Electromagnetic Compatibility Test Report

Tests Performed on a Segway, Inc.

Human Transporter (HT-V1A) , Model 2014500001

Radiometrics Document RP-5815-TX-FC

ACCREDITED
Certification # 1495.01

Product Detail:
FCC ID: T2Z2420-01
Equipment type: DTS
Digitally Modulated Spread Spectrum Transmitter

Test Standards:
US CFR Title 47, Chapter I, FCC Part 15 Subpart C
FCC Part 15 CFR Title 47: 2006
Industry Canada RSS-210, Issue 6 as required for Category I Equipment

This report concerns: Original Grant for Certification
FCC Part 15.247

Tests Performed For:	*Test Facility:*
Segway, Inc. 14 Technology Drive Bedford, NH 03110	**Radiometrics Midwest Corporation** 12 East Devonwood Romeoville, IL 60446 Phone: (815) 293-0772 e-mail: info@radiomet.com

Test Date(s): (Month-Day-Year)
April 3 to 28, 2006

Document RP-5815-TX-FC Revisions:

Rev.	Issue Date	Affected Pages	Revised By	Authorized Signature for Revision
0	July 17, 2006			

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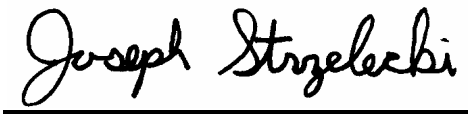
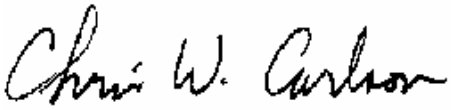
1 ADMINISTRATIVE DATA

Equipment Under Test:
A Segway, Inc., Human Transporter (HT-V1A)
Model: 2014500001

This device consists of the transporter section (UIC) Serial Number: 06211XV1X010
And a wireless Remote (FOB) Serial Number E51

The system will be referred to as the EUT in this Report. The transporter section will be referred to as a UIC and the remote will be referred to as a FOB.

Date EUT Received at Radiometrics: (Month-Day-Year)	*Test Date(s): (Month-Day-Year)*
April 3, 2006	April 3 to 28, 2006
Test Report Written By: Joseph Strzelecki Senior EMC Engineer	*Test Witnessed By:* Chris Kastel Segway, Inc.
Radiometrics' Personnel Responsible for Test:  Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE Jeffrey E. Tomes Senior EMC Technician	*Test Report Approved By*  Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Human Transporter (HT-V1A), Model 2014500001, manufactured by Segway, Inc. The detailed test results are presented in separate sections. The following tests results apply to both transceivers: the Base (UIC) and the remote device (FOB).

General Emissions Tests Results

Environmental Phenomena	Frequency Range	FCC Section	RSS Section	Test Result
RF Radiated Emissions	30 MHz to 25 GHz	Part 15.209	RSS-Gen Table 1	Pass
AC Mains Conducted Emissions	0.15 - 30 MHz	Part 15.207	RSS-Gen Table 2	Pass

Spread Spectrum Transmitter Requirements

Environmental Phenomena	Frequency Range	FCC Section	RSS-210 Section	Test Result
6 dB Bandwidth Test;	2400 to 2483.5 MHz	15.247 a	6.2.2 (o) (a)	Pass
6 dB Bandwidth Test;	2400 to 2483.5 MHz	15.247 a	6.2.2 (o) (a)	Pass
Peak Output Power	2400 to 2483.5 MHz	15.247 b	6.2.2 (o) (a)	Pass

Environmental Phenomena	Frequency Range	FCC Section	RSS-210 Section	Test Result
Band-edge Compliance of RF Emissions	2400 to 2483.5 MHz	15.247 d	6.2.2 (o) (e)	Pass
Spurious RF Conducted Emissions	30 MHz to 25 GHz	15.247 d	6.2.2 (o) (e1)	Pass
Spurious Radiated Emissions	30 MHz to 25 GHz	15.247 d	6.2.2 (o) (a)	Pass
Power Spectral Density	2400 to 2483.5 MHz	15.247 e	6.2.2 (o) (b)	Pass

Since there is no Antenna connector on either EUT, radiated tests were performed to show compliance with the conducted requirements in the above table.

2.1 RF Exposure Compliance Requirements

Since the power output is 1 mW, The EUT meets the FCC requirement for RF exposure and it is exempt from RSS-102. There are no power level adjustments and the antenna is permanently attached. The detailed calculations for RF Exposure are presented in a separate document.

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Human Transporter (HT-V1A), Model 2014500001, manufactured by Segway, Inc. The EUT was in good working condition during the tests, with no known defects.

This device consists of the transporter section (UIC) and a wireless Remote (FOB).

3.1.1 FCC Section 15.203 & RSS-210 Section 5.5 Antenna Requirements

The FOB Antenna is permanently installed inside of the EUT. The antenna is a trace on the circuit board. The UIC Antenna is permanently installed inside of the EUT. It has a unique Connector and cannot be readily accessed by the end user.

3.2 Related Submittals

Segway, Inc. is not submitting any other products simultaneously for equipment authorization related to the EUT.

4 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT has two parts, the UIC (the trasporter) and the FOB (Remote Control). The end user will use the FOB either attached to the UIC or seperated from it. During tests just on the FOB, it was placed on an 80-cm high, nonconductive test stand. The UIC is floor standing, and it was tested on a flush mount turntable.

The identification for all equipment, plus descriptions of all cables used in the tested system, are:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	Human Transporter (HT-V1A) This is the System	E	Segway, Inc.	2014500001	06211XV1X010 & E51
2	Transporter (UIC)	E	Segway, Inc.		06211XV1X010
3	Remote (FOB)	E	Segway, Inc.		E51

* Type: E = EUT

4.2 Operating Conditions of EUT

The EUT was in a normal operating mode during the tests. All circuits were activated during the tests. During the Conducted Emissions test, power was supplied the transporter at 115 VAC, 60 Hz and it was charging the battery. During all other tests, power was supplied with a new or fully charged battery. Since the EUT emissions are pulsed, the unit was modified for continuous operation.

4.3 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

4.4 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2006	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-2003	2003	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IC RSS-210 Issue 6	2005	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment
IC RSS-212 Issue 1	1999	Test Methods For Radio Equipment
IC RSS-Gen Issue 1	2005	General Requirements and Information for the Certification of Radio communication Equipment (RSS-Gen)
FCC 558074	2005	Measurement of Digital Transmission Systems Operating under Section 15.247

The test procedures used are in accordance with the FCC 15.247, Industry Canada RSS-212 and ANSI document 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". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

6 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 1999 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.org).

The following is a list of shielded enclosures located in Romeoville, Illinois:

Chamber A: Is an anechoic chamber that measures 24' L X 12' W X 12' H. The walls and ceiling are fully lined with ferrite absorber tiles. The floor has a 10' x 10' section of ferrite absorber tiles located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

Chamber B: Is a shielded enclosure that measures 24' L X 12' W X 8' H. Erik A. Lindgren & Associates of Chicago, Illinois manufactured the enclosure.

Chamber C: Is a shielded enclosure that measures 20' L X 10' W X 8' H. Lindgren RF Enclosures Inc. of Addison, Illinois manufactured the enclosure.

Chamber D: Is a fully anechoic chamber that measures 22' L X 10' W X 10' H. The walls, ceiling and floor are fully lined with ferrite absorber tiles. Braden Shielding Systems of Tulsa, Oklahoma manufactured the chamber.

Chamber E: Is a custom made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

Test Station F: Is an area that measures 10' D X 12' W X 10' H. The floor and back wall are metal shielded. This area is used for conducted emissions measurements.

A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

Open Area Test Site (OATS): Is located on 8625 Helmar Road in Newark, Illinois, USA and measures 56' L X 24' W X 17' H. The entire open field test site has a metal ground screen. The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as file number IC3124.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	12/22/05
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo	12/22/05
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	12/21/05
AMP-29	HP / Agilent	Amplifier for 18-26 GHz Mixer	11975A	2304A00158	2-8 GHz	12 Mo.	08/19/05
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	10/13/04
ANT-44	Impossible Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	12/12/05
ANT-48	RMC	Std Gain Horn	HW2020	1001	18-26 GHz	12 Mo.	08/19/05
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	24 Mo.	04/20/05
HPF-03	Mini-Circuits	High Pass Filter	VHP-39	HPF-03	3-10 GHz	12 Mo.	02/08/06
LSN-03	Farnell	50 uH LISN	1EXLSN30B	000314	0.01-30MHz	24 Mo.	04/25/05
MXR-01	HP / Agilent	Harmonic Mixer	11970K	3003A02243	18.6-26.5GHz	12 Mo.	08/19/05
REC-03	Anritsu	Spectrum Analyzer	MS2601B	MT94589	0.01-2200MHz	12 Mo.	12/07/05
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	02/07/06
REC-08	Hewlett Packard	Spectrum Analyzer	8566B	2648A13481 2209A01436	30Hz-22GHz	12 Mo.	06/14/05
THM-01	Extech Inst.	Temp/Humid Meter	4465CF	001106557	N/A	24 Mo.	03/31/06

Note: All calibrated equipment is subject to periodic checks.

10 TEST SECTIONS

The test equipment that was used in the performance of each of the tests can be determined by cross-referencing the coded equipment designations on the test equipment setup drawings with the equipment list on Table in section 9.

10.1 AC Conducted Emissions; Section 15.207

A computer-controlled analyzer was used to perform the conducted emissions measurements. The frequency range was divided into 500 subranges equally spaced on a logarithmic scale. The computer recorded the peak of each subrange. This data was then plotted on semi-log graph paper generated by the computer and plotter. Adjusting the positions of the cables and orientation of the test system then maximizes the highest emissions.

Mains Conducted emission measurements were performed using a 50 Ohm/50 uH Line Impedance Stabilization Network (LISN) as the pick-up device. Measurements were repeated on both leads within the power cord. If the EUT power cord exceeded 80 cm in length, the excess length of the power cord was made into a 30 to 40 cm bundle near the center of the cord. The LISN was placed on the floor at the base of the test platform and electrically bonded to the ground plane.

Broadband conducted emissions may exceed the following limits by no more than 13 dB. An emission is defined as broadband if the average detector amplitude is 6 dB or more under the quasi-peak detector amplitude.

FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBuV)	
	Quasi-Peak	Average
0.150 - 0.50*	66 - 56	56 - 46
0.5 – 5.0	56	46
5.0 - 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		

The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from the power cord, after testing all modes of operation.

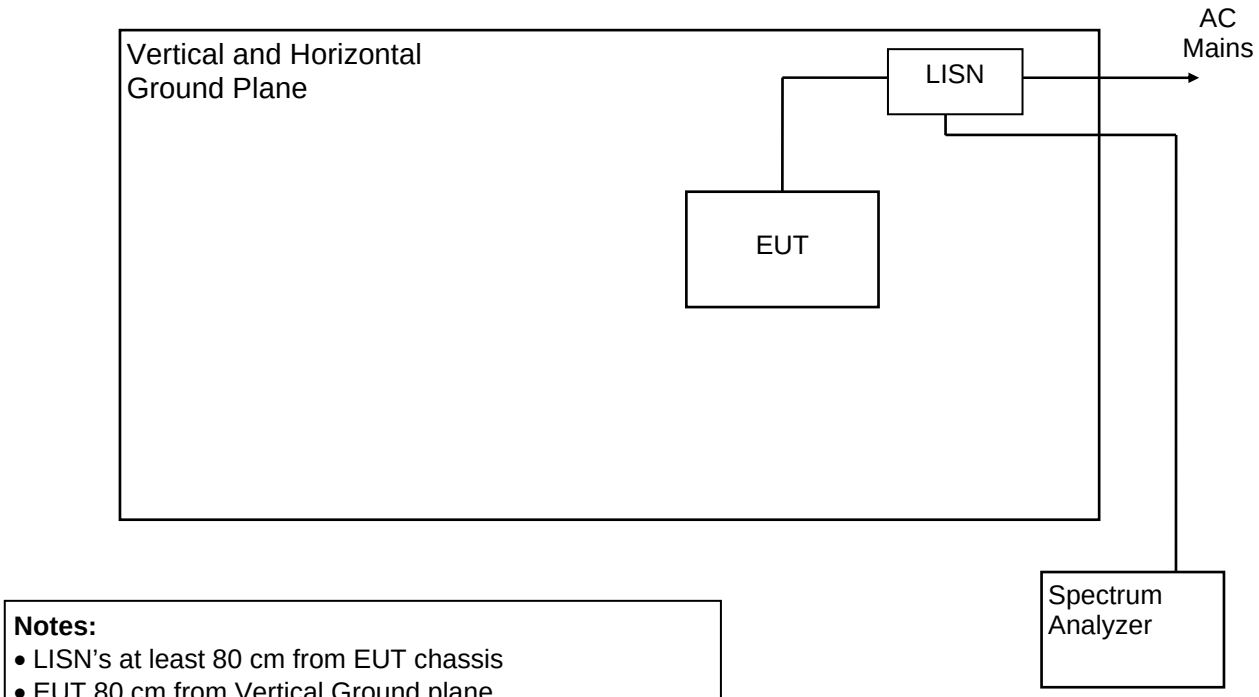
Test Date : April 26, 2006
The Amplitude is the final corrected value with cable and LISN Loss.

EUT	Lead Tested	Frequency MHz	QP Amplitude	QP Limit	Average Amplitude	Average Limit
S/N 010	AC Neutral	0.22	48.9	62.7	42.1	52.6
S/N 010	AC Neutral	16.61	40.4	60.0	32.8	50.0
S/N 010	AC Neutral	20.37	37.8	60.0	30.8	50.0
S/N 010	AC Hot	0.22	49.2	62.7	43.4	52.7
S/N 010	AC Hot	0.33	40.1	59.5	34.8	49.4
S/N 010	AC Hot	12.09	35.9	60.0	30.6	50.0

The above are the worst case results with three frequencies test for each EUT
* QP readings are quasi-peak with a 9 kHz bandwidth and no video filter.

Judgment: Passed by 9.3 dB

Figure 1. Conducted Emissions Test Setup



10.2 Time of Occupancy (Dwell Time)

As required by FCC section 15.35 and RSS-210 section 6.5, the Peak to Average correction factor was calculated for the highest duty cycle in percent over any 100mS transmission. The factor in dB is 20 * Log(Duty cycle/100). The information is provided by Segway, Inc.

UIC Worst Case Transmit Time per 100 mSec:
This assumes that the FOB is not transferring messages to the UIC and the UIC is repeatedly sending one 96-bit message back to the FOB. The following is the Transmission Time Calculations for Heartbeat/Message Transfer.

Description for UIC		
1	FOB->UIC start transfer (Off Time)	768 uS
2	Shortest UIC setup response delay (Off Time)	2900 uS
3	UIC->FOB transfer (On Time)	1216 uS
4	Shortest FOB setup response delay (Off Time)	1750 uS
5	Repeat 1-4	
	Total pulse train	6634 uS
	% UIC transmit time	=1216/6634
	% UIC transmit time	18.33 %
	Transmit time per 100ms	18.33 mS
	Duty Cycle Correction Factor dB	**14.74 dB**

FOB Worst Case Transmit Time per 100 mSec:
The worst case transmit time for a FOB is during the power up transmission. It repeats a probe frame continuously, allowing just enough time for an Auto ACK response from the UIC. The following is the Transmission Time Calculations for FOB Probe on Power Button.

Description for FOB		
1	Send Probe (On Time)	640 uS
2	Listen (Off Time)	632 uS
3	Repeat 1 and 2 for more than 100 mSec.	
	Total pulse train	1272 uS
	% FOB transmit time	=640/1272
	% FOB transmit time	50.31 %
	Transmit time per 100ms	50.31 mS
	Duty Cycle Correction Factor dB	**5.97 dB**

The correction factor was used to determine the average values for radiated emissions.

10.3 Bandwidth Tests

The following is the overall test results for the bandwidth tests.

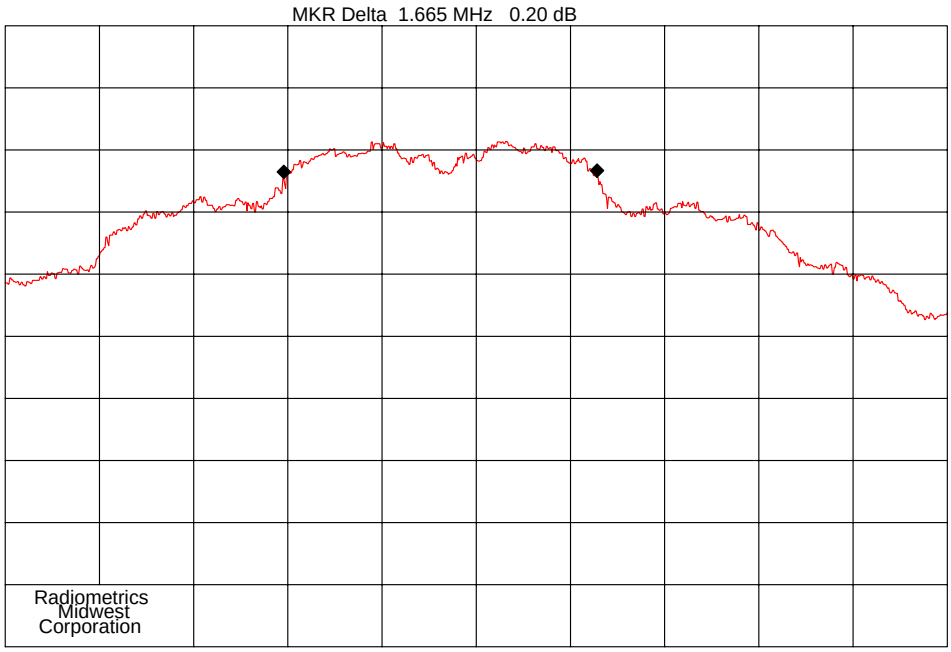
Channel	UIC 6 dB EBW MHz	FOB 6 dB EBW MHz	UIC 20 dB EBW MHz	FOB 20 dB EBW MHz
Low	1.575	1.665	2.564	3.514
Mid	1.595	1.604	2.585	2.583
High	1.570	1.619	2.594	2.654

Minimum Allowed Bandwidth is 500 kHz
Overall Test result: Pass; Lowest bandwidth is 1.575 MHz

10.3.1 Occupied Bandwidth for FCC (6 dB)

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize.

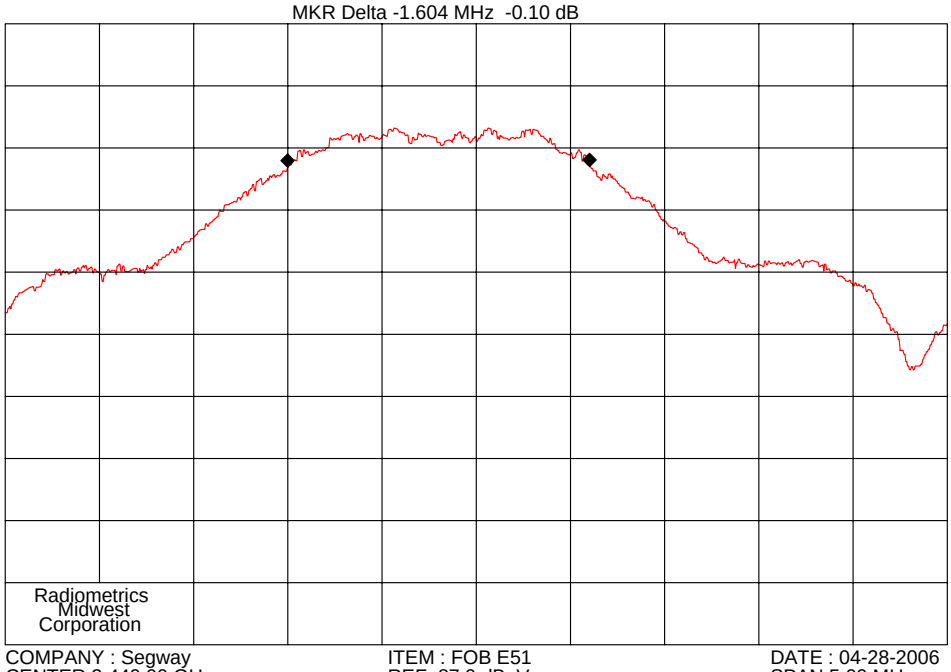
The marker-to-peak function was set to the peak of the emission. Then the marker-delta function was used to measure 6 dB down one side of the emission. The marker-delta function was reset and then moved to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 6 dB bandwidth of the emission.



COMPANY : Segway
CENTER 2.405 00 GHz
RES BW 100 kHz
10 dB/
NOTES : 6 dB Bandwidth, Channel 0

ITEM : FOB E51
REF 87.0 dBuV
VBW 300 kHz
TIME : 12:05

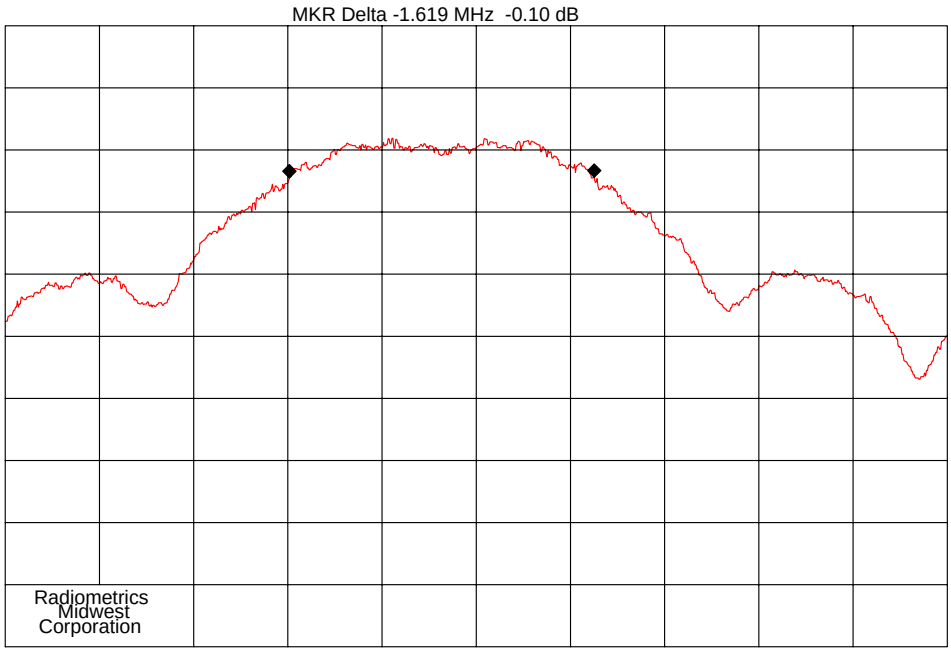
DATE : 04-28-2006
SPAN 5.00 MHz
ATTEN 0 dB
SWP 20.0 msec

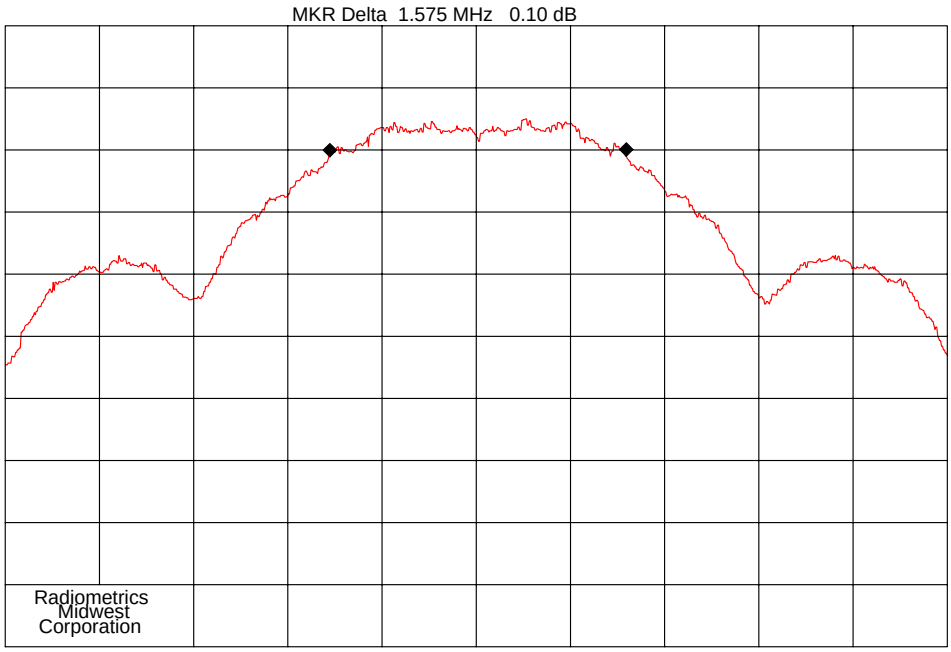


COMPANY : Segway
CENTER 2.440 00 GHz
RES BW 100 kHz
10 dB/
NOTES : 6 dB Bandwidth, Channel 7

ITEM : FOB E51
REF 87.0 dBuV
VBW 300 kHz
TIME : 12:07

DATE : 04-28-2006
SPAN 5.00 MHz
ATTEN 0 dB
SWP 20.0 msec

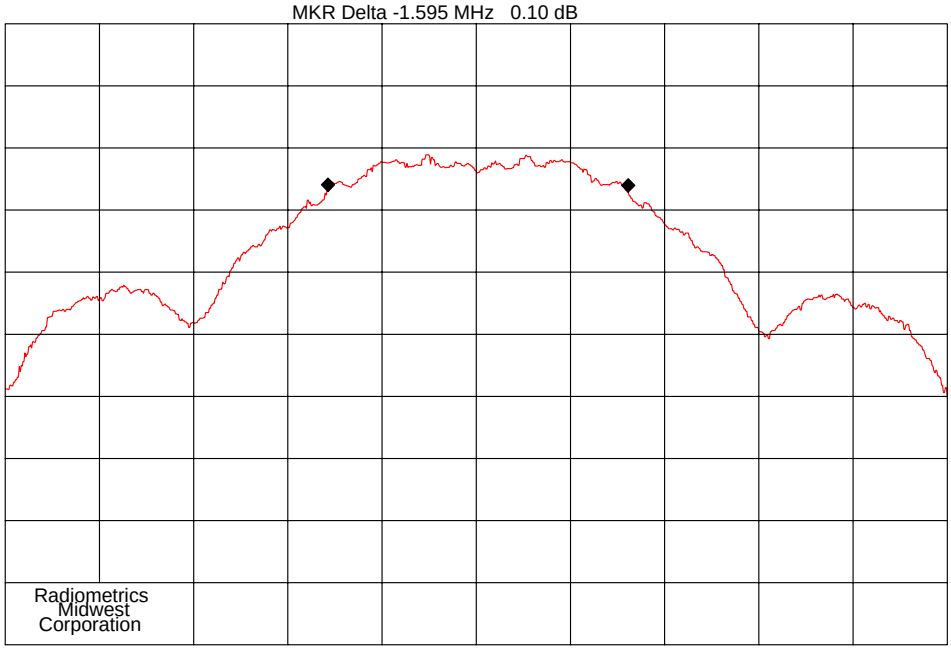

MKR Delta -1.619 MHz -0.10 dB
Radiometrics
Midwest
Corporation
COMPANY : Segway
CENTER 2.475 00 GHz
RES BW 100 kHz
10 dB/
NOTES : 6 dB Bandwidth, Channel 14
ITEM : FOB E51
REF 87.0 dBuV
VBW 300 kHz
TIME : 12:13
DATE : 04-28-2006
SPAN 5.00 MHz
ATTEN 0 dB
SWP 20.0 msec



COMPANY : Segway
CENTER 2.405 00 GHz
RES BW 100 kHz
10 dB/
NOTES : 6 dB Bandwidth, Channel 0

ITEM : UIC 010
REF 87.0 dBuV
VBW 300 kHz
TIME : 11:49

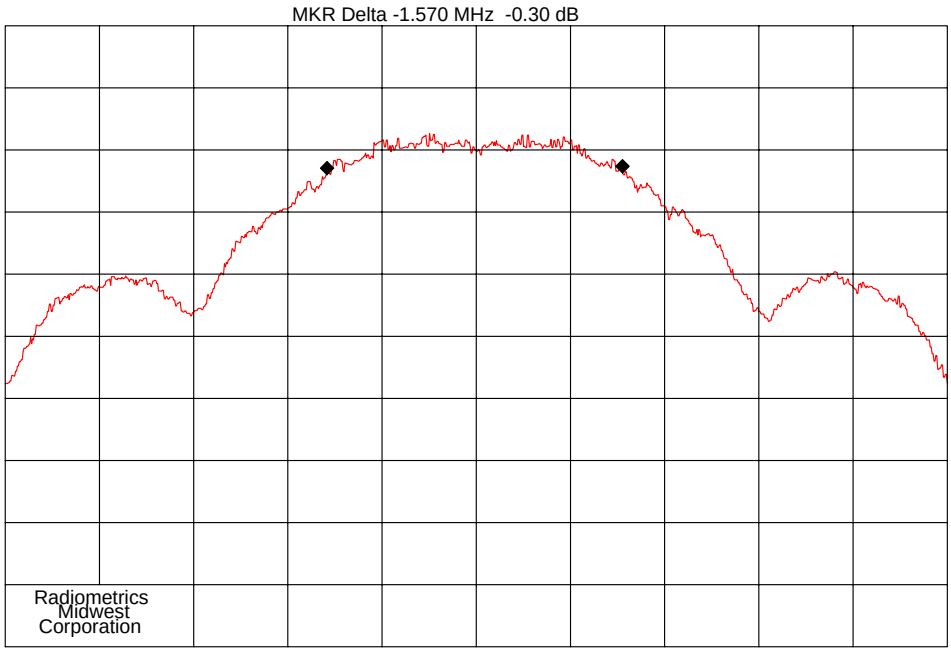
DATE : 04-28-2006
SPAN 5.00 MHz
ATTEN 0 dB
SWP 20.0 msec



COMPANY : Segway
CENTER 2.475 00 GHz
RES BW 100 kHz
10 dB/
NOTES : 6 dB Bandwidth, Channel 14

ITEM : UIC 010
REF 87.0 dBuV
VBW 300 kHz
TIME : 11:23

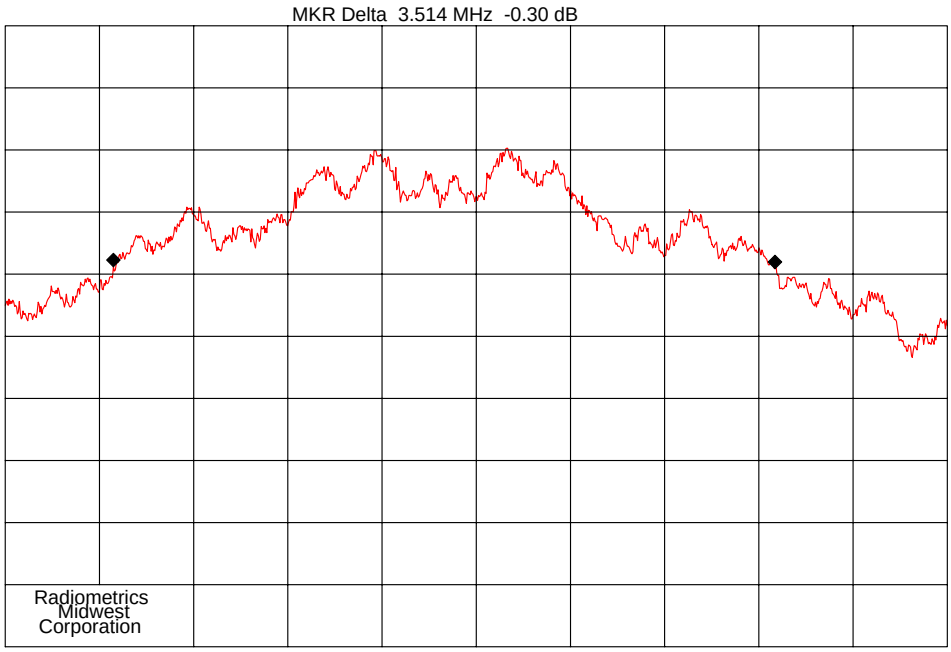
DATE : 04-28-2006
SPAN 5.00 MHz
ATTEN 0 dB
SWP 20.0 msec



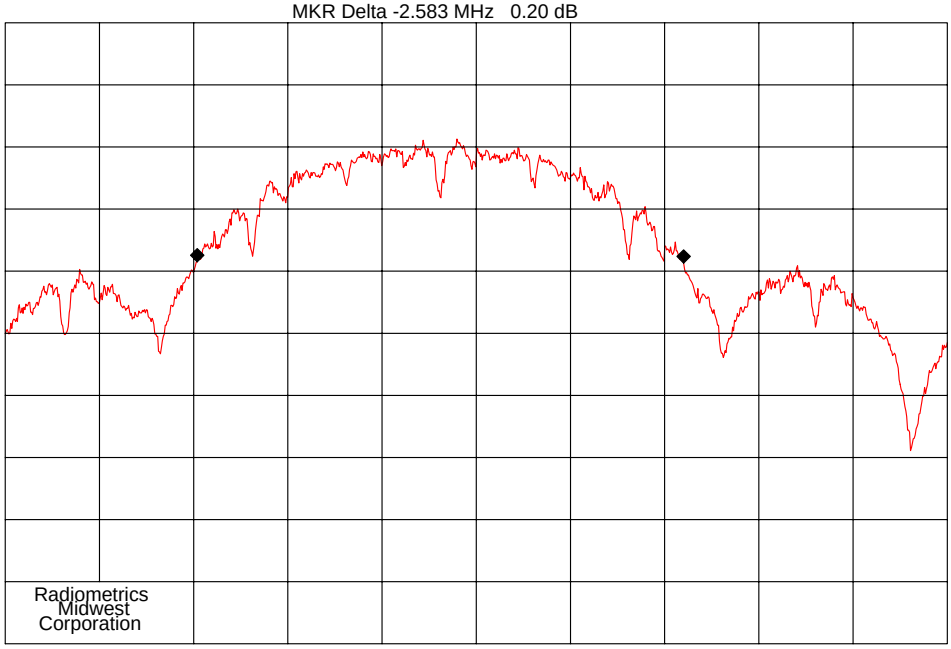
10.4 Occupied Bandwidth (20 dB) for Canada RSS-210

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize.

The marker-to-peak function was set to the peak of the emission. Then the marker-delta function was used to measure 20 dB down one side of the emission. The marker-delta function was reset and then moved to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.


MKR Delta 3.514 MHz -0.30 dB
Radiometrics
Midwest
Corporation
COMPANY : Segway
CENTER 2.405 00 GHz
RES BW 30 kHz
10 dB/
NOTES : 20 dB Bandwidth, Channel 0
ITEM : FOB E51
REF 87.0 dBuV
VBW 100 kHz
TIME : 12:03
DATE : 04-28-2006
SPAN 5.00 MHz
ATTEN 0 dB
SWP 20.0 msec

MKR Delta -2.583 MHz 0.20 dB

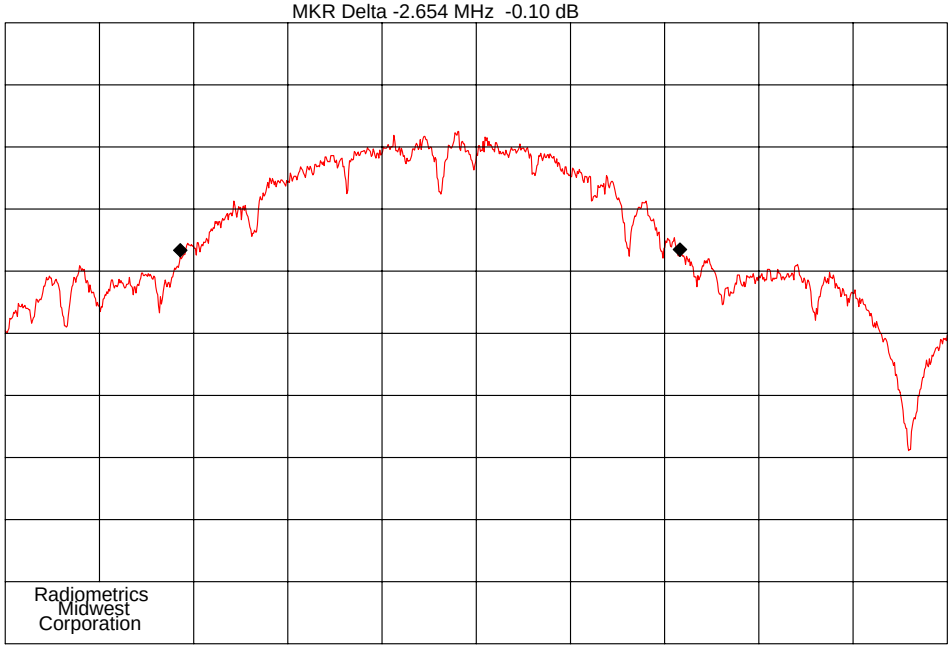


COMPANY : Segway
CENTER 2.475 00 GHz
RES BW 30 kHz
10 dB/
NOTES : 20 dB Bandwidth, Channel 14

ITEM : FOB E51
REF 87.0 dBuV
VBW 100 kHz
TIME : 12:11

DATE : 04-28-2006
SPAN 5.00 MHz
ATTEN 0 dB
SWP 20.0 msec

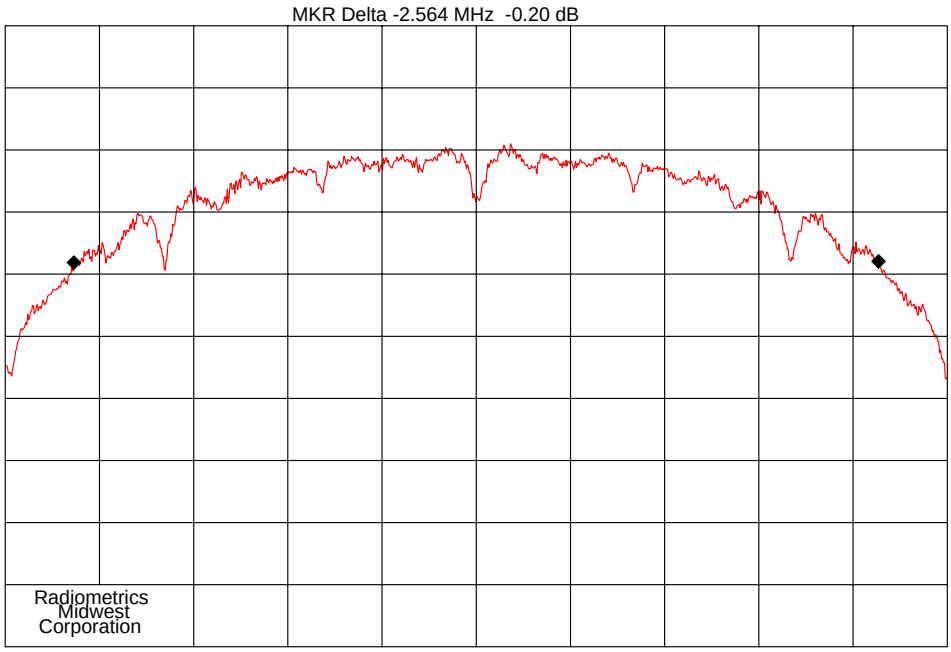
MKR Delta -2.654 MHz -0.10 dB



COMPANY : Segway
CENTER 2.440 00 GHz
RES BW 30 kHz
10 dB/
NOTES : 20 dB Bandwidth, Channel 7

ITEM : FOB E51
REF 87.0 dBuV
VBW 100 kHz
TIME : 12:09

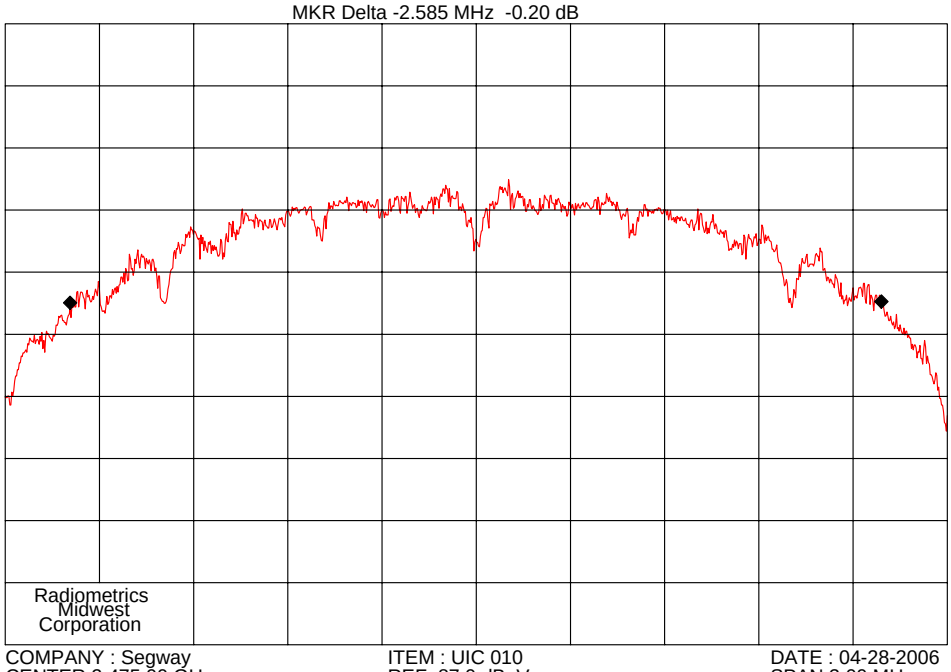
DATE : 04-28-2006
SPAN 5.00 MHz
ATTEN 0 dB
SWP 20.0 msec



COMPANY : Segway
CENTER 2.405 00 GHz
RES BW 30 kHz
10 dB/
NOTES : 20 dB Bandwidth, Channel 0

ITEM : UIC 010
REF 87.0 dBuV
VBW 100 kHz
TIME : 11:52

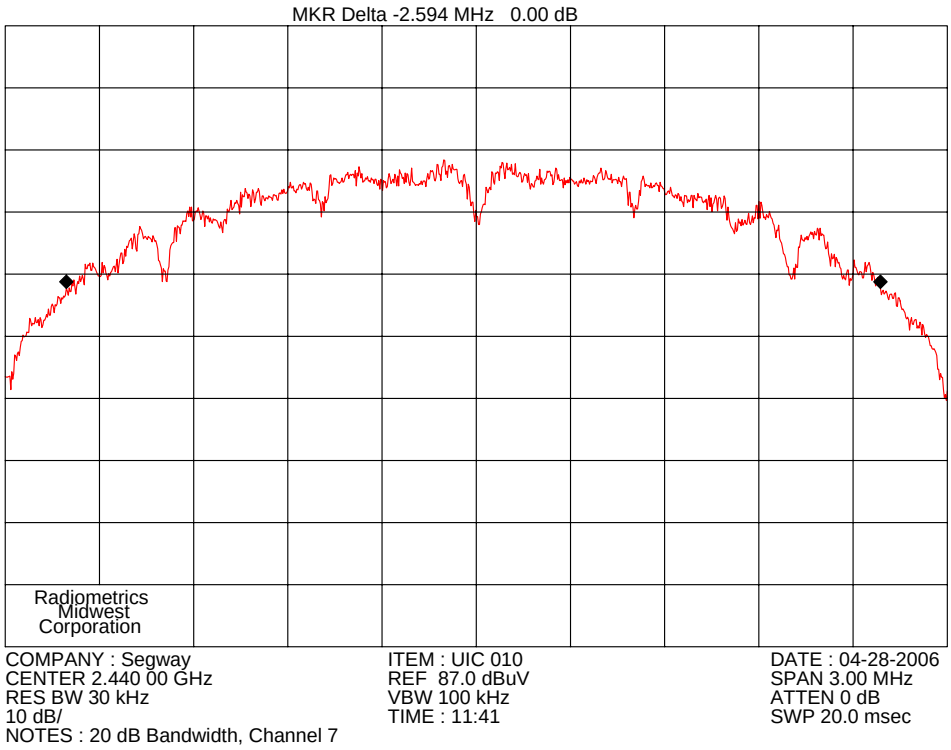
DATE : 04-28-2006
SPAN 3.00 MHz
ATTEN 0 dB
SWP 20.0 msec



COMPANY : Segway
CENTER 2.475 00 GHz
RES BW 30 kHz
10 dB/
NOTES : 20 dB Bandwidth, Channel 14

ITEM : UIC 010
REF 87.0 dBuV
VBW 100 kHz
TIME : 11:32

DATE : 04-28-2006
SPAN 3.00 MHz
ATTEN 0 dB
SWP 20.0 msec



10.5 Peak Output Power

Since antenna conducted tests cannot be performed on the EUT, radiated tests were performed to show compliance with this requirement. The FCC procedures from power output option 1 was used.

The transmitter's peak power was calculated using the following equation:

P = (E x d)^2 / (30 x G)

Where: E = the measured maximum peak field strength in V/m.
G = The numeric gain of the transmitting antenna over an isotropic radiator.
d = Distance in meters from which the field strength was measured. (3 meters)
P = The EUT power in watts

The field Strength was measured using the procedures described in section 10.9, with the exception of the resolution and video bandwidths. The spectrum analyzer was set to the following settings:

Span = 3 MHz ; RBW = 3 MHz (> the 20 dB bandwidth of the emission being measured)
VBW = 3 MHz; Sweep = auto; Detector function = peak; Trace = max hold

Since the gain of the antenna is always less than 6dB, the limit is not reduced.

	Freq	Peak Field Strength		Ant gain	Test Distance	Output power from EUT		Limit
EUT	MHz	dBuV/m	V/m	Numeric	Meters	Watts	dBm	dBm
FOB	2405	89.3	0.0292	1	3	2.55E-04	-5.93	30
FOB	2440	89.7	0.0305	1	3	2.80E-04	-5.53	30
FOB	2475	89.8	0.0309	1	3	2.86E-04	-5.43	30
UIC	2405	95.5	0.0596	1	3	1.06E-03	0.27	30
UIC	2440	95.9	0.0624	1	3	1.17E-03	0.67	30
UIC	2475	93.9	0.0495	1	3	7.36E-04	-1.33	30

Overall Test result: Pass by 29.3 dB

10.6 Power Spectral Density

Since antenna conducted tests cannot be performed on the EUT, radiated tests were performed to show compliance with this requirement. The FCC procedures from PSD option 1 was used. The power spectral density was measured as follows.

The field strength was measured using the procedures described in section 10.9, with the following exceptions: The analyzer was tuned to the highest point of the maximized fundamental emission. The analyzer was set to a RBW = 3 kHz, VBW > RBW, span = 300 kHz and a sweep = 100 Sec. Using this peak level, the transmitter's power spectral density was calculated using the following equation:

P = (E x d)^2 / (30 x G)

Where: E = the measured maximum peak field strength in V/m, using the bandwiths in this section.
G = The numeric gain of the transmitting antenna over an isotropic radiator.
d = Distance in meters from which the field strength was measured. (3 meters)
P = The EUT power in watts

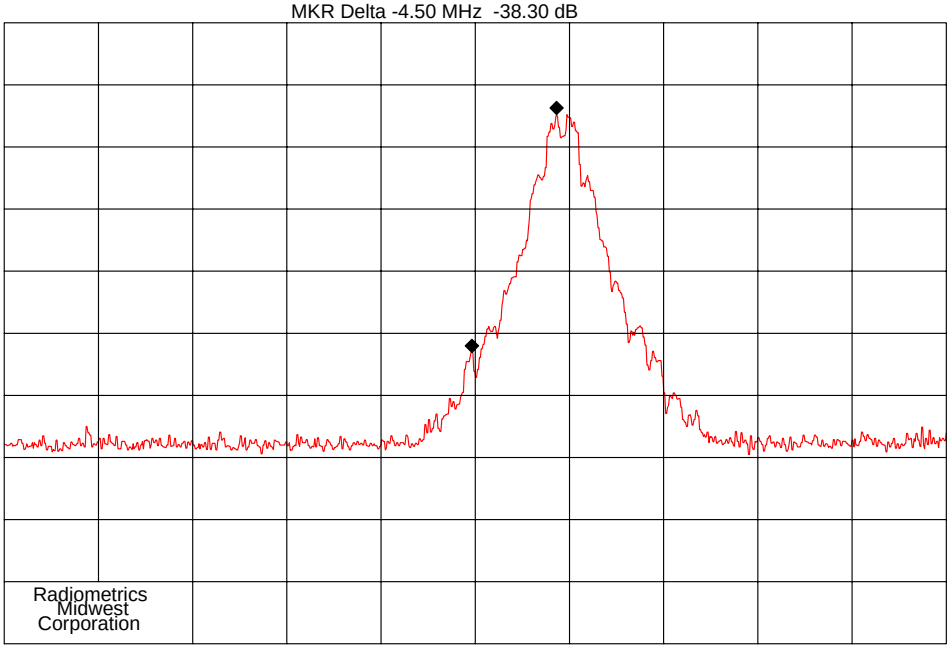
	Freq	3kHz PSD Field Strength		Ant gain	Test Distance	3 kHz Spectral Density from EUT		Limit
EUT	MHz	dBuV/m	V/m	Numeric	Meters	Watts	dBm	dBm
FOB	2405	79.2	0.0091	1	3	2.50E-05	-16.03	8
FOB	2440	77.6	0.0076	1	3	1.73E-05	-17.63	8
FOB	2475	80.1	0.0101	1	3	3.07E-05	-15.13	8
UIC	2405	85.5	0.0188	1	3	1.06E-04	-9.73	8
UIC	2440	84.9	0.0176	1	3	9.27E-05	-10.33	8
UIC	2475	84.3	0.0164	1	3	8.07E-05	-10.93	8

Overall Test result: Pass by 17.7 dB

10.7 Band-edge Compliance of RF Conducted Emissions

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation at the band-edge, with the EUT set to the lowest frequency. The trace was allowed to stabilize. The Test was performed using an Antenna 20 cm from the EUT.

MKR Delta -4.50 MHz -38.30 dB

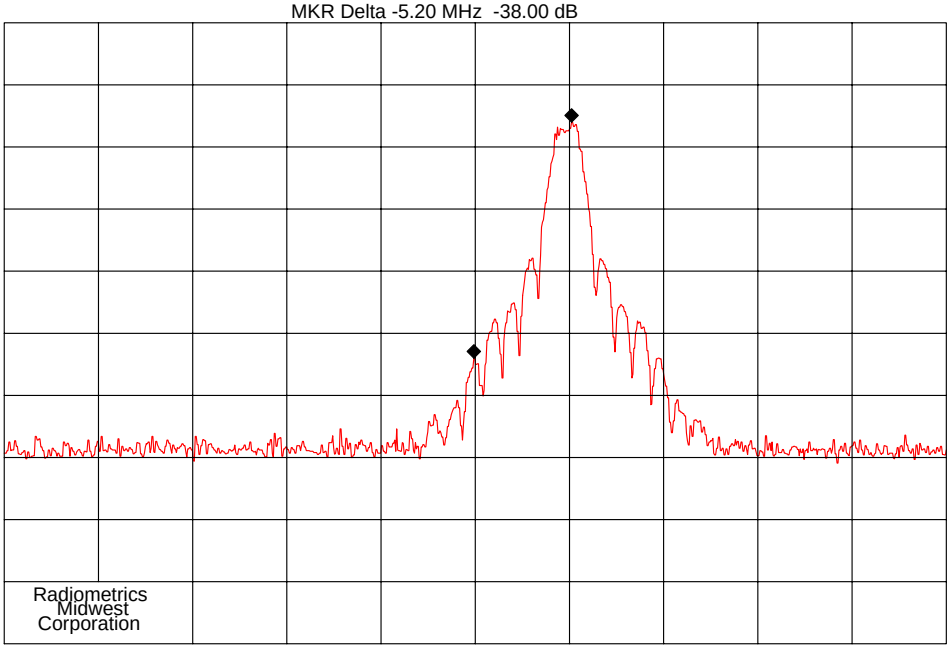


COMPANY : Segway
CENTER 2.400 0 GHz
RES BW 100 kHz
10 dB/
NOTES : Band Edge Test, Channel 0

ITEM : FOB E51
REF 87.0 dBuV
VBW 300 kHz
TIME : 09:48

DATE : 04-28-2006
SPAN 50.0 MHz
ATTEN 0 dB
SWP 20.0 msec

MKR Delta -5.20 MHz -38.00 dB

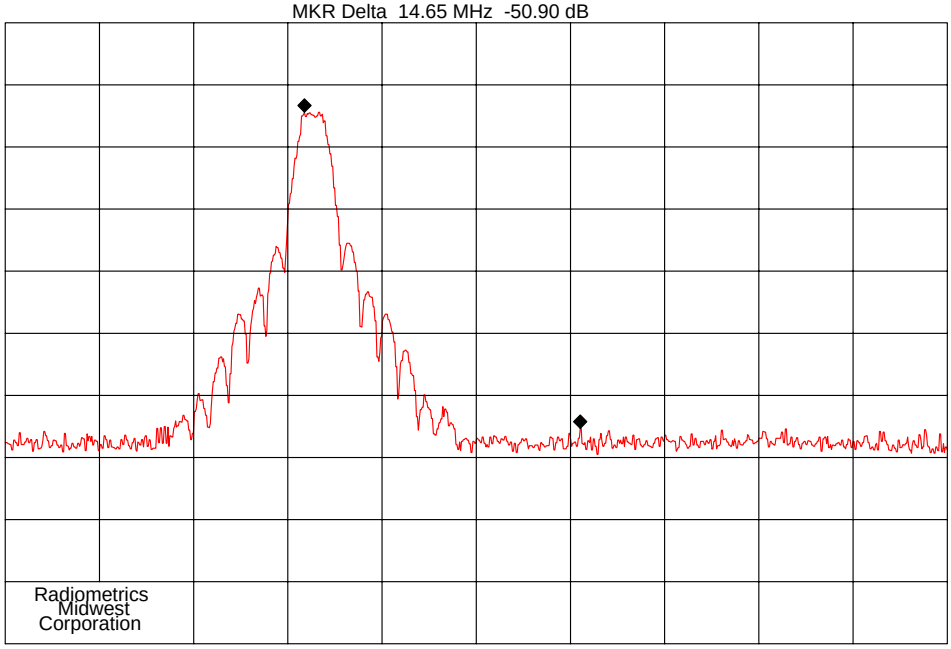


COMPANY : Segway
CENTER 2.400 0 GHz
RES BW 100 kHz
10 dB/
NOTES : Band Edge Test, Channel 0

ITEM : UIC 010
REF 87.0 dBuV
VBW 300 kHz
TIME : 10:59

DATE : 04-28-2006
SPAN 50.0 MHz
ATTEN 0 dB
SWP 20.0 msec

MKR Delta 14.65 MHz -50.90 dB

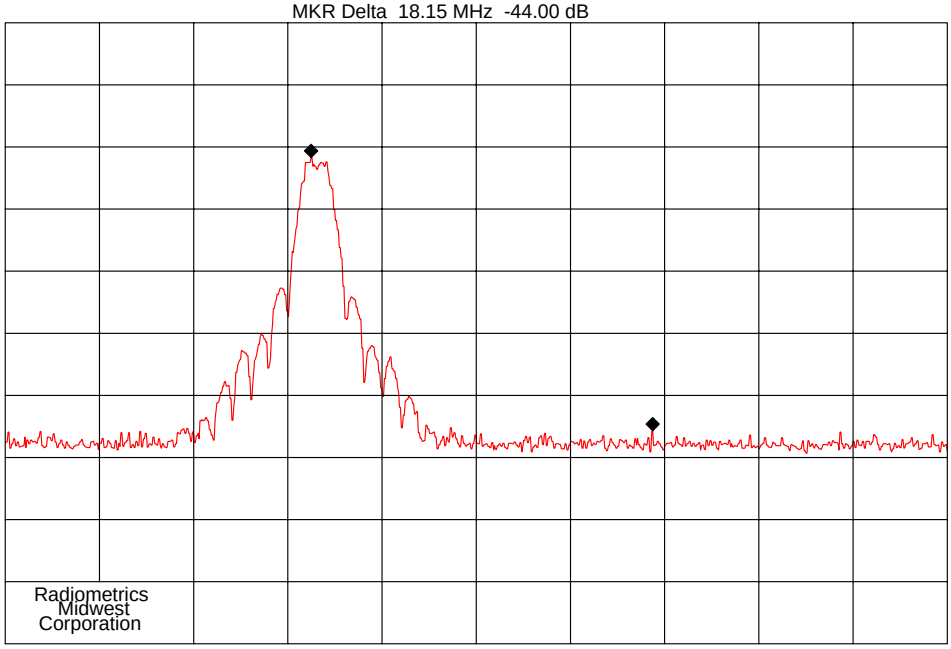


COMPANY : Segway
CENTER 2.483 5 GHz
RES BW 100 kHz
10 dB/
NOTES : Band Edge Test, Channel 14

ITEM : FOB E51
REF 87.0 dBuV
VBW 300 kHz
TIME : 09:55

DATE : 04-28-2006
SPAN 50.0 MHz
ATTEN 0 dB
SWP 20.0 msec

MKR Delta 18.15 MHz -44.00 dB



COMPANY : Segway
CENTER 2.483 5 GHz
RES BW 100 kHz
10 dB/
NOTES : Band Edge Test, Channel 14

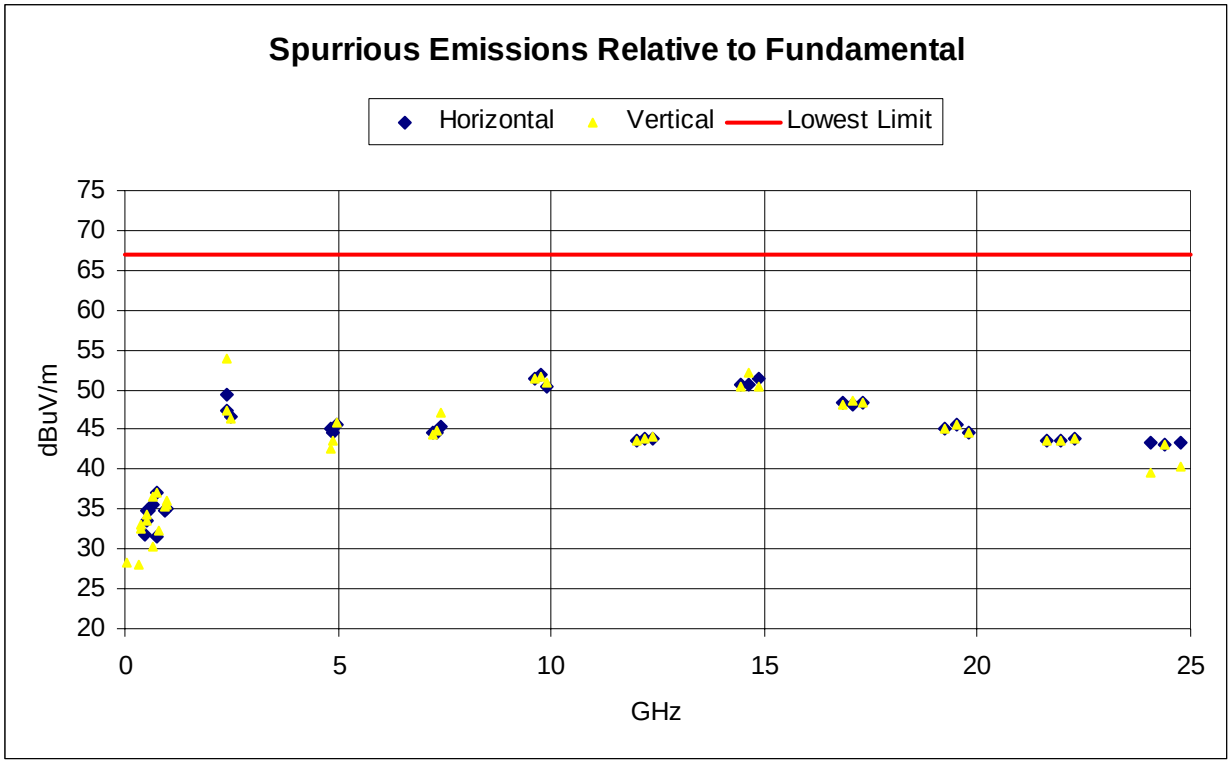
ITEM : UIC 010
REF 87.0 dBuV
VBW 300 kHz
TIME : 11:15

DATE : 04-28-2006
SPAN 50.0 MHz
ATTEN 0 dB
SWP 20.0 msec

10.8 Spurious RF Conducted Emissions

Since antenna conducted tests cannot be performed on the EUT, radiated tests were performed to show compliance with this requirement.

The UIC and the FOB were both tested in continous mode and peak readings were made from the lowest frequency generated in the EUT up through the 10th harmonic. The limit is 20 dB lower than the peak of the fundamental. For each polarization and fundamental frequency, there is a separate limit. The data is shown graphically and in tabular form.



Note that each row shows the peak and average data from both the UIC (base) and the FOB (handset remote).

hrm #	Tx Freq MHz	Pol.	UIC Peak RDG Spec An dBuV	FOB Peak RDG Spec An dBuV	Corr. Fact.	EUT Emission GHz	UIC FCC Limit Peak dBuV/m	FOB FCC Limit Peak dBuV/m	UIC Total Peak dBuV/m	FOB Total Peak dBuV/m	Lowest Margin dB
1	2405	H	85.1	78.9	10.4	2.405	N/A	N/A	95.5	89.3	N/A
BE	2405	H	37.1	35.3	10.3	2.39	75.5	69.3	47.4	45.6	23.7
BE	2405	H	43.5	40.6	10.3	2.399	75.5	69.3	53.8	50.9	18.4
2	2405	H	29.3	42.4	13.2	4.81	75.5	69.3	42.5	55.6	13.7
3	2405	H	25.2	29.7	19.2	7.215	75.5	69.3	44.4	48.9	20.4
4	2405	H	26.1	29.6	25.3	9.62	75.5	69.3	51.4	54.9	14.4
1	2405	V	79.4	77.5	10.4	2.405	N/A	N/A	89.8	87.9	N/A
BE	2405	V	37	34.6	10.3	2.39	69.8	71.3	47.3	44.9	22.5
BE	2405	V	39.1	42.7	10.3	2.399	69.8	71.3	49.4	53.0	18.3
2	2405	V	31.8	43.1	13.2	4.81	69.8	71.3	45.0	56.3	15.0
3	2405	V	25.4	32.1	19.2	7.215	69.8	71.3	44.6	51.3	20.0
4	2405	V	26.2	31.3	25.3	9.62	69.8	71.3	51.5	56.6	14.7
1	2440	H	85.3	78.1	10.6	2.44	N/A	N/A	95.9	88.7	N/A
2	2440	H	30.4	37.2	13.2	4.88	75.9	68.7	43.6	50.4	18.3
3	2440	H	25.4	25.5	19.5	7.32	75.9	68.7	44.9	45.0	23.7
4	2440	H	25.7	25.6	25.9	9.76	75.9	68.7	51.6	51.5	17.2
1	2440	V	79.6	76.4	10.6	2.44	N/A	N/A	90.2	87.0	N/A
2	2440	V	31.5	37.3	13.2	4.88	70.2	67.0	44.7	50.5	16.5
3	2440	V	25.1	25.9	19.5	7.32	70.2	67.0	44.6	45.4	21.6
4	2440	V	26.1	27.3	25.9	9.76	70.2	67.0	52.0	53.2	13.8
1	2475	H	83.2	76.7	10.7	2.475	N/A	N/A	93.9	87.4	N/A
BE	2475	H	35.5	35.3	10.8	2.4835	73.9	67.4	46.3	46.1	21.3
2	2475	H	32.3	36.3	13.6	4.95	73.9	67.4	45.9	49.9	17.5
3	2475	H	26.6	24.5	20.4	7.425	73.9	67.4	47.0	44.9	22.5

hrm #	Tx Freq MHz	Pol.	UIC Peak RDG Spec An dBuV	FOB Peak RDG Spec An dBuV	Corr. Fact.	EUT Emission GHz	UIC FCC Limit Peak dBuV/m	FOB FCC Limit Peak dBuV/m	UIC Total Peak dBuV/m	FOB Total Peak dBuV/m	Lowest Margin dB
4	2475	H	26.5	25.2	24.5	9.9	73.9	67.4	51.0	49.7	17.7
1	2475	V	80.4	79.1	10.7	2.475	N/A	N/A	91.1	89.8	N/A
BE	2475	V	35.9	35.1	10.8	2.4835	71.1	69.8	46.7	45.9	23.9
2	2475	V	32.1	32	13.6	4.95	71.1	69.8	45.7	45.6	24.2
3	2475	V	25	23.9	20.4	7.425	71.1	69.8	45.4	44.3	25.5
N/A	2405	V	29.4	N/A	5.4	0.5744	67.0	N/A	34.8	N/A	32.2
N/A	2405	V	22.6	N/A	8.9	0.771	67.0	N/A	31.5	N/A	35.5
N/A	2405	V	23.1	N/A	11.7	0.9289	67.0	N/A	34.8	N/A	32.2
N/A	2440	V	29.3	N/A	4.3	0.5056	67.0	N/A	33.6	N/A	33.4
N/A	2440	V	28.5	N/A	8.5	0.7376	67.0	N/A	37.0	N/A	30.0
N/A	2440	V	23	N/A	12.1	0.966	67.0	N/A	35.1	N/A	31.9
N/A	2475	V	29	N/A	2.9	0.4592	67.0	N/A	31.9	N/A	35.1
N/A	2475	V	30.5	N/A	4.3	0.5024	67.0	N/A	34.8	N/A	32.2
N/A	2475	V	28.9	N/A	6.7	0.6432	67.0	N/A	35.6	N/A	31.4

Notes: 1. hrm = Harmonic; BE = Band Edge emissions; V = Vertical; H = Horizontal
2. The margin (last column) is the worst case margin under the limits.
3. Corr. Factors = Cable Loss – Preamp Gain + Antenna Factor + High pass Filter

10.9 Spurious Radiated Emissions

Radiated emission measurements in the Restricted bands were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. Below 1 GHz, when a radiated emission is detected approaching the specification limit, the measurement of the emission is repeated using a tuned dipole antenna with a Roberts Balun. Since preamplifiers are used, a 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded. The out of band emissions and the ambient emissions were below the level of input overload (72 dBuV).

From 30 to 1000 MHz, an Anritsu Spectrum analyzer was used. For tests from 1 to 25 GHz, an HP 8566 spectrum analyzer was used. For tests from 1 to 10 GHz, a high pass filter was used to reduce the fundamental emission. A harmonic mixer was used from 18 to 25 GHz. Figure 4 herein lists the details of the test equipment used during radiated emissions tests.

Final radiated emissions measurements were performed in an anechoic chamber at a test distance of 3 meters. The entire frequency range from 30 to MHz was slowly scanned and the emissions in the restricted frequency bands were recorded. Measurements were performed using the peak detector function. The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground. The open area test site used to collect the radiated data is located on 8625 Helmar Road in Newark, Illinois. The open field test site has a metal ground screen. All other tests are performed at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

The FOB was rotated through three orthogonal axis as per 13.1.4.1 of ANSI C63.4 during the prescans and during final radiated tests.

10.9.1 Radiated Emissions Field Strength Sample Calculation

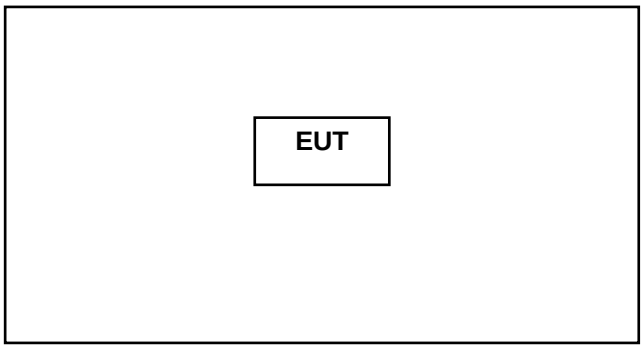
The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

FS = RA + AF + CF - AG

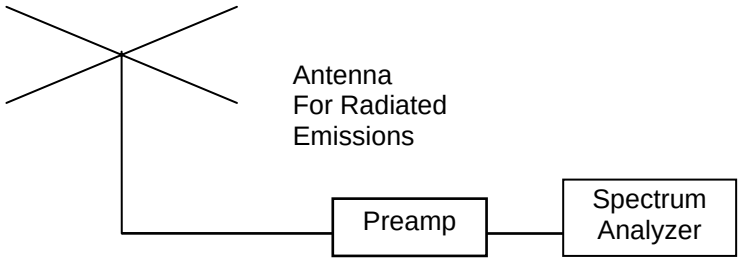
Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain
HPF = High pass Filter Loss
PKA = Peak to Average Factor (This is zero for non-average measurements)

The Peak to average factor is used when average measurements are required. It is calculated by the highest duty cycle in percent over any 100mS transmission. The factor in dB is 20 * Log(Duty cycle/100).

Figure 2. Drawing of Radiated Emissions Setup



Notes:
- AC outlet with low-pass filter at the base of the turntable
- Antenna height varied from 1 to 4 meters
- Distance from antenna to tested system is 3 meters
- Not to Scale



Frequency Range	Receive Antenna	Amplifier	Spectrum Analyzer	High Pass Filter
30 to 1000 MHz	ANT-44	None	REC-03	None*
1 to 10 GHz	ANT-13	AMP-05	REC-01	HPF-03
10 to 18 GHz	ANT-13	AMP-20	REC-01	None*
18 to 25 GHz	ANT-48	AMP-29	REC-08; MXR-01	None*

* A high pass filter was not needed since the fundamental frequency was outside of the amplifiers pass band.

10.9.2 Spurious Radiated Emissions Test Results

Company	Segway, Inc.	Specification	EN 55022; Class B
Model	2014500001 (HT-V1A)	Test Date	04/03/2006
Serial Number	010	Test Distance	3 Meters
Test Personnel	Jeffrey E. Tomes	Test Location	Chamber E
Notes	Corr. Factors = cable loss - preamp gain - distance factor.		
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical; LP = Log-Periodic; BL = Bilog; P = peak; Q = QP		

Emissions Below 1 GHz including non-restricted bands

Freq. MHz	Meter Reading dBuV	Antenna Factor dB	Antenna Pol/ ID	Corr. Factors dB	Field Strength dBuV/m EUT	Field Strength dBuV/m Limit	Margin Under Limit dB
31.7	27.4 P	17.5	H/44	-17.8	27.1	40.0	12.9
37.8	29.3 P	16.7	H/44	-17.7	28.5	40.0	11.5
45.6	28.5 P	16.7	H/44	-17.5	27.8	40.0	12.2
119.8	29.2 P	14.9	H/44	-16.5	27.7	43.5	15.8
130.0	28.6 P	14.1	H/44	-16.4	26.5	43.5	17.0
135.7	29.5 P	12.7	H/44	-16.3	26.0	43.5	17.5
188.4	31.8 P	9.8	H/44	-15.9	25.8	43.5	17.7
313.6	29.0 P	14.0	H/44	-15.0	28.1	46.0	17.9
398.4	31.4 P	16.3	H/44	-14.6	33.2	46.0	12.8
504.0	30.0 P	18.0	H/44	-13.8	34.2	46.0	11.8
507.2	29.5 P	17.9	H/44	-13.8	33.7	46.0	12.3
643.9	23.4 Q	19.5	H/44	-12.7	30.3	46.0	15.7
783.9	22.7 Q	21.1	H/44	-11.5	32.4	46.0	13.6
968.0	23.2 Q	22.6	H/44	-10.2	35.7	54.0	18.3
30.0	28.1 P	16.8	V/44	-17.9	27.2	40.0	12.8
34.4	28.4 P	15.9	V/44	-17.8	26.6	40.0	13.4
39.5	29.2 P	15.1	V/44	-17.7	26.7	40.0	13.3
41.6	29.7 P	14.9	V/44	-17.6	27.1	40.0	12.9
63.7	30.1 P	10.8	V/44	-17.2	23.9	40.0	16.1
80.0	34.6 P	6.5	V/44	-17.0	24.2	40.0	15.8
112.6	29.2 P	13.8	V/44	-16.6	26.5	43.5	17.0
159.2	31.0 P	10.9	V/44	-16.2	25.8	43.5	17.7
267.2	28.6 P	13.3	V/44	-15.3	26.7	46.0	19.3
276.8	29.1 P	13.2	V/44	-15.2	27.2	46.0	18.8
392.0	29.0 P	16.3	V/44	-14.6	30.8	46.0	15.2
505.6	29.3 P	18.0	V/44	-13.8	33.6	46.0	12.4
574.4	29.4 P	18.6	V/44	-13.3	34.9	46.0	11.1
737.6	28.5 P	20.3	V/44	-11.9	37.1	46.0	8.9
771.0	22.6 Q	20.4	V/44	-11.6	31.6	46.0	14.4
928.9	23.1 Q	21.9	V/44	-10.3	34.8	46.0	11.2
Notes	UIC in Charging Mode						
38.5	28.4 P	16.7	H/44	-17.7	27.5	40.0	12.5
108.2	29.8 P	12.1	H/44	-16.6	25.4	43.5	18.1
191.2	29.3 P	10.2	H/44	-15.9	23.7	43.5	19.8
222.0	29.2 P	11.4	H/44	-15.6	25.1	46.0	20.9
262.0	28.1 P	13.0	H/44	-15.3	25.9	46.0	20.1
378.2	30.4 P	16.3	H/44	-14.7	32.1	46.0	13.9
42.6	27.5 P	14.8	V/44	-17.6	24.7	40.0	15.3
134.4	27.3 P	13.4	V/44	-16.4	24.4	43.5	19.1
185.7	26.0 P	9.9	V/44	-15.9	20.1	43.5	23.4
223.8	27.5 P	12.0	V/44	-15.6	24.0	46.0	22.0
298.6	27.4 P	13.7	V/44	-15.1	26.1	46.0	19.9

The above emissions are from the UIC. There were no emissions detected from the FOB below 1 GHz.

Emissions above 1 GHz

The following spectrum analyzer settings were used .

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW = 1 MHz; Sweep = auto
Detector function = peak; Trace = max hold

Since the emission is pulsed, the unit was modified for continuous operation. The reading was corrected by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation from FCC Section 15.35(b) and (c). See Section 10.2 herein.

Note that each row shows the peak and average data from both the UIC (base) and the FOB (handset remote).

			UIC	FOB	Corr.	UIC	FOB	EUT	Peak	Avg	Peak	Ave	Peak	Ave
hrm	Tx Freq	Ant	Spec An Peak RDG		Fact.	Peak to Ave		Emission Freq	FCC Limit		UIC Total		FOB Total	
#	MHz	Pol	dBuV		dB	dB		GHz	dBuV/m		dBuV/m		dBuV/m	
be	2405	V	37.0	34.6	10.3	14.7	6.0	2.39	74	54	47.3	32.6	44.9	38.9
be	2405	H	37.1	35.3	10.3	14.7	6.0	2.39	74	54	47.4	32.7	45.6	39.6
2	2405	V	31.8	43.1	13.2	14.7	6.0	4.81	74	54	45.0	30.3	56.3	50.3
2	2405	H	29.3	42.4	13.2	14.7	6.0	4.81	74	54	42.5	27.8	55.6	49.6
3	2405	V	25.4	32.1	19.2	14.7	6.0	7.215	74	54	44.6	29.9	51.3	45.3
3	2405	H	25.2	29.7	19.2	14.7	6.0	7.215	74	54	44.4	29.7	48.9	42.9
4	2405	V	26.2	31.3	25.3	14.7	6.0	9.62	74	54	51.5	36.8	56.6	50.6
4	2405	H	26.1	29.6	25.3	14.7	6.0	9.62	74	54	51.4	36.7	54.9	48.9
2	2440	V	31.5	37.3	13.2	14.7	6.0	4.88	74	54	44.7	30.0	50.5	44.5
2	2440	H	30.4	37.2	13.2	14.7	6.0	4.88	74	54	43.6	28.9	50.4	44.4
3	2440	V	25.1	25.9	19.5	14.7	6.0	7.32	74	54	44.6	29.9	45.4	39.4
3	2440	H	25.4	25.5	19.5	14.7	6.0	7.32	74	54	44.9	30.2	45.0	39.0
4	2440	V	26.1	27.3	25.9	14.7	6.0	9.76	74	54	52.0	37.3	53.2	47.2
4	2440	H	25.7	25.6	25.9	14.7	6.0	9.76	74	54	51.6	36.9	51.5	45.5
be	2475	V	35.9	35.1	10.8	14.7	6.0	2.4835	74	54	46.7	32.0	45.9	39.9
be	2475	H	35.5	35.3	10.8	14.7	6.0	2.4835	74	54	46.3	31.6	46.1	40.1
2	2475	V	32.1	32	13.6	14.7	6.0	4.95	74	54	45.7	31.0	45.6	39.6
2	2475	H	32.3	36.3	13.6	14.7	6.0	4.95	74	54	45.9	31.2	49.9	43.9
3	2475	V	25	23.9	20.4	14.7	6.0	7.425	74	54	45.4	30.7	44.3	38.3
3	2475	H	26.6	24.5	20.4	14.7	6.0	7.425	74	54	47.0	32.3	44.9	38.9
4	2475	V	25.8	26.2	24.5	14.7	6.0	9.9	74	54	50.3	35.6	50.7	44.7
4	2475	H	26.5	25.2	24.5	14.7	6.0	9.9	74	54	51.0	36.3	49.7	43.7

hrm = Harmonic; BE = Band Edge emissions

Judgment: Passed by 3.4 dB for the FOB and 16.7 for the UIC
No other emissions were detected in the restricted bands, above 1 GHz.