SPECTRUM REPORT

Applicant:	Dragino Technology Co., Limited.
Address of Applicant:	Room 202, Block B, BCT Incubation Bases (BaoChengTai), No.8 CaiYunRoad LongCheng Street, LongGang District, Shenzhen 518116, China
Equipment Under Test (EUT)	
Product Name:	Temperature & Humidity Sensor
Model No.:	LHT65
Trade Mark:	DRAGINO
Applicable standards:	ETSI EN 300 220-1 V3.1.1 (2017-02) ETSI EN 300 220-2 V3.2.1 (2018-06)
Date of sample receipt:	24 Aug., 2019
Date of Test:	25 Aug., to 08 Oct., 2019
Date of report issue:	09 Oct., 2019
Test Result:	PASS*

*In the configuration tested, the EUT complied with the standards specified above.

The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The protection requirements with respect to electromagnetic compatibility contained in Directive 2014/53/EU are considered.

Bruce Zhang
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the CCIS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

2 Version

Version No.	Date	Description
00	*09 Oct., 2019*	*Original*

Tested by: Carey Chen ***Date:*** *09 Oct., 2019*

Test Engineer

Reviewed by: Winner Zhang ***Date:*** *09 Oct., 2019*

Project Engineer

3 Contents

Page

4 Test Summary

Test Items	Test Requirement	Test method	Result
Transmitter Part			
Operating frequency	EN 300 220-2 Clause 4.2.1	EN 300 220-1 Clause 5.1.2	PASS
Effective Radiated Power	EN 300 220-2 Clause 4.3.1	EN 300 220-1 Clause 5.2.2	PASS
Maximum e.r.p. spectral density	EN 300 220-2 Clause 4.3.2	EN 300 220-1 Clause 5.3.2	PASS
Duty Cycle	EN 300 220-2 Clause 4.3.3	EN 300 220-1 Clause 5.4.2	PASS
Occupied Bandwidth	EN 300 220-2 Clause 4.3.4	EN 300 220-1 Clause 5.6.3	PASS
Tx Out of Band Emissions	EN 300 220-2 Clause 4.3.5	EN 300 220-1 Clause 5.8.3	PASS
Transient power	EN 300 220-2 Clause 4.3.6	EN 300 220-1 Clause 5.10.3	PASS
Adjacent Channel Power	EN 300 220-2 Clause 4.3.7	EN 300 220-1 Clause 5.11.3	N/A
TX behaviour under Low Voltage Conditions	EN 300 220-2 Clause 4.3.8	EN 300 220-1 Clause 5.12.3	PASS
Adaptive Power Control	EN 300 220-2 Clause 4.3.9	EN 300 220-1 Clause 5.13.3	N/A
FHSS equipment	EN 300 220-2 Clause 4.3.10	EN 300 220-2 Clause 4.3.10.3	N/A
Short term behaviour	EN 300 220-2 Clause 4.3.11	EN 300 220-1 Clause 5.5.2	N/A
Unwanted emissions in the spurious domain	EN 300 220-2 Clause 4.2.2	EN 300 220-1 Clause 5.9.3	PASS
Receiver Part			
RX sensitivity	EN 300 220-2 Clause 4.4.1	EN 300 220-1 Clause 5.14.3	N/A
Blocking	EN 300 220-2 Clause 4.4.2	EN 300 220-1 Clause 5.18.6	PASS
Polite spectrum access conformance requirement			
Clear Channel Assessment threshold	EN 300 220-2 Clause 4.5.2	EN 300 220-1 Clause 5.21.2.3	N/A
Polite spectrum access timing parameters	EN 300 220-2 Clause 4.5.3	EN 300 220-1 Clause 5.21.2.3	N/A
Adaptive Frequency Agility	EN 300 220-2 Clause 4.5.4	EN 300 220-1 Clause 5.21.4.2	N/A

Remark:
Pass: Meet the requirement.
N/A: Not Applicable for Non-adaptive equipment.

5 General Information

5.1 Client Information

Applicant:	Dragino Technology Co., Limited.
Address:	Room 202, Block B, BCT Incubation Bases (BaoChengTai), No.8 CaiYunRoad LongCheng Street, LongGang District, Shenzhen 518116, China
Manufacturer/ Factory:	Dragino Technology Co., Limited.
Address:	Room 202, Block B, BCT Incubation Bases (BaoChengTai), No.8 CaiYunRoad LongCheng Street, LongGang District, Shenzhen 518116, China

5.2 General Description of E.U.T.

Product Name:	Temperature & Humidity Sensor
Model No.:	LHT65
Operation Frequency:	863.1MHz~869.9MHz
Hardware version:	LHT65 v1.3
Software version:	LHT65 SW v1.3
Modulation:	LoRa
Antenna type:	Internal Antenna
Antenna Gain:	0 dBi
Power supply:	Rechargeable Lithium Battery DC3.0V/1500mAh

5.3 Test environment and mode

Transmitting mode:	Keep the TX unit in transmitting mode with modulation.
Receiving mode:	Keep the RX unit in receiving mode.
Operating Environment:	
Temperature:	Normal: 15℃ ~ 35℃, Extreme: -20℃ ~ +55℃
Humidity:	20 % ~ 75 % RH
Atmospheric Pressure:	1008 mbar
Voltage:	Transmitter: Normal: 3.0, Extreme: Low 2.7High 3.3Vdc

5.4 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
LENOVO	Laptop	SL510	2847A65	DoC

5.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%)
Radio frequency	±0.5 ppm
RF output power, conducted	±1.5 dB
Conducted spurious emission of transmitter, valid up to 6 GHz	±3.0 dB
Conducted emission of receivers	±3.0 dB
RF level uncertainty for a given BER	±1.5 dB
Occupied BandWidth	±5 %
Temperature	±3 °C
Humidity	±10 %
Radiated Emission (30MHz ~ 1000MHz)	±4.32 dB
Radiated Emission (1GHz ~ 18GHz)	±5.38 dB

5.6 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Designation No.: CN1211**

Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

- **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber of Shenzhen Zhongjian Nanfang Testing Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **CNAS - Registration No.: CNAS L6048**

Shenzhen Zhongjian Nanfang Testing Co., Ltd. is accredited to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L6048.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf

5.7 Laboratory Location

Shenzhen Zhongjian Nanfang Testing Co., Ltd.
Address: No. B-C, 1/F., Building 2, Laodong No.2 Industrial Park, Xixiang Road,
Bao'an District, Shenzhen, Guangdong, China
Tel: +86-755-23118282, Fax: +86-755-23116366
Email: info@ccis-cb.com, Website: http://www.ccis-cb.com

5.8 Test Instruments list

Radiated Emission:					
Test Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Cal.Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
3m SAC	SAEMC	9m*6m*6m	966	07-22-2017	07-21-2020
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-18-2019	03-17-2020
Biconical Antenna	SCHWARZBECK	VUBA9117	359	06-22-2017	06-21-2020
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-18-2019	03-17-2020
Horn Antenna	SCHWARZBECK	BBHA9120D	1805	06-22-2017	06-21-2020
EMI Test Software	AUDIX	E3	Version: 6.110919b		
Pre-amplifier	HP	8447D	2944A09358	03-18-2019	03-17-2020
Pre-amplifier	CD	PAP-1G18	11804	03-18-2019	03-17-2020
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-18-2019	03-17-2020
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-18-2019	03-17-2020
Signal Generator	Rohde & Schwarz	SMX	835454/016	03-18-2019	03-17-2020
Signal Generator	R&S	SMR20	1008100050	03-18-2019	03-17-2020
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-18-2019	03-17-2020
Cable	MICRO-COAX	MFR64639	K10742-5	03-18-2019	03-17-2020
Cable	SUHNER	SUCOFLEX100	58193/4PE	03-18-2019	03-17-2020
RF Switch Unit	MWRFTEST	MW200	N/A	N/A	N/A
Test Software	MWRFTEST	MTS8200	Version: 2.0.0.0		

6 Radio Technical Requirements Specification in EN 300 220-2

6.1 Operating Frequency

Declared by the manufacturer operarting frequency for 863.1MHz-869.9MHz and OCW for 125kHz.

6.2 Duty Cycle

The manufacturer has declared that due to the time between transmissions by the devices, the duty cycle is less than 0.1%.

6.3 Adjacent Channel Power

Not applicable, only applies to transmitters with OCW ⩽ 25 kHz.

6.4 Adaptive Power Control

Not applicable, only applies to EUT with adaptive power control using annex C band AF.

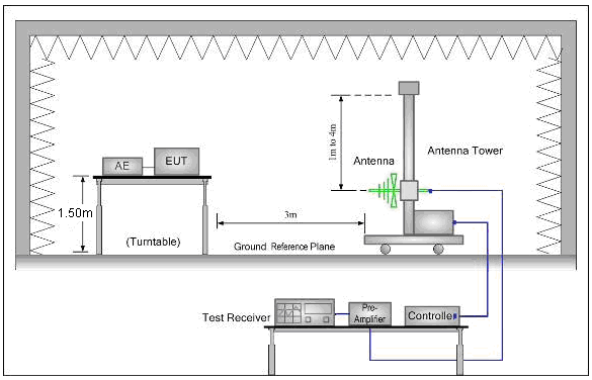
6.5 FHSS equipment

Not applicable, since the test applies to FHSS equipment.

6.6 Short term behaviour

Not applicable, only applies to EUT using annex C bands AD, AE, AF, AG, AH, or AI.

6.7 Effective Radiated Power

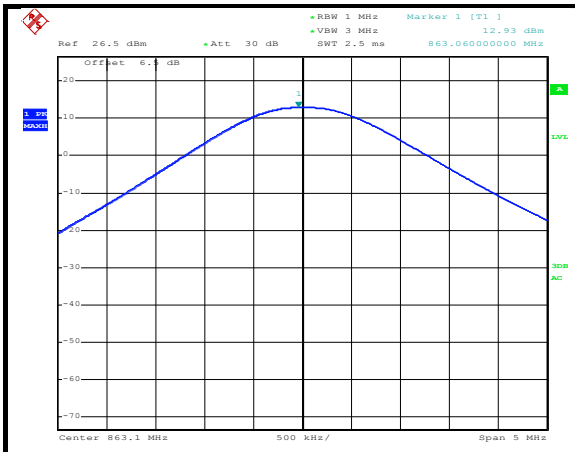
Test Requirement:	ETSI EN300 220-2 clause 4.3.1
Test Method:	ETSI EN300 220-1 clause 5.2.2.2
Receiver setup:	RBW=100 kHz, VBW=300 kHz, Detector= peak
Limit:	25 mW e.r.p.
Test setup:	
Test procedure:	Substitution method was performed to determine the actual ERP emission levels of the EUT. The following test procedure as below: 1. On the test site as test setup graph above,the EUT shall be placed at the 1.5m support on the turntable and in the position closest to normal use as declared by the provider. 2. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter.The output of the test antenna shall be connected to the measuring receiver. 3. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test. 4. The test antenna shall be raised and lowered from 1m to 4m until a maximum signal level is detected by the measuring receiver. Then the turntable should be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver. 5. Repeat step 4 for test frequency with the test antenna polarized horizontally. 6. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At the lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground. 7. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends vertically polarized, and with the signal generator tuned to a particular test frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output. 8. Repeat step 7 with both antennas horizontally polarized for each test

	frequency. 9. Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps 7 and 8 by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula: ERP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBd) where: Pg is the generator output power into the substitution antenna.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

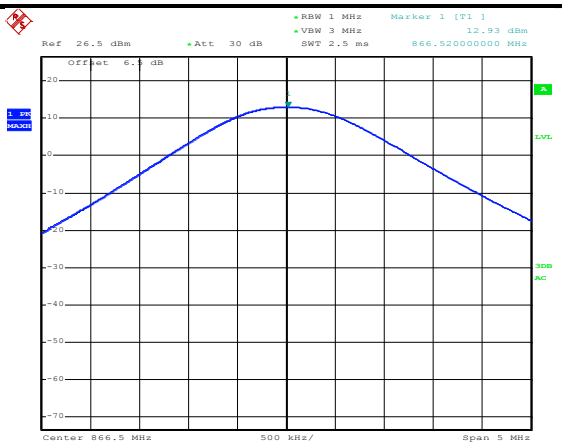
Measurement Data:

Test conditions	Frequency (MHz)	Read Level (dBm)	Antenna Gain (dBi)	ERP(dBm)	Limit (dB/m)	Result
NTNV	863.1	12.93	0	12.93	14	Pass
	866.5	12.93		12.93		
	869.9	12.91		12.91		
LTLV	863.1	12.92		12.92		
	866.5	12.91		12.91		
	869.9	12.90		12.90		
LTHV	863.1	12.91		12.91		
	866.5	12.90		12.90		
	869.9	12.90		12.90		
HTLV	863.1	12.93		12.93		
	866.5	12.92		12.92		
	869.9	12.91		12.91		
HTHV	863.1	12.92		12.92		
	866.5	12.91		12.91		
	869.9	12.90		12.90		
Remark：	*“NTNV” means Normal Temperature Normal Voltage, “LTLV” means Low Temperature Low Voltage, “LTHV” means Low Temperature High Voltage, “HTLV” means High Temperature Low Voltage, “HTHV” means High Temperature High Voltage.”Vib.” means Vibration.* *ERP (dBm) = EIRP (dBm) - 2.15 (dB).*					

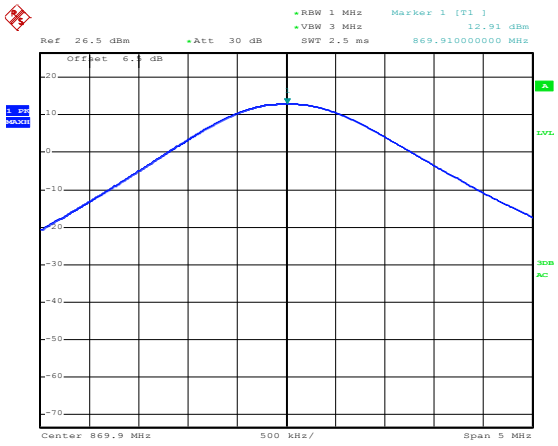
Test plot as follows:



Test Frequency: 863.1MHz



Test Frequency: 866.5MHz



Test Frequency: 869.9MHz

6.8 Occupied Bandwidth

Test Requirement:	EN300 220-2 Clause 4.3.4
Test Method:	EN 300 220-1 Clause 5.6.3
Limit:	300 kHz
Test procedure:	1. The spectrum analyser shall be configured as appropriate for the parameters shown in Table 12. **Table 12: Test Parameters for Max Occupied Bandwidth Measurement** 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 / 2. 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.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

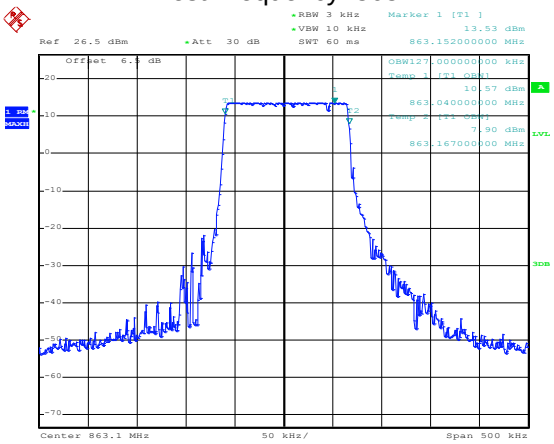
Measurement Data:

Test conditions	Test Frequency (MHz)	OBW (kHz)	f_L (MHz)	f_H (MHz)	Limit	Result
NTNV	863.1	127.0	863.0400	/	300KHz	Pass
LTLV		127.0	863.0400	/		
LTHV		126.9	863.0399	/		
HTLV		127.0	863.0400	/		
HTHV		126.8	863.0399	/		
NTNV	869.9	126.0	/	869.9660		
LTLV		126.0	/	869.9660		
LTHV		125.9	/	869.9659		
HTLV		125.8	/	869.9659		
HTHV		126.0	/	869.9660		
Remark:	*"NTNV" means Normal Temperature Normal Voltage, "LTLV" means Low Temperature Low Voltage, "LTHV" means Low Temperature High Voltage, "HTLV" means High Temperature Low Voltage, "HTHV" means High Temperature High Voltage."Vib." means Vibration.*					

Test Plots:

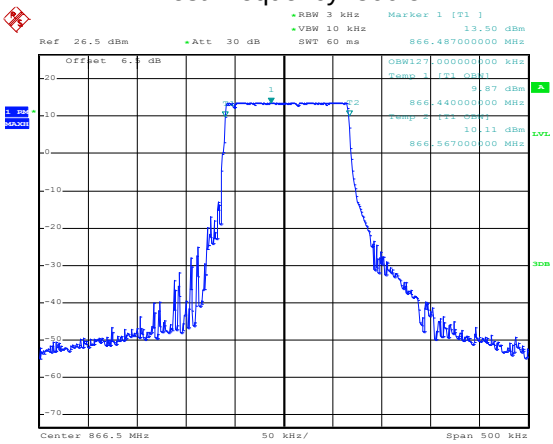
Normal Condition

Test Frequency: 863.1MHz



Date: 8.OCT.2019 14:47:50

Test Frequency: 866.5MHz



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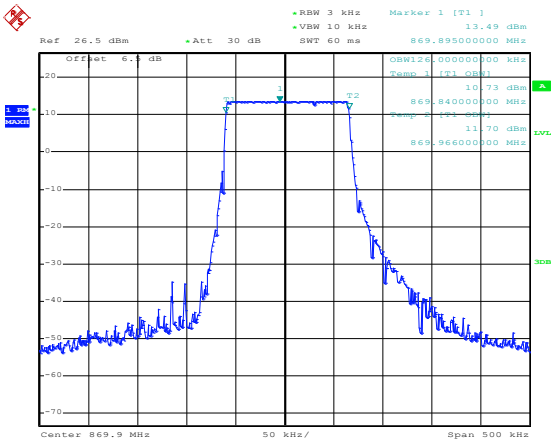
Test Frequency: 869.9MHz



Date: 8.OCT.2019 14:51:29

6.9 Tx Out of Band Emissions

Test Requirement:	EN300 220-2 Clause 4.3.5
Test Method:	EN 300 220-1 Clause 5.8.3
Limit:	Refer to ETSI EN300 220-1 Clause 5.8.2
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 RBW_{REF} 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} - fc_{high})	Ensures that the rightmost mask specification remains within the span
NOTE: f_{high_OFB} is the higher edge of the operational frequency Band.		

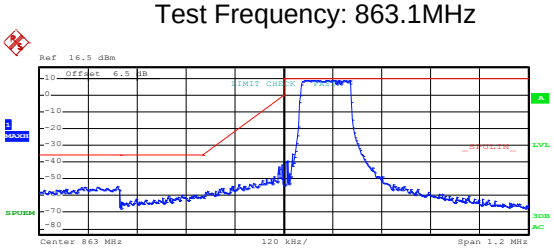
Operation of the EUT is restarted, with the appropriate test signal, on the highest Operating Frequency as declared by the manufacturer.
If the equipment is using only one Operating Frequency in the Operational Frequency Band, measurement shall be performed at the nominal Operating Frequency.
The signal 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.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Test Plots:

NTNV

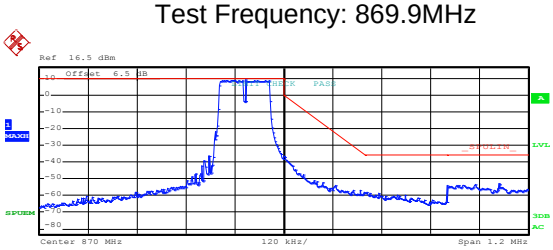
Test Frequency: 863.1MHz



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
862.400 M	862.600 M	10.00 k	862.590800 M	-54.69	-18.69
862.600 M	862.800 M	1.00 k	862.780000 M	-59.94	-23.94
862.800 M	863.000 M	1.00 k	862.807600 M	-58.30	-23.67
863.000 M	863.600 M	1.00 k	863.057600 M	8.70	-1.30

Date: 29.SEP.2019 15:44:31

Test Frequency: 869.9MHz

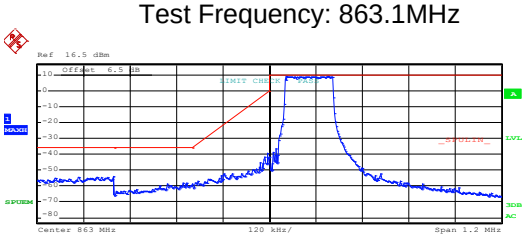


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
869.400 M	870.000 M	1.00 k	869.906400 M	8.94	-1.06
870.000 M	870.200 M	1.00 k	870.199600 M	-58.17	-22.24
870.200 M	870.400 M	1.00 k	870.202800 M	-58.26	-22.26
870.400 M	870.600 M	10.00 k	870.528400 M	-52.97	-16.97

Date: 29.SEP.2019 16:18:23

LTLV

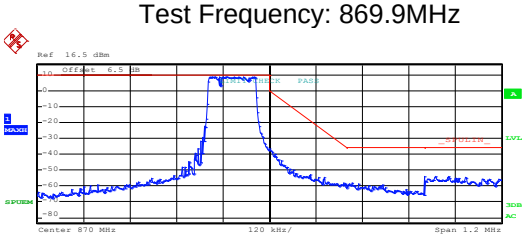
Test Frequency: 863.1MHz



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
862.400 M	862.600 M	10.00 k	862.598000 M	-53.87	-17.87
862.600 M	862.800 M	1.00 k	862.786800 M	-58.01	-22.01
862.800 M	863.000 M	1.00 k	862.800000 M	-58.79	-22.79
863.000 M	863.600 M	1.00 k	863.150000 M	9.15	-0.85

Date: 29.SEP.2019 15:56:01

Test Frequency: 869.9MHz

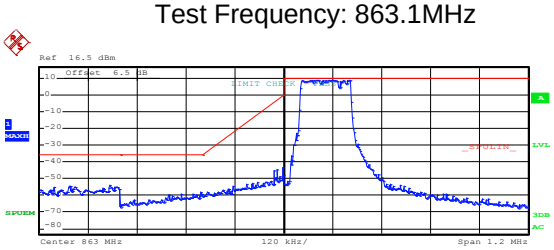


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
869.400 M	870.000 M	1.00 k	869.878800 M	8.50	-1.50
870.000 M	870.200 M	1.00 k	870.196800 M	-58.39	-22.97
870.200 M	870.400 M	1.00 k	870.212400 M	-58.16	-22.16
870.400 M	870.600 M	10.00 k	870.400000 M	-53.70	-17.70

Date: 29.SEP.2019 16:24:03

LTHV

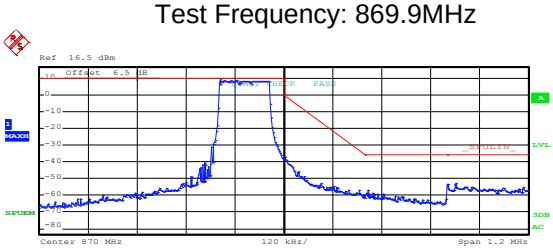
Test Frequency: 863.1MHz



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
862.400 M	862.600 M	10.00 k	862.573200 M	-54.17	-18.17
862.600 M	862.800 M	1.00 k	862.796800 M	-58.26	-22.26
862.800 M	863.000 M	1.00 k	862.812400 M	-58.01	-24.24
863.000 M	863.600 M	1.00 k	863.163200 M	8.46	-1.54

Date: 29.SEP.2019 15:59:27

Test Frequency: 869.9MHz

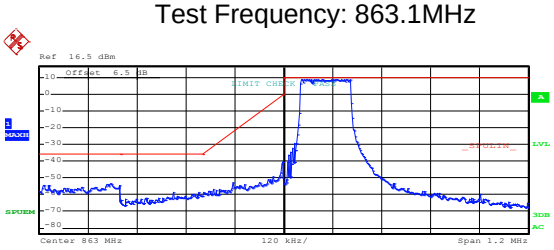


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
869.400 M	870.000 M	1.00 k	869.842800 M	9.12	-0.88
870.000 M	870.200 M	1.00 k	870.183600 M	-56.86	-23.81
870.200 M	870.400 M	1.00 k	870.205200 M	-57.11	-21.11
870.400 M	870.600 M	10.00 k	870.421600 M	-53.01	-17.01

Date: 29.SEP.2019 16:28:42

HTLV

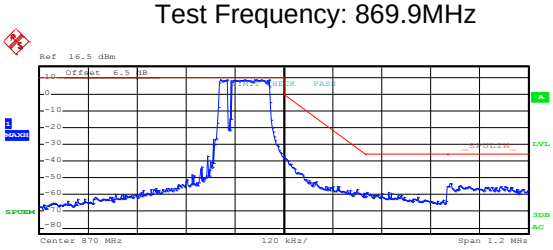
Test Frequency: 863.1MHz



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
862.400 M	862.600 M	10.00 k	862.574400 M	-53.52	-17.52
862.600 M	862.800 M	1.00 k	862.728000 M	-58.46	-22.46
862.800 M	863.000 M	1.00 k	862.802400 M	-58.51	-22.94
863.000 M	863.600 M	1.00 k	863.062400 M	8.82	-1.18

Date: 29.SEP.2019 16:03:23

Test Frequency: 869.9MHz

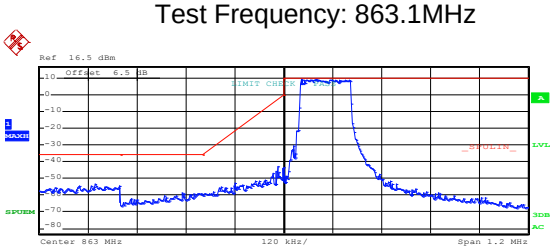


Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
869.400 M	870.000 M	1.00 k	869.931600 M	8.84	-1.16
870.000 M	870.200 M	1.00 k	870.199200 M	-59.19	-23.34
870.200 M	870.400 M	1.00 k	870.256400 M	-58.44	-22.44
870.400 M	870.600 M	10.00 k	870.409200 M	-53.27	-17.27

Date: 29.SEP.2019 16:33:04

HTHV

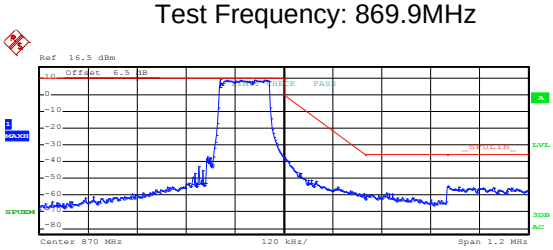
Test Frequency: 863.1MHz



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
862.400 M	862.600 M	10.00 k	862.537200 M	-53.67	-17.67
862.600 M	862.800 M	1.00 k	862.749600 M	-58.58	-22.58
862.800 M	863.000 M	1.00 k	862.804400 M	-59.32	-24.11
863.000 M	863.600 M	1.00 k	863.078000 M	9.32	-0.68

Date: 29.SEP.2019 16:08:19

Test Frequency: 869.9MHz



Start [Hz]	Stop [Hz]	RBW [Hz]	Freq [Hz]	PwrAbs [dBm]	ΔLimit [dB]
869.400 M	870.000 M	1.00 k	869.842800 M	9.13	-0.87
870.000 M	870.200 M	1.00 k	870.199600 M	-59.60	-23.67
870.200 M	870.400 M	1.00 k	870.252800 M	-58.74	-22.74
870.400 M	870.600 M	10.00 k	870.402800 M	-54.72	-18.72

Date: 29.SEP.2019 16:37:12

6.10 Transient power

Test Requirement:	EN300 220-2 Clause 4.3.6
Test Method:	EN 300 220-1 Clause 5.10.3
Limit:	**Table 23: Transmitter Transient Power limits** Absolute offset from centre frequency: ≤ 400 kHz; RBW_{REF}: 1 kHz; Peak power limit applicable at measurement points: 0 dBm Absolute offset from centre frequency: > 400 kHz; RBW_{REF}: 1 kHz; Peak power limit applicable at measurement points: -27 dBm
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: -0,5 x OCW - 3 kHz, 0,5 x OCW + 3 kHz, Not applicable for OCW < 25 kHz; Analyser RBW: 1 kHz; RBW_{REF}: 1kHz Measurement points: offset from centre frequency: ±12,5 kHz or ±OCW whichever is the greater; Analyser RBW: Max (RBW pattern 1, 3, 10 kHz) ≤ Offset frequency/6 (see note); RBW_{REF}: 1 kHz Measurement points: offset from centre frequency: -0,5 x OCW - 400 kHz, 0,5 x OCW + 400 kHz; Analyser RBW: 100 kHz; RBW_{REF}: 1 kHz Measurement points: offset from centre frequency: -0,5 x OCW -1 200 kHz, 0,5 x OCW + 1 200 kHz; Analyser RBW: 300 kHz; RBW_{REF}: 1 kHz 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: VBW/RBW; Value: 10; Notes: At higher RBW values VBW may be clipped to its maximum value Spectrum Analyser Setting: Sweep time; Value: 500 ms Spectrum Analyser Setting: RBW filter; Value: Gaussian Spectrum Analyser Setting: Trace Detector Function; Value: RMS Spectrum Analyser Setting: Trace Mode; Value: Max hold Spectrum Analyser Setting: Sweep points; Value: 501 Spectrum Analyser Setting: Measurement mode; Value: 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 RBWREF by the formula in clause 4.3.10.1.
Test Instruments:	Refer to section 5.7 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Measurement Data

Frequency (MHz)	Test points (offset from centre frequency)	Transient power (dBm)	Limit (dBm)	Result
863.1	0.5*OCW-1200kHz	-46.25	-27	PASS
	0.5*OCW-400kHz	-52.21		
	-OCW	-43.91	0	PASS
	-0.5*OCW-3KHz	-60.14		
	+0.5*OCW+3KHz	-56.14		
	+OCW	-37.69		
	+0.5*OCW+400Khz	-51.11	-27	PASS
	+0.5*OCW+1200KHz	-44.79		
866.5	0.5*OCW-1200kHz	-48.24	-27	PASS
	0.5*OCW-400kHz	-54.39		
	-OCW	-46.89	0	PASS
	-0.5*OCW-3KHz	-53.59		
	+0.5*OCW+3KHz	-53.21		
	+OCW	-40.23		
	+0.5*OCW+400Khz	-46.93	-27	PASS
	+0.5*OCW+1200KHz	-46.25		
869.9	0.5*OCW-1200kHz	-50.15	-27	PASS
	0.5*OCW-400kHz	-56.41		
	-OCW	-46.67	0	PASS
	-0.5*OCW-3KHz	-63.12		
	+0.5*OCW+3KHz	-59.84		
	+OCW	-39.21		
	+0.5*OCW+400Khz	-55.42	-27	PASS
	+0.5*OCW+1200KHz	-48.58		

6.11 TX behaviour under Low-voltage Conditions

Test Requirement:	EN 300 220-2 Clause 4.3.8
Test Method:	EN 300 220-1 Clause 5.12.3
Limit:	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.
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.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Only applies to battery powered EUT.

6.12 Unwanted emissions in the spurious domain

Test Requirement:	EN 300 220-2 Clause 4.2.2
Test Method:	EN 300 220-1 Clause 5.9.3
Receiver setup:	**Table 20: Parameters for TX Spurious Radiations Measurement**

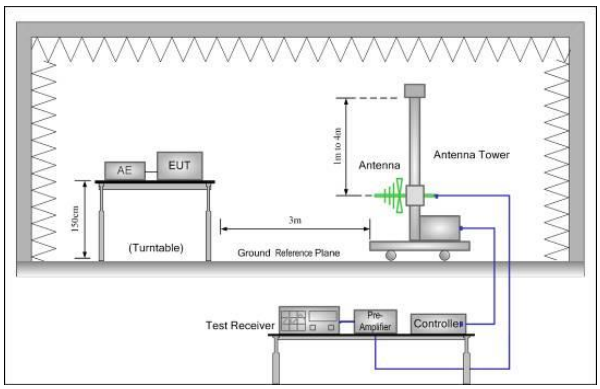
Operating Mode	Frequency Range	RBW_{REF} (see note 2)
Transmit mode	9 kHz ≤ f < 150 kHz	1 kHz
	150 kHz ≤ f < 30 MHz	10 kHz
	30 MHz ≤ f < f_c - m	100 kHz
	f_c - m ≤ f < f_c - n	10 kHz
	f_c - n ≤ f < f_c - p	1 kHz
	f_c + p < f ≤ f_c + n	1 kHz
	f_c + n < f ≤ f_c + m	10 kHz
	f_c + m < f ≤ 1 GHz	100 kHz
	1 GHz < f ≤ 6 GHz	1 MHz

NOTE 1: f is the measurement frequency.
f_c is the Operating Frequency.
m is 10 x OCW or 500 kHz, whichever is the greater.
n is 4 x OCW or 100 kHz, whichever is the greater.
p is 2,5 x OCW.
NOTE 2: If the value of RBW used for measurement is different from RBW_{REF}, use bandwidth correction from clause 4.3.10.1.

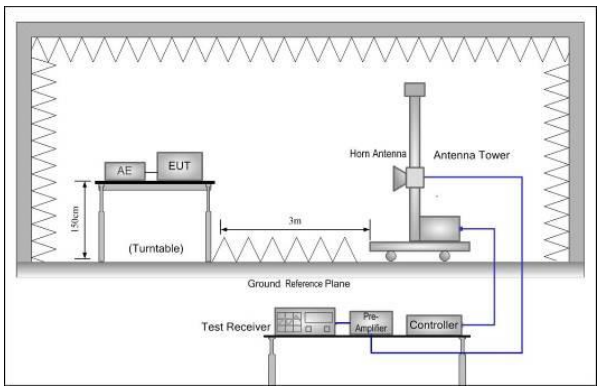
Limit:	**Table 19: Spurious domain emission limits**

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

Test Frequency range:	25MHz to 4GHz
Test setup:	Below 1GHz



Above 1GHz



Test procedure:	Substitution method was performed to determine the actual ERP emission levels of the EUT. The following test procedure as below: **Below 1GHz test procedure:** 1. On the test site as test setup graph above,the EUT shall be placed at the 1.5m support on the turntable and in the position closest to normal use as

	declared by the provider. 2. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter.The output of the test antenna shall be connected to the measuring receiver. 3. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test. 4. The test antenna shall be raised and lowered from 1m to 4m until a maximum signal level is detected by the measuring receiver. Then the turntable should be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver. 5. Repeat step 4 for test frequency with the test antenna polarized horizontally. 6. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At the lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground. 7. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends vertically polarized, and with the signal generator tuned to a particular test frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output. 8. Repeat step 7 with both antennas horizontally polarized for each test frequency. 9. Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps 7 and 8 by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula: ERP(dBm) = Pg(dBm) – cable loss (dB) + antenna gain (dBd) where: Pg is the generator output power into the substitution antenna. **Above 1GHz test procedure:** Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber, and the test antenna do not need to raise from 1 to 4m, just test in 1.5m height.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Measurement Data:

TX mode				
Test Frequency: 863.1MHz				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	polarization	Level(dBm)		
53.32	Vertical	-73.01	-54.00	Pass
111.35	V	-74.54		
34.64	V	-71.69	-36.00	
148.96	V	-69.49		
1726.20	V	-37.36	-30.00	
2589.30	V	-42.45		
71.83	Horizontal	-79.70	-54.00	
494.20	H	-74.28		
34.76	H	-73.84	-36.00	
173.81	H	-77.33		
1726.20	H	-39.25	-30.00	
2589.30	H	-43.34		

TX mode				
Test Frequency: 866.5MHz				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	polarization	Level(dBm)		
53.32	Vertical	-73.39	-54.00	Pass
111.35	V	-74.53		
34.64	V	-71.11	-36.00	
148.96	V	-69.69		
1733.00	V	-39.29	-30.00	
2599.50	V	-45.15		
71.83	Horizontal	-79.95	-54.00	
494.20	H	-74.68		
34.76	H	-73.89	-36.00	
173.81	H	-77.25		
1733.00	H	-39.24	-30.00	
2599.50	H	-43.19		

TX mode				
Test Frequency: 869.9MHz				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	polarization	Level(dBm)		
53.32	Vertical	-73.49	-54.00	Pass
111.35	V	-74.65		
34.64	V	-71.51	-36.00	
148.96	V	-69.08		
1739.90	V	-38.98	-30.00	
2609.70	V	-44.01		
71.83	Horizontal	-79.95	-54.00	
494.20	H	-74.57		
34.76	H	-73.11	-36.00	
173.81	H	-77.94		
1739.90	H	-39.73	-30.00	
2609.70	H	-43.76		

RX mode				
Test Frequency: 863.1MHz				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	polarization	Level(dBm)		
157.01	Vertical	-70.80	-57.00	Pass
470.52	V	-73.26		
1726.20	V	-61.36		
35.13	Horizontal	-68.47	-47.00	
153.20	H	-70.29	-57.00	
1726.20	H	-63.56		

RX mode				
Test Frequency: 866.5MHz				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	polarization	Level(dBm)		
157.01	Vertical	-70.93	-57.00	Pass
470.52	V	-73.56		
1733.00	V	-61.79		
35.13	Horizontal	-68.42	-47.00	
153.20	H	-70.15	-57.00	
1733.00	H	-63.68		

RX mode				
Test Frequency: 869.9MHz				
Frequency (MHz)	Spurious Emission		Limit (dBm)	Test Result
	polarization	Level(dBm)		
157.01	Vertical	-70.95	-57.00	Pass
470.52	V	-73.94		
1739.90	V	-61.15		
35.13	Horizontal	-68.22	-47.00	
153.20	H	-70.65	-57.00	
1739.90	H	-63.27		

6.13 Receiver Requirements

Receiver Classification, Table 1 of EN 300 220-1.

Table 1: Receiver categories

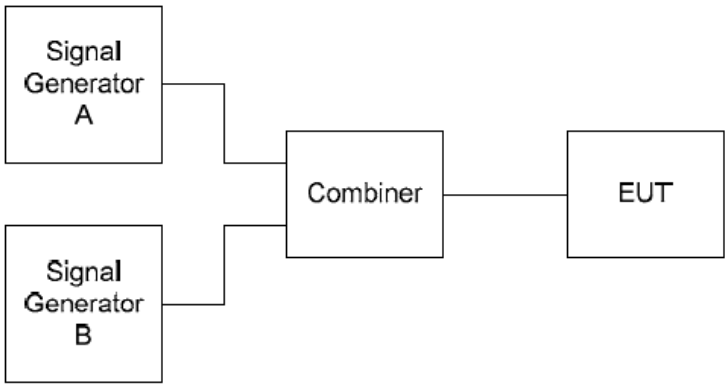
Receiver category	Description
1	Category 1 is a high performance level of receiver. In particular to be used where the operation of a SRD may have inherent safety of human life implications.
1.5	Category 1.5 is an improved performance level of receiver category 2.
2	Category 2 is standard performance 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.

Remark: The EUT (Rx part) belong to Class 3 with no polite spectrum access.

6.13.1 RX sensitivity

Not applicable, only applied to with polite spectrum access facility.

6.13.2 Blocking

Test Requirement:	EN 300 220-2 Clause 4.4.2
Test Method:	EN 300 220-1 Clause 5.18.6
Limit:	**Table 40: Blocking level parameters for RX category 3** Requirement: Blocking at ±2 MHz from OC edge f_{high} and f_{low} — Limits (Receiver category 3): ≥ -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
Test setup:	 **Figure 10: Blocking measurement arrangement**
Test procedure:	**Step 1:** Signal generator B shall be powered off. Signal generator A shall be set to the minimum level which gives the wanted performance criterion of EUT or the reference level in Table 32, whichever is the higher The output level of generator A shall then be increased by 3 dB unless otherwise specified in technical requirement. **Step 2:** Signal generator B is powered on and set to operate at the nominal operating frequency - offset frequency. Signal generator B is then switched on and the signal amplitude is adjusted to the minimum level at which the wanted performance criterion is not achieved. With signal generator B settings unchanged, the receiver shall be replaced with a suitable RF power measuring equipment. The power into the measuring equipment shall be measured and noted. The blocking level is then the conducted power received from generator B at the EUT antenna connector. This can either be measured on the antenna connector for conducted test or be calculated for radiated test (see clause C.5.4). The blocking level shall be higher or equal to the blocking power level requested in the technical requirement clause. **Step 3:** The measurement in steps 1 to 3 shall be repeated with signal offsets at required frequencies. **Step 4:** The information shown in Table 44 shall be recorded in the test report for each measured signal level and unwanted signal offset. **Table 44: Information Recorded in the Test Report** Value: Operating Frequency — Notes: Nominal centre frequency of the receiver Signal generator A — Power level of signal generator A Blocking level — Power level of signal generator B For equipment using CCA whatever is the receiver category, steps 1 to 4

	shall be repeated with signal generator A level adjusted +13 dB higher than in the measurements in clause 5.18.6.4.
Test Instruments:	Refer to section 5.8 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Measurement Data:

863.1MHz			
Requirement	**blocking level (dBm)**	**Limits Receiver category 3**	**Test Result**
Blocking at ±2 MHz from OC edge fhigh and flow	-73	≥ -80 dBm	Pass
Blocking at ±10 MHz from OC edge fhigh and flow	-56	≥ -60 dBm	Pass
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	-57	≥ -60 dBm	Pass

866.5MHz			
Requirement	**blocking level (dBm)**	**Limits Receiver category 3**	**Test Result**
Blocking at ±2 MHz from OC edge fhigh and flow	-79	≥ -80 dBm	Pass
Blocking at ±10 MHz from OC edge fhigh and flow	-51	≥ -60 dBm	Pass
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	-55	≥ -60 dBm	Pass

869.9MHz			
Requirement	**blocking level (dBm)**	**Limits Receiver category 3**	**Test Result**
Blocking at ±2 MHz from OC edge fhigh and flow	-77	≥ -80 dBm	Pass
Blocking at ±10 MHz from OC edge fhigh and flow	-56	≥ -60 dBm	Pass
Blocking at ±5 % of Centre Frequency or 15 MHz, whichever is the greater	-52	≥ -60 dBm	Pass

6.14 Polite spectrum access requirements

6.14.1 Clear Channel Assessment threshold

Not applicable, only applied to with polite spectrum access facility.

6.14.2 Polite spectrum access timing parameters

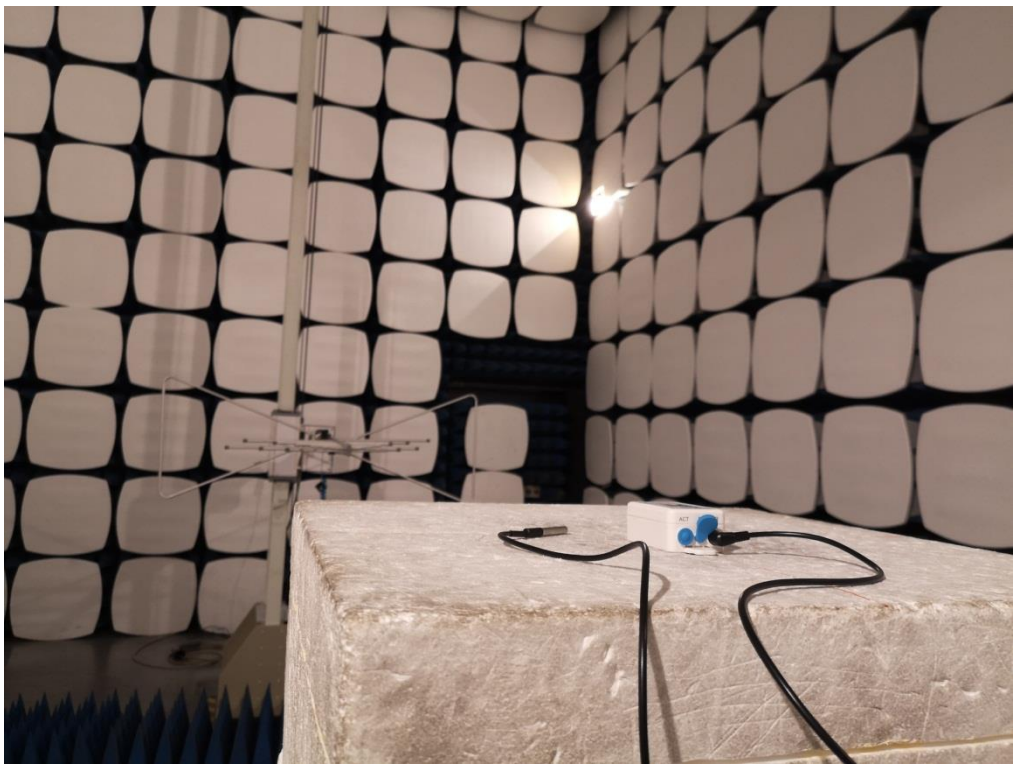
Not applicable, only applied to with polite spectrum access facility.

6.14.3 Adaptive Frequency Agility

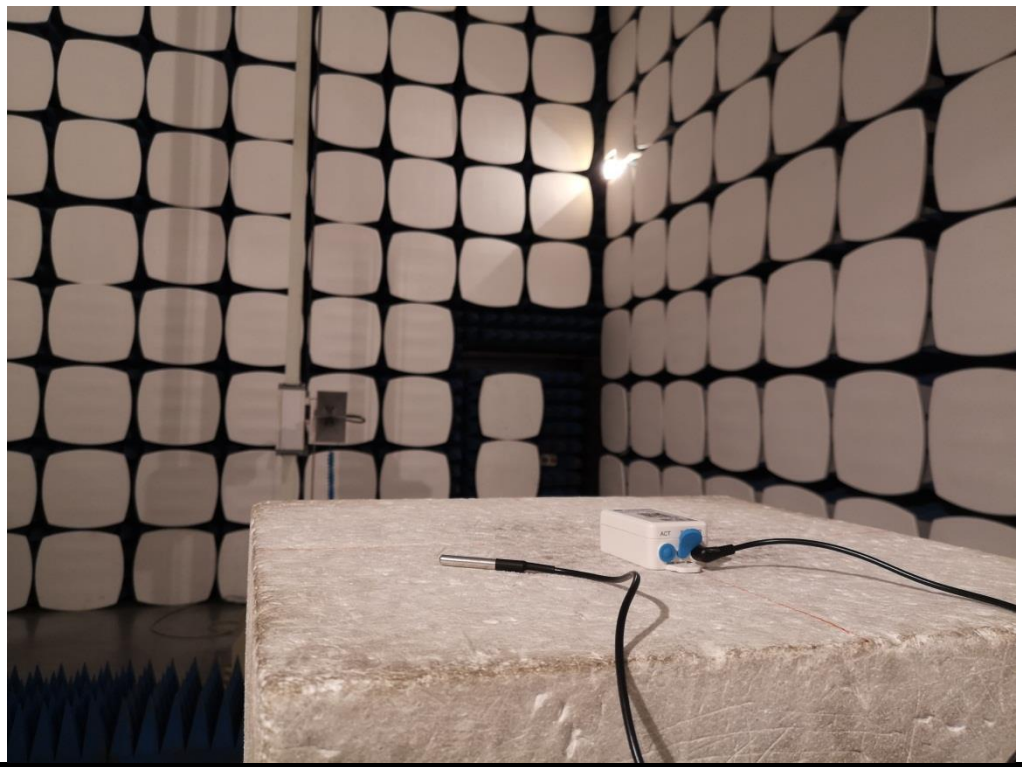
Not applicable, only applied to with polite spectrum access facility.

7 Test Setup Photo

Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



8 EUT Constructional Details

Reference to the test report No. CCISE190909701.

------End of report------