



中国认可  
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检测  
TESTING  
CNAS L6478



# TEST REPORT

**Reference No.** : WTF25F09233903W002  
**Applicant** : Mid Ocean Brands B.V.  
**Address** : Unit 711-716, 7/F., Tower A, 83 King Lam Street, Cheung Sha Wan, Kowloon, Hong Kong.  
**Manufacturer** : 118102  
**Address** : ---  
**Product Name** : Wireless multi speaker  
**Model No.** : MO6887  
**Test specification** : ETSI EN 300 328 V2.2.2 (2019-07)  
**Date of Receipt sample** : 2025-09-23  
**Date of Test** : 2025-09-28  
**Date of Issue** : 2025-09-30  
**Test Report Form No.** : WEW-300328A-01B  
**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 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 13	Pass
Receiver Blocking	ETSI EN 300 328 V2.2.2	Clause 4.3.2.11.4.2	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** ..... : Wireless multi speaker  
**Model No.** ..... : MO6887  
**Remark** ..... : ---  
**Rating** ..... : Wireless output power: 10W Max.  
 Input: DC 5V, 2A  
 Output: DC 9V, 1.22A  
 Power bank:  
 Type-C Input: DC 5V, 2A  
 USB Output: DC 5V, 2A  
 Battery: 3.7V, 4000mAh, 14.8Wh

#### 3.2 Technical Specification

**Bluetooth Version** ..... : Bluetooth LE  
**Frequency Range** ..... : 2402-2480MHz  
**Maximum RF Output Power** ..... : -1.85 dBm (EIRP)  
**Type of Modulation** ..... : GFSK  
**Quantity of Channels** ..... : 40  
**Channel Separation** ..... : 2MHz  
**Antenna Type** ..... : PCB Antenna  
**Antenna Gain** ..... : -0.58dBi  
**Receiver Category** ..... : 3

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.

### 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 and 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.

### 3.7 Disclaimer

The antenna gain information is provided by the customer. The laboratory is not responsible for the accuracy of the antenna gain information.



## 4 Equipment Used during Test

### 4.1 Equipment List

<input checked="" type="checkbox"/> 3m Semi-anechoic Chamber for Spurious Emission						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	3m Semi-anechoic Chamber	CHANGCHUANG	9mx6mx6m	-	2024-01-05	2027-01-04
2	EMI TEST RECEIVER	RS	ESR7	101566	2025-01-06	2026-01-05
3	Spectrum Analyzer	Agilent	N9020A	MY48011796	2025-01-06	2026-01-05
4	Trilog Broadband Antenna	SCHWARZBECK	VULB9162	9162-117	2025-01-12	2026-01-11
5	Coaxial Cable (below 1GHz)	Times Microwave Systems	RG223-NMNM-10M	-	2025-01-07	2026-01-06
6	Coaxial Cable (below 1GHz)	Times Microwave Systems	RG223-NMNM-3M	-	2025-01-07	2026-01-06
7	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	01561	2025-01-13	2026-01-12
8	Broadband Preamplifier (Above 1GHz)	Lunar E M	LNA1G18-40	20160501002	2025-01-06	2026-01-05
9	Coaxial Cable (above 1GHz)	Times-Microwave	CBL5-NN	-	2025-01-06	2026-01-05
<input checked="" type="checkbox"/> RF Conducted test						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Environmental Chamber	GERUI	GR-HWS-1000L	GR24061818	2025-07-02	2026-07-01
2	Spectrum Analyzer	Agilent	N9020A	MY48011796	2025-01-06	2026-01-05
3	EXG Analog Signal Generator	Agilent	N5181A	MY48180720	2025-01-06	2026-01-05
4	RF Control Unit	CHANGCHUANG	JS0806-2	-	2025-01-08	2026-01-07
5	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY56510008	2025-01-08	2026-01-07

: Not Used

: Used



## 4.2 Software List

Description	Manufacturer	Model	Version
EMI Test Software (Radiated Emission)	FARATRONIC	EZ-EMC	RA-03A1-2
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	±2.2dB	(1)
Occupied Bandwidth	±1.5%	(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  $U_{cisp}$ , then

- Compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If  $U_{LAB}$  is greater than  $U_{cisp}$ , then

- Compliance is deemed to occur if no measured disturbance level, increased by  $(U_{LAB}-U_{cisp})$ , exceeds the disturbance limit;
- Non-compliance is deemed to occur if any measured disturbance level, increased by  $(U_{LAB}-U_{cisp})$ , 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:

### 5.1 RF Channel and Frequency

The lowest, middle and highest channel were tested as representatives.

BLE							
Channel	Frequency (MHz)						
00	2402	10	2422	20	2442	30	2462
01	2404	11	2424	21	2444	31	2464
02	2406	12	2426	22	2446	32	2466
03	2408	13	2428	23	2448	33	2468
04	2410	14	2430	24	2450	34	2470
05	2412	15	2432	25	2452	35	2472
06	2414	16	2434	26	2454	36	2474
07	2416	17	2436	27	2456	37	2476
08	2418	18	2438	28	2458	38	2478
09	2420	19	2440	29	2460	39	2480

### 5.2 Independent Operation Modes

Test Mode	Description	Test Channel
A.1	Wireless with BLE mode, Transmitting	Lowest Channel, Middle Channel, Highest Channel
A.2	Wireless with BLE mode, Receiving	Lowest Channel, Highest Channel
B	Operating Normal mode with BLE connecting	/

### 5.3 Test Environment Condition

Test Condition	Temperature (°C)	Relative Humidity (%)	ATM Pressure (kPa)
Normal	22	45 %	101.2kPa
LTVN	-10	---	---
HTVN	+50	---	---



## 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 5.4.2.2.1.2 of the standard EN 300328, 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.

### 6.1.3 Test Condition

**Operating Mode** ..... : A.1

**Test Environment** ..... : Normal Condition, Extreme Condition

**Test Voltage** ..... : DC 3.3V (power to control panel)

**Ambient temperature** ..... : 22°C

**Humidity** ..... : 54%RH

**Atmospheric Pressure** ..... : 101.2kPa

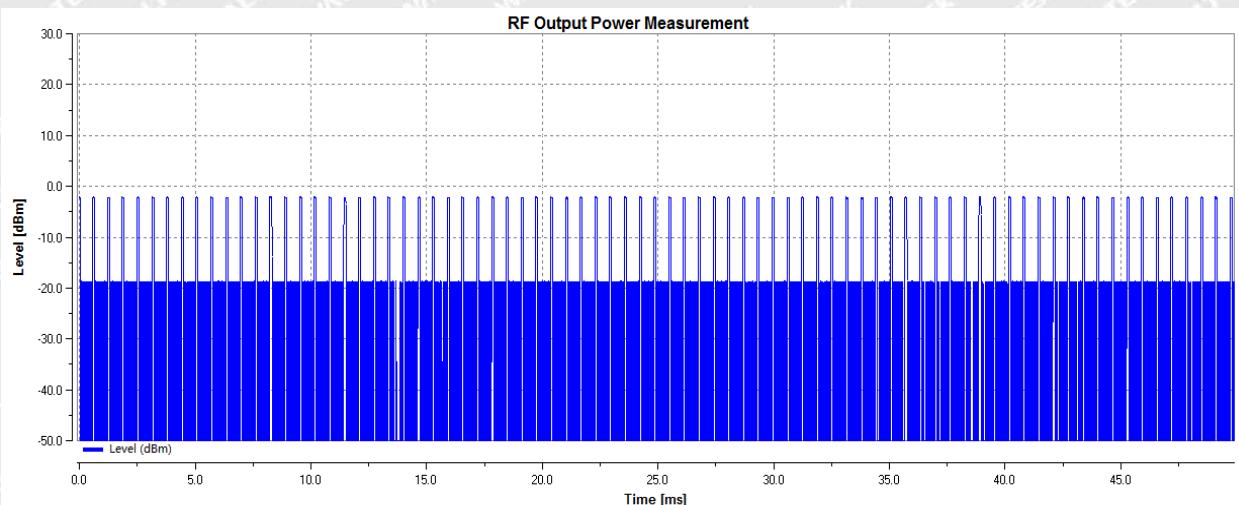
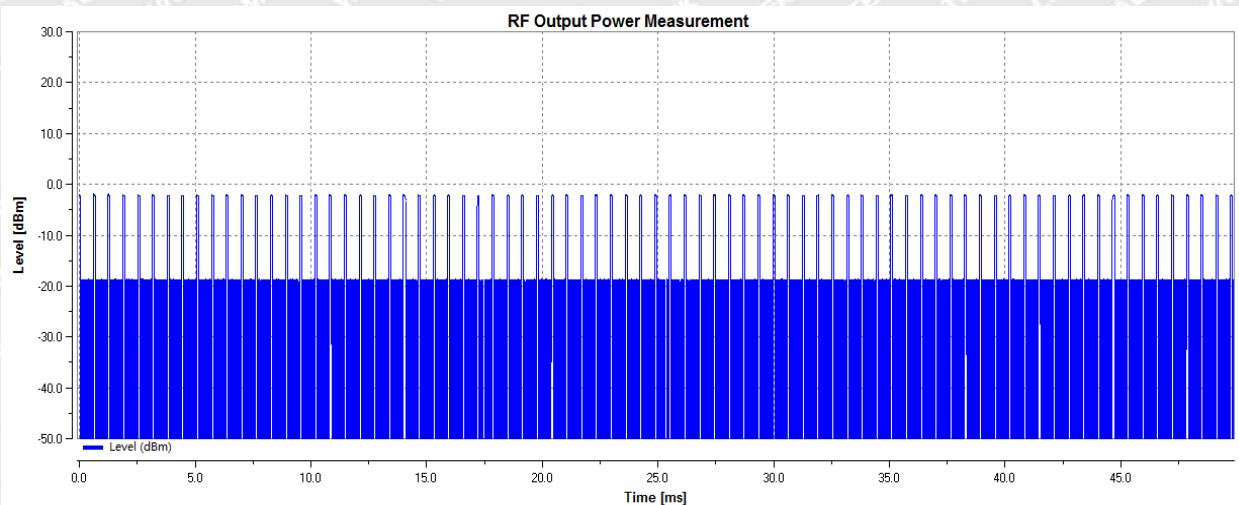
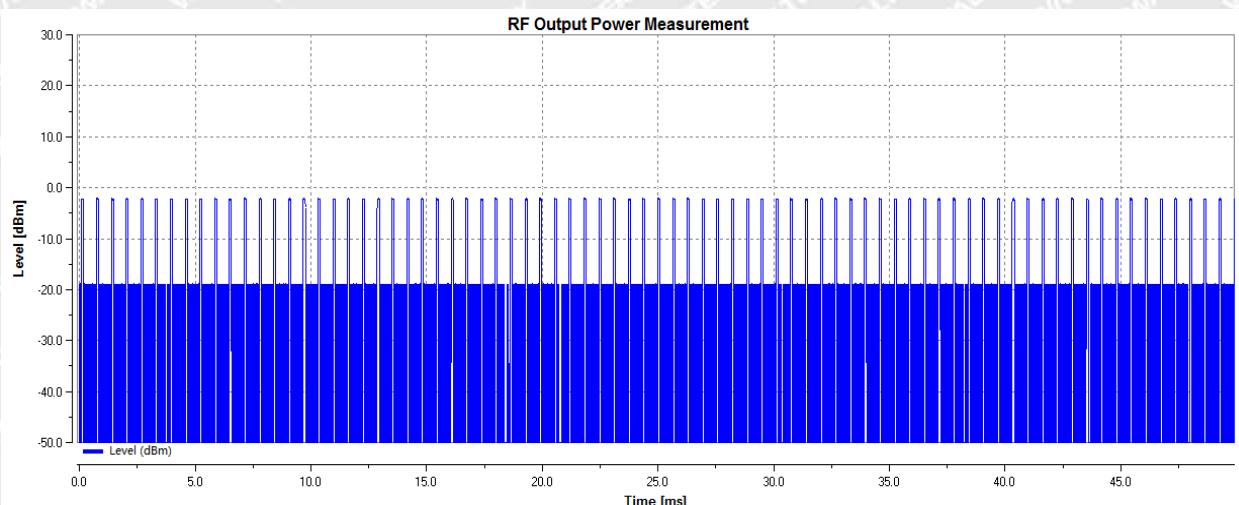


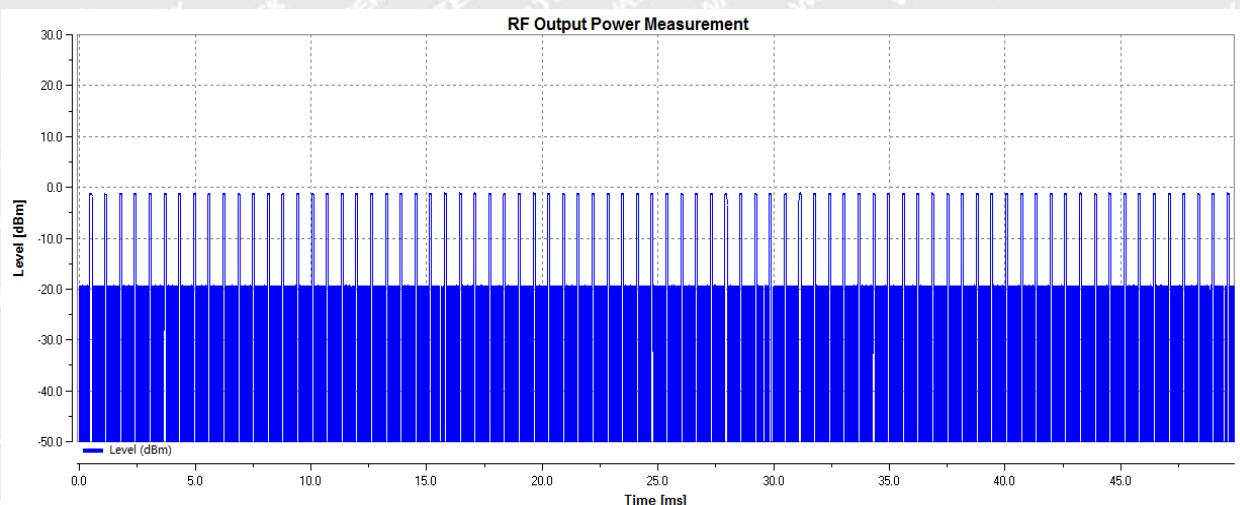
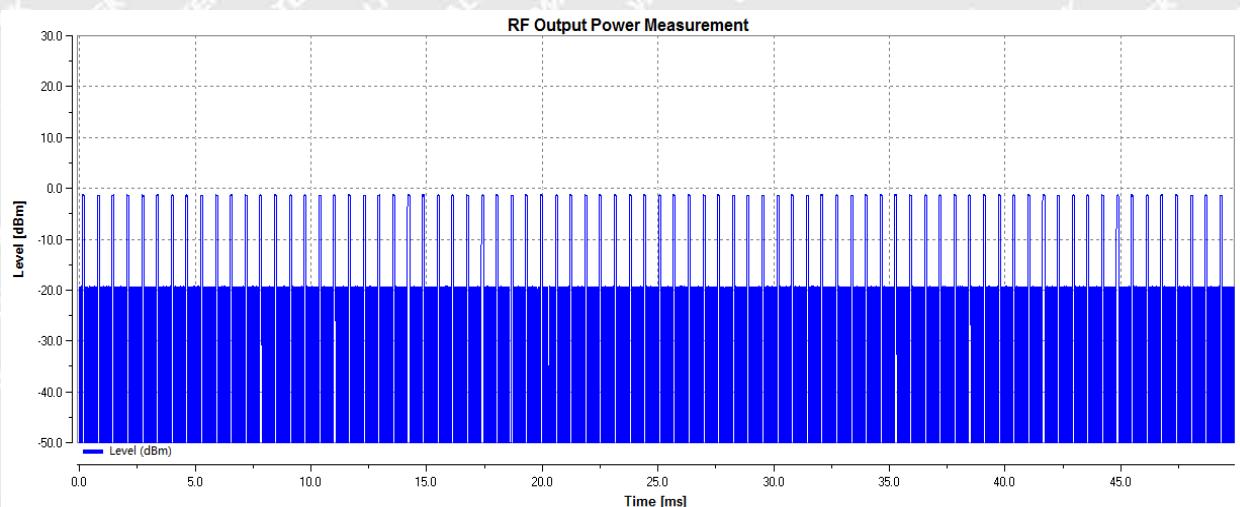
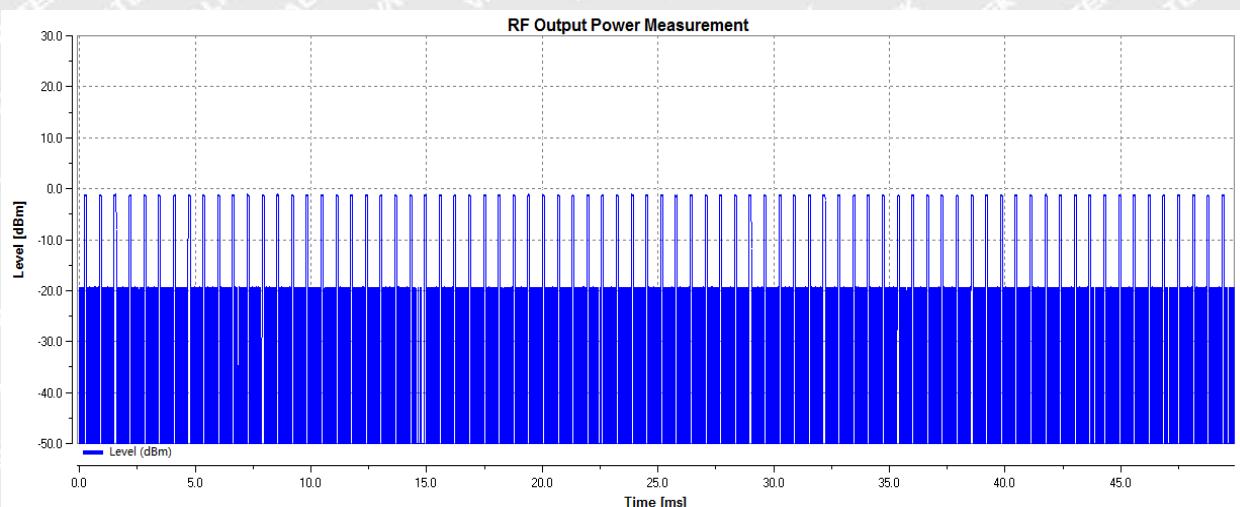
### 6.1.4 Test Result

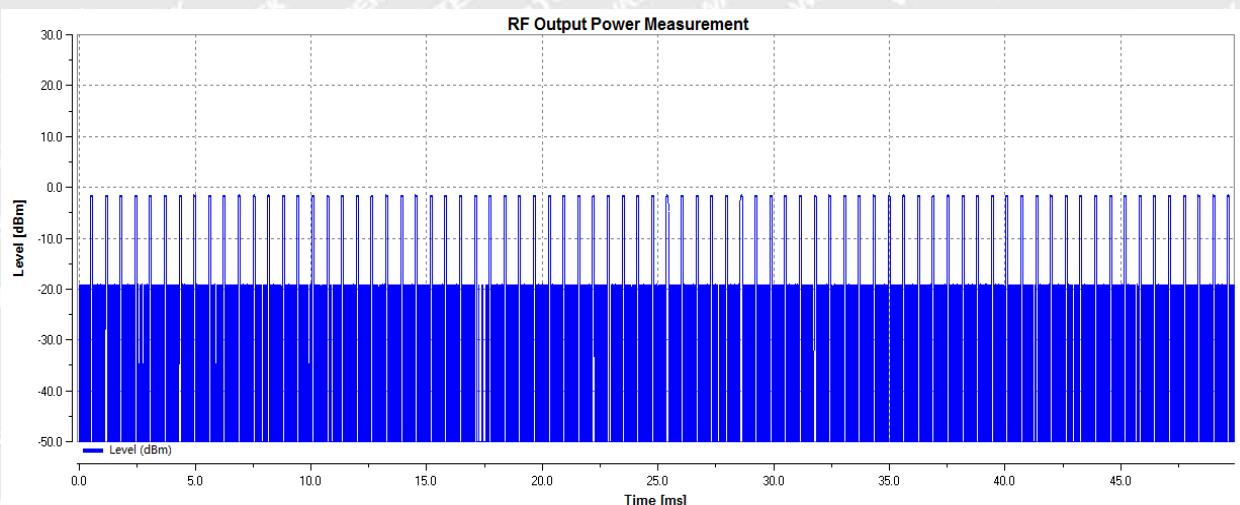
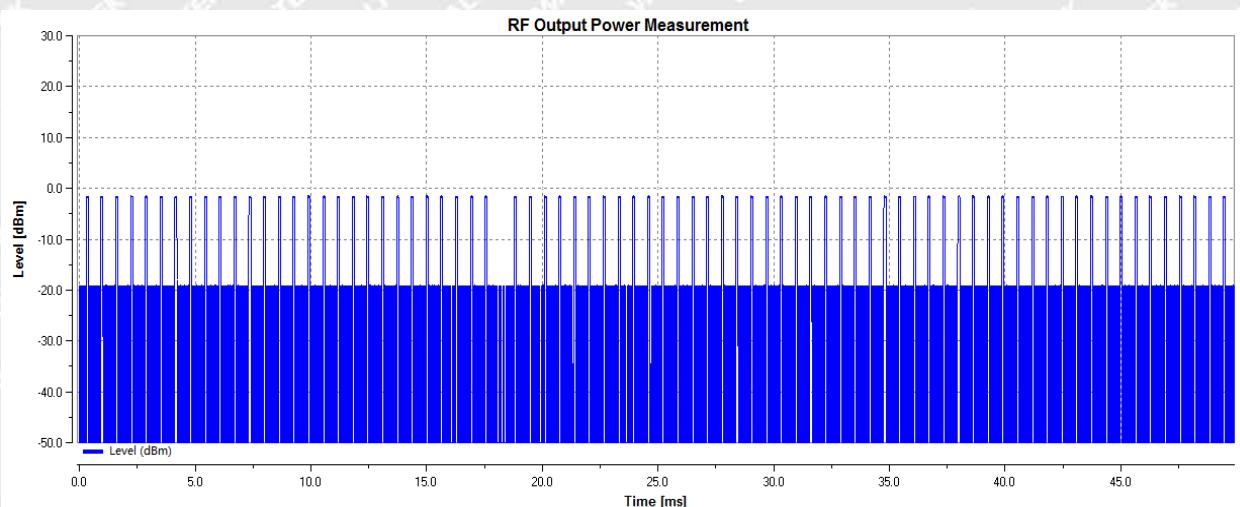
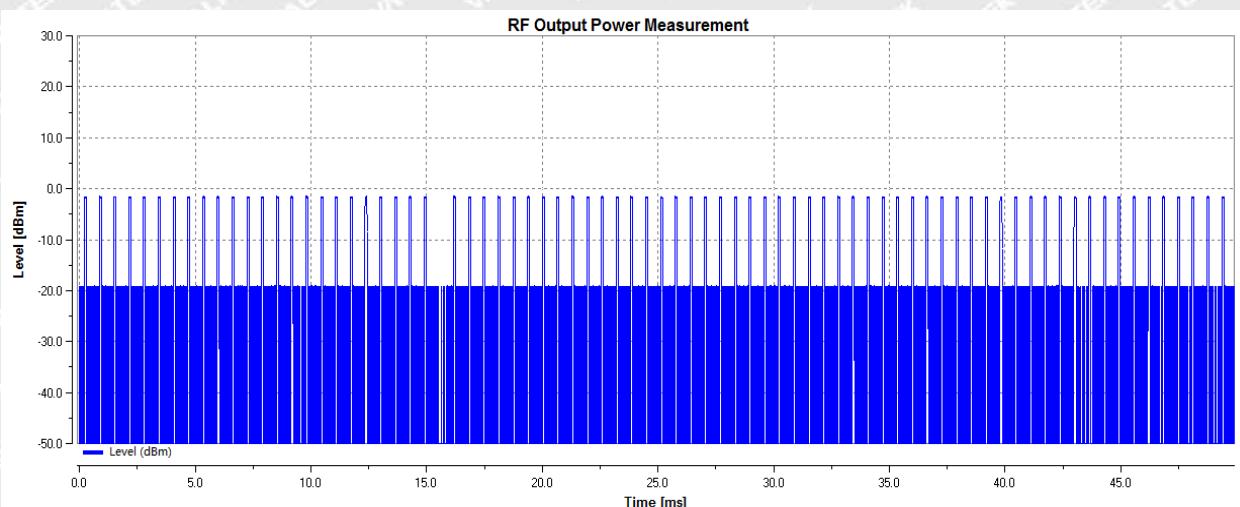
Test Condition	Test Mode	Test Channel (MHz)	EIRP (dBm)	Limit (dBm)	Verdict
TLVN	BLE	2402	-2.75	<=20	Pass
TNVN	BLE	2402	-2.74	<=20	Pass
THVN	BLE	2402	-2.78	<=20	Pass
TLVN	BLE	2440	-1.85	<=20	Pass
TNVN	BLE	2440	-1.92	<=20	Pass
THVN	BLE	2440	-1.87	<=20	Pass
TLVN	BLE	2480	-2.24	<=20	Pass
TNVN	BLE	2480	-2.21	<=20	Pass
THVN	BLE	2480	-2.21	<=20	Pass

Remark: EIRP=Conducted power+ ANT gain

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**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\_2440****RF Output Power\_TNVN\_BLE\_2440****RF Output Power THVN\_BLE\_2440**

**RF Output Power\_TLVN\_BLE\_2480****RF Output Power\_TNVN\_BLE\_2480****RF Output Power THVN\_BLE\_2480**

\*Remark: The antenna gain is not considered in the result plot.



## 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 5.4.3.2.1 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; for spectrum analysers not supporting this number of sweep points, the frequency band may be segmented
- Detector: RMS
- Trace Mode: Max Hold
- Sweep time:

For non-continuous transmissions:  $2 \times \text{Channel Occupancy Time} \times \text{number of sweep points}$ .

For non-adaptive equipment use the maximum TX-sequence time in the formula above instead of the Channel Occupancy Time.

For continuous transmissions: 10 s; the sweep time may be increased further until a value where the sweep time has no further impact anymore 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 5.3.2.2), 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 5.4.2 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 (PSD) 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 Condition

**Operating Mode** ..... : A.1

**Test Environment** ..... : Normal Condition

**Test Voltage** ..... : DC 3.3V (power to control panel)

**Ambient temperature** ..... : 22°C

**Humidity** ..... : 54%RH

**Atmospheric Pressure** ..... : 101.2kPa



### 6.2.4 Test Result

Test Condition	Test Mode	Test Channel	PSD (dBm)	Limit (dBm)	Verdict
NTNV	BLE	2402	-2.32	<=10	Pass
NTNV	BLE	2440	-2.28	<=10	Pass
NTNV	BLE	2480	-2.29	<=10	Pass

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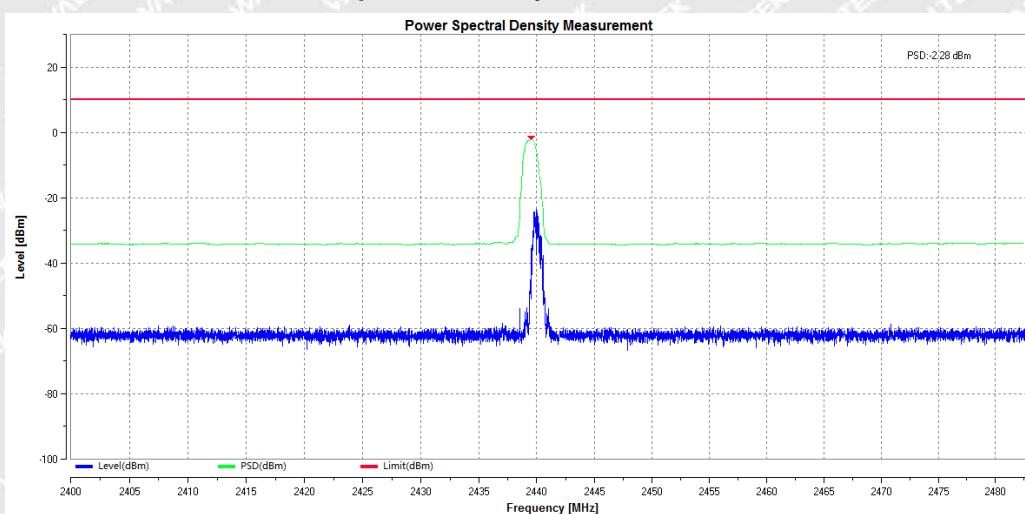


## Test Graphs:

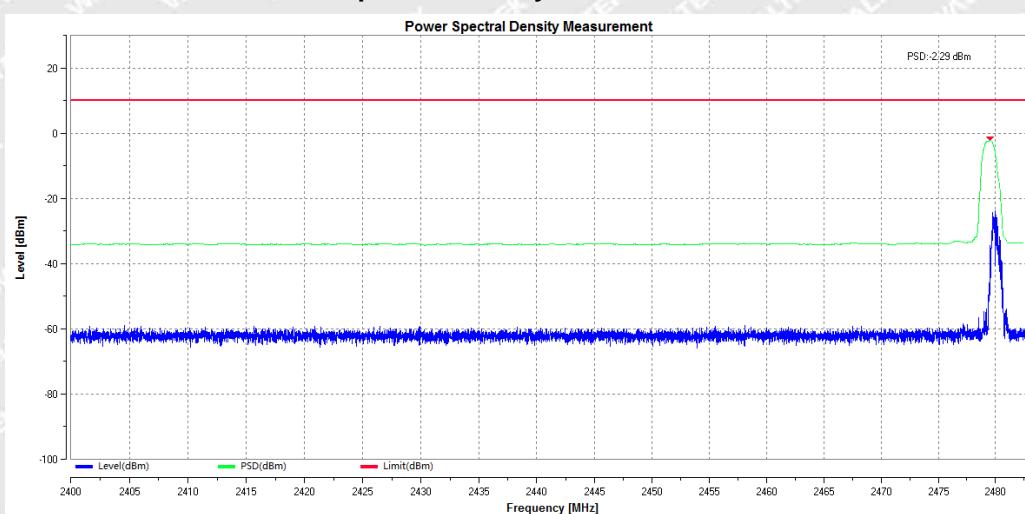
## Power Spectral Density\_NTNV\_BLE\_2402



## Power Spectral Density\_NTNV\_BLE\_2440



## 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 5.4.7.2.1, 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:  $3 \times$  RBW
- Frequency Span:  $2 \times$  Nominal Channel Bandwidth
- Detector Mode: RMS
- Trace Mode: Max Hold
- Sweep time: 1 s

#### Step 2:

Wait for the trace to stabilize.

Find the peak value of the trace and place the analyser marker on this peak.

#### Step 3:

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

### 6.3.3 Test Condition

**Operating Mode** ..... : A.1

**Test Environment** ..... : Normal Condition

**Test Voltage** ..... : DC 3.3V (power to control panel)

**Ambient temperature** ..... : 22°C

**Humidity** ..... : 54%RH

**Atmospheric Pressure** ..... : 101.2kPa

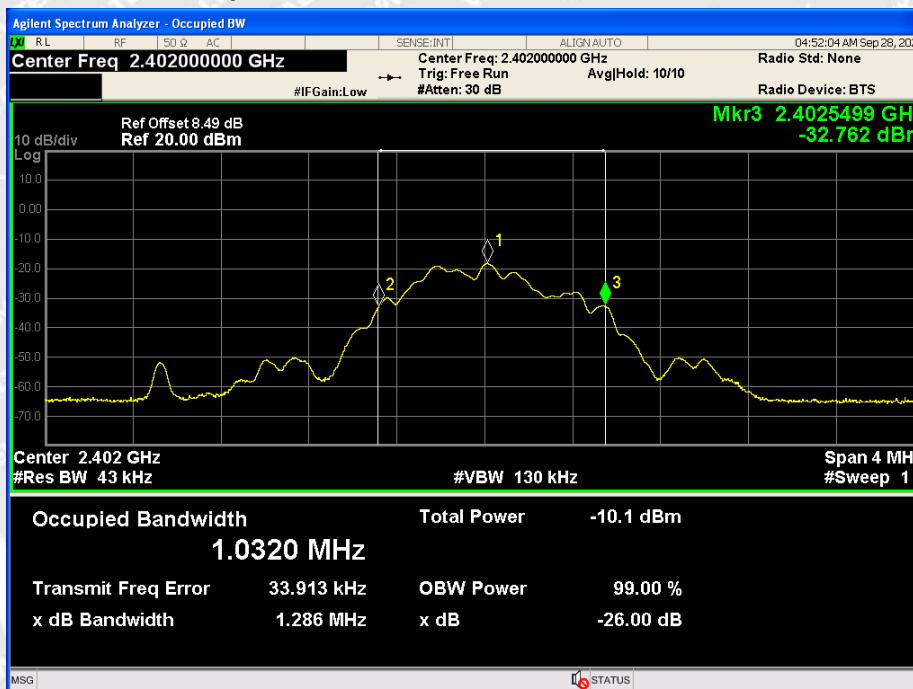


### 6.3.4 Test Result

Test Condition	Test Mode	Channel	OCB (MHz)	FL(MHz)	FH(MHz)	Limit(MHz)	Verdict
NTNV	BLE	2402	1.032	2401.52	2402.55	2400 to 2483.5	Pass
		2480	1.032	2479.52	2480.55	2400 to 2483.5	Pass

#### Test Graphs:

Occupied Channel Bandwidth\_NTNV\_BLE\_2402



Occupied Channel Bandwidth\_NTNV\_BLE\_2480

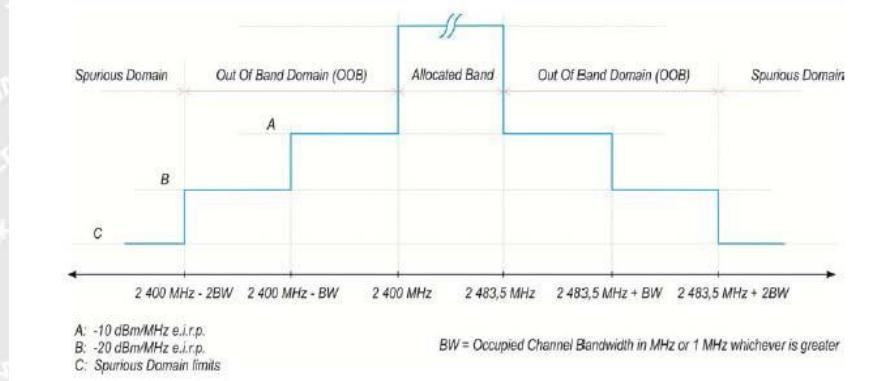




## 6.4 Transmitter unwanted emissions in the out-of-band domain

### 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 5.4.8.2.1, the measurement procedure shall be as follows:

The Out-of-band emissions within the different horizontal segments of the mask provided in figure 1 and figure 3 shall be measured using the procedure in step 1 to step 6 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:
  - Measurement Mode: Time Domain Power
  - Centre Frequency: 2 484 MHz
  - Span: Zero Span
  - Resolution BW: 1 MHz
  - Filter mode: Channel filter
  - Video BW: 3 MHz
  - Detector Mode: RMS
  - Trace Mode: Max Hold
  - Sweep Mode: Single Sweep
  - Sweep Points: Sweep time [ $\mu$ s] / (1  $\mu$ s) with a maximum of 30 000
  - Trigger Mode: Video
- Sweep Time: > 120 % of the duration of the longest burst detected during the measurement of the RF Output Power

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

- The measurement shall be performed and repeated while the trigger level is increased until no triggering takes place.
- For FHSS equipment operating in a normal hopping mode, the different hops will result in signal bursts with different power levels. In this case the burst with the highest power level shall be selected.
- Set a window (start and stop lines) to match with the start and end of the burst and in which the RMS power shall be measured using the Time Domain Power function.
- Select RMS power to be measured within the selected window and note the result which is the RMS power



within this 1 MHz segment (2 483,5 MHz to 2 484,5 MHz). Compare this value with the applicable limit provided by the mask.

- Increase the centre frequency in steps of 1 MHz and repeat this measurement for every 1 MHz segment 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 + 2 BW):**

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

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

- Change the centre frequency of the analyser to 2 399,5 MHz and perform the measurement for the first 1 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 - BW + 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

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

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

**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.
- Option 2: the limits provided by the mask given in figure 1 or figure 3 shall be reduced by  $10 \times \log_{10}(Ach)$  and the additional beamforming gain Y in dB. The results for each of the transmit chains shall be individually compared with these reduced limits.

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

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

RBW=1MHz VBW=3MHz



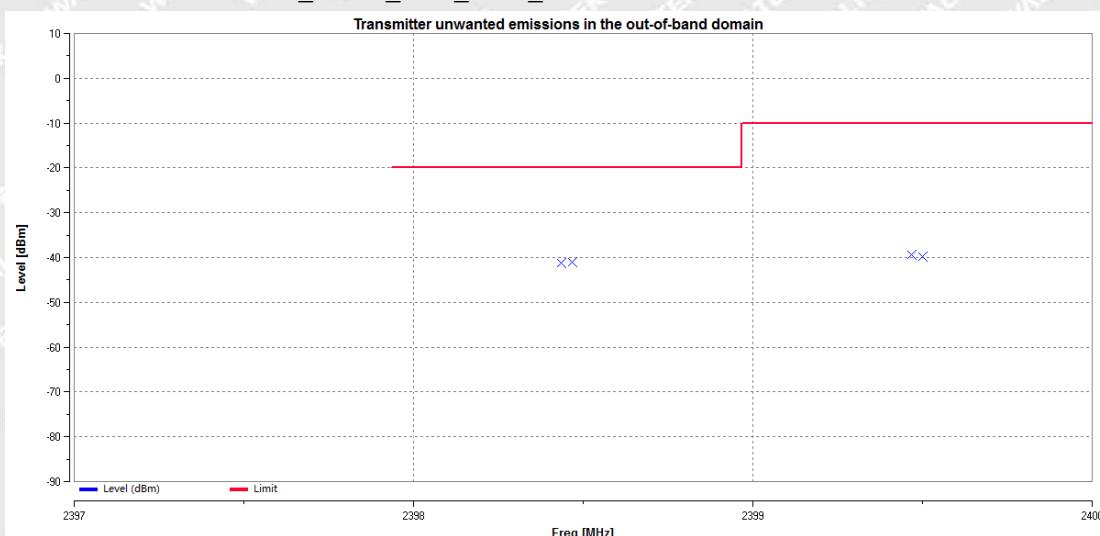
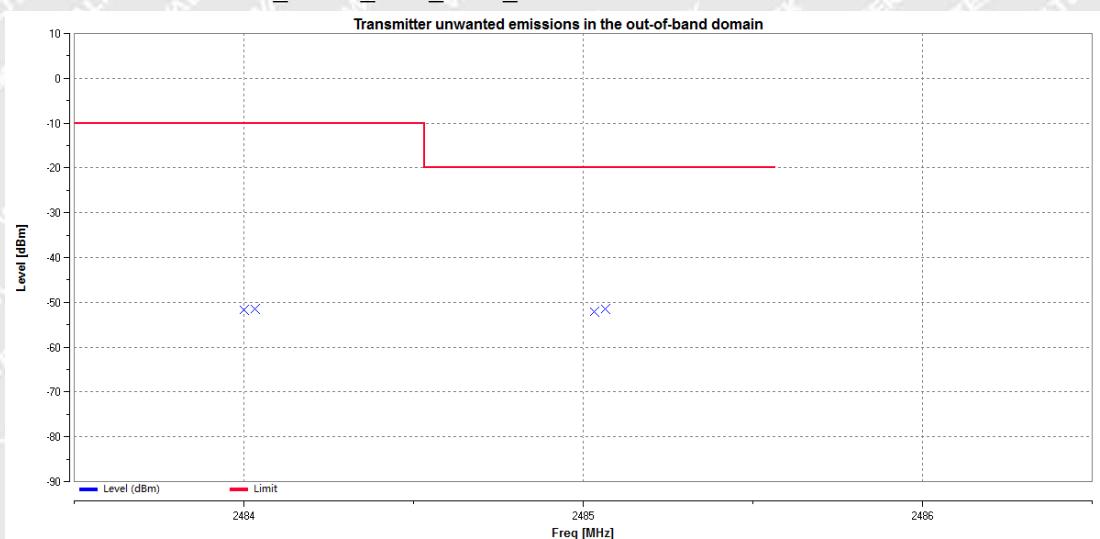
### 6.4.3 Test Condition

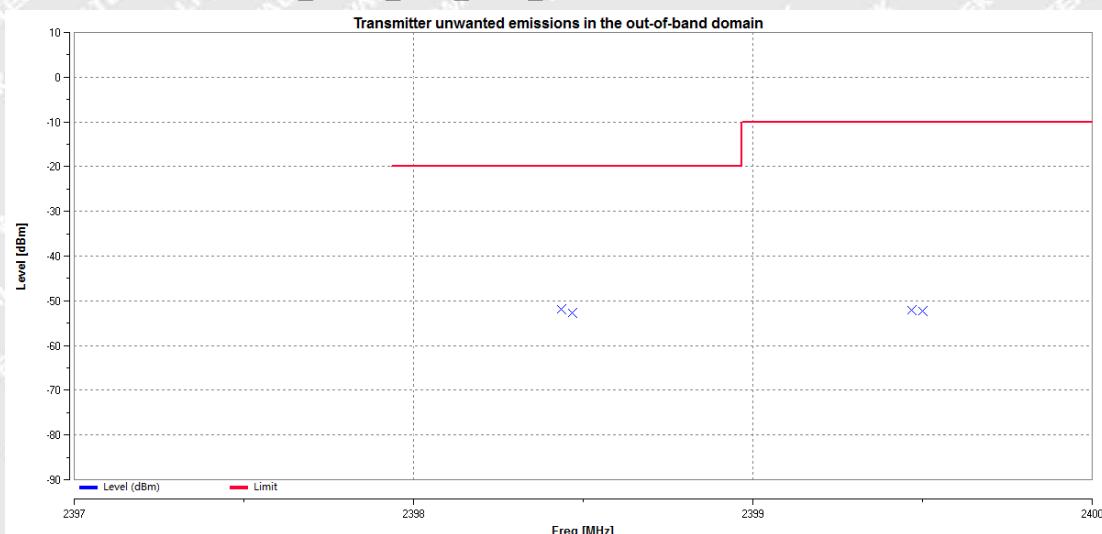
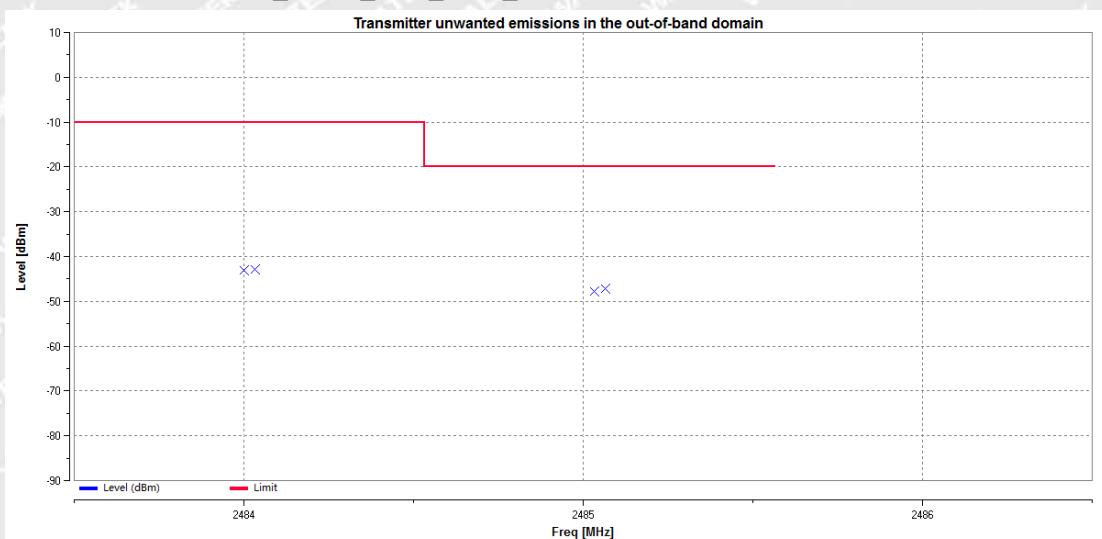
**Operating Mode** ..... : A.1  
**Test Environment** ..... : Normal Condition  
**Test Voltage** ..... : DC 3.3V (power to control panel)-  
**Ambient temperature** ..... : 22°C  
**Humidity** ..... : 54%RH  
**Atmospheric Pressure** ..... : 101.2kPa

### 6.4.4 Test Result

Test Mode	Test Channel	Test Segment (MHz)	Max. Emissions Reading (dBm)	Limit (dBm)	Verdict
BLE	Low	2400-2BW to 2400-BW	-41.05	<=-20	Pass
		2400-BW to 2400	-39.46	<=-10	Pass
		2483.5 to 2483.5+BW	-51.54	<=-10	Pass
		2483.5+BW to 2483.5+2BW	-51.53	<=-20	Pass
	High	2400-2BW to 2400-BW	-51.91	<=-20	Pass
		2400-BW to 2400	-52.19	<=-10	Pass
		2483.5 to 2483.5+BW	-42.92	<=-10	Pass
		2483.5+BW to 2483.5+2BW	-47.08	<=-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 5.4.9.2.

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

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

### 6.5.3 Test Condition

**Operating Mode** ..... : A.1

**Test Environment** ..... : Normal Condition

**Test Voltage** ..... : Battery 3.7V

**Ambient temperature** ..... : 22°C

**Humidity** ..... : 54%RH

**Atmospheric Pressure** ..... : 101.2kPa



### 6.5.4 Test Result

Frequency (MHz)	Receiver Reading (dB $\mu$ V)	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)			
<b>TX_BLE_Low Channel</b>										
929.51	21.33	248	1.0	H	-74.03	0.22	0.00	-73.81	-36	-37.81
929.51	21.18	145	1.3	V	-73.89	0.22	0.00	-73.67	-36	-37.67
2063.64	47.53	234	1.2	H	-45.84	0.35	10.40	-55.89	-30	-25.89
2063.64	46.85	140	1.4	V	-45.43	0.35	10.40	-55.48	-30	-25.48
4057.14	41.45	172	1.2	H	-49.82	2.49	12.60	-59.93	-30	-29.93
4057.14	44.75	285	1.0	V	-45.16	2.49	12.60	-55.27	-30	-25.27
<b>TX_BLE_High Channel</b>										
831.37	21.11	125	1.0	H	-74.38	0.22	0.00	-74.16	-36	-38.16
831.37	25.36	280	1.6	V	-70.24	0.22	0.00	-70.02	-36	-34.02
2799.66	43.48	270	2.0	H	-49.53	0.45	10.70	-59.78	-30	-29.78
2799.66	39.95	236	1.4	V	-48.97	0.45	10.70	-59.22	-30	-29.22
4817.35	42.90	255	1.4	H	-48.27	2.64	12.70	-58.33	-30	-28.33
4817.35	40.99	259	1.8	V	-47.25	2.64	12.70	-57.31	-30	-27.31



## 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 5.4.10.2.

RBW=100kHz VBW=300kHz 30MHz-1GHz  
RBW=1MHz VBW=3MHz 1GHz-12.75GHz

### 6.6.3 Test Condition

Operating Mode .....	A.2
Test Environment .....	Normal Condition
Test Voltage .....	Battery 3.7V
Ambient temperature .....	22°C
Humidity .....	54%RH
Atmospheric Pressure .....	101.2kPa



### 6.6.4 Test Result

Frequency (MHz)	Receiver Reading (dB $\mu$ V)	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)			
<b>RX_BLE_Low Channel</b>										
407.82	32.85	218	1.9	H	-70.79	0.16	0.00	-70.63	-57	-13.63
407.82	30.26	274	1.4	V	-73.93	0.16	0.00	-73.77	-57	-16.77
2079.04	47.97	278	1.0	H	-45.40	0.35	10.40	-55.45	-47	-8.45
2079.04	42.89	260	1.5	V	-49.39	0.35	10.40	-59.44	-47	-12.44
4528.43	41.61	138	1.9	H	-49.29	2.57	12.70	-59.42	-47	-12.42
4528.43	40.34	265	1.6	V	-49.26	2.57	12.70	-59.39	-47	-12.39
<b>RX_BLE_High Channel</b>										
775.65	22.17	212	2.0	H	-74.72	0.20	0.00	-74.52	-57	-17.52
775.65	24.49	253	1.3	V	-72.31	0.20	0.00	-72.11	-57	-15.11
2898.22	43.02	197	1.0	H	-48.68	0.46	11.20	-59.42	-47	-12.42
2898.22	41.71	244	1.4	V	-45.73	0.46	11.20	-56.47	-47	-9.47
5519.93	43.15	246	1.2	H	-46.56	2.85	12.80	-56.51	-47	-9.51
5519.93	40.12	156	1.1	V	-48.86	2.85	12.80	-58.81	-47	-11.81



## 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 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		
(-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	-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: 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.



### 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 for 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 <sub>10</sub> (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 for 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 <sub>10</sub> (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  $P_{min}$ . 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.

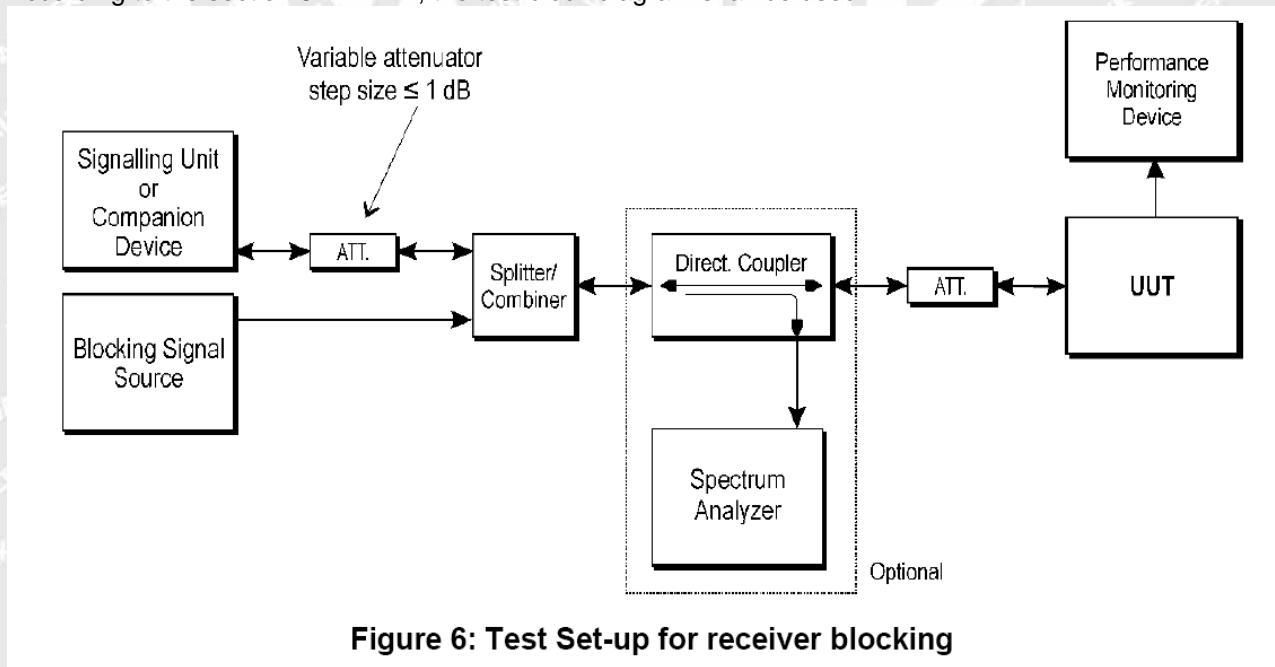


Figure 6: Test Set-up for receiver blocking

All test procedure is carried to the section 5.4.11.2.1  
 RBW/VBW=8MHz/30MHz



### 6.7.4 Test Condition

Operating Mode .....	B
Test Environment .....	Normal Condition
Test Voltage .....	DC 3.3V (power to control panel)
Ambient temperature .....	22°C
Humidity .....	54%RH
Atmospheric Pressure .....	101.2kPa

### 6.7.5 Test Result

GFSK						
Receiver Blocking Categories 3						
Wanted signal meanpower from companion device (dBm)	OCBW (Hz)	Blocking signal frequency (MHz)	Blocking signal power(dBm) CW	PER (%)	Limit	Results
-58.86	1032000	2380	-34	5.3	≤10%	Pass
		2504	-34	2.3		
		2300	-34	2.8		
		2584	-34	5.8		
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 Photographs - Test Setup

### 7.1 Photograph - Spurious Emissions Test Setup

Below 1GHz



Above 1GHz





## 8 Photographs – EUT Constructional Details

Please refer to "ANNEX" (Reference No. WTF25F09233903W).

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

**WALTEK**



中国认可  
国际互认  
检测  
TESTING  
CNAS L6478



# TEST REPORT

**Reference No.** ..... : WTF25F09233903W001

**Applicant** ..... : Mid Ocean Brands B.V.

**Address** ..... : Unit 711-716, 7/F., Tower A, 83 King Lam Street, Cheung Sha Wan, Kowloon, Hong Kong.

**Manufacturer** ..... : 118102

**Address** ..... : --

**Product Name** ..... : Wireless multi speaker

**Model No.** ..... : MO6887

**Test specification** ..... : ETSI EN 300 328 V2.2.2 (2019-07)

**Date of Receipt sample** ..... : 2025-09-23

**Date of Test** ..... : 2025-09-28

**Date of Issue** ..... : 2025-09-30

**Test Report Form No.** ..... : WEW-300328A-01B

**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 approver.

**Prepared By:**

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Tested by:

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Approved by:

Danny Zhou



## 1 Test Summary

Radio Spectrum			
Test	Test Requirement	Limit / Severity	Result
RF output power	ETSI EN 300 328 V2.2.2	≤20dBm	Pass
Duty Cycle, Tx-sequence, Tx-gap	ETSI EN 300 328 V2.2.2	-	N/A
Accumulated Transmit Time, Frequency Occupation and Hopping Sequence	ETSI EN 300 328 V2.2.2	Clause 4.3.1.4.3	Pass
Hopping Frequency Separation	ETSI EN 300 328 V2.2.2	≥100kHz	Pass
Medium Utilization	ETSI EN 300 328 V2.2.2	-	N/A
Adaptivity (Adaptive Frequency Hopping)	ETSI EN 300 328 V2.2.2	-	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 1	Pass
Transmitter unwanted emissions in the spurious domain	ETSI EN 300 328 V2.2.2	Table 4	Pass
Receiver spurious emissions	ETSI EN 300 328 V2.2.2	Table 5	Pass
Receiver Blocking	ETSI EN 300 328 V2.2.2	Clause 4.3.1.12.4	Pass

Remark:

Pass      Test item meets the requirement

N/A      Not Applicable



## 2 Contents

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### 3 General Information

#### 3.1 General Description of E.U.T.

**Product Name** ..... : Wireless multi speaker  
**Model No.** ..... : MO6887  
**Remark** ..... : ---  
**Rating** ..... : Wireless output power: 10W Max.  
 Input: DC 5V, 2A  
 Output: DC 9V, 1.22A  
 Power bank:  
 Type-C Input: DC 5V, 2A  
 USB Output: DC 5V, 2A  
 Battery: 3.7V, 4000mAh, 14.8Wh

#### 3.2 Technical Specification

**Bluetooth Version** ..... : Bluetooth BR+EDR  
**Frequency Range** ..... : 2402-2480MHz  
**Maximum RF Output Power** ..... : -2.27 dBm (EIRP)  
**Type of Modulation** ..... : GFSK,  $\pi/4$ QPSK, 8DPSK  
**Data Rate** ..... : 1Mbps, 2Mbps, 3Mbps  
**Quantity of Channels** ..... : 79  
**Channel Separation** ..... : 1MHz  
**Antenna Type** ..... : PCB Antenna  
**Antenna Gain** ..... : -0.58dBi  
**Receiver Category** ..... : 3

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.

### 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 and Economic Development Canada (ISED). The acceptance letter from the ISED is maintained in our files. Registration ISED number: 21895.

- **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.

- **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.

### 3.7 Disclaimer

The antenna gain information is provided by the customer. The laboratory is not responsible for the accuracy of the antenna gain information.



## 4 Equipment Used during Test

### 4.1 Equipment List

<input checked="" type="checkbox"/> 3m Semi-anechoic Chamber for Spurious Emission						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	3m Semi-anechoic Chamber	CHANGCHUANG	9mx6mx6m	-	2024-01-05	2027-01-04
2	EMI TEST RECEIVER	RS	ESR7	101566	2025-01-06	2026-01-05
3	Spectrum Analyzer	Agilent	N9020A	MY48011796	2025-01-06	2026-01-05
4	Trilog Broadband Antenna	SCHWARZBECK	VULB9162	9162-117	2025-01-12	2026-01-11
5	Coaxial Cable (below 1GHz)	Times Microwave Systems	RG223-NMNM-10M	-	2025-01-07	2026-01-06
6	Coaxial Cable (below 1GHz)	Times Microwave Systems	RG223-NMNM-3M	-	2025-01-07	2026-01-06
7	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	01561	2025-01-13	2026-01-12
8	Broadband Preamplifier (Above 1GHz)	Lunar E M	LNA1G18-40	20160501002	2025-01-06	2026-01-05
9	Coaxial Cable (above 1GHz)	Times-Microwave	CBL5-NN	-	2025-01-06	2026-01-05
<input checked="" type="checkbox"/> RF Conducted test						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Environmental Chamber	GERUI	GR-HWS-1000L	GR24061818	2025-07-02	2026-07-01
2	Spectrum Analyzer	Agilent	N9020A	MY48011796	2025-01-06	2026-01-05
3	EXG Analog Signal Generator	Agilent	N5181A	MY48180720	2025-01-06	2026-01-05
4	RF Control Unit	TONSCEND	JS0806-2	-	2025-01-08	2026-01-07
5	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY56510008	2025-01-08	2026-01-07

: Not Used

: Used



## 4.2 Software List

Description	Manufacturer	Model	Version
EMI Test Software (Radiated Emission)	FARATRONIC	EZ-EMC	RA-03A1-2
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	±2.2dB	(1)
Occupied Bandwidth	±1.5%	(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 if any measured disturbance level exceeds the disturbance limit.

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:

### 5.1 RF Channel and Frequency

The lowest, middle and highest channel were tested as representatives.

BT (BR+EDR)							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
01	2402	21	2422	41	2442	61	2462
02	2403	22	2423	42	2443	62	2463
03	2404	23	2424	43	2444	63	2464
04	2405	24	2425	44	2445	64	2465
05	2406	25	2426	45	2446	65	2466
06	2407	26	2427	46	2447	66	2467
07	2408	27	2428	47	2448	67	2468
08	2409	28	2429	48	2449	68	2469
09	2410	29	2430	49	2450	69	2470
10	2411	30	2431	50	2451	70	2471
11	2412	31	2432	51	2452	71	2472
12	2413	32	2433	52	2453	72	2473
13	2414	33	2434	53	2454	73	2474
14	2415	34	2435	54	2455	74	2475
15	2416	35	2436	55	2456	75	2476
16	2417	36	2437	56	2457	76	2477
17	2418	37	2438	57	2458	77	2478
18	2419	38	2439	58	2459	78	2479
19	2420	39	2440	59	2460	79	2480
20	2421	40	2441	60	2461	---	---



## 5.2 Modulation Configure

Modulation	Packet
GFSK	DH1
	DH3
	DH5
$\pi/4$ QPSK	2DH1
	2DH3
	2DH5
8DPSK	3DH1
	3DH3
	3DH5

## 5.3 Independent Operation Modes

Test Mode	Description	Test Channel
A.1	Wireless with BT mode, Transmitting	Lowest Channel, Middle Channel, Highest Channel
A.2	Wireless with BT mode, Receiving	Lowest Channel, Highest Channel
B	Operating Normal mode with BT connecting	/

## 5.4 Test Environment Condition

Test Condition	Temperature (°C)	Relative Humidity (%)	ATM Pressure (kPa)
Normal	22	45 %	101.2kPa
LTVN	-10	---	---
HTVN	+50	---	---



## 6 RF Requirements

### 6.1 RF Output power

#### 6.1.1 Standard Applicable

According to Section 4.3.1.2.3, The RF output power for FHSS equipment shall be equal to or less than 20 dBm.

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.

The measurements for RF output power shall be performed at both normal environmental conditions and at the extremes of the operating temperature range.

#### 6.1.2 Test Procedure

According to section 5.4.2.2.1.2 of the standard ETSI 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  $P_{burst}$  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.
- 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 Condition

**Operating Mode** ..... : A.1

**Test Environment** ..... : Normal Condition, Extreme Condition

**Test Voltage** ..... : DC 3.3V (power to control panel)

**Ambient temperature** ..... : 22°C

**Humidity** ..... : 54%RH

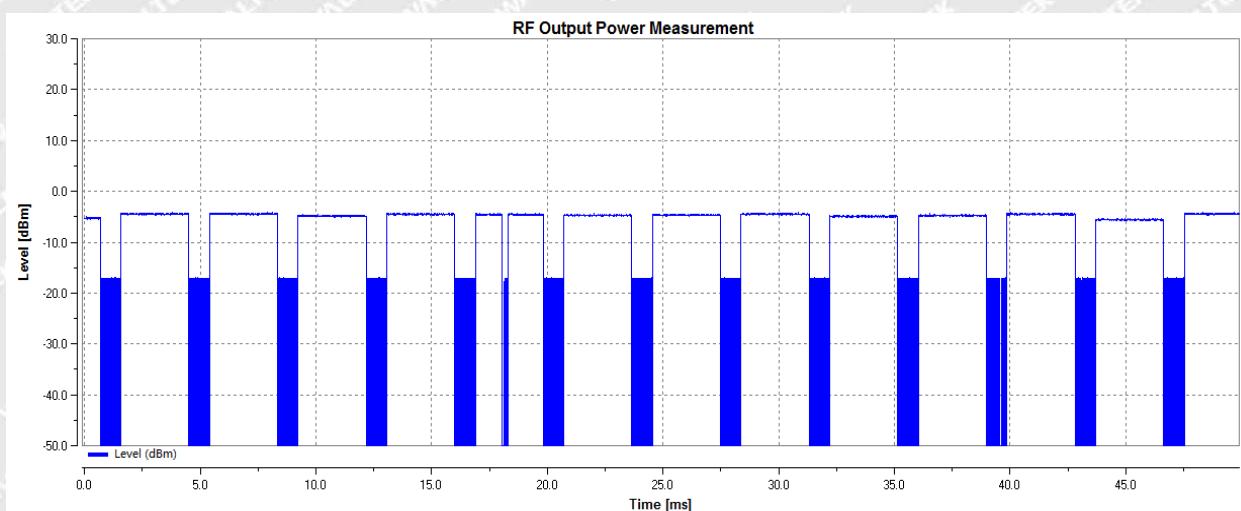
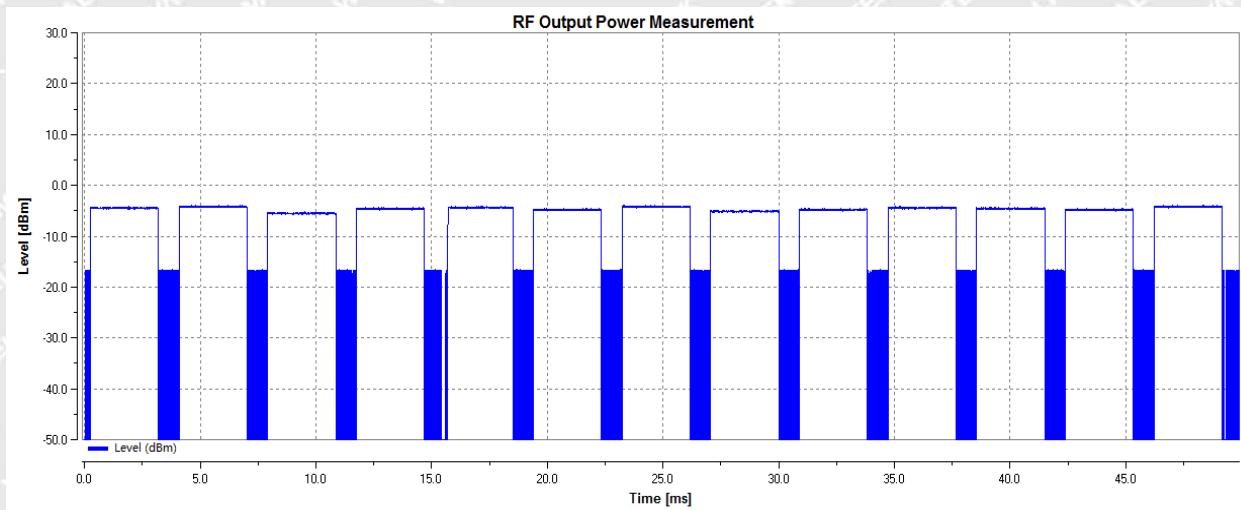
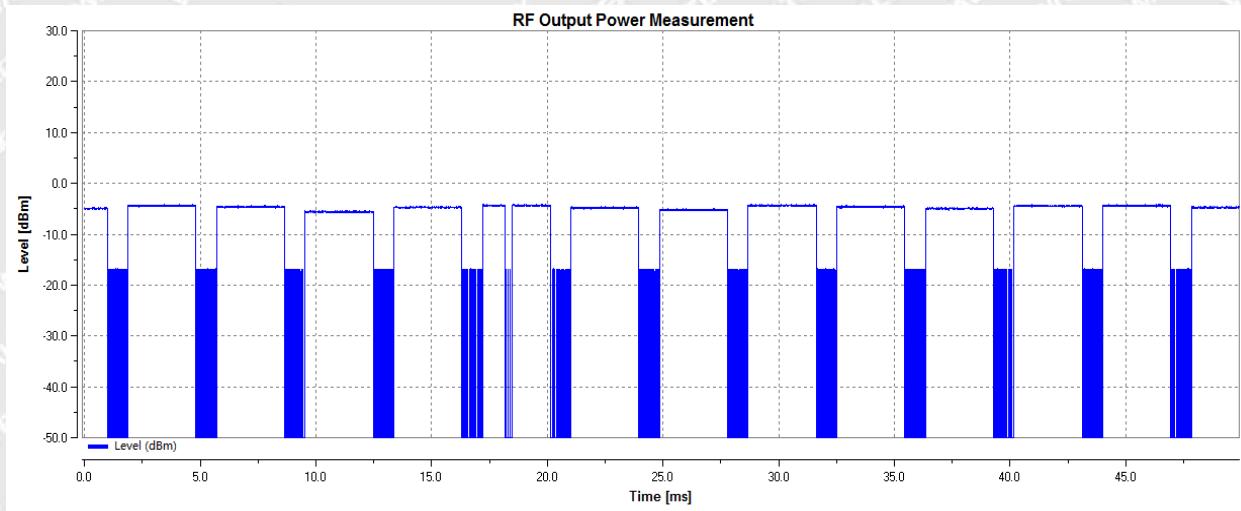
**Atmospheric Pressure** ..... : 101.2kPa

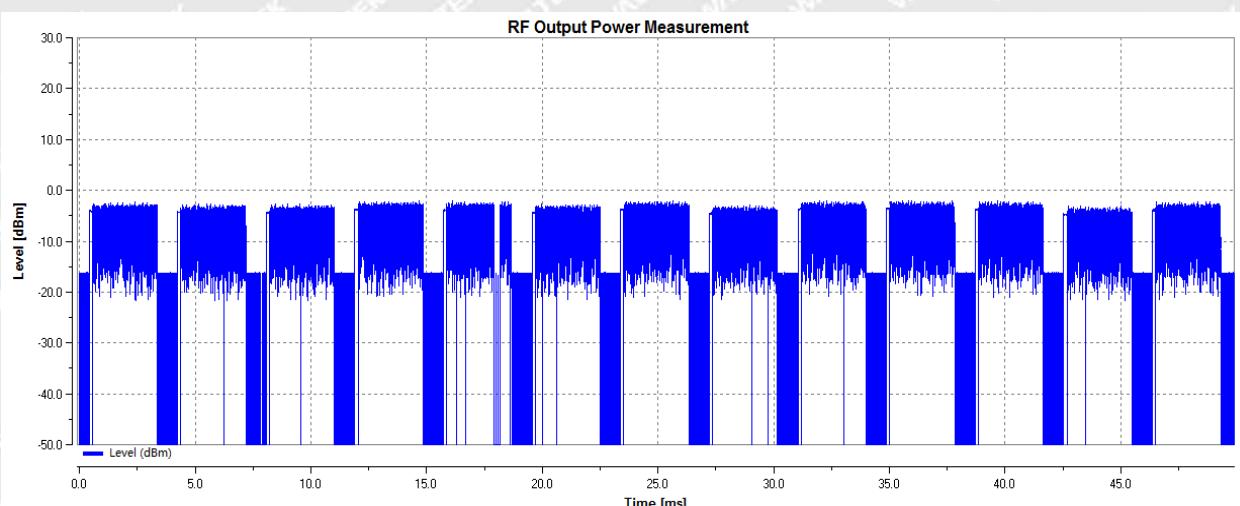
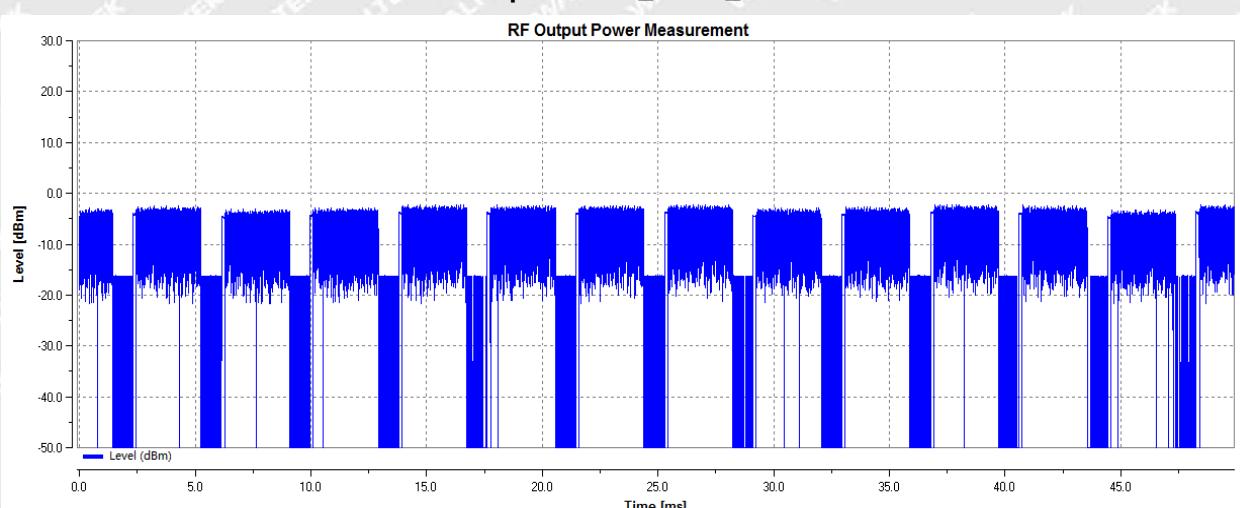
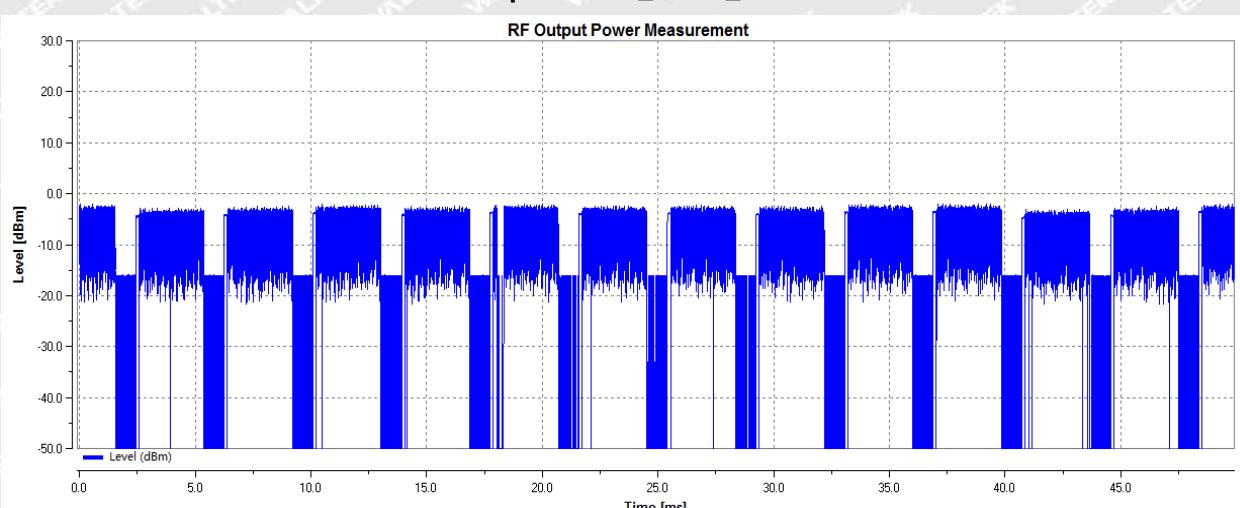


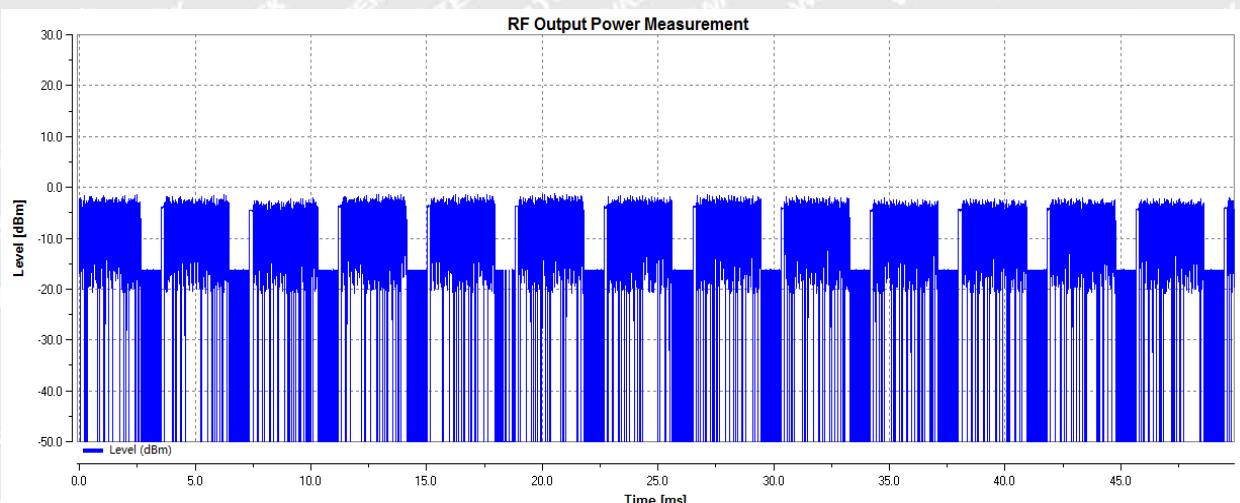
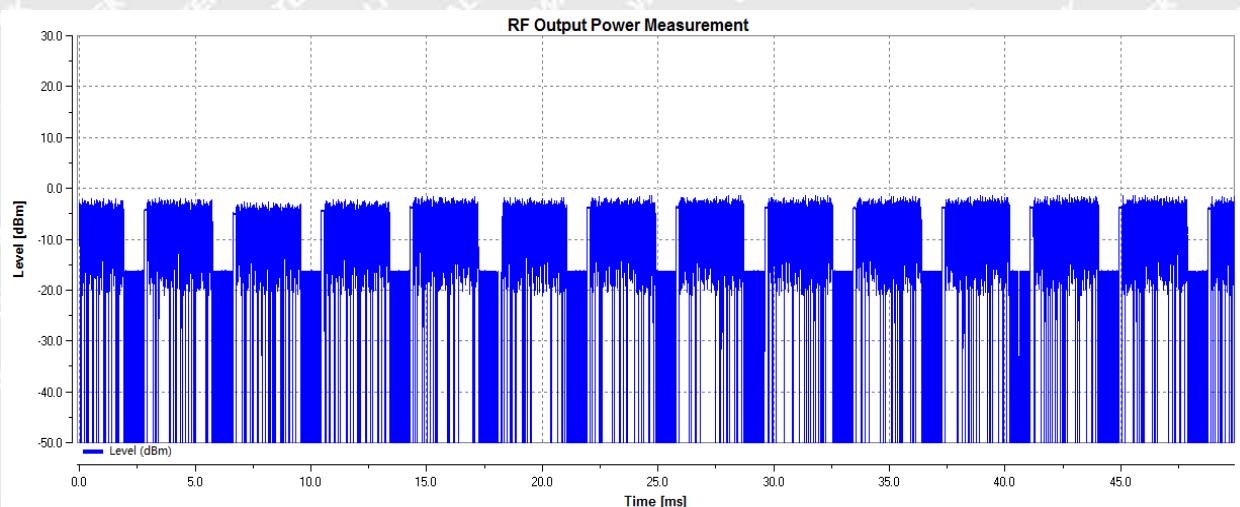
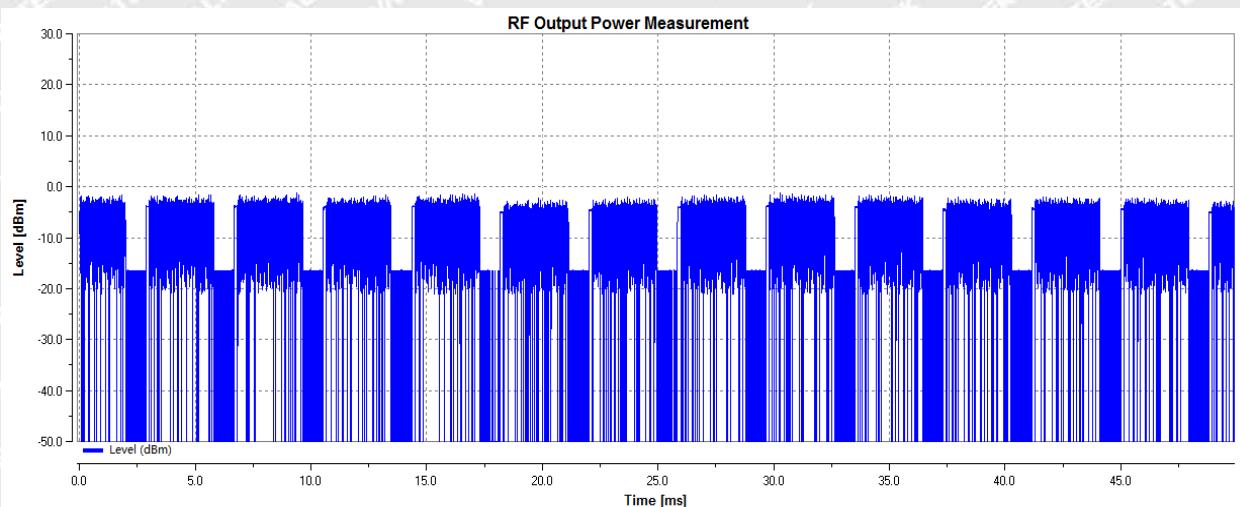
### 6.1.4 Test Result

Modulation Type	Test Condition	Test Mode	Channel	EIRP (dBm)	Limit (dBm)	Verdict
GFSK	TLVN	DH5	Hop	-4.96	20	Pass
	TNVN	DH5	Hop	-4.69	20	Pass
	THVN	DH5	Hop	-4.85	20	Pass
$\pi/4$ QPSK	TLVN	2DH5	Hop	-4.20	20	Pass
	TNVN	2DH5	Hop	-4.31	20	Pass
	THVN	2DH5	Hop	-4.12	20	Pass
8DPSK	TLVN	3DH5	Hop	-2.27	20	Pass
	TNVN	3DH5	Hop	-2.59	20	Pass
	THVN	3DH5	Hop	-2.28	20	Pass

Remark: EIRP=Conducted power+ ANT gain

**Test Graphs:****RF Output Power\_TLVN\_DH5****RF Output Power\_TNVN\_DH5****RF Output Power THVN\_DH5**

**RF Output Power\_TLVN\_2DH5****RF Output Power\_TNVN\_2DH5****RF Output Power THVN\_2DH5**

**RF Output Power\_TLVN\_3DH5****RF Output Power\_TNVN\_3DH5****RF Output Power THVN\_3DH5**

Remark: The antenna gain is not considered in the result plot.



## 6.2 Accumulated Transmit Time, Minimum Frequency Occupation and Hopping Sequence

### 6.2.1 Standard Applicable

According to section 4.3.1.4.3, 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.

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.

These measurements shall only be performed at normal test conditions.



## 6.2.2 Test Procedure

According to section 5.4.4.2.1 of the standard ETSI EN 300328, 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:  $4 \times$  dwell time  $\times$  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: ~ 400 / Occupied Channel Bandwidth (MHz); the number of sweep points may need to be further increased in case of overlapping channels
  - Trace Mode: Max Hold
  - Trigger: Free Run
- 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.

### 6.2.3 Test Condition

**Operating Mode** ..... : A.1

**Test Environment** ..... : Normal Condition

**Test Voltage** ..... : DC 3.3V (power to control panel)

**Ambient temperature** ..... : 22°C

**Humidity** ..... : 54%RH

**Atmospheric Pressure** ..... : 101.2kPa



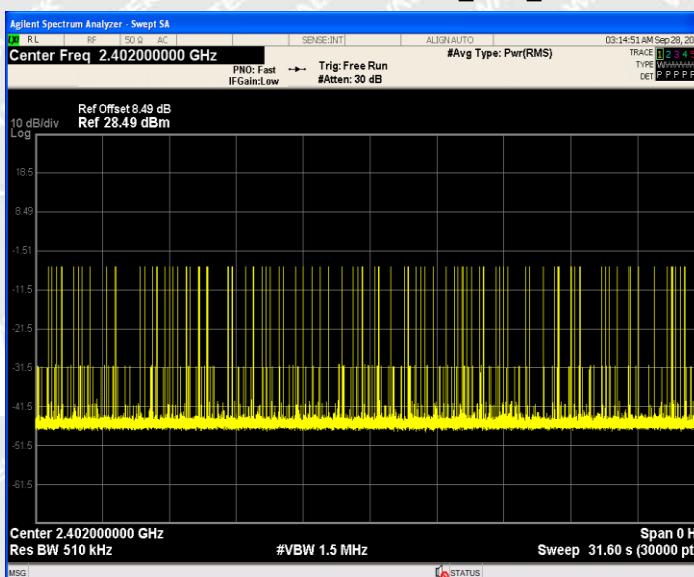
### 6.2.4 Test Result

Maximum Accumulated Dwell Time					
Modulation	Test Channel	Packet	Acc. Dwell Time (ms)	Limit (ms)	Verdict
GFSK	2402MHz	DH5	385.532	400	Pass
	2480MHz	DH5	388.692	400	Pass
$\pi/4$ QPSK	2402MHz	2DH5	388.692	400	Pass
	2480MHz	2DH5	377.105	400	Pass
8DPSK	2402MHz	3DH5	385.532	400	Pass
	2480MHz	3DH5	383.425	400	Pass

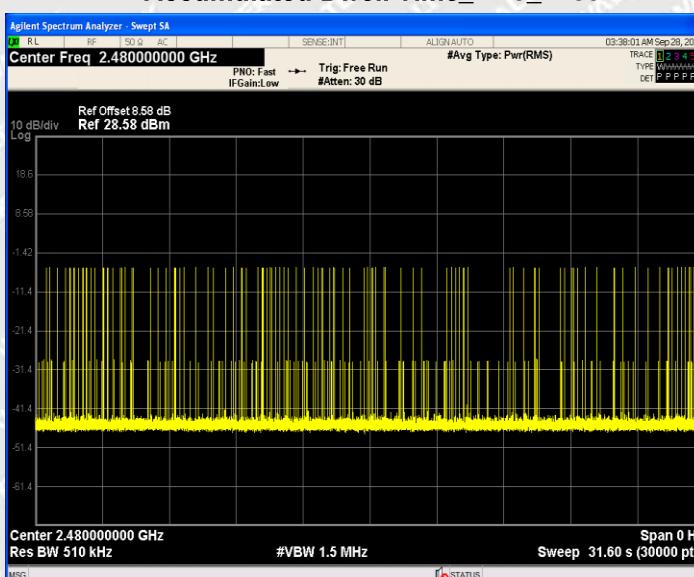
Test Period: 400ms X Minimum number of hopping frequencies (N)  
 Accumulated Dwell Time = Time slot length (Dwell time) X Number of data points within a test period

#### Test Graphs:

Accumulated Dwell Time\_DH5\_2402

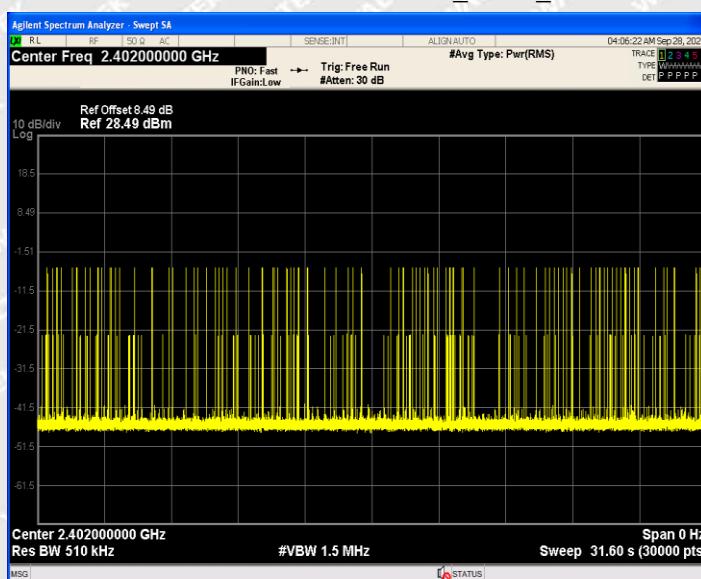


Accumulated Dwell Time\_DH5\_2480

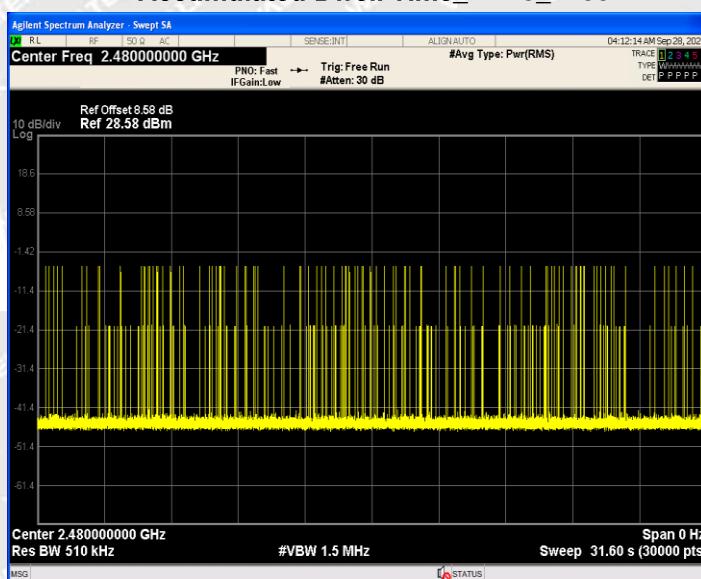




### Accumulated Dwell Time\_2DH5\_2402

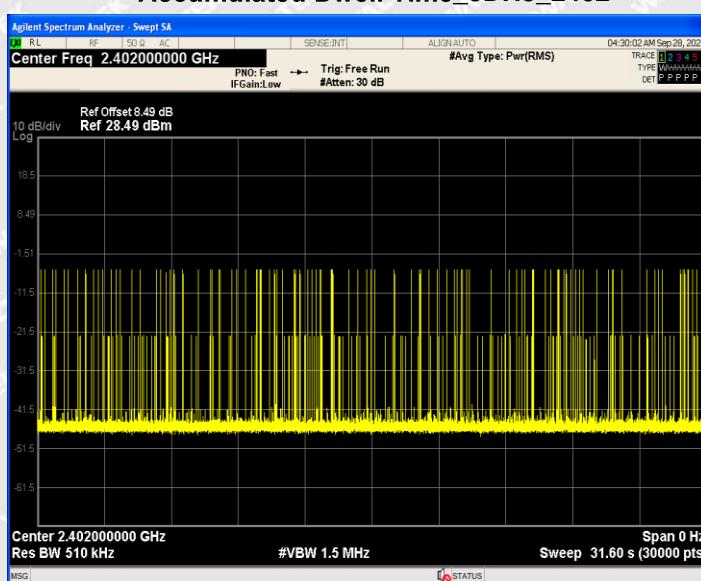


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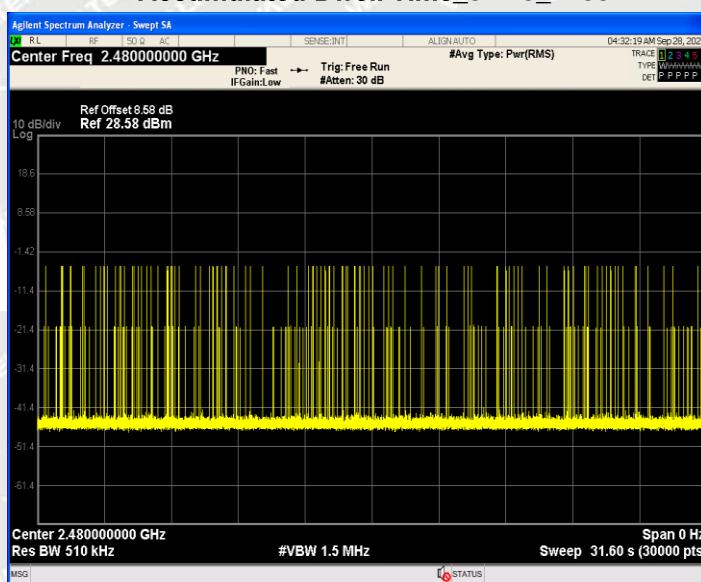




### Accumulated Dwell Time\_3DH5\_2402



### Accumulated Dwell Time\_3DH5\_2480



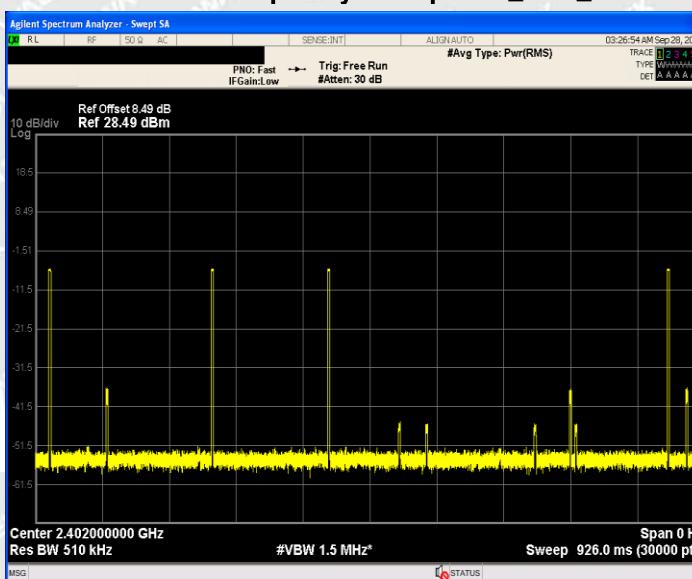


Frequency Occupation requirement					
Modulation	Test Channel	Packet	Burst Number	Limit(Burst Number)	Verdict
GFSK	2402MHz	DH5	4	≥1	Pass
	2480MHz	DH5	5	≥1	Pass
π/4QPSK	2402MHz	2DH5	2	≥1	Pass
	2480MHz	2DH5	4	≥1	Pass
8DPSK	2402MHz	3DH5	5	≥1	Pass
	2480MHz	3DH5	3	≥1	Pass

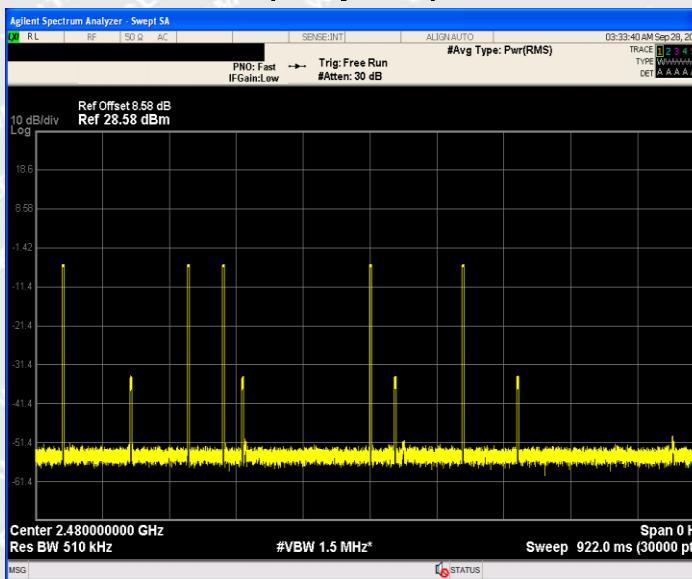
Test Period: 4 X Dwell time X Minimum number of hopping frequencies (N)  
Occupation Time = Time slot length (Dwell time) X Number of data points within a test period

#### Test Graphs:

Minimum Frequency Occupation\_DH5\_2402

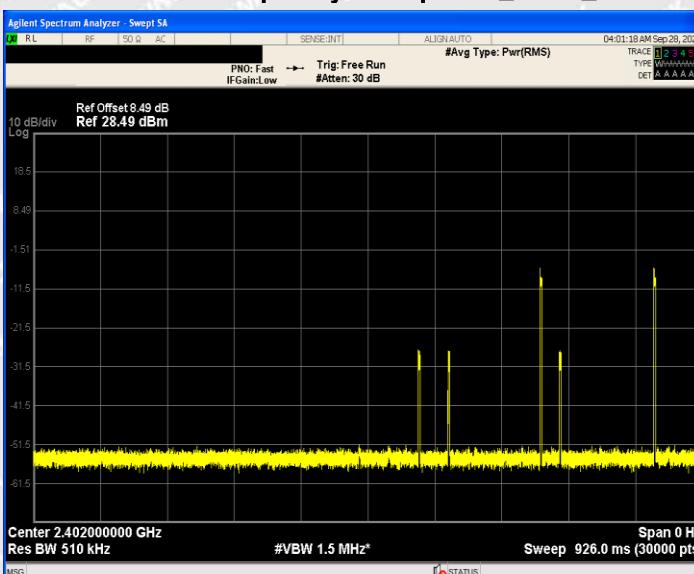


Minimum Frequency Occupation\_DH5\_2480

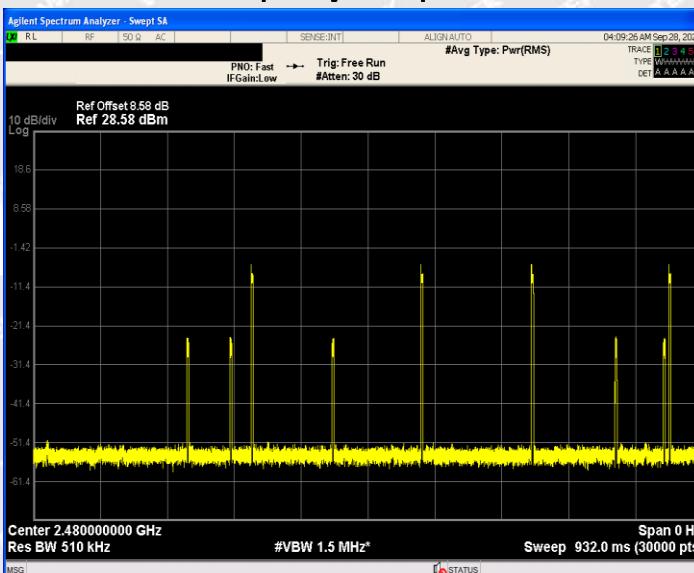




### Minimum Frequency Occupation\_2DH5\_2402

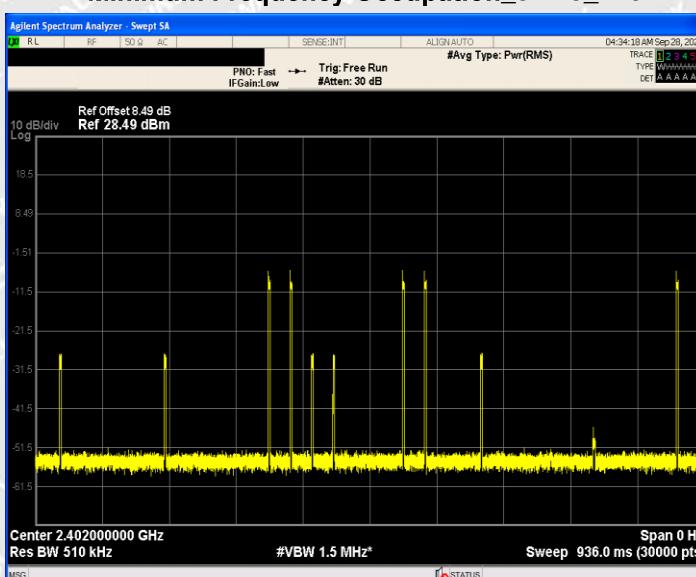


### Minimum Frequency Occupation\_2DH5\_2480

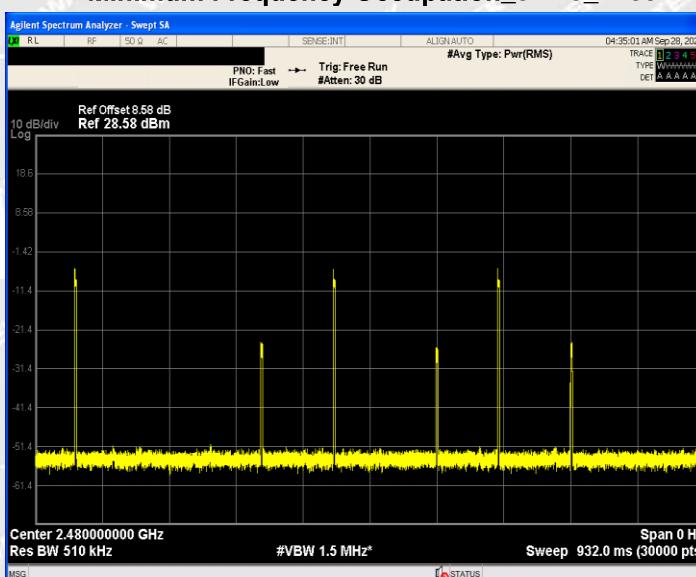




### Minimum Frequency Occupation\_3DH5\_2402



### Minimum Frequency Occupation\_3DH5\_2480

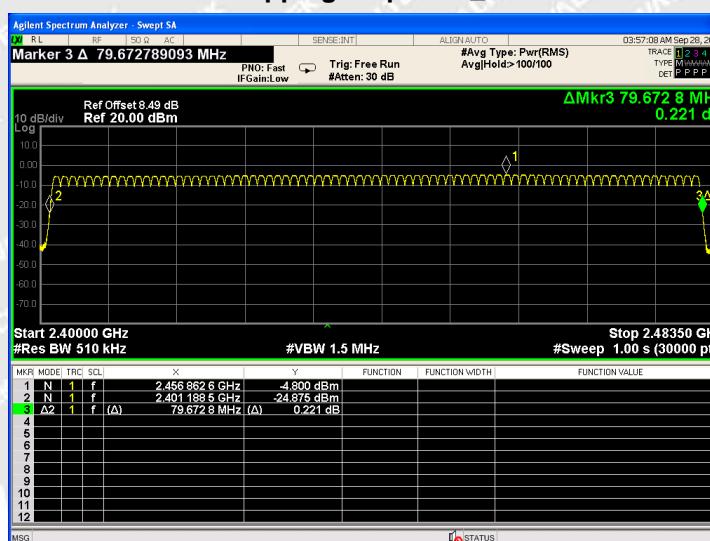




Hopping Sequence								
Modulation	Packet	Test Channel	Hop. (Num.)	Limit (Num.)	Band Use (%)	Limit (%)		Verdict
GFSK	DH5	Hop	79	15	95.05	70		Pass
$\pi/4$ QPSK	2DH5	Hop	79	15	95.95	70		Pass
8DPSK	3DH5	Hop	79	15	95.94	70		Pass

Test Graphs:

### Hopping Sequence\_DH5

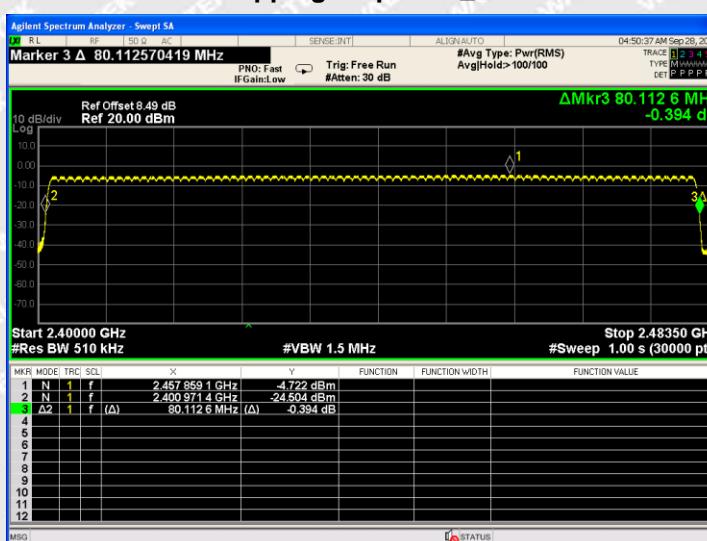


### Hopping Sequence\_2DH5





## Hopping Sequence\_3DH5





## 6.3 Hopping Frequency Separation

### 6.3.1 Standard Applicable

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.

These measurements shall only be performed at normal test conditions.

### 6.3.2 Test Procedure

According to the section 5.4.5.2, the measurement 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: 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:  $3 \times$  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 identifying 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.



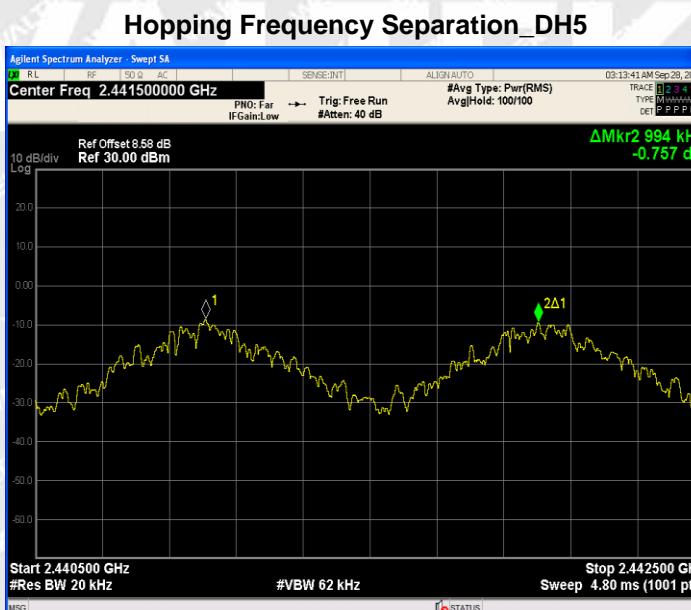
### 6.3.3 Test Condition

**Operating Mode** ..... A.1  
**Test Environment** ..... Normal Condition  
**Test Voltage** ..... DC 3.3V (power to control panel)  
**Ambient temperature** ..... 22°C  
**Humidity** ..... 54%RH  
**Atmospheric Pressure** ..... 101.2kPa

### 6.3.4 Test Result

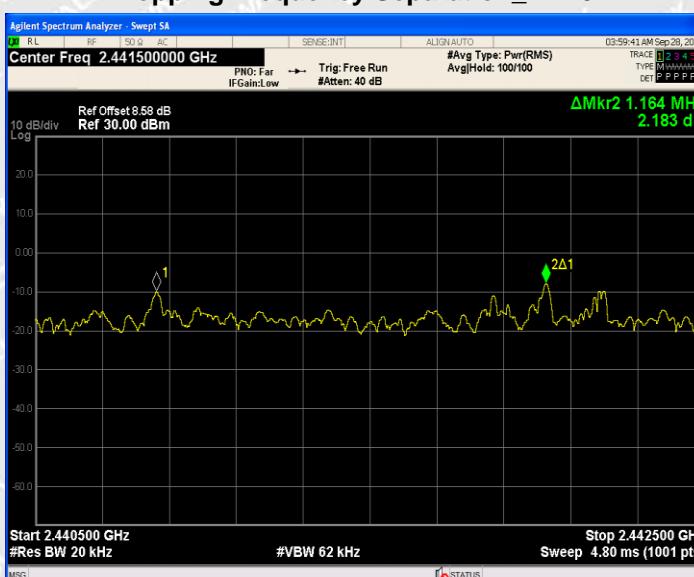
Modulation	Test Channel	Packet	Channel Separation (MHz)	Limit (MHz)	Verdict
GFSK	Hop	DH5	0.994	>=0.1	Pass
π/4QPSK	Hop	2DH5	1.164	>=0.1	Pass
8DPSK	Hop	3DH5	0.826	>=0.1	Pass

#### Test Graphs:





### Hopping Frequency Separation\_2DH5



### Hopping Frequency Separation\_3DH5





## 6.4 Occupied Channel Bandwidth

### 6.4.1 Standard Applicable

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.

### 6.4.2 Test Procedure

According to section 5.4.7.2, 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:  $3 \times$  RBW
- Frequency Span:  $2 \times$  Nominal Channel Bandwidth
- Detector Mode: RMS
- Trace Mode: Max Hold
- Sweep time: 1 s

#### Step 2:

Wait for the trace to stabilize.

Find the peak value of the trace and place the analyser marker on this peak.

#### Step 3:

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

Make sure that the power envelope is sufficiently above the noise floor of the analyser to avoid the noise signals left and right from the power envelope being taken into account by this measurement.

### 6.4.3 Test Condition

**Operating Mode** ..... : A.1

**Test Environment** ..... : Normal Condition

**Test Voltage** ..... : DC 3.3V (power to control panel)

**Ambient temperature** ..... : 22°C

**Humidity** ..... : 54%RH

**Atmospheric Pressure** ..... : 101.2kPa



#### 6.4.4 Test Result

Modulation	Channel	Packet	OCB (MHz)	FL (MHz)	FH (MHz)	Limit (MHz)	Verdict
GFSK	2402	DH5	0.87010	2401.59	2402.46	2400 to 2483.5	Pass
	2480		0.87092	2479.59	2480.46	2400 to 2483.5	Pass
$\pi/4$ QPSK	2402	2DH5	1.1910	2401.43	2402.62	2400 to 2483.5	Pass
	2480		1.1916	2479.43	2480.62	2400 to 2483.5	Pass
8DPSK	2402	3DH5	1.2029	2401.42	2402.62	2400 to 2483.5	Pass
	2480		1.2034	2479.42	2480.63	2400 to 2483.5	Pass

#### Test Graphs:

Occupied Channel Bandwidth\_DH5\_2402



Occupied Channel Bandwidth\_DH5\_2480





### Occupied Channel Bandwidth\_2DH5\_2402



### Occupied Channel Bandwidth\_2DH5\_2480





### Occupied Channel Bandwidth\_3DH5\_2402



### Occupied Channel Bandwidth\_3DH5\_2480

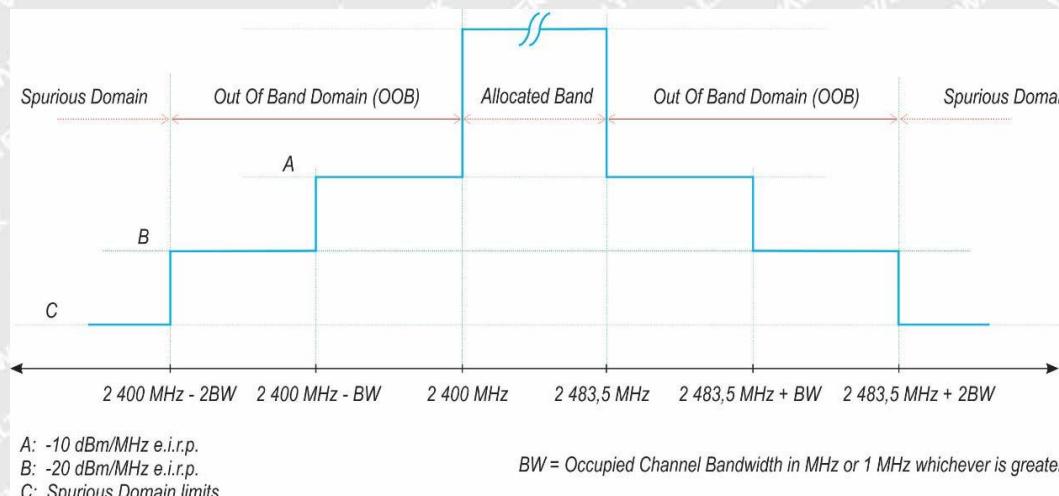




## 6.5 Transmitter unwanted emissions in the out-of-band domain

### 6.5.1 Standard Applicable

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



**Figure 1: Transmit mask**

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

### 6.5.2 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  $\mu$  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.
- Option 2: the limits provided by the mask given in figure 1 or figure 3 shall be reduced by  $10 \times \log_{10}(Ach)$  and the additional beamforming gain Y in dB. The results for each of the transmit chains shall be individually compared with these reduced limits.

NOTE 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

### 6.5.3 Test Condition

**Operating Mode** ..... : A.1

**Test Environment** ..... : Normal Condition

**Test Voltage** ..... : DC 3.3V (power to control panel)

**Ambient temperature** ..... : 22°C

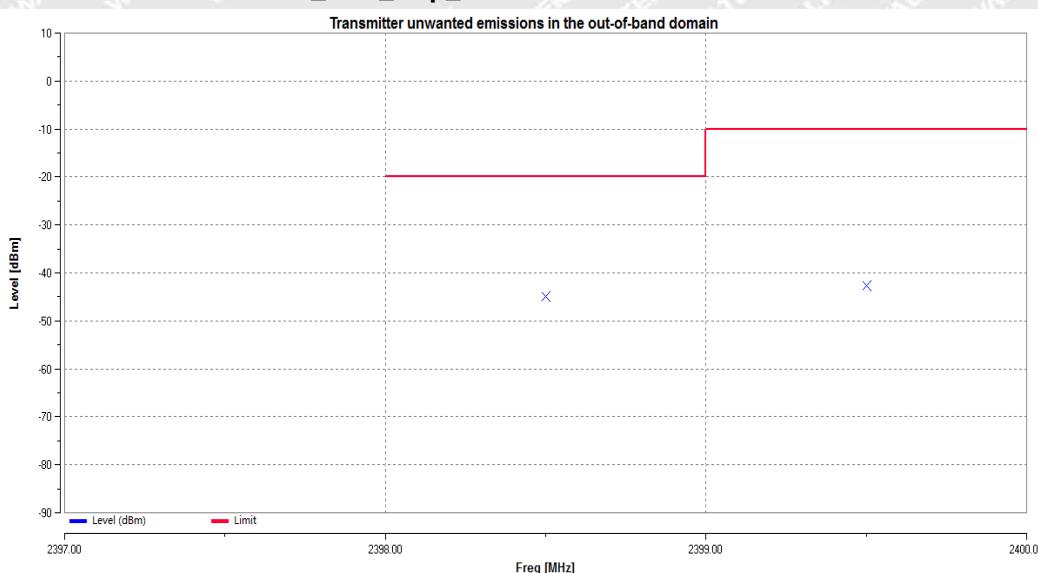
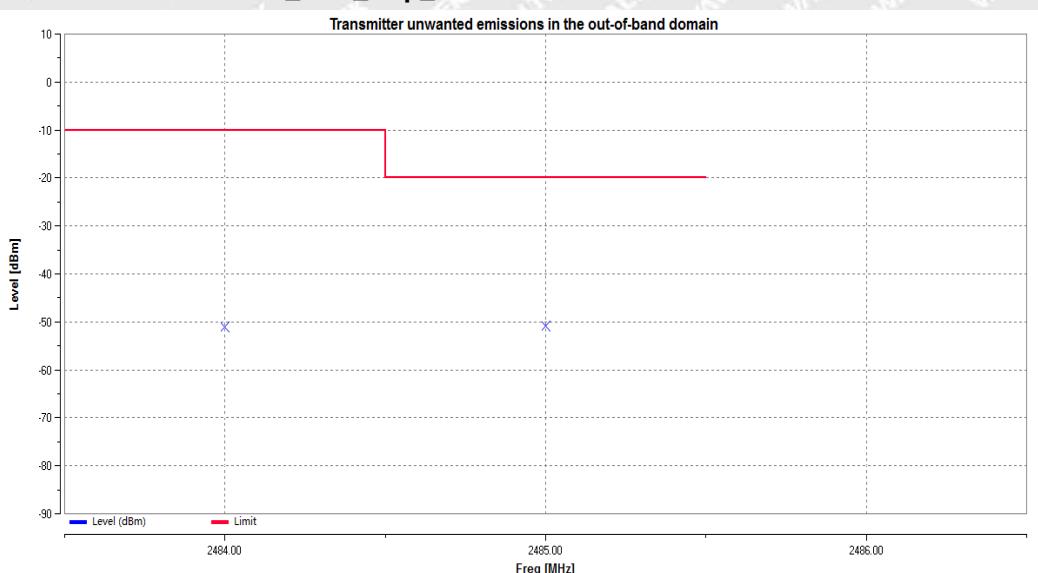
**Humidity** ..... : 54%RH

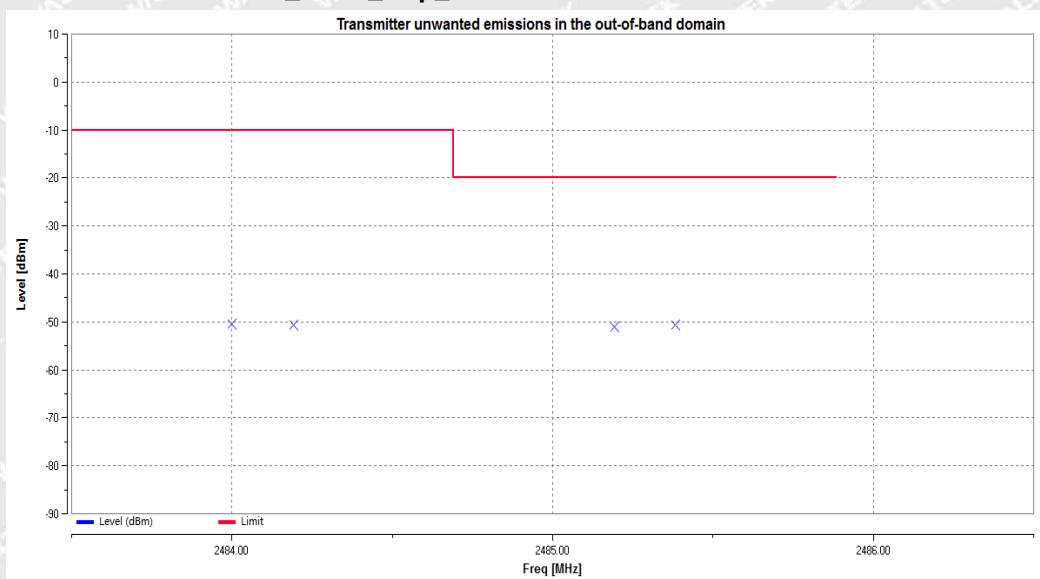
**Atmospheric Pressure** ..... : 101.2kPa

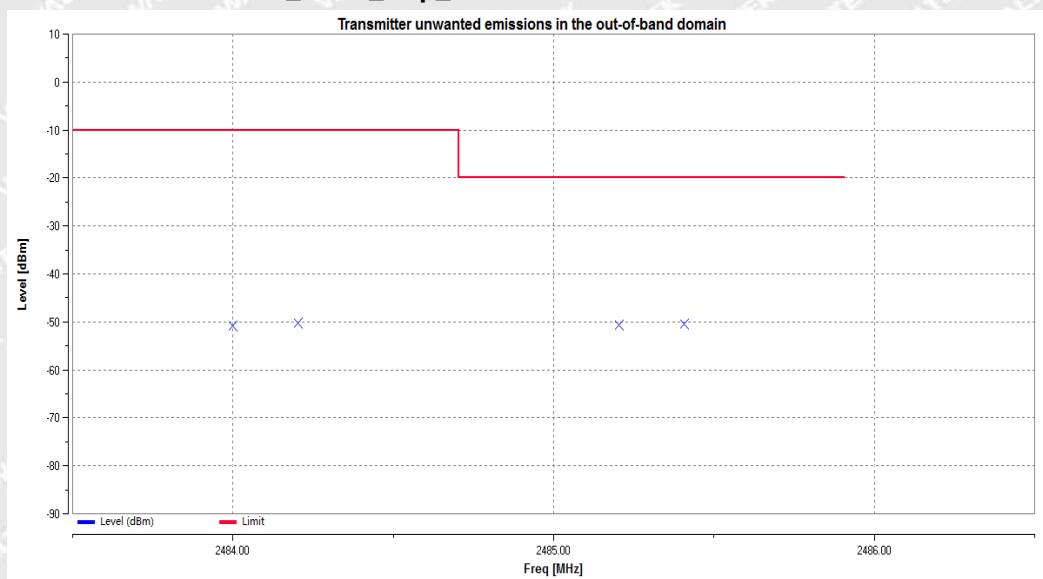
### 6.5.4 Test Result

Test Mode	Test Channel	Packet	Test Segment (MHz)	Max. Emissions Reading (dBm)	Limit (dBm)	Verdict
GFSK	Hop	DH5	2400-2BW to 2400-BW	-44.84	<=-20	Pass
			2400-BW to 2400	-42.74	<=-10	Pass
			2483.5 to 2483.5+BW	-51.13	<=-10	Pass
			2483.5+BW to 2483.5+2BW	-50.86	<=-20	Pass
$\pi/4$ QPSK	Hop	2DH5	2400-2BW to 2400-BW	-47.77	<=-20	Pass
			2400-BW to 2400	-43.74	<=-10	Pass
			2483.5 to 2483.5+BW	-50.53	<=-10	Pass
			2483.5+BW to 2483.5+2BW	-50.58	<=-20	Pass
8DPSK	Hop	3DH5	2400-2BW to 2400-BW	-48.32	<=-20	Pass
			2400-BW to 2400	-44.13	<=-10	Pass
			2483.5 to 2483.5+BW	-50.21	<=-10	Pass
			2483.5+BW to 2483.5+2BW	-50.47	<=-20	Pass

Note: The data just list the worst case.

**Test Graphs:****OOB\_DH5\_Hop\_2400MHz-2BW to 2400MHz****OOB\_DH5\_Hop\_2483.5MHz to 2483.5MHz+2BW**

**OOB\_2DH5\_Hop\_2400MHz-2BW to 2400MHz****OOB\_2DH5\_Hop\_2483.5MHz to 2483.5MHz+2BW**

**OOB\_3DH5\_Hop\_2400MHz-2BW to 2400MHz****OOB\_3DH5\_Hop\_2483.5MHz to 2483.5MHz+2BW**



## 6.6 Transmitter unwanted emissions in the spurious domain

### 6.6.1 Standard Applicable

According to section 4.3.1.10.3

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

### 6.6.2 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 ETSI EN 300 328 section 5.4.9.2.

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

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

### 6.6.3 Test Condition

**Operating Mode** ..... : A.1

**Test Environment** ..... : Normal Condition

**Test Voltage** ..... : Battery 3.7V

**Ambient temperature** ..... : 22°C

**Humidity** ..... : 54%RH

**Atmospheric Pressure** ..... : 101.2kPa



### 6.6.4 Test Result

Note: All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report.

Frequency (MHz)	Receiver Reading (dB $\mu$ V)	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)			
<b>TX_DH5_Low Channel</b>										
918.09	20.16	182	1.4	H	-75.21	0.22	0.00	-74.99	-36	-38.99
918.09	20.47	178	1.9	V	-74.65	0.22	0.00	-74.43	-36	-38.43
2175.40	46.00	268	1.8	H	-46.41	0.35	10.40	-56.46	-30	-26.46
2175.40	42.66	188	2.0	V	-47.94	0.35	10.40	-57.99	-30	-27.99
4539.75	45.77	220	1.2	H	-45.13	2.57	12.70	-55.26	-30	-25.26
4539.75	43.47	126	1.9	V	-46.13	2.57	12.70	-56.26	-30	-26.26
<b>TX_DH5_High Channel</b>										
999.26	22.59	160	1.8	H	-72.74	0.22	0.00	-72.52	-36	-36.52
999.26	20.50	299	2.0	V	-74.17	0.22	0.00	-73.95	-36	-37.95
2619.78	44.84	286	1.7	H	-48.77	0.45	10.70	-59.02	-30	-29.02
2619.78	41.85	281	1.1	V	-47.84	0.45	10.70	-58.09	-30	-28.09
5950.64	43.38	320	1.3	H	-45.09	2.90	12.90	-55.09	-30	-25.09
5950.64	38.55	125	1.6	V	-49.69	2.90	12.90	-59.69	-30	-29.69



## 6.7 Receiver spurious emissions

### 6.7.1 Standard Applicable

According to section 4.3.1.11.3, 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

### 6.7.2 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 ETSI EN 300 328 section 5.4.10.2.

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

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

### 6.7.3 Test Condition

<b>Operating Mode</b> .....	A.2
<b>Test Environment</b> .....	Normal Condition
<b>Test Voltage</b> .....	Battery 3.7V
<b>Ambient temperature</b> .....	22°C
<b>Humidity</b> .....	54%RH
<b>Atmospheric Pressure</b> .....	101.2kPa



### 6.7.4 Test Result

Note: All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report.

Frequency (MHz)	Receiver Reading (dB $\mu$ V)	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)			
<b>RX_DH5_Low Channel</b>										
600.15	24.43	184	1.3	H	-74.87	0.20	0.00	-74.67	-57	-17.67
600.15	23.89	222	1.5	V	-75.08	0.20	0.00	-74.88	-57	-17.88
1448.68	43.15	201	1.7	H	-51.41	0.28	8.00	-59.13	-47	-12.13
1448.68	45.27	124	1.5	V	-50.93	0.28	8.00	-58.65	-47	-11.65
1577.16	48.86	141	1.8	H	-47.60	0.28	8.00	-55.32	-47	-8.32
1577.16	49.04	165	1.9	V	-48.18	0.28	8.00	-55.90	-47	-8.90
<b>RX_DH5_High Channel</b>										
970.30	24.35	227	1.9	H	-70.99	0.22	0.00	-70.77	-57	-13.77
970.30	20.17	114	1.4	V	-74.61	0.22	0.00	-74.39	-57	-17.39
3566.70	43.69	281	1.9	H	-48.83	2.34	12.40	-58.89	-47	-11.89
3566.70	41.82	105	1.9	V	-48.79	2.34	12.40	-58.85	-47	-11.85
4786.59	41.68	185	1.6	H	-49.22	2.61	12.70	-59.31	-47	-12.31
4786.59	39.07	143	1.4	V	-49.86	2.61	12.70	-59.95	-47	-12.95



## 6.8 Receiver Blocking

### 6.8.1 Standard Applicable

According to section 4.3.1.12.3, 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 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 4.3.1.12.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category 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 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		
(-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	-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: 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.



### 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 7: Receiver Blocking parameters for 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 <sub>10</sub> (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 8: Receiver Blocking parameters for 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 <sub>10</sub> (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.



## 6.8.2 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  $P_{min}$ . 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.

## 6.8.3 Test Setup

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

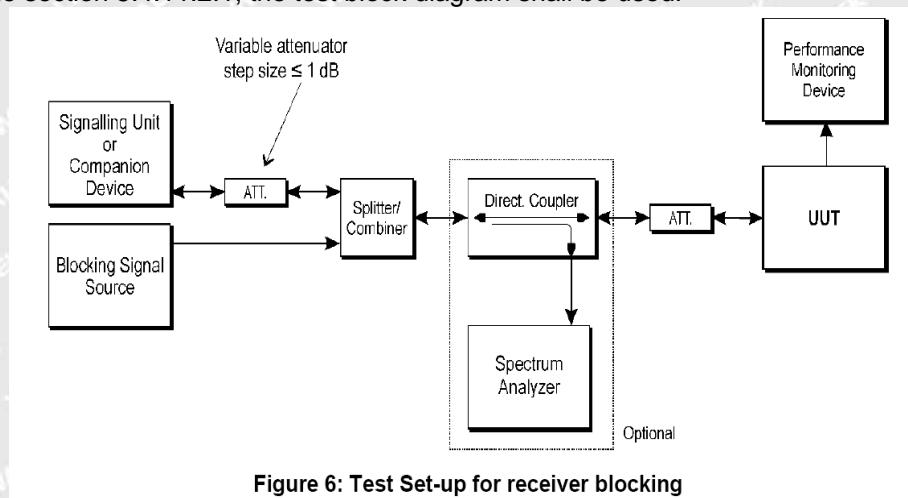


Figure 6: Test Set-up for receiver blocking

All test procedure is carried to the section 5.4.11.2.1  
RBW/VBW=8MHz/30MHz



### 6.8.4 Test Condition

Operating Mode .....	B
Test Environment .....	Normal Condition
Test Voltage .....	DC 3.3V (power to control panel)
Ambient temperature .....	22°C
Humidity .....	54%RH
Atmospheric Pressure .....	101.2kPa

### 6.8.5 Test Result

GFSK_DH5						
Receiver Blocking Categories 3						
Wanted signal meanpower from companion device (dBm)	OCBW (Hz)	Blocking signal frequency (MHz)	Blocking signal power(dBm) CW	PER (%)	Limit	Results
-59.60	870100	2380	-34	3.1	≤10%	Pass
		2504	-34	4.0		
		2300	-34	2.0		
		2584	-34	5.2		
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.						



<b>π/4QPSK_2DH5</b>						
<b>Receiver Blocking Categories 3</b>						
<b>Wanted signal meanpower from companion device (dBm)</b>	<b>OCBW (Hz)</b>	<b>Blocking signal frequency (MHz)</b>	<b>Blocking signal power(dBm) CW</b>	<b>PER (%)</b>	<b>Limit</b>	<b>Results</b>
-58.24	1191000	2380	-34	3.5	≤10%	Pass
		2504	-34	4.6		
		2300	-34	6.0		
		2584	-34	0.7		

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.

<b>8DPSK_3DH5</b>						
<b>Receiver Blocking Categories 3</b>						
<b>Wanted signal meanpower from companion device (dBm)</b>	<b>OCBW (Hz)</b>	<b>Blocking signal frequency (MHz)</b>	<b>Blocking signal power(dBm) CW</b>	<b>PER (%)</b>	<b>Limit</b>	<b>Results</b>
-58.20	1202900	2380	-34	4.5	≤10%	Pass
		2504	-34	4.9		
		2300	-34	2.4		
		2584	-34	6.0		

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.



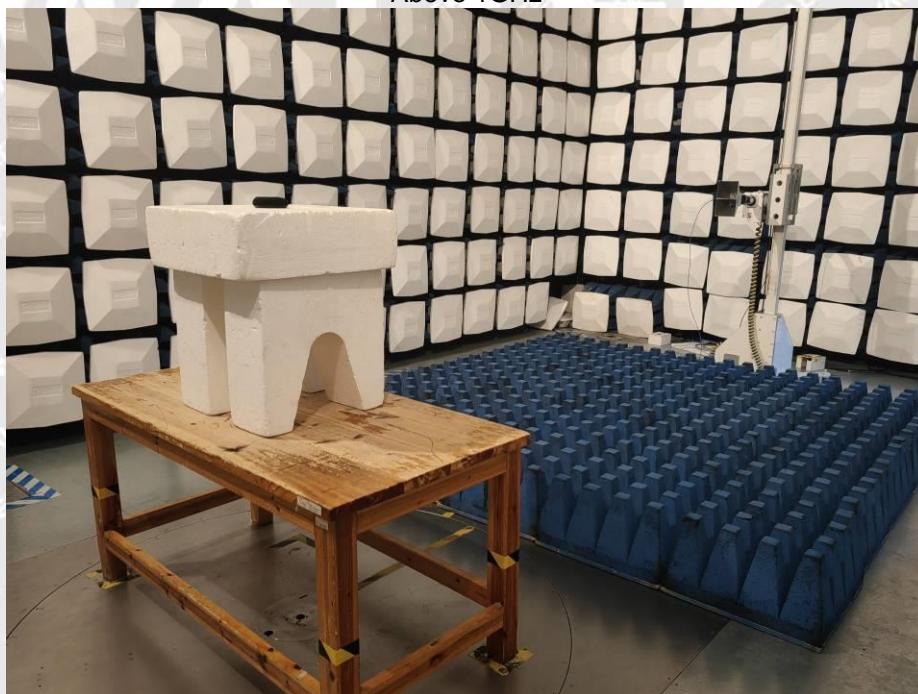
## 7 Photographs – Test Setup

### 7.1 Photograph – Spurious Emissions Test Setup

Below 1GHz



Above 1GHz





## 8 Photographs – EUT Constructional Details

Please refer to "ANNEX" (Reference No. WTF25F09233903W).

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

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中国认可  
国际互认  
检测  
TESTING  
CNAS L6478



# TEST REPORT

**Reference No.** ..... : WTF25F09233903W003  
**Applicant** ..... : Mid Ocean Brands B.V.  
**Address** ..... : Unit 711-716, 7/F., Tower A, 83 King Lam Street, Cheung Sha Wan, Kowloon, Hong Kong.  
**Manufacturer** ..... : 118102  
**Address** ..... : ---  
**Product Name** ..... : Wireless multi speaker  
**Model No.** ..... : MO6887  
**Test specification** ..... : ETSI EN 303 417 V1.1.1 (2017-09)  
**Date of Receipt sample** ..... : 2025-09-23  
**Date of Test** ..... : 2025-09-29  
**Date of Issue** ..... : 2025-09-30  
**Test Report Form No.** ..... : WEW-303417A-01B  
**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 approver.

**Prepared By:**

**Waltek Testing Group (Foshan) Co., Ltd.**

Address: 1/F., Building 19, Sunlink Machinery City, Xingye 4 Road,  
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Tested by:

Roy Hong

Approved by:

Danny Zhou



## 1 Test Summary

Radio Spectrum				
Test	Test Requirement	Reference	Result	
Permitted range of operating frequencies	ETSI EN 303 417 V1.1.1	4.3.2	Pass	
Operating frequency ranges	ETSI EN 303 417 V1.1.1	4.3.3	Pass	
H-field requirements	ETSI EN 303 417 V1.1.1	4.3.4	Pass	
Transmitter spurious emissions	ETSI EN 303 417 V1.1.1	4.3.5	Pass	
Transmitter out of band (OOB) emissions	ETSI EN 303 417 V1.1.1	4.3.6	Pass	
WPT system unwanted conducted emissions	ETSI EN 303 417 V1.1.1	4.3.7	N/A	
Receiver blocking	ETSI EN 303 417 V1.1.1	4.4.2	Pass	

### Remark:

Pass The EUT complies with the essential requirements in the standard

Fail The EUT does not comply with the essential requirements in the standard

N/A Not Applicable



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# WALTEK



### 3 General Information

#### 3.1 General Description of E.U.T.

**Product Name** ..... : Wireless multi speaker

**Model No.** ..... : MO6887

**Remark** ..... : ---

**Rating** ..... : Wireless output power: 10W Max.  
Input: DC 5V, 2A  
Output: DC 9V, 1.22A

Power bank:  
Type-C Input: DC 5V, 2A  
USB Output: DC 5V, 2A  
Battery: 3.7V, 4000mAh, 14.8Wh

#### 3.2 Details of E.U.T.

**Frequency Bands** ..... : 100-205kHz

**Radiated H-Field** ..... : 15.81 dBuA/m(@3m)

**Antenna Type** ..... : Coil Antenna

**Antenna Gain** ..... : 0dBi

#### Overview of operational modes within a WPT system

Operational Mode	Set-up	Function of base station	Function of mobile device	Test scenario	Conformance Requirements
Mode 1: base station in stand-by, idle mode	Single device	Transmitter	Not applicable	Single radiation test (TX) with the base station/charging pad. The test set-up as described in clause 6.1.2 shall be used.	Operating frequency range (clause 4.3.3) H-Field emission (clause 4.3.4) TX spurious (clauses 4.3.5, 4.3.6 and 4.3.7) Performance criteria test (RX test) (clause 4.4)
Mode 2: Communication before charging, adjustment charging mode / position	In combination	TX and RX	TX and RX	Specific test setup, declared by the manufacturer. Manufacturer shall declare the maximal distance between base station and mobile device the WPT system is able to communicate (distance D). The test setup- up shall be performed with the largest communication distance. The test	Operating frequency range (clause 4.3.3) H-Field emission (clause 4.3.4) TX spurious (clauses 4.3.5, 4.3.6 and 4.3.7) Wanted performance criteria test (RX test) (clause 4.4)



Operational Mode	Set-up	Function of base station	Function of mobile device	Test scenario	Conformance Requirements
				set-up as described in clause 6.1.3 shall be used.	
Mode3: Communication	WPT system alignment	TX and RX	TX and RX	Worst case alignment	Operating frequency range (clause 4.3.3) H-Field emission (clause 4.3.4) TX spurious (clauses 4.3.5, 4.3.6 and 4.3.7) Wanted Performance criteria test (RX test) (clause 4.4)
Mode 4: energy transmission	WPT system alignment	TX and RX	TX and RX	Both tests can be performed within one set-up, worst-case alignment. The test set-up as described in clause 6.1.4 shall be used.	

### 3.3 Standards Applicable for Testing

The tests were performed according to following standards:

ETSI EN 303 417 V1.1.1 (2017-09) Wireless power transmission systems, using technologies other than radio frequency beam in the 19 - 21 kHz, 59 - 61 kHz, 79 - 90 kHz, 100 - 300 kHz, 6 765 - 6 795 kHz ranges; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.

### 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 and Economic Development Canada (ISED). The acceptance letter from the ISED is maintained in our files. Registration ISED number: 21895.

- **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.

- **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.

### 3.7 Disclaimer

The antenna gain information is provided by the customer. The laboratory is not responsible for the accuracy of the antenna gain information.

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## 4 Equipment Used during Test

### 4.1 Equipment List

<input checked="" type="checkbox"/> 3m Semi-anechoic Chamber for Spurious Emission						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	3m Semi-anechoic Chamber	CHANGCHUANG	9mx6mx6m	-	2024-01-05	2027-01-04
2	EMI TEST RECEIVER	RS	ESR7	101566	2025-01-06	2026-01-05
3	Spectrum Analyzer	Agilent	N9020A	MY48011796	2025-01-06	2026-01-05
4	Trilog Broadband Antenna	SCHWARZBECK	VULB9162	9162-117	2025-01-12	2026-01-11
5	Coaxial Cable (below 1GHz)	Times Microwave Systems	RG223-NMNM-10M	-	2025-01-07	2026-01-06
6	Coaxial Cable (below 1GHz)	Times Microwave Systems	RG223-NMNM-3M	-	2025-01-07	2026-01-06
7	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	01561	2025-01-13	2026-01-12
8	Broadband Preamplifier (Above 1GHz)	Lunar E M	LNA1G18-40	20160501002	2025-01-06	2026-01-05
9	Coaxial Cable (above 1GHz)	Times-Microwave	CBL5-NN	-	2025-01-06	2026-01-05
<input checked="" type="checkbox"/> RF Conducted test						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Environmental Chamber	GERUI	GR-HWS-1000L	GR24061818	2025-07-02	2026-07-01
2	Spectrum Analyzer	Agilent	N9020A	MY48011796	2025-01-06	2026-01-05
3	EXG Analog Signal Generator	Agilent	N5181A	MY48180720	2025-01-06	2026-01-05
4	RF Control Unit	TONSCEND	JS0806-2	-	2025-01-08	2026-01-07

: Not Used

: Used



## 4.2 Software List

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

## 4.3 Special Accessories and Auxiliary Equipment

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

## 4.4 Measurement Uncertainty

Parameter	Uncertainty	Note
RF Output Power	±2.2dB	(1)
Occupied Bandwidth	±1.5%	(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 if any measured disturbance level exceeds the disturbance limit.

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 Permitted Range of Operating Frequency

### 5.1 Standard Applicable

1. This applies to all WPT systems.
2. The permitted range of operating frequencies denotes the frequency ranges set out in Table 1. It likewise denotes the respective frequency range for accommodation of the fundamental WPT frequency of the EUT within its operating frequency range (OFR).
3. Limits

The permitted range of operating frequency range(s) for intentional emissions shall be within 19 - 21 kHz, 59 - 61 kHz, 79 - 90 kHz, 100 - 300 kHz, 6 765 - 6 795 kHz, see Table 2.

### 5.2 Test Procedure

Please refer to ETSI EN 303 417 subclause 6.2.2.

### 5.3 Test Condition

Operating Mode .....	TX mode
Test Environment .....	Normal Condition
Test Voltage .....	DC 5V
Ambient temperature .....	25°C
Humidity .....	54%RH
Atmospheric Pressure .....	101.2kPa

### 5.4 Test Result

Permitted range of operating frequencies				
$F_L$ (kHz)	$F_H$ (kHz)	Limit (kHz)		Result
100	205	$F_L \geq 100$	$F_H \leq 300$	Pass



## 6 Operating Frequency Ranges

### 6.1 Standard Applicable

The operating frequency range is the frequency range over which the WPT system is intentionally transmitting (all operational modes, see clause 4.2.3, Table 2).

The operating frequency range(s) of the WPT system are determined by the lowest ( $f_L$ ) and highest frequency ( $f_H$ ) as occupied by the power envelope.

The WPT system could have more than one operating frequency range.

For a single frequency systems the OFR is equal to the occupied bandwidth (OBW) of the WPT system.

For multi-frequency systems the OFR is described in Figures 2 and 3.

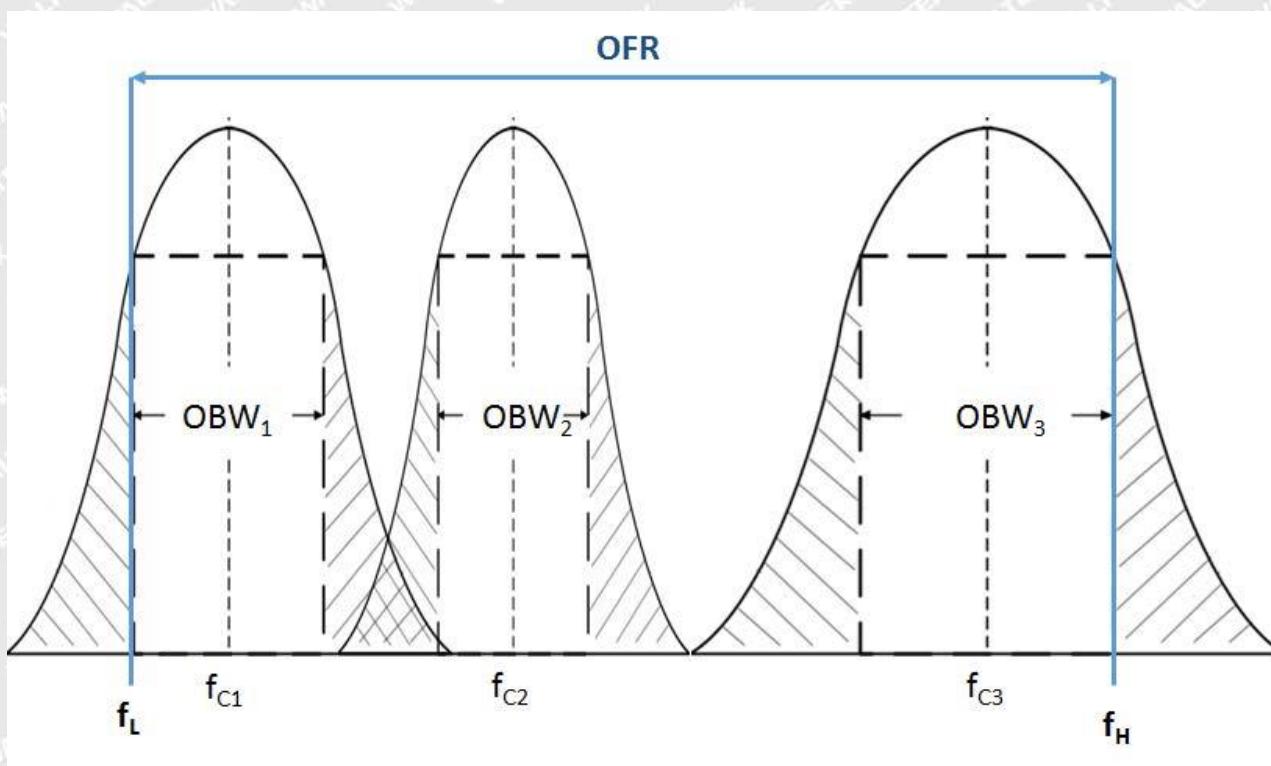


Figure 2: OFR of a multi - frequency WPT system within one frequency range of Table 2 and within one WPT system cycle time

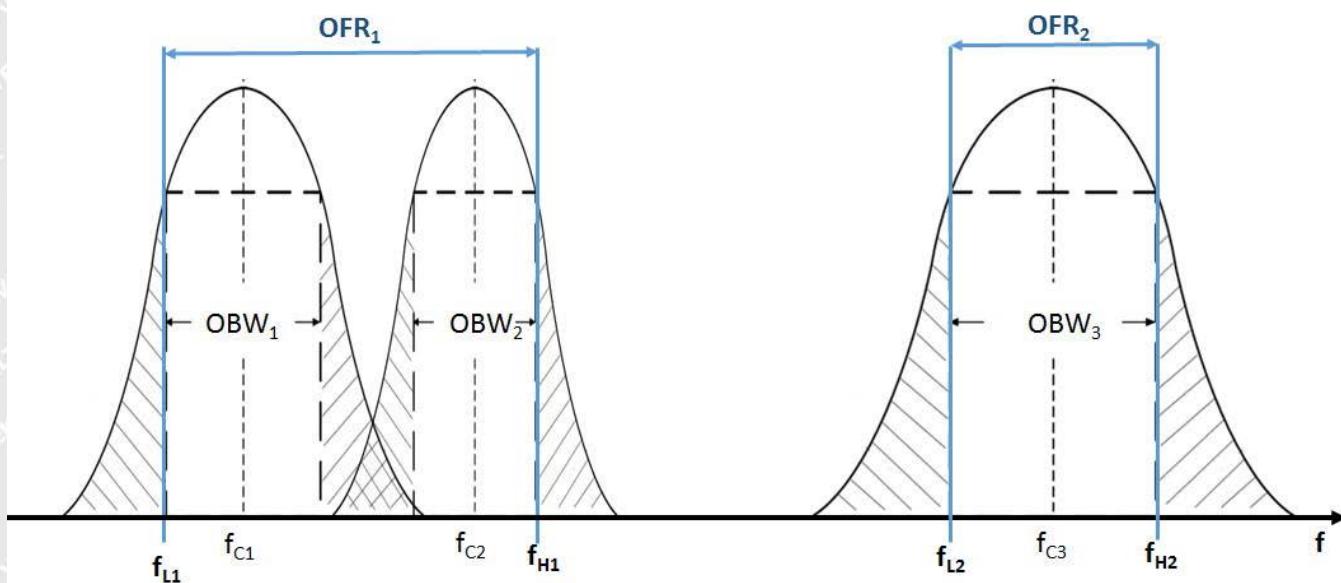


Figure 3: OFR of a multi - frequency WPT system within two frequency ranges of Table 2 and within one WPT system cycle time

#### Limits

The operating frequency range for emissions shall be within one of the following limits: 19 - 21 kHz, 59 - 61 kHz, 79 - 90 kHz, 100 - 300 kHz, 6 765 - 6 795 kHz.

## 6.2 Test Procedure

Please refer to ETSI EN 303 417 subclause 6.2.2.

## 6.3 Test Condition

<b>Operating Mode</b> .....	TX mode
<b>Test Environment</b> .....	Normal Condition
<b>Test Voltage</b> .....	DC 5V
<b>Ambient temperature</b> .....	25°C
<b>Humidity</b> .....	54%RH
<b>Atmospheric Pressure</b> .....	101.2kPa

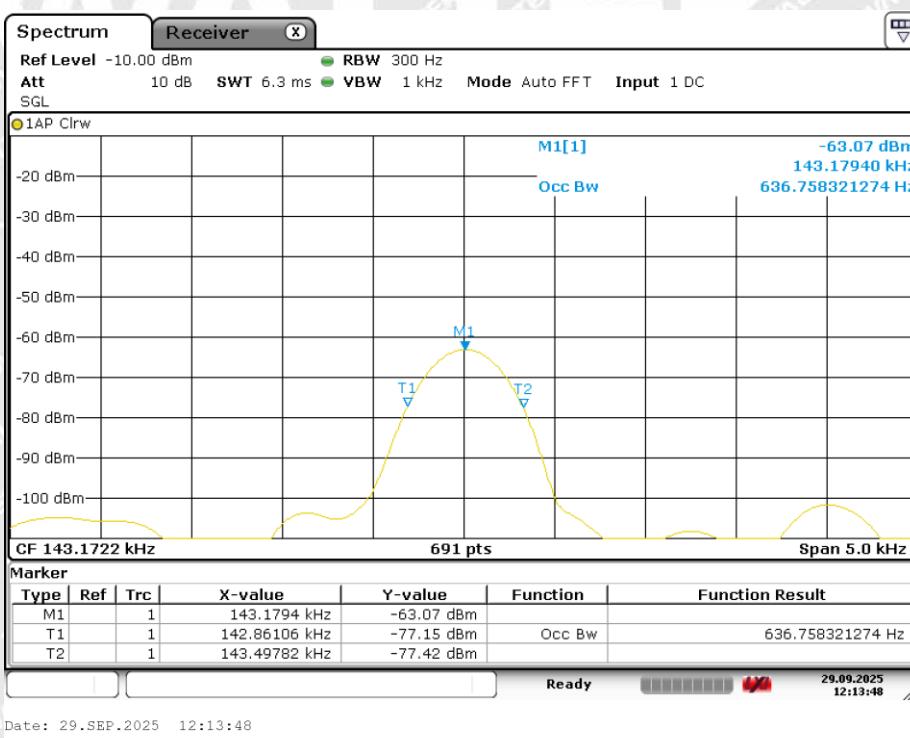
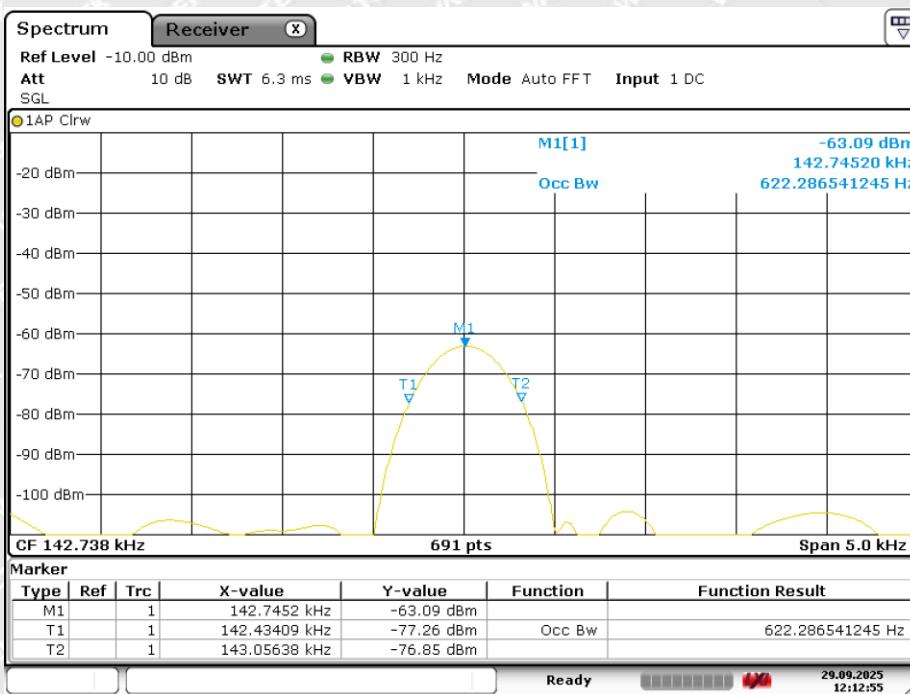
## 6.4 Test Result

Operating frequency range(s) (OFR)				Result
<b>F<sub>L</sub>(kHz)</b>	<b>F<sub>H</sub>(kHz)</b>	Limit (kHz)		
142.4	143.5	$F_L \geq 100$	$F_H \leq 300$	Pass



## Test Plots:

### Operating frequency range(s) (OFR)





## 7 Transmitter H-field Requirements

### 7.1 Standard Applicable

The radiated H-field is defined in the direction of maximum field strength under specified conditions of measurement.

The H-field limits are provided in Table 3.

They have been specified for control of any radiated emissions within the OFR originating from the WPT system (power transmission and accompanying data communication).

The H-field limits in Table 3 are EU wide harmonised according to EC Decision 2013/752/EU [i.2]. Further information is available in CEPT/ERC/REC 70-03 [i.1].

**Table 3: H-field limits**

Frequency range [MHz]	H-field strength limit [dB $\mu$ A/m at 10 m]	Comments
0,019 ≤ f < 0,021	72	
0,059 ≤ f < 0,061	69,1 descending 10 dB/dec above 0,059 MHz	See note 1
0,079 ≤ f < 0,090	67,8 descending 10 dB/dec above 0,079 MHz	See note 2
0,100 ≤ f < 0,119	42	
0,119 ≤ f < 0,135	66 descending 10 dB/dec above 0,119 MHz	See note 1
0,135 ≤ f < 0,140	42	
0,140 ≤ f < 0,1485	37,7	
0,1485 ≤ f < 0,30	-5	
6,765 ≤ f < 6,795	42	

NOTE 1: Limit is 42 dB $\mu$ A/m for the following spot frequencies: 60 kHz ± 250 Hz and 129,1 kHz ± 500 Hz.

NOTE 2: At the time of preparation of the present document the feasibility of increased limits for high power wireless power transmission systems to charge vehicles [i.4] was prepared. New specific requirements for such systems (e.g. higher H-field emission limits in the 79 - 90 kHz band) will be reflected within a future revision of the present document.

### 7.2 Test Procedure

Please refer to ETSI EN 303 417 subclause 6.2.2

### 7.3 Test Condition

Operating Mode .....	TX mode
Test Environment .....	Normal Condition
Test Voltage .....	DC 5V
Ambient temperature .....	25°C
Humidity .....	54%RH
Atmospheric Pressure .....	101.2kPa



## 7.4 Test Result

Frequency (MHz)	Level (dBuA/m)@3m	C <sub>3</sub> Factor (dB)	Level (dBuA/m)@10m	Limit (dBuA/m)@10m	Result
0.14	15.81	31.2	-15.39	37.7	Pass

Note 1: Pre-scan EUT X,Y,Z axis, and find the worst case at X axis.

Note 2:  $H_{3m} = H_{10m} + C_3$  refer to ETSI EN 300 330 Annex H.2

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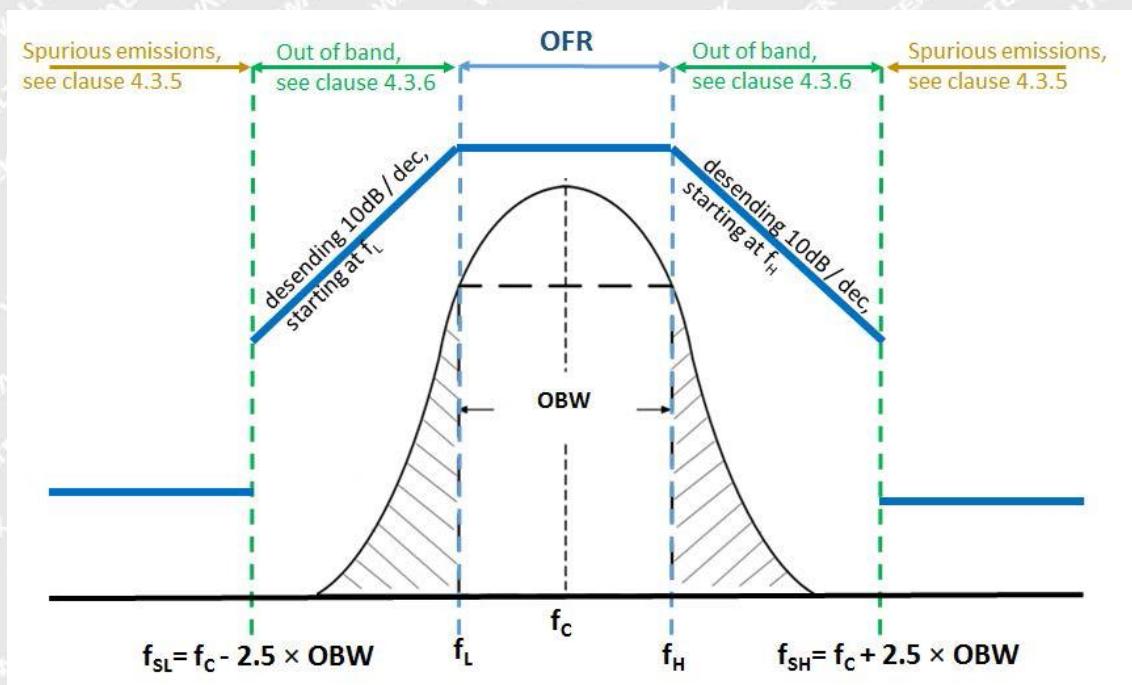


## 8 Transmitter Spurious Emissions

### 8.1 Standard Applicable

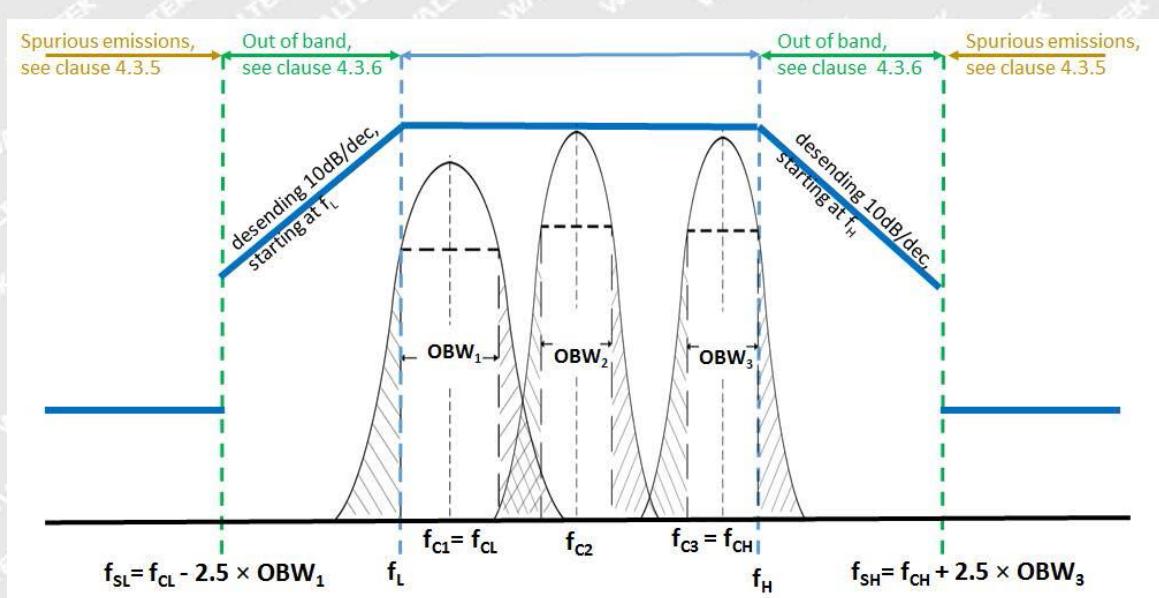
The transmitter spurious emissions for a single frequency system are to be considered in frequency ranges defined in Figure 4 ( $f < f_{SL}$  and  $f > f_{SH}$ ).

Figure 4: Out of band and spurious domain of a single frequency WPT system.



The transmitter spurious emissions for a multi frequency system (within one WPT frequency range from Table 2) are to be considered in frequency ranges defined in Figure 5 ( $f < f_{SL}$  and  $f > f_{SH}$ ).

Figure 5: Out of band and spurious domain of a multi - frequency system (during one WPT system cycle time).





### Limit

The radiated field strength of spurious emissions below 30 MHz shall not exceed the generated H-field given in Table 4.

State (see note)	Frequency 9 kHz $\leq$ f $<$ 10 MHz	Frequency 10 MHz $\leq$ f $<$ 30 MHz
Operating	27 dB $\mu$ A/m at 9 kHz descending 10 dB/dec	-3,5 dB $\mu$ A/m
Standby	5,5 dB $\mu$ A/m at 9 kHz descending 10 dB/dec	-25 dB $\mu$ A/m

NOTE: "Operating" means mode 2, 3 and 4 according to Table 2; "standby" means mode 1 according to Table 2.

The power of any radiated spurious emission between 30 MHz and 1 GHz shall not exceed the values given in Table 5.

State (see note)	47 MHz to 74 MHz 87,5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 790 MHz	Other frequencies between 30 MHz to 1 000 MHz
Operating	4 nW	250 nW
Standby	2 nW	2 nW

NOTE: "Operating" means mode 2, 3 and 4 according to Table 2; "standby" means mode 1 according to Table 2.

## 8.2 Test Procedure

Please refer to ETSI EN 303 417 subclause 6.2.2 and subclause 6.2.3 for the measurement method

## 8.3 Test Condition

**Operating Mode** ..... : TX mode, RX mode

**Test Environment** ..... : Normal Condition

**Test Voltage** ..... : DC 5V

**Ambient temperature** ..... : 25°C

**Humidity** ..... : 54%RH

**Atmospheric Pressure** ..... : 101.2kPa

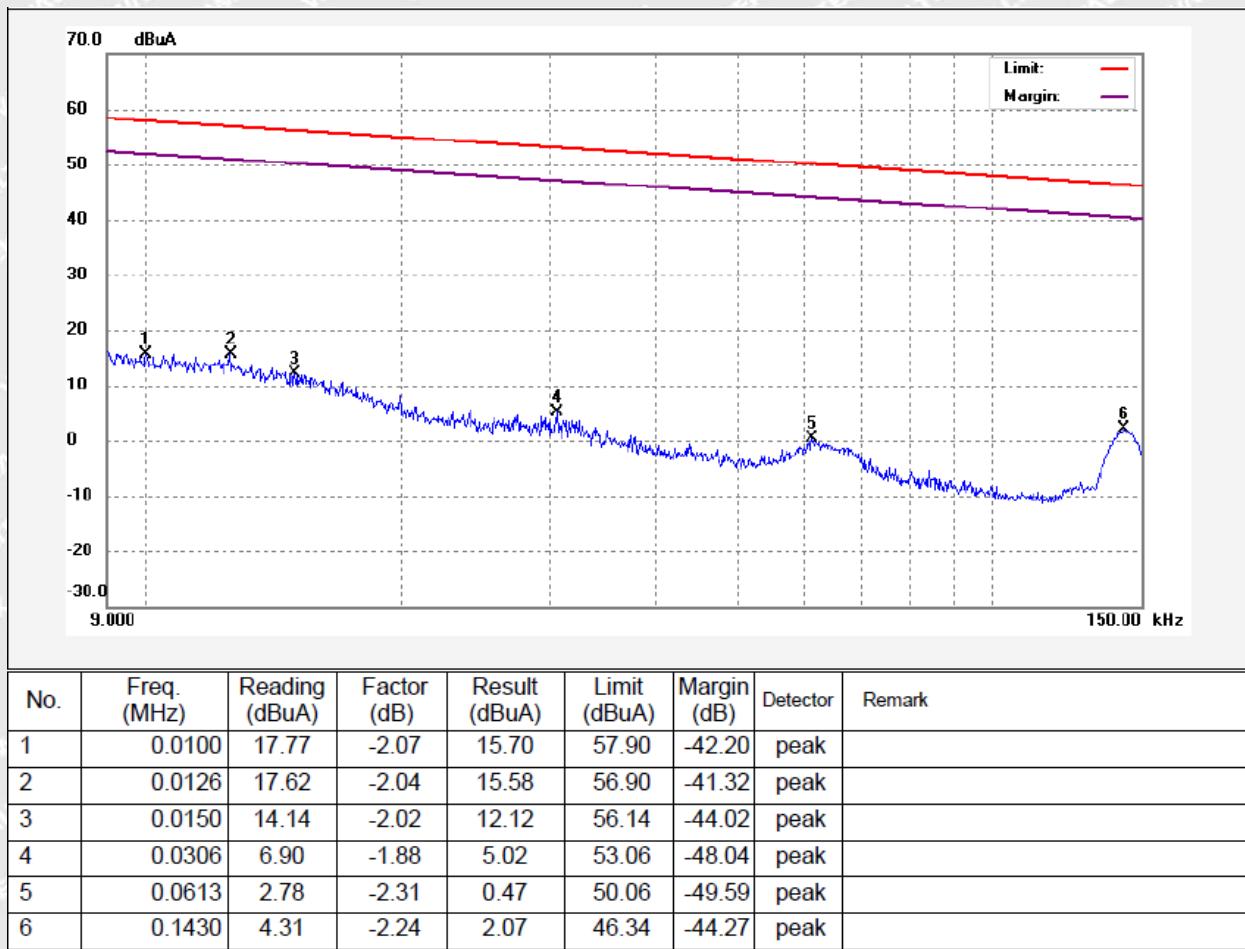


## 8.4 Test Result

Pre-scan EUT X,Y,Z axis, and find the worst case at X axis.

### 9kHz-150kHz Emission @3m

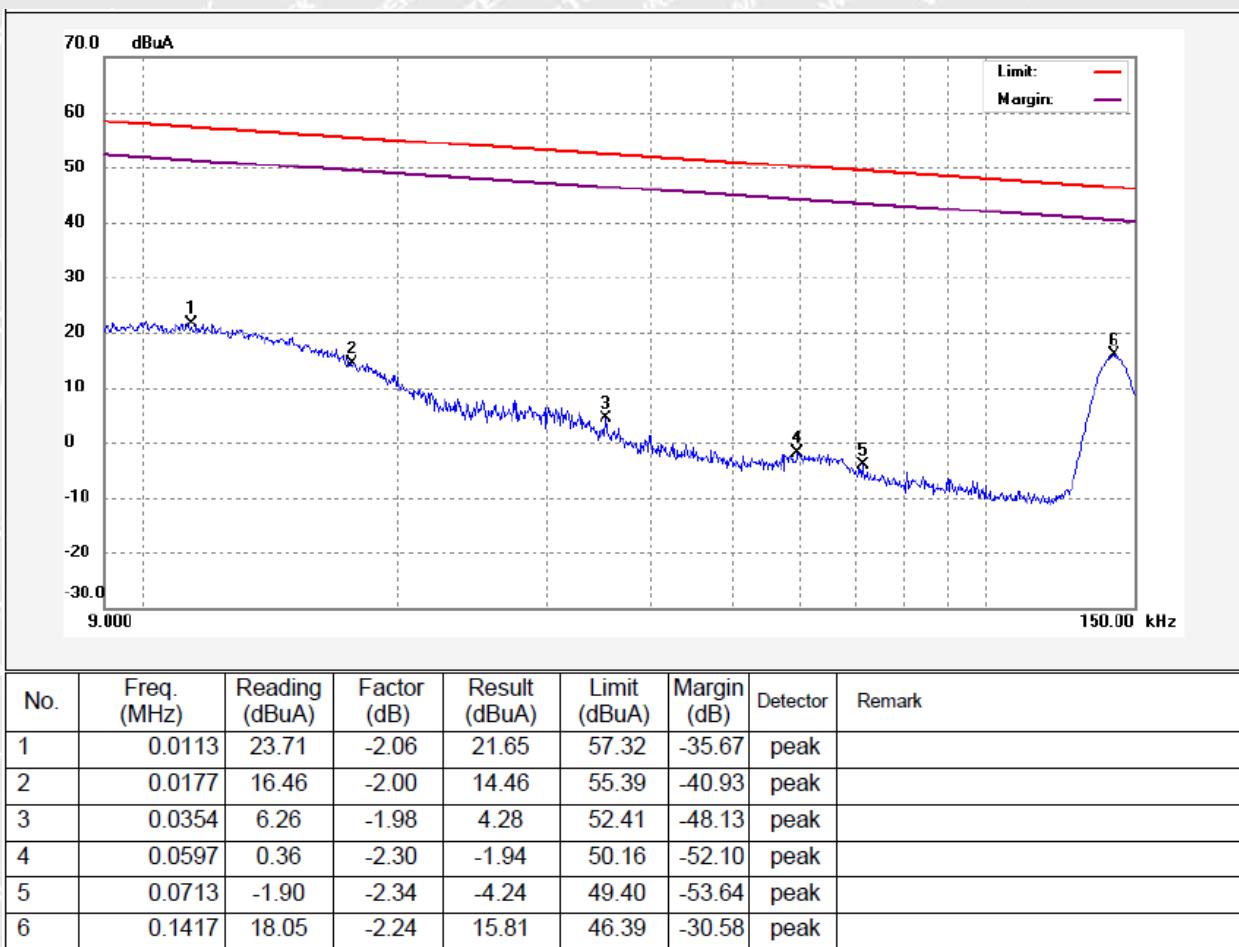
#### Vertical Polarization



Note 1:  $H_{3m} = H_{10m} + C_3$  refer to ETSI EN 300 330 Annex H.2



## Horizontal Polarization

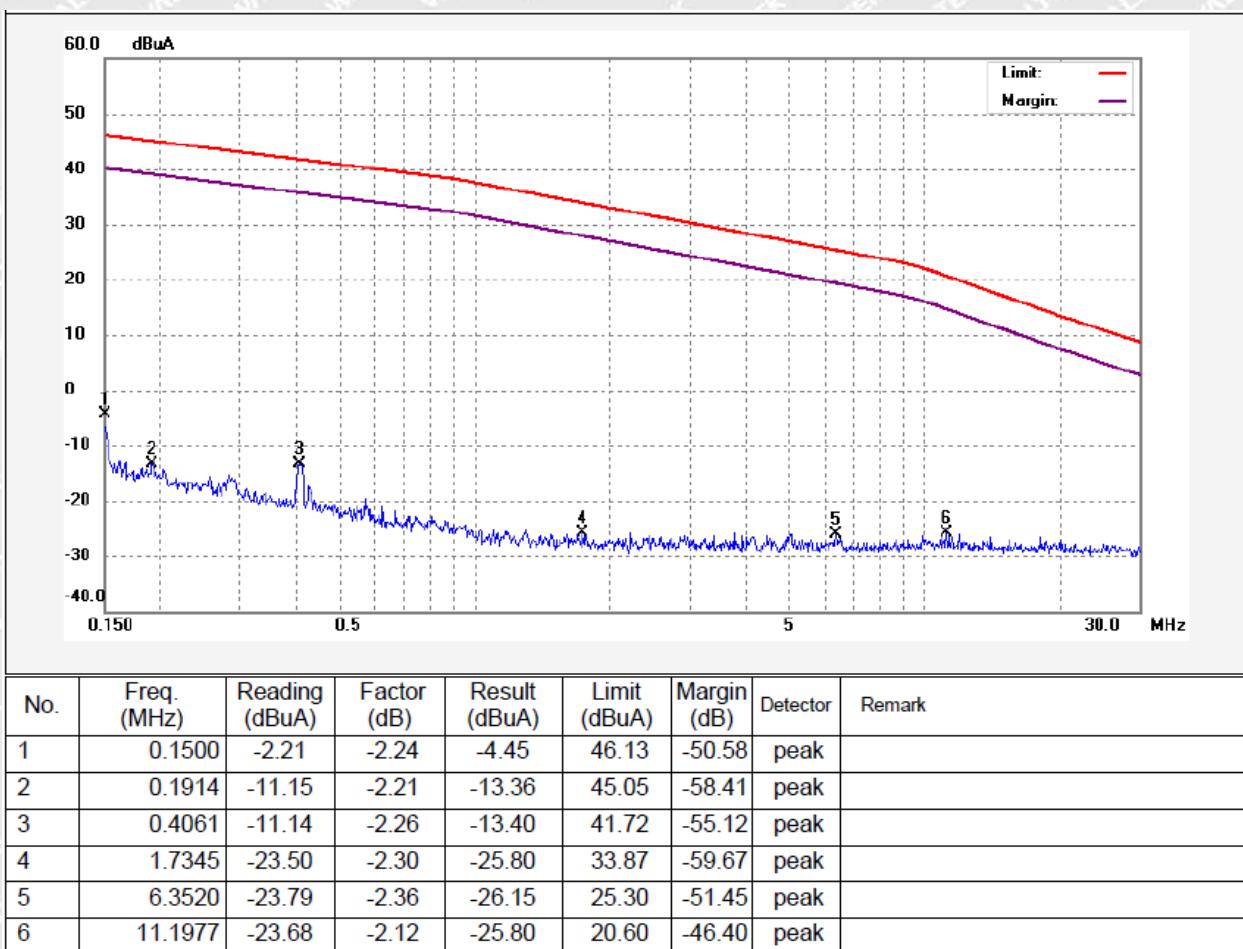


Note 1:  $H_{3m} = H_{10m} + C_3$  refer to ETSI EN 300 330 Annex H.2



## 150kHz-30MHz Emission @3m

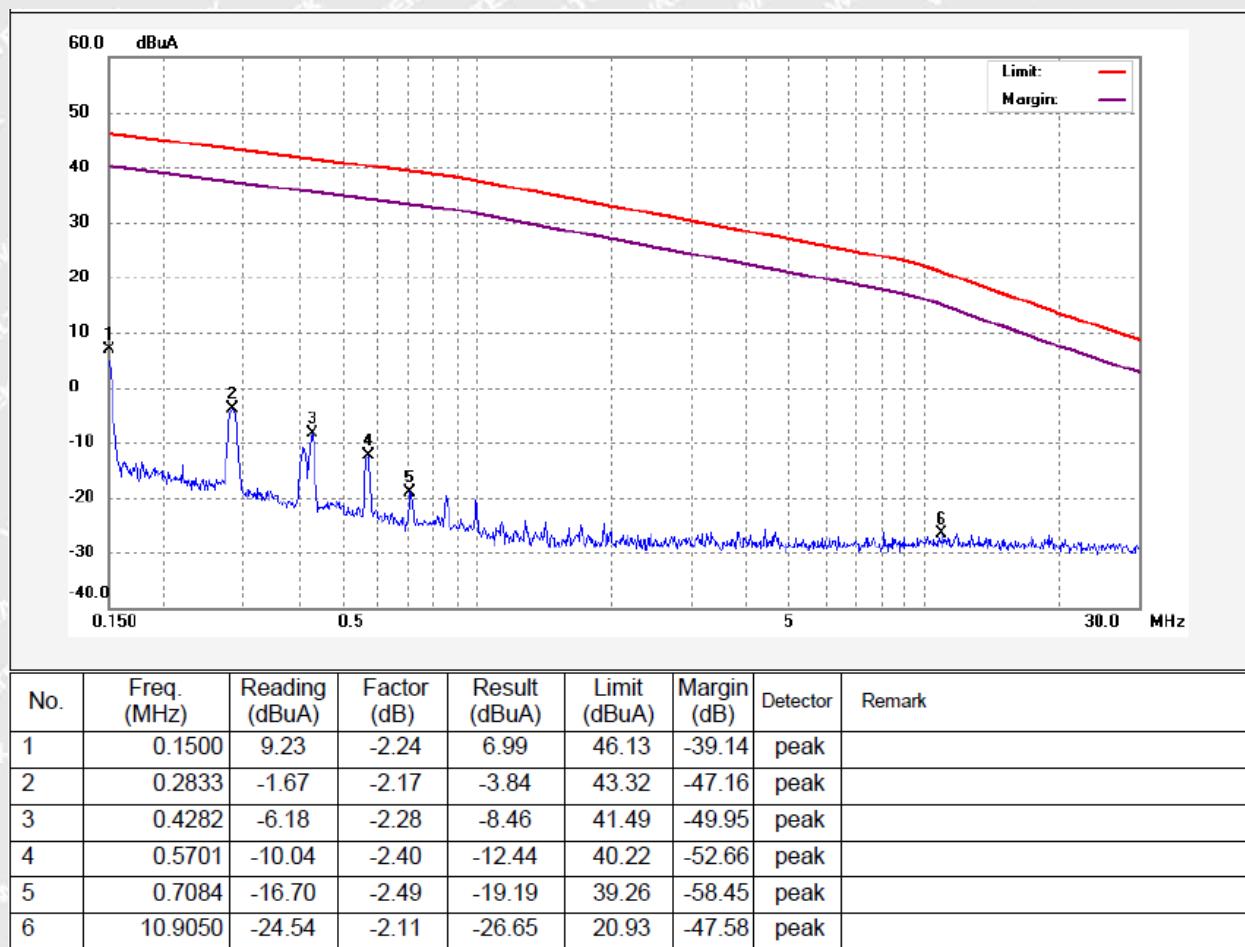
## Vertical Polarization



Note 1:  $H_{3m} = H_{10m} + C_3$  refer to ETSI EN 300 330 Annex H.2



## Horizontal Polarization

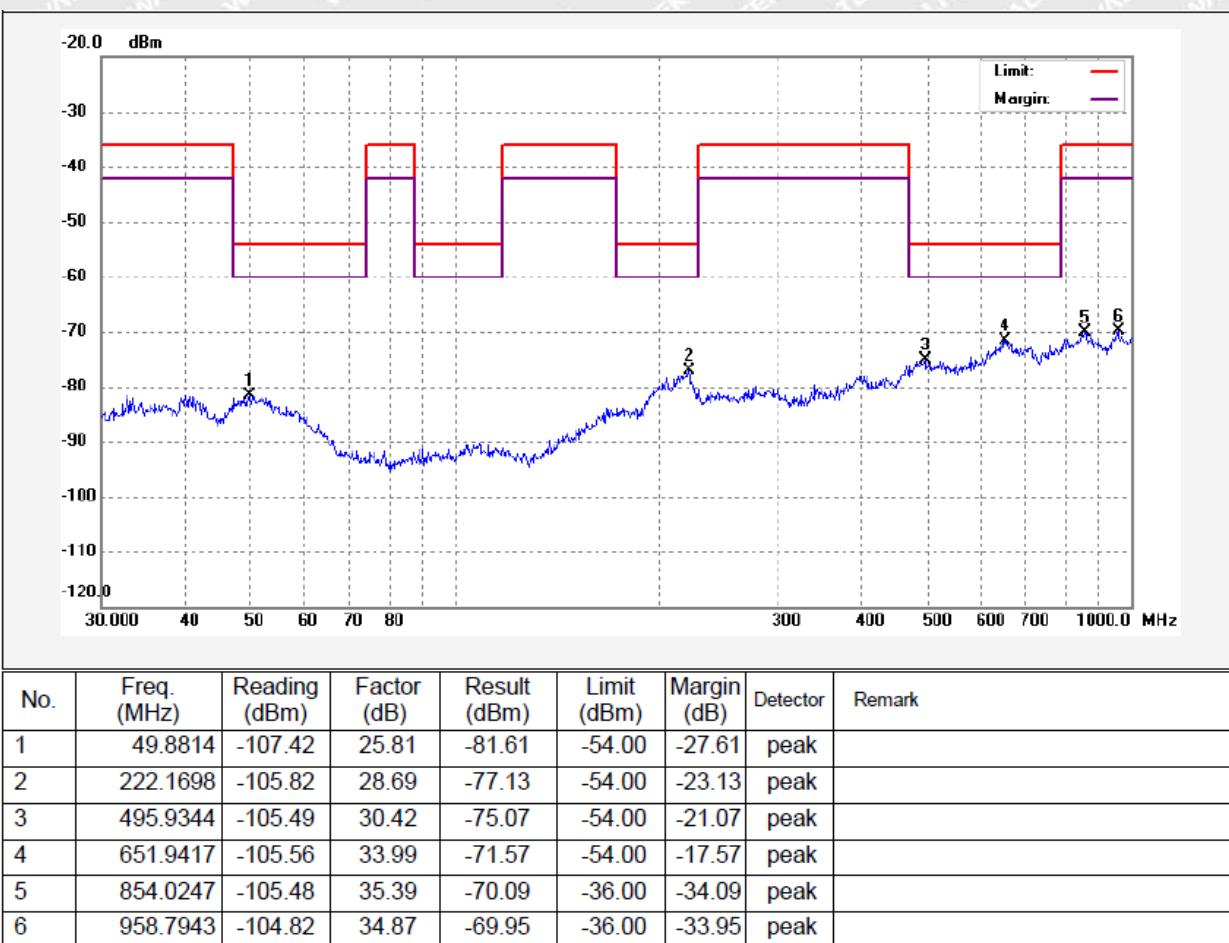


Note 1:  $H_{3m} = H_{10m} + C_3$  refer to ETSI EN 300 330 Annex H.2



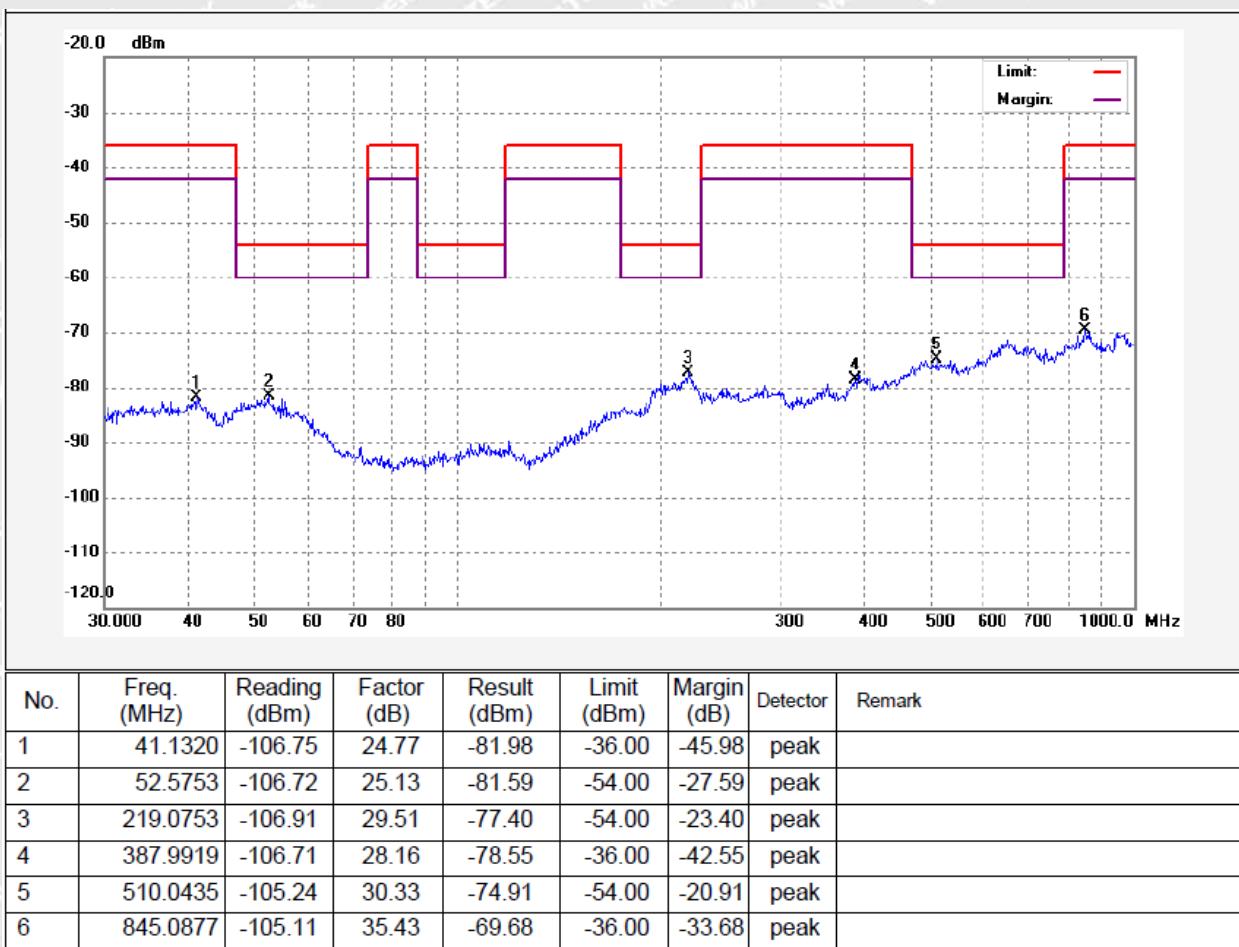
### 30MHz-1GHz Emission For TX

#### Vertical Polarization





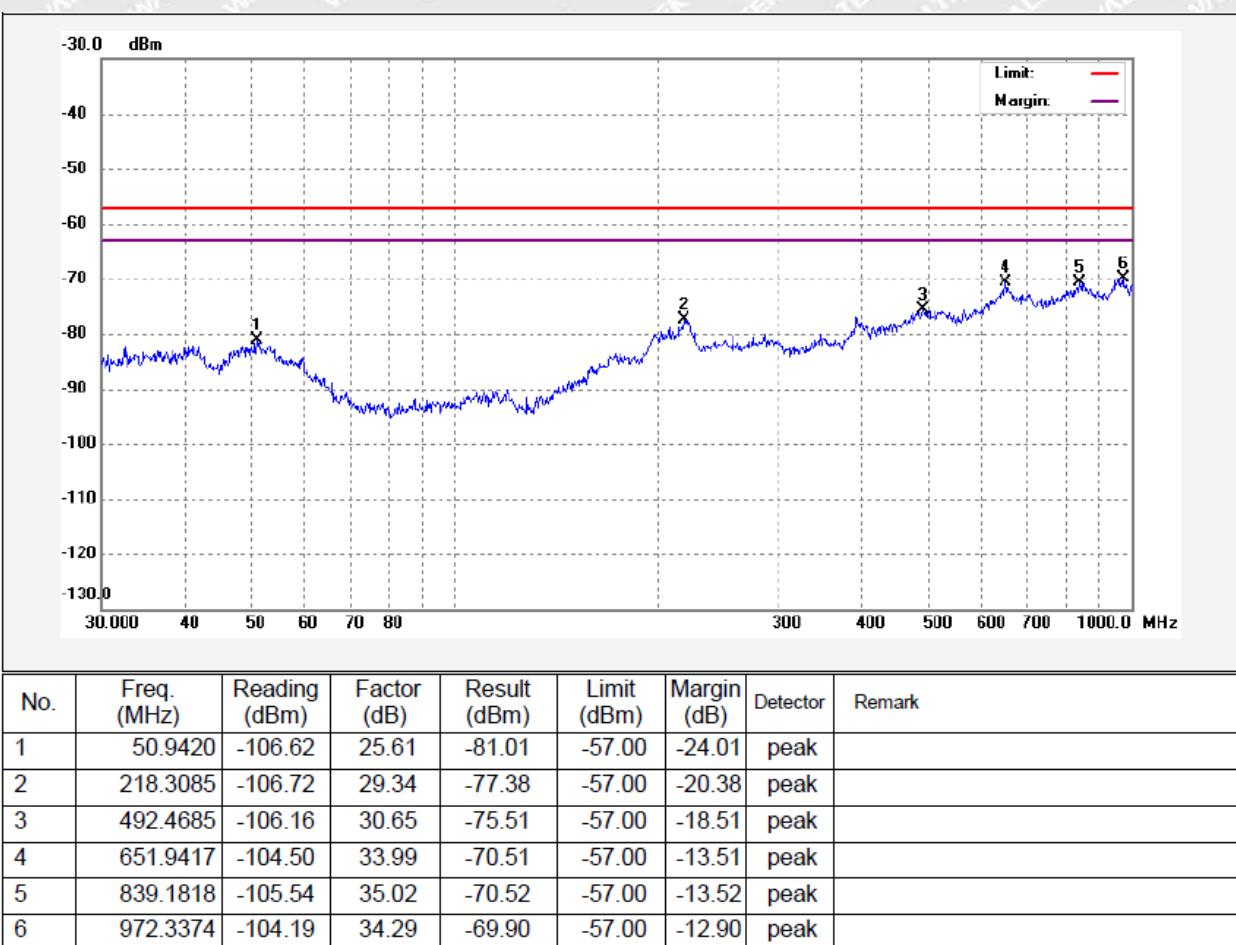
## Horizontal Polarization





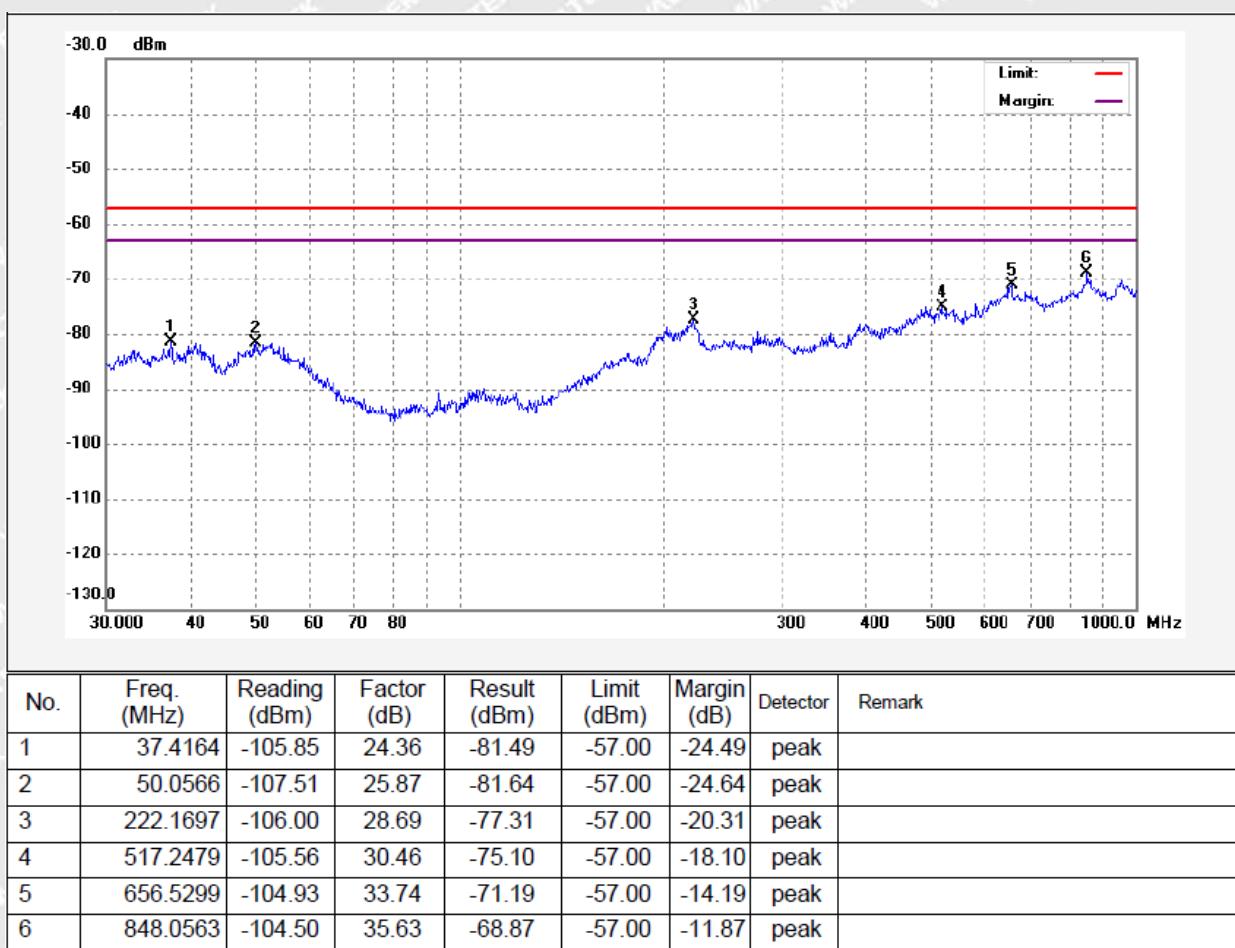
### 30MHz-1GHz Emission For RX

#### Vertical Polarization





## Horizontal Polarization



Note1: Standby mode dose not produce any emission, which no emission been detected.



## 9 Transmitter Out of Band(OOB) Emissions

### 9.1 Standard Applicable

The WPT system out of band emissions are to be considered in frequency ranges defined in Figure 4 and Figure 5 (between  $f_{SL}$  and  $f_L$  and between  $f_H$  and  $f_{SH}$ ).

Limit

The OOB limits are visualized in Figures 4 and 5; they are descending from the intentional limits from Table 3 at  $f_H/f_L$  with 10 dB/decade.

### 9.2 Test Procedure

Please refer to ETSI EN 303 417 subclause 6.2.2 for the measurement method

### 9.3 Test Condition

Operating Mode .....	TX mode
Test Environment .....	Normal Condition
Test Voltage .....	DC 5V
Ambient temperature .....	25°C
Humidity .....	54%RH
Atmospheric Pressure .....	101.2kPa

### 9.4 Test Result

No.	Frequency	Result@3m	$C_3$	Result@10	Limit@10	Margin	Remark
	(MHz)	(dBuA/m)	(dB)	(dBuA/m)	(dBuA/m)	(dB)	
1	$F_{cl}-2.5 \times OBW_1$	26.05	31.2	-5.15	42	-47.15	peak
2	$F_L$	27.53	31.2	-3.67	42	-45.67	peak
3	$F_H$	27.51	31.2	-3.69	42	-45.69	peak
4	$F_{ch}+2.5 \times OBW_3$	26.08	31.2	-5.12	42	-47.12	peak

Note 1:  $H_{3m} = H_{10m} + C_3$  refer to ETSI EN300 330 Annex H.2



## 10 Receiver Blocking

### 10.1 Standard Applicable

This requirement applies to all WPT systems operation in Mode 1, Mode 2 and Mode 3.

Blocking is a measure of the capability of the receiver to receive a wanted signal without exceeding a given degradation due to the presence of an unwanted input signal at any frequencies other than those of the receiver spurious responses.

The test shall be performed in the relevant operational modes (see clause 4.2.3).

The wanted performance criteria from clause 4.2.2 shall be used as criterion for the receiver blocking tests.

Limit

Table 6: Receiver blocking limits

	In-band signal	OOB signal	Remote-band signal
Frequency	Centre frequency ( $f_c$ ) of the WPT system (see clause 4.3.3)	$f = f_c \pm F$ (see note)	$f = f_c \pm 10 \times F$ (see note)
Signal level field strength at the EUT	72 dB $\mu$ A/m	72 dB $\mu$ A/m	82 dB $\mu$ A/m

NOTE:  $F = \text{OFR}$  see clause 4.3.3.

The EUT shall achieve the wanted performance criterion, see clause 4.2.2, in the presence of the blocking signal.

### 10.2 Test Procedure

Please refer to ETSI EN 303 417 Sub-clause 6.2.3 for the measurement method

### 10.3 Test Condition

Operating Mode .....	RX mode
Test Environment .....	Normal Condition
Test Voltage .....	DC 5V
Ambient temperature .....	25°C
Humidity .....	54%RH
Atmospheric Pressure .....	101.2kPa



## 10.4 Test Result

Test Frequency	Blocking Signal(dBuA/m)	Performance Criterion	Result
fc -10 xOFR	82	without degradation of performance	Pass
Fc+OFR	72	without degradation of performance	Pass
Fc	72	without degradation of performance	Pass
Fc+OFR	72	without degradation of performance	Pass
fc +10 xOFR	82	without degradation of performance	Pass

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## 11 Photographs – Test Setup

### 11.1 Photograph – Spurious Emissions Test Setup

9kHz to 30MHz



30MHz to 1GHz





## 12 Photographs – EUT Constructional Details

Please refer to "ANNEX" (Reference No. WTF25F09233903W).

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

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国际互认  
检测  
TESTING  
CNAS L6478



# TEST REPORT

**Reference No.** ..... : WTF25F09233903W004  
**Applicant** ..... : Mid Ocean Brands B.V.  
**Address** ..... : Unit 711-716, 7/F., Tower A, 83 King Lam Street, Cheung Sha Wan, Kowloon, Hong Kong.  
**Manufacturer** ..... : 118102  
**Address** ..... : --  
**Product Name** ..... : Wireless multi speaker  
**Model No.** ..... : MO6887  
**Test specification** ..... : EN IEC 62311:2020  
EN 50665:2017  
**Date of Receipt sample** ..... : 2025-09-23  
**Date of Test** ..... : 2025-09-28 to 2025-09-29  
**Date of Issue** ..... : 2025-09-30  
**Test Report Form No.** ..... : WEW-62311A-01B  
**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 approver.

**Prepared By:**

**Waltek Testing Group (Foshan) Co., Ltd.**

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Tested by:

Roy Hong

Approved by:

Danny Zhou



## 1 Test Summary

HEALTH				
Test	Test Method	Class / Severity	Result	
RF Exposure	EN IEC 62311:2020 EN 50665:2017	-	Pass	

Remark:

Pass      Test item meets the requirement

N/A      Not Applicable

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## 2 Contents

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### 3 General Information

#### 3.1 General Description of E.U.T.

<b>Product Name</b>	: Wireless multi speaker
<b>Model No.</b>	: MO6887
<b>Remark</b>	: ---
<b>Rating</b>	: Wireless output power: 10W Max. Input: DC 5V, 2A Output: DC 9V, 1.22A
	Power bank: Type-C Input: DC 5V, 2A USB Output: DC 5V, 2A Battery: 3.7V, 4000mAh, 14.8Wh

#### 3.2 Technical Specification

- BT

<b>Bluetooth Version</b>	: Bluetooth BR+EDR
<b>Frequency Range</b>	: 2402-2480MHz
<b>Maximum RF Output Power</b>	: -2.27 dBm (EIRP)
<b>Type of Modulation</b>	: GFSK, π/4QPSK, 8DPSK
<b>Data Rate</b>	: 1Mbps, 2Mbps, 3Mbps
<b>Quantity of Channels</b>	: 79
<b>Channel Separation</b>	: 1MHz
<b>Antenna Type</b>	: PCB Antenna
<b>Antenna Gain</b>	: -0.58dBi

- BLE

<b>Bluetooth Version</b>	: Bluetooth LE
<b>Frequency Range</b>	: 2402-2480MHz
<b>Maximum RF Output Power</b>	: -1.85 dBm (EIRP)
<b>Type of Modulation</b>	: GFSK
<b>Quantity of Channels</b>	: 40
<b>Channel Separation</b>	: 2MHz
<b>Antenna Type</b>	: PCB Antenna
<b>Antenna Gain</b>	: -0.58dBi
<b>Bluetooth Version</b>	: Bluetooth LE

- WPT

<b>Frequency Bands</b>	: 100-205kHz
<b>Radiated H-Field</b>	: 15.81 dBuA/m(@3m)
<b>Antenna Type</b>	: Coil Antenna
<b>Antenna Gain</b>	: 0dBi



### 3.3 Standards Applicable

The tests were performed according to following standards:

EN IEC 62311:2020	Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz)
EN 50665:2017	Generic standard for assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz).

### 3.4 Disclaimer

The antenna gain information is provided by the customer. The laboratory is not responsible for the accuracy of the antenna gain information.

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## 4 Health Requirements

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 (0Hz to 300GHz, unperturbed RMS values)

Frequency range	E-field strength (V/m)	H-field strength (A/m)	B-field (µT)	Equivalent plane wave power density Seq (W/m <sup>2</sup> )
0-1 Hz	-	$3.2 \times 10^4$	$4 \times 10^4$	-
1-8 Hz	10000	$3.2 \times 10^4 / f^2$	$4 \times 10^4 / f^2$	-
8-25 Hz	10000	$4000/f$	$5000/f$	-
0.025-0.8 kHz	250/f	4/f	5/f	-
0.8-3 kHz	250/f	5	6.25	-
3-150 kHz	87	5	6.25	-
0.15-1 MHz	87	0.73/f	0.92/f	-
1-10 MHz	$87/f^{1/2}$	0.73/f	0.92/f	-
10-400 MHz	28	0.073	0.095	2
400-2000 MHz	$1.375 f^{1/2}$	$0.0037 f^{1/2}$	$0.0046 f^{1/2}$	$f/200$
2-300 GHz	61	0.16	0.2	10

Note:

1. f as indicated in the frequency range column.
2. For frequencies between 100 kHz and 10 GHz, Seq, E2, H2 and B2 are to be averaged over any six-minute period.
3. For frequencies exceeding 10 GHz, Seq, E2, H2 and B2 are to be averaged over any 68 / f1.05 minute period (f in GHz).
4. No E-field value is provided for frequencies <1 Hz, which are effectively static electric fields. For most people the annoying perception of surface electric charges will not occur at field strengths less than 25 kV/m. Spark discharges causing stress or annoyance should be avoided.



## 4.1 RF Exposure Evaluations

### (1) MPE calculation method

$$E = \sqrt{30PG_{(\theta,\phi)}} / r$$

Where:

E= E Field Strength (V/m)

P= Maximum RF Output Power (W) =(10^(dBm/10))/1000

G= Antenna Gain (Numeric)=10^(Antenna gain in dBi/10)

r= Separation Distance Between Radiator and Human Body (m)=0.2m

From the peak EUT RF Output Power, the minimum mobile separation distance, d = 0.20m (specified by the manufacturer), as well as the gain of the used antenna, the RF power density can be obtained.

### (2) For single or multiple RF sources, the calculated power density should comply with following:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

Where:

$S_i$  = the power density when the  $f$  is  $i$ .

$S_{Limit,i}$  = the reference level requirement for power density when  $f$  is  $i$ .

$f$  = operating frequency.

## 4.2 RF Exposure test procedure

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.



### 4.3 Test Result of RF Exposure Evaluation

The antenna of the product, under normal use condition is at least 20 cm away from the body of the user.

Warning statement to the user to keeping at least 20 cm separation distance and the prohibition of operating to a person has been printed on the user's manual. So, this product under normal use is located on electromagnetic far field between the human body.

#### For BT and BLE (Standalone Mode)

Test Mode	Antenna Gain (dBi)	Antenna Gain (Numeric)	Maximum Output Power (dBm)	Maximum Output Power (W)	E Field Strength (V/m)	E Field Strength Limit (V/m)	Verdict
BT	-0.58	0.87	-2.27	0.0006	0.62	61	Pass
BLE	-0.58	0.87	-1.85	0.0007	0.65	61	Pass
Remark: For details of output power please refer to report No. WTF24F06133788W001 and WTF24F06133788W002.							

#### For BT and BLE (Simultaneous mode)

Operating Mode	$S_{(BT)}$	$S_{(BLE)}$	Sum Ratio	Limit	Verdict
BT+BLE	0.0014	0.009	0.0023	<1	Pass

#### For WPT

Frequency (kHz)	Radiated H-Field (dB $\mu$ A/m)	Radiated H-Field (A/m)	Limit (A/m)	Result
140	15.81	0.0000061731	5	Pass
Remark:				
1) For details of Radiated H-Field refer to report No. WTF24F06133788W003.				
2) Radiated H-Field (A/m)= $10^4[(dB\mu A/m)/20]/10^6$				

Which is less than the limit, RF exposure assessment has been performed above to prove that this unit will not generate the harmful EM emission above the reference level as specified in EC Council Recommendation (1999/519/EC).



## 5 Photographs – EUT Constructional Details

Please refer to "ANNEX" (Reference No. WTF25F09233903W).

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

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