



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



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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 (Compliance Manager)	
Date	Section	Name	Signature

Responsible for the Report:

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

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
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Compliance Manager:	Franz Engert
Project Engineer:	Yu-Chien Ho

2.2 Identification of the Client / Manufacturer

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

3 Equipment under Assessment

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

$P = \text{power input to the antenna (mW or W)}$

$G = \text{power gain of the antenna in the direction of interest relative to an isotropic radiator}$

$R = \text{distance to the center of radiation of the antenna (cm or m)}$

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)
GRPS 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
GRPS 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 ²)	FCC/IC Limit (mW/cm ²)	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