TEST REPORT

Reference No.	:	WTF21F09092922W001
Applicant	:	Mid Ocean Brands B.V.
Address	:	7/F., Kings Tower, 111 King Lam Street, Cheung Sha Wan, Kowloon, Hong Kong
Manufacturer	:	109328
Product Name	:	Health bracelet(smart watch)
Model No.	:	MO9771
Standards	:	EN 62479:2010 ETSI EN 300 328 V2.2.2 (2019-07)
Date of Receipt sample	:	2021-09-03
Date of Test	:	2021-09-09 to 2021-09-10
Date of Issue	:	2021-10-08
Test Report Form No	:	WEW-300328A-01A
Test Result	:	**Pass**

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

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1 Test Summary

Radio Spectrum			
Test	Test Requirement	Limit / Severity	Result
RF output power	ETSI EN 300 328 V2.2.2	≤20dBm	Pass
Power Spectral Density	ETSI EN 300 328 V2.2.2	≤10dBm/MHz	Pass
Duty Cycle, Tx-sequence, Tx-gap	ETSI EN 300 328 V2.2.2	Duty Cycle≤manufacturer declare value Tx-sequence:3.5~10ms Tx-gap:3.5~10ms	N/A
Medium Utilization	ETSI EN 300 328 V2.2.2	≤10%	N/A
Adaptivity	ETSI EN 300 328 V2.2.2	Clause 4.3.1.7	N/A
Occupied Channel Bandwidth	ETSI EN 300 328 V2.2.2	Within the band 2400-2483.5MHz	Pass
Transmitter unwanted in the OOB domain	ETSI EN 300 328 V2.2.2	Figure 3	Pass
Transmitter unwanted emissions in the spurious domain	ETSI EN 300 328 V2.2.2	Table 12	Pass
Receiver spurious emissions	ETSI EN 300 328 V2.2.2	Table 14/15/16	Pass
Receiver Blocking	ETSI EN 300 328 V2.2.2	Clause 4.3.2.11.4.2	Pass

HEALTH			
Test	Test Method	Class / Severity	Result
RF Exposure	EN 62479:2010	-	Pass

Remark:

Pass Test item meets the requirement

N/A Not Applicable

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3 General Information

3.1 General Description of E.U.T.

Product Name ....: Health bracelet(smart watch)

Model No. ....: MO9771

Remark ....: ---

Rated Voltage.................................: Input: DC 5V, 65mA
Rechargeable battery: 3.7V

Battery Capacity ....: ---

Adapter Model................................: ---

3.2 Details of E.U.T.

Bluetooth Version..........................: Bluetooth V4.0 (BLE)

Frequency Range...........................: 2402-2480MHz

Maximum RF Output Power.........: 4.72 dBm (EIRP)

Type of Modulation.......................: GFSK

Quantity of Channels ....: 40

Channel Separation......................: 2MHz

Antenna installation ....: PCB Printed Antenna

Antenna Gain ....: 0dBi

The lowest oscillator ....: 16MHz

Receiver Category ....: 2

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

3.3 Standards Applicable for Testing

The tests were performed according to following standards:

ETSI EN 300 328 V2.2.2 (2019-07)	Electromagnetic compatibility and Radio spectrum Matters (ERM); Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized EN covering essential requirements under article 3.2 of the RED Directive.
EN 62479:2010	Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz)

3.4 Test Facility

The test facility has a test site registered with the following organizations:

- **ISED – Registration No.: 21895**

Waltek Testing Group (Foshan) Co., Ltd. has been registered and fully described in a report filed with the Innovation, Science an Economic Development Canada(ISED). The acceptance letter from the ISED is maintained in our files. Registration ISED number:21895, March 12, 2019

- **FCC – Registration No.: 820106**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 820106, August 16, 2018

- **NVLAP – Lab Code: 600191-0**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 600191-0.
This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

3.5 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test items:---

Lab information:---

3.6 Abnormalities from Standard Conditions

None.

4 Equipment Used during Test

4.1 Equipment List

3m Semi-anechoic Chamber for Spurious Emission						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	EMI TEST RECEIVER	RS	ESR7	101566	2021-01-11	2022-01-10
2	Spectrum Analyzer	Agilent	N9020A	MY48011796	2021-06-04	2022-06-03
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9162	9162-117	2021-01-08	2022-01-07
4	Coaxial Cable (below 1GHz)	H+S	CBL3-NN-12+3 m	214NN320	2021-01-12	2022-01-11
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	01561	2021-01-08	2022-01-07
6	Broadband Preamplifier (Above 1GHz)	Lunar E M	LNA1G18-40	20160501002	2021-01-12	2022-01-11
7	Coaxial Cable (above 1GHz)	Times-Micorwave	CBL5-NN	-	2021-01-12	2022-01-11

RF Conducted test						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	Environmental Chamber	KSON	THS-D4C-100	5244K	2021-01-08	2022-01-07
2	Spectrum Analyzer	Agilent	N9020A	MY48011796	2021-06-04	2022-06-03
3	EXG Analog Signal Generator	Agilent	N5181A	MY48080720	2021-01-12	2022-01-11
4	RF Control Unit	CHANGCHUANG	JS0806-2	-	2021-01-12	2022-01-11
5	Wideband radio communication tester	Rohde&Schwarz	CMW500	1201.0002K50-158178-Qf	2021-07-17	2022-07-16

4.2 Software List

Description	Manufacturer	Model	Version
EMI Test Software (Radiated Emission)	FARATRONIC	EZ-EMC	RA-03A1-1
RF Conducted Test	TONSCEND	JS1120-2	2.6

4.3 Special Accessories and Auxiliary Equipment

Item	Equipment	Technical Data	Manufacturer	Model No.	Serial No.
1.	/	/	/	/	/

4.4 Measurement Uncertainty

Parameter	Uncertainty	Note
RF Output Power	±0.95dB	(1)
Occupied Bandwidth	±1.5%	(1)
Conducted Spurious Emission	±2.7dB	(1)
Conducted Emission	±2.7dB	(1)
Transmitter Spurious Emission	±3.8dB (for 25MHz-1GHz)	(1)
	±5.0dB (for 1GHz-18GHz)	(1)

(1)This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

4.5 Decision Rule

Compliance or non-compliance with a disturbance limit shall be determined in the following manner.

If U_{LAB} is less than or equal to U_{cispr}, then

-Compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;

-Non-compliance is deemed to occur is any measured disturbance level exceeds the disturbance limt.

If U_{LAB} is greater than U_{cispr}, then

-Compliance is deemed to occur if no measured disturbance level, increased by (U_{LAB}-U_{cispr}) , exceeds the disturbance limit;

-Non-compliance is deemed to occur if any measured disturbance level, increased by (U_{LAB}-U_{cispr}) , exceeds the disturbance limit.

5 Test Conditions and Test mode

The equipment under test (EUT) was configured to measure its highest possible emission/immunity level. The test modes were adapted according to the operation manual for use, the EUT was operated in the continuous transmitting mode that was for the purpose of the measurements, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Low	2402MHz
TM2	Middle	2442MHz
TM3	High	2480MHz

Test Conditions			
	Normal	LTNV	HTNV
Temperature (°C)	22	-10	+50
Voltage (Vdc)	5		
Relative Humidity:	45 %		
ATM Pressure:	101.2kPa		

6 RF Requirements

6.1 RF Output power

6.1.1 Standard Applicable

According to Section 4.3.1.2.3, The maximum RF output power for adaptive Frequency Hopping equipment shall be equal to or less than 20 dBm. The maximum RF output power for non-adaptive Frequency Hopping equipment, shall be declared by the supplier. The maximum RF output power for this equipment shall be equal to or less than the value declared by the supplier. This declared value shall be equal to or less than 20 dBm.

According to Section 4.3.2.2.3, 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. 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.

6.1.2 Test Procedure

According to section 5.3.2.2.1.1 of the standard EN 300328, the test procedure shall be as follows:

Step 1:

• Use a fast power sensor suitable for 2,4 GHz and capable of 1 MS/s.

• Use the following settings: - Sample speed 1 MS/s or faster.

- The samples must represent the power of the signal.

- Measurement duration: For non-adaptive equipment: equal to the observation period defined in clauses 4.3.1.2.1

or 4.3.2.3.1. For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) are captured.

NOTE 1: 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 half the time between two samples.

- For each individual sampling point (time domain), sum the coincident power samples of all ports and store them.

Use these summed samples in all following steps..

Step 3:

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

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

NOTE 2: In case of insufficient dynamic range, the value of 30 dB may need to be reduced appropriately.

Step 4:

• Between the start and stop times of each individual burst calculate the RMS power over the burst using the formula below. Save these Pburst values, as well as the start and stop times for each burst.

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

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

Step 5:

• The highest of all Pburst values (value "A" in dBm) will be used for maximum e.i.r.p. calculations.

Step 6:

• Add the (stated) antenna assembly gain "G" in dBi of the individual antenna.

• If applicable, add the additional beamforming gain "Y" in dB.

•If more than one antenna assembly is intended for this power setting, the maximum overall antenna gain (G or G
+ Y) shall be used.

• The RF Output Power (P) shall be calculated using the formula below: P = A + G + Y

• This value, which shall comply with the limit given in clause 4.3.1.2.3 or clause 4.3.2.2.3, shall be recorded in the test report.

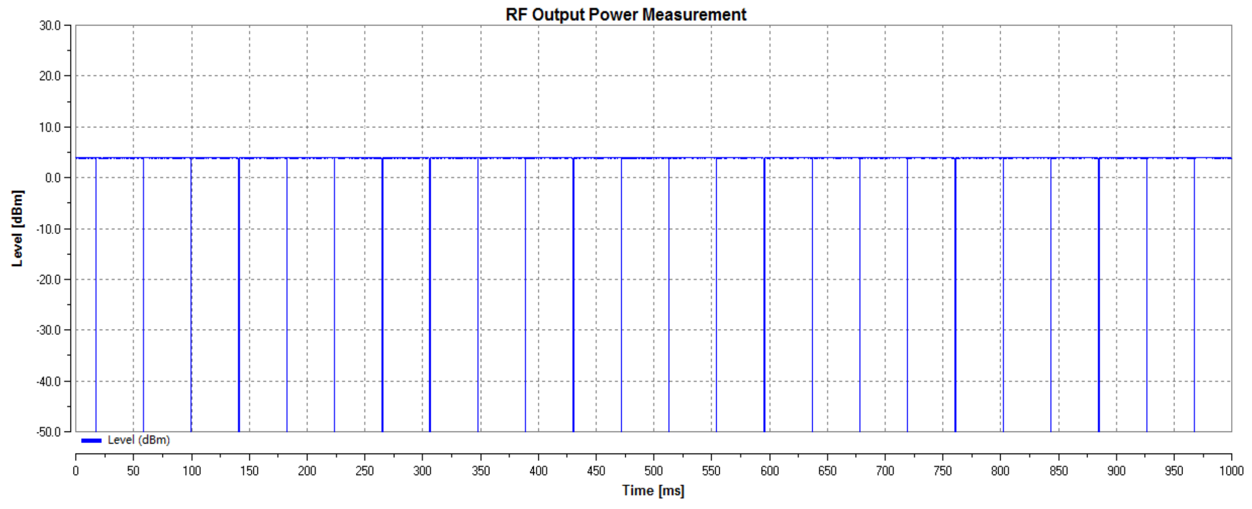
6.1.3 Test Result

Test Condition	Test Mode	Test Channel (MHz)	EIRP (dBm)	Limit (dBm)	Verdict
TLVN	BLE	2402	3.97	<=20	Pass
TNVN	BLE	2402	3.97	<=20	Pass
THVN	BLE	2402	3.98	<=20	Pass
TLVN	BLE	2442	4.5	<=20	Pass
TNVN	BLE	2442	4.5	<=20	Pass
THVN	BLE	2442	4.49	<=20	Pass
TLVN	BLE	2480	4.72	<=20	Pass
TNVN	BLE	2480	4.72	<=20	Pass
THVN	BLE	2480	4.72	<=20	Pass

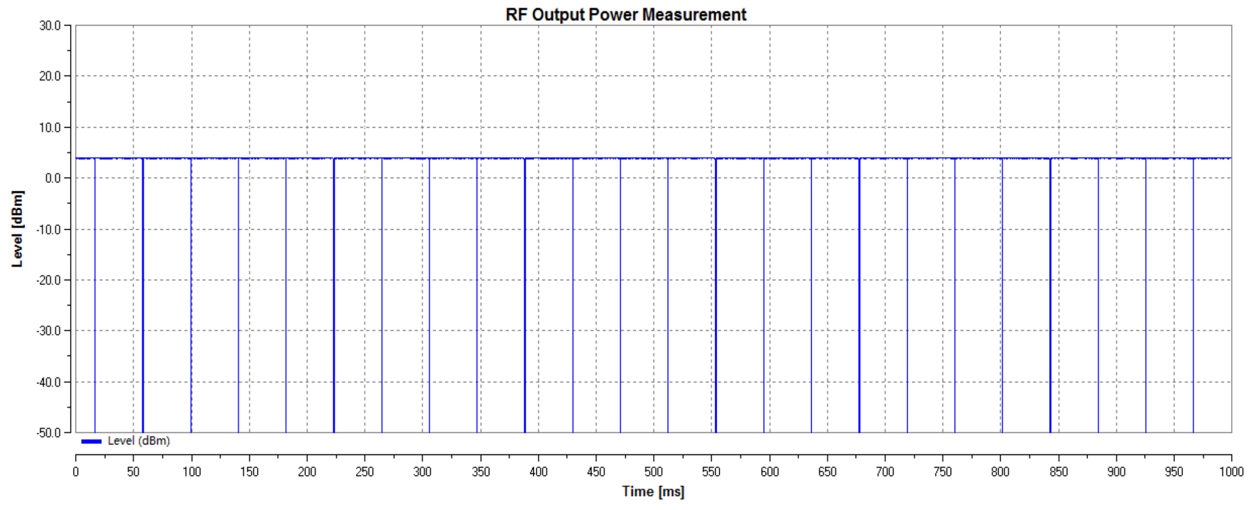
Remark: EIRP=Conducted power+ ANT gain

Test Graphs:

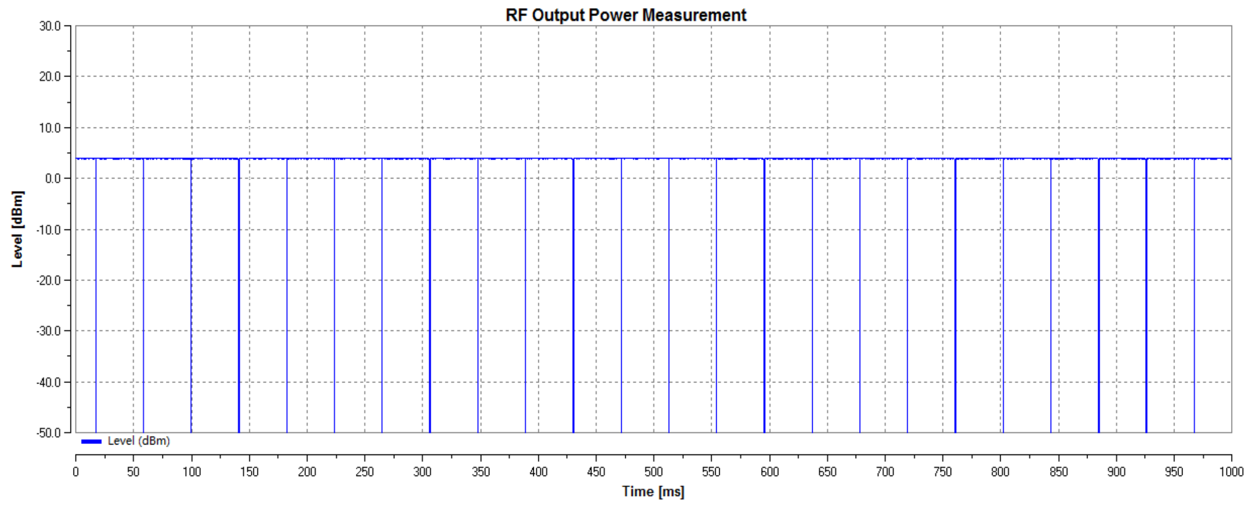
RF Output Power_TLVN _BLE_2402



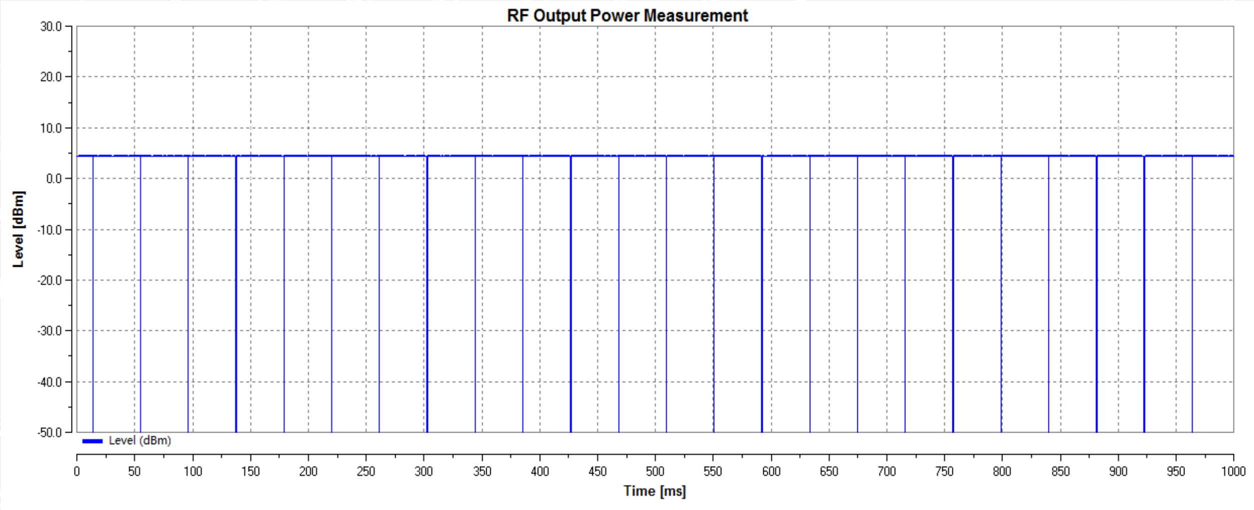
RF Output Power_TNVN _BLE_2402



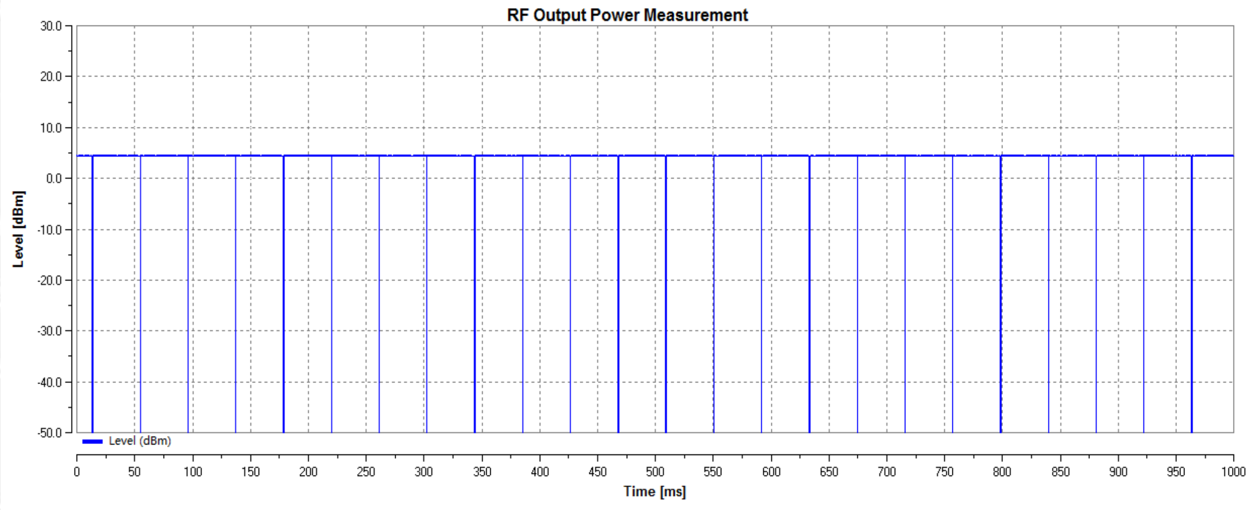
RF Output Power_THVN _BLE_2402



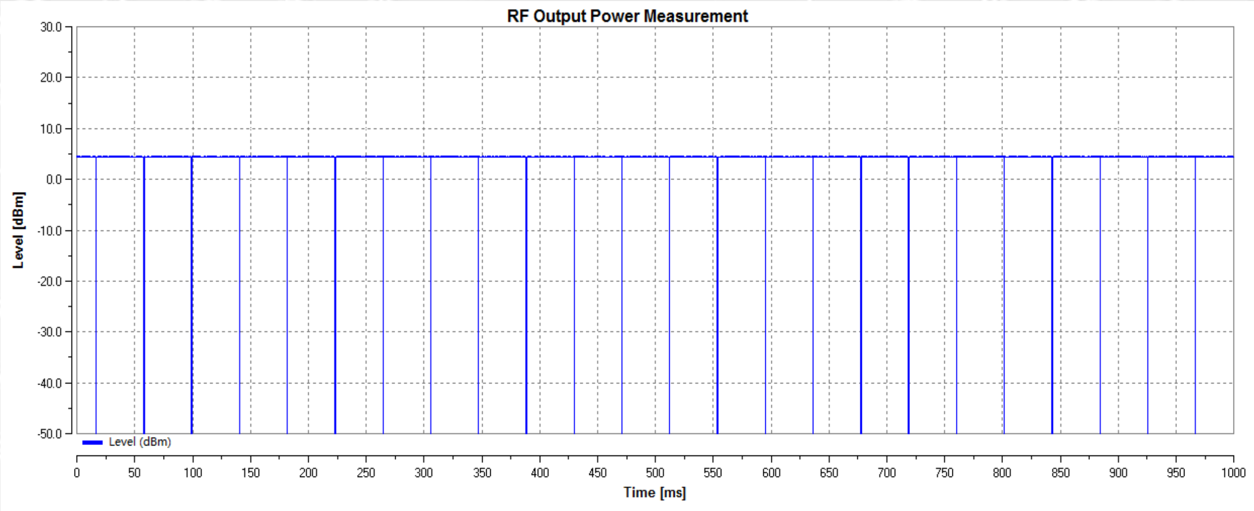
RF Output Power_TLVN _BLE_2442



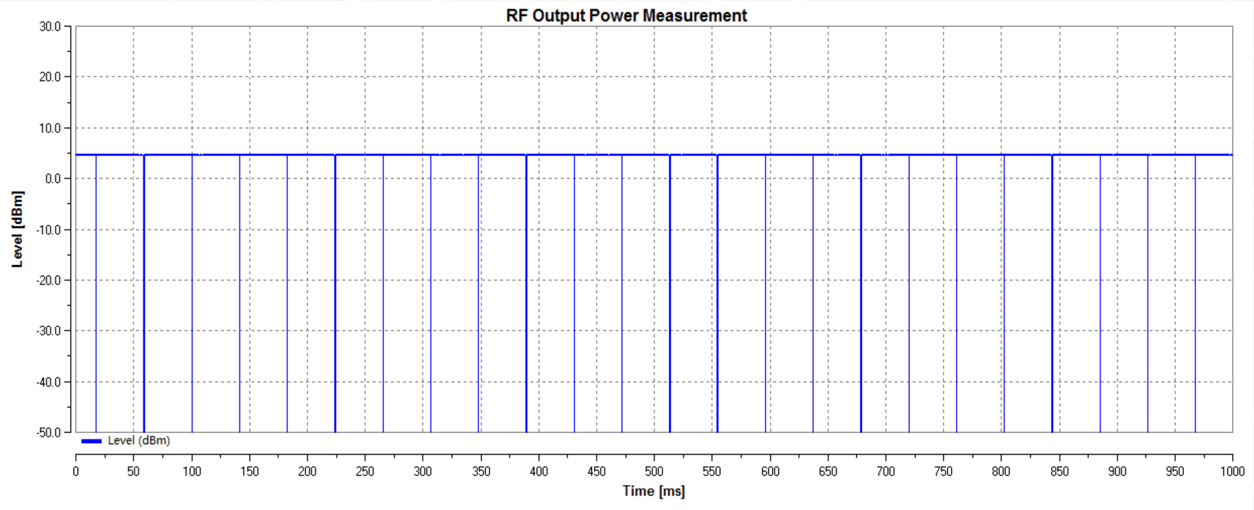
RF Output Power_TNVN _BLE_2442



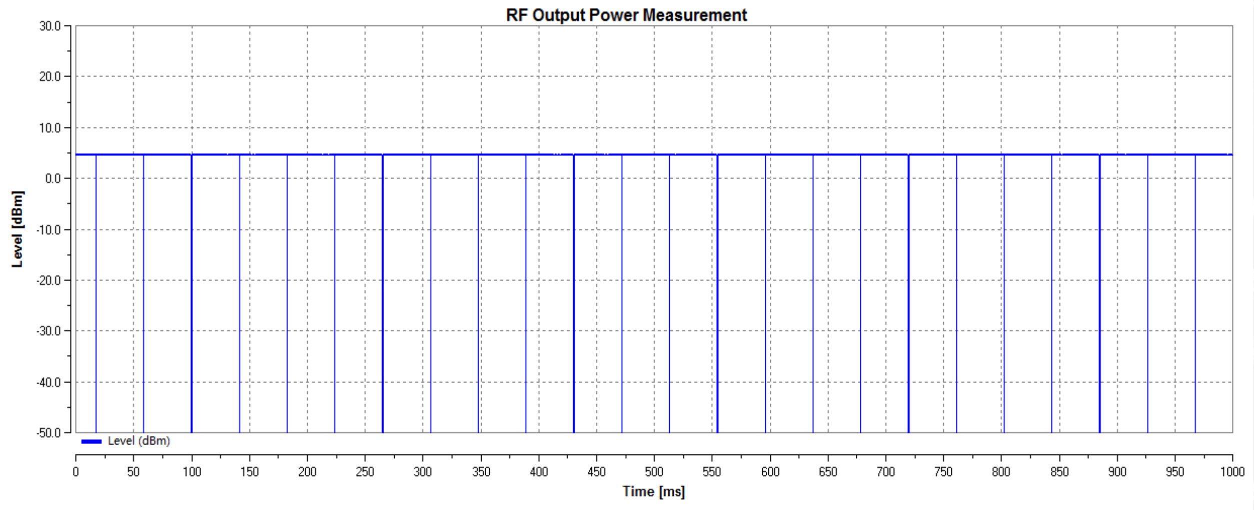
RF Output Power_THVN _BLE_2442



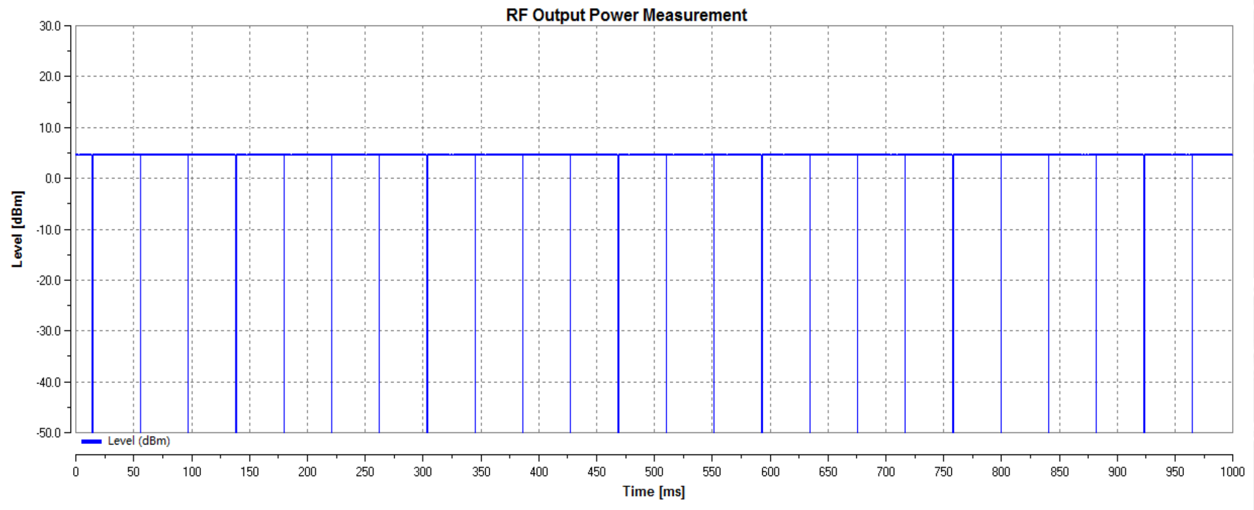
RF Output Power_TLVN _BLE_2480



RF Output Power_TNVN _BLE_2480



RF Output Power_THVN _BLE_2480



6.2 Power Spectral Density

6.2.1 Standard Applicable

According to Section 4.3.2.3.3, For equipment using wide band modulations other than FHSS, the maximum Power Spectral Density is limited to 10 dBm per MHz.

6.2.2 Test Procedure

According to section 5.3.3.2.1 of the standard EN 300328, the test procedure shall be as follows:

Step 1:

Connect the UUT to the spectrum analyser and use the following settings:

• Start Frequency: 2 400 MHz

• Stop Frequency: 2 483,5 MHz

• Resolution BW: 10 kHz

• Video BW: 30 kHz

• Sweep Points: > 8 350

NOTE: For spectrum analysers not supporting this number of sweep points, the frequency band may be segmented.

• Detector: RMS

• Trace Mode: Max Hold

• Sweep time: 10 s; the sweep time may be increased further until a value where the sweep time has no impact on

the RMS value of the signal

For non-continuous signals, wait for the trace to stabilize.

Save the data (trace data) set to a file.

Step 2:

For conducted measurements on smart antenna systems using either operating mode 2 or operating mode 3 (see clause 5.1.3.2), repeat the measurement for each of the transmit ports. For each sampling point (frequency domain), add up the coincident power values (in mW) for the different transmit chains and use this as the new data set.

Step 3:

Add up the values for power for all the samples in the file using the formula below.

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

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

Step 4:
Normalize the individual values for power (in dBm) so that the sum is equal to the RF Output Power (e.i.r.p.) measured in clause 5.3.2 and save the corrected data. The following formulas can be used:

$$C_{Corr} = P_{Sum} - P_{e.i.r.p.}$$

$$P_{Samplecorr}(n) = P_{Sample}(n) - C_{Corr}$$

with 'n' being the actual sample number

Step 5:
Starting from the first sample PSamplecorr(n) (lowest frequency), add up the power (in mW) of the following samples representing a 1 MHz segment and record the results for power and position (i.e. sample #1 to sample #100). This is the Power Spectral Density (e.i.r.p.) for the first 1 MHz segment which shall be recorded.

Step 6:
Shift the start point of the samples added up in step 5 by one sample and repeat the procedure in step 5 (i.e. sample #2 to sample #101).

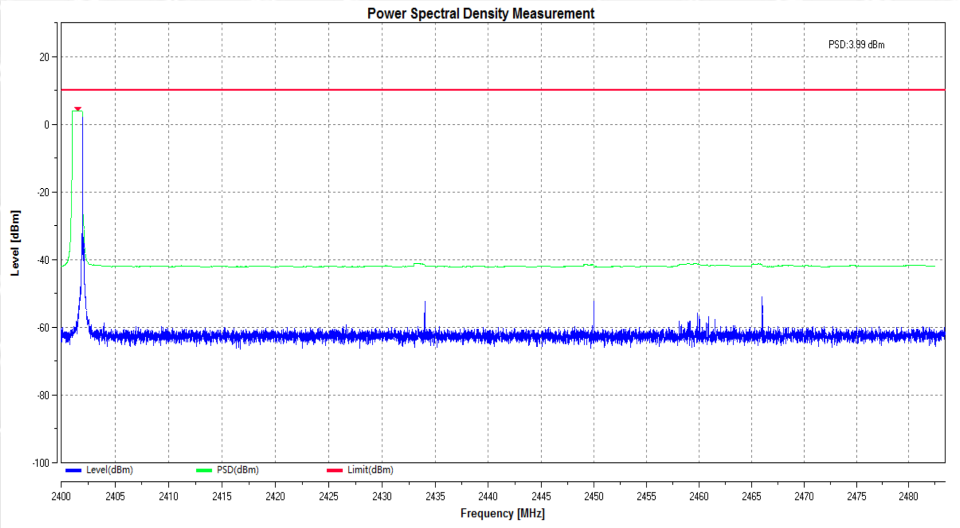
Step 7:
Repeat step 6 until the end of the data set and record the Power Spectral Density values for each of the 1 MHz segments.
From all the recorded results, the highest value is the maximum Power Spectral Density for the UUT. This value, which shall comply with the limit given in clause 4.3.2.3.3, shall be recorded in the test report.
RBW/VBW=10/30 kHz

6.2.3 Test Result

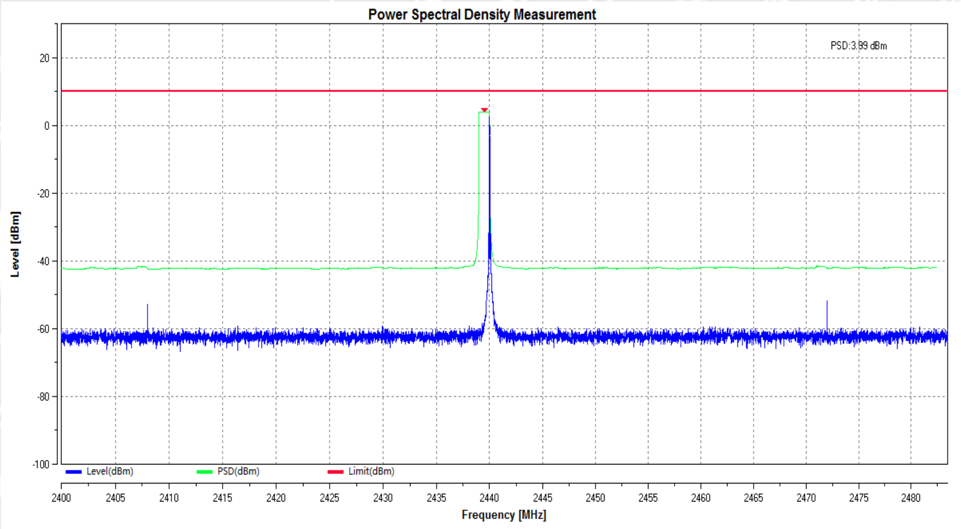
Test Condition	Test Mode	Test Channel	PSD (dBm)	Limit (dBm)	Verdict
NTNV	BLE	2402	3.99	<=10	Pass
NTNV	BLE	2442	3.99	<=10	Pass
NTNV	BLE	2480	3.99	<=10	Pass

Test Graphs:

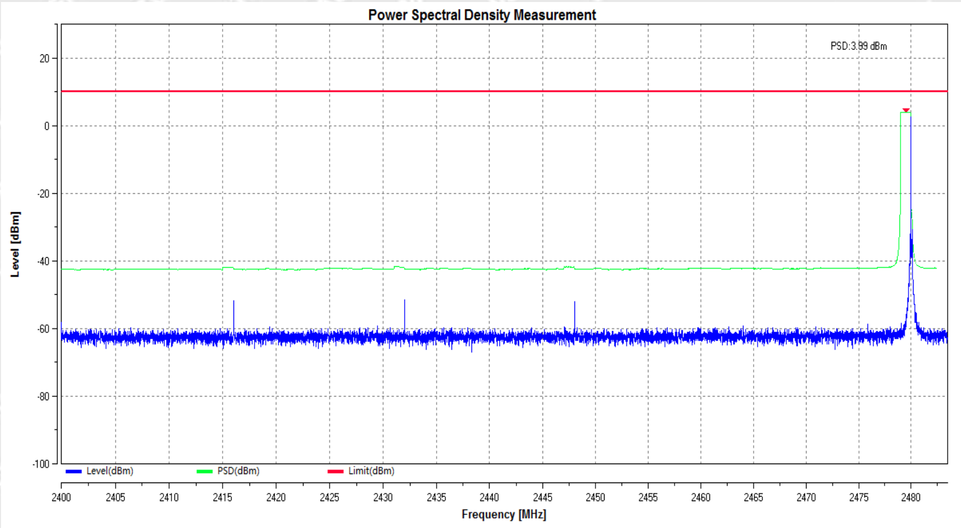
Power Spectral Density_ NTNV_BLE_2402



Power Spectral Density_ NTNV_BLE_2442



Power Spectral Density_ NTNV_BLE_2480



6.3 Occupied Channel Bandwidth

6.3.1 Standard Applicable

According to section 4.3.1.8.3. The Occupied Channel Bandwidth for each hopping frequency shall fall completely within the band given in clause 1.
For non-adaptive Frequency Hopping equipment with e.i.r.p greater than 10 dBm, the Occupied Channel Bandwidth for every occupied hopping frequency shall be equal to or less than the value declared by the supplier.
This declared value shall not be greater than 5 MHz.

According to section 4.3.2.7.3. The Occupied Channel Bandwidth shall fall completely within the band given in clause 1. In addition, for non-adaptive systems using wide band modulations other than FHSS and with e.i.r.p greater than 10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

6.3.2 Test Procedure

According to the section 5.3.8.2.1, the measurement procedure shall be as follows:
Step 1:
Connect the UUT to the spectrum analyser and use the following settings:
• Centre Frequency: The centre frequency of the channel under test
• Resolution BW: ~ 1 % of the span without going below 1 %
• Video BW: 3 × RBW
• Frequency Span for frequency hopping equipment: Lowest frequency separation that is used within the hopping
sequence
• Frequency Span for other types of equipment: 2 × Nominal Channel Bandwidth (e.g. 40 MHz for a 20 MHz channel)
• Detector Mode: RMS
• Trace Mode: Max Hold
•Sweep time: 1 s

Step 2:
Wait until the trace is completed.
Find the peak value of the trace and place the analyser marker on this peak.

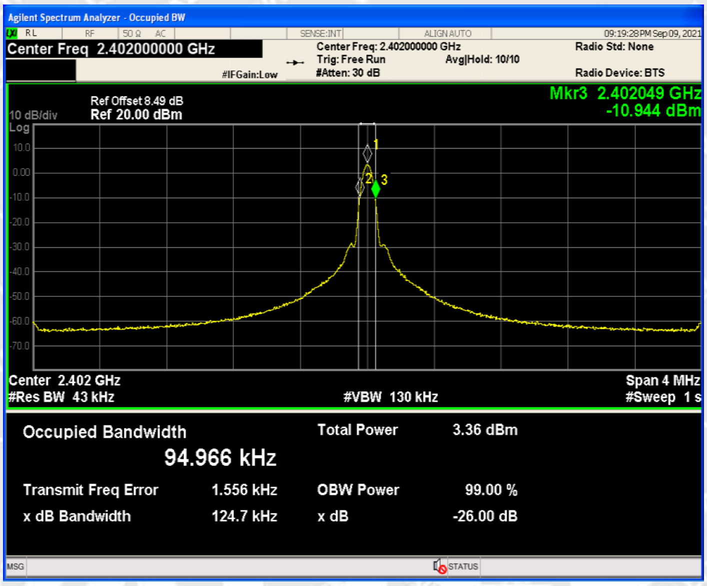
Step 3:
Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded.

6.3.3 Test Result

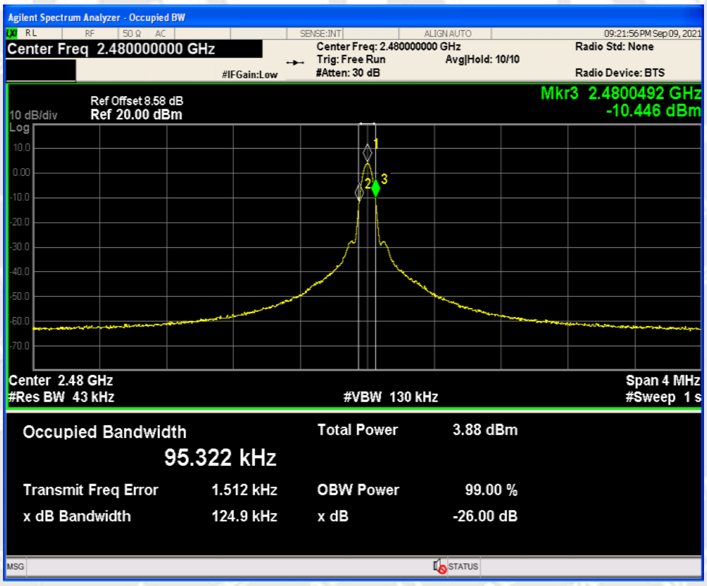
Test Condition	Test Mode	Channel	OCB (MHz)	FL(MHz)	FH(MHz)	Limit(MHz)	Verdict
NTNV	BLE	2402	0.09497	2401.95	2402.05	2400 to 2483.5	Pass
		2480	0.09532	2479.95	2480.05	2400 to 2483.5	Pass

Test Graphs:

Occupied Channel Bandwidth_NTNV_BLE_2402



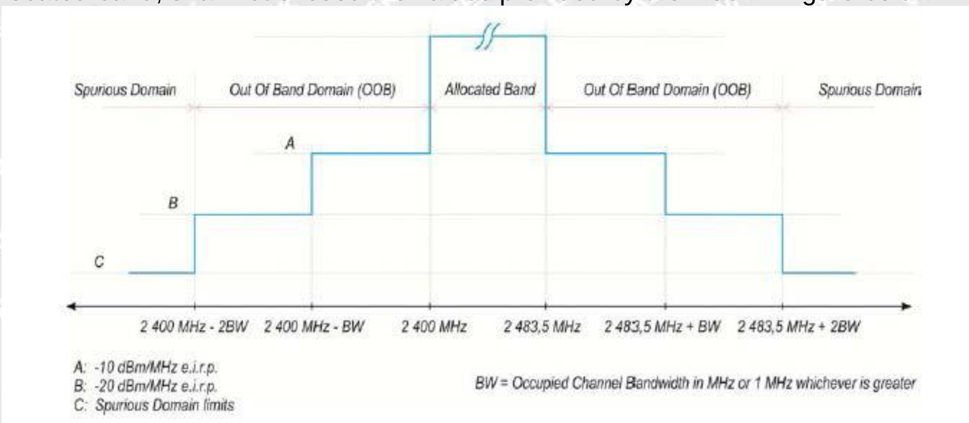
Occupied Channel Bandwidth_ NTNV_BLE_2480



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

6.4.1 Standard Applicable

According to section 4.3.1.9.3&4.3.2.8.3, The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in figure below



Within the 2 400 MHz to 2 483,5 MHz band, the Out-of-band emissions are fulfilled by compliance with the Occupied Channel Bandwidth requirement

6.4.2 Test Procedure

According to the section 5.3.9.2.1, the measurement procedure shall be as follows:
The Out-of-band emissions within the different horizontal segments of the mask provided in figures 1 and 3 shall
be measured using the steps below. This method assumes the spectrum analyser is equipped with the Time Domain Power option.

Step 1:

• Connect the UUT to the spectrum analyser and use the following settings:
- Centre Frequency: 2 484 MHz
- Span: 0 Hz
- Resolution BW: 1 MHz
- Filter mode: Channel filter
- Video BW: 3 MHz
- Detector Mode: RMS
- Trace Mode: Max Hold
- Sweep Mode: Continuous
- Sweep Points: Sweep Time [s] / (1 μ s) or 5 000 whichever is greater
- Trigger Mode: Video trigger

NOTE 1: In case video triggering is not possible, an external trigger source may be used.
- Sweep Time: > 120 % of the duration of the longest burst detected during the measurement of the RF Output Power

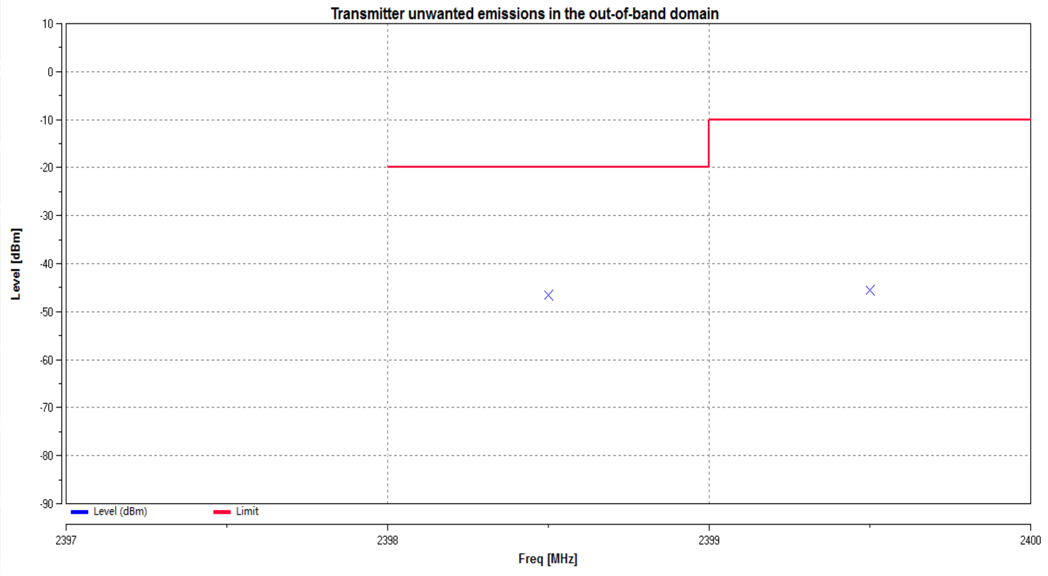
Step 2: (segment 2 483,5 MHz to 2 483,5 MHz + BW)
• Adjust the trigger level to select the transmissions with the highest power level.
• For frequency hopping equipment operating in a normal hopping mode, the different hops will result in signal bursts with different power levels. In this case the burst with the highest power level shall be selected.
• Set a window (start and stop lines) to match with the start and end of the burst and in which the RMS power shall be measured using the Time Domain Power function.
• Select RMS power to be measured within the selected window and note the result which is the RMS power within this 1 MHz segment (2 483,5 MHz to 2 484,5 MHz). Compare this value with the applicable limit provided by the mask.
• Increase the centre frequency in steps of 1 MHz and repeat this measurement for every 1 MHz segment within the range 2 483,5 MHz to 2 483,5 MHz + BW. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + BW - 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).
Step 3: (segment 2 483,5 MHz + BW to 2 483,5 MHz + 2BW)
• Change the centre frequency of the analyser to 2 484 MHz + BW and perform the measurement for the first 1 MHz segment within range 2 483,5 MHz + BW to 2 483,5 MHz + 2BW. Increase the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + 2 BW - 0,5 MHz.
Step 4: (segment 2 400 MHz - BW to 2 400 MHz)
• Change the centre frequency of the analyser to 2 399,5 MHz and perform the measurement for the first 1 MHz segment within range 2 400 MHz - BW to 2 400 MHz Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2BW + 0,5 MHz.
Step 5: (segment 2 400 MHz - 2BW to 2 400 MHz - BW)
• Change the centre frequency of the analyser to 2 399,5 MHz - BW and perform the measurement for the first 1 MHz segment within range 2 400 MHz - 2BW to 2 400 MHz - BW. Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2BW + 0,5 MHz.
Step 6:
• In case of conducted measurements on equipment with a single transmit chain, the declared antenna assembly gain "G" in dBi shall be added to the results for each of the 1 MHz segments and compared with the limits provided by the mask given in figure 1 or figure 3. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered.
• In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), the measurements need to be repeated for each of the active transmit chains. The declared antenna assembly gain "G" in dBi for a single antenna shall be added to these results. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered.
Comparison with the applicable limits shall be done using any of the options given below:
- Option 1: the results for each of the transmit chains for the corresponding 1 MHz segments shall be added. The additional beamforming gain "Y" in dB shall be added as well and the resulting values compared with the limits provided by the mask given in figure 1 or figure 3.
NOTE 2: A ch refers to the number of active transmit chains.
It shall be recorded whether the equipment complies with the mask provided in figure 1 or figure 3.
RBW=1MHz VBW=3MHz

6.4.3 Test Result

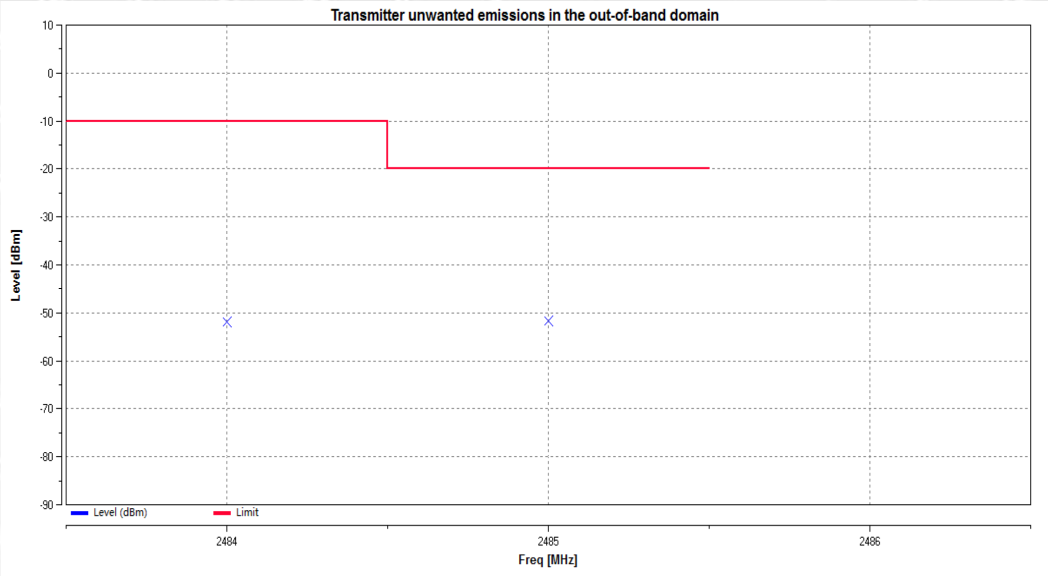
Test Mode	Test Channel	Test Segment (MHz)	Max. Emissions Reading (dBm)	Limit (dBm)	Verdict
BLE	Low	2400-2BW to 2400-BW	-46.63	<=-20	Pass
		2400-BW to 2400	-45.60	<=-10	Pass
		2483.5 to 2483.5+BW	-51.84	<=-10	Pass
		2483.5+BW to 2483.5+2BW	-51.73	<=-20	Pass
	High	2400-2BW to 2400-BW	-52.22	<=-20	Pass
		2400-BW to 2400	-50.53	<=-10	Pass
		2483.5 to 2483.5+BW	-46.25	<=-10	Pass
		2483.5+BW to 2483.5+2BW	-46.72	<=-20	Pass
Note: The data just list the worst case.					

Test Graphs:

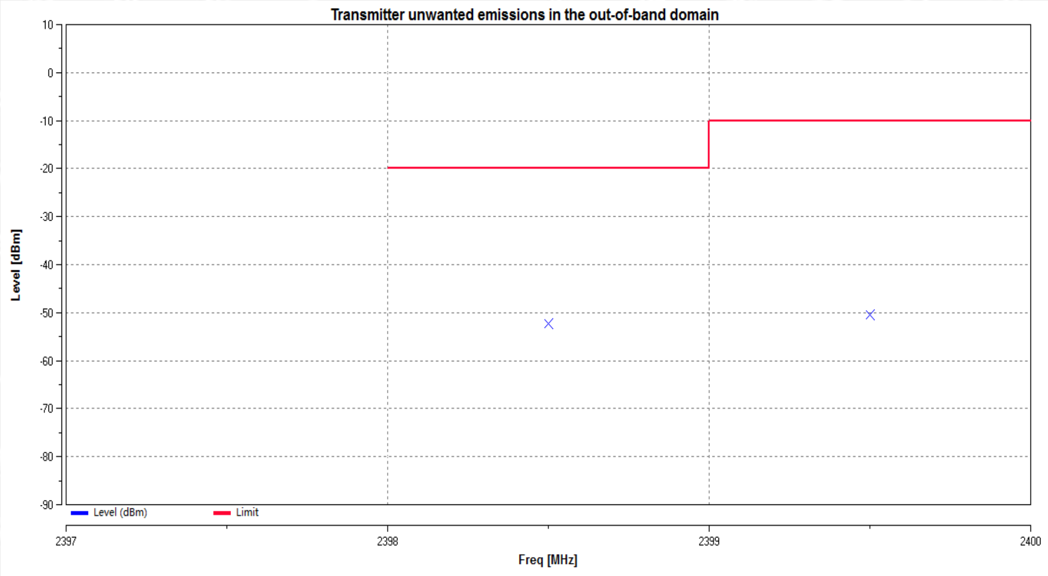
OOB_NTNV_BLE_2402_2400MHz-2BW to 2400MHz



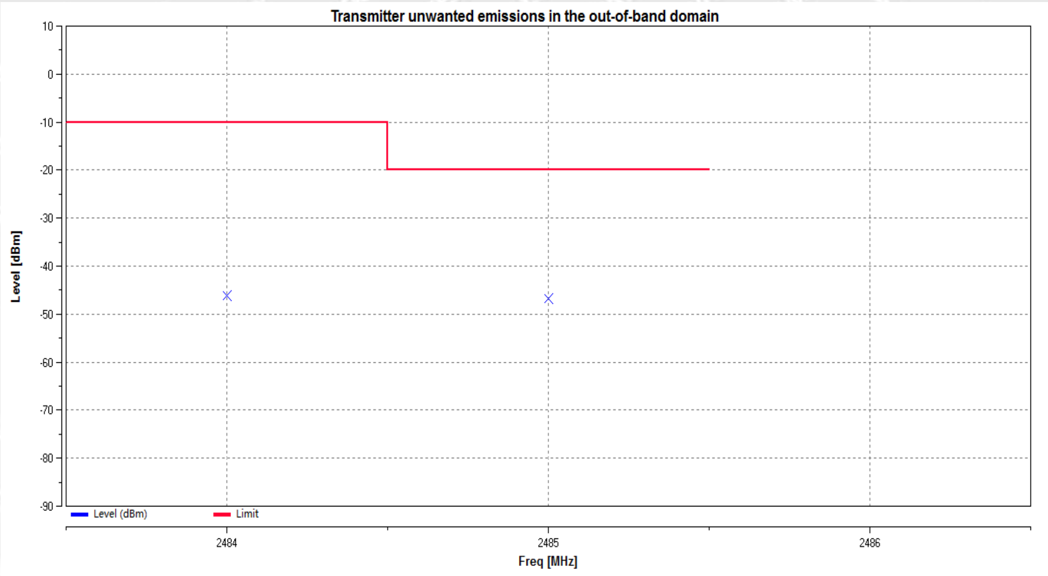
OOB_NTNV_BLE_2402_2483.5MHz to 2483.5MHz+2BW



OOB_NTNV_BLE_2480_2400MHz-2BW to 2400MHz



OOB_NTNV_BLE_2480_2483.5MHz to 2483.5MHz+2BW



6.5 Transmitter unwanted emissions in the spurious domain

6.5.1 Standard Applicable

According to section 4.3.1.10.3& 4.3.2.9.3
The transmitter unwanted emissions in the spurious domain shall not exceed the values given in the following table.

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

6.5.2 Test Procedure

The device under test has an integral antenna and the radiated measurement shall apply to the device, using the method of measurement as described in the EN300328 section 5.3.10.2.
RBW=100kHz VBW=300kHz 30MHz-1GHz
RBW=1MHz VBW=3MHz 1GHz-12.75GHz

6.5.3 Test Result

Frequency (MHz)	Receiver Reading (dBμV)	Turn table Angle (°)	RX Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable (dB)	Antenna Gain (dB)			
TX_BLE_Low Channel										
520.94	24.96	127	1.4	H	-74.75	0.18	0.00	-74.57	-54	-20.57
520.94	26.35	252	1.6	V	-74.52	0.18	0.00	-74.34	-54	-20.34
3648.17	50.74	301	1.8	H	-41.23	2.37	12.50	-51.36	-30	-21.36
3648.17	47.58	307	1.4	V	-42.47	2.37	12.50	-52.60	-30	-22.60
5487.56	48.10	235	1.3	H	-41.61	2.85	12.80	-51.56	-30	-21.56
5487.56	44.88	143	1.5	V	-44.11	2.85	12.80	-54.06	-30	-24.06
TX_BLE_High Channel										
518.95	26.06	267	1.9	H	-73.70	0.18	0.00	-73.52	-54	-19.52
518.95	24.73	123	1.4	V	-76.38	0.18	0.00	-76.20	-54	-22.20
3226.92	49.96	104	1.6	H	-41.49	2.11	12.00	-51.38	-30	-21.38
3226.92	46.36	281	1.0	V	-43.27	2.11	12.00	-53.16	-30	-23.16
5081.07	48.27	116	1.8	H	-41.15	2.79	12.70	-51.06	-30	-21.06
5081.07	43.57	298	1.5	V	-45.38	2.79	12.70	-55.29	-30	-25.29

6.6 Receiver spurious emissions

6.6.1 Standard Applicable

According to section 4.3.1.11.3&4.3.2.10.3, The spurious emissions of the receiver shall not exceed the values given in table below

NOTE: In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted) and to the emissions radiated by the cabinet. In case of integral antenna equipment (without temporary antenna connectors), these limits apply to emissions radiated by the equipment. Spurious emission limits for receivers

Frequency Range	Maximum Power	Bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

6.6.2 Test Procedure

The device under test has an integral antenna and the radiated measurement shall apply to the device, using the method of measurement as described in the EN300328 section 5.3.11.2.

RBW=100kHz VBW=300kHz 30MHz-1GHz

RBW=1MHz VBW=3MHz 1GHz-12.75GHz

6.6.3 Test Result

Frequency (MHz)	Receiver Reading (dBμV)	Turn table Angle (°)	RX Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable (dB)	Antenna Gain (dB)			
610.40	24.39	288	1.7	H	-74.99	0.20	0.00	-74.79	-57	-17.79
610.40	24.18	133	1.2	V	-74.82	0.20	0.00	-74.62	-57	-17.62
3708.67	49.86	205	1.4	H	-41.42	2.37	12.50	-51.55	-47	-4.55
3708.67	46.96	171	1.6	V	-42.59	2.37	12.50	-52.72	-47	-5.72
5670.92	48.14	181	2.0	H	-41.41	2.87	12.90	-51.44	-47	-4.44
5670.92	45.48	260	1.7	V	-43.63	2.87	12.90	-53.66	-47	-6.66

6.7 Receiver Blocking

6.7.1 Standard Applicable

According to section 4.3.2.11.2, 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) at frequencies other than those of the operating band.

Load Based Equipment not using any of the mechanisms referenced above shall comply with the following minimum set of requirements :

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

While maintaining the minimum performance criteria as defined in clause 4.3.2.11.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category 1, 2 and 3 provided in table 14, table 15 or table 16.

Receiver category 1

Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p. shall be considered as receiver category 1 equipment.

Table 14: Receiver Blocking parameters for Recevier Category 1 equipment

<table>
<tr><th>Wanted signal mean power from companion device (dBm)
(see notes 1 and 4)</th><th>Blocking signal frequency (MHz)</th><th>Blocking signal power (dBm)
(see note 4)</th><th>Type of blocking signal</th></tr>
<tr><td>(-133 dBm + 10 × $\log_{10}$(OCBW)) or -68 dBm whichever is less
(see note 2)</td><td>2 380
2 504</td><td rowspan="2">-34</td><td rowspan="2">CW</td></tr>
<tr><td>(-139 dBm + 10 × $\log_{10}$(OCBW)) or -74 dBm whichever is less
(see note 3)</td><td>2 300
2 330
2 360
2 524
2 584
2 674</td></tr>
<tr><td colspan="4">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 Pmin + 26 dB where Pmin 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 Pmin + 20 dB where Pmin 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.</td></tr>
</table>

Receiver category 2

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

Table 15: Receiver Blocking parameters receiver Category 2 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × $\log_{10}$(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

NOTE 1: OCBW is in Hz.

NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 26 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.

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

Receiver category 3

Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % or adaptive equipment with a maximum RF output power of 0 dBm e.i.r.p. shall be considered as receiver category 3 equipment.

Table 16: Receiver Blocking parameters receiver Category 3 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × $\log_{10}$(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW

NOTE 1: OCBW is in Hz.

NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative the test may be performed using a wanted signal up to Pmin + 30 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.

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

6.7.2 Test Procedure

Step 1: • For non-frequency hopping equipment, the UUT shall be set to the lowest operating channel.
Step 2: • The blocking signal generator is set to the first frequency as defined in the appropriate table corresponding to the receiver category and type of equipment.
Step 3: • With the blocking signal generator switched off, a communication link is established between the UUT and the associated companion device using the test setup shown in figure 6. The variable attenuator is set to a value that achieves the minimum performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 with a resolution of at least 1 dB. The resulting level for the wanted signal at the input of the UUT is Pmin. This value shall be measured and recorded in the test report.
• The signal level is increased by the value provided in the table corresponding to the receiver category and type of equipment.
Step 4: • The blocking signal at the UUT is set to the level provided in the table corresponding to the receiver category and type of equipment. It shall be verified and recorded in the test report that the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is met.
Step 5: • Repeat step 4 for each remaining combination of frequency and level for the blocking signal as provided in the table corresponding to the receiver category and type of equipment.
Step 6: • For non-frequency hopping equipment, repeat step 2 to step 5 with the UUT operating at the highest operating channel.

6.7.3 Test Setup

According to the section 5.4.11.2.1, the test block diagram shall be used.

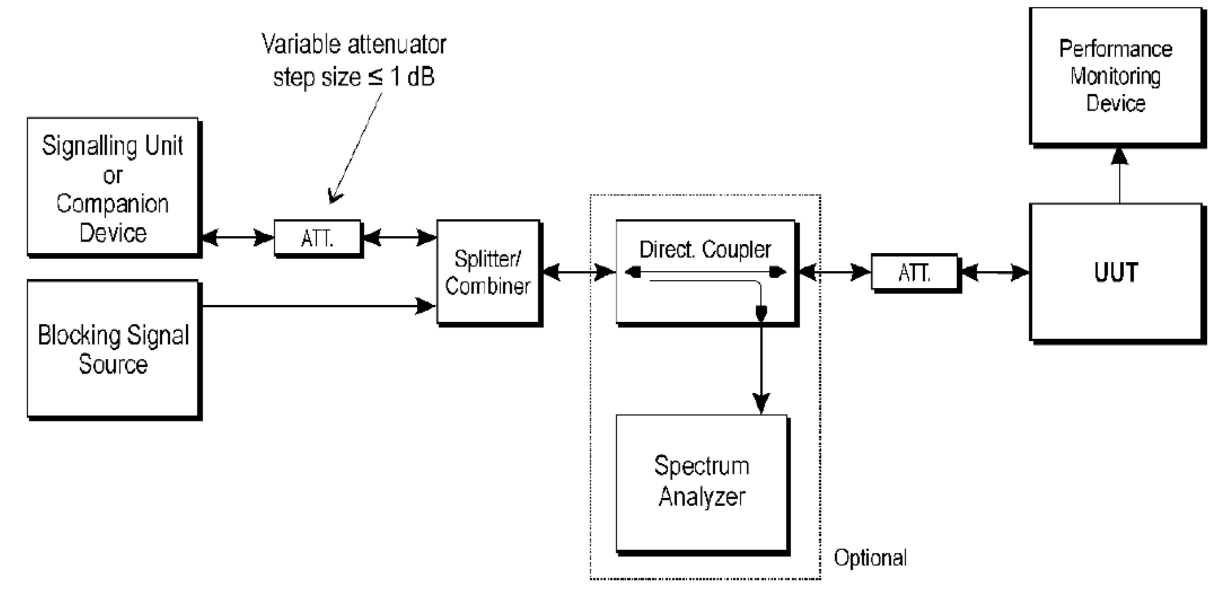


Figure 6: Test Set-up for receiver blocking

All test procedure is carried to the section 5.4.11.2.1

RBW/VBW=8MHz/30MHz

6.7.4 Test Result

GFSK						
Receiver Blocking Categories 2						
Wanted signal meanpower from companion device (dBm)	**OCBW (Hz)**	**Blocking signal frequency (MHz)**	**Blocking signal power(dBm) CW**	**PER (%)**	**Limit**	**Results**
-79.22	94970	2380	-34	2.6	≤10%	Pass
		2504	-34	4.4		
		2300	-34	4.9		
		2584	-34	3.0		

NOTE 1: 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 %.
NOTE 2: 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.
NOTE 3: The smallest channel bandwidth and the lowest data rate for this channel bandwidth which still allows the equipment to operate as intended shall be used. This mode of operation shall be aligned with the performance criteria defined in clause 4.3.1.12.3 or clause 4.3.2.11.3 and shall be described in the test report.

7 Health Requirements

7.1 Limits

According to Council Recommendation: the criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation.
Reference levels for electric, magnetic and electromagnetic fields (10MHz to 300GHz).
Low-power electronic and electrical equipment is deemed to comply with the provisions of this standard if it can be demonstrated using routes B, C or D that the available antenna power and/or the average total radiated power is less than or equal to the applicable low-power exclusion level Pmax.
Annex A contains example values for Pmax derived from existing exposure limits listed in the bibliography, such as the ICNIRP guidelines [1], IEEE Std C95.1-1999 [2], and IEEE Std C95.1-2005 [3].
For wireless devices operated close to a person’s body with available antenna powers and/or average total radiated powers higher than the Pmax values given in Annex A, the alternative Pmax values (called Pmax′), described in Annex B can also be used.
For low power equipment using pulsed signals, other limits may apply in addition to those considered in Annex A and Annex B. Both ICNIRP guidelines [1] and IEEE standards [2], [3] have specific restrictions on exposures to pulsed fields, and the requirements of those standards with respect to exposure to pulses shall be met. Annex C discusses this topic further.

7.2 Test Result of RF Exposure Evaluation

Test Mode	Transmit
Limit (Pmax)	20mW/13dBm

After performed the test at low/middle/high channel, the below recorded is the worst.

The worst e.i.r.p. (dBm)	Pmax(dBm)	Result
4.72	13	Compliant

8 Photographs - Test Setup

8.1 Photograph-Spurious Emissions Test Setup

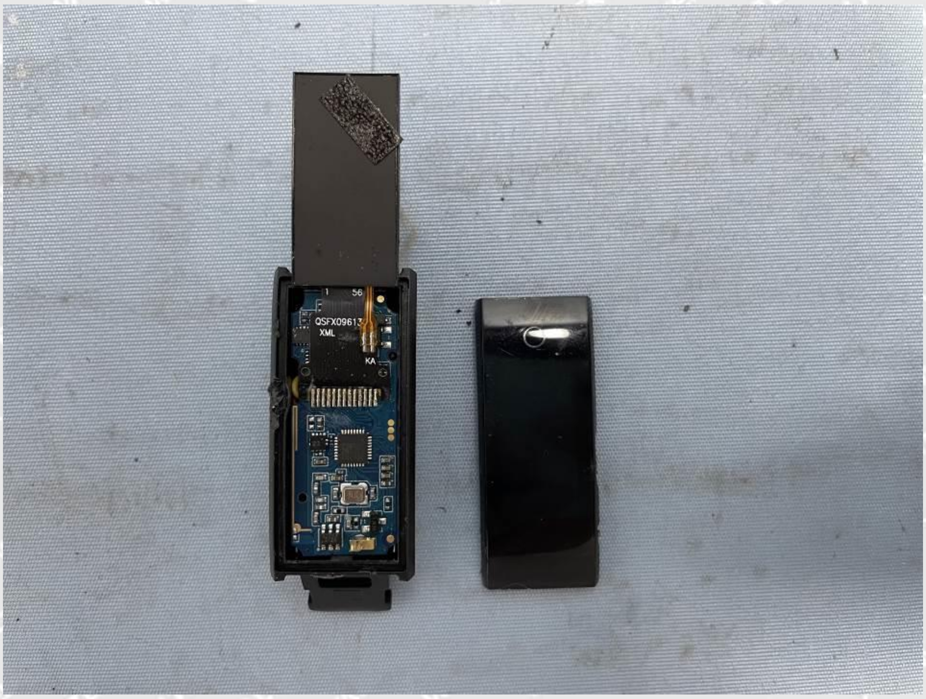
Below 1GHz

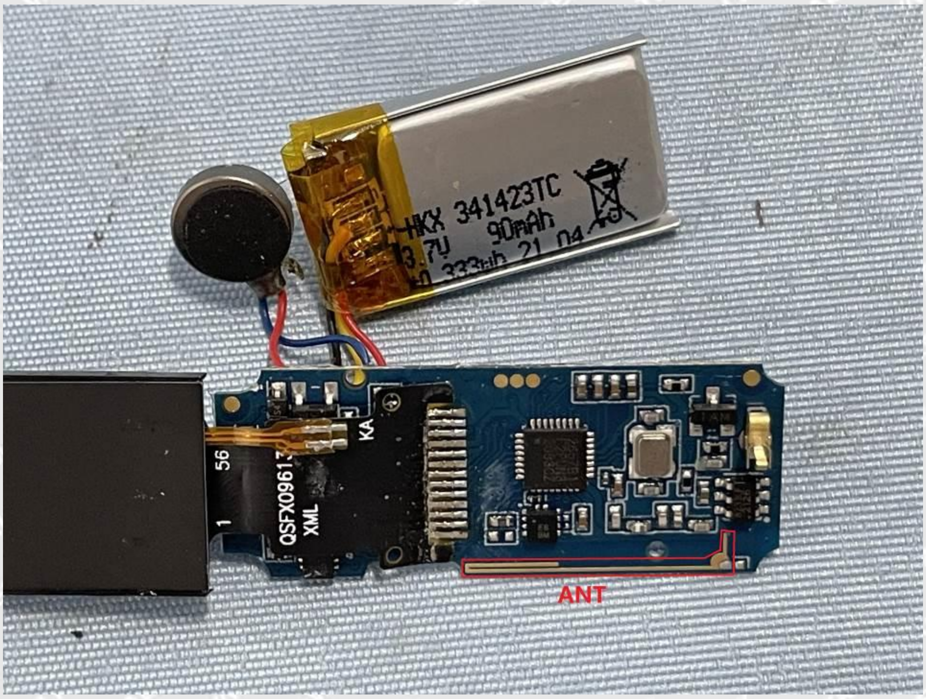
Above 1GHz

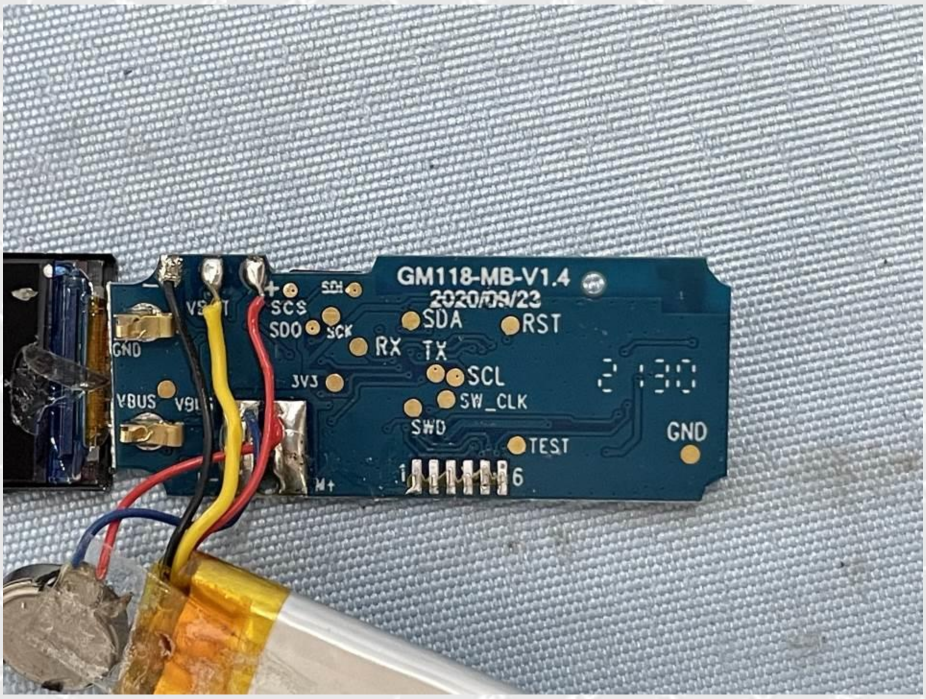
9 Photographs - Constructional Details

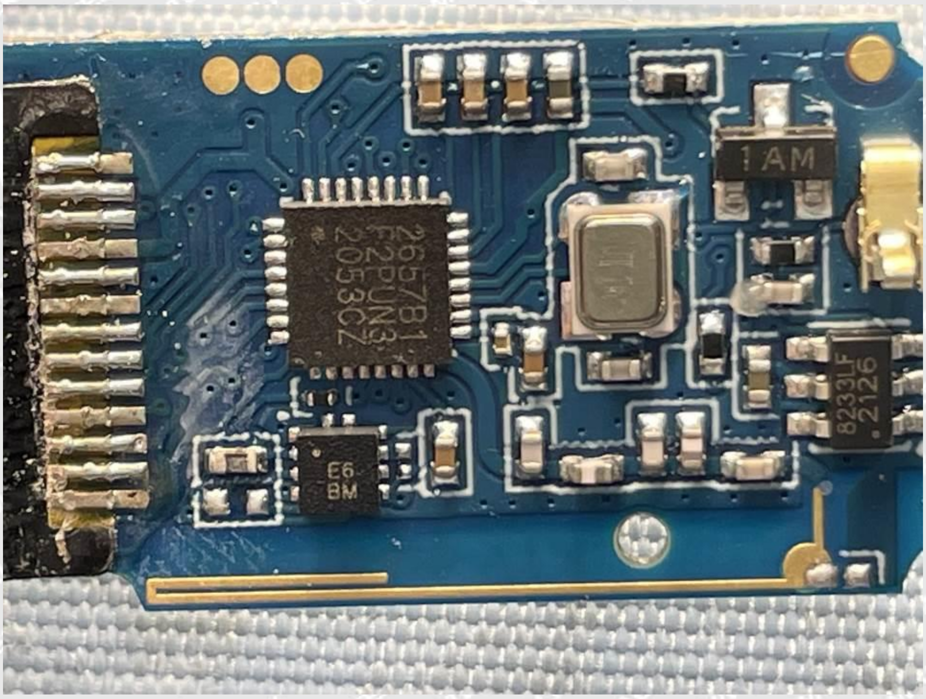
9.1 EUT – External Photos

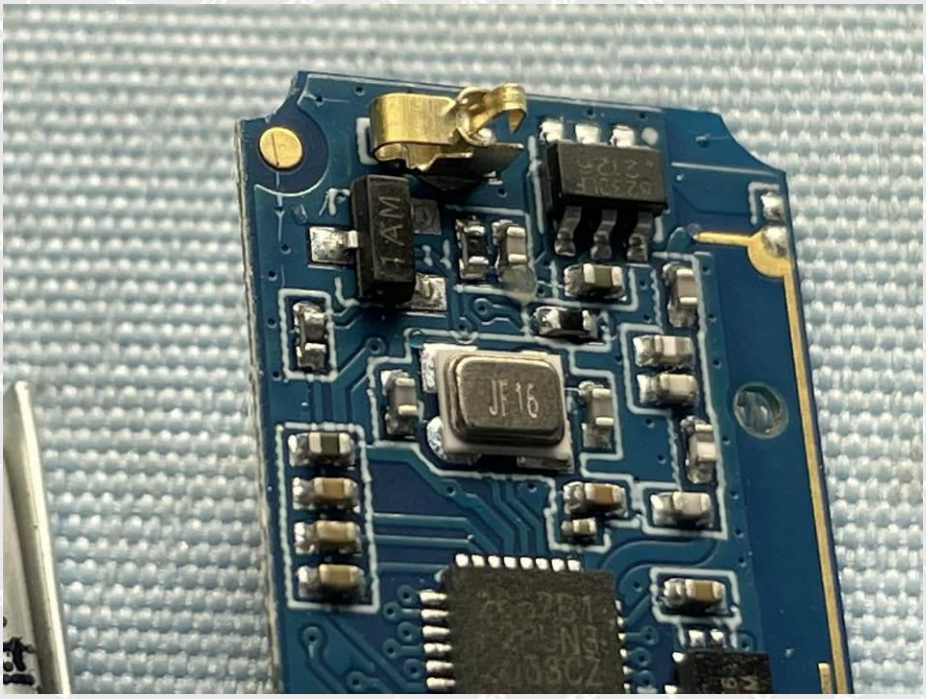
9.2 EUT – Internal Photos






GM118-MB-V1.4
2020/09/23
SDA
RST
RX
TX
SCL
SW_CLK
SWD
TEST
GND





======End of Report======