RF Exposure Evaluation Report

Date of Report	16/08/2019	**Client's Contact person:**	Ari Korva
Number of pages:	6	**Responsible Test engineer:**	Kirsi Kyllönen
Testing laboratory:	**Verkotan Oy** Elektroniikkatie 17 90590 Oulu Finland	**Client:**	**Haltian Oy** Yrttipellontie 1D 90230 Oulu, Finland
Tested device	**Automile Mini Tracker**		
Related reports:			
Testing has been carried out in accordance with:	**KDB procedures KDB 447498 D01** General RF Exposure Guidance v06		
Documentation:	The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory		
Test Results:	**The EUT complies with the requirements in respect of all parameters subject to the test.** The test results relate only to devices specified in this document		
Date and signatures:	16.08.2019		

Miia Nurkkala

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Laboratory Manager

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1. EVALUATION SUMMARY

1.1 Equipment under Evaluation:

Product:	Automile Mini Tracker
Manufacturer:	Automile
Model:	Mini Tracker
FCC ID Number:	2AUAJATMV1 Contains FCC ID: XPY1DIQN3NN
Hardware Version:	B1
Mobile/Portable device	Mobile
Controlled/ Uncontrolled Environment	Uncontrolled
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1.1 Evaluation Result

1.1.1 Standalone exposure

Calculated power densities are reported below. The device conforms the radiofrequency radiation exposure limits of 47CFR §1.1310 when the calculated power density value is less than or equal to the limit.

Modes of Operation	Power Density, S [mW/cm2]	Power Density Limit [mW/cm2]	Evaluation Result
LTE 2	0.06	1.0	**Pass**
LTE 4	0.05	1.0	**Pass**
LTE 12	0.01	0.47	**Pass**
BLE	0.001	1	**Pass**

1.1.2 Simultaneous transmission exposure

The compatibility in case of simultaneous cellular and BLE transmission was evaluated based on equation $\sum (S_f / L_f) \leq 1$, where: S_f is power density at a specific frequency and L_f is the power density limit for the frequence. The maximum cellular power density was used in the calculation.

(0.06/1) + (0.001/1) = 0.061 <1 Thus the evaluation result is **Pass**

2. DESCRIPTION OF THE EQUIPMENT UNDER EVALUATION

The DUT is a tracker that can be used to track the position of the equipment such as cars, trucks, trailers, motorcycles, equipment, earth movers, boats, ATVs, snowmobiles.

Generally, it is used in such a way that a separation distance of at least 20 centimeters is maintained between the transmitter and the body of the user or nearby persons.

2.1 Supported Frequency Bands and Operational Modes

TX Frequency bands	Modes of Operation	Transmitter Frequency Range
	LTE 2	1850.7 - 1909.3
	LTE 4	1710.7 - 1754.3
	LTE 12	699-716
	BLE	2400-2483.5

BLE and cellular modules can transmit simultaneously.

3. GENERAL CONSIDERATIONS

For devices that operate at larger distances from persons, where there are minimal RF coupling interactions between a device and the user or nearby persons, the more complex SAR evaluation can be avoided by evaluating RF exposure compliance using MPE (Maximum Permissible Exposure) limits. When these limits are used, a minimum separation distance of ≥ 20 cm is required between the antenna and radiating structures of the device and nearby persons. The limits are presented in table below.

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm 2)	Averaging time (minutes)
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**
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**

f = frequency in MHz
*** = Plane-wave equivalent power densi**

Occupational/controlled exposure limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when a person is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

General population/uncontrolled exposure limits apply in situations in which the general public may be exposed, or in which persons who are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Power Density is calculated by equation:

$$S = \frac{P \cdot G}{4 \cdot \pi \cdot R^2}$$

Where,
S = Power Density
P = Power Input to Antenna
G = Gain of Antenna
R = Distance from transmitting Antenna

4. POWER DENSITY CALCULATIONS

Modes of Operation	Frequency [MHz]	Distance, R [cm]	Maximum power input to Antenna, P [dBm]	Power Input to Antenna, P [mW]	Power Gain of Antenna, G [dBi]	Power Density, S [mW/cm^2]	Limit [mW/cm^2]
LTE 2	1850.7 - 1909.3	20	23	200	1.8	0.06	1.00
LTE 4	1710.7 - 1754.3	20	23	200	1.4	0.05	1.00
LTE 12	699-716	20	23	200	-5.5	0.01	0.47
BLE	2400-2483.5	20	4	2.5	3.5	0.001	1

Based on power density calculations at distance of 20cm, the power density of the equipment under evaluation is below the MPE limit.

Simultaneous transmission can be evaluated based on equation $\sum (S_f / L_f) \leq 1$, where: S_f is power density at a specific frequency and L_f is the power density limit for the frequence.

Maximum cellular power density is used in the calculation with BLE power density:

$$(0.06/1) + (0.001/1) = 0.061 < 1$$

== End of the report==