



RF Exposure Evaluation Report

FOR:

Model Name: 1E60326G07

FCC ID: Q371E60326REB
IC ID: 4638A-1E60326REB

References:

1. FCC OET Bulletin 65 Supplement C
2. FCC CFR Part 2
3. RSS-102- Radio Frequency Exposure Compliance of Radiocommunication Apparatus
Issue 4 March 2010

1 Administrative Data**1.1 Identification of the Testing Laboratory Issuing the Test Report**

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Department:	Compliance
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Test Lab Director:	Heiko Strehlow
Responsible Project Leader:	David Lang

1.2 Identification of the Client

Applicant's Name:	Thermo King Corp. Ingersoll
Street Address:	314 W 90th Street
City/Zip Code	Minneapolis, MN 55420
Country	USA
Contact Person:	Sofronio Eduardo Tan
Phone No.	952-887-3105
Fax:	---
e-mail:	eduardo_tan@irco.com

1.3 Identification of the Manufacturer

Manufacturer's Name:	Same as above
Manufacturers Address:	
City/Zip Code	
Country	

2 Equipment under Test (EUT)

2.1 Specification of the Equipment under Test

Marketing Name:	1E60326G07
Model No:	REB
HW Revision:	Rev F
SW Revision:	A010
FCC-ID:	Q371E60326REB
IC-ID:	4638A-1E60326REB
Product Description:	The REB (Radio Expansion Board) is a wireless communication platform that offers fleet owners the ability to monitor their refrigerated units. Cellular and GPS capabilities communicate with a web-based application.
Frequency Range :	GSM 850: 824.2-848.8MHz; /125 PCS 1900: 1850.2-1909.8MHz / 300 WiFi: WiFi: 2412-2462MHz / 11
Type(s) of Modulation:	Cellular & PCS: GMSK, 8PSK, QPSK WiFi: CCK, OFDM
Antenna Type and Gain:	<u>Multi Band Antenna Z3400:</u> Antenna Gain @ 850 MHz = 5.2dBi (measured ERP + 2,14dB – measured Conducted Output Power) Antenna Gain @ 1900 MHz = -0.19dBi Antenna Gain 2.3-2.6GHz with cable = 1dB (value taken from antenna specifications)
Co-located Transmitters/ Antennas?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Power supply:	12 VDC (Battery powered – 925- CCA wet cell)
Operating temperature range:	-40°C to +85°C
Prototype / Production unit:	Prototype
Device Category:	<input type="checkbox"/> Fixed Installation <input checked="" type="checkbox"/> Mobile <input type="checkbox"/> Portable
Exposure Category:	<input type="checkbox"/> Occupational/ Controlled <input checked="" type="checkbox"/> General Population/ Uncontrolled

3 Assessment

This report serves as the Technical Information regarding RF Exposure evaluation against the requirements in 47 CFR 2.1091 and as the RF Exposure Technical Brief according to RSS-102 Ch. 2.2.

The following device has been evaluated and meets/is exempt from the RF Exposure Limits defined in 47 CFR 1.310 and RSS-102 Issue 4 Ch. 4.

Company	Description	Model #
Thermo King Corp. Ingersoll	Radio Expansion Board "REB" Telematics board for transport refrigeration	1E60326G07

2012-04-11

Compliance

David Lang

Date	Section	Name	Signature
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4 RF Exposure Evaluation Requirements

4.1 FCC:

Calculations can be made to predict RF field strength and power density levels around typical RF sources using the general equations (3) and (4) on page 19 of the following FCC document: "OET Bulletin 65, Edition 97-01 - Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields".

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure:

Frequency Range (MHz)	Power density (mW/cm ²)	Averaging time (minutes)
300 – 1500	f (MHz) /1500	30
1500 – 100.000	1.0	30

Using the equation from page 19 of OET Bulletin 65, Edition 97-01:

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

where: S = power density (in appropriate units, e.g. mW/cm²)

P = power input to the antenna (in appropriate units, e.g., mW)

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 (appropriate units, e.g., cm)

Note:

1. This device is to be used only for fixed and mobile applications.
2. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all the persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Additionally, according to § 2.1091:

The limit for <1.5 GHz mobile operations where no routine evaluation is required is: 1.5W ERP

The limit for >1.5 GHz mobile operations where no routine evaluation is required is: 3W ERP

4.2 IC:

RSS-102 Section 2.5.2

RF exposure evaluation is required if the separation distance between the user and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 1.5 GHz and the maximum EIRP of the device is equal to or less than 2.5 W;
- at or above 1.5 GHz and the maximum EIRP of the device is equal to or less than 5 W.

RSS-102 4.2: RF Field strength limits for devices used by the General Public (Uncontrolled Environment):

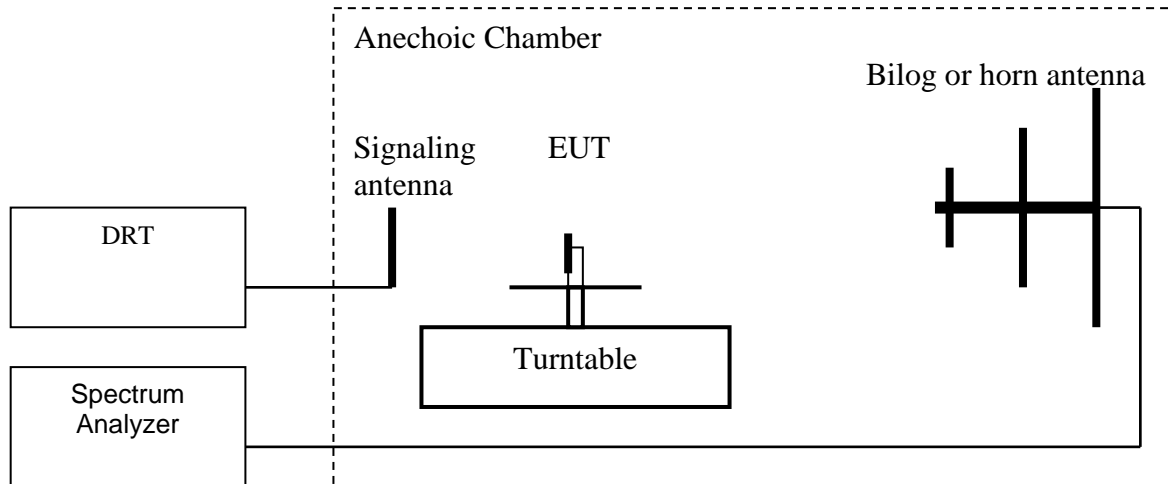
Power density

300MHz- 1500 MHz= f/150 W/m²

1500 MHz- 1500000 MHz= 10 W/m²

5 Measurement procedure:

5.1 Radiated power measurement- ERP/EIRP-

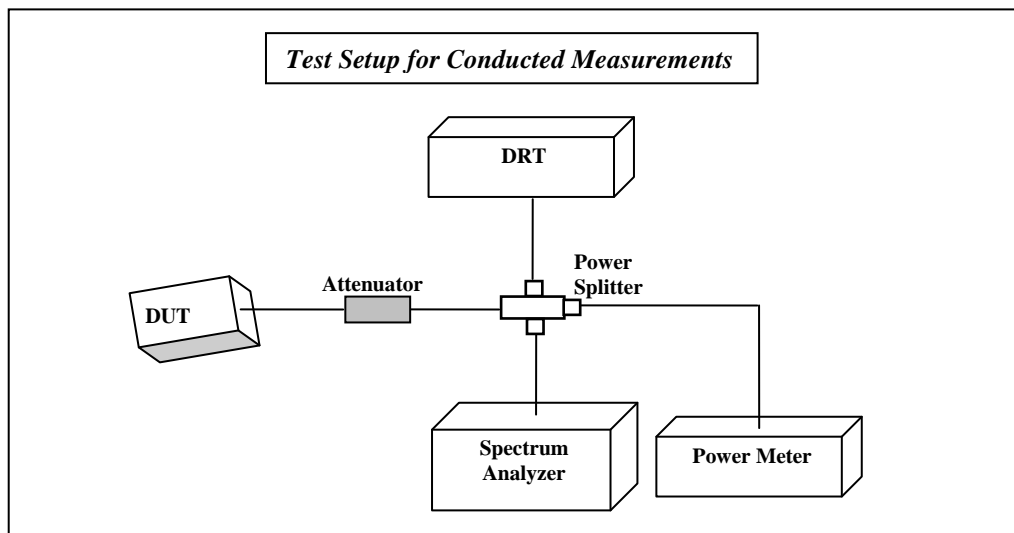


1. Connect the equipment as shown in the above diagram with the EUT's antenna in center of the turn table.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to set the EUT to its maximum power at the required channel.
3. Set the spectrum analyzer to the channel frequency. Set the analyzer to measure peak hold with the required settings.
4. Rotate the EUT 360°. Record the peak level in dBm (**LVL**).
5. Replace the EUT with a vertically polarized half wave dipole or known gain antenna. The center of the antenna should be at the same location as the center of the EUT's antenna.
6. Connect the antenna to a signal generator with known output power and record the path loss in dB (**LOSS**). **LOSS** = Generator Output Power (dBm) – Analyzer reading (dBm).
7. Determine the ERP using the following equation:
ERP (dBm) = LVL (dBm) + LOSS (dB)
8. Determine the EIRP using the following equation:
EIRP (dBm) = ERP (dBm) + 2.14 (dB)
9. Measurements are to be performed with the EUT set to the low, middle and high channel of each frequency band.

Measurement uncertainty: +/-3.0 dB

(**Note:** Steps 5 and 6 above are performed prior to testing and **LOSS** is recorded by test software. Steps 3, 4, 7 and 8 above are performed with test software.)

5.2 Radiated power Calculation- ERP/EIRP-



1. Connect the equipment as shown in the above diagram.
2. Adjust the settings of the Digital Radio Communication Tester (DRT) to connect the EUT at the required channel (OR) alternatively use the EUT to set to transmit at a specific mode.
3. Measure conducted power using the power meter or the Spectrum Analyzer.
4. ERP/EIRP is calculated by adding the antenna gain to the measured conducted power.

EIRP= Measured conducted power+ Antenna Gain (dBi)

(Antenna gain based on measurement or data from the antenna manufacturer.)

ERP= EIRP- 2.14

5.3 Measurement Equipment information:

Instrument/Ancillary	Model	Manufacturer	Serial No.	Cal Date	Cal Interval
Radio Communication Tester	CMU 200	Rohde & Schwarz	101821	May 2011	2 Years
EMI Receiver/Analyzer	ESIB 40	Rohde & Schwarz	100107	May 2011	2 Years
Spectrum Analyzer	FSU	Rohde & Schwarz	200302	May 2011	2 Years
Horn Antenna (1-18GHz)	3115	ETS	00035114	Apr 2012	3 years
Horn Antenna (1-18GHz)	3115	ETS	00035111	Apr 2012	3 years
Horn Antenna (18-40GHz)	3116	ETS	00070497	Aug 2011	3 years
Communication Antenna	IBP5-900/1940	Kathrein	n/a	n/a	n/a
High Pass Filter	5HC2700	Trilithic Inc.	9926013	Part of system calibration	
High Pass Filter	4HC1600	Trilithic Inc.	9922307	Part of system calibration	
Pre-Amplifier	JS4-00102600	Miteq	00616	Part of system calibration	
Power Smart Sensor	R&S	NRP-Z81	100161	May 2011	2 Years

5.4 Measurement Summary:

Band of operation	Peak Radiated Power- EIRP		Limits (IC)	Peak Radiated Power ERP		Limits (FCC)
	MHz	dBm	mW	W	dBm	mW
824.2-848.8	33.22	2099	2.5	31.08	1282	1.5
1850.2-1909.8	29.78	950.1	5	27.64	580	3
2412-2462	24.5	281.9	5	22.36	172.1	3

Since the Peak ERP/EIRP is within limits, this device is exempt from Routine evaluation.

Prediction for Simultaneous Transmission:

Not Applicable because WiFi and GSM radio will not transmit simultaneously