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Report On

RF Exposure Assessment of the
McMurdo Limited
Z501 Personal AIS SART (Non-SOLAS)

Document 75912801 Report 05 Issue 1 August 2011

Product Service

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REPORT ON

RF Exposure Assessment of the
McMurdo Limited
Z501 Personal AIS SART (Non-SOLAS)

Document 75912801 Report 05 Issue 1

August 2011

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SECTION 1

REPORT SUMMARY

RF Exposure Assessment of the
McMurdo Limited
Z501 Personal AIS SART (Non-SOLAS)

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the RF Exposure Assessment of the McMurdo Limited Z501 Personal AIS SART (Non-SOLAS) 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	McMurdo Limited
Manufacturer	McMurdo Limited
Manufacturing Description	Personal AIS SART (Non-SOLAS)
Model Number(s)	Z501
Serial Number(s)	N/A
Hardware Version	N/A
Software Version	N/A

Test Specification/Issue/Date

1. EN 62311:2008 - Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz).
2. EN 62479: 2010 -Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz)
3. OET Bulletin 65 Edition 97-01 August 1997 - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
4. RSS-102 Issue 4 March 2010 Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
5. Radiocommunications (Electromagnetic Radiation – Human Exposure) Standard 2003

Related Document(s)

6. Council Recommendation 1999/519/EC of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (Official Journal L 197 of 30 July1999).
7. FCC Guidelines for Evaluating exposure to RF Emissions - 47 CFR § 1.1310; 47 CFR § 1.1307(b) & 47 CFR § 80.83.
8. Health Canada's Safety Code 6: Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 KHz to 300 GHz.
9. ARPANSA, 'Radiation Protection Standard – Maximum Exposure Levels to Radiofrequency Fields – 3KHz to 300GHz'
10. ICNIRP 1998,'Guidelines for limiting exposure to time-varying electric magnetic, and electromagnetic fields (up to 300GHz). Guidelines of the International Commission on Non-Ionizing Radiation Protection', Health Physics, vol.74, no.4, pp.494-522.
11. National Council on Radiation Protection and Measurements (NRPC) - Report No. 86(1986) "Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields".
12. 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).
13. IEEE Std C95.1-2005: IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3KHz to 300GHz.
14. Australian Standard 2772.2 – 1988, 'Radiofrequency Radiation Part 2 – Principles and Methods of Measurement – 300KHz to 10GHz'

1.2 LOW POWER DEVICE EXEMPTION STATEMENT

EN 62479: 2010 Compliance Information

Compliance with EN 62479: 2010 is met based on the transmitting peak power being less than 20 Watts and the average emitted power of the radio being less than 20mW for general population exposure and less than 100mW for occupational population exposure. The device is thus compliant for use on trunk, limbs, head etc.

Pmax Calculation Average Emitted Power (mW):

161.975MHz: 2228mW * 0.384 * 8pulses * 0.024ms / 60s = 2.7mW.
162.075MHz: 2234mW * 0.384 * 8pulses * 0.024ms / 60s = 2.7mW.

Frequency (MHz)	Pmax Calculation Average Emitted Power (mW)	Pmax Limit Average Emitted Power (mW)	Exposure Type
161.975	2.7	20	General public
162.075	2.7	20	General public
161.975	2.7	100	Occupational
162.075	2.7	100	Occupational

1.3 BRIEF SUMMARY OF RESULTS

1.3.1 General Public Exposure Levels

Antenna Gain (Numeric)	Peak Output Power (mW)	Field	Calculated RF Exposure at 0.150 m (15.0cm)	General Public Exposure Limit	Application
0.384	2400	S	0.010 Wm-2	2.00 Wm-2	ICNIRP
		S	0.0010 mW/cm2	0.20 mW/cm2	FCC 47 CFR § 1.1310
		S	0.010 Wm-2	2.00 Wm-2	Canada's RF Safety Code 6
		S	0.010 Wm-2	2.00 Wm-2	ARPANSA
		E	1.982 V/m	28.00 V/m	ICNIRP
		E	1.982 V/m	27.50 V/m	FCC 47 CFR § 1.1310
		E	1.982 V/m	28.00 V/m	Canada's RF Safety Code 6
		E	1.982 V/m	27.40 V/m	ARPANSA
		H	0.005 A/m	0.073 A/m	ICNIRP
		H	0.005 A/m	0.07 A/m	FCC 47 CFR § 1.1310
		H	0.005 A/m	0.073 A/m	Canada's RF Safety Code 6
		H	0.005 A/m	0.073 A/m	ARPANSA

The calculations have shown that they **meet** the General Public Exposure Levels described in the ICNIRP Guidelines, FCC 47 CFR § 1.1310 Guidelines, Health Canada's RF exposure guideline Safety Code 6 and the Australian ARPANSA limits at **15.0** cm, the point of investigation.

1.3.2 Occupational Exposure Levels

Antenna Gain (Numeric)	Peak Output Power (mW)	Field	Calculated RF Exposure at 0.150 m (15.0 cm)	Occupational Exposure Limit	Application
0.384	2400	S	0.010 Wm-2	10.00 Wm-2	ICNIRP
		S	0.0010 mW/cm2	1.00 mW/cm2	FCC 47 CFR § 1.1310
		S	0.010 Wm-2	10.00 Wm-2	Canada's RF Safety Code 6
		S	0.010 Wm-2	10.00 Wm-2	ARPANSA
		E	1.982 V/m	61.00 V/m	ICNIRP
		E	1.982 V/m	27.50 V/m	FCC 47 CFR § 1.1310
		E	1.982 V/m	60.00 V/m	Canada's RF Safety Code 6
		E	1.982 V/m	61.40 V/m	ARPANSA
		H	0.005 A/m	0.16 A/m	ICNIRP
		H	0.005 A/m	0.16 A/m	FCC 47 CFR § 1.1310
		H	0.005 A/m	0.16 A/m	Canada's RF Safety Code 6
		H	0.005 A/m	0.163 A/m	ARPANSA

The calculations have shown that they **meet** the Occupational Exposure Levels described in the ICNIRP Guidelines, FCC 47 CFR § 1.1310 Guidelines, Health Canada's RF exposure guideline Safety Code 6 and the Australian ARPANSA limits at **15.0 cm,** the point of investigation.

1.4 PRODUCT INFORMATION

1.4.1 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).

1.4.2 Technical Description

The Equipment under test was a McMurdo Limited Z501 Personal AIS SART (Non-SOLAS). A full technical description can be found in the manufacturer's documentation.

All reported calculations were carried out on the relevant information supplied for the Z501 Personal AIS SART (Non-SOLAS) to demonstrate compliance with the applied test specification(s) the sample assessed was found to comply with the requirements of the applied rules.

1.5 SUMMARY

The RF exposure assessment is based upon the following criteria:

The Z501 Personal AIS SART (Non-SOLAS) operates in the frequency range of 161.975 MHz and 162.025 MHz.

The gain of the Z501 Personal AIS SART (Non-SOLAS) is -4.16 dBi (Numeric Gain 0.384).

The Z501 Personal AIS SART (Non-SOLAS) radio power is a maximum 2400 milliwatt.

The point of investigation is 0.150 m (15.0 cm).

The duty cycle is 0.32%.

SECTION 2

TEST DETAILS

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 EN50383:2002 Clause 5.2; E-field or H-field calculation. The method of calculation used is defined in 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 λ/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 161.975 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
Power density (Wm-2)	= 2.00	Australian Radiation Protection Series Publication No. 3
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
E-Field (Vm-1)	= 27.40	Australian Radiation Protection Series Publication No. 3
H-Field (Am-1)	= 0.073	ICNIRP
H-Field (Am-1)	= 0.07	FCC 47 CFR § 1.1310
H-Field (Am-1)	= 0.073	Canada's RF Safety Code 6
H-Field (Am-1)	= 0.073	Australian Radiation Protection Series Publication No. 3

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

At 161.975 MHz

Power density (Wm-2)	= 10.00	ICNIRP
Power density ($mWcm^2$)	= 1.00	FCC 47 CFR § 1.1310
Power density (Wm-2)	= 10.00	Canada's RF Safety Code 6
Power density (Wm-2)	= 10.00	Australian Radiation Protection Series Publication No. 3
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
E-Field (Vm-1)	= 61.40	Australian Radiation Protection Series Publication No. 3
H-Field (Am-1)	= 0.16	ICNIRP
H-Field (Am-1)	= 0.16	FCC 47 CFR § 1.1310
H-Field (Am-1)	= 0.16	Canada's RF Safety Code 6
H-Field (Am-1)	= 0.16	Australian Radiation Protection Series Publication No. 3

2.3 ESTABLISHING WAVELENGTH AND 1/4 WAVELENGTH

Frequency (MHz)	$\lambda = \frac{3x10^8}{f}$		$\frac{\lambda}{4}$	
	m	cm	m	cm
161.975	1.8521	185.21	0.4630	46.30
162.000	1.8519	185.19	0.4630	46.30
162.025	1.8516	185.16	0.4629	46.29

2.4 FAR FIELD CALCULATIONS

The following calculations are based on: -4.16 dBi gain antenna.

Duty cycle of 0.32% has been included in the calculations.

P = 2.4 (Power (Watts)) or 2400 (Power milliwatts)
G = 0.384 (Numeric Gain)
r = 15.0 (Distance (centimetres)) or 0.150 (Distance (meters))

The power flux:

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

S = 0.010 W/m2

S = 0.0010 mW/cm2

The electric field strength:

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

E = 1.98 V/m

The magnetic field strength:

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

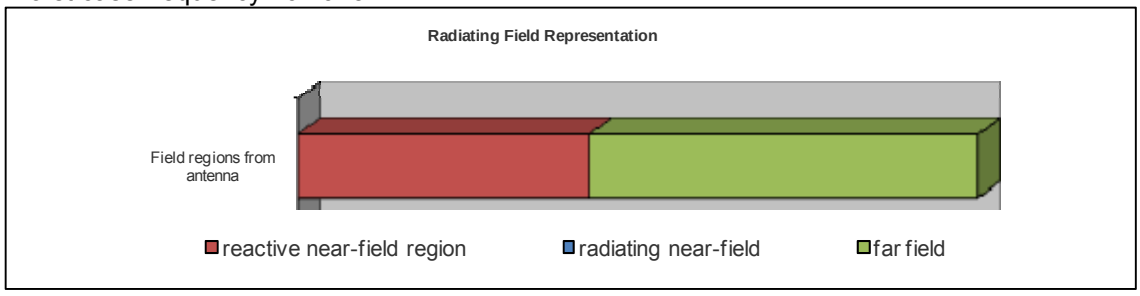
H = 0.005 A/m

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 General Public Exposure Levels described in the Australian Radiation Protection Series Publication No. 3

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
The calculations meet the Occupational Exposure Levels described in the Australian Radiation Protection Series Publication No. 3

2.5 FIELD REGIONS

Worst case frequency 161.975 MHz



The Reactive near-field region (from antenna) is less than : 0.463 m (46.303 cm)
The Radiating near-field region is greater than : 0.463 m (46.303 cm)
The Radiating near-field region is less than : 431.933 m (43193.33 cm)
The Far-field region is greater than : 431.933 m (43193.33 cm)

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SECTION 3

FIGURES

3.1 FIELD REPRESENTATIONS – ICNIRP

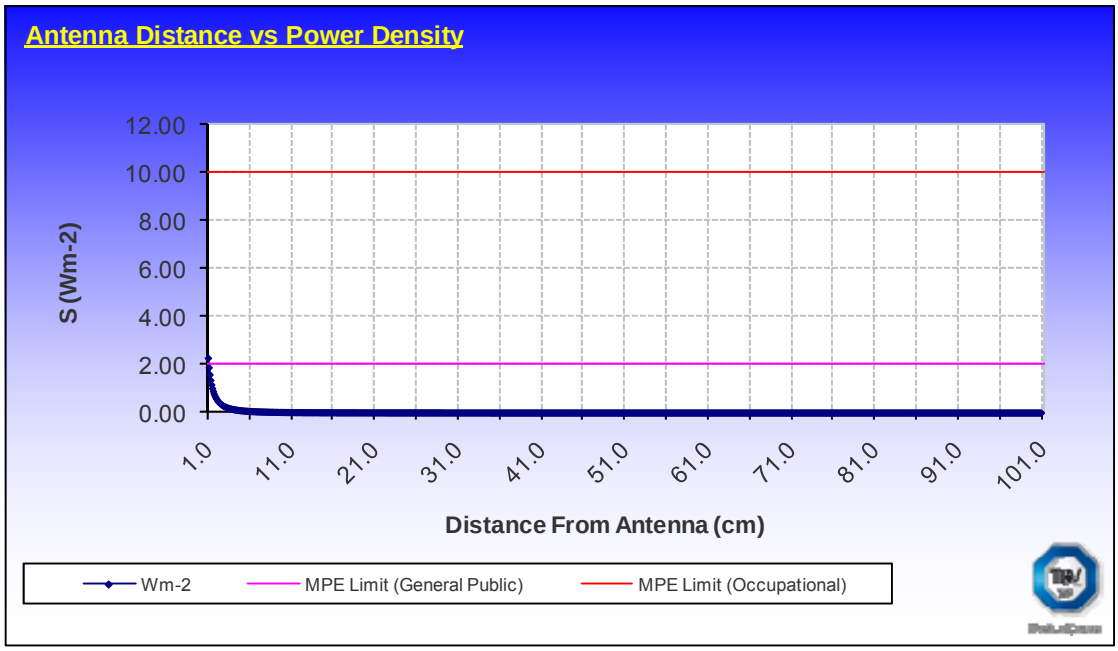

Figure 2 - This graph shows the S field (W/cm^2) strength value with regards to distance from the Antenna (cm)

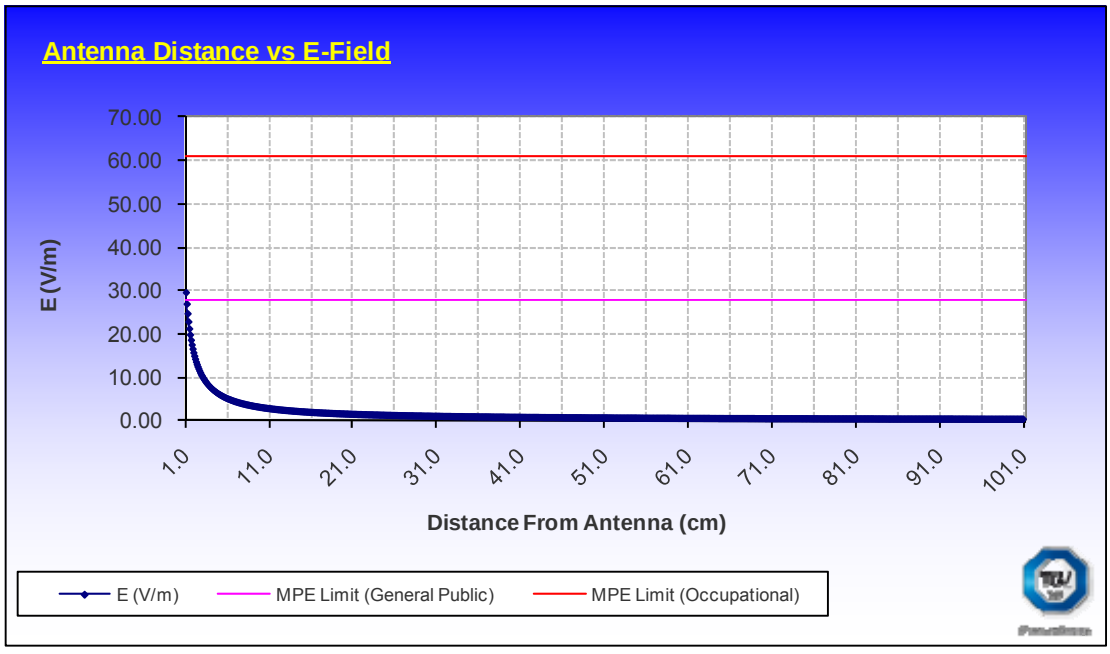

Figure 3 - This graph shows the E field (V/m) strength value with regards to distance from the Antenna (cm).

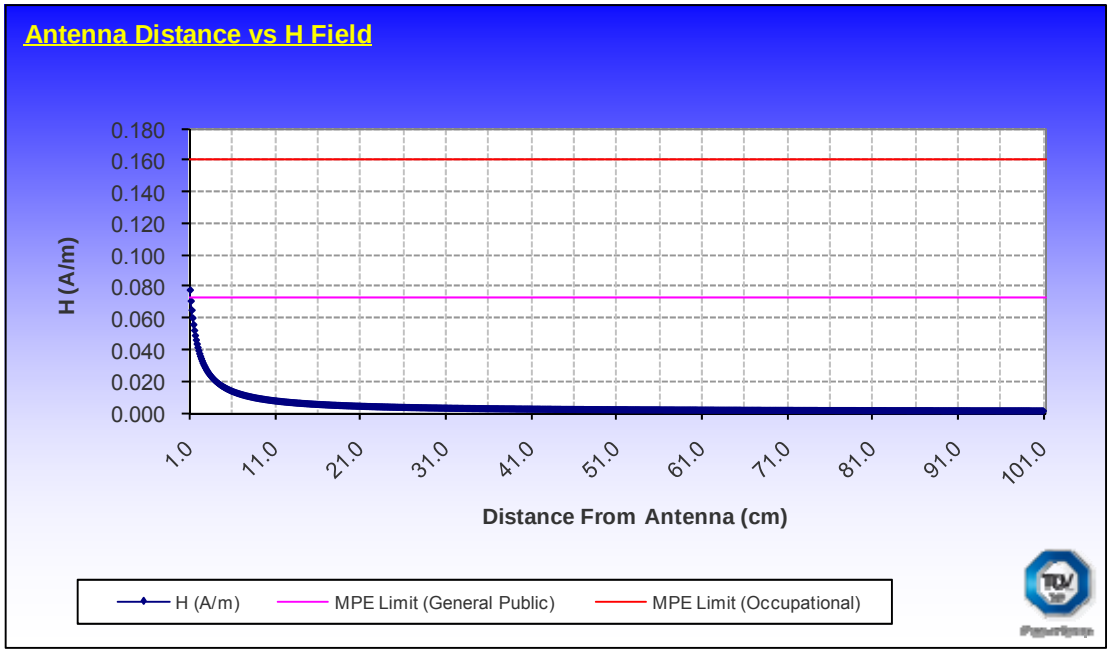

Figure 4 - This graph shows the H field (A/m) strength value with regards to distance from the Antenna (cm).

3.2 FIELD REPRESENTATIONS – FCC

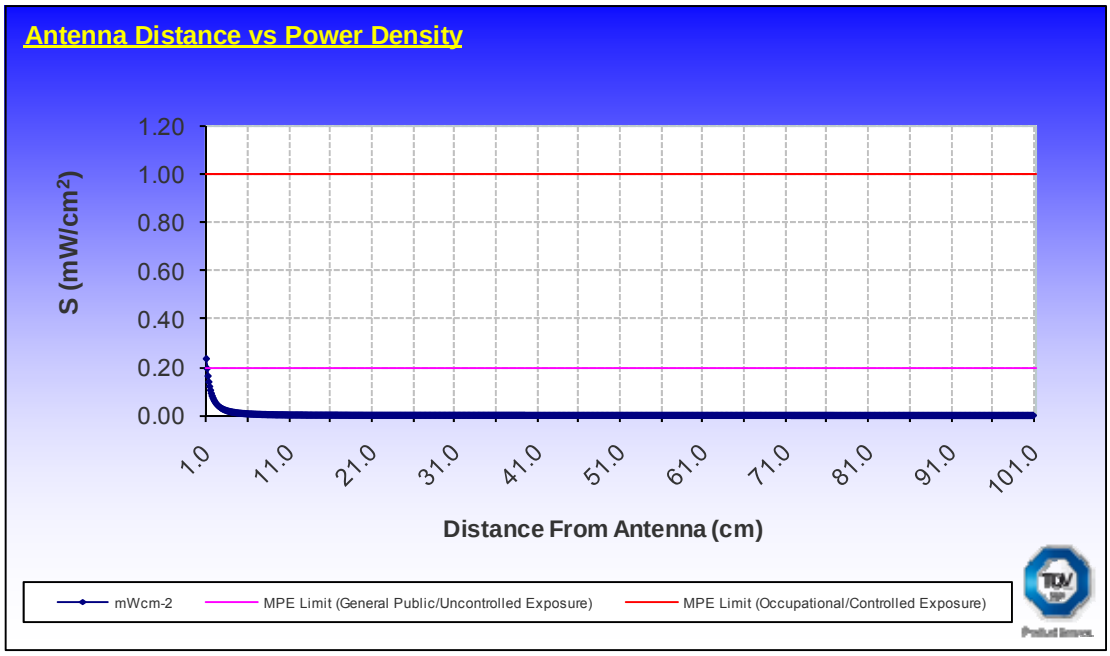

Figure 5 - This graph shows the S field (mW/cm^2) strength value with regards to distance from the Antenna (cm)

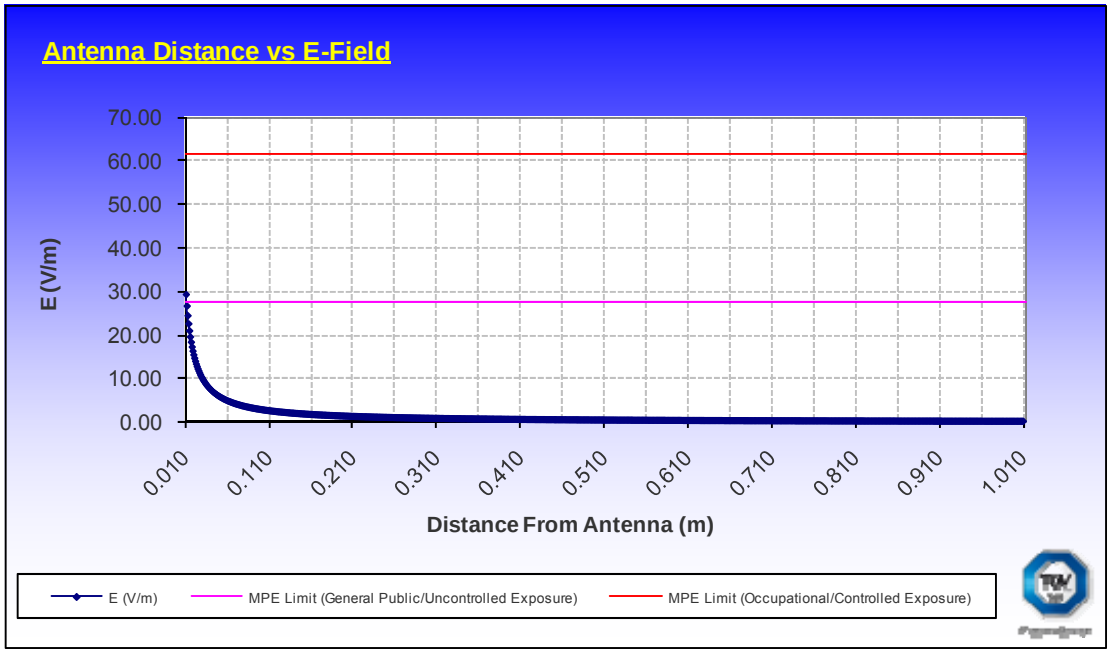

Figure 6 - This graph shows the E field (V/m) strength value with regards to distance from the Antenna (m). Note: No applicable limit.

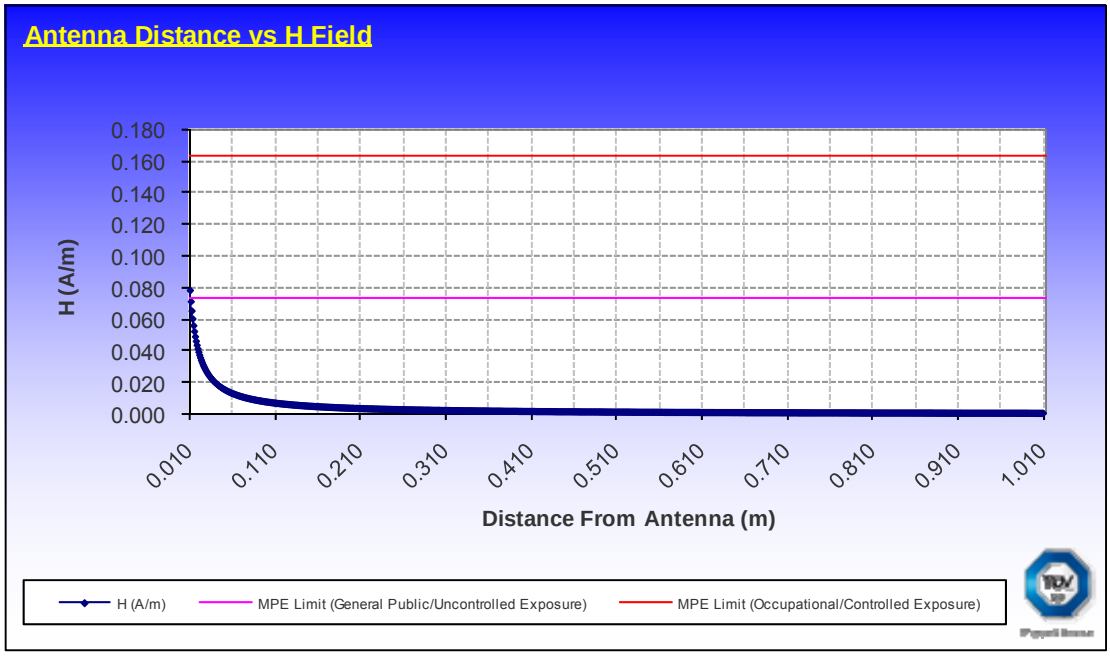

Figure 7 - This graph shows the H field (A/m) strength value with regards to distance from the Antenna (m). Note: No applicable limit.

3.3 FIELD REPRESENTATIONS – IC

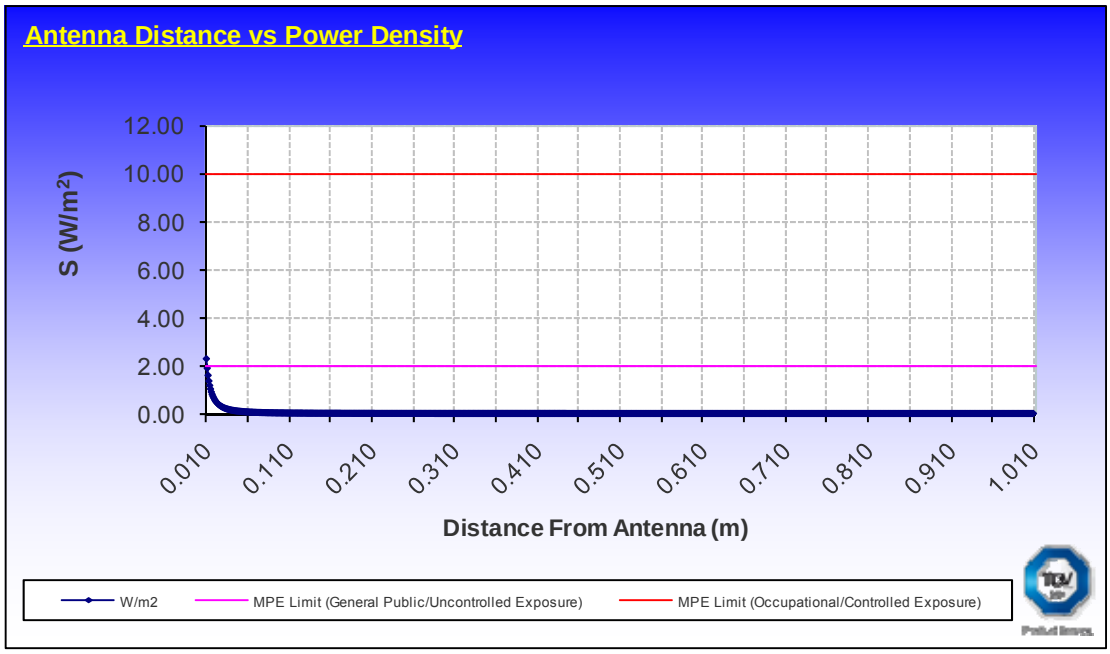

Figure 8 - This graph shows the S field (W/cm^2) strength value with regards to distance from the Antenna (m)

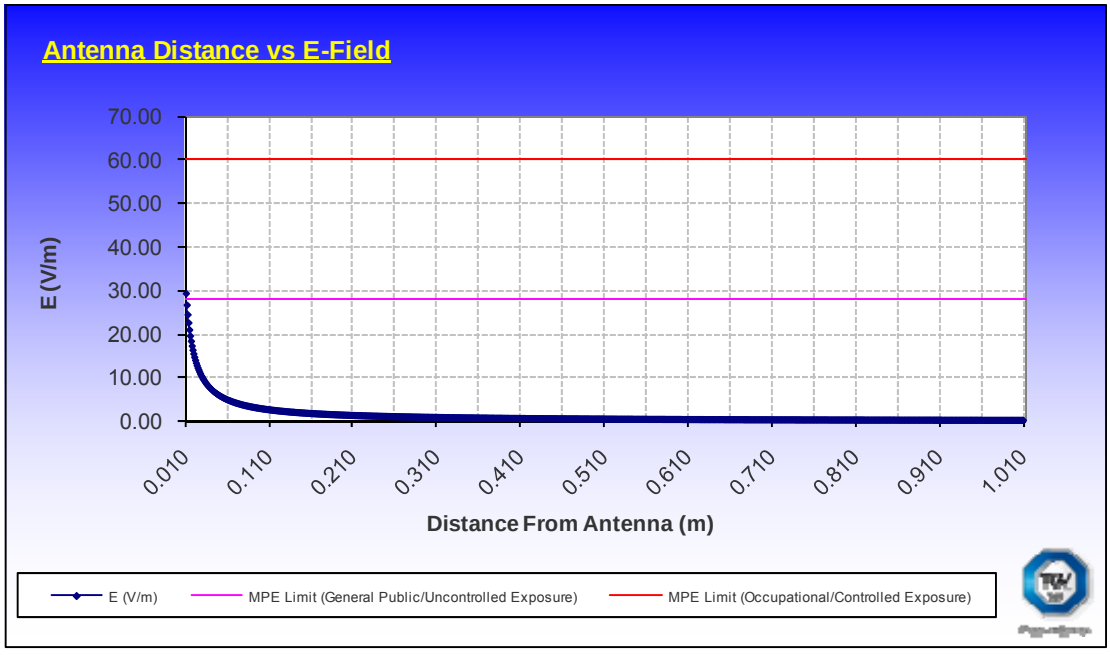

Figure 9 - This graph shows the E field (V/m) strength value with regards to distance from the Antenna (m).

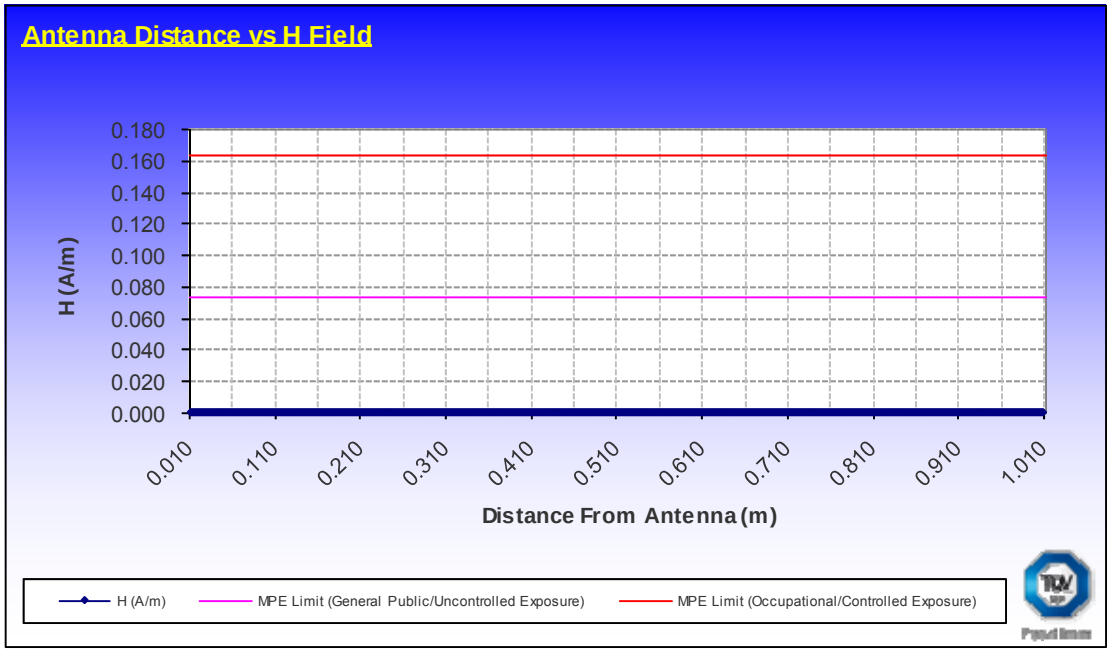

Figure 10 - This graph shows the H field (A/m) strength value with regards to distance from the Antenna (m).

3.4 FIELD REPRESENTATIONS – ACMA

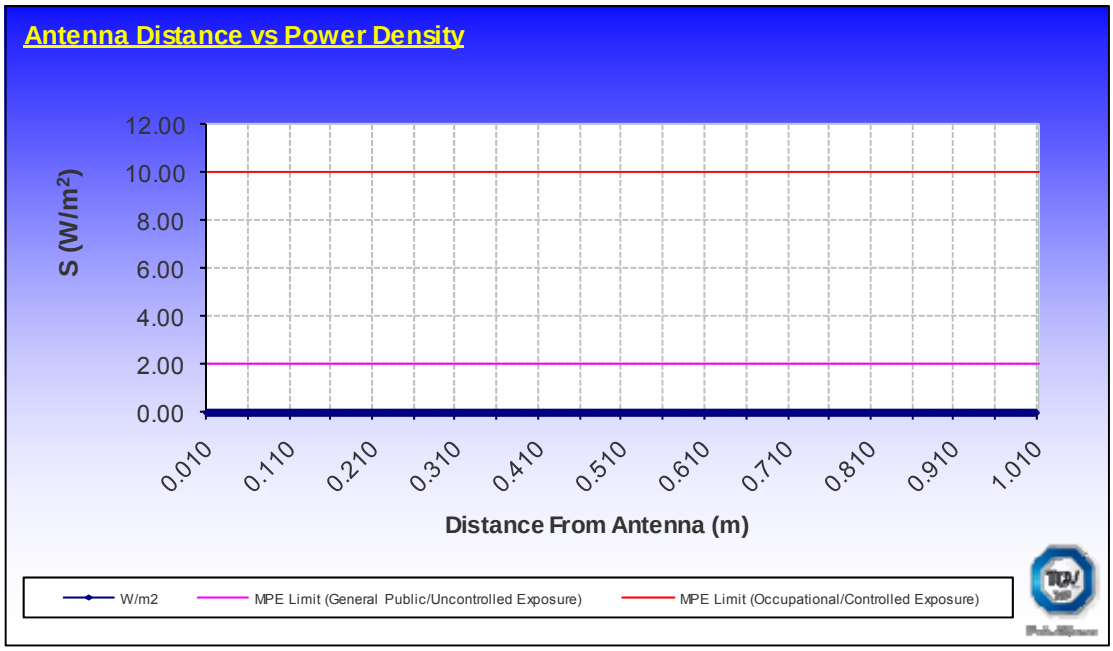

Figure 11 - This graph shows the S field (W/cm^2) strength value with regards to distance from the Antenna (m)

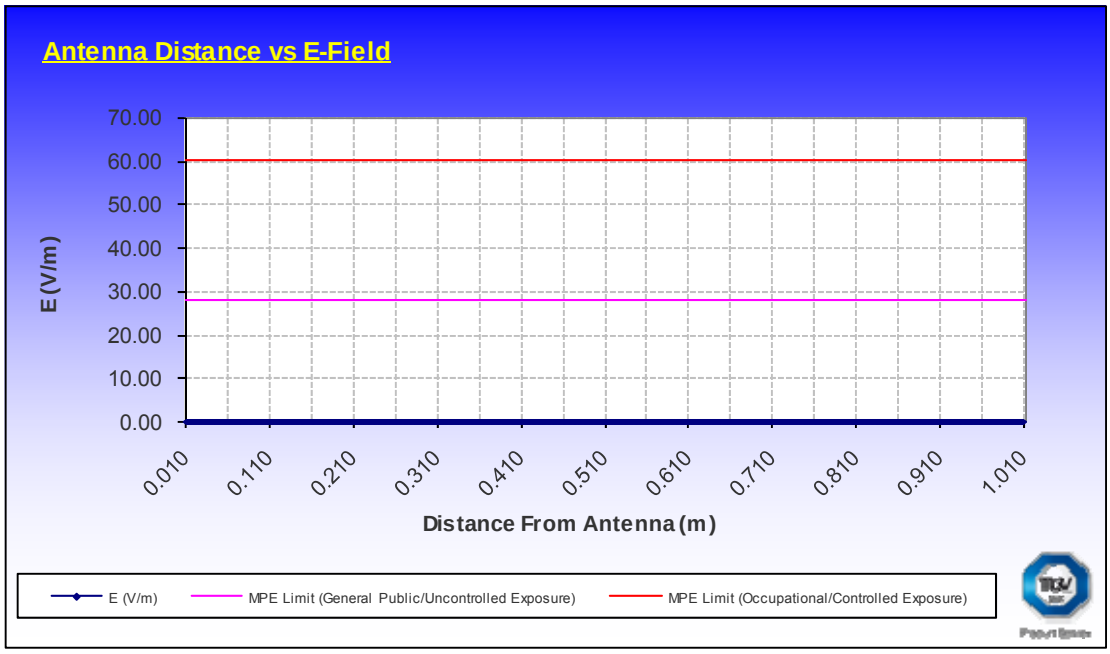

Figure 12 - This graph shows the E field (V/m) strength value with regards to distance from the Antenna (m).

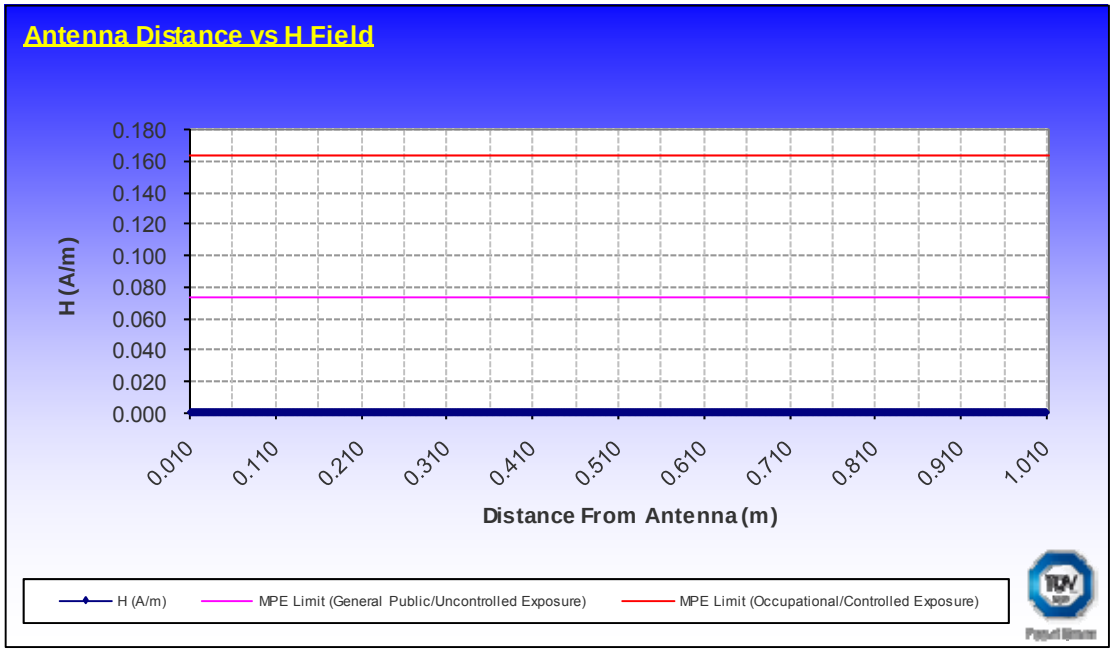

Figure 13 - This graph shows the H field (A/m) strength value with regards to distance from the Antenna (m).

SECTION 4

DISCLAIMERS AND COPYRIGHT

4.1 DISCLAIMERS AND COPYRIGHT

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