



ERM Test Report: ETSI EN 300 220-2 V3.1.1

**Short Range Device (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 the Directive 2014/53/EU for non specific radio
equipment**

Devices tested:

lrwccx-mpcie-868

Customer: n-fuse GmbH

Test Report No.: n-fuse/220/2018/185

**IMST GmbH
Frank Tofahrn
Jens Lerner**

July 30th, 2018

Administrative Summary

IMST GmbH

Dept. Test Center

Carl-Friedrich-Gauss-Strasse 2-4

D-47475 Kamp-Lintfort

Germany

Tel. +49 2842 981-0

Subject: ETSI EN 300 220-2 V3.1.1

Device : Irwccx-mpcie-868

Customer: n-fuse GmbH
Ossietzkystrasse 4
70174 Stuttgart, Germany

The devices have PASSED the tests hereunder with limitations.

Test Engineer: Frank Tofahrn, ERM Test Lab

Date: July 30th, 2018

Originator: 

Frank Tofahrn
Test Engineer

Approved: 

Jens Lerner
Quality Assurance

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1 Introduction

The objective of the investigation hereunder, was to perform testing of the devices “Irwccx-mpcie-868” for customer n-fuse GmbH, in accordance with the harmonized Standard EN 300 220-2 V3.1.1 covering the essential requirements of article 3.2 of the Directive 2014/53/EU for non specific radio equipment.

The test results herein refer to the tested sample(s) only.

2 General

	Manufacturer Information	Customer Information
Company Name	n-fuse GmbH	
Street Name, No.	Ossietzkystrasse 4	
PLZ/ZIP City	70174 Stuttgart	
Country	Germany	
Contact Person	Thomas Hoppe	
Phone	+49 (0)1601218888	
E-Mail	Thomas.hoppe@n-fuse.co	

Table 2.1: General Information about Manufacturer / Customer

Subject: Electromagnetic Radio Spectrum Matters (ERM)

Test Engineer: Frank Tofahrn
IMST GmbH, Germany

Place of test: Testcenter at IMST GmbH, ERM Test Lab,
Kamp-Lintfort, Germany

Persons present during testing:

IMST GmbH
Frank Tofahrn

n-fuse GmbH
N/A

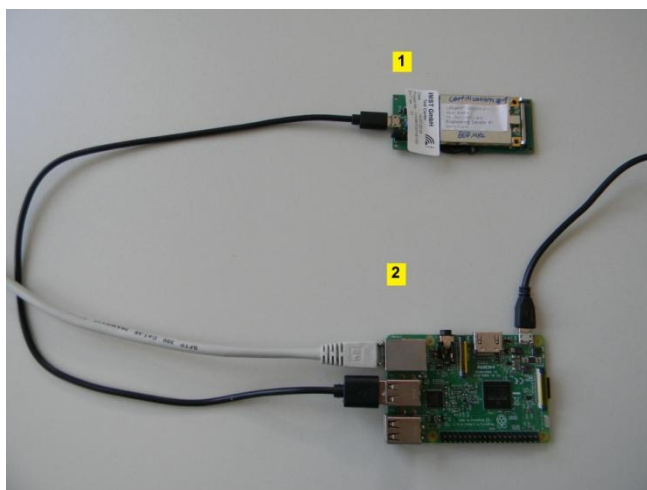
3 Description of the Device under Test (DUT)

3.1 General

Device :	Irwccx-mpcie-868
Serial No.:	n-fuse/220/18/185 (IMST-Marking)
Operating voltage:	5V (USB)
Frequency:	867,1 – 868,5 MHz
Bandwidth:	150 kHz
Modulation:	LORA 125



Picture 3.1: DUT Irwccx-mpcie-868 – Sample 1



Picture 3.2: DUT Setup 1: Irwccx-mpcie-868; 2: Raspberry Pi Control Unit

3.2 DUT-Modes of Operation

Device Designator:	lrvccx-mpcie-868
Marking of Units:	n-fuse/220/18/185 (IMST Marking)
Equipment Type:	Wideband
RF Output Power:	<14 dBm / 868 MHz
Frequency Range, Operational:	868 MHz Band L & M
Type of Modulation:	LORA
Duty Cycle:	N/A
Listen-Before-Talk Capability:	N/A
Single Frequency Operation:	N/A
Spread Spectrum Capability:	N/A
Receiver Category:	1.5
Environmental Conditions	
Temperature Range, Operational:	0 °C to +80 °C
Power Supply:	USB
Nominal Supply Voltage:	5 V
Supply Voltage Range:	N/A
Test Mode Capabilities:	
Test modulation to be used:	D-M3

Table 3.3: Characteristics of the DUT

3.2.1 DUT Setup

Normal setup

3.2.2 DUT Peripherals

None

3.2.3 DUT Modifications

None

3.2.4 Supporting Equipment

Raspberry Pi

3.2.5 Firmware on the module

None

3.2.6 External software used for the test

util_tx_continuous Version 0.2.2, util_tx_test Version 0.0.2, util_pkt_logger

All located and executed on the Raspberry Pi

4 Overview: Conformance Requirements and Tests Applied

Harmonised Standard ETSI EN 300 220-2				
Requirement			Requirement Conditionality	
No	Description	Reference: Clause No	U/C	Condition
1	Operating frequency	4.2.1	U	
2	Unwanted emissions in the spurious domain	4.2.2	U	
3	TX effective radiated power	4.3.1	U	
4	TX Maximum e.r.p. spectral density	4.3.2	€	Applies to EUT using annex B bands I, L. Applies to EUT using DSSS or wideband techniques other than FHSS modulation, using annex C band X.
5	TX Duty cycle	4.3.3	€	Not applicable to EUT with polite spectrum access where permitted in annex B, table B.1 or annex C, table C.1 or any NRI.
6	TX Occupied bandwidth	4.3.4	U	
7	TX out of band emissions	4.3.5	C	Applies to EUT with OCW > 25 kHz.
8	TX Transient	4.3.6	U	
9	TX Adjacent channel power	4.3.7	€	Applies to EUT with OCW ≤ 25 kHz.
10	TX behaviour under low voltage conditions	4.3.8	€	Applies to battery powered EUT.
11	TX Adaptive power control	4.3.9	€	Applies to EUT with adaptive power control using annex C band AA.
12	TX FHSS	4.3.10	€	Applies to FHSS EUT.
13	TX Short term behaviour	4.3.11	€	Applies to EUT using annex C bands Y, Z, AA, AB, AC, AD.
14	RX sensitivity	4.4.1	€	Applies to EUT with polite spectrum access.
15	Clear channel assessment threshold	4.5.2	€	Applies to EUT with polite spectrum access.
16	Polite spectrum access timing parameters	4.5.3	€	Applies to EUT with polite spectrum access.
17	RX Blocking	4.4.2	U	
18	Adaptive Frequency Agility	4.5.4	€	Applies to EUT with AFA.

Table 4.1: Conformance Requirements

Key to columns:**Requirement:**

- No** A unique identifier for one row of the table which may be used to identify a requirement.
- Description** A textual reference to the requirement.
- Clause Number** Identification of clause(s) defining the requirement in the present document unless another document is referenced explicitly.

Requirement Conditionality:

- U/C** Indicates whether the requirement shall be unconditionally applicable (U) or is conditional upon the manufacturers claimed functionality of the equipment (C).
- Condition** Explains the conditions when the requirement shall or shall not be applicable for a requirement which is classified "conditional".

Presumption of conformity stays valid only as long as a reference to the present document is maintained in the list published in the Official Journal of the European Union. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

5 Detailed Test Results

5.1 Transmitter Requirements

5.1.1 Operating Frequency

5.1.1.1 Reference

EN 300 220-2 V3.1.1, reference clause 4.2.1

5.1.1.2 Test Conditions

Values declared by the provider

5.1.1.3 Measurement Setup

No test

5.1.1.4 Manufacturer Declaration

Value	Notes
Operational Frequency band or bands	Band L / Band M
Nominal Operating Frequency or Frequencies	867,1 / 867,9 / 868,1 / 868,5 MHz
Operating Channel width(s) - OCW -	150 kHz

Table 5.1: Operating Frequency

5.1.2 Frequency Error or Frequency Drift

5.1.2.1 Reference

EN 300 220-1 V3.1.1, reference clause 5.7

5.1.2.2 Test Conditions

Extreme Conditions

5.1.2.3 Measurement Setup

Modifications to measurement setup: None

Measurement equipment used: [2]

Actual measurement uncertainty: N/A

5.1.2.4 Measurement Results

Value	Measured Frequency (MHz)
Measured Operating Frequency / MHz	N/A
Carrier frequency under lower extreme test conditions / MHz	N/A
Carrier frequency under higher extreme test conditions / MHz	N/A
Frequency error (upper) / kHz	N/A
Frequency error (lower) / kHz	N/A

Table 5.2: Result Table Frequency Error

Remark: No test. Device cannot generate an unmodulated carrier.

Result: N/A

5.1.3 Unwanted Emissions in the Spurious Domain

5.1.3.1 Reference

EN 300 220-2 V3.1.1, reference clause 4.2.2

5.1.3.2 Test Conditions

Operational Modes: TX only mode

Environmental Conditions: Normal

5.1.3.3 Limits

State	Frequency/[MHz]		
	47 to 74 87.5 to 118 174 to 230 470 to 862	Other frequencies below 1000	Frequencies above 1000
Operating	4 nW	250 nW	1 μ W
Standby	2 nW	2 nW	20 nW

Table 5.3: Limits for Spurious Emissions

Modifications to measurement setup: None

Test equipment used: [2], [4], [5], [104]

Actual measurement uncertainty: $<\pm 2$ dB, the Standard requests: ± 6 dB.

5.1.3.4 Measurement Results

No relevant spurious detected

Remark: None

Result: The devices PASSED the test without limitations.

5.1.4 TX effective radiated power

5.1.4.1 Reference

EN 300 220-2 V3.1.1, reference clause 4.3.1

5.1.4.2 Test Conditions

Normal conditions

5.1.4.3 Limits

See table B.1 and C.1 in Annex B of EN 300 220-2 V3.1.1

5.1.4.4 Measurement Setup

Measurement setup according to the standard applied hereunder.

Modifications to measurement setup: None

Measurement equipment used: [2], [4], [20], [104]

Actual measurement uncertainty: ± 1.5 dB, the Standard requests: ± 6 dB

5.1.4.5 Measurement Results

Frequency / MHz	0°C / dBm	25°C / dBm	80°C / dBm
867,10	13,40	12,05	10,56
867,90	13,34	12,09	10,59
868,10	13,31	12,07	10,62
868,50	13,29	11,98	10,66

Table 5.4: Result Table

Remark: Conducted test. An antenna gain of 0 dBd is assumed.

Note that in some countries a PSD limit applies for Band L. In this case the output power has to be reduced accordingly.

The program util_tx_continuous has been used for this test with the following parameters:

```
-f[testfrequency] -r1257 -dig 0 --mix 4 --pa 0 --mod LORA --sf 7 --bw 125
```

The final application has to be operated using the parameters shown above

Result: The devices PASSED the test with limitations.

5.1.5 TX Duty cycle

5.1.5.1 Reference:

EN 300 220-2 V3.1.1, reference clause 4.3.3

5.1.5.2 Test Conditions:

N/A

5.1.5.3 Limits:

See sub clause 4.3.3.2 in EN 300 220-2 V3.1.1

5.1.5.4 Measurement Setup

No test

5.1.5.5 Measurement Results

Value	Result
Declared Duty Cycle	N/A

Table 5.5: Result Table

Note: Not applicable.
The duty cycle has to be tested in the final application.

Remark: No test.

Result: N/A

5.1.6 Occupied Bandwidth

5.1.6.1 Reference

EN 300 220-2 V3.1.1, reference clause 4.3.4

5.1.6.2 Test Conditions

Tests are performed in a conducted measurement

Environmental conditions: Normal conditions.

5.1.6.3 Limits

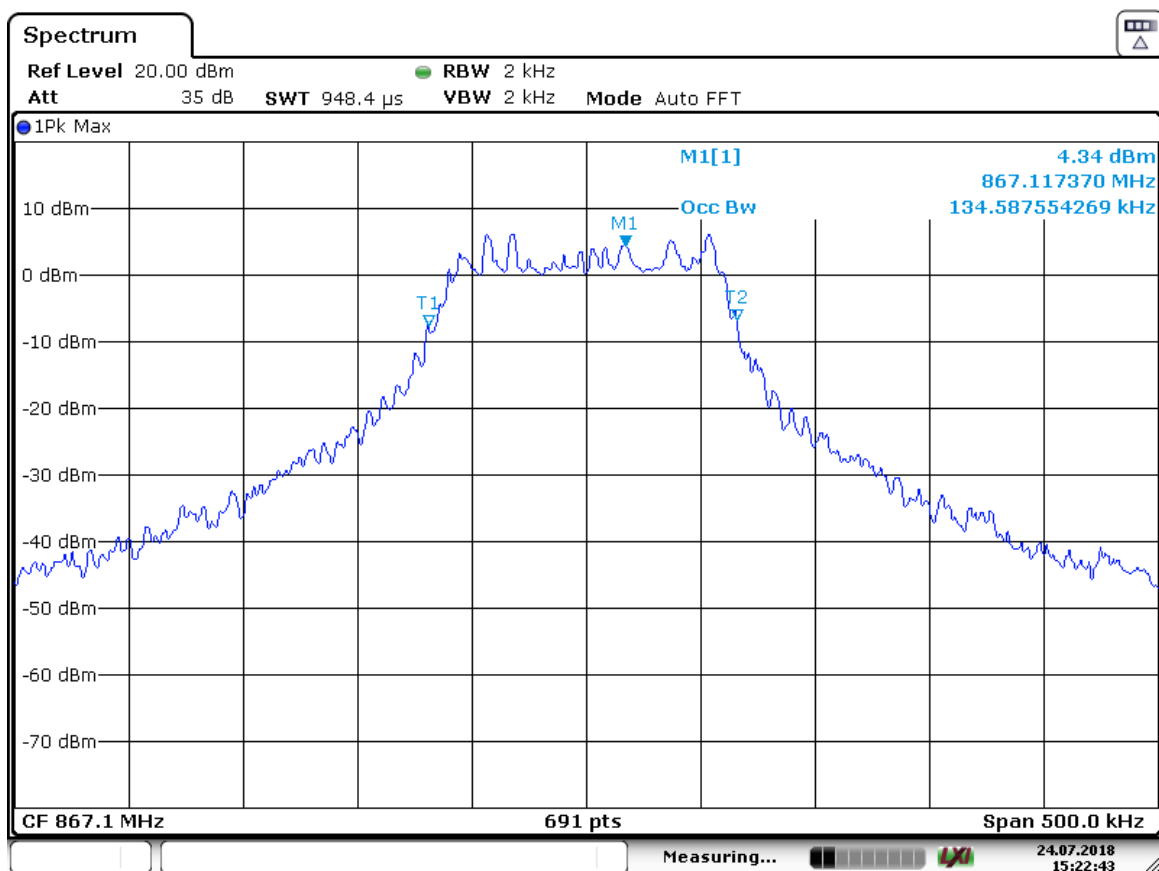
See sub clause 5.6. in EN 300 220-1 V3.1.1

5.1.6.4 Measurement Setup

Modifications to measurement setup: None

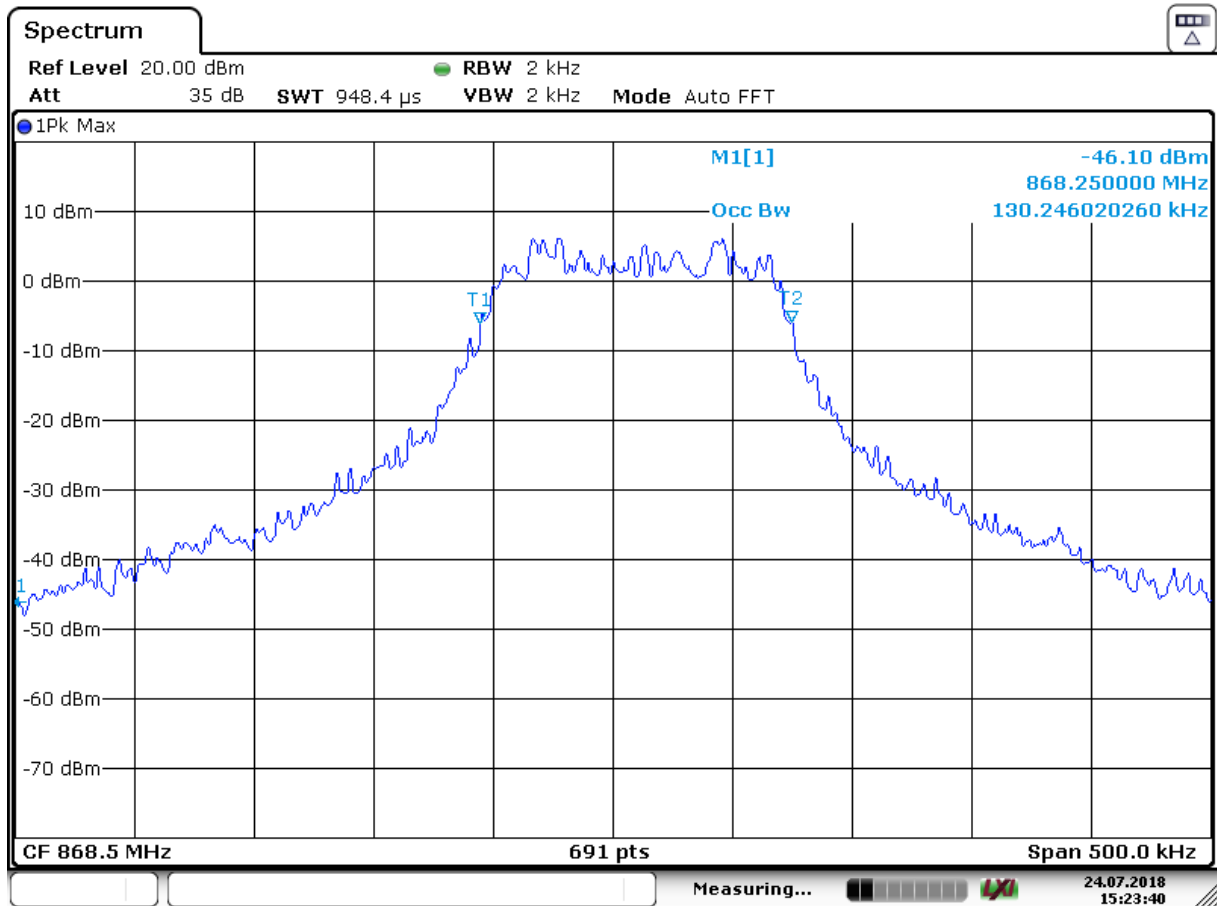
Test equipment used: [2]

5.1.6.5 Measurement Results



Date: 24.JUL.2018 15:22:43

Picture 5.6: OBW 867.10 MHz



Date: 24.JUL.2018 15:23:40

Picture 5.7: OBW 868.50 MHz

Remark: The program `util_tx_continuous` has been used for this test with the following parameters:

`-f[testfrequency] -r1257 -dig 0 --mix 4 --pa 0 --mod LORA --sf 7 --bw 125`

The final application has to be operated using the parameters shown above

Result: The devices PASSED the test without limitations.

5.1.7 TX out of band emissions

5.1.7.1 Reference

EN 300 220-2 V3.1.1, reference clause 4.3.5

5.1.7.2 Test Conditions

Modulation: LORA (D-M3)
Equipment Type: Wideband
Operational Modes: TX-only mode
Environmental Conditions: Extreme conditions

5.1.7.3 Limits:

See EN 300 220-1 V3.1.1, sub-clause 5.8

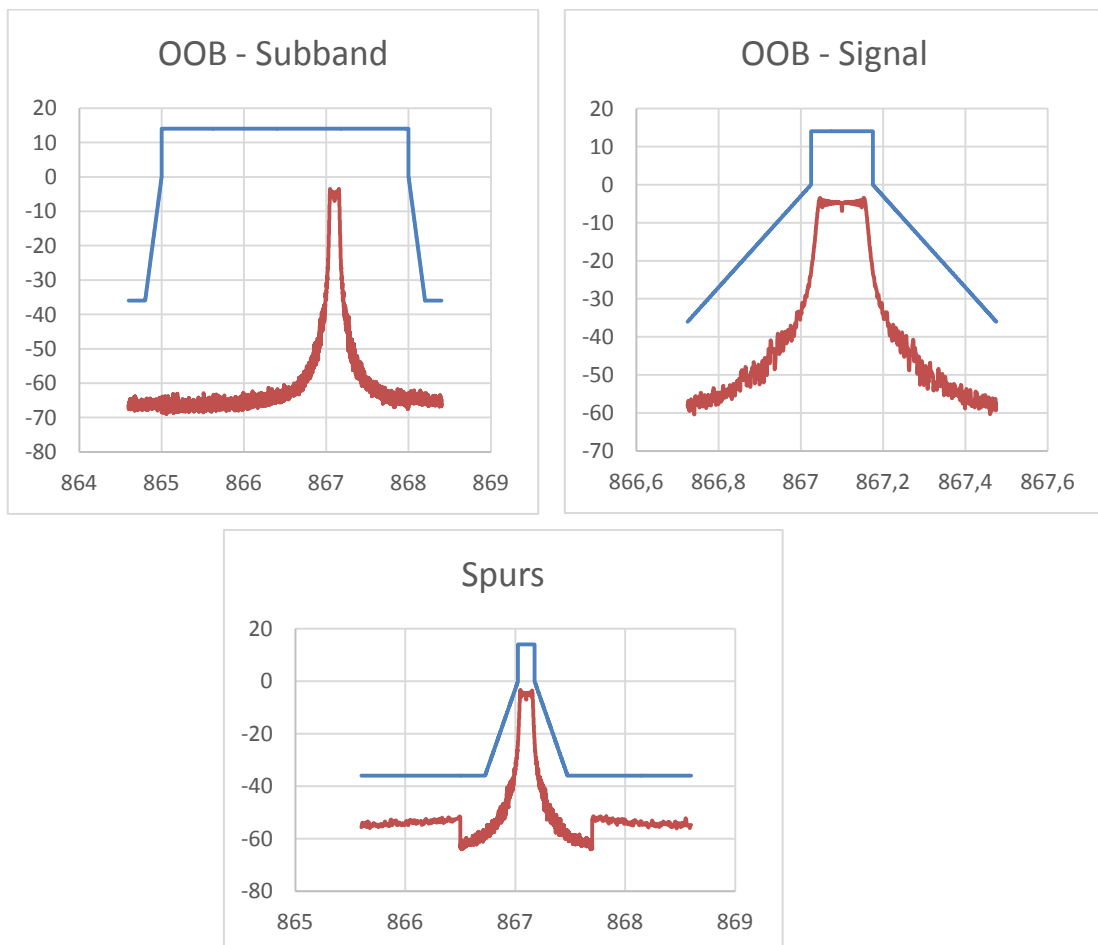
5.1.7.4 Measurement Setup

Modifications to measurement setup: None.

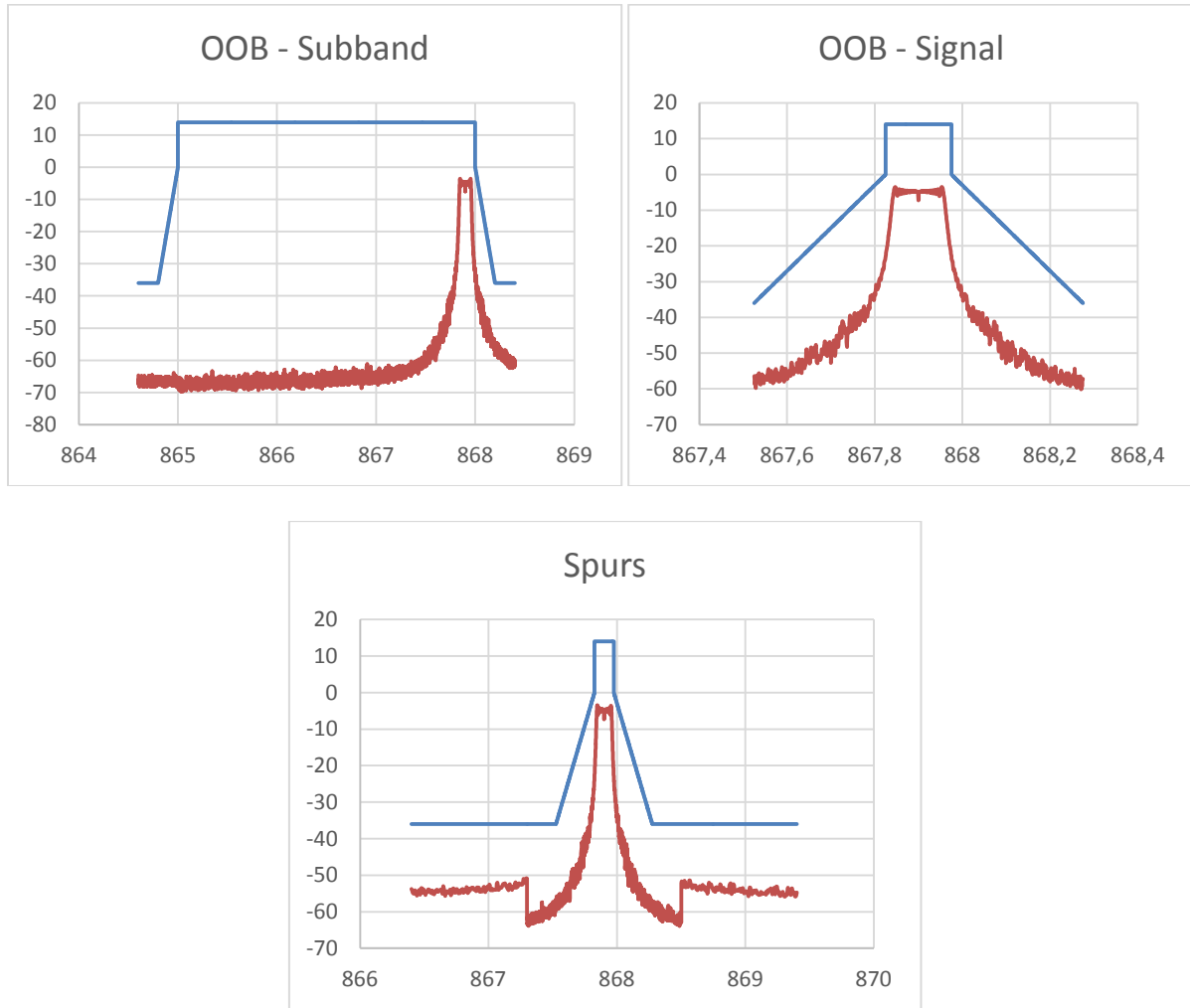
Test equipment used: [2], [105]

Actual measurement uncertainty: $< \pm 1$ dB, the Standard requests: ± 3 dB.

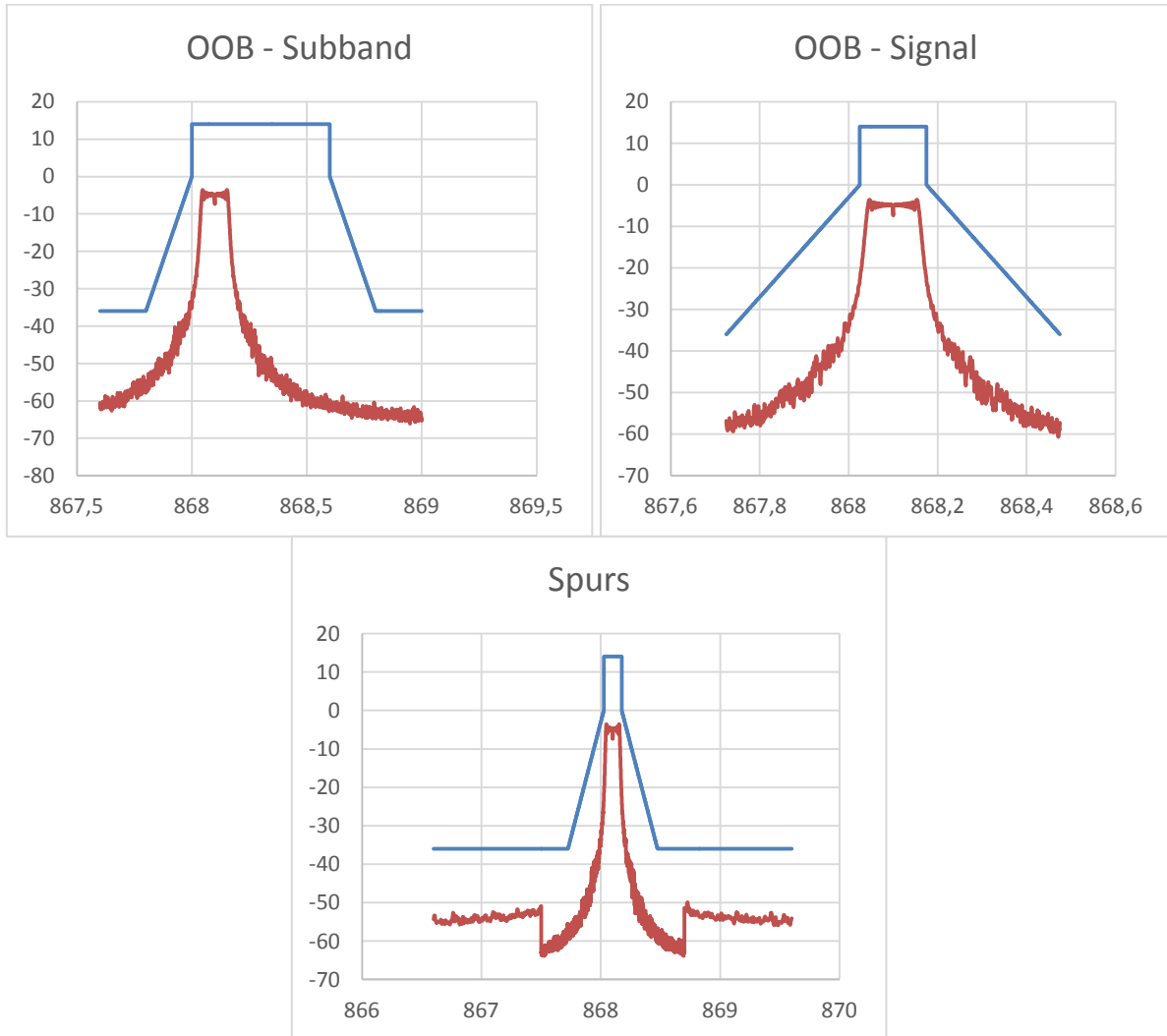
5.1.7.5 Measurement Results



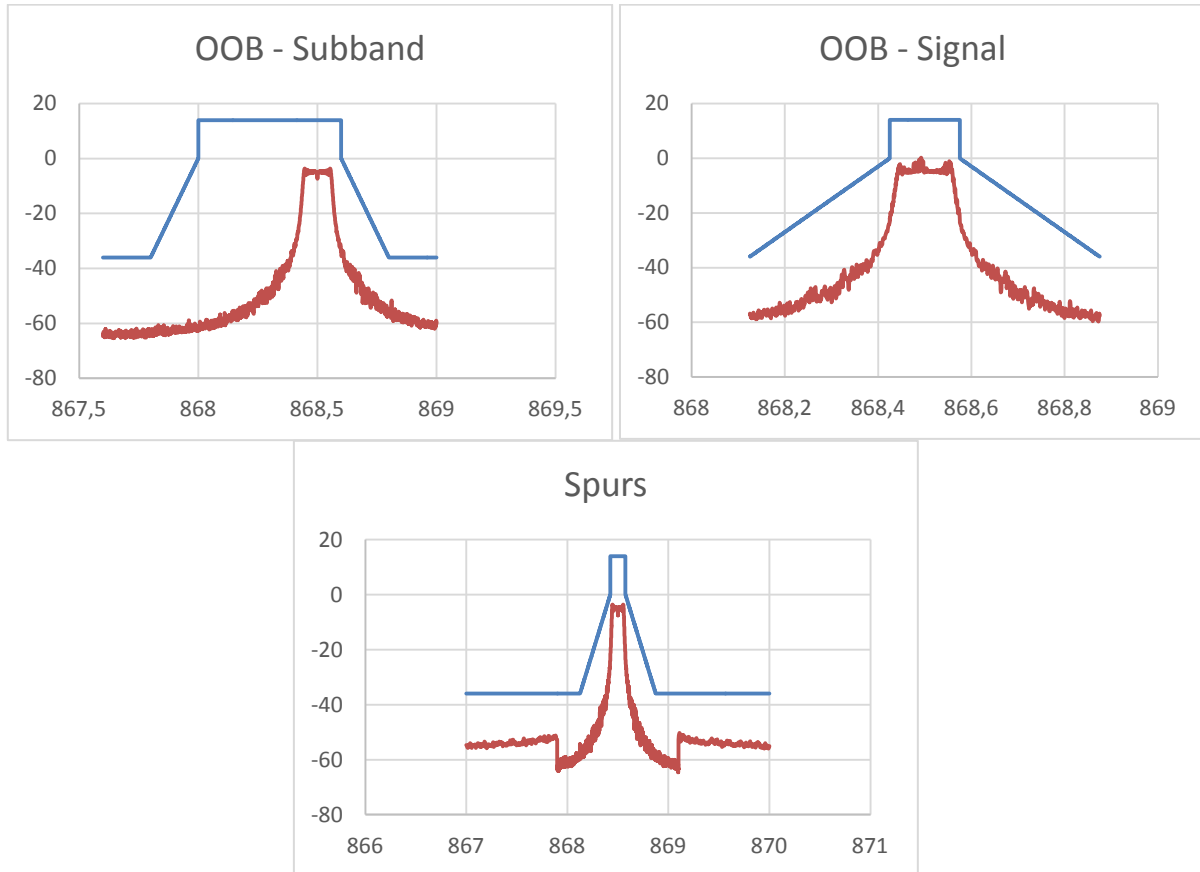
Picture 5.8: 867.10 MHz



Picture 5.9: 867.90 MHz



Picture 5.10: 868.10 MHz



Picture 5.11: 868.50 MHz

Remark: The program `util_tx_continuous` has been used for this test with the following parameters:

```
-f[testfrequency] -r1257 -dig 0 --mix 4 --pa 0 --mod LORA --sf 7 --bw 125
```

The final application has to be operated using the parameters shown above

Result: The devices PASSED the test without limitations.

5.1.8 TX Transients

5.1.8.1 Reference

EN 300 220-2 V3.1.1, reference clause 4.3.6

5.1.7.2 Test Conditions

Modulation: Operation EN 300 220-1 V3.1.1, sub-clause 6.1.2 (D-M3),

Equipment Type: Wideband equipment,

Operational Modes: Single carrier frequency, no channel spacing or plan

Environmental Conditions: Normal

5.1.7.3 Limits

See EN 300 220-1 V3.1.1 sub clause 5.10

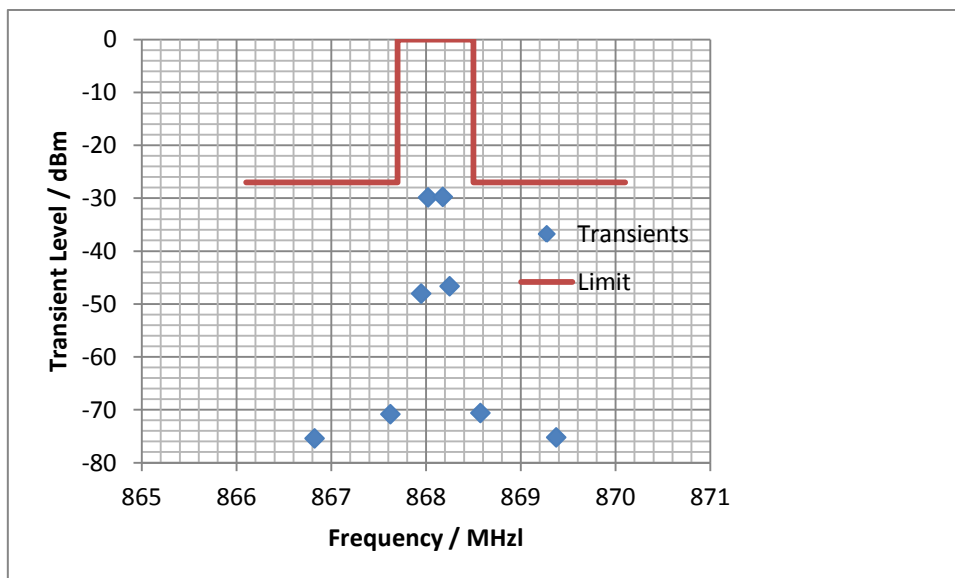
5.1.7.4 Measurement Setup

Modifications to measurement setup: None

Test equipment used: [2]

Actual measurement uncertainty: ± 1 dB, the Standard requests: ± 3 dB.

5.1.7.5 Measurement Results



Picture 5.12: TX Transients

Remark: None The program util_tx_test has been used for this test with the -p parameter set to 8dBm

The final application has to be operated using the parameters shown above

Result: The devices PASSED the test without limitations.

5.1.9 TX-Behaviour under Low-Voltage Conditions

5.1.9.1 *Reference*

EN 300 220-2 V3.1.1, reference clause 4.3.8

5.1.9.2 *Test Conditions*

Normal conditions

5.1.9.3 *Limits*

See EN 300 220-1 V3.1.1 sub clause 5.12

5.1.9.4 *Measurement Setup*

Modifications to measurement setup: None

Actual measurement uncertainty: N/A

5.10.5 Measurement Results:

Remark: No battery operation.

Result: The devices PASSED the test without limitations.

5.1.10 Blocking

5.1.10.1 Reference

EN 300 220-2 V3.1.1, reference clause 4.4.2

5.1.10.2 Test Conditions

Equipment Type: Receiver category 1.5

Operational Modes: Single carrier frequency, no channel spacing or plan,

Environmental Conditions: Normal.

5.1.10.3 Limits

See subclause 5.3.18 of the standard

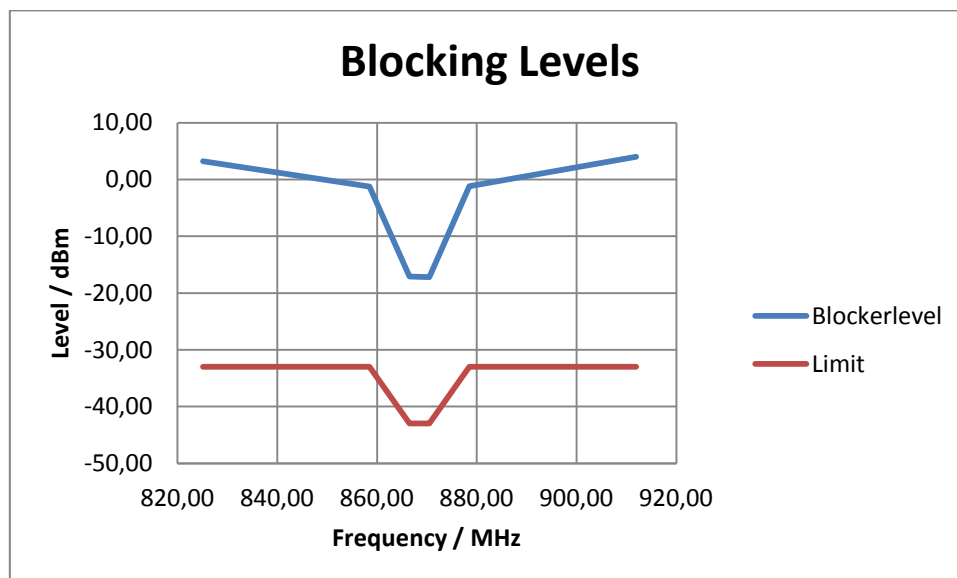
5.1.10.4 Measurement Setup

Modifications to measurement setup: None

Test equipment used: [2], [9], [19], [26]

Actual measurement uncertainty: ± 1 dB, the Standard requests: ± 3 dB.

5.1.10.5 Measurement Results



Picture 5.13: Blocking Levels

Remark: None

Result: The devices PASSED the test without limitations as category 1.5 receivers.

Annex

5.2 List of Measurement Equipment used for Testing

5.2.1 Hardware

No.	Type of equipment	Manufacturer	Type / Notifier	Serial Number	Cal due:
1	Spectrum Analyzer	R&S	FSQ26	200096	2018/1
2	Spectrum Analyzer	R&S	FSV13	100784	2019/04
3	Power Supply	Agilent	E3632A	MY40001408	N/A
4	Anechoic Chamber, small	Siemens-Matsushita	Project No. 007-A34-089/99A	N/A	ANT
5	Anechoic Chamber, large	Siemens-Matsushita	IMST	N/A	EMC
6	Shielded Room	EMC	Proj.-Nr 0284	N/A	N/A
8	Temperature Chamber	All	All	N/A	N/A
9	Antenna (LPA)	R&S	HL040		EMV
10	Antenna (LPA)	Chase	CBL 6111B		EMV
11	Antenna (Biconical)	Schwarzbeck	VUBA 9117		EMV
12	Antenna (Horn)	EMCO	3115		EMV
13	Antenna (dual ridged Horn, 0.8 - 12 GHz)	Satimo	SH 800		ANT
14	Cable	IMST		N/A	N/A
15	Cable	Huber & Suhner	brown, 2m	N/A	N/A
18	Vector Signal Generator	R&S	SMJ 100A	N/A	N/A
19	Vector Signal Generator	R&S	SMU 200A	N/A	N/A
20	Power Sensor	IMST	Watson 6000 or equivalent	all	N/A
21	Digital Scope	Agilent	MSO 8104A	all	N/A

5.2.2 Software

No.	Program	Version	Purpose	Manufacturer
100	ACCDwell.vxe	V1.0	Dataconversion	IMST
101	Sensorpico4.vxe	V1.5	Evaluation	IMST
102	MaxPowerDensity.vxe	V1.0	Evaluation	IMST
103	Occupation.vxe	V1.0	Evaluation	IMST
104	DARIC	all	Operation of the turntable in small chamber	IMST
105	OOB.vxe	V1.0	Evaluation	IMST