TRaC Radio Test Report

FOR

Widex A/S

ON

FM+DEX

Document No. TRA-007414WUS1

Total number of pages: 35

TRaC Wireless Test Report	**:** TRA-007414WUS1
Applicant	**:** Widex A/S
Apparatus	**:** FM+DEX
Specification(s)	**:** CFR47 Part 15 October 2008
Purpose of Test	**:** Certification
FCC ID	: TTY-FMD
IC ID	: 5676B-FMD

Authorised by	**:**
	: K J Anderson, Authorised Signatory
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Contents

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
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Denmark

1.3 Manufacturer

As above.

1.4 Apparatus Assessed

The following apparatus was assessed between 07/11/11 and 15/11/11:

FM+DEX

The FM+DEX is an advance remote control unit for controlling various functions of a hearing aid. The FM+DEX uses a proprietary 10.6 MHz radio as connection to the hearing aid, which is used to transmit an audio stream to the hearing aid. The audio stream may be received from a proprietary FM transmitter, direct audio input or the built-in telecoil.

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 C63.10	Pass
Intentional Emission Frequency	Title 47 of the CFR: Part 15 Subpart (c) 15.209	ANSI C63.10	Pass
Intentional Emission Field Strength:	Title 47 of the CFR: Part 15 Subpart (c) 15. 209	ANSI C63.10	Pass
Intentional Emission Band Occupancy	Title 47 of the CFR: Part 15 Subpart (c) 15.215	ANSI C63.10	Pass
Unintentional Radiated Spurious Emissions	Title 47 of the CFR: Part 15 Subpart (b) 15.109	ANSI C63.10	Pass
Antenna Arrangements Integral:	Title 47 of the CFR: Part 15 Subpart (c) 15.203	-	Pass
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 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.

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 Effective Radiated Power 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
Radiated magnetic field emissions 3m alternative test site		9kHz to 150kHz 150kHz to 30 MHz	±2.1dB ±1.6dB
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
Mod	: Modification
EUT	: Equipment Under Test
SE	: Support Equipment
L	: Live Power Line
N	: Neutral Power Line
E	: Earth Power Line
Pk	: Peak Detector
QP	: Quasi-Peak Detector
Av	: Average Detector
CDN	: Coupling & decoupling network
ALSR	: Absorber Lined Screened Room
OATS	: Open Area Test Site
ATS	: Alternative Test Site
Ref	: Reference
Freq	: Frequency
MD	: Measurement Distance
SD	: Spec Distance
Pol	: Polarisation
H	: Horizontal Polarisation
V	: Vertical Polarisation

A1 Transmitter Intentional Emission Radiated

Carrier power was verified with the EUT transmitting.

Test details:	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.209(b)(1)
Measurement standard	ANSI C63.10:2009
EUT sample number	S05
Modification state	0
SE in test environment	TTR-003135S35 and Audio Source
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1

Ref No.	FREQ. (MHz)	Det.	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	Measurement distance (m)	FIELD ST'GH @MD (dBµV/m)	EXTRAP FACT (dB)	FIELD ST'GH @SD (dBµV/m)	LIMIT (dBµV/m)	Margin (dB)
1	10.818	QP	41.3	0.2	18.7	3	60.2	40	20.2	29.5	9.3

Limit value @ fc	**30 µV/m (29.5 dBµV/m)**	
Band occupancy @ -20 dBc	freq lower	freq higher
	10.2803 MHz	10.9501 MHz
	669.8 kHz	

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 3 - 30 Meters 40.0 dB as per 15.31(f)
5 MD = Measurement Distance SD = Specification Distance

Test Method:
1 As per Radio – Noise Emissions, ANSI C63.10
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 filed 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 : [X]

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 C63.10:2009
Frequency range	9kHz – 1000MHz
EUT sample number	S05
Modification state	0
SE in test environment	TTR-003135S35 and Audio Source
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photographs 1 and 2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below:

Ref No.	FREQ. (MHz)	Det.	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBµV/m)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	LIMIT (dBµV/m)	Margin (dB)
1	73.601	QP	51.9	0.9	8.4	31.6	29.6	0.0	29.6	40.0	-10.4
2	149.136	QP	52.7	1.0	12.5	31.5	34.7	0.0	34.7	43.5	-8.8
3	275.681	QP	48.3	1.6	12.8	31.5	31.2	0.0	31.2	46.0	-14.8
4	583.096	QP	41.7	3.1	18.4	31.6	31.6	0.0	31.6	46.0	-14.4

Notes:

1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 1. For emissions below 30MHz the cable losses are assumed to be negligible.
2 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.
3 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.
4 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 15:2008 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 µV/m	Measurement Distance m	Field strength dBµV/m
0.009-0.490	2400/F(kHz)	300	67.6/F (kHz)
0.490-1.705	24000/F(kHz)	30	87.6/F (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:

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

(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:

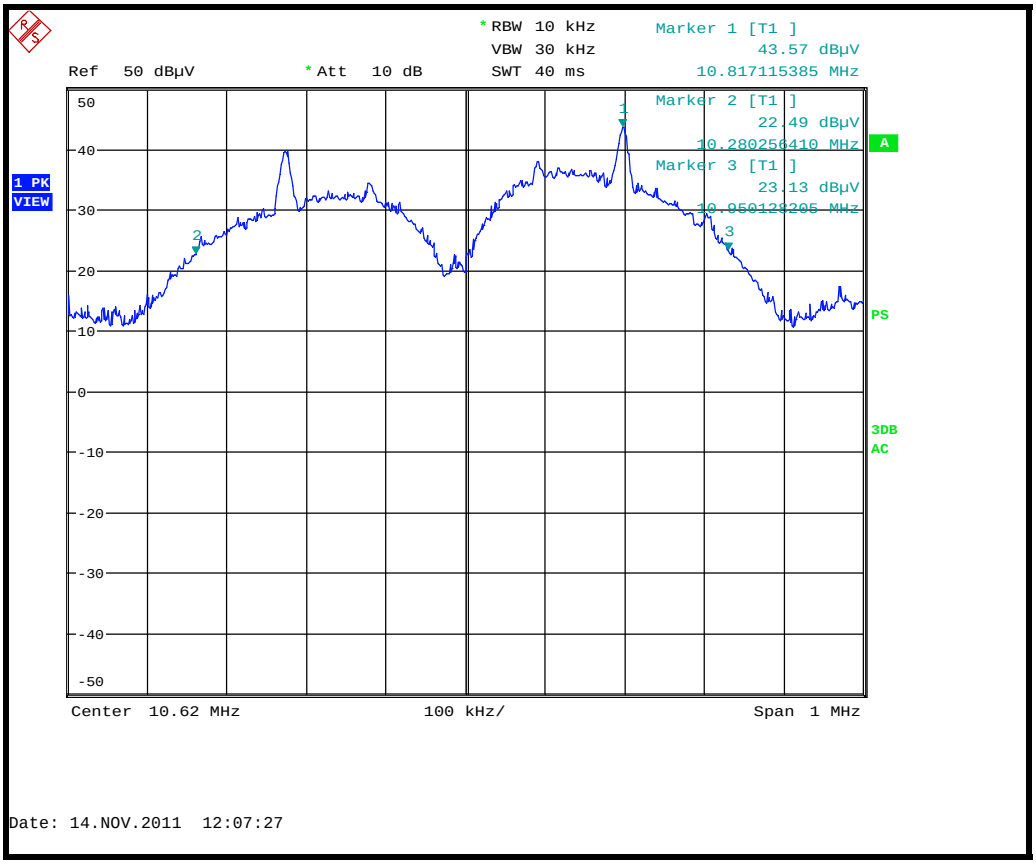
(a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.

(b) The time and date on the plots do not necessarily equate to the time of the test.

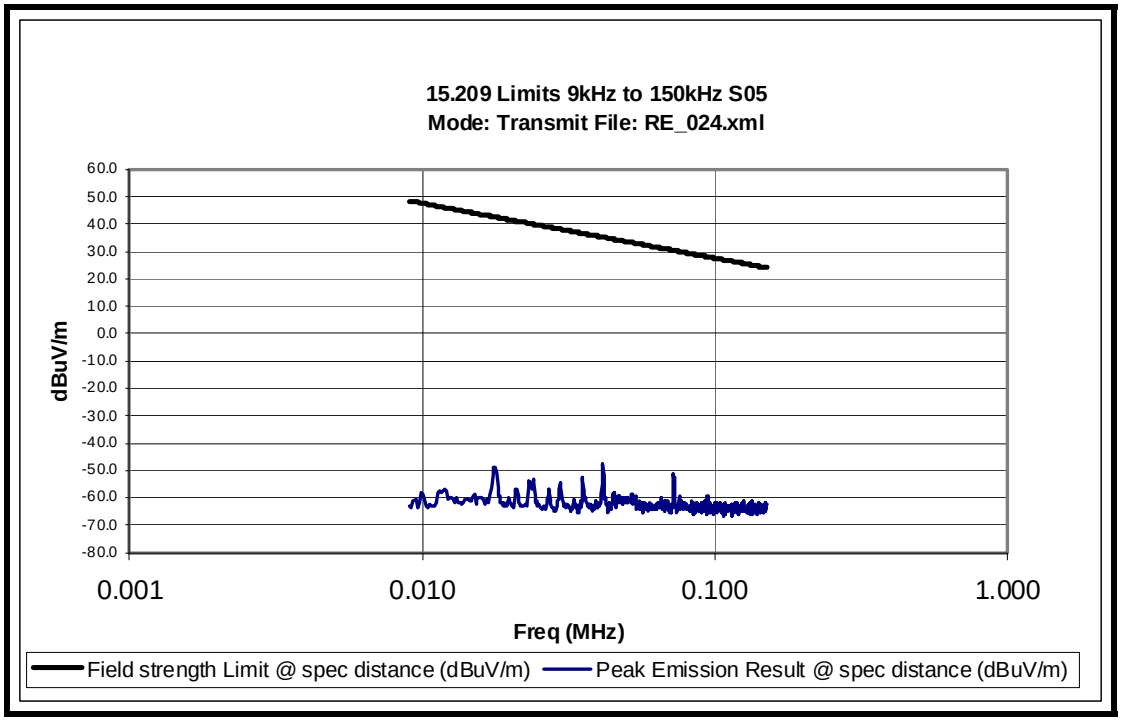
(c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.

(d) Appendix C details the numbering system used to identify the sample and its modification state.

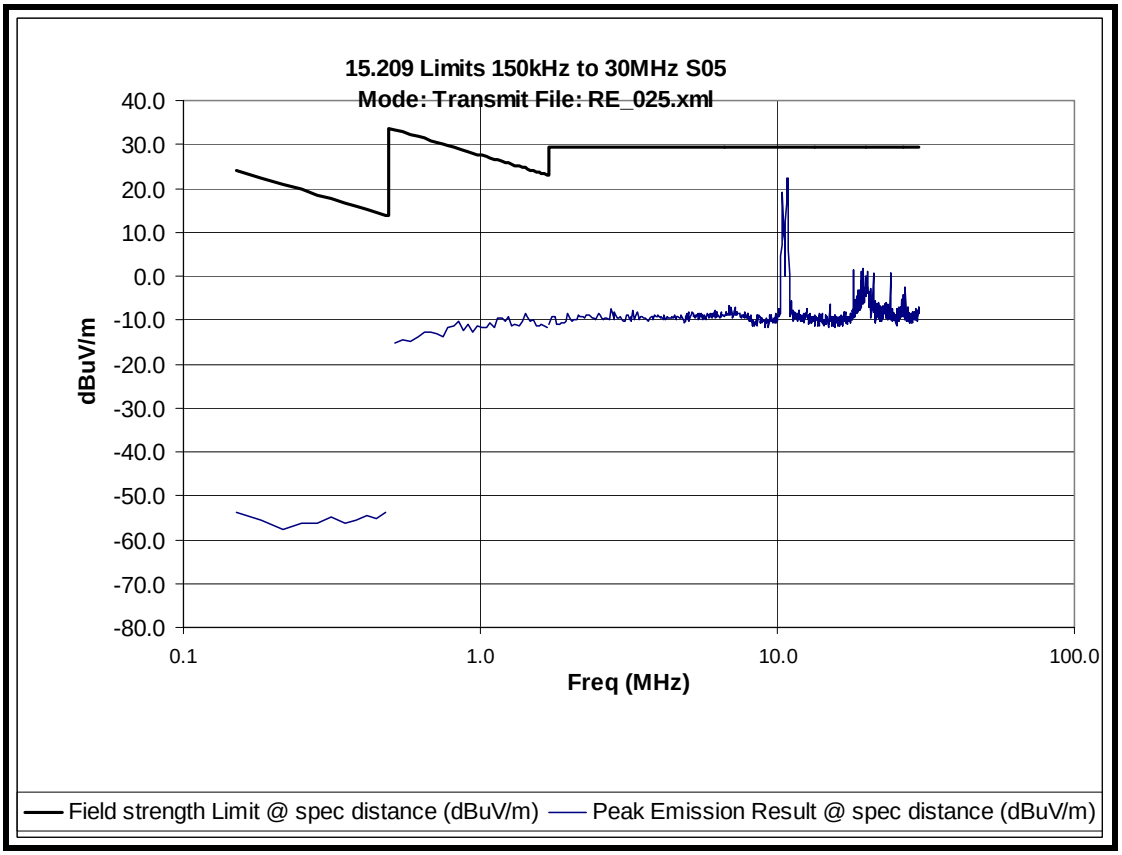
(e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.



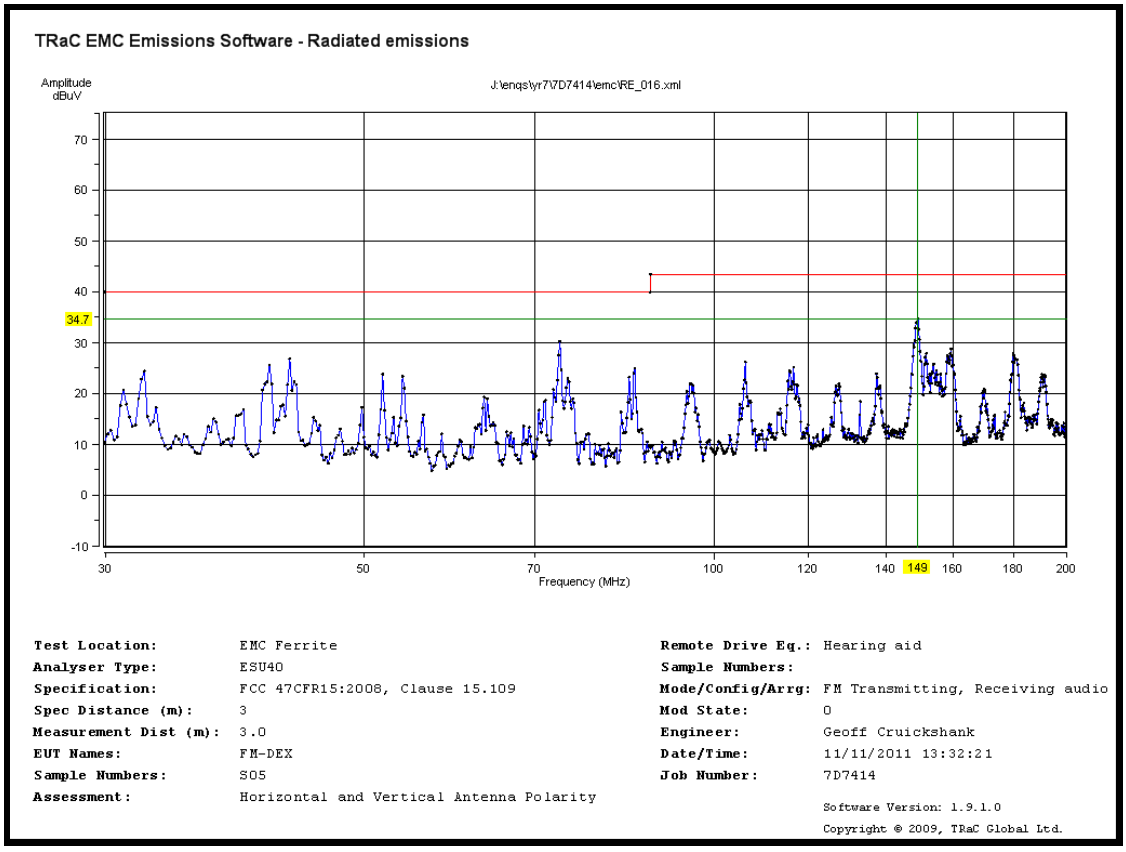
20dB Bandwidth



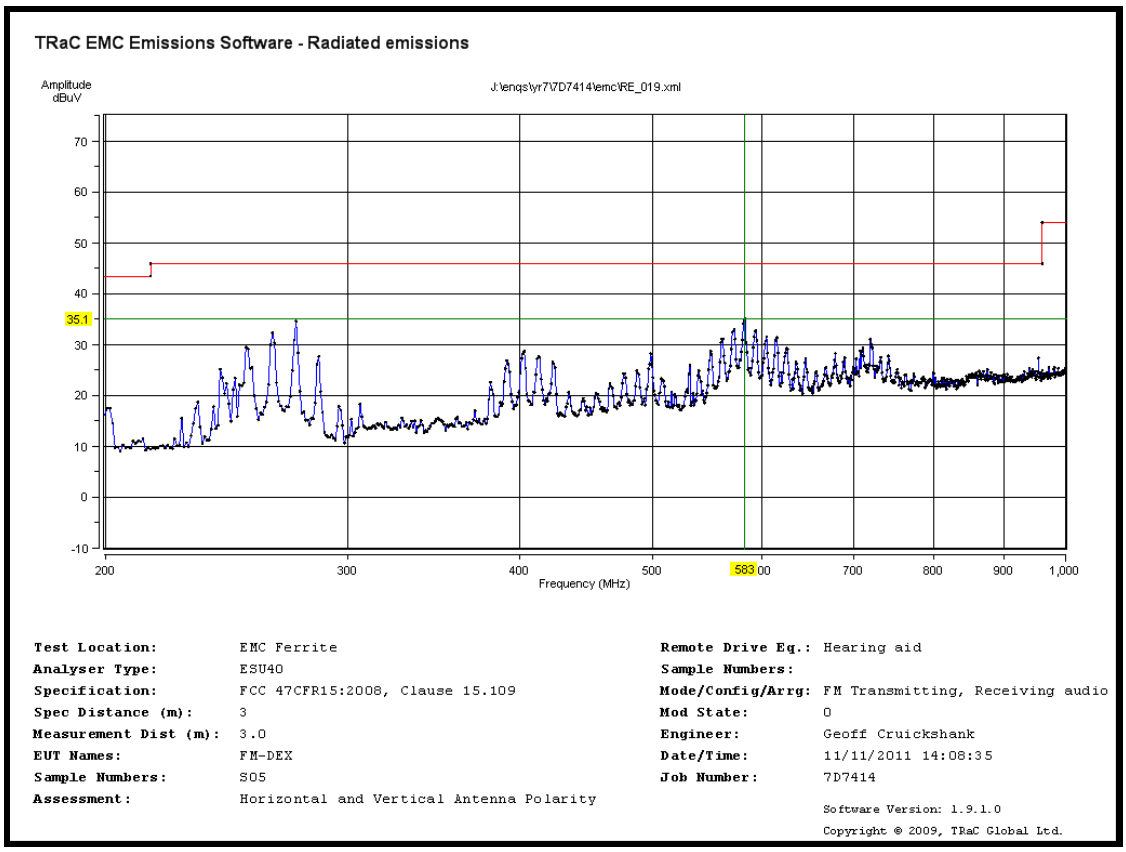
Radiated spurious emissions 9kHz to 150kHz



Radiated spurious emissions 150kHz to 30MHz



Radiated spurious emissions 30MHz to 200MHz



Radiated spurious emissions 200MHz to 1GHz

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 Global upon request.

C1 Test samples

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

Sample No.	Description	Identification
S05	FM+DEX	None

The following samples of apparatus were supplied by the client as support or drive equipment (auxiliary equipment):

Sample No.	Description	Identification
TTR-003135S35	S4-VS Hearing Aid	S/N: 001049

The following samples of apparatus were supplied by TRaC Global as support or drive equipment (auxiliary equipment):

Sample No.	Description	Identification
N/A	Audio Source - IPod	S/N: YM8479YB3QZ

C2 EUT Operating Mode During Testing

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

Test	Description of Operating Mode:
REFE: Radiated E-Field (Transmitter carrier output levels dBuV/m)	The EUT was transmitting continuously on maximum power using FSK (centre frequency 10.6MHz / Deviation ±200kHz) modulation and powered by a new battery.
REFE: Radiated Spurious emissions E-Field at frequencies below 30MHz (dBuV/m) (15.209)	
Radiated Spurious emissions (E-Field) at frequencies ≥ 30MHz (15.209)	
20dB Bandwidth of Emissions	

C3 EUT Configuration Information

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

C4 List of EUT Ports

The table below describes the termination of EUT ports:

Sample : S05
Tests : All

Port	Description of Cable Attached	Cable length	Equipment Connected
USB Port	None	N/A	None
Audio Port	Unscreened phono cable	1.5m	Audio Source

.

C5 Details of Equipment Used

For Radiated Electric Field Emissions 9 kHz to 30 MHz

REF No	Type	Description	Manufacturer	Date Calibrated.
886	ATS	Semi-Anechoic Chamber	TRaC	27/07/11
023	HFH-Z2	Mag Loop Antenna 9kHz-30MHz	R & S	24/03/11
847	ESU40	Spec Analyser/Test Receiver (LF/HF)	R & S	18/10/11
881	N-type	RF coaxial cable (Lab 16)	Teledyne Reynolds	06/06/11
882	N-type	RF coaxial cable (Lab 16)	Teledyne Reynolds	06/06/11
884	N-type	RF coaxial cable (Lab 16)	Teledyne Reynolds	06/06/11
885	N-type	RF coaxial cable (Lab 16)	Teledyne Reynolds	06/06/11

For Radiated Electric Field Emissions 30MHz to 1GHz

REF No	Type	Description	Manufacturer	Date Calibrated.
886	ATS	Semi-Anechoic Chamber	TRaC	27/07/11
RFG095	3109	Biconical Antenna	EMCO	12/05/10
RFG191	3146	Log Periodic Antenna	EMCO	12/05/10
847	ESU40	Spec Analyser/Test Receiver (LF/HF)	R & S	18/10/11
927	N10149	Preamp 9kHz to 1GHz	Sonoma	17/07/11
881	N-type	RF coaxial cable (Lab 16)	Teledyne Reynolds	06/06/11
882	N-type	RF coaxial cable (Lab 16)	Teledyne Reynolds	06/06/11
884	N-type	RF coaxial cable (Lab 16)	Teledyne Reynolds	06/06/11
885	N-type	RF coaxial cable (Lab 16)	Teledyne Reynolds	06/06/11
RFG452		HF RF coaxial cable 1.0m	UTIFLEX	25/05/11

For 20dB Bandwidth measurement

REF No	Type	Description	Manufacturer	Date Calibrated.
886	ATS	Semi-Anechoic Chamber	TRaC	27/07/11
023	HFH-Z2	Mag Loop Antenna 9kHz-30MHz	R & S	24/03/11
847	ESU40	Spec Analyser/Test Receiver (LF/HF)	R & S	18/10/11
881	N-type	RF coaxial cable (Lab 16)	Teledyne Reynolds	06/06/11
882	N-type	RF coaxial cable (Lab 16)	Teledyne Reynolds	06/06/11
884	N-type	RF coaxial cable (Lab 16)	Teledyne Reynolds	06/06/11
885	N-type	RF coaxial cable (Lab 16)	Teledyne Reynolds	06/06/11

Appendix D: Additional Information

No additional information is included within this test report.

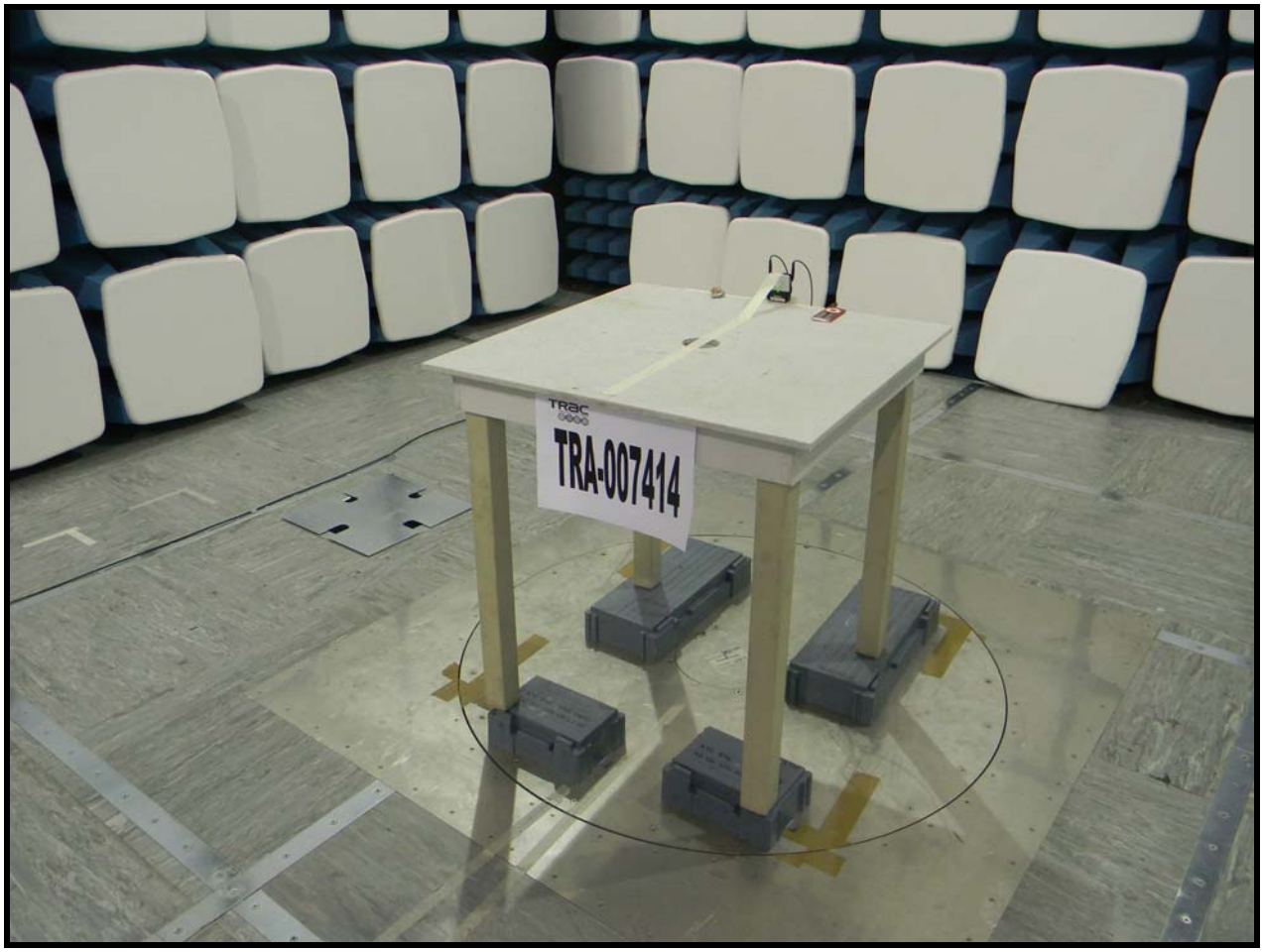
Appendix E: Calculation of the duty cycle correction factor

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

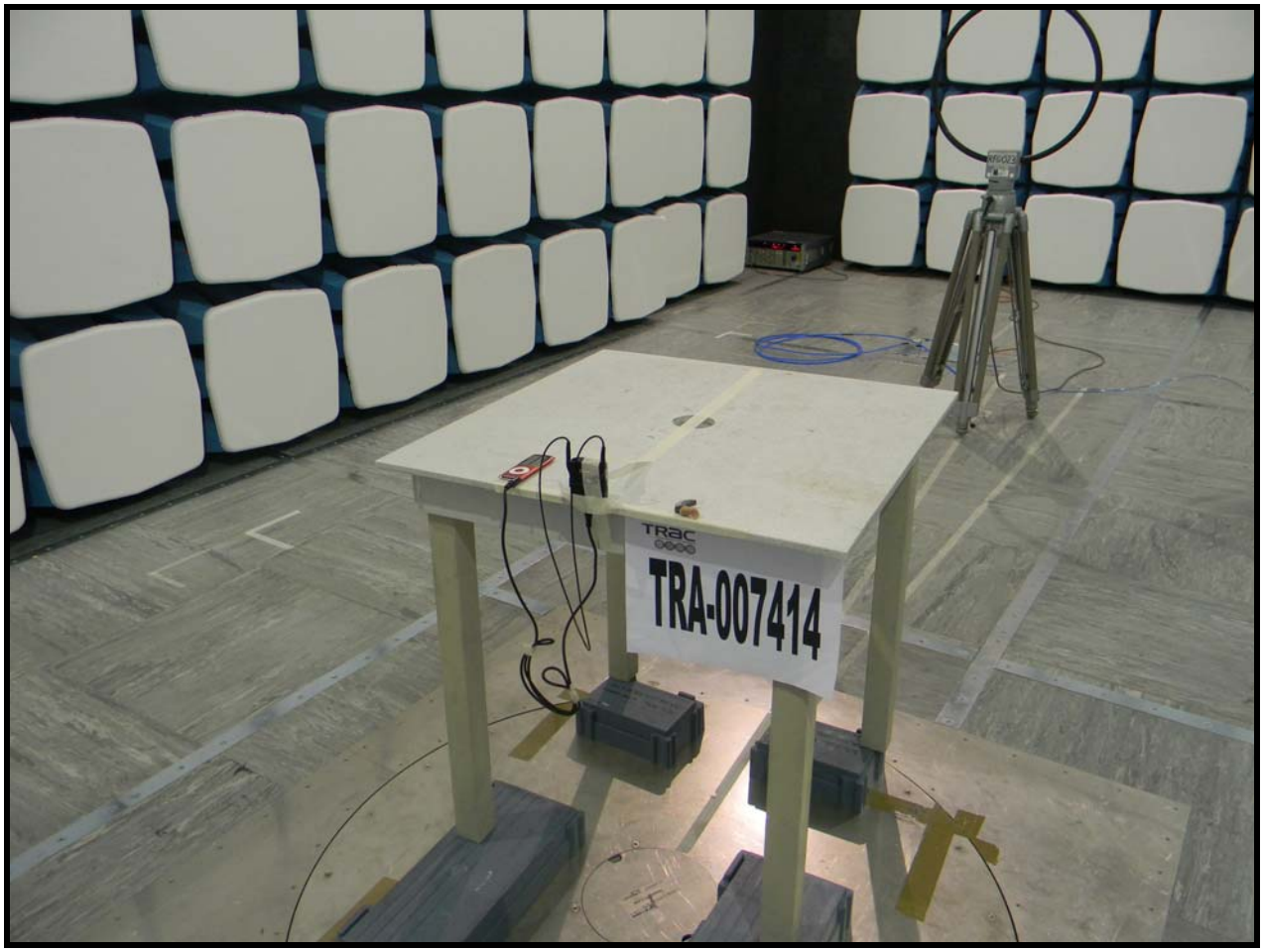
Appendix F: Photographs and Figures

The following photographs were taken of the test samples:

1. H-Field emissions arrangement - front view.
2. H-Field emissions arrangement - rear view.
3. Radiated electric field emissions arrangement - front view.
4. Radiated electric field emissions arrangement - rear view.



Photograph 1



Photograph 2

Photograph 3

Photograph 4

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 **1.538mW/cm^2** power density limit, as required under FCC rules.

Prediction of MPE limit at a given distance

Equation from Supplement B to OET Bulletin No. 65 Edition 97-01 June 2001, Page 17

$$S = \frac{PG}{4\pi R^2} = \frac{EIRP}{4\pi R^2} \quad \text{re-arranged } R = \sqrt{\frac{EIRP}{S4\pi}}$$

where:

R = distance to the centre of radiation of the antenna (appropriate units, e.g., cm)
S = power density (in appropriate units, e.g. mW/cm2)
EIRP = equivalent (or effective) isotropically radiated power

Note:

The EIRP value was determined using the peak H Field measurement

Result:

Prediction Frequency (MHz)	Maximum EIRP (mW)	Power density limit (S) (mW/cm^2)	Distance (R) cm required to be less than 1.538 mW/cm^2
10.818	3.121E-08	1.538	4.018E-05

Limits:

Supplement C 01-01 to OET Bulletin No. 65 Edition 97-01 June 2001:
Page 26, (B) Limits for General Population/Uncontrolled Exposure

Frequency range = 1.34MHz-30MHz
Power density limit (S) = (180/f^2) (f= MHz)

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

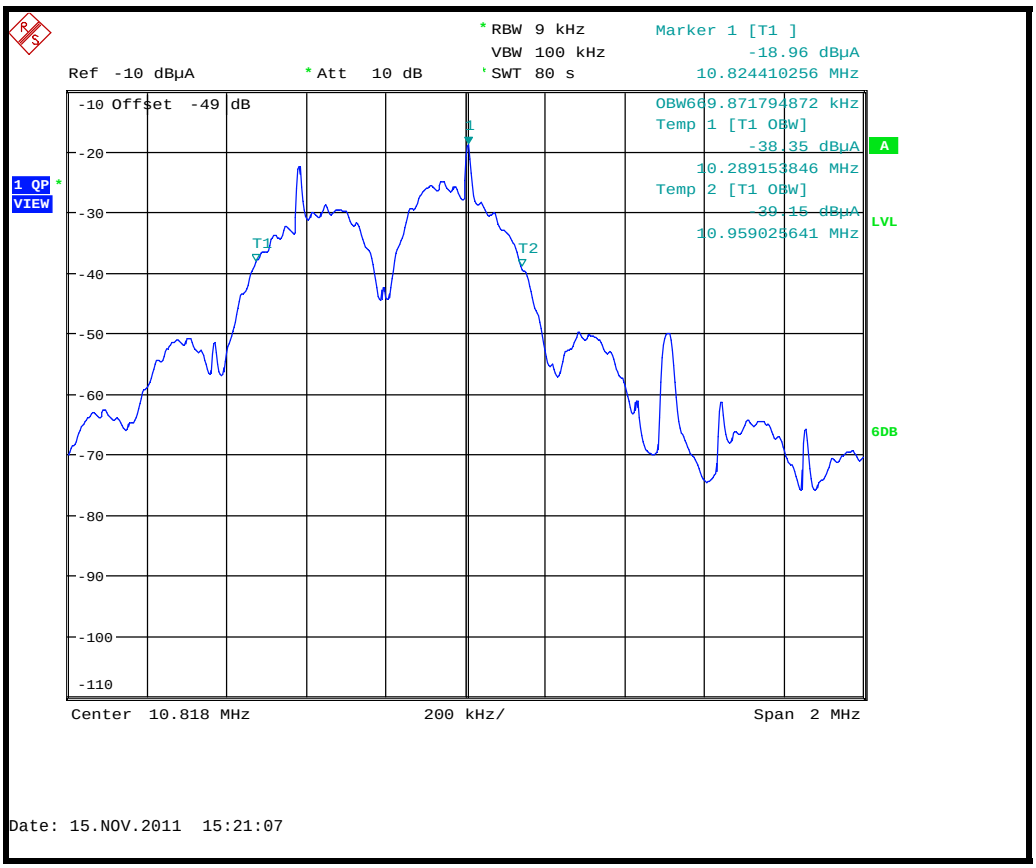
The testing of the FM+DEX was carried out to FCC 47CFR Part 15c and the results for this testing can be found in Appendix A of this report.

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 Issue 8/RSS-Gen Issue 3 parts and the corresponding FCC 47CFR Part 15 rules:

RSS-Gen/RSS-210	FCC 47CFR Part 15
RSS-210 Section 2.5	Part 15.109
RSS-Gen Section 7.2.5	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.



99% Band occupancy	**freq lower**	**freq higher**
	10.289 MHz	10.824 MHz
	669.872 kHz	

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testing regulatory and compliance