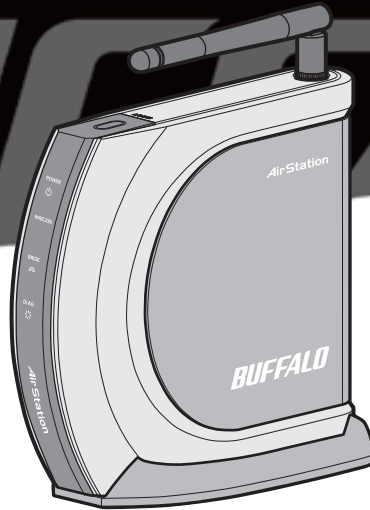


**User Manual**  
**High Speed Wireless**  
**Broadband Router**  
**WHR-G54S**



Rev A

Introduction . . . . .	05
Installation / Setup . . . . .	10
Internal Antennas. . . . .	12
Standard Settings . . . . .	13
AOSS . . . . .	22
Advanced Setup . . . . .	25
LAN Settings . . . . .	25
Wireless Settings . . . . .	25
Wireless LAN Security . . . . .	27
LAN Port . . . . .	30
DHCP Server . . . . .	31
Wireless MAC Filter . . . . .	34
Wireless Bridge (WDS) . . . . .	36
WAN Settings . . . . .	38
WAN Port . . . . .	38
WAN Network . . . . .	41

Network Settings . . . . .	42
Router Setup . . . . .	42
Address Translation . . . . .	44
Packet Filter . . . . .	47
Intrusion Detector . . . . .	52
UPnP . . . . .	54
Management . . . . .	55
System Information . . . . .	55
Change Password . . . . .	56
Time Setup . . . . .	57
Packet Traffic Information . . . . .	58
Client Monitor . . . . .	59
Ping Test . . . . .	60
Log Information . . . . .	61

Syslog Transfer . . . . .	62
Save/Restore Settings . . . . .	63
Reboot/Reload Settings . . . . .	64
Firmware Update . . . . .	65
AOSS . . . . .	66
File & Printer Sharing / Audio/Video Playback . .	68
Specifications . . . . .	69
Troubleshooting . . . . .	72
Glossary . . . . .	80
FCC/CE Information . . . . .	86
Warranty Information. . . . .	91
Contact Information . . . . .	92

## AirStation High Speed Mode Wireless Cable/DSL Router (WHR-G54S)

This manual introduces you to the AirStation Cable/DSL Router, and will help you connect to your network quickly.

The WHR-G54S router, is a wireless 4-port router network device that complies with the 2.4GHz IEEE 802.11g standard specification on wireless LANs. It also supports High Speed Mode technology. The WHR-G54S supports enhanced built-in NAT/SPI firewall functions and is used as a multi-functional router/link between wired and wireless LAN computers.

Summary of the AirStation WHR-G54S features:

- Wi-Fi™ (Wireless Fidelity) certified by the Wi-Fi Alliance as an 802.11b/g device. The AirStation will communicate with other IEEE 802.11b/g/Wi-Fi compliant wireless LAN products.
- Supports High Speed Mode
- Auto-Channel Selection
- Support for Wi-Fi Protected Access™ (WPA), TKIP, AES, and WEP.
- DHCP client/server function.
- Auto roaming, supports seamless roaming over multiple channels.
- Packet Filtering for eliminating unwanted communications.
- SOHO/SMB routing and firewall functions provide a safer private networking environment, including support for MS NetMeeting and MSN-Messenger.
- Additional SPI Firewall Functions - DMZ, intrusion detection and notification
- Syslog transmits some or all system activities to a central Syslog server.

- Extended range WDS (Wireless Distribution System).
- Auto Media Dependent Interface/Crossover (MDI/X) port, allows connection by standard and crossover CAT5 cables.
- Supports Universal Plug and Play (UPnP).
- Buffalo's AOSS System for easy, secure wireless client configuration.
- Enhanced security features:
  - SPI Firewall and DMZ zone functions to prevent unknown intruders.
  - Intrusion Detector Firewall (NAT) with a pop-up or email alert warning unwanted attacks.
  - Dynamic packet filtering.
  - WPA, TKIP, AES, and WEP.
  - Packet monitoring and filtering by MAC address, IP address and port.
  - PPPoE support
  - WDS support
- Buffalo's easy web interface configuration
- Broadband router static and dynamic routing methods between WAN and LAN based on updated routing tables. An economical way to bridge multiple networks.
- Buffalo's AOSS System for easy, secure wireless client configuration.

## Home Networking

Buffalo AirStation wireless access points enable sharing broadband by simply connecting the AirStation to a DSL or Cable modem to:

- Share files and printers
- Access and share the Internet
- Share media files

## System Requirements

- Broadband (High-Speed) Internet connection or existing Local area connection
- Any Wi-Fi (wireless) compatible computer with a Web Browser Internet Explorer or Netscape 4.5 or later.



## AirStation WHR-G54S Package Contents

The AirStation WHR-G54S package consists of the following items.

1. WHR-G54S Base Station and antenna
2. AC adapter and Power cable
3. CAT5 LAN cable
4. Utility CD with Manual
5. Quick Setup Guides
6. Warranty Statement
7. Base Plate

## Product Views

**Power** - Lit when the device is powered on.

**Wireless** - Lit when the wireless radio is on.

Flashes when wireless traffic is present.

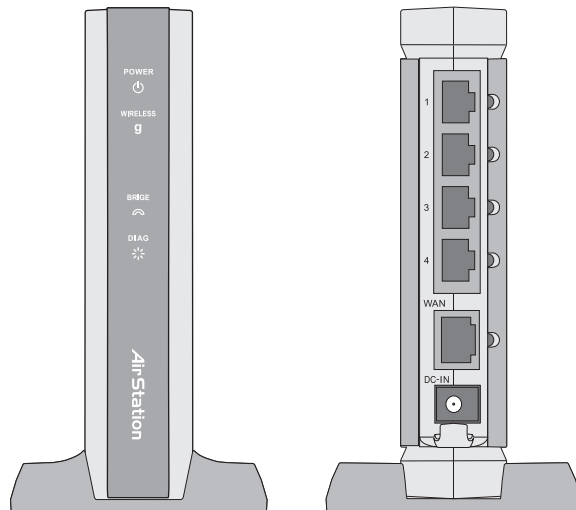
**Bridge** - Lit when the Bridge mode is running. Off when the Router mode is running.

**WAN** - Lit when connection to Cable/DSL modem is present. Flashes when internet traffic is present.

**Diag** - Flashes red when performing diagnostic functions.

**AOSS** - Flashes when in AOSS mode, solid when AOSS encryption has been set.

**Ethernet** - 1, 2, 3, or 4 lit when ethernet clients are connected. Flashes when ethernet traffic is present.





## About the AirStation CD

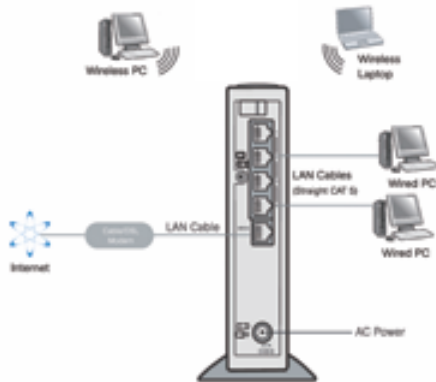
The AirStation does not require any software to be installed on your computer for configuration. The AirStation CD contains product documentation and Buffalo's Client Manager which provides AOSS functionality for any Buffalo client card or any Intel Centrino notebook.

It is the policy of Buffalo Technology to improve products as new technology, components, software and firmware become available.

Please consult the AirStation wireless website (<http://www.buffalotech.com>) to download and install the latest firmware for your product.

Follow these simple steps to connect the AirStation to your Broadband Internet connection allowing you to combine and share wired and wireless computers and printers with the high-speed internet connection.

1. Power down the Cable or DSL modem and the computer which will be used to configure the AirStation router.
2. Plug the Cable or DSL's LAN Ethernet cable into the AirStation's WAN port. Initially, you may need to unplug this cable from your computer, hub or other router.



consult Buffalo Technical Support.

3. Plug the provided Ethernet cable into a LAN port on the AirStation and plug the other end into your computer Ethernet adapter's (NIC) port. If you plan to initially configure the AirStation via a wireless connection, (not recommended), you may skip this step.

4. Power on your cable or DSL modem, wait one full minute, Power on the AirStation router, wait another full minute and then power on the computer which will be used to configure the AirStation. If the red DIAG light on the AirStation is lit or flashing after several minutes of being powered on, please

### **Introduction**

Configuring the AirStation using a standard web browser requires basic wireless configuration knowledge. Setup includes manual wireless configuration and basic administrative management.

### **Setup Preparation**

Make note of the AirStation's wired MAC address (found on the underside of the WHR-G54S). It is also recommended you record any other broadband ISP information such as global IP address, subnet mask address, default gateway address, DNS server address and PPPoE parameters.

### **Setup Overview**

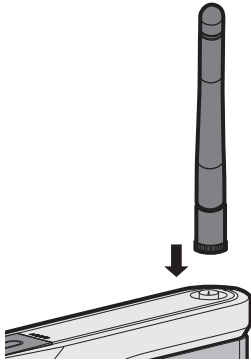
Buffalo recommends using a wired connection, meaning your computer is physically connected to the AirStation with a CAT5 straight cable plugged into one of the four LAN ports. This type of setup will eliminate possible setup problems due to any issues with the wireless adapter on the computer being used to configure the AirStation.

A Web browser version 4.5 or later can be used to configure the AirStation.

Advanced settings for security, filtering and other features will be explained in later sections.

## Internal Antennas

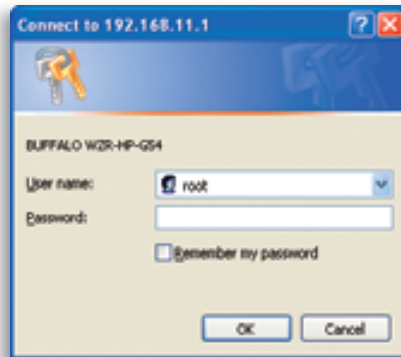
The WHR-G54S has one hoip antennas. This setup is ideal because it allows for proper antenna polarization with both desktop and notebook style wireless adapter antennas.



## Open the Setup Screen

- Connect the WHR-G54S according to the wiring instructions in Section 2.
- The WHR-G54S has a default LAN IP address of 192.168.11.1 and Subnet Mask of 255.255.255.0.

Initial  
Settings  
Login



enter a User ID and Password.

Enter “**root**” as the User ID and leave the password field **blank**.

- Note: These are the factory default settings

■ Note: The computer used to configure the AirStation should be set to obtain an IP address automatically using a DHCP server. The Quick Setup Guide enclosed with the product contains detailed instructions on how to configure your computer for initial configuration.

On the computer used to configure the AirStation, launch a Web Browser 4.5 or later.

- Enter **192.168.11.1** into the URL field.
- A window will open prompting you to

Initial  
Settings  
Screen



## Enter ISP information

- Click the appropriate button to select the type of broadband access. (Users more experienced in networking may choose to select the Advanced button and skip to Section 4.)
- For supplementary tools, use the tabs along the top of the screen.

Initial DSL  
button  
Screen



## DSL Button

Select the appropriate connection method.

## Automatic IP Assignment by ISP

- The DHCP server of the ISP assigns an IP address automatically.

Manual DSL  
IP Settings  
Screen

The screenshot shows a web browser window displaying the 'Manual DSL IP Settings' screen. The page title is 'DSL / DSL IP'. The form contains the following fields and options:

- Manual IP Address:** A text input field with the value '192.168.1.1'.
- Netmask:** A text input field with the value '255.255.255.0'.
- Gateway:** A text input field.
- DNS Servers:** A text input field.
- Dynamic IP Address:** A radio button that is currently unselected.
- Manual IP Address:** A radio button that is currently selected.
- Save:** A blue button at the bottom right.

## Manual IP Address Setup

- Enter the IP Address given by the ISP.
- Use 'Enter IP Address Manually' if the ISP requires use of a static IP address.

DSL PPPoE  
Settings  
Screen

The screenshot shows a web browser window displaying the 'DSL PPPoE Settings' screen. The page title is 'DSL / DSL PPPoE'. The form contains the following fields and options:

- User Name:** A text input field.
- Password:** A text input field with a 'Confirm Password' label.
- Vendor Name:** A text input field.
- DSL Speed:** A text input field with the value '1000000'.
- DSL Modem:** A text input field with the value '1000000'.
- PPPoE:** A radio button that is currently selected.
- PPPoE:** A radio button that is currently unselected.
- Save:** A blue button at the bottom right.

## PPPoE Connection

- Enter the PPPoE information provided by the ISP.

Initial CATV  
Settings  
Screen



## Cable Button

Select the appropriate connection method.

## Automatic IP Addressing

- Select 'Automatic IP Assignment by ISP' if your ISP's DHCP server assigns an IP address automatically.

Manual IP  
Address  
Settings



## Manual IP Address Setup

- Select 'Enter IP Address Manually' if the ISP requires use of a static IP address.



Auto IP/  
Manual DNS  
Settings



## Automatic IP Address - Manual DNS Server Configuration

- Select 'IP address is acquired automatically but DNS server address is entered manually' if the ISP's DHCP server supplies an IP address but not DNS server addresses.

Line  
Test Tab



## Line Test

Tests the connection to the Internet.

Security Tab



## Security

The Security Tab offers three Simple Security Settings. Follow the instructions in each screen to enter Encryption Keys, MAC Address Filtering and the degree of firewall security for the AirStation.



## Setup Encryption on the AirStation(WEP/TKIP/AES).

- Select the desired encryption scheme from the choices. After it has been selected, press the **'Next'** button. You will then be prompted to enter the appropriate key(s) for that method of encryption.



## Setup the Wireless MAC Filter.

- Select **'Enable'** to use MAC filtering. See **'Page 34'** for more information on MAC Address Filtering.



## Setup Basic Security.

- See **'Page 52'** for more information on Intrusion Detector.

Application  
Tab



## Applications

The Application Tab offers setup for special applications such as games, MS NetMeeting and MSN Messenger. Then follow the on-screen menus to configure the AirStation for the application.



## Playing Internet Games

-Enter the **ports**(refer to Game documentation) the game runs on, and enter the Local IP Address of the PC that plays the game.



## Using Netmeeting

-Enter the **IP Address** of the PC that will use Netmeeting.



## Using Windows (MSN) Messenger

-Refer to the **on-screen help** for information about Messenger.

Although your AirStation will function fine using only the **Standard Settings**, you may wish to explore more advanced options. The **Advanced Settings** section explains each function in the Advanced settings area.

Click the Top tab and click the Advanced button to enter the Advanced settings area.

**AOSS** (AirStation One-Touch Secure System) is a simple, one-touch setup for connecting wireless clients to an access point while setting up the most secure possible connection. Users no longer need to worry about choosing the proper security protocols, IP addresses, or SSID's. The intelligence of AOSS determines the most optimal connection and configures itself in seconds.

■ **NOTE:** AOSS automatically creates a secure connection between your AOSS Access Point and client. You must have an AOSS enabled wireless client device to use the AOSS features of your AOSS Access Point/Router. Intel Centrino supports AOSS by installing Buffalo's Client Manager software.

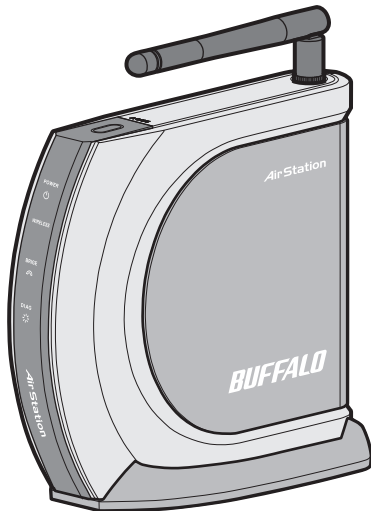
- ▶ Configure your WHR-G54S' internet connection by referring to the instructions in the WHR-G54S' Quick Setup Guide.
- ▶ Once the WHR-G54S has been configured, follow the directions to install your wireless client device and its drivers if necessary. Certain wireless client adapters require client software to configure them. If your device has a Client Manager, then install it as well.

		
<p>Standalone AOSS Device</p>	<p>Client Manager Device</p>	<p>Client Manager Software</p>

■ **NOTE:** If the wireless client adapter is installed on a PC, then the AOSS client manager will need to be installed as well. If your wireless client adapter is a standalone device that does not require a PC, then just power up the device.

**Standalone Devices:** Ethernet Converters and Access Point Bridges

**Client Manager Devices:** CardBus, USB, and PCI Adapters.



▶ Now that the WHR-G54S and wireless client adapter are installed, you can use AOSS to configure them.

▶ To begin the configuration, press the AOSS button on the top of the WHR-G54S for 3-5 seconds. The orange AOSS light will begin to flash rapidly when the AOSS mode has been enabled. You can stop pressing the button at this point.

■ NOTE: AOSS mode will stay active for a period of two minutes. This is the time-slot required to initiate AOSS on the wireless client adapter.

▶ Refer to your wireless client adapter's AOSS supplement to initiate the wireless client adapter's AOSS mode.

▶ Once the client adapter has finished communicating with the AOSS router, the orange light will stop flashing and become solid. This indicates that the AOSS process has completed and the devices are now using AOSS. It typically takes 15-60 seconds for the entire AOSS process to complete. Please refer to your wireless client adapter's supplement for the remainder of the setup.

***Additional AOSS Information:***

- ▶ Only one AOSS wireless client adapter can be configured to the AOSS router at a time. Thus, the button will need to be repressed for each additional AOSS wireless client adapter that will be connected.
- ▶ It is not necessary to AOSS client devices that have already been configured via AOSS, unless significant changes have been made to the wireless network.
- ▶ Do not attempt to configure two separate AOSS networks at the same time, as it may cause undesired configurations.
- ▶ If an undesired client has connected via AOSS, it can be disconnected from within the WHR-G54S' advanced configuration menus.



## LAN Settings

Wireless  
Settings



Set up LAN connections.

## Wireless Settings

**Wireless Mode** - Enable or disable wireless LAN computer communication.

**SSID** - Allows administrator to alter the SSID of the AirStation. To communicate with a specific AP only, the AP's SSID must be entered in the client computer. The client computer looks for the specific AP (or SSID) for wireless communication. Use up to 32 alphanumeric characters

for the SSID (case sensitive). By default the SSID is the LAN Mac address of the AirStation.

■ **Note:** Roaming - When multiple AirStations have an identical SSID, WEP key (if WEP is used), (and channel in WDS mode), client computers may Roam between the AirStations.

**Wireless Channel** - Select the channel used for wireless communication. There are 11 overlapping channels. Channels 1, 6 and 11 are non-overlapping. The 'Auto-Channel' option is recommended, as it constantly assesses the best available channel for the AirStation to operate on.

If there are multiple APs in close proximity using the same channel, there may be interference. In this case, change to a non-overlapping channel.

**Privacy Separator** - Enable or disable communication between wireless clients. If you choose to use this feature, every wireless client that is associated to the AirStation will not be able to communicate with any other wireless clients.

■ **Note:** If this function is used, wired clients can still communicate with wireless clients.

**BSS (Basic Service Set) Basic Rate Set** - The transmission data rates offered by the AirStation. It is recommended to use the 'Default' selection to accommodate 802.11 and 802.11b rate sets. It is NOT recommended to use the 'All' selection, as some devices may not understand all of the rate sets offered by the AirStation.

**Frame Bursting Mode** - This function increases 802.11g communication throughput by transferring packets more efficiently. The following conditions affect this function:

- The wireless LAN client adapter must support Frame Bursting (and it must be enabled). If the wireless LAN client adapter does not support Frame Bursting, or Frame Bursting is not enabled, then it will operate at non-Frame Bursting speeds.

**High Speed Mode** - This function further increases 802.11g communication. The following conditions affect this function:

- The wireless LAN client adapter must support High Speed Mode (and it must be enabled). If the wireless LAN client adapter does not support High Speed Mode, or it is not enabled, then it will operate at regular 802.11g speeds.

It is recommended to leave High Speed Mode enabled as it can only help throughput, not hurt it.

**802.11g Protection** - This enables protection mechanisms for when 802.11b clients join the network. It enables CTS (Clear-to-Send)

**DTIM Period** - An access point transmits beacon signals to nearby clients at a preset interval. This parameter sets the beacon transmission interval time (1-255 seconds). Selection of a larger number may conserve energy for the client computer (when client power management is enabled), but may delay wireless communication. The default value of 1 is recommended.

**Wireless Output Power** - Configure output power of the AirStation. Decrease wireless output power to shrink the wireless communication range. The default setting of 100% is recommended unless decreased range is desired

Wireless  
Security  
Settings



### Wireless LAN Security

**Broadcast SSID** - Enable or Disable the SSID (SSID) from being broadcasted. If denied, the AirStation will not be found unless the specific AirStation's SSID is entered in the client computer manually.

**Data Encryption** - Disable to have no encryption of the wireless data. This will make accessing the AirStation and the network very easy. It is im-

important to note, that without encryption it is easy for strangers to connect to your network, especially if the AirStation is broadcasting its SSID.

Select the type of data encryption:

- Disabled - Disable data encryption.
  - WEP - Uses WEP encryption. Encryption key should be entered.
  - TKIP - Uses TKIP (Temporal Key Integrity Protocol) for data encryption.

The encryption key is renewed every “Re-key interval” when “TKIP” is selected.

**WEP** - When the WEP (Wired Equivalent Protection) encryption standard is implemented into a wireless network, a WEP key is used between the client and access point to successfully encrypt, transmit and decrypt data. For this reason, the same WEP key must be used for communication between the client and the AirStation.

An access point and client may both carry multiple WEP keys. It is necessary for not only the WEP keys to match, but also the WEP key’s order. If a wireless client cannot support multiple WEP keys, the AirStations must be configured to transmit key number 1 for a connection to take place.

Examples of WEP key:

64-bit ASCII: 5 digits of alphanumeric characters, “ab34Y”

128-bit ASCII: 13 digits of alphanumeric characters, “123456abcdef7”

■ **Note:** ASCII WEP keys are case sensitive.

64-bit HEX: 10 digits, using characters 0-9 and a-f, “00234ABCDE”

128-bit HEX: 26 digits, using characters 0-9 and a-f, “20123456789abcdeabcdeabcde”

**TKIP** - TKIP (Temporal Key Integrity Protocol) is a WEP expanded encryption technique. TKIP has greatly improved WEP's weaknesses by rotating secret keys between every packet. TKIP uses WPA-PSK (pre-Shared Key).

### Characteristics:

- The Initialization Vector is expanded from 24-bits to 48-bits.
- The Initialization Vector is randomized.
- Uses a different RC4 key for every packet.

**AES** - AES further improves TKIP by using AES (Advanced Encryption Standard) encryption method. Due to its hardware co-processor, AES uses the toughest encryption without sacrificing throughput like WEP and TKIP.

TKIP & AES require an 8 to 63 character passphrase in ASCII or 64 digits hexadecimal key.

Example 1: [ airstation -WPA-PSK ]

Example 2: [0123456789abcdef0123456789abcdef0123456789abcdef0123456789abcdef]

**WPA Rekey Interval** - When TKIP is selected, the encryption key is renewed at this interval. This interval is in seconds; the range of acceptable values is 0-3600.

If 0 is entered, the key is never renewed.

■ **Note:** The lower the rekey interval, the more often a rekey occurs. Setting a low rekey interval may affect performance negatively.

## LAN Port Settings



## LAN Port

Set the LAN side Ethernet settings.

**LAN Side IP Address** - Allows administrator to specify a static IP and Subnet Mask for the LAN side of the AirStation.

■ **Note:** If the AirStation's IP address is changed, the configuring computer's IP must be changed to the same range to continue configuration. If the LAN IP is changed, restart the AirStation. (Section 4.4.10). If

the IP address is changed, then the DHCP scope must be changed to match.

**DHCP Server Function** - Allows administrator to enable/disable the DHCP server function for the AirStation LAN side. Select **Use** to enable and **Do not use** to disable the function. Once **Use** is selected, the assigned IP address range can be specified. Enter the starting LAN IP address and total number of computers the DHCP server can accommodate.

■ **Note:** If there is another DHCP server on the network, one either must be disabled or the IP range must be changed to avoid conflicts derived from overlapping DHCP scopes.

## DHCP Server Settings



## DHCP Server

Allows a more advanced configuration of the DHCP server functions.

### DHCP Server Settings -

Allows administrator to enable/disable the DHCP server function for the AirStation LAN side. Select Use to enable or Do not use to disable this function.

If the DHCP service is enabled, wireless and wired clients may receive IP addresses and other network information from the

AirStation. If the DHCP server is turned off, all client PC's must have unique, static IP addresses and valid network settings manually entered. Check with your LAN administrator for static IP information.

**DHCP IP Address Pool** - Sets the beginning address and range of addresses to be assigned by the AirStation's DHCP server function. Select up to 253 consecutive addresses (nodes). The IPs to be excluded from the range specification should be entered in the specified field.

**Lease Period** - Specifies the time in hours (1-999) an assigned IP address is valid. If the client computer does not request a renewal of IP address before the lease period expires, the AirStation can issue the IP to another client computer.

**Default Gateway** - Allows administrator to use the Default Gateway address (the AirStation's IP address), assign a specific Gateway address, or block clients from Gateway notification.

**DNS Server** - Allows administrator to use the default DNS address (the AirStation's IP address), assign specific DNS addresses, or block clients from DNS address notification.

**WINS Server** - Allows administrator to use a WINS address. Select auto assignment of the IP address, enter a specific WINS IP address, or block clients from the WINS address notification.

**Domain Name** - Allows administrator to use an assigned domain name, assign a specific domain name, or block clients from domain name notification. Domain names will be sent to LAN computers when an IP address is assigned. Enter a maximum of 64 alphanumeric characters.



Manual IP  
and MAC  
Address  
Assignment  
Settings



**Manual Assignment** - Allows administrator to add additional leased IP addresses tied to a specific MAC address. When a specific MAC address connects to the AP, the IP address specified will be given to that client.

Display/Delete lease information - List of IP addresses, MAC addresses, lease periods and status is displayed.

Wireless MAC  
Filter



## Wireless MAC Filter

**Enforce MAC Filtering** - Select **Enable** to restrict wireless connections to the registered adapters in the list. Select **Disable** to disable MAC address filtering.

Press the **Apply** button to enter the MAC Address registration menus. This is where MAC Addresses can be assigned and deleted.

Register for Allowable PC's MAC Address



**Registration for MAC Addresses** - MAC access restriction set up in LAN. Input the MAC addresses that are allowed to communicate with the AirStation.

MAC address list - Displays a table list of all MAC addresses allowed to communicate with the AirStation.

## Wireless Bridge (WDS) Settings



## Wireless Bridge (WDS)

The Wireless Distribution System supports peer-to-peer AP communication.

## Wireless Bridging (WDS)-

Select **Enable** to allow Bridge (WDS) mode between AirStations or **Disable** to block communication between AirStations.

## Wireless Bridge (WDS) Dedicated Mode -

Select **Enable** to restrict wireless computer communication with the AirStation. In dedicated mode wireless clients CANNOT connect to WDS AirStations.

■ Note: All AirStations must support WDS and be on the same channel. Do not use 'Auto-Channel' when using WDS. For roaming support, use the same SSID on all devices.

**Add a WDS Partner:** Allows administrator to input the wireless MAC address of AirStations for Bridge (WDS) communication. The wireless MAC address is found in the Management section => System Information, labeled Wireless MAC Address.

Wireless  
Bridge (WDS)  
Settings



To enable WDS, set the Wireless Bridge (WDS) function to **Enable**.

Enter the Wireless MAC address of the AirStation to communicate with in the form of two characters separated by a colon and click **Add**.

MAC Address Ex:  
00:00:00:00:00:00

Up to six AirStation MAC addresses may be registered.

Click **Apply** under Wireless Bridge (WDS) settings when the wireless Mac addresses AirStation are entered.

Repeat this process on every other AirStation used in Bridge (WDS) mode.

WAN port  
Setup



## WAN Settings

### WAN Port

#### Wired WAN Performance

- Select port speed and type of duplex connecting to the WAN port. If unknown, select Auto negotiation.

#### MAC Address of WAN Port

- Set the AirStation MAC address to be used for WAN communication. Some ISP's may require you to set the MAC Address of WAN to be the same MAC address of your cable or DSL modem.

#### WAN IP Address

- Allows administrator to select DHCP server, PPPoE, or manual setting for the WAN port of the AirStation.  
Auto IP assignment from DHCP server - acquire the IP address automatically from the DHCP server.  
Use PPPoE client - If selected, the information listed below must be entered.  
Manual setting - Enter the appropriate IP address and subnet mask.

**PPPoE Setting (for enabling PPPoE Client function)** - Allows administrator to use PPPoE as specified by the ISP.

The following parameters should be entered for PPPoE Settings:

**Name of Connection** - Enter the name of your connection.

**User Name** - Enter the user name (up to 64 alphanumeric characters) for PPPoE authorization.

**Password** - Enter the password provided by your ISP (up to 64 alphanumeric characters). Reenter the password in the Confirmation box.

**Service Name** - Enter the PPPoE service name (up to 64 alphanumeric characters). If your ISP doesn't require a service name, then leave it blank.

**Connection Type** - Select from:

- Continuous Connection - connects immediately after setting and never disconnects.
- Connect on Demand - Reconnects when the disconnect time elapses.
- Manual - Disables Automatic Connection. Connects to the Internet using the connect button on the initial settings page.

The **Enter New Connection** button will not appear until Use **PPPoE Client** is set.

**Disconnection Time** - Specify the number of minutes (0-1440) before automatic disconnect is performed. If "0" is entered, the disconnect function is disabled. If **Continuous Connection** is selected, the timer is disabled.

PPPoE  
Settings  
Screen

Name of connection ?	Net	
Host name ?		
Password ?		(Confirmation)
Service name ?		
Connection type ?	Connection on demand	
Disconnection time ?	20 minutes	* If disconnection time is set to 0, the AirStation will maintain the connection indefinitely.
Authorization ?	Auto authorization	
MTU size ?	1454 bytes	
MRU size ?	1454 bytes	
Keep Alive ?	<input checked="" type="radio"/> Enable <input type="radio"/> Disable	
Activation ?	<input checked="" type="radio"/> Enable <input type="radio"/> Disable	

Apply

**Authorization** - Authorization method for accessing the ISP's PPPoE server. If unknown, select Auto authorization.

**MTU (Maximum Transmit Unit) Size** - Maximum Transmit Unit (578-1492) when using PPPoE.

**MRU (Maximum Receive Unit) Size** - Maximum Receive Unit (578-1492) when using PPPoE.

**Keep Alive** - Enables the PPPoE client to send a Link Control Protocol (LCP) echo request to the PPPoE server

once per minute. If there is no reply within six minutes, the client disconnects. Set to **Disable** if frequent disconnection occurs.

**Activation** - Enable/disable registered connection settings. If disabled, the connection is not permitted.



## WAN Network

Network of  
WAN



WAN side (Internet) parameters. These settings are generally not required if your ISP is providing DHCP services. In this case these fields can be left blank if desired.

**Host Name** - Enter the host name as desired.

**Default Gateway** - A default gateway IP should be assigned

to the AirStation. If unknown, leave blank. If **Auto IP assignment from DHCP Server** is selected in the **WAN Port** section, a gateway IP is assigned automatically, provided the DHCP server is set to provide one.

**DNS Server Address** - Enter the primary and secondary DNS address(es) of the server to be used by the AirStation for DNS resolution.

**Remote Management Port Number** - Set a specific port number when remote setup of the AirStation is planned. Using port 80 allows the AirStation to be accessed from the internet by connecting to <http://xxx.xxx.xxx.xxx> (where xxx.xxx.xxx.xxx is your WAN IP address). You will need to configure the NAT (**Address Translation Settings**) to forward PORT 80 back to the AirStation.

**Block Ping from WAN** - Allows a PING test from the WAN/Internet. Select **Disable** or **Enable**.

Routing  
Setup



## Network Settings Routing Setup

**RIP transmission to WAN** - Allows RIP transmission or None (no RIP) to WAN

**RIP reception from WAN** - Allows RIP reception or None (no RIP) from WAN

**RIP transmission to LAN** - Allows RIP transmission or None (no RIP) to LAN

**RIP reception from LAN** - Allows RIP reception or None (no RIP) from LAN

**RIP transmission to WAN** - Allows RIP transmission or None (no RIP) to WAN

**Display Routing Table** - Allows administrator to view and delete routing information.

Add Routing  
Table Entry

The screenshot shows a Windows dialog box titled "Add Routing Table Entry". It has a title bar with the text "Mtg-2/192.168.11.1 - Routing Information Setup - Microsoft I...". The dialog contains the following fields and controls:

- Destination Address**: A text box with a question mark icon, currently empty.
- IP Address**: A text box with a question mark icon, currently empty.
- Subnet Mask**: A dropdown menu with a question mark icon, currently set to "255.255.255.0".
- Gateway**: A text box with a question mark icon, currently empty.
- Metric**: A text box with a question mark icon, currently set to "15".
- Buttons**: "Add Route" and "Close" buttons are located at the bottom of the dialog.

(1-15) to be passed before the packet reaches its destination.

Click **Add Route** to Add a Routing Table Entry

- **Destination address** - Network IP address and subnet mask.
- **Gateway** - Address through which the packet passes before it reaches the destination address.
- **Metric** - Number of routers

## Address Translation Setup



## Address Translation

Address Translation - Select **Enable** or **Disable**. Address Translation must be enabled for client computers to connect to the Internet. Selecting **Enable** enables the following functions:

- **IP Masquerade** - When the LAN computer connects to the WAN side, the IP address of LAN computer is dynamically translated to become the WAN IP address of the AirStation. Multiple LAN computers can share one WAN IP address to access the Internet.

- **Static IP address translation** -When the WAN requests connection to the LAN, the WAN IP address of the AirStation is translated into the IP address of the LAN computer.

**Log Output** - Set 'Log Output' to log discarded packets. Otherwise, a dropped packet is not logged.

**IPSec PassThrough** - Enables the AirStation's ability to pass IPSec VPN data.

**IP Address of DMZ** - Allows administrator to set the DMZ (De-Militarized Zone) address. Incoming packets containing no recognizable destination port information will be redirected to the DMZ's IP address.

**Display/Delete NAT Table** - Allows administrator to delete NAT tables.

## Add NAT Table

Address  
Translation  
Setup



**Group** - Specify a group (up to 16 characters) that the NAT rule belongs to. Groups are simply used to visually organize the NAT table for the administrator. It is recommended to name the group after the protocol that is being setup (e.g. Group Name FTP when setting up address translation for FTP)

Click **New Group** to create new group or select an existing group to add a NAT rule to it.

**WAN Side IP Address** - Select **AirStation's WAN Side IP Address** or **Manual IP Address**. For Manual setting, enter the IP address

used by the WAN computer to connect to the local computer.

**AirStation's IP Address of WAN** should be used unless you have multiple WAN side IP addresses.

Some network applications (online games or streaming software) require adding Address Translation tables; consult the software's documentation for port information).

### **Protocol (WAN):**

- **All** - Selects all IP protocols.
- **ICMP** - Network Diagnostic Protocol (1).
- **Manual** - Specify the protocol number (0-65535).
- **TCP/UDP** - Enter port number for TCP or UDP protocols. If both TCP and UDP are required, then separate entries are required.

**LAN IP Address** - Select **Manual IP Address** and enter the destination IP address of the LAN computer; or select **AirStation's LAN IP Address**.

**Protocol (LAN)** - Enter the destination port number. If left blank, the packets are transferred to the same port number as the source port number. Typically the destination port should be left the same as the source port.

• Click **Add to NAT table**. This will add the information to the NAT table. Once you have gone through this process for every desired translation, you will need to press the **Apply** button on the top of the screen to start the translating.

## Packet Filter Setup



## Packet Filter

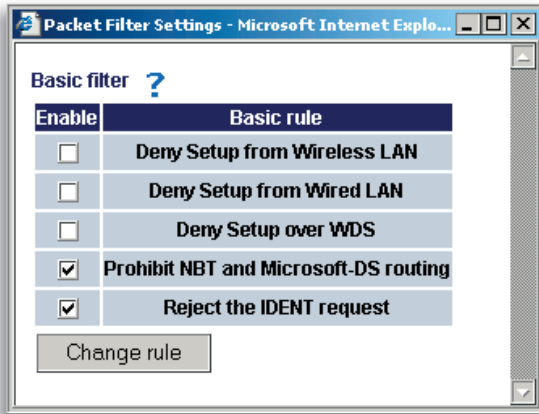
**Log Output** - Select **Output** to activate the packet filter log.

### Packet Filter Information

**Basic Rule** - Click add/delete basic rules. Place a check mark next to the basic rule to enable:

- **Deny setup from wireless LAN** - Prohibits administration from a wireless computer.
- **Deny setup from wired LAN** - Prohibits administration from a wired computer.
- **Deny setup via wireless bridge access point** - Prohibits a personal computer connected to another AirStation in a wireless bridge.
- **Prohibit NBT and Microsoft-DS routing** - Prevent unexpected external access via Microsoft network sharing. This prohibits computers on the internet from accessing shared resources on Windows machines. It is recommended to leave this filter activated.
- **Reject the IDENT request** - The AirStation sends reject packets if it receives an IDENT request.

Basic Filter  
Setting



Use this filter when the communication speed goes down using a network application like E-mail, FTP and WEB.

\* If IDENT requests are forwarded to a LAN side client by address translation setting (DMZ or TCP port :113 ), this basic rule is ignored.



IP Filter  
setting



**IP Filter Settings** - Limits the type of packets allowed to pass between the WAN and LAN. The maximum number of rules is 32.

• **Operation** - Packets from WAN (or LAN), select **ignored**, **rejected**, or **accepted**. Select the operation to be performed on the packets. Packets from:

- WAN side - packets coming from the WAN side will be filtered.
- LAN side - packets from the LAN side will be filtered.

Are :

- Ignored - Stop the packet and do not route it.
- Rejected - Return the rejected packet to the point of origin.
- Accepted - Pass the packet through.
- **Destination IP Address** - The IP address to be filtered.
- **Source IP Address** - The IP address designated for filtering. If all IP addresses must be filtered, leave this box blank.

**Warning:** If administrator selects packet from LAN is **Ignored** or **Rejected**, the administrator will

no longer have access to the AirStation configuration screens. This function prohibits setup from a wireless or wired computer. The AirStation can be returned to the factory default settings by holding down the INIT button on the back of the unit for five seconds or until the red DIAG light becomes solid.

**Protocol** - Mark and select a specific protocol. Select from **all** protocols, **ICMP**, arbitrary **protocol number** and **TCP/UDP** protocol number.

- **All** - Selects all IP protocols.
- **ICMP** - Network Diagnostic Protocol (1).
- **Manual** - Enter protocol number (0-65535).
- **TCP/UDP Destination Port** - Select TCP or UDP, then enter port number.

**Priority** - Specify the priority of an item. The smaller the number, the higher the priority.

Add MAC  
Filter  
setting



**MAC Filter** - Click Enter MAC filter to enter MAC address.

**Source MAC address** -The MAC address of the source of the packets that will be filtered may be set. Click Add rule when complete.

■ Note: If configuring from a wireless computer, add your MAC address to the list of authorized wireless LAN PCs. The MAC address must be in two-digit groups separated by colons.  
Example: 00:40:26:00:11:22

Click **Apply** when settings are complete.

## Intrusion Detector Setup



## Intrusion Detector

The Intrusion Detector watch guards and prevents unauthorized access from the WAN (Internet). This function also records information on unauthorized access attempts.

**Intrusion Detector** - Select **Do not use**, **Use** or **Use (Apply Packet filter setting for Intrusion Detector setting)**.

**IP Spoofing** - Check **Block** to prevent IP spoofing.

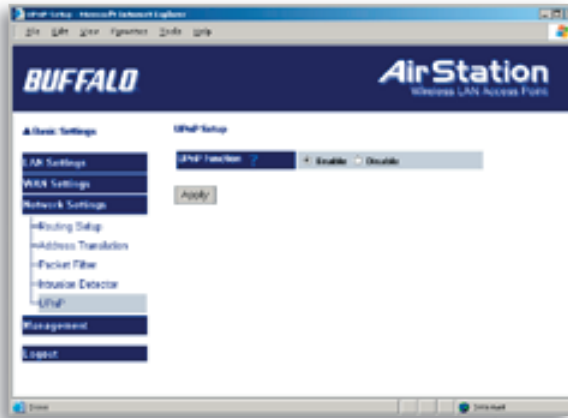
**Threshold Value** - Enter the number (1-999) of suspect packets before the notification occurs.

Notify by email

- **Email Alert Notification** - Enter destination email address
- **Sender email address** - Enter the email address that will send the email. This is the name that will appear as the sender when the email is read. This email can be made up (e.g. DETECTOR@AIRSTATION)

- **Sender email server address** - Enter the SMTP Server address.
  - **Receiving email server authorization** - Enter the POP3 Server address, User name and Password. This is only required if your SMTP server requires POP verification before it allows email to be sent. Consult your ISP or mail server support for more information.
  - **Send test** - Click **Send** to test notification; this will also save and commit the entries.
- Pop-up notification** - Pop-up window alert of unwanted activity. Client Manager must be installed and running on a client machine to use this feature.
- **Destination IP address** - Enter the IP address to be notified. The LAN computer with this IP address must have Buffalo's Client Manager software installed and running for the verification to occur. If the machine is off the verification will not be received, and the AirStation will NOT resend information.
- Intrusion Detector information** - displays log activity detected by the Intrusion Detector service.

UPnP  
Setting



## UPnP

Select **Enable** to enable UPnP (Universal Plug and Play). When a computer with UPnP support connects to the AirStation, that computer automatically receives configuration information from the AirStation.

## System Information



## Management - System Information

System information of the AirStation is obtained here.

- **Model** - Displays model and firmware version
- **AirStation Name** - Displays AirStation host name
- **DHCP Server** - Displays On or Off
- **Wireless Settings** - Displays the wireless LAN settings such as wireless MAC address and wireless firmware. The wireless MAC address is required for setting up WDS with other access points. This is the best place to determine the wireless MAC address. If High Speed

mode is enabled, then the [AfterBurner] color will be red or grey. When it is red, High Speed mode is running. When it is grey, High Speed mode is enabled but not running due to a client being connected at 54 Mbps or another access point running on the same channel.

- **LAN Settings** - Displays the AirStation LAN settings .
- **WAN Settings** - Displays the AirStation WAN settings and PPTP client settings if available.
- **Default Gateway** - Displays the default gateway settings.
- **WAN side IP address auto acquisition** - This is the method to acquire the IP address from the WAN (Internet) side DHCP server. Press Release to release current DHCP WAN information. Press

Renew to obtain WAN information from the DHCP server. **NOTE:** If a manual IP is assigned to the WAN port, this feature is not displayed.

Name and  
Password  
Setup



## Change Password

**AirStation name** - When using multiple AirStations, select a unique name to make it easier to identify each AirStation through the AirStation Manager utility. This utility is seldomly used, thus, the AirStation name value has little value.

**Administrator Name** - "root", cannot be changed

**Administrator Password** - Allows the administrator to enter an administrator password to restrict access to the setting screens.



## Time setup

**Time setup** - Enter the current date and time, and click **Set**.

Time Setup  
Screen



**NTP** - Network Time Protocol.  
Select **Use** or **Do not use**.

■ Note: If NTP is used, time is set automatically.

**NTP Server Address** - Enter the NTP Server Address

**Update Time** - Enter the time interval (in hours) for the time check frequency

**Time Zone** - Select local time zone

Click **Apply**.

Packet Traffic Information



## Packet Traffic Information

Displays number of packets sent and received for:

**Wired WAN**

**Wired LAN**

**Wireless LAN**

Click **Refresh** to start update the transfer packet log.

Client Monitor Screen



## Client Monitor

Displays the wired and wireless clients (computers) that are accessing the AirStation.

- **MAC address** - Shows the client's MAC address.

- **IP Address and Medium** - Shows the IP address that is assigned to the client from the DHCP server.

The network medium is indicated as wireless or wired depending on how the client is accessing the AirStation.

■ **Note:** The Client Monitor only shows clients that have received an IP address from the AirStation's DHCP server. Clients that have static IP addresses will not appear in the Client Monitor.

PING Test



## PING Test

Performs a PING test from the AirStation to a LAN or WAN address.

Enter the target IP address and click **OK** (e.g. **192.168.11.2** - OR- **www.buffalotech.com**)

**If the test results in an error, then verify you correctly inputted the address and check your connections.**

Log  
Information  
Screen



## Log Information

Display log info level - Select **Error** and/or **Notify** to specify the types of reports to be logged by the AirStation.

**Display log info** - Select the specific reports to be logged.

**Log information** - Displays recorded logs.

Syslog  
Transmitting  
Screen



## Syslog Transfer

Select **Enable** or **Disable** to enable or disable the AirStation's ability to transmit information to a Syslog server.

- **Syslog Server** - Enter the IP address of the Syslog server.

- **Log Information Level** - Select **Error** and/or **Notice** to specify the types of reports to be sent to the Syslog server.

- **Log Information** - Select the specific reports to be sent to the Syslog server.

■ **Note:** A server on the network running a Syslog service is required for this.

Save/  
Restore  
Settings  
Screen



## Save/Restore Settings

**Save current settings** - Click **Save** to open the file saving dialog and save the current AirStation settings to a file.

**Restored saved settings** - Restores settings from a file that has been saved. Click **Choose file** to select the saved file and click **Restore**.

■ **Note:** If the setting file is saved by a newer firmware than the current one, the AirStation can't restore the settings.

Initialization/  
Reboot



**Reboot/Reload Defaults**

**Click Restart to reboot  
AirStation**

Click Restore to reset the  
AirStation to default factory  
settings.

■ **Note:** Resetting to default  
factory settings will erase  
all settings and passwords  
previously entered. The  
AirStation will return to the  
condition it was in when first  
purchased.



Firmware  
Update



## Firmware Update

### Firmware File Name

- Click Browse to browse to the path and filename for the new firmware. Click Firmware Update to load firmware to the AirStation.

■ Note: Firmware update does not erase current user settings. It does however delete all of the service information from the Network Service List; you will need to perform a new service search after you update the firmware.

Please visit the Buffalo Technology Web Page to download the latest firmwares free of charge.

<http://www.buffalotech.com>

AOSS



AOSS

**Client Table** - Displays the clients connected via AOSS. The 'Disconnect' button disconnects the client from the AOSS router by using MAC Address filtering. Once disconnected, the client will still appear in the client list but will appear as disconnected. The client can then be re-enabled by pressing the 'Re-Enable' button. A separate table exists for connected Ethernet Converters. The 'Refresh' button updates the tables.

**Encryption type** - This forces AOSS to use a specified type of encryption. It is recommended to not change this setting. If the setting is changed then every client that connects must have support for that encryption type.

AOSS



**AOSS** - Click Enable to allow the AirStation to use AOSS function. Click Disable to shut off the AOSS system. Clicking Disable will disable the AOSS button on the AirStation.

**Start AOSS** - Click AOSS icon to begin the AOSS sequence. This starts the AOSS process just like pressing the AOSS button.

**Stop AOSS Process**- Click AOSS icon to stop AOSS operation. Stopping the AOSS function will turn off AOSS and return the router to non-AOSS function.

# File & Printer Sharing - Audio/Video Playback



The Shared Files icon on the Network Service List gives you access to a PC or network device's shared files and printers. For Windows PC's, File and Printer sharing must be setup properly before this service will work. On Network Storage Centers like Buffalo's LinkStation, the Shared Files icon should work with little to no configuration. Please consult your Windows documentation to learn more about setting up File and Printer Sharing.

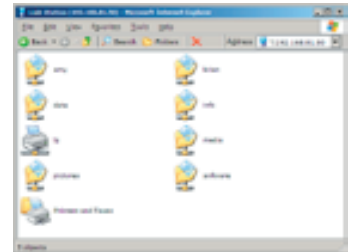
After clicking on the Shared Files icon you will see the available shared files and printers.

**Printing:** To print you can right click on a shared printer and press the 'Connect' button to install it as a printer on your computer. You can also drag a document, image, or text file directly over the printer share and it will connect to the printer and print it. Thus, you can drag a Microsoft Word Document over the shared printer and it will print out on the printer in the remote location.

**Files:** To access files, double click on the file or folder icon just like you would on your local machine. Files can be moved, copied, and renamed normally as well.

**Audio/Video Playback\*:** To play audio or video files through shared files just double click on the audio or video file you would like to play or select multiple files and create a playlist.

\* Streaming audio or video over the internet requires an internet connection sufficient enough to move the necessary amount of data. For instance, to stream a 128kbps MP3, a 150k or greater internet connection would need to be present on the remote and local side. Video often requires a faster internet connection. Most broadband DSL/Cable connections will have no problem streaming audio and most video files.



**NOTE:** It may take a few moments for the Shared Files folder to open after you click on the icon.



## Additional Information

For more information, please consult:

- The AirStation website at:

<http://www.buffalotech.com> - for frequently asked questions (FAQ's) and Software Updates.

## WHR-G54S BASE STATION SPECIFICATIONS

### Physical Specifications

W1.10 x H5.28 x D5.67 in. (28 x 134 x 144 mm)

Weight 0.6 lb. (270g)

### Temperature & Humidity

Operation 0° to 40° C

Maximum humidity 85%

Transit/Storage 0° to 40° C maximum humidity 85% (no condensation)

### Power Characteristics

Power Supply 100-240 V AC Universal, 50/60 Hz

Power Consumption About 3.4 W (Max)

## Regulatory Information

Wireless communication is often subject to local radio regulations. Although AirStation wireless networking products have been designed for operation in the license-free 2.4 GHz band, local radio regulations may impose limitations on the use of wireless communication equipment.

## Networking Characteristics

### Compatibility

- IEEE802.11g/b Standard for Wireless LANs (High Speed Mode also Available)
- Wi-Fi (Wireless Fidelity) certified by the Wi-Fi Alliance.

## Host Operating System

Microsoft Windows® 98SE/ME/NT4.0/2000/XP, Unix, Linux and MacOS

Media Access Protocol

Wired - CSMD/CD (Collision Detection)

Wireless - CSMD/CA (Collision Avoidance) with Acknowledgment (ACK)

## Radio Characteristics

RF Frequency Band 2.4 GHz (2,412-2,462 MHz)

11 selectable channels (3 non-overlapping)

Modulation Technique Direct Sequence Spread Spectrum

- OFDM for High Transmit Rate
- DQPSK for Standard Transmit Rate
- DBPSK for Low Transmit Rate

Spreading 11-chip Barker Sequence

Nominal Output Power 19.05 dBm (CCK) / 16.05dBm (OFDM)

Transmit Rate / Range

802.11g : 6, 9, 12, 18, 24, 36, 48, 54 Mbps

802.11b : 1, 2, 5.5, 11 Mbps

AirStation IEEE 802.11 Channel Sets

The range of the wireless signal is related to the Transmit Rate of the wireless communication. Communications at a lower Transmit range may travel longer distances.

Center Channel ID FCC

1 2412 2 2417 3 2422 4 2427 5 2432 6 2437 7 2442 8 2447 9 2452 10 2457 11 2462  
11 default channel

## Common Problems:

- Out of range, client cannot connect to the AirStation.
- Configuration mismatch, client cannot connect to the AirStation.
- Absence or conflict with the Client Driver.
- Conflict of another device with the AirStation hardware.

## (1) LED Activity

Monitoring LED activity helps identify problems.

- Power LED should be GREEN,
- Wireless LED should be GREEN if the line is active. If it is blinking GREEN, wireless communication is active.

## DIAG LED Activity

Unplug the power for three seconds. Plug the power back in to monitor the DIAG LEDs during start-up.

If any symptoms match section the table below, contact to your local agency described on the “Contact Information” section on the bottom pages of this manual.

## DIAG LED Activity Table



DIAG LED Display	Status	Description
Red flash, 1 time	RAM Error	Failed to read/write internal memory
Red flash, 2 times	Flash ROM Error	Failed to read/write Flash memory
Red flash, 3 times	Wired LAN Error	Wired LAN Controller is failed
Red flash, 4 times	Wireless LAN Error	Wireless LAN Controller is failed
Red flash, 5 times	IP Address Configuration Error	Not communicating because the WAN port and the LAN port have a same network address. Change LAN IP address setting of the WHR-G54S.
Red flash, 9 times	Other Errors	
Continuous flash	Updating Firmware Saving Configuration	

## (2) LEDs Work But Client PC Cannot Connect to Network

If the LEDs indicate that the network is working properly (Power LED is on, Transmit/Receive LED blinks), check the TCP/IP settings of the network.

### Changing Client TCP/IP Settings in Windows

Consult the LAN Administrator for TCP/IP settings.

To add or change the TCP/IP Settings:

1. On the Windows task bar click Start.
2. Select Settings, then Control Panel.
3. Double-click on the Network icon to view the Network Properties.

4. From the list of installed components, verify the TCP/IP => wireless LAN adapter protocol is installed.
  - If the wireless adapter protocol is not yet installed, click the Add button and select the TCP/IP protocol from the list. Refer to Windows Help for more information.
  - If the wireless adapter protocol is installed, select the protocol and click the Properties button. Verify the parameters match the settings provided by your LAN Administrator. Make changes if necessary, and click OK.
5. When or if prompted, restart your computer.

### **(3) Other Problems**

Please refer to our Technical Support (refer to **Pages 92-94**) for further reference materials.

### ***Troubleshooting WDS (Step-by-Step Instructions)***

The most common issue with WDS installations is using the wrong MAC address. The proper MAC Address for the access points is the 'Wireless MAC Address'. The best place to document this is under the 'System Information' section of the configuration web page. For proper setup, please continue reading this document.

#### **Problem:**

Communication problems with WDS (wireless bridging/repeating).

#### **Cause:**

WDS is a very complex bridging system, and it is not part of the 802.11b or 802.11g standard.

#### **Restrictions:**

Please verify that the following conditions are met (if just one condition is not satisfied, then WDS cannot be used on the wireless network):

1. All wireless access points in the wireless bridge need to be from the same vendor (e.g. all Buffalo access points).

(At time of publication, the Apple Airport Extreme WILL work in WDS with Buffalo G54 access points.)

2. No single access point can communicate with more than six other access points in the wireless bridge. Good Practices: proper location.

The following is a list of good practices with WDS:

1. Start the wireless bridge system with only two access points and then add more access points.
2. Setup all access points in the wireless bridge in close proximity before they are deployed to their proper location.
3. Only one access point in the wireless bridge should be serving DHCP and routing services unless a routed wired network exists.

### **Proper Setup:**

Please follow the following steps to properly setup WDS.

1. It is recommended that all access points in the bridge are reset to their factory default settings. This is done by holding the INIT button on the rear of the access point down for 5-10 seconds.
2. Login to the first access point in the wireless bridge (this should be the DHCP server enabled access point if there is not already a routed wired network).
3. Click on the 'Advanced' button.
4. The wireless settings page will appear. Select the proper settings for the wireless network. Record all settings on a piece of paper. All settings except for the SSID need to be identical amongst all access points in the bridge.

(If roaming is desired, then make sure the SSID settings need to be identical as well). Press the 'Set' button if any changes are made.

(If the IP address was changed, then reconnecting to the access point for configuration will require accessing it via its new IP address in a web browser (e.g. [http://NEW\\_IP\\_ADDRESS](http://NEW_IP_ADDRESS)).

5. Click on the 'LAN port' link on the left.
6. Check that the 'LAN side IP address' values are correct for your network, or leave them as default. Record the 'LAN side IP address'. Press the 'Set' button if any settings on this page have been set.
7. Click on the 'Management' link on the left.
8. The System Information page will appear. In the Wireless section of the table record the MAC address (including the ':s'). Please make sure the MAC address is recorded from the Wireless section and not the other sections.
9. Logout of the access point by clicking on the 'Logout' link on the left. Close the browser window.
10. Login to the second access point in the wireless bridge.
11. Click on the 'Advanced' button.
12. The wireless settings page will appear. Select the proper settings for the wireless network. Refer to the settings recorded from the first access point. All settings except for the SSID need to be identical amongst all access points in the bridge.  
(If roaming is desired, then make sure the SSID settings need to be identical as well).
13. Click on the 'LAN port' link on the left.
14. Make sure that the 'LAN side IP address' 'IP address' setting is different then the first access point. The IP addresses cannot be the same, but they should be on the same network. It is recommended that the IP address of the second access point is one higher then that of the first access point. Thus, if access point one's address is 1.1.1.1, then access point two's address should be 1.1.1.2. If there is a 'DHCP server function' setting on this page, then make sure to set it to 'Do not use' or to 'Disabled'. Press the 'Set' button when finished.

15. Click on the 'Wireless bridge (WDS)' link on the left.
16. Enable the WDS function and press the 'Set' button.
17. Enter the Wireless MAC Address of the first access point (which was recorded on Step 8) into the field that say 'MAC Address of AirStation(Wireless)' (include the ':s'). Press the 'Add' button.
18. The Wireless MAC address inputted on the step above will appear in the 'Connected AirStation' table. Please check that the checkbox under enable is checked, and then press the 'Enable marked item' button.
19. At the top of the page, press the 'Apply' button.
20. Once the router has rebooted, click on the 'Management' tab on the left.
21. The System Information page will appear. In the Wireless section of the table record the MAC address (including the ':s'). Please make sure the MAC address is recorded from the Wireless section and not the other sections.
22. Logout of the access point by clicking on the 'Logout' link on the left. Close the browser window.
23. Login to access point one again.
24. Click on the 'Advanced' button.
25. Click on the 'Wireless bridge (WDS)' link on the left.
26. Enable the WDS function and press the 'Set' button.
27. Enter the Wireless MAC Address of the first access point (which was recorded on Step 21) into the field that say 'MAC Address of AirStation(Wireless)' (include the ':s'). Press the 'Add' button.

29. At the top of the page, press the 'Apply' button.
30. Once the router has rebooted, click on the 'Management' tab on the left.
31. Click on the 'PING test' link on the left.
32. In the 'Destination' field enter the IP address of the second access point and press the 'OK' button.
  - a. If the 'Result' section of the table reports information like, "1st: 64 bytes from IP\_ADDRESS" then the WDS bridge is effectively working.
  - b. If the 'Result' section of the table reports "Destination Host Unreachable", then an error has occurred during the setup.

WDS is a complicated bridging system with a lot of variables. If there are still problems with WDS configuration on the network, then please contact your local agency described in Quick Setup Guide.

**10BaseT or 100BaseTx:** 802.3 based Ethernet network that uses UTP (Unshielded twisted pair) cable and a star topology. 10 is 10 Mbps and 100 is 100 Mbps.

**802.1x:** The standard for wireless LAN authentication used between an AP and a client. 802.1x with EAP will initiate key handling.

**Ad-Hoc Network:** The wireless network based on a peer-to-peer communications session. Also referred to as AdHoc.

**Bandwidth:** The transmission capacity of a computer or a communication channel, stated in Megabits per second (Mbps).

**BSS (Basic Service Set):** An 802.11 networking framework that includes an Access Point.

**Bus Mastering:** A system in which the specified Input/Output device (e.g. NIC Card) can perform tasks without the intervention of the CPU.

**Client:** A PC or workstation on a network.

**Cross-Over Wiring:** A UTP cable that has its transmit and receive pair crossed to allow communications between two devices.

**DCE (Data Communications Equipment):** Hardware used for communication with a Data Terminal Equipment (DTE) device.

**Default Gateway:** The IP Address of either the nearest router or server for the LAN.

**Default Parameter:** Parameter set by the manufacturer.

**Destination Address:** The address portion of a packet that identifies the intended recipient station.

**DHCP (Dynamic Host Configuration Protocol):** Based on BOOTP, it uses a pool of IP addresses, which it assigns to each device connected to it, and retrieves the address when the device becomes dormant for a period of time.

**DNS (Domain Name System):** System used to map readable machine names into IP addresses



**Driver:** Software that interfaces a computer with a specific hardware device.

**DSSS (Direct Sequence Spread Spectrum):** Method of spreading a wireless signal into wide frequency bandwidth.

**DTE (Data Terminal Equipment): Device that con10BaseT or 100BaseTx:** 802.3 based Ethernet network that uses UTP (Unshielded twisted pair) cable and a star topology. 10 is 10 Mbps and 100 is 100 Mbps.

**Dynamic IP Address:** An IP address that is automatically assigned to a client station in a TCP/IP network, typically by a DHCP server.

**ESS (Extended Service Set):** A set of two or more BSSs that form a single sub-network. SSID is user identification used in the ESS LAN configuration.

**Ethernet:** The most widely used architecture for Local Area Networks (LANs). It is a shared-media network architecture. The IEEE 802.3 standard details its functionality.

**Ethernet cable:** A wire similar to telephone cable that carries signals between Ethernet devices.

**File and Print Sharing:** A Microsoft application that allows computers on a network to share files and printers.

**Firmware:** Programming inserted into programmable read-only memory, thus becoming a permanent part of a computing device.

**Frame:** A fixed block of data, transmitted as a single entity. Also referred to as packet.

**Full-Duplex:** To transmit on the same channel in both directions simultaneously.

**Half-duplex:** To transmit on the same channel in both directions, one direction at a time.

**Hub:** A device which allows connection of computers and other devices to form a LAN.

**IEEE (Institute of Electrical and Electronics Engineers):** The professional organization which promotes development of electronics technology.

**IP (Internet Protocol) Address:** A unique 32-binary-digit number that identifies each sender or receiver of information sent in packets.

**Infrastructure:** A wireless network or other small network in which the wireless network devices are made a part of the network through the Access Point.

**ISP (Internet Service Provider):** A company that provides access to the Internet and other related services.

**IV (Initialization Vector):** The header section of an encrypted message packet.

**LAN (Local Area Network):** A group of computers and peripheral devices connected to share resources.

**LED (Light Emitting Diode):** The lights on a hardware device representing the activity through the ports.

**MAC (Medium Access Control) Address:** A unique number that distinguishes network cards.

**Mbps (Mega Bits Per Second):** A measurement of millions of bits per second.

**MDI/X (Media Dependent Interface/Crossover):** Port on a network hub or switch that crosses the incoming transmit lines with the outgoing receive lines.

**MHz (MegaHertz):** One million cycles per second.

**NAT (Network Address Translation):** An internet standard that enables a LAN to use one set of IP addresses for internal traffic and a second set for external traffic.

**NIC (Network Interface Card):** An expansion card connected to a computer so the computer can be connected to a network.

**Packet:** A block of data that is transferred as a single unit, also called a frame or a block.

**Packet Filtering:** Discarding unwanted network traffic based on its originating address or its type.

**PCI (Peripheral Component Interconnect):** A bus that is connected directly to the CPU.

**PCMCIA (Personal Computer Memory Card International Association) Card:** Removable module that adds features to a portable computer.

**Ping (Packet Internet Groper):** An Internet utility used to determine whether a particular IP address is online.

**Plug and Play:** Hardware that, once installed (“plugged in”), can immediately be used (“played”), as opposed to hardware that requires manual configuration.

**PoE (Power over Ethernet):** A mechanism to send DC power to a device using a CAT5 Ethernet cable.

**PPPoE (Point-to-Point Protocol over Ethernet):** A specification for connecting users on an Ethernet line to the Internet through a common broadband medium.

**Protocol:** A standard way of exchanging infor-

mation between computers.

**RADIUS (Remote Authentication Dial In User Service):** A server that issues authentication key to clients.

**RAM (Random Access Memory):** Non-permanent memory.

**Repeater Hub:** A device that collects, strengthens and transmits information to all connected devices, allowing the network to be extended to accommodate additional workstations.

**RC4:** The encryption algorithm that is used in WEP.

**RJ-45 connector:** An 8-pin connector used between a twisted pair cable and a data transmission device.

**ROM (Read Only Memory):** Permanent memory.

**Router:** Device that can connect individual LANs and remote sites to a server.

**Roaming:** The ability to use a wireless device while moving from one access point to another without losing the connection.

**Script:** A macro or batch file containing instructions and used by a computer to perform a task.

**Server:** Any computer that makes files or peripheral devices available to users of the network and has a resident Network OS.

**SMTP (Simple Mail Transfer Protocol):** The protocol used to define and deliver electronic mail (E-mail) from one location to another.

**SNMP (Simple Network Management Protocol):** An application layer protocol that outlines the formal structure for communication among network devices.

**Static IP Address:** A permanent IP address is assigned to a node in a TCP/IP network. Also known as global IP.

**STP (Shielded Twisted Pair):** Twisted Pair cable wrapped in a metal sheath to provide extra protection from external interfering signals.

**Subnet Mask:** An eight-byte address divided into 4 parts separated by periods.

**TCP/IP (Transmission Control Protocol/Internet Protocol):** Protocol used by computers when communicating across the Internet or Intranet.

**TKIP (Temporal Key Integrity Protocol):** An encryption method replacing WEP. TKIP uses random IV and frequent key exchanges.

**Topology:** The shape of a LAN (Local Area Network) or other communications system.

**Twisted Pair:** Cable that comprises 2 or more pair of insulated wires twisted together.

**UDP (User Datagram Protocol):** A communication method (protocol) that offers a limited amount of service when messages are exchanged between computers in a network. UDP is used as an alternative to TCP/IP.

**Uplink:** Link to the next level up in a communication hierarchy.

**UTP (Unshielded Twisted Pair) cable:** Two or more unshielded wires twisted together to form a cable.

**WAN (Wide Area Network):** A networking system covering a wide geographical area.

**WEP (Wired Equivalent Privacy):** An encryption method based on 64 or 128-bit algorithm.

**Web Browser:** A software program that allows viewing of web pages.

**Wi-Fi (Wireless Fidelity):** An organization that tests and assures interoperability among WLAN devices.

**Wire Speed:** The maximum speed at which a given packet can be transferred using Ethernet and Fast Ethernet standard specifications.

**WLAN (Wireless LAN):** A LAN topology using wireless devices.

**VPN (Virtual Private Network):** A security method to connect remote LAN users to a corporate LAN system.

### **Federal Communication Commission Interference Statement**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: To assure continued compliance, (example - use only shielded interface cables when connecting to computer or peripheral devices). Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

### IMPORTANT NOTE:

#### **Federal Communication Commission Interference Statement**

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### **FCC RF Radiation Exposure Statement:**

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

BUFFALO declared that WHR-G54S is limited in CH1~11 by specified firmware controlled in USA.

### **Safety**

This equipment is designed with the utmost care for the safety of those who install and use it. However, special attention must be paid to the dangers of electric shock and static electricity when working with electrical equipment. All guidelines of this manual and of the computer manufacturer must therefore be allowed at all times to ensure the safe use of the equipment.



CE 0560 ⓘ

### **Important Notice:**

This device is a 2.4 GHz wireless LAN transceiver, intended for indoor home and office use in all EU and EFTA member states.

### **Intended use**

This device is a 2.4 GHz wireless LAN transceiver, intended for indoor home and office use in all EU and EFTA member states.

### **EU Countries intended for use**

This device is intended for indoor Home and office use in the following countries,

Austria, Belgium, Germany, Denmark, Spain, Greece, France, Finland, Italy, Ireland, Luxembourg, The Netherlands, Portugal, Sweden, United Kingdom, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovak Republic and Slovenia.

The device is also authorised for use in all EFTA member states Iceland, Liechtenstein, Norway and Switzerland.

### **EU countries not intended for use**

None

### **Potential restrictive use**

This device is a 2.4 GHz wireless LAN transceiver, intended for indoor home and office use in all EU and EFTA member states, except in France, Belgium and Italy where restrictive use applies. In Italy the end-user should apply for a license at the national spectrum authorities in order to obtain an authorization to use the device for setting up outdoor radio links.

In Belgium there is a restriction in outdoor use. The frequency range in which outdoor operation in Belgium is permitted is 2460 – 2483.5 MHz.

This device may not be used for setting up outdoor radio links in France. For more information see <http://www.anfr.fr/> and/or <http://www.art-telecom.fr>

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#### TECHNICAL SUPPORT

European Technical Support is available between the hours of 9am-6pm (GMT) Monday to Thursday and 9am-4:30pm (GMT) Friday for this product. Customers in Europe can obtain Technical Support using the following information:

- ▶ E-mail [helpdesk@buffalo-technology.ie](mailto:helpdesk@buffalo-technology.ie)
- ▶ Web [www.buffalo-technology.com](http://www.buffalo-technology.com)

The constantly evolving state of wireless products and operating systems requires Buffalo Technology to occasionally release updated software to take advantage of new technologies and to comply with industry standards. For the most recent software, firmware, driver, and technical whitepaper releases available, please visit the Buffalo Technology website.

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