

# 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, ISSED: 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      |
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**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<br>B2  | Frequency Range (MHz)  | 1850 – 1910 MHz |
|             | Maximum Power (dBm)    | 25.7 dBm        |
|             | Maximum Duty Cycle (%) | 0.37%           |
| WWAN<br>B4  | Frequency Range (MHz)  | 1710 – 1755 MHz |
|             | Maximum Power (dBm)    | 25.7 dBm        |
|             | Maximum Duty Cycle (%) | 0.37%           |
| WWAN<br>B12 | Frequency Range (MHz)  | 699 – 716 MHz   |
|             | Maximum Power (dBm)    | 25.7 dBm        |
|             | Maximum Duty Cycle (%) | 0.37%           |
| WWAN<br>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<sup>4,5</sup>**

| 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 ISSED, 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.

$$B2 \text{ WWAN Power} = 2.87 \text{ mW}$$

$$B4 \text{ WWAN Power} = 3.01 \text{ mW}$$

$$B12 \text{ WWAN Power} = 2.74 \text{ mW}$$

$$B13 \text{ WWAN Power} = 2.74 \text{ mW}$$

$$\text{BLE Power} = 1.2 \text{ mW}$$

$$\text{WWAN B2 Exclusion Power} - 7.5 \text{ mW}$$

$$\text{WWAN B4 Exclusion Power} - 10 \text{ mW}$$

$$\text{WWAN B12 Exclusion Power} - 27.5 \text{ mW}$$

$$\text{WWAN B13 Exclusion Power} - 25 \text{ mW}$$

$$\text{BLE Exclusion Power} - 7.5$$

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.