

Test report No:
 NIE: 58694RAN.001

Assessment report

RF EXPOSURE REPORT ACCORDING TO FCC 47 CFR Part 2.1091 ISED RSS-102 Issue 5:2015

Identification of item tested	Wireless module
Trademark	TELIT
Model and /or type reference	ML865C1-NA
Other identification of the product	HW version: 0.0 SW Version: M0B.150003
Features	LTE wireless cellular module
Manufacturer	TELIT COMMUNICATION S.P.A. Via stazione di prosecco 5/B. 34010. Sgonico. Italy.
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)
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Francisco Cañas Regulatory Lab Director
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Index

Competences and guarantees	3
General conditions	3
Identification of the client.....	3
General description of the device under evaluation.....	4
Assessment summary.....	5
Appendix A: FCC RF Exposure.....	6
FCC RF Exposure evaluation for mobile devices	7
FCC MPE Evaluation Results	8
Appendix B: ISED RF Exposure.....	13
ISED RF Exposure evaluation for mobile devices	14
ISED MPE Evaluation Results	15

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Identification of the client

TELIT COMMUNICATION S.P.A.

Via stazione di prosecco 5/B. 34010. Sgonico. Italy.

General description of the device under evaluation

The device under evaluation consists of a TELIT ML865C1-NA module, which supports LTE transmission.

This module will be installed into host devices that will be used at a distance greater than 20 cm from the user. The evaluation distance used for this assessment has been 20 cm.

The equipment specifications declared by the manufacturer for each

Band (MHz)	Technology	Band	Maximum RF output power (incl. tune-up) (dBm)	Maximum Average RF output power (dBm)
1900	LTE	2	24.0	24.0
1700	LTE	4	24.0	24.0
700	LTE	12	24.5	24.0
750	LTE	13	24.0	24.0

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	1900	LTE	2	Pass
2	1700	LTE	4	Pass
3	700	LTE	12	Pass
4	750	LTE	13	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; 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:

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

$$\text{Minimum compliance distance: } R_{\min}[cm] = \sqrt{\frac{P_{\max}[mW]}{4\pi S[mW/cm^2]}}$$

$$\text{Maximum gain to meet the MPE limit: } G_{\max}[dBi] = (10 * \log[S[mW/cm^2] * 4\pi R[cm]^2) - P_{\max}[dBm]$$

S = power density

P_{\max} = power input to the antenna

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

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

G_{\max} = power gain of the antenna in the direction of interest relative to an isotropic radiator

Assessment 1 - LTE Band 2

Maximum output power (dBm):	24.0
Maximum antenna Gain (dBi):	N/A
Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	24.0
Maximum EIRP (mW):	251.19
General population - Power density limit (mW/cm ²):	1.0

Power density at minimum use distance:

Power density (mW/cm ²):	0.05
General population - Power density limit (mW/cm ²):	1.0
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):	4.47
Minimum use distance (cm):	20.0
Verdict for general population:	PASS

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

Maximum gain to meet the §1.1310 Radiofrequency radiation exposure limits:

Maximum antenna gain to meet reference level (dBi):	13.0
Power density using max antenna gain (mW/cm ²):	0.997

The power density level using the maximum antenna gain for this transmission mode will be below power density reference level.

Assessment 2 - LTE Band 4

Maximum output power (dBm):	24.0
Maximum antenna Gain (dBi):	N/A
Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	1710.0
Maximum EIRP (dBm):	24.0
Maximum EIRP (mW):	251.19
General population - Power density limit (mW/cm ²):	1.0

Power density at minimum use distance:

Power density (mW/cm ²):	0.05
General population - Power density limit (mW/cm ²):	1.0
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):	4.47
Minimum use distance (cm):	20.0
Verdict for general population:	PASS

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

Maximum gain to meet the §1.1310 Radiofrequency radiation exposure limits:

Maximum antenna gain to meet reference level (dBi):	13.0
Power density using max antenna gain (mW/cm ²):	0.997

The power density level using the maximum antenna gain for this transmission mode will be below power density reference level.

Assessment 3 - LTE Band 12

Maximum output power (dBm):	24.5
Maximum antenna Gain (dBi):	N/A
Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	699.0
Maximum EIRP (dBm):	24.5
Maximum EIRP (mW):	281.84
General population - Power density limit (mW/cm ²):	0.466

Power density at minimum use distance:

Power density (mW/cm ²):	0.056
General population - Power density limit (mW/cm ²):	0.466
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):	6.94
Minimum use distance (cm):	20.0
Verdict for general population:	PASS

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

Maximum gain to meet the §1.1310 Radiofrequency radiation exposure limits:

Maximum antenna gain to meet reference level (dBi):	9.1
Power density using max antenna gain (mW/cm ²):	0.456

The power density level using the maximum antenna gain for this transmission mode will be below power density reference level.

Assessment 4 - LTE Band 13

Maximum output power (dBm):	24.0
Maximum antenna Gain (dBi):	N/A
Minimum use distance (cm):	20.0
Worst Case Frequency (MHz):	777.0
Maximum EIRP (dBm):	24.0
Maximum EIRP (mW):	251.19
General population - Power density limit (mW/cm ²):	0.518

Power density at minimum use distance:

Power density (mW/cm ²):	0.05
General population - Power density limit (mW/cm ²):	0.518
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):	6.21
Minimum use distance (cm):	20.0
Verdict for general population:	PASS

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

Maximum gain to meet the §1.1310 Radiofrequency radiation exposure limits:

Maximum antenna gain to meet reference level (dBi):	10.1
Power density using max antenna gain (mW/cm ²):	0.511

The power density level using the maximum antenna gain for this transmission mode will be below power density reference level.

Appendix B: ISED RF Exposure

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/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ <i>f</i> ^{0.25}	0.1540/ <i>f</i> ^{0.25}	8.944/ <i>f</i> ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 <i>f</i> ^{0.3417}	0.008335 <i>f</i> ^{0.3417}	0.02619 <i>f</i> ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/ <i>f</i> ^{1.2}
Note: <i>f</i> is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

ISED MPE Evaluation Results

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:

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

$$\text{Minimum compliance distance: } R_{\min}[m] = \sqrt{\frac{P_{\max}[W]}{4\pi S[W/m^2]}}$$

$$\text{Maximum gain to meet the RSS -102 limit: } G_{\max}[dBi] = (10 * \log[S[W/m^2] * 4\pi R[m]^2) + 30 - P_{\max}[dBm]$$

S = power density

P_{\max} = power input to the antenna

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

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

G_{\max} = power gain of the antenna in the direction of interest relative to an isotropic radiator

Assessment 1 - LTE Band 2

Maximum output power (dBm):	24.0
Maximum antenna gain (dBi):	N/A
Minimum use distance (m):	0.2
Worst Case Frequency (MHz):	1850.0
Maximum EIRP (dBm):	24.0
Maximum EIRP (W):	0.25
General public - Power density limit (W/m ²):	4.476

Power density at minimum use distance:

Power density (W/m ²):	0.5
General public - Power density limit (W/m ²):	4.476
Verdict for general public:	PASS

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

Minimum compliance distance for this technology:

Minimum compliance distance for general public (m):	0.067
Minimum use distance (m):	0.2
Verdict for general public:	PASS

The minimum use distance is greater than general public minimum compliance distance.

Maximum gain to meet the RSS -102 limits:

Maximum antenna gain to meet reference level (dBi):	9.5
Power density using max antenna gain (W/m ²):	4.45

The power density level using the maximum antenna gain for this transmission mode will be below power density reference level.

Assessment 2 - LTE Band 4

Maximum output power (dBm):	24.0
Maximum antenna gain (dBi):	N/A
Minimum use distance (m):	0.2
Worst Case Frequency (MHz):	1710.0
Maximum EIRP (dBm):	24.0
Maximum EIRP (W):	0.25
General public - Power density limit (W/m ²):	4.24

Power density at minimum use distance:

Power density (W/m ²):	0.5
General public - Power density limit (W/m ²):	4.24
Verdict for general public:	PASS

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

Minimum compliance distance for this technology:

Minimum compliance distance for general public (m):	0.069
Minimum use distance (m):	0.2
Verdict for general public:	PASS

The minimum use distance is greater than general public minimum compliance distance.

Maximum gain to meet the RSS -102 limits:

Maximum antenna gain to meet reference level (dBi):	9.2
Power density using max antenna gain (W/m ²):	4.16

The power density level using the maximum antenna gain for this transmission mode will be below power density reference level.

Assessment 3 - LTE Band 12

Maximum output power (dBm):	24.5
Maximum antenna gain (dBi):	N/A
Minimum use distance (m):	0.2
Worst Case Frequency (MHz):	699.0
Maximum EIRP (dBm):	24.5
Maximum EIRP (W):	0.28
General public - Power density limit (W/m ²):	2.30

Power density at minimum use distance:

Power density (W/m ²):	0.561
General public - Power density limit (W/m ²):	2.30
Verdict for general public:	PASS

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

Minimum compliance distance for this technology:

Minimum compliance distance for general public (m):	0.099
Minimum use distance (m):	0.2
Verdict for general public:	PASS

The minimum use distance is greater than general public minimum compliance distance.

Maximum gain to meet the RSS -102 limits:

Maximum antenna gain to meet reference level (dBi):	6.1
Power density using max antenna gain (W/m ²):	2.28

The power density level using the maximum antenna gain for this transmission mode will be below power density reference level.

Assessment 4 - LTE Band 13

Maximum output power (dBm):	24.0
Maximum antenna gain (dBi):	N/A
Minimum use distance (m):	0.2
Worst Case Frequency (MHz):	777.0
Maximum EIRP (dBm):	24.0
Maximum EIRP (W):	0.25
General public - Power density limit (W/m ²):	2.474

Power density at minimum use distance:

Power density (W/m ²):	0.5
General public - Power density limit (W/m ²):	2.474
Verdict for general public:	PASS

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

Minimum compliance distance for this technology:

Minimum compliance distance for general public (m):	0.09
Minimum use distance (m):	0.2
Verdict for general public:	PASS

The minimum use distance is greater than general public minimum compliance distance.

Maximum gain to meet the RSS -102 limits:

Maximum antenna gain to meet reference level (dBi):	6.9
Power density using max antenna gain (W/m ²):	2.45

The power density level using the maximum antenna gain for this transmission mode will be below power density reference level.