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Scanter 1000 Series Antenna Power Density Analysis

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Record of Changes

ECR/ECO	Description	Rev	Date
	Released.	A	2013-06-21
	Increased peak power from 4 W to 8 W. Evaluated failure modes. Released.	B	See header

Contents

1 Introduction

1.1 Purpose

The purpose of this document is to provide an analysis of the power density in the vicinity of a Scanter SC1xxx (Astra) radar system.

2 References

Ref.	Doc. No. / Source	Title
[1]	ICNIRP Publications, 1998. (www.icnirp.de)	ICNIRP Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz). Published in “Health Physics” April 1998, Volume 74, Number 4, p. 495.

3 Definitions

dBW	Logarithmic power measure 10 $\log_{10}(P/P_0)$ where P_0=1W

4 Power density

4.1 Exposure limits

Estimating the power density at a given point in the vicinity of a radiating antenna requires knowledge of the near-field distribution of the antenna power on a suitable aperture. For the antenna used in the Scanter 1K radar systems, the antenna design data are not directly available, as this antenna is sourced from an external supplier. Instead, an aperture distribution has been fitted to the known far-field, with the phase and amplitude across the aperture being adjusted as required.

The resulting electrical field strength in the near vicinity to the antenna has been calculated using a planar aperture located at the parabolic antenna surface, replacing the aperture fields with the equivalent current density. For electrically large antennas, the average power density (*S*) is related to the electrical field amplitude (*E*) and free-space impedance (η) through

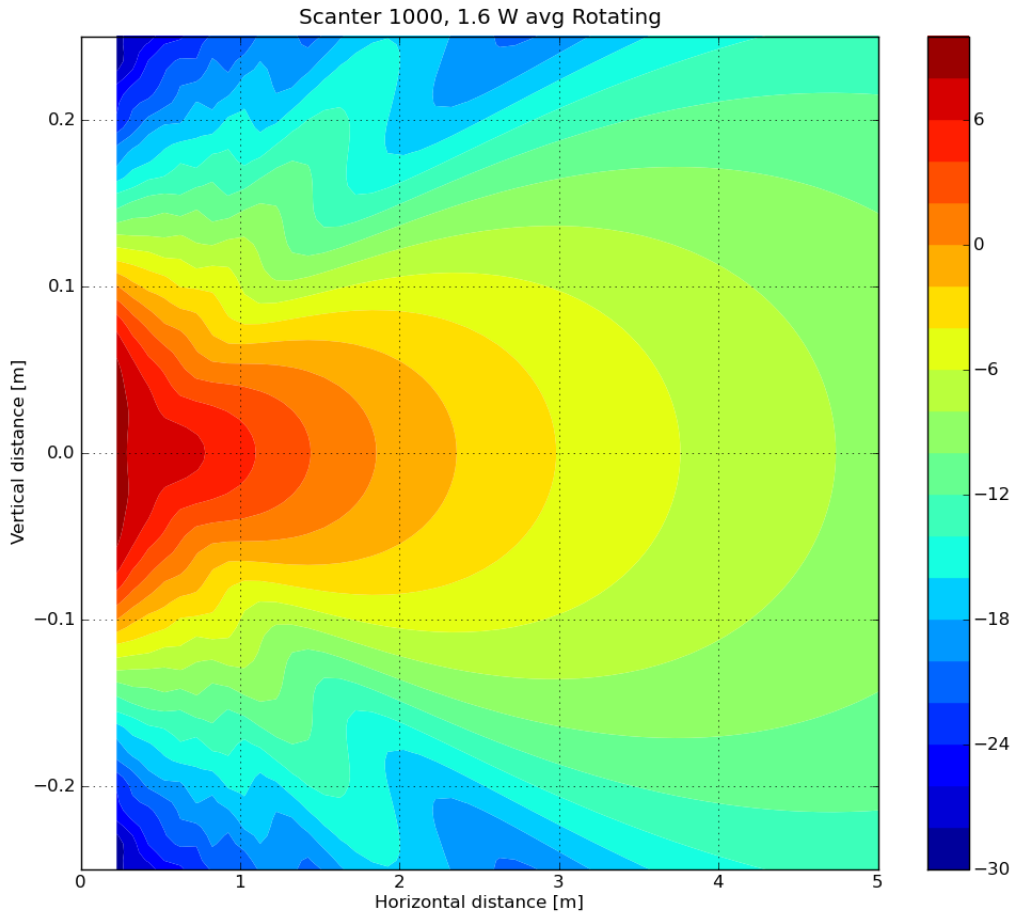
$$S = \frac{|E|^2}{2\eta}$$

The resulting fields are evaluated with respect to the ICNIRP Guidelines [1] for exposure to electromagnetic radiation. According to [1], the maximum recommended exposure to electromagnetic radiation is:

- Occupational exposure 50 W/m^2 (17 dBW/m^2)
- General public 10 W/m^2 (10 dBW/m^2)

4.2 Normal operation

For the Scanter SC1xxx the normal operation worst-case scenario is a transmission with a peak power of 8 W and a duty cycle of 20% equivalent to an average power of 1.6 W.



Figur 1 Power density for 1.6 W average power transmitted with a rotating antenna. The contour levels are power density in dBW/m^2. The start of the plot indicates the approximate radius of the radome.

4.3 Failure mode: Transmitter duty cycle

The transmitter is designed for a duty cycle between 0% and 20%. Software controls the duty cycle and limits this to 20 %. A duty beyond 20 % will be a fault in the radar. In such a case, the power source for the transmitter is designed to be gradually depleted. An average power higher than 3.5 W cannot be achieved.

4.4 Failure mode: Antenna rotation

During normal operation the software controlling the transmitter detects a non-rotating antenna and turns the transmission off.
In the service controls of the Scanter SC1xxx radar, the rotation of the antenna can be turned off deliberately while continuing transmission. Assess to the service controls is restricted to service personnel with access to the Terma Radar Service Tool.

5 Summary

The analysis shows that the power density is at the limit for exposure to the general public at the radius of the radome, and well below the limit for occupational exposure for normal operation of a Scanter SC1xxx radar.

A failure mode with increased duty cycle of the transmitter can lead to an increase in average power from 1.6 W to 3.5W equivalent to 3.4dB. Inspection of figure 1 shows that the limit for exposure to the general public is less than 0.8 m.

A conservative recommendation of a 1 meter safety distance (both vertical and horizontal) from a Scanter SC1xxx radar shall be used. This recommendation also covers failure modes of the radar.