

RF Exposure Lab

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CERTIFICATE OF COMPLIANCE SAR EVALUATION

TraceX Inc.
13 Laetitia Lane
Landenberg, PA 19350

Dates of Test: December 7, 2021
Test Report Number: SAR.20211203
Revision A

Model(s):	TX4871
Marketing Name:	Affirm™ A 002
Contains BT Module:	TX4871 FCC ID: 2A3UI-TX4871, IC: 27990-TX4871
Contains WWAN Module:	SIMCom Model: SIM7000A FCC ID: 2AJYU-SIM7000A, ISED: 23761-SIM7000A
Equipment Type:	Wireless Low Power Alcohol Tester
Classification:	Portable Transmitter
TX Frequency Range:	699 -716 MHz; 777 – 787 MHz; 1710 – 1755 MHz; 1850 – 1910 MHz
Frequency Tolerance:	± 2.5 ppm
Maximum Conducted RF Output:	700 MHz – 25.7 dBm, 1750 MHz – 25.7 dBm, 1900 MHz – 25.7 dBm Conducted
Signal Modulation:	QPSK, 16QAM
Antenna Type:	Internal
Application Type:	Certification
Standard(s):	47CFR1.1310, 47CFR2.1093, KDB447498 D01 v07, KDB941225 D05 v02r05, RSS-102, Safety Code 6
Separation Distance:	0 mm

This wireless portable device has been shown to be excluded for RF exposure requirements for uncontrolled environment/general exposure limits specified in above listed standards for standalone SAR. The device has also been shown to meet the simultaneous requirements of each standard as well (See test report).

I attest to the accuracy of the data. I assume full responsibility for the completeness of these calculations and vouch for the qualifications of all persons making them.



Jay M. Moulton
Vice President



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Comment/Revision	Date
Original Release	December 10, 2021
Revision A – Add BLE	May 10, 2022

Note: The latest version supersedes all previous versions listed in the above table. The latest version shall be used.

1. Introduction

This report shows exclusion calculations of the TraceX Inc. Model TX4871 Wireless Low Power Alcohol Tester with 47CFR1.1310, 47CFR2.1093, KDB447498 D01 v07, RSS-102, Safety Code 6.

2. Radiation Sources

Radio	Description	
WWAN B2	Frequency Range (MHz)	1850 – 1910 MHz
	Maximum Power (dBm)	25.7 dBm
	Maximum Duty Cycle (%)	0.37%
WWAN B4	Frequency Range (MHz)	1710 – 1755 MHz
	Maximum Power (dBm)	25.7 dBm
	Maximum Duty Cycle (%)	0.37%
WWAN B12	Frequency Range (MHz)	699 – 716 MHz
	Maximum Power (dBm)	25.7 dBm
	Maximum Duty Cycle (%)	0.37%
WWAN B13	Frequency Range (MHz)	777 – 787 MHz
	Maximum Power (dBm)	25.7 dBm
	Maximum Duty Cycle (%)	0.37%
BLE	Frequency Range (MHz)	2402 – 2480 MHz
	Maximum Power (dBm)	0.8 dBm
	Maximum Duty Cycle (%)	100%

3. Low Power Alcohol Tester



4. RF Exposure Classifications

Device Types	
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. (47 CFR 2.1091)
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. (47 CFR 2.1093)

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.

5. RF Exposure Limits Standalone

FCC Requirements

The FCC SAR test exclusion for standalone SAR is determined for each operating configuration and exposure condition the device can operate.

$$P_{th}(\text{mW}) = \begin{cases} ERP_{20\text{cm}} (d/20 \text{ cm})^x & 0.5 \text{ cm} \leq d \leq 20 \text{ cm} \\ ERP_{20\text{cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

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

$$ERP_{20\text{cm}}(\text{mW}) = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f \leq 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} < f \leq 6.0 \text{ GHz} \end{cases}$$

d = separation distance (cm)

ISED Requirements

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

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

6. Cellular Modem Specifications

The tolerance for the SIMCom Wireless Solutions Company Limited modem is 23 dBm \pm 2.7 dBm. Therefore, the upper end of the conducted tolerance is 25.7 dBm (371.5 mW). The antenna gain for each band is a positive gain. The table below shows the gain for each band.

Band	Gain	Radiated Power
B2	3.2 dBi	776.2 mW
B4	3.4 dBi	812.8 mW
B12	3.0 dBi	741.3 mW
B13	3.0 dBi	741.3 mW

Therefore, the radiated power level is used to calculate the exclusion.

7. BT Modem Specifications

The tolerance for the Microchip Technology Inc. modem is 0.8 dBm maximum TX power. Therefore, the upper end of the conducted tolerance is 0.8 dBm (1.2 mW). The antenna gain for each band is a negative gain. Therefore, the gain was not used in the maximum radiated power numbers.

Band	Radiated Power
BLE	1.2 mW

Therefore, the radiated power level is used to calculate the exclusion.

8. Duty Cycle Evaluation for WWAN

The WWAN transmitter has a duty cycle of 0.37%. The evaluation (see below) shows a maximum transmit period of 0.37 seconds in a 1 hour period. The maximum allowable period is 100 seconds for the FCC. Therefore, the evaluation in this report is based on a 0.37 second transmit period for a 100 second interval yielding the 0.37% duty cycle. Therefore, the maximum source based time averaged power for the WWAN bands is listed below for each band.

B2 – $776.2 \text{ mW} * 0.0037 = 2.87 \text{ mW}$
B4 – $812.8 \text{ mW} * 0.0037 = 3.01 \text{ mW}$
B12 – $741.3 \text{ mW} * 0.0037 = 2.74 \text{ mW}$
B13 – $741.3 \text{ mW} * 0.0037 = 2.74 \text{ mW}$

For the FCC and ISED, the calculations are as follows. The upload speed for Cat-M1 is 375 Kbps and for NB-IoT is 70 Kbps. The slower speed of the NB-IoT was used for calculating the duty cycle. The worst case data upload is when the device is catching up for data logs. The device will continue to upload data logs up to 12 log entries or until completed. The POST header consists of 200 Bytes of data and each log entry consists of 250 Bytes. A total of 3.20 KB is uploaded for the data catch up sequence. The transfer speed of 70 Kbps equates to 8.75 KB/s. Calculating the time in which the data will be transmitting is $(3.2 \text{ KB}) / (8.75 \text{ KB/s}) = 0.37 \text{ seconds}$.

9. Standalone SAR Exclusion Assessment

FCC Requirements

Based on the formula in section 5, the exclusion calculation for each of the transmitters is listed below.

B2 WWAN Power = 2.87 mW
B4 WWAN Power = 3.01 mW
B12 WWAN Power = 2.74 mW
B13 WWAN Power = 2.74 mW
BLE Power = 1.2 mW

WWAN B2 Exclusion Power – 7.5 mW
WWAN B4 Exclusion Power – 10 mW
WWAN B12 Exclusion Power – 27.5 mW
WWAN B13 Exclusion Power – 25 mW

BLE Exclusion Power – 7.5

Therefore, all transmitters are excluded from standalone SAR evaluations.

ISED Requirements

Based on the table in RSS-102, Band 2 transmitter must be less than 7 mW to be excluded, Band 4 must be less than 8 mW and Band 12 & 13 must be less than 24 mW. All four bands are less than the required power level to be excluded. Therefore, all bands are excluded from SAR testing.

10. Simultaneous SAR Exclusion Assessment

FCC and ISED Requirements

The worst case value for each transmitter is evaluated based on the ratio to the exclusion limit and the sum must be less than 1.

B2 WWAN Power = 2.87 mW
B4 WWAN Power = 3.01 mW
B12 WWAN Power = 2.74 mW
B13 WWAN Power = 2.74 mW
BLE Power = 1.2 mW

	Ratio
WWAN B2 Exclusion Power – 7.5 mW	0.38
WWAN B4 Exclusion Power – 10 mW	0.30
WWAN B12 Exclusion Power – 27.5 mW	0.10
WWAN B13 Exclusion Power – 25 mW	0.11
BLE Exclusion Power – 7.5	0.16

The highest ratio is between the WWAN B2 and BLE which is 0.54 which is less than 1.0.

Therefore, device meets the simultaneous evaluation requirements.