KTL EMC Test Report : 4A7667GUS3

Applicant : Cambridge Silicon Radio

Apparatus : CSR BlueCore4 Bluetooth Module

Authorised by : M Render, EMC and Radio Group Manager

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Contents

Section 1: Introduction

1.1 General

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

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1.2 Tests Requested By

This testing in this report was requested by:

Cambridge Silicon Radio
1651 N. Collins Boulevard
Suite 210
Richardson
Texas
USA
75080

1.3 Manufacturer

Universal Scientific Industrial Co. Ltd
11400 Burnet Road
Suite 5160
Austin
Texas
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78758

1.4 Apparatus Assessed

The following apparatus was assessed between 18/11/04 and 15/12/04:

CSR BlueCore4 Bluetooth Module

The above equipment was a Bluetooth radio module for fitting into a laptop computer

1.5 Test Result Summary

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

The statements relating to compliance with the standards below apply ONLY as qualified in the notes and deviations stated in sections 1.6 to 1.7 of this test report.

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

Test Type	Regulation	Measurement standard	Result
REFE	Title 47 of the CFR: 2004, Part 15 Subpart (c) 15.247	ANSI C63.4: 2003	PASS
AC Power conducted emissions	Title 47 of the CFR: 2004, Part 15 Subpart (c) 15.207	ANSI C63.4: 2003	PASS
20dB Bandwidth and Channel Spacing	Title 47 of the CFR :2004, Part 15 Subpart (c) 15.247(a)(1)(i)	Public Notice DA 00-705 March 30, 2000	PASS
Conducted Carrier Power	Title 47 of the CFR :2004, Part 15 Subpart (c) 15.247(b)(2)	Public Notice DA 00-705 March 30, 2000	PASS
Hopping Frequencies	Title 47 of the CFR :2004, Part 15 Subpart (c) 15.247(a)(1)	Public Notice DA 00-705 March 30, 2000	PASS
Channel Occupancy	Title 47 of the CFR :2004, Part 15 Subpart (c) 15.247(a)(1)(i)	Public Notice DA 00-705 March 30, 2000	PASS

Abbreviations used in the above table:

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

1.6 Notes Relating To The Assessment

With regard to this assessment, the following points should be noted:

The results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 1.7 of this test report (Deviations from Test Standards).

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

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

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

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

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

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

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

1.7 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 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

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
Mod	: Modification
EUT	: Equipment Under Test
SE	: Support Equipment
L	: Live Power Line
N	: Neutral Power Line
E	: Earth Power Line
Pk	: Peak Detector
QP	: Quasi-Peak Detector
Av	: Average Detector
ALSR	: Absorber Lined Screened Room
OATS	: Open Area Test Site
ATS	: Alternative Test Site
Ref	: Reference
Freq	: Frequency
MD	: Measurement Distance
SD	: Spec Distance
Pol	: Polarisation
H	: Horizontal Polarisation
V	: Vertical Polarisation
CDN	: Coupling & decoupling network

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	
Regulation	Title 47 of the CFR :2002, Part 15 Subpart (c) Clause 15.247
Measurement standard	ANSI C63.4:2003
Frequency range	16 MHz to 25 GHz
EUT sample number	S13
Modification state	0
SE in test environment	S01 and S03
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photograph 1

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)	SD (m)	Result at SD (dBμV/m)	Spec. Limit (dBμV/m)	Margin (dB)	Summary
1	39.075	QP	245	102	V	3	47.6	3	47.6	71.1	-23.5	Pass
2	72.025	QP	227	123	V	3	47.6	3	47.6	71.1	-23.5	Pass
4	902	QP	227	111	V	3	47.4	3	47.4	71.1	-23.7	Pass
5	1630	Pk	145	100	V	3	63.9	3	63.9	91.1	-27.2	Pass
6	1630	Av	145	100	V	3	61.8	3	61.8	71.1	-9.3	Pass
7	2441	Pk	225	100	V	3	93.1	3	93.1	Note 3	N/A	Pass
8	2441	Av	225	100	V	3	91.1	3	91.1	Note 3	N/A	Pass
9	3280	Pk	190	100	V	3	51.4	3	51.4	91.1	-39.7	Pass
10	3280	Av	190	100	V	3	48.2	3	48.2	71.1	-22.9	Pass
11	4800	Pk	185	100	V	3	48.3	3	48.3	74	-25.7	Pass
12	4800	Av	185	100	V	3	44.9	3	44.9	54	-9.1	Pass
13	3540	Pk	145	100	H	3	51.8	3	51.8	91.1	-39.3	Pass
14	3540	Av	145	100	H	3	48.5	3	48.5	71.1	-22.6	Pass
15	2400	Pk	195	100	V	3	52.9	3	52.9	91.1	-38.2	Pass
16	2400	Av	195	100	V	3	46.3	3	46.3	71.1	-24.8	Pass
17	2483.5	Pk	195	100	V	3	53.1	3	53.1	74	-20.9	Pass
18	2483.5	Av	195	100	V	3	47.9	3	47.9	54	-6.1	Pass

Notes:

1. Testing below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.4:2003 section 8.2.1.
2. All other emissions in the restricted bands defined in 47CFR15.205(a) were greater than 10 dB below the 47CFR15.209 limit.
3. The emissions limits for emissions outside the restricted bands defined in 47CFR15.205(a) are based on a transmitted carrier level of 94.8 dBμV/m at 3m. Emissions from the EUT are required to be 20 dB below the level of the emissions in the operating band. The carrier level was measured whilst varying the supply voltage between 85% and 105% of the nominal supply voltage as required by 15.31(e). No variation in carrier level was observed.
4. 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.
5. The measurements at 2400 MHz and 2483.5 MHz were made to ensure band edge compliance.
6. Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded.

The upper frequency of the measurement range was decided according to 47 CFR 15:1999 Clause 15.33.

Radiated emission limits (47 CFR 15:1999 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 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	
Regulation	Title 47 of the CFR Part 15(c) Section 15.207
Measurement standard	ANSI C63.4:2003
Frequency range	150kHz to 30MHz
EUT sample number	S13
Modification state	0
SE in test environment	S01 and S03
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix E)	Photograph 2

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

Ref No.	Freq (MHz)	Conductor	Detector Used	Result (dBuV)	Av Spec Limit (dBuV)	Result Summary
1	0.536	Neutral	Av	37.6	46	Pass
2	0.75	Neutral	Av	37.5	46	Pass
3	1.715	Neutral	Av	36	46	Pass
4	1.924	Neutral	Av	30.6	46	Pass
5	2.25	Neutral	Av	32.1	46	Pass
6	4.823	Neutral	Av	32.2	46	Pass
7	0.536	Live	Av	36.4	46	Pass
8	0.75	Live	Av	37	46	Pass
9	1.715	Live	Av	35.5	46	Pass
10	1.924	Live	Av	30.2	46	Pass
11	2.25	Live	Av	31.2	46	Pass
12	4.823	Live	Av	28.3	46	Pass

Ref No.	Freq (MHz)	Conductor	Detector Used	Result (dBuV)	QP Spec Limit (dBuV)	Result Summary
1	0.536	Neutral	QP	38.3	56	Pass
2	0.75	Neutral	QP	38	56	Pass
3	1.715	Neutral	QP	37.2	56	Pass
4	1.924	Neutral	QP	36.3	56	Pass
5	2.25	Neutral	QP	38.4	56	Pass
6	4.823	Neutral	QP	36.7	56	Pass
7	0.536	Live	QP	37.2	56	Pass
8	0.75	Live	QP	37.7	56	Pass
9	1.715	Live	QP	36.8	56	Pass
10	1.924	Live	QP	35.8	56	Pass
11	2.25	Live	QP	38	56	Pass
12	4.823	Live	QP	31.5	56	Pass

Conducted emission limits (47 CFR 15:1999 Clause 15.207):

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 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

A3 20 dB Bandwidth and Channel Spacing

Title 47 of the CFR: 2002, Part 15 Subpart (c) 15.247(a)(1)(i) requires the measurement of the bandwidth of the transmission between the -20 dB points on the transmitted spectrum. The results of this test determine the limits for channel spacing. The channel spacing shall be equal to a minimum of 25 kHz or the 20 dB bandwidth, whichever is the greater. The formal measurements are detailed below:

Test Details: Conference Phone	
Regulation	Title 47 of the CFR :2002, Part 15 Subpart (c) 15.247(a)(1)(i)
EUT sample number	S07
Modification state	0
SE in test environment	S15 and S16
SE isolated from EUT	None
EUT set up	Refer to Appendix C

Measured 20 dB Bandwidth	Limit	Result
1005 kHz	N/A	N/A

Measured Channel Spacing	Limit	Result
1005 kHz	≥1005 kHz	Pass

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

A4 Conducted carrier power

Conducted carrier power was verified using a spectrum analyser with the EUT transmitting on its lowest, centre and highest carrier frequency in turn.

Test Details: Conference Phone	
Regulation	Title 47 of the CFR2002, Part15 Subpart (c) 15.247(b)(2)
EUT sample number	S07
Modification state	0
SE in test environment	S15 and S16
SE isolated from EUT	None
EUT set up	Refer to Appendix C

Frequency (GHz)	Measured Conducted Carrier Power (W)	Limit (W)	Result
2.402	0.0044	1	Pass
2.441	0.0027	1	Pass
2.481	0.0001	1	Pass

Note

The carrier power was measured whilst varying the supply voltage between 85% and 105% of the nominal supply voltage as required by 15.31(e). No variation in carrier power was observed.

A5 Hopping frequencies

Hopping frequencies were verified using a spectrum analyser set to 20 MHz spans, displaying sub sets of the hopping channels in turn, while the EUT was operating in its normal frequency hopping mode.

Test Details:	
Regulation	Title 47 of the CFR :2002, Part 15 Subpart (c) 15.247(a)(1)(i)
EUT sample number	S07
Modification state	0
SE in test environment	S15 and S16
SE isolated from EUT	None
EUT set up	Refer to Appendix C

No. of Hopping Channels	Requirement	Result
79	For 1W conducted carrier power Limit, greater than 75	Pass

Plots showing the hopping channels are contained in Appendix B

A6 Channel Occupancy

Channel occupancy time was verified using a spectrum analyser in zero span mode, centred on the middle hopping channel frequency (2441 MHz), while the EUT was operating in its normal frequency hopping mode. The other channels were then verified to ensure that the channel occupancy was identical for all channels.

Test Details: Conference Phone	
Regulation	Title 47 of the CFR2002, Part15 Subpart (c) 15.247(a)(1)(i)
EUT sample number	S07
Modification state	0
SE in test environment	S15 and S16
SE isolated from EUT	None
EUT set up	Refer to Appendix C

Measured Channel Occupancy Time	Limit	Result
0.45 ms	400 ms	Pass

Plots showing the channel occupancy time and time between successive transmissions are contained in Appendix B of this test report.

Average Occupancy

For a frequency hopping system utilising 79 channels (N), with a channel occupancy time (t_{occ}) of 0.45 ms and a repetition time (t_{rep}) of 99 ms

No of transmission cycles in specified averaging period (400 x N ms)

= (0.4 x N)/ t_{rep}

= (0.4 x 79)/0.099

= 319

total activation time = t_{occ} x 319 ms

= 0.45x 319 ms

= 143.55ms

limit = 400 ms

Result: Pass

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.

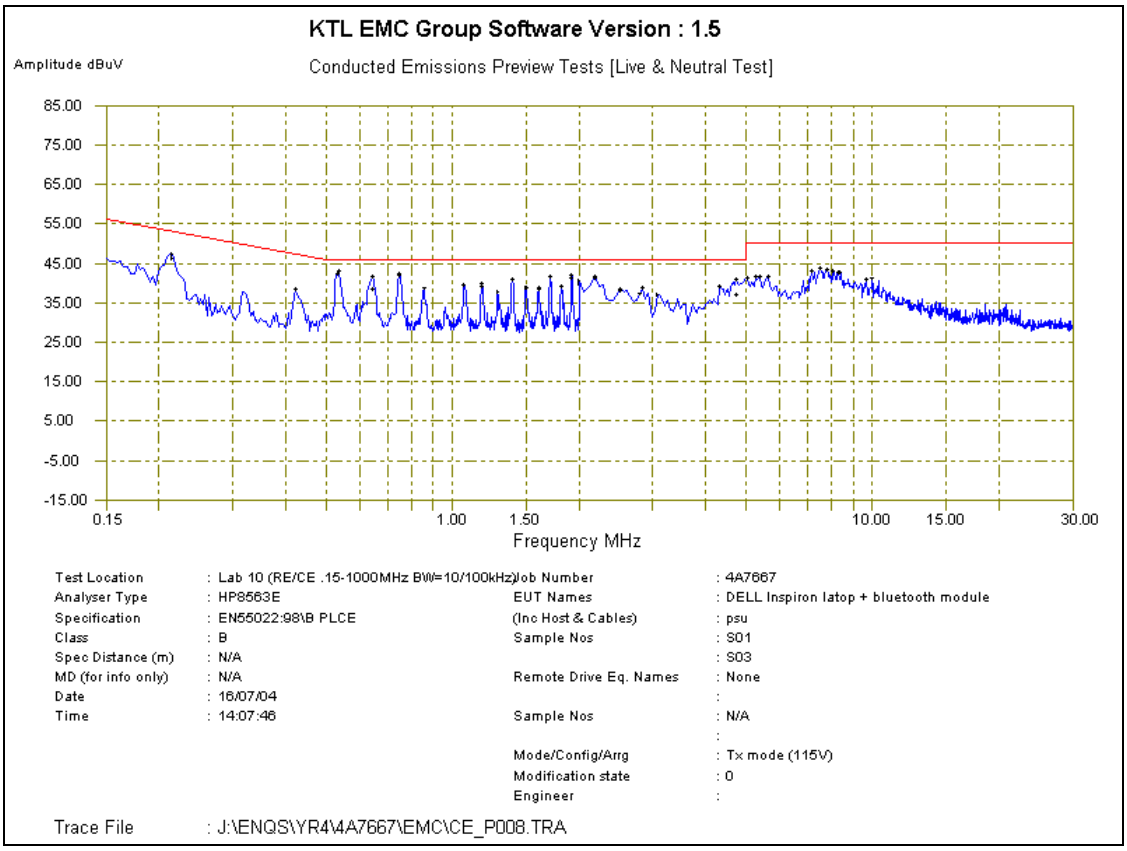
(c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit which is stricter than the quasi peak limit.

(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.

(f) The limit line on the conducted emissions plots is the EN55022:1998 class B limit. This is identical to the 47 CFR Part 15(b) class B limit.

(g) The limit line on the radiated emissions is the limit for emissions outside the restricted bands. Any emissions detected within the restricted band were formally assessed against the limits in 15.209.


KTL EMC Group Software Version : 1.5
Amplitude dBuV
Conducted Emissions Preview Tests [Live & Neutral Test]
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75.00
65.00
55.00
45.00
35.00
25.00
15.00
5.00
-5.00
-15.00
0.15
1.00
1.50
10.00
15.00
30.00
Frequency MHz
Test Location : Lab 10 (RE/CE .15-1000MHz BW=10/100kHz)
Analyser Type : HP8563E
Specification : EN55022:98\B PLCE
Class : B
Spec Distance (m) : N/A
MD (for info only) : N/A
Date : 16/07/04
Time : 14:07:46
Job Number : 4A7667
EUT Names : DELL Inspiron latop + bluetooth module
(Inc Host & Cables) : psu
Sample Nos : S01
: S03
Remote Drive Eq. Names : None
:
Sample Nos : N/A
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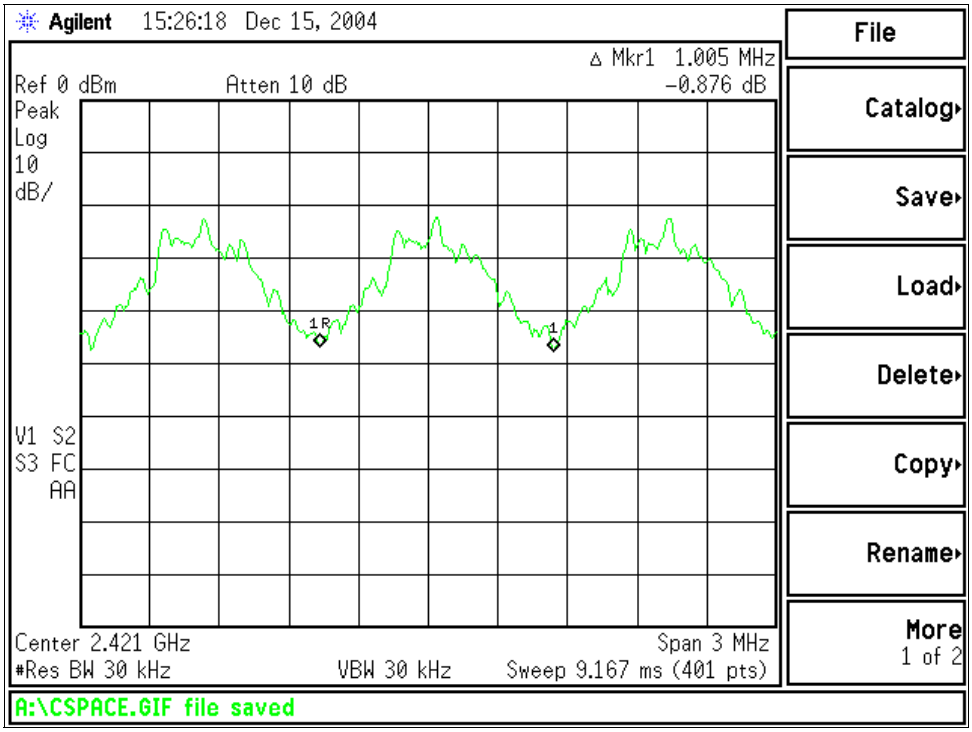
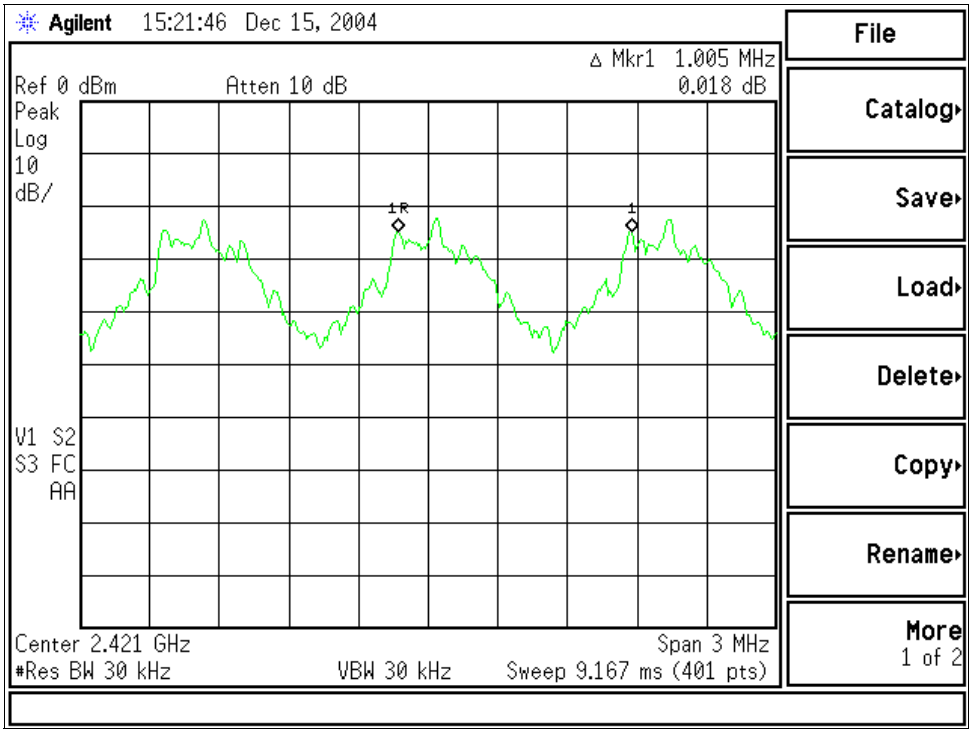
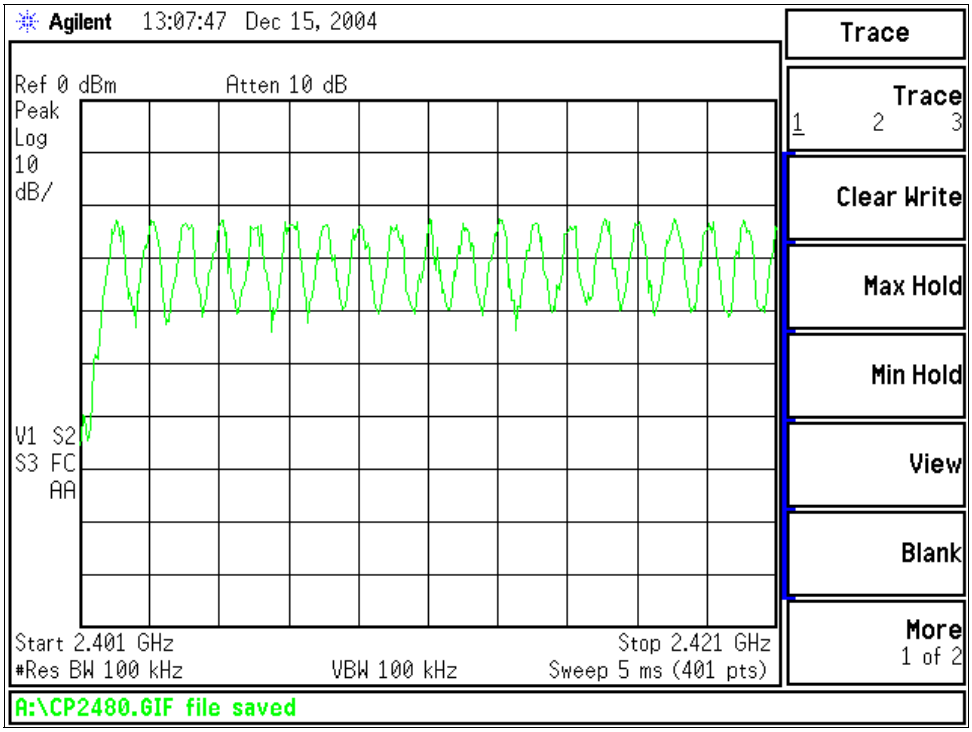
Mode/Config/Arrg : Tx mode (115V)
Modification state : 0
Engineer :
Trace File : J:\ENQS\YR4\4A7667\EMC\CE_P008.TRA



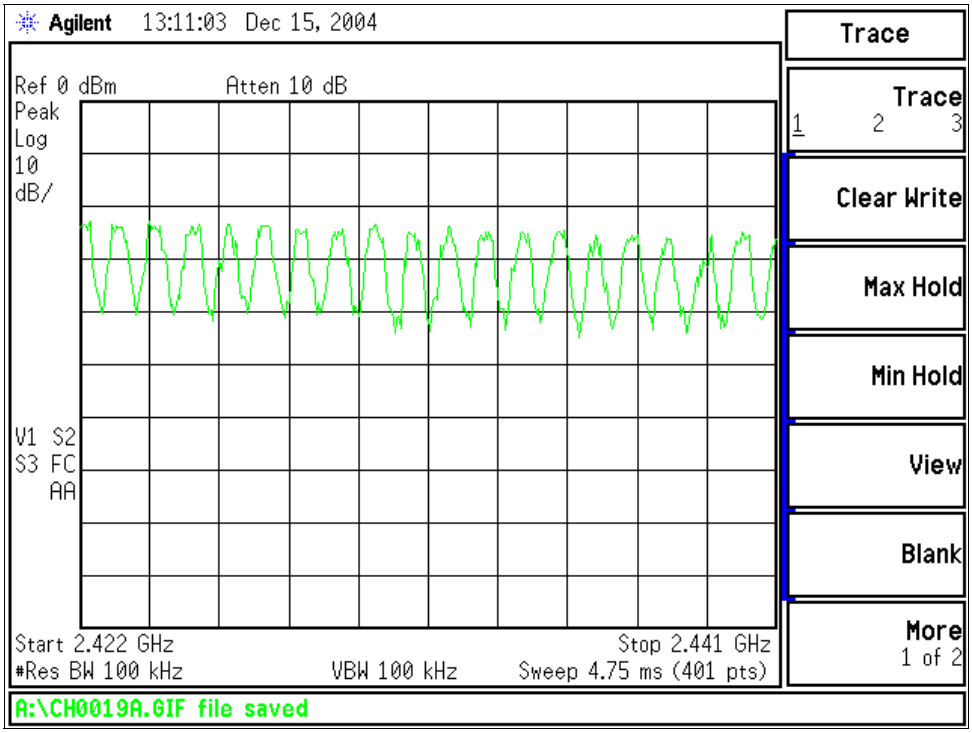
20 dB Bandwidth



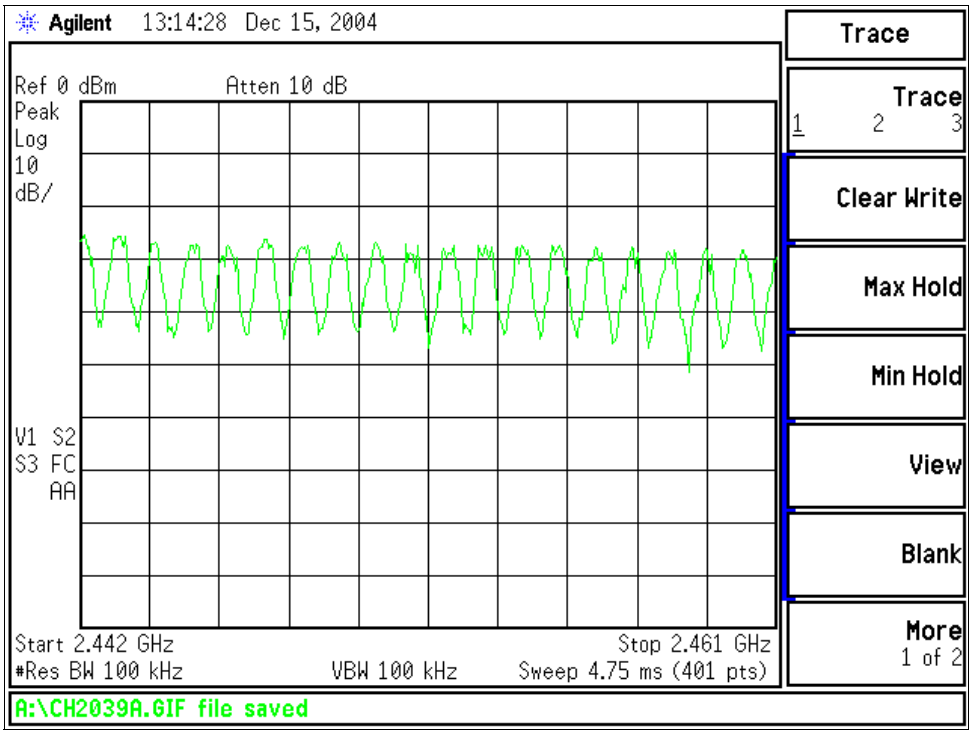
Channel Spacing



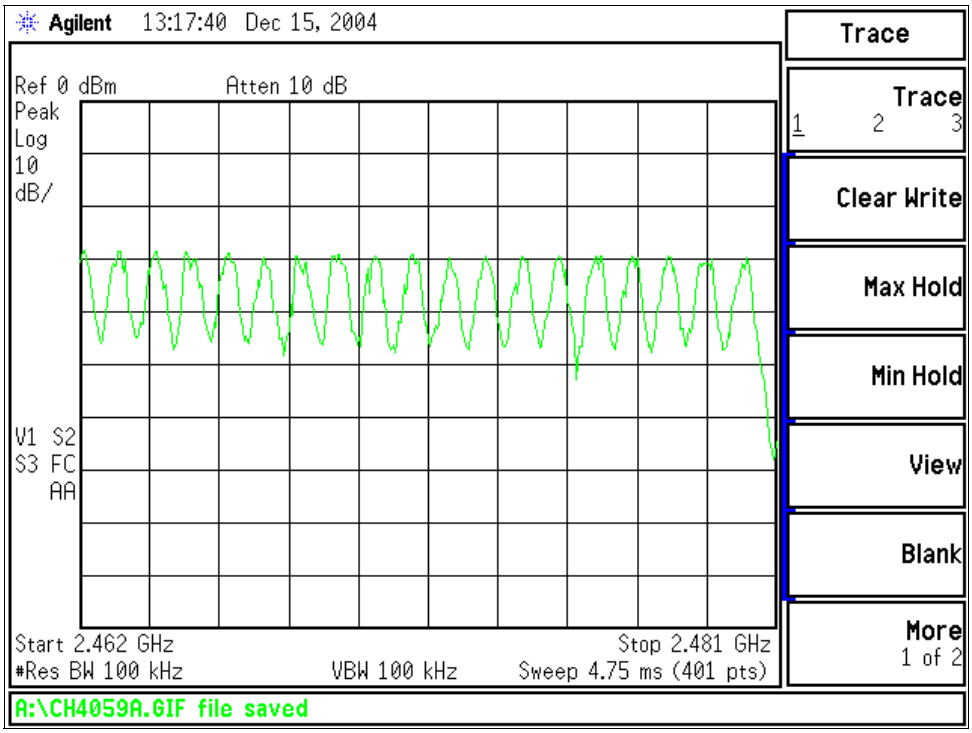
Channels 0 to 19



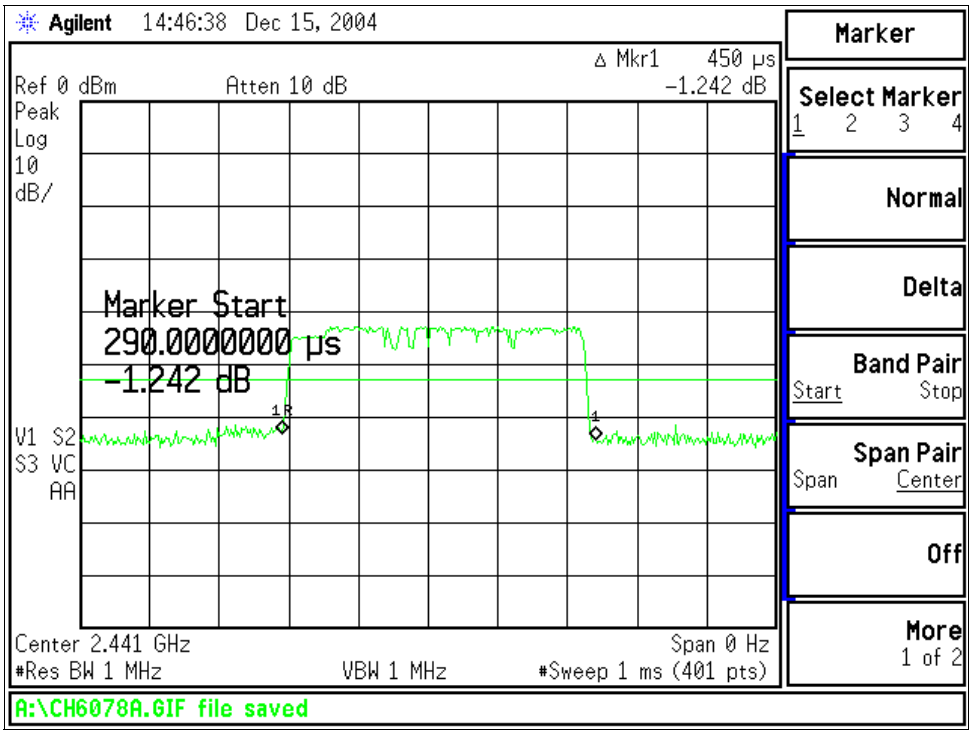
Channels 20 to 39



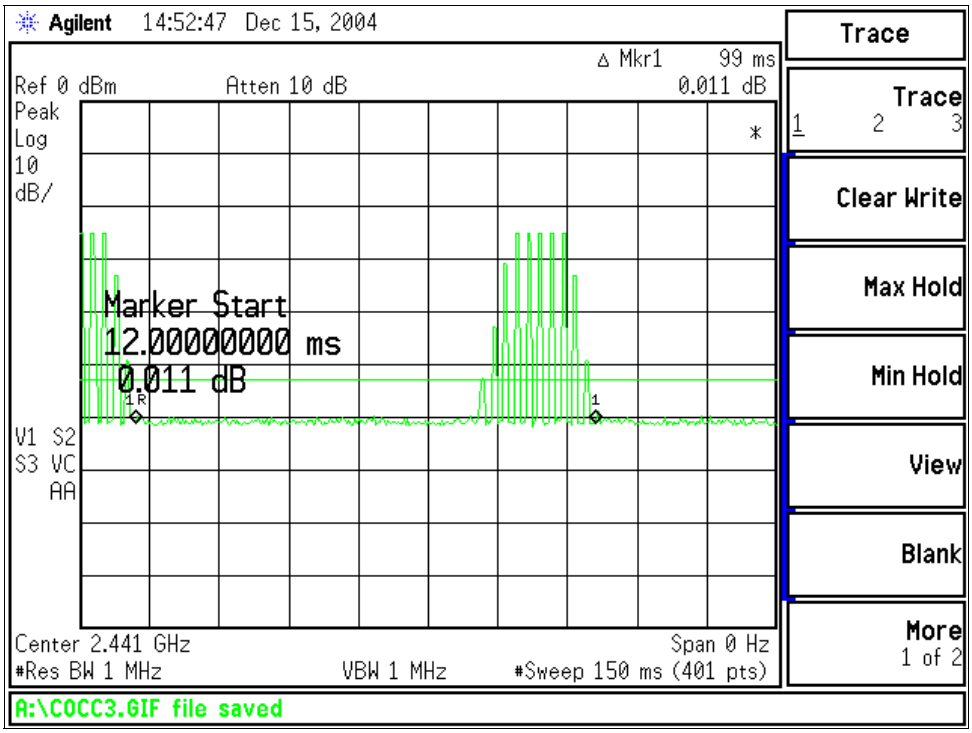
Channels 40 to 59



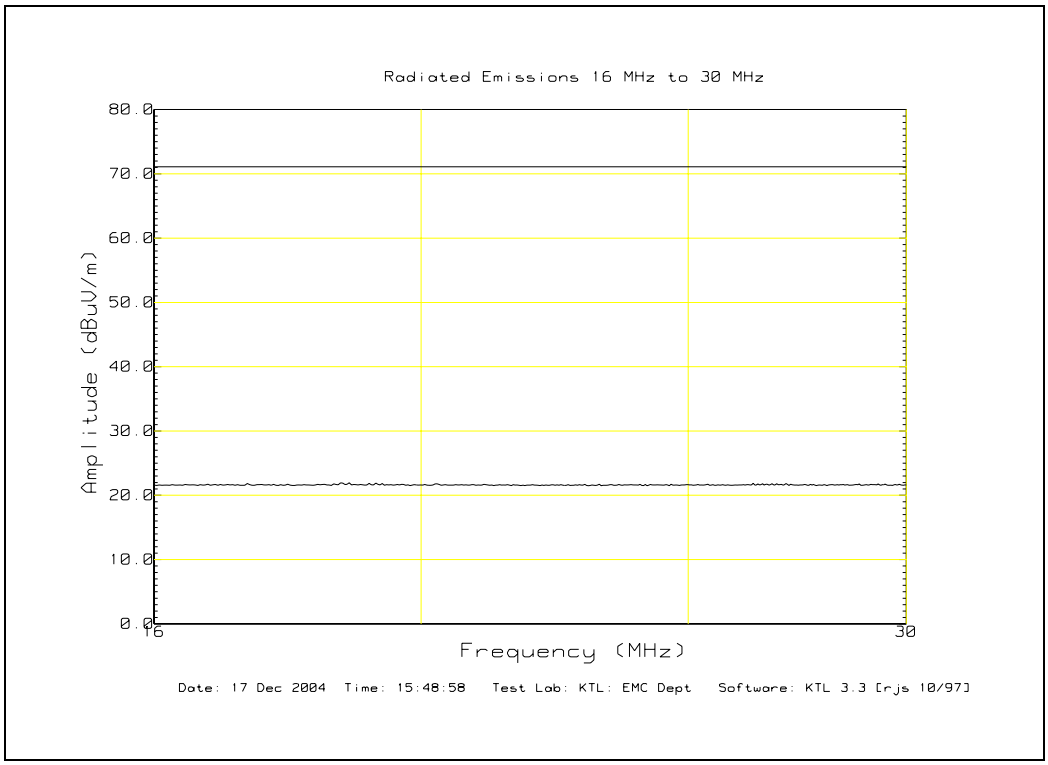
Channels 60 to 78

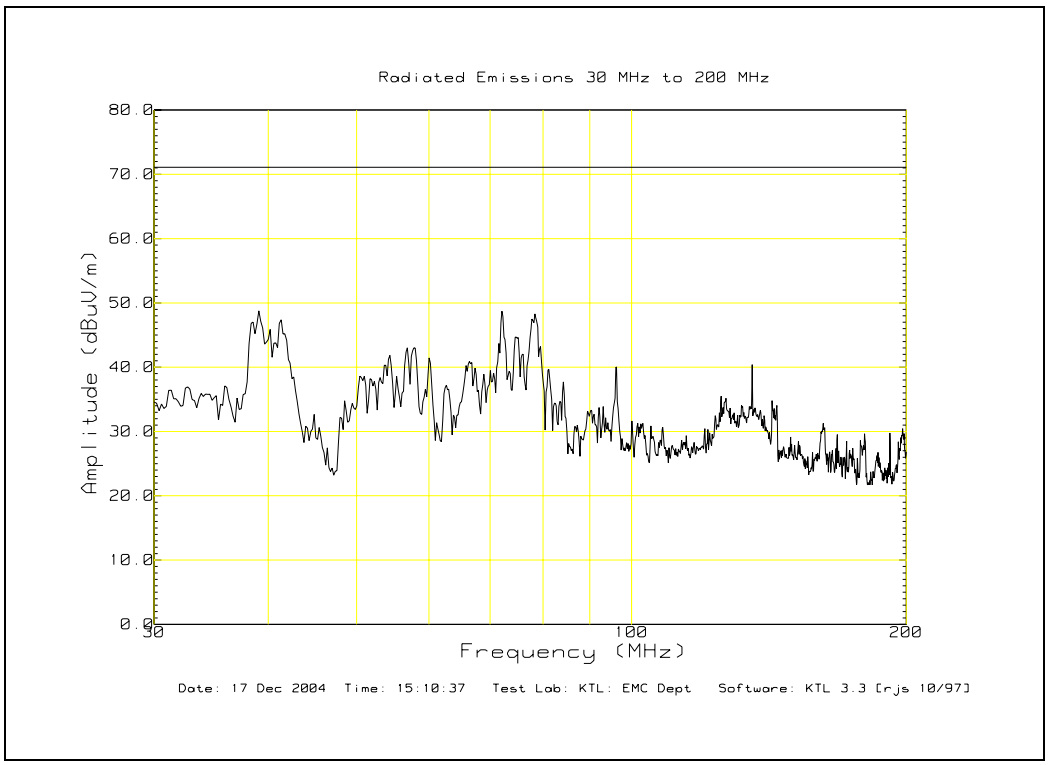


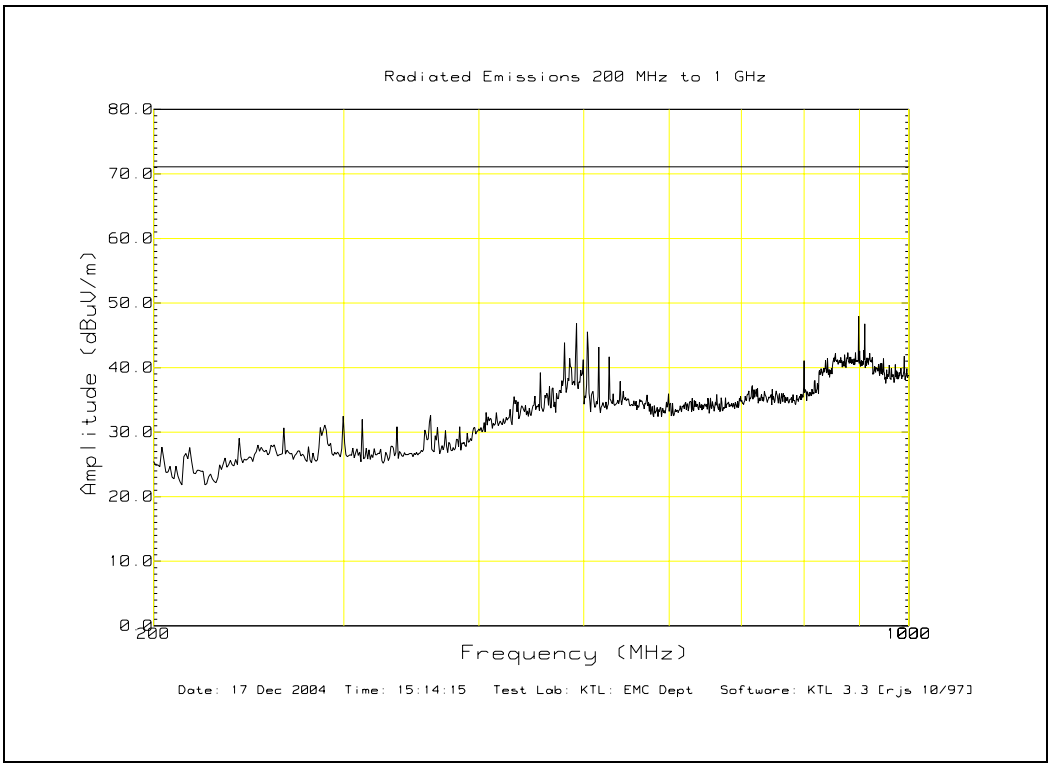
Channel occupancy

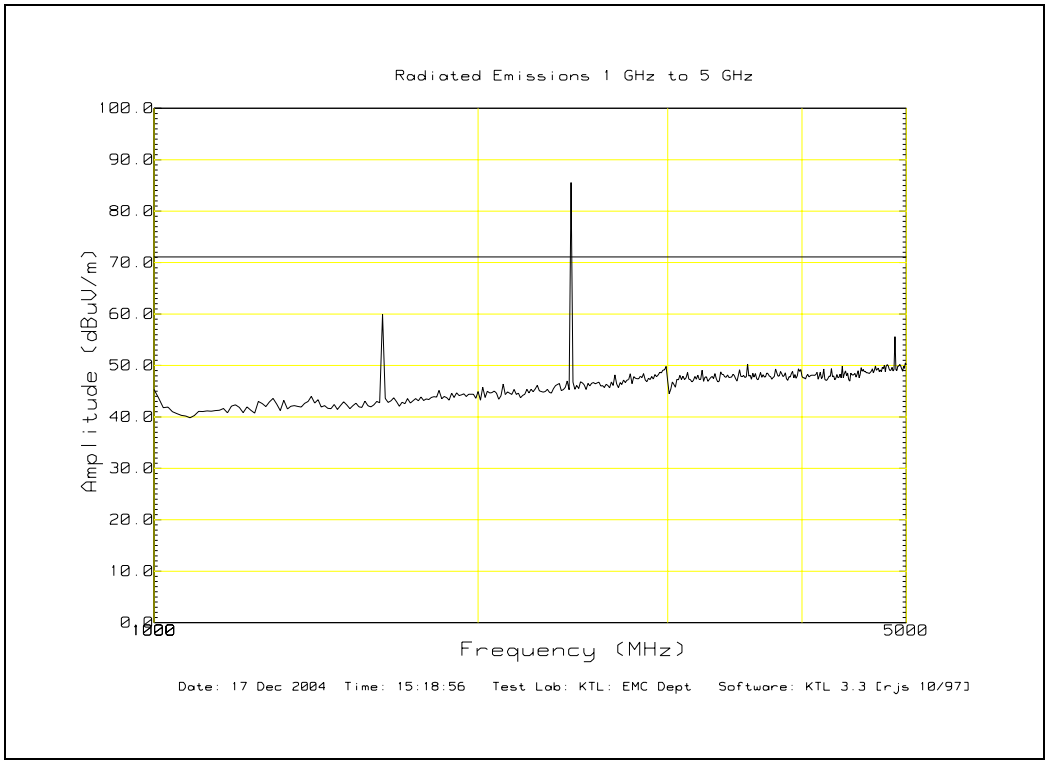


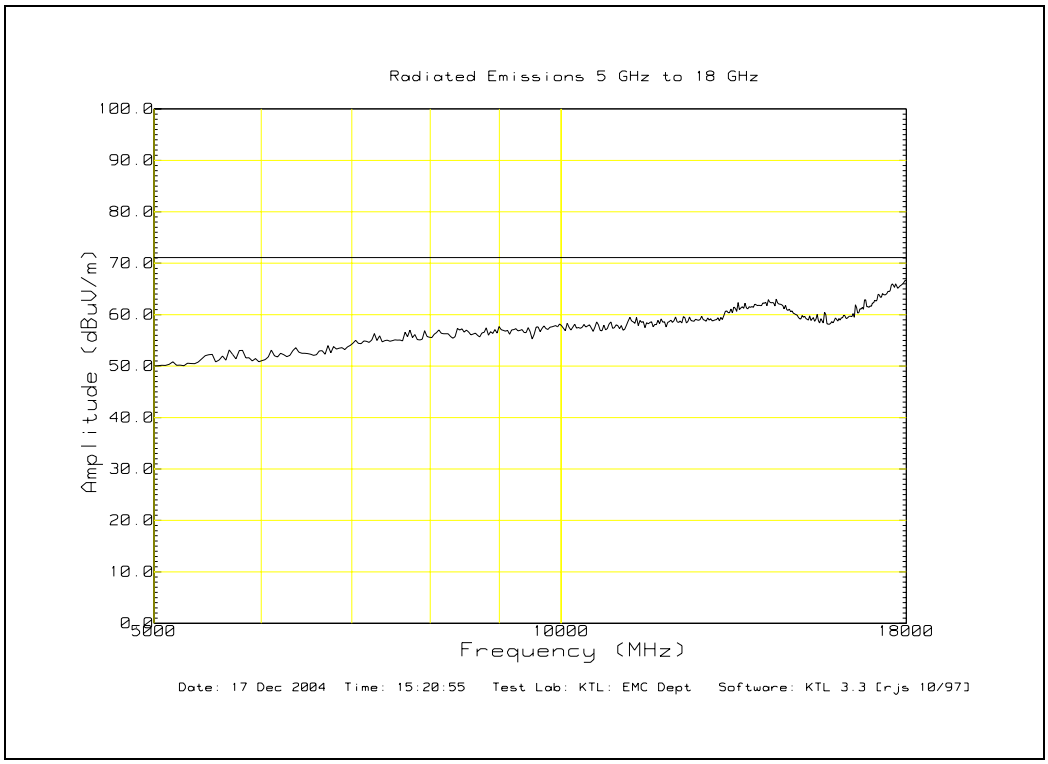
Channel repetition time

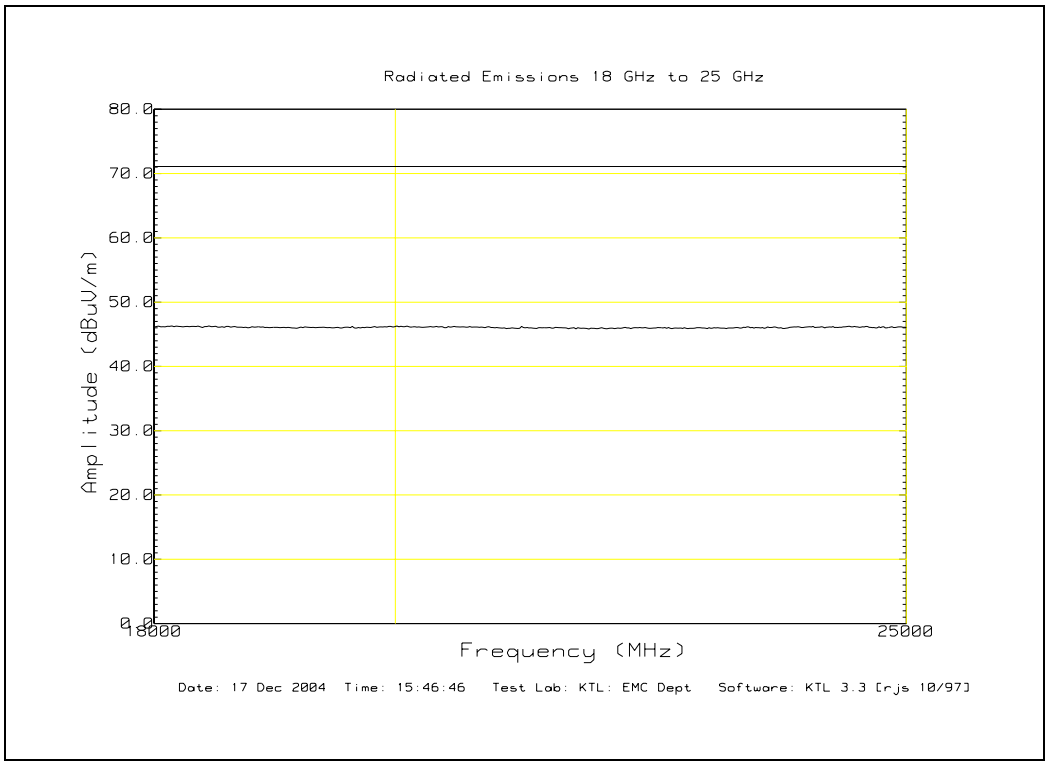

Radiated Emissions 16 MHz to 30 MHz
Amplitude (dBuV/m)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
16
30
Frequency (MHz)
Date: 17 Dec 2004 Time: 15:48:58 Test Lab: KTL: EMC Dept Software: KTL 3.3 [rjs 10/97]

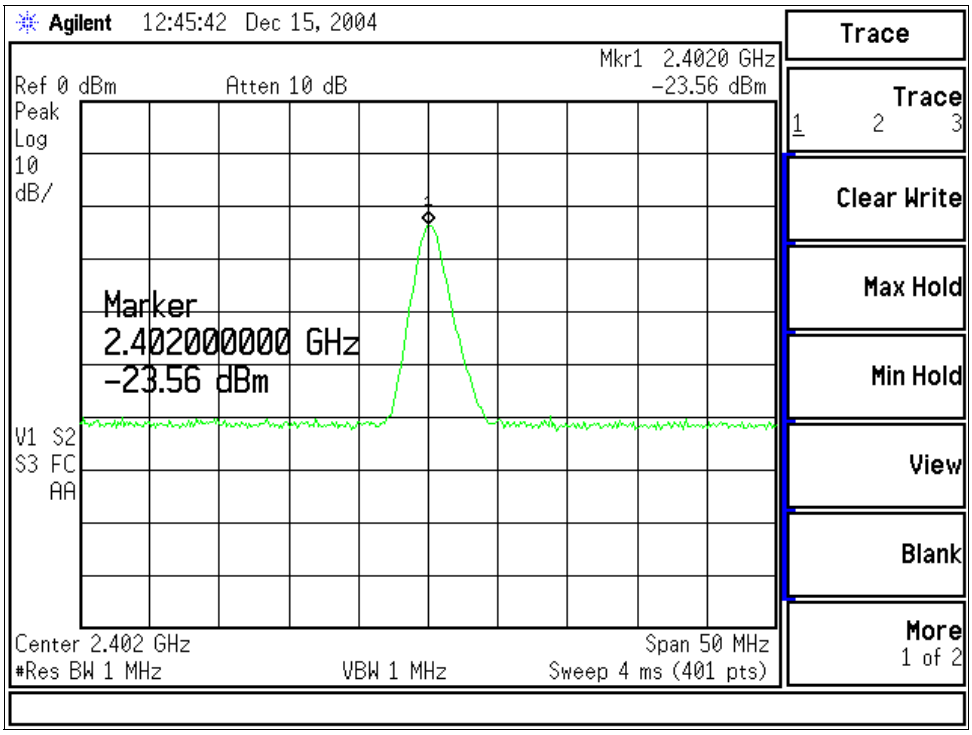

Radiated Emissions 30 MHz to 200 MHz
Amplitude (dBuV/m)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
30
100
200
Frequency (MHz)
Date: 17 Dec 2004 Time: 15:10:37 Test Lab: KTL: EMC Dept Software: KTL 3.3 [rjs 10/97]


Radiated Emissions 200 MHz to 1 GHz
Amplitude (dBuV/m)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
200
1000
Frequency (MHz)
Date: 17 Dec 2004 Time: 15:14:15 Test Lab: KTL: EMC Dept Software: KTL 3.3 [rjs 10/97]

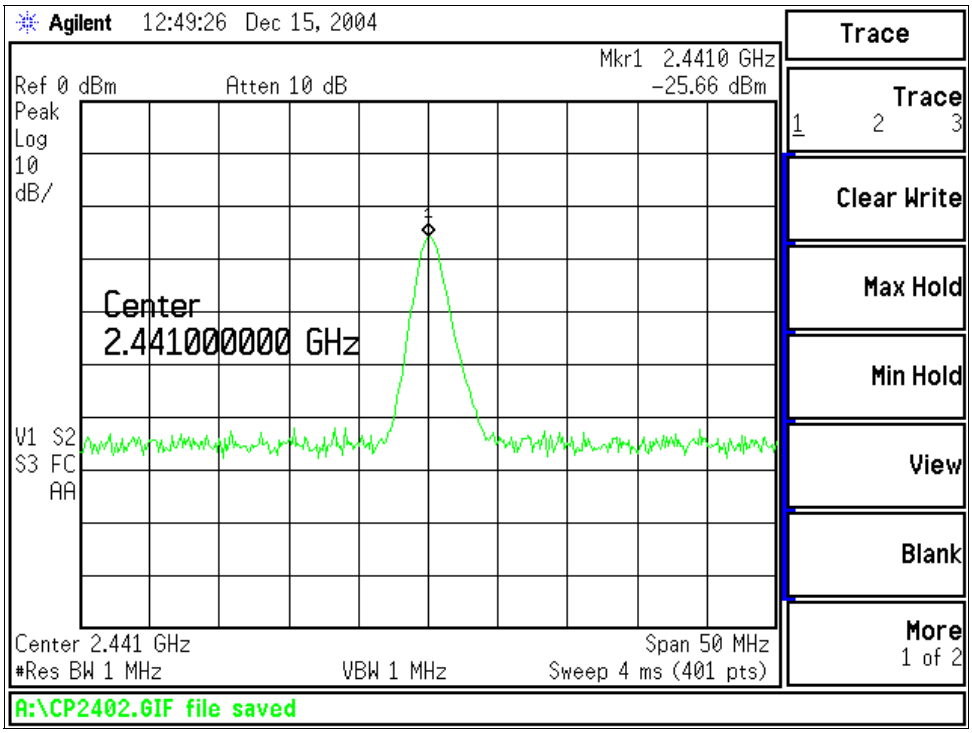

Radiated Emissions 1 GHz to 5 GHz
Amplitude (dBuV/m)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
1000
5000
Frequency (MHz)
Date: 17 Dec 2004 Time: 15:18:56 Test Lab: KTL: EMC Dept Software: KTL 3.3 [rjs 10/97]


Radiated Emissions 5 GHz to 18 GHz
Amplitude (dBuV/m)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
5000
10000
18000
Frequency (MHz)
Date: 17 Dec 2004 Time: 15:20:55 Test Lab: KTL: EMC Dept Software: KTL 3.3 [rjs 10/97]

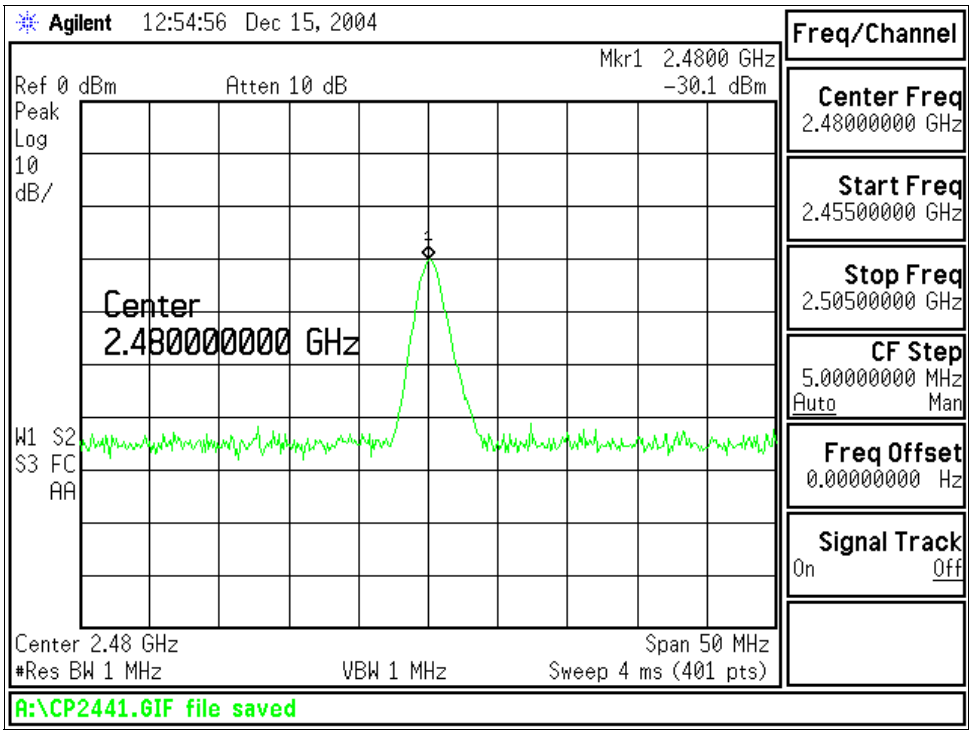

Radiated Emissions 18 GHz to 25 GHz
Amplitude (dBuV/m)
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
18000
25000
Frequency (MHz)
Date: 17 Dec 2004 Time: 15:46:46 Test Lab: KTL: EMC Dept Software: KTL 3.3 [rjs 10/97]



Conducted carrier power 2.402GHz



Conducted carrier power 2.441GHz



Conducted carrier power 2.480GHz

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
S07	CSR BlueCore4 Bluetooth Module (conducted sample)	None
S13	CSR BlueCore4 Bluetooth Module	None

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

Sample No.	Description	Identification
S01	Dell Inspiron 8600 Laptop PC	Serial No. 34092423217
S03	Dell PSU Model No. AA22856	Serial No. CN-072357-16291-3B0-0308
S15	Dell Latitude D400 Laptop PC	Serial No. 28656970615
S16	Dell PSU Model No. PA-1650-05D	Serial No. CN 05U092 7161549M 444C

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	EUT transmitting on maximum power using FHSS over 79 channels with 1 MHz channel spacing using FSK Modulation

C3) EUT Configuration Information.

The EUT was submitted for testing in one single possible configuration.

C4) List of EUT Ports

The EUT was an internal RF Module with no external ports and is powered from a host PC. For the purposes of testing the EUT was fitted with cable connections to enable it to be connected directly to the measurement instruments used.

C5) Details of test equipment used

For Radiated Electric Field Emissions 16MHz to 25GHz:

RFG No	Type	Description	Manufacturer	Date Calibrated.
274	ATS	Ferrite Lined Chamber	KTL	11/05/04
231	CBL6111	Blue Bilog Antenna (0.03 - 1GHz)	Chase	10/05/00
214	ESAI	Spec Analyser/Test Rxer (LF/HF)	R & S	26/06/03
249	N-type	RF coaxial cable (Lab 10)	KTL	08/09/03
255	N-type	RF coaxial cable (Lab 10)	KTL	08/09/03
270	N-type	RF coaxial cable (Lab 10)	KTL	08/09/03

For Radiated Electric Field Emissions 1GHz to 25GHz

RFG No	Type	Description	Manufacturer	Date Calibrated
274	ATS	Ferrite Lined Chamber	KTL	16/09/03
129	3115	Horn Antenna	EMCO	29/07/98
N/A	3160-9	Horn Antenna	EMCO	19/08/02
307	HP8449B	Microwave Pre-Amp (1-26.5GHz)	HP	09/02/04
311	-	Sucoflex uW Adapter Cable 1m	Suhner	05/11/03
312	-	Sucoflex uW Adapter Cable 1m	Suhner	05/11/03
313	-	Sucoflex uW Adapter Cable 1m	Suhner	05/11/03
137	N-104	Sucoflex uW Cable 2m	Suhner	05/11/03
138	N-104	Sucoflex uW Cable 2m	Suhner	05/11/03
139	N-104	Sucoflex uW Cable 2m	Suhner	05/11/03
158	N-106	Sucoflex uW Cable 6m	Suhner	05/11/03
404	E4407B	Spectrum Analyser	Agilent	18/12/03

For conducted RF power

RFG No	Type	Description	Manufacturer	Date Calibrated
404	E4407B	Spectrum Analyser	Agilent	18/12/03

Appendix D: Additional Information

The following information is a copy of an E-Mail from the client confirming the lowest frequency used within the EUT.

We use a 16MHz oscillator/clock also.

That would be the lowest freq. generated on the module.

- MBE

-----Original Message-----
From: Ken Anderson [mailto:kanderson@ktl.com]
Sent: 02 August 2004 08:32
To: Miguel Bravo-Escos
Cc: Mark Boughen
Subject: Test report information.

Miguel,
thanks for the frequency info via Mark Boughen. However can you confirm that
no lower frequencies are used within the unit e.g. local oscillators, clocks
etc, as the FCC regulations refer to highest and lowest frequencies generated within the equipment. The highest frequency should be the highest
frequency hopping channel unless you know different.

Regards

Ken

K J Anderson
Senior EMC Engineer

E-mail: kanderson@ktl.com

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Saxon Way
Priory Park West
Hull HU13 9PB
Tel: +44 (0) 1482 801801
Fax: +44 (0) 1482 801806

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We cannot accept any liability for any loss or damage sustained as a result of software
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Please note we reserve the right to monitor all e-mail communication through our internal and external networks.

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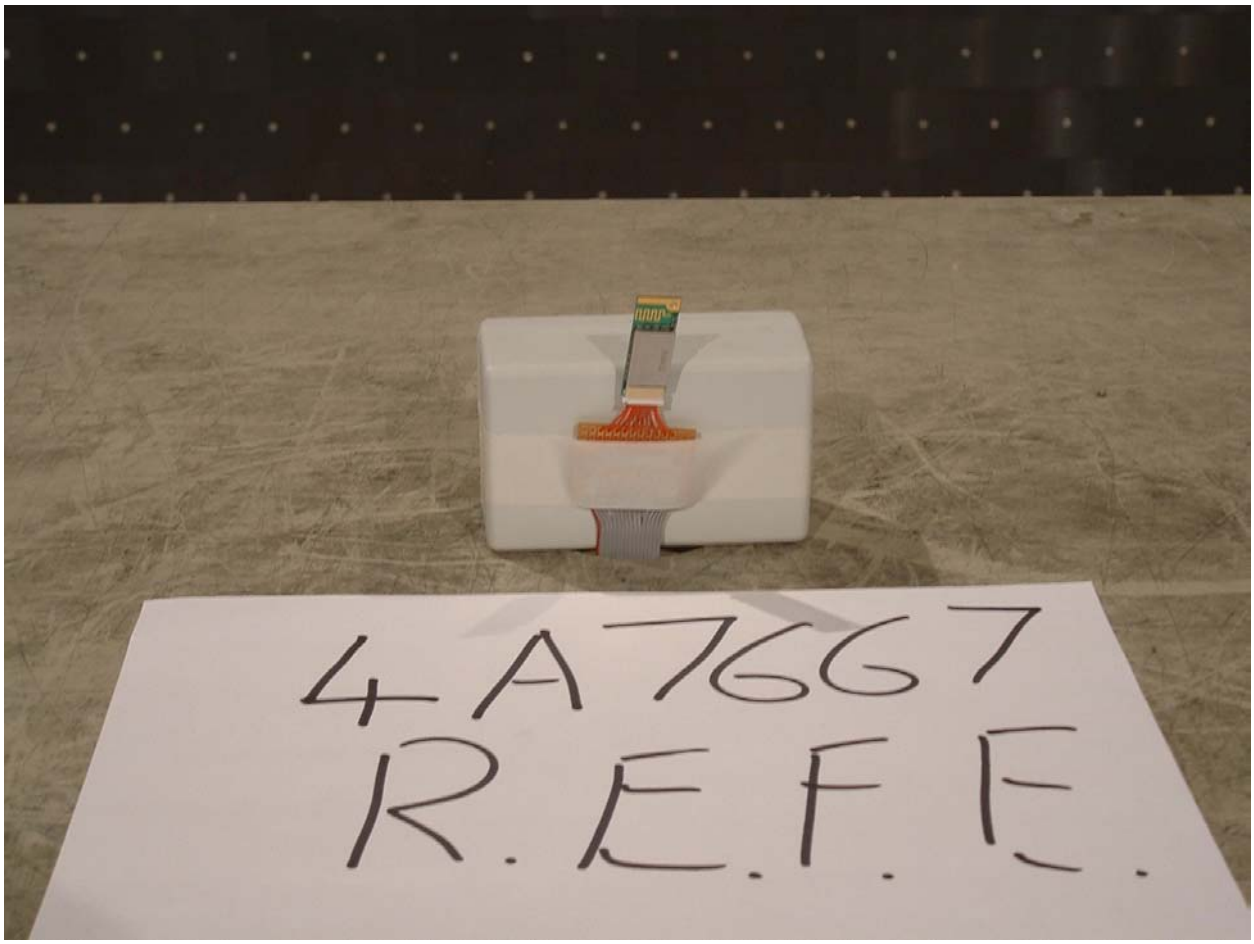
Registered Office: KTL, Saxon Way, Priory Park West, Hull, HU13 9PB,UK.
Tel (01482) 801801 Fax (01482) 801806 Email: info@ktl.com Website Address www.ktl.com

Appendix E: Photographs and Figures

The following photographs were taken of the test samples:

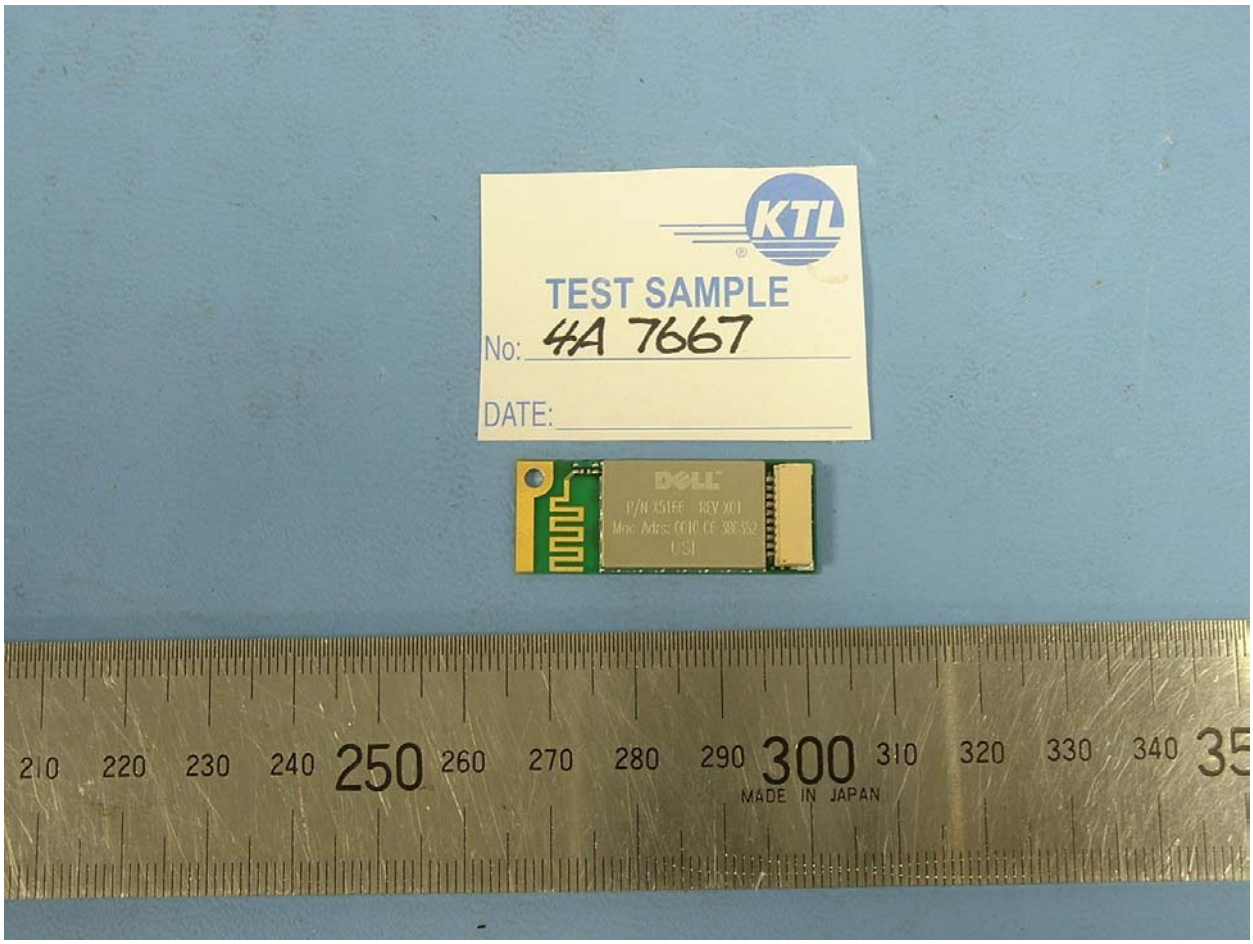
1. Radiated electric field emissions arrangement: front view.
2. Radiated electric field emissions arrangement: close up view
3. AC power line emissions arrangement.
4. Sample RF Module Top View
5. Sample RF Module Bottom View
6. Sample RF Module Top View: Test Fixture
7. Sample RF Module Bottom View: Test Fixture

Photograph 1

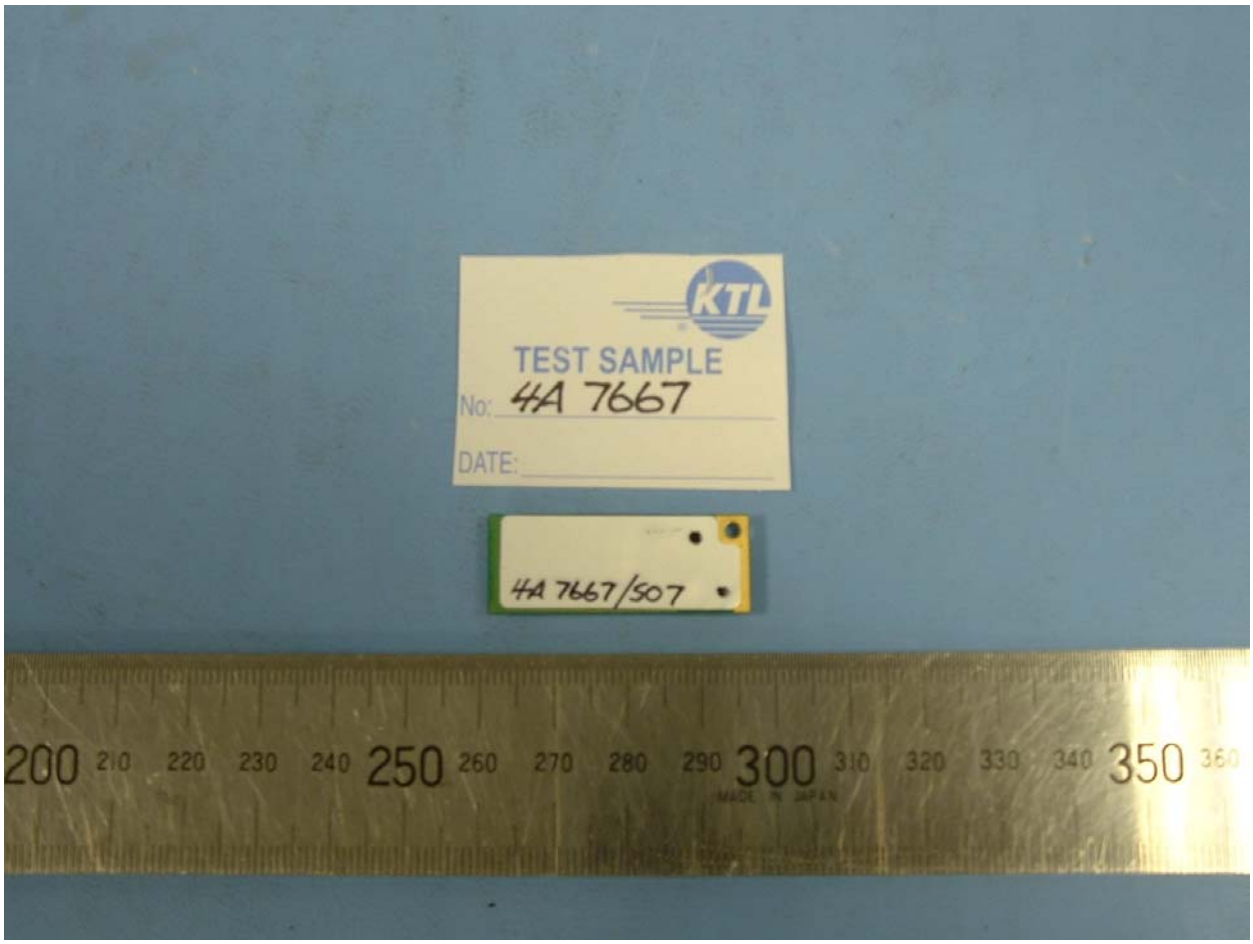


Photograph 2

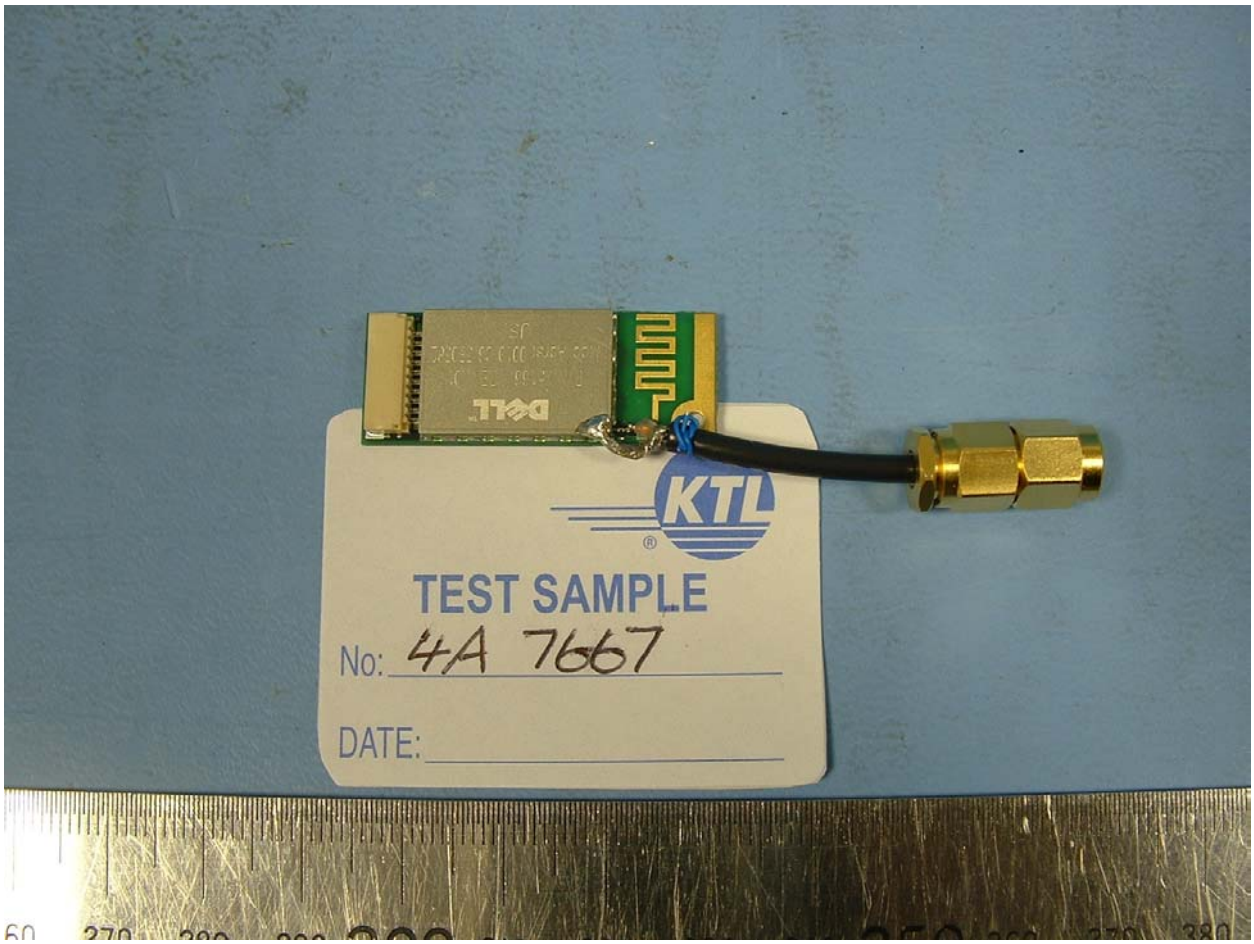
Photograph3



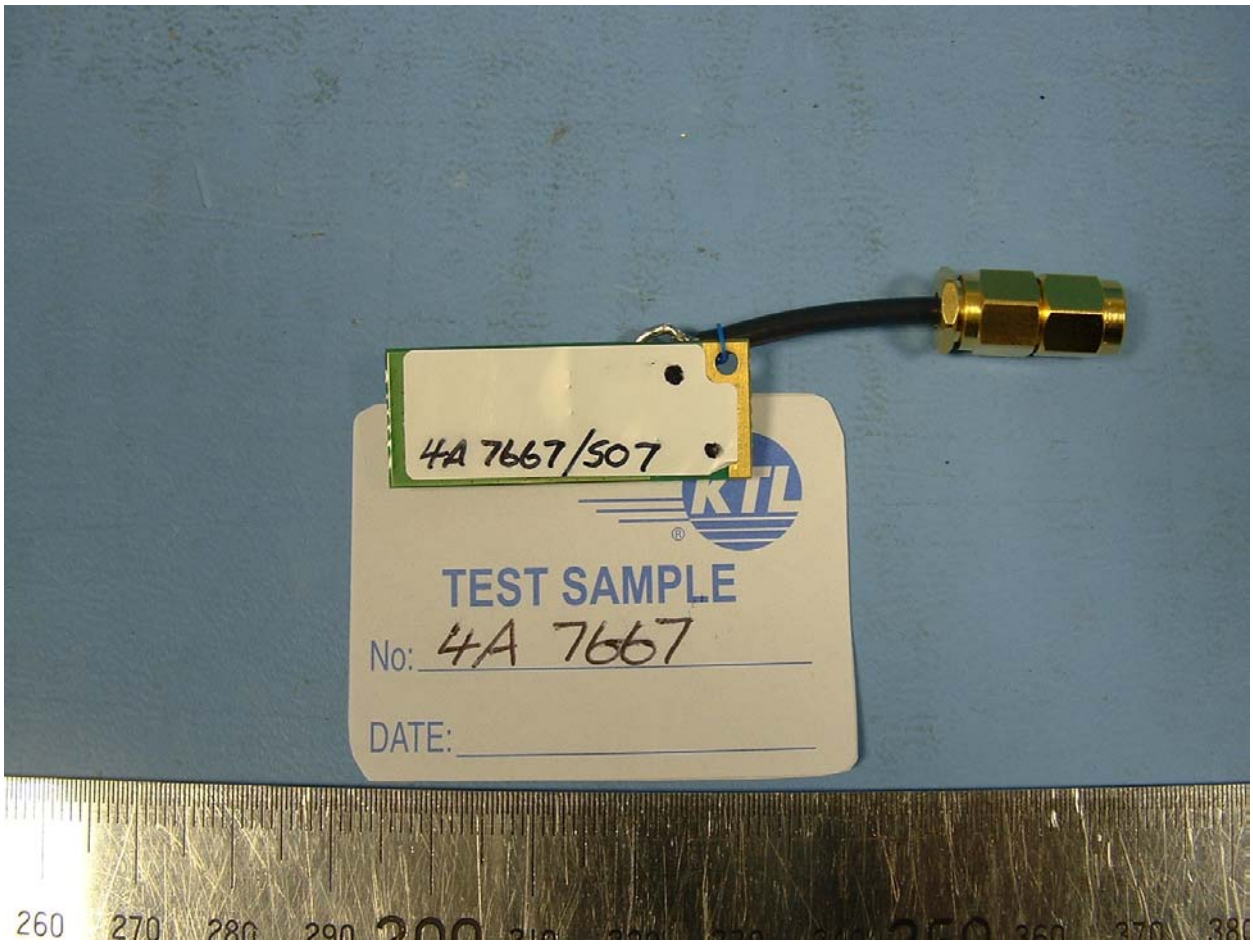
Photograph 4



Photograph 5



Photograph 6



Photograph 7