



EN62311 TEST REPORT

Product: LoRa Module

Trade Mark:



Model Name: Ra-01SH

Family Model: N/A

Report No.: S20110203403002

Prepared for

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TEST RESULT CERTIFICATION**Applicant's name** Shenzhen Ai-Thinker Technology Co., LtdAddress..... 410, Block C, Huafeng Smart Innovation Port, Gushu 2nd Road,
Gushu Community, Xixiang Street, Baoan District, Shenzhen, China**Manufacturer's Name** Shenzhen Ai-Thinker Technology Co., LtdAddress..... 410, Block C, Huafeng Smart Innovation Port, Gushu 2nd Road,
Gushu Community, Xixiang Street, Baoan District, Shenzhen, China**Product description**

Product name..... LoRa Module

Trademark



Model Name Ra-01SH

Family Model N/A

Standards EN 62311:2008

This device described above has been tested by Shenzhen NTEK, and the test results show that the equipment under test (EUT) is in compliance with the 2014/53/EU Directive Art.3.1(a) requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test

Date (s) of performance of tests 02 Nov. 2020 ~04 Dec. 2020

Date of Issue..... 04 Dec. 2020

Test Result..... **Pass**

Testing Engineer :

(Mary Hu)

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[illegible]

1. General Information**1.1 General Description Of EUT**

Equipment	LoRa Module	
Trade Mark	 	
Model Name.	Ra-01SH	
Family Model	N/A	
Model Difference	N/A	
Product Description	The EUT is LoRa Module	
	Operation Frequency:	Band AA: 863MHz-870MHz
	Antenna Designation:	Spring Antenna
	Antenna Gain(Peak)	3dBi
	Modulation Type:	FSK/OOK
Channel List	Refer to below	
Power Rating	DC 3.3V form Uart	
Adapter	N/A	
Battery	N/A	
Hardware Version	N/A	
Software Version	N/A	

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. Test Channel:

TX

Channel	Frequency (MHz)
01	864
02	865
03	866
04	867
05	868
06	869

RX

Channel	Frequency (MHz)
01	864
02	865
03	866
04	867
05	868
06	869

2.EN 62311 REQUIREMENT

2.1 GENERAL INFORMATION

The essential requirements of Directive 99/5/ec in the article 3.1(a) and the limits must be taken from Council Recommendation 99/519/EC for General Population or from the ICNIRP Guidelines for Occupational Exposure, EN 62311:2008 Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz)

2.2 LIMIT

Basic Restrictions Reference levels

Council Recommendation 99/519/EC Annex II

Basic restrictions for electric, magnetic and electromagnetic fields (0Hz to 300GHz)

Frequency range	Magnetic flux density (mT)	Current density (Ma/m2) (rms)	Whole body average SAR (W/kg)	Localised SAR (head and trunk) (W/kg)	Localised SAR (limbs) (W/kg)	Power density, S (W/m2)
0Hz	40	-	-	-	-	-
>0-1Hz	-	8	-	-	-	-
1-4Hz	-	8/f	-	-	-	-
4-1000Hz	-	2	-	-	-	-
1000Hz-100kHz	-	f/500	-	-	-	-
100kHz-10MHz	-	f/500	0.08	2	4	-
10MHz-10GHz	-	-	0.08	2	4	-
10-300GHz	-	-	-	-	-	10

Note:

(1)f is the frequency in Hz.

(2)The basic restriction on the current density is intended to protect against acute exposure effects on central nervous system tissues in the head and trunk of the body and includes a safety factor. The basic restrictions for ELF fields are based on established adverse effects on the central nervous system. Such acute effects are essentially instantaneous and there is no scientific justification to modify the basic restrictions for exposure of short duration. However, since the basic restriction refers to adverse effects on the central nervous system, this basic restriction may permit higher current densities in body tissues other than the central nervous system under the same exposure conditions.

(3)Because of electrical inhomogeneity of the body, current densities should be averaged over a cross section of 1cm² perpendicular to the current direction.

(4)For frequencies up to 100 kHz, peak current density values can be obtained by multiplying the rms value by $\sqrt{2}$ (=1.414). For pulses of duration tp the equivalent frequency to apply in the basic restrictions should be calculated as $1/(2tp)$

(5)For frequencies up to 100kHz and for pulsed magnetic fields, the maximum current density associated with the pulses can be calculated from the rise/fall times and the maximum rate of change of magnetic flux density. The induced current density can then be compared with the appropriate basic restriction.

(6)All SAR values are to be averaged over any six-minute period.

(7) Localised SAR averaging mass is any 10g of contiguous tissue; the maximum SAR so obtained should be the value used for the estimation of exposure. These 10g of tissue are intended to be a mass of contiguous tissue with nearly homogeneous electrical properties. In specifying a contiguous mass of tissue, it is recognised that this concept can be used in computational dosimetry but may present difficulties for direct physical measurements. A simple geometry such as cubic tissue mass can be used provided that the calculated dosimetric quantities have conservation values relative to the exposure guidelines.

(8) For pulses of duration t_p the equivalent frequency to apply in the basic restrictions should be calculated as $\omega = 1/(2t_p)$. Additionally, for pulsed exposures, in the frequency range 0,3 to 10GHz and for localised exposure of the head, in order to limit and avoid auditory effects caused by thermoelastic expansion, an additional basic restriction is recommended. This is that SA should not exceed 2mJ kg⁻¹ averaged over 10g of tissue.

Reference Levels

Council Recommendation 99/519/EC Annex III

Reference levels for electric, magnetic and electromagnetic fields (0Hz to 300GHz)

Frequency range	E-field strength (V/m)	H-field strength (A/m)	B-field (μT)	Equivalent plane wave power density Seq (W/m ²)
0-1Hz	-	$3,2 \times 10^4$	4×10^4	-
1-8Hz	1000	$3,2 \times 10^4 / f^2$	$4 \times 10^4 / f^2$	-
8-25Hz	1000	4000/f	5000/f	-
0.025Hz-0,8kHz	250/f	4/f	5/f _{6,25}	-
0,8-3kHz	250/f	5	6,25	-
3-150kHz	87	5	6,25	-
0,15-1MHz	87	0.73/f	0,92/f	-
1-10MHz	$87/f^{1/2}$	0.73/f	0,92/f	-
10-400MHz	28	0.073	0,092	2
400-2000MHz	$1,375 f^{1/2}$	$0,0037 f^{1/2}$	$0,0046 f^{1/2}$	f/200
2-300GHz	61	0,16	0,20	10

Note:

(1) As indicated in the frequency range column.

(2) For frequencies between 100kHz and 10GHz, Seq, E2, H2 and B2 are to be averaged over any six-minute period.

(3) For frequencies exceeding 10GHz, Seq, E2, H2 and B2 are to be averaged over any 68/1.05-minute period (.in GHz).

(4) No E-field value is provided for frequencies <1Hz, which are effectively static electric fields. For most people the annoying perception of surface electric charges will not occur at field strengths less than 20kV/m. Spark discharges causing stress or annoyance should be avoided.

2.3 Limit calculations for radiated electric field strength measurement

For the calculation of the limits, the near field proportionality factor $1/d^3$ has been used. For ten times the distance, the level is decreased by the cubical, giving 60 dB.

Frequency range	Limit V/m @0.3m	Limit V/m @3m	Limit (add.span)
30MHz-400MHz	28V/m(149dBuV/m)	89dBuV/m	69 dBuV/m
400MHz-2GHz	27.5V/m-61.5V/m (149dBuV/m-155dBuV/m)	89dBuV/m	69dBuV/m
		95dBuV/m	75dBuV/m
2GHz-300GHz	61V/m(155dBuV/m)	95dBuV/m	75dBuV/m

To deal with reflexions, other effects due to the measurement in 3 m distance and to deal with a measurement uncertainty of at least 5 dB, an additional span of 20 dB has been added.

For additional three times the distance, the level is decreased by additional 30 dB.

Frequency range	Limit V/m @0.1m	Limit V/m @3m	Limit (add.span)
30MHz-400MHz	28V/m(149dBuV/m)	59dBuV/m	39 dBuV/m
400MHz-2GHz	27.5V/m-61.5V/m (149dBuV/m-155dBuV/m)	59dBuV/m	39dBuV/m
		65dBuV/m	45dBuV/m
2GHz-300GHz	61V/m(155dBuV/m)	65dBuV/m	45dBuV/m

To deal with reflexions, other effects due to the measurement in 3 m distance and to deal with a measurement uncertainty of at least 5 dB, an additional span of 20 dB has been added.

Limits for radiated field according to EN 55032 / CISPR 32 for a class B appliance:

Frequency range	Limit dBuV/m @3m Peak	Limit dBuV/m @3m QP or Average
30MHz-230MHz		40 dBuV/m QP
230MHz-1GHz		47dBuV/m QP
1GHz-3GHz	70dBuV/m Peak	50dBuV/m AV
3GHz-6GHz	74dBuV/m Peak	54dBuV/m AV

Conclusion: If the requirements for radiated emissions according to EN 55032 / CISPR 32 or other standards with the same limits are fulfilled, also the EMF requirements for the measured frequency range are fulfilled

3.Result

$$P_d = (P_{out} * G) / (4 * \pi * R^2)$$

Where

P_d = Power density in mW/cm^2

P_{out} = output power to antenna in mW

G = Numeric gain of the antenna relative to isotropic antenna

π = 3.1416

R = distance between observation point and center of the radiator in cm (20cm)

P_d the limit of MPE, $1mW/cm^2$. If we know the maximum gain of the antenna and total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.
 $mW = 10^{(dBm/10)}$

Antenna gain: 3dBi,

$R = 20cm$

Band AA

Frequency (MHz)	Channel	maximum output power (dBm)	maximum output power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Result
864	CH01	13.54	22.59	0.0045	0.432	Pass
866	CH13	13.32	21.48	0.0043	0.433	Pass
869	CH25	13.26	21.18	0.0042	0.435	Pass

Note:

1. The Output power is the maximum erp power of this EUT, and the data comes from the RF report for this EUT.
2. The assess distance is 20cm.