

Appendix A: RF Exposure Evaluation

Device Type: 13.56 MHz NFC / RFID Transmitter

Model: CSM

Measurement Distance: 3 meters

Peak Field Strength: 48.7 dBμV/m

Evaluation Standards: FCC 47 CFR §1.1307, §1.1310, §2.1091/2.1093; OET Bulletin 65; KDB 447498 D04; ISED RSS-102 Issue 6

1. Introduction

This report evaluates the RF exposure compliance of the 13.56 MHz NFC/RFID transmitter in accordance with FCC 47 CFR §1.1307, §1.1310, §2.1091; OET Bulletin 65; KDB 447498; and ISED RSS-102 Issue 6. The device is classified as a Mobile RF device and is intended to be installed and operated with a minimum separation distance of 20 cm between the radiator and the user. BLE and 13.56 MHz transmitters do not operate simultaneously; therefore, simultaneous transmission RF exposure summation is not applicable.

2. Applicable Limits

FCC Power Density Limit (13.56 MHz):

$$S = \frac{180}{f^2} \text{ mW/cm}^2$$

At 13.56 MHz:

$$S = 0.979 \text{ mW/cm}^2$$

FCC general population limit: 0.979 mW/cm²

ISED Limit Basis: Maximum permitted EIRP = 1 W (30 dBm), including tolerance

3. Field Strength Measurement at (E_{3m}) 3 meters

Measured field strength **E_{3m}**: 2.72×10^{-3} V/m.

4. Power Density Calculation (20 cm Evaluation Distance)

For MPE comparison, the measured field strength was conservatively scaled to a separation distance of 20 cm using inverse-distance scaling.

$$E_{0.2m} = 2.72 \times 10^{-4} \times (3/0.2) = 4.08 \times 10^{-3} \text{ V/m}$$

$$S = E^2/377 = 4.42 \times 10^{-8} \text{ W/m}^2 = 4.42 \times 10^{-9} \text{ mW/cm}^2$$

$$\text{Applying +1 dB tune-up tolerance: } S_{tot} = S \times 10^{1/10} = 5.57 \times 10^{-9} \text{ mW/cm}^2$$

5. Comparison to MPE Limits

Worst-case calculated power density at 20 cm (including +1 dB tolerance): 5.57×10^{-9} mW/cm²

FCC limit at 13.56 MHz: 0.979 mW/cm²

The calculated value is approximately 1.76×10^8 times below the applicable FCC limit.

6. EIRP

The equivalent isotropically radiated power (EIRP) derived from the measured field strength is:

$EIRP = 2.224 \times 10^{-8} \text{ W} = -46.53 \text{ dBm}$

Applying +1 dB tune-up tolerance:

Worst-case EIRP = -45.53 dBm

7. FCC RF Exposure Statement

This device complies with FCC RF exposure requirements for the general population/uncontrolled environments as specified in 47 CFR §1.1310. Portable exemption thresholds under §1.1307 are not applicable because compliance is demonstrated using MPE evaluation at 20 cm.

8. ISED RF Exposure Statement

The 13.56 MHz transmitter operates exclusively at a fixed ISM-band frequency (13.553–13.567 MHz) designated as a Category 1 ISM frequency under the Radio Regulations and RSS-Gen. Under Section 6.6 of RSS-102 Issue 6, fixed-frequency ISM-band equipment with a maximum time-averaged EIRP not exceeding 1 W (30 dBm) is exempt from routine RF exposure evaluation. The worst-case EIRP derived from the 3-metre field strength measurement, including +1 dB tune-up tolerance, is -45.53 dBm (2.80×10^{-8} W). This is more than eight orders of magnitude below the 1 W (30 dBm) Section 6.6 exemption threshold. The device therefore satisfies the Section 6.6 exemption from routine evaluation. Annex B of RSS-102 has been completed and submitted in accordance with Section 6.6 requirements.

9. Conclusion

The device complies with all applicable FCC and ISED RF exposure requirements for mobile operation at a minimum separation distance of 20 cm. BLE and 13.56 MHz transmitters do not operate simultaneously. No additional RF exposure testing is required.