Radio Test Report

for

Savox

ON

Clarity

DOCUMENT NO. TRA-010248-W-US-5

Total number of pages: 32

TRaC Wireless Test Report	**:** TRA-010248-W-US-5
Applicant	**:** Savox Communications UK
Apparatus	**:** Clarity
Specification(s)	**:** CFR47 Part 15 C 15.209:October 2012
FCCID	**:** TUF078
Purpose of Test	**:** Certification
Authorised by	**:**  Radio Product Manager
Issue Date	**:** 1st March 2013
Authorised Copy Number	**:** *PDF*

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:

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1.3 Manufacturer

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1.4 Apparatus Assessed

The following apparatus was assessed between: 04/10/12 and 29/11/12

Clarity

The apparatus is a neck worn radio controller designed to be used with the Savox WPTT.

The device contains an AM modulated transmitter operating at 12.5 kHz

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
Spurious Emissions Radiated >1000MHz	Title 47 of the CFR: Part 15 Subpart (c)	ANSI C63.10	N/A
AC Power conducted emissions	Title 47 of the CFR: Part 15 Subpart (c) 15.207	ANSI C63.10	N/A
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
Intentional Emission ERP (mW)	Title 47 of the CFR: Part 15 Subpart (c)	ANSI C63.10	N/A
Unintentional Radiated Spurious Emissions	Title 47 of the CFR: Part 15 Subpart (b) 15.109	ANSI C63.10	N/A
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

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

Radiated Electric Field Emissions

Quantity Range	Quantity	Expanded Uncertainty
9kHz to 150 kHz	Amplitude dB(µV/m)	±1.6dB
150 kHz to 30 MHz	Amplitude dB(µV/m)	±2.1dB
30MHz to 300MHz Horizontal	Amplitude dB(µV/m)	±5.1dB
30MHz to 300MHz Vertical	Amplitude dB(µV/m)	±5.2dB
300MHz to 1GHz Horizontal	Amplitude dB(µV/m)	±5.4dB
300MHz to 1GHz Vertical	Amplitude dB(µV/m)	±5.2dB
1GHz to 18GHz Horizontal	Amplitude dB(µV/m)	±4.4dB
1GHz to 18GHz Vertical	Amplitude dB(µV/m)	±4.4dB
18GHz to 26.5GHz Horizontal	Amplitude dB(µV/m)	±4.2dB
18GHz to 26.5GHz Vertical	Amplitude dB(µV/m)	±4.2dB
26.5GHz to 40GHz Horizontal	Amplitude dB(µV/m)	±4.3dB
26.5GHz to 40GHz Vertical	Amplitude dB(µV/m)	±4.3dB

Power Line Conducted Emissions

Quantity Range	Quantity	Expanded Uncertainty
9kHz to 150kHz	Amplitude dB(µV)	±4.2dB
150kHz to 30MHz	Amplitude dB(µV)	±3.1dB

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

Test Details	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.209(b)(1)
Measurement standard	ANSI C63.10:2009
EUT sample number	S13
Modification state	0
SE in test environment	None
SE isolated from EUT	Test Laptop
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 1

Frequency (kHz)	Measurement Distance (m)	Measurement Rx Reading (dBµV/m)	Extrapolation Factor (dB)	Field Strength (µV/m)
12.5	3	54.6	80	0.053
Limit value @ frequency		**192 µV/m**		
Band occupancy @ -20 dBc		BW = 367.688 Hz		

Notes:
1 Results quoted are extrapolated as indicated
2 Receiver detector @ fc = Quasi Peak, 10 kHz bandwidth
3 When battery powered the EUT was powered with new batteries
4 Extrapolation 3 - 300 Meters 80 dB as per 15.31(f)
5 Band occupancy plot is provided in Annex B

Test Method:
1 As per Radio – Noise Emissions, ANSI C63.10
2 Measuring distance = 3m
3 EUT 0.8 m above ground plane
4 Emissions maximized by rotation of EUT, on an automatic turntable
5 Raising and lowering the receiver antenna between 1m & 4m
6 Horizontal and vertical polarizations, of the receive antenna
7 EUT orientation in three orthogonal planes
8 Maximum results recorded

A2 Radiated Spurious Emissions

Preliminary scans were performed using a peak detector with CISPR bandwidths. 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 : [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	S13
Modification state	0
SE in test environment	None
SE isolated from EUT	Test Laptop
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photographs 1 and 2

Ref No.	Frequency (MHz)	Measured at Rx (dBµV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-Amp Gain (dB)	Field Strength (dBµV/m)	Extrapolation Factor (dB)	Field Strength (µV/m)	Limit (µV/m)
No Significant emissions within 20dB of the limit									

Note:

All emissions other than the fundamental are noise floor levels of the measurement equipment.

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 15:209 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

A3 Unintentional Radiated Emissions

The EUT is a transmitter only and the transmitter is permanently transmitting, therefore measurements of unintentional radiated emissions with the transmitter in non-transmitting mode are not applicable.

Appendix B: Supporting Graphical Data

This appendix contains graphical data obtained during testing.

Notes:

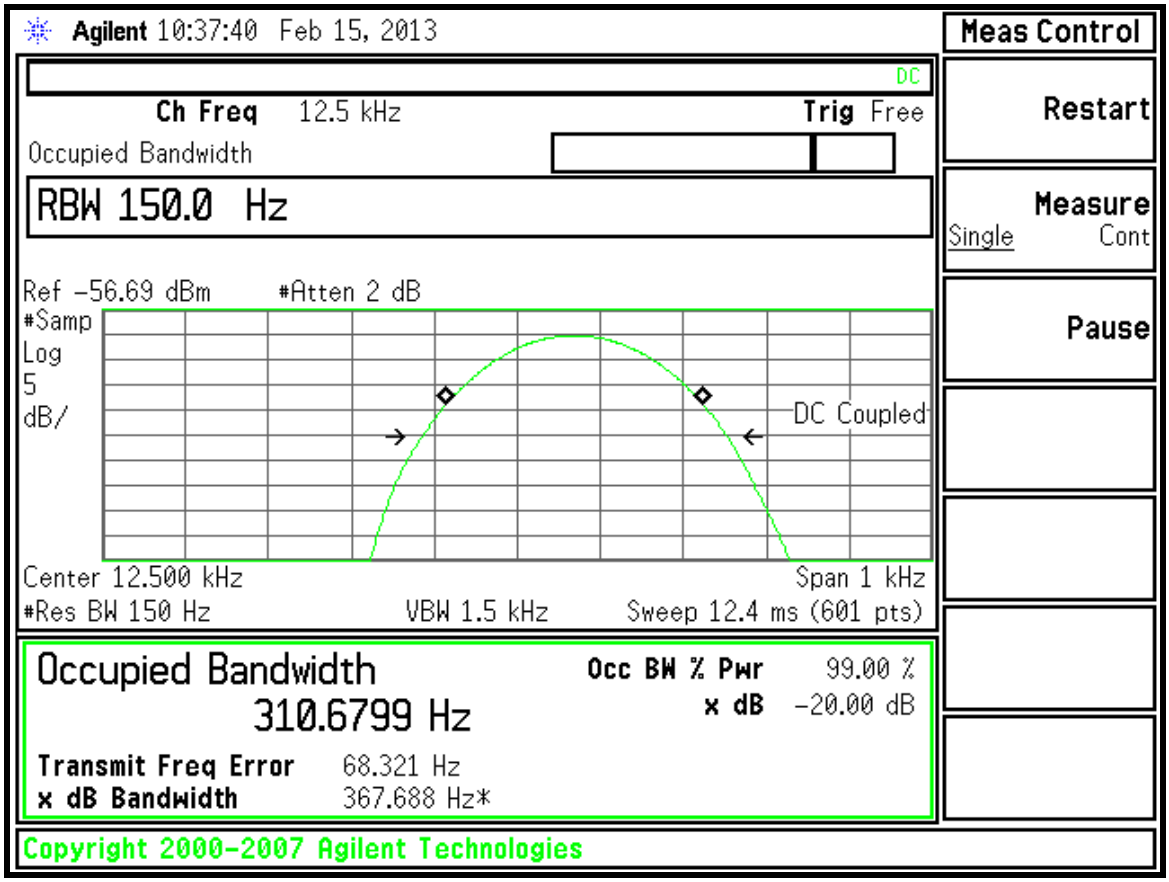
(a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer Appendix A and B.

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

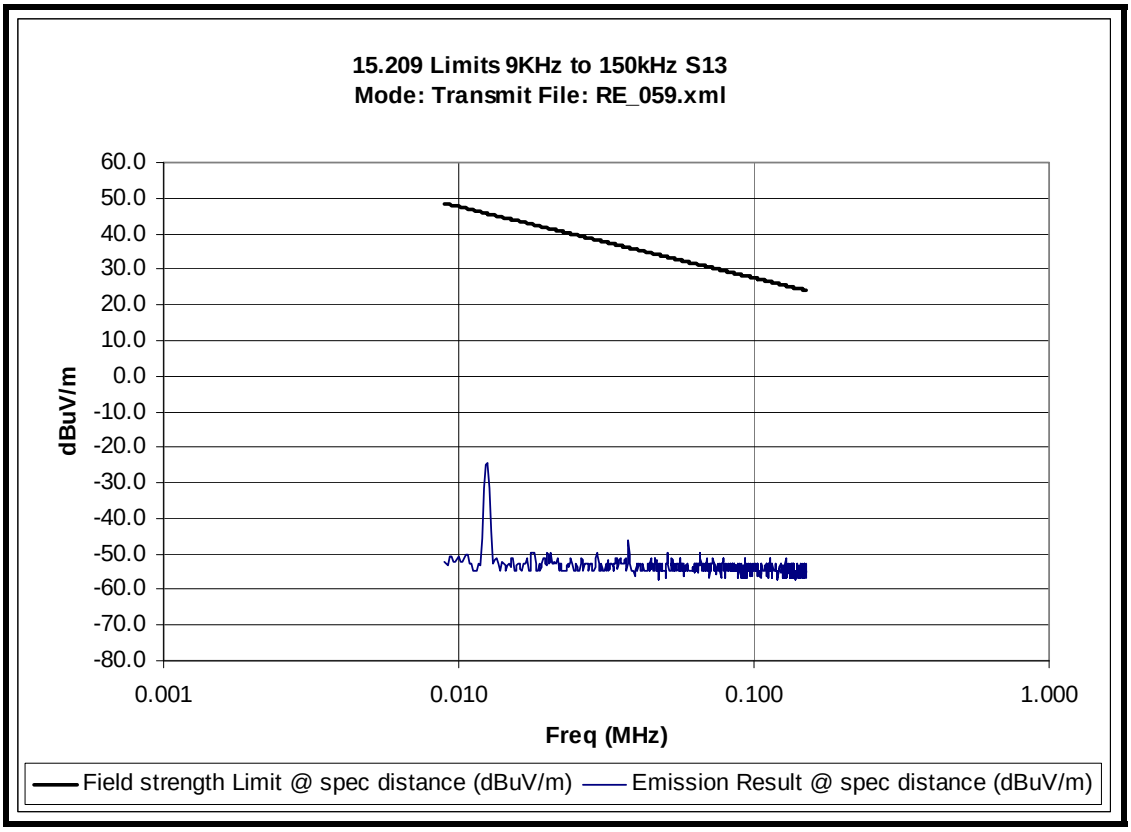
(c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.

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

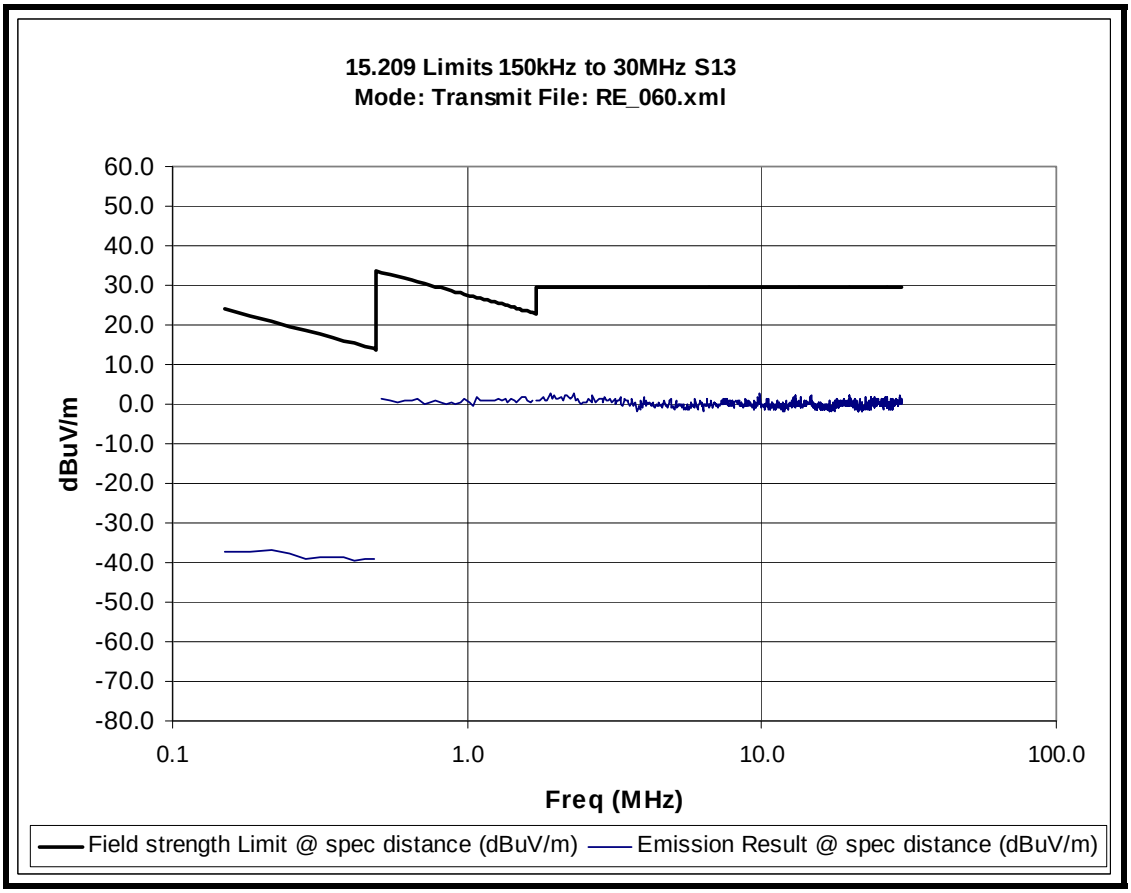
(e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.



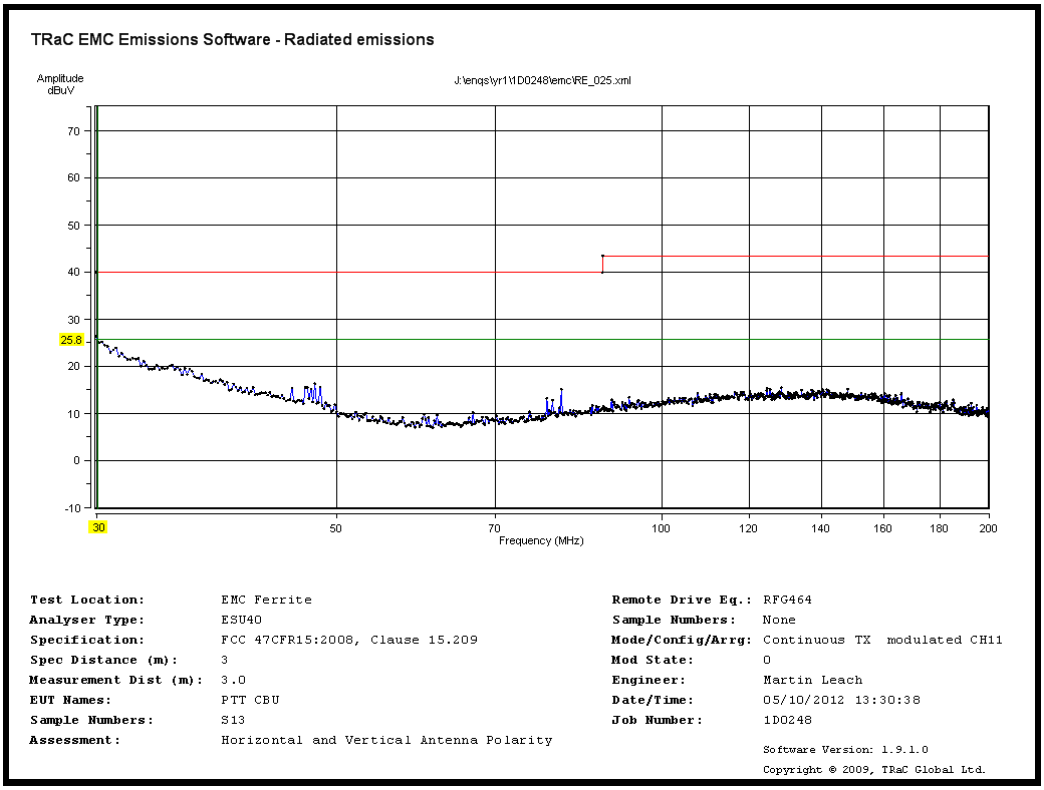
20dB Bandwidth



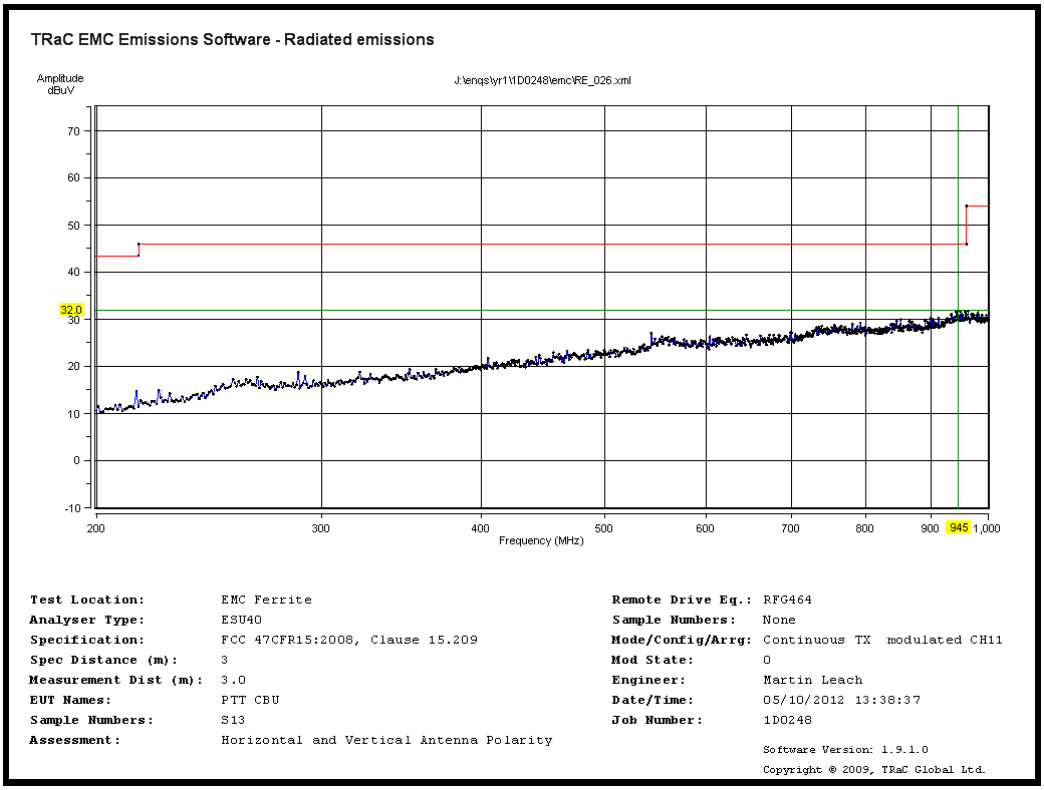
Spurious Emissions 9 kHz to 150 kHz



Spurious Emissions 150 kHz to 30MHz



Spurious Emissions 30MHz to 200 MHz



Spurious Emissions 200 MHz to 1000 MHz

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 its 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
S13	Clarity Radiated Sample	None

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

TRaC Identification	Description
	Test Laptop

C2 EUT operating mode during testing

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

Test	Description of Operating Mode: Transmit
Radiated Field Strength (Transmitter carrier output levels)	The EUT was transmitting continuously on maximum power using AM (centre frequency 12.5kHz modulation and powered by external supply
Radiated Spurious emissions (H-Field) at frequencies below 30MHz (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 : S13
Tests : all

Port	Description of Cable Attached	Cable length	Equipment Connected
Battery	2 core unscreened	1.5m	dc PSU
Serial data*	Multicore unscreened	20 cm	Laptop

*used only during setup

.

C5 Details of Equipment Used

RFG No	Type	Description	Manufacturer	Date Calibrated
REF886	Lab 16	Large Anechoic Chamber	Rainford	27/07/12
095	3109	Bicon Antenna (30-200MHz)	Eaton	12/05/10
191	3146	Log Periodic Antenna (200-100MHz)	EMCO	12/05/10
REF927	N10149	Pre-Amp	Sonoma	15/09/11
REF909	FSU46	Spectrum Analyser	R & S	02/12/11
RFG452		HF RF coaxial cable	UTIFLEX	02/07/12
REF881		HF RF coaxial cable	Teledyne Reynolds	02/07/12
REF882		HF RF coaxial cable	Teledyne Reynolds	02/07/12
REF884		HF RF coaxial cable	Teledyne Reynolds	02/07/12
REF885		HF RF coaxial cable	Teledyne Reynolds	02/07/12
RFG023	HFH-Z2	Magnetic Loop Antenna	R & S	24/05/11

Appendix D: Additional Information

No additional information is included within this test report

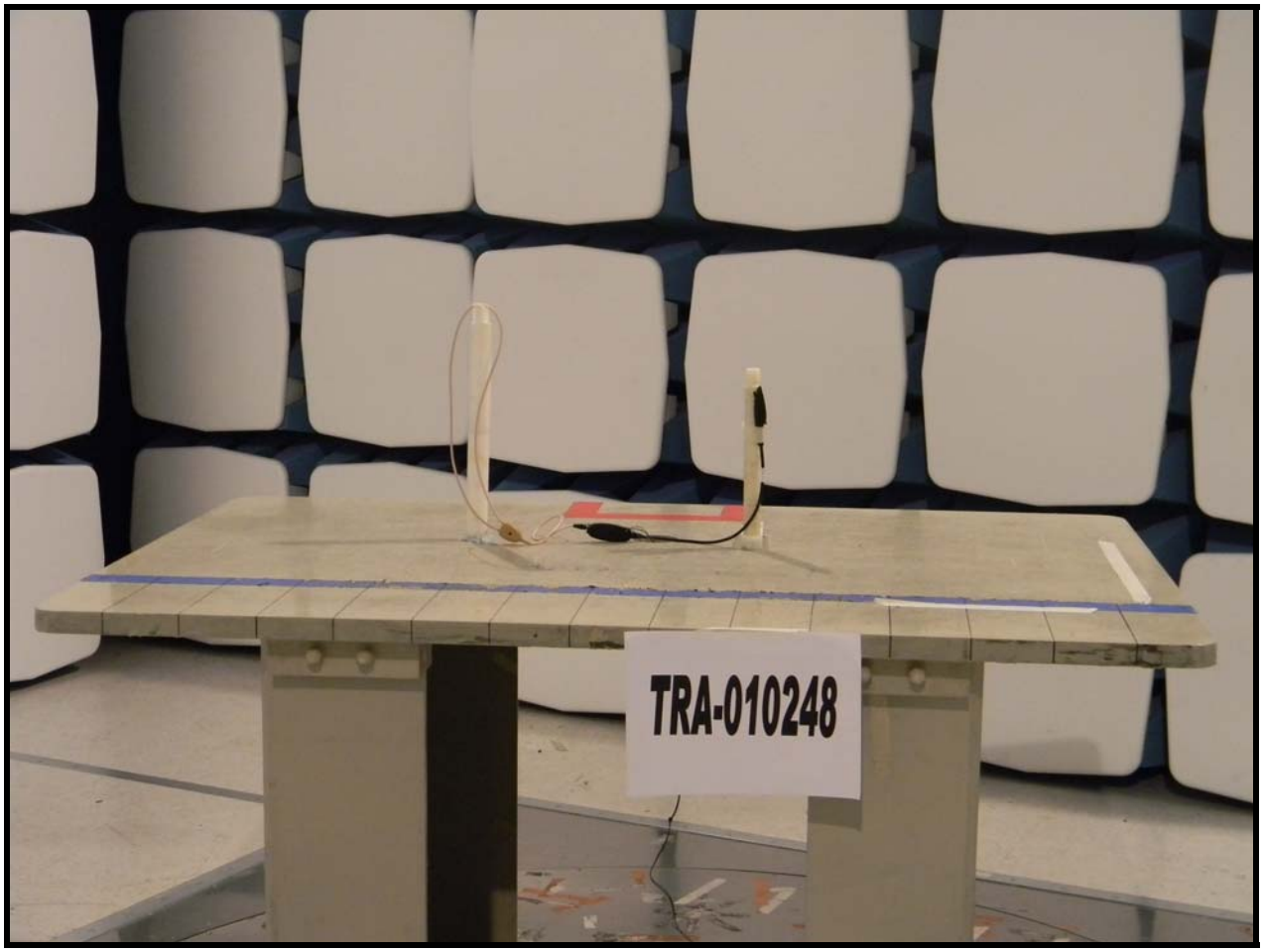
Appendix E: Calculation of the duty cycle correction factor

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. Test setup
2. Test setup close up view



Photograph 1

Photograph 2

Appendix G: Cross Reference FCC Part 15c to IC RSS-Gen

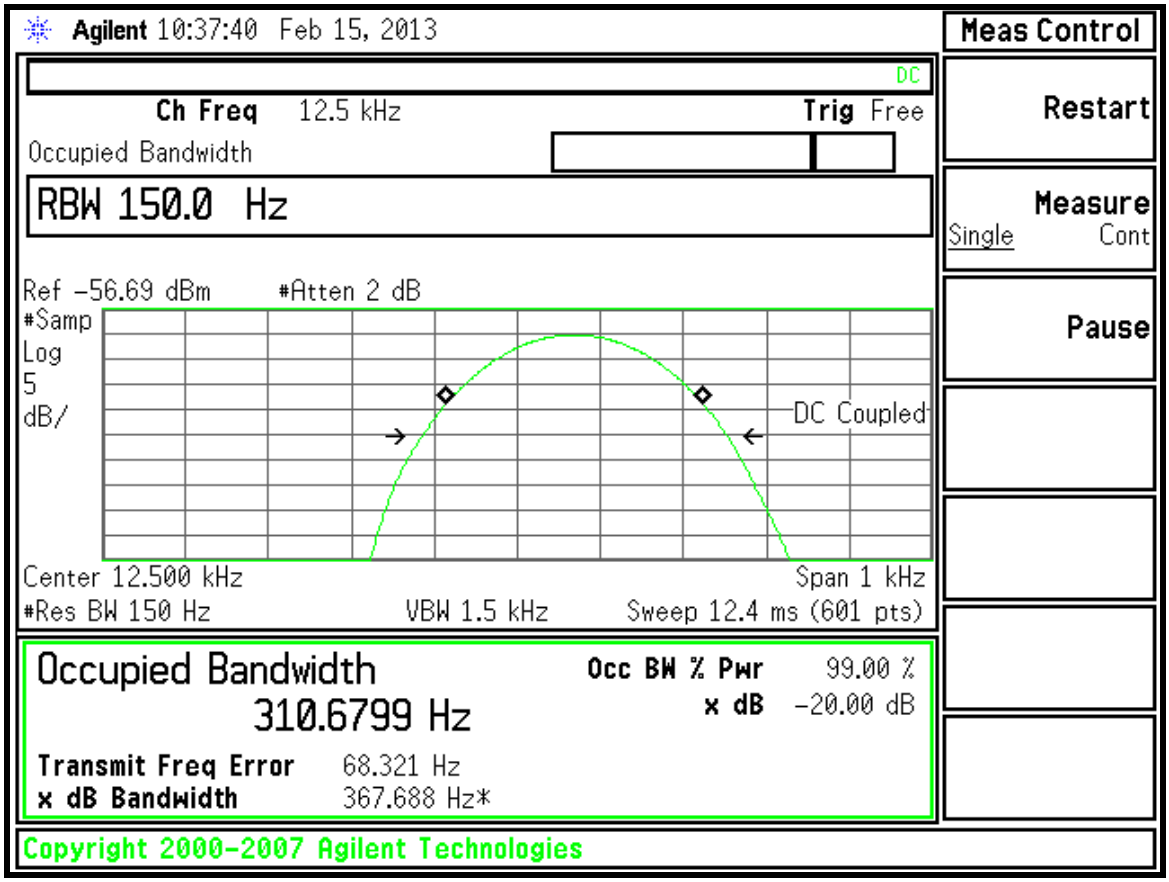
The testing was carried out to FCC 47CFR Part 15c and the results for this testing can be found in Appendix A of this report.

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 9 kHz to 1 GHz.

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

RSS-Gen Issue 3	FCC 47CFR Part 15
6.1	Part 15.109
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.



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