



Radio Frequency Exposure Evaluation Report

FOR:

Telular Corporation

Model:

ST90

Product Description:

Fuel Tank Monitor

Applied Rules and Standards:

CFR 47 Part 2 (2.1093),

FCC KDB 447498 D01 General RF Exposure Guidance v06

ISED RSS-102 Issue 5

FCC ID: MTFST90

IC ID: 2175D-ST90

Report number: EMC_TELUL-072-17001_FCC_ISED_MPE_Rev1

DATE: 2018-07-03



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1. Assessment

This RF Exposure evaluation report provides evidence for compliance of the below identified device with the RF Exposure limits for mobile devices as defined in FCC CFR Part 1 (1.1307 & 1.1310), Part 2 (2.1091) and IC standard RSS-102 issue 5. Evaluated under worse case conditions (measured or rated RF output power, antenna gain, distance towards human body, multiple transmitter information as presented by the applicant). In addition, maximum antenna gain or minimum distance towards the human body is calculated where relevant.

The device meets the limits as stipulated by the above given FCC and IC rule parts based on available specifications for worst case conditions at 20cm distance to the body.

Company	Description	Model #
Telular Corporation	Fuel Tank Monitor	ST90

Responsible for Testing Laboratory:

2018-07-03	Compliance	James Donnellan (EMC Lab Manager)	
Date	Section	Name	Signature

Responsible for the Report:

2018-07-03	Compliance	Kevin Wang (Sr. EMC Engineer)	 Kevin Wang
Date	Section	Name	Signature

The test results of this test report relate exclusively to the test item specified in Section 3. CETECOM Inc. USA does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of CETECOM Inc. USA.

2. Administrative Data

2.1. Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
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EMC Lab Manager:	James Donnellan
Responsible Project Leader:	Chaman Bhardwaj

2.2. Identification of the Client / Manufacturer

Applicant's Name:	Telular Corporation.
Street Address:	3225 Cumberland Blvd. Suite 300
City/Zip Code	Atlanta, GA 30339
Country	USA

3. Equipment under Assessment

Model No	ST90
HW Version	Rev B
SW Version	2.50
FCC-ID	MTFST90
IC ID	2175D-ST90
HVIN	ST90
PMN	SMARTank
Product Description	Fuel Tank Monitor
Device Category	☐ Fixed Installation ☐ Mobile ☒ Portable ☐ Mixed Mobile and Portable
Frequency Range / number of channels	GSM 850: 824.2-848.8; 125 channels; PCS 1900: 1850.2-1909.8; 300 channels; FDD V: 826.4 - 846.6; 278 channels; FDD II: 1852.4 – 1907.6; 103 channels; ISM: 902-928; 20 channels
Type(s) of Modulation	Telit LE910-NA1, HW: 0 ; SW: 20.00.522 FCC ID: R17 LE910NAV2 ; IC ID: 5131A-LE910NAV2 QPSK,GMSK, 8PSK
Modes of Operation	Telit LE910-NA1: UMTS Bands II and V; LTE Bands 2,4,5,12, & 13; and ISM 20 channels (902-928 MHz)
Declared ISM Radio Output power	Conducted Power 10.65 dBm
Max. declared antenna gain	6 dBi for Cellular; For ISM 3.0 dBi
Minimum distance of antenna or radiating parts to user	≥ 20 cm
Power Supply/ Rated Operating Voltage Range	6.3 VDC max, nominal 6 VDC, Low 5 VDC
Operating Temperature Range	- 30°C to +70°C
Other Radios included in the device	ISM; 902MHz to 928MHz & GPS
Co-located Transmitters / Antennas	☒ Yes ☐ No
Sample Revision	☐ Prototype ☒ Production ☐ Pre-Production
Exposure Category	☐ Occupational/ Controlled ☒ General Population/ Uncontrolled

4 RF Exposure Limits and FCC and IC Basic Rules

For the specific described radio apparatus the following basic limits and rules apply for both, FCC and IC where not indicated differently.

4.1 Power Density Limits acc. to FCC 1.1310(e) / RSS-102 i5, cl. 4:

FCC

Frequency Range (MHz)	Power density (mW/cm ²)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100,000	1.0	30

IC

300 – 6000	0.02619 x f (MHz) ^{0.6834}	6
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4.2 Routine Environmental Evaluation Categorical Exclusion Limits acc. to FCC 2.109(c) / RSS-102, cl. 2.5 (rounded to 1 decimal point):

FCC

operating frequency < 1.5GHz: excluded if ERP < 1.5W / 31.8dBm (EIRP: 33.9);
 operating frequency > 1.5GHz: excluded if ERP < 3.0W / 34.8dBm (EIRP: 36.9);

IC

300MHz <= operating frequency < 6 GHz: excluded if EIRP < 0.0131 x f (MHz)^{0.6834} W

4.3 RF Exposure Estimation (MPE Estimation)

Having available the source based average output power and peak antenna gain or the ERP/EIRP of the specified device and for a known minimum distance of its radiating structures from the body of persons according to its use cases (at least 20cm) the power density at that distance can be estimated by the following formula for plane-wave equivalent conditions (far-field conditions), when ground reflection is neglected.

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density (mW/cm² or W/m²)

P = power input to the antenna (mW or W)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (cm or m)

5 Evaluations

5.1 Analysis to Exclude Routine RF Exposure evaluation for Stand Alone Operation

band	lowest frequency [MHz]	FCC EIRP limit	IC EIRP limit in (W)	IC EIRP limit in (dBm)	EIRP in dBm	Verdict
UMTS II	1850.00	36.900	2.24	33.50	30.5	Exempt
UMTS V	824.00	33.900	1.29	31.11	30.5	Exempt
LTE 2	1850.00	36.900	2.25	33.51	30.0	Exempt
LTE 4	1710.00	36.900	2.13	33.28	30.0	Exempt
LTE 5	824.00	33.900	1.29	31.12	30.0	Exempt
LTE 12	699.00	33.900	1.16	30.64	30.0	Exempt
LTE 13	777.00	33.900	1.24	30.93	30.0	Exempt
ISM	902	33.900	1.37	31.37	13.65	Exempt

The single radios are exempt from routine environmental evaluation.

5.2 Analysis of RF Exposure for simultaneous transmission

Standalone MPE analysis:

- Evaluations are based on worst case power density limits for Canada.
- Calculations are made for 20cm.
- Evaluations are based on EIRP measured or calculated from known gain and conducted output power.
- Cellular and ISM *do not* transmit simultaneously

Radio	Freq MHz	EIRP in W	Canada W/m2	Actual W/m2	How much of limit is used up
Band II	1852.4	1.12	4.480	2.232	49.82%
Band V	826.4	1.12	2.581	2.232	86.48%
Band 2	1857.5	1.00	4.489	1.989	44.32%
Band 4	1717.5	1.00	4.255	1.989	46.75%
Band 5	829	1.00	2.586	1.989	76.91%
Band 12	699	1.00	2.302	1.989	86.42%
Band 13	777	1.00	2.474	1.989	80.39%
ISM	902	0.02	2.740	0.046	1.68%

Conclusion:

- There is no simultaneous operation of ISM and Cellular modes in this case
- The equipment is passing RF exposure requirements for ≥ 20 cm distance.

5.3 Routine Environmental Evaluation Applicability Simultaneous Transmission

Possible simultaneous transmissions: According to the manufacturer, the two radio modules incorporated within the device operate independently from each other. Theoretically, the worst case of simultaneous transmission is with two transmitters operating at the highest output power mode, within the same band (not applicable).

Transmission Mode	Sum of the Ratios for the Highest Possible Simultaneous Operation	Limits for the Highest Combined Ratio	Exempt from Routine evaluation
Cellular or ISM	Not applicable	Not applicable	Yes

Note: Power Density to Applicable limit for Stand Alone Operation are derived from table in section 5.2

Conclusion:

- The equipment meets the MPE requirements limits for simultaneous transmission for distance greater than or equal to 20 cm.

6 Revision History

Date	Report Name	Changes to report	Report prepared by
2018-04-26	EMC_TELUL-072-17001_FCC_ISED_MPE_Draft	Draft Version	Chaman Bhardwaj
2018-05-22	EMC_TELUL-072-17001_FCC_ISED_MPE	Initial Release. Updated signature fields and report dates	Kevin Wang
2018-07-03	EMC_TELUL-072-17001_FCC_ISED_MPE_Rev1	Update EUT Model number, HW version, SW version, FCC ID and IC ID	Kevin Wang