

TRaC Radio Test Report
FOR
Technology Solutions (UK) Ltd
ON
1117 HF RFID Reader
Document No. TRA-007847WUS1

TRaC Wireless Test Report : TRA-007847WUS1

Applicant : Technology Solutions (UK) Ltd

Apparatus : 1117 HF RFID Reader

Specification(s) : CFR47 Part 15 C 15.225:July 2008

FCCID : S6J1117

Purpose of Test : Certification

Authorised by :



: Radio Product Manager

Issue Date : 12th December 2011

Total number of pages : 43

Authorised Copy Number : PDF

Contents

Section 1:	Introduction	4
1.1	General	4
1.2	Tests Requested By	5
1.3	Manufacturer	5
1.4	Apparatus Assessed	5
1.5	Test Result Summary	6
1.6	Notes Relating To The Assessment	7
1.7	Deviations from Test Standards	7
Section 2:	Measurement Uncertainty	8
2.1	Measurement Uncertainty Values	8
Section 3:	Modifications	9
3.1	Modifications Performed During Assessment	9
Appendix A:	Formal Emission Test Results	10
A1	Intentional H-Field Emission Field Strength	11
A2	Spurious Emissions Radiated: (TX Mode)	13
A3	Transmitter Frequency Stability	16
A4	20dB Bandwidth	17
A5	Unintentional Radiated Electric Field Emissions	18
A6	ac Power Line Conducted Emissions – Receiver/Digital circuitry	20
Appendix B:	Supporting Graphical Data	22
Appendix C:	Additional Test and Sample Details	29
C1	Test samples	30
C2	EUT Operating Mode During Testing.	31
C3	EUT Configuration Information.	32
C4	List of EUT Ports	33
C5	Details of Equipment Used	34
Appendix D:	Additional Information	35
Appendix E:	Photographs and Figures	36
Appendix F:	MPE Calculation	42

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.

Test performed by: TRaC Global [X]
Unit E
South Orbital Trading Park
Hedon Road
Hull, HU9 1NJ.
United Kingdom.

Telephone: +44 (0) 1482 801801
Fax: +44 (0) 1482 801806

TRaC Global []
Unit 1
Pendle Place
Skelmersdale
West Lancashire, WN8 9PN
United Kingdom

Telephone: +44 (0) 1695 556666
Fax: +44 (0) 1695 557077

Email: test@tracglobal.com
Web site: <http://www.tracglobal.com>

Tests performed by:



Geoff Cruickshank

Report author:



Geoff Cruickshank

This report must not be reproduced except in full without prior written permission from TRaC Global Ltd

1.2 Tests Requested By

This testing in this report was requested by:

Technology Solutions (UK) Ltd
Suite C
Loughborough Technology Centre
Epinal Way
Loughborough
Leicestershire
LE11 3GE
United Kingdom

1.3 Manufacturer

As above

1.4 Apparatus Assessed

The following apparatus was assessed between 22/11/11 and 25/11/11:

1117 HF RFID Reader

The 1117 HF RFID reader is a device capable of providing the Motorola MC55 and MC65 series Mobile Computers with the functionality of reading and writing ISO15693, ISO14443A, ISO14443B compliant Radio Frequency Identification (RFID) transponders operating at 13.56MHz. The 1117 HF RFID reader has an internal loop antenna.

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 1.7 to 1.8 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
Intentional H-Field Emission Field Strength	Title 47 of the CFR : Part 15 Subpart C; 15.225(a, b and c)	ANSI C63.10	Pass
Radiated spurious emissions (TX mode)	Title 47 of the CFR : Part 15 Subpart C; 15.209 and 15.225(d)	ANSI C63.10	Pass
Radiated spurious emissions (Restricted bands)	Title 47 of the CFR: Part 15 Subpart C; 15.205	ANSI C63.10	Pass
Transmitter Frequency Tolerance	Title 47 of the CFR : Part 15 Subpart C; 15.225(e)	ANSI C63.4	Pass
20dB Bandwidth	Title 47 of the CFR : Part 15 Subpart C; 15.215(c)	ANSI C63.4	Pass
Unintentional Radiated Spurious Emissions	Title 47 of the CFR: Part 15 Subpart B; 15.109	ANSI C63.4	Pass
ac Power conducted emissions	Title 47 of the CFR: Part 15 Subpart B; 15.107	ANSI C63.4	Pass

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 1.8 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.

Radiated Electric Field Emissions

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

Power Line Conducted Emissions

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

Transmitter Frequency Tolerance and 20dB Bandwidth

Quantity Range	Quantity	Expanded Uncertainty
13.56MHz	Frequency (Hz)	± 34 Hz

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 Intentional H-Field Emission Field Strength

Carrier power was verified with the EUT transmitting on its centre carrier frequency only.

Test Details:	
Regulation	Title 47 of the CFR : Part 15 Subpart C; 15.225(a, b and c)
Measurement standard	ANSI C63.10
EUT sample number	S02
Modification state	0
SE in test environment	S08 and S14
SE isolated from EUT	None
EUT set up	Refer to Appendix C

Carrier H-Field Strength											
Ref No.	FREQ. (MHz)	Det.	MEAS Rx (dBμV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	Measurement distance (m)	FIELD ST'GH (dBμV/m)	EXTRAP FACT (dB)	FIELD ST'GH (dBμV/m)	LIMIT (dBμV/m)	Margin (dB)
1	13.560	QP	48.9	0.2	18.4	3	67.5	-40.0	27.5	84.0	-56.5

Note

Carrier power was verified with the EUT transmitting on its centre carrier frequency only.

Plots of the Intentional Emission Field Strength (Carrier Mask) are contained in Appendix B of this test report.

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: 40dB as per 15.31(f)(2)

- 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 Horizontal and vertical polarizations, of the receive antenna
 - 6 EUT orientation in three orthogonal planes
 - 7 Maximum results recorded

Limits Title 47 of the CFR : Part 15 Subpart C; 15.225 (a, b and c)

The carrier output levels shall not exceed the values in the table below.

Frequency Range	H-Field Strength Limit (H_f) dB μ V/m at 30m
13.553 to 13.567	84.0
13.410 to 13.553 13.567 to 13.710	50.5
13.110 to 13.410 13.710 to 14.010	40.5
Outside 13.110 to 14.010	29.5

A2 Spurious Emissions Radiated: (TX Mode)

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The EUT was set to transmit on its centre carrier frequency only.

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; 15.225(d) and 15.209
Measurement standard	ANSI C63.10
Frequency range	9kHz to 1GHz
EUT sample number	S02
Modification state	0
SE in test environment	S08 and S14
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 both within and outside of 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	40.679	QP	57.2	0.5	11.4	31.6	37.5	0.0	37.5	40.0	-2.5
2	67.799	QP	52.9	0.9	7.8	31.6	30.0	0.0	30.0	40.0	-10.0
3	94.919	QP	48.2	0.9	8.7	31.6	26.2	0.0	26.2	43.5	-17.3
4	176.278	QP	43.2	1.0	12.2	31.5	24.9	0.0	24.9	43.5	-18.6
5	559.980	QP	48.0	3.0	18.5	31.6	37.9	0.0	37.9	46.0	-8.1
6	590.300	QP	35.7	2.9	18.5	31.6	25.5	0.0	25.5	46.0	-20.5
7	599.992	QP	52.2	3.1	18.6	31.6	42.3	0.0	42.3	46.0	-3.7
8	623.751	QP	41.5	3.4	19.2	31.7	32.4	0.0	32.4	46.0	-13.6
9	639.991	QP	45.2	3.1	19.6	31.6	36.3	0.0	36.3	46.0	-9.7

Notes:

- 1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10-2009 section 4.5, Table 1 and 6.4.2
- 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= 100 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= 1 MHz, VBW = 10 Hz or using an average detector.

These settings as per ANSI C63.10-2009

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

Limits

Radiated emission limits (47 CFR Part15: Clause 15.209) for emissions falling within the restricted bands defined in 15.205(a):

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:

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

The results displayed take into account applicable antenna factors and cable losses.

- (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 C (ii) Parameter defined by client and / or single possible, refer to Appendix C (iii) Parameter had a negligible effect on emission levels, refer to Appendix C (iv) Worst case determined by initial measurement, refer to Appendix C				

A3 Transmitter Frequency Stability

Carrier frequency was verified with the EUT transmitting on its nominal carrier frequency unmodulated.

Test Details:	
Regulation	Title 47 of the CFR , Part 15 Subpart (c) 15.225(e)
Measurement standard	ANSI C63.10-2009
EUT sample number	S02
Modification state	0
SE in test environment	S08
SE isolated from EUT	None
EUT set up	Refer to Appendix C

Temperature (°C)	Measured frequency (MHz)	Frequency Error (kHz)	Frequency Error (%)	Limit
-20	13.559936	-0.064	-0.00047198	± 0.01%
-10	13.5598	-0.2	-0.00147493	± 0.01%
0	13.559823	-0.177	-0.00130531	± 0.01%
10	13.559807	-0.193	-0.0014233	± 0.01%
20	13.559815	-0.185	-0.00136431	± 0.01%
30	13.559768	-0.232	-0.00171091	± 0.01%
40	13.559756	-0.244	-0.00179941	± 0.01%
50	13.559762	-0.238	-0.00175516	± 0.01%

Notes:

For battery operated equipment, the equipment tests shall be performed using a new battery.

Limits:

Title 47 of the CFR 2008, Part 15 Subpart (c) 15.225(e)

The frequency tolerance of the carrier signal shall be maintained within ± 0.01% (100ppm)

A4 20dB Bandwidth

Title 47 of the CFR: Part 15 Subpart (c) 15.215(c) requires the measurement of the bandwidth of the transmission between the -20 dB points on the transmitted spectrum.

Test Details:	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) 15.215 (c)
Measurement standard	ANSI C63.4-2003
EUT sample number	S02
Modification state	0
SE in test environment	S08 and S14
SE isolated from EUT	None
EUT set up	Refer to Appendix C

Band occupancy @ -20 dBc:			
Frequency (MHz)	f_{lower} (MHz)	f_{higher} (MHz)	Band occupancy (kHz)
13.56	13.559067	13.560601	1.534

Plots of the 20dB bandwidth are contained in Appendix B of this test report.

A5 Unintentional Radiated Electric Field Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The maximum permitted field strength is listed in Section 15.109. The EUT was set to receive mode only.

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 :

☒

Test Details:	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.109
Measurement standard	ANSI C63.4-2003
Frequency range	30MHz to 1GHz
EUT sample number	S02
Modification state	0
SE in test environment	S08
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photographs 3 and 4

The worst case radiated emission measurements for spurious emissions 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	456.000	QP	38.9	2.7	16.6	31.5	26.7	0.0	26.7	46.0	-19.3
2	504.000	QP	36.5	2.8	18.0	31.6	25.7	0.0	25.7	46.0	-20.3
3	600.000	QP	36.5	3.1	18.6	31.6	26.6	0.0	26.6	46.0	-19.4
4	625.000	QP	36.2	3.3	19.3	31.7	27.1	0.0	27.1	46.0	-18.9

Specification limits :

The upper frequency of the measurement range was decided according to 47 CFR Part 15: Clause 15.33.

Radiated emission limits (47 CFR Part 15: Clause 15.109):

Except for a Class A digital device, the field strength of radiated emissions from unintentional radiators at a distance of 3m shall not exceed the following values:

Frequency of emission (MHz)	Field strength $\mu\text{V/m}$	Field strength $\text{dB}\mu\text{V/m}$
30-88	100	40.0 (quasi-peak)
88-216	150	43.5 (quasi-peak)
216-960	200	46.0 (quasi-peak)
960-1000	500	54.0 (quasi-peak)
Above 1000	500	54.0 (average)
Above 1000	-	74.0 (peak)

Notes:

- (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:

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

The results displayed take into account applicable antenna factors and cable losses.

- (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 C (ii) Parameter defined by client and / or single possible, refer to Appendix C (iii) Parameter had a negligible effect on emission levels, refer to Appendix C (iv) Worst case determined by initial measurement, refer to Appendix C				

A6 ac Power Line Conducted Emissions – Receiver/Digital circuitry

Preview ac power line port conducted emission measurements were performed with a peak detector in a screened room. The effect of the EUT set-up on the measurements is summarised in note (b) below. Where applicable formal measurements of the emissions were performed with a peak, average and/or quasi peak detector. The formal measurements are detailed below:

Test Details:	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.109
Measurement standard	ANSI C63.4-2003
Class	B
Frequency range	150kHz to 30MHz
EUT sample number	S02, S09 and S10
Modification state	0
SE in test environment	S08
SE isolated from EUT	RFG636
EUT set up	Refer to Appendix C
Photographs (Appendix F)	Photograph 5

The worst-case power line conducted emission measurements are listed below:

Results measured using the average detector compared to the average limit

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
1	0.150	L1	38.7	56.0	-17.3	Pass
2	0.156	L1	40.6	55.7	-15.1	Pass
3	0.196	L1	29.8	53.8	-24.0	Pass
4	0.275	L1	26.9	51.0	-24.1	Pass
5	0.472	L1	30.0	46.5	-16.5	Pass
6	4.800	L1	17.8	46.0	-28.2	Pass
7	0.150	N	36.8	56.0	-19.2	Pass
8	0.156	N	40.5	55.7	-15.2	Pass
9	0.196	N	30.1	53.8	-23.7	Pass
10	0.275	N	25.8	51.0	-25.2	Pass
11	0.472	N	30.3	46.5	-16.2	Pass
12	4.800	N	17.3	46.0	-28.7	Pass

Results measured using the quasi-peak detector compared to the quasi-peak limit

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
1	0.150	L1	49.9	66.0	-16.1	Pass
2	0.156	L1	50.3	65.7	-15.4	Pass
3	0.196	L1	42.2	63.8	-21.6	Pass
4	0.275	L1	35.9	61.0	-25.1	Pass
5	0.472	L1	37.1	56.5	-19.4	Pass
6	4.800	L1	26.7	56.0	-29.3	Pass
7	0.150	N	48.6	66.0	-17.4	Pass
8	0.156	N	49.2	65.7	-16.5	Pass
9	0.196	N	41.7	63.8	-22.1	Pass
10	0.275	N	34.8	61.0	-26.2	Pass
11	0.472	N	36.6	56.5	-19.9	Pass
12	4.800	N	26.6	56.0	-29.4	Pass

Specification limits :

Conducted emission limits (47 CFR Part 15 Subpart (c): Clause 15.107):

Conducted disturbance at the mains ports.

Frequency range MHz	Limits dB μ V	
	Quasi-peak	Average
0.15 to 0.5	66 to 56 ²	56 to 46 ²
0.5 to 5	56	46
5 to 30	60	50

Notes:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

Notes:

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

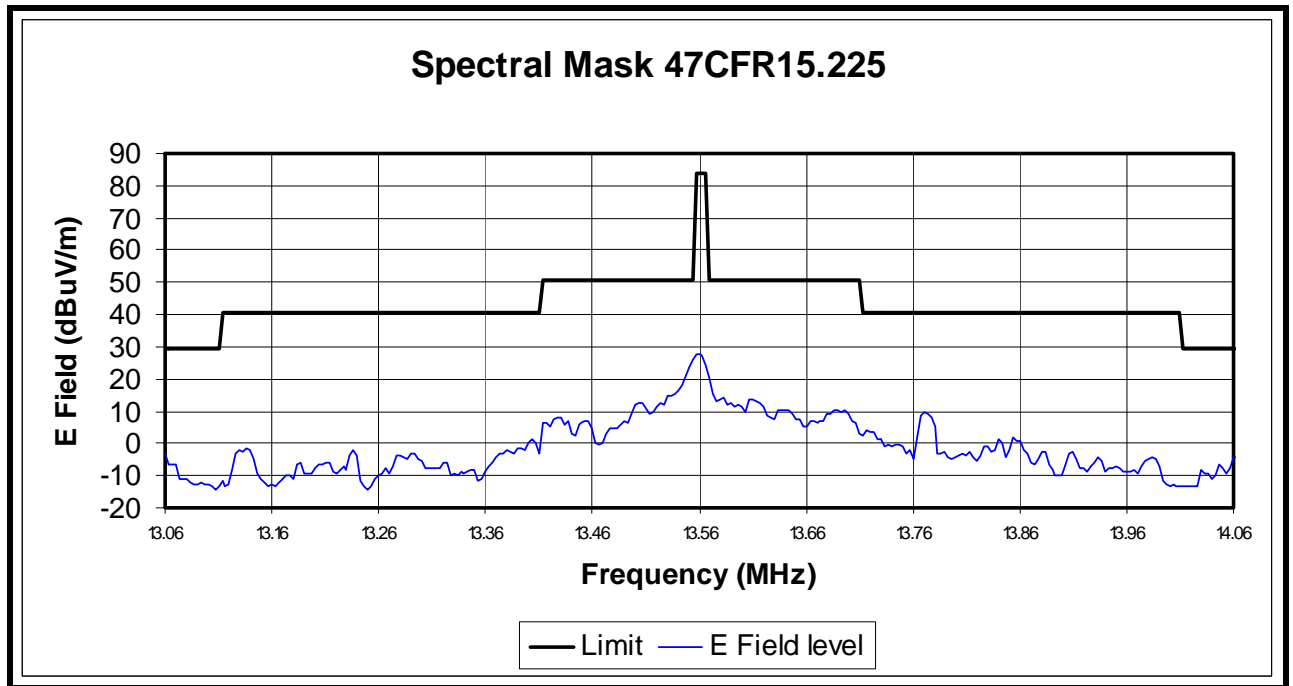
	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels		✓		
Effect of EUT internal configuration on emission levels		✓		
(i) Parameter defined by standard and / or single possible, refer to Appendix C (ii) Parameter defined by client and / or single possible, refer to Appendix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

Appendix B:**Supporting Graphical Data**

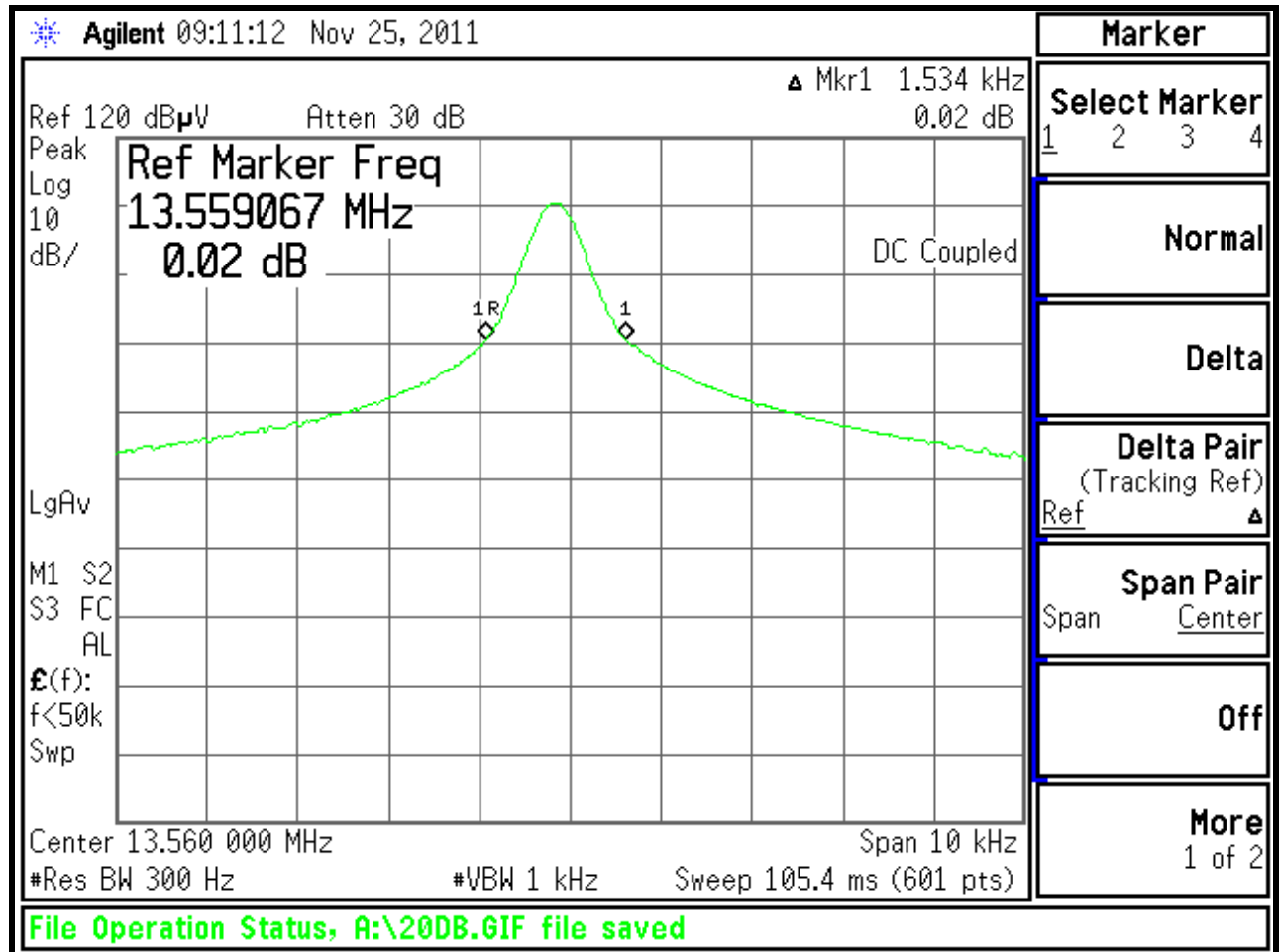
This appendix contains graphical data obtained during testing.

Notes:

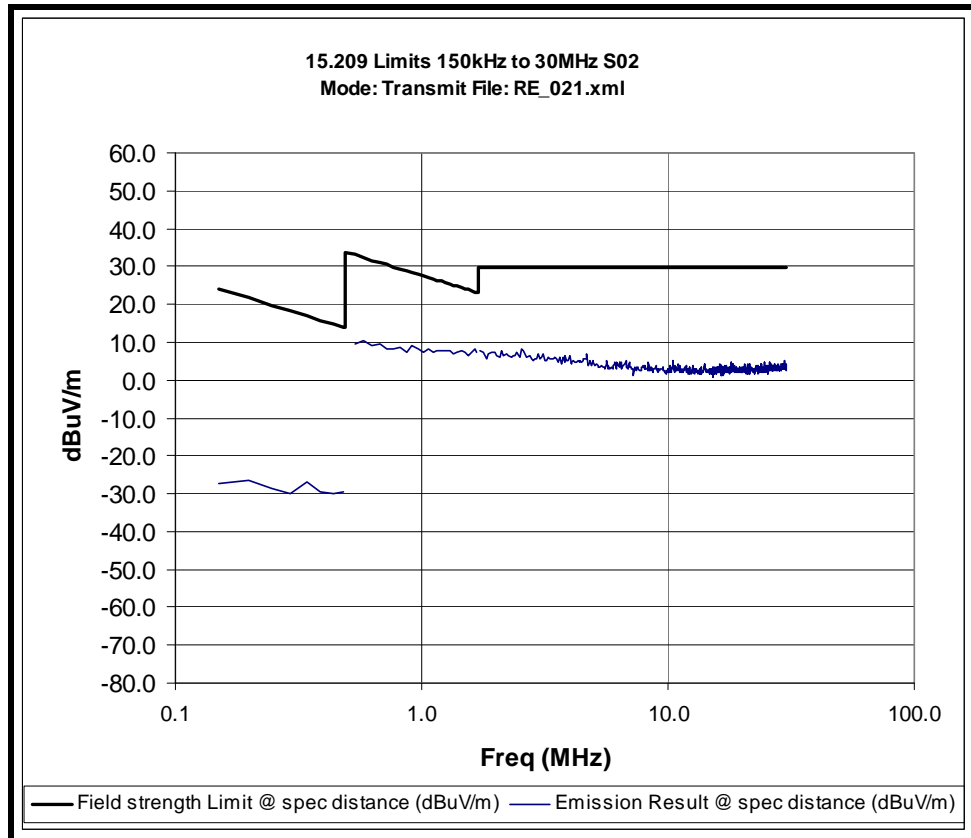
- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.
- (b) The time and date on the plots do not necessarily equate to the time of the test.
- (c) Where relevant, on power 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.



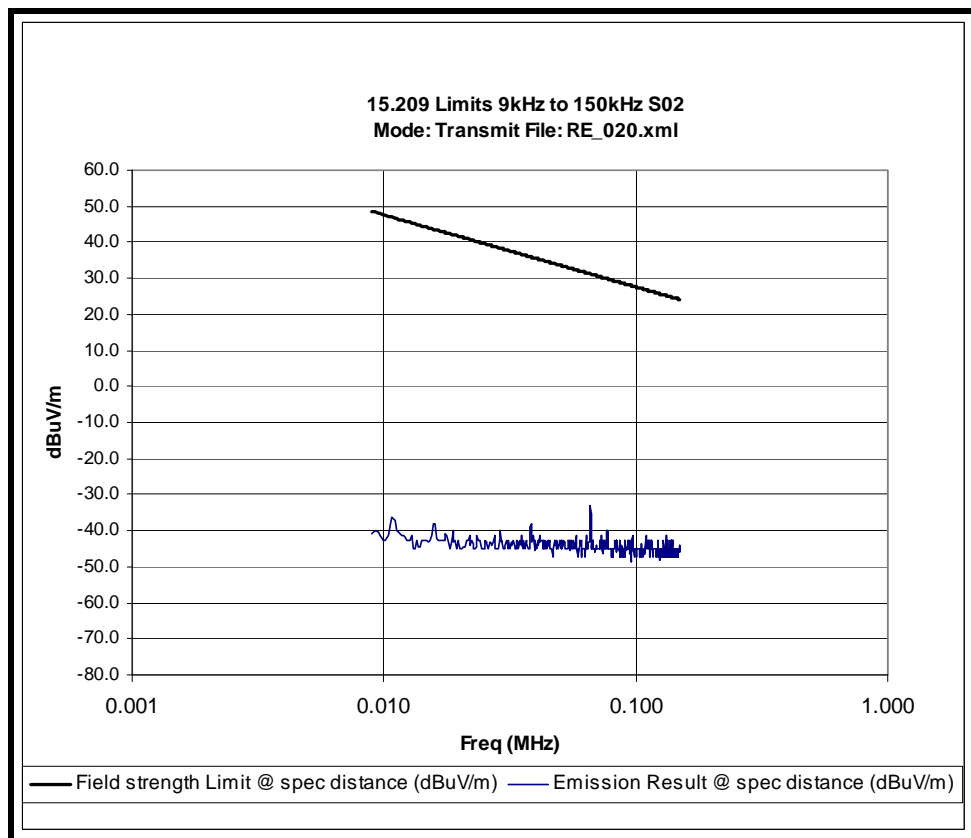
Intentional Emission Field Strength (Carrier Mask)



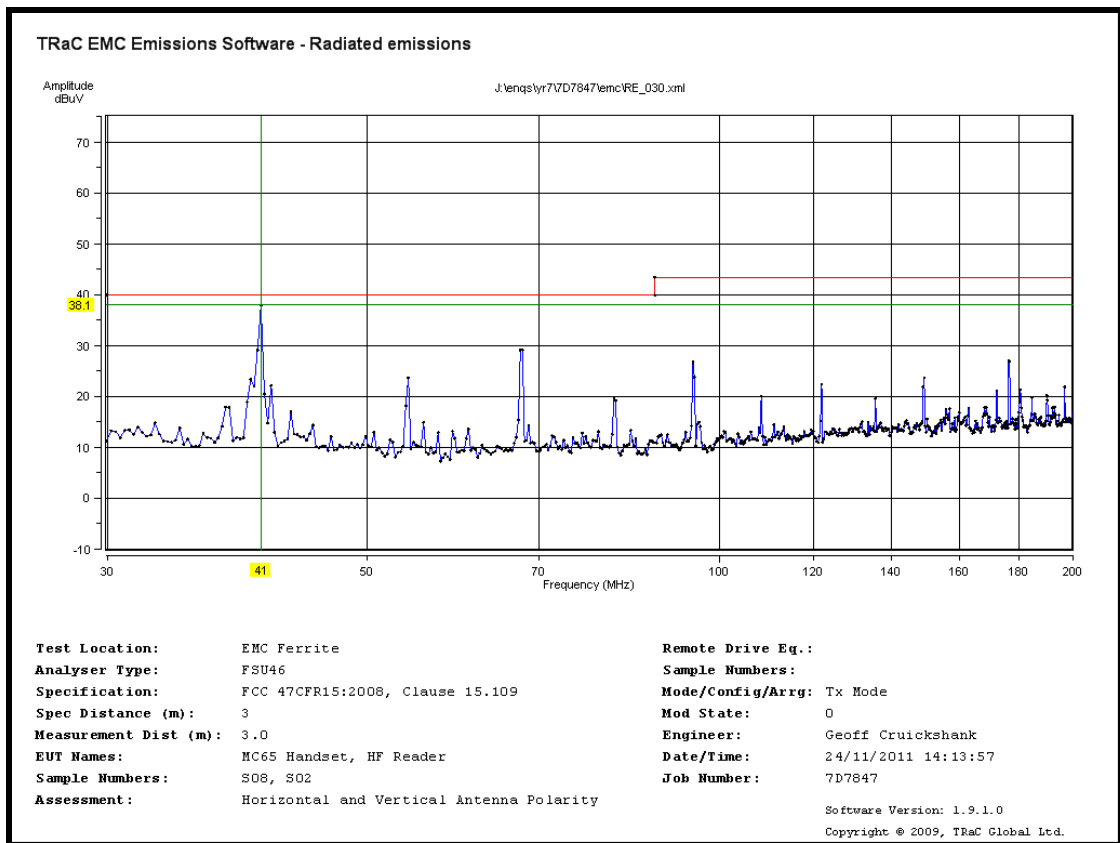
20dB Bandwidth



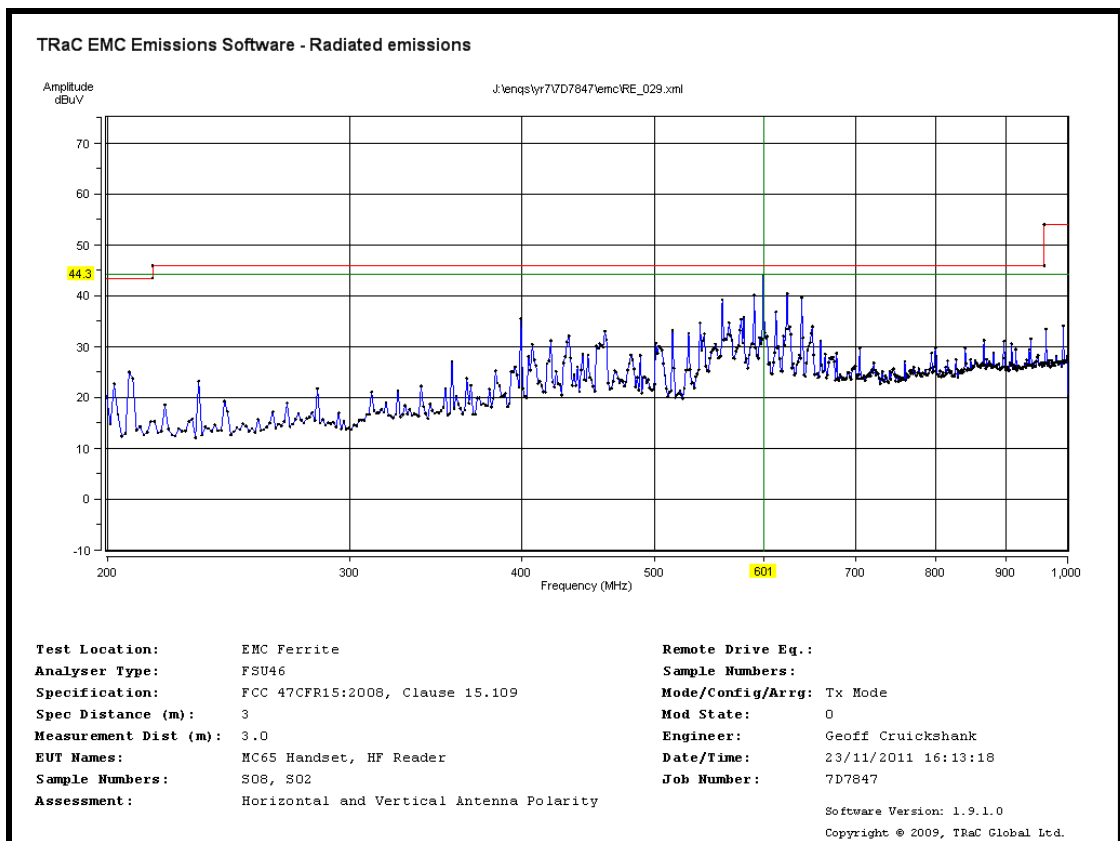
Radiated Spurious emissions 9kHz to 150kHz – Tx Mode



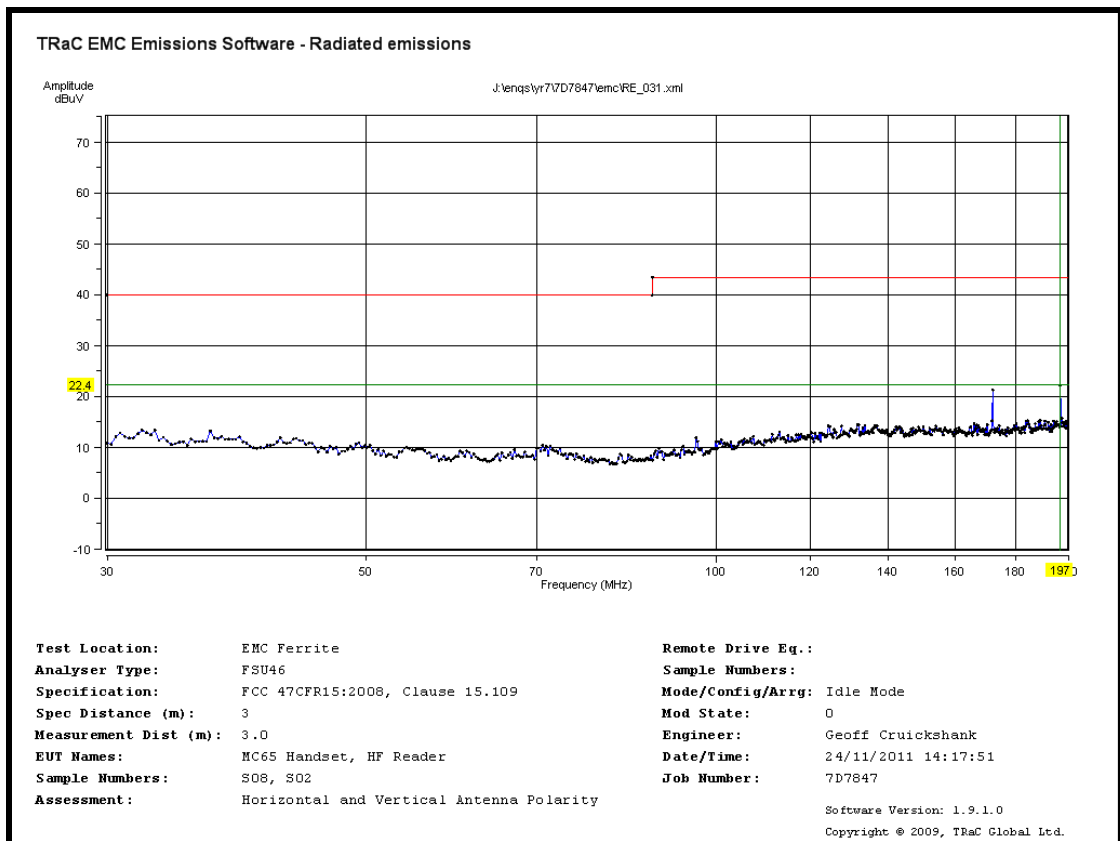
Radiated Spurious emissions 150kHz to 30MHz – Tx Mode



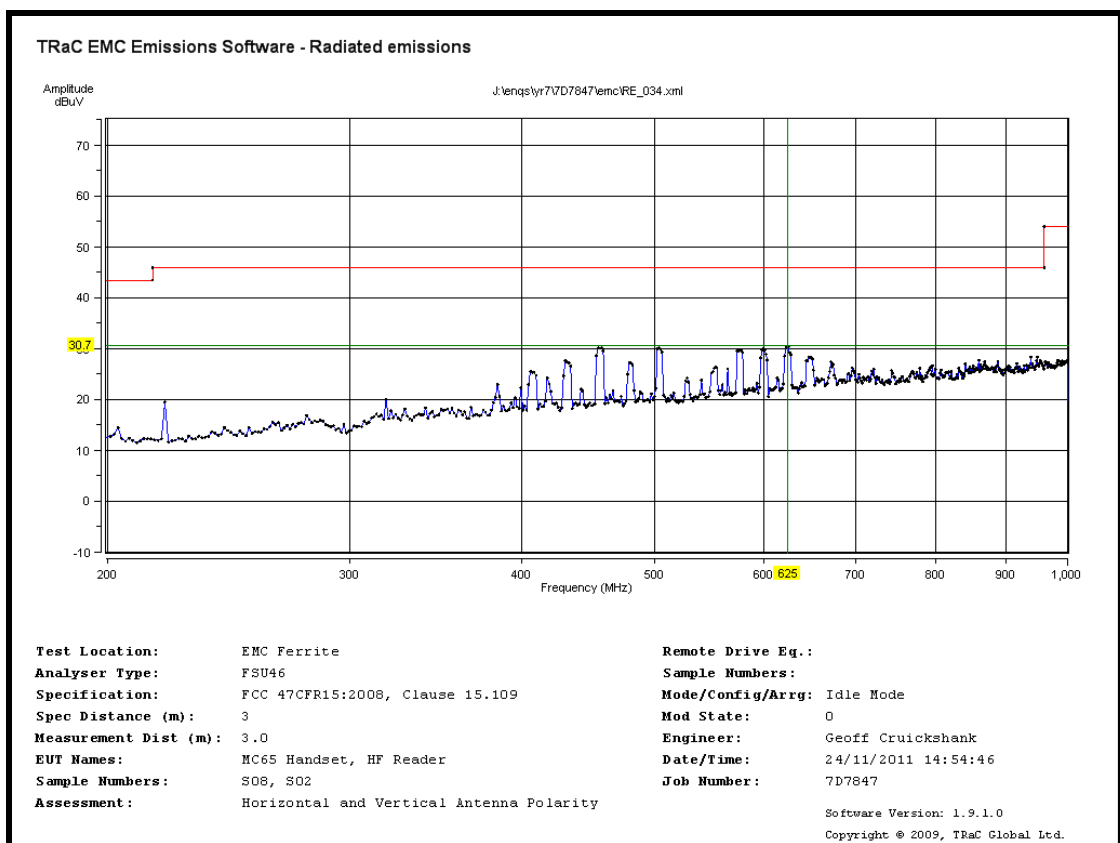
Radiated Spurious emissions 30MHz to 200MHz – Tx Mode



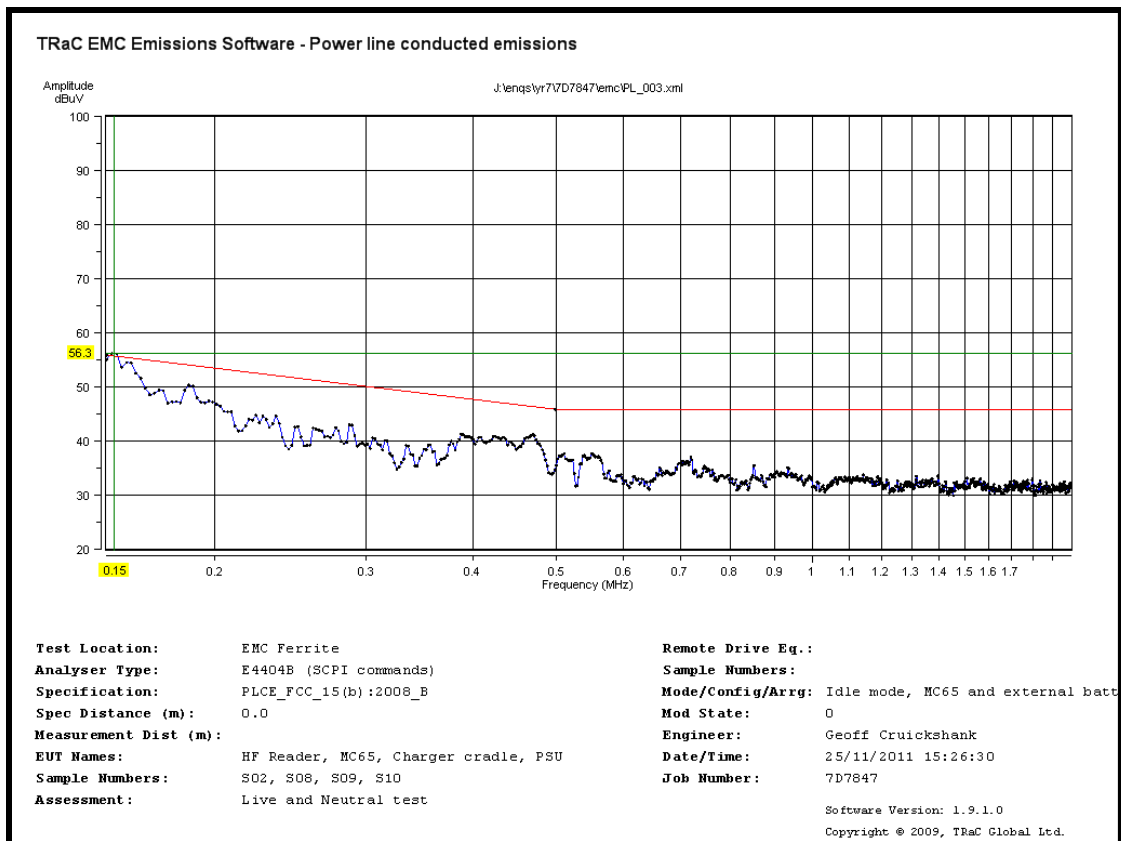
Radiated Spurious emissions 200MHz to 1GHz – Tx Mode



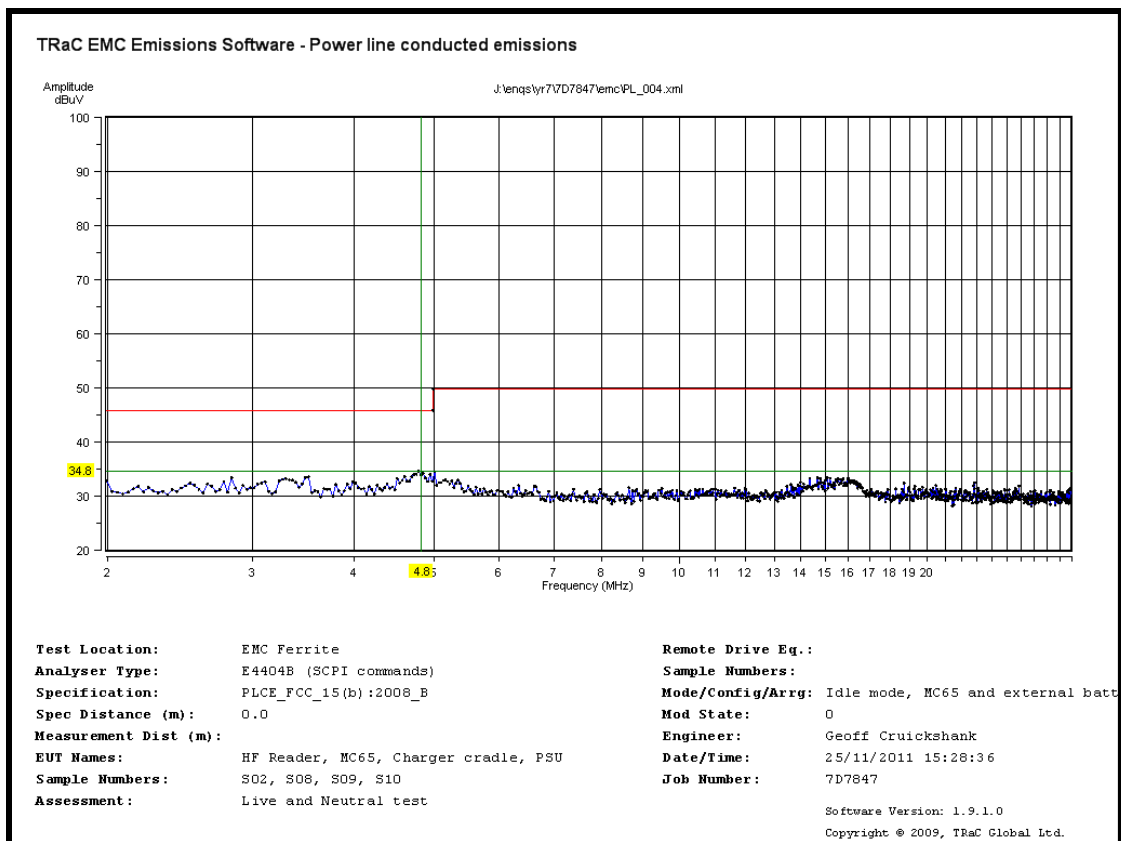
Unintentional Radiated Spurious emissions 30MHz to 200MHz – Rx Mode



Unintentional Radiated Spurious emissions 200MHz to 1GHz – Rx Mode



Power Line Conducted emissions 150kHz to 2MHz – Rx Mode



Power Line Conducted emissions 2MHz to 30MHz – Rx Mode

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
S02	1117 HF RFID Reader	S/N: 1117-000141
S09	CRD5500-1000 Charging Cradle	S/N: 1117552400370
S10	HIPRO PWRS-14000-148R PSU	S/N: F3351049012436

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

Sample No.	Description	Identification
S08	Motorola MC65 Mobile Computer	S/N: 10194521400137
S14	HF Transponder	None

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

TRaC Identification	Description
RFG636	NSG1007 Power Source

C2 EUT Operating Mode During Testing.

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

Test	Description of Operating Mode:TX
Intentional Emission Field Strength, Spurious Emissions Radiated, Transmitter Frequency stability and 20dB Bandwidth	The reader is fully powered via the internal battery of S08 and the RFID reader section is active and constantly reading the transponder (S04).

Test	Description of Operating Mode: RX/Idle mode
Unintentional Radiated Spurious Emissions	The reader is powered via the internal battery of S08 but not attempting to read transponders. The RFID reader section is powered off in this mode.

Test	Description of Operating Mode: RX/Idle mode
ac Power Line Conducted Emissions – Receive Mode.	The reader is powered via the charging cradle (S09) from 110Vac / 60Hz power supply (RFG636) but not attempting to read transponders. The RFID reader section is powered off in this mode.

C3 EUT Configuration Information.

Sample	Internal Configuration Details
S02	Single possible internal configuration
S09	Single possible internal configuration
S10	Single possible internal configuration

C4 List of EUT Ports

The tables below describes the termination of EUT ports

Sample : S02
 Tests : Intentional Emission Field Strength, Spurious Emissions Radiated, Transmitter Frequency stability and 20dB Bandwidth

Port	Description of Cable Attached	Cable length	Equipment Connected
Docking port	None	N/A	None
Handset docking port	None	N/A	S08
Reader receiver	None	N/A	S14

Sample : S02
 Tests : Unintentional Radiated Spurious Emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
Docking port	None	N/A	None
Handset docking port	None	N/A	S08
Reader receiver	None	N/A	None

Sample : S02
 Tests : ac Power Line Conducted Emissions – Receive Mode

Port	Description of Cable Attached	Cable length	Equipment Connected
Docking port	None	N/A	S09
Handset docking port	None	N/A	S08
Reader receiver	None	N/A	None

Sample : S09
 Tests : ac Power Line Conducted Emissions – Receive Mode.

Port	Description of Cable Attached	Cable length	Equipment Connected
dc Power Port	2 core unscreened	2.0 m	S10
Docking port	None	N/A	S08

Sample : S10
 Tests : ac Power Line Conducted Emissions – Receive Mode.

Port	Description of Cable Attached	Cable length	Equipment Connected
ac Power Port	3 core unscreened	1.0 m	RFG636
dc Power Port	2 core unscreened	2.0 m	S09

C5 Details of Equipment Used

For Radiated Measurements:

Intentional Emission Field Strength and Spurious Emissions Radiated 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
125	ESHS 10	Test Receiver (LF)	R&S	19/05/11
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

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 ac Power Line Conducted Emissions –Receive Mode

TRAC Ref	Type	Description	Manufacturer	Date Calibrated.
N/A	Lab 5	Screened room 2	TRaC	N/A
189	ESH3-Z5	2-Phase LISN	R&S	09/06/11
674	ESH3-Z2	Pulse Limiter	R&S	02/05/11
657	E4404B	Spectrum Analyser	Agilent	17/05/11
296	K0017F	BNC Type 3m Cable RF	Huber & Suhner UK Ltd	12/09/11
298	K0017F	BNC Type 3m Cable RF	Huber & Suhner UK Ltd	12/09/11
125	ESHS 10	Test Receiver (LF)	R&S	19/05/11
636	NSG 1007	5kVA ac Power Source	Schaffner	N/A

For Transmitter Frequency Stability, 20dB Bandwidth and Intentional Carrier Field Strength (carrier mask) tests

RFG No	Type	Description	Manufacturer	Date Calibrated
REF837	E4440	Spectrum Analyser	Agilent	18/05/11
365	BM80/-20/150/p	Temperature Chamber	JTS Enviromental	17/06/11

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 Magnetic field emissions arrangement: front view.
2. Radiated Magnetic field emissions arrangement: front view.
3. Radiated electric field emissions arrangement: front view.
4. Radiated electric field emissions arrangement: rear view.
5. Power line conducted emissions



Photograph 1



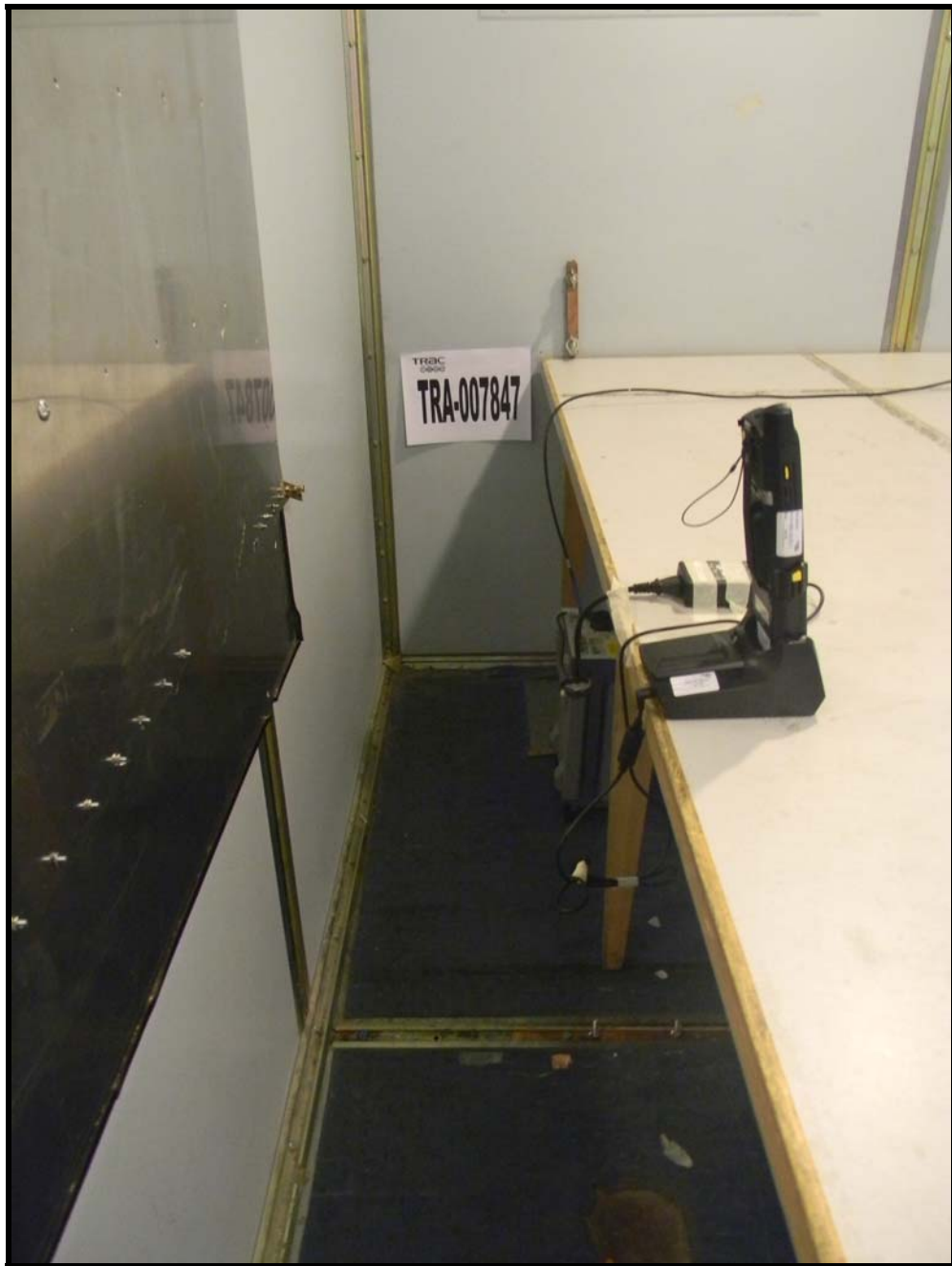
Photograph 2



Photograph 3



Photograph 4



Photograph 5

Appendix F:**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 **0.979mW/cm²** 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

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

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 0.979 mW/cm ²
13.56	1.676E-07	0.979	0.000116719

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/f²) (f= MHz)

