



# REPORT

For

## OMNEX Control Systems ULC

Bldg. 74-1833 Coast Meridian Road  
Port Coquitlam, B.C.  
V3C 6G5, CANADA

Date: Dec. 07, 2007  
Report No.: 8972-1E  
Revision No.: 1  
Project No.: 8972  
Equipment: 2.4GHz Spread Spectrum Transceiver Module  
Model No.: HPD-24RC

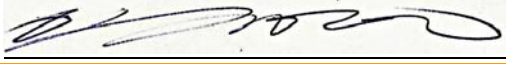

### ONE STOP GLOBAL CERTIFICATION SOLUTIONS



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<b>FCC Part 15.247/IC RSS 210</b>	
<b>Report reference No.</b> .....	8972-1E
<b>Report Revision History:</b>	<ul style="list-style-type: none"> <li>➤ 0 – October 29, 2007</li> <li>➤ 1 - December 07, 2007: Updated by re-testing</li> </ul>
<b>Tested by</b> (printed name and signature) .....	Jeremy LEE 
<b>Approved by</b> (printed name and signature) .....	Kavinder Dhillon, Eng.L. 
<b>Date of issue</b> .....	Dec. 07, 2007
<p><b>Note:</b> By signing this report, both the Testing Technician and the Reviewer hereby declare to abide by the applicable LabTest policies:</p> <p>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).</p>	
<b>FCC Site Registration No.:</b>	552549
<b>IC Site Registration No.:</b>	5970A
<b>Testing Laboratory Name</b> .....	LabTest Certification Inc.
<b>Address</b> .....	3133 – 20800 Westminster Hwy, Richmond, B.C. V6V-2W3
<b>OATS Test Location Name</b> .....	LabTest Certification Inc.
<b>Address</b> .....	5340 – 164 Street, Surrey, BC, Canada
<b>Applicant's Name</b> .....	Omnex Control Systems ULC
<b>Address</b> .....	Bldg.74-1833 Coast Meridian Road, Port Coquitlam, B.C. V3C 6G5
<b>Manufacturer's Name</b> .....	Same as Applicant
<b>Address</b> .....	Same as Applicant
<b>Test specification</b>	
<b>Standards</b> .....	FCC15.247/RSS-210, Issue 7
<b>Date Test sample received</b> .....	Oct. 04, 2007
<b>Date of Testing</b> .....	Oct. 10 to Dec. 07, 2007
<b>Test item description</b> .....	2.4GHz Spread Spectrum Transceiver Limited Module
<b>Trademark</b> .....	
<b>Manufacturer</b> .....	Omnex Control Systems ULC
<b>Model and/or type reference</b> .....	HPD-24RC
<b>Transmitter Board ID</b>	FPCB-3097R04
<b>Frequency Range:</b>	2403 MHz - 2479MHz
<b>Power (dBm):</b>	+21 dBm (MAX)

Prepared by: LabTest Certification Inc.  
Date Issued: December 07, 2007  
Project No.: 8972

Client: Omnex Control Systems ULC  
Report No.: 8972-1E  
Revision No.: 1

Rating(s).....:	+9 – +12 VDC
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## 1 Device Under Test Description

<b>Type of modulation:</b>	
No. Hopping Channels: (FHSS)	63 channels
Dwell time per channel	0.023 second
Max. time between two instances of use of the same channel:	2.835 second
Operating Frequency Range:	2403 MHz to 2479MHz
Type of Equipment:	2.4GHz Spread Spectrum Data Transceiver Module
Operating Temperature Range:	-30 °C to +70 °C
<b>Nominal Voltages for:</b>	<input type="checkbox"/> stand-alone equipment <input checked="" type="checkbox"/> combined (or host) equipment <input type="checkbox"/> test jig
Supply Voltage:	<input type="checkbox"/> AC <input type="checkbox"/> Amps <input checked="" type="checkbox"/> 12V_ DC <input type="checkbox"/> Amps
If DC Power:	<input type="checkbox"/> Internal Power Supply <input checked="" type="checkbox"/> External Power Supply or AC/DC adapter <input type="checkbox"/> Battery <ul style="list-style-type: none"> <li><input type="checkbox"/> Nickel Cadmium</li> <li><input type="checkbox"/> Alkaline</li> <li><input type="checkbox"/> Nickel-Metal Hydride</li> <li><input type="checkbox"/> Lithium-Ion</li> <li><input type="checkbox"/> Lead Acid (Vehicle regulated)</li> <li><input type="checkbox"/> Other</li> </ul>
Test Modulation Used:	FSK
<b>General Product Information:</b>	The module will typically be integrated into systems used for the remote control and monitoring of industrial equipment such as cranes, concrete pumps, loaders, etc.. The HPD-24RC transceiver module is embedded as part of a complete OMNEX control system and is not sold separately as a stand-alone device.

**2 Additional Information from Client**

Highest overall EIRP value:	_____ dBm	Power Setting:	
Corresponding conducted power setting:	_____ dBm		
Power level to be used for testing:	___+21___ dBm		
Corresponding Antenna assembly gain:	_____ dBm	Antenna Assembly:	
Antenna gain to be taken into account for calculating EIRP values:	___0___ dBi		

<b>a) Modulation:</b>	ITU Class of emissions:	
	Can the transmitter operate un-modulated?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>b) Duty Cycle:</b>	The transmitter is intended for:	<input type="checkbox"/> Continuous duty <input type="checkbox"/> Intermittent duty <input checked="" type="checkbox"/> Continuous operation possible for testing purposes
<b>c) About EUT:</b>	<input checked="" type="checkbox"/> EUT submitted are representative product models <input type="checkbox"/> If not, the EUT submitted are pre-production models	
	<input type="checkbox"/> If pre-production equipment are submitted, the final production equipment will be identical in all respects with equipment tested. <input type="checkbox"/> If not, supply full details:	
	<input type="checkbox"/> The equipment submitted is CE marked:	
	<input type="checkbox"/> The CE marking does include the Class-II identifier (Alert Sign) <input type="checkbox"/> The CE marking does include a 4 digit number referring to the Notified Body involved	

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

<b>Model:</b>	<b>Description:</b>	<b>Ratings:</b>	<b>Approvals/Standards</b>
T2400	Test Transmitter	24VDC	-
R2160	Transceiver Unit	12VDC	-
None	¼ wavelength Whip Antenna	-	-

#### 4 Test Summary

Test	FC CFR 47	RSS 210	Result
Antenna Requirements	15.204(c)		PASS
Bandwidth & Channel Separation	15.247(a)(1)	A8.1	PASS
Number of Channels	15.247(a)(1)	A8.1	PASS
Time of occupancy	15.247(a)(1)	A8.1	PASS
Transmitted Power Output	15.247(b)(1)	A8.4	PASS
Antenna Gain	15.247(b)(4)		PASS
RF Exposure	15.247(b)(5)		PASS
Conducted Spurious Emissions	15.247(d)	A8.5	PASS
Radiated Spurious Emissions	15.247(d)	A8.5	PASS
Continuous data and short transmissions	15.247(g)		PASS
Coordination Frequency Hopping	15.247(h)		PASS
Band Edge Compliance	15.247(d)	A8.5	PASS
AC Power Line Conducted Emission	15.207(a)		N/A



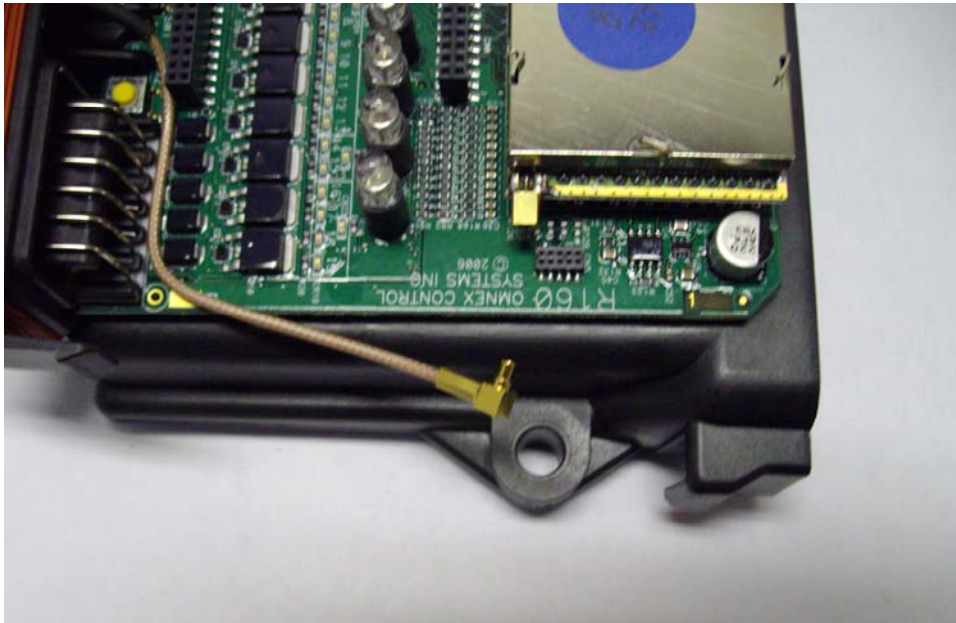
## 5 Antenna Requirements

### FCC15.204(C)

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 the user can replace a broken antenna, 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 Sections 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 Section 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 Result:

The 2.4GHz Spread Spectrum Data Transceiver Module, R2160, Model HPD-24RC was embedded on, incorporated internal coaxial antenna or attached MCX connector to comply with the requirements.



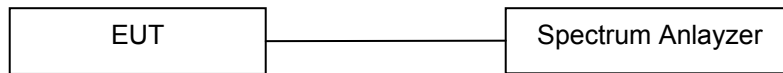
## 6 20dB Bandwidth

15.247(a)(1)

The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

### 6.1 Test Procedure:

- 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 shall be transmitting at its maximum data rate.
- The following measurements were made with
  - Span = approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel
  - RBW  $\geq$  1% of the 20dB BW span
  - VBW  $\geq$  RBW
  - Sweep = auto
  - Detector Function = peak
  - Trace = max hold
- Allow the trace to stabilize.
- Use the marker-to-peak function to set the marker to peak of the signal.
- Use the marker-delta function to measure 20 dB down on left side of the signal.
- The 20dB Bandwidth is the delta reading in frequency between two markers.



### 6.2 Test Results:

Channel Frequency(MHz)	20dB BW(kHz)	Limit(kHz)	Pass/Fail
2403.1	32.5	$\leq$ 500	Pass
2441.7	32.0	$\leq$ 500	Pass
2478.6	34.3	$\leq$ 500	Pass

- Carrier Frequency is: 2403.1MHz

11:35:54 DEC 07, 2007

HP OMNEX,HPD-24RC,S#:449028

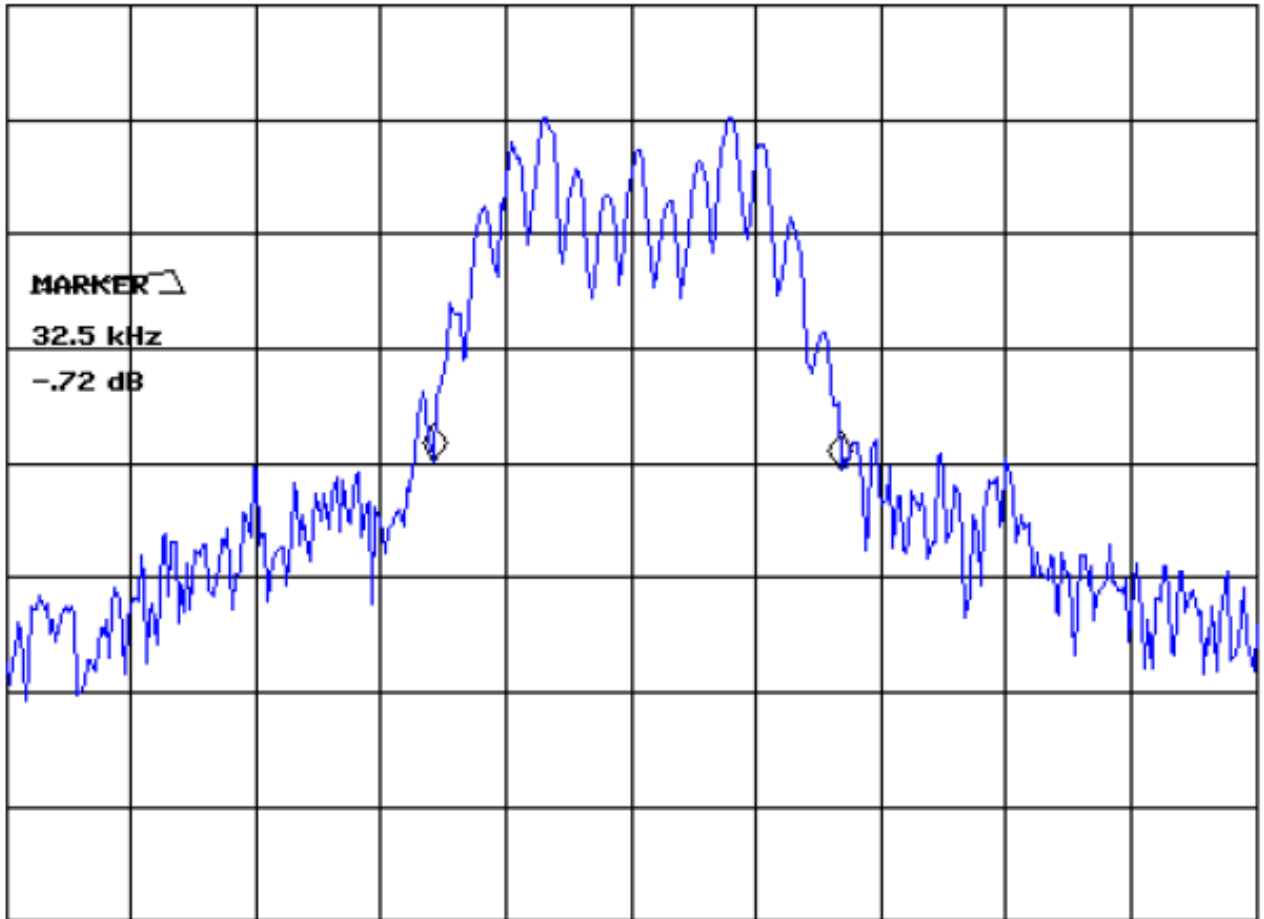
MKR 32.5 kHz

REF 21.0 dBm

AT 40 dB

-.72 dB

PEAK  
LOG  
10  
dB/  
OFFST  
.4  
dB



CENTER 2.4031000 GHz

SPAN 100.0 kHz

#RES BW 1.0 kHz

#UBW 1 kHz

SWP 300 msec

- Carrier Frequency is: 2441.7MHz

11:37:15 DEC 07, 2007

OMNEX,HPD-24RC,S#:449028

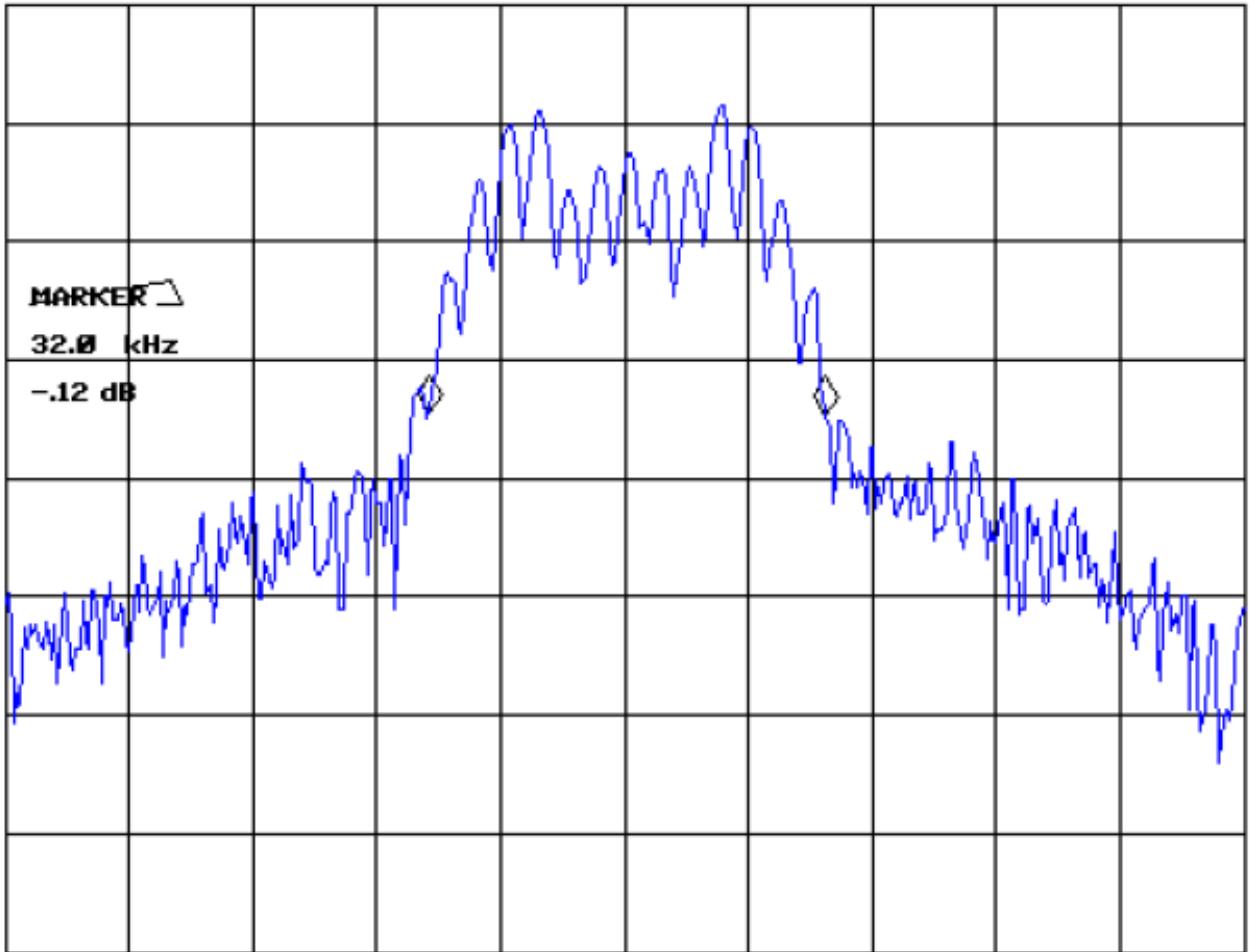
MKR 32.0 kHz

REF 21.0 dBm

AT 40 dB

-12 dB

PEAK  
LOG  
10  
dB/  
OFFST  
.4  
dB  
VA SB  
SC FC  
CORR



CENTER 2.4417000 GHz

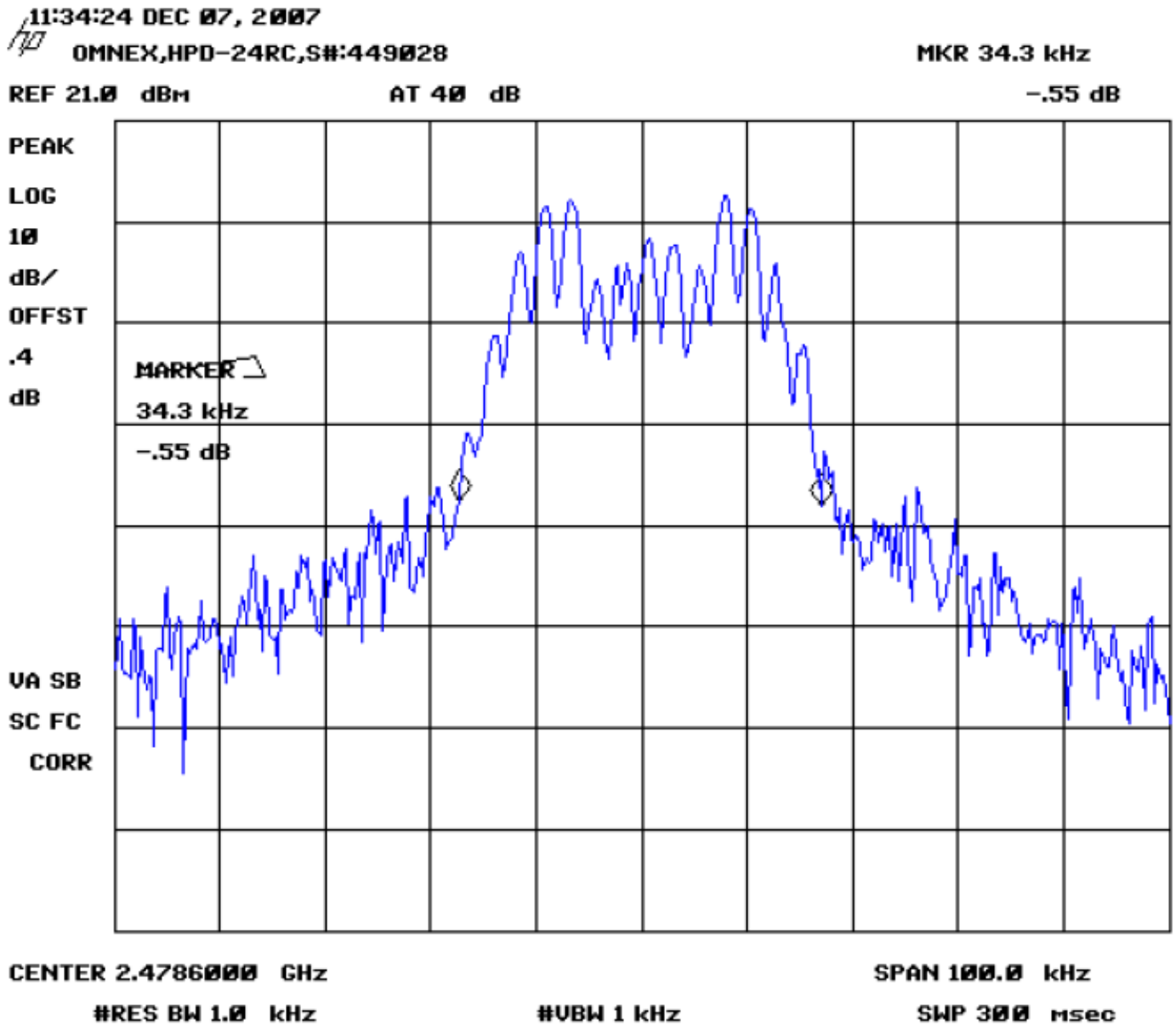
SPAN 100.0 kHz

#RES BW 1.0 kHz

#UBW 1 kHz

SWP 300 msec

- Carrier Frequency is: 2478.6MHz



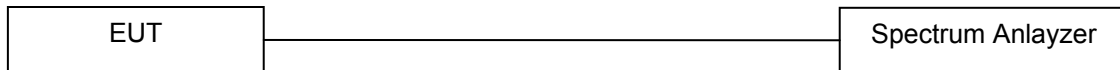
## 7 Channel Separation

15.247(a)(1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

### 7.1 Test Procedure:

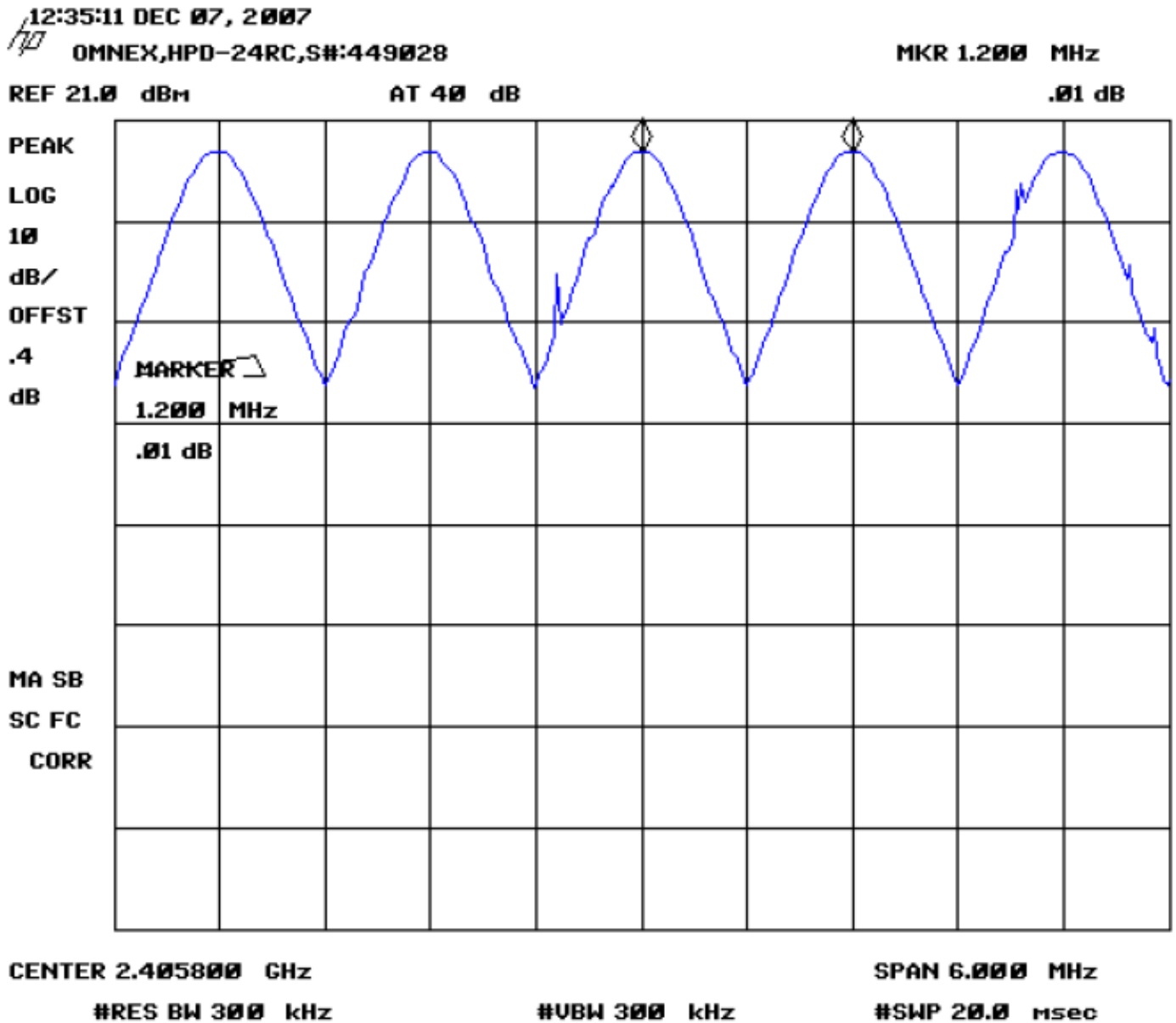
- The RF output of the EUT was connected to the RF input port of the Spectrum Analyzer.
- The EUT had its hopping function enabled.
- The transmitter shall be transmitting at its maximum data rate.
- The following measurements were made with
  - Span = wide enough to capture the peaks of two adjacent channels
  - RBW  $\geq$  1% of the span
  - VBW  $\geq$  RBW
  - Sweep = auto
  - Detector Function = peak
  - Trace = max hold
- Allow the trace to stabilize.
- Use the marker-to-peak function to set the marker to peak of the signal.
- Use the marker-delta function to next peak of the signal.
- The Channel Separation is the delta reading in frequency between two markers.



### 7.2 Test Results:

Centre Frequency(MHz)	Channel Separation (kHz)	Limit(kHz)	Pass/Fail
2405.8	1,200	$\geq 34.3$	Pass
2444.2	1,200	$\geq 34.3$	Pass
2476.6	1,200	$\geq 34.3$	Pass

- Centre Frequency is: 2405.8MHz



- Centre Frequency is: 2444.2MHz

12:31:55 DEC 07, 2007

HP OMNEX,HPD-24RC,S#:449028

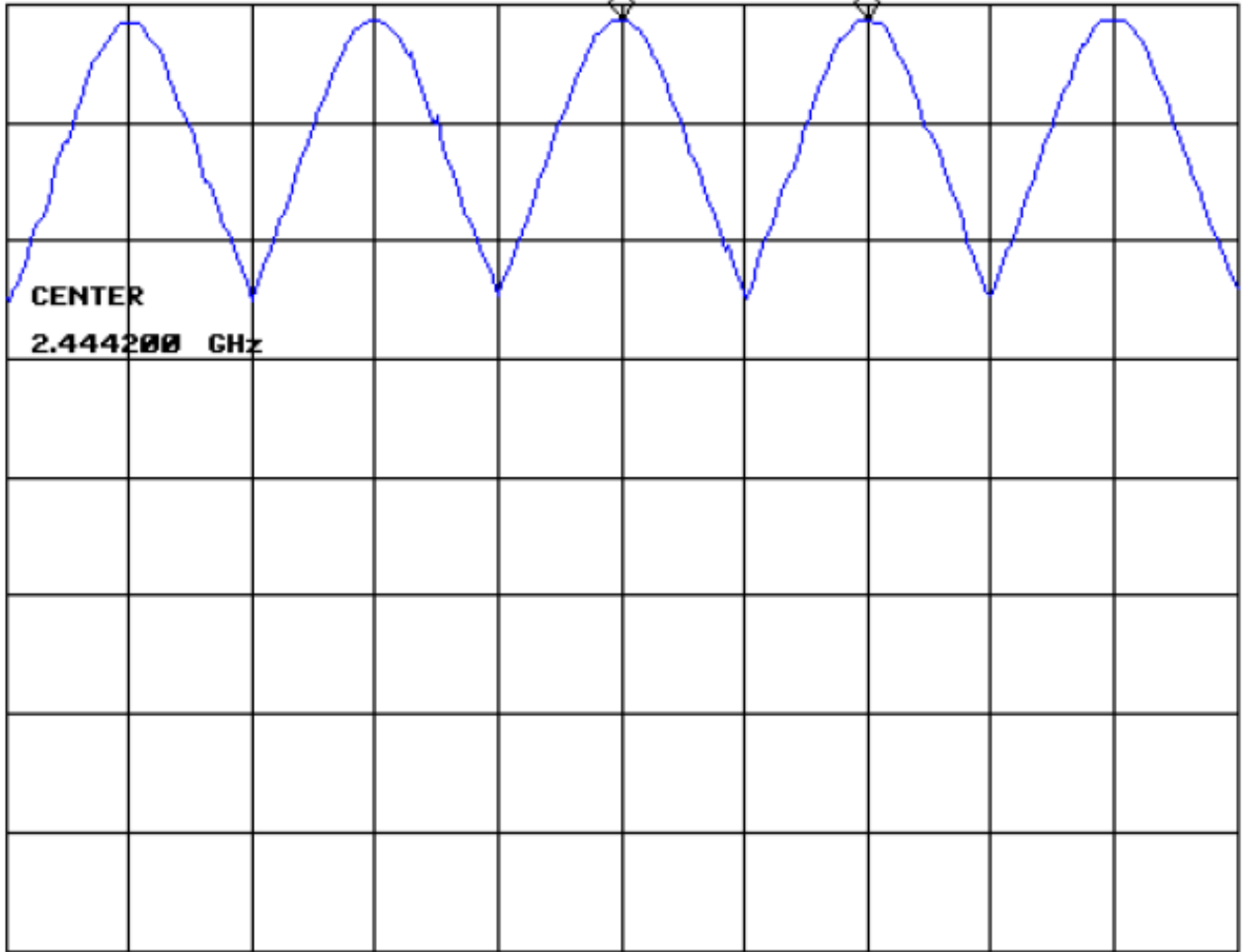
MKR 1.222 MHz

REF 21.0 dBm

AT 40 dB

.03 dB

PEAK  
LOG  
10  
dB/  
OFFST  
.4  
dB



CENTER 2.444200 GHz

SPAN 6.000 MHz

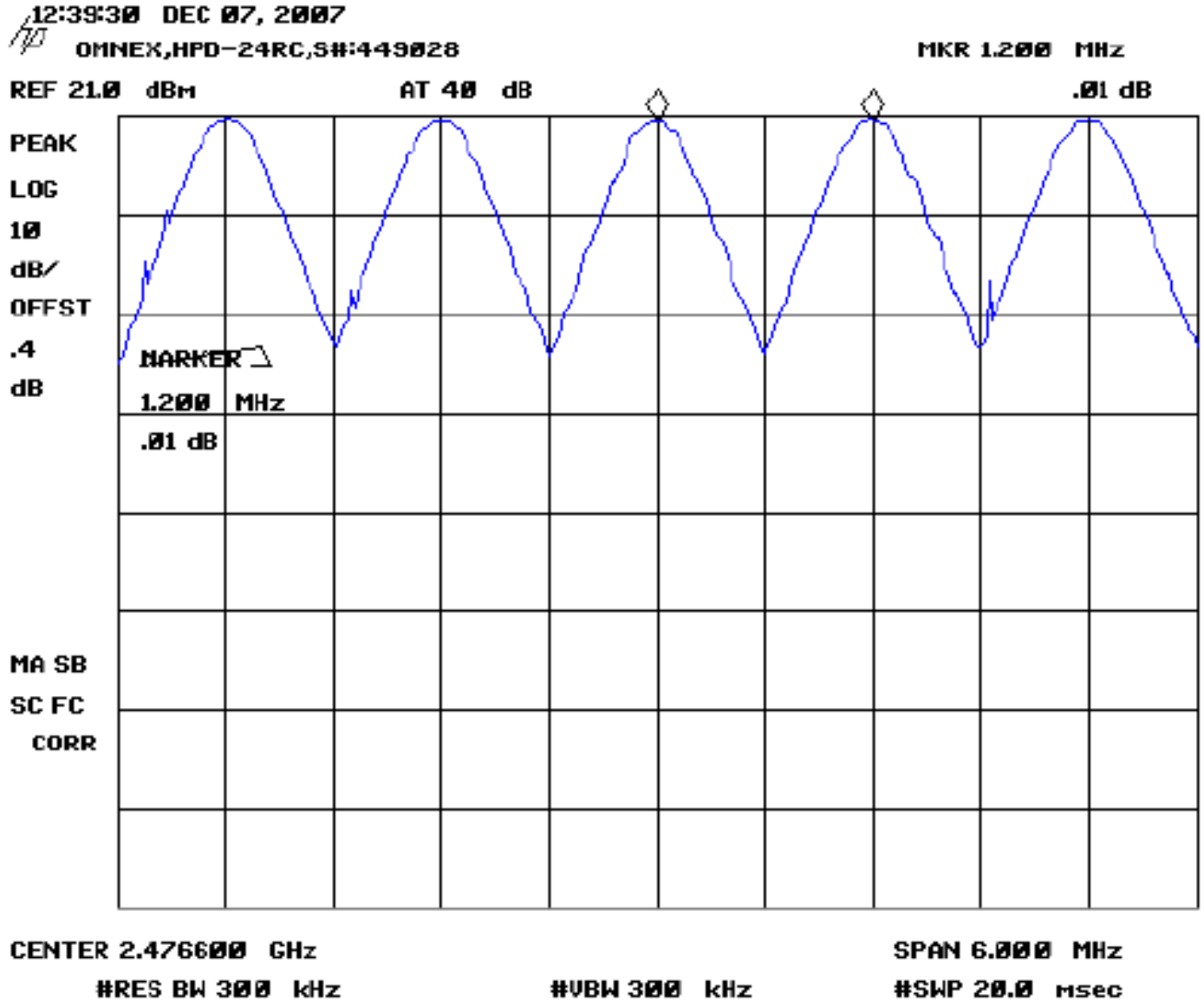
#RES BW 300 kHz

#VBW 300 kHz

#SWP 20.0 msec



- Centre Frequency is: 2476.6MHz



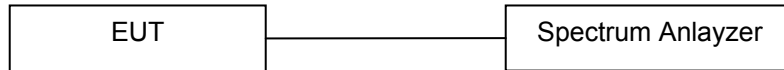
## 8 Number of Channels

FCC15.247(a)(1)

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

### 8.1 Test Procedures:

- 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 shall be transmitting at its maximum data rate.
- The following measurements were made with
  - Span = the frequency band of operation
  - RBW  $\geq$  1% of the span
  - VBW  $\geq$  RBW
  - Sweep = auto
  - Detector Function = peak
  - Trace = max hold
- Allow the trace to stabilize.



### 8.2 Test Results:

Frequency range (MHz)	Channel Number	Limit	Pass/Fail
2403.1 to 2478.6	63	$\geq 15$	Pass

12:47:46 DEC 07, 2007

OMNEX,HPD-24RC,SN:449020

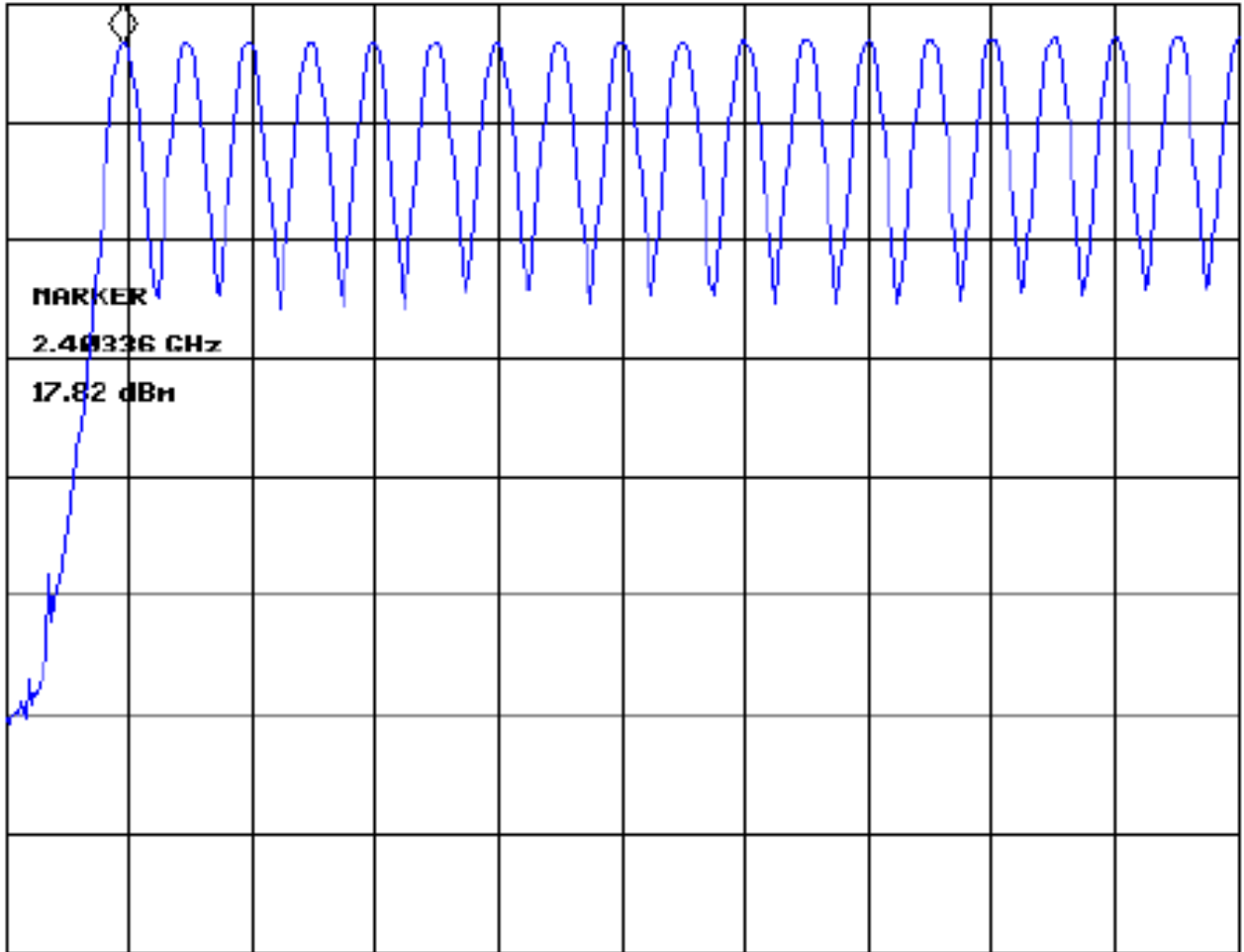
MKR 2.40336 GHz

REF 21.0 dBm

AT 40 dB

17.82 dBm

PEAK  
LOG  
10  
dB/  
OFFST  
.4  
dB



CENTER 2.41308 GHz

SPAN 24.00 MHz

#RES BW 300 kHz

#VBW 300 kHz

#SWP 20.0 msec

12:51:02 DEC 07, 2007

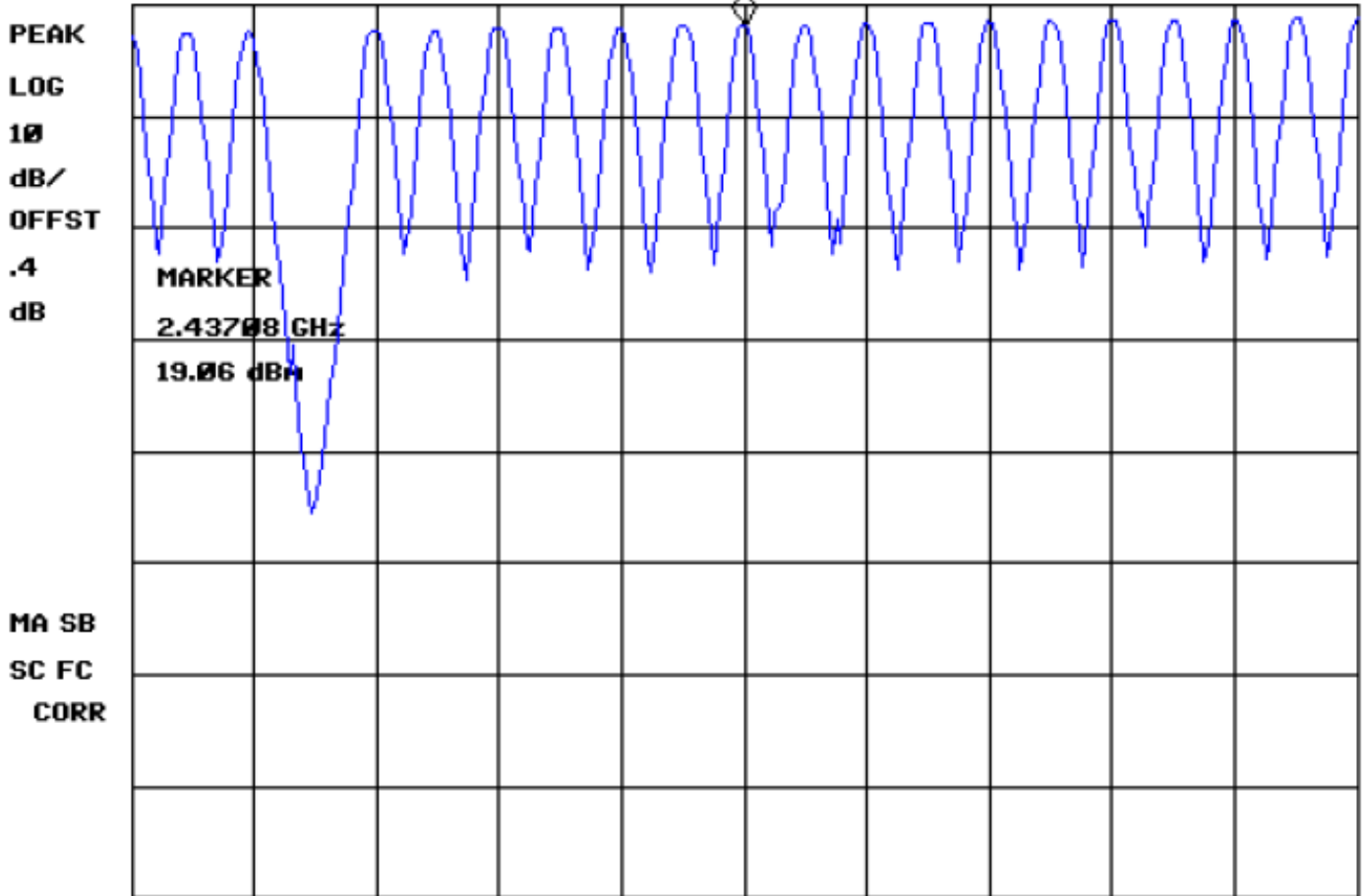
OMNEX,HPD-24RC,S#:449028

MKR 2.43708 GHz

REF 21.0 dBm

AT 40 dB

19.06 dBm



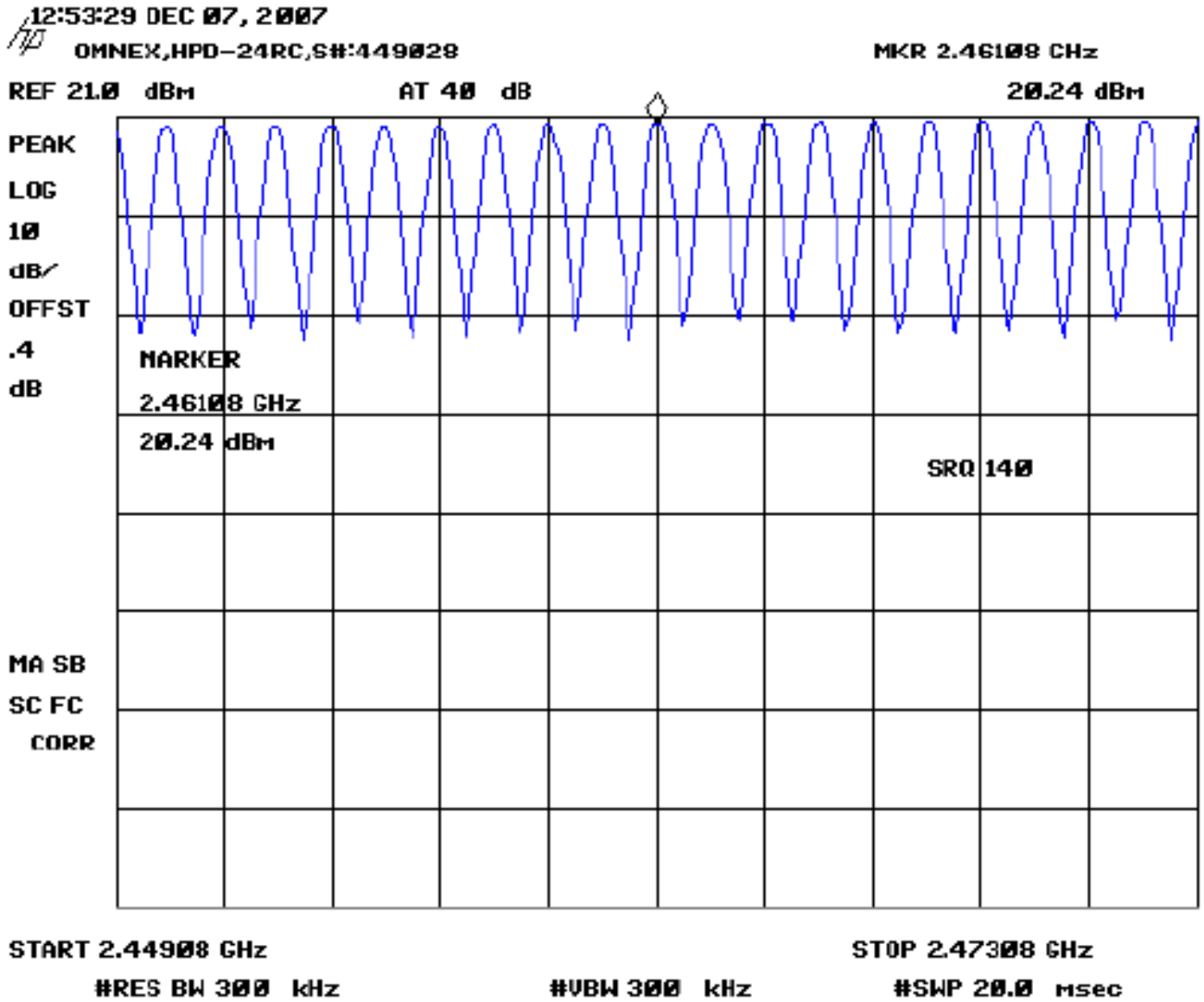
CENTER 2.43708 GHz

SPAN 24.00 MHz

#RES BW 300 kHz

#UBW 300 kHz

#SWP 20.0 msec



12:56:19 DEC 07, 2007

OMNEX,HPD-24RC,S#:449028

MKR 2.47908 GHz

REF 21.0 dBm

AT 40 dB

20.66 dBm

PEAK

LOG

10

dB/

OFFST

.4

dB

MARKER

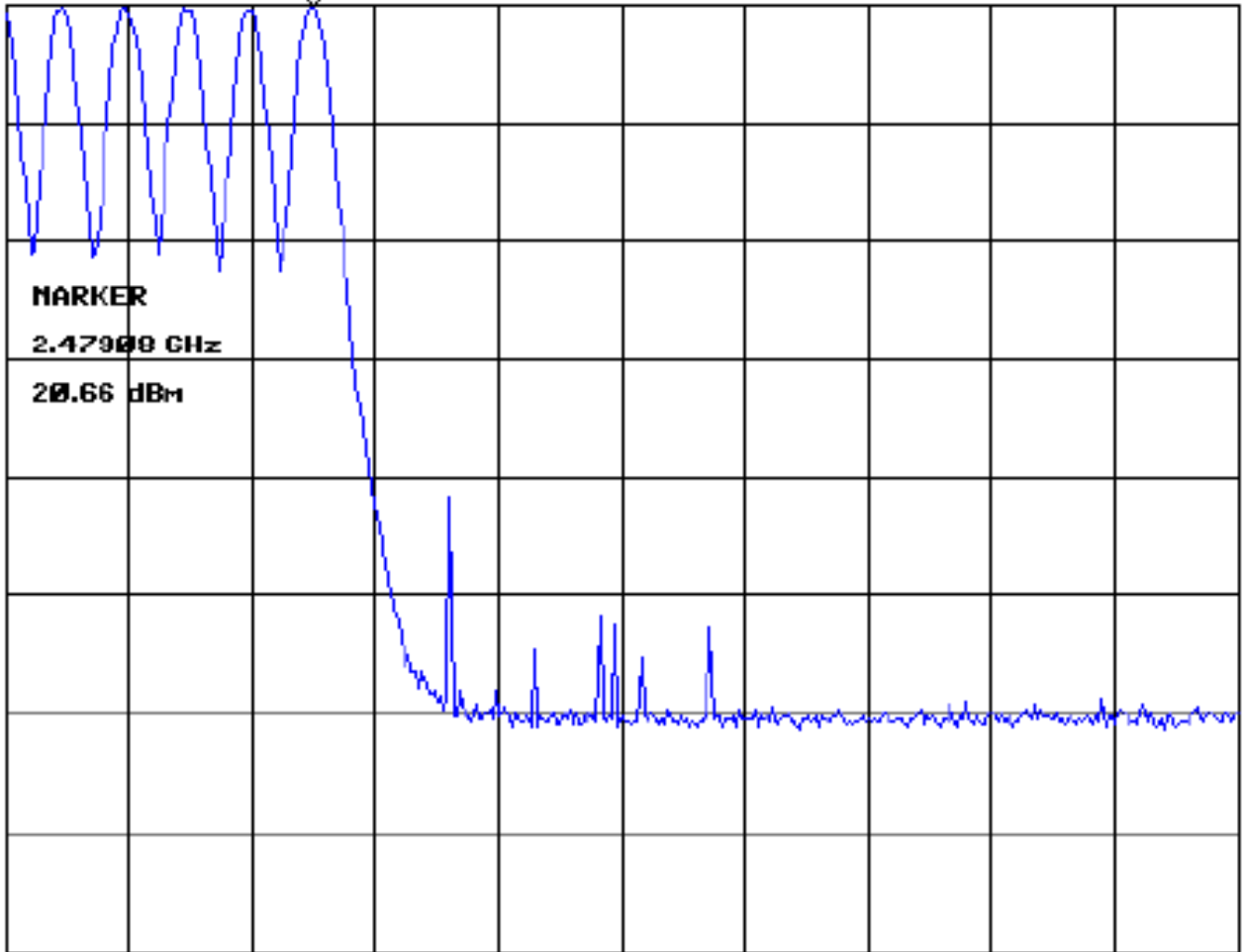
2.47908 GHz

20.66 dBm

MA SB

SC FC

CORR



START 2.47308 GHz

STOP 2.49708 GHz

#RES BW 300 kHz

#VBW 300 kHz

#SWP 20.0 msec

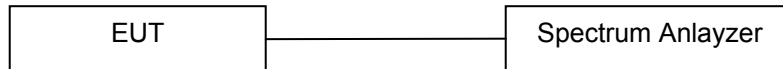
## 9 Time of Occupancy (Dwell Time)

FCC15.247(a)(1)

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.

### 9.1 Test Procedures

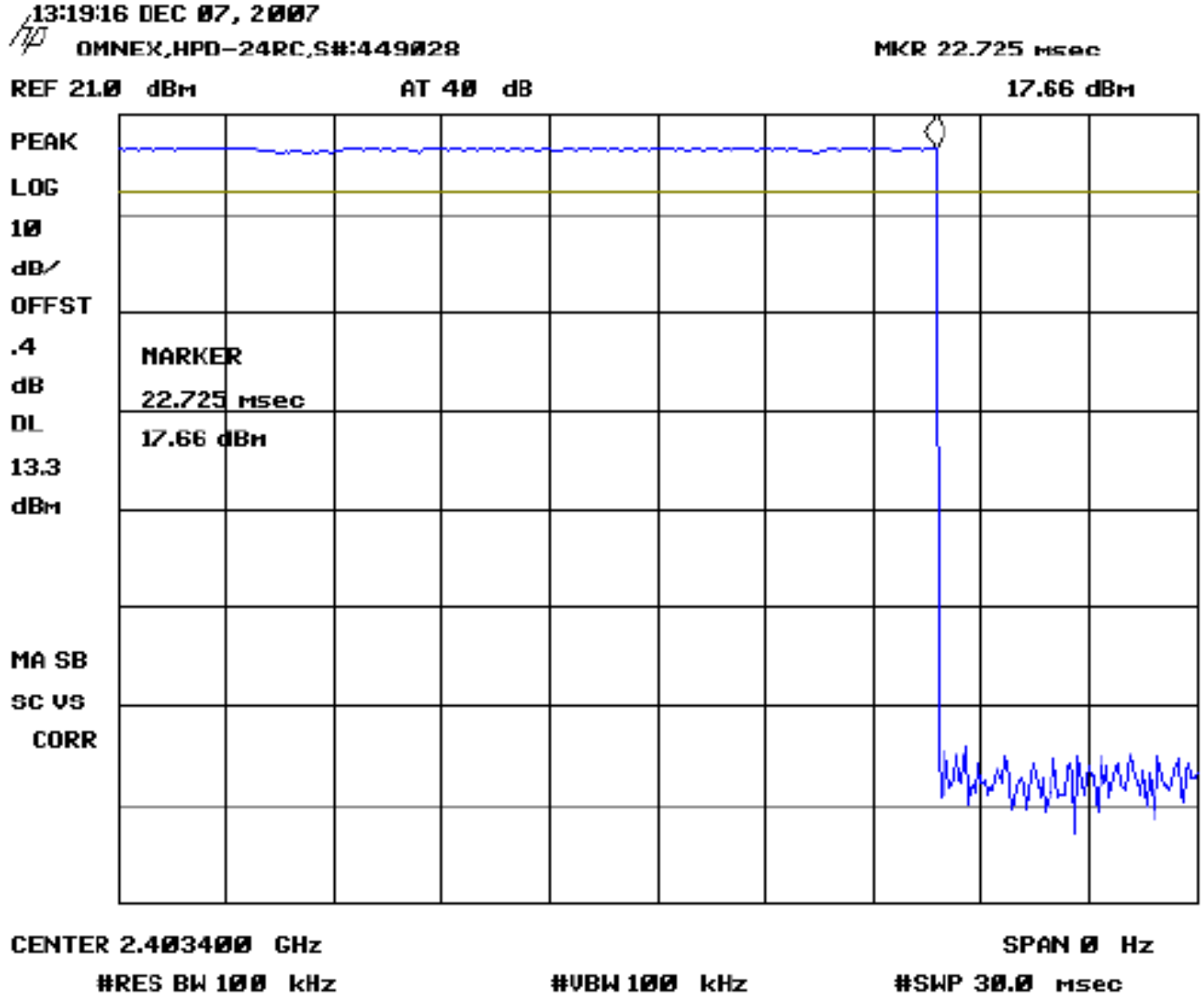
- The RF output of the EUT was connected to the RF input port of the Spectrum Analyzer.
- The EUT had its hopping function enabled.
- The transmitter shall be transmitting at its maximum data rate.
- The following measurements were made with
  - Span = 0Hz centered on a hopping channel
  - RBW = 1MHz
  - VBW  $\geq$  RBW
  - Sweep = as necessary to capture the entire dwell time per hopping 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.



### 9.2 Test Results:

Channel Frequency(MHz)	Dwell Time (msec)	Limit(msec)	Pass/Fail
2403.1	204.5	< 400	Pass
2441.7	181.8	< 400	Pass
2478.6	181.8	< 400	Pass

- Carrier Frequency is: 2403.4MHz





13:33:57 DEC 07, 2007

OMNEX,HPD-24RC,S#:449020

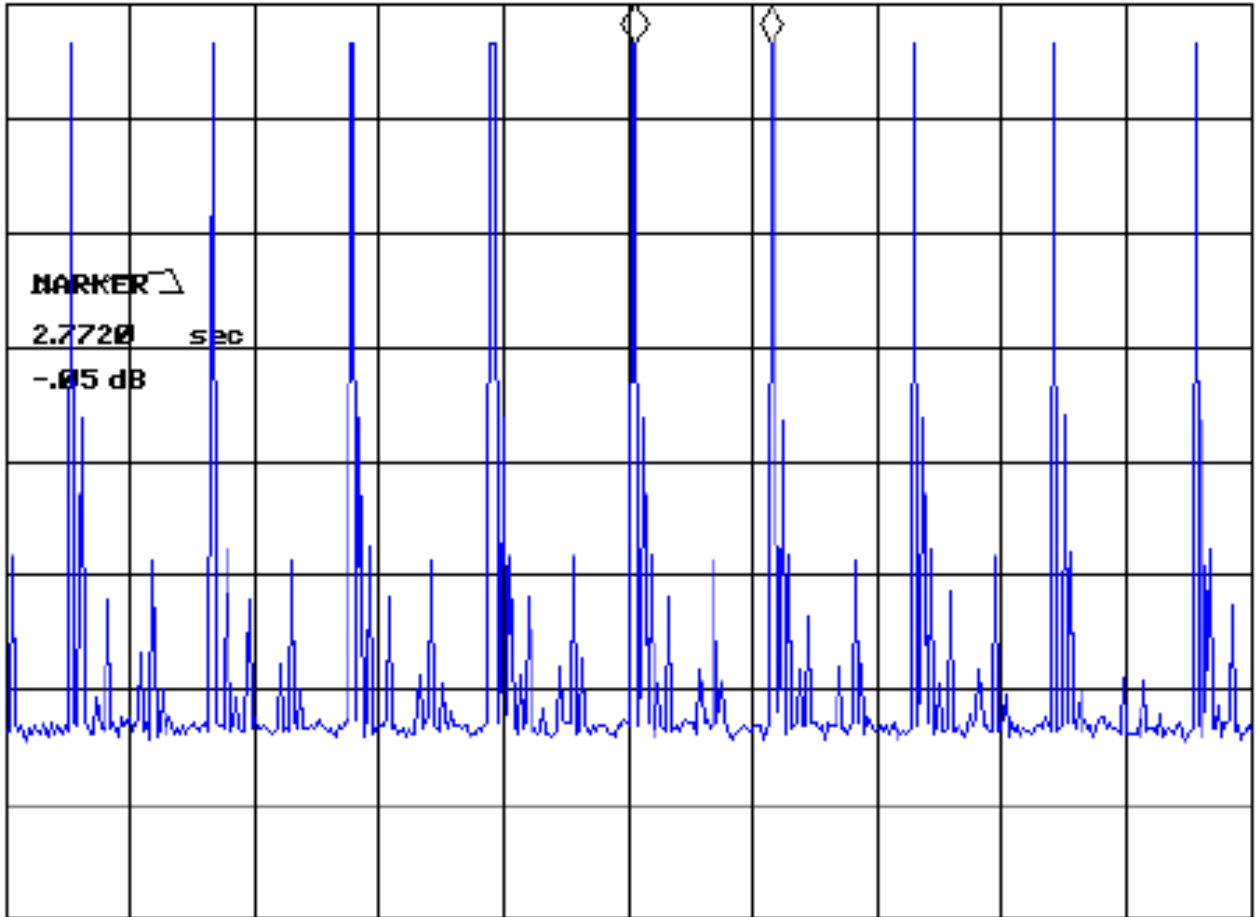
MKR 2.7720 sec

REF 21.0 dBm

AT 40 dB

-.05 dB

PEAK  
LOG  
10  
dB/  
OFFST  
.4  
dB  
WA SB  
SC FS  
CORR



CENTER 2.403400 GHz

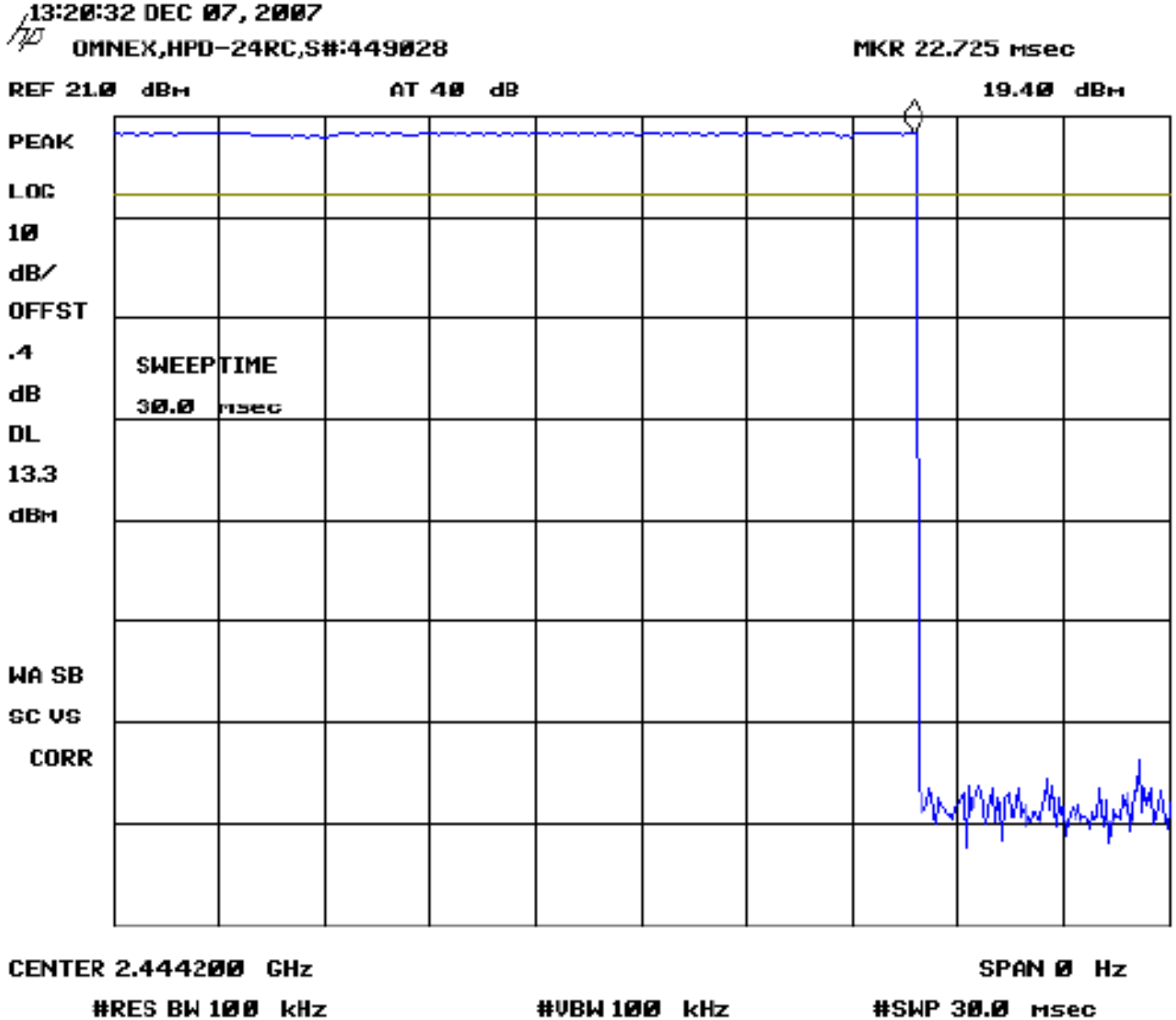
SPAN 0 Hz

#RES BW 100 kHz

#VBW 100 kHz

#SWP 25.2 sec

- Carrier Frequency is: 2444.2MHz



13:37:32 DEC 07, 2007

OMNEX,HPD-24RC,S#:449028

MKR 2.8350 sec

REF 21.0 dBm

AT 40 dB

.00 dB

PEAK

LOG

10

dB/

OFFST

.4

dB

MARKER

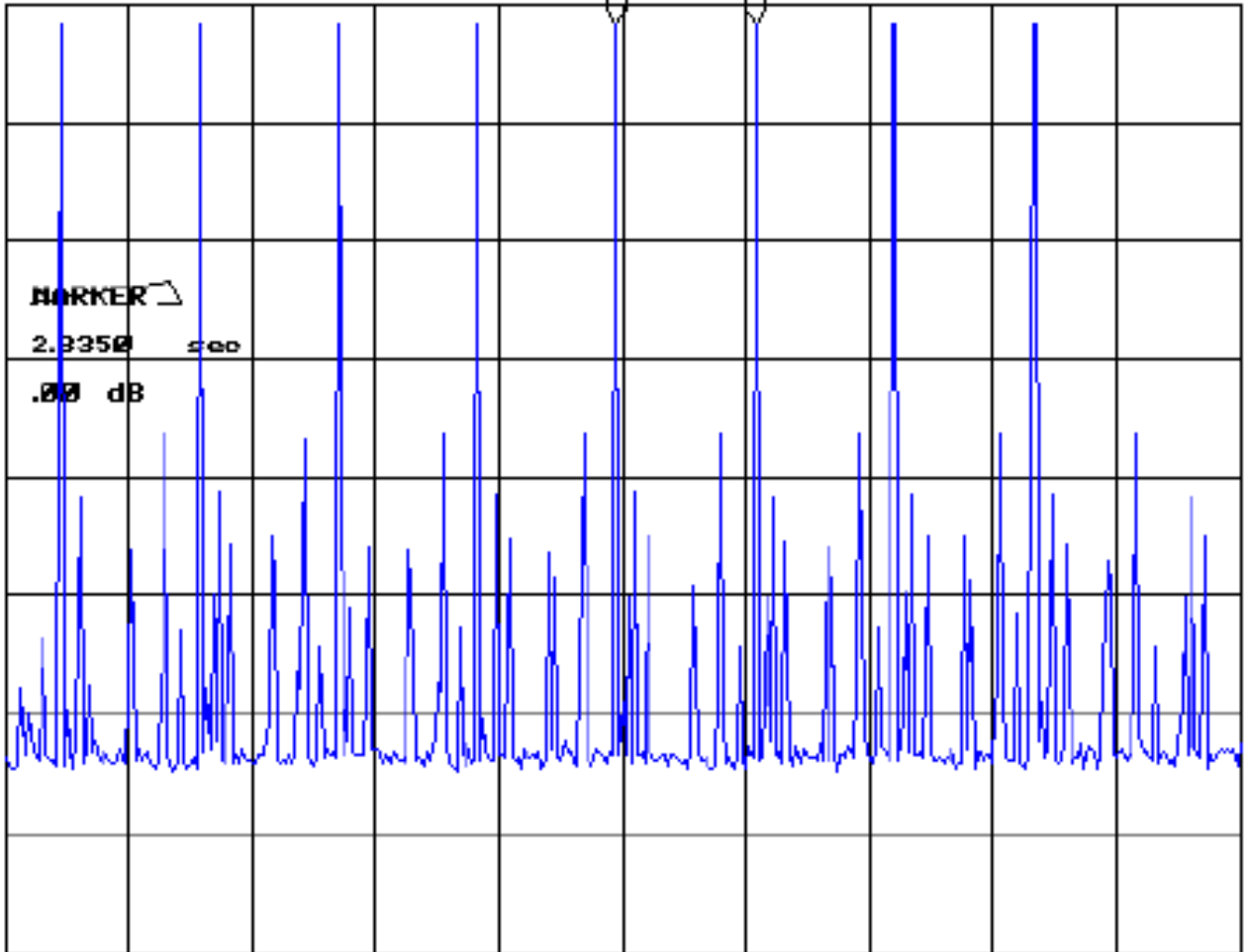
2.8350 sec

.00 dB

WA SB

SC FS

CORR



CENTER 2.444200 GHz

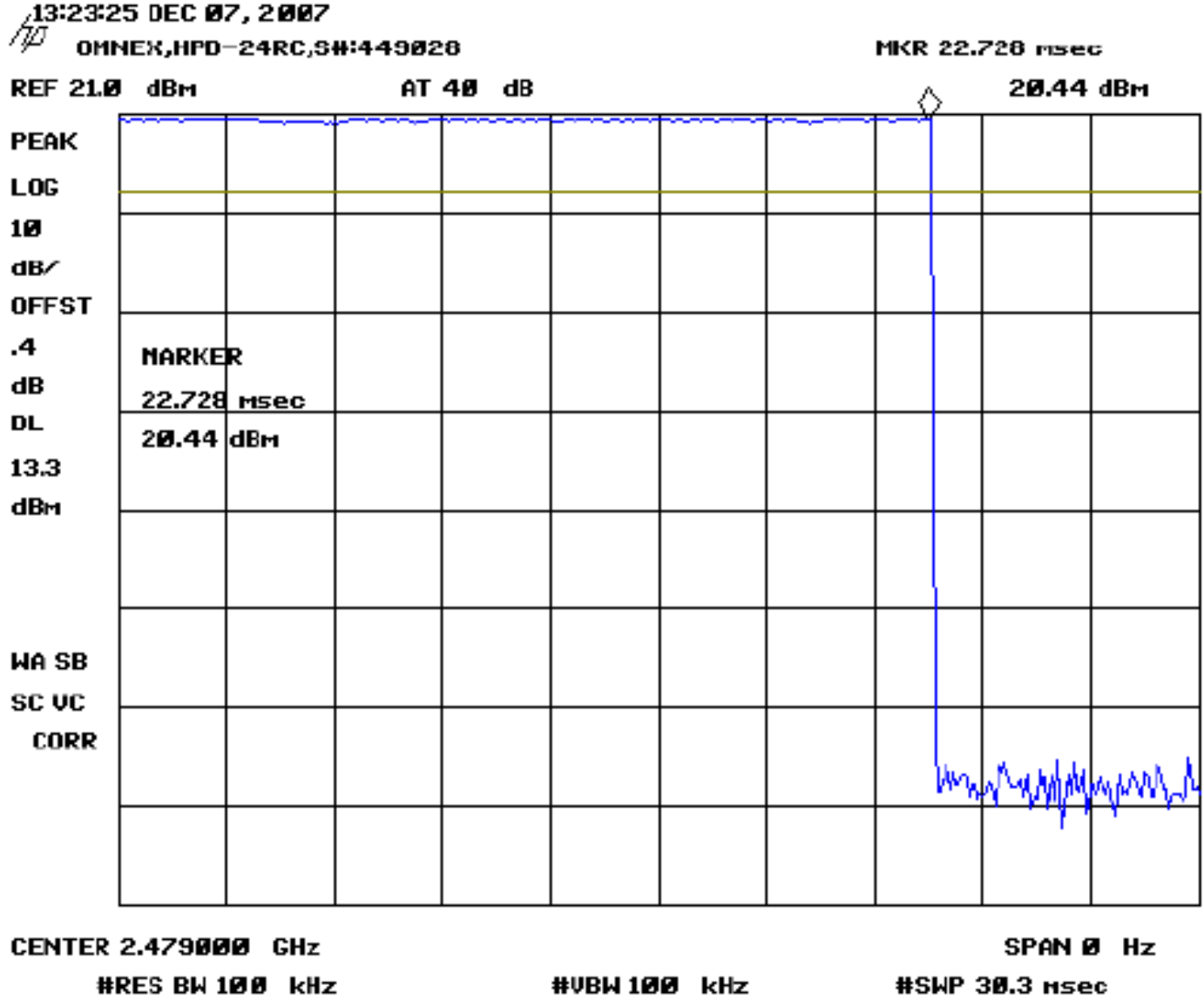
SPAN 0 Hz

#RES BW 100 kHz

#VBW 100 kHz

#SWP 25.2 sec

- Carrier Frequency is: 2479MHz



13:38:39 DEC 07, 2007

OMNEX,HPD-24RC,S#:449020

MKR 2.8350 sec

REF 21.0 dBm

AT 40 dB

.01 dB

PEAK

LOG

10

dB/

OFFST

.4

dB

MARKER

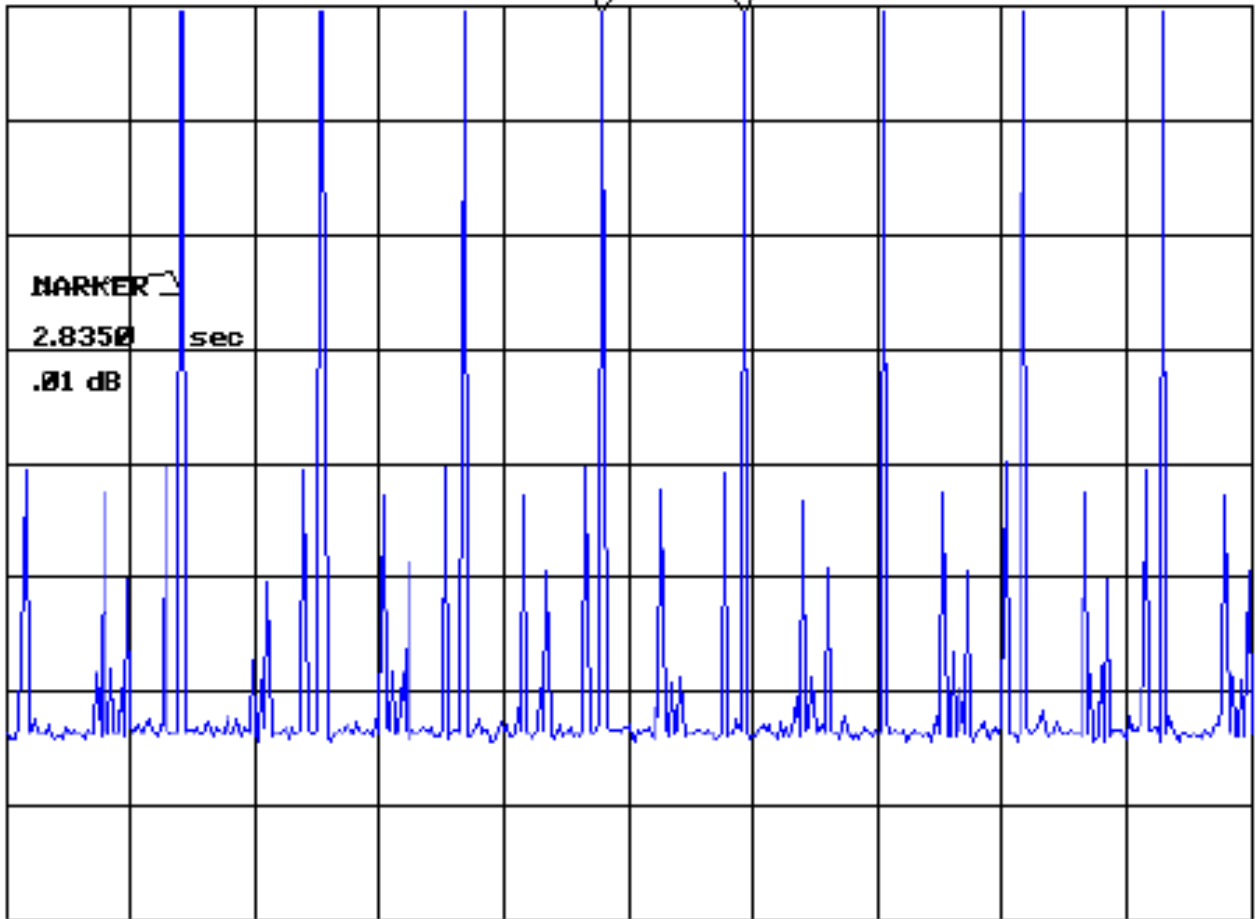
2.8350 sec

.01 dB

WA SB

SC FS

CORR



CENTER 2.479000 GHz

SPAN 0 Hz

#RES BW 100 kHz

#VBW 100 kHz

#SWP 25.2

sec

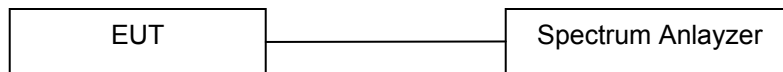
## 10 Transmitter Output Power

FCC15.247(b)(1)

For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts. Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4W.

### 10.1 Test Procedures

- 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 shall be transmitting at its maximum data rate.
- The following measurements were made with
  - Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
  - RBW > the 20 dB bandwidth of the emission being measured
  - VBW ≥ RBW
  - Sweep = Auto
  - Detector Function = peak
  - Trace = Max Hold
- Allowed the trace to stabilize.
- Use the marker-to-marker function to set the marker to the peak of the signal.
- The indicated level is the peak conducted output power (with the addition of the external attenuation and cable loss).



### 10.2 Test Results:

Channel Frequency(MHz)	Peak Power(W)	Limit(W)	Pass/Fail
2403.1	0.066	≤ 0.125	Pass
2441.7	0.093	≤ 0.125	Pass
2478.6	0.122	≤ 0.125	Pass

- Carrier Frequency is: 2403.1MHz

11:30:47 DEC 07, 2007

OMNEX,HPD-24RC,S#:449028

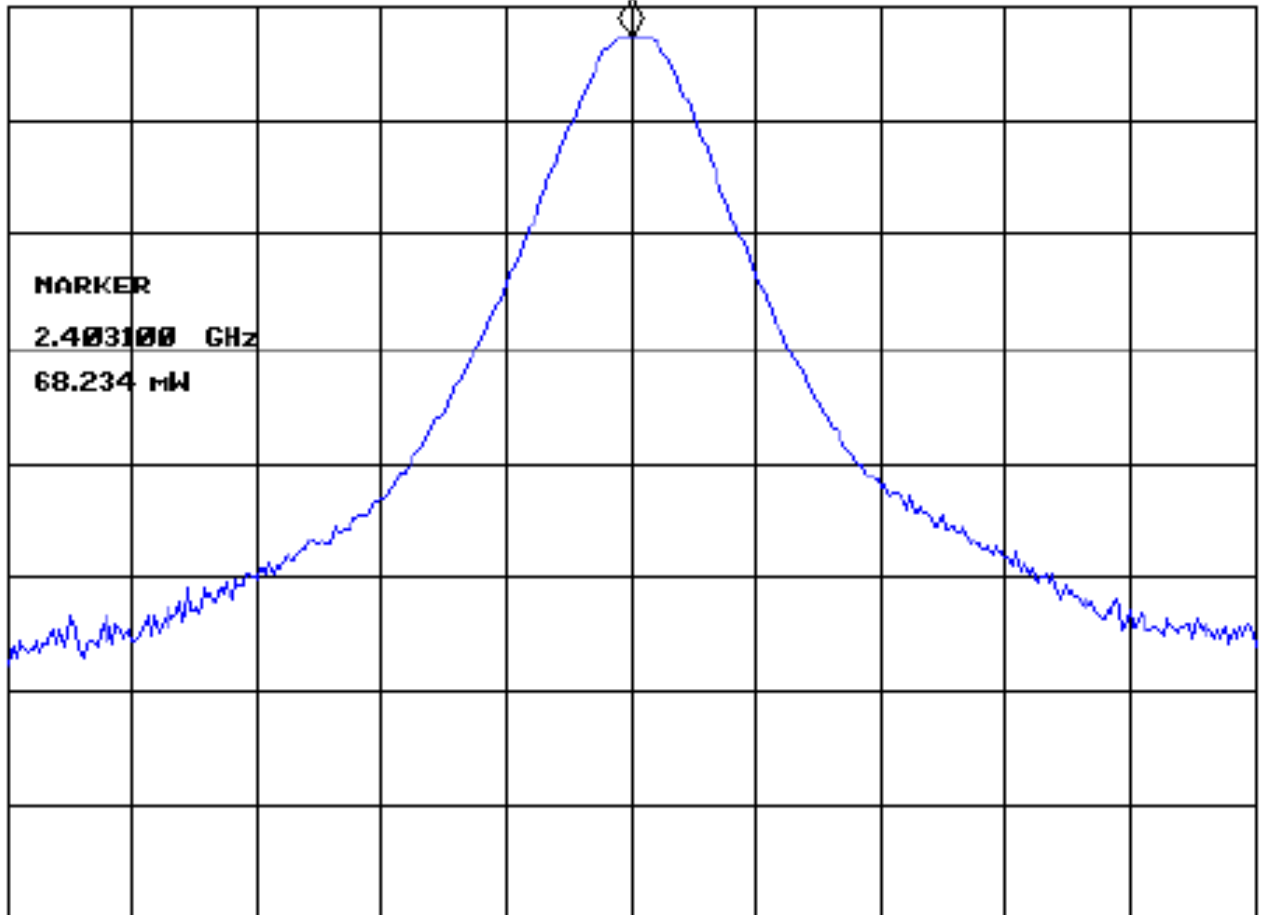
MKR 2.403100 GHz

REF 125.0 mW

AT 40 dB

68.234 mW

PEAK  
LOG  
10  
dB/  
OFFST  
.4  
dB  
MA SB  
SC FC  
CORR



CENTER 2.403100 GHz

#RES BW 100 kHz

#VBW 100 kHz

SPAN 2.000 MHz

SHP 20.0 msec

- Carrier Frequency is: 2441.7MHz

11:29:07 DEC 07, 2007

OMNEX,HPD-24RC,SN:449020

MKR 2.441700 GHz

REF 125.0 mW

AT 40 dB

93.111 mW

PEAK

LOG

10

dB/

OFFST

.4

dB

MARKER

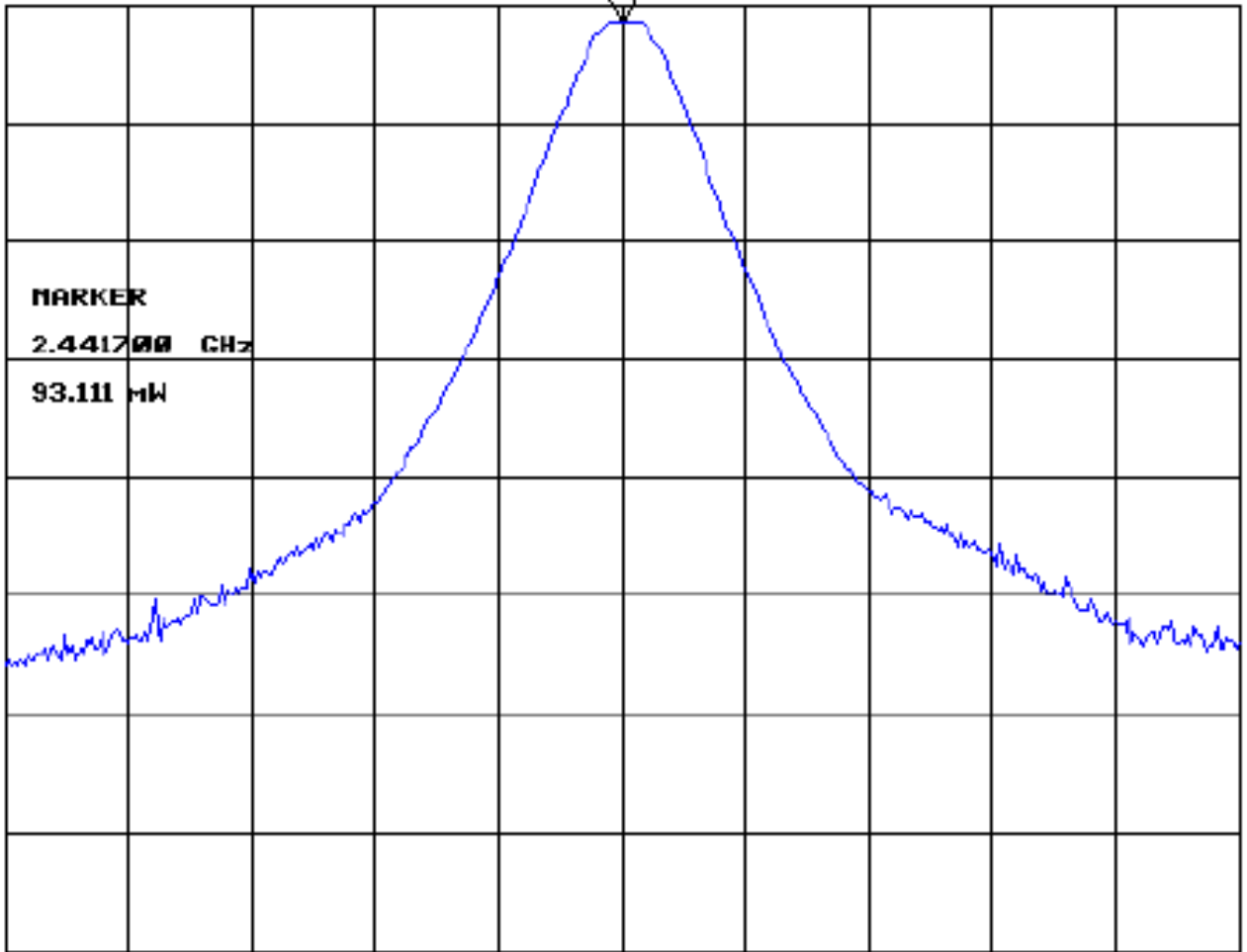
2.441700 GHz

93.111 mW

MA SB

SC FC

CORR



CENTER 2.441700 GHz

SPAN 2.000 MHz

#RES BW 100 kHz

#VBW 100 kHz

SMP 20.0 msec



- Carrier Frequency is: 2478.6MHz

11:24:52 DEC 07, 2007

HP OMNEX,HPD-24RC,S#:449028

MKR 2.478600 GHz

REF 125.0 mW

AT 40 dB

122.46 mW

PEAK

LOC

10

dB/

OFFST

.4

dB

MARKER

2.478600 GHz

122.46 mW

MA SB

SC FC

CORR

CENTER 2.478600 GHz

#RES BW 100 kHz

#VBW 100 kHz

SPAN 2.000 MHz

SMP 20.0 msec

## 11 Antenna Gain

FCC15.247(b)

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 6dBi.

### 11.1 Results:

The 2.4GHz Spread Spectrum Data Transceiver, R2160 and T2400, both were embedded on module HPD-24RC, incorporated internal coaxial antenna of 0dBi to comply with the requirements. And, they are also suggesting to extending 2dBi Whip Antenna. All of antennas are not exceed 6dBi of any direction.

- 2dBi Whip Antenna

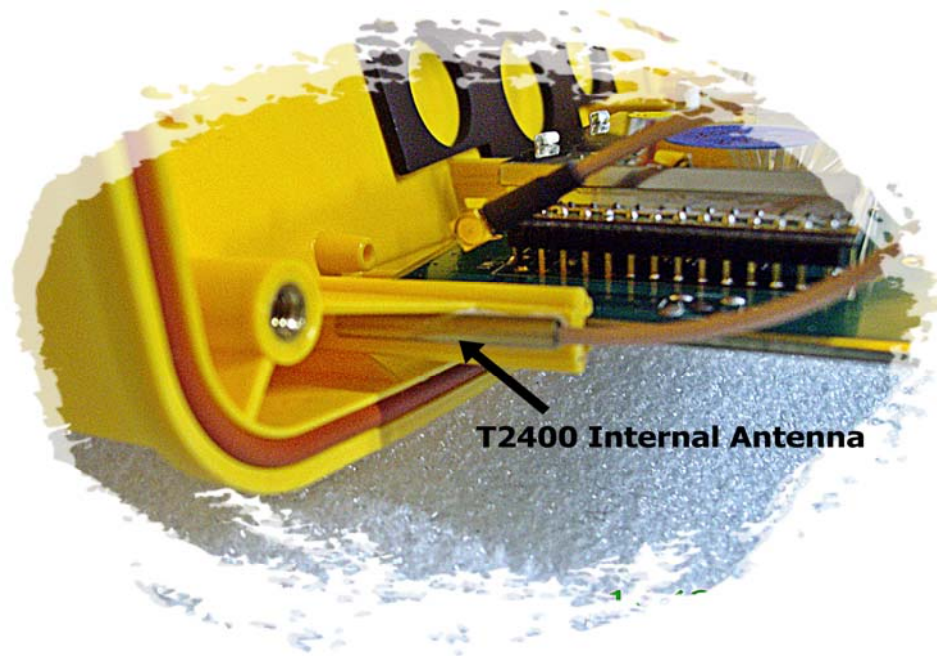


- 0dBi Wire Antenna

## Antenna Wire



- 0dBi Internal coaxial Antenna



## 12 RF Exposure (SAR)

FCC15.247(b)

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this chapter.

According to Section 1.1307b(1), the EUT does not require an environmental evaluation.

1. This equipment classification is not listed within Table 1 of Section 1.1307 and is not listed in Section 1.1307b(2).
2. The DUT is categorically exempt from routine environmental evaluation per Section 2.1093.

Included are calculations that determine that minimum distance from the transmitter antenna that will ensure an exposure limit at or below the guidelines given in Table 1 of Section 1.1310 for the general population. The formula for these calculations are taken from OET Bulletin 65, edition 97-01, August 1997; "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields".

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm <sup>2</sup> )	Averaging time (minutes)
<b>(A) Limits for Occupational/Controlled Exposures</b>				
0.3–3.0 .....	614	1.63	*(100)	6
3.0–30 .....	1842/f	4.89/f	*(900/f <sup>2</sup> )	6
30–300 .....	61.4	0.163	1.0	6
300–1500 .....	.....	.....	f/300	6
1500–100,000 .....	.....	.....	5	6
<b>(B) Limits for General Population/Uncontrolled Exposure</b>				
0.3–1.34 .....	614	1.63	*(100)	30
1.34–30 .....	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30–300 .....	27.5	0.073	0.2	30
300–1500 .....	.....	.....	f/1500	30
1500–100,000 .....	.....	.....	1.0	30

f = frequency in MHz

\* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

### 12.1 Calculations

Per Table 1 of Section 1.1310, the limit for General Population/Uncontrolled Exposure at 2400 to 2483.5MHz is 1 mW/cm<sup>2</sup>.

Per OET Bulletin 65, Edition 97-01, the formula for calculating power density is:  $S=P*G/4\pi R^2$  with:

Channel Frequency(MHz)	Peak Power(mW)	Gain of Antenna	Max. safety distance(cm)
<b>1. Whip Antenna(2dBi)</b>			
2403.1	66.23	1.585	2.89
2441.7	93.11	1.585	3.43
2478.6	122.46	1.585	3.93
<b>2. Internal wire and coaxial Antenna(0dBi)</b>			
2403.1	66.23	1.0	2.30
2441.7	93.11	1.0	2.72
2478.6	122.46	1.0	3.12

### **12.2 Conclusion**

The manufacturer has to specify 4 cm as the minimum safe distance in the EUT's User Manual.

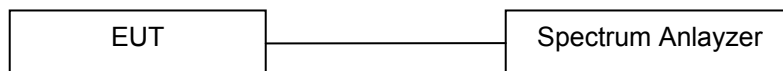
### 13 Conducted Spurious Emissions

FCC15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

#### 13.1 Test Procedures

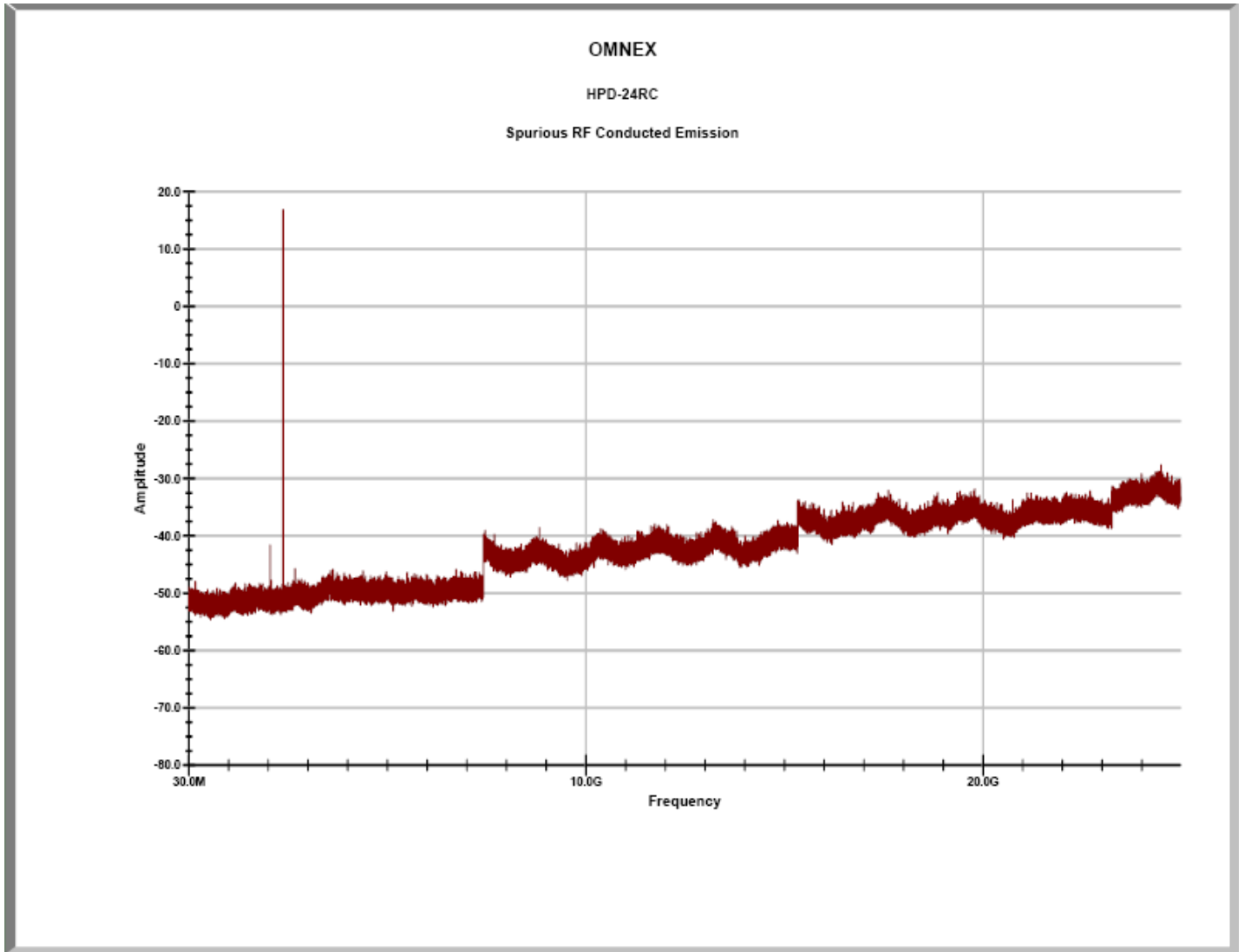
- The RF output of the EUT was connected to the RF input port of the Spectrum Analyzer.
- The EUT had its hopping function enabled.
- The transmitter shall be transmitting at its maximum data rate.
- The following measurements were made with
  - Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the DUT up through the 10<sup>th</sup> harmonic.
  - RBW = 100kHz
  - VBW ≥ RBW
  - Sweep = Auto
  - Detector Function = peak
  - Trace = Max Hold
- The level displayed must comply with the limit specified in this section.
- Submit this plot



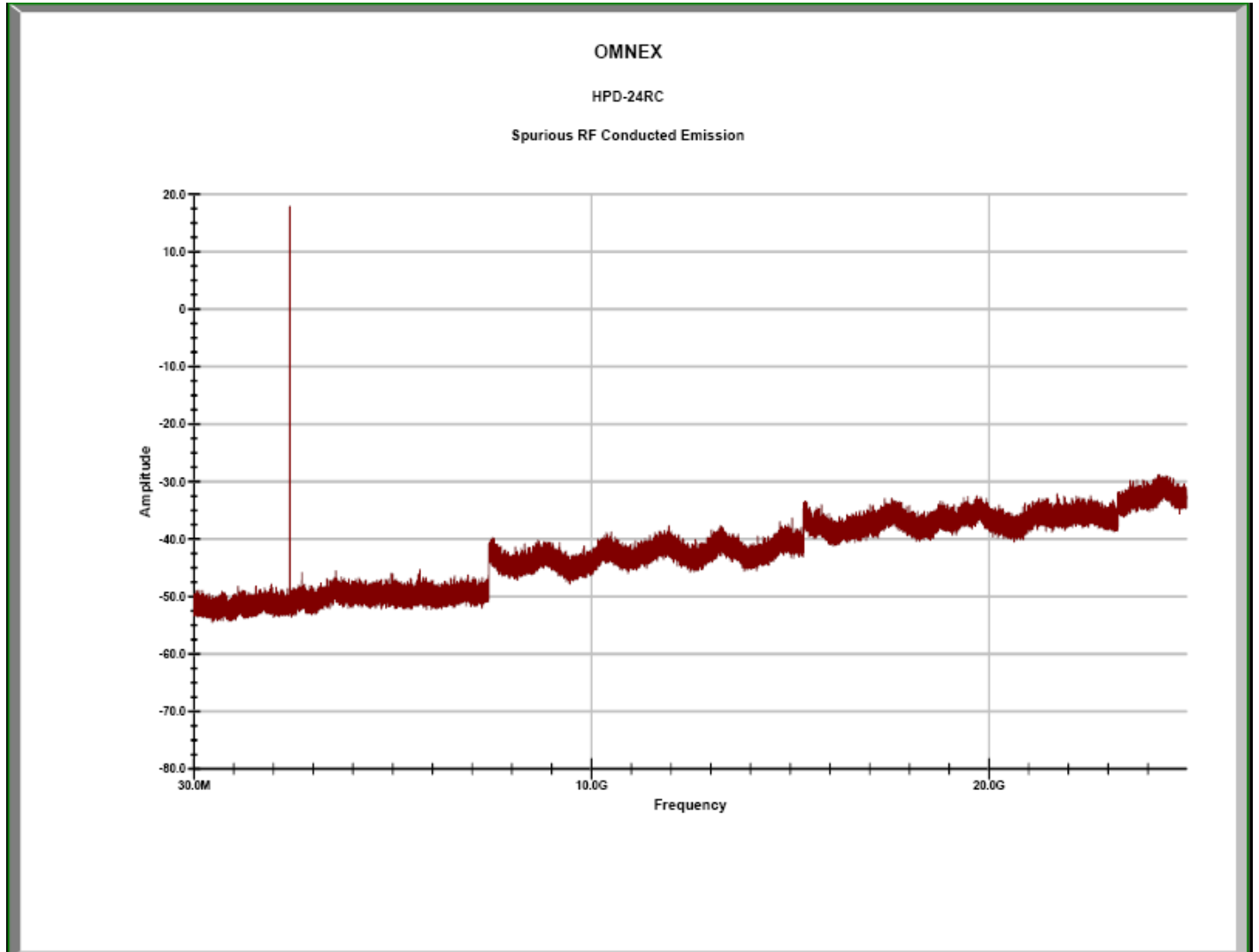
#### 13.2 Test Results:

All conducted spurious emission is under limit (20dB below of Carrier).

- EUT Operating Frequency for Test: 2403.1MHz

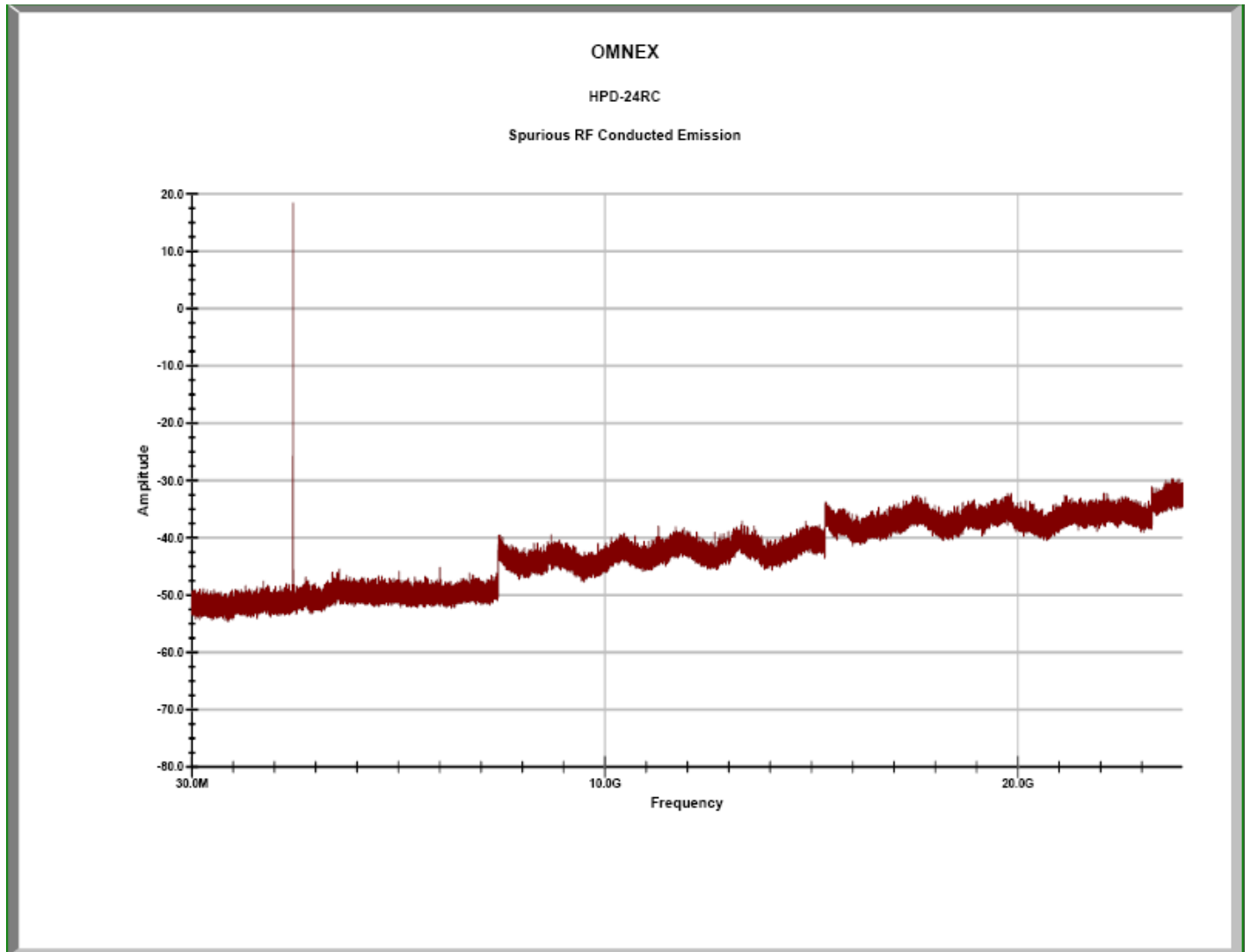


- EUT Operating Frequency for Test: 2441.7MHz





- EUT Operating Frequency for Test: 2478.6MHz



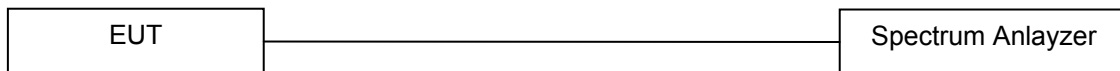
## 14 Out of Band Emissions

FCC15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

### 14.1 Test Procedures

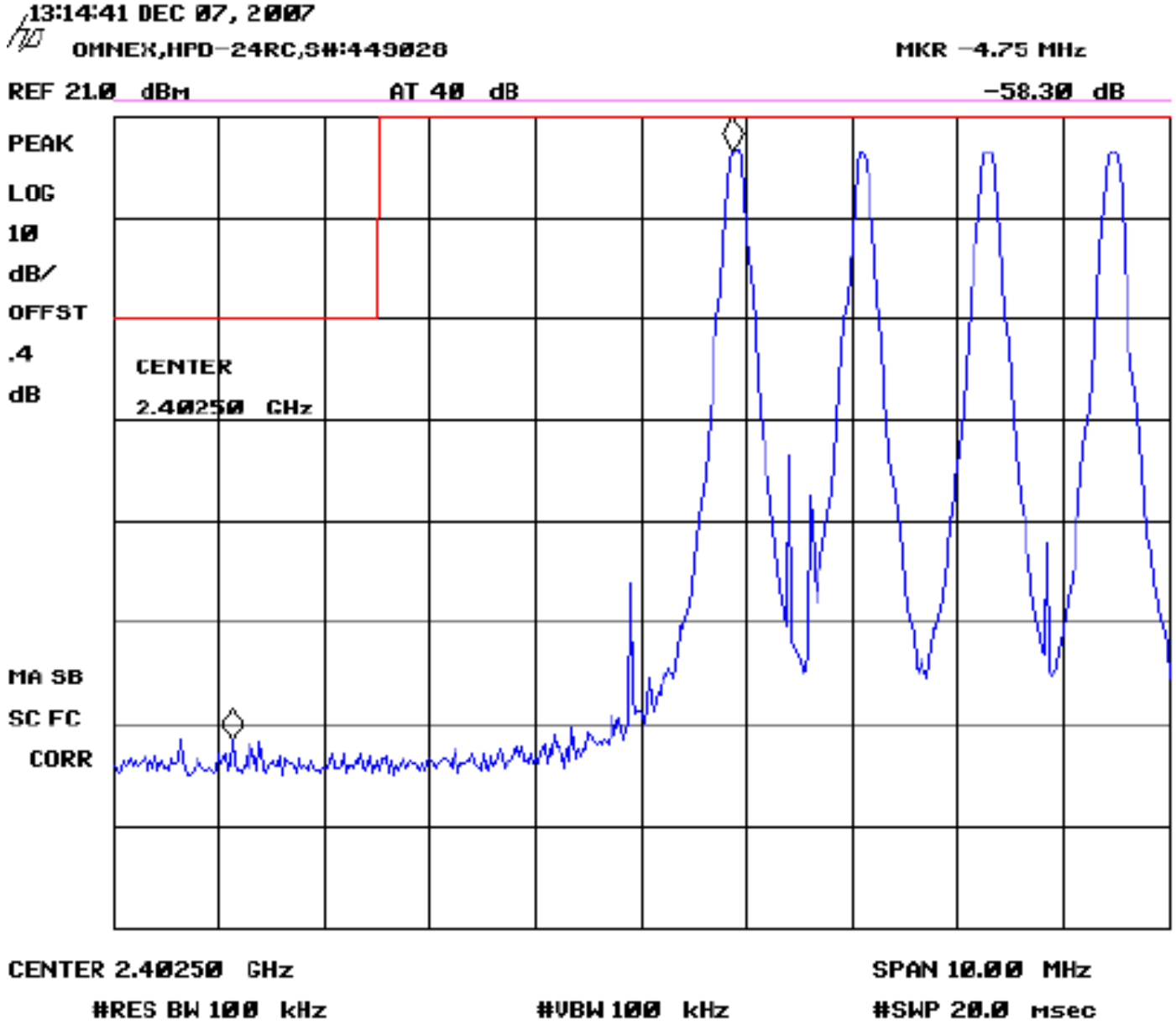
- The RF output of the EUT was connected to the RF input port of the Spectrum Analyzer.
- The EUT had its hopping function enabled.
- The transmitter shall be transmitting at its maximum data rate.
- The following measurements were made with
  - Span = wide enough to capture the peak level of the emission operating closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
  - RBW  $\geq$  1% of the span.
  - VBW  $\geq$  RBW
  - Sweep = Auto
  - Detector Function = peak
  - Trace = Max Hold
- The level displayed must comply with the limit specified in this section.
- Submit this plot



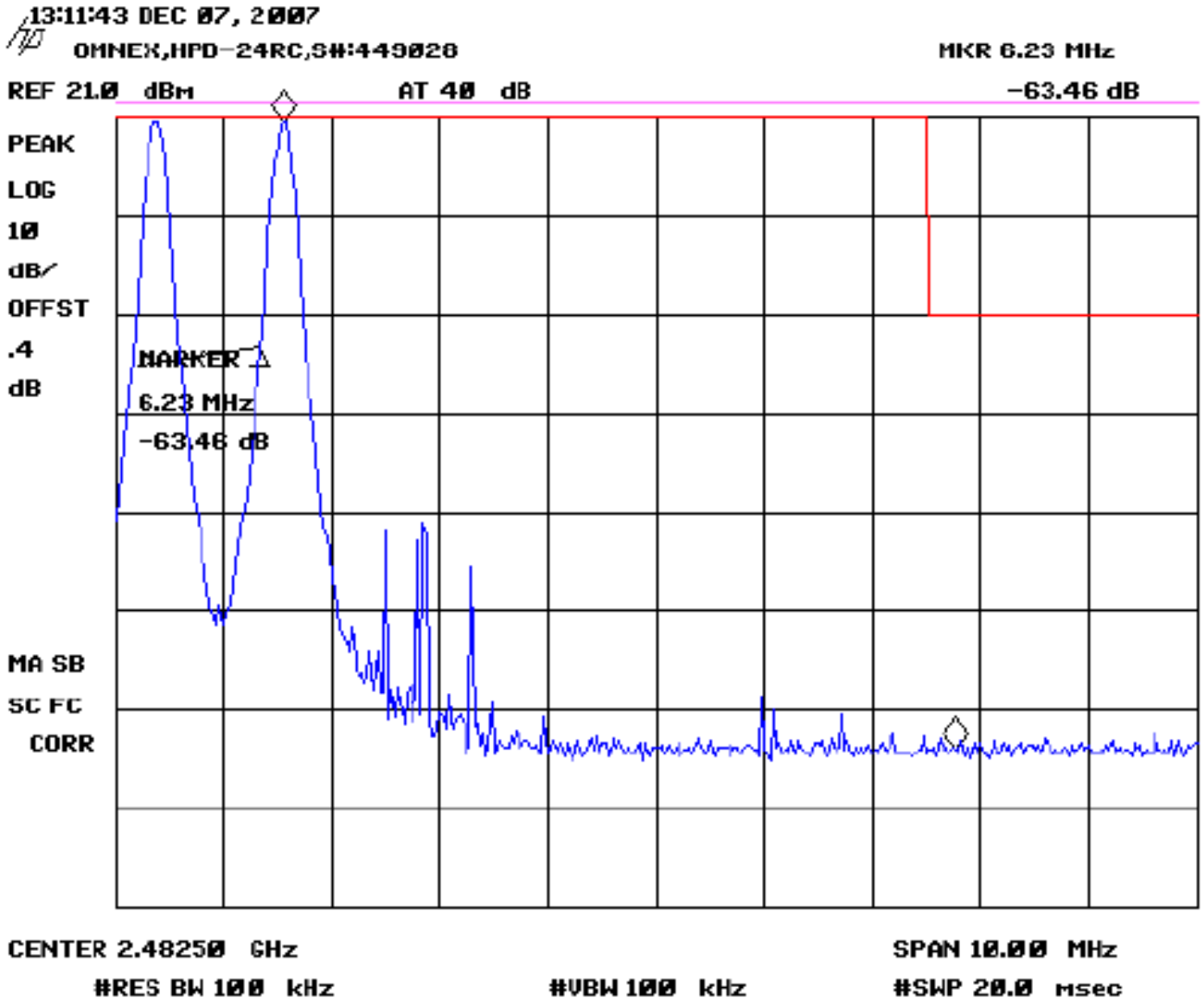
### 14.2 Test Results

All out of band emission is under limit (20dB below of Carrier).

- Lower Band-edge



- Upper Band-edge



**15 Radiated Spurious Emissions**

FCC15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

**FCC CFR 47, Part15, Subpart C, Para. 15.205(a)- Restricted bands of operation.**

[69 FR 54034, Sept. 7, 2004]

MHz	MHz	MHz	GHz
0.090-0.110 .....	16.42-16.423	399.9-410	4.5-5.15
<sup>1</sup> 0.495-0.505 .....	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905 .....	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128 .....	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775 .....	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775 .....	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218 .....	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825 .....	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225 .....	123-138	2200-2300	14.47-14.5
8.291-8.294 .....	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366 .....	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675 .....	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475 .....	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293 .....	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025 .....	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725 .....	322-335.4	3600-4400	( <sup>2</sup> )
13.36-13.41.			

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

**FCC CFR 47, Part15, Subpart C, Para. 15.209(a)  
 - Field Strength Limit within Restricted Frequency Bands**

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490 .....	2400/F(kHz)	300
0.490-1.705 .....	24000/F(kHz)	30
1.705-30.0 .....	30	30
30-88 .....	100**	3
88-216 .....	150**	3
216-960 .....	200**	3
Above 960 .....	500	3

**15.1 Test Procedures**

Test procedure is based on the FCC15.31(a)(3) - Other intentional and unintentional radiators are to be measured for compliance using the following procedure excluding sections 4.1.5.2, 5.7, 9 and 14: ANSI C63.4-2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see § 15.38). This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51.

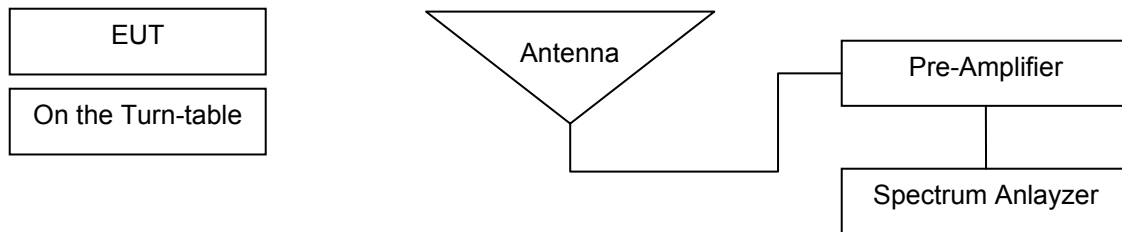
NOTE to Paragraph (a)(3): Digital devices tested to show compliance with the provisions of §§ 15.107(e) and 15.109(g) must be tested following the ANSI C63.4 procedure described in paragraph (a)(3) of this section.[As stated in the adopting R&O, ANSI C63.4 is not used for measurements below 30 MHz.]

The EUT was placed on a 1 meter by 1.5 meters wide and 0.8-meter high nonconductive table that was placed directly onto a flush mounted turntable. The EUT was connected to its support equipment with any excess I/O cabling bundled to approximately 1 meter.

Prescan tests were performed to determine the "worst-case" orientation of the EUT (By Manipulating the EUT's position through all three orthogonal axes). With the EUT positioned in the "worst case" orientation, emissions from the unit were maximized by manipulating the cables, and by adjusting the polarization and height of the receive antenna and rotating the EUT on the turntable.

**Radiated Emissions Test Characteristics**

Frequency range	30 MHz – 25000 MHz
Test distance	3 m
Test instrumentation resolution bandwidth	120kHz(under 1GHz), 1MHz(Over 1GHz)
Detecting Method	- Quasi-Peak(below 1GHz) - Average(above 1GHz)
Receive antenna scan height	1 m – 4 m
Receive antenna polarization	Vertical/Horizontal



**15.2 Test Results:**

All radiated spurious signals were under limit of FCC15.247B.

All measured data are calculated as below formula.

$$\text{Field Strength(dBuV/m)} = \text{Spectrum Analyzer's Level(dBuV)} + \text{Antenna Factor(1/m)} + \text{Cable Loss(dB)}$$

- Carrier Frequency is 2401.4MHz, the unit of data is dBuV/m.

LabTest Certification Inc.  
 FCC15.247, Radiated Spurious Emissions  
 Ch. Freq: 2403.1MHz, Scan:30 to 300MHz

Operator: Jeremy Lee  
 01:20:59 PM, Wednesday, November 28, 2007

Equipment ID: HPD-24RC  
 Contact: George R.  
 Company: Omnex Controls Systems ULC

Frequency MHz	limit	qp_out_1	turn_out_1	twr_out_1	pol_1	comment_1
30.000 MHz	40.00					
31.534 MHz	40.00	20.01	273.80	1.50	V	
47.875 MHz	40.00	22.90	80.20	1.50	V	
59.101 MHz	40.00	23.14	235.40	1.50	V	
88.000 MHz	40.00		89.73	1.50		
88.000 MHz	43.52		89.73	1.50		
105.802 MHz	43.52	0.00	0.00	1.50	V	Under Ambient Signal
136.474 MHz	43.52	22.60	12.10	1.50	V	
140.160 MHz	43.52	26.33	26.50	1.50	V	
206.738 MHz	43.52	32.95	349.30	1.50	V	

LabTest Certification Inc.  
 FCC15.247, Radiated Spurious Emissions  
 Ch. Freq: 2403.1MHz, Scan:300 to 1000MHz

Operator: Jeremy Lee  
 03:08:37 PM, Wednesday, November 28, 2007

Equipment ID: HPD-24RC  
 Contact: George R.  
 Company: Omnex Controls Systems ULC

Frequency MHz	limit	qp_out_1	turn_out_1	twr_out_1	pol_1	comment_1
30.000 MHz	40.00					
88.000 MHz	40.00					
88.000 MHz	43.52					
216.000 MHz	43.52					
216.000 MHz	46.02					
751.093 MHz	46.02	34.87	181.00	1.10	V	
901.084 MHz	46.02	34.33	124.00	1.10	V	

LabTest Certification Inc.  
 FCC15.247, Radiated Spurious Emissions  
 Ch. Freq: 2403.1MHz, Scan:1 to 26.5GHz

Operator: Jeremy Lee  
 04:35:12 PM, Wednesday, November 28, 2007

Equipment ID: HPD-24RC  
 Contact: George R.  
 Company: Omnex Controls Systems ULC

Frequency MHz	limit	avg_out_1	turn_out_1	twr_out_1	pol_1	comment_1
30.000 MHz	40.00					
88.000 MHz	40.00					
88.000 MHz	43.52					
216.000 MHz	43.52					
216.000 MHz	46.02					
960.000 MHz	46.02					
960.000 MHz	53.98					
1.201 GHz	53.98	31.74	227.50	1.20	V	
26.500 GHz	53.98					

- Carrier Frequency is 2441.7MHz, the unit of data is dBuV/m.

LabTest Certification Inc.  
 FCC15.247, Radiated Spurious Emissions  
 Ch. Freq: 2441.7MHz, Scan:30 to 300MHz

Operator: Jeremy Lee  
 02:11:52 PM, Wednesday, November 28, 2007

Equipment ID: HPD-24RC  
 Contact: George R.  
 Company: Omnex Controls Systems ULC

Frequency MHz	limit	qp_out_1	turn_out_1	twr_out_1	pol_1	comment_1
30.000 MHz	40.00					
31.775 MHz	40.00	19.85	14.00	1.50	V	
47.966 MHz	40.00	22.28	279.20	1.50	V	
70.135 MHz	40.00	16.22	136.00	1.50	V	
88.000 MHz	40.00		128.22	1.50		
88.000 MHz	43.52		128.22	1.50		
105.708 MHz	43.52	0.00	120.50	1.50	V	Under Ambient Signals
136.455 MHz	43.52	17.81	17.50	1.50	V	
140.156 MHz	43.52	22.32	27.10	1.50	V	
143.840 MHz	43.52	0.00	106.70	1.50	V	Under Ambient Signals
206.641 MHz	43.52	28.25	12.70	1.50	V	

LabTest Certification Inc.  
 FCC15.247, Radiated Spurious Emissions  
 Ch. Freq: 2441.7MHz, Scan:300 to 1000MHz

Operator: Jeremy Lee  
 03:17:06 PM, Wednesday, November 28, 2007

Equipment ID: HPD-24RC  
 Contact: George R.  
 Company: Omnex Controls Systems ULC

Frequency MHz	limit	qp_out_1	turn_out_1	twr_out_1	pol_1	comment_1
30.000 MHz	40.00					
88.000 MHz	40.00					
88.000 MHz	43.52					
216.000 MHz	43.52					
216.000 MHz	46.02					
916.041 MHz	46.02	36.35	228.80	1.10	V	

LabTest Certification Inc.  
 FCC15.247, Radiated Spurious Emissions  
 Ch. Freq: 2441.7MHz, Scan:1 to 26.5GHz

Operator: Jeremy Lee  
 04:40:39 PM, Wednesday, November 28, 2007

Equipment ID: HPD-24RC  
 Contact: George R.  
 Company: Omnex Controls Systems ULC

Frequency MHz	limit	avg_out_1	turn_out_1	twr_out_1	pol_1	comment_1
30.000 MHz	40.00					
88.000 MHz	40.00					
88.000 MHz	43.52					
216.000 MHz	43.52					
216.000 MHz	46.02					
960.000 MHz	46.02					
960.000 MHz	53.98					
1.221 GHz	53.98	32.45	245.50	1.20	H	
26.500 GHz	53.98					



- Carrier Frequency is 2478.6MHz, the unit of data is dBuV/m.

LabTest Certification Inc.  
 FCC15.247, Radiated Spurious Emissions  
 Ch. Freq: 2478.6MHz, Scan:30 to 300MHz

Operator: Jeremy Lee  
 02:35:07 PM, Wednesday, November 28, 2007

Equipment ID: HPD-24RC  
 Contact: George R.  
 Company: Omnex Controls Systems ULC

Frequency MHz	limit	qp_out_1	turn_out_1	twr_out_1	pol_1	comment_1
30.000 MHz	40.00					
31.642 MHz	40.00	20.86	55.30	1.50	V	
47.945 MHz	40.00	23.68	259.80	1.50	V	
70.156 MHz	40.00	16.09	243.70	1.50	V	
88.000 MHz	40.00		223.89	1.50		
88.000 MHz	43.52		223.89	1.50		
136.636 MHz	43.52	17.28	169.90	1.50	V	
140.183 MHz	43.52	22.75	91.90	1.50	V	
143.836 MHz	43.52	0.00	313.10	1.50	V	Under Ambient Signals
184.550 MHz	43.52	32.00	27.20	1.50	V	
206.741 MHz	43.52	33.63	293.60	1.50	V	

LabTest Certification Inc.  
 FCC15.247, Radiated Spurious Emissions  
 Ch. Freq: 2478.6MHz, Scan:300 to 1000MHz

Operator: Jeremy Lee  
 03:28:32 PM, Wednesday, November 28, 2007

Equipment ID: HPD-24RC  
 Contact: George R.  
 Company: Omnex Controls Systems ULC

Frequency MHz	limit	qp_out_1	turn_out_1	twr_out_1	pol_1	comment_1
30.000 MHz	40.00					
88.000 MHz	40.00					
88.000 MHz	43.52					
216.000 MHz	43.52					
216.000 MHz	46.02					
310.034 MHz	46.02	18.68	215.90	1.10	V	
775.069 MHz	46.02	26.39	334.60	1.10	V	

LabTest Certification Inc.  
 FCC15.247, Radiated Spurious Emissions  
 Ch. Freq: 2478.6MHz, Scan:1 to 26.5GHz

Operator: Jeremy Lee  
 04:47:15 PM, Wednesday, November 28, 2007

Equipment ID: HPD-24RC  
 Contact: George R.  
 Company: Omnex Controls Systems ULC

Frequency MHz	limit	avg_out_1	turn_out_1	twr_out_1	pol_1	comment_1
30.000 MHz	40.00					
88.000 MHz	40.00					
88.000 MHz	43.52					
216.000 MHz	43.52					
216.000 MHz	46.02					
960.000 MHz	46.02					
960.000 MHz	53.98					
1.239 GHz	53.98	32.28	153.30	1.20	H	
26.500 GHz	53.98					

## **16 Continuous Data and Short Transmission**

FCC15.247(g)

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

### **16.1 Test Results**

When required to send continuous data, all frequencies of a sequence were used once before any re-use of frequencies occurred. When presented with a short burst, any one frequency is not reused until all frequencies of the sequence have been used. In no case is a sequence truncated and restarted.

## **17 Coordination of Frequency Hopping**

FCC15.247(h)

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

### **17.1 Test Results**

This system did not incorporate intelligence to avoid interfering carriers. It progressed linearly through the hopping sequence.

## **18 AC Power Line Conducted Emission**

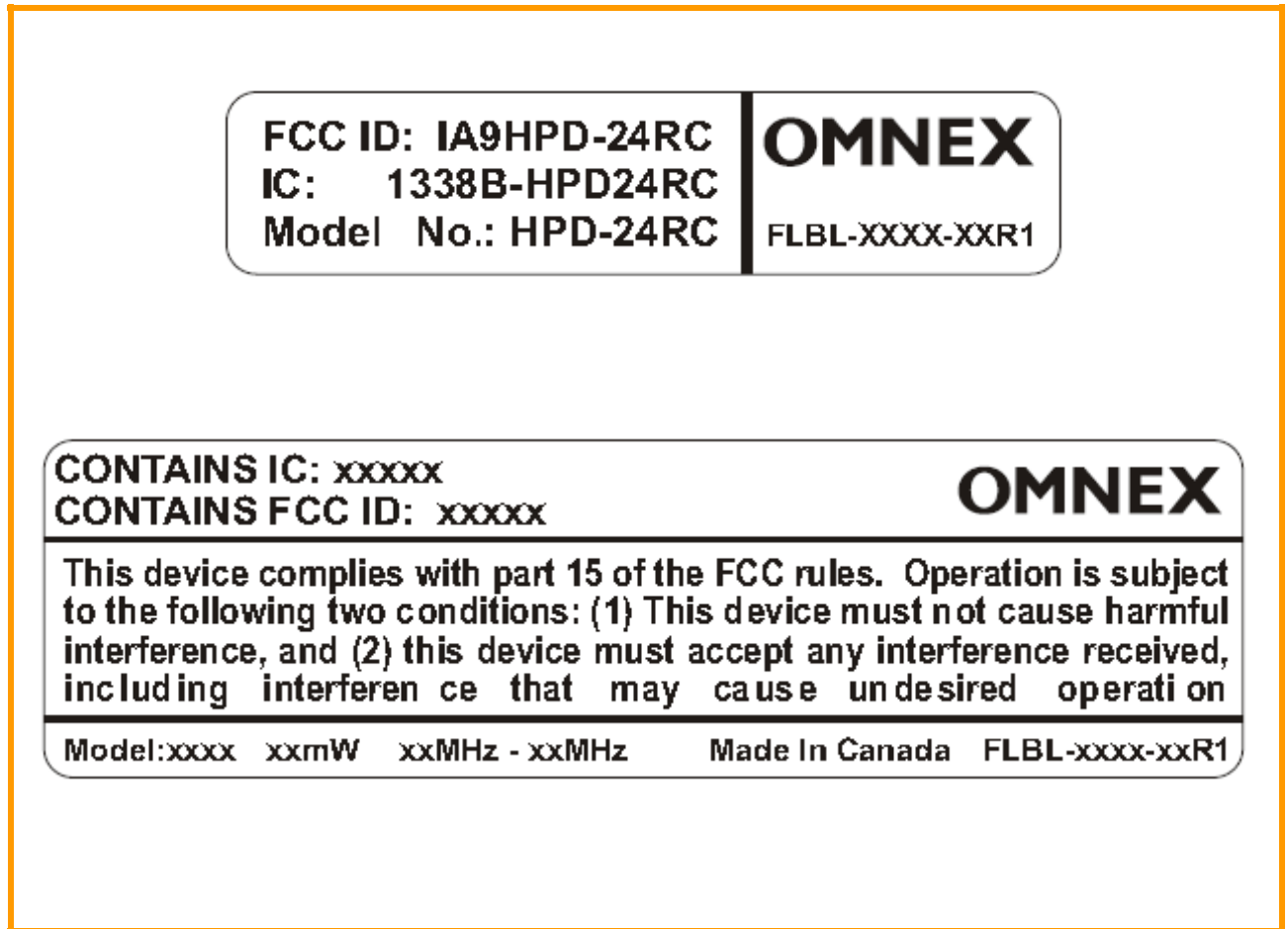
### FCC15.207 (a)

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

### **18.1 Test Results**

This test is not applicable because this EUT is battery powered.

**19 Markings**



## 20 Test Equipment Used

Item	Type	Equipment No	Calibration date		Comment
			Last	Due	
HP8593EM	Spectrum Analyzer	3536A00113	Sep. 15,2007	Sep. 13,2008	
ADVR3271	Spectrum Analyzer	15050455	Oct. 11, 2007	Oct. 11, 2008	
EMCO5317	GTEM		Oct. 04, 2005	Oct. 04, 2010	
EMCO3110B	Antenna (30-300MHz)	9211-1595	Mar. 09,2007	Mar. 09,2008	
SAS-501-2	Antenna (0.3-1GHz)		Mar. 30,2007	Mar. 30,2008	
SAS-571	Antenna (1-18GHz)		Mar. 30,2007	Mar. 30,2008	
XP605	DC Power Supply	20030712152	N/A	N/A	

Prepared by: LabTest Certification Inc.  
Date Issued: December 07, 2007  
Project No.: 8972

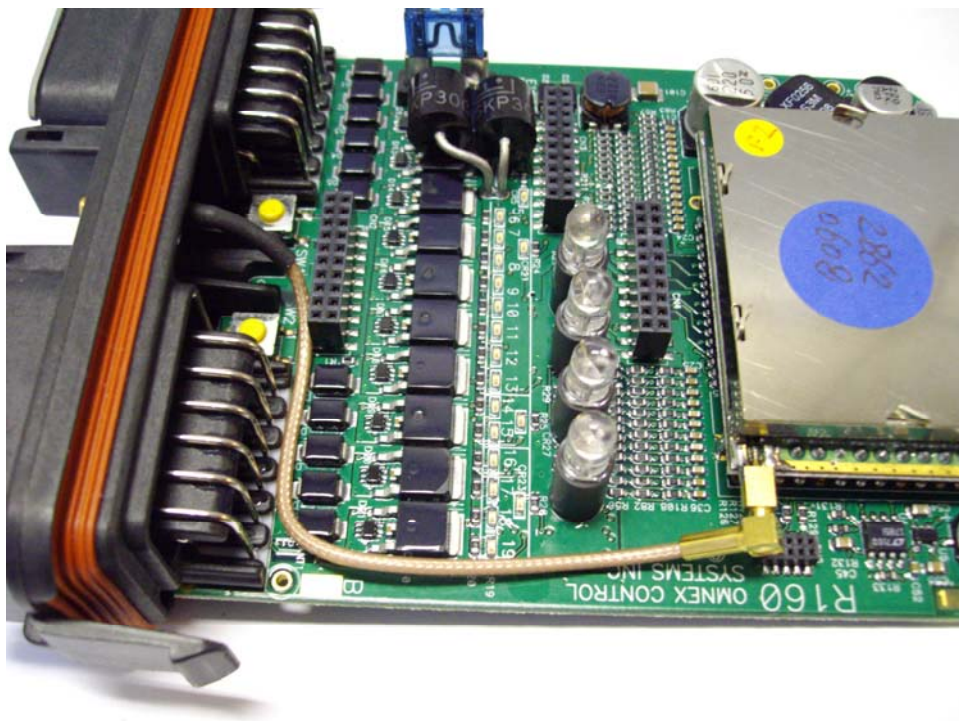
Client: Omnex Control Systems ULC  
Report No.: 8972-1E  
Revision No.: 1

## **21 FIGURES AND SCHEMATICS**

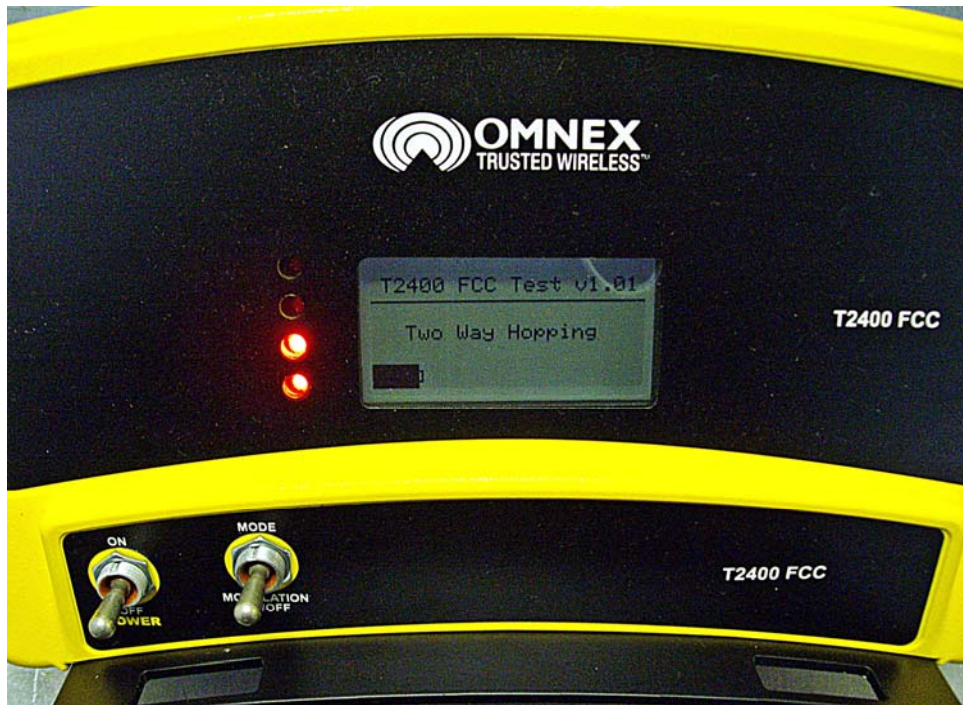
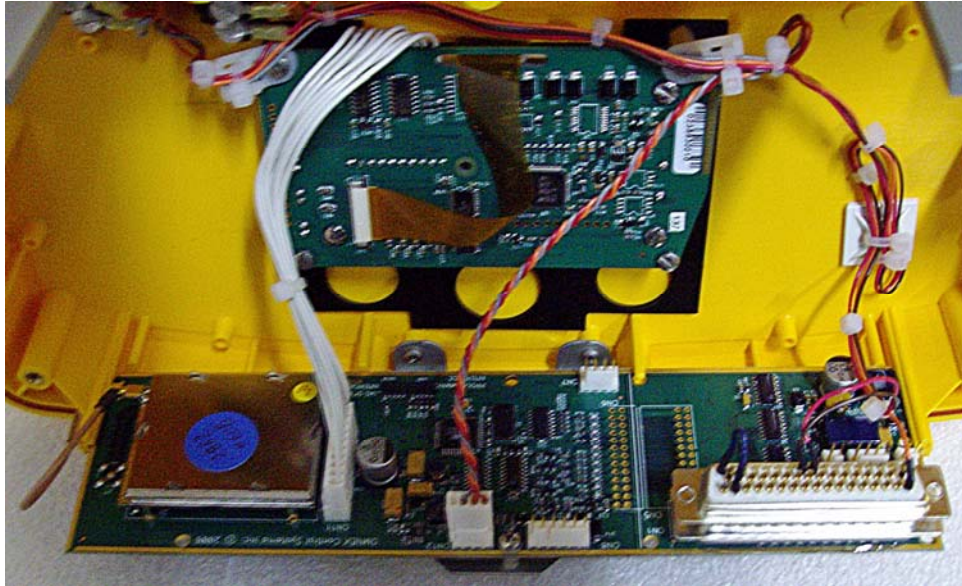
## 22 Photographs















**END OF REPORT**