Radio Frequency Exposure Evaluation Report

For:
Appareo Systems, LLC

Model Name:
Galeo

Product Description:
Small tracking tag that communicates with a mobile application over BLE or cellular. The DUT acquires GPS location and reports its location back to the user.

FCC ID: 2AETC-GALEO

Applied Rules and Standards:
CFR 47 Part 2.1093
FCC KDB 447498 D01 General RF Exposure Guidance v06

Test Report #: SAR_EX_APPAR-003-20501_FCC

DATE: 10/12/2020

A2LA Accredited

IC recognized # 3462B-1

***CETECOM* Inc.**
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Contents

1 Assessment

The following device meets the limits of general population uncontrolled exposure specified in CFR 47 Part 2.1093 according to SAR evaluation exclusion requirements specified in FCC regulation as listed in KDB 447498.

Responsible for Testing Laboratory:

Date	Section	Name	Signature
10/12/2020	Compliance	Cindy Li (Lab Manager)	Cindy Li Digitally signed by cindy.li@cetecom.com DN: CN=cindy.li@cetecom.com Reason: I have reviewed this document Location: Date: 2020-10-15 11:58:57

Responsible for the Report:

Date	Section	Name	Signature
10/12/2020	Compliance	Kris Lazarov (EMC Engineer)	Kris Lazarov Digitally signed by Kris Lazarov Date: 2020.10.15 11:18:14 -07'00'

The test results of this test report relate exclusively to the test item specified in Section3.
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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
Compliance Manager:	Li, Cindy
Responsible Project Manager:	Akanksha Baskaran

2.2 Identification of the Client

Applicant's Name:	Appareo Systems, LLC
Street Address:	1810 NDSU Research Cir. N.
City/Zip Code	Fargo, ND 58102
Country	USA

2.3 Identification of the Manufacturer

Applicant's Name:	----Same as Client ----------
Street Address:	----Same as Client ----------
City/Zip Code	----Same as Client ----------
Country	----Same as Client ----------

3 Equipment under Assessment

Model #:	Galeo
FCC ID:	2AETC-GALEO
HW Version :	X07
SW Version :	0.4.0.373
HVIN:	N/A
PMN:	N/A
Product Description:	Small tracking tag that communicates with a mobile application over BLE or cellular. The DUT acquires GPS location and reports its location back to the user.
Minimum distance of antenna or radiating parts to user	5mm
Radios included in the device:	• nRF9160 with CAT M1, LTE Bands 4,13 Enabled ○ FCC ID: 2ANPO00NRF9160 • nRF52832 with BTLE ○ 12dBm peak conducted measurement
Co-located Transmitters/ Antennas:	☐ No ■ Yes
Exposure Category:	☐ Occupational/ Controlled ■ General Population/ Uncontrolled
Device Category:	■ Fixed Installation ☐ Mobile ■ Portable ☐ Mixed Mobile and Portable
Power Supply/ Rated Operating Voltage Range:	Vmin: 4.75 VDC / Vnom: 5.0 VDC / Vmax: 5.25 VDC
Operating Temperature Range:	20ºC to 60 ºC
Sample Revision:	☐Prototype Unit; ☐Production Unit; ■Pre-Production
EUT Dimensions [mm]:	74*53*20
EUT Diameter:	■ < 60 cm ☐ Other _____

4 FCC Exemption Limits for Routine Evaluation

4.1 FCC SAR test exclusions are set by KDB 447498 D01 General RF Exposure Guidance v06

4.1.1 KDB 447498 Section: 4.3.1. Standalone SAR test exclusion considerations

a) For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)]
≤ 3.0 for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR, where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- The values 3.0 and 7.5 are referred to as *numeric thresholds* in step b) below

The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

b) For 100 MHz to 6 GHz and *test separation distances* > 50 mm, the 1-g and 10-g *SAR test exclusion thresholds* are determined by the following (also illustrated in Appendix B):[32]

1) {[Power allowed at *numeric threshold* for 50 mm in step a)] + [(test separation distance – 50 mm)·(f(MHz)/150)]} mW, for 100 MHz to 1500 MHz
2) 2) {[Power allowed at numeric threshold for 50 mm in step a)] + [(test separation distance – 50 mm)·10]} mW, for > 1500 MHz and ≤ 6 GHz

c) For frequencies below 100 MHz, the following may be considered for SAR test exclusion (also illustrated in Appendix C):

1) For *test separation distances* > 50 mm and < 200 mm, the power threshold at the corresponding test separation distance at 100 MHz in step b) is multiplied by [1 + log(100/f(MHz))]
2) For *test separation distances* ≤ 50 mm, the power threshold determined by the equation in c) 1) for 50 mm and 100 MHz is multiplied by ½

5 SAR Exclusion Evaluation

5.1 Standalone

FCC Standalone Transmission SAR Exclusion Calculations ≤ 5 mm							
Radio	**Frequency [GHz]**	**Max Conducted plus tune up [dBm]**	**Applying DC Correction [dBm]**	**Power to Antenna [mW]**	**Min.Distance [mm]**	**4.3.1 a ***	**10-g**
LTE 4	1.755	24	9.19	8.29	5	2.20	<=7.5
LTE 13	0.787	24	9.19	8.29	5	1.47	<=7.5
BLE	2.48	12	7.47	5.58	5	1.76	<=7.5

* Formula used for threshold calculation described in section 4.3.1 a) for cellular radio / BTLE

The Duty Cycle of 3.3% for LTE and 35.2% for BLE is as described in the KDB Inquiry for this device is used. The way the device is to be used also allows for Extremity limits.

5.2 Co Transmission

FCC Co Transmission SAR Exclusion Calculations ≤ 5 mm							
Radio	**Frequency [GHz]**	**Max Conducted plus tune up [dBm]**	**Applying DC Correction [dBm]**	**Power to Antenna [mW]**	**Min.Distance [mm]**	**4.3.1 a ***	**10-g**
LTE 4	1.755	24	9.19	8.29	5	2.20	<=7.5
BLE	2.48	12	7.47	5.58	5	1.76	<=7.5
CO TX	-	-	-	-	-	3.95	<=7.5

Using the worst case transmission from Cellular and BTLE the device meets the SAR exclusion requirements limits for co transmission for Extremity Limits.

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6 Revision History

Date	Report Name	Changes to report	Report prepared by
8/14/2020	SAR_EX_APPAR-003-20501_FCC	Draft Version	Kris Lazarov
10/12/2020	SAR_EX_APPAR-003-20501_FCC	Initial Version. Updated verbiage Section 5. Used max power per Op description. Removed Draft Watermark.	Kris Lazarov

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