FCC Part 15
Certification Report

for the

Gemini Data Logger (UK) Limited

TinyTag Logger TGRF-3xxx-C
(917.8 MHz)

Project Engineer: R. P. St John James

Approval Signatory

Approved signatories: S. M. Connolly ☑ J. A. Jones ☐

The above named are authorised Hursley EMC Services engineers.

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Contents

Document History

Issue#1: 17th December 2010 was withdrawn and replaced by Issue#2: Field Strength calculation Examples added.

1.0 DECLARATION

1.1 Statement of Compliance

The Equipment Under Test (EUT), as described and reported within this document, complies with the Part 15 of the FCC CFR 47 regulations. The EUT operates at a frequency of 917.8 MHz and complies with the emission requirements.

Note: The EUT is a battery-operated device and therefore only radiated emission measurements were performed in the frequency range 30.0 MHz to 10.0 GHz.

1.2 Related Submittal(s)

This is a single application for certification of a 917.8 MHz Transmitter.

Note: The receiver used with the system complies with FCC Part 15B limits for Digital Equipment (unintentional transmitters).

1.3 EUT Manufacturer

Trade name:	TinyTag Loggers
Manufacturer name:	Gemini Data Loggers (UK) Limited Scientific House Terminus Road Chichester PO19 8UJ United Kingdom
Company representative:	Mr Mike Millen Tel: +44 (0) 1243 813000

2.0 EUT DESCRIPTION

2.1 Identity

EUT: TinyTag Logger s/n 597256
Model: TGRF-3xxx-C

The TinyTag Transmitter (s/n 597256) was configured to transmit continuously and was used for the transmit power and spurious emission tests. A second TinyTag Transmitter (s/n 597255) was configured not to transmit (standby mode).

Sample build: Prototype

2.2 Product Operation

The TinyTag Logger measures and records temperature from temperature probes connected to it. At preset intervals (minutes or hours) the logger transmits the recorded data to a receiver connected to a computer where the data is collated and recorded.

2.3 Support Equipment

None: tested stand-alone.

2.4 Exerciser Program

For the purposes of measurement the EUT was configured to repeatedly transmit. In normal operations the transmitter will only transmit infrequently for short periods (<1s).

Before the start of the tests the transmitter was fitted with a new alkaline battery.

3.0 MEASUREMENT PROCEDURE AND INSTRUMENTATION

3.1 EMI Site Address & Test Date

EMI Company Offices	Hursley EMC Services Ltd Unit 16, Brickfield Lane, Chandlers Ford, Hampshire
EMI Measurement Site	Hursley EMC Services Ltd Hursley Park, Winchester; FCC & Industry Canada Registered
Test Date	9th and 15th November & 14th December 2010*

*The EUT was with the customer between 15th November and 13th December 2010.

3.2 General Operating Conditions

Testing was performed according to the procedures in ANSI C63.4:2003. Final radiated testing was performed at an EUT to antenna distance of three metres.

Instrumentation, including receiver and spectrum analyser bandwidth, comply with the requirements of ANSI C63.2:1996.

3.3 Radiated Emissions

Initial Scan

A radiated profile scan was taken at a three metre distance on eight azimuths of the system under test in both vertical and horizontal polarities of the antenna in a semi-anechoic chamber. Instrumentation used in the chamber as below:

Computer	Animal Systems PC
Spectrum analyser	Hewlett Packard 8593EM, 30 to 1000 MHz range in peak hold mode Hewlett Packard 8593EM, >1.0 GHz, 1.0 MHz bandwidth, average and peak detector
Pre-amplifier	Hewlett Packard 8447D, 30 to 1000 MHz Hewlett Packard 8449B, 1.0 to 26.5 GHz
Antennae	Chase CBL6140 Bilog Schwarzbeck BBHA9120B Horn, 1.0 to 10.0 GHz
Cable	Sucoflex, 18GHz SMA-N

The data obtained from the profile scan was used as a guide for the final Open Area Test Site (OATS) measurements.

Final Measurements

The system under test was transferred to the OATS from the semi-anechoic chamber. The data obtained from the chamber profile-scan was used to guide the test engineer. Each emission from the transmitter was maximised by revolving the system on the turntable and moving the antennae in height and azimuth. The worst-case data is presented in this report. Test instrumentation used in the OAT's measurements was as follows:

Computer	Animal Systems PC
Spectrum analyser	Hewlett Packard 8593EM, >1.0 GHz, 1.0 MHz bandwidth, average & peak detector
Pre-amplifier	Hewlett Packard 8449B, 1.0 to 26.5GHz
Receiver	Rohde & Schwarz Model ESVP 30-1000MHz set to CISPR Quasi-Peak
Antennae	Schwarzbeck VULB 9163, 30 to 1000 MHz Schwarzbeck BBHA9120B Horn, 1.0 to 10.0 GHz
Cable	Sucoflex, 18GHz SMA-N

3.4 Conducted Emissions

Note: The transmitter is battery powered therefore the conducted emissions test does not apply.

3.5 Environmental Ambient

Test Type	Temperature	Humidity	Atmospheric Pressure
Radiated	21 to 22 degrees Celsius	36 to 39% relative	972 to 1000 millibars

3.6 EMC Test Equipment

#ID	CP	Manufacturer	Type	Serial Nø	Description	Calibration due date
009	1	HP	8447D	1937A01808	Pre-amplifier (30-1000MHz)	28/06/2011
013	LAB	Schaffner	CBL6140A	1235	Antenna X-wing (20-2000MHz)	Internal
033	1	HP	8593EM	3726U00203	Spectrum analyser (9kHz-26.5GHz)	15/03/2011
040	1	HP	8593EM	3536A00137	Spectrum analyser (9kHz-26.5GHz)	29/04/2011
053	1	HP	8449B	3008A01394	Pre-amplifier (1.0-26.5GHz)	15/03/2011
070	1	HP+short cable	8449B	3008A00481	Pre-amplifier (1.0-26.5GHz) + 0.5m cable	08/11/2011
073	3	Schwarzbeck	BBHA9120B	237	Horn antenna (1-10GHz)	17/06/2013
092	2	Schwarzbeck	VULB 9163	232 (grey)	Trilog antenna (30-3000MHz)	03/08/2011
127	3	Schwarzbeck	BBHA9120B	391	Horn antenna (1-10GHz)	15/12/2012
261	1	Rohde Schwarz	ESVP	892322/015	Test receiver (30-1300MHz)	28/05/2011

CP = Interval period [year] prescribed for external calibrations

Note: 'Calibration due date' means that the instrument is certified with a UKAS or traceable calibration certificate. 'Internal' means internally calibrated using HEMCS procedures

3.7 Field Strength Calculation Examples

The actual values given in the following tables have been corrected for transducer losses and gains using the following formulae. The cable factors, antenna factors and amplifier gain are obtained from tables of calibrated data associated with each instrument.

For 30-1000MHz ; At each frequency the maximum receiver reading (Rx) plus the Cable Loss (C) plus the Antenna Factor (Af) equals the Actual Quasi Peak Value (E) in dB microvolt per metre.

Rx + C +Af = E (dBµV/m)

So for example at 221.190MHz

E = 18+10.8+1.7 = 30.5 dBµV/m where C= 1.7dB, AF=10.8dB and Rx=18dB

For 1-40GHz ; At each frequency the maximum analyser reading (Rx) plus the Cable Loss (C) plus the Antenna Factor (Af) less the amplifier gain (G) equals the Peak or Average Value (E) in dB microvolt per metre.

Rx + C +Af - G = E (dBµV/m)

So for example at 2.753GHz

E = 55.7+26.7+2.7 - 38 = 47.1 dBµV/m where C= 2.7dB, AF=26.7dB, G=38dB and Rx=55.7dB

4.0 TEST DATA

4.1 Transmitter – Radiated Emissions

A search was made of the frequency spectrum from 30.0 MHz to 10.0 GHz and the measurements reported are the highest emissions relative to the FCC CFR 47 Section 15.249 limits at a measuring distance of three metres.

	Actual quasi-peak value	Specified limit	
Frequency	**@ 3m**	**@3m**	
MHz	**dBµV/m**	**dBµV/m**	**µV/m**
60.204	20.2	40.0	100
69.959	11.2	40.0	100
127.132	16.6	43.5	150
131.156	26.6	43.5	150
133.500	25.5	43.5	150
135.692	25.3	43.5	150
139.414	20.4	43.5	150
191.706	26.4	43.5	150
221.190	30.5	46.0	200
*917.796	93.3	94.0	50,000

*917.796 was the recorded transmitter frequency.

	Actual average value	Specified average limit	
Frequency	**@ 3m**	**@3m**	
GHz	**dBµV/m**	**dBµV/m**	**µV/m**
2.753	47.1	54.0	500

	Actual peak value	Specified peak limit	
Frequency	**@ 3m**	**@3m**	
GHz	**dBµV/m**	**dBµV/m**	**µV/m**
2.753	53.9	74.0	5,000

Procedure: In accordance with ANSI C63.4:2003.

Measurements below 1.0 GHz performed with a quasi-peak detector. Measurements above 1.0 GHz performed with an average and peak detector.

TEST ENGINEER: Rob St John James

Test Data (continued)

4.2 Transmitter (Standby) – Radiated Emissions

	Actual Quasi-peak value	Specified average limit	
Frequency	@ 3m	@3m	
MHz	dBμV/m	dBμV/m	μV/m
128.809	15.8	43.5	150
132.280	10.1	43.5	150
191.703	21.1	43.5	150
221.174	22.3	46.0	200
250.691	22.1	46.0	200
917.883	34.4	46.0	200

Procedure: In accordance with CNS 13438.

Measurements below 1.0 GHz performed with a quasi-peak detector. Measurements above 1.0 GHz performed with an average and peak detector.

4.3 Modulation Bandwidth

Section 15.249

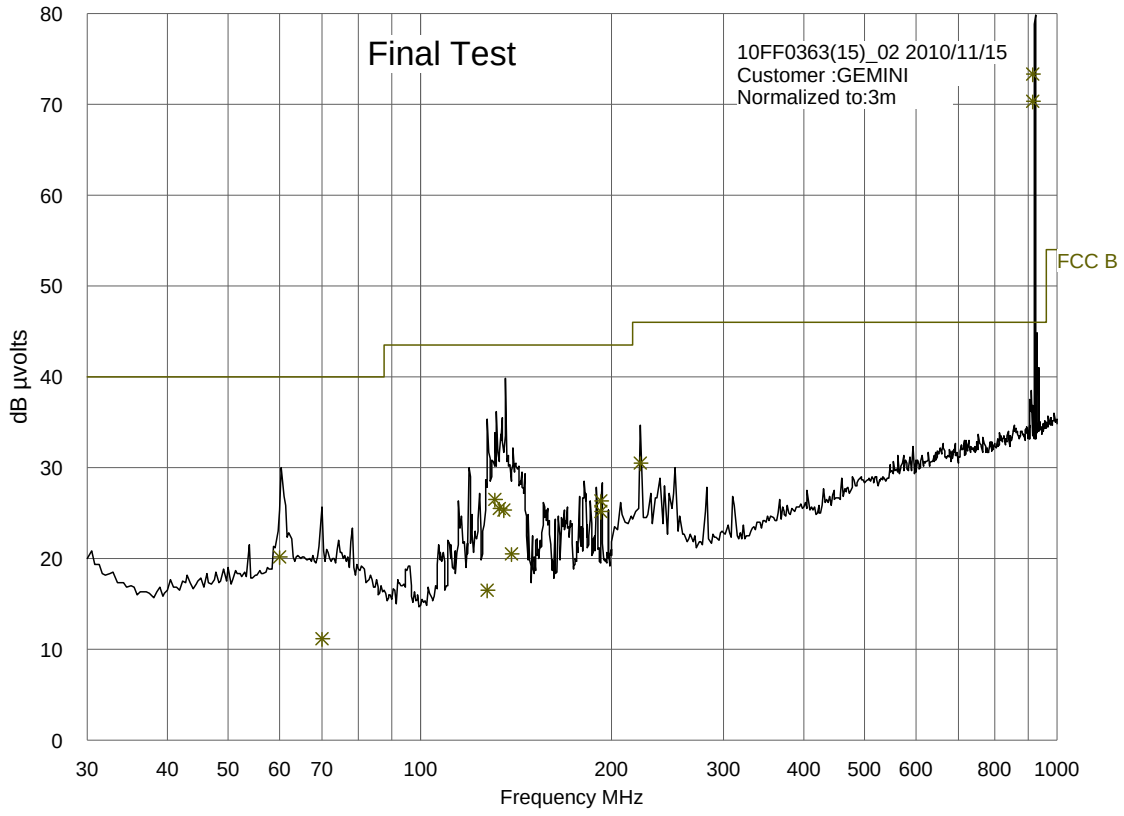
A small loop antenna was placed in a jig under the Transmitter; the output from the loop antenna was fed via a 10 dB attenuator into the input of the spectrum analyzer. The bandwidth of the transmitter was measured at the point at which the waveform envelope was 20 dB below the modulated carrier peak.

The bandwidth of the 917.8 MHz Transmitter was measured as less than 153 kHz

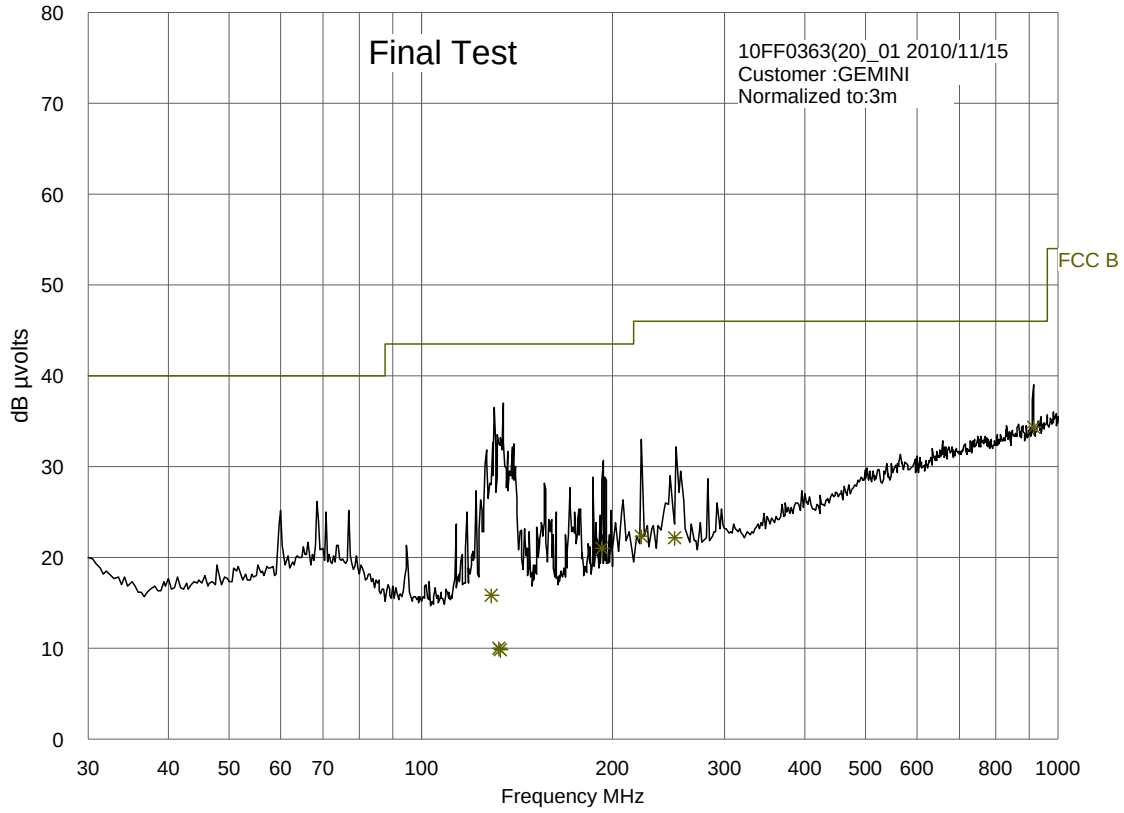
The limit is 0.25% of the transmitter frequency which equates to 2.295 MHz.

5.0 TEST PLOTS

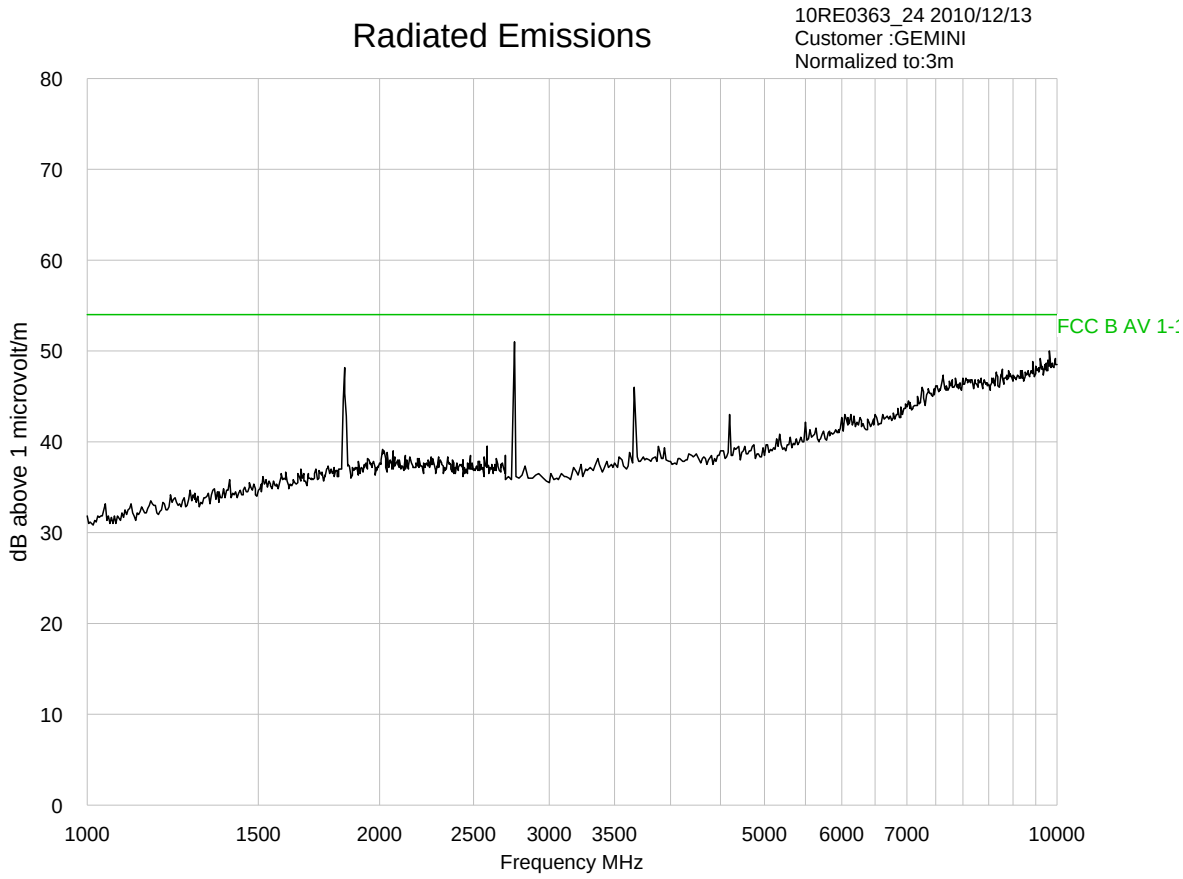
5.1 Transmitter Emission Plot, 30 to 1000 MHz



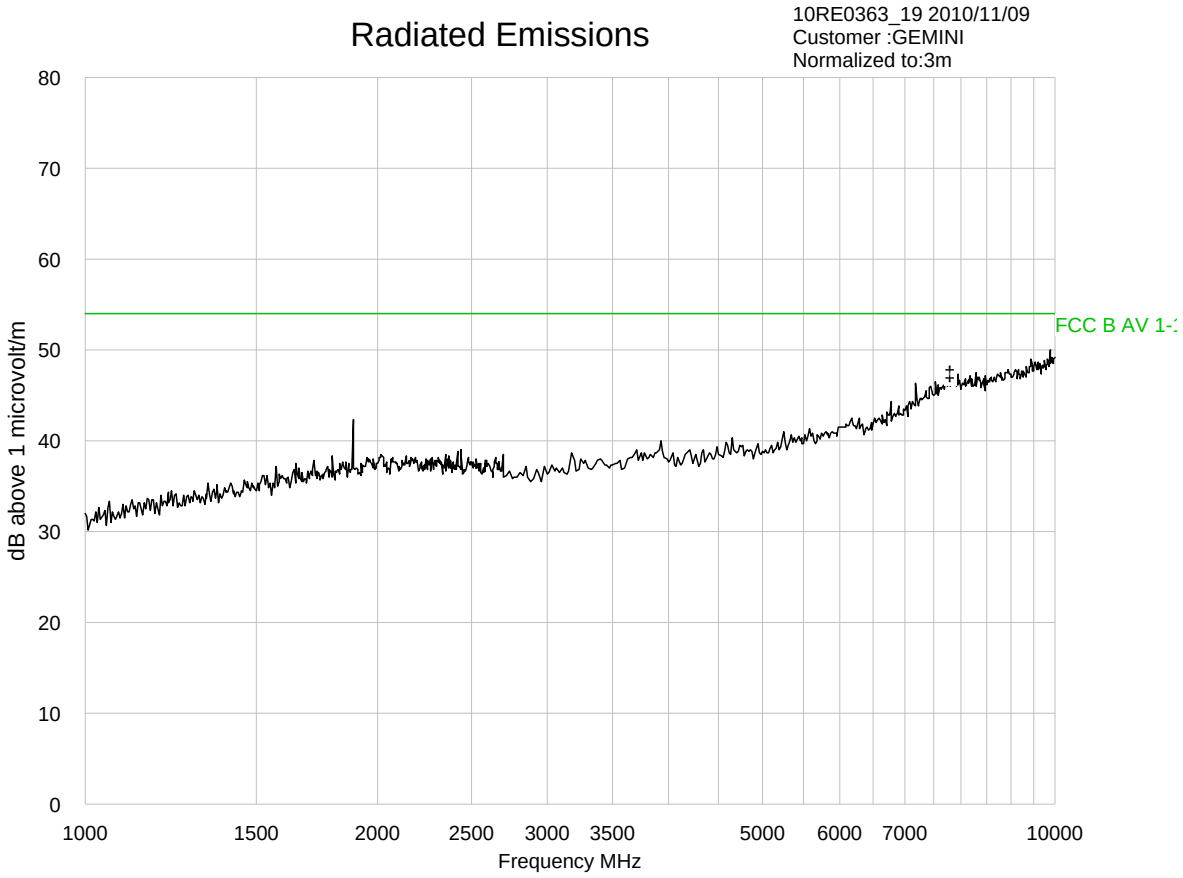
5.2 Transmitter Emissions (Standby) Plot, 30 to 1000 MHz



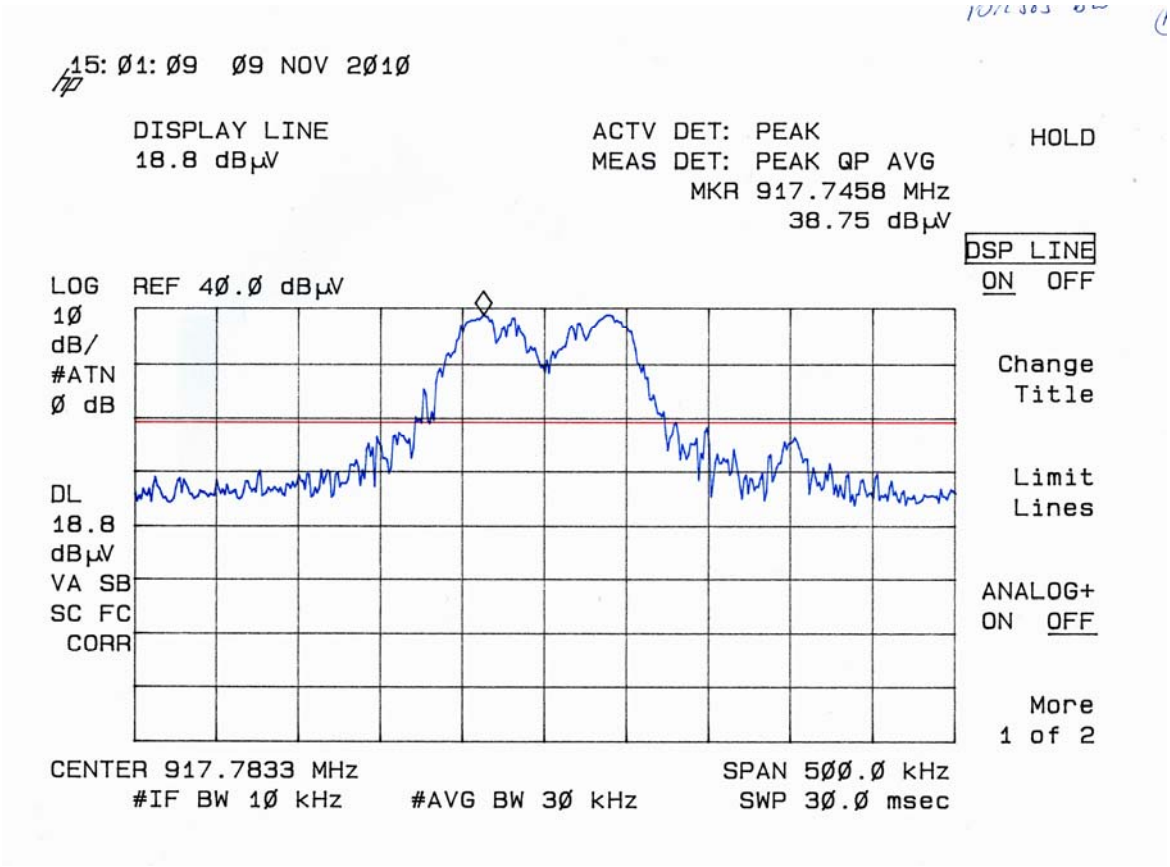
5.3 Transmitter Emissions Plot, 1.0 to 10.0 GHz



5.4 Transmitter Emission (Standby) plot, 1.0 to 10.0 GHz



5.5 Bandwidth Plot



6.0 PHOTO LOG

Open area test site measurements with Trilog Antenna

7.0 FCC LETTER

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

February 13, 2006

Hursley EMC Services Ltd.
Unit 16
Brickfield Lane
Chandlers Ford - Hampshire, SO53 4DB
United Kingdom
Attention: R P St John James

Re: Accreditation of Hursley EMC Services Ltd.
Designation Number: UK0006

Dear Sir or Madam:

We have been notified by Department of Trade and Industry (DTI) that Hursley EMC Services Ltd. has been accredited as a Conformity Assessment Body (CAB).

At this time your organization is hereby designated to perform compliance testing on equipment subject to Declaration Of Conformity (DOC) and Certification under Parts 15 and 18 of the Commission's Rules.

This designation will expire upon expiration of the accreditation or notification of withdrawal of designation.

Sincerely,

Thomas Phillips
Electronics Engineer

EU Notified Body
FCC & VCCI Registered
BSMI Lab ID: SL2-IN-E-3008

FCC Part 15 Report

for the

Gemini Data Logger (UK) Limited

TinyTag Logger TGRF-3xxx-C (Receiver)

Project Engineer: R. P. St John James

Approval Signatory

Approved signatories: S. M. Connolly ☑ J. A. Jones ☐

The above named are authorised Hursley EMC Services engineers.

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Document History

Issue#1: 17th December 2010 was withdrawn and replaced by Issue#2: Field Strength calculation Examples added.

1.0 DECLARATION

1.1 Statement of Compliance

The Equipment Under Test (EUT), as described and reported within this document, complies with the Part 15 of the FCC CFR 47 regulations and the Industry Canada RSS-210 & RSS-GEN specifications. The EUT operates at a frequency of 917.8 MHz and complies with the emission requirements.

1.2 Related Submittal(s)

The TinyTag Logger receiver connects to a PC via a USB to Serial cable and as such comes under Part 15B of the FCC CFR 47 regulations. The TinyTag Logger also receives radio data from nearby transmitters operating at 917.8MHz which also brings it under Part 15C of the FCC CFR 47 regulation

The transmitter part of the system complies with FCC Part 15C limits for radio equipment (see report 10R363 CFR for details).

1.3 EUT Manufacturer

Trade name:	TinyTag Loggers
Manufacturer name:	Gemini Data Loggers (UK) Limited Scientific House Terminus Road Chichester PO19 8UJ United Kingdom
Company representative:	Mr Mike Millen Tel: +44 (0) 1243 813000

2.0 EUT DESCRIPTION

2.1 Identity

EUT:	TinyTag Logger Model: TGRF-3xxx-C	s/n 583003
Sample build:	Prototype	

2.2 Product Operation

The TinyTag Logger measures and records temperature from temperature probes connected to it. At preset intervals (minutes or hours) the logger transmits the recorded data to a receiver connected to a computer where the data is collated and recorded.

2.3 Support Equipment

The receiver was tested connected to a laptop. The laptop was a Dell Inspiron 8000 (s/n 105-827-990-59) powered from a Dell 9364 Power Supply (s/n CN-09364V-12761-090-6288).

2.4 Exerciser Program

Proprietary software called "TinyTag Explorer" was run on the laptop which communicated and collected data from the TinyTag Logger receiver.

3.0 MEASUREMENT PROCEDURE AND INSTRUMENTATION

3.1 EMI Site Address & Test Date

EMI Company Offices	Hursley EMC Services Ltd Unit 16, Brickfield Lane, Chandlers Ford, Hampshire
EMI Measurement Site	Hursley EMC Services Ltd Hursley Park, Winchester; FCC & Industry Canada Registered
Test Date	9th and 15th November 2010

3.2 General Operating Conditions

Testing was performed according to the procedures in ANSI C63.4:2003. Final radiated testing was performed at an EUT to antenna distance of three metres.

Instrumentation, including receiver and spectrum analyser bandwidth, comply with the requirements of ANSI C63.2:1996.

3.3 Radiated Emissions

Initial Scan

A radiated profile scan was taken at a three metre distance on eight azimuths of the system under test in both vertical and horizontal polarities of the antenna in a semi-anechoic chamber. Instrumentation used in the chamber as below:

Computer	Animal Systems PC
Spectrum analyser	Hewlett Packard 8568B, 30 to 1000 MHz range in peak hold mode Hewlett Packard 8593EM, >1.0 GHz, 1.0 MHz bandwidth, average and peak detector
Pre-amplifier	Hewlett Packard 8447D, 30 to 1000 MHz Hewlett Packard 8449B, 1.0 to 26.5 GHz
Antennae	Chase CBL6140 Bilog Schwarzbeck BBHA9120B Horn, 1.0 to 10.0 GHz
Cable	Sucoflex, 18GHz SMA-N

The data obtained from the profile scan was used as a guide for the final Open Area Test Site (OATS) measurements.

Final Measurements

The system under test was transferred to the OATS from the semi-anechoic chamber. The data obtained from the chamber profile-scan was used to guide the test engineer. Each emission from the transmitter was maximised by revolving the system on the turntable and moving the antennae in height and azimuth. The worst-case data is presented in this report. Test instrumentation used in the OAT's measurements was as follows:

Computer	Animal Systems PC
Spectrum analyser	Hewlett Packard 8593EM, >1.0 GHz, 1.0 MHz bandwidth, average & peak detector
Pre-amplifier	Hewlett Packard 8449B, 1.0 to 26.5GHz
Receiver	Rohde & Schwarz Model ESVP 30-1000MHz set to CISPR Quasi-Peak
Antennae	Schwarzbeck VULB 9163, 30 to 1000 MHz Schwarzbeck BBHA9120B Horn, 1.0 to 10.0 GHz
Cable	Sucoflex, 18GHz SMA-N

3.4 Conducted Emissions

Test Configuration

A filtered 115V/60Hz supply was fed to the system under test, via a 50Ω/50µH Line Impedance Stabilisation Network (LISN). The LISN was directly bonded to a conductive ground plane.

Test Measurement

The worst-case emissions were identified on both the neutral and phase(s) with a spectrum analyser set to scan from 0.15 MHz to 30 MHz.

The worst-case peaks were then identified and measured using an RF receiver using a quasi-peak detector and compared to the frequency range and limits of CISPR 22 as specified by ANSI C63.4-2003. Quasi-peak values that exceeded the average limit were then re-measured using the average signal detector.

The worst-case results are presented in this report.

Test instrumentation used in the conducted test was as follows:

#ID	CP	Manufacturer	Type	Serial No	Description	Calibration due date
004	1	Rohde Schwarz	ESH-3	893607/002	Test receiver (9kHz-30MHz)	03/06/2011
010	1	HP	8568B	2601A02322	Spectrum analyser	27/11/2010
239	1	Rohde Schwarz	ENV216	100016	AMN - single phase	17/05/2011

CP = Interval period [year] prescribed for external calibrations

Note: 'Calibration due date' means that the instrument is certified with a UKAS or traceable calibration certificate.

3.5 Environmental Ambient

Test Type	Temperature	Humidity	Atmospheric Pressure
Radiated	21 to 22 degrees Celsius	36 to 39% relative	972 to 1000 millibars

3.6 EMC Test Equipment

#ID	CP	Manufacturer	Type	Serial Nø	Description	Calibration due date
004	1	Rohde Schwarz	ESH-3	893607/002	Test receiver (9kHz-30MHz)	03/06/2011
009	1	HP	8447D	1937A01808	Pre-amplifier (30-1000MHz)	28/06/2011
010	1	HP	8568B	2601A02322	Spectrum analyser	27/11/2010
013	LAB	Schaffner	CBL6140A	1235	Antenna X-wing (20-2000MHz)	Internal
040	1	HP	8593EM	3536A00137	Spectrum analyser (9kHz-26.5GHz)	29/04/2011
070	1	HP+short cable	8449B	3008A00481	Pre-amplifier (1.0-26.5GHz) + 0.5m cable	08/11/2011
073	3	Schwarzbeck	BBHA9120B	237	Horn antenna (1-10GHz)	17/06/2013
092	2	Schwarzbeck	VULB 9163	232 (grey)	Trilog antenna (30-3000MHz)	03/08/2011
239	1	Rohde Schwarz	ENV216	100016	AMN - single phase	17/05/2011
261	1	Rohde Schwarz	ESVP	892322/015	Test receiver (30-1300MHz)	28/05/2011

CP = Interval period [year] prescribed for external calibrations

Note: 'Calibration due date' means that the instrument is certified with a UKAS or traceable calibration certificate. 'Internal' means internally calibrated using HEMCS procedures

3.7 Field Strength Calculation Examples

The actual values given in the following tables have been corrected for transducer losses and gains using the following formulae. The cable factors, antenna factors and amplifier gain are obtained from tables of calibrated data associated with each instrument.

For 30-1000MHz ; At each frequency the maximum receiver reading (Rx) plus the Cable Loss (C) plus the Antenna Factor (Af) equals the Actual Quasi Peak Value (E) in dB microvolt per metre.

Rx + C +Af = E (dBµV/m)

So for example at 433.948MHz

E = 8.6+16.4+2.6 = 27.6 dBµV/m where C= 2.6dB, AF=16.4dB and Rx=8.6dB

For 1-40GHz ; At each frequency the maximum analyser reading (Rx) plus the Cable Loss (C) plus the Antenna Factor (Af) less the amplifier gain (G) equals the Peak or Average Value (E) in dB microvolt per metre.

Rx + C +Af - G = E (dBµV/m)

So for example at 1.882GHz

E = 49.6+26.3+2.2– 38.5=39.6 dBµV/m where C= 2.2dB, AF=26.3dB, G=38.5dB and Rx=49.6dB

4.0 TEST DATA

4.1 Radiated Emissions

A search was made of the frequency spectrum from 30.0 MHz to 10.0 GHz and the measurements reported are the highest emissions relative to the FCC CFR 47 Part 15 limits at a measuring distance of three metres.

	Actual quasi-peak value	Specified limit	
Frequency	@ 3m	@3m	
MHz	dBµV/m	dBµV/m	µV/m
33.457	25.7	40.0	100
44.426	19.0	40.0	100
70.625	11.6	40.0	100
129.009	16.0	43.5	150
321.249	25.4	46.0	200
433.948	27.6	46.0	200
917.886	33.6	46.0	200

*917.796 was the recorded transmitter frequency.

	Actual average value	Specified average limit	
Frequency	@ 3m	@3m	
GHz	dBµV/m	dBµV/m	µV/m
1.882	23.9	54.0	500

	Actual peak value	Specified peak limit	
Frequency	@ 3m	@3m	
GHz	dBµV/m	dBµV/m	µV/m
1.882	39.6	74.0	5,000

Procedure: In accordance with ANSI C63.4:2003.

Measurements below 1.0 GHz performed with a quasi-peak detector. Measurements above 1.0 GHz performed with an average and peak detector.

TEST ENGINEER: Rob St John James

Test Data (continued)

4.2 Power Line Conducted Emissions

A search was made of the frequency spectrum between 0.15 MHz to 30 MHz and the measurements reported here are the highest emissions relative to the CISPR 22 Class B limits. Emissions that meet the average limit on a quasi-peak measurement are deemed to meet both the average and quasi-peak specification.

MAINS – LINE

Frequency (MHz)	Quasi-peak value (dBµV)		Average value (dBµV)		Status
	Measured	Limit	Measured	Limit	
0.203	57.6	63.5	31.6	53.5	Pass
0.264	50.5	61.3	13.0	57.3	Pass
0.320	46.8	59.7	27.3	49.7	Pass

MAINS – NEUTRAL

Frequency (MHz)	Quasi-peak value (dBµV)		Average value (dBµV)		Status
	Measured	Limit	Measured	Limit	
0.175	60.1	64.7	19.4	54.7	Pass
0.210	59.1	63.2	39.8	53.2	Pass
0.295	48.8	60.4	32.5	50.4	Pass

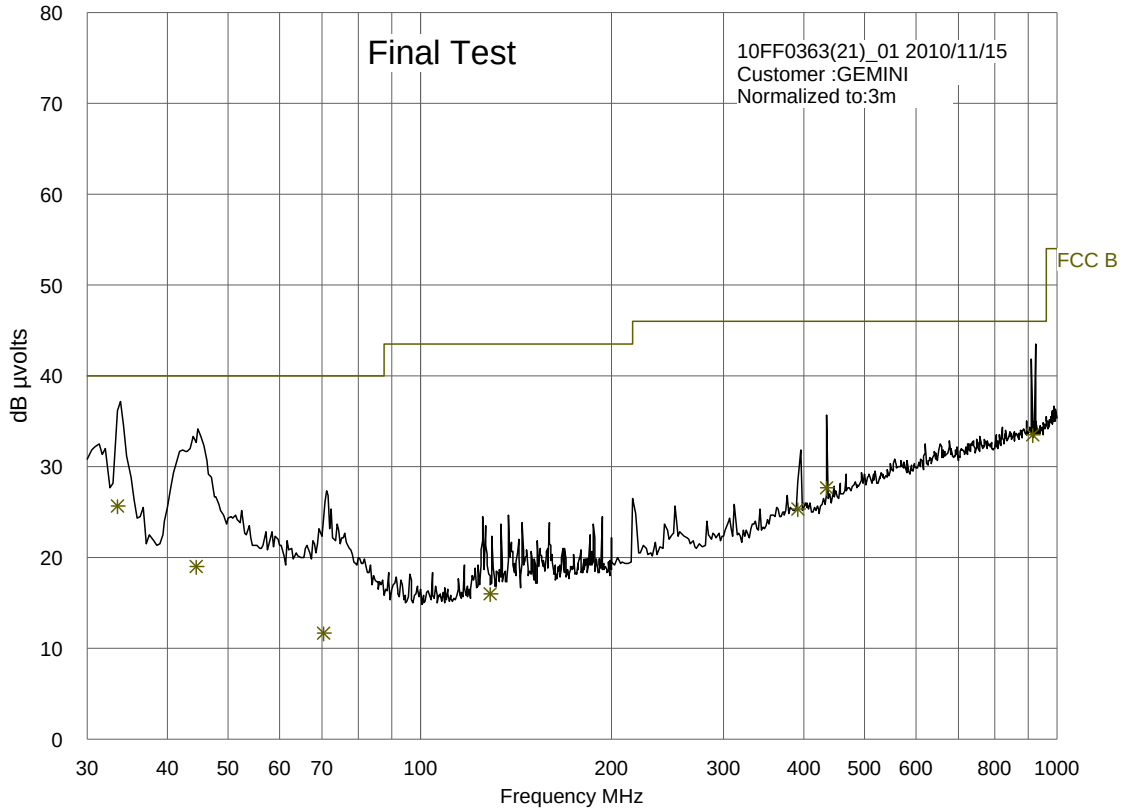
Uncertainty of measurement: ± 3.22dBµV for a 95% confidence level.

Measurements made according to the FCC rules and Hursley EMC Services test procedure CON-02.

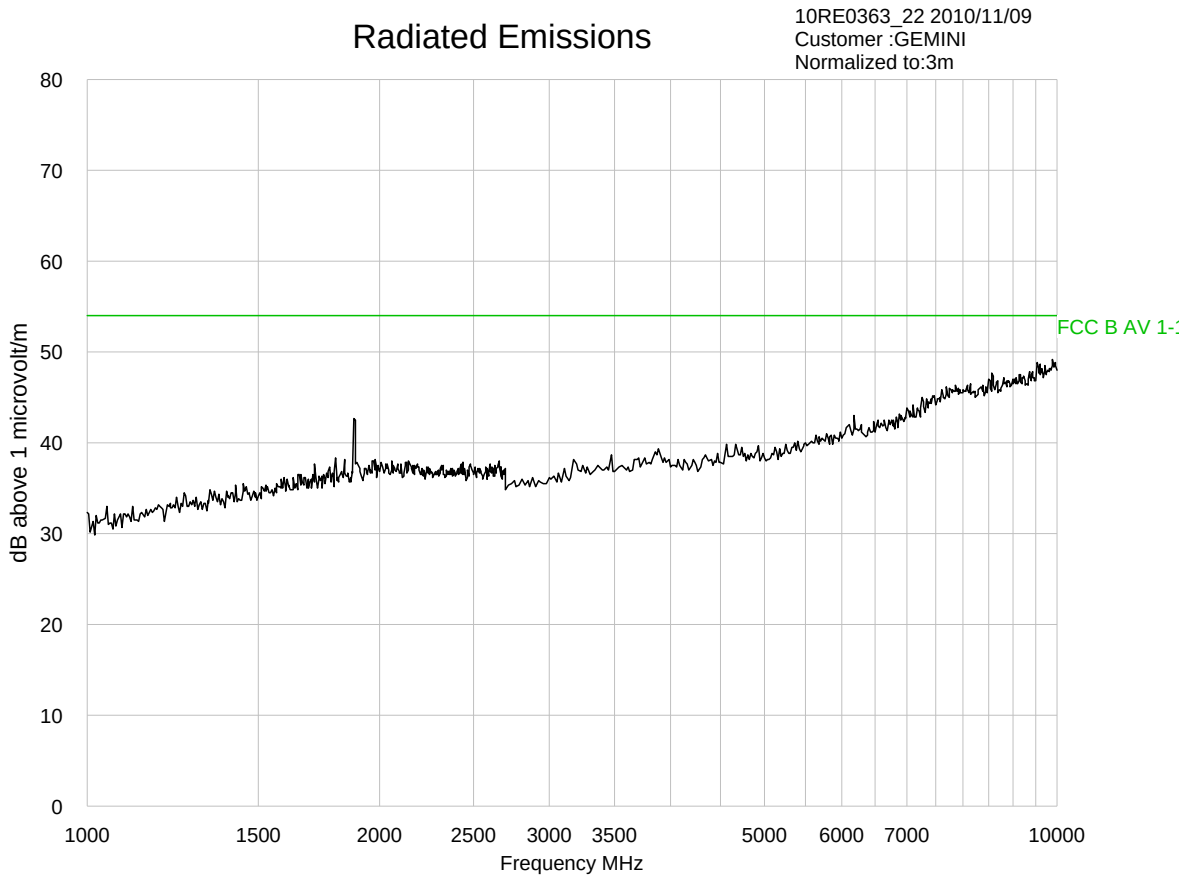
TEST ENGINEER: Rob St John James

5.0 TEST PLOTS

5.1 Radiated Emission Plot, 30 to 1000 MHz

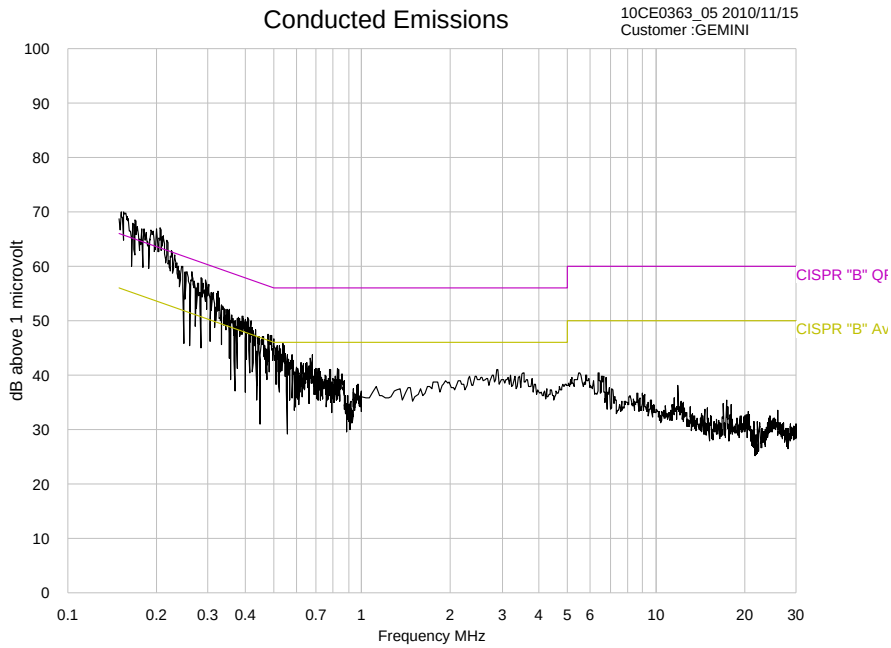


5.2 Radiated Emissions Plot, 1.0 to 10.0 GHz

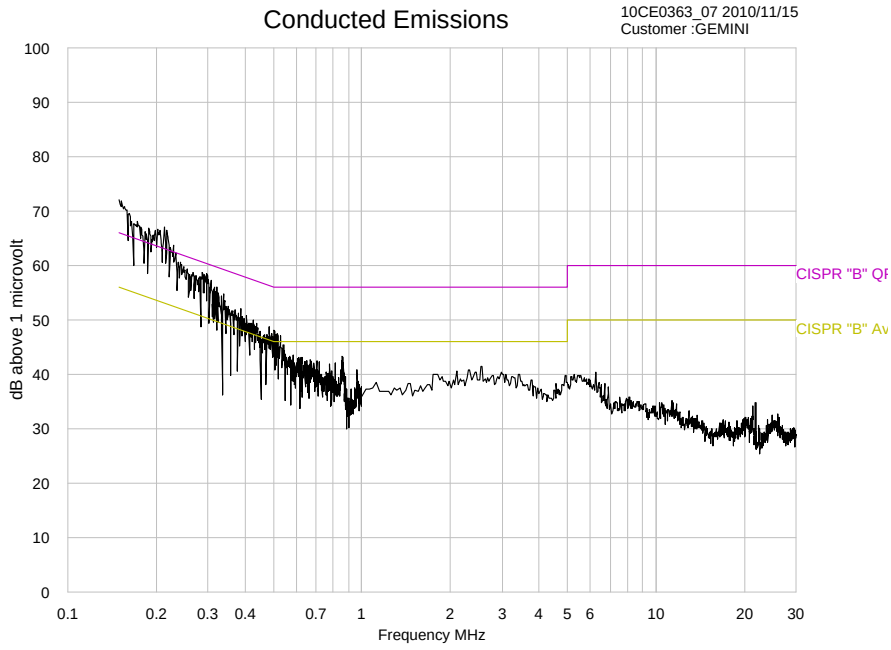


5.3 Conducted Emissions Plots

Shown here is the mains-line plot.

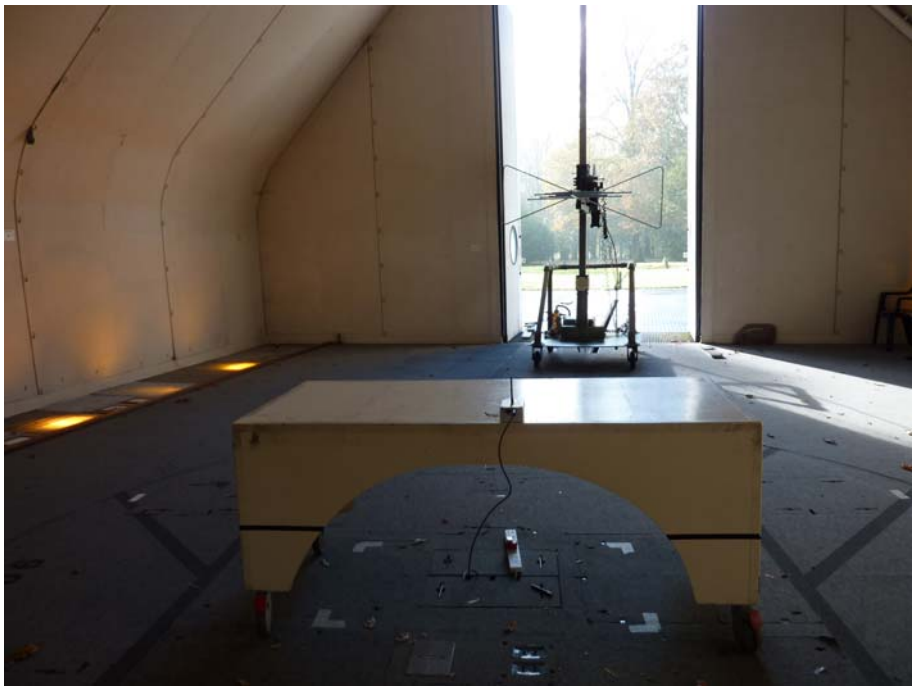


Shown here is the mains-neutral plot.



6.0 PHOTO LOG

Open area test site measurements with Trilog Antenna



Note: USB extended to 7m – Laptop situated below ground

Conducted emissions

7.0 FCC LETTER

FEDERAL COMMUNICATIONS COMMISSION

Laboratory Division
7435 Oakland Mills Road
Columbia, MD 21046

February 13, 2006

Hursley EMC Services Ltd.
Unit 16
Brickfield Lane
Chandlers Ford - Hampshire, SO53 4DB
United Kingdom
Attention: R P St John James

Re: Accreditation of Hursley EMC Services Ltd.
Designation Number: UK0006

Dear Sir or Madam:

We have been notified by Department of Trade and Industry (DTI) that Hursley EMC Services Ltd. has been accredited as a Conformity Assessment Body (CAB).

At this time your organization is hereby designated to perform compliance testing on equipment subject to Declaration Of Conformity (DOC) and Certification under Parts 15 and 18 of the Commission's Rules.

This designation will expire upon expiration of the accreditation or notification of withdrawal of designation.

Sincerely,

Thomas Phillips
Electronics Engineer