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TRaC Radio Test Report

FOR

Widex A/S

ON

D-XP

Document No. TRA-007944-W-US5

TRaC Radio Test Report : TRA-007944-W-US5

Applicant : Widex A/S

Apparatus : D-XP

Specification(s) : CFR47 Part 15 2011

Purpose of Test : Certification

FCCID : TTY-DXP

IC ID : 5676B-DXP

Authorised by :



:Radio Product Manager

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Section 1:**Introduction****1.1 General**

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on samples submitted to the Laboratory.


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1.2 Tests Requested By

This testing in this report was requested by :

Widex A/S
Nymoellevej 6
DK-3540 Lynge
Denmark

1.3 Manufacturer

As above.

1.4 Apparatus Assessed

The following apparatus was assessed between: 25/04/12 and 26/04/12

D-XP

The above equipment was a hearing aid containing radio circuitry operating at 10.6 MHz.

1.5 Test Result Summary

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

The statements relating to compliance with the standards below apply ONLY as qualified in the notes and deviations stated in sections 1.6 to 1.7 of this test report.

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

Test Type	Regulation	Measurement standard	Result
Spurious Emissions Radiated <1000MHz	Title 47 of the CFR: Part 15 Subpart (c) 15.209	ANSI C63.4	Pass
Intentional Emission Frequency	Title 47 of the CFR: Part 15 Subpart (c) 15.209	ANSI C63.4	Pass
Intentional Emission Field Strength:	Title 47 of the CFR: Part 15 Subpart (c) 15. 209	ANSI C63.4	Pass
Intentional Emission Band Occupancy	Title 47 of the CFR: Part 15 Subpart (c) 15.215	ANSI C63.4	Pass
Unintentional Radiated Spurious Emissions	Title 47 of the CFR: Part 15 Subpart (b) 15.109	ANSI C63.4	Pass
Antenna Arrangements Integral:	Title 47 of the CFR: Part 15 Subpart (c) 15.203	-	Pass
Antenna Arrangements External Connector	Title 47 of the CFR: Part 15 Subpart (c) 15.204	-	-
Restricted Bands	Title 47 of the CFR: Part 15 Subpart (c) 15.205	-	-
Maximum Frequency Of Search	Title 47 of the CFR: Part 15 Subpart (c) 15.33	-	-
Extrapolation Factor	Title 47 of the CFR: Part 15 Subpart (c) 15.31(f)	-	-

Abbreviations used in the above table:

CFR : Code of Federal Regulations
REFE : Radiated Electric Field Emissions

ANSI : American National Standards Institution
PLCE : Power Line Conducted Emissions

1.6 Notes Relating To The Assessment

With regard to this assessment, the following points should be noted:

The results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 1.7 of this test report (Deviations from Test Standards).

For emissions testing, throughout this test report, "Pass" indicates that the results for the sample as tested were below the specified limit (refer also to Section 2, Measurement Uncertainty).

Where relevant, the apparatus was only assessed using the monitoring methods and susceptibility criteria defined in this report.

All testing with the exception of testing at the Open Area Test Site was performed under the following environmental conditions:

Temperature	: 17 to 23 °C
Humidity	: 45 to 75 %
Barometric Pressure	: 86 to 106 kPa

All dates used in this report are in the format dd/mm/yy.

This assessment has been performed in accordance with the requirements of ISO/IEC 17025.

1.7 Deviations from Test Standards

There were no deviations from the standards tested to.

Section 2:**Measurement Uncertainty****2.1 Measurement Uncertainty Values**

For test data recorded, the following measurement uncertainty was calculated:

Test type	Quantity	Quantity frequency range	Uncertainty
Radiated electric field emissions 3m alternative test site	Amplitude	30MHz to 300MHz Horizontal	±4.6dB
		30MHz to 300MHz Vertical	±5.1dB
		300MHz to 1000MHz Horizontal	±5.2dB
		300MHz to 1000MHz Vertical	±5.5dB
		1GHz to 26.5GHz Horizontal and Vertical	±4.1dB
Effective Radiated Power 3m alternative test site		9kHz to 150kHz 150kHz to 30 MHz	±2.1dB ±1.6dB
Radiated magnetic field emissions 3m alternative test site		N/A	±0.9 dB
Conducted emissions		N/A	±0.9 dB
Absolute RF power (via antenna connector)		N/A	±0.9 dB
PSD		N/A	±0.9 dB
Frequency Range	Frequency	9kHz to 26.5GHz	3.611kHz

Section 3:

Modifications

3.1 Modifications Performed During Assessment

No modifications were performed during the assessment

Appendix A:**Formal Emission Test Results**

Abbreviations used in the tables in this appendix:

Spec	: Specification	ALSR	: Absorber Lined Screened Room
Mod	: Modification	OATS	: Open Area Test Site
EUT	: Equipment Under Test	ATS	: Alternative Test Site
SE	: Support Equipment	Ref	: Reference
L	: Live Power Line	Freq	: Frequency
N	: Neutral Power Line	MD	: Measurement Distance
E	: Earth Power Line	SD	: Spec Distance
Pk	: Peak Detector	Pol	: Polarisation
QP	: Quasi-Peak Detector	H	: Horizontal Polarisation
Av	: Average Detector	V	: Vertical Polarisation
CDN	: Coupling & decoupling network		

A1 Transmitter Intentional Emission Radiated

Test Details:	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.209(b)(1)
Measurement standard	ANSI C63.4:2009
EUT sample number	S12
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C

FREQ. (MHz)	MEASUREMENT DISTANCE Meters	MEASUREMENT READING (dBμV/m)	EXTRAP. FACTOR (dB)	FIELD STRENGTH (μV/m)
10.817	1	37.1	-59.1	0.08
Limit value @ fc		30 μV/m (29.5dBuV/m) @ 30m		
Band occupancy @ -20 dBc		f lower		f higher
		10.2667 MHz		10.9496MHz
		682.900kHz		

- Notes:**
- 1 Results quoted are extrapolated as indicated
 - 2 Receiver detector @ fc = Quasi Peak 10 kHz
 - 3 When battery powered the EUT was powered with new batteries
 - 4 Extrapolation 1 - 30 Meters 59.1 dB as per 15.31(f)
 - 5 Due to the low level of the signal measurements at a distance greater than 1 meter could not be made.

- Test Method:**
- 1 As per Radio – Noise Emissions, ANSI C63.4
 - 2 Measuring distances 3m
 - 3 EUT 0.8 metre above ground plane
 - 4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthogonal planes.
Maximum results recorded

A2 Radiated Electric Field Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to all spurious emissions and harmonics emissions. The maximum permitted field strength is listed in Section 15.209. The EUT was set to transmit as required.

The following test site was used for final measurements as specified by the standard tested to:

3m open area test site :

☐

3m alternative test site :

☒

The effect of the EUT set-up on the measurements is summarised in note (c) below.

Test Details:	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) Clause 15.209
Measurement standard	ANSI C63.4:2009
Frequency range	9kHz – 1000MHz
EUT sample number	S12
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photographs 1 and 2

All radiated emission measurement values for spurious emissions and harmonics were a minimum of 20 dB below the test limit.

All spurious emissions were below the level of the fundamental emission, the worst case emission being 15.6 dBµV/m at 11.625 MHz.

Notes:

- Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.4: section 4.5, Table 1.
- In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
- Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.
- For Frequencies below 1 GHz, RBW= 120 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

Peak	RBW=VBW= 1MHz
Average	RBW=VBW= 1MHz

The upper and lower frequency of the measurement range was decided according to 47 CFR Part 15:2011 Clause 15.33(a) and 15.33(a)(1).

Radiated emission limits 47 CFR Part 15: Clause 15.209 for all emissions:

Frequency of emission (MHz)	Field strength $\mu\text{V/m}$	Measurement Distance m	Field strength $\text{dB}\mu\text{V/m}$
0.009-0.490	$2400/F(\text{kHz})$	300	$67.6/F(\text{kHz})$
0.490-1.705	$24000/F(\text{kHz})$	30	$87.6/F(\text{kHz})$
1.705-30	30	30	29.5
30-88	100	3	40.0
88-216	150	3	43.5
216-960	200	3	46.0
Above 960	500	3	54.0

- (a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

$$\text{Extrapolation (dB)} = 20 \log_{10} \left(\frac{\text{measurement distance}}{\text{specification distance}} \right)$$

- (b) The levels may have been rounded for display purposes.
- (c) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels		✓		
Effect of EUT internal configuration on emission levels		✓		
Effect of Position of EUT cables & samples on emission levels	✓			
(i) Parameter defined by standard and / or single possible, refer to Appendix D (ii) Parameter defined by client and / or single possible, refer to Appendix D (iii) Parameter had a negligible effect on emission levels, refer to Appendix D (iv) Worst case determined by initial measurement, refer to Appendix D				

A3 Unintentional Radiated Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to all spurious emissions on directly related to the transmitter. The maximum permitted field strength is listed in Section 15.109. The EUT was set to operate in a transmit standby / receive mode.

The following test site was used for final measurements as specified by the standard tested to:

3m open area test site :

☐

3m alternative test site :

☒

The effect of the EUT set-up on the measurements is summarised in note (c) below.

Test Details:	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) Clause 15.109
Measurement standard	ANSI C63.4:2009
Frequency range	9kHz – 1000MHz
EUT sample number	S09
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photographs 1 and 2

All radiated emission measurement values for spurious emissions and harmonics were a minimum of 20 dB below the test limit.

Notes:

- Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.4: section 4.5, Table 1.
- In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
- Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.
- For Frequencies below 1 GHz, RBW = 120 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

Peak	RBW=VBW= 1MHz
Average	RBW=VBW= 1MHz

The upper and lower frequency of the measurement range was decided according to 47 CFR Part 15:2011 Clause 15.33(a) and 15.33(a)(1).

Radiated emission limits 47 CFR Part 15: Clause 15.109 for all emissions:

Frequency of emission (MHz)	Field strength $\mu\text{V/m}$	Measurement Distance m	Field strength $\text{dB}\mu\text{V/m}$
30-88	100	3	40.0
88-216	150	3	43.5
216-960	200	3	46.0
Above 960	500	3	54.0

- (a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

$$\text{Extrapolation (dB)} = 20 \log_{10} \left(\frac{\text{measurement distance}}{\text{specification distance}} \right)$$

- (b) The levels may have been rounded for display purposes.
- (c) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

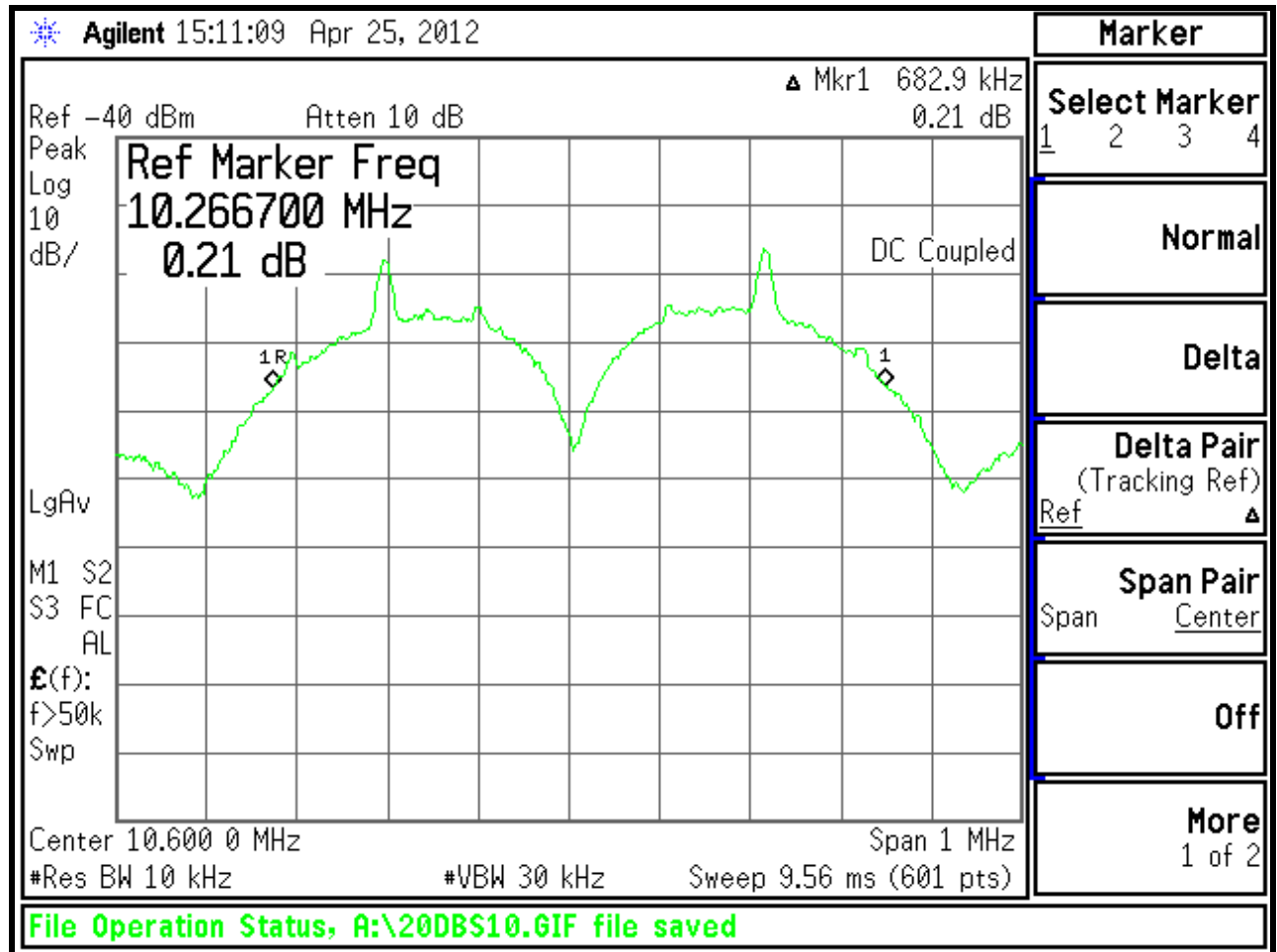
	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels		✓		
Effect of EUT internal configuration on emission levels		✓		
Effect of Position of EUT cables & samples on emission levels	✓			
(i) Parameter defined by standard and / or single possible, refer to Appendix D (ii) Parameter defined by client and / or single possible, refer to Appendix D (iii) Parameter had a negligible effect on emission levels, refer to Appendix D (iv) Worst case determined by initial measurement, refer to Appendix D				

Appendix B:**Supporting Graphical Data**

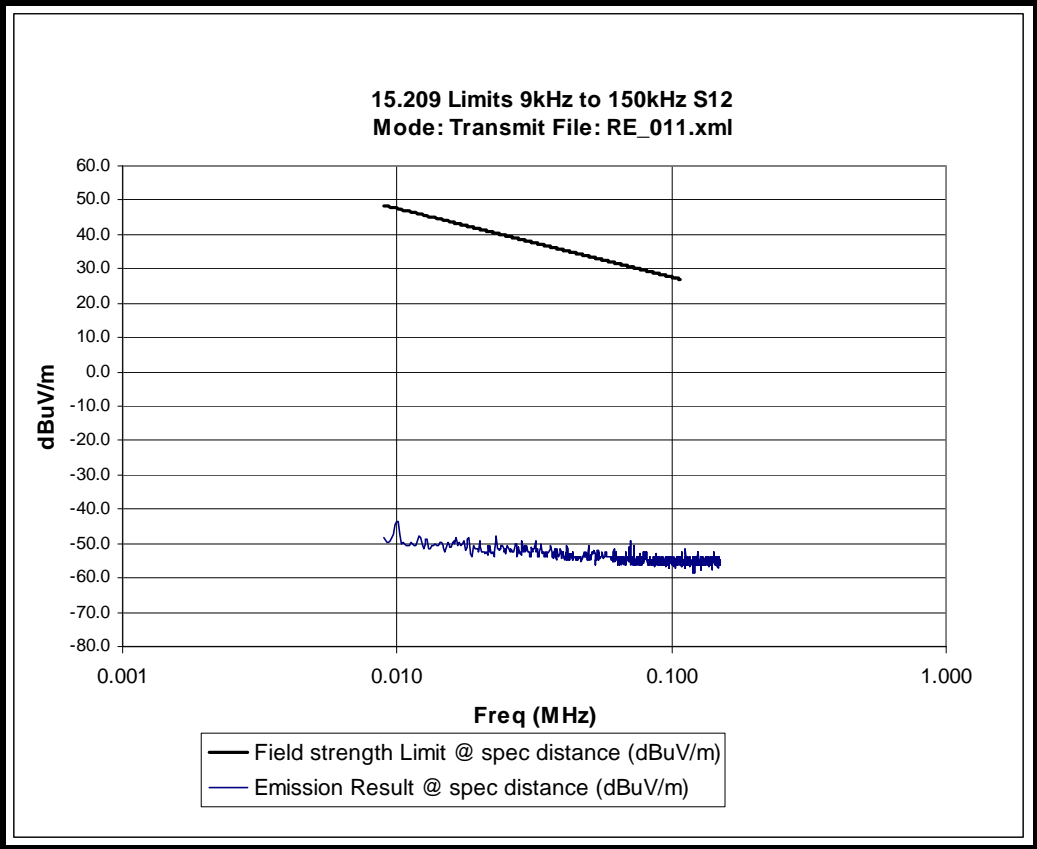
This appendix contains graphical data obtained during testing.

Notes:

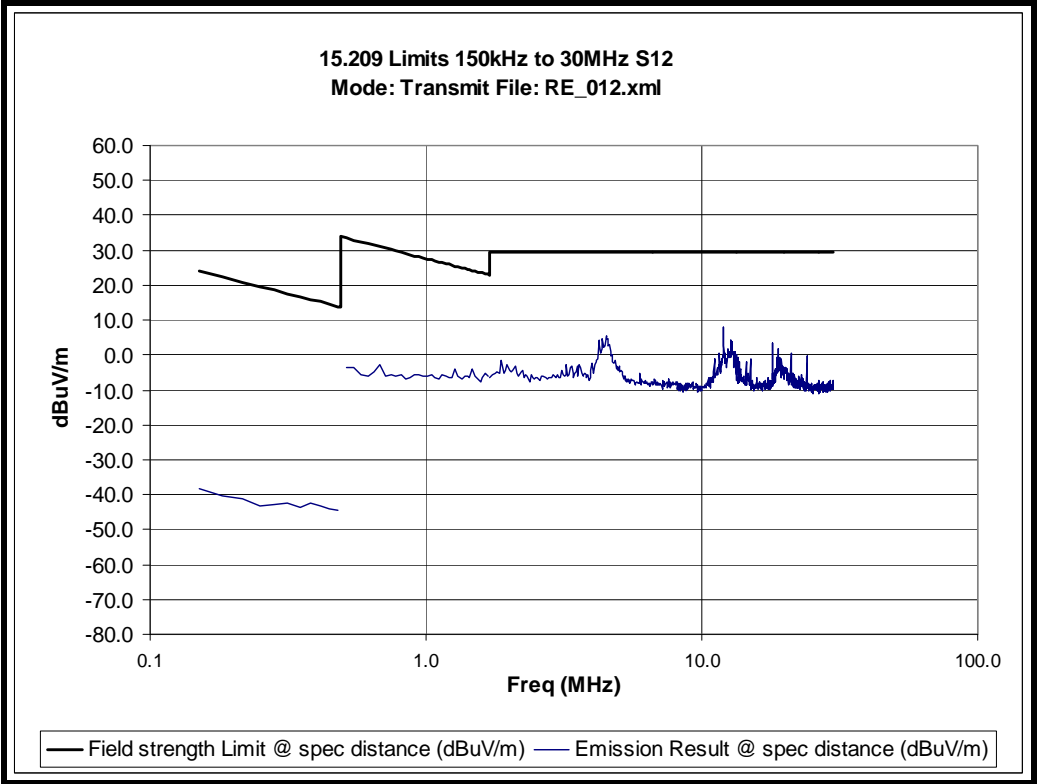
- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.
- (b) The time and date on the plots do not necessarily equate to the time of the test.
- (c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.
- (d) Appendix C details the numbering system used to identify the sample and its modification state.
- (e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.



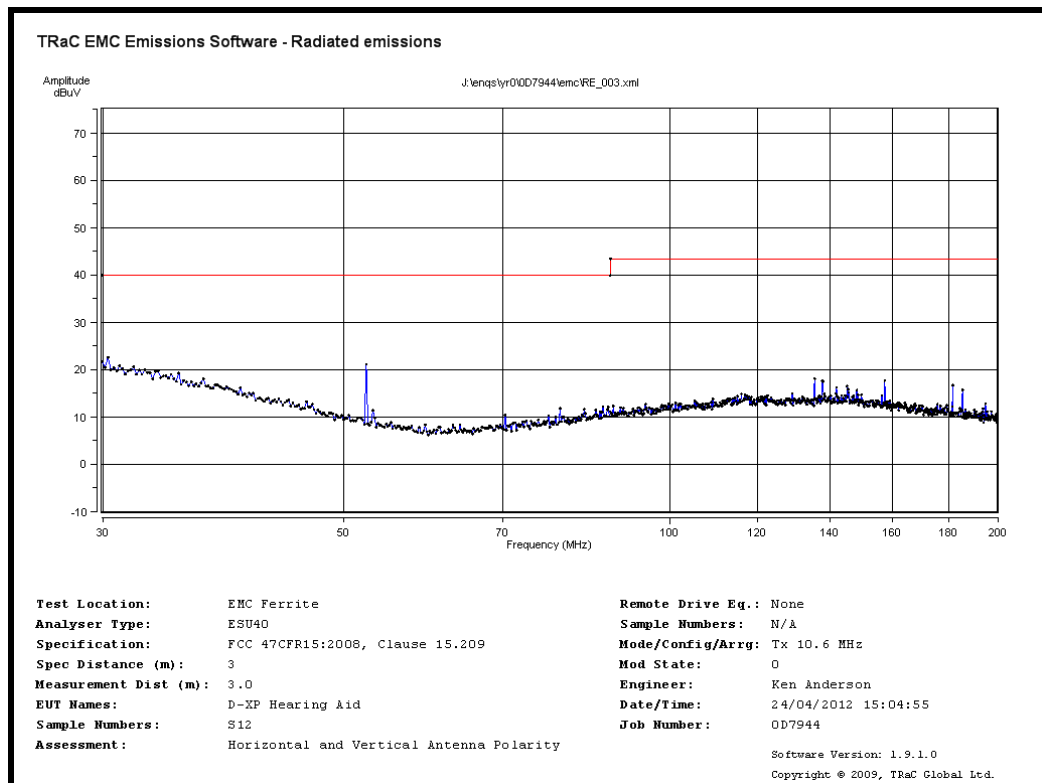
20dB Bandwidth



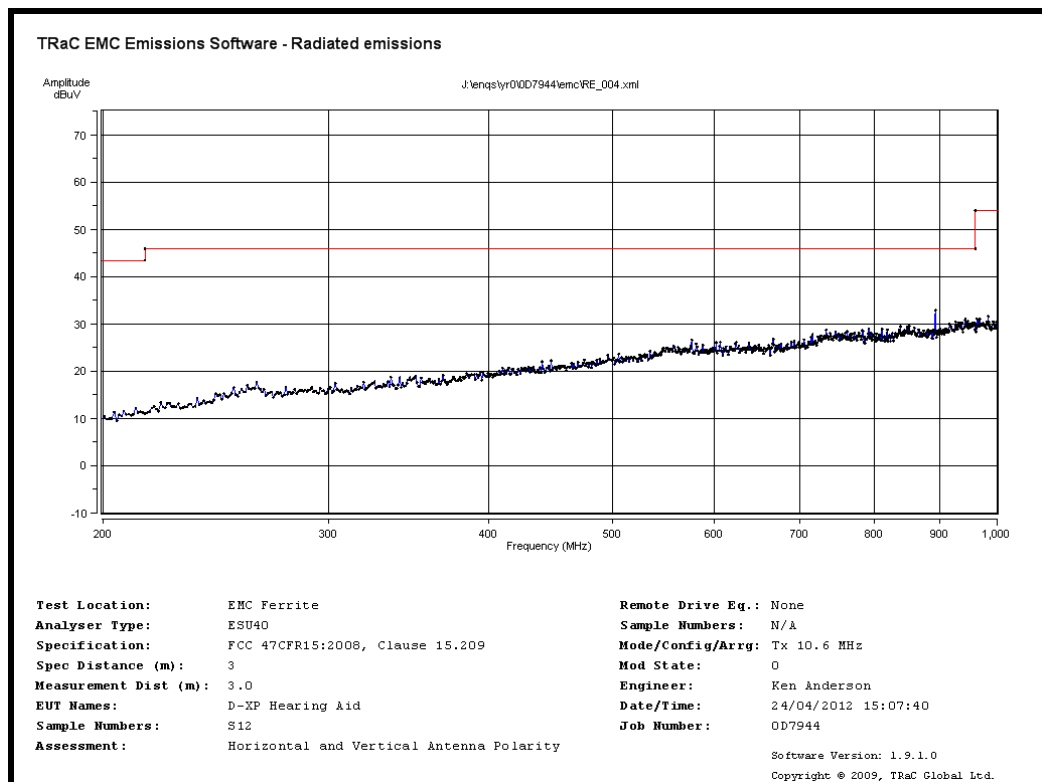
Radiated spurious emissions 9kHz to 150kHz



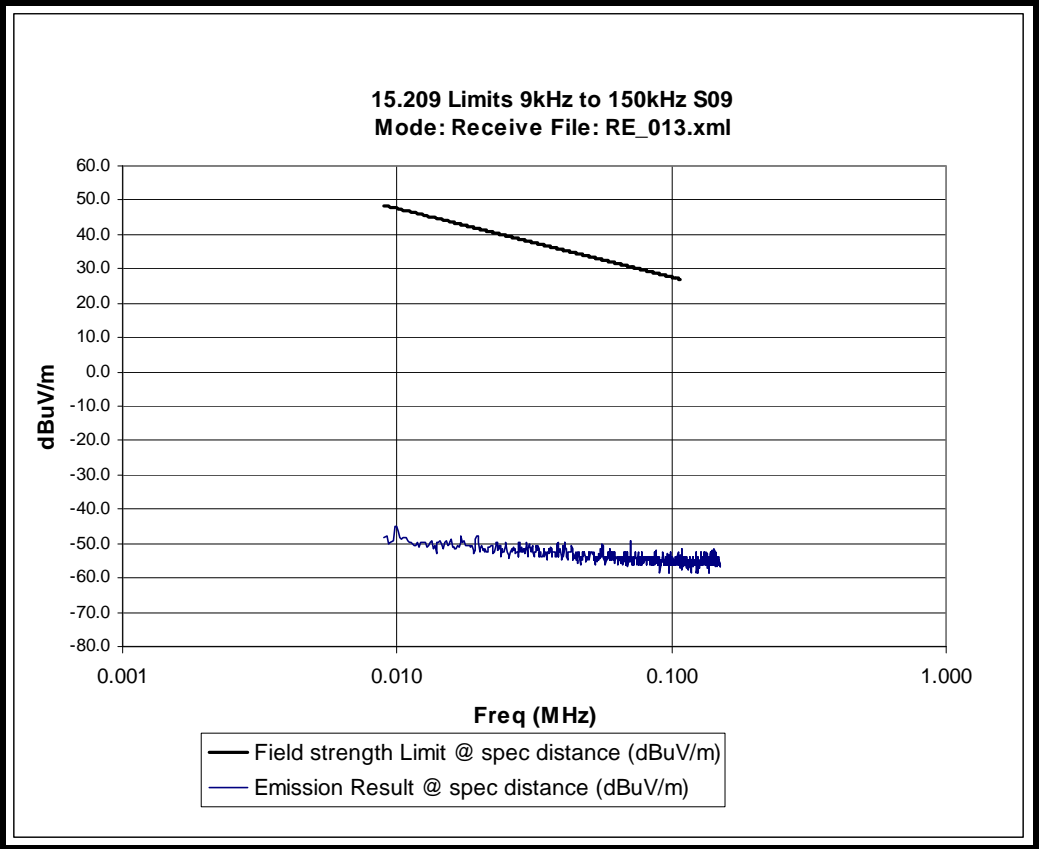
Radiated spurious emissions 150kHz to 30MHz



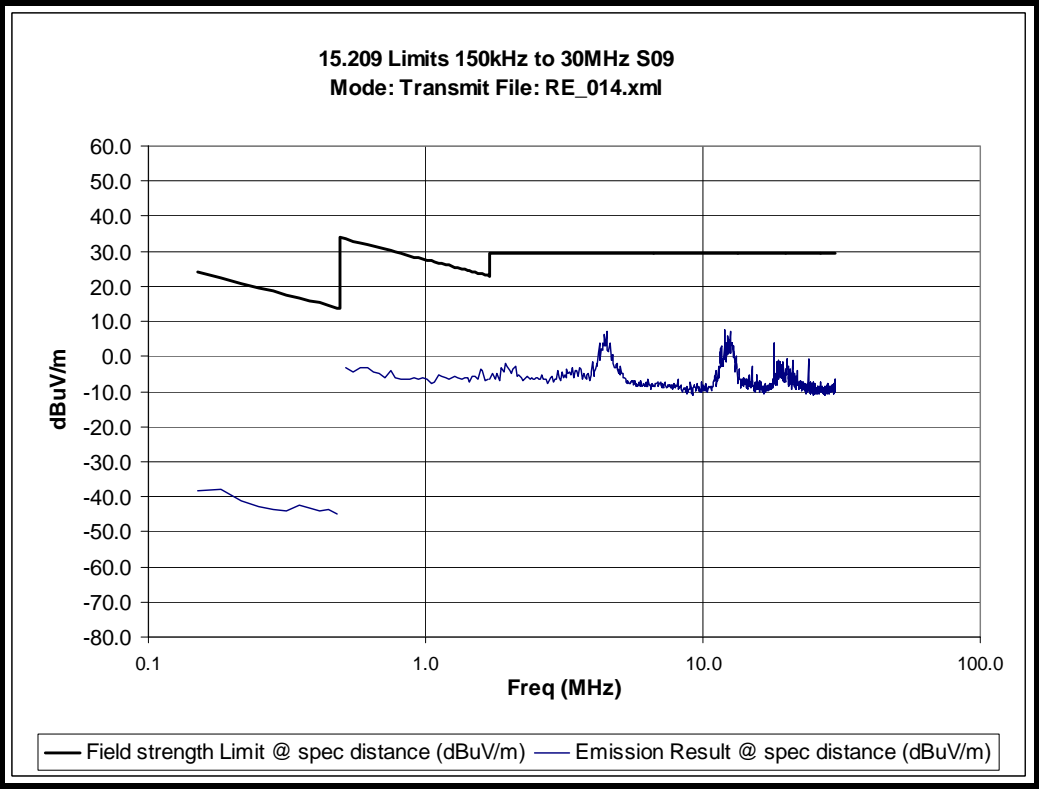
Radiated spurious emissions 30MHz to 200MHz



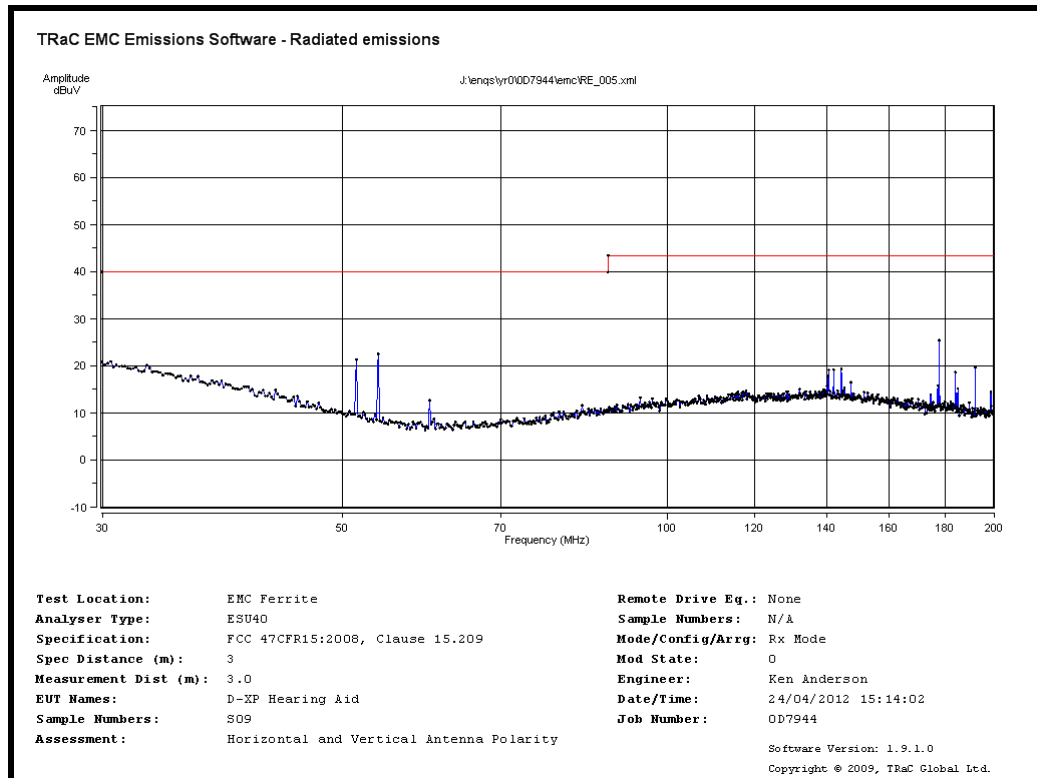
Radiated spurious emissions 200MHz to 1GHz



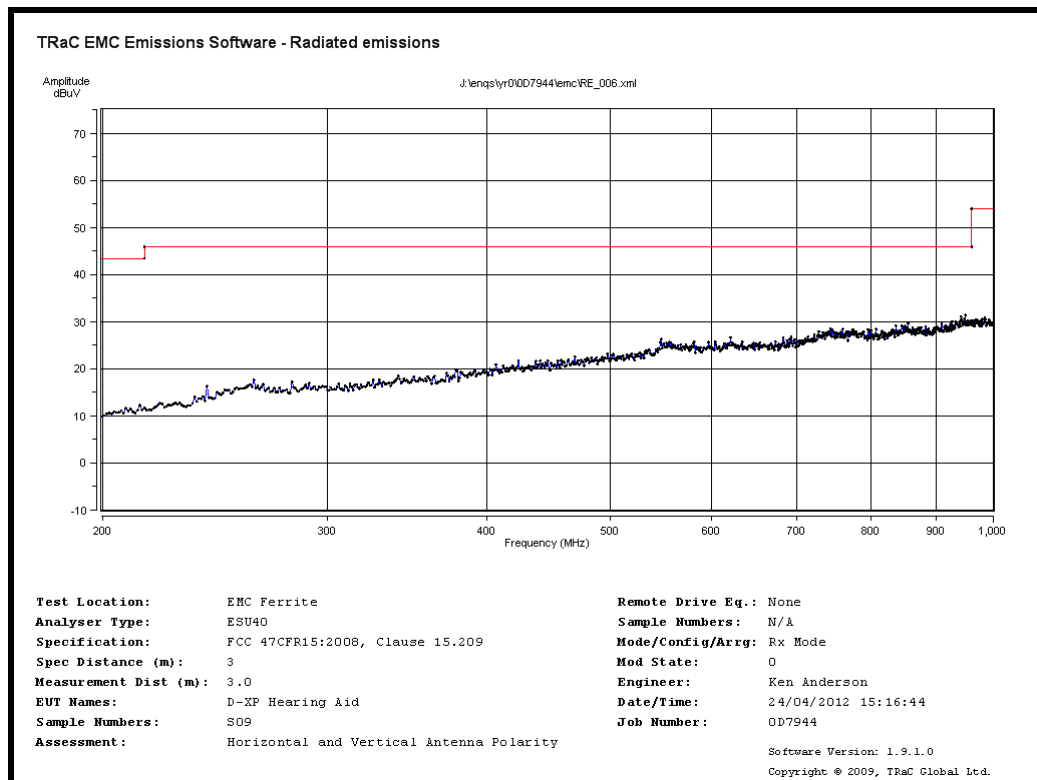
Unintentional Radiated spurious emissions 9kHz to 150kHz



Unintentional Radiated spurious emissions 150kHz to 30MHz



Unintentional Radiated spurious emissions 30MHz to 200MHz



Unintentional Radiated spurious emissions 200MHz to 1GHz

Appendix C:**Additional Test and Sample Details**

This appendix contains details of:

1. The samples submitted for testing.
2. Details of EUT operating mode(s)
3. Details of EUT configuration(s) (see below).
4. EUT arrangement (see below).

Throughout testing, the following numbering system is used to identify the sample and it's modification state:

Sample No: Sxx Mod w

where:

xx	= sample number	eg. S01
w	= modification number	eg. Mod 2

The following terminology is used throughout the test report:

Support Equipment (SE) is any additional equipment required to exercise the EUT in the applicable operating mode. Where relevant SE is divided into two categories:

SE in test environment: The SE is positioned in the test environment and is not isolated from the EUT (e.g. on the table top during REFE testing).

SE isolated from the EUT: The SE is isolated via filtering from the EUT. (e.g. equipment placed externally to the ALSR during REFE testing).

EUT configuration refers to the internal set-up of the EUT. It may include for example:

- Positioning of cards in a chassis.
- Setting of any internal switches.
- Circuit board jumper settings.
- Alternative internal power supplies.

Where no change in EUT configuration is **possible**, the configuration is described as "single possible configuration".

EUT arrangement refers to the termination of EUT ports / connection of support equipment, and where relevant, the relative positioning of samples (EUT and SE) in the test environment.

For further details of the test procedures and general test set ups used during testing please refer to the related document "EMC Test Methods - An Overview", which can be supplied by TRaC Telecoms & Radio upon request.

C1 Test samples

The following samples of the apparatus were submitted by the client for testing :

Sample No.	Description	Identification
S09	D-XP Hearing Aid (Normal sample)	None
S12	D-XP Hearing Aid (Constant transmit sample)	None

C2 EUT Operating Mode During Testing

During testing, the EUT was exercised as described in the following tables:

Test	Description of Operating Mode: Transmit
Transmitter Intentional Emission Radiated, 20dB Bandwidth and Radiated Electric Field Emissions	The EUT was transmitting continuously on maximum power using FSK (centre frequency 10.6MHz / Deviation $\pm 200\text{kHz}$) modulation and powered by a new battery.

Test	Description of Operating Mode: Receive mode
Unintentional Radiated Emissions	The EUT was placed in receive (non-transmitting) mode during the test and powered by a new battery.

C3 EUT Configuration Information

The EUT was submitted for testing in one single possible configuration.

C4 List of EUT Ports

The tables below describe the termination of EUT ports:

Sample : S12
Tests : Transmitter Intentional Emission Radiated, 20dB Bandwidth and Radiated Electric Field Emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
dc power port	None	N/A	IEC 60086Type PR41 Cell
Antenna port	None	N/A	Integral

Sample : S09
Tests : Unintentional Radiated Emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
dc power port	None	N/A	IEC 60086Type PR41 Cell
Antenna port	None	N/A	Integral

C5 Details of Equipment Used

For Radiated Measurements:

Intentional Emission Field Strength, Spurious Emissions Radiated and Unintentional Radiated Spurious Emissions between 9kHz to 30MHz

RFG No	Type	Description	Manufacturer	Date Calibrated
REF886	Lab 16	Large Anechoic Chamber	TRaC	27/07/11
023	HFH-Z2	Mag Loop Antenna	R&S	24/03/11
REF909	FSU	Spectrum Analyser	R&S	04/08/11
REF881		HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF882		HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF884		HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF885		HF RF coaxial cable	Teledyne Reynolds	06/06/11

Spurious Emissions Radiated and Unintentional Radiated Spurious Emissions between 30MHz and 1GHz

RFG No	Type	Description	Manufacturer	Date Calibrated.
REF886	Lab 16	Large Anechoic Chamber	TRaC	27/07/11
095	96002	Bicon Antena (30-200MHz)	Eaton	12/05/10
191	3146	Log Periodic Antenna (200-1000MHz)	EMCO	12/05/10
REF927	310	Pre-Amp (9kHz-1GHz)	Sonoma	17/07/11
REF909	FSU	Spectrum Analyser	R&S	04/08/11
126	ESVS 20	Test Receiver (HF)	R&S	18/05/11
452		1m UTIFLEX sma to sma cable	Teledyne Reynolds	25/05/11
REF881		HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF882		HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF884		HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF885		HF RF coaxial cable	Teledyne Reynolds	06/06/11

For 20dB Bandwidth measurement

RFG No	Type	Description	Manufacturer	Date Calibrated
REF837	E4440	Spectrum analyser	Agilent	18/05/11
408	7429-1	Loop Antenna	Solar Electronics Co.	N/A

Appendix D:

Additional Information

This appendix contains no additional information

Appendix E:

Calculation of the duty cycle correction factor

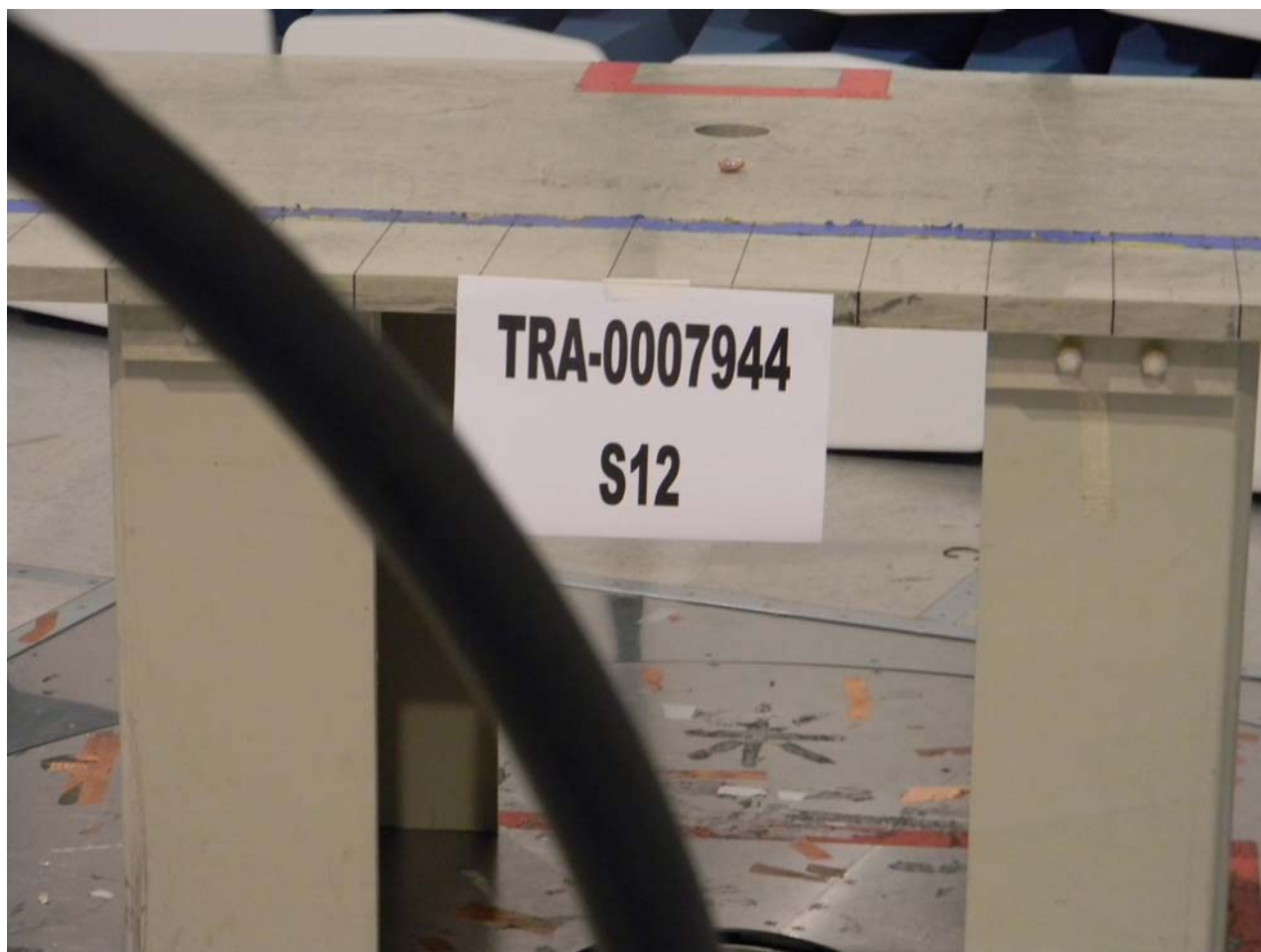
No average detector measurements were made during testing, therefore this calculation is not required

Appendix F:

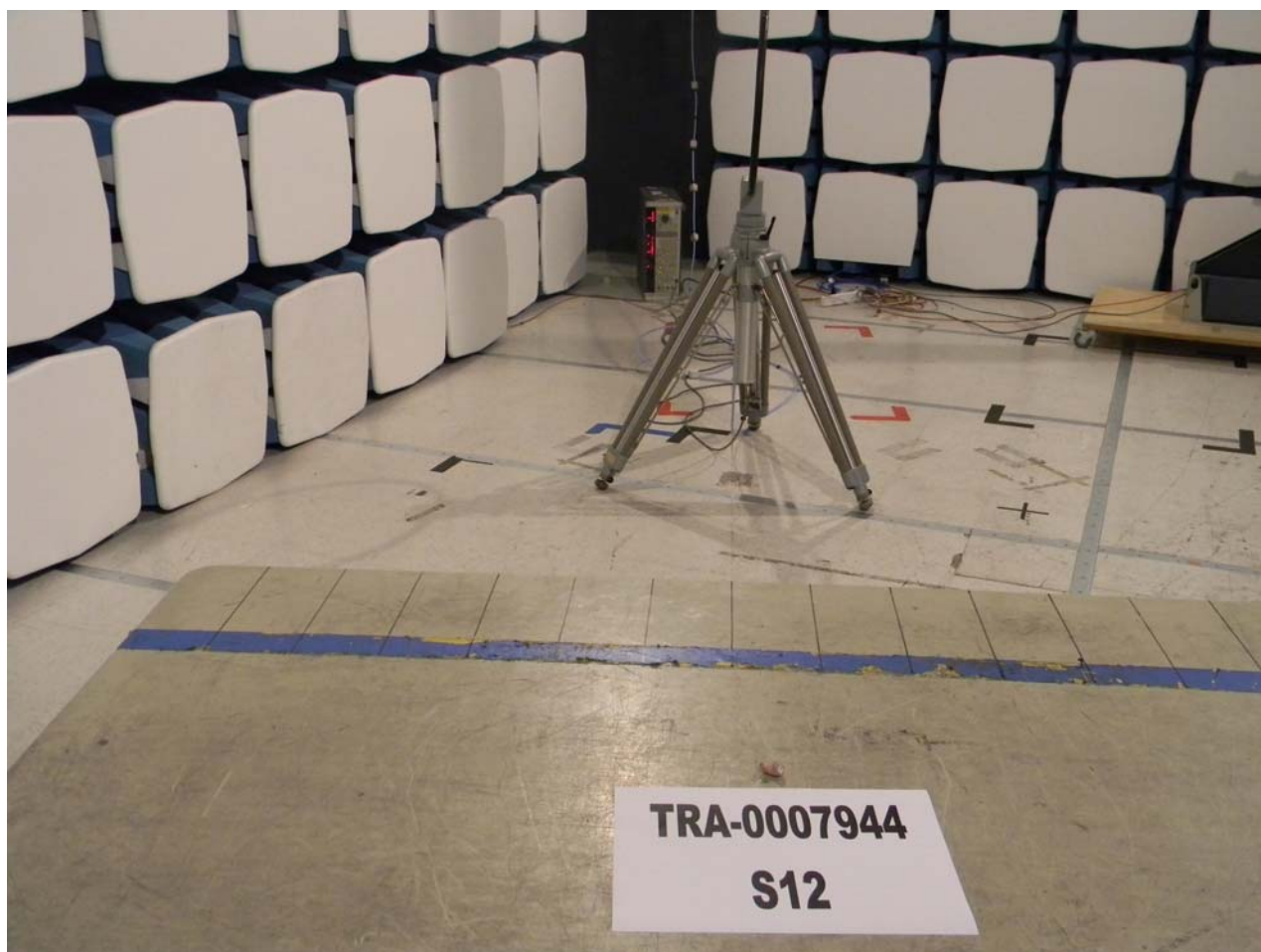
Photographs and Figures

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement: front view.
2. Radiated electric field emissions arrangement: rear view.



Photograph 1



Photograph 2

Appendix G:**MPE Calculation**

OET Bulletin No. 65, Supplement C 01-01

47 CFR §§1.1307 and 2.1091

2.1091 Radio frequency radiation exposure evaluation: mobile devices.

For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimetres is normally maintained between radiating structures and the body of the user or nearby persons. These devices are normally evaluated for exposure potential with relation to the MPE limits. As the 20cm separation specified under FCC rules may not be achievable under normal operation of the EUT, an RF exposure calculation is needed to show the minimum distance required to be less than 1.602mW/cm² power density limit, as required under FCC rules.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{EIRP}{4 \pi R^2} \text{ re - arranged} \quad R = \sqrt{\frac{EIRP}{S 4 \pi}}$$

where:

S = power density

R = distance to the centre of radiation of the antenna

EIRP = EUT Maximum power

Note:

The EIRP value was determined using the peak E Field measurement.

Result

Prediction Frequency (MHz)	Maximum EIRP (mW)	Power density limit (S) (mW/cm ²)	Distance (R) cm required to be less than 1.54mW/cm ²
10.82	1.70E-07	1.54	9.38E-05

Appendix H:**Cross Reference FCC Part 15c to IC RSS 210**

The testing of the D-XP was carried out to FCC 47CFR Part 15c and the results for this testing can be found in Appendix A of this report.

All measurements were carried out in accordance with ANSI C63.4, 'Methods of Measurements of RF Emissions from low voltage Electrical and Electronic Equipment in the Range 9kHz to 40GHz.

The table below shows the applicable RSS-210 parts and the corresponding FCC 47CFR Part 15 rules:

RSS-210 Issue 8	FCC 47CFR Part 15
2.5 (RSS-Gen Issue 3 Section 6.1)	Part 15.109
2.5.1	Part 15.209

In addition below is a plot of the 99% emissions bandwidth, as stipulated in Section 4.6.1 of RSS-Gen Issue 3.

