

Test report No:
NIE: 67871RAN.002A2

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

(*) Identification of item under evaluation	Mobile UWB anchor
(*) Trademark	Romware
(*) Model and /or type reference	M-Anchor 100
(*) Other identification of the product	HW version: W4 SW version: 1.2.1 FCC ID: 2AVTBRWM1W5 IC: 27593-RWM1W5
(*) Features	LTE Cat M1, Cat NB2, UWB
(*) Manufacturer	Rombit Meir 30, 2000 Antwerpen, Belgium
Test method requested, standard	FCC 47 CFR Part 2.1091 Radiofrequency radiation exposure evaluation: mobile devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager
Date of issue	2022-03-07
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Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item under evaluation", "Trademark", "Model and/or type reference", "General description of the device" and "Other identification of the product").
2. Maximum output power, maximum antenna gain and use distance information.
3. The device is a connected UWB anchor, to be installed on industrial vehicles such as forklifts or reach-stackers.

DEKRA Testing and Certification, S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Identification of the client

Rombit

Meir 30, 2000 Antwerpen, Belgium

Document history

Report number	Date	Description
67871RAN.002	2021-12-17	First release
67871RAN.002A1	2022-03-04	Second release: typo correction on IC number. This modification test report cancels and replaces the test report 67871RAN.002.
67871RAN.002A2	2022-03-07	Third release: UWB values on table 1 have been updated. This modification test report cancels and replaces the test report 67871RAN.002A1.

Appendix A: FCC RF Exposure assessment result

General description of the device under evaluation

The device under evaluation consists of a connected UWB anchor, to be installed on industrial vehicles such as forklifts or reach-stackers.

According to the manufacturer, during its normal use, the separation distance between the radiating structures of the device and nearby users will be greater than 1 meter. In order to perform the assessment a conservative evaluation distance of 20 cm has been used.

The equipment specifications for each supported technology are shown in Table 1. Values corresponding to LTE Cat-M1&NB-IoT have been declared by the manufacturer. Values corresponding to UWB maximum E.I.R.P. and antenna peak gain have been measured and stated into DEKRA Testing and Certification, S.A.U. test report num. 67871RRF.001A1

Technology / Mode	Band	Frequency (MHz)	Maximum Conducted Output Power (Incl. Tune-Up) (dBm)	Antenna peak gain (dBi)	Maximum E.I.R.P. (dBm)	Maximum E.I.R.P. (mW)
LTE Cat-M1 & NB-IoT	2	1850 - 1910	22.00	6.00	28.00	630.96
LTE Cat-M1 & NB-IoT	4	1710 - 1755	22.00	6.00	28.00	630.96
LTE Cat-M1 & NB-IoT	5	824 - 849	22.00	6.00	28.00	630.96
LTE Cat-M1 & NB-IoT	12	699 - 716	22.00	6.00	28.00	630.96
LTE Cat-M1 & NB-IoT	13	777 - 787	22.00	6.00	28.00	630.96
LTE Cat-M1 & NB-IoT	25	1850 - 1915	22.00	6.00	28.00	630.96
LTE Cat-M1	26	814 - 849	22.00	6.00	28.00	630.96
LTE Cat-M1 & NB-IoT	66	1710 - 1780	22.00	6.00	28.00	630.96
LTE NB-IoT	71	663 - 698	22.00	6.00	28.00	630.96
LTE Cat-M1 & NB-IoT	85	698 - 716	22.00	6.00	28.00	630.96
UWB	CH2	3743.6 - 4243.6	-6.50	6.00	-0.50	0.89
UWB	CH5	6239.6 - 6739.6	-7.19	6.00	-1.19	0.76

Table 1: Equipment specifications

RF Exposure Assessment result and verdict

Limits for Maximum Permissible Exposure (MPE) to comply with FCC 47 CFR § 2.1091 are defined in “§1.1310 Radiation Exposure limits, paragraph (e)”:

Technology / Mode	Band	Frequency (MHz)	Distance (cm)	Power density (mW/cm ²)	FCC General Population Limit (mW/cm ²)	Verdict
LTE Cat-M1 & NB-IoT	2	1850 - 1910	20.00	0.13	1.00	Pass
LTE Cat-M1 & NB-IoT	4	1710 - 1755	20.00	0.13	1.00	Pass
LTE Cat-M1 & NB-IoT	5	824 - 849	20.00	0.13	0.55	Pass
LTE Cat-M1 & NB-IoT	12	699 - 716	20.00	0.13	0.47	Pass
LTE Cat-M1 & NB-IoT	13	777 - 787	20.00	0.13	0.52	Pass
LTE Cat-M1 & NB-IoT	25	1850 - 1915	20.00	0.13	1.00	Pass
LTE Cat-M1	26	814 - 849	20.00	0.13	0.54	Pass
LTE Cat-M1 & NB-IoT	66	1710 - 1780	20.00	0.13	1.00	Pass
LTE NB-IoT	71	663 - 698	20.00	0.13	0.44	Pass
LTE Cat-M1 & NB-IoT	85	698 - 716	20.00	0.13	0.47	Pass
UWB	CH2	3743.6 - 4243.6	20.00	0.00	1.00	Pass
UWB	CH5	6239.6 - 6739.6	20.00	0.00	1.00	Pass

Table 2: Assessment result and verdict

Simultaneous transmission assessment:

Simultaneous technologies and modes	Result	Limit	Verdict
LTE Cat-M1 & NB-IoT 71 + UWB CH2	0.28	1	Pass
LTE Cat-M1 & NB-IoT 71 + UWB CH5	0.28	1	Pass

Table 3: Simultaneous Transmission assessment

Appendix B: FCC RF Exposure information

RF Exposure evaluation

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

MPE Evaluation

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:

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

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)

$$P_{E.I.R.P.} = P_T + G_T - L_C$$

Where:

P_T = transmitter output power (including tune-up tolerance)

G_T = gain of the transmitting antenna

L_C = signal attenuation in the connecting cable between the transmitter and the antenna if applicable

Multiple frequencies assessment

When multiple sources are introduced into an environment, it becomes necessary to address the sources interdependently, since each source will contribute some percentage of the maximum exposure towards the total exposure at a fixed location. The sum of the ratios of the exposure from each source to the corresponding maximum exposure for the frequency of each source must be evaluated.

The exposure complies with the maximum permissible exposure if the sum of the ratios is less than unity:

$$\sum_{i=1}^n \frac{S_i}{Lim_i}$$

Where

S_i is the applicable contribution of each source (e.g. power flux density).

Lim_i is the limit for the applicable contribution of each source (e.g. MPE power flux density basic restriction).