

**RADIO TEST REPORT**

**FOR**

**HWM Water**

**ON**

**Ecochirp**

**DOCUMENT NO. TRA-010645-W-US1**

**HULL**

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**TRaC Wireless Test Report** : TRA-010645-W-US1

**Applicant** : HWM-Water Limited

**Apparatus** : Ecochirp VHF

**Specification(s)** : CFR47 Part 90.217

**Purpose of Test** : Certification

**FCCID** : RUZ-485

**Authorised by** :



: Radio Product Manager

**Issue Date** : 23<sup>rd</sup> July 2013

**Authorised Copy Number** : PDF

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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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Tests performed by: A Longley

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## **1.2 Tests Requested By**

This testing in this report was requested by :

HWM-Water Limited  
Ty Coch House  
Llantarnam Industrial Park  
Cwmbran  
NP44 3AW  
United Kingdom

## **1.3 Manufacturer**

As above.

## **1.4 Apparatus Assessed**

The following apparatus was assessed between the 19<sup>th</sup> of June and 4<sup>th</sup> of July 2013:

Ecochirp VHF

The Ecochirp counts pulses from any pulsed output including electricity, water and gas meters. Once installed, the Ecochirp will transmit consumption data as well as tamper and battery information via radio at regular intervals. The apparatus is designed to transmit at 153.1 MHz with a carrier power below 120 mW to allow exemption from the full 47CFR Part 90 technical requirements.

## 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
Maximum Radiated Output Power	Title 47 of the CFR: Part 90.217	ASNI/TIA-603-C-2004	Pass
Transmitter Spurious Emissions Radiated (ERP)	Title 47 of the CFR: Part 2.1051	ASNI/TIA-603-C-2004	Pass
Occupied bandwidth/ Frequency Stability	Title 47 of the CFR: Part 90.217 (b).	ASNI/TIA-603-C-2004	Pass

Abbreviations used in the above table:

ANSI C 63.10:2009 and ASNI/TIA-603-C-2004 is outside the scope of the laboratories UKAS accreditation.

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 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 the test data recorded the following measurement uncertainty was calculated:

**Radio Testing – General Uncertainty Schedule**

*All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence where no required test level exists.*

**[1] Adjacent Channel Power**

Uncertainty in test result = **1.86dB**

**[2] Carrier Power**

Uncertainty in test result (Power Meter) = **1.08dB**

Uncertainty in test result (Spectrum Analyser) = **2.48dB**

**[3] Effective Radiated Power**

Uncertainty in test result = **4.71dB**

**[4] Spurious Emissions**

Uncertainty in test result = **4.75dB**

**[5] Maximum frequency error**

Uncertainty in test result (Frequency Counter) = **0.113ppm**

Uncertainty in test result (Spectrum Analyser) = **0.265ppm**

**[6] Radiated Emissions, field strength OATS 14kHz-18GHz Electric Field**

Uncertainty in test result (14kHz – 30MHz) = **4.8dB**,

Uncertainty in test result (30MHz – 1GHz) = **4.6dB**,

Uncertainty in test result (1GHz – 18GHz) = **4.7dB**

**[7] Frequency deviation**

Uncertainty in test result = **3.2%**

**[8] Magnetic Field Emissions**

Uncertainty in test result = **2.3dB**

**[9] Conducted Spurious**

Uncertainty in test result – Up to 8.1GHz = **3.31dB**

Uncertainty in test result – 8.1GHz – 15.3GHz = **4.43dB**

Uncertainty in test result – 15.3GHz – 21GHz = **5.34dB**

Uncertainty in test result – Up to 26GHz = **3.14dB**

**[10] Channel Bandwidth**

Uncertainty in test result = **15.5%**

**[11] Amplitude and Time Measurement – Oscilloscope**

Uncertainty in overall test level = **2.1dB**,  
Uncertainty in time measurement = **0.59%**,  
Uncertainty in Amplitude measurement = **0.82%**

**[12] Power Line Conduction**

Uncertainty in test result = **3.4dB**

**[13] Spectrum Mask Measurements**

Uncertainty in test result = **2.59% (frequency)**  
Uncertainty in test result = **1.32dB (amplitude)**

**[14] Adjacent Sub Band Selectivity**

Uncertainty in test result = **1.24dB**

**[15] Receiver Blocking – Listen Mode, Radiated**

Uncertainty in test result = **3.42dB**

**[16] Receiver Blocking – Talk Mode, Radiated**

Uncertainty in test result = **3.36dB**

**[17] Receiver Blocking – Talk Mode, Conducted**

Uncertainty in test result = **1.24dB**

**[18] Receiver Threshold**

Uncertainty in test result = **3.23dB**

**[19] Transmission Time Measurement**

Uncertainty in test result = **7.98%**

**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
		ATS	: Alternative Test Site
EUT	: Equipment Under Test		
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 Maximum Radiated Output Power (Effective Radiated Power)

The assessment method used was a radiated measurement at normal test conditions. 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 (b) below.

Test Details: Maximum output power was verified with the EUT transmitting	
Regulation	Title 47 of the CFR: Part 90.217
Measurement standard	ASNI/TIA-603-C-2004
Application	Cabinet and Antenna
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	23°C
Photographs (Appendix E)	1 to 2

Ref No.	Freq (MHz)	Result (dBm)	Spec. Limit (dBm)	Margin (dB)	Summary
1.	153.1	10.4	20.8	10.4	Pass

The frequency listed in the above table corresponds to the peak emission measured and does not necessarily correspond with the specified carrier frequency for devices employing frequency or phase shift keying techniques. Radiated carrier power tests are carried out at nominal test conditions only for equipment having an integral antenna

### Limits:

In accordance with Title 47 of the CFR: Part 90.217 the effective radiated power shall not exceed 120mW (20.8dBm).

## Notes:

(a) The levels may have been rounded for display purposes.

(b) 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			

## A2 Radiated Transmitter Spurious Emissions (ERP)

The assessment method used was a radiated measurement at normal test conditions. Please refer to section A1 for Effective Radiated Power (Transmitter Carrier Power e.r.p). Preliminary scans were performed using a peak detector with the RBW = 100kHz. The effective radiated power emission test applies to all spurious emissions and harmonics emissions

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 (b) below.

Test Details: Maximum output power was verified with the EUT transmitting	
Regulation	Title 47 of the CFR: Part 90.217(b)
Measurement standard	ASNI/TIA-603-C-2004
Application	Cabinet and Antenna
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	23°C
Photographs (Appendix E)	1 to 2

The worst-case radiated emission measurements for spurious emissions and harmonics are listed below:

ERP TX 153.1MHz						
Ref No.	Freq (MHz)	Det.	Result (dBm)	Spec. Limit (dBm)	Margin (dB)	Summary
1.	1531.016	Pk	-36.2	-19.6	16.6	Pass

No further emissions were detected within 10dB of the specification limit

## Limits

In accordance with Title 47 of the CFR: Part 90.217 the radiated transmitter spurious emissions limit was determined relative to the maximum measured effective radiated power as at normal test conditions.

The limit in 100 kHz RBW = (Measured radiated carrier power -30dB)

Where:

Channel Frequency (MHz)	Measured ERP Carrier (dBm)	Measured ERP Carrier – 30dB	Emission Limit (dBm)
153.1	10.4	10.4 – 30	-19.6

Notes:

- (a) The levels may have been rounded for display purposes.
- (b) 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 Occupied Bandwidth

Test Details:	
Regulation	Title 47 of the CFR: Part 90.217(b)
Measurement standard	Title 47 of the CFR: Part 2.1049
EUT sample number	S03
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C

Measurements were made on the EUT at points 30 dB down from the peak carrier emission with the EUT transmitting.

153.1025 MHz		
Test Conditions	Measured FL (MHz)	Measured FU (MHz)
-30°C	153.09402	153.10987
-20°C	153.09722	153.10817
-10°C	153.09747	153.10842
0°C	153.09742	153.10947
+10°C	153.09712	153.10912
+20°C	153.09672	153.10877
+30°C	153.09642	153.10837
+40°C	153.09582	153.10792
+50°C	153.09457	153.10772
Measured lowest FL (MHz)	153.09402	
Measured highest FH (MHz)	153.10987	
Permitted FL	153.0775	
Permitted FH	153.1275	
Result	PASS	

Test Conditions	153.1025 MHz
-30°C	153.101945MHz
-20°C	153.102695MHz
-10°C	153.102945MHz
0°C	153.103445MHz
+10°C	153.10312MHz
+20°C	153.102745MHz
+30°C	153.102395MHz
+40°C	153.10187MHz
+50°C	153.101145MHz
Result	PASS

### Limits

In accordance with Title 47 of the CFR: Part 90.217 (b) For equipment designed to operate with a 12.5 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 25 kHz or more removed from the assigned frequency is attenuated at least 30 dB below the unmodulated carrier.

## Appendix B:

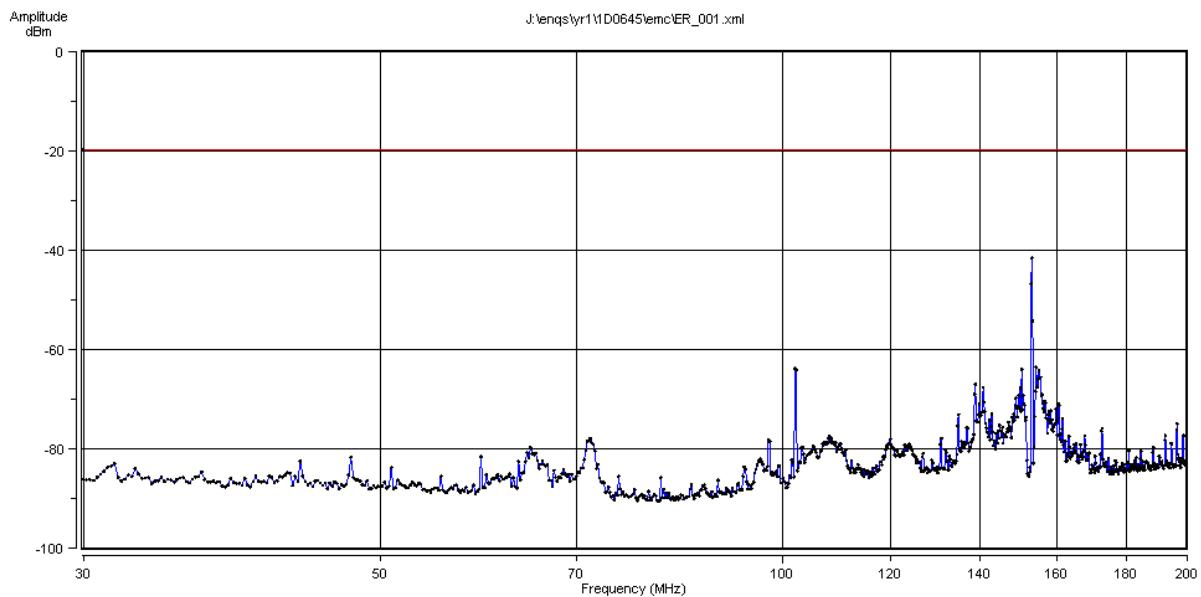
## Supporting Graphical Data

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.

## TRaC EMC Emissions Software - ERP

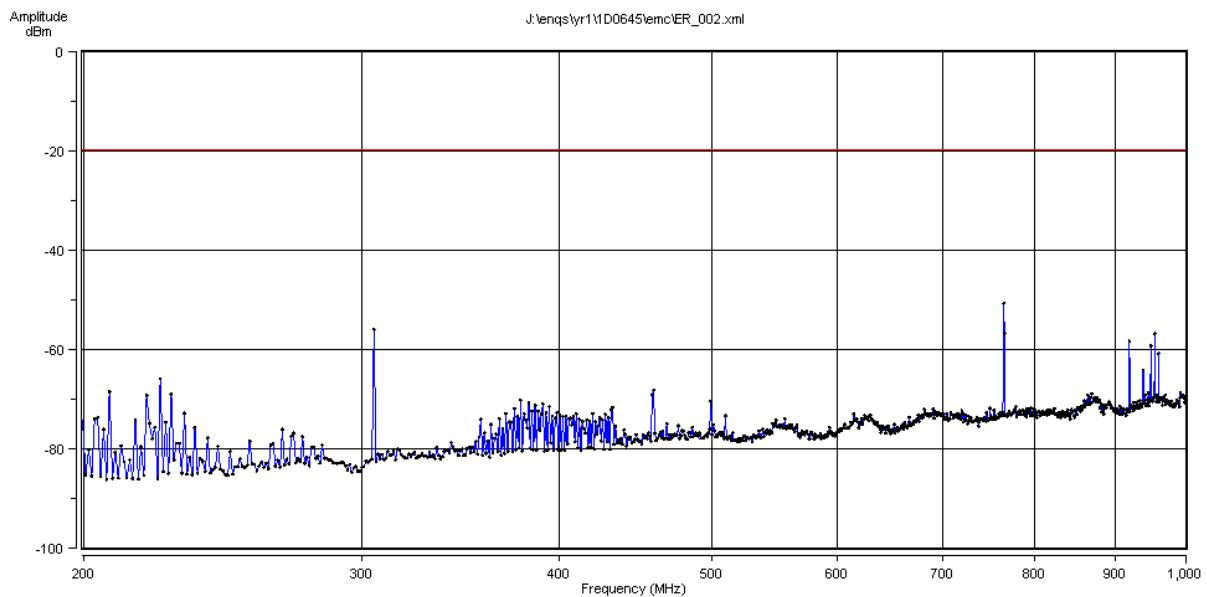


**Test Location:** EMC Ferrite  
**Analyser Type:** FSU46  
**Specification:** FCC 90.217  
**Spec Distance (m):** 3.0  
**Measurement Dist (m):** 3.0  
**EUT Names:** Echochirp  
**Sample Numbers:** S03  
**Assessment:** Horizontal and Vertical Antenna Polarity

**Remote Drive Eq.:** None  
**Sample Numbers:** N/A  
**Mode/Config/Arrg:** TX 153.1 MHz  
**Mod State:** 0  
**Engineer:** Adam Longley  
**Date/Time:** 19/06/2013 16:07:57  
**Job Number:** 1D0645  
**Software Version:** 1.9.1.0  
**Copyright © 2009, TRaC Global Ltd.**

**ERP TX 153.1MHz Radiated spurious emissions 30 MHz to 200 MHz**

## TRaC EMC Emissions Software - ERP

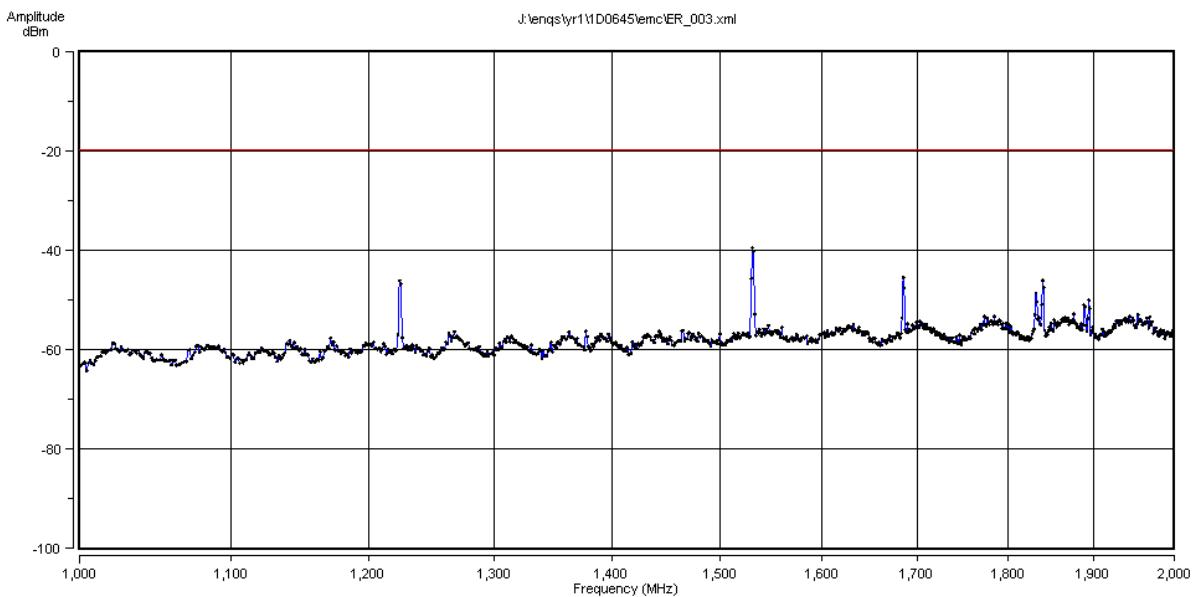


**Test Location:** EMC Ferrite  
**Analyser Type:** FSU46  
**Specification:** FCC 90.217  
**Spec Distance (m):** 3.0  
**Measurement Dist (m):** 3.0  
**EUT Names:** Echochirp  
**Sample Numbers:** S03  
**Assessment:** Horizontal and Vertical Antenna Polarity

**Remote Drive Eq.:** None  
**Sample Numbers:** N/A  
**Mode/Config/Arrg:** TX 153.1 MHz  
**Mod State:** 0  
**Engineer:** Adam Longley  
**Date/Time:** 19/06/2013 16:15:49  
**Job Number:** 1D0645  
**Software Version:** 1.9.1.0  
**Copyright © 2009, TRaC Global Ltd.**

**ERP TX 153.1MHz Radiated spurious emissions 200 MHz to 1000 MHz**

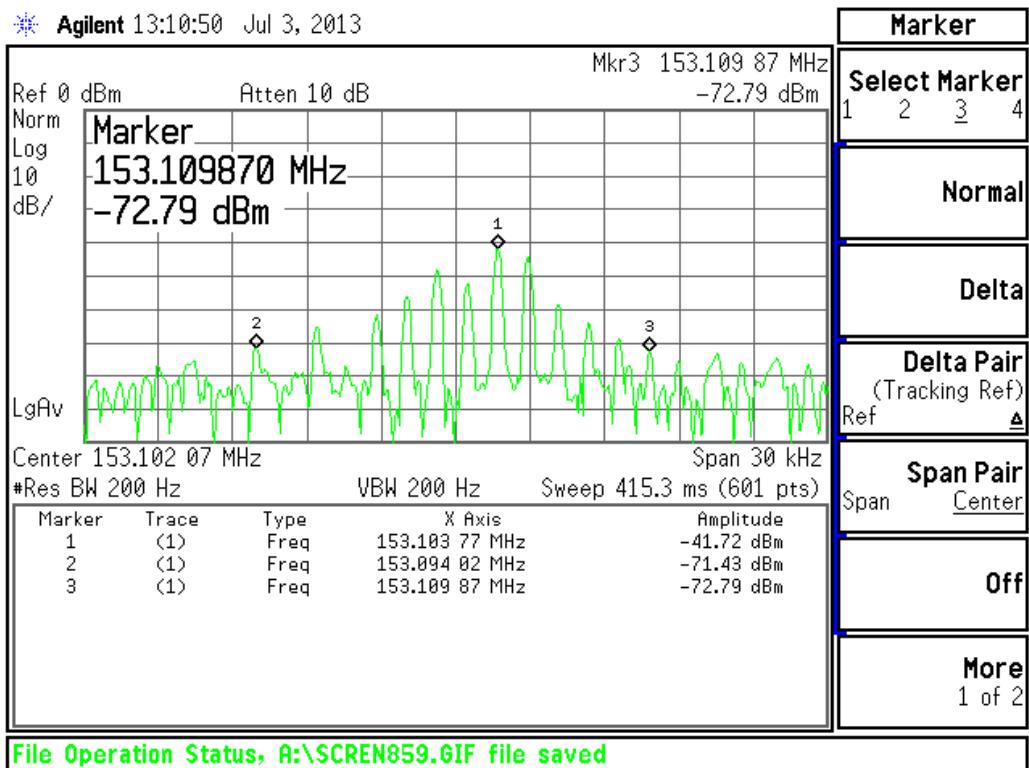
## TRaC EMC Emissions Software - ERP



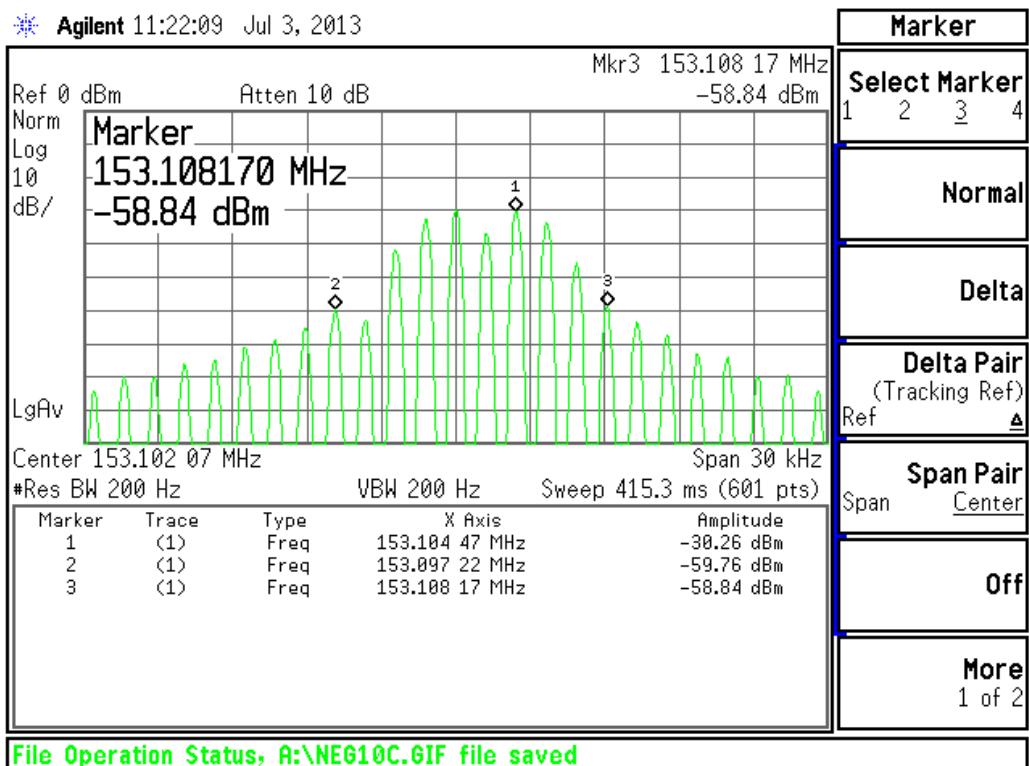
**Test Location:** EMC Ferrite  
**Analyser Type:** FSU46  
**Specification:** FCC 90.217  
**Spec Distance (m):** 3.0  
**Measurement Dist (m):** 3.0  
**EUT Names:** Echochirp  
**Sample Numbers:** S03  
**Assessment:** Horizontal and Vertical Antenna Polarity

**Remote Drive Eq.:** None  
**Sample Numbers:** N/A  
**Mode/Config/Arrg:** TX 153.1 MHz  
**Mod State:** 0  
**Engineer:** Adam Longley  
**Date/Time:** 19/06/2013 16:26:37  
**Job Number:** 1D0645  
**Software Version:** 1.9.1.0  
**Copyright © 2009, TRaC Global Ltd.**

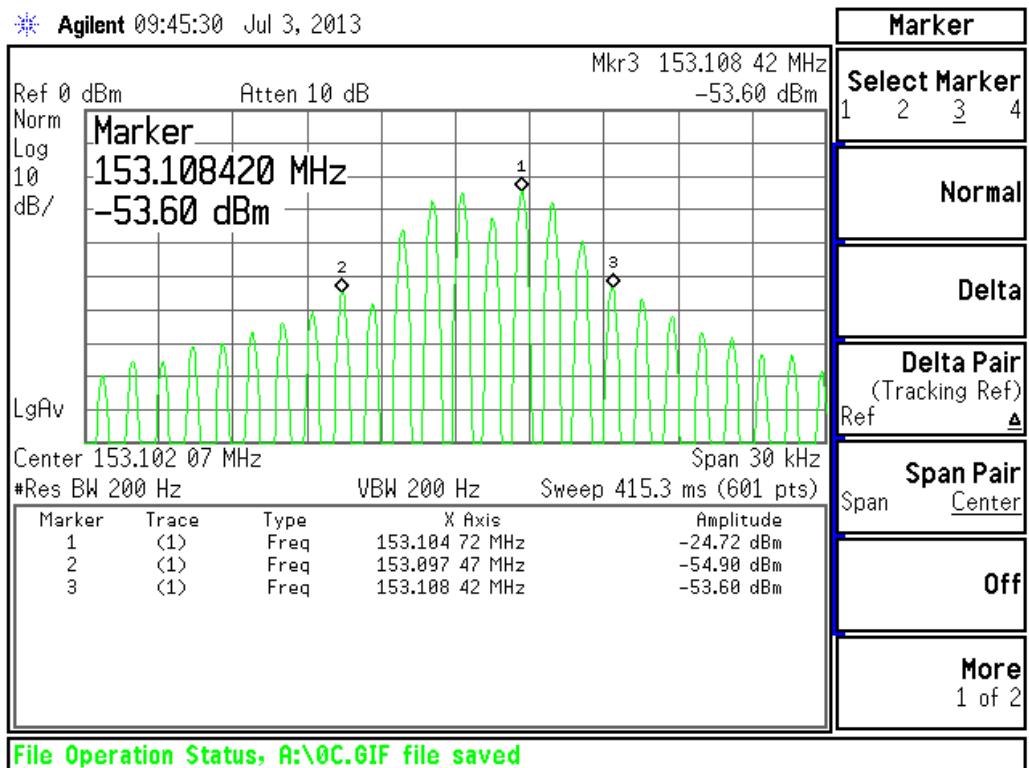
### ERP TX 153.1MHz Radiated spurious emissions 1GHz to 2GHz



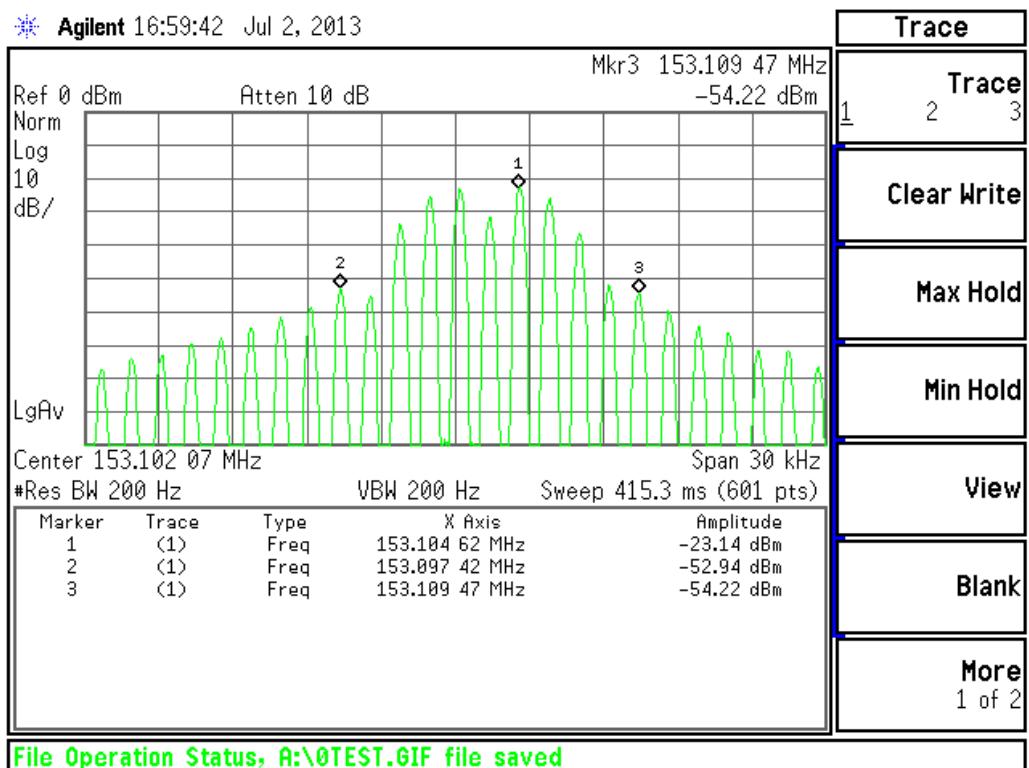
## TX 153.1MHz Occupied Bandwidth/Frequency Stability: -30°C



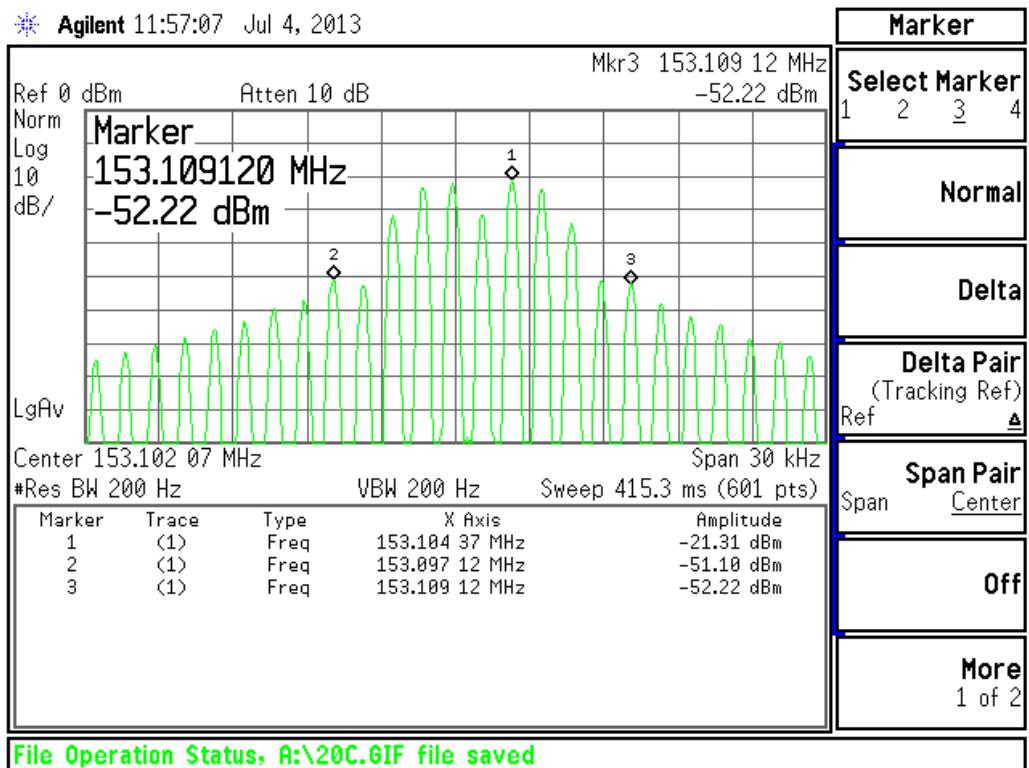
## TX 153.1MHz Occupied Bandwidth/Frequency Stability: -20°C



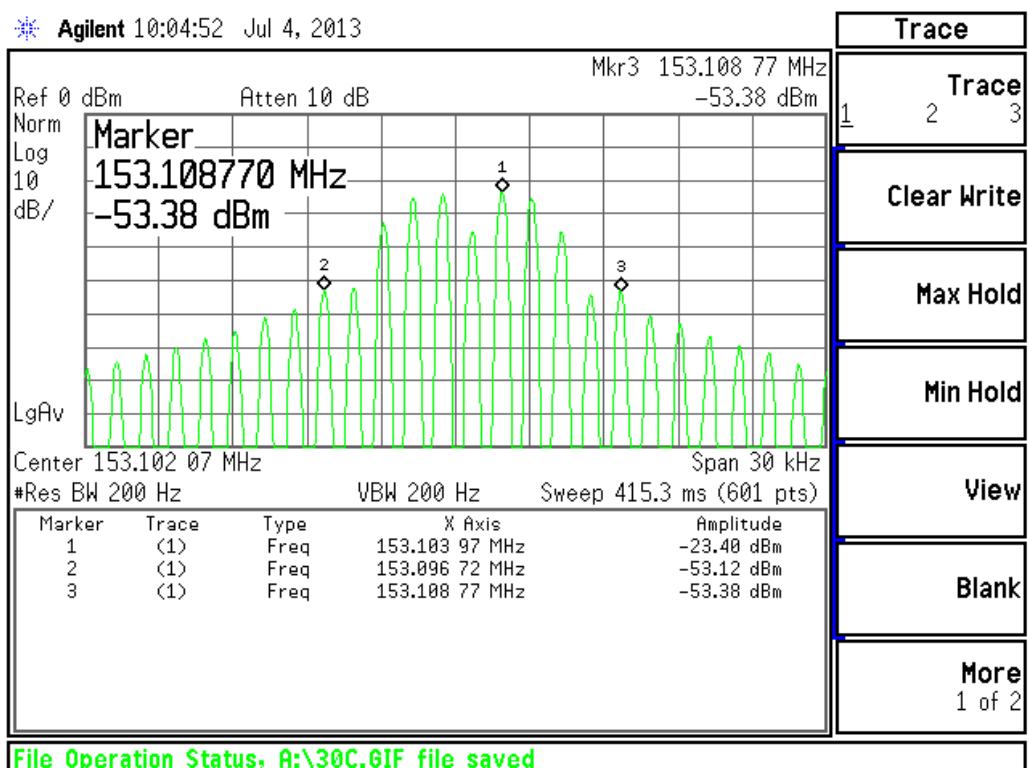
## TX 153.1MHz Occupied Bandwidth/Frequency Stability: -10°C



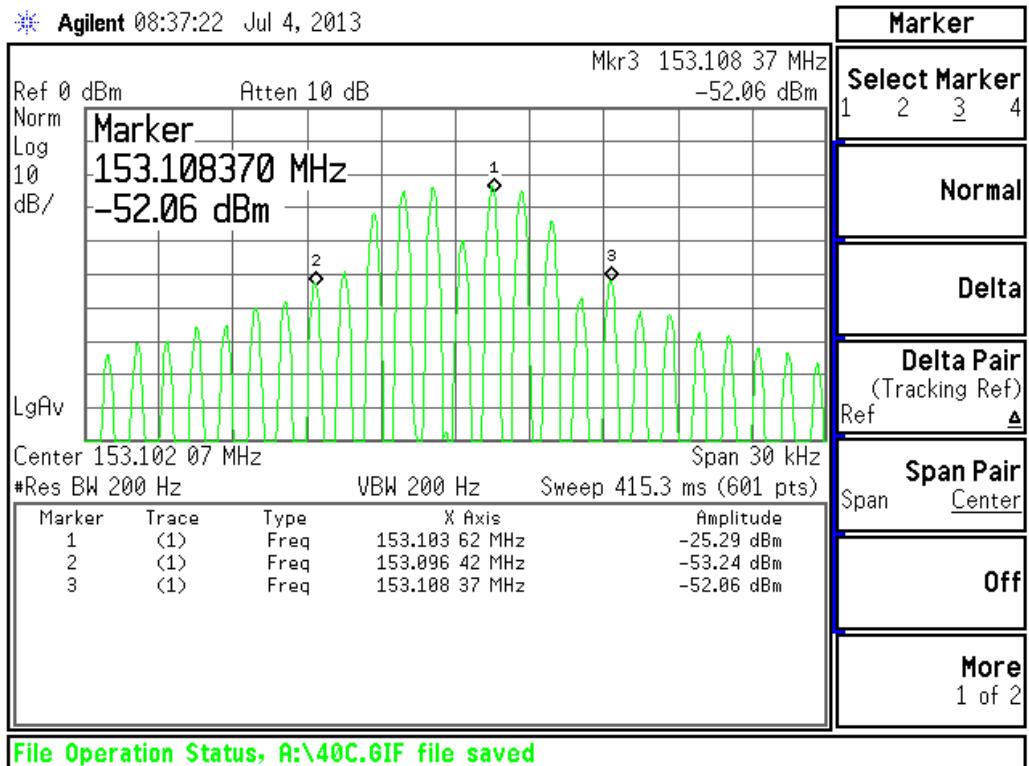
## TX 153.1MHz Occupied Bandwidth/Frequency Stability: 0°C



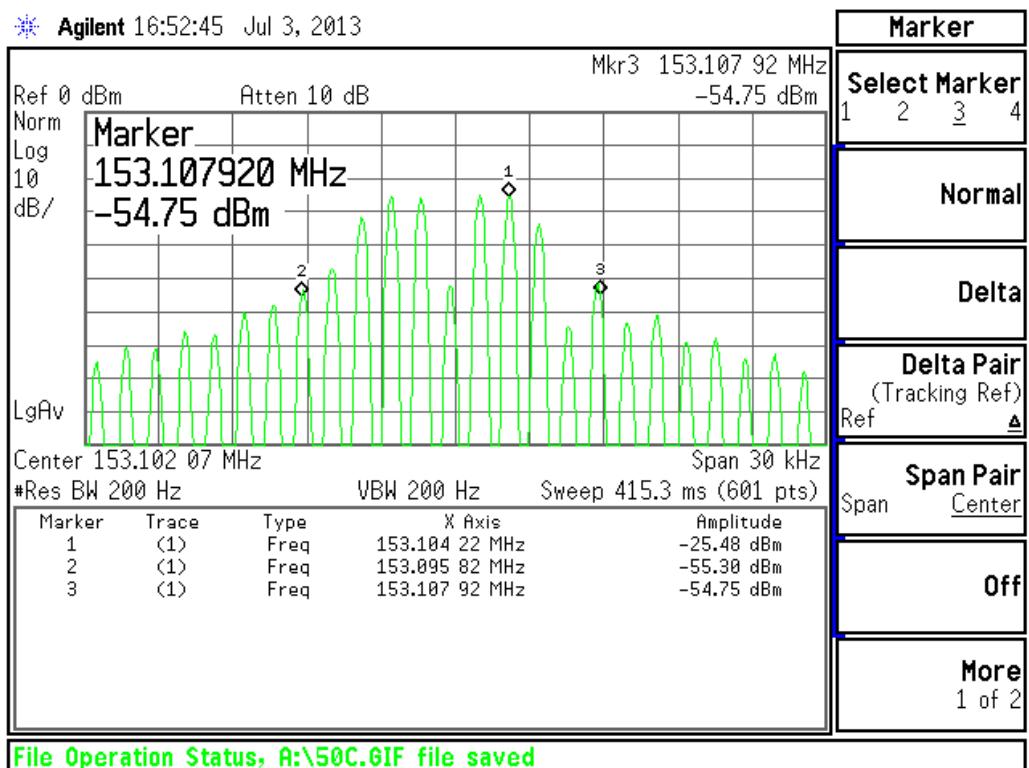
## TX 153.1MHz Occupied Bandwidth/Frequency Stability: 10°C



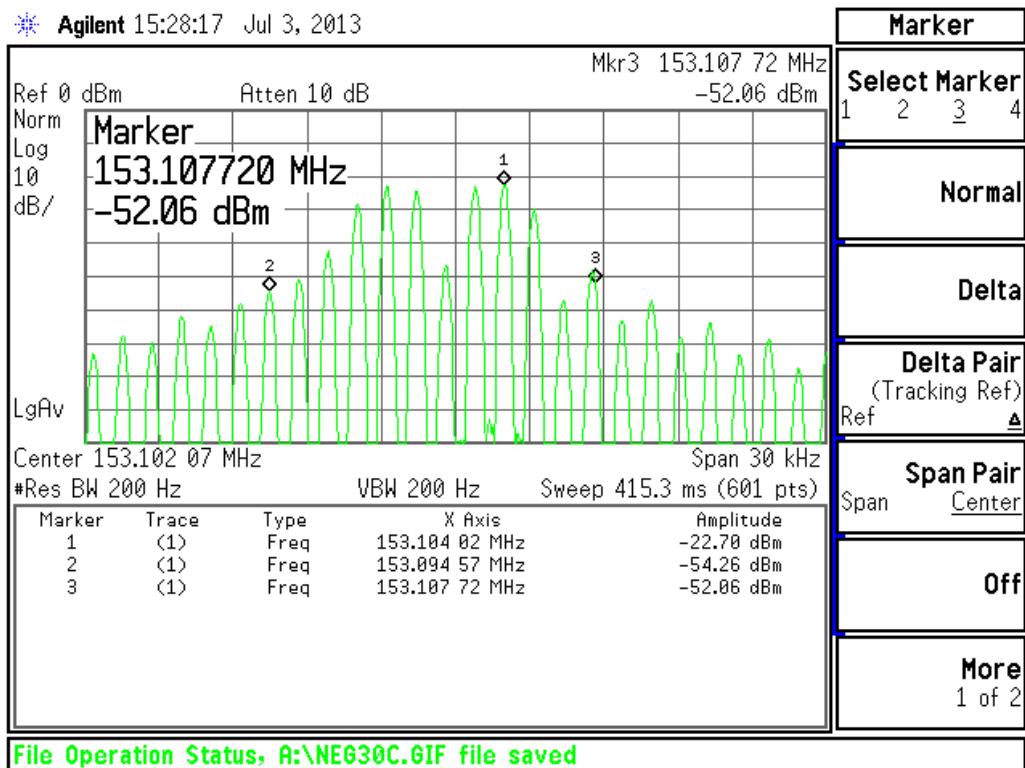
## TX 153.1MHz Occupied Bandwidth/Frequency Stability: 20°C



## TX 153.1MHz Occupied Bandwidth/Frequency Stability: 30°C



## TX 153.1MHz Occupied Bandwidth/Frequency Stability: 40°C



TX 153.1MHz Occupied Bandwidth/Frequency Stability: 50°C

**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
S03	Ecochirp VHF	S/N 130202

**C2) EUT Operating Mode During Testing.**

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

Test	Description of Operating Mode
All tests detailed in this report	EUT transmitting FSK modulation on 153.1025 MHz

**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 : S03  
Tests : Radiated

Port	Description of Cable Attached	Cable length	Equipment Connected
Signal	4 core signal cable	2m	Unterminated

**C5 Details of Equipment Used**

TRaC No	Equipment Type	Equipment Description	Manufacturer	Last Cal Calibration	Calibration Period	Due For Calibration
REF 910	FSU46	Spectrum Analyser	Rohde&Schwarz	03/2013	12 months	03/2014
REF 837	PSA	Spectrum Analyser	Agilent	10/05/2013	12 months	10/05/2014
REF 927	310	Pre-Amp	Sonoma	15/09/2011	12 months	15/09/2013
REF 913	HP8449B	Pre-Amp	HP	31/01/2013	12 months	31/01/2014
RFG 095	96002	Biconical Antenna	Eaton	12/05/2010	36 months	12/09/2013
RFG 191		Log Periodic Antenna	EMCO	12/05/2010	36 months	12/09/2013
REF 880	HL050	Log Periodic Antenna	Rohde&Schwarz	26/05/2011	24 month	26/09/2013
REF 886		3m Semi-Anechoic Chamber	Rainford	10/05/2013	12 months	10/05/2014
REF 684	DR130	Temp. Measuring Set	Yokogawa	09/08/2012	12 months	09/08/2013
RFG 365		Temperature Chamber	JTS	-	-	-

**Appendix D:**

**Additional Information**

No additional information is included within this test report.

**Appendix E:**

**Photographs and Figures**

The following photographs were taken of the test samples:

1. Radiated electric field emissions: Front view.
2. Radiated electric field emissions: Rear view.



Photograph 1



Photograph 2

