

Assessment report No:
NIE: 54035RAN.001

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

Identification of item tested.....:	LoraWAN Radio Module
Trademark	WiMOD
Model and /or type reference	iM980A
Other identification of the product	FCC ID: Q9B409810
Final HW version	A
Final SW version	V2_0
Features	US LoRaWAN V1.0.2
Manufacturer.....:	IMST GMBH Carl-Friedrich-Gauss-Str.2-4 47475 Kamp-Lintfort Germany
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
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Identification of the client

IMST GMBH

Carl-Friedrich-Gauss-Str.2-4 47475 Kamp-Lintfort Germany

General description of the device under evaluation

The device under evaluation consists of a LoRaWAN Radio Module US which will be installed into host devices that will be used at a distance greater than 20 cm from any user. The evaluation distance used for this assessment has been 20 cm.

As stated in DEKRA Testing and Certification, S.A.U. test report num. 54035RRF.001, the maximum measured output power values and the maximum antenna gain value declared by the manufacturer are:

Band (MHz)	Technology	Maximum Output Power (dBm)			Max. Antenna gain (dBi)	Maximum E.I.R.P. (dBm)
		902.3 MHz	908.7 MHz	914.9 MHz		
902.3-914.9	LoRa 125 kHz	18.07	17.98	17.93	+4.0	22.07
Band (MHz)	Technology	Maximum Output Power (dBm)			Max. Antenna gain (dBi)	Maximum E.I.R.P. (dBm)
		903.0 MHz	909.4 MHz	914.2 MHz		
903.0-914.2	LoRa 500 kHz	18.26	18.23	18.20	+4.0	22.26

Table 1: Equipment specifications

Assessment summary

Radiofrequency radiation exposure limits				
FCC 47 CFR § 2.1091				
Assessment	Band (MHz)	Technology	Mode	VERDICT (Pass/Fail)
1	902.3-914.9	LoRa	125 kHz	Pass
2	903.0-914.2	LoRa	500 kHz	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/cm ²)	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/f ²	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/f ²	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:

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

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

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)

R_{\min} = distance to the center of radiation of the antenna

Assessment 1 – LoRa 125 kHz – 900 MHz Band

Maximum output power (dBm):	18.07
Antenna Gain (dBi):	4.0
Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	902.3
Maximum EIRP (dBm):	22.07
Maximum EIRP (mW):	161.06
General public - Power density limit (mW/cm ²):	0.60

Power density at minimum use distance:

Power density (mW/cm ²):	0.032
Verdict for general public:	PASS

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

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	4.62
Verdict for general public:	PASS

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

Assessment 2 – LoRa 500 kHz – 900 MHz Band

Maximum output power (dBm):	18.26
Antenna Gain (dBi):	4.0
Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	903.0
Maximum EIRP (dBm):	22.26
Maximum EIRP (mW):	168.27
General public - Power density limit (mW/cm ²):	0.602

Power density at minimum use distance:

Power density (mW/cm ²):	0.033
Verdict for general public:	PASS

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

Minimum compliance distance for this technology:

Minimum distance for general public (cm):	4.72
Verdict for general public:	PASS

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