

Logitech, Inc.

F-0228A

August 23, 2004

Report No. LABT0098 Rev 02

Report Prepared By:



www.nwemc.com

1-888-EMI-CERT

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Test Report



22975 NW Evergreen Parkway
Suite 400
Hillsboro, Oregon 97124

Certificate of Test
Issue Date: August 23, 2004
Logitech, Inc.
Model: F-0228A

Emissions			
Specification	Test Method	Pass	Fail
FCC 15.247(a) Occupied Bandwidth:2003	ANSI C63.4:2001	☒	☐
FCC 15.247(b) Output Power:2003	ANSI C63.4:2001	☒	☐
FCC 15.247(c) Band Edge Compliance:2003	ANSI C63.4:2001	☒	☐
FCC 15.247(c) Spurious Conducted Emissions:2003	ANSI C63.4:2001	☒	☐
FCC 15.247(c) Spurious Radiated Emissions:2003	ANSI C63.4:2001	☒	☐
FCC 15.247(d) Power Spectral Density:2003	ANSI C63.4:2001	☒	☐

Modifications made to the product

See the Modifications section of this report

Test Facility

The measurement facility used to collect the data is located at:

Northwest EMC, Inc.
22975 NW Evergreen Parkway, Suite 400; Hillsboro, OR 97124
Phone: (503) 844-4066
Fax: 844-3826

This site has been fully described in a report filed with and accepted by the FCC (Federal Communications Commission) and Industry Canada.

Approved By:

Don Facteau, IS Manager

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.

Product compliance is the responsibility of the client, therefore the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. This Report may only be duplicated in its entirety. The results of this test pertain only to the sample(s) tested, the specific description is noted in each of the individual sections of the test report supporting this certificate of test.

Revision Number	Description	Date	Page Number
01	Corrected model number of EUT	9/15/04	13,19,25,30,45,51
02	Correct supply voltage	9/30/04	9, 17, 43, 45, 46, 47

FCC: Accredited by NVLAP for performance of FCC radio, digital, and ISM device testing. Our Open Area Test Sites, certification chambers, and conducted measurement facilities, have been fully described in reports filed with the FCC and accepted by the FCC in letters maintained in our files. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by the FCC as a Telecommunications Certification Body (TCB). This allows Northwest EMC to certify transmitters to FCC specifications in accordance with 47 CFR 2.960 and 2.962.



NVLAP: Northwest EMC, Inc. is recognized under the United States Department of Commerce, National Institute of Standards and Technology, National Voluntary Laboratory Accreditation Program for satisfactory compliance with the requirements of ISO/IEC 17025 for Testing Laboratories. The NVLAP accreditation encompasses Electromagnetic Compatibility Testing in accordance with the European Union EMC Directive 89/336/EEC, ANSI C63.4, MIL-STD 461E, DO-160D and SAE J1113. Additionally, Northwest EMC is accredited by NVLAP to perform radio testing in accordance with the European Union R&TTE Directive 1999/5/EEC, the requirements of FCC, and the RSS radio standards for Industry Canada. Accreditation has been granted to Northwest EMC, Inc. under Certificate Numbers: 200629-0, 200630-0, and 200676-0.



Industry Canada: Accredited by NVLAP for performance of Industry Canada RSS and ICES testing. Our Open Area Test Sites and certification chambers comply with RSS 212, Issue 1 (Provisional) and have been filed with Industry Canada and accepted. Northwest EMC has been accredited by ANSI to ISO / IEC Guide 65 as a product certifier. We have been designated by NIST and recognized by Industry Canada as a Certification Body (CB) per the APEC Mutual Recognition Arrangement (MRA). This allows Northwest EMC to certify transmitters to Industry Canada technical requirements.



CAB: Designated by NIST and validated by the European Commission as a Conformity Assessment Body (CAB) to conduct tests and approve products to the EMC directive and transmitters to the R&TTE directive, as described in the U.S. - EU Mutual Recognition Agreement



TÜV Product Service: Included in TÜV Product Service Group's Listing of Recognized Laboratories. It qualifies in connection with the TÜV Certification after Recognition of Agent's Testing Program for the product categories and/or standards shown in TÜV's current Listing of CARAT Laboratories available from TÜV. A certificate was issued to represent that this laboratory continues to meet TÜV's CARAT Program requirements. Certificate No. USA0401C



TÜV Rheinland: Authorized to carryout EMC tests by order and under supervision of TÜV Rheinland. This authorization is based on "Conditions for EMC-Subcontractors" of November 1992.



NEMKO: Assessed and accredited by NEMKO (Norwegian testing and certification body) for European emissions and immunity testing. As a result of NEMKO's laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification (Authorization No. ELA 119).



Technology International: Assessed in accordance with ISO Guide 25 defining the general international requirements for the competence of calibration and testing laboratories and with ITI assessment criteria LACO196. Based upon that assessment Interference Technology International, Ltd., has granted approval for specifications implementing the EU Directive on EMC (89/336/EEC and amendments). The scope of the approval was provided on a Schedule of Assessment supplied with the certificate and is available upon request.



Australia/New Zealand: The National Association of Testing Authorities (NATA), Australia has been appointed by the ACA as an accreditation body to accredit test laboratories and competent bodies for EMC standards. Accredited test reports or assessments by competent bodies must carry the NATA logo. Test reports made by an overseas laboratory that has been accredited for the relevant standards by an overseas accreditation body that has a Mutual Recognition Agreement (MRA) with NATA are also accepted as technical grounds for product conformity. The report should be endorsed with the respective logo of the accreditation body. (NVLAP)



VCCI: Accepted as an Associate Member to the VCCI, Acceptance No. 564. Conducted and radiated measurement facilities have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. (*Registration Nos. - Hillsboro: C-1071 and R-1025, Irvine: C-2094 and R-1943, Newberg: C-1877 and R-1760, Sultan: R-871, C-1784 and R-1761*)



BSMI: Northwest EMC has been designated by NIST and validated by C-Taipei (BSMI) as a CAB to conduct tests as described in the APEC Mutual Recognition Agreement. License No.SL2-IN-E-1017.



GOST: Northwest EMC, Inc. has been assessed and accredited by the Russian Certification bodies Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC, to perform EMC and Hygienic testing for Information Technology Products. As a result of their laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification



SCOPE

For details on the Scopes of our Accreditations, please visit:

<http://www.nwemc.com/scope.asp>

What is measurement uncertainty?

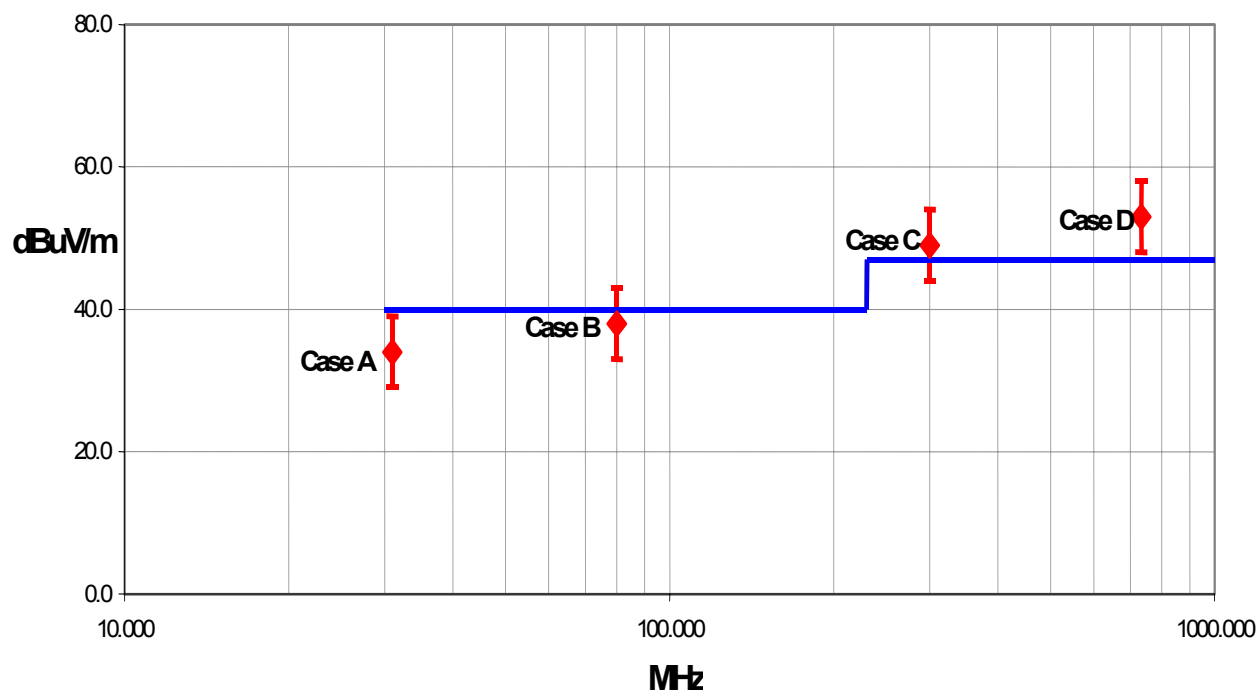
When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. The following statement of measurement uncertainty is used to reflect the accuracy of the measured result as compared with its “true” value. In the case of transient tests (ESD, EFT, Surge, Voltage Dips and Interruptions), the test equipment has been demonstrated by calibration to provide at least a 95% confidence that it complies with the test specification requirements.

The following documents were the basis for determining the uncertainty levels of our measurements:

- “ISO Guide to the Expression of Uncertainty in Measurements”, October 1993
- “NIS81: The Treatment of Uncertainty in EMC Measurements”, May 1994
- “IEC CISPR 16-3 A1 f1 Ed.1: Radio-interference measurements and statistical techniques”, December 2000

How might measurement uncertainty be applied to test results?

If the diamond marks the measured value for the test and the vertical bars bracket the range of + and – measurement uncertainty, then test results can be interpreted from the diagram below.

**Test Result Scenarios:**

Case A: Product complies.

Case B: Product conditionally complies. It is not possible to say with 95% confidence that the product complies.

Case C: Product conditionally does not comply. It is not possible to say with 95% confidence that the product does not comply.

Case D: Product does not comply.

Radiated Emissions ≤ 1 GHz

Value (dB)

Test Distance	Probability Distribution	Biconical Antenna		Log Periodic Antenna		Dipole Antenna	
		3m	10m	3m	10m	3m	10m
Combined standard uncertainty $u_c(y)$	normal	+ 1.86 - 1.88	+ 1.82 - 1.87	+ 2.23 - 1.41	+ 1.29 - 1.26	+ 1.31 - 1.27	+ 1.25 - 1.25
Expanded uncertainty U (level of confidence $\approx 95\%$)	normal (k=2)	+ 3.72 - 3.77	+ 3.64 - 3.73	+ 4.46 - 2.81	+ 2.59 - 2.52	+ 2.61 - 2.55	+ 2.49 - 2.49

Radiated Emissions > 1 GHz

Value (dB)

Test Distance	Probability Distribution	Without High Pass Filter		With High Pass Filter	
		3m	10m	3m	10m
Combined standard uncertainty $u_c(y)$	normal	+ 1.29 - 1.25	+ 1.29 - 1.25	+ 1.38 - 1.35	+ 1.38 - 1.35
Expanded uncertainty U (level of confidence $\approx 95\%$)	normal (k=2)	+ 2.57 - 2.51	+ 2.57 - 2.51	+ 2.76 - 2.70	+ 2.76 - 2.70

Conducted Emissions

Test Distance	Probability Distribution	Value (+/- dB)	
		3m	10m
Combined standard uncertainty $u_c(y)$	normal	1.48	1.48
Expanded uncertainty U (level of confidence $\approx 95\%$)	normal (k = 2)	2.97	2.97

Radiated Immunity

Test Distance	Probability Distribution	Value (+/- dB)	
		3m	10m
Combined standard uncertainty $u_c(y)$	normal	1.05	1.05
Expanded uncertainty U (level of confidence $\approx 95\%$)	normal (k = 2)	2.11	2.11

Conducted Immunity

Test Distance	Probability Distribution	Value (+/- dB)	
		3m	10m
Combined standard uncertainty $u_c(y)$	normal	1.05	1.05
Expanded uncertainty U (level of confidence $\approx 95\%$)	normal (k = 2)	2.10	2.10

Legend

$u_c(y)$ = square root of the sum of squares of the individual standard uncertainties

U = combined standard uncertainty multiplied by the coverage factor: k . This defines an interval about the measured result that will encompass the true value with a confidence level of approximately 95%. If a higher level of confidence is required, then $k=3$ (CL of 99.7%) can be used. Please note that with a coverage factor of one, $u_c(y)$ yields a confidence level of only 68%.

**California****Orange County Facility**

41 Tesla Ave.
Irvine, CA 92618
(888) 364-2378
FAX (503) 844-3826

**Oregon****Evergreen Facility**

22975 NW Evergreen Pkwy.,
Suite 400
Hillsboro, OR 97124
(503) 844-4066
FAX (503) 844-3826

**Oregon****Trails End Facility**

30475 NE Trails End Lane
Newberg, OR 97132
(503) 844-4066
FAX (503) 537-0735

**Washington****Sultan Facility**

14128 339th Ave. SE
Sultan, WA 98294
(888) 364-2378
FAX (360) 793-2536

Party Requesting the Test

Company Name:	Logitech, Inc.
Address:	1499 SE Tech Center Place Suite 350
City, State, Zip:	Vancouver, WA 98683
Test Requested By:	Mitchell Phillipi
Model:	F-0228A
First Date of Test:	08-06-2004
Last Date of Test:	08-15-2004
Receipt Date of Samples:	08-05-2004
Equipment Design Stage:	Production
Equipment Condition:	No visual damage.

Information Provided by the Party Requesting the Test

Clocks/Oscillators:	Not provided.
I/O Ports:	DC

Functional Description of the EUT (Equipment Under Test):

Bluetooth headset with integral antenna. Battery operated. No provision for radio operation while charging.

Client Justification for EUT Selection:

Not Provided

Client Justification for Test Selection:

Not Provided

EUT Photo

Equipment modifications					
Item	Test	Date	Modification	Note	Disposition of EUT
1	Occupied bandwidth	08/06/2004	No EMI suppression devices were added or modified during this test.	Same configuration as delivered.	EUT remained at Northwest EMC.
2	Band Edge Compliance	08/06/2004	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.
3	Spurious Conducted Emissions	08/06/2004	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.
4	Spurious Radiated Emissions	08/11/2004	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.
5	Output Power	08/15/2004	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.
6	Power Spectral Density	08/15/2004	No EMI suppression devices were added or modified during this test.	Same configuration as in previous test.	EUT remained at Northwest EMC.

Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:

Low
Mid
High

Operating Modes Investigated:

No Hop

Data Rates Investigated:

Maximum

Output Power Setting(s) Investigated:

Maximum

Power Input Settings Investigated:

Battery

Software\Firmware Applied During Test

Exercise software	Special Test Software	Version	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT	Logitech, Inc.	F-0228A	#1

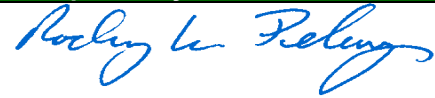
Measurement Equipment

Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	02/26/2003	24 mo
Pre-Amplifier	Amplifier Research	LN1000	APA	NCR	NA
Pre-Amplifier	Amplifier Research	LN1000	APB	11/18/2003	13 mo
Signal Generator	Hewlett Packard	8341B	TGN	01/23/2004	13 mo

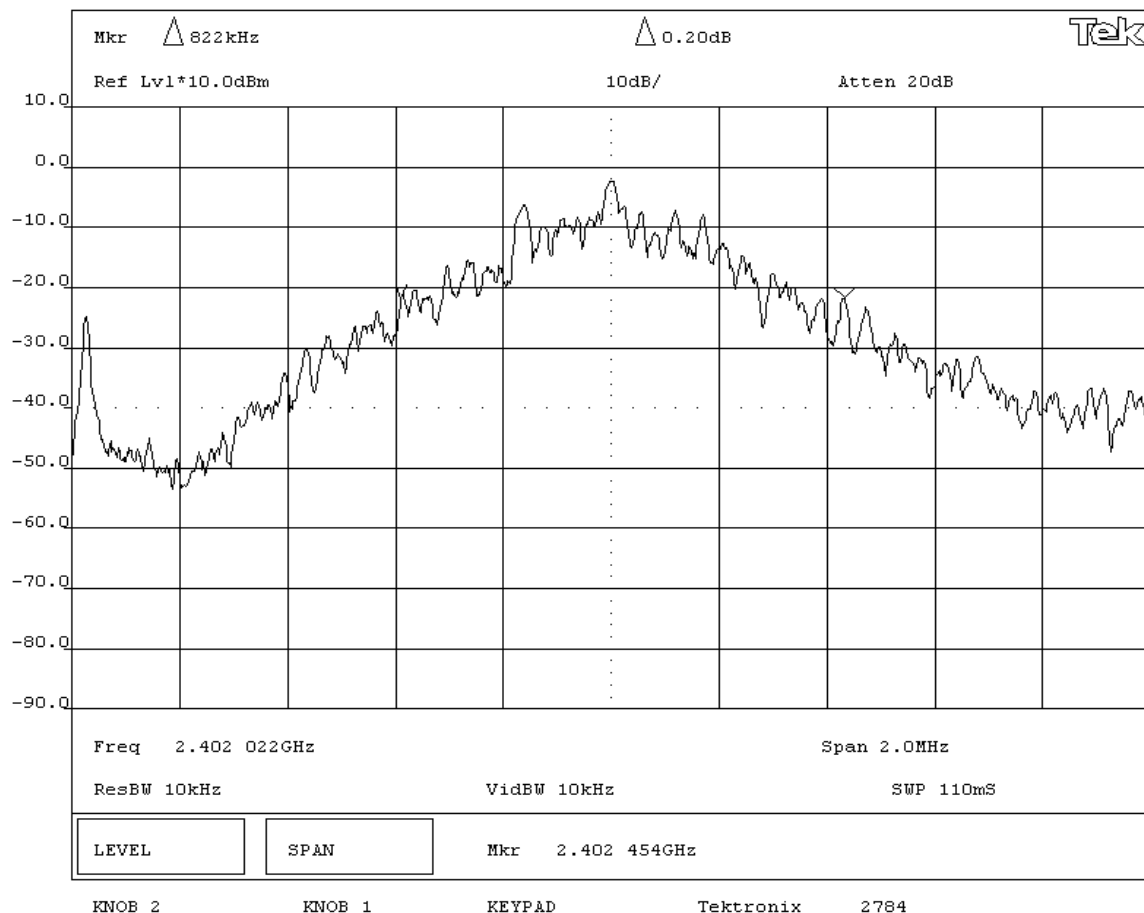
Test Description

Requirement: Per an FCC Interpretation sent to TCBs on October 8, 2002, frequency hoppers in the 2.4 GHz band operating under 15.247 are required to use a minimum of 15 non-overlapping channels. The hopping channel bandwidth can be wider than 1 MHz as long as the channels do not overlap and all emissions stay within the 2400-2483.5 MHz band. For example, a system that uses the minimum 15 channels can have hopping channel bandwidth that are up to 5 MHz wide. The measurement is made with the spectrum analyzer's resolution bandwidth set to $\geq 1\%$ of the 20dB bandwidth, and the video bandwidth set to greater than or equal to the resolution bandwidth.

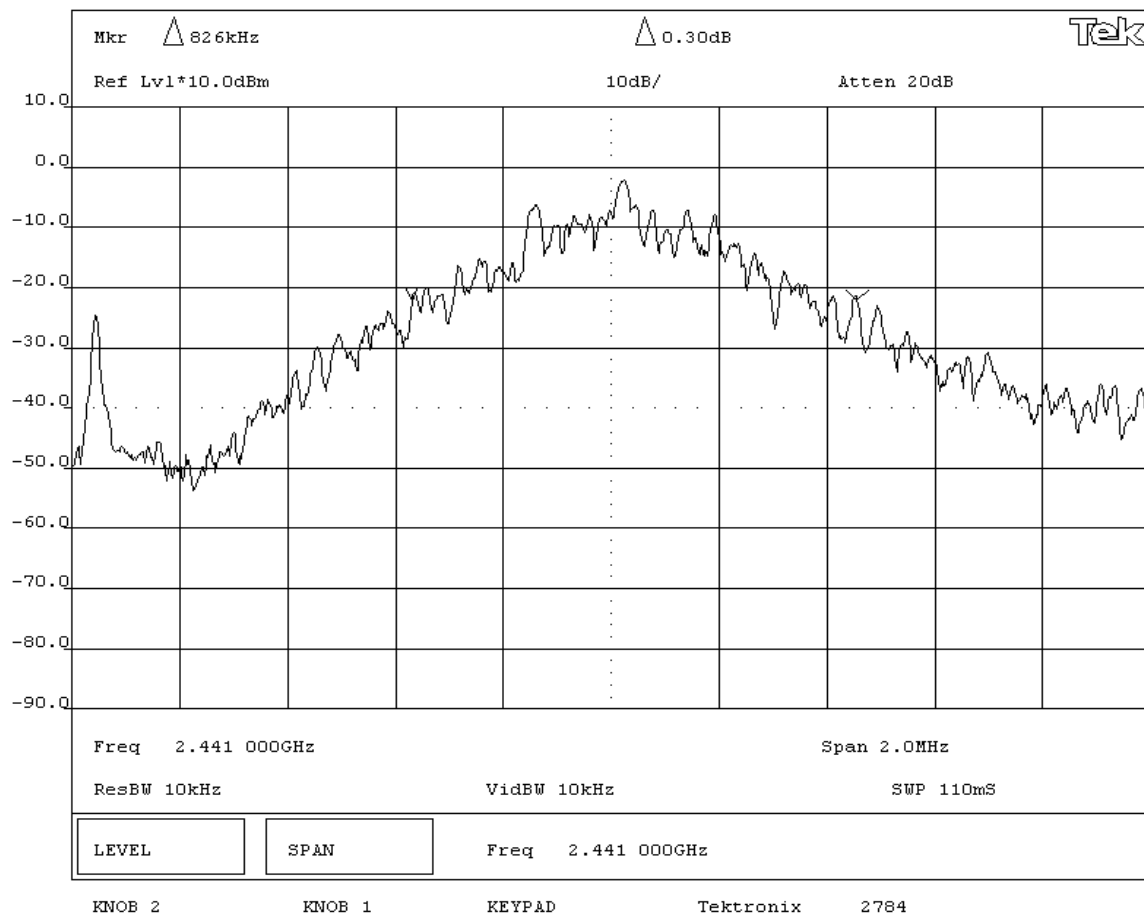
Configuration: The occupied bandwidth was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate in a no hop mode.

Completed by:

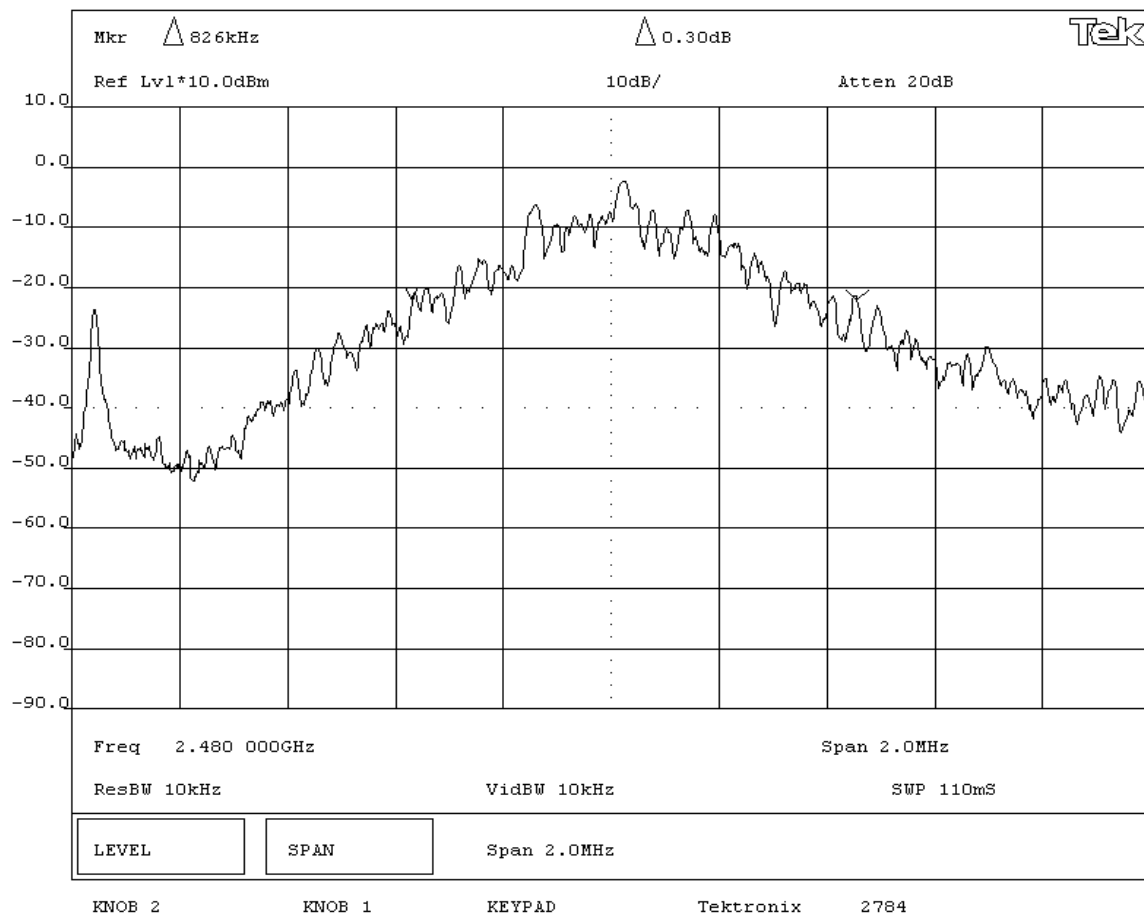
NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/06/04		
Customer: Logitech, Inc.			Temperature: 23 degrees C		
Attendees: None			Humidity: 48% RH		
Customer Ref. No.: N/A			Job Site: EV06		
Tested by: Rod Peloquin			Power: Internal Battery		
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(a)(1)(ii)		Year: 2003		Method: DA 00-705, ANSI C63.4	
				Year: 2001	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated, No hop mode					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
The maximum 20dB bandwidth of the hopping channel is 1 MHz					
RESULTS					
Pass			BANDWIDTH 822 kHz		
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
20dB Bandwidth - Low Channel					

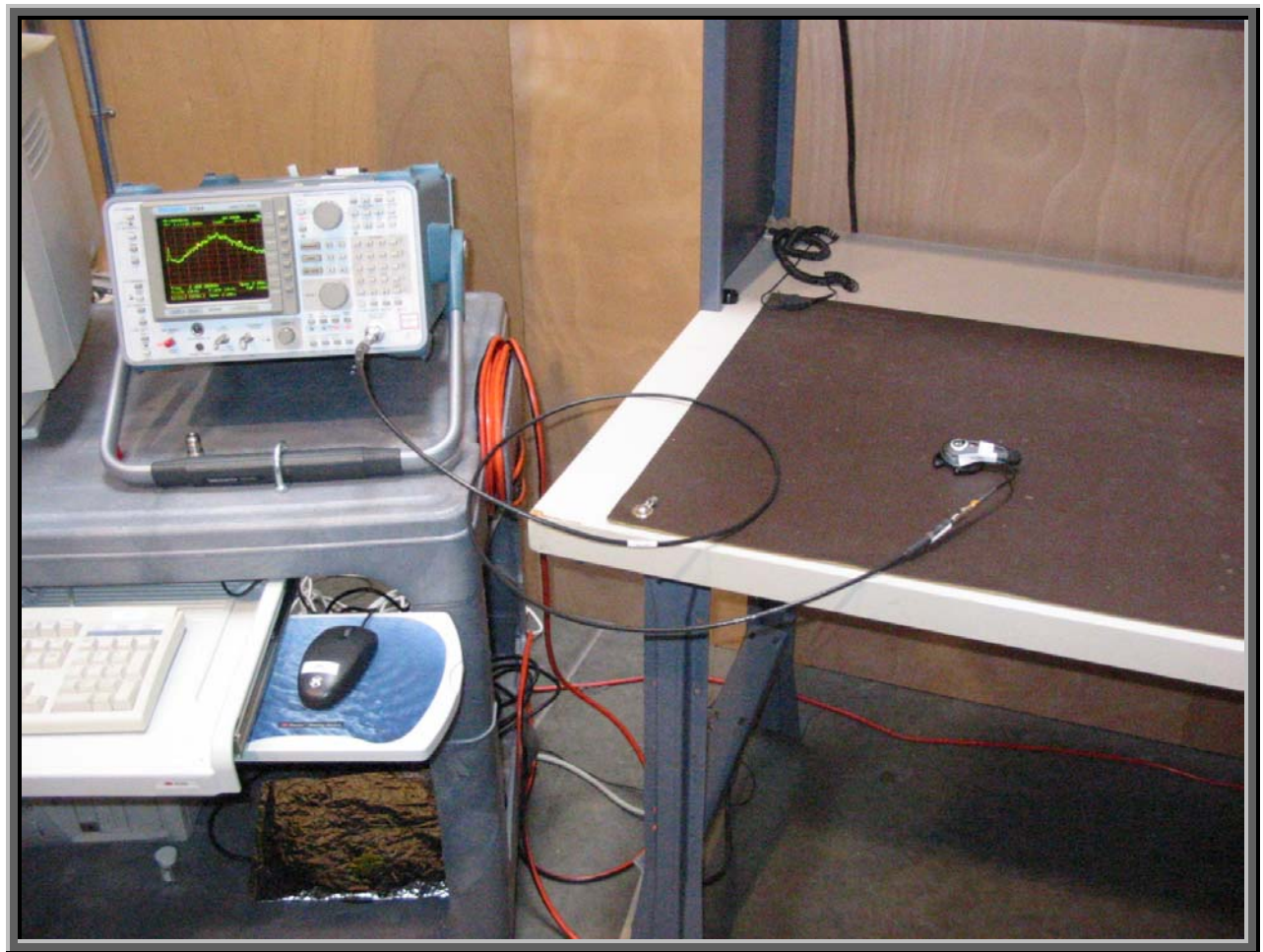


NORTHWEST EMC				EMISSIONS DATA SHEET				Rev BETA 01/30/01	
EUT: F-0228A				Work Order: LABT0098					
Serial Number: #1				Date: 08/06/04					
Customer: Logitech, Inc.				Temperature: 23 degrees C					
Attendees: None				Tested by: Rod Peloquin				Humidity: 48% RH	
Customer Ref. No.: N/A				Power: Internal Battery				Job Site: EV06	
TEST SPECIFICATIONS									
Specification: 47 CFR 15.247(a)(1)(ii)				Year: 2003		Method: DA 00-705, ANSI C63.4		Year: 2001	
SAMPLE CALCULATIONS									
COMMENTS									
EUT OPERATING MODES									
Modulated, No hop mode									
DEVIATIONS FROM TEST STANDARD									
None									
REQUIREMENTS									
The maximum 20dB bandwidth of the hopping channel is 1 MHz									
RESULTS									
Pass				BANDWIDTH 826 kHz					
SIGNATURE									
 Tested By: _____									
DESCRIPTION OF TEST									
20dB Bandwidth - Mid Channel									



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/06/04		
Customer: Logitech, Inc.			Temperature: 23 degrees C		
Attendees: None			Humidity: 48% RH		
Customer Ref. No.: N/A			Job Site: EV06		
Tested by: Rod Peloquin			Power: Internal Battery		
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(a)(1)(ii)		Year: 2003		Method: DA 00-705, ANSI C63.4	
				Year: 2001	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated, No hop mode					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
The maximum 20dB bandwidth of the hopping channel is 1 MHz					
RESULTS					
Pass			BANDWIDTH 826 kHz		
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
20dB Bandwidth - High Channel					





Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:

Low
Mid
High

Operating Modes Investigated:

No Hop

Data Rates Investigated:

Maximum

Output Power Setting(s) Investigated:

Maximum

Power Input Settings Investigated:

Battery

Software\Firmware Applied During Test

Exercise software	Special Test Software	Version	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT	Logitech, Inc.	F-0228A	#1

Cables

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Leads	No	2.0	No	AC Power Adapter	EUT

Measurement Equipment

Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	02/26/2003	24 mo
Power Meter	Hewlett Packard	E4418A	SPA	07/23/2004	24 mo
Power Sensor	Hewlett-Packard	8481H	SPB	07/23/2004	24 mo
Signal Generator	Hewlett Packard	8341B	TGN	01/23/2004	13 mo

Test Description

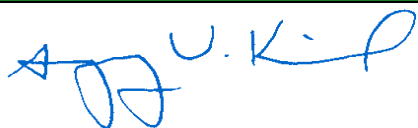
Requirement: Per 47 CFR 15.247(b)(1), the maximum peak output power must not exceed 1 Watt. The measurement is made using a spectrum analyzer using the following settings:

- Resolution bandwidth set to greater than the 6 dB bandwidth of the modulated carrier, and
- The video bandwidth set to greater than or equal to the resolution bandwidth.

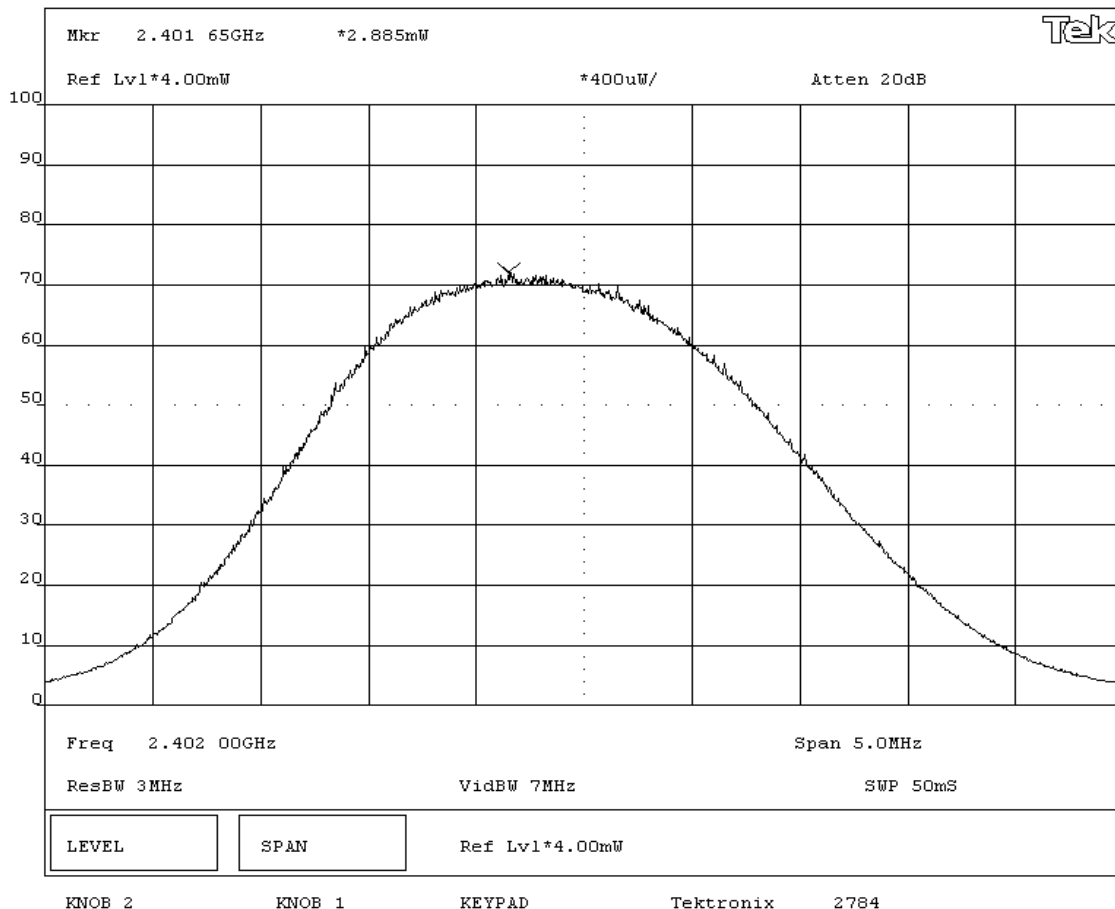
Configuration: The peak output power was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was transmitting at its maximum data rate in a no hop mode.

The spectrum analyzer power reading was calibrated prior to testing using the power meter, power sensor, and signal generator via the substitution method.

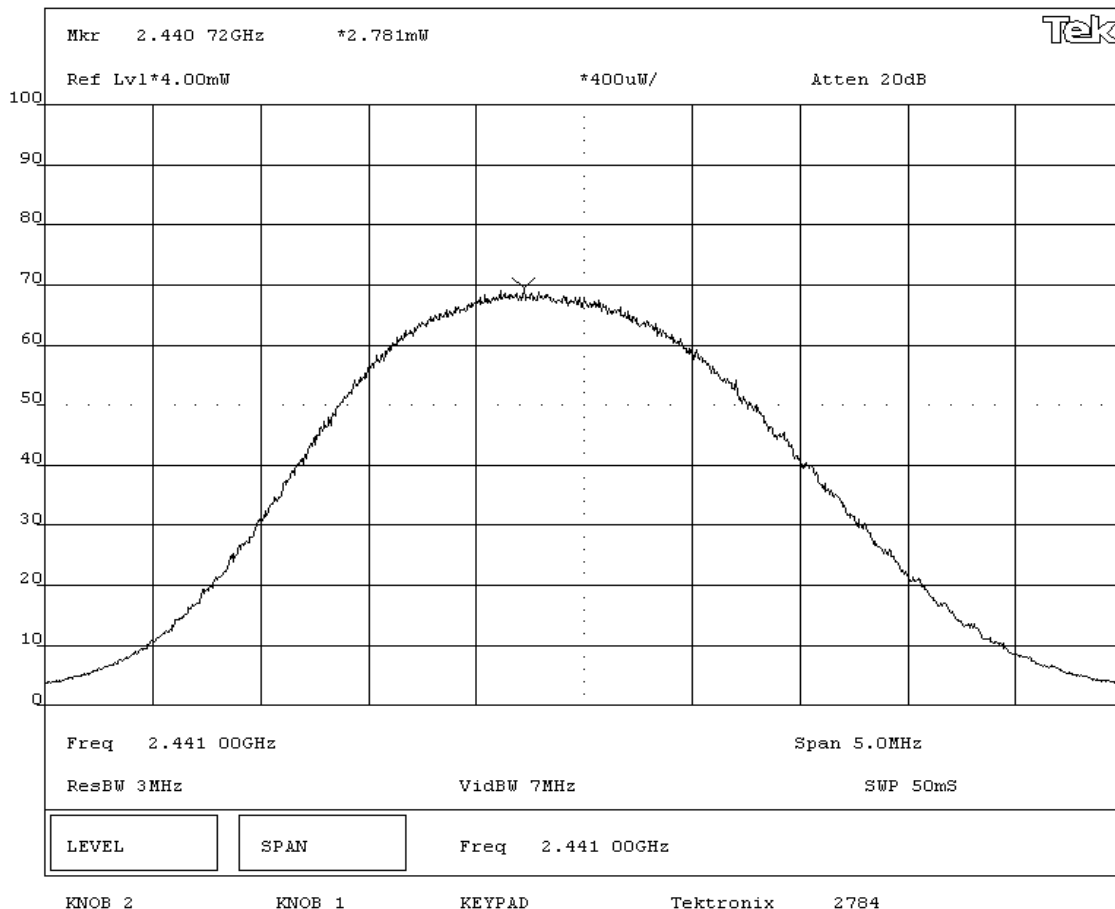
De Facto EIRP Limit: Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36dBm.

Completed by:

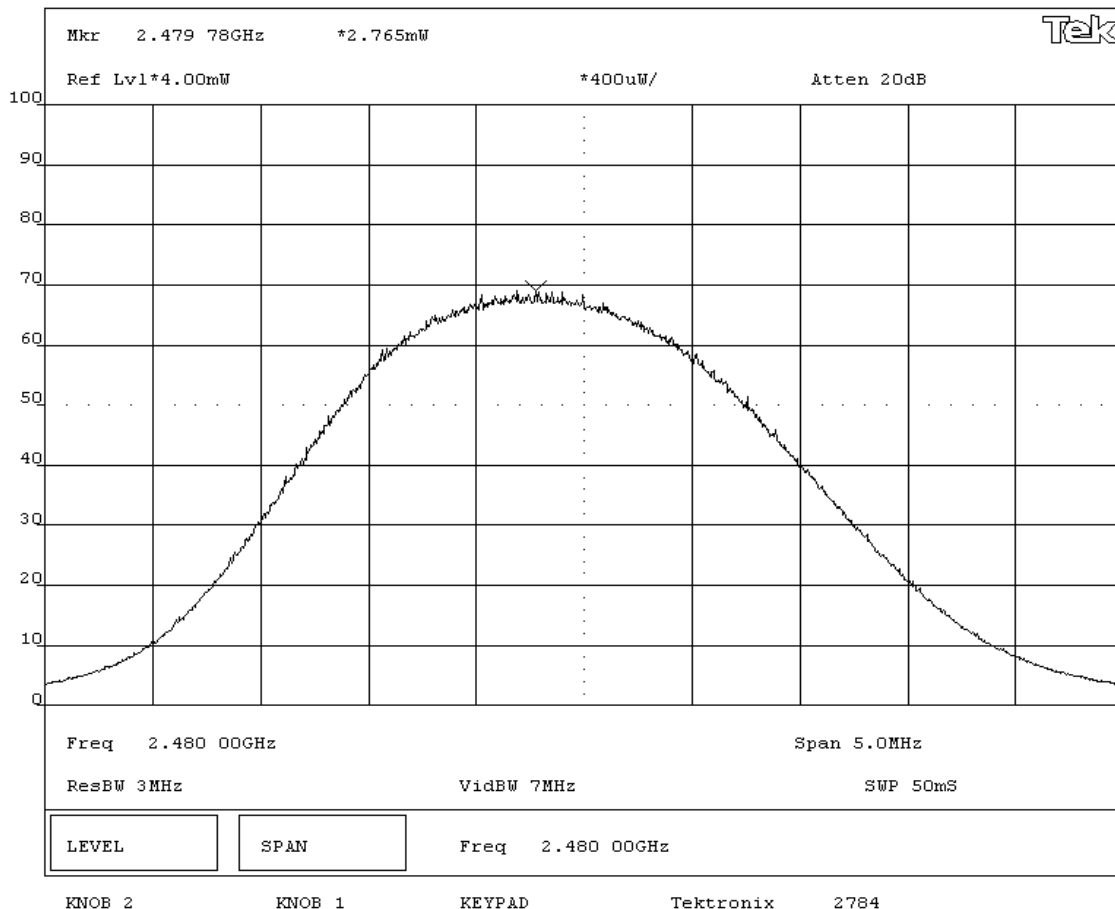
NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/15/04		
Customer: Logitech, Inc.			Temperature: 79 degrees F		
Attendees: None		Tested by: Greg Kiemel	Humidity: 45% RH		
Customer Ref. No.: N/A		Power: Battery	Job Site: EV06		
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(b)(1)		Year: 2003	Method: DA 00-705, ANSI C63.4	Year: 2001	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated by PRBS at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum peak conducted output power does not exceed 1 Watt					
RESULTS			AMPLITUDE		
Pass			2.885 mW		
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Output Power - Low Channel					

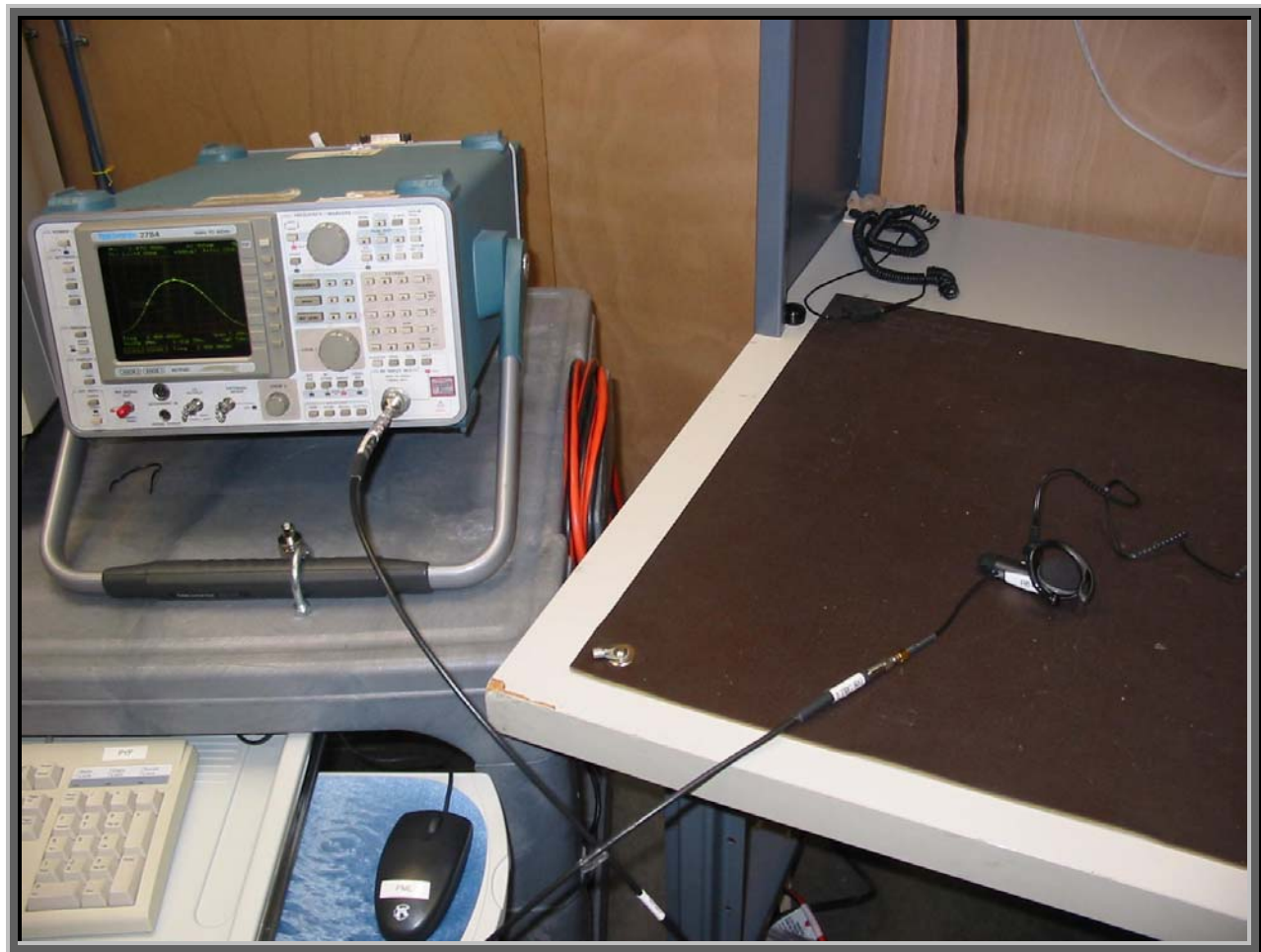


NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/15/04		
Customer: Logitech, Inc.			Temperature: 79 degrees F		
Attendees: None		Tested by: Greg Kiemel	Humidity: 45% RH		
Customer Ref. No.: N/A		Power: Battery	Job Site: EV06		
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(b)(1)		Year: 2003	Method: DA 00-705, ANSI C63.4	Year: 2001	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated by PRBS at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum peak conducted output power does not exceed 1 Watt					
RESULTS			AMPLITUDE		
Pass			2.781 mW		
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Output Power - Mid Channel					



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/15/04		
Customer: Logitech, Inc.			Temperature: 79 degrees F		
Attendees: None		Tested by: Greg Kiemel	Humidity: 45% RH		
Customer Ref. No.: N/A		Power: Battery	Job Site: EV06		
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(b)(1)		Year: 2003	Method: DA 00-705, ANSI C63.4	Year: 2001	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated by PRBS at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum peak conducted output power does not exceed 1 Watt					
RESULTS			AMPLITUDE		
Pass			2.765 mW		
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Output Power - High Channel					





Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:

Low

High

Operating Modes Investigated:

No Hop

Data Rates Investigated:

Maximum

Output Power Setting(s) Investigated:

Maximum

Power Input Settings Investigated:

Battery

Software\Firmware Applied During Test

Exercise software	Special Test Software	Version	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT	Logitech, Inc.	F-0228A	#1

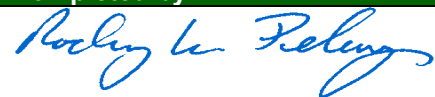
Measurement Equipment

Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	02/26/2003	24 mo

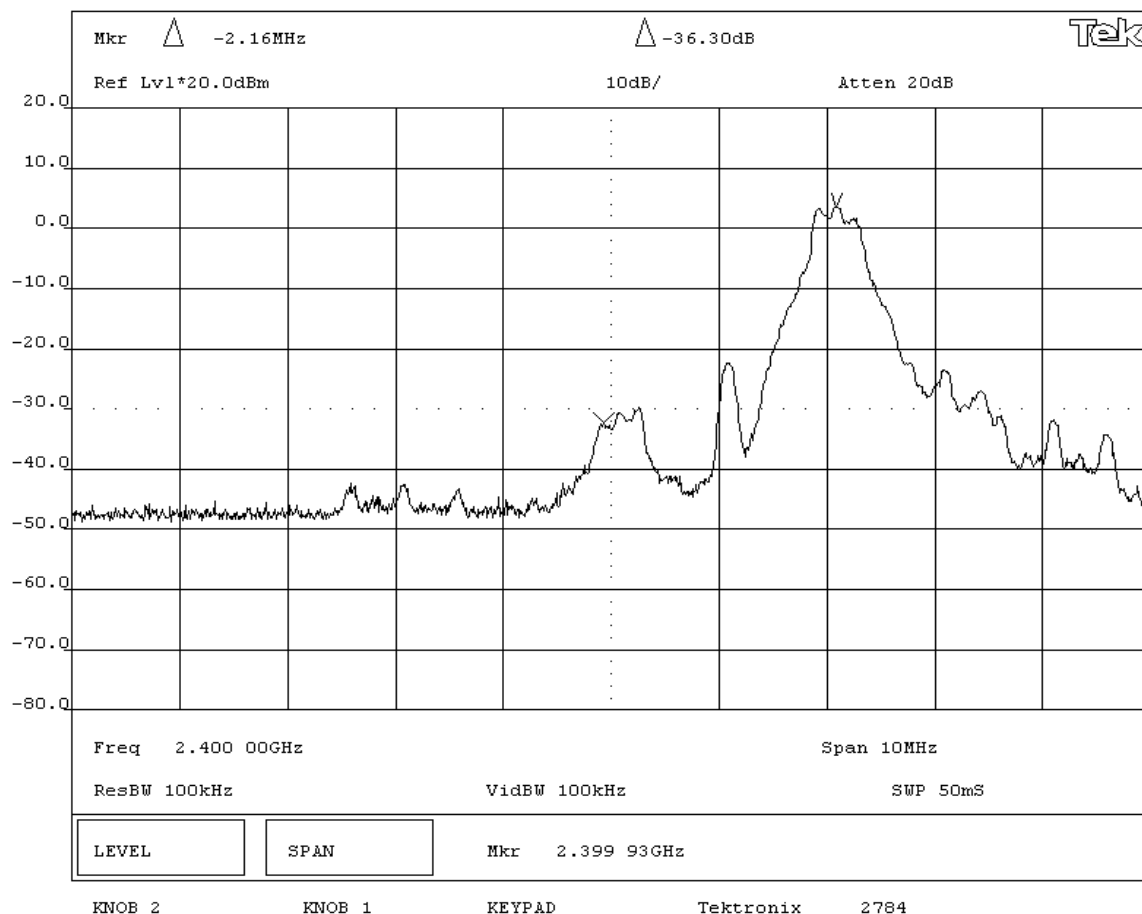
Test Description

Requirement: Per 47 CFR 15.247(c), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power must be at least 20dB down from the highest emission level within the authorized band. The measurement is made with the spectrum analyzer's resolution bandwidth set to 100 kHz, and the video bandwidth set to greater than or equal to the resolution bandwidth.

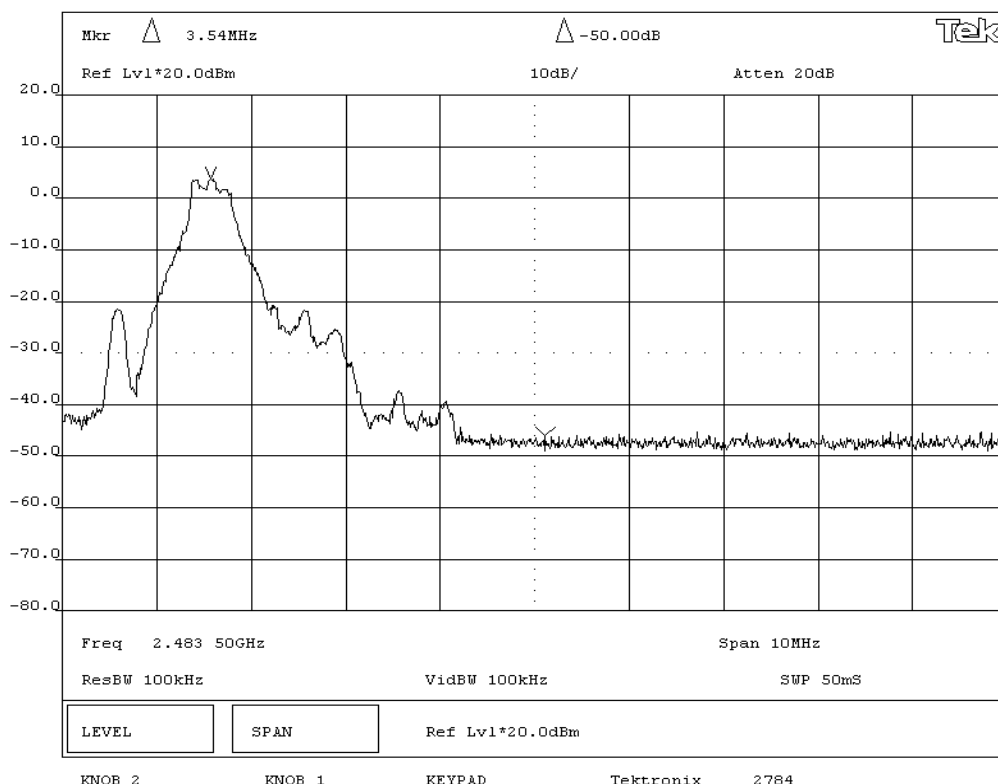
Configuration: The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to low and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate in a no hop mode. The channels closest to the band edges were selected. The spectrum was scanned across each band edge from 5 MHz below the band edge to 5 MHz above the band edge.

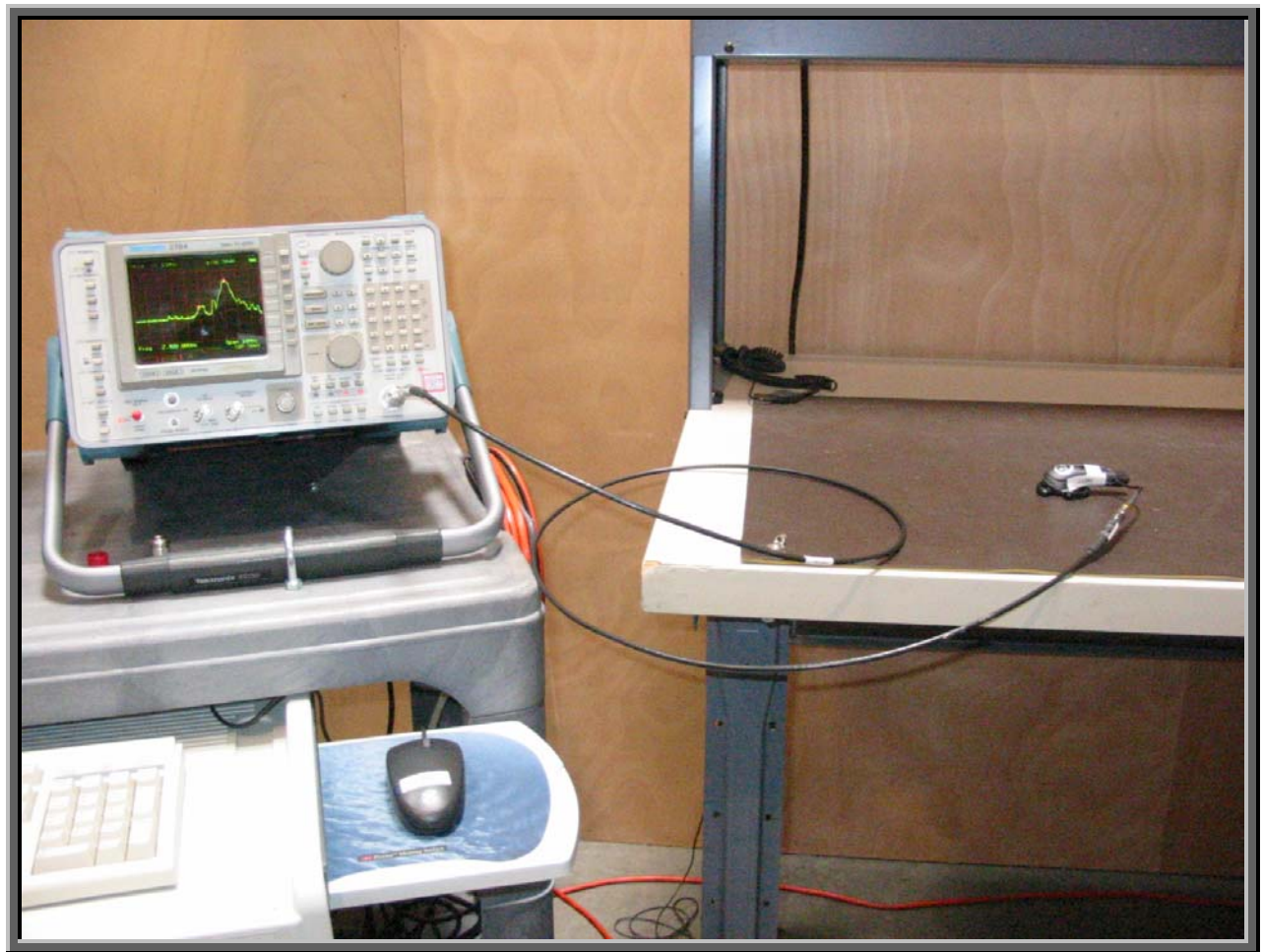
Completed by:

NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/06/04		
Customer: Logitech, Inc.			Temperature: 23 degrees C		
Attendees: None			Humidity: 48% RH		
Customer Ref. No.: N/A			Job Site: EV06		
Tested by: Rod Peloquin			Power: Internal Battery		
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(c)		Year: 2003		Method: DA 00-705, ANSI C63.4	
				Year: 2001	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated, No hop mode					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission at the edge of the authorized band is 20 dB down from the fundamental					
RESULTS					
			AMPLITUDE		
Pass			-36.3 dB		
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Band Edge Compliance - Low Channel					



NORTHWEST EMC				EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A				Work Order: LABT0098			
Serial Number: #1				Date: 08/06/04			
Customer: Logitech, Inc.				Temperature: 23 degrees C			
Attendees: None				Tested by: Rod Peloquin		Humidity: 48% RH	
Customer Ref. No.: N/A				Power: Internal Battery		Job Site: EV06	
TEST SPECIFICATIONS							
Specification: 47 CFR 15.247(c)		Year: 2003		Method: DA 00-705, ANSI C63.4		Year: 2001	
SAMPLE CALCULATIONS							
COMMENTS							
EUT OPERATING MODES							
Modulated, No hop mode							
DEVIATIONS FROM TEST STANDARD							
None							
REQUIREMENTS							
Maximum level of any spurious emission at the edge of the authorized band is 20 dB down from the fundamental							
RESULTS				AMPLITUDE			
Pass				-50 dB			
SIGNATURE							
 Tested By: _____							
DESCRIPTION OF TEST							
Band Edge Compliance - High Channel							





Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:

Low
Mid
High

Operating Modes Investigated:

No Hop

Data Rates Investigated:

Maximum

Output Power Setting(s) Investigated:

Maximum

Power Input Settings Investigated:

Battery

Software\Firmware Applied During Test

Exercise software	Special Test Software	Version	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT	Logitech, Inc.	F-0228A	#1

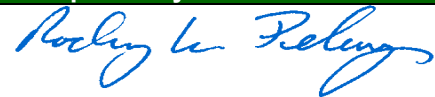
Measurement Equipment

Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	02/26/2003	24 mo

Test Description

Requirement: Per 47 CFR 15.247(c), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power must be at least 20dB down from the highest emission level within the authorized band. The measurement is made with the spectrum analyzer's resolution bandwidth set to 100 kHz, and the video bandwidth set to greater than or equal to the resolution bandwidth.

Configuration: The spurious RF conducted emissions were measured with the EUT set to low, medium, and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate in a no hop mode. For each transmit frequency, the spectrum was scanned throughout the specified frequency.

Completed by:

NORTHWEST
EMC

EMISSIONS DATA SHEET

Rev BETA
01/30/01

EUT: F-0228A		Work Order: LABT0098
Serial Number: #1		Date: 08/06/04
Customer: Logitech, Inc.		Temperature: 23 degrees C
Attendees: None	Tested by: Rod Peloquin	Humidity: 48% RH
Customer Ref. No.: N/A	Power: Internal Battery	Job Site: EV06

TEST SPECIFICATIONS

Specification: 47 CFR 15.247(c)	Year: 2003	Method: DA 00-705, ANSI C63.4	Year: 2001
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SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated by "FFFF" at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

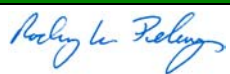
REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

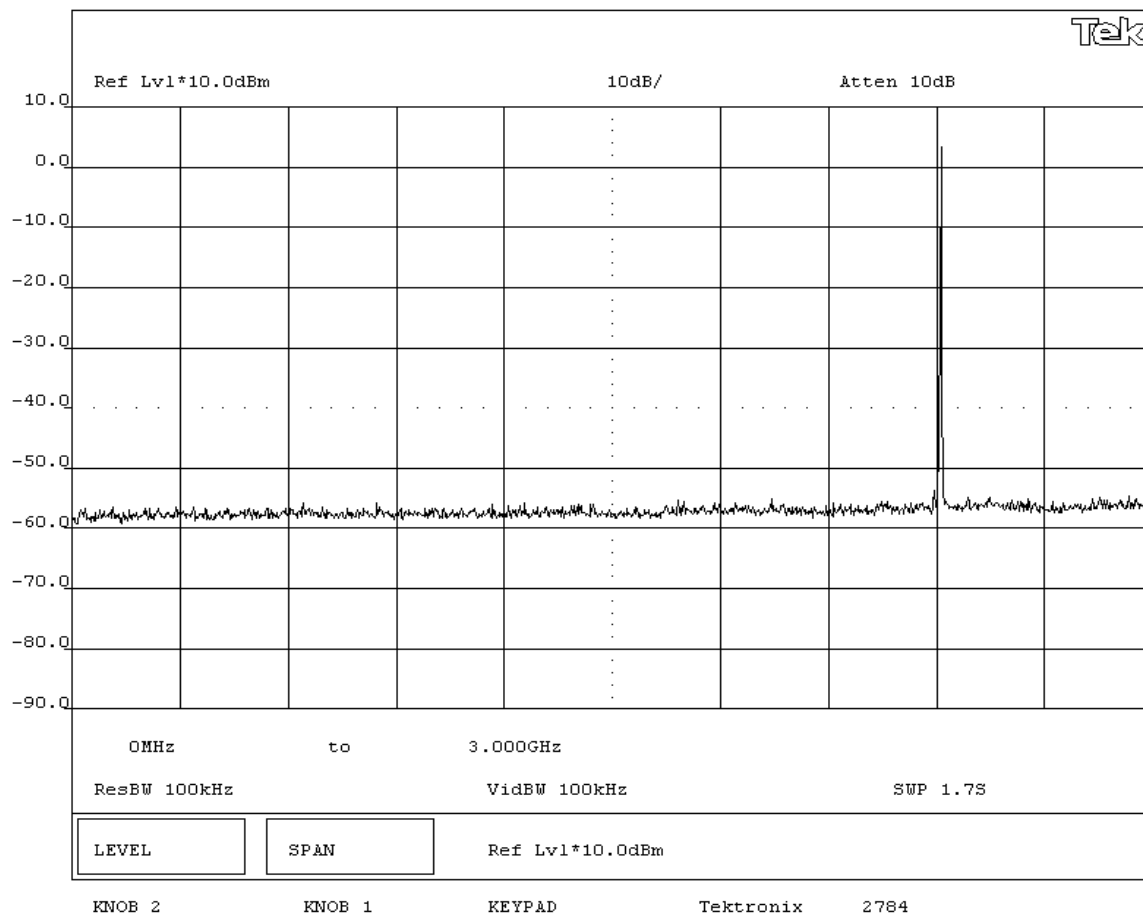
Pass

SIGNATURE

Tested By: 

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - Low Channel 0MHz-3GHz



NORTHWEST
EMC

EMISSIONS DATA SHEET

Rev BETA
01/30/01

EUT: F-0228A				Work Order: LABT0098	
Serial Number: #1				Date: 08/06/04	
Customer: Logitech, Inc.				Temperature: 23 degrees C	
Attendees: None		Tested by: Rod Peloquin		Humidity: 48% RH	
Customer Ref. No.: N/A		Power: Internal Battery		Job Site: EV06	

TEST SPECIFICATIONS

Specification: 47 CFR 15.247(c)	Year: 2003	Method: DA 00-705, ANSI C63.4	Year: 2001
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SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated by "FFFF" at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

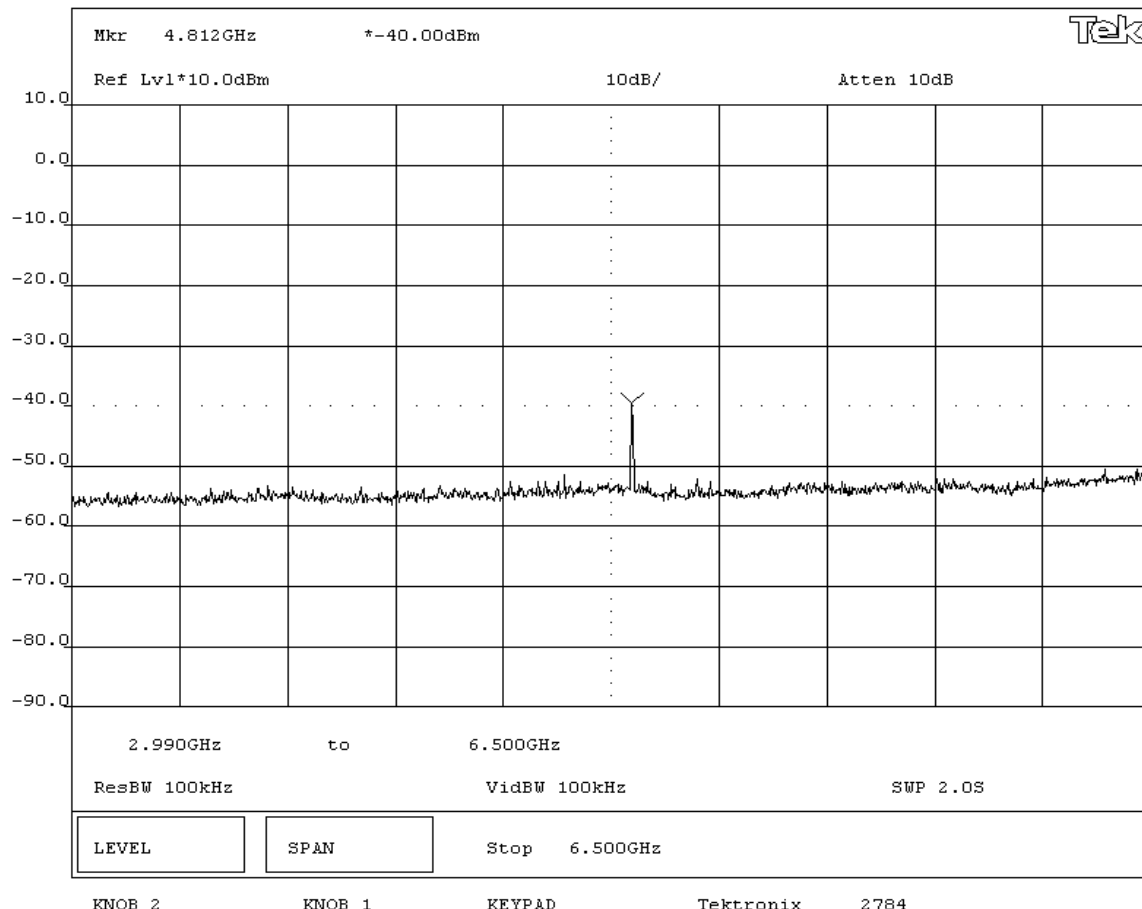
Pass

SIGNATURE

Tested By: 

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - Low Channel 3GHz-6.5GHz



EUT:	F-0228A	Work Order:	LABT0098
Serial Number:	#1	Date:	08/06/04
Customer:	Logitech, Inc.	Temperature:	23 degrees C
Attendees:	None	Tested by:	Rod Peloquin
Customer Ref. No.:	N/A	Power:	Internal Battery
		Humidity:	48% RH
		Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	Year:	2003	Method:	DA 00-705, ANSI C63.4	Year:	2001
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SAMPLE CALCULATIONS

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COMMENTS

Comments	

EUT OPERATING MODES

Modulated by "FFFF" at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

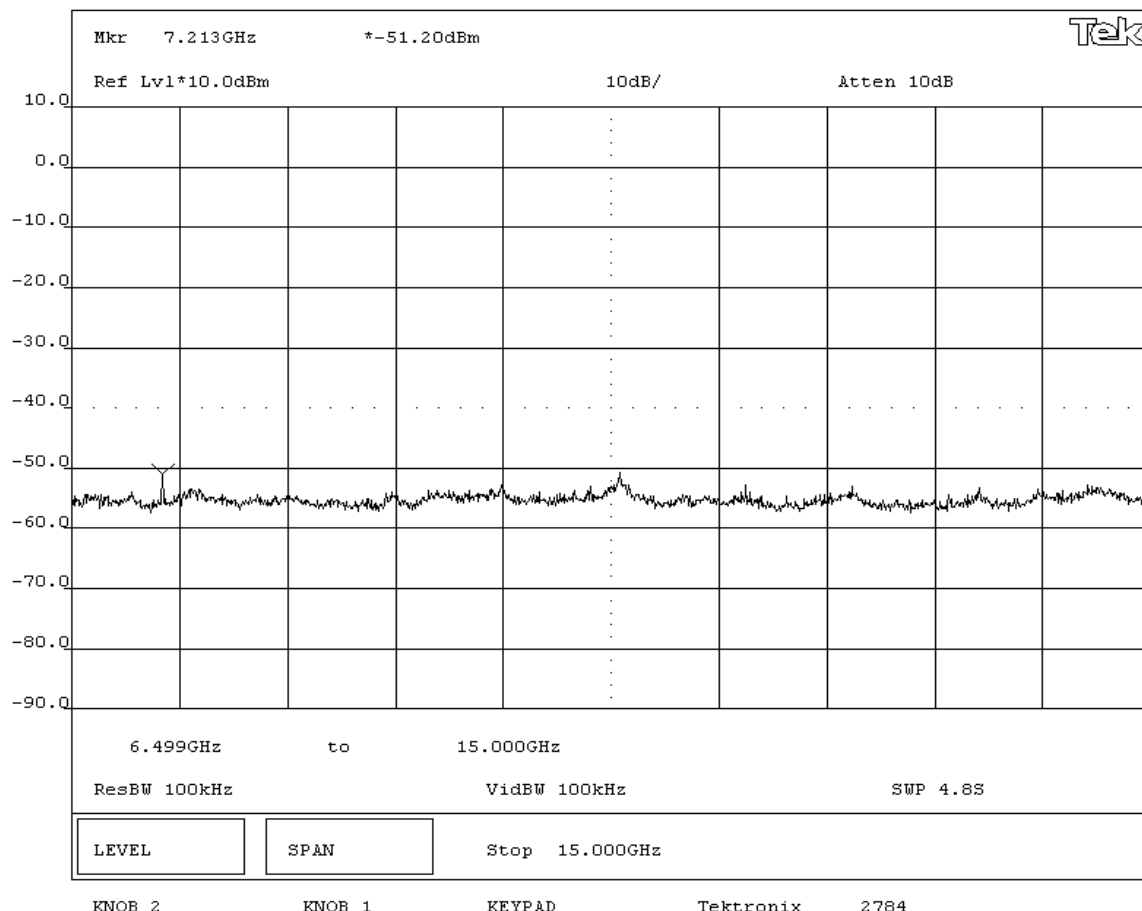
Pass

SIGNATURE

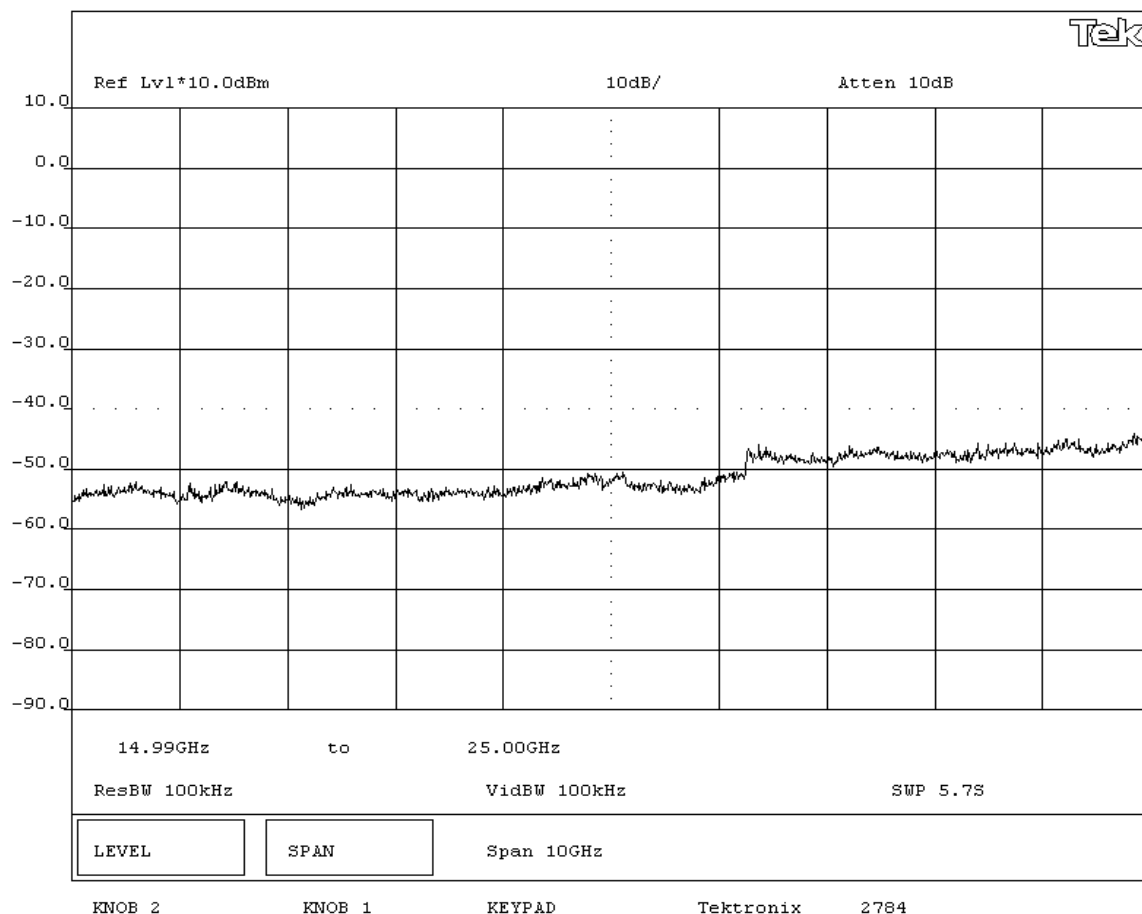
Tested By: _____

DESCRIPTION OF TEST

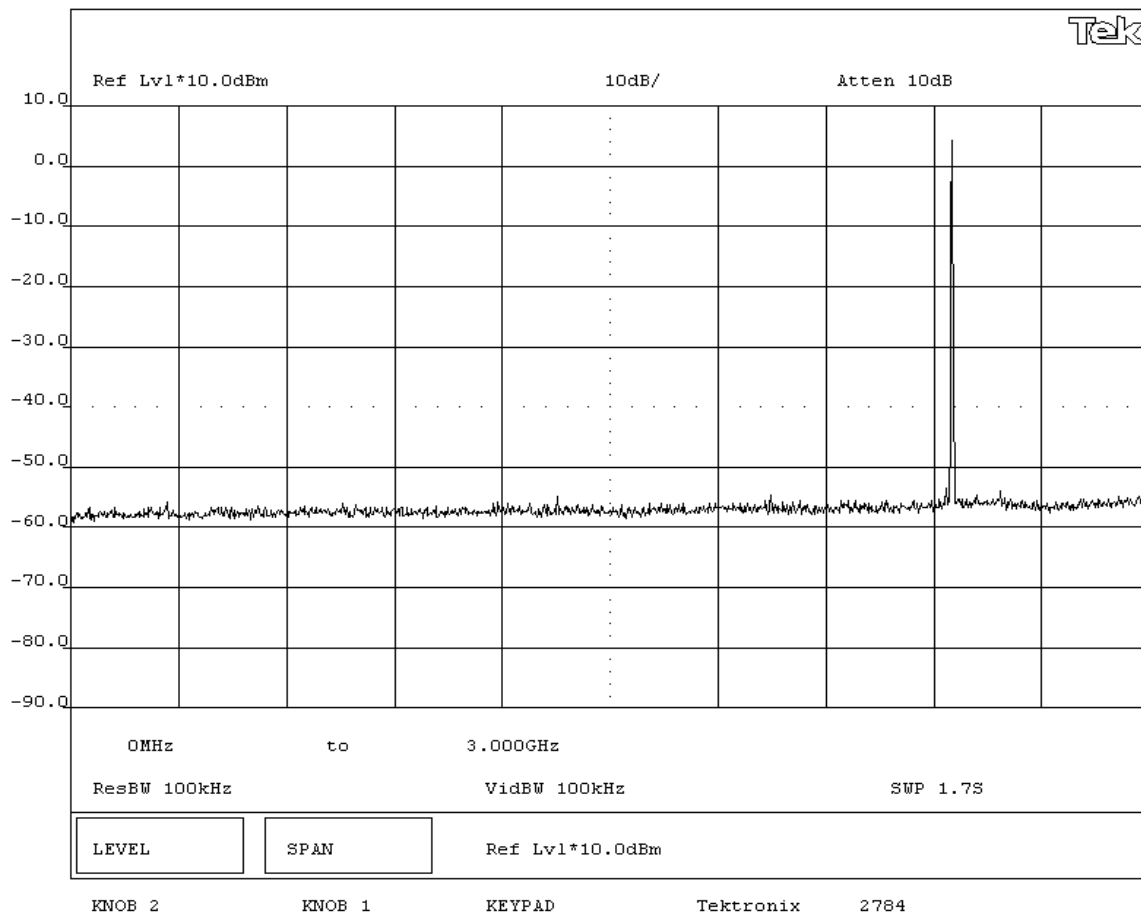
Antenna Conducted Spurious Emissions - Low Channel 6.5GHz-15GHz



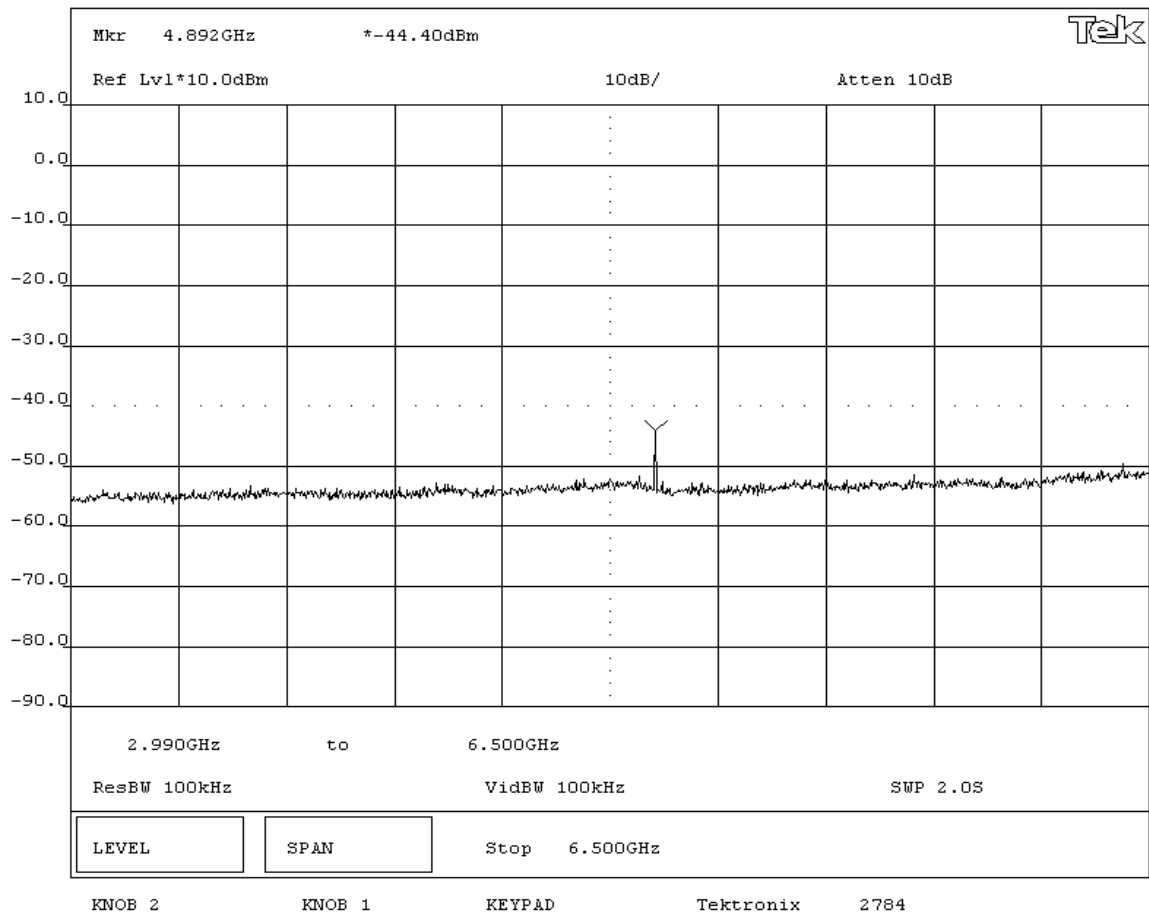
NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A				Work Order: LABT0098	
Serial Number: #1				Date: 08/06/04	
Customer: Logitech, Inc.				Temperature: 23 degrees C	
Attendees: None				Humidity: 48% RH	
Customer Ref. No.: N/A				Job Site: EV06	
Tested by: Rod Peloquin				Power: Internal Battery	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(c)		Year: 2003		Method: DA 00-705, ANSI C63.4	
				Year: 2001	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated by "FFFF" at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - Low Channel 15GHz - 25GHz					



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/06/04		
Customer: Logitech, Inc.			Temperature: 23 degrees C		
Attendees: None			Humidity: 48% RH		
Customer Ref. No.: N/A			Job Site: EV06		
Tested by: Rod Peloquin			Power: Internal Battery		
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(c)		Year: 2003		Method: DA 00-705, ANSI C63.4	
				Year: 2001	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated by "FFFF" at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - Mid Channel 0MHz-3GHz					



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/06/04		
Customer: Logitech, Inc.			Temperature: 23 degrees C		
Attendees: None			Tested by: Rod Peloquin		
Customer Ref. No.: N/A			Power: Internal Battery		
			Humidity: 48% RH		
			Job Site: EV06		
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(c)		Year: 2003		Method: DA 00-705, ANSI C63.4	
				Year: 2001	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated by "FFFF" at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - Mid Channel 3GHz-6.5GHz					



EUT:	F-0228A		Work Order:	LABT0098	
Serial Number:	#1		Date:	08/06/04	
Customer:	Logitech, Inc.		Temperature:	23 degrees C	
Attendees:	None	Tested by:	Rod Peloquin	Humidity:	48% RH
Customer Ref. No.:	N/A	Power:	Internal Battery	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	Year:	2003	Method:	DA 00-705, ANSI C63.4	Year:	2001
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SAMPLE CALCULATIONS

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COMMENTS

Comments	

EUT OPERATING MODES

Modulated by "FFFF" at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

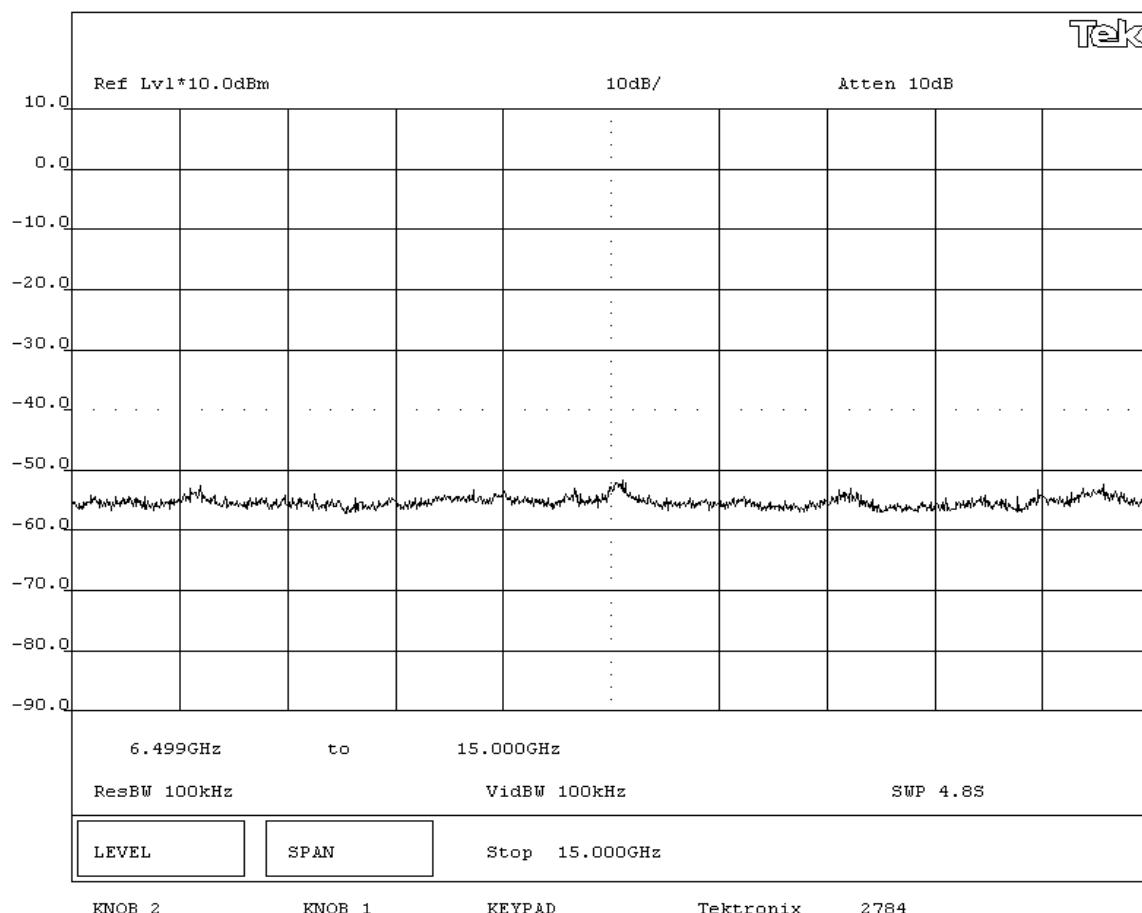
Pass

SIGNATURE

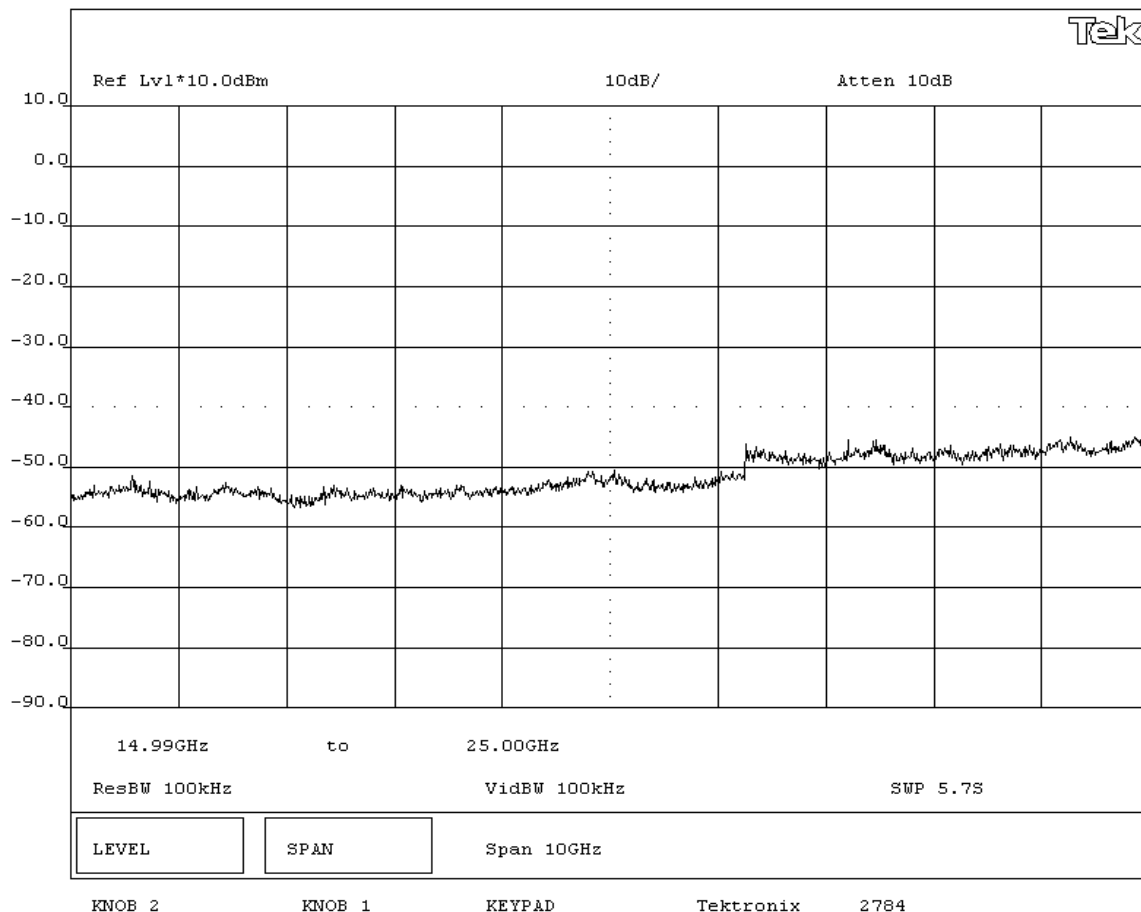
Tested By: Bohly L. Poling

DESCRIPTION OF TEST

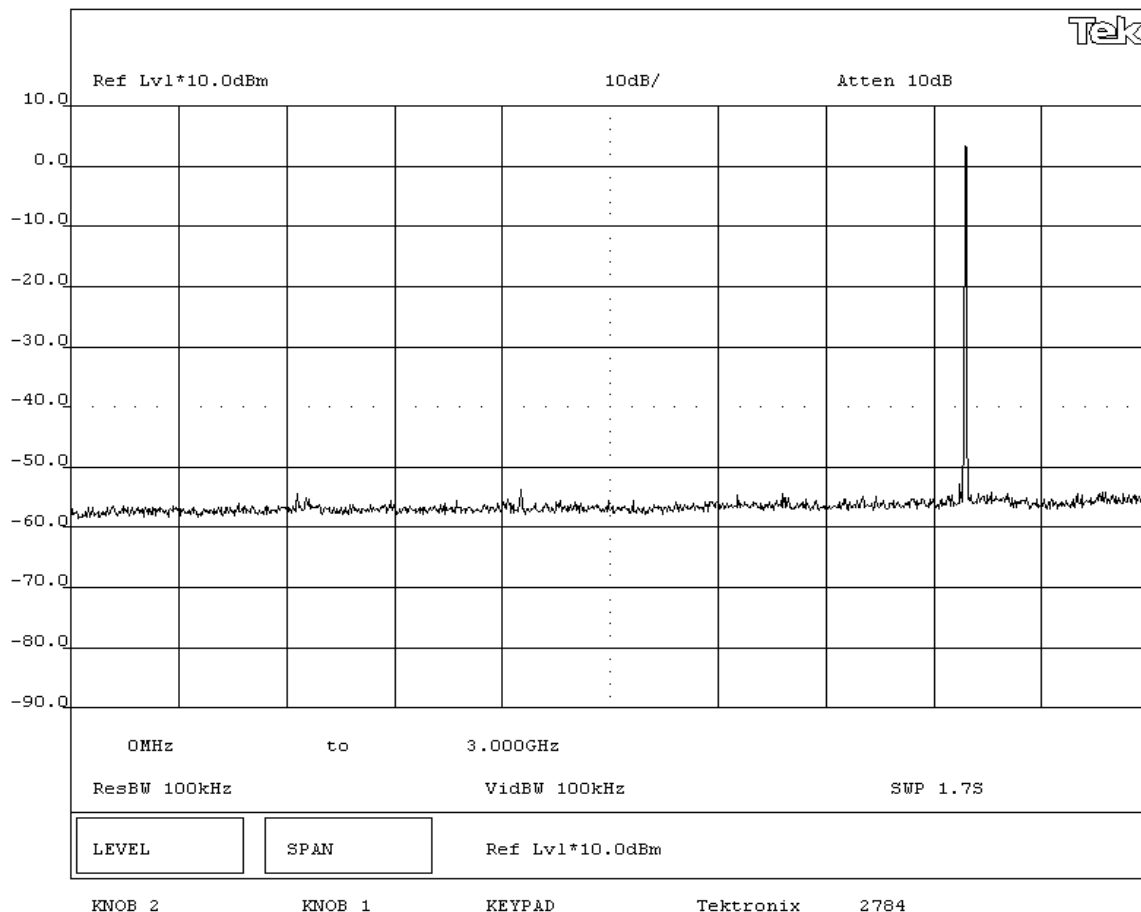
Antenna Conducted Spurious Emissions - Mid Channel 6.5GHz-15GHz



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/06/04		
Customer: Logitech, Inc.			Temperature: 23 degrees C		
Attendees: None			Humidity: 48% RH		
Customer Ref. No.: N/A			Job Site: EV06		
Tested by: Rod Peloquin			Power: Internal Battery		
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(c)		Year: 2003		Method: DA 00-705, ANSI C63.4	
				Year: 2001	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated by "FFFF" at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - Mid Channel 15GHz-25GHz					



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/06/04		
Customer: Logitech, Inc.			Temperature: 23 degrees C		
Attendees: None			Humidity: 48% RH		
Customer Ref. No.: N/A			Job Site: EV06		
Tested by: Rod Peloquin			Power: Internal Battery		
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(c)		Year: 2003		Method: DA 00-705, ANSI C63.4	
				Year: 2001	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated by "FFFF" at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - High Channel 0MHz-3GHz					



NORTHWEST
EMC

EMISSIONS DATA SHEET

Rev BETA
01/30/01

EUT: F-0228A				Work Order: LABT0098	
Serial Number: #1				Date: 08/06/04	
Customer: Logitech, Inc.				Temperature: 23 degrees C	
Attendees: None		Tested by: Rod Peloquin		Humidity: 48% RH	
Customer Ref. No.: N/A		Power: Internal Battery		Job Site: EV06	

TEST SPECIFICATIONS

Specification: 47 CFR 15.247(c)	Year: 2003	Method: DA 00-705, ANSI C63.4	Year: 2001
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SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Modulated by "FFFF" at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

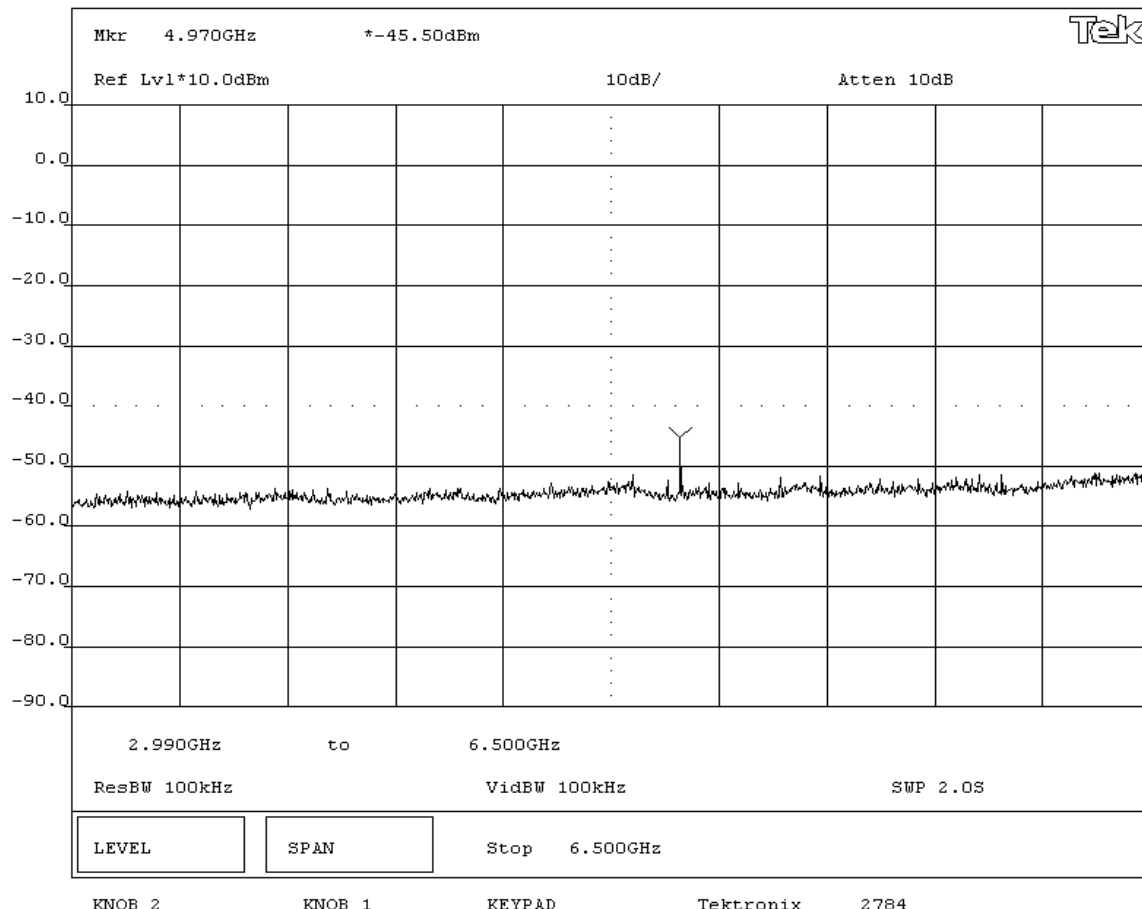
Pass

SIGNATURE

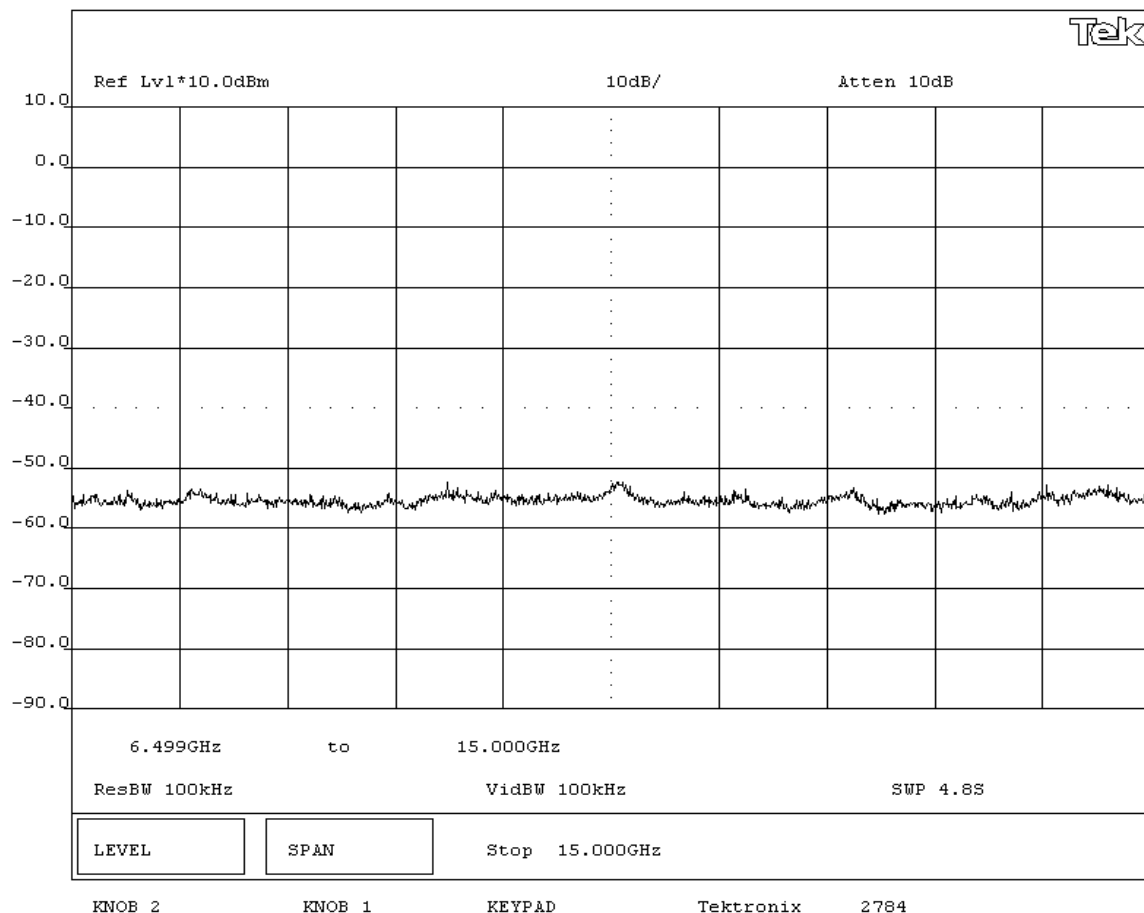
Tested By: 

DESCRIPTION OF TEST

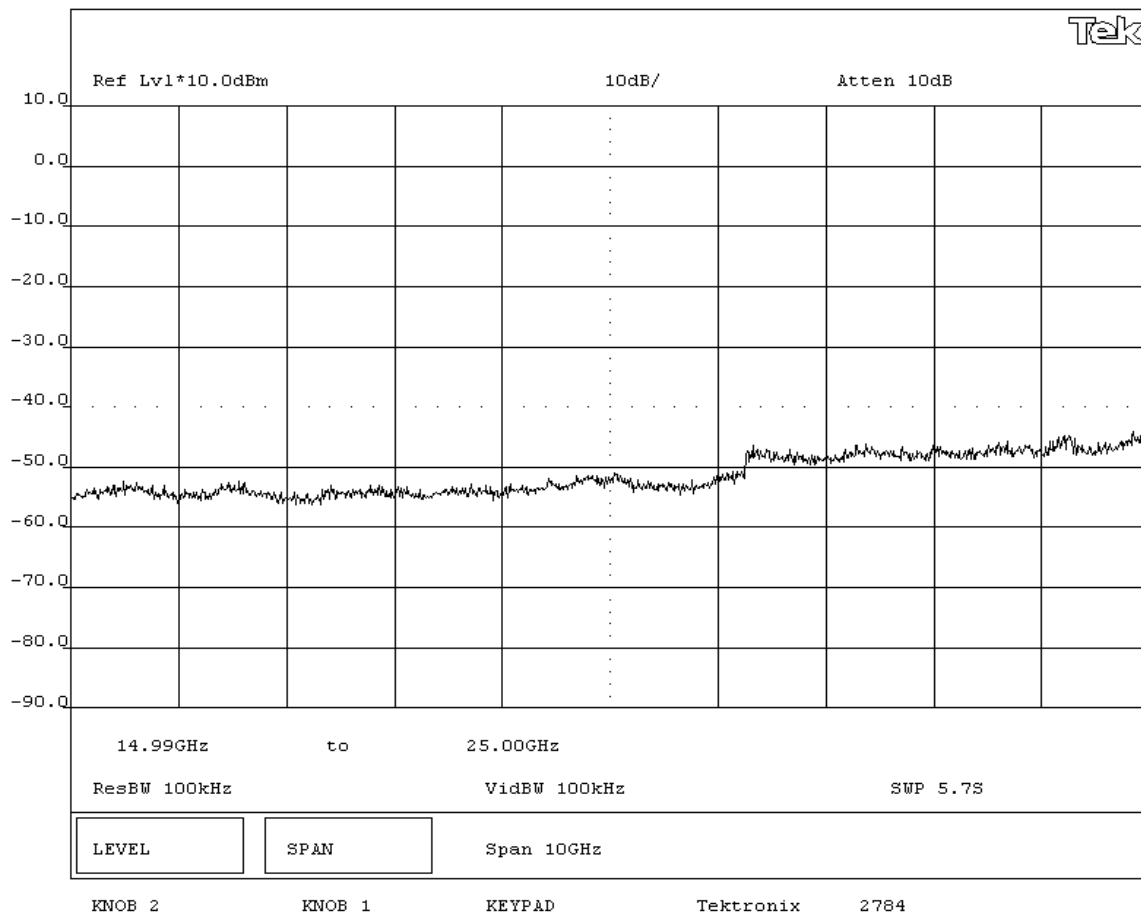
Antenna Conducted Spurious Emissions - High Channel 3GHz-6.5GHz

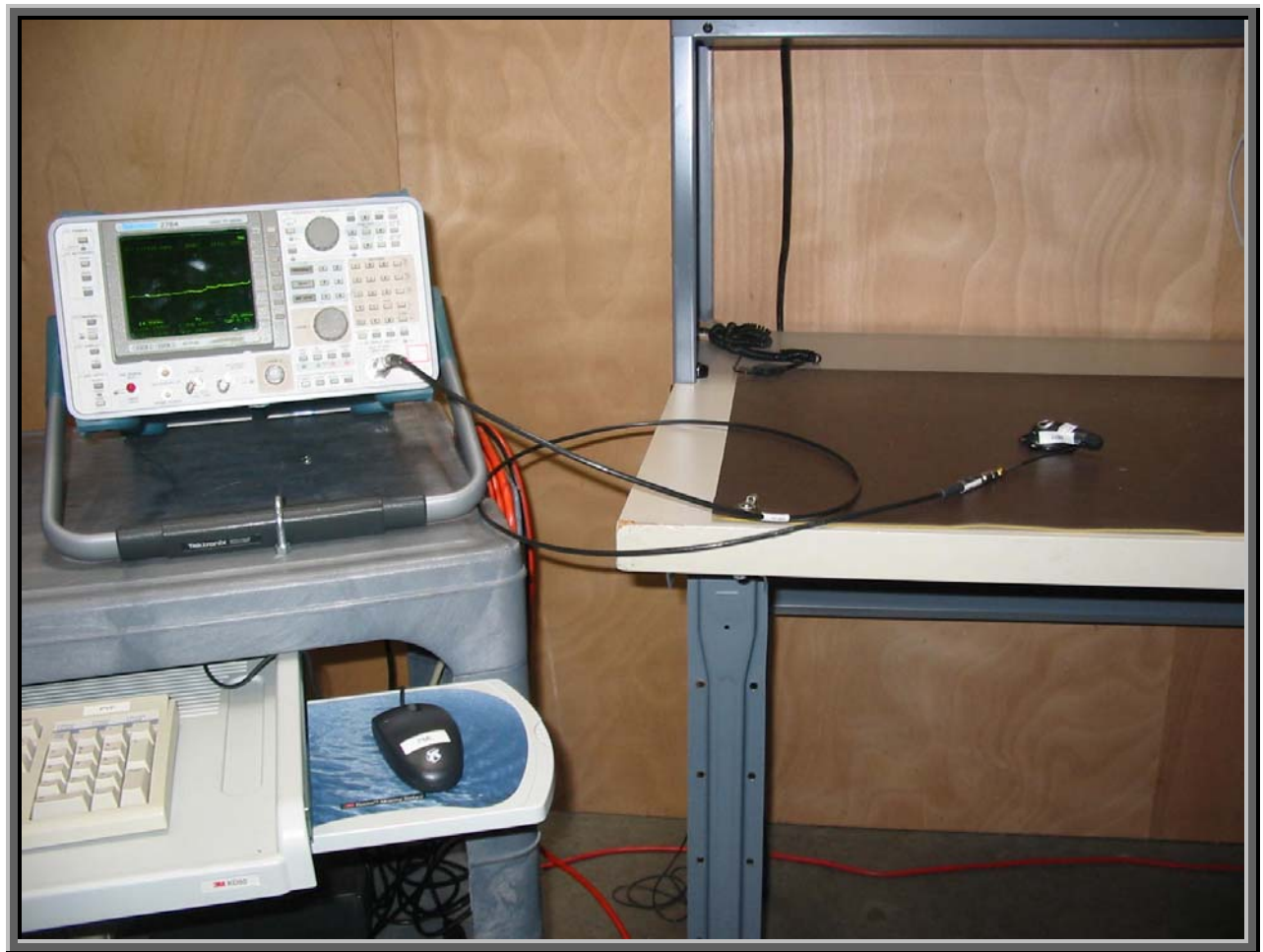


NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/06/04		
Customer: Logitech, Inc.			Temperature: 23 degrees C		
Attendees: None		Tested by: Rod Peloquin	Humidity: 48% RH		
Customer Ref. No.: N/A		Power: Internal Battery	Job Site: EV06		
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(c)		Year: 2003	Method: DA 00-705, ANSI C63.4	Year: 2001	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated by "FFFF" at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - High Channel 6.5GHz-15GHz					



NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/06/04		
Customer: Logitech, Inc.			Temperature: 23 degrees C		
Attendees: None			Humidity: 48% RH		
Customer Ref. No.: N/A			Job Site: EV06		
Tested by: Rod Peloquin			Power: Internal Battery		
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(c)		Year: 2003		Method: DA 00-705, ANSI C63.4	
				Year: 2001	
SAMPLE CALCULATIONS					
COMMENTS					
EUT OPERATING MODES					
Modulated by "FFFF" at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental					
RESULTS					
Pass					
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Antenna Conducted Spurious Emissions - High Channel 15GHz-25GHz					





Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:

Low
Mid
High

Operating Modes Investigated:

No Hop

Data Rates Investigated:

Maximum

Output Power Setting(s) Investigated:

Maximum

Power Input Settings Investigated:

Battery

Software\Firmware Applied During Test

Exercise software	Special Test Software	Version	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT	Logitech, Inc.	F-0228A	#1

Cables

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
DC Leads	No	2.0	No	AC Power Adapter	EUT

Measurement Equipment

Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	02/26/2003	24 mo
Power Meter	Hewlett Packard	E4418A	SPA	07/23/2004	24 mo
Power Sensor	Hewlett-Packard	8481H	SPB	07/23/2004	24 mo
Signal Generator	Hewlett Packard	8341B	TGN	01/23/2004	13 mo

Test Description

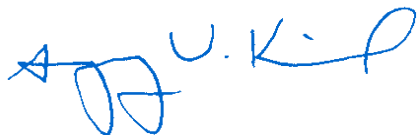
Requirement: Per 47 CFR 15.247(d), the peak power spectral density conducted from the antenna port of a direct sequence transmitter must not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission.

Configuration: The peak power spectral density measurements were measured with the EUT set to low, mid, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate using direct sequence modulation. Per the procedure outlined in FCC 97-114, the spectrum analyzer was used as follows:

The emission peak(s) were located and zoom in on within the passband. The resolution bandwidth was set to 3 kHz, the video bandwidth was set to greater than or equal to the resolution bandwidth. The sweep speed was set equal to the span divided by 3 kHz (sweep = $(SPAN/3 \text{ kHz})$). For example, given a span of 1.5 MHz, the sweep should be $1.5 \times 10^6 \div 3 \times 10^3 = 500$ seconds. External attenuation was used and added to the reading. The following FCC procedure was used for modifying the power spectral density measurements:

"If the spectrum line spacing cannot be resolved on the available spectrum analyzer, the noise density function on most modern conventional spectrum analyzers will directly measure the noise power density normalized to a 1 Hz noise power bandwidth. Add 34.8 dB for correction to 3 kHz."

The spectrum analyzer power reading was calibrated prior to testing using the power meter, power sensor, and signal generator via the substitution method.

Completed by:

NORTHWEST
EMC**EMISSIONS DATA SHEET**Rev BETA
01/30/01

EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/15/04		
Customer: Logitech, Inc.			Temperature: 79 degrees F		
Attendees: None			Humidity: 45% RH		
Customer Ref. No.: N/A			Job Site: EV06		
Tested by: Greg Kiemel			Power: Battery		

TEST SPECIFICATIONS

Specification: 47 CFR 15.247(d)	Year: 2003	Method: FCC 97-114, ANSI C63.4	Year: 2001
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SAMPLE CALCULATIONS

Meter reading on spectrum analyzer is internally compensated for cable loss and external attenuation.

Power Spectral Density per 3kHz bandwidth = Power Spectral Density per 1 Hz bandwidth + Bandwidth Correction Factor.

Bandwidth Correction Factor = $10 \cdot \log(3\text{kHz}/1\text{Hz})$ **COMMENTS****EUT OPERATING MODES**

Modulated by PRBS at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

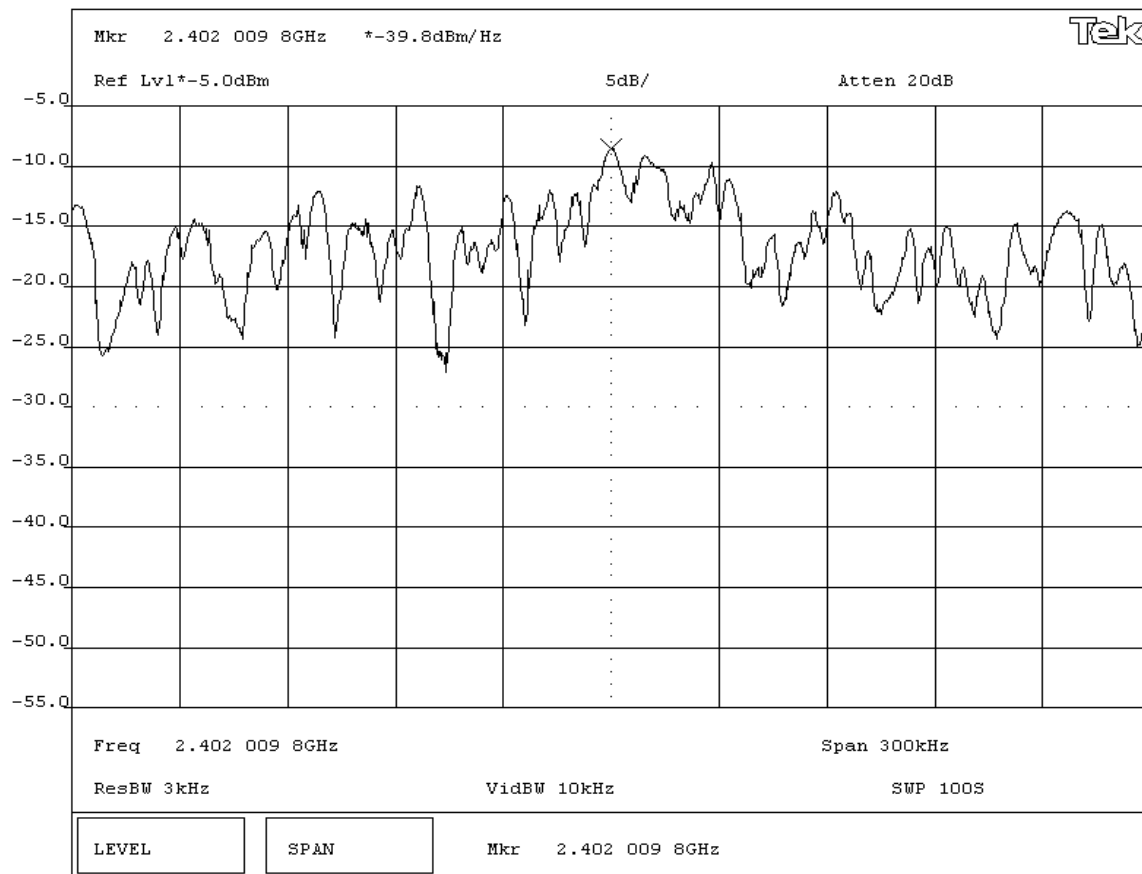
REQUIREMENTS

Maximum peak power spectral density conducted from a DSSS transmitter does not exceed 8 dBm in any 3 kHz band

RESULTS**AMPLITUDE**

Pass

Power Spectral Density = -5.03 dBm / 3kHz

SIGNATURETested By: **DESCRIPTION OF TEST****Power Spectral Density - Low Channel**

KNOB 2

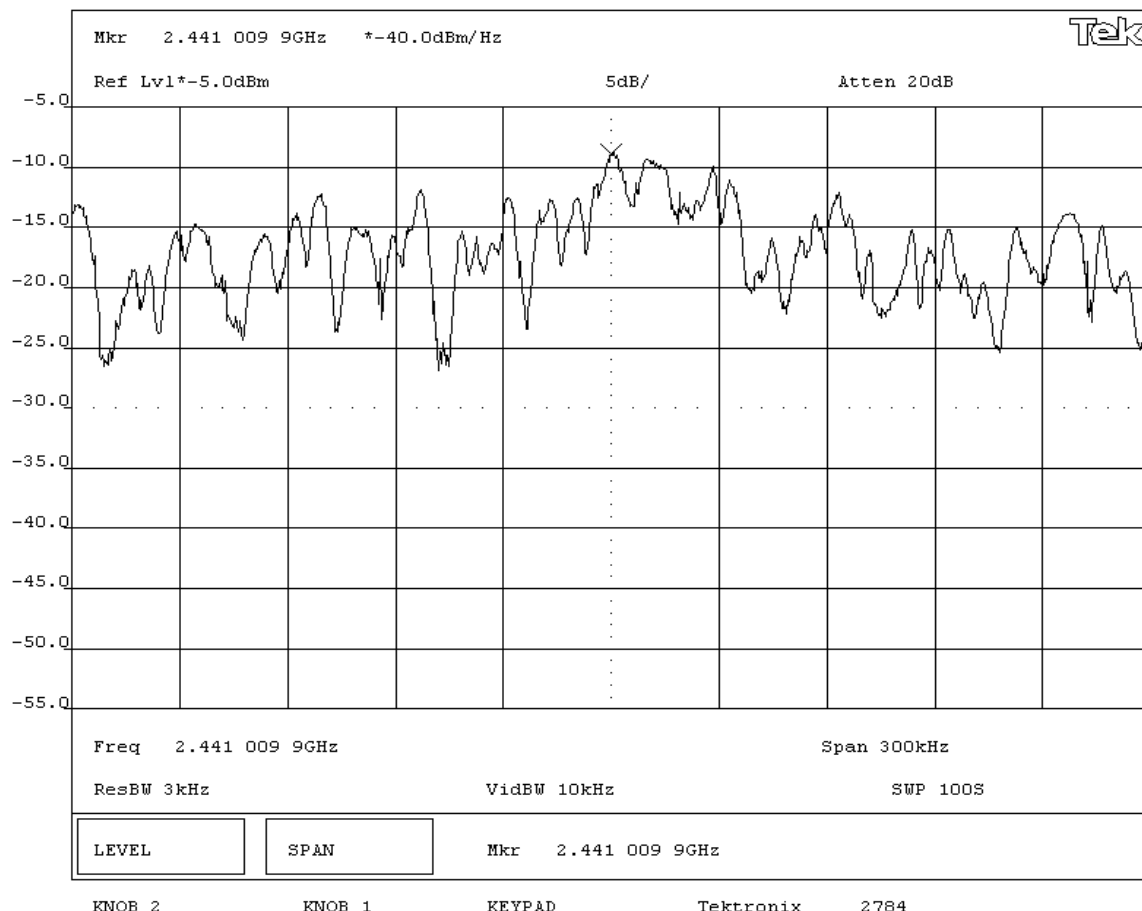
KNOB 1

KEYPAD

Tektronix

2784

NORTHWEST EMC		EMISSIONS DATA SHEET		Rev BETA 01/30/01	
EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/15/04		
Customer: Logitech, Inc.			Temperature: 79 degrees F		
Attendees: None		Tested by: Greg Kiemel		Humidity: 45% RH	
Customer Ref. No.: N/A		Power: Battery		Job Site: EV06	
TEST SPECIFICATIONS					
Specification: 47 CFR 15.247(d)		Year: 2003		Method: FCC 97-114, ANSI C63.4	
				Year: 2001	
SAMPLE CALCULATIONS					
Meter reading on spectrum analyzer is internally compensated for cable loss and external attenuation					
Power Spectral Density per 3kHz bandwidth = Power Spectral Density per 1 Hz bandwidth + Bandwidth Correction Factor.					
Bandwidth Correction Factor = $10 \cdot \log(3\text{kHz}/1\text{Hz})$					
COMMENTS					
EUT OPERATING MODES					
Modulated by PRBS at maximum data rate					
DEVIATIONS FROM TEST STANDARD					
None					
REQUIREMENTS					
Maximum peak power spectral density conducted from a DSSS transmitter does not exceed 8 dBm in any 3 kHz band					
RESULTS			AMPLITUDE		
Pass			Power Spectral Density = -5.23 dBm / 3kHz		
SIGNATURE					
 Tested By: _____					
DESCRIPTION OF TEST					
Power Spectral Density - Mid Channel					



EMISSIONS DATA SHEET

Rev BETA
01/30/01

EUT: F-0228A			Work Order: LABT0098		
Serial Number: #1			Date: 08/15/04		
Customer: Logitech, Inc.			Temperature: 79 degrees F		
Attendees: None			Humidity: 45% RH		
Customer Ref. No.: N/A			Job Site: EV06		
Tested by: Greg Kiemel			Power: Battery		

TEST SPECIFICATIONS

Specification: 47 CFR 15.247(d)	Year: 2003	Method: FCC 97-114, ANSI C63.4	Year: 2001
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SAMPLE CALCULATIONS

Meter reading on spectrum analyzer is internally compensated for cable loss and external attenuation

Power Spectral Density per 3kHz bandwidth = Power Spectral Density per 1 Hz bandwidth + Bandwidth Correction Factor.

Bandwidth Correction Factor = $10 \cdot \log(3\text{kHz}/1\text{Hz})$

COMMENTS

EUT OPERATING MODES

Modulated by PRBS at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum peak power spectral density conducted from a DSSS transmitter does not exceed 8 dBm in any 3 kHz band

RESULTS

AMPLITUDE

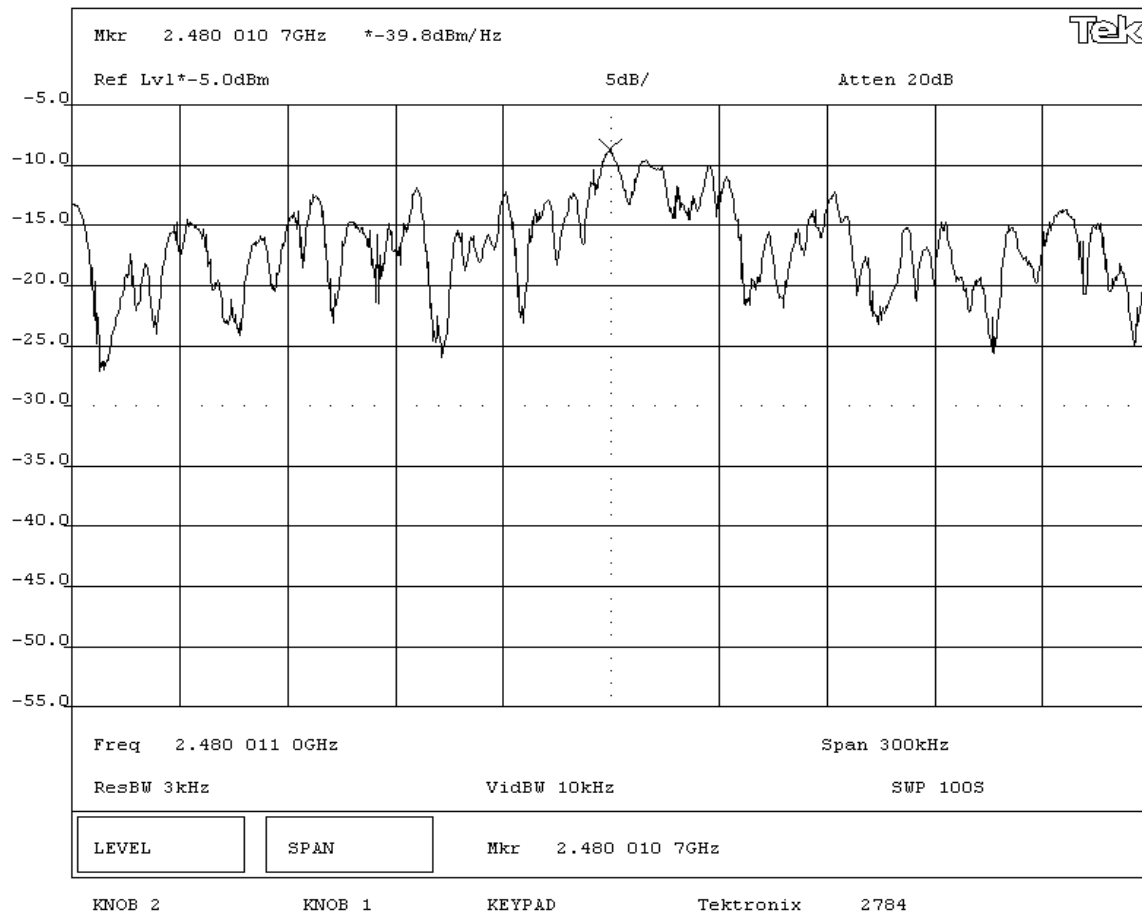
Pass Power Spectral Density = -5.03 dBm / 3kHz

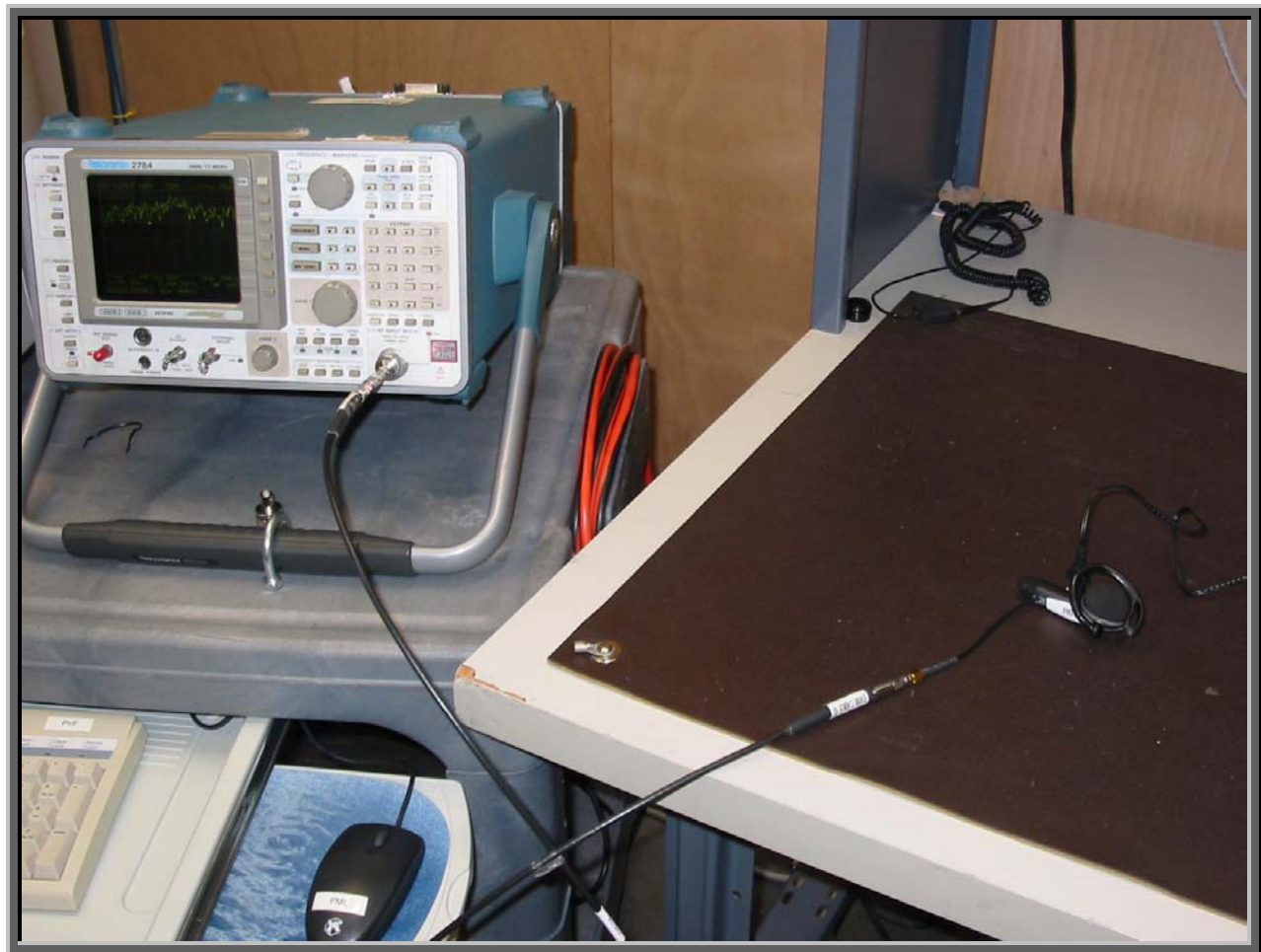
SIGNATURE

Tested By: 

DESCRIPTION OF TEST

Power Spectral Density - High Channel





Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:

Low
Mid
High

Operating Modes Investigated:

No Hop

Data Rates Investigated:

Maximum

Output Power Setting(s) Investigated:

Maximum

Power Input Settings Investigated:

Battery

Frequency Range Investigated

Start Frequency	30 MHz	Stop Frequency	26 GHz
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Software\Firmware Applied During Test

Exercise software	Special Test Software	Version	Unknown
Description			
The system was tested using special software developed to test all functions of the device during the test.			

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT	Logitech, Inc.	F-0228A	#2

Measurement Equipment					
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Quasi-Peak Adapter	Hewlett-Packard	85650A	AQF	12/23/2003	13 mo
Spectrum Analyzer	Hewlett-Packard	8566B	AAL	12/23/2003	13 mo
Spectrum Analyzer Display	Hewlett Packard	85662A	AALD	12/23/2003	13 mo
Pre-Amplifier	Amplifier Research	LN1000A	APS	02/05/2004	13 mo
Antenna, Biconilog	EMCO	3141	AXE	12/03/2003	24 mo
Pre-Amplifier	Miteq	AMF-4D-005180-24-10P	APJ	01/05/2004	13 mo
Antenna, Horn	EMCO	3115	AHC	09/18/2003	12 mo
Antenna, Horn	EMCO	3160-08	AHK	NCR	NA
Pre-Amplifier	Miteq	AMF-4D-005180-24-10P	APC	10/08/2003	12 mo
Antenna, Horn	EMCO	3160-09	AHG	NCR	NA
Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	10/08/2003	12 mo
Attenuator	Pasternack	2082-6148-20	ATE	02/03/2004	13 mo
High Pass Filter	Micro-Tronics	HPM50111	HFO	04/13/2004	13 mo

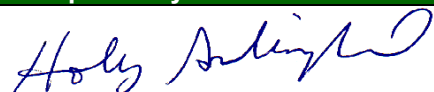
Test Description

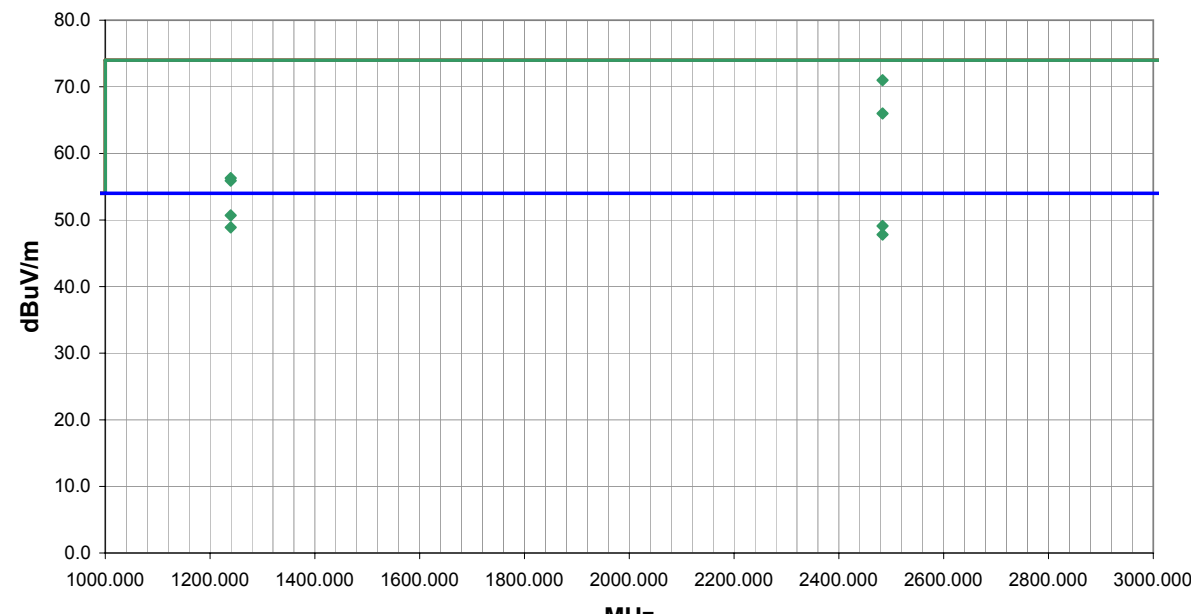
Requirement: The field strength of any spurious emissions or modulation products that fall in a restricted band, as defined in 47 CFR 15.205, is measured. The peak level must comply with the limits specified in 47 CFR 15.35(b). The average level (taken with a 10Hz VBW) must comply with the limits specified in 15.209.

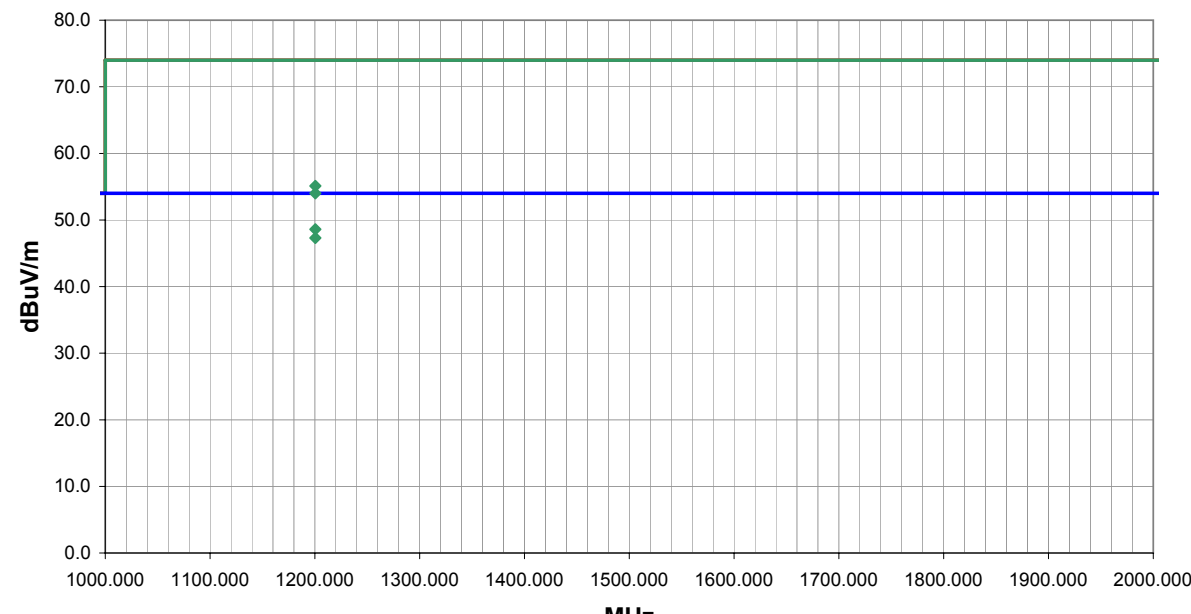
Configuration: The integral antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and the EUT antenna in three orthogonal axis, and adjusting measurement antenna height and polarization, and manipulating the EUT antenna in 3 orthogonal planes (per ANSI C63.4:2001). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

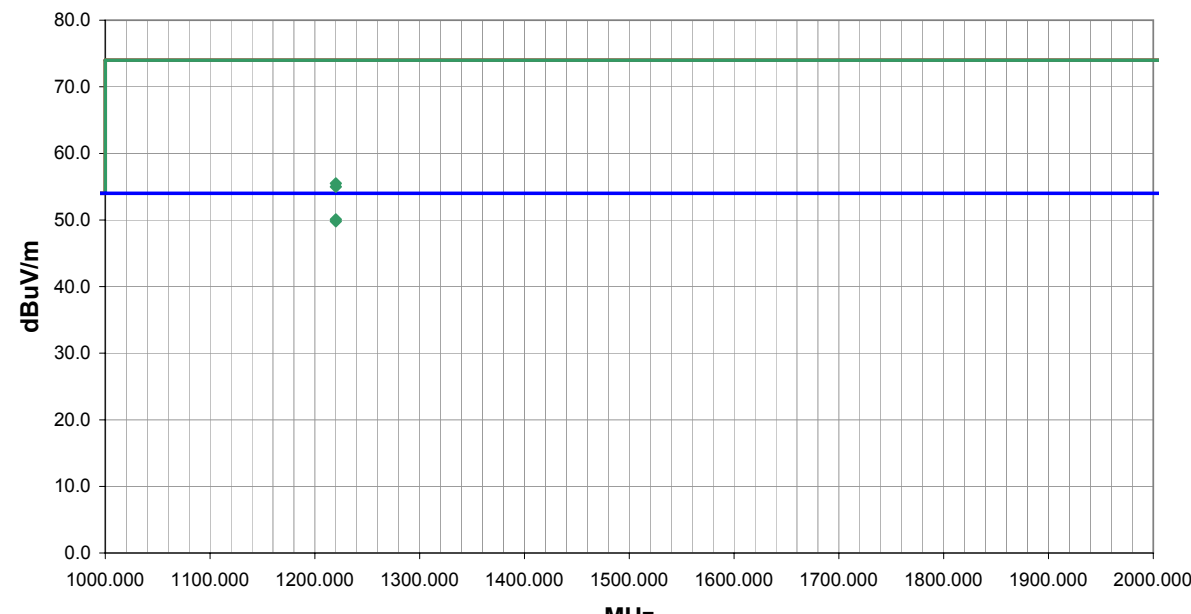
Bandwidths Used for Measurements			
Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 – 0.15	1.0	0.2	0.2
0.15 – 30.0	10.0	9.0	9.0
30.0 – 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0
Measurements were made using the bandwidths and detectors specified. No video filter was used.			

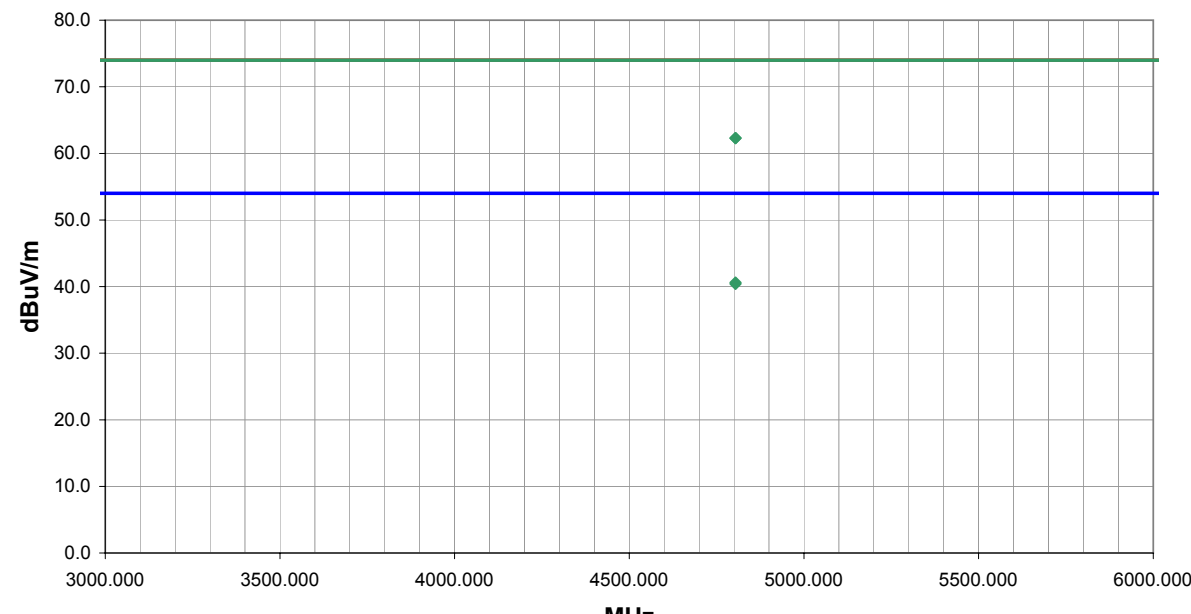
Completed by:

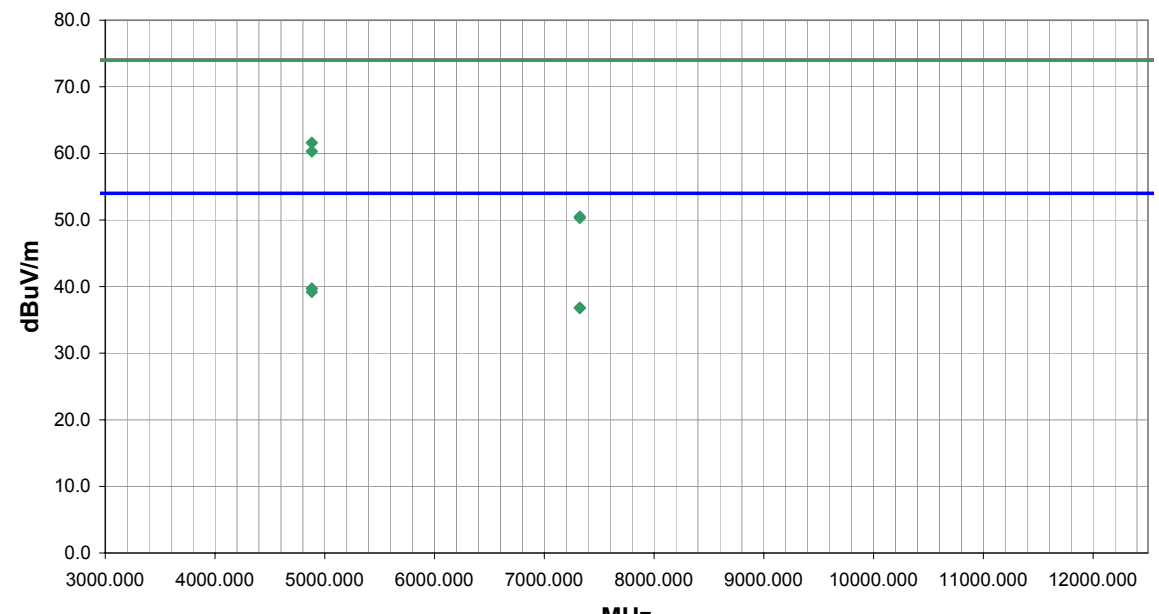


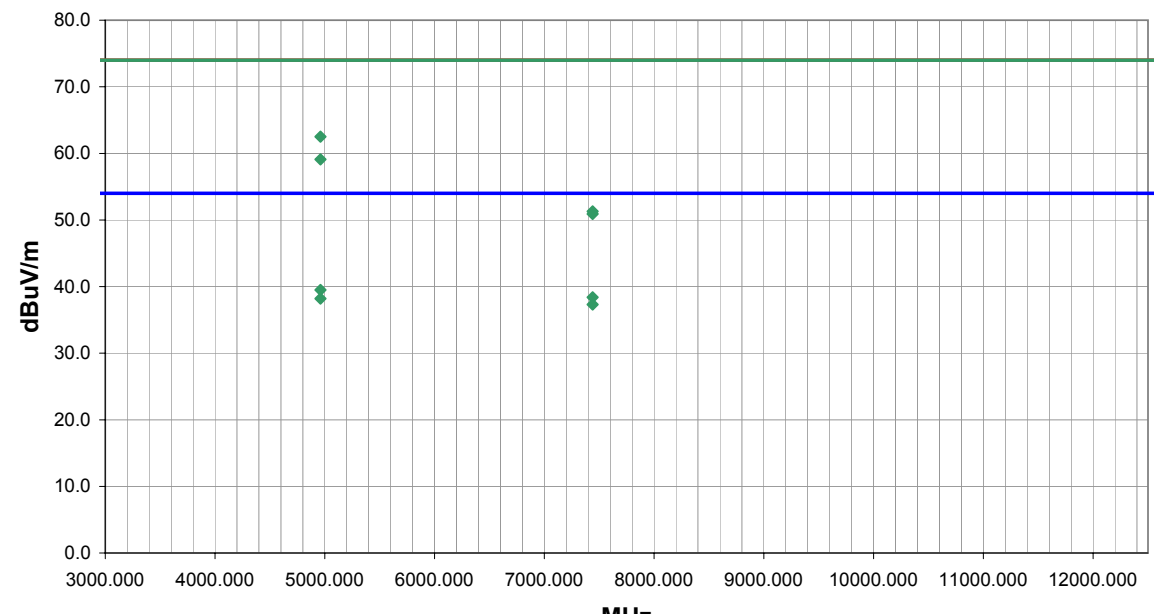
NORTHWEST EMC		RADIATED EMISSIONS DATA SHEET		REV df4.2 08/10/2004								
EUT: F-0228A			Work Order: LABT0098									
Serial Number: #2			Date: 08/11/04									
Customer: Logitech, Inc.			Temperature: 79									
Attendees: none			Humidity: 45%									
Cust. Ref. No.:			Barometric Pressure: 29.9									
Tested by: Holly Ashkannejhad		Power: Battery		Job Site: EV01								
TEST SPECIFICATIONS												
Specification: FCC 15.247(c) Spurious Radiated Emissions			Year: 2003									
Method: ANSI C63.4			Year: 2001									
SAMPLE CALCULATIONS												
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation												
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator												
COMMENTS												
EUT OPERATING MODES												
Bluetooth, High Channel												
DEVIATIONS FROM TEST STANDARD												
No deviations.												
RESULTS												
Pass					Run # 1							
Other												
					 Tested By:							
												
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
2483.500	53.5	-2.5	78.0	1.1	3.0	20.0	H-Horn	PK	0.0	71.0	74.0	-3.0
1239.511	39.0	-8.3	157.0	1.1	3.0	20.0	V-Horn	AV	0.0	50.7	54.0	-3.3
2483.500	31.6	-2.5	17.0	1.7	3.0	20.0	V-Horn	AV	0.0	49.1	54.0	-4.9
1239.511	37.2	-8.3	231.0	1.3	3.0	20.0	H-Horn	AV	0.0	48.9	54.0	-5.1
2483.500	30.3	-2.5	78.0	1.1	3.0	20.0	V-Horn	AV	0.0	47.8	54.0	-6.2
2483.500	48.5	-2.5	17.0	1.7	3.0	20.0	V-Horn	PK	0.0	66.0	74.0	-8.0
1239.511	44.6	-8.3	231.0	1.3	3.0	20.0	H-Horn	PK	0.0	56.3	74.0	-17.7
1239.511	44.2	-8.3	157.0	1.1	3.0	20.0	V-Horn	PK	0.0	55.9	74.0	-18.1

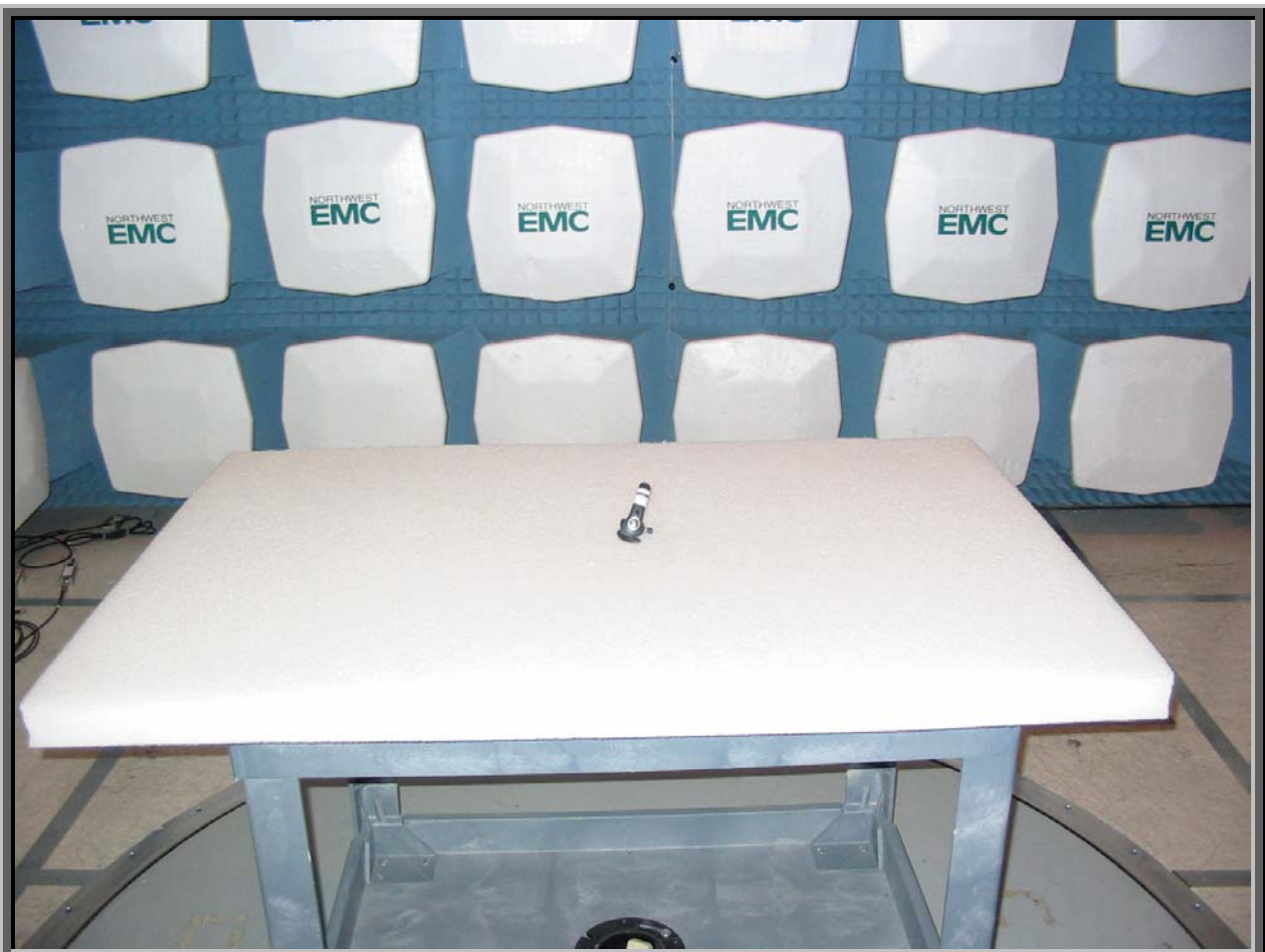
NORTHWEST EMC										RADIATED EMISSIONS DATA SHEET				REV df4.2 08/10/2004	
EUT: F-0228A										Work Order: LABT0098					
Serial Number: #2										Date: 08/11/04					
Customer: Logitech, Inc.										Temperature: 79					
Attendees: none										Humidity: 45%					
Cust. Ref. No.:										Barometric Pressure: 29.9					
Tested by: Holly Ashkannejhad					Power: Battery					Job Site: EV01					
TEST SPECIFICATIONS															
Specification: FCC 15.247(c) Spurious Radiated Emissions										Year: 2003					
Method: ANSI C63.4										Year: 2001					
SAMPLE CALCULATIONS															
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation															
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator															
COMMENTS															
EUT OPERATING MODES															
Bluetooth, Low Channel															
DEVIATIONS FROM TEST STANDARD															
No deviations.															
RESULTS															
Pass														Run #	
														3	
Other															
										 Tested By:					
															
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)			
1200.515	37.2	-8.6	127.0	1.2	3.0	20.0	V-Horn	AV	0.0	48.6	54.0	-5.4			
1200.515	35.9	-8.6	257.0	1.4	3.0	20.0	H-Horn	AV	0.0	47.3	54.0	-6.7			
1200.515	43.7	-8.6	127.0	1.2	3.0	20.0	V-Horn	PK	0.0	55.1	74.0	-18.9			
1200.515	42.6	-8.6	257.0	1.4	3.0	20.0	H-Horn	PK	0.0	54.0	74.0	-20.0			

NORTHWEST EMC		RADIATED EMISSIONS DATA SHEET		REV df4.2 08/10/2004								
EUT: F-0228A			Work Order: LABT0098									
Serial Number: #2			Date: 08/11/04									
Customer: Logitech, Inc.			Temperature: 79									
Attendees: none			Humidity: 45%									
Cust. Ref. No.:			Barometric Pressure: 29.9									
Tested by: Holly Ashkannejhad		Power: Battery		Job Site: EV01								
TEST SPECIFICATIONS												
Specification: FCC 15.247(c) Spurious Radiated Emissions			Year: 2003									
Method: ANSI C63.4			Year: 2001									
SAMPLE CALCULATIONS												
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation												
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator												
COMMENTS												
EUT OPERATING MODES												
Bluetooth, Mid Channel												
DEVIATIONS FROM TEST STANDARD												
No deviations.												
RESULTS					Run #							
Pass					2							
Other												
					 Tested By:							
												
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
1220.014	38.6	-8.5	234.0	1.6	3.0	20.0	H-Horn	AV	0.0	50.1	54.0	-3.9
1220.014	38.3	-8.5	170.0	1.1	3.0	20.0	V-Horn	AV	0.0	49.8	54.0	-4.2
1220.014	44.0	-8.5	234.0	1.6	3.0	20.0	H-Horn	PK	0.0	55.5	74.0	-18.5
1220.014	43.5	-8.5	170.0	1.1	3.0	20.0	V-Horn	PK	0.0	55.0	74.0	-19.0

NORTHWEST EMC										RADIATED EMISSIONS DATA SHEET				REV df4.2 08/10/2004	
EUT: F-0228A						Work Order: LABT0098									
Serial Number: #2						Date: 08/11/04									
Customer: Logitech, Inc.						Temperature: 79									
Attendees: none						Humidity: 45%									
Cust. Ref. No.:						Barometric Pressure: 29.9									
Tested by: Holly Ashkannejhad				Power: Battery		Job Site: EV01									
TEST SPECIFICATIONS															
Specification: FCC 15.247(c) Spurious Radiated Emissions						Year: 2003									
Method: ANSI C63.4						Year: 2001									
SAMPLE CALCULATIONS															
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation															
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator															
COMMENTS															
EUT OPERATING MODES															
Bluetooth, Low Channel															
DEVIATIONS FROM TEST STANDARD															
No deviations.															
RESULTS										Run #					
Pass										4					
Other															
										 Tested By:					
															
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)			
4804.026	59.0	3.3	39.0	1.2	3.0	0.0	H-Horn	PK	0.0	62.3	74.0	-11.7			
4804.026	59.0	3.3	352.0	1.2	3.0	0.0	V-Horn	PK	0.0	62.3	74.0	-11.7			
4804.026	37.3	3.3	352.0	1.2	3.0	0.0	V-Horn	AV	0.0	40.6	54.0	-13.4			
4804.026	37.1	3.3	39.0	1.2	3.0	0.0	H-Horn	AV	0.0	40.4	54.0	-13.6			

NORTHWEST EMC		RADIATED EMISSIONS DATA SHEET		REV df4.2 08/10/2004								
EUT: F-0228A			Work Order: LABT0098									
Serial Number: #2			Date: 08/11/04									
Customer: Logitech, Inc.			Temperature: 79									
Attendees: none			Humidity: 45%									
Cust. Ref. No.:			Barometric Pressure: 29.9									
Tested by: Holly Ashkannejhad		Power: Battery		Job Site: EV01								
TEST SPECIFICATIONS												
Specification: FCC 15.247(c) Spurious Radiated Emissions			Year: 2003									
Method: ANSI C63.4			Year: 2001									
SAMPLE CALCULATIONS												
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation												
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator												
COMMENTS												
EUT OPERATING MODES												
Bluetooth, Mid Channel												
DEVIATIONS FROM TEST STANDARD												
No deviations.												
RESULTS					Run #							
Pass					5							
Other												
					 Tested By:							
												
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
4882.040	58.0	3.6	66.0	1.5	3.0	0.0	H-Horn	PK	0.0	61.6	74.0	-12.4
4882.040	56.7	3.6	325.0	1.2	3.0	0.0	V-Horn	PK	0.0	60.3	74.0	-13.7
4882.040	36.1	3.6	66.0	1.5	3.0	0.0	H-Horn	AV	0.0	39.7	54.0	-14.3
4882.040	35.6	3.6	325.0	1.2	3.0	0.0	V-Horn	AV	0.0	39.2	54.0	-14.8
7323.000	26.2	10.6	247.0	1.3	3.0	0.0	H-Horn	AV	0.0	36.8	54.0	-17.2
7323.000	26.2	10.6	260.0	1.2	3.0	0.0	V-Horn	AV	0.0	36.8	54.0	-17.2
7323.000	39.9	10.6	260.0	1.2	3.0	0.0	V-Horn	PK	0.0	50.5	74.0	-23.5
7323.000	39.7	10.6	247.0	1.3	3.0	0.0	H-Horn	PK	0.0	50.3	74.0	-23.7

NORTHWEST EMC		RADIATED EMISSIONS DATA SHEET		REV df4.2 08/10/2004								
EUT: F-0228A			Work Order: LABT0098									
Serial Number: #2			Date: 08/11/04									
Customer: Logitech, Inc.			Temperature: 79									
Attendees: none			Humidity: 45%									
Cust. Ref. No.:			Barometric Pressure: 29.9									
Tested by: Holly Ashkannejhad		Power: Battery		Job Site: EV01								
TEST SPECIFICATIONS												
Specification: FCC 15.247(c) Spurious Radiated Emissions			Year: 2003									
Method: ANSI C63.4			Year: 2001									
SAMPLE CALCULATIONS												
Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation												
Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator												
COMMENTS												
EUT OPERATING MODES												
Bluetooth, High Channel												
DEVIATIONS FROM TEST STANDARD												
No deviations.												
RESULTS					Run #							
Pass					6							
Other												
					 Tested By:							
												
Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
4960.070	58.7	3.8	194.0	1.2	3.0	0.0	V-Horn	PK	0.0	62.5	74.0	-11.5
4960.070	35.7	3.8	194.0	1.2	3.0	0.0	V-Horn	AV	0.0	39.5	54.0	-14.5
4960.070	55.3	3.8	301.0	1.6	3.0	0.0	H-Horn	PK	0.0	59.1	74.0	-14.9
7440.075	27.4	11.0	349.0	1.3	3.0	0.0	H-Horn	AV	0.0	38.4	54.0	-15.6
4960.070	34.4	3.8	301.0	1.6	3.0	0.0	H-Horn	AV	0.0	38.2	54.0	-15.8
7440.075	26.3	11.0	186.0	1.2	3.0	0.0	V-Horn	AV	0.0	37.3	54.0	-16.7
7440.075	40.3	11.0	349.0	1.3	3.0	0.0	H-Horn	PK	0.0	51.3	74.0	-22.7
7440.075	39.9	11.0	186.0	1.2	3.0	0.0	V-Horn	PK	0.0	50.9	74.0	-23.1





BLUETOOTH APPROVALS
FCC Procedure Received from Joe Dichoso on 2-15-02

The following exhibit indicates the FCC Spread Spectrum requirements in Section 15.247 for devices meeting the Bluetooth Specifications in the 2.4 GHz band as of February 2001 operating in the USA. The purpose of this exhibit is to help expedite the approval process for Bluetooth devices. This exhibit provides items that vary for each device and also provides a list of items that are common to Bluetooth devices that explains the remaining requirements. The list of common items can be submitted for each application for equipment authorization. This exhibit only specifies requirements in Section 15.247, requirements in other rule Sections for intentional radiators such as in Section 15.203 or 15.207 must be also be addressed. A Bluetooth device is a FHSS transmitter in the data mode and applies as a Hybrid spread spectrum device in the acquisition mode.

For each individual device, the following items, 1-7 will vary from one device to another and must be submitted.

- 1) The occupied bandwidth in Section 15.247(a)(1)(ii).
- 2) Conducted output power specified in Section 15.247(b)(1).
- 3) EIRP limit in Section 15.247(b)(3).
- 4) RF safety requirement in Section 15.247(b)(4)
- 5) Spurious emission limits in Section 15.247(c).
- 6) Processing gain and requirements for Hybrids in Section 15.247(f) in the acquisition mode.
- 7) Power spectral density requirement in Section 15.247(f) in the acquisition mode.

For all devices, the following items, 1-12, are common to all Bluetooth devices and will not vary from one device to another. This list can be copied into the filing.

1 Output power and channel separation of a Bluetooth device in the different operating modes:

The different operating modes (data-mode, acquisition-mode) of a Bluetooth device don't influence the output power and the channel spacing. There is only one transmitter which is driven by identical input parameters concerning these two parameters.

Only a different hopping sequence will be used. For this reason, the RF parameters in one op-mode is sufficient.

2 Frequency range of a Bluetooth device:

The maximum frequency of the device is: **2402 – 2480 MHz**.

This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for devices which will be operated in the USA. Other frequency ranges (e.g. for Spain, France, Japan) which are allowed according the Core Specification must **not be** supported by the device.

3 Co-ordination of the hopping sequence in data mode to avoid simultaneous occupancy by multiple transmitters:

Bluetooth units which want to communicate with other units must be organized in a structure called piconet. This piconet consist of max. 8 Bluetooth units. One unit is the master the other seven are the slaves. The master co-ordinates frequency occupation in this piconet for all units. As the master hop sequence is derived from it's BD address which is unique for every Bluetooth device, additional masters intending to establish new piconets will always use different hop sequences.

4 Example of a hopping sequence in data mode:

Example of a 79 hopping sequence in data mode:

40, 21, 44, 23, 42, 53, 46, 55, 48, 33, 52, 35, 50, 65, 54, 67,
56, 37, 60, 39, 58, 69, 62, 71, 64, 25, 68, 27, 66, 57, 70, 59,
72, 29, 76, 31, 74, 61, 78, 63, 01, 41, 05, 43, 03, 73, 07, 75,
09, 45, 13, 47, 11, 77, 15, 00, 64, 49, 66, 53, 68, 02, 70, 06,
01, 51, 03, 55, 05, 04

5 Equally average use of frequencies in data mode and short transmissions:

The generation of the hopping sequence in connection mode depends essentially on two input values:

1. LAP/UAP of the master of the connection
2. Internal master clock

The LAP (lower address part) are the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24 MSB's of the 48 BD_ADDRESS. The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For synchronization with other units, only the offsets are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5 μ s. The clock has a cycle of about one day (23h30). In most case it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire LAP (24 bits), 4 LSB's (4 bits) (Input 1) and the 27 MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions, the Bluetooth system has the following behavior:

The first connection between the two devices is established, a hopping sequence is generated. For transmitting the wanted data, the complete hopping sequence is not used and the connection ends. The second connection will be established. A new hopping sequence is generated. Due to the fact that the Bluetooth clock has a different value, because the period between the two transmission is longer (and it cannot be shorter) than the minimum resolution of the clock (312.5 μ s). The hopping sequence will always differ from the first one.

6 Receiver input bandwidth, synchronization and repeated single or multiple packets:

The input bandwidth of the receiver is 1 MHz.

In every connection, one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence (see chapter 5). The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection (e.g. single or multi-slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing is according to the packet type of the connection. Also, the slave of the connection uses these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence

7 Dwell time in data mode

The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is as follows:

Dwell time = time slot length * hop rate / number of hopping channels * 30s

Example for a DH1 packet (with a maximum length of one time slot)

Dwell time = 625 μ s * 1600 1/s / 79 * 30s = 0.3797s (in a 30s period)

For multi-slot packet the hopping is reduced according to the length of the packet.

Example for a DH5 packet (with a maximum length of five time slots)

Dwell time = $5 * 625 \mu s * 1600 * 1/5 * 1/s / 79 * 30s = 0.3797s$ (in a 30s period)

This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for all Bluetooth devices. Therefore, all Bluetooth devices **comply** with the FCC dwell time requirement in the data mode.

This was checked during the Bluetooth Qualification tests.

The Dwell time in hybrid mode is approximately 2.6 mS (in a 12.8s period)

8 Channel Separation in hybrid mode

The nominal channel spacing of the Bluetooth system is 1Mhz independent of the operating mode.

The maximum "initial carrier frequency tolerance" which is allowed for Bluetooth is $f_{center} = 75 \text{ kHz}$.

This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/07-E) for three frequencies (2402, 2441, 2480 MHz).

9 Derivation and examples for a hopping sequence in hybrid mode

For the generation of the inquiry and page hop sequences the same procedures as described for the data mode are used (see item 5), but this time with different input vectors:

****For the inquiry hop sequence, a predefined fixed address is always used. This results in the same 32 frequencies used by all devices doing an inquiry but every time with a different start frequency and phase in this sequence.**

****For the page hop sequence, the device address of the paged unit is used as the input vector. This results in the use of a subset of 32 frequencies which is specific for that initial state of the connection establishment between the two units. A page to different devices would result in a different subset of 32 frequencies.**

So it is ensured that also in hybrid mode, the frequency is used equally on average.

Example of a hopping sequence in inquiry mode:

48, 50, 09, 13, 52, 54, 41, 45, 56, 58, 11, 15, 60, 62, 43, 47, 00, 02, 64, 68, 04, 06, 17, 21, 08, 10, 66, 70, 12, 14, 19, 23

Example of a hopping sequence in paging mode:

08, 57, 68, 70, 51, 02, 42, 40, 04, 61, 44, 46, 63, 14, 50, 48, 16, 65, 52, 54, 67, 18, 58, 56, 20, 53, 60, 62, 55, 06, 66, 64

10 Receiver input bandwidth and synchronization in hybrid mode:

The receiver input bandwidth is the same as in the data mode (1 MHz). When two Bluetooth devices establish contact for the first time, one device sends an inquiry access code and the other device is scanning for this inquiry access code. If two devices have been connected previously and want to start a new transmission, a similar procedure takes place. The only difference is, instead of the inquiry access code, a special access code, derived from the BD_ADDRESS of the paged device will be, will be sent by the master of this connection. Due to the fact that both units have been connected before (in the inquiry procedure) the paging unit has timing and frequency information about the page scan of the paged unit. For this reason the time to establish the connection is reduced.

11 Spread rate / data rate of the direct sequence signal

The Spread rate / Data rate in inquiry and paging mode can be defined via the access code. The access code is the only criterion for the system to check if there is a valid transmission or not. If you regard the presence of a valid access code as one bit of information, and compare it with the length of the access code of 68 bits, the Spread rate / Data rate will be 68/1.

12 Spurious emission in hybrid mode

The Dwell in hybrid mode is shorter than in data mode. For this reason the spurious emissions average level in data mode is worst case. The spurious emissions peak level is the same for both modes.