FCC Part 15 & Industry Canada Certification Report

for the

Hitmate Limited

Epee Hitmate Transmitter and Hitmate Console Receiver (434 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

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 Industry Canada (IC) RSS-210 standard. The EUT operates at a frequency of 434 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 5 GHz.

1.2 Related Submittal(s)

This is a single application for certification of a 434 MHz Transmitter under section 15.231 of the FCC CFR 47 regulations and IC RSS-210.

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

1.3 EUT Manufacturer

Trade name:	Hitmate
Manufacturer name:	Hitmate Limited 19 Riverside Drive Richmond Surrey TW10 7QA United Kingdom
Company representative:	Mr Ian Bowden Tel: +44 (0) 20 8948 8147

2.0 EUT DESCRIPTION

2.1 Identity

EUT:	Epee Hitmate Transmitter Model: EH2100	s/n 33
	Hitmate Console Receiver Model: HC2100	s/n 35

In addition, another EH2100 (s/n 32) was modified to transmit continuously and was used for the transmit power and spurious emission tests.

Sample build: Prototype

2.2 Product Operation

The transmitter and receiver are used for sword fencing. At the end of the sword is a press switch and when this is depressed (e.g. when the sword tip hits an opponent) the transmitter is triggered and activates an LED and buzzer on the receiver. The transmitter is connected to the sword via a 3-wire cable.

Both the transmitter and receiver are powered by 9V alkaline batteries. When triggered the transmitter transmits three 20ms pulses on a 300ms period and then stops transmitting until re-triggered. The transmitter is manually operated and uses an integrated antenna with no external antenna port connections.

2.3 Support Equipment

None: tested stand-alone.

2.4 Exerciser Program

For the purposes of measurement a transmitter was modified to repeatedly transmit. In normal operations the transmitter will only transmit when the transmit button is manually operated.

Before the start of the tests the transmitter was fitted with a new alkaline battery. The receiver was also fitted with a new 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	2nd August to the 5th September 2011

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 Environmental Ambient

Test Type	Temperature	Humidity	Atmospheric Pressure
Radiated	23 to 25 degrees Celsius	38 to 67% relative	999 to 1011 millibars

3.4 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:

#ID	CP	Manufacturer	Type	Serial No	Description	Calibration due date
009	1	HP	8447D	1937A01808	Pre-amplifier (30-1000MHz)	31/05/2012
013	LAB	Schaffner	CBL6140A	1235	Antenna X-wing (20-2000MHz)	Internal
040	1	HP	8593EM	3536A00137	Spectrum analyser (9kHz-26.5GHz)	17/06/2012
070	1	HP+short cable	8449B	3008A00481	Pre-amplifier (1.0-26.5GHz) + 0.5m cable	08/11/2011
127	3	Schwarzbeck	BBHA9120B	391	Horn antenna (1-10GHz)	15/12/2012
271	1	Sucoflex	106		Cable SMA (18GHz)	10/01/2012

The EUT was measured in three orthogonal axes to determine which produced the highest emissions.

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:

#ID	CP	Manufacturer	Type	Serial No	Description	Calibration due date
033	1	HP	8593EM	3726U00203	Spectrum analyser (9kHz-26.5GHz)	28/03/2012
073	3	Schwarzbeck	BBHA9120B	237	Horn antenna (1-10GHz)	17/06/2013
092	2	Schwarzbeck	VULB 9163	232 (grey)	Trilog antenna (30-3000MHz)	*05/08/2011
240	1	Sucoflex	106	52427/6	Cable SMA (18GHz)	14/02/2012
250	1	HP	8449B	3008A01077	Pre-amplifier (1.0-26.5GHz)	03/03/2012
288	1	Rohde & Schwarz	ESVP	894276/008	Receiver	17/03/2012
289	1	Rohde & Schwarz	ESCI 7	100765	CISPR 7GHz Receiver	28/03/2012

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.
'*' denotes that the calibration, as defined by Hursley EMC Services quality system, remains valid whilst within one calendar month of the due date.

3.5 Conducted Emissions

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

4.0 TEST DATA

4.1 Transmitter – Radiated Emissions

A search was made of the frequency spectrum from 30.0 MHz to 5 GHz and the measurements reported are the highest emissions relative to the FCC CFR 47 Section 15.231 limits at a measuring distance of three metres

RESULTS - 30 MHz to 1000 MHz

Frequency GHz	Receiver amplitude dBµV	Antenna factor dB	Cable loss dB	Actual quasi-peak Value @ 3m dBµV/m	Average Value with 14dB pulse correction dBµV/m	Specified limit @ 3m dBµV/m
47.995	12.0	13.4	0.9	26.3	n/a	40.00
153.981	7.9	8.5	1.6	18.0	n/a	43.50
*433.975	71.0	16.4	3.1	90.5	76.5	80.8
867.954	33.3	21.7	4.8	59.8	45.8	62.0

*433.975 was the recorded transmitter frequency. The measured level of 76.5dBµV/m takes into account the provision of 15.35 (c) for pulse duty cycle. The duty cycle is pulse On for 20ms, pulse Off for 80ms giving a duty cycle of 20/100 in any 100ms period. This is a duty cycle of 0.2 which equates to -14dB.

Radiated emissions (continued)

RESULTS - 1.0 GHz to 5.0 GHz

Frequency GHz	Receiver amplitude dBµV	Antenna factor dB	Cable loss dB	Pre-amp gain dB	Actual peak value @ 3m dBµV/m	Average Value with 14dB pulse correction @ 3m dBµV/m	Specified limit @ 3m dBµV/m
1.3010	79.8	25.4	1.8	39.2	67.8	53.8	54.0
1.7358	78.5	26.9	2.1	38.7	68.8	54.8	62.0
2.1697	79.6	27.7	2.4	38.3	71.4	57.4	74.0
3.4716	72.5	28.2	3.1	37.5	66.3	52.3	74.0

Procedure: In 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 a peak detector and corrected for average using the provision of 15.3 (c) for pulse duty cycle. With the transmitter in standby all results were below the noise floor of the measuring system (30.0 MHz to 5 GHz).

Note: The transmitter was re-submitted for test with a 6dB attenuator inserted on the PCB output to the antenna.

TEST ENGINEER: Rob St John James

Test Data (continued)

4.2 Receiver – Radiated Emissions

Frequency MHz	Actual quasi-peak value @ 3m dBµV/m	Specified average limit @ 3m dBµV/m
31.000	20.8	40.0
72.000	10.8	40.0
245.000	18.4	46.0
435.116	32.3	46.0
868.048	35.6	46.0

Frequency GHz	Actual average value @ 3m dBµV/m	Specified limit @ 3m dBµV/m
1.911	25.2	54.0

Frequency GHz	Actual peak value @ 3m dBµV/m	Specified limit @ 3m dBµV/m
1.911	37.9	74.0

Procedure: In accordance with ANSI C63.4.

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

4.3 Modulation Bandwidth

Section 15.231 (C) (and Industry Canada RSS-210 A1.1.3)

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 434 MHz Transmitter was measured as 69 kHz

The limit is 0.25% of the transmitter frequency which equates to 1.085 MHz.

The 99% bandwidth was measured as 100 kHz using a Rohde & Schwarz ESIB receiver.

4.4 Transmission Time

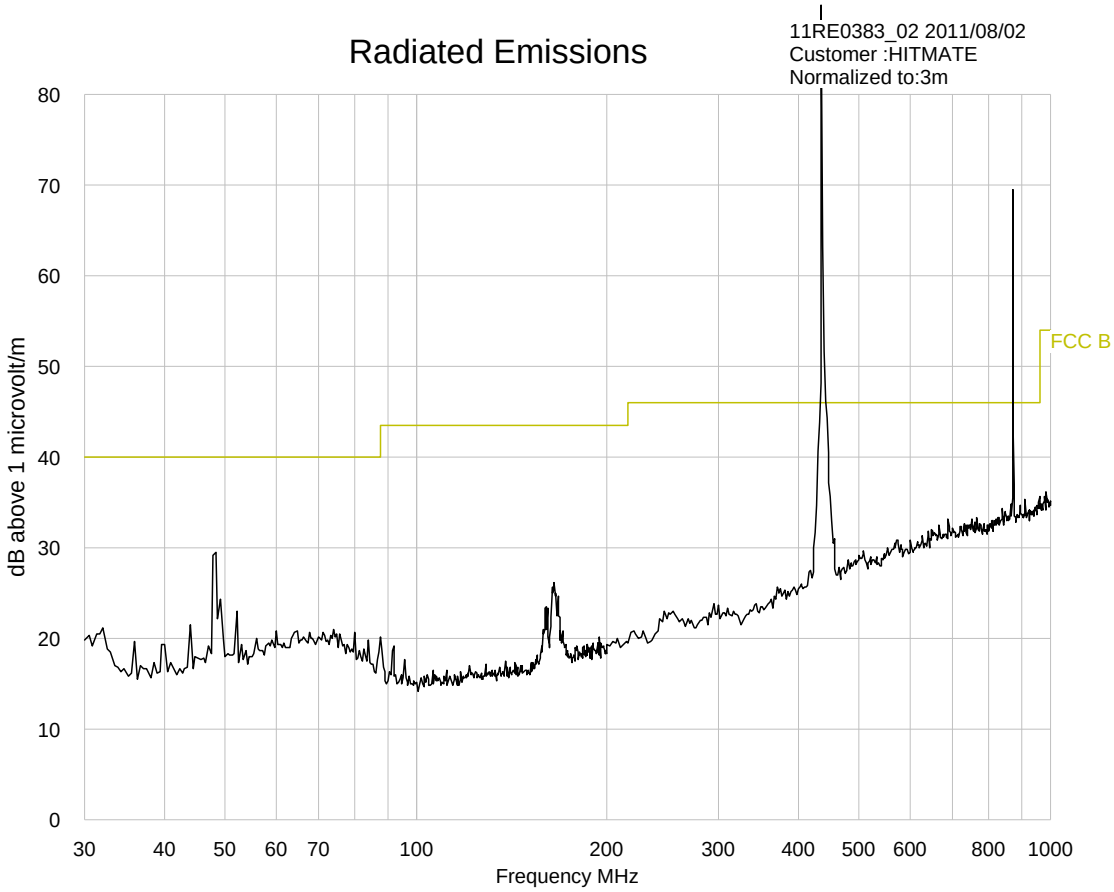
Section 15.231 a (I)

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 spectrum analyser was placed on zero span with a sweep time of one second and a bandwidth of 10 kHz. The Tx button was depressed and the transmitter output was recorded on the analyser. In addition, the video output was fed into the input of an oscilloscope with the analyser in linear amplitude mode to confirm the transmit pulse duty cycle.

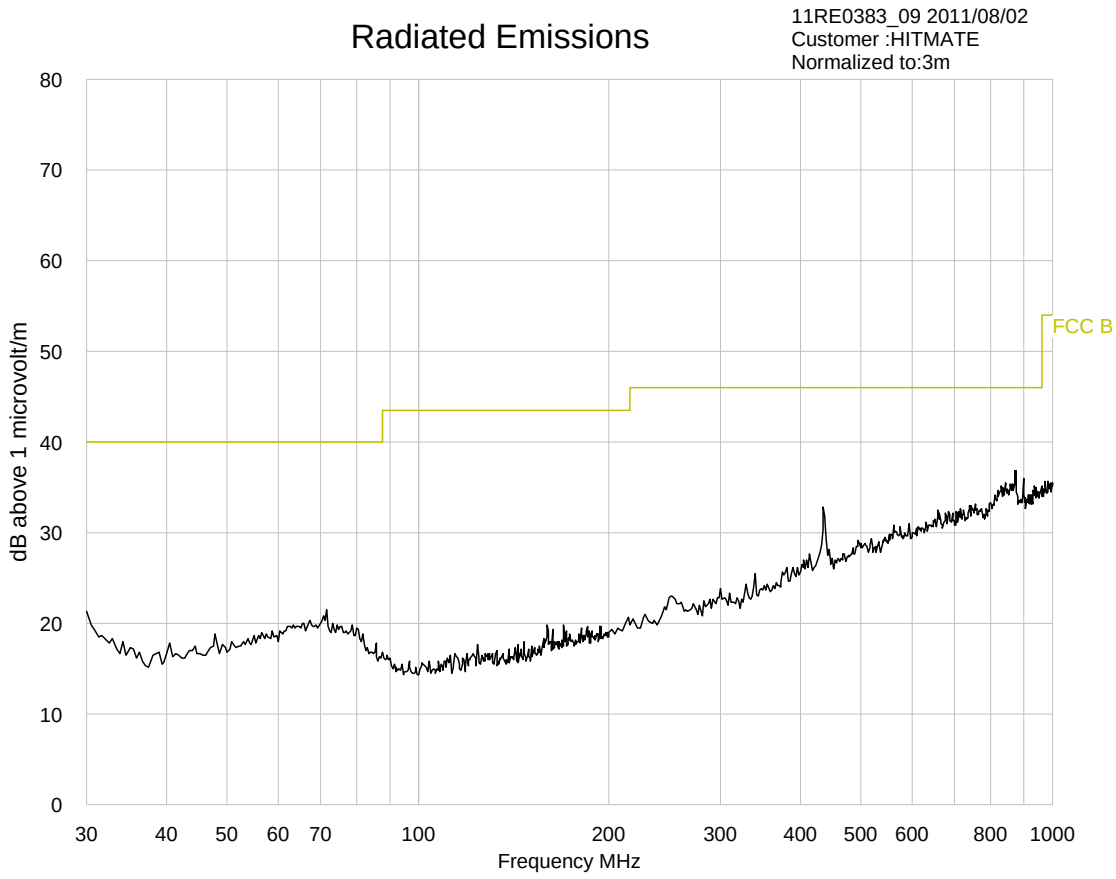
The transmitter was on for less than 300ms, the limit is 5s after the Tx button is released.

5.0 TEST PLOTS

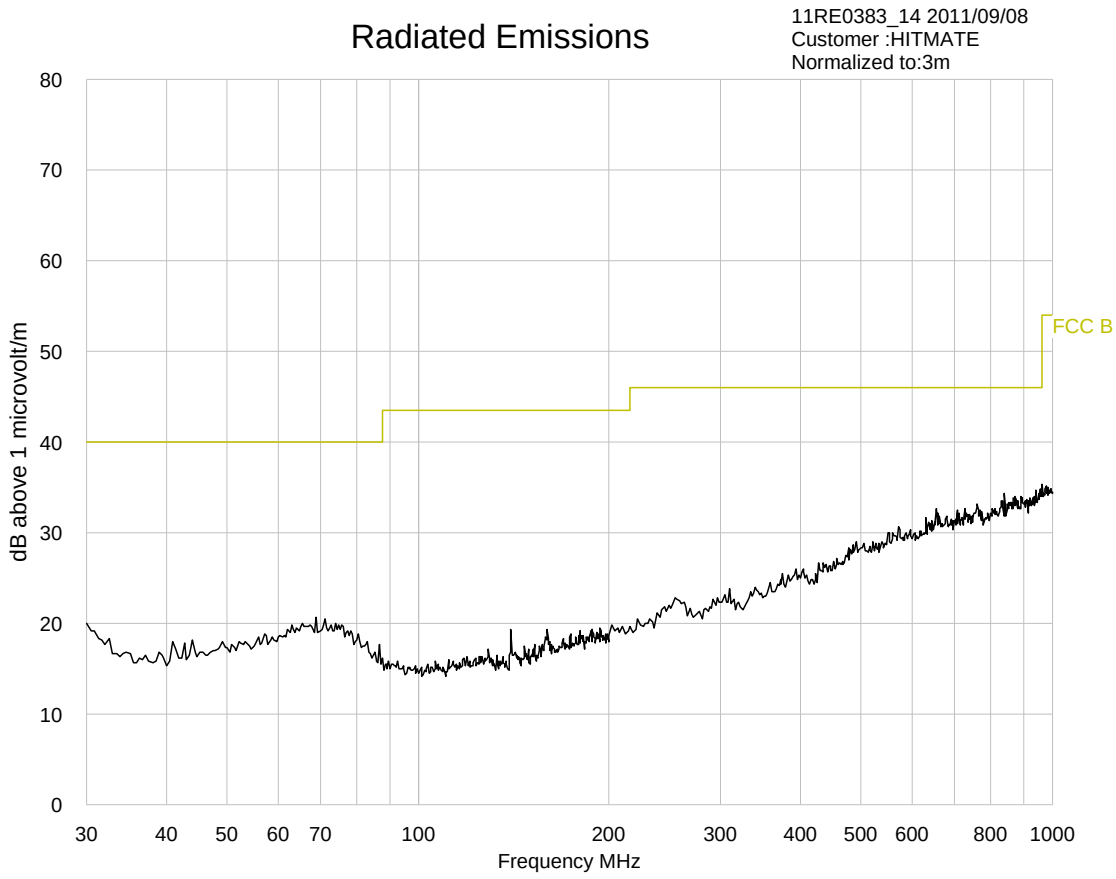
5.1 Transmitter Emission Plot, 30 to 1000 MHz



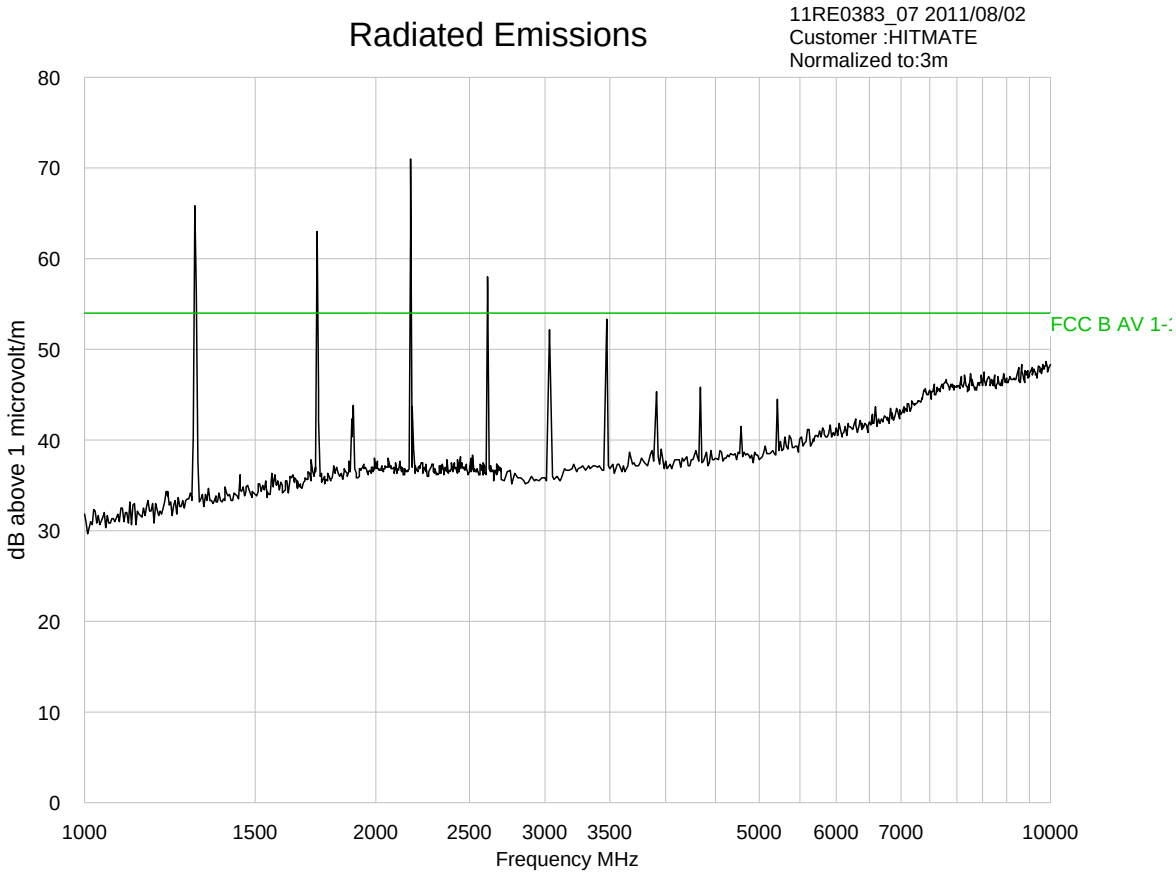
5.2 Receiver Emissions Plot, 30 to 1000 MHz



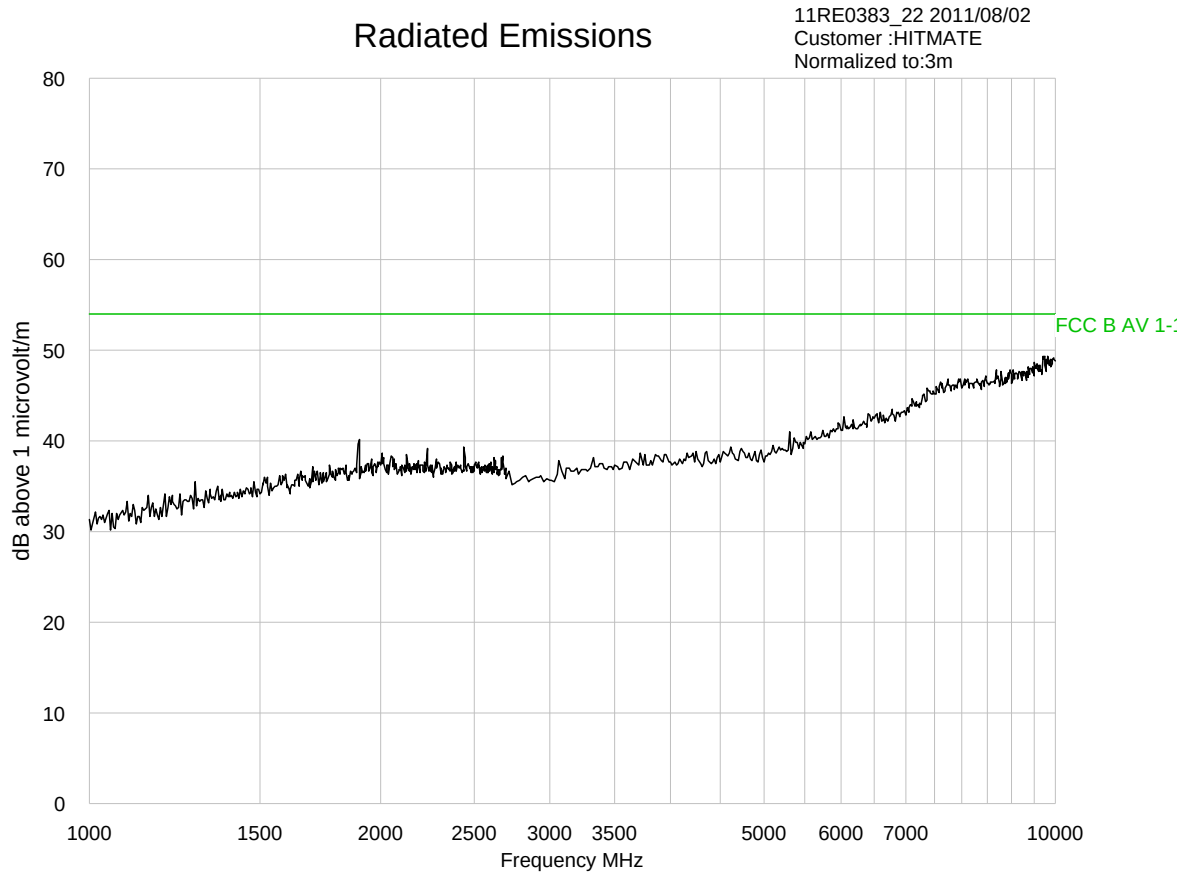
5.3 Transmitter Emissions (Idle) Plot, 30 to 1000 MHz



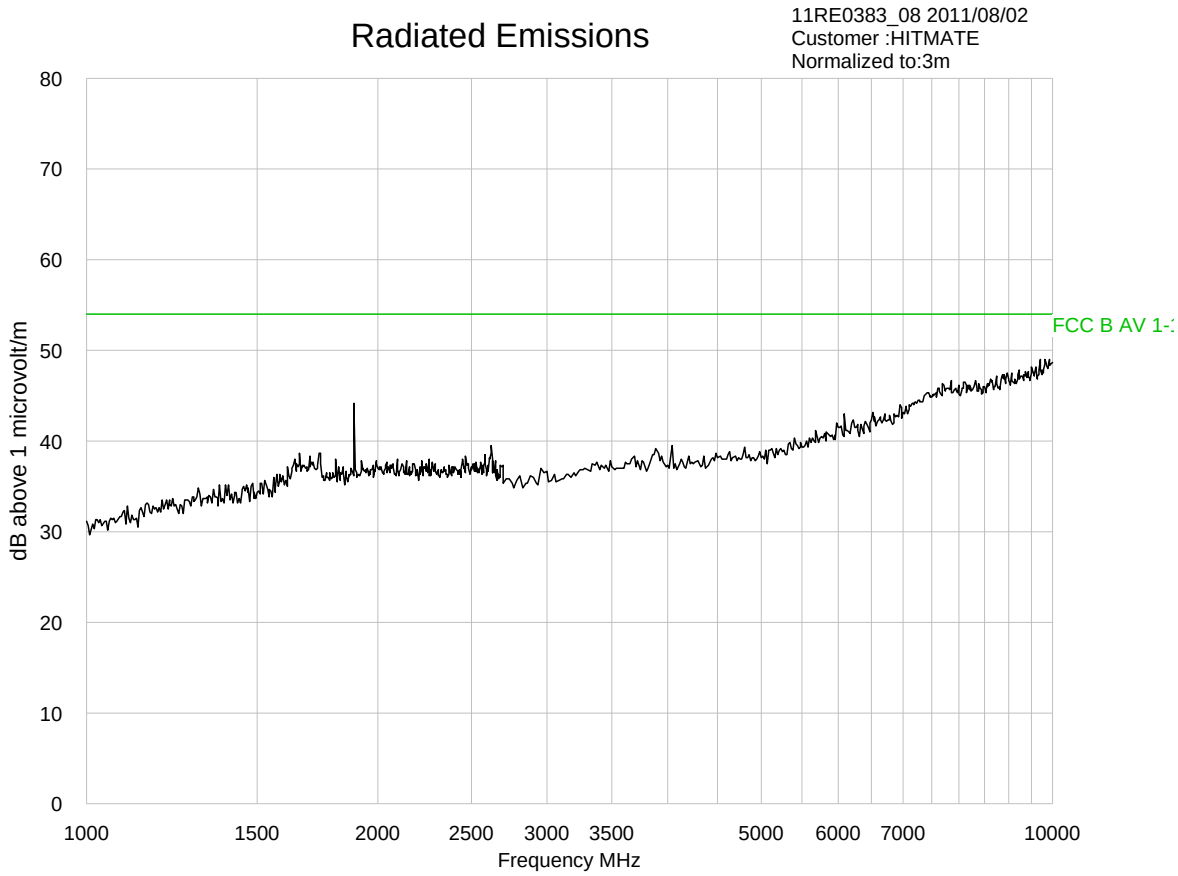
5.4 Transmitter Emissions Plots, 1 to 10 GHz



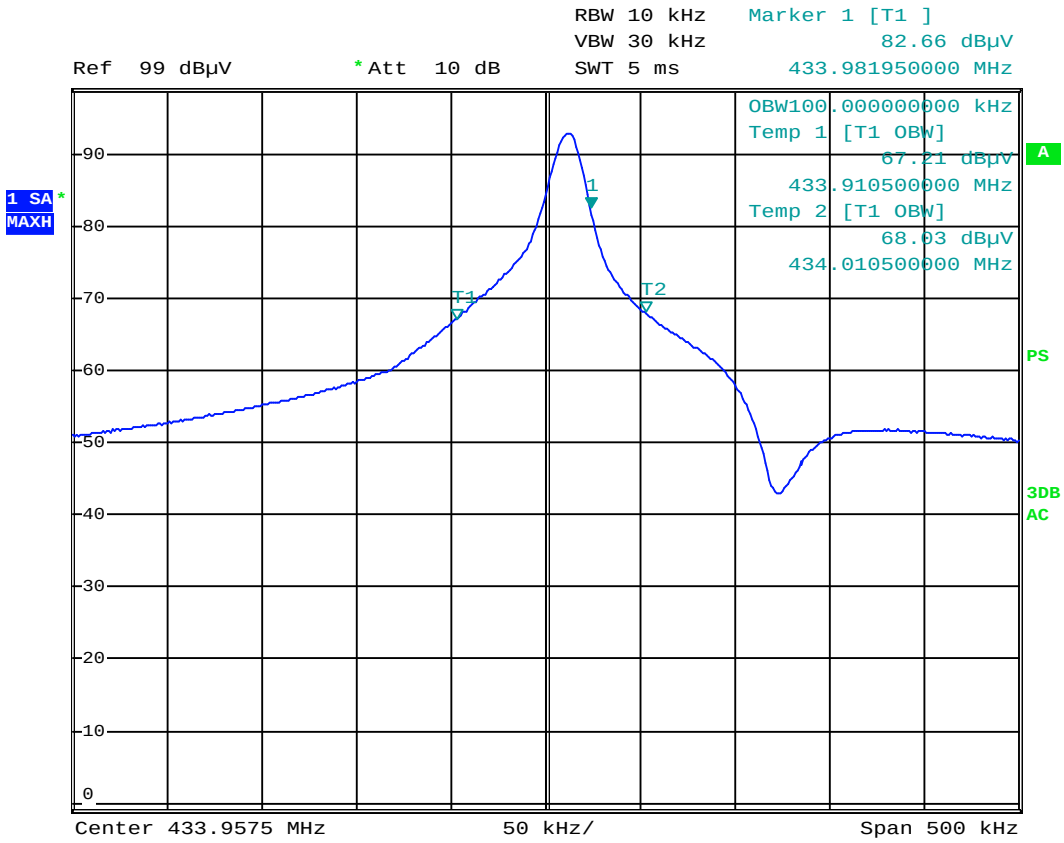
5.5 Transmitter Emission (Idle) plot, 1 to 10 GHz



5.6 Receiver Emission Plots, 1 to 10 GHz

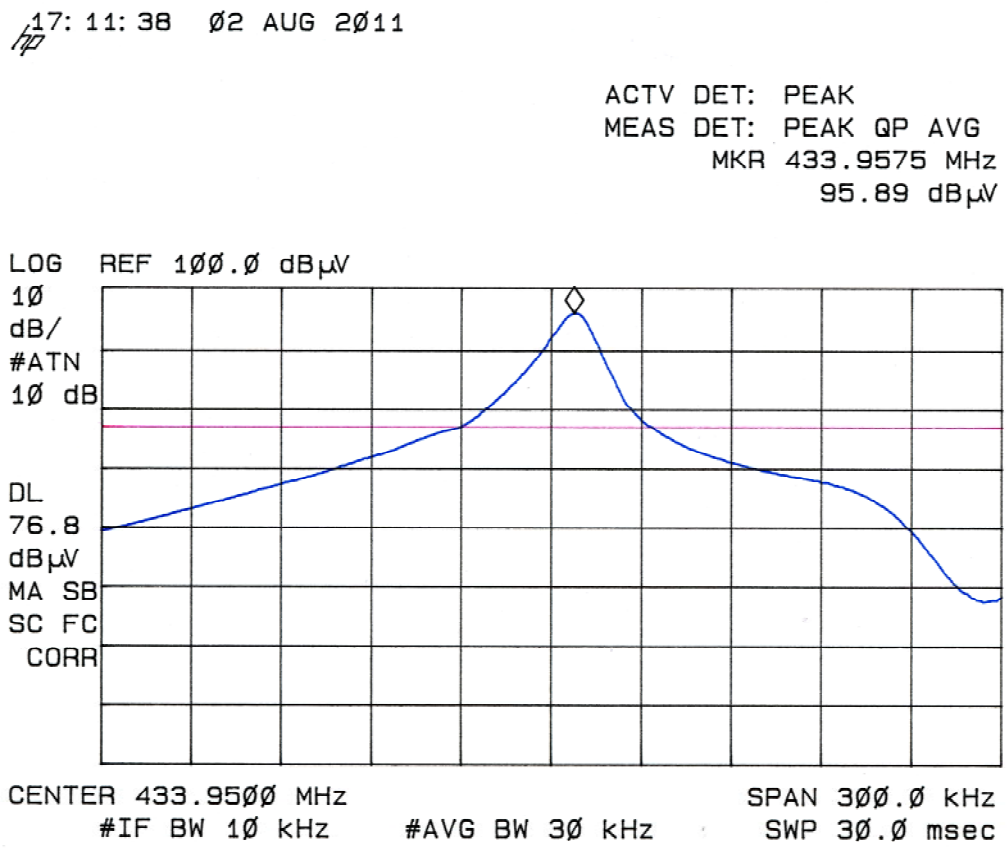


5.7 99% Bandwidth Plot

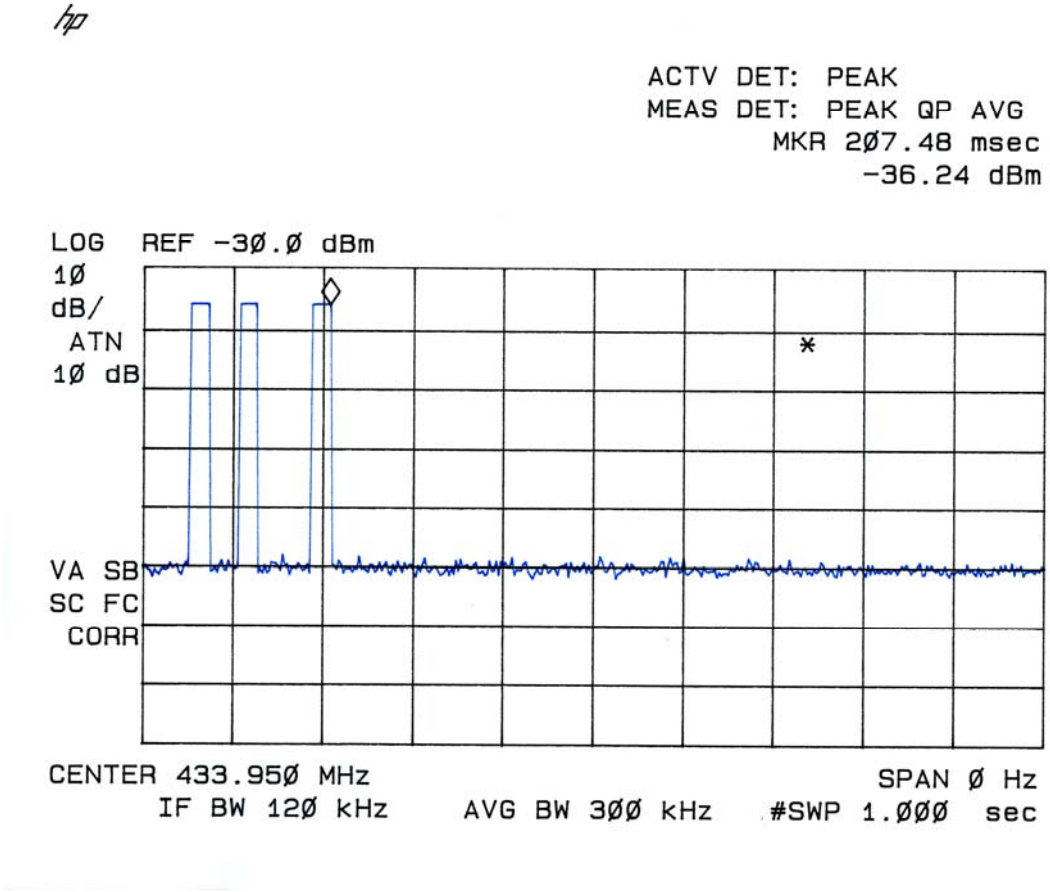


Date: 2.AUG.2011 19:56:40

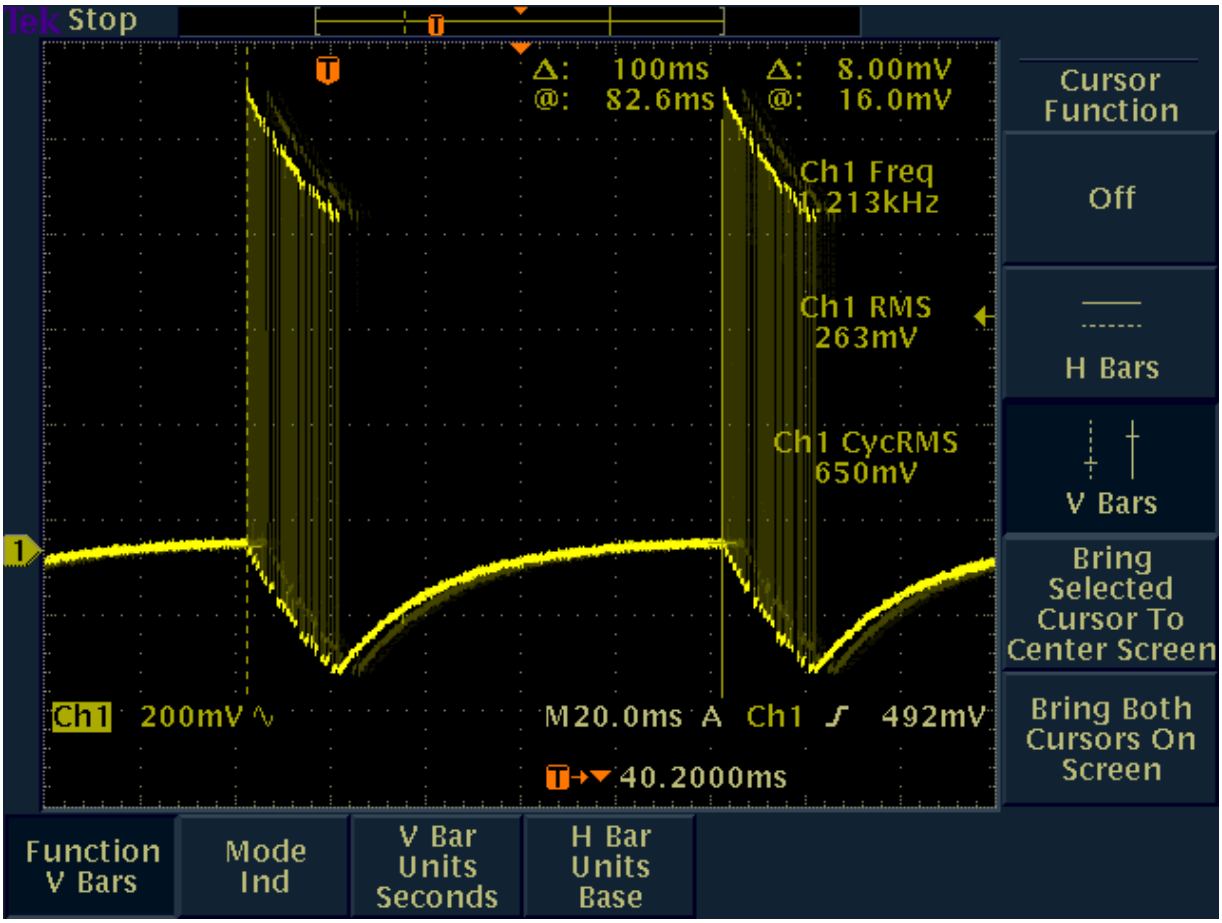
5.8 Bandwidth Plot



5.9 Transmitter On Time Plot



5.10 Transmitter Duty Cycle Plot



6.0 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

7.0 INDUSTRY CANADA LETTER

Industry Canada Industrie Canada

September 24, 2010

OUR FILE: 46405-7104
Submission No: 142641

Hursley EMC Services Ltd.
Unit 16, Brickfield Lane, Eastleigh
Hampshire, SO53 4DP
Great Britain

Attention: Rob St. John James

Dear Sir/Madame:

The Bureau has received your application for the renewal of a 3/10m OATS. Be advised that the information received was satisfactory to Industry Canada. The following number(s) is now associated to the site(s) for which registration / renewal was sought **(7104A-1).** Please reference the appropriate site number in the body of test reports containing measurements performed on the site. In addition, please keep for your records the following information;

- The company address code associated to the site(s) located at the above address is: **7104A**

Furthermore, to obtain or renew a unique site number, the applicant shall demonstrate that the site has been accredited to ANSI C63.4-2003 or later. A scope of accreditation indicating the accreditation by a recognized accreditation body to ANSI C63.4-2003 or later shall be accepted. Please indicate in a letter the previous assigned site number if applicable and the type of site (example: 3 metre OATS or 3 metre chamber). If the test facility is not accredited to ANSI C63.4-2003 or later, the test facility shall submit test data demonstrating full compliance with the ANSI standard. The Bureau will evaluate the filing to determine if recognition shall be granted.

The frequency for re-validation of the test site and the information that is required to be filed or retained by the testing party shall comply with the requirements established by the accrediting organization. However, in all cases, test site re-validation shall occur on an interval not to exceed two years. There is no fee or form associated with an OATS filing. OATS submissions are encouraged to be submitted electronically to the Bureau using the following URL;
http://strategis.ic.gc.ca/epic/internet/inceb-bhst.nsf/en/h_tt00052e.html.

If you have any questions, you may contact the Bureau by e-mail at certification.bureau@ic.gc.ca Please reference our file and submission number above for all correspondence.

Yours sincerely,

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