Technical Certification

I. Phillip Barsky, Consultant - Spectrum Management/Regulatory for XM Radio Inc., certify under penalty of perjury that:

I am the technically qualified person with overall responsibility for the preparation of the technical information contained in the above "Comments." The information contained in this document is true and correct to the best of my belief.

Phillip Barsky

Dated: February 12, 2002

Exhibit A

Interference from Bluetooth Devices to Satellite DARS Receivers

I. Scope

This preliminary document is intended to address the potential impact of the Bluetooth transceiver out of band emissions when co-located with SDARS receiver. This analysis was performed for the automotive environment.

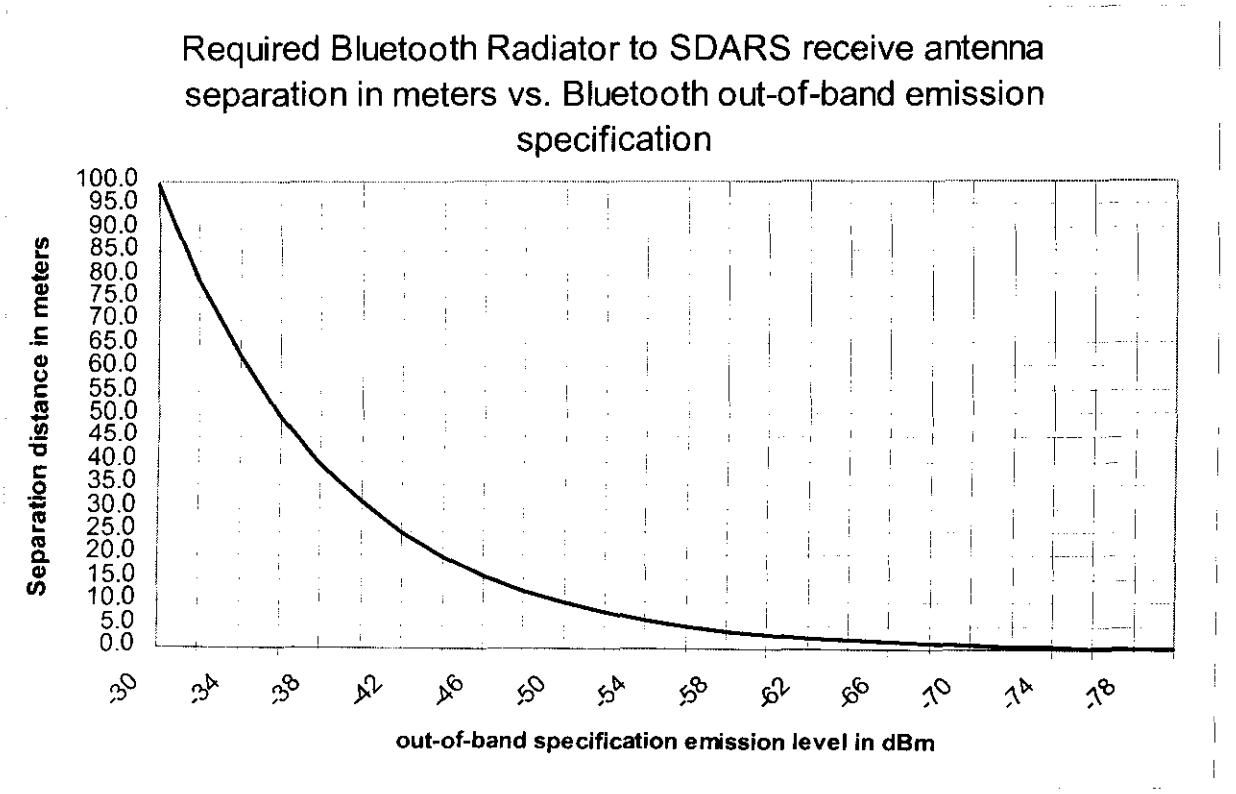
II. Summary

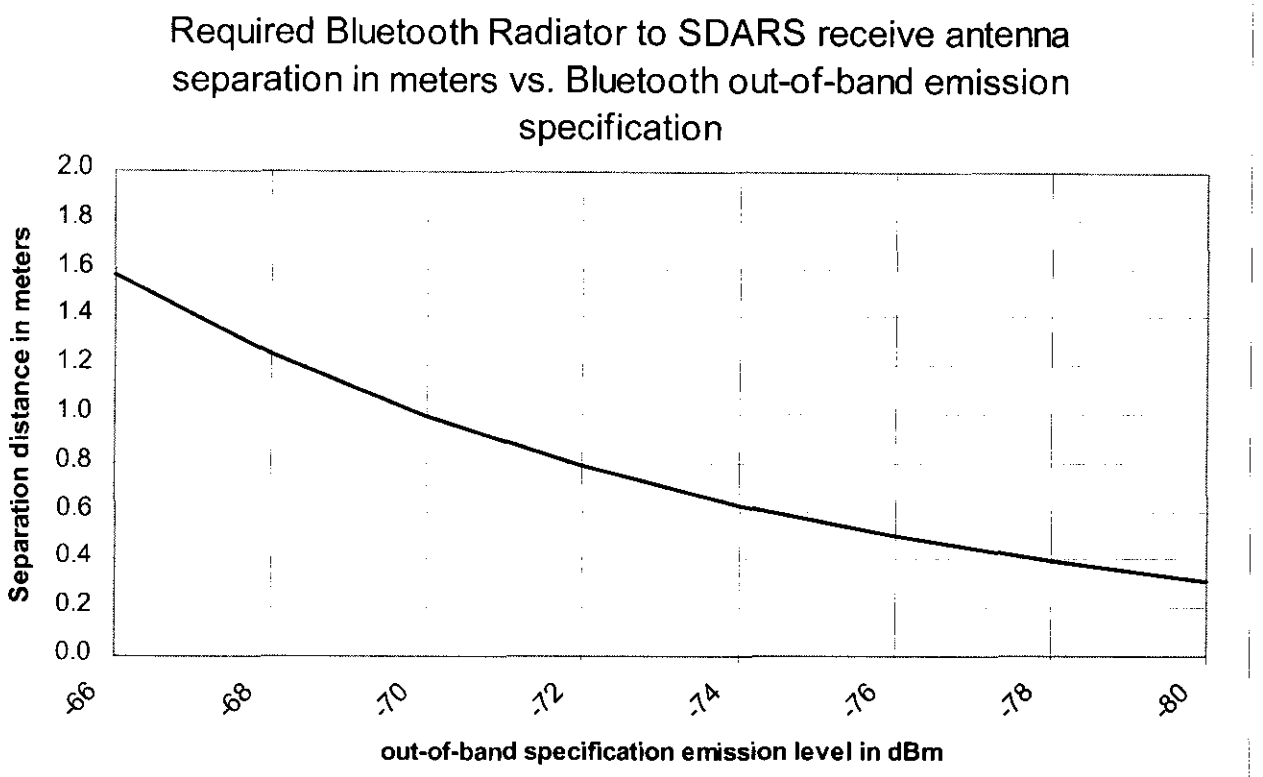
The Bluetooth transceiver operates in the 2.4 GHz ISM band. Bluetooth transceivers operate under approval of the following Standards: Federal Communications Commission, FCC, USA Documents: CFR47, Part 15, Sections 15.205, 15.209, 15.247.

The Bluetooth out of band emissions specification limits the emissions in the frequency range of 1 GHz – 12.75 GHz to -30 dBm for active mode and -47 dBm for idle mode.

The value of thermal noise at the XM receiver input is -110 dBm (290 degree noise temperature and 2 MHz noise bandwidth). The additional increase of the noise floor in the SDARS band due to the allowable out-of-band emissions reduces the available SDARS Satellite link margin. This indicates the isolation required between the Bluetooth radiator and the SDARS receive antenna is 80 dB.

The following charts illustrate the separation distance between Bluetooth a radiator and SDARS receiver in a line of site condition that is required to achieve the 80dB of isolation and limit the effect of Bluetooth out-of-band emissions on the reliability of the SDARS service.





III. FCC Specification

The current FCC specification of 500 microvolts per meter equates to an out of band emissions level of –41 dBm. This level is well below that stated in the Bluetooth specification but does not eliminate the requirement for an improvement in the current limit. At –41 dBm the separation distance required to ensure that the out of band emissions would not interfere with the SDARS receiver would be approximately 30 meters.

IV. Recommended FCC Specification Change

The current requirement for the FCC limits should be modified to restrict the emissions level limit for the 2320-2345 MHz to no more than –100 dBW (1.8 microvolts per meter at 30 meters or 18 microvolts per meter at 3 meters)- all measured in a 2MHz bandwidth . The SDARS system is designed to be primarily a direct Satellite broadcast system with a very high target availability (>99%) and as such operates at very low signal to noise level and is therefore very any additional in band noise impacts the service reliability.

V. Conclusion

The allowable out-of-band emissions limit for the Bluetooth transceiver in the SDARS band of operation should be reduced to at –100dBW over a 2 MHz measurement interval. This would allow co-location of Bluetooth transceivers and SDARS receivers within one meter of each

other. This analysis has assumed that 6db of attenuation will be realized from the car roof. When we reduce the interfering level by 6 dB, the signal level then becomes 6dB below the DARS receiver noise floor.

Exhibit B

Comsearch Study

RADIO FREQUENCY INTERFERENCE (RFI) MEASUREMENT REPORT

Prepared For

XM Radio
Washington, DC

February 2002

19700 Janelia Farm Blvd. Ashburn, Virginia USA 703-726-5500

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SECTION

ONE

SECTION 1

INTRODUCTION AND BACKGROUND

1.1 Introduction

Radio Frequency Interference (RFI) measurements were performed for XM Radio between the dates of January 16, 2001 and January 21, 2002 at various points in the surrounding Washington, DC area. The purpose of these measurements was to determine the relative RFI levels in the DARS frequency band from 2320-2345 MHz especially from systems operating in adjacent bands and other spurious emissions. These adjacent bands include the ISM band (2400-2483.5 MHz) and the WCS bands (2300-2320 and 2345-2365 MHz). Measurements were performed at eight different locations, which were classified as urban, suburban, or rural. The purpose of this report is to document the results of the measurements that were performed and to characterize the electromagnetic environment in the DARS band and to then compare the results to measurements performed by Comsearch in the DARS band previously.

The previous measurement activity and the reports is:

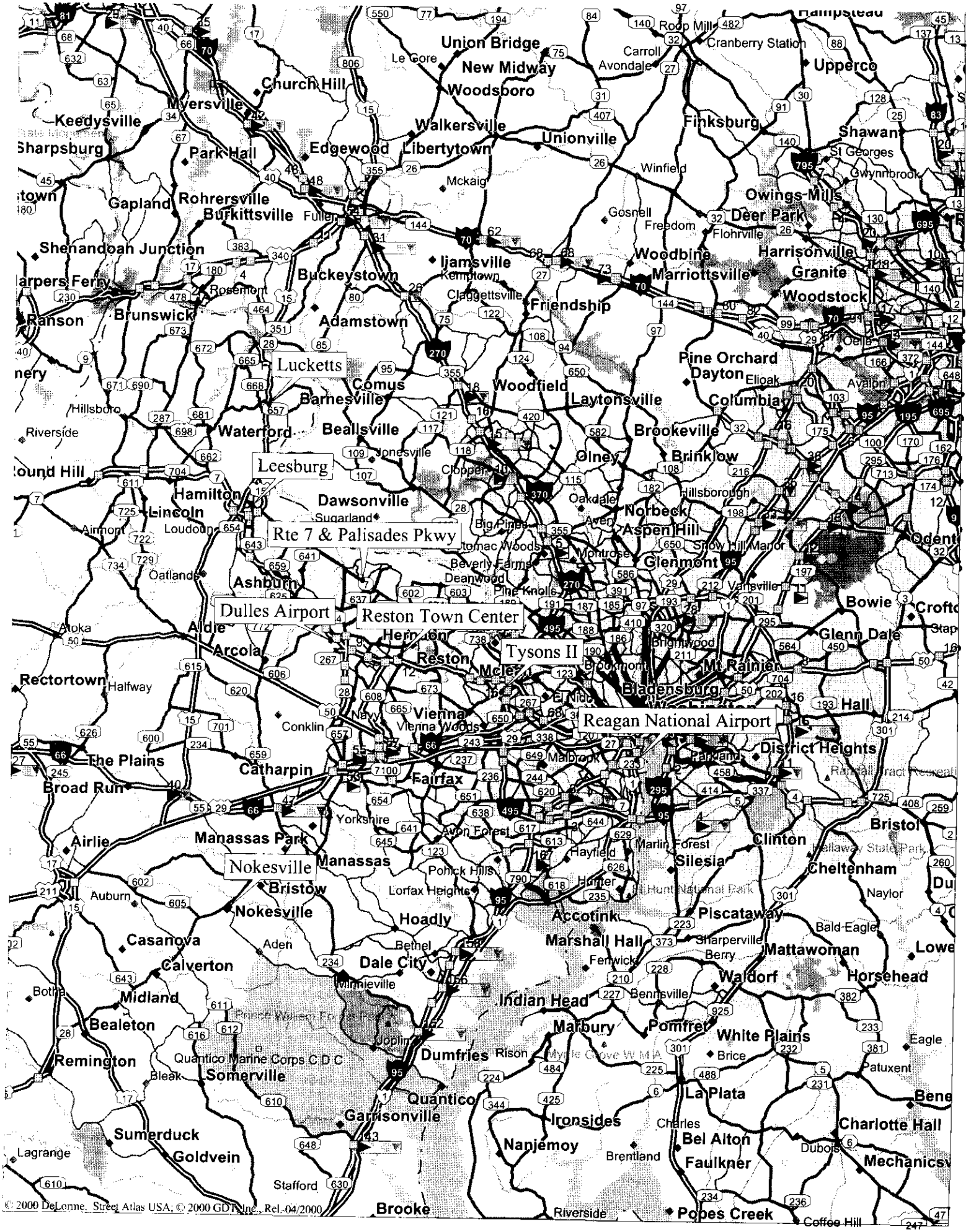
Survey of the XM Radio Electromagnetic Spectrum in the Northern Virginia Metropolitan Area, October 9 - October 29, 2000

- Frequency Range Considered: 2300 to 2500 MHz
- Type of Reception: Digital
- Measured Antenna Center Line: 10 Feet

1.2 Background

XM Radio contacted Comsearch to perform interference measurements in the DARS frequency band from 2320- 2345 MHz. Measurements were requested across the WCS and ISM Bands (2300-2483.5) MHz. Measurements were conducted in various settings to include urban, suburban, and rural environments.

The measured sites are identified on a portion of a map shown on the following page.


Lucketts
Leesburg
Rte 7 & Palisades Pkwy
Dulles Airport
Reston Town Center
Tysons II
Reagan National Airport
Nokesville
Union Bridge
New Midway
Woodsboro
Walkersville
Libertytown
Unionville
Finksburg
Shawan
Upperco
Church Hill
Myersville
Keedysville
Sharpsburg
Park Hall
Edgewood
Gapland
Rohrersville
Burkittsville
Shenandoah Junction
Harpers Ferry
Brunswick
Ranson
Buckeystown
Adamstown
Ijamsville
Friendship
Woodbine
Marriottsville
Granite
Woodstock
Harrisonville
Owings Mills
Deer Park
Pine Orchard
Dayton
Columbia
Comus
Barnesville
Beallsville
Waterford
Woodfield
Laytonsville
Brookeville
Olney
Brinklow
Hamilton
Lincoln
Dawsonville
Norbeck
Aspen Hill
Glenmont
Ashburn
Aldie
Arcola
Reston
Herndon
McLean
Bladensburg
Mt Rainier
Bowie
Glenn Dale
Rectortown
Vienna
Fairfax
Catharpin
The Plains
Broad Run
Manassas Park
Manassas
Airlie
Bristow
Nokesville
Hoadly
Accotink
Marshall Hall
Piscataway
Mattawoman
Waldorf
Horsehead
Casanova
Calverton
Dale City
Midland
Bealeton
Remington
Somerville
Quantico
Dumfries
Garrisonville
Sumerduck
Goldvein
Indian Head
Marbury
Pomfret
White Plains
La Plata
Ironsides
Nanjemoy
Bel Alton
Faulkner
Charlotte Hall
Mechanicsville
Popes Creek
Brooke
Stafford
Lagrange
Clinton
Silesia
District Heights
Cheltenham
Bristol
Hillsboro
Riverside
Round Hill
Airmont
Oatlands
Atoka
Halfway
Conklin
Yorkshire
Auburn
Aden
Bethel
Winnifield
Bothe
Bleak
Quantico Marine Corps C D C
Rison
Brentland
Charles
Dubois
Naylor
Bald Eagle
Sharpsville
Berry
Benedict
Eagle
Patuxent
Brice
Coffee Hill
Gwynnbrook
St Georges
Winfield
Mckaig
Gosnell
Freedom
Flohrville
Kemptown
Claggettsville
Jonesville
Clopper
Oakdale
Avery
Big Pines
Potomac Woods
Montrose
Beverly Farms
Deanwood
Pine Knolls
Snow Hill Manor
Vansville
Brightwood
Brookmont
Navy
Vienna Woods
Malbrook
Parkland
Avon Forest
Marlin Forest
Hayfield
Pohick Hills
Lorfax Heights
Hunter
Fernwick
Bennsville
Myrtle Grove W M A
Hunt National Park
Ellicott
Elioak
Avalon
Oella
Roop Mill
Cranberry Station
Carroll
Avondale
Le Gore
Fullerton
Rosemont
Hampstead
© 2000 DeLorme, Street Atlas USA; © 2000 GDT Inc., Rel. 04/2000

1.3 Constraints

The analysis in this report is based upon the following assumptions and constraints.

- It is assumed that during the measurement period all of the 2.4 GHz transmitters were active and operating at full transmit power.

SECTION

TWO

SECTION 2

TEST PROCEDURE

2.1 Calibration

Figures 2.1-1, 2.1-2, and 2.1-3 are the block diagrams of the 2.4 GHz test set. All test equipment used was allowed a proper warm-up period prior to calibration. The test set was calibrated by the signal substitution method, as recommended by NSMA, utilizing a synthesized signal generator. The reference signal from the signal generator was adjusted for the frequency of test (2400 MHz) and measured with a thermal power meter for calibrated reference test level (-60 dBm). This calibrated reference signal from the signal generator was then injected into the end of the coaxial cable of the test set at the point that normally connects to the test antenna. A spectrum analyzer then measured the reference test signal level after passing through the test set. Upon completion of the calibration process, a known reference level was obtained for the measurements that corresponds to a given set of spectrum analyzer display readings.

The following formula is used to transform the measured signal level as read on the spectrum analyzer display (dBm) to an isotropic reference signal level (dBW_I) as seen at the point of test:

$$dBW_I = LI - GA - 30$$

Where: dBW_I = Isotropic level in dBW

LI = Level (dBm) of injected signal

GA = Test antenna gain (17.5 dBm at 2.4 GHz)

-30 = Conversion factor from dBm to dBW

at 2.4 GHz: $dBW_I = -60\ dBm - 17.5\ dB - 30\ dB$

$= -107.5\ dBW_I$

In this instance, the spectrum analyzer displayed measured signal level of -60 dBm equates to an isotropic signal level of $-107.5\ dBW_I$.

Figures 2.1-2A, 2.1-2B, and 2.1-3A display the spectrum photographs of the described calibration procedure employed during measurements using various filter arrangements.

Figure 2.1-3B shows the output of a –10 dBm signal swept across two notch filters which

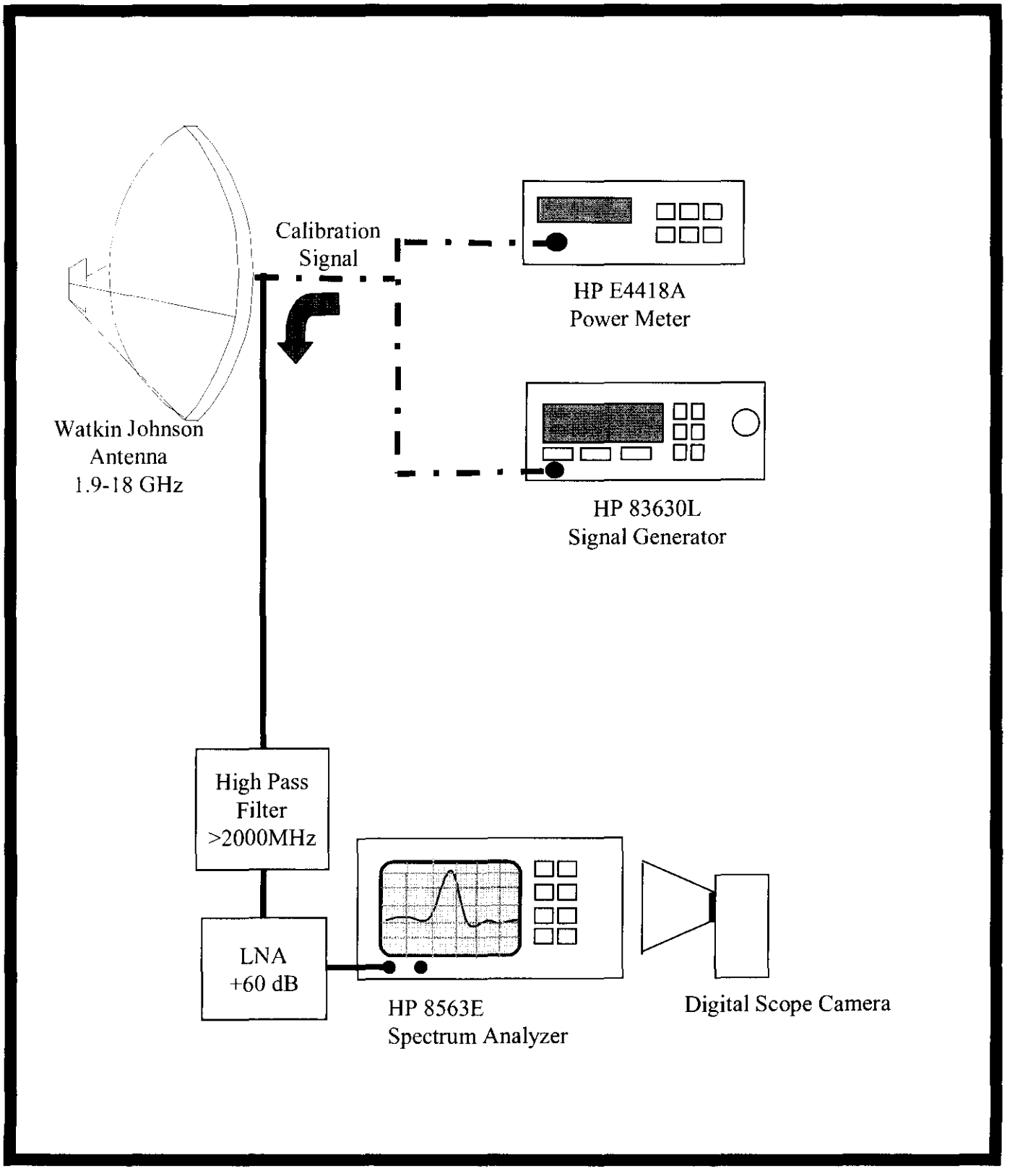


Figure 2.1-1 Test Equipment Block Diagram

COMSEARCH

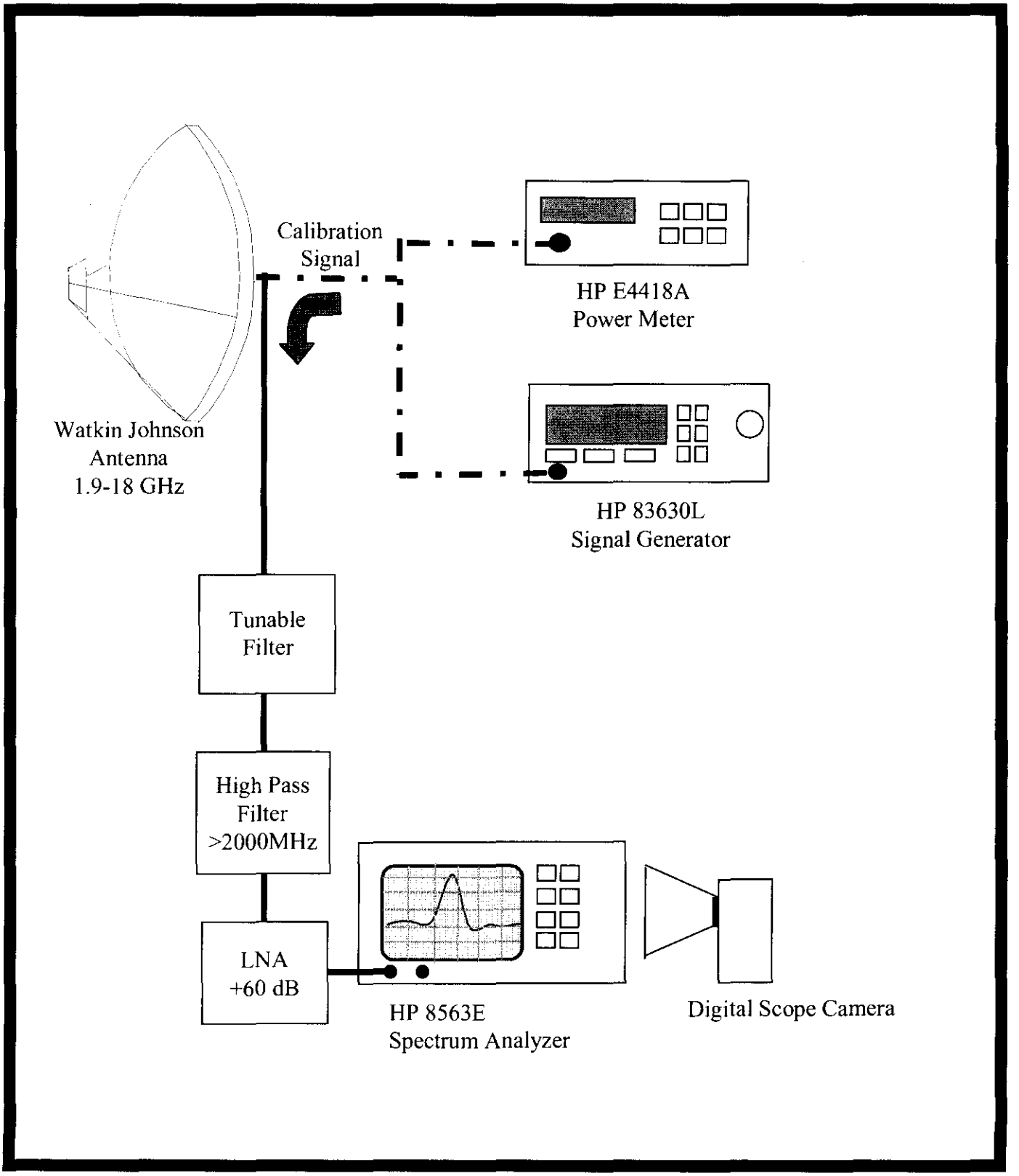


Figure 2.1-2 Test Equipment Block Diagram

COMSEARCH

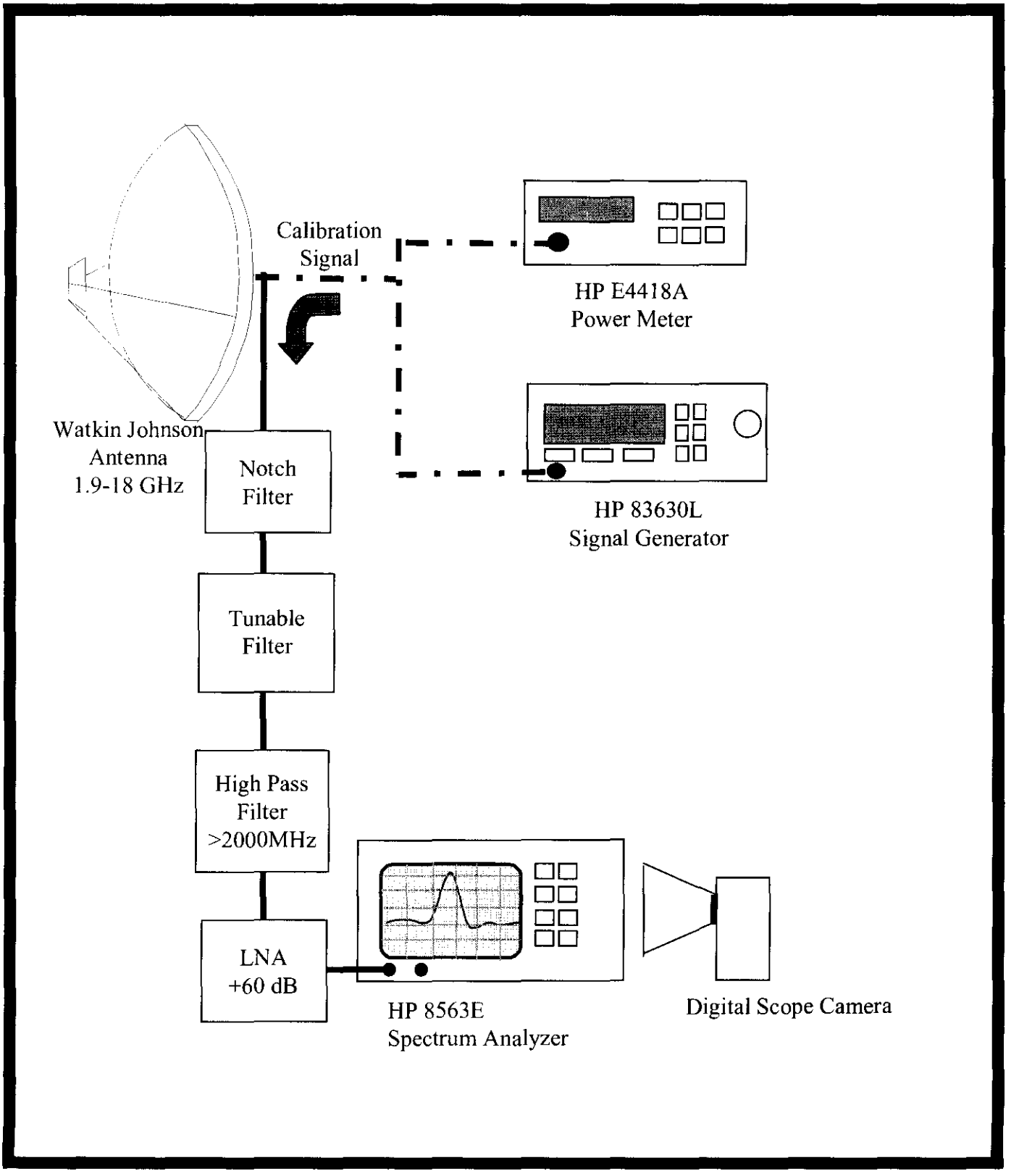


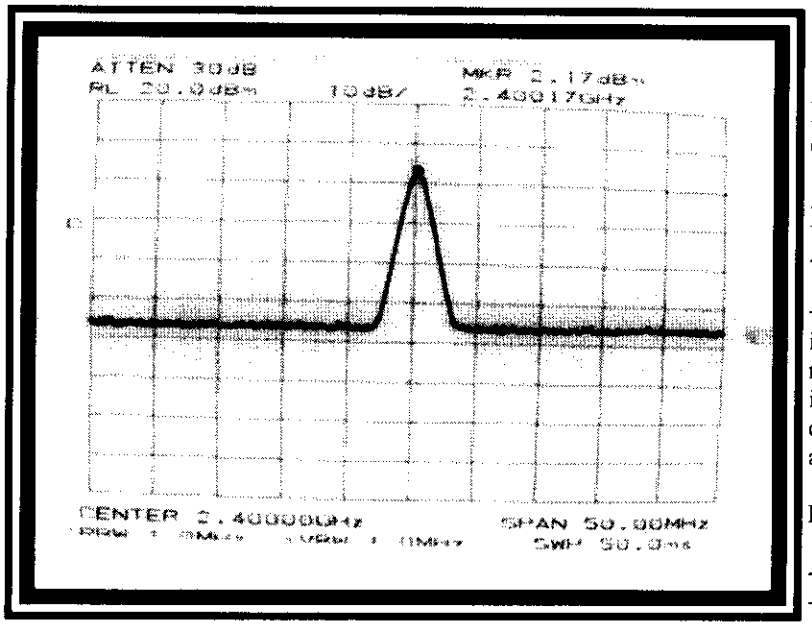
Figure 2.1-3 Test Equipment Block Diagram

COMSEARCH

Reference Level dBW_I

XM Radio

-89.5



High-Pass Filter

Date: January 16, 2002
Center Freq: 2400 MHz
Span/Div: 50 MHz
Res. Bandwidth: 1 MHz
Amplitude/Div: 10 dB

+2.17 dBm, 2400 MHz signal indication on the spectrum photograph represents a -60 dBm signal being injected at the point where the test cable connects to the output of the test antenna.

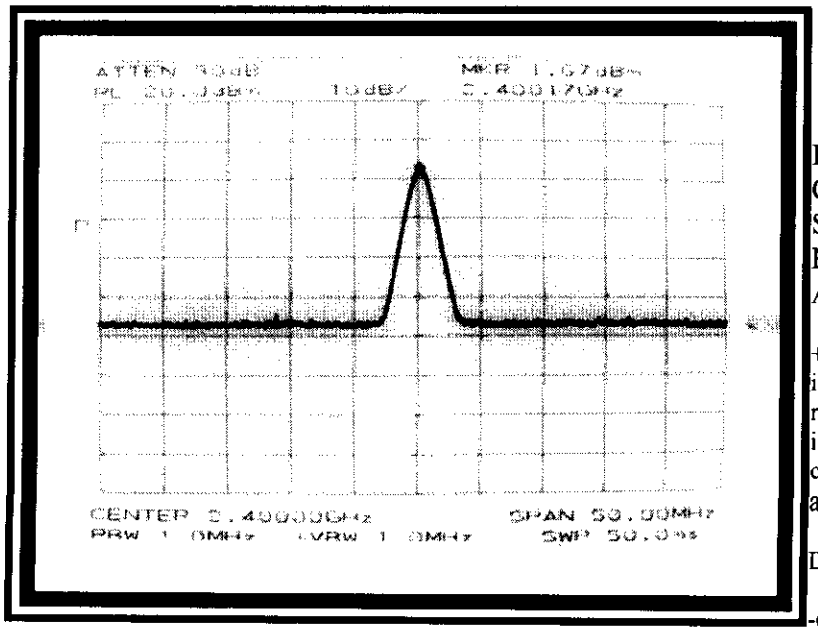
Displayed reference level is equal:

-60 dBm injected signal
-17.5 dB antenna gain
-30 dB conversion from dBm to dBW
-107.5 dBW_I; therefore, a displayed signal level of +20 dBm equals an isotropic level of –89.5 dBW_I.

(A)

Reference Level dBW_I

-89



High-Pass and Tunable Filters

Date: January 16, 2002
Center Freq: 2400 MHz
Span/Div: 50 MHz
Res. Bandwidth: 1 MHz
Amplitude/Div: 10 dB

+1.67 dBm, 2400 MHz signal indication on the spectrum photograph represents a -60 dBm signal being injected at the point where the test cable connects to the output of the test antenna.

Displayed reference level is equal:

-60 dBm injected signal
-17.5 dB antenna gain
-30 dB conversion from dBm to dBW
-107.5 dBW_I; therefore, a displayed signal level of +20 dBm equals an isotropic level of -89 dBW_I.

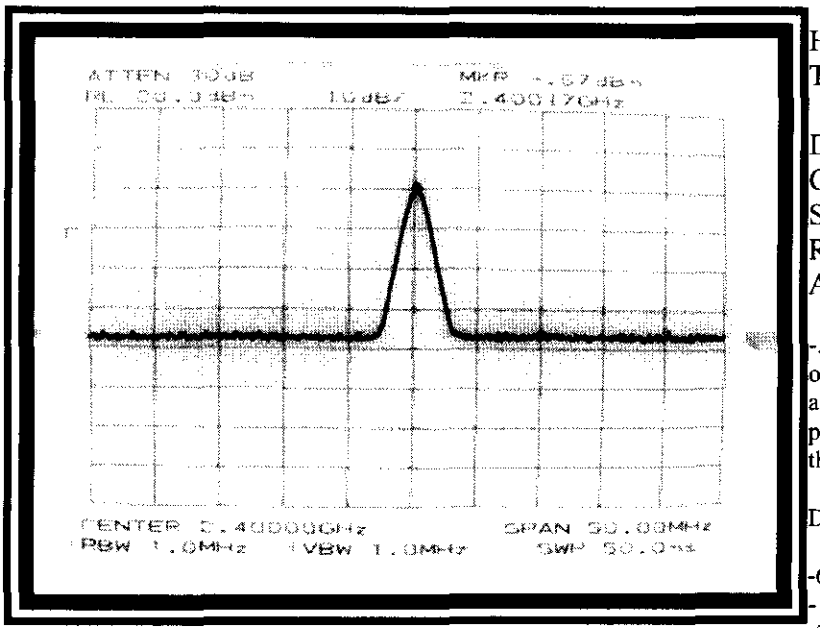
(B)

Figure 2.1-2 RF Calibration Photographs

Reference
Level
dBW_I

XM Radio

-87



High-Pass, Notch Filter and Tunable Filter

Date: January 16, 2002
Center Freq: 2400 MHz
Span/Div: 50 MHz
Res. Bandwidth: 1 MHz
Amplitude/Div: 10 dB

-.67 dBm, 2400 MHz signal indication on the spectrum photograph represents a -60 dBm signal being injected at the point where the test cable connects to the output of the test antenna.

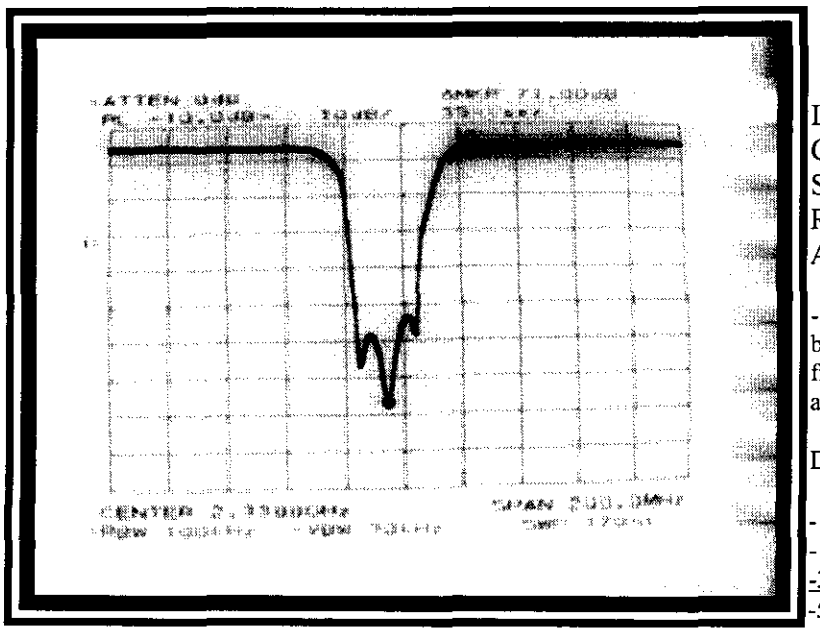
Displayed reference level is equal:

-60 dBm injected signal
-17.5 dB antenna gain
-30 dB conversion from dBm to dBW
-107.5 dBW_I; therefore, a displayed signal level of +20 dBm equals an isotropic level of -87 dBW_I.

(A)

Reference
Level
dBW_I

-52.5



Date: January 16, 2002
Center Freq: 2338 MHz
Span/Div: 200 MHz
Res. Bandwidth: 100 MHz
Amplitude/Div: 10 dB

-10 dBm, signal swept through entire band. Showing 71dB of difference from top signal to maximum attenuation of filters

Displayed reference level is equal:

-10 dBm injected signal
-17.5 dB antenna gain
-30 dB conversion from dBm to dBW
-57.5 dBW_I

(B)

Figure 2.1-3 RF Calibration Photographs

SECTION

THREE

SECTION 3.1

Reagan National Airport

SECTION 3.1

DATA PRESENTATION

The following section contains the tables, site photos, and spectrum photos pertaining to the site location measured.

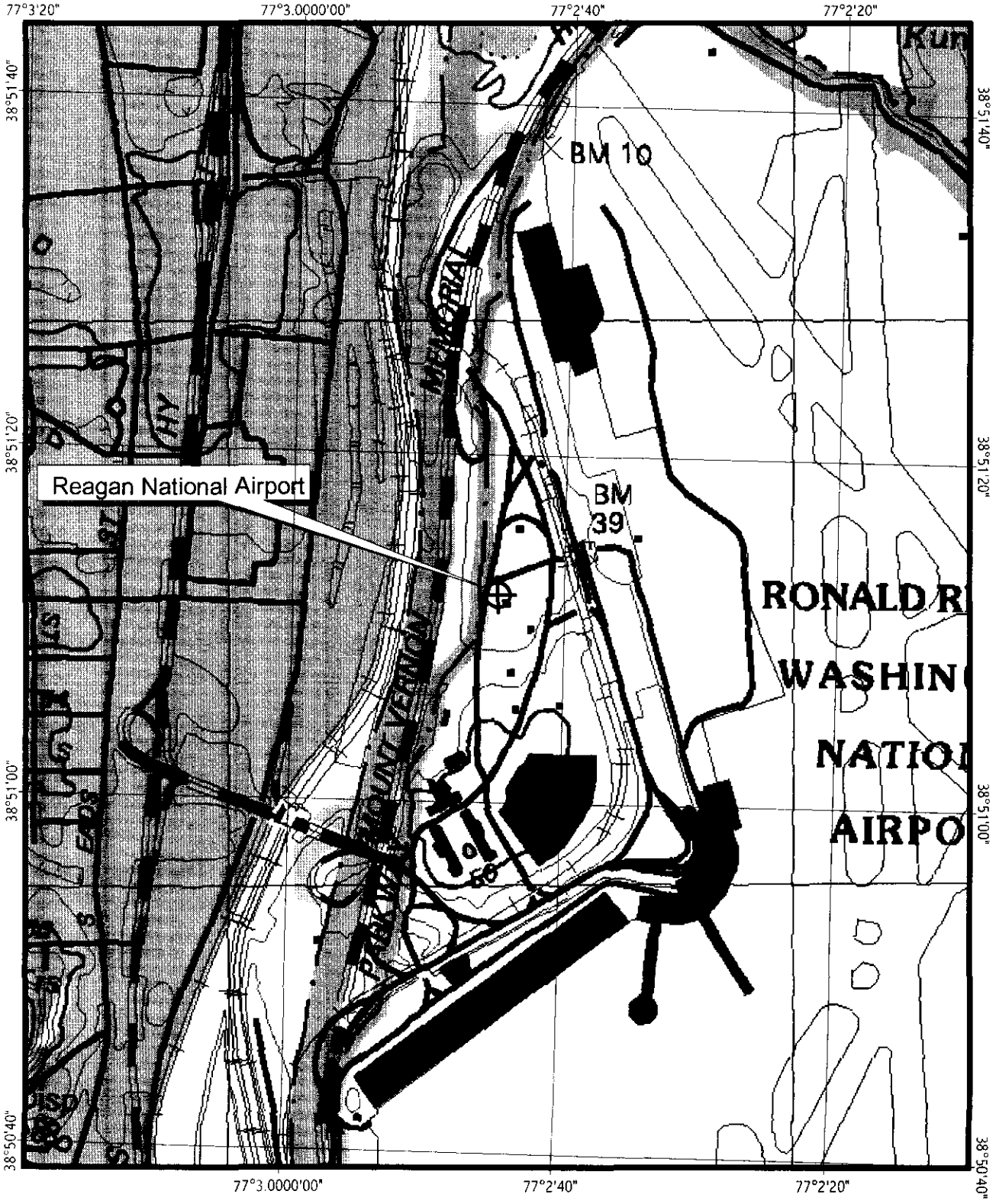
3.1 XM Radio – Reagan National Airport

- Table 3.1-1 presents a site data sheet including all pertinent site information.
- Figure 3.1-1 contains topographic map denoting the test location throughout the measurements.
- Figures 3.1-2 are the photographs depicting the test site.
- Figures 3.1-3 through 3.1-5 are the RF spectrum photographs depicting the interference environment at the test site.

TABLE 3.1-1

MEASUREMENT SITE DATA SHEET

1. SYSTEM NAME:	XM Radio
2. CITY AND STATE:	Arlington, VA
3. SITE IDENTIFICATION:	Reagan National Airport
4. COORDINATES: (NAD 1983)	LATITUDE: 38° 51' 12.6" N LONGITUDE: 77° 02' 44.8"W
5. SITE TYPE:	Urban
6. MEASUREMENT DATES & TIMES:	January 16, 2002 1300-1700 January 18, 2002 1000-1200

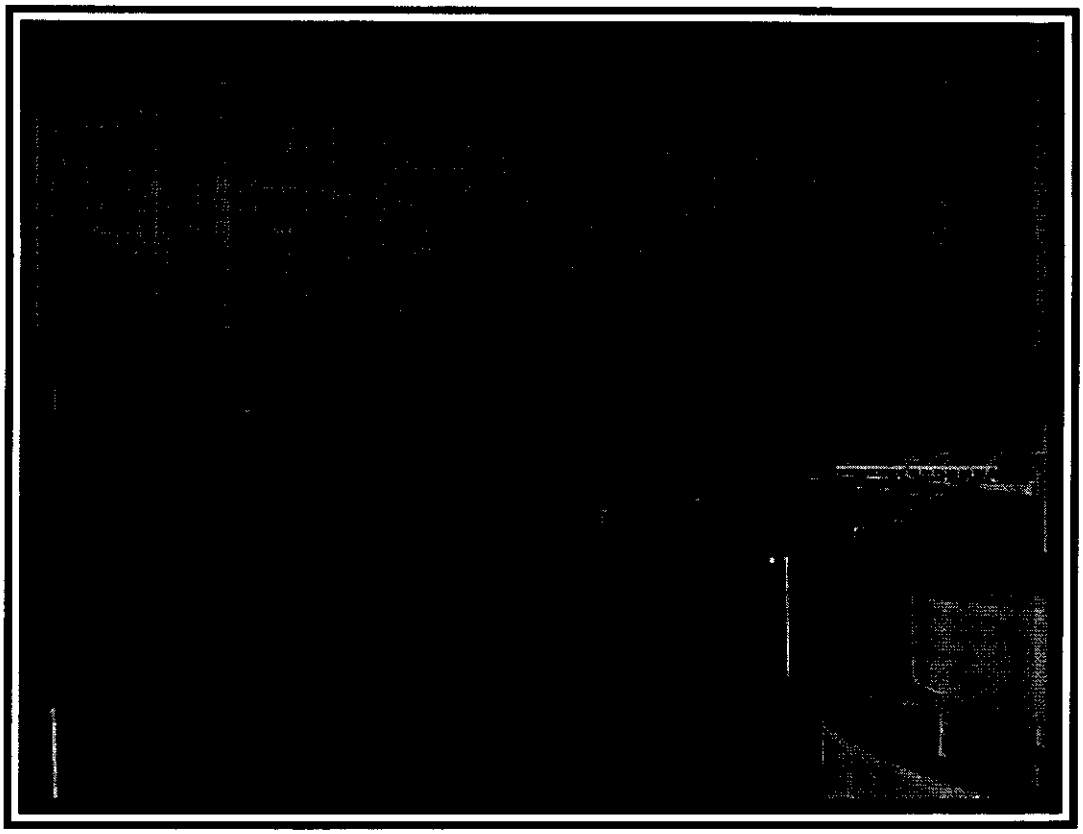


XM RADIO

FIGURE 3.1-1

COMSEARCH

North



East

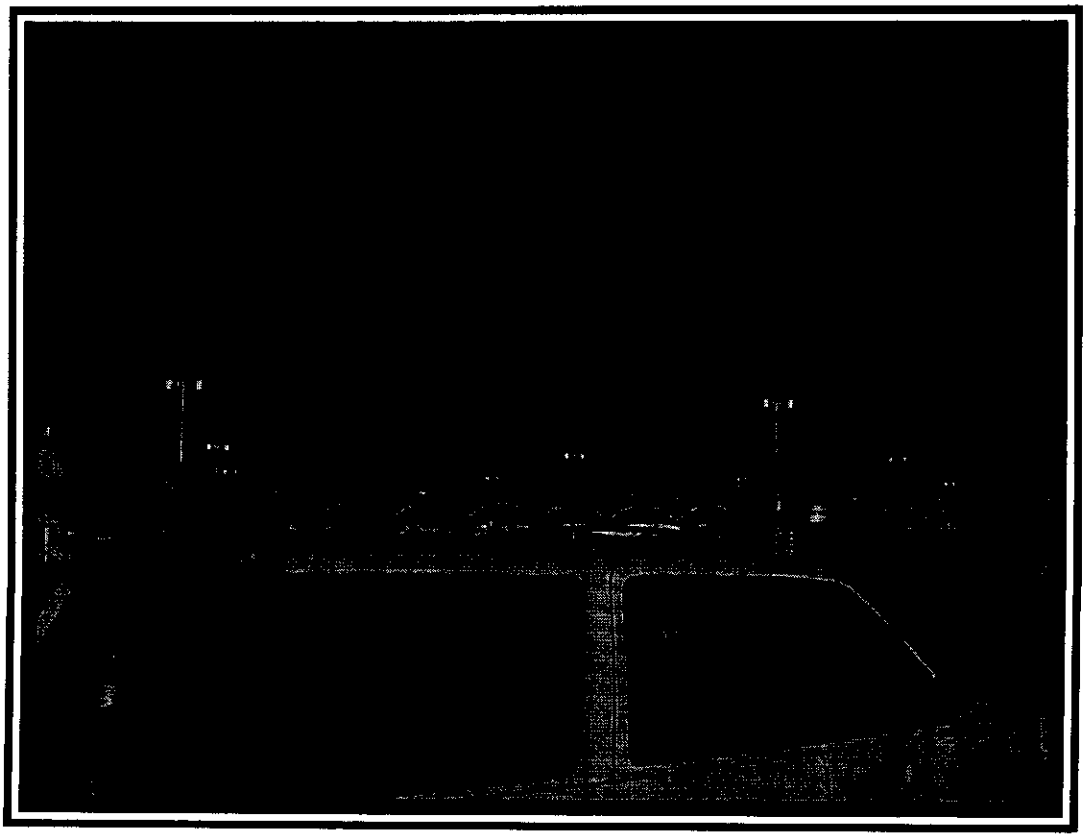
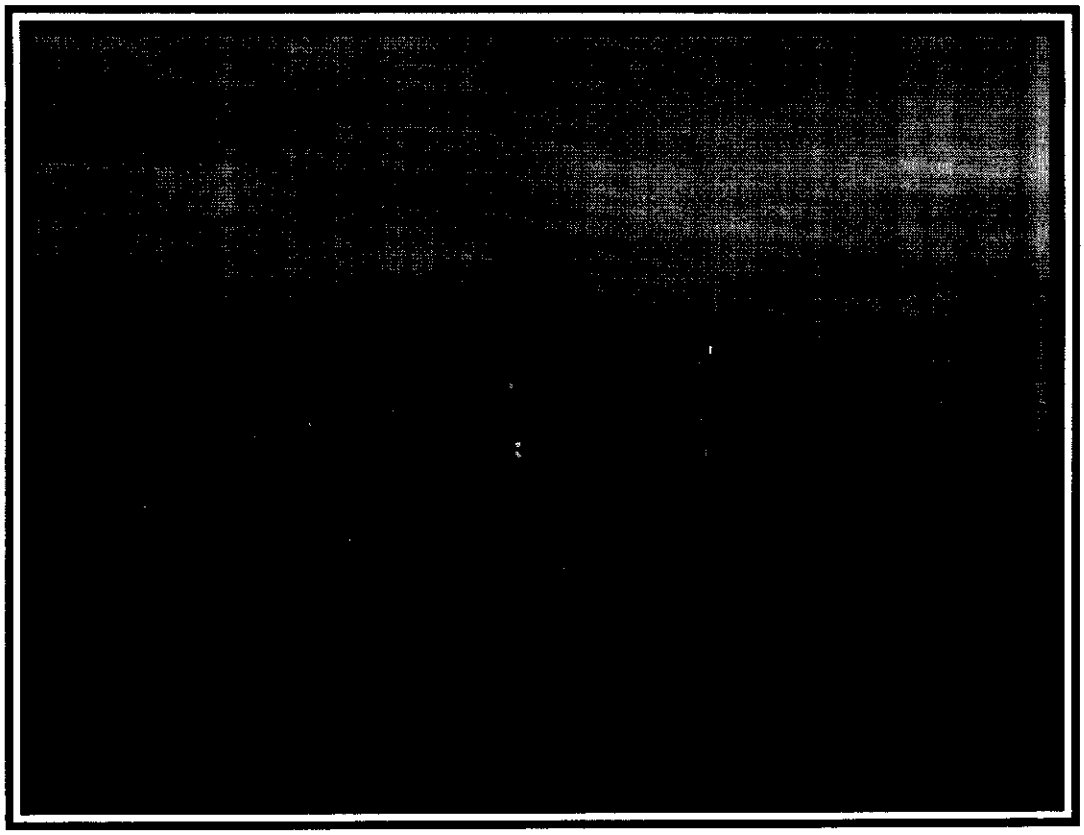


Figure 3.1-2 Measurement Site Photographs

South



West

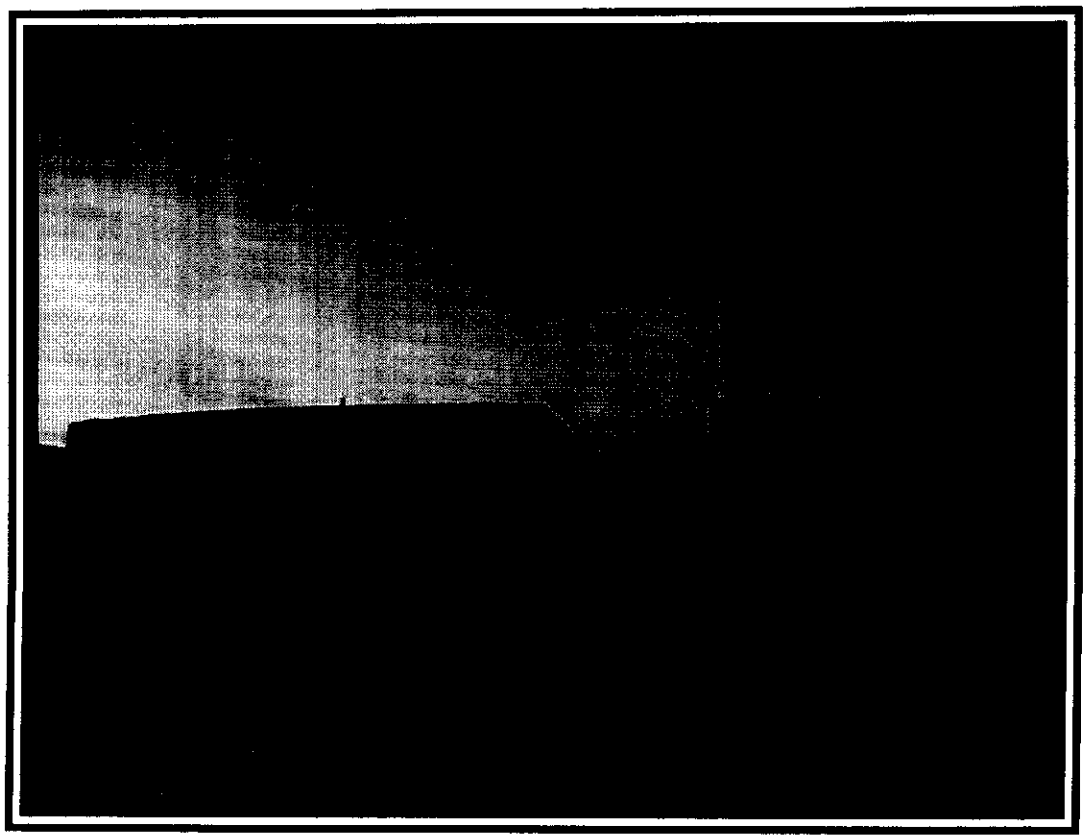
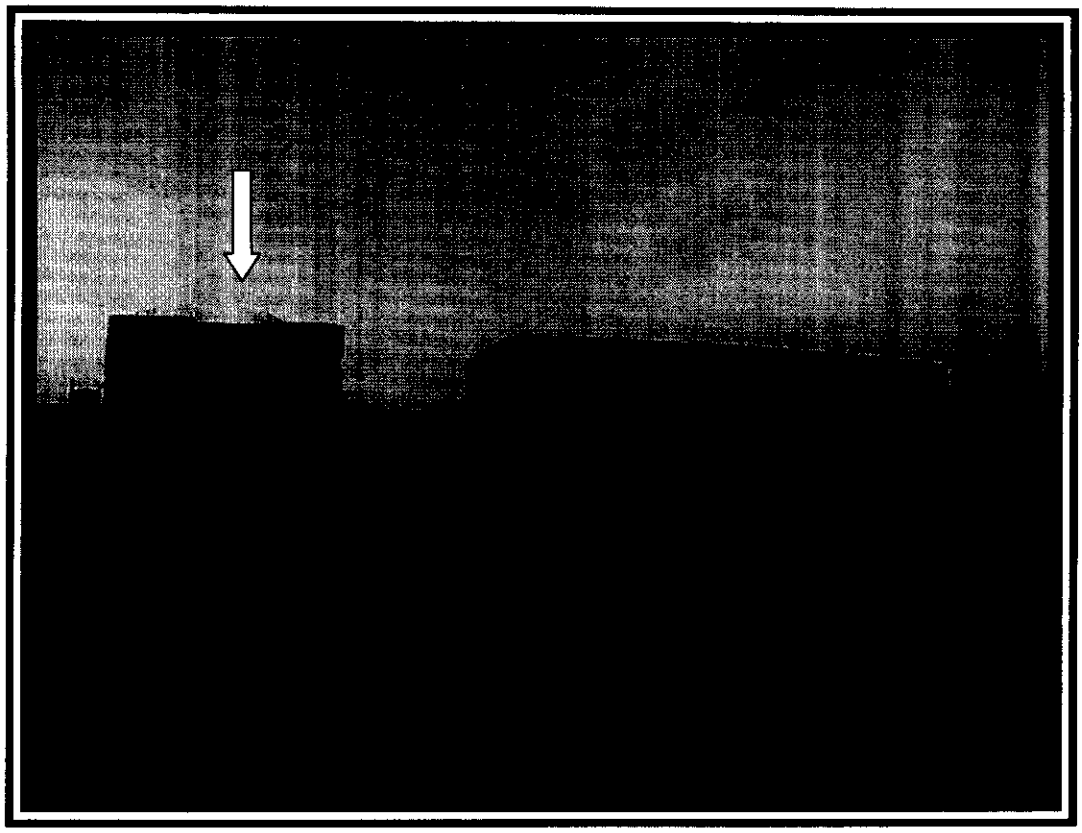


Figure 3.1-2 (cont.) Measurement Site Photographs

Az 295°



Az 358° Az 12°

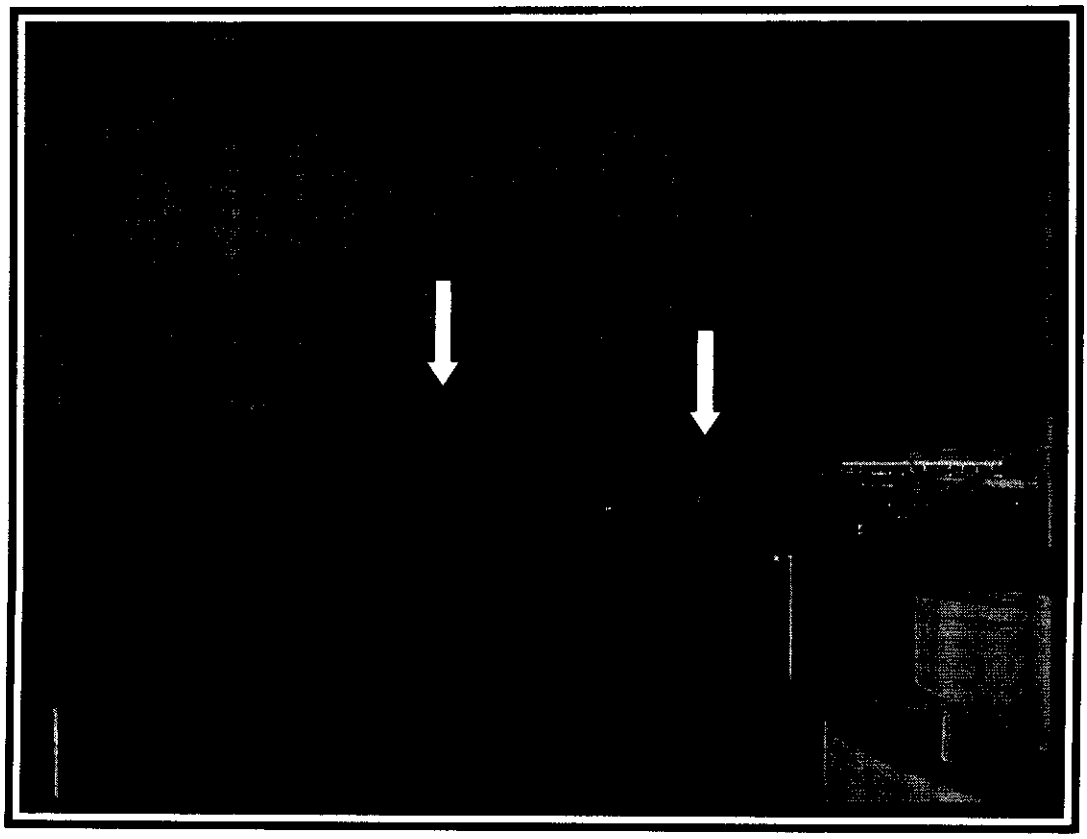


Figure 3.1- 2(cont.) Measurement Site Photographs

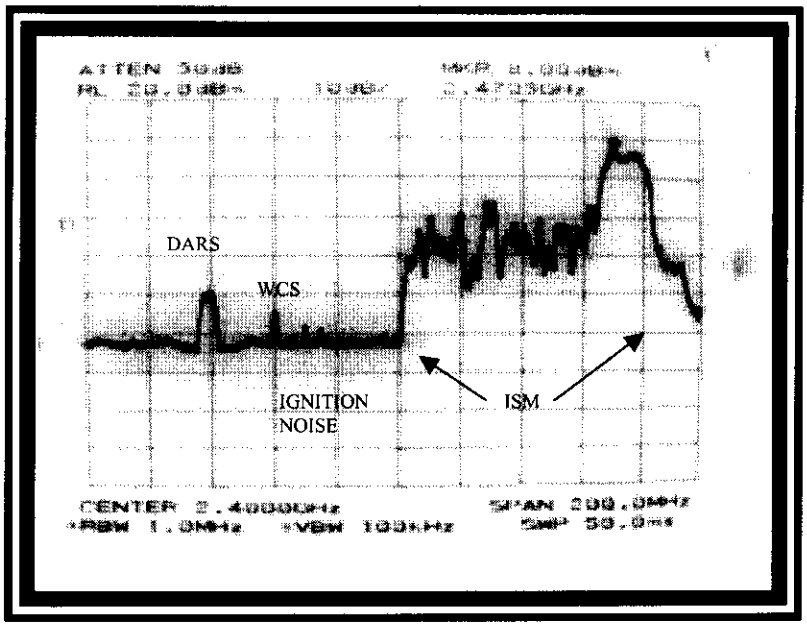
Reagan National Airport

Reference Level dBW_I

XM Radio

Azimuth 0-360°

-87



With High-Pass, Tunable and Notch Filters

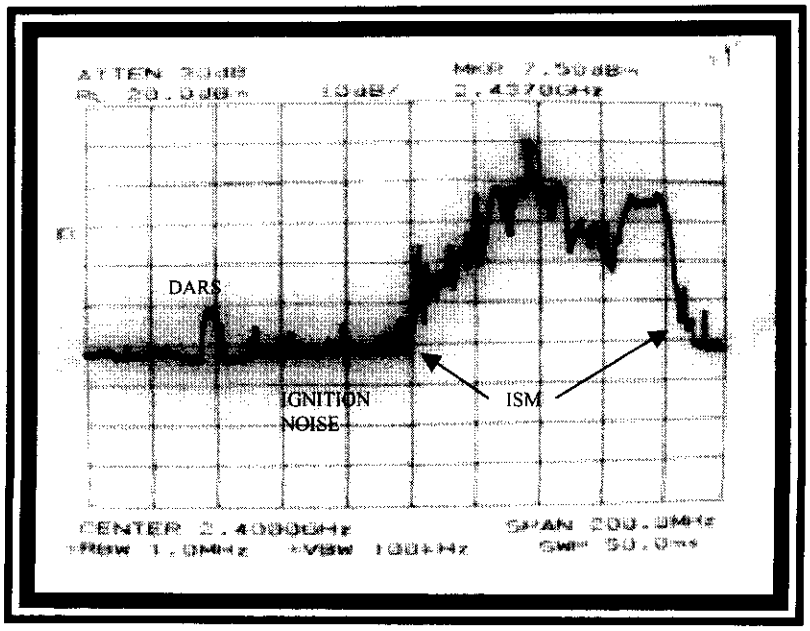
Date: January 18, 2002
Time of Day: 1100
Ant. Polarization: V
Ant. Centerline: 10 Ft.

Full Antenna Sweep

(A)

Reference Level dBW_I

-87



Date: January 18, 2002
Time of Day: 1105
Ant. Polarization: H
Ant. Centerline: 10 Ft.

Full Antenna Sweep

(B)

Figure 3.1-3 RF Spectrum Analysis

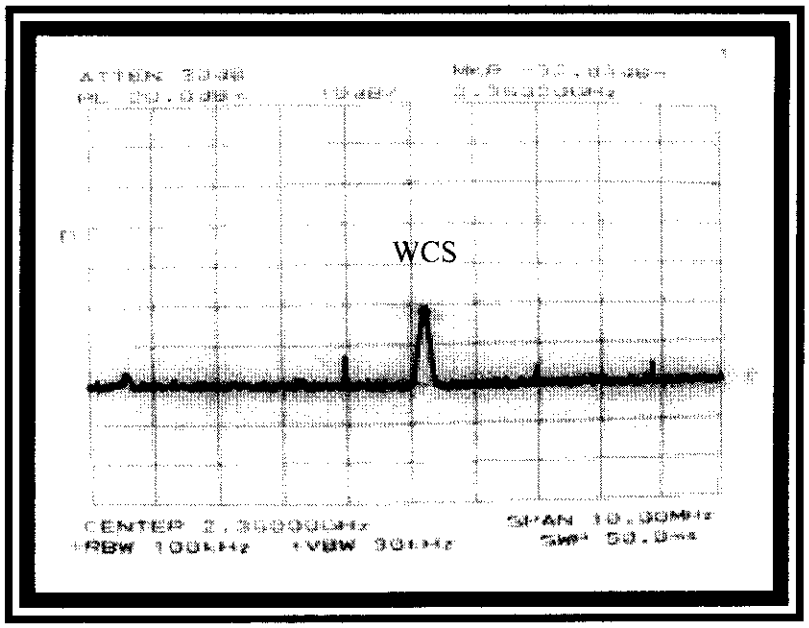
Reagan National Airport

Reference Level dBW_I

Azimuth: 12°

XM Radio

-87



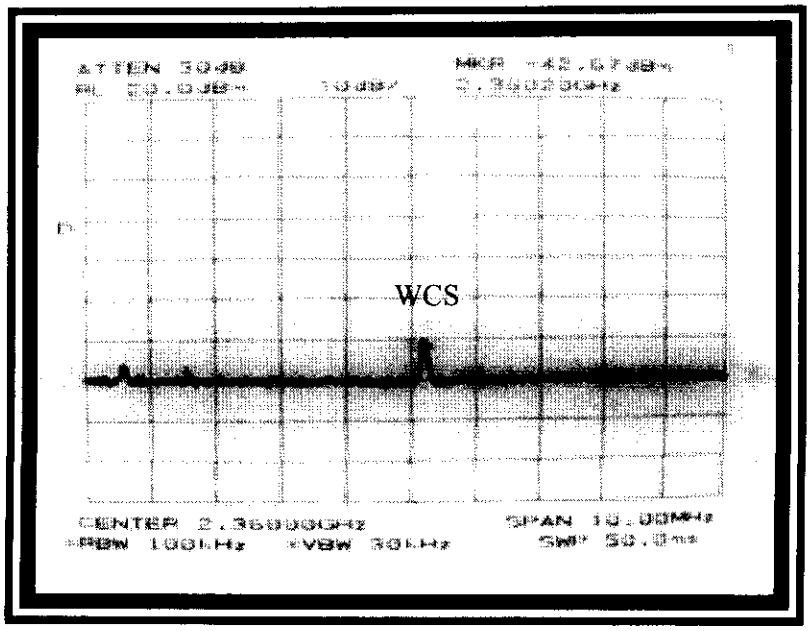
With High-Pass, Tunable and Notch Filters

Date: January 18, 2002
Time of Day: 1125
Ant. Polarization: V
Ant. Centerline: 10 Ft.

(A)

Reference Level dBW_I

-87



Date: January 18, 2002
Time of Day: 1130
Ant. Polarization: H
Ant. Centerline: 10 Ft.

(B)

Figure 3.1-4 RF Spectrum Analysis

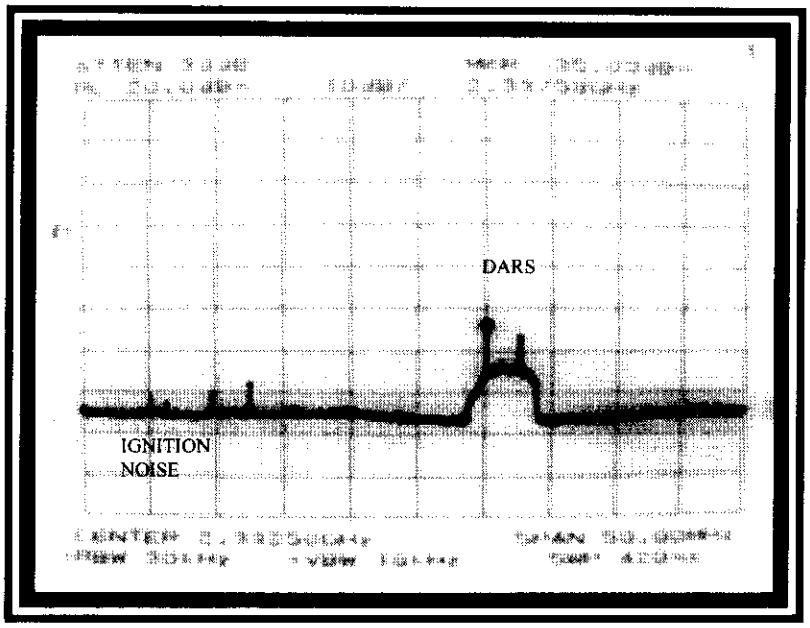
Reagan National Airport

Reference Level dBW_I

XM Radio

Azimuth 358°

-87



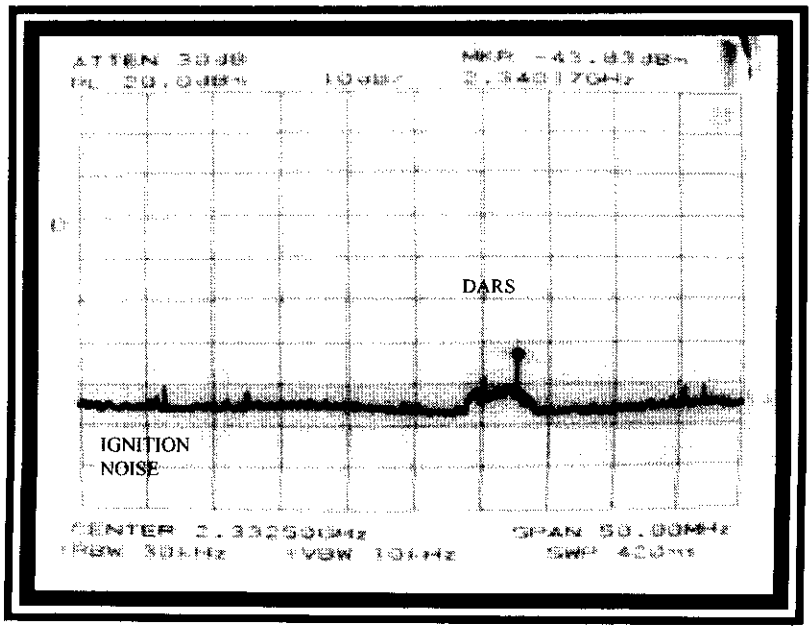
With High-Pass, Tunable and Notch Filters

Date: January 18, 2002
Time of Day: 1140
Ant. Polarization: V
Ant. Centerline: 10 Ft.

(A)

Reference Level dBW_I

-87



Date: January 18, 2002
Time of Day: 1145
Ant. Polarization: H
Ant. Centerline: 10 Ft.

(B)

Figure 3.1-5 RF Spectrum Analysis