Castra MPE Evaluation Report

FCC Part 22 & 24 Certification	
FCC ID:	**J9CCASTRA**
Model:	**Castra**

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 modular approval for the Castra wireless tracking module to be used in a mobile configuration. Based on the FCC CFR 47 §1.1310, 2.1091, we have concluded that the Castra module will comply with the FCC rules on RF exposure for mobile devices if the antenna again does not exceed 7 dBi in cellular and 4 dBi in PCS. 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/cm^2)
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)

Castra Operating in Cellular Band (824 - 849 MHz)

The highest peak conducted output power of Castra module measured in cellular band is 23.92 dBm while the Castra module operates in CDMA channel 777. Take the worst case as an example, in which an antenna with 7dBi gain is used. The resulted power density at a distance of 20cm can be calculated as follows:

$$EIRP = 23.92 + 7 = 30.92 \text{ dBm} = 1235.9 \text{ mW}$$

$$
\begin{aligned}
\text{Power Density} &= (EIRP * DutyCycle) / (4\pi R^2) \\
&= 1235.9 * 1 / (4*\pi* 20^2) \\
&= 0.246 \text{ mW/cm}^2
\end{aligned}
$$

Where DutyCycle is 1 for CDMA (the worst case) and 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 Castra module in cellular band is compliant with the FCC rules on RF exposure.

Castra Operating in PCS Band (1850 - 1910 MHz)

The highest peak conducted output power of Castra module measured in PCS is 24.75 dBm while the Castra module operates in CDMA channel 25. In the worst case, where an antenna gain is 4dBi, the resulted ERP can be expressed as follows:

$$ERP = 24.75 + 4 - 2.15 = 26.6 \text{ dBm } (0.457W) < 3 \text{ W}$$

In FCC CFR 47 §2.1091, it states that mobile devices identified in the section §2.1091(c) that operate at frequencies above 1.5 GHz with an ERP of 3 watts or more are required to perform routine environmental evaluation for RF exposure prior to equipment authorization or use; otherwise, they are categorically excluded.

Therefore, as we can see this resulted ERP is below 3W, the routine environmental evaluation for RF exposure prior to equipment authorization or use for Castra module in PCS band is categorically excluded.

Conclusion

The Castra module 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.