

File Number **24/36402511M1**

TECHNICAL REPORT

Human exposure

Petitioner's Reference: **BARCELONA SMART TECHNOLOGIES, S.L.**

Company Address: C/ GUITARD 43 2-1 08014 BARCELONA

Represented by: Mayte Penella

Equipment: U-Spot

Brand: Urbiotica

PMN:

U-SPOT-3.0

Result: **complies**

It has been tested and complies with the applicable standard. See test result summary section.

Applicable Standard:

EMC standard/s: **FCC 47 CFR Part 2 Subpart J Section 2.1093 (October 2022)¹**
KDB 447498 D01 - General RF Exposure Guidance
RSS-102 Issue 6 – 2023 (December 2023)¹

¹The latest modifications of the standard, published at the date of the tests reported in this document, have been considered.

Dates and Test Site: Applus Barcelona, Bellaterra

Equipment Reception Date: October 6, 2023

Test Initial Date: February 20, 2024

Test Final Date: March 6, 2024

Modification Description: M1

This report replaces and supersedes the report 24/36402511 dated on June 4 2024

Modifications performed:

- Eliminated General Description of Test Items. For confidentiality issues, the identification of the samples is deleted. The equipment on the cover page and the general description of the test items in clause 2 are affected.

It is responsibility of the petitioner to replace the previous version with this one

Test Manager: Alejandro Sáez

Date of issue: Bellaterra, July 26, 2024

EMC & Wireless Technical Manager
Electrical and Electronics
LGAI Technological Center S.A.

The results refer only and exclusively to the sample, product or material delivered for testing, and tested under conditions stipulated in this document. The equipment has been tested under conditions stipulated by standard(s) quoted in this document.

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2 TEST RESULTS

2.1 HUMAN EXPOSURES STANDARDS

2.1.1 Test Parameters

2.1.1.1 Requirements

According to the standard FCC 47 CFR Part 2 Subpart J KDB 447498 D01.

For operations within the frequency range of 300 kHz and 6 GHz (inclusive), the limits for maximum permissible exposure (MPE), derived from whole-body SAR limits and listed in Table 1 in paragraph (e)(1) of this section, may be used instead of whole-body SAR limits as set forth in paragraphs (a) through (c) of this section to evaluate the environmental impact of human exposure to RF radiation as specified in § 1.1307(b) of this part, except for portable devices as defined in § 2.1093 of this chapter as these evaluations shall be performed according to the SAR provisions in § 2.1093.

Frequency Range [MHz]	Electric field strength [V/m]	Magnetic field strength [A/m]	Power density [mW/cm ²]	Avering time [minutes]
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 - 1500	-	-	f/300	<6
1500 - 100000	-	-	5	<6
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 - 1500	-	-	f/1500	<30
1500 - 100000	-	-	1.0	<30

Table 1: Requirements – Human exposure - FCC

f=frequency

*=Plane-wave equivalent power density

According to RSS-102 section 5.3, the electric and magnetic field strength reference levels for devices employed by the general public (uncontrolled environment) and controlled-use devices (controlled environment) are summarized in table 5 and table 6.

Frequency Range [MHz]	Electric field strength [V/m]	Magnetic field strength [A/m]	Power density [W/m ²]	Reference period [minutes]
Limits for Occupational / Controlled Exposure				
10 - 20	27.46	0.0728	2	6
20-48	58.07 / f ^{0.25}	0.1540 / f ^{0.25}	8.944 / f ^{0.5}	6
48 - 300	22.06	0.05852	1.291	6
300 - 6000	3.142 f ^{0.3417}	0.008335 f ^{0.3417}	0.02619 f ^{0.6834}	6
6000 - 15000	61.4	0.163	10	6
15000 - 150000	61.4	0.163	10	616000/ f ^{1.2}
150000 - 300000	0.158 f ^{0.5}	4.21×10 ⁻⁴ f ^{0.5}	6.67×10 ⁻⁵ f	616000/ f ^{1.2}
Limits for General Population / Uncontrolled Exposure				
10 - 20	61.4	0.163	10	6
20 - 48	129.8 / f ^{0.25}	0.3444 / f ^{0.25}	44.72 / f ^{0.5}	6
48 - 100	49.33	0.1309	6.455	6
100 - 6000	15.60 f ^{0.25}	0.04138 f ^{0.25}	0.6455 f ^{0.5}	6
6000 - 15000	137	0.364	50	6
15000 - 150000	137	0.364	50	616000/ f ^{1.2}
150000 - 300000	0.354 f ^{0.5}	9.40×10 ⁻⁴ f ^{0.5}	3.33×10 ⁻⁴ f	616000/ f ^{1.2}

Table 2: Requirements – Human exposure - ISED

f=frequency in MHz

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2.1.2 Test Results

For the evaluation of the RF exposure, the maximum conducted output power of LoraWan technology is obtained from the following test reports: 24/36402498

Channel	Central Frequency [MHz]	Maximum Conducted Peak Power [dBm]	Antenna Gain [dBi]	E.I.R.P [dBm]
Low	902.3	17.52	-2.02	15.50
Middle	908.5	17.06	-2.02	15.04
High	914.9	16.60	-2.02	14.58

Table 3: Maximum Conducted Output Power – LoraWan

For the evaluation of the RF exposure, the maximum conducted output power is obtained from the following test reports: 200330213GZU-001

Channel	Central Frequency [MHz]	Maximum Conducted Peak Power [dBm]	Antenna Gain [dBi]	E.I.R.P [dBm]
37	2402	1.270	-0.5	0.77
17	2440	1.280	-0.5	0.78
39	2480	1.280	-0.5	0.78

Table 4: Maximum Conducted Output Power – BLE

Therefore, through the following equation, is computed the power density at each frequency transmitted band for a minimum distance of 20 cm between the DUT and the person to comply with the power density limit.

$$S = \frac{EIRP}{4 * \pi * d^2}$$

Where:

S = Power density (mW/cm²)

EIRP = Radiated output power of an isotropic antenna (mW)

d = Distance to the center of radiation of the antenna (cm). Limit for MPE = 20 cm.

According to Radiofrequency radiation exposure limits of FCC Part 1 Section §1.1310 paragraph (e), the maximum permissible exposure (MPE) for 300 – 1500 MHz, which the DUT is operating is:

Channel	Central Frequency [MHz]	Power Density at 20 cm [mW/cm ²]	Power Density Limits [mW/cm ²]	Result
Low	902.3	0.0071	0.602	PASS
Middle	908.5	0.0063	0.606	PASS
High	914.9	0.0057	0.610	PASS

Table 5: Results – LoraWan - ISED

According to Radiofrequency radiation exposure limits of FCC Part 1 Section §1.1310 paragraph (e), the maximum permissible exposure (MPE) for 1500 MHz - 100000 MHz, which the DUT is operating is:

Channel	Central Frequency [MHz]	Power Density at 20 cm [mW/cm ²]	Power Density Limits [mW/cm ²]	Result
37	2402	0.0002	1	PASS
17	2440	0.0002	1	PASS
39	2480	0.0002	1	PASS

Table 6: Results – BLE - FCC

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According to Radiofrequency radiation exposure limits of RSS-102 section 5.3.2, the maximum permissible exposure (MPE) for 100 – 6000 MHz, which the DUT is operating is:

Channel	Central Frequency [MHz]	Power Density at 20 cm [W/m ²]	Power Density Limits [W/m ²]	Result
Low	902.3	0.0706	19.390	PASS
Middle	908.5	0.0635	19.456	PASS
High	914.9	0.0571	19.525	PASS

Table 7: Results – LoraWan - ISED

According to Radiofrequency radiation exposure limits of RSS-102 section 5.3.2, the maximum permissible exposure (MPE) for 100 – 6000 MHz, which the DUT is operating is:

Channel	Central Frequency [MHz]	Power Density at 20 cm [W/m ²]	Power Density Limits [W/m ²]	Result
37	2402	0.0024	31.636	PASS
17	2440	0.0024	31.885	PASS
39	2480	0.0024	32.146	PASS

Table 8: Results – BLE - ISED

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