

RF-EXPOSURE REPORT FCC 47 CFR Part 2.1091 ISED RSS-102 Maximum permissible exposure	
Report Reference No	G0M-2508-3271-TFC091MP02-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	  DAkkS - Deutsche Akkreditierungsstelle D-PL-12092-01-00 DAkkS - Registration number : D-PL-12092-01-00 FCC Filed Test Laboratory, Reg.-No.: 96970
Applicant	Treon Oy
Address	Visiokatu 3 33720 Tampere FINLAND
Test Specification	According to FCC rules
Standard	FCC 47 CFR 2.1091
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	In-container Sensor
Model(s)	4221
Brand Name(s)	None
Hardware Version(s)	05
Software Version(s)	0.1.0.4
FCC-ID	2AR86-AS42
Test Result	PASSED

Possible test case verdicts:		
required by standard but not tested	N/T	
not required by standard	N/R	
test object does meet the requirement	P(PASS)	
test object does not meet the requirement	F(FAIL)	
Testing:		
Test Lab Temperature	20 °C - 30 °C	
Test Lab Humidity	25 % - 55 %	
Date of performance	2026-01-21	
Date of receipt of test item	See test sample identification table on page 7	
Report:		
Compiled by	Florian Voigt	
Tested by (+ signature) (Responsible for Test)	Florian Voigt	
Approved by (+ signature) (Test Lab Engineer)	Radwan Jaafar	
Date of Issue	2026-01-22	
Total number of pages	15	
General Remarks:		
The test results presented in this report relate only to the object tested. The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory. The above equipment has been tested by Eurofins Product Service GmbH, and found compliance with the requirements of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report. Compliance of electromagnetic emission from electronic and electrical equipment with the basic restrictions usually is determined by measurements and, in some cases, calculation of the exposure level. If the electrical power used by or radiated by the equipment is sufficiently low, the electromagnetic fields emitted will be incapable of producing exposures that exceed the basic restrictions. Any relevant compliance assessment procedure which is consistent with the state of the art, reproducible and gives valid results can be used.		

For transmitters intended for use with more than one antenna configuration option, the combination of transmitter and antenna(s) which generates the highest available antenna power and/or average total radiated power shall be assessed.

Additional Comments:

RF-Exposure calculation is based on measurement results from reference documents.

VERSION HISTORY

Version History			
Version	Issue Date	Remarks	Revised By
01	2026-01-22	Initial Release	--

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EIRP	Equivalent Isotropic Radiated Power
EUT	Equipment Under Test
MPE	Maximum Permissible Exposure

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1 Equipment (Test Item) Under Test

Description	In-container Sensor			
Model	4221			
Brand Name(s)	None			
Sample Identification	EUT #	Sample-ID	Serial Number	Date of receipt
	EUT 1	See reference documents	See reference documents	See reference documents
Hardware Version(s)	05			
Software Version(s)	0.1.0.4			
FCC ID	2AR86-AS42			
Equipment type	End Product			
Number of antennas	3			
Number of radios	2			
Radio 1	Type	Bluetooth LE SoC		
	Model	nRF52840		
	Manufacturer	Nordic Semiconductor		
	HW Version	Not specified		
	SW Version	Not specified		
Antenna 1 connected to Radio 1	Type	PCB Integrated Antenna		
	Model	Not specified		
	Manufacturer	Treon Oy		
	Gain	1.1 dBi (antenna test report)		
Radio Module 2	Type	Pulsed Coherent Radar module		
	Model	A121		
	Manufacturer	Acconeer AB		
	HW Version	1.0.0		
	SW Version	1.0.0		
	FCC-ID	2AQ6KA1201		
Antenna 2/3 connected to Radio 2	Type	Embedded Dipole Antenna Pair		
	Model	Dielectric lens LH113		
	Manufacturer	Acconeer AB		
	Gain	6 dBi (antenna gain) + 6.19 dB (lens gain) Antenna datasheet values		
Supply Voltage	V _{NOM}	3.6 V DC via internal Li-SOCl ₂ battery		
Dedicated AC/DC-Adaptor	None			
Environment	General public			

1.1 Reference Documents

Document Type	Document No.	Issued by	Date
Antenna test report	Treon_4221_BT_Rev1_antenna_under_test_report	Saku Lahti Oy	2025-08-24
RF test report	EUFI29-25002915-O5	Eurofins Electric & Electronics Finland Oy	2025-10-27
RF test report	1-5794/23-01-03	cetecom advanced GmbH	2023-08-02
Antenna Datasheet Report	A121 + Treon lens Antenna Datasheet v1.0	Acconeer AB	2026-01-20

1.2 Power density radiation sources

Mode	Operating Frequency [MHz]	Maximum conducted power [dBm]	Maximum radiated power [dBm EIRP]	Maximum duty cycle [%]	Tune-up tolerance [dB]	Maximum antenna gain [dBi]	Maximum antenna diameter [cm]
Bluetooth LE	2402	9.1	10.2	100	2.0	1.1	N/A
	2440	7.9	9	100	2.0	1.1	N/A
	2480	8.4	9.5	100	2.0	1.1	N/A
SRD Radar	57000	--	13.6	--	2.0	--	N/A
	64000	--	13.6	--	2.0	--	N/A

Comment: All conducted and radiated power values in this and all further tables are adjusted by given tune-up tolerance. The higher value of conducted and radiated power is chosen for evaluation.
EIRP value is the averaged radiated output power taken from module test report with 2 dB tune-up tolerance and is directly used for calculation.

1.3 Field strength radiation sources

None

1.4 Concurrent Sources

Concurrent operating conditions
Bluetooth LE + SRD Radar
Comment: --

2 Result Summary

FCC MPE Evaluation - Single radiation sources					
Product Standard Reference	Requirement	Reference Method	Mode	Distance [m]	Verdict
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	Bluetooth LE	0.20	PASS
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	SRD Radar	0.20	PASS
Comment: --					

FCC MPE Evaluation - Multi-transmitter sources					
Product Standard Reference	Requirement	Reference Method	Mode	Distance [m]	Verdict
47 CFR 2.1091	Maximum permissible exposure	FCC KDB 447498	Bluetooth LE + SRD Radar	0.20	PASS
Comment: --					

3 RF-Exposure classification

RF-Exposure Categories	
Fixed	A fixed device is defined as a device physically secured at one fixed location and cannot be easily re-located.
Mobile	A mobile device is defined as a 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.
Portable	A portable device is defined as a 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.

RF-Exposure Categories	
Occupational / Controlled	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 an individual 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	Exposures apply in situations in which the general public may be exposed, or in which persons that 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.

4 RF-Exposure limits

FCC Limits – General Population / Uncontrolled Exposure				
Frequency range [MHz]	Electric field strength [V/M]	Magnetic field strength [A/M]	Power density [W/m ²]	Averaging time [min]
0.3 – 1.34	614	1.63	1000	30
1.34 – 30	824/f	2.19/f	1800/f ²	30
30 – 300	27.5	0.073	2	30
300 – 1500	-	-	f/150	30
1500 – 100000	-	-	10.0	30

FCC Limits – Occupational / Controlled Exposure				
Frequency range [MHz]	Electric field strength [V/M]	Magnetic field strength [A/M]	Power density [W/m ²]	Averaging time [min]
0.3 – 3.0	614	1.63	1000	6
3.0 – 30	1842/f	4.89/f	9000/f ²	6
30 – 300	61.4	0.163	10.0	6
300 – 1500	-	-	f/30	6
1500 – 100000	-	-	50	6

5 RF-Exposure Evaluation

Evaluation Relations
$\lambda[m] = \frac{c \left[\frac{m}{s} \right]}{f[Hz]} ; R_{FF}[m] \geq \frac{2 \cdot D[m]^2}{\lambda[m]}$ $S[W/m^2] = \frac{P_{E.I.R.P.}[W]}{4\pi R[m]^2} ; R[m] = \sqrt{\frac{P_{E.I.R.P.}[W]}{4\pi S[W/m^2]}}$ $DCC [dB] = 10 \cdot \log_{10} \left(\frac{DC[\%]}{100} \right)$ $\sum_{i=1}^N \frac{S_i \left[\frac{W}{m^2} \right]}{S_{Li} \left[\frac{W}{m^2} \right]} + \sum_{j=1}^M \left(\frac{E_j \left[\frac{V}{m} \right]}{E_{Lj} \left[\frac{V}{m} \right]} \right)^2 + \sum_{k=1}^O \left(\frac{H_k \left[\frac{A}{m} \right]}{H_{Lk} \left[\frac{A}{m} \right]} \right)^2 < 1$

Evaluation Procedure
<u>Standalone operation evaluation:</u> For each radio and frequency band the worst case transmission mode with the highest peak conducted or radiated power is evaluated at the frequency that results in the most restrictive rf-exposure limit. From the peak power values, antenna gains and duty cycles taken from the reference documents, the source average radiated power values are calculated. From the average radiated power the power densities at antenna far-field distance is calculated. The distance from the radiation source for compliance power density is calculated. If the separation distance is lower than the far-field distance, the far-field distance is given as compliance separation distance because the plane wave power density assessment is only valid in the far-field of the radiation source. For radiation sources for which the average electric and magnetic fields are measured using field probes, the measured field strength values are compared to the reference limits. For those sources no calculations are performed. Compliance with the reference values is determined with the near field measurements. <u>Concurrent operation evaluation:</u> First the evaluation distance is set to an appropriate value. For all radiation sources for which power densities are calculated, the power densities at the evaluation distance are calculated and for all other sources the electric or magnetic field strengths are measured using field probes. Finally the ratios of the power densities and/or field strength values and the corresponding limits are calculated and summed and the sum is compared to the maximum of 1.

6 Single Source Evaluation Results - FCC

Bluetooth LE			
Transmission Mode			
Transmission Frequency (f) [MHz]	2402	2440	2480
Antenna far-field distance			
Maximum antenna diameter (D) [m]	N/A	N/A	N/A
Transmission wavelength (λ) [m]	N/A	N/A	N/A
Antenna far-field distance (R_{FF}) [m]	N/A	N/A	N/A
Source average power			
Peak radiated power (PR) [dBm EIRP]	10.2	9	9.5
Maximum transmission duty cycle (DC)	1.00	1.00	1.00
Duty cycle correction (DCC) [dB]	0.00	0.00	0.00
Average radiated power (PRAVG) [dBm EIRP]	10.20	9.00	9.50
Power density			
Compliance power density limit [W/m ²]	10.000	10.000	10.000
Power density (S) @ Antenna far-field distance [W/m ²]	N/A	N/A	N/A
Power density (S) @ 0.20 m [W/m ²]	0.021	0.016	0.018
Power density ratio @ 0.20 m	0.00	0.00	0.00
Distance for compliance power density (S=SL) [m]	0.009	0.008	0.008
Compliance			
Verdict	PASS	PASS	PASS
Comment: --			

SRD Radar		
Transmission Mode		
Transmission Frequency (f) [MHz]	57000	64000
Antenna far-field distance		
Maximum antenna diameter (D) [m]	N/A	N/A
Transmission wavelength (λ) [m]	N/A	N/A
Antenna far-field distance (R_{FF}) [m]	N/A	N/A
Source average power		
Peak conducted power (PR) [dBm EIRP]	--	--
Maximum transmission duty cycle (DC)	--	--
Duty cycle correction (DCC) [dB]	--	--
Average conducted power (PRAVG) [dBm EIRP]	13.60	13.60
Power density		
Compliance power density limit [W/m ²]	10.000	10.000
Power density (S) @ Antenna far-field distance [W/m ²]	N/A	N/A
Power density (S) @ 0.20 m [W/m ²]	0.046	0.046
Power density ratio @ 0.20 m	0.00	0.00
Distance for compliance power density (S=SL) [m]	0.014	0.014
Compliance		
Verdict	PASS	PASS
Comment: --		

7 Concurrent Evaluation Results - FCC

Bluetooth LE + SRD Radar	
Information	
Number of concurrent modes	2
Evaluation distance [m]	0.20
Maximum MPE Ratios	
Bluetooth LE	0.00
SRD Radar	0.00
Sum of MPE Ratios	
Sum	0.00
Compliance	
Verdict	PASS

=== End of test report ===