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Report On

RF Exposure Assessment of the
e2v Technologies (UK) Ltd
COMFDM Transmitter L Band and S Band

Document 75907291 Report 01 Issue 1

September 2009



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SECTION 1

REPORT SUMMARY

RF Exposure Assessment of the
e2v Technologies (UK) Ltd
COMFDM Transmitter L Band and S Band



1.1 INTRODUCTION

The information contained in this report is intended to show verification of the RF Exposure Assessment of the e2v Technologies (UK) Ltd COMFDM Transmitter L Band and S Band 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	e2v Technologies (UK) Ltd
Manufacturer	e2v Technologies (UK) Ltd
Manufacturing Description	COMFDM Transmitter L Band and S Band
Model Number(s)	L Band: DTX1### S Band: DTX2### (where ### is frequency in MHz)
Serial Number(s)	Not Supplied
Hardware Version	Version 1
Software Version	Not Supplied

Test Specification/Issue/Date

- EN62311:2008 – Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz - 300 GHz).

Related Document(s)

- National Council on Radiation Protection and Measurements (NRP) - Report No. 86(1986) "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields".
- 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).
- 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

COMFDM Transmitter L Band and S Band

Antenna Gain (Numeric)	Peak Output Power (mW)	Field	Calculated RF Exposure at 0.20 m (20.0 cm)	General Public Exposure Limit	
1.995	100	S	0.404 or 0.397 Wm-2	6.00	ICNIRP
		E	12.233 V/m	47.63	ICNIRP
		H	0.032 A/m	0.128	ICNIRP

The calculations have shown that they meet the General Public Exposure Levels described in the ICNIRP Guidelines at **20.0 cm**, the point of investigation.

1.2.2 Occupational Exposure Levels

COMFDM Transmitter L Band and S Band

Antenna Gain (Numeric)	Peak Output Power (mW)	Field	Calculated RF Exposure at 0.20 m (20 cm)	Occupational Exposure Limit	
1.995	100	S	0.404 or 0.397 Wm-2	30.00	ICNIRP
		E	12.233 V/m	103.92	ICNIRP
		H	0.032 A/m	0.28	ICNIRP

The calculations have shown that they meet the Occupational Exposure Levels described in the ICNIRP Guidelines at **20 cm**, the point of investigation.



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 e2v Technologies (UK) Ltd COMFDM Transmitter L Band and S Band. 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 or measured of a sample of COMFDM Transmitter L Band and S Band 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 COMFDM Transmitter L Band operates in the frequency range of 1200 – 1400 MHz.

The numeric gain of the COMFDM Transmitter L Band is 1.995.

The COMFDM Transmitter L Band radio power is a maximum 100 milliwatts.

The point of investigation is 20.0 cm (0.20 m).

The antenna gain of 3 dBi.

The COMFDM Transmitter S Band operates in the frequency range of 2200 – 2500 MHz

The numeric gain of the COMFDM Transmitter S Band is 1.995.

The COMFDM Transmitter S Band radio power is a maximum 100 milliwatt.

The point of investigation is 20.0 cm (0.20 m).

The antenna gain of 3 dBi.

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SECTION 2

TEST DETAILS

RF Exposure Assessment of the
e2v Technologies (UK) Ltd
COMFDM Transmitter L Band and S Band



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-filed 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.

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

At 1200.000 MHz

Power density (Wm-2)	= 6.00	ICNIRP
E-Field (Vm-1)	= 47.63	ICNIRP
H-Field (Am-1)	= 0.128	ICNIRP

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

At 1200.000 MHz

Power density (Wm-2)	= 30.00	ICNIRP
E-Field (Vm-1)	= 103.92	ICNIRP
H-Field (Am-1)	= 0.28	ICNIRP

2.3 ESTABLISHING WAVELENGTH AND 1/4 WAVELENGTH

The COMFDM Transmitter L Band

Frequency (MHz)	$\lambda = \frac{3 \times 10^8}{f}$		$\frac{\lambda}{4}$	
	m	cm	m	cm
1200.000	0.2500	25.00	0.065	6.25
1300.000	0.2308	23.08	0.0577	5.77
1400.000	0.2143	21.43	0.0536	5.36

The COMFDM Transmitter S Band

Frequency (MHz)	$\lambda = \frac{3 \times 10^8}{f}$		$\frac{\lambda}{4}$	
	m	cm	m	cm
2200.000	0.1364	13.64	0.0341	3.41
2350.000	0.1277	12.77	0.0319	3.19
2500.000	0.1200	12.00	0.0300	3.00



2.4 FAR FIELD CALCULATIONS

The COMFDM Transmitter L Band and S Band

The following calculations are based on: 3 dBi gain antenna

P = 0.1 (Power (Watts)) or 100 (Power milliwatts)

G = 1.995 (Numeric Gain)

r = 20.0 (Distance (centimetres)) or 0.20 (Distance (meters))

The power flux:

$$S = \frac{PG_{(\theta, \phi)}}{4\pi r^2} \quad S = 0.397 \text{ W/m}^2$$

$$S = 0.040 \text{ mW/cm}^2$$

The electric field strength:

$$E = \frac{\sqrt{30PG_{(\theta, \phi)}}}{r} \quad E = 12.233 \text{ V/m}$$

The magnetic field strength:

$$H = \frac{E}{\eta_o} \quad H = 0.032 \text{ A/m}$$

The calculations met the General Public Exposure Levels described in the ICNIRP Guidelines.

The calculations met the Occupational Exposure Levels described in the ICNIRP Guidelines.

2.5 FIELD REPRESENTATIONS

The COMFDM Transmitter L Band

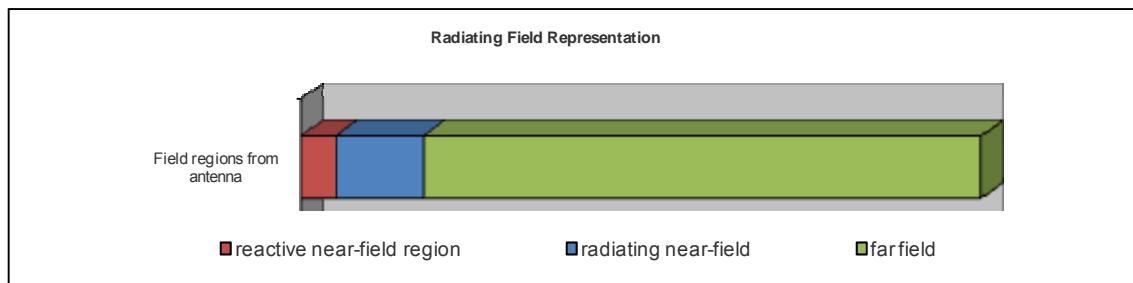


Figure 1: This graph shows the radiating field representation and is not to scale

Worst case frequency 1200.000 MHz

The Reactive near-field region (from antenna) is less than : 0.063 m (6.250 cm)

The Radiating near-field region is greater than : 0.063 m (6.250 cm)

The Radiating near-field region is less than : 0.157 m (15.68 cm)

The Far-field region is greater than : 0.157 m (15.68 cm)

The COMFDM Transmitter S Band

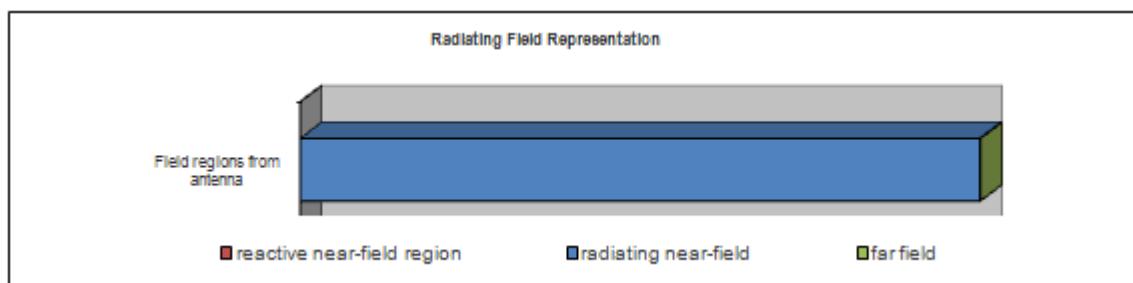


Figure 2: This graph shows the radiating field representation and is not to scale

Worst case frequency 1200.000 MHz

The Reactive near-field region (from antenna) is less than : 0.034 m (3.409 cm)

The Radiating near-field region is greater than : 0.034 m (3.409 cm)

The Radiating near-field region is less than : 825.000 m (82500.00 cm)

The Far-field region is greater than : 825.000 m (82500.00 cm)

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SECTION 3

FIGURES

3.1 FIELD REPRESENTATIONS – ICNIRP

The COMFDM Transmitter L Band

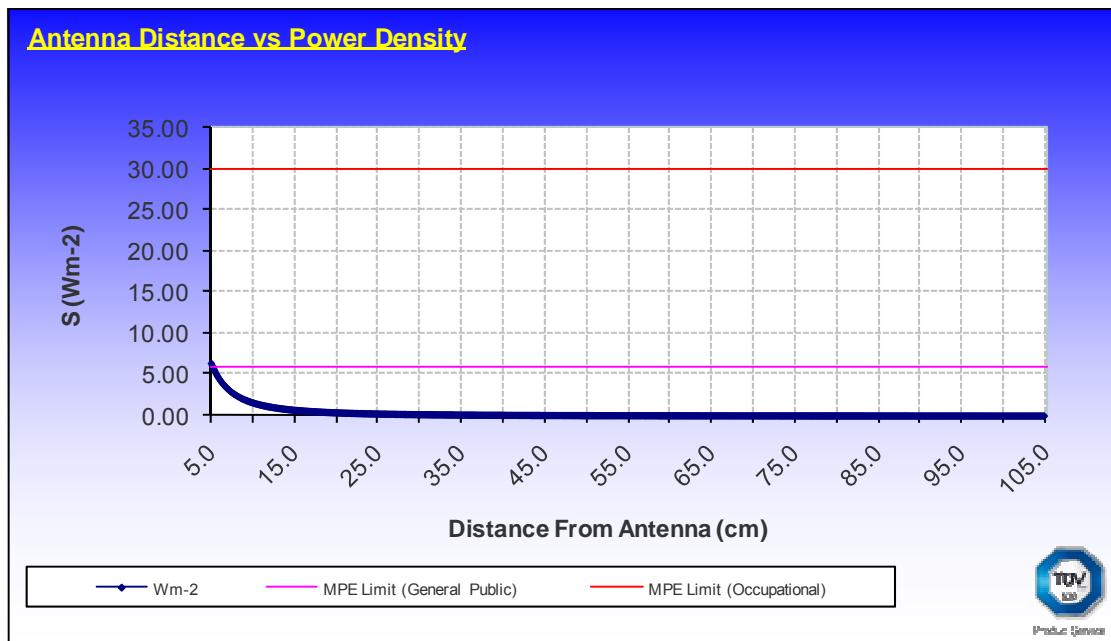


Figure 3: This graph shows the S field (W/cm^2) strength value with regards to distance from the Antenna (cm)

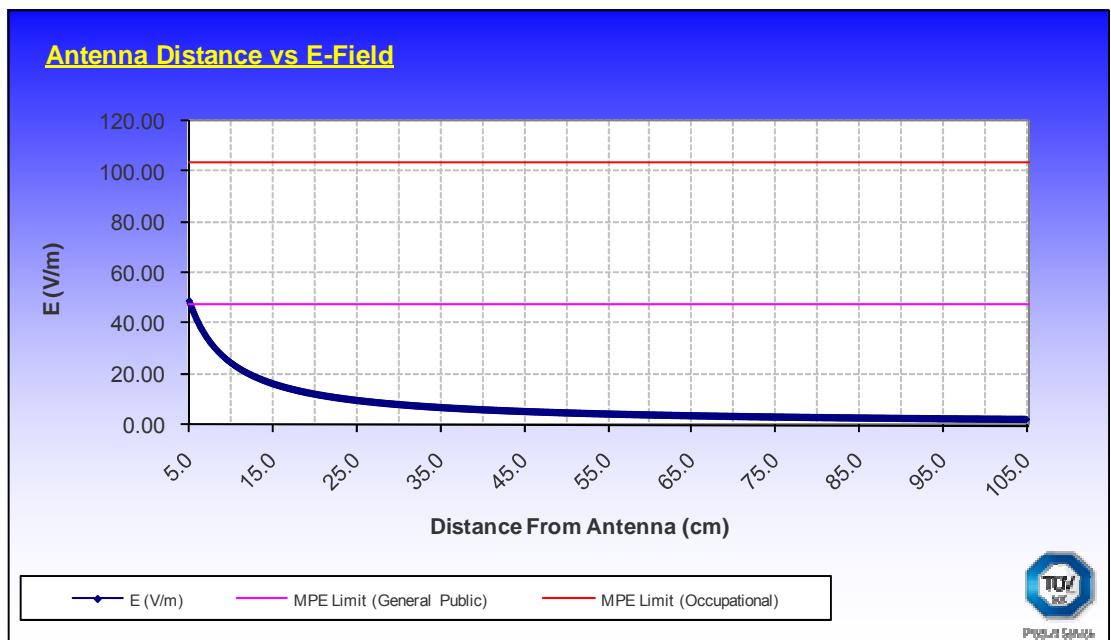


Figure 4: This graph shows the E field (V/m) strength value with regards to distance from the Antenna (cm)

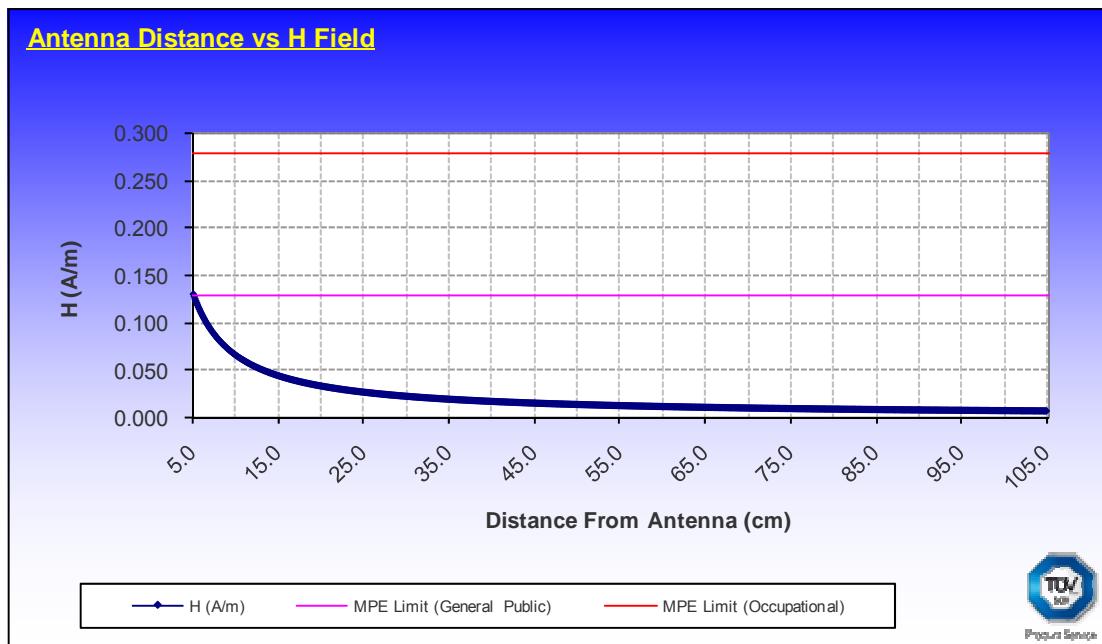


Figure 5: This graph shows the H field (A/m) strength value with regards to distance from the Antenna (cm)

The COMFDM Transmitter S Band

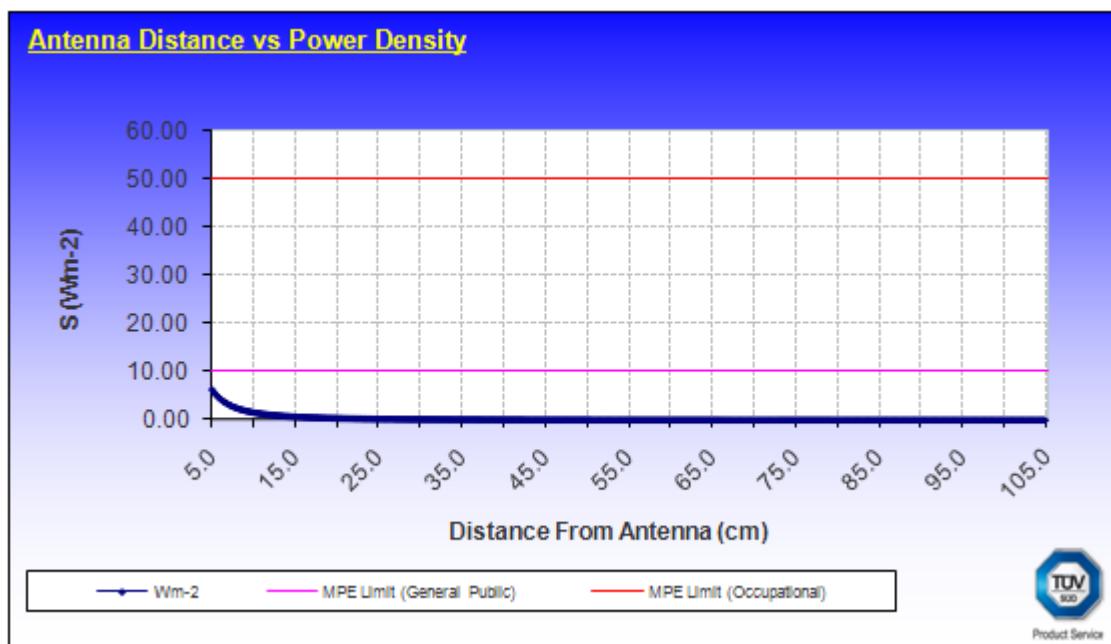


Figure 6: This graph shows the S field (W/cm²) strength value with regards to distance from the Antenna (cm)

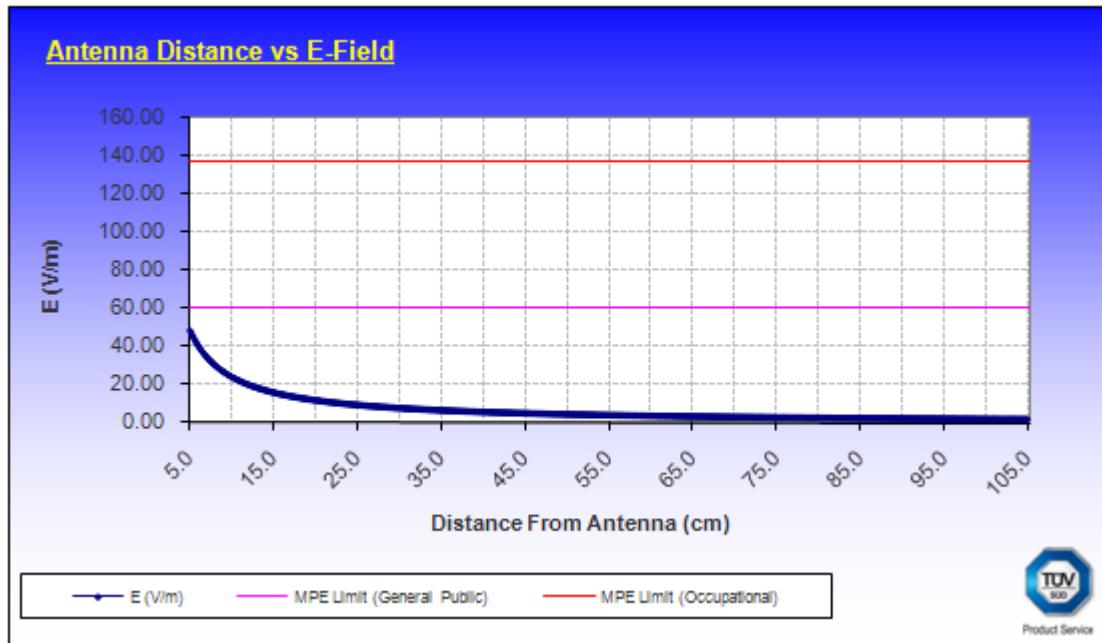


Figure 7: This graph shows the E field (V/m) strength value with regards to distance from the Antenna (cm)

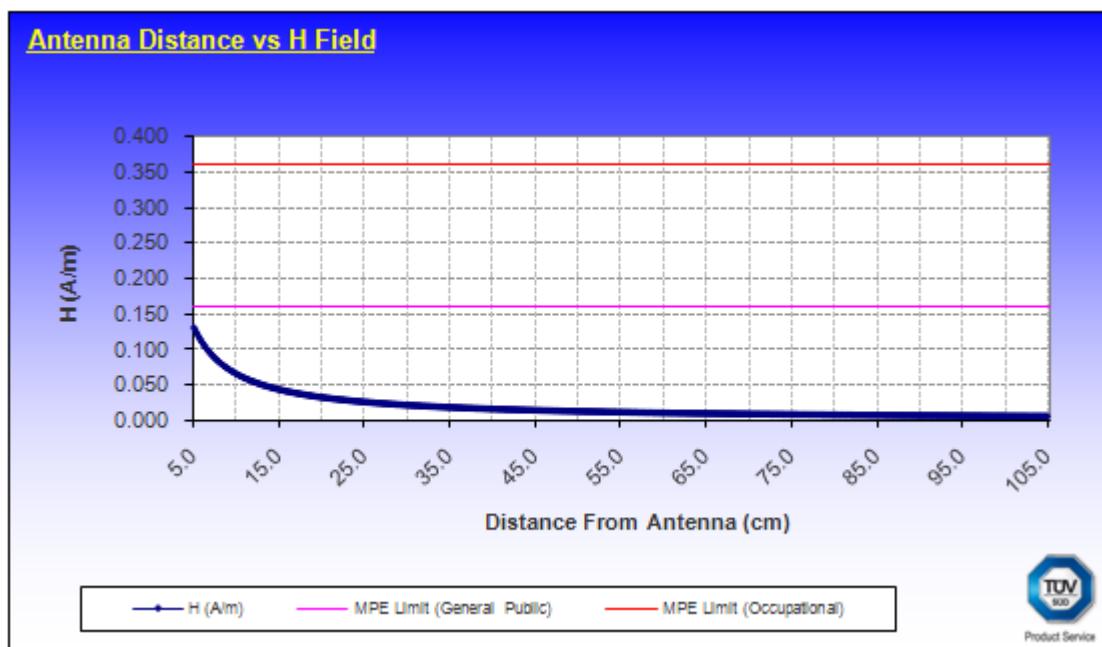


Figure 8: This graph shows the H field (A/m) strength value with regards to distance from the Antenna (cm)

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SECTION 4

DISCLAIMERS AND COPYRIGHT



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4.1 DISCLAIMERS AND COPYRIGHT

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