TÜVRheinland®

LAB N° 1356 L

Test Report No.:	**DE21CTNH 001 Annex 2**	**Order No.:**	7974615	*Page 1 of 11*
Order date:	01-03-2021			
Client:	ABAX AS – Hammergata 20, 3264 Larvik, Norway			
Test item:	BLE tracker			
Identification / Type No.:	**MINI2**			
FCC ID:	**2A2EO-MINI2**			
Trademark:	ABAX			
Order content:	RF exposure evaluation according to the following standard:			
Test specification:	**47 CFR § 1.1310**			
Date of receipt:	22-04-2021			
Test sample No.:	Storage no.: A003039511-001 to 003			
Testing period:	08-06-2021 ÷ 15-06-2021			
Place of testing:	TÜV Rheinland Italia S.r.l. Via E. Mattei, 3 20005 Pogliano Milanese (MI) - IT			
Testing laboratory:	TÜV Rheinland Italia S.r.l. Via E. Mattei,3 20005 Pogliano Milanese (MI) - IT			
Test result:	*Pass*			
Tested by:	Roberto Radice	**Authorized by:**	Giovanni Molteni	
Date: 30-06-2021	(Laboratory technician)	**Date:** 30-06-2021	*(Laboratory manager)*	
Position	Expert	**Position**	Expert	
Other:	---			
Condition of the test item at delivery:	*Test item complete and undamaged*			

RF EXPOSURE EVALUATION

1	*Description*	BLE tracker
2	*Model name*	**MINI2**
3	*Serial number*	Not present
4	*Manufacturer*	Norautron - Nedre vei 8, 3183 Horten, Norway
5	*Trademark*	ABAX
6	*Power supply*	Coin Cell Battery 3V 220mAH
7	*Rated voltage*	3V
8	*Rated frequency*	D.C.
9	*Rated current*	220mAH
10	*Maximum power consumption*	----
11	*Modulation type*	☐ Frequency hopping (FHSS) equipment ☒ Wideband data transmission (non-FHSS equipment) ☐ Direct Sequence Spread Spectrum (DSSS equipment) ☐ Others:
12	*Hardware version*	Mini 2 rev. 2
13	*Software version*	1.0.0
14	*Dimensions*	19x43x6.5 mm
15	*Weight*	25g
16	*Test sample obtaining*	☐ Sampling by customer ☒ Sampling by TÜV Rheinland Group ☐ others:

17	*Applied basic standards*

Reference document	
47 CFR § 1.1310	Radiofrequency radiation exposure limits
47 CFR 2.1093	Radiofrequency radiation exposure evaluation: portable devices
47 CFR § 2.1091	Radiofrequency radiation exposure evaluation: mobile devices
447498 D01 General RF Exposure Guidance v06	RF exposure procedures and equipment authorization policies for mobile and portable devices

RF EXPOSURE EVALUATION

18 *Used radio technologies and frequencies*

Radio Type	☒ Transreceiver ☐ Receiver only
Radio technology	☐ Short – Range Device ☐ WiFi ☒ Bluetooth Low Energy ☐ GPS / GNSS ☐ GSM/ GPRS (2G) ☐ UTRA (UMTS, 3G) ☐ E-UTRA (LTE, 4G) ☐ Other: ZigBee
Equipment type	☒ Without audio speech (data only) ☐ With audio speech
Antenna type	☐ External (dedicated antenna) ☒ Intergrated antenna
Short –Range Band / Frequency	---
WiFi Channel / Frequency	---
Bluetooth Channel / Frequency	2400 – 2483.5MHz Frequency Band 2402 – 2480 MHz Frequency Range
GPS / GNSS Band / Frequency	---
GSM Bands / Frequency	---
Utra Bands / Frequency	---
E-Utra Bands / Frequency	---
Other Bands / Frequency	---

19	*Radio module identification (technical data of the Bluetooth low energy)*	
	Module manufacturer	Nordic Semiconductor
	Module type	System-on-Chip (SoC) model nRF52820
	Frequency Band	2402 – 2480MHz
	Number of channel	40
	Channel bandwith	1MHz
	Channel Separation	2MHz
	Modulation	GFSK
	Antenna	Antegrated Antenna
	Antenna Gain	-0.9 dBi

RF EXPOSURE EVALUATION

20 *Operating modes*

No.	***Description***
1	Continuous BLE Modulation RF Transmission (duty cycle >98%), at Low channel (frequency: 2402MHz) at 1Mb/s
2	Continuous BLE Modulation RF Transmission (duty cycle >98%), at Middle channel (frequency: 2440MHz) at 1Mb/s
3	Continuous BLE Modulation RF Transmission (duty cycle >98%), at High channel (frequency: 2480MHz) at 1Mb/s

For details see the corresponding protocol

21 *Channel list Bluetooth Low Energy*

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	**2402**	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	**19**	**2440**	29	2460	**39**	**2480**

For details see the corresponding protocol

22	***Change history***

Test report number	**List of revisions**	**Date**
DE21CTNH 001 Annex 2	First edition	30-06-2021

RF EXPOSURE EVALUATION

SAR EVALUATION

Test date	17-06-2021
Applied Standard	47 CFR 2.1093
EUT classification (fixed, mobile or portable devices)	☐ Fixed: device physically secured at one fixed location and cannot be easily re-located. ☐ Mobile: transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons (47 cfr 2.1091) ☒ Portable: transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user (47 cfr 2.1093)
Temperature	22° C
Humidity	42%
Air pressure	1027 mbar
Tested by	Roberto Radice
Model	MINI2
Test sample No.	N°3 Sample tested (1 for each frequency)
Operating mode	1, 2, 3
Tested terminals	Enclosure
Result	PASS

FCC SAR limits

Region	Occupational SAR values (W/Kg)	General public SAR values (W/Kg)
Whole body SAR averaging mass = entire body	0,4	0,08
Partial body SAR averaging mass = 1g	8,0	1,6
Hands, wrists, feet and akles SAR averaging mass = 10g	20	4

FCC SAR test exclusion

General SAR test exclusion guidance according to KDB 447498 (Par. 4.3)

Standalone SAR test exclusion considerations:

Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition(s), listed below, is (are) satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.The minimum test separation distance defined in 4.1 f) is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander. To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified, typically in the SAR measurement or SAR analysis report, by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, according to the required published RF exposure KDB procedures. When no other RF exposure testing

or reporting are required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops and tablets, etc.

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) {[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

3) SAR measurement procedures are not established below 100 MHz.

When SAR test exclusion cannot be applied, a KDB inquiry is required to determine SAR evaluation requirements for any SAR test results below 100 MHz to be acceptable.

RF EXPOSURE EVALUATION

CH	Frequency	Max Conducted Output Power (P)		Antenna Gain	Transmission duty cycle	Minimum separation distance	Limit
	(MHz)	(dBm)	(mW)	numerical	(%)	(mm)	/
Low	2402	4.39	2.74	3.428	100	10	≤ 3.0 for 1-g SAR
Middle	2440	4.40	2.75	3.828	100	10	
High	2480	4.52	2.83	3.908	100	10	

FORMULA

FCC SAR test exlusion condition:

$$\frac{\text{Max. power of channel (mW)}}{\text{Min. test separation distance (mm)}} \times \sqrt{\text{frequency (GHz)}}$$

VERDICT

FCC SAR test exlusion condition:

$$\frac{2{,}74\ (\text{mW})}{10\ (\text{mm})} \times \sqrt{2{,}402\ (\text{GHz})} = 0{,}421 \quad (\leq 3.0) = \text{PASS}$$

$$\frac{2{,}75\ (\text{mW})}{10\ (\text{mm})} \times \sqrt{2{,}440\ (\text{GHz})} = 0{,}429 \quad (\leq 3.0) = \text{PASS}$$

$$\frac{2{,}83\ (\text{mW})}{10\ (\text{mm})} \times \sqrt{2{,}480\ (\text{GHz})} = 0{,}445 \quad (\leq 3.0) = \text{PASS}$$

---END OF TEST REPORT---