

RF-EXPOSURE REPORT FCC 47 CFR Part 2.1093 RF-Exposure evaluation of portable equipment	
Report Reference No	G0M-2404-2541-TFC093PE01-V01
Testing Laboratory	Eurofins Product Service GmbH
Address	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation	 A2LA Accredited Testing Laboratory, Certificate No.: 1983.01 FCC Test Firm Designation Number: DE0008 ISED Testing Laboratory site: 3470A
Applicant	Andreas Stihl AG & Co. KG
Address	Badstraße 115 71336 Waiblingen Germany
Test Specification	According to FCC rules
Standard	FCC 47 CFR 2.1093
Non-Standard Test Method	None
Equipment under Test (EUT):	
Product Description	battery pack 4871 AR
Model(s)	AR 2000 L
Additional Model(s)	None
Brand Name(s)	Andreas Stihl AG & Co. KG
Hardware Version(s)	03.11
Software Version(s)	00.16
FCC-ID	2ALP8AR1
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	2024-12-04	
Date of receipt of test item	See test sample identification table on page 7	
Report:		
Compiled by	Stephan Liebich	
Tested by (+ signature) (Responsible for Test)	Stephan Liebich	
Approved by (+ signature) (Senior Radio Expert)	Radwan Jaafar	
Date of Issue	2024-12-11	
Total number of pages	15	
General Remarks:		
<p>The test results presented in this report relate only to the object tested.</p> <p>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.</p> <p>This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.</p> <p>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.</p> <p>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.</p> <p>Any relevant compliance assessment procedure which is consistent with the state of the art, reproducible and gives valid results can be used.</p>		

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	2024-12-11	Initial Release	--

ABBREVIATIONS AND ACRONYMS

Acronyms	
Acronym	Description
EIRP	Equivalent Isotropic Radiated Power
ERP	Effective Radiated Power
EUT	Equipment Under Test
LPE	Low Power Exclusion

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1 Equipment (Test Item) Under Test

Description	battery pack 4871 AR			
Model	AR 2000 L			
Additional Model(s)	None			
Brand Name(s)	Andreas Stihl AG & Co. KG			
Sample Identification	EUT #	Sample-ID	Serial Number	Date of receipt
	EUT 1	See reference documents	See reference documents	See reference documents
Hardware Version(s)	03.11			
Software Version(s)	00.16			
FCC ID	2ALP8AR1			
Equipment type	End Product			
Number of antenna ports	1			
Number of radios	1			
Radio 1	Radio type	Transceiver		
	Assigned frequency bands	2400.0 MHz - 2483.5 MHz		
	Radio technology	Bluetooth LE 5.0		
	Bluetooth Specification	LE 1M PHY		
Antenna 1	Type	Integrated antenna		
	Model	Inverted F		
	Manufacturer	PCB Antenna		
	Gain	1.1 dBi		
Supply Voltage	V _{NOM}	36 V DC via external AC/DC charger		
Dedicated AC/DC-Adaptor	Model	STIHL AL 301.0 B		
	Vendor	STIHL		
	Input	120 V / 60 Hz		
	Output	36 V		
Environment	General public			
Use case	Body worn			

1.1 Reference Documents

Document Type	Document No.	Issued by	Date
RADIO REPORT	G0M-2106-9857-TFC247BL-V02	Eurofins Product Service GmbH	2021-11-18
RADIO REPORT	G0M-2404-2541-TFC247BL-V01	Eurofins Product Service GmbH	2024-12-10
ANTENNA UNDER TEST REPORT	G0M-2404-2541-TFCAUT-V01	Eurofins Product Service GmbH	2024-12-10

1.2 Standalone radiation sources

Standalone radiation sources					
Mode	Operating Frequency [MHz]	Maximum conducted power [dBm]	Maximum radiated power [dBm EIRP]	Maximum duty cycle [%]	Antenna distance to body [mm]
Bluetooth LE	2402	3.196	4.296	87	5.0
	2440	3.062	4.162	87	5.0
	2480	2.773	3.873	87	5.0
Comment: SAR test exclusion power threshold acc. to FCC KDB 447498 D01 is max. $0.8 \leq 3.0$ 1g SAR					

1.3 Concurrent Sources

No concurrent radiation sources

2 Result Summary

Standalone sources - FCC KDB 447498				
Product Standard Reference	Requirement	Reference Method	Mode	Verdict
KDB 447498	SAR Test Exclusion	KDB 447498 4.3.1	Bluetooth LE	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 and exclusion thresholds

4.1 SAR limits

SAR Limits		
Type	Occupational SAR values [W / kg]	General population SAR values [W / kg]
Whole-body SAR averaging mass = entire body	0.4	0.08
Partial-body Localized Head, Neck and Trunk SAR averaging mass = 1g	8.0	1.6
Hands, Wrists, Feet and Ankles Localized Limbs SAR averaging mass = 10g	20.0	4

4.2 SAR standalone test exclusion threshold

SAR test exclusion power acc. to FCC KDB 447498 D01 – Standalone operation
<p>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 Exclusion Threshold condition, listed below, is 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.</p> <p>The minimum test separation distance 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</p> <p>The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:</p> <p>a) For 100 MHz to 6 GHz and test separation distances ≤ 50 mm</p> $\frac{\text{max. power of channel [mW]}}{\text{min. test separation distance [mm]}} \cdot \sqrt{f[\text{GHz}]} \leq \begin{cases} 3.0 & 1\text{g SAR} \\ 7.5 & 10\text{g SAR} \end{cases}$ <p>b) For 100 MHz to 6 GHz and test separation distances > 50 mm</p> <p>1) For 100 to 1500 MHz</p> $\left\{ \text{Power allowed at numeric threshold for 50 mm in step a} + (\text{test separation distance} - 50\text{mm}) \cdot \frac{f(\text{MHz})}{150} \right\}, \text{mW}$ <p>2) for > 1500 MHz and ≤ 6 GHz</p> $\{ \text{Power allowed at numeric threshold for 50 mm in step a} + (\text{test separation distance} - 50\text{mm}) \cdot 10 \}, \text{mW}$ <p>c) for frequencies below 100 MHz:</p> <p>1) test separation distances > 50 mm and < 200 mm:</p> <p>the power threshold at the corresponding test separation distance at 100 MHz in step b) is multiplied by</p> $\left(1 + \log \left(\frac{100}{f(\text{MHz})} \right) \right)$ <p>2) test separation distances ≤ 50 mm:</p> <p>the power threshold determined by the equation in c) 1) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$</p>

4.3 SAR concurrent test exclusion threshold

SAR test exclusion acc. to FCC KDB 447498 D01 – Concurrent operation	
<p>When the sum of 1-g or 10-g SAR of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit, SAR test exclusion applies to that simultaneous transmission configuration.</p> <p>For the test exclusion to apply, the maximum output power, duty factor, and other applicable parameters used in the standalone SAR tests, must be the same or more conservative than those required for simultaneous transmission.</p> <p>When an antenna qualifies for the standalone SAR test exclusion and also transmits simultaneously with other antennas, the standalone SAR value must be estimated according to the following to determine the simultaneous transmission SAR test exclusion criteria:</p>	
1)	$\frac{\text{max.power of channel,including tune-up tolerance,mW}}{\text{min.test separation distance,mm}} \cdot \frac{\sqrt{f(\text{GHz})}}{x}, \text{ for test separation distances } \leq 50 \text{ mm}$ <p>where x = 7.5 for 1-g SAR and x = 18.75 for 10-g SAR</p>
2)	0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distance is > 50 mm

5 RF-Exposure Evaluation

Evaluation procedure acc. to FCC KDB 447498	
<u>Standalone operational modes</u>	
1)	For each standalone operational mode the associated frequencies, radiated output power values, duty cycles and antenna separation distances to the human body are specified
2)	From the radiated power and the duty cycle the source-based time averaged radiated output power is calculated
3)	The transmission frequency, average power and separation distance is used to determine the SAR test exclusion power threshold value acc. to FCC KDB 447498 D01
4)	If the time averaged output power of the transmission mode is lower than the SAR test exclusion power threshold value, the mode clarifies for SAR test exclusion and no further SAR evaluation is needed
<u>Concurrent operational modes</u>	
1)	For each operational mode that participates in the concurrent operational mode, the estimated SAR is calculated from the source-based time average conducted output power and the separation distance to the human body for each transmission frequency of the operation mode
2)	The maximum estimated SAR value for each operational is determined
3)	The sum of SAR values of the maximum estimated SAR values for each operational mode is calculated
4)	If the sum of SAR values is below the corresponding SAR limit, the concurrent operational mode clarifies for SAR test exclusion and no further evaluation is needed

6 Single Source Evaluation Results - FCC

Results – Standalone Operational Modes							
Mode	Frequency [MHz]	Power [mW]	Duty Cycle	Average Power [mW]	Distance [mm]	Power Limit [mW]	Verdict
Bluetooth LE	2402	2.09	0.87	1.82	5.0	10	PASS
	2440	2.02	0.87	1.76	5.0	10	PASS
	2480	1.89	0.87	1.65	5.0	10	PASS
Comment: --							

=== End of test report ===