TEST REPORT

Reference No.	:	WTF22F05099992W
Applicant	:	Mid Ocean Brands B.V.
Address	:	7/F., Kings Tower, 111 King Lam Street, Cheung Sha Wan, Kowloon, Hong Kong
Manufacturer	:	111590
Product Name	:	Weatherstation
Model No.	:	MO6664
Test specification	:	ETSI EN 300 328 V2.2.2 (2019-07)
Date of Receipt sample	:	2022-07-01
Date of Test	:	2022-07-19 to 2022-07-20
Date of Issue	:	2022-08-02
Test Report Form No.	:	WEW-300328A-01A
Test Result	:	**Pass**

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

Prepared By:
Waltek Testing Group (Foshan) Co., Ltd.
Address: No.13-19, 2/F., 2nd Building, Sunlink International Machinery City,
Chencun, Shunde District, Foshan, Guangdong, China
Tel:+86-757-23811398 Fax:+86-757-23811381 E-mail:info@waltek.com.cn

Tested by:

Roy Hong

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
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	Pass
Occupied Channel Bandwidth	ETSI EN 300 328 V2.2.2	Within the band 2400-2483.5MHz	Pass
Transmitter unwanted in the OOB domain	ETSI EN 300 328 V2.2.2	Figure 3	Pass
Transmitter unwanted emissions in the spurious domain	ETSI EN 300 328 V2.2.2	Table 12	Pass
Receiver spurious emissions	ETSI EN 300 328 V2.2.2	Table 14/15/16	Pass
Receiver Blocking	ETSI EN 300 328 V2.2.2	Clause 4.3.2.11.4.2	Pass

Remark:

Pass Test item meets the requirement

N/A Not Applicable

2 Contents

3 General Information

3.1 General Description of E.U.T.

Product Name ..... : Weatherstation

Model No. ..... : MO6664

Remark ..... : ---

Rated Voltage..... : **Outdoor Unit:** Battery 3V (2*1.5V AAA)
Indoor Unit: Battery 4.5V (3*1.5V AAA)

Battery Capacity ..... : ---

Adapter ..... : HX075-0501200-AG-001 (For indoor unit only)
Input: 100-240V~, 50/60Hz, 0.3A Max
Output: DC 5V, 1.2A, 6.0W

3.2 Details of E.U.T.

Frequency Range ..... : 2412~2472MHz for 802.11b/g/n(HT20)
2422~2462MHz for 802.11n(HT40)

Maximum RF Output Power ..... : 17.34 dBm (EIRP)

Type of Modulation ..... : DSSS, OFDM

Quantity of Channels ..... : 13 for 802.11b/g/n(HT20); 9 for 802.11n(HT40)

Channel Separation..... : 5MHz

Antenna installation ..... : PCB Printed Antenna

Antenna Gain ..... : 2.2dBi

Oscillator..... : 40MHz

Receiver Category..... : 1

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 an Economic Development Canada(ISED). The acceptance letter from the ISED is maintained in our files. Registration ISED number:21895, March 12, 2019

- **FCC – Registration No.: 820106**

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

- **NVLAP – Lab Code: 600191-0**

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

3.5 Subcontracted

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

☐ Yes ☒ No

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

Test items:---

Lab information:---

3.6 Abnormalities from Standard Conditions

None.

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

☒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	9m×6m×6m	-	2021-01-11	2024-01-10
2	EMI TEST RECEIVER	RS	ESR7	101566	2022-01-07	2023-01-06
3	Spectrum Analyzer	Agilent	N9020A	MY48011796	2022-05-17	2023-05-16
4	Trilog Broadband Antenna	SCHWARZBECK	VULB9162	9162-117	2022-01-09	2023-01-08
5	Coaxial Cable (below 1GHz)	H+S	CBL3-NN-12+3 m	214NN320	2022-01-07	2023-01-06
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	01561	2022-01-09	2023-01-08
7	Broadband Preamplifier (Above 1GHz)	Lunar E M	LNA1G18-40	20160501002	2022-01-06	2023-01-05
8	Coaxial Cable (above 1GHz)	Times-Micorwave	CBL5-NN	-	2022-01-06	2023-01-05
☒RF Conducted test						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	Environmental Chamber	KSON	THS-D4C-100	5244K	2022-01-08	2023-01-07
2	Spectrum Analyzer	Agilent	N9020A	MY48011796	2022-05-17	2023-05-16
3	EXG Analog Signal Generator	Agilent	N5181A	MY48080720	2022-01-06	2023-01-05
4	RF Control Unit	CHANGCHUANG	JS0806-2	-	2022-01-06	2023-01-05
5	Wideband radio communication tester	Rohde&Schwarz	CMW500	1201.0002K50 -158178-Qf	2022-07-09	2023-07-08

☐: ***Not Used***

☒: ***Used***

4.2 Software List

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

4.3 Special Accessories and Auxiliary Equipment

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

4.4 Measurement Uncertainty

Parameter	Uncertainty	Note
RF Output Power	±2.2dB	(1)
Occupied Bandwidth	±1.5%	(1)
Conducted Spurious Emission	±2.7dB	(1)
Transmitter Spurious Emission	±4.1dB (for 30MHz-1GHz)	(1)
	±5.0dB (for 1GHz-18GHz)	(1)

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

4.5 Decision Rule

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

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

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

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

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

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

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

5 Test Conditions and Test mode

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

Test Mode List		
Test Mode	Description	Remark
TM1	802.11b	Low: 2412MHz, Middle:2442MHz, High:2472MHz
TM2	802.11g	Low: 2412MHz, Middle:2442MHz, High:2472MHz
TM3	802.11n(HT20)	Low: 2412MHz, Middle:2442MHz, High:2472MHz
TM4	802.11n(HT40)	Low: 2422MHz, Middle:2442MHz, High:2462MHz

Test Conditions			
	Normal	LTNV	HTNV
Temperature (°C)	22	-10	+50
Voltage (Vdc)	4.5		
Relative Humidity:	45 %		
ATM Pressure:	101.2kPa		

6 RF Requirements

6.1 RF Output power

6.1.1 Standard Applicable

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

According to Section 4.3.2.2.3, For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be 20 dBm. The maximum RF output power for non-adaptive equipment shall be declared by the supplier and shall not exceed 20 dBm. For non-adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be equal to or less than the value declared by the supplier.

6.1.2 Test Procedure

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

Step 1:

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

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

- The samples must represent the power of the signal.

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

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

NOTE 1: For adaptive equipment, to increase the measurement accuracy, a higher number of bursts may be used.

Step 2:

• For conducted measurements on devices with one transmit chain:

- Connect the power sensor to the transmit port, sample the transmit signal and store the raw data.Use these stored samples in all following steps.

• For conducted measurements on devices with multiple transmit chains:

- Connect one power sensor to each transmit port for a synchronous measurement on all transmit ports.

- Trigger the power sensors so that they start sampling at the same time. Make sure the time difference between

the samples of all sensors is less than half the time between two samples.

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

Use these summed samples in all following steps..

Step 3:

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

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

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

Step 4:

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

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

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

Step 5:

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

Step 6:

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

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

•If more than one antenna assembly is intended for this power setting, the maximum overall antenna gain (G or G

+ Y) shall be used.

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

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

6.1.3 Test Result

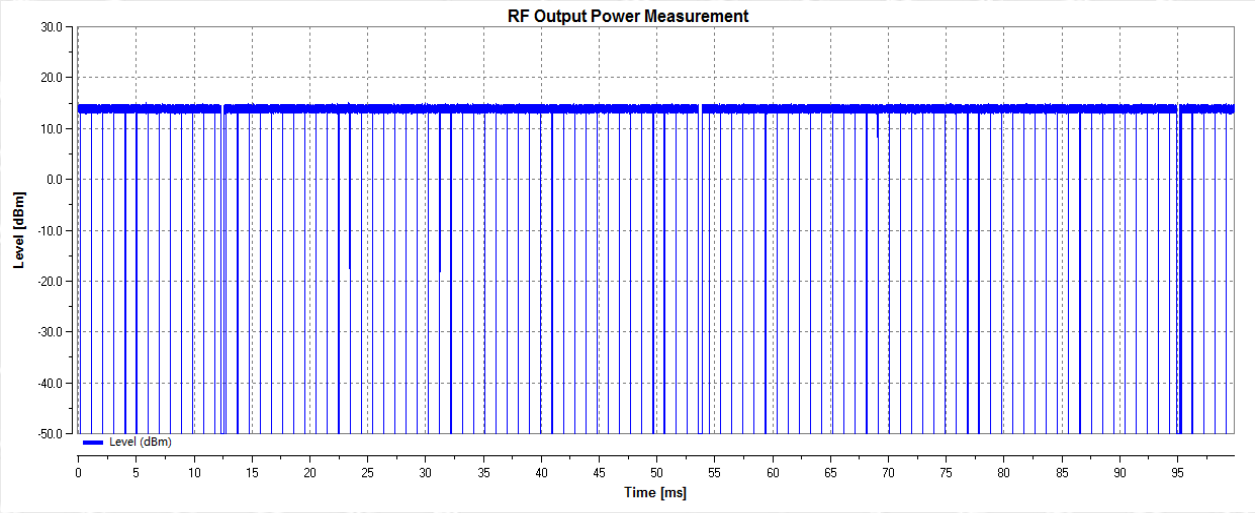
Test Condition	Test Mode	Test Channel (MHz)	EIRP (dBm)	Limit (dBm)	Verdict
TLVN	11b	2412	16.33	<=20	Pass
TNVN	11b	2412	16.34	<=20	Pass
THVN	11b	2412	17.34	<=20	Pass
TLVN	11b	2442	17.27	<=20	Pass
TNVN	11b	2442	17.16	<=20	Pass
THVN	11b	2442	17.12	<=20	Pass
TLVN	11b	2472	16.07	<=20	Pass
TNVN	11b	2472	15.95	<=20	Pass
THVN	11b	2472	15.97	<=20	Pass
TLVN	11g	2412	11.06	<=20	Pass
TNVN	11g	2412	10.74	<=20	Pass
THVN	11g	2412	10.66	<=20	Pass
TLVN	11g	2442	10.54	<=20	Pass
TNVN	11g	2442	10.39	<=20	Pass
THVN	11g	2442	10.5	<=20	Pass
TLVN	11g	2472	9.61	<=20	Pass
TNVN	11g	2472	9.31	<=20	Pass
THVN	11g	2472	9.22	<=20	Pass
TLVN	11n(HT20)	2412	10.73	<=20	Pass
TNVN	11n(HT20)	2412	10.54	<=20	Pass
THVN	11n(HT20)	2412	10.83	<=20	Pass
TLVN	11n(HT20)	2442	10.54	<=20	Pass
TNVN	11n(HT20)	2442	10.59	<=20	Pass
THVN	11n(HT20)	2442	10.33	<=20	Pass
TLVN	11n(HT20)	2472	9.08	<=20	Pass
TNVN	11n(HT20)	2472	9.27	<=20	Pass
THVN	11n(HT20)	2472	9.11	<=20	Pass
TLVN	11n(HT40)	2422	9.84	<=20	Pass
TNVN	11n(HT40)	2422	9.19	<=20	Pass

Test Condition	Test Mode	Test Channel (MHz)	EIRP (dBm)	Limit (dBm)	Verdict
THVN	11n(HT40)	2422	9.13	<=20	Pass
TLVN	11n(HT40)	2442	8.85	<=20	Pass
TNVN	11n(HT40)	2442	8.79	<=20	Pass
THVN	11n(HT40)	2442	8.58	<=20	Pass
TLVN	11n(HT40)	2462	8.41	<=20	Pass
TNVN	11n(HT40)	2462	8.26	<=20	Pass
THVN	11n(HT40)	2462	8.62	<=20	Pass

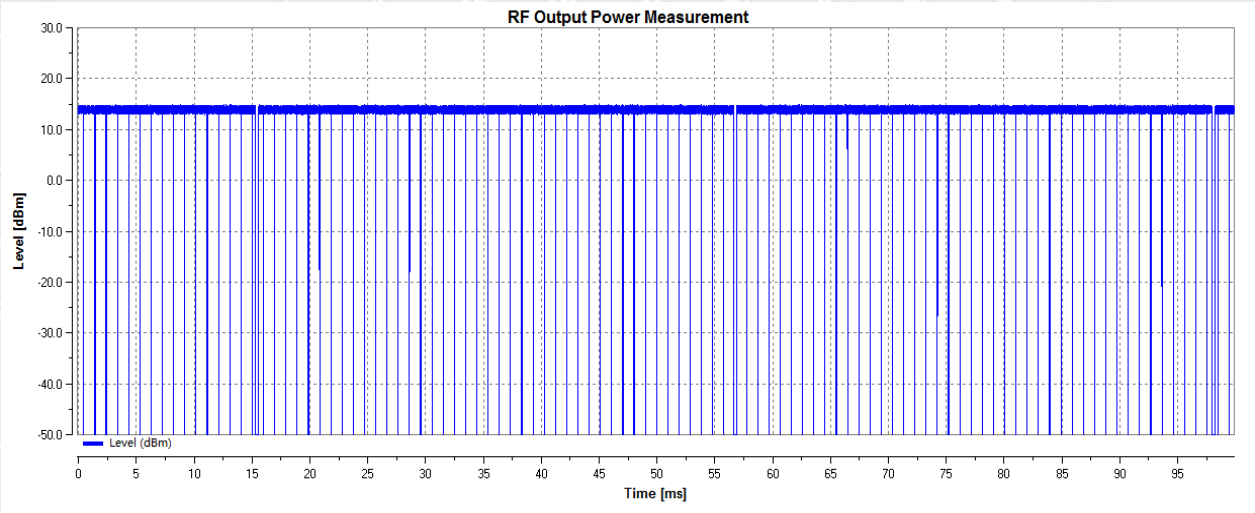
Remark: EIRP=Conducted power+ ANT gain

Test Graphs:

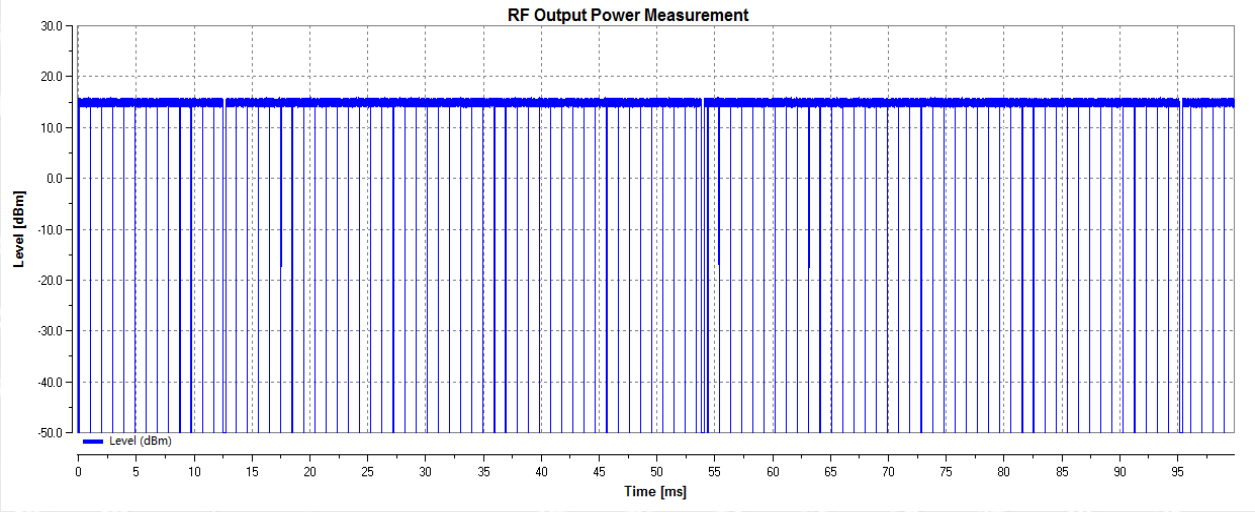
RF Output Power_TLVN_11b_2412



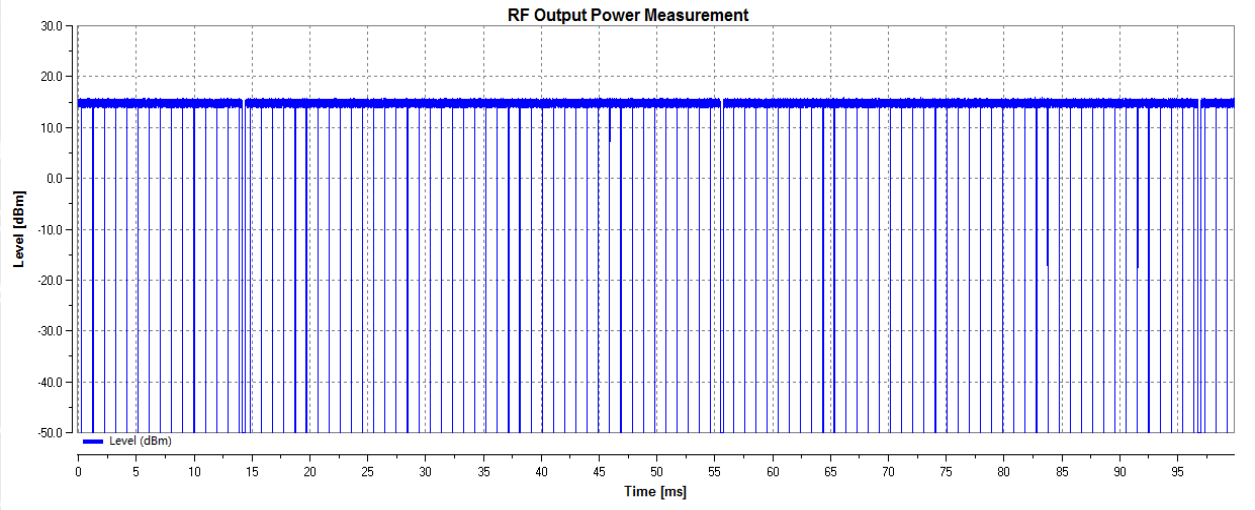
RF Output Power_TNVN_11b_2412



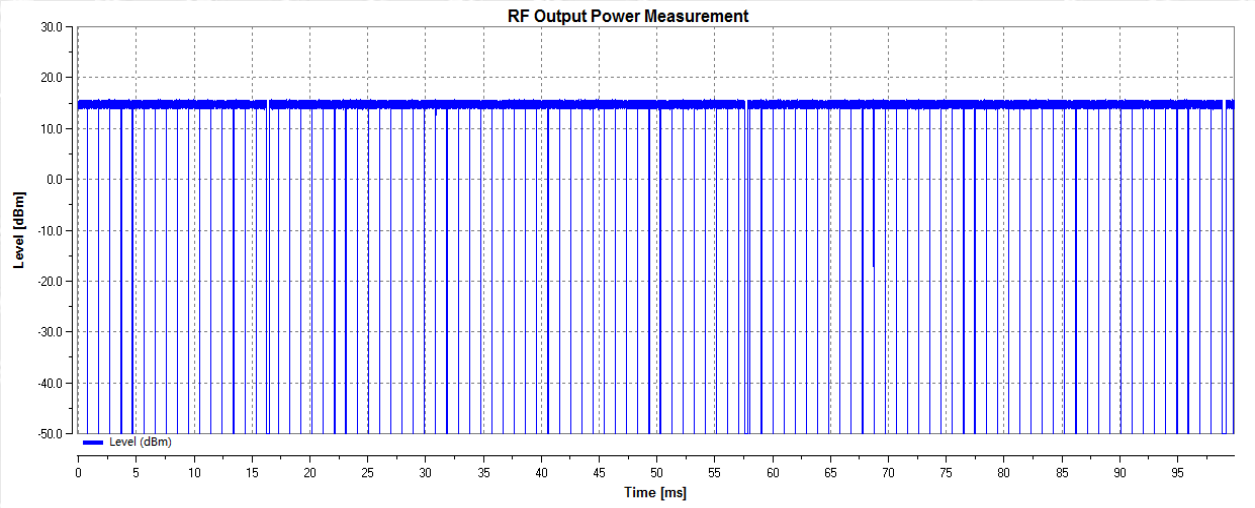
RF Output Power_THVN_11b_2412



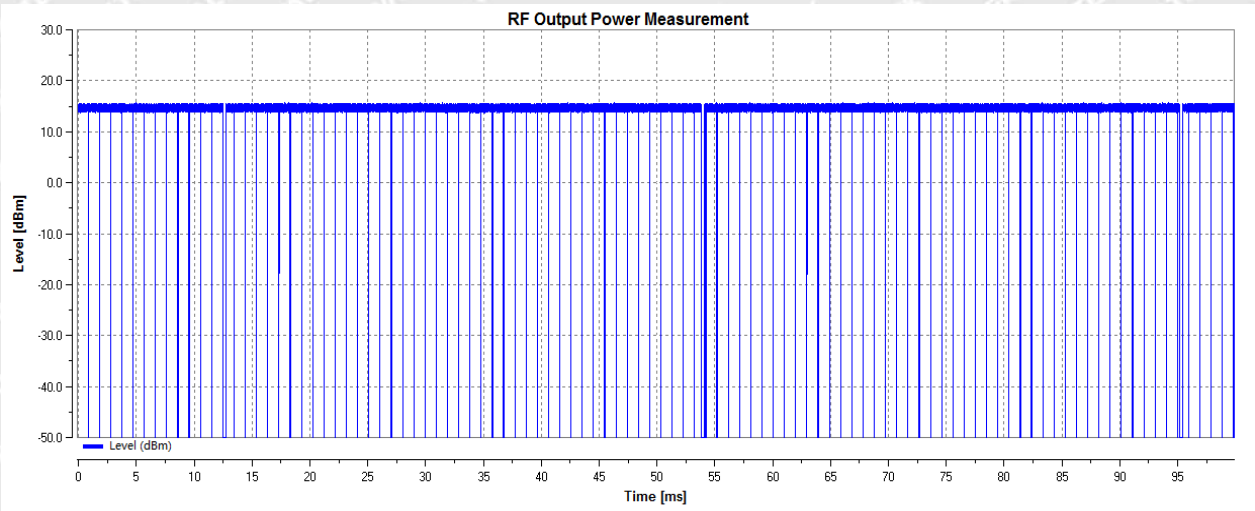
RF Output Power_TLVN_11b_2442



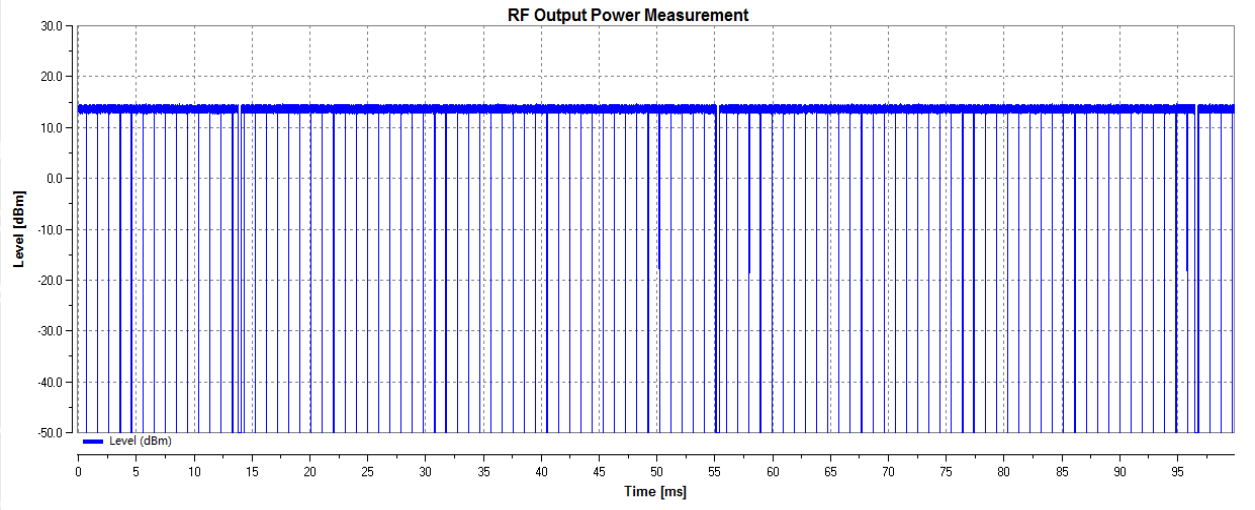
RF Output Power_TNVN_11b_2442



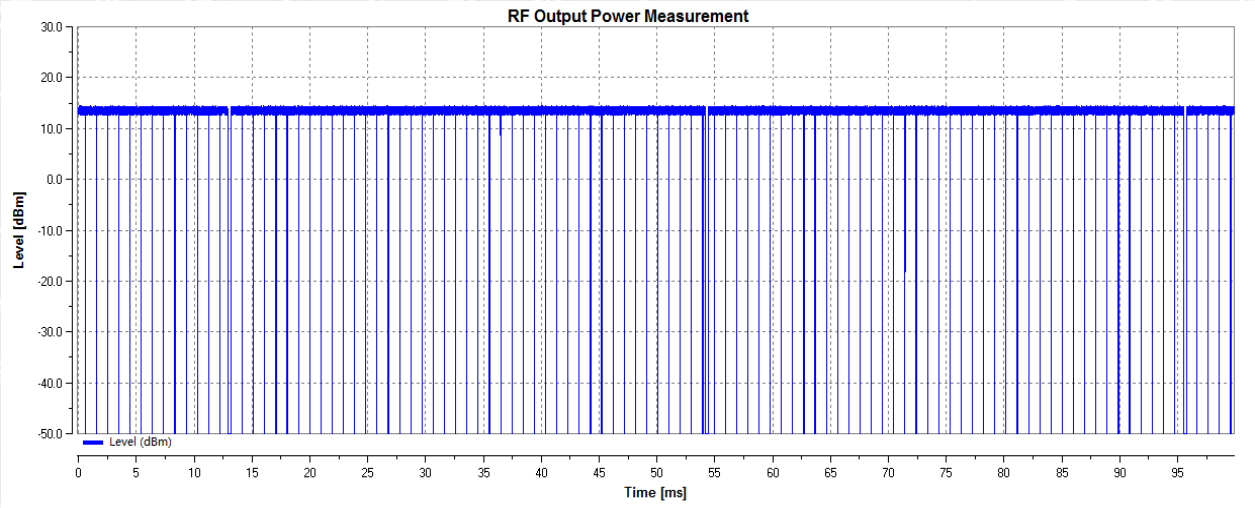
RF Output Power_THVN_11b_2442



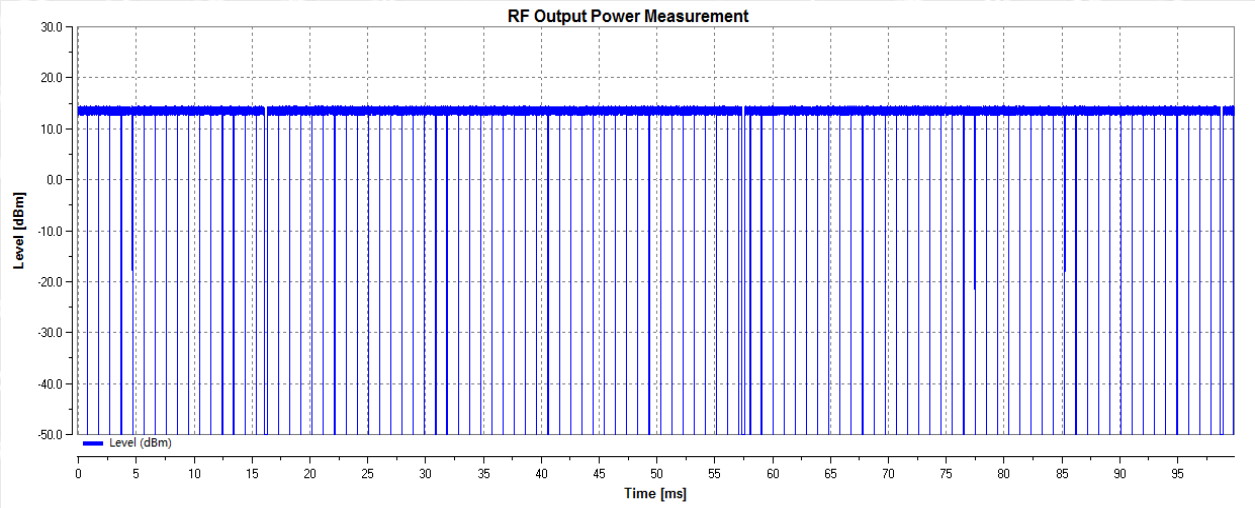
RF Output Power_TLVN_11b_2472



RF Output Power_TNVN_11b_2472



RF Output Power_THVN_11b_2472



6.2 Power Spectral Density

6.2.1 Standard Applicable

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

6.2.2 Test Procedure

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

Step 1:

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

• Start Frequency: 2 400 MHz

• Stop Frequency: 2 483,5 MHz

• Resolution BW: 10 kHz

• Video BW: 30 kHz

• Sweep Points: > 8 350

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

• Detector: RMS

• Trace Mode: Max Hold

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

the RMS value of the signal

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

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

Step 2:

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

Step 3:

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

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

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

Step 4:

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

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

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

with 'n' being the actual sample number

Step 5:

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

Step 6:

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

Step 7:

Repeat step 6 until the end of the data set and record the Power Spectral Density values for each of the 1 MHz segments.

From all the recorded results, the highest value is the maximum Power Spectral Density for the UUT. This value, which shall comply with the limit given in clause 4.3.2.3.3, shall be recorded in the test report.

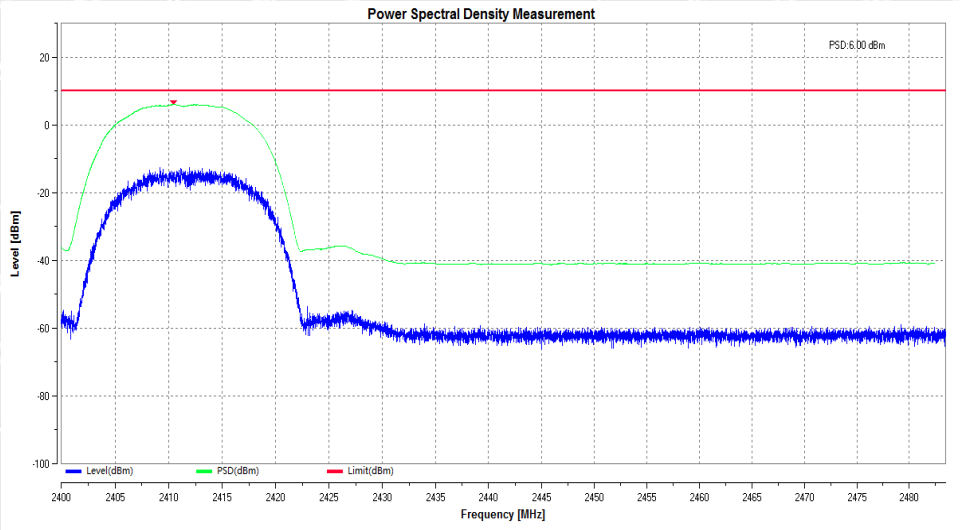
RBW/VBW=10/30 kHz

6.2.3 Test Result

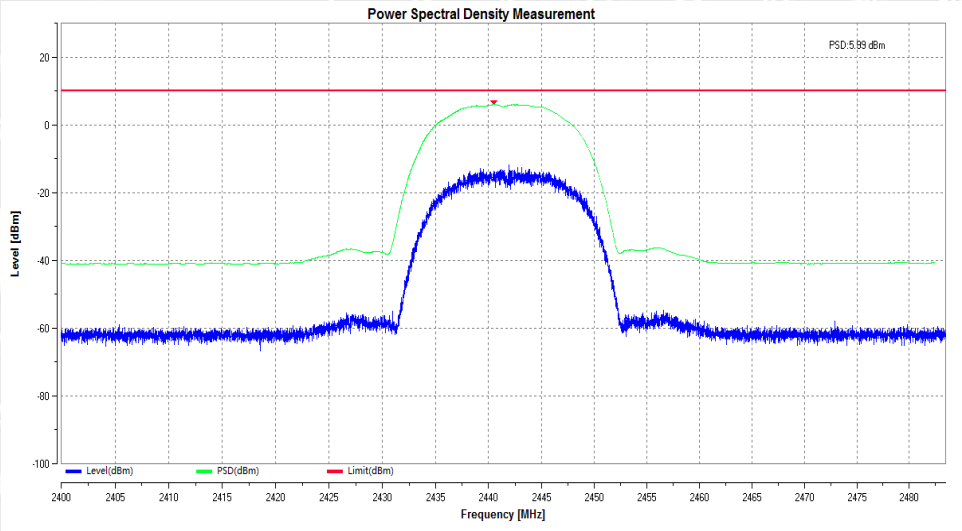
Test Condition	Test Mode	Test Channel (MHz)	PSD (dBm)	Limit (dBm)	Verdict
TNVN	11b	2412	6.00	<=10	Pass
TNVN	11b	2442	5.99	<=10	Pass
TNVN	11b	2472	5.97	<=10	Pass
TNVN	11g	2412	-1.38	<=10	Pass
TNVN	11g	2442	-1.31	<=10	Pass
TNVN	11g	2472	-1.38	<=10	Pass
TNVN	11n(HT20)	2412	-1.33	<=10	Pass
TNVN	11n(HT20)	2442	-1.26	<=10	Pass
TNVN	11n(HT20)	2472	-1.33	<=10	Pass
TNVN	11n(HT40)	2422	-4.60	<=10	Pass
TNVN	11n(HT40)	2442	-4.66	<=10	Pass
TNVN	11n(HT40)	2462	-4.83	<=10	Pass

Test Graphs:

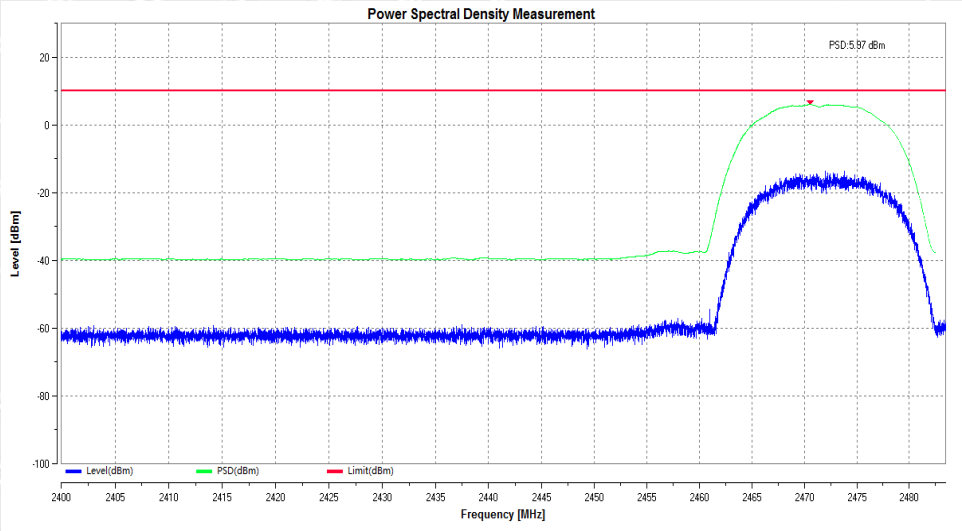
Power Spectral Density_TNVN_11b_2412



Power Spectral Density_TNVN_11b_2442



Power Spectral Density_TNVN_11b_2472



6.3 Occupied Channel Bandwidth

6.3.1 Standard Applicable

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

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

6.3.2 Test Procedure

According to the section 5.3.8.2.1, the measurement procedure shall be as follows:

Step 1:

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

• Centre Frequency: The centre frequency of the channel under test
• Resolution BW: ~ 1 % of the span without going below 1 %
• Video BW: 3 × RBW
• Frequency Span for frequency hopping equipment: Lowest frequency separation that is used within the hopping
sequence
• Frequency Span for other types of equipment: 2 × Nominal Channel Bandwidth (e.g. 40 MHz for a 20 MHz channel)
• Detector Mode: RMS
• Trace Mode: Max Hold
•Sweep time: 1 s

Step 2:

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

Step 3:

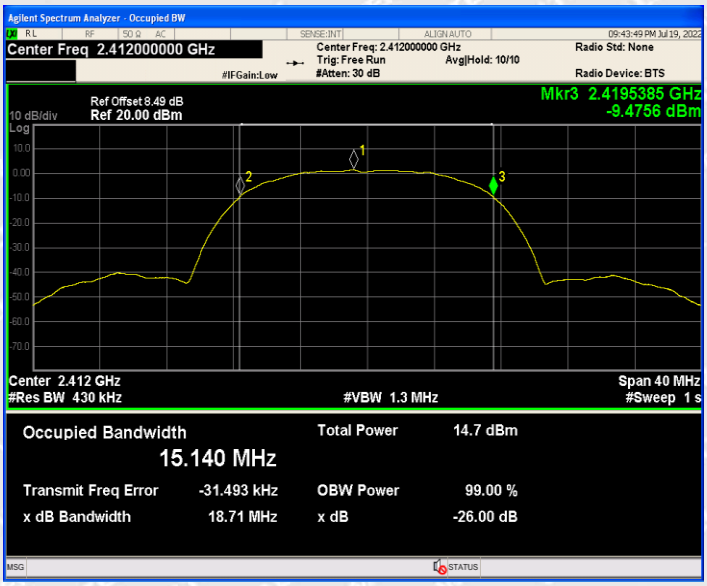
Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded.

6.3.3 Test Result

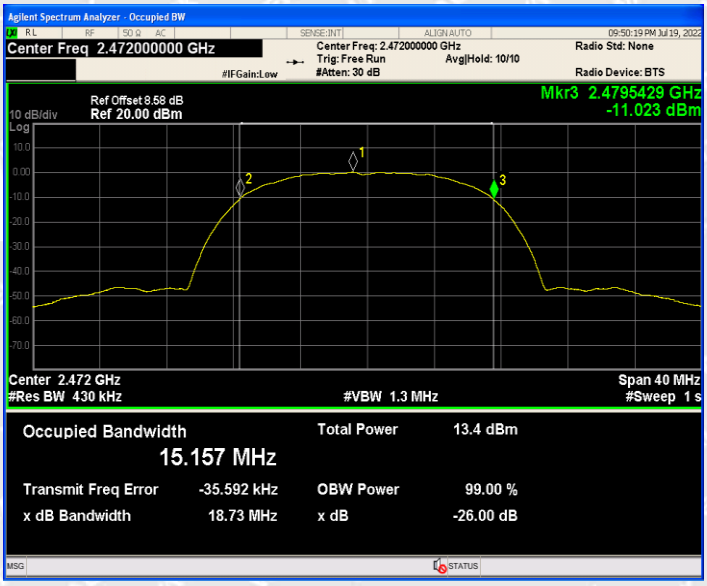
Test Condition	Test Mode	Test Channel (MHz)	OBW (MHz)	FL@OBW (MHz)	FH@OBW (MHz)	Limit (MHz)	Verdict
TNVN	11b	2412	15.140	2404.40	2419.54	2400 to 2483.5	Pass
TNVN	11b	2472	15.157	2464.39	2479.54	2400 to 2483.5	Pass
TNVN	11g	2412	17.037	2403.43	2420.47	2400 to 2483.5	Pass
TNVN	11g	2472	17.033	2463.43	2480.46	2400 to 2483.5	Pass
TNVN	11n(HT20)	2412	17.809	2403.04	2420.85	2400 to 2483.5	Pass
TNVN	11n(HT20)	2472	17.812	2463.04	2480.85	2400 to 2483.5	Pass
TNVN	11n(HT40)	2422	36.619	2403.69	2440.31	2400 to 2483.5	Pass
TNVN	11n(HT40)	2462	36.018	2443.96	2479.98	2400 to 2483.5	Pass

Test Graphs:

Occupied Channel Bandwidth_TNVN_11b_2412



Occupied Channel Bandwidth_TNVN_11b_2472



6.4 Adaptivity (non-FHSS)

6.4.1 Standard Applicable

Adaptive non-FHSS using LBT is a mechanism by which non-FHSS adaptive equipment avoids transmissions in a channel in the presence of an interfering signal in that channel. This mechanism shall operate as intended in the presence of an unwanted signal on frequencies other than those of the operating band.

The present document defines two types of adaptive non-FHSS equipment that uses an LBT mechanism: Frame Based Equipment and Load Based Equipment.

Adaptive non-FHSS equipment which is capable of operating as either Load Based Equipment or as Frame Based Equipment is allowed to switch dynamically between these types of operation.

•Frame Based Equipment shall comply with the following requirements:

1) Before transmission, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18 µs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5 below. If the equipment finds the channel to be clear, it may transmit immediately. See figure 2.

2) If the equipment finds the channel occupied, it shall not transmit on this channel during the next Frame Period. The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive equipment. See clause 4.3.2.6.1. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4.

3) The total time during which an equipment has transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time. The Channel Occupancy Time shall be in the range 1 ms to 10 ms followed by an Idle Period of at least 5 % of the Channel Occupancy Time used in the equipment for the current Frame Period. See figure 2.

4) An equipment, upon correct reception of a transmission which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames. A consecutive sequence of such transmissions by the equipment without a new CCA shall not exceed the maximum Channel Occupancy Time.

For the purpose of multi-cast, the ACK transmissions (associated with the same data packet) of the individual devices are allowed to take place in a sequence.

5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account.

For power levels less than 20 dBm e.i.r.p. the CCA threshold level may be relaxed to:

$$TL = -70\ \text{dBm/MHz} + 10 \times \log_{10}(100\ \text{mW} / P_{out}) \qquad (P_{out}\ \text{in mW e.i.r.p.})$$

6) The equipment shall comply with the requirements defined in step 1 to step 4 in the present clause in the presence of an unwanted CW signal as defined in table 10.

Table 10: Unwanted Signal parameters

Wanted signal mean power from companion device	Unwanted signal frequency (MHz)	Unwanted signal power (dBm)
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 3)

NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1.
NOTE 2: A typical conducted value which can be used in most cases is -50 dBm/MHz.
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 in front of the UUT antenna.

•Load Based Equipment

Load Based Equipment may implement an LBT based spectrum sharing mechanism based on the Clear Channel Assessment (CCA) mode using energy detect as described in IEEE 802.11™ [i.3], clause 10 clause 11, clause 15, clause 16, clause 18 and clause 19, or in IEEE 802.15.4™ [i.4], clause 5, clause 6 and clause 10 providing the equipment complies with the conformance requirements referred to in clause 4.3.2.6.3.4. Load Based Equipment not using any of the mechanisms referenced above shall comply with the following minimum set of requirements:

1) Before a transmission or a burst of transmissions, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18 µs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5 below. If the equipment finds the channel to be clear, it may transmit immediately.

2) If the equipment finds the channel occupied, it shall not transmit on this channel (see also the next paragraph). The equipment shall perform an Extended CCA check in which the channel is observed for a random duration in the range between 18 µs and at least 160 µs. If the extended CCA check has determined the channel to be no longer occupied, the equipment may resume transmissions on this channel. If the Extended CCA time has determined the channel still to be occupied, it shall perform new Extended CCA checks until the channel is no longer occupied.

NOTE: The Idle Period in between transmissions is considered to be the CCA or the Extended CCA check as there are no transmissions during this period.

The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive equipment. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4.

3) The total time that an equipment makes use of a RF channel is defined as the Channel Occupancy Time. This Channel Occupancy Time shall be less than 13 ms, after which the device shall perform a new CCA as described in step 1 above.

4) The equipment, upon correct reception of a transmission which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames. A consecutive sequence of transmissions by the equipment without a new CCA shall not exceed the maximum channel occupancy time as defined in step 3 above.

For the purpose of multi-cast, the ACK transmissions (associated with the same data packet) of the

individual devices are allowed to take place in a sequence.

5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account.

For power levels less than 20 dBm e.i.r.p., the CCA threshold level may be relaxed to:

$$TL = -70 \text{ dBm/MHz} + 10 \times \log_{10}(100 \text{ mW} / P_{out}) \quad (P_{out} \text{ in mW e.i.r.p.})$$

6) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in table 11.

Table 11: Unwanted Signal parameters

Wanted signal mean power from companion device	Unwanted signal frequency (MHz)	Unwanted signal power (dBm)
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 3)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1. NOTE 2: A typical conducted value which can be used in most cases is -50 dBm/MHz. 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.		

6.4.2 Test Procedure

Step 1:

• The UUT shall connect to a companion device during the test. The interference signal generator, the unwanted signal generator, the spectrum analyser, the UUT and the companion device are connected using a set-up equivalent to the example given by figure 5 although the interference and unwanted signal generator do not generate any signals at this point in time. The spectrum analyser is used to monitor the transmissions of both the UUT and the companion device and it should be possible to distinguish between either transmission. In addition, the spectrum analyser is used to monitor the transmissions of the UUT in response to the interfering and the unwanted signals.

• Adjust the received signal level (wanted signal from the companion device) at the UUT to the value defined in table 10 (clause 4.3.2.6.3.2.2) for Frame Based Equipment or in table 11 (clause 4.3.2.6.3.2.3) for Load Based Equipment.

Testing of Unidirectional equipment does not require a link to be established with a companion device.

• The analyser shall be set as follows:

- RBW: ≥ Occupied Channel Bandwidth (if the analyser does not support this setting, the highest available setting shall be used)

- VBW: 3 × RBW (if the analyser does not support this setting, the highest available setting shall be used)

- Detector Mode: RMS

- Centre Frequency: Equal to the centre frequency of the operating channel

- Span: 0 Hz

- Sweep time: > maximum Channel Occupancy Time

- Trace Mode: Clear Write

- Trigger Mode: Video

Step 2:

• Configure the UUT for normal transmissions with a sufficiently high payload resulting in a minimum transmitter activity ratio (TxOn / (TxOn + TxOff)) of 0,3. Where this is not possible, the UUT shall be configured to the maximum payload possible.

• For Frame Based Equipment, using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that the UUT complies with the maximum Channel Occupancy Time and minimum Idle Period defined in clause 4.3.2.6.3.2.2, step 3. When measuring the Idle Period of the UUT, only transmissions from the UUT shall be considered.

• For Load Based equipment, using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that the UUT complies with the maximum Channel Occupancy Time and minimum Idle Period defined in clause 4.3.2.6.3.2.3, step 2 and step 3. When measuring the Idle Period of the UUT, only transmissions from the UUT shall be considered.

For the purpose of testing Load Based Equipment referred to in the first paragraph of clause 4.3.2.6.3.2.3 (IEEE 802.11™ [i.3] or IEEE 802.15.4™ [i.4] equipment), the limits to be applied for the minimum Idle Period and the maximum Channel Occupancy Time are the same as defined for other types of Load Based Equipment (see clause 4.3.2.6.3.2.3, step 2 and step 3). The Idle Period is considered to be equal to the CCA or Extended CCA time defined in clause 4.3.2.6.3.2.3, step 1 and step 2.

Step 3: Adding the interference signal

• An interference signal as defined in clause B.7 is injected on the current operating channel of the UUT. The power spectral density level (at the input of the UUT) of this interference signal shall be equal to the detection threshold defined in clause 4.3.2.6.3.2.2, step 5 (frame based equipment) or clause 4.3.2.6.3.2.3, step 5 (load based equipment).

Step 4: Verification of reaction to the interference signal

• The spectrum analyser shall be used to monitor the transmissions of the UUT on the selected operating channel with the interfering signal injected. This may require the spectrum analyser sweep to be triggered by the start of the interfering signal.

• Using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that:

i) The UUT shall stop transmissions on the current operating channel.

The UUT is assumed to stop transmissions within a period equal to the maximum Channel Occupancy Time defined in clause 4.3.2.6.3.2.2 (frame based equipment) or clause 4.3.2.6.3.2.3 (load based equipment).

ii) Apart from Short Control Signalling Transmissions, there shall be no subsequent transmissions while the interfering signal is present.

To verify that the UUT is not resuming normal transmissions as long as the interference signal is present, the monitoring time may need to be 60 s or more.

iii) The UUT may continue to have Short Control Signalling Transmissions on the operating channel while the interfering signal is present. These transmissions shall comply with the limits defined in clause 4.3.2.6.4.2.

The verification of the Short Control Signalling transmissions may require the analyser settings to be changed (e.g. sweep time).

iv) Alternatively, the equipment may switch to a non-adaptive mode.

Step 5: Adding the unwanted signal

• With the interfering signal present, a 100 % duty cycle CW signal is inserted as the unwanted signal. The frequency and the level are provided in table 10 (clause 4.3.2.6.3.2.2) for Frame Based Equipment or in table 11 (clause 4.3.2.6.3.2.3) for Load Based Equipment.

• The spectrum analyser shall be used to monitor the transmissions of the UUT on the selected operating channel. This may require the spectrum analyser sweep to be triggered by the start of the unwanted signal.

• Using the procedure defined in clause 5.4.6.2.1.5, it shall be verified that:

i) The UUT shall not resume normal transmissions on the current operating channel as long as both the interference and unwanted signals remain present.

To verify that the UUT is not resuming normal transmissions as long as the interference and unwanted signals are present, the monitoring time may need to be 60 s or more.

ii) The UUT may continue to have Short Control Signalling Transmissions on the operating channel while the interfering and unwanted signals are present. These transmissions shall comply with the limits defined in clause 4.3.2.6.4.2.

The verification of the Short Control Signalling transmissions may require the analyser settings to be changed (e.g. sweep time).

Step 6: Removing the interference and unwanted signal

• On removal of the interference and unwanted signals the UUT is allowed to start transmissions again on this channel; however, this is not a requirement and, therefore, does not require testing.

Step 7:

• Step 2 to step 6 shall be repeated for each of the frequencies to be tested.

6.4.3 Test Result

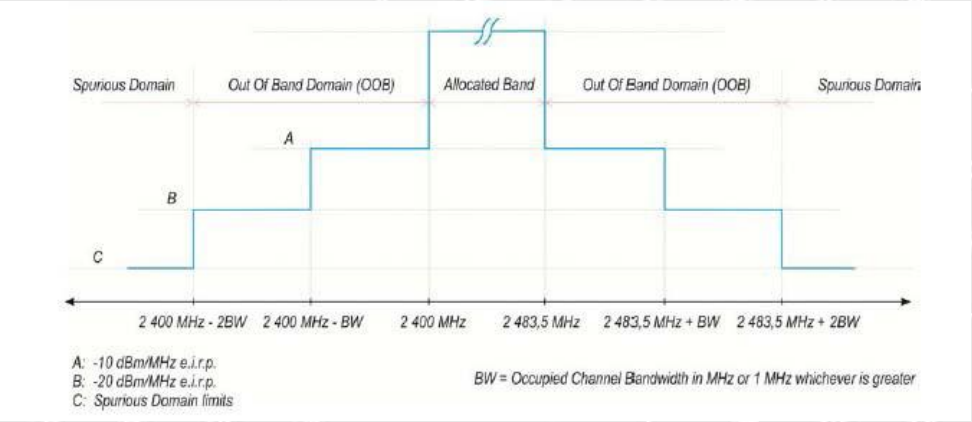
Test Mode	Channel	Max.COT (ms)	Limit(ms)	Min.Idle Time (ms)	Limit (ms)	Verdict
11b	2412	0.110	<=13	0.050	>0.018	Pass
	2472	0.840	<=13	0.070	>0.018	Pass
11g	2412	0.340	<=13	0.090	>0.018	Pass
	2472	0.330	<=13	0.070	>0.018	Pass
11n(HT20)	2412	0.320	<=13	0.080	>0.018	Pass
	2472	1.050	<=13	0.090	>0.018	Pass
11n(HT40)	2422	0.310	<=13	0.050	>0.018	Pass
	2462	0.330	<=13	0.040	>0.018	Pass

Test Mode	Channel	Add Signal Type	Add Signal Time(ms)	Add Signal Level (dBm)	Max. Short Time (%)	Limit (%)	Verdict
11b	2412	AWGN	2114	-68.00	0.00	10	Pass
		CW	62152	-35.00	0.00	10	Pass
	2472	AWGN	2114	-68.00	0.00	10	Pass
		CW	62152	-35.00	0.00	10	Pass
11g	2412	AWGN	2114	-68.00	0.00	10	Pass
		CW	62152	-35.00	0.00	10	Pass
	2472	AWGN	2114	-68.00	0.00	10	Pass
		CW	62152	-35.00	0.00	10	Pass
11n(HT20)	2412	AWGN	2114	-68.00	0.00	10	Pass
		CW	62152	-35.00	0.00	10	Pass
	2472	AWGN	2114	-68.00	0.00	10	Pass
		CW	62152	-35.00	0.00	10	Pass
11n(HT40)	2422	AWGN	2114	-68.00	0.00	10	Pass
		CW	62152	-35.00	0.00	10	Pass
	2462	AWGN	2114	-68.00	0.00	10	Pass
		CW	62152	-35.00	0.00	10	Pass

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

6.5.1 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

6.5.2 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 μ s) or 5 000 whichever is greater
- Trigger Mode: Video trigger

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

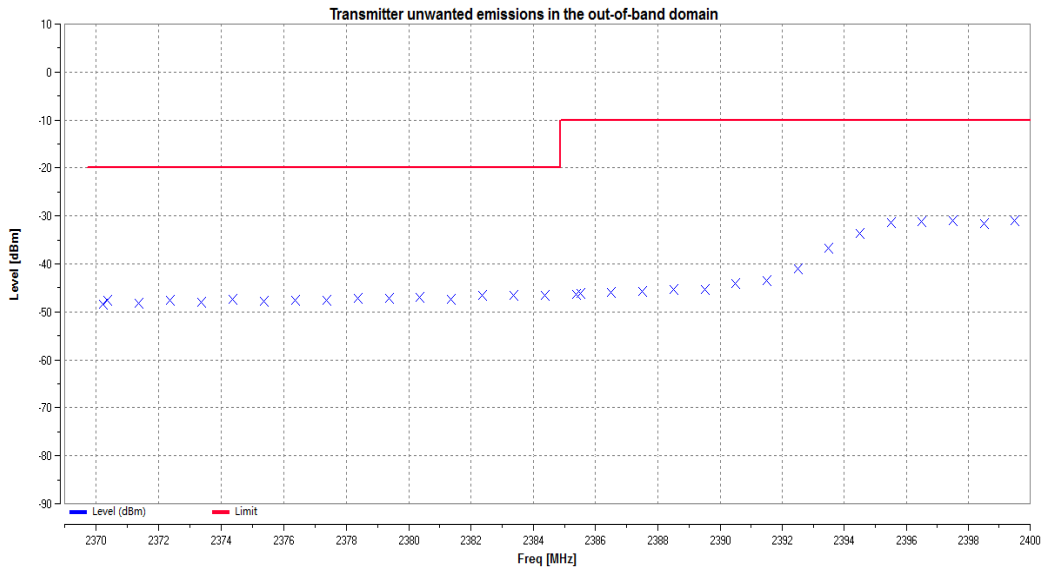
Step 2: (segment 2 483,5 MHz to 2 483,5 MHz + BW)
• Adjust the trigger level to select the transmissions with the highest power level.
• For frequency hopping equipment operating in a normal hopping mode, the different hops will result in signal bursts with different power levels. In this case the burst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

6.5.3 Test Result

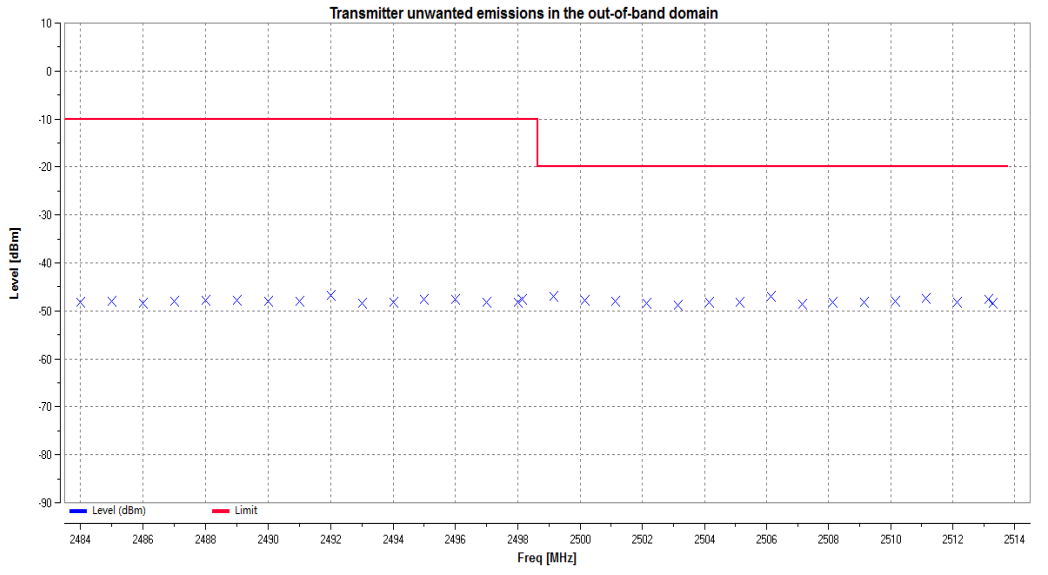
Test Mode	Test Channel	Test Segment (MHz)	Max. Emissions Reading (dBm)	Limit (dBm)	Verdict
11b	Low	2400-2BW to 2400-BW	-46.46	<=-20	Pass
		2400-BW to 2400	-30.97	<=-10	Pass
		2483.5 to 2483.5+BW	-46.7	<=-10	Pass
		2483.5+BW to 2483.5+2BW	-47.02	<=-20	Pass
	High	2400-2BW to 2400-BW	-49.06	<=-20	Pass
		2400-BW to 2400	-48.68	<=-10	Pass
		2483.5 to 2483.5+BW	-34.93	<=-10	Pass
		2483.5+BW to 2483.5+2BW	-46.11	<=-20	Pass
11g	Low	2400-2BW to 2400-BW	-44.96	<=-20	Pass
		2400-BW to 2400	-33.21	<=-10	Pass
		2483.5 to 2483.5+BW	-47.41	<=-10	Pass
		2483.5+BW to 2483.5+2BW	-46.63	<=-20	Pass
	High	2400-2BW to 2400-BW	-49.73	<=-20	Pass
		2400-BW to 2400	-49.1	<=-10	Pass
		2483.5 to 2483.5+BW	-34.5	<=-10	Pass
		2483.5+BW to 2483.5+2BW	-45.52	<=-20	Pass
11n(HT20)	Low	2400-2BW to 2400-BW	-45.33	<=-20	Pass
		2400-BW to 2400	-33.92	<=-10	Pass
		2483.5 to 2483.5+BW	-47.89	<=-10	Pass
		2483.5+BW to 2483.5+2BW	-47.86	<=-20	Pass
	High	2400-2BW to 2400-BW	-49.19	<=-20	Pass
		2400-BW to 2400	-35.46	<=-10	Pass
		2483.5 to 2483.5+BW	-45.86	<=-10	Pass
		2483.5+BW to 2483.5+2BW	-50.87	<=-20	Pass
11n(HT40)	Low	2400-2BW to 2400-BW	-50.57	<=-20	Pass
		2400-BW to 2400	-49.76	<=-10	Pass
		2483.5 to 2483.5+BW	-49.3	<=-10	Pass
		2483.5+BW to 2483.5+2BW	-50.7	<=-20	Pass
	High	2400-2BW to 2400-BW	-50.14	<=-20	Pass
		2400-BW to 2400	-49.61	<=-10	Pass
		2483.5 to 2483.5+BW	-49.44	<=-10	Pass
		2483.5+BW to 2483.5+2BW	-46.46	<=-20	Pass
Note: The data just list the worst case.					

Test Graphs:

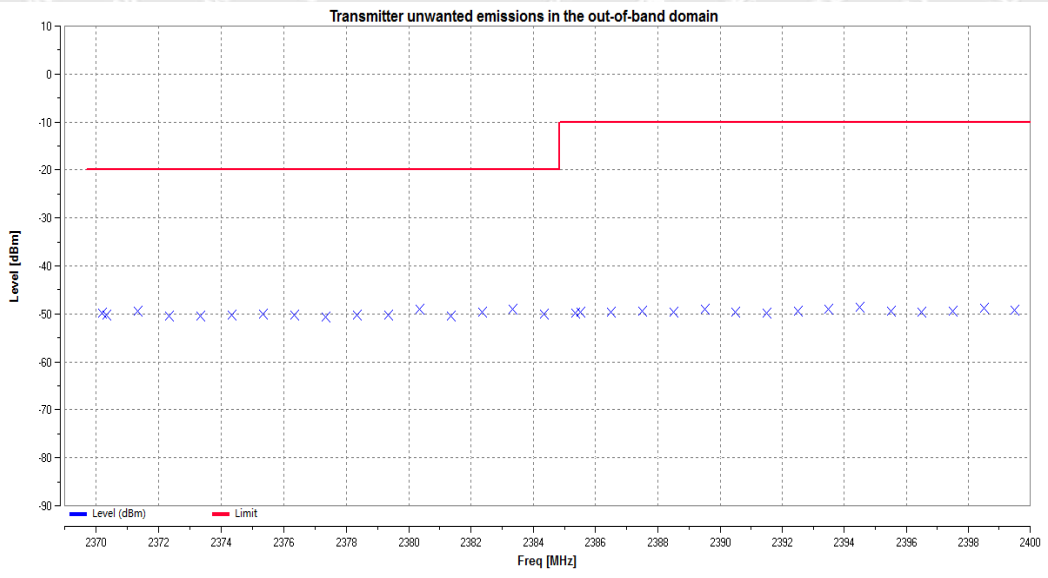
OOB_TNVN_11b_2412_2400MHz-2BW to 2400MHz



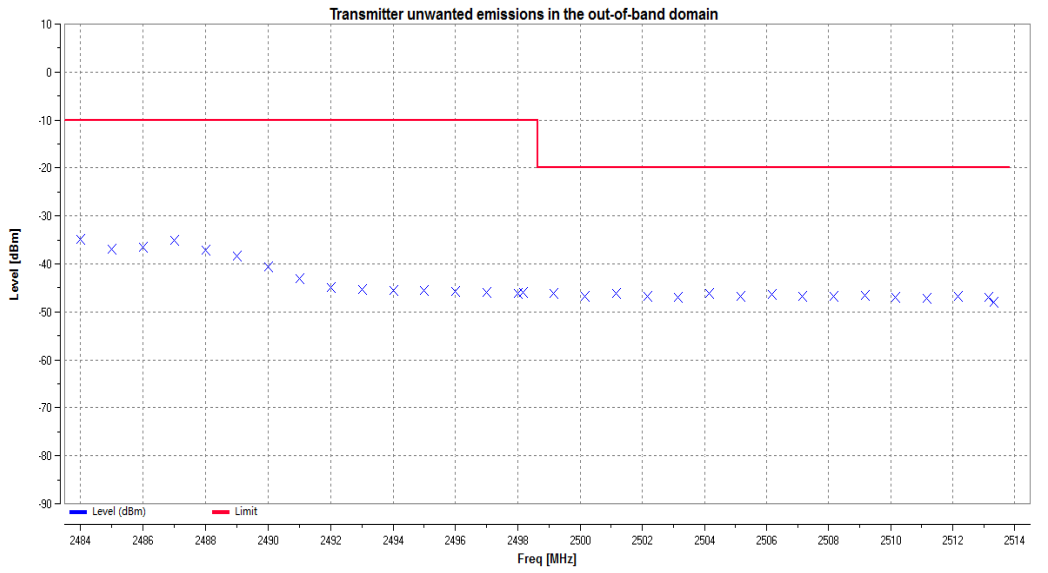
OOB_TNVN_11b_2412_2483.5MHz to 2483.5MHz+2BW



OOB_TNVN_11b_2472_2400MHz-2BW to 2400MHz



OOB_TNVN_11b_2472_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& 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

6.6.2 Test Procedure

The device under test has an integral antenna and the radiated measurement shall apply to the device, using the method of measurement as described in the EN300328 section 5.3.10.2.

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

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

6.6.3 Test Result

Frequency (MHz)	Receiver Reading (dBμV)	Turn table Angle (°)	RX Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable (dB)	Antenna Gain (dB)			
TX_TNVN_11b_2412										
613.73	24.28	108	1.6	H	-75.10	0.20	0.00	-74.90	-54	-20.90
613.73	27.27	151	1.3	V	-71.73	0.20	0.00	-71.53	-54	-17.53
1003.47	56.00	301	1.7	H	-43.98	0.25	6.00	-49.73	-30	-19.73
1003.47	56.81	152	1.3	V	-44.50	0.25	6.00	-50.25	-30	-20.25
3273.64	50.17	315	2.0	H	-41.28	2.11	12.00	-51.17	-30	-21.17
3273.64	51.37	123	1.5	V	-38.25	2.11	12.00	-48.14	-30	-18.14
TX_TNVN_11b_2472										
155.35	36.47	131	1.9	H	-72.33	0.15	0.00	-72.18	-36	-36.18
155.35	32.38	157	1.7	V	-74.84	0.15	0.00	-74.69	-36	-38.69
1667.90	54.04	183	1.3	H	-41.56	0.30	9.40	-50.66	-30	-20.66
1667.90	54.94	301	1.9	V	-40.39	0.30	9.40	-49.49	-30	-19.49
3862.72	50.24	242	1.0	H	-40.25	2.42	12.60	-50.43	-30	-20.43
3862.72	48.19	174	1.4	V	-40.76	2.42	12.60	-50.94	-30	-20.94

Frequency (MHz)	Receiver Reading (dBμV)	Turn table Angle (°)	RX Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable (dB)	Antenna Gain (dB)			
TX_TNVN_11g_2412										
58.61	35.35	295	1.2	H	-72.45	0.15	0.00	-72.30	-54	-18.30
58.61	35.32	286	1.9	V	-71.91	0.15	0.00	-71.76	-54	-17.76
2569.16	51.86	239	1.2	H	-41.80	0.43	10.60	-51.97	-30	-21.97
2569.16	48.13	156	1.0	V	-41.81	0.43	10.60	-51.98	-30	-21.98
4123.81	52.77	315	1.6	H	-38.50	2.49	12.60	-48.61	-30	-18.61
4123.81	51.90	303	1.5	V	-38.01	2.49	12.60	-48.12	-30	-18.12
TX_TNVN_11g_2472										
680.68	27.24	219	1.4	H	-72.72	0.20	0.00	-72.52	-54	-18.52
680.68	28.45	287	1.6	V	-70.76	0.20	0.00	-70.56	-54	-16.56
1840.42	54.60	230	1.8	H	-39.48	0.31	10.40	-49.57	-30	-19.57
1840.42	53.36	123	1.9	V	-39.91	0.31	10.40	-50.00	-30	-20.00
4278.96	51.99	163	1.0	H	-39.35	2.53	12.60	-49.42	-30	-19.42
4278.96	49.97	145	2.0	V	-39.98	2.53	12.60	-50.05	-30	-20.05

Frequency (MHz)	Receiver Reading (dBμV)	Turn table Angle (°)	RX Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable (dB)	Antenna Gain (dB)			
TX_TNVN_11n(HT20)_2412										
231.41	37.46	196	1.5	H	-72.55	0.15	0.00	-72.40	-36	-36.40
231.41	34.74	316	1.0	V	-72.55	0.15	0.00	-72.40	-36	-36.40
1012.20	55.19	189	1.0	H	-44.79	0.25	6.00	-50.54	-30	-20.54
1012.20	56.44	119	2.0	V	-44.87	0.25	6.00	-50.62	-30	-20.62
5128.44	48.14	127	1.0	H	-41.45	2.79	12.70	-51.36	-30	-21.36
5128.44	49.10	129	1.6	V	-39.85	2.79	12.70	-49.76	-30	-19.76
TX_TNVN_11n(HT20)_2472										
892.57	21.40	316	1.0	H	-73.99	0.22	0.00	-73.77	-36	-37.77
892.57	24.00	239	1.1	V	-71.24	0.22	0.00	-71.02	-36	-35.02
2624.05	52.40	154	1.7	H	-41.21	0.45	10.70	-51.46	-30	-21.46
2624.05	51.02	120	1.1	V	-38.67	0.45	10.70	-48.92	-30	-18.92
4200.92	52.87	201	1.2	H	-38.47	2.53	12.60	-48.54	-30	-18.54
4200.92	48.23	137	1.5	V	-41.72	2.53	12.60	-51.79	-30	-21.79

Frequency (MHz)	Receiver Reading (dBμV)	Turn table Angle (°)	RX Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable (dB)	Antenna Gain (dB)			
TX_TNVN_11n(HT40)_2422										
121.16	34.29	206	1.8	H	-73.30	0.15	0.00	-73.15	-36	-37.15
121.16	34.55	283	1.9	V	-72.27	0.15	0.00	-72.12	-36	-36.12
2538.09	53.59	292	1.7	H	-40.07	0.43	10.60	-50.24	-30	-20.24
2538.09	49.50	281	1.9	V	-40.44	0.43	10.60	-50.61	-30	-20.61
4621.62	48.79	281	1.1	H	-41.90	2.61	12.70	-51.99	-30	-21.99
4621.62	49.30	149	1.1	V	-40.38	2.61	12.70	-50.47	-30	-20.47
TX_TNVN_11n(HT40)_2462										
911.14	21.33	230	2.0	H	-74.04	0.22	0.00	-73.82	-36	-37.82
911.14	23.80	125	1.2	V	-71.32	0.22	0.00	-71.10	-36	-35.10
2237.89	51.74	110	1.8	H	-39.78	0.38	10.50	-49.90	-30	-19.90
2237.89	50.17	242	1.4	V	-38.61	0.38	10.50	-48.73	-30	-18.73
3436.13	54.44	117	2.0	H	-38.49	2.34	12.40	-48.55	-30	-18.55
3436.13	49.48	101	1.6	V	-41.55	2.34	12.40	-51.61	-30	-21.61

6.7 Receiver spurious emissions

6.7.1 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

6.7.2 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 EN300328 section 5.3.11.2.

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

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

6.7.3 Test Result

Frequency (MHz)	Receiver Reading (dBμV)	Turn table Angle (°)	RX Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable (dB)	Antenna Gain (dB)			
RX_TNVN_11b_2412										
273.51	36.51	309	1.3	H	-72.43	0.15	0.00	-72.28	-57	-15.28
273.51	35.90	131	1.4	V	-70.60	0.15	0.00	-70.45	-57	-13.45
2167.07	51.66	203	1.9	H	-40.75	0.35	10.40	-50.80	-47	-3.80
2167.07	49.12	169	1.2	V	-41.48	0.35	10.40	-51.53	-47	-4.53
4596.64	48.83	174	1.4	H	-42.07	2.57	12.70	-52.20	-47	-5.20
4596.64	46.18	319	1.9	V	-43.42	2.57	12.70	-53.55	-47	-6.55
RX_TNVN_11b_2472										
977.78	22.73	293	1.2	H	-72.61	0.22	0.00	-72.39	-57	-15.39
977.78	23.79	133	1.9	V	-70.99	0.22	0.00	-70.77	-57	-13.77
1582.55	51.19	192	1.7	H	-45.27	0.28	8.00	-52.99	-47	-5.99
1582.55	53.77	114	1.3	V	-43.45	0.28	8.00	-51.17	-47	-4.17
5201.33	47.81	297	1.4	H	-41.79	2.81	12.80	-51.78	-47	-4.78
5201.33	46.07	252	1.7	V	-42.75	2.81	12.80	-52.74	-47	-5.74

Remark: Only the worst case 802.11b mode was recorded.

6.8 Receiver Blocking

6.8.1 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 × $\log_{10}$(OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + 10 × $\log_{10}$(OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674		

NOTE 1: OCBW is in Hz.

NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to 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 × $\log_{10}$(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to Pmin + 26 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

Receiver category 3

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

Table 16: Receiver Blocking parameters 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 × $\log_{10}$(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative the test may be performed using a wanted signal up to Pmin + 30 dB where Pmin is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

6.8.2 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 Pmin. This value shall be measured and recorded in the test report.

• The signal level is increased by the value provided in the table corresponding to the receiver category and type of equipment.

Step 4: • The blocking signal at the UUT is set to the level provided in the table corresponding to the receiver category and type of equipment. It shall be verified and recorded in the test report that the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is met.

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

Step 6: • For non-frequency hopping equipment, repeat step 2 to step 5 with the UUT operating at the highest operating channel.

6.8.3 Test Setup

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

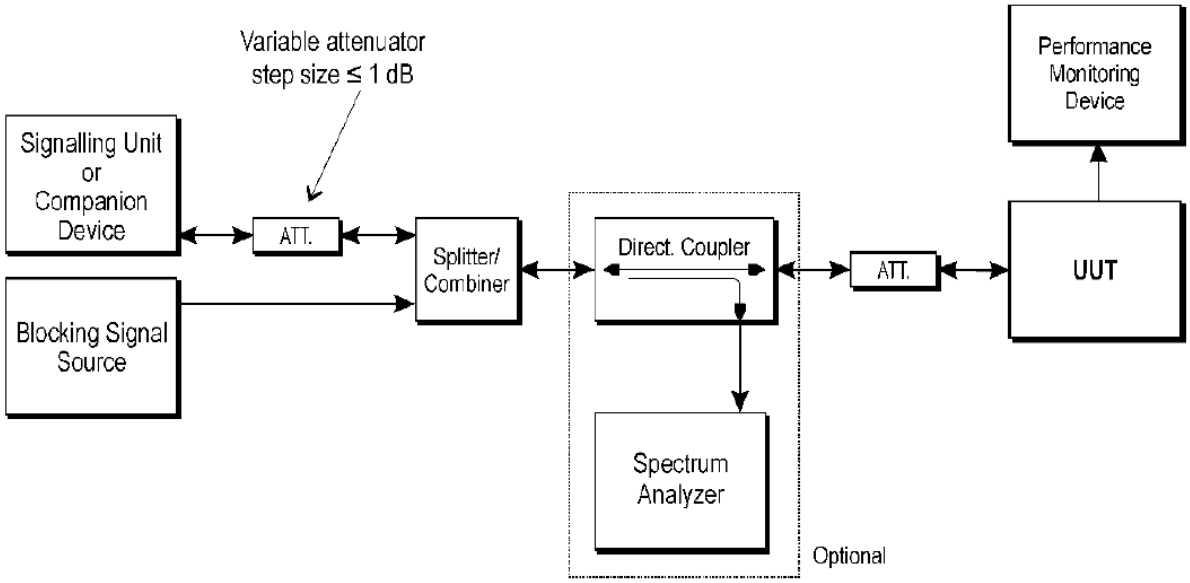


Figure 6: Test Set-up for receiver blocking

All test procedure is carried to the section 5.4.11.2.1

RBW/VBW=8MHz/30MHz

6.8.4 Test Result

802.11b (Receiver Blocking Categories 1)						
Wanted signal meanpower from companion device (dBm)	**OCBW (Hz)**	**Blocking signal frequency (MHz)**	**Blocking signal power(dBm) CW**	**PER (%)**	**Limit**	**Results**
-68	15140000	2380	-34	4.2	≤10%	Pass
		2504	-34	5.9		
-74	15140000	2300	-34	1.2		
		2330	-34	2.9		
		2360	-34	4.6		
		2524	-34	1.0		
		2584	-34	5.1		
		2674	-34	3.9		
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.						

802.11g (Receiver Blocking Categories 1)						
Wanted signal meanpower from companion device (dBm)	**OCBW (Hz)**	**Blocking signal frequency (MHz)**	**Blocking signal power(dBm) CW**	**PER (%)**	**Limit**	**Results**
-68	17033000	2380	-34	1.4	≤10%	Pass
		2504	-34	5.6		
-74	17033000	2300	-34	0.8		
		2330	-34	5.6		
		2360	-34	2.3		
		2524	-34	1.1		
		2584	-34	1.8		
		2674	-34	0.5		
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.						

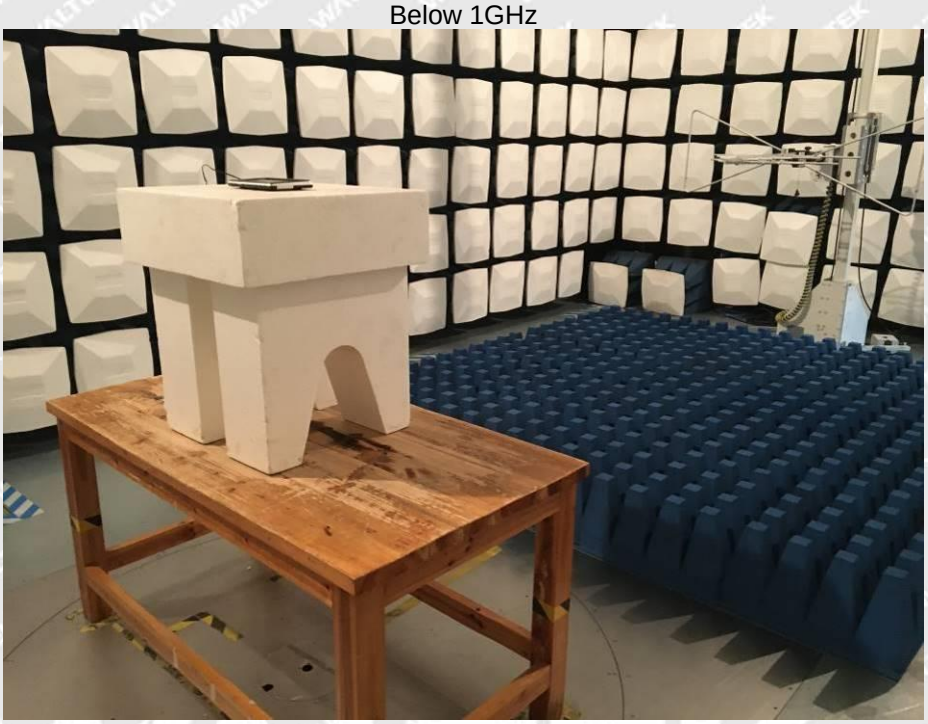
802.11n(HT20) (Receiver Blocking Categories 1)						
Wanted signal meanpower from companion device (dBm)	**OCBW (Hz)**	**Blocking signal frequency (MHz)**	**Blocking signal power(dBm) CW**	**PER (%)**	**Limit**	**Results**
-68	17809000	2380	-34	2.5	≤10%	Pass
		2504	-34	4.2		
-74	17809000	2300	-34	5.3		
		2330	-34	4.3		
		2360	-34	2.8		
		2524	-34	0.6		
		2584	-34	4.6		
		2674	-34	4.9		
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.						

802.11n(HT40) (Receiver Blocking Categories 1)						
Wanted signal meanpower from companion device (dBm)	**OCBW (Hz)**	**Blocking signal frequency (MHz)**	**Blocking signal power(dBm) CW**	**PER (%)**	**Limit**	**Results**
-68	36018000	2380	-34	1.3	≤10%	Pass
		2504	-34	4.4		
-74	36018000	2300	-34	0.5		
		2330	-34	0.6		
		2360	-34	1.1		
		2524	-34	2.3		
		2584	-34	1.8		
		2674	-34	1.3		
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.						

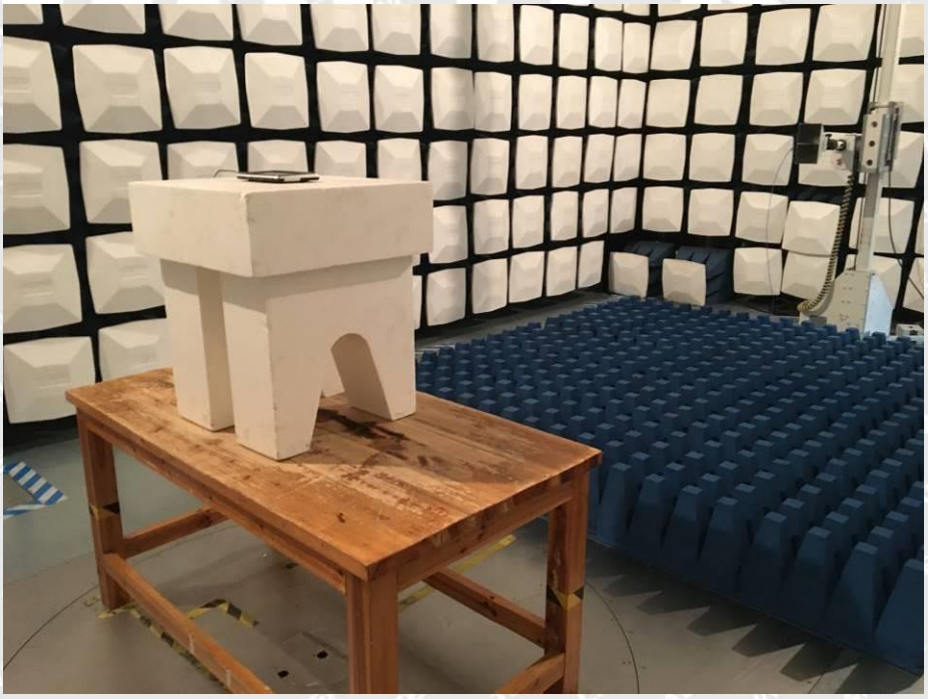
7 Photographs —Test Setup

7.1 Photograph –Spurious Emissions Test Setup

Below 1GHz



Above 1GHz



8 Photographs - Constructional Details

8.1 EUT – External Photos

Indoor Unit


MAX/MIN
ALERTS
UP
CHANNEL
SNOOZE/LIGHT
MODE
DOWN

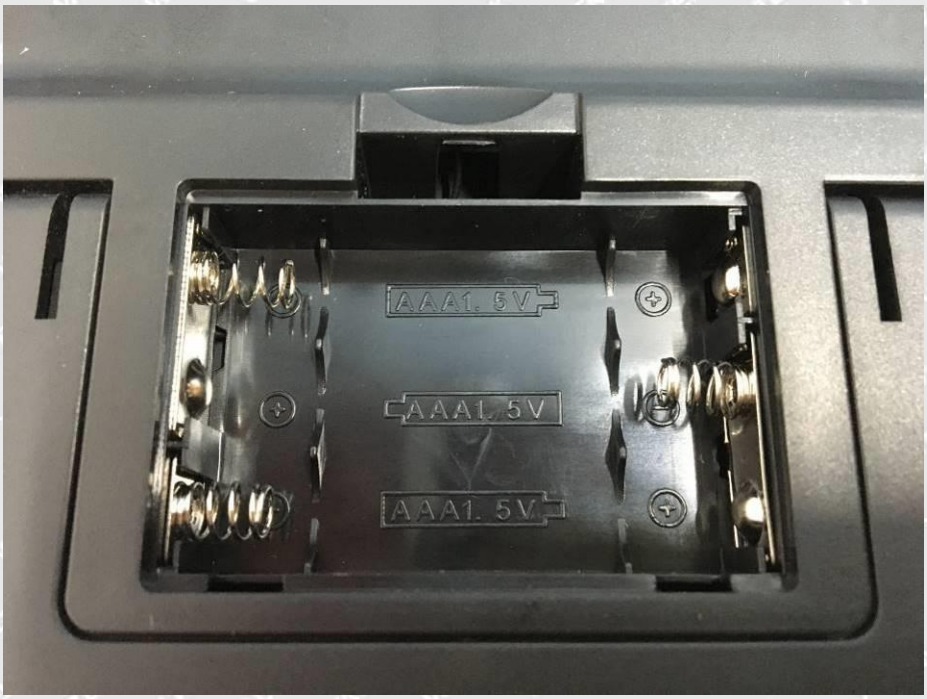

CHARGE
USB DEVICE
Output: 1.0Amps
DC 5V

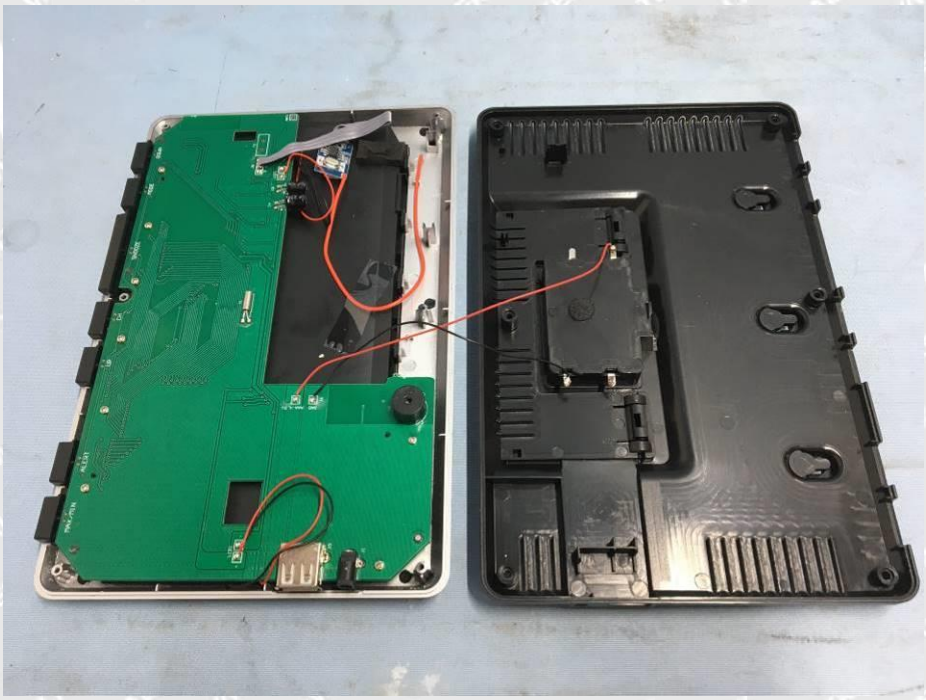

SWITCHING ADAPTER
Model No.:HX075-0501200-AG-001
Input:100-240V ~ 50/60Hz 0.3A Max
Output:5.0V ⎓ 1.2A 6.0W
No.200,Technology East Road,Shijie Town,Dongguan City,Guangdong,P.R.China
Dongguan Shijie Hua Xu Electronics Factory
2204HX
MADE IN CHINA

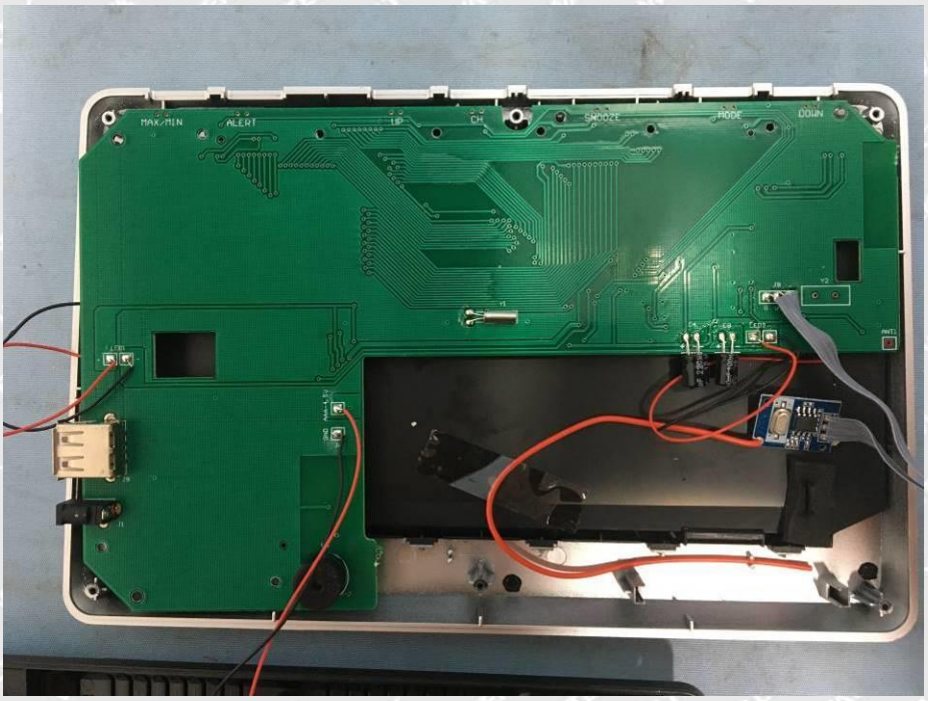
Outdoor Unit

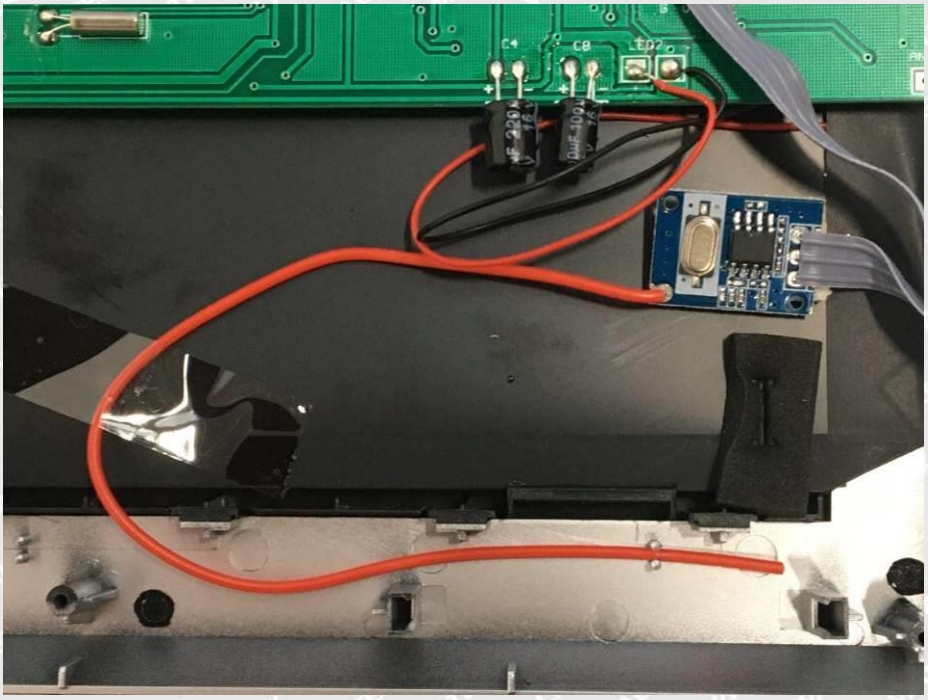
8.2 EUT – Internal Photos

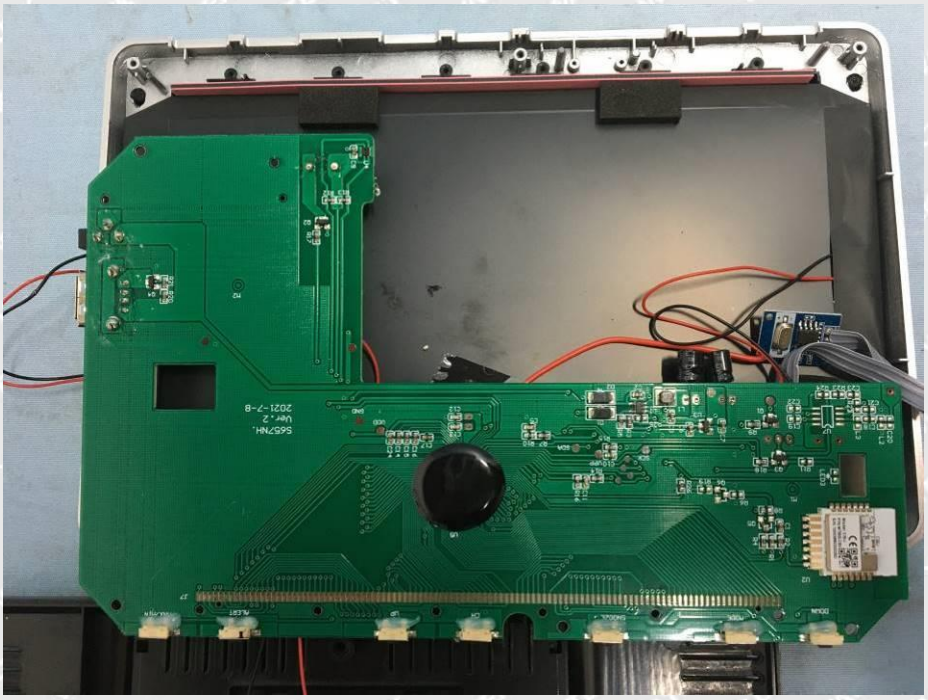
Indoor Unit

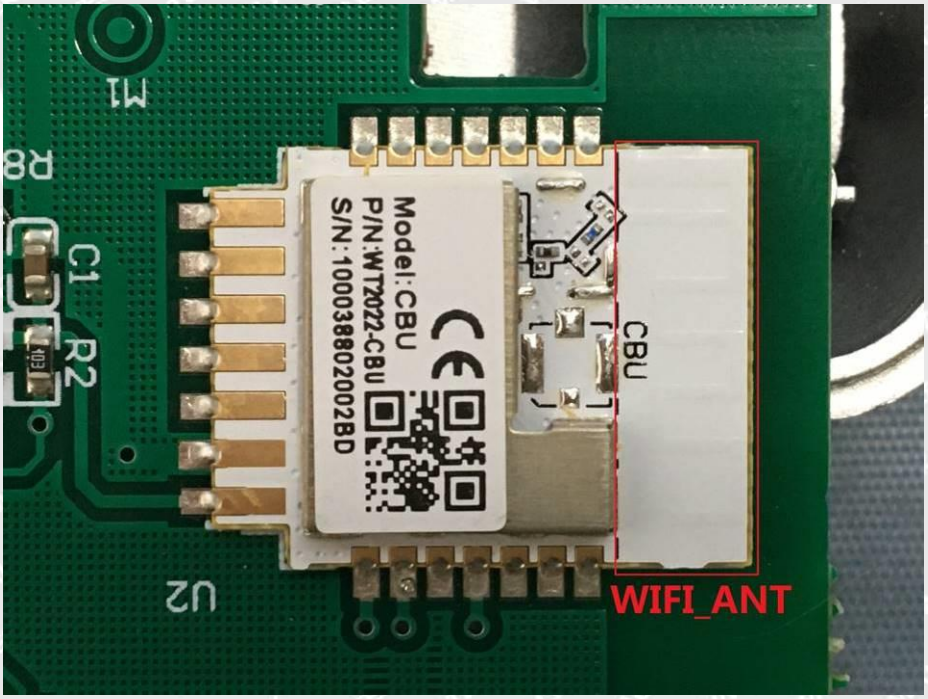


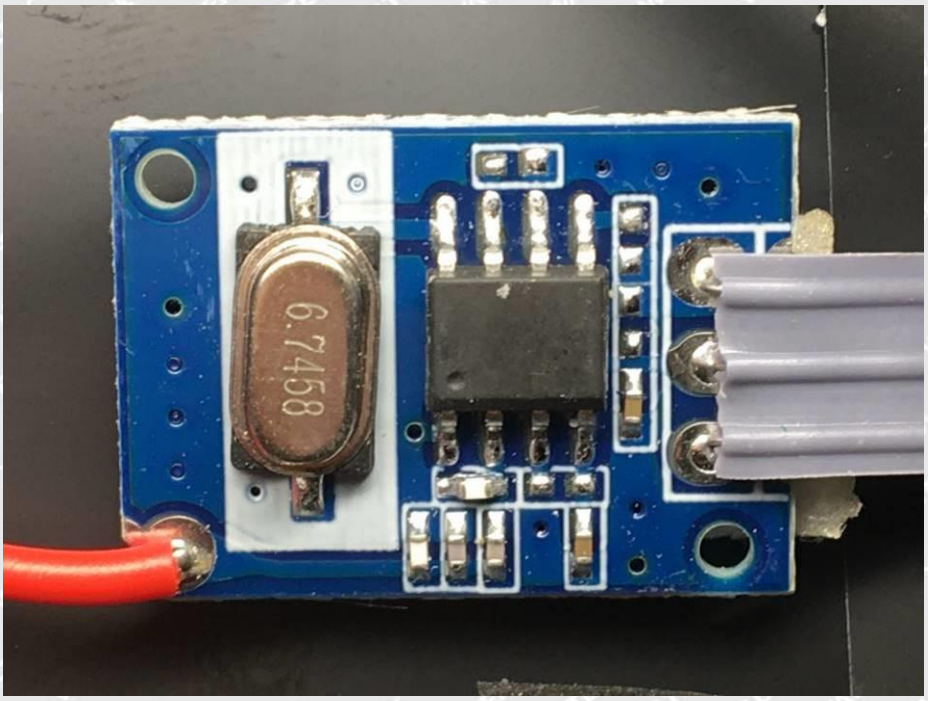


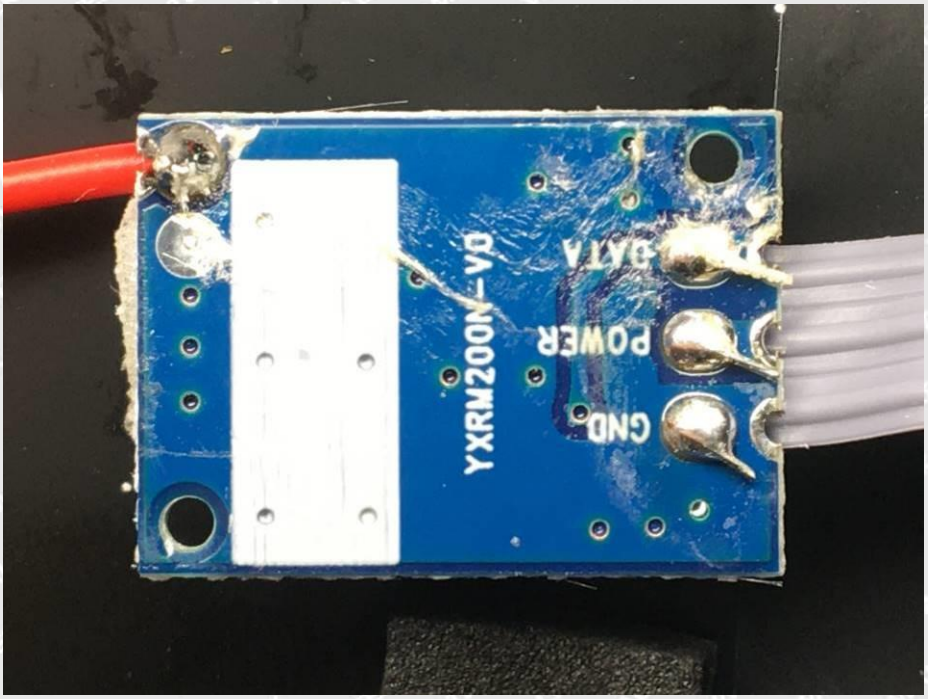

MAX/MIN
ALERT
SNOOZE
MODE
DOWN


C4
C8

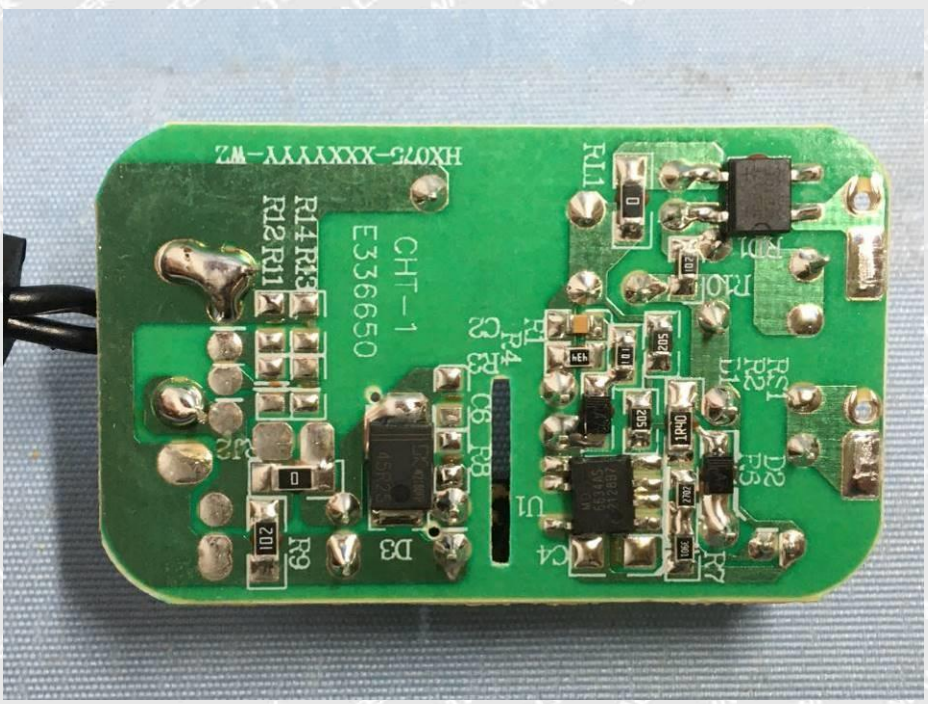



M1
R8
C1
R2
U2
Model:CBU
P/N:WT2022-CBU
S/N:1000388020028D
CBU
WIFI_ANT

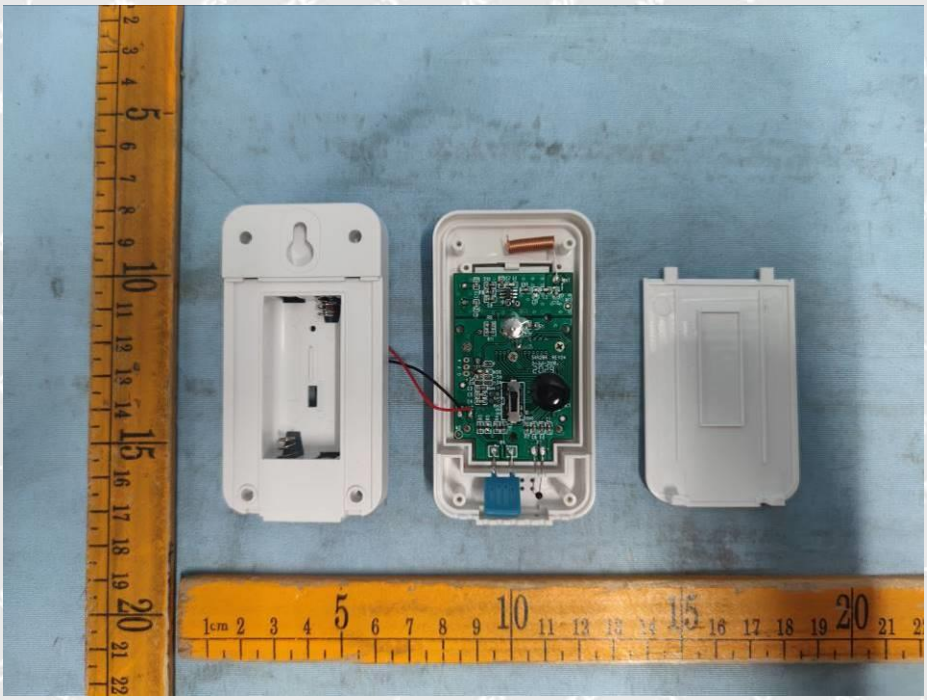

6.7458

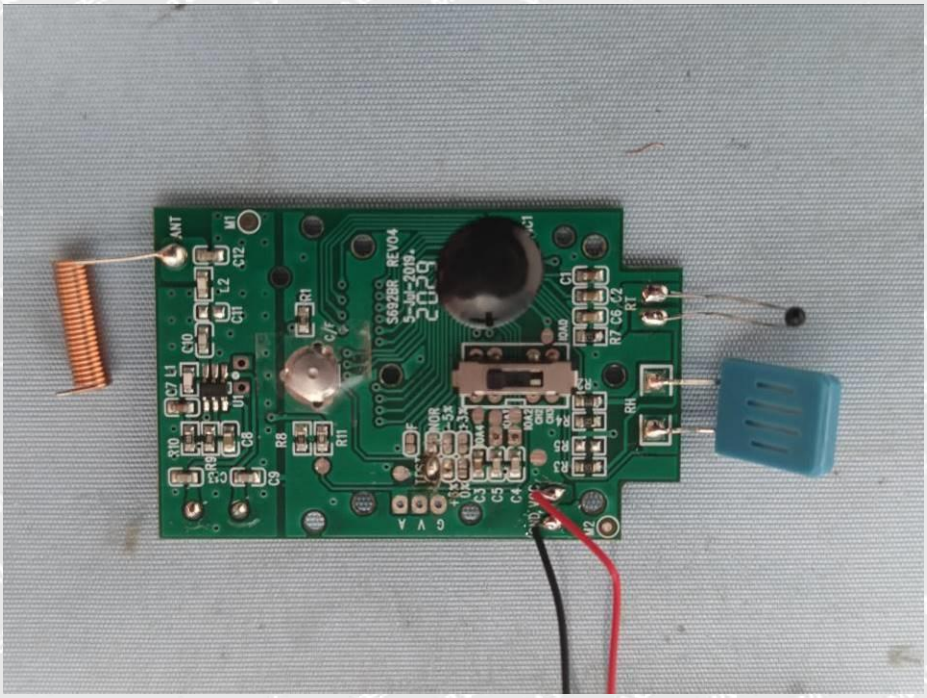

YXRM200N-V0
DATA
POWER
GND

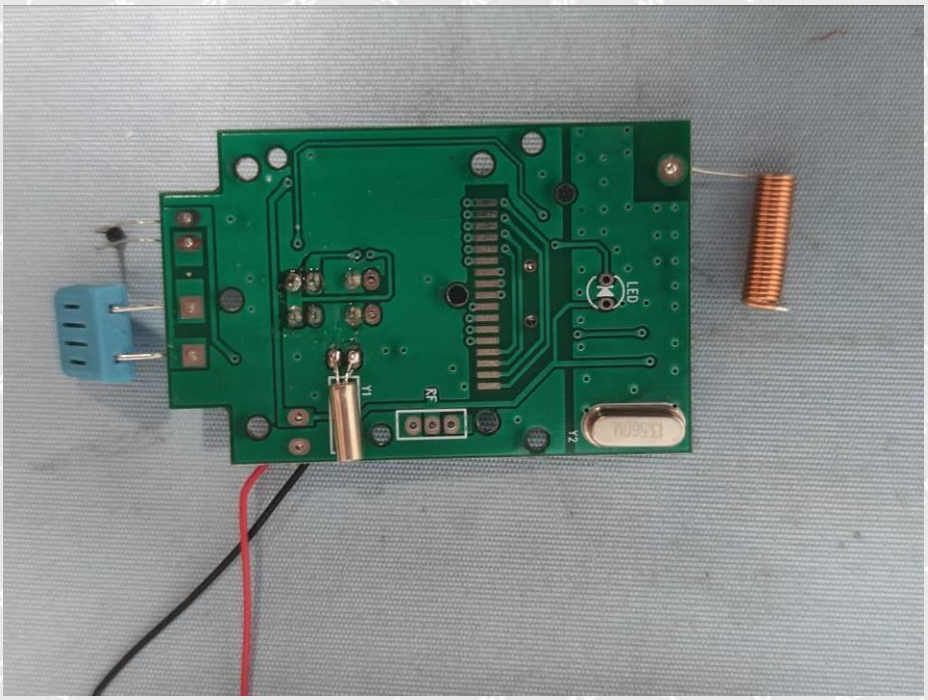

HX075-T-1
1.5mH
CHT-1
CE5
CE4
CE2
CY1
CE3
F1
E123995


HX075-XXXXYYY-W2
CHT-1
E336650
RL1
R14
R13
R12
R11
R9
D3
U1
C4

Outdoor Unit







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

TEST REPORT

Reference No.	:	WTF22F05099995W
Applicant	:	Mid Ocean Brands B.V.
Address	:	7/F., Kings Tower, 111 King Lam Street, Cheung Sha Wan, Kowloon, Hong Kong
Manufacturer	:	111590
Product Name	:	Weatherstation
Model No.	:	MO6664
Test specification	:	ETSI EN 300 220-1 V3.1.1 (2017-02) ETSI EN 300 220-2 V3.2.1 (2018-06)
Date of Receipt sample	:	2022-07-01
Date of Test	:	2022-07-19 to 2022-07-20
Date of Issue	:	2022-08-02
Test Report Form No.	:	WEW-300220A-01A
Test Result	:	**Pass**

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

Prepared By:
Waltek Testing Group (Foshan) Co., Ltd.
Address: No.13-19, 2/F., 2nd Building, Sunlink International Machinery City,
Chencun, Shunde District, Foshan, Guangdong, China
Tel:+86-757-23811398 Fax:+86-757-23811381 E-mail:info@waltek.com.cn

Tested by:

Roy Hong

Approved by:

Danny Zhou

1 Test Summary

Radio Spectrum				
Test	Test Requirement	Test Method	Limit / Severity	Result
Operating frequency	ETSI EN 300 220-2 V3.2.1	ETSI EN 300 220-1 V3.1.1	Within 433.050MHz to 434.790MHz	Pass
Unwanted emissions in the spurious domain for TX mode	ETSI EN 300 220-2 V3.2.1	ETSI EN 300 220-1 V3.1.1	Table 19	Pass
Unwanted emissions in the spurious domain for RX mode	ETSI EN 300 220-2 V3.2.1	ETSI EN 300 220-1 V3.1.1	Table 19	Pass
TX effective radiated power	ETSI EN 300 220-2 V3.2.1	ETSI EN 300 220-1 V3.1.1	<10mW	Pass
TX Maximum e.r.p. spectral density	ETSI EN 300 220-2 V3.2.1	ETSI EN 300 220-1 V3.1.1	-13dBm/10kHz	N/A
TX Duty Cycle	ETSI EN 300 220-2 V3.2.1	ETSI EN 300 220-1 V3.1.1	Clause 5.5	N/A
TX Occupied bandwidth	ETSI EN 300 220-2 V3.2.1	ETSI EN 300 220-1 V3.1.1	The whole band	Pass
TX out of band emissions	ETSI EN 300 220-2 V3.2.1	ETSI EN 300 220-1 V3.1.1	Table 15	Pass
TX Transient Power	ETSI EN 300 220-2 V3.2.1	ETSI EN 300 220-1 V3.1.1	Table 23	Pass
TX Adjacent channel power	ETSI EN 300 220-2 V3.2.1	ETSI EN 300 220-1 V3.1.1	-	N/A
TX behaviour under low voltage conditions	ETSI EN 300 220-2 V3.2.1	ETSI EN 300 220-1 V3.1.1	Clause 5.12.2	Pass
RX Sensitivity	ETSI EN 300 220-2 V3.2.1	ETSI EN 300 220-1 V3.1.1	Table 32	N/A
RX Blocking	ETSI EN 300 220-2 V3.2.1	ETSI EN 300 220-1 V3.1.1	Table 40	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

2 Contents

3 General Information

3.1 General Description of E.U.T.

Product Name ..... : Weatherstation

Model No. ..... : MO6664

Remark ..... : ---

Rated Voltage..... : **Outdoor Unit:** Battery 3V (2*1.5V AAA)
Indoor Unit: Battery 4.5V (3*1.5V AAA)

Battery Capacity ..... : ---

Adapter Model..... : HX075-0501200-AG-001 (For indoor unit only)
Input: 100-240V~, 50/60Hz, 0.3A Max
Output: DC 5V, 1.2A, 6.0W

3.2 Technical Specification

Operational Frequency Band .. : 433.05MHz-434.79MHz

Operating Frequency ..... : 433.92MHz

Maximum RF Output Power .... : 4.077 dBm (ERP)

Type of Modulation ..... : ASK

Quantity of Channels ..... : 1

Antenna installation ..... : Spring Antenna for TX
Whip Antenna for RX

Antenna Gain ..... : 0dBi

Oscillator..... : TX: 13.56MHz; RX: 6.7458MHz

Receiver Category..... : 3

Receiver category	Description
1	Category 1 is a high performance level of receiver. In particular to be used where the operation of a SRD may have inherent safety of human life implications.
1.5	Category 1.5 is an improved performance level of receiver category 2.
2	Category 2 is standard performance level of receiver.
3	Category 3 is a low performance level of receiver. Manufacturers have to be aware that category 3 receivers are not able to work properly in case of coexistence with some services such as a mobile radio service in adjacent bands. The manufacturer shall provide another mean to overcome the weakness of the radio link or accept the failure.

3.3 Standards Applicable for Testing

The tests were performed according to following standards:

ETSI EN 300 220-1 V3.1.1 (2017-02)	Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz;Part 1: Technical characteristics and methods of measurement.
ETSI EN 300 220-2 V3.2.1 (2018-06)	Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz;Part 2: Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU for non specific radio equipment.

3.4 Test Facility

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

- **ISED – Registration No.: 21895**

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

- **FCC – Registration No.: 820106**

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

- **NVLAP – Lab Code: 600191-0**

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

3.5 Subcontracted

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

☐ Yes ☒ No

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

Test items:---

Lab information:---

3.6 Abnormalities from Standard Conditions

None.

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

☒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	9m×6m×6m	-	2021-01-11	2024-01-10
2	EMI TEST RECEIVER	RS	ESR7	101566	2022-01-07	2023-01-06
3	Spectrum Analyzer	Agilent	N9020A	MY48011796	2022-05-17	2023-05-16
4	Trilog Broadband Antenna	SCHWARZBECK	VULB9162	9162-117	2022-01-09	2023-01-08
5	Coaxial Cable (below 1GHz)	H+S	CBL3-NN-12+3 m	214NN320	2022-01-07	2023-01-06
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	01561	2022-01-09	2023-01-08
7	Broadband Preamplifier (Above 1GHz)	Lunar E M	LNA1G18-40	20160501002	2022-01-06	2023-01-05
8	Coaxial Cable (above 1GHz)	Times-Micorwave	CBL5-NN	-	2022-01-06	2023-01-05
☒RF Conducted test						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	Environmental Chamber	KSON	THS-D4C-100	5244K	2022-01-08	2023-01-07
2	Spectrum Analyzer	Agilent	N9020A	MY48011796	2022-05-17	2023-05-16
3	EXG Analog Signal Generator	Agilent	N5181A	MY48080720	2022-01-06	2023-01-05
4	RF Control Unit	CHANGCHUANG	JS0806-2	-	2022-01-06	2023-01-05
5	Wideband radio communication tester	Rohde&Schwarz	CMW500	1201.0002K50 -158178-Qf	2022-07-09	2023-07-08

☐: ***Not Used***

☒: ***Used***

4.2 Software List

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

4.3 Special Accessories and Auxiliary Equipment

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

4.4 Measurement Uncertainty

Parameter	Uncertainty	Note
RF Output Power	±2.2dB	(1)
Occupied Bandwidth	±1.5%	(1)
Conducted Spurious Emission	±2.7dB	(1)
Transmitter Spurious Emission	±4.1dB (for 3MHz-1GHz)	(1)
	±5.0dB (for 1GHz-18GHz)	(1)

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

4.5 Decision Rule

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

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

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

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

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

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

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

5 Test Conditions and Test mode

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

Test Mode List		
Test Mode	Description	Remark
TM1	Transmitting	433.92MHz

Test Conditions					
	Normal	LTLV	LTHV	HTHV	HTLV
Temperature (°C)	20	-20	-20	55	55
Voltage (Vdc)-TX	3	2.7	3.3	3.3	2.7
Voltage (Vdc)-RX	4.5	4.05	4.95	4.95	4.05
Relative Humidity:	45 %				
ATM Pressure:	101.2kPa				

6 Operating Frequency

6.1 Standard Applicable

According to ETSI EN 300 220-1 section 5.1, the nominal Operating Frequency is the centre of a channel of width OCW.

6.2 Test Procedure

Reference to ETSI EN 300 220-1 V3.1.1 clause 5.1.2

6.3 Test Result

Item	Value
Operational Frequency band or bands	433.05MHz-434.79MHz
Nominal Operating Frequency or Frequencies	433.92 MHz
Operating Channel width(s) - OCW	235 kHz
Note: Declared by the manufacturer	

7 Effective Radiated Power

7.1 Standard Applicable

According to EIST EN 300 220-2 Annex B, the effective radiated power shall not exceed the power class value given in following table:

Operational Frequency Band		Maximum effective radiated power, e.r.p.	Channel access and occupation rules (e.g. Duty cycle or LBT + AFA)	Maximum occupied bandwidth	Other usage restrictions	Band number from EC Decision 2013/752/EU [i.3]	Class 1 sub-class number according Commission Decision 2000/299/EU [i.7]
F	169,4875 MHZ to 169,5875 MHz	10 mW	≤0,001 % duty cycle Between 00.00 and 06.00 local time a duty cycle limit of 0,1 % may be used	The whole band	Equipment that concentrates or multiplexes individual equipment is excluded.	39b	124
G	169,5875 MHz to 169,8125 MHz	10 mW	≤0,1 % duty cycle	The whole band	Equipment that concentrates or multiplexes individual equipment is excluded.	40	129
H	433,050 MHz to 434,790 MHz	10 mW	10 %	The whole band		44b, 45b	20, 125
I	433,050 MHz to 434,790 MHz	1 mW e.r.p. -13 dBm/10 kHz PSD for bandwidth modulation larger than 250 kHz	No requirement	The whole band	Audio and video applications are excluded.	44a, 45a	61, 63
J	434,040 MHz to 434,790 MHz	10 mW	No requirement	25 kHz	Audio and video applications are excluded.	45c	65
K	863 MHz to 865 MHz	25 mW e.r.p.	≤0,1 % duty cycle or polite spectrum access	The whole band except for audio & video applications limited to 300 kHz		46a	66
L	865 MHz to 868 MHz	25 mW e.r.p. Power density: -4,5 dBm/100	≤1 % duty cycle or polite spectrum access	The whole band except for audio & video	DSSS and any techniques other than	47	67

		kHz The power density can be increased to +6,2 dBm/100 kHz if the band of operation is limited to 865 MHz to 868 MHz		applications limited to 300 kHz	FHSS.		
M	868,000 MHz to 868,600 MHz	25 mW e.r.p.	≤1 % duty cycle or polite spectrum access	The whole band except for audio & video applications limited to 300 kHz		48	28
N	868,700 MHz to 869,200 MHz	25 mW e.r.p.	≤0,1% duty cycle or polite spectrum access	The whole sub-band except for audio & video applications limited to 300 kHz		50	29
O	869,400 MHz to 869,650 MHz	25 mW e.r.p.	≤0.1% duty cycle or polite spectrum access	The whole band		54a	130
P	869,400 MHz to 869,650 MHz	500 mW e.r.p.	≤10 % duty cycle or polite spectrum access	The whole band		54b	30
Q	869,700 MHz to 870,000 MHz	5 mW e.r.p.	No requirement	The whole band	Audio and video applications are excluded.	56a	31
R	869,700 MHz to 870,000 MHz	25 mW e.r.p.	≤1% duty cycle or polite spectrum access	The whole band	Analogue audio applications are excluded. Analogue video applications are excluded.	56b	69

7.2 Test Procedure

Test is conducting under the description of ETSI EN 300 220-1 section 5.2.2.2.2

7.3 Test Result

Test Frequency(MHz)		433.92		
Test Conditions	**Measured power (dBm)**	**Antenna Gain (dBi)**	**ERP (dBm)**	**Limit (dBm)**
Normal	4.077	0	4.077	10
LTLV	4.075	0	4.075	10
LTHV	4.074	0	4.074	10
HTLV	4.070	0	4.070	10
HTHV	4.065	0	4.065	10

Note: ERP= Measured Power + Antenna Gain

8 Occupied Bandwidth

8.1 Standard Applicable

According to ETSI EN 300 220-1 section 5.6, the occupied bandwidth (OBW) is the Frequency Range in which 99 % of the total mean power of a given emission falls. The residual part of the total power being denoted as β, which, in cases of symmetrical spectra, splits up into β/2 on each side of the spectrum. Unless otherwise specified, β/2 is taken as 0,5 % as described in Figure 3.

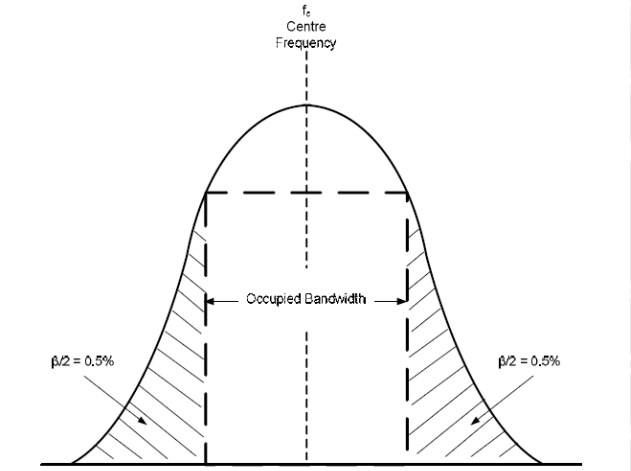


Figure 3: Signal occupied bandwidth

The maximum occupied bandwidth includes all associated side bands above the appropriate emissions level and the frequency error or drift under extreme test conditions.

The Operating Channel shall be declared and shall reside entirely within the Operational Frequency Band. The Maximum Occupied Bandwidth at 99 % shall reside entirely within the Operating Channel defined by Flow and Fhigh

1) The measurement shall be performed on the lowest and the highest Operating Frequencies declared by the manufacturer. Additional frequencies may be tested.
2) The measurement shall be performed with a spectrum analyser.
3) For devices with e.r.p. ≤ -30 dBm, OBW may be either measured or taken as equal to the OCW within the operational frequency band.

8.2 Test Procedure

The spectrum analyser shall be configured as appropriate for the parameters shown in Table 12.

Setting	Value	Notes
Centre frequency	The nominal Operating Frequency	The highest or lowest Operating Frequency as declared by the manufacturer
RBW	1 % to 3 % of OCW without being below 100 Hz	/
VBW	3 x RBW	Nearest available analyser setting to 3 x RBW
Span	At least 2 x Operating Channel width	Span should be large enough to include all major components of the signal and its side bands
Detector Mode	RMS	/
Trace	Max hold	/

If the equipment is capable of producing an unmodulated carrier and the test in clause 5.8 is performed, then the OBW measurements need only be performed under normal test conditions. Any required results for Maximum OBW under extreme conditions are obtained by addition and substraction of the upper and lower frequency error results to each bandwidth measurement obtained in this test.

Step 1: Operation of the EUT shall be started, on the highest operating frequency as declared by the manufacturer, with the appropriate test signal. The signal attenuation shall be adjusted to ensure that the signal power envelope is sufficiently above the noise floor of the analyser to avoid the noise signals on either side of the power envelope being included in the measurement.

Step 2: When the trace is completed the peak value of the trace shall be located and the analyser marker placed on this peak.

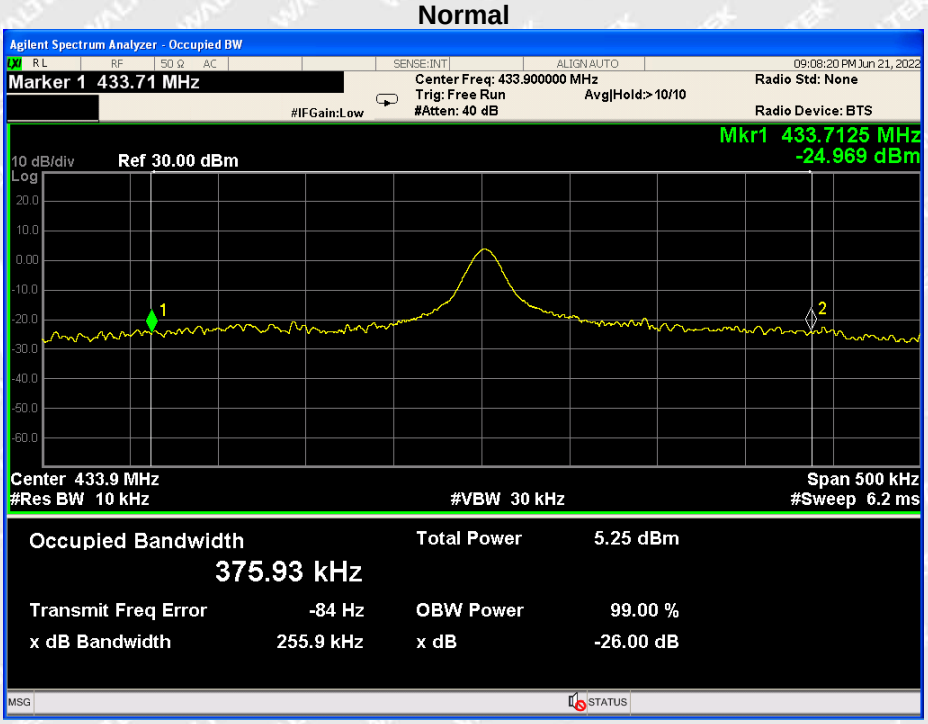
Step 3: The 99 % occupied bandwidth function of the spectrum analyser shall be used to measure the occupied bandwidth of the signal.

8.3 Test Result

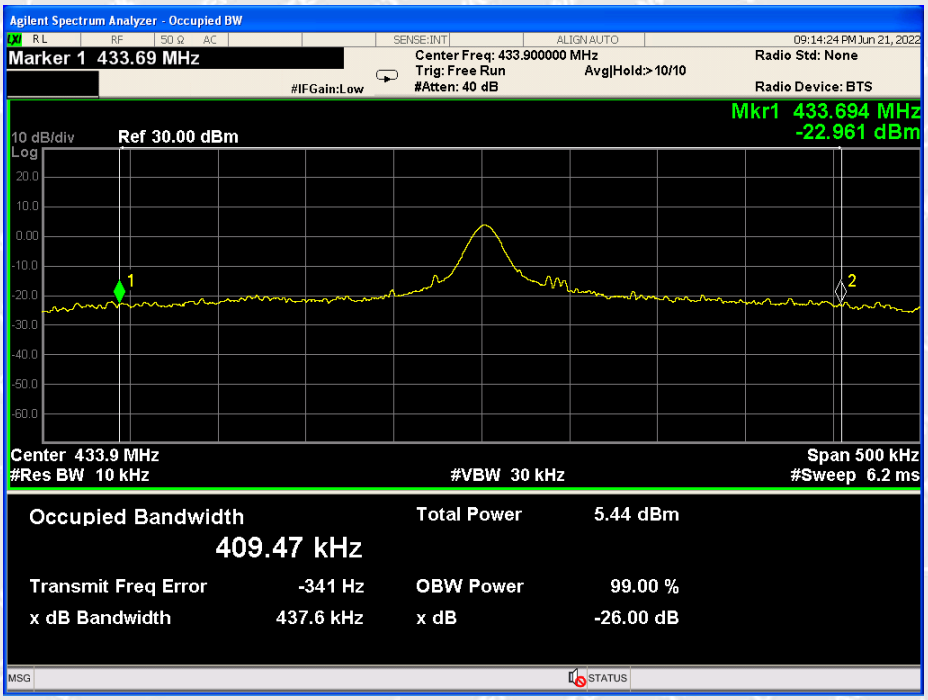
Test Frequency(MHz)		433.92		
Test Conditions	Occupied Bandwidth (kHz)	F_L(MHz)	FH(MHz)	Result
Normal	375.93	433.7125	434.0905	Pass
LTLV	409.47	433.6940	434.1040	Pass
LTHV	391.87	433.7020	434.0940	Pass
HTLV	389.37	433.7060	434.0960	Pass
HTHV	387.94	433.7050	434.0930	Pass
Limit		FL > 433.050MHz and FH <434.790MHz		

Test plot as following:

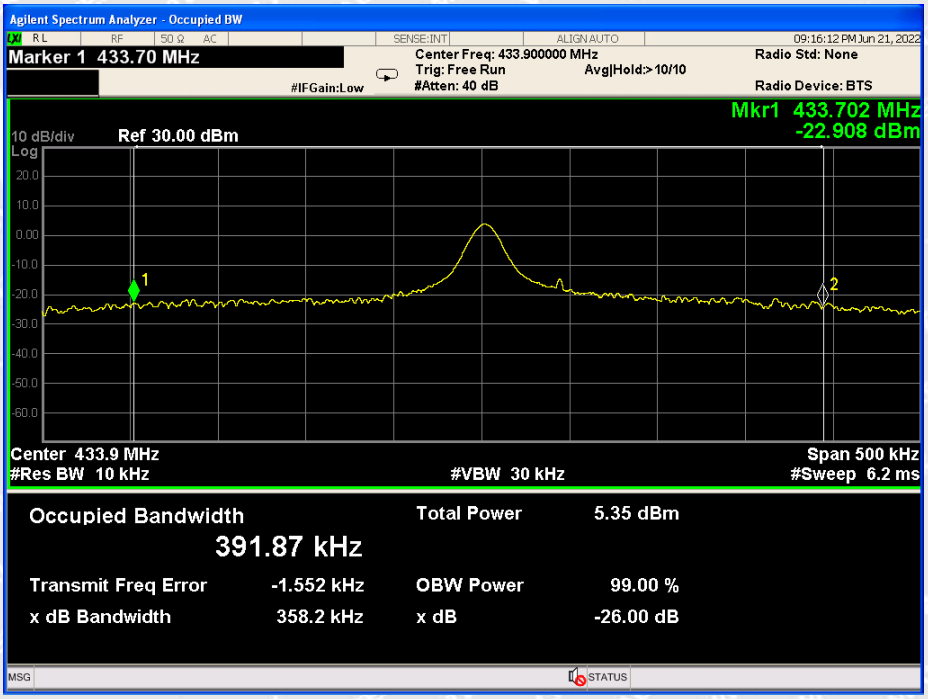
Normal



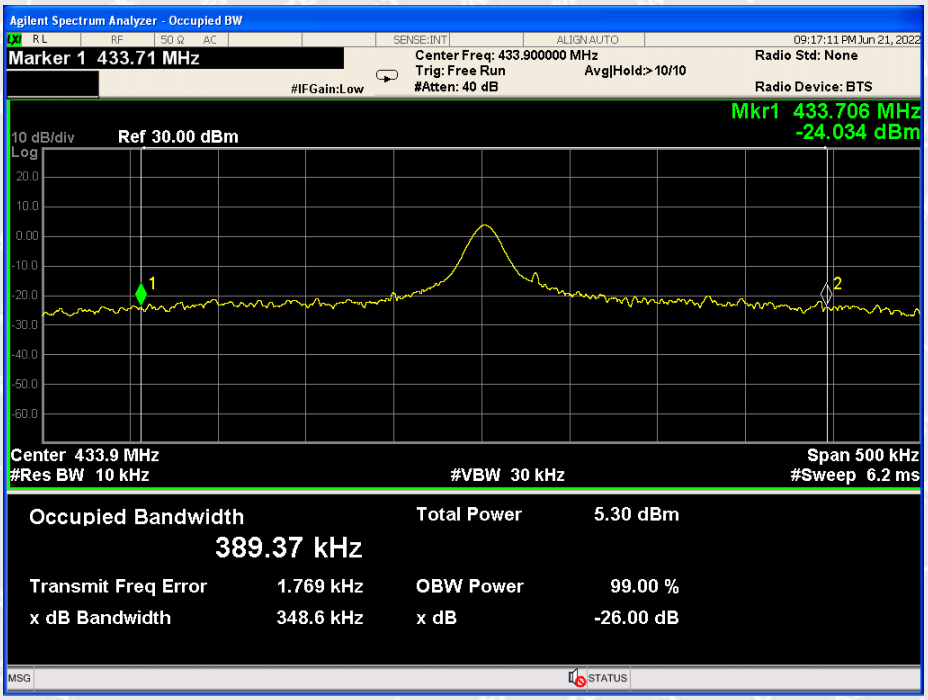
LTLV


Agilent Spectrum Analyzer - Occupied BW
Marker 1 433.69 MHz
Center Freq: 433.900000 MHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 40 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
09:14:24 PM Jun 21, 2022
Mkr1 433.694 MHz
-22.961 dBm
10 dB/div
Ref 30.00 dBm
Log
Center 433.9 MHz
#Res BW 10 kHz
#VBW 30 kHz
Span 500 kHz
#Sweep 6.2 ms
Occupied Bandwidth
409.47 kHz
Total Power 5.44 dBm
Transmit Freq Error -341 Hz
OBW Power 99.00 %
x dB Bandwidth 437.6 kHz
x dB -26.00 dB
MSG
STATUS

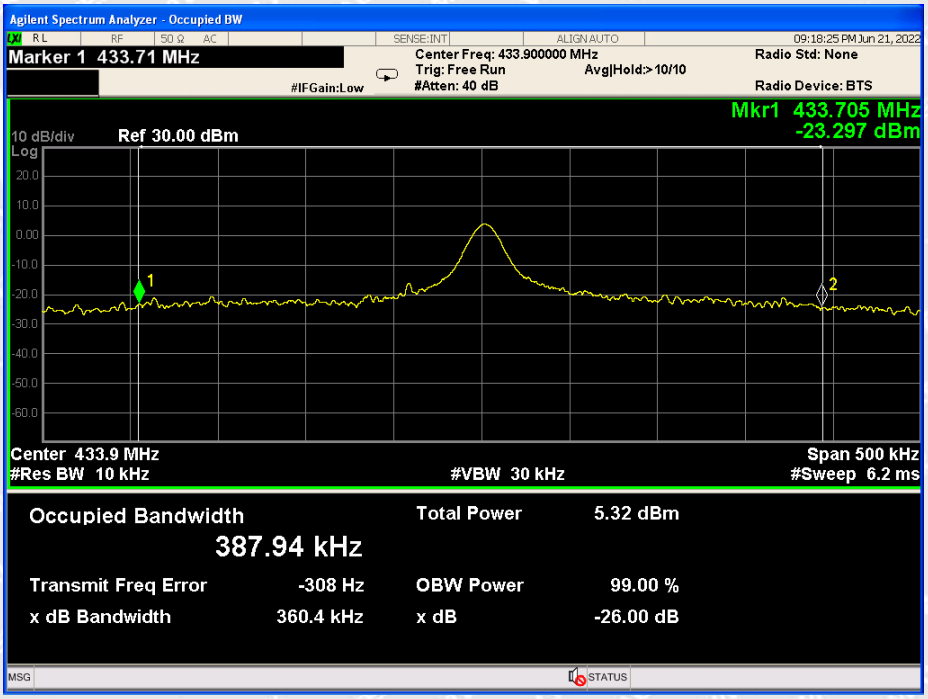
LTHV


Agilent Spectrum Analyzer - Occupied BW
Marker 1 433.70 MHz
Center Freq: 433.900000 MHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 40 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
09:16:12 PM Jun 21, 2022
Mkr1 433.702 MHz
-22.908 dBm
10 dB/div
Ref 30.00 dBm
Log
Center 433.9 MHz
#Res BW 10 kHz
#VBW 30 kHz
Span 500 kHz
#Sweep 6.2 ms
Occupied Bandwidth
391.87 kHz
Total Power 5.35 dBm
Transmit Freq Error -1.552 kHz
OBW Power 99.00 %
x dB Bandwidth 358.2 kHz
x dB -26.00 dB
MSG
STATUS

HTLV


Agilent Spectrum Analyzer - Occupied BW
Marker 1 433.71 MHz
Center Freq: 433.900000 MHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 40 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
09:17:11 PM Jun 21, 2022
Mkr1 433.706 MHz
-24.034 dBm
10 dB/div
Ref 30.00 dBm
Log
Center 433.9 MHz
#Res BW 10 kHz
#VBW 30 kHz
Span 500 kHz
#Sweep 6.2 ms
Occupied Bandwidth
389.37 kHz
Total Power 5.30 dBm
Transmit Freq Error 1.769 kHz
OBW Power 99.00 %
x dB Bandwidth 348.6 kHz
x dB -26.00 dB
MSG
STATUS

HTHV


Agilent Spectrum Analyzer - Occupied BW
Marker 1 433.71 MHz
Center Freq: 433.900000 MHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 40 dB
#IFGain:Low
Radio Std: None
Radio Device: BTS
09:18:25 PM Jun 21, 2022
Mkr1 433.705 MHz
-23.297 dBm
10 dB/div
Ref 30.00 dBm
Log
Center 433.9 MHz
#Res BW 10 kHz
#VBW 30 kHz
Span 500 kHz
#Sweep 6.2 ms
Occupied Bandwidth
387.94 kHz
Total Power 5.32 dBm
Transmit Freq Error -308 Hz
OBW Power 99.00 %
x dB Bandwidth 360.4 kHz
x dB -26.00 dB
MSG
STATUS

9 Transient Power

9.1 Standard Applicable

According to ETSI EN 300 220-1, section 5.10, transmitter transient power is power falling into frequencies other than the operating channel as a result of the transmitter being switched on and off.
The transient power shall not exceed the values given in Table 23.

Absolute offset from centre frequency	RBW_{REF}	Peak power limit applicable at measurement points
≤ 400 kHz	1 kHz	0 dBm
> 400 kHz	1 kHz	-27 dBm

9.2 Test Procedure

The output of the EUT shall be connected to a spectrum analyser or equivalent measuring equipment. The measurement shall be undertaken in zero span mode. The analyser's centre frequency shall be set to an offset from the operating centre frequency. These offset values and their corresponding RBW configurations are listed in Table 24.

Table 24: RBW for Transient Measurement

Measurement points: offset from centre frequency	Analyser RBW	RBW_{REF}
-0,5 x OCW - 3 kHz 0,5 x OCW + 3 kHz Not applicable for OCW < 25 kHz	1 kHz	1kHz
±12,5 kHz or ±OCW whichever is the greater	Max (RBW pattern 1, 3, 10 kHz) ≤ Offset frequency/6 (see note)	1 kHz
-0,5 x OCW - 400 kHz 0,5 x OCW + 400 kHz	100 kHz	1 kHz
-0,5 x OCW -1 200 kHz 0,5 x OCW + 1 200 kHz	300 kHz	1kHz
NOTE: Max (RBW pattern 1, 3, 10 kHz) means the maximum bandwidth that falls into the commonly implemented 1, 3, 10 kHz RBW filter bandwidth incremental pattern of spectrum analysers. EXAMPLE: If OCW is 25 kHz then the RBW value corresponding to one OCW offset frequency is 3 kHz. The rest of the analyser settings are listed in Table 25, and if OCW is 250 kHz then the RBW value corresponding to one OCW offset frequency is 30 kHz.		

Table 25: Parameters for Transient Measurement

Spectrum Analyser Setting	Value	Notes
VBW/RBW	10	At higher RBW values VBW may be clipped to its maximum value
Sweep time	500 ms	/
RBW filter	Gaussian	/
Trace Detector Function	RMS	/
Trace Mode	Max hold	/
Sweep points	501	/
Measurement mode	Continuous sweep	/
NOTE: The ratio between the number of sweep points and the sweep time shall be the same ratio as above if different number of sweep points is used.		

The used modulation shall be D-M3. The analyser shall be set to the settings of Table 25 and a measurement shall be started for each offset frequency. The EUT shall transmit at least five D-M3 test signal. The peak value shall be recorded and the measurement shall be repeated at each offset frequency mentioned in Table 24.

The recorded power values shall be converted to power values measured in RBW_{REF} by the formula in clause 4.3.10.1.

9.3 Test Result

Measurement points: offset from centre frequency (KHz)	Operating Channel Width (OCW) (KHz)	Measurement Frequency (MHz)	Analyser RBW (KHz)	RBWref (KHz)	Measured value at the Analyser RBW (dBm)	Limit (dBm)
(-0,5 x OCW - 3 kHz)	235	433.7995	1	1	-75.38	0
(+0,5 x OCW + 3 kHz)		434.0405	1	1	-66.83	0
min (-12,5 kHz, -OCW)		433.685	1/3/10	1	-69.45	-27
max (+12,5 kHz, OCW)		434.155	1/3/10	1	-79.15	-27
(-0,5 x OCW - 400 kHz)		433.4025	100	1	-66.58	-27
(+0,5 x OCW + 400 kHz)		434.4375	100	1	-70.69	-27
(-0,5 x OCW -1 200 kHz)		432.6025	300	1	-60.47	-27
(+0,5 x OCW + 1 200 kHz)		435.2375	300	1	-78.28	-27

10 TX Out of Band Emissions

10.1 Standard Applicable

TX Out of Band Emissions applies to all transmitters with OCW > 25 kHz.

According to ETSI EN 300 220-1 section 5.8. Two OOB domains are defined, one for OC (see Figure 5) and one for Operational Frequency band (see Figure 6). The spectrum masks for these two OOB domains may overlap.

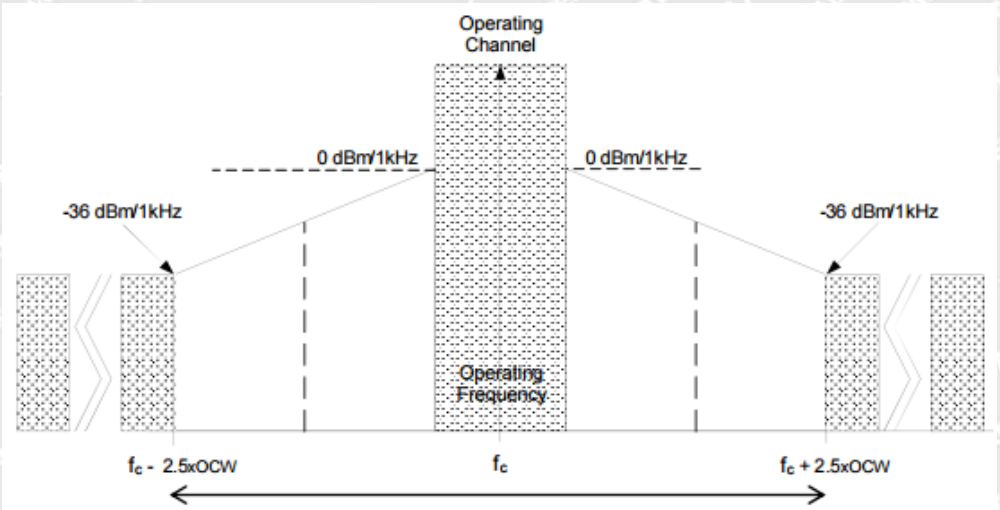


Figure 5: Out Of Band Domain for Operating Channel with reference BW

Unwanted emissions in the Out Of Band domain are those falling in the frequency range immediately below the lower, and above the upper, frequency of the Operating Channel. The OOB domain includes both frequencies outside the Operating Channel within the Operational Frequency Band and frequencies outside the Operational Frequency Band.

The relevant Out Of Band domain is shown in Figure 5 and applies within the Operational Frequency Band.

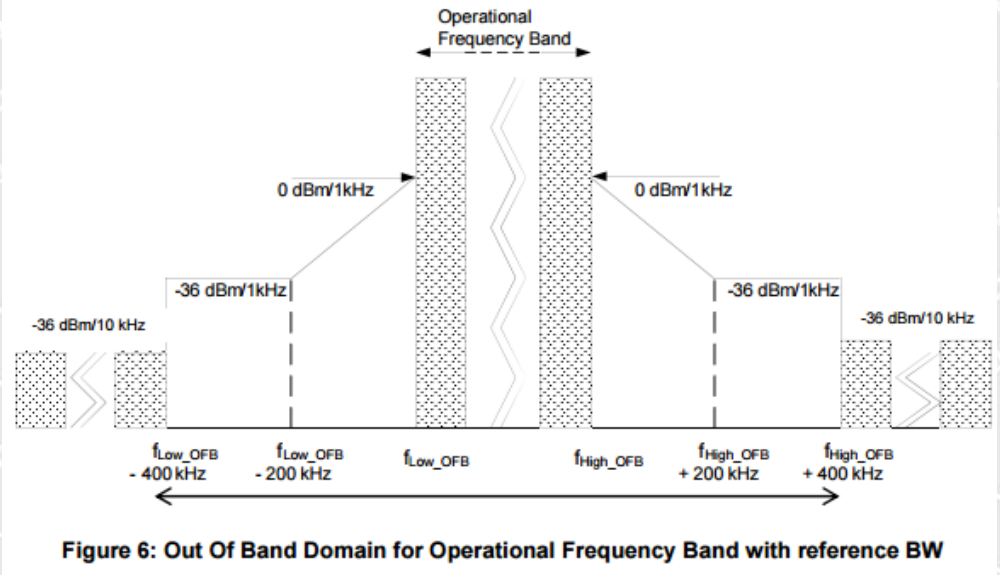


Figure 6: Out Of Band Domain for Operational Frequency Band with reference BW

Specific limits apply at frequencies immediately above and below the Operational Frequency Band as shown in Figure 6.

NOTE:

flow_OFB is the lower edge of the Operational Frequency Band.

fhigh_OFB is the upper edge of the Operational Frequency Band

The EUT emissions level in OOB domains for the Operating Channel and the Operational Frequency Band shall be less or equal to Table 15 spectrum mask.

Table 15: Emission limits in the Out Of Band domains

Domain	Frequency Range	RBW_{REF}	Max power limit
OOB limits applicable to Operational Frequency Band(See Figure 6)	$f \le f_{low\_OFB}$ - 400 kHz	10 kHz	-36 dBm
	F_{low_OFB} - 400 kHz ≤ f ≤ f_{low_OFB} - 200 kHz	1 kHz	-36 dBm
	f_{low} - 200 kHz ≤ f < f_{low_OFB}	1 kHz	See Figure 6
	$f = f_{low\_OFB}$	1 kHz	0 dBm
	$f = f_{high\_OFB}$	1 kHz	0 dBm
	F_{high_OFB} < f ≤ f_{high_OFB} + 200 kHz	1 kHz	See Figure 6
	F_{high_OFB} + 200 kHz ≤ f ≤ f_{high_OFB} + 400 kHz	1 kHz	-36 dBm
	F_{high_OFB} + 400 kHz ≤ f	10 kHz	-36 dBm
OOB limits applicable to Operating Channel (See Figure 5)	$f = f_c$- 2.5 x OCW	1 kHz	-36 dBm
	f_c - 2,5 x OCW ≤ f ≤ f_c - 0,5 x OCW	1 kHz	See Figure 5
	$f = f_c$ - 0,5 x OCW	1 kHz	0 dBm
	$f = f_c$ + 0,5 x OCW	1 kHz	0 dBm
	f_c + 0,5 x OCW ≤ f ≤ f_c + 2,5 x OCW	1 kHz	See Figure 5
	$f = f_c$+ 2,5 x OCW	1 kHz	-36 dBm
NOTE: f is the measurement frequency. fc is the Operating Frequency. F_{low_OF}B is the lower edge of the Operational Frequency Band. F_{high_OFB} is the upper edge of the Operational Frequency Band. OCW is the operating channel bandwidth.			

10.2 Test Procedure

Table 16: Test Parameters for Out Of Band for Operating Channel Measurement

Spectrum Analyser Setting	Value	Notes
Centre frequency	Operating Frequency	/
Span	6 x Operating Channel width	/
RBW	1 kHz (see note)	Resolution bandwidth for Out Of Band domain measurements
Detector Function	RMS	/
Trace Mode	Linear AVG	Applies only for EUT generating D-M2 test signal. An appropriate number of samples should be averaged to give a stable reading
	Max Hold	Applies only for EUT generating D-M2a or D-M3 test signal.
NOTE: If the value of RBW used is different from RBWREF in clause 5.8.2, use the bandwidth correction in clause 4.3.10.1.		

The test equipment shall be configured as appropriate for the parameters shown in Table 16.

Step 1: Operation of the EUT shall be started, on the highest operating frequency as declared by the manufacturer, with the appropriate test signal. The signal shape is recorded when stable and shall be below the spectrum mask Out Of Band for operating channel.

Step 2: The test equipment shall be reconfigured as appropriate for the parameter shown in Table 17.

Table 17: Test Parameter Setting for Lower Out Of Band Measurement

Spectrum Analyser Setting	Value	Notes
Centre frequency	fc_{low}	The lowest Operating Frequency in the band
Span	2 x (500 kHz + fc_{low} - f_{low_OFB})	Ensures that the left most mask specification remains within the span
NOTE: f_{low_OFB} is the lower edge of the Operational Frequency Band.		

Operation of the EUT is restarted, with the appropriate test signal, on the lowest operating frequency as declared by the manufacturer.

If the equipment is using only one operating Frequency in the operational Frequency Band, measurement shall be performed the nominal operating frequency.

The signal shape is recorded when stable; and shall be below the spectrum mask for operating channel and the spectrum mask for operational frequency band.

Step 3: The test equipment shall be reconfigured as appropriate for the parameter shown in Table 18.

Table 18: Test Parameter Setting for upper Out Of Band Measurement

Spectrum Analyser Setting	Value	Notes
Centre frequency	fc_{high}	The highest Operating Frequency in the band
Span	2 x (500 kHz + f_{high_OFB} - f_{chigh})	Ensures that the rightmost mask specification remains within the
NOTE: f_{high_OFB} is the higher edge of the Operational Frequency Band.		

Operation of the EUT is restarted, with the appropriate test signal, on the highest Operating Frequency as declared by the manufacturer.

If the equipment is using only one Operating Frequency in the Operational Frequency Band, measurement shall be performed at the nominal Operating Frequency

The signal shape is recorded when stable and shall be below the spectrum mask for Out Of Band emissions for operating channel and for operational Frequency Band.

Step 4: For frequency agile devices, the measurement shall be repeated in each Operational Frequency Band.

Step 5: Where required (see clause 5.8.3.1 condition 1), the measurements in step 1 to Step 5 shall be repeated under extreme test conditions.

10.3 Test Result

Test Condition	Frequency Range	Measurement Frequency (MHz)	Reading (dBm)	Limit (dBm)	Verdict
Normal	f c - 0.5 x OCW	433.8025	-78.53	0	Pass
	f c + 0.5 x OCW	434.0375	-62.4		Pass
	f c - 2.5 x OCW	433.3325	-66.53	-36	Pass
	f c + 2.5 x OCW	434.5075	-79.57		Pass
LTLV	f c - 0.5 x OCW	433.8025	-77.25	0	Pass
	f c + 0.5 x OCW	434.0375	-57.06		Pass
	f c - 2.5 x OCW	433.3325	-67.51	-36	Pass
	f c + 2.5 x OCW	434.5075	-85.73		Pass
LTHV	f c - 0.5 x OCW	433.8025	-78.86	0	Pass
	f c + 0.5 x OCW	434.0375	-58.96		Pass
	f c - 2.5 x OCW	433.3325	-67.65	-36	Pass
	f c + 2.5 x OCW	434.5075	-86.82		Pass
HTLV	f c - 0.5 x OCW	433.8025	-74.62	0	Pass
	f c + 0.5 x OCW	434.0375	-60.01		Pass
	f c - 2.5 x OCW	433.3325	-66.93	-36	Pass
	f c + 2.5 x OCW	434.5075	-85.19		Pass
HTHV	f c - 0.5 x OCW	433.8025	-68.81	0	Pass
	f c + 0.5 x OCW	434.0375	-60.43		Pass
	f c - 2.5 x OCW	433.3325	-68.91	-36	Pass
	f c + 2.5 x OCW	434.5075	-84.3		Pass

*Remark: OCW: 235kHz, Operating Centre Frequency: 433.92MHz

11 TX Behaviour Under Low Voltage Conditions

11.1 Applicable Standard

According to ETSI EN 300 220-1 section 5.12

The equipment shall either:

a) remain in the Operating Channel OC without exceeding any applicable limits (e.g. Duty Cycle); or

b) reduce its effective radiated power below the Spurious Emission limits without exceeding any applicable limits (e.g. Duty Cycle); or

c) shut down, (ceasing function);

as the voltage falls below the manufacturers declared operating voltage.

11.2 Test Procedure

Step 1: Operation of the EUT shall be started, on Operating Frequency as declared by the manufacturer, with the appropriate test signal and with the EUT operating at nominal operating voltage. The centre frequency of the transmitted signal shall be measured and noted.

Step 2: The operating voltage shall be reduced by appropriate steps until the voltage reaches zero. The centre frequency of the transmitted signal shall be measured and noted. Any abnormal behaviour shall be noted.

11.3 Test Result

The EUT remains on the operating frequency when the power source was reduced below the lower extreme voltage level. The EUT ceases to function below the voltage **DC 2.1V**.

12 Unwanted Emissions In The Spurious Domain

12.1 Limit of Spurious Emissions

According to ETSI EN 300 220-1 section 5.9, the power of any unwanted emission in the spurious domain shall not exceed the values given in the following table.

Table 19: Spurious domain emission limits

Frequency / State	47 MHz to 74 MHz 87,5 MHz to 118 MHz 174 MHz to 230 MHz 470 MHz to 790 MHz	Other frequencies below 1 000 MHz	Frequencies above 1 000 MHz
TX mode	-54 dBm	-36 dBm	-30 dBm
RX and all other modes	-57 dBm	-57 dBm	-47 dBm

12.2 Test Procedure

Tx was placed on a nonmetal table which is 1.5 meter above the grounded reference plane and set to work in normal operation mode. Details refer to ETSI EN 300 220-1 subclause 5.9.

The EUT was operating at normal to represent worst case during final qualification test.

12.3 Test Result

Frequency (MHz)	Receiver Reading (dBμV)	Turn table Angle (°)	RX Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable (dB)	Antenna Gain (dB)			
TX mode										
867.91	49.53	234	1.9	H	-45.91	0.22	0.00	-45.69	-36	-9.69
867.91	45.45	262	1.6	V	-49.97	0.22	0.00	-49.75	-36	-13.75
4849.59	50.52	143	1.5	H	-40.66	2.64	12.70	-50.72	-30	-20.72
4849.59	43.23	290	1.3	V	-45.01	2.64	12.70	-55.07	-30	-25.07
5851.58	49.84	172	1.1	H	-39.25	2.90	12.90	-49.25	-30	-19.25
5851.58	45.35	158	1.0	V	-43.05	2.90	12.90	-53.05	-30	-23.05

Frequency (MHz)	Receiver Reading (dBμV)	Turn table Angle (°)	RX Antenna		Substituted			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Height (m)	Polar (H/V)	SG Level (dBm)	Cable (dB)	Antenna Gain (dB)			
RX mode										
867.81	22.56	307	1.8	H	-72.88	0.22	0.00	-72.66	-57	-15.66
867.81	20.28	283	1.1	V	-75.14	0.22	0.00	-74.92	-57	-17.92
5032.89	49.18	274	1.9	H	-40.24	2.79	12.70	-50.15	-47	-3.15
5032.89	43.37	303	1.5	V	-45.58	2.79	12.70	-55.49	-47	-8.49
5743.18	47.70	309	2.0	H	-41.59	2.87	12.90	-51.62	-47	-4.62
5743.18	44.72	304	2.0	V	-43.73	2.87	12.90	-53.76	-47	-6.76

13 Blocking

13.1 Standard Applicable

According to ETSI EN 300 220-1 section 5.18, blocking is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted input signal at any frequencies other than those of the spurious responses or the adjacent channels or bands,

The blocking level shall not be less than the values given in the following table, except at frequencies on which spurious responses are found.

Table 1: Receiver categories

Receiver category	Description
1	Category 1 is a high performance level of receiver. In particular to be used where the operation of a SRD may have inherent safety of human life implications.
1.5	Category 1.5 is an improved performance level of receiver category 2.
2	Category 2 is standard performance level of receiver.
3	Category 3 is a low performance level of receiver. Manufacturers have to be aware that category 3 receivers are not able to work properly in case of coexistence with some services such as a mobile radio service in adjacent bands. The manufacturer shall provide another mean to overcome the weakness of the radio link or accept the failure.

Table 40: Blocking level parameters for RX category 3

Requirement	Limits
	Receiver category 3
Blocking at ±2 MHz from OC edge f_{high} and f_{low}	≥ -80 dBm
Blocking at ±10 MHz from OC edge f_{high} and f_{low}	≥ -60 dBm
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	≥ -60 dBm

Table 41: Blocking level parameters for RX category 2

Requirement	Limits
	Receiver category 2
Blocking at ±2 MHz from OC edge f_{high} and f_{low}	≥ -69 dBm
Blocking at ±10 MHz from OC edge f_{high} and f_{low}	≥ -44 dBm
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	≥ -44 dBm

Table 42: Blocking level parameters for RX category 1.5

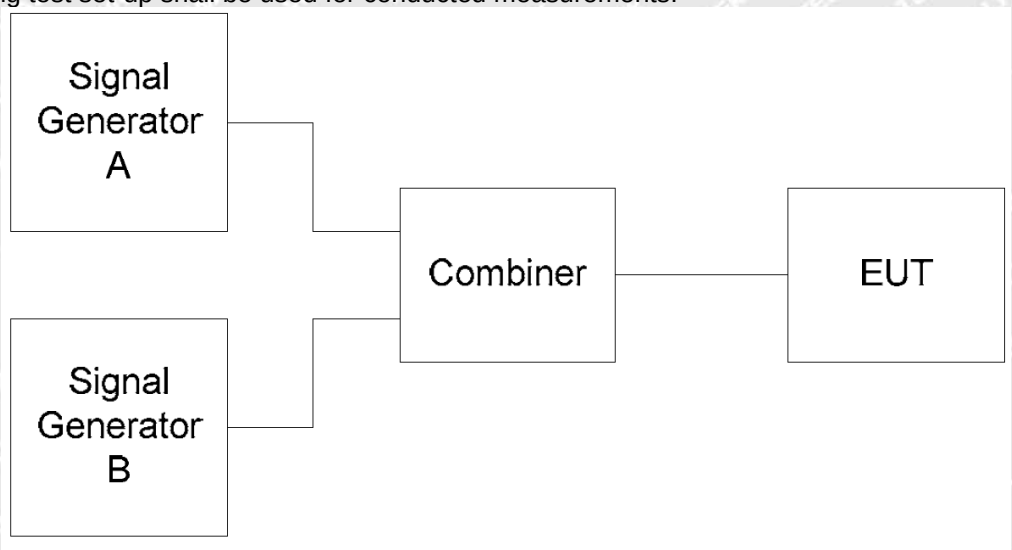
Requirement	Limits
	Receiver category 1.5
Blocking at ±2 MHz from OC edge f_{high} and f_{low}	≥ -43 dBm
Blocking at ±10 MHz from OC edge f_{high} and f_{low}	≥ -33 dBm
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	≥ -33 dBm

Table 42: Blocking level parameters for RX category 1

Requirement	Limits
	Receiver category 1
Blocking at ±2 MHz from Centre Frequency	≥ -20 dBm
Blocking at ±10 MHz from Centre Frequency	≥ -20 dBm
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	≥ -20 dBm

13.2 Test Procedure

The following test set-up shall be used for conducted measurements.



Two signal generators A and B shall be connected to the receiver via a combining network to the receiver antenna connector.

For equipment with integral antenna the connection to the equipment is made either to a temporary antenna connector or via a validated test fixture.

Signal generator A shall be at the nominal frequency of the receiver, with normal modulation of the wanted signal.

Signal generator B shall be unmodulated.

Measurements shall be carried out at frequencies of the unwanted signal at approximately ±2 MHz and ±10 MHz, avoiding those frequencies at which spurious responses occur.

Initially signal generator B shall be switched off and using signal generator A the level which still gives sufficient response shall be established, however, the level at the receiver input shall not be adjusted below the sensitivity limit given in clause 8.1.4. The output level of generator A shall then be increased by 3 dB.

Signal generator B is then switched on and adjusted until the wanted criteria (see clause 8.1.1) is just exceeded. With signal generator B settings unchanged the power into the receiver is measured by replacing the receiver with a power meter or spectrum analyzer. This level shall be recorded.

For equipment using LBT (which can be Receiver category 1 or 2) the above measurements shall be repeated with signal generator A level adjusted +13 dB higher than in the measurements above (this is equal to a level of +16 dB above the sensitivity).

Additionally, for category 1 receivers it is necessary to determine the receiver saturation by repeating the above measurements with a +40 dB increased level for signal generator A.

Alternatively, equipment having a dedicated or integral antenna may use a radiated measurement setup. For this, a test site from clause A.1 shall be selected and the requirements from clauses A.2 and A.3 apply.

Signal generators A and B together with a combiner shall be placed outside the anechoic chamber and a TX test antenna shall be placed with the EUT's antenna polarisation. The EUT shall be placed at the location of

the turntable at the orientation of the most sensitive position. Generator A shall be set in order to reach the EUT sensitivity limit +3 dB.

The procedure shall be the same as for the conducted measurement. Bloking is the difference between signal generator B and signal generator A levels.

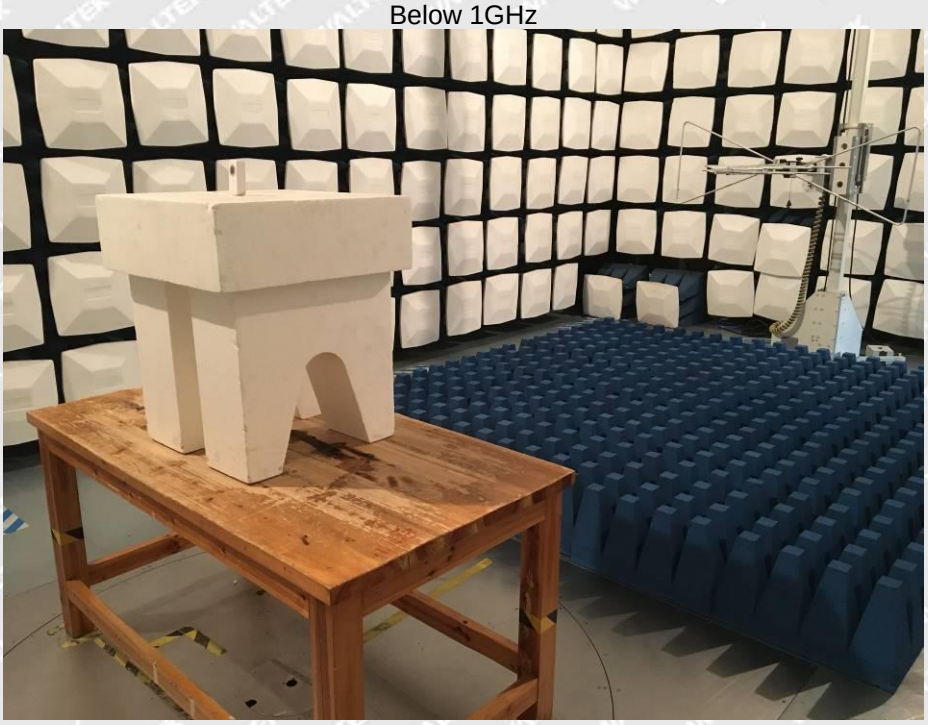
13.3 Test Result

Canter Frequency(MHz)	TEST Frequency (MHz)	OCW (kHz)	Reading (dBm)	Limit (dBm)	Result
433.92	OC+2MHz	235	-19.5	≥-69	Pass
	OC-2MHz		-22.19	≥-69	Pass
	OC+10MHz		-18.61	≥-44	Pass
	OC-10MHz		-17.58	≥-44	Pass
	OC+5%FC(or 15MHz)		-18.17	≥-44	Pass
	OC-5%FC(or 15MHz)		-14.2	≥-44	Pass

14 Photographs —Test Setup

14.1 Photograph –Spurious Emissions Test Setup For Transmitter

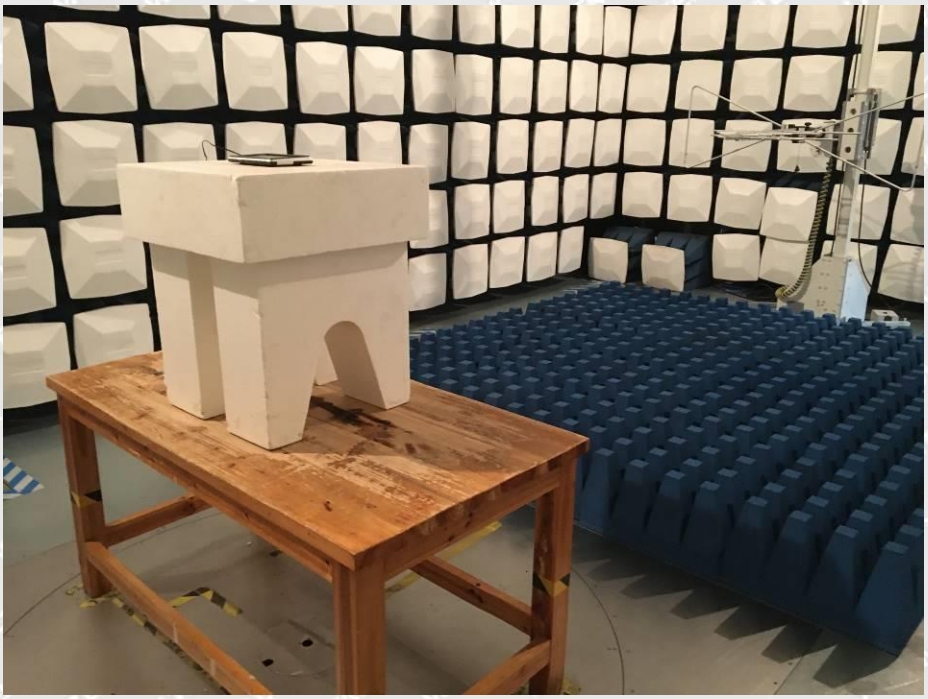
Below 1GHz



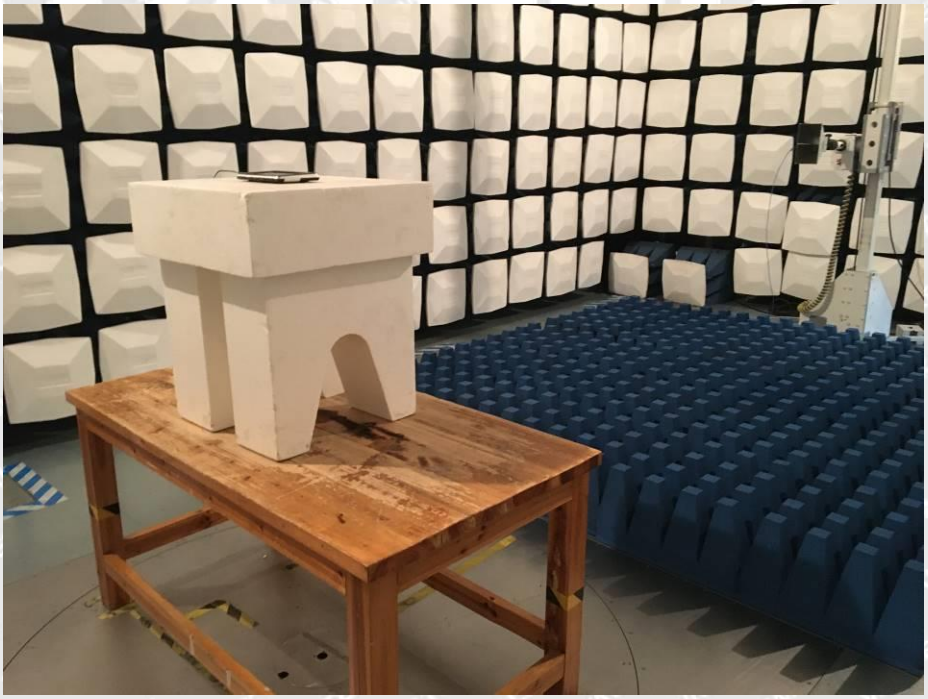
Above 1GHz

14.2 Photograph –Spurious Emissions Test Setup For Receiver

Below 1GHz



Above 1GHz



15 Photographs - Constructional Details

15.1 EUT – External Photos

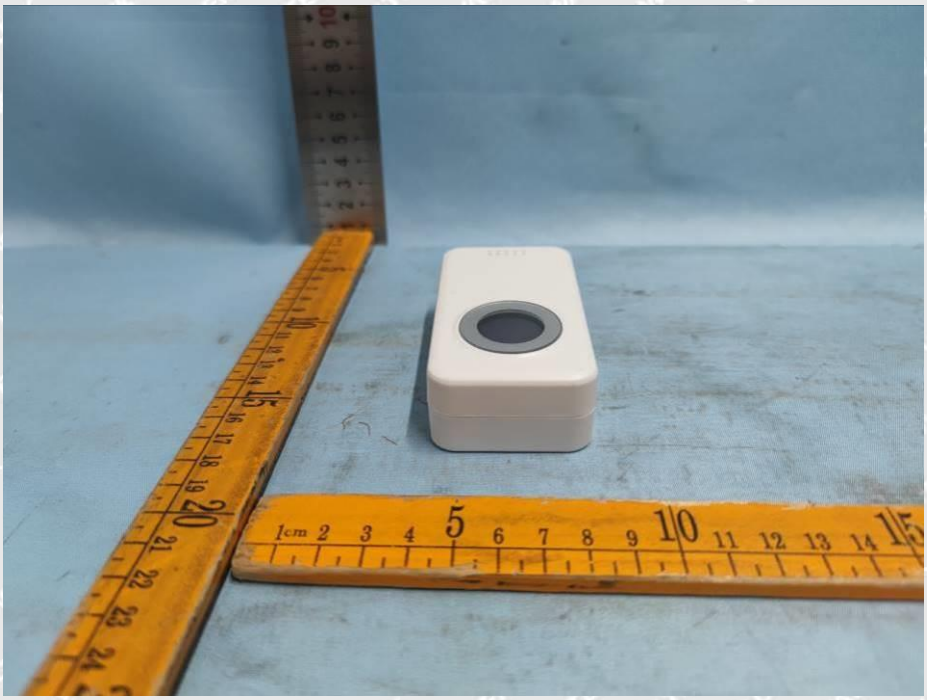
Indoor Unit


MAX/MIN
ALERTS
UP
CHANNEL
SNOOZE/LIGHT
MODE
DOWN


CHARGE
USB DEVICE
Output: 1.0Amps
DC 5V

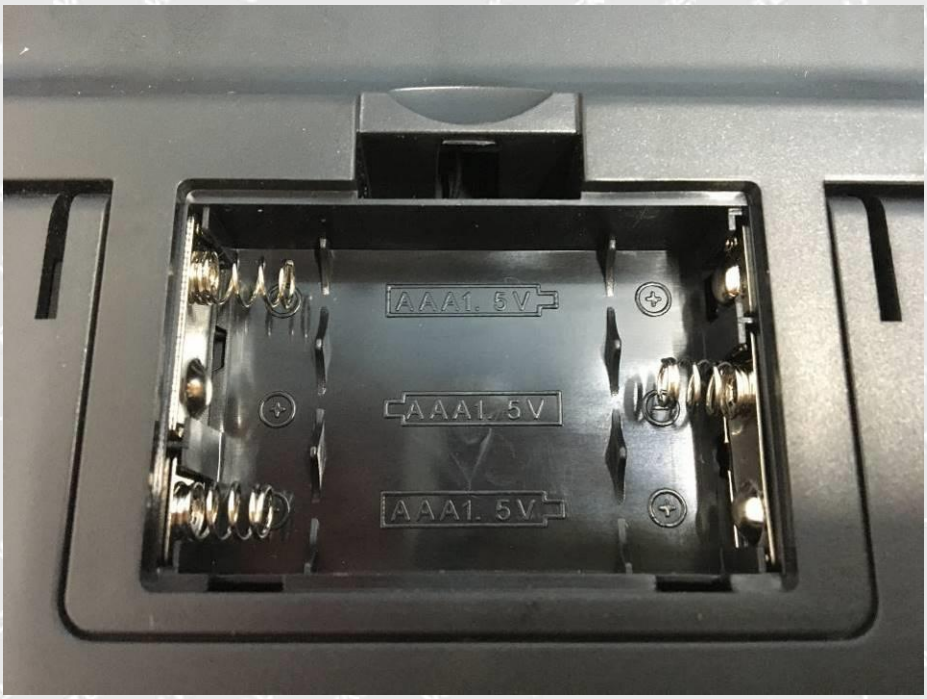

SWITCHING ADAPTER
Model No.:HX075-0501200-AG-001
Input:100-240V ~ 50/60Hz 0.3A Max
Output:5.0V 1.2A 6.0W
No.200,Technology East Road,Shijie Town,Dongguan City,Guangdong,P.R.China
Dongguan Shijie Hua Xu Electronics Factory
2204HX
MADE IN CHINA

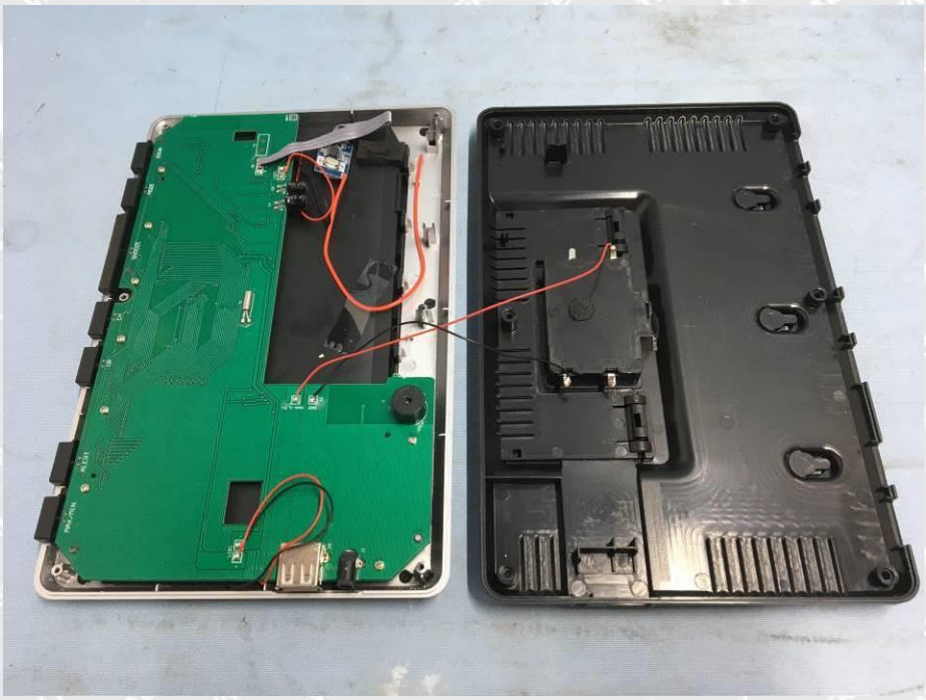
Outdoor Unit

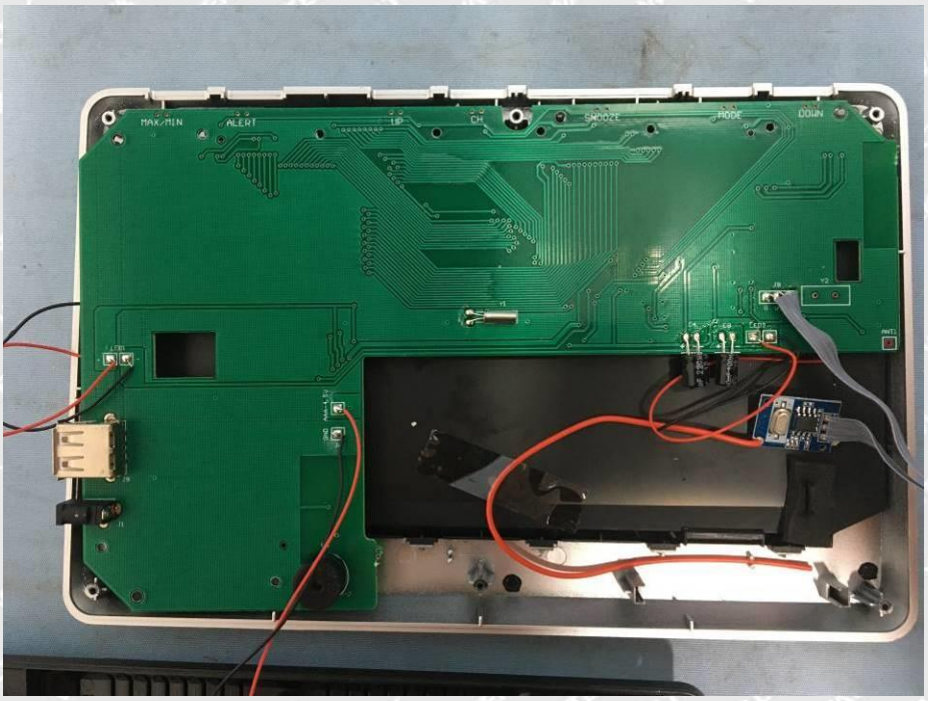


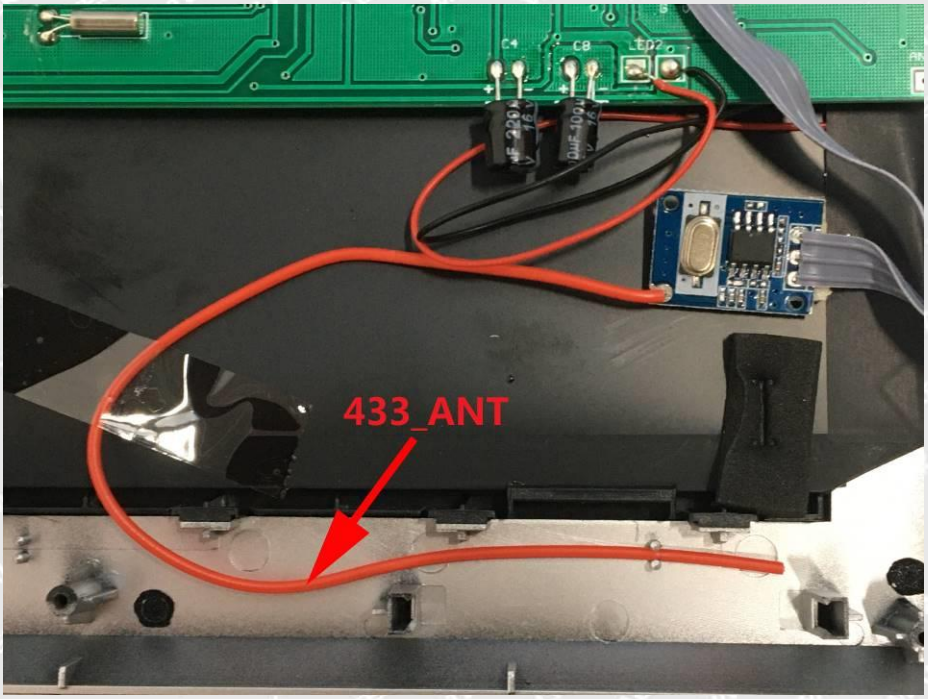
15.2 EUT – Internal Photos

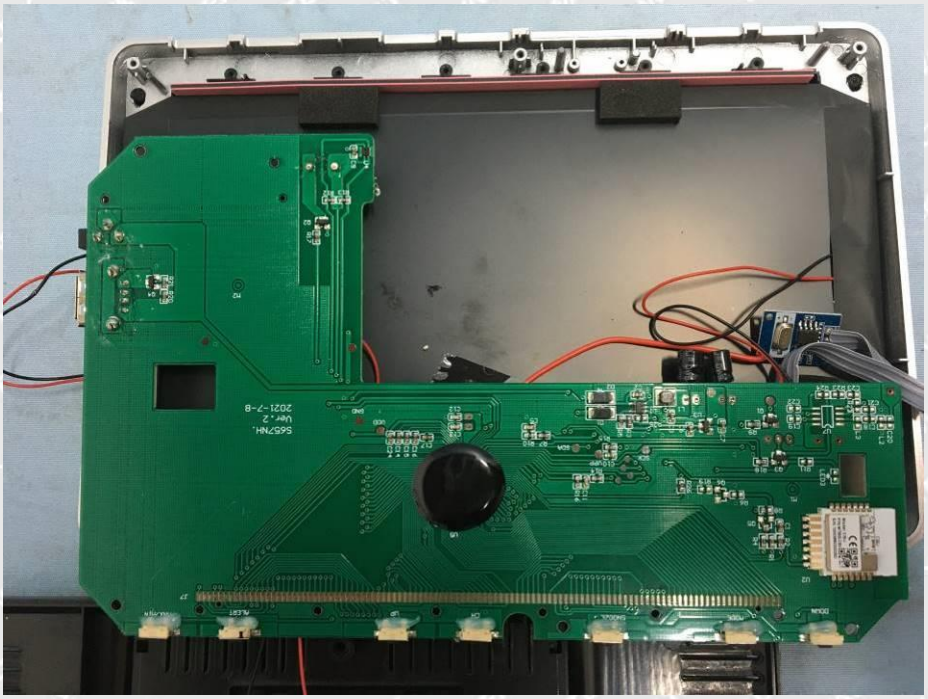
Indoor Unit

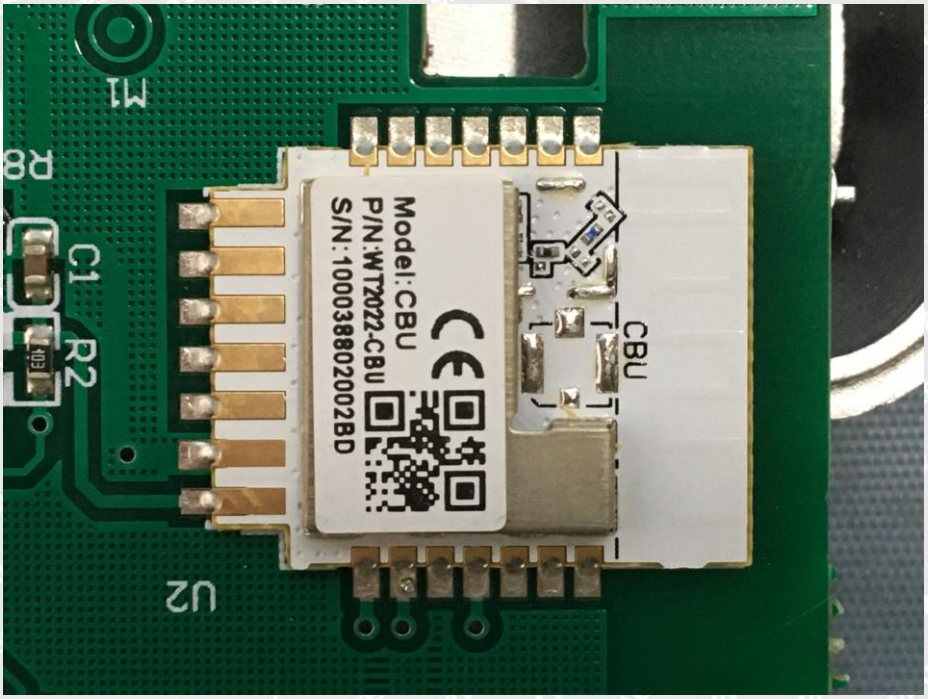


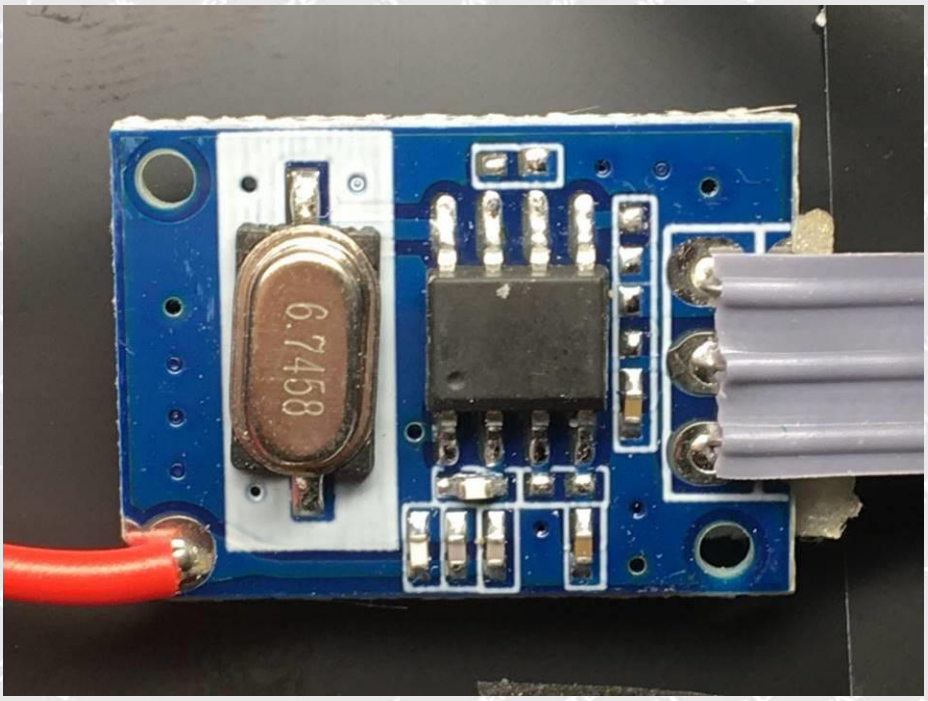


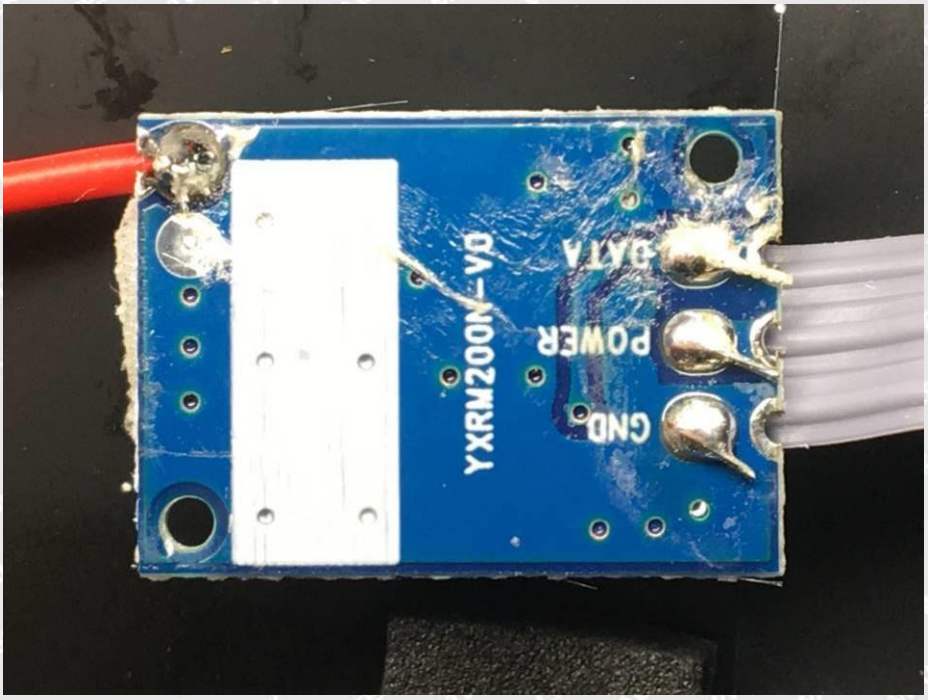

MAX/MIN
ALERT
CH
SNOOZE
MODE
DOWN


433_ANT

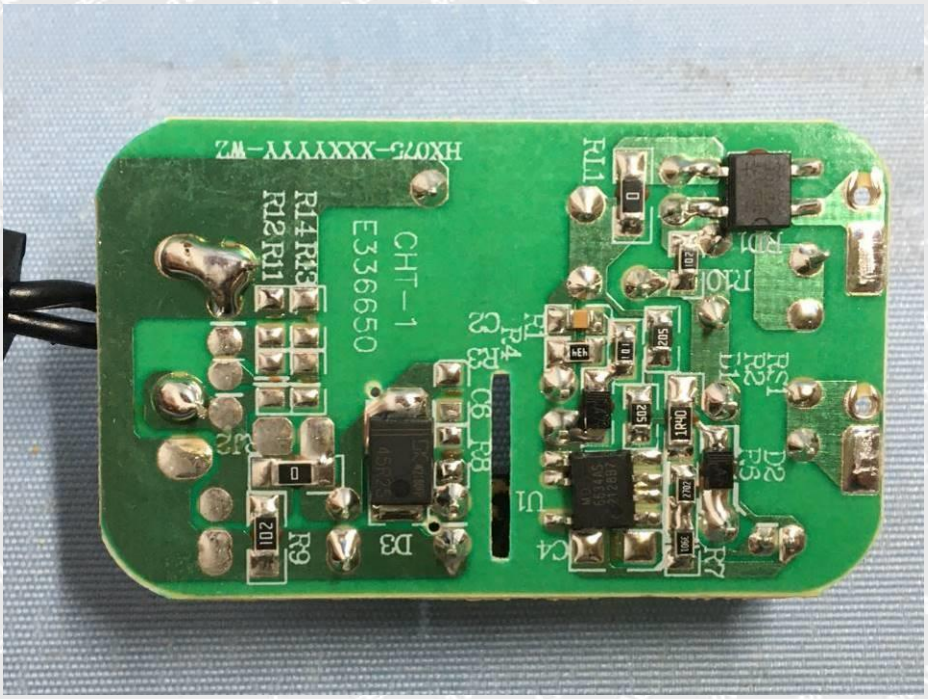



M1
R8
C1
R2
U2
Model:CBU
P/N:WT2022-CBU
S/N:1000388020028D
CBU

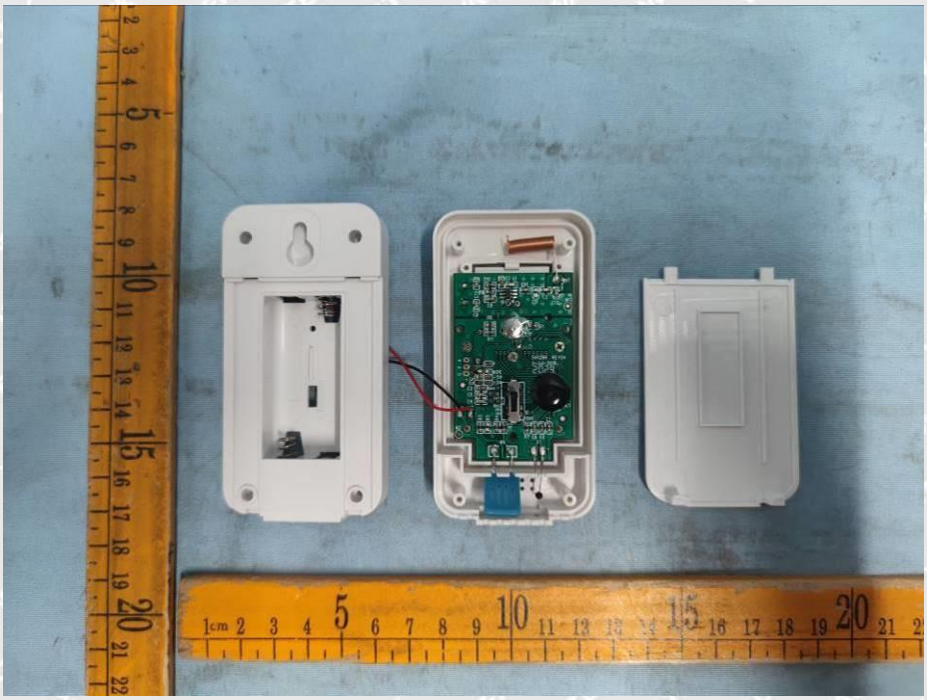

6.7458

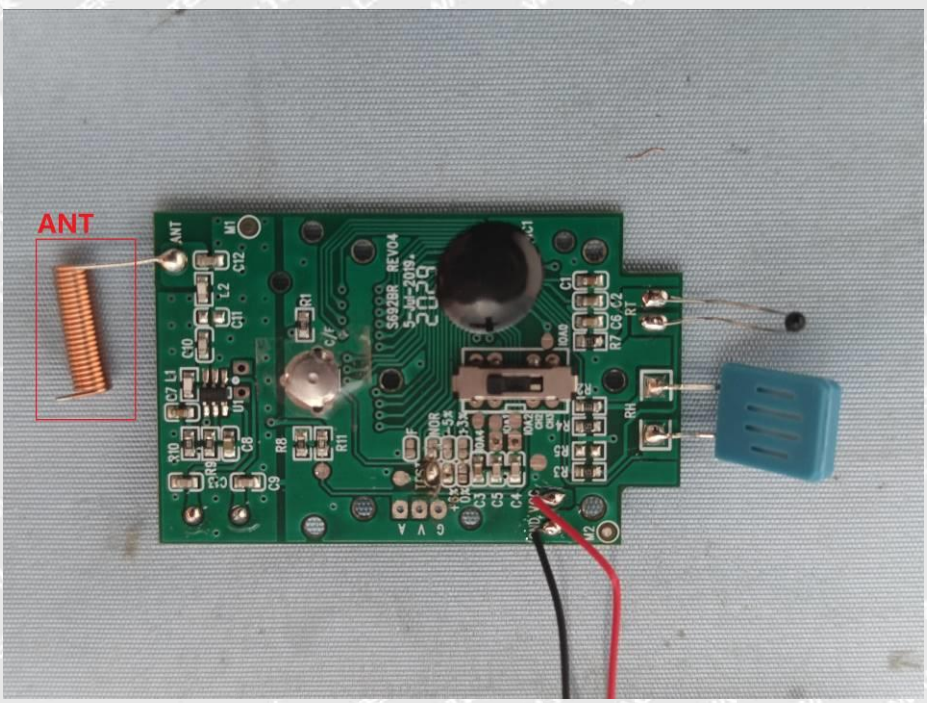

YXRM200N-V0
DATA
POWER
GND

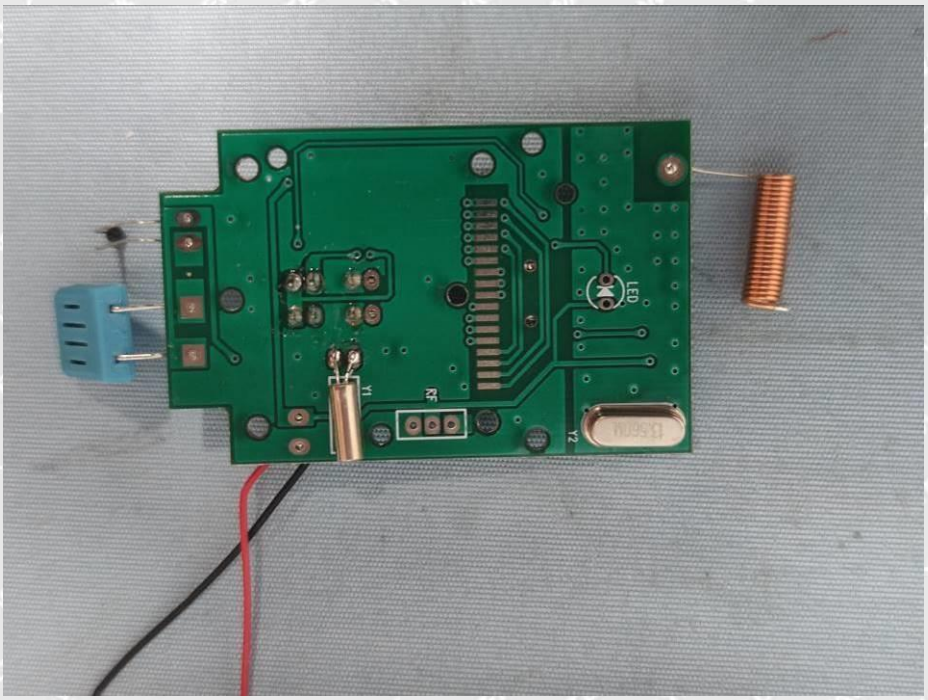

HX075-T-1
1.5mH
CHT-1
CE5
CE4
CE2
CY1
CX1
F1
E123995


HX075-XXXXYYY-W2
CHT-1
E336650
RL1
R4
R3
R12
R11
R9
D3
U1
C4

Outdoor Unit







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

TEST REPORT

Reference No.	:	WTF22F05100007W
Applicant	:	Mid Ocean Brands B.V.
Address	:	7/F., Kings Tower, 111 King Lam Street, Cheung Sha Wan, Kowloon, Hong Kong
Manufacturer	:	111590
Product Name	:	Weatherstation
Model No.	:	MO6664
Test specification	:	EN IEC 62311:2020 EN 50665:2017
Date of Receipt sample	:	2022-07-01
Date of Test	:	2022-07-19
Date of Issue	:	2022-08-02
Test Report Form No.	:	WEW-62311A-01A
Test Result	:	**Pass**

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

Prepared By:
Waltek Testing Group (Foshan) Co., Ltd.
Address: No.13-19, 2/F., 2nd Building, Sunlink International Machinery City,
Chencun, Shunde District, Foshan, Guangdong, China
Tel:+86-757-23811398 Fax:+86-757-23811381 E-mail:info@waltek.com.cn

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

2 Contents

3 General Information

3.1 General Description of E.U.T.

Product Name	:	Weatherstation
Model No.	:	MO6664
Remark	:	---
Rated Voltage	:	**Outdoor Unit:** Battery 3V (2*1.5V AAA) **Indoor Unit:** Battery 4.5V (3*1.5V AAA)
Battery Capacity	:	---
Adapter Model	:	HX075-0501200-AG-001 (For indoor unit only) Input: 100-240V~, 50/60Hz, 0.3A Max Output: DC 5V, 1.2A, 6.0W

3.2 Technical Specification For WiFi Mode

Frequency Range	:	2412~2472MHz for 802.11b/g/n(HT20) 2422~2462MHz for 802.11n(HT40)
Maximum RF Output Power	:	17.34 dBm (EIRP)
Type of Modulation	:	DSSS, OFDM
Quantity of Channels	:	13 for 802.11b/g/n(HT20); 9 for 802.11n(HT40)
Channel Separation	:	5MHz
Antenna installation	:	PCB Printed Antenna
Antenna Gain	:	2.2dBi
Oscillator	:	40MHz

3.3 Technical Specification For 433.92MHz Mode

Operational Frequency Band	:	433.05MHz-434.79MHz
Operating Frequency	:	433.92MHz
Maximum RF Output Power	:	4.077 dBm (ERP)
Type of Modulation	:	ASK
Quantity of Channels	:	1
Antenna installation	:	Spring Antenna for TX Whip Antenna for RX
Antenna Gain	:	0dBi
Oscillator	:	TX: 13.56MHz; RX: 6.7458MHz

3.4 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).

3.5 Disclaimer

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

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/m2)
0-1 Hz	-	3.2×10^4	4×10^4	-
1-8 Hz	10000	$3.2\times10^4/f^2$	$4\times10^4/f^2$	-
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

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

E= E Field Strength (V/m)

P= Maximum RF Output Power (W)

G= Antenna Gain (Numeric)

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

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.

The temperature and related humidity: 18°C and 78% RH.

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.

Test Mode	Antenna Gain (Numeric)	Maximum Output Power (dBm)	Maximum Output Power (mW)	E Field Strength (V/m)	E Field Strength Limit (V/m)	Result
WiFi	1.66	17.34*	54.20	8.21	61	Pass
433.92MHz	1	4.077**	2.56	1.38	28.64	Pass

* Note: The details of Output Power test data refer to test report WTF22F05099992W.
** Note: The details of Output Power test data refer to test report WTF22F05099995W.

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