REPORT

For

OMNEX Control Systems ULC

Bldg. 74 - 1833 Coast Meridian Road
Port Coquitlam, British Columbia
V3C 6G5, Canada

Date:	January 22, 2010
Report No.:	9576-1E
Revision No.:	1
Project No.:	9576
Equipment:	2.4G Spread Spectrum Data Transceiver Module
Model No.:	OEM2400MR

ONE STOP GLOBAL CERTIFICATION SOLUTIONS

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TABLE OF CONTENTS

TEST REPORT

FCC15.247:2008 / RSS-210, Issue 7

Report reference No.	9576-1E
Report Revision History:	✓ Rev. 0: Dec. 03, 2009 ✓ Rev. 1: Jan. 22, 2010 , update a band edge testing results and connector info.
Tested by (printed name and signature)	Jeremy Lee
Approved by (printed name and signature)	Kavinder Dhillon, Eng.L
Date of issue	January 22, 2010

Note: By signing this report, both the Testing Technician and the Reviewer hereby declare to abide by the applicable LabTest policies:
1.) Statement of Independence # 3014 (LabTest Employees),
2.) Independence, Impartiality, and Integrity #1039, clause 11 (Engineering Service Subcontractors), or
3.) Independence, Impartiality, and Integrity #1019, clause 3.5 (Testing Subcontractors).

Testing Laboratory Name	LabTest Certification Inc.
Address	3133 – 20800 Westminster Hwy, Richmond, B.C. V6V-2W3
FCC Site Registration No.	444229
IC Site Registration No.	5970B-1
OATS Test Location Name	LabTest Certification Inc.
Address	17325-48Ave., Surrey, BC, Canada
Applicant's Name	OMNEX Control Systems ULC
Address	Bldg. 74 - 1833 Coast Meridian Road, Port Coquitlam, B.C. V3C 6G5, Canada
Manufacturer's Name	Same as Applicant
Address	Same as Applicant
Test specification	
Standards	FCC15.247:2008 / RSS-210, Issue 7, June 2007
Testing	
Date of receipt of test item	Nov. 10, 2009
Date(s) of performance of test	Nov. 10 to Dec. 02, 2009 Jan. 21, 2010
Test item description	
Trademark	OMNEX TRUSTED WIRELESS

Model and/or type reference ..... :	OEM2400MR
Serial numbers ..... :	0353300009
Electrical Rating(s) ..... :	24VDC

Product descriptions	
Type of modulation ..... :	Frequency Hopping Spread Spectrum(FHSS)
No. Hopping Channels: (FHSS) ..... :	26 Channels
Dwell time per channel ..... :	< 170 ms
Max. time between two instances of use of the same channel ..... :	≤ 0.5 sec
Operating Frequency Range:	2.4GHz to 2.4835GHz
Application for ..... :	2.4GHz Spread Spectrum Data Transceiver Module
Equipment mobility ..... :	Yes
Nominal Voltages for ..... :	___ stand-alone equipment _X_ combined (or host) equipment __ test jig
Supply Voltage ..... :	_____ AC _____ Amps ____Hz ___24V___ DC __0.062__Amps
If DC Power ..... :	____ Internal Power Supply _X__ Host system is supplied the DC power via connector ____ Battery □ Nickel Cadmium □ Alkaline □ Nickel-Metal Hydride □ Lithium-Ion □ Lead Acid (Vehicle regulated) □ Other
Size of equipment(H X D X W, mm)..... :	77 x 54 x 22
Mass of equipment (g)..... :	24.6
Operating Temperature Range ..... :	-40 °C to +70 °C
Test case verdicts	
Test case does not apply to the test object :	N/A
Test item does meet the requirement ..... :	Pass
Test item does not meet the requirement .. :	Fail

General remarks

"This report is not valid as a CB Test Report unless appended by an approved CB Testing Laboratory and appended to a CB Test Certificate.

The test result presented in this report relate only to the object(s) tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

"(see Enclosure #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.

☒ Throughout this report a comma is used as the decimal separator.

☐ Throughout this report a period is used as the decimal separator.

General product information:

The OEM2400MR is a frequency hopped spread spectrum transceiver module designed to be compatible with US and Canadian regulations for license free use in the 2400 MHz ISM band.

List of ancillary and/or support equipment provided by the applicant

Model No.	Description	Manufacturer	Approvals/Standards
N/A	RS-232, Host Board with ribbon cable and adaptor board connections	OMNEX	N/A
ANT-2.4-CW-CT-RPS	External 1/2wave 2.4GHz Antenna, + 1.76 dBi	Antenna Factor	N/A
RF Connector	MCX(m) to SMA(f)	N/A	N/A

Description of Interface Cables for Testing

Description	Cable Type	Cable length	Ferrite
Power Cable	Twisted two wire	3ft	No
Connect to RS232 port of Laptop to RS232 port of Host Board for controlling the EUT	RS232(m) to RS-232(f)	6ft	No
RF Cable, for connucted testing and attaching the Antenna	SMA(m) to SMA(m)	1.5ft	No

ARRANGEMENT OF INTERFACE CABLES: All interface cables were positioned for worst-case maximum emissions within the manner assumed to be a typical operation condition (please reference photographs).

Software and Firmware

Description	Version
Hyper-terminal, for Windows XP	5.1

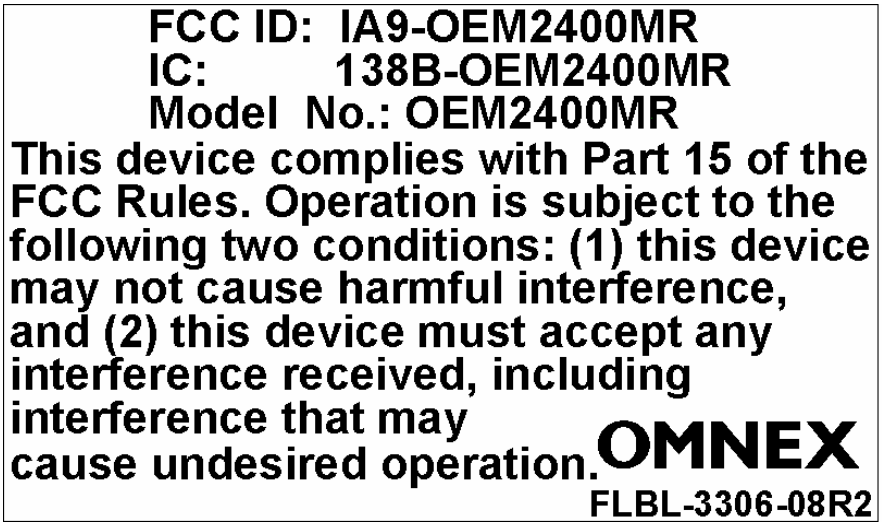
Worst-case configuration and mode of operation during testing

The radio was set up in hopping mode in which it hops on all 26 available channels. The output power was configured to output + 20 dBm. The EUT can be configured to support the following serial interfaces: TTL level, USB and CAN-bus. The serial interfaces signals are routed to the external world through the connector CN1. The chip radio generates three configurable over the air data rates which include 19.2, 125 and 250 kbps. The EUT was operated as continually its hopping sequence during all testing.

Modifications Required for Compliance

None

Markings



Test Equipment Verified for function

Model #	Description	Checked Function	Results
R3271	Spectrum Analyzer	Frequency and Amplitude	Connected 300MHz and -20dBm Cal_siganl and checked OK.
PA-103	Pre-Amplifier, 1 to 1,000MHz	Gain at 30 and 1,000Mhz	Gains are normal.
LPA-10-10	Pre-Amplifier, 1 to 10GHz	Gain at 1 and 4GHz	Gains are normal.
SAS-542	Anatenna, 30 to 300MHz	Checked structure	Normal – no damage
SAS-542	Anatenna, 300 to 1000MHz	Checked structure	Normal – no damage
SAS-571	Anatenna, 1 to 18GHz	Checked structure	Normal – no damage
SAS-572	Anatenna, 18 to 26.5GHz	Checked structure	Normal – no damage
SAC-26G-3	RF Cable, up to 26.5GHz	Insertion Loss at 1 and 4GHz	Insertion Losses are normal
LCI-001	RF Cable, up to 1GHz	Insertion Losses from 30 to 1,000MHz	Saved data
OC-LMR100A-4	RF Cable, SMA(m) to SMA(m)	Insertion Loss at 30 to 4GHz	Saved data
UNAT-15+	Attenuator	Insertion Loss at 30 to 4GHz	Saved data

Measurement Uncertainty

Where relevant, the folllowing measurement uncertainty levels have been estimated for tests:

Parameter	Uncertainty(dB)
Radiated Emission, 30 to 300MHz	4.94
Radiated Emission, 300 to 1,000MHz	5.05
Radiated Emission, 1 to 26.5GHz	5.05
Conducted Measurements	2.86

Uncertainty figures are valid to a confidence level of 95%.

Test Summary

When configured and operated as specified in this report, the product was found to comply with the requirements as indicated below.

Test Type	Regulation	Measurement Method	Result
Antenna Requirements	15.203	N/A	PASS
Channel Separation and 20dB Bandwidth	15.247(a)(1) & RSS-210	FCC Public notice DA 00-705	PASS
Number of Channels	15.247(a)(1)(iii) & RSS-210	FCC Public notice DA 00-705	PASS
Time of occupancy(Dwell Time)	15.247(a)(1)(iii) & RSS-210	FCC Public notice DA 00-705	PASS
Conducted Output Power	15.247(b)(1) & RSS-210	FCC Public notice DA 00-705	PASS
Antenna Gain	15.247(b)(4) & RSS-210	FCC Public notice DA 00-705	PASS
Band Edge Compliance of RF Conducted Emissions	15.247(d) & RSS-210	FCC Public notice DA 00-705	PASS
Spurious RF Conducted Emissions	15.247(d) & RSS-210	FCC Public notice DA 00-705	PASS
Spurious Radiated Emissions	15.249, 15.205, 15.209 & RSS-210	ANSI C63.4:2003	PASS
Continuous data and short transmissions	15.247(g) & RSS-210	FCC Public notice DA 00-705	PASS
Coordination Frequency Hopping	15.247(h) & RSS-210	FCC Public notice DA 00-705	PASS
RF Exposure	15.247(i) & RSS-102	FCC1.1310	PASS
Radiated Emissions-Unintentional radiators	15.109, Class B & RSS-210	ANSI C63.4:2003	PASS
AC Power Line Conducted Emission	15.207(a) RSS-Gen	ANSI C63.4:2003	N/A[1)]

Note1): The EUT connected to host power system. This test was exempted by no connection to AC Power Line.

Antenna Requirements

Test Date	Dec. 03, 2009
Sample Number	773533
Tested By	Jeremy Lee

Use the barometric pressure reported at: http://www.theweathernetwork.com/weather/cabc0248

Test Limits

FCC15.203

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Test Results:

The 2.4GHz Spread Spectrum Data Transceiver Module, OEM2400MR was connected using a RP-SMA antenna as specified by the user manual.

X Pass Fail N/A

Channel Separation and 20dB Bandwidth

Temperature	20.3 °C
Relative Humidity	40.5 %
Barometric Pressure:	101.72 kPa
Test Date	Nov. 10, 2009
Sample Number	773533
Calibrated Test Equipment (ID)	152, 228
Reference Equipment (ID) (Calibration not required)	059, N1, N2
Tested By	Jeremy Lee

Use the barometric pressure reported at: http://www.theweathernetwork.com/weather/cabc0248

Test Limits

15.247(a)

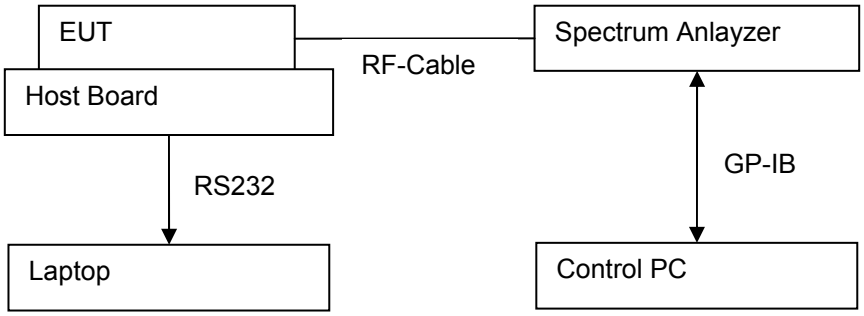
(1) Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Setup

The test was performed in accordance with **FCC 15.247:2008, FCC 15.31:2008, and FCC Public notice DA 00-705 Released March 30, 2000.**

- The RF output of the EUT was connected to the RF input port of the Spectrum Analyzer.
- The EUT 's hopping function was enabled and the channel separation measurement.
- The transmitter was transmitting at its maximum data rate, 250kbps for measuring 20dB BW.
- The following measurements were made with
  - Span = approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel for 20dB Bandwidth and wide enough to capture the peaks of two adjacent channels for Channel Separation.
  - RBW ≥ 1% of each span
  - VBW ≥ RBW
  - Sweep = auto
  - Detector Function = peak
  - Trace = max hold
- Allowed the trace to stabilize.
- Use the 20 dB method used for detecting the bandwidth.
- The Channel Separation is the delta reading in frequency between two markers.

Setup Block Diagram



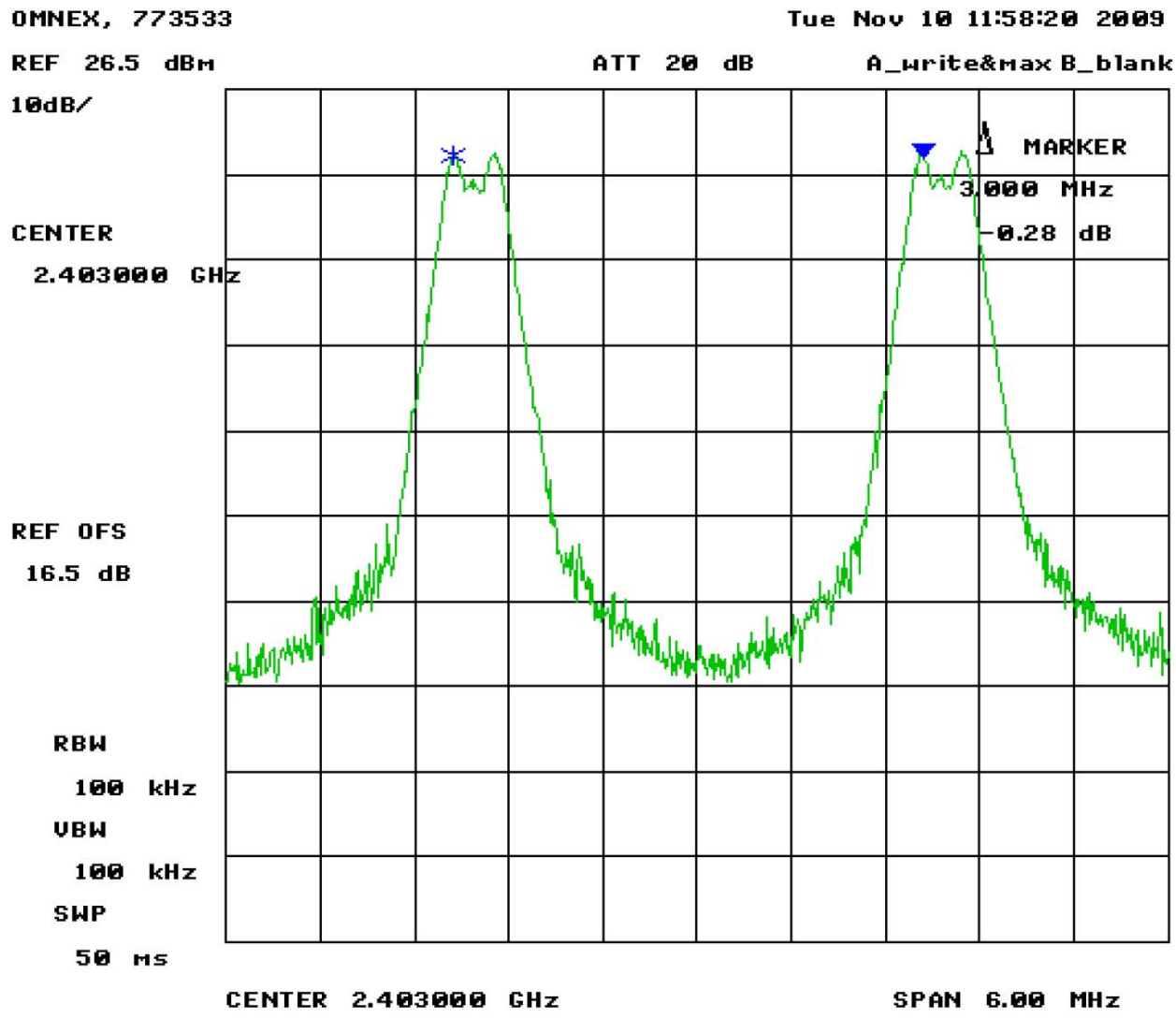
Test Results:

Centre Frequency(MHz)	Channel Separation (kHz)	Limit(kHz)	Pass/Fail
2403.0	3000	≥ 358.67	Pass
2442.0	3000	≥ 354.00	Pass
2472.0	3000	≥ 356.00	Pass

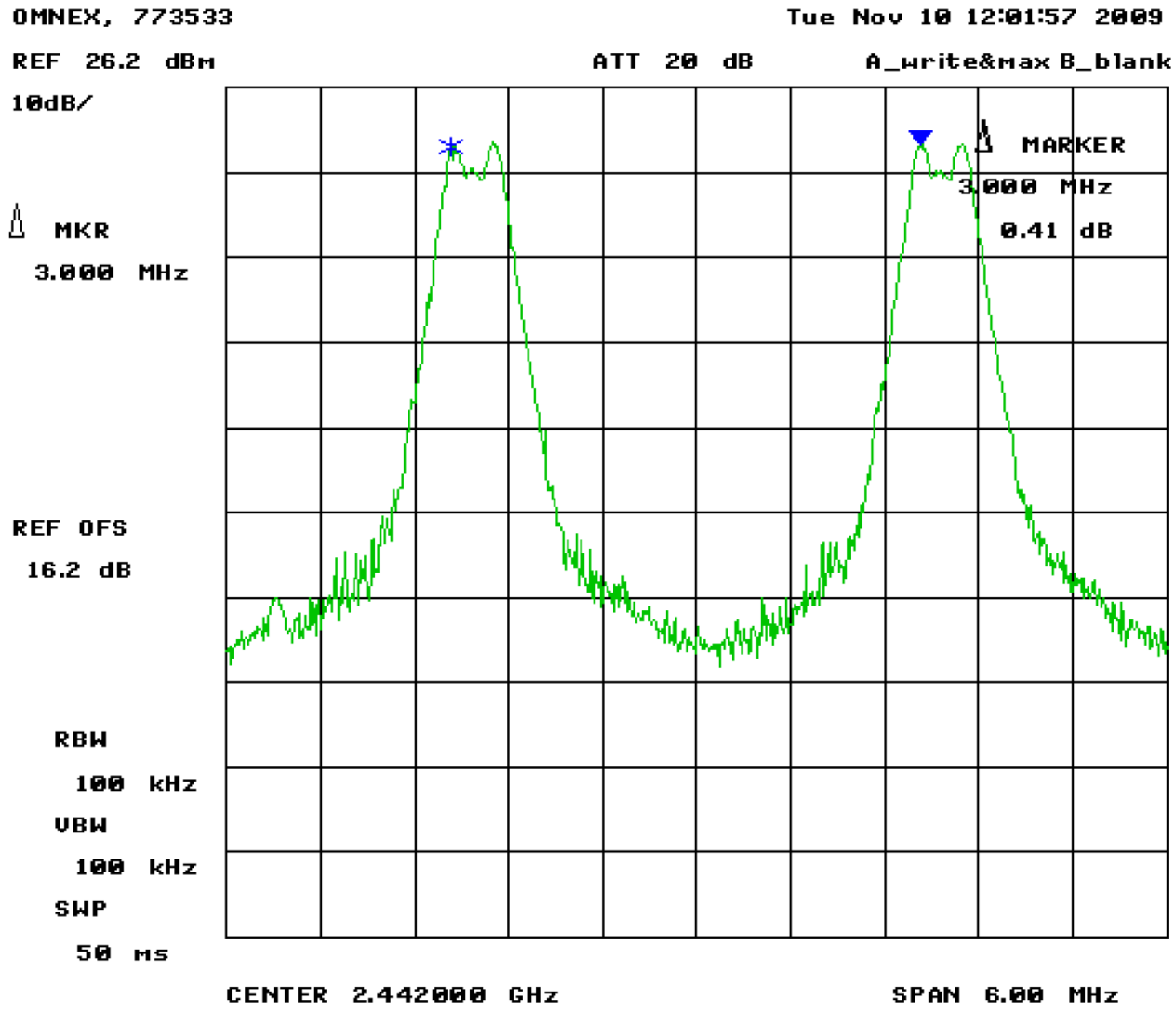
Channel Frequency(MHz)	20dB BW(kHz)	Limit(kHz)	Pass/Fail
2401.5	538	N/A	N/A
2441.5	531	N/A	N/A
2481.5	534	N/A	N/A

X Pass Fail N/A

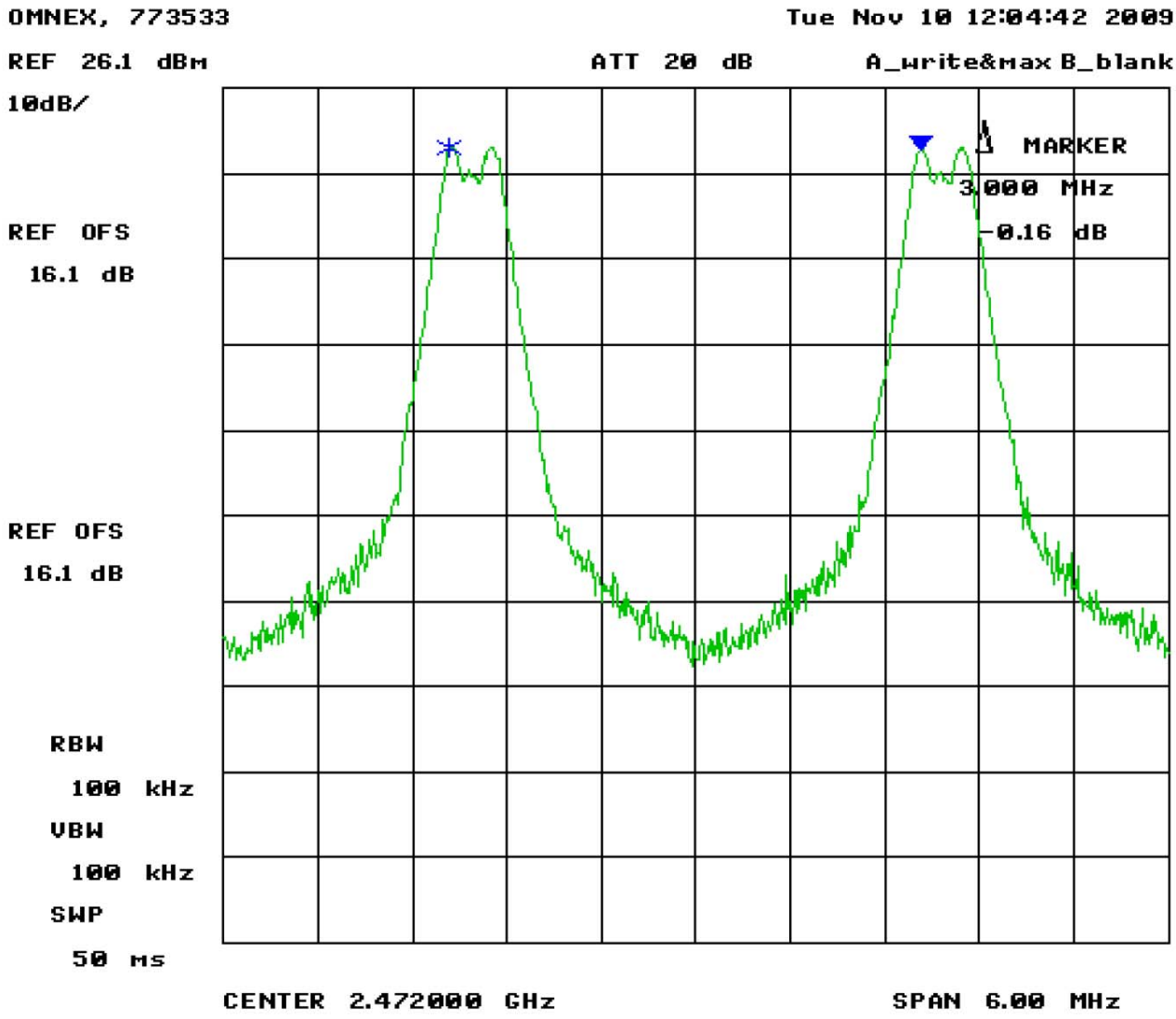
- Channel Separation of Low End, at centre frequency is: 2403.0MHz



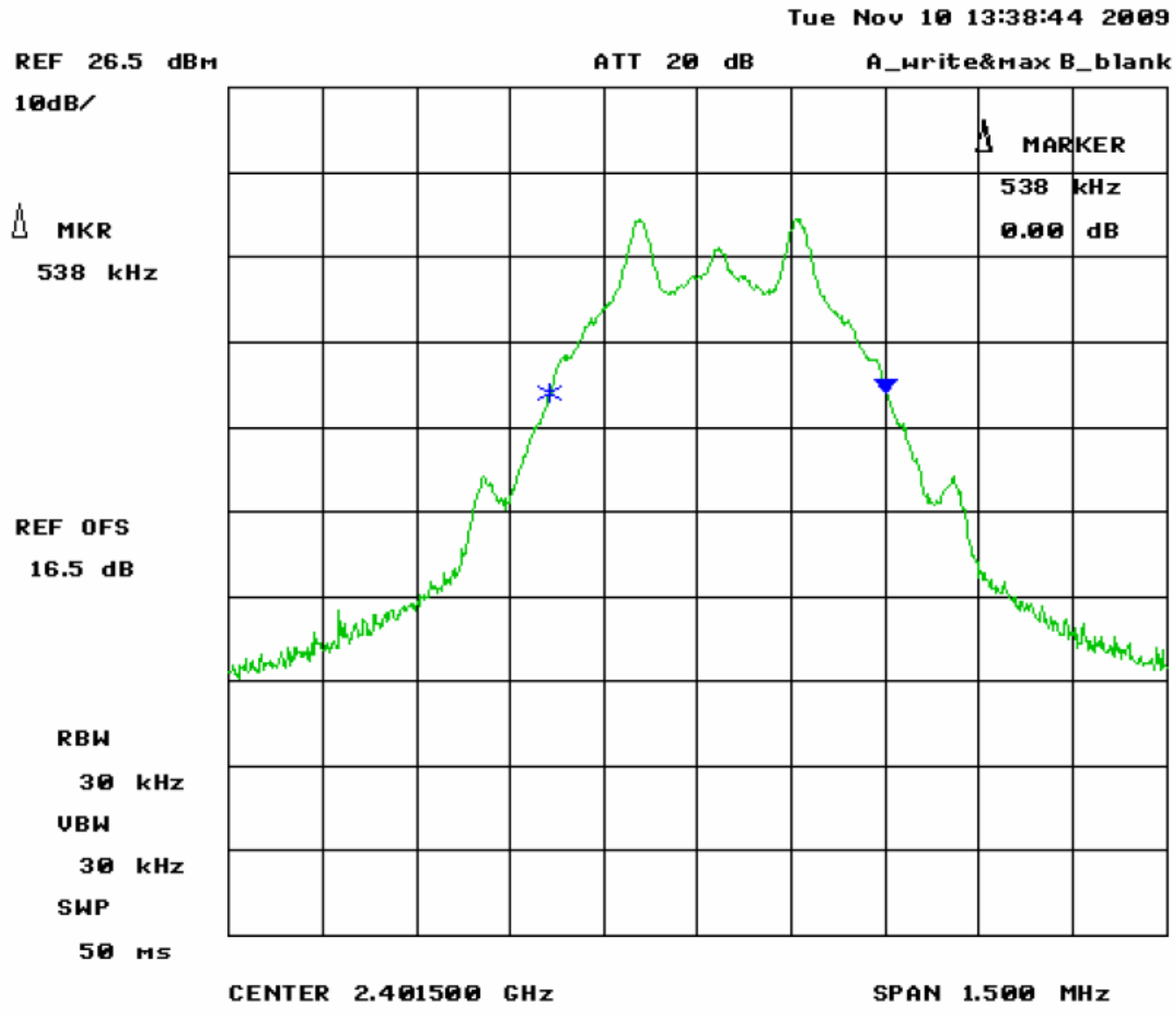
- Channel Separation of middle, at centre frequency is: 2442.0MHz



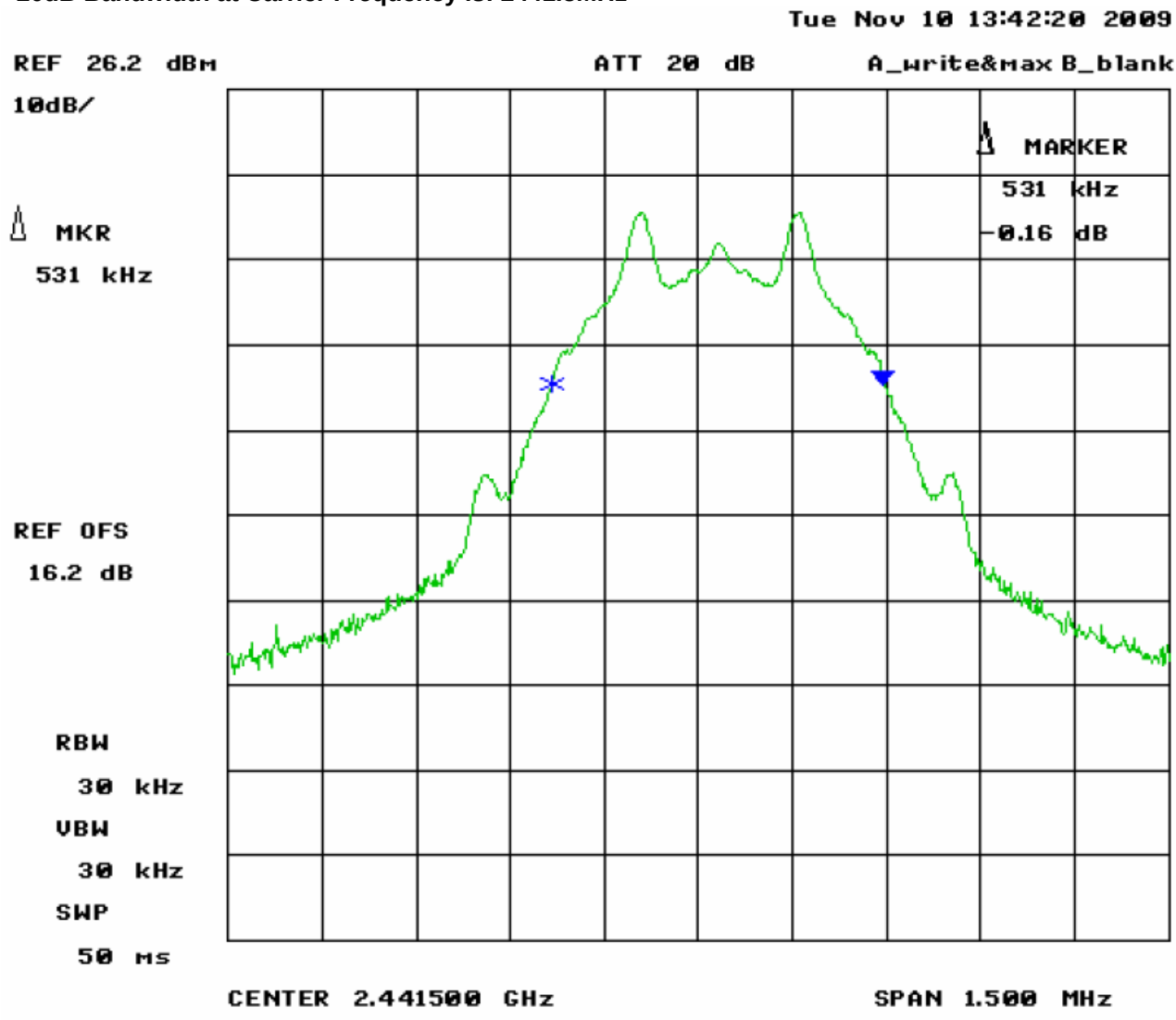
- Channel Separation of High End, at centre frequency is: 2472MHz



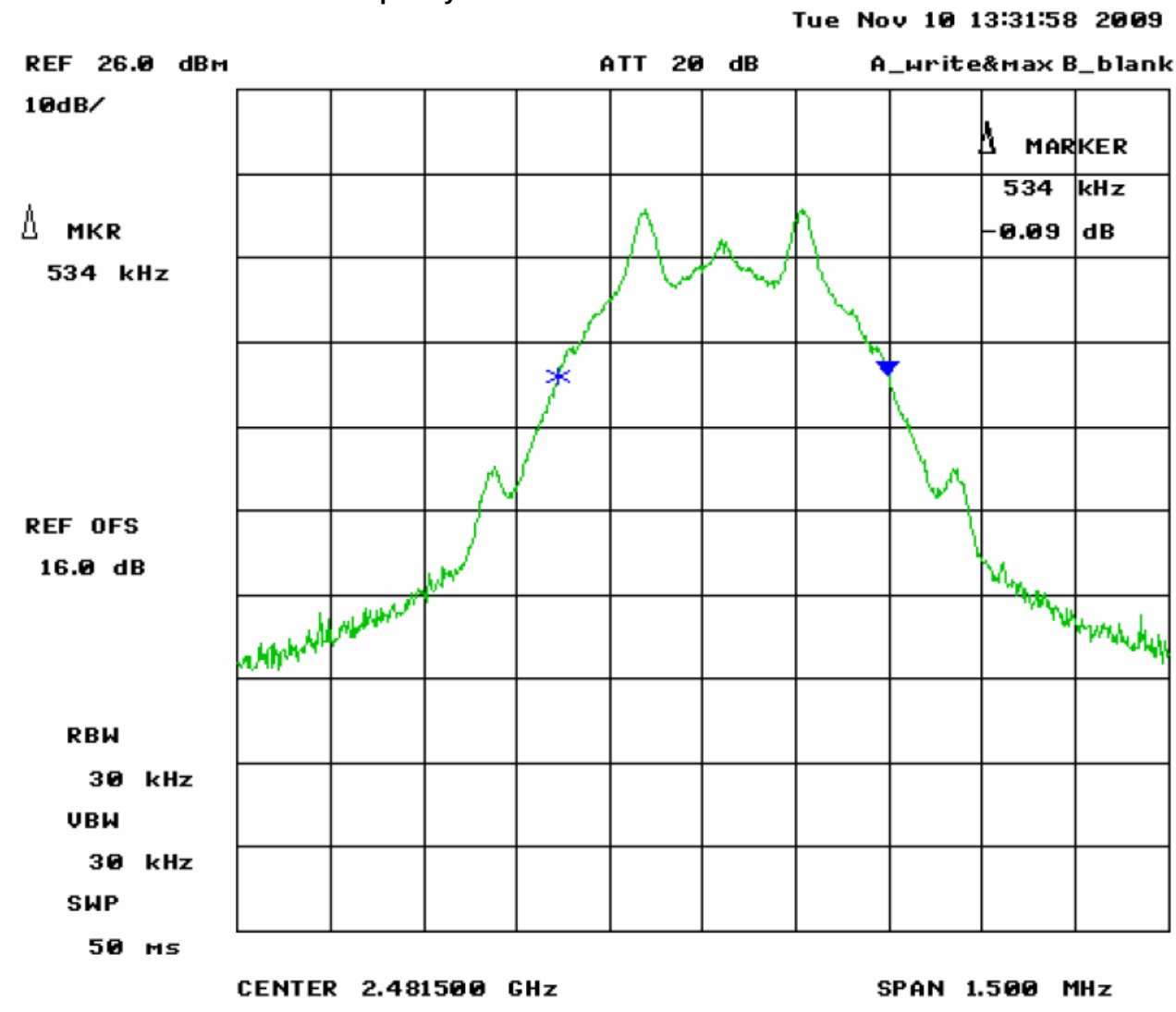
- 20dB Bandwidth at Carrier Frequency is: 2401.5MHz



- 20dB Bandwidth at Carrier Frequency is: 2441.5MHz



- **20dB Bandwidth at Carrier Frequency is: 2481.5MHz**



Number of Channels

Temperature	20.3 °C
Relative Humidity	40.5 %
Barometric Pressure:	101.72 kPa
Test Date	Nov. 10, 2009
Sample Number	773533
Calibrated Test Equipment (ID)	152, 228
Reference Equipment (ID) (Calibration not required)	059, N1, N2
Tested By	Jeremy Lee

Use the barometric pressure reported at: http://www.theweathernetwork.com/weather/cabc0248

Test Limits

15.247(a)(1)

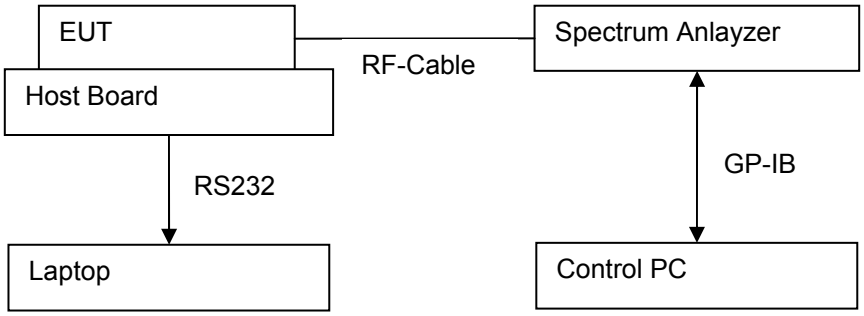
(iii) Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

Test Setup

The test was performed in accordance with **FCC 15.247:2008, FCC 15.31:2008, and FCC Public notice DA 00-705 Released March 30, 2000.**

- The RF output of the EUT was connected to the RF input port of the Spectrum Analyzer.
- The EUT had its hopping function enabled.
- The transmitter was transmitting at its maximum data rate, 250kbps.
- The following measurements were made with
  - Span = 30.26MHz.
  - RBW = 300kHz
  - VBW ≥ RBW
  - Sweep = auto
  - Detector Function = peak
  - Trace = max hold
- Allowed the trace to stabilize.
- Count to the peak detected signals.

Setup Block Diagram

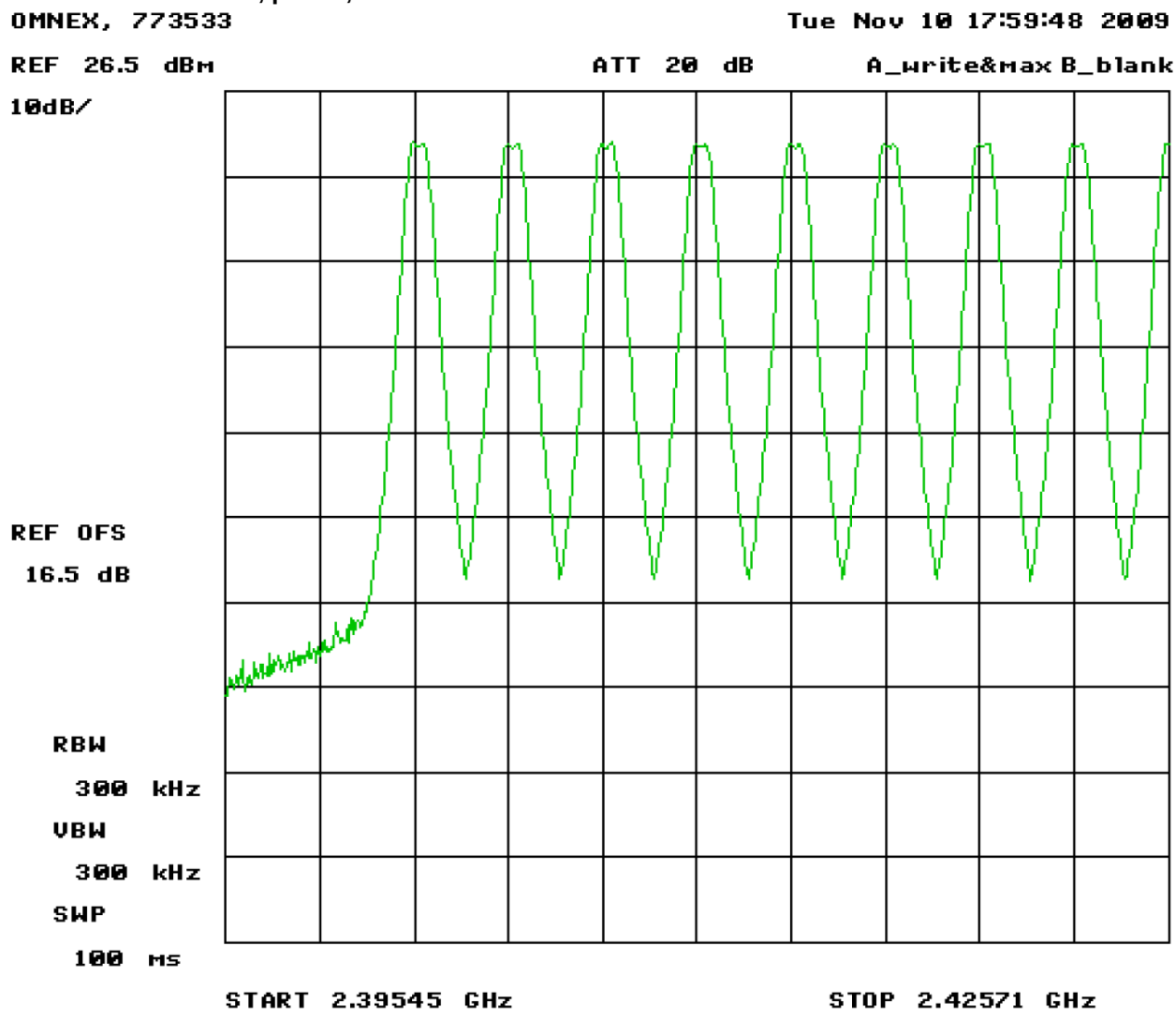


Test Results:

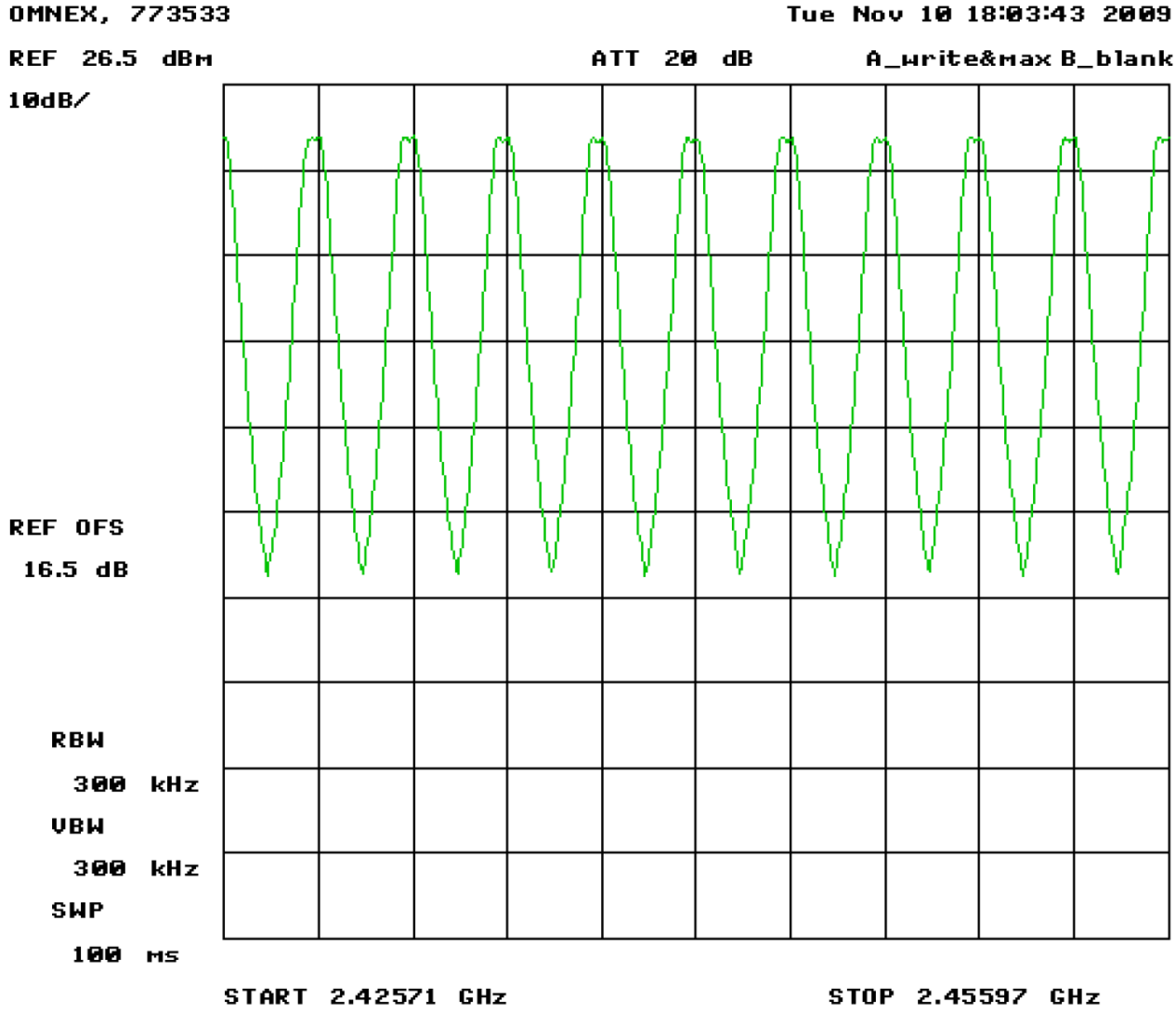
Frequency range (MHz)	Channel Number	Limit	Pass/Fail
2400 to 2483.5	26	≥ 15	Pass

X Pass Fail N/A

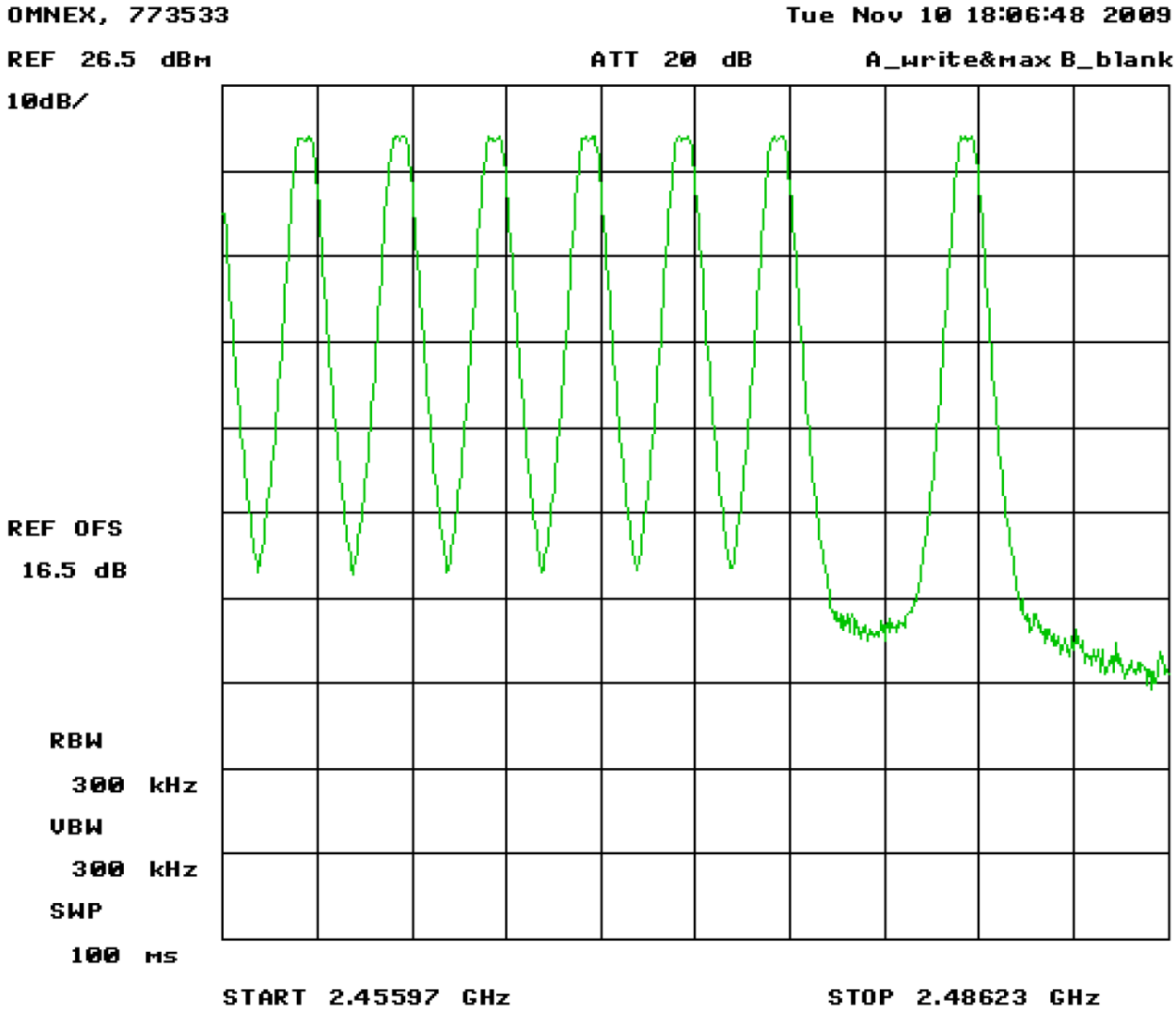
- Number of Channels, plot#1, 9channels



- Number of Channels, plot#2, 10channels



- Number of Channels, plot#3, 7channels



Time of Occupancy (Dwell Time)

Temperature	20.3 °C
Relative Humidity	40.5 %
Barometric Pressure:	101.72 kPa
Test Date	Nov. 10, 2009
Sample Number	773533
Calibrated Test Equipment (ID)	152, 228
Reference Equipment (ID) (Calibration not required)	059, N1, N2
Tested By	Jeremy Lee

Use the barometric pressure reported at: http://www.theweathernetwork.com/weather/cabc0248

Test Limits

15.247(a)(1)

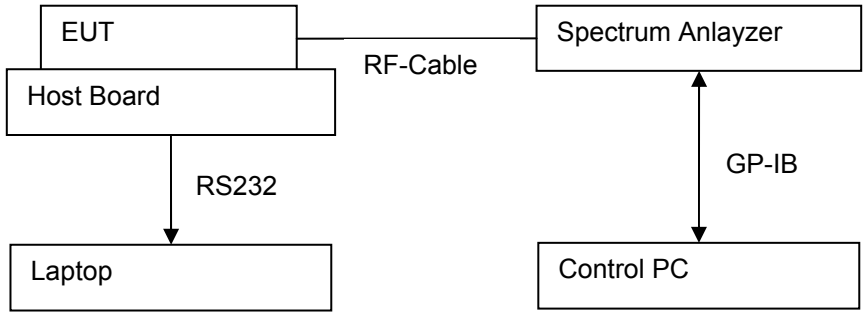
(iii) Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress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

Test Setup

The test was performed in accordance with **FCC 15.247:2008, FCC 15.31:2008, and FCC Public notice DA 00-705 Released March 30, 2000.**

- The RF output of the EUT was connected to the RF input port of the Spectrum Analyzer.
- The EUT had its hopping function enabled.
- The transmitter was transmitting at its maximum data rate, 250kbps.
- The following measurements were made with
  - Span = 0Hz centered on a hopping channel.
  - RBW = 1MHz
  - VBW ≥ RBW
  - Sweep = 20ms for measuring the Dwell time and 1.0sec for appearance of channel
  - Detector Function = peak
  - Trace = Single trace up to capturing the whole range of signal
- Use the marker function to set the marker to top of left-end of the signal.
- Use the marker-delta function to set the marker to top of right-end of the signal.
- The Dwell Time is the delta reading in time between two markers multiplied by the number of times they appearance in 10.4 sec (10.4 sec is 400ms times 26 channels).

Setup Block Diagram

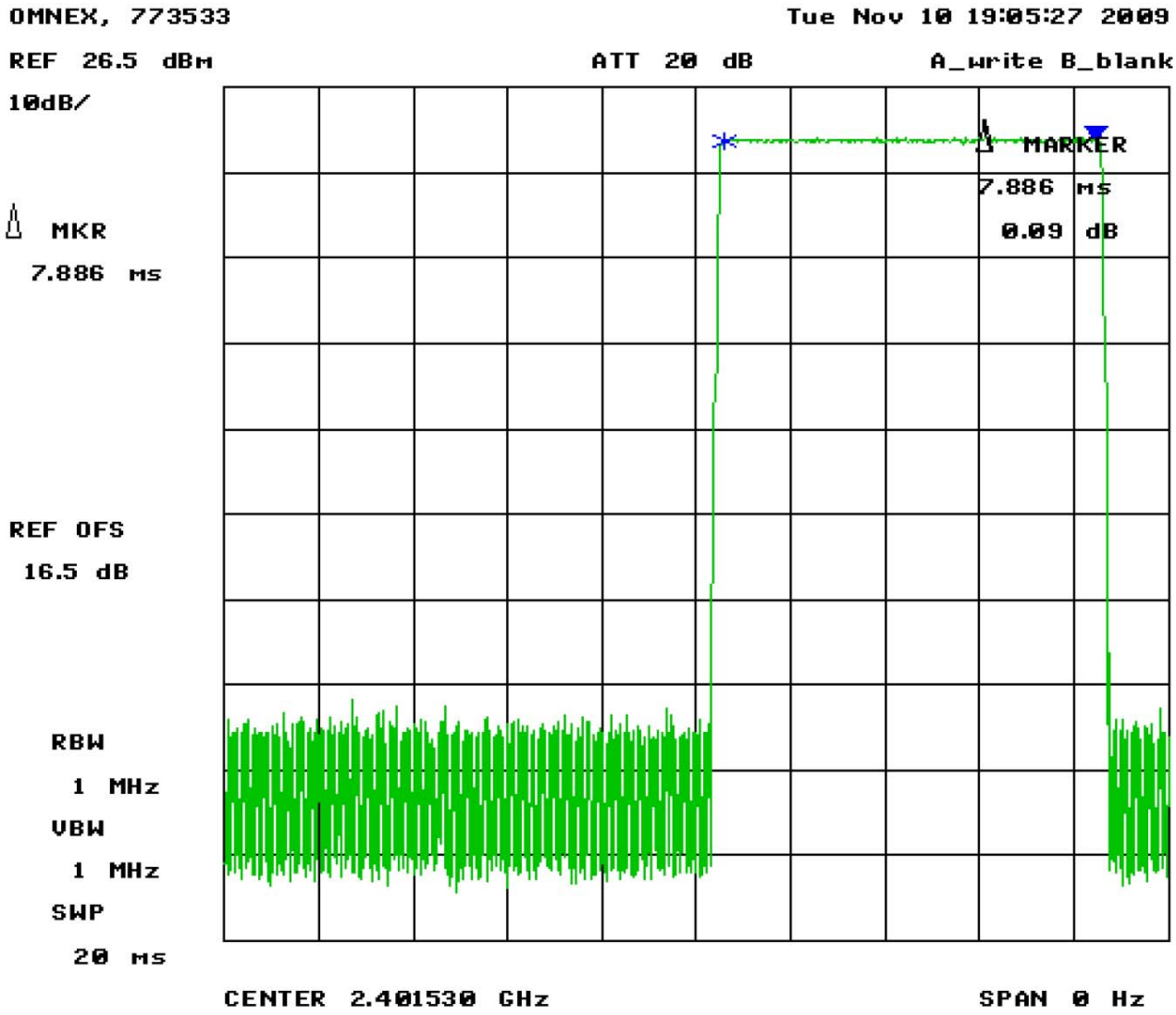


Test Results:

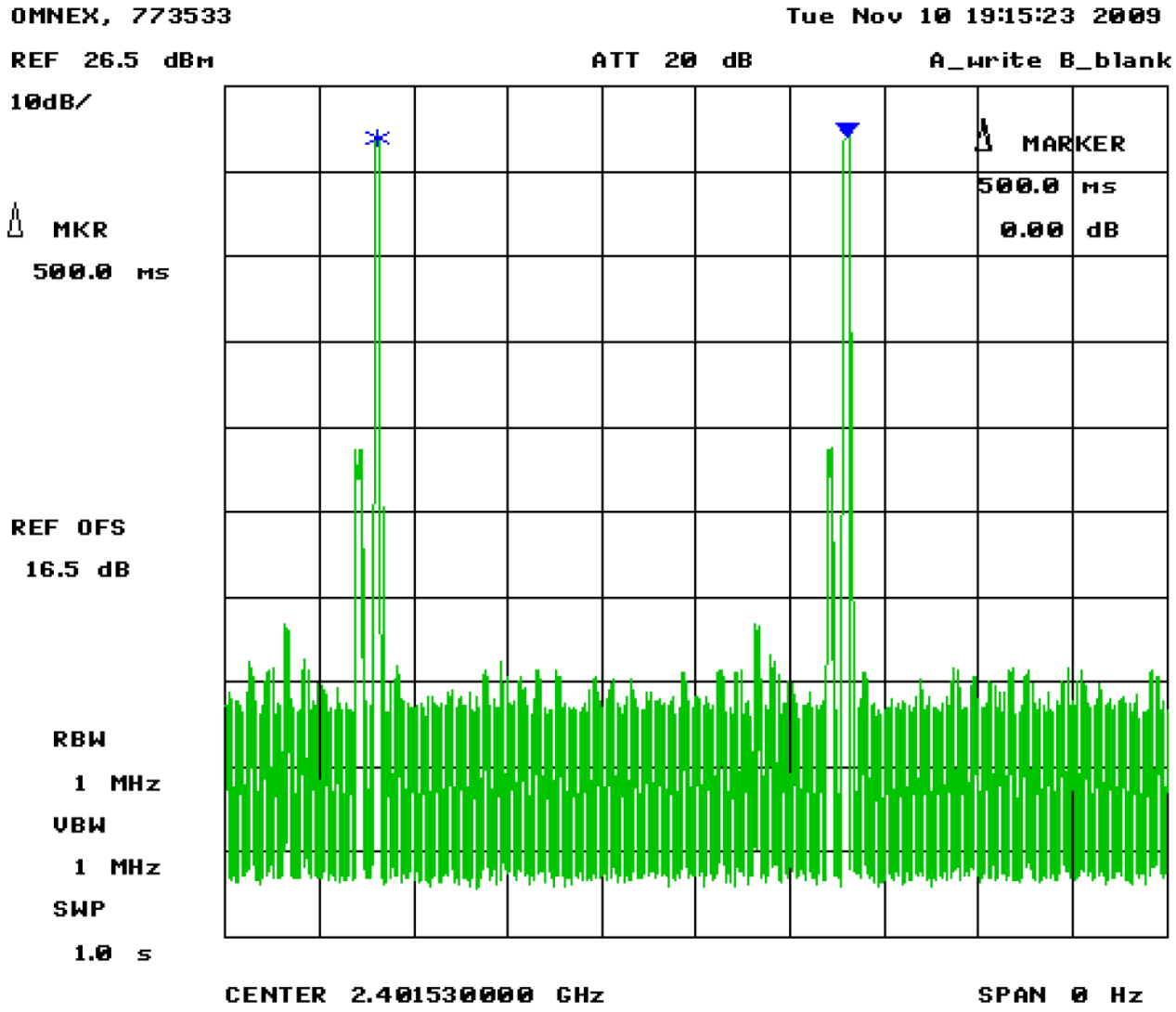
Channel Frequency(MHz)	Dwell Time (ms)	Limit(ms)	Pass/Fail
2401.5	165.61	< 400	Pass
2440.5	166.19	< 400	Pass
2479.5	166.80	< 400	Pass

X Pass Fail N/A

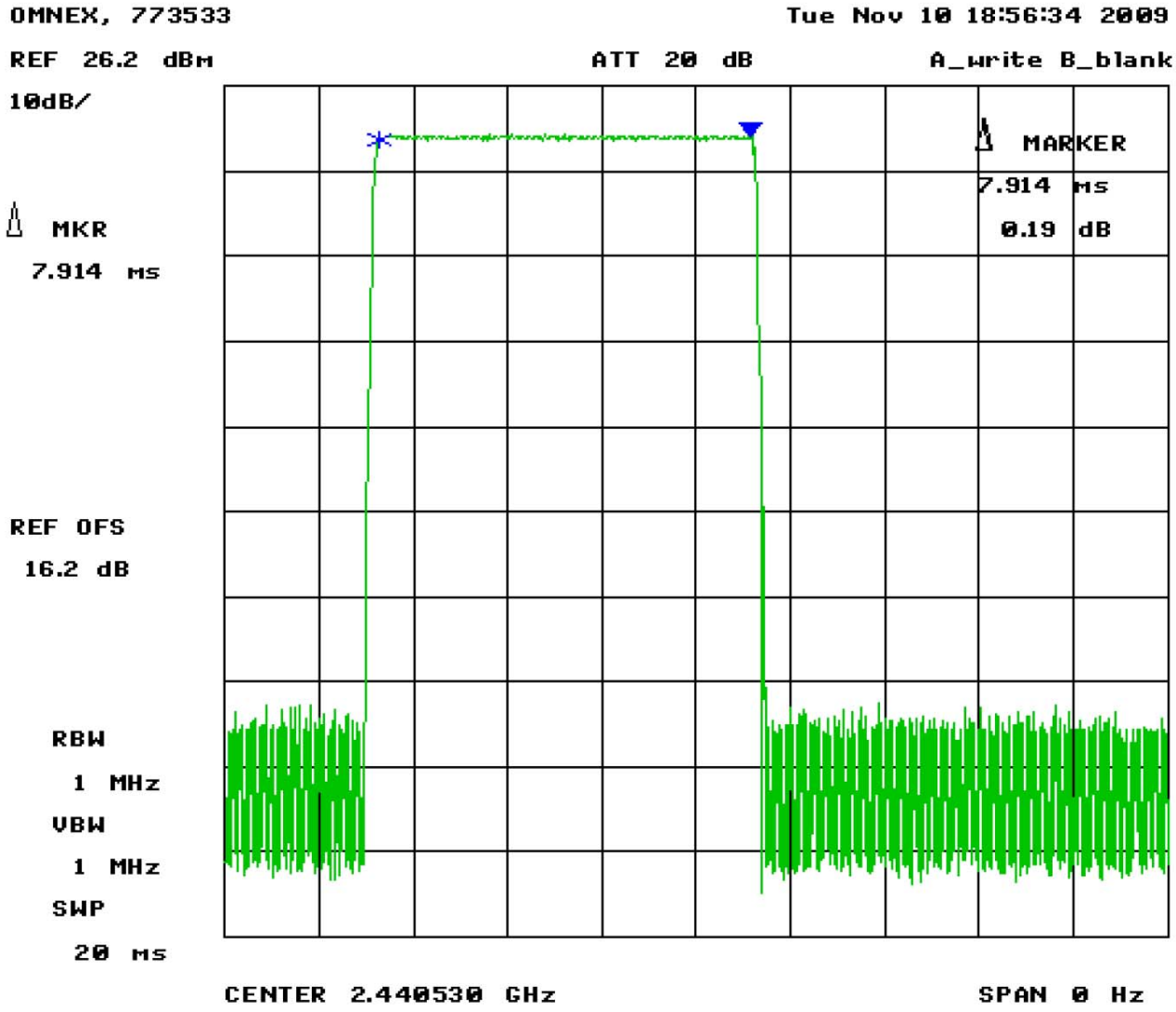
- Dwell time at the channel frequency is 2401.5MHz



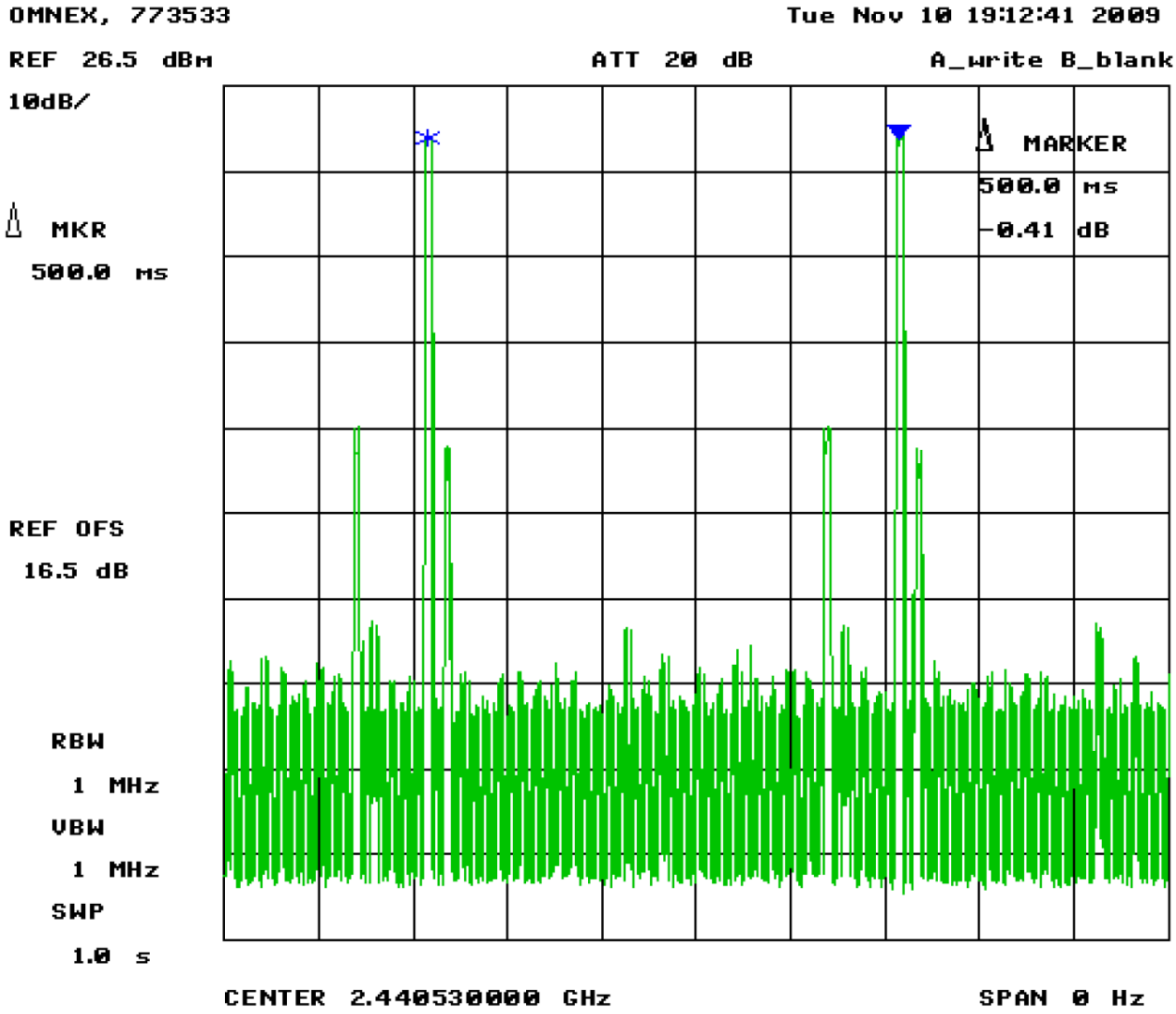
- Channel appearance at the channel frequency is 2401.5MHz



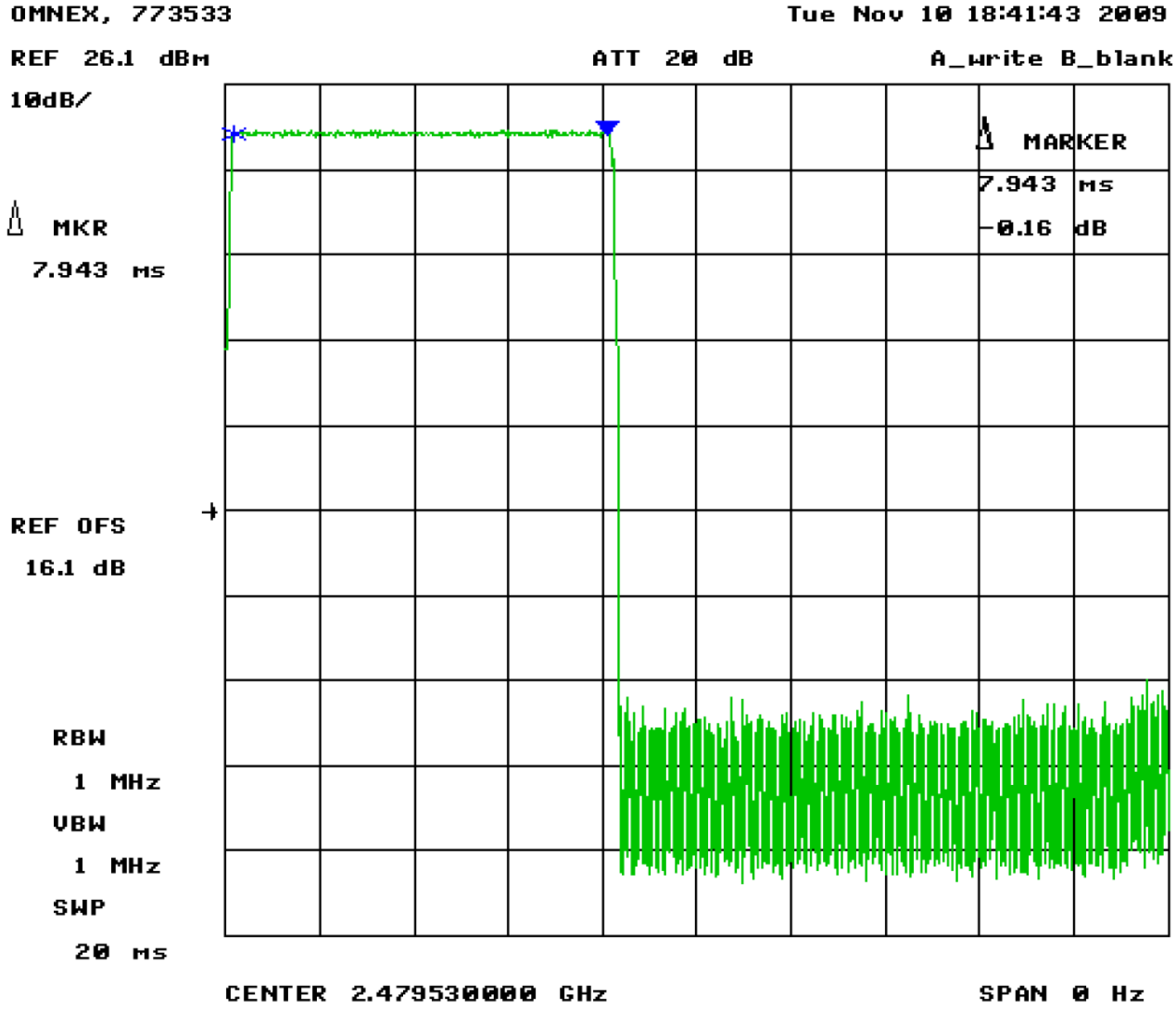
- Dwell time at the channel frequency is 2440.5MHz



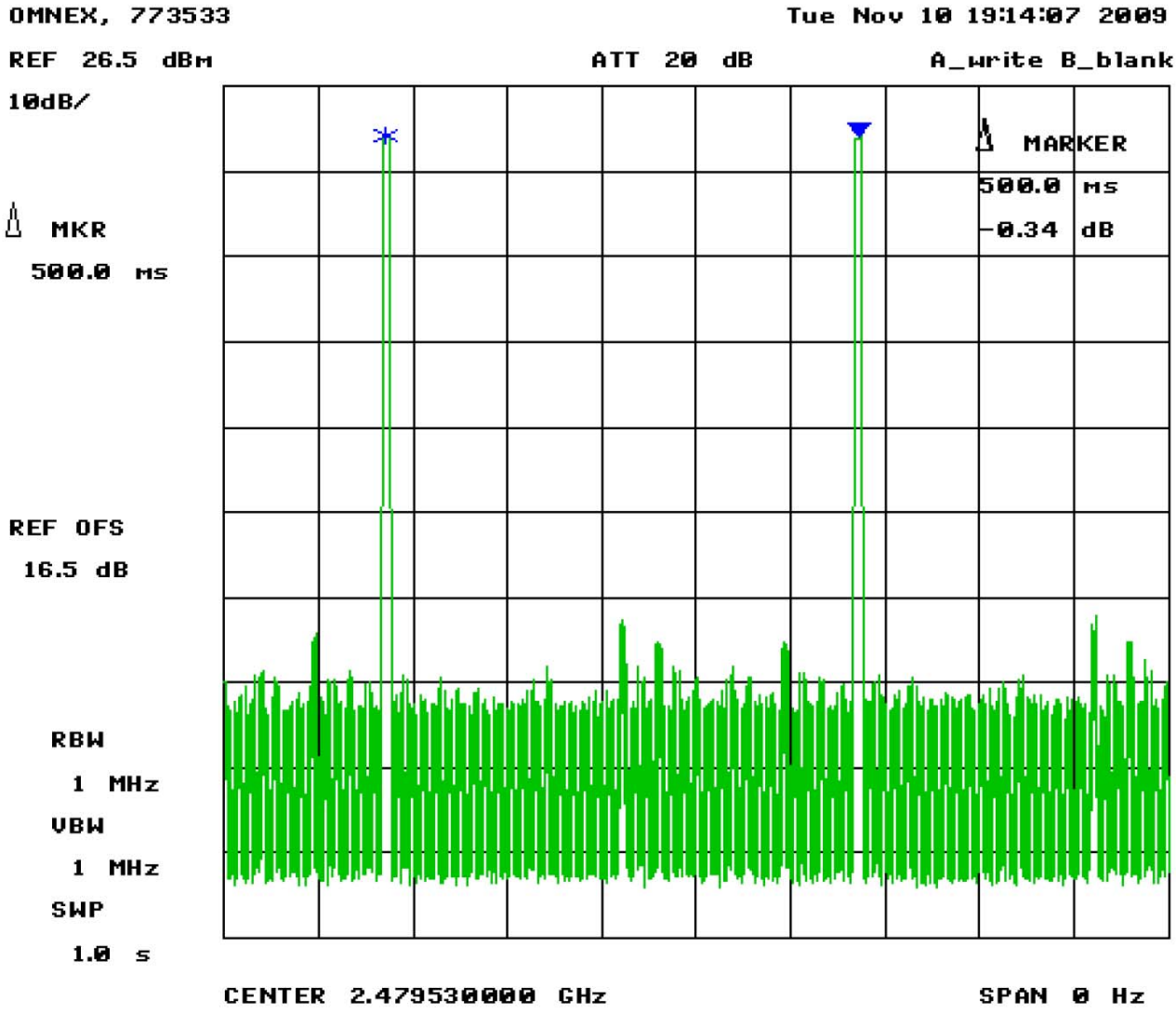
- Channel appearance at the channel frequency is 2440.5MHz



- Dwell time at the channel frequency is 2479.5MHz



- Channel appearance at the channel frequency is 2479.5MHz



Conducted Output Power

Temperature	18.5 °C
Relative Humidity	44.3 %
Barometric Pressure:	100.16 kPa
Test Date	Nov. 13, 2009
Sample Number	773533
Calibrated Test Equipment (ID)	152, 228
Reference Equipment (ID) (Calibration not required)	059, N1, N2
Tested By	Jeremy Lee

Use the barometric pressure reported at: http://www.theweathernetwork.com/weather/cabc0248

Test Limits

15.247(b)

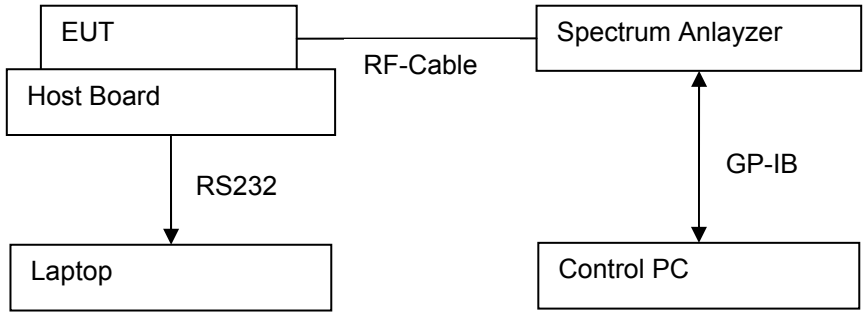
(1) For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

Test Setup

The test was performed in accordance with **FCC 15.247:2008, FCC 15.31:2008, and FCC Public notice DA 00-705 Released March 30, 2000.**

- The RF output of the EUT was connected to the RF input port of the Spectrum Analyzer.
- The EUT was measured at three differrent transmitting frequencies, low-end, middle, and high-end.
- The transmitter was set-up as its maximum power.
- The transmitter was transmitting at its maximum data rate, 250kbps.
- The following measurements were made with
  - Span = 5MHz
  - RBW = 1MHz
  - VBW ≥ RBW
  - Sweep = Auto
  - Detector Function = peak
  - Trace = Single trace up to capturing the whole range of signal
- Allowed the trace to stabilize.
- Use the marker function to set the peak of the signal.
- The indicated level is the peak conductyed output power(with the addition of the cable loss).
- The measurement was not repeated at different power supply levels, because of the DC power was supplied by host system.

Setup Block Diagram

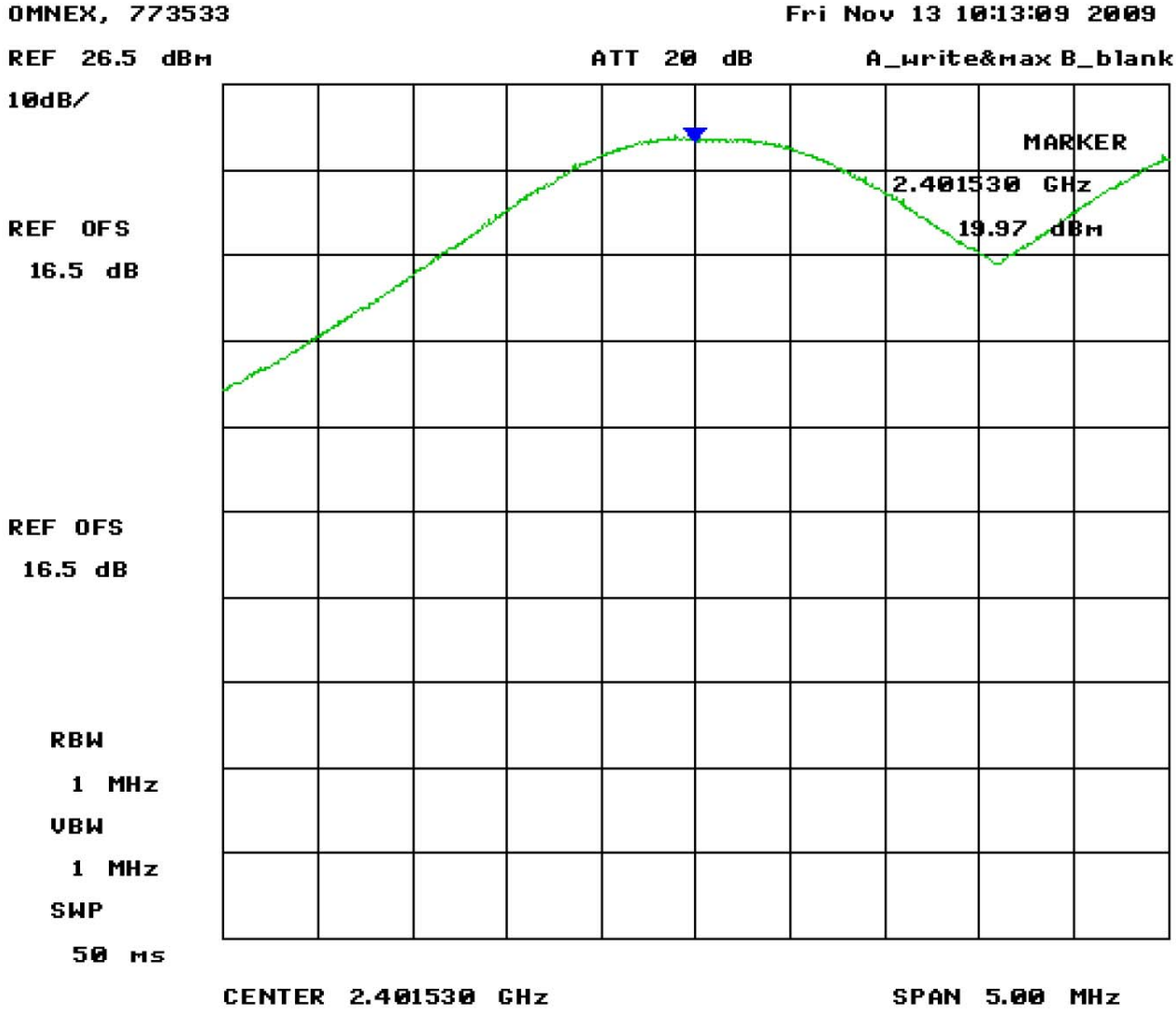


Test Results:

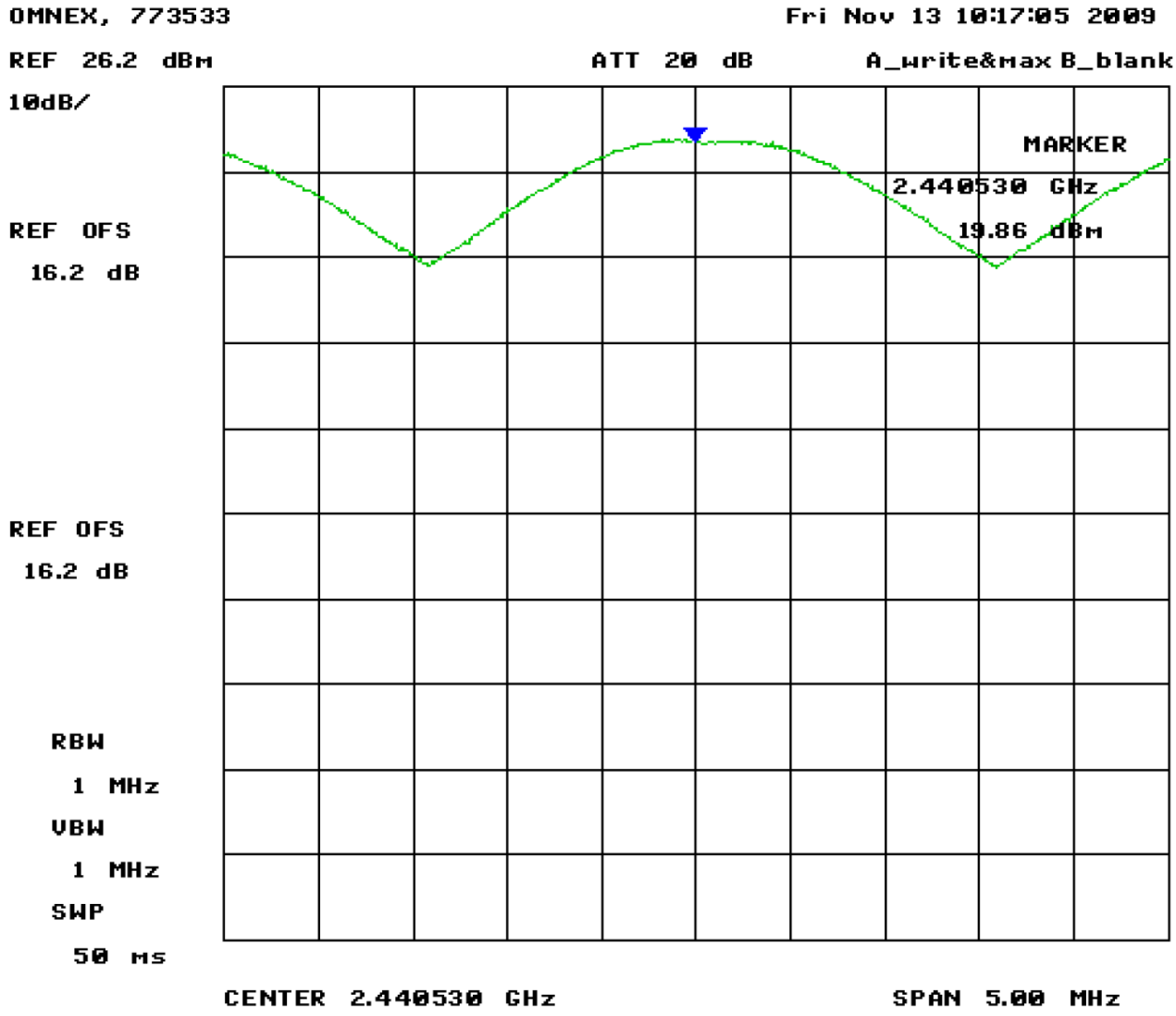
Channel Frequency(MHz)	Peak Power(dBm)	Limit(W/dBm)	Pass/Fail
2401.5	+19.97	≤ 0.125/+20.97	Pass
2440.5	+19.86	≤ 0.125/+20.97	Pass
2479.5	+20.13	≤ 0.125/+20.97	Pass

X Pass Fail N/A

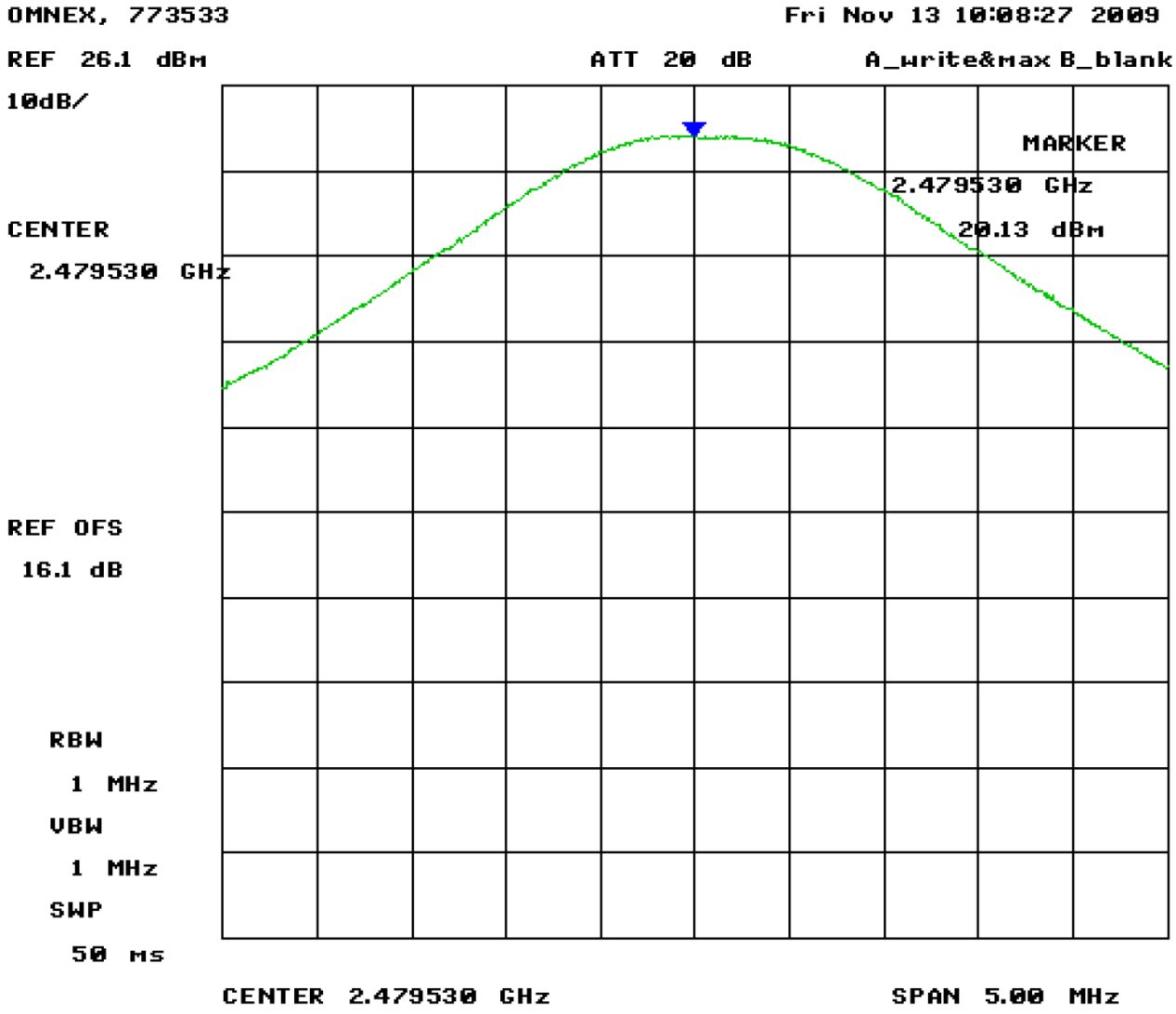
- Conducted maximum power at the Carrier Frequency is: 2401.5MHz



- Conducted maximum power at the Carrier Frequency is: 2440.5MHz



- Conducted maximum power at the Carrier Frequency is: 2479.5MHz



Antenna Gain

Test Date	Dec. 03, 2009
Sample Number	773533
Tested By	Jeremy Lee

Use the barometric pressure reported at: http://www.theweathernetwork.com/weather/cabc0248

Test Limits

15.247(b)

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

Test Results:

Antenna description	Peak Antenna Gain(dBi)	Limit(dBi)	Pass/Fail
1/wave 2.4GHz Antenna	1.76	≤ 6	Pass

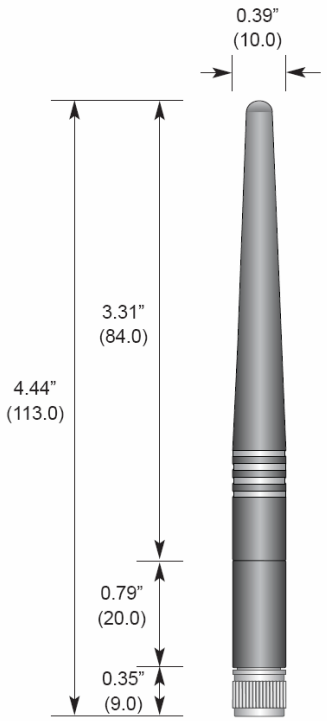
X Pass Fail N/A

- **Antenna Specification**

ANTENNA FACTOR

ANT-2.4-CW-CT-xxx DATA SHEET

Product Dimensions



Description

The CT Series 1/2-wave 2.4GHz antenna delivers outstanding performance in a rugged and cosmetically-attractive package. The antenna's internal counterpoise eliminates external ground plane dependence and maximizes performance. CT Series antennas attach using a standard SMA or Part 15 compliant RP-SMA connector, though alternate connectors and custom colors are available for volume OEM customers.

Features

- Internal counterpoise
- Excellent performance
- Omni-directional pattern
- Very low VSWR
- Fully weatherized
- Rugged and damage-resistant
- Standard SMA or Part 15 compliant RP-SMA connector

Electrical Specifications

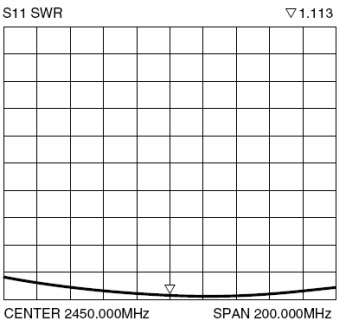
- Center Freq. 2.45GHz
- Bandwidth 150MHz
- Wavelength 1/2-wave
- VSWR <1.9 typ. at center
- Impedance 50 ohms
- Connector RP-SMA or SMA

Electrical specifications and plots measured on 4.00" x 4.00" reference ground plane

Ordering Information

- ANT-2.4-CW-CT-RPS (with RP-SMA connector)
- ANT-2.4-CW-CT-SMA (with SMA connector)

VSWR Graph



Typical VSWR

Antenna Factor 159 Ort Lane Merlin, OR 97532 **www.antennafactor.com**
541-956-0931 (phone) 541-471-6251 (fax)

Rev 07-22-08