

RF Exposure Evaluation for 13.56 MHz RFID

As per 447498 D01 General RF Exposure Guidance v06 General SAR test exclusion guidance

4.3.1 (c)

For frequencies below 100 MHz, the following may be considered for SAR test exclusion

- a) 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:
$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{F(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR, and } \leq 7.5 \text{ for 10-g extremity SAR}$$
where $F(\text{GHz})$ is the RF channel transmit frequency in GHz

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 in step b) below

The test exclusions are applicable only when the minimum test separation distance is \leq 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is $<$ 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.

- b) For 100 MHz to 6 GHz and test separation distances $>$ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following
 - 1) $\{[\text{Power allowed at numeric threshold for 50 mm in step a}]] + [(\text{test separation distance} - 50 \text{ mm}) \cdot (f(\text{MHz})/150)]\} \text{ mW, for 100 MHz to 1500 MHz}$
 - 2) $\{[\text{Power allowed at numeric threshold for 50 mm in step a}]] + [(\text{test separation distance} - 50 \text{ mm}) \cdot 10]\} \text{ mW, for } > 1500 \text{ MHz and } \leq 6 \text{ GHz}$
- c) For frequencies below 100 MHz, the following may be considered for SAR test exclusion
 - 1) For test separation distances $>$ 50 mm and $<$ 200 mm, the power threshold at the corresponding test separation distance at 100 MHz in step b) is multiplied by $[1 + \log(100/f(\text{MHz}))]$
 - 2) For test separation distances \leq 50 mm, the power threshold determined by the equation in c) 1) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$
 - 3) SAR measurement procedures are not established below 100 MHz

P=Power limit in mW at 100 MHz

D=Distance in mm

F=frequency in GHz

f=frequency in MHz

Step a (100 MHz at 5mm)

$$(P/D)*F^{0.5}=3$$

$$P=3D/F^{0.5}=3\times 5/0.1^{0.5}=47.43\text{mW}$$

Step b P=47.43mW

Step C1

$$P*(1+\log 100/f)=47.43*(1+\log(100/13.56))=47.43*1.867=88.6\text{mW}$$

For distance below 50mm

Step c2

$$0.5*\text{step C1}=88.6*0.5=44.3\text{ mW}$$

Field strength measured at 10m FS=43.2 dBuV/m

$$\text{EIRP} = \text{FS} + 20 \log(\text{distance in m}) - 104.8 = \text{FS} - 84.8 = -41.6\text{dBm} = 6.918 \times 10^{-5}\text{mW}$$

Verdict:

At 13.56 MHz the device meets the power threshold limit of 44.3mW for a distance less than 50mm.