



Product Service

**Choose certainty.
Add value.**

Report On

RF Exposure Assessment of the
Japan Radio Company
Marine VHF Radio (DSC)

Document 75902880 Report 05 Issue 1

August 2008



Product Service

TUV Product Service Ltd, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuvps.co.uk

REPORT ON

RF Exposure Assessment of the
Japan Radio Company
Marine VHF Radio (DSC)

Document 75902880 Report 05 Issue 1

August 2008

PREPARED FOR

Japan Radio Company
1-1 Shimorenjaku 5 Chome
Mitaka-Shi
Tokyo 181-8510
Japan

PREPARED BY

A handwritten signature in black ink, appearing to read 'A Miller', positioned above a horizontal line.

A Miller
Principal Engineer

APPROVED BY

A handwritten signature in black ink, appearing to read 'M Jenkins', positioned above a horizontal line.

M Jenkins
Authorised Signatory

DATED

07 August 2008



Product Service

CONTENTS

Section		Page No
1	REPORT SUMMARY	3
1.1	Introduction	4
1.2	Brief Summary of Results	5
1.3	Product Information	6
1.4	Summary	6
2	TEST DETAILS	7
2.1	Rationale for Assessment of the RF Exposure	8
2.2	Defined Limits	9
2.3	Establishing Wavelength and 1/4 Wavelength	9
2.4	Far Field Calculations	10
2.5	Field Summary	10
3	FIGURES	11
3.1	Field Representations – ICNIRP	12
3.2	Field Representations – FCC	14
3.3	Field Representations – IC	16
4	DISCLAIMERS AND COPYRIGHT	18
4.1	Disclaimers and Copyright	19



Product Service

SECTION 1

REPORT SUMMARY

RF Exposure Assessment of the
Japan Radio Company
Marine VHF Radio (DSC)



Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the RF Exposure Assessment of the Japan Radio Company Marine VHF Radio (DSC) to the requirements of the applied test specifications.

Objective	To perform RF Exposure Assessment to determine the Equipment Under Test's (EUT's) compliance of the applied rules..
Applicant	Japan Radio Company Ltd
Manufacturer	Japan Radio Company Ltd
Manufacturing Description	Marine VHF Radio (DSC)
Model Number(s)	JHS-780D
Hardware Version	Not supplied
Software Version	Not supplied

Test Specification/Issue/Date

1. OET Bulletin 65 Edition 97-01 August 1997 - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
2. RSS-102 Issue 2 November 2005 Radio frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
3. EN50392:2004 - Generic standard to demonstrate the compliance of electronic and electrical apparatus with the basic restrictions related to human exposure to electromagnetic fields (0 Hz - 300 GHz).

Related Document(s)

4. National Council on Radiation Protection and Measurements (NRP) - Report No. 86(1986) "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields".
5. Health Canada's Safety Code: Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 KHz to 300 GHz.
6. FCC Guidelines for Evaluating exposure to RF Emissions - 47 CFR § 1.1310; 47 CFR § 1.1307(b) & 47 CFR § 80.83.
7. EN 50383:2002 - Basic standard for the calculation and measurement of electromagnetic field strength and SAR related to human exposure from radio base stations and fixed terminal stations for wireless telecommunication systems (110 MHz - 40 GHz).
8. IEEE Std C95.1-2005: IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3KHz to 300GHz.



1.2 BRIEF SUMMARY OF RESULTS

1.2.1 General Public Exposure Levels

Antenna Gain (Numeric)	Peak Output Power (mW)	Field	Calculated RF Exposure at 2.00 m (200 cm)	General Public Exposure Limit	
1.995	50000	S	1.985 Wm-2	2.00 Wm-2	ICNIRP
		S	0.1985 mW/cm2	0.20 mW/cm2	FCC 47 CFR § 1.1310
		S	1.985 Wm-2	2.00 Wm-2	Canada's RF Safety Code 6
		E	27.354 V/m	28.00 V/m	ICNIRP
		E	27.354 V/m	27.50 V/m	FCC 47 CFR § 1.1310
		E	27.354 V/m	28.00 V/m	Canada's RF Safety Code 6
		H	0.073 A/m	0.073 A/m	ICNIRP
		H	0.073 A/m	0.07 A/m	FCC 47 CFR § 1.1310
		H	0.073 A/m	0.163 A/m	Canada's RF Safety Code 6

The calculations have shown that they **meet** the General Public Exposure Levels described in the ICNIRP Guidelines, FCC 47 CFR § 1.1310 Guidelines and the Health Canada's RF exposure guideline Safety Code 6 and ICNIRP Guidelines at **200 cm**, the point of investigation.

1.2.2 Occupational Exposure Levels

Antenna Gain (Numeric)	Peak Output Power (mW)	Field	Calculated RF Exposure at 2.00 m (200 cm)	Occupational Exposure Limit	
1.995	50000	S	1.985 Wm-2	10.00 Wm-2	ICNIRP
		S	0.1985 mW/cm2	5.00 mW/cm2	FCC 47 CFR § 1.1310
		S	1.985 Wm-2	10.00 Wm-2	Canada's RF Safety Code 6
		E	27.354 V/m	61.00 V/m	ICNIRP
		E	27.354 V/m	27.50 V/m	FCC 47 CFR § 1.1310
		E	27.354 V/m	60.00 V/m	Canada's RF Safety Code 6
		H	0.073 A/m	0.16 A/m	ICNIRP
		H	0.073 A/m	N/A	FCC 47 CFR § 1.1310
		H	0.073 A/m	0.16 A/m	Canada's RF Safety Code 6

The calculations have shown that they **meet** the Occupational Exposure Levels described in the ICNIRP Guidelines, FCC 47 CFR § 1.1310 Guidelines and the Health Canada's RF exposure guideline Safety Code 6 and ICNIRP Guidelines at **200 cm**, the point of investigation.



Product Service

1.3 PRODUCT INFORMATION

1.3.1 Attestation

The wireless device described within this report has been shown to be capable of compliance with the basic restrictions related to human exposure to electromagnetic fields (10 MHz - 300 MHz) - General public. The calculations shown in this report were made in accordance the procedures specified in the applied test specification(s)

1.3.2 Technical Description

The Equipment Under Test was a Japan Radio Company Marine VHF Radio (DSC). A full technical description can be found in the manufacturer's documentation.

The wireless device described within this report has been shown to be capable of compliance with the basic restrictions related to human exposure to electromagnetic fields (10 MHz - 300 MHz) - General public. The calculations shown in this report were made in accordance the procedures specified in the applied test specification(s).

All reported calculations were carried out on the relevant information supplied for the Marine VHF Radio (DSC) to demonstrate compliance with the applied test specification(s) the sample assessed was found to comply with the requirements of the applied rules.

1.4 SUMMARY

The RF exposure assessment is based upon the following criteria:

The Marine VHF Radio (DSC) operates in the frequency range of 156.025MHz to 157.425MHz

The numeric gain of the Marine VHF Radio (DSC) is 1.995.

The Marine VHF Radio (DSC) radio power is a maximum 50000¹ Milliwatt.

The point of investigation is 200 cm (2.000 m).

The antenna gain of 3 dBi.

Note ¹: The applicant has declared a maximum output power of 100 Watts and an operating duty cycle of one minute on/one minute off (50%). Therefore an average output power of 50 Watts has been used to perform the calculations within this report.



Product Service

SECTION 2

TEST DETAILS

RF Exposure Assessment of the
Japan Radio Company
Marine VHF Radio (DSC)



2.1 RATIONALE FOR ASSESSMENT OF THE RF EXPOSURE

The aim of the assessment report is to evaluate the compliance boundary for a set of given input power(s) according to the basic restrictions (directly or indirectly via compliance with reference levels) related to human exposure to radio frequency electromagnetic fields.

The chosen assessment method to establish the compliance boundary in the far-field region is the reference method as defined in BS EN50383:2002 Clause 5.2; E-field or H-field calculation.

The method of calculation used is defined in BS EN50383:2002; Clause 8.2.2, 8.2.3 and 8.2.4.

The calculated values have been compared with limits provided in the ICNIRP guidelines.

Calculations can be made in three separate regions, based on distance from the antenna. These are called:

- far-field region,
- radiating near-field region,
- reactive near-field region.

The theory that defines these regions is given in EN50383:2002 Annex A.

Far-field region

As shown in EN50383 Annex A, the far-field calculations are accurate when the distance, r , from an antenna of length D to a point of investigation is greater than

$$r = \frac{2D^2}{\lambda}$$

Where, r is the distance from the antenna to the point of investigation.

Radiating near-field region

The radiating near-field region of an antenna of length D as shown in EN50383 Annex A, this region is defined by

$$\frac{\lambda}{4} < r < \frac{2D^2}{\lambda}$$

Reactive near-field region

The reactive near-field region of an antenna as shown in EN50383 Annex A, this region is defined by

$$r \leq \frac{\lambda}{4}$$

Where, r is the distance from the antenna to the point of investigation.

Recommend $\lambda/4$ as the boundary between the radiated near-field and reactive near-field for RF exposure compliance assessment.



2.2 DEFINED LIMITS

Normative Reference: ICNIRP Advice on Limiting Exposure to Electromagnetic Fields (0-300GHz). Table A4, Reference Levels for General Public Exposure to Time Varying Electric & Magnetic Fields. Vol 15 No.2. 2004. The defined limits are in accordance with 47 CFR § 1.1310 Radiofrequency radiation exposure limits.

Reference levels for general public exposure to time-varying electric and magnetic fields (unperturbed rms values)

At 156.000 MHz

Power density (Wm ⁻²)	= 2.00	ICNIRP
Power density (mWcm ²)	= 0.20	FCC 47 CFR § 1.1310
Power density (Wm ⁻²)	= 2.00	Canada's RF Safety Code 6
E-Field (Vm ⁻¹)	= 28.00	ICNIRP
E-Field (Vm ⁻¹)	= 27.50	FCC 47 CFR § 1.1310
E-Field (Vm ⁻¹)	= 28.00	Canada's RF Safety Code 6
H-Field (Am ⁻¹)	= 0.073	ICNIRP
H-Field (Am ⁻¹)	= 0.07	FCC 47 CFR § 1.1310
H-Field (Am ⁻¹)	= 0.163	Canada's RF Safety Code 6

Reference levels for occupational exposure to time-varying electric and magnetic fields (unperturbed rms values)

At 156.000 MHz

Power density (Wm ⁻²)	= 10.00	ICNIRP
Power density (mWcm ²)	= 5.00	FCC 47 CFR § 1.1310
Power density (Wm ⁻²)	= 10.00	Canada's RF Safety Code 6
E-Field (Vm ⁻¹)	= 61.00	ICNIRP
E-Field (Vm ⁻¹)	= 27.50	FCC 47 CFR § 1.1310
E-Field (Vm ⁻¹)	= 60.00	Canada's RF Safety Code 6
H-Field (Am ⁻¹)	= 0.16	ICNIRP
H-Field (Am ⁻¹)	= N/A	FCC 47 CFR § 1.1310
H-Field (Am ⁻¹)	= 0.16	Canada's RF Safety Code 6

2.3 ESTABLISHING WAVELENGTH AND 1/4 WAVELENGTH

Frequency (MHz)	$\lambda = \frac{3 \times 10^8}{f}$		$\frac{\lambda}{4}$	
	m	cm	m	cm
156.000	1.9231	192.31	0.4808	48.08
156.725	1.9142	191.42	0.4785	47.85
157.425	1.9057	190.57	0.4764	47.64



2.4 FAR FIELD CALCULATIONS

The following calculations are based on: 3 dBi gain antenna

P = 50.000 (Power (Watts)) or 50000 (Power milliwatts)
G = 1.995 (Numeric Gain)
r = 200 (Distance (centimetres)) or 2.000 (Distance (meters))

The power flux:

$$S = \frac{PG_{(\theta, \phi)}}{4\pi r^2}$$

S = 1.985 W/m²
S = 0.198 mW/cm²

The electric field strength:

$$E = \frac{\sqrt{30PG_{(\theta, \phi)}}}{r}$$

E = 27.354 V/m

The magnetic field strength:

$$H = \frac{E}{\eta_0}$$

H = 0.073 A/m

The calculations meet the General Public Exposure Levels described in the ICNIRP Guidelines.
The calculations meet the General Public Exposure Levels described in the FCC 47CFR§1.1310
The calculations meet the General Public Exposure Levels described in the Canada's RF Safety Code 6

The calculations meet the Occupational Exposure Levels described in the ICNIRP Guidelines.
The calculations meet the Occupational Exposure Levels described in the FCC 47CFR§1.1310
The calculations meet the Occupational Exposure Levels described in the Canada's RF Safety Code 6

2.5 FIELD SUMMARY

Worst case frequency 156.000 MHz

The Reactive near-field region (from antenna) is less than : 0.481 m (48.1 cm)
The Radiating near-field region is greater than : 0.479 m (47.9 cm)
The Radiating near-field region is less than : 1.731 m (173.1 cm)
The Far-field region is greater than : 1.731 m (173.1 cm)



Product Service

SECTION 3

FIGURES

3.1 FIELD REPRESENTATIONS – ICNIRP

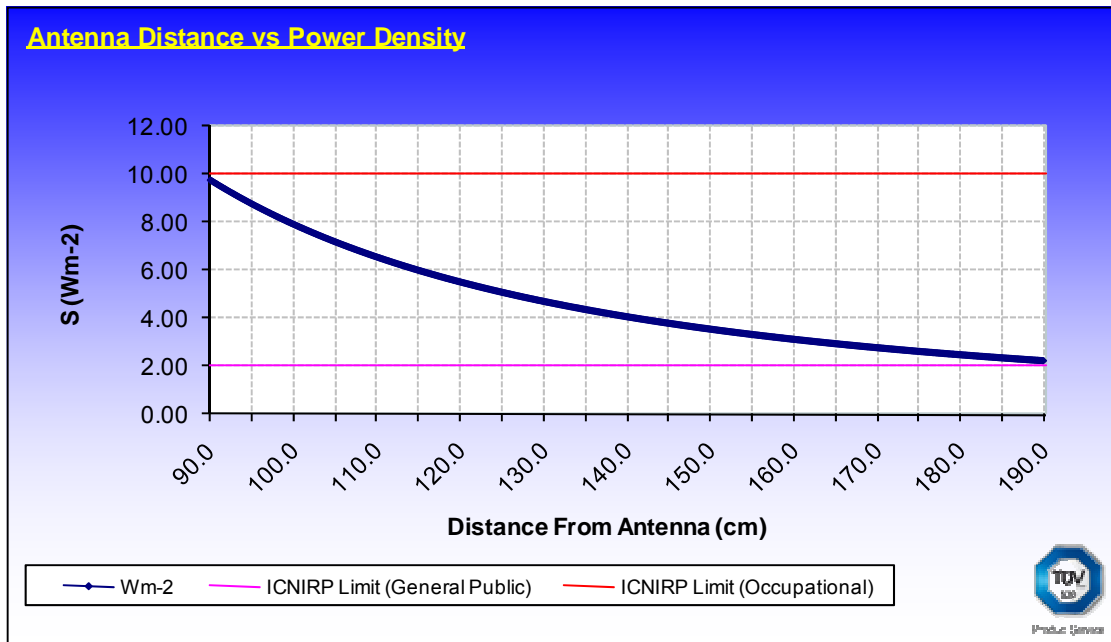


Figure 1 - This graph shows the S field (W/cm²) strength value with regards to distance from the Antenna (cm)

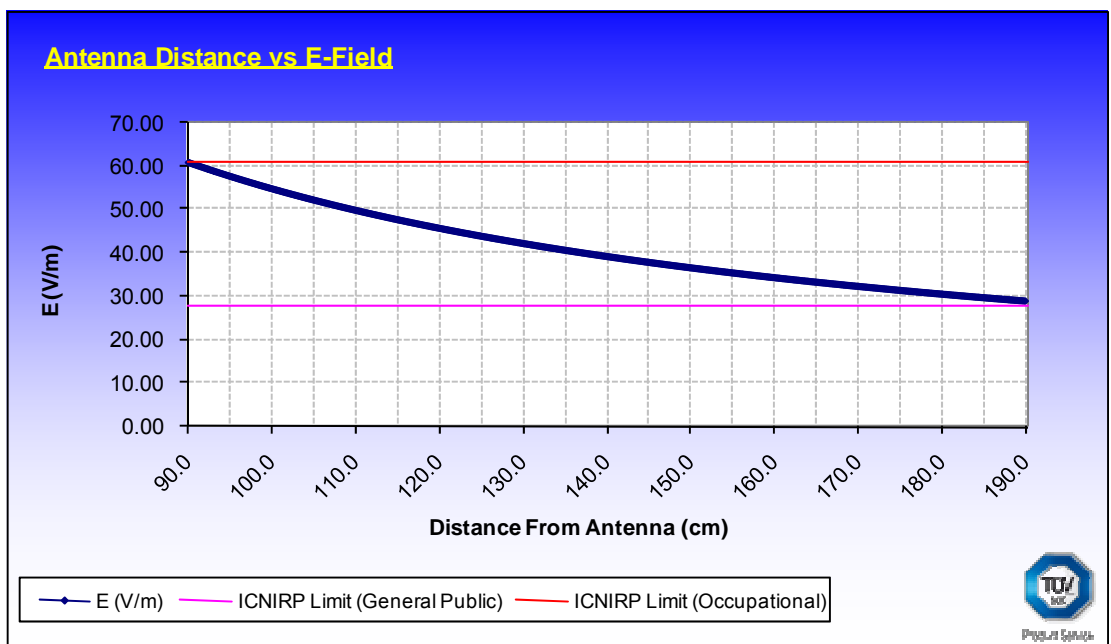


Figure 2 - This graph shows the E field (V/m) strength value with regards to distance from the Antenna (cm).

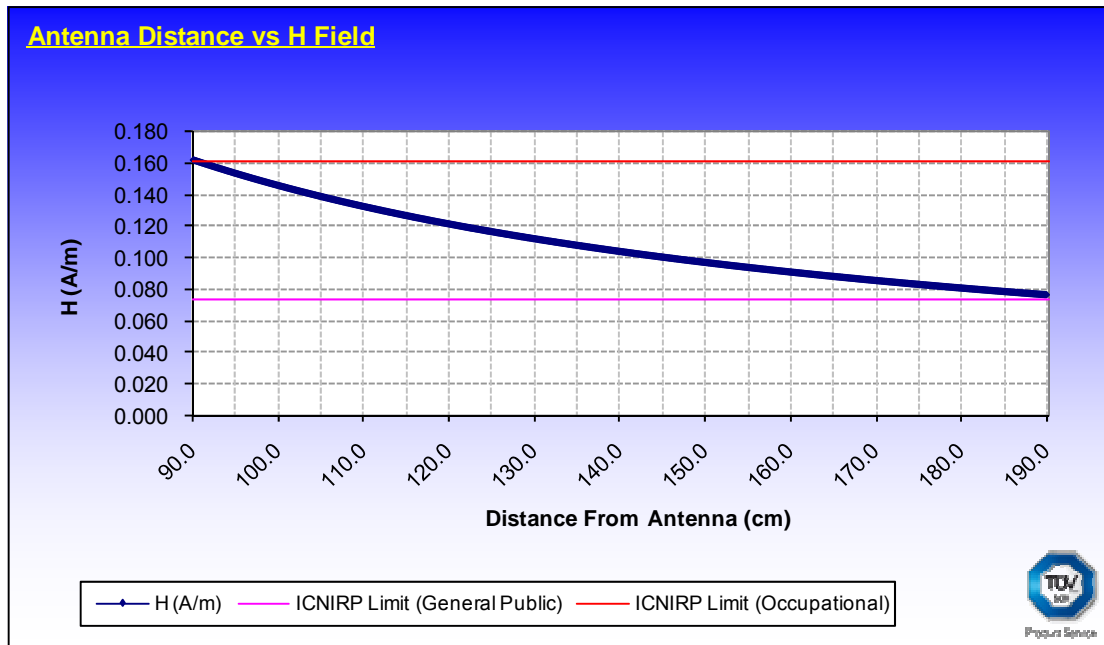


Figure 3 - This graph shows the H field (A/m) strength value with regards to distance from the Antenna (cm).

3.2 FIELD REPRESENTATIONS – FCC

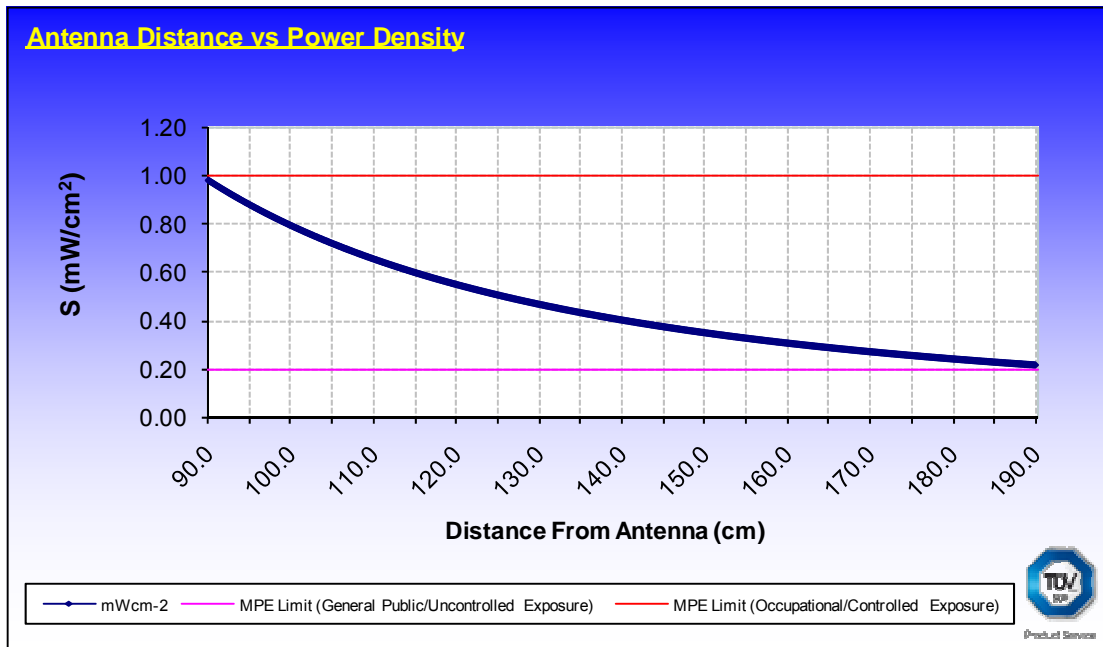


Figure 4 - This graph shows the S field (mW/cm²) strength value with regards to distance from the Antenna (cm)

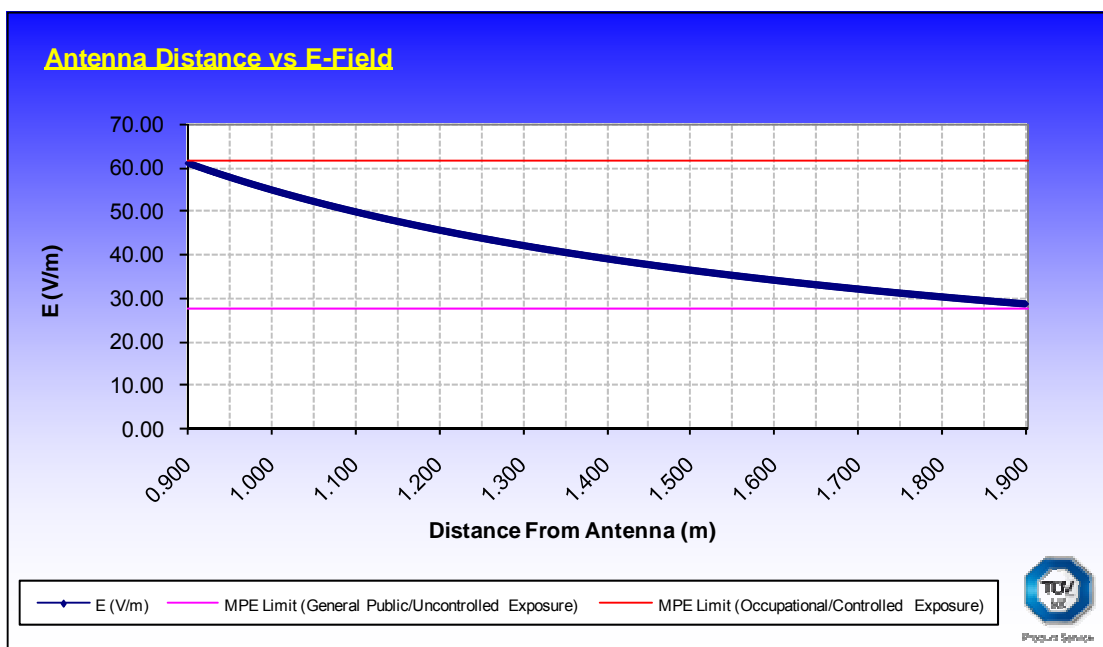


Figure 5 - This graph shows the E field (V/m) strength value with regards to distance from the Antenna (cm).

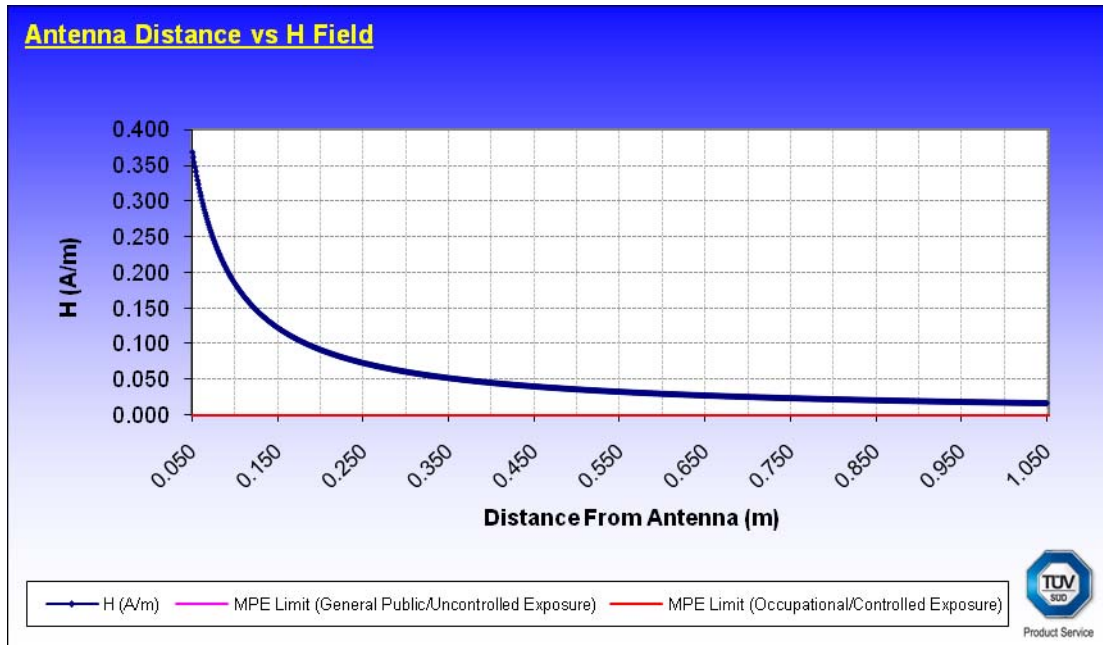


Figure 6 - This graph shows the H field (A/m) strength value with regards to distance from the Antenna (cm).

3.3 FIELD REPRESENTATIONS – IC

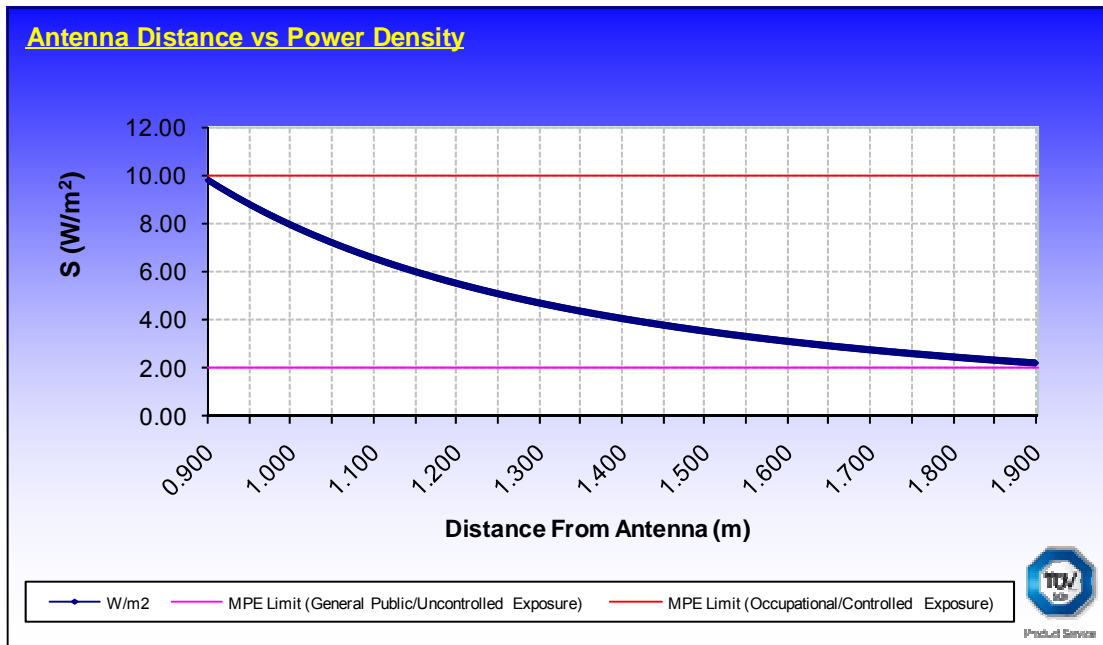


Figure 7 - This graph shows the S field (W/cm²) strength value with regards to distance from the Antenna (cm)

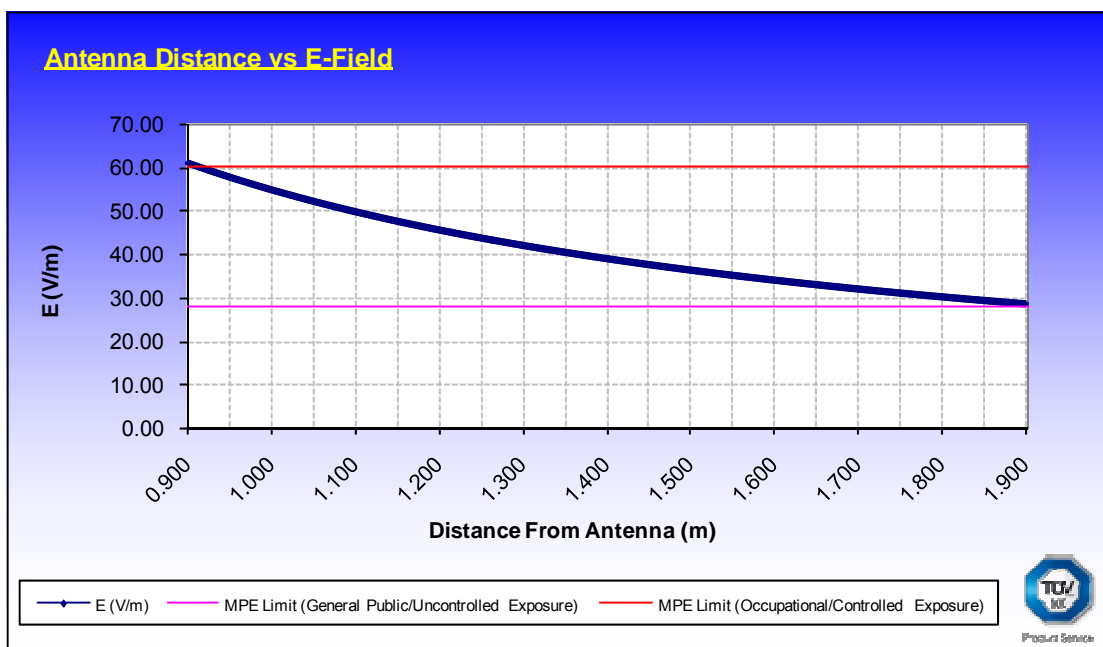


Figure 8 - This graph shows the E field (V/m) strength value with regards to distance from the Antenna (cm).

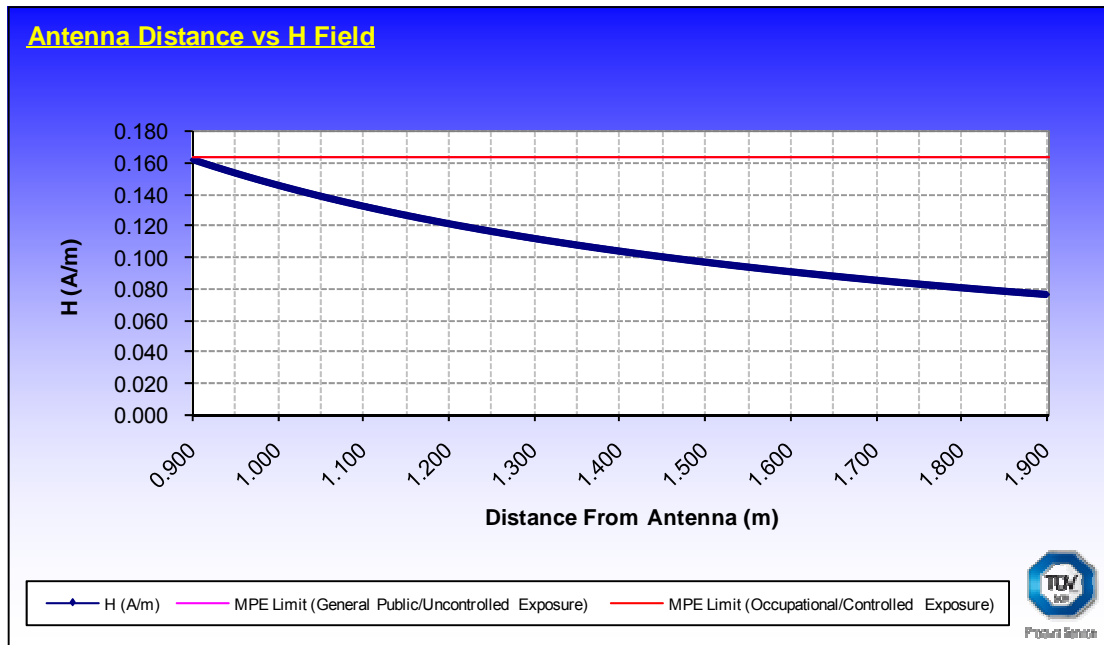


Figure 9 - This graph shows the H field (A/m) strength value with regards to distance from the Antenna (cm).



Product Service

SECTION 4

DISCLAIMERS AND COPYRIGHT



Product Service

4.1 DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

This report must not be reproduced, except in its entirety, without the written permission of
TÜV Product Service Limited

© 2008 TÜV Product Service Limited