

Test report No:
NIE: 59770RAN.001

Assessment report

RF EXPOSURE REPORT ACCORDING TO

FCC 47 CFR Part 2.1091

ISED RSS-102 Issue 5:2015

(*) Identification of item under evaluation	M2M/IoT Linux based open platform designed to gather, process and report data.
(*) Trademark	OWASYS
(*) Model and /or type reference	Owa450
Other identification of the product	HW version: R1A SW version: 1 FCC ID: QIPPLS62-W IC: 7830A-PLS62W
(*) Features	LTE, WIFI, BLUETOOTH 4.2, 802.11@2.4, 802.11@5
Manufacturer	OWASYS ADVANCED WIRELESS DEVICES S.L. Parque tecnológico, 207B, 48160 Derio, Vizcaya, España
Test method requested, standard	FCC 47 CFR Part 2.1091 Radiofrequency radiation exposure evaluation: mobile devices. ISED RSS-102 Issue 5 (2015-03) – Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) IEEE Std C95.3™ -2002 (R2008). IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields With Respect to Human Exposure to Such Fields, 100 kHz–300 GHz
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Miguel Lacave Antennas Lab Manager
Date of issue	2020-02-14
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Index

Competences and guarantees	3
General conditions	3
Data provided by the client.....	3
Identification of the client.....	3
Document history	3
General description of the device under evaluation.....	4
RF Exposure Assessment result and verdict.....	5
Appendix A: FCC RF Exposure information	7
FCC RF Exposure evaluation	8
FCC MPE Evaluation	9
Appendix B: ISED RF Exposure information	10
ISED RF Exposure evaluation for mobile devices.....	11
ISED MPE Evaluation	12

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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 tested", "Trademark", "Model and/or type reference tested").
2. Maximum output power and maximum antenna gain information.
3. The device includes a Linux core with different communication interfaces, cellular communication with LTE capabilities, WIFI, BT, and GNSS.

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Identification of the client

OWASYS ADVANCED WIRELESS DEVICES S.L.
Parque tecnológico, 207B, 48160 Derio, Vizcaya, España.

Document history

Report number	Date	Description
59770RAN.001	2020-02-14	First release

General description of the device under evaluation

The device under evaluation consists of a Linux core with different communication interfaces, cellular communication with LTE capabilities, WIFI, BT, and GNSS.

Minimum compliance distance between device and any nearby person is 23 cm for FCC market and 33 cm for Canada market.

The equipment specifications declared by the manufacturer for each supported technology and band are:

Technology / Mode	Band	Frequency (MHz)	Maximum Conducted Output Power RMS Burst (Incl. Tune-Up) (dBm)	Duty Cycle (%)	Average Conducted Power (dBm)	Antenna peak gain (dBi)	Maximum E.I.R.P. (dBm)	Maximum E.I.R.P. (mW)
GSM	850	824 - 849	35.00	12.50	25.97	3.40	29.37	864.79
GPRS 1TX	850	824 - 849	35.00	12.50	25.97	3.40	29.37	864.79
GPRS 2TX	850	824 - 849	35.00	25.00	28.98	3.40	32.38	1729.58
GPRS 3TX	850	824 - 849	35.00	37.50	30.74	3.40	34.14	2594.37
GPRS 4TX	850	824 - 849	35.00	50.00	31.99	3.40	35.39	3459.15
EGPRS 1TX	850	824 - 849	30.00	12.50	20.97	3.40	24.37	273.47
EGPRS 2TX	850	824 - 849	30.00	25.00	23.98	3.40	27.38	546.94
EGPRS 3TX	850	824 - 849	30.00	37.50	25.74	3.40	29.14	820.41
EGPRS 4TX	850	824 - 849	30.00	50.00	26.99	3.40	30.39	1093.88
GSM	1900	1850 - 1910	32.00	12.50	22.97	3.50	26.47	443.52
GPRS 1TX	1900	1850 - 1910	32.00	12.50	22.97	3.50	26.47	443.52
GPRS 2TX	1900	1850 - 1910	32.00	25.00	25.98	3.50	29.48	887.03
GPRS 3TX	1900	1850 - 1910	32.00	37.50	27.74	3.50	31.24	1330.55
GPRS 4TX	1900	1850 - 1910	32.00	50.00	28.99	3.50	32.49	1774.07
EGPRS 1TX	1900	1850 - 1910	29.00	12.50	19.97	3.50	23.47	222.28
EGPRS 2TX	1900	1850 - 1910	29.00	25.00	22.98	3.50	26.48	444.57
EGPRS 3TX	1900	1850 - 1910	29.00	37.50	24.74	3.50	28.24	666.85
EGPRS 4TX	1900	1850 - 1910	29.00	50.00	25.99	3.50	29.49	889.14
UMTS	II	1850 - 1910	25.00	100.00	25.00	3.50	28.50	707.95
UMTS	IV	1710 - 1755	25.00	100.00	25.00	3.50	28.50	707.95
UMTS	V	869 - 894	25.00	100.00	25.00	3.40	28.40	691.83
LTE	2	1850 - 1910	25.00	100.00	25.00	3.50	28.50	707.95
LTE	4	1710 - 1755	25.00	100.00	25.00	3.50	28.50	707.95
LTE	5	824 - 849	25.00	100.00	25.00	3.40	28.40	691.83
LTE	7	2500 - 2570	25.00	100.00	25.00	3.90	28.90	776.25
LTE	12	699 - 716	25.00	100.00	25.00	3.40	28.40	691.83
802.11b/g/n	2.4 GHz	2412 - 2472	17.00	100.00	17.00	1.80	18.80	75.86
802.11a/n/ac	5 GHz	5150 - 5850	15.00	100.00	15.00	4.90	19.90	97.72
Bluetooth/BTLE	ISM	2402 - 2480	7.00	100.00	7.00	1.80	8.80	7.59

Table 1: Equipment specifications

RF Exposure Assessment result and verdict

FCC assessment:

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
GSM/GPRS	850	824 - 849	23.00	0.52	0.55	Pass
GSM/GPRS	1900	1850 - 1910	23.00	0.27	1.00	Pass
UMTS	II	1850 - 1910	23.00	0.11	1.00	Pass
UMTS	IV	1710 - 1755	23.00	0.11	1.00	Pass
UMTS	V	869 - 894	23.00	0.10	0.58	Pass
LTE	2	1850 - 1910	23.00	0.11	1.00	Pass
LTE	4	1710 - 1755	23.00	0.11	1.00	Pass
LTE	5	824 - 849	23.00	0.10	0.55	Pass
LTE	7	2500 - 2570	23.00	0.12	1.00	Pass
LTE	12	699 - 716	23.00	0.10	0.47	Pass
802.11b/g/n20	2.4 GHz	2412 - 2472	23.00	0.01	1.00	Pass
802.11a/n20/ac80	5 GHz	5150 - 5850	23.00	0.01	1.00	Pass
Bluetooth/BTLE	ISM	2402 - 2480	23.00	0.00	1.00	Pass

Table 2: Assessment result and verdict

*Note: Only the maximum output power mode has been taken into account as a worst case mode for technologies with different transmission modes that use the same module and antenna at the same transmission frequency range.

Simultaneous Transmission assessment:

Simultaneous technologies and modes	Result	Limit	Verdict
GPRS 4TX 850 + WLAN 2.4 GHz	0.959	1	Pass
GPRS 4TX 850 + WLAN 5 GHz	0.962	1	Pass
GPRS 4TX 850 + Bluetooth/BTLE	0.948	1	Pass

Table 3: Simultaneous Transmission assessment

ISED assessment:

Limits for RF Field Strength to comply with RSS-102 Issue 5 are defined in “Health Canada’s RF exposure guideline, Safety code 6”:

Technology / Mode	Band	Frequency (MHz)	Distance (cm)	Power density (W/m ²)	ISED General Public Limit (W/m ²)	Verdict
GSM/GPRS	850	824 - 849	33.00	2.53	2.58	Pass
GSM/GPRS	1900	1850 - 1910	33.00	1.30	4.48	Pass
UMTS	II	1850 - 1910	33.00	0.52	4.48	Pass
UMTS	IV	1710 - 1755	33.00	0.52	4.24	Pass
UMTS	V	869 - 894	33.00	0.51	2.67	Pass
LTE	2	1850 - 1910	33.00	0.52	4.48	Pass
LTE	4	1710 - 1755	33.00	0.52	4.24	Pass
LTE	5	824 - 849	33.00	0.51	2.58	Pass
LTE	7	2500 - 2570	33.00	0.57	5.50	Pass
LTE	12	699 - 716	33.00	0.51	2.30	Pass
802.11b/g/n20	2.4 GHz	2412 - 2472	33.00	0.06	5.37	Pass
802.11a/n20/ac80	5 GHz	5150 - 5850	33.00	0.07	8.72	Pass
Bluetooth/BTLE	ISM	2402 - 2480	33.00	0.01	5.35	Pass

Table 4: Assessment result and verdict

*Note: Only the maximum output power mode has been taken into account as a worst case mode for technologies with different transmission modes that use the same module and antenna at the same transmission frequency range.

Simultaneous Transmission assessment:

Simultaneous technologies and modes	Result	Limit	Verdict
GPRS 4TX 850 + WLAN 2.4 GHz	0.992	1	Pass
GPRS 4TX 850 + WLAN 5 GHz	0.989	1	Pass
GPRS 4TX 850 + Bluetooth/BTLE	0.982	1	Pass

Table 5: Simultaneous Transmission assessment

Appendix A: FCC RF Exposure information

FCC 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

FCC 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)

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 toward 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:

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

Where

S_i is the power flux density of each source;

MPE_i is the power flux density basic restriction of each source.

Appendix B: ISED RF Exposure information

ISED RF Exposure evaluation for mobile devices

According to RSS-102 Issue 5, Paragraph "4. Exposure Limits", Industry of Canada has adopted the RF field strength limits established in Health Canada's RF exposure guideline, Safety code 6:

**Table 4: RF Field Strength Limits for Devices Used by the General Public
(Uncontrolled Environment)**

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ⁻²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ $f^{0.5}$	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
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 x 10 ⁻⁴ $f^{0.5}$	6.67 x 10 ⁻⁵ f	616000/ $f^{1.2}$

Note: f is frequency in MHz.
 *Based on nerve stimulation (NS).
 ** Based on specific absorption rate (SAR).

Table 6: RF Field Strength Limits for Controlled Use Devices (Controlled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ⁻²³	170	180	-	Instantaneous*
0.1-10	-	1.6/ f	-	6**
1.29-10	193/ $f^{0.5}$	-	-	6**
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 x 10 ⁻⁴ $f^{0.5}$	3.33 x 10 ⁻⁴ f	616000/ $f^{1.2}$

Note: f is frequency in MHz.
 *Based on nerve stimulation (NS).
 ** Based on specific absorption rate (SAR).

ISED MPE Evaluation

Each supported transmission technology will be evaluated to determine if it is in compliance with RSS-102 Issue 5, RF Field Strength Limits for devices used by the General Public.

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:

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

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)

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 toward 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:

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

Where

S_i is the power flux density of each source;

MPE_i is the power flux density basic restriction of each source.