Certification Test Report

CFR 47 FCC Part 15, Subpart C Section 15.249
Industry Canada RSS 210, Issue 7

BlackLine GPS
KEY FOB

FCC ID: W77BLF
IC: 8255A-BLF
Project Code CG-1084

(Report CG-1084-RA-2-1)
Revision: 1

May 21, 2009

Prepared for:	Blackline GPS
Author:	Deniz Demirci Senior Wireless / EMC Technologist
Approved by:	Nick Kobrosly Director of Canadian Operations

Report Summary

Test Facility:	**National Technical Systems, Canada** Product Integrity Laboratory 5151-47th Street, N.E. Calgary Alberta T3J 3R2
Accreditation Numbers:	0214.22 Electrical 0214.23 Mechanical Accredited by A2LA The American Association for Laboratory Accreditation CLIENTS SERVED: All interested parties FIELDS OF TESTING: Electrical/Electronic, Mechanical/Physical ACCREDITATION DATE:: May 14, 2009 VALID TO: December 31, 2009
Applicant:	BlackLine GPS Suite 101, 1215 13th Street SE Calgary, AB T2G 3J4 Canada
Customer Representative:	Name: Barry Moore Title: VP of product development Phone #: 403-809-8966 Email Address: bmoore@blacklinegps.com

EUT Description

EUT Description	Manufacturer	Model	Revision	Serial Number
2.4 GHz Wireless transceiver	BlackLine GPS	KEY FOB	N/A	N/A

Test Summary

Appendix	Test/Requirement Description	Deviations* from:			Pass / Fail	Applicable FCC Rule Parts	Applicable Industry Canada Rule Parts
		Base Standard	Test Basis	NTS Procedure			
A	20 dB Bandwidth	No	No	No	Pass	FCC Subpart C 15.215 (c)	NA
B	Occupied Bandwidth (99% emission bandwidth)	No	No	No	N/A	N/A	RSS-Gen Issue 2 4.6.1
C	Duty Cycle Correction Factor	No	No	No	N/A	FCC Subpart C 15.35 (c)	RSS-Gen Issue 2 4.5
D	Field Strength of Fundamental	No	No	No	Pass	FCC Subpart C 15.249 (a)	RSS 210 Issue 7 A2.9 (a)
E	Radiated Spurious Emissions Band Edge	No	No	No	Pass	FCC Subpart C 15.249, 15.205	RSS 210 Issue 7 A8.5
F	Radiated Spurious Emissions	No	No	No	Pass	FCC Subpart C 15.249, 15.205	RSS 210 Issue 7 2.7 (Rx), A8.5 (Tx)

Test Result: The product presented for testing complied with test requirements as shown above.

Prepared By: 2009.06.03 12:58:21 -06'00'
Deniz Demirci
Senior Wireless/EMC Technologist

Reviewed By: Glen Moore 2009.06.03 13:32:05 -06'00'
Glen Moore
Wireless/EMC Manager

Approved By: Alex Mathews
Alex Mathews
Quality Management Representative

Table of Contents

Register of revisions

Revision	Date	Description of Revisions
1	May 21, 2009	Final release

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to describe the tests applied by NTS Canada to demonstrate compliance of the KEY FOB from BlackLine GPS to FCC Part 15 Subpart C section 15.249 for DTS transmitter and the equivalent sections of Industry Canada's RSS 210, Issue 7

2.0 EUT DESCRIPTION

2.1 CONFIGURATION

EUT	Name	Model	Revision	Serial Number
	KEY FOB	KEY FOB	701-0005-AB	N/A
Power Supply	3VDC Coin Cell Battery (CR2032)			
Device Classification	Mobile			
Antenna	KEY FOB 2.4GHz antenna: Internal PCB trace antenna. This is an inverted F antenna tuned to 2.45 GHz. Connection to the 2.45 GHz radio module is by PCB trace.			
Modulation	GPSK			
EUT Size with Enclosure (H x W x D) (in mm)	50 x 22 x 10			
EUT Weight (in grams)	Less than 100			
Channels/Frequency Range	1 channel, 2450 MHz			
Functional Description	The Fob operates on unregulated power from a 220mAh 3.0V Lithium coin cell battery. When a battery is installed the unit is active and will broadcast an encrypted message containing its identity string every 8 seconds. Transmission is a 200 microsecond burst repeated 3 times at 250 millisecond intervals. When the device is not transmitting, the 2.45GHz radio is turned off and the device is in a low power sleep state. The Fob contains a motion sensor. If no motion is detected, the Fob will reduce it's transmit period from 8 seconds to 100 seconds.			

2.2 EUT CABLES

Quantity	Model/Type	Routing		Shielded / Unshielded	Description	Cable Length (m)
		From	To			
N/A						

For all test cases pre-scans were completed in all three orientations and modes to determine worst case levels.

3.0 SUPPORT EQUIPMENT

3.1 CONFIGURATION

N/A

3.2 TEST BED/PERIPHERAL CABLES

N/A

4.0 TEST ENVIRONMENT

4.1 NORMAL TEST CONDITIONS

Temperature:	20 – 23 °C
Relative Humidity:	28 – 35 %
Atmospheric pressure:	883 – 890 mbar
Nominal test voltage:	3 VDC (Coin Cell Battery)

The values are the limits registered during the test period.

APPENDICES

APPENDIX A: 20 DB BANDWIDTH

A.1. Base Standard & Test Basis

Base Standard	FCC PART 15.215 (c)
Test Basis	FCC PART 15.215 (c)
Test Method	FCC PART 15.215 (c)

A.2. Specifications

15.215 (c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

A.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
None						

A.4. Test Procedure

FCC Publication 558074.

A.5. Test Results

The EUT is in compliance with the requirement as specified above

Frequency (MHz)	20 dB Bandwidth (MHz)
2450	1.142

All final reported values are corrected values.

A.6. Operating Mode During Test

Key FOB ver 701-0005-AB, 250ms message period (Duty cycle was set to the highest supported duty cycle of the device, to speed up and simplify measurements) Tx mode, coin cell battery

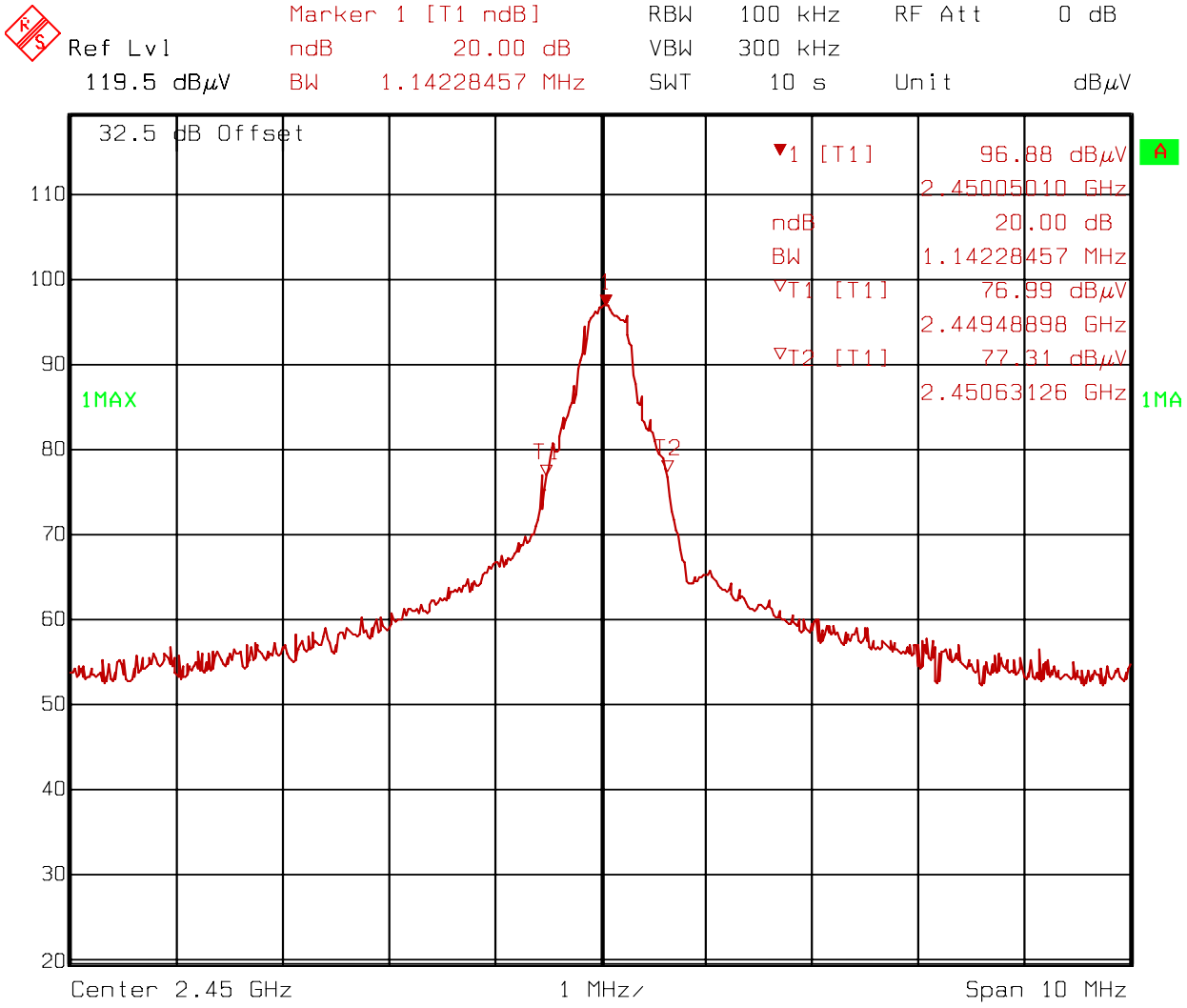
A.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Spencer Watson
Function: EMC Technologist

A.8. Test date

April 9, 2009

Figure 1 20 dB Bandwidth



Title: CG-1084 Blackline Key FOB Conf38
Date: 9.APR.2009 14:00:56

APPENDIX B: OCCUPIED BANDWIDTH

B.1. Base Standard & Test Basis

Base Standard	RSS-Gen Issue 2 4.6.1
Test Basis	RSS-Gen Issue 2 4.6.1
Test Method	RSS-Gen Issue 2 4.6.1

B.2. Specifications

4.6.1 When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.

B.3. Test Procedure

RSS-Gen Issue 2

B.4. Test Results

Frequency (MHz)	Occupied Bandwidth (MHz)
2450	1.082

All final reported values are corrected values

B.5. Operating Mode During Test

Key FOB ver 701-0005-AB, 250ms message period (Duty cycle was set to the highest supported duty cycle of the device, to speed up and simplify measurements) Tx mode, coin cell battery

B.6. Tested By

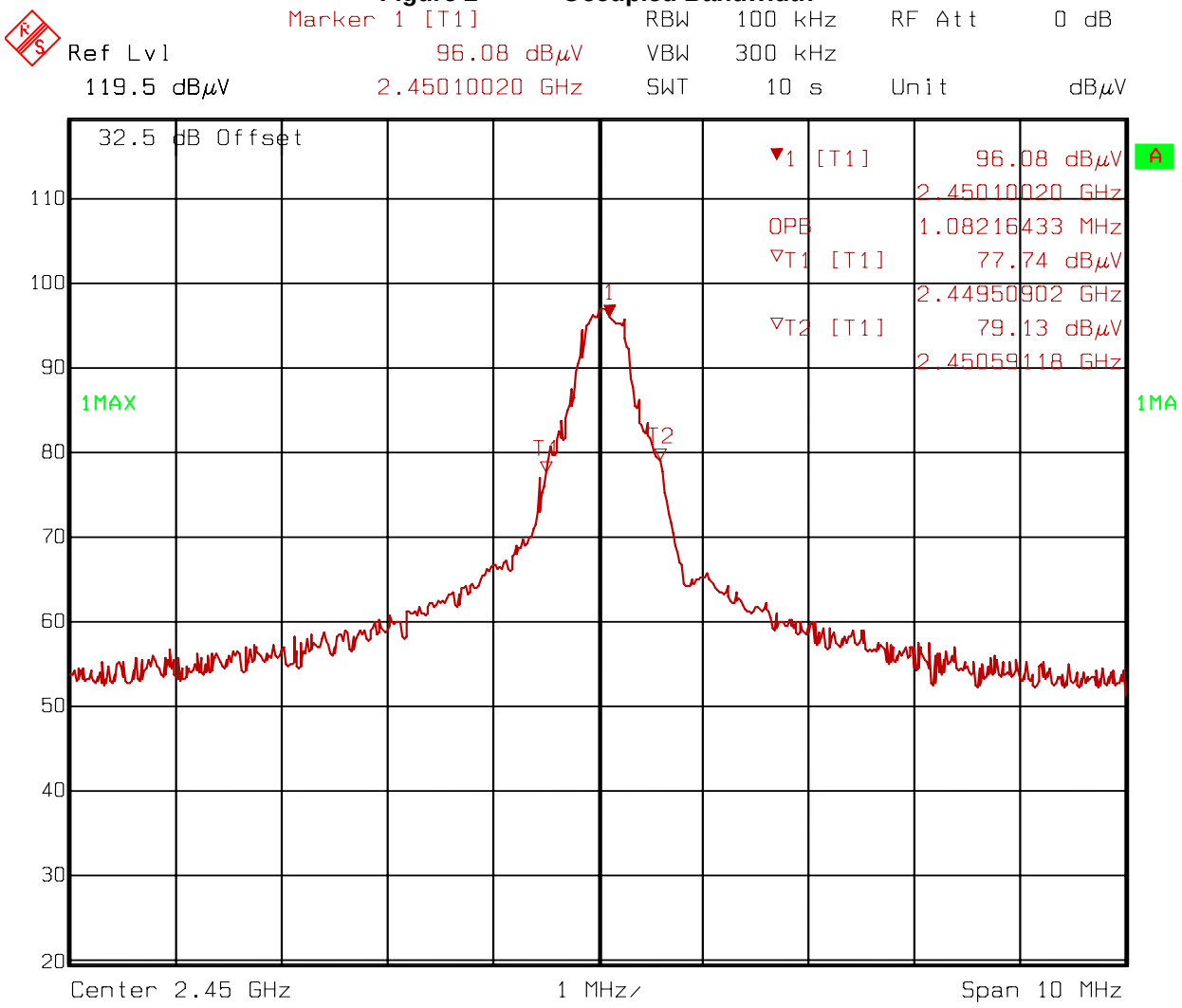
This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Spencer Watson
Function: EMC Technologist

B.7. Test date

April 9, 2009

Figure 2 Occupied Bandwidth



Title: CG-1084 Blackline Key FOB Conf38
Date: 9.APR.2009 13:59:47

APPENDIX C: DUTY CYCLE CORRECTION FACTOR

C.1. Base Standard & Test Basis

Base Standard	FCC 15.35 (c) RSS-Gen Issue 2 4.5
Test Basis	FCC 15.35 (c) as per FCC Publication 558074 RSS-Gen Issue 2 4.5
Test Method	NTS Calgary SOP CAG EMC 02 Emission Test Methods and Zero span

C.2. Specifications

15.35 (c) Unless otherwise specified, e.g. §15.255(b), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to notification or verification.

C.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

C.4. Test Procedure

Radiated Emission as per FCC 15.35 with analyzer in Zero span mode.

C.5. Operating Mode During Test

KEY FOB normal operating mode

C.6. Test Results

Duty cycle correction factor = 20*log (0.244/15.685) = -36.16 dB
Therefore the maximum allowable Duty cycle correction factor of -20 dB can be applied

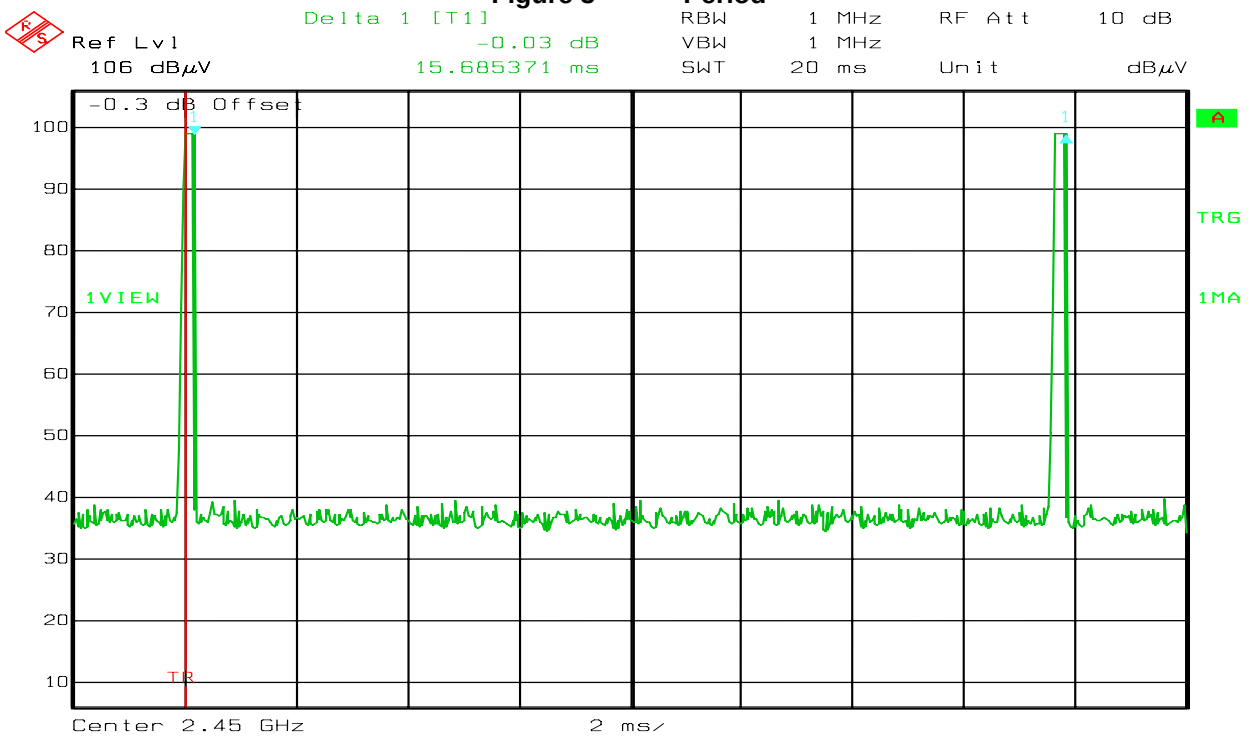
C.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Spencer Watson
Function: EMC Technologist

C.8. Test date

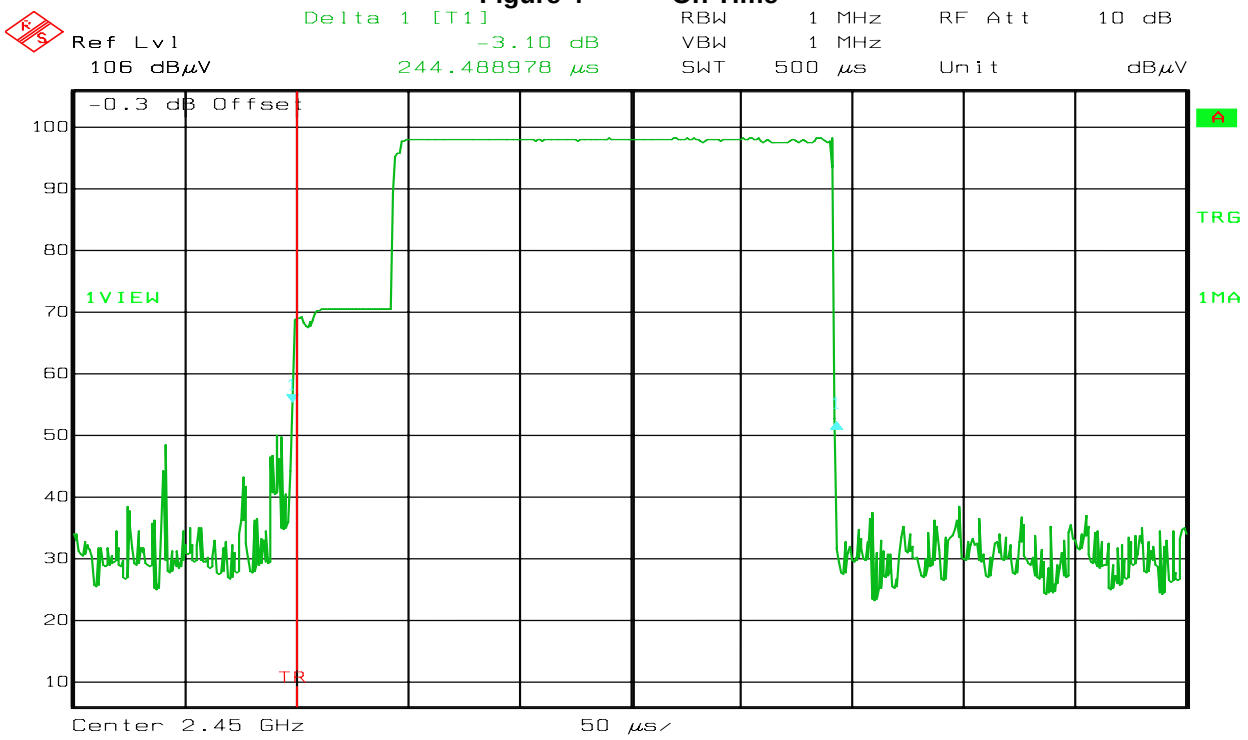
Jan 14, 2009

Figure 3 Period



Title: CG-1084 Blackline FOB
Comment A: FOB Tx, Upright, H:100cm, TT:165degree V-Pol
Date: 14.JAN.2009 19:35:16

Figure 4 On Time



Title: CG-1084 Blackline FOB
Comment A: FOB Tx, Upright, H:100cm, TT:165degree V-Pol
Date: 14.JAN.2009 19:39:03

APPENDIX D: FIELD STRENGTH OF FUNDAMENTAL

D.1. Base Standard & Test Basis

Base Standard	FCC 15.249 (a) RSS 210 Issue 7 A2.9 (a)
Test Basis	FCC 15.247 RSS-Gen Issue 2 4.8
Test Method	NTS Calgary SOP CAG EMC 02 Emission Test Methods

D.2. Specifications

(a) The maximum field strength shall not exceed 50 millivolts/meter at 3 m distance in the 2400 MHz-2483.5 MHz band
(e) The Field strength limits in this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

D.3. Operating Mode During Test

Key FOB ver 701-0005-AB, 250ms message period (Duty cycle was set to the highest supported duty cycle of the device, to speed up and simplify measurements) Tx mode, coin cell battery

D.4. Test Results

Compliant – The maximum Peak field strength of fundamental was 99.13 dBµV/m at 3 meter distance. It has 14.85 dB margin to the peak and average limits

D.5. Test Data Summary

Frequency (MHz)	Peak field strength of fundamental (dBµV/m)	Duty Cycle Correction Factor (dB)	Average field strength of fundamental (dBµV/m)
2450	99.13	-20	79.13

All final reported values are corrected values

D.6. Sample Calculations

Average Limit = 20*Log(50000) = 93.98 dBµV/m
Peak Limit = Average Limit + 20 = 113.98 dBµV/m

D.7. Tested By

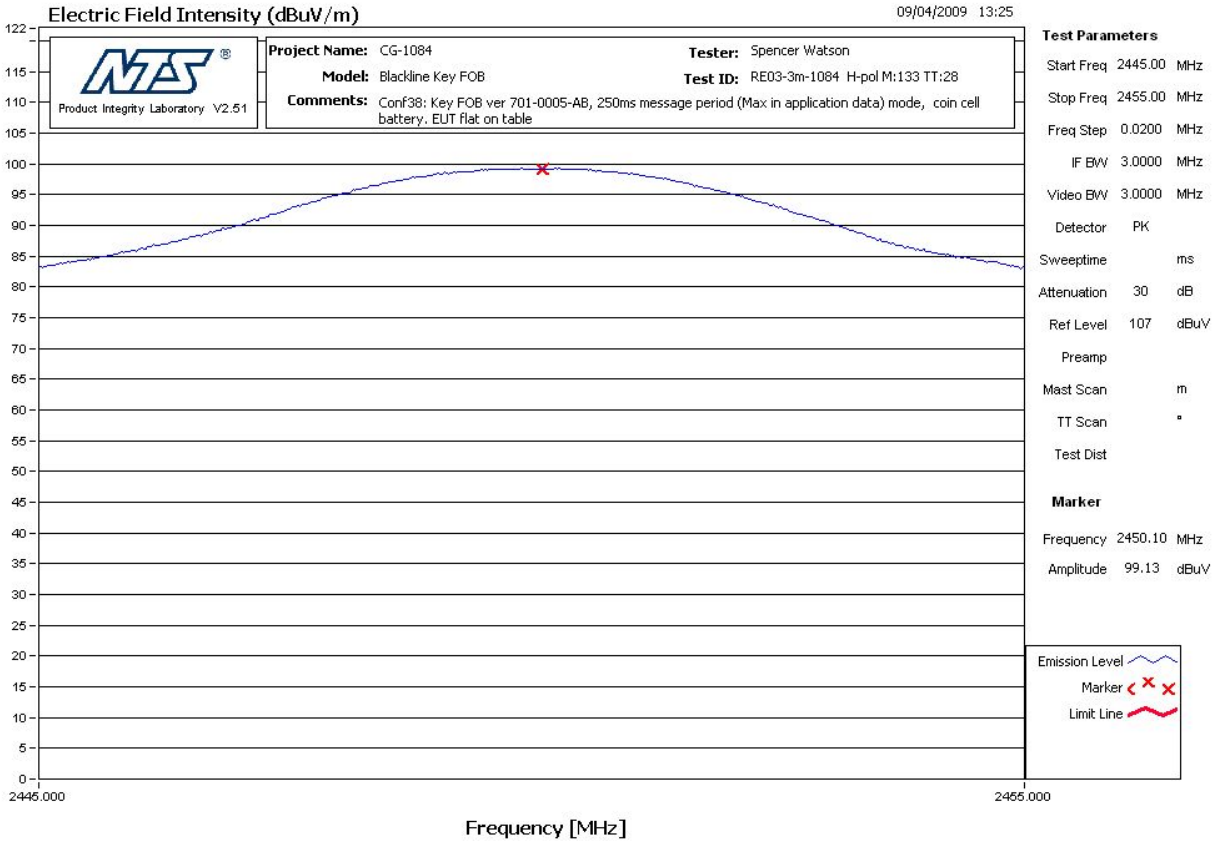
This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Spencer Watson
Function: EMC Technologist

D.8. Test date

April 9, 2009

Figure 5 Field Strength of fundamental at 3 m distance



APPENDIX E: RADIATED SPURIOUS EMISSIONS BAND EDGE

E.1. Base Standard & Test Basis

Base Standard	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.209 – Radio Frequency Devices, Part 15.205 – Restricted bands of operation RSS 210 Issue 7 A8.5
Test Basis	ANSI C63.4-2003 Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz,
Test Method	NTS Calgary SOP CAG EMC 02 Emission Test Methods

E.2. Specifications: FCC 15.205 and RSS 210 Issue 7 2.2 Restricted bands of operation.

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1]0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	N/A
13.36–13.41	N/A	N/A	N/A

(b) The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

E.3. Test Procedure

RF radiated measurement at 3 meters distance.

E.4. Operating Mode During Test

Key FOB ver 701-0005-AB, 250ms message period (Duty cycle was set to the highest supported duty cycle of the device, to speed up and simplify measurements) Tx mode, coin cell battery

E.5. Test Results

Compliant

Frequency (MHz)	Band Edge Peak Emission Level (dBµV/m)	Duty cycle Correction Factor (dB)	Band Edge Average Emission Value (dBµV/m)	Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
2386.48	49.62	-20	29.62	73.98	53.98	24.36
2485.03	67.10	-20	47.10	73.98	53.98	6.88
2549.13*	67.97	-20	47.97	73.98	53.98	6.01

* Not in the restricted bands

All final reported values are corrected values

E.6. Sample Calculations

Average Limit: 500 µV/m @ 3m = 20*Log (500) = 53.98 dBµV/m,
Peak limit = Average Limit + 20 = 73.98 dBµV/m

Band Edge Average Emission value (dBµV/m) = Band Edge Peak Emission Level (dBµV/m) + Duty cycle correction factor (dB)

E.7. Tested By

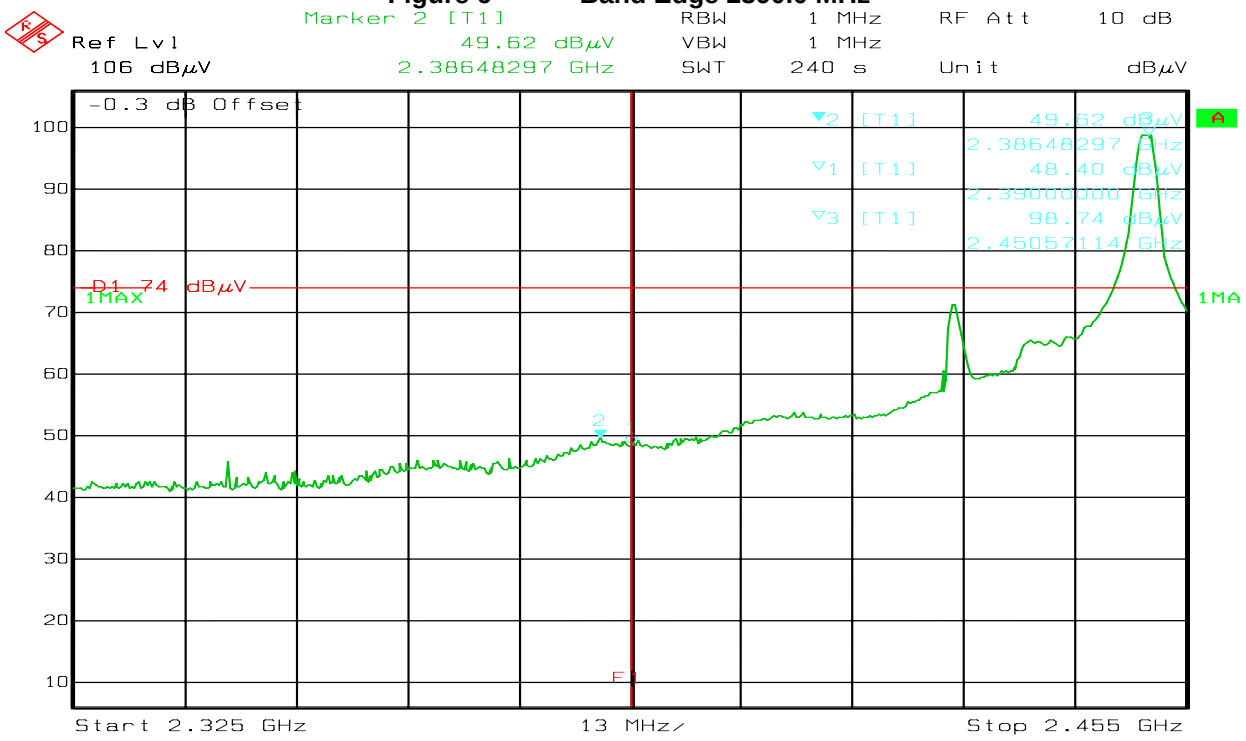
This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Spencer Watson
Function: EMC Technologist

E.8. Test date

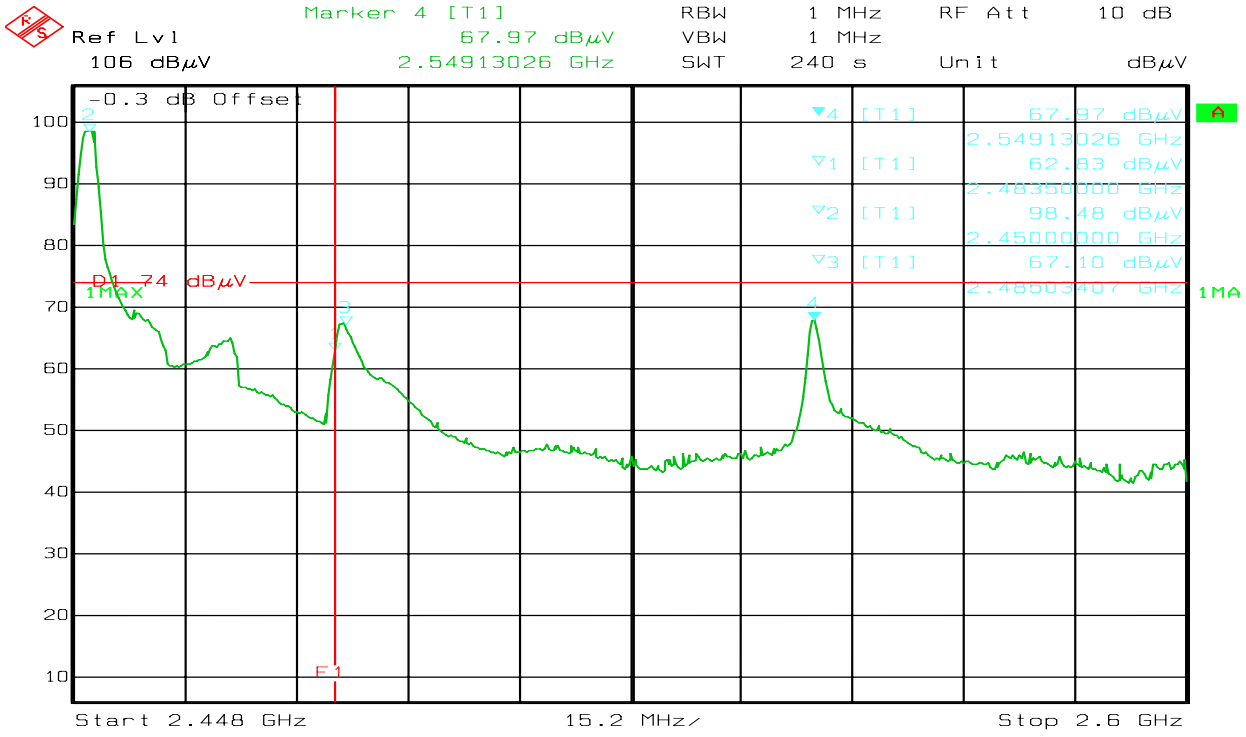
Jan 14, 2009

Figure 6 Band Edge 2390.0 MHz



Title: CG-1084 Blackline FOB
Comment A: FOB Tx, Upright, H:100cm, TT:165degree V-Pol
Date: 14.JAN.2009 20:25:47

Figure 7 Band Edge 2483.5 MHz



Title: CG-1084 Blackline FOB
Comment A: FOB Tx, Upright, H:100cm, TT:165degree V-Pol
Date: 14.JAN.2009 20:19:38

APPENDIX F: RADIATED SPURIOUS EMISSIONS

F.1. Base Standard & Test Basis

Base Standard	FCC CFR Title 47 – Telecommunications, Chapter I Part 15.209 – Radio Frequency Devices, RSS 210 Issue 7 A2.9, 2.7
Test Basis	ANSI C63.4-2003 Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz,
Test Method	NTS Calgary SOP CAG EMC 02 Emission Test Methods

F.2. Specifications:

FCC 15.205 and RSS 210 Issue 7 2.2 Restricted bands of operation.

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1]0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	N/A
13.36–13.41	N/A	N/A	N/A

(b) The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

FCC 15.249 and RSS 210 Issue 7 (A2.9)

Fundamental frequency (MHz)	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928	50	500
2400–2483.5	50	500
5725–5875	50	500

The field strength of harmonic emissions from intentional radiators operated in this frequency band shall comply with 500 microvolts / meter at 3 meter distance.

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation

RSS 210 Issue 7, 2.7
Table 2: General Field Strength Limits for Transmitters and Receivers at Frequencies Above 30 MHz

Frequency (MHz)	Field strength microvolts/m at 3 metres (watts, e.i.r.p.)	
	Transmitters	Receivers
30-88	100 (3 nW)	100 (3 nW)
88-216	150 (6.8nW)	150 (6.8nW)
219-960	200 (12nW)	200 (12nW)
Above 960	500 (75 nW)	500 (75 nW)

F.3. Test Procedure

Radiated Emission per SOP CAG EMC 02.

F.4. Operating Modes During Test

- Key FOB ver 701-0005-AB, 250ms message period (Duty cycle was set to the highest supported duty cycle of the device, to speed up and simplify measurements) Tx mode, coin cell battery
- Key FOB ver 701-0005-AB, Rx Mode

Worst case emissions presented

F.5. Test Results

F.5.1. Tx Mode 30 MHz – 1000 MHz Radiated Emission at 10m distance

There was no measurable emission observed between 30 MHz and 1000 MHz. Highest peak noise floor was 30.02 dBµV/m at 982.73 MHz. It has 13.50 dB margin to the quasi-peak limit.

F.5.2 Tx mode 1 GHz to 26 GHz Radiated Emission at 3m distance

Antenna Polarization	Frequency (MHz)	Peak Emission Level (dBµV/m)	Duty cycle Correction Factor (dB)	Average Emission Value (dBµV/m)	Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
Horizontal	2549.13	67.97	-20	47.97	73.98	53.98	6.01
Vertical	2549.13	68.33	-20	48.33	73.98	53.98	5.65
Horizontal	4899.80	66.22	-20	46.22	73.98	53.98	7.76
Vertical	4899.80	61.01	-20	41.01	73.98	53.98	12.97
Horizontal	9791.58	60.70	-20	40.70	73.98	53.98	13.28
Vertical	9801.60	60.95	-20	40.95	73.98	53.98	13.03

Maximum measured emission level was 68.33 dBµV/m at 2549.13 MHz with vertical receive antenna polarization. Calculated Average Emission Value was 48.33 dBµV/m with duty cycle correction factor. It has 5.65 dB margin to the limits.

F.5.3 Rx mode 30 MHz to 26 GHz Radiated Emission

There was no measurable emission observed with Rx mode

Notes:

- All final reported values are corrected values

- Plots were not provided in order to reduce file size

F.6. Sample Calculations

Quasi-peak limit for above 960 MHz at 10m distance= 20*Log (500) + 20*Log (3/10) = 43.52 dBµV/m
Average Limit for above 960 MHz at 3m distance = 20*Log (500) = 53.98 dBµV/m
Peak Limit for above 960 MHz at 3m distance= Average Limit + 20 (dB) = 73.98 dBµV/m

F.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name:	Spencer Watson	Deniz Demirci
Function:	EMC Technologist	Senior EMC / Wireless Technologist

F.8. Test dates

Started: Jan 14, 2009 Ended: Jan 14, 2009

APPENDIX G: TEST EQUIPMENT LIST

Descriptions	Manufacturer	Type/Model	Serial #	Cal Due	Cal Date
Test Receiver	Rohde & Schwarz	ESMI	CG0433 CG0434	02APR09	02APR08
Bilog Antenna	Teseq	CBL 6112D	CG1177	10OCT09	10OCT07
HPIB Extender	HP	37204	CG0181	N/A	N/A
Mast Controller	EMCO	2090	CG0179	N/A	N/A
Turntable Controller	EMCO	2090	CG0178	N/A	N/A
Digital Barometer / Thermometer	Cole-Parmer	1870	CG0728	30JUN09	30JUN08
Horn Antenna (Rx) 1 GHz – 18 GHz	EMCO	3115	CG0368	23AUG09	23AUG07
Standard Gain Horn (Rx) 18 GHz – 26.5 GHz	EMCO	3160-09	CG0075	N/A (1)	27NOV01
High pass filter f >1000 MHz	MicroTronics	HPM14576	CG0963	01DEC10	01DEC08
High pass filter f >2800 MHz	MicroTronics	HPM50111	CG0964	01DEC10	01DEC08
LNA 1 GHz - 18 GHz	Miteq	JSD00121	CG0317	01DEC10	01DEC08
LNA 18 GHz - 26.5 GHz	Miteq	JSD00119	CG0482	02OCT09	02OCT07
Spectrum Analyzer 9 kHz – 40 GHz	Rohde & Schwarz	FSEK-20	CG0118	01JUL09	01JUL08
LNA DC Power Supply	Xantrex	LXO 30-2	CG0493	N/A	N/A
HPIB Extender	HP	37204	CG0110	N/A	N/A
Turntable and Mast Controller	EMCO	2090	CG0161	N/A	N/A

(1): As per manufacturer recommend, this item does not require periodic calibration. Its electromagnetic performance is almost exclusively depended on the physical dimension of the horn. A thorough mechanical check is all that is needed to guarantee the antenna performance.

END OF DOCUMENT