



SIGNALHAWK™  
PC AND RACK MOUNT MODELS

OPERATION MANUAL

MODEL SH-36S-PC  
MODEL SH-36S-RM

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INSTRUCTION BOOK PART NUMBER 920-SHPC-OPS REV. F  
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# Safety Precautions

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The following are general safety precautions that are not necessarily related to any specific part or procedure, and do not necessarily appear elsewhere in this publication. These precautions must be thoroughly understood and apply to all phases of operation and maintenance.

**WARNING**

**Keep Away From Live Circuits**

Operating Personnel must at all times observe general safety precautions. Do not replace components or make adjustments to the inside of the test equipment with the high voltage supply turned on. To avoid casualties, always remove power.

**WARNING**

**Shock Hazard**

Do not attempt to remove the RF transmission line while RF power is present.

**WARNING**

**Do Not Service Or Adjust Alone**

Under no circumstances should any person reach into an enclosure for the purpose of service or adjustment of equipment except in the presence of someone who is capable of rendering aid.

**WARNING**

**Safety Earth Ground**

An interruptible earth safety ground must be supplied from the main power source to test instruments. Grounding one conductor of a two conductor power cable is not sufficient protection. Serious injury or death can occur if this grounding is not properly supplied.

**WARNING**

**Resuscitation**

Personnel working with or near high voltages should be familiar with modern methods of resuscitation.

**WARNING**

**Remove Power**

Observe general safety precautions. Do not open the instrument with the power on.

## Safety Symbols

### WARNING

Warning notes call attention to a procedure, which if not correctly performed, could result in personal injury.

### CAUTION

Caution notes call attention to a procedure, which if not correctly performed, could result in damage to the instrument.

**Note:** *Calls attention to supplemental information.*

## Warning Statements

The following safety warnings appear in the text where there is danger to operating and maintenance personnel, and are repeated here for emphasis.

### WARNING

When using the AC adapter, connect the AC plug only to a properly grounded receptacle. Serious injury or death can occur if not properly grounded.

See page 5.

### WARNING

Care should be taken when handling batteries.

Keep out of the reach of children.

Do not heat or dispose of batteries in fire. May burst or release toxic materials.

Avoid forced discharge.

Do not short circuit.

Restrict charging current and time to the recommended value.

Do not solder the battery directly.

Do not disassemble, apply excessive pressure, or deform.

Avoid placing the battery in reverse polarity.

Battery disposal method should be in accordance with local and state regulations.

See page 78.

## Caution Statements

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The following equipment cautions appear in the text and are repeated here for emphasis.

**CAUTION**

Do not block the fan's airflow to prevent overheating.

See page 4.

**CAUTION**

Spectrum Analyzer has a +20 dBm (100 mW) max. RF input. Exceeding the maximum input will damage the SignalHawk. If unsure of power levels, measure the test connection with a power sensor before using the SignalHawk.

See pages 7 and 21.

**CAUTION**

Avoid installing the SignalHawk near equipment that exhausts or radiates excessive heat (such as power amplifiers or DC power supplies). Proper ventilation should always be considered as part of the installation location.

See page 12.

**CAUTION**

Harsh or abrasive detergents, and some solvents, can damage the display unit and information on the labels.

See page 77.

## **Safety Statements**

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### **USAGE**

ANY USE OF THIS INSTRUMENT IN A MANNER NOT SPECIFIED BY THE MANUFACTURER MAY IMPAIR THE INSTRUMENT'S SAFETY PROTECTION.

### **USO**

EL USO DE ESTE INSTRUMENTO DE MANERA NO ESPECIFICADA POR EL FABRICANTE, PUEDE ANULAR LA PROTECCIÓN DE SEGURIDAD DEL INSTRUMENTO.

### **BENUTZUNG**

WIRD DAS GERÄT AUF ANDERE WEISE VERWENDET ALS VOM HERSTELLER BESCHRIEBEN, KANN DIE GERÄTESICHERHEIT BEEINTRÄCHTIGT WERDEN.

### **UTILISATION**

TOUTE UTILISATION DE CET INSTRUMENT QUI N'EST PAS EXPLICITEMENT PRÉVUE PAR LE FABRICANT PEUT ENDOMMAGER LE DISPOSITIF DE PROTECTION DE L'INSTRUMENT.

### **IMPIEGO**

QUALORA QUESTO STRUMENTO VENISSE UTILIZZATO IN MODO DIVERSO DA COME SPECIFICATO DAL PRODUTTORE LA PROZIONE DI SICUREZZA POTREBBE VENIRNE COMPROMESSA.

## **SERVICE**

SERVICING INSTRUCTIONS ARE FOR USE BY SERVICE - TRAINED PERSONNEL ONLY. TO AVOID DANGEROUS ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING UNLESS QUALIFIED TO DO SO.

## **SERVICIO**

LAS INSTRUCCIONES DE SERVICIO SON PARA USO EXCLUSIVO DEL PERSONAL DE SERVICIO CAPACITADO. PARA EVITAR EL PELIGRO DE DESCARGAS ELÉCTRICAS, NO REALICE NINGÚN SERVICIO A MENOS QUE ESTÉ CAPACITADO PARA HACERLO.

## **WARTUNG**

ANWEISUNGEN FÜR DIE WARTUNG DES GERÄTES GELTEN NUR FÜR GESCHULTES FACHPERSONAL.

ZUR VERMEIDUNG GEFÄHRLICHE, ELEKTRISCHE SCHOCKS, SIND WARTUNGSARBEITEN AUSSCHLIEßLICH VON QUALIFIZIERTEM SERVICEPERSONAL DURCHZUFÜHREN.

## **ENTRETIEN**

L'EMPLOI DES INSTRUCTIONS D'ENTRETIEN DOIT ÊTRE RÉSERVÉ AU PERSONNEL FORMÉ AUX OPÉRATIONS D'ENTRETIEN. POUR PRÉVENIR UN CHOC ÉLECTRIQUE DANGEREUX, NE PAS EFFECTUER D'ENTRETIEN SI L'ON N'A PAS ÉTÉ QUALIFIÉ POUR CE FAIRE.

## **ASSISTENZA TECNICA**

LE ISTRUZIONI RELATIVE ALL'ASSISTENZA SONO PREVISTE ESCLUSIVAMENTE PER IL PERSONALE OPPORTUNAMENTE ADDESTRATO. PER EVITARE PERICOLOSE SCOSSE ELETTRICHE NON EFFETTUARE ALCUNA RIPARAZIONE A MENO CHE QUALIFICATI A FARLA.

**UNITS ARE EQUIPPED WITH RECHARGEABLE BATTERIES.**

THESE ARE TO BE REPLACED BY AUTHORIZED SERVICE PERSONNEL ONLY!!!

**LAS UNIDADES VIENEN EQUIPADAS CON BATERIAS RECARGABLES.**

¡¡¡Y SOLAMENTE EL PERSONAL DE SERVICIO AUTORIZADO PUEDE REEMPLAZARLAS!!!

**GERÄTE SIND MIT WIEDER AUFLADBAREN BATTERIEN BESTÜCKT.**

BATTERIEN SIND NUR VON QUALIFIZIERTEM SERVICE PERSONAL AUSZUWECHSELN!!!

**CES DISPOSITIFS SONT ÉQUIPÉS DE BATTERIES RECHARGEABLES.**

SEUL LE PERSONNEL D'ENTRETIEN AUTORISÉ EST HABILITÉ À LES REMPLACER!

**LE UNITÀ SONO DOTATE DI BATTERIE RICARICABILI,**

CHE DEVONO DA COME SPECIFICATO DAL PRODUTTORE LA PROTEZIONE DI SICUREZZA POTREBBE VENIRNE COMPROMESSA.

**USE CORRECT VOLTAGE SETTING AND FUSE - SEE MANUAL.**

**UTILISER UNE TENSION ET UN FUSIBLE CORRECTS - CONSULTER LE MODE D'EMPLOI.**

**USE LA INSTALACION Y FUSIBLE DE VOLTAJE CORRECTO - VEA EL MANUAL.**

**AUSSCHLIESSLICH VORSCHRIFTSMÄSSIGE  
WECHSELSPANNUNGS-EINSTELLUNG UND SICHERUNG  
BENUTZEN - SIEHE DAZU HANDBUCH.**

**UTILIZZARE TENSIONE E FUSIBLE ADATTI - FARE RIFERIMENTO AL MANUALE.**



## About This Manual

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This manual covers the operating and maintenance instructions for the following models:

SH-36S-PC

SH-36S-RM

## Changes to this Manual

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We have made every effort to ensure this manual is accurate. If you discover any errors, or if you have suggestions for improving this manual, please send your comments to our Solon, Ohio factory. This manual may be periodically updated. When inquiring about updates to this manual refer to the part number and revision on the title page.

## Chapter Layout

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**Introduction** — Describes the features of the Bird SignalHawk, lists equipment supplied and optional equipment, and provides power-up instructions.

**Settings** — Describes how to connect SignalHawk to the user's system, describes the spectrum analyzer measurements, and provides quick start steps for each measurement.

**Measurements** — Describes the power measurement feature, lists compatible power sensors, describes how to connect SignalHawk to the user's system, and provides quick start steps to make power measurements.

**Utilities** — Describes built-in instrument utility features and how to use them.

**Maintenance** — Lists routine maintenance tasks as well as troubleshooting for common problems. Specifications and parts information are also included.

# TABLE OF CONTENTS

<b>Safety Precautions</b> .....	<b>i</b>
Safety Symbols .....	ii
Warning Statements .....	ii
Caution Statements .....	iii
Safety Statements .....	iv
<b>About This Manual</b> .....	<b>viii</b>
Changes to this Manual .....	viii
Chapter Layout .....	viii
<b>Chapter 1 Introduction</b> .....	<b>1</b>
Items Supplied .....	2
Looking at the SignalHawk .....	3
Power Supply - PC SignalHawk .....	5
Internal Battery .....	5
Power Adapters .....	5
Charge Indicator Light .....	5
Power Supply - Rack-Mount SignalHawk .....	6
AC Power Connector .....	6
DC Supply .....	6
Spectrum Analyzer Quick Start .....	7
<b>Chapter 2 PC SignalHawk Set-Up</b> .....	<b>9</b>
Installing the SignalHawk Program .....	9
<b>Chapter 3 Rack Mount SignalHawk Set-Up</b> .....	<b>12</b>
Installing the SignalHawk into a Rack .....	12
Connecting the Rack-Mount via USB Connection .....	13
Connecting Remotely via LAN/WAN Connection .....	15
Configuring a Basic Network Connection .....	15
Connecting a Remote Computer to the Host Computer .....	19
Changing the Password on Auto Logon .....	20
<b>Chapter 4 Settings</b> .....	<b>21</b>
Getting Started with the SignalHawk .....	21
Setting Up .....	21
Start Menu, Menu Keys .....	21
Spec Analysis Menu Key .....	21
Utilities Menu Key .....	21
Help Menu Key .....	21

Setup Menu	23
Quick Save Setup	23
Label & Save Setup	24
Recall Setup	24
Recall Default Setup	24
Manage Setup Files	24
Delete	25
Delete All Setups	25
View Setup	25
View Setup	25
Recall Setup	26
Delete	26
Top of List	26
Bottom of List	26
View Next Setup	26
View Previous Setup	26
Looking At The Screen	27
Freq & Span Menu	28
Start / Stop Freq and Center / Span	29
Wheel Step	29
Full Span	29
Freq List	30
BW & Sweep Menu	31
Resolution & Video BW Modes	32
Resolution & Video BW	33
Span/RBW	33
RBW / VBW	33
Detection Mode	34
+ Peak Detection	34
- Peak Detection	34
Sample Detection	34
Average Power	34
Sweep	35
Single	36
External Trigger	36
External - Low Level / High Level / Rise Edge / Fall Edge /	
Either Edge	36
Gate Delay	36
Video	37
Gate Delay	37

- Ampt & Trace Menu ..... 38
  - Autoscale ..... 38
  - Reference ..... 38
  - Scale ..... 38
  - Attenuation ..... 38
  - Preamp ..... 39
  - Offset ..... 39
  - Units ..... 39
  - Trace ..... 39
    - Clear Write ..... 39
    - Max Hold ..... 39
    - Min Hold ..... 40
    - Average ..... 40
    - Average Readings ..... 40
    - Reset Average ..... 40
    - Water Fall Spectrogram ..... 40
- Mark & Limit Menu ..... 41
  - Select Marker ..... 41
  - Marker On / Off ..... 41
  - Marker to Max Peak ..... 41
  - Markers to Peak/Valley ..... 41
    - Markers Detect ..... 42
    - Threshold ..... 42
    - Marker to Max Peak or Marker to Min Valley ..... 42
    - Marker to Next Peak Left or Marker to Next Valley Left ..... 42
    - Marker to Next Peak Right or Marker to Next Valley Right ..... 42
    - All Markers to Max Peaks or All Markers to Min Valleys ..... 42
    - All Markers Off ..... 42
  - Marker Delta ..... 42
  - Marker Display ..... 42
    - Marker Type ..... 42
    - All Markers Type to Icon ..... 42
    - All Markers Type to Line ..... 42
    - Marker Display ..... 42
  - Marker More ..... 43
    - RSSI (Received Signal Strength Indicator) ..... 43
    - Volume ..... 43
    - Marker Freq to Center ..... 43
    - Center Freq to Marker ..... 43
    - Ref Level Ampt to Marker ..... 43

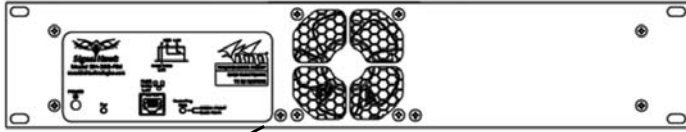
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Frequency Counter .....	43
Limit Lines .....	43
Limit Upper/Lower .....	43
Limit On/Off .....	43
Limit Alarm On/Off .....	43
Select Line/Mask .....	43
File & Help Menu .....	45
Quick Save Trace .....	45
Label & Save Trace .....	45
Log Traces .....	46
Recall Trace .....	46
Recall Trace .....	46
Recall & Compare .....	46
Clear Recalled Trace .....	46
Manage Trace Files .....	46
Delete Trace .....	46
Delete All Traces .....	46
Full Screen .....	46
Utility .....	46
Help .....	46
<b>Chapter 5 Measurements .....</b>	<b>47</b>
Spectrum Analysis Measurement .....	48
Occupied Bandwidth Measurement .....	49
Threshold Modes .....	49
% .....	49
dBc .....	49
Setting Occupied Bandwidth .....	49
Channel Power Measurement .....	51
Setting Channel Power .....	51
Adjacent Channel Power Measurement .....	53
Time Domain (Zero Span) .....	55
Field Strength Measurement .....	56
Received Signal Strength Indicator (RSSI) .....	57
Demodulate Signal .....	58
Carrier-to-Interference Ratio .....	59
Out-of-Band and In-Band, Out-of-Channel Spurious .....	61
<b>Chapter 6 Utilities .....</b>	<b>62</b>
Utility .....	62
Utility Main Menu .....	63

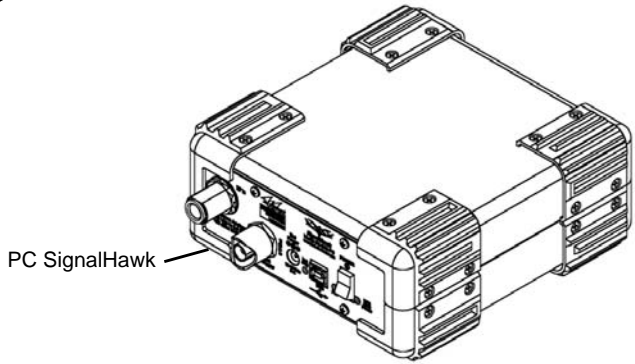
Version Info .....	63
Utility Main Menu Selections .....	63
Spectrum Analyzer Help .....	63
Custom Help .....	63
Exit to Windows .....	63
Customizing SignalHawk Content .....	63
<b>Chapter 7 PC Tool .....</b>	<b>65</b>
Computer Requirements .....	65
Installing Windows 7 Drivers for the BTG Signal Hawk .....	65
Downloading and Installing Software .....	68
Installing the PC Tool Software .....	68
Menu Bar .....	69
File .....	69
Edit .....	69
View .....	69
Tools .....	69
Measurements .....	69
Communicate .....	69
Tool Bar .....	70
Save .....	70
Open .....	70
Cut .....	70
Copy .....	70
Paste .....	70
Delete Trace .....	70
Return to Normal Mode .....	71
Zoom In .....	71
Zoom Out .....	71
Autoscale Graph .....	71
Add Markers .....	71
Add to Upper Limit Line .....	71
Add to Lower Limit Line .....	71
Delete Markers or Limit Lines .....	71
Option Dialog Box .....	71
Measurement Types .....	71
VNA Tool Bar .....	72
Match .....	72
Distance to Fault .....	72
Cable .....	72
Smith .....	72

---

Options Dialog Box	72
DTF Wizard	72
Options Dialog Box (View>Options)	73
Scale Tab	73
Units Tab	73
Markers Tab	74
Limits 1 Tab	74
Limits 2 Tab	75
Labels Tab	76
GPS	76
<b>Chapter 8 Maintenance</b>	<b>77</b>
Cleaning	77
Charging the Battery	77
Replacing the Battery on the PC SignalHawk	78
Updating the Firmware	79
Updating the Firmware on a Remote Rack Mount SignalHawk	80
Troubleshooting	82
Customer Service	83
Specifications	84
SH-36S-RM	84
Distortion & DANL	89
SH-36S-PC	89
Parts List	94
Optional Accessories	95
SH-36S-PC	95
General	95
Test Cables and Adapters	96
SH-36S-RM	97
General	97
Test Cables and Adapters	97
ROHS	98
<b>Appendix 1 Menu Maps</b>	<b>99</b>
Spectrum Analyzer Menu Maps	99
Setup Function Menu Maps	106
<b>Appendix 2 Software License Terms</b>	<b>107</b>
MICROSOFT SOFTWARE LICENSE TERMS WINDOWS 7 PROFESSIONAL	107
LIMITED WARRANTY	120



Rack-Mount  
SignalHawk



PC SignalHawk

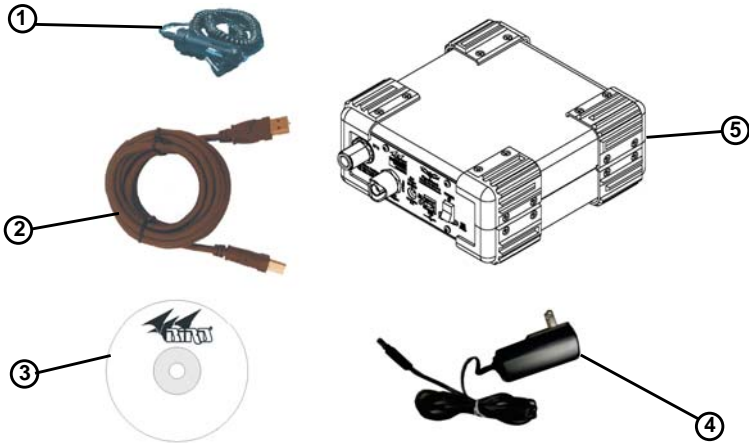
The SignalHawk is a multifunction test instrument for use in the installation and maintenance of Radio Frequency (RF) and wireless systems. The model number is identified on the unit and also on the display screen at the end of the power-on sequence.

The firmware installed on the SignalHawk is updated on a regular basis. The operator's manual covers the most recent upgrade to the firmware up to the date listed on the manual. See "[Troubleshooting](#)" on [page 82](#).



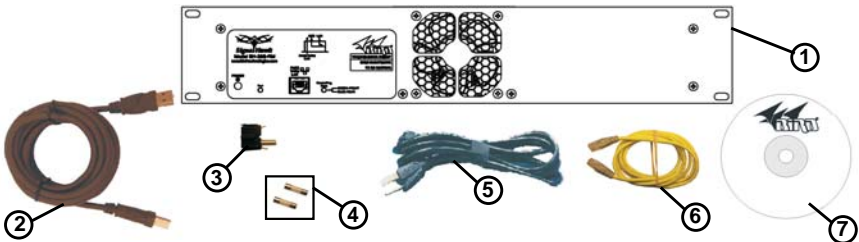
## Items Supplied

**Figure 1 SignalHawk PC Hardware and Software Supplied**



Item	Description
1	Car Adapter Cable
2	USB Cable
3	Software CD
4	AC Power Adapter and Cord
5	PC SignalHawk

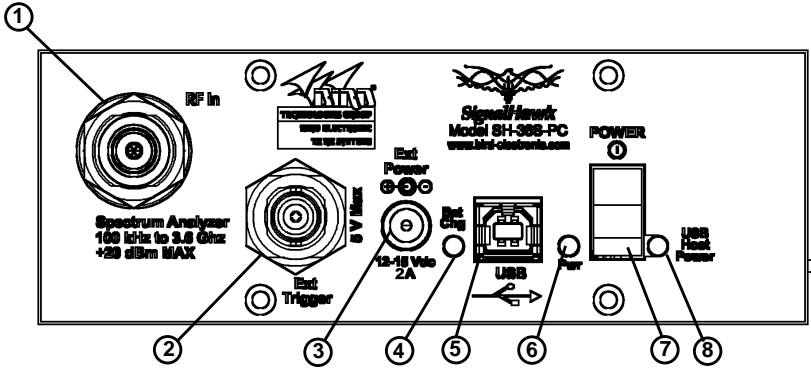
**Figure 2 SignalHawk Rack-Mount Hardware and Software Supplied**



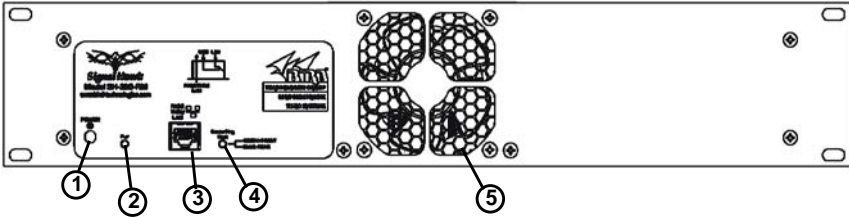
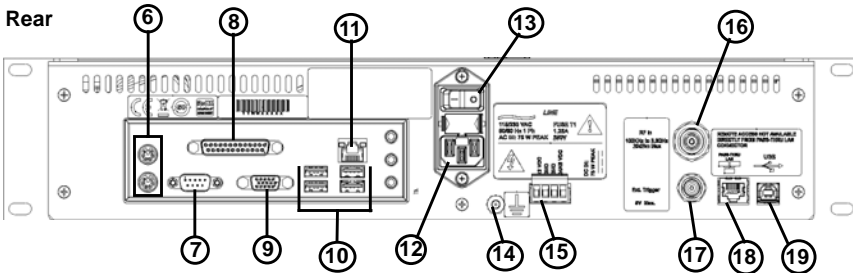
Item	Description
1	Rack-Mount SignalHawk
2	USB Cable
3	Fuse Drawer with Shorting Bar
4	2 SLO-BLO 5mm x 20mm .63A Fuses
5	AC Power Cord
6	Ethernet Cable
7	Software CD

## Looking at the SignalHawk

Figure 3 PC SignalHawk Controls and Indicators



Item	Description
1	Spectrum Analyzer Port, N(F) RF input, +20 dBm max.
2	BNC(F) external trigger input, 5V TTL
3	2.1mm DC jack for external power supplies
4	Battery Charge Indicator
5	USB Type B for PC connection
6	Charge Indicator Light
7	Power Switch
8	USB Host Power Indicator

**Figure 4 SignalHawk Rack-Mount Controls and Indicators****Front****Rear**

Item	Description
1	Power Button
2	Power Indicator
3	Pass-Thru LAN Connector
4	Host Indicator
5	Fan <div style="border: 1px solid black; padding: 5px; text-align: center;"><b>CAUTION</b> Do not block the fan's airflow to prevent overheating.</div>
6	PS/2 Keyboard/Mouse Connectors
7	RS-232 Connector
8	Parallel Port
9	VGA Port
10	USB Connectors
11	LAN Connector
12	AC Power Connector
13	AC Power Switch
14	Ground Post
15	External 12/24/48 VDC Connector
16	BNC(F) external trigger input, 5V TTL
17	Spectrum Analyzer Port, N(F) RF input, +20 dBm max.
18	Pass-Thru LAN Connector
19	USB Type B for PC connector

## Power Supply - PC SignalHawk

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### Internal Battery

---

The PC SignalHawk has an internal, rechargeable, lithium-ion battery pack that will operate the unit for a minimum of 3 hours of continuous use. Recharging time, from a full discharge, is approximately 4 hours.

**Note:** *When the unit is shipped from the factory, the battery may not be fully charged. Use an AC adapter when operating the unit for the first time.*

### Power Adapters

---

**WARNING**

When using the AC adapter, connect the AC plug only to a properly grounded receptacle. Serious injury or death can occur if not properly grounded.

The PC SignalHawk can be operated using the supplied AC adapter or a 12V automobile cigarette lighter adapter. Using these adapters will also charge the internal battery.

**Note:** *The charge LED will be steady amber while charging and steady green when fully charged.*

### Charge Indicator Light

---

The charge indicator light on the PC SignalHawk has a dual function.

Power Source	Light Color	Condition
External Power	Amber	Charging battery.
	Green	Battery fully charged.
Battery Power	None (light is off)	100% to 30% Power Available
	Yellow	Below 30% Power Available

When the yellow light comes on, the PC SignalHawk has approximately 1 to 1.5 hrs of operation left depending on temperature and battery age. At this time, the unit should be charged or the battery should be replaced. See "[Charging the Battery](#)" on page 77 or "[Replacing the Battery on the PC SignalHawk](#)" on page 78.

**Note:** *To avoid damage to the battery pack, the unit will shut-off completely when the battery charge falls below 10%. If this occurs, the battery must be charged to a minimum voltage before the unit is allowed to resume operation. Full recharging is recommended.*

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## Power Supply - Rack-Mount SignalHawk

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### AC Power Connector

---

The AC Power connector provides operating power for the Rack-Mount SignalHawk. The AC power supply cord is also the line disconnect device for this product. Use the supplied AC power cord or an approved power cord to connect to the Rack-Mount SignalHawk, such as domestic type SVT, 300 VAC, 18 AWG, 10 A, 3 conductor (including ground) or international type H05VV-F, 300 VAC, 1.00 mm, 10 A, 3 conductor (including ground).

**Note:** *The Rack-Mount SignalHawk is shipped from the factory configured for 110VAC operation, 2-pole fuse (fused line and neutral). If the Rack-Mount SignalHawk will be installed with 220VAC supply, follow these instructions:*

1. Remove the fuse drawer from the power entry module on the rear of the unit.
2. Remove fuses from drawer & set aside.

**Note:** *There are two different fuse drawers supplied with the Rack-Mount SignalHawk. One is a 2-pole fuse tray (fuse on both lines) the other is a single fuse tray (line fuse, shorting bar on neutral). Check with local regulations to determine whether single or dual pole fuse protection is required.*

3. Install one or both fuses into the appropriate fuse drawer:
  - 110VAC operation: 5x20mm SLO BLO 1.25A
  - 220VAC operation: 5x20mm SLO BLO 0.63A
4. Replace fuse drawer into the power entry module
5. Insert AC power cord into the IEC receptacle on the power entry module.

### DC Supply

---

The Rack-Mount SignalHawk can also be powered by a direct DC voltage wired into the terminal lugs on the rear of the unit. This is useful if the installation site has DC power readily available or it can be connected in addition to the AC power if the DC source is part of a battery back-up system. There are two separate DC power inputs on the terminal connector. The combination of the two allows a wide range of DC voltage sources. Refer to the specifications page for voltage range and current requirements.

**Note:** *Ensure proper polarity is observed on the DC supply and input voltage is connected to the correct pair of terminal lugs.*

## Spectrum Analyzer Quick Start

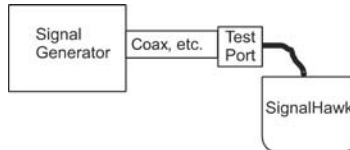
### CAUTION

Spectrum Analyzer has a +20 dBm (100 mW) max. RF input. Exceeding the maximum input will damage the SignalHawk. If unsure of power levels, measure the test connection with a power sensor before using the SignalHawk.

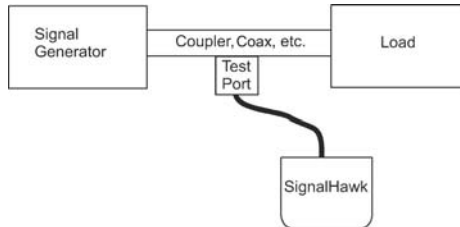
1. Measure the output power, or signal power, at the system's test port using a power meter, service monitor, or equivalent.

**Note:** Ensure the output power is less than +20 dBm (100 mW).

2. Connect the SignalHawk's "RF Input" connector:
  - **For low-power connections**, connect directly to the output of the signal source. See the below graph:



- **For high-power connections**, use a directional coupler or attenuator to reduce the output level of the signal source. See the below graph:



3. Power up the SignalHawk.
4. In the Start Menu, use the arrow keys to highlight the desired measurement, and press Enter.
5. In the Freq & Span Menu, set the frequency range (See ["Freq & Span Menu" on page 28](#)).
6. Wait for one sweep, then go into the Amplitude Menu and click on Autoscale (see ["Ampt & Trace Menu" on page 38](#)).
7. In the Start menu, select the desired measurement.
  - ["Spectrum Analysis Measurement" on page 48](#).
  - ["Occupied Bandwidth Measurement" on page 49](#).
  - ["Channel Power Measurement" on page 51](#).
  - ["Adjacent Channel Power Measurement" on page 53](#).

- ["Time Domain \(Zero Span\)" on page 55](#)
  - ["Field Strength Measurement" on page 56.](#)
  - ["Demodulate Signal" on page 58](#)
  - ["Carrier-to-Interference Ratio" on page 59.](#)
  - ["Out-of-Band and In-Band, Out-of-Channel Spurious" on page 61.](#)
  - ["Water Fall Spectrogram" on page 40.](#)
8. Turn on markers or limit lines if needed ([see "Marker On / Off" on page 41](#) and ["Limit Lines" on page 43](#)).
  9. Make a sweep.
  10. In the File & Help Menu, click on Quick Save Trace to save the data ([see "File & Help Menu" on page 45](#)).

## Installing the SignalHawk Program

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**Note:** *Install the PC software before connecting the PC SignalHawk for the first time.*

1. Insert installation CD.
2. Select Install Software when prompted.

**Note:** *Set-up will inspect the computer for any missing operating system prerequisites. If all are present, skip to step 6.*

3. Select “Next” and the install utility begins the Prerequisites Installation process.
4. Review the End-User License Agreement, check “I accept the terms of the License Agreement” and select “Install.”

**Note:** *The install Utility will install the prerequisites. This may take several minutes*

**Note:** *When completed, check with Microsoft® support center for any security updates. Typically, if “Automatic Updates” are configured on the host PC, these will be automatically flagged and selected for download and installation.*

**Note:** *The installation utility will launch after the OS prerequisites are installed.*

5. Do one of the following:
  - Accept the default installation location.
  - Select a different folder.
6. Select “Next” and the installer will complete.
7. Select “Finish” to launch the SignalHawk program.
8. Connect PC SignalHawk to a PC using the supplied USB cable.

**Note:** *The “USB Host Power” LED will illuminate when the host port is active and has power. It is not an indication of proper USB connectivity to the host. Refer to software installation instructions for how to address the PC SignalHawk from the host.*

9. Turn power on.
10. Select “Install the software automatically...” in the Found New Hardware Wizard window.



**Figure 5 Found New Hardware Wizard**



11. Click "Next".
12. Follow the instructions that are presented.
13. Click "Finish" in the Completing the Found New Hardware Wizard window.

**Figure 6 Completing the Found New Hardware Wizard**

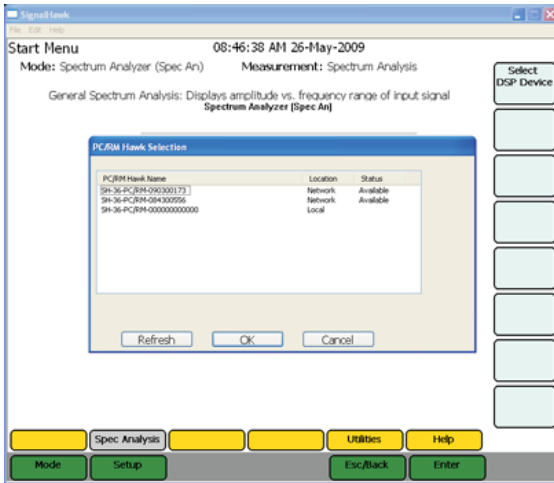


14. Launch the SignalHawk program.

**Note:** PC SignalHawk can be used in any orientation.

15. Select the unit from the DSP Device List, if necessary.
16. Connect RF signal.
17. Connect a TTL trigger source to the BNC connector, if necessary.

Figure 7 Select DSP Device List



# CHAPTER 3 RACK MOUNT SIGNALHAWK SET-UP

## Installing the SignalHawk into a Rack

---

### CAUTION

Do not block the fans airflow to prevent overheating.

The Rack-Mount SignalHawk is a short-depth, 2 rack-unit (RU) device designed for installation into standard 19" equipment test racks. It can also be used free-standing. Use installation hardware available for the rack to mount the SignalHawk.

**Note:** *For maximum stability, use four screws to secure the SignalHawk into the rack.*

### CAUTION

Avoid installing the SignalHawk near equipment that exhausts or radiates excessive heat (such as power amplifiers or DC power supplies). Proper ventilation should always be considered as part of the installation location.

1. Install the Rack-Mount SignalHawk into the equipment or test rack.
2. Connect proper power supply. See "[Power Supply - Rack-Mount SignalHawk](#)" on page 6.
3. Connect the SignalHawk to a host PC though one of the following:
  - Rear USB
  - Rear LAN

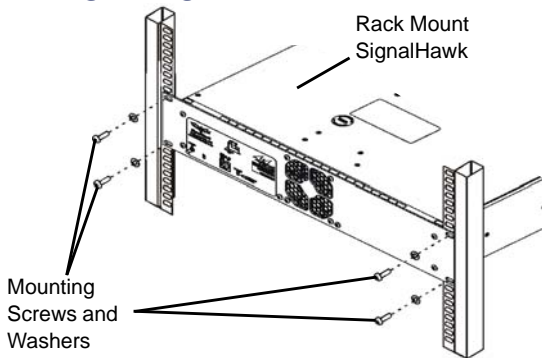
**Note:** See "[Rack-Mount SignalHawk Connection Diagram](#)" on page 18. There are three RJ45 (Ethernet) jacks on the unit. Use the rear LAN connection jack for remote access.

**Note:** *Host control priority is given in the order shown above.*

**Example** - *If the normal remote connection is via a Rear LAN connection, and the Rear USB is connected to a local host the remote LAN connection will be disconnected & the local host connection will be allowed control. The remote LAN connection will be restored upon disconnection from the local host.*

4. There are two additional connectors on the front and rear of the unit used for a "Pass-thru LAN" connection. The rear jack may be connected to an on-site router or hub. This now enables convenient, local connection to a network while on-site without having to have physical access to an on-site hub.

**Figure 8** Installing the SignalHawk into a Rack



## Connecting the Rack-Mount via USB Connection

---

1. Insert installation CD into host PC.
2. Select Install Software when prompted.

**Note:** *Install the PC software before connecting the Rack Mount SignalHawk for the first time.*

**Note:** *Set-up will inspect the computer for any missing operating system prerequisites. If all are present, skip to step 6.*

3. Select “Next” and the install utility begins the Prerequisites Installation process.
4. Review the End-User License Agreement, check “I accept the terms of the License Agreement” and select “Install.”

**Note:** *The install utility will install the prerequisites. This may take several minutes.*

**Note:** *When completed, check with Microsoft® support center for any security updates. Typically, if “Automatic Updates” are configured on the host PC, these will be automatically flagged and selected for download and installation.*

**Note:** *The installation utility will launch after the OS prerequisites are installed.*

5. Do one of the following:
  - Accept the default installation location.
  - Select a different folder.
6. Select “Next” and the installer will complete.
7. Select “Finish” to launch the SignalHawk program.

- Connect Rack Mount SignalHawk to a PC using the supplied USB cable.

**Note:** The “USB Host Power” LED will illuminate when host port is active and has power. It is not an indication of proper USB connectivity to the host. Refer to software installation instructions for how to address the PC SignalHawk from the host.

- Turn power on.
- Select “Install the software automatically...” in the Found New Hardware Wizard window.

**Note:** This procedure is performed when connecting either a PC or Rack-Mount SignalHawk for the first time. Driver installation is required for every distinct SH-36S-PC or SH- 36S-RM connected to the computer.

**Figure 9 Found New Hardware Wizard**



- Click “Next”.
- Follow the instructions that are presented.
- Click “Finish” in the Completing the Found New Hardware Wizard window.

**Figure 10 Completing the Found New Hardware Wizard**



- Launch the SignalHawk program.
- Select the SignalHawk unit from the Select DSP Device list.

## Connecting Remotely via LAN/WAN Connection

---

**Note:** *The Rack-Mount SignalHawk provides the following connections to a network:*

- 10/100 auto sensing RJ45 Ethernet connector
- Half and full duplex support
- IP address: 192.168.1.10
- Subnet Mask: 255.255.255.0

### Configuring a Basic Network Connection

---

1. Do one of the following:

- **For connecting to a stand alone computer** - Connect the Rack Mount to the computer with a crossover cable.
- **For connecting to a network** - Connect the Rack Mount to the network using the cable supplied.

**Note:** *Do not use the 'Pass-thru LAN' RJ-45 connector next to the BNC trigger connector for direct remote access. Use the RJ-45 connector in the PC back-panel.*

**Note:** *Before making changes to the client computer, it is highly recommended to create a "System Restore Point":*

- a. Click Start
- b. Go to Programs or All Programs.
- c. Go to Accessories.
- d. Go to System Tools.
- e. Select System Restore.

**Note:** *Permissions affiliated with being an administrator or a member of the Administrators group are needed in order to complete this procedure. If the computer is connected to a network, network policy settings might also prevent you from completing this procedure.*

2. Install TCP/IP Services on the client computer controlling the Rack Mount by doing the following:

- a. Open Add or Remove Programs in Control Panel.
- b. Click Add/Remove Windows Components.
- c. In Components, select Networking Services, and then select Details.
- d. In Subcomponents of Networking Services, select Simple TCP/IP Services, and then click OK.
- e. Click Next.

**Note:** *If prompted to do so, type the path where the Windows XP distribution files are located, and then click OK.*

- f. Click Finish.
- g. Click Close.

3. Configure TCP/IP settings on the client computer:

**Note:** *The client computer may have TCP/IP settings previously configured. Changing settings may prevent access to other network resources such as the Internet or file sharing. Consult with your network administrator before making any changes.*

- a. Open Network Connections in Control Panel.
- b. Select Local Area Connection and then, under Network Tasks, click Change settings of this connection.
- c. On the General tab, under This connection uses the following items, click Internet Protocol (TCP/IP), and then click Properties.
- d. Specify an IP address:

"Click Use the following IP address, and in IP address, type the following IP address:  
192.168.1.11

- e. Specify a subnet mask:

"In Subnet Mask, type the following:  
255.255.255.0

**Note:** *Default IP settings for the Rack Mount are IP address: 192.168.1.10 and Subnet Mask: 255.255.255.0. DHCP is NOT enabled by default on the Rack Mount.*

**Note:** *Use automated IP settings (DHCP) whenever possible for the majority of client computers. DHCP is enabled by default and when automated IP settings are used for all connections, they eliminate the need to configure settings (i.e. DNS, WINS, etc.).*

4. Create a Remote Desktop Connection on the client computer:

- a. Open Remote Desktop Connection:
  - i. Click Start
  - ii. Select Programs or All Programs
  - iii. Select Accessories
  - iv. Click Remote Desktop Connection.
- b. In the Computer box, type the following default IP address for the Rack Mount:  
192.168.1.10
- c. Click Connect.

**Note:** *If a connection cannot be achieved, disable the computers wireless networking function.*

**Note:** Depending on which version of Windows is being used, the Windows Security or the Log On to Windows dialog box appears at this time.

- d. In the Windows Security or Log On to Windows dialog box, type user credentials.

**Example** - User name, password, and domain. Default user credentials for the Rack Mount are:

Username: Bird

Password: Bird

- e. Click OK or Submit.

**Note:** To change the connection settings, (such as screen size, automatic logon information, and performance options), click Options before connecting. For more information, see “To Change Connection Settings” in the Remote Desktop Help.

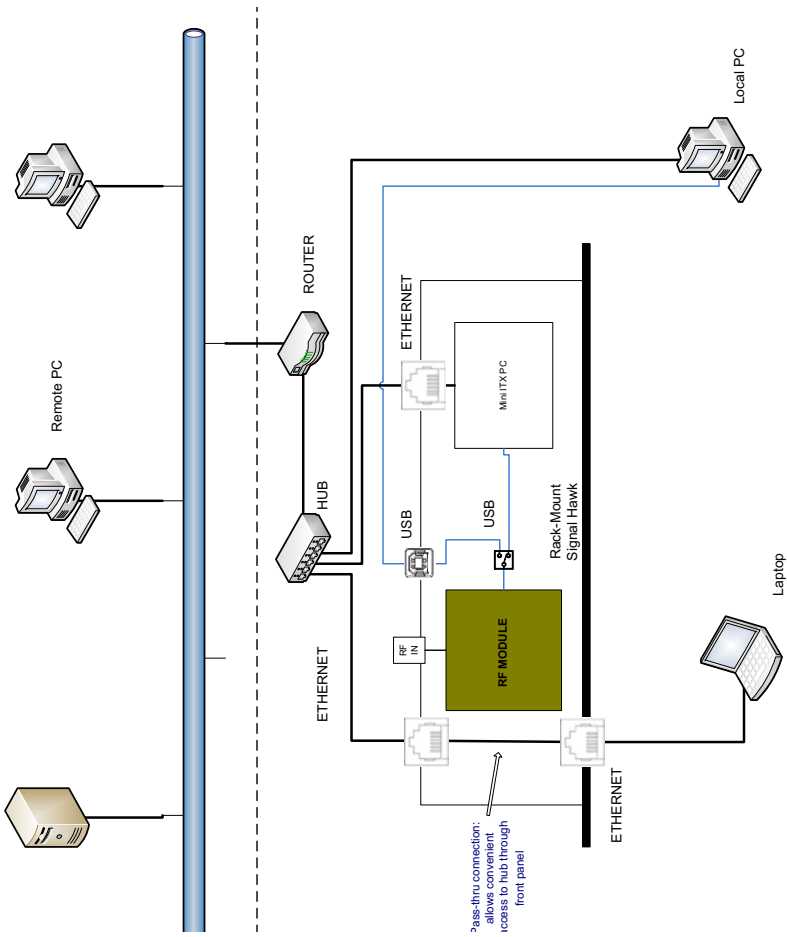
Advanced network settings such as configuring the Rack Mount on a domain, can be configured by using the remote desktop connection or by logging in locally to the Rack Mount using an external monitor, keyboard and mouse (not included) connected to the I/O ports on the back panel of the unit. Consult the network administrator for proper configuration.

**Note:** Other programs may be used on the Rack Mount Hawk as long as they directly support its specific use or provide system utilities, resource management, anti-virus or similar protection. Software such as email, word processing, spreadsheet, database, scheduling or personal finance software cannot run on this device, however, you may use terminal services protocols to access such software running on a server. For more information, refer to the User End License Agreement in the Appendix.

**Note:** The Rack Mount operating system has Windows Firewall ‘On’ by default but does not have any anti-virus/anti-spyware installed. Use caution when connecting the Rack Mount to a WAN or Internet gateway. Consult with the network administrator.



Figure 11 Rack-Mount SignalHawk Connection Diagram



## Connecting a Remote Computer to the Host Computer

To connect your home computer, which is the client (or remote) computer to the Rack Mount, follow these steps:

1. On your home computer, click **Start**, point to **All Programs**, and then point to **Accessories**.
2. In the Accessories menu, point to Communications, and then click Remote Desktop Connection.
3. In the Computer box, type the computer name of your host computer.

**Note:** The default computer name of the Rack Mount is 'SH-36S-RM' and the default IP address and Subnet mask is 192.168.1.10 and 255.255.255.0



4. Click Connect.
5. When the Log On to Windows dialog box appears, type your user name, password, and domain (if required), and then click OK.



6. The Remote Desktop window opens, and you see the desktop settings, files, and programs that are on your host computer, which in this example is the Rack Mount. Your host computer remains locked, and nobody can access it without a password. In addition, no one will be able to see the work you are doing remotely.

To end your Remote Desktop session:

1. Click Start, and then click Log Off at the bottom of the Start menu.
2. When prompted, click Log Off.

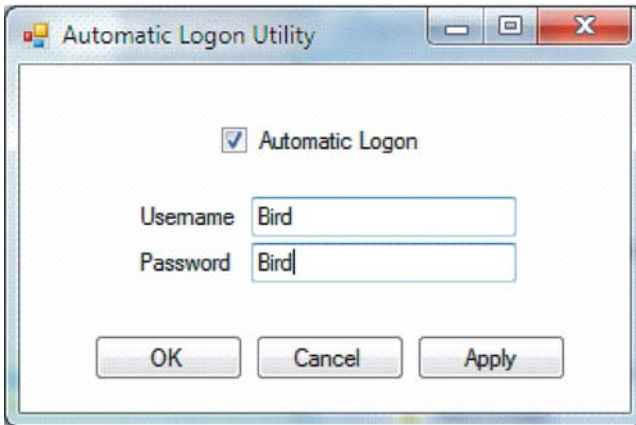


## Changing the Password on Auto Logon

---

1. Go to the Start Menu.
2. Select All Programs
3. Select Bird Technologies Group.
4. Go to Utilities.
5. Go to Automatic Logon Utility.
6. Enter a username and new password.
7. Click Ok.

**Figure 12** Automatic Logon Utility



In order to obtain the most accurate information possible, it is very important to use the proper settings. The SignalHawk can be configured in various ways, allowing for a wide range of measurement capabilities.

## Getting Started with the SignalHawk

---

### CAUTION

Spectrum Analyzer has a +20 dBm (100 mW) max. RF input. Exceeding the maximum input will damage the SignalHawk. If unsure of power levels, measure the test connection with a power sensor before using the SignalHawk.

Press the Power button to turn on the unit.

### Setting Up

---

See "[PC SignalHawk Set-Up](#)" on page 9. Use this chapter to adjust the Settings.

### Start Menu, Menu Keys

---

Menu keys are the six rectangular yellow keys located below the display screen. Click a menu key to move the highlight selection bar to the desired menu list. When using a menu list, use the mouse scroll wheel or the up- and down-arrow keys to move the highlight bar through the list. Use the left- and right-arrow keys to move to a different list box.

#### Spec Analysis Menu Key

Click here to enter the Spectrum Analyzer mode.

#### Utilities Menu Key

Click here to display the Utility Menu main screen. The Utilities menu provides information about the instrument software, amount of available memory, battery charge status, system date and time, and how to contact Bird Technologies Group.

#### Help Menu Key

Displays the Help options but does not exit the current screen. Click on the Back... selection to display the default selections for the current menu.

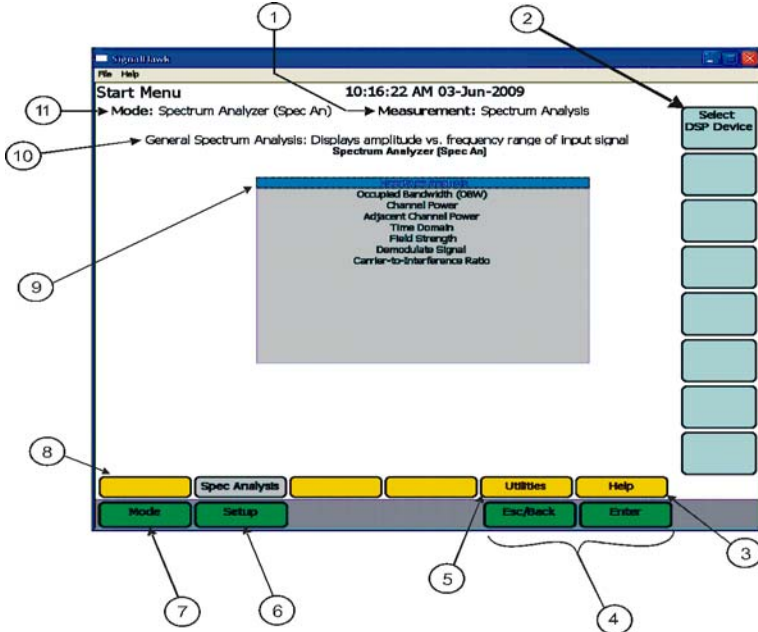
**Operations Manual (Quick Start Guide)** — This manual contains quick start steps for measurements and for the Menu keys.

**Menu List** — Displays the list of all measurements available in the active operating mode. This list can be expanded and collapsed to reveal or hide more detail about the measurement, such as setup parameters and custom configurations.

**Reference Manual (User Manual)** — This manual expands upon the information in the Operations Manual to include complete descriptions of features, measurement setup parameters, and system setup options.

**Back...** — Clicking here exits Help and returns to the features for the currently active menu.

**Figure 13** *SignalHawk Start Menu - Spectrum Analyzer*

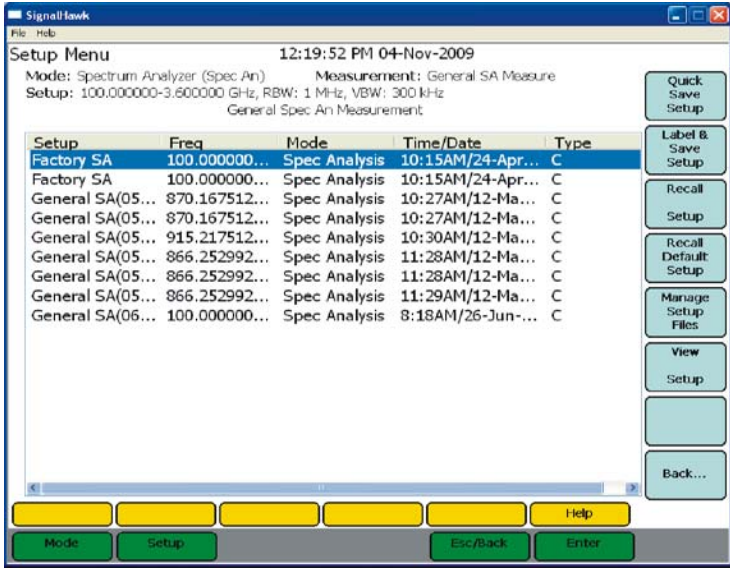


Item	Description
1	Name of measurement being used
2	Menu Selection labels
3	Go to the Help menu. Select Esc/Back to return here. There are two functions in the help menu.
4	Enter goes to a menu. Esc will exit a menu.
5	Go to the Utilities menu. See " <a href="#">Utilities</a> " on page 62.
6	Go to setup screen
7	Go to mode selection screen
8	Menu key labels
9	Selected measurement (highlighted)
10	Name and brief description of highlighted measurement
11	Current active operating mode
--	Mouse scroll wheel will increase values.
--	Keyboard can be used to manually enter values.
--	Function Keys correlate with the selections on side of the display.

## Setup Menu

The Setup Menu allows access to saved setups and settings used previously on the SignalHawk. Click on Setup to access the menu.

Figure 14 Setup Menu

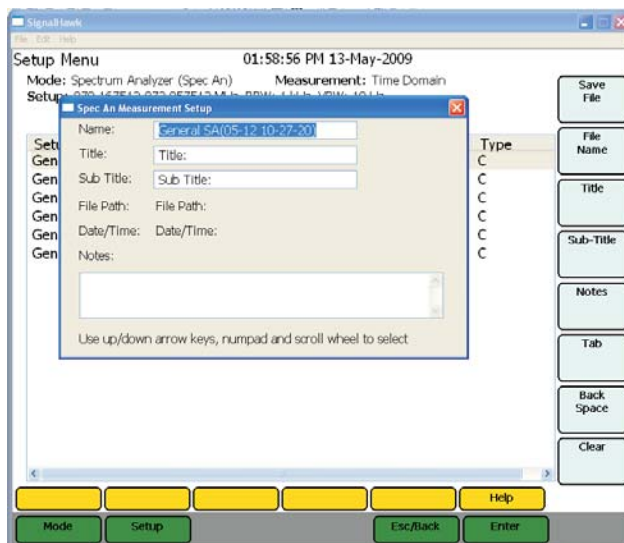


## Quick Save Setup

The saved settings are stored as a file in the internal drive of the host PC. Each quick save is stored in a separate file that is named using the date-time file naming format *GeneralSA(MM-DD-hh-mm-ss).shs* where YYYY is the year, the first MM is the month, DD is the day, HH is the hour, the second MM is the minute, and SS is the second of the time when the file was saved.

## Label & Save Setup

Figure 15 Setup Menu - Save



Labels and saves the settings for a setup for future use.

To save a Setup:

1. Click on Save Trace.
2. Enter a file name.

## Recall Setup

Recalls a saved setup and sets the instrument parameters to run the recalled setup.

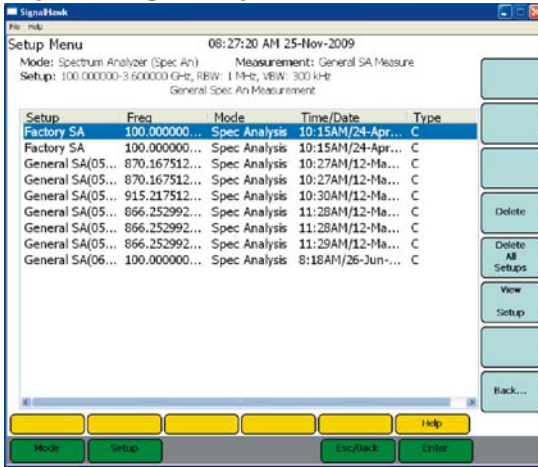
## Recall Default Setup

Recalls the factory default setup and sets the instrument parameters to run this setup.

## Manage Setup Files

Allows access to the file management of the saved Setups.

Figure 16 Setup - Manage Setup Files



**Delete**

Deletes the selected Setup on the list.

**Delete All Setups**

Deletes all of the Setups on the list.

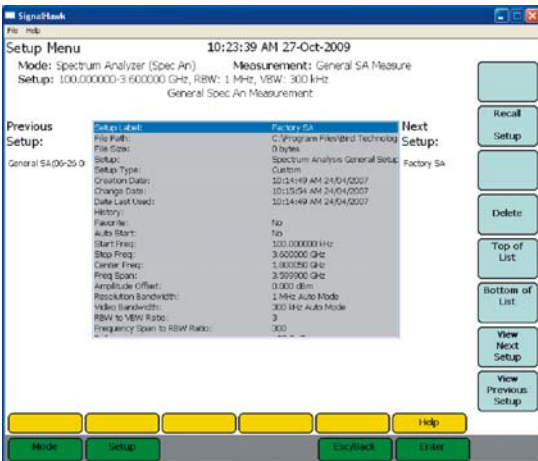
**View Setup**

See "[View Setup](#)" on page 25 in the Setup Menu.

**View Setup**

Displays the properties of a selected saved Setup on the list.

Figure 17 Setup - View Setup





### **Recall Setup**

Recalls a saved setup and sets the instruments parameters to run the recalled setup.

### **Delete**

Deletes the displayed Setup.

### **Top of List**

Displays the Setup from the top of list of saved Setups.

### **Bottom of List**

Displays the Setup from the bottom of list of saved Setups.

### **View Next Setup**

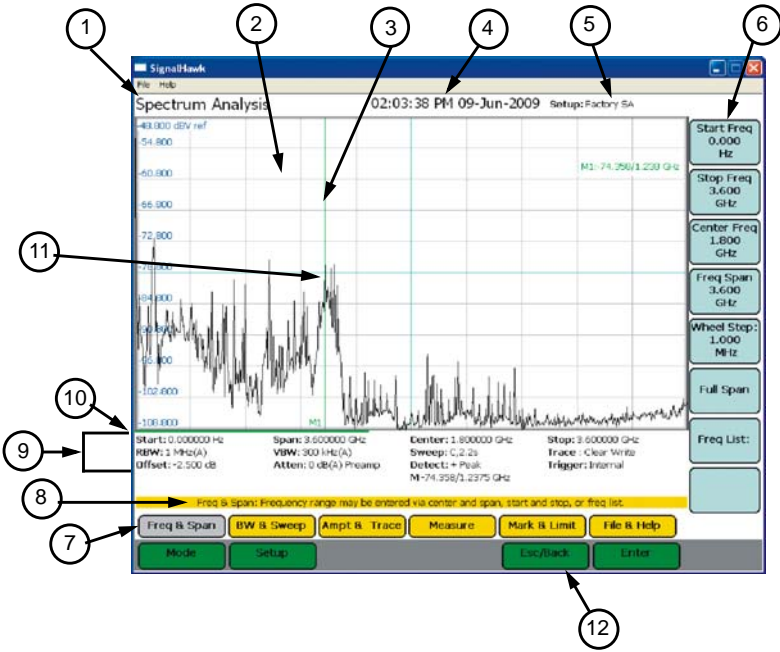
Displays the next Setup on the list of saved Setups.

### **View Previous Setup**

Displays the previous Setup on the list of saved Setups.

## Looking At The Screen

Figure 18 General Screen Features



Item	Description
1	Name of selected measurement
2	Sweep display area
3	Marker
4	Date and time
5	Name of setup file being used
6	Menu selection labels
7	Menu key labels
8	Help tips for the current screen
9	Measurement settings
10	Sweep progress bar
11	Data trace
12	System key labels

## Freq & Span Menu

Figure 19 Freq & Span Menu



In the Freq & Span Menu the range of frequencies to sweep are specified. The SignalHawk can sweep frequencies between 100 kHz and 3.6 GHz.

Frequencies can be selected at spans from 1 kHz up to the entire range of the instrument. These frequencies can be set to sweep by one of the following methods:

- Set the Center Freq and Freq Span.
- Set the Start Freq and Stop Freq.
- Select the Full Span of the instrument.
- Select a band from the Freq List.

The most common of these methods is to set the center frequency and a frequency span (a range) and let SignalHawk calculate the start and stop frequencies for the sweep. Reducing the span, by default (with RBW and VBW, both on auto mode) will usually speed up the sweep, provide more detail, and lower the noise floor. Unless specified otherwise, set the center frequency to the center of the signal being measured.

## Start / Stop Freq and Center / Span

---

These settings control the frequency range being swept.

**Note:** *“Center / Span” are used in this manual, but using “Start / Stop Freq” achieves the same results.*

After clicking the menu selection, it will highlight the active function. Then the following can be performed:

- **Up/Down Arrow Keys:** Increase and decrease the frequency or span in small steps.
- **Left/Right Arrow Keys:** Increase and decrease the frequency or span in large steps.
- **Mouse Scroll Wheel:** Each click of the mouse scroll wheel changes the frequency or span by the value of the “Wheel Step”.
- **Number Keys:** Press any key except +/- to open a box to type in a new frequency.

**Note:** *If a mistake happens, press Esc/Back. When done, press enter (to keep the same frequency units) or click the menu selection corresponding to the desired units.*

## Wheel Step

---

When another frequency function is active and the mouse scroll wheel is turned, the value will change in steps of the “Wheel Step”. After clicking “Wheel Step” to highlight it, the following is enabled:

- **Up/Down Arrow Keys and Mouse Scroll Wheel:** Change the step value by a small amount.
- **Left/Right Arrow Keys:** Change the step value by a large amount.
- **Number Keys:** Press any key except +/- to open a box to type in a new frequency. If a mistake is made, press Esc/Back. When done, press enter, or click the menu selection corresponding to the desired units.

## Full Span

---

Click on this to set the Start Freq to 0, and the Stop Freq to the max freq of the unit, currently 3.6 GHz.

**Note:** *The start frequency can be set to 0 as a convenience. However, the accuracy spec does not apply below the minimum freq of the unit (100 kHz).*

## Freq List

Selecting this opens up a list of predefined frequency bands. Use the up/down arrows or mouse scroll wheel to scroll to the desired band, then press Enter to use it. Recently used bands are displayed at the top of the list.

**Note:** Channelized bands are denoted on the Frequency List by a plus sign; “+”.

**Figure 20** Example, Freq List

Recently Used Bands

Band	Start	Stop	Span	Center
CDMA CHA 1 U/D	889.000	960.000	71.000	924.500
+CDMA CNA1 U	872.013	914.988	42.975	893.500
+CDMA CNA1 D	917.013	959.988	42.975	938.500
CDMA CHA 2 U/D	889.000	960.000	71.000	924.500
+CDMA CNA2 U	872.013	902.488	30.475	887.250
+CDMA CNA2 D	917.013	947.488	30.475	932.250
CDMA JPN U/D	860.000	926.000	66.000	893.000
+CDMA JPN U	887.013	924.988	37.975	906.000
+CDMA JPN D	832.013	869.988	37.975	851.000
CDMA US Cel U/D	825.000	895.000	70.000	860.000
+CDMA US Cel U	824.010	848.970	24.960	836.490
+CDMA US Cel D	869.010	893.970	24.960	881.490
CDMA US PCS U/D	1850.000	1990.000	140.000	1920.00
+CDMA US PCS U	1850.050	1909.950	59.900	1880.00
+CDMA US PCS D	1930.050	1989.950	59.900	1960.00
CDMA KOR PCS U/D	934.000	1780.000	846.000	1357.00
+CDMA KOR PCS U	1750.050	1779.900	29.850	1764.975

Start: 0 s      Span: 0 Hz      Center: 868.097992 MHz      Stop: 5.000 s  
 RBW: 10 kHz(A)      VBW: 10 Hz(M)      Sweep: C,8,2s      Trace: Clear Write  
 Offset: 0.000 dB      Atten: 0 dB(A) Preamp      Detect: Avg Power      Trigger: Internal

Freq List: Select frequency range from list. Note, '+' indicates a channelized frequency band.

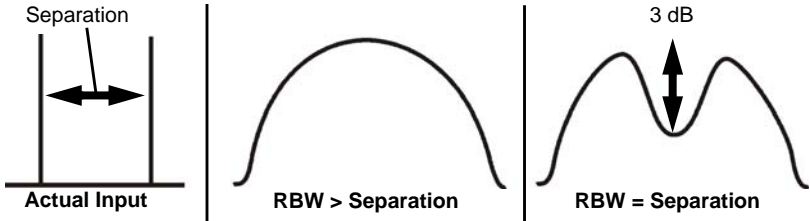
Buttons: Freq & Span, BW & Sweep, Ampt & Trace, Measure, Mark & Limit, File & Help, Mode, Setup, Esc/Back, Enter

## BW & Sweep Menu

The bandwidth menu includes functions that control sweep speed and accuracy, and has the interface for customizing sweep triggers.

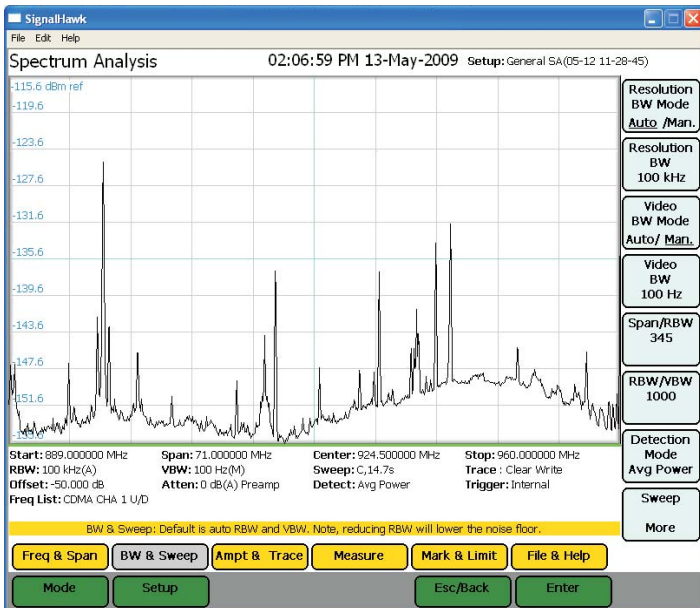
When two signals are separated by a freq distance equal to the Resolution BW, a 3 dB dip between them will appear on the screen. This is the minimum resolvable frequency spacing. The menu selections legend displays the current value.

Figure 21 Signal Representation



Lowering the RBW will lower the noise floor, which can make low-power signals easier to see, and makes readings close to the noise floor more accurate.

Figure 22 Example, BW & Sweep Menu



Click on the Resolution BW selection then use the arrow keys or the mouse wheel to enter the desired bandwidth.

RBW goes from 100 Hz - 1 MHz, steps of 1 / 3 / 10 (e.g.: 1 kHz to 3 kHz to 10 kHz to 30 kHz, etc.)

Video BW Mode (VBW) determines how much smoothing takes place.

**Note:** VBW goes from 10 Hz to 300 kHz.

- **Wide (high) VBW setting:** Faster sweep times, but can obscure signal details.
- **Narrow (lower) VBW setting:** Better trace smoothing for signals present in high noise levels.

As the VBW is reduced, longer sweep times will be necessary to obtain a measurement. To be useful, VBW must be narrower than RBW. No smoothing takes place when VBW is greater than or equal to RBW.

## Resolution & Video BW Modes

---

Click on these to toggle RBW or VBW, respectively, between automatic and manual control. In automatic, they are controlled by the current span and the values of Span/RBW and RBW/VBW. If either the RBW or VBW is changed, these will switch to manual.

Auto RBW sets the RBW based upon the frequency span. When in Auto mode, the RBW is set according to the nearest ratio of the Span/RBW selection. The default ratio is 300. When the frequency span is reduced, the RBW will also be reduced accordingly.

**Example** - When the span is changed to 3600 MHz, the RBW will automatically be set to 1 MHz. When the span is reduced to 100 MHz, the RBW will automatically reduce to 300 kHz.

Auto VBW sets the VBW based upon the RBW value. When in Auto mode, the VBW is set according to the nearest ratio as set using the VBW/RBW selection. The default ratio is 3. As the RBW span is reduced the VBW will be reduced accordingly.

**Example** - When the RBW is changed to 1MHz, the VBW will automatically be set to 300kHz. When the RBW is reduced to 30kHz, the VBW will automatically be set to 10kHz.

## Resolution & Video BW

Click on the selection to highlight it. Then:

- **Up/Down Keys** - Change the bandwidth incrementally.
- **Left/Right Keys** - Change the bandwidth from min to max.
- **Mouse Scroll Wheel** - Change the bandwidth incrementally.

## Span/RBW

Click on the Span/RBW selection then enter the desired ratio. Values range from 10 to 3600 in steps of one.

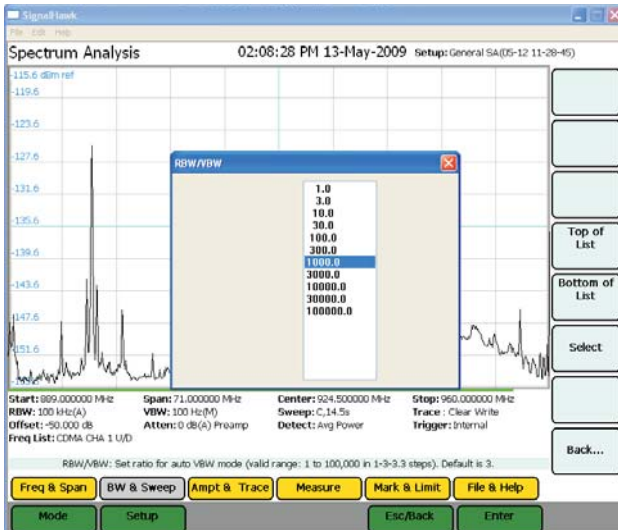
The ratio of frequency span to RBW determines how the RBW tracks with frequency span when the Resolution BW mode is in Auto. This value is ignored when Resolution BW Mode is in Manual mode. The menu selection legend displays the current value.

- **Up and Down Arrow Keys** - Press these keys to increase or decrease the ratio in steps of one.
- **Left and Right Arrow Keys** - Press these keys to enter the minimum ratio (left-arrow) or the maximum ratio (right-arrow).
- **Mouse Scroll Wheel** - Rotate the wheel to increase or decrease the ratio in steps of one.

## RBW / VBW

Clicking on the key brings up a list of allowed values for RBW / VBW. When VBW is set to auto, the RBW is divided by this value and set as the VBW.

Figure 23 Example, RBW/VBW





## Detection Mode

Depending on measurement settings, many more data points are collected than there are pixels on the screen. Detection modes allow the user to choose how the collected data in each pixel is represented.

### + Peak Detection

Returns the maximum value of the data collected for each display pixel. Recommended for pure sine waves or narrow bandwidth signals. In zero-span mode, this mode acts like a peak detector and can be used to show AM band frequencies.

### - Peak Detection

Returns the minimum value of the data collected for each display pixel. Recommended for displaying the difference between CW and pulsed signals.

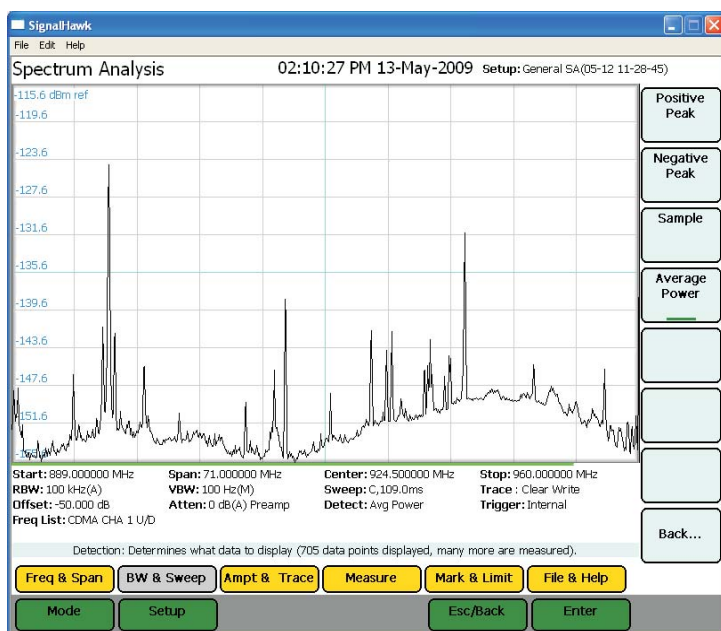
### Sample Detection

Returns a sample of the data collected for each display pixel. Use this method for noise-like signals.

### Average Power

Returns the average of the data collected for each display pixel. Recommended for noise-reduction.

**Figure 24** Example, Detection Mode



## Sweep

Sweep sets up the properties of individual sweeps that the SignalHawk performs. It can set whether the sweeping is continuous or single, and the properties of video triggers (if enabled).

Figure 25 Example, Sweep More

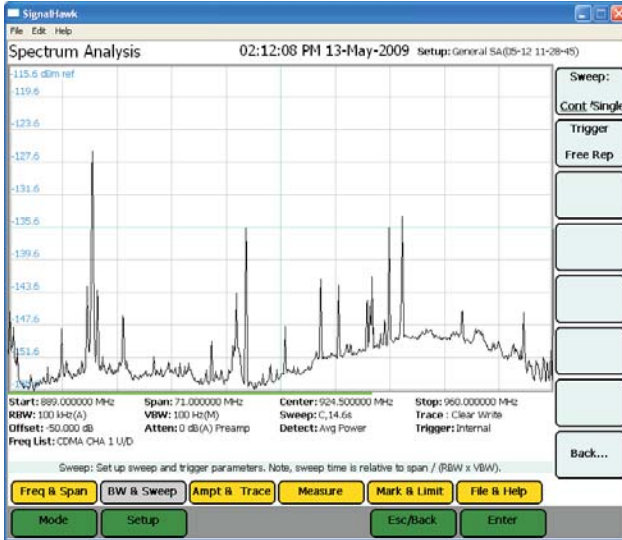
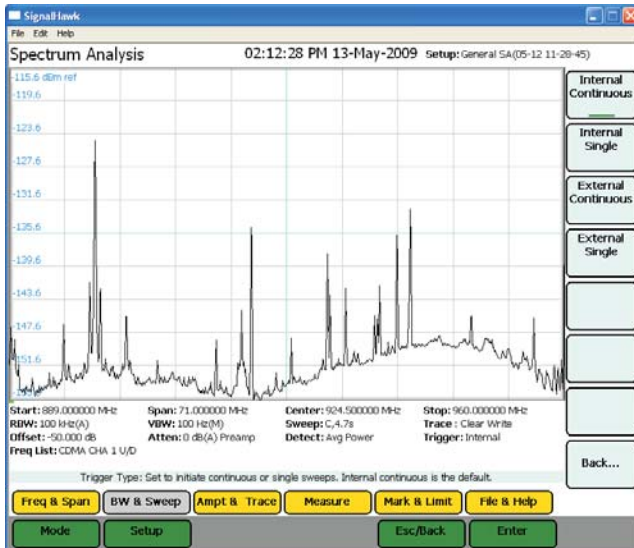


Figure 26 Example, Trigger Rep



---

## Single

Performs a single sweep. Before a single sweep is triggered, the SignalHawk will display the previous sweep. To begin a sweep, press the Manual Trigger soft key. After the sweep finishes, it will display the results and stop sweeping.

**Trigger** — Sets the type of trigger that initiates a sweep. There are four types of trigger to choose from:

- **Internal Continuous** - Sweeps continuously and is controlled by the SignalHawk.
- **Internal Single** - Sweeps once when triggered. Controlled by the SignalHawk through the Arm Trigger soft key.
- **External Continuous** - See “External Trigger” below.
- **External Single** - See “External Trigger” below.

**Note:** *Useful for signals that are time varying. Ones that change slow enough to trigger manually as well as carrier/interference ratios. See "[Carrier-to-Interference Ratio](#)" on page 59.*

**Arm Trigger** — Manually initiates a sweep.

## External Trigger

---

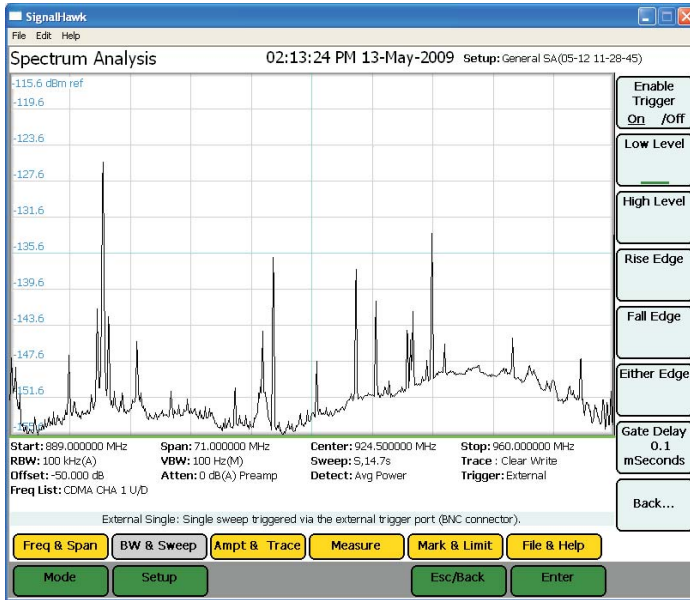
### External - Low Level / High Level / Rise Edge / Fall Edge / Either Edge

- **Low Level** - Triggers if input =  $0 \pm 0.5$  V (TTL “Low”).
- **High Level** - Triggers if input =  $4.2 \pm 0.8$  V (TTL “High”).
- **Rise Edge** - Triggers if the input goes from “Low” to “High”.
- **Fall Edge** - Triggers if the input goes from “High” to “Low”.
- **Either Edge** - Triggers if the input goes from either “High” to “Low” OR “Low” to “High”.

## Gate Delay

Length of wait after the trigger signal and before beginning a sweep. The range is 100  $\mu$ s to 1 s.

Figure 27 Example, Low Level / High Level / Rise Edge / Fall Edge / Either Edge



## Video

**Note:** This can only be used if the Time Domain measurement is enabled. See "[Time Domain \(Zero Span\)](#)" on page 55.

Trigger control and sweeping both happen on the radio frequency connector. Once a sweep is done, it will be displayed until a trigger condition occurs again and it performs another sweep. This is used in zero-span mode.

In order to use this function, the trigger condition needs to be set up:

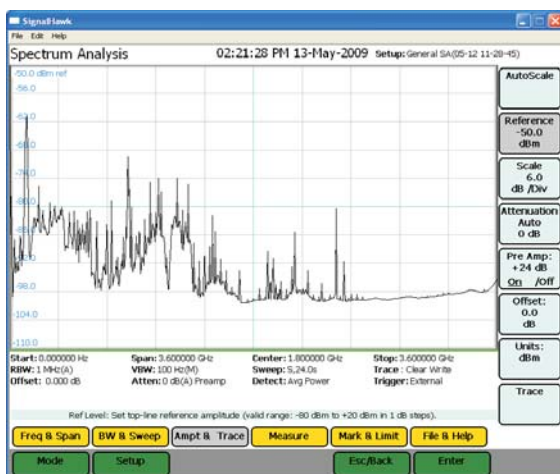
1. Monitor the RF data to determine the trigger condition.
2. Set the power level at center freq.
3. Set the trigger level:
  - **High Level** - Trigger if dBm rises ABOVE the power level.
  - **Low Level** - Trigger if dBm falls BELOW the power level.
  - **Pwr Level** - Set the power level using the keypad.
4. Enable the trigger.

## Gate Delay

Length of wait after the trigger signal and before beginning a sweep The range is 100  $\mu$ s to 1 s.

## Ampt & Trace Menu

Figure 28 Example, Ampt & Trace Menu



### Autoscale

Resizes the graph to fit the whole trace on the screen. This function will change the reference and scale of a trace.

### Reference

Sets the y-axis value at the top of the graph.

### Scale

Sets the dB value of each partition of the graph on a scale from 1 to 15. The graph is partitioned into 10 divisions, giving a set number of dB per division.

**Note:** This soft key is not displayed if the Units of measure is in Volt or Watt. See "Units" on page 39.

### Attenuation

Controls the built-in attenuator on the signal input. This reduces the amplitude of a high-powered signal. The attenuation can be set to Auto, or at levels of 0, 10, 20, and 30 dB. The reported value of the signal is automatically corrected for the selected attenuation.

**Note:** When the Reference (See "Reference" on page 38) is set to a higher setting, Attenuation will automatically set itself above this setting.

**Example -** Reference is set to 25 dBm, Attenuation automatically sets itself to 30 dB and cannot be lowered.

## Preamp

---

Controls the built-in amplifier on the signal input. This lowers the noise floor, allowing very low power signals be detected, by giving a 24 dB nominal gain boost.

**Note:** Attenuation is automatically disabled to 0 when Preamp is activated.

**Note:** The preamp should not be used with input signals greater than -30 dBm.

## Offset

---

Shifts the signal to compensate for external factors (attenuation, couplers, amplifiers, etc.) This allows for a true signal level reading.

1. Measure the total amount of loss for all attached signal devices.
2. Enter the measured amount as the Offset value or gain.

**Example** - The system has 10 dB of loss due the use of a coupler; enter the value of 10 in the Offset. Offset range is -100 to +100.

## Units

---

### dBm

$$dBm = 10 \times \text{Log}[\text{Power}(\text{Watts})] + 30dB$$

### dBuV

$$dBm = dBuV - 10 * (\log 50) - 90$$

### dBmV

$$dBm = dBmV - 10 * (\log 50 - 30)$$

### dBV

$$dBm = dBV - 10 * (\log 50 + 30)$$

### Volts

$$dBm = 20 \times \text{Log}[\text{Power}(\text{Volts})] + 30dB$$

### Watts

$$\text{Watts} = 10^{\wedge}((dBm - 30) / 10)$$

## Trace

---

Opens a trace submenu with the following options:

### Clear Write

Switches off the Average and Max Hold functions.

### Max Hold

Holds and displays the highest point of a any given sweep until Max Hold is turned off.

## Min Hold

Holds and displays the lowest point of any given sweep until Min Hold is turned off.

## Average

Displays the running average of multiple readings which is used to smooth a signal and decrease noise amplitude.

## Average Readings

Sets the number of averaged readings. The valid range is from 2 to 1024.

## Reset Average

Resets the current running average of multiple readings.

## Water Fall Spectrogram

The Water Fall Spectrogram shows how the spectral density of a signal varies with time and presents it in a visual image. Also known as spectral waterfalls, sonograms, voiceprints, or voicegrams, spectrograms are used to identify phonetic sounds and specific noise disturbances.

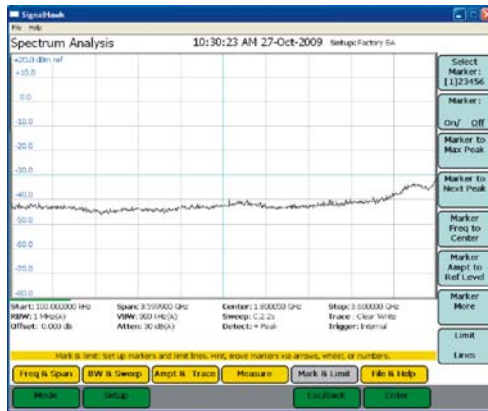
1. Go to the Ampt & Trace menu.
2. Click on the Trace selection.
3. Click on the Water Fall selection.
4. Turn the Water Fall spectrogram on.
5. Select the dual screen display, if desired

**Figure 29 Example, Water Fall Spectrogram**



## Mark & Limit Menu

Figure 30 Example, Mark & Limit Menu



### Select Marker

Changes the active marker. There are six markers to choose from (measurements that use some of the markers for data display have less selectable markers). Pressing the soft key will cycle through each of the six markers.

### Marker On / Off

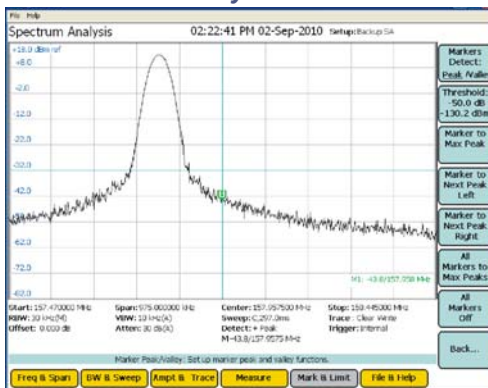
Turns a Marker on and off.

### Marker to Max Peak

Moves the active marker to the highest point on the trace.

### Markers to Peak/Valley

Figure 31 Markers to Peak/Valley





---

## Markers Detect

Toggles the functionality of the submenu between finding peaks or finding valleys.

## Threshold

The threshold offset, displayed on the first line, is used to calculate the threshold level, displayed on the second line, above the noise floor.

**Note:** *The low level peaks below the threshold level are filtered out. Only peaks above or at the threshold level are detected.*

## Marker to Max Peak or Marker to Min Valley

Sets the marker to the either the maximum peak or minimum valley depending on the functionality chosen in Markers Detect. See ["Markers Detect" on page 42](#).

## Marker to Next Peak Left or Marker to Next Valley Left

Cycles the active marker to the left through the points on the trace either from highest peaks or lowest valleys (See ["Markers Detect" on page 42](#)) progressing to the left.

## Marker to Next Peak Right or Marker to Next Valley Right

Cycles the active marker to the right through the points on the trace either from highest peaks or lowest valleys (See ["Markers Detect" on page 42](#)) progressing to the right.

## All Markers to Max Peaks or All Markers to Min Valleys

Sets all the markers to either the maximum peaks or minimum valleys depending on the functionality chosen in Markers Detect. See ["Markers Detect" on page 42](#).

## All Markers Off

Turns off all markers on the trace.

---

## Marker Delta

Turns On/Off and displays the delta of the one to five markers.

---

## Marker Display

### Marker Type

Sets the current marker to either be displayed as a line or floating numbered icon.

### All Markers Type to Icon

Sets all markers to be displayed as floating numbered icons.

### All Markers Type to Line

Sets all markers to be displayed as numbered lines.

### Marker Display

Turns On/Off and sets the location of the delta display into one of the four corners of the screen.

## Marker More

---

Sets the properties of active markers through the following attributes:

### **RSSI (Received Signal Strength Indicator)**

Turns the audio indicator On or Off (an electronic ping). See "[Received Signal Strength Indicator \(RSSI\)](#)" on page 57.

### **Volume**

Sets the volume of the electronic ping generated from the RSSI.

### **Marker Freq to Center**

Moves the current marker to the center frequency.

### **Center Freq to Marker**

Sets the center frequency to the frequency of the active marker.

### **Ref Level Ampt to Marker**

Sets the top-line amplitude reference level to the amplitude of the active marker.

### **Frequency Counter**

Turns the Frequency Counter on or off. This enables the frequency read out of all displayed markers to read the exact frequency of the peak within the pixel to a resolution of 1 Hz.

**Note:** *Signals that vary in frequency must be within the RBW to obtain accurate results.*

## Limit Lines

---

Limit lines give notification of when a signal has reached or gone over a set measurement amount. Limit lines can be moved with arrow keys.

**Note:** *All valid traces are black, and any part of any trace that is outside of a limit is red. Red indicates a failed limit.*

### **Limit Upper/Lower**

Pick between upper & lower limit line.

### **Limit On/Off**

Pick between limit line on or off.

### **Limit Alarm On/Off**

Pick whether a limit line fail makes the unit beep.

### **Select Line/Mask**

Creates a specific set of limit lines and presents a list of these predefined masks to choose from.

**Note:** *Custom Masks can be saved to the Mask list. See "[Customizing SignalHawk Content](#)" on page 63.*

Figure 32 Example, Mask List

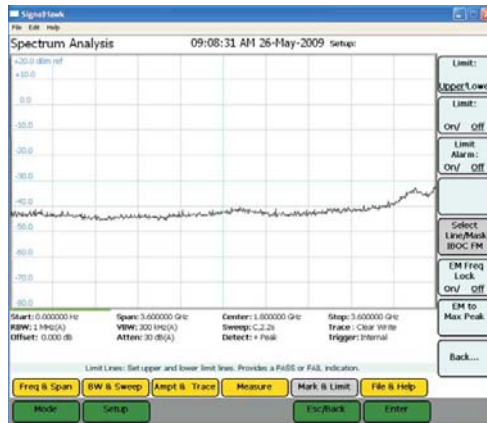


Once a mask is selected, it is controlled by the following options:

**Freq Lock** — Locks the mask onto the selected band even if the frequency is changed.

**EM to Max Peak** — Sets mask's reference level to the maximum peak in each sweep.

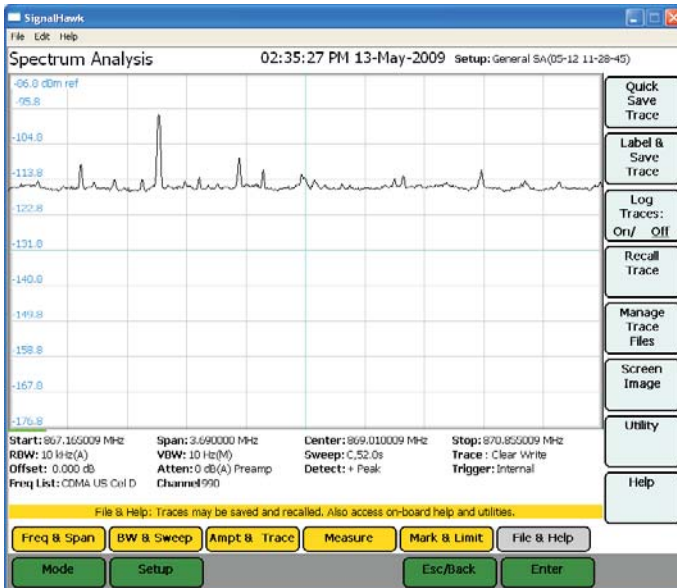
Figure 33 Example, Limit Line Mask



## File & Help Menu

When File & Help is clicked, menu selections for saving the current trace, selecting the utility option, activating the logging feature, and accessing help features (Figure 34) are enabled. A trace is saved as a file and stored in the default file location of the host PC.

Figure 34 Example, File & Help Menu



### Quick Save Trace

Saves the trace that is displayed on the screen.

1. Click on File & Help.
2. Click on Quick Save Trace.

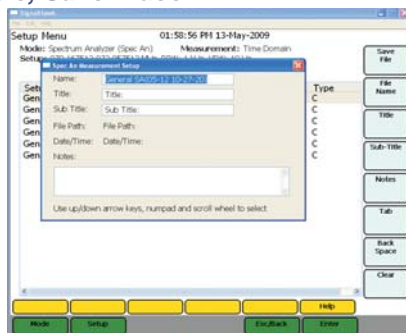
**Note:** The trace is stored as a file in the default file location of the host PC. Each quick save is stored in a separate file that is named using the measurement and date-time file naming format: Measurement name(MM-DD HH-MM-SS).shf. Where the first MM is the month, DD is the day, HH is the hour, the second MM is the minute, and SS is the second of the time when the file was saved.

### Label & Save Trace

Labels and saves the trace for future use.

1. Click on Save Trace.
2. Enter a file name.

**Figure 35 Example, Save Trace**



## Log Traces

Saves a sweep every 60 seconds and assigns a default name to each save.

## Recall Trace

Opens up a submenu with three options:

### Recall Trace

Displays a saved trace on the screen.

### Recall & Compare

Displays a saved trace overlapping over the current trace on the screen.

**Note:** *The Saved trace is orange. The current trace is black.*

### Clear Recalled Trace

Deletes the highlighted trace.

## Manage Trace Files

Copy trace files to and from network drives, and delete traces.

### Delete Trace

Deletes a selected trace.

### Delete All Traces

Deletes all traces in the directory.

## Full Screen

Enlarges the graph area to the size of the whole screen. Press escape to go back to regular screen.

## Utility

See "[Utility Main Menu](#)" on page 63.

## Help

Brings up the menu selections that will enable either the Quick Start Guide or the User Manual, saved in the unit.

Spectrum Analysis, measuring the power at each frequency in the sweep range, is the basic measurement. The other measurements interpret that data to provide useful results.

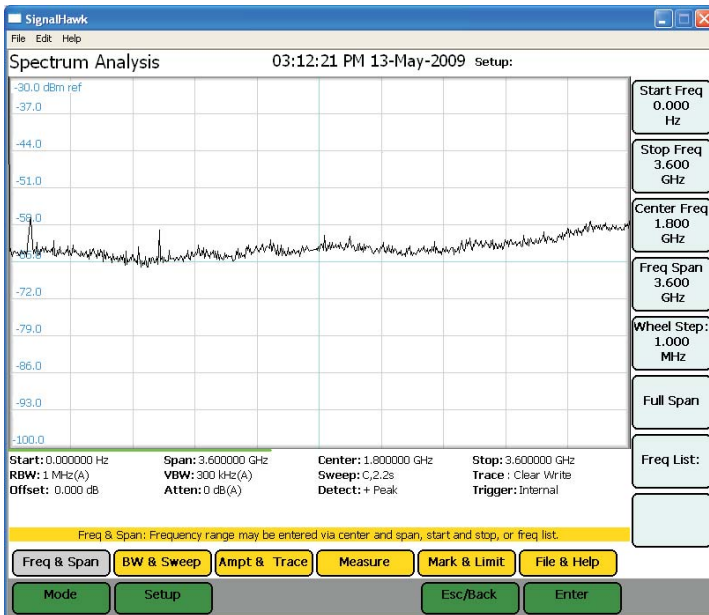
In the Spectrum Analyzer mode, the following measurements can be used:

- “Spectrum Analysis Measurement” on page 48.
- “Occupied Bandwidth Measurement” on page 49.
- “Channel Power Measurement” on page 51.
- “Adjacent Channel Power Measurement” on page 53.
- “Time Domain (Zero Span)” on page 55
- “Field Strength Measurement” on page 56.
- “Carrier-to-Interference Ratio” on page 59.
- “Out-of-Band and In-Band, Out-of-Channel Spurious” on page 61.
- “Water Fall Spectrogram” on page 40.

## Spectrum Analysis Measurement

Spectrum Analysis measures the power at each frequency in the range shown on the screen. From the Spectrum Analyzer list on the Start Menu, select Spectrum Analysis then press the Enter key.

**Figure 36** Example, Spectrum Analysis, Frequency and Span Screen



## Occupied Bandwidth Measurement

Occupied Bandwidth measures the frequency band bandwidth that contains a specified percentage of the total power of the signal.

It gives best results with single-peaked signals. Bandwidth can be defined in two ways. Both give measurement results in Hz units.

### Threshold Modes

#### %

The calculated occupied bandwidth represents the user specified percent of the total power of the displayed span. Best for Watts power units.

#### dBc

The bandwidth is calculated by finding the frequencies above and below the center or carrier frequency that is the user specified dB below the carrier level. This method is best for measuring dBm power units.

### Setting Occupied Bandwidth

**Note:** For the best accuracy, set the center frequency so the main or carrier signal is centered on the screen before taking measurements.

1. Select either % or dBc under Threshold Mode.
2. Do one of the following:
  - **If the % Threshold has been selected**, go the % soft key and set the desired threshold via either the mouse scroll wheel or keyboard.
  - **If the dBc Threshold has been selected**, go the dBc and set the desired threshold via either the mouse scroll wheel or keyboard.

**Note:** The threshold and the measured bandwidth will be displayed in the “measurement settings” area at the bottom of the display. Markers 1 and 2 will be turned on, and placed at the band edges.

Figure 37 Example, Occupied Bandwidth

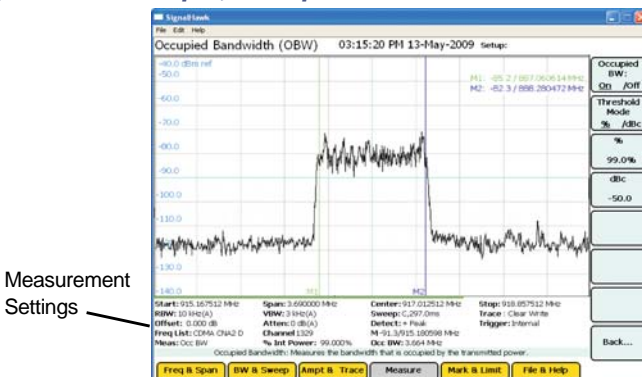




Figure 38 Example, Occupied Bandwidth - %



Note: Limit can be set without changing the Threshold Mode.

Figure 39 Example, Occupied Bandwidth - dBc



Note: Limit can be set without changing the Threshold Mode.

## Channel Power Measurement

Channel Power measures the Integration Bandwidth, the total power over a frequency range, concentrated on the center frequency of the sweep. It is useful for channelized (frequency-division multiplexed) signals. Results are shown in both total power in the channel (in dBm or Watts), and spectral density (dBm or Watts per Hz).

### Setting Channel Power

**Note:** For best accuracy, set the center frequency so the signal is roughly centered before taking measurements. In addition, the span should be  $1\frac{1}{2}$  – 5 times as large as the desired channel width.

1. Select the Integration Bandwidth (IBW).

**Note:** The IBW is automatically set when a channelized frequency band is selected from the Frequency list.

2. Enter the desired bandwidth.
3. Select the desired unit.

**Note:** The default unit is MHz.

**Note:** The integration bandwidth, channel power, and power density will be displayed in the “measurement settings” area at the bottom of the display. Markers 1 and 2 will be turned on, and placed at the band edges.

Figure 40 Example, Channel Power

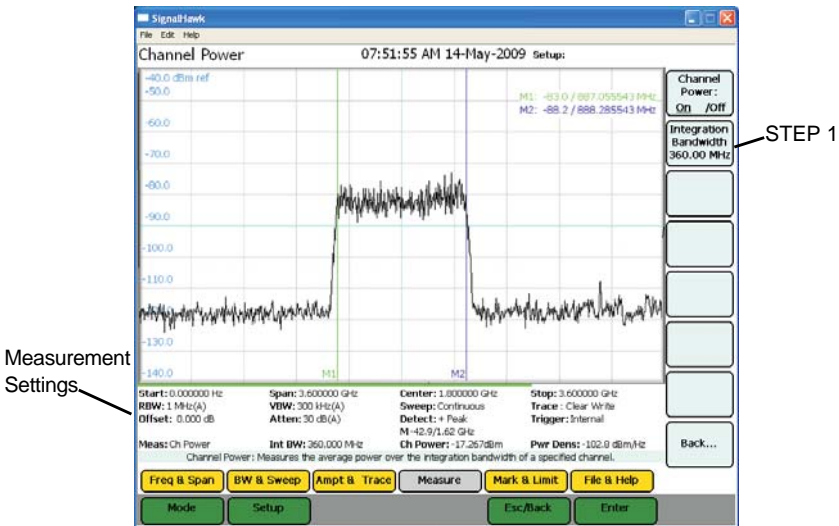
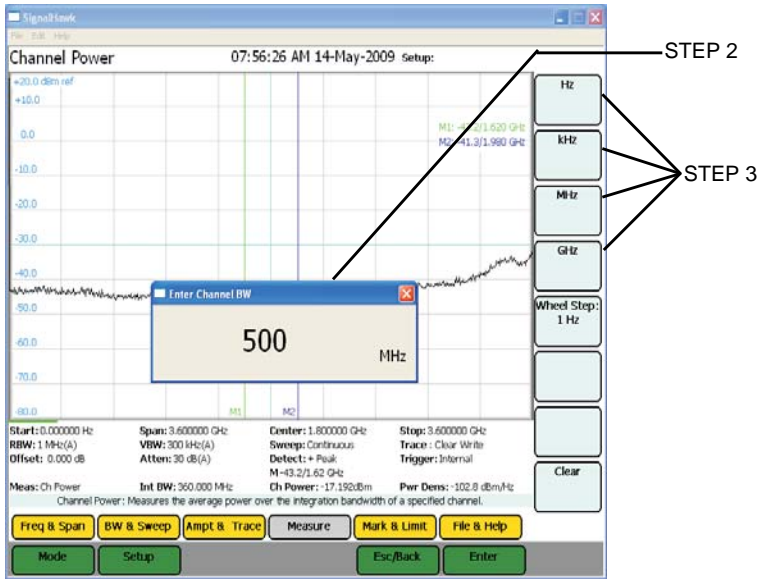


Figure 41 Example, Channel Power, Integration Bandwidth



## Adjacent Channel Power Measurement

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Adjacent Channel Power measures the relative power of frequency bands adjacent to a central channel. This is often used to identify power leakage from the center channel into the adjacent channels. The total power in the central (main) channel is displayed in dBm

(Ch Power), and the power in the adjacent channels is displayed as dB below and above the main channel power (Dn ACPR and Up ACPR).

**Note:** *For best accuracy, set the central frequency so the signal is centered before taking measurements. In addition, set the span so the central, upper, and lower channels are all shown on the screen.*

**Note:** *If a channelized band is selected from the Frequency list, these parameters are automatically set.*

1. Set the width of the central channel.

**Note:** *The central channel can be set to a different frequency width than the adjacent channels, but both adjacent channels have the same width.*

2. Set both adjacent channels.
3. Set the Center-to-Center channel spacing.

**Note:** *Channel spacing is the distance from the central channel's center frequency to the adjacent channel's center frequency. If there is no guardband between channels, the channel spacing should be half (channel width + adjacent channel width).*

4. Enter the desired bandwidth in each variable.
5. Select the desired unit of measurement.

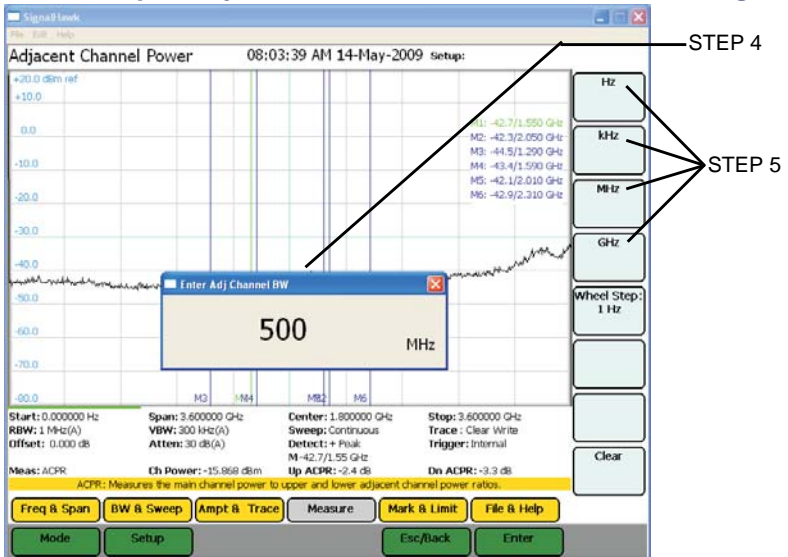
**Note:** *Pressing Enter will default the Unit to MHz.*

**Note:** *All 6 markers will be used to show the edges of the central, upper, and lower channels.*

Figure 42 Example, Adjacent Channel Power



Figure 43 Example, Adjacent Channel Power, Bandwidth Settings



## Time Domain (Zero Span)

In Time Domain, the amplitude of a single frequency is measured, rather than sweeping a range of frequencies. The SignalHawk measures and displays the amplitude of the frequency for a specified period (sweep time) and refreshes during the next sweep. The Time Domain trace resembles the horizontal line display on an oscilloscope.

**Note:** *The center frequency will be measured.*

1. Activate the measurement by doing one of the following:
  - Select Time Domain in the Start Menu.
  - Select Time Domain in the Measurement Menu.
  - Set the Frequency Span to 0 Hz. See "[Freq & Span Menu](#)" on page 28.
2. Press the Sweep Time soft key and enter how long a single sweep should be using one of these methods:

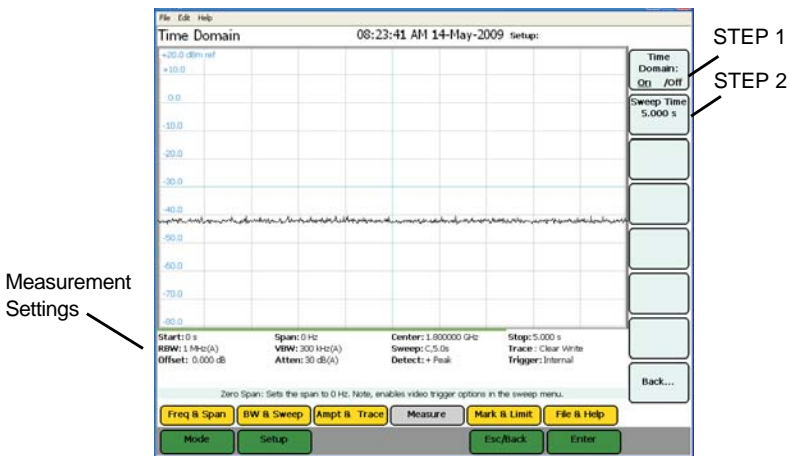
**Note:** *Time range can be set from 1 ms to 100 s.*

- **Up/Down Arrows:** Step increments of one second.
- **Right/Left Arrows:** Step increments of one millisecond.
- **Mouse Scroll Wheel:** Step increments of one second per click.
- **Number Keys:** Enter the time in seconds.

**Note:** *There are a limited number of pixels, so longer sweep times mean less detail in the display.*

**Note:** *This enables the Video Trigger in the BW & Sweep menu. To use the Video Trigger, See "[Resolution & Video BW](#)" on page 33.*

Figure 44 Example, Time Domain



## Field Strength Measurement

Field Strength measures the signals reaching an antenna. The SignalHawk automatically corrects the sweep data for the antenna's gain and frequency dependence and displays it in dBm / m.

1. Connect an antenna to the RF In connector on the SignalHawk.

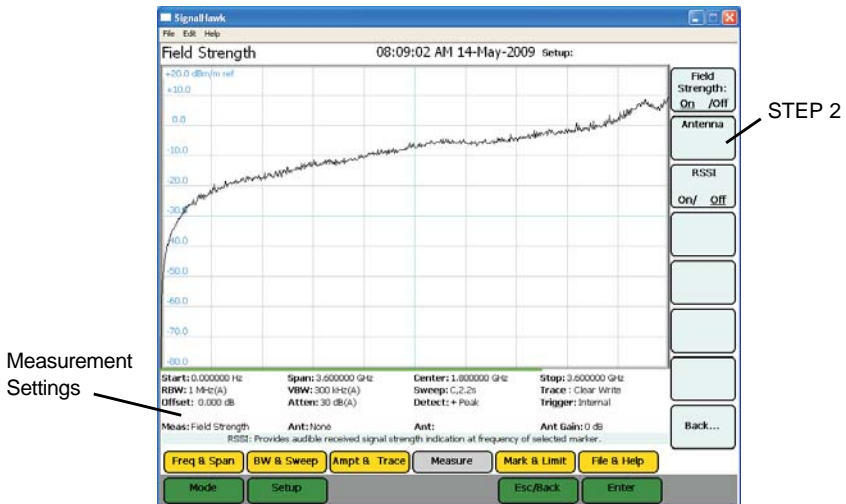
**Note:** Use an antenna with known gain characteristics. For best accuracy, set the start and stop frequencies to the measurement range of the chosen antenna.

2. Select Antenna and select the antenna type from the drop down list.

**Note:** The antenna type, valid frequency range, and gain in dB (relative to an isotropic radiator) are shown in the measurement settings area.

3. Measure the strength of the signal emanating from a transmission antenna (within the frequency range of the antenna connected to the RF In port).
4. Move to various positions relative to the transmitting source and observe the signal value.

**Figure 45** Example, Field Signal Strength



## Received Signal Strength Indicator (RSSI)

RSSI provides an audible indication at the frequency of the current marker. It will beep faster as the received signal strength goes up and slows as it goes down.

Similar to Water Fall, power is linearly mapped to a range of 0-210 using the same range as for the Water Fall for simplicity. The beep rate and volume are proportional to the mapped power value at the current marker index. Values of zero are equivalent to continuous beeps and -210 are equivalent to a beep every 4 seconds.

**Figure 46 Example, Field Signal Strength - RSSI**



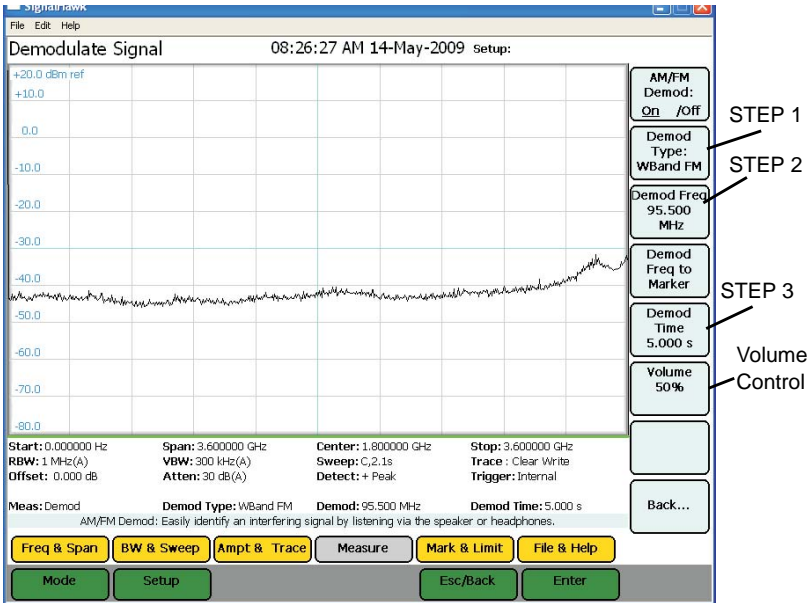


## Demodulate Signal

Removes the carrier and sends the signal to the internal speaker or headphones. The SignalHawk can demodulate AM, narrowband FM, and wideband FM signals. It can also set the specific frequency and volume.

1. Set the type of demodulation:
  - a. Select the Demodulate Type.
  - b. Select the type of demodulation desired.
2. Set the demodulation carrier frequency:
  - a. Select the Demod Freq button.
  - b. Enter the carrier frequency using the number keys.
  - c. Select the frequency units.
3. Set the time to demodulate the signal:
  - a. Select the Demodulate Time button.
  - b. Enter a value.
  - c. Select the time units.
  - d. Allow audio to play for the demodulate time.
  - e. Repeat as necessary.

**Figure 47 Example, Demodulate Signal**



## Carrier-to-Interference Ratio

Calculates the ratio of the carrier signal power to the power level of the noise and interference signals.

To determine the ratio, two measurements need be done. First sweep should be the carrier and interferer. The second sweep should be the interferer alone.

**Note:** *Because the transmitted carrier must be turned off for the second portion of this measurement, access to the transmitter is needed to complete this procedure.*

1. Do one of the following:

- Move marker to the desired frequency.

**Note:** *The default marker placement assumes the carrier to be measured is the center of the frequency span. It can be moved via the arrow keys and/or wheel.*

- Select Marker to Max Peak to quickly identify the signal to be measured.

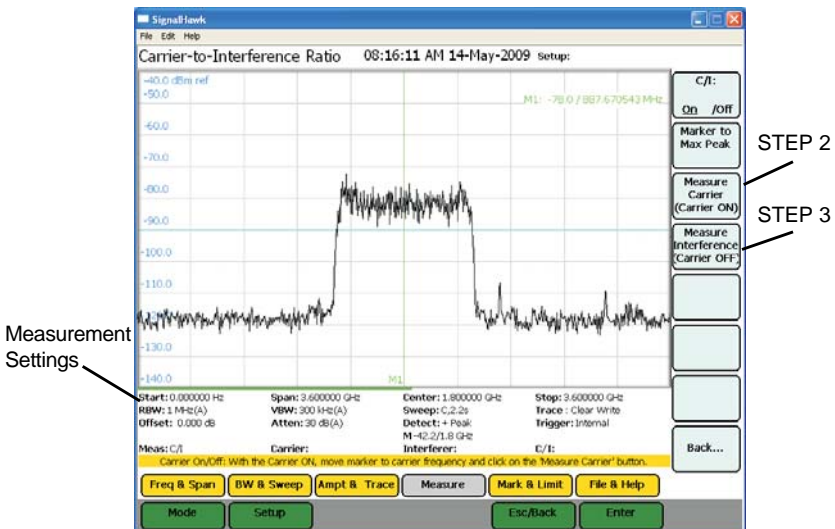
2. Measure the carrier signal.

3. Turn off the transmitter.

4. Measure the noise and interference signal levels as follows:

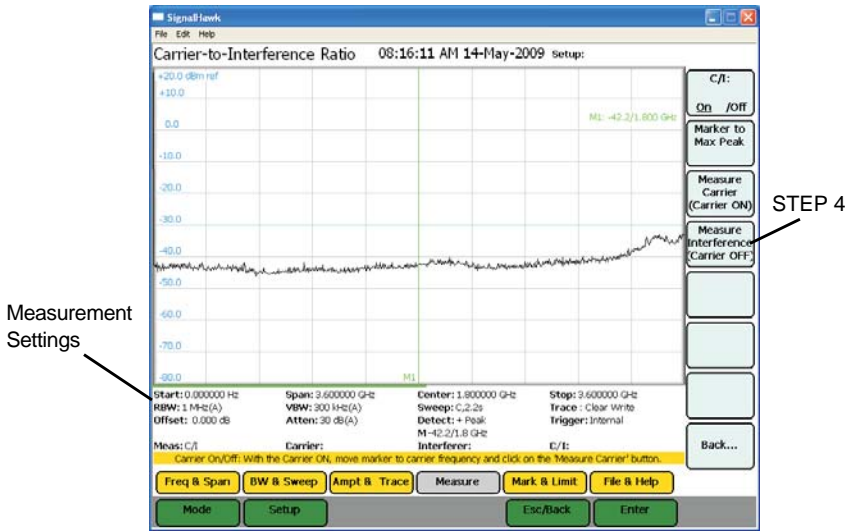
**Note:** *The carrier power and interferer power will be displayed in selected power units, and the ratio in dB.*

**Figure 48 Example, Carrier-to-Interference Ratio - Carrier On**



**Note:** *In the status area, the carrier power, interferer power will be displayed in selected power units, and the ratio in dB.*

Figure 49 Example, Carrier-to-Interference Ratio - Carrier Off



## Out-of-Band and In-Band, Out-of-Channel Spurious

---

**Note:** *These two measurement methods are not listed on the interface.*

Out-of-Band & In-Band, Out-of-Channel Spurious measures the distortion and interference inside or outside a system band.

1. Click on Mark & Limit.
2. Click on the Marker 1 2 3 4 5 6 selection to select marker 1.

**Note:** *The bracketed number indicates the active marker.*

3. Click on On/Off.
4. Use the arrow keys, the number keys or mouse scroll wheel to move the marker over one of the spurs.
5. Compare the value of the marker to the specified allowable level of Out-of-Band (In-Band, Out-of-Channel) spurious emissions for the corresponding channel transmit frequency.

With SignalHawk’s built-in utilities, information about the instrument is displayed. The Menu keys provide information about the software, hardware, and data files.

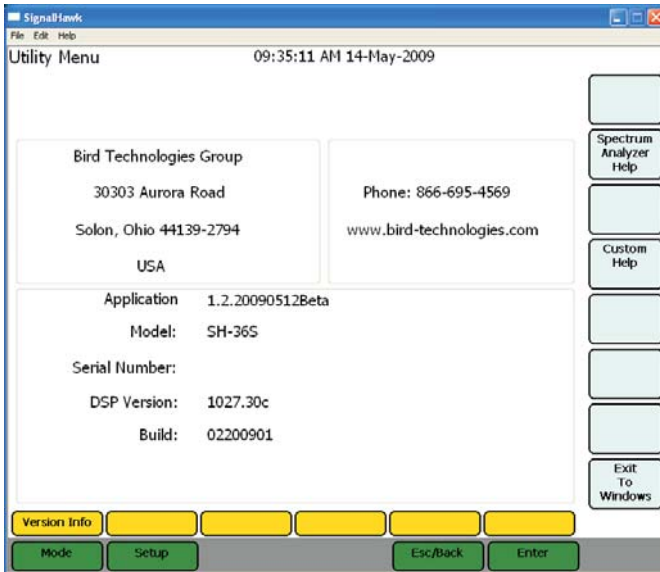
Utilities can be accessed by clicking on Utilities from the Start Menu screen, or by clicking on File & Help from a measurement screen then click on Utility.

To exit the Utility mode, press the Esc/Back function key to return to the previous screen, or press the Mode key to go to the Start Menu screen.

## Utility

Click on Utility to go to the Utility Menu. When the utility menu is accessed, new menu keys and selections for getting help and exiting to the Windows operating system are activated. The Utility Menu screen displays status information about the instrument and about the operating system.

**Figure 50** Utility Menu, Main Screen, Version Info Screen



## Utility Main Menu

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### Version Info

---

Click on this to view general information such as how to contact Bird Technologies Group.

The selections for this menu provide access to user help and the Windows operating system.

### Utility Main Menu Selections

---

#### Spectrum Analyzer Help

Click on this selection to display the SignalHawk Start-up Instructions. Press the up- and down-arrow keys or use the mouse scroll wheel to scroll through the displayed text. Click on Exit Menu or Esc to return to the Utility Menu.

#### Custom Help

Displays user created help files that have been uploaded to the SignalHawk.

#### Exit to Windows

Click on this to exit the SignalHawk program.

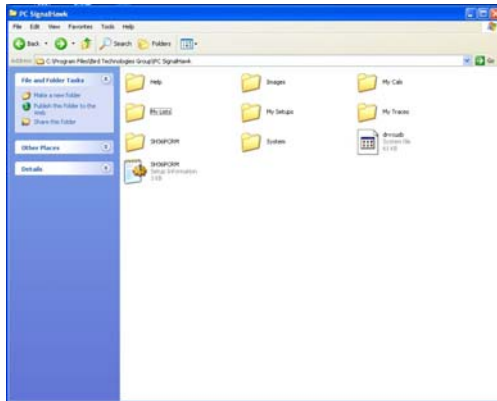
## Customizing SignalHawk Content

---

1. Go to the Utilities menu.
2. Press the Exit to Windows soft key.

**Note:** *The SignalHawk will ask for verification.*

3. Go to My Computer on the PC.
4. Click on the following:
  - a. Hard Drive
  - b. Program Files
  - c. Bird Technologies Group
  - d. PC SignalHawk
  - e. My Lists

**Figure 51 PC SignalHawk Directory**

5. Copy the csv file of the list to be edited to the desktop of the PC.
6. Open the csv file.
7. Add custom information into the list.
8. Copy the csv file back into the My Lists directory.

**Note:** *The computer will ask for verification to overwrite the file in the directory.*

9. Close the My Lists directory window.
10. Launch the PC SignalHawk program.

Bird's SignalHawk PCTool enables the use of a PC to store measurement data, transfer it between units, and do individual analysis. Traces can be transferred from the SignalHawk to the PC and back. One or more saved traces can be opened and compared. They can also be copied and pasted into other open files, as well as adding markers or limit lines. In addition, labels can be added and modifications saved to files.

**Note:** *Not all sections of this chapter apply to the PC and Rack Mount SignalHawks.*

## Computer Requirements

---

The PC must meet the following minimum requirements:

- Windows 98 or later operating system
- Internet Explorer version 6 or later
- Hard disk with 30 MB of free space

## Installing Windows 7 Drivers for the BTG Signal Hawk

---

1. Download the appropriate version of Microsoft® WMDC (Windows® Mobile Device Center) from here: <http://support.microsoft.com/kb/931937>.

**Note:** *You will have to go through Microsoft Genuine Advantage validation, either via ActiveX script or manually, whichever your system allows.*

2. Install WMDC on your PC.

**Note:** *Do not follow Microsoft's instructions.*

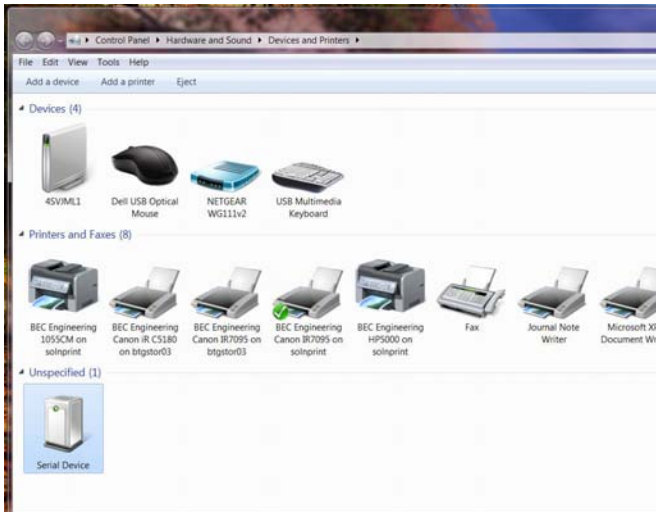
3. Turn the Signal Hawk on.
4. Connect a standard A/B USB cable from the PC to the SignalHawk.

**Note:** *Windows 7 will try to install drivers but will be unsuccessful. Ignore its results.*

5. From the Start Menu, open the Devices and Printers folder.



**Figure 52** Devices and Printers Folder



6. Select the new “Serial Device.”

**Note:** It will have a yellow “caution” triangle with an (!) in it which indicates that no driver has been installed.

7. Select the “Hardware” tab and click on “Properties” for the “Serial Device”.

**Figure 53** Hardware Tab

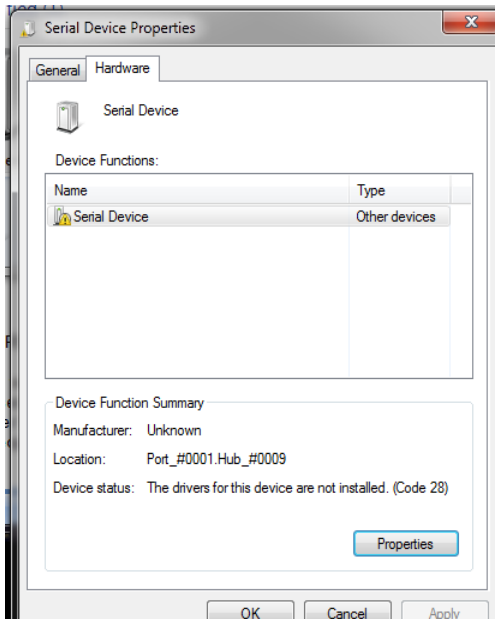
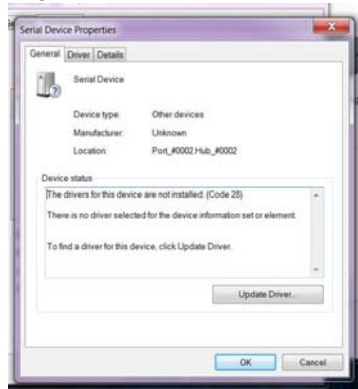


Figure 54 Device Properties



8. Click on the “Update Driver” button.
9. Select “Browse my computer for driver software.”
10. Select “Let me pick from a list of device drivers on my computer.”
11. Scroll down to “Mobile devices” and click the “Next” button.
12. In the left box scroll down and highlight “Microsoft.”
13. In the right box select “Microsoft USB Sync.”

Figure 55 Mobile List



14. Click the “Next” button.
15. Click the “Yes” button in the “Update Driver Warning” message box that appears.
16. Wait while the driver is installed.
17. A confirmation box appears indicating success. Click the “Close” button. Accept the BitsyX license terms after reading them in the pop-up.
18. The Windows Media Device Center dialog will open.

**Figure 56 Windows Mobile Device Control Screen**

19. Close the WMDC window.
20. Run the SH PC Tool to transfer traces or upgrade the Signal Hawk firmware.

## Downloading and Installing Software

---

**Note:** *These files are on the CD supplied with the SignalHawk, and can also be downloaded from the website.*

**Note:** *For the latest versions of the PCTool, Microsoft<sup>®</sup> ActiveSync<sup>®</sup>, and USB Drivers download them from the Bird Technologies SignalHawk website.*

*For PC and Rack Mount:*

<http://birdrf.com>

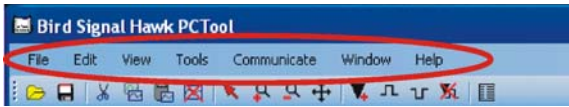
### Installing the PC Tool Software

---

1. Download and install Microsoft ActiveSync.
2. Click on "Install PC Interface Tool."
3. Save the compressed file to the PC's desktop.
4. Double click the compressed file on the PC desktop.
5. Click-and-drag the SHPCTool icon (Setup file) out of the compressed file window and onto the PC desktop.
6. Double-click the Setup file.
7. Follow the instructions in the Install Wizard to complete the installation.

## Menu Bar

---



### File

---

Presents commands to Open, Close, Save, Export, and Print SignalHawk files that are stored on the PC.

**Note:** *By default, traces will be saved to the “My Traces”, which is a subfolder under the folder where the PCTool was installed.*

### Edit

---

Presents commands to copy the active trace from a graph and paste it into another graph. Traces can also be deleted from a graph.

**Note:** *The last trace remaining on a graph cannot be removed.*

### View

---

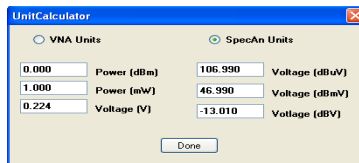
Presents commands to manipulate the trace - Zoom In, Zoom Out, Add, and Delete Markers or Limit Lines, Autoscale the Trace, Set to Normal Mode, and Set Options. Normal mode is identified by the standard Windows “selection” cursor (arrow pointing to the upper left). DTF Settings (Cable Vp & Loss, Start & Stop Distance, etc) can also be viewed.

### Tools

---

Presents access to the units converter.

**Figure 57** Units Converter



### Measurements

---

**Note:** *This option will only appear for VNA traces.*

Presents the various measurement types to display the reading. The types of measurement depend on the type of trace file being read. VNA files will give Match Measurement, Distance-to-Fault, Cable Loss, and Smith Chart as options.

### Communicate

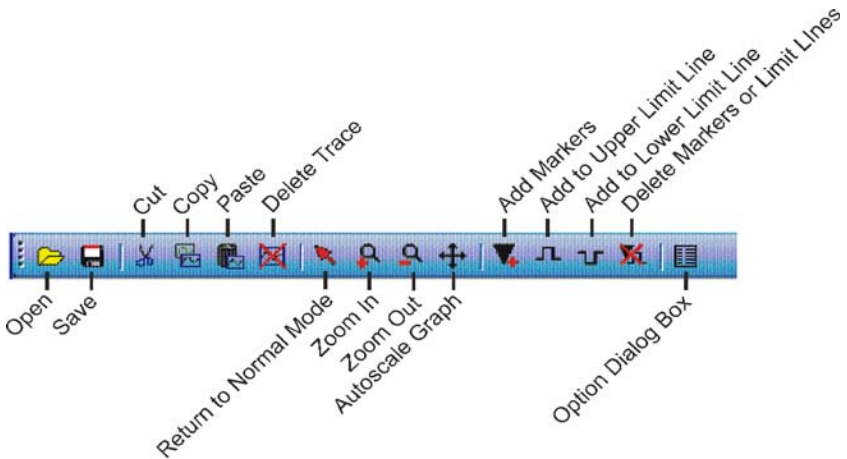
---

Presents commands to get files from and/or send files to the SignalHawk. In addition, use this function to upgrade the SignalHawk software/firmware.

## Tool Bar

---

Use the tool icons to perform the tasks that are available on the Menu bar.



### Save

---

Saves a copy of a graph.

### Open

---

Opens a graph.

### Cut

---

Cuts a trace from a graph.

### Copy

---

Copies a trace from a graph.

### Paste

---

Pastes a trace onto a graph.

**Note:** A trace from one measurement type cannot be placed onto a graph from another measurement type (Occupied Bandwidth, Channel Power, etc). The graphs do not match.

### Delete Trace

---

Deletes a trace from a graph.

**Note:** The last trace on a graph cannot be deleted.

## **Return to Normal Mode**

---

Returns the display back to the start menu.

## **Zoom In**

---

Increases the focus on a specific area of a graph.

## **Zoom Out**

---

Decreases the focus from a specific area of a graph.

## **Autoscale Graph**

---

Resizes the axis to fit all traces on the graph.

## **Add Markers**

---

Drops a marker onto a graph.

## **Add to Upper Limit Line**

---

Adds a limit line to the graph.

- First click will create a point on the graph with a highlighted line.
- Second click will create another point that connects to the first point via a line.
- Third click connects to the second, and so on.

## **Add to Lower Limit Line**

---

Adds a limit line to the graph.

- First click will create a point on the graph with a line.
- Second click will create another point that connects to the first point via a line.
- Third click connects to the second, and so on

## **Delete Markers or Limit Lines**

---

Deletes a marker, a limit line, or a point on a limit line. When deleting points, the icon will change to an eraser graphic when the icon floats over something that can be deleted.

## **Option Dialog Box**

---

Opens the pop-up Option Dialog box. See "[Options Dialog Box \(View>Options\)](#)" on page 73.

## **Measurement Types**

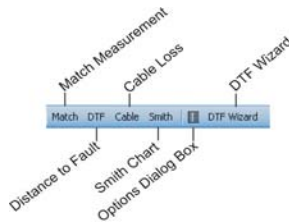
---

The measurement types for that file are displayed, depending on the type of file being read.

## VNA Tool Bar

**Note:** There is an addendum, with additional options, to the menu bar when the PC Tool is reading a VNA file.

**Note:** This section does not apply to PC and Rack Mount SignalHawks.



### Match

Sets the current trace to a Match measurement display.

### Distance to Fault

Sets the current trace to a Distance to Fault display.

### Cable

Sets the current trace to a Cable Loss display.

### Smith

Sets the current trace to display a Smith Chart.

### Options Dialog Box

Opens the pop up Option Dialog box. See "[Options Dialog Box \(View>Options\)](#)" on [page 73](#).

### DTF Wizard

Opens the Distance to Fault Wizard.

**Figure 58** DTF Wizard

 A screenshot of the DTF Wizard dialog box. It is divided into several sections:
 

- Cable Parameters:** Includes a dropdown menu, Velocity of Propagation (Vp) set to 1.000, and Loss (dB/m) set to 0.000.
- Window Type:** Radio buttons for None (selected), Low, Med, and High.
- Distance Parameters:** Max Distance (m) set to 35.176, Resolution (m/point) set to 0.050, Start Distance (m) set to 0.000, and Stop Distance (m) set to 1.000.
- Distance Units:** Radio buttons for Meters (selected) and Feet.
- Apply to all traces:** An unchecked checkbox.
- Buttons:** Cancel, < Prev, Next >, and OK.

## Options Dialog Box (View>Options)

The Options dialog box contains six tabs - Scale, Units, Markers, Limits1, Limits 2, and Labels. Select a tab and enter or edit specific values for the currently active graph.

### Scale Tab

1. Enter the x- and y- axis.
2. Enter the y- axis offset.
3. Do one of the following:
  - Select the Autoscale box.
  - Manually enter values for the scales.

**Note:** *The Offset setting for a specific trace is displayed. The setting changes when the Trace changes.*

Figure 59 Example, Scale Tab



### Units Tab

1. Select the units of measure for the y axis.
2. Set the size of text for the entire graph.
3. Set whether or not to display grid lines.

Figure 60 Example, Units Tab





## Markers Tab

When a frequency or distance for a marker is entered, the marker will be set to the datapoint closest to that frequency or distance. The actual frequency of the marker will replace the value entered and will also display on the screen below the graph area.

For each marker:

1. Specify or change the frequency.
2. Specify the symbol type.
3. Specify a delta with another marker.
4. Turn a marker on or off.

**Note:** After turning a marker on in the Options window, the marker can be moved by clicking on the marker and dragging it to a desired location.

Figure 61 Example, Markers Tab



## Limits 1 Tab

Defines and turns on or off upper/lower limit lines.

**Note:** The options displayed on this tab will change slightly depending on the type of graph opened.

**Note:** The upper limit fails any datapoints that are above the line.

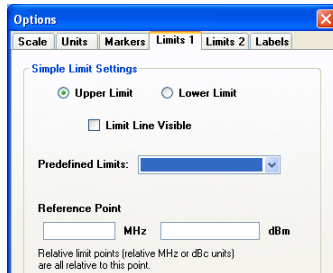
**Note:** The lower limit fails any datapoints that are below the line.

**Note:** The limit line will be flat across the graph at the power level specified.

1. Click on the line
2. Drag the line to move it up and down.

**Note:** There is a drop down menu of predefined limits that is available to be utilized.

Figure 62 Example, Limits 1 Tab



### Limits 2 Tab

**Note:** The options displayed on this tab will change slightly depending on the type of graph opened.

**Note:** The upper limit fails any datapoints that are above the line.

**Note:** The lower limit fails any datapoints that are below the line.

**Note:** Up to thirty points, for both upper and lower limit lines can be set up. Using multiple points, a bracketed area may be created.

1. Click on a segment
2. Drag each segment at its set point to move it up or down.

**Note:** If a limit line point is disabled, it is removed from the list in the Options dialog box.

Figure 63 Example, Limits 2 Tab

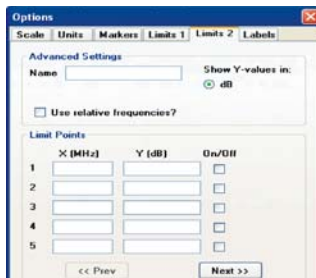
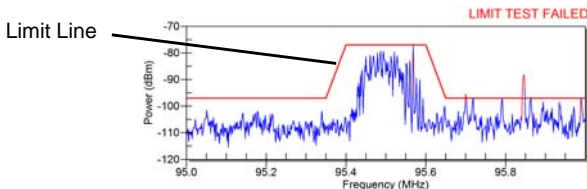


Figure 64 Multiple limit line points used to create a bracketed area



## Labels Tab

Creates a title, subtitle, and a trace name for the displayed trace.

The title will be in larger letters and centered above the graph. The subtitle will be smaller.

Edit a trace name by typing in the list of traces on this tab. The trace and date will be located above the graph and on the left.

**Note:** *If a specific trace name is not created, the PC tool will create one automatically.*

Other options are to display or hide the title, subtitle, trace name, and trace date on the graph.

**Figure 65** Example, Labels Tab

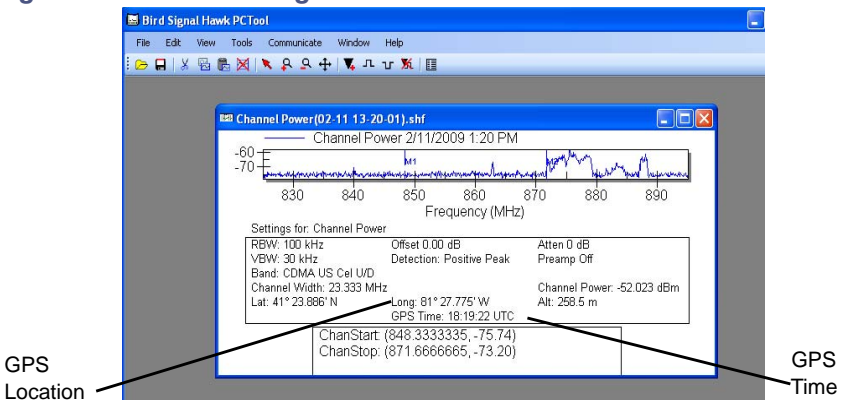


## GPS

If a GPS sensor is attached to the SignalHawk, it will display a location and GPS time reading at the bottom of the trace.

**Note:** *This section does not apply to PC and Rack Mount SignalHawks.*

**Figure 66** GPS Reading



Regular maintenance is essential for proper and accurate performance of the SignalHawk. These procedures cover the basic maintenance of the SignalHawk. For more advanced issues, please contact Bird Technologies customer service.

## Cleaning

---

**CAUTION**

Harsh or abrasive detergents, and some solvents, can damage the unit and labels.

Clean the Bird SignalHawk only with a soft cloth dampened with mild detergent and water. Do not use any other type of cleaning solution.

## Charging the Battery

---

The internal battery pack will automatically recharge when the SignalHawk is powered from the AC or cigarette lighter adapter. Recharging time, from a full discharge, is approximately 4 hours.

## Replacing the Battery on the PC SignalHawk

### WARNING

Care should be taken when handling batteries.

Keep out of the reach of children.

Do not heat or dispose of batteries in fire. May burst or release toxic materials.

Avoid forced discharge.

Do not short circuit.

Restrict charging current and time to the recommended value.

Do not solder the battery directly.

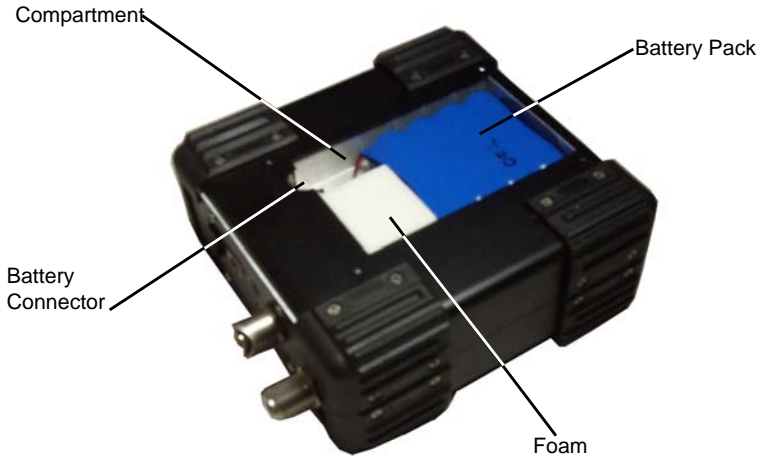
Do not disassemble, apply excessive pressure, or deform.

Avoid placing the battery in reverse polarity.

Battery disposal method should be in accordance with local and state regulations.

1. Remove the four screws securing the back cover to the SignalHawk.
2. Remove the back cover.
3. Remove the battery pack.
4. Detach the power cord from the battery connector.
5. Reverse Steps 1 to 4 to install a new battery.

**Figure 67** Replacing the Battery



## Updating the Firmware

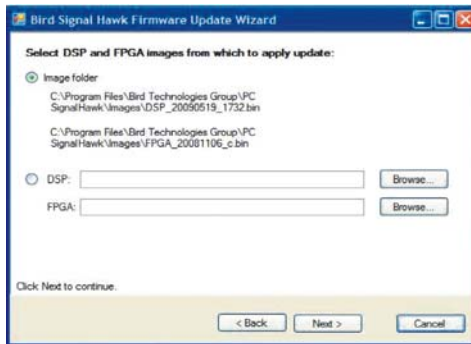
**Note:** There are two different firmware files: one containing the DSP image and the other containing the FPGA image.

1. Navigate to Bird Technologies Group>PC SignalHawk in the Start menu.
2. Click on Firmware Update Wizard.

**Note:** The wizard will launch and provide step-by-step instructions.

3. Select the DSP and FPGA images to be updated.

**Figure 68** DSP and FPGA Image Selection

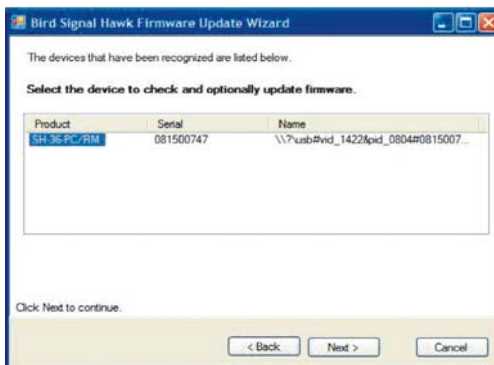


4. Connect the unit to the PC via USB cable.
5. Turn on the SignalHawk.
6. Select “Install the software automatically...” if the “Found New Hardware Wizard” is presented.

**Note:** Both program wizards will run co-currently. See ["Installing the SignalHawk Program"](#) on page 9 for the PC SignalHawk.

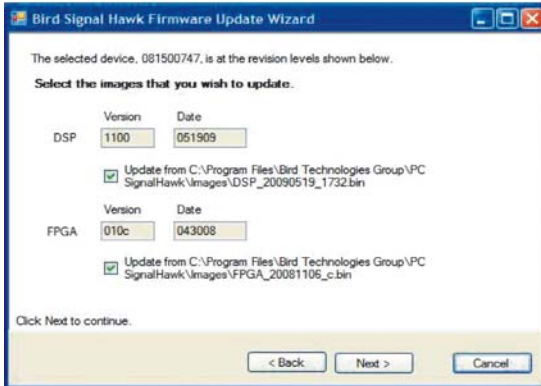
7. Click “Next.”

**Figure 69** DSP List



8. Select the unit from the list presented.
9. Select the images that need updating.
10. Click “Next” repeatedly until the update is completed.

**Figure 70 Image Selection**



11. Cycle power when prompted by the program wizard.

## Updating the Firmware on a Remote Rack Mount SignalHawk

1. Go to <http://birdrf.com>.
2. Download the Rack Mount SignalHawk software upgrade to a local PC.
3. Connect the remote computer to the host computer. See "[Connecting a Remote Computer to the Host Computer](#)" on page 19.
4. Click on “Options-Local Resources” at the start of the Remote Desktop Connection window.

**Figure 71 Remote Desktop Connection Window**



5. Select “Disk drives”.

**Note:** This will enable access of the local drives to the remote Rack Mount SignalHawk.

Figure 72 Options-Local Resources



6. Click on the “Connect”.
7. Click “OK” to access the local drives from the remote computer.
8. Log into the remote computer.
9. Stop the Rack Hawk application.
10. Copy the PC Hawk software upgrade from the local PC to the Rack Hawk at XXXXXXXXXXXX.
11. Double click “Setup” and follow the upgrade instructions.



## Troubleshooting

Any service procedure not covered in this manual should be referred to an authorized service facility.

Locate the problem, review the possible causes, and perform the action listed. If the problem is not corrected, give us a call or return the unit for service.

Problem	Possible Cause	Possible Correction
Unit will not power up.	AC adapter is damaged.	Replace the AC adapter.
	Battery is not fully charged or is damaged.	Allow battery to fully charge or replace the battery. See <a href="#">"Replacing the Battery on the PC SignalHawk" on page 78.</a>
Self test fails.	Error condition.	Turn the unit off and then back on. If the problem persists, return the unit for service.
Keys do not respond.	Unit is "Locked Up".	Turn the unit off and then back on.
Unit turns off.	Internal error.	Turn the unit back on and continue.
	Unit was shut down because the battery was too low to operate the unit.	Operate the unit from the AC adapter.
Unit operates erratically.	System has become unstable.	Turn off power, wait 15 seconds, then reapply power.
Unit ceases to operate (locks up).	System has become unstable.	Turn off power, wait 15 seconds, then reapply power.
Unit gives inaccurate readings below 100 kHz.	Unit can be set below 100 kHz for user convenience, but is not specified below 100 kHz.	Do not use unit below 100 kHz.
Sweep is too slow.	Bandwidth set too low.	Increase BW. See <a href="#">"Setting Occupied Bandwidth" on page 49.</a>
Sweep stopped.	Sweep set to single-sweep or external trigger.	Set unit to continuous sweep, free rep trigger. See <a href="#">"Sweep" on page 35.</a>

## **Customer Service**

---

Any maintenance or service procedure beyond the scope of those in this chapter should be referred to a qualified service center.

If the unit needs to be returned for any reason, request an Return Material Authorization (RMA) through the Bird Technologies website. All instruments returned must be shipped prepaid and to the attention of the RMA number.

### **Bird Service Center**

30303 Aurora Road  
Cleveland (Solon), Ohio 44139-2794  
Fax: (440) 248-5426  
E-mail: *bsc@birdrf.com*

For the location of the Sales Office nearest you, visit our Web site at:

*<http://www.birdrf.com>*

## Specifications

Model Number	Model Name
SH-36S-RM	Rack-Mount SignalHawk
SH-36S-PC	PC SignalHawk

### SH-36S-RM

Frequency	
Range	100 kHz to 3.6 GHz
Resolution	1 Hz
Uncertainty	$\pm 1$ ppm ( $2\sigma$ ) of measured frequency
Aging	$\pm 1$ ppm / year ( $2\sigma$ )
Temperature Drift	$\pm 1$ ppm / °C ( $2\sigma$ )
Span	1 kHz to 3.5999 GHz; 0 Hz (zero span)
Spectral Purity, Max @ 1 GHz	
30 kHz from carrier	-85 dBc / (RBW Hz) <sup>1/2</sup>
100 kHz from carrier	-100 dBc / (RBW Hz) <sup>1/2</sup>
1 MHz from carrier	-124 dBc / (RBW Hz) <sup>1/2</sup>
Sweep Time:	15.5 ms per data point to >2000 s, full span; 1 ms to 100 s, zero span
Displayed Data Points	705
Resolution Bandwidth (RBW):	100 Hz to 1 MHz in 1, 3, 10 steps
Video Bandwidth (VBW):	10 Hz to 300 kHz in 1, 3, 10 steps

Amplitude	
Display Range	-150 dBm to +30 dBm
Intermodulation-Free Dynamic Range	66 dB; Third-order IM products, Two -20 dBm inputs, Reference = -10 dBm
Displayed Average Noise Level (DANL)	-135 dBm; 24 dB gain, 100 Hz RBW, 10 Hz VBW, average detection
Inherent Spurious	-80 dBm; reference $\leq -10$ dBm, $f > 30$ MHz, RBW $\leq 100$ kHz
Input Related Spurious	-70 dBc; mixer level $\leq -30$ dBm, carrier offset $\geq 1$ MHz
Reference Level	-140 dBm to +30 dBm
Attenuator	Built-in: 0, 10, 20, 30 dB
Pre-Amp	Built-in: +24 dB

<b>Amplitude</b>	
Resolution dB-based units W or V-based units	1 to 15 dB per division in 1 dB steps 1%, 2%, 5%, or 10% of reference level per division
Units	dBm, $\mu$ W, mW, W, dB $\mu$ V, dBmV, dBV, $\mu$ V, mV, V, dB/m <sup>2</sup> , $\mu$ V/m <sup>2</sup>
Offset Range	-99 to +99 dB
Accuracy	$\pm$ 1.5 dB max (2 $\sigma$ ), $\pm$ 1.0 dB typical, >-50 dB ref, 15 to 35 °C, max detector
Averaging	Running display average, 2 to 100 sweeps
Detection Modes	sample, +peak, -peak, average, video average

<b>Measurements</b>	
Spectrum Analysis	Analyzes radio frequency spectrum. Measures intended and interfering signals. Allows setup of parameters such as frequency, amplitude and markers. Graphically displays signals amplitude vs. frequency and saves traces internally or to a compatible PC. Allows remote logging & monitoring.
Worldwide Applications	Cellular, PCS, DCS, 2 G, 3 G, CDMA, cdmaOne, CDMA 2000, 1x, 1x EV-DO, GSM, GPRS, EDGE, UMTS, HSDPA, W-CDMA, TDMA, AMPS as well as 802.11, Bluetooth, Broadcast, Emergency, Fire, GPS, Microwave, NPSPAC, Paging, Police, Private, Project 25, Public Safety, Tactical Military, Telematics, Tetra, Trunking, Utilities, WLAN and WLL.
Predefined Measurements	Spectrum Analysis, Occupied Bandwidth (OBW), Channel Power, Adjacent Channel Power Ratio (ACPR), Arbitrary Power Range, Field Strength, Zero Span, AM/FM Demodulation, Carrier-to-Interference Ratio (C/I), and Frequency Counter. The user manual includes step-by-step procedures for these one-button measurements as well as Out-of-Band Spurious and In-Band, Out-of-Channel Spurious measurements.
Help Functions	Help menu displays on-board user manual and customizable help files.
Travel Logging	Sample rate 60 to 3600 sec.
Internal Trace/Setup Storage Capacity	140 Gb
Trigger Modes	Single, free run
Trigger Sources	Internal, external TTL, internal video

<b>Measurements</b>	
External Trigger Types	Rising edge, falling edge, any edge, trigger on HIGH, trigger on LOW
External Trigger Level	TTL Levels
External Trigger Delay	User-settable, 100 $\mu$ s to 1000 ms after trigger received before starting sweep
External Trigger Connector	BNC(F)
Markers	6 Markers; Modes: On/Off, Standard, Marker to Max Peak, Marker to Next Peak, Marker Freq to Center, Marker Ampt to Ref Level, Marker Delta, Marker Type Line/Icon, Marker Noise, All Marker to Peaks, All Markers Off. Also, Marker to Max/Min Peak
User Interface	Reference the user manual and design specification for further details.
Warm-Up	Specifications apply after a 30 minute warm-up period at ambient temperature.

<b>General Specifications</b>	
Model	Name: Rack-Mount Signal Hawk Model: SH-36S-RM Description: Rack-Mount Spectrum Analyzer
Housing	Sheet metal
Power Switch	Momentary push-button
Power Indicator	Green LED
Connectors	N(F) for RF input Rear USB 2.0 Type B BNC(F) for external trigger RJ-45 for Ethernet Terminal strip for DC input One front & one rear RJ-45 for pass-through Ethernet connection
Additional Peripheral Connectors	2.5mm Audio out (rear) VGA and DVI Video out (rear) USB ports (rear) DB 25 parallel port (rear)
Host Status Indicator	Multi-Colored LED's for individual host device power present
RF Input Impedance	50 ohms, nominal
RF Input VSWR	1.8:1 typ, 2.0:1 max (internal attenuator = 10dB or greater)
Max DC input	± 50 V
Max RF input	+20 dBm; damage level is +30dBm for 30 sec.
Power Input	120/240 VAC, IEC inlet 12 & 24/48 VDC, detachable screw terminal strip
Voltage Range and Power Requirements	9-60 VDC, 75W peak 84-264 VAC, 75W peak
AC Fuse Options	Dual fuse line/neutral or single line fuse/neutral shorting bar (neutral un-fused)
Chassis Grounding Terminal	#10-32 x 3/4" UNC
Cooling Method	Forced air, front panel intake
Operating Temperature	0 to 50 °C (MIL-PRF-28800F, Class 3)
Storage Temperature	-20 to +80 °C
Humidity, Max	95% non-condensing (MIL-PRF-28800F, Class 2)
Altitude, Max	4600m above sea level (MIL-PRF-28800F, Class 2)
Weight	10.1 lbs.
Dimensions, Max	19" x 10" x 3.5: thk (2 RU)

### General Specifications

CE Compliance	61326-2-1:2006 – EMC (ESD immunity meets performance criteria C) 61010-1:2001 – Safety 89/336/EEC - EMC 73/23/EEC and Amendment 93/68/EEC - Low Voltage
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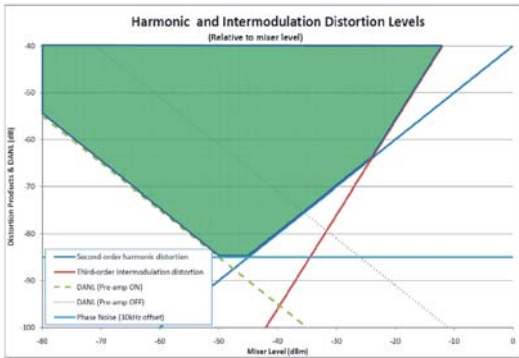
### PC Software

Built-In Operating System	Microsoft Windows 7, embedded
Client Hardware Requirements General	256 MB RAM & Pentium III or equivalent processor (512 MB RAM & Pentium 4/M or higher recommended) 800 x 600, 256 color display (1280 x 720, 16 bit or higher resolution recommended) Mouse or pointing device 100 MB free disk space. CD-ROM Drive (for client software installation) Adobe Acrobat Reader (for manual)
Remote LAN/WAN Operation	Microsoft Windows XP, XPpro, Vista or 7. 10/100 base T LAN adapter TCP/IP services
Local USB	Microsoft Remote Desktop Windows XP Sp2, XP pro only. 1 available USB port
Direct Communication Method	USB
Remote Communication Method	TCP/IP, Windows Remote Desktop
Minimum Network Bandwidth for Remote Connection	28.8 Kbps
Client Priority	Local USB client, single client only (local or remote)

### Input

Connector	Precision N-F
RF Input Impedance	50 ohms, nominal
RF Input VSWR	1.8:1 typ, 2.0:1 max (internal attenuator = 10dB or greater)
Max DC Input	± 50 V
Max RF Input	+20 dBm; damage level is +30dBm for 30 sec.

**Distortion & DANL**



**SH-36S-PC**

<b>Frequency</b>	
Range	100 kHz to 3.6 GHz
Resolution	1 Hz
Uncertainty	± 1 ppm (2σ) of measured frequency
Aging	± 1 ppm / year (2σ)
Temperature Drift	± 1 ppm / °C (2σ)
Span	1 kHz to 3.5999 GHz; 0 Hz (zero span)
Spectral Purity, Max @ 1 GHz	
30 kHz from Carrier	-85 dBc / (RBW Hz) <sup>1/2</sup>
100 kHz from Carrier	-100 dBc / (RBW Hz) <sup>1/2</sup>
1 MHz from Carrier	-124 dBc / (RBW Hz) <sup>1/2</sup>
Sweep Time	15.5 ms per data point to >2000 s, full span; 1 ms to 100 s, zero span
Displayed Data Points	705
Resolution Bandwidth (RBW)	100 Hz to 1 MHz in 1, 3, 10 steps
Video Bandwidth (VBW)	10 Hz to 300 kHz in 1, 3, 10 steps

<b>Amplitude</b>	
Display Range	-150 dBm to +30 dBm
Intermodulation-Free Dynamic Range	66 dB; Third-order IM products, Two -20 dBm inputs, Reference = -10 dBm
Displayed Average Noise Level (DANL)	-135 dBm; 24 dB gain, 100 Hz RBW, 10 Hz VBW, average detection



<b>Amplitude</b>	
Inherent Spurious	-80 dBm; reference $\leq -10$ dBm, $f > 30$ MHz, RBW $\leq 100$ kHz
Input Related Spurious	-70 dBc; mixer level $\leq -30$ dBm, carrier offset $\geq 1$ MHz
Accuracy	$\pm 1.5$ dB max ( $2\sigma$ ), $\pm 1.0$ dB typical, $> -50$ dB ref, 15 to 35 °C, max detector
Reference Level	-140 dBm to +30 dBm
Attenuator	Built-in: 0, 10, 20, 30 dB
Pre-Amp	Built-in: +24 dB
Resolution dB-based units W or V-based units	1 to 15 dB per division in 1 dB steps 1%, 2%, 5%, or 10% of ref level per division
Units	dBm, $\mu$ W, mW, W, dB $\mu$ V, dBmV, dBV, $\mu$ V, mV, V, dB/m <sup>2</sup> , $\mu$ V/m <sup>2</sup>
Offset Range	-99 to +99 dB

<b>Measurements</b>	
Spectrum Analysis	Analyzes radio frequency spectrum. Measures intended and interfering signals. Allows setup of parameters such as frequency, amplitude and markers. Graphically displays signal amplitude vs. frequency using a compatible PC.
Worldwide Applications	Cellular, PCS, DCS, 2G, 3G, 4G, CDMA, cdmaOne, CDMA 2000, 1x, 1x EV-DO, GSM, GPRS, EDGE, UMTS, HSDPA, W-CDMA, TDMA, AMPS, 802.11, Bluetooth, Broadcast, Emergency, Fire, GPS, HDTV, IBOC, In-Building, Lab, Microwave, NPSPAC, Paging, Police, Private, Project 25, Public Safety, Tactical Military, Telematics, Tetra, Trunking, Utilities, WiMAX, WLAN and WLL.
Predefined Measurements	Spectrum Analysis, Occupied Bandwidth (OBW), Channel Power, Adjacent Channel Power Ratio (ACPR), Arbitrary Power Range, Field Strength, Zero Span, AM/FM Demodulation, Carrier-to-Interference Ratio (C/I), and Frequency Counter. The user manual includes step-by-step procedures for these one-button measurements as well as Out-of-Band Spurious and In-Band, Out-of-Channel Spurious measurements.
Help Functions	Help menu displays on-board user manual and customizable help files. Tip line provides helpful hints with each key stroke.
Averaging	Running display average, 2 to 100 sweeps

<b>Measurements</b>	
Detection Modes	Sample, +peak, –peak, average, video average
Trigger Modes	Single, free run
Trigger Sources	Internal, external TTL, internal video
External Trigger Types	Rising edge, falling edge, any edge, trigger on HIGH, trigger on LOW
External Trigger Level	TTL Levels
External Trigger Delay	User-settable, 100 μs to 1000 ms after trigger received before starting sweep
External Trigger Connector	BNC(F)
Markers	6 Markers; Modes: On/Off, Standard, Marker to Max Peak, Marker to Next Peak, Marker Freq to Center, Marker Ampt to Ref Level, Marker Delta, Marker Type Line/Icon, Marker Noise, All Marker to Peaks, All Markers Off. Also, Marker to Max/Min Peak

<b>General Specifications</b>	
Model	Name: Hand-Held, PC SignalHawk Model: SH-36S-PC Description: PC-based Spectrum Analyzer
Housing	Aluminum Case, Plastic corner protectors
Power Indicator	Green LED
Charge Indicator	Green/Amber LED – Amber: low battery or charging, Green: fully charged.
Connectors	N(F) for RF input 2.1 mm DC jack for AC adapter/charger external power USB Type B for PC connection BNC(F) for external trigger
RF Input Impedance	50 ohms, nominal
RF Input VSWR	1.8:1 typ, 2.0:1 max (internal attenuator = 10dB or greater)
Max DC Input	± 50 V
Max RF Input	+20 dBm; damage level is +30dBm for 30 sec.
AC Adapter/Charger	External DC power supply, 12 VDC, 2 A, 2.1mm pin connector
Internal Battery	Rechargeable, field replaceable, lithium-ion battery. 5.5 hours continuous operation, 25°C.
Warm-Up	Specifications apply after a 30 minute warm-up period at ambient temperature. Typical values are provided for reference and are not guaranteed.
Operating Temperature	0 to 50 °C (MIL-PRF-28800F, Class 3)

<b>General Specifications</b>	
Storage Temperature	-20 to +80 °C  If storing above 60°C for prolonged periods it is recommended that the battery be stored separately
Humidity, Max	95% non-condensing (MIL-PRF-28800F, Class 2)
Altitude, Max	4600m above sea level (MIL-PRF-28800F, Class 2)
Weight	3 lbs
Dimensions, Max	6.5" x 6.5" x 2.5" thk, not including connectors
CE Compliance	61326:1997 +A1:1998 and A2:2001 – EMC 61010-1:2001 – Safety 89/336/EEC - EMC 73/23/EEC and Amendment 93/68/EEC - Low Voltage
Drop Tested	1 meter drop in most severe position per EN 61010-1
Transit Drop	10 drops on corners and faces per MIL-PRF-28800F, Class 2
Bench Handling	4 drops on each face per MIL-PRF-28800F, Class 2
Vibration	Random 10 to 500 Hz per MIL-PRF-28800F, Class 2
Shock, Functional	30 G half-sine shock pulse per MIL-PRF-28800F, Class 2

<b>PC Software</b>	
Built-In Operating System	Microsoft Windows 7, embedded
Client Hardware Requirements General	256 MB RAM & Pentium III or equivalent processor (512 MB RAM & Pentium 4/M or higher recommended) 800 x 600, 256 color display (1280 x 720, 16 bit or higher resolution recommended) Mouse or pointing device 100 MB free disk space. CD-ROM Drive (for client software installation) Adobe Acrobat Reader (for manual) Microsoft Windows XP, XPpro, Vista or 7.
Remote LAN/WAN Operation	10/100 base T LAN adapter TCP/IP services Microsoft Remote Desktop
Local USB	Windows XP Sp2, XP pro only. 1 available USB port
Direct Communication Method	USB
Remote Communication Method	TCP/IP, Windows Remote Desktop
Minimum Network Bandwidth for Remote Connection	28.8 Kbps
Client Priority	Local USB client, single client only (local or remote)

## Parts List

**Note:** Contact Bird Service Center for parts information.

Standard Accessories		
Description	Part No.	Qty
Operations Manual - PDF electronic copy <sup>1</sup>	920-SHPC-OPS	1
Start-Up Instructions <sup>1</sup>	920-SHPC-REF	1
AC Line Cord	4421-055	1
USB Cable, 10 ft, USB 2.0 certified, USB A male to USB B male	5A2653-10	1
AC Adapter/Charger, input 100-240 VAC @ 50-60Hz, output +12V, 2A <sup>2</sup>	5B2229-1224G-1	1
RJ45 Ethernet Cable <sup>3</sup>	5A2744-S07	1
PC Hawk Emulator Software CD	7002A148	1
Cigarette Lighter Adapter <sup>2</sup>	5A2238-2	1
Internal Li-Ion Field Replaceable Battery <sup>2</sup>	5C2431-2	1
Fuse, 5x20 mm SLO-BLO <sup>3</sup>	5A2257-17	1
Fuse Drawer <sup>3</sup>	5A2821-F6	1
Fuse Drawer with Shorting Bar <sup>3</sup>	5A2821-F7	1

<sup>1</sup> Spare standard accessories are available as optional accessories. Manuals, software, and firmware updates are available at: [www.birdrf.com](http://www.birdrf.com).

<sup>2</sup> For SH-36S-PC only.

<sup>3</sup> For SH-36S-RM only.

## Optional Accessories

### SH-36S-PC

#### General

Description	Part No.	Qty
User Manual, paper copy	920-SHPC-OPS	1
Field Strength Antenna, 136 to 221 MHz, Field Tunable, 0 dB Gain	ANT-100	1
Field Strength Antenna, 400 to 512 MHz, Field Tunable, 0 dB Gain	ANT-400	1
Field Strength Antenna, 824 to 894 MHz, 0 dB Gain, Articulating	ANT-800	1
Field Strength Antenna, 890 to 960 MHz, 0 dB Gain, Articulating	ANT-900	1
Field Strength Antenna, 1710 to 1880 MHz, 0 dB Gain, Articulating	ANT-1800	1
Field Strength Antenna, 1850 to 1990 MHz, 0 dB Gain, Articulating	ANT-1900	1
Field Strength Antenna, 2400 to 2500 MHz, 0 dB Gain, Articulating	ANT-2400	1
Attenuator, 100 W, 40 dB, NM/NF, 2.4 GHz	100-SA-MFN-40	1
Attenuator, 50 W, 30 dB, NM/NF, 4 GHz	50-A-MFN-30	1
Attenuator, 25 W, 30 dB, NM/NF, 4 GHz	25-A-MFN-30	1
Attenuator, 10 W, 30 dB, NM/NF, 4 GHz	10-A-MFN-30	1
Attenuator, 5 W, 20 dB, NM/NF, 4 GHz	5-A-MFN-20	1
Attenuator, 2 W, 20 dB, NM/NF, 4 GHz	2-A-MFN-20	1

**Note:** Recommend N(M) to SMA(F) adapter (model 4240-500-10) for field strength antennas.

## Test Cables and Adapters

Description	Part No.	Qty
Test Cable, Phase Stable, 1.5 m, N(M) to N(F)	TC-MNFN-1.5	1
Test Cable, Phase Stable, 3.0 m, N(M) to N(F)	TC-MNFN-3.0	1
Test Cable, Phase Stable, 1.5 m, N(M) to N(M)	TC-MNMN-1.5	1
Test Cable, Phase Stable, 3.0 m, N(M) to N(M)	TC-MNMN-3.0	1
Test Cable, Phase Stable, 1.5 m, N(M) to 7/16 DIN(F)	TC-MNFE-1.5	1
Test Cable, Phase Stable, 3.0 m, N(M) to 7/16 DIN(F)	TC-MNFE-3.0	1
Test Cable, Phase Stable, 1.5 m, N(M) to 7/16 DIN(M)	TC-MNME-1.5	1
Test Cable, Phase Stable, 3.0 m, N(M) to 7/16 DIN(M)	TC-MNME-3.0	1
Adapter, N(M) to 7/16 DIN(M)	PA-MNME	1
Adapter, N(F) to 7/16 DIN(M)	PA-FNME	1
Adapter, N(M) to 7/16 DIN(F)	PA-MNFE	1
Adapter, N(F) to 7/16 DIN(F)	PA-FNFE	1
Adapter Kit, 7/16 DIN	4240-550	1
Adapter, N(F) to N(F)	4240-500-1	1
Adapter, N(M) to N(M)	4240-500-2	1
Adapter, N(M) to SMA(F)	4240-500-10	1

**Note:** All specifications are subject to change without notice.

**SH-36S-RM****General**

Description	Part No.	Qty
User Manual, paper copy	920-SHPC-OPS	1
USB Cable, 10 ft, USB 2.0 certified, USB A male to USB B male	5A2653-10	1
Attenuator, 100 W, 40 dB, NM/NF, 2.4 GHz	100-SA-MFN-40	1
Attenuator, 50 W, 30 dB, NM/NF, 4 GHz	50-A-MFN-30	1
Attenuator, 25 W, 30 dB, NM/NF, 4 GHz	25-A-MFN-30	1
Attenuator, 10 W, 30 dB, NM/NF, 4 GHz	10-A-MFN-30	1
Attenuator, 5 W, 20 dB, NM/NF, 4 GHz	5-A-MFN-20	1
Attenuator, 2 W, 20 dB, NM/NF, 4 GHz	2-A-MFN-20	1

**Test Cables and Adapters**

Description	Part No.	Qty
Test Cable, Phase Stable, 1.5 m, N(M) to N(F)	TC-MNFN-1.5	1
Test Cable, Phase Stable, 3.0 m, N(M) to N(F)	TC-MNFN-3.0	1
Test Cable, Phase Stable, 1.5 m, N(M) to N(M)	TC-MNMN-1.5	1
Test Cable, Phase Stable, 3.0 m, N(M) to N(M)	TC-MNMN-3.0	1
Test Cable, Phase Stable, 1.5 m, N(M) to 7/16 DIN(F)	TC-MNFE-1.5	1
Test Cable, Phase Stable, 3.0 m, N(M) to 7/16 DIN(F)	TC-MNFE-3.0	1
Test Cable, Phase Stable, 1.5 m, N(M) to 7/16 DIN(M)	TC-MNME-1.5	1
Test Cable, Phase Stable, 3.0 m, N(M) to 7/16 DIN(M)	TC-MNME-3.0	1
Adapter, N(M) to 7/16 DIN(M)	PA-MNME	1
Adapter, N(F) to 7/16 DIN(M)	PA-FNME	1
Adapter, N(M) to 7/16 DIN(F)	PA-MNFE	1
Adapter, N(F) to 7/16 DIN(F)	PA-FNFE	1
Adapter Kit, 7/16 DIN	4240-550	1
Adapter, N(F) to N(F)	4240-500-1	1
Adapter, N(M) to N(M)	4240-500-2	1
Adapter, N(M) to SMA(F)	4240-500-10	1



## ROHS

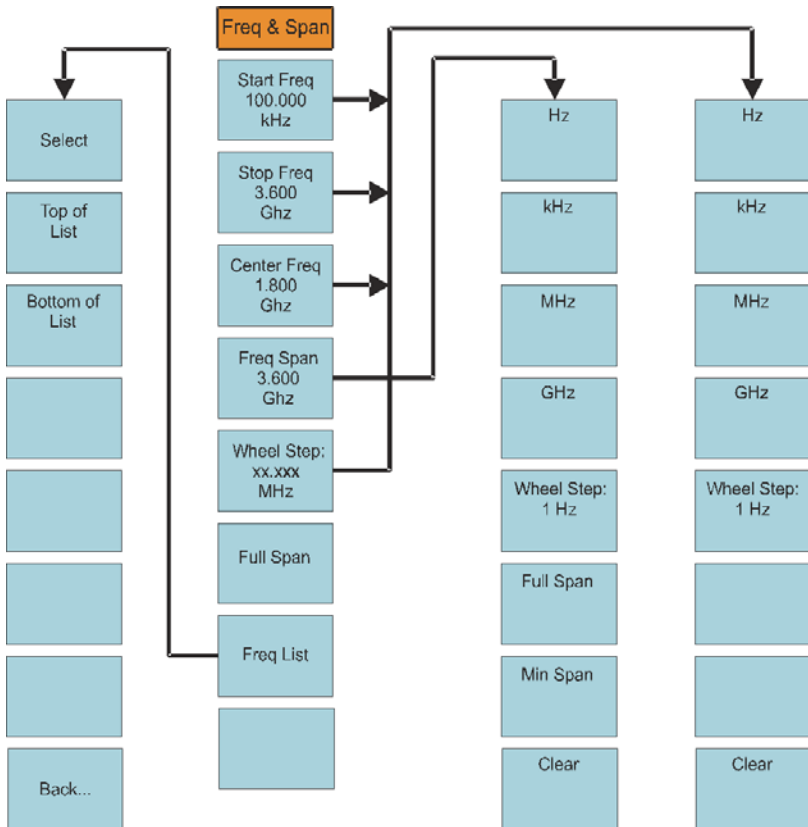
Part Name	Toxic or hazardous Substances and Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr(VI))	Polybrominated biphenyls (PBB)	Polybrominated diphenyl ethers (PBDE)
<b>Copper Alloy</b>	X	O	O	O	O	O
<b>Florescent Backlight</b>	O	X	O	O	O	O
<b>Printed Circuit Assembly</b>	X	O	O	O	O	O
<p><b>O:</b> Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.</p> <p><b>X:</b> Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirements in SJ/T11363-2006.</p>						

### Spectrum Analyzer Menu Maps

The illustrations in this section show the options that are available when selecting a measurement function.

**Figure 73** Menu Map, Freq & Span Menu, All Measurements

**Note:** If a channelized band is selected, there will be an extra selection named Channel (see [Figure 74](#)).



**Figure 74** Menu Map, Freq/Span Menu, Channelized Band

**Note:** If a channelized band is selected, the system displays the Channel selection in addition to those shown in [Figure 73](#).

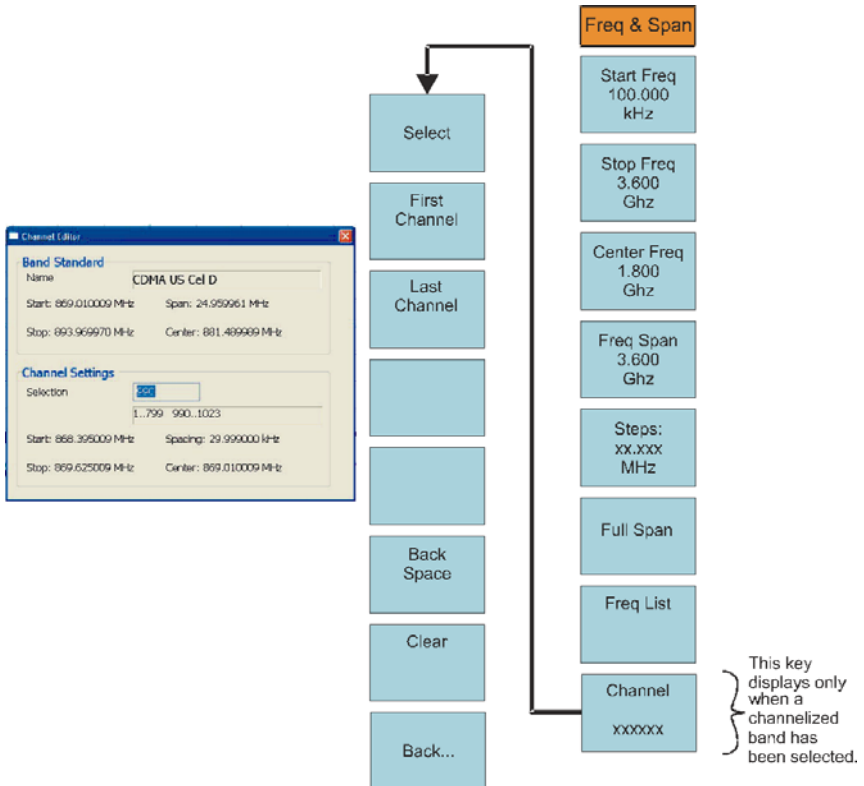


Figure 75 Menu Map, BW & Sweep Menu, All Measurements

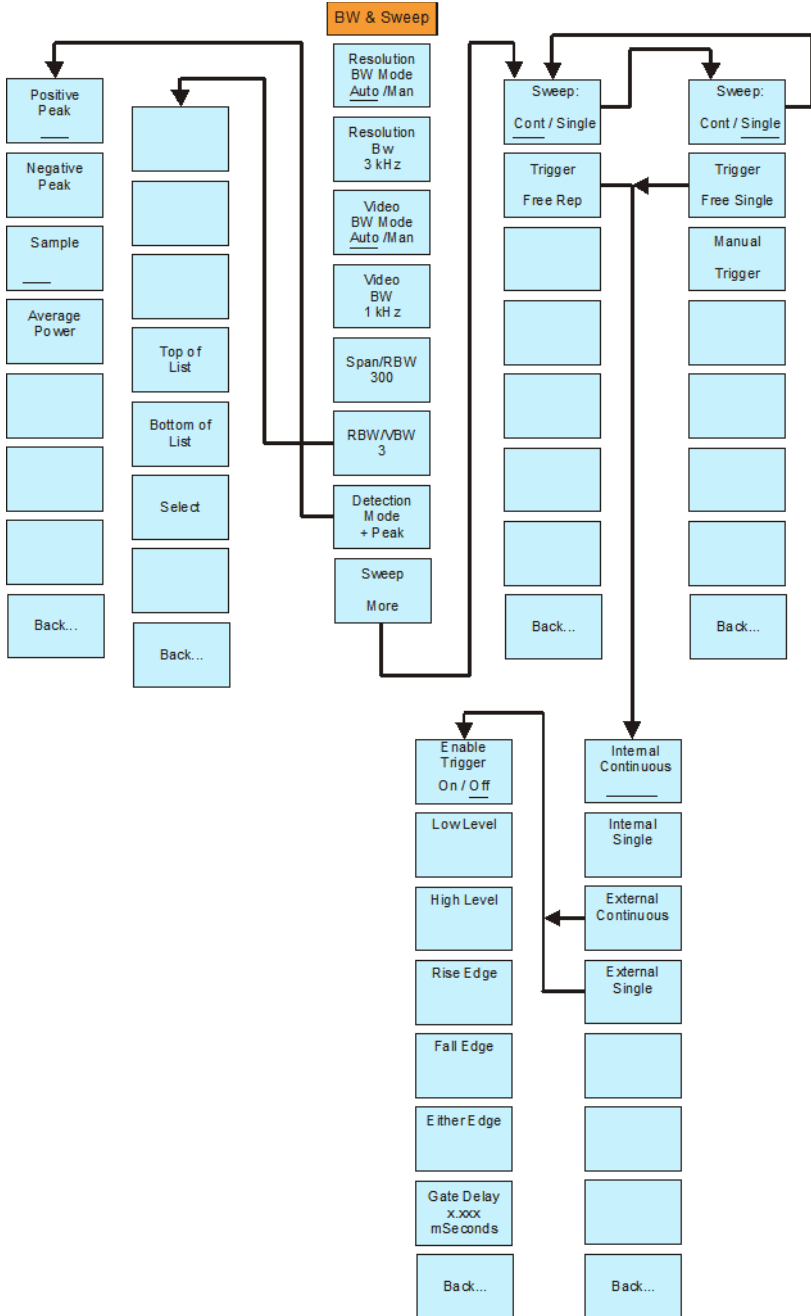


Figure 76 Menu Map, Amplitude, All Measurements

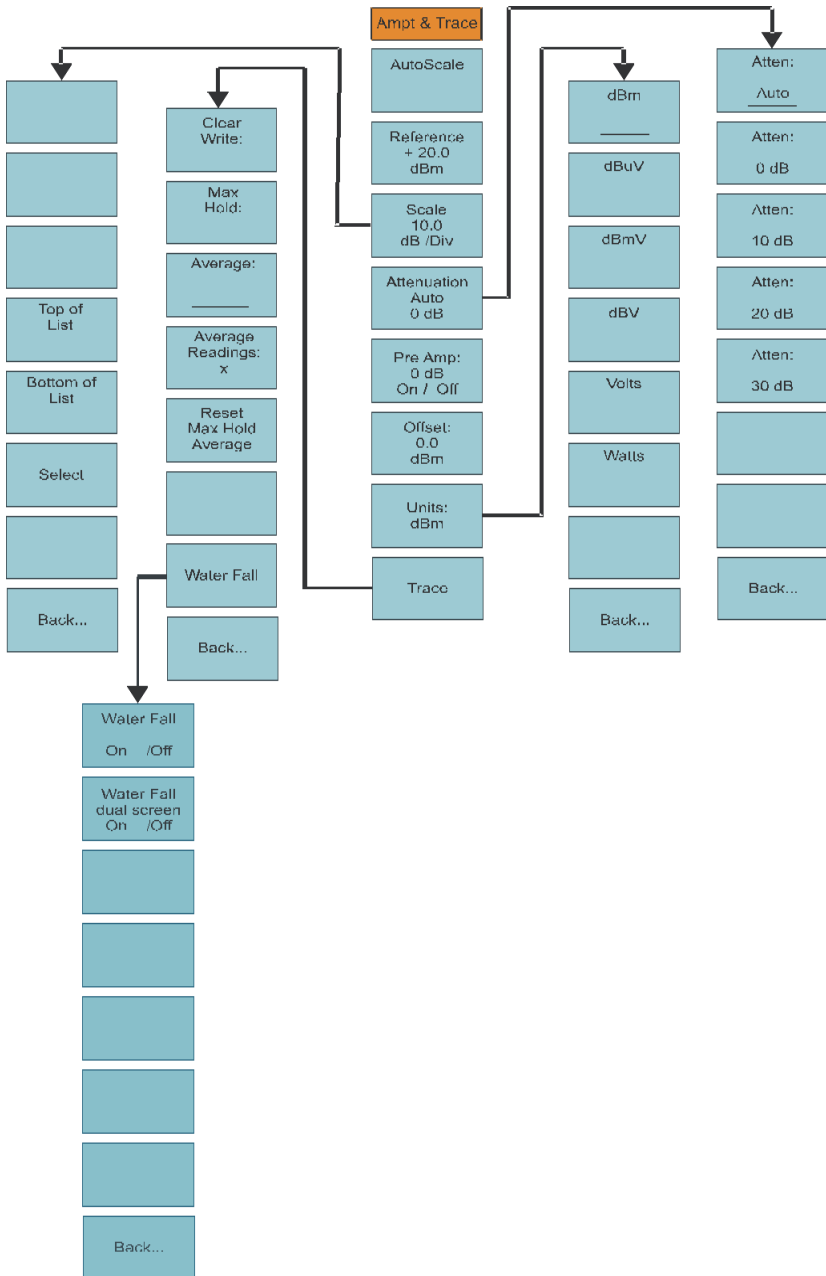


Figure 77 Menu Map, Measurement, All Measurements

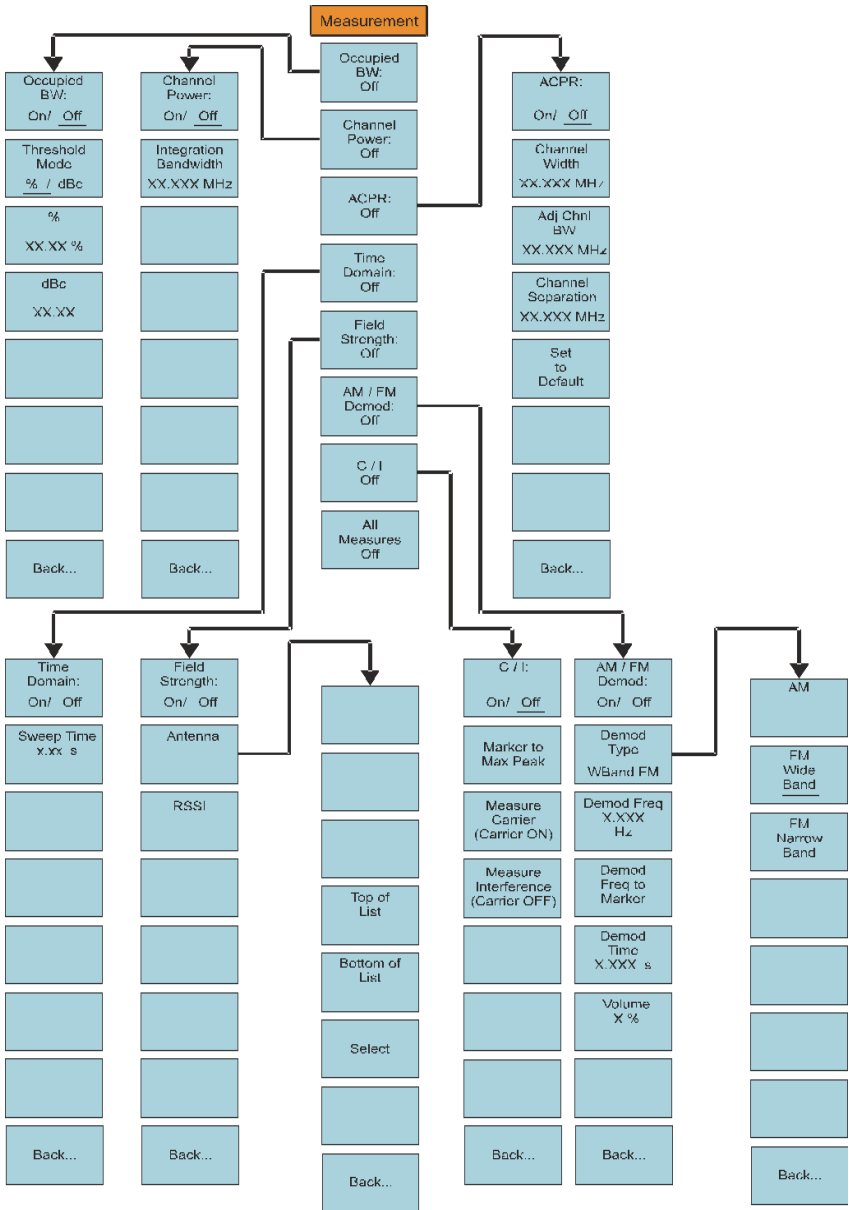


Figure 78 Menu Map, Mark &amp; Limit Menu, All Measurements

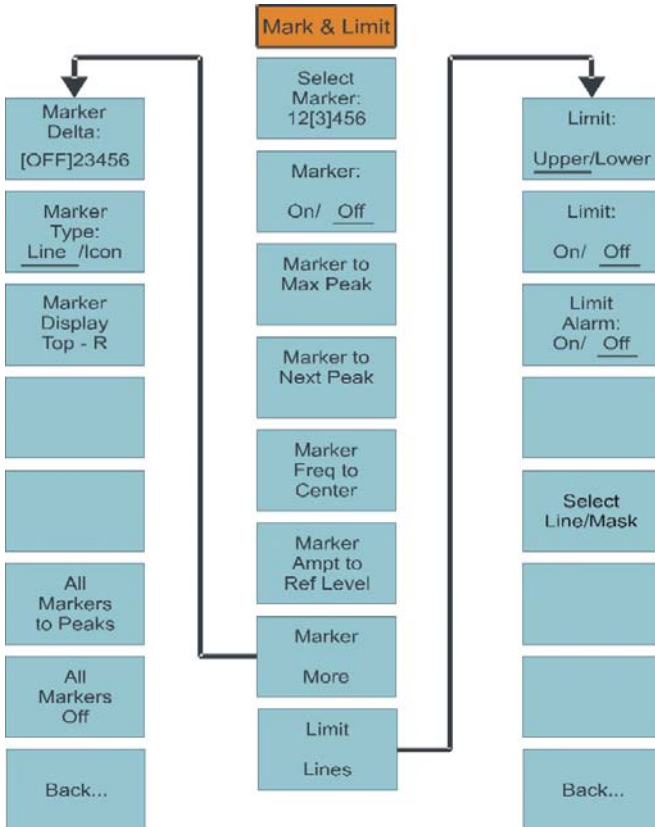
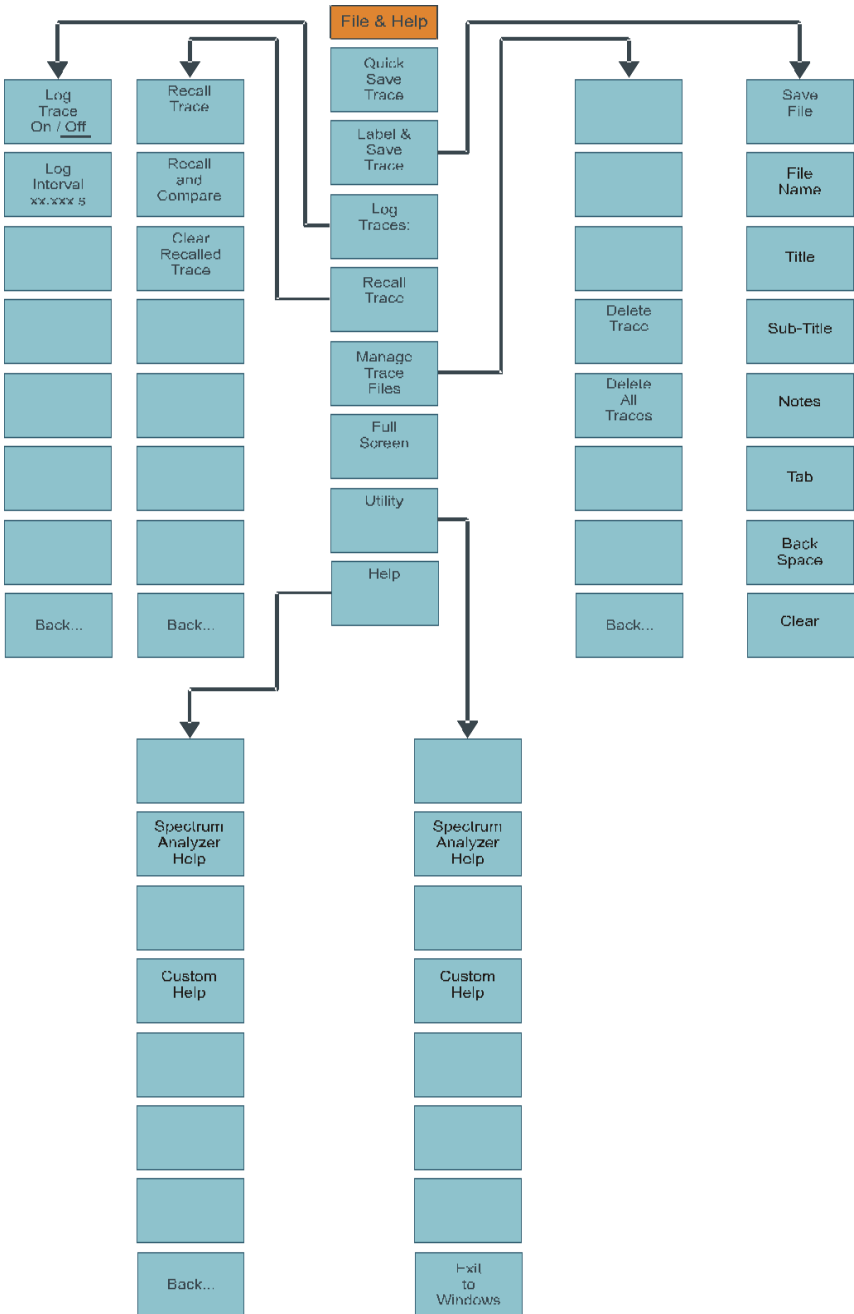


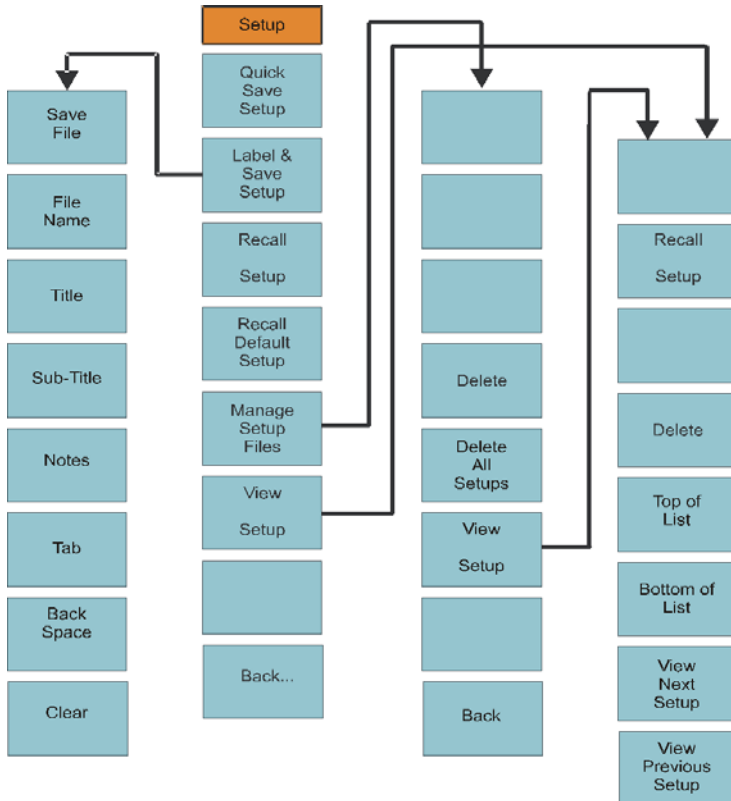
Figure 79 Menu Map, File & Help, All Measurements





## Setup Function Menu Maps

Figure 80 Map, Setup (Mode), Main Screen



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  - Other Access Technologies. You may use Remote Assistance or similar technologies to share an active session.
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- k. **Worldwide Use of the Media Center.** Media Center is not designed for use in every country. For example, although the Media Center information may refer to certain features such as an electronic programming guide or provide information on how to configure a TV tuner, these features may not work in your area. Please refer to the Media Center information for a list of features that may not work in your area.

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- a. Validation verifies that the software has been activated and is properly licensed. It also verifies that no unauthorized changes have been made to the validation, licensing, or activation functions of the software. Validation may also check for certain malicious or unauthorized software related to such unauthorized changes. A validation check confirming that you are properly licensed permits you to continue to use the software, certain features of the software or to obtain additional benefits. **You are not permitted to circumvent validation.** This is to prevent unlicensed use of the software. For more information, see [go.microsoft.com/fwlink/?Linkid=104610](http://go.microsoft.com/fwlink/?Linkid=104610).
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- check and remove malicious or unauthorized software known to be related to such unauthorized changes, or
- provide notices that the software is improperly licensed or a non-genuine Windows product

and you may

- receive reminders to obtain a properly licensed copy of the software, or
- need to follow Microsoft's instructions to be licensed to use the software and reactivate,

and you may not be able to

- use or continue to use the software or some of the features of the software, or
- obtain certain updates or upgrades from Microsoft

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- other software on your computer ceasing to work, or
- your breaching a license to use other software on your computer.

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7. **INTERNET-BASED SERVICES.** Microsoft provides Internet-based services with the software. It may change or cancel them at any time.

- a. **Consent for Internet-Based Services.** The software features described below and in the Windows 7 Privacy Statement connect to Microsoft or service provider computer systems over the Internet. In some cases, you will not receive a separate notice when they connect. In some cases, you may switch off these features or not use them. For more information about these features, see the Windows 7 Privacy Statement at [go.microsoft.com/fwlink/?linkid=104604](http://go.microsoft.com/fwlink/?linkid=104604).

**By using these features, you consent to the transmission of this information.** Microsoft does not use the information to identify or contact you.

Computer Information. The following features use Internet protocols, which send to the appropriate systems computer information, such as your Internet protocol address, the type of operating system, browser and name and version of the software you are using, and the language code of the computer where you installed the software. Microsoft uses this information to make the Internet-based services available to you.

- Plug and Play and Plug and Play Extensions. You may connect new hardware to your computer, either directly or over a network. Your computer may not have the drivers needed to communicate with that hardware. If so, the update feature of the software can obtain the correct driver from Microsoft and install it on your computer. An administrator can disable this update feature.
- Windows Update. To enable the proper functioning of the Windows Update service in the software (if you use it), updates or downloads to the Windows Update service will be required from time to time and downloaded and installed without further notice to you.
- Web Content Features. Features in the software can retrieve related content from Microsoft and provide it to you. Examples of these features are clip art, templates, online training, online assistance and Appshelp. You may choose not to use these web content features.
- Digital Certificates. The software uses digital certificates. These digital certificates confirm the identity of Internet users sending X.509 standard encrypted information. They also can be used to digitally sign files and macros, to verify the integrity and origin of the file contents. The software retrieves cer-

ificates and updates certificate revocation lists over the Internet, when available.

- Auto Root Update. The Auto Root Update feature updates the list of trusted certificate authorities. You can switch off the Auto Root Update feature.
- Windows Media Digital Rights Management. Content owners use Windows Media digital rights management technology (WMDRM) to protect their intellectual property, including copyrights. This software and third party software use WMDRM to play and copy WMDRM-protected content. If the software fails to protect the content, content owners may ask Microsoft to revoke the software's ability to use WMDRM to play or copy protected content. Revocation does not affect other content. When you download licenses for protected content, you agree that Microsoft may include a revocation list with the licenses. Content owners may require you to upgrade WMDRM to access their content. Microsoft software that includes WMDRM will ask for your consent prior to the upgrade. If you decline an upgrade, you will not be able to access content that requires the upgrade. You may switch off WMDRM features that access the Internet. When these features are off, you can still play content for which you have a valid license.
- Windows Media Player. When you use Windows Media Player, it checks with Microsoft for
  - compatible online music services in your region; and
  - new versions of the player.
- For more information, go to [go.microsoft.com/fwlink/?Linkid=104605](http://go.microsoft.com/fwlink/?Linkid=104605).
- Malicious Software Removal. During setup, if you select "Get important updates for installation", the software may check and remove certain malware from your computer. "Malware" is malicious software. If the software runs, it will remove the Malware listed and updated at [www.support.microsoft.com/?kbid=890830](http://www.support.microsoft.com/?kbid=890830). During a Malware check, a report will be sent to Microsoft with specific information about Malware detected, errors, and other information about your computer. This information is used to improve the software and other Microsoft products and services. No information included in these reports will be used to identify or contact you. You may disable the software's reporting functionality by following the instructions found at [www.support.microsoft.com/?kbid=890830](http://www.support.microsoft.com/?kbid=890830). For more information, read the Windows Malicious Software Removal Tool privacy statement at [go.microsoft.com/fwlink/?Linkid=113995](http://go.microsoft.com/fwlink/?Linkid=113995).
- Network Awareness. This feature determines whether a system is connected to a network by either passive monitoring of network traffic or active DNS or HTTP queries. The query only transfers standard TCP/IP or DNS information for routing purposes. You can switch off the active query feature through a registry setting.



- Windows Time Service. This service synchronizes with time.windows.com once a week to provide your computer with the correct time. You can turn this feature off or choose your preferred time source within the Date and Time Control Panel applet. The connection uses standard NTP protocol.
- IPv6 Network Address Translation (NAT) Traversal service (Teredo). This feature helps existing home Internet gateway devices transition to IPv6. IPv6 is next generation Internet protocol. It helps enable end-to-end connectivity often needed by peer-to-peer applications. To do so, each time you start up the software the Teredo client service will attempt to locate a public Teredo Internet service. It does so by sending a query over the Internet. This query only transfers standard Domain Name Service information to determine if your computer is connected to the Internet and can locate a public Teredo service. If you
  - use an application that needs IPv6 connectivity or
  - configure your firewall to always enable IPv6 connectivity by default standard Internet Protocol information will be sent to the Teredo service at Microsoft at regular intervals. No other information is sent to Microsoft. You can change this default to use non-Microsoft servers. You can also switch off this feature using a command line utility named “netsh”.
- Accelerators. When you click on or move your mouse over an Accelerator in Internet Explorer, any of the following may be sent to the service provider:
  - the title and full web address or URL of the current webpage,
  - standard computer information, and
  - any content you have selected.

If you use an Accelerator provided by Microsoft, use of the information sent is subject to the Microsoft Online Privacy Statement. This statement is available at [go.microsoft.com/fwlink/?linkid=31493](http://go.microsoft.com/fwlink/?linkid=31493).

If you use an Accelerator provided by a third party, use of the information sent will be subject to the third party’s privacy practices.

- Search Suggestions Service. In Internet Explorer, when you type a search query in the Instant Search box or type a question mark (?) before your search term in the Address bar, you will see search suggestions as you type (if supported by your search provider). Everything you type in the Instant Search box or in the Address bar when preceded by a question mark (?) is sent to your search provider as you type. Also, when you press Enter or click the Search button, the text in the Instant Search box or Address bar is sent to the search provider. If you use a Microsoft search provider, use of the information sent is

subject to the Microsoft Online Privacy Statement. This statement is available at [go.microsoft.com/fwlink/?linkid=31493](http://go.microsoft.com/fwlink/?linkid=31493).

If you use a third-party search provider, use of the information sent will be subject to the third party's privacy practices. You can turn search suggestions off at any time. To do so, use Manage Add-ons under the Tools button in Internet Explorer. For more information about the search suggestions service, see [go.microsoft.com/fwlink/?linkid=128106](http://go.microsoft.com/fwlink/?linkid=128106).

- **Consent to Update Infrared Emitter/Receiver.** The software may contain technology to ensure proper functioning of the infrared emitter/receiver device shipped with certain Media Center-based products. You agree that the software may update the firmware of this device.
- **Media Center Online Promotions.** If you use Media Center features of the software to access Internet-based content or other Internet-based services, such services may obtain the following information from the software to enable you to receive, accept and use certain promotional offers:
  - certain computer information, such as your Internet protocol address, the type of operating system and browser you are using, and the name and version of the software you are using,
  - the requested content, and
  - the language code of the computer where you installed the software.

Your use of the Media Center features to connect to those services serves as your consent to the collection and use of such information.

- b. **Use of Information.** Microsoft may use the computer information, accelerator information, search suggestions information, error reports, and Malware reports to improve our software and services. We may also share it with others, such as hardware and software vendors. They may use the information to improve how their products run with Microsoft software.
  - c. **Misuse of Internet-based Services.** You may not use these services in any way that could harm them or impair anyone else's use of them. You may not use the services to try to gain unauthorized access to any service, data, account or network by any means.
8. **SCOPE OF LICENSE.** The software is licensed, not sold. This agreement only gives you some rights to use the features included in the software edition you licensed. Microsoft reserves all other rights. Unless applicable law gives you more rights despite this limitation, you may use the software only as expressly permitted in this agreement. In doing so, you must comply with any technical limitations in the software that only allow you to use it in certain ways. You may not
- work around any technical limitations in the software;

- reverse engineer, decompile or disassemble the software, except and only to the extent that applicable law expressly permits, despite this limitation;
  - use components of the software to run applications not running on the software;
  - make more copies of the software than specified in this agreement or allowed by applicable law, despite this limitation;
  - publish the software for others to copy;
  - rent, lease or lend the software; or
  - use the software for commercial software hosting services.
9. **MICROSOFT .NET BENCHMARK TESTING.** The software includes one or more components of the .NET Framework (“.NET Components”). You may conduct internal benchmark testing of those components. You may disclose the results of any benchmark test of those components, provided that you comply with the conditions set forth at [go.microsoft.com/fwlink/?LinkID=66406](http://go.microsoft.com/fwlink/?LinkID=66406). Notwithstanding any other agreement you may have with Microsoft, if you disclose such benchmark test results, Microsoft shall have the right to disclose the results of benchmark tests it conducts of your products that compete with the applicable .NET Component, provided it complies with the same conditions set forth at [go.microsoft.com/fwlink/?LinkID=66406](http://go.microsoft.com/fwlink/?LinkID=66406).
10. **BACKUP COPY.**
- a. **Media.** If you acquired the software on a disc or other media, you may make one backup copy of the media. You may use it only to reinstall the software on the licensed computer.
  - b. **Electronic Download.** If you purchased and downloaded the software online, you may make one copy of the software on a disc or other media in order to install the software on a computer. You may also use it to reinstall the software on the licensed computer.
11. **DOCUMENTATION.** Any person that has valid access to your computer or internal network may copy and use the documentation for your internal, reference purposes.
12. **NOT FOR RESALE SOFTWARE.** You may not sell software marked as “NFR” or “Not for Resale.”
13. **ACADEMIC EDITION SOFTWARE.** You must be a “Qualified Educational User” to use software marked as “Academic Edition” or “AE.” If you do not know whether you are a Qualified Educational User, visit [www.microsoft.com/education](http://www.microsoft.com/education) or contact the Microsoft affiliate serving your country.
14. **GEOGRAPHIC RESTRICTIONS.** If the software is marked as requiring activation in a specific geographic region, then you are only permitted to activate this software in the geographic region indicated on the software packaging. You may not be able to activate the software outside of that region. For further information on geographic restrictions, visit [go.microsoft.com/fwlink/?LinkID=141397](http://go.microsoft.com/fwlink/?LinkID=141397).

15. **UPGRADES.** To use upgrade software, you must first be licensed for the software that is eligible for the upgrade. Upon upgrade, this agreement takes the place of the agreement for the software you upgraded from. After you upgrade, you may no longer use the software you upgraded from.

16. **PROOF OF LICENSE.**

- a. **Genuine Proof of License.** If you acquired the software on a disc or other media, your proof of license is the genuine Microsoft certificate of authenticity label with the accompanying genuine product key, and your proof of purchase. If you purchased and downloaded the software online, your proof of license is the genuine Microsoft product key for the software which you received with your purchase, and your proof of purchase from an authorized electronic supplier of genuine Microsoft software. Proof of purchase may be subject to verification by your merchant's records.
- b. **Windows Anytime Upgrade License.** If you upgrade the software using Windows Anytime Upgrade, your proof of license is the proof of license for the software you upgraded from, your Windows Anytime Upgrade product key and your proof of purchase. Proof of purchase may be subject to verification by your merchant's records.
- c. To identify genuine Microsoft software, see [www.howtotell.com](http://www.howtotell.com).

17. **TRANSFER TO ANOTHER COMPUTER.**

- a. **Software Other than Windows Anytime Upgrade.** You may transfer the software and install it on another computer for your use. That computer becomes the licensed computer. You may not do so to share this license between computers.
- b. **Windows Anytime Upgrade Software.** You may transfer the software and install it on another computer, but only if the license terms of the software you upgraded from allows you to do so. That computer becomes the licensed computer. You may not do so to share this license between computers.

18. **TRANSFER TO A THIRD PARTY.**

- a. **Software Other Than Windows Anytime Upgrade.** The first user of the software may make a one time transfer of the software and this agreement, by transferring the original media, the certificate of authenticity, the product key and the proof of purchase directly to a third party. The first user must remove the software before transferring it separately from the computer. The first user may not retain any copies of the software.
- b. **Windows Anytime Upgrade Software.** You may transfer the software directly to a third party only with the licensed computer. You may not keep any copies of the software or any earlier edition.

- c. **Other Requirements.** Before any permitted transfer, the other party must agree that this agreement applies to the transfer and use of the software.
19. **NOTICE ABOUT THE H.264/AVC VISUAL STANDARD, THE VC-1 VIDEO STANDARD, THE MPEG-4 VISUAL STANDARD AND THE MPEG-2 VIDEO STANDARD.** This software includes H.264/AVC, VC-1, MPEG-4 Part 2, and MPEG-2 visual compression technology. MPEG LA, L.L.C. requires this notice:

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22. **SUPPORT SERVICES.** Microsoft provides support services for the software as described at [www.support.microsoft.com/common/international.aspx](http://www.support.microsoft.com/common/international.aspx). If you are using software that is not properly licensed, you will not be entitled to receive support services.
23. **ENTIRE AGREEMENT.** This agreement (including the warranty below), additional terms (including any printed-paper license terms that accompany the software and may modify or replace some or all of these terms), and the terms for supplements, updates, Internet-based services and support services that you use, are the entire agreement for the software and support services.
24. **APPLICABLE LAW.**
  - a. **United States.** If you acquired the software in the United States, Washington state law governs the interpretation of this agreement and applies to claims for breach of it, regardless of conflict of laws principles. The laws of the state where you live govern all other claims, including claims under state consumer protection laws, unfair competition laws, and in tort.
  - b. **Outside the United States.** If you acquired the software in any other country, the laws of that country apply.
25. **LEGAL EFFECT.** This agreement describes certain legal rights. You may have other rights under the laws of your state or country. You may also have

rights with respect to the party from whom you acquired the software. This agreement does not change your rights under the laws of your state or country if the laws of your state or country do not permit it to do so.

26. **LIMITATION ON AND EXCLUSION OF DAMAGES. You can recover from Microsoft and its suppliers only direct damages up to the amount you paid for the software. You cannot recover any other damages, including consequential, lost profits, special, indirect or incidental damages.**

This limitation applies to

- anything related to the software, services, content (including code) on third party Internet sites, or third party programs; and
- claims for breach of contract, breach of warranty, guarantee or condition, strict liability, negligence, or other tort to the extent permitted by applicable law.

It also applies even if

- repair, replacement or a refund for the software does not fully compensate you for any losses; or
- Microsoft knew or should have known about the possibility of the damages.

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. They also may not apply to you because your country may not allow the exclusion or limitation of incidental, consequential or other damages.

## LIMITED WARRANTY

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**A. LIMITED WARRANTY.** If you follow the instructions and the software is properly licensed, the software will perform substantially as described in the Microsoft materials that you receive in or with the software.

**B. TERM OF WARRANTY; WARRANTY RECIPIENT; LENGTH OF ANY IMPLIED WARRANTIES.** The limited warranty covers the software for one year after acquired by the first user. If you receive supplements, updates, or replacement software during that year, they will be covered for the remainder of the warranty or 30 days, whichever is longer. If the first user transfers the software, the remainder of the warranty will apply to the recipient.

**To the extent permitted by law, any implied warranties, guarantees or conditions last only during the term of the limited warranty.** Some states do not allow limitations on how long an implied warranty lasts, so these limitations may not apply to you. They also might not apply to you because some countries may not allow limitations on how long an implied warranty, guarantee or condition lasts.

**C. EXCLUSIONS FROM WARRANTY.** This warranty does not cover problems caused by your acts (or failures to act), the acts of others, or events beyond Microsoft's reasonable control.

**D. REMEDY FOR BREACH OF WARRANTY.** Microsoft will repair or replace the software at no charge. If Microsoft cannot repair or replace it, Microsoft will refund the amount shown on your receipt for the software. It will also repair or replace supplements, updates and replacement software at no charge. If Microsoft cannot repair or replace them, it will refund the amount you paid for them, if any. You must uninstall the software and return any media and other associated materials to Microsoft with proof of purchase to obtain a refund. These are your only remedies for breach of the limited warranty.

**E. CONSUMER RIGHTS NOT AFFECTED.** You may have additional consumer rights under your local laws, which this agreement cannot change.

**F. WARRANTY PROCEDURES.** You need proof of purchase for warranty service.

- 1. United States and Canada.** For warranty service or information about how to obtain a refund for software acquired in the United States and Canada, contact Microsoft at
  - (800) MICROSOFT;
  - Microsoft Customer Service and Support, One Microsoft Way, Redmond, WA 98052-6399; or
  - visit [www.microsoft.com/info/nareturns.htm](http://www.microsoft.com/info/nareturns.htm).
- 2. Europe, Middle East and Africa.** If you acquired the software in Europe, the Middle East or Africa, Microsoft Ireland Operations Limited makes this limited warranty. To make a claim under this warranty, you should contact either

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3. **Outside United States, Canada, Europe, Middle East and Africa.** If you acquired the software outside the United States, Canada, Europe, the Middle East and Africa, contact the Microsoft affiliate serving your country (see [www.microsoft.com/worldwide](http://www.microsoft.com/worldwide)).

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**H. LIMITATION ON AND EXCLUSION OF DAMAGES FOR BREACH OF WARRANTY.** The Limitation on and Exclusion of Damages clause above applies to breaches of this limited warranty.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state. You may also have other rights which vary from country to country.



# Limited Warranty

All products manufactured by Seller are warranted to be free from defects in material and workmanship for a period of one (1) year, unless otherwise specified, from date of shipment and to conform to applicable specifications, drawings, blueprints and/or samples. Seller's sole obligation under these warranties shall be to issue credit, repair or replace any item or part thereof which is proved to be other than as warranted; no allowance shall be made for any labor charges of Buyer for replacement of parts, adjustment or repairs, or any other work, unless such charges are authorized in advance by Seller.

If Seller's products are claimed to be defective in material or workmanship or not to conform to specifications, drawings, blueprints and/or samples, Seller shall, upon prompt notice thereof, either examine the products where they are located or issue shipping instructions for return to Seller (transportation-charges prepaid by Buyer). In the event any of our products are proved to be other than as warranted, transportation costs (cheapest way) to and from Seller's plant, will be borne by Seller and reimbursement or credit will be made for amounts so expended by Buyer. Every such claim for breach of these warranties shall be deemed to be waived by Buyer unless made in writing within ten (10) days from the date of discovery of the defect.

The above warranties shall not extend to any products or parts thereof which have been subjected to any misuse or neglect, damaged by accident, rendered defective by reason of improper installation or by the performance of repairs or alterations outside of our plant, and shall not apply to any goods or parts thereof furnished by Buyer or acquired from others at Buyer's request and/or to Buyer's specifications. Routine (regularly required) calibration is not covered under this limited warranty. In addition, Seller's warranties do not extend to the failure of tubes, transistors, fuses and batteries, or to other equipment and parts manufactured by others except to the extent of the original manufacturer's warranty to Seller.

The obligations under the foregoing warranties are limited to the precise terms thereof. These warranties provide exclusive remedies, expressly in lieu of all other remedies including claims for special or consequential damages. SELLER NEITHER MAKES NOR ASSUMES ANY OTHER WARRANTY WHATSOEVER, WHETHER EXPRESS, STATUTORY, OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS, AND NO PERSON IS AUTHORIZED TO ASSUME FOR SELLER ANY OBLIGATION OR LIABILITY NOT STRICTLY IN ACCORDANCE WITH THE FOREGOING.