

# RADIO FREQUENCY EXPOSURE REPORT

REVISED REPORT TO 110223-23

FH7k2H

Report No.: 110223-23A

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The test data contained in this report documents the observed testing parameters pertaining to and are relevant for only the sample equipment tested in the agreed upon operational mode(s) and configuration(s) as identified herein. Compliance assessment remains the client's responsibility. This report may not be used to claim product endorsement by A2LA or any government agencies. This test report has been authorized for release under quality control from CKC Laboratories, Inc.



**Steve Behm**  
*Director of Quality Assurance & Engineering Services*  
*CKC Laboratories, Inc.*

### Purpose:

To demonstrate compliance with United States, Canada, Australia, New Zealand, European Union and/or United Kingdom RF Exposure requirements for Portable equipment (devices used  $\leq 20$ cm from the body) with power output below exemption levels or Mobile equipment (devices used  $> 20$ cm from the body) where Maximum Permissible Exposure (MPE) Calculations apply.

### Device and Antenna Operating Configuration:

Device operating at maximum output power with continuous transmission of modulated data.

### Method:

This equipment is evaluated in accordance with the guidelines set forth in 47 CFR 1.1310, KDB 447498 & ANSI C95.1 for the US, Health Canada Safety Code 6 & RSS 102 for Canada, ARPANSA RPS S-1 for AU & NZ and EN 62479 or EN 62311 for EU and UK.

### Other Considerations:

Report considers stand-alone equipment configurations only. RF Exposure limits are calculated at the mid-point of each operating band. Multi-transmitter equipment are assumed to permit simultaneous transmission, unless indicated otherwise. Simultaneous transmissions are aggregated providing a worst case assessment.

### Referenced Test Reports:

The following test reports were referenced in conjunction with this assessment:  
CKC laboratories reports: 109749-30, 109749-31, 109749-33, 109749-34, 109749-35  
Sporton Lab report: FR241118001

### Decision Rule:

Outcome of RF exposure assessment is listed in the comment section(s) below as a binary statement for simple acceptance rule according to ILAC-G8 (2019).

### Designation Information:

| Location                 | *NIST CB# | FCC    | Canada |
|--------------------------|-----------|--------|--------|
| Canyon Park, Bothell, WA | US0103    | US1024 | 3082C  |
| Brea, CA                 |           |        | 3082D  |
| Fremont, CA              |           |        | 3082B  |
| Mariposa, CA             |           |        | 3082A  |

## Revision History

**Original:** Testing of the FH7k2H to Radio Frequency Exposure.

**Revision A:** To add the Designation Information table and to add LTE and WLAN2 Data.

## RF Exposure Mobile Equipment Assessment (Multi Transmitter, Simultaneous Transmission)

### MPE Calculation:

$$\text{Power Density } (S) = \frac{EIRP}{4\pi d^2} \quad \text{Given: EIRP in mW or W and d in cm or m}$$

For multi-transmitter (including multi-band) equipment with simultaneous transmission, assessment of compliance to MPE limits is based on fractional analysis for each band of operation:  $\sum_i \frac{S(\text{Calculated})_i}{\text{MPE Limit}_i} \leq 1$ .

For Mixed Measurements, the calculation is modified to include multiple RF exposure assessment types:

$$\sum_i \frac{S(\text{Calculated})_i}{\text{MPE Limit}_i} + \sum_i \frac{S(\text{Measured})_i}{\text{MPE Limit}_i} + \sum_i \frac{SAR_i}{SAR \text{ Limit}_i} \leq 1.$$

The equipment is deemed to meet mobile RF exposure conditions when aggregate values are less than 1.

### US MPE Assessment

| Power Reported is:      |           | <input checked="" type="checkbox"/> Peak <input type="checkbox"/> Average                             |          |             |                        |                          |                       |
|-------------------------|-----------|---|----------|-------------|------------------------|--------------------------|-----------------------|
| Limit Used is:          |           | <input checked="" type="checkbox"/> General Population <input type="checkbox"/> Occupational Exposure |          |             |                        |                          |                       |
| Operating Band MHz      | Power dBm | Ant Type/Gain dBi   | EIRP dBm | Distance cm | MPE mW/cm <sup>2</sup> | Limit mW/cm <sup>2</sup> | S/Limit               |
| 13.56                   | NA        | NA  | -55.9    | 20          | 5.1*10 <sup>-10</sup>  | 0.98                     | 5.2*10 <sup>-10</sup> |
| 24150                   | NA        | NA  | 4.5      | 20          | 5.6*10 <sup>-4</sup>   | 1                        | 5.6*10 <sup>-4</sup>  |
| 782 (LTE Band 13)       | 23        | -2.64   | 20.4     | 20          | 0.022                  | 0.518                    | 0.042                 |
| 2440 (WLAN 2.4GHz Band) | 27.0      | 2.0   | 29.0     | 20          | 0.158                  | 1                        | 0.158                 |
| Aggregate:              |           |   |          |             |                        | 0.20                     |                       |
| Comment                 |           |   |          |             |                        | Pass                     |                       |

### IC MPE Assessment

| Power Reported is:      |           | <input checked="" type="checkbox"/> Peak <input type="checkbox"/> Average                             |          |            |                      |                        |                      |
|-------------------------|-----------|---|----------|------------|----------------------|------------------------|----------------------|
| Limit Used is:          |           | <input checked="" type="checkbox"/> General Population <input type="checkbox"/> Occupational Exposure |          |            |                      |                        |                      |
| Operating Band MHz      | Power dBm | Ant Type/Gain dBi   | EIRP dBm | Distance m | MPE W/m <sup>2</sup> | Limit W/m <sup>2</sup> | S/Limit              |
| 13.56                   | NA        | NA  | -55.9    | 0.2        | 5.1*10 <sup>-9</sup> | 2                      | 2.6*10 <sup>-9</sup> |
| 24150                   | NA        | NA  | 4.5      | 0.2        | 5.6*10 <sup>-3</sup> | 10                     | 5.6*10 <sup>-4</sup> |
| 782 (LTE Band 13)       | 23        | -2.64   | 20.4     | 20         | 0.22                 | 2.46                   | 0.089                |
| 2440 (WLAN 2.4GHz Band) | 27.0      | 2.0   | 29.0     | 20         | 1.58                 | 5.41                   | 0.292                |
| Aggregate:              |           |   |          |            |                      | 0.38                   |                      |
| Comment                 |           |   |          |            |                      | Pass                   |                      |

### EU MPE Assessment

| Power Reported is:      | <input checked="" type="checkbox"/> Peak <input type="checkbox"/> Average                             |                   |          |            |                      |                        |                      |
|-------------------------|---|-------------------|----------|------------|----------------------|------------------------|----------------------|
| Limit Used is:          | <input checked="" type="checkbox"/> General Population <input type="checkbox"/> Occupational Exposure |                   |          |            |                      |                        |                      |
| Operating Band MHz      | Power dBm   | Ant Type/Gain dBi | EIRP dBm | Distance m | MPE W/m <sup>2</sup> | Limit W/m <sup>2</sup> | S/Limit              |
| 13.56                   | NA  | NA                | -55.9    | 0.2        | $5.1 \times 10^{-9}$ | 2                      | $2.6 \times 10^{-9}$ |
| 24150                   | NA  | NA                | 4.5      | 0.2        | $5.6 \times 10^{-3}$ | 10                     | $5.6 \times 10^{-4}$ |
| 782 (LTE Band 13)       | 23  | -2.64             | 20.4     | 0.2        | 0.22                 | 3.85                   | 0.057                |
| 2440 (WLAN 2.4GHz Band) | 27.0  | 2.0               | 29.0     | 0.2        | 1.58                 | 10                     | 0.158                |
| Aggregate:              |   |                   |          |            |                      |                        | 0.22                 |
| Comment                 |   |                   |          |            |                      |                        | Pass                 |

### UK MPE Assessment

| Power Reported is:      | <input checked="" type="checkbox"/> Peak <input type="checkbox"/> Average                             |                   |          |            |                      |                        |                      |
|-------------------------|---|-------------------|----------|------------|----------------------|------------------------|----------------------|
| Limit Used is:          | <input checked="" type="checkbox"/> General Population <input type="checkbox"/> Occupational Exposure |                   |          |            |                      |                        |                      |
| Operating Band MHz      | Power dBm   | Ant Type/Gain dBi | EIRP dBm | Distance m | MPE W/m <sup>2</sup> | Limit W/m <sup>2</sup> | S/Limit              |
| 13.56                   | NA  | NA                | -55.9    | 0.2        | $5.1 \times 10^{-9}$ | $2.6 \times 10^{-9}$   | $2.6 \times 10^{-9}$ |
| 24150                   | NA  | NA                | 4.5      | 0.2        | $5.6 \times 10^{-3}$ | $5.6 \times 10^{-4}$   | $5.6 \times 10^{-4}$ |
| 782 (LTE Band 13)       | 23  | -2.64             | 20.4     | 0.2        | 0.22                 | 3.85                   | 0.057                |
| 2440 (WLAN 2.4GHz Band) | 27.0  | 2.0               | 29.0     | 0.2        | 1.58                 | 10                     | 0.158                |
| Aggregate:              |   |                   |          |            |                      |                        | 0.22                 |
| Comment                 |   |                   |          |            |                      |                        | Pass                 |

## **Summary:**

### ***Exemptions:***

Equipment demonstrating compliance by portable RF exposure exemption have been evaluated, without further testing, for use under either portable or mobile RF exposure configurations. Additional configurations including collocation or simultaneous transmission with other transmitters (including necessary separation distances) are subject to further assessment. Certain exemption criteria may define specific separation distances. It is assumed that the manufacturer shall design the equipment such that these minimum separation distance is met.

### ***MPE Calculation Results:***

Equipment demonstrating compliance with MPE calculations have been evaluated, without further testing, for use under mobile RF exposure configurations as identified herein. Additional configurations including collocation or simultaneous transmission with other transmitters (including necessary separation distances) are subject to further assessment. It is assumed that the manufacturer shall design the equipment such that the minimum separation distance of 20cm (or greater, as listed above) is met or that the manufacturer provides a protection guide (e.g. installation instructions) to the end user such that the antenna(s) may be installed in accordance with the manufacturer's instructions in such a manor to maintain the minimum separation distance.

### ***General Comments:***

The absorption and distribution of Electromagnetic energy in the body is a very complex phenomena that depends on the mass, shape and physiological condition of the body; the orientation of the body with respect to the fields; and, the electrical properties of the body and the environment. Variables that may play a substantial role in possible biological effects are those that characterize the environment (including but not limited to: ambient temperature, air velocity, relative humidity and body insulation); and those that characterize the individual (including but not limited to: age, gender, activity level and existing debilitation or disease). Because innumerable factors may interact to determine specific biological effects of exposure to electromagnetic fields, any protection guide should consider both intended and unintended operational environments and provide guidance for installation and use of the equipment such that proper separation distances can be maintained. (ANSI C95.1)

## APPENDIX A - RF Exposure Limits

### United States Compliance Requirements (1.1310):

#### *RF Exposure Evaluation Limits Occupational / Controlled Exposure*

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> )     | Averaging Time (minutes) |
|-----------------------|-------------------------------|-------------------------------|---|--------------------------|
| 0.3-3.0               | 614                           | 1.63                          | *(100)                                  | < 6                      |
| 3.0-30                | 1842 / f <sub>MHz</sub>       | 4.89 / f <sub>MHz</sub>       | *(900 / f <sub>MHz</sub> <sup>2</sup> ) | < 6                      |
| 30-300                | 61.4                          | 0.163                         | 1                                       | < 6                      |
| 300-1500              | --                            | --                            | f <sub>MHz</sub> / 300                  | < 6                      |
| 1500-100,000          | --                            | --                            | 5.0                                     | < 6                      |

#### *RF Exposure Evaluation Limits General Population / Uncontrolled Exposure*

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> )     | Averaging Time (minutes) |
|-----------------------|-------------------------------|-------------------------------|---|--------------------------|
| 0.3-1.34              | 614                           | 1.63                          | *(100)                                  | < 30                     |
| 1.34-30               | 824 / f <sub>MHz</sub>        | 2.19 / f <sub>MHz</sub>       | *(180 / f <sub>MHz</sub> <sup>2</sup> ) | < 30                     |
| 30-300                | 27.5                          | 0.073                         | 0.2                                     | < 30                     |
| 300-1500              | --                            | --                            | f <sub>MHz</sub> / 1500                 | < 30                     |
| 1500-100,000          | --                            | --                            | 1.0                                     | < 30                     |

\* Plane wave equivalent power density

Limit is calculated based on the mid-band frequency used in the operating frequency range.

### Exemption Limits for Stand-Alone SAR Evaluation:

In accordance with 47 CFR 1.1307(b)(3)(i)

| Exemption Threshold for Maximum Time Averaged Output Power or EIRP (mW) |   |  |
|---|---|--|
| Frequency (MHz)   | $0.5 \leq d \leq 20\text{cm}$   | $20\text{cm} < d \leq 40\text{cm}$   |
| 0.1 – 100,000   | $\leq 1$ (including $d < 0.5$ )   |  |
| 0.3 – 1.34  | $1.64 * 192 * d^2 \mid d \geq \lambda/2\pi$   |  |
| 1.34 – 30   | $1.64 * 345 * \frac{d^2}{f_{\text{MHz}}^2} \mid d \geq \lambda/2\pi$  |  |
| 30 – 300  | $1.64 * 0.383 * d^2 \mid d \geq \lambda/2\pi$   |  |
| 300 - 1500 -  | $1.64 * 0.00128 * d^2 * f_{\text{MHz}} \mid d \geq \lambda/2\pi, \text{ or}$<br>$1.64 * 2.04 * f_{\text{MHz}} * \left(\frac{d}{20}\right)^{-\text{Log}\left(\frac{60}{2040 * f_{\text{MHz}}^{1.5}}\right) - 4.5}$ | $1.64 * 0.00128 * d^2 * f_{\text{MHz}} \mid d \geq \lambda/2\pi, \text{ or}$<br>$1.64 * 2.04 * f_{\text{MHz}}$ |
| 1500 – 6000   | $164 * 1.92 * d^2 \mid d \geq \lambda/2\pi, \text{ or}$<br>$1.64 * 3060 * \left(\frac{d}{20}\right)^{-\text{Log}\left(\frac{60}{3060 * f_{\text{MHz}}^{0.5}}\right) - 1.5}$                                       | $1.64 * 1.92 * d^2 \mid d \geq \lambda/2\pi, \text{ or}$<br>$1.64 * 3060$                                      |
| 6000 – 100,000  | $1.64 * 1.92 * d^2 \mid d \geq \lambda/2\pi$  |  |

Equations have been modified from the published version to reflect consistent units of  $d$  in cm,  $P_{\text{th}}$  in mW (EIRP) and  $f$  in MHz.

## Canadian Compliance Requirements (RSS-102):

### *RF Exposure Evaluation Limits Occupational / Controlled Exposure:*

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m)              | Power Density (W/m <sup>2</sup> )    | Averaging Time (minutes)        |
|-----------------------|-------------------------------|--|--------------------------------------|---------------------------------|
| 0.003-10              | 170                           | 180  | --                                   | Instantaneous                   |
| 0.1-10                | --                            | $1.6 / f_{\text{MHz}}$                     | --                                   | 6                               |
| 1.29-10               | $193 / f_{\text{MHz}}^{0.5}$  | --   | --                                   | 6                               |
| 10-20                 | 61.4                          | 0.163                                      | 10                                   | 6                               |
| 20-48                 | $129.8 / f^{0.5}$             | $0.3444 / f_{\text{MHz}}^{0.25}$           | $44.72 / f_{\text{MHz}}^{0.5}$       | 6                               |
| 48-100                | 49.33                         | 0.1309                                     | 6.455                                | 6                               |
| 100-6000              | $15.60 f_{\text{MHz}}^{0.25}$ | $0.04138 f_{\text{MHz}}^{0.25}$            | $0.6455 f_{\text{MHz}}^{0.5}$        | 6                               |
| 6000-15000            | 137                           | 0.364                                      | 50                                   | 6                               |
| 15000-150,000         | 137                           | 0.364                                      | 50                                   | $616000 / f_{\text{MHz}}^{1.2}$ |
| 150,000-300,000       | $0.354 f_{\text{MHz}}^{0.5}$  | $9.40 \times 10^{-4} f_{\text{MHz}}^{0.5}$ | $3.33 \times 10^{-4} f_{\text{MHz}}$ | $616000 / f_{\text{MHz}}^{1.2}$ |

### *RF Exposure Evaluation Limits General Population / Uncontrolled Exposure*

| Frequency Range (MHz) | Electric Field Strength (V/m)   | Magnetic Field Strength (A/m)              | Power Density (W/m <sup>2</sup> )    | Averaging Time (minutes)        |
|-----------------------|---------------------------------|--|--------------------------------------|---------------------------------|
| 0.003-10              | 83                              | 90   | --                                   | Instantaneous                   |
| 0.1-10                | --                              | $0.73 / f$                                 | --                                   | 6                               |
| 1.1-10                | $87 / f_{\text{MHz}}^{0.5}$     | --   | --                                   | 6                               |
| 10-20                 | 27.46                           | 0.0728                                     | 2                                    | 6                               |
| 20-48                 | $58.07 / f_{\text{MHz}}^{0.25}$ | $0.1540 / f_{\text{MHz}}^{0.25}$           | $8.944 / f_{\text{MHz}}^{0.5}$       | 6                               |
| 48-300                | 22.06                           | 0.05852                                    | 1.291                                | 6                               |
| 300-6000              | $3.142 f_{\text{MHz}}^{0.3417}$ | $0.008335 f_{\text{MHz}}^{0.3417}$         | $0.02619 f_{\text{MHz}}^{0.6834}$    | 6                               |
| 6000-15000            | 61.4                            | 0.163                                      | 10                                   | 6                               |
| 15000-150,000         | 61.4                            | 0.163                                      | 10                                   | $616000 / f_{\text{MHz}}^{1.2}$ |
| 150,000-300,000       | $0.158 f_{\text{MHz}}^{0.5}$    | $4.21 \times 10^{-4} f_{\text{MHz}}^{0.5}$ | $6.67 \times 10^{-5} f_{\text{MHz}}$ | $616000 / f_{\text{MHz}}^{1.2}$ |

**Exemption Limits for Stand-Alone SAR Evaluation:**

| Exemption Limits (mW) at Separation Distance (mm) |    |     |     |     |     |     |     |     |     |     |
|---|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Freq(MHz)   | ≤5 | 10  | 15  | 20  | 25  | 30  | 35  | 40  | 45  | ≥50 |
| ≤300  | 71 | 101 | 132 | 162 | 193 | 223 | 254 | 284 | 315 | 345 |
| 450   | 52 | 70  | 88  | 106 | 123 | 141 | 159 | 177 | 195 | 213 |
| 835   | 17 | 30  | 42  | 55  | 67  | 80  | 92  | 105 | 117 | 130 |
| 1900  | 7  | 10  | 18  | 34  | 60  | 99  | 153 | 225 | 316 | 431 |
| 2450  | 4  | 7   | 15  | 30  | 52  | 83  | 123 | 173 | 235 | 309 |
| 3500  | 2  | 6   | 16  | 32  | 55  | 86  | 124 | 170 | 225 | 290 |
| 5800  | 1  | 6   | 15  | 27  | 41  | 56  | 71  | 85  | 97  | 106 |

**Exemption Limits for Stand-Alone Mobile Routine Evaluation:**

| Frequency (MHz) | RF Exposure Exemption Limit (mW) |
|-----------------|----------------------------------|
| <20             | 1000                             |
| 20-48           | $4490 / f_{\text{MHz}}^{0.5}$    |
| 48-300          | 600                              |
| 300-6000        | $13.1 f_{\text{MHz}}^{0.6834}$   |
| ≥6000           | 5000                             |



## Australian Radiation Protection and Nuclear Safety Agency Requirements (ARPANSA):

### *RF Exposure Evaluation Limits Occupational / Controlled Exposure:*

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m)  | Power Density (W/m <sup>2</sup> ) | Averaging Time (minutes) |
|-----------------------|-------------------------------|--------------------------------|-----------------------------------|--------------------------|
| 0.1 – 6.943           | 170                           | $4.9 / f_{\text{MHz}}$         | --                                | 30                       |
| 6.943-30              | $660 / f_{\text{MHz}}$        | $4.9 / f_{\text{MHz}}$         | --                                | 30                       |
| 30-400                | 61                            | 0.16                           | 10                                | 30                       |
| 400-2000              | $3 * f_{\text{MHz}}^{0.5}$    | $0.008 * f_{\text{MHz}}^{0.5}$ | $f_{\text{MHz}} / 40$             | 30                       |
| 2000-300,000          | --                            | --                             | 50                                | 30                       |

### *RF Exposure Evaluation Limits General Population / Uncontrolled Exposure*

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m)   | Power Density (W/m <sup>2</sup> ) | Averaging Time (minutes) |
|-----------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|
| 0.1 - 6.27            | 83                            | $2.2 / f_{\text{MHz}}$          | --                                | 30                       |
| 6.27 – 30             | $300 / f_{\text{MHz}}^{0.7}$  | $2.2 / f_{\text{MHz}}$          | --                                | 30                       |
| 30-400                | 27.7                          | 0.073                           | 2                                 | 30                       |
| 400-2000              | $1.375 f_{\text{MHz}}^{0.5}$  | $0.0037 * f_{\text{MHz}}^{0.5}$ | $f_{\text{MHz}} / 200$            | 30                       |
| 2000-300,000          | --                            | --                              | 10                                | 30                       |

### **Exemption Limits for Stand-Alone Evaluation:**

In accordance with ARPANSA RPS S-1 Advisory Note.

| Exemption Threshold for Maximum Time Averaged Output Power (mW) |                |              |
|---|----------------|--------------|
| Frequency (MHz)   | General Public | Occupational |
| 0.1 – 6000  | 20             | 100          |
| 6000 – 30,000   | 8              | 40           |
| 30,000 – 300,000  | 4              | 20           |

## New Zealand Requirements (NZS 2772.1):

### *RF Exposure Evaluation Limits Occupational / Controlled Exposure:*

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m)  | Power Density (W/m <sup>2</sup> ) | Averaging Time (minutes) |
|-----------------------|-------------------------------|--------------------------------|-----------------------------------|--------------------------|
| 0.1 – 1               | 610                           | $1.6 / f_{\text{MHz}}$         | --                                | 6                        |
| 1-10                  | $610 / f_{\text{MHz}}$        | $1.6 / f_{\text{MHz}}$         | --                                | 6                        |
| 10-400                | 61                            | 0.16                           | 10                                | 6                        |
| 400-2000              | $3 * f_{\text{MHz}}^{0.5}$    | $0.008 * f_{\text{MHz}}^{0.5}$ | $f_{\text{MHz}} / 40$             | 6                        |
| 2000-300,000          | 137                           | 0.36                           | 50                                | 6                        |

### *RF Exposure Evaluation Limits General Population / Uncontrolled Exposure*

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m)   | Power Density (W/m <sup>2</sup> ) | Averaging Time (minutes) |
|-----------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|
| 0.1 – 0.15            | 87                            | 5                               | --                                | 6                        |
| 0.15 – 1              | 87                            | $0.73 / f_{\text{MHz}}$         | --                                | 6                        |
| 1 – 10                | $87 / f_{\text{MHz}}^{0.5}$   | $0.73 / f_{\text{MHz}}$         | --                                | 6                        |
| 10-400                | 28                            | 0.073                           | 2                                 | 6                        |
| 400-2000              | $1.375 f_{\text{MHz}}^{0.5}$  | $0.0037 * f_{\text{MHz}}^{0.5}$ | $f_{\text{MHz}} / 200$            | 6                        |
| 2000-300,000          | 61                            | 0.16                            | 10                                | 6                        |

## Exemption Limits for Stand-Alone Evaluation:

Mean Power < 20mW

Mean power with duty cycle ≤ 50% and d > 2.5cm:  $\begin{cases} 7000 & | 0.1 < f_{\text{MHz}} < 450 \text{ MHz} \\ 630,000/f_{\text{MHz}} & | 450 < f_{\text{MHz}} < 2500 \text{ MHz} \end{cases} \text{ mW}$

## European Union Compliance Requirements 1999/519/EC

### *RF Exposure Evaluation Limits General Population / Uncontrolled Exposure*

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m)   | Power Density (W/m <sup>2</sup> ) | Averaging Time (minutes) |
|-----------------------|-------------------------------|---------------------------------|-----------------------------------|--------------------------|
| 0.003-0.150           | 87                            | 5.0                             | --                                | 6                        |
| 0.150-1.0             | 87                            | $0.73 / f_{\text{MHz}}$         | --                                | 6                        |
| 1.0-10                | $87 / f_{\text{MHz}}^{0.5}$   | $0.73 / f_{\text{MHz}}$         | --                                | 6                        |
| 10-400                | 28                            | 0.073                           | 2                                 | 6                        |
| 400-2000              | $1.375 f_{\text{MHz}}^{0.5}$  | $0.0037 * f_{\text{MHz}}^{0.5}$ | $f_{\text{MHz}} / 200$            | 6                        |
| 2000-300,000          | 61                            | 0.16                            | 10                                | 6                        |

*\*Power density limit applicable >100MHz*

### **Exemption Limits<sup>1</sup> for Stand-Alone SAR Evaluation:**

Head / Body: 20mW

Extremity: 40mW

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<sup>1</sup> EN 62479 Annex A, General Public

**General Reference Levels for Local Exposure (ICNIRP 1998):**

***RF Exposure Evaluation Limits  
Occupational / Controlled Exposure:***

| Frequency Range (MHz) | Electric Field Strength (V/m)         | Magnetic Field Strength (A/m)           | Power Density (W/m <sup>2</sup> ) | Averaging Time (minutes) |
|-----------------------|---------------------------------------|---|-----------------------------------|--------------------------|
| 0.00082-0.065         | 610                                   | 24.4                                    | --                                | 6                        |
| 0.065-1.0             | 610                                   | 1.6/f                                   | --                                | 6                        |
| 1.0-10                | 610 / f <sub>MHz</sub>                | 1.6/f                                   | --                                | 6                        |
| 10-400                | 61                                    | 0.16                                    | 10                                | 6                        |
| 400-2000              | 3.0 * f <sub>MHz</sub> <sup>0.5</sup> | 0.008 * f <sub>MHz</sub> <sup>0.5</sup> | f <sub>MHz</sub> / 40             | 6                        |
| 2000-300,000          | 137                                   | 0.36                                    | 50                                | 6                        |

***RF Exposure Evaluation Limits  
General Population / Uncontrolled Exposure***

| Frequency Range (MHz) | Electric Field Strength (V/m)         | Magnetic Field Strength (A/m)            | Power Density (W/m <sup>2</sup> ) | Averaging Time (minutes) |
|-----------------------|---------------------------------------|--|-----------------------------------|--------------------------|
| 0.003-0.150           | 87                                    | 5.0                                      | --                                | 6                        |
| 0.150-1.0             | 87                                    | 0.73 / f <sub>MHz</sub>                  | --                                | 6                        |
| 1.0-10                | 87 / f <sub>MHz</sub> <sup>0.5</sup>  | 0.73 / f <sub>MHz</sub>                  | --                                | 6                        |
| 10-400                | 28                                    | 0.073                                    | 2                                 | 6                        |
| 400-2000              | 1.375 f <sub>MHz</sub> <sup>0.5</sup> | 0.0037 * f <sub>MHz</sub> <sup>0.5</sup> | f <sub>MHz</sub> / 200            | 6                        |
| 2000-300,000          | 61                                    | 0.16                                     | 10                                | 6                        |

*\*Power density limit applicable >100MHz*

## General Reference Levels for Local Exposure (ICNIRP 2020):

### *RF Exposure Evaluation Limits Occupational / Controlled Exposure:*

| Frequency Range (MHz) | Electric Field Strength (V/m)   | Magnetic Field Strength (A/m)    | Power Density (W/m <sup>2</sup> ) | Averaging Time (minutes) |
|-----------------------|---------------------------------|----------------------------------|-----------------------------------|--------------------------|
| 0.1-30                | $1504 / f_{\text{MHz}}^{0.7}$   | $10.8 / f_{\text{MHz}}$          | --                                | 6                        |
| 30-400                | 139                             | 0.36                             | 50                                | 6                        |
| 400-2000              | $10.58 * f_{\text{MHz}}^{0.43}$ | $0.0274 * f_{\text{MHz}}^{0.43}$ | $0.29 * f_{\text{MHz}}^{0.86}$    | 6                        |
| 2000-6000             | --                              | --                               | 200                               | 6                        |
| 6000-300,000          | --                              | --                               | $275 / f_{\text{GHz}}^{0.177}$    | 6                        |
| 300,000               | --                              | --                               | 100                               | 6                        |

### *RF Exposure Evaluation Limits General Population / Uncontrolled Exposure*

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m)    | Power Density (W/m <sup>2</sup> ) | Averaging Time (minutes) |
|-----------------------|-------------------------------|----------------------------------|-----------------------------------|--------------------------|
| 0.1-30                | $671 / f_{\text{MHz}}^{0.7}$  | $4.9 / f_{\text{MHz}}$           | --                                | 6                        |
| 30-400                | 62                            | 0.163                            | 10                                | 6                        |
| 400-2000              | $4.72 f_{\text{MHz}}^{0.43}$  | $0.0123 * f_{\text{MHz}}^{0.43}$ | $0.058 * f_{\text{MHz}}^{0.86}$   | 6                        |
| 2000-6000             | --                            | --                               | 40                                | 6                        |
| 6000-300,000          | --                            | --                               | $55 / f_{\text{GHz}}^{0.177}$     | 6                        |
| 300,000               | --                            | --                               | 20                                | 6                        |

## Selected Excerpts:

Note 4: For frequencies of 100 kHz to 30 MHz, regardless of the far-field/near-field zone distinctions, compliance is demonstrated if neither peak spatial Electric Field or peak spatial Magnetic Field, over the projected whole-body space, exceeds the above reference level values.

Note 5: For frequencies of >30MHz to 6 GHz: within the far-field zone, compliance is demonstrated if one of peak spatial Incident Power Density, Electric Field or Magnetic Field, over the projected whole-body space, does not exceed the above reference level values (only one is required)

## Appendix B - References

1. ACMA Radiocommunications (Electromagnetic Radio – Human Exposure) Standard, 2014.
2. AS/NZS 2772.2, Radiofrequency fields – Principles and method of measurement and computation – 3 kHz to 300 GHz, 2011.
3. Australian Radiation Protection and Nuclear Safety Agency, ARPANSA RPS S-1, Standard for Limiting Exposure to Radiofrequency Fields 100 kHz to 300 GHz, 2021.
4. New Zealand Standard, NZS 2772.1, Radiofrequency Fields Part 1: Maximum Exposure Levels 3 kHz to 300 GHz, 1999.
5. Federal Communications Commission Knowledge Database (KDB) Publication 447498, “What are the RF exposure requirements and procedures for mobile and portable devices?” As in effect on the issue date of this report.
6. Title 47 Code of Federal Regulations, Part 1.1307(b)(3), “Determination of exemption.” As in effect on the issue date of this report.
7. Title 47 Code of Federal Regulations, Part 1.1310, “Radiofrequency radiation exposure limits.” As in effect on the issue date of this report.
8. Title 47 Code of Federal Regulations, Part 2.1091, “Radiofrequency radiation exposure evaluation: mobile devices.” As in effect on the issue date of this report.
9. ANSI C95.1 (2005) IEEE Standard for Safety Level with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 GHz, 2005.
10. Health Canada Safety Code 6 Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz, 2015.
11. Industry Canada GL-01 Guidelines for the Measurement of Radio Frequency Fields at Frequencies From 3 kHz to 300 GHz, Issue 3, March 2015.
12. Industry Canada RSS-102 Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) Issue 5, March 2015.
13. EC Council Recommendation 1999/519/EC “On the limitation of exposure of the general public to electromagnetic fields (0Hz to 300GHz),” (1999).
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15. European Committee for Electrotechnical Standardization. European Normative, EN 62479 Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz), 2010.
16. International Commission on Non-Ionizing Radiation Protection. Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz). Health Physics 74 (4): 494-522; 1998.
17. International Commission on Non-Ionizing Radiation Protection Statement on the "Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz). Health Physics 97(3):257-259, 2009.
18. International Commission on Non-Ionizing Radiation Protection. Guidelines for Limiting Exposure to Electromagnetic Fields (100kHz to 300 GHz). Health Physics 118-(5): 483-524; 2020.