

W66 N220 Commerce Court • Cedarburg, WI 53012 • USA Phone: 262.375.4400 • Fax: 262.375.4248 www.lsr.com

> TEST REPORT # 310117 LSR Job #: C-884

Compliance Testing of: TiWi Module

<u>Test Date(s)</u>: April 15, 22, May 6, June 13, August 7-9, 24, 31, Sept 8, 2010

Prepared For: LS Research Attn: Brian Petted W66 N220 Commerce Ct Cedarburg, WI 53012

> In accordance with: Federal Communications Commission (FCC) Part 15, Subpart C, Section 15.247 Industry Canada (IC) RSS 210 Annex 8 Operating in the Frequency Band 2400 MHz – 2483.5 MHz

This Test Report is issued under the Authority of:			
Signature: Thomas T.Smith Date: 10.20.2010			
Test Report Reviewed by:	Tested by:		
	Peter Feilen, EMC Engineer		
Signature: Themas Touth Date: 10.20.2010	Signature: Ida Line Date: 10.20.10		

This Test Report may not be reproduced, except in full, without written approval of LS Research, LLC.

TABLE OF CONTENTS (page 1 of 2)

EXH	IBIT 1: INTRODUCTION	
1.1	Scope	4
1.2	Normative References	4
1.3	LS Research, LLC Test Facility	5
1.4	Location of Testing	5
1.5	Test Equipment Utilized	5
	· ·	
	IBIT 2: PERFORMANCE ASSESSMENT	
2.1	Client Information	6
2.2	Equipment Under Test (EUT) Information	6
2.3	Associated Antenna Description	6
2.4	EUT's Technical Specifications	7
2.5	Product Description	9
EXH TES	IBIT 3: EUT OPERATING CONDITIONS & CONFIGURATIONS DURING	10
3.1	Climate Test Conditions	10
3.2	Applicability & Summary of EMC Emission Test Results	10
3.3	Modifications Incorporated in the EUT for Compliance Purposes	10
3.4	Deviations & Exclusions from Test Specifications	10
EXH	IBIT 4: DECLARATION OF CONFORMITY	11
EXH	IBIT 5: RADIATED EMISSIONS TESTING	12
	Note: Items 5.1 through 5.8 are for TRANSMIT MODE	
	Item 5.9 is for RECEIVE MODE	
5.1	Test Setup	12
5.2	Test Procedure	12
5.3	Test Equipment Utilized	13
5.4	Test Results	13
5.5	Calculation of Radiated Emissions Limits	14
5.6	Radiated Emissions Test Data Chart	15
5.7	Test Setup Photo(s) – Radiated Emissions Test	18
5.8	Screen Captures – Radiated Emissions Test	20
5.9	Receive Mode Testing	40
	IBIT 6: Conducted AC Line Emissions	50
6.1	Test Setup	50
6.2	Test Procedure	50
6.3	Test Equipment List	50
6.4	Test Results	50
6.5	FCC Limits of Test Data	51
6.6	Conducted Emissions Test Data	51
6.7	Conducted Emissions Data	56

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 2 of 108

TABLE OF CONTENTS (Page 2 of 2)

EXHIBIT 7: OCCUPIED BANDWIDTH	56
7.1 Limits	56
7.2 Method of Measurements	56
7.3 Test Equipment List	57
7.4 Test Data	57
7.5 Screen Captures – Occupied Bandwidth	58
EXHIBIT 8: BAND-EDGE MEASUREMENTS	66
8.1 Method of Measurements	66
8.2 Screen Captures	66
	70
EXHIBIT 9: POWER OUTPUT (CONDUCTED): 15.247(b)	70
9.1 Method of Measurements	70
9.2 Test Equipment List	70
9.3 Test Data9.4 Screen Captures – Power Output (Conducted)	70 74
9.4 Screen Captures – Power Output (Conducted)	/4
EXHIBIT 10: POWER SPECTRAL DENSITY: 15.247(e)	80
10.1 Limits	80
10.2 Test Equipment List	80
10.3 Test Data	80
10.4 Screen Captures – Power Spectral Density	80
EXHIBIT 11: SPURIOUS RADIATED EMISSIONS: 15.247(d)	83
11.1 Limits	83
11.2 Test Equipment List	85
11.3 Test Data	85
11.4 Screen Captures – Spurious Radiated Emissions	87
EXHIBIT 12: FREQUENCY & POWER STABILITY OVER VOLTAGE &	92
TEMPERATURE VARIATIONS	
	0.2
EXHIBIT 13: CHANNEL PLAN AND SEPARATION	93
13.1 Data Table	93
13.2 Summary Table 13.3 Screen Captures	<u>93</u> 94
	94
EXHIBIT 14: MPE CALCULATIONS	98
APPENDICES	
APPENDIX A: TEST EQUIPMENT LIST	103
APPENDIX B: TEST STANDARDS – RADIO	105
APPENDIX C: UNCERTAINTY STATEMENT	106
APPENDIX D: JUSTIFICATIONS OF AVERAGE DUTY FACTOR	107
CALCULATIONS	

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 3 of 108

EXHIBIT 1. INTRODUCTION

1.1 <u>SCOPE</u>

References:	FCC Part 15, Subpart C, Section 15.247 and 15.209	
	FCC Part 2, Section 2.1043 paragraph (b)1.	
	RSS GEN and RSS 210 Annex 8	
Title:	FCC : Telecommunication – Code of Federal Regulations,	
	CFR 47, Part 15.	
	IC : Low-power License-exempt Radio-communication Devices	
	(All Frequency Bands): Category I Equipment	
Purpose of Test:	To gain FCC and IC Certification Authorization for Low-	
	Power License-Exempt Transmitters.	
Test Procedures:	Both conducted and radiated emissions measurements	
	were conducted in accordance with American National	
	Standards Institute ANSI C63.4 – American National	
	Standard for Methods of Measurement of Radio-Noise	
	Emissions from Low-Voltage Electrical and Electronic	
	Equipment in the Range of 9 kHz to 40 GHz.	
Environmental Classification:	 Commercial, Industrial or Business 	
	Residential	

1.2 NORMATIVE REFERENCES

Publication	Year	Title	
47 CFR, Parts 0-15 (FCC)	2008-10	Code of Federal Regulations - Telecommunications	
RSS 210 Annex 8	2007 June	Low-power License-exempt Radio-communication Devices (All Frequency Bands): Category I Equipment	
ANSI C63.4	2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.	
CISPR 16-1-1	2006-03 A1: 2006-09 A2: 2007-07	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus.	
CISPR 16-2-1	2003 A1: 2004-04 A2: 2007-07	Specification for radio disturbance and immunity measuring apparatus and methods. Part 201: Conducted disturbance measurement.	
FCC Public Notice DA 00-1407	2000	Part 15 Unlicensed Modular Transmitter Approval	
FCC ET Docket No. 99-231	2002	Amendment to FCC Part 15 of the Commission's Rules Regarding Spread Spectrum Devices.	
FCC Procedures	2007	Measurement of Digital Transmission Systems operating under Section 15.247.	

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 4 of 108

1.3 LS Research, LLC TEST FACILITY

LS Research, LLC is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025, 2005 "General Requirements for the Competence of Calibration and Testing Laboratories".

LS Research, LLC's scope of accreditation includes all test methods listed herein, unless otherwise noted. A copy of the accreditation may be accessed on our web site: <u>www.lsr.com</u>. Accreditation status can be verified at A2LA's web site: <u>www.a2la2.net</u>.

1.4 LOCATION OF TESTING

All testing was performed at LS Research, LLC, W66 N220 Commerce Court, Cedarburg, Wisconsin, 53012 USA, utilizing the facilities listed below, unless otherwise noted.

List of Facilities Located at LS Research, LLC:

- Compact Chamber
- Semi-Anechoic Chamber
- Open Area Test Site (OATS)

1.5 <u>TEST EQUIPMENT UTILIZED</u>

A complete list of equipment utilized in testing is provided in Appendix A of this test report. Calibration dates are indicated in Appendix A. All test equipment is calibrated in accordance with A2LA standards.

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 5 of 108

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1 CLIENT INFORMATION

Manufacturer Name:	LS Research
Address:	W66 N220 Commerce Ct, Cedarburg, WI 53012
Contact Name:	Brian Petted

2.2 EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information has been supplied by the applicant.

Product Name:	TiWi
Model Number:	TIWI-R1 and TIWI-R2
Serial Number:	TIWI01-00-2544

2.3 ASSOCIATED ANTENNA DESCRIPTION

Antenna Option 1:

A dipole antenna with dual orientation capability was used. This antenna has a peak gain of +4.3 dBi and is connected via SMA.

Antenna Option 2:

A PIFA with an average gain of -0.6dBi. It has a u.fl connector and is used for applications such as • Notebook Computers, Access Points, Industrial Handhelds, and WiFi enabled Televisions & Monitors.

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 6 of 108

2.4 **EUT'S TECHNICAL SPECIFICATIONS**

Additional Information:

Bluetooth

EUT Frequency Range (in MHz)	2402-2480 MHz
RF Power (Watts)	0.00631 W
Conducted Output Power (in dBm)	8.0 dBm
Field Strength at 3 meters	Dipole: 98.32 dBuV/m
	PIFA: 105.88 dBuV/m
Occupied Bandwidth (99% BW)	875 kHz
Type of Modulation	GFSK
Emission Designator	87k5F1D
EIRP (in mW)	Dipole: 8.32 mW
	PIFA: 5.50 mW
Transmitter Spurious (worst case)	55.9 dBuV/m @ 4803.80 MHz
Receiver Spurious (worst case)	44.9 dBuV/m @ 3756.90 MHz
Frequency Tolerance %, Hz, ppm	Better than 100 ppm
Antenna Information	
Detachable/non-detachable	Detachable, each antenna is
	detachable
Туре	Dipole
	PIFA (trace)
Gain (in dBi)	Dipole: +4.3dbi average
	PIFA: -0.6 dBi average
EUT will be operated under FCC Rule	15.247
Part(s)	
EUT will be operated under RSS Rule	210
Part(s)	
Modular Filing	🛛 Yes 🗌 No
Portable or Mobile?	Mobile

RF Technical Information:

Type of		SAR Evaluation: Device Used in the Vicinity of the Human Head
Evaluation		SAR Evaluation: Body-worn Device
	Х	RF Evaluation

If <u>RF Evaluation</u> checked above, test engineer to complete the following:

- Evaluated against exposure limits: 🛛 General Public Use •
- Duty Cycle used in evaluation: 100 %
- Standard used for evaluation: OET 65 •
- Measurement Distance: 20 cm •
- RF Value: 0.03379 V/m A/m W/m² Measured Computed Computed Calculated

Controlled Use

WLAN

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 7 of 108

EUT Frequency Range (in MHz)	2412-2462 MHz
RF Power (Watts)	1 Mbps data rate: 0.092683 W
	MCS7 data rate: 0.020277 W
Conducted Output Power (in dBm)	20.1 dBm at 1Mbps data rate
	15.6 dBm at MCS7 data rate
Field Strength at 3 meters	Dipole: 121.50 dBuV/m @ 3m
	PIFA: 109.25 dBuV/m @ 3m
Occupied Bandwidth (99% BW)	1320 kHz at 1 Mbps data rate
	1795 kHz at MCS7 data rate
Type of Modulation	FSK
Emission Designator	1M795D1D
EIRP (in mW)	Dipole and 1 mbps data rate: 134.90 mW
	Dipole and MCS7 data rate: 47.86 mW
	PIFA and 1 mbps data rate: 89.13 mW
	PIFA and MCS7 data rate: 31.62 mW
Transmitter Spurious (worst case)	39.7 dBuV/m at 3161 MHz
Receiver Spurious (worst case)	44.5 dBuV/m at 3756 MHz
Frequency Tolerance %, Hz, ppm	Better than 100 ppm
Antenna Information	
Detachable/non-detachable	Detachable
Туре	Dipole
Gain (in dBi)	Dipole: +4.3 dBi average
	PIFA:-0.6 dBi average
EUT will be operated under FCC Rule	15.247
Part(s)	
EUT will be operated under RSS Rule	210
Part(s)	
Modular Filing	🖂 Yes 🗌 No
Portable or Mobile?	Mobile

RF Technical Information:

Type of		SAR Evaluation: Device Used in the Vicinity of the Human Head
Evaluation		SAR Evaluation: Body-worn Device
	Х	RF Evaluation

If <u>RF Evaluation</u> checked above, test engineer to complete the following:

Evaluated against exposure limits: 🔀 General Public Use Duty Cycle used in evaluation: 100 % •

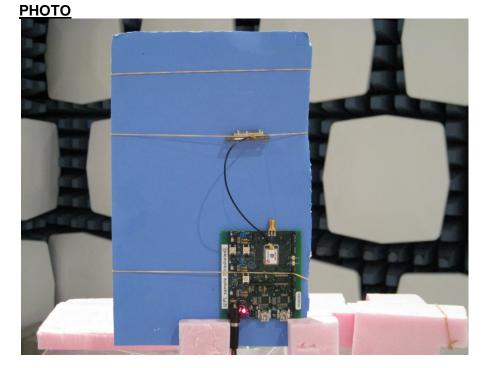
Controlled Use

- •
- Standard used for evaluation: OET 65
- Measurement Distance: 20 cm
- RF Value: 0.54794 □ V/m □ A/m ⊠ W/m² Measured □ Computed □ Calculated

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 8 of 108

2.5 **PRODUCT DESCRIPTION**

The TiWi module is a multi-standard module with support for WLAN (802.11 b/g/n), Bluetooth, FM broadcast receiver and FM transmitter. The WLAN features include an output power that is rated at 19dBm with an RF sensitivity of up to -75dBm.



Radio module shown on host board with PIFA antenna

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 9 of 108

EXHIBIT 3. EUT OPERATING CONDITIONS & CONFIGURATIONS DURING TESTS

3.1 CLIMATE TEST CONDITIONS

Temperature:	15-35 °C
Humidity:	30-60%
Pressure:	725-745 mmHg

3.2 APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC and IC Paragraph	Test Requirements	Compliance (yes/no)
FCC : 15.207 IC : RSS GEN sect. 7.2.2	Power Line Conducted Emissions Measurements	Yes
FCC : 15.247(a)(2) IC : RSS 210 A8.2(a)	6 dB Bandwidth of a Digital Modulation System	Yes
IC : RSS GEN section 4.6.1	20 dB Bandwidth	Yes
FCC : 15.247(b) & 1.1310 IC : RSS 210 A8.4	Maximum Output Power	Yes
FCC : 15.247(i), 1.1307, 1.1310, 2.1091 & 2.1093 IC : RSS 102	RF Exposure Limit	Yes
FCC :15.247(c) IC : RSS 210 A8.5	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	Yes
FCC : 15.247(d) IC : RSS 210 A8.2(b)	Transmitted Power Spectral Density of a Digital Modulation System	Yes
FCC : 15.247(c), 15.209 & 15.205 IC : RSS 210 A8.2(b), section 2.2, 2.6 and 2.7	Transmitter Radiated Emissions	Yes
The digital circuit portion of the EUT has been tested and verified to comply with FCC Part 15, Subpart B, Class B Digital Devices (RSS GEN and RSS 210 of IC) and the associated Radio Receiver has also been tested and found to comply with Part 15, Subpart B – Radio Receivers (RSS GEN and RSS 210 of IC). The Receiver Test Report is available upon request.		

3.3 <u>MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES</u> None Yes (explain below)

3.4 DEVIATIONS & EXCLUSIONS FROM TEST SPECIFICATIONS

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 10 of 108

EXHIBIT 4. DECLARATION OF CONFORMITY

The EUT was found to MEET the requirements as described within the specification of FCC Title 47, CFR Part 15.247, and Industry Canada RSS-210, Issue 7 (2007), Section Annex 8 (section 8.2).

If some emissions are seen to be within 3 dB of their respective limits:

As these levels are within the tolerances of the test equipment and site employed, there is a possibility that this unit, or a similar unit selected out of production may not meet the required limit specification if tested by another agency.

LS Research, LLC certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specifications. The results in this Test Report apply only to the item(s) tested on the above-specified dates. Any modifications made to the EUT subsequent to the indicated test date(s) will invalidate the data herein, and void this certification.

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 11 of 108

EXHIBIT 5. RADIATED EMISSIONS TEST

5.1 <u>Test Setup</u>

The test setup was assembled in accordance with Title 47, CFR FCC Part 15, RSS GEN and ANSI C63.4. The EUT was placed on an 80cm high non-conductive pedestal, centered on a flush mounted 2-meter diameter turntable inside a 3 meter Semi-Anechoic, FCC listed Chamber. The EUT was operated in normal mode, and final testing was performed using normal mode, using power as provided by a bench top supply set for 5 VDC. The unit has the capability to operate on 11 channels, controllable via laptop PC.

The applicable limits apply at a 3 meter distance. Measurements above 4 GHz were performed at a 1.0 meter separation distance. The calculations to determine these limits are detailed in the following pages. Please refer to Appendix A for a complete list of test equipment. The test sample was operated on one of three (3) standard channels: WiFi: low (2412 MHz), middle (2437 MHz) and high (2462 MHz), and Bluetooth: low (2402 MHz), middle (2441 MHz) and high (2480 MHz) to comply with FCC Part 15.35. The channels and operating modes were changed using a PC.

5.2 <u>Test Procedure</u>

Radiated RF measurements were performed on the EUT in a 3 meter Semi-Anechoic, FCC listed Chamber. The frequency range from 30 MHz to 25000 MHz was scanned and investigated. The radiated RF emission levels were manually noted at the various fixed degree settings of azimuth on the turntable and antenna height. The EUT was placed on a non-conductive pedestal in the 3 meter Semi-Anechoic Chamber, with the antenna mast placed such that the antenna was 3 meters from the EUT. A Biconical Antenna was used to measure emissions from 30 MHz to 300 MHz, and a Log Periodic Antenna was used to measure emissions from 300 MHz to 1000 MHz. A Double-Ridged Waveguide Horn Antenna was used from 1 GHz to 4 GHz. The maximum radiated RF emissions were found by raising and lowering the antenna between 1 and 4 meters in height, using both horizontal and vertical antenna polarities. From 4 GHz to 25 GHz, the EUT was measured at a 1.0 meter separation, using a standard gain Horn Antenna and pre-amplifier, raising the antenna between 1 and 1.8m.

The EUT was rotated along three orthogonal axes during the investigations to find the highest emission levels.

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 12 of 108

5.3 <u>Test Equipment Utilized</u>

A list of the test equipment and antennas utilized for the Radiated Emissions test can be found in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. All calibrations of the antennas used were performed at an N.I.S.T. traceable site. Correction factors obtained from calibrations were entered into the EMI Receiver database. As a result, the data taken from the EMI Receiver accounts for the antenna correction factor or other corrections, and can therefore be entered into the database as a corrected meter reading. The EMI Receiver was operated with a resolution bandwidth of 120 kHz for measurements below 1 GHz (video bandwidth of 300 kHz), and a bandwidth of 1 MHz for measurements above 1 GHz (video bandwidth of 1 MHz From 4 GHz to 18 GHz, an Agilent E4446A Spectrum Analyzer and an EMCO Horn Antenna were used. From 18 GHz to 25 GHz, the Agilent E4446A Spectrum Analyzer with a standard gain horn, and preamp were used.

Test Equipment	Manufacturer	Model No.	Serial No.
EMI Receiver	Agilent	E4445A	3617A00320
EMI Receiver Pre-Select.	Agilent	N9039A	3448A00296
Spectrum Analyzer	Agilent	E4446A	US45300564
Log Periodic Antenna	EMCO	93146	9701-4855
Horn Antenna	EMCO	3115	6907
Bicon Antenna	EMCO	93110B	9702-2918
Pre-Amp	Adv. Microwave	WLA612	1145A04094
Horn Antenna – Std. Gain	EMCO	3160-09	9809-1120

Test Equipment List

5.4 Test Results

The EUT was found to **MEET** the Radiated Emissions requirements of Title 47 CFR, FCC Part 15.247 and Canada RSS-210, Issue 7 (2007), Annex 8. The frequencies with significant RF signal strength were recorded and plotted as shown in the Data Charts and Graphs.

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 13 of 108

5.5 CALCULATION OF RADIATED EMISSIONS LIMITS

The maximum peak output power of an intentional radiator in the 2400-2483.5 MHz band, as specified in Title 47 CFR 15.247 (b)(3) and RSS 210 A8.4 is 1 Watt. The harmonic and spurious RF emissions, as measured in any 100 kHz bandwidth, as specified in 15.247 (d) and RSS 210 A8.2(b), shall be at least 20 dB below the measured power of the desired signal, and must also meet the requirements described in 15.205(c) for FCC and section 2.2,2.6 and 2.7 of RSS 210 for IC.

The following table depicts the general radiated emission limits above 30 MHz. These limits are obtained from Title 47 CFR, Part 15.209, for radiated emissions measurements. These limits were applied to any signals found in the 15.205 restricted bands. The mentioned limits correspond to those limits listed in RSS 210 section 2.7.

Frequency (MHz)	3 m Limit μV/m	3 m Limit (dBµV/m)	1 m Limit (dBµV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
> 960	500	54.0	63.5

Sample conversion from field strength μ V/m to dB μ V/m: dB μ V/m = 20 log ₁₀ (100) = 40 dB μ V/m (from 30-88 MHz)

For measurements made at 1.0 meter, a 9.5 dB correction has been invoked.

> 960 MHz 500 μ V/m or 54.0 dB/ μ V/m at 3 meters 54.0 + 9.5 = 63.5 dB/ μ V/m at 1 meter

For measurements made at 0.3 meter, a 20 dB correction has been invoked.

960 MHz to 10,000 MHz 500 μ V/m or 54.0 dB/ μ V/m at 3 meters 54.0 + 20 = 74 dB/ μ V/m at 0.3 meters

Generic example of reported data at 200 MHz:

Reported Measurement data = 18.2 (raw receiver measurement) + 15.8 (antenna factor) + 1.45 (cable factor) = 35.45 (dBµV/m).

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 14 of 108

5.6 RADIATED EMISSIONS TEST DATA CHART									
3 Meter Measurements of Electromagnetic Radiated Emissions Test Standard: 47CFR, Part 15.205 and 15.247(
	lest					(
		RSS 210 A8, section	is 2.2	,2.6 a	ind 2.7				
F	reque	ncy Range Inspected	I: 30	MHz	to 25000 M	Ηz			
Manufacturer:	LS Re	esearch							
Date(s) of Test:	April 1	15, 22, May 6, June 13,	Augu	st 8, 9), 24, 31, Se	pt. 8	8, 28, 29, 2010		
Test Engineer(s):		Feilen, Tom Smith, Ry							
Voltage:	5 VDC	5 VDC							
Operation Mode:	Norma	Normal mode							
Environmental	Temp	erature: 20 – 25°C							
Conditions in the Lab:	Relati	ve Humidity: 30 – 60 %	6						
EUT Power:		Single PhaseVAC	;		3 Phase _	_V/	AC		
EUT FOWEI.		Battery		Х	Other: DC	Ben	ch Supply		
EUT Placement:	X	80cm non-conductive	table		10cm Space	cers			
EUT Test Location:	X	3 Meter Semi-Anecho FCC Listed Chamber		3/10m OA	ГS				
Measurements:		Pre-Compliance	Pre-Compliance				Final		
Detectors Used:	Х	Peak	•				Average		

A. WLAN Data

Data for WLAN radio and Dipole Antenna The following table depicts the level of significant spurious radiated RF emissions found:

Frequency (MHz)	Ant./EUT Polarity	Height (meters)	Azimuth (0° - 360°)	Measured EFI (dBµV/m)	Limit (dBµV/m)	Margin (dB)
35.33	V/H	1.00	90	12.1	40.0	27.9
180.31	V/H	1.00	187	21.5	43.0	21.6
295.68	V/H	1.00	0	24.4	46.0	21.6
982.50	H/H	1.00	0	29.7	54.0	24.4
940.10	V/V	1.00	0	27.6	46.0	18.4
299.05	H/V	1.00	0	26.0	46.0	20.0
35.96	V/V	1.00	0	12.2	40.0	27.8
1224.38	V/S	1.00	0	34.3	54.0	19.7
1005.28	V/S	1.00	0	35.1	54.0	18.9
1178.32	H/V	1.00	0	34.8	54.0	19.2
1005.28	V/V	1.00	0	35.0	54.0	19.0
3161.09	H/V	1.00	0	39.7	54.0	14.3
2554.57	V/H	1.00	21	36.0	54.0	18.0

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 15 of 108

	(continued)								
The following	The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 1								
Frequency	Ant.	Height	Azimuth	Measured Peak Value	Peak Limit Value	Peak Margin	Measured Average Value	Average Limit	Average Margin
(MHz)	Polarity	(meters)	(0° - 360°)	(dBuV/m)	(dBuV/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
4824.00	Horizontal	1.16	346	51.9	83.5	31.6	47.0	63.5	16.5
7230.67	Horizontal	1.03	44	49.1	83.5	34.4	37.8	63.5	25.7
9648.00	Horizontal	1.03	51	71.7	101.5	29.8	71.4	101.5	30.1
12059.40	Horizontal	1.03	317	49.7	83.5	33.8	39.2	63.5	24.3
14471.80	Horizontal	1.03	10	52.0	83.5	31.5	44.6	63.5	18.9
16877.77	Horizontal	1.03	11	53.0	101.5	48.5	40.6	101.5	60.9
19296.00	Horizontal	1.00	0	49.8	83.5	33.7	47.3	63.5	16.2
21708.00	Horizontal	1.00	0	Note 3	101.5	-	Note 3	101.5	-
24120.00	Horizontal	1.00	0	Note 3	101.5	-	Note 3	101.5	-
4824.17	Vertical	1.07	200	50.2	83.5	33.3	43.0	63.5	20.5
7235.77	Vertical	1.03	7	47.9	83.5	35.6	36.9	63.5	26.6
9648.00	Vertical	1.09	8	60.8	101.5	40.7	59.2	101.5	42.3
12061.03	Vertical	1.05	332	49.7	83.5	33.8	38.0	63.5	25.5
14471.83	Vertical	1.26	339	51.4	83.5	32.1	43.1	63.5	20.4
16875.03	Vertical	1.03	4	52.7	101.5	48.8	40.7	101.5	60.8
19296.00	Vertical	1.00	0	Note 3	83.5	-	Note 3	63.5	-
21708.00	Vertical	1.00	0	44.6	101.5	56.9	41.8	101.5	59.7
24120.00	Vertical	1.00	0	49.2	101.5	52.3	45.3	101.5	56.2

RADIATED EMISSIONS DATA CHART (continued)

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 6:

Frequency	Ant.	Height	Azimuth	Measured Peak Value	Peak Limit Value	Peak Margin	Measured Average Value	Average Limit	Average Margin
(MHz)	Polarity	(meters)	(0° - 360°)	(dBuV/m)	(dBuV/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
4874.13	Horizontal	1.15	26.2	50.3	83.5	33.2	44.7	63.5	18.8
7318.67	Horizontal	1.08	325.1	48.4	83.5	35.1	37.2	63.5	26.3
9747.93	Horizontal	1.10	244.1	56.4	101.5	45.1	53.9	101.5	47.6
12182.97	Horizontal	1.07	309.2	50.6	83.5	32.9	40.2	63.5	23.3
14621.77	Horizontal	1.00	307.1	52.7	83.5	30.8	44.2	63.5	19.3
17062.37	Horizontal	1.04	9.1	55.0	101.5	46.5	42.9	101.5	58.6
19496.00	Horizontal	1.00	179	50.1	83.5	33.4	43.4	63.5	20.1
21933.00	Horizontal	1.00	0	48.0	101.5	-	44.6	101.5	56.9
24370.00	Horizontal	1.00	0	49.2	101.5	-	43.9	101.5	57.6
4874.07	Vertical	1.09	179.2	48.6	83.5	34.9	42.5	63.5	21
7316.93	Vertical	1.04	5.6	48.5	83.5	35.0	36.4	63.5	27.1
9747.93	Vertical	1.09	18.3	54.9	101.5	46.6	50.8	101.5	50.7
12183.93	Vertical	1.02	347	51.5	83.5	32.0	43	63.5	20.5
14622.00	Vertical	1.29	311.9	54.0	83.5	29.5	47.9	63.5	15.6
17057.63	Vertical	1.02	17.8	53.9	101.5	47.6	42.9	101.5	58.6
19496.00	Vertical	1.00	0	51.3	83.5	-	42.2	63.5	21.3
21933.00	Vertical	1.00	0	49.8	101.5	51.7	41.8	101.5	59.7
24370.00	Vertical	1.00	0	57.1	101.5	44.4	44.1	101.5	57.4

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 16 of 108

Frequency	Ant./EUT	Height	Azimuth	Measure Peak Value	Peak Limit Value	Peak Margin	Measured Average Value	Average Limit	Average Margin
(MHz)	Polarity	(meters)	(0° - 360°)	(dBµV/m)	(dBuV/m)	(dB)	(dBµV/m)	(dBµV/m)	(dB)
4924.03	Horizontal	1.02	229.8	50.5	83.5	33.0	43.7	63.5	19.8
7381.53	Horizontal	1.04	105.5	47.9	83.5	35.6	36.3	63.5	27.2
9847.87	Horizontal	1.01	231.3	52.0	101.5	49.5	51.4	101.5	50.1
12312.00	Horizontal	1.01	161.9	50.1	83.5	33.4	40.6	63.5	22.9
14772.03	Horizontal	1.15	201.5	53.8	83.5	29.7	43.5	63.5	20
17225.80	Horizontal	1.06	16.7	55.5	101.5	46.0	43.9	101.5	57.6
19696.00	Horizontal	1.00	175	50.3	83.5	33.2	42.7	63.5	20.8
22158.00	Horizontal	1.00	0	50.7	101.5	-	42.8	101.5	58.7
24620.00	Horizontal	1.00	0	56.5	101.5	-	43.4	101.5	58.1
4924.20	Vertical	1.08	85.6	50.4	83.5	33.1	44.9	63.5	18.6
7376.10	Vertical	1.03	120.9	49.3	83.5	34.2	37.4	63.5	26.1
9847.80	Vertical	1.29	74.7	55.5	101.5	46.0	51.9	101.5	49.6
12310.03	Vertical	1.06	59.3	51.4	83.5	32.1	41.3	63.5	22.2
14772.07	Vertical	1.16	194.6	54.4	83.5	29.1	49.3	63.5	14.2
17225.80	Vertical	1.05	4	55.6	101.5	45.9	43.9	101.5	57.6
19696.00	Vertical	1.00	0	49.8	83.5	-	43.1	63.5	20.4
22158.00	Vertical	1.00	0	48.5	101.5	53.0	41.4	101.5	60.1
24620.00	Vertical	1.00	0	55.4	101.5	46.1	45.9	101.5	55.6

The following table depicts the level of significant radiated RF fundamental and harmonic emissions seen on Channel 11:

Notes:

1) Measurements above 4 GHz were made at 1 meters of separation from the EUT

A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak Detector was used in measurements above 1 GHz. Only the results from the 2) video-averaged measurements using a Peak detector are published in the table above. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.

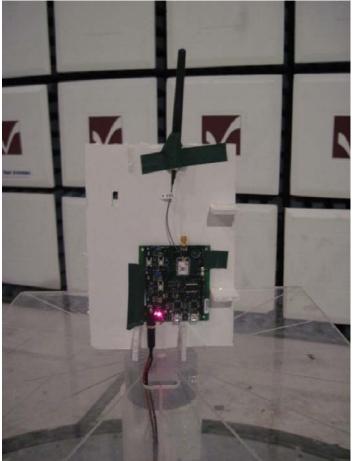
Measurement at receiver system noise floor.

3) 4) For measurements of the fundamental power, because of spectral bandwidth, the receiver was set to RBW=VBW=10 MHz.

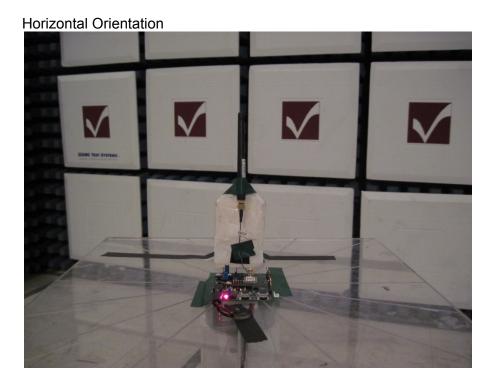
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 17 of 108

5.7 <u>Test Setup Photo(s) – Radiated Emissions Test</u>

Vertical Orientation



Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 18 of 108



Side Orientation



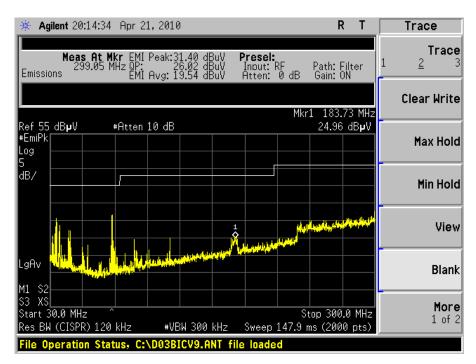
Radio module shown on host board with dipole antenna

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 19 of 108

5.8 Screen Captures - Radiated Emissions Test

These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and an Average detector function is utilized when measuring frequencies above 1 GHz.

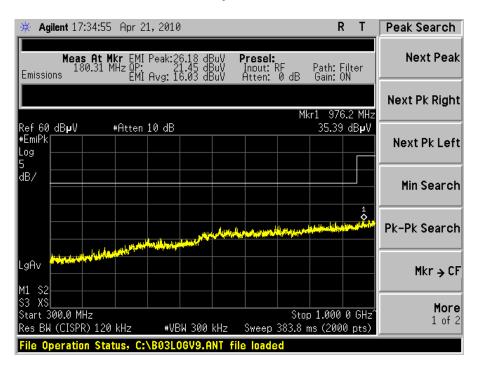
The signature scans shown here are from worst-case emissions, as measured on channels 1, 6, or 11 of the WiFi radio, with the sense antenna both in vertical and horizontal polarity for worst case presentations.



Channel 1, Antenna Vertically Polarized, 30-300 MHz, at 3m

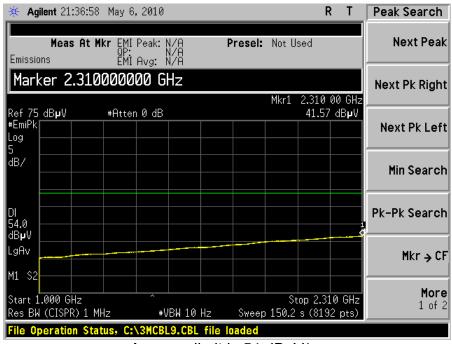
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 20 of 108

Screen Captures - Radiated Emissions Testing (continued)



Channel 1, Antenna Vertically Polarized, 300-1000 MHz, at 3m

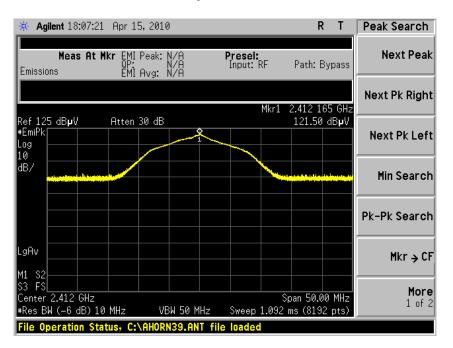
Channel 1, Antenna Vertically Polarized, 1000-2310 MHz, at 3m



Average limit is 54 dBuV/m

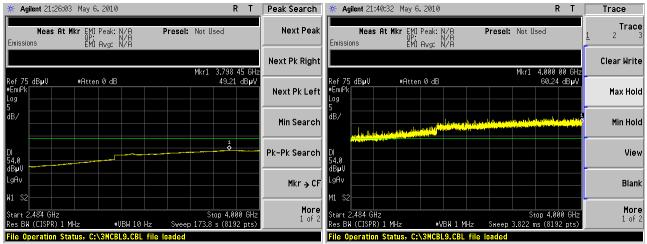
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 21 of 108

Screen Captures - Radiated Emissions Testing (continued)



Channel 1, Antenna Vertically Polarized, 2400-2483.5 MHz, at 3m

Channel 11, Antenna Vertically Polarized, 2484.0-2500 MHz, at 3m



Average limit is 54 dBuV/m, Peak limit is 74dBuV/m

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 22 of 108

Screen Captures - Radiated Emissions Testing (continued)

🔆 Agilent 22:26:25 May 6, 2010 R T Peak Search Meas At Mkr EMIPeak: N/A OP: N/A 5 EMIAvg: N/A Next Peak Presel: Not Used Emissions Next Pk Right Mkr1 3.801 67 GHz 49.20 dBµV Ref 75 dB**µ**V #EmiPk #Atten 0 dB Next Pk Left Log 5 dB/ Min Search 1 Pk-Pk Search LgAv Mkr→CF M1 S2 More Start 2.500 GHz #Res BW (CISPR) 1 MHz Stop 4.000 GHz Sweep 172 s (8192 pts) 1 of 2 #VBW 10 Hz File Operation Status, C:\3MCBL9.CBL file loaded

Channel 11, Antenna Vertically Polarized, 2500-4000 MHz, at 3m

Average limit is 54 dBuV/m

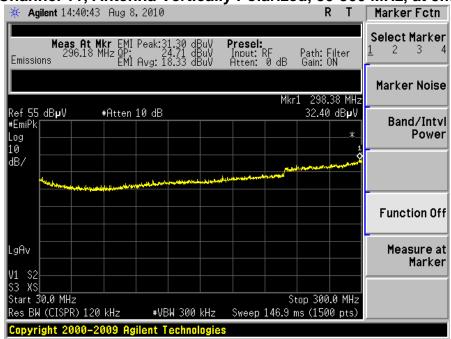
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 23 of 108

Screen Captures for WLAN radio and PIFA Antenna

Screen Captures - Radiated Emissions Test

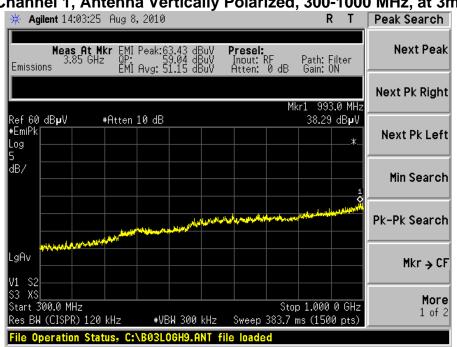
These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and an Average detector function is utilized when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured on channels 1, 6, or 11 of the WiFi radio, with the sense antenna both in vertical and horizontal polarity for worst case presentations.



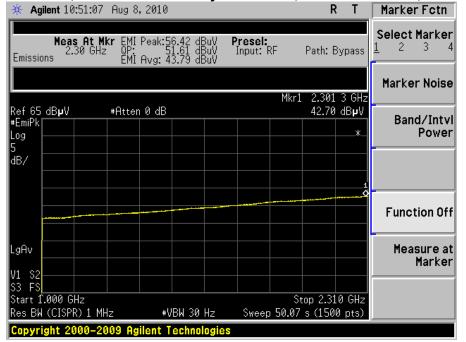


Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 24 of 108

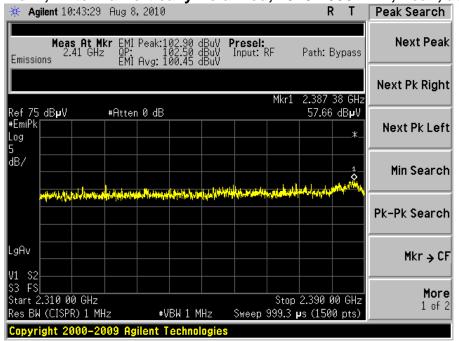


Channel 1, Antenna Vertically Polarized, 300-1000 MHz, at 3m

Channel 1, Antenna Vertically Polarized, 1000-2310 MHz, at 3m



Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 25 of 108

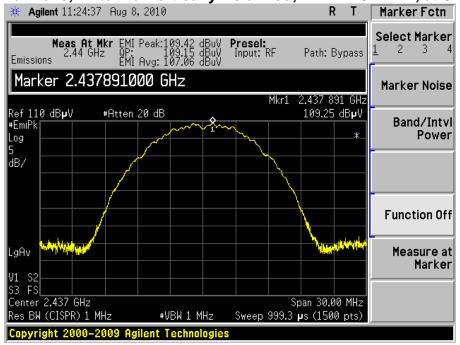


Channel 1, Antenna Vertically Polarized, 2310-2390 MHz, Peak, at 3m

Channel 1, Antenna Vertically Polarized, 2310-2390 MHz, Average, at 3m

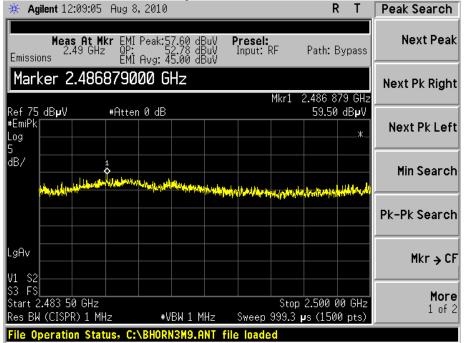
Meas At Mi 2.41 GHz Emissions	kr EMI Peak:10	12.90 dBuV			
	ĚMİ Avg: 10	2.50 dBuV 0.45 dBuV	Presel: Input: RF	Path: Bypass	Next Peak
			Mkr1	2.386 69 GHz	Next Pk Right
Ref 75 dB µ V #EmiPk Log 5	#Atten 0 dB			47.61 dB µ V	Next Pk Left
dB/					Min Search
					Pk-Pk Search
LgAv					Mkr → CF
V1 S2 S3 FS Start 2.310 00 GHz Res BW (CISPR) 1 MH Copyright 2000-20		3W 10 Hz	Sweep 9.173	2.390 00 GHz s (1500 pts)	More 1 of 2

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 26 of 108



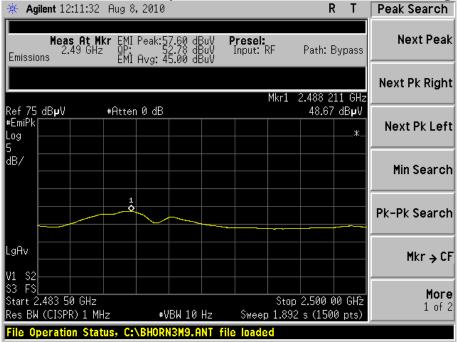
Channel 6, Antenna Vertically Polarized, 2422-2452 MHz, at 3m

Channel 11, Antenna Vertically Polarized, 2483.5-2500 MHz, Peak, at 3m

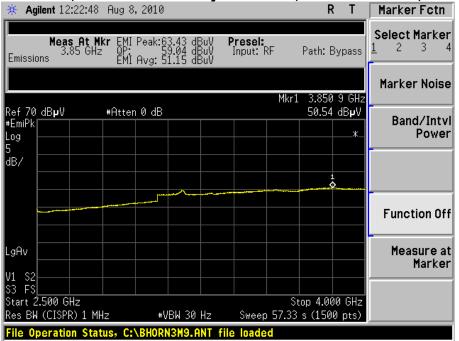


Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 27 of 108

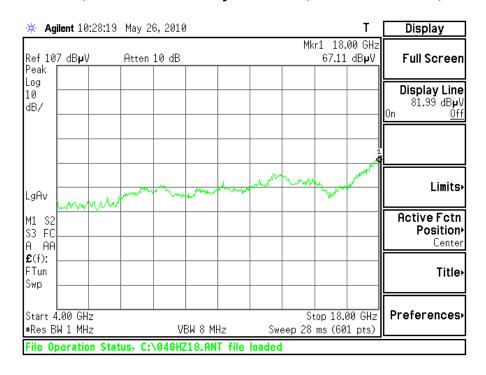
Channel 11, Antenna Vertically Polarized, 2483.5-2500 MHz, Average, at 3m



Channel 11, Antenna Vertically Polarized, 2500-4000 MHz, at 3m

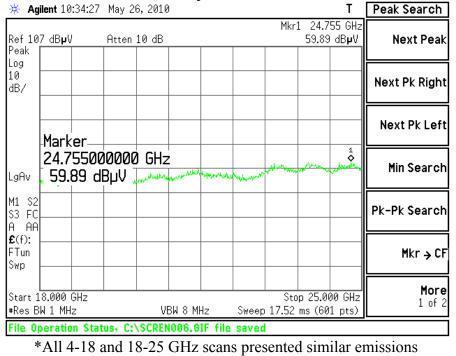


Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 28 of 108



Channel 11, Antenna Vertically Polarized, 4000-18000 MHz, at 1m

Channel 1, Antenna Vertically Polarized, 18000-25000 MHz, at 1m



Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 29 of 108

B. Bluetooth Data

Data for Bluetooth Radio and Dipole Antenna

Harmonic Data for Bluetooth Radio with Worst Case Data Presented

	Frequency (MHz)	Peak (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Height (cm)	Az (deg)
Horizontal	4803.80	58.9	83.5	44.6	55.9	63.5	7.6	101.6	73
Horizontal	7205.98	54.1	85.9	51.8	48.9	85.9	37.0	106.1	301
Horizontal	9608.77	52.1	85.9	53.8	44.9	85.9	41.0	99.6	108
Horizontal	12013.45	49.7	83.5	53.8	37.8	63.5	25.7	176.8	7
Horizontal	14411.15	60.6	83.5	42.9	51.2	63.5	12.3	109.7	299
Vertical	4803.87	57.5	83.5	46.0	54.1	63.5	9.4	101.2	94
Vertical	7205.93	52.7	85.9	53.2	45.6	85.9	40.3	112.3	224
Vertical	9607.43	50.5	85.9	55.4	40.4	85.9	45.5	106.1	197
Vertical	12010.03	50.5	83.5	53.0	38.7	63.5	24.8	176.5	5
Vertical	14411.03	54.3	83.5	49.2	44.3	63.5	19.2	108.2	118

Bluetooth with Dipole Bent

Bluetooth with Dipole Straight

	Frequency (MHz)	Peak (dBuV/m)	Peak Limit (dBuV/m)	Peak Margin (dB)	Average (dBuV/m)	Average Limit (dBuV/m)	Average Margin (dB)	Height (cm)	Az (deg)
Horizontal	4804.35	61.8	83.5	41.8	59.9	63.5	3.6	101.8	336.3
Horizontal	7205.75	53.3	85.9	52.6	46.3	85.9	39.6	112.7	314.8
Horizontal	9608.23	53.1	85.9	52.8	45.0	85.9	40.9	106.5	72.8
Horizontal	12012.33	46.3	83.5	57.2	34.9	63.5	28.6	174.3	9.2
Horizontal	14412.7	56.1	83.5	47.4	46.0	63.5	17.5	106.8	315.7
Horizontal	16817.28	51.8	85.9	54.1	40.6	85.9	45.3	104.4	333
Vertical	4803.87	57.5	83.5	24.6	56.0	63.5	7.5	109.6	89.6
Vertical	7205.93	52.7	85.9	33.9	45.6	85.9	40.3	109.5	218.3
Vertical	9607.43	50.5	85.9	33.0	45.2	85.9	40.7	103.9	12.9
Vertical	12010.03	50.5	83.5	34.6	36.8	63.5	26.7	174.1	7.9
Vertical	14411.03	54.3	83.5	29.7	43.1	63.5	20.4	111.5	323

Notes:

1) Measurements above 4 GHz were made at 1 meters of separation from the EUT

 A Quasi-Peak Detector was used in measurements below 1 GHz, and a Peak Detector was used in measurements above 1 GHz. Only the results from the video-averaged measurements using a Peak detector are published in the table above. The peak detector was used to ensure the peak emissions did not exceed 20 dB above the limits.

3) Measurement at receiver system noise floor.

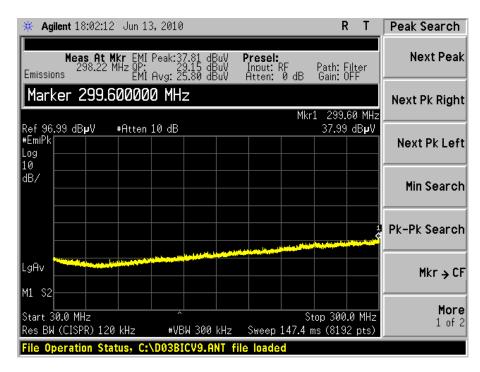
4) For measurements of the fundamental power, because of spectral bandwidth, the receiver was set to RBW=VBW=10 MHz.

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 30 of 108

Bluetooth with Dipole Antenna Screen Captures - Radiated Emissions Test

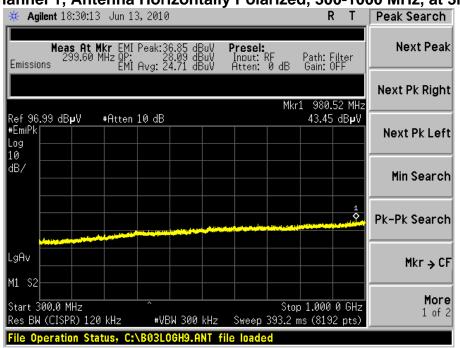
These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and an Average detector function is utilized when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured on channels 11,18, or 25 of the Bluetooth (BT) radio, with the sense antenna both in vertical and horizontal polarity for worst case presentations.



Channel 1, Antenna Vertically Polarized, 30-300 MHz, at 3m

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 31 of 108

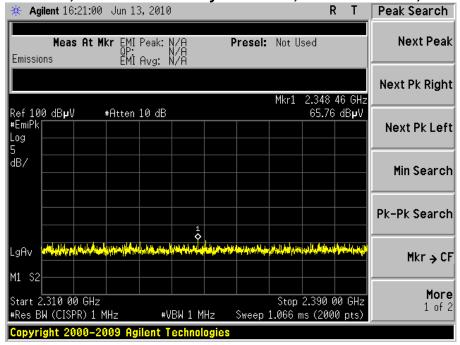


Channel 1, Antenna Horizontally Polarized, 300-1000 MHz, at 3m

Channel 1, Antenna Vertically Polarized, 1000-2310 MHz, at 3m

Meas At Emissions	Mkr EMI Peak: N QP: EMI Avg: N	/A /A	Presel: N	lot Used	<u>1</u>	2 2
	EMI HVG: N,	/H				Clear Write
ef 65 dB µ V EmiPk og	#Atten 0 dB		M	lkr1 2.275 41.4	77 GHZ 4 dBµV	Max Hol
B/						Min Hol
					&	Viev
gAv						Blan
tart 1.000 GHz es BW (CISPR) 1	MHz #VE	3W 30 Hz	Sweep 5	^ Stop 2.3 0.07 s (81%		Mor 1 of

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 32 of 108

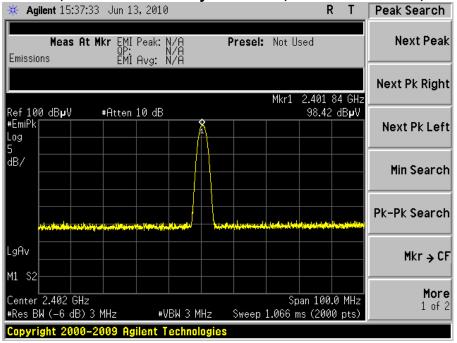


Channel 1, Antenna Vertically Polarized, 2310-2390 MHz, at 3m

Channel 1, Antenna Vertically Polarized, 2390-2400 MHz, at 3m

Peak Search	RT					L3,2010	1:49 Jun (j ilent 16:1	₩ A(
Next Peak		ot Used	resel:	F	1/A 1/A 1/A	I Peak:	I t Mkr EM QP EM	Meas	Emissi
Next Pk Right	623 GU-	r1 2.395 I					956230		Mar
Next Pk Lef	.53 dBµV					10 dB	#Atter	0 dB µ V	Ref 10 #EmiPk Log 5
Min Search									dB/
Pk-Pk Search				1					
Mkr → Cl	und Maanii 1999 da	ny tangkang langana	lei de gager de	****	ydd ^{fy} yddyd yn yn	w	llettingle stiller sig		_gAv
More 1 of 2		itop 2.400 66 ms (20	Sweep 1	IHz	BW 1 M	#\	Hz 1 MHz	2.390 00	
				ogies	echnol	gilent T	-2009 A	ight 200	Copyr

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 33 of 108



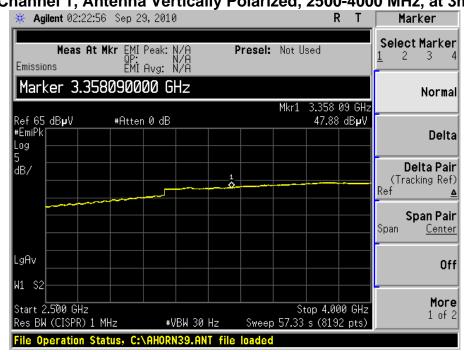
Channel 1, Antenna Vertically Polarized, 2400-2483.5 MHz, at 3m

Channel 1, Antenna Vertically Polarized, 2483.5-2500 MHz, at 3m

ዡ Agilent 17:33:50 Jun 13, 2010	R	Т	Peak Search
Meas At Mkr EMI Peak: N/A Presel: Not Used OP: N/A Emissions EMI Avg: N/A			Next Peak
Marker 2.499942000 GHz Mkr1 2.499 3	942	GHz	Next Pk Right
Ref 100 dBµV #Atten 10 dB 66.7 #EmiPk			Next Pk Left
dB/			Min Search
		1	Pk-Pk Search
LgAv		di jangi	Mkr → CF
M1 S2 Start 2.483 50 GHz Stop 2.500 #Res BW (CISPR) 1 MHz #VBW 1 MHz Sweep 1.066 ms (200			More 1 of 2
Copyright 2000-2009 Agilent Technologies			

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 34 of 108

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 35 of 108



Channel 1, Antenna Vertically Polarized, 2500-4000 MHz, at 3m

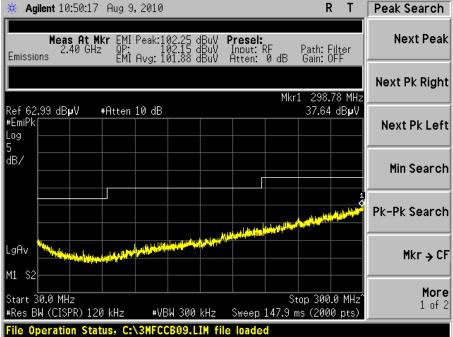
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 36 of 108

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 37 of 108

Bluetooth with PIFA Antenna Screen Captures - Radiated Emissions Test

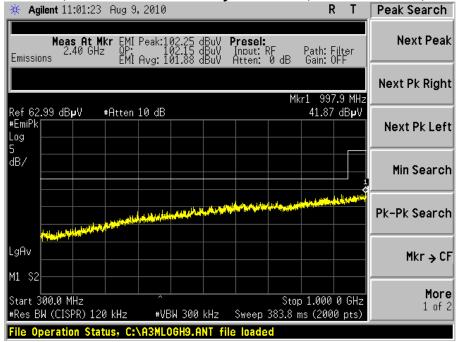
These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and an Average detector function is utilized when measuring frequencies above 1 GHz.

The signature scans shown here are from worst-case emissions, as measured on channels 11,18, or 25 of the Bluetooth (BT) radio, with the sense antenna both in vertical and horizontal polarity for worst case presentations.



Channel 1, Antenna Vertically Polarized, 30-300 MHz, at 3m

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 38 of 108

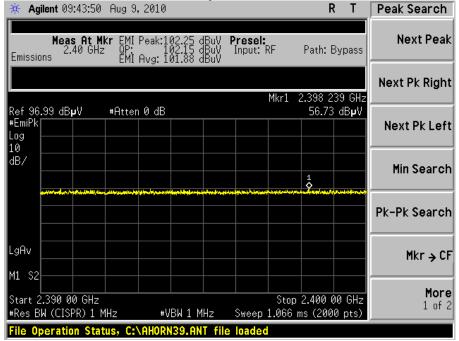


Channel 1, Antenna Horizontally Polarized, 300-1000 MHz, at 3m

Channel 1, Antenna Vertically Polarized, 1000-2200 MHz, at 3m

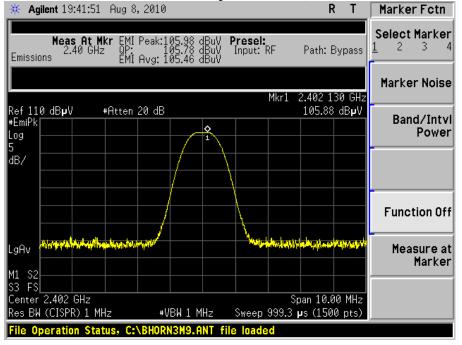
🔆 Agilent 10:27:32	Aug 9,2010			RT	Peak Search
Meas At M 2.40 GHz Emissions	kr EMI Peak:10 z OP: 10 EMI Avg:10	02.25 dBuV 02.15 dBuV 01.88 dBuV	Presel: Input: RF	Path: Bypass	Next Peak
Marker 2.044	500000 GI	łz	Mkri	1 2.044 5 GHz	Next Pk Right
Ref 96.99 dB µ V #EmiPk Log 10	#Atten 0 dB			55.63 dBµV	Next Pk Left
dB/					Min Search
kar ja Londinskar o franklikar hurr					Pk-Pk Search
LgAv					Mkr → CF
Start 1.000 GHz #Res BW (CISPR) 1 M	MHz #V	BW 1 MHz		 top 2.200 GHz ms (2000 pts)	More 1 of 2
Printer not respor	nding				

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 39 of 108

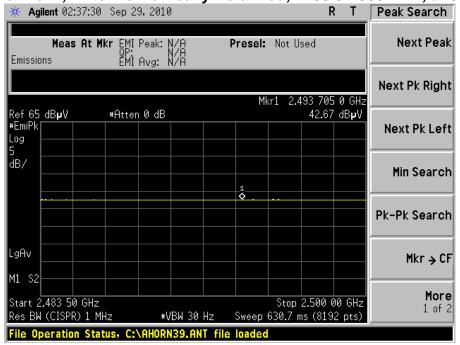


Channel 1, Antenna Vertically Polarized, 2390-2400 MHz, at 3m

Channel 1, Antenna Horizontally Polarized, 2397-2407 MHz, at 3m



Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 40 of 108



Channel 1, Antenna Vertically Polarized, 2483.5-2500 MHz, at 3m

Channel 1, Antenna Vertically Polarized, 2500-4000 MHz, Average, at 3m

Emission	Meas At 2.40 G IS	Hz OP: EMI	Peak:10 10 Avg:10)2.25 c)2.15 c)1.88 c	IBuV P IBuV IBuV	Presel: Input: {	RF	Path: E	⊰ypass	Next Pea
							ML:e1	2 0 4 0	9 GHz	Next Pk Righ
∼t de (99 dB µ V	#Atter	0 dB				MRLT		dB µ V	
EmiPk og -								30.00		Next Pk Lef
0 B/										Min Searc
1 4.0						· · · · · · · · · · · · · · · · · · ·		1		Pk-Pk Searc
B µ V gAv										Mkr → C
	500 GHz (CISPR) :	^			Hz		St ep 172		10 GHz	 Mor 1 of

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 41 of 108

5.9 <u>Receive Mode Testing</u>

Per the requirements of RSS-210, the EUT was placed in continuous receive mode and the radiated spurious emissions were measured and compared to the limits stated in RSS-Gen Section 4.10.

The test setup, procedure, and equipment utilized were identical to that described in sections 5.1, 5.2, and 5.3 of this document.

Measurement data and screen captures from the receive tests are presented below:

Radio	Antenna	Frequency (MHz)	Height (m)	Azimuth (degree)	Quasi Peak Reading (dBµV/m)	Quasi Peak Limit (dBµV/m)	Margin (dB)	Antenna Polarity
WLAN	Dipole	298.38	1.00	0	26.1	46.0	19.9	Н
WLAN	Dipole	2412.50	1.00	0	40.2	54.0	13.8	V
WLAN	Dipole	3756.90	1.00	0	44.5	54.0	9.5	Н
WLAN	PIFA	59.32	1.00	0	9.8	40.0	30.2	V
WLAN	PIFA	297.43	1.00	0	24.9	46.0	21.1	V
WLAN	PIFA	295.27	1.00	0	25.2	46.0	20.8	Н
WLAN	PIFA	997.20	1.00	0	29.3	54.0	14.7	V
WLAN	PIFA	3761.40	1.00	0	44.2	54.0	9.8	Н

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 42 of 108

Screen Captures - Radiated Emissions Testing - Receive Mode

These screen captures represent Peak Emissions. For radiated emission measurements, a Quasi-Peak detector function is utilized when measuring frequencies below 1 GHz, and an Average detector function is utilized when measuring frequencies above 1 GHz.

WLAN

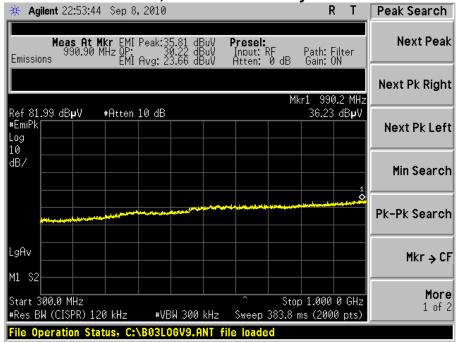
The signature scans shown here are from worst-case emissions, as measured on channels 11, 18 and 25, with the sense antenna both in vertical and horizontal polarity for worst case presentations.

Data Taken with WLAN Radio and PIFA Antenna – WLAN Radio with Dipole antenna demonstrated similar results



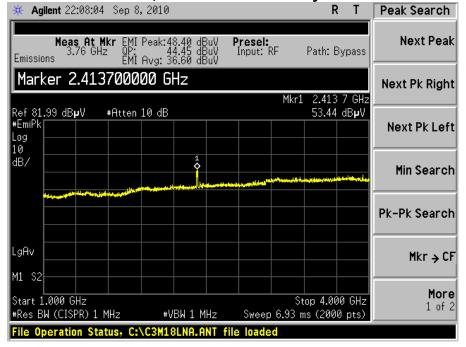
Channel 11, Antenna Horizontally Polarized

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 43 of 108



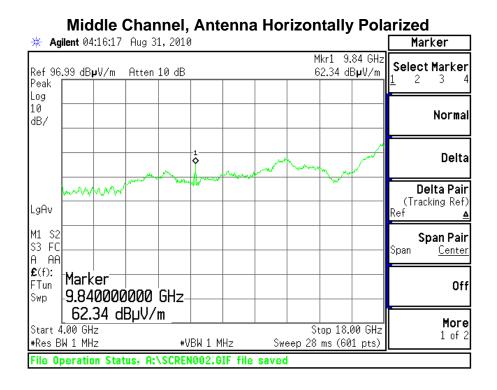
Channel 11, Antenna Vertically Polarized

Channel 11, Antenna Horizontally Polarized

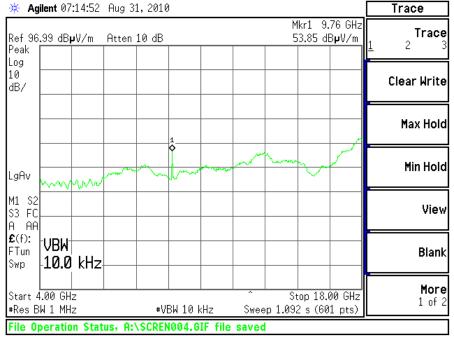


Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 44 of 108

<u>Screen Captures - Radiated Emissions Testing – Receive Mode</u> (continued)

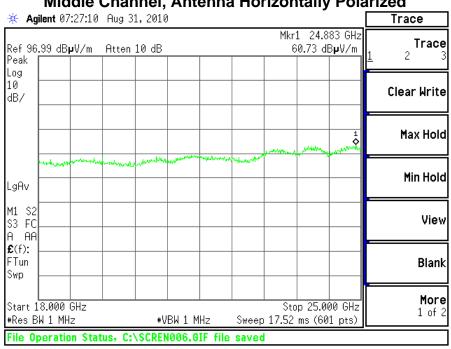


Middle Channel, Antenna Horizontally Polarized



Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 45 of 108

Screen Captures - Radiated Emissions Testing – Receive Mode (continued)



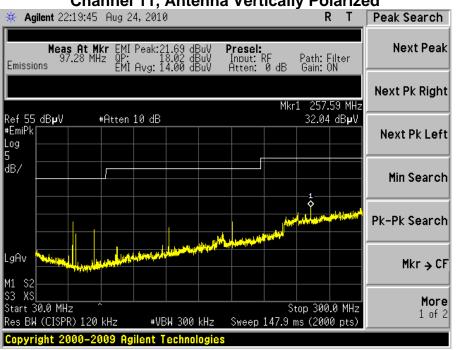
Middle Channel, Antenna Horizontally Polarized

Middle Channel, Antenna Horizontally Polarized



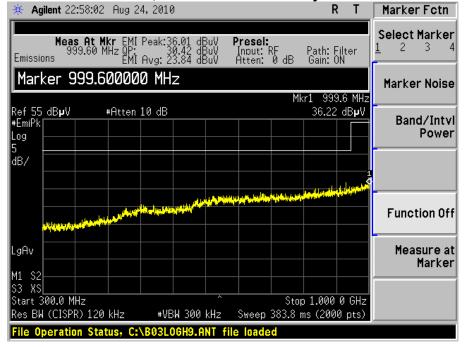
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 46 of 108

Screen Captures - Radiated Emissions Testing – Receive Mode (continued) BT Radio with PIFA Antenna – BT Radio with Dipole Antenna Produced Similar Results



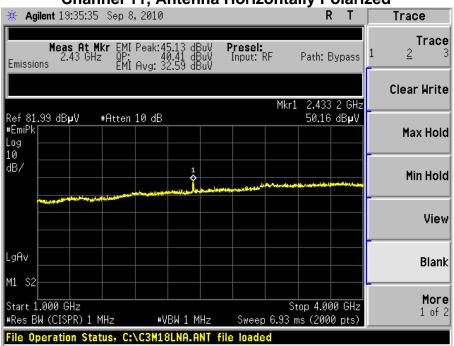
Channel 11, Antenna Vertically Polarized

Channel 11, Antenna Horizontally Polarized

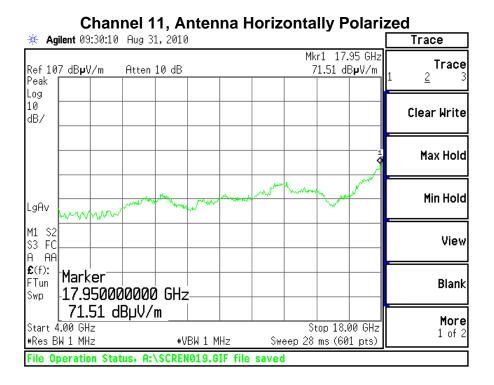


Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 47 of 108

Screen Captures - Radiated Emissions Testing - Receive Mode (continued)

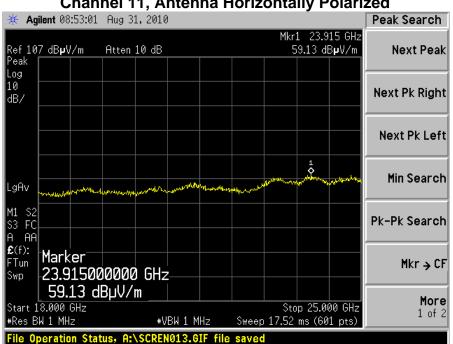


Channel 11, Antenna Horizontally Polarized

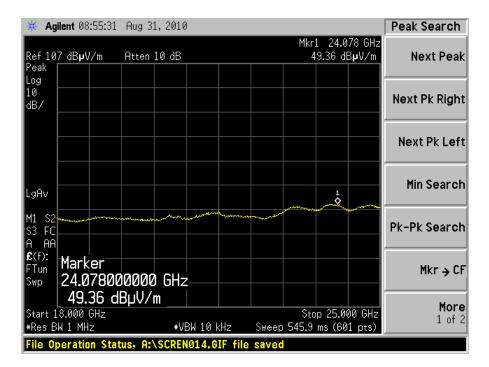


Prepared For: LS ResearchEUT: TiWiLS Research, LLCReport # 310117Model #:TiWi- R1LSR Job #: C-884Serial #:0020303Page 48 of 108

Screen Captures - Radiated Emissions Testing – Receive Mode (continued)

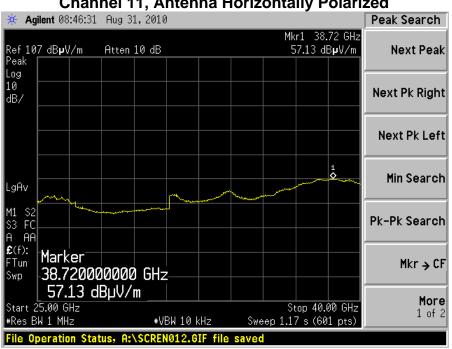


Channel 11, Antenna Horizontally Polarized



Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 49 of 108

Screen Captures - Radiated Emissions Testing - Receive Mode (continued)



Channel 11, Antenna Horizontally Polarized

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 50 of 108

EXHIBIT 6. CONDUCTED EMISSIONS TEST, AC POWER LINE

6.1 - Test Setup

The test area and setup are in accordance with ANSI C63.4-2003 and with Title 47 CFR, FCC Part 15, Industry Canada RSS-210 and RSS GEN. The EUT was placed on a non-conductive wooden table, with a height of 80 cm above the reference ground plane. The EUT's power cable was plugged into a 50 Ω (ohm), 50/250 μ H Line Impedance Stabilization Network (LISN). The AC power supply of 120V was provided via an appropriate broadband EMI Filter, and then to the LISN line input. 5VDC was supplied to the EUT via an AC to DC supply converting the 120VAC supply to the necessary 5VDC to operate the radio and host board. Final readings were then taken and recorded. After the EUT was setup and connected to the LISN, the RF Sampling Port of the LISN was connected to a 10 dB Attenuator-Limiter, and then to the EMI Receiver. The EMCO LISN used has the ability to terminate the unused port with a 50 Ω (ohm) load when switched to either L1 (line) or L2 (neutral).

6.2 - Test Procedure

The EUT was investigated in continuous modulated transmit mode and continuous receive mode for this portion of the testing. The appropriate frequency range and bandwidths were selected on the EMI Receiver, and measurements were made. The bandwidth used for these measurements is 9 kHz, as specified in CISPR 16-1, Section 1, Table 1, for Quasi-Peak and Average detectors in the frequency range of 150 kHz to 30 MHz. Final readings were then taken and recorded.

6.3 - Test Equipment Utilized

A list of the test equipment and accessories utilized for the Conducted Emissions test is provided in Appendix A. This list includes calibration information and equipment descriptions. All equipment is calibrated and used according to the operation manuals supplied by the manufacturers. Calibrations of the LISN and Limiter are traceable to N.I.S.T. All cables are calibrated and checked periodically for conformance. The emissions are measured on the EMI Receiver, which has automatic correction for all factors stored in memory and allows direct readings to be taken.

6.4 - Test Results

The EUT was found to **MEET** the Conducted Emission requirements of FCC CFR 47 Part **15.207** and **15.107**, Conducted Emissions. See the Data Charts and Graphs for more details of the test results. By virtue of meeting the requirements of FCC, the EUT also meets the requirements of IC **RSS 210** and **RSS GEN**.

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 51 of 108

6.5 - FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range	Class B Limit	s (dBµV)	Measuring		
(MHz)	Quasi-Peak	Average	Bandwidth		
0.150 -0.50 *	66-56	56-46	RBW = 9 kHz		
0.5 - 5.0	56	46	VBW \geq 9 kHz for QP		
5.0 - 30	60	50	VBW = 1 Hz for		
* The limit decreases linearly wit	Average				
this range.					

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 52 of 108

6.6.1 WLAN RADIO:

Transmit mode

Agilent 00:41:36 Sep 29, 2010	R	Т	Peak Search
Meas At Mkr EMI Peak:28.84 dBuV Presel: 167.73 kHz QP: 21.18 dBuV Input: RF Pa Emissions EMI Avg: 5.56 dBuV	ath: By	DC /pass	Next Peak
	r1 15	0 kHz	Next Pk Right
*EmiPk Log	50.91	3BµV	Next Pk Left
10 dB/	DC Co	upled	Min Search
			Pk-Pk Search
	when the set	<mark>la hat dan</mark> Majari dan	Mkr→CF
	30.00 (8192		More 1 of 2
Copyright 2000–2009 Agilent Technologies			

LINE 1

ዡ Agilent 00:52:51 Sep 29, 2010	Peak Search
Meas At Mkr EMI Peak:34.82 dBuV Presel: 171.98 kHz QP: 28.26 dBuV Input: RF Path: Bypas: Emissions EMI Avg: 16.62 dBuV	Next Peak
Marker 161.000 kHz Mkr1 161 kH	
Ref 100 dBµV #Atten 10 dB 35.78 dBµ\ #EmiPk	Next Pk Left
	d Min Search
	Pk-Pk Search
LgAv Hundlahenskeland untilterungen at slete an stere og store det gester og store det slete en slete store slete store at sle	Mkr→CF
Res BW (CISPR) 9 kHz VBW 91 kHz Sweep 715.3 ms (8192 pts)	
Copyright 2000–2009 Agilent Technologies	

LINE 2

Notes:

All other emissions were better than 20 dB below the limits.
 The EUT exhibited similar emissions across the Low and High channels tested.

3) Measured levels and limits are in units of dBuV/m.

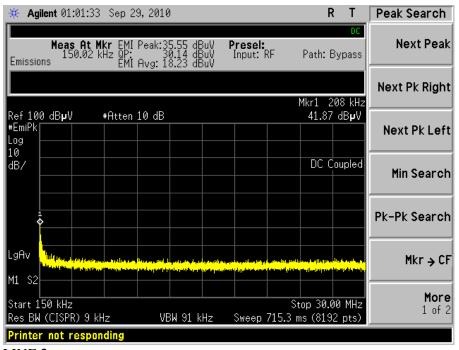
4) Operation was verified by monitoring the emission with a PSA

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 53 of 108

Receive mode.

* Agilent 01:00		2010			R T	Peak Search
Meas A 150.0 Emissions	N t Mkr EMI Pe 02 kHz QP: EMI Av	ak:35.55 dBuV 30.14 dBuV g: 18.23 dBuV	Presel: Input: R	F Path:	DC Bypass	Next Peak
				Mkr1	168 kHz	Next Pk Right
Ref 100 dB µ V #EmiPk Log 10	#Atten 10	dB		36.6	0 dBµV	Next Pk Left
dB/				DC	Coupled	Min Search
						Pk-Pk Search
LgAv		hi ang di sang br>Sang di sang di		a de la constanti de la constanta de la consta Nomes de la constanta de la cons	Harat das stars References das	Mkr → CF
M1 S2 Start 150 kHz Res BW (CISPR)	9 kHz	VBW 91 kHz	Sweep 7	Stop 30 15.3 ms (81	.00 MHz 92 pts)	More 1 of 2
Printer not res	ponding					

LINE 1



LINE 2

Notes:

1) All other emissions were better than 20 dB below the limits.

2) The EUT exhibited similar emissions across the Low and High channels tested.

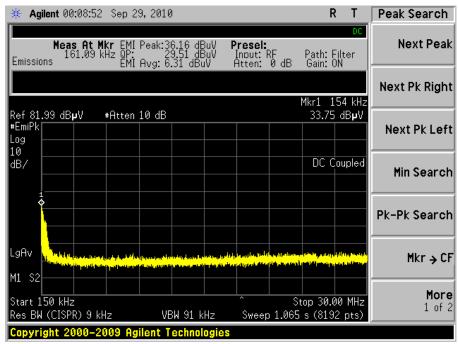
3) Measured levels and limits are in units of dBuV/m.

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 54 of 108

6.6.2 BT RADIO:

Transmit mode

* Agilent 00:00:41	Sep 29, 2010			R	T Peak Search
Meas At Mkr 15.72 MHz Emissions	EMI Peak:59 QP: 56 EMI Avg: 50	0.13 dBuV 0.61 dBuV 0.58 dBuV	Presel: Input: RF Atten: 0 dB	Path: Filter Gain: ON	Next Peak
Marker 157.00				Mkr1 157	Next Pk Right
Ref 81.99 dB µ V #f #EmiPk Log 10	Atten 10 dB			33.27 dB	
				DC Coup	ed Min Search
¢					Pk-Pk Search
LgAv <mark>versteiner teiler</mark> M1 S2				i indiali in minani in dian	Mkr → CF
Start 150 kHz Res BW (CISPR) 9 kHz Copyright 2000-200		W 91 kHz		6top 30.00 M 5 s (8192 pt	
LINE 1	e nynent n	sennerogies			

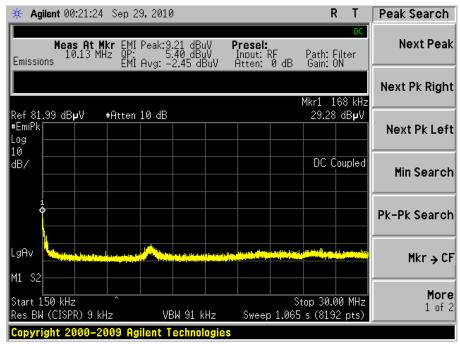


LINE 2

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 55 of 108

Receive mode.

🔆 Agilent 00:15:29 Sep 29, 2010			R	T Marker Fotn
Meas At Mkr EMI Peak:34.09 (153.90 kHz QP: 28.84 (Emissions EMI Avg: 6.61 df	dBuV Prese dBuV Input: BuV Atten:	RF Pa	th: Filte ain: ON	r Select Marker
		Mkr	1 165	Marker Noise
Ref 81.99 dB µ V # Atten 10 dB #EmiPk Log		2	3.11 dB	Band/Intvl Power
10 dB/			DC Coup	led
4				Function Off
LgAv				- Measure at Marker
M1 \$2		Stop	30.00 1	1Hz
Res BW (CISPR) 9 kHz VBW 91 Copyright 2000-2009 Agilent Techn		ep 1.065 s	(8192 p	ts)
INE 1				



LINE 2

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 56 of 108

<u>6.7 – Conducted Emissions Test Data</u> Frequency Range inspected: 150 KHz to 30 MHz Test Standard: FCC 15.207 Class B IC RSS GEN 7.2.2

Manufacturer:	LS	LS Research					
Date(s) of Test:	Sep	tember 28, 2010					
Project Engineer:	Pete	er Feilen					
Test Engineer:	Pete	er Feilen					
Voltage:	5VI	DC					
Operation Mode:	Cor	ntinuous TX and Co	ntinu	ous RX			
Environmental	Ten	nperature: $20 - 25^{\circ}$	С				
Conditions in the	Rel	ative Humidity: 30	- 60	%			
Lab:	22°	C and 48 % R.H.					
Test Location:		Outside of chambe	er witl	n VGP and HGP		Chamber	
		present					
EUT Placed On:	Х	40cm from Vertica	l Gro	ound Plane		10cm Spacers	
EUT Flaced OII.	Х	80cm above Ground Plane				Other:	
Measurements:		Pre-Compliance	Pre-Compliance Preliminary X Fi				
Detector Used:	Х	Peak	Х	Quasi-Peak	Х	Average	

CONDUCTED AC EMISSIONS DATA

	۰.	т	•
H	٢.	L	
ᄂ	,		

BT	0.157	TX1	29.03	65.62	36.59	6.89	55.62	48.73
	0.161	TX1	29.51	65.41	35.90	6.31	55.41	49.10
	0.157	TX2	28.8	65.62	36.82	6.53	55.62	49.09
	0.154	TX2	28.84	65.78	36.94	6.61	55.78	49.17
	0.165	RX2	16.57	65.21	48.64	4.51	55.21	50.70
	0.167	RX1	21.18	65.11	43.93	5.56	55.11	49.55
WLAN	0.150	TX1	39.01	66.00	26.99	20.77	56.00	35.23
	0.165	TX2	29.26	65.21	35.95	17.56	55.21	37.65
	0.150	RX2	30.14	66.00	35.86	18.23	56.00	37.77
	0.172	RX1	36.77	64.86	28.09	18.58	54.86	36.28

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 57 of 108

EXHIBIT 7. OCCUPIED BANDWIDTH:

7.1 Limits

For a Digital Modulation System, the 6 dB bandwidth shall be at least 500 kHz.

7.2 Method of Measurements

7.2.1 Method for Bluetooth Measurements

Refer to ANSI C63.4 and FCC Procedures (2007) for Digital Transmission Systems operating under 15.247.

The transmitter output was connected to the Spectrum Analyzer. The bandwidth of the fundamental frequency was measured with the Spectrum Analyzer using 30 kHz resolution bandwidth and 100 kHz video bandwidth.

The bandwidth requirement found in FCC Part 15.247(a)(1) and (a)(1)(iii) and RSS 210 A8.1(a) requires a minimum -6dBc occupied bandwidth of 500 kHz. In addition, Industry Canada (IC RSS GEN 4.6.1) requires the measurement of the -20dBc occupied bandwidth. For this portion of the tests, a direct measurement of the transmitted signal was performed at the antenna port of the EUT, via a cable connection to the Agilent E4446A spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, thereby allowing direct measurements, without the need for any further corrections. An Agilent E4446A spectrum analyzer was used with the resolution bandwidth set to 30 kHz for this portion of the tests. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used in peak-hold mode while measurements were made, as presented in the chart below.

From this data, the closest measurement (20 dB bandwidth) when compared to the specified limit, is 858.33 kHz, which is greater than the minimum of 500 kHz.

7.2.2 Method for WiFi Measurements

Refer to ANSI C63.4 and FCC Procedures (2007) for Digital Transmission Systems operating under 15.247.

The transmitter output was connected to the Spectrum Analyzer. The bandwidth of the fundamental frequency was measured with the Spectrum Analyzer using 100 kHz RBW and VBW=300 kHz.

The bandwidth requirement found in FCC Part 15.247(a)(2) and RSS 210 A8.2(a) requires an occupied bandwidth measurement to insure that channel separation requirements are met. In addition, Industry Canada (IC RSS GEN 4.6.1) requires the measurement of the -20dBc occupied bandwidth. For this portion of the tests, a direct measurement of the transmitted signal was performed at the antenna port of the EUT, via a cable connection to the Agilent E4446A spectrum analyzer. An attenuator was placed in series with the cable to protect the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, thereby allowing direct measurements, without the need for any further corrections. An Agilent E4446A spectrum analyzer was used with the resolution bandwidth set to 300 kHz for this portion of the tests. The EUT was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used in peak-hold mode while measurements were made, as presented in the chart below.

From this data, the closest measurement (6 dB bandwidth) when compared to the specified limit, is 9220 kHz, which is greater than the minimum of 500 kHz.

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 58 of 108

7.3 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4446A	US45300564

7.4 Test Data

7.4.1 Bluetooth

Channel	Center Frequency (MHz)	Measured -20 dBc Occ.Bw (kHz)
1	2402	866.66
40	2441	858.33
79	2480	875.00

7.4.2 WiFi at 1 Mbps Data Rate

	Contor Fraguanov	Measured	Minimum	Measured
Channel	Center Frequency	-6 dBc Occ BW	-6 dBc Occ BW	-20 dBc Occ.Bw
	(MHz)	(kHz)	(kHz)	(kHz)
1	2412	962.50	500	1200.00
6	2437	922.50	500	1320.00
11	2462	922.00	500	1320.00

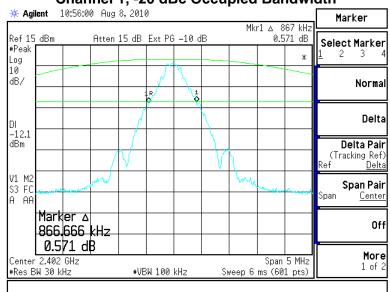
WiFi at MCS7 Data Rate

	Center Frequency	Measured	Minimum	Measured
Channel		-6 dBc Occ BW	-6 dBc Occ BW	-20 dBc Occ.Bw
	(MHz)	(kHz)	(kHz)	(kHz)
1	2412	1731.90	500	1750.00
6	2437	1746.50	500	1795.00
11	2462	1756.40	500	1790.00

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 59 of 108

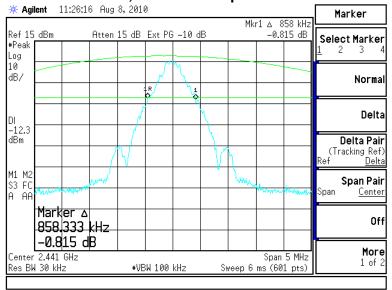
7.5 Screen Captures - OCCUPIED BANDWIDTH

7.5.1 BLUETOOTH

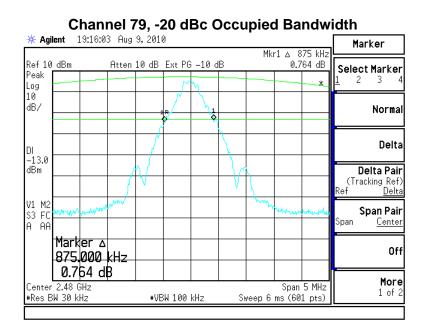




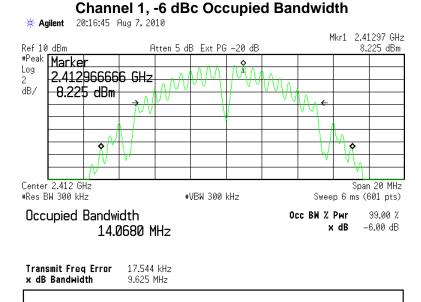
Channel 40, -20 dBc Occupied Bandwidth



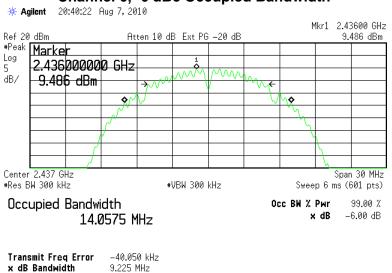
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 60 of 108



7.5.2 WiFi i. 1 Mbps Data Rate

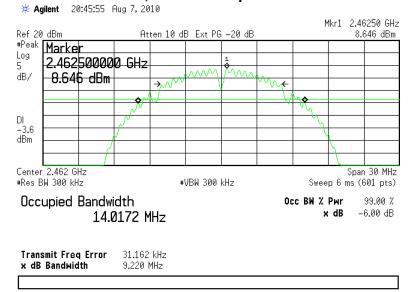


Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 61 of 108

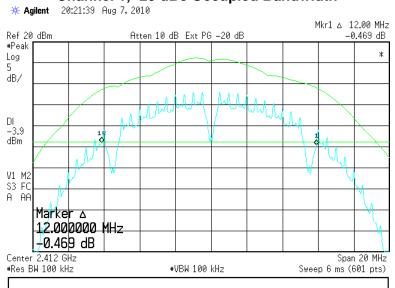


Channel 6, -6 dBc Occupied Bandwidth

Channel 11, -6 dBc Occupied Bandwidth

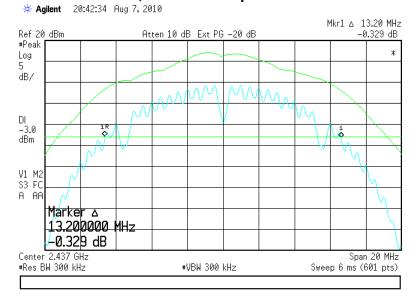


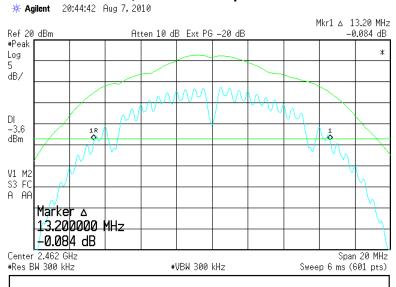
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 62 of 108



Channel 1, -20 dBc Occupied Bandwidth

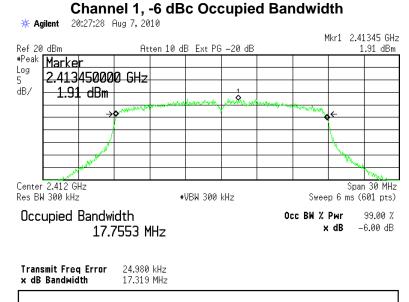




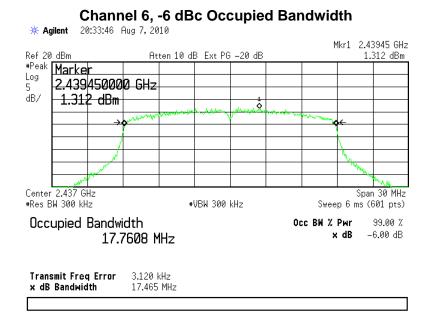


Channel 11, -20 dBc Occupied Bandwidth

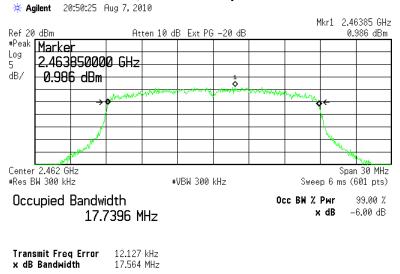
ii. MCS7 Data Rate



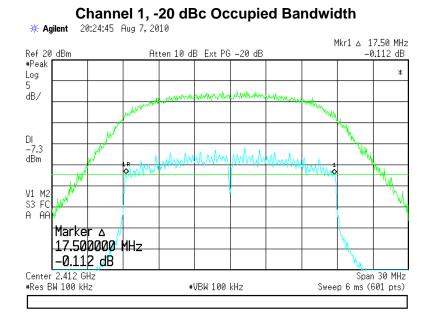
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 64 of 108

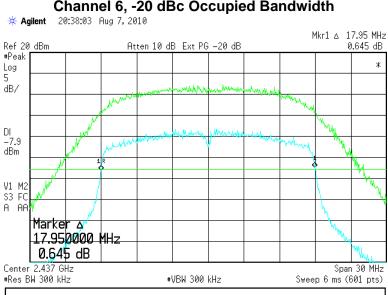


Channel 11, -6 dBc Occupied Bandwidth



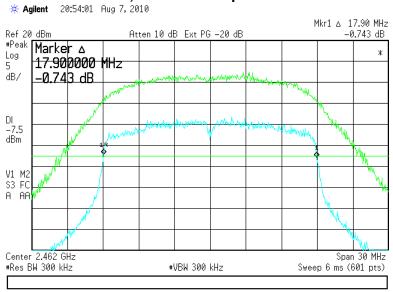
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 65 of 108





Channel	6, -20	dBc	Occupied	Bandwidth

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 66 of 108



Channel	11, -20 dBc	Occupied	Bandwidth

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 67 of 108

EXHIBIT 8. BAND-EDGE MEASUREMENTS

8.1 <u>Method of Measurements</u>

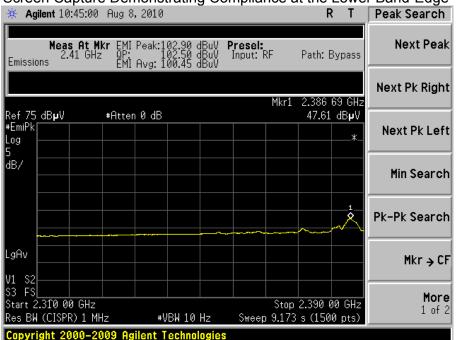
FCC 15.209(b) and 15.247(d) require a measurement of spurious emission levels to be at least 20 dB lower than the fundamental emission level, in particular at the Band-Edges where the intentional radiator operates. Also, RSS 210 Section 2.2 requires that unwanted emissions meet limits listed in tables 2 and 3 of the same standard and also to the limits in the applicable annex. The following screen captures demonstrate compliance of the intentional radiator at the 2400-2483.5 MHz Band-Edges. The EUT was operated in continuous transmit mode with continuous modulation, with internally generated data as the modulating source. The EUT was operated at the lowest channel for the investigation of the lower Band-Edge, and at the highest channel for the investigation of the higher Band-Edge.

The Lower Band-Edge limit from 2390-2400(MHz) would be -20 dBc with respect to the fundamental level.

The Lower Band-Edge (2310-2390MHz) and Upper Band-Edge limit(2483.5-2500MHz), in this case, would be + 54 dB μ V/m at 3m.

8.2 <u>Screen Captures</u>

BLUETOOTH:



Screen Capture Demonstrating Compliance at the Lower Band-Edge

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 68 of 108

* Agilent 16:16:12	Jun 13	, 2010					F	R .	T	Peak Search
Meas At M Emissions	kr emi f Op: Émi f	Peak: N	1/A 1/A 1/A	F	Presel:	Not U	sed			Next Peak
		179. 1	,,,,,			Mkr1 (2.399 9	005 (203	Next Pk Right
	#Atten 1	.0 dB				PIKI I	2.500 0 52.61			
#EmiPk Log 5										Next Pk Left
3 dB/										Min Search
										Pk-Pk Search
LgAv										Mkr → CF
M1 S2								<u> </u>	1	
Start 2.390 00 GHz #Res BW (CISPR) 1 №	1Hz		BW 10	Hz	Sweep		2.400 s (200			More 1 of 2
Copyright 2000-20	009 Agi	lent T	echnol	ogies						

🔆 Agilent 16:25:44 Jun 13, 2010	R T Peak Search
Meas At Mkr EMI Peak: N/A OP: N/A Emissions EMI Avg: N/A	Presel: Not Used Next Peak
	Next Pk Right Mkr1 2.387 00 GHz
Ref 100 dB µ V #Atten 10 dB #EmiPk Log	52.48 dBµV Next Pk Left
5 dB/	Min Search
	Pk-Pk Search
LgAv	Mkr → CF
M1 S2 Start 2.310 00 GHz #Res BW (CISPR) 1 MHz #VBW 10 Hz	top 2,390 00 GHz Stop 2,390 00 GHz Sweep 9,174 s (2000 pts)

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 69 of 108

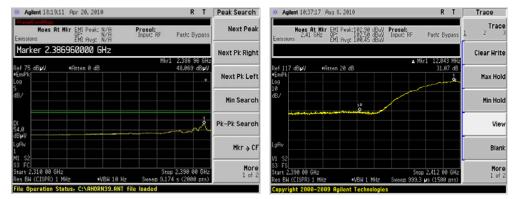
4:38 Jun 1	3,2010					R T	Trace
At Mkr EMI OP: EMI	Peak: N/A N/A Avg: N/A		Presel:	Not L	lsed		Trace
				Mkr1	2.499 \$)42 GHz	Clear Write
#Atten	10 dB						Max Hol
							Min Hol
							Vie
							Blan
GHz) 1 MHz	#\/BW	10 Hz	Sween				- Mor 1 of
	At Mkr EMI PP: HMI *Atten		At Mkr EMI Peak: N/A P: EMI Avg: N/A *Atten 10 dB () () () () () () () () () ()	At Mkr EMI Peak: N/A Presel: #Atten 10 dB //A //A //A #Atten 10 dB	At Mkr EMI Peak: N/A PP: Avg: N/A Presel: Not U Mkr1 Mkr1 *Atten 10 dB Image: Amge:	At Mkr EMI Peak: N/A EMI Avg: N/A Presel: Not Used Mkr1 2.499 S *Atten 10 dB 53.01 Image: Not Used *Atten 10 dB Image: Not Used Image: Not Used Image: N/A Image: N/A <td>At Mkr EMI Peak: N/A Presel: Not Used P: N/A Mkr1 2.499 942 GHz *Atten 10 dB 53.01 dBµV 53.01 dBµV 10</td>	At Mkr EMI Peak: N/A Presel: Not Used P: N/A Mkr1 2.499 942 GHz *Atten 10 dB 53.01 dBµV 53.01 dBµV 10

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 70 of 108

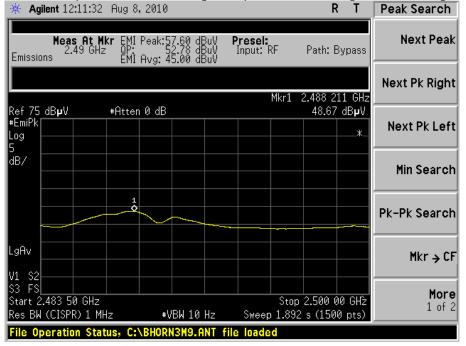
Screen Capture Demonstrating Compliance at the Higher Band-Edge

WIFI:

Screen Capture Demonstrating Compliance at the Lower Band-Edge



Screen Capture Demonstrating Compliance at the Higher Band-Edge



Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 71 of 108

EXHIBIT 9. POWER OUTPUT (CONDUCTED): 15.247(b)

9.1 Method of Measurements

The conducted RF output power of the EUT was measured at the antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, thereby allowing direct measurements without the need for any further corrections. The unit was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source.

For the WiFi radio in 1 Mbps mode conducted output power test the spectrum analyzer was used with resolution and video bandwidths set to 1 MHz, and a span of 5 MHz respectively, and in MCS7 mode conducted output power test the spectrum analyzer was used with resolution and video bandwidths set to 3 MHz, and a span of 10 MHz respectively, with measurements from a peak detector presented in the chart below for each setup.

9.2 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	HP	E4407B	US39160256
Spectrum Analyzer	Agilent	E4446A	US45300564

9.3 Test Data

Bluetooth with Dipole Antenna:

Channel	Center Freq. (MHz)	Peak Power at Antenna Terminal (dBm)	(1) Calculated EIRP (dBm)	Conducted Power Limit (dBm)	Peak Power Margin (dB)	EIRP Limit (dBm)
Low	2402	8.00	12.30	30.00	22.00	36.00
Middle	2441	7.70	12.00	30.00	22.30	36.00
High	2480	7.30	11.60	30.00	22.70	36.00

Bluetooth with Ethertronix Antenna:

Channel	Center Freq. (MHz)	Peak Power at Antenna Terminal (dBm)	(1) Calculated EIRP (dBm)	Conducted Power Limit (dBm)	Peak Power Margin (dB)	EIRP Limit (dBm)
Low	2402	8.00	7.40	30.00	22.00	36.00
Middle	2441	7.70	7.10	30.00	22.30	36.00
High	2480	7.30	6.70	30.00	22.70	36.00

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 72 of 108

<u>WiFi</u>:

Channel	Center Freq. (MHz)	Peak Power at Antenna Terminal (dBm)	(1) Calculated EIRP (dBm)	Conducted Power Limit (dBm)	Peak Power Margin (dB)	EIRP Limit (dBm)
Low	2412	19.54	23.84	30.00	10.46	36.00
Middle	2437	19.67	23.97	30.00	19.67	36.00
High	2462	18.80	23.10	30.00	11.20	36.00

Test Data for 1 Mbps with PIFA antenna

Channel	Center Freq. (MHz)	Peak Power at Antenna Terminal (dBm)	(1) Calculated EIRP (dBm)	Conducted Power Limit (dBm)	Peak Power Margin (dB)	EIRP Limit (dBm)
Low	2412	19.54	18.94	30.00	10.46	36.00
Middle	2437	19.67	19.07	30.00	19.67	36.00
High	2462	18.80	18.20	30.00	11.20	36.00

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 73 of 108

Channel	Center Freq. (MHz)	Peak Power at Antenna Terminal (dBm)	(1) Calculated EIRP (dBm)	Conducted Power Limit (dBm)	Peak Power Margin (dB)	EIRP Limit (dBm)
Low	2412	13.07	17.37	30.00	16.93	36.00
Middle	2437	12.66	16.96	30.00	17.34	36.00
High	2462	12.22	16.52	30.00	17.78	36.00

Test Data for MCS7 with Dipole antenna

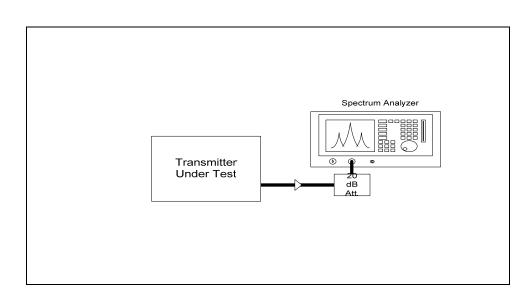
Test Data for MCS7 with PIFA antenna

Channel	Center Freq. (MHz)	Peak Power at Antenna Terminal (dBm)	(1) Calculated EIRP (dBm)	Conducted Power Limit (dBm)	Peak Power Margin (dB)	EIRP Limit (dBm)
Low	2412	13.07	12.47	30.00	16.93	36.00
Middle	2437	12.66	12.06	30.00	17.34	36.00
High	2462	12.22	11.62	30.00	17.78	36.00

⁽¹⁾ EIRP Calculation:

EIRP = (Peak power at antenna terminal in dBm) + (EUT Antenna gain in dBi)

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 74 of 108



Bluetooth

Measured RF Power Output (in Watts): 0.006310 W Declared RF Power Output (in Watts): 0.006310 W

WiFi (with 1 Mbps Data Rate)

Measured RF Power Output (in Watts): 0.092683 W Declared RF Power Output (in Watts): 0.092863 W

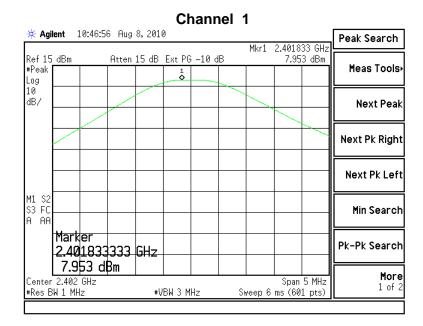
WiFi (with MCS7 Data Rate)

Measured RF Power Output (in Watts): 0.020277 W Declared RF Power Output (in Watts): 0.020277 W

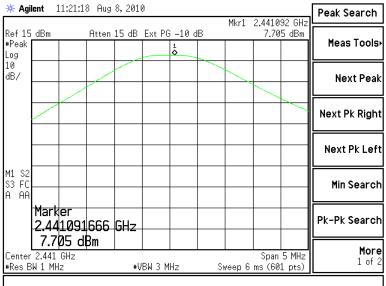
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 75 of 108

9.4 Screen Captures – Power Output (Conducted)

Bluetooth:



Channel 40

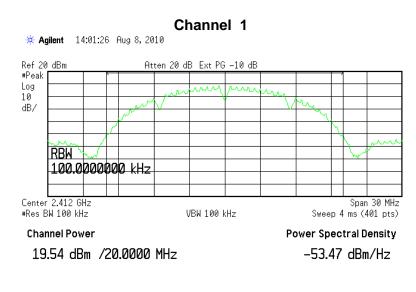


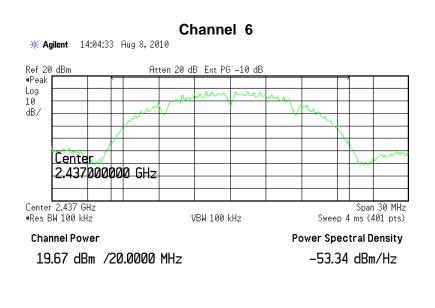
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 76 of 108

Peak Searc					9	9,201	2 Aug	19:33:02	lent 🔅	🗧 Agi
	2.479833 GHz	Mkr1								
	7.347 dBm		dB	<u>G -10</u>		10 dB	Atten		dBm	ef 10
Meas Tool			+		1					eak og
						r				0 B/
Next Pe										57
								1		
Next Pk Rig										
Next Pk Le										
										1 \$2
Min Searc			_							3 FC AA
									Mark	I AA
Pk-Pk Seard						cu-	222	9833		
								47 d		
Mo	Span 5 MHz						, III		2.48 (enter
1 of	ms (601 pts)	Gweep 6	9	MHz	BW 3 M	ŧ۷			W 1 MF	

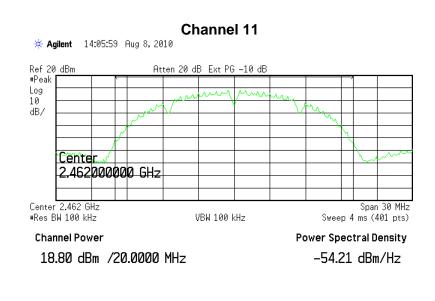
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 77 of 108

WiFi: 1 Mbps Data Rate

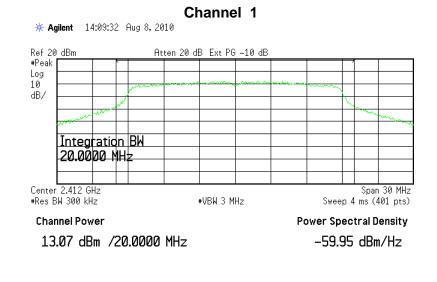




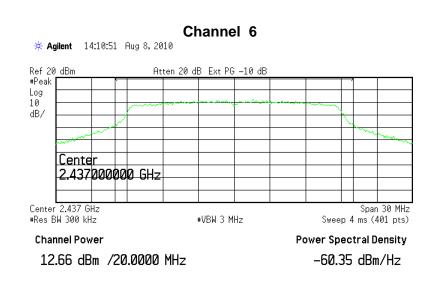
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 78 of 108

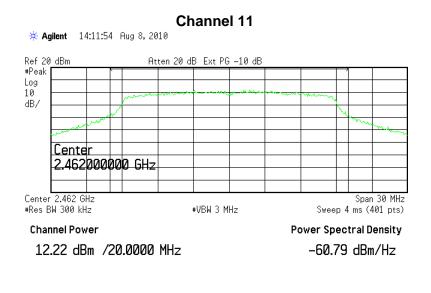


MCS7 Data Rate



Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 79 of 108





Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 80 of 108

EXHIBIT 10. POWER SPECTRAL DENSITY: 15.247(e)

10.1 Limits

For digitally modulate systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

In accordance with FCC Part 15.247(e) and RSS 210 A8.2(b), the peak power spectral density should not exceed +8 dBm in any 3 kHz band. This measurement was performed along with the conducted power output readings performed as described in previous sections. The peak output frequency for each representative frequency was scanned, with a narrow bandwidth, and reduced sweep, and a power density measurement was performed using the utility built into the HP Analyzer. The resultant density was then corrected to a 3 kHz bandwidth. The highest density was found to be no greater than -3.3 dBm, which is under the allowable limit by 11.3 dB.

10.2 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Agilent	E4446A	US45300564

10.3 Test Data

WiFi at 1 Mbps

Transmitter Channel	Frequency (MHz)	RF Power Level In 3 kHz BW (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Comments Pass/Fail
Lowest	2412	-4.3	8.0	12.3	Pass
Middle	2437	-3.3	8.0	11.3	Pass
Highest	2462	-4.1	8.0	12.1	Pass

WiFi at MCS7

Transmitter Channel	Frequency (MHz)	RF Power Level In 3 kHz BW (dBm/3 kHz)	Limit (dBm/3 kHz)	Margin (dB)	Comments Pass/Fail
Lowest	2412	-16.0	8.0	24.0	Pass
Middle	2437	-16.0	8.0	24.0	Pass
Highest	2462	-15.8	8.0	23.8	Pass

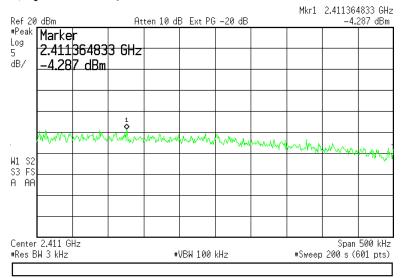
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 81 of 108

10.4 Screen Captures – Power Spectral Density

WiFi at 1 Mbps Data Rate

Channel 1

🔆 Agilent 21:17:00 Aug 7, 2010



Channel 6

🔆 Agilent 21:25:36 Aug 7, 2010

Ref 20 <u>dBm</u>		At	ten 10 di	B Ext PG	i -20 dB		Mkr1	2.436323 -3.3	7499 GHz 297 dBm
	er 5 32749 37 dBm								
WVV	1 1 1 1 1 1 1 1 1 1 1 1 1	Mmm	www.	www.h	Murum	www.w	where.	Non-second	
41 S2 53 FS A AA								- <u> </u>	K ¥₽ ₩ <mark>₩₩</mark>
Center 2.437 #Res BW 3 kHz		I	*	VBW 100	ı kHz		#Sweep	Span 200 s (6	1 500 kHz 501 pts)

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 82 of 108

Channel 11

🔆 Agi	lent (21:31:1	2 Aug	7,201	0		Mk	r1 24	626183	33 GHz	Peak Search
Ref 20 #Peak Log	Mark			10 dB	Ext P0	<u>6 -20 c</u>				5 dBm	Meas Tools+
5 dB/		2618 15 d		бНZ							Next Peak
								1			Next Pk Right
	MANA	when	Mhm	man	num	m	mutri		www	nvnit vi	Next Pk Left
M1 S2 S3 FS A AA											Min Search
											Pk-Pk Search
	∙2.462 3W 3 kH			l #VE	W 100	kHz	 #Swe	eep 200	 Span 5 0 s (60		More 1 of 2

WiFi at MCS7 Data Rate

Channel 1

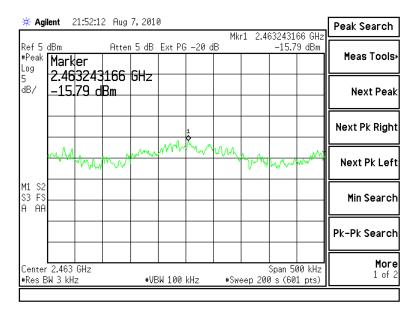
🔆 Agil	ent ä	21:40:1	2 Aug	7,201	9		ML	r1 2.4	132445	00 CU-	Peak Search
Ref 5 d #Peak Log	Mark			5 dB	Ext PG	; -20 c		1 2.4		6 dBm	Meas Tools•
5 dB/		3244 96 d		бНz							Next Peak
					1						Next Pk Right
	shalled a	w	n.M	m	NAM	hwh	MAYA	Myor	which	~~~~	Next Pk Left
M1 S2 S3 FS A AA											Min Search
											Pk-Pk Search
Center #Res B				 #VE	 W 100	 kHz	#Sw	eep 200	 Span 5 0 s (60		More 1 of 2

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 83 of 108

Channel 6

🔆 Agi	lent i	21:46:4	2 Aug	7,201	0		ML	r1 2.43	202420	00.01-	Peak Search
Ref 5 #Peak Log	Mark			n 5 dB	Ext PG	i — 20 c		r1 2.4.		1 dBm	Meas Tools•
5 dB/		8243 Ø1 d	1999 Bm	GHz							Next Peak
					1						Next Pk Right
	a, A, A	mu	w	mar	WMM	m h	M	WWW	www	~~~	Next Pk Left
M1 S2 S3 FS A AA											Min Search
											Pk-Pk Search
Center #Res B				 #VE	W 100	kHz	#Sw	eep 200	Span 50 0 s (60		More 1 of 2
#Res B	W 3 kH	z		#VE	W 100	kHz	#Sw	eep 200	0 s (60	1 pts)	1 UT 2

Channel 11



Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 84 of 108

EXHIBIT 11. SPURIOUS EMISSIONS

11.1 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at lease 20 db below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

In addition, radiated emissions, which fall in the restricted band, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(e)

Remarks:

- Applies to harmonics/spurious emissions that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209.
- The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in Section 15.35 for limiting peak emissions apply.

MHz	MHz	MHz	GHz	
0.090 - 0.110	162.0125 – 167.17	2310 – 2390	9.3 – 9.5	
0.49 - 0.51	167.72 – 173.2	2483.5 – 2500	10.6 – 12.7	
2.1735 – 2.1905	240 – 285	2655 – 2900	13.25 – 13.4	
8.362 - 8.366	322 – 335.4	3260 – 3267	14.47 – 14.5	
13.36 – 13.41	399.9 – 410	3332 – 3339	14.35 – 16.2	
25.5 - 25.67	608 – 614	3345.8 – 3358	17.7 – 21.4	
37.5 – 38.25	960 – 1240	3600 – 4400	22.01 – 23.12	
73 – 75.4	1300 – 1427	4500 – 5250	23.6 - 24.0	
108 – 121.94	1435 – 1626.5	5350 – 5460	31.2 – 31.8	
123 – 138	1660 – 1710	7250 – 7750	36.43 - 36.5	
149.9 – 150.05	1718.8 – 1722.2	8025 – 8500	Above 38.6	
156.7 – 156.9	2200 – 2300	9000 – 9200		

FCC 47 CFR 15.205(a) – Restricted Frequency Bands

FCC 47 CFR 15.209(a) Field Strength Limits within Restricted Frequency Bands

Frequency	Field Strength Limits	Distance
(MHz)	(microvolts/m)	(Meters)
0.009 - 0.490	2,400 / F (kHz)	300
0.490 – 1.705	24,000 / F (kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

Calculation of Radiated Emission Measurements

Frequency (MHz)	3 m Limit (μV/m)	3 m Limit (dBμV/m)	1 m Limit (dBµV/m)
30-88	100	40.0	-
88-216	150	43.5	-
216-960	200	46.0	-
960-25,000	500	54.0	63.5

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 85 of 108

FCC Part 15.247(d) and IC RSS 210 A8.5 requires a measurement of conducted harmonic and spurious RF emission levels, as reference to the carrier level when measured in a 100 kHz bandwidth. For this test, the spurious and harmonic RF emissions from the EUT were measured at the EUT antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, there by allowing direct readings of the measurements made without the need for any further corrections. A Hewlett Packard model E4407B spectrum analyzer was used to make measurements. The unit was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used with measurements from a peak detector presented in the chart below. Screen captures were acquired and any noticeable spurious and harmonic signals were identified and measured.

No significant emissions could be noted within -35 dBc of the fundamental level for this product.

Bluetooth:

	Channel 2402	Channel 2441	Channel 2480
2 nd Harmonic	- 55.9 (dBm)	- 59.2 (dBm)	- 53.7 (dBm)
3 rd Harmonic	- 61.1 (dBm)	- 62.7 (dBm)	- 63.0 (dBm)
4 th Harmonic	- 60.6 (dBm)	- 66.1 (dBm)	- 67.3 (dBm)
5 th Harmonic	- 69.6 (dBm)	Note (1)	- 67.6 (dBm)
6 th Harmonic	- 61.7 (dBm)	- 62.4 (dBm)	- 66.3 (dBm)
7 th Harmonic	- 65.7 (dBm)	- 66.8 (dBm)	- 67.7 (dBm)
8 th Harmonic	Note (1)	Note (1)	Note (1)
9 th Harmonic	Note (1)	Note (1)	Note (1)
10 th Harmonic	Note (1)	Note (1)	Note (1)

WiFi 1 Mbps Data Rate

	Channel 2412	Channel 2437	Channel 2462
2 nd Harmonic	- 53.0 (dBm)	Note (1)	- 54.8 (dBm)
3 rd Harmonic	Note (1)	Note (1)	Note (1)
4 th Harmonic	- 47.9 (dBm)	- 48.3 (dBm)	- 48.2 (dBm)
5 th Harmonic	Note (1)	Note (1)	Note (1)
6 th Harmonic	Note (1)	Note (1)	Note (1)
7 th Harmonic	Note (1)	Note (1)	Note (1)
8 th Harmonic	Note (1)	Note (1)	Note (1)
9 th Harmonic	Note (1)	Note (1)	Note (1)
10 th Harmonic	Note (1)	Note (1)	Note (1)

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 86 of 108

WiFi MCS7 Data Rate

	Channel 2412	Channel 2437	Channel 2462
2 nd Harmonic	Note (1)	Note (1)	Note (1)
3 rd Harmonic	Note (1)	Note (1)	Note (1)
4 th Harmonic	- 47.9 (dBm)	- 48.3 (dBm)	- 48.2 (dBm)
5 th Harmonic	Note (1)	Note (1)	Note (1)
6 th Harmonic	Note (1)	Note (1)	Note (1)
7 th Harmonic	Note (1)	Note (1)	Note (1)
8 th Harmonic	Note (1)	Note (1)	Note (1)
9 th Harmonic	Note (1)	Note (1)	Note (1)
10 th Harmonic	Note (1)	Note (1)	Note (1)

Notes:

(1) Measurement at system noise floor.

11.2 Test Equipment List

Test Equipment	Manufacturer	Model No.	Serial No.
Spectrum Analyzer	Hewlett-Packard	E4407	

11.3 Test Data

Bluetooth:

Frequency (MHz)	Measured RF Level (dBm)	Channel Measured On	Limit 15.247 (dBm)	Margin (dB)	Pass/ Fail
479.40	-70.2	MID	-12.3	-57.9	Pass
814.10	-53.2	MID	-12.3	-40.9	Pass
1630.00	-50.3	MID	-12.3	-38.0	Pass
801.15	-52.0	LOW	-12.0	-40.0	Pass
1600.00	-51.2	LOW	-12.0	-39.2	Pass
827.00	-50.5	HIGH	-12.7	-37.8	Pass
1660.00	-50.0	HIGH	-12.7	-37.3	Pass

WiFi at 1 Mbps Data Rate

Frequency (MHz)	Measured RF Level (dBm)	Channel Measured On	Limit 15.247 (dBm)	Margin (dB)	Pass/ Fail
479.40	-70.2	MID	-12.3	-57.9	Pass
814.10	-53.2	MID	-12.3	-40.9	Pass
1630.00	-50.3	MID	-12.3	-38.0	Pass
801.15	-52.0	LOW	-12.0	-40.0	Pass
1600.00	-51.2	LOW	-12.0	-39.2	Pass
827.00	-50.5	HIGH	-12.7	-37.8	Pass
1660.00	-50.0	HIGH	-12.7	-37.3	Pass

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 87 of 108

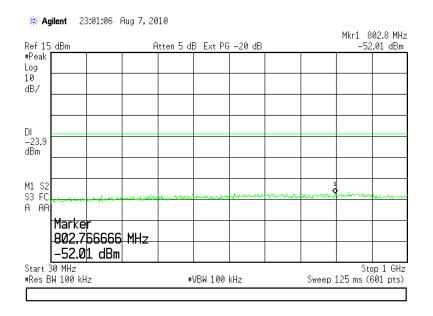
Frequency (MHz)	Measured RF Level (dBm)	Channel Measured On	Limit 15.247 (dBm)	Margin (dB)	Pass/ Fail
479.40	-70.2	MID	-12.3	-57.9	Pass
814.10	-53.2	MID	-12.3	-40.9	Pass
1630.00	-50.3	MID	-12.3	-38.0	Pass
801.15	-52.0	LOW	-12.0	-40.0	Pass
1600.00	-51.2	LOW	-12.0	-39.2	Pass
827.00	-50.5	HIGH	-12.7	-37.8	Pass
1660.00	-50.0	HIGH	-12.7	-37.3	Pass

WiFi at MCS7 Data Rate

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 88 of 108

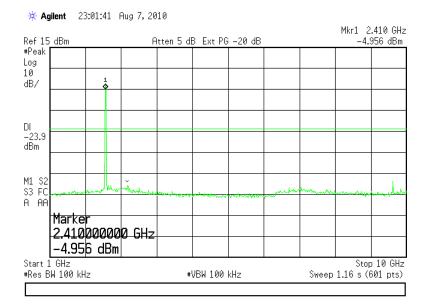
11.4 Screen Captures – Spurious Radiated Emissions

Bluetooth:

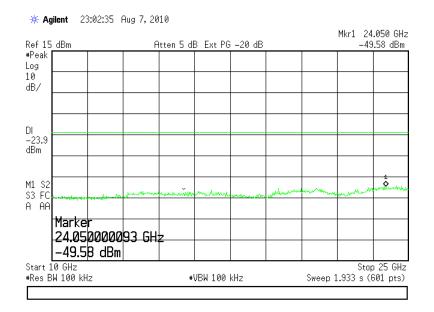


Channel 2402, shown from 30 MHz up to 1000 MHz

Channel 2402, shown from 1000 MHz up to 10000 MHz



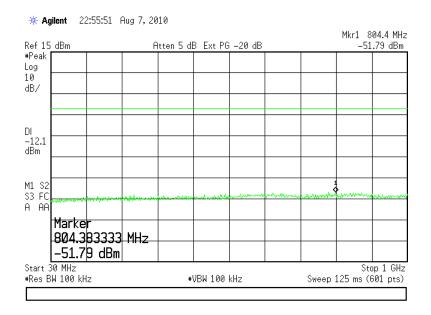
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 89 of 108



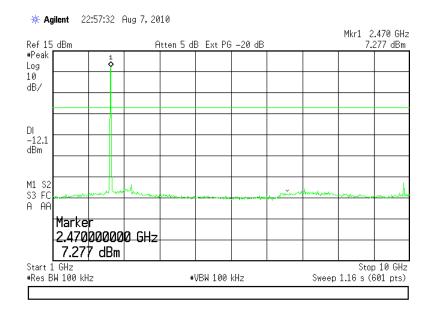
Channel 2402, shown from 10000 MHz up to 25000 MHz

WiFi: 1Mbps Data Rate

Channel 2480, shown from 30 MHz up to 1000 MHz

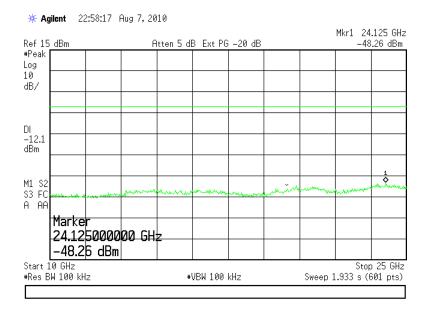


Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 90 of 108

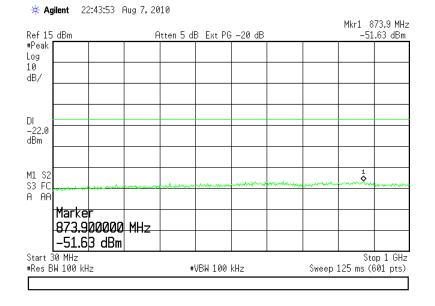


Channel 2480, shown from 1000 MHz up to 10000 MHz

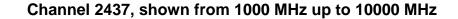
Channel 2480, shown from 10000 MHz up to 25000 MHz

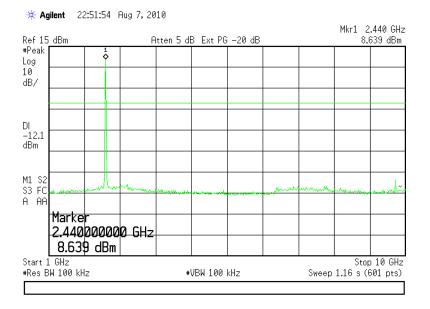


Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 91 of 108

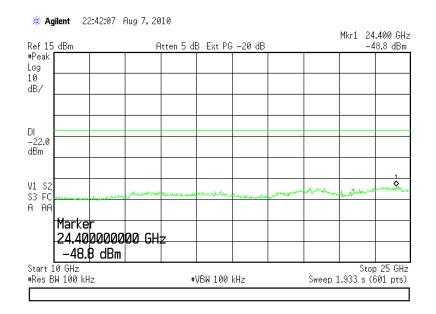


Channel 2437, shown from 30 MHz up to 1000 MHz





Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 92 of 108



Channel 2437, shown from 10000 MHz up to 25000 MHz

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 93 of 108

EXHIBIT 12. FREQUENCY & POWER STABILITY OVER VOLTAGE VARIATIONS

A spectrum analyzer was used to measure the frequency at the appropriate frequency markers. For this test, the EUT was placed in continuous transmit CW mode. Power to the EUT was supplied by an external bench-type variable power supply. The frequency of operation was monitored using the spectrum analyzer with RBW=VBW=1 kHz settings while the voltage was varied.

Bluetooth

	4.25		5.0		5.75	
Power	Frequency	Power	Frequency	Power	Frequency	Channel
8.0	2401991193	8.0	2401991199	8.1	2401991216	LOW
7.5	2440991100	7.7	2440991100	7.7	2440991050	MID
7.3	2479990916	7.3	2479990950	7.3	2479990883	2480

Frequency Drift for Bluetooth Radio over voltage variation

		<u> </u>	
Channel	max	min	freq drift (Hz)
lo	2401991216	2401991193	23
mid	2440991100	2440991050	50
2479	2478991032	2478990999	33
2480	2479990950	2479990883	67

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 94 of 108

EXHIBIT 13. CHANNEL PLAN AND SEPARATION

An HP E4407B spectrum analyzer was used with a resolution bandwidth of 30 kHz to measure the channel separation of the Bluetooth FHSS Radio on the TiWi product.

The minimum and maximum channel-separations measured for this device are 997.50 kHz and 1021.25 kHz respectively. The maximum occupied bandwidth of the device, as reported in the previous section is 875.00 kHz. The following plots describe this spacing, and also establish the channel separation and plan.

13.1 Data Table

RANGE (MHz)	# OF CHANS	Max separation (Hz)
2400 - 2410.5	9.0	997.50
2410.5 - 2420	9.5	1021.25
2420 - 2430	10.0	1000.00
2430 - 2440	10.0	1000.00
2440-2450	10.0	1000.00
2450-2460	10.0	1000.00
2460-2470	10.0	1000.00
2470-2483.5	10.5	1011.25

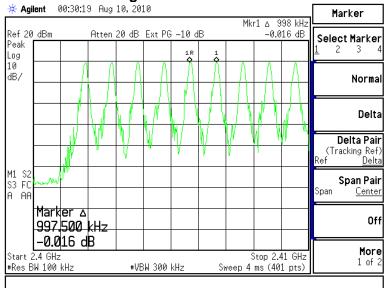
13.2 Summary Table

Total Chans	79
Max	
separation	1021.25
Min	
Separation	997.50

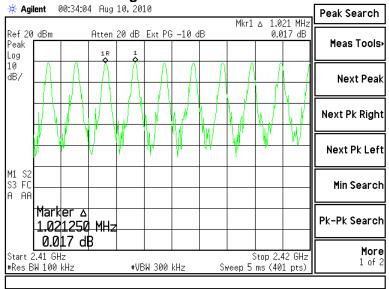
Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 95 of 108

13.3 <u>Screen Captures – Channel Separation</u>

Channels 01 through 09

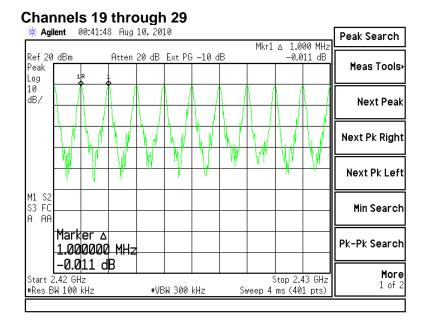


Channels 10 through 19

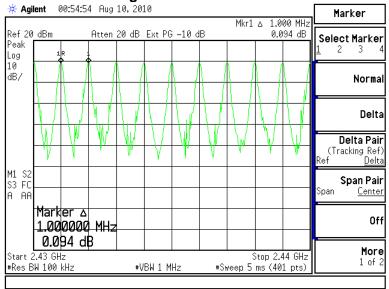


Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 96 of 108

Screen Captures - Channel Separation (continued)

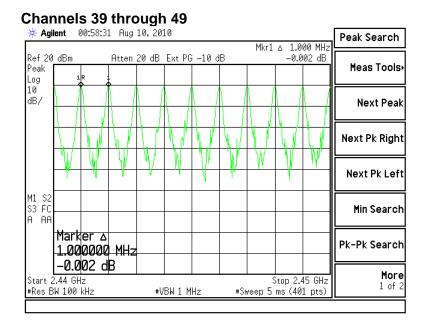


Channels 29 through 39

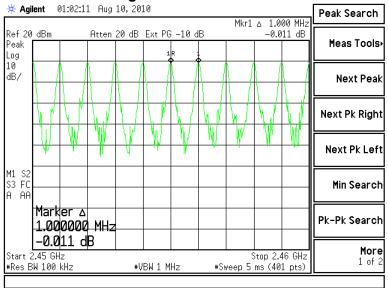


Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 97 of 108

Screen Captures - Channel Separation (continued)

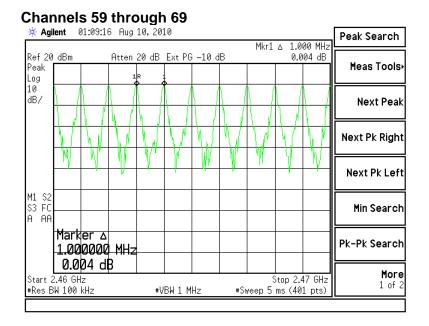


Channels 49 through 59



Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 98 of 108

Screen Captures - Channel Separation (continued)



Channels 69 through 79

🔆 Agilent	nt 01:13:33	3 Aug 1	10,201	.0			Mlas	1 . 1	01 MHz	Peak Search
Ref 20 df Peak Log	IBm 1R 1	Atten 2	20 dB	Ext PG	i —10 d	B	PINE		01 dB	Meas Tools+
10 dB/		AA	A	A	A /	A	A			Next Peak
				\square			\square			Next Pk Right
Ą	<u>v</u> v v	Ŵ	Ψ	Ц	V	Ψ				Next Pk Left
M1 S2 S3 FC A AA								Ym		Min Search
1	1arker ∆ 1.011250									Pk-Pk Search
		8	*V	BW 1 M	Hz	<u>+</u> \$۱	St veep 5	op 2.48 ms (40		More 1 of 2

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 99 of 108

EXHIBIT 14. MPE CALCULATIONS

The following MPE calculations are based on a dipole antenna or printed circuit board antenna, and a Bluetooth and WLAN radio paired to each.

BT With Dipole Antenna

	Prediction of MP	E limit at	a given	<u>distance</u>				
Equation	n from page 18 of (tin 65. Ed	lition 97-0	1			
	$S = \frac{PG}{4\pi R^2}$							
where:	S = power density	/						
	P = power input to	the anter	nna					
	G = power gain of	f the anter	na in the	of interest relative	e to an iso	tropic ra	diator	
	R = distance to th							
	um peak output pov					(dBm)		
Maxim	um peak output pov				6.310			
			_	n(typical):		(dBi)		
				enna gain:		(numeric)	
				distance:		(cm)		
				requency:		(MHz)		
MPE limit f	or uncontrolled expo	sure at pr	ediction f	requency:	1	(mW/cm	2)	
	Power de	nsity at pr	ediction f	requency:	0.003379	(mW/cm	2)	
	Maxir	num allow	able ante	enna gain:	29.0	(dBi)		
	Margin of Comp	liance at	20	cm =	24.7	dB		

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 100 of 108

BT With PIFA Antenna

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	8.00 (dBm)
Maximum peak output power at antenna input terminal:	6.310 (mW)
Antenna gain(typical):	<u>-0.6</u> (dBi)
Maximum antenna gain:	0.871 (numeric)
Prediction distance:	<u>20</u> (cm)
Prediction frequency:	2402 (MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1 (mW/cm^2)
Power density at prediction frequency:	0.001093 (mW/cm^2)
Maximum allowable antenna gain:	29.0 (dBi)
Margin of Compliance at 20 cm =	29.6 dB

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 101 of 108

AN With	Dipole A	Antenna							
	Predictio	on of MP	E limit at	a given	<u>distance</u>				
Equatio	n from nav	no 18 of C		tin 65. Ed	lition 97-01	1			
Lyuano	πποπτραξ			un 05, Eu	111011 97-0	1			
	$S = \frac{1}{4\pi}$	PG —							
	$3 - \frac{1}{42}$	πR^2							
where:	S = pow	er density							
	P = pow	er input to	the anter	nna					
	G = pow	er gain of	the anter	nna in the	of interest relative	e to an isot	ropic radiator	r	
	R = dista	ance to the	e center o	f radiatio	n of the an	tenna			
Maxim	um peak o	output pow	ver at ante	enna inpu	t terminal:	20.10	(dBm)		
Maxim	um peak o	utput pow	ver at ante	enna inpu	t terminal:	102.329	(mW)		
			An	tenna gai	n(typical):	4.3	(dBi)		
			Maxi	mum ante	enna gain:	2.692	(numeric)		
			F	rediction	distance:		(cm)		
			Pr	ediction f	requency:	2402	(MHz)		
PE limit fo	r uncontro	lled expo	sure at pr	ediction f	requency:	1	(mW/cm [^]	2)	
	F	Power der	nsity at pr	ediction f	requency:	0.054794	(mW/cm ²	2)	
		Maxin	num allow	able ante	enna gain:	16.9	(dBi)		
		in a Airi	an alon	asio unic	and gam.	10.0	(30)		
	Margin	of Comp	liance at	20	cm =	12.6	dB		

WLAN	With	Dipole	Antenna	
------	------	--------	---------	--

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 102 of 108

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4\pi R^2}$$

where: S = power density

P = power input to the antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	20.10 (dBm)
Maximum peak output power at antenna input terminal:	102.329 (mW)
Antenna gain(typical):	-0.6 (dBi)
Maximum antenna gain:	0.871 (numeric)
Prediction distance:	<u>20 (cm)</u>
Prediction frequency:	2402 (MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1 (mW/cm^2)
Power density at prediction frequency:	0.017731 (mW/cm^2)
Maximum allowable antenna gain:	16.9 (dBi)
Margin of Compliance at 20 cm =	17.5 dB `

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 103 of 108

APPENDIX A



	Image: Section in the sectio		29-Sep-2010	Type rear	Radiated Emiss	sions		Job #	: <u>C-884</u>	-
E Boli 12 Str. 12 One Searchan Angere 4444. Novel 55202 Str. 12 One Searchan Angere 4444. Novel 55203 Str. 12 One Searchan Str. 12 One Searchan Angere 4444. Novel 55203 Str. 12 One Searchan Str. 12 One Sea	Ef Biol 1 301-13 Dots Statement Angere Agent Extended 101-13 Dots Statement Adverte Ed Biol 1 301-13 Dots Statement Attenue BIOL 2013 8111-143 1110/2018 Adverte Extension Ad 80001 Double Rogs Find Attenue BIOL 2013 8111-143 1110/2018 Adverte Extension Ad 80001 Double Rogs Find Attenue BIOL 2013 815 811-143 1110/2018 Adverte Extension Ad 80001 Double Rogs Find Attenue BIOL 2013 815 821-143 1110/2018 Adverte Extension Ad 80001 Double Rogs Find Attenue BIOL 2012 1202/2019 Rogs Extension Adverte Extension Ad 8001 Double Rogs Find Attenue BIOL 2010/2018 Extension Adverte Extension Ad 8001 Double Rogs Find Attenue BIOL 2010/2018 Adverte Extension Ad 8001 Double Rogs Find Attenue BIOL 2010/2018 Adverte Extension Ad 8001 Double Rogs Find Attenue BIOL 2010/2018 Adverte Extension Biol 2018 Adverte Rogs Find Attenue BIOL 2010/2018 Adverte Extension Biol 2018 Biol 2018 Biol 2018	Prepared By:	Peter	Customer :	LSR			Quote #	310117	_
		1								
Bit	81 8010 Minescent Aplett Notability Minescent Biolity Minescent Biolity <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>									
A BORDY DURA BRUGE Antima EUG DI 11 B B11 - 121 11/102014 Antie Calebrand A BORDY DURA BRUGE Antima EUG DI 11 B B11 - 121 11/102014 Antie Calebrand A BORDY DURA BRUGE Antima EUG DI 11 B B11 - 121 11/102014 Antie Calebrand A BORDY DURA BRUGE Antima EUG DI 11 B B11 - 121 11/102014 Antie Calebrand A BORDY DURA BRUGE Antima EUG DI 11 B B11 - 121 11/102014 Antie Calebrand A BORDY DURA BRUGE Antima EUG DI 11/102 Antie Calebrand Antie Calebrand A BORDY DURA BRUGE Antima EUG DI 11/1020 Antie Calebrand Antie Calebrand A BORDY DURA BRUGE Antima EUG DI 11/1020 Antie Calebrand Antie Calebrand Concert DURA BRUGE Antima EUG DI 11/1020 Antie Calebrand Antie Calebrand Concert DURA BRUGE Antima EUG DI 11/1020 Antie Calebrand Antie Calebrand A BORDY DURA BRUGE Antima EUG DI 11/1020 Antie Calebrand Antie Calebrand A BORDY DURA BRUGE Antima EUG DI 11/10200 Antie Calebrand Antie Calebrand A BORDY DURA BRUGE Antima EUG DI 11/10200 Antie Calebrand Antie Ca										
Add Barlow EUG 314 80 444 10 102000 Auto Calentamin Add Barlow Adv. Univ V.A.H2 12 101 10 202000 12 002010 Auto Calentamin Adv. Univ V.A.H2 12 101 10 202000 12 002010 Auto Calentamin Adv. Univ V.A.H2 12 101 10 202000 12 002010 Auto Calentamin Adv. Univ V.A.H2 12 101 10 202000 12 00201 Auto Calentamin Adv. Univ V.A.H2 12 101 10 20200 12 00201 Auto Calentamin Adv. Univ V.A.H2 12 101 10 20200 12 00201 Auto Calentamin Adv. Univ V.A.H2 12 101 10 20200 12 0010 Auto Calentamin Adv. Univ V.A.H2 12 101 10 20200 12 0010 Auto Calentamin Adv. Univ V.A.H2 12 101 10 20200 12 20201 12 0010 Auto Calentamin Adv. Univ V.A.H2 12 101 10 0000 11 00000 10 00000 10 00000 Auto Calentamin Adv. Univ V.A.H2 12 101 10 020000										
Ale Bolt Program Production BUC D 31 St BUT T 12020031 32020031 Active Extension Ale Bolt D Prosenting BUC D 100 St BUC D 12020031 42020031 Active Extension EVENT D Extension BUC D 100 St BUC D 12020031 42020031 Active Extension EVENT D Extension Extension Extension Extension Extension Extension Event D Prosent D Extension Extension Extension Extension Extension Event D Prosent D Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension Extension	All Boards Duble Right marketime All Do 15 bit Mit 6000 bit Mit Mit Mit Mit Mit Mit Mit Mit Mit M		-						Active Calibration	
11 model Pre-Amp Arr. Nom VL-AB12 1212111 12220209 12220209 Adve Cabreton 12 model Bisen Amma Grad 13100 10001072 1000109 1100009 Adve Cabreton 12 model Bisen Amma Grad Pre-Amp Adve Cabreton Adve Cabreton 12 model Marketon Experimental Cabreton Marketon Experimental Cabreton Adve Cabreton 12 model Experimental Cabreton Experimental Cabreton Experimental Cabreton Adve Cabreton 12 model Experimental Cabreton Experimental Cabreton Experimental Cabreton Adve Cabreton 12 model Experimental Cabreton Experimental Cabreton Experimental Cabreton Adve Cabreton 12 model Experimental Cabreton Experimental Cabreton Experimental Cabreton Adve Cabreton 12 model Experimental Cabreton Experimental Cabreton Experimental Cabreton Experimental Cabreton 12 model Experimental Cabreton Experimental Cabreton Experimental Cabreton Experimental Cabreton 12 model Experimental Cabreton Experimental Cabreton Experimental Cabr	Et B0114 Pix.duri dar. Nore VL.A12 12020219 2020219 Athe Callbarder Ex B0114 Pix.duri Bon Anterna ET 3118 2003334 1102029 12020219 Athe Callbarder Ex B0114 Pix.duri Bon Anterna ET 3118 2003334 1102029 1202019 Athe Callbarder Ex B0114 Pix.duri Experiment Callbarder Experim Callbarder Experiment Callbar		-							
Add Model Model Prosentiarie Open BL001001/201 S0007/3 0020000 002000 002000 000000 000000 000000	Ale 6010 Presention Open Explosition Explosition Explosition EVENENCE Explosition Type Text Space State 100.000 100.000 Active Calcuration EVENENCE Explosition Type Text Space State 0.004 # 31011 Explosition Explosition Explosition 0.004 # 310110 0.004 # 3101010 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # 310110 0.004 # </td <td>AA 960081</td> <td>Double Ridge Horn Antenna</td> <td>EMCO</td> <td>3115</td> <td>6907</td> <td>12/22/2009</td> <td>12/22/2010</td> <td>Active Calibration</td> <td></td>	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	12/22/2009	12/22/2010	Active Calibration	
Ale More No. Bote Andrew More No. Control International Active Calibration Active Calibration	An Addition Boto Andrianty Ets 31.98 00.33.348 11.02.009 11.02.018 Active Calebraterie An Addition Control Contro Control Control Contro Control Control Con	EE 960147	Pre-Amp	Adv. Micro	WLA612	123101	12/28/2009	12/28/2010	Active Calibration	
		AA 960144	Phaseflex	Gore	EkD01D010720	5800373	6/25/2009	6/25/2010	Active Calibration	
Writesbracksteperstere Dre: Dre: <tddre:< td=""> Dre: <tddre:< td="" td<=""><td></td><td>AA 960150</td><td>Bicon Antenna</td><td>ETS</td><td>3110B</td><td>0003-3346</td><td>11/3/2009</td><td>11/3/2010</td><td>Active Calibration</td><td></td></tddre:<></tddre:<>		AA 960150	Bicon Antenna	ETS	3110B	0003-3346	11/3/2009	11/3/2010	Active Calibration	
Presend by: Peer Cutome: LSR Cutome: Cutome: <thcutome:< th=""> <thcutome:< th=""> <thcuto< th=""><th>Prepared by Peter Customer LSR Outer # 19117 2 Assatz Description Manufacturer Node# # 1017 2 Assatz Description Assatz Description Assatz 2 Assatz Description Assatz Description Assatz 2 Assatz Description Assatz Description Assatz 4 Biolification Assatz Description Assatz Description Assatz 4 Biolification Assatz Assatz Description Assatz Description Assatz 4 Biolification Assatz Appendix Assatz Description Assatz Description Assatz Description Assatz Description Assatz Description <</th><th>Wireless</th><th>s Product Development</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></thcuto<></thcutome:<></thcutome:<>	Prepared by Peter Customer LSR Outer # 19117 2 Assatz Description Manufacturer Node# # 1017 2 Assatz Description Assatz Description Assatz 2 Assatz Description Assatz Description Assatz 2 Assatz Description Assatz Description Assatz 4 Biolification Assatz Description Assatz Description Assatz 4 Biolification Assatz Assatz Description Assatz Description Assatz 4 Biolification Assatz Appendix Assatz Description Assatz Description Assatz Description Assatz Description Assatz Description <	Wireless	s Product Development							
Nester Description Numerical weak Cal Date Cal Date Description C 0002010 Secture Analyzer HP E44076 USS10026 Secture Analyzer Adve Calabration A 80143 Secture Analyzer Agent E44076 USS10026 Secture Analyzer Adve Calabration A 801517 Str.1.32015 Secture Analyzer Agent E44058 M14252012 317/2009 Str10218 Adve Calabration A 800507 Coulde Reg inton Anatoma E100 3118 E311-1138 111/102018 Adve Calabration A 800507 Coulde Reg inton Anatoma E100 3118 E311-1138 111/102018 Adve Calabration A 801507 Secture Anatoma E400 MM MM WED 1002117 Adve Calabration A 80159 Bioin Anatoma E100 3118 E0003738 61202009 4120210 Adve Calabration A 80159 Bioin Anatoma E100 Type Test Occupied Bandwidth (6dB & 20dB) 1002010 Adve Calabration A 80159 Secture Anatoma	Asset # Description Unterfacture Description Cal Date Description C 000221 Spectrum Analyzer AP E4477 US3980256 SPECIDE Active Calibration E 86015 317:13 2016 Active Calibration SPECIDE Active Calibration E 86015 317:13 2016 Active Calibration SPECIDE Active Calibration A 86007 Duble Rige Introm Analyzer Apliet SPECIDE Active Calibration A 86007 Duble Rige Introm Analyzer Apliet SPECIDE SPECIDE Active Calibration A 86007 Duble Rige Introm Analyzer Apliet SPECIDE SPECIDE Active Calibration A 86007 Duble Rige Introm Analyzer Apliet SPECIDE SPECIDE Active Calibration A 86007 Duble Rige Introm Analyzer Apliet SPECIDE SPECIDE Active Calibration A 86014 Introm Analyzer Apliet SPECIDE SPECIDE Active Calibration E 80017 Duble Rige Introm Analyzer Apliet SPECIDE Active Calibrat	Date :	29-Sep-2010	Type Test	Spurious Emiss	sions		Job #	: <u>C-884</u>	-
C 0002010 Spectrum Analyzer A 409149 Preasetox Spectrum Analyzer Applet Preasetox Spectrum Analyzer Applet Spectrum A	LC 000210 Dectrum Analyzer P E44078 US3810526 340009 Antre Cammain A 80143 Presenter Apient E44078 US3810526 340209 940010 Antre Cammain EE 60151 Th:13.2016 Antre Cammain Apient E44456 Mr4252010 77/2009 Antre Cammain A 80007 Duale Rogetion Antona E100 3115 8911-4138 11/102019 Antre Cammain A 80007 Duale Rogetion Antona E100 3116 8971-4380 11/102019 Antre Cammain A 80007 Duale Rogetion Antona E100 3116 8971-4386 11/102009 Antre Cammain A 80007 Duale Rogetion Antona E100 3116 8971-4386 11/102019 Antre Cammain A 80007 Duale Rogetion Antona E100 3116 8971-4386 11/102019 Antre Cammain A 80007 Duale Rogetion Antona E100 S116 80010 10/20209 Antre Cammain A 80010 Duale Rogetion Antona E100 Type Test: Occupied Bandwidth (688 & 20459 10/20209 10/2019 Antre Cammai	Prepared By:	Peter	Customer :	LSR			Quote #	310117	_
CC 0002010 Spectrum Analyzer HP E44778 US3816028 Sec000 Active Caluration A 490143 Presenter Agental Micro2005 Sin2000 Sin2000 Active Caluration EE 601157 Thir13.2010 Active Caluration Active Caluration Active Caluration AA 80070 Duale Roge from Antenna EUCO Sin44 Mir4220223 Sin72009 Active Caluration AA 80071 Duale Roge from Antenna EUCO Sin44 Sin4452010 Tri22010 Active Caluration AA 80071 Duale Roge from Antenna EUCO Sin44 Sin4202009 1/202009 Active Caluration AA 80071 Duale Roge from Antenna EUCO Sin44 Sin4202009 1/202009 Active Caluration AA 80151 Duale Roge from Antenna EUCO Sin44 Sin44 Active Caluration Active Caluration AA 80151 Duale Roge from Antenna EUCO Sin44 Sin44 Active Caluration Active Caluration AA 80151 Buale Roge from Antenna EUCO Caluration Active Caluration Active Caluration CC 0002210 <td>LC 00021C Secture Analyzer PP £4478 US3816025 340205 340205 Anter Cammelie A 80143 Mastria Gene £44078 US3816025 316205 340205</td> <td>1</td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>	LC 00021C Secture Analyzer PP £4478 US3816025 340205 340205 Anter Cammelie A 80143 Mastria Gene £44078 US3816025 316205 340205	1	-							
A 8013 E 80157 A 80070 A 80070	A 80131 Best Nr. See to D1101 108.05.84519 Apent 44456.000 B102009 B102009 B102009 B102009 B102009 B102009 B102009 B102009 B102009 B102009 B102009 B102009 B102009 B102009 B000 R0ge Hom Atenna E1CO B115 B000 R0ge Hom Atenna E1CO B000007 B000033338 B1102009 B10200									
E 6 00157 391-13 2012 Spectrum Analyzer Aglent E4445.4	E E 60107 M1-13-20162 Spectrum Analyzer Apert Apert M142502203 M172009 Andre Cabronion AA 80070 Daule Rage from Anteina EUCO 3115 S9114138 11/102016 Andre Cabronion AA 80071 Daule Rage from Anteina EUCO 3116 S9114138 11/102016 Andre Cabronion AA 80071 Daule Rage from Anteina EUCO 3116 697 12220001 Actre Cabronion AA 80071 Daule Rage from Anteina EUCO 3116 697 12220010 Actre Cabronion AA 80174 Daule Rage from Anteina EUCO 3116 697 12220001 1220010 Actre Cabronion AA 80174 Daule Rage from Anteina EUCO Type Test Cocupied Bandwidth (6dB & 20dP) Jole 1 CABR 4 Progares By Peter Customer LSR Quole # 31017 C C 0002216 Darde Cabronion Marketcutztr Moser U Market Cabronion C C 0002216 Darde Cabronion Marketcutztr Moser U S102005 S102016 Achre Cabronion C 0002216 Peter Darde Cabronion		Spectrum Analyzer	HP	E4407B		3/9/2009	3/9/2010	Active Calibration	
EE 60153 BF Presenteriar Agient 10039.4 M1/4520110 7/202010 Actor Calkination A 800070 Log Pendoc Antenna EUCO 9114 9714435 101120209 11010209 Actor Calkination A 800070 Log Pendoc Antenna EUCO 9114 9714435 1011202009 12022009 Actor Calkination A 800170 Deve Right Finan Antenna EUCO 9114 9714435 1011202009 12022009 Actor Calkination A 800170 Deve Stantenna EUCO 9114 970410 12022009 12022010 Actor Calkination A 800171 Presenter Orace EUO1001072 950073 950073 Actor Calkination E 900170 Date 15-Un-2010 Type Test: Occupied Bandwidth (6dB & 20dB) Jub # : C-884 Jub # : C-884 E 900170 Stantena Use # E4078 US984025 3902010 Actor Calkination A 80141 Maaufacturer Use # E4078 US984025 3902010 Actor Calkination A 80141 Maaufacturer Use # E4078 US984025 3902010 Actore Calkination <	EE 60138 RF Presenter Agient N003A M14452010 720209 Active Calibration A 800070 Log Periods Antenna EUCO 3116 93114.35 11016209 110162010 Active Calibration A 800070 Log Periods Antenna EUCO 3116 97014.455 110162009 11026200 Active Calibration A 800170 Double Rige fram Antenna EUCO 3116 97014.455 110162009 Active Calibration A 800174 Presenter Gore EUCO0010170 500073 60262009 512622010 Active Calibration A 800174 Presenter Gore EUCID010170 500073 60273 61262010 Active Calibration A 800174 Presenter Customer: LSR Oute # 210117 Oute # 210117 Sector Description Manufacturer: LSR Oute # 210117 Oute # 210117 Sector Description Manufacturer: LSR Oute # 210117 Oute # 210117 CO 000210 Sector Sector Sector Sector Sector Active Calibration CO 000210	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	9/16/2009	9/16/2010	Active Calibration	
AA 88007 Double Rigge Hom Antenna EUCO 3115 93114133 11/102010 Ache Calkination AA 88007 Double Rigge Hom Antenna EUCO 3115 9071-495 10/22020 Ache Calkination AA 880081 Double Rigge Hom Antenna EUCO 3115 9071-495 10/22020 Ache Calkination AA 880140 Double Rigge Hom Antenna EUCO 3115 9071-495 10/220209 4/2002010 Ache Calkination AA 88104 Peak-Ang Gore EUODID10720 500373 6/25/2010 Ache Calkination AA 88104 Dise Stressenettic Gore EUODID10720 500373 6/25/2010 Ache Calkination Markets Gore EUODID10720 500373 6/25/2010 Ache Calkination Markets Gore EUR Lot Lot 2.0012 Ache Calkination Markets Gore EUR Cal Date Cal Date Euroment Status Date 10010170 Status Date 10010170 Achee Calkination Ada 80141 Markets Gore Euroment LSR Cal Date Cal Date Euroment Status <td>AA 80070 Duble Roge trom Antenna EUCO 3115 931141.38 11/102010 Active Calibration AA 80071 Duble Roge trom Antenna EUCO 3116 9971-4358 10/102009 Active Calibration AA 80071 Duble Roge trom Antenna EUCO 3116 6971 12/22/2019 Active Calibration AA 80174 Duble Roge trom Antenna EUCO 3116 6971 12/22/2019 Active Calibration AA 80174 Duble Roge trom Antenna EUCO 3116 6071 12/22/2019 Active Calibration AA 80174 Duble Roge trom Antenna EUCO 3116 6071 12/22/2019 Active Calibration Construction Type Test: Occupied Bandwidth (6dB & 20dB) Jos # : C-884 </td> <td>EE 960157</td> <td>3Hz-13.2GHz Spectrum Analyzer</td> <td>Agilent</td> <td>E4445A</td> <td>MY48250225</td> <td>3/17/2009</td> <td>3/17/2010</td> <td>Active Calibration</td> <td></td>	AA 80070 Duble Roge trom Antenna EUCO 3115 931141.38 11/102010 Active Calibration AA 80071 Duble Roge trom Antenna EUCO 3116 9971-4358 10/102009 Active Calibration AA 80071 Duble Roge trom Antenna EUCO 3116 6971 12/22/2019 Active Calibration AA 80174 Duble Roge trom Antenna EUCO 3116 6971 12/22/2019 Active Calibration AA 80174 Duble Roge trom Antenna EUCO 3116 6071 12/22/2019 Active Calibration AA 80174 Duble Roge trom Antenna EUCO 3116 6071 12/22/2019 Active Calibration Construction Type Test: Occupied Bandwidth (6dB & 20dB) Jos # : C-884	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	3/17/2009	3/17/2010	Active Calibration	
A 4 8907 A 4 9907 A 4 9907 A 4 9907 A 4 9907 A 4 9907 A 4 9907 B 0 004 B 4 0 0 4 8 4 4 1 10 10 0 0 1 0 4 4 0 4 2 8 4 4 1 10 10 0 0 1 0 4 4 0 4 2 8 4 4 4 1 10 10 0 1 0 4 4 0 4 2 8 4 4 4 1 10 10 0 1 0 10 10 0 4 4 0 4 2 8 4 4 4 1 10 10 0 1 0 10 10 0 1 0 10 10 0 0 1 0 10 1	A 4 8007 A 9007 A 9	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	7/2/2009	7/2/2010	Active Calibration	
A 480075 Log Berolde Antenna EUCQ 8148 8701-4855 10/16/2010 Active Calibration A 480015 Duble Ridge Hum Antenna EUCQ 8146 8007 1/22/2006 Active Calibration A 480015 Duble Ridge Hum Antenna EUCQ 3115 8007 1/22/2006 Active Calibration A 4800150 Bion Antenna ETS 31108 8003-33-46 11/0/2009 11/0/2010 Active Calibration A 480150 Bion Antenna ETS 31108 0003-33-46 11/0/2019 Active Calibration View Fischer Customer LSR Guote # 310117	A 48073 A 48075 A 48075 A 48075 A 48075 A 48074 A 48074 B		Double Ridge Horn Antenna					11/10/2010	Active Calibration	
AA 80031 AA 80114 AA 8014	AA 80031 AA 80011 AA 80014 Dup Begings Horn Antenna EUO ACK MOV Gree 3115 E001070720 6007 13220209 12222010 2222010 4252009 Active Calibration Active Calibration AA 80010 Sign Antenna ETS 31108 0003.33.45 11/32009 12222010 4252009 Active Calibration AA 80010 Sign Antenna ETS 31108 0003.33.45 11/32009 Active Calibration AA 80010 Sign Antenna ETS 31108 0003.33.45 11/32009 Active Calibration AA 80010 Sign Antenna ETS 31108 0003.33.45 11/32009 Active Calibration Mass 15 Description Type Test: Occupied Bandwidth (6dB & 20dB) Joe # C-884 Outle # 310117 CC 0002210 Sector Anave Calibration Haw/racturer Mode# # SireCoop SireCoop SireCoop SireCoop View Filse Product Development EE 90073 Sector Anave Calibration SireCoop SireCoop<									
EE 8017 A 49014 A 490140 A 40010 E 000 1010 102 Bicon Antenna Adv. Nicro W. Ala2 E 000 1010 102 Bicon Antenna Adv. Nicro E 000 1010 102 Bicon Antenna 2/232009 E 2023009 Bicon Antenna 2/282009 Bicon Antenna 2/282010 Adve Calibration	EE 8047 A 48014 A 48014 Bion Anterna Pre-Arry Gore ETS Autor Status Status ETS 1132101 Status Status ETS 1132101 Status									
A 4 801919 PhaseNex Gore EU01 D010720 \$00373 625/2010 Active Caluration EVEN Exclamational ETS 31108 0003-3348 11/3/2009 11/3/2010 Active Caluration EVEN EXCLAMATIONAL Diversionment Exclamation Type Test: Occupied Bandwidth (60B & 20dB) Job # : C-884 Propriet By: featre Customer: LSR Oute # : 31017 2 Asset # Description Adve Caluration Status A 40014 Status Calurate Adve Caluration Adve Caluration A 40014 Status Calurate Status Oute # : 31017 2 Status Calurate Model# Serial# Calurate Adve Caluration 4 40014 Status Calurate Model# Serial# Calurate Adve Caluration 4 40014 Status Calurate Status Status Status Adve Caluration C 000221C Spectrum Analyzer Aptent E4407B US49100268 9172010 Adve Caluration A 40014 Model# Status	A 480101 Pisasterk Ore EU010010720 S800373 6252009 6252010 Ache Caloration A 480101 Bion Anterna ETS 31198 0003.33.4 11/32009 11/32010 Achee Caloration A 480101 Bion Anterna ETS 31198 0003.33.4 11/32009 11/32010 Achee Caloration A 480101 Bion Anterna ETS 31198 0003.33.4 11/32009 11/32010 Achee Caloration Date : 15-Jun-2010 Type Test: Occupied Bandwidth (6dB & 20dB) Job # : C-884 0uote # 310117 C0 000210 Spectrum Analyzer HP E44717 U35100268 316/2009 316/201 Achee Caloration A 80014 Prepared By: Peter Customer: LSR Cal Date Calorate Calorate <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td>									
2 A 489190 Bicon Antenna ETS 31108 0003-3348 11/3/2009 11/3/2010 Active Calibration EVENENESS Product Columnent Equipment Calibration Date :: 15-Jun-2010 Type Test : Occupied Bandwidth (6dB & 20dB) Job # : C-884 Prepared By: Peter Customer: LSR Outle # : 310117 2 Asset # Description Manufacturer Model # Sarai # Cal Date Cal Date Equipment Status C0: 0002210 Spectrum Analyzer HP E4407B U339160226 SiPi2010 Active Calibration A1960143 Spectrum Analyzer Aglent E4402A U345500564 Si772006 Si72010 Active Calibration A200107 Spectrum Analyzer Aglent E4402A U345500564 Si772006 Si72010 Active Calibration EE 900173 Spectrum Analyzer Aglent EA402A U345500564 Si772006 Si772010 Active Calibration C0 C02002210 Type Test : Conducted Power Output Job # : C-884	A 48010 Biton Antenna ETS 31108 0003-3348 11/3/2019 11/3/2019 Active Calibration Date: LSUIL Second Date Colume # Column #									
Description Type Test: Conducted Power Output Job #: 15-000-201 Asset # Description Manufacturer Model # Status COC000221C Spectrum Analyzer HP E44078 US38180256 SPA2010 Active Calibration COC000221C Spectrum Analyzer HP E44078 US38180256 SPA2010 Active Calibration Asset # Description Manufacturer Model # Status SPA2010 Active Calibration Asset # Description Manufacturer Model # Status SPA2010 Active Calibration Asset # Description Manufacturer Model # Status SPA2010 Active Calibration Massetex Gore EXOTID0104.80 S548519 SPA2010 Active Calibration Massetex Gore EXOTID0104.80 S548519 SPA2010 Active Calibration Massetex Gore EXOTID0104.80 S548519 SPA2010 Active Calibration Coloco Massetex Gore EXOTID0104.80 S548519 SPA2010 Active Calibration Coc00002210	Description Type Test: Occupied Bandwidth (8dB & 20dB) Job #: C-884 Prepared By: fefar Customer: LSR Outle #: 310117 Image: Sescription Manufacturer: Mode# Sescription Active Calibration Image: Sescription Manufacturer: Mode# Sescription Active Calibration Image: Sescription Manufacturer: Mode# Sescription Secription Active Calibration Image: Sescription Manufacturer: Mode# Seription Secription Active Calibration Image: Secription Active Calibration Active Calibration Active Calibration Image: Secription Active Calibration Manufacturer: Mode# Secription Active Calibration Image: Secription Type Test: Conducted Power Output Job #: C-884 Secription Active Calibration Image: Secription Type Test: Conducted Power Output Job #: C-884 Secription Active Calibration Secription Active Calibration Secription Active Calibration Secription									
Wrightess Product Divelopment Calibration Date::::::::::::::::::::::::::::::::::::	Wrighess Product Development Wrighess Product Development to the server serve	U AA 960150	bicon Antenna	EIS	3110B	0003-3346	11/3/2009	11/3/2010	Active Calibration	
CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2010 Active Calibration AA 960143 Phaseflex Gere EK001D01048.0 546519 9/9/8/2010 Active Calibration AA 960144 Phaseflex Gere EK001D010720 5800373 6/25/2009 9/17/2010 Active Calibration AA 960144 Phaseflex Gore EK001D010720 5800373 6/25/2009 6/25/2010 Active Calibration Wireless Product Development Equipment Calibration Type Test: Conducted Power Output Job #: C-884 Prepared By: Peter Customer: LSR Quote #: 31017 A 980143 Phaseflex Gore EK001D01048.0 546519 9/16/2009 3/6/2010 Active Calibration AA 980143 Phaseflex Gore EK001D01048.0 546519 9/16/2009 3/6/2010 Active Calibration C0 0002210 Spectrum Analyzer Aglent E4407B US39160256 9/16/2019 3/6/2010 Active Calibration A	CC 000221C Spectrum Analyzer HP E44075 US38160256 3/9/2010 Active Calibration AA 90143 Phaseffex Gore EX001D01048.0 S544519 9/16/2009 9/16/2010 Active Calibration AA 90143 Phaseffex Gore EX001D01048.0 S544519 9/17/2009 9/17/2010 Active Calibration AA 90144 Phaseffex Gore EX001D010720 S800373 6/25/2009 6/25/2010 Active Calibration Exercises Product Development Calibration Equipment Calibration Type Test: Conducted Power Output Job #: C-884 Prepared By: Peter Customer: LSR Quote #: 31/17 A 9/0143 Phaseffex Gore EX001D01048.0 S54519 9/16/2009 9/16/2010 Active Calibration ACC 000221C Spectrum Analyzer HP E44078 U3300564 9/17/2009 3/9/2010 Active Calibration AS 90143 Phaseffex Gore EX001D01048.0 S54519 9/17/2009 3/9/2010 Active Calibration					width (6dB & 20d	3)	_		-
CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration AA 860143 Phaseflex Gore EX001D01048.0 546519 5/9/62010 Active Calibration AA 860144 Phaseflex Gore EX001D010720 5800373 6/25/2009 6/25/2010 Active Calibration AS 80144 Phaseflex Gore EX001D010720 5800373 6/25/2009 6/25/2010 Active Calibration AS 80144 Phaseflex Gore EX001D010720 5800373 6/25/2009 6/25/2010 Active Calibration View Felss Product Development Equipment Calibration Active Calibration Active Calibration AA 860143 Phaseflex Customer: LSR Quote # 31017 A 860143 Phaseflex Gore EK001D01048.0 5546519 9/16/2009 3/9/2010 Active Calibration AA 860144 Phaseflex Gore EK001D01048.0 5546519 9/16/2009 3/9/2010 Active Calibration AA 8601	CC 0002210 Spectrum Analyzer HP E44076 US3110226 3/9/2010 Active Calibration AA 960143 Phaseffex Gore EK001D01048.0 5548519 9/16/2009 9/	o. Asset#	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status	
EE 980073 A 98014 Spectrum Analyzer Phaseflex Aglent Gore E4486. US45300564 S00373 9/17/200 6/25/2019 Active Calibration Image: Second Control Contrecont Contente Control Control Control Contrecont Contr	EE 980073 A 80114 Spectrum Analyzer Phaseffex Aglent Gore E448A EX010010720 US4500564 5800373 917/2009 625/2010 917/2010 625/2010 Active Calibration	CC 000221C	Spectrum Analyzer	HP	E4407B	US39160256	3/9/2009	3/9/2010	Active Calibration	
AA 980144 Phaseflex Gore EXD01D010720 5800373 6/25/2019 Active Calibration Det: S-Jun-2010 Type Test: Conducted Power Output Job #: C-884 Prepared By: Peter Customer: LSR Quote #: 310117 0. Asset# Description Manufacturer Model# Serial# Cal Date Cal Due Date Equipment Status AA 960143 Phaseflex Gore EXD01D01048.0 S548519 9/16/2019 Active Calibration AA 960143 Phaseflex Gore EXD01D01048.0 S548519 9/16/2019 Active Calibration AA 960143 Phaseflex Gore EXD01D01048.0 S548519 9/16/2019 Active Calibration CC 000221C Spectrum Analyzer Aplent E4407B US39160256 3/9/2019 Active Calibration Ay 901144 Phaseflex Gore KD01D010720 S800373 6/25/2009 6/25/2010 Active Calibration Mirel Baseflex Gore KD01D010720 S800373 6/25/2009 6/25/2010 Active Calibration Mirel Basef	AA 980144 Phaseflex Gree EXD01010720 \$800373 6/25/2019 6/25/2010 Active Calibration Image: Source Calibration Image: Source Calibration Image: Source Calibration Job #: C-884 Image: Colored Calibration Image: Source Calibration Manufacturer Model# Serie # Calibration Calibration Image: Source Calibration Manufacturer Model# Serie # Calibrate Calibrate Calibration Image: Source Calibration Manufacturer Model# Serie # Calibrate Calibration Image: Source Calibration Manufacturer Model# Serie # Calibrate Calibration Image: Source Calibration Manufacturer Model# Serie # Calibrate Calibration Image: Source Calibration Manufacturer Model# Serie # Calibrate Calibration Image: Source Calibration Source Exponduct Development Editor States States States Image: Source Calibration Source Exponduct Development Calibration States State	AA 960143	Phaseflex	Gore	EKD01D01048.0	5546519	9/16/2009	9/16/2010	Active Calibration	
AA 980144 Phaseftex Gore Ek D01D010720 5800373 6/25/2009 6/25/2010 Active Calibration Virteless Product Development Equipment Calibration Date: 5-Jun-2010 Type Test: Conducted Power Output Job #: C-884 Prepared By: Peter Customer: LSR Quote #: 310117 A A 980143 Phaseffex Gore EKD01D01040.0 5548519 9/16/2010 Active Calibration AA 980143 Phaseffex Gore EKD01D01040.0 5548519 9/16/2010 Active Calibration AA 980143 Phaseffex Gore EKD01D01040.0 5548519 9/16/2010 Active Calibration C C 000221C Spectrum Analyzer ApleInt E4407B US39160256 3/9/2010 Active Calibration E 980073 Spectrum Analyzer ApleInt E4407B US39160256 3/9/2010 Active Calibration E 980075 Spectrum Analyzer ApleInt E4407B US39160256 3/9/2010 Active Calibration Dest: 15-Jun-2010 Type Test: Power Spectral Density Job #: C-884	AA 980144 Phaseflex Gine EXD01010720 5800373 6/25/2019 6/25/2010 Active Calibration Image: S-Jun-2010 Type Test: Conducted Power Output Job #: C-884 Prepared By: Peter Customer: LSR Quote #: 310117 2 Asset# Description Mainfacturer Model# Serial # Cal Date Equipment Calibration AA 980143 Phaseflex Gone EKD01D01048.0 \$549519 39/2009 39/16/2010 Active Calibration AA 980143 Phaseflex Gone EKD01D01048.0 \$549519 39/2009 39/16/2010 Active Calibration C0 0002210 Spectrum Analyzer Aglient E4446A U345300564 9/17/2009 9/17/2010 Active Calibration MA 80144 Phaseflex Gore EkD010010720 5800373 8/25/2009 8/25/2010 Active Calibration Maselit4 Prepared By: Peter Customer: Ls User User : C-884 Prepared By: Peter Customer: <t< td=""><td>EE 960073</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	EE 960073								
Date: 5-Jun-2010 Type Test: Conducted Power Output Job #: C-884 Prepared By: Peter Customer: LSR Quote #: 310117 A Asset # Description Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status CO Operation Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status A Asset # Description Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status CO Operation Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status AAsset # Description Gore EKD01D01048.0 S546519 91/62209 91/822010 Active Calibration AAsset # Description Gore EkD01D010720 S800373 6/25/2009 91/822010 Active Calibration Vireless Product Development Calibration Gore EkD01D010720 S800373 6/25/2009 6/25/2010 Active Calibration Date: 15-Jun-2010 Type Test: Prower Spectr	Image: Second Development Calibration Date: 5-Jun-2010 Type Test: Conducted Power Output Job #: C-884 Prepared By: Peter Customer: LSR Quote #: 310117 A Asset # Description Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status AA 980143 Phaseflex Gore EX001001048.0 5546519 9/162010 Active Calibration CC 000221C Spectrum Analyzer HP E44078 U339160256 3/9/2009 9/15/2010 Active Calibration E 960073 Spectrum Analyzer Agilent E44078 U34300584 9/17/2009 9/17/2010 Active Calibration E 960073 Spectrum Analyzer Agilent E44078 U34300584 9/17/2010 Active Calibration E 960073 Spectrum Analyzer Customer: LSR Dest: 15-Jun-2010 Active Calibration Date: 15-Jun-2010 Type Test: Power Spectral Density Job #: C-884 Dest: 310117 Prepared By: Peter Customer: LSR Quote #: 310117 Dest #: 301017 Dest #: 30017 Spectrum Analyzer HP E44078 U339160256		Spectrum Analyzer	Agilent	E4446A	US45300564	9/17/2009		Active Calibration	
o. Asset # Description Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status AA 980143 Phaseflex Gore EKD01D01048.0 \$546519 9/16/2009 3/16/2009 3/16/2010 Active Calibration CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration EE 960073 Spectrum Analyzer Aglient E4448A US45300564 9/17/2009 9/17/2010 Active Calibration AA 960144 Phaseflex Gore EkD01D010720 5800373 6/25/2010 Active Calibration Experiment Calibration Date: 15-Jun-2010 Type Test: Power Spectral Density Job #: C-884 Prepared By: Peter Customer: LSR Quote #: 310117 c. Asset # Description Manufacturer Model # Serial # Cal Due Date Equipment Status CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration	o. Asset # Description Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status AA 960143 Phaseflex Gore EKD01D01048.0 5548519 9/16/2009 3/9/2010 Active Calibration CC 000221C Spectrum Analyzer HP E4407B US39160264 3/9/2009 3/9/2010 Active Calibration AA 980144 Phaseflex Gore EkD01D010720 5800373 6/25/2010 Active Calibration Vireless Product Development Equipment Calibration Type Test: Power Spectral Density Job # : C-884 Date : 15-Jun-2010 Type Test: Power Spectral Density Job # : C-884 Prepared By: Peter Customer: LSR Quote #: 310117 o. Asset # Description Manufacturer Model # Serial # Cal Date Cal Date Equipment Status CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2009 Active Calibration AA 960143 Phaseflex Gore EXD01D010148.0 5546519 9/16/2009 9/16/2009 9/16/2009 Active Cali	AA 960144						9/17/2010		
AA 960143 Phaseflex Gore EKD01D01048.0 5548519 9/16/2009 9/16/2010 Active Calibration CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2010 Active Calibration EE 960073 Spectrum Analyzer Aglient E4446A US45300564 9/17/2009 9/17/2010 Active Calibration AA 960144 Phaseflex Gore EK001D010720 5800373 6/25/2019 Active Calibration Vireless Product Development Equipment Calibration Type Test: Power Spectral Density Job # : C-884 Prepared By: Peter Customer : LSR Quote #: 310117 a. Asset # Description Manufacturer Model# Serial # Cal Due Date Equipment Status CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2010 Active Calibration	AA 960143 Phaseflex Gore EKD01D01048.0 5546519 9/16/2009 9/16/2010 Active Calibration CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration EE 960073 Spectrum Analyzer Aglient E4446A US45300564 9/17/2010 Active Calibration AA 960144 Phaseflex Gore EkD01D010720 5800373 6/25/2009 9/25/2010 Active Calibration Vireless Product Development Equipment Calibration Date : 15-Jun-2010 Type Test : Power Spectral Density Job # : C-884 Prepared By: Peter Customer : LSR Quote #: 310117 c. Asset # Description Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status AG 960143 Phaseflex Gore EKD01D01048.0 5546519 9/16/2009 9/16/2010 Active Calibration	LS RE Wireless Equi	Phaseflex SEARCH LLC Product Development pment Calibration	Gore	EkD01D010720	5800373		9/17/2010 6/25/2010	Active Calibration	-
AA 960143 Phaseflex Gore EKD01D01048.0 5546519 9/16/2009 9/16/2010 Active Calibration CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2010 Active Calibration EE 960073 Spectrum Analyzer Aglient E4446A US45300564 9/17/2009 9/17/2010 Active Calibration AA 960144 Phaseflex Gore Ek001D010720 5800373 6/25/2019 Active Calibration Vireless Product Development Equipment Calibration Type Test: Power Spectral Density Job # : C-884 Prepared By: Peter Customer : LSR Quote #: 310117 2. Asset # Description Manufacturer Model # Serial # Cal Due Date Equipment Status CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2010 Active Calibration	AA 960143 Phaseflex Gore EKD01D01048.0 5546519 9/16/2009 9/18/2010 Active Calibration CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration EE 960073 Spectrum Analyzer Agilent E4446A US45300564 9/17/2009 9/17/2010 Active Calibration AA 960144 Phaseflex Gore EKD01D010720 5800373 6/25/2009 6/25/2010 Active Calibration Wireless Product Development Equipment Calibration Type Test : Power Spectral Density Job # : C-884 Job # : C-884 Prepared By: Peter Customer : LSR Quote #: 310117 2. Asset # Description Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status AA 960143 Phaseflex Gore EK001D01048.0 5546519 9/16/2009 9/16/2010 Active Calibration	LS RE Wireless Equi	Phaseflex SEARCH LLC Product Development pment Calibration 5-Jun-2010	Gore	EkD01D010720	5800373		9/17/2010 6/25/2010 Job #	Active Calibration	-
CC 000221C EE 980073 AA 960144 Spectrum Analyzer HP E4407B 4glent US39160256 E4446A 3/9/2009 9/17/2009 3/9/2010 9/17/2010 Active Calibration Comparing the section of the sec	CC 000221C EE 980073 AA 960144 Spectrum Analyzer Phaseflex HP Aglient E4407B E4446A US39160256 US4300564 3/9/2009 9/17/2019 3/9/2010 9/17/2019 Active Calibration Active Calibration Image: Lis-Jun-2010 Type Test : Power Spectral Density Job # : C-884 Prepared By: Peter Customer : LSR Quote #: 310117 2. Asset # Description Manufacturer Model # Serial # Cal Date Cal Date Equipment Status C000221C A 990143 Spectrum Analyzer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration	Date :	Phaseflex SEARCH LLC Product Development pment Calibration 5-Jun-2010 Peter	Gore Type Test Customer :	EKD01D010720 <u>Conducted Pow</u> LSR	5800373 ver Output	6/25/2009	9/17/2010 6/25/2010 Job # Quote #	Active Calibration : <u>C-884</u> : <u>310117</u>	-
EE 960073 AA 960144 Spectrum Analyzer Phaseflex Aglient Gore E446A EK001D010720 US45300564 5800373 9/17/2019 6/25/2019 Active Calibration Image: Spectrum Analyzer Aglient Gore EK001D010720 5800373 6/25/2009 6/25/2010 Active Calibration Image: Date : Image:	EE 960073 AA 960144 Spectrum Analyzer Phaseflex Agilent Gore E4446A US45300564 9/17/2009 9/17/2010 Active Calibration Image: Description By: Execution Calibration Gore EVENT Second Gore E4401D010720 Second Gore Gore E4401D010720 Second Gore	Date : Prepared By:	Phaseflex SEARCH LLC Product Development prment Calibration 5-Jun-2010 Peter Description	Gore Type Test Customer : Manufacturer	EkD01D010720 Conducted Pow LSR Model #	5800373 ver Output	6/25/2009 Cal Date	9/17/2010 6/25/2010 Job # Quote # Cal Due Date	Active Calibration : C-884 : 310117 Equipment Status	-
AA 960144 Phaseflex Gore EkD01D010720 5800373 6/25/2009 6/25/2010 Active Calibration Image: Second and the sevel opment Equipment Calibration Type Test: Power Spectral Density Job #: C-884 Image: Date : 15-Jun-2010 Type Test: Power Spectral Density Job #: C-884 Prepared By: Peter Customer: LSR Image: Asset # Description Manufacturer Model # Serial # Cal Due to the Equipment Status CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration	AA 960144 Phaseflex Gore EkD01D010720 5800373 6/25/2009 6/25/2010 Active Calibration Image: Second and the	Date : Prepared By: A 960143	Phaseflex SEARCH LLC Product Development S-Jun-2010 Peter Description Phaseflex	Gore Type Test Customer : Manufacturer Gore	EKD01D010720 : Conducted Pow LSR Model # EKD01D01048.0	5800373 ver Output	6/25/2009 Cal Date 9/16/2009	9/17/2010 6/25/2010 Job # Quote # Quote # 9/16/2010	Active Calibration : C-884 : <u>310117</u> Equipment Status Active Calibration	-
Date: 15-Jun-2010 Type Test: Power Spectral Density Job #: C-884 Prepared By: Peter Customer: LSR Quote #: 310117 2. Asset # Description Manufacturer Model # Serial # Cal Due Cal Due Date Equipment Status CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration	Date: 15-Jun-2010 Type Test: Power Spectral Density Job #: C-884 Prepared By: Peter Customer: LSR Quote #: 310117 2. Asset # Description Manufacturer Model # Serial # Cal Date Cal Date Equipment Status 2. Asset # Description Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status 2. Asset # Description Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status 2. Asset # Description Manufacturer Model # US39160256 3/9/2009 3/9/2010 Active Calibration 2. Asset # Description Manufacturer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration 2. Serieturum Analyzer HP E4407B US39160256 9/17/2010 Active Calibration 2. Serieturum Analyzer Aglient E4446A US45300564 9/17/2010 Active Calibration	Date : Prepared By: AA 960143 CC 000221C	Phaseflex SEARCH LLC Product Development priment Calibration S-Jun-2010 Peter Description Phaseflex Spectrum Analyzer	Gore Type Test Customer : Manufacturer Gore HP	EkD01D010720	5800373 /er Output 	6/25/2009	9/17/2010 6/25/2010 Job # Quote # Cal Due Date 9/16/2010 3/9/2010	Active Calibration : C-884 : 310117 Equipment Status Active Calibration Active Calibration	-
Wireless Product Development Equipment Calibration Date: 15-Jun-2010 Prepared By: Peter Customer: LSR Quote #: 310117 Asset # Description Manufacturer Model # Serial # Cal Due Date Equipment Status CC 000221C Spectrum Analyzer	Wireless Product Development Equipment Calibration Date: 15-Jun-2010 Type Test: Power Spectral Density Job #: C-884 Prepared By: Peter Customer: LSR Quote #: 310117 Asset # Description Manufacturer Model # Sect # Description Manufacturer Model # Sect # Description Asset # Description Kaset # Description Manufacturer Model # Section Manufacturer Model # Serial # Cal Date CC 000221C Spectrum Analyzer HP E4407B US39180256 3/9/2009 3/9/2010 AA 980143 Phasefex Gore EK001D01048.0 5548519 9/17/2009 9/17/2010 EE 960073 Spectrum Analyzer Agilent E4446A US45300564 9/17/2009 9/17/2010 Active Calibration	A 960143 CC 000221C EE 960073	Phaseflex SEARCH LLC Product Development pment Calibration 5-Jun-2010 Peter Description Phaseflex Spectrum Analyzer Spectrum Analyzer	Gore Type Test Customer : Manufacturer Gore HP Agilent	EkD01D010720 : <u>Conducted Pow</u> LSR Model # EKD01D01048.0 E4407B E4448A	5800373 ver Output Serial # 5546519 US39160256 US45300564	6/25/2009 Cal Date 9/16/2009 3/9/2009 9/17/2009	9/17/2010 6/25/2010 Job # Quote # 9/18/2010 3/9/2010 9/17/2010	Active Calibration : C-884 : 310117 Equipment Status Active Calibration Active Calibration	-
Prepared By: Peter Customer : LSR Quote #: 310117 0. Asset # Description Manufacturer Model # Serial # Cal Due Date Equipment Status CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration	Prepared By: Peter Customer : LSR Quote #: 310117 b. Asset # Description Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status CC 0000221C Spectrum Analyzer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration AA 960143 Phaseflex Gore EK001D01048.0 5546519 9/16/2010 Active Calibration EE 960073 Spectrum Analyzer Agilent E4446A US45300564 9/17/2009 9/17/2010 Active Calibration	Date : Prepared By: A 990143 CC 000221C EE 960073	Phaseflex SEARCH LLC Product Development pment Calibration 5-Jun-2010 Peter Description Phaseflex Spectrum Analyzer Spectrum Analyzer	Gore Type Test Customer : Manufacturer Gore HP Agilent	EkD01D010720 : <u>Conducted Pow</u> LSR Model # EKD01D01048.0 E4407B E4448A	5800373 ver Output Serial # 5546519 US39160256 US45300564	6/25/2009 Cal Date 9/16/2009 3/9/2009 9/17/2009	9/17/2010 6/25/2010 Job # Quote # 9/18/2010 3/9/2010 9/17/2010	Active Calibration : C-884 : 310117 Equipment Status Active Calibration Active Calibration	-
o. Asset # Description Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration	o. Asset # Description Manufacturer Model # Serial # Cal Date Cal Due Date Equipment Status CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2010 Active Calibration AA 960143 Phaseflex Gore EK001D01048.0 5546519 9/16/2010 Active Calibration EE 960073 Spectrum Analyzer Agilent E446A US45300564 9/17/2009 9/17/2010 Active Calibration	Constant Section 12 C	Phaseflex SEARCH LLC Product Development pment Calibration S-Jun-2010 Peter Description Phaseflex Spectrum Analyzer Phaseflex SEARCH LLC Product Development pment Calibration	Gore Type Test Customer : Manufacturer Gore HP Aglient Gore	EkD01D010720	5800373 ver Output Serial # 5546519 US39160256 US45300564 5800373	6/25/2009 Cal Date 9/16/2009 3/9/2009 9/17/2009	9/17/2010 6/25/2010 Job # Quote # 9/16/2010 3/9/2010 9/17/2010 6/25/2010	Active Calibration : C-884 : 310117 Equipment Status Active Calibration Active Calibration Active Calibration	-
CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration	CC 000221C Spectrum Analyzer HP E4407B US39160256 3/9/2009 3/9/2010 Active Calibration AA 960143 Phaseflex Gore EKD01D01048.0 5546519 9/16/2009 9/16/2010 Active Calibration EE 960073 Spectrum Analyzer Agilent E4446A US45300564 9/17/2009 9/17/2010 Active Calibration	A sect # A second A sect # A second A second Condect a A second Condect a A second Condect a Cond	Phaseflex SEARCH LLC Product Development priment Calibration S-Jun-2010 Peter Description Phaseflex Spectrum Analyzer Spectrum Analyzer Phaseflex SEARCH LLC Product Development priment Calibration 15-Jun-2010	Gore Type Test Customer : Manufacturer Gore HP Aglient Gore Type Test	EkD01D010720 Conducted Pow LSR Model # EKD01D01048.0 E44078 E44078 E44048 EkD01D010720 Power Spectral	5800373 ver Output Serial # 5546519 US39160256 US45300564 5800373	6/25/2009 Cal Date 9/16/2009 3/9/2009 9/17/2009	9/17/2010 6/25/2010 	Active Calibration C-884	-
	AA 960143 Phaseflex Gore EKD01D01048.0 5546519 9/16/2009 9/16/2010 Active Calibration EE 960073 Spectrum Analyzer Agilent E4446A US45300564 9/17/2009 9/17/2010 Active Calibration	Date : Prepared By: A 960143 CC 000221C EE 960073 AA 960144 CC 000221C EE 960073 CC 000221C EE 96073 CC 000221C EE 96075 CC 000221C EE 96075 CC 000221C EE 96075 CC 000221C EE 96075 EE 96075	Phaseflex SEARCH LLC Product Development priment Calibration S-Jun-2010 Peter Description Phaseflex Spectrum Analyzer Spectrum Analyzer Phaseflex SEARCH LLC Product Development priment Calibration 15-Jun-2010	Gore Type Test Customer : Manufacturer Gore HP Aglient Gore Type Test Customer :	EKD01D010720 Conducted Pow LSR Model # EKD01D01048.0 E4407B E4446A EkD01D010720 Power Spectral LSR	5800373 ver Output Serial # 5546519 US45300564 5800373 Density	6/25/2009 Cal Date 9/16/2009 3/9/2009 9/17/2009 6/25/2009	9/17/2010 6/25/2010 	Active Calibration C-884 310117 Equipment Status Active Calibration Active Calibration Active Calibration Active Calibration Active Calibration C-884 310117	-
	AA 960143 Phaseflex Gore EKD01D01048.0 5546519 9/16/2009 9/16/2010 Active Calibration EE 960073 Spectrum Analyzer Agilent E4446A US45300564 9/17/2009 9/17/2010 Active Calibration	Date : Prepared By: A 960143 CC 000221C EE 960073 AA 960144 Wireless Equil Date : Prepared By:	Phaseflex SEARCH LLC Product Development pment Calibration 5-Jun-2010 Peter Description Phaseflex Spectrum Analyzer Phaseflex SEARCH LLC product Development pment Calibration 15-Jun-2010 Peter	Gore Type Test Customer : Manufacturer Gore HP Aglient Gore Type Test Customer :	EKD01D010720 Conducted Pow LSR Model # EKD01D01048.0 E4407B E4446A EkD01D010720 Power Spectral LSR	5800373 ver Output Serial # 5546519 US45300564 5800373 Density	6/25/2009 Cal Date 9/16/2009 3/9/2009 9/17/2009 6/25/2009	9/17/2010 6/25/2010 	Active Calibration C-884 310117 Equipment Status Active Calibration Active Calibration Active Calibration Active Calibration Active Calibration C-884 310117	-
	EE 960073 Spectrum Analyzer Aglient E4446A US45300564 9/17/2009 9/17/2010 Active Calibration	A set # Date : Prepared By: Date : Prepared By: Date : Prepared By: Date :	Phaseflex SEARCH LLC s Product Development pment Calibration 5-Jun-2010 Peter Description Phaseflex Spectrum Analyzer Spectrum Analyzer Phaseflex Struct Development pment Calibration 15-Jun-2010 Peter Description	Gore Type Test Customer : Manufacturer Gore HP Aglient Gore Type Test Customer : Manufacturer	EkD01D010720	5800373 ver Output Serial # 5546519 US45300564 5800373 Density Serial #	6/25/2009 Cal Date 9/16/2009 3/9/2009 9/17/2009 6/25/2009 6/25/2009	9/17/2010 6/25/2010 	Active Calibration : C-884 : 310117 Equipment Status Active Calibration Active Calibration Active Calibration Active Calibration : C-884 : 310117 Equipment Status	-
		A 960143 CC 000221C EE 960073 AA 960144 CC 000221C EE 960073 AA 960144 Exception Date : Prepared By: Date : Prepared By: CC 000221C	Phaseflex SEARCH LLC Product Development pment Calibration 5-Jun-2010 Peter Description Phaseflex Spectrum Analyzer Phaseflex SEARCH LLC SProduct Development pment Calibration 15-Jun-2010 Peter Description Spectrum Analyzer	Gore Type Test Customer : Manufacturer Gore HP Aglient Gore Type Test Customer : Manufacturer HP Aglient	EkD01D010720	5800373 /er Output	6/25/2009 Cal Date 9/16/2009 3/9/2009 9/17/2009 6/25/2009 Cal Date 3/9/2009	9/17/2010 6/25/2010 	Active Calibration C-884 C-884 Calibration Active Calibration Active Calibration Active Calibration Active Calibration C-884 C-884 C-884 Calibration Active Calibration Active Calibration Active Calibration Active Calibration C-884 -	
		CC 200221C C2	Phaseflex SEARCH LLC Product Development pment Calibration S-Jun-2010 Peter Description Phaseflex Spectrum Analyzer Phaseflex SEARCH LLC Product Development pment Calibration 15-Jun-2010 Peter Description Spectrum Analyzer Phaseflex	Gore Type Test Customer : Manufacturer Gore HP Aglient Gore Type Test Customer : Manufacturer HP Gore	EkD01D010720	5800373 ver Output Serial # S548519 US39160256 US45300564 5800373 Density Serial # US39160256 S546519 US39160256	6/25/2009 Cal Date 9/16/2009 3/9/2009 9/17/2009 6/25/2009 Cal Date 2/9/2009 9/16/2009	9/17/2010 6/25/2010 	Active Calibration : C-884 : 310117 Equipment Status Active Calibration Active Calibration Active Calibration : C-884 : 310117 Equipment Status Active Calibration	-

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 104 of 108

LS RESEARCH LLC Wireless Product Development Equipment Calibration	
Date : 29-Sep-2010	Type Test : Band-Edge
Presented Drug Deter	Customer LSD

	Prepared By:	Peter	Customer :	LSR			Quote #:	310117
No. A	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1 E	E 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	3/17/2010	3/17/2011	Active Calibration
2 E	E 960158	RF Preselecter	Agilent	N9039A	MY46520110	7/2/2009	7/2/2010	Active Calibration
3 A	AA 960081	Double Ridge Horn Antenna	EMCO	3115	6907	12/22/2009	12/22/2010	Active Calibration

Job # : <u>C-884</u>

_

LS RESEARCH LLC Wireless Product Development Equipment Calibration

Quote #: 310117
Cal Date Cal Due Date Equipment Status
225 3/17/2009 3/17/2010 Active Calibration
110 7/2/2009 7/2/2010 Active Calibration
8 11/10/2009 11/10/2010 Active Calibration
5 10/16/2009 10/16/2010 Active Calibration
12/22/2009 12/22/2010 Active Calibration
12/28/2009 12/28/2010 Active Calibration
5



	Date	28-Sep-2010	Type Test :	Conducted AC Er	missions		Job # :	<u>C-884</u>
	Prepared By:	Peter	Customer :	LSR			Quote #:	310117
No.	Asset #	Description	Manufacturer	Model #	Serial #	Cal Date	Cal Due Date	Equipment Status
1	AA 960008	LISN	EMCO	3816/2NM	9701-1057	12/15/2009	12/15/2010	Active Calibration
2	EE 960157	3Hz-13.2GHz Spectrum Analyzer	Agilent	E4445A	MY48250225	3/17/2009	3/17/2010	Active Calibration
3	EE 960158	RF Preselecter	Agilent	N9039A	MY46520110	7/2/2009	7/2/2010	Active Calibration
4	AA 960072	Transient Limiter	HP	11947A	3107A01708	9/15/2009	10/15/2010	Active Calibration

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 105 of 108

STANDARD #	DATE	Am. 1	Am. 2
ANSI C63.4	2009		
ANSI C63.10	2009		
CISPR 11	2009-05	2009-12 P	
CISPR 12	2007-05		
CISPR 14-1	2005-11	2008-11	
CISPR 14-2	2001-11	2001-11	2008-05
CISPR 16-1-1 Note 1	2010-01		
CISPR 16-1-2 Note 1	2003	2004-04	2006-07
CISPR 22	2008-09		
CISPR 24	1997-09	2001-07	2002-10
EN 55011	2007-05		
EN 55014-1	2006		
EN 55014-2	1997		
EN 55022	2006	2007	
EN 60601-1-2	2007-03		
EN 61000-3-2	2006-05		
EN 61000-3-3	2008-12		
EN 61000-4-2	2009-05		
EN 61000-4-3	2006-07	2008-05	
EN 61000-4-4	2004		
EN 61000-4-5	2006-12		
EN 61000-4-6	2009-05		
EN 61000-4-8	1994	2001	
EN 61000-4-11	2004-10		
EN 61000-6-1	2007-02		
EN 61000-6-2	2005-12		
EN 61000-6-3	2007-02		
EN 61000-6-4	2007-02		
FCC 47 CFR, Parts 0-15,	2009		
18, 90, 95 FCC Public Notice DA 00-	2008		
1407	2000		
FCC ET Docket # 99-231	2002		
FCC Procedures	2007		
ICES 001	2006-06		
ICES 002	2009-08		
ICES 003	2004-02		
IEC 60601-1-2 Note 1	2007-03		
IEC 61000-3-2	2005-11	2008-03	2009-02
IEC 61000-3-3	2008-06		
IEC 61000-4-2	2008-12		0000 10
IEC 61000-4-3	2008-04	incl in 2008-04	2009-12 FD

APPENDIX B TEST STANDARDS – CURRENT PUBLICATION DATES RADIO

IT PUBLICATION DATES RADIO		-	
STANDARD #	DATE	Am. 1	Am. 2
IEC 61000-4-4	2004-07	2010-10	
IEC 61000-4-5	2005-11		
IEC 61000-4-6	2008-10		
IEC 61000-4-8	2009-09		
IEC 61000-4-11	2004-03		
IEC 61000-6-1	2005-03		
IEC 61326-1	2006-06		
ISO 14982	1998-07		
MIL Std. 461E	1999-08		
RSS GEN	2007-06		
RSS 119	2007-06		
RSS 123	1999-11		
RSS 125	2000-03		
RSS 131	2003-07		
RSS 136	2002-10		
RSS 137	2009-02		
RSS 210	2007-06		
RSS 213	2005-12		
RSS 243	2005-11		
RSS 310	2007-06		
	T	「 <u> </u>	ſ <u> </u>
Note de Teat an LOD			

Note 1: Test not on LSR Scope of Accreditation. Updated on 02-03-10 P=Project FD= Final Draft

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 106 of 108

APPENDIX C Uncertainty Statement

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of k=2.

Table of Expanded Uncertainty Values, (K=2) for Specified Measurements

Measurement Type	Particular Configuration	Uncertainty Values
Radiated Emissions	3 – Meter chamber, Biconical Antenna	4.24 dB
Radiated Emissions	3-Meter Chamber, Log Periodic Antenna	4.8 dB
Radiated Emissions	10-Meter OATS, Biconical Antenna	4.18 dB
Radiated Emissions	10-Meter OATS, Log Periodic Antenna	3.92 dB
Conducted Emissions	Shielded Room/EMCO LISN	1.60 dB
Radiated Immunity	3 Volts/Meter in 3-Meter Chamber	1.128 Volts/Meter
Conducted Immunity	3 Volts level	1.0 V

Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 107 of 108

Appendix D

Justifications of Average Duty Factor Calculations

BLUETOOTH RADIO

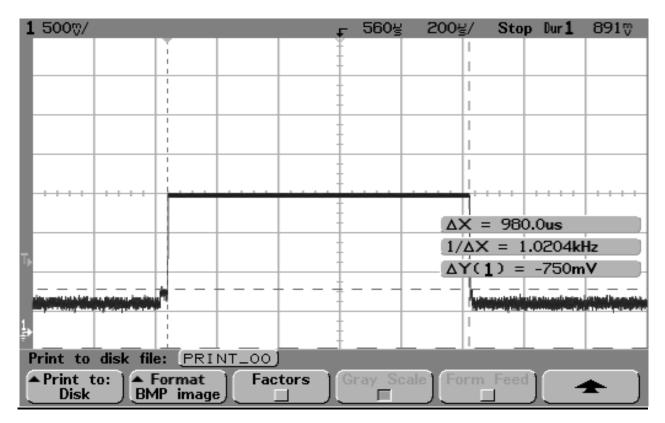
Average (Relaxation) Factor

Average Factor = 20* Log₁₀ (Worst Case EUT On-time over 100 ms time window)

The transmit packet occupies 0.98 ms of time, within any 100 ms window. Therefore, the relaxation factor allowance is calculated as:

Average Factor = 20* Log₁₀ (.98 / 100 ms) = 40.18

A maximum relaxation factor of 20 dB would be allowable for this product.



Prepared For: LS Research	EUT: TiWi	LS Research, LLC
Report # 310117	Model #:TiWi- R1	
LSR Job #: C-884	Serial #:0020303	Page 108 of 108