



RF Exposure Evaluation Report

FOR:

Sierra Innotek, Inc.

Brand:

Sierra Innotek, Inc.

Marketing Name:

Cell-CAT

Model:

Cell-CAT

Product Description:

Tracking beacon for law enforcement and VHF alarm transmitter

FCC ID: 2AIQACCT

Per:

CFR Part Part1 (1.1307 & 1.1310), Part 2 (2.1091),
FCC KDB 447498 D01 General RF Exposure Guidance v06

Report number: EMC_INNOT_003_23001_FCC_RF_Exposure

DATE: 9/7/2023



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1 Assessment

This RF Exposure evaluation report provides evidence for compliance of the equipment (as identified in section 3 of this test report) with the RF Exposure limits for mobile devices as defined in FCC CFR Part 1.1307, 1.1310, and Part 2 (2.1091) under worst case conditions (measured or rated RF output power including tune-up tolerance, antenna gain, the distance towards the 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 stipulated by the above given FCC rule parts based on available specifications for worst-case conditions at a separation distance greater than 20cm to the body.

Company	Description	Model
Sierra Innotek, Inc.	Tracking beacon for law enforcement and VHF alarm transmitter	Cell-CAT

Responsible for Testing Laboratory:

9/7/2023	Compliance	Stoecker, Arndt (Director of Regulatory Services)	
Date	Section	Name	Signature

Responsible for the Report:

9/7/2023	Compliance	Lui, Chin Ming (Associate Test Engineer)	
Date	Section	Name	Signature

2 Administrative Data

2.1 Identification of the Testing Laboratory Issuing the Test Report

Company Name:	CETECOM Inc.
Department:	Compliance
Street Address:	411 Dixon Landing Road
City/Zip Code	Milpitas, CA 95035
Country	USA
Telephone:	+1 (408) 586 6200
Fax:	+1 (408) 586 6299
EMC Lab Manager:	Stoecker, Arndt
Responsible Project Leader:	Saman, Rami

2.2 Identification of the Client / Manufacturer

Applicant's Name:	Sierra Innotek, Inc.
Street Address:	3013 Alhambra Drive
City/Zip Code	Cameron Park, CA 95682
Country	USA

2.3 Identification of the Manufacturer

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

3 Equipment under Assessment

Brand:	Sierra Innotek, Inc.
Model:	Cell-CAT
Marketing name:	Cell-CAT
FCC-ID :	2AIQACCT
HW Version :	1
SW Version :	6
Product Description:	Tracking beacon for law enforcement and VHF alarm transmitter
Frequency Range/number of channels:	<ul style="list-style-type: none"> ❖ Cellular: <ul style="list-style-type: none"> ○ LTE Cat-M1 Band 2: 1850 – 1910 MHz ○ LTE Cat-M1 Band 4: 1710 – 1755 MHz ○ LTE Cat-M1 Band 12: 699 – 716 MHz ❖ BT LE: <ul style="list-style-type: none"> ○ Nominal band: 2400 MHz – 2483.5 MHz ○ Center to center: 2402 MHz (ch 0) – 2480 MHz (ch 39), 40 Channels ❖ VHF: <ul style="list-style-type: none"> ○ NBFM: 136 MHz – 173.39 MHz ○ NBFM: 216.0125 – 216.9875 MHz / 40 standard band channels / 20 extra band channels
Radio information:	<ul style="list-style-type: none"> ❖ Cellular: Telit ME310G1-WW ❖ Bluetooth LE – Proprietary ❖ VHF – Proprietary
Max. Output Power:	<ul style="list-style-type: none"> ❖ Cellular <ul style="list-style-type: none"> ○ LTE Cat-M1 Bands 2, 4, 12: 23 dBm ± 2dB Power class 3 ❖ BT LE (Measured): -6.68 dBm ❖ VHF (Measured): <ul style="list-style-type: none"> ○ 136 MHz – 173.39 MHz: 20.07 dBm ○ 216.0125 – 216.9875 MHz: 17.58 dBm
Power Supply/ Rated Operating Voltage Range:	3.7 V DC
Operating Temperature Range:	T min: 0 °C / T Nom: 25 °C / T max: 60 °C
Antenna Information as declared:	<ul style="list-style-type: none"> ❖ Cellular <ul style="list-style-type: none"> ○ Type: SMD Dielectric Antenna ○ Tx/Rx ○ Max Gain <ul style="list-style-type: none"> ▪ 698 – 746 MHz: -4.8 dBi ▪ 1710 – 2690 MHz: 3.2 dBi ❖ BT LE <ul style="list-style-type: none"> ○ Type: Low Profile Mini Chip Antenna ○ Tx/Rx ○ Max Gain <ul style="list-style-type: none"> ▪ 2.4 – 2.48 GHz: -2.0 dBi ❖ VHF <ul style="list-style-type: none"> ○ Type: Wire ○ Tx/Rx ○ Max Gain <ul style="list-style-type: none"> ▪ 136 – 173.39 MHz: 2.15 dBi ▪ 216.0125 – 216.9875 MHz: 2.15 dBi
Sample Revision:	<input checked="" type="checkbox"/> Production Unit; <input type="checkbox"/> Pre-Production
Product dimensions [mm]:	90mm long x 60mm wide x 6mm thick
Note: The information of the EUT specifications in the table above is provided by the client except the specified (Measured or calculated) output power.	

4 RF Exposure Limits and FCC Basic Rules

4.1 § 2.1091(c)(1)

Evaluation of compliance with the exposure limits in § 1.1310 of this chapter, and preparation of an EA if the limits are exceeded, is necessary for mobile devices with single RF sources having either more than an available maximum time-averaged power of 1 mW or more than the ERP listed in Table 1 to § 1.1307(b)(3)(i)(C), whichever is greater. For mobile devices not exempt by § 1.1307(b)(3)(i)(C) at distances from 20 centimeters to 40 centimeters and frequencies from 0.3 GHz to 6 GHz, evaluation of compliance with the exposure limits in § 1.1310 of this chapter is necessary if the ERP of the device is greater than $ERP_{20\text{cm}}$ in the formula below. If the ERP of a single RF source at distances from 20 centimeters to 40 centimeters and frequencies from 0.3 GHz to 6 GHz is not easily obtained, then the available maximum time-averaged power may be used (i.e., without consideration of ERP) in comparison with the following formula only if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

4.2 § 2.1091(c)(2)

For multiple mobile or portable RF sources within a device operating in the same time averaging period, routine environmental evaluation is required if the formula in § 1.1307(b)(3)(ii)(B) of this chapter is applied to determine the exemption ratio and the result is greater than 1.

4.3 § 1.1307(b)(3)(i)

For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz};$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

d = the separation distance (cm);

(C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to § 1.1307(b)(3)(i)(C)—Single RF Sources Subject to Routine Environmental Evaluation

RF Source frequency (MHz)	Threshold ERP (watts)
0.3–1.34	$1,920 R^2$.
1.34–30	$3,450 R^2/f^2$.
30–300	$3.83 R^2$.
300–1,500	$0.0128 R^2f$.
1,500–100,000	$19.2R^2$.

4.4 § 1.1307(b)(3)(ii)

For multiple RF sources: Multiple RF sources are exempt if:

(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^a \frac{P_i}{P_{th,i}} + \sum_{j=1}^b \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^c \frac{Evaluated_k}{Exposure Limit_k} \leq 1$$

4.5 Maximum Permissible Exposure (MPE)

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)

Table 1 to [§ 1.1310\(e\)\(1\)](#)—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)
(i) 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
(ii) 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

5 Evaluations

5.1 Single RF Sources Subject to Routine Environmental Evaluation

Radio	Technology / Band	Frequency [GHz]	Power [mW]	Gain [dBi]	ERP [mW]	FCC 2.1091(c)(1) Pth[mW] = ERP _{20cm}	ERP<Threshold
Cellular	LTE Cat-M1 Band 2	1850.0	316.0	3.2	402.72	3060.00	Exempt
	LTE Cat-M1 Band 4	1710.0	316.0	3.2	402.72	3060.00	Exempt
	LTE Cat-M1 Band 12	699.0	316.0	-4.8	63.83	1425.96	Exempt
BT	LE	2400.0	0.2	-2.0	0.08	3060.00	Exempt

Note: Maximum Output Power for LTE Bands leveraged from TÜV Rheinland Test Report No.: 60356613 014 (FCC ID: R17ME310GWW)

The VHF radio frequencies 136 – 173.39 MHz and 216.0125 – 216.9875 MHz fall outside the 0.3 GHz – 6 GHz frequency range, thus P_{th} (mW) = ERP_{20cm} threshold according to §2.1091(c)(1) and §1.1307(b)(3)(i)(B) cannot be applied. In addition, the minimum separation distance (R) of 0.20 meters does not meet at least $\lambda / 2\pi$ as stated in §1.1307(b)(3)(i)(C), thus the exemption in Table 1 to §1.1307(b)(3)(i)(C) cannot be applied.

6.2 Maximum Permissible Exposure (MPE) Evaluation

Radio	Technology / Band	Frequency [MHz]	Max Conducted power [W]	Gain [dBi]	Gain [lin]	EIRP [W]	Power Density Limit [mW/cm ²]	Actual [mW/cm ²] ^{Note}	How much of limit is used up
VHF	NBFM	136	0.1016	2.15	1.64	0.167	0.2	0.0332	16.60%
		216.0125	0.05728	2.15	1.64	0.094	0.2	0.0187	9.35%

Note: The calculation is based on the distance of 20cm

6.3 Multiple RF sources

The EUT's VHF transmitter, cellular transceiver, and 2.4 GHz BTLE link are never active at the same time as stated in the operational description. Therefore, no simultaneous transmission is possible.

7 Revision History

Date	Report Name	Changes to report	Prepared by
9/7/2023	EMC_INNOT_003_23001_FCC_ISED_RF_Exposure	Initial Version	Lui, Chin Ming

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