

INGEO MPE Evaluation Report

FCC Part 22 & 24 Certification	
FCC ID:	J9CINGEO1
Model:	INGEO1

STATEMENT OF CERTIFICATION

The data, data evaluation and equipment configuration represented herein are a true and accurate representation of the measurements of the sample's radio frequency interference emissions characteristics as of the dates and at the times of the test under the conditions herein specified.

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In this application we seek approval for the INGEO1 wireless asset tracking device for use in mobile configuration. Based on the FCC CFR 47 §1.1310, 2.1091, we have conclude that the INGEO1 device will comply with the FCC rules on RF exposure for mobile devices. The following analysis will demonstrate such compliance. The analysis will be done in both cellular and PCS bands which operates in North American.

RF Exposure Limit

According to FCC CFR 47 §1.1310: the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (Minutes)
(A) Limits For Occupational / Control Exposures (f = frequency)				
30-300	61.4	0.163	1.0	6
300-1500	...	...	f/300	6
1500-100,000	...	...	5.0	6
(B) Limits For General Population / Uncontrolled Exposure (f = frequency)				
30-300	27.5	0.073	0.2	30
300-1500	...	...	f/1500	30
1500-100,000	...	...	1.0	30

Friis Transmission Formula

Friis transmission formula:

$$P_d = (P_{out} * G) / (4\pi R^2)$$

Where,

P_d = power density (mW/cm²)

P_{out} = output power to antenna (mW)

G = gain of antenna in linear scale

R = distance between observation point and center of the radiator (cm)

INGEO Operating in Cellular Band (824 - 849 MHz)

The highest peak conducted output power of INGEO measured in cellular band is 24.2 dBm when the INGEO operates in channel 1013. At this frequency, the antenna has a gain of – 0.7 dBi. The resulted power density at a distance of 20cm can be calculated as follows:

$$\text{EIRP} = \text{ERP} \times 1.64 = 224 \times 1.64 = 367 \text{ mW}$$

$$\begin{aligned} \text{Power Density} &= (\text{EIRP} * \text{DutyCycle}) / (4\pi R^2) \\ &= 367 * 1 / (4 * \pi * 20^2) \\ &= 0.073 \text{ mW/cm}^2 \end{aligned}$$

Where using a DutyCycle of 1 is the worst case evaluation. The INGEO device typically transmits only for a few seconds every 2 minutes. R is 20cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the table above and can be derived as follows:

$$\text{MPE limit} = 824/1500 = 0.55 \text{ mW/cm}^2$$

As per the above analysis, the resulted power density is below the MPE limit. Therefore the INGEO device in cellular band is compliant with the FCC rules on RF exposure.

INGEO Operating in PCS Band (1850 - 1910 MHz)

The maximum EIRP of the INGEO device measured in PCS band is 234 mW when the INGEO operates in channel 25. The resulted power density at a distance of 20cm can be calculated as follows:

$$\begin{aligned} \text{Power Density} &= (\text{EIRP} * \text{DutyCycle}) / (4\pi R^2) \\ &= 234 * 1 / (4 * \pi * 20^2) \\ &= 0.046 \text{ mW/cm}^2 \end{aligned}$$

Where using a DutyCycle of 1 is the worst case evaluation. The INGEO device typically transmits only for a few seconds every 2 minutes. R is 20cm.

The MPE limit for General Population/Uncontrolled Exposure is shown in the table above:

$$\text{MPE limit at 1850 MHz} = 1.0 \text{ mW/cm}^2$$

As per the above analysis, the resulted power density is below the MPE limit. Therefore the INGEO device in the PCS band is compliant with the FCC rules on RF exposure.

Conclusion

The INGEO asset tracking device meets the mobile 20 cm separation distance as specified in Section 2.1091 of the FCC rules. An appropriate RF exposure compliance statement will be placed in the User's Guide to direct all user's of the device, that a 20 cm separation distance must be maintained between the device and the user at all times. This device is only used to track asset packages. There are no hand held or body worn applications for this device.