Test report

KTL EMC Test Report : 6G 9939GUS1

Applicant : Technology Solutions (UK) Limited

Apparatus : Model 1062-01 Hand Scanner and Model 1062-03 Hand Scanner.

Authorised by :
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Section 1: Introduction

1.1 General

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

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1.2 Tests Requested By

This test report has been prepared on behalf of:

Technology Solutions (UK) Limited
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1.3 Manufacturer

As above.

1.4 Apparatus Assessed

The following apparatus was assessed between 18/05/07 and 23/05/07:

Model 1062-01 Hand Scanner and Model 1062-03 Hand Scanner.

The above equipment consisted of combined barcode/RFID scanners, operating at 13.56MHz.

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.

Test Type	Regulation	Measurement standard	Range	Result
REFE**	Title 47 of the CFR:2005, Part 15 Subpart (c), Clause 15.225(a)	ANSI C63.4:2003	13.553MHz to 13.567MHz	Pass
REFE**	Title 47 of the CFR:2005, Part 15 Subpart (c), Clause 15.225(b)	ANSI C63.4:2003	13.410MHz to 13.553MHz and 13.567MHz to 13.710MHz	Pass
REFE**	Title 47 of the CFR:2005, Part 15 Subpart (c), Clause 15.225(c)	ANSI C63.4:2003	13.110MHz to 13.410MHz and 13.710MHz to 14.010MHz	Pass
REFE**	Title 47 of the CFR:2005, Part 15 Subpart (c), Clause 15.209 (d)	ANSI C63.4:2003	6MHz to 30MHz*	Pass
REFE	Title 47 of the CFR:2005, Part 15 Subpart (c), Clause 15.209	ANSI C63.4:2003	30MHz to 1GHz	Pass
PLCE	Title 47 of the CFR:2005, Part 15 Subpart (c), Clause 15.207	ANSI C63.4:2003	150kHz to 30MHz	Pass
Frequency Stability	Title 47 of the CFR:2005, Part 15 Subpart (c), Clause 15.225(e)	ANSI C63.4:2003	0.01% of nominal	Pass

*Excluding frequency bands identified in Clauses 15.225(a), 15.225(b) and 15.225(c).

**Measurements made using a screened magnetic loop antenna.

Abbreviations used in the above table:

CFR : Code of Federal Regulations
REFE : Radiated Electric Field Emissions
PLCE : AC power conducted emissions
ANSI : American National Standards Institution

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).

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

Temperature	: 17 to 23 degrees 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.

KTL’s facilities are listed with the Federal Communications Commission (FCC) as suitable for performing measurements in support of application for certification under parts 15 and 18 of the FCC rules: Registration number 90743.

KTL Hull is a listed electromagnetic compatibility Conformance Assessment Body (CAB) for EC access to the US market. (Decision No 3/2000 of the Joint Committee established under the Agreement on Mutual Recognition between the European Community and the United States of America. This decision was effective from 16th January 2001).

1.7 Deviations from Test Standards

There were no deviations from the standards tested to.

Section 2: Measurement Uncertainty

2.1 Introduction

The standard ISO/IEC 17025 used for laboratory accreditation requires laboratories to estimate measurement uncertainty using accepted methods of analysis.

Where required, the reported expanded uncertainty is based on a standard uncertainty providing a confidence level of approximately 95%.

Measurement uncertainty is calculated using the methods defined in the UKAS document LAB34 Edition 1 August 2002.

KTL measurement uncertainty is recorded in the KTL document UNC/RFG/001 Issue 16.

2.2 Application of Measurement Uncertainty

The following procedure is used when determining the result of a measurement :

(i) If specification limits are not exceeded by the measured result, extended by the positive component of the expanded uncertainty interval at a confidence level of 95%, then a pass result is recorded.

(ii) Where a specification limit is exceeded by the result even when the result is decreased by the negative component of the expanded uncertainty interval, a fail result is recorded.

(iii) Where measured result is below a limit, but by a margin less than the positive measurement uncertainty component, it is not possible to record a pass based on a 95% confidence level. However, the result indicates that a pass result is more probable than a fail result.

(iv) Where a measured result is above a limit, but by a margin less than the negative measurement uncertainty component, it is not possible to record a fail based on a 95% confidence level. However the result indicates that a fail is more probable than a pass.

2.3 Measurement Uncertainty Values

All results were recorded in accordance with Section 2.2(i).

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 state	OATS	: Open Area Test Site
CDN	: Coupling & decoupling network	ATS	: Alternative Test Site
EUT	: Equipment Under Test	Verd	: Verdict
SE	: Support Equipment	Deg	: Degree
Sum	: Summary	Det	: Detector
MD	: Measurement Distance	Ref	: Reference
SD	: Specification Distance	Freq	: Frequency
No	: Number	Res	: Result
L	: Live Power Line	Ang	: Angle
N	: Neutral Power Line	Pol	: Polarisation
E	: Earth Power Line	H	: Horizontal Polarisation
Pk	: Peak Detector	V	: Vertical Polarisation
QP	: Quasi-Peak Detector	Hgt	: Height
Av	: Average Detector		

Frequency range of measurement:

The lowest radio frequency signal generated in the device was 6MHz. Pursuant to Section 15.33(a) of the Part 15 of the FCC Rules, the lowest frequency of measurement was 6MHz.

Persuant to Section 15.33(a)(1) of Part 15 of the FCC Rules, since the transmitter operated at 13.56MHz, the highest frequency to be investigated was the tenth harmonic of the fundamental frequency, 135.6MHz

The intentional radiator also contained a digital device where the highest frequency signal generated in the device was 32MHz. Persuant to Section 15.33(a)(4) of Part 15 of the FCC Rules the frequency range to be investigated was in accordance with the requirements of unintentional radiators, Section 15.33(b)(1). For an unintentional radiator where the highest frequency signal generated in the device was 32MHz, the highest frequency to be investigated was 1GHz.

The frequency range investigated was therefore 6MHz to 1GHz.

A1 Radiated Electric Field Emissions Within the Bands 13.553MHz to13.567MHz

Preliminary radiated electric field emission testing was performed using a peak detector in an absorber lined screened room.

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

10m 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 - 1062-01 Model	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.225(a)
Measurement standard	ANSI C63.4:2003
Frequency	13.553MHz to 13.567MHz
EUT sample number	S01
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photograph 2

The worst case radiated emission measurements are listed below:

Ref No	Freq (MHz)	Det	Ang Deg	Hgt (cm)	MD (m)	SD (m)	Res at SD (dBuV/m)	Spec Limit (dBuV/m)	Margin (dB)	Result Summary
1	13.560*	QP	0	100	10	30	27.8	84.0	-56.2	Pass
2	13.560*	QP	90	100	10	30	27.4	84.0	-56.6	Pass

*Carrier frequency.

The effect on the carrier of varying the supply voltage between 85% and 115% of the normal supply voltage (110Vac), whilst the EUT was in its charger unit, was investigated pursuant to 47 CFR Part 15 section 15.31(e). No variation in carrier level was observed.

Note:

The apparatus was tested using a fully charged battery.

The apparatus was tested positioned in three orthogonal planes. The above measurements are the worst case results.

Test Details - 1062-03 Model	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.225(a)
Measurement standard	ANSI C63.4:2003
Frequency	13.553MHz to 13.567MHz
EUT sample number	S11
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photograph 2

The worst case radiated emission measurements are listed below:

Ref No	Freq (MHz)	Det	Ang Deg	Hgt (cm)	MD (m)	SD (m)	Res at SD (dBuV/m)	Spec Limit (dBuV/m)	Margin (dB)	Result Summary
1	13.560*	QP	0	100	10	30	27.5	84.0	-56.5	Pass
2	13.560*	QP	90	100	10	30	26.9	84.0	-57.1	Pass

*Carrier frequency.

The effect on the carrier of varying the supply voltage between 85% and 115% of the normal supply voltage (110Vac), whilst the EUT was in its charger unit, was investigated pursuant to 47 CFR Part 15 section 15.31(e). No variation in carrier level was observed.

Note:

The apparatus was tested using a fully charged battery.

The apparatus was tested positioned in three orthogonal planes. The above measurements are the worst case results.

Specification limits:

Radiated emission limits stated in 47 CFR 15:2005 Clause 15.225 (a):

Frequency of emission (MHz)	Field strength μV/m	Field strength dBμV/m	Measurement Distance (meters)
13.553 to 13.567	15848.0	84.0	30

Notes:

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

(b) Measurement of magnetic field strength were performed using an active magnetic field loop antenna, according to ANSIC63.4:2003 Section 4.1.5.1, referenced by 47 CFR Part 15 Section 15.31(3). The results were expressed as electric field strength assuming far field measurement conditions in order to compare with the limit which is expressed as electric field.

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

$$\text{Extrapolation}\left(\text{dB}\right) = 40\log_{10}\left(\frac{\text{measurement distance}}{\text{specification distance}}\right)$$

A2 Radiated Electric Field Emissions Within the Bands 13.410MHz to 13.553MHz and 13.567MHz to 13.710MHz

Preliminary radiated electric field emissions testing was performed using a peak detector in an absorber lined screened room.

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

10m 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 – 1062-01 Model	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.225(b)
Measurement standard	ANSI C63.4:2003
Frequency	13.410MHz to 13.553MHz and 13.567MHz to 13.710MHz
EUT sample number	S01
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photograph 2

No emissions were detected that were within 20dB of the specification limit.

Test Details – 1062-03 Model	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.225(b)
Measurement standard	ANSI C63.4:2003
Frequency	13.410MHz to 13.553MHz and 13.567MHz to 13.710MHz
EUT sample number	S11
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photograph 2

No emissions were detected that were within 20dB of the specification limit.

Specification limits:

Radiated emission limits stated in 47 CFR 15:2005 Clause 15.229 (a):

Frequency of emission (MHz)	Field strength μV/m	Field strength dBμV/m	Measurement Distance (meters)
13.410MHz to 13.553MHz	334.0	50.5	30.0
13.567MHz to 13.710MHz	334.0	50.5	30.0

Notes:

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

(b) Measurement of magnetic field strength were performed using an active magnetic field loop antenna, according to ANSIC63.4:2003 Section 4.1.5.1, referenced by 47 CFR Part 15 Section 15.31(3). The results were expressed as electric field strength assuming far field measurement conditions in order to compare with the limit which is expressed as electric field.

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

$$\text{Extrapolation}\left(\text{dB}\right) = 40\log_{10}\left(\frac{\text{measurement distance}}{\text{specification distance}}\right)$$

A3 Radiated Electric Field Emissions Within the Bands 13.110MHz to 13.410MHz and 13.710MHz to 14.010MHz

Preliminary radiated electric field emissions testing was performed using a peak detector in an absorber lined screened room.

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

10m 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 – 1062-01 Model	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.225(c)
Measurement standard	ANSI C63.4:2003
Frequency	13.110MHz to 13.410MHz and 13.710MHz to 14.010MHz
EUT sample number	S01
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photograph 2

No emissions were detected that were within 20dB of the specification limit.

Test Details – 1062-03 Model	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.225(c)
Measurement standard	ANSI C63.4:2003
Frequency	13.110MHz to 13.410MHz and 13.710MHz to 14.010MHz
EUT sample number	S11
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photograph 2

No emissions were detected that were within 20dB of the specification limit.

Specification limits:

Radiated emission limits stated in 47 CFR 15:2004 Clause 15.229 (a):

Frequency of emission (MHz)	Field strength μV/m	Field strength dBμV/m	Measurement Distance (meters)
13.110MHz to 13.410MHz	106.0	40.5	30
13.710MHz to 14.010MHz	106.0	40.5	30

Notes:

(a) Measurement of magnetic field strength were performed using an active magnetic field loop antenna, according to ANSIC63.4:2003 Section 4.1.5.1, referenced by 47 CFR Part 15 Section 15.31(3). The results were expressed as electric field strength assuming far field measurement conditions in order to compare with the limit which is expressed as electric field.

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

$$\text{Extrapolation}\,(\text{dB}) = 40\log_{10}\left(\frac{\text{measurement distance}}{\text{specification distance}}\right)$$

The levels may have been rounded for display purposes.

A4 Radiated Emissions 6MHz to 30MHz Outside the 13.110MHz to14.010MHz Band

Preliminary radiated electric field emissions testing was performed using a peak detector in an absorber lined screened room.

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

10m 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 – 1062-01 Model	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.225(d)
Measurement standard	ANSI C63.4:2003
Frequency	6MHz to 30MHz
EUT sample number	S01
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photograph 2

No emissions were detected that were within 20dB of the specification limit.

Measurements were made at a 3m measurement distance, and the data extrapolated using 40dB/decade to the value expected at the specification distance; see note (a) below.

Test Details – 1062-03 Model	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.225(d)
Measurement standard	ANSI C63.4:2003
Frequency	6MHz to 30MHz
EUT sample number	S11
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photograph 2

No emissions were detected that were within 20dB of the specification limit.

Measurements were made at a 3m measurement distance, and the data extrapolated using 40dB/decade to the value expected at the specification distance; see note (a) below

Specification limits:

Radiated emission limits (47 CFR 15:2004 Clause 15.209):

Frequency of emission (MHz)	Field strength μV/m	Field strength dBμV/m	Measurement Distance (meters)
0.009 to 0.490	2400/F(kHz)	67.6-20logF	300
0.490 to 1.705	24000/F(kHz)	87.6-20logF	30
1.705 to 30	30	29.5	30

Notes:

(a) Measurement of magnetic field strength were performed using an active magnetic field loop antenna, according to ANSIC63.4:2003 Section 4.1.5.1, referenced by 47 CFR Part 15 Section 15.31(3). The results were expressed as electric field strength assuming far field measurement conditions in order to compare with the limit which is expressed as electric field.

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

$$\text{Extrapolation}\,(\text{dB}) = 40\log_{10}\left(\frac{\text{measurement distance}}{\text{specification distance}}\right)$$

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

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

A5 Radiated Electric Field Emissions – 30MHz to 1GHz

Preliminary radiated electric field emissions testing was performed using a peak detector in an absorber lined screened room.

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

10m 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 – 1062-01 Model	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.225(d)
Measurement standard	ANSI C63.4:2003
Frequency	30MHz to 1GHz
EUT sample number	S01
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photographs 3 and 4

The worst case radiated emission measurements are listed below:

Ref No	Freq (MHz)	Det	Ang Deg	Hgt (cm)	Pol	MD (m)	Res at MD (dBuV/m)	Spec Limit (dBuV/m)	Margin (dB)	Res Sum
1	40.681	QP	0	100	V	3	22.3	40	-17.7	Pass
2	54.241	QP	220	105	V	3	18.5	40	-21.5	Pass
3	67.801	QP	23	101	V	3	16.9	40	-23.1	Pass

Test Details – 1062-03 Model	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.225(d)
Measurement standard	ANSI C63.4:2003
Frequency	30MHz to 1GHz
EUT sample number	S11
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photographs 3 and 4

The worst case radiated emission measurements are listed below:

Ref No	Freq (MHz)	Det	Ang Deg	Hgt (cm)	Pol	MD (m)	Res at MD (dBuV/m)	Spec Limit (dBuV/m)	Margin (dB)	Res Sum
1	40.681	QP	0	100	V	3	22.6	40	-17.4	Pass
2	54.240	QP	232	105	v	3	18.9	40	-21.1	Pass
3	67.800	QP	18	101	V	3	17.2	40	-22.8	Pass

Specification limits

The upper frequency of the measurement range was decided according to 47 CFR 15:2005 Clause 15.33.

Radiated emission limits (47 CFR 15:2004 Clause 15.209):

Frequency of emission (MHz)	Field strength μV/m	Field strength dBμV/m	Measurement Distance (meters)
30 to 88	100	40.0	3
88 to 216	150	43.5	3
216 to 960	200	46.0	3
Above 960	500	54.0	3

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:

$$\text{Extrapolation}\,(\text{dB}) = 40\log_{10}\left(\frac{\text{measurement distance}}{\text{specification distance}}\right)$$

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

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

A6 AC Power Line Conducted Emissions

Preview power line 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 – 1062-01 Model	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.207
Measurement standard	ANSI C63.4:2003
Frequency	0.15 MHz to 30 MHz
EUT sample number	S01, S05 and S07
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photograph 1

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

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	0.351	L	41.0	60.5	-19.5	Pass
2	0.569	L	40.2	56.0	-15.8	Pass
3	0.692	L	42.1	56.0	-13.9	Pass
4	1.029	L	39.9	56.0	-16.1	Pass
5	13.560	L	53.6	60.0	-6.4	Pass
6	30.000	L	45.6	60.0	-14.4	Pass
7	0.351	N	40.7	60.5	-19.8	Pass
8	0.569	N	40.0	56.0	-16.0	Pass
9	0.692	N	40.9	56.0	-15.1	Pass
10	1.029	N	39.7	56.0	-16.3	Pass
11	13.560	N	53.1	60.0	-6.9	Pass
12	30.000	N	45.4	60.0	-14.6	Pass

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	0.351	L	36.0	50.5	-14.5	Pass
2	0.569	L	34.3	46.0	-11.7	Pass
3	0.692	L	35.5	46.0	-10.5	Pass
4	1.029	L	33.6	46.0	-12.4	Pass
5	13.560	L	41.4	50.0	-8.6	Pass
6	30.000	L	37.3	50.0	-12.7	Pass
7	0.351	N	35.6	50.5	-14.9	Pass
8	0.569	N	34.2	46.0	-11.8	Pass
9	0.692	N	35.3	46.0	-10.7	Pass
10	1.029	N	33.4	46.0	-12.6	Pass
11	13.560	N	41.2	50.0	-8.8	Pass
12	30.000	N	37.4	50.0	-12.6	Pass

Test Details – 1062-03 Model	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.207
Measurement standard	ANSI C63.4:2003
Frequency	0.15 MHz to 30 MHz
EUT sample number	S05 S07 and S11
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photograph 1

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

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	0.190	L	42.0	64.9	-22.9	Pass
2	0.350	L	40.8	60.3	-19.5	Pass
3	0.700	L	39.4	56.0	-16.6	Pass
4	1.218	L	34.6	56.0	-21.4	Pass
5	13.560	L	54.4	60.0	-5.6	Pass
6	29.960	L	44.6	60.0	-15.4	Pass
7	0.190	N	40.8	64.9	-24.1	Pass
8	0.350	N	39.4	60.3	-20.9	Pass
9	0.700	N	39.5	56.0	-16.5	Pass
10	1.218	N	34.1	56.0	-21.9	Pass
11	13.560	N	54.2	60.0	-5.8	Pass
12	29.960	N	44.1	60.0	-15.9	Pass

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	0.190	L	35.1	54.9	-19.8	Pass
2	0.350	L	35.8	50.3	-14.5	Pass
3	0.700	L	33.7	46.0	-12.3	Pass
4	1.218	L	29.9	46.0	-16.1	Pass
5	13.560	L	41.9	50.0	-8.1	Pass
6	29.960	L	36.0	50.0	-14.0	Pass
7	0.190	N	34.2	54.9	-20.7	Pass
8	0.350	N	33.1	50.3	-17.2	Pass
9	0.700	N	33.2	46.0	-12.8	Pass
10	1.218	N	29.7	46.0	-16.3	Pass
11	13.560	N	41.7	50.0	-8.3	Pass
12	29.960	N	35.7	50.0	-14.3	Pass

Specification limits:

Title 47 of the CFR:2004, Part 15 Subpart (c) Section 15.207 limits for conducted disturbance at the mains ports of intentional radiators:

Frequency range MHz	Limits dBμV	
	Quasi-peak	Average
0.15 to 0.5	66 to 56	56 to 46
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 communications port of the charger which was not populated during testing is used solely for maintenance purposes and is not populated during normal use.
(c) 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 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

A7 Frequency Tolerance of the Carrier Signal

The frequency tolerance of the carrier signal was measured over the temperature range –20 degrees C to +50 degrees C.

Test Details 1062-01 Model	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.225(e)
Measurement standard	ANSI C63.4:2003
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C

Frequency stability versus ambient temperature measurements, at t=0 (startup), t+2 minutes, t+5 minutes and t+10 minutes:

Temperature	t=0 (startup)	Frequency error (%)	t+2	Frequency Error (%)	t+5	Frequency Error (%)	t+10	Frequency error (%)
-20	13.560327	0.0024	13.560325	0.0024	13.56032	0.0024	13.560318	0.0023
-10	13.560345	0.0025	13.560335	0.0025	13.56034	0.0025	13.560333	0.0025
0	13.560359	0.0026	13.560345	0.0025	13.56034	0.0025	13.56033	0.0024
10	13.560335	0.0025	13.560333	0.0025	13.560343	0.0025	13.560328	0.0024
20	13.560297	0.0022	13.560297	0.0022	13.560295	0.0022	13.560292	0.0022
30	13.560303	0.0022	13.5603	0.0022	13.5603	0.0022	13.560299	0.0022
40	13.56031	0.0023	13.5603	0.0022	13.560305	0.0022	13.560022	0.0002
50	13.560314	0.0023	13.560312	0.0023	13.560309	0.0023	13.560308	0.0023

Graphical representation of the measured frequency versus temperature is contained within Appendic C.

The frequency tolerance of the carrier signal was measured over a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

Test Details	
Regulation	Title 47 of the CFR:2005, Part 15 Subpart 15.225(a)
Measurement standard	ANSI C63.4:2003
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C

The frequency tolerance from the nominal-rated at 20 degrees C :

Temperature	Voltage Supply (110 VAC 60Hz)		Frequency	Frequency error (%)
20	85%	93.5 VAC	13.560313	-0.0023
20	115%	126.5 VAC	13.560322	-0.0024

Specification limits:

The frequency tolerance of the carrier signal shall be maintained within 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery-operated equipment, the equipment tests shall be performed using a new battery.
The EUT was powered from a rechargeable Lithium Ion battery. Therefore temperature stability tests were performed using a fully charged battery. Voltage stability tests were performed by varying the ac supply voltage to the EUT charging cradle whilst the EUT was contained within it, in transmit mode.

Appendix B: Supporting Graphical Data

This appendix contains graphical data obtained during testing.

Notes:

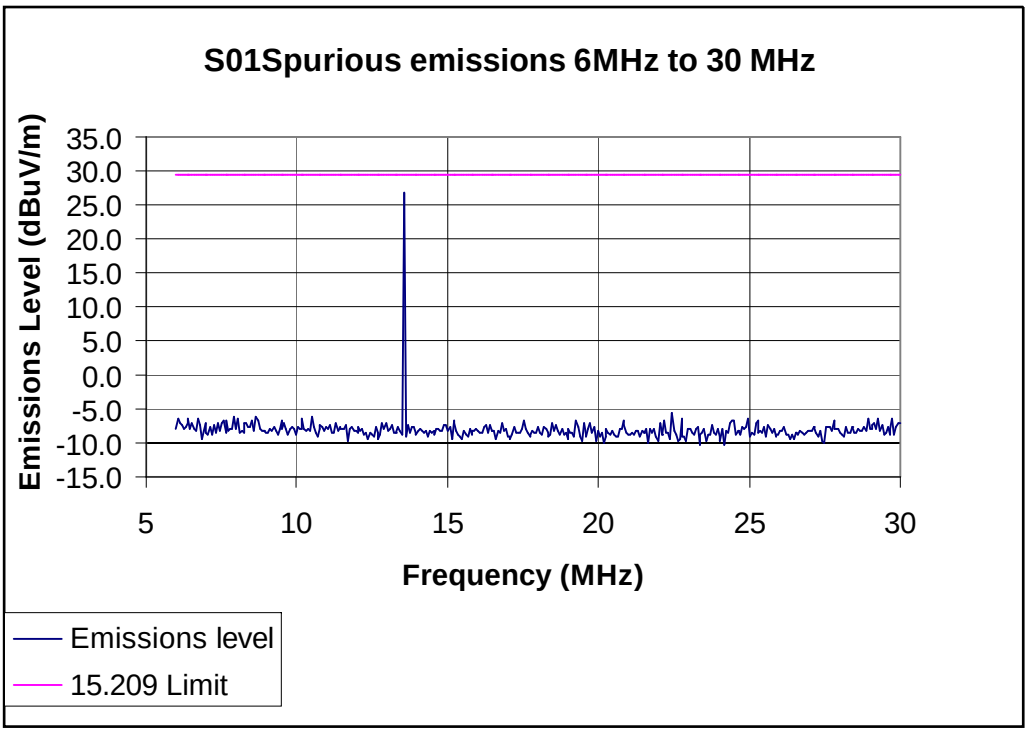
(a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A.

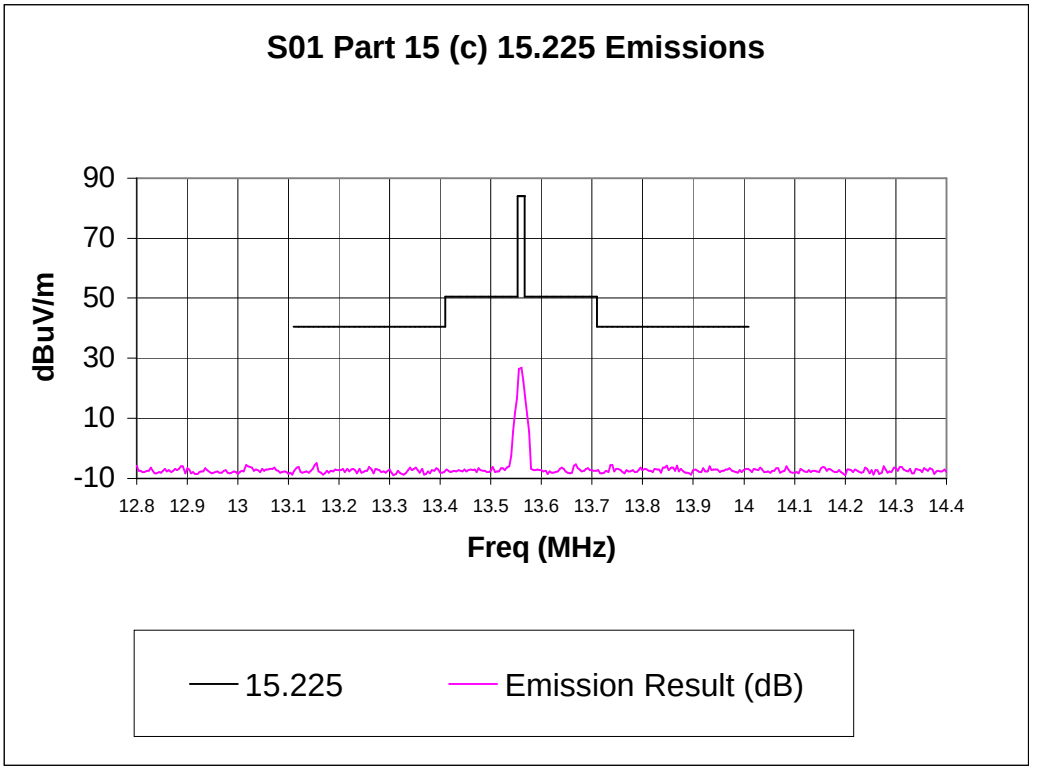
(b) The time and date on the plots do not necessarily equate to the time of the test.

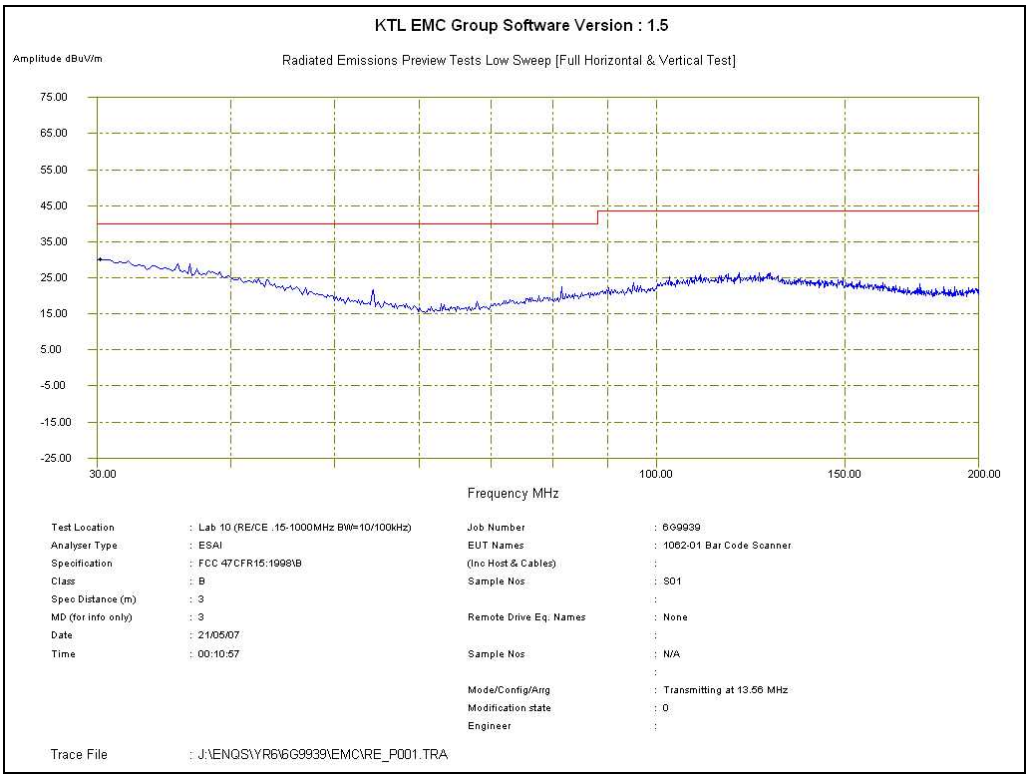
(c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.

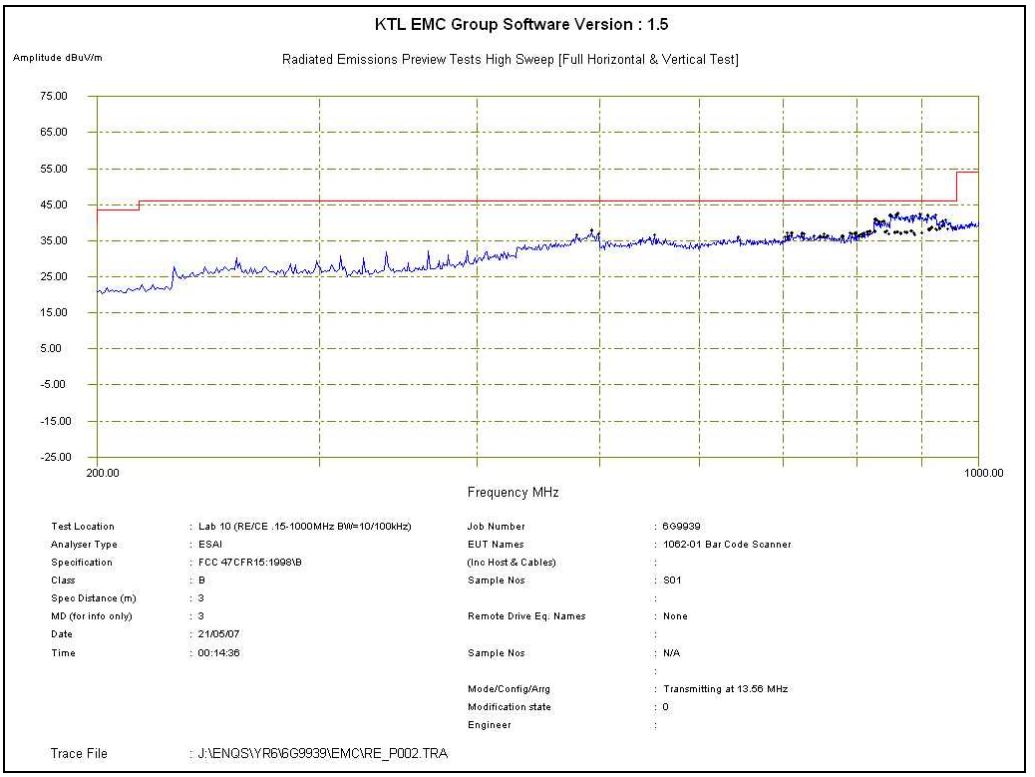
(d) Appendix C details the numbering system used to identify the sample and its modification state.

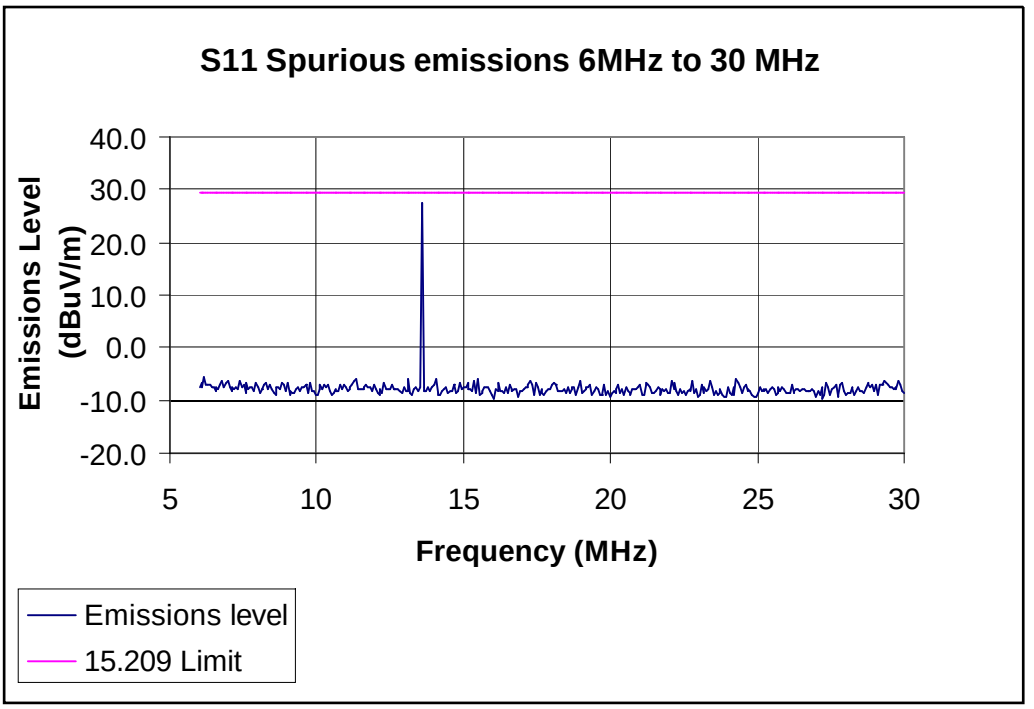
(e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.

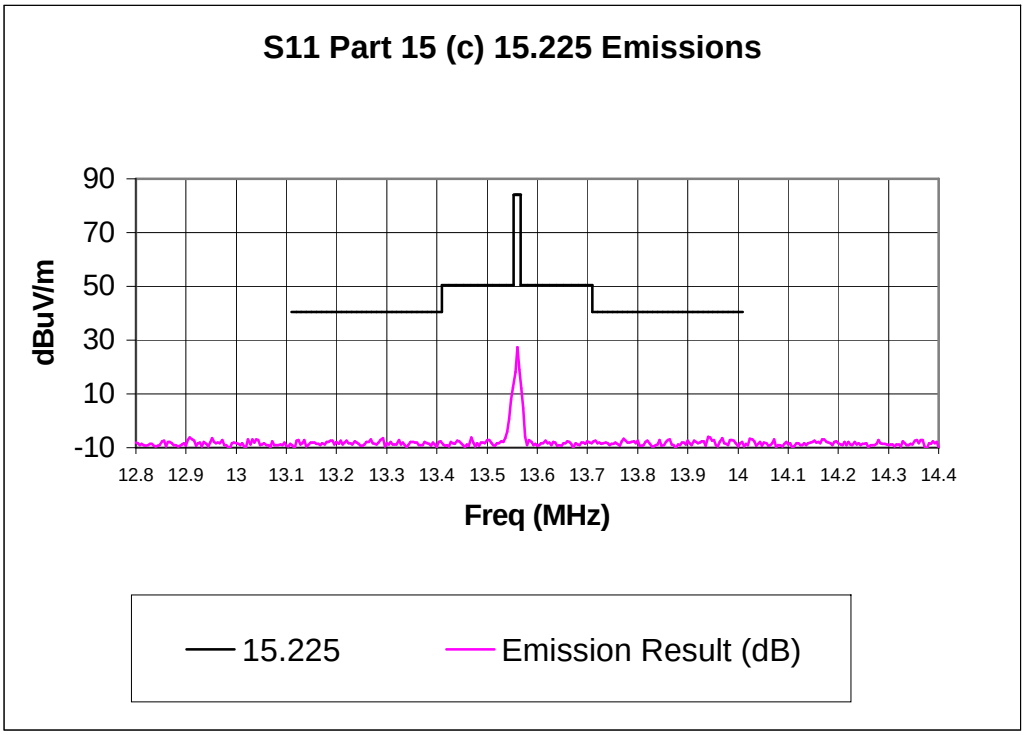

S01Spurious emissions 6MHz to 30 MHz
Emissions Level (dBuV/m)
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
5
10
15
20
25
30
Frequency (MHz)
Emissions level
15.209 Limit

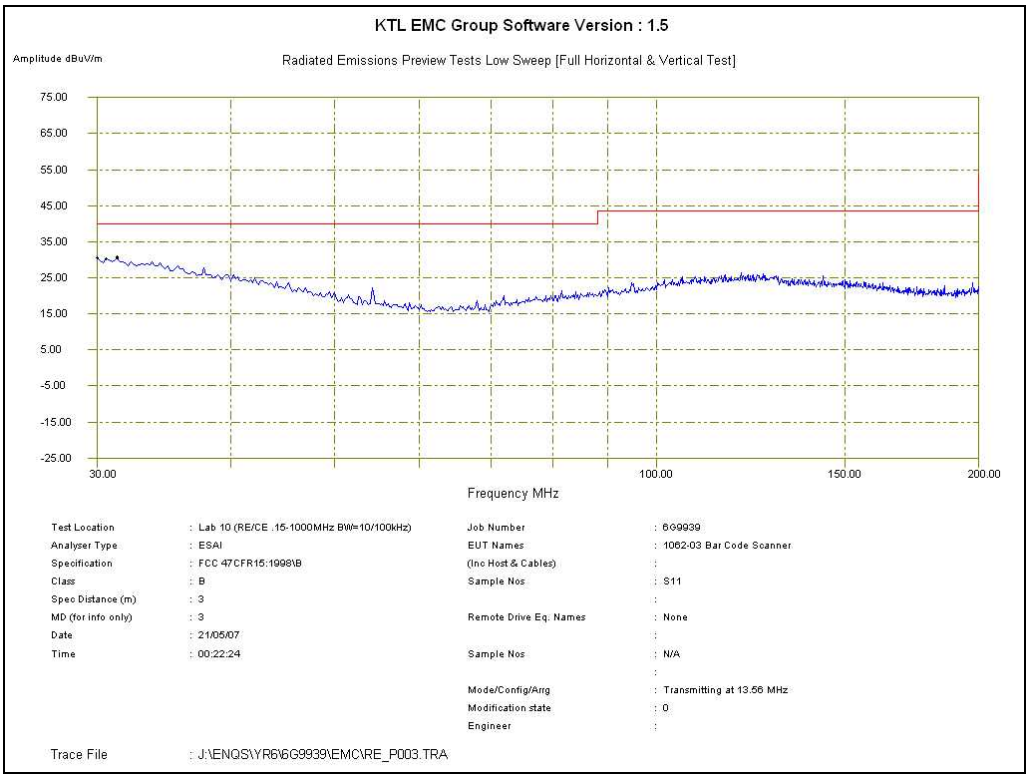

S01 Part 15 (c) 15.225 Emissions
dBuV/m
90
70
50
30
10
-10
12.8
12.9
13
13.1
13.2
13.3
13.4
13.5
13.6
13.7
13.8
13.9
14
14.1
14.2
14.3
14.4
Freq (MHz)
15.225
Emission Result (dB)

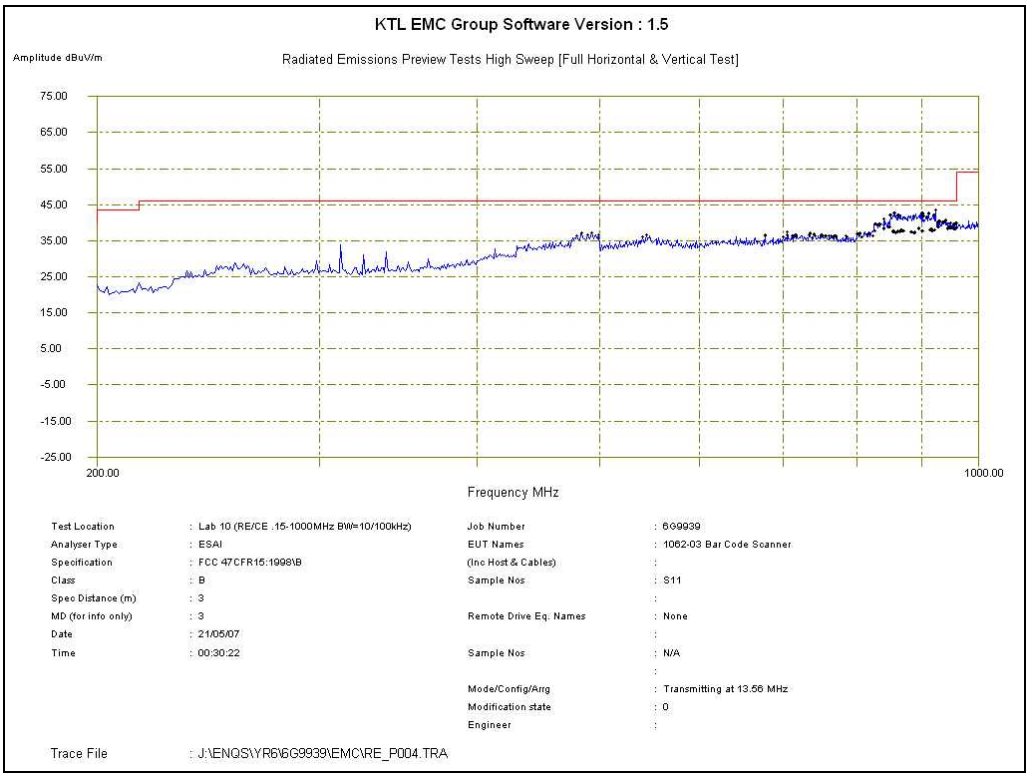

KTL EMC Group Software Version : 1.5
Amplitude dBuV/m
Radiated Emissions Preview Tests Low Sweep [Full Horizontal & Vertical Test]
75.00
65.00
55.00
45.00
35.00
25.00
15.00
5.00
-5.00
-15.00
-25.00
30.00
100.00
150.00
200.00
Frequency MHz
Test Location : Lab 10 (RE/CE .15-1000MHz BW=10/100kHz)
Analyser Type : ESAI
Specification : FCC 47CFR15:1998\B
Class : B
Spec Distance (m) : 3
MD (for info only) : 3
Date : 21/05/07
Time : 00:10:57
Job Number : 6G9939
EUT Names : 1062-01 Bar Code Scanner
(Inc Host & Cables) :
Sample Nos : S01
Remote Drive Eq. Names : None
Sample Nos : N/A
Mode/Config/Arrg : Transmitting at 13.56 MHz
Modification state : 0
Engineer :
Trace File : J:\ENQS\YR6\6G9939\EMC\RE_P001.TRA

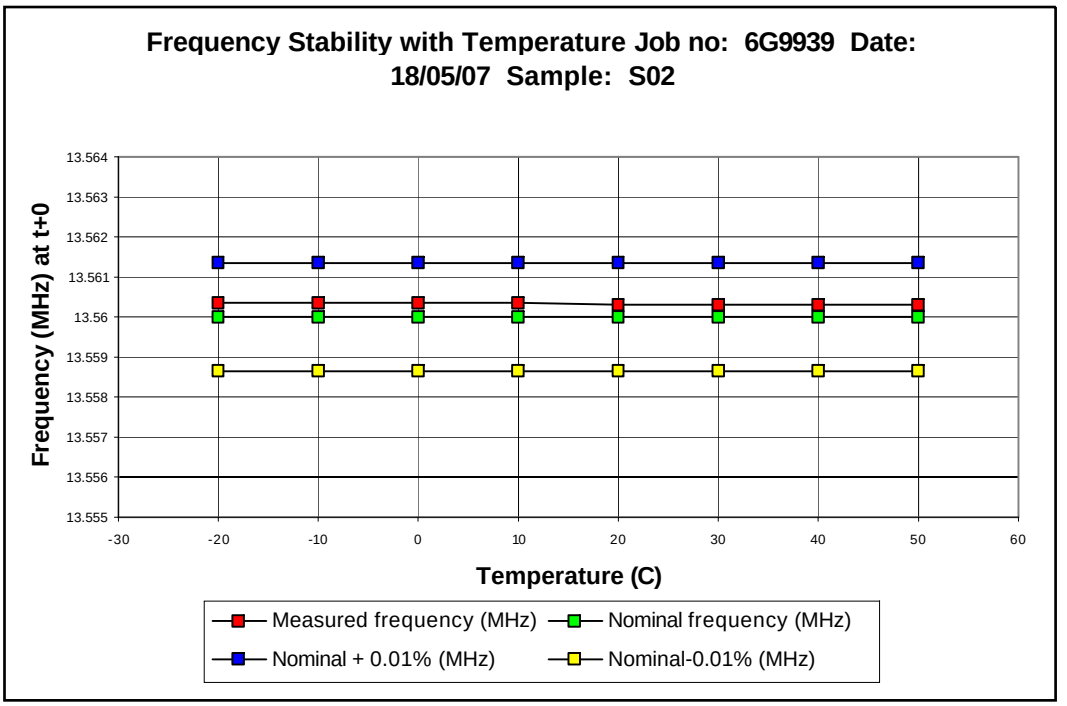

KTL EMC Group Software Version : 1.5
Amplitude dBuV/m
Radiated Emissions Preview Tests High Sweep [Full Horizontal & Vertical Test]
75.00
65.00
55.00
45.00
35.00
25.00
15.00
5.00
-5.00
-15.00
-25.00
200.00
1000.00
Frequency MHz
Test Location : Lab 10 (RE/CE .15-1000MHz BW=10/100kHz)
Analyser Type : ESAI
Specification : FCC 47CFR15:1998\B
Class : B
Spec Distance (m) : 3
MD (for info only) : 3
Date : 21/05/07
Time : 00:14:36
Job Number : 6G9939
EUT Names : 1062-01 Bar Code Scanner
(Inc Host & Cables) :
Sample Nos : S01
Remote Drive Eq. Names : None
Sample Nos : N/A
Mode/Config/Arrg : Transmitting at 13.56 MHz
Modification state : 0
Engineer :
Trace File : J:\ENQS\YR6\6G9939\EMC\RE_P002.TRA

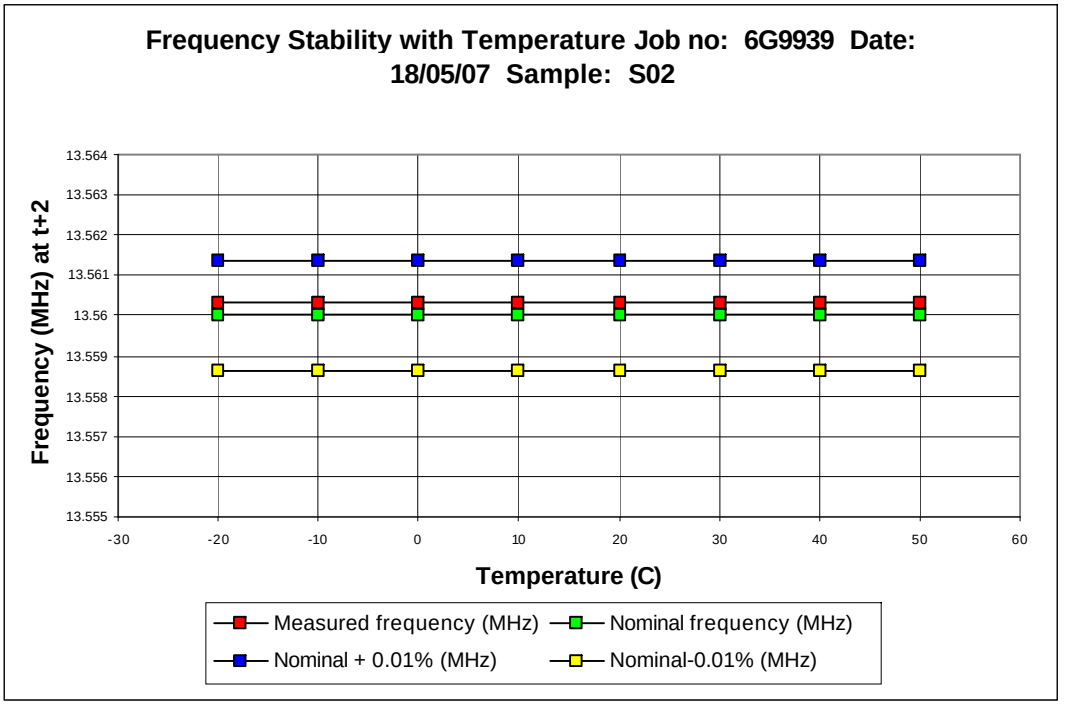

S11 Spurious emissions 6MHz to 30 MHz
Emissions Level (dBuV/m)
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
5
10
15
20
25
30
Frequency (MHz)
Emissions level
15.209 Limit

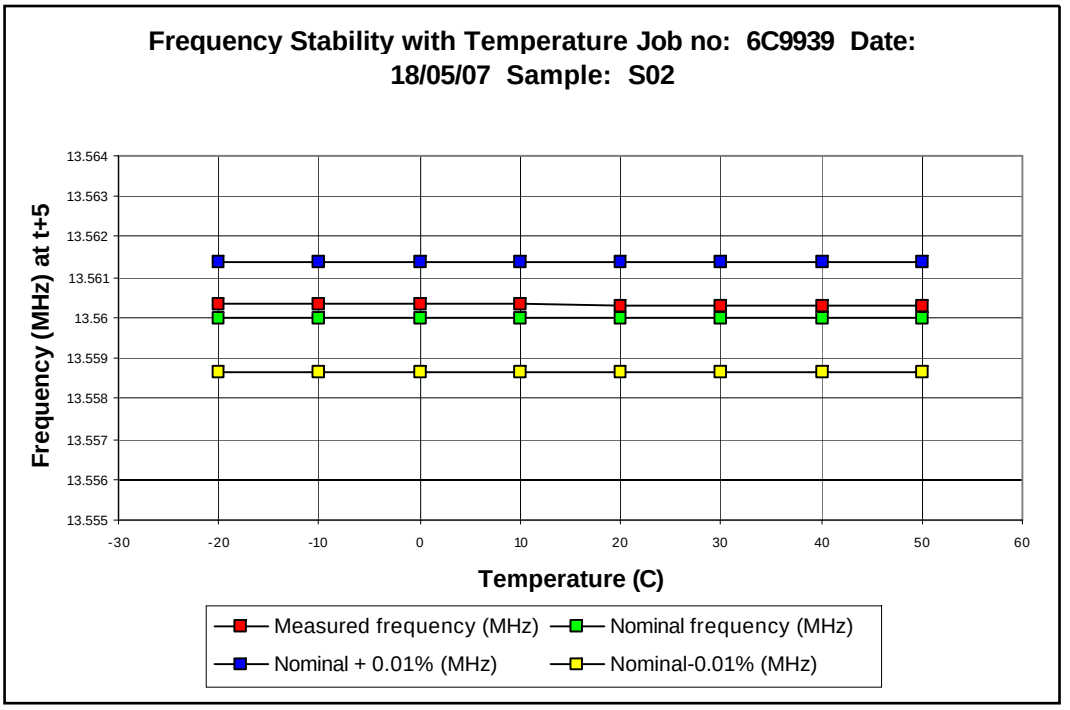

S11 Part 15 (c) 15.225 Emissions
dBuV/m
90
70
50
30
10
-10
12.8
12.9
13
13.1
13.2
13.3
13.4
13.5
13.6
13.7
13.8
13.9
14
14.1
14.2
14.3
14.4
Freq (MHz)
15.225
Emission Result (dB)

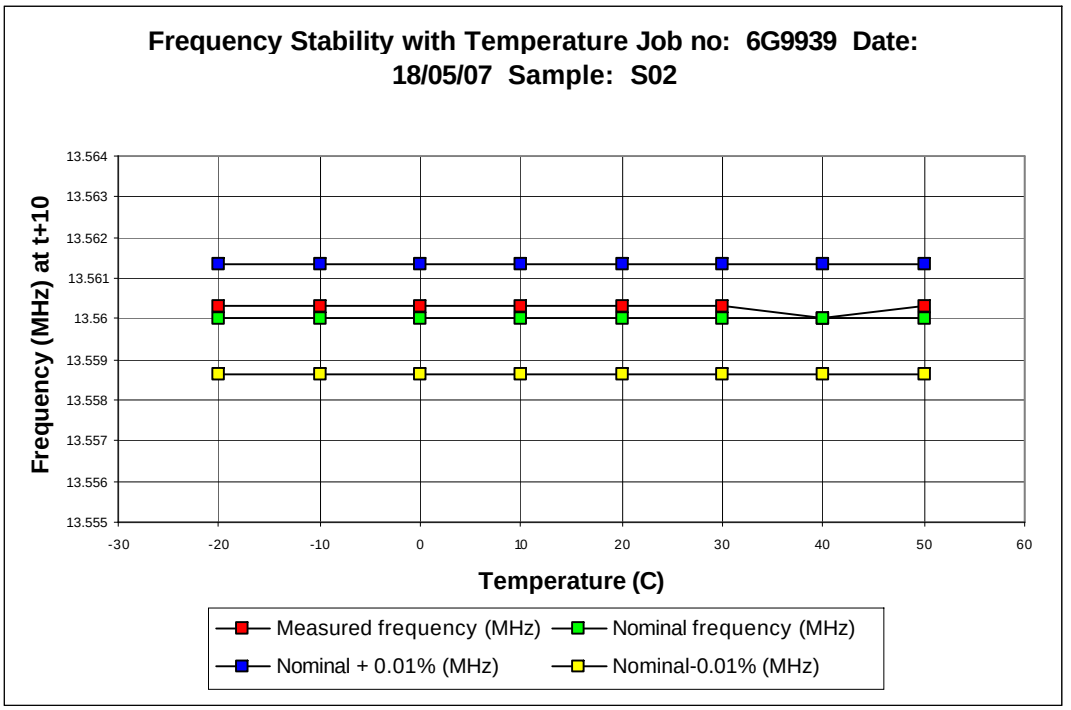

KTL EMC Group Software Version : 1.5
Amplitude dBuV/m
Radiated Emissions Preview Tests Low Sweep [Full Horizontal & Vertical Test]
75.00
65.00
55.00
45.00
35.00
25.00
15.00
5.00
-5.00
-15.00
-25.00
30.00
100.00
150.00
200.00
Frequency MHz
Test Location : Lab 10 (RE/CE .15-1000MHz BW=10/100kHz)
Analyser Type : ESAI
Specification : FCC 47CFR15:1998\B
Class : B
Spec Distance (m) : 3
MD (for info only) : 3
Date : 21/05/07
Time : 00:22:24
Job Number : 6G9939
EUT Names : 1062-03 Bar Code Scanner
(Inc Host & Cables) :
Sample Nos : S11
Remote Drive Eq. Names : None
Sample Nos : N/A
Mode/Config/Arrg : Transmitting at 13.56 MHz
Modification state : 0
Engineer :
Trace File : J:\ENQS\YR6\6G9939\EMC\RE_P003.TRA


KTL EMC Group Software Version : 1.5
Amplitude dBuV/m
Radiated Emissions Preview Tests High Sweep [Full Horizontal & Vertical Test]
75.00
65.00
55.00
45.00
35.00
25.00
15.00
5.00
-5.00
-15.00
-25.00
200.00
1000.00
Frequency MHz
Test Location : Lab 10 (RE/CE .15-1000MHz BW=10/100kHz)
Analyser Type : ESAI
Specification : FCC 47CFR15:1998\B
Class : B
Spec Distance (m) : 3
MD (for info only) : 3
Date : 21/05/07
Time : 00:30:22
Job Number : 6G9939
EUT Names : 1062-03 Bar Code Scanner
(Inc Host & Cables) :
Sample Nos : S11
Remote Drive Eq. Names : None
Sample Nos : N/A
Mode/Config/Arrg : Transmitting at 13.56 MHz
Modification state : 0
Engineer :
Trace File : J:\ENQS\YR6\6G9939\EMC\RE_P004.TRA


Frequency Stability with Temperature Job no: 6G9939 Date: 18/05/07 Sample: S02
Frequency (MHz) at t+0
13.564
13.563
13.562
13.561
13.56
13.559
13.558
13.557
13.556
13.555
-30
-20
-10
0
10
20
30
40
50
60
Temperature (C)
Measured frequency (MHz)
Nominal frequency (MHz)
Nominal + 0.01% (MHz)
Nominal-0.01% (MHz)


Frequency Stability with Temperature Job no: 6G9939 Date: 18/05/07 Sample: S02
Frequency (MHz) at t+2
13.564
13.563
13.562
13.561
13.56
13.559
13.558
13.557
13.556
13.555
-30
-20
-10
0
10
20
30
40
50
60
Temperature (C)
Measured frequency (MHz)
Nominal frequency (MHz)
Nominal + 0.01% (MHz)
Nominal-0.01% (MHz)


Frequency Stability with Temperature Job no: 6C9939 Date: 18/05/07 Sample: S02
Frequency (MHz) at t+5
13.564
13.563
13.562
13.561
13.56
13.559
13.558
13.557
13.556
13.555
-30
-20
-10
0
10
20
30
40
50
60
Temperature (C)
Measured frequency (MHz)
Nominal frequency (MHz)
Nominal + 0.01% (MHz)
Nominal-0.01% (MHz)


Frequency Stability with Temperature Job no: 6G9939 Date: 18/05/07 Sample: S02
Frequency (MHz) at t+10
13.564
13.563
13.562
13.561
13.56
13.559
13.558
13.557
13.556
13.555
-30
-20
-10
0
10
20
30
40
50
60
Temperature (C)
Measured frequency (MHz)
Nominal frequency (MHz)
Nominal + 0.01% (MHz)
Nominal-0.01% (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 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.

C1 Test Samples

The following samples of the apparatus were submitted for testing :

Sample No.	Description	Identification
S01	Model 1062-01 Hand Scanner	Serial No 1062-01-BT-HSCAN-005133
S02	Model 1062-03 Hand Scanner	Serial No 1062-03-BT-HSCAN-001145
S05	Model 1068 Charging Cradle	Serial No. 1068-001327
S07	L.T.E. Power Adapter Model No. GFP181DA-0628	Serial No 0701-00080ROHS
S11	Model 1062-03 Hand Scanner	Serial No 1062-03-BT-HSCAN-001146

C2 EUT Operating Mode During Testing.

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

Test	Description of Operating Mode
All tests detailed in this report execpt PLCE	Transmitting 13.56MHz continuously.

Test	Description of Operating Mode
PLCE	Transmitting 13.56MHz continuously. In addition the charging cradle was charging the scanners' battery.

C3 EUT Configuration Information

Sample	Internal Configuration Details
S01	Single possible internal configuration.
S02	Single possible internal configuration.
S05	Single possible internal configuration.
S07	Single possible internal configuration.
S11	Single possible internal configuration.

C4 List of EUT and Support Equipment Ports

The table below describes the termination of EUT ports:

Sample : S01, S02 and S11
Tests : All

Port	Description of Cable Attached	Cable length	Equipment Connected
Charger	None	N/A	S05

Sample : S05
Tests : All

Port	Description of Cable Attached	Cable length	Equipment Connected
dc Input	2 core unscreened	2m	S07

Sample : S07
Tests : All

Port	Description of Cable Attached	Cable length	Equipment Connected
ac supply input	2 core unscreened	2m	ac supply
dc output	2 core unscreened	2m	S05

Notes on the above:

The connection of cables and drive or support equipment was identical for all tests.

C5 Details of Equipment Used

For Radiated Electric (magnetic) Field Emissions 6MHz to 30MHz

RFG No	Type	Description	Manufacturer	Date Calibrated.
RFG023	HFH-Z2	Magnetic Field Loop antenna	R&S	09/02/06
RFG404	E44077B	Spectrum analyser	Agilent	25/01/06
RFG125	ESHS-10	Test Receiver	R&S	06/11/06

For Radiated Electric Field Emissions 30MHz to 1GHz:

RFG No	Type	Description	Manufacturer	Date Calibrated.
274	ATS	Ferrite Lined Chamber	KTL	10/05/06
231	CBL6111	Blue Bilog Antenna (0.03 - 1GHz)	Chase	31/08/05
214	ESAI	Spec Analyser/Test Rxer (LF/HF)	R & S	21/11/06
RFG126	ESVS-20	Test Receiver	R&S	03/11/06
249	N-type	RF coaxial cable (Lab 10)	KTL	25/08/06
255	N-type	RF coaxial cable (Lab 10)	KTL	25/08/06
270	N-type	RF coaxial cable (Lab 10)	KTL	25/08/06

For power line conducted emissions

RFG No	Type	Description	Manufacturer	Date Calibrated
n/a	Lab 14	Small Screened Chamber	KTL	-
030	ESH3-Z5	Single-phase LISN	R & S	18/04/07
190	ESH3-Z2	Pulse Limiter	R & S	20/04/07
012	ESH3	Test Receiver (LF)	R & S	15/11/06
127	HP8563E	Spectrum Analyser	HP	31/10/06
092	BNC	RF coaxial cable (Lab 14)	KTL	25/08/06
295	BNC	RF coaxial cable (Lab 14)	KTL	25/08/06

For Frequency tolerance measurements

RFG / REF No	Type	Description	Manufacturer	Date Calibrated.
RFG365	BM80/-20/150/P	Environmental chamber	JTS	08/11/05
REF 470	Fluke 45	Calibrated digital multi-meter	Fluke	21/09/06
REF269	VHMTF	Variac	Zenith	N/A
RFG404	E44077B	Spectrum analyser	Agilent	25/01/06
RFG001	2A	Off Air Frequency Standard	Quartzlock	21/09/06
RFG011	5385A	Frequency Counter	HP	05/10/06

Appendix D: Additional Information

The following product description was supplied by the applicant:

Hi Ken,

As requested:

This compact, Bluetooth dual technology RFID and laser bar code scanner is battery operated and communicates wirelessly with a host computer via a standard Bluetooth interface. The hand scanner is compatible with devices running Pocket PC2003, Windows CE, Windows Mobile 5 or Windows XP (the host device must have Bluetooth functionality). The Bluetooth interface enables the operator to use the scanner up to 100m from the host computer. The scanner has audible, visual and vibrator indication of a read. The design incorporates either a 1D laser scanner or a 2D imager for reading barcodes. The combination dual technology scanner also provides the ability to read and write to ISO15693 13.56MHz high frequency smart label transponders.

The charge cradle also provides charging for a spare battery pack and for serial communications with a host PC for firmware up-grades and downloading of batch collected data.

The difference between the units submitted for test is the that the 1062-01 unit contains a 1D linear barcode scanner whereas the 1062-03 unit contains a 2D imager. The units are otherwise functionally identical.

Best regards,

David

Appendix E: Photographs and Figures

The following photographs were taken of the test samples:

Photograph 1: Power line conducted emissions.

Photograph 2: Radiated emissions 6MHz to 30MHz showing use of the loop antenna.

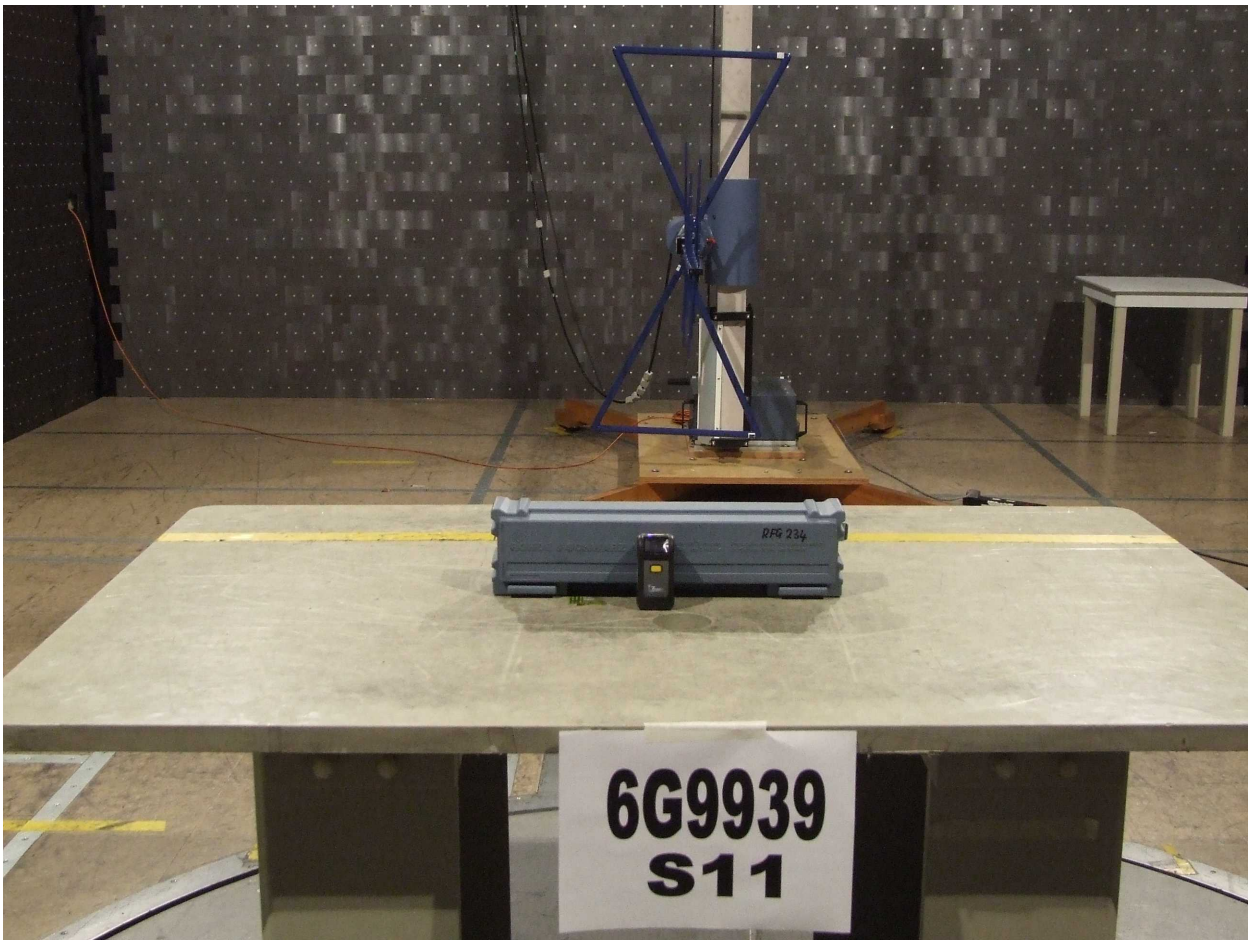
Photograph 3: Radiated emission measurements 30MHz to 1GHz – front view.

Photograph 4: Radiated emission measurements 30MHz to 1GHz – rear view.

Photograph 1

Photograph 2

Photograph 3



Photograph 4

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part of TRaC global

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F +44 (0)1482 801806
E info@ktl.com

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