Product Service

Choose certainty.
Add value.

Report On

RF Exposure Assessment of the
F3507g Ericsson Mobile Broadband Module
Installed in DELL Studio 1535 Laptop Computer

Document 75903561 Report 01 Issue 1 June 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
F3507g Ericsson Mobile Broadband Module
Installed in DELL Studio 1535 Laptop Computer

Document 75903561 Report 01 Issue 1

June 2008

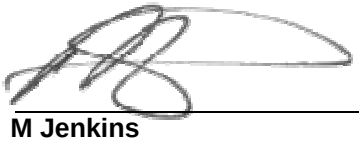
PREPARED FOR

Ericsson AB
Lindholmspiren 11
417 56 Goteborg
Sweden

PREPARED BY

A Miller
Principal Engineer

APPROVED BY



M Jenkins
Authorised Signatory

DATED

12th June 2008

Product Service

CONTENTS

Section **Page No**

Product Service

SECTION 1

REPORT SUMMARY

RF Exposure Assessment of the
F3507g Ericsson Mobile Broadband Module
Installed in DELL Studio 1535 Laptop Computer

2.1 INTRODUCTION

The information contained in this report is intended to show verification of the RF Exposure Assessment of the F3507g Ericsson Mobile Broadband Module Installed in DELL Studio 1535 Laptop Computer to the requirements of the applied test specifications. Consideration of co-location transmission with the fitted modules is described within section 4 of this report.

Objective	To perform RF Exposure Assessment to determine the Equipment Under Test's (EUT's) compliance of the applied rules.
Applicant	Ericsson AB
Manufacturer	Ericsson
Type of Product	Ericsson Mobile Broadband Module
Model Number	F3507g
FCC ID	VV7–MBMF3507G–D

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 (NRPC) - 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.

2.2 BRIEF SUMMARY OF RESULTS

2.2.1 General Public Exposure Levels

Antenna Gain (Numeric)	Peak Output Power (mW)	Field	Calculated RF Exposure at 0.200 m (20 cm)	General Public Exposure Limit	Requirement
1.445	500	S	1.438 Wm-2	4.12	ICNIRP
		S	0.1438 mW/cm2	0.55	FCC 47 CFR § 1.1310
		S	1.438 Wm-2	5.49	Canada's RF Safety Code 6
		E	23.282 V/m	39.47	ICNIRP
		E	23.282 V/m	N/A	FCC 47 CFR § 1.1310
		E	23.282 V/m	45.50	Canada's RF Safety Code 6
		H	0.062 A/m	0.106	ICNIRP
		H	0.062 A/m	N/A	FCC 47 CFR § 1.1310
		H	0.062 A/m	0.121	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 **20 cm,** the point of investigation.

2.2.2 Occupational Exposure Levels

Antenna Gain (Numeric)	Peak Output Power (mW)	Field	Calculated RF Exposure at 0.200 m (20 cm)	Occupational Exposure Limit	Requirement
1.445	500	S	1.438 Wm-2	20.61	ICNIRP
		S	0.1438 mW/cm2	5.00	FCC 47 CFR § 1.1310
		S	1.438 Wm-2	27.47	Canada's RF Safety Code 6
		E	23.282 V/m	86.13	ICNIRP
		E	23.282 V/m	N/A	FCC 47 CFR § 1.1310
		E	23.282 V/m	101.63	Canada's RF Safety Code 6
		H	0.062 A/m	0.23	ICNIRP
		H	0.062 A/m	N/A	FCC 47 CFR § 1.1310
		H	0.062 A/m	0.27	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 **20 cm,** the point of investigation.

2.3 PRODUCT INFORMATION

2.3.1 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)

2.3.2 Technical Description

The Equipment under test was an F3507g Ericsson Mobile Broadband Module Installed in DELL Studio 1535 Laptop Computer. A full technical description can be found in the manufacturer's documentation.

2.4 SUMMARY

All reported calculations were carried out on an F3507g Ericsson Mobile Broadband Module Installed in DELL Studio 1535 Laptop Computer; the relevant information supplied below was used to demonstrate compliance with the applied test specification(s). The sample assessed was found to comply with the requirements of the applied rules.

The RF exposure assessment is based upon the worst case analysis of the frequency bands, in which the Ericsson Mobile Broadband Module can operate:-

GSM 850: 824 – 849MHz / 869 – 894 MHz
GSM 900: 880 – 915MHz / 925 – 960 MHz
DCS 1800: 1710 - 1785MHz / 1805 – 1880 MHz
PCS 1900: 1850 – 1910MHz / 1930 – 1990 MHz
WCDMA FDD1: 1920 – 1980 / 2110 – 2170 MHz
WCDMA FDD2: 1850 – 1910 / 1930 – 1990 MHz
WCDMA FDD5: 824 – 849 / 869 – 894 MHz

For details of the location of the antenna and the modules that can be considered as co-located, see section 4 of this report.

Display size	Antenna	Antenna location	Antenna to user distance (mm)	Antenna to WWAN Tx antenna distance (mm)	Co - located
15.4	WWAN Tx antenna	Top of the LCD	> 200	-	-
	WLAN main	Top of the LCD	> 200	< 200	Yes
	WLAN aux	Bottom of the LCD	< 200	> 200	No
	WLAN MIMO	Top of the LCD	> 200	< 200	Yes
	Bluetooth antenna	Top of the LCD	> 200	< 200	Yes
	UWB antenna	Top of the LCD	> 200	< 200	Yes

The numeric gain of the Mobile Broadband Module is 1.445.
The Mobile Broadband Module radio power is considered to be a worst case input power of 2 watts with a duty cycle of 25% (GPRS Multi-slot Class 10). Therefore for this assessment the maximum output power for the Ericsson Mobile Broadband Module is considered to be 500 Milliwatts. The point of investigation is 20 cm (0.200 m) with a maximum antenna gain of 1.6 dBi.

Product Service

SECTION 2

TEST DETAILS

3.1 RATIONALE FOR ASSESSMENT OF THE RF EXPOSURE

The aim of this 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 λ/4 as the boundary between the radiated near-field and reactive near-field for RF exposure compliance assessment.

3.2 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 824.200 MHz

Power density (Wm-2)	= 4.12	ICNIRP
Power density ($mWcm^2$)	= 0.55	FCC 47 CFR § 1.1310
Power density (Wm-2)	= 5.49	Canada's RF Safety Code 6
E-Field (Vm-1)	= 39.47	ICNIRP
E-Field (Vm-1)	= N/A	FCC 47 CFR § 1.1310
E-Field (Vm-1)	= 45.50	Canada's RF Safety Code 6
H-Field (Am-1)	= 0.106	ICNIRP
H-Field (Am-1)	= N/A	FCC 47 CFR § 1.1310
H-Field (Am-1)	= 0.121	Canada's RF Safety Code 6

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

At 824.200 MHz

Power density (Wm-2)	= 20.61	ICNIRP
Power density ($mWcm^2$)	= 5.00	FCC 47 CFR § 1.1310
Power density (Wm-2)	= 27.47	Canada's RF Safety Code 6
E-Field (Vm-1)	= 86.13	ICNIRP
E-Field (Vm-1)	= N/A	FCC 47 CFR § 1.1310
E-Field (Vm-1)	= 101.63	Canada's RF Safety Code 6
H-Field (Am-1)	= 0.23	ICNIRP
H-Field (Am-1)	= N/A	FCC 47 CFR § 1.1310
H-Field (Am-1)	= 0.27	Canada's RF Safety Code 6

3.3 ESTABLISHING WAVELENGTH AND 1/4 WAVELENGTH

Frequency (MHz)	$\lambda = \frac{3x10^8}{f}$		$\frac{\lambda}{4}$	
	m	cm	m	cm
824.200	0.3640	36.40	0.0910	9.10
836.400	0.3587	35.87	0.0897	8.97
848.800	0.3534	35.34	0.0884	8.84

3.4 FAR FIELD CALCULATIONS

The following calculations are based on: 1.6 dBi gain antenna

P = 0.500 (Power (Watts)) or 500 (Power milliwatts)
G = 1.445 (Numeric Gain)
r = 20 (Distance (centimetres)) or 0.200 (Distance (meters))

The power flux:

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

S = 1.438 W/m2

S = 0.144 mW/cm2

The electric field strength:

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

E = 23.282 V/m

The magnetic field strength:

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

H = 0.062 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

3.5 FIELD REPRESENTATIONS

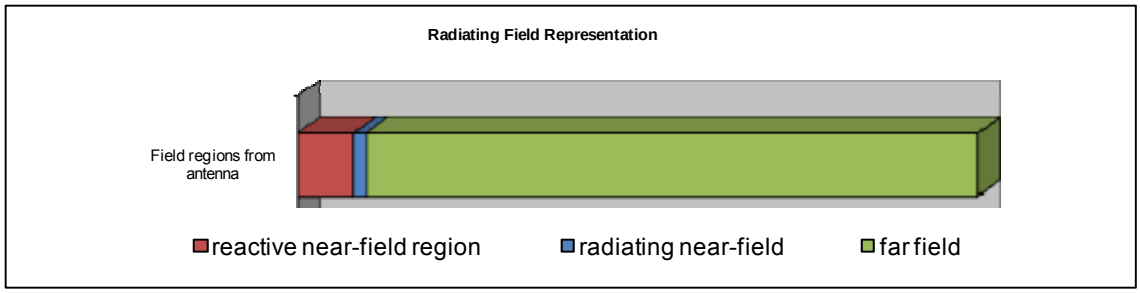


Figure 1: This graph shows the radiating field representation and is not to scale

Worst case frequency 824.200 MHz
The Reactive near-field region (from antenna) is less than : 0.091 m (9.100 cm)
The Radiating near-field region is greater than : 0.0198 m (1.98 cm)
The Radiating near-field region is less than : 0.0198 m (1.98cm)
The Far-field region is greater than : 0.091 m (9.100 cm)

Product Service

SECTION 3

FIGURES

4.1 FIELD GRAPHS – ICNIRP

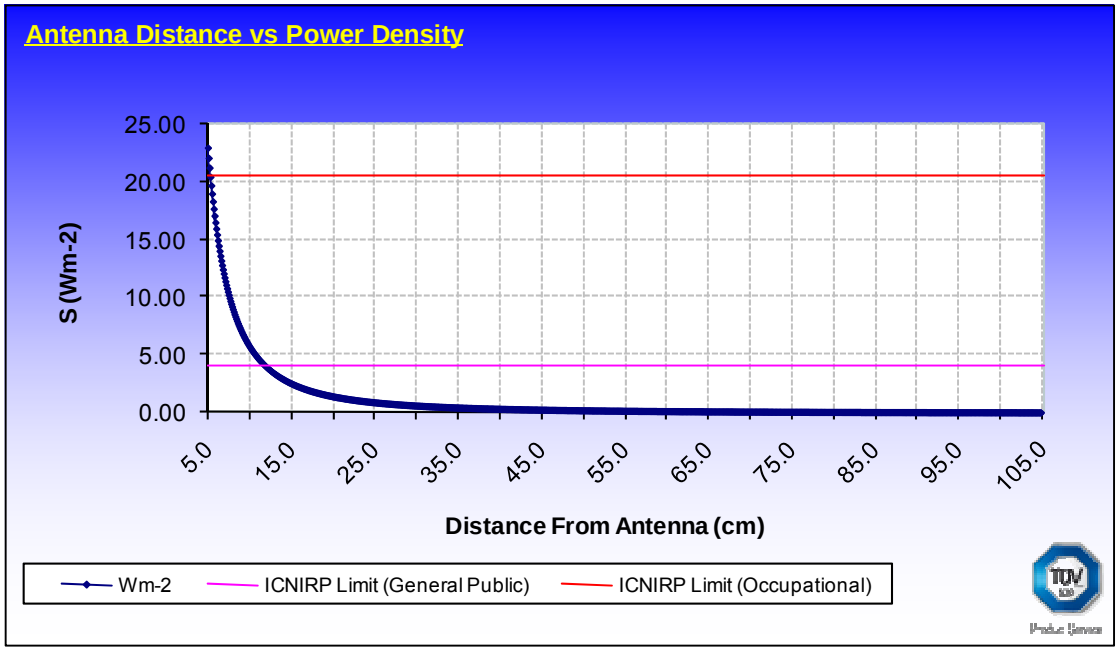


Figure 2 - This graph shows the S field (W/cm^2) strength value with regards to distance from the Antenna (cm)

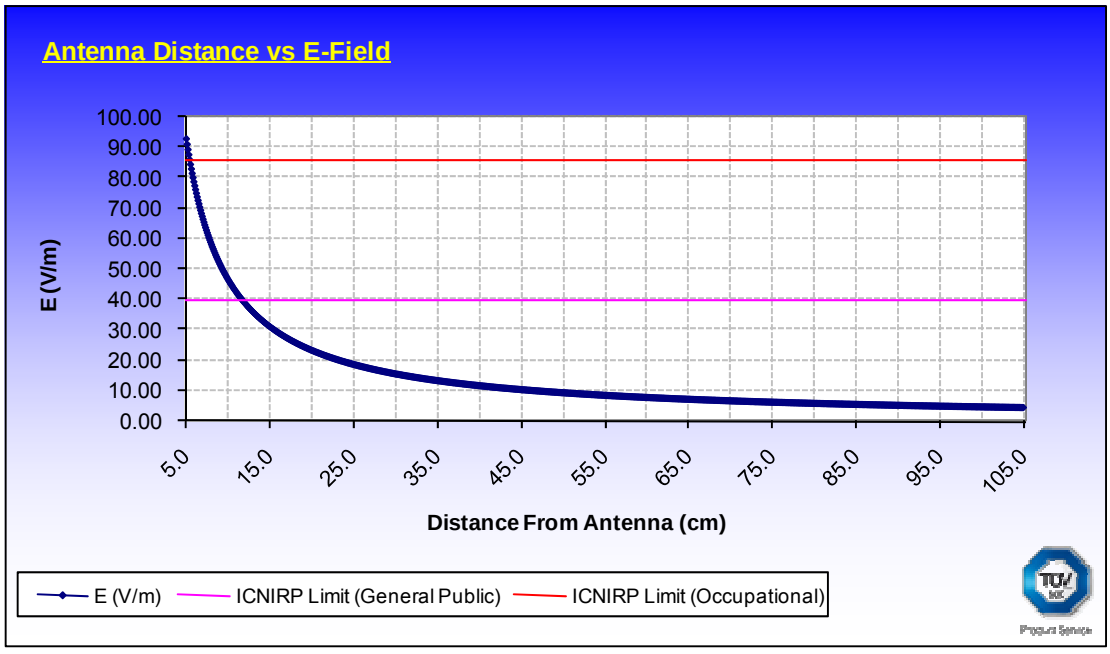


Figure 3 - This graph shows the E field (V/m) strength value with regards to distance from the Antenna (cm).

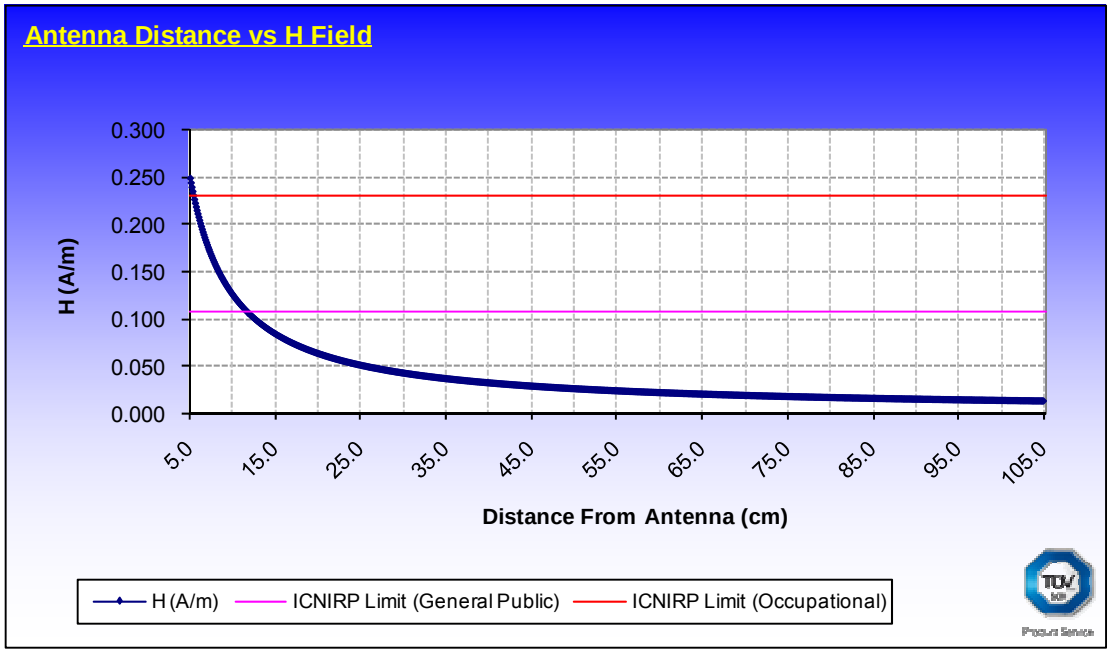


Figure 4 - This graph shows the H field (A/m) strength value with regards to distance from the Antenna (cm).

4.2 FIELD GRAPHS – FCC

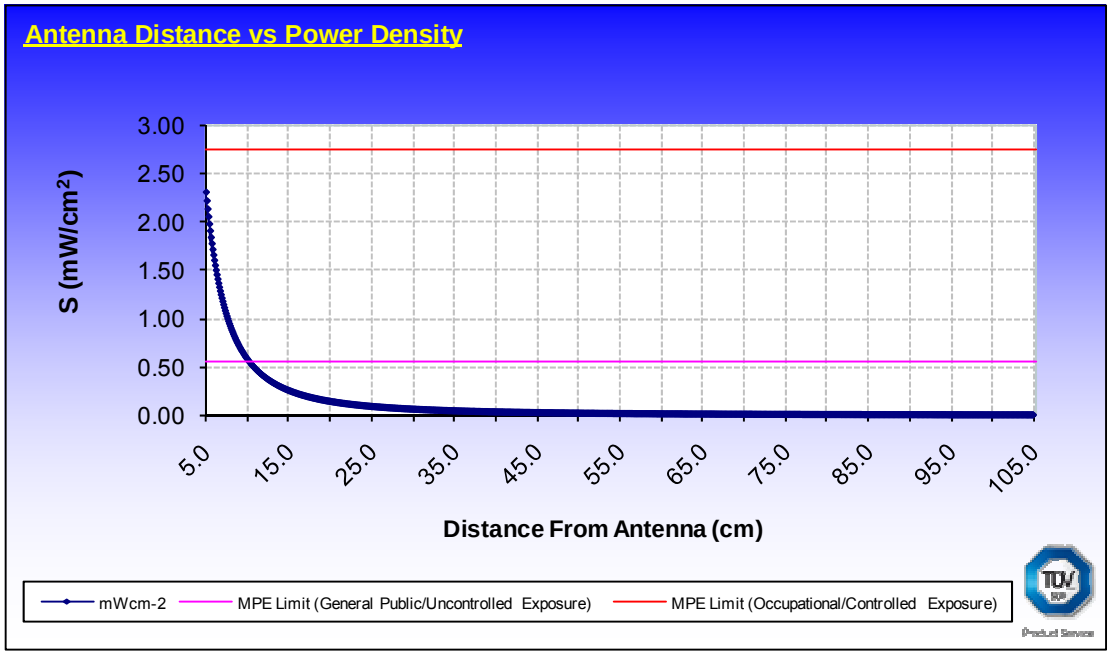


Figure 5 - This graph shows the S field (mW/cm^2) strength value with regards to distance from the Antenna (cm)

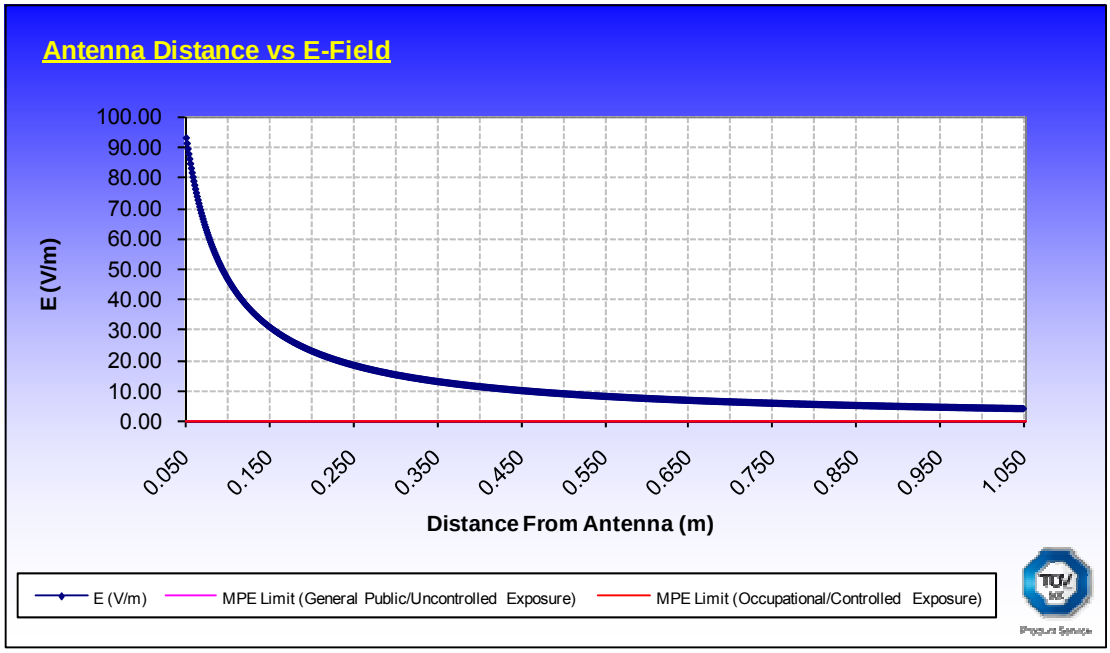


Figure 6 - This graph shows the E field (V/m) strength value with regards to distance from the Antenna (cm).

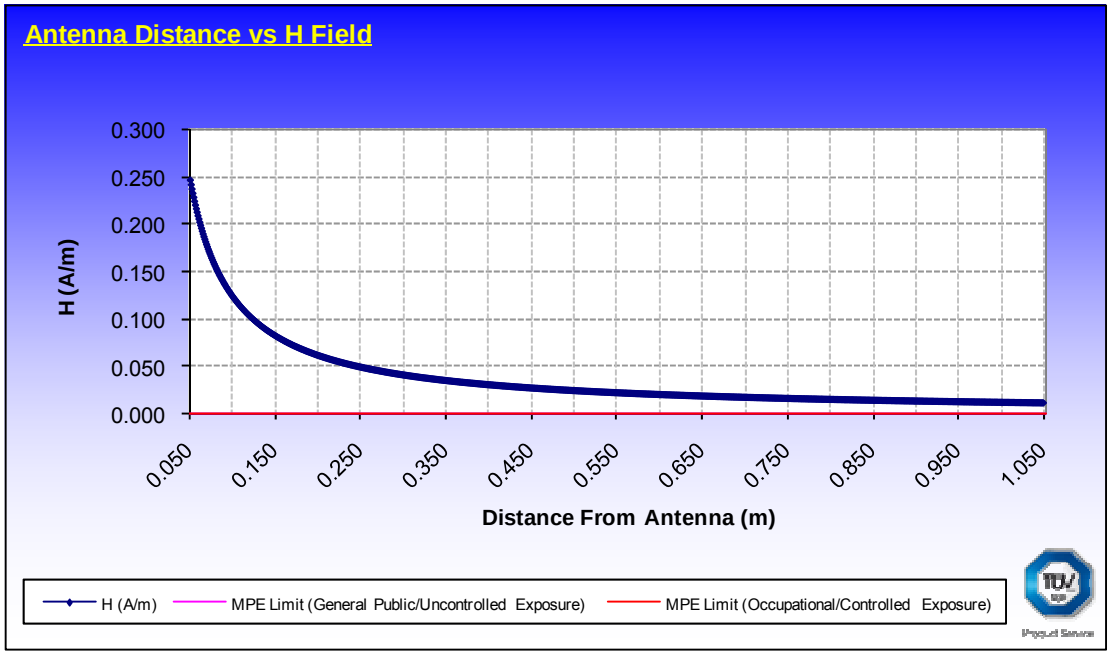


Figure 7 - This graph shows the H field (A/m) strength value with regards to distance from the Antenna (cm).

4.3 FIELD GRAPHS – IC

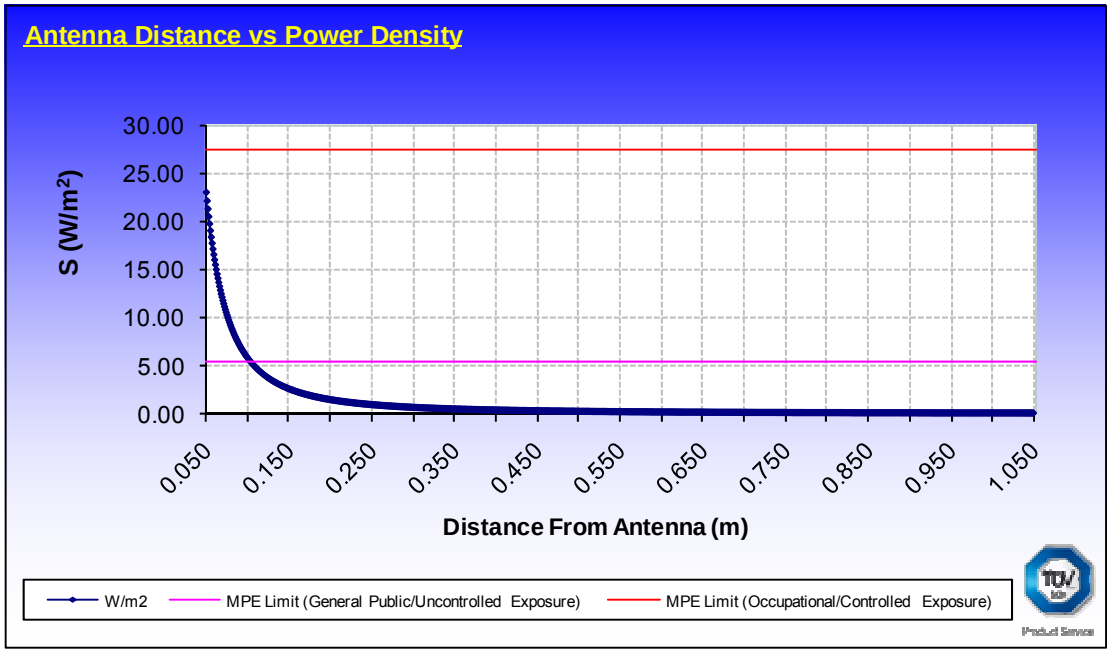


Figure 8 - This graph shows the S field (W/cm^2) strength value with regards to distance from the Antenna (cm)

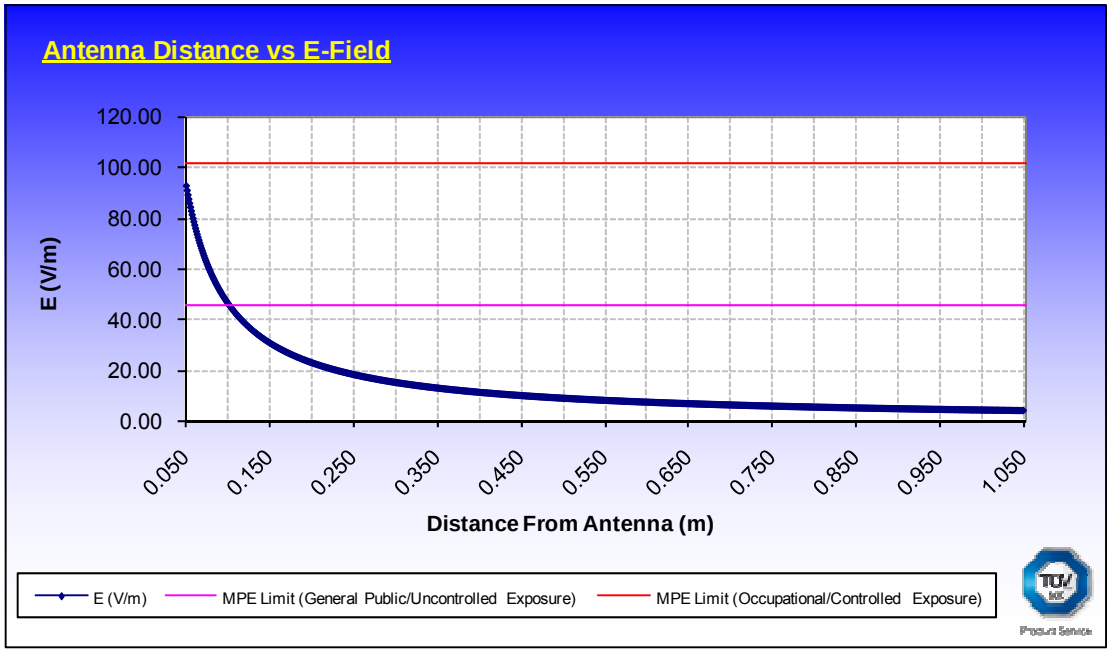


Figure 9 - This graph shows the E field (V/m) strength value with regards to distance from the Antenna (cm).

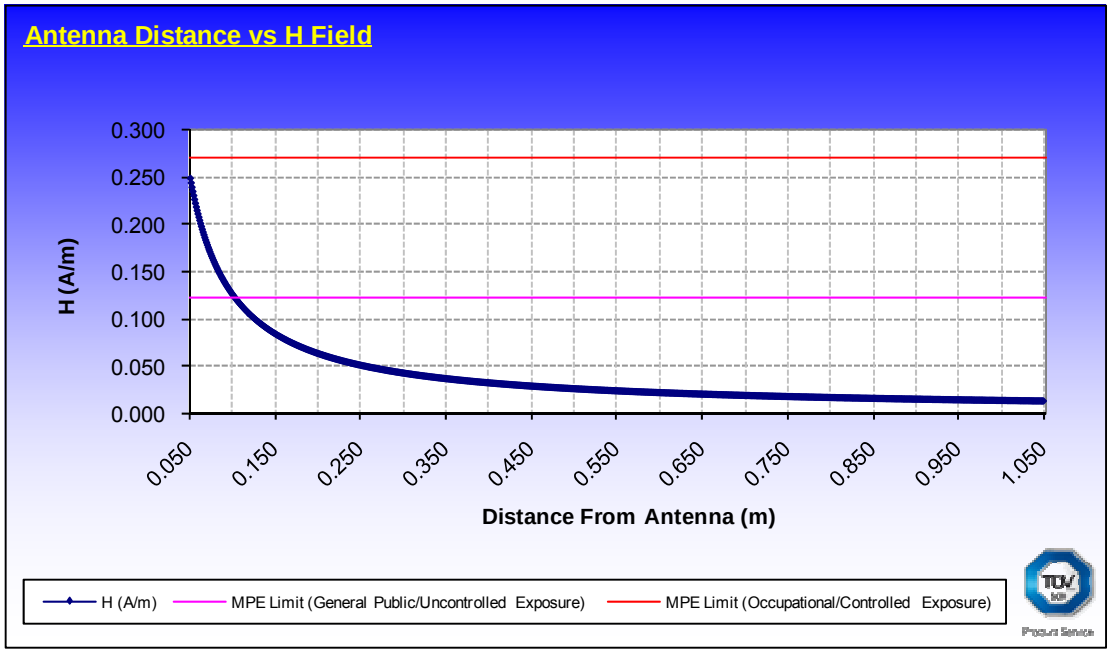


Figure 10 - This graph shows the H field (A/m) strength value with regards to distance from the Antenna (cm).

SECTION 4

CO-TRANSMISSION CONSIDERATION

4.1 CO-TRANSMISSION MODULE OPTIONS

The information contained in this report is intended to show verification of the F3507g Ericsson Mobile Broadband Module Installed in DELL Studio 1535 Laptop Computer. The DELL Studio 1535 Laptop Computer can also be fitted with the following wireless device modules, described below. This section aims to show the co-transmission quotient value based upon the highest reported conducted power value for the co-located modules.

The DELL Studio 1535 laptop can also be fitted with the following Wireless Module options:-

DELL Wireless 1397 WLAN Mini-Card 802.11g;
BroadCom BCM94312HMG
FCCID: QDS-BRCM1030
Frequency range (MHz): 2412.0 – 2462.0
Maximum Conducted Output power (W): 0.202

Dell Wireless 1510 WLAN Mini-Card 802.11n;
BroadCom BCM94322HMG
FCCID: QDS-BRCM1031
Frequency range (MHz): 2412.0 – 5795.0
Maximum Conducted Output power (W): 0.159

Dell Wireless 1515 WLAM Mini-card 802.11agn;
Atheros AR5BHB92
FCCID: PPD-AR5BHB92
Frequency range (MHz): 2412.0 – 5795.0
Maximum Conducted Output power (W): 0.965

Dell Wireless 370 Bluetooth;
Frequency range (MHz): 2402.0 – 2480.0
FCCID: QDS-BRCM1034
Maximum Conducted Output power (W): 0.0027

Dell Wireless 410 Bluetooth + UWB;
Frequency range (MHz): 2402.0 – 4800.0
FCCID: QDS-BRCM1035
Maximum Conducted Output power (W): 0.0043

5.1 SOURCES CONTRIBUTING TO THE WORST-CASE QUOTIENT CALCULATION

The Ericsson Mobile Broadband Module
DELL Wireless 1515; 802.11agn Module
DELL Wireless 410 Module

DIST(m)	FREQ. (MHz)	INPUT POWER (W)	GAIN (dBi)	FIELD (V/m)	FIELD (W/m)	REF. LEVEL	% QUOTIENT
0.2	824.2	0.500*	1.6	23.28	1.438	4.12	34.89
0.2	5755	0.965	3	38.00	3.831	10.00	38.31
0.2	2480	0.0043	3	2.54	0.017	10.00	0.17
TOTAL QUOTIENT (%)							73.37
FRACTION OF PUBLIC EXPOSURE LIMIT - 1 /							1

*Note: Input power of 2 watts with a duty cycle of 25% (GPRS Multi-slot Class 10)

Product Service

SECTION 5

DISCLAIMERS AND COPYRIGHT

6.1 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