RF Exposure Evaluation Report

1. Product Information

Manufacturer	Furuno Electric Co., Ltd. 9-52 Ashihara-cho, Nishinomiya city, Hyogo, 662-8580 Japan
Trade name	Furuno
Type	RTR-136
Model	Transceiver for RADAR SENSOR DRS4DL X-Class
Product Description	Ship radar station operating in the band 9300–9500 MHz
FCC ID	ADB9ZWRTR136
Frequency Range	9380MHz ~ 9440MHz
Peak Envelope Power (PEP)	4kW
Antenna Gain (G_p)	21.5dBi
Beam Width (θ)	5.2°
Maximum Pulse Width (τ)	0.8μs
Pulse Repetition Frequency (PRF)	360Hz
Minimum separation distance	0.73m

2. Evaluation method and Limit

FCC requirements

According to FCC CFR 47 part1 1.1307 (b)(3)(i)(C): The criteria listed in the following table shall be used to determine the exemption of further evaluation.

RF Source frequency (MHz)	Threshold ERP (watts)
0.3-1.34	1,920 R^2.
1.34-30	3,450 R^2/f^2.
30-300	3.83 R^2.
300-1,500	0.0128 $R^2 f$.
1,500-100,000	19.2R^2.

R is the separation distance and is 0.73m instructed in the installation manual.

Threshold ERP* is

$ERP_{TH} = 19.2 \times 0.73^2 = 10.23$ [W]

* ERP: refer to FCC CFR 47 part1 1.1307 (b)(2)

3. Evaluation Results

Calculated ERP

$$ERP = PEP \times 10^{\wedge}\left(\frac{G_p - 2.15}{10}\right) \times (\tau \times PRF) \times \frac{\theta}{360}$$

$$\mathrm{ERP} = 4000 \times 10\text{^}\left(\frac{21.5 - 2.15}{10}\right) \times (0.8 \times 10^{-6} \times 360) \times \frac{5.2}{360} = 1.43 \ \text{[W]} \leq 10.23 \ \text{[W]}$$

where:

PEP is converted to the mean power using the pulse width and the pulse repetition frequency.

G_p is converted to a gain relative to a dipole.

The antenna rotates continuously over 360 degrees in the horizontal plane and illuminates the subjects only by its main lobe. Therefore, time-averaged power is derated by the beamwidth and the angle of rotation.