

## SAR Exclusion Letter

FCC Guidance document reference: 447498 D01 General RF Exposure Guidance v07

ISED Guidance document reference: RSS-102 Issue 6; Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

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For 100 MHz to 6 GHz and test separation distances  $\leq 50$  mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following (§1.1307(b)(3)(i)(B)):

$$P_{th}(mW) = \begin{cases} ERP_{20cm} \cdot \left(\frac{d}{20}\right)^x & d \leq 20 \\ ERP_{20cm} & 20 < d \leq 40 \end{cases}$$

where

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

and

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

- $f_{GHz}$  is the RF channel transmit frequency in GHz
    - This device transmits in the 902-928 MHz band. 928 MHz is the worst-case and is used for all applicable calculations.
  - Power and distance are rounded to the nearest mW and mm before calculation
  - The result is rounded to one decimal place for comparison
  - The values 3.0 and 7.5 are referred to as numeric thresholds below
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### FCC Calculations:

- $f_{GHz} = 0.928$
- $d = 1.553$  cm
  - When the device is properly worn using the attached belt clip, the separation distance is 1.553 cm. The separation distance is measured from the outer housing of the device where it is closest to the antenna.

$$ERP_{20cm}(mW) = 2040 \cdot 0.928 = 1893.12 mW$$

$$x = -\log_{10}\left(\frac{60}{1893.1 \cdot \sqrt{0.928}}\right) = 1.4828$$

$$P_{th}(mW) = 1893.1 \cdot \left(\frac{1.553}{20}\right)^{1.4828} = 42.8 mW$$

ISED Calculations: Using Section “6.3 SAR exemption limits, Table 11” found in RSS-102

**Table 11: Power limits for exemption from routine SAR evaluation based on the separation distance**

Frequency (MHz)	≤ 5 mm (mW)	10 mm (mW)	15 mm (mW)	20 mm (mW)	25 mm (mW)	30 mm (mW)	35 mm (mW)	40 mm (mW)	45 mm (mW)	> 50 mm (mW)
≤ 300	45	116	139	163	189	216	246	280	319	362
450	32	71	87	104	124	147	175	208	248	296
835	21	32	41	54	72	96	129	172	228	298
1900	6	10	18	33	57	92	138	194	257	323
2450	3	7	16	32	56	89	128	170	209	245
3500	2	6	15	29	50	72	94	114	134	158
5800	1	5	13	23	32	41	54	74	102	128

“When the operating frequency of the device is between two frequencies located in table 11, linear interpolation shall be applied for the applicable separation distance. If the separation distance of the device is between two distances located in table 11, linear interpolation may be applied for the applicable frequency. Alternatively, the limit corresponding to the smaller distance may be employed. For example, in case of a 7 mm separation distance, either use the exception value for a 5 mm separation distance or interpolate between the limits corresponding to 5 mm and 10 mm separation distances.”

To interpolate a power limit solving for separation distance:

$$P_{interpolated} = \frac{d_{target} - d_{nextlowest}}{d_{nexthighest} - d_{nextlowest}} * (P_{nexthighestdist} - P_{nextlowestdist}) + P_{nextlowestdist}$$

To interpolate a power limit solving for frequency:

$$P_{interpolated} = \frac{f_{target} - f_{nextlowest}}{f_{nexthighest} - f_{nextlowest}} * -(P_{nextlowestfreq} - P_{nexthighestfreq}) + P_{nextlowestfreq}$$

Using the following values:

$d_{\text{target}} = 15.53 \text{ mm}$

$f_{\text{target}} = 928 \text{ MHz}$

We can calculate the following values:

Frequency (MHz)	≤5 mm (mW)	10 mm (mW)	15 mm (mW)	15.53 mm (mW)	20 mm (mW)
≤300	45	116	139		163
450	32	71	87		104
835	21	32	41	42.378	54
928			38.99	40.39	52.17
1900	6	10	18	19.59	33
2450	3	7	16		32
3500	2	6	15		29
5800	1	5	13		23

**Conclusion:**

The power threshold for FCC is 42.8 mW and for ISED is 40.39 mW. We will be using the ISED (40.39 mW) measurement as a most conservative value and for cross-compatibility.

The DUT has the following maximum specifications:

- Peak Output Power: 22 dBm
- Maximum Tune-up Power: 22 dBm or 158.5 mW
- ISED  $P_{\text{th}}$ (mW): 40.39 mW

$$\text{Maximum Duty Cycle} = \frac{P_{\text{th}}(\text{mW})}{\text{Maximum Tuneup Power}(\text{mW})} * 100$$

$$\text{Maximum Duty Cycle} = \frac{40.39 \text{ mW}}{158.5 \text{ mW}} * 100$$

$$\text{Maximum Duty Cycle} = 25.5\%$$

The DUT is excluded from ISED/FCC SAR testing if the duty cycle is guaranteed to not exceed 25.5%.