Washington Laboratories, Ltd.

7560 Lindbergh Drive Gaithersburg, Maryland 20879 (301) 216-1500 Fax (301) 216-1590

FCC & Industry Canada Certification Test Report
For the
Etymotic Research Inc.
ER-892 etyBLU2 Bluetooth Headset

FCC ID: RWT-ER892
IC ID: 6648A-ER892

WLL JOB# **10800**
February 27, 2009

Prepared for:

Etymotic Research Inc.
61 Martin Lane
Elk Grove Village, IL 60007

Prepared By:

Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879

ACCREDITED
Testing Certificate 2675.01

FCC & Industry Canada Certification Test Report
for the
Etymotic Research
ER-892 etyBLU2 Bluetooth Headset
FCC ID: RWT-ER892
IC ID: 6648A-ER892

February 27, 2009

WLL JOB# 10800

Prepared by: James Ritter
EMC Compliance Engineer

Reviewed by: Steven D. Koster
EMC Operations Manager

Abstract

This report has been prepared on behalf of Etymotic Research to support the attached Application for Equipment Authorization. The test report and application are submitted for a Frequency Hopping Spread Spectrum Transmitter under Part 15.247 (7/2008) of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-210 of Industry Canada. This Certification Test Report documents the test configuration and test results for a Etymotic Research ER-892 etyBLU2 Bluetooth Headset.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by the American Association for Laboratory Accreditation (A2LA) under Certificate 2675.01 as an independent FCC test laboratory.

The Etymotic Research ER-892 etyBLU2 Bluetooth Headset complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under FCC Part 15.247 and Industry Canada RSS-210.

Table of Contents

List of Tables

List of Figures

1 Introduction

1.1 Compliance Statement

The Etymotic Research ER-892 etyBLU2 Bluetooth Headset complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under FCC Part 15.247 (7/2008) and Industry Canada RSS-210 issue 7.

1.2 Test Scope

Tests for radiated and conducted (at antenna terminal) emissions were performed. All measurements were performed in accordance with "FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems".

Contract Information

Customer:	TEM Consulting LP 140 River Road Georgetown, TX 78628
On Behalf of:	Etymotic Research 61 Martin Lane Elk Grove Village, IL 60007
Purchase Order Number:	1026
Quotation Number:	64560

1.3 Test Dates

Testing was performed on the following date(s):	2/19/09-2/26/09

1.4 Test and Support Personnel

Washington Laboratories, LTD	James Ritter
Client Representative	Stephen Berger

1.5 Abbreviations

A	**A**mpere
ac	**a**lternating **c**urrent
AM	Amplitude Modulation
Amps	**Amp**eres
b/s	**b**its per **s**econd
BW	**B**and**W**idth
CE	**C**onducted **E**mission
cm	**C**enti**m**eter
CW	**C**ontinuous **W**ave
dB	**decibel**
dc	**d**irect **c**urrent
EMI	**E**lectro**m**agnetic **I**nterference
EUT	**E**quipment **U**nder **T**est
FM	**F**requency **M**odulation
G	**g**iga - prefix for 10^9 multiplier
Hz	**H**ertz
IF	**I**ntermediate **F**requency
k	**k**ilo - prefix for 10^3 multiplier
LISN	**L**ine **I**mpedance **S**tabilization **N**etwork
M	**M**ega - prefix for 10^6 multiplier
m	**M**eter
µ	**m**icro - prefix for 10^{-6} multiplier
NB	**N**arrow**b**and
QP	**Q**uasi-**P**eak
RE	**R**adiated **E**missions
RF	**R**adio **F**requency
rms	**r**oot-**m**ean-**s**quare
SN	**S**erial **N**umber
S/A	**S**pectrum **A**nalyzer
V	**V**olt

2 Equipment Under Test

2.1 EUT Identification & Description

The Etymotic Research ER-892 etyBLU2 Bluetooth Headset is a device used to pair to cell phones or other Bluetooth devices and is used to transmit and receive analog signals such as voice or music between the pair.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Etymotic Research
FCC ID:	RWT-ER892
IC:	6648A-ER892
Model:	ER-892 etyBLU2 Bluetooth Headset
FCC Rule Parts:	§15.247
Industry Canada:	RSS210
Frequency Range:	2402-2480MHz
Maximum Output Power:	3.29mW (5.18dBm) Conducted at antenna port
Modulation:	GFSK
Occupied Bandwidth:	911.4kHz
Keying:	Automatic, Manual
Type of Information:	Digital Audio
Number of Channels:	79
Power Output Level	Fixed
Antenna Connector	Integral Antenna
Antenna Type	Folded Monopole
Antenna Gain	1.832dBi
Interface Cables:	None
Power Source & Voltage:	Battery (rechargeable via USB connection)
Emission Designator	911K4FXD
Receiver Spurious (worst Case)	50.3 µV/m @ 3 meters

2.2 Test Configuration

The ER-892 etyBLU2 Bluetooth Headset was controlled from a support laptop PC through a customer provided interface board. This interface board connected into the EUT via soldered on temporary communications cables. For conducted tests a temporary antenna connector replaced the onboard integral antenna.

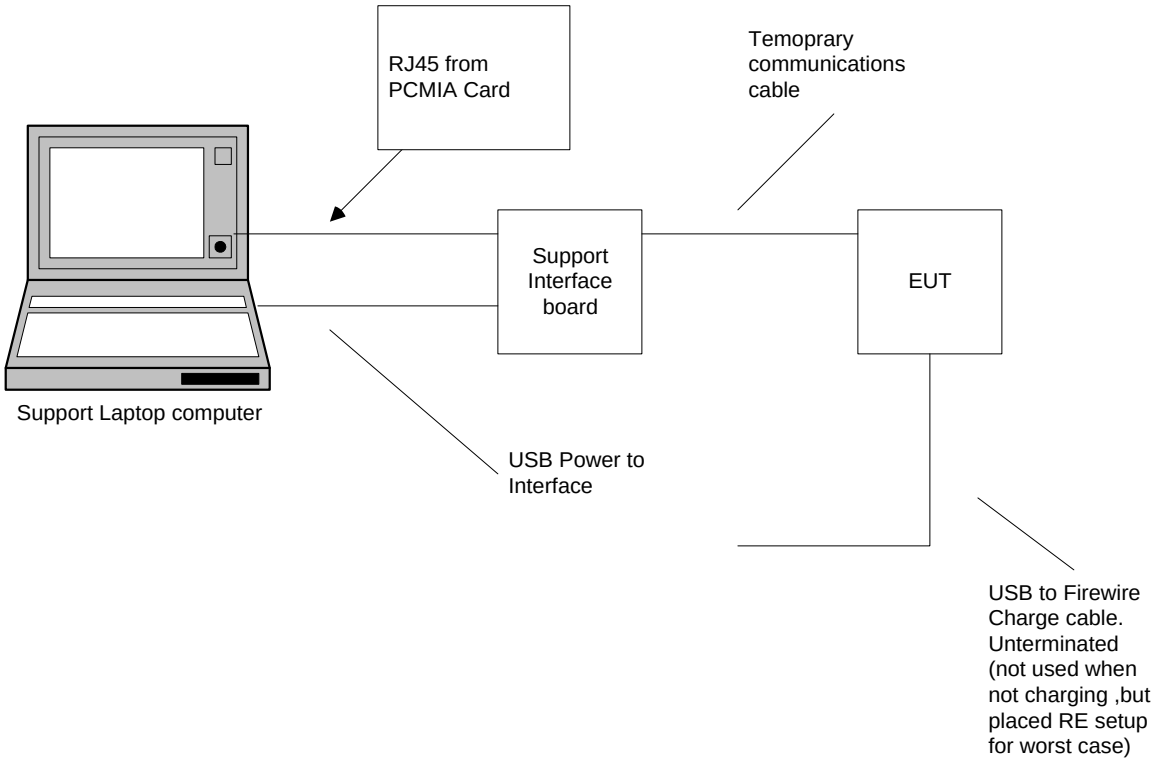

Figure 2-1 Test Configuration

2.3 Testing Algorithm

The ER89 Bluetooth Headset was configured with software supplied by the radio chip manufacturer. It allowed for setting the device for continuous transmit mode with both the hopping and non-hopping modes along with channel selection. Additionally, as the device is portable, the emissions were checked in three orthogonal with the worst case being reported.

Worst case emission levels are provided in the test results data.

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by the American Association for Laboratory Accreditation (A2LA) under Certificate 2675.01 as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

KDB558074: "Measurement of Digital Transmission Systems operating under Section 15.247." (Used for Power Spectral Density Tests)

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ±2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5\ (2^2 + 1^2 + 4^2)^{1/2} = \pm 4.55$ dB.

3 Test Equipment

Table 2 shows a list of the test equipment used for measurements along with the calibration information.

Table 2: Test Equipment List

Typical Equipment List

Test Name: **Conducted Emissions Voltage**		Test Date: **02/26/2009**	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
125	Solar, 8028-50-TS-24-BNC	LISN	07/01/2009
126	Solar, 8028-50-TS-24-BNC	LISN	07/01/2009
53	HP, 11947A	Limiter, Transient	04/09/2009
68	HP, 85650A	Adapter, QP	07/07/2009
72	HP, 8568B	Analyzer, Spectrum	07/03/2009
70	HP, 85685A	Preselector, RF w/opt 8ZE	07/07/2009
Test Name: **Radiated Emissions**		Test Date: **02/26/2009**	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
382	Sunol, JB1	Antenna, Biconlog	01/27/2010
4	ARA, DRG-118/A	Antenna, DRG, 1-18GHz	02/06/2011
68	HP, 85650A	Adapter, QP	07/07/2009
72	HP, 8568B	Analyzer, Spectrum	07/03/2009
70	HP, 85685A	Preselector, RF w/opt 8ZE	07/07/2009
528	Agilent, E4446A	Analyzer, Spectrum	04/24/2009
66	HP, 8449B	Pre-Amplifier, RF. 1-26.5GHz	07/15/2009
Test Name: **Bench Emissions**		Test Date: **02/26/2009**	
Asset #	**Manufacturer/Model**	**Description**	**Cal. Due**
474	HP, 8563E	Analyzer, Spectrum	02/03/2011

4 Test Summary

The Table Below shows the results of testing for compliance with a Frequency Hopping (Hybrid) System in accordance with FCC Part 15.247:2008 and RSS210e issue 7. Full results are shown in section 5.

Table 3: Test Summary Table

TX Test Summary (Frequency Hopping Spread Spectrum)			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.247 (a)(1)(iii)	RSS-210 [A8. 1]	20dB Bandwidth	Pass
15.247 (b)(1)	RSS-210 [A8.4 (2)]	Transmit Output Power	Pass
15.247 (a)(1)	RSS-210 [A8.1 (2)]	Channel Separation	Pass
15.247 (a)(1)(iii)	RSS-210 [A8. 1 (4)]	Number of Channels >15	Pass
15.247 (a)(1)(iii)	RSS-210 [A8. 1 (4)]	Time of Occupancy	Pass
15.247 (e)	RSS-210 [A8. 2 (b)]	Power Spectral Density	Pass
15.247 (d)	RSS-210 [A8. 5]	Occupied BW / Out-of-Band Emissions (Band Edge @ 20dB below)	Pass
15.205 15.209	RSS-210 [A8. 5]	General Field Strength Limits (Restricted Bands & RE Limits)	Pass
RX/Digital Test Summary (Frequency Hopping Spread Spectrum)			
FCC Rule Part	**IC Rule Part**	**Description**	**Result**
15.207	RSS-Gen [7.2.2]	AC Conducted Emissions	Pass
15.209	RSS-Gen [7.2.3.2]	General Field Strength Limits (Restricted Bands & RE Limits)	Pass

5 Test Results

5.1 Time of Occupancy

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

The following plots show that each channel on time is 440uSec per hop with 0.153Sec total On time per 31.6Sec.

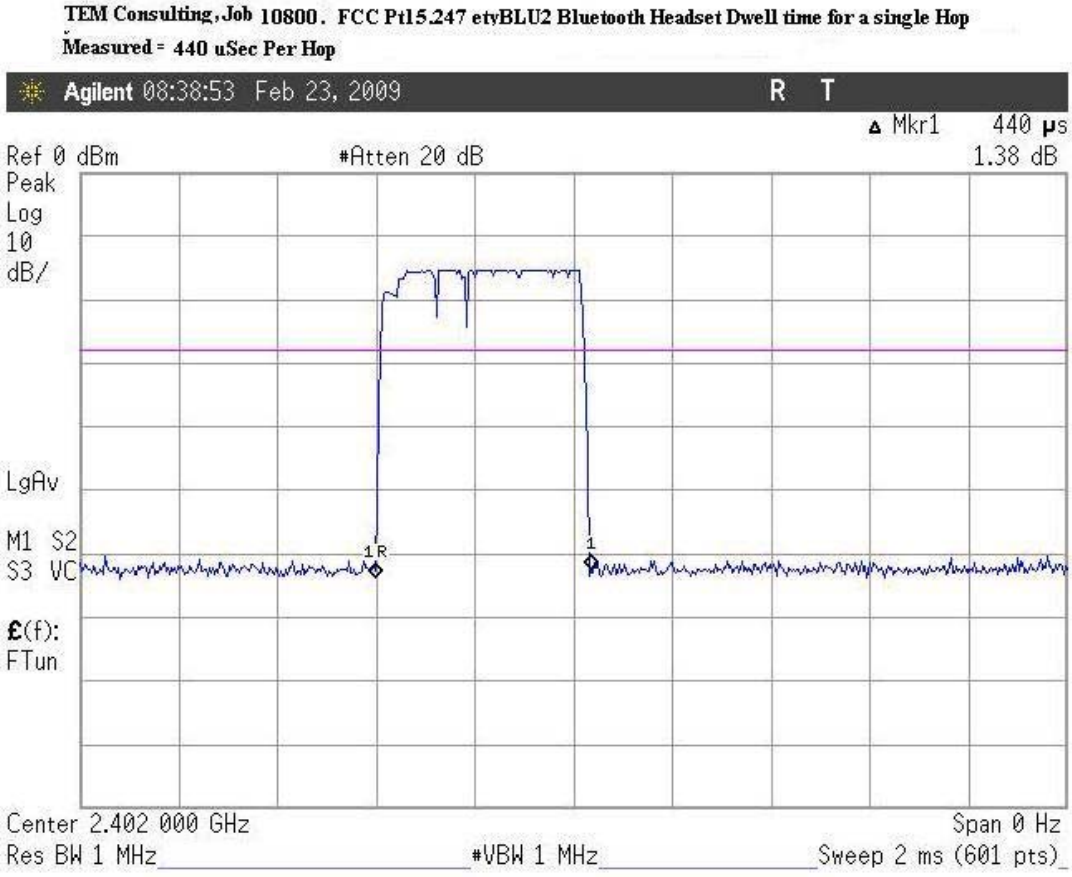

Figure 5-1. Single Hop Dwell Time

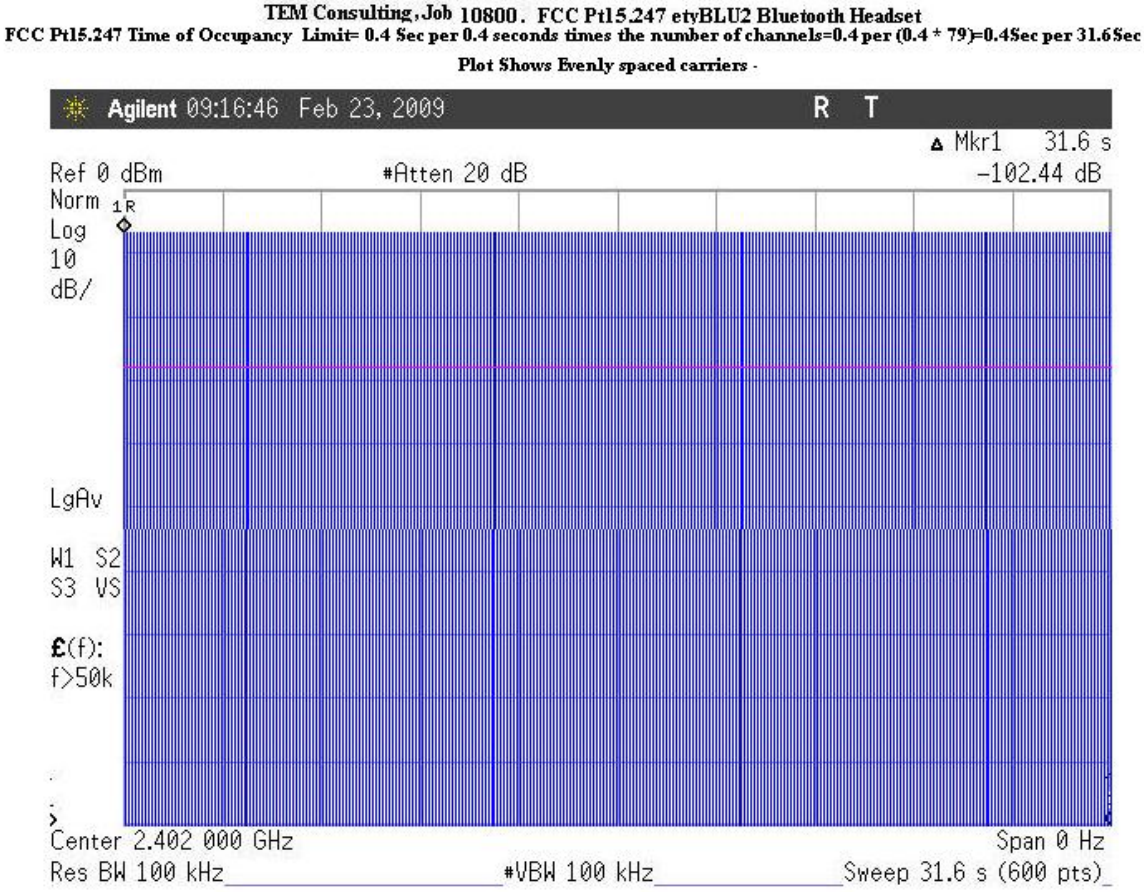

Figure 5-2. Dwell time per channel over 31.6 Seconds

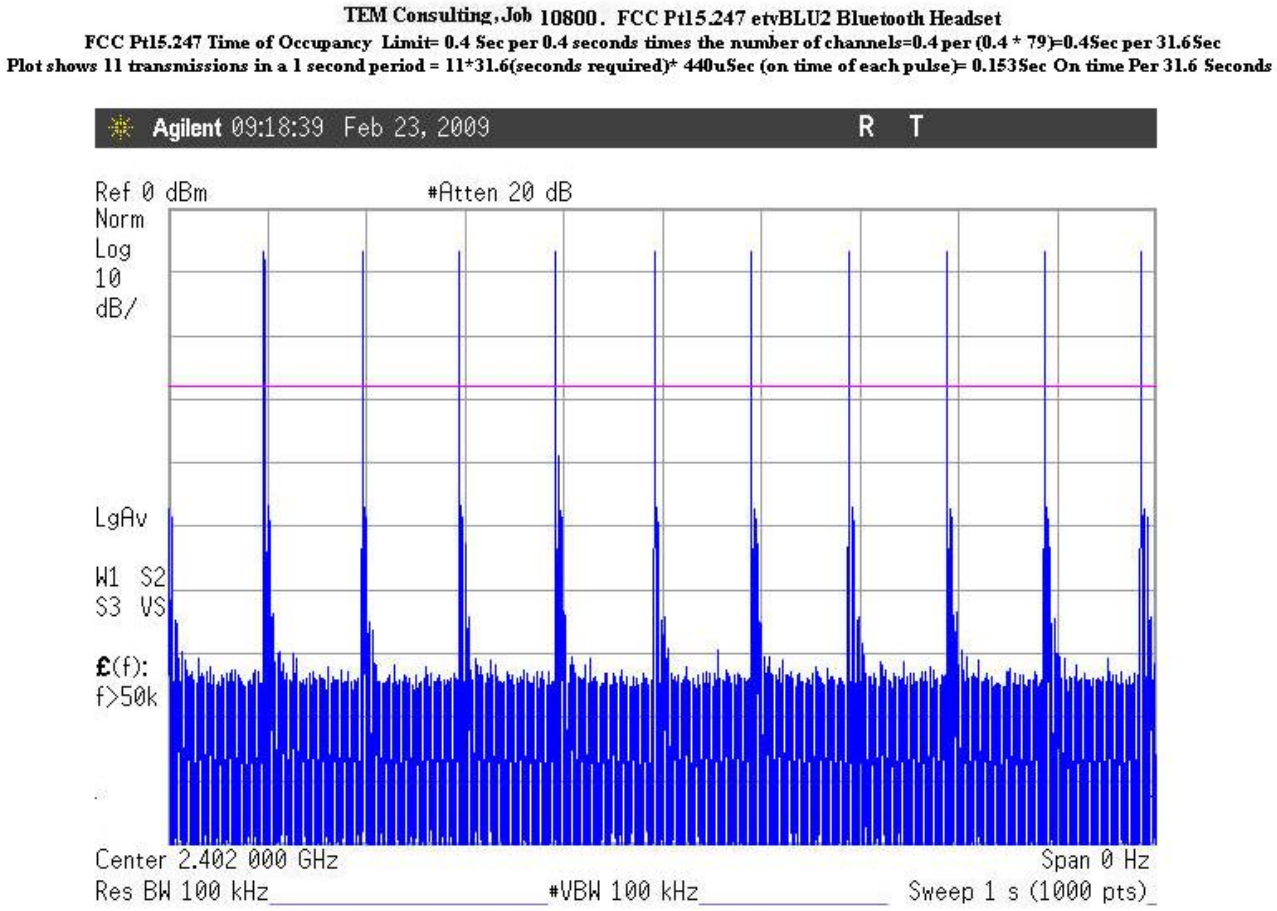

Figure 5-3. Close-up of Dwell time per channel over 1 Second

5.2 RF Power Output: (FCC Part §2.1046)

To measure the output power the hopping sequence was stopped while the frequency dwelled on a low, high and middle channel. The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system.

Table 4. RF Power Output

Frequency	Level	Limit	Pass/Fail
Low Channel: 2402MHz	4.85 dBm	30 dBm	Pass
Mid Channel: 2441MHz	5.18 dBm	30 dBm	Pass
High Channel: 2480MHz	4.35 dBm	30 dBm	Pass

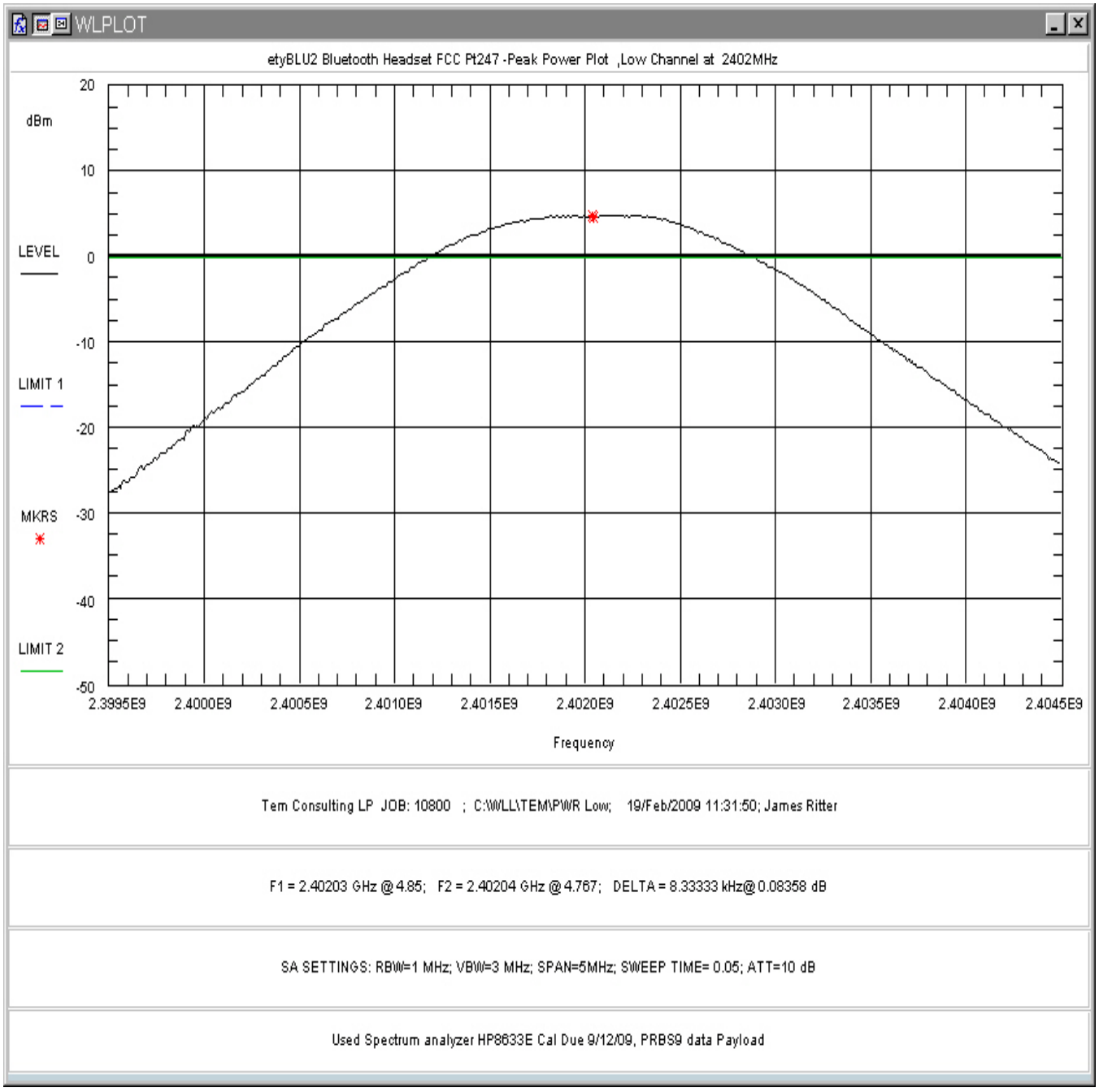

Figure 5-4. RF Peak Power, Low Channel

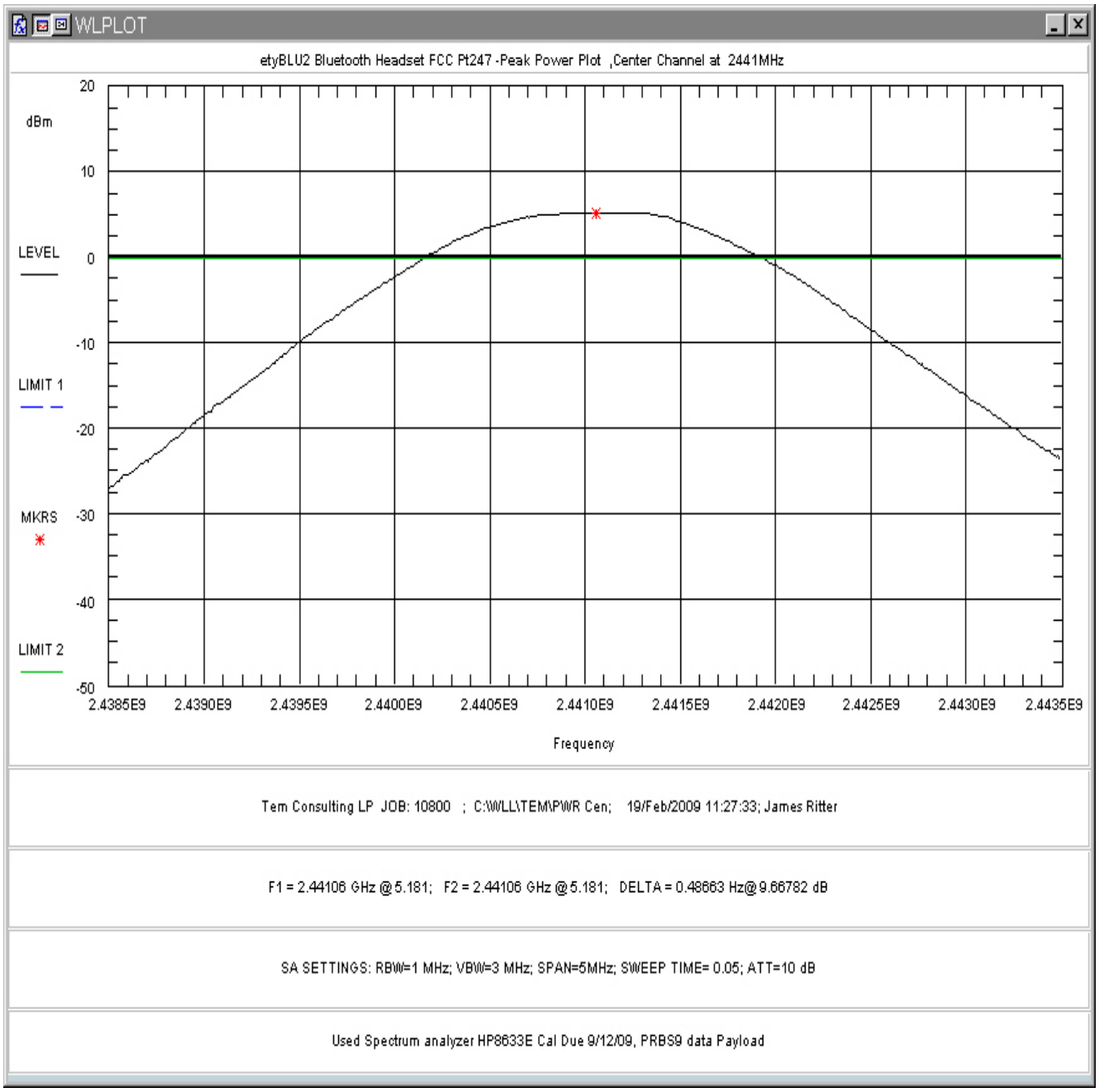

Figure 5-5. RF Peak Power, Mid Channel

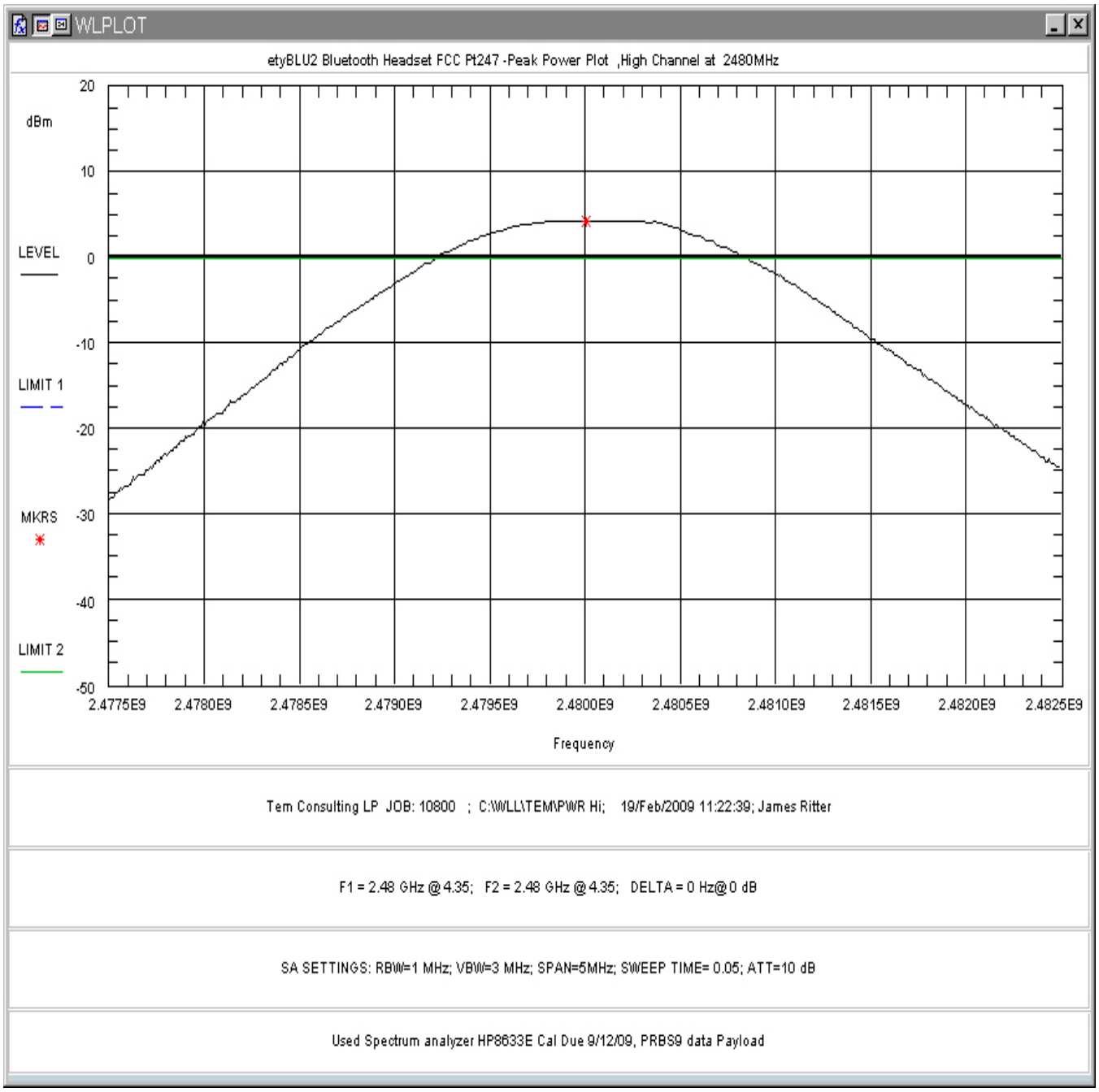

Figure 5-6. RF Peak Power, High Channel

5.3 Occupied Bandwidth: (FCC Part §2.1049)

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.

At full modulation, the occupied bandwidth was measured as shown:

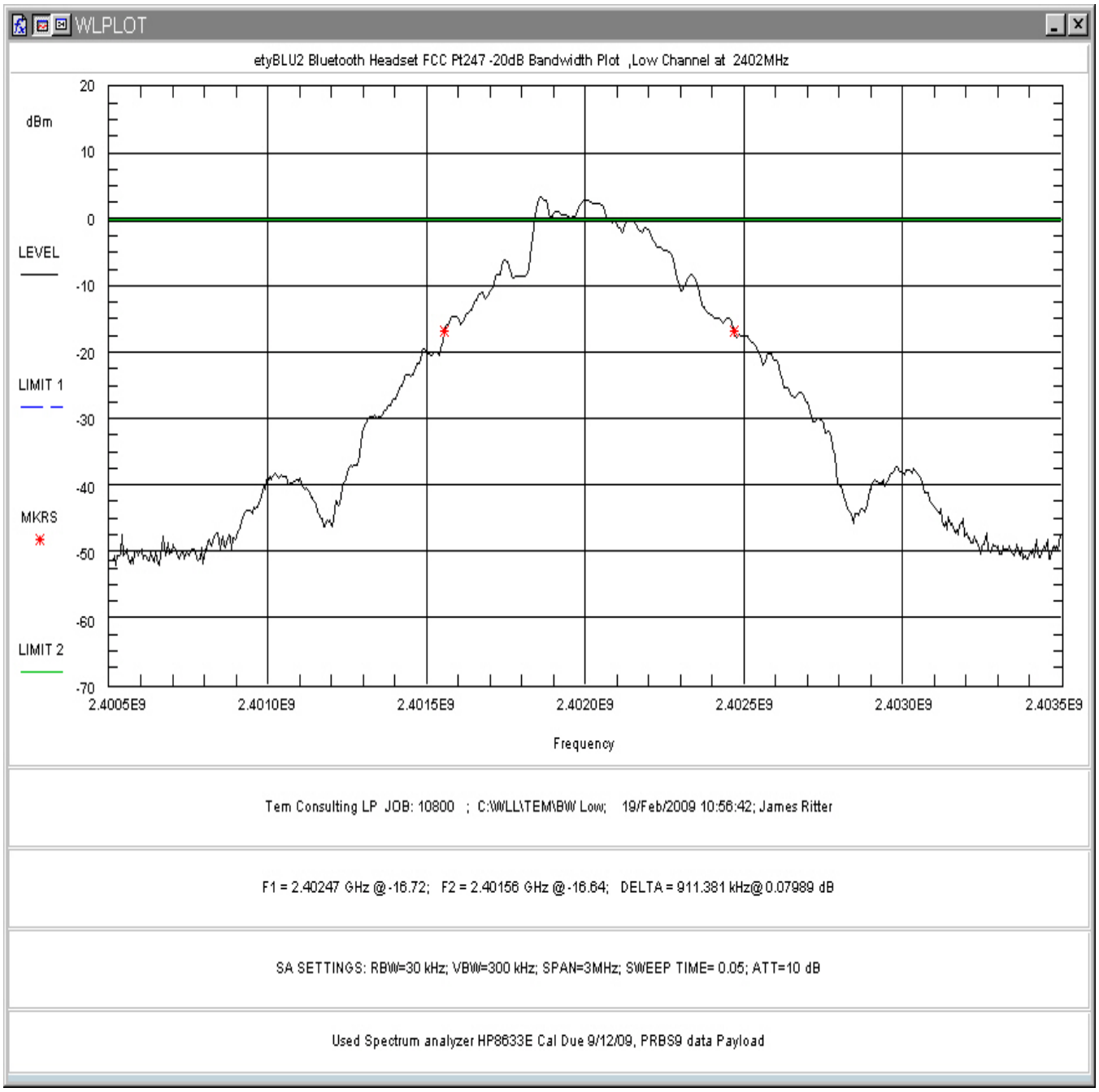

Figure 5-7. Occupied Bandwidth, Low Channel

