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Alcohol Monitoring Systems, Inc. SAR EXEMPTION REPORT

SCOPE OF WORK
SAR EXEMPTION CALCULATION
ON THE GPS900-W1

REPORT NUMBER
105373087LEX-006.1

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SAR EXEMPTION TEST REPORT

Report Number:	105373087LEX-006.1
Project Number:	G105373087
Report Issue Date:	8/13/2024
Report Revised Date:	10/15/2024
Model(s) Covered by this Evaluation:	GPS900-W1, GPS910-W1
Standards:	FCC Part 2.1093 RSS-102 Issue 5

Tested by:
Intertek Testing Services NA, Inc.
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Lexington, KY 40510
USA

Client:
Alcohol Monitoring Systems, Inc.
6251 Greenwood Plaza Blvd
Suite #300
Greenwood Village, CO 80111
USA

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Report reviewed by

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Table of Contents

1 Introduction and Conclusion

SAR exemption calculations were performed on the product constructed as described in section 4. Information provided by the client including maximum output power, antenna gain(s), and minimum separation distance(s) was used to determine if the product under evaluation was exempt from SAR. Any change in these stated values may invalidate these results. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product under evaluation is **exempt** from SAR requirements for each of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) evaluated. Intertek does not make any claims of compliance for samples or variants which were not evaluated.

2 Test Summary

Section	Requirement	Result
9	FCC SAR Exemption Criteria (FCC Title 47 CFR Part 1.1307, 2.1093)	Exempt from SAR
10	ISED SAR Exemption Criteria (RSS-102 Issue 5)	Exempt from SAR

3 Client Information

This product was tested at the request of the following:

Client Information	
Client Name:	Alcohol Monitoring Systems, Inc.
Address:	6251 Greenwood Plaza Blvd Suite #300 Greenwood Village, CO 80111 USA
Contact:	Don Pruitt
Telephone:	+1 (678) 387-1902
Email:	dpruitt@scramsystems.com
Manufacturer Information	
Manufacturer Name:	Alcohol Monitoring Systems, Inc.
Manufacturer Address:	6251 Greenwood Plaza Blvd Suite #300 Greenwood Village, CO 80111 USA

4 Description of Equipment under Test and Variant Models

Equipment Under Test	
Product Name	GPS900-W1, GPS910-W1
Model Number	GPS900-W1, GPS910-W1
FCC Identifier	P8M-GPS9
IC Identifier	8549A-GPS9
Type of Transmission	FHSS
Rated Output Power	14.1mW
Antenna Model and Gain[1]	-3dBi (custom)
Frequency Range	902-928MHz
Embedded Module	
Embedded Module	Telit ME310G1-W1
Module FCC Identifier	P8M-GPS900W1
Module IC Identifier	8549A-GPS900W1
Type of Transmission	LTE Cat M
Rated RF Output Power[1]	158mW (B2), 153mW (B4), 157mW (B12), 138mW (B13), 147mW (B25), 158mW (B66), 130mW (B85)
Antenna Model and Gain[1]	0.4dBi (B2), -0.2dBi (B4), -0.2dBi (B12), -7.81 (B13), 0.4dBi (B25), -0.2dBi (B66), -0.2dBi (B85)
Supported Transmit Bands	B2, B4, B12, B13, B25, B66, B85
Embedded Module	
Embedded Module	Silicon Labs RS9116 B00
Module FCC Identifier	P8M-GPS900
Module IC Identifier	8549A-GPS900
Type of Transmission	802.11b/g/n
Rated RF Output Power[1]	22.4dBm
Antenna Model and Gain[1]	2.2 dBi
Supported Transmit Bands	2412 – 2462 MHz
Description of Equipment Under Test (provided by client)	
The ScramGPS GPS900-W1 is an ankle worn offender monitoring and tracking device. The device combines cellular, GPS, and RF technologies to ascertain the offender's current location and verify compliance with program requirements. This information can be gathered at variable rates with the nominal maximum location data rate of 1 locate per minute and the maximum transmission frequency of 1 per minute. The time required to transmit a single packet of location data is constant regardless of the transmission frequency. A typical rate plan locates an offender once each minute and transmits the location data once every 10 minutes.	

4.1 Variant Models:

The following variant models have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested. Intertek does not make any claims of compliance for samples or variants which were not tested.

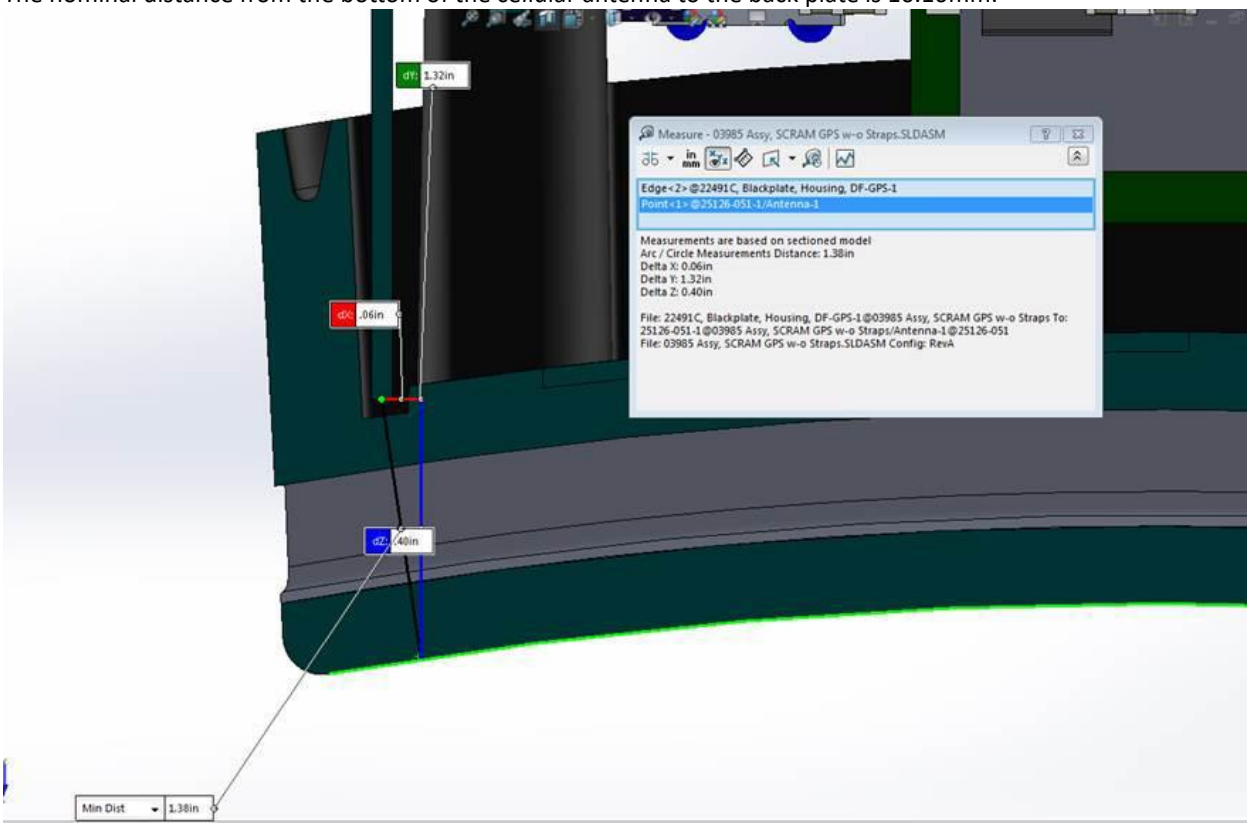
- GPS900-W1 – AT&T Firmware and Band Support
- GPS910-W1 – Verizon Firmware and Band Support

[1] This information was provided by Alcohol Monitoring Systems, Inc. and may affect compliance. Intertek does not make any claim of compliance for values other than those shown.

4.2 Antenna Separation

The following information was provided by Alcohol Monitoring Systems, Inc. and may affect compliance. Intertek does not make any claims of compliance for values other than those shown below.

The nominal distance from the bottom of the cellular antenna to the back plate is 10.16mm:



The nominal distance from the bottom of the 900MHz and Wi-Fi antenna to the back plate is 25.95mm:

4.3 Antenna Gain

The following information was provided by Alcohol Monitoring Systems, Inc. and may affect compliance. Intertek does not make any claims of compliance for values other than those shown below.

The maximum gain of the 900MHz radio was taken from Verkotan report Passive_OTA_test_report_ID6667 _13082024:

Frequency [MHz]	Max gain [dBi]	Efficiency [dB]
820	-8.5	-12.0
830	-7.7	-10.9
840	-6.5	-9.7
850	-5.4	-8.2
860	-4.5	-7.4
870	-3.5	-6.5
880	-3.1	-6.1
890	-3.1	-6.0
900	-3.0	-6.4
910	-4.0	-7.4
920	-5.1	-8.1
930	-6.3	-9.3
940	-7.3	-10.3
950	-8.3	-11.4
960	-9.4	-12.6

Table 1 ISM 820-960 MHz max gain and efficiency

The maximum gain of the cellular radio was taken from Verkotan report Passive_OTA_test_report_ID6667 _13082024 and Eurofins report WIRS 113261-PassiveAntennaTestingRev.1.1:

Frequency [MHz]	Max gain [dBi]	Efficiency [dB]
695	-0.2	-4.2
705	-0.8	-4.6
715	-1.5	-5.5
725	-2.2	-6.1
735	-3.4	-6.6
745	-4.1	-7.4

Table 2 Cell 670-720 MHz max gain and efficiency

Frequency [MHz]	Antenna Efficiency [%]	Antenna Peak Gain [dBi]
746	10.38	-6.13
756	8.98	-6.72
766	7.56	-7.61
776	7.19	-7.78
786	6.77	-8.11
787	6.73	-8.14

Frequency [MHz]	Max gain [dBi]	Efficiency [dB]	Frequency [MHz]	Max gain [dBi]	Efficiency [dB]
1710	-0.2	-5.4	1940	0.5	-4.9
1720	-0.3	-5.3	1950	0.6	-4.9
1730	-0.6	-5.2	1960	0.9	-4.6
1740	-1.4	-5.7	1970	0.7	-4.6
1750	-1.0	-5.0	1980	0.2	-4.7
1760	-1.4	-5.5	1990	0.4	-4.6
1770	-0.9	-5.1	2000	0.6	-4.8
1780	-1.1	-5.4	2010	0.4	-4.7
1790	-1.3	-5.4	2020	0.2	-4.5
1800	-1.3	-5.3	2030	-0.2	-4.6
1810	-1.3	-5.4	2040	-0.2	-4.6
1820	-1.1	-5.5	2050	-0.1	-4.5
1830	-0.5	-5.1	2060	-0.7	-4.5
1840	-0.5	-5.1	2070	-0.7	-4.6
1850	-0.6	-5.4	2080	-0.4	-4.5
1860	0.0	-5.1	2090	-0.2	-4.7
1870	-0.1	-5.4	2100	0.5	-4.5
1880	-0.1	-5.5	2110	0.5	-4.7
1890	0.0	-5.3	2120	0.4	-4.7
1900	0.4	-4.9	2130	0.0	-5.1
1910	0.4	-5.2	2140	0.2	-5.1
1920	0.8	-4.9	2150	-0.3	-5.4
1930	0.5	-4.9	2160	-0.7	-5.7

Table 3 Cell 1710-2160 MHz max gain and efficiency

The maximum gain of the Wi-Fi radio was taken from Verkotan report Passive_OTA_test_report_ID6669_13082024:

Frequency [MHz]	Max gain [dBi]	Efficiency [dB]
2400	1.6	-3.5
2410	1.4	-3.6
2420	1.6	-3.8
2430	1.6	-3.7
2440	1.7	-3.6
2450	1.5	-4.0
2460	1.9	-3.7
2470	1.9	-3.5
2480	2.2	-3.3
2490	1.6	-3.9

Table 1 2400-2490 MHz max gain and efficiency

4.4 Maximum Output Power

The following information was provided by Alcohol Monitoring Systems, Inc. and may affect compliance. Intertek does not make any claims of compliance for values other than those shown below.

The maximum output power of the 900MHz radio was measured and reported in Intertek report 105373087LEX-021:

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)
7	903.4	10.58	0.01143	1
8	903.6	11.34	0.01361	1
59	913.8	11.39	0.01377	1
120	926.0	11.48	0.01406	1
121	926.2	10.72	0.01180	1

Channel	Frequency (MHz)	Output Power (dBm)	Antenna Gain (dB)	EIRP (dBm)	EIRP (W)	Limit (W)
7	903.4	10.58	-3	7.58	0.005728	4
8	903.6	11.34	-3	8.34	0.006823	4
59	913.8	11.39	-3	8.39	0.006902	4
120	926.0	11.48	-3	8.48	0.007047	4
121	926.2	10.72	-3	7.72	0.005916	4

The maximum output power of the cellular module was taken from the module grant FCCID P8M-GPS900W1:

FCC IDENTIFIER:	P8M-GPS900W1	
Name of Grantee:	Alcohol Monitoring Systems Inc.	
Equipment Class:	PCS Licensed Transmitter	
Notes:	Data Terminal Module	
Modular Type:	Single Modular	

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
	24E	1850.1 - 1909.9	0.144	0.0153 PM	130KG7D
	24E	1850.1 - 1909.9	0.144	0.153 PM	185KG7D
	24E	1850.7 - 1909.3	0.158	0.0071 PM	1M12G7D
	24E	1850.7 - 1909.3	0.154	0.0391 PM	1M12W7D
	27	1710.1 - 1754.9	0.143	0.0187 PM	129KG7D
	27	1710.1 - 1754.9	0.137	0.0187 PM	185KG7D
	27	1710.7 - 1754.3	0.153	0.0073 PM	1M12G7D
	27	1710.7 - 1754.3	0.149	0.0432 PM	1M12W7D
	22H	824.1 - 848.9	0.124	0.0256 PM	127KG7D
	22H	824.1 - 848.9	0.126	0.0256 PM	184KG7D
	22H	824.7 - 848.3	0.138	0.0286 PM	1M10G7D
	22H	824.7 - 848.3	0.125	0.1017 PM	1M10W7D
	27	699.1 - 715.9	0.127	0.0116 PM	127KG7D
	27	699.1 - 715.9	0.127	0.0116 PM	184KG7D
	27	699.7 - 715.3	0.157	0.0144 PM	1M12G7D
	27	699.7 - 715.3	0.136	0.1122 PM	1M10W7D
	27	777.1 - 786.9	0.128	0.0187 PM	127KG7D
	27	777.1 - 786.9	0.129	0.0187 PM	184KG7D
	27	779.5 - 784.5	0.138	0.013 PM	1M10G7D
	27	779.5 - 784.5	0.134	0.0857 PM	1M10W7D
	24E	1850.1 - 1914.9	0.142	0.0207 PM	130KG7D
	24E	1850.1 - 1914.9	0.138	0.0207 PM	185KG7D
	24E	1850.7 - 1914.3	0.147	0.0207 PM	1M12G7D
	24E	1850.7 - 1914.3	0.136	0.0485 PM	1M12W7D
	90	814.1 - 823.9	0.114	0.0184 PM	128KG7D
	90	814.1 - 823.9	0.12	0.0184 PM	184KG7D
	90	814.7 - 823.3	0.145	0.0157 PM	1M10G7D
	90	814.7 - 823.3	0.126	0.0754 PM	1M10W7D
	22H	824.1 - 848.9	0.117	0.0223 PM	128KG7D
	22H	824.1 - 848.9	0.124	0.0223 PM	184KG7D
	22H	824.7 - 848.3	0.139	0.0312 PM	1M11G7D
	22H	824.7 - 848.3	0.137	0.1012 PM	1M11W7D
	27	1710.1 - 1779.9	0.134	0.0095 PM	130KG7D
	27	1710.1 - 1779.9	0.13	0.0095 PM	185KG7D
	27	1710.7 - 1779.3	0.158	0.0057 PM	1M12G7D
	27	1710.7 - 1779.3	0.155	0.0505 PM	1M12W7D
	27	663.1 - 697.9	0.142	0.0181 PM	127KG7D
	27	663.1 - 697.9	0.14	0.0181 PM	184KG7D
	27	698.1 - 715.9	0.129	0.0152 PM	127KG7D
	27	698.1 - 715.9	0.13	0.0152 PM	184KG7D
	27	700.5 - 713.5	0.15	0.0102 PM	1M10G7D
	27	700.5 - 713.5	0.146	0.1029 PM	1M10W7D

The maximum output power of the Wi-Fi radio was taken from the original grant P8M-GPS900:

FCC IDENTIFIER: P8M-GPS900
Name of Grantee: Alcohol Monitoring Systems Inc.
Equipment Class: Digital Transmission System
Notes: Communication Module
Modular Type: Single Modular

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
	15C	2402.0 - 2480.0	0.1439		
	15C	2412.0 - 2462.0	0.1718		

4.5 Duty Cycle Correction

The following information was provided by Alcohol Monitoring Systems, Inc. and may affect compliance. Intertek does not make any claims of compliance for values other than those shown below.

The device features variable location and transmission rates with a maximum location rate of once per minute and a maximum transmission rate of once per 10 minutes. The on-air transmission time from 1 location is 3 seconds.

Derived by direct measurement of the transmit completion time on the device of nominal operation for various rate plans. A typical rate plan of 1 location per minute and transmits on 30-minute intervals is shown below.

Duty Cycle = Transmission Time / TOTAL Time = (3 x 3s)/(30min x 60s/min) = 0.005 = 0.5%

5 FCC SAR Exemption Criteria

FCC Title 47 CFR Part 1.1307(b)(3)(i):

For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph (b)(2) of this section): A single RF source is exempt if:

(A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph (b)(3)(ii)(A) of this section. Medical implant devices may only use this exemption and that in paragraph (b)(3)(ii)(A);

(B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold Pth (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). Pth is given by:

$$P_{th}\ (\text{mW}) = \begin{cases} ERP_{20\ cm}(d/20\ \text{cm})^{x} & d \le 20\ \text{cm} \\ ERP_{20\ cm} & 20\ \text{cm} < d \le 40\ \text{cm} \end{cases}$$

Where

$$x = -\log_{10}\left(\frac{60}{ERP_{20\ cm}\sqrt{f}}\right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20\ cm}\ (\text{mW}) = \begin{cases} 2040f & 0.3\ \text{GHz} \le f < 1.5\ \text{GHz} \\ 3060 & 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \end{cases}$$

d = the separation distance (cm);

RF Source	Frequency (GHz)	Separation Distance (cm)	Max Time-Averaged Output Power or ERP (mW)	P_{th} (mW)	Exempt from SAR?
900MHz Radio	0.9	2.6	14.1	229.9	Exempt[2]
Wi-Fi Radio	2.412	2.6	1.44	158.9	Exempt[2]
LTE Cat M Band 2	1.85	1.1	0.87	1	Exempt[3]
LTE Cat M Band 4	1.71	1.1	0.77	1	Exempt[3]
LTE Cat M Band 12	0.699	1.1	0.79	1	Exempt[3]
LTE Cat M Band 13	0.777	1.1	0.69	1	Exempt[3]
LTE Cat M Band 25	1.85	1.1	0.81	1	Exempt[3]
LTE Cat M Band 66	1.71	1.1	0.79	1	Exempt[3]
LTE Cat M Band 85	0.698	1.1	0.65	1	Exempt[3]

[2] The device is exempt per 47 CFR Part 1.1307(b)(3)(i)(B)
[3] The device is exempt per 47 CFR Part 1.1307(b)(3)(i)(A)

6 ISED SAR Exemption Criteria

RSS-102 Issue 5 § 2.5.1: SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Table 1: SAR evaluation — Exemption limits for routine evaluation based on frequency and separation distance[4,5]

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.

Device	Frequency (MHz)	Time-Averaged Output Power (mW)	Antenna Gain (dBi)	EIRP (mW)	Separation Distance (mm)	Limit (mW)	Exempt from SAR?
900MHz Radio	900	14.1	-3	7.05	26	166	Exempt
Wi-Fi Radio	2412	0.859	2.2	1.43	26	62.7	Exempt
LTE Cat M Band 2	1850	0.79	0.4	0.87	11	27	Exempt
LTE Cat M Band 4	1710	0.77	-0.2	0.48	11	33	Exempt
LTE Cat M Band 12	699	0.79	-0.2	0.75	11	110	Exempt
LTE Cat M Band 13	777	0.69	-7.81	0.11	11	90	Exempt
LTE Cat M Band 25	1850	0.74	0.4	0.81	11	27	Exempt
LTE Cat M Band 66	1710	0.79	-0.2	0.75	11	33	Exempt
LTE Cat M Band 85	698	0.65	-0.2	0.62	11	110	Exempt

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7 Revision History

Revision Level	Date	Report Number	Prepared By	Reviewed By	Notes
0	8/13/20024	105373087LEX-006	BL	MC	Original Issue
1	10/15/2024	105373087LEX-006.1	BL	MC	Updated with feedback from TCB review