



# Radio Frequency Exposure Evaluation Report

For:

**Moog Inc.**

Model Name:

**ILC3000**

Product Description:

**Asset Tracker**

**FCC ID: 2AGRZ-ILC3000**

**IC: 20942-ILC3000**

**Per:**

CFR Part Part 1 (1.1307 & 1.1310), Part 2 (2.1091),  
FCC KDB 447498 D01 General RF Exposure Guidance v06

**Report number:** EMC\_MOOGI-005-15001\_FCC\_MPE

**DATE:** February 3, 2016



**CETECOM Inc.**

411 Dixon Landing Road ♦ Milpitas, CA 95035 ♦ U.S.A.

Phone: + 1 (408) 586 6200 ♦ Fax: + 1 (408) 586 6299 ♦ E-mail: [info@cetecom.com](mailto:info@cetecom.com) ♦ <http://www.cetecom.com>  
CETECOM Inc. is a Delaware Corporation with Corporation number: 2905571

## 1 Assessment

This RF Exposure evaluation report provides information about 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 under given 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, respectively, where relevant.

The device meets the limits as stipulated by the above given FCC and IC rule parts based on available specifications.

| Company   | Description                                                   | Model # |
|-----------|---------------------------------------------------------------|---------|
| Moog Inc. | Cellular, WLAN, GPS, Bluetooth LE Radio Enabled Asset Tracker | ILC3000 |

### Responsible for the Test Laboratory:

| February 3, 2016 | Compliance | Franz Engert<br>(Compliance Manager) | <br>Digitally signed by Franz Engert<br>DN: cn=Franz Engert, c=US,<br>o=CETECOM,<br>ou=Compliance, email=franz.Engert@cetecom.com |
|------------------|------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Date             | Section    | Name                                 | Signature                                                                                                                                                                                                             |

### Responsible for the Report:

| February 3, 2016 | Compliance | Yu-Chien Ho<br>(EMC Test Engineer) | Yu-Chien Ho |
|------------------|------------|------------------------------------|-------------|
| Date             | Section    | Name                               | Signature   |

## 2 Administrative Data

### 2.1 Identification of the Testing Laboratory Issuing the Test Report

|                            |                                                         |
|----------------------------|---------------------------------------------------------|
| <b>Company Name:</b>       | CETECOM Inc.                                            |
| <b>Department:</b>         | Compliance                                              |
| <b>Address:</b>            | 6370 Nancy Ridge Drive<br>San Diego, CA 92121<br>U.S.A. |
| <b>Telephone:</b>          | +1 (858) 362 2400                                       |
| <b>Fax:</b>                | +1 (858) 687-4809                                       |
| <b>Compliance Manager:</b> | Franz Engert                                            |
| <b>Project Engineer:</b>   | Yu-Chien Ho                                             |

### 2.2 Identification of the Client / Manufacturer

|                          |                     |
|--------------------------|---------------------|
| <b>Applicant's Name:</b> | Moog Inc.           |
| <b>Street Address:</b>   | 1421 McCarthy Blvd. |
| <b>City/Zip Code</b>     | Milpitas, CA 95035  |
| <b>Country</b>           | USA                 |

### 3 Equipment under Assessment

|                                                      |                                                                                                                                                                                                                                                                                                                                                                             |
|------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Model #:</b>                                      | ILC3000                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Product Description:</b>                          | Asset Tracker                                                                                                                                                                                                                                                                                                                                                               |
| <b>FCC-ID:</b>                                       | <b>2AGRZ-ILC3000</b>                                                                                                                                                                                                                                                                                                                                                        |
| <b>IC certification number with HVIN, PMN, FVIN:</b> | IC: <b>20942-ILC3000</b> / HVIN:ILC3000 / PMN:ILC3000 / FVIN: n.a.                                                                                                                                                                                                                                                                                                          |
| <b>Technology/ Type(s) of Modulation:</b>            | GSM/GPRS/EGPRS 900/1800MHz, multislots class 12;<br>UMTS/HSPA FDD BAND II, V;<br>(per integrated pre-certified Module UBlox Lisa U201 with FCC-ID: XPYLISAU201, IC: 8595A-LISAU201)<br>WLAN: 802.11b/g/n with CCK, DQPSK, DBPSK + DSSS<br>QPSK, BPSK, 16 QAM, 64 QAM + OFDM<br>Bluetooth LE version 4.1, using Direct Sequence Spread Spectrum with GFSK modulation.        |
| <b>Operating Frequency Ranges (MHz)/ Channels:</b>   | GSM 900: 824 - 848 MHz; 124 channels;<br>GSM 1800: 1850 - 1910 MHz; 373 channels;<br>UMTS FDD BAND V: 826 - 847 MHz; 288 channels;<br>UMTS FDD BAND II: 1852 - 1908 MHz; 107 channels;<br>WLAN: Nominal band: 2400 – 2483.5 MHz;<br>2412 MHz (Ch. 1) – 2462 (Ch.11), 11 channels<br>BTLE: Nominal band: 2400 – 2483.5 MHz;<br>2402 MHz (Ch. 0) – 2480 (Ch.39), 40 channels; |
| <b>Antenna info:</b>                                 | cellular radio: internal, PIFA, peak gain: 1.5dBi@850, 2.4dBi@1850<br>WLAN / BT: 2.5 dBi@2.4 GHz:                                                                                                                                                                                                                                                                           |
| <b>Co-located Transmitters/ Antennas?</b>            | <input type="checkbox"/> Yes<br><input checked="" type="checkbox"/> No                                                                                                                                                                                                                                                                                                      |
| <b>Device Category:</b>                              | <input checked="" type="checkbox"/> Fixed Installation<br><input type="checkbox"/> Mobile<br><input type="checkbox"/> Portable<br><input type="checkbox"/> Mixed Mobile and Portable                                                                                                                                                                                        |
| <b>Exposure Category:</b>                            | <input type="checkbox"/> Occupational/ Controlled<br><input checked="" type="checkbox"/> General Population/ Uncontrolled                                                                                                                                                                                                                                                   |
| <b>Power Supply/ Rated Operating Voltage Range:</b>  | Vmin: 3.3V dc/ Vnom: 3.8V dc / Vmax: 4.2V dc                                                                                                                                                                                                                                                                                                                                |
| <b>operating temperature range</b>                   | Tlow: -20° C/ Tnom: 22° C/ Tmax: 60° C                                                                                                                                                                                                                                                                                                                                      |
| <b>Test Sample Status:</b>                           | Prototype                                                                                                                                                                                                                                                                                                                                                                   |

#### 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 <sup>2</sup> ) | Averaging time (minutes) |
|-----------------------|-------------------------------------|--------------------------|
| 300 – 1500            | f (MHz) / 1500                      | 30                       |
| 1500 – 100.000        | 1.0                                 | 30                       |

IC

|            |                                           |   |
|------------|-------------------------------------------|---|
| 300 – 6000 | $0.02619 \times f \text{ (MHz)}^{0.6834}$ | 6 |
|------------|-------------------------------------------|---|

##### 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 <  $0.0131 \times f \text{ (MHz)}^{0.6834}$  W

##### 4.3 EMC Output Power Limits (ERP/EIRP) acc. to FCC part 22/24 / IC RSS-132, RSS-133 (to be additionally taken into account for maximum antenna gain considerations)

part 22: 7W ERP / 38.5dBm (IC: 11.5W / 40.6dBm EIRP)

part 24: 2W EIRP / 33.0dBm

Per KDB 447498 D01 FCC allows calculative estimation of RF exposure for mobile applications when routine environmental evaluation categorical exclusion applies and also for fixed applications. When categorical exclusion can not be claimed for mobile applications MPE measurement is required for TCB approval.

RSS-102 of Industry Canada does generally not require RF exposure evaluation for fixed or mobile applications which stay below the given exclusion limits.

##### 4.4 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 it's radiating structures from the body of persons according to it's 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/cm<sup>2</sup> or W/m<sup>2</sup>)  
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 Routine Environmental Evaluation Applicability

Based on the higher value of documented and measured maximum conducted output power and peak antenna gain values, as available and appropriate.

| Transmission Mode | Max. conducted output power (dBm) | Duty Cycle (%) | peak antenna gain (dBi) | calculated max EIRP | Total EIRP simultaneous transmissions intra-band (worst cases only) (dBm) | FCC / IC Limits for Routine Environmental Evaluation Applicability, EIRP (dBm) | Exempt from Routine evaluation (Yes/No) |
|-------------------|-----------------------------------|----------------|-------------------------|---------------------|---------------------------------------------------------------------------|--------------------------------------------------------------------------------|-----------------------------------------|
| GPRS 850          | 31.5 (1,2)                        | 50             | 1.5                     | 30.0                | N/A (4)                                                                   | 33.9 / 31.1                                                                    | Yes                                     |
| UMTS FDD BAND V   | 25.0 (1)                          | 100            | 1.5                     | 26.5                |                                                                           | 33.9 / 31.1                                                                    | Yes                                     |
| GPRS 1900         | 30.0 (1,2)                        | 50             | 2.4                     | 29.4                |                                                                           | 36.9 / 33.5                                                                    | Yes                                     |
| UMTS FDD BAND II  | 25.0 (1)                          | 100            | 2.4                     | 26.5                |                                                                           | 36.9 / 33.5                                                                    | Yes                                     |
| Wi-Fi 2.4 GHz     | 18.2 (3)                          | 78             | 2.5                     | 20.7                |                                                                           | 36.9 / 34.3                                                                    | Yes                                     |
| BTLE              | 0.9 (3)                           | 100            | 2.5                     | 3.4                 |                                                                           | 36.9 / 34.3                                                                    | Yes                                     |

- (1) max. cellular output powers as declared for cellular module;  
(2) documented power back-off of -2dB applied for TS 4 (4 multislot operation);  
(3) based on maximum measured power from related emc test report;  
(4) no simultaneous transmissions occur acc. to documentation;

#### Conclusion:

- The equipment is exempted from FCC and IC RF exposure routing evaluation.

### 5.2 Compliance with MPE (Power Density) limits

| Power Density Calculation for a distance between the transmitter and the human body of 20cm |                           |                                     |                                    |         |
|---------------------------------------------------------------------------------------------|---------------------------|-------------------------------------|------------------------------------|---------|
| Band of Operation (MHz)                                                                     | calculated max EIRP (dBm) | Power Density (mW/cm <sup>2</sup> ) | FCC/IC Limit (mW/cm <sup>2</sup> ) | Verdict |
| GSM 850                                                                                     | 30.0                      | 0.20                                | 0.55 / 0.26                        | Pass    |
| UMTS FDD BAND II                                                                            | 26.5                      | 0.09                                | 1.0 / 0.45                         | Pass    |
| GSM1900                                                                                     | 29.4                      | 0.17                                | 1.0 / 0.45                         | Pass    |
| UMTS FDD BAND V                                                                             | 26.5                      | 0.09                                | 0.55 / 0.26                        | Pass    |
| 802.11 b/g/n                                                                                | 20.7                      | <<                                  | 1.0 / 0.54                         | Pass    |
| BTLE                                                                                        | 3.4                       | <<                                  | 1.0 / 0.54                         | Pass    |

**Conclusion:**

- The equipment fulfills the FCC and IC MPE limits for the minimum distance between the antenna and the human body of 20cm.

**5.3 Maximum allowed Antenna Gain – Gmax**

- not applicable since fixed internal antenna is used in the product;

**5.4 Routine Environmental Evaluation Applicability Simultaneous Transmission**

- not applicable no simultaneous transmissions occur acc. to documentation;

**5.5 Maximum allowed Antenna Gain – Gmax**

- Not applicable since fixed internal antennae are used in the product.

## 6 Revision History

| Date             | Report Name                 | Changes to report                | Report prepared by |
|------------------|-----------------------------|----------------------------------|--------------------|
| January 22, 2016 | EMC_MOOGI-005-15001_FCC_MPE | First Draft                      | Yu-Chien Ho        |
| February 3, 2016 | EMC_MOOGI-005-15001_FCC_MPE | revised to have IC rules covered | Yu-Chien Ho        |