

Handheld RF Exposure

The IP30 is a RFID tag reader and is an optional accessory for several Intermec ultra-mobile computers. IP30 uses two separate transmitters: FCC ID: EHAIM4 (915 MHz RFID) and EHA-BTM4 (Bluetooth).

The CN4 family of computers contains Wide-area Wireless LAN (WWLAN), WiFi or WLAN(802.11b/g) and Bluetooth transmitters. This document addresses the collocation for the UMTS/GSM versions of CN4 under the following:

FCC ID: EHA-03CN4 (CN4 with UMTS/GSM-802.11b/g-BT)

Utilizing recent FCC guidance, the highest output transmitter IP30, FCC ID: EHAIM4 (RFID) will contain the collocation grant information for the IP30 – CN4 configurations.

KDB 447498 D01 Mobile Portable RF Exposure v04 (4)(c)(iii)(1)-(3) was reviewed for RF Safety test requirement for the combined IP30 – CN4 configuration:

“c) Extremity and body SAR evaluation considerations

- i) PDA, UMPC (Ultra-Mobile PC), and devices with similar form factor and configurations that allow next to the ear transmissions are tested according to the handset procedures in IEEE Std 1528-2003, OET Bulletin 65 Supplement C 01-01 and the *specific FCC test procedures*.
- ii) Devices that allow transmissions while worn next to the body using an accessory are tested with the device and associated accessories in all applicable orientations, at the minimum separation distance, using a flat phantom.
- iii) Contact the FCC Laboratory to determine whether:
 - (1) Hand SAR is required for hand-held and hand-operated devices with output power $> 1000 \cdot [f(\text{GHz})]^{-0.5}$ mW that are designed with the hand operating closer than 5 cm from the antenna during normal use.²⁵
 - (2) Extremity SAR is required for wrist, feet or ankle worn devices.
 - (3) Body SAR is required for hand-held and hand-operated or wrist, feet and ankle worn devices that operate closer than 5 cm to the body and the output power is $> 300 \cdot [f(\text{GHz})]^{-0.5}$ mW. “

Discussion for items (iii)(1)-(3) related to IP30 - CN4 with UMTS/GSM configuration.

Item i), the CN4 in a stand-alone configuration can be used as a cellular phone hand-set against the head or body and in “walkie-talkie” Push-To-Talk (PTT) mode, these conditions are currently addressed with SAR evaluations under the above FCC ID’s. The use against the head or PTT mode is not likely while the IP30 is attached to the CN4.

Item ii), the IP30 RFID reader cannot operate while worn next to the body. The user is instructed to operate the reader from the hand, aimed toward the remote tags, and pull the trigger to engage the transmitter.

Item iii), the attached pictures show the closest spacing between the users hands and the radio antennas contained in the CN4 to be 6-cm. The closes spacing from the IP30 RFID antenna to the hand is 7-cm.

Since the spacing is greater than 5-cm between the antennas and the user’s hands, SAR testing is not required. The following MPE estimates are used to demonstrate compliance of the IP30 – CN4 system.

²⁵ Hand-held and hand-operated devices are inherently designed to only transmit while operated in the user’s hands.







EIRP Calculation of RF Exposure

cm
23.0
inches
9.06

CFR 47 Part 15.247 (b)(5)

(b)(5) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See Sec. 1.1307(b)(1) of this chapter.

The EUT is categorically excluded from routine environmental evaluation per 47 CFR 2.1091(c).

System Description

IP30, RFID hand grip scanner with CN4 mobile computer

The IP30 RFID scanner is operated by the user only when in the hand.

The user manual instruct to provide for a separation distance of 23-cm or greater distance between the IP30 / CN4 system antennas and the head or torso of the user or near by persons.

IP30

The IP30 is a RFID hand grip option. It contains the IM4 RFID PC Card and Bluetooth Radios

FCC ID: EHAIM4 915 MHz

FCC ID: EHA-BTM4 Bluetooth

The IP30 power output will be 26 dBm maximum to ensure that the WAN (UMTS/GSM) radio will not be damaged by operation in close proximity to the RFID radio.

The radios all transmit on separate antennas.

CN4

The CN4 is a hand held computer. The unit contains WWAN, WLAN and Bluetooth radios.

FCC ID: EHA-03CN4 **all transmitters for this model are filed under a single FCC ID**

The UMTS/GSM radio operates at anytime when the CN4 is connected to the IP30, operation against the head or body is not considered normal when the IP30 is used to read RFID tags as the IP30 should be aimed toward those tags.

The WLAN and Bluetooth radios share a PCB but transmit on separate antennas, they cannot transmit simultaneously, the WLAN portion contributes the most RF energy for this calculation.

Radio Disc / Rule	MHz -	MHz	Watts (conducted)	Watts (ERP)	Watts (EIRP)	Antenna Gain (dBi)
IP30						
RFID radio FCC ID: EHAIM4 IC: 1223A-IM4						
15C	902.75	927.25	0.400			5.2
Bluetooth Radio FCC ID: EHA-BTM4 IC: 1223A-BTM4						
15C	2402	2480	0.00964			0
FCC ID: EHA-03CN4 (UMTS/GSM-WLAN-BT) IC: 1223A-01CN4						
UMTS-GSM						
22H	824.2	848.8	1.486	0.708		1.14
24E	1850.2	1909.8	0.891		1.862	1.59
802.11bg radio (DHIB)						
15C	2412	2462	0.175			-0.045
Bluetooth radio (DHIB) {Cannot operate simultaneous with 802.11bg transmitter}						
15C	2402	2480	0.00156			-1.65

EIRP Calculation of RF Exposure

cm inches
23.0 9.06

Table 1 in 47 CFR 1.1310 defines the maximum permissible exposure (MPE) for the general population. The exposure level at the distance listed from the EUT's transmitting antenna is calculated using the general equation:

Calculations cm inches
23.0 9.06

The exposure level at a 23 cm distance from the EUT's transmitting antenna is calculated using the general equation (See OET 65, Page 19, Eq. 4):

$$S = (PG)/4\pi R^2$$

Where: S = power density (mW/cm²)

P = power input to the antenna (mW)

G = numeric power gain relative to an isotropic radiator

R = distance to the center of the radiation of the antenna (23 cm = limit for MPE estimates)

PG = EIRP

Solving for S, the maximum power densities 23 cm from the transmitting antennas are summarized in the following tables:

RFID Radio 915 MHz
FCC ID: EHAIM4
IC: 1223A-IM4

IP30 yagi antenna worst case EIRP

Calculation for exposure at 23 cm distance

Antenna Description	Antenna Type	Antenna Part No.	Transmit Freq. (MHz)	Peak Conducted Power (mW)	Gain (dBi)	Pwr Density @ 23 cm mW/cm ²	Pwr Density Limit mW/cm ²	Power Density Ratio
Intermec IP30	yagi	NA	915	400.000	5.2	0.1992	0.610	0.326636

Bluetooth
FCC ID: EHA-BTM4
IC: 1223A-BTM4

IP30 Bluetooth PC trace antenna worst case EIRP

Calculation for exposure at 23 cm distance

Antenna Description	Antenna Type	Antenna Part No.	Transmit Freq. (MHz)	Peak Conducted Power (mW)	Gain (dBi)	Pwr Density @ 23 cm mW/cm ²	Pwr Density Limit mW/cm ²	Power Density Ratio
PC trace	microstrip	NA	2450	9.640	0	0.001450	1.0	0.001450

FCC ID: EHA-03CN4
IC: 1223A-01CN4

CN4 UMTS-GSM antenna with highest power frequency band worst case EIRP

UMTS-GSM

Calculation for exposure at 23 cm distance

Antenna Description	Antenna Type	Antenna Part No.	Transmit Freq. (MHz)	Peak Conducted Power (mW)	Gain (dBi)	Pwr Density @ 23 cm mW/cm ²	Pwr Density Limit mW/cm ²	Power Density Ratio
CN4 850 / 1900	linear	NA	850	1486.000	1.14	0.2906	0.558	0.520858
CN4 850 / 1900	linear	NA	1900	891.000	1.59	0.1933	1.0	0.193291

802.11abg Radio (DHIB)

CN4 802.11bg antenna with highest power frequency band worst case EIRP

Calculation for exposure at 23 cm distance

Antenna Description	Antenna Type	Antenna Part No.	Transmit Freq. (MHz)	Peak Conducted Power (mW)	Gain (dBi)	Pwr Density @ 23 cm mW/cm ²	Pwr Density Limit mW/cm ²	Power Density Ratio
CN4 DHIB	linear	NA	2450	175.000	-0.045	0.0261	1.0	0.026054

Bluetooth

CN4 GSM-802.11bg-BT Bluetooth chip antenna worst case EIRP {Cannot operate simultaneous with 802.11bg transmitter}

Calculation for exposure at 23 cm distance

Antenna Description	Antenna Type	Antenna Part No.	Transmit Freq. (MHz)	Peak Conducted Power (mW)	Gain (dBi)	Pwr Density @ 23 cm mW/cm ²	Pwr Density Limit mW/cm ²	Power Density Ratio
CN4 BT chip	linear	NA	2450	1.600	-1.65	0.0002	1.0	0.000165

EIRP Calculation of RF Exposure

cm inches
23.0 9.06

Collocated Transmitter Calculation of RF Exposure

Per FCC TCB Training April 3, 2002

"Devices operating in multiple frequency bands

When RF exposure evaluation is required for TCB approval

Separate antennas – estimated minimum separation distances may be considered for the frequency bands that do not require evaluation or TCB approval, however, the estimated distance should take into account the effect of collocated transmitters. (Note 24)

Note 24 According to multiple frequency exposure criteria, the ratio of field strength or power density to the applicable exposure limit at the exposure location should be determined for each transmitter and the sum of these ratios must not exceed 1.0 for the location to be compliant."

Worst Case Exposure for IP30 / CN4 when using collocated transmitters.

Calculation for exposure at 23 cm distance

Transmitter FCC ID: Antenna Description	Antenna Type	Antenna Part No.	Transmit Freq. (MHz)	Peak Conducted Power (mW)	Gain (dBi)	Pwr Density @ 23 cm mW/cm ²	Pwr Density Limit mW/cm ²	Power Density Ratio
FCC ID: EHAIM4 IP30 yagi	yagi	NA	915	400.00	5.2	0.1992	0.610	0.326636
FCC ID: EHA-BTM4 PC trace	microstrip	NA	2450	9.64	0	0.0015	1.0	0.001450
FCC ID: EHA03CN4 UMTS-GSM 802.11bg	linear	NA	850	1486.00	1.14	0.2906	0.558	0.520858
	chip	NA	2450	175.00	-0.045	0.0261	1.0	0.026054
							ratio limit	
Total							1.0	0.874998

The worst case configuration for collocated transmitters and antennas is shown.

The ratio of exposure compared the limit when totaled does not exceed 1.0.