



**FCC Test Report**  
**for**  
**47CFR15, Subpart B for Unintentional Radiators, per Section 101**  
**Equipment authorization of unintentional radiators, *and***  
**47CFR15, Subpart C for Intentional Radiators, per Section 247**  
**Operation within the bands 902 to 928 MHz**

on  
**TempSens**  
[FCC ID: TS4 – TWS-049]

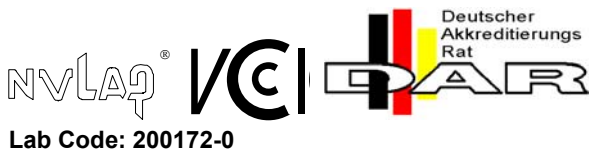
model  
**TWS-049 - Sensor**

report number  
**20051019-01-Fc15**

manufacturer  
**Tehama Wireless Design Group**  
**423 Tehama Street**  
**San Francisco, California, 94103**

judgement  
**Complies**

tests and report by  
**ITC Engineering Services, Inc. (ITC)**  
**9959 Calaveras Road, P.O. Box 543**  
**Sunol, California 94586**  
Tel.: (925) 862-2944  
Fax: (925) 862-9013  
E-Mail: docs@itcemc.com  
Web Site: www.itcemc.com



Lab Code: 200172-0

EN45001 Accredited Compliance Laboratory (RES-GmbH)  
Registration number: TTI-P-G 159/98-00 (RES-GmbH)

## Table of Contents

<b>PART 1</b>	<b>GENERAL</b>	<b>5</b>
Section 1.1	General Information	5
Section 1.2	Tests Performed:	5
Section 1.3	Declaration/Disclaimer	6
Section 1.4	Test Methodology	7
Section 1.5	Accuracy of Test Data	7
Section 1.6	What is being Tested	8
Section 1.7	EUT Ports and connectors	8
Section 1.8	List of peripherals used during Test	8
Section 1.9	General Test Remarks	8
Section 1.10	Test Equipment Used	8
Section 1.11	Test Software Used	9
Section 1.11	Test Summary and Results	9
<b>PART 2</b>	<b>RECEIVER MEASUREMENTS</b>	<b>10</b>
<b>SECTION 2.0</b>	<b>OPEN FIELD RADIATED EMISSIONS per FCC Part 15b</b>	<b>10</b>
Section 2.1	Test procedure	10
Section 2.2	Administrative And Environmental Details	10
Section 2.3	Test Equipment Used	10
Section 2.4	Software Used	10
Section 2.5	Test Results	10
Section 2.6	Test Range (Radiated Emissions Tests)	11
Section 2.7	Spectrum Analyzer Configuration (swept frequency scans)-	11
Section 2.8	Data Table Legend and Field Strength Calculation – Radiated Emissions Tests	11
Section 2.9	Open Field Radiated Emission Test Results (Below 1 GHz)	12
Section 2.10	Radiated Emissions Test Results (Above 1 GHz)	12
Section 2.11	Test Data Summary	12
Section 2.12	Conclusion	12
Section 2.13	Radiated Emissions Test Setup Photographs	13
<b>PART 3</b>	<b>RF MEASUREMENTS</b>	<b>15</b>
Section 3.1	List of Support equipment used during RF Tests	15
Section 3.2	Test Equipment Used	15
Section 3.3	Software Used	15
Section 3.4	Data Table Legend and Field Strength Calculation	15
Section 3.5	Setup Photographs	16
<b>PART 4</b>	<b>NUMBER OF HOPPING FREQUENCIES MEASUREMENT per 15.247 (a)</b>	<b>18</b>
Section 4.1	Test Setup And Procedure	18
Section 4.2	Administrative and Environmental details	18
Section 4.3	Test Plot – Number of Hopping Frequency (915 MHz)	18
<b>PART 5</b>	<b>CARRIER FREQUENCY SEPARATION MEASUREMENT per 15.247(a)</b>	<b>19</b>
Section 5.1	Test Setup And Procedure	19
Section 5.2	Administrative And Environmental Details – Channel Separation Measurement	19
Section 5.3	Test Plot – Channel Separation Measurement	19
<b>PART 6</b>	<b>TIME OF OCCUPANCY (DWELL TIME) per 15.247(a)</b>	<b>20</b>
Section 6.1	Test Procedure	20
Section 6.2	Administrative and Environmental Details	20

Section 6.3	Test Plot – Time of Occupancy (Dwell time, Channel 0).....	20
Section 6.4	Test Plot – Time of Occupancy (Dwell time, channel 30).....	21
Section 6.5	Test Plot – Time of Occupancy (Dwell time, channel 59).....	22
<b>PART 7</b>	<b>20 DB BANDWIDTH per 15.247(a).....</b>	<b>23</b>
Section 7.1	Test Procedure.....	23
Section 7.2	Administrative & Environmental – 20 dB Bandwidth Details .....	23
Section 7.3	Test Plot – 20 DB Bandwidth Measurement (CHannel 0 – 903.68 MHz) .....	23
Section 7.4	Test Plot – 20 dB Bandwidth Measurement (CH 28 – 914.4 MHz) .....	24
Section 7.5	Test Plot – 20 dB Bandwidth Measurement (CH 59 – 927.6 MHz).....	25
<b>PART 8</b>	<b>MAXIMUM POWER OUTPUT per 15.247(b).....</b>	<b>26</b>
Section 8.1	Test Procedure.....	26
Section 8.2	Administrative Details – Maximum Power Measurement.....	26
Section 8.3	Test Plot – Maximum Power Measurement (CH 0 – 902.4 MHz) .....	26
Section 8.4	Test Plot – Maximum Power Measurement (CH 28 – 914.4 MHz) .....	27
Section 8.5	Test Plot – Maximum Power Measurement (CH 59 – 927.6 MHz) .....	28
<b>PART 9</b>	<b>BANDEDGE MEASUREMENT per 15.247(c).....</b>	<b>29</b>
Section 9.1	Test Procedure.....	29
Section 9.2	Administrative and Environmental Details–Band-Edge Measurement .....	29
Section 9.3	Test Plot –Band-Edge Measurement (Upper Band Edge - 928MHz).....	29
Section 9.4	Test Plot –Band-Edge Measurement (Lower BandEdge - 902MHz) .....	30
<b>PART 10</b>	<b>SPURIOUS RF CONDUCTED EMISSIONS.....</b>	<b>31</b>
Section 10.1	Test Procedure.....	31
Section 10.2	Administrative & Environmental.....	31
Section 10.3	Test Plot – RF Cond Emissions, (Channel 0, 27 MHz – 940 MHz).....	31
Section 10.4	Test Plot – RF Cond Emissions, (Channel 0, 848 MHz – 5 GHz).....	32
Section 10.5	Test Plot – RF Cond Emissions, (Channel 0, 5 GHz – 10 GHz) .....	33
Section 10.6	Test Plot – RF Cond Emissions, (channel 28, Start 27 MHz, Stop 940 MHz).....	34
Section 10.7	Test Plot – RF Cond Emissions, (channel 28, Start 850 MHz – Stop 5 GHz).....	35
Section 10.8	Test Plot – RF Cond Emissions, (channel 28, Start 5 GHz – 10 GHz).....	36
Section 10.9	Test Plot – RF Cond Emissions, (channel 59, Start 27 MHz – Stop 940 MHz).....	37
Section 10.10	Test Plot– RF Cond Emissions, (channel 59, Start 850 MHz – Stop 5 Ghz).....	38
Section 10.11	Test Plot – RF Cond Emissions, (channel 59, Start 5 GHz 0- Stop 10 GHz).....	39
<b>PART 11</b>	<b>SPURIOUS/HARMONIC EMISSIONS IN THE RESTRICTED BANDS .....</b>	<b>40</b>
Section 11.1	Test Specification:.....	40
Section 11.2	Test Range – Spurious/Harmonics Emissions: .....	40
Section 11.3	Administrative and Environmental Details .....	40
Section 11.4	Spurious Emissions (Below 1 GHz) .....	40
Section 11.5	Spurious and Harmonics Emissions (Above 1GHz) channel 0 .....	41
Section 11.6	Spurious and Harmonics Emissions (Above 1GHz) channel 28 .....	42
Section 11.7	Spurious and Harmonics Emissions (Above 1GHz) channel 59 .....	43
Section 11.8	Spurious Photographs.....	44
<b>PART 12</b>	<b>ANTENNA REQUIREMENT PER 15.203 .....</b>	<b>46</b>
<b>PART 13</b>	<b>APPENDICES.....</b>	<b>47</b>
Section A.	EUT Technical Specification .....	47
Section B.	EUT Photographs .....	48
Section C.	Modification Letter .....	52

## List of Figures

Figure 1: Radiated Emissions Test Setup (Below 1 GHz) Front View .....	13
Figure 2 Radiated Emissions Test Setup (Below 1 GHz) closed up view .....	13
Figure 3: Radiated Emissions Test Setup (Above 1 GHz) Front View .....	14
Figure 4: Radiated Emissions Test Setup (Above 1 GHz) Rear View .....	14
Figure 5 Test Set Up Photo – Front View .....	16
Figure 6 Test Set Up Photo (Front Close up View) .....	16
Figure 7 Test Set Up Photo (Rear View) .....	17
Figure 8: Plot of Number of Hopping Frequencies .....	18
Figure 9: Plot of Carrier Frequency Separation Measurement at 915.8 MHz .....	19
Figure 10: Plot of Time of Occupancy (Dwell Time, Channel 0) .....	20
Figure 11: Plot of Time of Occupancy (Dwell Time, Channel 30) .....	21
Figure 12: Plot of Time of Occupancy (Dwell Time, Channel 59) .....	22
Figure 13: Plot of 20dB Bandwidth Measurement at Channel 0 .....	23
Figure 14: Plot of 20 dB Bandwidth Measurement at Channel 28 .....	24
Figure 15: Plot of 20 dB Bandwidth Measurement at Channel 59 .....	25
Figure 16: Plot of Maximum Power Measurement at Channel 0 .....	26
Figure 17: Plot of Maximum Power Measurement at Channel 28 .....	27
Figure 18: Plot of Maximum Power Measurement at Channel 59 .....	28
Figure 19: Plot of Upper Band-Edge Measurement at 928 MHz .....	29
Figure 20: Plot of Lower Band-Edge Measurement at 902MHz .....	30
Figure 21: Plot of Spurious RF Conducted Emissions, Ch 0 (27.0MHz – 940MHz) .....	31
Figure 22: Plot of Spurious RF Conducted Emissions, Ch 0 ( 848MHz – 5GHz) .....	32
Figure 23: Plot of Spurious RF Conducted Emissions, Ch 0 ( 5GHz – 10GHz) .....	33
Figure 24: Plot of Spurious RF Conducted Emissions, Ch 28 (27.0MHz – 940MHz) .....	34
Figure 25: Plot of Spurious RF Conducted Emissions, Ch 28 ( 848MHz – 5GHz) .....	35
Figure 26: Plot of Spurious RF Conducted Emissions, Ch 28 ( 5GHz – 10GHz) .....	36
Figure 27: Plot of Spurious RF Conducted Emissions, Ch 59 (27.0MHz – 940MHz) .....	37
Figure 28: Plot of Spurious RF Conducted Emissions, Ch 59 ( 848MHz – 5GHz) .....	38
Figure 29: Plot of Spurious RF Conducted Emissions, Ch 59 ( 5GHz – 10GHz) .....	39
Figure 30: Spurious Emissions Front View (Below 1 GHz) .....	44
Figure 31: Spurious Emissions Rear View (Below 1 GHz) .....	44
Figure 32: Spurious Emissions Front View (Above 1 GHz) .....	45
Figure 33: Spurious Emissions Rear View (Above 1 GHz) .....	45
Figure 34: EUT External View (Top) .....	48
Figure 35: EUT External View (Bottom) .....	48
Figure 36: EUT Component View 1 .....	49
Figure 37: EUT Internal View 1 .....	49
Figure 38: EUT Internal View 2 .....	50
Figure 39: EUT Internal View 3 .....	50
Figure 40: EUT Component View 2 .....	51
Figure 41: EUT Component View 3 .....	51

## List of Tables

Table 1 Radio Device Measurement Information .....	7
----------------------------------------------------	---

## PART 1 GENERAL

### SECTION 1.1 GENERAL INFORMATION

<b>Product Type Model(s)</b>	TempSens TWS-049 - Sensor	
<b>Manufacturer's Name Manufacturer's Address</b>	Tehama Wireless Design Group. 423 Tehama Street San Francisco, California 94103 USA Tel: +1 (415) 495-7344 Mr. Jim Orton	Fax: +1 (415) 495-7314 orton@tehamawireless.com
<b>Country Telephone and Fax Contact and Email</b>		
<b>Test Laboratory</b>	ITC Engineering Services, Inc. 9959 Calaveras Road, PO Box 543 Sunol, CA 94586-0543 Email: <a href="mailto:docs@itcemc.com">docs@itcemc.com</a> Web Site: <a href="http://www.itcemc.com">http://www.itcemc.com</a>	Tel: +1(925) 862-2944 Fax: +1(925) 862-9013
<b>Test Number and Report Numbers</b>	20051019-01	20051019-01-Fc15
<b>Test Date(s) &amp; Issue Date</b>	Oct. 27 <sup>th</sup> - Nov. 2 <sup>nd</sup> of 2005	November 11 <sup>th</sup> , 2005
<b>Test Engineer(s)</b>	Femi Ojo and Lan Vu	
<b>Chief Engineer</b>	Michael Gbadebo, P.E	
<b>Documentation</b>	George W Brown II.	
<b>Test Results</b>	<input checked="" type="checkbox"/> Complies as Tested	<input type="checkbox"/> Fail

The electromagnetic interference and RF tests, which this report describes, were performed by an independent Engineering Consultancy firm, ITC Engineering Services, Inc. (ITC), in accordance with the emissions and RF requirements specified in the FCC rules Part 15, Subparts B and C. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications specified in this report for compliance must be implemented in all production units for compliance to be maintained.

### SECTION 1.2 TESTS PERFORMED:

#### FCC Rules and Regulations per 47 CFR 15.247

##### Emissions Requirements:

- OPEN FIELD RADIATED EMISSIONS in accordance with the FCC 47CFR15.109, Class B

##### RF Requirements:

- NUMBER OF HOPPING FREQUENCIES per section 15.247(a)
- CARRIER FREQUENCY SEPARATION per section 15.247(a)
- TIME OF OCCUPANCY (Dwell Time) per section 15.247(a)
- 20dB BANDWIDTH per section 15.247(a)
- PEAK OUTPUT POWER per section 15.247(b)
- BAND-EDGE MEASUREMENT per section 15.247(c)
- SPURIOUS RF CONDUCTED EMISSIONS per section 15.247(c)
- SPURIOUS AND HARMONICS EMISSIONS IN RESTRICTED BAND per section 15.247 (c)

## PART 1 General (Cont)

### SECTION 1.3 DECLARATION/DISCLAIMER

ITC Engineering Services, Inc. (ITC) reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. ITC Engineering Services, Inc. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from ITC Engineering Services, Inc. issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full with our written approval. The applicant/manufacturer shall not use this report to claim product endorsement by NVLAP or any US Government agency.

#### **ITC Engineering Services, Inc. (ITC) is:**

Accepted by the Federal Communications Commission (FCC) for FCC Methods, CISPR Methods and AUSTEL Technical Standards (Ref: NVLAP Lab Code 200172-0)

Approved by the Industry Canada for Telecom Testing

Certified by Rockford Engineering Services GmbH for EMC Testing according to the European EMC Directive 89/336/EEC per EN45001

Certified by Reg. TP for EMC Testing according to the European EMC Directive 89/336/EEC per EN45001 for RES GmbH (DAR-Registration number: TTI-P-G 159/98-00)

Certified by the Voluntary Control Council for Interference by Information Technology Equipment (VCCI) for EMC testing, in accordance with the Regulations for Voluntary Control Measures, Article 8, Registration Numbers - Site 1: C-1582 and R-1497.

## PART 1 General (Cont)

### SECTION 1.4 TEST METHODOLOGY

The electromagnetic interference and RF tests, which this report describes, were performed by an independent Engineering Consultancy firm, ITC Engineering Services, Inc., in accordance with FCC test procedure.

**Table 1 Radio Device Measurement Information**

<b>Product Type Model(s)</b>	TempSens TWS-049 - Sensor	
<b>Applicant / Manufacturer Address</b>	Tehama Wireless Design Group. 423 Tehama Street San Francisco, California 94103	
<b>Contact</b>	Mr. Jim Orton Tel: 1 (415) 495-7344	orton@tehamawireless.com Fax: +1 (415) 495-7314
<b>Test Results</b>	<input checked="" type="checkbox"/> <b>Complies</b>	<input type="checkbox"/> <b>Not Compliant</b>
<b>Total Number of Pages including Appendices</b>	52 Pages	
<b>Test Report File No.</b>	20051019-01-Fc15	

### SECTION 1.5 ACCURACY OF TEST DATA

The test results contained in this report accurately represent the emissions generated by the sample equipment under test. ITC Engineering Services, Inc. (ITC) as an independent testing laboratory declares that the equipment as tested complies with the requirements of:

1. FCC standard 47CFR15.247 for Intentional Radiators Operation within the bands 902MHz to 928MHz



## SECTION 1.6 WHAT IS BEING TESTED

Tehama Wireless Design Group's, Product "TempSens", Model(s) "TWS-049 - Sensor" referred to as the "EUT" in this report is a temperature sensor system.

## SECTION 1.7 EUT PORTS AND CONNECTORS

- One (1) SMA Connector (female)

## SECTION 1.8 LIST OF PERIPHERALS USED DURING TEST

No	Description	Manufacturer	Model Name	Serial Number
1	NOTEBOOK	DELL	LATITUDE	N/A
2	PLOTTER	HEWLETT PACKARD	7440A	2539A45993

Test Voltage: 5.0Vdc

## SECTION 1.9 GENERAL TEST REMARKS

The EUT and peripheral equipment were operated under the following conditions during testing

<input type="checkbox"/>	Standby	<input type="checkbox"/>	Test Program (H - Pattern)
<input type="checkbox"/>	Test Program (Color Bar)	<input checked="" type="checkbox"/>	Test Program (Customer Specific)
<input type="checkbox"/>	Laptop Video Signal Input	<input type="checkbox"/>	Signal Generator Input
<input type="checkbox"/>	Continuous Audio Tone (1kHz)	<input type="checkbox"/>	Cycled Audio Tone (1kHz)
<input type="checkbox"/>	Printer/Parallel Function	<input type="checkbox"/>	Modem/Serial Function
<input type="checkbox"/>	Serpentine Program with I/O	<input type="checkbox"/>	Serpentine Program without I/O
<input type="checkbox"/>	Practice Operation	<input checked="" type="checkbox"/>	Normal Operating Mode
<input type="checkbox"/>	Essential Operation (Functional Safety)	<input type="checkbox"/>	Continuous Unmonitored Operation
<input checked="" type="checkbox"/>	Continuous Monitored Operation	<input type="checkbox"/>	Non-Continuous Operation

## SECTION 1.10 TEST EQUIPMENT USED

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due
Spectrum Analyzer	Hewlett-Packard	8568B	2841A04315	11-29-05
Spectrum Analyzer Display	Hewlett-Packard	85662A	2848A17028	11-29-05
Quasi Peak Adapter	Hewlett-Packard	85650	2521A00871	11-29-05
Preselector	Hewlett-Packard	85685A	2620A00265	11-29-05
Spectrum Analyzer	Hewlett-Packard	8565E	2618A02909	03-29-06
Biconical Antenna	EMCO	3104	3667	02-03-06
L. P. Ant. (200-1000 MHz)	EMCO	3146	9510-4202	02-03-06
Horn Antenna (Below 18GHz)	EMCO	3115	8812-3050	12-19-05
Amplifier	Agilent	83051A	09010	12-16-05



## SECTION 1.11 TEST SOFTWARE USED

Description	Manufacturer	Model Name	Version Number	Calibration/Validation Date
Test Software	ITC	1.04b1	Rev. 4	02-05-06
Antenna Software	ITC	L.P-V/H 10m	Rev. 4	02-05-06
Antenna Software	ITC	B-V/H 10m	Rev. 4	02-05-06
Cable Software	ITC	OATS 30MHz-1GHz	Rev. 4	02-01-06

## SECTION 1.11 TEST SUMMARY AND RESULTS

### The Equipment under Test does

- ☒ Fulfill the general approval requirements
- ☐ Not fulfill the general approval requirements

## PART 2 RECEIVER MEASUREMENTS

### SECTION 2.0 OPEN FIELD RADIATED EMISSIONS per FCC Part 15b

#### SECTION 2.1 TEST PROCEDURE

The EUT TWS – 049 – Sensor was set up at 3 and 10 meters in accordance with the suggested configuration given in FCC Measurement Procedure ANSI C63.4-2003. The measurement instrumentation used was a spectrum analyzer with bandwidth parameters as stipulated in ANSI C63.4-2003. The EUT was set up on a wooden non-conductive tabletop, 80 cm above the ground reference plane, in an open field. The transmit function was de-activated for the tests. For measurements below 1GHz, the EUT was set up at a 10 meters distance from the search antenna with the EUT running in a periodic mode. The EUT was rotated 360 degrees azimuth and the search antenna height varied 1 to 4m in order to maximize the emissions. Significant peaks from the EUT were then recorded to determine margin to the limits. For measurements above 1GHz, the EUT running in periodic mode was set up at a 3 meter distance from the search antenna and was rotated 360 degrees azimuth and also rotated in its x-y-z axis positions to determine the precise amplitude of the emissions.

#### SECTION 2.2 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

<b>Test Site;</b>	Test Site 1 – 10m Open Field Radiated Site
<b>Test Date:</b>	October 27, 2005
<b>Test Engineer:</b>	Lan Vu
<b>Temperature:</b>	72°F
<b>Humidity:</b>	39%

#### SECTION 2.3 TEST EQUIPMENT USED

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due
Spectrum Analyzer	Hewlett-Packard	8568B	2841A04315	11-29-05
Spectrum Analyzer Display	Hewlett-Packard	85662A	2848A17028	11-29-05
Quasi Peak Adapter	Hewlett-Packard	85650	2521A00871	11-29-05
Preselector	Hewlett-Packard	85685A	2620A00265	11-29-05
Biconical Antenna	EMCO	3104	3667	02-03-06
L. P. Ant. (200-1000 MHz)	EMCO	3146	9510-4202	02-03-06
Spectrum Analyzer	Hewlett-Packard	8565E	2618A02909	03-29-06
Amplifier	Agilent	83051A	09010	12-16-05

#### SECTION 2.4 SOFTWARE USED

Description	Manufacturer	Model Name	Version Number	Calibration/Validation Date
Test Software	ITC	1.04b1	Rev. 4	02-05-06
Antenna Software	ITC	L.P-V/H 10m	Rev. 4	02-05-06
Antenna Software	ITC	B-V/H 10m	Rev. 4	02-05-06
Antenna Software	ITC	H-V/H 3m	Rev. 4	02-05-06
Cable Software	ITC	CH 30MHz-1GHz	Rev. 4	02-01-06

#### SECTION 2.5 TEST RESULTS

The EUT, “TempSens”, Model(s) “TWS-049 - Sensor” meets the requirements of the test reference for Open Field Radiated emissions.

## OPEN FIELD RADIATED EMISSIONS (cont)

### SECTION 2.6 TEST RANGE (RADIATED EMISSIONS TESTS)

The frequency search range investigated was from 30 MHz to 10GHz

### SECTION 2.7 SPECTRUM ANALYZER CONFIGURATION (SWEPT FREQUENCY SCANS)-

IF Bandwidth.....120 kHz  
Measurements below 1000 MHz (unless stated otherwise)  
Analyzer Mode (for Peak Measurements) ..... Peak/Log  
Resolution Bandwidth ..... 100 kHz  
Video Bandwidth..... 100 kHz  
Analyzer Mode (for Quasi-Peak Measurements)  
Quasi-Peak/Linear Resolution Bandwidth..... 1000 kHz  
Video Bandwidth..... 1000 kHz  
Measurements above 1000 MHz (unless stated otherwise)  
Quasi-Peak Adapter Mode ..... Disabled  
Analyzer Mode (for Peak Measurements) ..... Peak  
Resolution Bandwidth ..... 1000 kHz  
Video Bandwidth..... 1000 kHz  
Analyzer Mode (for Average Measurements) ..... Video Filter  
Resolution Bandwidth ..... 1000 kHz  
Video Bandwidth..... 10 Hz

### SECTION 2.8 DATA TABLE LEGEND AND FIELD STRENGTH CALCULATION – RADIATED EMISSIONS TESTS

Detector mode: Peak (P) or Quasi-Peak (QP) or Average (A)

	Polarization	Antenna	Freq Range (MHz)
VB	Vertical	EMCO 3104/sn 3549 Biconical	30 – 200
HB	Horizontal	EMCO 3104/sn 3549 Biconical	30 – 200
VL	Vertical	EMCO 3146/sn. 2075 Log Periodic	200 – 1000
HL	Horizontal	EMCO 3146/sn. 2075 Log Periodic	200 – 1000
VH1	Vertical	EMC 3115/sn. 2362 Horn	Below 18000
HH1	Horizontal	EMC 3115/sn. 2362 Horn	Below 18000
VH2	Vertical	EMC 3116/sn. 2655 Horn	Below 26500
HH2	Horizontal	EMC 3116/sn. 2655 Horn	Below 26500
VH4	Vertical	S&D DBD-520 Horn	Below 75000
HH4	Horizontal	S&D DBD-520 Horn	Below 75000

**The margin in the Table is calculated as follows:**

Margin = Corrected Amplitude – Limit, where Corrected Amplitude = Spectrum Analyzer Amplitude + Cable Loss + Antenna Factor – Pre-Amp Gain.

## SECTION 2.9 OPEN FIELD RADIATED EMISSION TEST RESULTS (BELOW 1 GHZ)

The table below shows a summary of the highest amplitudes of the radiated emissions from the equipment under test at various antenna heights, antenna polarization, and EUT orientations. The EUT was tested at low, mid and high frequency and the results obtained are similar for all three frequencies.

INDICATED		CORRECTION		CORR	TURNTABLE ANT			CLASS A		CLASS B		NOTES
FREQ	AMPL	ANT	CAB	AMPL	ANG	HT	POL	AMPL	MARG	AMPL	MARG	
MHz	dBuV/m	dB	dB	dBuV/m	DEG	m	-	dBuV/m	dB	dBuV/m	db	
40.07	4.9	11.3	2.2	18.4	90	1.0	VB	40.0	-21.6	30.0	-11.6	
65.70	7.5	7.9	2.6	18.0	0	1.0	VB	40.0	-22.0	30.0	-12.0	
121.60	3.6	13.0	3.2	19.8	90	2.0	HB	40.0	-20.2	30.0	-10.2	
127.90	2.9	12.8	3.3	18.9	0	1.0	VB	40.0	-21.1	30.0	-11.1	
148.00	4.9	11.8	3.8	20.5	90	1.0	VB	40.0	-19.5	30.0	-9.5	
232.40	3.2	10.9	4.2	18.3	90	1.0	VL	47.0	-28.7	37.0	-18.7	
240.30	4.1	11.0	4.5	19.6	0	2.0	HL	47.0	-27.4	37.0	-17.4	
326.90	2.3	14.0	6.3	22.6	90	2.0	HL	47.0	-24.4	37.0	-14.4	
397.50	2.8	15.5	6.3	24.6	90	1.0	VL	47.0	-22.4	37.0	-12.4	
425.80	1.2	15.8	6.0	23.0	0	2.0	HL	47.0	-24.0	37.0	-14.0	
552.37	2.4	18.4	7.9	28.6	90	1.0	VL	47.0	-18.4	37.0	-8.4	
646.90	1.5	18.4	8.6	28.6	90	1.0	VL	47.0	-18.4	37.0	-8.4	

No emissions of significant level were observed between 30MHz – 40.07MHz and 646.90 MHz – 1 GHz

## SECTION 2.10 RADIATED EMISSIONS TEST RESULTS (ABOVE 1 GHZ)

The table below shows a summary of the highest amplitudes of the radiated emissions from the equipment under test at various antenna heights, antenna polarization, and EUT orientations. The EUT was tested at low, mid and high frequency and the results obtained are similar for all three frequencies.

INDICATED		CORRECTION		CORR	TURNTABLE ANT			CLASS A		CLASS B		NOTES
FREQ	AMPL	ANT	CAB	AMPL	ANG	HT	POL	AMPL	MARG	AMPL	MARG	
MHz	dBuV/m	dB	dB	dBuV/m	DEG	m	-	dBuV/m	dB	dBuV/m	db	
1024.0	30.2	24.2	-14.1	40.4	90	1.2	HH	-	-	54.0	-13.6	
1029.0	28.2	24.3	-14.1	38.4	0	1.2	VH	-	-	54.0	-15.6	
1142.0	29.6	24.5	-13.7	40.4	90	1.2	VH	-	-	54.0	-13.6	
1235.0	28.4	24.6	-13.4	39.6	90	1.2	VH	-	-	54.0	-14.4	
1298.0	27.6	24.7	-13.2	39.2	270	1.2	HH	-	-	54.0	-14.8	
1536.0	26.9	25.3	-12.5	39.7	270	1.2	VH	-	-	54.0	-14.3	
1923.0	30.1	27.5	-12.0	45.6	270	1.2	HH	-	-	54.0	-8.4	
1928.0	29.3	27.3	-12.0	44.7	90	1.2	VH	-	-	54.0	-9.3	
2147.0	26.5	28.0	-10.8	43.6	90	1.2	VH	-	-	54.0	-10.4	
2468.0	28.8	28.6	-10.5	46.9	180	1.2	HH	-	-	54.0	-7.1	
2707.0	29.3	29.2	-10.8	47.7	90	1.2	VH	-	-	54.0	-6.3	
3164.0	25.1	30.5	-10.3	45.3	0	1.2	VH	-	-	54.0	-8.7	
3915.0	25.7	32.5	-10.9	47.2	90	1.2	HH	-	-	54.0	-6.8	
4428.0	24.9	32.4	-9.7	47.7	90	1.2	VH	-	-	54.0	-6.3	

No emission of significant level was observed above 4428MHz thru 10GHz

## SECTION 2.11 TEST DATA SUMMARY

The margin is calculated as follows:

Margin = Corrected Amplitude - Limit; where Corrected Amplitude = Amplitude + Cable Loss + Antenna Factor.

## SECTION 2.12 CONCLUSION

The Product “TempSens”, Model “TWS-049 - Sensor” meets the requirements of FCC Part 15, Class B for Radiated Emissions.

## OPEN FIELD RADIATED EMISSIONS Results (cont)

### SECTION 2.13 RADIATED EMISSIONS TEST SETUP PHOTOGRAPHS



Figure 1: Radiated Emissions Test Setup (Below 1 GHz) Front View



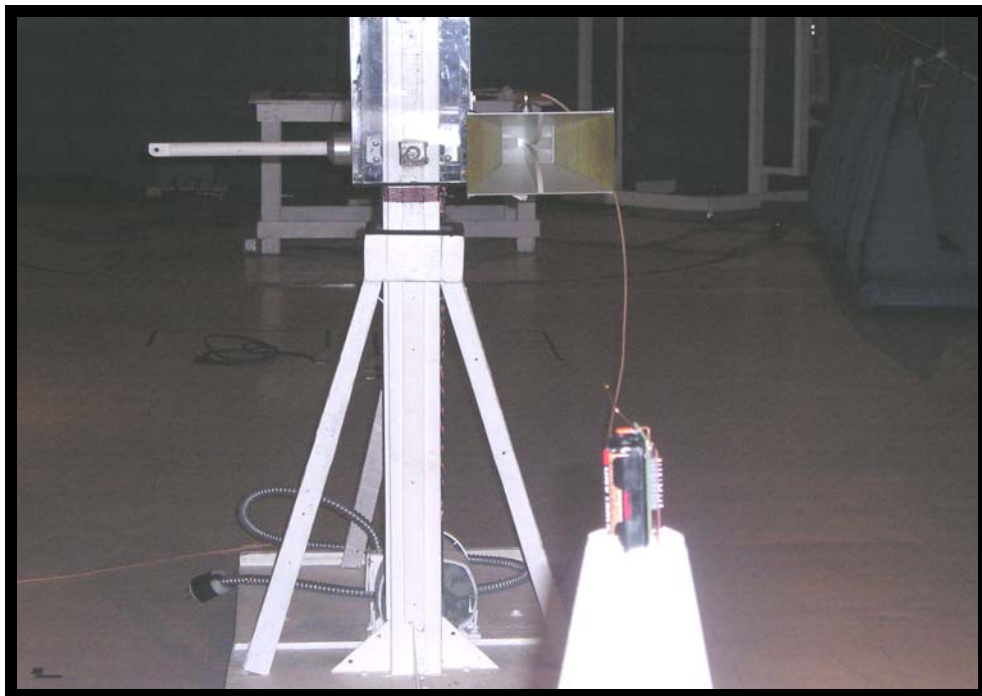
Figure 2 Radiated Emissions Test Setup (Below 1 GHz) closed up view



## RADIATED EMISSIONS (cont)



**Figure 3: Radiated Emissions Test Setup (Above 1 GHz) Front View**



**Figure 4: Radiated Emissions Test Setup (Above 1 GHz) Rear View**

## PART 3 RF MEASUREMENTS

### SECTION 3.1 LIST OF SUPPORT EQUIPMENT USED DURING RF TESTS

No	Description	Manufacturer	Model Name	Serial Number
1	NOTEBOOK	DELL	LATITUDE	N/A
2	PLOTTER	HEWLETT PACKARD	7440A	2539A45993

### SECTION 3.2 TEST EQUIPMENT USED

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due
Spectrum Analyzer	Hewlett-Packard	8568B	2841A04315	11-29-05
Spectrum Analyzer Display	Hewlett-Packard	85662A	2848A17028	11-29-05
Quasi Peak Adapter	Hewlett-Packard	85650	2521A00871	11-29-05
Preselector	Hewlett-Packard	85685A	2620A00265	11-29-05
Spectrum Analyzer	Hewlett-Packard	8565E	2618A02909	03-29-06
Biconical Antenna	EMCO	3104	3667	02-03-06
L. P. Ant. (200-1000 MHz)	EMCO	3146	9510-4202	02-03-06
Horn Antenna (Below 18GHz)	EMCO	3115	8812-3050	12-19-05
Amplifier	Agilent	83051A	09010	12-16-05

### SECTION 3.3 SOFTWARE USED

Description	Manufacturer	Model Name	Version Number	Calibration/Validation Date
Test Software	ITC	1.04b1	Rev. 4	02-05-06
Antenna Software	ITC	L.P-V/H 10m	Rev. 4	02-05-06
Antenna Software	ITC	B-V/H 10m	Rev. 4	02-05-06
Cable Software	ITC	OATS 30MHz-1GHz	Rev. 4	02-01-06

### SECTION 3.4 DATA TABLE LEGEND AND FIELD STRENGTH CALCULATION

Detector mode: Peak (P) or Quasi-Peak (QP) or Average (A)

	Polarization	Antenna	Freq Range (MHz)
VB	Vertical	EMCO 3104/sn 3549 Biconical	30 – 200
HB	Horizontal	EMCO 3104/sn 3549 Biconical	30 – 200
VL	Vertical	EMCO 3146/sn. 2075 Log Periodic	200 – 1000
HL	Horizontal	EMCO 3146/sn. 2075 Log Periodic	200 – 1000
VH1	Vertical	EMC 3115/sn. 2362 Horn	Below 18000
HH1	Horizontal	EMC 3115/sn. 2362 Horn	Below 18000
VH2	Vertical	EMC 3116/sn. 2655 Horn	Below 26500
HH2	Horizontal	EMC 3116/sn. 2655 Horn	Below 26500
VH4	Vertical	S&D DBD-520 Horn	Below 75000
HH4	Horizontal	S&D DBD-520 Horn	Below 75000



## RF Conducted Measurements

### SECTION 3.5 SETUP PHOTOGRAPHS



Figure 5 Test Set Up Photo – Front View

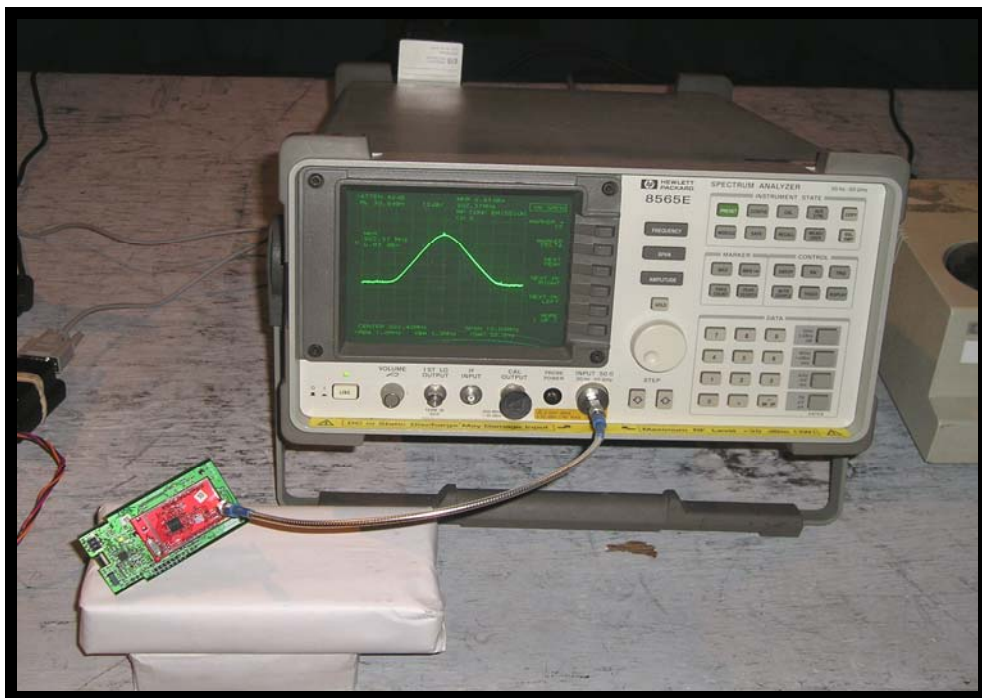


Figure 6 Test Set Up Photo (Front Close up View)



**Figure 7 Test Set Up Photo (Rear View)**

## PART 4 NUMBER OF HOPPING FREQUENCIES MEASUREMENT per 15.247 (a)

### SECTION 4.1 TEST SETUP AND PROCEDURE

The EUT "TempSens", Model "TWS-049 - Sensor" was set up on a wooden non-conductive tabletop, attached at the antenna connector to the measuring device. The measurement instrumentation used was a spectrum analyzer with bandwidth parameters as stipulated in ANSI C63.4-2003. The EUT was configured to run in hopping mode during the tests. The measurement data below represents the maximum worst-case result from the measurement performed in accordance to the requirements of this section.

### SECTION 4.2 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	Semi-Anechoic Absorber Lined Shielded Room
Test Date(s):	November 1, 2005
Test Engineer(s):	Femi Ojo
Temperature	70.6°F
Humidity	49%

### SECTION 4.3 TEST PLOT – NUMBER OF HOPPING FREQUENCY (915 MHZ)

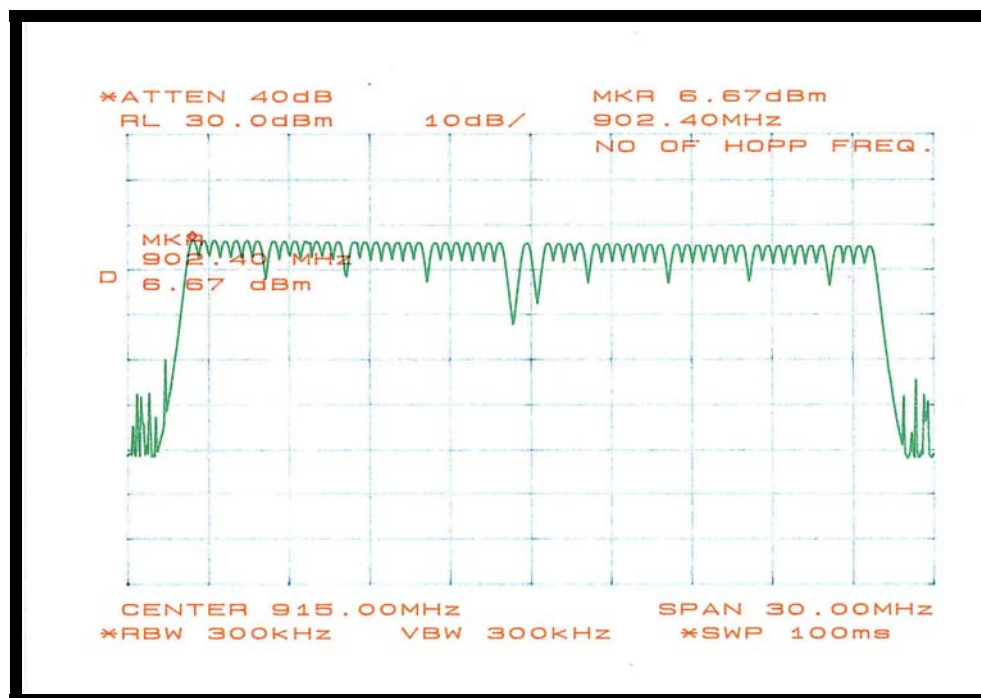


Figure 8: Plot of Number of Hopping Frequencies

#### Test-Data Summary – Peak Measurement:

**Peak Frequency** = 902.4MHz  
**Peak Level:** = 6.67dBm  
**Number of Channels** = 60

## PART 5 CARRIER FREQUENCY SEPARATION MEASUREMENT per 15.247(a)

### SECTION 5.1 TEST SETUP AND PROCEDURE

The EUT "TempSens", Model "TWS-049 - Sensor" was set up on a wooden non-conductive tabletop, attached at the antenna connector to the measuring device. The measurement instrumentation used was a spectrum analyzer with bandwidth parameters as stipulated in ANSI C63.4-2003. The EUT was configured to run in hopping mode during the tests. The measurement data below represents the maximum worst-case result from the measurement performed in accordance to the requirements of this section.

### SECTION 5.2 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS – CHANNEL SEPARATION MEASUREMENT

Site Used:	Semi-Anechoic Absorber Lined Shielded Room
Test Date:	November 1, 2005
Test Engineer:	Femi Ojo
Temperature:	70.6°F
Humidity:	49%

### SECTION 5.3 TEST PLOT – CHANNEL SEPARATION MEASUREMENT

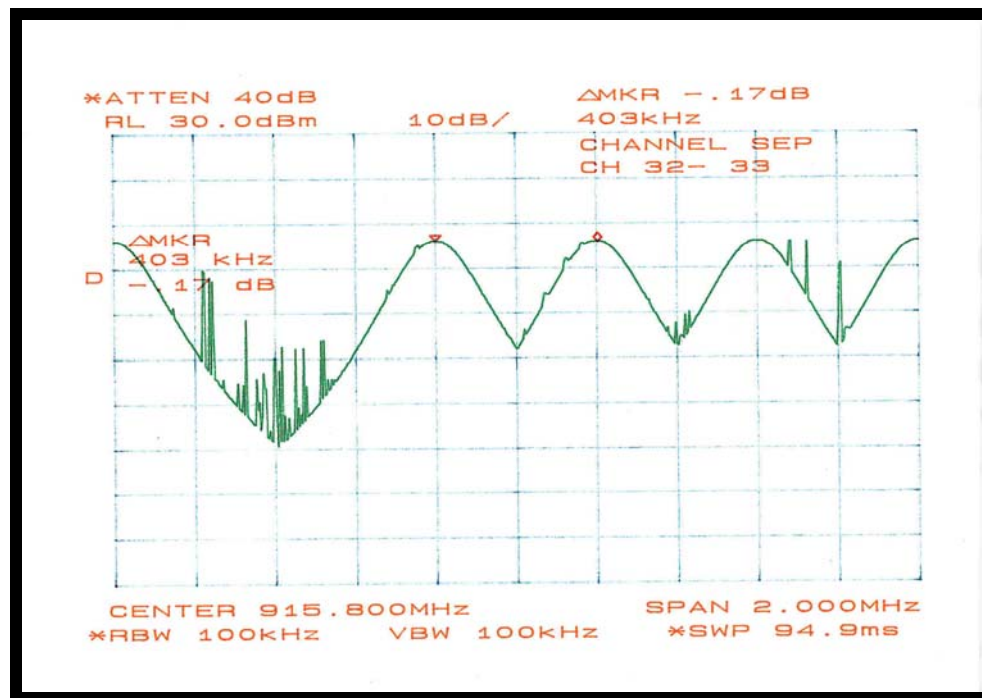


Figure 9: Plot of Carrier Frequency Separation Measurement at 915.8 MHz

#### Test-Data Summary – Channel Separation Measurement:

Peak Frequencies	=	916 MHz (CH 32) & 916.4 MHz (CH 33)
Channel Separation (measured)	=	403 KHz
Limit per 15.247(a)	=	25 KHz or 20dB bandwidth of the hopping channel (minimum)

## PART 6 TIME OF OCCUPANCY (DWELL TIME) per 15.247(a)

### SECTION 6.1 TEST PROCEDURE

The EUT "TempSens", Model "TWS-049 - Sensor" was set up on a wooden non-conductive tabletop, attached at the antenna connector to the measuring device. The measurement instrumentation used was a spectrum analyzer with bandwidth parameters as stipulated in ANSI C63.4-2003. The EUT was configured to run in hopping mode during the tests. The measurement data below represents the maximum worst-case result from the measurement performed in accordance to the requirements of this section.

### SECTION 6.2 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	Semi-Anechoic Absorber Lined Shielded Room
Test Date:	November 1, 2005
Test Engineer:	Femi Ojo
Temperature:	70.6°F
Humidity:	49%

### SECTION 6.3 TEST PLOT – TIME OF OCCUPANCY (DWELL TIME, CHANNEL 0)

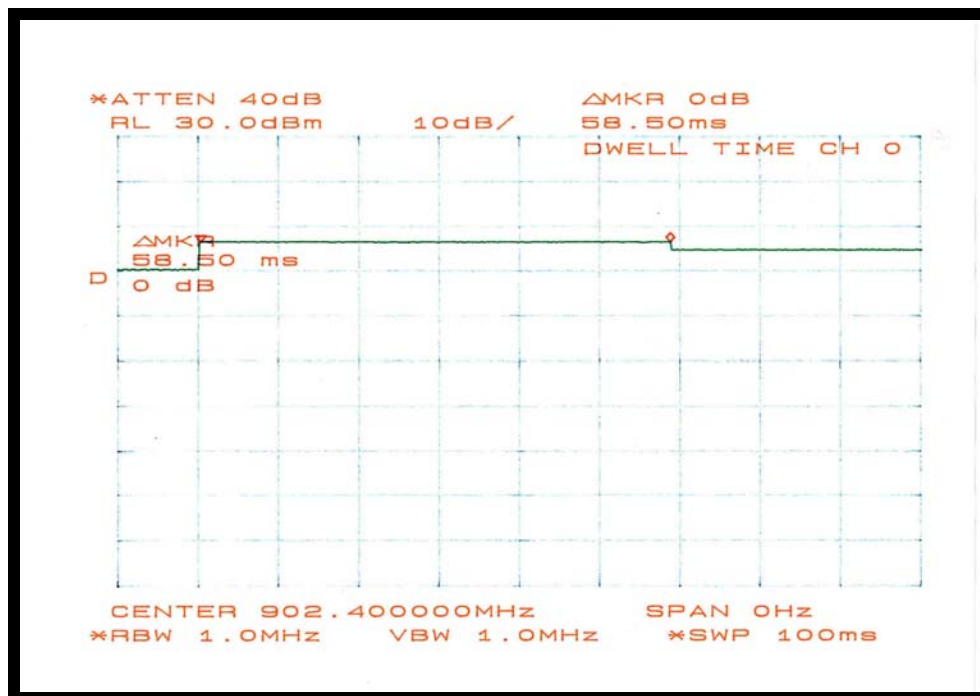


Figure 10: Plot of Time of Occupancy (Dwell Time, Channel 0)

#### Test-Data Summary

Center Frequency = 902.4 MHz  
Dwell Time = 58.50ms  
Dwell Time Limit per 15.247(a) = 0.4s



## SECTION 6.4 TEST PLOT – TIME OF OCCUPANCY (DWELL TIME, CHANNEL 30)

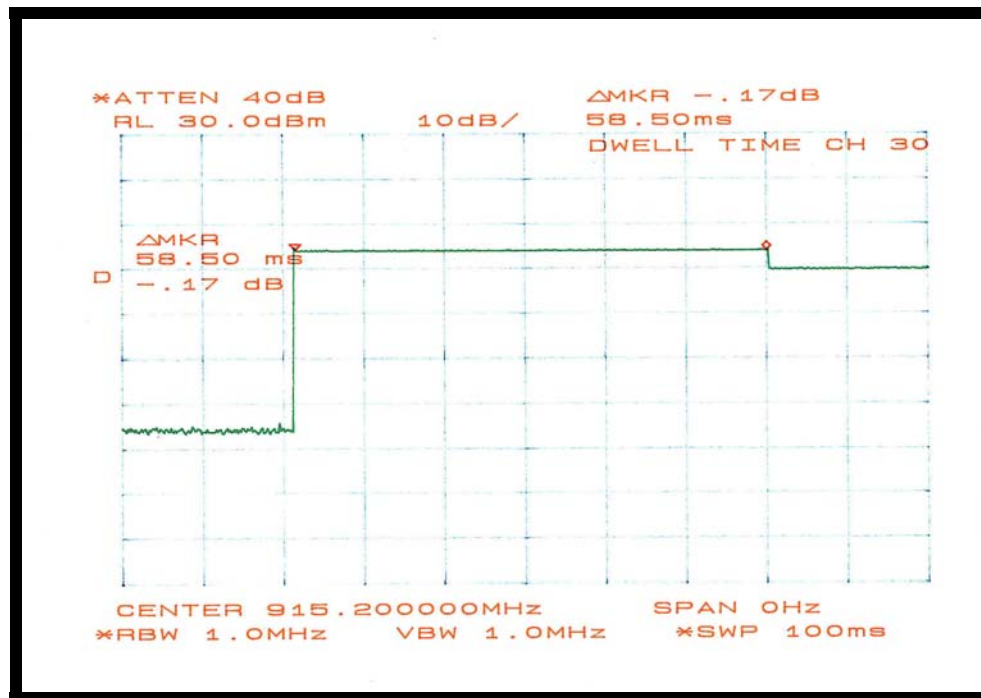


Figure 11: Plot of Time of Occupancy (Dwell Time, Channel 30)

### Test-Data Summary

Center Frequency = 915.2 MHz  
Dwell Time = 58.50ms  
Dwell Time Limit per 15.247(a) = 0.4s

## SECTION 6.5 TEST PLOT – TIME OF OCCUPANCY (DWELL TIME, CHANNEL 59)

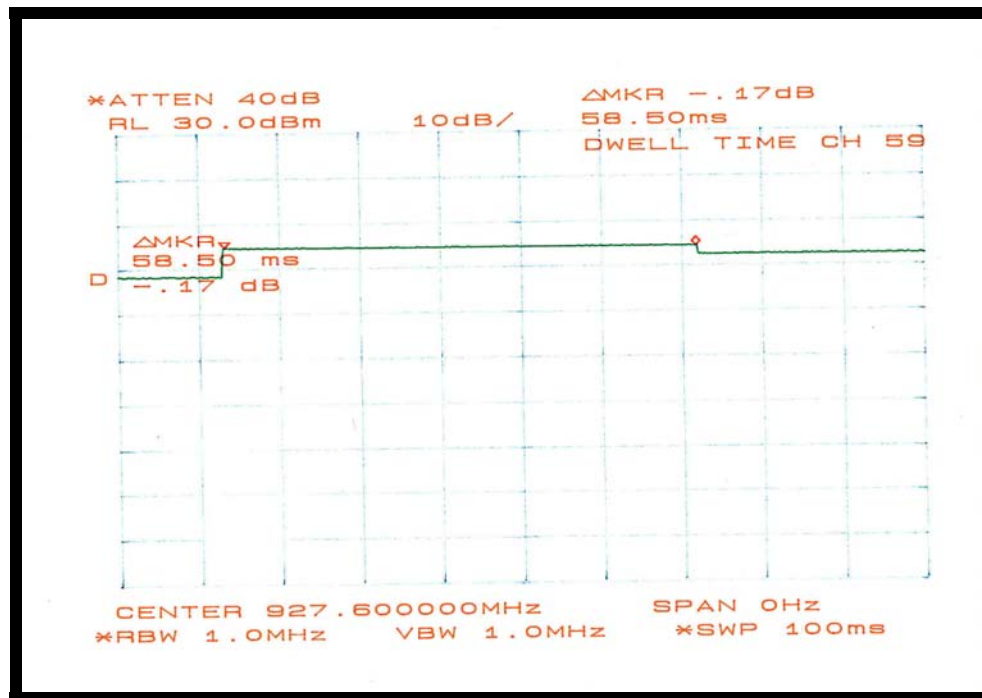


Figure 12: Plot of Time of Occupancy (Dwell Time, Channel 59)

### Test-Data Summary

Center Frequency =	927.6 MHz
Dwell Time =	58.50ms
Dwell Time Limit per 15.247(a) =	0.4s



## PART 7 20 DB BANDWIDTH per 15.247(a)

### SECTION 7.1 TEST PROCEDURE

The EUT "TempSens", Model "TWS-049 - Sensor" was set up on a wooden non-conductive tabletop, attached at the antenna connector to the measuring device. The measurement instrumentation used was a spectrum analyzer with bandwidth parameters as stipulated in ANSI C63.4-2003. The EUT was configured to run in hopping mode during the tests. The measurement data below represents the maximum worst-case result from the measurement performed in accordance to the requirements of this section.

### SECTION 7.2 ADMINISTRATIVE & ENVIRONMENTAL – 20 DB BANDWIDTH DETAILS

Site Used:	Semi-Anechoic Absorber Lined Shielded Room
Test Date(s):	November 1, 2005
Test Engineer(s):	Femi Ojo
Temperature	70.6°F
Humidity	49%

### SECTION 7.3 TEST PLOT – 20 DB BANDWIDTH MEASUREMENT (CHANNEL 0 – 903.68 MHZ)

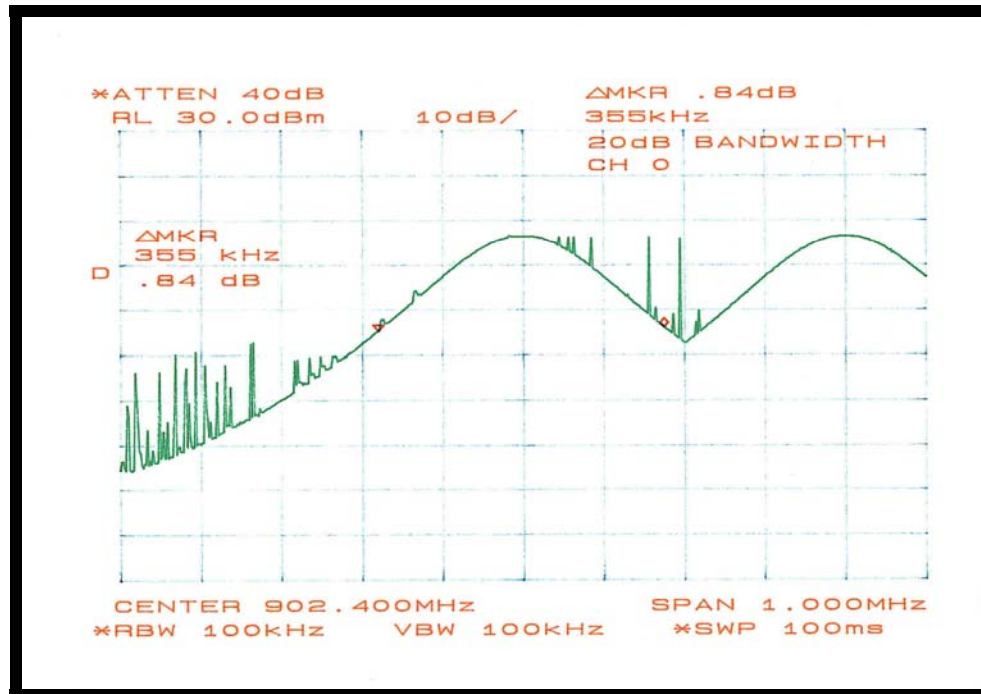


Figure 13: Plot of 20dB Bandwidth Measurement at Channel 0

#### Test-Data Summary – 20 dB Bandwidth Measurement (CH 0 –902.4 MHz):

Center Frequency = 902.4 MHz  
 20 dB Bandwidth = 355 KHz  
 Limit per 15.247(a) = 500 KHz maximum

## SECTION 7.4 TEST PLOT – 20 DB BANDWIDTH MEASUREMENT (CH 28 – 914.4 MHZ)

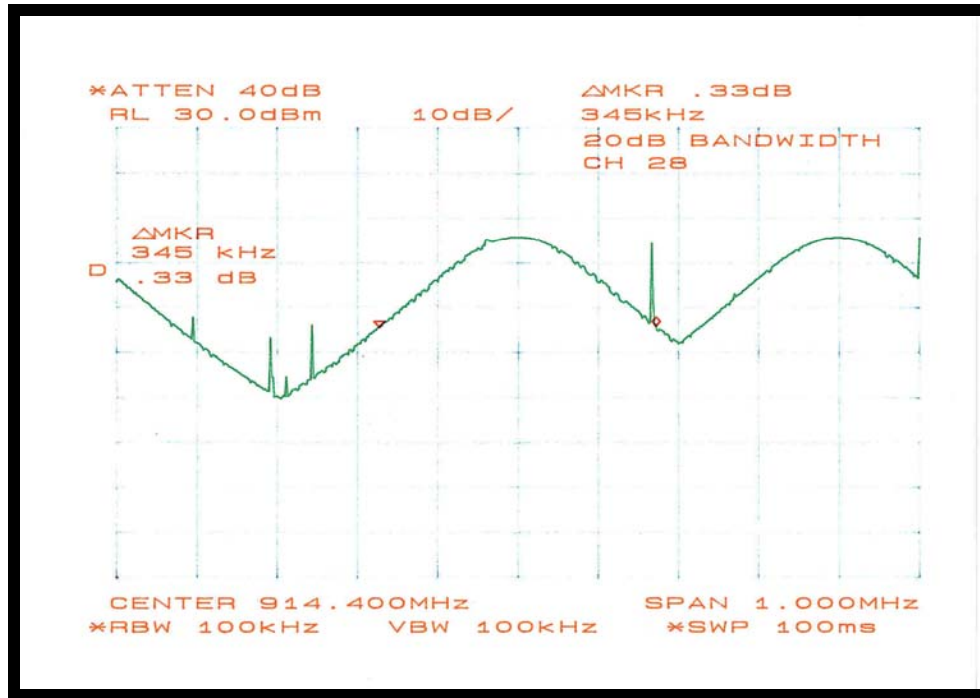


Figure 14: Plot of 20 dB Bandwidth Measurement at Channel 28

### Test-Data Summary – 20 dB Bandwidth Measurement (CH 28 – 914.4 MHz):

Center Frequency	=	914.4 MHz
20 dB Bandwidth	=	345 KHz
Limit per 15.247(a)	=	500 KHz maximum

## SECTION 7.5 TEST PLOT – 20 DB BANDWIDTH MEASUREMENT (CH 59 – 927.6 MHZ)

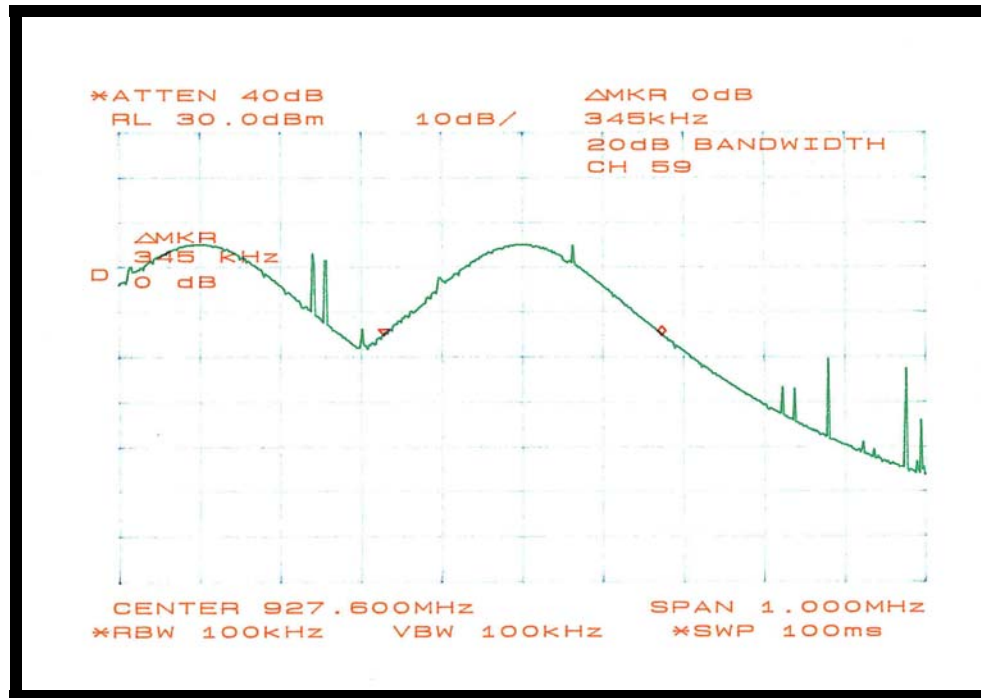


Figure 15: Plot of 20 dB Bandwidth Measurement at Channel 59

### Test-Data Summary – 20dB Bandwidth Measurement (CH 59 – 927.6 MHz).

Center Frequency	=	927.6 MHz
20 dB Bandwidth	=	345 KHz
Limit per 15.247(a)	=	500 KHz maximum

## PART 8 MAXIMUM POWER OUTPUT per 15.247(b)

### SECTION 8.1 TEST PROCEDURE

The EUT "TempSens", Model "TWS-049 - Sensor" was set up on a wooden non-conductive tabletop, attached at the antenna connector to the measuring device. The measurement instrumentation used was a spectrum analyzer with bandwidth parameters as stipulated in ANSI C63.4-2003. The EUT was configured to run in continuous mode during the tests. The measurement data below represents the maximum worst-case result from the measurement performed in accordance to the requirements of this section.

### SECTION 8.2 ADMINISTRATIVE DETAILS – MAXIMUM POWER MEASUREMENT

Site Used:	Semi-Anechoic Absorber Lined Shielded Room
Test Date(s):	November 1, 2005
Test Engineer(s):	Femi Ojo
Temperature	70.6°F
Humidity	49%

### SECTION 8.3 TEST PLOT – MAXIMUM POWER MEASUREMENT (CH 0 – 902.4 MHZ)

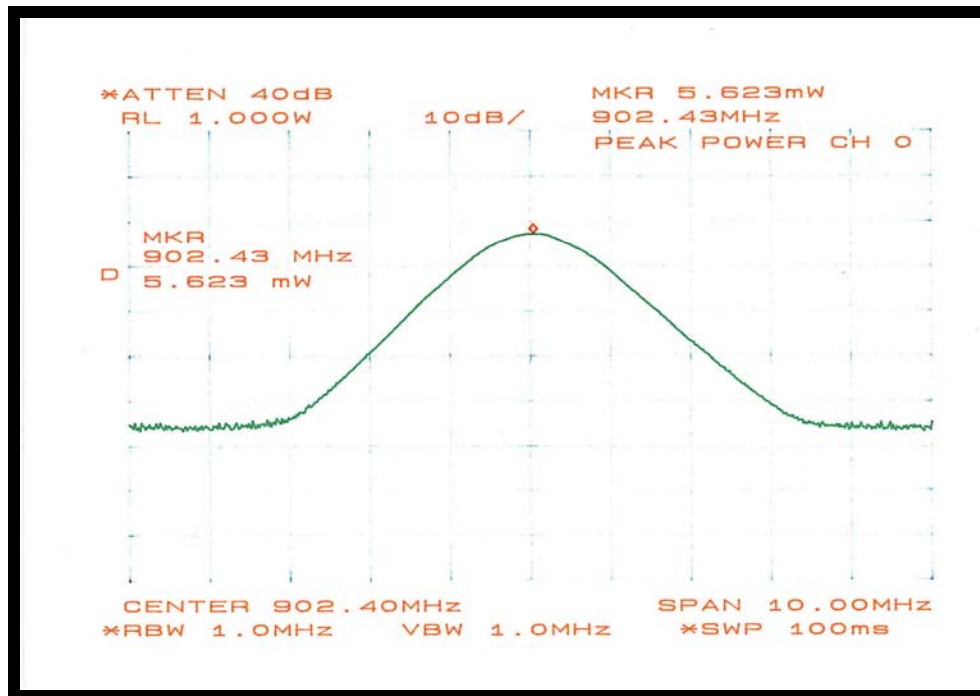


Figure 16: Plot of Maximum Power Measurement at Channel 0

#### Test-Data Summary – Peak Measurement (CH 0 – 902.4 MHz):

Center Frequency = 902.4 MHz  
Peak Level: = 5.623 mW  
Limit per 15.247(b) = 1 W

## SECTION 8.4 TEST PLOT – MAXIMUM POWER MEASUREMENT (CH 28 – 914.4 MHz)

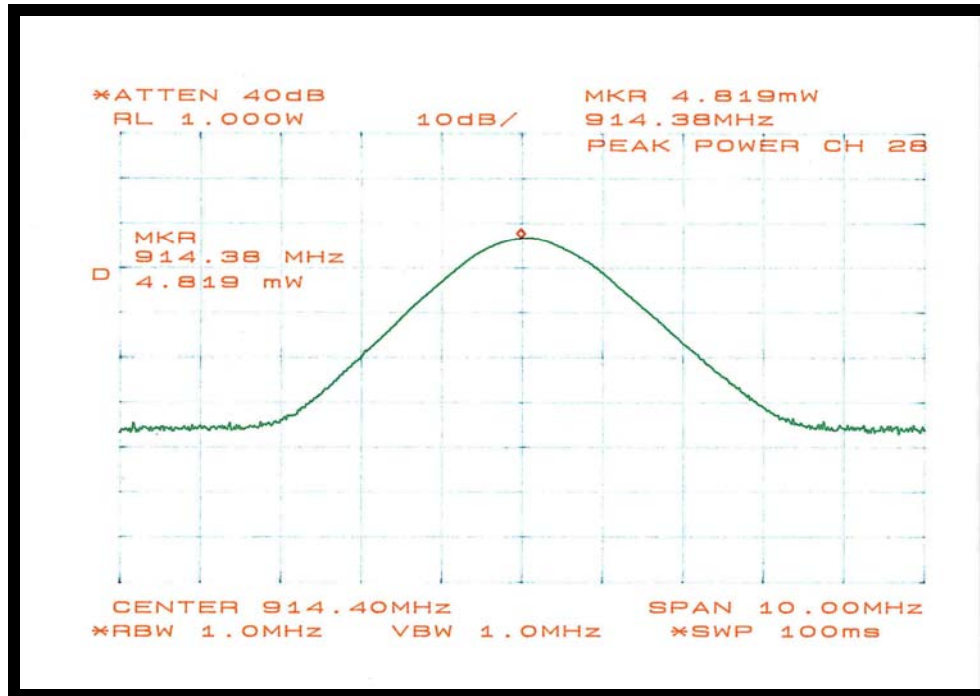


Figure 17: Plot of Maximum Power Measurement at Channel 28

### Test-Data Summary – Maximum Power Measurement (CH 28 – 914.4 MHz):

Center Frequency = 914.4 MHz  
Peak Level: = 4.81 mW  
Limit per 15.247(b) = 1 W

## SECTION 8.5 TEST PLOT – MAXIMUM POWER MEASUREMENT (CH 59 – 927.6 MHz)

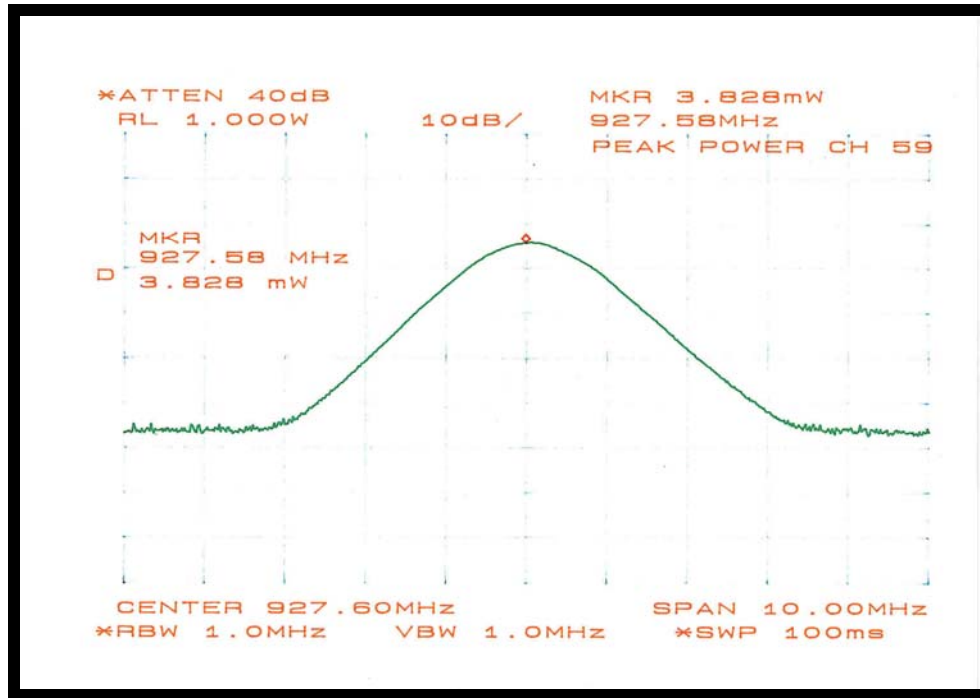


Figure 18: Plot of Maximum Power Measurement at Channel 59

### Test-Data Summary – Maximum Power Measurement (CH 11 – 927.6 MHz):

Center Frequency = 927.6 MHz  
Peak Level: = 3.828 mW  
Limit per 15.247(b) = 1 W

## PART 9 BANEDGE MEASUREMENT per 15.247(c)

### SECTION 9.1 TEST PROCEDURE

The EUT "TempSens", Model "TWS-049 - Sensor" was set up on a wooden non-conductive tabletop, attached at the antenna connector to the measuring device. The measurement instrumentation used was a spectrum analyzer with bandwidth parameters as stipulated in ANSI C63.4-2003. The EUT was configured to run in continuous mode during the tests. The measurement data below represents the maximum worst-case result from the measurement performed in accordance to the requirements of this section.

### SECTION 9.2 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS-BAND-EDGE MEASUREMENT

Site Used:	Semi-Anechoic Absorber Lined Shielded Room
Test Date(s):	November 1, 2005
Test Engineer(s):	Femi Ojo
Temperature	70.6°F
Humidity	49%

### SECTION 9.3 TEST PLOT -BAND-EDGE MEASUREMENT (UPPER BAND EDGE - 928MHZ)

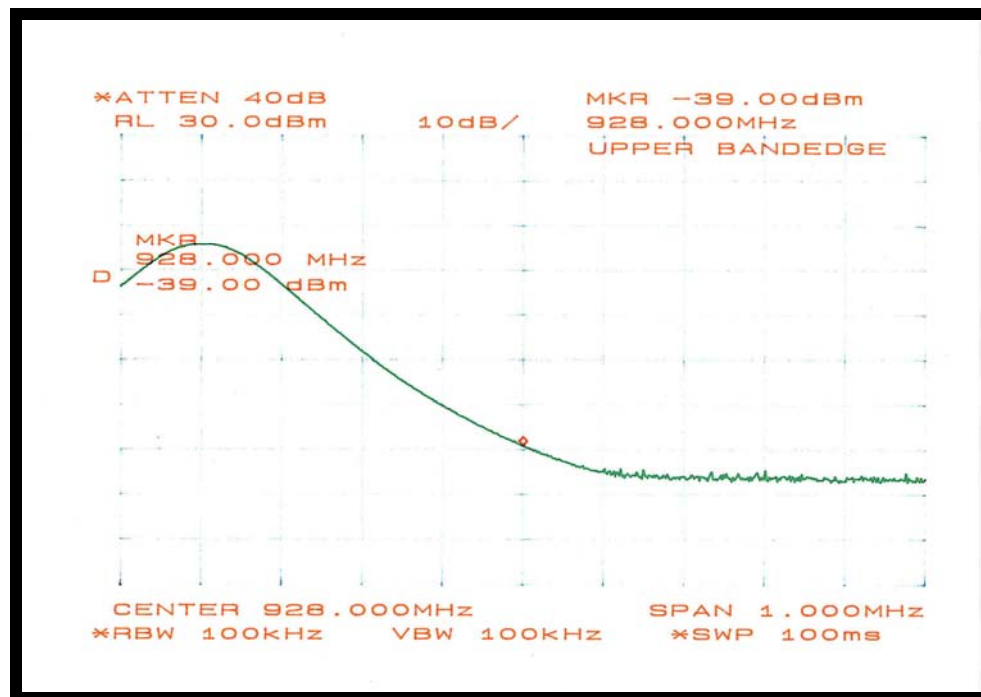


Figure 19: Plot of Upper Band-Edge Measurement at 928 MHz

#### Test-Data Summary -Band-Edge Measurement (Upper Band Edge – 928MHz):

**Center Frequency** = 928 MHz  
**Band-Edge Level** = -39 dBm  
**Limit per 15.247(c)** = 20dB below in-band peak (or -20dB)



## BAND-EDGE MEASUREMENT (cont)

### SECTION 9.4 TEST PLOT –BAND-EDGE MEASUREMENT (LOWER BANDEDGE - 902MHZ)

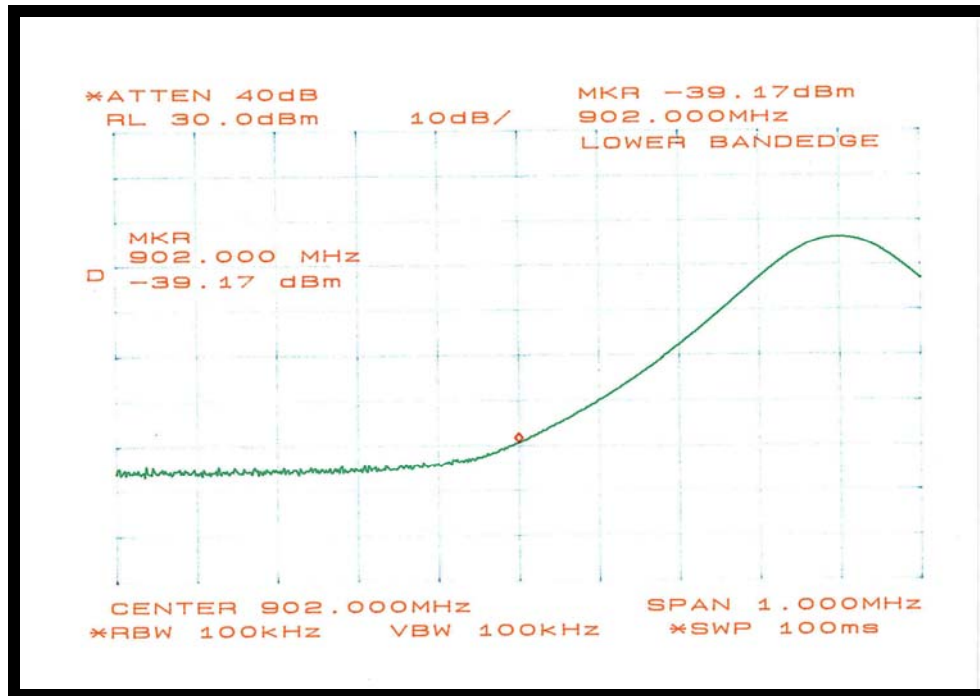


Figure 20: Plot of Lower Band-Edge Measurement at 902MHz

#### Test-Data Summary –Band-Edge Measurement (Lower Band Edge – 902MHz):

**Center Frequency** = 902 MHz  
**Band-Edge Level** = -39.17 dBm  
**Limit per 15.247(c)** = 20dB below in-band peak (or -20dB)

## PART 10 SPURIOUS RF CONDUCTED EMISSIONS

### SECTION 10.1 TEST PROCEDURE

The EUT "TempSens", Model "TWS-049 - Sensor" was set up on a wooden non-conductive tabletop, attached at the antenna connector to the measuring device. The measurement instrumentation used was a spectrum analyzer with bandwidth parameters as stipulated in ANSI C63.4-2003. The EUT was configured to run in periodic mode during the tests. The measurement data below represents the maximum worst-case result from the measurement performed in accordance to the requirements of this section.

### SECTION 10.2 ADMINISTRATIVE & ENVIRONMENTAL

Site Used:	Semi-Anechoic Absorber Lined Shielded Room
Test Date(s):	November 1, 2005
Test Engineer(s):	Femi Ojo
Temperature	70.6°F
Humidity	49%

### SECTION 10.3 TEST PLOT – RF COND EMISSIONS, (CHANNEL 0, 27 MHz – 940 MHz)

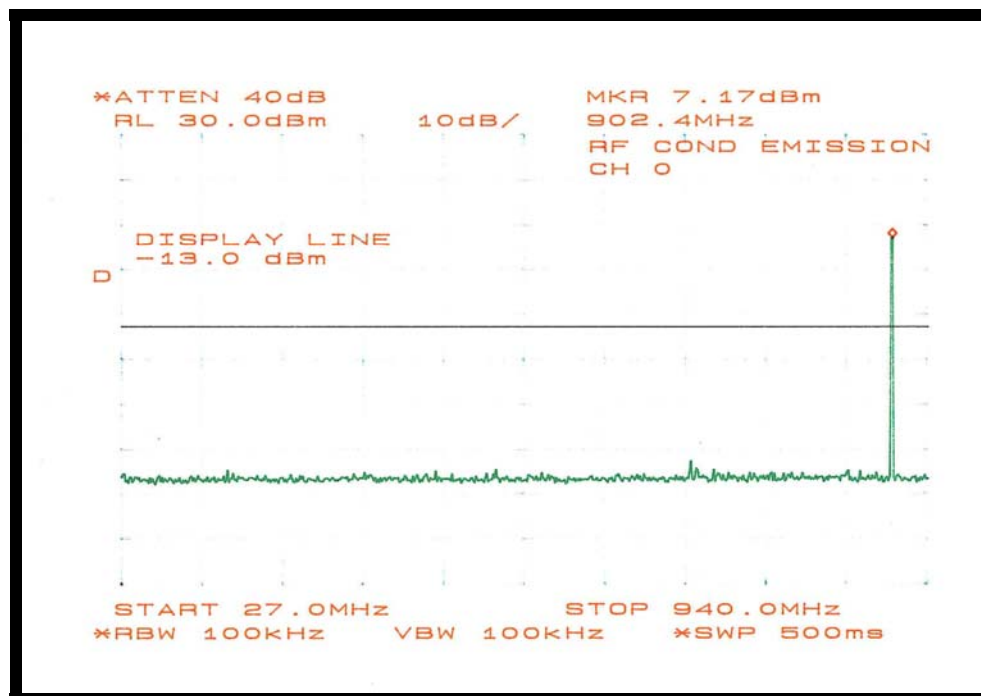


Figure 21: Plot of Spurious RF Conducted Emissions, Ch 0 (27.0MHz – 940MHz)

#### Test-Data Summary – Spurious RF Conducted Emissions

Peak Frequency (Fundamental) = 902.4MHz  
 Maximum Peak (27MHz to 940MHz) = Noise floor  
 20dB Limit (measured) per 15.247(c) = -13.0dBm

## SECTION 10.4 TEST PLOT – RF COND EMISSIONS, (CHANNEL 0, 848 MHZ – 5 GHZ)

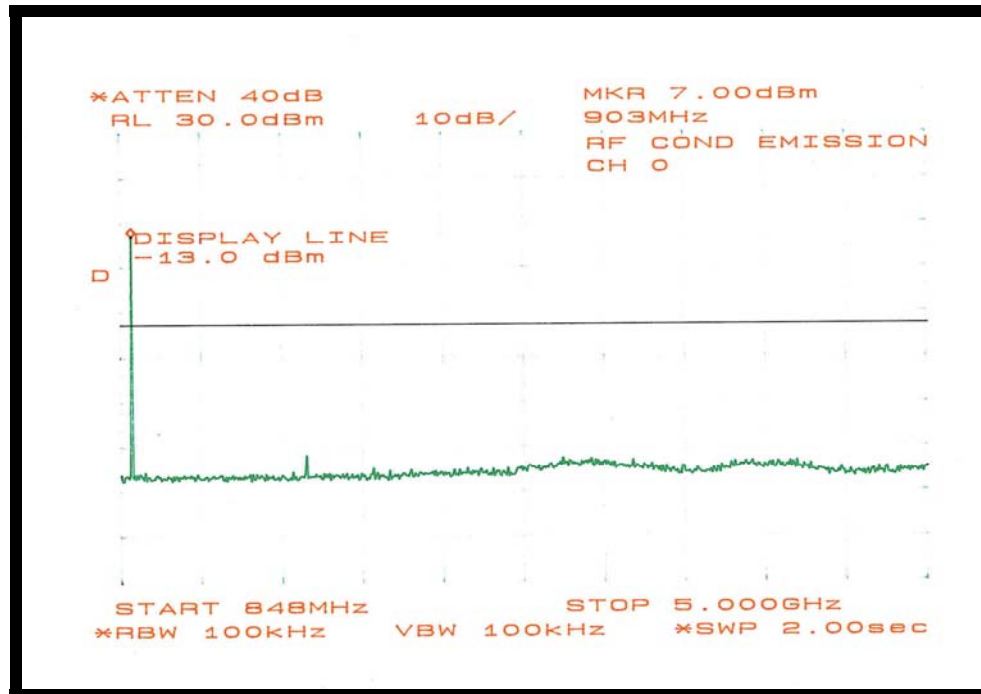


Figure 22: Plot of Spurious RF Conducted Emissions, Ch 0 ( 848MHz – 5GHz)

### Test-Data Summary – Spurious RF Conducted Emissions

Peak Frequency (Fundamental)	=	903MHz
Maximum Peak (848MHz to 5GHz)	=	Noise floor
20dB Limit (measured) per 15.247(c)	=	-13.0dBm

## SECTION 10.5 TEST PLOT – RF COND EMISSIONS, (CHANNEL 0, 5 GHZ – 10 GHZ)

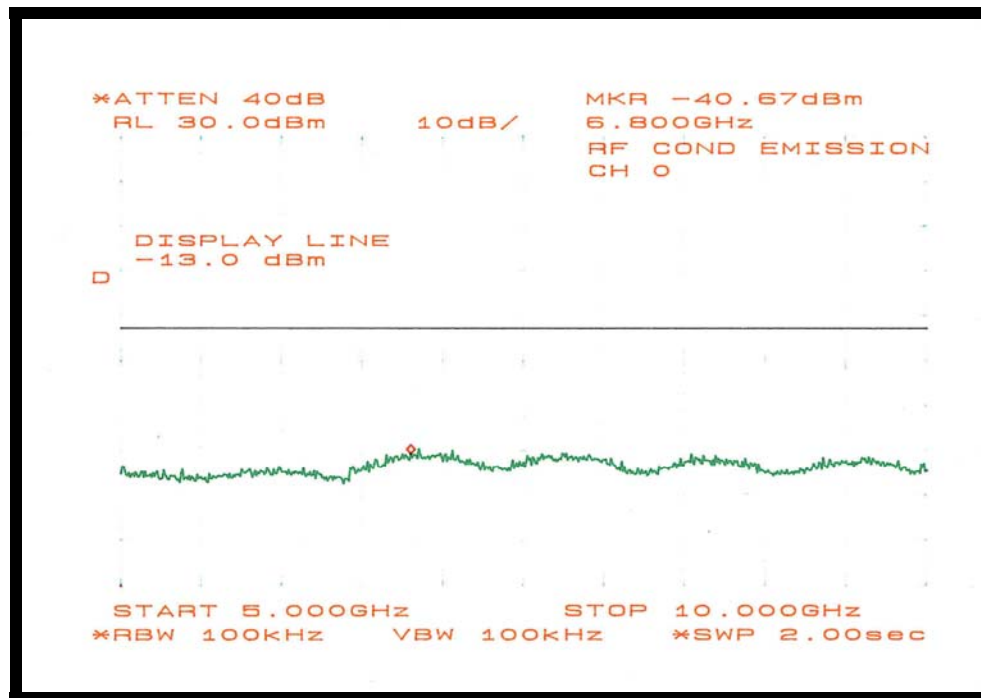


Figure 23: Plot of Spurious RF Conducted Emissions, Ch 0 (5GHz – 10GHz)

### Test-Data Summary – Spurious RF Conducted Emissions

Peak Frequency (Fundamental)	=	902.4MHz
Maximum Peak (5GHz to 10GHz)	=	Noise floor
20dB Limit (measured) per 15.247(c)	=	-13.0dBm

## SECTION 10.6 TEST PLOT – RF COND EMISSIONS, (CHANNEL 28, START 27 MHZ, STOP 940 MHZ)

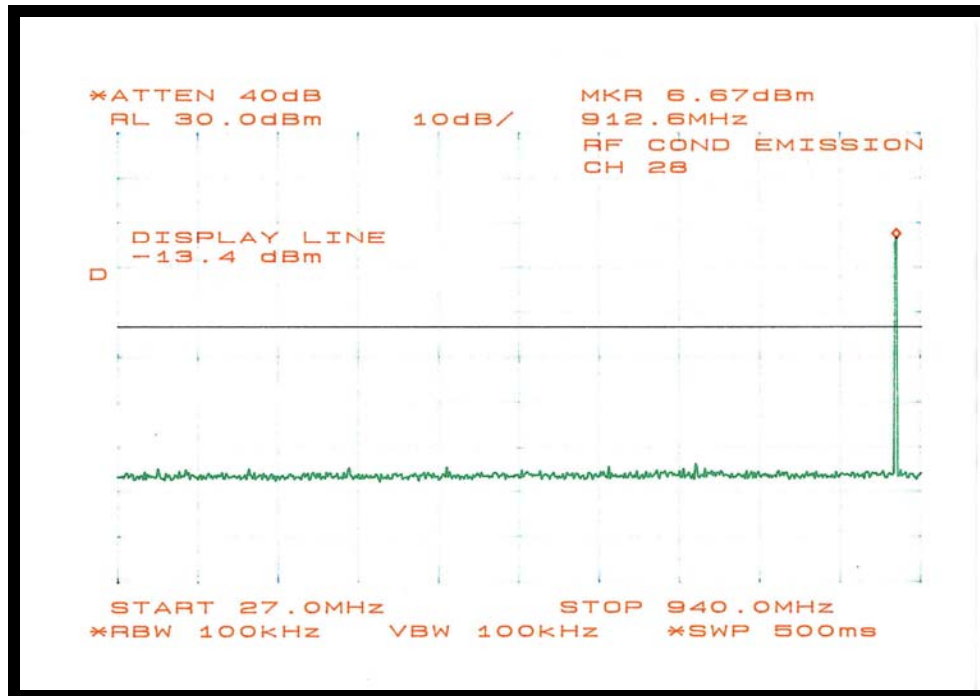


Figure 24: Plot of Spurious RF Conducted Emissions, Ch 28 (27.0MHz – 940MHz)

### Test-Data Summary – Spurious RF Conducted Emissions

Peak Frequency (Fundamental)	=	912.6MHz
Maximum Peak (27MHz to 940MHz)	=	Noise floor
20dB Limit (measured) per 15.247(c)	=	-13.4dBm

## SECTION 10.7 TEST PLOT – RF COND EMISSIONS, (CHANNEL 28, START 850 MHZ – STOP 5 GHZ)

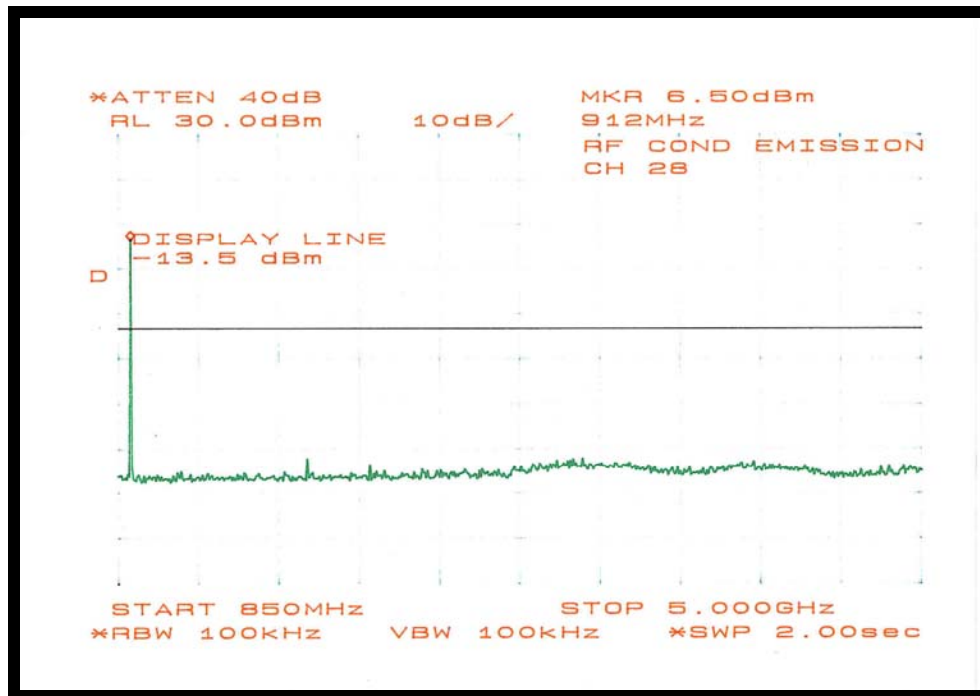


Figure 25: Plot of Spurious RF Conducted Emissions, Ch 28 ( 848MHz – 5GHz)

### Test-Data Summary – Spurious RF Conducted Emissions

Peak Frequency (Fundamental)	=	912MHz
Maximum Peak (848MHz to 5GHz)	=	Noise floor
20dB Limit (measured) per 15.247(c)	=	-13.5dBm

## SECTION 10.8 TEST PLOT – RF COND EMISSIONS, (CHANNEL 28, START 5 GHZ – 10 GHZ)

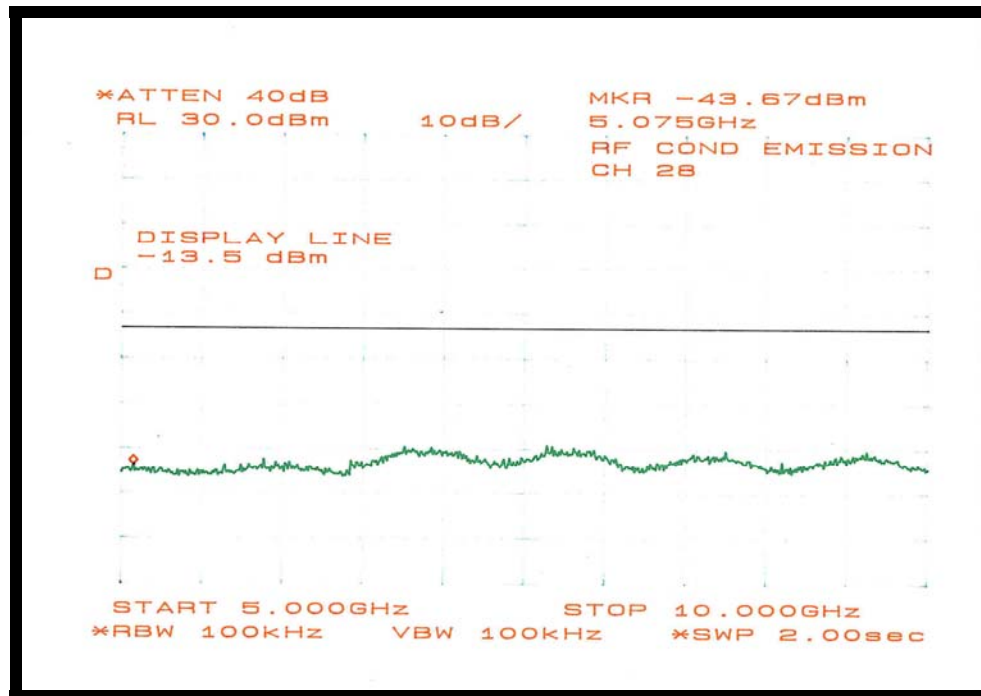


Figure 26: Plot of Spurious RF Conducted Emissions, Ch 28 ( 5GHz – 10GHz)

### Test-Data Summary – Spurious RF Conducted Emissions

Peak Frequency (Fundamental)	=	912.0MHz
Maximum Peak (5GHz to 10GHz)	=	Noise floor
20dB Limit (measured) per 15.247(c)	=	-13.5dBm



## SECTION 10.9 TEST PLOT – RF COND EMISSIONS, (CHANNEL 59, START 27 MHZ – STOP 940 MHZ)

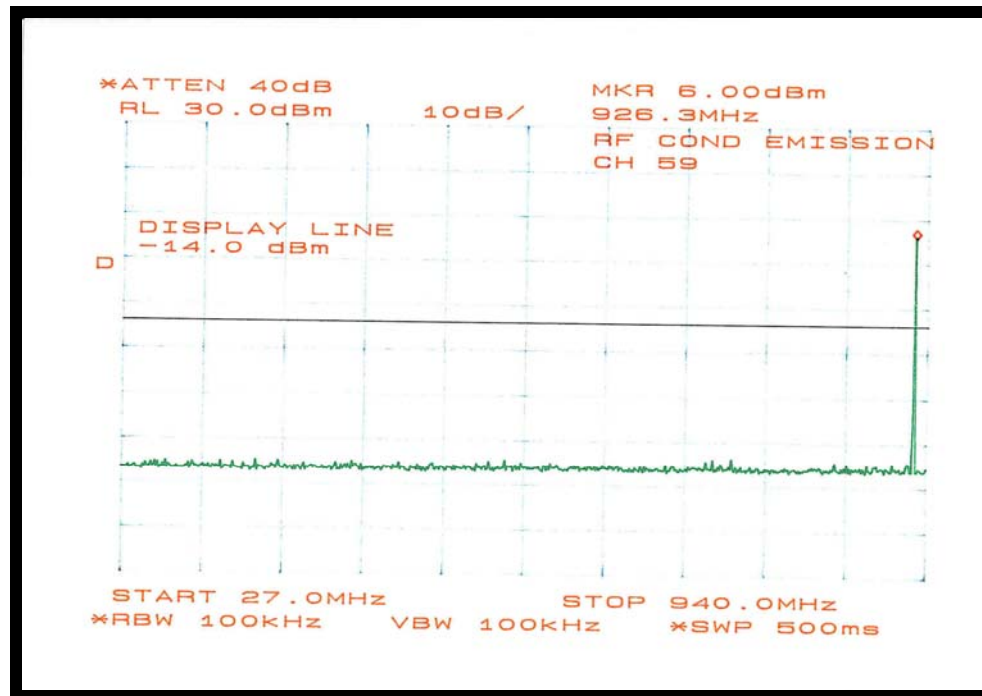


Figure 27: Plot of Spurious RF Conducted Emissions, Ch 59 (27.0MHz – 940MHz)

### Test-Data Summary – Spurious RF Conducted Emissions

Peak Frequency (Fundamental)	=	926.3MHz
Maximum Peak (27MHz to 940MHz)	=	Noise floor
20dB Limit (measured) per 15.247(c)	=	-14.0dBm

## SECTION 10.10 TEST PLOT– RF COND EMISSIONS, (CHANNEL 59, START 850 MHZ – STOP 5 GHZ)

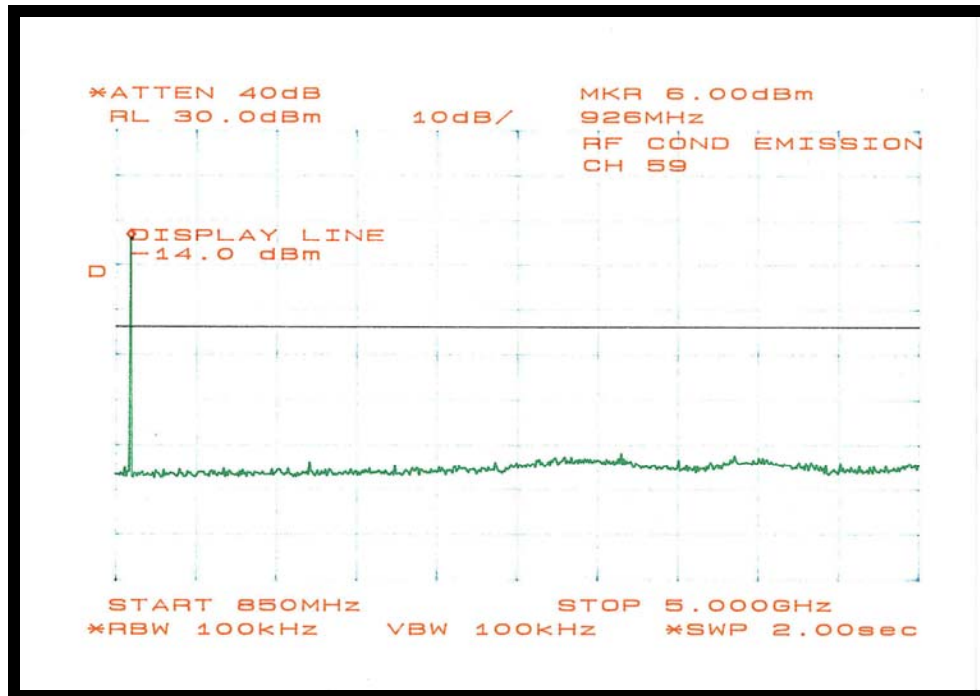


Figure 28: Plot of Spurious RF Conducted Emissions, Ch 59 ( 848MHz – 5GHz)

### Test-Data Summary – Spurious RF Conducted Emissions

Peak Frequency (Fundamental)	=	926MHz
Maximum Peak (848MHz to 5GHz)	=	Noise floor
20dB Limit (measured) per 15.247(c)	=	-14.0dBm

## SECTION 10.11 TEST PLOT – RF COND EMISSIONS, (CHANNEL 59, START 5 GHZ 0- STOP 10 GHZ)

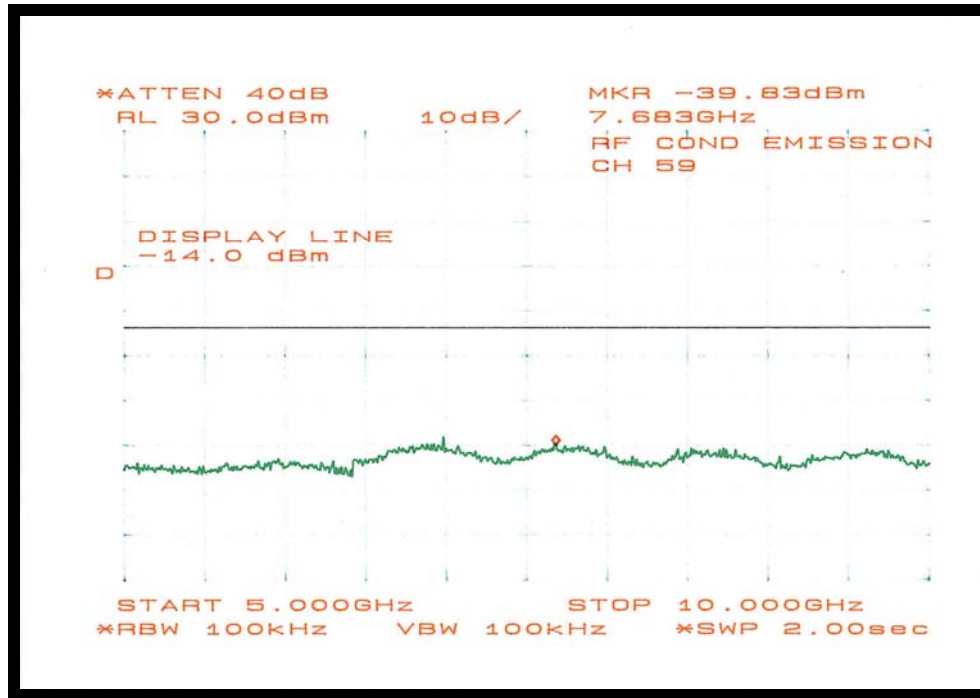


Figure 29: Plot of Spurious RF Conducted Emissions, Ch 59 ( 5GHz – 10GHz)

### Test-Data Summary – Spurious RF Conducted Emissions

Peak Frequency (Fundamental)	=	926.0MHz
Maximum Peak (5GHz to 10GHz)	=	Noise floor
20dB Limit (measured) per 15.247(c)	=	-14.0dBm

## PART 11 SPURIOUS/HARMONIC EMISSIONS IN THE RESTRICTED BANDS

### SECTION 11.1 TEST SPECIFICATION:

FCC PART 15 SECTION 47 CFR 15.205  
FCC PART 15 SECTION 47 CFR 15.247(c)

### SECTION 11.2 TEST RANGE – SPURIOUS/HARMONICS EMISSIONS:

The measurement range investigated was from 30 MHz to 10GHz.

### SECTION 11.3 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	Semi-Anechoic Absorber Lined Shielded Room
Test Date:	Nov .2, 2005
Test Engineer:	Femi Ojo
Temperature:	69.4°F
Humidity:	43%

### SECTION 11.4 SPURIOUS EMISSIONS (BELOW 1 GHZ)

The table below shows the summary of the highest amplitudes of the spurious RF radiated emissions from the equipment under test. The EUT was tested at low, mid and high frequencies and the results are similar for the three frequencies.

INDICATED		CORRECTION		CORR	TURNTABLE ANT			CLASS A		CLASS B		NOTES
FREQ	AMPL	ANT	CAB	AMPL	ANG	HT	POL	AMPL	MARG	AMPL	MARG	
MHz	dBuV/m	dB	dB	dBuV/m	DEG	m	-	dBuV/m	dB	dBuV/m	db	
38.90	28.2	11.2	-9.0	30.4	90	1.0	VB	-	-	40.0	-9.6	
41.40	29.6	11.7	-9.2	32.1	90	2.0	HB	-	-	40.0	-7.9	
68.20	28.9	7.6	-11.2	25.3	90	1.0	VB	-	-	40.0	-14.7	
125.70	28.8	12.7	-11.8	29.7	90	1.0	VB	-	-	43.0	-13.3	
232.00	29.9	11.2	-11.2	29.9	90	1.0	VL	-	-	43.0	-13.1	
250.30	28.4	12.0	-11.0	29.4	90	2.0	HL	-	-	46.0	-16.6	
319.50	26.4	14.1	-10.7	29.8	90	1.0	VL	-	-	46.0	-16.2	
320.14	29.5	14.5	-10.7	33.3	90	2.0	HL	-	-	46.0	-12.7	
386.25	25.1	14.8	-10.5	29.4	90	1.0	VL	-	-	46.0	-16.6	
445.39	24.3	16.0	-10.2	30.0	90	1.0	VL	-	-	46.0	-16.0	
480.29	25.2	17.4	-10.2	32.4	90	2.0	HL	-	-	46.0	-13.6	
614.35	24.8	18.4	-9.7	33.5	90	1.0	VL	-	-	46.0	-12.5	
851.46	23.4	21.4	-8.8	36.0	90	1.0	VL	-	-	46.0	-10.0	

No emission of significant level was observed above 851.46 MHz thru 1 GHz

## Spurious and Harmonics Emissions (cont)

### SECTION 11.5 SPURIOUS AND HARMONICS EMISSIONS (ABOVE 1GHZ) CHANNEL 0

The table below shows a summary of the highest amplitudes of the radiated emissions from the equipment under test at various antenna heights, antenna polarization, and EUT orientations

INDICATED		CORRECTION		CORR	TURNTABLE ANT			CLASS A		CLASS B		NOTES
FREQ	AMPL	ANT	CAB	AMPL	ANG	HT	POL	AMPL	MARG	AMPL	MARG	
MHz	dBuV/m	dB	dB	dBuV/m	DEG	m	-	dBuV/m	dB	dBuV/m	db	
902.37	83.0	21.3	-14.6	89.6	90	1.5	VL	-	-	143.0	-53.4	
902.37	93.1	21.3	-14.6	99.8	90	1.5	VL	-	-	143.0	-43.2	
1291.80	22.0	24.7	-13.2	33.5	180	1.5	VH	-	-	54.0	-20.5	A
1291.80	21.8	24.7	-13.2	33.4	0	1.5	HH	-	-	54.0	-20.6	A
1554.00	23.5	25.4	-12.5	36.4	0	1.5	VH	-	-	54.0	-17.6	A
1554.00	22.2	25.4	-12.5	35.1	90	1.5	HH	-	-	54.0	-18.9	A
1804.90	28.8	26.8	-12.3	43.3	180	1.5	VH	-	-	54.0	-10.7	A
1804.90	21.2	26.7	-12.3	35.5	90	1.5	HH	-	-	54.0	-18.5	A
1926.00	21.7	27.3	-12.0	37.0	180	1.5	HH	-	-	54.0	-17.0	A
2050.00	23.0	28.0	-11.4	39.5	180	1.5	VH	-	-	54.0	-14.5	A
2419.00	23.0	28.5	-10.4	41.1	0	1.5	HH	-	-	54.0	-12.9	A
2707.30	22.3	29.2	-10.8	40.8	90	1.5	HH	-	-	54.0	-13.2	A
2707.33	25.0	29.2	-10.8	43.4	180	1.5	VH	-	-	54.0	-10.6	A
2971.50	24.3	30.0	-10.7	43.7	90	1.5	VH	-	-	54.0	-10.3	A
3124.00	0.0	30.4	-10.4	20.0	180	1.5	HH	-	-	54.0	-34.0	A
3609.67	25.3	31.6	-10.1	46.8	90	1.5	VH	-	-	54.0	-7.2	A
3609.67	23.5	31.5	-10.1	44.9	0	1.5	HH	-	-	54.0	-9.1	A
4518.90	24.0	32.4	-9.6	46.9	180	1.5	VH	-	-	54.0	-7.1	A
4518.90	23.2	32.4	-9.6	46.0	0	1.5	HH	-	-	54.0	-8.0	A
5411.30	23.8	34.0	-8.0	49.8	0	1.5	VH	-	-	54.0	-4.2	A
5411.30	22.5	34.0	-8.0	48.5	180	1.5	HH	-	-	54.0	-5.5	A
6314.00	22.5	34.4	-6.4	50.6	90	1.5	VH	-	-	54.0	-3.4	A
6314.00	21.5	34.5	-6.4	49.6	90	1.5	HH	-	-	54.0	-4.4	A
7218.00	21.0	35.8	-5.8	51.0	90	1.5	VH	-	-	54.0	-3.0	A
8121.00	18.4	36.9	-5.7	49.6	0	1.5	VH	-	-	54.0	-4.4	A
9023.00	0.0	37.4	-5.5	31.9	180	1.5	VH	-	-	54.0	-22.1	A

No emission of significant level was observed above 9023 MHz thru 10 GHz

## SECTION 11.6 SPURIOUS AND HARMONICS EMISSIONS (ABOVE 1GHZ) CHANNEL 28

The table below shows a summary of the highest amplitudes of the radiated emissions from the equipment under test at various antenna heights, antenna polarization, and EUT orientations

INDICATED		CORRECTION		CORR	TURNTABLE ANT			CLASS A		CLASS B		NOTES
FREQ	AMPL	ANT	CAB	AMPL	ANG	HT	POL	AMPL	MARG	AMPL	MARG	
MHz	dBuV/m	dB	dB	dBuV/m	DEG	m	-	dBuV/m	dB	dBuV/m	db	
915.20	83.0	22.9	-12.7	93.2	0	1.5	VL	-	-	143.0	-49.8	
915.20	94.5	21.7	-12.7	103.5	0	1.5	HL	-	-	143.0	-39.5	
1293.00	21.2	24.7	-13.2	32.7	90	1.5	VH	-	-	54.0	-21.3	A
1293.00	21.8	24.7	-13.2	33.4	90	1.5	HH	-	-	54.0	-20.6	A
1549.00	21.7	25.4	-12.5	34.5	0	1.5	VH	-	-	54.0	-19.5	A
1830.40	21.5	26.8	-12.3	36.1	180	1.5	VH	-	-	54.0	-17.9	A
1830.40	21.7	27.0	-12.3	36.4	180	1.5	HH	-	-	54.0	-17.6	A
1928.00	22.3	27.5	-12.0	37.9	180	1.5	HH	-	-	54.0	-16.1	A
2064.00	0.0	27.8	-11.3	16.5	90	1.5	VH	-	-	54.0	-37.5	A
2534.00	21.7	28.7	-10.5	39.8	180	1.5	HH	-	-	54.0	-14.2	A
2745.60	22.0	29.3	-10.8	40.5	180	1.5	VH	-	-	54.0	-13.5	A
2745.60	22.3	29.3	-10.8	40.8	90	1.5	HH	-	-	54.0	-13.2	A
2966.00	0.0	30.0	-10.7	19.3	180	1.5	VH	-	-	54.0	-34.7	A
3144.00	0.0	30.4	-10.4	20.1	90	1.5	HH	-	-	54.0	-33.9	A
3660.80	23.3	31.7	-10.2	44.9	90	1.5	VH	-	-	54.0	-9.1	A
3660.80	22.8	31.8	-10.2	44.4	180	1.5	HH	-	-	54.0	-9.6	A
4576.00	22.8	32.5	-9.3	46.1	180	1.5	VH	-	-	54.0	-7.9	A
4576.00	23.2	32.5	-9.3	46.4	180	1.5	HH	-	-	54.0	-7.6	A
5491.20	22.5	34.2	-7.9	48.8	90	1.5	VH	-	-	54.0	-5.2	A
5491.20	22.2	34.2	-7.9	48.5	90	1.5	HH	-	-	54.0	-5.5	A
6406.40	21.7	34.5	-6.2	50.0	180	1.5	VH	-	-	54.0	-4.0	A
6406.40	21.0	34.4	-6.2	49.2	90	1.5	HH	-	-	54.0	-4.8	A
7338.00	19.9	36.1	-5.8	50.2	90	1.5	HH	-	-	54.0	-3.8	A
7338.00	20.4	36.1	-5.8	50.7	90	1.5	VH	-	-	54.0	-3.3	A
8256.00	17.5	37.0	-5.7	48.8	180	1.5	HH	-	-	54.0	-5.2	A
8256.00	18.1	37.0	-5.7	49.4	180	1.5	VH	-	-	54.0	-4.6	A
9173.00	18.0	37.4	-5.3	50.1	90	1.5	HH	-	-	54.0	-3.9	A
9173.00	18.2	37.4	-5.3	50.3	90	1.5	VH	-	-	54.0	-3.7	A

No emission of significant level was observed above 9173 MHz thru 10 GHz

## SECTION 11.7 SPURIOUS AND HARMONICS EMISSIONS (ABOVE 1GHZ) CHANNEL 59

The table below shows a summary of the highest amplitudes of the radiated emissions from the equipment under test at various antenna heights, antenna polarization, and EUT orientations

INDICATED		CORRECTION		CORR	TURNTABLE ANT			CLASS A		CLASS B		NOTES
FREQ	AMPL	ANT	CAB	AMPL	ANG	HT	POL	AMPL	MARG	AMPL	MARG	
MHz	dBuV/m	dB	dB	dBuV/m	DEG	m	-	dBuV/m	dB	dBuV/m	db	
927.57	83.1	23.2	-15.0	91.3	0	1.5	VL	-	-	143.0	-51.7	
927.57	94.2	22.4	-15.0	101.5	0	1.5	HL	-	-	143.0	-41.5	
1264.00	21.5	24.7	-13.3	32.9	180	1.5	VH	-	-	54.0	-21.1	A
1264.00	21.2	24.7	-13.3	32.6	0	1.5	HH	-	-	54.0	-21.4	A
1292.00	21.5	24.7	-13.2	33.0	90	1.5	VH	-	-	54.0	-21.0	A
1292.00	21.8	24.7	-13.2	33.4	180	1.5	HH	-	-	54.0	-20.6	A
1539.00	21.7	25.3	-12.5	34.5	180	1.5	VH	-	-	54.0	-19.5	A
1855.00	21.5	26.9	-12.2	36.3	0	1.5	VH	-	-	54.0	-17.7	A
1855.00	21.7	27.1	-12.2	36.6	90	1.5	HH	-	-	54.0	-17.4	A
2064.00	21.7	27.8	-11.3	38.2	90	1.5	VH	-	-	54.0	-15.8	A
2423.00	0.0	28.5	-10.4	18.1	180	1.5	VH	-	-	54.0	-35.9	A
2423.00	21.5	28.5	-10.4	39.6	180	1.5	HH	-	-	54.0	-14.4	A
2782.00	22.3	29.4	-10.8	41.0	90	1.5	VH	-	-	54.0	-13.0	A
2782.00	21.5	29.4	-10.8	40.1	90	1.5	HH	-	-	54.0	-13.9	A
2968.00	24.3	30.0	-10.7	43.6	0	1.5	HH	-	-	54.0	-10.4	A
3125.00	23.7	30.4	-10.4	43.7	0	1.5	VH	-	-	54.0	-10.3	A
3710.00	22.5	31.8	-10.2	44.2	180	1.5	VH	-	-	54.0	-9.8	A
3710.00	23.3	31.9	-10.2	45.1	180	1.5	HH	-	-	54.0	-8.9	A
4637.00	22.5	32.6	-8.9	46.2	180	1.5	VH	-	-	54.0	-7.8	A
4637.00	22.8	32.6	-8.9	46.5	90	1.5	HH	-	-	54.0	-7.5	A
5565.00	22.2	34.2	-7.7	48.7	0	1.5	VH	-	-	54.0	-5.3	A
5565.00	22.2	34.2	-7.7	48.7	180	1.5	HH	-	-	54.0	-5.3	A
6493.00	21.6	34.5	-6.0	50.1	90	1.5	VH	-	-	54.0	-3.9	A
6493.00	21.0	34.4	-6.0	49.4	0	1.5	HH	-	-	54.0	-4.6	A
7420.00	20.1	36.3	-5.8	50.6	180	1.5	VH	-	-	54.0	-3.4	A
7420.00	19.8	36.3	-5.8	50.3	90	1.5	HH	-	-	54.0	-3.7	A
8348.00	18.9	37.1	-5.7	50.3	0	1.5	VH	-	-	54.0	-3.7	A
8348.00	8.6	37.0	-5.7	39.9	90	1.5	HH	-	-	54.0	-14.1	A
9275.00	18.0	37.5	-5.2	50.2	180	1.5	VH	-	-	54.0	-3.8	A
9275.00	18.2	37.5	-5.2	50.4	0	1.5	HH	-	-	54.0	-3.6	A

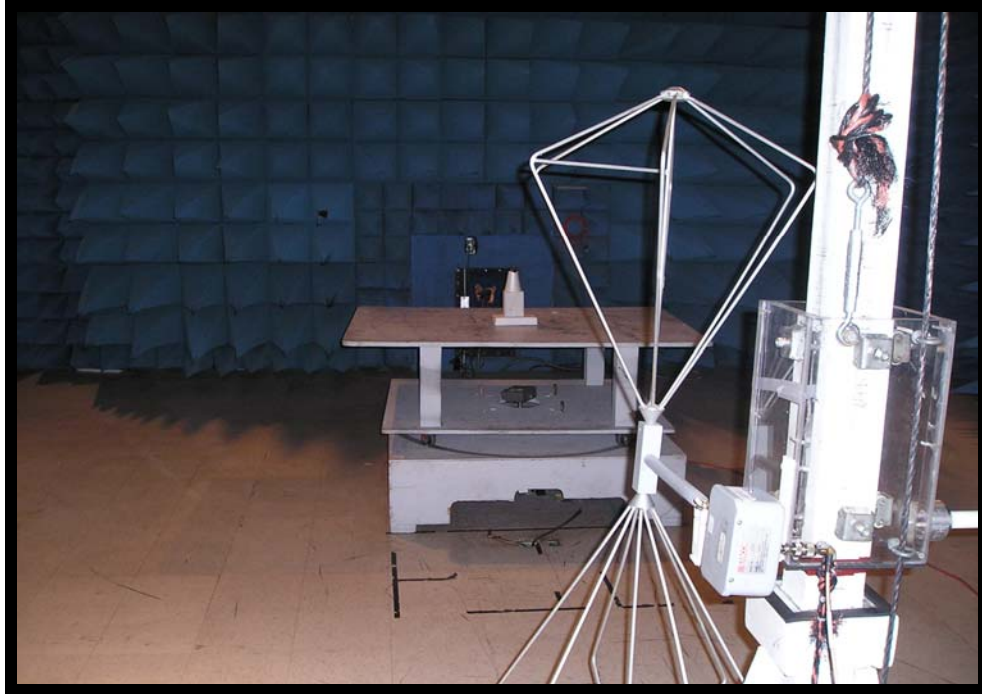
No emission of significant level was observed above 9275 MHz thru 10 GHz

### Remarks:

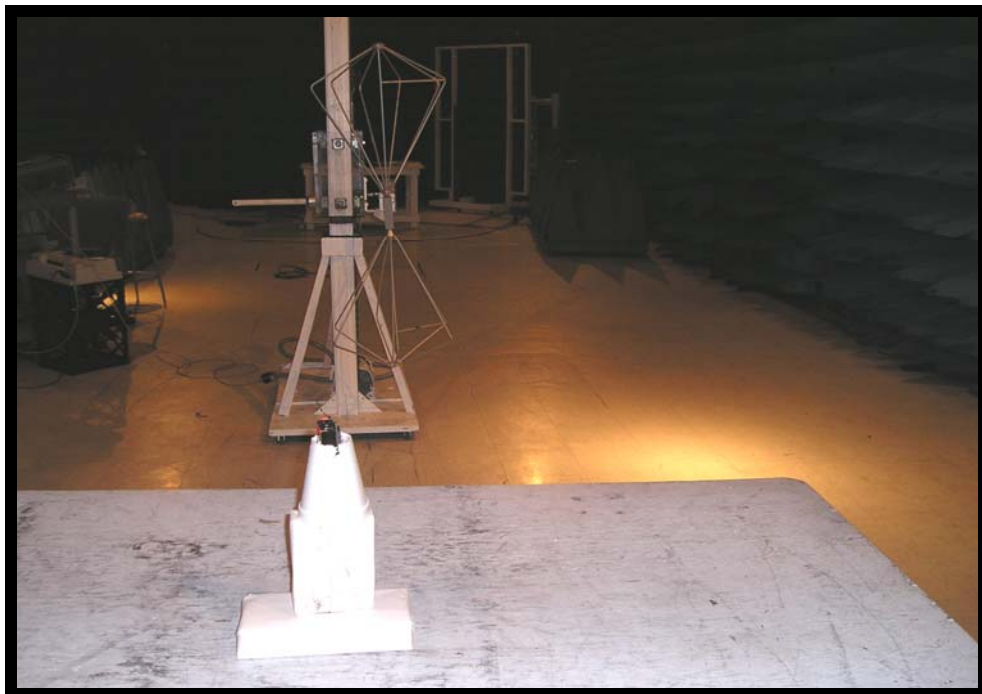
The Product "TempSens", Model "TWS-049 - Sensor" meets the requirements of the test reference for Spurious and Harmonics emissions in Restricted Bands specified in 15.209



## SECTION 11.8 SPURIOUS PHOTOGRAPHS



**Figure 30: Spurious Emissions Front View (Below 1 GHz)**

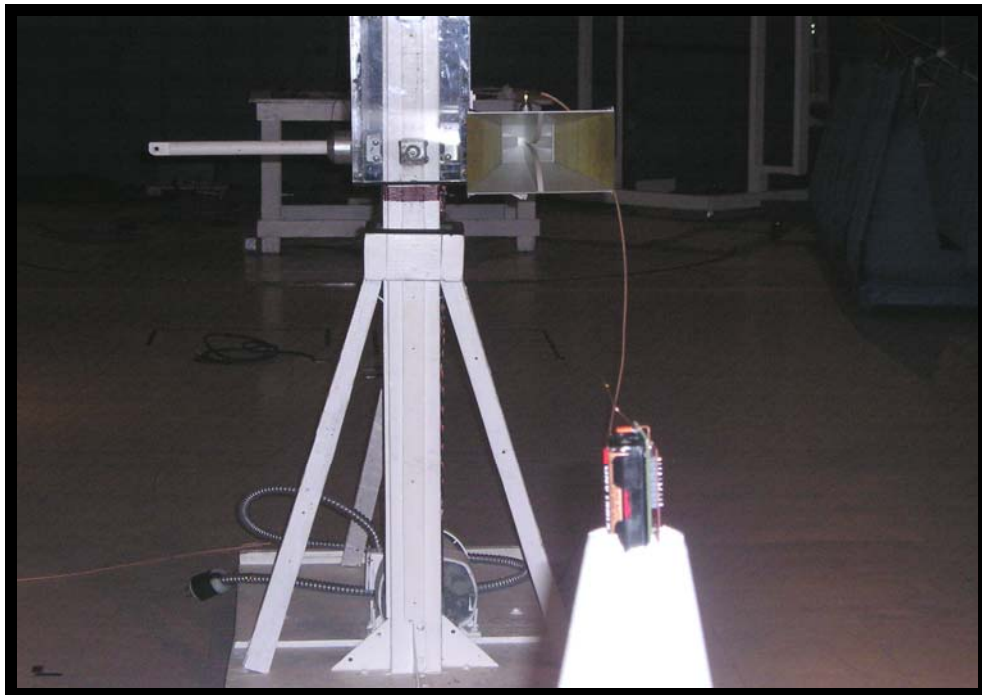


**Figure 31: Spurious Emissions Rear View (Below 1 GHz)**

## Spurious Emissions (cont.)



**Figure 32: Spurious Emissions Front View (Above 1 GHz)**



**Figure 33: Spurious Emissions Rear View (Above 1 GHz)**

## PART 12 ANTENNA REQUIREMENT PER 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

**Remark:** The antenna for TWS – 049 Sensor is permanently attached to the device.

## PART 13 APPENDICES

### SECTION A. EUT TECHNICAL SPECIFICATION

Applicant	Tehama Wireless Design Group
General Description	Temperature Sensor System
Model	TWS – 049
Dimension	3.2 x 1.75 0.85 Inches (PCB only)
Main Board	Part Number: TW-049,Rev 2
Low Power Radio Board	Part Number : TW-1020
Power Input	5.0Vdc

## SECTION B. EUT PHOTOGRAPHS

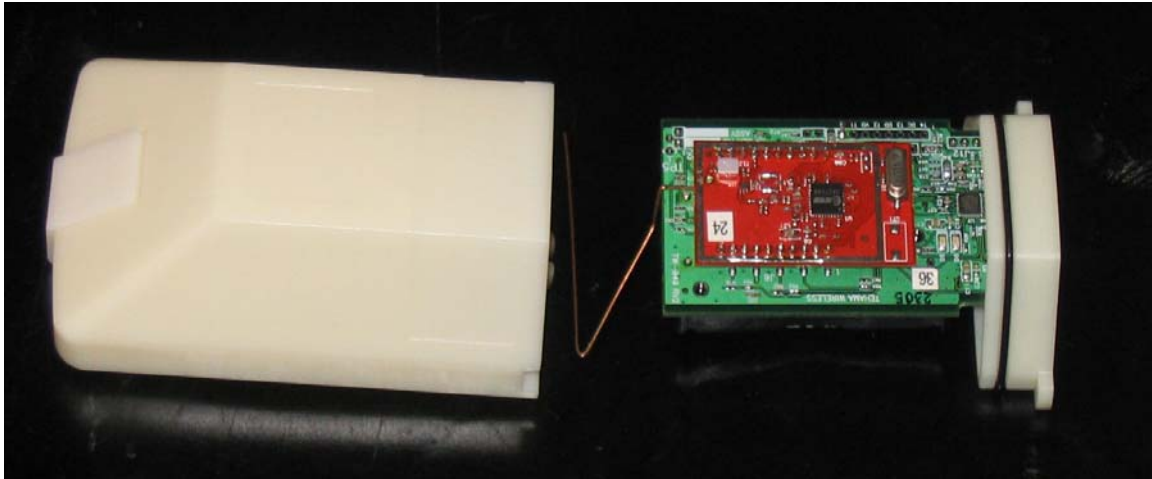


**Figure 34: EUT External View (Top)**

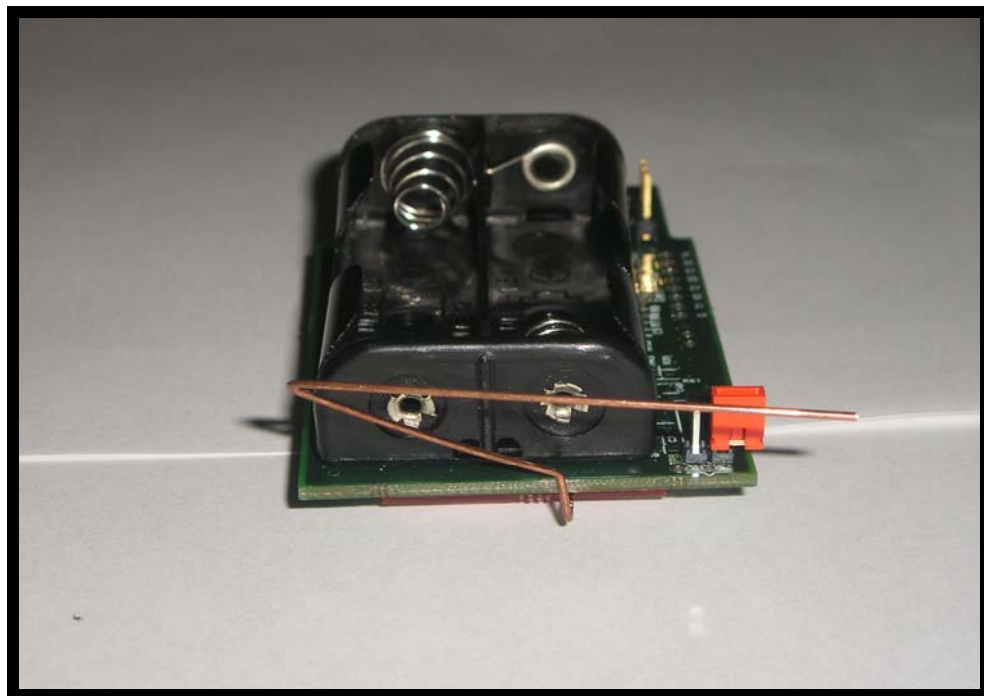


**Figure 35: EUT External View (Bottom)**





**Figure 36: EUT Component View 1**



**Figure 37: EUT Internal View 1**

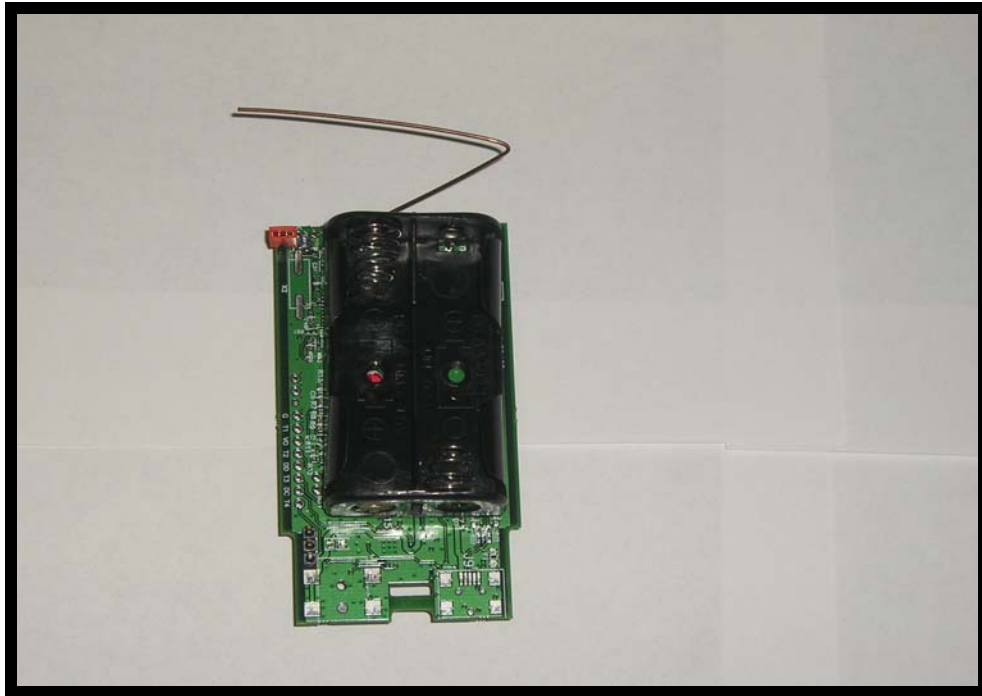


Figure 38: EUT Internal View 2

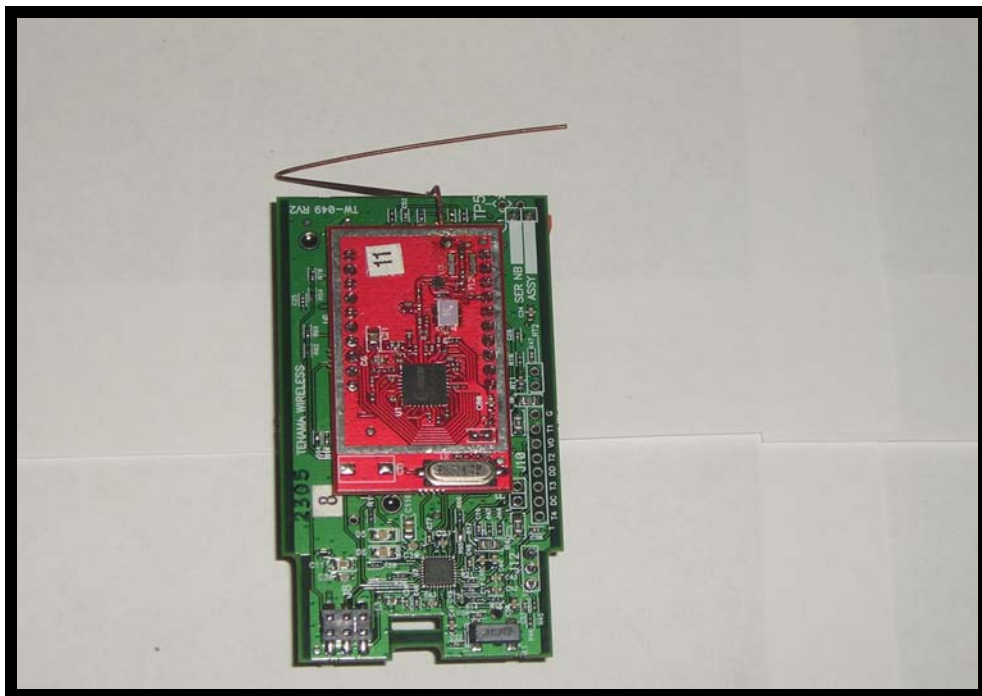


Figure 39: EUT Internal View 3



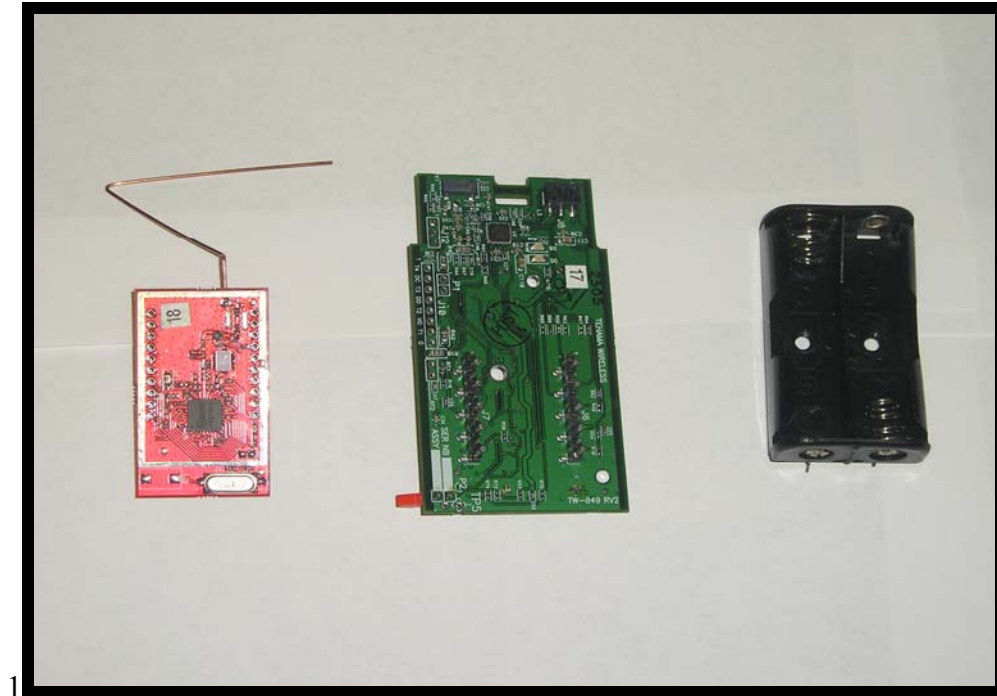


Figure 40: EUT Component View 2

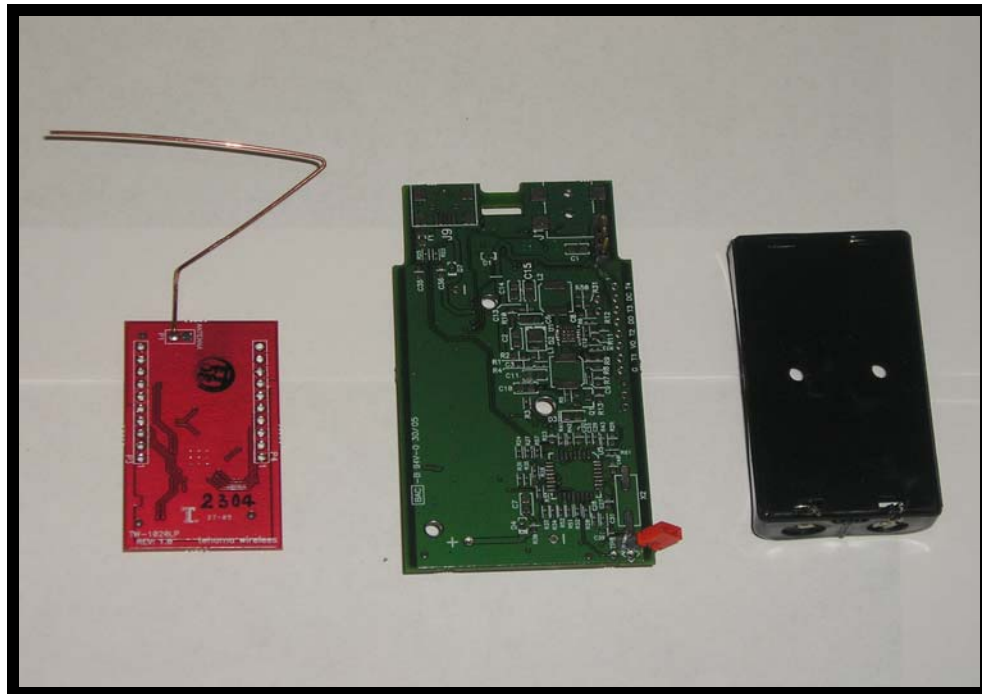


Figure 41: EUT Component View 3

## SECTION C. MODIFICATION LETTER

To Whom It May Concern:

This is to certify that no modifications were required for tehama wireless product "TempSens", Model "TWS-049 - Sensor" to comply with the requirements of the standard listed below.

### FCC Rules and Regulations per 47 CFR 15.247

It is the manufacturer's responsibility to ensure that additional production units of the EUT are manufactured with identical electrical and mechanical characteristics.

For further information, please contact the manufacturer at:

**Tehama Wireless Design Group**  
423 Tehama Street  
San Francisco, California, 94103

ATTN: Mr. Jim Orton  
Tel: +1 (415) 495-7344  
Fax: +1 (415) 495-7314  
Email: orton@tehamawireless.com