

Maximum Permissible Exposure (MPE) & Exposure evaluation

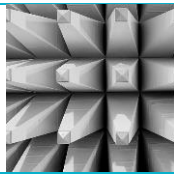
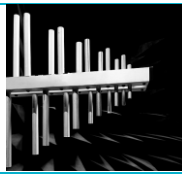
Report identification number: 1-3265/16-01-17

Certification numbers and labeling requirements	
FCC ID	Z4NRF-R400
IC number	9941A-RFR400
HVIN (Hardware Version Identification Number)	Ha-VIS RF-R400
PMN (Product Marketing Name)	Ha-VIS RF-R400-US
FVIN (Firmware Version Identification Number)	-/-
HMN (Host Marketing Name)	-/-

This test report is electronically signed and valid without handwriting signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

Document authorized:

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EUT technologies:

Technologies:	Max. power conducted: (AVG)	Max. antenna gain:	Min. pathloss:
RFID Reader ISM 902 – 928 MHz	Declared 30 dBm	6 different antenna types: see tables below	see tables below

See CTC advanced test report 1-3265/16-01-05-A for reference

Prediction of MPE limit at given distance - FCC

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where: S = Power density
P = Power input to the antenna
G = Antenna gain
R = Distance to the center of radiation of the antenna

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled “Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure”

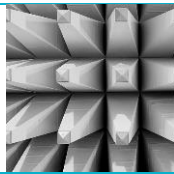
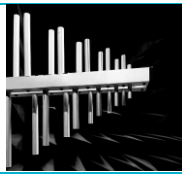
Frequency Range (MHz)	Power Density (mW/cm ²)	Averaging Time (minutes)
300 -1500	f/1500	30
1500 - 100000	1.0	30

where f = Frequency (MHz)

Prediction: worst case

	Technology	ISM 902 - 928	ISM 902 - 928	ISM 902 - 928
	Antenna	Harting Ha-VIS RF-ANT LR10 US	Harting Ha-VIS RF-ANT MR20 US	Harting Ha-VIS RF-ANT WR30 US
P	Maximum output power	30 dBm	30 dBm	30 dBm
L	Path loss	0 dB	0 dB	0 dB
G	Antenna gain	-30 dBi	-1.2 dBi	5.2 dBi
S	MPE limit for uncontrolled exposure	0.60 mW/cm ²	0.60 mW/cm ²	0.60 mW/cm ²
	Calculated Power density:	0.60 mW/cm²	0.60 mW/cm²	0.60 mW/cm²
	Calculated Distance:	0.36 cm (< 20 cm)	10.02 cm (< 20 cm)	20.93 cm

	Technology	ISM 902 - 928	ISM 902 - 928	ISM 902 - 928
	Antenna	Harting Ha-VIS RF-ANT WR80 US	Harting Ha-VIS RF-ANT WR24 US	Harting Ha-VIS LOCFIELD
P	Maximum output power	30 dBm	30 dBm	30 dBm
L	Path loss	1.5 dB	0 dB	0 dB
G	Antenna gain	7.1 dBi	5.9 dBi	-7 dBi
S	MPE limit for uncontrolled exposure	0.60 mW/cm ²	0.60 mW/cm ²	0.60 mW/cm ²
	Calculated Power density:	0.60 mW/cm²	0.60 mW/cm²	0.60 mW/cm²
	Calculated Distance:	21.92 cm	22.70 cm	5.14 cm (< 20 cm)



Prediction of MPE limit at given distance - IC

RSS-102, Issue 5, 2.5.2 and Table 4

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5} \text{ W}$ (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834} \text{ W}$ (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

Prediction: worst case

	Technology	ISM 902 - 928	ISM 902 - 928	ISM 902 - 928
	Antenna	Harting Ha-VIS RF-ANT LR10 US	Harting Ha-VIS RF-ANT MR20 US	Harting Ha-VIS RF-ANT WR30 US
P	Maximum output power	30 dBm	30 dBm	30 dBm
L	Path loss	0 dB	0 dB	0 dB
G	Antenna gain	-30 dBi	-1.2 dBi	5.2 dBi
S	MPE limit for uncontrolled exposure	2.73 W/m ²	2.73 W/m ²	2.73 W/m ²
	Calculated Power density: $S = PG / 4\pi R^2$	2.73 W/m²	2.73 W/m²	2.73 W/m²
	Calculated Distance:	0.54 cm (< 20 cm)	14.9 cm (< 20 cm)	31.1 cm

	Technology	ISM 902 - 928	ISM 902 - 928	ISM 902 - 928
	Antenna	Harting Ha-VIS RF-ANT WR80 US	Harting Ha-VIS RF-ANT WR24 US	Harting Ha-VIS LOCFIELD
P	Maximum output power	30 dBm	30 dBm	30 dBm
L	Path loss	1.5 dB	0 dB	0 dB
G	Antenna gain	7.1 dBi	5.9 dBi	-7 dBi
S	MPE limit for uncontrolled exposure	2.73 W/m ²	2.73 W/m ²	2.73 W/m ²
	Calculated Power density: $S = PG / 4\pi R^2$	2.73 W/m²	2.73 W/m²	2.73 W/m²
	Calculated Distance:	32.5 cm	33.7 cm	7.63 cm (<20 cm)