

# TEST REPORT

Applicant/Manufacturer: Shenzhen Huafului Technology Co., Ltd.  
Address : Unit 1401 & 1402, 14/F, Jinqi Zhigu Mansion (No.4 Building of Chongwen Garden), Crossing of the Liuxian Street and Tangling Road, Taoyuan Street, Nanshan District, Shenzhen, P.R. China  
Report Number : SZ1230223-08060E-RF-22A

## Test Standard (s)

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

## Sample Description

Product Type: SmartWatch  
Model No.: C21  
Multiple Model(s) No.: N/A  
Trade Mark: CUBOT  
Date Received: 2023/02/23  
Report Date: 2023/03/10

Test Result:	Pass*
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\* In the configuration tested, the EUT complied with the standards above.

**Prepared and Checked By:**

**Approved By:**



Michelle Zeng  
RF Engineer

Jacob Kong  
RF Supervisor

Note: BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk "\*". Customer model name, addresses, names, trademarks etc. are not considered data.

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## Bay Area Compliance Laboratories Corp. (Shenzhen)

5F(B-West) , 6F, 7F, the 3rd Phase of Wan Li Industrial Building D, Shihua Rd, FuTian Free Trade Zone, Shenzhen, China  
Tel: +86-755-33320018 Fax: +86-755-33320008 www.baclcorp.com.cn

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**DOCUMENT REVISION HISTORY**

Revision Number	Report Number	Description of Revision	Date of Revision
0	SZ1230223-08060E-RF-22A	Original Report	2023-03-10

## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

Frequency Range	Bluetooth: 2402-2480MHz
Maximum EIRP	Bluetooth: 1.26dBm
Modulation Technique	Bluetooth: GFSK, $\pi/4$ -DQPSK, 8DPSK
Antenna Specification*	0.5dBi(It is provided by the manufacturer)
Voltage Range	DC 3.8V from battery or DC 5V from USB charging port
Sample serial number	22V5_1 (RF Conducted Test) 22V5_2 (RF Radiated Test) (Assigned by BACL, Shenzhen)
Sample/EUT Status	Good condition
Normal/Extreme Condition	N.V.: Nominal Voltage: 3.8V <sub>DC</sub> L.T.: Low Temperature 0°C N.T.: Normal Temperature +25°C H.T.: High Temperature +50°C Note: the extreme test condition was declared by manufacturer.

### Objective

This test report is in accordance with 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.

The objective is to determine the compliance of EUT with ETSI EN 300 328 V2.2.2 (2019-07).

## Measurement Uncertainty

Item	Frequency Range		Expanded Measurement uncertainty
Spurious Emissions, Radiated	30MHz~200MHz	Horizontal	4.46dB(k=2, 95% level of confidence)
	30MHz~200MHz	Vertical	4.53dB(k=2, 95% level of confidence)
	200MHz~1000MHz	Horizontal	4.85dB(k=2, 95% level of confidence)
	200MHz~1000MHz	Vertical	4.76dB(k=2, 95% level of confidence)
	1GHz~6GHz	/	5.02dB(k=2, 95% level of confidence)
	6GHz~18GHz	/	5.11dB(k=2, 95% level of confidence)
	18GHz~40GHz	/	5.50dB(k=2, 95% level of confidence)
Occupied Channel Bandwidth	/		±5%
Power Spectral Density	/		1.75 dB(k=2, 95% level of confidence)
RF output power, conducted	/		0.74dB(k=2, 95% level of confidence)
Unwanted Emission, conducted	/		1.75dB(k=2, 95% level of confidence)
Temperature	/		±1℃
Supply voltages	/		±0.4%
Humidity	/		±1%

*Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.*

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 5F(B-West) , 6F, 7F, the 3rd Phase of Wan Li Industrial Building D, Shihua Rd, FuTian Free Trade Zone, Shenzhen, China.

Each test item follows test standards and with no deviation.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in an engineering mode.

### EUT Exercise Software

“FCC assist 1.0.2.2” exercise software was used and the power level is Default\*. The power level was provided by the manufacturer.

### Special Accessories

No special accessory.

### Equipment Modifications

No modification was made to the EUT.

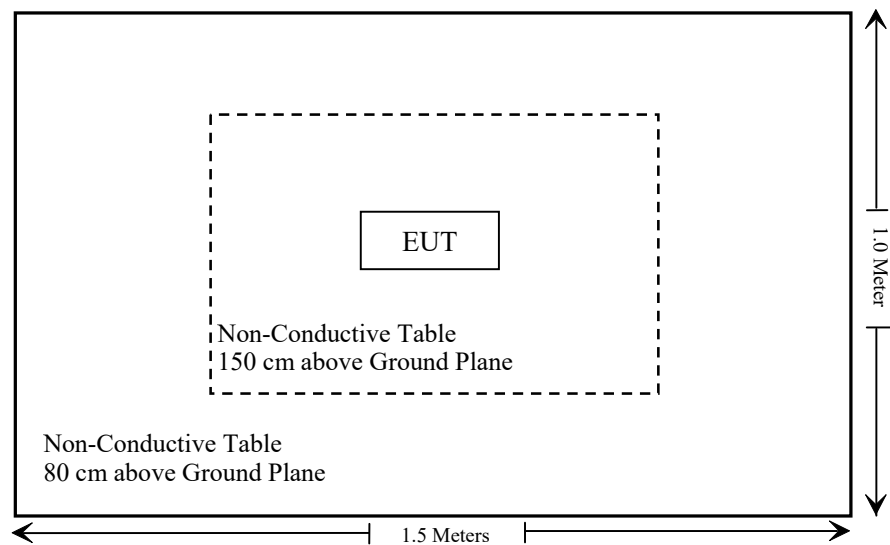
### Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	/	/	/

### External I/O Cable

Cable Description	Length (m)	From Port	To
/	/	/	/

Block Diagram of Test Setup





**SUMMARY OF TEST RESULTS**

<b>ETSI EN 300 328 V2.2.2 (2019-07)</b>	<b>Description of Test</b>	<b>Test Result</b>
§ 4.3.1.2	RF output power	Compliant
§ 4.3.1.3	Duty Cycle, Tx-sequence, Tx-gap	Not Applicable
§ 4.3.1.4	Accumulated Transmit Time, Frequency Occupation and Hopping Sequence	Compliant
§ 4.3.1.5	Hopping Frequency Separation	Compliant
§ 4.3.1.6	Medium Utilisation (MU) factor	Not Applicable
§ 4.3.1.7	Adaptivity (Adaptive Frequency Hopping)	Not Applicable*
§ 4.3.1.8	Occupied Channel Bandwidth	Compliant
§ 4.3.1.9	Transmitter unwanted emissions in the out-of-band domain	Compliant
§ 4.3.1.10	Transmitter unwanted emissions in the spurious domain	Compliant
§ 4.3.1.11	Receiver spurious emissions	Compliant
§ 4.3.1.12	Receiver Blocking	Compliant
§ 4.3.1.13	Geo-location capability	Not Applicable**

**Note:**

The supplier declared that the equipment is adaptive equipment

Not Applicable – This item only for non-adaptive mode

Not Applicable\* – The test item was not required for adaptive frequency hopping equipment of the output power less than 10mW (e.i.r.p).

Not Applicable\*\* –The supplier declared that the equipment has no this function.

**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Radiated Emission Test</b>					
R&S	EMI Test Receiver	ESR3	102455	2022/07/28	2023/07/27
Sonoma instrument	Pre-amplifier	310 N	186238	2022/11/11	2023/11/10
Sunol Sciences	Broadband Antenna	JB1	A040904-2	2020/12/22	2023/12/21
Unknown	Cable	Chamber Cable 1	F-03-EM236	2022/11/11	2023/11/10
Unknown	Cable	Chamber Cable 4	EC-007	2022/11/11	2023/11/10
COM-POWER	Dipole Antenna	AD-100	721027	NCR	NCR
Rohde & Schwarz	Spectrum Analyzer	FSV40	101605	2022/07/04	2023/07/03
COM-POWER	Pre-amplifier	PA-122	181919	2022/11/25	2023/11/24
Sunol Sciences	Horn Antenna	3115	9107-3694	2021/01/15	2024/01/14
A.H.System	Horn Antenna	SAS-200/571	135	2021/07/14	2024/07/13
Insulated Wire Inc.	RF Cable	SPS-2503-3150	02222010	2022/11/25	2023/11/24
Unknown	RF Cable	W1101-EQ1 OUT	F-19-EM005	2022/11/25	2023/11/24
Agilent	Signal Generator	N5183A	MY51040755	2023/02/08	2024/02/07
<b>RF Conducted Test</b>					
BACL	Temperature & Humidity Chamber	BTH-150-40	30145	2023/02/08	2024/02/07
Rohde & Schwarz	Wideband Radio Communication Tester	CMW500	146520	2022/06/27	2023/06/26
Tonscend	RF control Unit	JS0806-2	19D8060154	2022/09/15	2023/09/14
Rohde & Schwarz	Signal and Spectrum Analyzer	FSV40	101473	2023/02/08	2024/02/07
Agilent	MXG Vector Signal Generator	N5182B	MY53051503	2022/07/04	2023/07/03

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

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**ETSI EN 300 328 V2.2.2 (2019-07) §4.3.1.2 – RF OUTPUT POWER**

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**Applicable Standard**

The RF output power is defined as the mean equivalent isotropically radiated power (e.i.r.p.) of the equipment during a transmission burst.

**Limit**

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

1) For Non-adaptive FHSS equipment, the manufacturer may have declared a reduced RF Output Power (see clause 5.4.1 m)) and associated Duty Cycle (see clause 5.4.1 e)) that will ensure that the equipment meets the requirement for the Medium Utilization (MU) factor further described in clause 4.3.1.6. This is verified by the conformance test referred to in clause 4.3.1.6.4.

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

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

**Test Procedure**

The test procedure shall be as follows:

**Step 1:**

- Use a fast power sensor with a minimum sensitivity of -40 dBm and capable of minimum 1 MS/s.
  - Use the following settings:
    - Sample speed 1 MS/s or faster.
    - The samples shall represent the RMS power of the signal.
    - Measurement duration: For non-adaptive equipment: equal to the observation period defined in clause 4.3.1.3.2 or clause 4.3.2.4.2. For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) is captured.
- For adaptive equipment, to increase the measurement accuracy, a higher number of bursts may be used.

**Step 2:**

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

**Step 3:**

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

The start and stop times are defined as the points where the power is at least 30 dB below the highest value of the stored samples in step 2.

In case of insufficient sensitivity of the power sensor (e.g. in case of radiated measurements), the value of 30 dB may need to be reduced appropriately.

**Step 4:**

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

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

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

**Step 5:**

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

**Step 6:**

- Add the (stated) antenna assembly gain G in dBi of the individual antenna.
- 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 or G + Y) shall be used.
- The RF Output Power ( $P_{out}$ ) shall be calculated using the formula below:  

$$P_{out} = A + G + Y$$
- This value, which shall comply with the limit given in clause 4.3.1.2.3 or clause 4.3.2.2.3, shall be recorded in the test report.

**Test Data****Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	39 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Cloud Qiu on 2023-03-10.*

*EUT operation mode: Transmitting*

*Test Result: Compliant. Please refer to the Appendix.*

## **ETSI EN 300 328 V2.2.2 (2019-07) §4.3.1.4 –ACCUMULATED TRANSMIT TIME, FREQUENCY OCCUPATION AND HOPPING SEQUENCE**

### **Applicable Standard**

The Accumulated Transmit Time is the total of the transmitter 'on'-times, during an observation period, on a particular hopping frequency.

The Frequency Occupation is the number of times that each hopping frequency is occupied within a given period. A hopping frequency is considered to be occupied when the equipment selects that frequency from the Hopping Sequence. FHSS equipment may be transmitting, receiving or stay idle during the dwell time spent on that hopping frequency.

The Hopping Sequence of a FHSS equipment is the pattern of the hopping frequencies used by the equipment.

Limit:

For Non-adaptive frequency hopping systems:

The Accumulated Transmit Time on any hopping frequency shall not be greater than 15 ms within any observation period of 15 ms multiplied by the minimum number of hopping frequencies (N) that have to be used.

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

- Option 1: Each hopping frequency of the Hopping Sequence shall be occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use.
- Option 2: The probability that each hopping frequency is occupied shall be between  $((1 / U) \times 25 \%)$  and 77 % where U is the number of hopping frequencies in use.

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

NOTE: See also clause 4.3.1.5.3.1 for the Hopping Frequency Separation applicable to non-adaptive FHSS equipment.

Non-Adaptive FHSS equipment, may blacklist some but not all hopping frequencies. From the N hopping frequencies defined above, the equipment shall transmit on at least one hopping frequency. For the blacklisted frequencies, the equipment has to occupy these frequencies for the duration of the average dwell time (see also definition for blacklisted frequency in clause 3.1).

### For Adaptive frequency hopping systems:

Adaptive FHSS equipment shall be capable of operating over a minimum of 70 % of the band specified in table 1.

The Accumulated Transmit Time on any hopping frequency shall not be greater than 400 ms within any observation period of 400 ms multiplied by the minimum number of hopping frequencies (N) that have to be used.

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

- Option 1: Each hopping frequency of the Hopping Sequence shall be occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use.
- Option 2: The occupation probability for each frequency shall be between  $((1 / U) \times 25 \%)$  and 77 % where U is the number of hopping frequencies in use.

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

NOTE: See also clause 4.3.1.5.3.2 for the Hopping Frequency Separation applicable to adaptive FHSS equipment.

For Adaptive FHSS equipment, from the N hopping frequencies defined above, the equipment shall consider at least one hopping frequency for its transmissions. Providing that there is no interference present on this hopping frequency with a level above the detection threshold defined in clause 4.3.1.7.2.2, point 5 or clause 4.3.1.7.3.2, point 5, then the equipment shall have transmissions on this hopping frequency. For Adaptive FHSS equipment using LBT, if a signal is detected during the CCA, the equipment may jump immediately to the next hopping frequency in the Hopping Sequence (see clause 4.3.1.7.2.2, point 2) provided the limit for Accumulated Transmit Time on the new hopping frequency is respected.

## Test Procedure

The test procedure shall be as follows:

### 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:  $\geq$  RBW
  - Detector Mode: RMS
  - Sweep time: Equal to the applicable observation period (see clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2)
  - Number of sweep points: 30 000
  - Trace mode: Clear/Write
  - Trigger: Free Run

### Step 2:

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

**Step 3:**

- Identify the data points related to the frequency being investigated by applying a threshold.

The data points resulting from transmissions on the hopping frequency being investigated are assumed to have much higher levels compared to data points resulting from transmissions on adjacent hopping frequencies. If a clear determination between these transmissions is not possible, the RBW in step 1 shall be further reduced. In addition, a channel filter may be used.

- Count the number of data points identified as resulting from transmissions on the frequency being investigated and multiply this number by the time difference between two consecutive data points.

**Step 4:**

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

**Step 5:**

This step is only applicable for equipment implementing Option 1 in clause 4.3.1.4.3.1 or Option 1 in clause 4.3.1.4.3.2 for complying with the Frequency Occupation requirement.

- Make the following changes on the analyser and repeat step 2 and step 3.

Sweep time:  $4 \times \text{dwell time} \times \text{Actual number of hopping frequencies in use}$ .

The hopping frequencies occupied by the equipment without having transmissions during the dwell time

(blacklisted frequencies) should be taken into account in the actual number of hopping frequencies in use. If

this number cannot be determined (number of blacklisted frequencies unknown) it shall be assumed that the

equipment uses the maximum possible number of hopping frequencies.

- The result shall be compared to the limit for the Frequency Occupation defined in clause 4.3.1.4.3.1, Option 1 or clause 4.3.1.4.3.2, Option 1. The result of this comparison shall be recorded in the test report.

**Step 6:**

- Make the following changes on the analyser:

- Start Frequency: 2 400 MHz

- Stop Frequency: 2 483,5 MHz

- RBW: ~ 50 % of the Occupied Channel Bandwidth (single hopping frequency)

- VBW:  $\geq$  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:  $\sim 400 / \text{Occupied Channel Bandwidth (MHz)}$ ; the number of sweep points may need to be further increased in case of overlapping channels

- Trace Mode: Max Hold

- Trigger: Free Run

- Wait for the trace to stabilize. Identify the number of hopping frequencies used by the Hopping Sequence.

- The result shall be compared to the limit (value N) defined in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2. This value shall be recorded in the test report.

For equipment with blacklisted frequencies, it might not be possible to verify the number of hopping frequencies in use. However, they shall comply with the requirement for Accumulated Transmit Time and

Frequency Occupation assuming the minimum number of hopping frequencies (N) defined in clause 4.3.1.4.3.1 or clause 4.3.1.4.3.2 is used.

**Step 7:**

- For adaptive 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 Data****Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	39 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Cloud Qiu on 2023-03-10.*

*EUT operation mode: Transmitting*

*Test Result: Compliant. Please refer to the Appendix.*



## ETSI EN 300 328 V2.2.2 (2019-07) §4.3.1.5 – HOPPING FREQUENCY SEPARATION

### Applicable Standard

The Hopping Frequency Separation is the frequency separation between two adjacent hopping frequencies.

#### Limit:

For Non-adaptive frequency hopping equipment

For non-adaptive Frequency Hopping equipment, the Hopping Frequency Separation shall be equal or greater than the Occupied Channel Bandwidth (see clause 4.3.1.8), with a minimum separation of 100 kHz.

For FHSS equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for non-adaptive FHSS equipment operating in a mode where the RF Output power is less than 10 dBm e.i.r.p., the Hopping Frequency Separation shall be equal to or greater than 100 kHz.

For Adaptive frequency hopping equipment

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

Adaptive FHSS equipment that switched to a non-adaptive mode for one or more hopping frequencies because interference was detected on each of these hopping frequencies with a level above the threshold level defined in clause 4.3.1.7.2.2, point 5 or clause 4.3.1.7.3.2, point 5, does not have to comply with the Hopping Frequency Separation provided in clause 4.3.1.5.3.1 for non-adaptive FHSS equipment. If the Hopping Frequency Separation is below the Occupied Channel Bandwidth but greater than 100 kHz, the equipment is allowed to continue to operate with this Hopping Frequency Separation as long as the interference remains present on these hopping frequencies. As this relaxed Hopping Frequency Separation only applies to adaptive FHSS equipment, the FHSS equipment shall continue to operate in an adaptive mode on all other hopping frequencies.

Adaptive FHSS equipment which decided to operate in a non-adaptive mode on one or more hopping frequencies without the presence of interference, shall comply with the limit for Hopping Frequency Separation for non-adaptive FHSS equipment defined in clause 4.3.1.5.3.1 (first paragraph) for these hopping frequencies.

### Test Procedure

Option 1, the test procedure shall be as follows:

#### Step 1:

- The output of the transmitter shall be connected to a spectrum analyzer or equivalent.
- The analyzer shall be set as follows:
  - Centre Frequency: 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:  $3 \times \text{RBW}$
  - Detector Mode: Max Peak
  - Trace Mode: Max Hold
  - Sweep time: Auto

**Step 2:**

- Wait for the trace to stabilize.
- Use the marker function of the analyser to define the frequencies corresponding to the lower -20 dBr point and the upper -20 dBr point for both hopping frequencies F1 and F2. This will result in F1<sub>L</sub> and F1<sub>H</sub> for hopping frequency F1 and in F2<sub>L</sub> and F2<sub>H</sub> for hopping frequency F2. These values shall be recorded in the report.

**Step 3:**

- Calculate the centre frequencies F1<sub>C</sub> and F2<sub>C</sub> for both hopping frequencies using the formulas below. These values shall be recorded in the report.

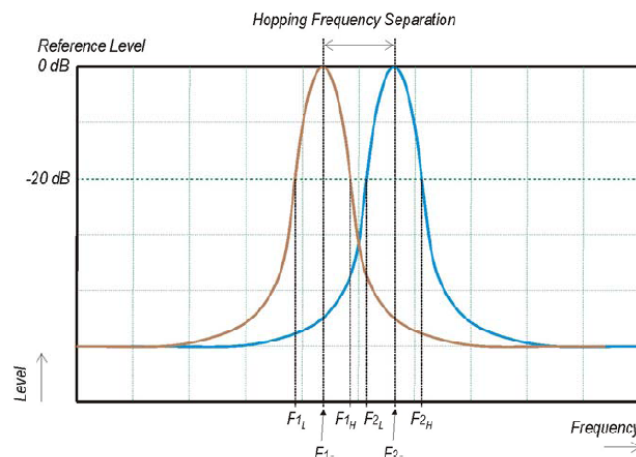
$$F1_C = \frac{F1_L + F1_H}{2} \quad F2_C = \frac{F2_L + F2_H}{2}$$

- Calculate the Hopping Frequency Separation (F<sub>HS</sub>) using the formula below. This value shall be recorded in the report.

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

- Compare the measured Hopping Frequency Separation with the limit defined in clause 4.3.1.5.3.

- See figure 4:



**Figure 4: Hopping Frequency Separation**

For adaptive systems, in case of overlapping channels which will prevent the definition of the -20 dBr reference points F1<sub>H</sub> and F2<sub>L</sub>, a higher reference level (e.g. -10 dBr or -6 dBr) may be chosen to define the reference points F1<sub>L</sub>; F1<sub>H</sub>; F2<sub>L</sub> and F2<sub>H</sub>.

Alternatively, special test software may be used to:

- force the UUT to hop or transmit on a single Hopping Frequency by which the -20 dBr reference points can be measured separately for the two adjacent Hopping Frequencies; and/or;
- force the UUT to operate without modulation by which the centre frequencies F1<sub>C</sub> and F2<sub>C</sub> can be measured directly.

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

Option 2, the test procedure shall be as follows:

**Step 1:**

- The output of the transmitter shall be connected to a spectrum analyzer or equivalent.
- The analyzer shall be set as follows:
  - Centre Frequency: 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:  $3 \times \text{RBW}$
  - Detector Mode: Max Peak
  - Trace Mode: Max Hold
  - Sweep Time: Auto

**Step 2:**

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

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	39 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Cloud Qiu on 2023-03-10.*

*EUT operation mode: Transmitting*

*Test Result: Compliant. Please refer to the Appendix.*

## ETSI EN 300 328 V2.2.2 (2019-07) §4.3.1.8 – OCCUPIED CHANNEL BANDWIDTH

### Applicable Standard

The Occupied Channel Bandwidth is the bandwidth that contains 99 % of the power of the signal when considering a single hopping frequency.

### Limit:

The Occupied Channel Bandwidth for each hopping frequency shall be within the band given in table 1.

In addition, for non-adaptive FHSS equipment with e.i.r.p. greater than 10 dBm, the Occupied Channel Bandwidth for every occupied hopping frequency shall be equal to or less than 5 MHz.

### Test Procedure

The conformance tests for this requirement are defined in clause 5.4.7.

### Test Data

#### Environmental Conditions

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	39 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Cloud Qiu on 2023-03-10.*

*EUT operation mode: Transmitting*

*Test Result: Compliant. Please refer to the Appendix.*

## ETSI EN 300 328 V2.2.2 (2019-07) §4.3.1.9 – TRANSMITTER UNWANTED EMISSION IN THE OUT-OF-BAND DOMAIN

### Applicable Standard

In the present document, transmitter unwanted emissions in the out-of-band domain are emissions when the equipment is in Transmit mode, on frequencies immediately outside the allocated band, but excluding unwanted emissions in the spurious domain.

### Limit:

The transmitter unwanted emissions in the out-of-band domain shall not exceed the values provided by the mask in figure 1.

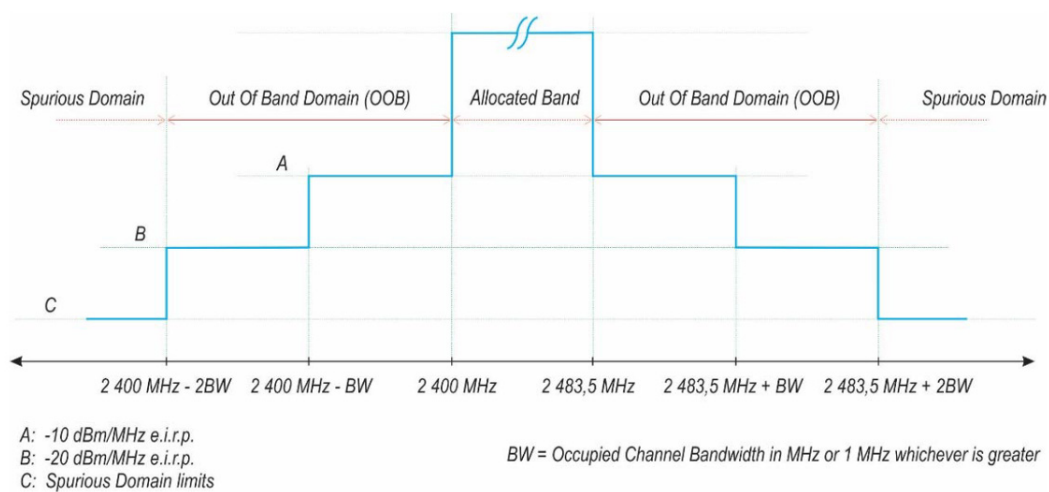


Figure 1: Transmit mask

### Test Procedure

The conformance tests for this requirement are defined in clause 5.4.8.

### Test Data

#### Environmental Conditions

Temperature:	25 °C
Relative Humidity:	39 %
ATM Pressure:	101.0 kPa

The testing was performed by Cloud Qiu on 2023-03-10.

EUT operation mode: Transmitting

Test Result: Compliant. Please refer to the Appendix.

## ETSI EN 300 328 V2.2.2 (2019-07) §4.3.1.10 – TRANSMITTER UNWANTED EMISSION IN THE SPURIOUS DOMAIN

### Applicable Standard

In the present document, transmitter unwanted emissions in the spurious domain are emissions outside the allocated band and outside the out-of-band domain as indicated in figure 1 when the equipment is in Transmit mode.

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 4.

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

### Transmitter limits for spurious emissions

Frequency Range	Maximum power e.r.p ( $\leq 1$ GHz) e.i.r.p ( $> 1$ GHz)	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87.5 MHz	-36 dBm	100 kHz
87.5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 694 MHz	-54 dBm	100 kHz
694 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12.75 GHz	-30 dBm	1 MHz

### Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

### Test Procedure

#### Conducted measurement

In case of conducted measurements, the radio equipment shall be connected to the measuring equipment via a suitable attenuator.

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

The measurement procedure refer to ETSI EN 300 328 V2.2.2 (2019-07) §5.4.9.2.1

Radiated measurement:

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

The test procedure is further as described under clause 5.4.9.2.1.

## Test Data

### Environmental Conditions

Temperature:	25~26 °C
Relative Humidity:	50 %
ATM Pressure:	101.0 kPa

The testing was performed by Anson Su on 2023-03-09 for below 1GHz and Tom Liu on 2023-03-08 for above 1GHz.

EUT operation mode: Transmitting

Note: Pretest with BDR mode, EDR mode ( $\pi/4$ -DQPSK) and EDR mode (8DPSK), the worst case was BDR mode.

Test Result: Compliant, please refer to the below table for the worst case.

### 30 MHz ~ 12.75 GHz:

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	EN 300 328	
			Height (m)	Polar (H/V)	Substituted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)		Limit (dBm)	Margin (dB)
BDR-Low Channel										
953.5	33.35	354	2	H	-63.2	1.36	0.0	-64.56	-36	28.56
953.5	32.49	13	2	V	-61.6	1.36	0.0	-62.96	-36	26.96
4804.00	51.18	130	2.0	H	-50.5	1.60	12.10	-40.00	-30	10.00
4804.00	48.66	271	1.1	V	-52.0	1.60	12.10	-41.50	-30	11.50
BDR-High Channel										
957.0	34.21	324	1	H	-62.3	1.36	0.0	-63.66	-36	27.66
957.0	33.66	75	1	V	-60.4	1.36	0.0	-61.76	-36	25.76
4960.00	51.84	48	1.9	H	-49.7	1.70	12.00	-39.40	-30	9.40
4960.00	48.19	194	2.1	V	-52.8	1.70	12.00	-42.50	-30	12.50

**Note 1:** The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.

**Note 2:**

Absolute Level = Substituted Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

## ETSI EN 300 328 V2.2.2 (2019-07) §4.3.1.11 - RECEIVER SPURIOUS EMISSIONS

### Applicable Standard

Receiver spurious emissions are emissions at any frequency when the equipment is in receive mode.

#### Limit:

The receiver spurious emissions shall not exceed the values given in table 5.

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

**Spurious emission limits for receivers**

Frequency range	Maximum power e.r.p. ( $\leq 1$ GHz) e.i.r.p. ( $> 1$ GHz)	Measurement bandwidth
30 MHz to 1GHz	-57 dBm	100 kHz
1 GHz to 12.75GHz	-47 dBm	1 MHz

### Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

### Test Procedure

Conducted measurement:

In case of conducted measurements, the radio equipment shall be connected to the measuring equipment via a suitable attenuator.

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

The measurement procedure refer to ETSI EN 300 328 V2.2.2 (2019-07) §5.4.10.2.1

Radiated measurement

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

The test procedure is further as described under clause 5.4.10.2.1.



**Test Data****Environmental Conditions**

<b>Temperature:</b>	25~26 °C
<b>Relative Humidity:</b>	50 %
<b>ATM Pressure:</b>	101.0 kPa

The testing was performed by Anson Su on 2023-03-09 for below 1GHz and Tom Liu on 2023-03-08 for above 1GHz.

EUT operation mode: Receiving

Note: Pretest with BDR mode, EDR mode ( $\pi/4$ -DQPSK) and EDR mode (8DPSK), the worst case was BDR mode.

Test Result: Compliant, please refer to the below table for the worst case.

**30 MHz ~ 12.75 GHz**

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	EN 300 328	
			Height (m)	Polar (H/V)	Substituted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBd/dBi)		Limit (dBm)	Margin (dB)
Low Channel										
951.6	32.53	254	2	H	-64.0	1.36	0.0	-65.36	-57	8.36
951.6	31.78	111	2	V	-62.3	1.36	0.0	-63.66	-57	6.66
1483.73	42.93	64	2.5	H	-65.7	1.60	8.50	-58.80	-47	11.80
1483.73	42.46	87	2.4	V	-66.5	1.60	8.50	-59.60	-47	12.60
High Channel										
954.8	33.94	254	1	H	-62.6	1.36	0.0	-63.96	-57	6.96
954.8	32.22	44	1	V	-61.8	1.36	0.0	-63.16	-57	6.16
1462.07	42.31	307	1.3	H	-66.4	1.60	8.50	-59.50	-47	12.50
1462.07	42.13	341	1.4	V	-66.8	1.60	8.50	-59.90	-47	12.90

**Note 1:** The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.

**Note 2:**

Absolute Level = Substituted Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

## ETSI EN 300 328 V2.2.2 (2019-07) §4.3.1.12 - RECEIVER BLOCKING

### Applicable Standard

This requirement applies to all receiver categories as defined in clause 4.2.3.

Receiver blocking is a measure of the ability of the equipment to receive a wanted signal on its operating channel without exceeding a given degradation due to the presence of an unwanted input signal (blocking signal) on frequencies other than those of the operating band and spurious responses.

### Performance Criteria:

For equipment that supports a PER or FER test to be performed, the minimum performance criterion shall be a PER or FER less than or equal to 10 %.

For equipment that does not support a PER or a FER test to be performed, the minimum performance criterion shall be no loss of the wireless transmission function needed for the intended use of the equipment.

### Limit:

While maintaining the minimum performance criteria as defined in clause 4.3.1.12.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in table 6, table 7 or table 8.

**Table 6: 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 <sub>10</sub> (OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + 10 × log <sub>10</sub> (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 <sub>min</sub> + 26 dB where P <sub>min</sub> 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 <sub>min</sub> + 20 dB where P <sub>min</sub> 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 7: 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 + $10 \times \log_{10}(\text{OCBW}) + 10 \text{ dB}$ ) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
<p>NOTE 1: OCBW is in Hz.</p> <p>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 <math>P_{\min} + 26 \text{ dB}</math> where <math>P_{\min}</math> 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.</p> <p>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.</p>			

**Table 8: 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 + $10 \times \log_{10}(\text{OCBW}) + 20 \text{ dB}$ ) or (-74 dBm + 20 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
<p>NOTE 1: OCBW is in Hz.</p> <p>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 <math>P_{\min} + 30 \text{ dB}</math> where <math>P_{\min}</math> 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.</p> <p>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.</p>			

## Test Procedure

The conformance tests for this requirement are defined in clause 5.4.11.

**Test Data****Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	39 %
<b>ATM Pressure:</b>	101.0 kPa

*The testing was performed by Cloud Qiu on 2023-03-10.*

*EUT operation mode: Receiving (Worst Case)*

*Test Result: Compliant. Please refer to the Appendix.*

**EXHIBIT A - E.2 INFORMATION AS REQUIRED BY EN 300 328 V2.2.2,  
CLAUSE 5.4.1**

In accordance with EN 300 328, clause 5.4.1, the following information is provided by the supplier.

**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: 79;

The minimum number of Hopping Frequencies: 79;

The (average) Dwell time: 3.64ms;

**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 maximum 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 equipment has implemented a 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 cycle and corresponding power levels to be declared):

\_\_\_\_\_.

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

RF Output Power: 1.26dBm;  
Power Spectral Density N/A;  
Duty cycle, Tx-Sequence, Tx-gap N/A;  
Accumulated Transmit Time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment) 356ms, 1, 79;  
Hopping Frequency Separation (only for FHSS equipment) 1.00MHz;  
Medium Utilisation N/A;  
Adaptivity N/A;  
Receiver Blocking Pass;  
Nominal Channel Bandwidth 1.00MHz;  
Transmitter unwanted emissions in the OOB domain -46.78dBm/MHz;  
Transmitter unwanted emissions in the spurious domain -39.40dBm;  
Receiver spurious emissions -63.16dBm;

**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 1 antenna 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: N/A;

Note: The additional 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) Nominal Channel Bandwidth(s):**Occupied Channel Bandwidth 1: 1 MHzOccupied Channel Bandwidth 2:     MHzOccupied Channel Bandwidth 3:     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 normal and the extreme operating conditions that apply to the equipment:****Normal operating conditions (if applicable):**Operating temperature range: +25 ° COther (please specify if applicable):                     **Extreme operating conditions:**Operating temperature range: Minimum: 0 ° C Maximum +50 ° COther (please specify if applicable):                      Minimum:                      Maximum                     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 and their corresponding e.i.r.p levels:**

Antenna Type:

☒ Integral Antenna (information to be provided in case of conducted measurements)Antenna Gain: 0.5 dBiIf applicable, additional beamforming 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:            dBmPower Level 2:            dBmPower 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: \_\_\_\_\_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 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 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 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 \_\_\_\_ V  
☒ DC State DC voltage 3.8 / 5 V

In case of DC, indicate the type of power source

- ☐ Internal Power Supply  
☒ External Power Supply or AC/DC adapter  
☒ Battery  
☐ Other: \_\_\_\_\_.

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

The measurements shall be performed during continuously transmitting.

**p) The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], IEEE 802.15.4™, proprietary, etc.):**  
Bluetooth®.**q) If applicable, the statistical analysis referred to in clause 5.4.1 q)**

(to be provided as separate attachment)

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

(to be provided as separate attachment)

**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

## **EXHIBIT B - EUT PHOTOGRAPHS**

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Please refer to the report number is SZ1230223-08060E-EUT.

## EXHIBIT C - TEST SETUP PHOTOGRAPHS

**Radiated Spurious Emissions Test View (Below 1GHz)**



**Radiated Spurious Emissions Test View (Above 1GHz)**



## APPENDIX

### Appendix A: RF Output Power

#### Test Result

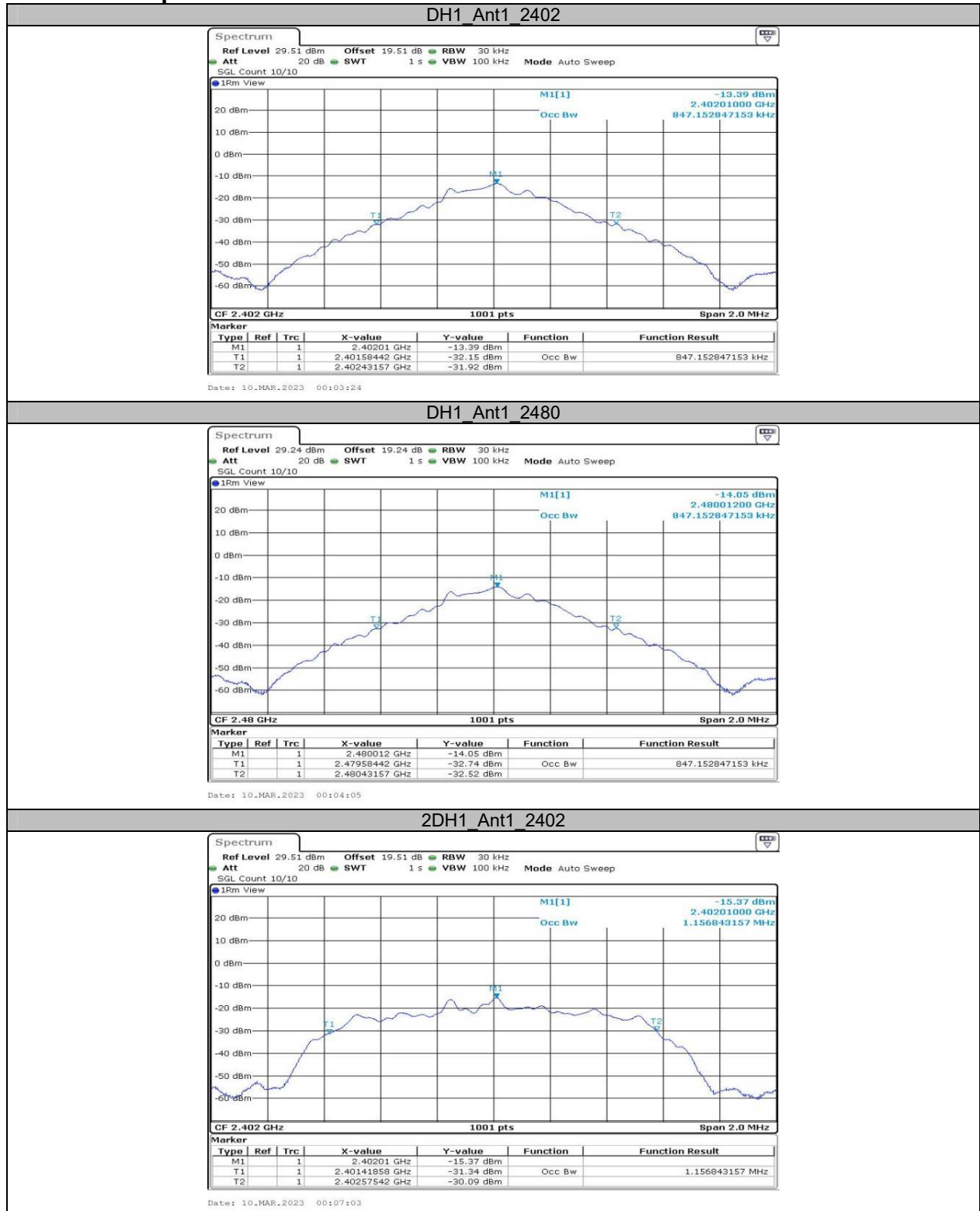
Test Condition	Test Mode	Antenna	Channel	EIRP[dBm]	Limit[dBm]	Verdict
NTNV	DH1	Ant1	Hop	1.09	20	PASS
	2DH1	Ant1	Hop	1.20	20	PASS
	3DH1	Ant1	Hop	1.16	20	PASS
LTVN	DH1	Ant1	Hop	1.11	20	PASS
	2DH1	Ant1	Hop	1.15	20	PASS
	3DH1	Ant1	Hop	1.20	20	PASS
HTNV	DH1	Ant1	Hop	1.10	20	PASS
	2DH1	Ant1	Hop	1.26	20	PASS
	3DH1	Ant1	Hop	1.24	20	PASS

Note: The antenna gain is 0.5dBi which was added into the EIRP.

**Appendix B: Occupied Channel Bandwidth****Test Result**

Test Mode	Antenna	Channel	OCB[MHz]	Limit[MHz]	Verdict
DH1	Ant1	2402	0.847	2400 to 2483.5	PASS
		2480	0.847	2400 to 2483.5	PASS
2DH1	Ant1	2402	1.157	2400 to 2483.5	PASS
		2480	1.157	2400 to 2483.5	PASS
3DH1	Ant1	2402	1.159	2400 to 2483.5	PASS
		2480	1.159	2400 to 2483.5	PASS

## Test Graphs





**Appendix C: Accumulated Transmit Time, Frequency Occupation and Hopping Sequence****Test Result****Accumulated Transmit Time**

Test Mode	Antenna	Channel	Result [ms]	Limit[ms]	Verdict
3DH5	Ant1	Hop_2402	355.840	400	PASS
		Hop_2480	356.000	400	PASS

**Frequency Occupation**

Test Mode	Antenna	Channel	Dwell Time [ms]	Result [Num.]	Limit [Num.]	Verdict
3DH5	Ant1	Hop_2402	3.64	3	1	PASS
		Hop_2480	3.54	1	1	PASS

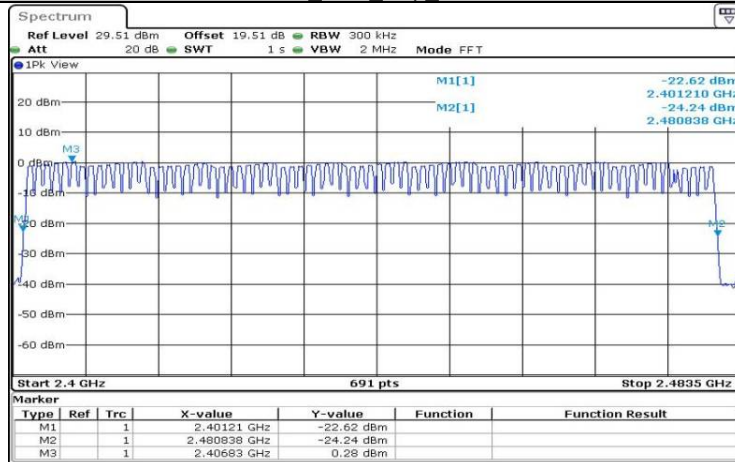
**Hopping Sequence**

Test Mode	Antenna	Channel	Hop. [Num.]	Limit[Num.]	Band Use [%]	Limit [%]	Verdict
DH1	Ant1	Hop	79	15	95.36	70	PASS
2DH1	Ant1	Hop	79	15	95.80	70	PASS
3DH1	Ant1	Hop	79	15	95.80	70	PASS



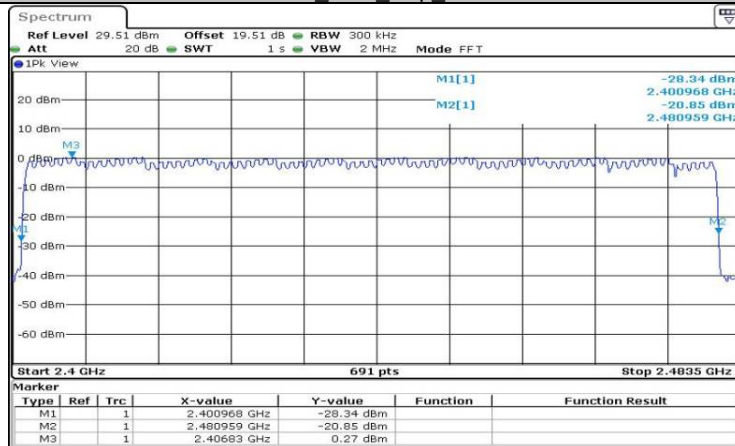
## Test Graphs

DH1\_Ant1\_Hop\_2402



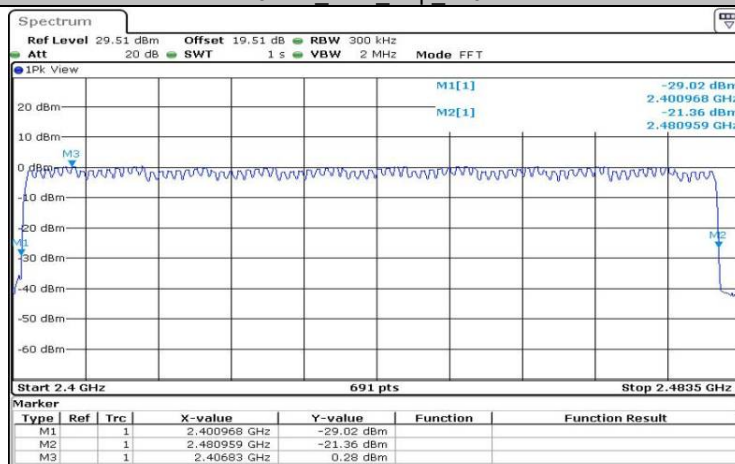
Date: 10.MAR.2023 00:14:36

2DH1\_Ant1\_Hop\_2402



Date: 10.MAR.2023 00:23:13

3DH1\_Ant1\_Hop\_2402

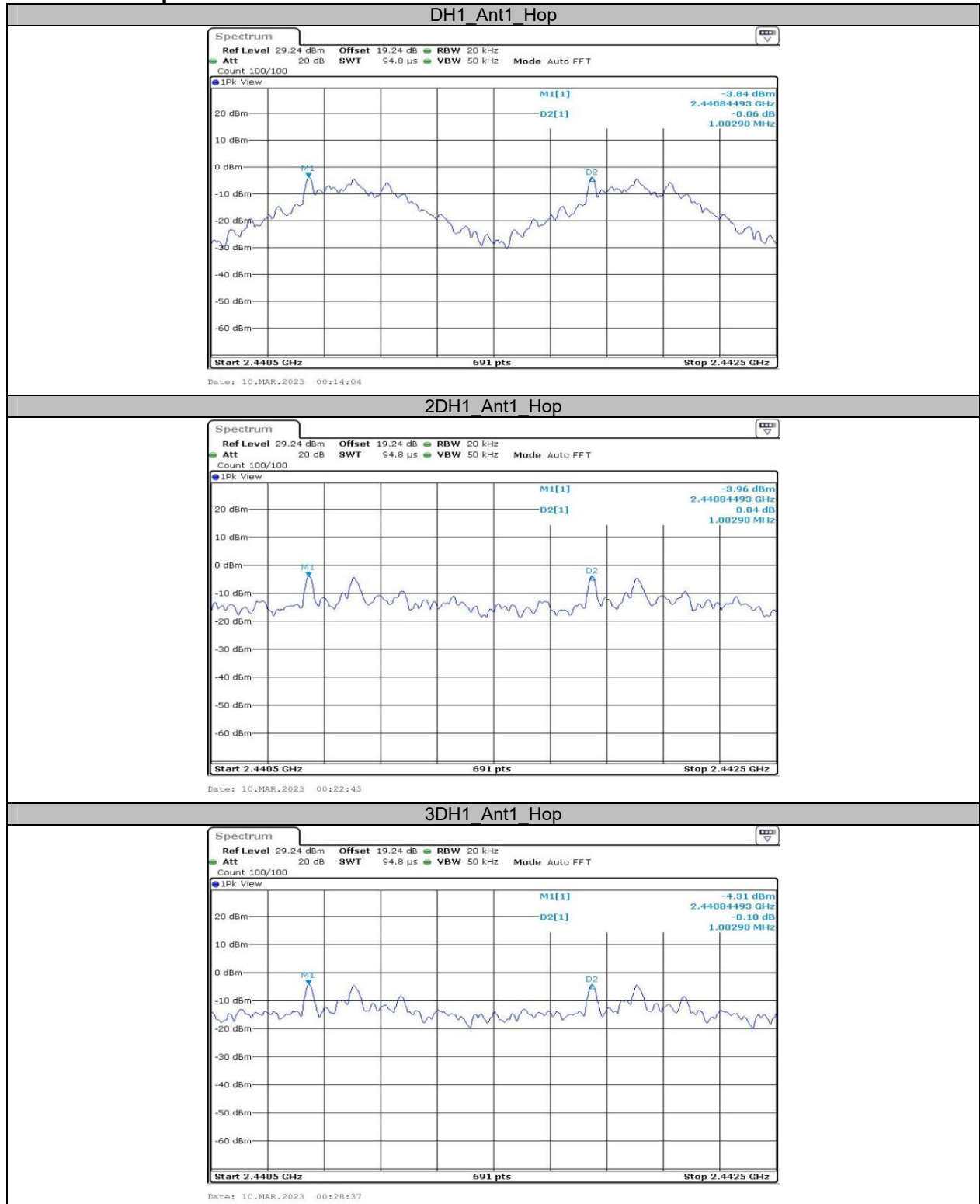


Date: 10.MAR.2023 00:29:05

**Appendix D: Hopping Frequency Separation****Test Result**

Test Mode	Antenna	Channel	Result [MHz]	Limit[MHz]	Verdict
DH1	Ant1	Hop	1.003	0.100	PASS
2DH1	Ant1	Hop	1.003	0.100	PASS
3DH1	Ant1	Hop	1.003	0.100	PASS

## Test Graphs

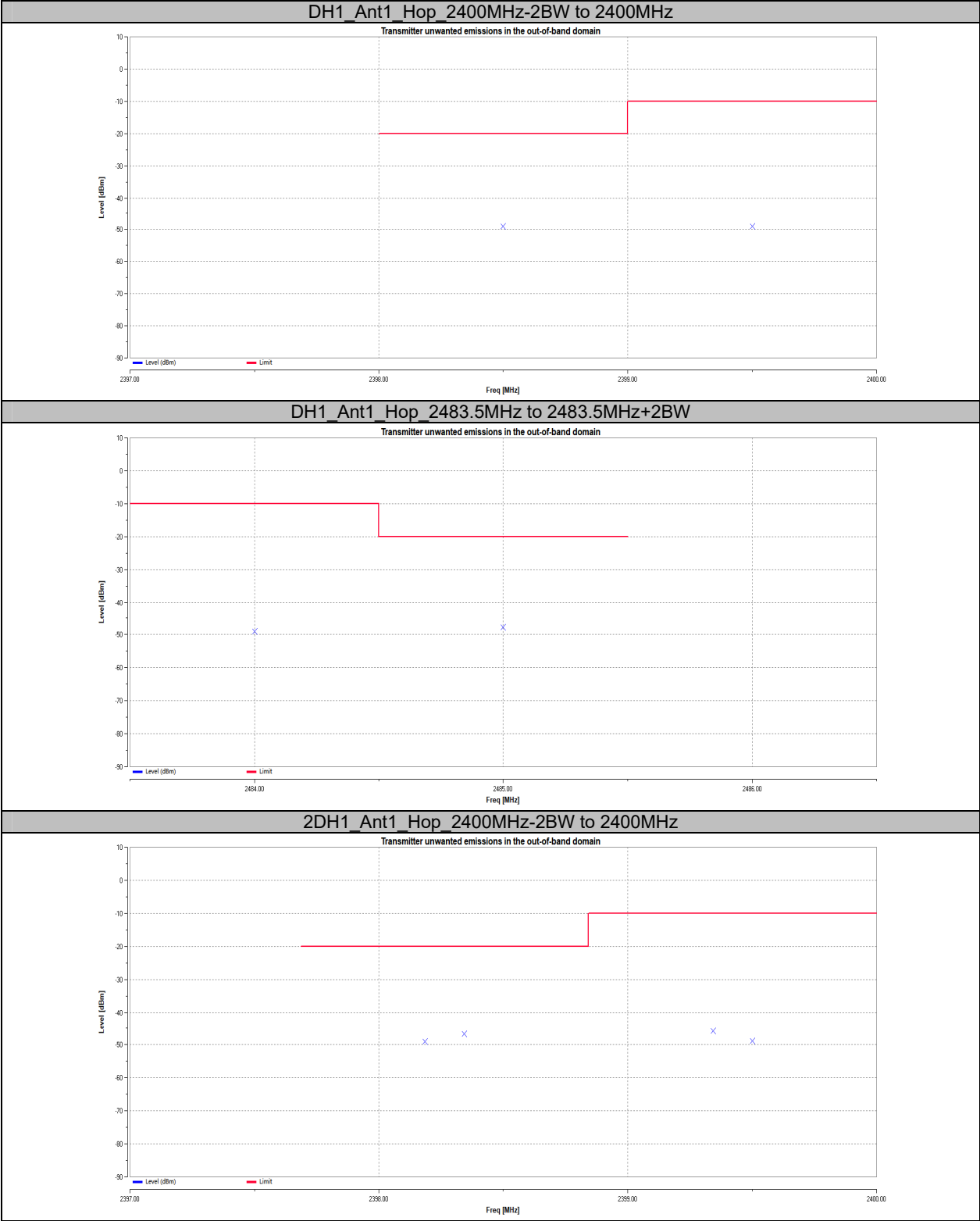


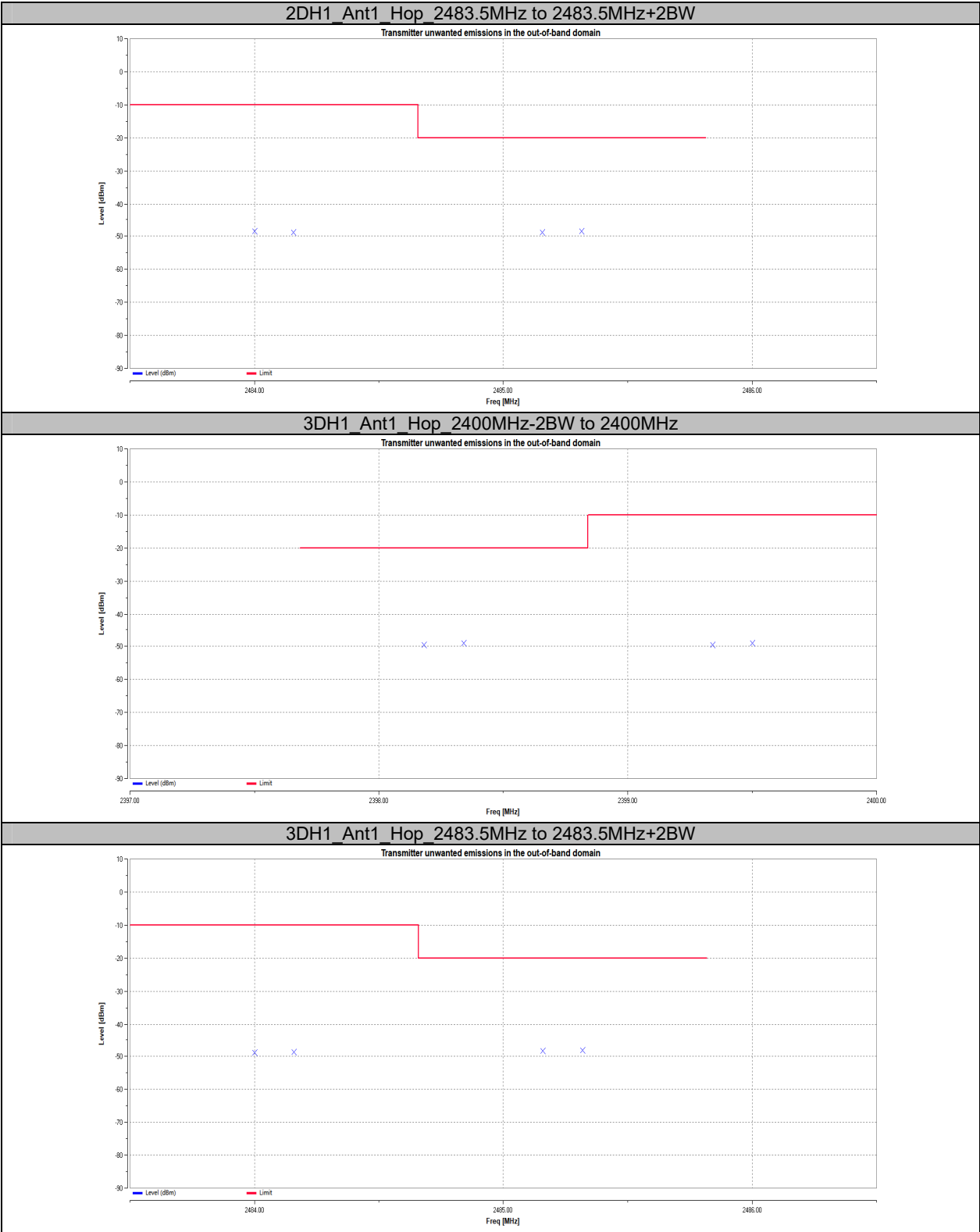
**Appendix E: Transmitter Unwanted Emissions In The Out-Of-Band Domain****Test Result**

Test Mode	Antenna	Channel	Freq. [MHz]	Level[dBm/MHz]	Limit[dBm/MHz]	Verdict
DH1	Ant1	Hop	2398.5	-48.98	-20.00	PASS
			2399.5	-49.11	-10.00	PASS
			2484	-49.02	-10.00	PASS
			2485	-47.85	-20.00	PASS
2DH1	Ant1	Hop	2398.186	-49.09	-20.00	PASS
			2398.343	-46.78	-20.00	PASS
			2399.343	-45.85	-10.00	PASS
			2399.5	-48.77	-10.00	PASS
			2484	-48.47	-10.00	PASS
			2484.157	-48.93	-10.00	PASS
			2485.157	-48.82	-20.00	PASS
			2485.314	-48.49	-20.00	PASS
3DH1	Ant1	Hop	2398.182	-49.60	-20.00	PASS
			2398.341	-49.03	-20.00	PASS
			2399.341	-49.64	-10.00	PASS
			2399.5	-49.08	-10.00	PASS
			2484	-48.87	-10.00	PASS
			2484.159	-48.74	-10.00	PASS
			2485.159	-48.37	-20.00	PASS
			2485.318	-48.19	-20.00	PASS

Note: The antenna gain is 0.5dBi which was added into the final result.

Test Graphs





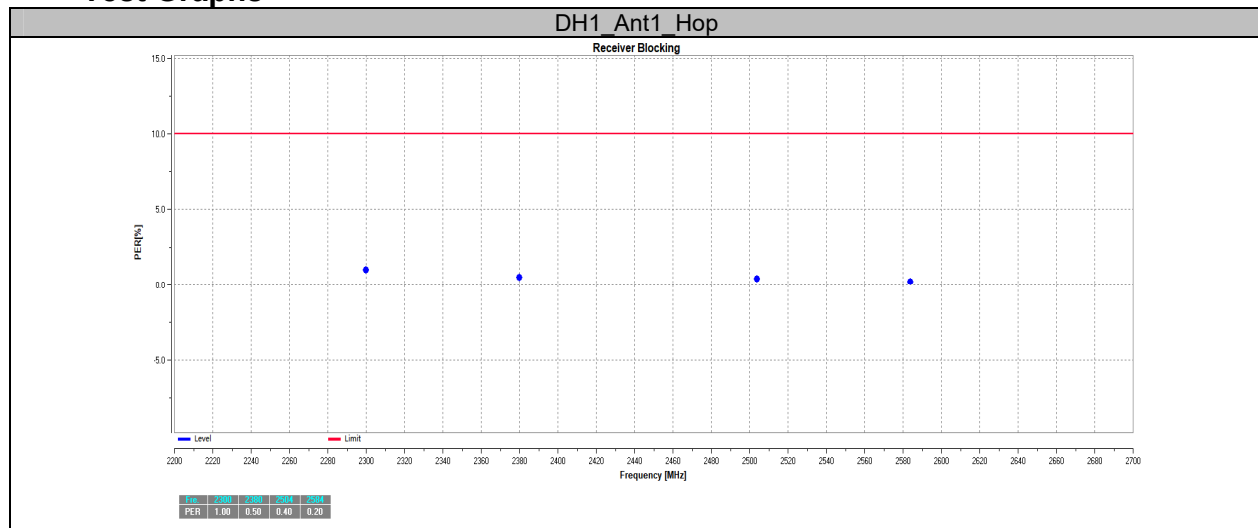
## Appendix F: Receiver Blocking

### Test Result

Test Mode	Antenna	Channel	Pmin [dBm]	Wanted signal [dBm]	Freq. [MHz]	CW [dBm]	PER [%]	Limit [%]	Verdict
DH1	Ant1	Hop	---	-68.50	2300	-33.5	1.00	≤10	PASS
			---	-68.50	2380	-33.5	0.50	≤10	PASS
			---	-68.50	2504	-33.5	0.40	≤10	PASS
			---	-68.50	2584	-33.5	0.20	≤10	PASS

Note: The Maximum EIRP is 1.26dBm<10dBm and the EUT is an adaptive device, so it belongs to the receiver category 2.

### Test Graphs



\*\*\*\*\* END OF REPORT \*\*\*\*\*