
RF Test Report

Report No.: ATL20191108787R01

TEST NAME : 2014/53/EU RED Directive Art.3.2

PRODUCT DESIGNATION : LoRa module

BRAND NAME : RAK

MODEL NAME : RAK4260(H)

CLIENT : Shenzhen RAKwireless Technology Co., Ltd.

DATE OF ISSUE : Jan. 15, 2020

STANDARD(S) : ETSI EN 300 220-1 V3.1.1 (2017-02),
ETSI EN 300 220-2 V3.1.1 (2017-02)

REPORT VERSION : V1.0

Shenzhen ATL Testing Technology Co., Ltd.

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Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jan. 15, 2020	Valid	Original Report

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TEST RESULT CERTIFICATION

Applicant Name:	Shenzhen RAKwireless Technology Co., Ltd.
Address:	Room 506, Bldg B, New Compark, Pingshan First Road, Taoyuan Street, XiLi town Nanshan District, Shenzhen, China
Manufacturer Name:	Shenzhen RAKwireless Technology Co., Ltd.
Address:	Room 506, Bldg B, New Compark, Pingshan First Road, Taoyuan Street, XiLi town Nanshan District, Shenzhen, China
Product Designation:	LoRa module
Brand Name:	RAK
Test Model	RAK4260(H)
Series Model	N/A
Model Difference	N/A
Date of test	Dec. 16, 2019 to Jan.15, 2020

We (ATL), Shenzhen ATL Testing Technology Co., Ltd. for compliance with the requirements set forth in the European Standard ETSI EN 300 220-1 V3.1.1 (2017-02), ETSI EN 300 220-2 V3.1.1 (2017-02). The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By Rose Fang
(Rose Fang) Jan. 15, 2020

Reviewed By Jane He
(Jane He) Jan. 15, 2020

Approved By July Yan
(July Yan) Jan. 15, 2020
Authorized Officer

**Shenzhen ATL Testing Technology Co., Ltd.**

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TECHNICAL INFORMATION

EUT DESCRIPTION

Operating Frequency Range(s)	K:863MHz-865MHz L:865MHz-868MHz M:868MHz-868.6MHz N:868.7MHz-869.2MHz P:869.4MHz-869.65MHz Q:869.7MHz-870MHz
Type of Equipment	Stand-alone module
Modulation	ASK
Hardware Version	V2.0
Software Version	V1.0
Adaptive / non-adaptive equipment	non-adaptive equipment
The number of channel Frequencies	18 for Lora 863MHz-870MHz
The maximum RF Output Power (e.i.r.p.)	11.79dBm
Antenna designation	negative TNC to connect
Antenna gain	3 dBi
Nominal voltages	DC 3.3V
The extreme operating conditions	Operating temperature range: -20°C~55°C Operating voltage range: DC 3.3V

Note:

1. The above information was declared by the applicant.
2. The equipment submitted are representative production models.
3. The EUT provides Bluetooth wireless interface operating at Lora band (863MHz-870MHz).
4. Only the Bluetooth was tested according the standard requirement.
5. The EUT is an adaptive equipment and hand-portable station according to Draft ETSI EN 300 220-1/-2 V3.1.1.
6. Please refer to Appendix I for the photographs of the EUT. For more details, please refer to the User's manual of the EUT.

SUPPORT EQUIPMENT

Item	Equipment	Mfr/Brand	Model/Type No.	Remark
1	IPOD	APPLE	A1367	--
2	PC	Lenovo	SL410K	--

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DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX
2	Middle channel TX
3	High channel TX
4	Low channel RX
5	Middle channel RX
6	High channel RX

Note: All the test modes can be supply by battery, only the result of the worst case was recorded in the report if no any records.

■ Test Instruments

Description	Manufacturer	Model No.	S/N	Calibration Date	Calibration Due.
SIGNAL ANALYZER	Agilent	N9020A	MY49100060	Oct. 21, 2019	Oct. 20,2020
SIGNAL GENERATOR	Agilent	N5182A	MY50140530	Oct. 21, 2019	Oct. 20,2020
SIGNAL GENERATOR	Agilent	E8257D	MY45141029	Dec. 04, 2019	Dec. 03, 2020
USB Wideband Power Sensor	Agilent	U2021XA	MY54110007	Oct. 24, 2019	Oct. 23, 2020
USB Wideband Power Sensor	Agilent	U2021XA	MY54110009	Oct. 24, 2019	Oct. 23, 2020
USB Wideband Power Sensor	Agilent	U2021XA	MY54110014	Oct. 24, 2019	Oct. 23, 2020
USB Wideband Power Sensor	Agilent	U2021XA	MY54110012	Oct. 24, 2019	Oct. 23, 2020
USB Simultaneous Sampling Multifunction DAQ	Agilent	U2531A	MY5211038	Oct. 24, 2019	Oct. 23, 2020
2.4 GHz Filter	Micro-Tronics	BRM50702	017	Mar. 06, 2019	Mar. 05, 2020
Spectrum Analyzer	Agilent	E4440A	US41421290	July 25, 2019	July 24, 2020

OBJECTIVE

Perform Radio Spectrum tests for CE Marking according to the provisions of article 3.2 of the RED Directive (2014/53/EU) for the Bluetooth function of the EUT.

A) TEST STANDARDS AND RESULTS

The EUT has been tested according to ETSI EN 300 220 V3.1.1(2017-02).

ETSI EN 300 328 V2.2.2	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 the essential requirements of article 3.2 of the RED Directive
------------------------	---

SUMMARY OF TEST RESULT

Transmitter Parameters			
Description	Clause	Result	Note
Frequency error	7.1	PASS	---
Average power (conducted) (external antenna only)	7.2	PASS	Applies to transmitters with permanent external antenna connector
Effective radiated power (integral antenna only)	7.3	pass	Applies to transmitters with an integral or dedicated antenna
Spread spectrum modulation	7.4	N/A	The EUT is not support FHSS, DSSS and other spread spectrum than FHSS Mode.
Transient power	7.5	PASS	---
Adjacent channel power	7.6	PASS	Applies to narrowband transmitters
Modulation bandwidth	7.7	PASS	Applies to all transmitters not covered by Adjacent channel power
Unwanted emissions in the spurious domain	7.8	PASS	---
Frequency stability under low voltage conditions	7.9	N/A	Applies to battery-operated transmitters
Duty Cycle	7.10	PASS	---
Time-out-timer	7.11	N/A	Applies to transmitters operating in the frequency bands 433,050 MHz to 434,790 MHz or 869,7 MHz to 870 MHz and supporting voice applications not employing duty cycle restriction

Receiver Parameters			
Description	Clause	Result	Note
Receiver sensitivity	8.1	N/A	Applies to receivers with LBT
Receiver LBT threshold	8.2	N/A	Applies to receivers with LBT
Adjacent channel selectivity	8.3	N/A	Applies to Category 1 receivers

Blocking	8.4	PASS	---
Spurious response rejection	8.5	N/A	Applies to Category 1 receivers
Receiver spurious radiation	8.6	PASS	---

The test results of this report relate only to the tested sample(s) identified in this report. Manufacturer or whom it may concern should recognize the pass or fail of the test result.

1 Transmitter

1.1. Frequency Error Test

■ Limit

ETSI EN 300 220-1 (V2.4.1) clause 7.1.3

The frequency error shall not exceed the values given in table 4a for systems with channel spacing of less or equal to 25 kHz, or table 4b for all other systems, under normal and extreme conditions (see specific bands in ETSI EN 300 220-1 (V2.4.1) clause 7.2.3, table 5).

Frequency error for systems with channel spacing of less than or equal to 25 kHz

Channelization	Frequency error limit (kHz)				
	< 47 MHz	47 MHz to 137 MHz	> 137 MHz to 300 MHz	> 300 MHz to 500 MHz	> 500 MHz to 1 000 MHz
Channelized systems	± 10.0	± 10.0	± 10.0	± 12.0	± 12.5

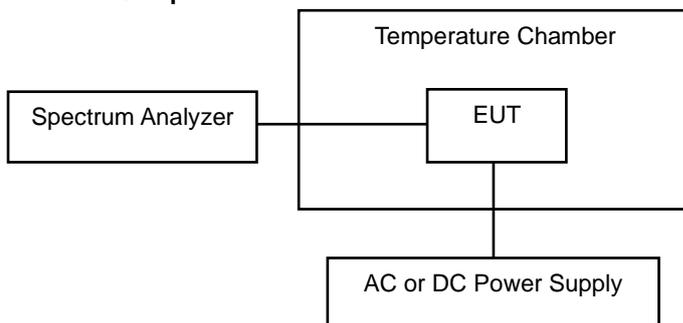
Note 1: Adjacent channel power as defined in clause 7.6.1 shall not exceed the limit in clause 7.6.3.
 Note 2: For equipment having a channel spacing of 12,5 kHz or less, the frequency error limit shall not exceed 50 % of the channel spacing.

Frequency error for all other systems

Operating frequency (MHz)	Frequency error limit, see note (ppm)
≤ 1 000	± 100

Note: The frequency error measured shall not exceed the designated frequency band.

■ Test Setup



■ Test Procedure

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 5.3 for the test conditions.

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.1.2 for the measurement method.

■ Test Result

Test Mode		Transmitter mode							
Temperature		25°C	-40° C		80° C		Measured frequencies (MHz)	Maximum deviation from rate frequency (KHz)	Maximum deviation from rate frequency (ppm)
Test Conditions		3.30 Vdc	2.97 Vdc	3.63 Vdc	2.97 Vdc	3.63 Vdc			
863.1 MHz	Low	863.10085	863.10093	863.10078	863.10092	863.10084	863.10085	863.10078	0.9
	High	863.10085	863.10093	863.10078	863.10092	863.10084	863.10085	863.10093	1.1
Limit								± 12 KHz	± 100 ppm

1.2. Average Power (Conducted) Test

■ Limit

ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.2.3

Under normal and extreme test conditions (see clauses 5.3 and 5.4.1 as well as 5.4.2), the average output power (conducted) shall be less than or equal to the value given in table 5 for the respective frequency band, application, and channel spacing.

Maximum radiated power limit, e.r.p., channel spacing, spectrum access and mitigation requirements

Frequency Bands	Applications	Maximum radiated power, e.r.p. / power spectral density	Channel spacing	Spectrum access and mitigation requirement (e.g. Duty cycle or LBT + AFA)
26.995 MHz, 27,045 MHz, 27.095 MHz, 27.145 MHz, 27.195 MHz 34.995 MHz to 35.225 MHz 40.665 MHz, 40.675 MHz, 40.685 MHz, 40.695 MHz	Model control	100 mW	10 kHz 10 kHz 10 kHz	No restriction
26.957 MHz to 27.283 MHz	Non-specific use	10 mW	No requirement	No restriction
40.660 MHz to 40.700 MHz	Non-specific use	10 mW	No requirement	No restriction
138.200 MHz to 138.450 MHz	Non-specific use	10 mW	No requirement	1 % (see note 3)
169.400 MHz to 169.475 MHz	Tracking and tracing	500 mW	≤50 kHz	1 % (see note 3)
169.400 MHz to 169.475 MHz	Meter Reading	500 mW	≤50 kHz	10 %
169.475 MHz to 169.4875 MHz	Social alarms	10 mW	12.5 kHz	0.1 %
169.5875 MHz to 169.6000 MHz	Social alarms	10 mW	12.5 kHz	0.1 %
433.050 MHz to 434.790 MHz (see note 4)	Non-specific use	10 mW	No requirement	10 % (see note 3)
433.050 MHz to 434.790 MHz (see note 5)	Non-specific use	1 mW For bandwidth greater than 250 kHz the power density is limited to -13 dBm/ 10 kHz	No requirement	100 %
434.040 MHz to 434.790 MHz (see note 5)	Non-specific use	10 mW	≤25 kHz	100 %
863.000 MHz to 870.000 MHz (see note 4) Modulation bandwidth up	Non-specific use (Narrow/wideband modulation)	25 mW	≤100 kHz (see note 6)	0,1 % or LBT + AFA (see notes 2, 3 and 9)

to 300 kHz is allowed (see clause 7.7.3)				
863.000 MHz to 870.000 MHz (see note 4)	Non-specific use (DSSS and other wideband modulation other than FHSS)	Power density is limited to -4,5 dBm/100 kHz (see notes 1 and 7)	No requirement	0,1 % or LBT + AFA (see notes 3, 8 and 9)
863.000 MHz to 870.000 MHz (see note 4)	Non-specific use (FHSS modulation)	25 mW (see note 1)	≤100 kHz (see table 6) (see note 6)	0,1 % or LBT (see notes 2 and 9)

Frequency Bands	Applications	Maximum radiated power, e.r.p. / power spectral density	Channel spacing	Spectrum access and mitigation requirement (e.g. Duty cycle or LBT + AFA)
864.800 MHz to 865.000 MHz	Wireless audio applications	10 mW	50 kHz	No restriction
868.000 MHz to 868.600 MHz (see note 4)	Non-specific use	25 mW	No requirement (see note 6)	1 % or LBT + AFA (see note 3)
868.600 MHz to 868.700 MHz	Alarms	10 mW	25 kHz The whole stated frequency band may be used as 1 wideband channel for high speed data transmission	1 %
868.700 MHz to 869.200 MHz (see note 4)	Non-specific use	25 mW	No requirement (see note 6)	0.1 % or LBT + AFA (see note 3)
869.200 MHz to 869.250 MHz	Social alarms	10 mW	25 kHz	0.1 %
869.250 MHz to 869.300 MHz	Alarms	10 mW	25 kHz	0.1 %
869.300 MHz to 869.400 MHz	Alarms	10 mW	25 kHz	1 %
869.400 MHz to 869.650 MHz	Non-specific use	500 mW	≤25 kHz The whole stated frequency band may be used as 1 wideband channel for high speed d	10 % or LBT + AFA (see note 3)
869.650 MHz to 869.700 MHz	Alarms	25 mW	25 kHz	10 %
869.700 MHz to 870.000 MHz (see note 5)	Non-specific use	25 mW	No requirement	1 % or LBT+AFA (see notes 2 and 3)
869.700 MHz to 870.000 MHz (see note 5)	Non-specific use	5 mW	No requirement	No restriction

Note 1: The power limits, channel arrangement and duty cycle for FHSS equipment are given in clause 7.4.1.2; for DSSS and other non-FHSS spread spectrum equipment are given in clause 7.4.1.3.

Note 2: For frequency agile devices without LBT (or equivalent techniques) operating in the frequency range 863 MHz to 870 MHz, the duty cycle limit applies to the total transmission unless specifically stated otherwise (e.g. clause 7.10.3).

Note 3: When either a duty cycle, Listen Before Talk (LBT) or equivalent technique applies then it shall not be user dependent/adjustable and shall be guaranteed by appropriate technical means. For LBT devices without Adaptive Frequency Agility (AFA) or equivalent techniques, the duty cycle limit applies.

Note 4: Devices supporting audio and video applications shall use a digital modulation method with a maximum

bandwidth of 300 kHz. Devices supporting analogue and/or digital voice shall have a maximum bandwidth not exceeding 25 kHz.

Note 5: Devices shall not support audio and/or video applications. Devices supporting voice applications shall not exceed 25 kHz bandwidth and shall use spectrum access technique such as LBT or equivalent; the transmitter shall include a power output sensor controlling the transmitter to a maximum transmit period of 1 minute for each transmission.

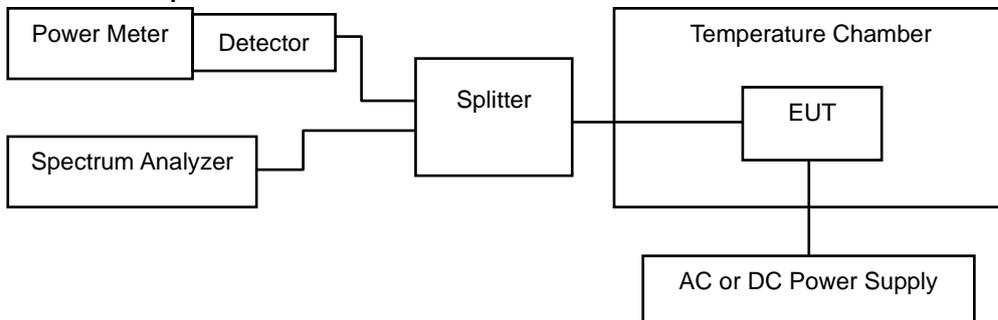
Note 6: The preferred channel spacing is 100 kHz allowing for subdivision into 50 kHz or 25 kHz.

Note 7: The power density can be increased to +6,2 dBm/100 kHz and -0,8 dBm/100 kHz, if the band is limited to 865 MHz to 868 MHz and 865 MHz to 870 MHz respectively.

Note 8: For wideband modulation other than FHSS and DSSS with a bandwidth of 200 kHz to 3 MHz, duty cycle can be increased to 1 % if the band is limited to 865 MHz to 868 MHz and power to ≤ 10 mW e.r.p.

Note 9: Duty cycle may be increased to 1 % if the band is limited to 865 MHz to 868 MHz.

■ **Test Setup**



■ **Test Procedure**

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 6.1.3 for the test conditions.

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.2.2 for the measurement method.

■ **Test Result**

Not applicable. The EUT is use internal antenna.

or

Test Mode	Mode 1: Transmitter mode				
Temperature	25°C	-40° C		80° C	
Test Conditions	3.30 Vdc	2.97 Vdc	3.63 Vdc	2.97 Vdc	3.63 Vdc
863.1 MHz	7.79	7.60	7.66	7.83	7.86
869.9 MHz	7.87	7.73	7.79	7.90	7.95
Limit	14 dBm				

1.3. Effective Radiated Power Test

■ Limit

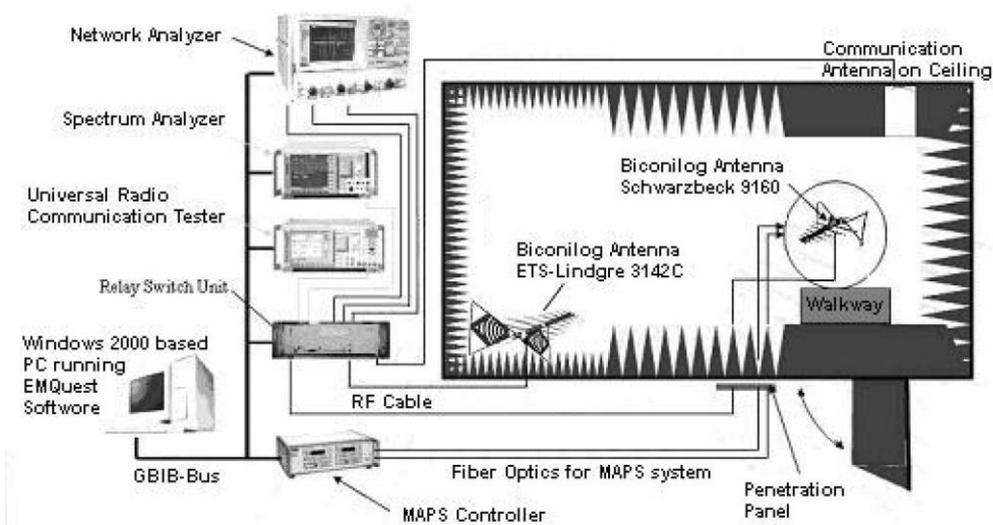
ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.3.3

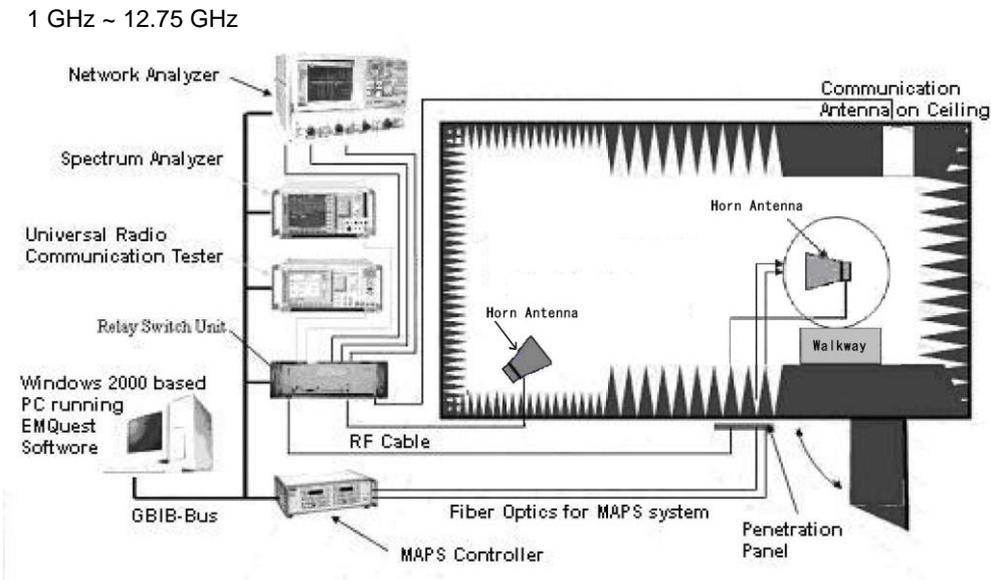
The permitted carrier powers in different SRD frequency bands are given in ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.2.3 table 5; as implemented through National Radio Interfaces (NRI) and additional NRI as relevant.

The power density limits for DSSS and other non-FHSS spread spectrum equipment are given in clause 7.4.2.2.

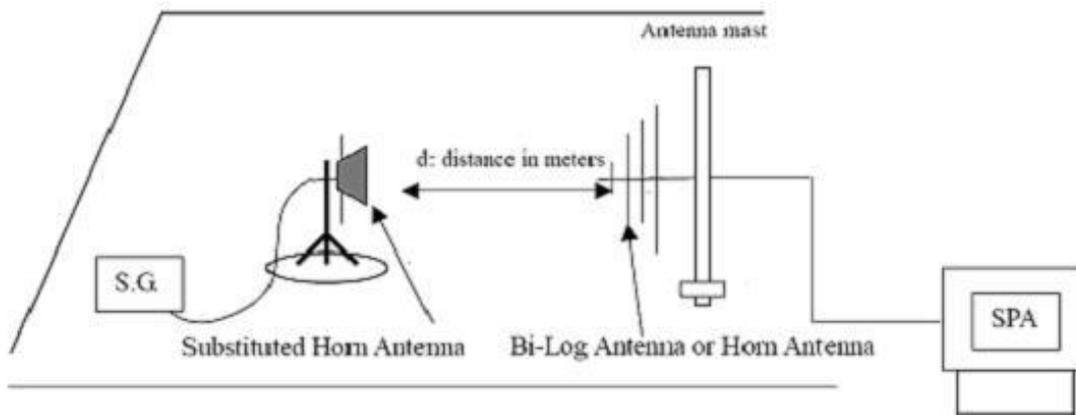
■ Test Setup

Below 1GHz





Substituted Method Test Set-up



■ Test Procedure

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 6.1.3 for the test conditions.

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.3.2 for the measurement method.

■ Test Result

Not applicable. The EUT is use external antenna

Or

Test Mode	Mode 1: Transmitter mode
Temperature	25°C
Test Conditions	3.0 Vdc
869.1 MHz	11.97 dBm
Limit	14 dBm

1.4. Spread Spectrum Modulation Test

■ **Limit**

ETSI EN 300 220-1 (V2.4.1) clause 7.4.1.3

1. The number of FHSS hopping channels shall be greater than or equal to the values given in table 6.

Minimum of hop channels and other requirements for FHSS

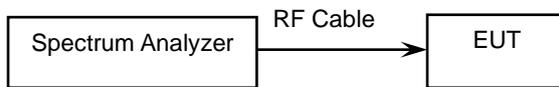
Sub-band	Number of hop channels/bandwidth (BW)	Other requirements
865 MHz to 868 MHz	≥ 58 at ≤ 50 kHz BW each	LBT or < 1 % TX duty cycle (see note 1)
863 MHz to 870 MHz (see note 2)	≥ 47 at ≥ 100 kHz BW each	LBT or < 0,1 % TX duty cycle (see note 1)
Note 1: The duty cycle applies to the entire transmission (not at each hopping channel). Note 2: FHSS as shown in the present table shall not be used in the frequency bands for alarms as defined in ETSI EN 300 220-1 (V2.4.1) tables 1 and 5.		

2. The maximum dwell time per channel shall be equal to or less than 400 ms.
3. The return time to a hopping channel shall be equal or less than the product of 4 x channel dwell time x the number of hopping channels, and shall not exceed 20 s.
4. Each channel of the hopping sequence shall be occupied at least once during a period not exceeding the product of 4 x dwell time per hop and the number of hopping channels.
5. In case of LBT being used for FHSS, this function shall be used at each hop channel. LBT can also be used on the first frequency corresponding to frame preamble transmissions, FHSS can then apply to remaining data frame provided the duty cycle is respected during the entire transmission, i.e. preamble excluded.
6. When LBT access is used the requirement of clause 9.2.5.2.3 shall apply.
7. In the case of FHSS with a dwell time less than the LBT listen time defined in clause 9.2.2.2, a 0,1 % duty cycle restriction applies for the entire FHSS transmission mode. LBT can also be used on the first frequency corresponding to frame preamble transmissions, FHSS can then apply to remaining data frame provided the duty cycle is respected during the entire transmission, i.e. preamble excluded.
8. Using the additional test conditions for FHSS in clause 6.1.3, the conducted power, clause 7.2.3, or radiated power limit, clause 7.3.3, shall not be exceeded.
9. Using the additional test conditions for FHSS in clause 6.1.3, the adjacent channel power, see clauses 7.6.3 or 7.7.3, and spurious emissions, see clause 7.8.3, shall not be exceeded.

ETSI EN 300 220-1 (V2.4.1) clause 7.4.2.2

For Direct Sequence Spread spectrum or spread spectrum modulation other than FHSS the following limits given in table 7 apply in addition to the conducted power, clause 7.2.3, or radiated power limit, clause 7.3.3.

Sub-band	Maximum Occupied bandwidth	Maximum radiated power density e.r.p.	Duty cycle
865 MHz to 868 MHz	0.6 MHz	6.2 dBm / 100 kHz	1 %
865 MHz to 870 MHz	3.0 MHz	-0.8 dBm / 100 kHz	0.1 %
863 MHz to 870 MHz	7.0 MHz	-4.5 dBm / 100 kHz	0.1 %

■ Test Setup**■ Test Procedure**

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.4.1 for the measurement method.

■ Test Result

Not applicable. The EUT is not support FHSS, DSSS and other spread spectrum than FHSS Mode.

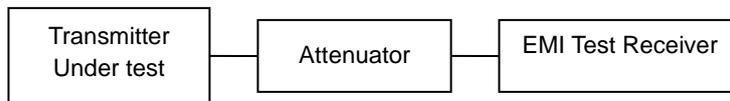
1.5. Transient Power Test

■ Limit

ETSI EN 300 220-1 (V2.4.1) Clause 7.5.3

At all frequencies where the emission levels measured in step 1 exceed the modulation bandwidth spectrum mask limits (see clause 7.7.3) for wideband equipments or the spurious domain limits (clause 7.8.3) for narrowband equipments, the power level measured in step 1 shall not exceed the power level measured in step 2 by more than 3 dB.

■ Test Setup



■ Test Procedure

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.5.2 for the measurement method.

■ Test Result

Test Mode	Transmitter mode
-----------	------------------

Frequency	863.1 MHz	
	f_a (MHz)	f_b (MHz)
	863.0416	863.1527

Center frequency (MHz)	Transient Power(dBm)		
	Step 1 Power (dBm)	Step 2 Power (dBm)	Delta (dB)
863.2527	-35.31	-35.92	0.61
862.9416	-37.85	NA	NA
863.3727	-42.69	-44.14	1.45
862.8216	NA	NA	NA
863.4927	-46.76	-48.54	1.78
862.7016	NA	NA	NA
863.6127	-49.88	-51.41	1.53
Limit(dBm)	Step 1 Power >-36dBm, Delta<3dB		

Frequency	869.9 MHz	
	f_a (MHz)	f_b (MHz)
	869.8407	869.9523

Center frequency (MHz)	Transient Power(dBm)		
	Step 1 Power (dBm)	Step 2 Power (dBm)	Delta (dB)
870.0523	-34.18	-34.86	0.68
869.7407	-37.12	NA	NA
870.1723	-42.71	-43.62	0.91
869.6207	NA	NA	NA
870.2923	-46.15	-47.57	1.42
869.5007	NA	NA	NA
870.4123	-49.65	-51.03	1.38
Limit(dBm)	Step 1 Power >-36dBm, Delta<3dB		

1.6. Adjacent Channel Power Test

■ **Limit**

ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.6.3

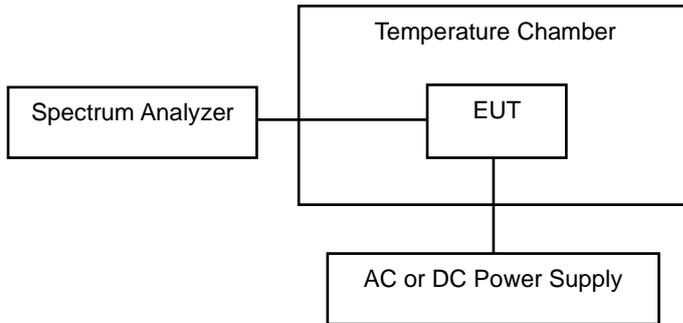
The power in the adjacent channel shall not exceed the maximum values given in table 9.

Adjacent channel power limits applicable to narrowband systems:

Conditions	Channel separation <20kHz	Channel separation ≥ 20 kHz
Normal condition	10 μ W	200nW
Extreme condition	32 μ W	640nW

Note: These limits also apply to spread spectrum equipment.

■ **Test Setup**



■ **Test Procedure**

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 6.1.3 for the test conditions.

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.6.2 for the measurement method.

■ **Test Result**

Not applicable. The EUT is not narrowband transmitters

or

Test Mode	Mode : Transmitter mode				
Test Conditions			ACP (dBm)		Limit (dBm)
Temperature (°C)	Voltage (Vdc)		Low	Up	
25	V _{Nom}	3.0	-39.38	-38.93	-31.94
-10	V _{min}	2.7	-38.82	-37.75	37
	V _{max}	3.3	-38.75	-37.66	
50	V _{min}	2.7	-41.26	-38.16	
	V _{max}	3.3	-41.12	-39.25	

1.7. Modulation Bandwidth Test

■ **Limit**

ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.7.3

The permitted range of modulation bandwidth including the frequency error or drift as measured in clause 7.1 shall be within the limits shown in table 10.

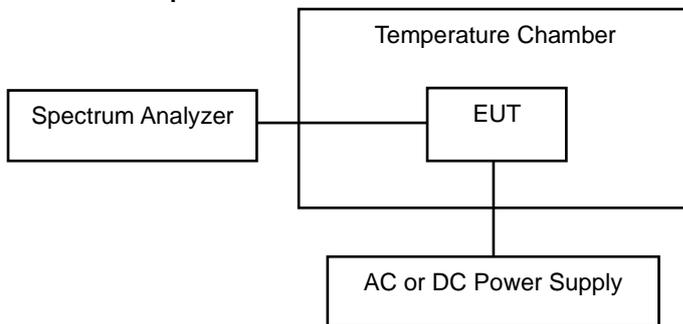
Where the band is divided into sub-bands the limits shall apply to the sub-band edge frequencies. In table 10, $f_{e,lower}$ and $f_{e,upper}$ are the lower and upper edges of the band in which the equipment operates.

This limit also applies to spread spectrum equipment.

Emission Limits of the modulated signal

Reference Bandwidth (RBW)	Limit	Lower envelope point minimum frequency	Upper envelope point maximum frequency
1 kHz	1 uW	$f_{e,lower}$	$f_{e,upper}$
1 kHz	250 nW	$(f_{e,lower} - 200 \text{ kHz})$	$(f_{e,upper} - 200 \text{ kHz})$
10 kHz	250 nW	$(f_{e,lower} - 400 \text{ kHz})$	$(f_{e,upper} - 400 \text{ kHz})$
100 kHz	250 nW	$(f_{e,lower} - 1000 \text{ kHz})$	$(f_{e,upper} - 1000 \text{ kHz})$

■ **Test Setup**



■ **Test Procedure**

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 6.1.3 for the test conditions.

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.7.2 for the measurement method.

■ **Test Result**

Not applicable. The EUT have Adjacent channel power.

Or

Test Mode	Mode 1: Transmitter mode
-----------	--------------------------

Frequency		863.1MHz					
Test Conditions			Measured Frequency (MHz)		Modulation Bandwidth (MHz)	Limit	Result
Temperature (°C)	Voltage (Vdc)		$f_{e,lower}$ (MHz)	$f_{e,upper}$ (MHz)			
25	V_{Nom}	3.30	863.0416	863.1527	0.1111	$\cong 300KHz$	Pass
-40	V_{min}	2.97	863.0421	863.1542	0.1121	$\cong 300KHz$	Pass
	V_{max}	3.63	863.0429	863.1548	0.1119	$\cong 300KHz$	Pass
80	V_{min}	2.97	863.0408	863.1512	0.1104	$\cong 300KHz$	Pass
	V_{max}	3.63	863.0406	863.1511	0.1105	$\cong 300KHz$	Pass

Frequency		863.1MHz				
Test Conditions			Measured Level (dBm)		Limit	Result
Temperature (°C)	Voltage (Vdc)		$f_{e,lower} -200KHz$	$f_{e,upper} +200KHz$		
25	V_{Nom}	3.30	-53.21	-88.09	30dBm/KHz	Pass
-40	V_{min}	2.97	-53.12	-88.11	30dBm/KHz	Pass
	V_{max}	3.63	-53.15	-88.02	30dBm/KHz	Pass
80	V_{min}	2.97	-53.37	-88.27	30dBm/KHz	Pass
	V_{max}	3.63	-53.44	-88.25	30dBm/KHz	Pass
Test Conditions			Measured Level (dBm)		Limit	Result
Temperature (°C)	Voltage (Vdc)		$f_{e,lower} -200KHz \sim f_{e,lower} -400KHz$	$f_{e,upper} +200KHz \sim f_{e,upper} +400KHz$		
25	V_{Nom}	3.30	-71.35	-88.31	36dBm/KHz	Pass
-40	V_{min}	2.97	-71.27	-88.17	36dBm/KHz	Pass
	V_{max}	3.63	-71.11	-88.15	36dBm/KHz	Pass
80	V_{min}	2.97	-71.48	-88.31	36dBm/KHz	Pass
	V_{max}	3.63	-71.52	-88.37	36dBm/KHz	Pass
Test Conditions			Measured Level (dBm)		Limit	Result
Temperature (°C)	Voltage (Vdc)		$f_{e,lower} -400KHz \sim f_{e,lower} -1MHz$	$f_{e,upper} +400KHz \sim f_{e,upper} +1MHz$		
25	V_{Nom}	3.30	-59.12	-70.03	36dBm/10KHz	Pass
-40	V_{min}	2.97	-58.55	-69.61	36dBm/10KHz	Pass
	V_{max}	3.63	-58.73	-69.72	36dBm/10KHz	Pass
80	V_{min}	2.97	-59.15	-70.35	36dBm/10KHz	Pass
	V_{max}	3.63	-59.36	-70.24	36dBm/10KHz	Pass
Test Conditions			Measured Level (dBm)		Limit	Result
Temperature (°C)	Voltage (Vdc)		Below $f_{e,lower} -1MHz$	Above $f_{e,upper} +1MHz$		
25	V_{Nom}	3.30	-58.10	-65.68	36dBm/100KHz	Pass
-40	V_{min}	2.97	-58.05	-65.52	36dBm/100KHz	Pass
	V_{max}	3.63	-58.15	-65.52	36dBm/100KHz	Pass
80	V_{min}	2.97	-58.32	-65.85	36dBm/100KHz	Pass
	V_{max}	3.63	-58.45	-65.83	36dBm/100KHz	Pass

Frequency		869.9MHz					
Test Conditions			Measured Frequency (MHz)		Modulation Bandwidth (MHz)	Limit \leq Channel Spacing	Result
Temperature (°C)	Voltage (Vdc)		$f_{e,lower}$ (MHz)	$f_{e,upper}$ (MHz)			
25	V_{Nom}	3.30	869.8407	869.9523	0.1116	$\leq 300KHz$	Pass
-40	V_{min}	2.97	869.8423	869.9545	0.1122	$\leq 300KHz$	Pass
	V_{max}	3.63	869.8429	869.9548	0.1119	$\leq 300KHz$	Pass
80	V_{min}	2.97	869.8402	869.9514	0.1112	$\leq 300KHz$	Pass
	V_{max}	3.63	869.8405	869.9514	0.1109	$\leq 300KHz$	Pass

Frequency		869.9MHz				
Test Conditions			Measured Level (dBm)		Limit	Result
Temperature (°C)	Voltage (Vdc)		$f_{e,lower} -200KHz$	$f_{e,upper} +200KHz$		
25	V_{Nom}	3.30	-88.26	-53.29	30dBm/KHz	Pass
-40	V_{min}	2.97	-88.15	-53.16	30dBm/KHz	Pass
	V_{max}	3.63	-88.09	-53.03	30dBm/KHz	Pass
80	V_{min}	2.97	-88.34	-53.42	30dBm/KHz	Pass
	V_{max}	3.63	-88.31	-53.48	30dBm/KHz	Pass
Test Conditions			Measured Level (dBm)		Limit	Result
Temperature (°C)	Voltage (Vdc)		$f_{e,lower} -200KHz \sim f_{e,lower} -400KHz$	$f_{e,upper} +200KHz \sim f_{e,upper} +400KHz$		
25	V_{Nom}	3.30	-88.36	-71.42	36dBm/KHz	Pass
-40	V_{min}	2.97	-88.21	-71.23	36dBm/KHz	Pass
	V_{max}	3.63	-88.12	-71.15	36dBm/KHz	Pass
80	V_{min}	2.97	-88.35	-71.53	36dBm/KHz	Pass
	V_{max}	3.63	-88.42	-71.59	36dBm/KHz	Pass
Test Conditions			Measured Level (dBm)		Limit	Result
Temperature (°C)	Voltage (Vdc)		$f_{e,lower} -400KHz \sim f_{e,lower} -1MHz$	$f_{e,upper} +400KHz \sim f_{e,upper} +1MHz$		
25	V_{Nom}	3.30	-70.12	-59.06	36dBm/10KHz	Pass
-40	V_{min}	2.97	-69.73	-58.64	36dBm/10KHz	Pass
	V_{max}	3.63	-69.84	-58.71	36dBm/10KHz	Pass
80	V_{min}	2.97	-70.34	-59.25	36dBm/10KHz	Pass
	V_{max}	3.63	-70.28	-59.33	36dBm/10KHz	Pass
Test Conditions			Measured Level (dBm)		Limit	Result
Temperature (°C)	Voltage (Vdc)		Below $f_{e,lower} -1MHz$	Above $f_{e,upper} +1MHz$		
25	V_{Nom}	3.30	-65.78	-58.26	36dBm/100KHz	Pass
-40	V_{min}	2.97	-65.43	-58.03	36dBm/100KHz	Pass
	V_{max}	3.63	-65.59	-58.19	36dBm/100KHz	Pass
80	V_{min}	2.97	-65.91	-58.46	36dBm/100KHz	Pass
	V_{max}	3.63	-65.88	-58.52	36dBm/100KHz	Pass

1.8. Unwanted Emissions in the Spurious Domain Test

■ **Limit**

ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.8.3

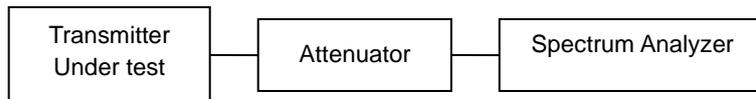
The power of any unwanted emission in the spurious domain shall not exceed the values given in table 11.

Spurious domain emission limits:

State	47MHz-74MHz 87.5MHz-118 MHz 174 MHz -230 MHz 470 MHz -862 MHz	Other frequencies below 1000MHz	Frequencies above 1000MHz
Operating	4nW	250nW	1μW
Standby	2nW	2nW	20nW

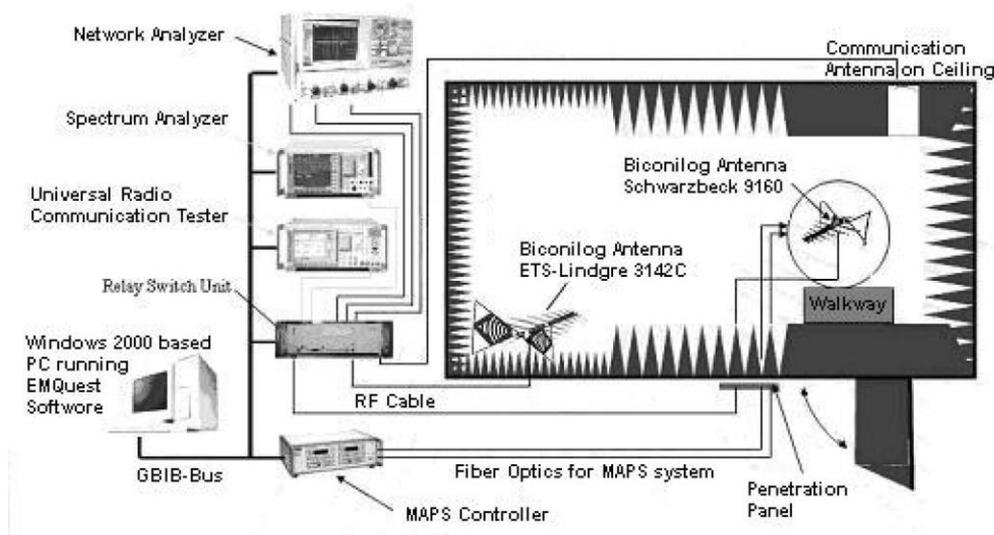
■ **Test Setup**

Conducted Spurious Emission:

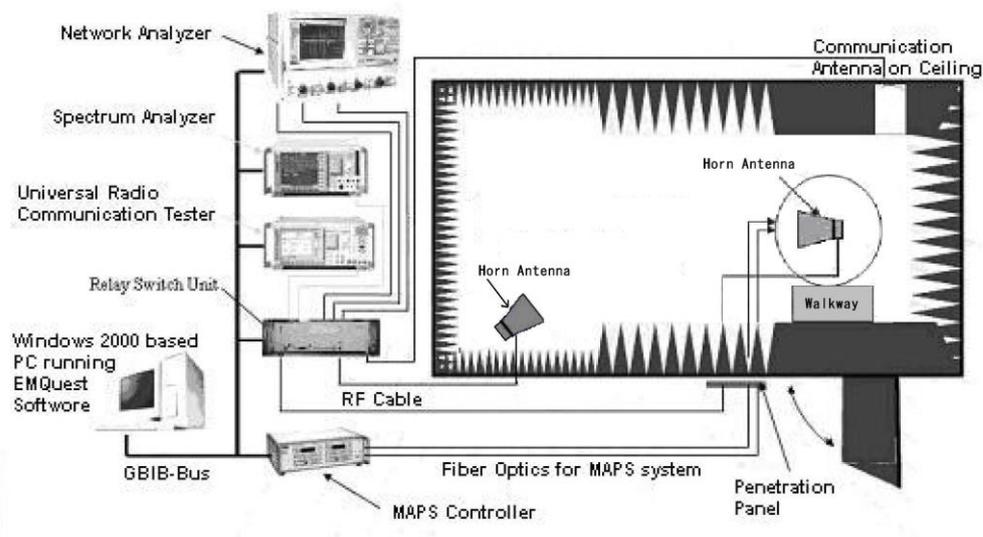


Radiated Emission:

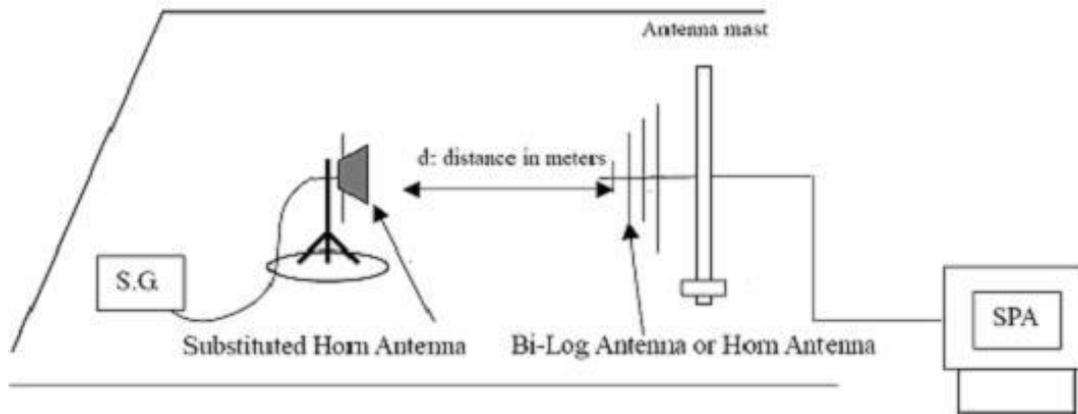
Below 1GHz



1 GHz ~ 12.75 GHz



Substituted Method Test Set-up

**■ Test Procedure**

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 6.1.3 for the test conditions.

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.8.2 for the measurement method.

■ Test Result

Conducted Measurement

Test Mode	Transmitter mode					
Frequency	863.1 MHz					
Power setting	11					
Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	EIRP Result (dBm)	ERP Result (dBm)	Limit (dBm)	Margin (dB)
623.2	-58.88	3	-55.88	-58.03	-54	-4.03
1740	-48.87	3	-45.87	-48.02	-30	-18.02
Frequency	869.9 MHz					
Power setting	11					
Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	EIRP Result (dBm)	ERP Result (dBm)	Limit (dBm)	Margin (dB)
630	-58.2	3	-55.2	-57.35	-54	-3.35
1740	-49.27	3	-46.27	-48.42	-30	-18.42

Radiated Measurement

Test Mode	Transmitter mode						
Frequency	863.1MHz						
Radiated Measurement							
Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
60.0000	-59.06	-1.21	-60.27	-54.00	-6.27	peak	H
223.0000	-60.78	-0.50	-61.28	-54.00	-7.28	peak	H
623.0000	-75.32	7.98	-67.34	-54.00	-13.34	peak	H
672.0000	-72.35	8.89	-63.46	-54.00	-9.46	peak	H
719.0000	-74.60	9.67	-64.93	-54.00	-10.93	peak	H
744.0000	-75.90	10.13	-65.77	-54.00	-11.77	peak	H
1810.000	-53.98	-4.89	-58.87	-30.00	-28.87	peak	H
2773.000	-55.98	-1.69	-57.67	-30.00	-27.67	peak	H
3790.000	-59.05	1.54	-57.51	-30.00	-27.51	peak	H
60.0000	-61.57	-1.21	-62.78	-54.00	-8.78	peak	V
202.0000	-64.56	-1.65	-66.21	-54.00	-12.21	peak	V
552.0000	-71.61	6.31	-65.30	-54.00	-11.30	peak	V
623.0000	-73.32	7.98	-65.34	-54.00	-11.34	peak	V
648.0000	-72.44	8.49	-63.95	-54.00	-9.95	peak	V
672.0000	-74.39	8.89	-65.50	-54.00	-11.50	peak	V
1837.000	-53.52	-4.81	-58.33	-30.00	-28.33	peak	V
2890.000	-54.14	-1.41	-55.55	-30.00	-25.55	peak	V
3853.000	-58.88	1.64	-57.24	-30.00	-27.24	peak	V

Test Mode		Stand by mode					
Frequency		863.1MHz					
Radiated Measurement							
Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
217.5000	-62.63	-0.89	-63.52	-57.00	-6.52	peak	H
312.0000	-69.21	2.21	-67.00	-57.00	-10.00	peak	H
623.0000	-74.74	7.98	-66.76	-57.00	-9.76	peak	H
648.0000	-73.52	8.49	-65.03	-57.00	-8.03	peak	H
696.0000	-73.75	9.25	-64.50	-57.00	-7.50	peak	H
719.0000	-74.30	9.67	-64.63	-57.00	-7.63	peak	H
1801.000	-55.94	-4.92	-60.86	-47.00	-13.86	peak	H
2773.000	-56.94	-1.69	-58.63	-47.00	-11.63	peak	H
3718.000	-58.46	1.43	-57.03	-47.00	-10.03	peak	H
204.5000	-65.17	-1.59	-66.76	-57.00	-9.76	peak	V
552.0000	-72.05	6.31	-65.74	-57.00	-8.74	peak	V
623.0000	-73.24	7.98	-65.26	-57.00	-8.26	peak	V
648.0000	-71.97	8.49	-63.48	-57.00	-6.48	peak	V
672.0000	-74.62	8.89	-65.73	-57.00	-8.73	peak	V
963.0000	-77.46	13.69	-63.77	-57.00	-6.77	peak	V
1846.000	-54.55	-4.78	-59.33	-47.00	-12.33	peak	V
2845.000	-57.02	-1.50	-58.52	-47.00	-11.52	peak	V
3835.000	-58.66	1.62	-57.04	-47.00	-10.04	peak	V

Test Mode		Mode : Transmitter mode					
Frequency		869.9MHz					
Radiated Measurement							
Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
60.0000	-61.04	-1.21	-62.25	-54.00	-8.25	peak	H
223.0000	-62.00	-0.50	-62.50	-54.00	-8.50	peak	H
640.0000	-72.08	8.34	-63.74	-54.00	-9.74	peak	H
648.0000	-71.99	8.49	-63.50	-54.00	-9.50	peak	H
688.0000	-70.10	9.13	-60.97	-54.00	-6.97	peak	H
744.0000	-75.86	10.13	-65.73	-54.00	-11.73	peak	H
1765.0000	-51.78	-5.04	-56.82	-30.00	-26.82	peak	H
2926.0000	-54.54	-1.31	-55.85	-30.00	-25.85	peak	H
3799.0000	-58.33	1.55	-56.78	-30.00	-26.78	peak	H
210.0000	-65.27	-1.47	-66.74	-54.00	-12.74	peak	V
552.0000	-71.92	6.31	-65.61	-54.00	-11.61	peak	V
640.0000	-70.97	8.34	-62.63	-54.00	-8.63	peak	V
660.0000	-71.49	8.69	-62.80	-54.00	-8.80	peak	V
688.0000	-70.75	9.13	-61.62	-54.00	-7.62	peak	V
848.0000	-78.68	11.58	-67.10	-54.00	-13.10	peak	V
1774.0000	-52.59	-5.02	-57.61	-30.00	-27.61	peak	V
2827.0000	-53.73	-1.56	-55.29	-30.00	-25.29	peak	V
3790.0000	-58.02	1.54	-56.48	-30.00	-26.48	peak	V

Test Mode		Mode : Stand by mode					
Frequency		869.9MHz					
Radiated Measurement							
Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
60.0000	-62.71	-1.21	-63.92	-57.00	-6.92	peak	H
216.0000	-63.67	-1.01	-64.68	-57.00	-7.68	peak	H
312.0000	-68.82	2.21	-66.61	-57.00	-9.61	peak	H
640.0000	-72.52	8.34	-64.18	-57.00	-7.18	peak	H
652.0000	-73.02	8.57	-64.45	-57.00	-7.45	peak	H
688.0000	-72.98	9.13	-63.85	-57.00	-6.85	peak	H
1801.000	-54.64	-4.92	-59.56	-47.00	-12.56	peak	H
2809.000	-57.20	-1.59	-58.79	-47.00	-11.79	peak	H
3763.000	-58.33	1.49	-56.84	-47.00	-9.84	peak	H
60.0000	-63.07	-1.21	-64.28	-57.00	-7.28	peak	V
204.0000	-65.01	-1.61	-66.62	-57.00	-9.62	peak	V
552.0000	-71.57	6.31	-65.26	-57.00	-8.26	peak	V
624.0000	-74.08	8.01	-66.07	-57.00	-9.07	peak	V
640.0000	-72.43	8.34	-64.09	-57.00	-7.09	peak	V
688.0000	-73.09	9.13	-63.96	-57.00	-6.96	peak	V
1855.000	-53.24	-4.74	-57.98	-47.00	-10.98	peak	V
2917.000	-55.73	-1.33	-57.06	-47.00	-10.06	peak	V
3871.000	-59.33	1.67	-57.66	-47.00	-10.66	peak	V

1.9. Duty Cycle Test

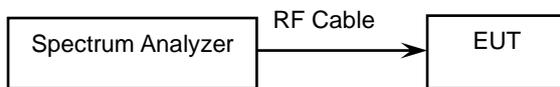
■ **Limit**

ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.10.3

In a period of 1 hour the duty cycle shall not exceed the spectrum access and mitigation requirement values as given in table 5, clause 7.2.3.

For frequency agile devices without LBT operating in the frequency range 863 MHz to 870 MHz the duty cycle shall apply to the total transmission time as given in table 5, clause 7.2.3 or shall not exceed 0,1 % per channel in a period of 1 hour.

■ **Test Setup**



■ **Test Procedure**

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.10.2 for the measurement method.

■ **Test Result**

Test Mode	Mode : Transmitter mode		
Tx on(s)	Tx on+ Tx off(s)	Duty cycle of the transmitter Tx on/(Tx on+Tx off)	
		(s)	(%)
0.00635	10.01	0.000634366	0.0634366
Limit			0.1 %

1.10. Time-out-Timer Test

■ **Limit**

ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.11.3

The limit for voice communications transmitter timeout is a maximum of 1 minute.

■ **Test Setup**



■ **Test Procedure**

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 7.11.2 for the measurement method.

■ **Test Result**

Not applicable, The EUT does not support voice application.

2 Receiver

2.1. Receiver Sensitivity Test

■ **Limit**

ETSI EN 300 220-1 (V2.4.1) Sub-clause 8.1.4

Under normal test conditions, the value of the maximum usable sensitivity for a 25 kHz channel spacing equipment with a 16 kHz bandwidth shall not exceed +6 dBμV emf for a 50 Ω receiver input impedance. This corresponds to a receiver sensitivity of -107 dBm which shall not be exceeded.

The limit for usable sensitivity for other receiver bandwidths than 16 kHz is given by:

$$S = +6 + 10 \log \frac{BW}{16} \text{ dB}\mu\text{V emf}; \text{ or}$$

$$S_p = 10 \log \frac{BW}{16} - 107 \text{ dBm}$$

where:

S is the sensitivity in dBμV emf;

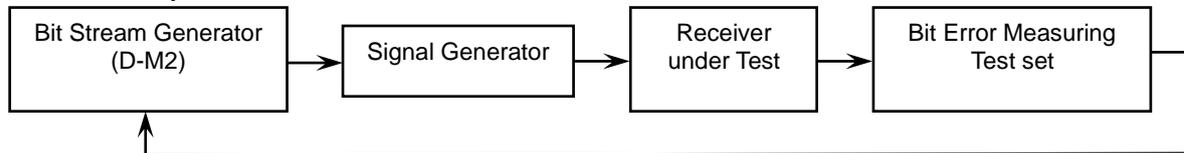
S_p is the sensitivity in dBm;

BW is the receiver bandwidth in kHz. The receiver bandwidth is a declaration by the manufacturer. The declaration shall be stated in the test report.

For further information on receiver sensitivity expressed in terms of field strength for equipment with integral or dedicated antenna, see clause E.2.

For equipment using a Listen Before Talk (LBT) protocol, see clause 8.2.

■ **Test Setup**



■ **Test Procedure**

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 8.1.2 for the measurement method.

■ **Test Result**

Not applicable. The EUT is not an LBT device.

2.2. Receiver LBT Threshold Test

■ Limit

ETSI EN 300 220-1 (V2.4.1) Sub-clause 8.2.3

The maximum value of the LBT threshold for the receiver in the listen mode is given in table 12.

Receiver LBT threshold limit versus transmit power and channel spacing:

Receiver bandwidth	TX Power		Maximum TX on-time
	< 100 mW	500 mW	
6.25 kHz	-102 dBm	-106 dBm	< 1 s
12.5 kHz	-99 dBm	-103 dBm	
20 / 25 kHz	-96 dBm	-100 dBm	
50 kHz	-93 dBm	-97 dBm	
100 kHz	-90 dBm	-94 dBm	
200 kHz	-87 dBm	-91 dBm	
500 kHz	-83 dBm	---	
600 kHz	-82 dBm	---	

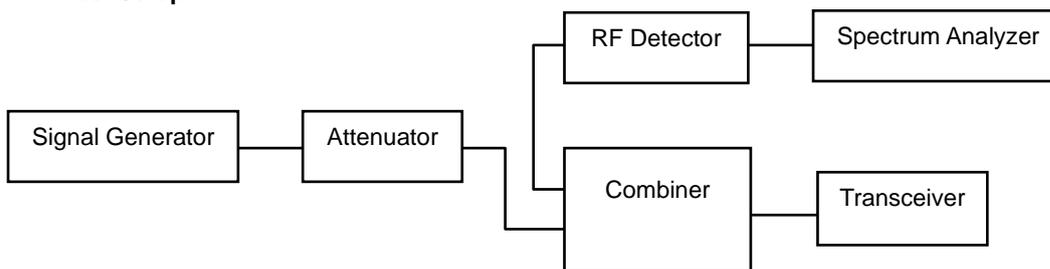
Note 1: The limit is independent of the receiver category, see clause 4.1.1.

Note 2: For intermediate channel spacings, a straight line interpolation shall be used.

Note 3: The limits are based on an antenna gain of +2 dBi maximum. For other antenna gains different to +2 dBi the limits shall be adjusted accordingly.

Note 4: Limits for receiver bandwidth not mentioned in the table shall be adjusted to the receiver sensitivity +9 dB, see clause 8.1. However, limits can be also obtained by a simple interpolation between values in this table.

■ Test Setup



■ **Test Procedure**

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 8.2.2 for the measurement method.

■ **Test Result**

Not applicable. The EUT is not an LBT device.

2.3. Adjacent Channel Selectivity Test

■ **Limit**

ETSI EN 300 220-1 (V2.4.1) Sub-clause 8.3.3

The adjacent channel selectivity of the equipment under specified conditions shall be equal to or greater than the unwanted signal as stated in table 13.

Limit for adjacent channel selectivity

Receiver category	Channel spacing \leq 25 kHz	Channel spacing $>$ 25 kHz
1	$\geq 54 \text{ dB} - 10\log BW_{\text{kHz}} / 16$	$\geq 60 \text{ dB} - 10\log BW_{\text{kHz}} / 16$

Note: The limits are based on an antenna gain of +2 dBi. For other antenna gains different to +2 dBi the limits shall be adjusted accordingly.

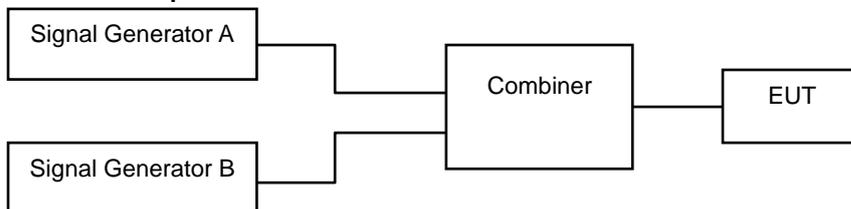
ETSI EN 300 220-1 (V2.4.1) Sub-clause 8.3.4.3

Limit for receiver saturation at adjacent channel

Receiver category	Channel spacing $12.5 \text{ kHz} \leq 25 \text{ kHz}$	Channel spacing $> 25 \text{ kHz}$
1	$\geq 87 \text{ dB}$ above the sensitivity level	$\geq 97 \text{ dB}$ above the sensitivity level

Note: Measured at a wanted receiving signal at +43 dB above the sensitivity.

■ **Test Setup**



■ **Test Procedure**

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 8.3.2 for the measurement method.

■ **Test Result**

Not applicable. The EUT is a receiver class III device.

2.4. Blocking Test

■ Limit

ETSI EN 300 220-1 (V2.4.1) Sub-clause 8.4.3

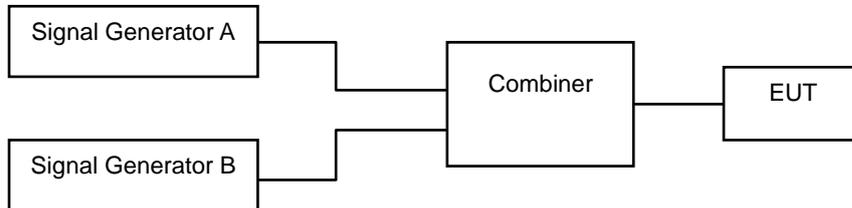
The blocking level shall not be less than the values given in table 15, except at frequencies on which spurious responses are found.

Limits for receiver blocking:

Receiver category	Frequency offset	Limit
1	± 2 MHz	≥ 84 dB - A (see note 2)
2	± 2 MHz	≥ 35 dB - A (see note 2)
3	± 2 MHz	≥ 24 dB - A (see note 2)
1	± 10 MHz	≥ 84 dB - A (see note 2)
2	± 10 MHz	≥ 60 dB - A (see note 2)
3	± 10 MHz	≥ 44 dB - A (see note 2)

Note 1: The limits apply also for the repeated tests in case of equipment using LBT or category 1 receivers, reduced by 13 dB or 40 dB, respectively, to account for the increased wanted signal level.
 Note 2: A = $10 \log (BW_{\text{kHz}} / 16 \text{ kHz})$ BW is the receiver bandwidth (see clause 8.1.4).

■ Test Setup



■ **Test Procedure**

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 8.4.2 for the measurement method.

■ **Test Result**

Test Mode	Mode : Receiver mode					
Frequency (MHz)	Receiving Bandwidth (kHz)	Receiver Category	Frequency Offset	Limit (dB)	Value (dB)	Results
863.1	100	3	- 2 MHz	16.04	43.4	PASS
			- 10 MHz	36.04	73.4	PASS
			+ 2 MHz	16.04	58.4	PASS
			+ 10 MHz	36.04	73.4	PASS
869.9	100	3	- 2 MHz	16.04	63.4	PASS
			- 10 MHz	36.04	73.4	PASS
			+ 2 MHz	16.04	48.4	PASS
			+ 10 MHz	36.04	73.4	PASS

2.5. Spurious Response Rejection Test

■ Limit

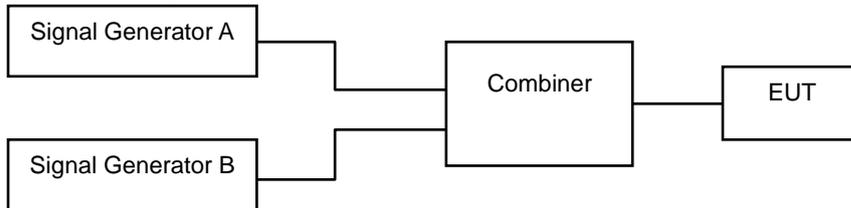
ETSI EN 300 220-1 (V2.4.1) Sub-clause 8.5.3

The spurious response rejection of the equipment under specified conditions shall be equal to or greater than the unwanted signal as stated in table 16.

Limits for spurious response rejection:

Receiver class	Channel spacing $12.5 \leq 25$ kHz	Channel spacing > 25 kHz
1	≥ 60 dB	≥ 70 dB
Note 1: For spurious response tests separated from the wanted signal by less than 0,1 % of the centre frequency, the limits above are relaxed by 25 dB.		

■ Test Setup



■ Test Procedure

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 8.5.2 for the measurement method.

■ Test Result

Not applicable. The EUT is a receiver class III device.

2.6. Receiver Spurious Radiation Test

■ Limit

ETSI EN 300 220-1 (V2.4.1) Sub-clause 8.6.5

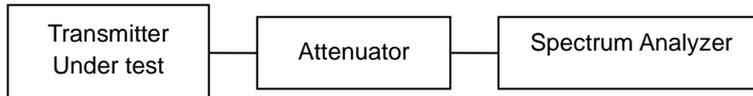
The power of any spurious emission, radiated or conducted, shall not exceed the values given below.

The limits are applicable to all receiver categories:

- 2 nW below 1 000 MHz;
- 20 nW above 1 000 MHz.

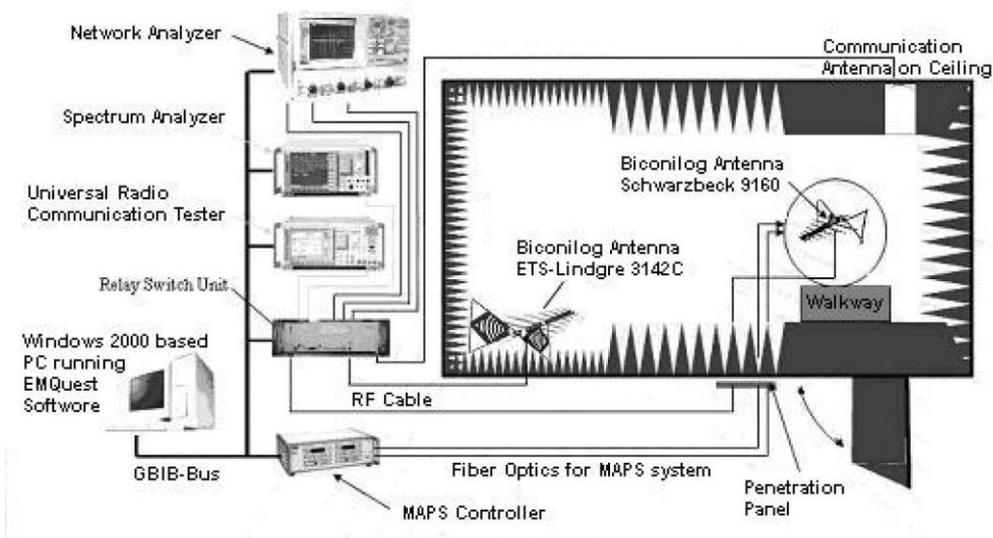
■ Test Setup

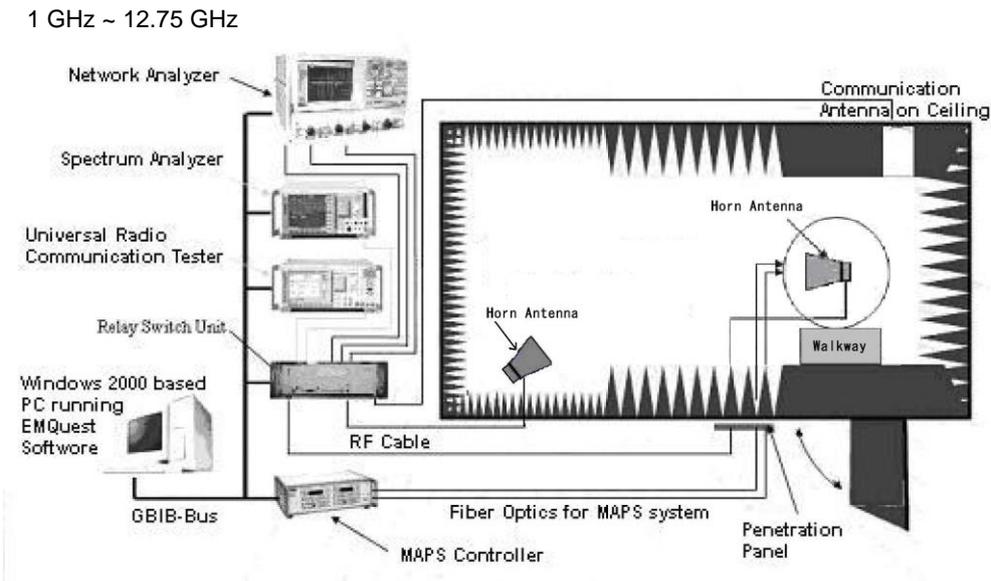
Conducted Spurious Emission:



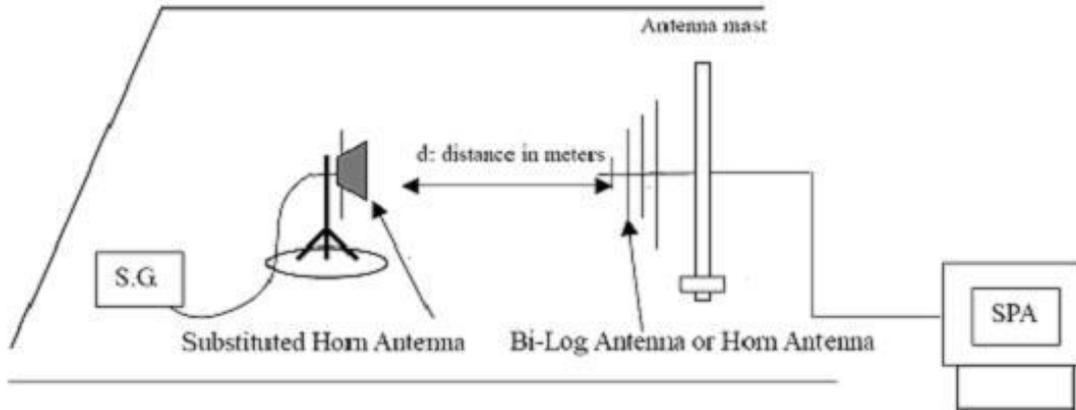
Radiated Emission:

Below 1GHz





Substituted Method Test Set-up



■ Test Procedure

Please refer to ETSI EN 300 220-1 (V2.4.1) Sub-clause 8.6.2 / 8.6.3 / 8.6.4 for the measurement method.

■ Test Result

Conducted Measurement

Test Mode	Mode : Receiver mode					
Frequency	863.1 MHz					
Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	EIRP Result (dBm)	ERP Result (dBm)	Limit (dBm)	Margin (dB)
729	-83.43	3	-80.43	-82.58	-57	-25.58
3450	-53.57	3	-50.57	-52.72	-47	-5.72
Frequency	869.9 MHz					
Frequency (MHz)	Measured Level (dBm)	Antenna Gain (dBi)	EIRP Result (dBm)	ERP Result (dBm)	Limit (dBm)	Margin (dB)
476.9	-84.27	3	-81.27	-83.42	-57	-26.42
3478	-53.65	3	-50.65	-52.8	-47	-5.8

Radiated Measurement

Test Mode	Mode : Receiver mode						
Frequency	863.1MHz						
Radiated Measurement							
Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
218.5000	-63.08	-0.82	-63.90	-57.00	-6.90	peak	H
312.0000	-69.49	2.21	-67.28	-57.00	-10.28	peak	H
648.0000	-73.36	8.49	-64.87	-57.00	-7.87	peak	H
672.0000	-73.59	8.89	-64.70	-57.00	-7.70	peak	H
719.0000	-74.65	9.67	-64.98	-57.00	-7.98	peak	H
792.0000	-77.02	10.81	-66.21	-57.00	-9.21	peak	H
1810.000	-55.63	-4.89	-60.52	-47.00	-13.52	peak	H
2755.000	-54.81	-1.74	-56.55	-47.00	-9.55	peak	H
3655.000	-58.02	1.32	-56.70	-47.00	-9.70	peak	H
209.0000	-65.42	-1.49	-66.91	-57.00	-9.91	peak	V
552.0000	-72.03	6.31	-65.72	-57.00	-8.72	peak	V
623.0000	-74.30	7.98	-66.32	-57.00	-9.32	peak	V
648.0000	-72.88	8.49	-64.39	-57.00	-7.39	peak	V
696.0000	-76.33	9.25	-67.08	-57.00	-10.08	peak	V
943.0000	-78.51	13.51	-65.00	-57.00	-8.00	peak	V
1846.000	-54.05	-4.78	-58.83	-47.00	-11.83	peak	V
2746.000	-56.54	-1.74	-58.28	-47.00	-11.28	peak	V
3781.000	-59.04	1.52	-57.52	-47.00	-10.52	peak	V

Test Mode	Mode : Receiver mode						
Frequency	869.9MHz						
Radiated Measurement							
Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
60.0000	-62.41	-1.21	-63.62	-57.00	-6.62	peak	H
211.5000	-62.70	-1.35	-64.05	-57.00	-7.05	peak	H
312.0000	-68.62	2.21	-66.41	-57.00	-9.41	peak	H
640.0000	-72.52	8.34	-64.18	-57.00	-7.18	peak	H
648.0000	-72.43	8.49	-63.94	-57.00	-6.94	peak	H
688.0000	-72.64	9.13	-63.51	-57.00	-6.51	peak	H
1810.000	-53.45	-4.89	-58.34	-47.00	-11.34	peak	H
2863.000	-56.43	-1.47	-57.90	-47.00	-10.90	peak	H
3826.000	-57.31	1.60	-55.71	-47.00	-8.71	peak	H
58.0000	-63.82	-1.12	-64.94	-57.00	-7.94	peak	V
200.0000	-65.60	-1.70	-67.30	-57.00	-10.30	peak	V
552.0000	-71.92	6.31	-65.61	-57.00	-8.61	peak	V
640.0000	-72.68	8.34	-64.34	-57.00	-7.34	peak	V
680.0000	-72.87	9.02	-63.85	-57.00	-6.85	peak	V
688.0000	-72.80	9.13	-63.67	-57.00	-6.67	peak	V
1837.000	-54.02	-4.81	-58.83	-47.00	-11.83	peak	V
2899.000	-56.16	-1.38	-57.54	-47.00	-10.54	peak	V
3799.000	-60.03	1.55	-58.48	-47.00	-11.48	peak	V

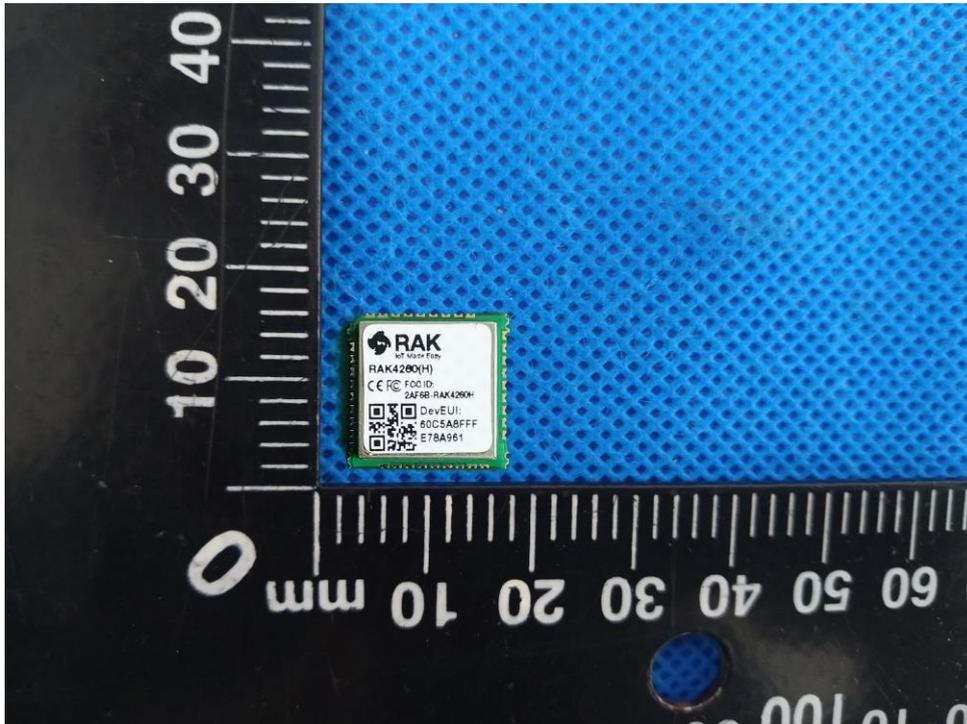
APPENDIX A: PHOTOGRAPHS OF THE EUT

Fig.1

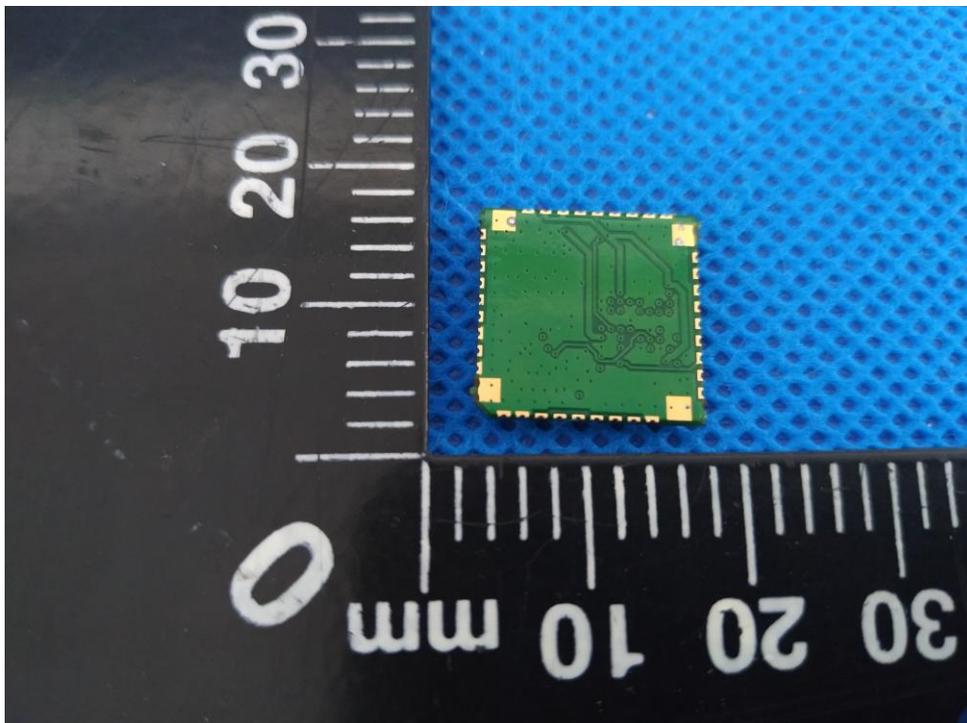


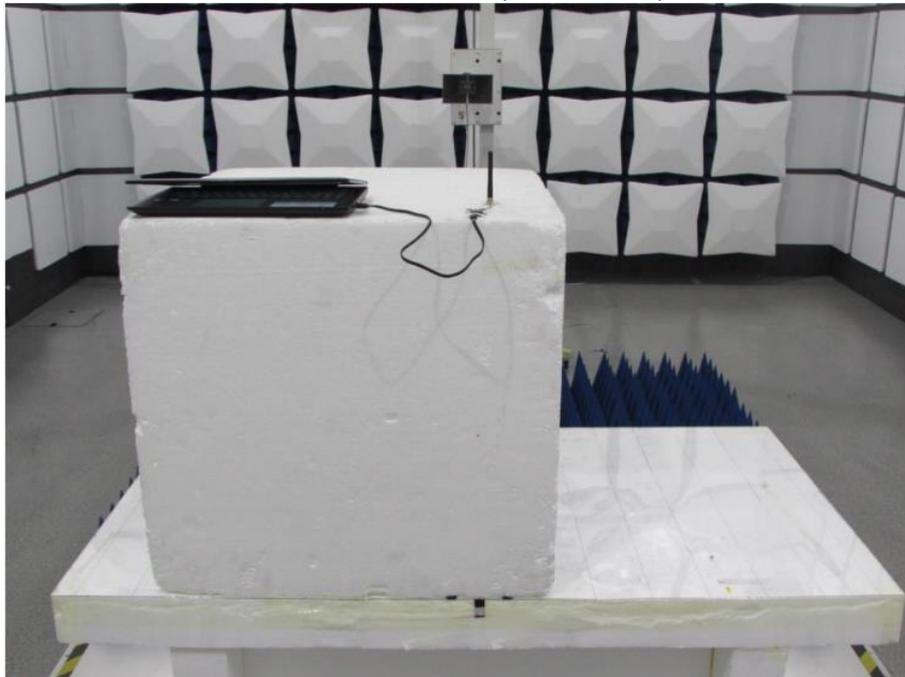
Fig.2

APPENDIX B: TEST PHOTOS

Radiated Emission (30MHz-1GHz)



Radiated Emission (1GHz-6GHz)

**----END OF REPORT----**