# RF Test Report

Report No.: AGC00552180502EE11

| | | |
|---|---|---|
| **PRODUCT DESIGNATION** | : | Smart Phone |
| **BRAND NAME** | : | CUBOT |
| **MODEL NAME** | : | P20 |
| **MANUFACTURER** | : | Shenzhen Huafurui Technology Co., Ltd. |
| **DATE OF ISSUE** | : | Jun. 04, 2018 |
| **STANDARD(S)** | : | EN 300 328 V2.1.1 (2016-11) |
| **REPORT VERSION** | : | V1.0 |

***A***ttestation of ***G***lobal ***C***ompliance (Shenzhen) Co., Ltd

**CAUTION:**
This report shall not be reproduced except in full without the written permission of the test laboratory and shall not be quoted out of context.

# REPORT REVISE RECORD

| Report Version | Revise Time | Issued Date | Valid Version | Notes |
|---|---|---|---|---|
| V1.0 | / | Jun. 04, 2018 | Valid | Initial release |

# TABLE OF CONTENTS

## 1. TEST RESULT CERTIFICATION

| | |
|---|---|
| **Manufacturer** | Shenzhen Huafurui Technology Co., Ltd. |
| **Address** | Unit 1401 &1402, 14/F, Jin qi zhi gu mansion (No. 4 building of Chong wen Garden), Crossing of the Liu xian street and Tang ling road, Tao yuan street, Nan shan district, Shenzhen, P.R. China |
| **Factory Name** | Shenzhen Huafurui Technology Co., Ltd. |
| **Address** | Unit 1401 &1402, 14/F, Jin qi zhi gu mansion (No. 4 building of Chong wen Garden), Crossing of the Liu xian street and Tang ling road, Tao yuan street, Nan shan district, Shenzhen, P.R. China |
| **Product Designation** | Smart Phone |
| **Brand Name** | CUBOT |
| **Test Model** | P20 |
| **Date of test** | May 18, 2018 to May 30, 2018 |
| **Deviation** | None |
| **Condition of Test Sample** | Normal |
| **Report Template** | AGCRT-EC-BLE/RF |

We (AGC), Attestation of Global Compliance (Shenzhen) Co., Ltd. for compliance with the requirements set forth in the European Standard ETSI EN 300 328 V2.1.1. The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

The test results of this report relate only to the tested sample identified in this report.

| | | |
|---|---|---|
| Tested By | Donjon Huang(Huang Dongyang) | May 30, 2018 |
| Reviewed By | Bart Xie(Xie Xiaobin) | Jun. 04, 2018 |
| Approved By | Forrest Lei(Lei Yonggang) Authorized Officer | Jun. 04, 2018 |

# 2. TECHNICAL INFORMATION

## 2.1 EUT DESCRIPTION

| | |
|---|---|
| Operating Frequency Range(s) | 2402MHz~2480MHz |
| Modulation | GFSK |
| Bluetooth Version | V 4.0 |
| Adaptive / non-adaptive equipment | Adaptive Equipment |
| The number of Hopping Frequencies | 40 Channels (37 adaptive automatic frequency hopping data channel, 3 advertising channel) |
| The maximum RF Output Power (e.i.r.p.) | 1.24dBm |
| Hardware Version | HCT-S590MB-A2 |
| Software Version | CUBOT_P20_8023C_V02_20180504 |
| Antenna designation | PIFA antenna |
| Antenna gain | 3.9dBi |
| Nominal voltages | DC 3.8V by battery |
| The extreme operating conditions | Operating temperature range: -20°C~55°C |

**Note:**

1. The above information was declared by the applicant.
2. The equipment submitted are representative production models.
3. The EUT can not operated unmodulated.
4. The EUT provides Bluetooth wireless interface operating at 2.4G ISM band (2402MHZ-2480MHZ).
5. Only the Bluetooth was tested according the standard requirement.
6. The EUT is a multi-radio equipment and hand-portable station according to ETSI EN 300 328 V2.1.1.
7. Please refer to Appendix Ⅰ for the photographs of the EUT. For more details, please refer to the User's manual of the EUT.

## 2.2 OBJECTIVE

Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU for the FHSS function of the EUT.

## 2.3 TEST STANDARDS AND RESULTS

The EUT has been tested according to ETSI EN 300 328 V2.1.1 (2016-11).

| | |
|---|---|
| ETSI EN 300 328 V2.1.1 (2016-11) | Wideband transmission systems;<br>Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; |

## 2.4. TEST ITEMS AND THE RESULTS

| No. | Basic Standard | Test Type | Result |
|---|---|---|---|
| 1 | ETSI EN 300 328 4.3.2.2 | RF Output Power | Pass |
| 2 | ETSI EN 300 328 4.3.2.3 | Power Spectral Density | Pass |
| 3 | ETSI EN 300 328 4.3.2.4 | Duty Cycle, Tx-sequence, Tx-gap | N/A |
| 4 | ETSI EN 300 328 4.3.2.4 | Medium Utilisation(MU) factor | N/A |
| 5 | ETSI EN 300 328 4.3.2.6 | Adaptivity | N/A |
| 6 | ETSI EN 300 328 4.3.2.7 | Occupied Channel Bandwidth | Pass |
| 7 | ETSI EN 300 328 4.3.2.8 | Transmitter unwanted emissions in the out-of-band domain | Pass |
| 8 | ETSI EN 300 328 4.3.2.9 | Transmitter unwanted emissions in the spurious domain | Pass |
| 9 | ETSI EN 300 328 4.3.2.10 | Receiver spurious emissions | Pass |
| 10 | ETSI EN 300 328 4.3.2.11 | Receiver Blocking | Pass |

**Note:**

1. N/A- Not Applicable.
2. The latest versions of basic standards are applied.

# 3. DETAILS OF TEST

## 3.1 IDENTIFICATION OF THE RESPONSIBLE TESTING LOCATION

| | |
|---|---|
| Company Name: | Attestation of Global Compliance (Shenzhen) Co., Ltd. |
| Address: | 2/F., Building 2, No.1-No.4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Bao'an District, Shenzhen, Guangdong, China |

## 3.2 LIST OF EQUIPMENTS USED

| Description | Manufacturer | Model No. | S/N | Calibration Date | Calibration Due. |
|---|---|---|---|---|---|
| SIGNAL ANALYZER | Agilent | N9020A | MY52090123 | Sep. 21, 2017 | Sep. 20, 2018 |
| SIGNAL GENERATOR | Agilent | N5182A | MY50140530 | Sep. 21, 2017 | Sep. 20, 2018 |
| SIGNAL GENERATOR | Agilent | E8257D | MY45141029 | Sep. 21, 2017 | Sep. 20, 2018 |
| USB Wideband Power Sensor | Agilent | U2021XA | MY54110007 | Sep. 21, 2017 | Sep. 20, 2018 |
| USB Wideband Power Sensor | Agilent | U2021XA | MY54110009 | Sep. 21, 2017 | Sep. 20, 2018 |
| USB Wideband Power Sensor | Agilent | U2021XA | MY54110014 | Sep. 21, 2017 | Sep. 20, 2018 |
| USB Wideband Power Sensor | Agilent | U2021XA | MY54110012 | Sep. 21, 2017 | Sep. 20, 2018 |
| USB Simultaneous Sampling Multifunction DAQ | Agilent | U2531A | MY5211038 | Sep. 21, 2017 | Sep. 20, 2018 |
| 2.4 GHz Filter | Micro-Tronics | BRM50702 | 017 | Mar. 01, 2018 | Feb. 28, 2019 |
| VECTOR ANALYZER | Agilent | E4440A | MY44303916 | June 29, 2017 | June 28,2018 |
| Trilog-Broadband Antenna | SCHWARZBEK | VULB 9168 | VULB 9168-492 | Mar. 01, 2018 | Feb. 28, 2020 |
| Trilog-Broadband Antenna | SCHWARZBEK | VULB 9168 | VULB 9168-494 | Mar. 01, 2018 | Feb. 28, 2020 |
| Amplifier | EM | EM30180 | 060552 | Mar. 01, 2018 | Feb. 28, 2019 |
| Horn Antenna | EM | EM-AH-10180 | 67 | Mar. 01, 2018 | Feb. 28, 2020 |

## 3.3 ENVIRONMENTAL CONDITIONS

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

- Temperature: 15-35ºC
- Humidity: 30-60 %
- Atmospheric pressure: 86-106 kPa

### 3.4 MEASUREMENT UNCERTAINTY

The uncertainty is calculated using the methods suggested in the “Guide to the Expression of Uncertainty in Measurement” (GUM) published by ISO.

- Uncertainty of Radio Frequency, Uc=±1 x $10^{-5}$
- Uncertainty of total RF power, conducted, Uc = ±1.5dB
- Uncertainty of RF power density, conducted, Uc = ±3dB
- Uncertainty of spurious emissions, conducted, Uc = ±3dB
- Uncertainty of all emissions, radiated, Uc = ±6dB
- Uncertainty of Temperature: ±1° C
- Uncertainty of Humidity: ±5 %
- Uncertainty of DC and low frequency voltages: ±3 %

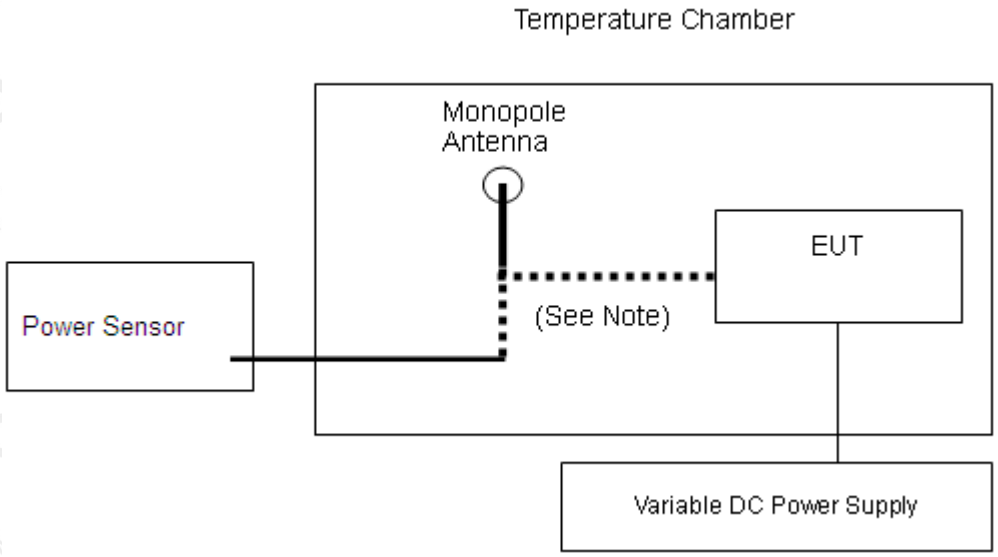
# 4. ETSI EN 300 328 REQUIREMENTS

## 4.1 RF OUTPUT POWER

**EN 300 328 Clause 4.3.2.2**

For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be 20 dBm.
The maximum RF output power for non-adaptive equipment shall be declared by the supplier and shall not exceed 20 dBm. See clause 5.3.1 m). For non-adaptive equipment using wide band modulations other than FHSS, the maximum 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**




***Remarks:***
EUT was direct connected to test equipment through coupling device.

**TEST PROCEDURE**

1) Use a fast power sensor and set the samples speed 1MS/s or faster.
2) Connect one power sensor to each transmit port, Trigger the power sensors so that they start sampling at the same time. For each instant in time, sum the power of the individual samples of all ports and store them. Use these stored samples in all following steps.
3) Find the start and stop times of each burst in the stored measurement samples.
4) Between the start and stop times of each individual burst calculate the RMS power over the burst. Save these Pburst values, as well as the start and stop times for each burst.
5) The highest of all Pburst values (Value “A” in dBm) will be used for maximum e.i.r.p calculations.
6) The cable loss and attenuator factor shall be considered to the value “A”.
6) Add the (stated) antenna assembly gain “G” in dBi of the individual antenna. If applicable, add the additional beamforming gain “Y” in dB.

7) The RF output power (P) shall be calculated using the formula: P=A+G+Y

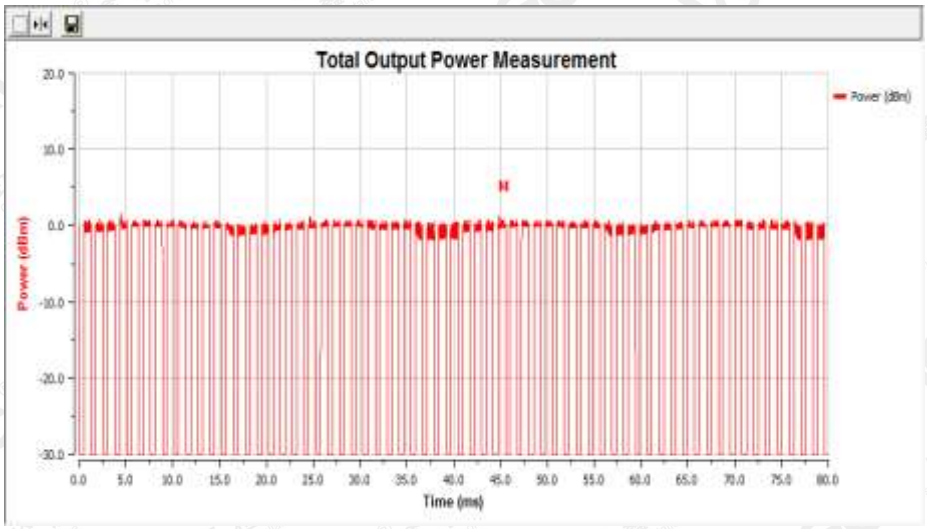
**TEST RESULTS**

| | | | |
|---|---|---|---|
| Operation Mode: | TX | Test Date: | May 28, 2018 |
| Temperature: | 23.4°C | Tested by: | Donjon |
| Humidity: | 56.4% RH | | |
| Number of Burst | | = 10 | |
| Measurement Time | | = 45.53ms | |

| TEST CONDITIONS | RF OUTPUT POWER (dBm) | | |
|---|---|---|---|
| | Temp (25)°C | Temp (-20)°C | Temp (55)°C |
| CHANNEL | DC 3.8V | DC 3.8V | DC 3.8V |
| Low Channel TX | **1.24** | 1.15 | 1.01 |
| Middle Channel TX | -1.07 | -1.30 | -1.16 |
| High Channel TX | -1.77 | -1.76 | -2.03 |
| Limit | 20dBm | | |

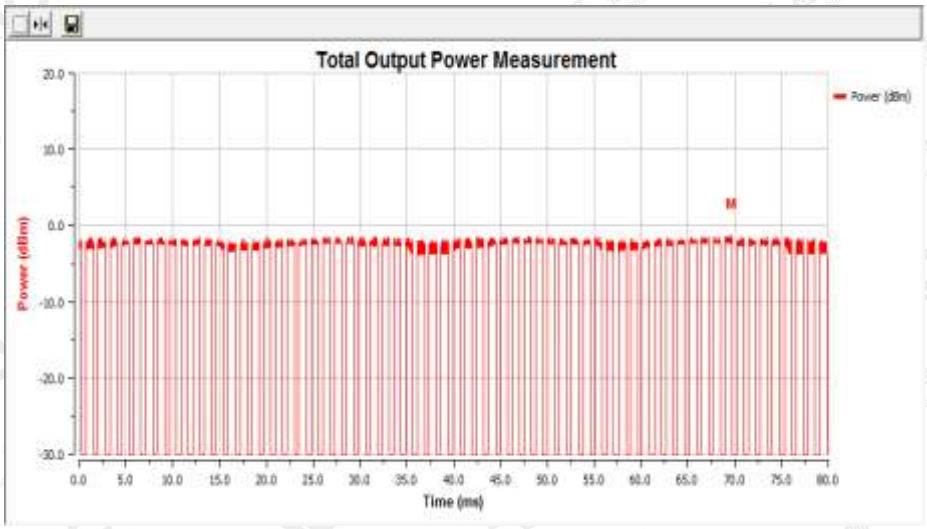
## 1*BLE:CH Low-2402: ( Temp - Normal )

| Channel | Voltage | Conducted Power (dBm) | EIRP (dBm) |
|---|---|---|---|
| CH Low-2402 | Normal | -2.66 | 1.24 |



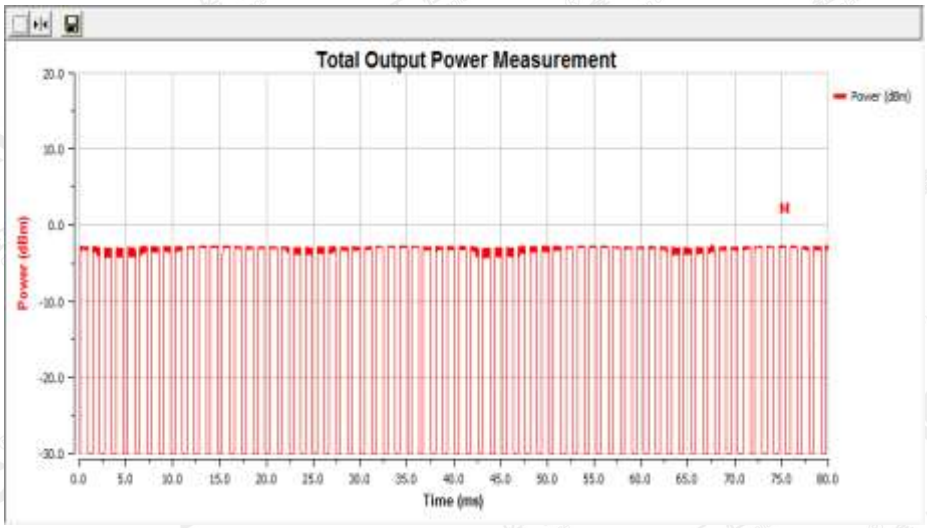
## 2*BLE:CH Mid-2440: ( Temp - Normal )

| Channel | Voltage | Conducted Power (dBm) | EIRP (dBm) |
|---|---|---|---|
| CH Mid-2440 | Normal | -4.97 | -1.07 |




## 3*BLE:CH High-2480: ( Temp - Low)

| Channel | Voltage | Conducted Power (dBm) | EIRP (dBm) |
|---|---|---|---|
| CH High-2480 | Normal | -5.66 | -1.76 |




**Note:** Result=Reading+ Ant. Gain
The reading value included cable loss.

**Conclusion: PASS**

## 4.2. POWER SPECTRAL DENSITY
## EN 300 328 Clause 4.3.2.3

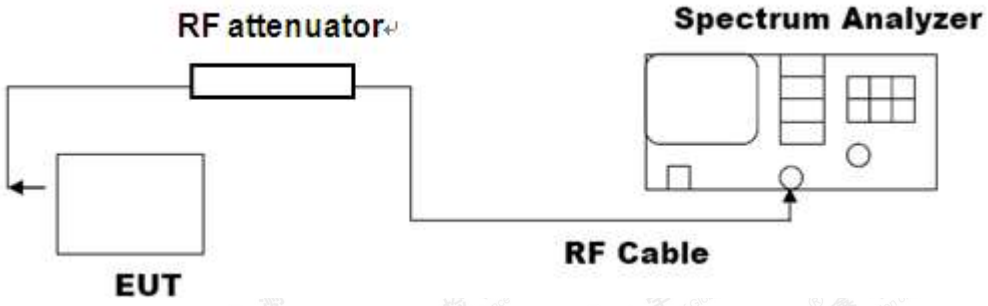
### 4.2.1 LIMIT

For non-adaptive equipment using wide band modulations other than FHSS, The maximum Power spectral density is limited to 10mW Per MHz

### 4.2.2 TEST PROCEDURE

1) Set the frequency from 2400MHz to 2483.5MHz, use 10kHz RBW and 30kHz VBW for pre-scan. The number of sweep points shall be more than 8350. Wait for the trace to be completed and save the (trace) data set to a file.
2) Add up the values for amplitude (power) for all the samples in the file.
3) Normalize the individual values for amplitude so that the sum is equal to the RF Output Power(e.i.r.p) measured in 5.1.
4)Starting from the first sample in the file (lowest frequency), add up the power of the following samples representing a 1MHz segment and record the results for power and position (i.e. sample #1 to #100). This is the Power Spectral Density (e.i.r.p) for the first 1MHz segment which shall be recorded.
5) Shift the start point of the samples added up in step 5 by 1 sample and repeat the procedure in step 4(i.e. sample #2 to #101).
6) Repeat step 5 until the end of the data set and record the radiated power spectral Density values for each of the 1MHz segments.
7) The cable loss and attenuator factor shall be considered to the test result.
8) The highest value shall be recorded in the test report.

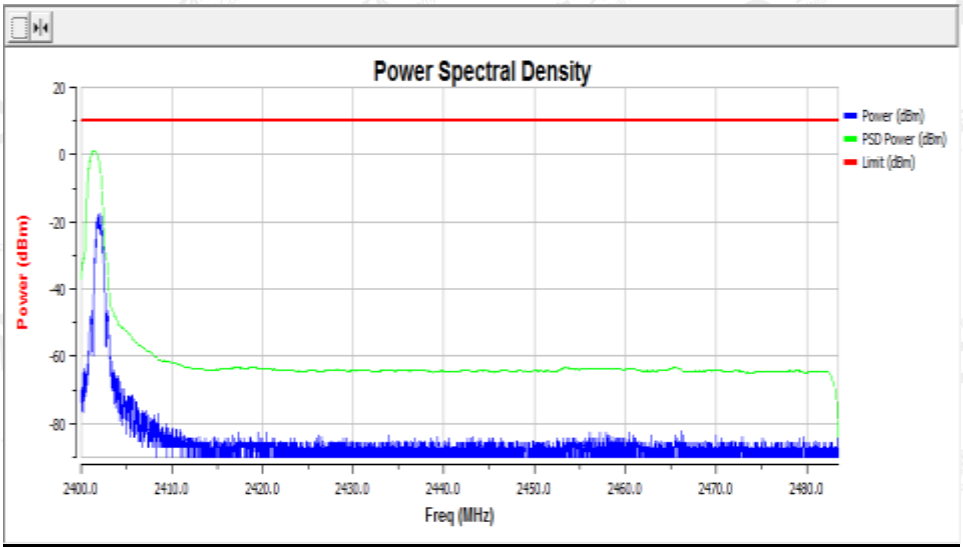
### 4.2.3 TEST CONFIGURATION



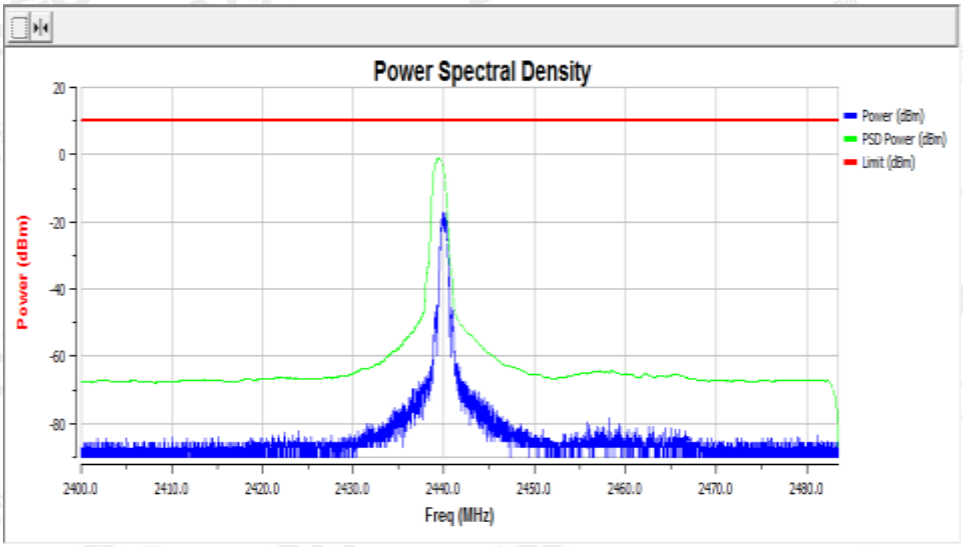
## TEST RESULTS

| PEAK POWER DENSITY | | | |
|---|---|---|---|
| **Channel Tested** | **Power Density (dBm/MHz)** | **Test Limit (dBm/MHz)** | **Pass / Fail** |
| Low Channel TX | 1.19 | 10 | Pass |
| Middle Channel TX | -1.12 | 10 | Pass |
| High Channel TX | -1.82 | 10 | Pass |

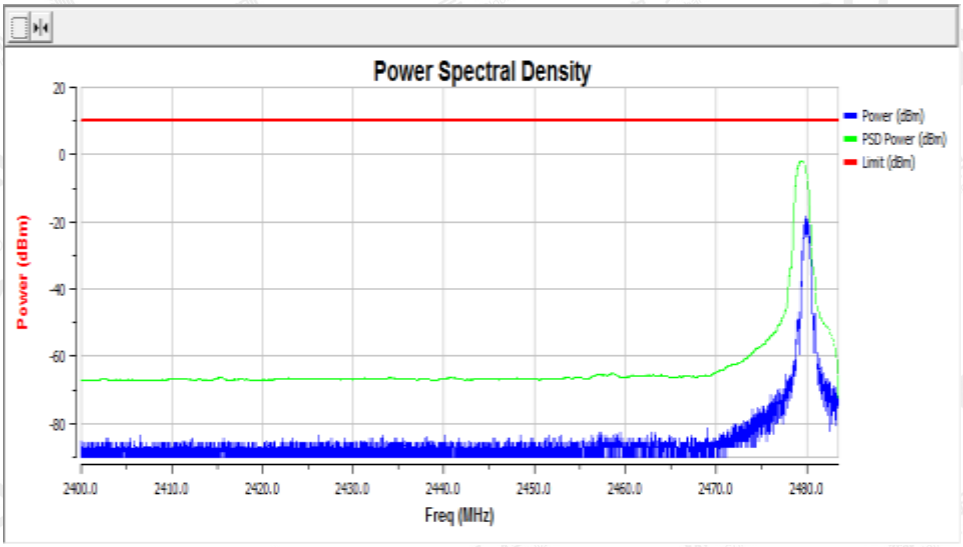
| Channel | Max Power Spectral Density Level (dBm) |
|---|---|
| CH Low-2402 | 1.19 |




| Channel | Max Power Spectral Density Level (dBm) |
|---|---|
| CH Mid-2440 | -1.12 |



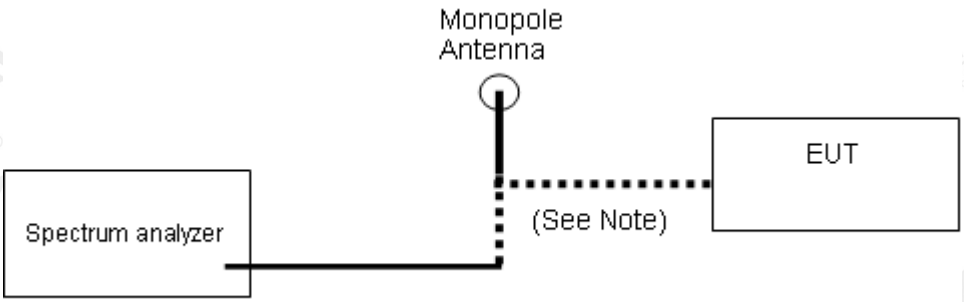
| Channel | Max Power Spectral Density Level (dBm) |
|---|---|
| CH High-2480 | -1.82 |



## 4.3 OCCUPIED CHANNEL BANDWIDTH

EN300328 4.3.2.7 OCCUPIED CHANNEL BANDWIDTH
The Occupied Channel Bandwidth is the bandwidth that contains 99 % of the power of the signal.

**CONFIGURATION**



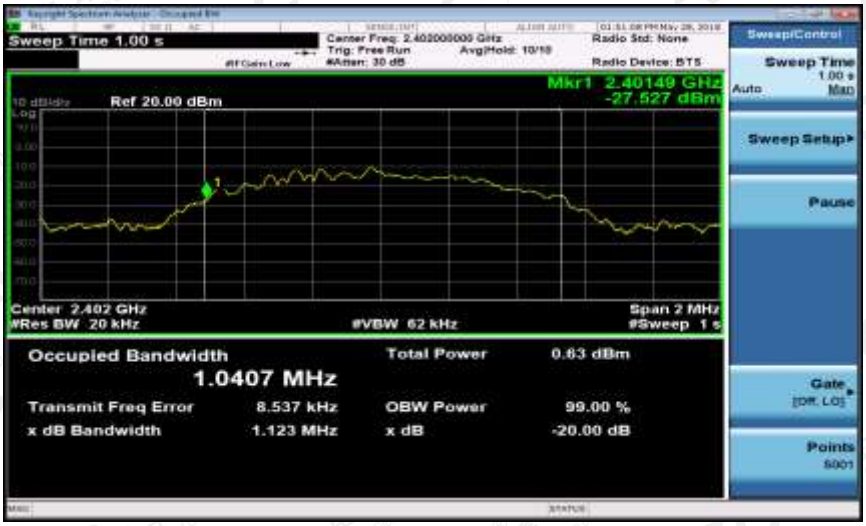

**TEST PROCEDURE**

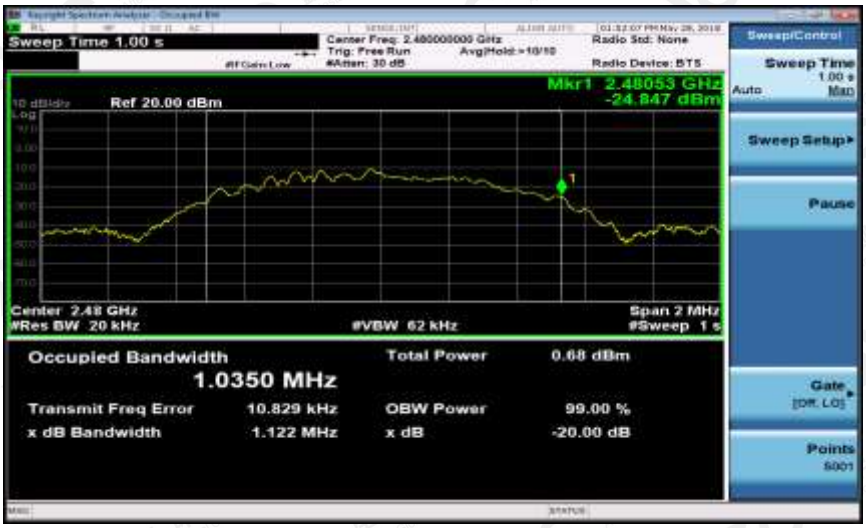
1) The spectrum analyser shall be used the following settings:
   Centre Frequency: The centre frequency of the channel under test
   Resolution BW: ~1% of the span without going below 1%
   Video BW: 3×RBW
   Span: 2×OBW
   Detector: RMS
   Trace mode: Max Hold
2) Wait until the trace is completed, find the peak value of the trace and place the analyser marker on this peak.
3) Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded.

**TEST RESULT**

| | |
|---|---|
| **TEST ITEM** | OCCUPIED CHANNEL BANDWIDTH |
| **TEST MODE** | GFSK MODULATION |

| **MEASUREMENT RESULT** | | |
|---|---|---|
| **Test Data (MHz)** | | **Criteria** |
| Low Channel | 1.041 | PASS |
| High Channel | 1.035 | PASS |



## 4.4 TRANSMITTER UNWANTED EMISSIONS IN THE OUT OF BAND DOMAIN

ETSI EN300328 SUBCLAUSE 4.3.2.8

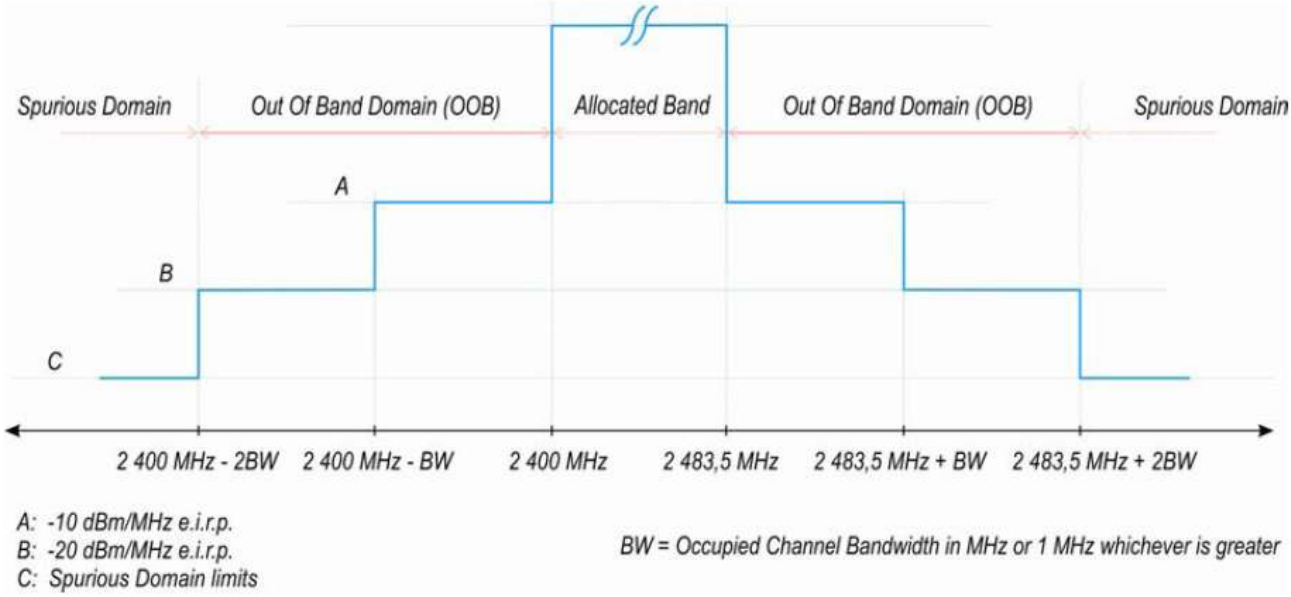
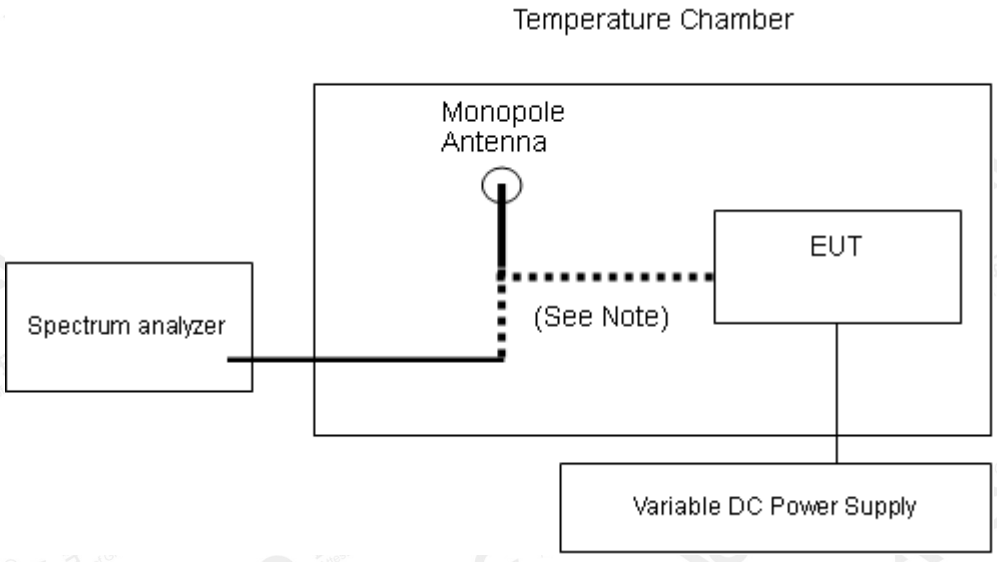
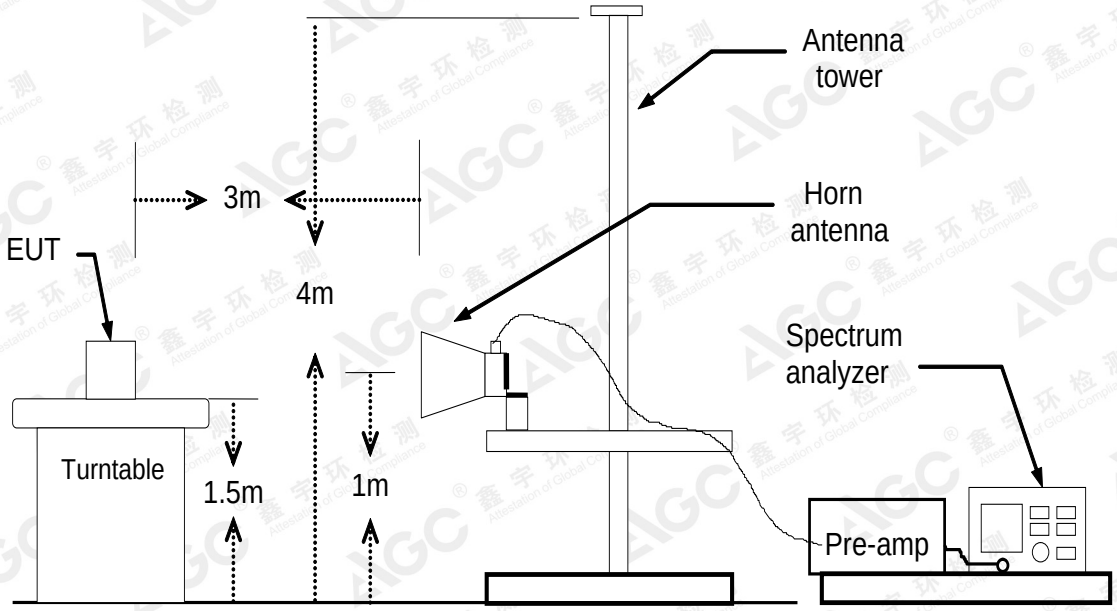



**Figure 1: Transmit mask**

**TEST CONFIGURATION**




For have temporary antenna connector product




For have no temporary antenna product

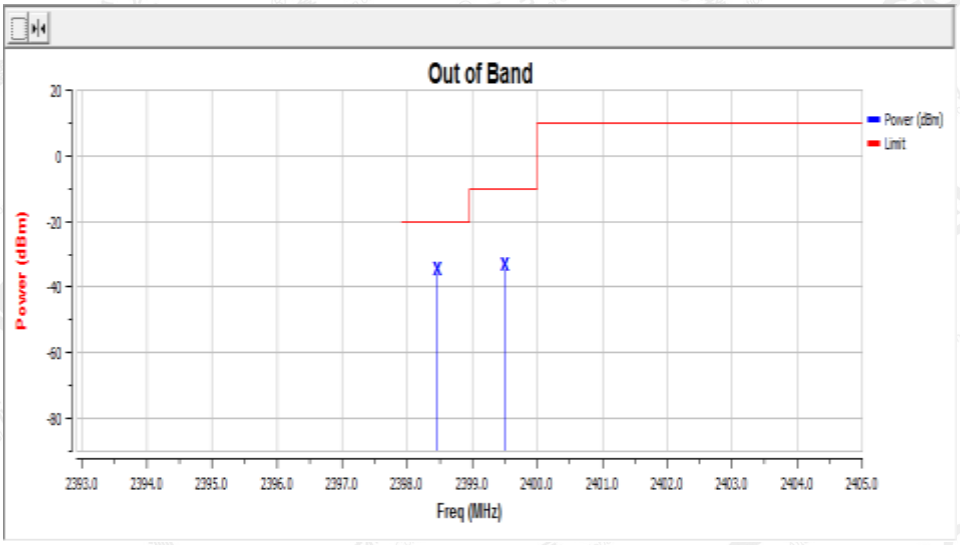
**TEST PROCEDURE**

1) The spectrum analyser shall be used the following settings:
   Centre Frequency: 2484MHz
   Resolution BW: 1MHz; Video BW: 3MHz; Span: 0Hz; Detector: RMS
   Trace mode: Max Hold; Sweep Points: 5000
2) (segment 2 483.5 MHz to 2 483.5 MHz + BW)
   Adjust the trigger level to select the transmissions with the highest power level.
   Increase the centre frequency in steps of 1 MHz and repeat this measurement for every 1 MHz segment within the range 2 483.5 MHz to 2 483.5 MHz + BW.
3) Segment 2 483.5 MHz + BW to 2 483.5 MHz + 2BW
   Change the centre frequency of the analyser to 2 484 MHz + BW and perform the measurement for the first 1 MHz segment within range 2 483.5 MHz + BW to 2 483.5 MHz + 2BW. Increase the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + 2 BW – 0.5 MHz.
4) Segment 2 400 MHz - BW to 2 400 MHz
   Change the centre frequency of the analyser to 2 399.5 MHz and perform the measurement for the first 1 MHz segment within range 2 400 MHz - BW to 2 400 MHz Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2BW + 0.5 MHz.
5) Segment 2 400 MHz - 2BW to 2 400 MHz - BW
   Change the centre frequency of the analyser to 2 399,5 MHz - BW and perform the measurement for the first 1 MHz segment within range 2 400 MHz - 2BW to 2 400 MHz - BW. Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2BW + 0.5 MHz.
6) The cable loss and attenuator factor shall be considered to the test result.

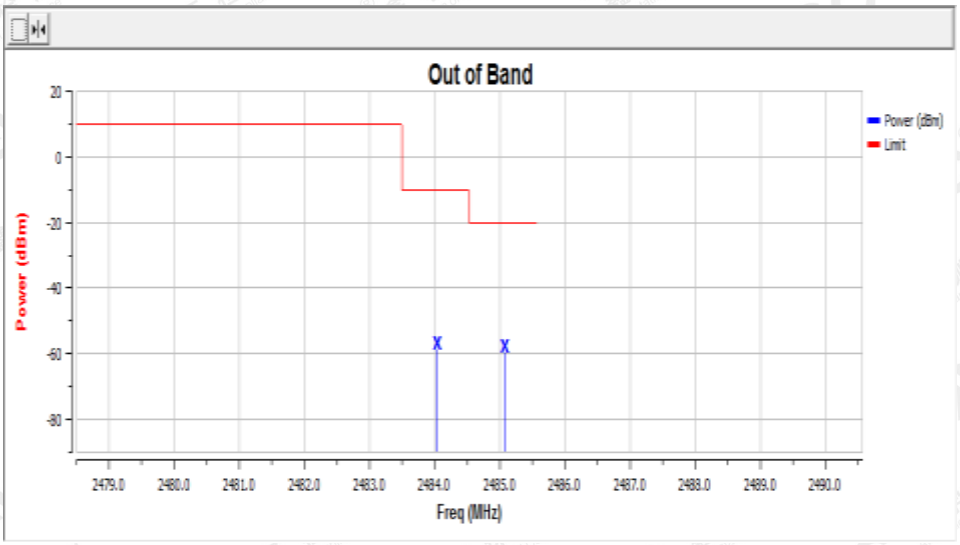
**TEST RESULT**

**NORMAL TEMPERATURE**

| Channel | Antenna | Frequency | Level | Limit |
|---|---|---|---|---|
| CH Low-2402 | Antenna 1 | 2399.5 | -34.77 | -10 |
| CH Low-2402 | Antenna 1 | 2398.459 | -36.33 | -20 |

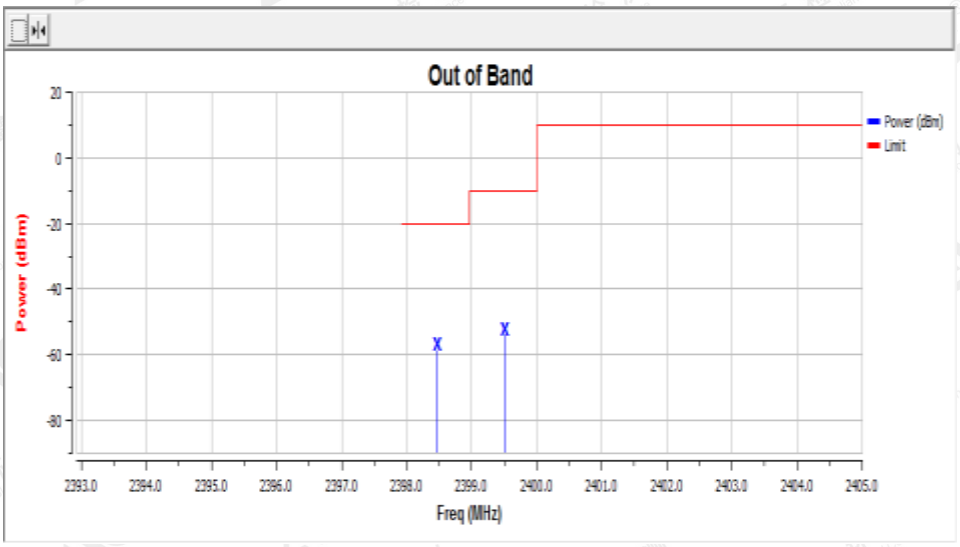



| Channel | Antenna | Frequency | Level | Limit |
|---|---|---|---|---|
| CH High-2480 | Antenna 1 | 2484.035 | -58.84 | -10 |
| CH High-2480 | Antenna 1 | 2485.07 | -59.7 | -20 |

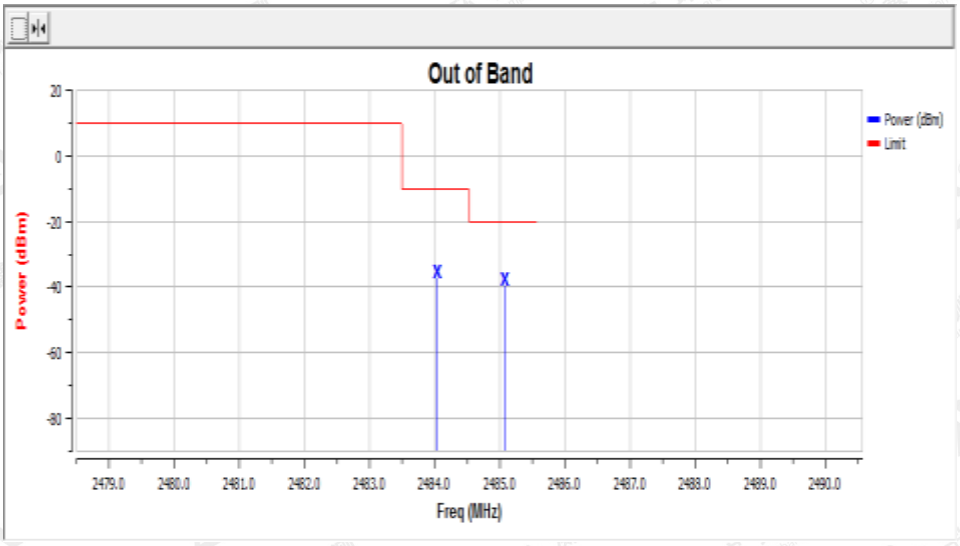


## LOW TEMPERATURE

| Channel | Antenna | Frequency | Level | Limit |
|---|---|---|---|---|
| CH Low-2402 | Antenna 1 | 2399.5 | -54.06 | -10 |
| CH Low-2402 | Antenna 1 | 2398.465 | -58.88 | -20 |

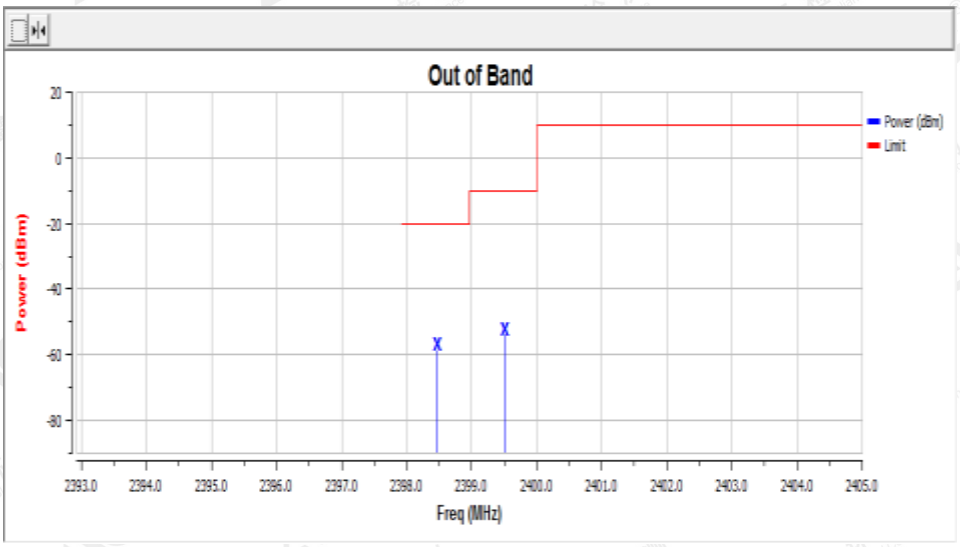



| Channel | Antenna | Frequency | Level | Limit |
|---|---|---|---|---|
| CH High-2480 | Antenna 1 | 2484.035 | -37.3 | -10 |
| CH High-2480 | Antenna 1 | 2485.07 | -39.71 | -20 |

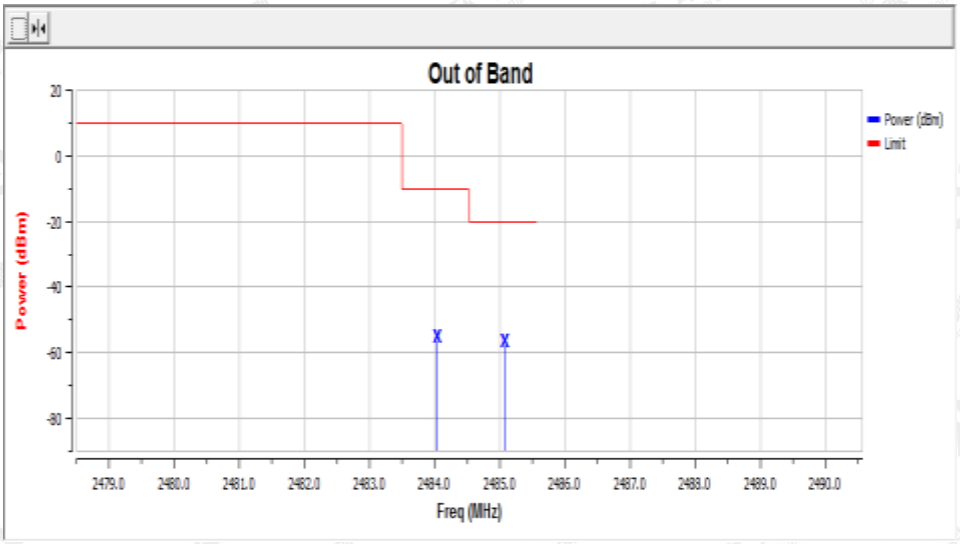


**HIGH TEMPERATURE**

| Channel | Antenna | Frequency | Level | Limit |
|---|---|---|---|---|
| CH Low-2402 | Antenna 1 | 2399.5 | -54.07 | -10 |
| CH Low-2402 | Antenna 1 | 2398.465 | -58.84 | -20 |




| Channel | Antenna | Frequency | Level | Limit |
|---|---|---|---|---|
| CH High-2480 | Antenna 1 | 2484.035 | -56.88 | -10 |
| CH High-2480 | Antenna 1 | 2485.07 | -58.01 | -20 |




**Note:** The modulation used during test is GFSK at high channel and this is the worst case.
**Conclusion: PASS**

## 4.5 TRANSMITTER SPURIOUS EMISSIONS

Spurious emissions are emissions outside the frequency range(s) of the equipment as defined in Clause 4.3.2.9.

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 spurious emissions of the transmitter shall not exceed the values in tables in the indicated bands:

| Frequency Range | Maximum Power e.r.p(<=1GHz)/e.i.r.p(>1GHz) | Bandwidth |
|---|---|---|
| 30MHZ to 47MHZ | -36dBm | 100kHz |
| 47MHZ to 74MHZ | -54dBm | 100kHz |
| 74MHZ to 87.5MHZ | -36dBm | 100kHz |
| 87.5MHZ to 118MHZ | -54dBm | 100kHz |
| 118MHZ to 174MHZ | -36dBm | 100kHz |
| 174 MHZ to 230MHZ | -54dBm | 100kHz |
| 230 MHZ to 470MHZ | -36dBm | 100kHz |
| 470 MHZ to 862MHZ | -54dBm | 100kHz |
| 862 MHZ to 1GHZ | -36dBm | 100kHz |
| 1 GHZ to 12.75GHZ | -30dBm | 1MHz |

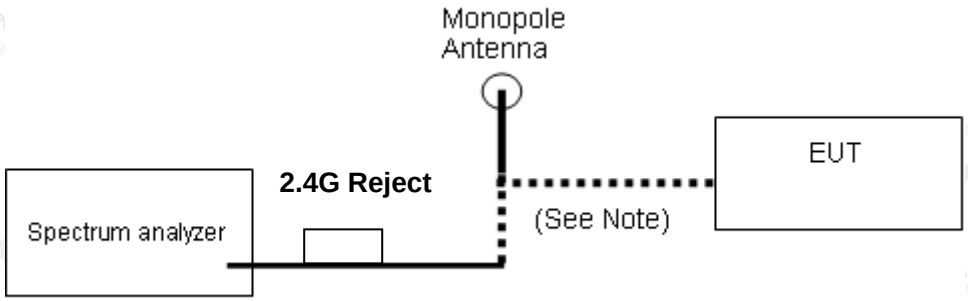
**TEST PROCEDURE**

Refer to chapter5.4.9.2 of ETSI EN 300 328 V2.1.1

**Measurement**

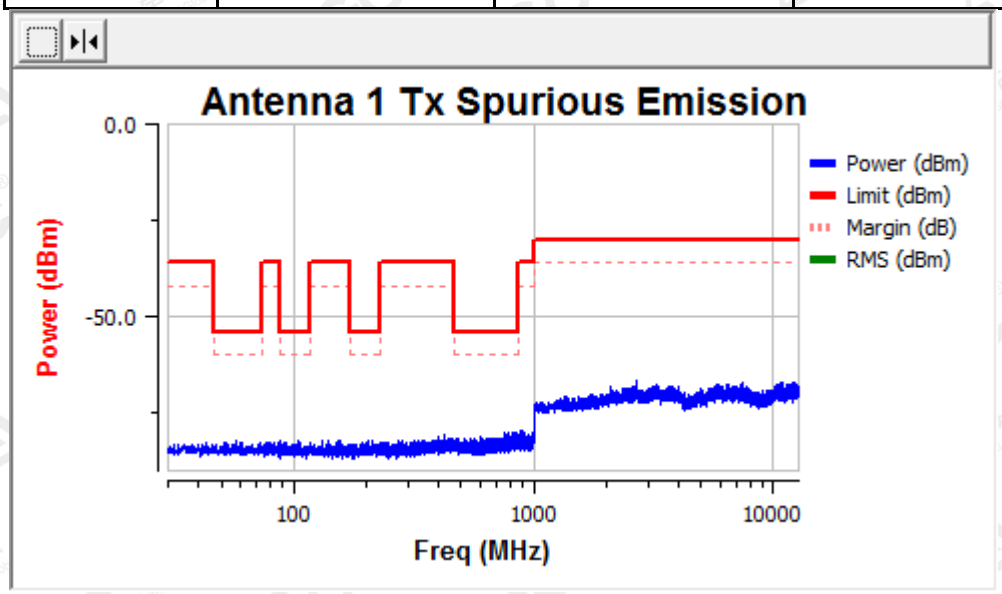
| Measurement | |
|---|---|
| ☒Conducted measurement | ☒Radiated measurement |

## TEST CONFIGURATION



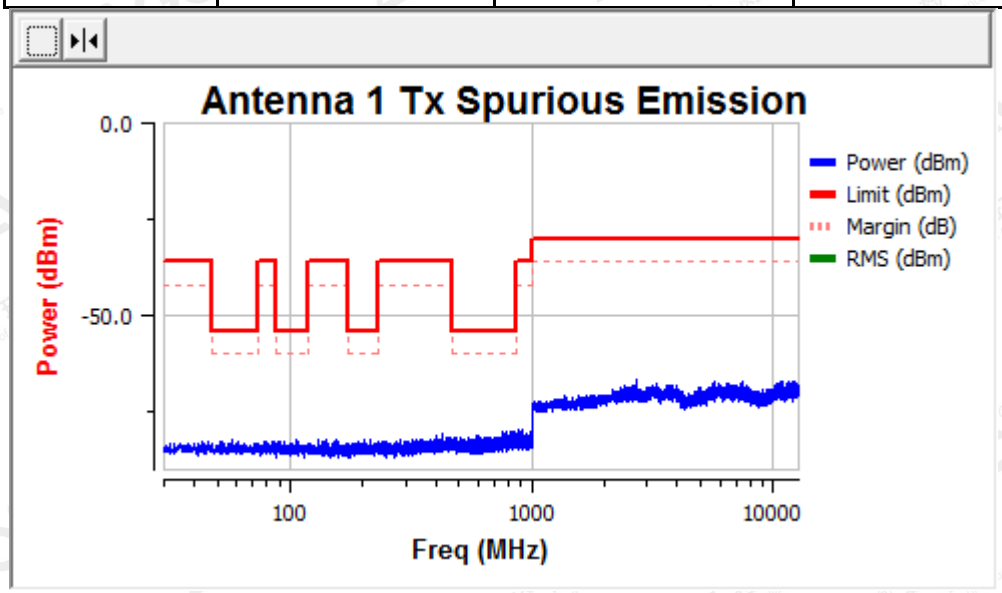
**CONDUCTED RESULTS: (Low channel)**

| Freq | RMS Level (dBm) | Limit (dBm) | Over Limit (dB) | Status |
|---|---|---|---|---|
| 790.628 | -80.60 | -54.00 | -26.60 | Pass |
| 1889.000 | -51.49 | -30.00 | -21.49 | Pass |




**(High channel)**

| Freq | RMS Level (dBm) | Limit (dBm) | Over Limit (dB) | Status |
|---|---|---|---|---|
| 817.383 | -81.48 | -54.00 | -27.48 | Pass |
| 1949.000 | -53.23 | -30.00 | -23.23 | Pass |




*Note: 1. All the modes had been test but only the worst data record in the report.*

*2.The 2.4G fundamental frequency is filtered out.*

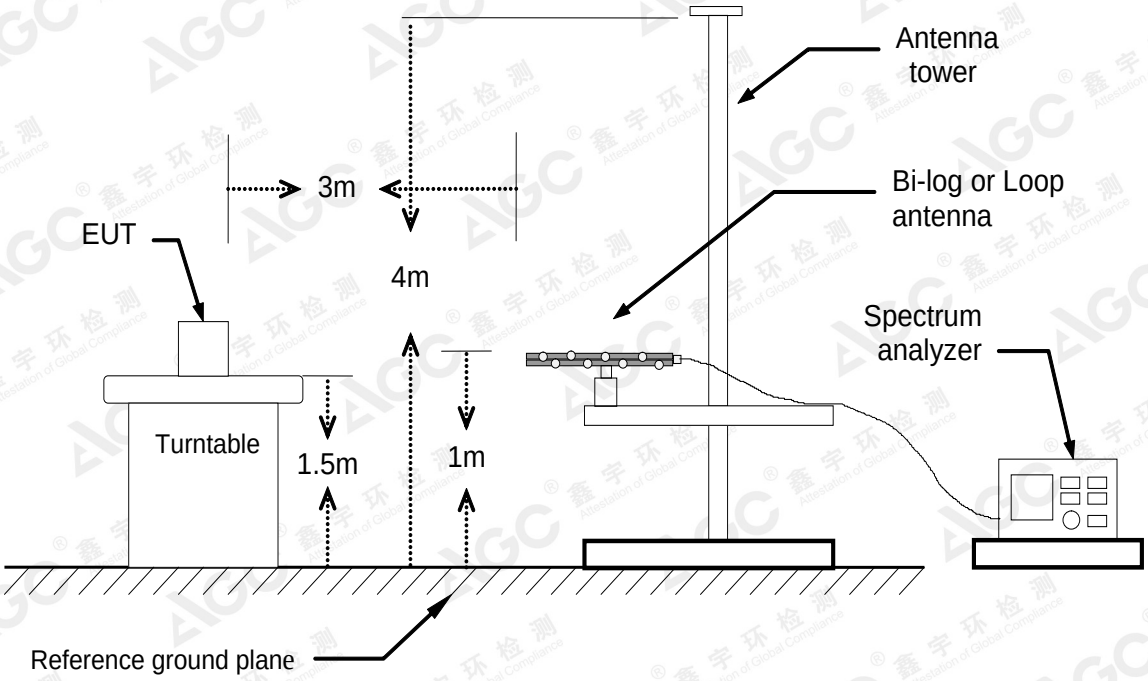
*3. The effective radiated power has been considered in this test.*

## RADIATED MEASUREMENT

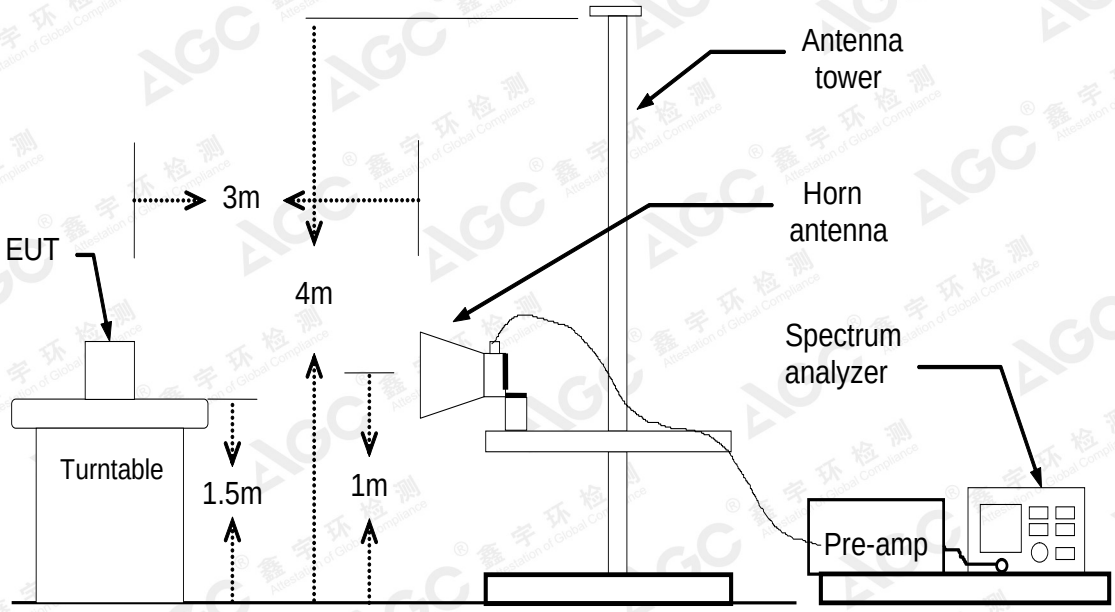
### TEST SETUP

1. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).
2. The measurements were performed when normal hopping was disabled. In this case measurements were performed when operating at the lowest and the highest hopping frequency.
3. The equipment was configured to operate under its worst case situation with respect to output power.
4. The test setup has been constructed as the normal use condition. Controlling software (Button Function) has been activated to set the EUT on specific status.

**Below 1GHz**



**Above 1GHz**



**TEST RESULTS for Radiated Method**

**Transmitter Operating Mode (Worst case: 1Mbps)**

| SPURIOUS EMISSION FREQUENCY RANGE | 30MHz ~ 1GHz | OPERATING CHANNEL | Low |
|---|---|---|---|

| Frequency (MHz) | Antenna Polarization | Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|
| 33.41 | H | -64.92 | -36 | -28.92 |
| 56.62 | H | -69.6 | -54 | -15.6 |
| 156.8 | H | -65.2 | -36 | -29.2 |
| 290.84 | H | -70.63 | -36 | -34.63 |
| 560.33 | H | -68.46 | -54 | -14.46 |
| 966.98 | H | -65.05 | -36 | -29.05 |
| 55.9 | V | -69.45 | -54 | -15.45 |
| 206.44 | V | -69.39 | -54 | -15.39 |
| 147.89 | V | -64.91 | -36 | -28.91 |
| 176.01 | V | -65.62 | -54 | -11.62 |
| 298.04 | V | -72.44 | -36 | -36.44 |
| 881.79 | V | -65.73 | -36 | -29.73 |
| 30MHz ~ 1GHz | H | -- | -36 | >10 |
| 30MHz ~ 1GHz | V | -- | -36 | >10 |
| 30MHz ~ 1GHz | H | -- | -54 | >10 |
| 30MHz ~ 1GHz | V | -- | -54 | >10 |

**NOTE:** 1.The emission behavior belongs to narrowband spurious emission.

2. The margins of the other spectrum below 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

| SPURIOUS EMISSION FREQUENCY RANGE | 30MHz ~ 1GHz | OPERATING CHANNEL | High | |
|---|---|---|---|---|
| **Frequency (MHz)** | **Antenna Polarization** | **Level (dBm)** | **Limit (dBm)** | **Margin (dB)** |
| 34.16 | H | -65.51 | -36 | -29.51 |
| 62.82 | H | -68.86 | -54 | -14.86 |
| 160.08 | H | -62.28 | -36 | -26.28 |
| 451.68 | H | -73.12 | -36 | -37.12 |
| 562.66 | H | -67.99 | -54 | -13.99 |
| 941.36 | H | -65.54 | -36 | -29.54 |
| 62.22 | V | -69.76 | -54 | -15.76 |
| 204.82 | V | -66.5 | -54 | -12.5 |
| 129.97 | V | -65.47 | -36 | -29.47 |
| 198.56 | V | -68.14 | -54 | -14.14 |
| 345.96 | V | -73.02 | -36 | -37.02 |
| 932.27 | V | -65.73 | -36 | -29.73 |
| 30MHz ~ 1GHz | H | -- | -36 | >10 |
| 30MHz ~ 1GHz | V | -- | -36 | >10 |
| 30MHz ~ 1GHz | H | -- | -54 | >10 |
| 30MHz ~ 1GHz | V | -- | -54 | >10 |

**NOTE:** 1.The emission behavior belongs to narrowband spurious emission.

2. The margins of the other spectrum below 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

**Standby Mode:**

| NO. | Frequency | Measurement Bandwidth | Level | Limit | Margin |
|---|---|---|---|---|---|
| | **MHz** | **KHz** | **dBm** | **dBm** | **dB** |
| **Standby Mode ,Antenna Polarization: Vertical** | | | | | |
| 1 | 30-1000 | 100 | \ | -54 | >20 |
| 2 | 30-1000 | 100 | \ | -36 | >20 |
| **Standby Mode ,Antenna Polarization: Horizontal** | | | | | |
| 1 | 30-1000 | 100 | \ | -54 | >20 |
| 2 | 30-1000 | 100 | \ | -36 | >20 |

**Conclusion: PASS**

Above 1GHz (1GHz-12.75GHz)

| NO. | Frequency | Measurement Bandwidth | Level | Limit | Margin |
|---|---|---|---|---|---|
| | MHz | KHz | dBm | dBm | dB |
| **TX:2402MHz ,Antenna Polarization: Vertical** | | | | | |
| 1 | 4804 | 1000 | -48.36 | -30 | >10 |
| 2 | 7206 | 1000 | -49.77 | -30 | >10 |
| 3 | 9608 | 1000 | \ | -30 | >40 |
| 4 | 12010 | 1000 | \ | -30 | >40 |
| 5 | Other(1000-12750) | 1000 | \ | -30 | >40 |
| **TX:2402MHz ,Antenna Polarization: Horizontal** | | | | | |
| 1 | 4804 | 1000 | -57.65 | -30 | >10 |
| 2 | 7206 | 1000 | -46.36 | -30 | >10 |
| 3 | 9608 | 1000 | \ | -30 | >40 |
| 4 | 12010 | 1000 | \ | -30 | >40 |
| 5 | Other(1000-12750) | 1000 | \ | -30 | >40 |
| **TX:2440MHz ,Antenna Polarization: Vertical** | | | | | |
| 1 | 4882 | 1000 | -56.56 | -30 | >10 |
| 2 | 7323 | 1000 | -54.89 | -30 | >10 |
| 3 | 9764 | 1000 | \ | -30 | >40 |
| 4 | 12205 | 1000 | \ | -30 | >40 |
| 5 | Other(1000-12750) | 1000 | \ | -30 | >40 |
| **TX:2440MHz ,Antenna Polarization: Horizontal** | | | | | |
| 1 | 4882 | 1000 | -50.55 | -30 | >10 |
| 2 | 7323 | 1000 | -55.11 | -30 | >10 |
| 3 | 9764 | 1000 | \ | -30 | >40 |
| 4 | 12205 | 1000 | \ | -30 | >40 |
| 5 | Other(1000-12750) | 1000 | \ | -30 | >40 |
| **TX:2480MHz ,Antenna Polarization: Vertical** | | | | | |
| 1 | 4960 | 1000 | -52.78 | -30 | >10 |
| 2 | 7440 | 1000 | -50.69 | -30 | >10 |
| 3 | 9920 | 1000 | \ | -30 | >40 |

| | | | | | |
|---|---|---|---|---|---|
| 4 | 12400 | 1000 | \ | -30 | >40 |
| 5 | Other(1000-12750) | 1000 | \ | -30 | >40 |
| **TX:2480MHz ,Antenna Polarization: Horizontal** | | | | | |
| 1 | 4960 | 1000 | -57.76 | -30 | >10 |
| 2 | 7440 | 1000 | -59.45 | -30 | >10 |
| 3 | 9920 | 1000 | \ | -30 | >40 |
| 4 | 12400 | 1000 | \ | -30 | >40 |
| 5 | Other(1000-12750) | 1000 | \ | -30 | >40 |
| Measurement uncertainty:±3.2dB | | | | | |

**Standby Mode:**

| NO. | Frequency | Measurement Bandwidth | Level | Limit | Margin |
|---|---|---|---|---|---|
| | MHz | KHz | dBm | dBm | dB |
| **Standby Mode ,Antenna Polarization: Vertical** | | | | | |
| 1 | 1000-12750 | 1000 | \ | -30 | >20 |
| **Standby Mode ,Antenna Polarization: Horizontal** | | | | | |
| 1 | 1000-12750 | 1000 | \ | -30 | >20 |

**Conclusion: PASS**

## 4.6 RECEIVER SPURIOUS EMISSIONS

ETSI EN300328 SUBCLAUSE 4.3.2.10

Receiver spurious emissions are emissions at any frequency when the equipment is in receive mode. The spurious emissions of the receiver shall not exceed the values given in table 5.

**Table 5: Spurious emission limits for receivers**

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

**Test Configuration**

Same as section 4.5 in this test report

**TEST PROCEDURE**

Refer to chapter 5.4.10.2 of ETSI EN 300 328 V2.1.1

**Measurement**

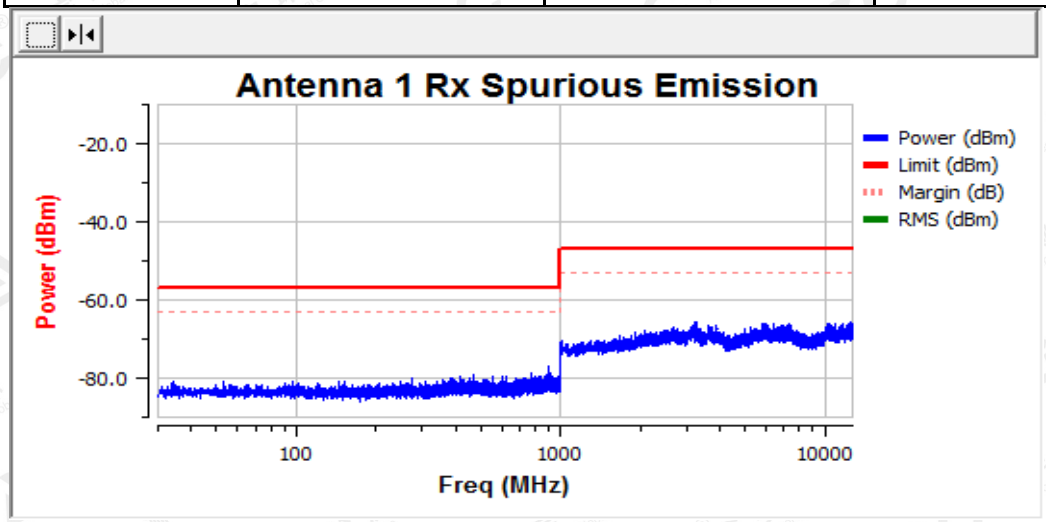
| Measurement | |
|---|---|
| ☒Conducted measurement | ☒Radiated measurement |

## CONDUCTED MEASUREMENT

## TEST RESULTS FOR CONDUCTED METHOD

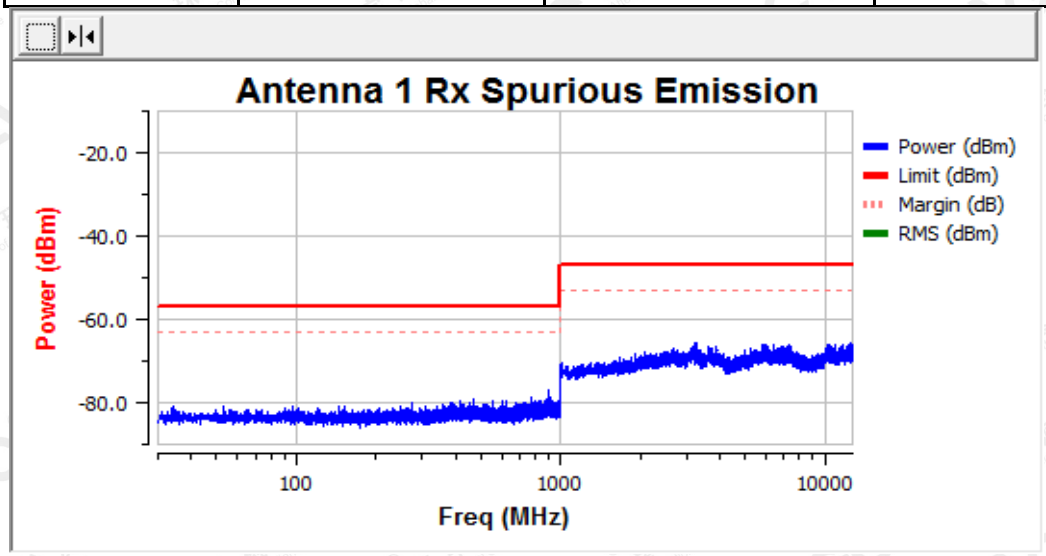
**RECEIVER MODE: (Low channel)**

| Freq | RMS Level (dBm) | Limit (dBm) | Over Limit (dB) | Status |
|---|---|---|---|---|
| 770.488 | -79.31 | -57.00 | -22.31 | Pass |
| 12532.000 | -66.26 | -47.00 | -19.26 | Pass |




**(High channel)**

| Freq | RMS Level (dBm) | Limit (dBm) | Over Limit (dB) | Status |
|---|---|---|---|---|
| 897.941 | -78.28 | -57.00 | -21.28 | Pass |
| 12532.000 | -66.26 | -47.00 | -19.26 | Pass |




*Note: 1. All the modes had been test but only the worst data record in the report..*

*2.The effective radiated power has been considered in this test.*

**RADIATED MEASUREMENT**

**TEST SETUP**

1 For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration).

2 Testing was performed when the equipment was in a receive-only mode.

3 The measurements were performed when normal hopping was disabled. In this case measurements were performed when operating at the lowest and the highest hopping frequency.

4 The test setup has been constructed as the normal use condition. Controlling software (Button Function) has been activated to set the EUT on specific status.

**TEST RESULTS for Radiated Method (Worst case :1Mbps)**

**Low Channel**: Receiver Spurious Emission below 1GHz (30MHz-1GHz)

| Frequency | Reading Level | Antenna | S.G. | Cable Loss | Ant.Gain | Emission Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuv) | Polarization | (dBm) | (dB) | (dBi) | (dBm) | (dBm) | (dB) |
| 75.67 | 30.11 | V | -71 | 0.22 | 0.33 | -70.89 | -57 | -13.89 |
| 181.22 | 30.79 | V | -71.14 | 0.28 | 0.5 | -70.92 | -57 | -13.92 |
| 426.47 | 30.74 | V | -70.97 | 0.36 | 0.48 | -70.85 | -57 | -13.85 |
| 736.8 | 31.81 | V | -71.18 | 0.55 | 0.82 | -70.91 | -57 | -13.91 |
| 515.35 | 30.48 | V | -70.03 | 0.38 | 0.49 | -69.92 | -57 | -12.92 |
| 570.03 | 31.28 | V | -71.06 | 0.41 | 0.44 | -71.03 | -57 | -14.03 |
| | | | | | | | | |
| 76.16 | 30.68 | H | -70.37 | 0.23 | 0.09 | -70.51 | -57 | -13.51 |
| 184.22 | 30.74 | H | -70.49 | 0.31 | 0.44 | -70.36 | -57 | -13.36 |
| 736.17 | 31.01 | H | -70.57 | 0.51 | 0.53 | -70.55 | -57 | -13.55 |
| 426.2 | 29.88 | H | -70.9 | 0.33 | 0.88 | -70.35 | -57 | -13.35 |
| 512.34 | 31.61 | H | -70.59 | 0.37 | 0.5 | -70.46 | -57 | -13.46 |
| 572.17 | 31.32 | H | -71.1 | 0.45 | 0.73 | -70.82 | -57 | -13.82 |
| | | | | | | | | |
| 30MHz ~ 1GHz | -- | V | -- | -- | -- | -- | -57 | >10 |
| 30MHz ~ 1GHz | -- | H | -- | -- | -- | -- | -57 | >10 |

Note: The margins of the other spectrum below 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

**High Channel**: Receiver Spurious Emission below 1GHz (30MHz-1GHz)

| Frequency | Reading Level | Antenna | S.G. | Cable Loss | Ant.Gain | Emission Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuv) | Polarization | (dBm) | (dB) | (dBi) | (dBm) | (dBm) | (dB) |
| 75.96 | 30.11 | V | -71 | 0.51 | 0.33 | -71.18 | -57 | -14.18 |
| 181.51 | 30.79 | V | -71.14 | 0.57 | 0.5 | -71.21 | -57 | -14.21 |
| 426.76 | 30.74 | V | -70.97 | 0.65 | 0.48 | -71.14 | -57 | -14.14 |
| 737.09 | 31.81 | V | -71.18 | 0.84 | 0.82 | -71.2 | -57 | -14.2 |
| 515.64 | 30.48 | V | -70.03 | 0.67 | 0.49 | -70.21 | -57 | -13.21 |
| 570.32 | 31.28 | V | -71.06 | 0.7 | 0.44 | -71.32 | -57 | -14.32 |
| | | | | | | | | |
| 76.45 | 30.68 | H | -70.37 | 0.52 | 0.09 | -70.8 | -57 | -13.8 |
| 184.51 | 30.74 | H | -70.49 | 0.6 | 0.44 | -70.65 | -57 | -13.65 |
| 736.46 | 31.01 | H | -70.57 | 0.8 | 0.53 | -70.84 | -57 | -13.84 |
| 426.49 | 29.88 | H | -70.9 | 0.62 | 0.88 | -70.64 | -57 | -13.64 |
| 512.63 | 31.61 | H | -70.59 | 0.66 | 0.5 | -70.75 | -57 | -13.75 |
| 572.46 | 31.32 | H | -71.1 | 0.74 | 0.73 | -71.11 | -57 | -14.11 |
| | | | | | | | | |
| 30MHz ~ 1GHz | -- | V | -- | -- | -- | -- | -57 | >10 |
| 30MHz ~ 1GHz | -- | H | -- | -- | -- | -- | -57 | >10 |

Note: The margins of the other spectrum below 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

**Low Channel**: Receiver Spurious Emission above 1GHz (1GHz-12.75GHz)

| Frequency | Reading Level | Antenna | S.G. | Cable Loss | Ant.Gain | Emission Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuv) | Polarization | (dBm) | (dB) | (dBi) | (dBm) | (dBm) | (dB) |
| 1954.67 | 39.77 | V | -62.69 | 2.51 | 0.52 | -64.68 | -47 | -17.68 |
| -- | -- | V | -- | -- | -- | -- | -- | -- |
| -- | -- | V | -- | -- | -- | -- | -- | -- |
| -- | -- | V | -- | -- | -- | -- | -- | -- |
| -- | -- | V | -- | -- | -- | -- | -- | -- |
| -- | -- | V | -- | -- | -- | -- | -- | -- |
| | | | | | | | | |
| 2443.78 | 39.04 | H | -62.62 | 2.72 | 0.71 | -64.63 | -47 | -17.63 |
| -- | -- | H | -- | -- | -- | -- | -- | -- |
| -- | -- | H | -- | -- | -- | -- | -- | -- |
| -- | -- | H | -- | -- | -- | -- | -- | -- |
| -- | -- | H | -- | -- | -- | -- | -- | -- |
| -- | -- | H | -- | -- | -- | -- | -- | -- |
| | | | | | | | | |
| 1GHz-12.75 GHz | -- | V | -- | -- | -- | -- | -47 | >10 |
| 1GHz-12.75 GHz | -- | H | -- | -- | -- | -- | -47 | >10 |

Note: The margins of the other spectrum above 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

**High Channel**: Receiver Spurious Emission above 1GHz (1GHz-12.75GHz)

| Frequency | Reading Level | Antenna | S.G. | Cable Loss | Ant.Gain | Emission Level | Limit | Margin |
|---|---|---|---|---|---|---|---|---|
| (MHz) | (dBuv) | Polarization | (dBm) | (dB) | (dBi) | (dBm) | (dBm) | (dB) |
| 1954.72 | 39.77 | V | -62.69 | 2.52 | 0.52 | -64.69 | -47 | -17.69 |
| -- | -- | V | -- | -- | -- | -- | -- | -- |
| -- | -- | V | -- | -- | -- | -- | -- | -- |
| -- | -- | V | -- | -- | -- | -- | -- | -- |
| -- | -- | V | -- | -- | -- | -- | -- | -- |
| -- | -- | V | -- | -- | -- | -- | -- | -- |
| | | | | | | | | |
| 2443.79 | 39.04 | H | -62.62 | 2.75 | 0.71 | -64.66 | -47 | -17.66 |
| -- | -- | H | -- | -- | -- | -- | -- | -- |
| -- | -- | H | -- | -- | -- | -- | -- | -- |
| -- | -- | H | -- | -- | -- | -- | -- | -- |
| -- | -- | H | -- | -- | -- | -- | -- | -- |
| -- | -- | H | -- | -- | -- | -- | -- | -- |
| | | | | | | | | |
| 1GHz-12.75 GHz | -- | V | -- | -- | -- | -- | -47 | >10 |
| 1GHz-12.75 GHz | -- | H | -- | -- | -- | -- | -47 | >10 |

Note: The margins of the other spectrum above 1GHz are not exceeding the minimum value of margin, and this part of the results without recording in the test report.

**Remarks:**

1. The emission behaviour belongs to narrowband spurious emission.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "--" remark, if no specific emission from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.

**Conclusion: PASS**

### 4.7 RECEIVER BLOCKING

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 in the presence of an unwanted signal (blocking signal) on frequencies other than those of the operating band provided in table 1.

#### 4.7.1 LIMIT

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

**Table 7: Receiver Blocking parameters receiver category 2 equipment**

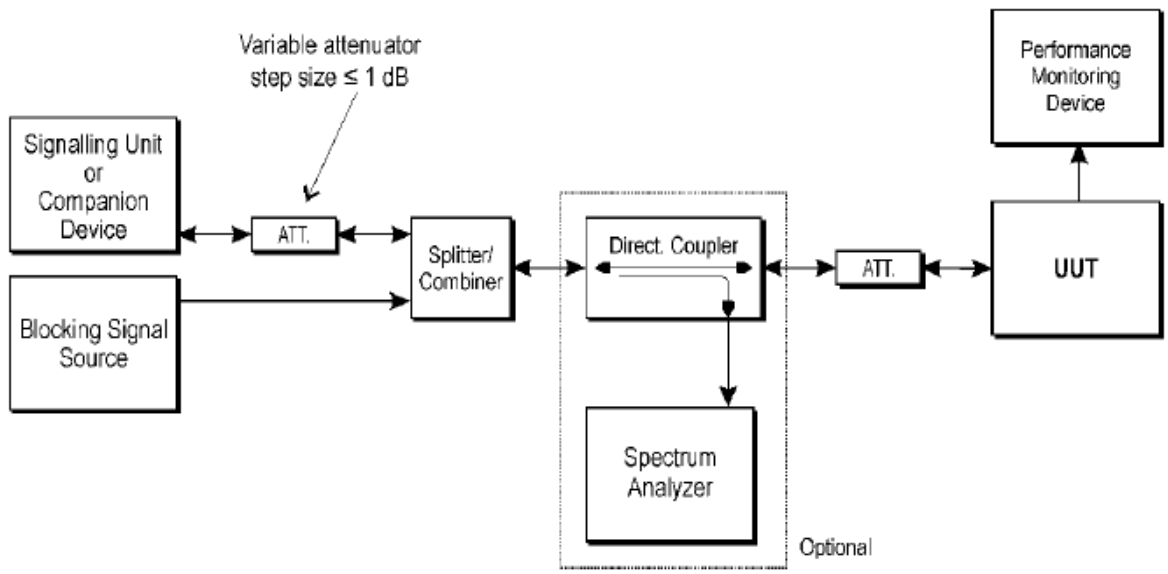
| Wanted signal mean power from companion device (dBm) | Blocking signal frequency (MHz) | Blocking signal power (dBm) (see note 2) | Type of blocking signal |
|---|---|---|---|
| $P_{min}$ + 6 dB | 2 380<br>2 503,5 | -57 | CW |
| $P_{min}$ + 6 dB | 2 300<br>2 583,5 | -47 | CW |
| NOTE 1: $P_{min}$ is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.<br>NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain. | | | |

Note: Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % or adaptive equipment with a maximum RF output power of 10 dBm e.i.r.p. shall be considered as receiver category 2 equipment.

#### 4.7.2 TEST PROCEDURE

Test Procedure please refer to clause 5.4.11.2

#### 4.7.3 TEST CONFIGURATION



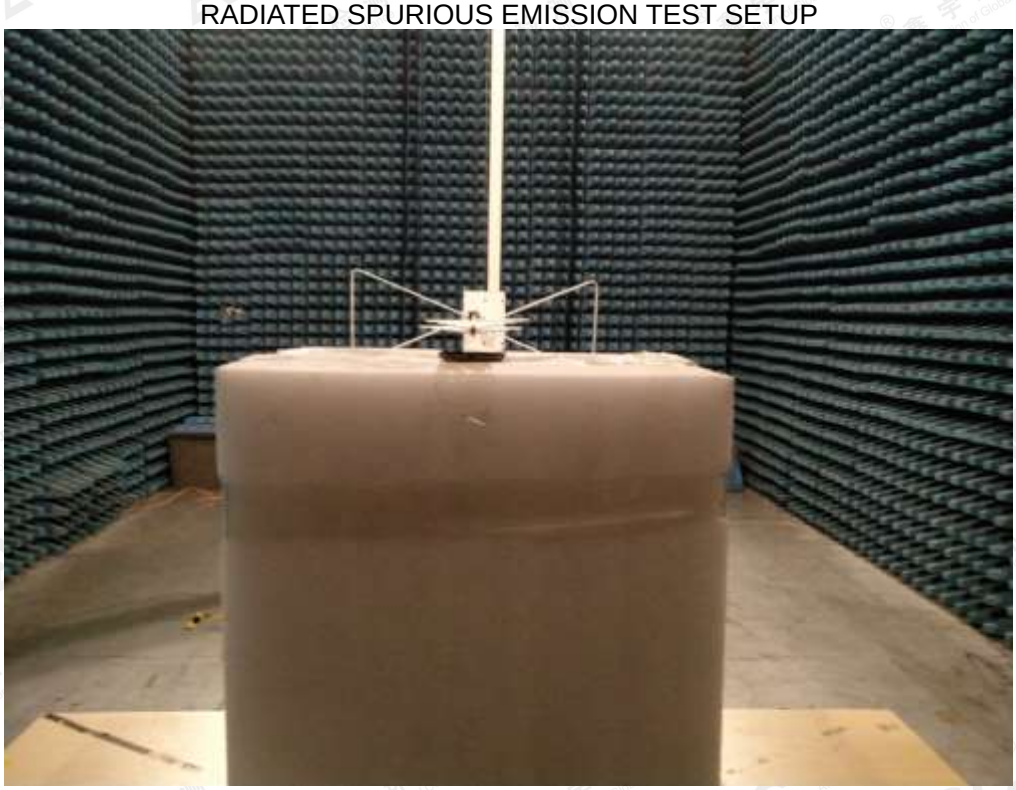
### 4.7.4 TEST RESULTS

**GFSK MODE(HOPPING CHANNEL)**

| Wanted Signal Power (MHz) | Blocking Signal Frequency (MHz) | Blocking Signal Power (dBm) | Test Result ( PER) | Limit ( PER) | Result |
|---|---|---|---|---|---|
| $P_{-84}$+6dB | 2380 | -57 | 0.72% | 10% | Pass |
| $P_{-84}$+6dB | 2503.5 | -57 | 0.46% | 10% | Pass |
| $P_{-84}$+6dB | 2300 | -47 | 1.23% | 10% | Pass |
| $P_{-84}$+6dB | 2583.5 | -47 | 0.63% | 10% | Pass |

# APPENDIX A: PHOTOGRAPHS OF THE TEST SETUP

RADIATED SPURIOUS EMISSION TEST SETUP



RADIATED SPURIOUS EMISSION-ABOVE 1G TEST SETUP

CONDUCTED TEST SETUP


**----END OF REPORT----**