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Test report No:
NIE: 57446RAN.001A1

Assessment report
RF EXPOSURE REPORT ACCORDING TO
FCC 47 CFR Part 2.1091

Identification of item tested	The 32001409 is a transceiver operating in the 902-928 MHz SRD Band optimized for very long range, low consumption applications, suitable for LPWA networks. Based on LoRa TM RF Technology and LoRaWAN protocol it provides ultra-long range spread spectrum communication and high interference immunity.
Trademark	MIPOT
Model and /or type reference	32001409
Other identification of the product	FCC ID: 2AQJP-32001409
Features	N/A
Manufacturer	MIPOT SPA Via Corona,5 34071, Cormons (GO), Italy
Test method requested, standard	FCC 47 CFR Part 2.1091 Radiofrequency radiation exposure evaluation: mobile devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Miguel Lacave Antennas Lab Manager  MIGUEL LACAVE GARCÍA 2018.11.19 11:24:01 +01'00'
Date of issue	2018-11-19
Report template No	FAN36_00

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Data provided by the client

DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Identification of the client

MIPOT SPA

Via Corona,5

34071, Cormons (GO), Italy

Document history

Report number	Date	Description
57446RAN.001	2018-11-08	First release
57446RAN.001A1	2018-11-19	Second release. Updated antenna gain value.

This report cancels and replaces test report 57446RAN.001.

General description of the device under evaluation

The device under evaluation consists of a transceiver which operates in the 902-928 MHz SRD Band optimized for very long range, low consumption applications, suitable for LPWA networks. Based on LoRaTM RF Technology and LoRaWAN protocol it provides ultra-long range spread spectrum communication and high interference immunity.

According to the manufacturer, during its normal use, the separation distance between the device and the body of nearby users will be greater than 20 cm. In order to perform the assessment a conservative separation distance of 20 cm has been used.

The equipment specifications declared by the manufacturer for LoRa supported technology are:

Band (MHz)	Technology	Band	Max. RF Output Power (dBm)	Max. Antenna gain (dBi)	Maximum E.I.R.P. (dBm)
903.0-914.2	LoRa	ISM 915MHz	18.0	+2.14	20.14

Table 1: Equipment specifications

Assessment summary

Radiofrequency radiation exposure limits				
FCC 47 CFR § 2.1091 & ISED RSS-102 Issue 5 (2015-03)				
Assessment	**Band (MHz)**	**Technology**	**Band**	**VERDICT (Pass/Fail)**
1	903.0-914.2	LoRa	ISM 915MHz	Pass

Table 2: Assessment summary

Appendix A: FCC RF Exposure

FCC RF Exposure evaluation for mobile devices

Devices operating in standalone mobile device exposure conditions may contain a single transmitter or multiple transmitters that do not transmit simultaneously. A minimum test separation distance ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons to apply mobile device exposure limits. The distance must be at least 20 cm and fully supported by the operating and installation configurations of the transmitter and its antenna(s), according to the source-based time-averaged maximum power requirements of § 2.1091(d)(2). In cases where cable losses or other attenuations are applied to determine compliance, the most conservative operating configurations and exposure conditions must be evaluated. The minimum test separation distance required for a device to comply with mobile device exposure conditions must be clearly identified in the installation and operating instructions, for all installation and exposure conditions, to enable users and installers to comply with RF exposure requirements. For mobile devices that have the potential to operate in portable device exposure conditions, similar to the configurations described in § 2.1091(d)(4), a KDB inquiry is required to determine the SAR test requirements for demonstrating compliance.

When a device qualifies for the categorical exclusion provision of § 2.1091(c), the minimum test separation distance may be estimated, when applicable, by simple calculations according to plane-wave equivalent conditions, to ensure the transmitter and its antenna(s) can operate in manners that meet or exceed the estimated distance. The source-based time-averaged maximum radiated power, according to the maximum antenna gain, must be applied to calculate the field strength and power density required to establish the minimum test separation distance. When the estimated test separation distance becomes overly conservative and does not support compliance, MPE measurement or computational modeling may be used to determine the required minimum separation distance.

According to §1.1310 Radiofrequency radiation exposure limits, paragraph (e), the limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields are:

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
0.3–3.0	614	1.63	*100	6
3.0–30	1842/f	4.89/f	*900/f²	6
30–300	61.4	0.163	1.0	6
300–1,500			f/300	6
1,500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*100	30
1.34–30	824/f	2.19/f	*180/f²	30
30–300	27.5	0.073	0.2	30
300–1,500			f/1500	30
1,500–100,000			1.0	30

f = frequency in MHz * = Plane-wave equivalent power density

FCC MPE Evaluation Results

Each supported transmission technology will be evaluated to determine if it is in compliance with limits for Maximum Permissible Exposure (MPE) to radiofrequency electromagnetic fields.

In order to perform the assessment, the following equations have been used for the calculations; these equations are accurate in the far-field of an antenna and will over-predict power density in the near field, where they could be used for making a "worst case" or conservative prediction:

Power density: $S[mW/cm^2] = \frac{P_{E.I.R.P.}[mW]}{4\Pi R[cm]^2}$

Minimum compliance distance: $R_{\min}[cm] = \sqrt{\frac{P_{E.I.R.P.}[mW]}{4\Pi S[mW/cm^2]}}$

Where:

S = power density

$P_{E.I.R.P.}$ = Equivalent isotropically radiated power

R = distance to the center of radiation of the antenna (evaluation distance

Assessment 1 – LoRa 900 MHz Band

Maximum output power (dBm):	18.0
Maximum antenna Gain (dBi):	2.14
Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	903.0
Maximum EIRP (dBm):	20.14
Maximum EIRP (mW):	103.28
General population - Power density limit (mW/cm^2):	0.602

Power density at minimum use distance:

Power density (mW/cm^2):	0.021
General population - Power density limit (mW/cm^2):	0.602
Verdict for general population:	PASS

The power density level for this transmission mode is below general population exposure power density limit.

Minimum compliance distance for this technology:

Minimum compliance distance for general population (cm):	3.69
Minimum use distance (cm):	20.0
Verdict for general population:	PASS

The minimum use distance is greater than general population exposure minimum compliance distance.