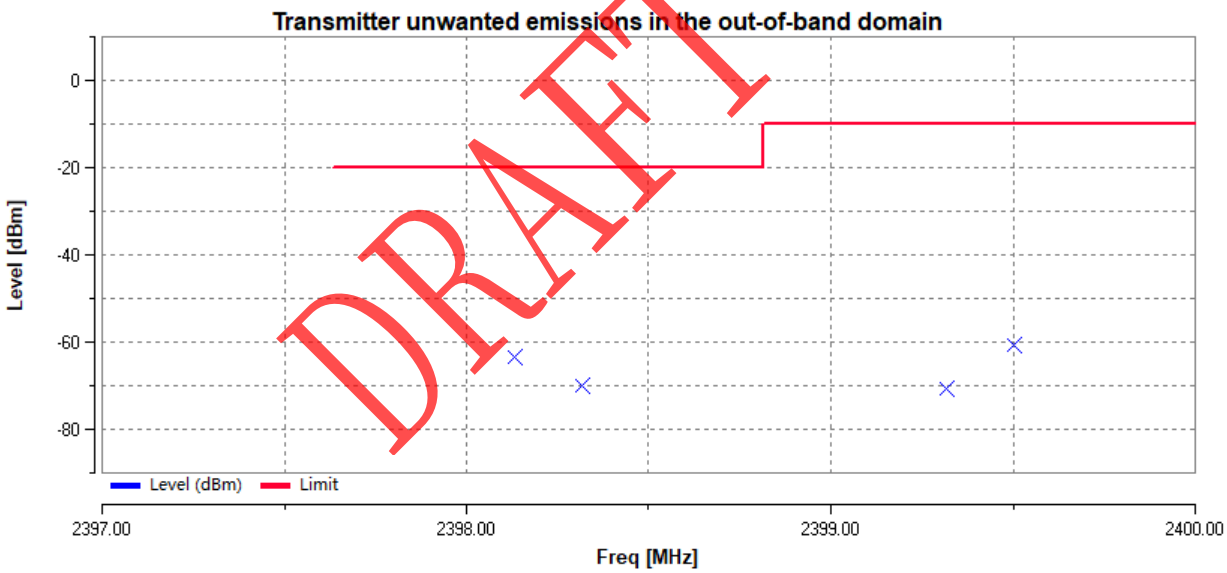
DH5_2480_Ant1_2400MHz-2BW to 2400MHz



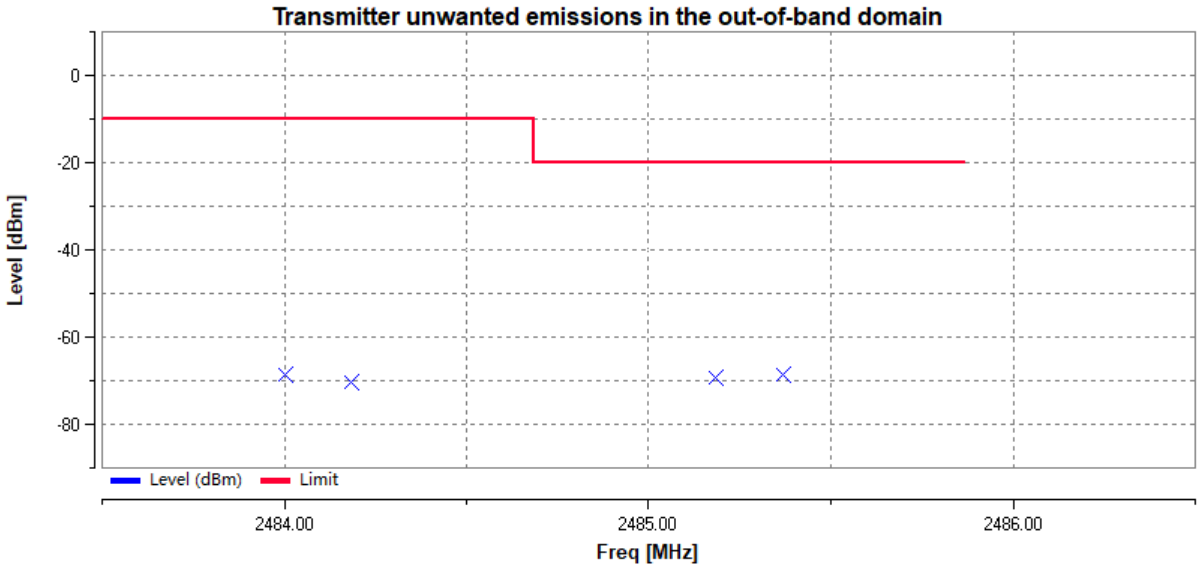
DH5_2480_Ant1_2483.5MHz to 2483.5MHz+2BW



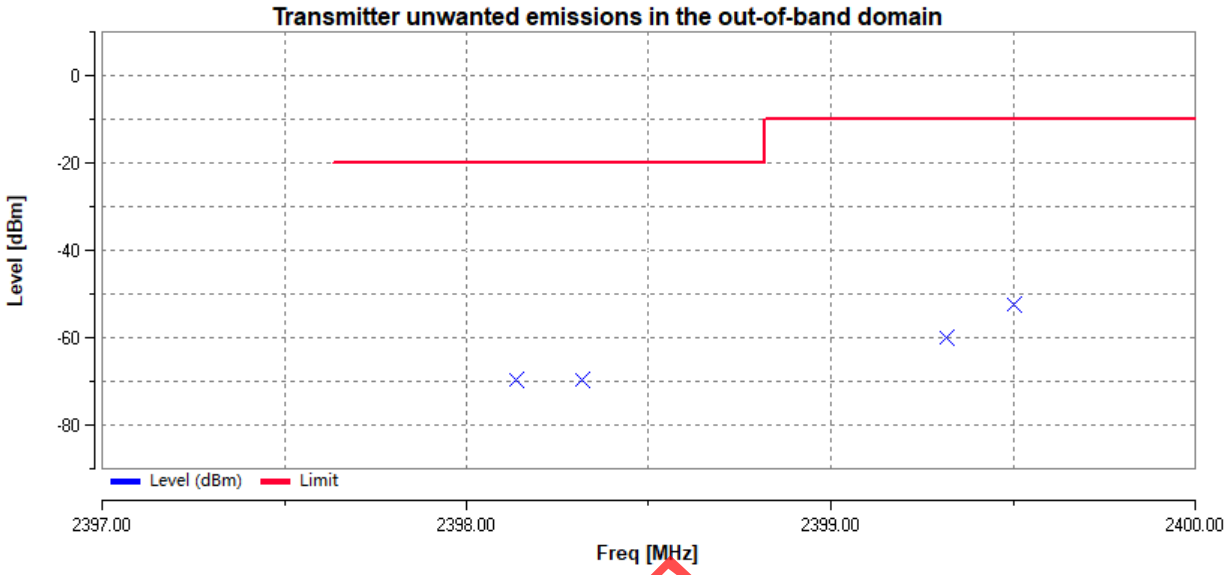
2DH5_2402_Ant1_2400MHz-2BW to 2400MHz



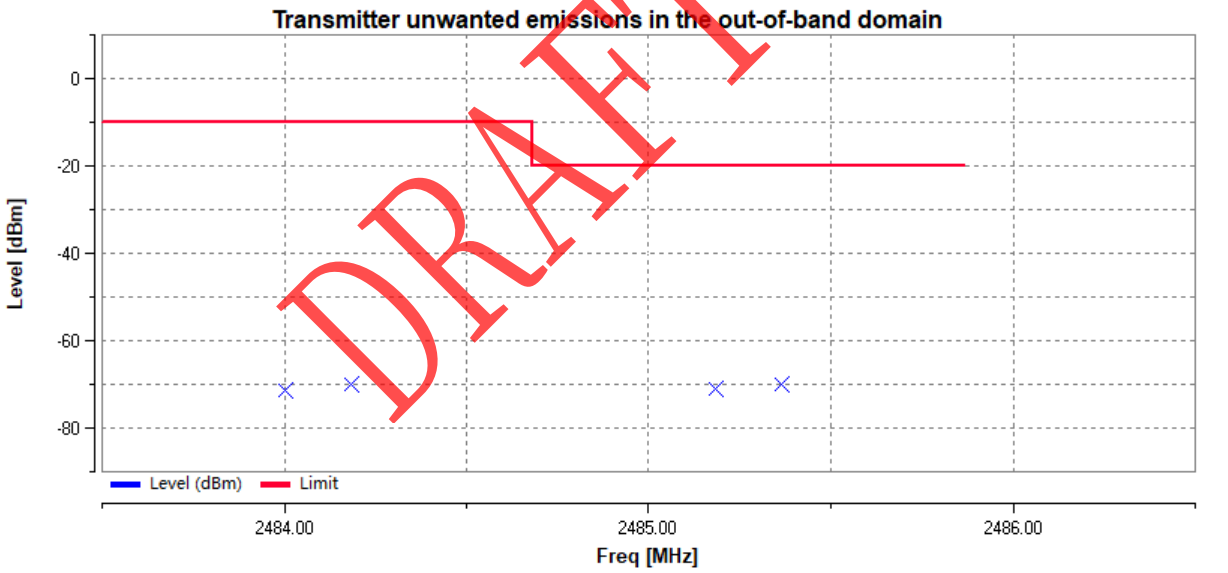
2DH5_2402_Ant1_2483.5MHz to 2483.5MHz+2BW



2DH5_2480_Ant1_2400MHz-2BW to 2400MHz



2DH5_2480_Ant1_2483.5MHz to 2483.5MHz+2BW



4.1.9. Transmitter unwanted emissions in the spurious domain

Limit

According to ETSI EN 300 328 V2.2.2(2019-07) §4.3.2.9.3
The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 4.

Table 4: Transmitter limits for spurious emissions

Frequency Range	Maximum power e.r.p.(.≤1 GHz) e.i.r.p.(＞1 GHz)	Limit when Standby
30 MHz to 47 MHz	-36 dBm	100 KHz
47 MHz to 74 MHz	-54 dBm	100 KHz
74MHz 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 1GHz	-36 dBm	100 KHz
1 GHz to 12.75GHz	-30 dBm	1 MHz

These measurements shall only be performed at normal testconditions.
The level of spurious emissions shall be measured as, either:
a) their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment (cabinet radiation); or
b) their effective radiated power when radiated by cabinet and antenna in case of Integral antenna equipment withno antenna connectors.

For equipment using FHSS modulation, the measurements may be performed when normal hopping is disabled. In thiscase measurements need to be performed when operating at the lowest and the highest hopping frequency. When this isnot possible, the measurement shall be performed during normal operation (hopping).

For systems using wide band modulations other than FHSS, the measurement shall be performed at the lowest and thehighest channel on which the equipment can operate. These frequencies shall be recorded.

The equipment shall be configured to operate under its worst case situation with respect to output power.

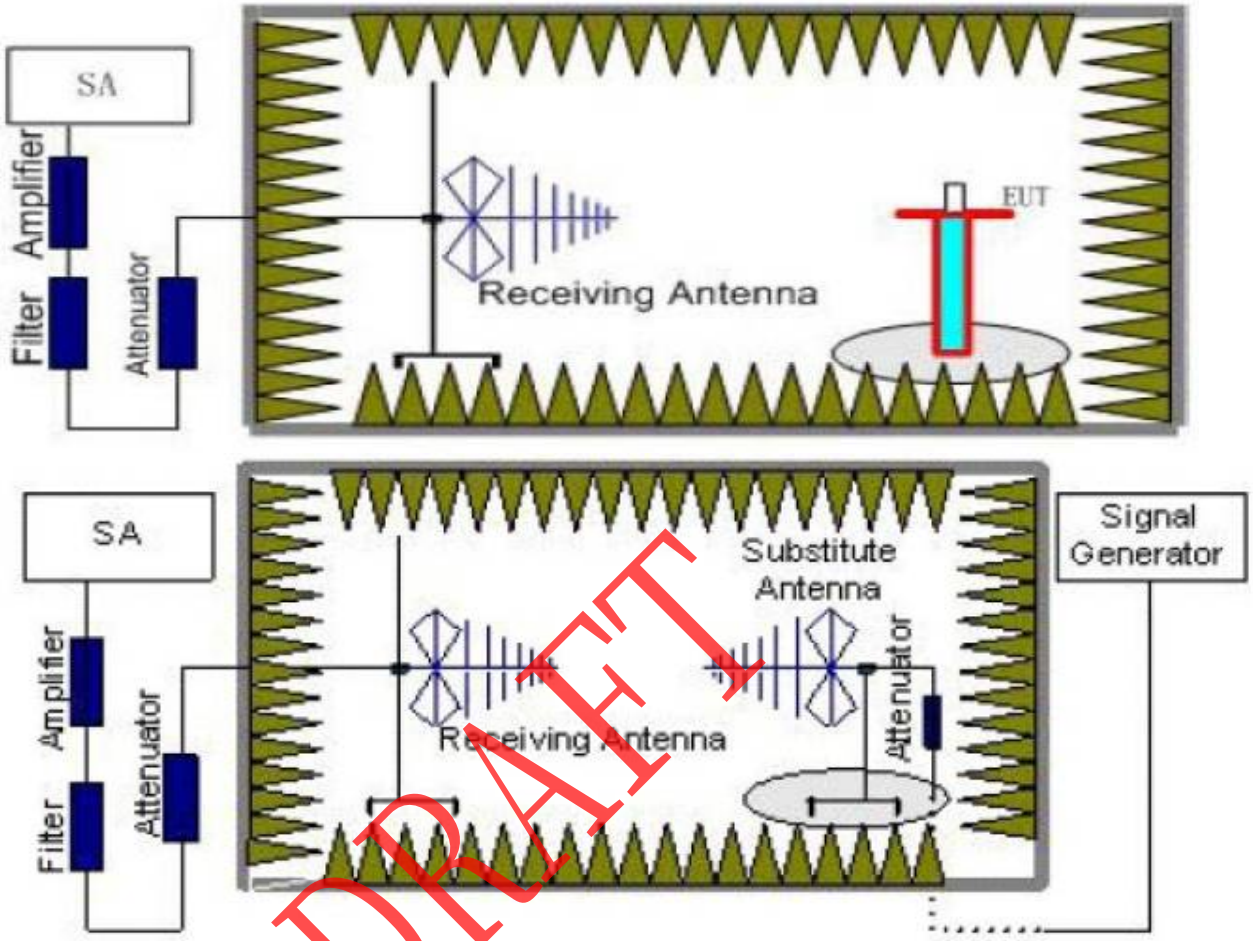
If the equipment can operate with different Nominal Channel Bandwidths (e.g. 20 MHz and 40 MHz), then the equipment shall be configured to operate under its worst case situation with respect to spurious emissions.

Test Procedure

According to ETSI EN 300 328 V2.2.2 (2019-07) §5.4.9.2.2, Radiated measurement.

Test Configuration

Effective Radiated Power measurement (30 MHz to 12.75 GHz)



Test Results

Remark:We testall modulation type, and recorded the worst case mode for GFSK test.

Fre. (MHz)	ANT. Pol.	Result (dBm)	Limit	Margin	Conclusion
Below 1GHz:					
168.23	V	-54.12	-36	-18.12	PASS
264.12	V	-56.13	-36	-20.13	PASS
359.33	V	-56.35	-36	-20.35	PASS
434.52	V	-72.45	-36	-36.45	PASS
556.93	V	-77.52	-54	-23.52	PASS
886.03	V	-76.38	-36	-40.38	PASS
216.43	H	-72.24	-54	-18.24	PASS
246.25	H	-66.55	-36	-30.55	PASS
389.11	H	-75.42	-36	-39.42	PASS
478.43	H	-78.58	-36	-42.58	PASS
607.72	H	-71.16	-54	-17.16	PASS
889.13	H	-58.65	-36	-22.65	PASS

Note:
1.Cable loss and antenna gain was combined in the calculated result.
2. Other point of the measurements are below 20dB from the limit.

Fre. (MHz)	ANT. Pol.	Result (dBm)	Limit	Margin	Conclusion
Above 1GHz:					
Test Mode：Low Channel					
1789.42	H	-54.34	-30	-24.34	PASS
1868.82	V	-55.45	-30	-25.45	PASS
2986.92	H	-58.15	-30	-28.15	PASS
3169.02	V	-53.22	-30	-23.22	PASS
3933.43	H	-53.36	-30	-23.36	PASS
3937.73	V	-56.47	-30	-26.47	PASS
4458.18	H	-55.57	-30	-25.57	PASS
4378.96	V	-50.12	-30	-20.12	PASS
5171.02	H	-51.28	-30	-21.28	PASS
4951.42	V	-52.39	-30	-22.39	PASS
5944.34	H	-54.24	-30	-24.24	PASS
6188.52	V	-56.37	-30	-26.37	PASS
Test Mode：High Channel					
1861.62	H	-54.06	-30	-24.06	PASS
2180.03	V	-54.32	-30	-24.32	PASS
2925.48	H	-54.14	-30	-24.14	PASS
3275.16	V	-55.68	-30	-25.68	PASS
3884.11	H	-53.12	-30	-23.12	PASS
3932.61	V	-55.25	-30	-25.25	PASS
4715.12	H	-54.33	-30	-24.33	PASS
4693.25	V	-52.52	-30	-22.52	PASS
5291.91	H	-51.35	-30	-21.35	PASS
5039.41	V	-54.29	-30	-24.29	PASS
5978.13	H	-52.46	-30	-22.46	PASS
6170.83	V	-50.56	-30	-20.56	PASS

Note:
1.Cable loss and antenna gain was combined in the calculated result.
2. Other point of the measurements are below 20dB from the limit.

4.1.10. Receiver spurious emissions

LIMIT

Accordi ng to ETSI EN 300 328 V2.2.2(2019-07) §4.3.2.10.3
The spurious emissions of the receiver shall not exceed the values given in table 5.

Table 5: spurious emission limits for receivers

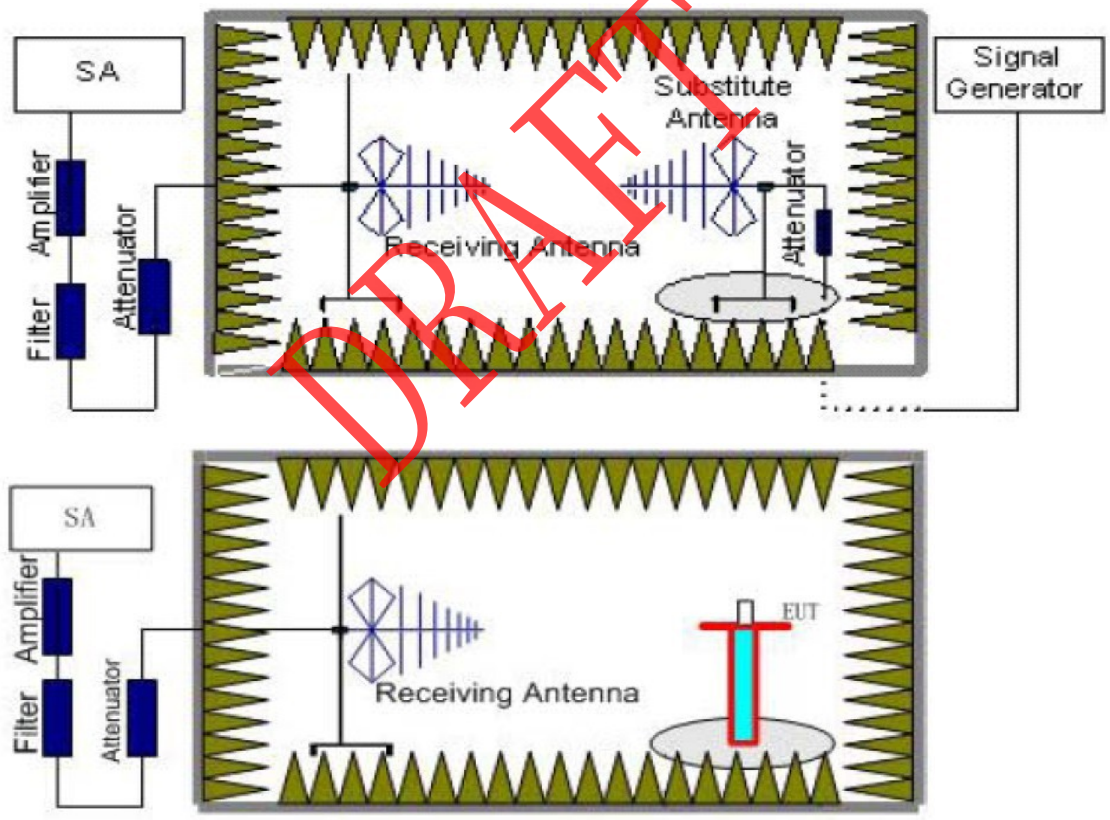
Frequency	Maximum power, e.r.p.	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 KHz
30 MHz to 12.75 GHz	-47 dBm	1 MHz

Test Procedure

The same as clause 4.1.8

Test Configuration

Effective Radiated Power measurement (30 MHz to 12.75 GHz)



The level of spurious emissions shall be measured as, either:
a) their power in a specified load (conducted spurious emissions) and their effective radiated power when radiated by the cabinet or structure of the equipment (cabinet radiation); or
b) their effective radiated power when radiated by cabinet and antenna in case of Integral antenna equipment withno temporary antenna connectors.
Testing shall be performed when the equipment is in a receive-only mode.
For equipment using wide band modulations other than FHSS, the measurement shall be performed at the lowest andthe highest channel on which the equipment can operate. These frequencies shall be recorded.
For equipment using FHSS modulation, the measurements may be performed when normal hopping is disabled. In thiscase measurements need to be performed when operating at the lowest and the highest hopping frequency. Thesefrequencies shall be recorded. When disabling the normal hopping is not possible, the measurement shall be performedduring normal operation (hopping).

Test Results

Remark:We testall modulation type, and recorded the worst case mode for GFSK test.

Fre. (MHz)	ANT. Pol.	ERP (dBm)	Limit	Margin	Conclusion
Below 1GHz:					
253.31	V	-76.75	-57	-19.75	PASS
288.82	V	-78.16	-57	-21.16	PASS
369.41	V	-75.37	-57	-18.37	PASS
438.53	V	-74.77	-57	-17.77	PASS
509.28	V	-77.42	-57	-20.42	PASS
876.12	V	-75.55	-57	-18.55	PASS
216.13	H	-74.38	-57	-17.38	PASS
359.12	H	-72.48	-57	-15.48	PASS
376.68	H	-73.47	-57	-16.47	PASS
489.44	H	-77.34	-57	-20.34	PASS
628.44	H	-75.22	-57	-18.22	PASS
877.35	H	-75.16	-57	-18.16	PASS
Note: 1.Cable loss and antenna gain was combined in the calculated result. 2.Other point of the measurements are below 20dB from the limit.					

Fre. (MHz)	ANT. Pol.	ERP (dBm)	Limit	Margin	Conclusion
Above 1GHz:					
Test Mode：Lowest frequency					
2190.92	H	-64.18	-47	-17.18	PASS
2194.44	V	-68.32	-47	-21.32	PASS
3165.45	H	-67.48	-47	-20.48	PASS
2953.85	V	-67.58	-47	-20.58	PASS
3292.36	H	-66.13	-47	-19.13	PASS
3618.87	V	-65.26	-47	-18.26	PASS
4057.25	H	-64.34	-47	-17.34	PASS
3980.41	V	-63.54	-47	-16.54	PASS
4786.27	H	-67.88	-47	-20.88	PASS
5037.34	V	-67.12	-47	-20.12	PASS
6378.67	H	-68.13	-47	-21.13	PASS
6219.04	V	-66.45	-47	-19.45	PASS
Test Mode：Highest frequency					
2134.55	H	-63.18	-47	-16.18	PASS
2120.85	V	-64.42	-47	-17.42	PASS
2243.32	H	-66.15	-47	-19.15	PASS
2445.54	V	-67.58	-47	-20.58	PASS
3415.17	H	-68.28	-47	-21.28	PASS
3450.72	V	-67.38	-47	-20.38	PASS
3877.45	H	-63.26	-47	-16.26	PASS
3947.45	V	-67.08	-47	-20.08	PASS
5288.86	H	-65.38	-47	-18.38	PASS
5326.14	V	-66.37	-47	-19.37	PASS
6357.25	H	-64.88	-47	-17.88	PASS
6469.07	V	-65.46	-47	-18.46	PASS

Note:
1. Cable loss and antenna gain was combined in the calculated result.
2. Other point of the measurements are below 20dB from the limit.

4.1.11. Receiver Blocking

LIMIT

According to ETSI EN 300 328 V2.2.2 (2019-07) §4.3.2.11.4

While maintaining the minimum performance criteria as defined in clause 4.3.2.11.3, the blocking levels at specifiedfrequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided intable 14, table 15 or table 16.

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.

Table 14: Receiver Blocking parameters for Receiver Category 1 equipment

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.

Table 15: Receiver Blocking parameters receiver Category 2 equipment

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.			

Table 16: Receiver Blocking parameters receiver Category 3 equipment

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 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.			

According to ETSI EN 300 328 V2.2.2 (2019-07) § 4.2.3 Receiver categories
4.2.3.2.1 Receiver category 1
Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p. shall be considered as receivercategory 1 equipment.
4.2.3.2.2 Receiver category 2
Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % oradaptive equipment with a maximum RF output power of 10 dBm e.i.r.p. shall be considered as receiver category 2equipment.
4.2.3.2.3 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.

These measurements shall only be performed at normal testconditions.
For non-frequency hopping equipment, having more than one operating channel, the equipment shall be tested operatingat both the lowest and highest operating channels. Equipment which can change their operating channel automatically(adaptive channel allocation), and where this function cannot be disabled, shall be tested as a frequency hoppingequipment.
If the equipment can be configured to operate with different Nominal Channel Bandwidths (e.g. 20 MHz and 40 MHz)and different data rates, then the combination of the smallest channel bandwidth and the lowest data rate for thischannel bandwidth which still allows the equipment to operate as intended shall be used. This mode of operation shallbe aligned with the performance criteria defined in clause 4.3.1.12.3 or clause 4.3.2.11.3 as declared by themanufacturer (see clause 5.4.1 t)) and shall be described in the test report.
It shall be verified that this performance criteria as declared by the manufacturer is achieved.

TEST CONFIGURATION

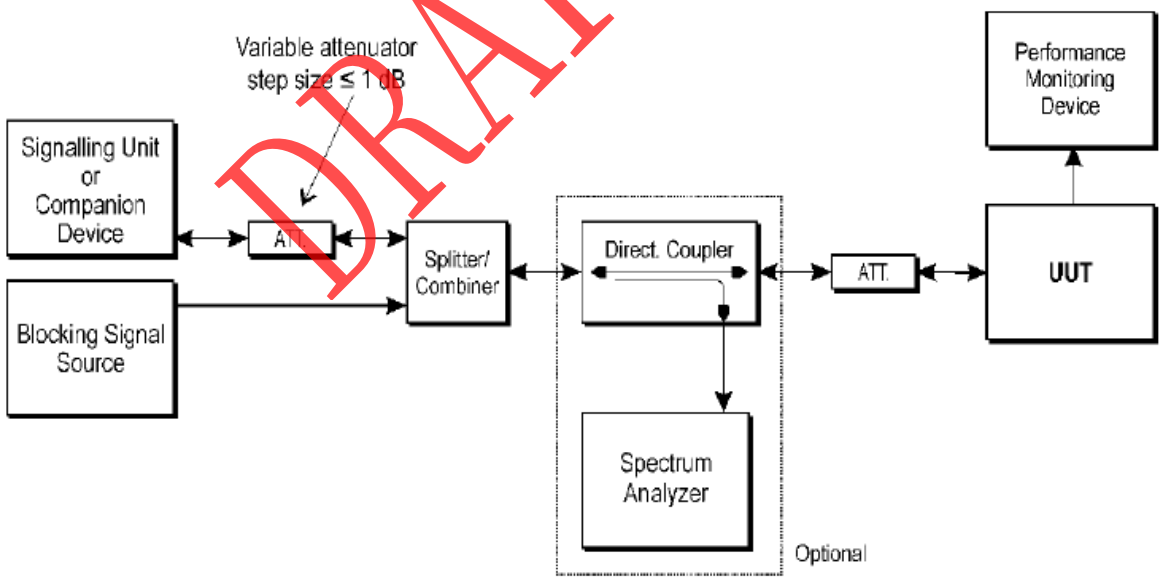


Figure 6: Test Set-up for receiver blocking

MEASUREMENT DESCRIPTION

According to ETSI EN 300 328 V2.2.1 (2019-04) §5.4.11.2.1, Conducted measurements
Step 1:
• For non-FHSS equipment, the UUT shall be set to the lowest operating channel on which the blocking test hasto be performed (see clause 5.4.11.1).
Step 2:
• The blocking signal generator is set to the first frequency as defined in the appropriate table corresponding tothe receiver category and type of equipment.
Step 3:
• With the blocking signal generator switched off, a communication link is established between the UUT and theassociated companion device using the test setup shown in figure 6.

• Unless the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, the level ofthe wanted signal shall be set to the value provided in the table corresponding to the receiver category and typeof equipment. The test procedure defined in clause 5.4.2, and more in particular clause 5.4.2.2.1.2, can be usedto measure the (conducted) level of the wanted signal however no correction shall be made for antenna gain ofthe companion device (step 6 in clause 5.4.2.2.1.2 shall be ignored). This level may be measured directly at theoutput of the companion device and a correction is made for the coupling loss into the UUT. The actual levelfor the wanted signal shall be recorded in the test report.
• When the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, the attenuation of the variable attenuator shall be increased in 1 dB steps to a value at which the minimum performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still met. The resulting level for thewanted signal at the input of the UUT is Pmin. This signal level (Pmin) is increased by the value provided innote 2 of the applicable table corresponding to the receiver category and type of equipment.

Step 4:

• The blocking signal at the UUT is set to the level provided in the table corresponding to the receiver categoryand type of equipment.
• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 are met then proceed to step 6.

Step 5:

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

• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been decreased with avalue equal to the Occupied Channel Bandwidth except:
- For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by3 dB.
- For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by3 dB.

• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, the UUT fails to comply with the Receiver Blocking requirement and step 6 and step 7 are no longer required.
• It shall be recorded in the test report whether the shift of blocking frequencies as described in the present stepwas used.

Step 6:

Repeat step 4 and step 5 for each remaining combination of frequency and level for the blocking signal as provided in the table corresponding to the receiver category and type of equipment.

Step 7:

For non-FHSS equipment, repeat step 2 to step 6 with the UUT operating at the highest operating channel on which the blocking test has to be performed (see clause 5.4.11.1).

Step 8:

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

TEST RESULTS

Record GFSK for this test item

Channel 00@Result

Wanted signal mean power form companion device(dBm)	Blocking signal frequency(MHz)	Blocking sgnal power(dBm)	PER (%)	Limit (%)	Result
-69.59	2380	-34	1.61	10	Pass
-69.59	2504	-34	0.19	10	Pass
-69.59	2300	-34	0.31	10	Pass
-69.59	2584	-34	1.15	10	Pass

Channel 78@Result

Wanted signal mean power form companion device(dBm)	Blocking signal frequency(MHz)	Blocking sgnal power(dBm)	PER (%)	Limit (%)	Result
-69.59	2380	-34	0.24	10	Pass
-69.59	2504	-34	0.19	10	Pass
-69.59	2300	-34	0.25	10	Pass
-69.59	2584	-34	1.71	10	Pass

Note: EUT is Receiver Category 2 equipment.

Record π/4DQPSK for this test item

Channel 00@Result

Wanted signal mean power form companion device(dBm)	Blocking signal frequency(MHz)	Blocking sgnal power(dBm)	PER (%)	Limit (%)	Result
-68.25	2380	-34	1.67	10	Pass
-68.25	2504	-34	0.31	10	Pass
-68.25	2300	-34	0.21	10	Pass
-68.25	2584	-34	1.91	10	Pass

Channel 78@Result

Wanted signal mean power form companion device(dBm)	Blocking signal frequency(MHz)	Blocking sgnal power(dBm)	PER (%)	Limit (%)	Result
-68.25	2380	-34	1.91	10	Pass
-68.25	2504	-34	0.21	10	Pass
-68.25	2300	-34	1.67	10	Pass
-68.25	2584	-34	1.75	10	Pass

Note: EUT is Receiver Category 2 equipment.

4.1.12. Geo-location capability

Definition& Requirements

ETSI EN 300 328 (V2.2.2) Sub-clause 4.3.2.12.2&4.3.2.12.3

Geo-location capability is a feature of the equipment to determine its geographical location with the purpose to configure itself according to the regulatory requirements applicable at the geographical location where it operates.

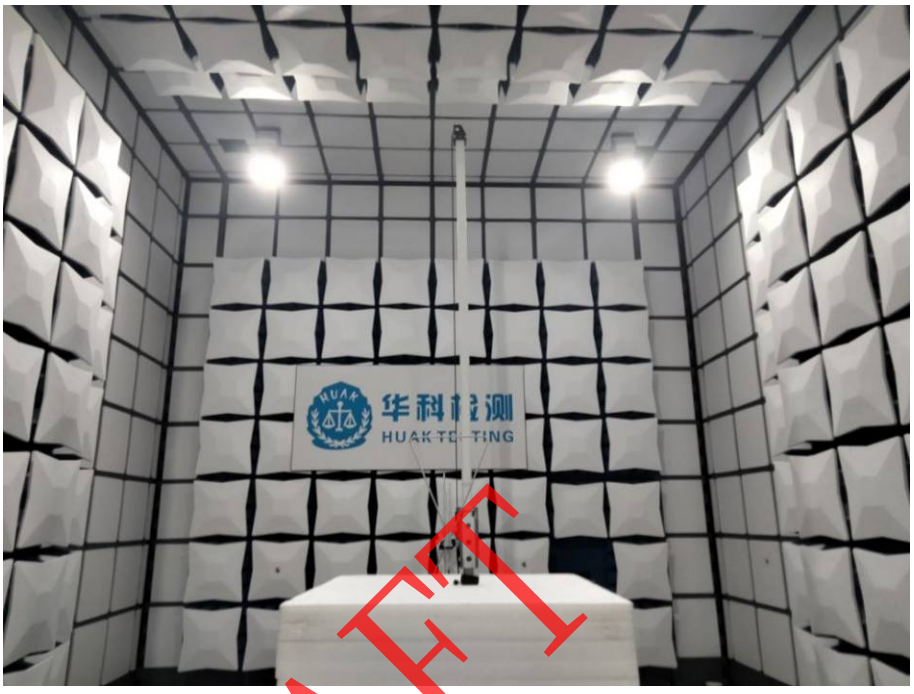
The geo-location capability may be present in the equipment or in an external device (temporary) associated with theequipment operating at the same geographical location during the initial power up of the equipment.

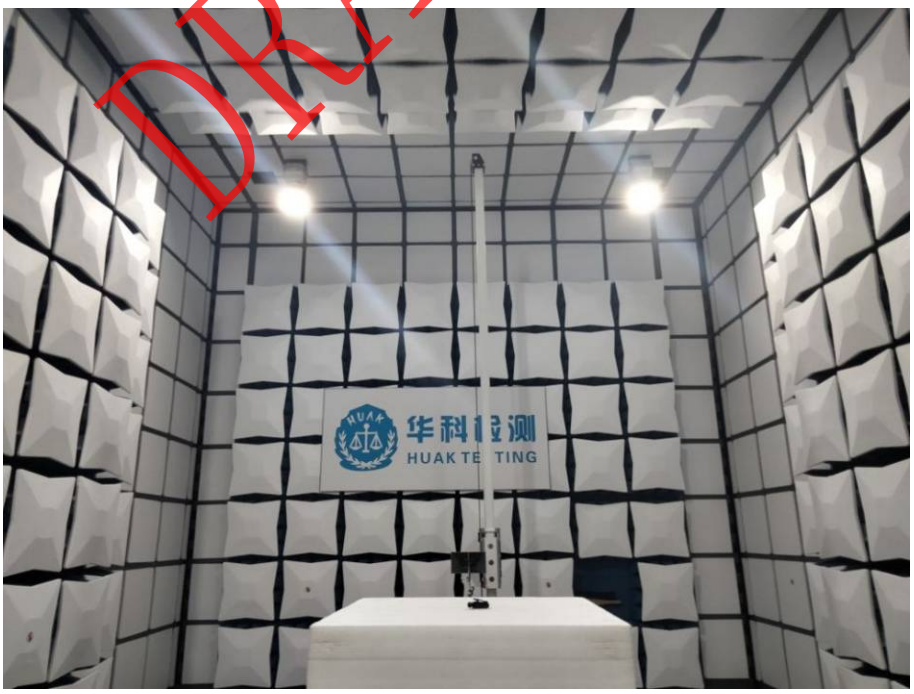
The geographicallocation may also be available in equipment already installed and operating at the same geographical location

RESULTS

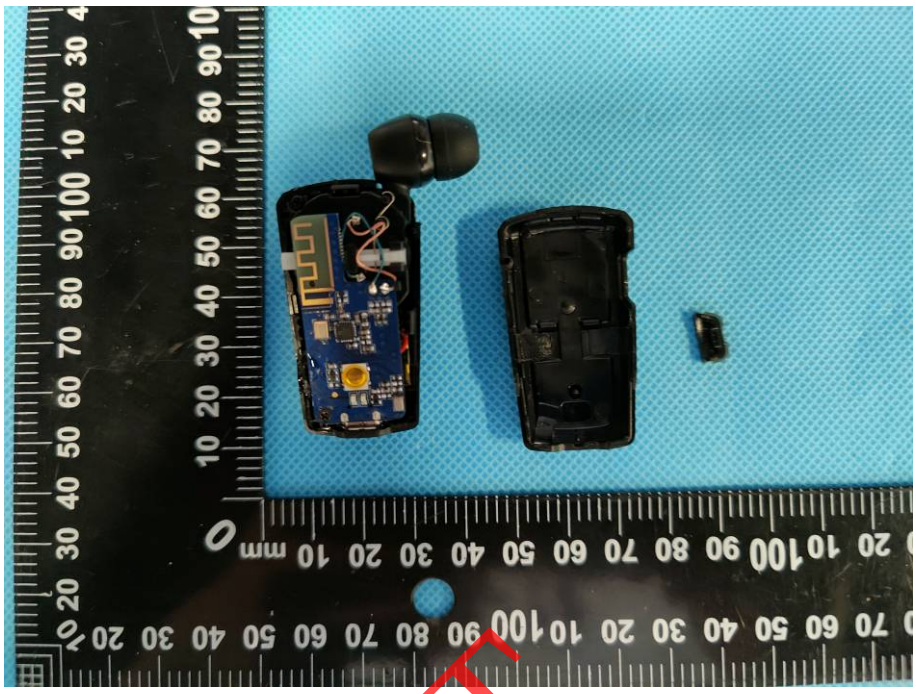
This equipment does not support Geo-location.

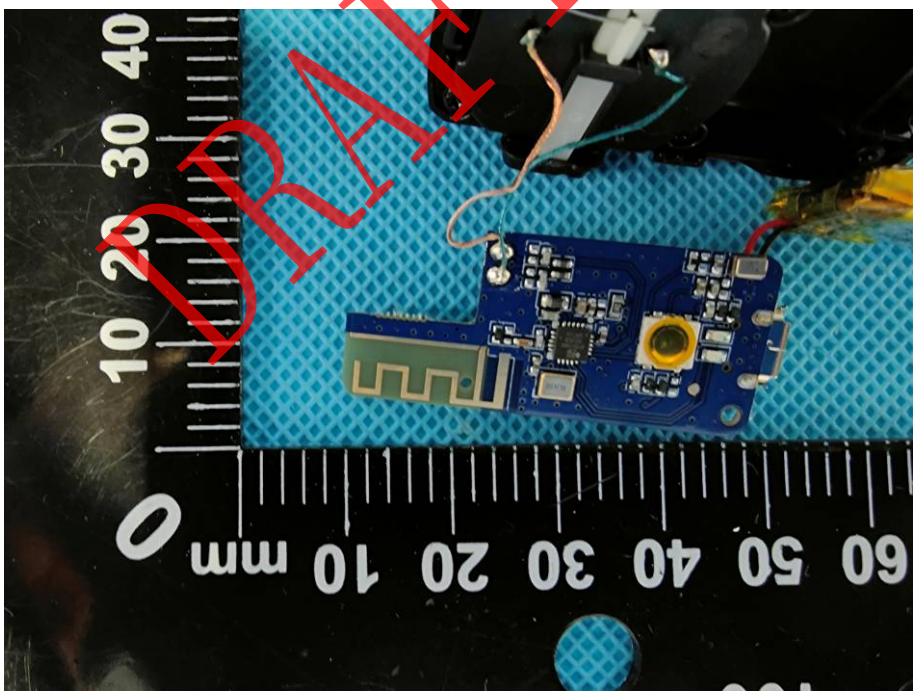
5. Test Setup Photos of the EUT

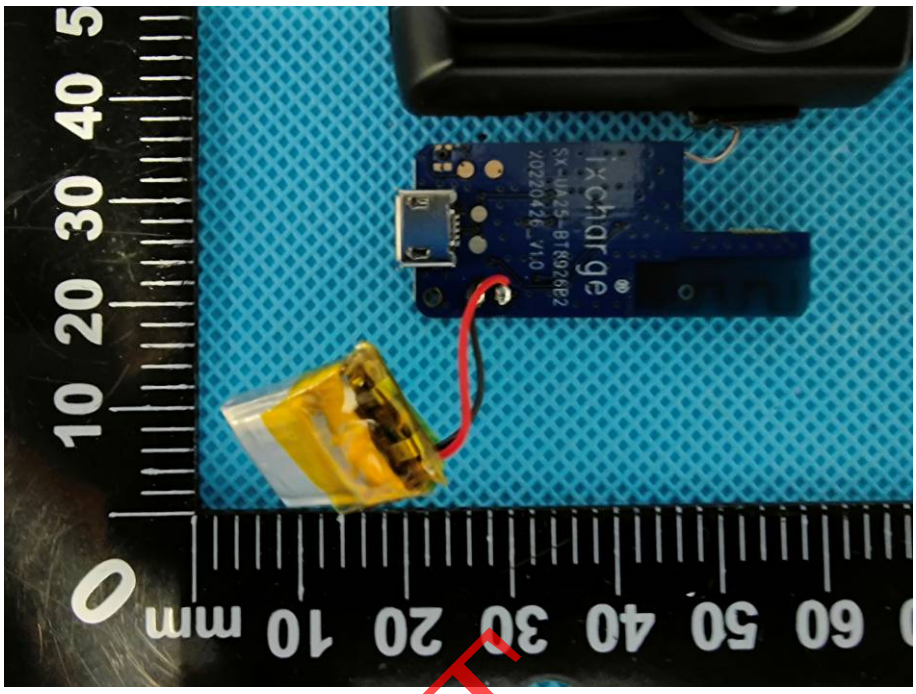


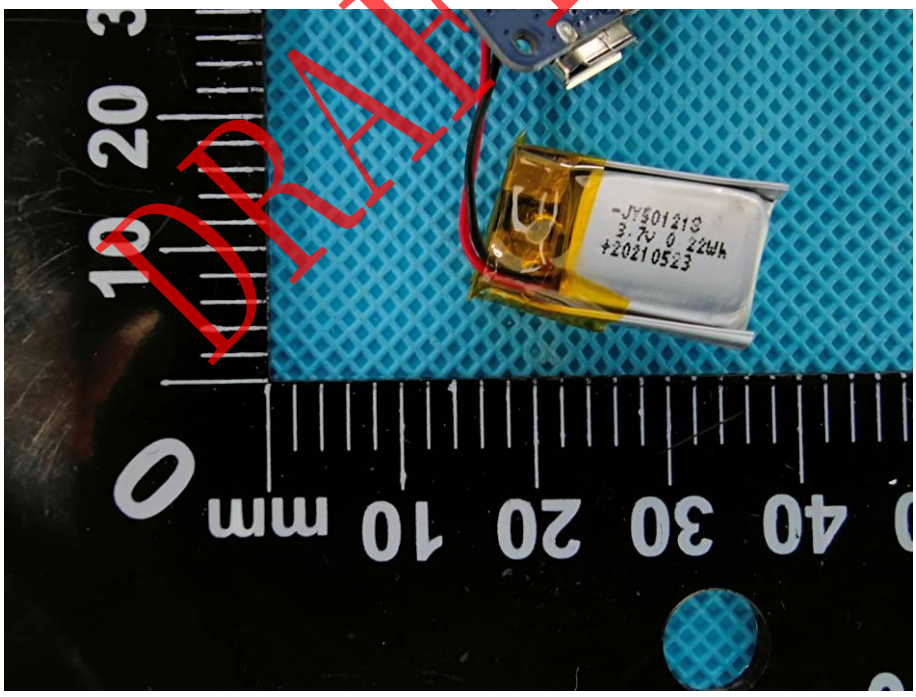


6. External and Ceramic Photos of the EUT









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

ANNEX

a) The type of modulation used by the equipment:

■FHSS

☐other forms of modulation

b) In case of FHSS modulation:

•In case of non-Adaptive Frequency Hopping equipment:

The number of Hopping Frequencies:

•In case of Adaptive Frequency Hopping Equipment:

The maximum number of Hopping Frequencies:

The minimum number of Hopping Frequencies:

The Dwell Time:

The Minimum Channel Occupation Time:

c) Adaptive / non-adaptive equipment:

☐non-adaptive Equipment

■adaptive Equipment without the possibility to switch to a non-adaptive mode

☐adaptive Equipment which can also operate in a non-adaptive mode

d) In case of adaptive equipment:

The Channel Occupancy Time implemented by the equipment: ms

■The equipment has implemented an LBT based DAA mechanism

• In case of equipment using modulation different from FHSS:

☐The equipment is Frame Based equipment

■The equipment is Load Based equipment

☐The equipment can switch dynamically between Frame Based and Load Based equipment

The CCA time implemented by the equipment: ..... µs

The value q as referred to in clause 4.3.2.5.2.2.2 .....

☐The equipment has implemented an non-LBT based DAA mechanism

☐The equipment can operate in more than one adaptive mode

e) In case of non-adaptive Equipment:

The maximum RF Output Power (e.i.r.p.):dBm

The maximum (corresponding) Duty Cycle: …%

Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycleand corresponding power levels to be declared):

f) The worst case operational mode for each of the following tests:

• RF Output Power

GFSK, π /4DQPSK

• Power Spectral Density

GFSK, π /4DQPSK

• Duty cycle, Tx-Sequence, Tx-gap

GFSK, π /4DQPSK

• Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment)

GFSK, π /4DQPSK

• Hopping Frequency Separation (only for FHSS equipment)

GFSK, π /4DQPSK

• Medium Utilisation

GFSK, π /4DQPSK,

• Adaptivity & Receiver Blocking

.....

• Occupied Channel Bandwidth

GFSK, π /4DQPSK

• Transmitter unwanted emissions in the OOB domain

GFSK, π /4DQPSK

• Transmitter unwanted emissions in the spurious domain

GFSK, π /4DQPSK

• Receiver spurious emissions

GFSK, π /4DQPSK

g) The different transmit operating modes (tick all that apply):

■Operating mode 1: Single Antenna Equipment

■Equipment with only 1 antenna

☐Equipment with 2 diversity antennas but only 1 antenna active at any moment in time

☐Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)

☐Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming

☐Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)

☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1

☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2

NOTE: Add more lines if more channel bandwidths are supported.

☐Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming

☐Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)

☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1

☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2

NOTE: Add more lines if more channel bandwidths are supported.

h) In case of Smart Antenna Systems:

- The number of Receive chains: .....
- The number of Transmit chains: .....

☐symmetrical power distribution

☐asymmetrical power distribution

In case of beam forming, the maximum beam forming gain: .....

NOTE: Beam forming gain does not include the basic gain of a single antenna.

i) Operating Frequency Range(s) of the equipment:

- Operating Frequency Range 1: 2402 MHz to 2480 MHz
- Operating Frequency Range 2: ..... MHz to ..... MHz

NOTE: Add more lines if more Frequency Ranges are supported.

j) Occupied Channel Bandwidth(s):

☐ Occupied Channel Bandwidth 1: 1.190MHz

☐ Occupied Channel Bandwidth 2: MHz

NOTE: Add more lines if more channel bandwidths are supported.

k) Type of Equipment (stand-alone, combined, plug-in radio device, etc.):

■Stand-alone

☐Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)

☐Plug-in radio device (Equipment intended for a variety of host systems)

Other .....

l) The extreme operating conditions that apply to the equipment:

Operating temperature range:-10° C to 40° C

Operating voltage range: 3.145V to 4.255V ☐AC■DC

Details provided are for the: ■stand-alone equipment

☐combined (or host) equipment

☐test jig

m) The intended combination(s) of the radio equipment power settings and one or more antenna assemblies andtheir corresponding e.i.r.p levels:

- Antenna Type

■PCB Antenna

Antenna Gain: 0dBi

If applicable, additional beam forming gain (excluding basic antenna gain): ..... dB

☐Temporary RF connector provided

☐No temporary RF connector provided
☐Dedicated Antennas (equipment with antenna connector)
☐Single power level with corresponding antenna(s)
☐Multiple power settings and corresponding antenna(s)
Number of different Power Levels: .....
Power Level 1: ..... dBm
Power Level 2: ..... dBm
Power Level 3: ..... dBm

NOTE 1: Add more lines in case the equipment has more power levels.
NOTE 2: These power levels are conducted power levels (at antenna connector).
For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the
resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable
Power Level 1: 1.18dBm
Number of antenna assemblies provided for this power level: .....

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1	0	1.18	
2			
3			
4			

NOTE 3: Add more rows in case more antenna assemblies are supported for this power level.
Power Level 2: ..... dBm
Number of antenna assemblies provided for this power level: .....

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			
3			
4			

NOTE 4: Add more rows in case more antenna assemblies are supported for this power level.
Power Level 3: ..... dBm
Number of antenna assemblies provided for this power level: .....

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1			
2			
3			
4			

NOTE 5: Add more rows in case more antenna assemblies are supported for this power level.

n) The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host)equipment or test jig in case of plug-in devices:
Details provided are for the: ■stand-alone equipment
☐combined (or host) equipment
☐test jig
Supply Voltage ☐AC mains State AC voltage:
■DC State DC voltage : DC 3.7V

In case of DC, indicate the type of power source
☐Ceramic Power Supply
■External Power Supply or AC/DC Adapter
■Battery: DC 3.7V
☐Other: .....

o) Describe the test modes available which can facilitate testing:

p) The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):
Other: NO FHSS
q) If applicable, the statistical analysis referred to in clause 5.4.1 q)
Not apply

r) If applicable, the statistical analysis referred to in clause 5.4.1 r)

Not apply

s) Geo-location capability supported by the equipment:

☐Yes

☐The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user

■No

t) Describe the minimum performance criteria that apply to the equipment (see clause 4.3.1.12.3 orclause 4.3.2.11.3):

The minimum performance criterion shall be a PER less than or equal to 10 %.

The intended use of the equipment should be in the normal operation without lost the communication link or no unintentionally operation occurs.