Cert. No. 1152.01
Electrical (EMC)

DATE: 01 March 2004

I.T.L. (PRODUCT TESTING) LTD.

FCC EMC Test Report

for

Bluesoft Inc.

Equipment under test:

AeroScout™ T2 Tag

(For Transmitter Section)

BWH3000

Approved by:_____

I. Raz, EMC Laboratory Manager

Cert. No. 1152.01
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Measurement/Technical Report for

Bluesoft Inc.

AeroScout™ T2 Tag

(For Transmitter Section)

BWH3000

FCC ID: Q3H BS2032-0

01 March 2004

This report concerns: Original Grant x Class II change

Class B verification ___ Class A verification_____Class I change

Equipment type: Radio Telemetry Transmitter
Request Issue of Grant:
__**x**__Immediately upon completion of review

Limits used:
CISPR 22 _____ Part 15 __x__

Measurement procedure used is ANSI C63.4-2001.

Application for Certification
prepared by:
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Applicant for this device:
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1. General Information

1.1 Administrative Information

Manufacturer:	Bluesoft Inc.
Manufacturer's Address:	10 Oppenheimer St. Park Tamar Rechovot 76701 Israel Tel: +972-8-9363136 Fax: +972-8-9365977
Manufacturer's Representative:	Reuven Amsalem Edward Mirodin
Equipment Under Test (E.U.T):	AeroScout™ T2 Tag
Equipment Model No.:	BWH3000
Equipment Serial No.:	Not designated
Date of Receipt of E.U.T:	22.01.04
Start of Test:	22.01.04
End of Test:	12.02.04
Test Laboratory Location:	I.T.L (Product Testing) Ltd. Kfar Bin Nun, ISRAEL 99780
Test Specifications:	See Section 2

1.2 List of Accreditations

The EMC laboratory of I.T.L. is accredited by the following bodies:

1. The American Association for Laboratory Accreditation (A2LA) (U.S.A.), Certificate No. 1152.01.
2. The Federal Communications Commission (FCC) (U.S.A.), Registration No. 90715.
3. The Israel Ministry of the Environment (Israel), Registration No. 1104/01.
4. The Voluntary Control Council for Interference by Information Technology Equipment (VCCI) (Japan), Registration Numbers: C-1350, R-1285.
5. Industry Canada (Canada), File No. IC 4025.
6. TUV Product Services, England, ASLLAS No. 97201.
7. Nemko (Norway), Authorization No. ELA 207.

I.T.L. Product Testing Ltd. is accredited by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with I.T.L.'s terms of accreditation unless stated otherwise in the report.

1.3 Product Description

The AeroScout™ T2 Tag is a key component of the AeroScout™ Location System. These dedicated battery-powered Tags send Wi-Fi compatible messages at pre-defined intervals and can be attached to non-Wi-Fi assets in order to locate them. Tags send messages with their unique ID number that are detected by Location Receivers and used to estimate the Tag's location.

The AeroScout T2 Tag enables the wireless network infrastructure to locate people and assets otherwise not connected to a wireless network. The tag can be used to track people in many valuable applications - child tracking in amusement parks, security personnel in enterprises, hospital patients and many more. Various types of equipment can be tagged. These include vehicles in parking lots; inventory in a manufacturing line; containers, forklifts and other assets for efficient supply chain management; shopping carts in supermarkets; and medical equipment in hospitals.

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2001. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The radiated emissions tests were performed at I.T.L.'s testing facility at Kfar Bin-Nun, Israel. This site is a FCC listed test laboratory (FCC Registration No. 90715, date of listing December 12, 2003).
I.T.L.'s EMC Laboratory is also accredited by A2LA, certificate No. 1152.01.

1.6 Measurement Uncertainty

Radiated Emission

The Open Site complies with the ±4 dB Normalized Site Attenuation requirements of ANSI C63.4-2001. In accordance with Paragraph 5.4.6.1 of this standard, this tolerance includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies.

2. Product Labeling

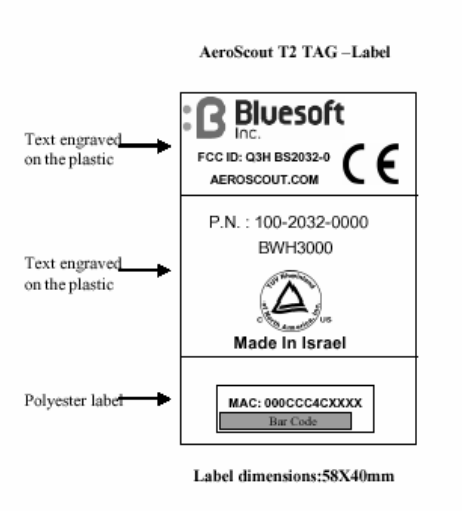

Figure 1. FCC Label

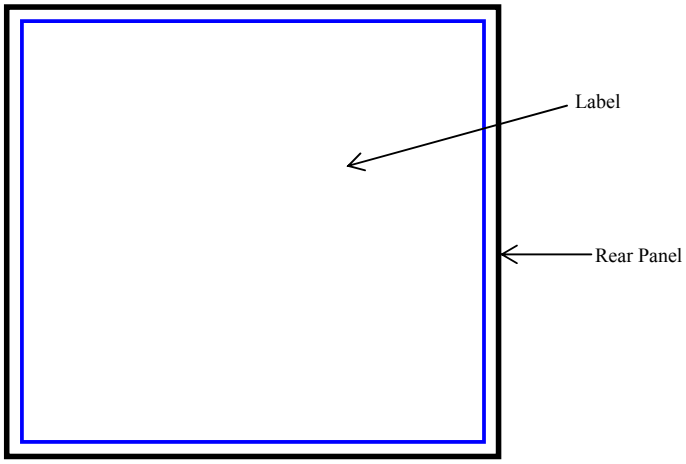

Figure 2. Location of Label on EUT

3. System Test Configuration

3.1 Justification

The product is mounted on a wristband and worn on the user's wrist.
To determine the E.U.T. orientation for the spurious radiated emissions tests, the product carrier field level was measured in three orthogonal directions of the E.U.T. The vertical position was selected as the worst case final orientation position.

The typical operation of the Tag (as a customer would normally use) is that the Tag wakes up every predefined interval (from 1 sec to 3.5 hours) and it is in receive mode for a period of 100uSec in order to sniff the air traffic (RSSI detection). If the channel is free, it will transmit a message for a period of max 500uS.

The Tag includes a low frequency receiver, which is set to be in continuous receive mode.

Due to the short period in transmit and receive mode in a typical operation mode, the tag was configured in this test mode to be in continuous receive mode and in continuous transmit mode as it was found to be the worst case operating mode.

3.2 EUT Exercise Software

The Tag SW uses two working mode in typical operation, a receive mode for the RSSI detection and then the transmit mode.

In the testing SW configuration, the Tag was configured to operate on two programmable modes 1) continuous receive mode 2) continuous transmit mode.

The Low frequency receiver is active in the two test modes above.

The testing of those two modes was done on three different channels.

3.3 Special Accessories

No special accessories were needed to achieve compliance.

3.4 Equipment Modifications

No modifications were needed to achieve compliance.

3.5 Configuration of Tested System

Figure 3. Configuration of Tested System

4. Block Diagram

4.1 Schematic Block/Connection Diagram

Intentionally Blank for Reasons of Confidentiality

Figure 4. E.U.T. Block Diagram

4.2 Theory of Operation

Each Tag has its own MAC address. Before any transmission the Tag sniffs the air interface in order to detect 802.11b transmissions (RSSI detection). If the air is free, the Tag transmits its preprogrammed 802.11b message (1 Mbps, DBPSK modulation).

5. Spurious Radiated Measurement Photo

Figure 5. Spurious Radiated Emission Test Front

6 Spurious Radiated Emission in the Restricted Band, Below 1 GHz

6.1 Test Specification

9kHz-1000 MHz, F.C.C., Part 15, Subpart C

6.2 Test Procedure

The E.U.T. operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room at a distance of 3 meters, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The frequency range 9 kHz-1000 MHz was scanned, and the list of the highest emissions was verified and updated accordingly.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.

The emissions were measured using a computerized EMI receiver complying to CISPR 16 requirements. The specification limits and applicable correction factors are loaded to the receiver via a 3.5" floppy disk.

In the frequency range 9 kHz-30 MHz, the loop antenna was rotated on its vertical axis, The antenna height (center of loop) was 1 meter.

In the frequency range 30-1000 MHz, the readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.

Verification of the E.U.T emissions was based on the following methods:

Turning the E.U.T on and off.

Using a frequency span less than 10 MHz.

Observation of the signal level during turntable rotation. Background noise is not affected by the rotation of the E.U.T.

The E.U.T. was tested at the operating frequencies of 2412, 2442, and 2462 MHz.

6.3 Test Data

The signals in the band 9 kHz – 1.0 GHz were –20dB below the specification limit.

TEST PERSONNEL:

Tester Signature: _____ Date: 08.03.04

Typed/Printed Name: E. Pitt

6.4 Test Instrumentation Used, Radiated Measurements

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
EMI Receiver	HP	85422E	3411A00102	January 31, 2003	1 year
RF Section	HP	85420E	3427A00103	January 31, 2003	1 year
Antenna Bioconical	ARA	BCD 235/B	1041	April 20, 2003	1 year
Antenna Log Periodic	ARA	LPD-2010/A	1038	April 20, 2003	1 year
Active Loop Antenna	EMCO	6502	9506-2950	October 17, 2003	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet 2225	2738508357.0	N/A	N/A

6.5 Field Strength Calculation

The field strength is calculated directly by the EMI Receiver software, and a "Correction Factors" data disk, using the following equation:

$$[dB\mu v/m]\ FS = RA + AF + CF$$

FS:	Field Strength [dBμv/m]
RA:	Receiver Amplitude [dBμv]
AF:	Receiving Antenna Correction Factor [dB/m]
CF:	Cable Attenuation Factor [dB]

No external pre-amplifiers are used.

7 Spurious Radiated Emission in the Restricted Band, Above 1 GHz

7.1 Radiated Emission Above 1 GHz

The E.U.T operation mode and test set-up are as described in Section 3.

See Section 3.1 Justification of the System Test Configuration concerning the E.U.T. orientation for this test.

A preliminary measurement to characterize the E.U.T was performed inside the shielded room, using peak detection mode and broadband antennas. The preliminary measurements produced a list of the highest emissions. The E.U.T was then transferred to the open site, and placed on a remote-controlled turntable. The E.U.T was placed on a non-metallic table, 0.8 meters above the ground. The configuration tested is shown in Figure 3.1.

The levels of the emissions within the frequency ranges of the restricted bands (Section 15.205 of FCC Part 15) were compared to the limits of the table in Section 15.209 (a), General Requirements.
In the frequency range 1-2.9 GHz, a computerized EMI receiver complying to CISPR 16 requirements was used.
In the frequency range 2.9-25.0 GHz, a spectrum analyzer including a low noise amplifier was used. During average measurements, the IF bandwidth was 1 MHz and the video bandwidth was 100Hz. During peak measurements, the IF bandwidth was 1 MHz and the video bandwidth was 3 MHz.
The test distance was 3 meters.
Above 12.0 GHz:

a. The test distance was 1.5 meters. The reduced distance was used to increase the signal to noise ratio.
b. For the average test, the IF bandwidth was reduced to 100kHz.

The readings were maximized by adjusting the antenna height between 1-4 meters, the turntable azimuth between 0-360°, and the antenna polarization.
Verification of the E.U.T emissions was based on the following methods: turning the E.U.T on and off; using a frequency span less than 10 MHz; observation of the signal level during turntable rotation. (Background noise is not affected by the rotation of the E.U.T.)

7.2 Test Data

JUDGEMENT: Passed by 12.8 dB

The EUT met the requirements of the F.C.C. Part 15, Subpart C, specification. The worst cases were:

for 2412 MHz, 16.5 dB margin at 4824.00 MHz frequency, vertical polarization.

for 2442 MHz, 13.0 dB margin at 7326.00 MHz frequency, vertical polarization

for 2462 MHz, 12.8 dB margin at 7386.00 MHz frequency, vertical polarization

The details of the highest emissions are given in Figure 6 to Figure 17.

TEST PERSONNEL:

Tester Signature: _____ Date: 08.03.04

Typed/Printed Name: E. Pitt

Radiated Emission Above 1 GHz

E.U.T Description	AeroScout™ T2 Tag
Type	BWH3000
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 2412 MHz

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factor	Peak. Specification	Peak. Margin
(MHz)	(dBµV/m)	(dB)	(dB µV/m)	(dB)
2390.00	47.4	41.8	74.0	-26.6
4824.00	56.4	40.5	74.0	-17.6

Figure 6. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes Correction Factor

"Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description AeroScout™ T2 Tag
Type BWH3000
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 2412 MHz
Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq.	Average Amp	Correction Factor	Average Result	Average Specification	Peak. Margin
(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dB μV/m)	(dB)
2390.00	47.4	41.8	1.4	54.0	-52.6
4824.00	56.5	40.5	-10.5	54.0	-43.5

Figure 7. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Amp" includes correction factor.

"Correction Factor" = Antenna Factor + Cable Loss

"Duty Cycle Factor" = $20\log\frac{0.5}{100} = -46dB$

Note: Maximum transmission "ON" time is 0.5 msec.

"Average Result" = Average Amp + Duty Cycle Factor

Radiated Emission Above 1 GHz

E.U.T Description	AeroScout™ T2 Tag
Type	BWH3000
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 2412 MHz

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factor	Peak. Specification	Peak. Margin
(MHz)	(dBµV/m)	(dB)	(dB µV/m)	(dB)
2390.00	48.4	48.4	74.0	-25.6
4824.00	57.5	41.8	74.0	-16.5

Figure 8. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp." includes Correction Factor.

"Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description AeroScout™ T2 Tag
Type BWH3000
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 2412 MHz
Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq.	Average Amp	Correction Factor	Average Result	Average Specification	Peak. Margin
(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dB μV/m)	(dB)
2390.00	48.4	41.8	2.4	54.0	-51.6
4824.00	57.5	57.5	11.5	54.0	-40.1

Figure 9. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Amp." Includes correction factor.

"Correction Factor" = Antenna Factor + Cable Loss

"Duty Cycle Factor" $= 20\log\frac{0.5}{100} = -46dB$

Note: Maximum transmission "ON" time is 0.5 msec.

"Average Result" = Average Amp + Duty Cycle Factor

Radiated Emission Above 1 GHz

E.U.T Description	AeroScout™ T2 Tag
Type	BWH3000
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 2442 MHz

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factor	Peak. Specification	Peak. Margin
(MHz)	(dBµV/m)	(dB)	(dB µV/m)	(dB)
4884.00	55.7	40.7	74.0	-18.3
7326.00	60.0	45.0	74.0	-14.0

Figure 10. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes Correction Factor

"Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description AeroScout™ T2 Tag
Type BWH3000
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 2442 MHz
Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq.	Average Amp	Correction Factor	Average Result	Average Specification	Peak. Margin
(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dB μV/m)	(dB)
4884.00	55.7	40.7	9.7	54.0	-44.3
7326.00	60.0	45.0	14.0	54.0	-40.0

Figure 11. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Amp" includes correction factor.

"Correction Factor" = Antenna Factor + Cable Loss

"Duty Cycle Factor" = $20\log\frac{0.5}{100} = -46dB$

Note: Maximum transmission "ON" time is 0.5 msec.

"Average Result" = Average Amp + Duty Cycle Factor

Radiated Emission Above 1 GHz

E.U.T Description	AeroScout™ T2 Tag
Type	BWH3000
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 2442 MHz
Frequency range: 1.0 GHz to 25.0 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factor	Peak. Specification	Peak. Margin
(MHz)	(dBµV/m)	(dB)	(dB µV/m)	(dB)
4884.00	56.7	40.7	74.0	-17.3
7326.00	61.0	45.0	74.0	-13.0

Figure 12. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes Correction Factors

"Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description AeroScout™ T2 Tag
Type BWH3000
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 2442 MHz
Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq.	Average Amp	Correction Factor	Average Result	Average Specification	Peak. Margin
(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dB μV/m)	(dB)
4884.00	56.7	40.7	10.7	54.0	-43.3
7326.00	61.0	45.0	15.0	54.0	-39.0

Figure 13. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Amp" includes correction factor.

"Correction Factor" = Antenna Factor + Cable Loss

"Duty Cycle Factor" = $20\log\frac{0.5}{100} = -46dB$

Note: Maximum transmission "ON" time is 0.5 msec.

"Average Result" = Average Amp + Duty Cycle Factor

Radiated Emission Above 1 GHz

E.U.T Description	AeroScout™ T2 Tag
Type	BWH3000
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 2462 MHz

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factor	Peak. Specification	Peak. Margin
(MHz)	(dBµV/m)	(dB)	(dB µV/m)	(dB)
2492.00	46.2	42.3	74.0	-27.8
4924.00	55.8	40.8	74.0	-18.2
4338.00	60.2	45.3	74.0	-13.8

Figure 14. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Peak

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes Correction Factors

"Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description AeroScout™ T2 Tag
Type BWH3000
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Horizontal
Test Distance: 3 meters
Operating Frequency: 2462 MHz
Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq.	Average Amp	Correction Factor	Average Result	Average Specification	Peak. Margin
(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dB μV/m)	(dB)
2492.00	46.2	42.3	0.2	54.0	-53.8
4924.00	56.8	40.8	10.8	54.0	-43.2
7386.00	60.3	45.3	14.3	54.0	-39.7

Figure 15. Radiated Emission. Antenna Polarization: HORIZONTAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average amp" includes correction factor.

"Correction Factor" = Antenna Factor + Cable Loss

"Duty Cycle Factor' = $20\log\frac{0.5}{100} = -46dB$

Note: Maximum transmission "ON" time is 0.5 msec.

"Average Result" = Average Amp + Duty Cycle Factor

Radiated Emission Above 1 GHz

E.U.T Description	AeroScout™ T2 Tag
Type	BWH3000
Serial Number:	Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 2462 MHz

Frequency range: 1.0 GHz to 25.0 GHz
Detector: Peak

Freq.	Peak Amp	Correction Factor	Peak. Specification	Peak. Margin
(MHz)	(dBμV/m)	(dB)	(dB μV/m)	(dB)
2492.00	47.2	42.3	74.0	-26.8
4924.00	56.8	40.8	74.0	-17.2
7386.00	61.2	45.3	74.0	-12.8

Figure 16. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Peak

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Peak Amp" includes Correction Factors

"Correction Factor" = Antenna Factor + Cable Loss

Radiated Emission Above 1 GHz

E.U.T Description AeroScout™ T2 Tag
Type BWH3000
Serial Number: Not designated

Specification: FCC, Part 15, Subpart C

Antenna Polarization: Vertical
Test Distance: 3 meters
Operating Frequency: 2462 MHz
Frequency range: 1.0 GHz to 25.0 GHz
Detector: Average

Freq.	Average Amp	Correction Factor	Average Result	Average Specification	Peak. Margin
(MHz)	(dBμV/m)	(dB)	(dBμV/m)	(dB μV/m)	(dB)
2492.00	47.2	42.3	1.2	54.0	-52.8
4924.00	56.8	40.8	10.8	54.0	-43.2
7386.00	61.3	45.3	15.3	54.0	-38.7

Figure 17. Radiated Emission. Antenna Polarization: VERTICAL. Detector: Average

Notes:

Margin refers to the test results obtained minus specified requirement; thus a positive number indicates failure, and a negative result indicates that the product passes the test.

"Average Amp" includes correction factor.

"Correction Factor" = Antenna Factor + Cable Loss

"Duty Cycle Factor" = $20\log\frac{0.5}{100} = -46dB$

Note: Maximum transmission "ON" time is 0.5 msec.

"Average Result" = Average Amp + Duty Cycle Factor

7.3 Test Instrumentation Used, Radiated Measurements Above 1 GHz

Instrument	Manufacturer	Model	Serial Number	Calibration	Period
Receiver	HP	85422E	3411A00102	January 31, 2003	1 year
RF Section	HP	85420E	3427A00103	January 31, 2003	1 year
Antenna Mast	ARA	AAM-4A	1001	N/A	N/A
Turntable	ARA	ART-1001/4	1001	N/A	N/A
Mast & Table Controller	ARA	ACU-2/5	1001	N/A	N/A
Printer	HP	ThinkJet2225	2738508357	N/A	N/A
Antenna-Log Periodic	A.H.System	SAS-200/511	253	January 31,2003	2 year
Double Ridged Waveguide Horn Antenna	EMCO	3115	9702-5111	May 1, 2003	1 year
Horn Antenna	ARA	SWH-28	1007	October 28, 2003	1 year
Band Pass Filter	SERNO	22102-0001	322	August 15, 2003	1 year
Low Noise Amplifier	DBS MICROWAVE	LNA-DBS-0411N313	013	April 10, 2003	1 year
Spectrum Analyzer	HP	8592L	3926A01204	January 31,2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

8 Maximum Transmitted Peak Power Output

8.1 Test procedure

The E.U.T. antenna terminal was connected to the Power Meter through appropriate coaxial cable. Peak power level was measured at selected operation frequencies.

8.2 Results table

E.U.T. Description: AeroScout™ T2 Tag
Model No.: BWH3000
Serial Number: Not designated
Specification: F.C.C. Part 15, Subpart C

Operation Frequency (MHz)	Reading Power Meter (dBm)	Cable Attenuation (dB)	Peak Output Power (dBm)	Specification (dBm)	Margin (dB)
2412	18.6	0.5	19.1	30.0	-10.9
2442	18.5	0.5	19.0	30.0	-11.0
2472	18.4	0.5	18.9	30.0	-11.1

Figure 18 Maximum Peak Power Output

JUDGEMENT: Passed by 10.9 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 08.03.04

Typed/Printed Name: E. Pitt

8.3 Test Equipment Used.

Peak Power Output

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Power Meter	HP	436A	2031V02262	August 7, 2003	1 year
Power Sensor	HP	8482A	2235A06179	August 7, 2003	1 year
Cable	Avnet	MTS	N/A	September 9, 2003	1 year

Figure 19 Test Equipment Used

9 Peak Power Output Out of 2400-2483.5 MHz Band

9.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through a 16dB external attenuator and an appropriate coaxial cable. The spectrum analyzer was set to 100 kHz resolution BW except for the frequency range 9 kHz-1 MHz where the RBW was set to 3kHz. The frequency range from 9 kHz to 25 GHz was scanned. Level of spectrum components out of the 2400-2483.5 MHz was measured at the selected operation frequencies.

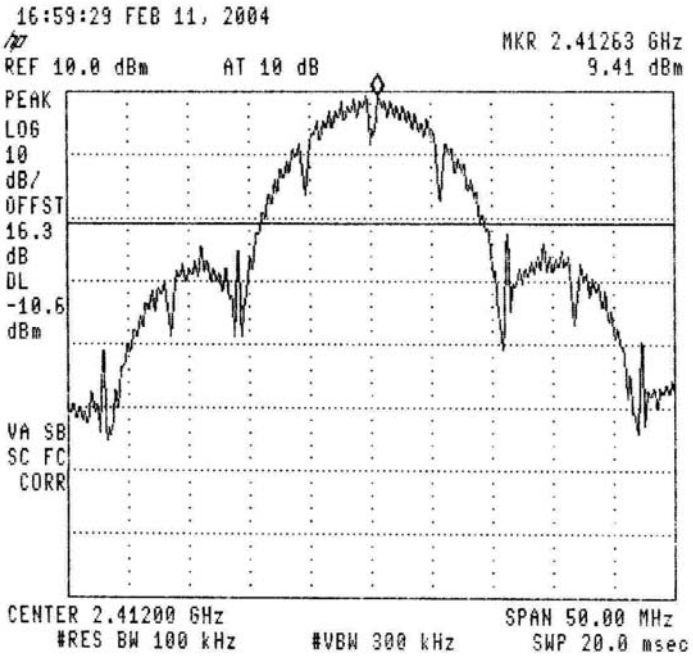

Figure 20 —2412 MHz

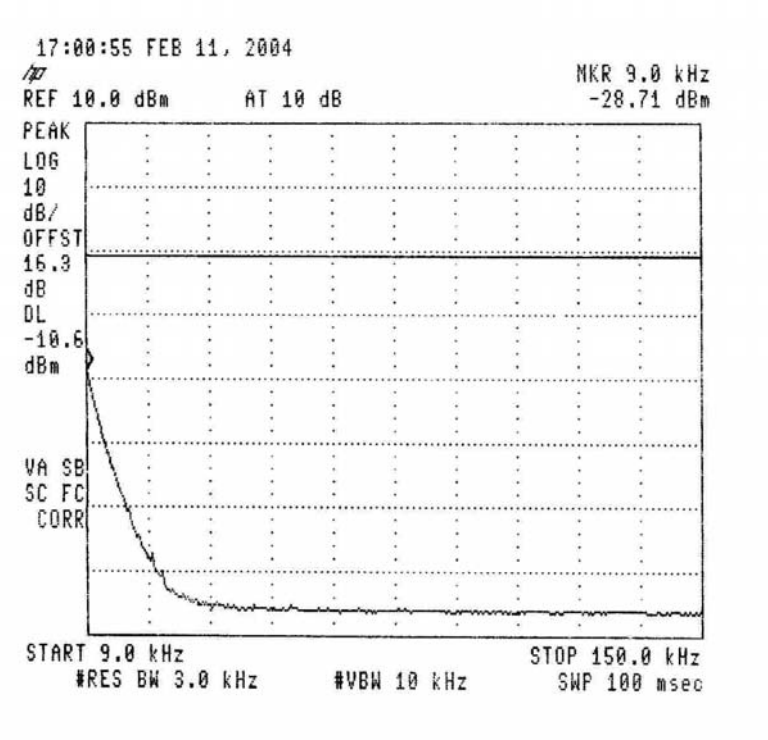

Figure 21 —2412 MHz

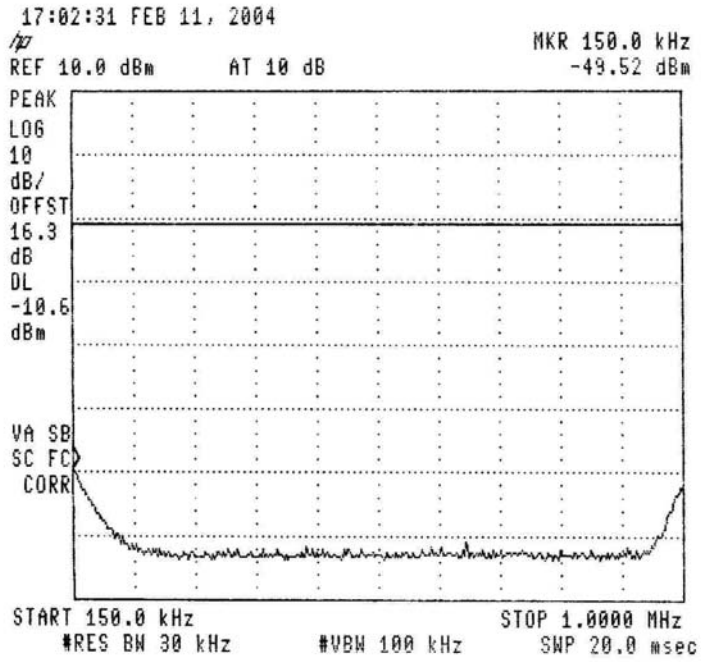

Figure 22 —2412 MHz

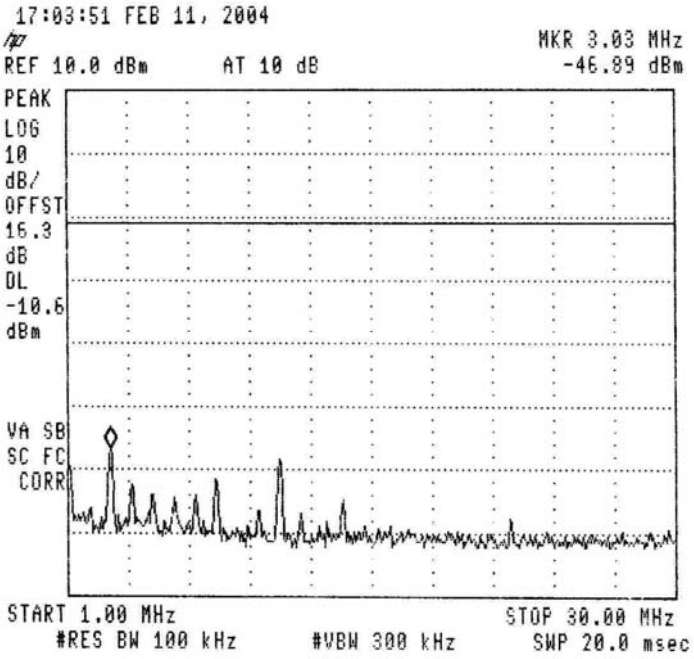

Figure 23 —2412 MHz

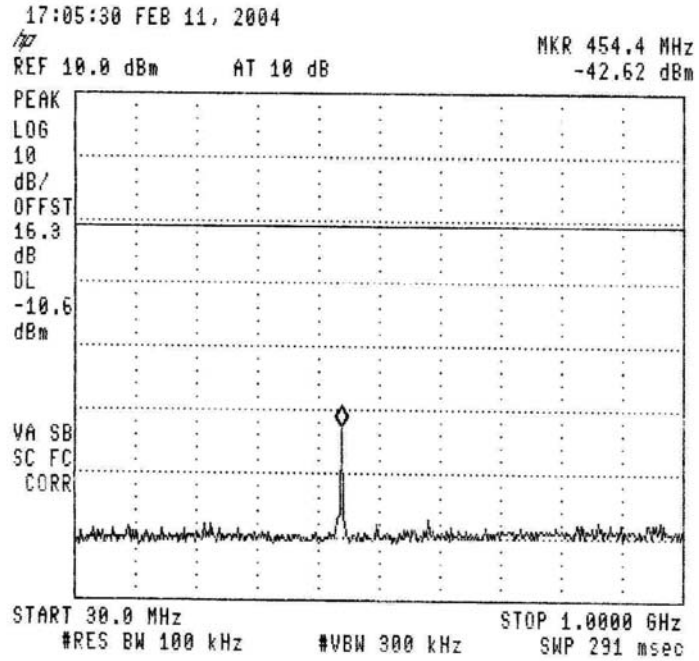

Figure 24 —2412 MHz

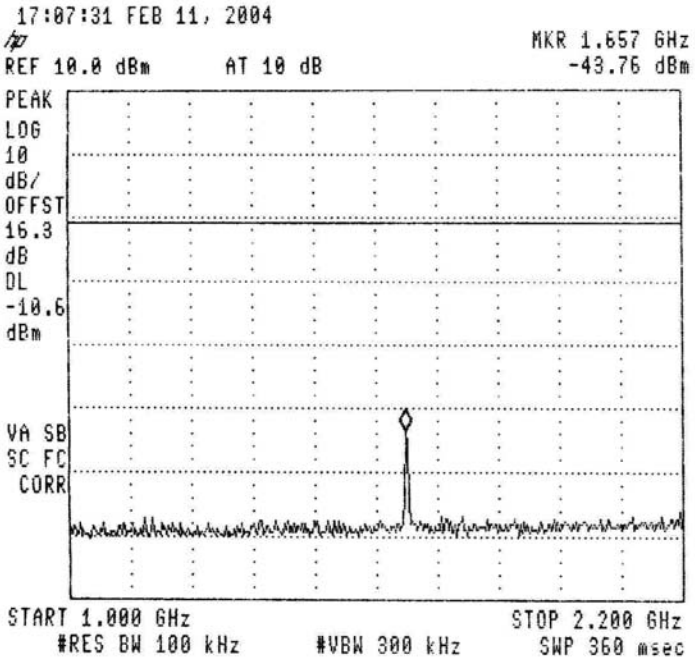

Figure 25 —2412 MHz

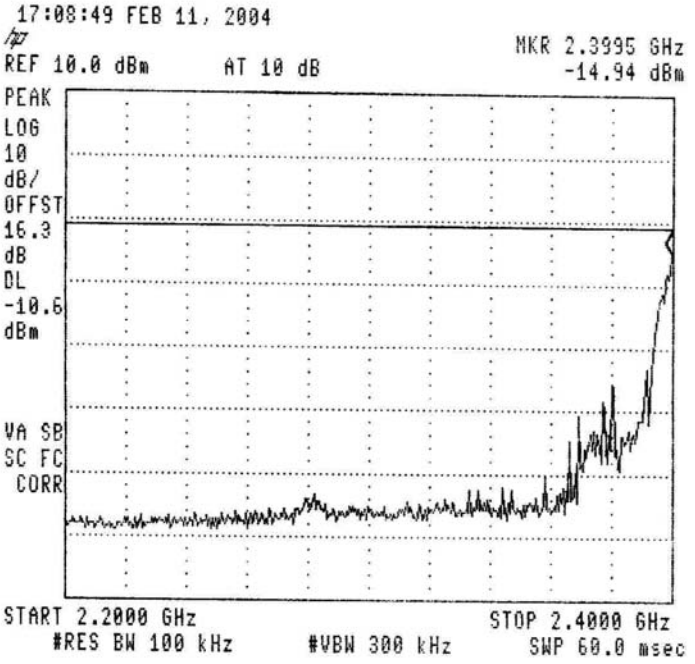

Figure 26 —2412 MHz

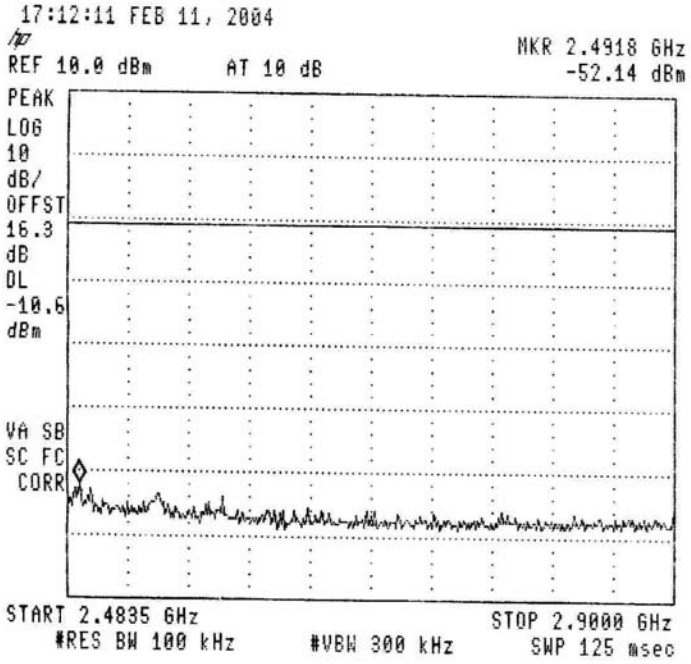

Figure 27 —2412 MHz

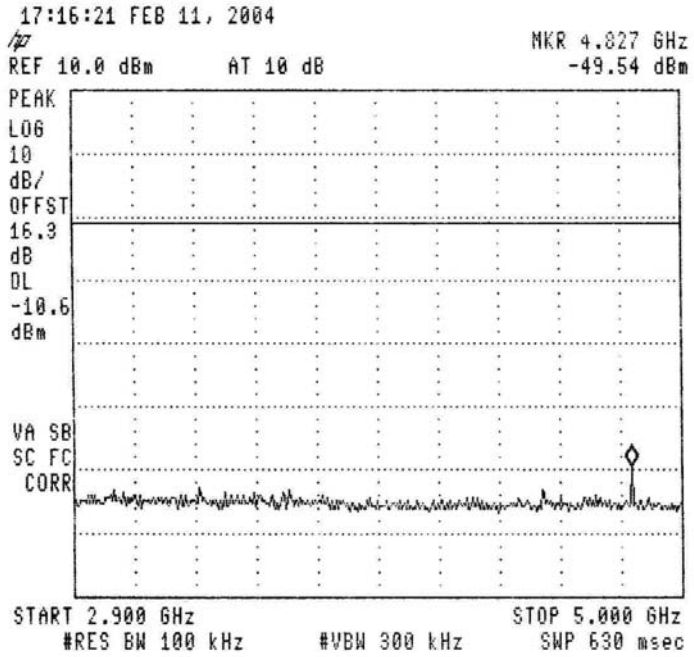

Figure 28 —2412 MHz

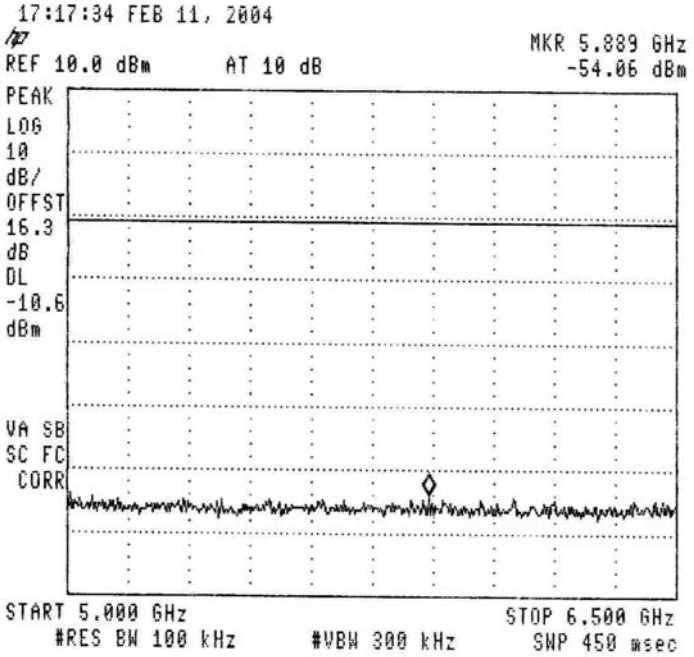

Figure 29 —2412 MHz

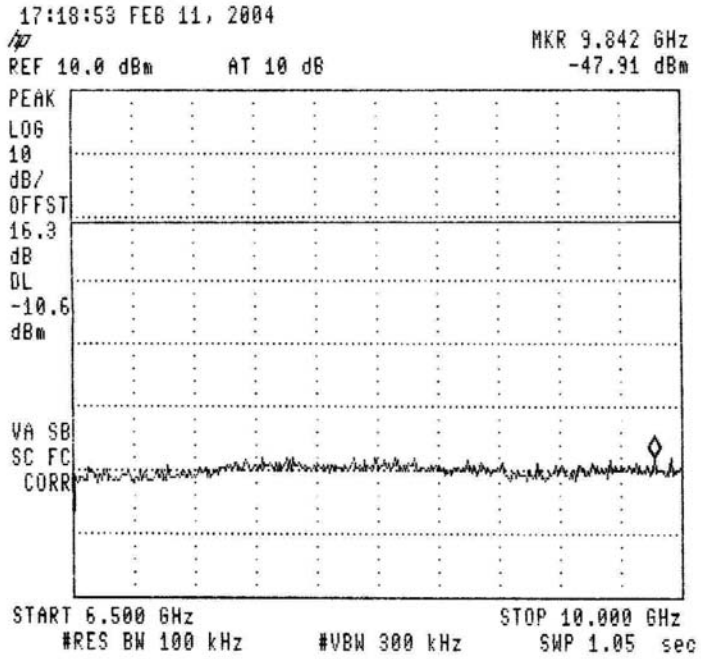

Figure 30 —2412 MHz

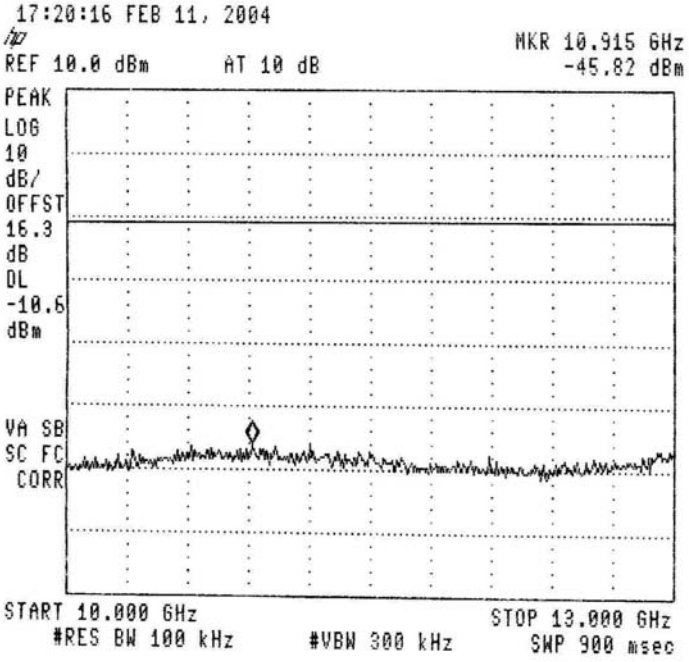

Figure 31 —2412 MHz

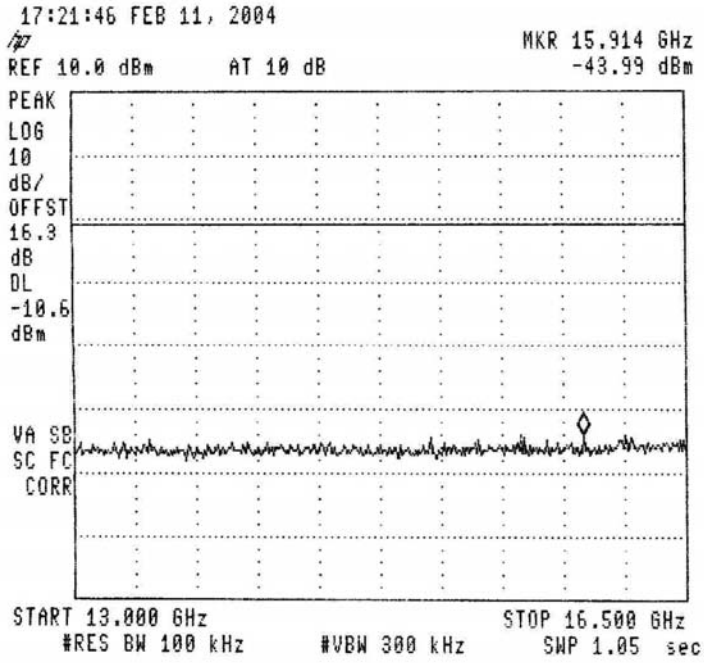

Figure 32 —2412 MHz

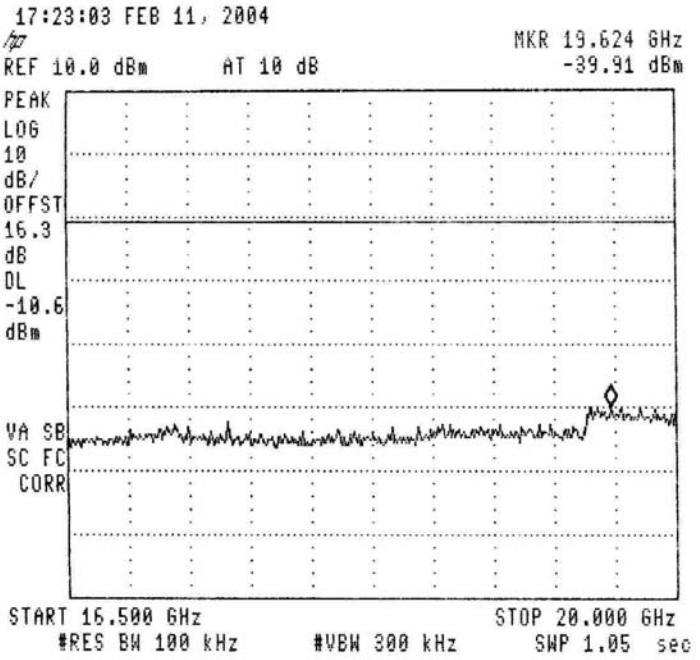

Figure 33 —2412 MHz

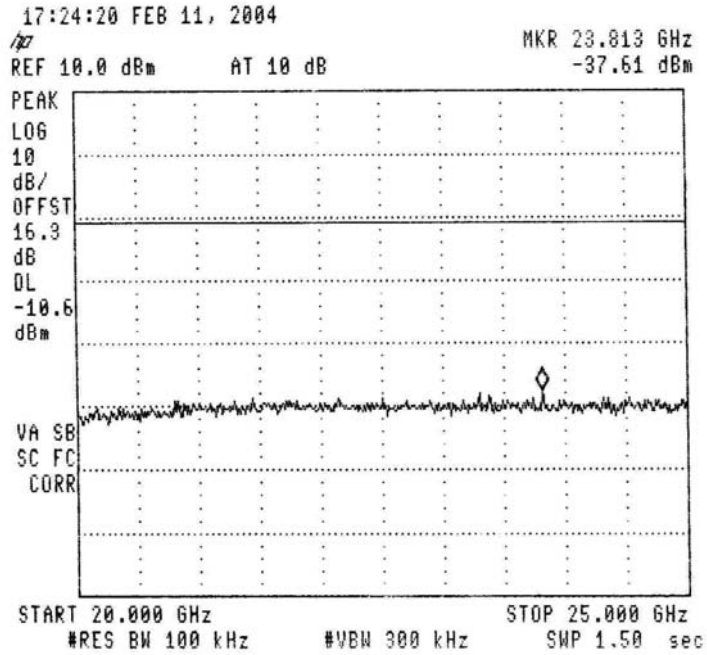

Figure 34 —2412 MHz

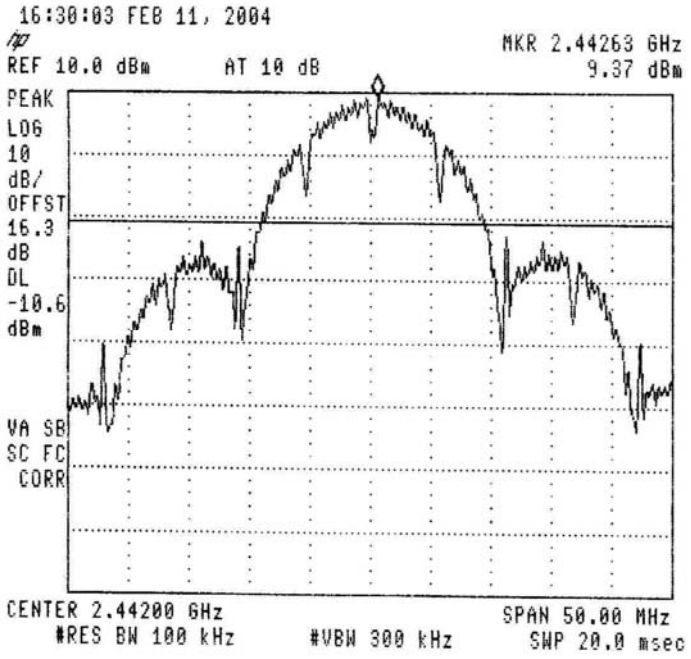

Figure 35 —2442 MHz

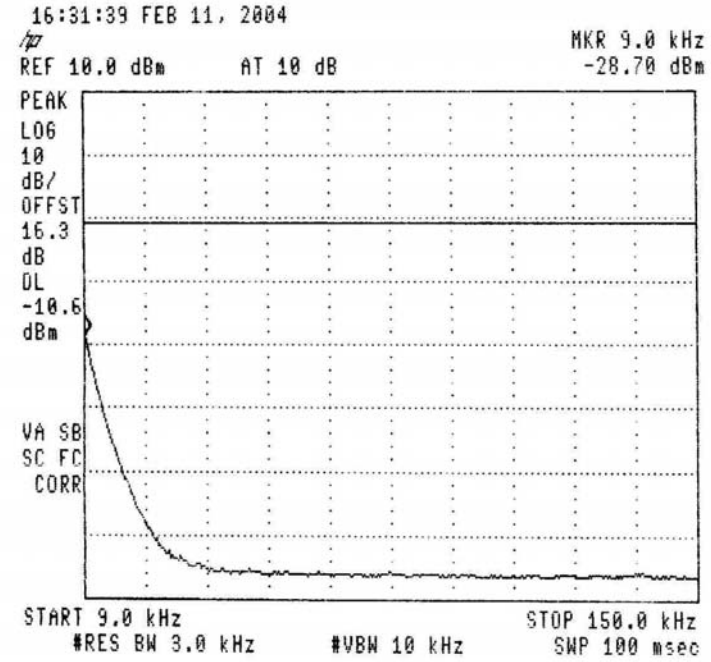

Figure 36 —2442 MHz

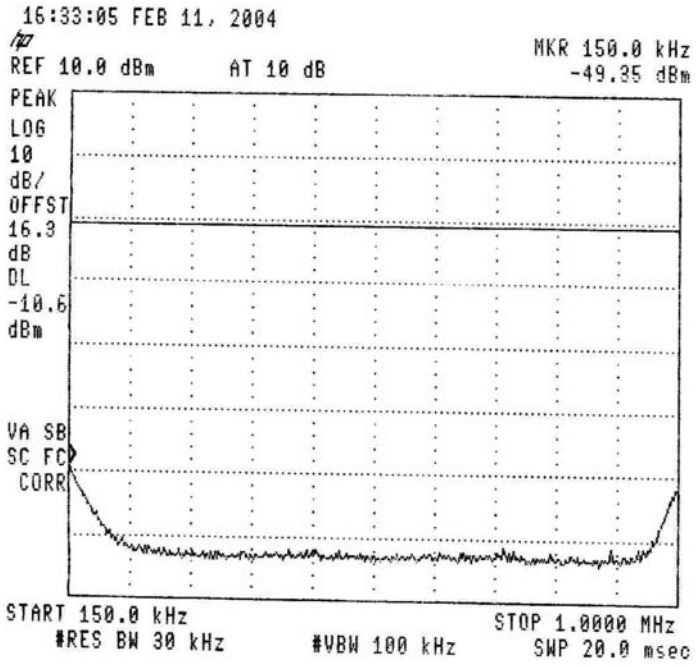

Figure 37 —2442 MHz

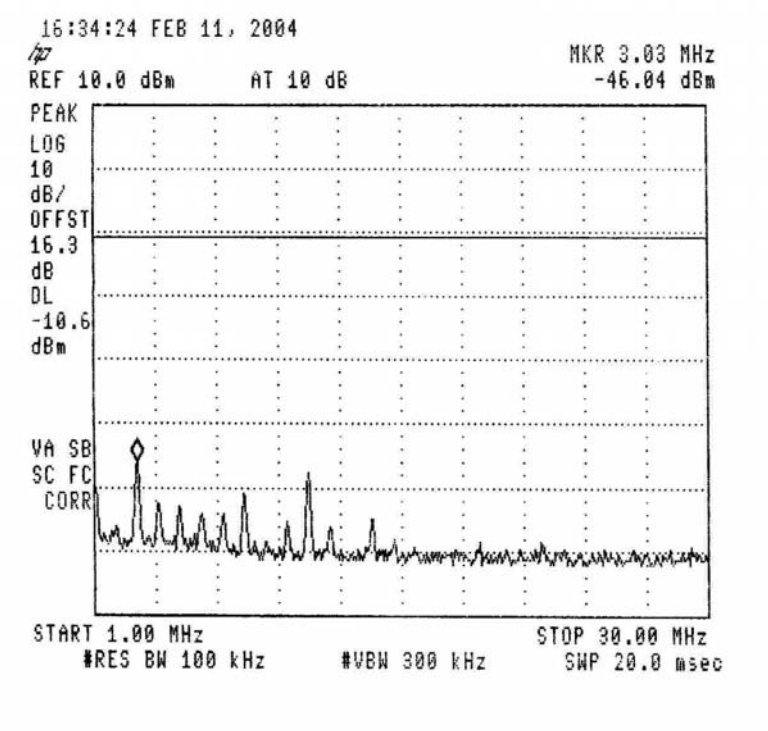

Figure 38 —2442 MHz

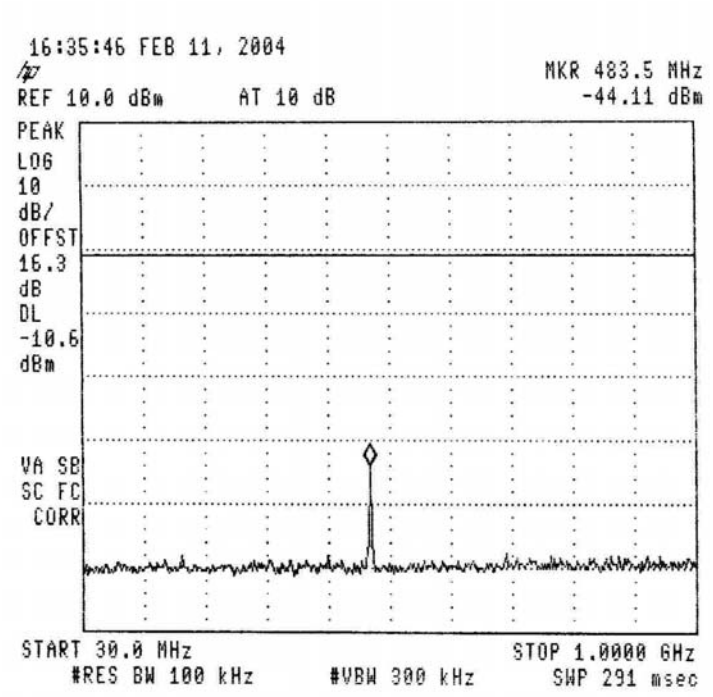

Figure 39 —2442 MHz

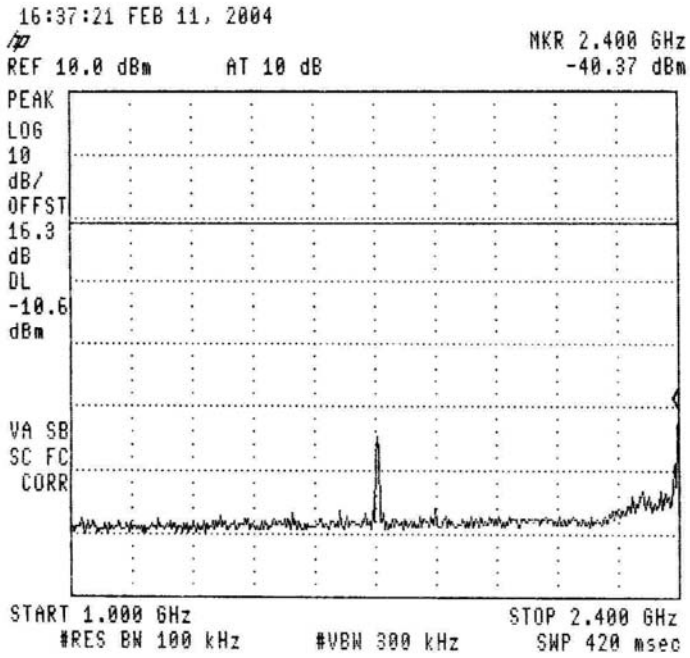

Figure 40 —2442 MHz

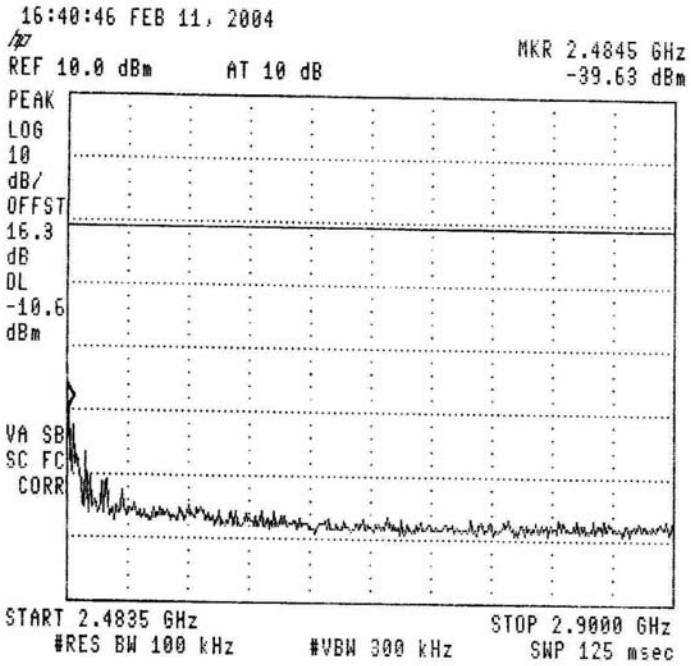

Figure 41 —2442 MHz

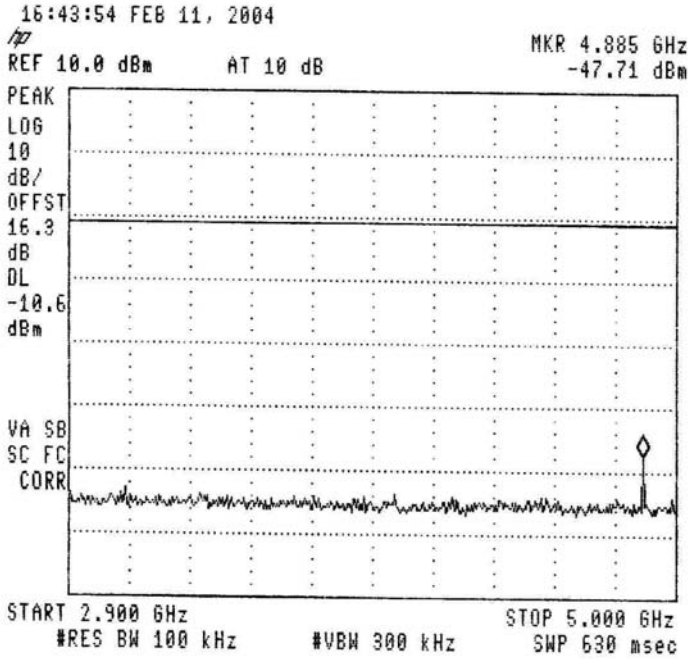

Figure 42 —2442 MHz

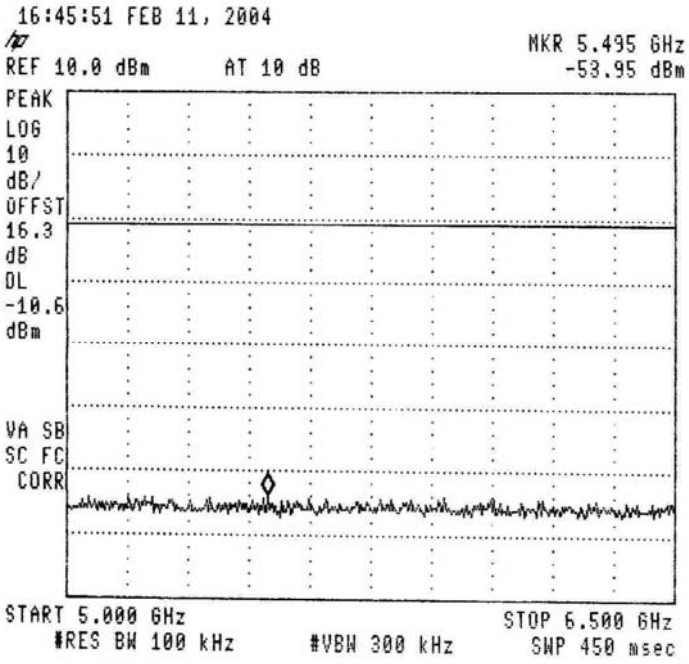

Figure 43 —2442 MHz

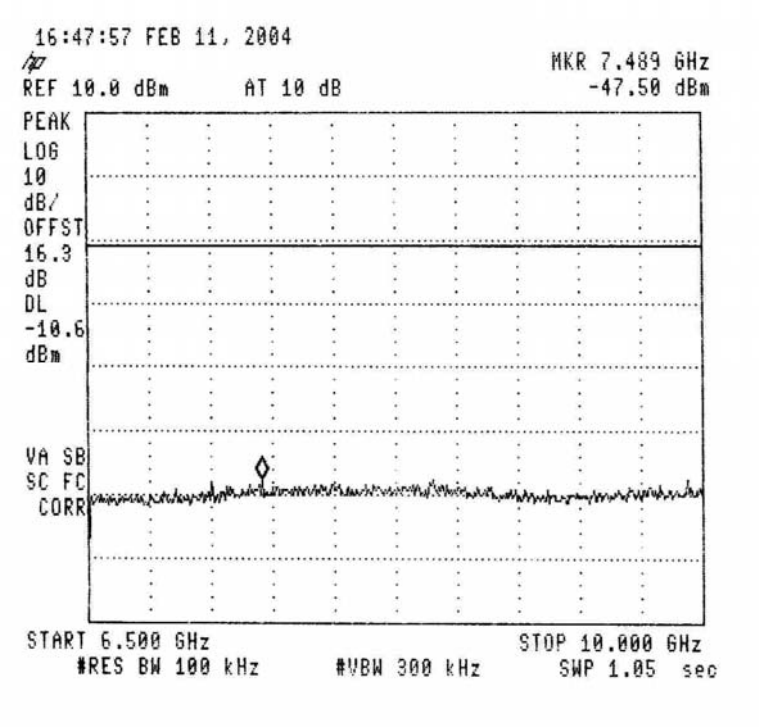

Figure 44 —2442 MHz

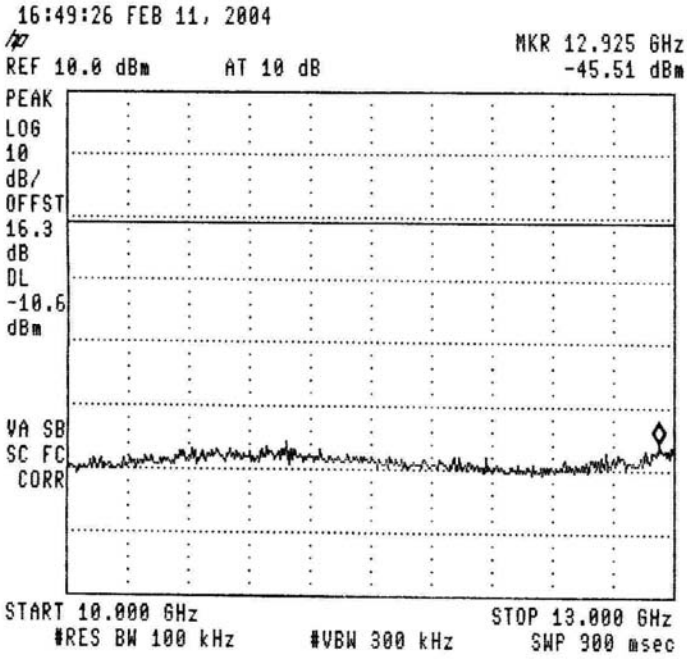

Figure 45 —2442 MHz

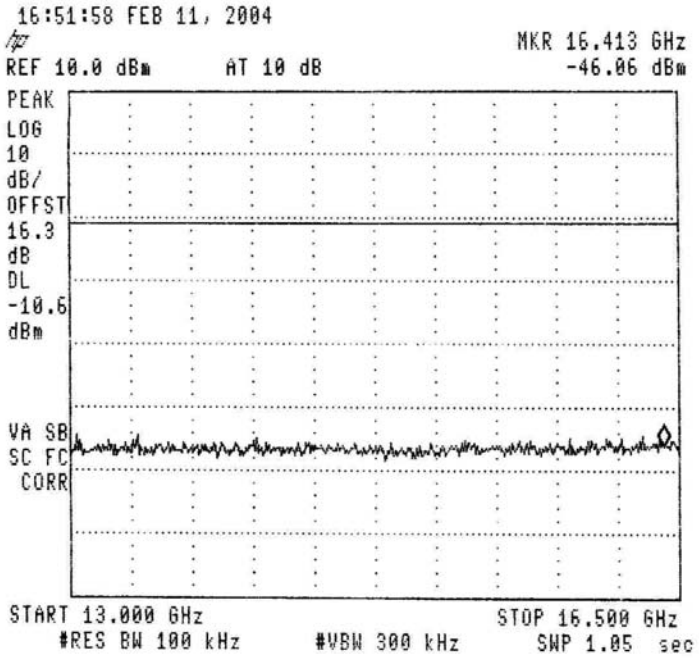

Figure 46 —2442 MHz

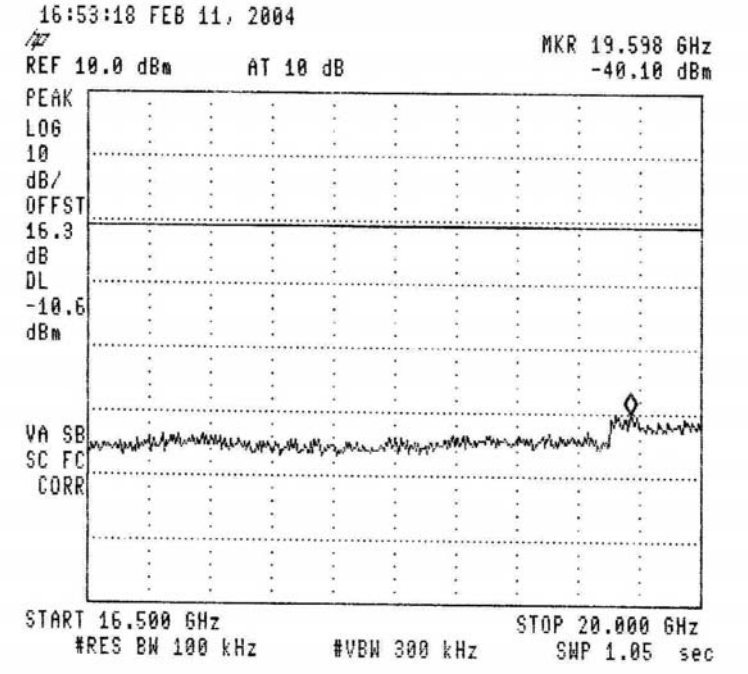

Figure 47 —2442 MHz

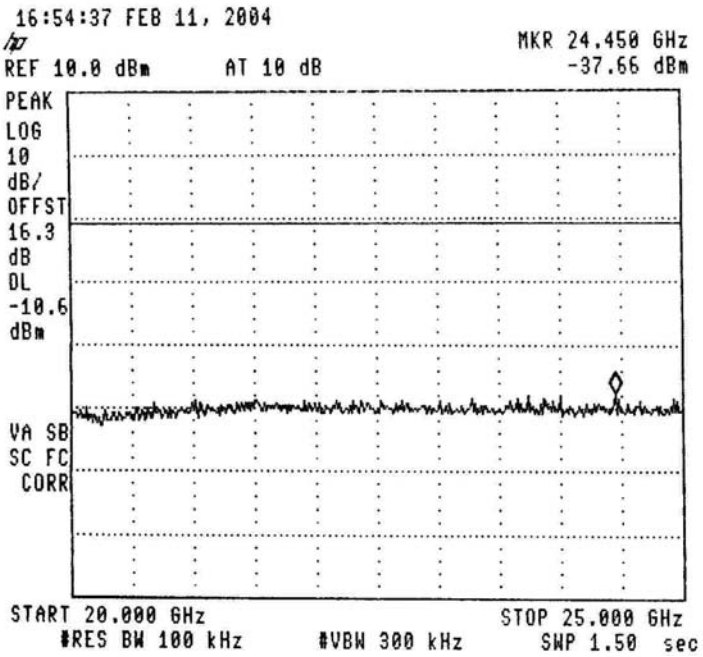

Figure 48 —2442 MHz

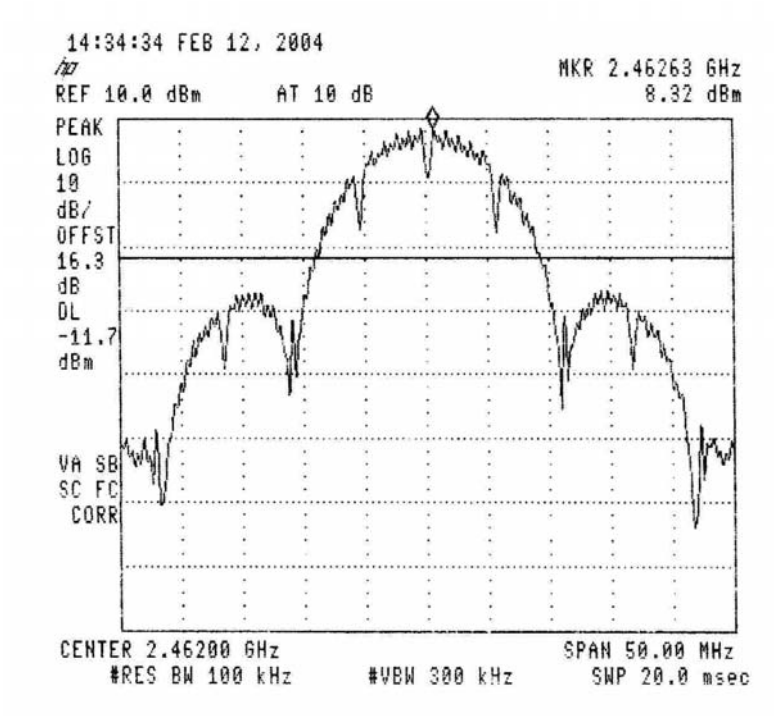

Figure 49 —2462 MHz

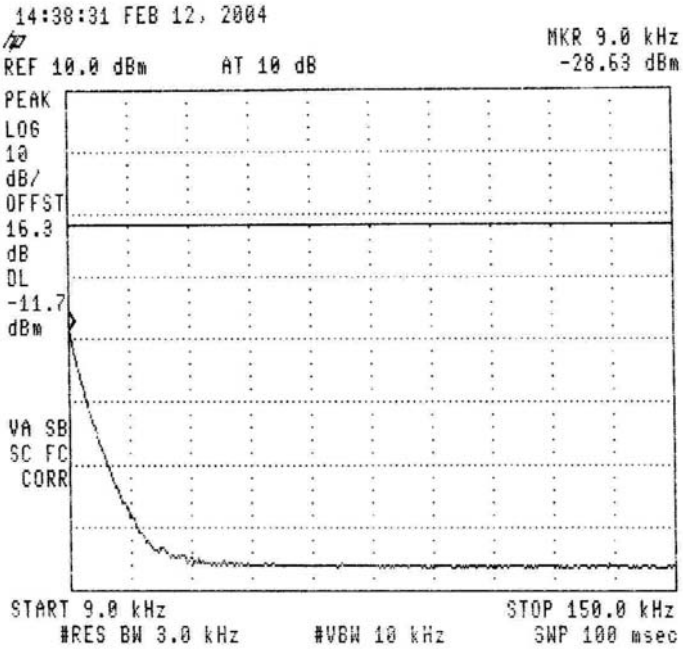

Figure 50 —2462 MHz

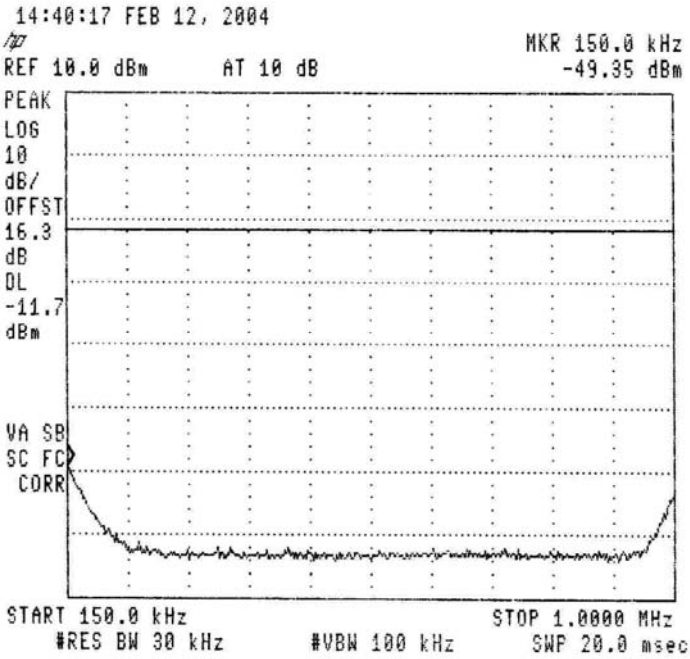

Figure 51 —2462 MHz

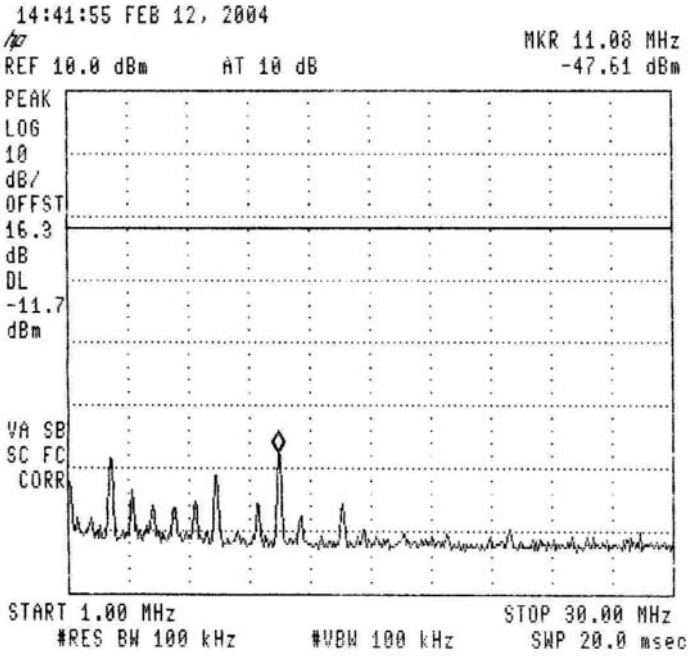

Figure 52 —2462 MHz

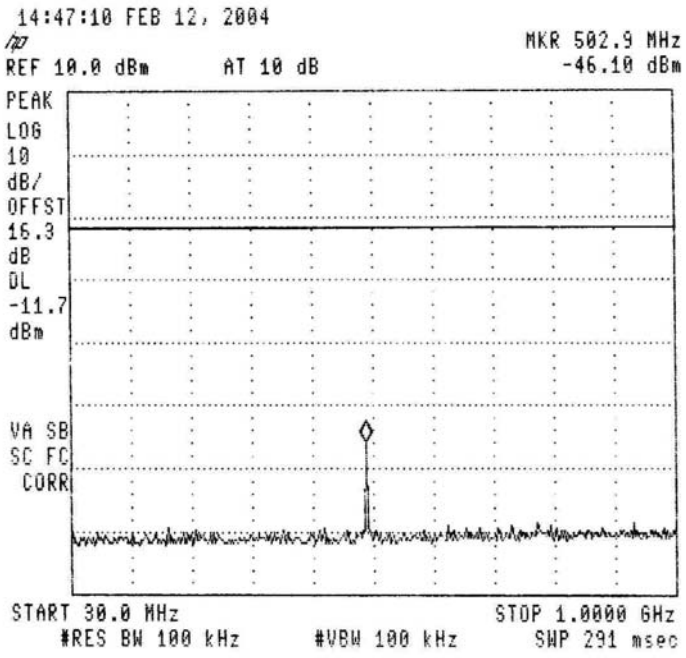

Figure 53 —2462 MHz

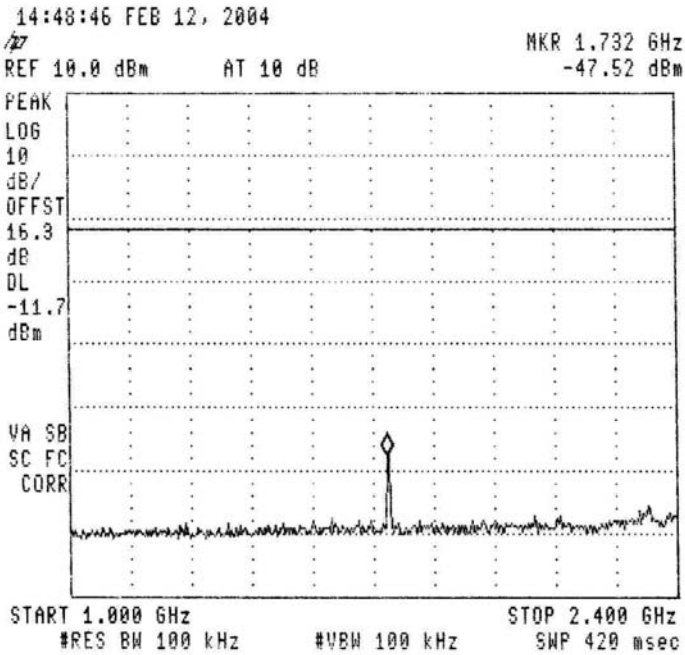

Figure 54 —2462 MHz

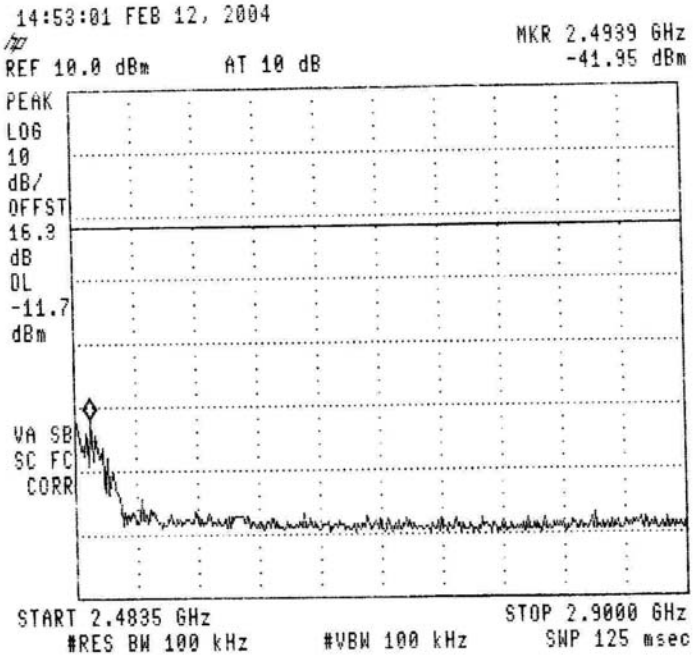

Figure 55 —2462 MHz

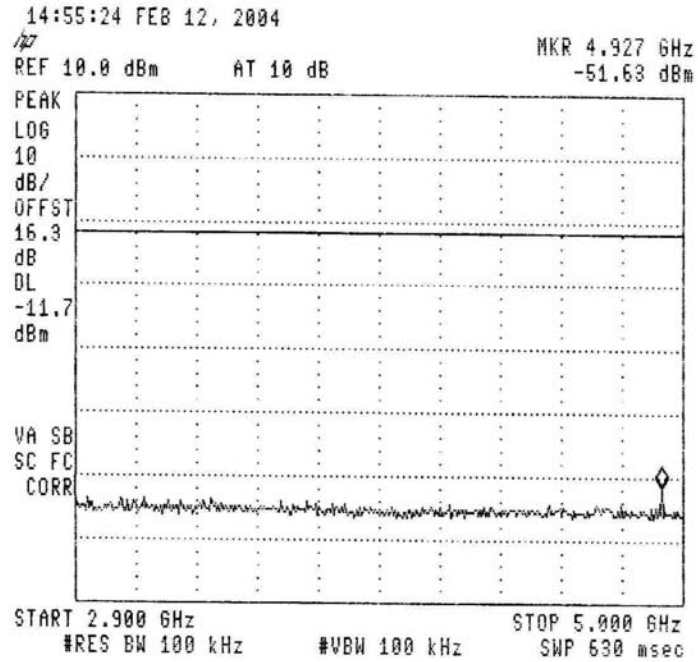

Figure 56 —2462 MHz

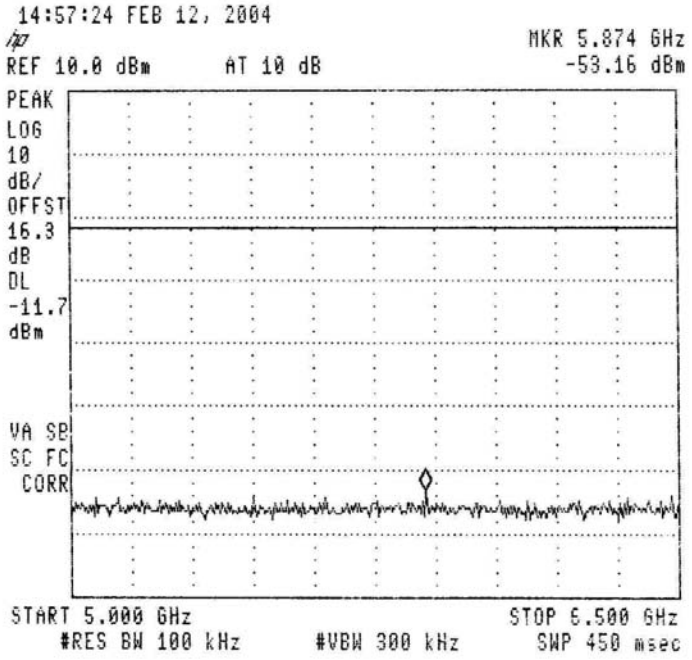

Figure 57 —2462 MHz

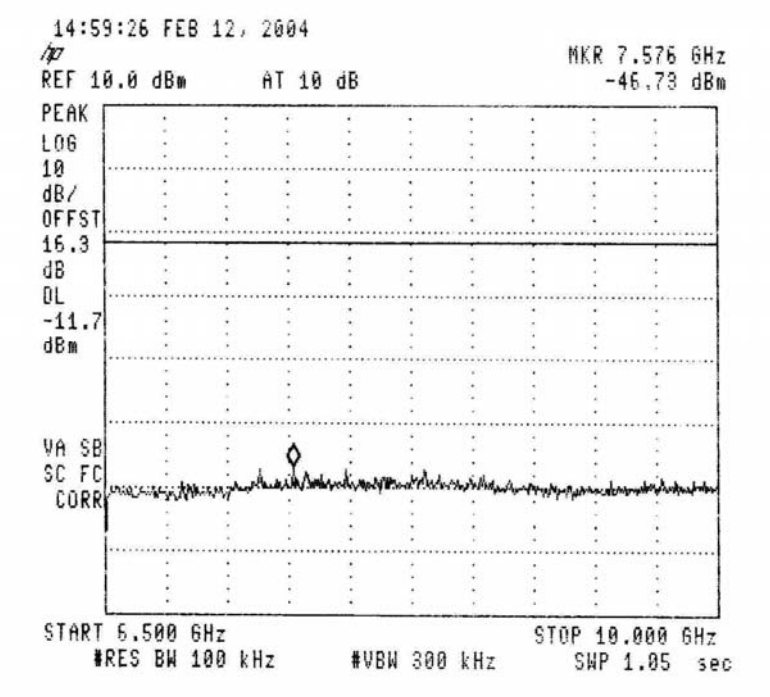

Figure 58 —2462 MHz

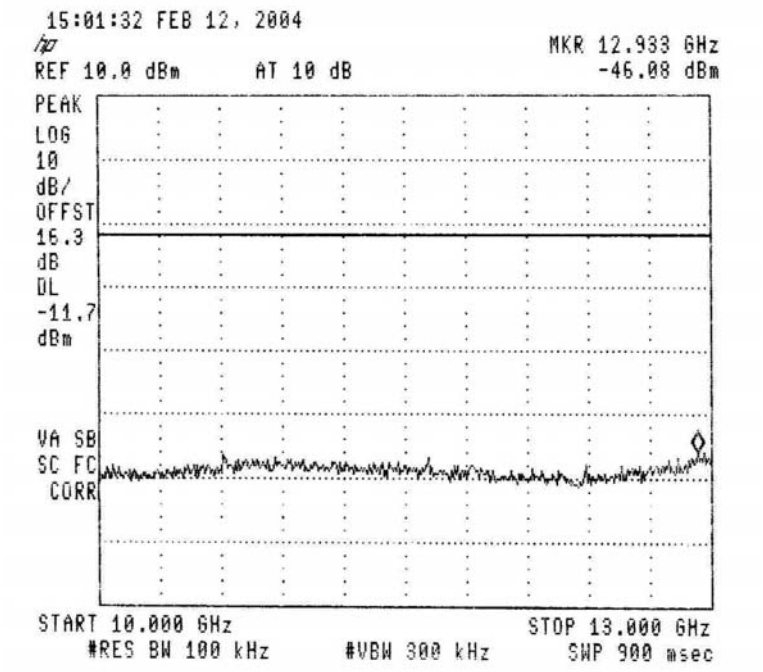

Figure 59 —2462 MHz

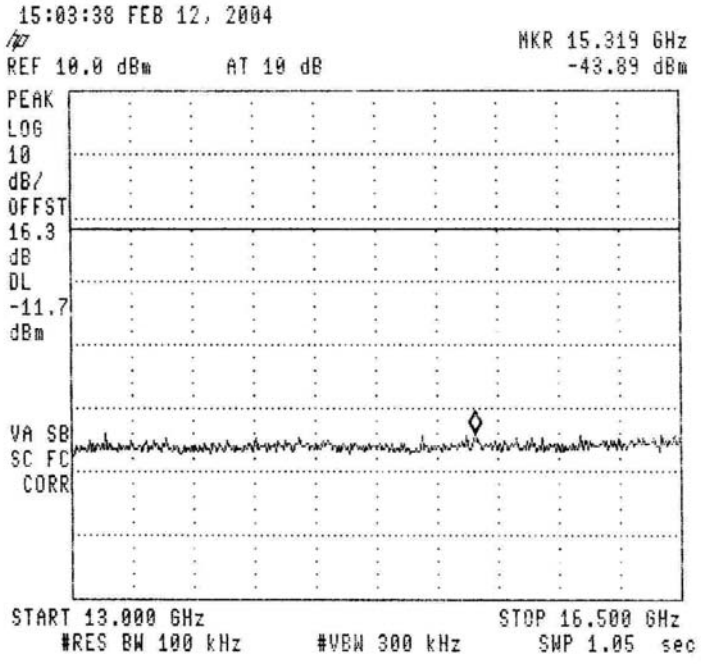

Figure 60 —2462 MHz

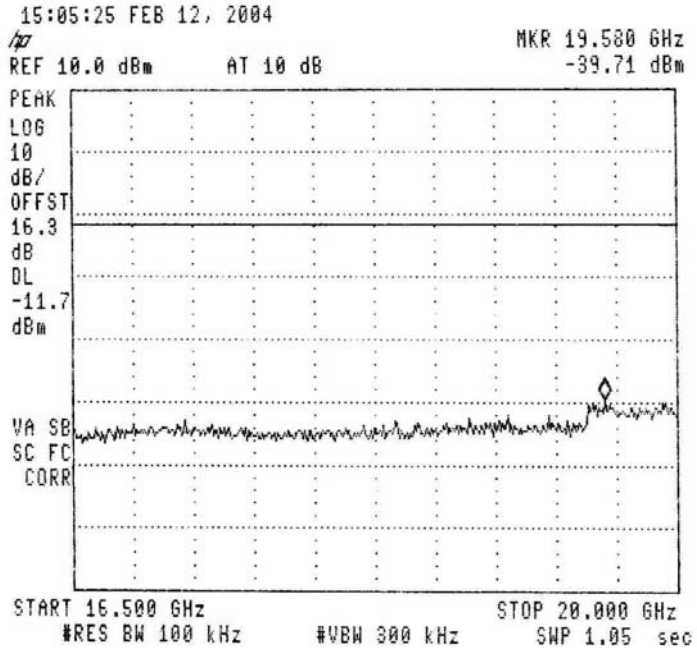

Figure 61 —2462 MHz

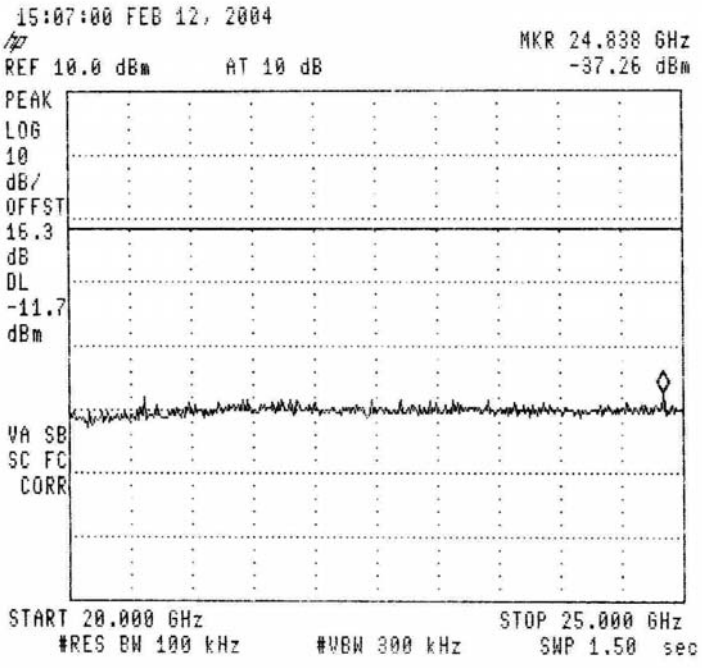

Figure 62 —2462 MHz

9.2 Results table

E.U.T Description: AeroScout™ T2 Tag
Model No.: BWH3000
Serial Number: Not designated
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading (dBc)	Specification (dBc)	Margin (dB)
2412	24.3	20.0	4.3
2442	38.1	20.0	18.1
2462	37.9	20.0	17.9

Figure 63 Peak Power Output of 2400-2483.5 MHz Band

JUDGEMENT: Passed by 4.3 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 08.03.04

Typed/Printed Name: E. Pitt

9.3 Test Equipment Used.

Peak Power Output of 2400-2438.5 MHz Band

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	January 31, 2003	1 year
Cable	Avnet	MTS	N/A	September 20, 2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

Figure 64 Test Equipment Used

10 6 dB Minimum Bandwidth

10.1 Test procedure

The E.U.T. was set to the applicable test frequency. The E.U.T. antenna terminal was connected to the spectrum analyzer through a 16dB external attenuator and an appropriate coaxial cable section. The spectrum analyzer was set to 100 kHz resolution BW. The spectrum bandwidth of the E.U.T. at the point of 6 dB below maximum peak power was measured and recorded.

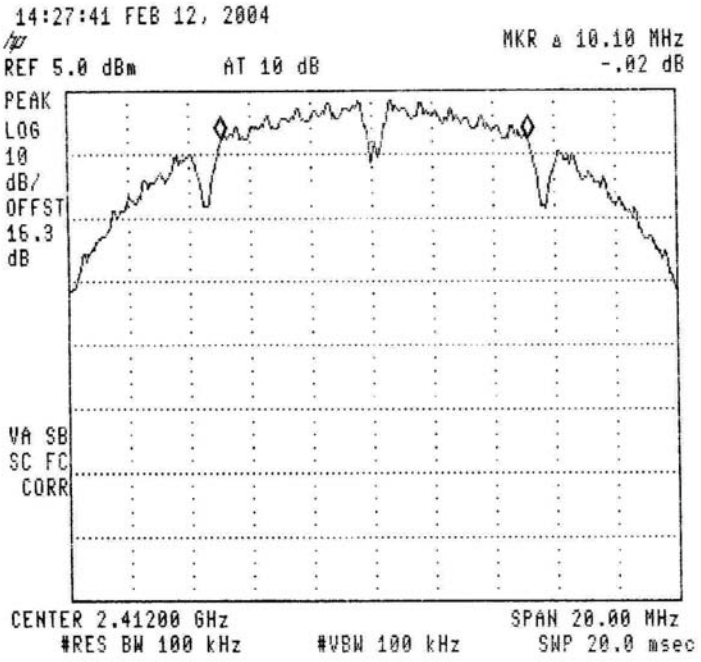

Figure 65 —2412 MHz

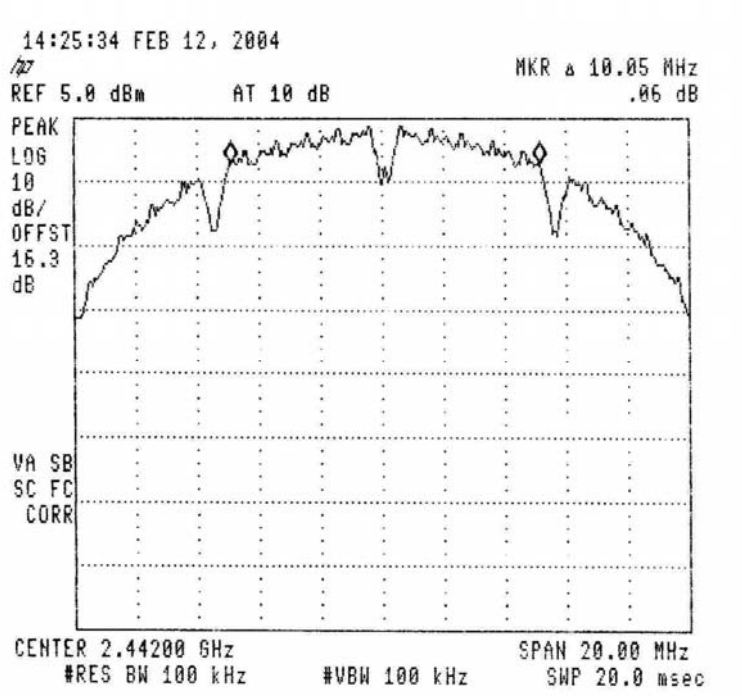

Figure 66 —2442 MHZ

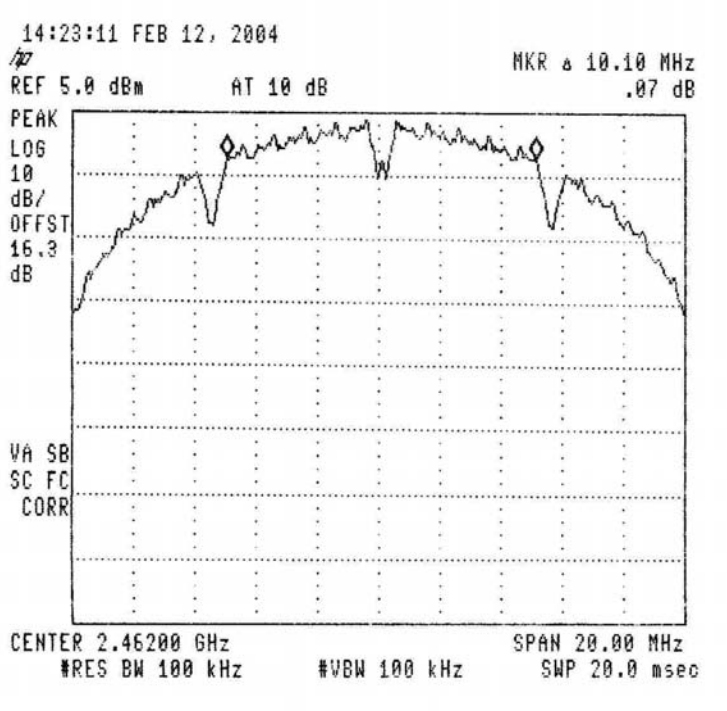

Figure 67 —2462 MHz

10.2 Results table

E.U.T Description: AeroScout™ T2 Tag
Model No.: BWH3000
Serial Number: Not designated
Specification: F.C.C. Part 15, Subpart C: (15.247-a2)

Operation Frequency (MHz)	Reading (MHz)	Specification (MHz)
2412	10.10	0.5
2442	10.05	0.5
2462	10.10	0.5

Figure 68 6 dB Minimum Bandwidth

JUDGEMENT: Passed

TEST PERSONNEL:
Tester Signature: _____ Date: 08.03.04
Typed/Printed Name: E. Pitt

10.3 Test Equipment Used.

6 dB Minimum Bandwidth

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	January 31, 2003	1 year
Cable	Avnet	MTS	N/A	September 20, 2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

Figure 69 Test Equipment Used

11 Band Edge Spectrum

[In Accordance with section 15.247(c)]

11.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through a 16dB external attenuator and an appropriate coaxial cable. The spectrum analyzer was set to 100 kHz resolution BW. Maximum power level below 2400 MHz and above 2483.5 MHz was measured relative to power level at 2412 MHz, 2442 MHz and 2462 MHz correspondingly.

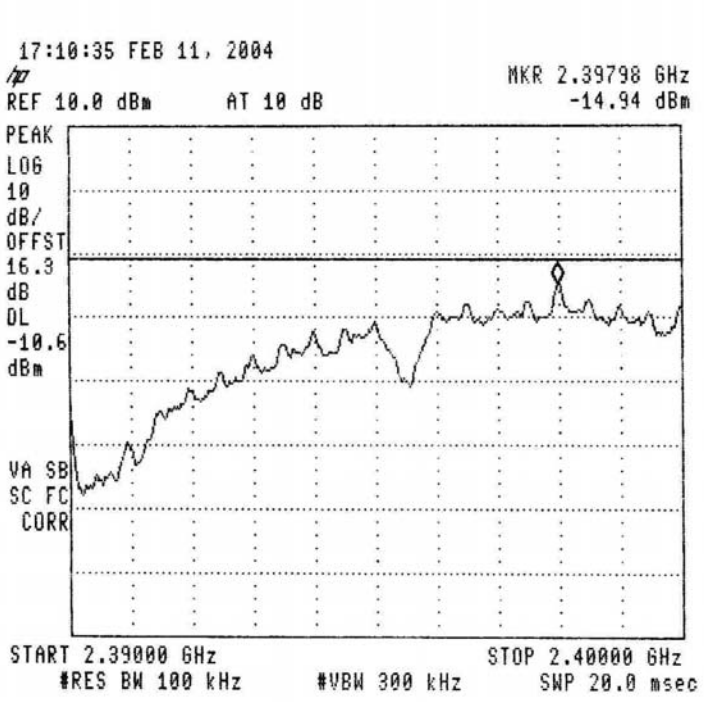

Figure 70 —2412 MHz

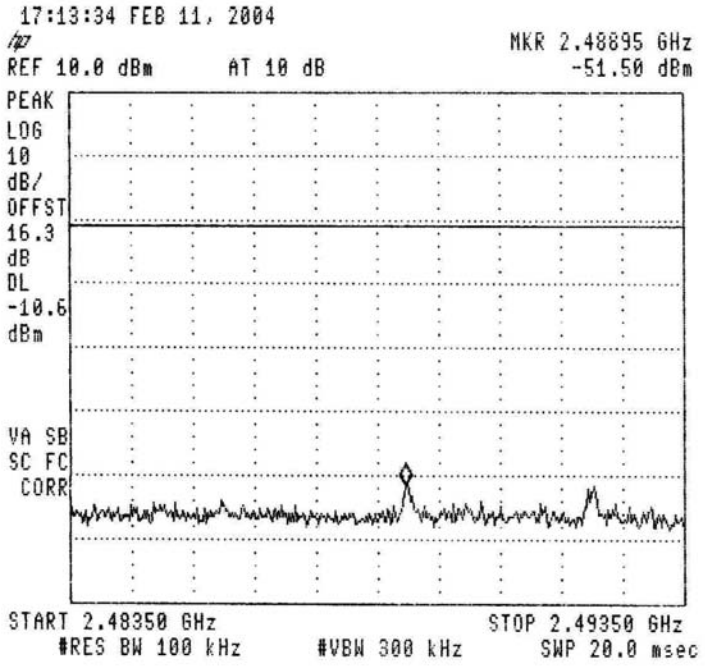

Figure 71 —2412 MHz

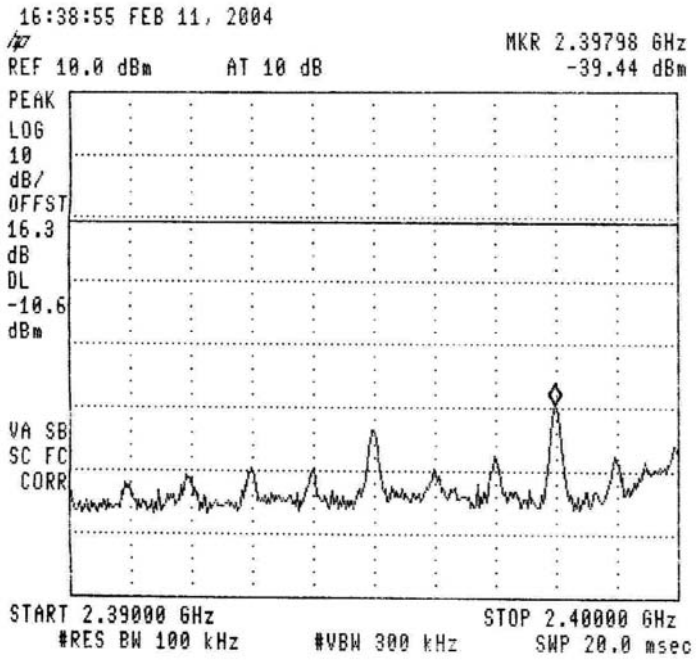

Figure 72 —2442 MHz

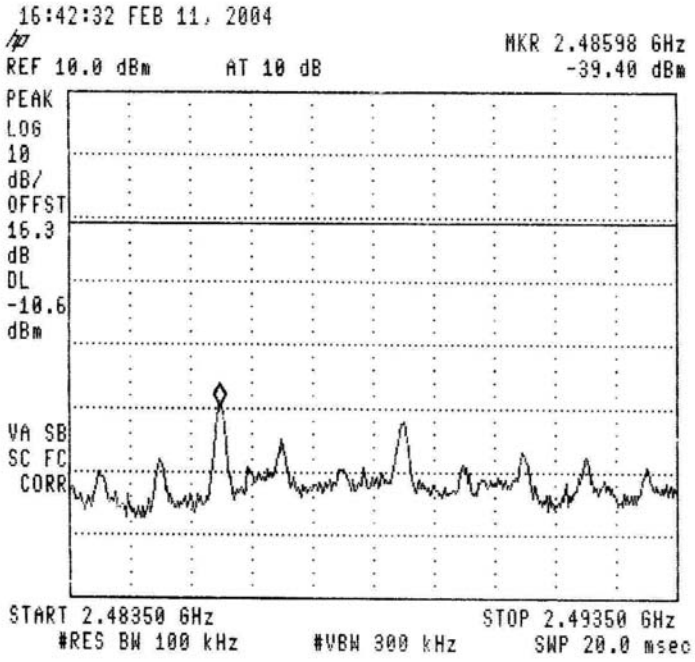

Figure 73 —2442 MHz

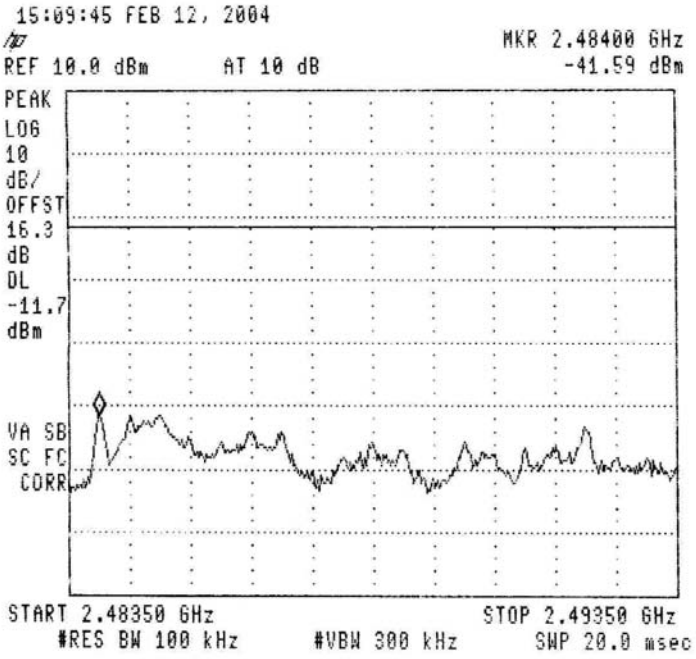

Figure 74 —2462 MHz

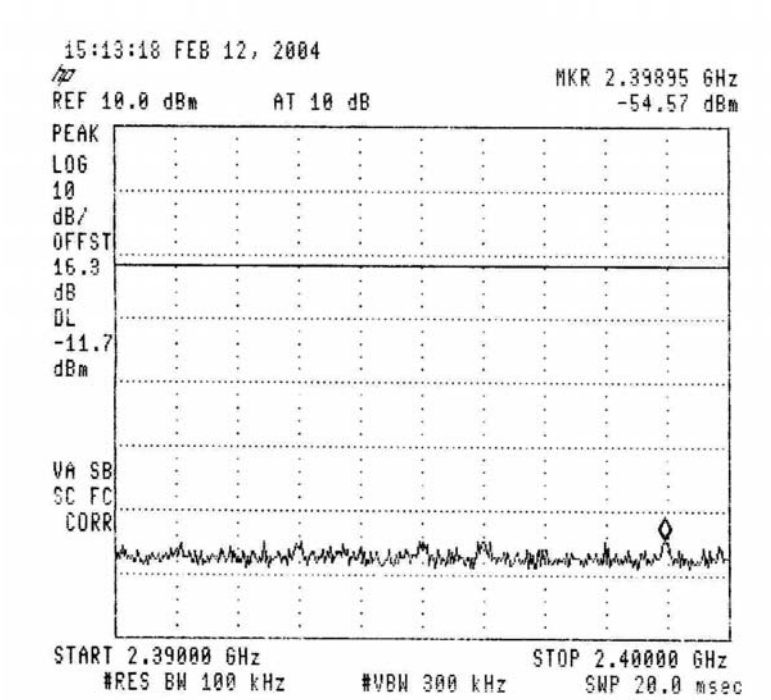

Figure 75 —2462 MHz

11.2 Results table

E.U.T. Description: AeroScout™ T2 Tag
Model No.: BWH3000
Serial Number: Not designated
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Band Edge Frequency (MHz)	Spectrum Level (dBc)	Specification (dBc)	Margin (dB)
2412	23979.8	24.3	20.0	4.3
2442	24859.8	48.8	20.0	28.8
2462	24840.0	49.9	20.0	29.9

Figure 76 Band Edge Spectrum

JUDGEMENT: Passed by 4.3 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 08.03.04

Typed/Printed Name: E. Pitt

11.3 Test Equipment Used.

Band edge Spectrum

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	January 31, 2003	1 year
Cable	Avnet	MTS	N/A	September 20, 2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

Figure 77 Test Equipment Used

12 Transmitted Power Density

[In accordance with section 15.247(d)]

12.1 Test procedure

The E.U.T. antenna terminal was connected to the spectrum analyzer through a 16dB external attenuator and an appropriate coaxial cable. The spectrum analyzer was set to 3 kHz resolution BW. 10 kHz video BW and sweep time of 1 second for each 3 kHz "window". The spectrum peaks were located at each of the 3 operating frequencies.

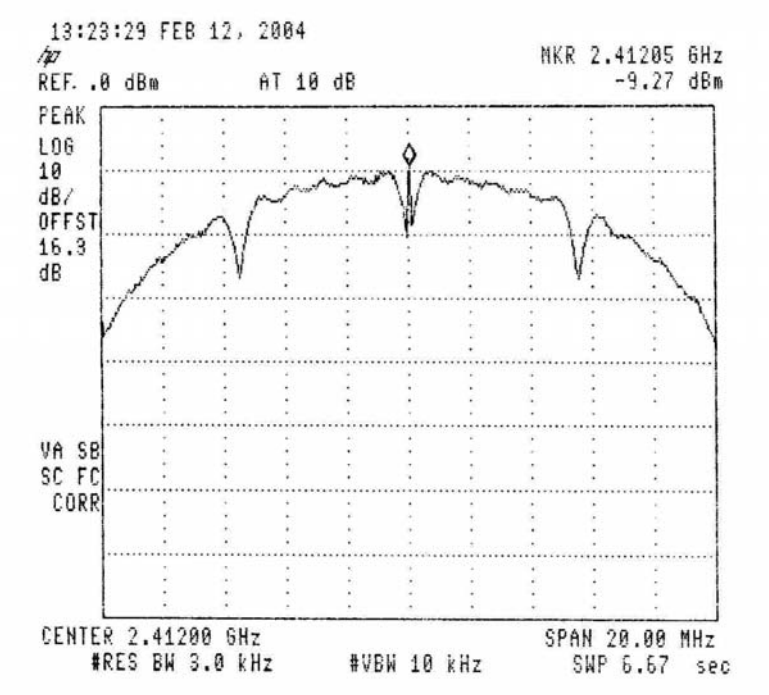

Figure 78 —2412 MHz

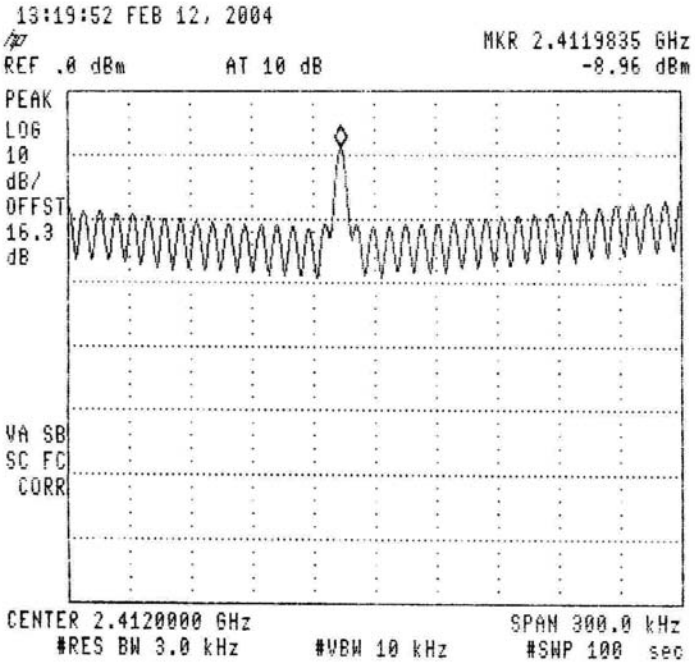

Figure 79 —2412 MHz

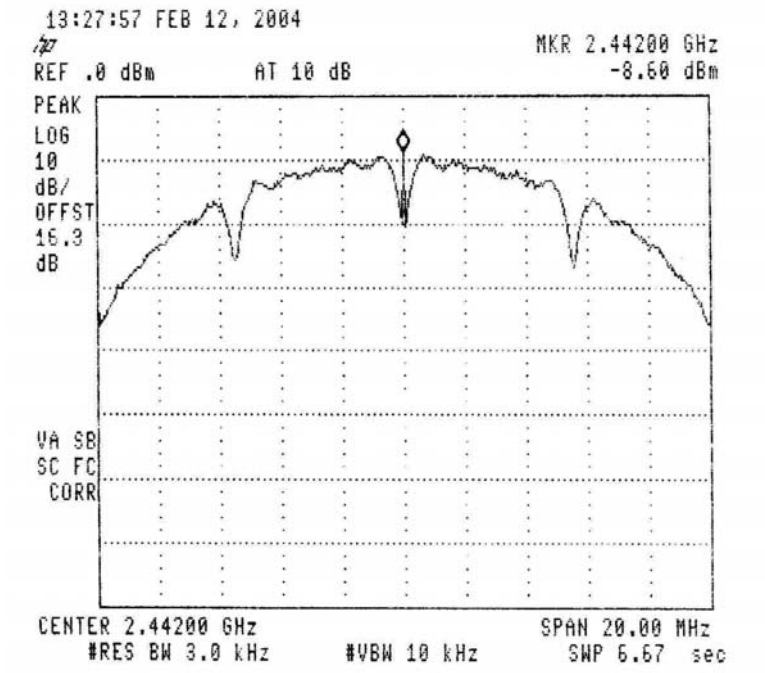

Figure 80 —2442 MHz

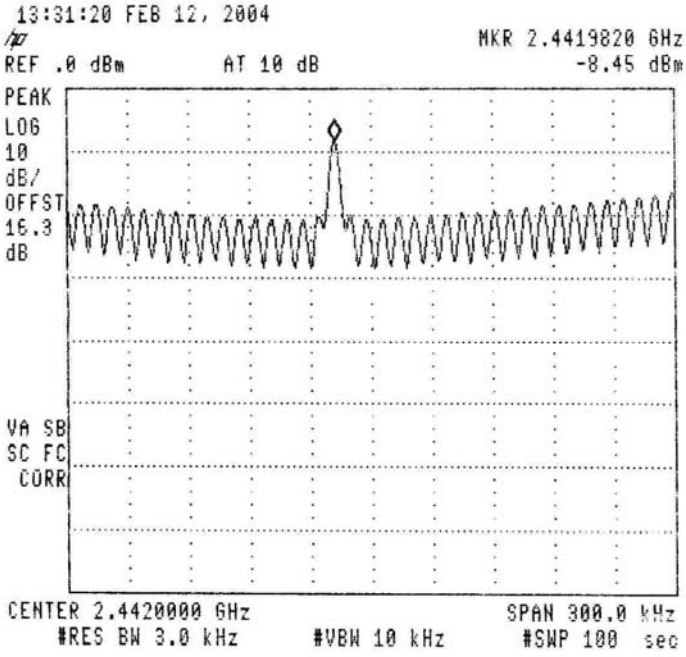

Figure 81 —2442 MHz

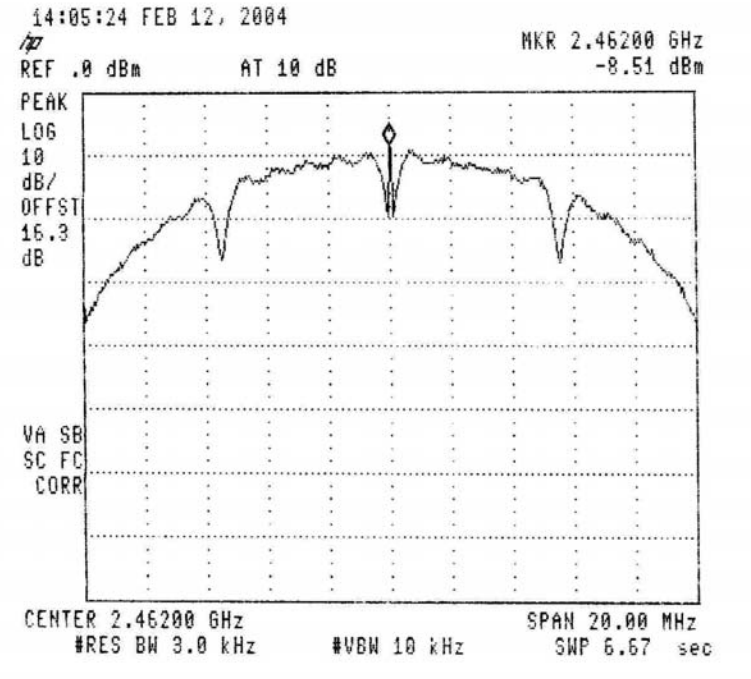

Figure 82 —2462 MHz

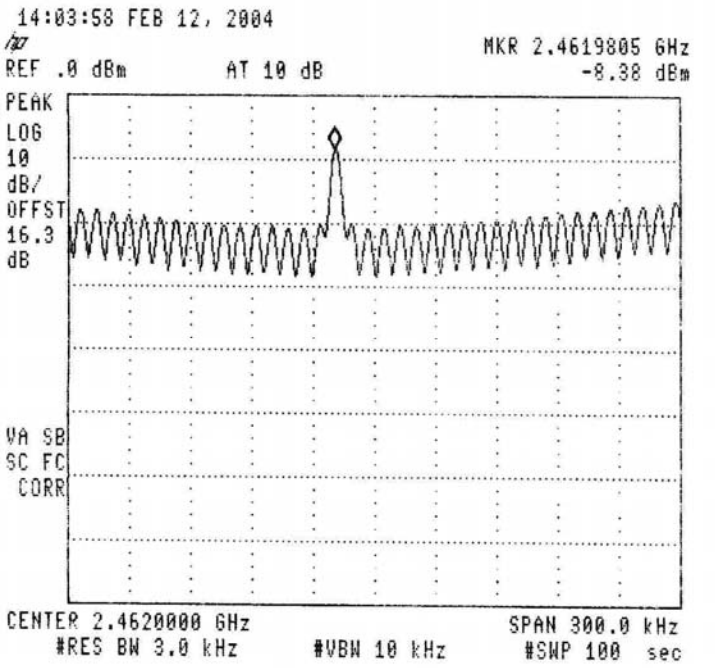

Figure 83 —2462 MHz

12.2 Results table

E.U.T. Description: AeroScout™ T2 Tag
Model No.: BWH3000
Serial Number: Not designated
Specification: F.C.C. Part 15, Subpart C (15.247)

Operation Frequency (MHz)	Reading Signal Analyzer (dBm)	Specification (dBm)	Margin (dB)
2412	-8.96	8.0	16.96
2442	-8.45	8.0	16.45
2462	-8.38	8.0	16.38

Figure 84 Test Results

JUDGEMENT: Passed by 16.38 dB

TEST PERSONNEL:

Tester Signature: _____ Date: 08.03.04

Typed/Printed Name: E. Pitt

12.3 Test Equipment Used.

Transmitted Power Density

Instrument	Manufacturer	Model	Serial Number	Calibration	
				Last Calibr.	Period
Spectrum Analyzer	HP	8592L	3826A01204	January 31, 2003	1 year
Cable	Avnet	MTS	N/A	September 20, 2003	1 year
Attenuator	MACOM	M3933/25-74	0056	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0202	November 13, 2003	1 year
Attenuator	MACOM	M3933/25-74	0211	November 13, 2003	1 year

Figure 85 Test Equipment Used

13 Antenna Gain

The antenna gain is 0dBi.

KOSAN

Specifications Sheet

Object	Chip Antenna	Rev.	IR		
Model name	KBI-165F-XX	Date	December 7, 2002		
System	Bluetooth	Written by	D. H. JUNG		

Electrical Specifications	
Frequency	2400 ~ 2483.5 (MHz)
Bandwidth	83.5 (MHz)
V.S.W.R	1.9 : 1
Gain (max)	0 (dBi)
Input Impedance	50 (O)
Polarization	Linear
Mechanical Specifications	
Size	16 x 5 x 1.6 (mm)
Weight	0.5g
Radiator Material	Copper
Operation Temperature	-30 ~ 90 (?)
Operation Humidity	10 ~ 90 (%)
Option	
Others	

KRD01-00A05-01IR

KOSAN I & T Co., Ltd.

14 R.F Exposure/Safety

The E.U.T. is worn on a wristband for application of collecting location data. Typical uses of the E.U.T. are child tracking in amusement parks, security personnel in enterprises, hospital patients and many more. The typical distance between the E.U.T. and the general population in the worst case application is <2.5cm.

Calculation of Maximum Permissible Exposure (MPE)

Based on Section 1.1307(b)(1) Requirements

(a) FCC limits at 2442 MHz is: $1\frac{mW}{cm^2}$

Using table 1 of Section 1.1310 limit for general population/uncontrolled exposures, the above level is an average over 30 minutes.

(b) The power density produced by the E.U.T. is

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

P_t- Transmitted Power 100mw (Peak)

G_T- Antenna Gain, 0dBi

R- Distance from Transmitter using 1cm worst case

(c) The peak power density is :

$$S_p = \frac{100}{4\pi(1)^2} = 7.96\frac{mW}{cm^2}$$

(d) The duty cycle of transmission in actual worst case is 500 microsecond “on” and 1 second “Off”.

The average power over 30 minutes is:

$$P_{AV} = \frac{100 \times 0.5}{1000} = 0.05mW$$

(e) The averaged power density of the E.U.T. is:

$$S_{AV} = \frac{0.05}{4\pi(1)^2} = 4\times10^{-3}\ \frac{mW}{cm^2}$$

(f) This is 3 orders of magnitude below the FCC limit.

15 Photographs of Tested E.U.T.

Figure 86 Top View External

Figure 87 Bottom View External

Figure 88 Top Cover Internal View

Figure 89 Bottom Cover Internal View

Figure 90 PCB in Case

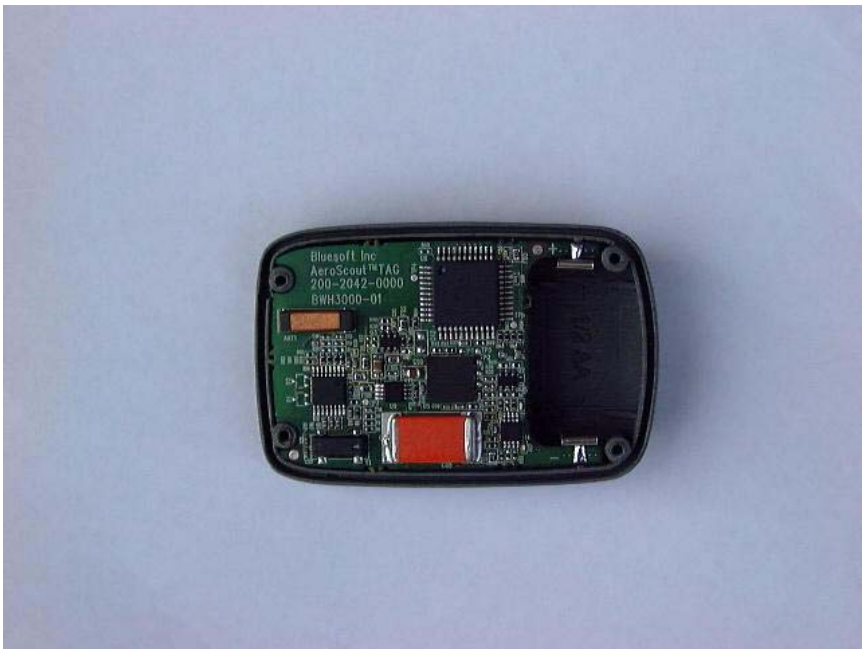

Figure 91 PCB in Case Without Battery

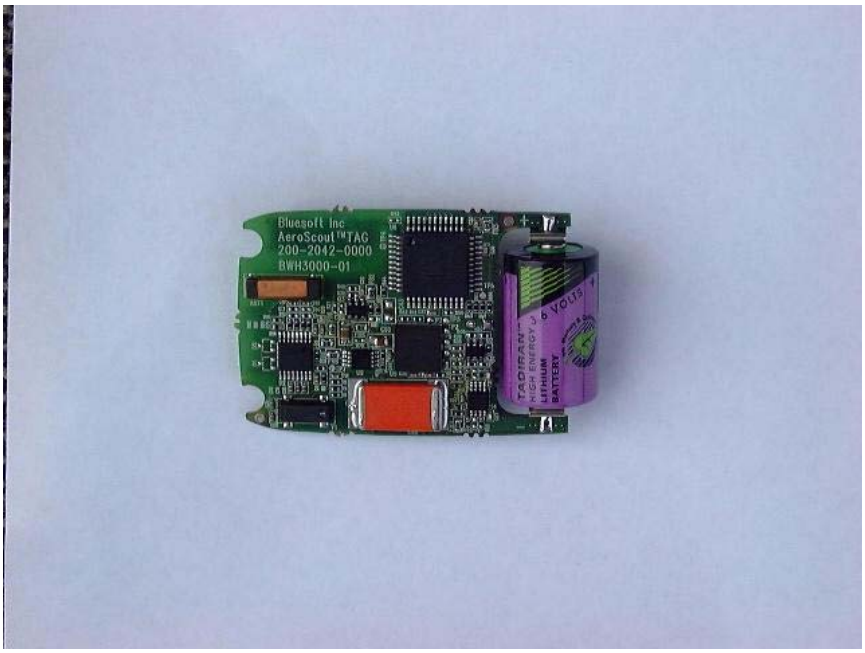

Figure 92 PCB Side 1 With Battery

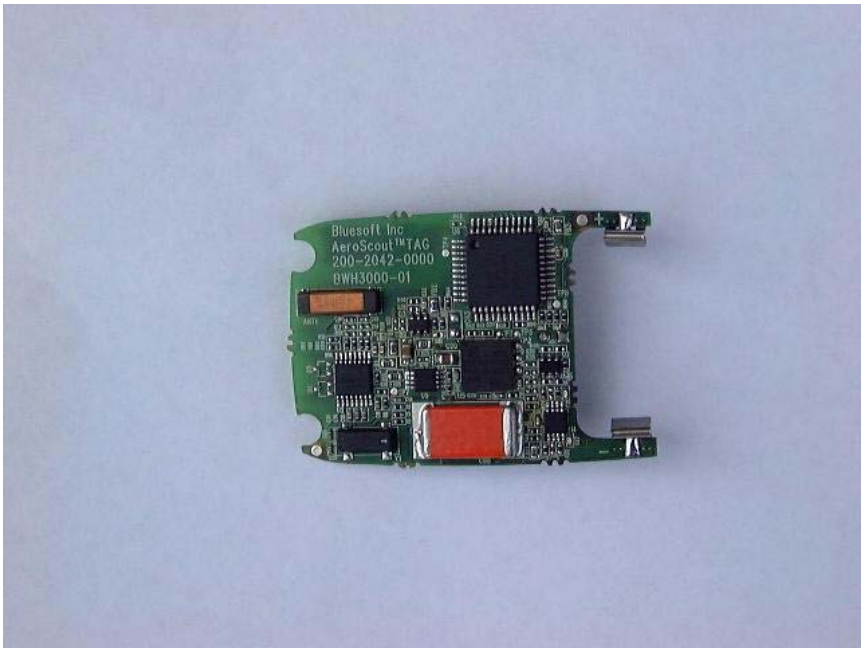

Figure 93 PCB Side 1 Without Battery

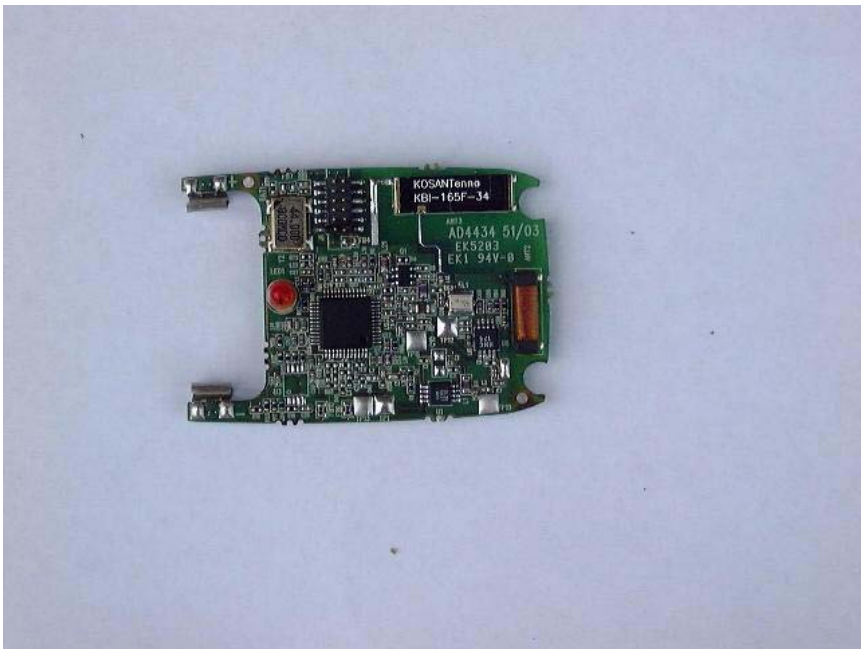

Figure 94 PCB Side 2