Test report

KTL EMC Test Report : 8F1521WUS1

Applicant : Tunstall Healthcare (UK) Ltd

Apparatus : Gem Trigger

Authorised by :

A M Leach EMC Group Manager

Issue Date : 23rd September 2008

Authorised Copy Number : *PDF*

Total number of pages : 35

Contents

Section 1: Introduction

1.1 General

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

Test performed by:

KTL
Unit E
South Orbital Trading Park
Hedon Road
Hull HU9 1NJ
United Kingdom

Telephone: +44 (0) 1482 801801
Fax: +44 (0) 1482 801806
Email: ktl@ktl.com
Web site: www.ktl.com

Tests performed by:

K J Anderson Senior EMC and Radio Engineer

Report author: As above.

This report must not be reproduced except in full without prior written permission from KTL.

1.2 Tests Requested By

This testing in this report was requested by:

Tunstall Healthcare (UK) Ltd
Whitely Lodge
Whitely Bridge
Yorkshire
DN14 0HR
United Kingdom

1.3 Manufacturer

As above.

1.4 Apparatus Assessed

The following apparatus was assessed between: 18/08/08 and 20/08/08

Gem Trigger

The above equipment was a battery powered, hand-held trigger device for a social alarm system. The transmitter operates at 312 MHz and is manually triggered. The EUT is powered by a 3.0 V battery type MH 13654.

1.4 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 1.5 and 1.6 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
Manually Activated Transmitter Duration	Title 47 of the CFR : 2008, Part 15 Subpart (c) 15.231(a1)	ANSI C63.4: 2003	PASS
Transmitter 20dB Bandwidth	Title 47 of the CFR : 2008, Part 15 Subpart (c) 15.231(c)	ANSI C63.4: 2003	PASS
Transmitter Fundamental Field Strength	Title 47 of the CFR :2008, Part 15 Subpart (c) 15.231(b)	ANSI C63.4: 2003	PASS
REFE	Title 47 of the CFR : 2008, Part 15 Subpart (c) 15.231(b1,b2,b3)	ANSI C63.4: 2003	PASS

Abbreviations used in the above table:

Mod : Modification
CFR : Code of Federal Regulations
REFE : Radiated Electric Field Emissions
ANSI : American National Standards Institution

1.5 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 1.6 of this test report (Deviations from Test Standards).

For emissions testing, throughout this test report, “Pass” indicates that the results for the sample as tested were below the specified limit (refer also to Section 2, Measurement Uncertainty).

Where relevant, the apparatus was only assessed using the monitoring methods and susceptibility criteria defined in this report.

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

Temperature	: 17 to 23 °C
Humidity	: 45 to 75 %
Barometric Pressure	: 86 to 106 kPa

All dates used in this report are in the format dd/mm/yy.

This assessment has been performed in accordance with the requirements of ISO/IEC 17025.

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).

FCC Facility Registration number (3m semi anechoic chamber) : 90743

1.6 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 NAMAS document NIS81: May 1994.

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

For the test data recorded in accordance with note (iii) of Section 2.2 the following measurement uncertainty was calculated:

Test type	Quantity	Quantity frequency range	Expanded uncertainty
Radiated electric field emissions 3m alternative test site	Amplitude	30MHz to 300MHz Horizontal	±4.6dB
		30MHz to 300MHz Vertical	±5.1dB
		300MHz to 1000MHz Horizontal	±5.2dB
		300MHz to 1000MHz Vertical	±5.5dB
		1GHz to 18GHz Horizontal and Vertical	±4.1dB

Section 3: Modifications

3.1 Modifications Performed During Assessment

No modifications were performed during the assessment.

Appendix A: Formal Test Results

Abbreviations used in the tables in this appendix:

Spec	: Specification
Mod	: Modification
EUT	: Equipment Under Test
SE	: Support Equipment
Pol	: Polarisation
H	: Horizontal Polarisation
V	: Vertical Polarisation
Pk	: Peak Detector
QP	: Quasi-Peak Detector
RBW	: Resolution Bandwidth
ALSR	: Absorber Lined Screened Room
OATS	: Open Area Test Site
ATS	: Alternative Test Site
Ref	: Reference
Freq	: Frequency
Av	: Average Detector
SD	: Spec Distance
MD	: Measurement Distance
VBW	: Video Bandwidth

A1 Radiated Electric Field Emissions

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 Transmitting 1.2 seconds every 2 seconds	
Regulation	Title 47 of the CFR :2008, Part 15 Subpart (c) Clause 15.231(b)
Measurement standard	ANSI C63.4:2003
Frequency range	9KHz to 3.12 GHz
EUT sample number	S02
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 and 2

The worst case radiated emission measurements are listed below:

Ref No.	Freq (MHz)	Det.	Angle Deg.	Height (cm)	Pol	MD (m)	Result at MD (dBμV/m)	Spec. Limit (dBμV/m)	Margin (dB)	Summary
1	312.000*	QP	0	100	H	3	73.9	75.4	-1.5	Pass**
2	624.002	QP	0	100	H	3	37.2	55.4	-18.2	Pass
3	936.003	QP	0	100	H	3	36.4	55.4	-19.0	Pass
4	1560.000	Pk	0	100	H	3	52.4	74.0	-21.6	Pass
5	1560.000	Av	0	100	H	3	37.9	54.0	-16.1	Pass
6	2180.000	Pk	0	100	H	3	50.1	75.4	-23.9	Pass
7	2180.000	Av	0	100	H	3	32.5	55.4	-21.5	Pass
8	2500.000	Pk	0	100	H	3	53.1	74.0	-20.9	Pass
9	2500.000	Av	0	100	H	3	32.9	54.0	-21.1	Pass

*Fundamental Carrier power
**See section 2.2 Note (iii).

Notes:

1. All other emissions were greater than 20 dB below the test limit.
2. In accordance with section 15.231 (b) the maximum permitted fundamental field strength at 3 meters is :
3. $$uV/m \text{ at 3 meters} = 41.6667(f) - 7083.3333$$

   Where (f) is in MHz

   $$5916.6771\mu V/m = 75.4dB\mu V/m$$

4. In accordance with 15.231(b), the maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level

5. The highest operating frequency of the EUT was 312MHz, therefore the highest measurement frequency range was decided according to 47 CFR 15:2008 part 15 (a) section15.33. Plots are contained in Appendix B of this test report.
6. Testing was performed using a new battery, as referenced in 47CFR15.31(e)

Radiated emission limits (47 CFR 15:2008 Clause 15.231 (b) for the maximum permitted fundamental field strength and the maximum permitted unwanted emission levels:

Fundamental Frequency (MHz)	Field strength of Fundamental (μV/m)	Field strength of Spurious Emissions (μV/m)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750**	125 to 375**
174-260	3750	375
260-470	3750 to 12500**	375 to 1250
Above 470	12500	1250

** Linear interpolations

Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strength are as follows: for the band 130-174MHz, uV/m at 3 meters = 56.81818(F)-6136.3636; for the band 260-470MHz, uV/m at 3 meters = 41.6667(F)-7083.3333. The maximum permitted unwanted emission level is 20dB below the maximum permitted level.

Radiated emission limits (47 CFR 15:2008 Clause 15.209) for emissions falling within the restricted bands defined in 15.205(a):

Frequency of emission (MHz)	Field strength μV/m	Measurement Distance m	Field strength dBμV/m
0.009-0.490	2400/F(kHz)	300	67.6/F (kHz)
0.490-1.705	24000/F(kHz)	30	87.6/F (kHz)
1.705-30	30	30	29.5
30-88	100	3	40.0
88-216	150	3	43.5
216-960	210	3	46.4
Above 960	500	3	54.0

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:

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

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 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 Transmitter 20dB Bandwidth

Title 47 of the CFR: 2008, Part 15 Subpart (c) 15.231(c) requires the measurement of the occupied bandwidth of the transmitted fundamental frequency. The bandwidth is determined at the point's 20dB down from the modulated carrier. To determine the occupied bandwidth a RBW of 100 kHz and a VBW three times greater than the RBW (300 kHz) was used. The spectrum analyser was then set to take a peak hold measurement. The peak level was found and set to a 0dB reference point and markers offset by -20dB determined the bandwidth. The formal measurements are detailed below:

Test Details Normal operating mode	
Regulation	Title 47 of the CFR :2008, Part 15 Subpart (c) 15.231(c)
EUT sample number	S01
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C

Measured 20 dB Bandwidth (MHz)	Limit (MHz)	Margin(MHz)	Result
0.200	0.780	0.580	Pass

The 20 dB bandwidth shall be less than 0.25% of the carrier frequency, for devices operating below 900 MHz.

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

A3 Transmitter Transmission Duration and Operation.

Title 47 of the CFR: 2008, Part 15 Subpart (c) 15.231(a) requires the measurement of the transmission duration of a manually activated transmitter to comply with the provisions for periodic operation:

Using a spectrum analyser in zero span mode, centred on the fundamental carrier frequency with a RBW of 1000 kHz and a video Bandwidth of 300 kHz the sweep time was set accordingly to capture the transmission duration time. The formal measurements are detailed below

Test Details: Normal operating mode	
Regulation	Title 47 of the CFR :2008, Part 15 Subpart (c) 15.231(a1)
EUT sample number	S01
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C

Manually Activated Transmitter Duration (Seconds)	Limit (Seconds)	Margin (Seconds)	Result
1.82	5	3.18	Pass

A plot of the transmission duration is contained in Appendix B of this test report.

Appendix B: **Supporting Graphical Data**

This appendix contains graphical data obtained during testing.

Notes:

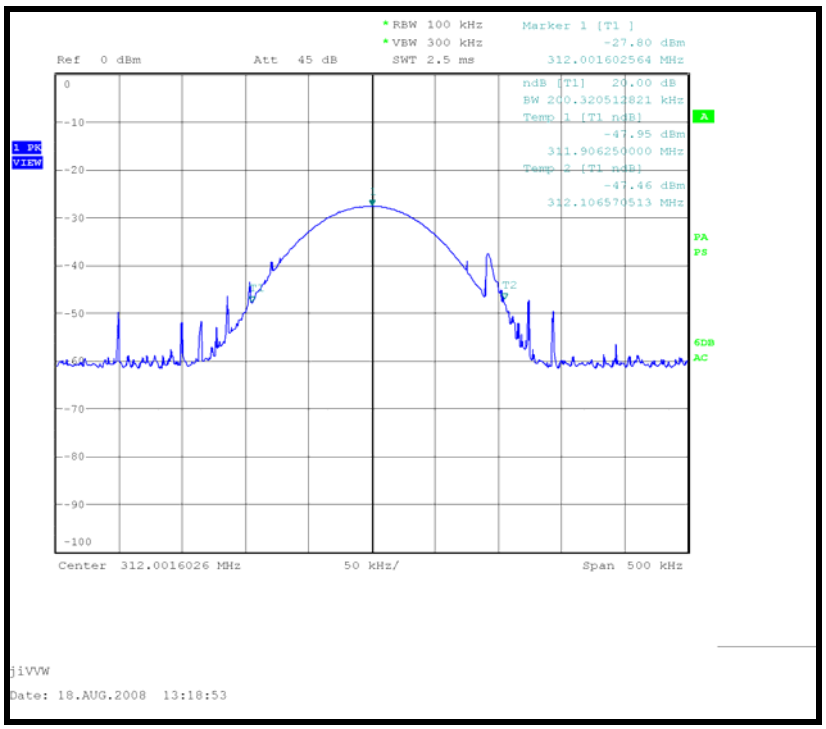
(a) The radiated electric field emissions graphical data in this appendix is peak preview data. For details of formal results, refer to Appendix A.

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

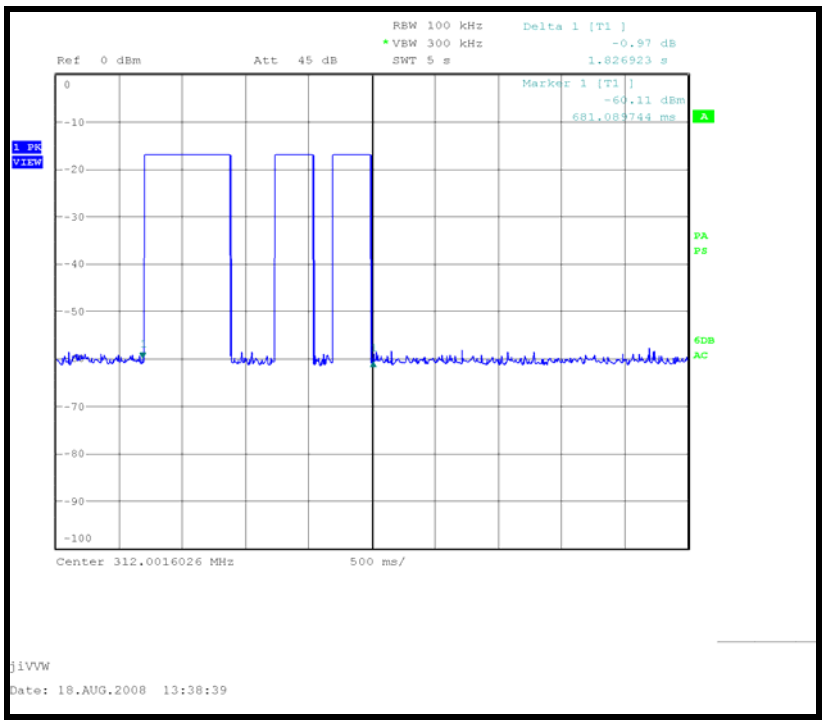
(c) Appendix C details the numbering system used to identify the sample and its modification state.

(d) 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.

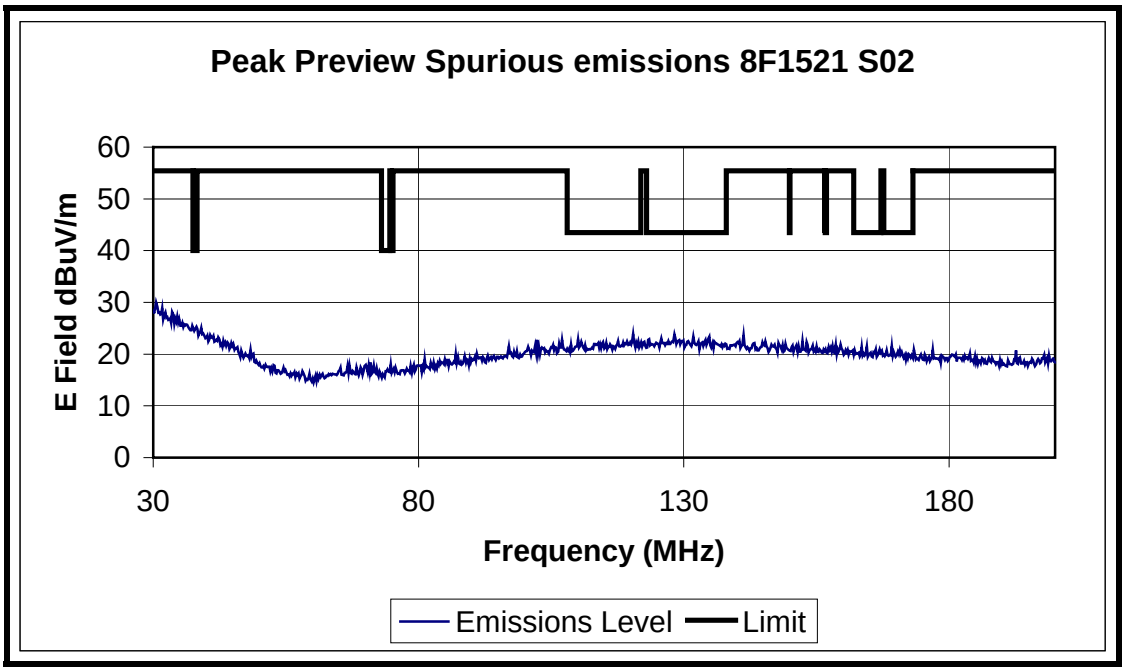
(e) The limit line shown on the radiated emission plots is a combined 15.231(b) and15.209 limit; any emissions detected above 1GHz and within the restricted bands of operation (defined in section 15.205) were formally assessed against the 15.209 limits. All emissions below 1GHz and outside the restricted band were formally assessed against the limits in 15.231(b).



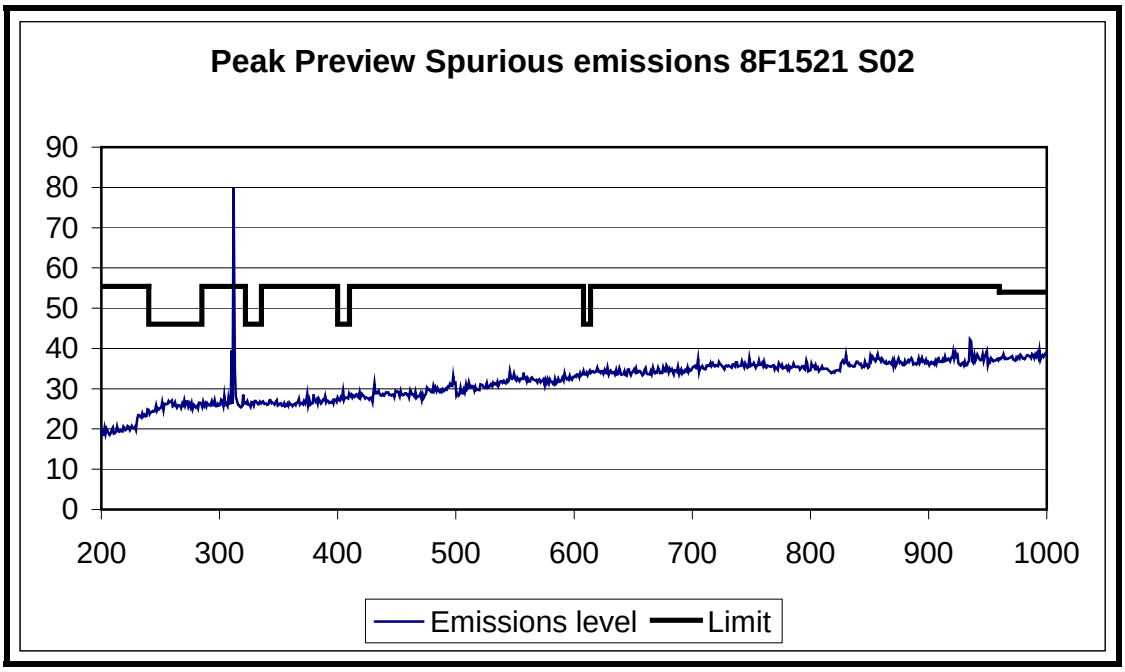
20 dB Bandwidth from the modulated carrier



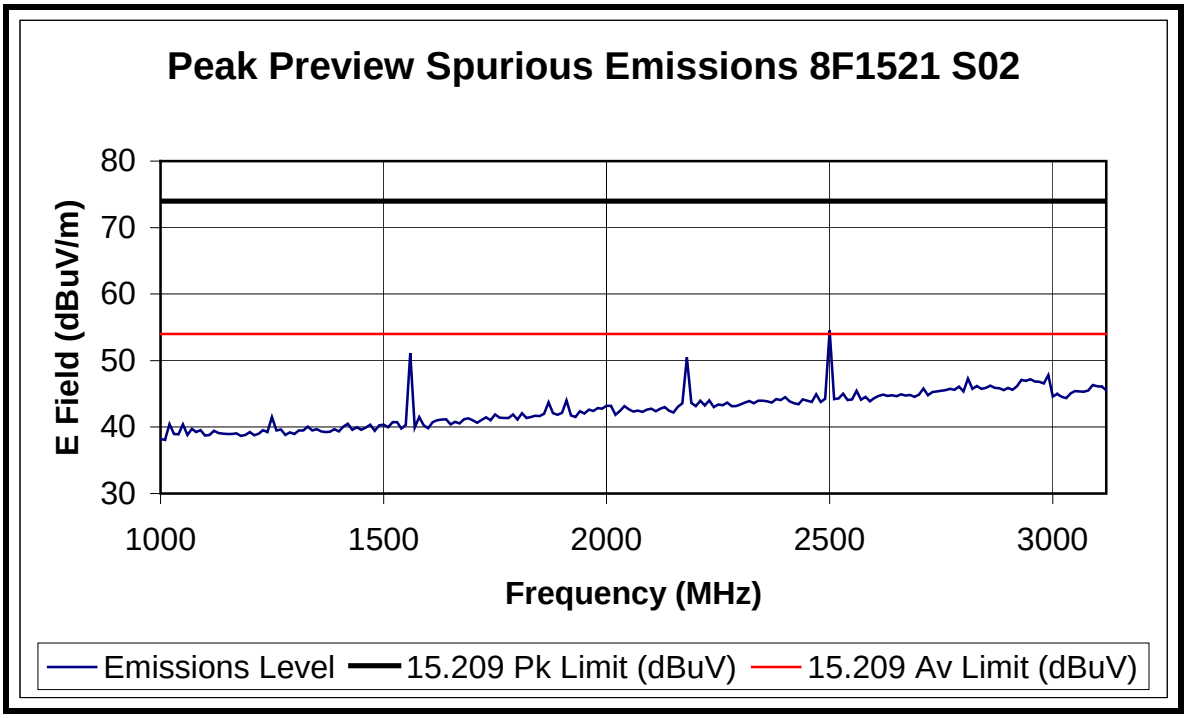
Manually Activated Transmitter Duration



The plot above shows the radiated electric field emission preview scan data using a max hold peak detector: The plot is for indication only: TX Modulated 30MHz to 200MHz



The plot above shows the radiated electric field emission preview scan data using a max hold peak detector: The plot is for indication only: TX Modulated 200MHz to 1000MHz



The plot above shows the radiated electric field emission preview scan data using a max hold peak detector: The plot is for indication only: TX Modulated 1GHz to 3.120GHz

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 KTL upon request.

C1) Test samples

The following samples of the apparatus were submitted for testing :

Sample No.	Description	Identification
S01	Gem Trigger (Standard Sample)	None
S02	Gem Trigger (Continuous Transmit Sample)	None

C2) EUT Operating Mode During Testing.

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

Test	Description of Operating Mode S02
Transmitter field strength and Spurious Emissions	Continuous modulated transmission, transmitting 1.2 seconds every 2 seconds.

Test	Description of Operating Mode S01
Manually Activated Transmitter Duration	Modulated transmission, transmitting for 1.82 seconds on triggering.
20dB Occupied Bandwidth	

C3) EUT Configuration Information.

The EUT’s were submitted for testing in one single possible configuration.

C4) List of EUT Ports

The EUTs were battery powered with no external ports.

C5) Details of test equipment used

For Radiated Electric Field Emissions 9KHz to 1GHz:

RFG No	Type	Description	Manufacturer	Date Calibrated.
274	ATS	Ferrite Lined Chamber	KTL	11/01/08
244	CBL6111	Blue Bilog Antenna (0.03 - 1GHz)	Chase	22/01/06
023	HFH2-Z2	Magnetic Loop Antenna	R & S	03/04/02
214	ESAI	Spec Analyser/Test Rxer (LF/HF)	R & S	21/11/06
847	ESU	Spectrum Analyser	R&S	29/02/08
267	N-type	RF coaxial cable (Lab 10)	KTL	28/01/08
270	N-type	RF coaxial cable (Lab 10)	KTL	25/08/07

For Radiated Electric Field Emissions 1GHz to 5GHz

RFG No	Type	Description	Manufacturer	Date Calibrated
274	ATS	Ferrite Lined Chamber	KTL	11/01/08
129	3115	Horn Antenna	EMCO	11/08/08
650	N-106	Sucoflex uW Cable 3m	Suhner	14/07/08
651	N-106	Sucoflex uW Cable 7m	Suhner	14/07/08
847	ESU	Spectrum Analyser	R&S	29/02/08

For Transmitter 20dB Bandwidth

RFG No	Type	Description	Manufacturer	Date Calibrated
847	ESU	Spectrum Analyser	R&S	29/02/08

Manually Activated Transmitter Duration

RFG No	Type	Description	Manufacturer	Date Calibrated
847	ESU	Spectrum Analyser	R&S	29/02/08

Appendix D: Additional Information

The following is the contents of an email from the client, confirming frequencies used within the unit.

Hi Ken,

I attached the GEM block diagram.

There are a 9.75MHz xtal and a 32 KHz xtal for the Microcontroller.

Thanks!

Quanli Qu

The following is a declaration from the client of the battery used in the unit.

Hi Ken,

The part number in our company is D6700001A and it is 3V.

UL recognition is MH 13654.

Quanli Qu

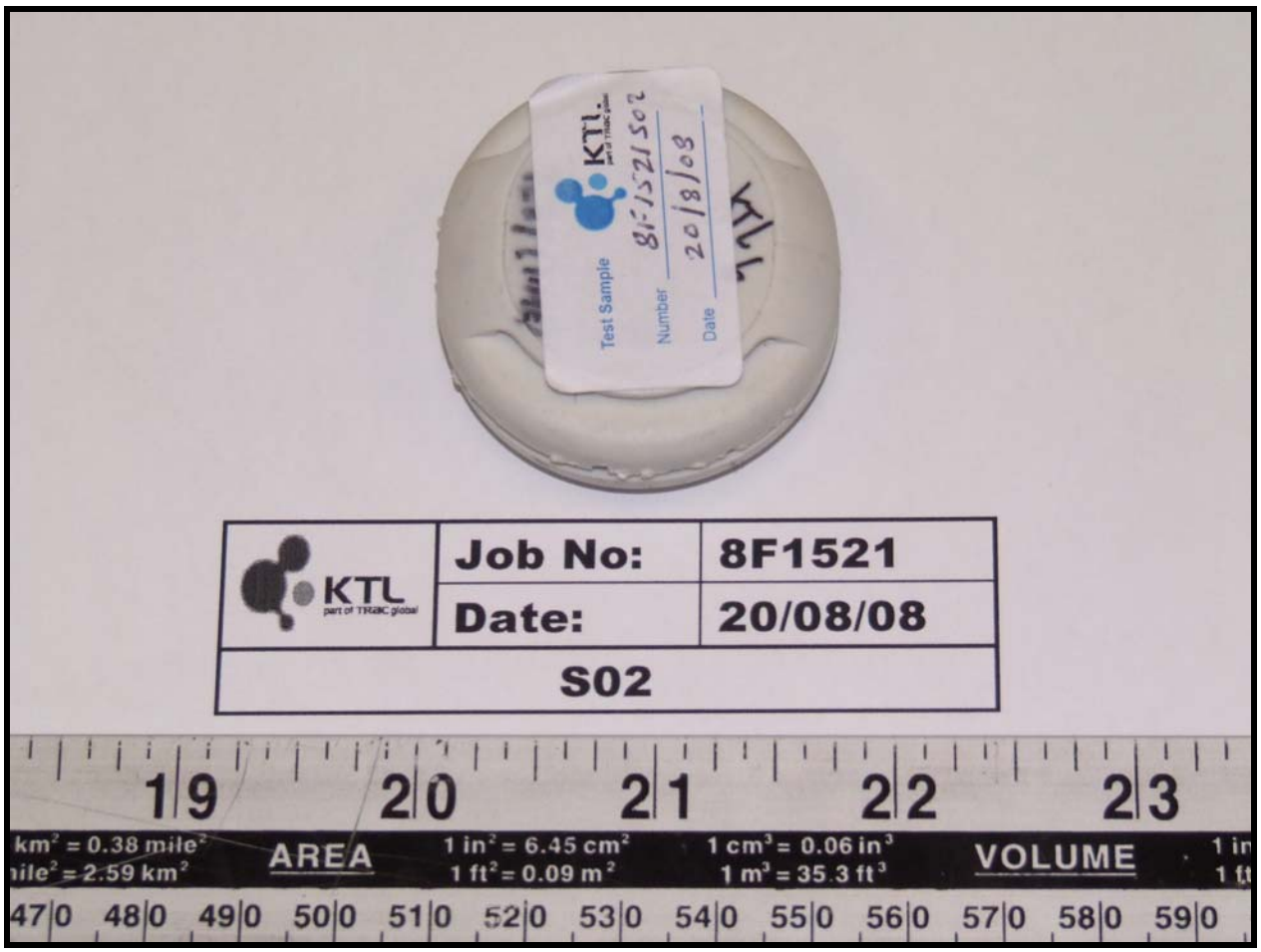
Appendix E: **Photographs and Figures**

The following photographs were taken of the test samples:

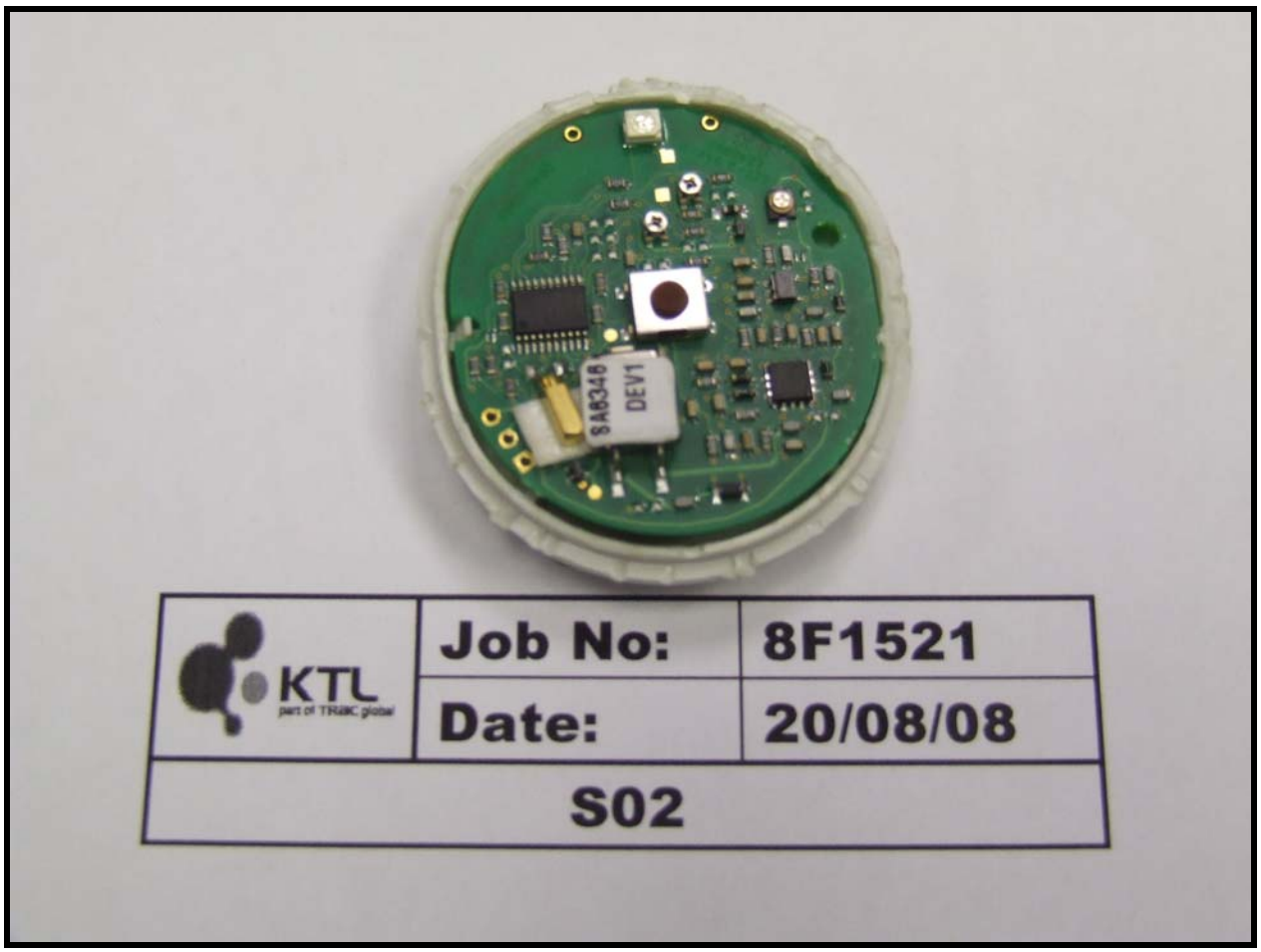
1. Radiated electric field emissions arrangement:
2. Photo of the RF module front view
3. Photo of the RF module rear view
4. Photo of PCB front view
5. Photo of PCB rear view

Photograph 1

Photograph 2



Photograph 3



Photograph 4

Photograph 5

KTL
part of TRaC global

- Unit E, South Orbital Trading Park, Hedon Road, Hull, HU9 1NJ, UK.
- **T** +44 (0)1482 801801
  F +44 (0)1482 801806
  E info@trac-ktl.com

Total number of pages : 35

TRaC
testing regulatory and compliance