Prevent Messages Destined for a Specific Multicast Group from Being Forwarded to the Wireless LAN

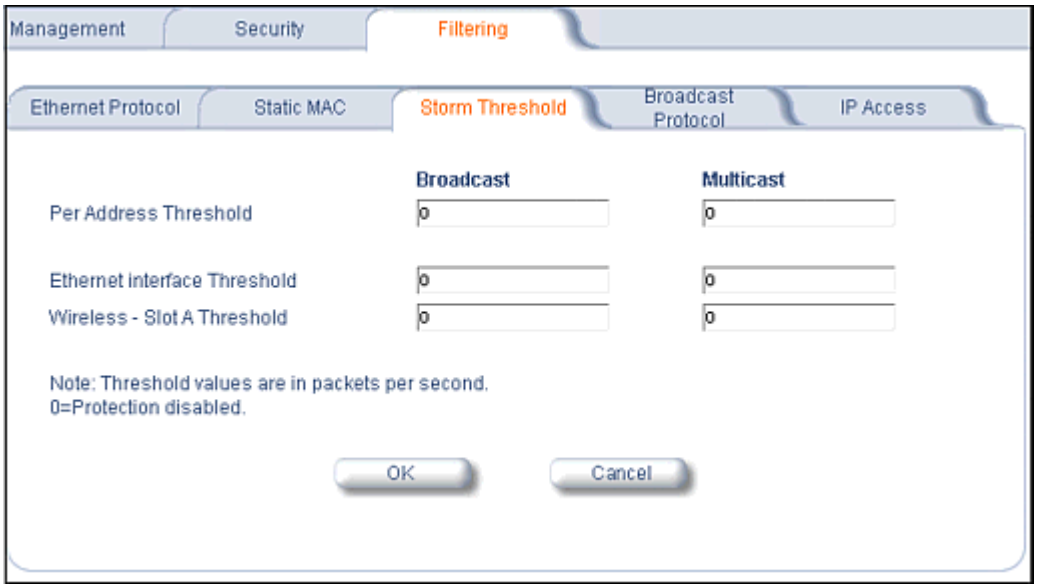
If there are devices on your Ethernet network that use multicast packets to communicate and these packets are not required by your wireless clients, you can set up a Static MAC filter to preserve wireless bandwidth. For example, if routers on your network use a specific multicast address (such as 01:00:5E:00:32:4B) to exchange information, you can set up a filter to prevent these multicast packets from being forwarded to the wireless network:

- **Wired MAC Address:** 01:00:5E:00:32:4B
- **Wired Mask:** FF:FF:FF:FF:FF:FF
- **Wireless MAC Address:** 00:00:00:00:00:00
- **Wireless Mask:** 00:00:00:00:00:00

Result: The unit does not forward any packets that have a destination address of 01:00:5E:00:32:4B to the wireless network.

Configure Storm Threshold Filtering

Click the **Configure** button, the **Filtering** tab, and the **Storm Threshold** sub-tab to use threshold limits to prevent broadcast/multicast overload.



Storm Threshold is an advanced **Bridge** setup option that you can use to protect the network against data overload by specifying:

- A maximum number of frames per second as received from a single network device (identified by its MAC address).
- An absolute maximum number of messages per port.

The **Storm Threshold** parameters let you specify a set of thresholds for each port of the unit, identifying separate values for the number of broadcast messages per second and multicast messages per second.

When the number of frames for a port or identified station exceeds the maximum value per second, the unit ignores all subsequent messages issued by the particular network device, or ignores all messages of that type.

Field Descriptions

Per Address Threshold

Enter the maximum allowed number of packets per second.

Ethernet Threshold

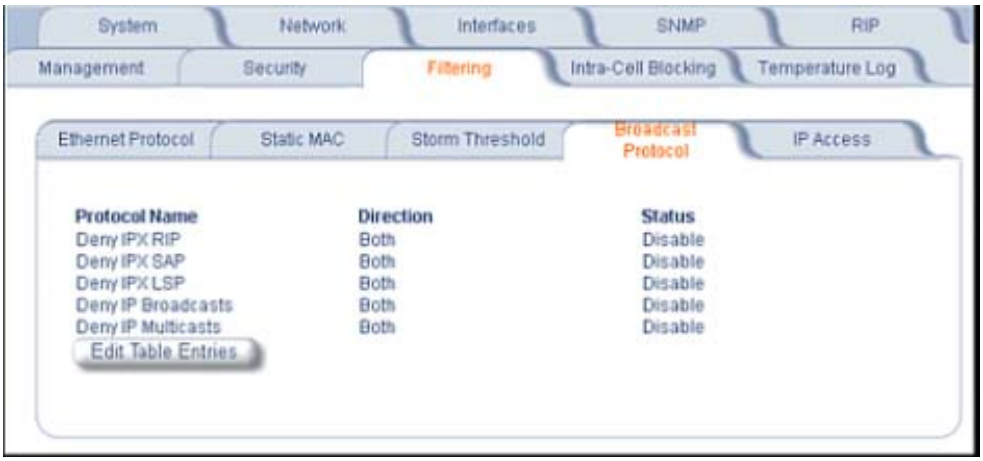
Enter the maximum allowed number of packets per second.

Wireless Threshold

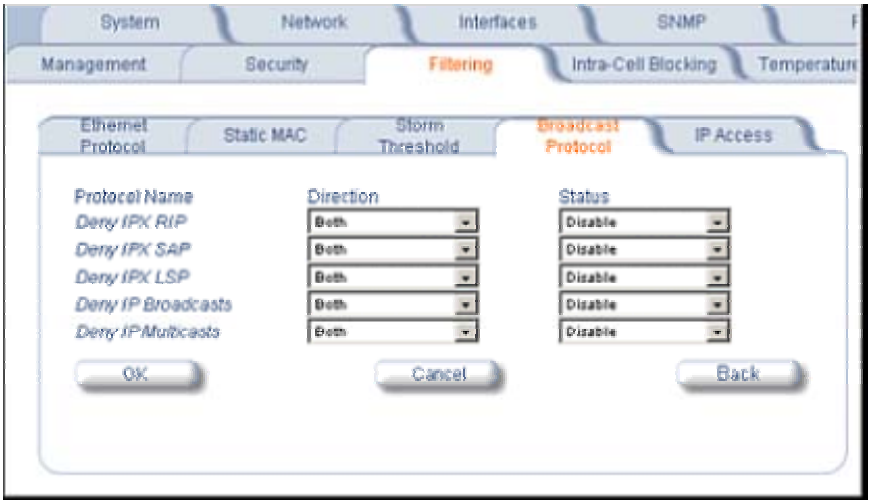
Enter the maximum allowed number of packets per second.

Configure Broadcast Protocol Filtering

Click the **Configure** button, the **Filtering** tab, and the **Broadcast Protocol** sub-tab to deny specific IP broadcast, IPX broadcast, and multicast traffic.

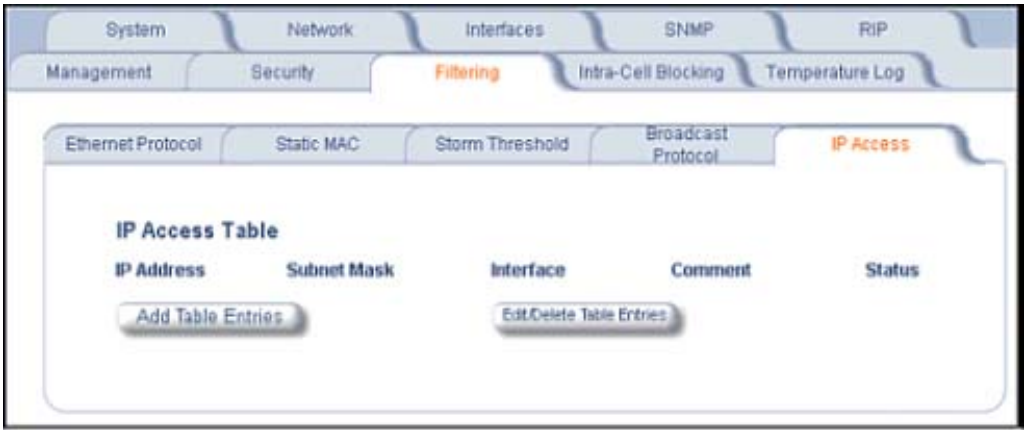


Click the **Edit Table Entries** button to display an editable window such as the following. You can configure whether this traffic must be blocked for Ethernet to wireless, wireless to Ethernet, or both.

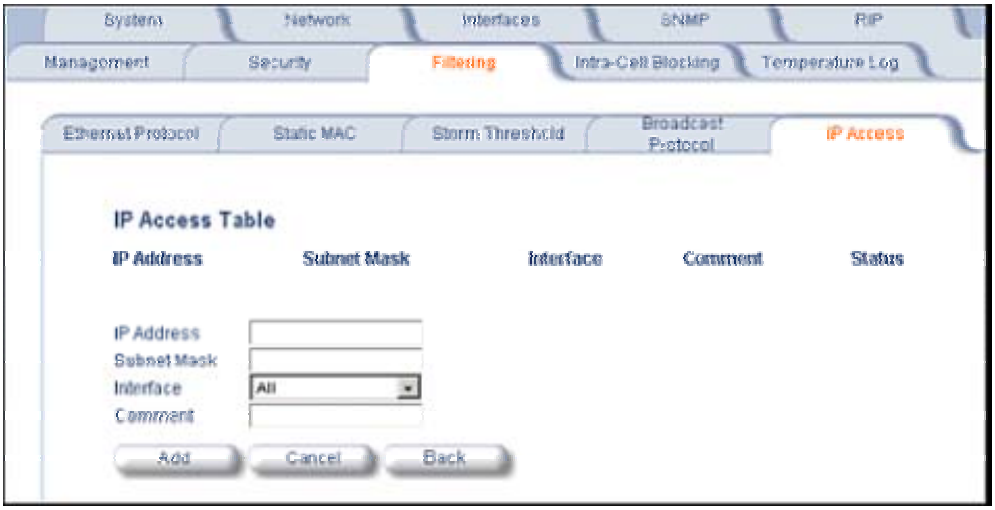


Configure IP Access Table Filtering

The IP Access Table limits in-band management access to the IP addresses or range of IP addresses specified in the table. This feature applies to all management services (SNMP, HTTP, and CLI) except for CLI management t over the serial port.



To add an entry, click the **Add Table Entries** button, specify the IP address and mask of the wireless stations to which you want to grant access, and click **Add**. To edit or delete table entries, click the **Edit/Delete Table Entries** button, make your changes, and click **OK**.



For example, **172.17.23.0/255.255.255.0** allows access from all wireless stations with an IP address in the 172.17.23.xxx range.

Ensure that the IP address of the management PC you use is within the first entry in the table, as this filter takes effect immediately. Otherwise, you have locked yourself out.

When you do lock yourself out, you may try to give the PC the correct IP address; otherwise you must reset the unit.

9) Configure Intra-Cell Blocking (Base Station only)

The Intra-Cell Blocking feature lets traffic be blocked between two SUs registered to the same Base Station. There are two potential reasons to isolate traffic among wireless subscribers:

- To provide better security to the subscribers by isolating the traffic from one subscriber to another in a public space.
- To block unwanted traffic between subscribers to prevent this traffic from using bandwidth.

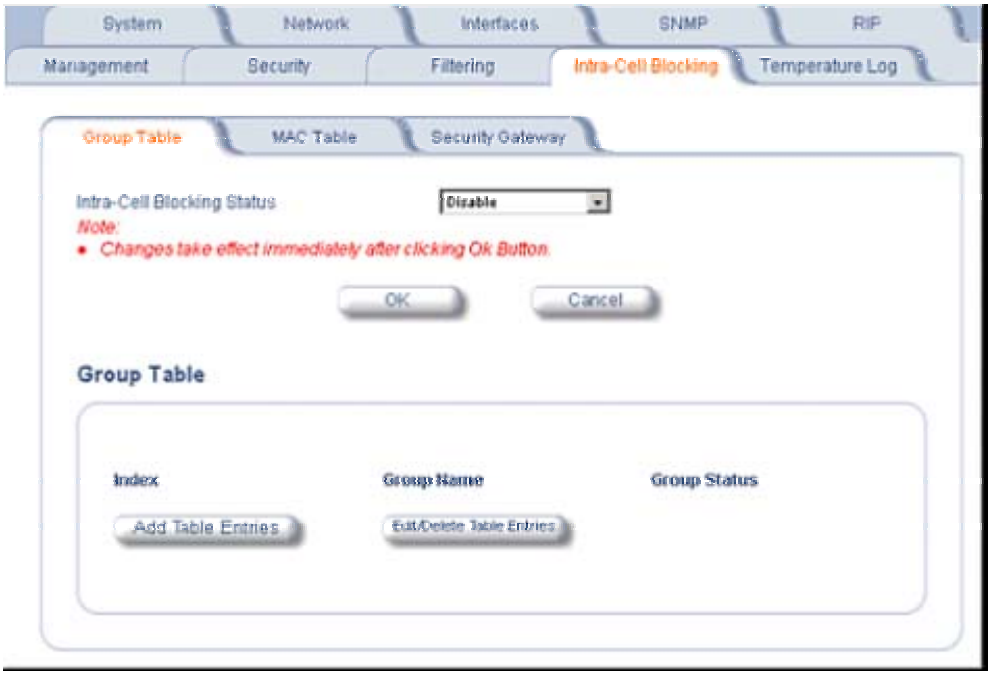
You can form groups of SUs at the Base Station, which define the filtering criteria. All data to or from SUs belonging to the same group are bridged. All other data from SUs that do not belong to a particular group are automatically forwarded through the Ethernet interface of the Base Station. If an SU does not belong to any group, the Base Station discards the data.

You can also configure a *Security Gateway* to block traffic between SUs connected to different BSUs. All packets destined for SUs not connected to the same Base Station are forwarded to the Security Gateway MAC address (configured in the *Security Gateway* tab).

When you change the device from **Bridge** to **Routing** mode, Intra-Cell Blocking stops working with or without a reboot. When you change the device from **Routing** to **Bridge** mode, Intra-Cell Blocking starts working with or without a reboot.

Enable Intra-Cell Blocking

The Group Table tab lets you enable the Intra-Cell Blocking feature and to configure Intra-Cell Blocking Groups.



Field Descriptions

Intra-Cell Blocking Status

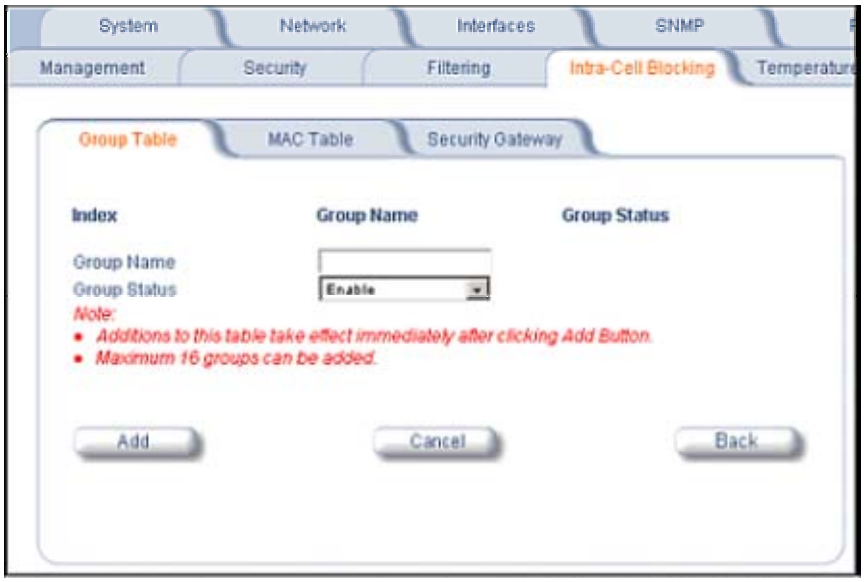
Enables or disables the Intra-Cell Blocking feature.

Group Table

Entries in this table show the Intra-Cell Blocking filter groups that have been configured. When Intra-Cell Blocking is enabled, the Base Station Unit discards all packets coming from one SU to another SU, if both SUs do not belong to the same filter group.

Configure Intra-Cell Blocking Groups

Click the **Add Table Entries** button to add groups to the Group Table.

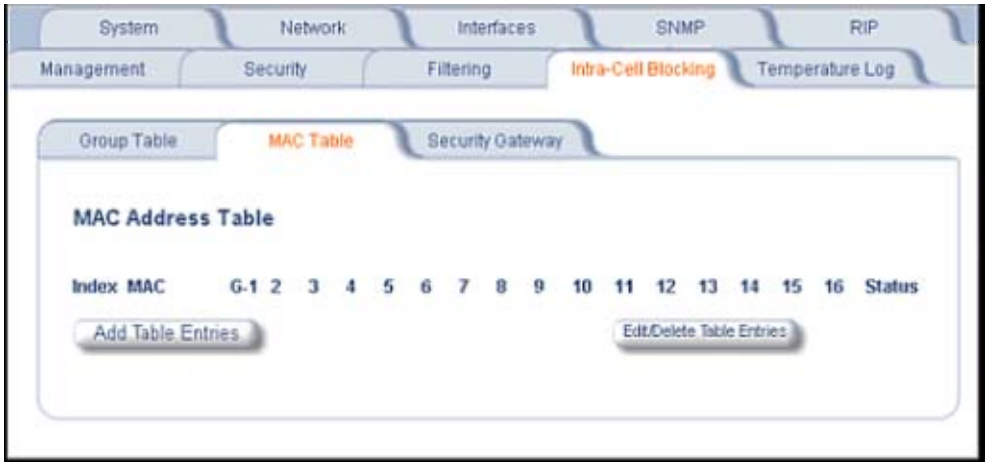


Enter the group name, and click **Add**. The group is assigned an Index and appears in the Group Table. Up to 16 groups can be configured per Base Station.

You can enable, disable or delete an existing filter group by using the **Edit/Delete Table Entries** button.

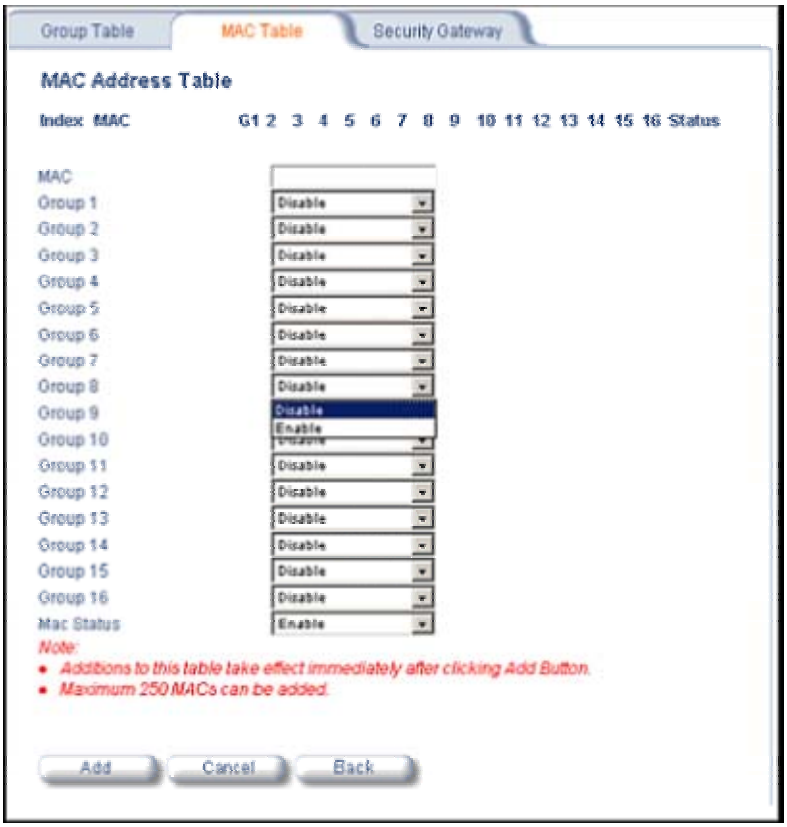
Assign MAC Addresses

After configuring the Intra-Cell Blocking Groups on the **Group Table** tab, use the **MAC Table** tab to assign specific MAC addresses to an Intra-Cell Blocking Group.



Adding Entries

Click the **Add Table Entries** button.

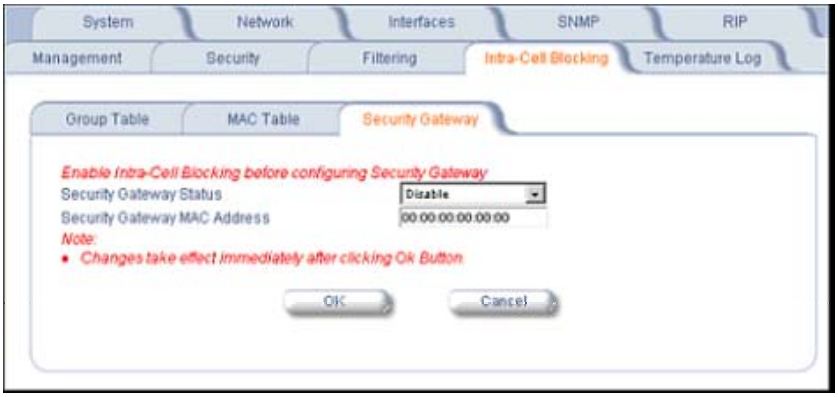


Enter the MAC address of the SU. Select **Enable** from the drop-down menu for the Group Index.

Click **Add**. The MAC address is assigned to the groups. Additions to the MAC Table take effect immediately after clicking the **Add** button. You can **enable**, **disable**, **delete**, or **reassign** the groups for a MAC address by using the **Edit/Delete Table Entries** button. A maximum of 250 MAC addresses can be added among all filter groups.

Block Traffic Between SUs

You can configure a Security Gateway to block traffic between SUs connected to different Base Stations. Verify that Intra-Cell Blocking has been enabled on the **Group Table** tab before configuring the Security Gateway.



Security Gateway Status

Enables or disables packet forwarding to the external Security Gateway.

Security Gateway MAC Address

Lets you configure the MAC address of the external Security Gateway.

Intra-Cell Blocking Group Rules

The following rules apply to Intra-Cell Blocking Groups:

- One SU can be assigned to more than one group.
- An SU that has not been assigned to any group cannot communicate to any other SU connected to the same or different Base Station Unit.

Example of Intra-Cell Blocking Groups

Four Intra-Cell Blocking Groups have been configured on one Base Station Unit. SUs 1 through 6 are registered to Base Station Unit 1. SUs 7 through 9 are registered to Base Station Unit 2.

Intra-Cell Blocking Group Example			
Group 1	**Group 2**	**Group 3**	**Group 4**
SU 1	SU 2	SU 6	SU 8
SU 4	SU 3	SU 1	SU 9
SU 5	SU 8	SU 3	SU 2

In this example, SU 1 belongs to two groups, Group 1 and Group 3. Therefore, packets from SU 1 destined to SU 4, SU 5, SU 6, and SU 3 are not blocked. However, SU 9 belongs to group 4 only and packets from SU 9 are blocked unless sent to SU 8 or SU 2.

Achieving Communication Between Two SUs

In a multipoint configuration, an SU can communicate with another SU through the BSU when in Bridge mode by default. Use the intra-cell blocking feature if this is not desired. In a routing configuration, each of the SUs must have a different subnet on their Ethernet port to distinguish traffic for each SU, and each subnet must be entered into a routing rule in the BSU as well as into an upstream router. The wireless side of all SUs must share the same subnet with the BSU wireless interface. These IP addresses must be used as next hop when creating the routes for the SU subnets.

10) Configure VLAN Parameters

Virtual LAN (VLAN) implementation in the Tsunami MP.11 products:

- Lets the BSU and SU be used in a VLAN-aware network.
- Processes IEEE 802.1Q VLAN-tagged packets.

Network resources behind the BSU and SU can be assigned to logical groups.

VLAN Modes

Transparent Mode

Transparent mode applies to both the SU and the BSU. This mode is equivalent to NO VLAN support and is the default mode. It is used when the devices behind the SU and BSU are both VLAN aware or unaware. The SU/BSU transfers both tagged and untagged frames received on Ethernet or WORP interface. Both tagged and untagged management frames can access the device.

Trunk Mode

Trunk mode VLAN applies to both the SU and the BSU. It is used when all devices behind the SU and BSU are VLAN aware. The SU and BSU transfer only tagged frames received on Ethernet or WORP interface.

Access Mode

Access mode applies only to the SU. It is used when the devices behind the SU are VLAN unaware. Frames to and from the Ethernet interface behind the SU map into only one VLAN segment.

Frames received on the Ethernet interface are tagged with the configured Access VLAN ID before forwarding them to the WORP interface. Only management frames so tagged can access the device from the WORP interface; however, untagged management frames can access the device from Ethernet Interface.

VLAN Forwarding

The VLAN Trunk mode provides a means to configure a list of VLAN IDs in a Trunk VLAN Table. The SU and BSU only forward frames (between Ethernet and WORP interface) tagged with the VLAN IDs configured in the Trunk VLAN Table. Up to 256 VLAN IDs can be configured for the BSU and up to 16 VLAN IDs can be configured for the SU (depending upon the capabilities of your switching equipment).

VLAN Relaying

The VLAN Trunk mode for BSU operation provides an option to enable and disable a VLAN relaying flag; when enabled, the BSU shall relay frames between SUs on the same BSU having the same VLAN ID.

Management VLAN

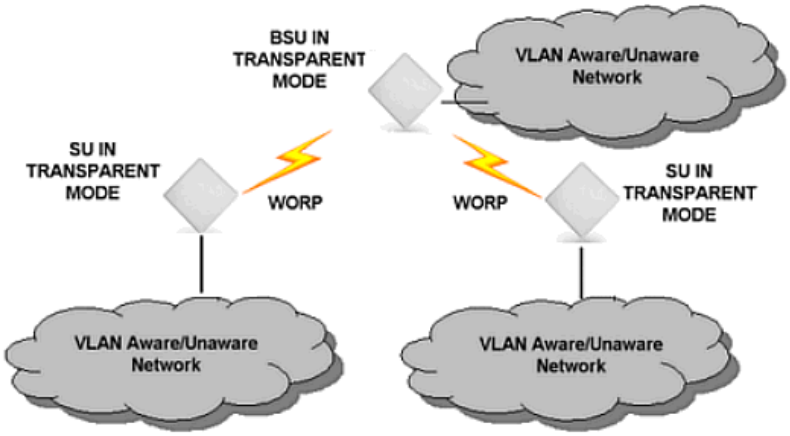
The BSU and SU allow the configuration of a separate VLAN ID and priority for SNMP, ICMP, Telnet, and TFTP management frames for device access.

The management VLAN ID and management VLAN priority apply in both **Trunk** and **Access** mode. The management stations tag the management frames they send to the BSU or SU with the management VLAN ID configured in the device. The BSU and SU tag all the management frames from the device with the configured management VLAN and priority.

- BSUs and SUs in **Trunk** mode let only management frames tagged with the configured management VLAN ID access the device from both WORP and Ethernet interfaces.
- SUs in **Access** mode let management frames tagged with the configured management VLAN ID access the device from WORP interface; untagged management frames can access the device from Ethernet Interface.

BSU in Transparent Mode

When the BSU is in Transparent mode, all associated SUs must be in Transparent mode.



How the BSU and SUs function in Transparent mode is described in the following table.

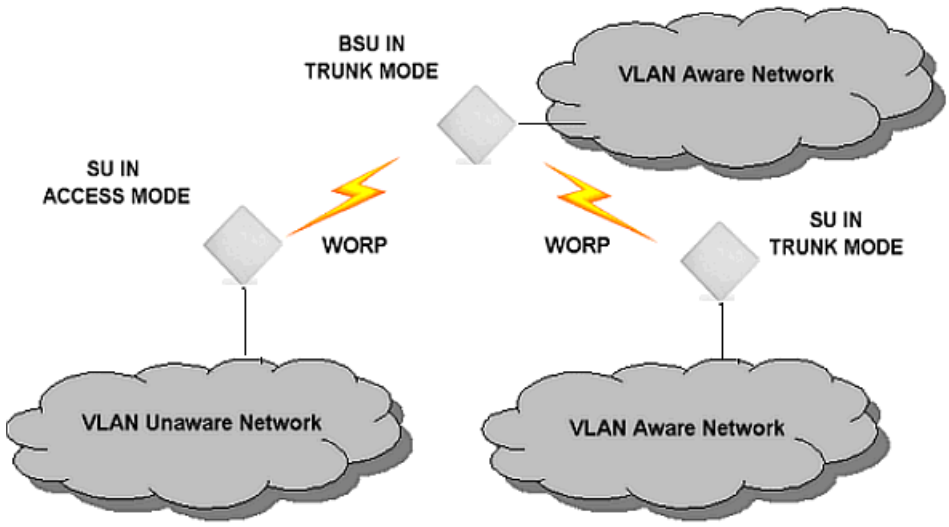
BSU Function – Transparent Mode	SU Function – Transparent Mode
• BSU forwards both tagged an untagged frames received on the WORP interface or on the Ethernet Interface. • BSU lets both tagged and untagged management frames access the device.	• SU forwards both tagged an untagged frames received on either the WORP interface or on the Ethernet Interface. • SU lets both tagged and untagged management frames access the device.

BSU in Trunk Mode

When the BSU is in **Trunk** mode, all associated SUs must be in either **Access** mode or **Trunk** mode. When an SU associates to a BSU that is in Trunk mode, it gets the VLAN mode from the BSU.

How the BSU and SUs function in Trunk mode is described in the following table.

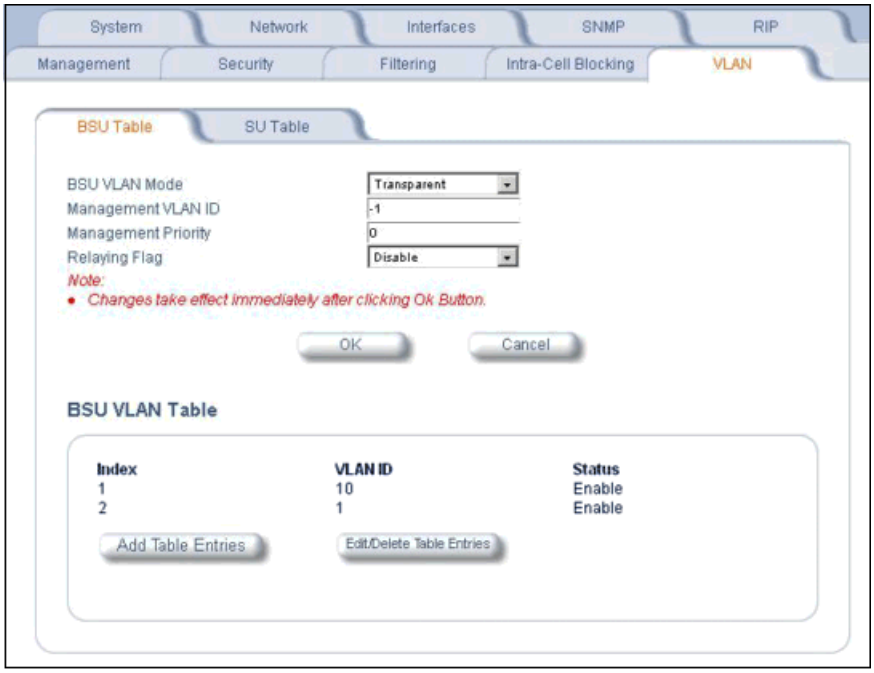
BSU Function **Trunk Mode**	**SU Function**	
	Trunk Mode	**Access Mode**
• Up to 256 VLAN IDs can be configured on a BSU • The BSU discards all untagged frames received from the Ethernet interface or from any of the associated SUs. • The BSU forwards only VLAN-tagged frames received from the Ethernet interface, or any of the associated SUs that are tagged with the configured VLAN IDs, and discards all other tagged frames. • The BSU allows only management frames tagged with the configured management VLAN ID to access it. • The BSU tags all management frames generated by the BSU with the configured management VLAN ID and priority.	• Up to 16 VLAN IDs can be configured on SUs. • SUs discard all untagged frames received from the Ethernet interface or from the BSU (unexpected). • SUs forward only VLAN-tagged frames received from the Ethernet interface or from the BSU that are tagged with the configured VLAN IDs; it discards all other tagged frames. • SUs allow only management frames tagged with the configured management VLAN ID to access them. • SUs tag all management frames generated by them with the configured management VLAN ID and priority.	• SUs discard all tagged frames received from the Ethernet interface (unexpected). • SUs allow untagged management frames to access the device from the Ethernet interface . • SUs tag all untagged frames received from the Ethernet interface with the configured Access VLAN ID and forwards them to the BSU. • SUs untag all tagged frames received from the BSU that are tagged with the configured Access VLAN ID and forwards them to the Ethernet interface, and discards all other tagged frames from the BSU. • SUs tag all management frames generated by the SU with the configured management VLAN ID and priority.



BSU in Trunk Mode

BSU VLAN Configuration

The HTTP Interface to configure SU VLAN parameters is shown in the following figure.



The BSU **Trunk VLAN Table** applies when the BSU is in **Trunk** mode. The VLAN ID values for the Trunk VLAN Table range from **1** to **4095**; the default value is **-1**. The maximum number of VLAN IDs that can be configured in the Trunk VLAN Table for the BSU is 256. An SU in Trunk mode is assigned VLAN IDs from this table.

The following VLAN parameters must be configured for the BSU:

VLAN Mode

The **BSU VLAN mode** can be either **Transparent** mode or **Trunk** mode. By default, the BSU is in **Transparent** mode.

Management VLAN ID

The **Management VLAN ID** applies when the BSU is in **Trunk** mode. The management VLAN ID has a

default value of **-1** in Transparent mode and must be configured with a value in the range of **1** to **4095** to change the BSU VLAN mode to **Trunk** mode.

Management VLAN Priority

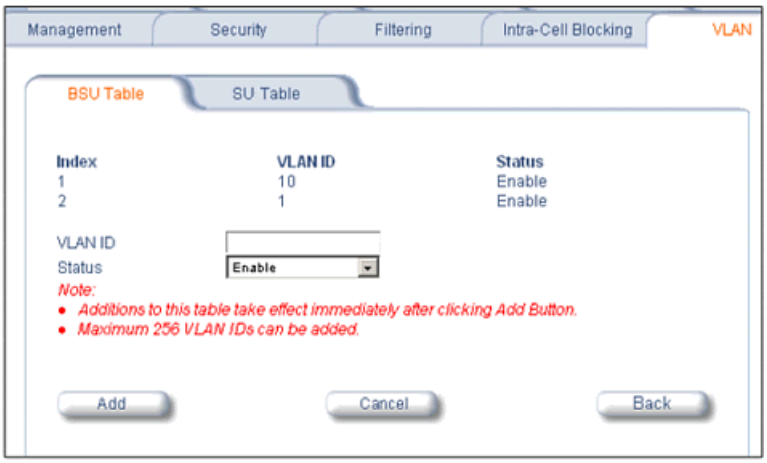
The **Management VLAN priority** values range from **0** to **7** and the default priority is **0** (zero).

Relaying Flag

When this flag is enabled, the BSU relays frames between SUs on the same BSU

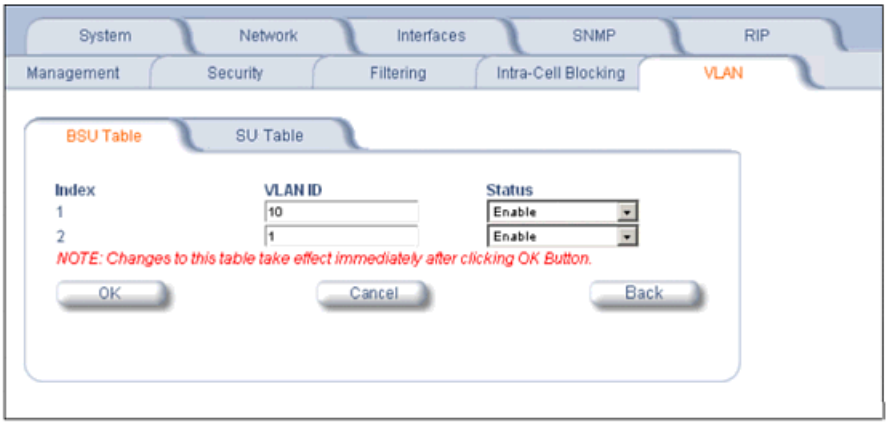
Add BSU Table Entries

To add entries to the BSU table, click the **Add Table Entries** button on the **BSU Table** tab. Enter a **VLAN ID** and select a **Status**, then click **Add** to add your entry to the table.



Edit or Delete BSU Table Entries

To edit or delete entries in the BSU Table, click the **Edit/Delete Table Entries** button on the **BSU Table** tab, make your changes, then click **OK** for your changes to take effect.



Restrict Unit Management

Management access to the unit can be secured easily by making management stations or hosts and the unit itself members of a common VLAN. Simply configure a non-zero management VLAN ID; management of the unit will be restricted to members of the same VLAN.

CAUTION	***If a non-zero management VLAN ID is configured, management access to the unit is restricted to hosts that are members of the same VLAN. Ensure your management platform or host is a member of the same VLAN before attempting to manage the unit.***

1. Click the **Configure** button and the **VLAN** tab.
2. Set the **Management ID** to a value between 1 and 4095.
3. Click **OK**.

Provide Access to a Host in the Same VLAN

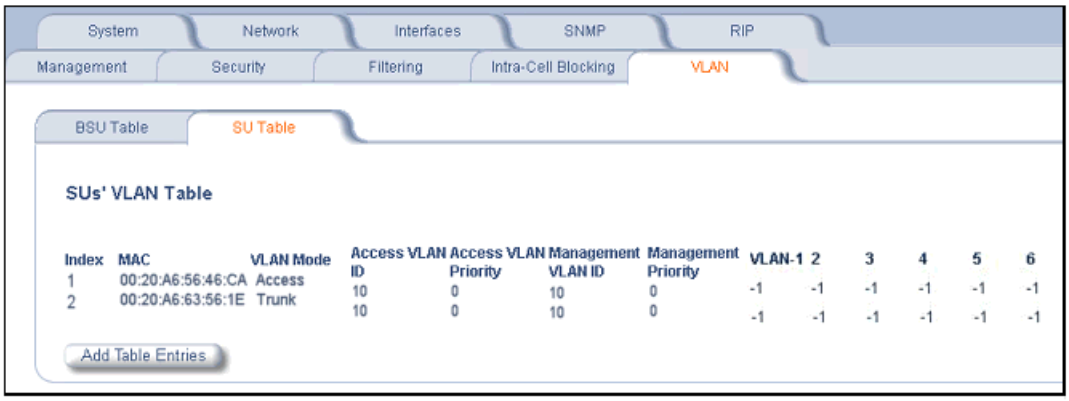
The VLAN feature lets hosts manage the unit. If the VLAN **Management ID** matches a VLAN **Access ID**, those hosts who are members of that VLAN will have management access to the unit.

CAUTION	***Once a VLAN Management ID is configured and is equivalent to one of the VLAN User IDs on the unit, all members of that VLAN will have management access to the unit. Be careful to restrict VLAN membership to those with legitimate access to the unit.***

1. Click the **Configure** button and the **VLAN** tab.
2. Set the VLAN **Management ID** to the same value as the wireless client VLAN User ID.
3. Click **OK**.

SU VLAN Configuration

The HTTP Interface to configure SU VLAN parameters is shown in the following figure.



The **Trunk VLAN table** applies when the SU is in **Trunk** mode. The VLAN ID values for the Trunk VLAN Table range from **1** to **4095**; the default value is **-1**. A maximum of 16 VLAN IDs can be configured in the Trunk VLAN Table for each SU. The VLAN IDs must be in the Trunk VLAN Table that corresponds to the BSU.

The following VLAN parameters must be configured for each SU associated to the BSU.

VLAN Mode

The **SU VLAN mode** can be either **Transparent** mode, **Trunk** mode, or **Access** mode. By default, the BSU is in **Transparent** mode.

- When the BSU is in **Transparent** mode, the SU must be in **Transparent** mode.
- When the BSU is in **Trunk** mode the SU must be in either **Access** mode or **Trunk** mode.

- When the BSU is changed to **Trunk** mode from **Transparent** mode, all the configured SUs are changed to **Trunk** mode by default.

Access VLAN ID

The **Access VLAN ID** applies when the SU is in **Access** mode.

The Access VLAN ID values range from **1** to **4095**; the default value is **1**.

Access VLAN Priority

The **Access VLAN Priority** applies when the SU is in **Access** Mode. The Access VLAN priority values range from **0** to **7**; the default priority is **0**. For voice frames, the priority field is set to the VoIP configured value (**5** according to latest IETF draft, or **6** according to IEEE 802.1D) regardless of the priority value configured.

Management VLAN ID

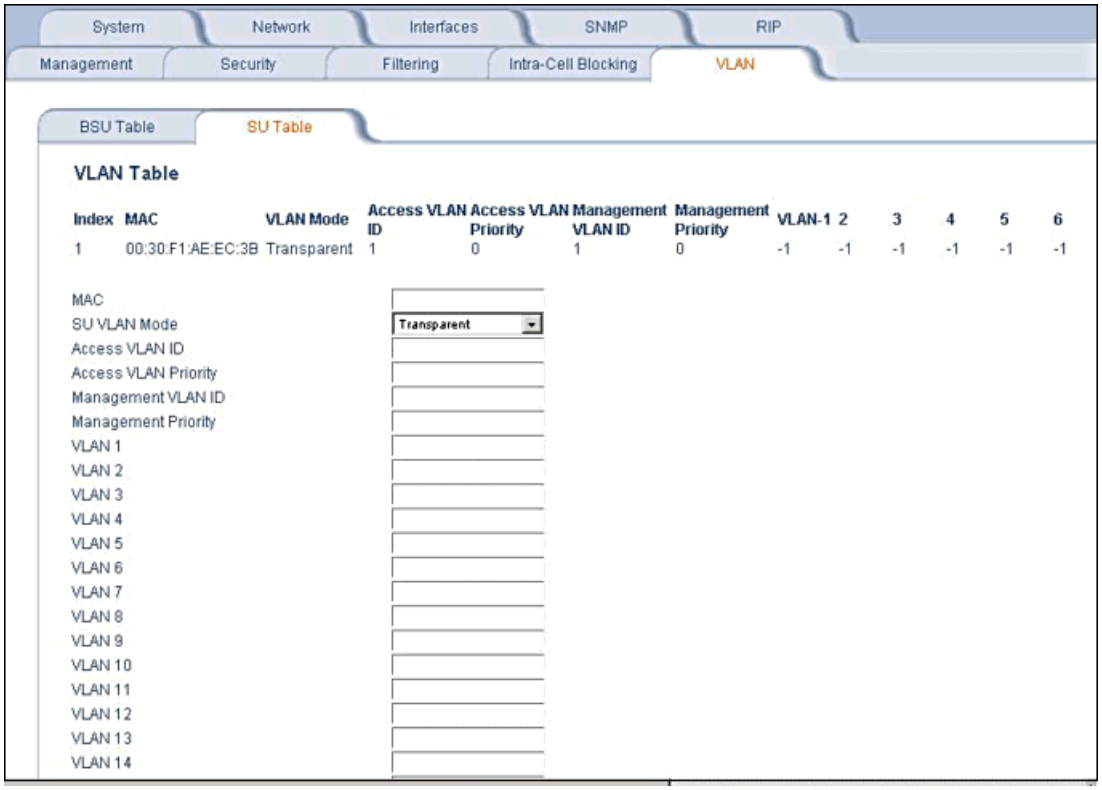
The **management VLAN ID** applies when the SU is in **Trunk** mode or **Access** mode. The management VLAN **ID values** range from **1** to **4095**; the default value is **1**.

Management VLAN Priority

The Management VLAN Priority applies when the SU is in **Trunk** mode or **Access** mode. The management VLAN **priority** values range from **0** to **7**; the default priority is 0.

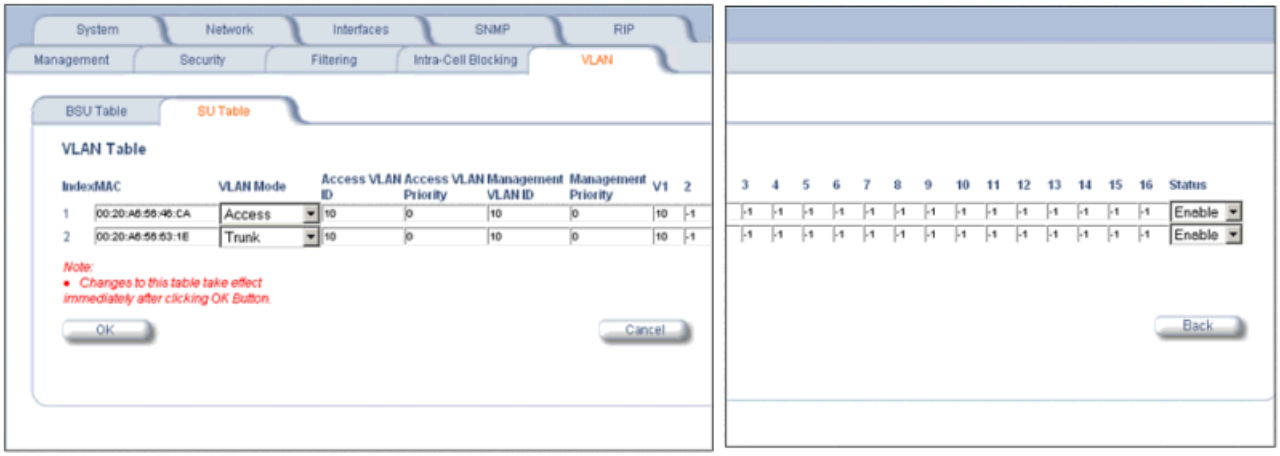
Adding SU Table Entries

To add entries to the SU Table, click the **Add Table Entries** button. Enter the **VLAN ID** and select a **Status**, then click **Add** to add and save the entry.



Editing SU Table Entries

To edit SU table entries, click the **Edit/Delete Table Entries** button; make your changes on the window displayed, then click **OK** to save your changes. (You may need to scroll to the right to see the **Edit/Delete Table Entries** button.)



Typical User VLAN Configurations

VLANs segment network traffic into groups, which lets you limit broadcast and multicast traffic. These groups enable hosts from different VLANs to access different resources using the same network infrastructure. Hosts using the same physical network are limited to those resources available to their workgroup.

The unit can segment users into a maximum of 16 different VLANs per unit, based upon a VLAN ID.

The primary scenarios for using VLAN workgroups are as follows:

VLAN disabled:

Your network does not use VLANs.

VLAN enabled:

Each VLAN workgroup uses a different VLAN ID Tag
A mixture of Tagged and Untagged workgroups

11) QoS (Quality of Service) Parameters

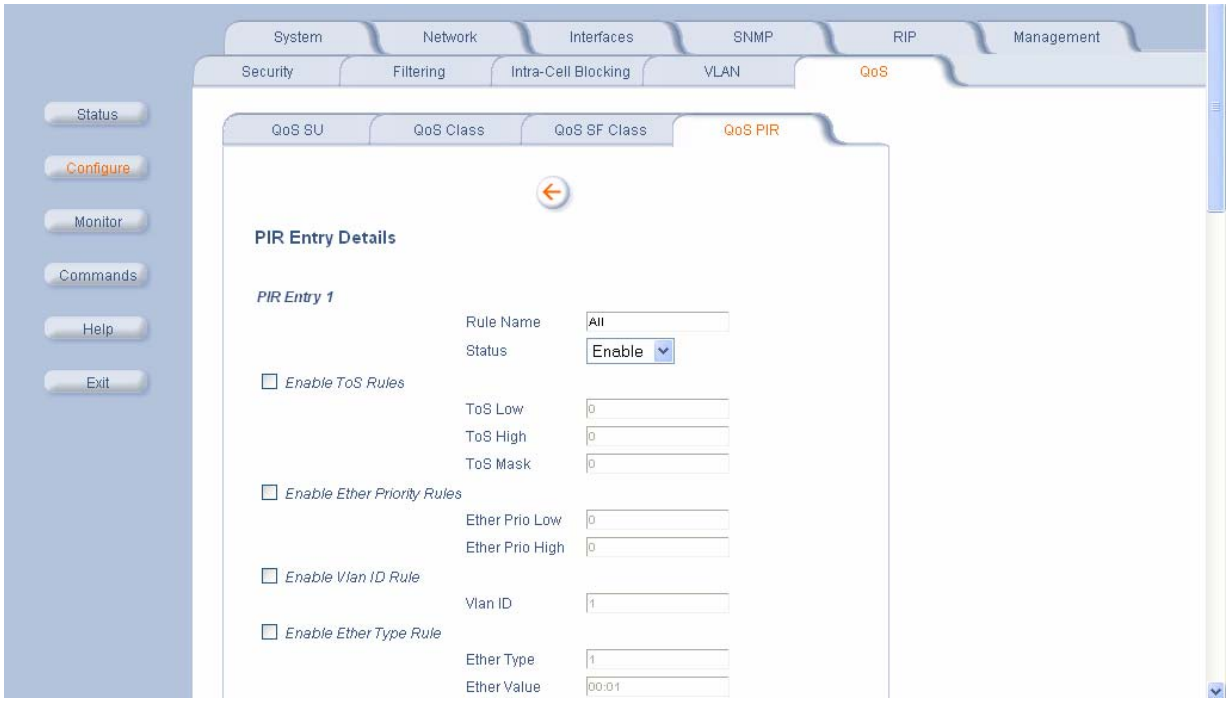
The Quality of Service (QoS) feature is based on 802.16 standard and defines the classes, service flows (SFCs), and packet identification rules (PIRs) for specific types of traffic. QoS main priority is to guarantee a reliable and adequate transmission quality for all traffic types under conditions of high congestion and bandwidth over-subscription (for a complete discussion on QoS see “Quality of Service (QoS)” on page 28).

There are already several pre-defined QoS classes, SFCs and PIRs available that you may choose from which cover the most common types of traffic. If you want to configure something else, you start building the hierarchy of a QoS class by defining PIRs; then you associate some of those PIRs to specific Service Flow classes (SFCs); you assign priorities to each PIR within each SFC; and finally you define the QoS class by associating relevant SFCs to each QoS class.

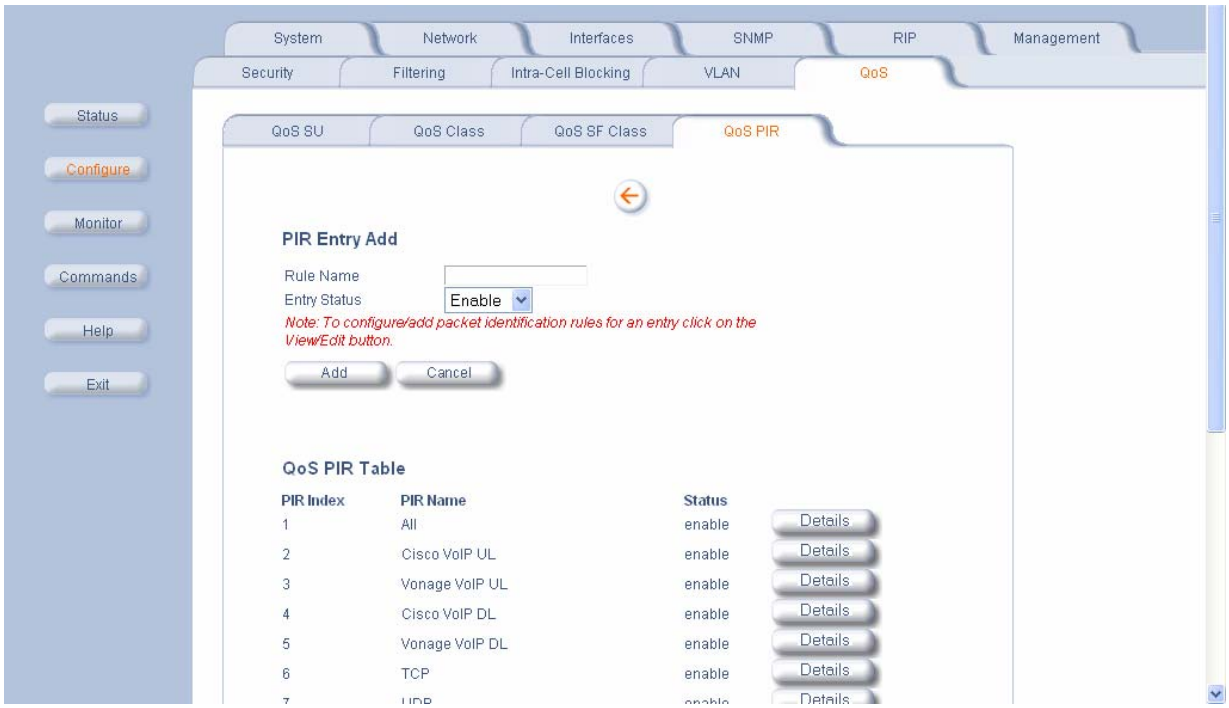
QoS PIR Configuration

Click the **Configure** button, the **QoS** tab and the **QoS PIR Table** sub-tab. The 17 predefined PIRs are shown.

To view/edit the parameters of each PIR click on its **Details** button. You may enable, disable or delete this PIR entry by clicking on the **Status** drop-down box and then clicking **OK**.

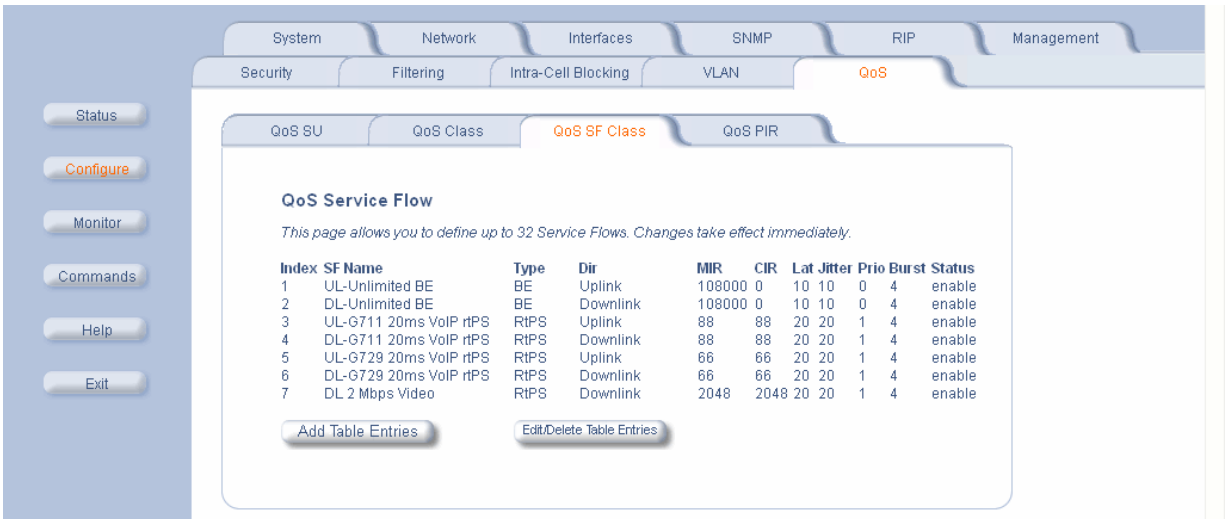


To add entries to the PIR Table, click the **Add Table Entries** button. Enter the **Rule Name** and select Enable or Disable from the **Entry Status** drop-down box, then click **Add** to add the entry. Once the new entry shows up on the screen, click its **Details** button to view/edit its parameters.

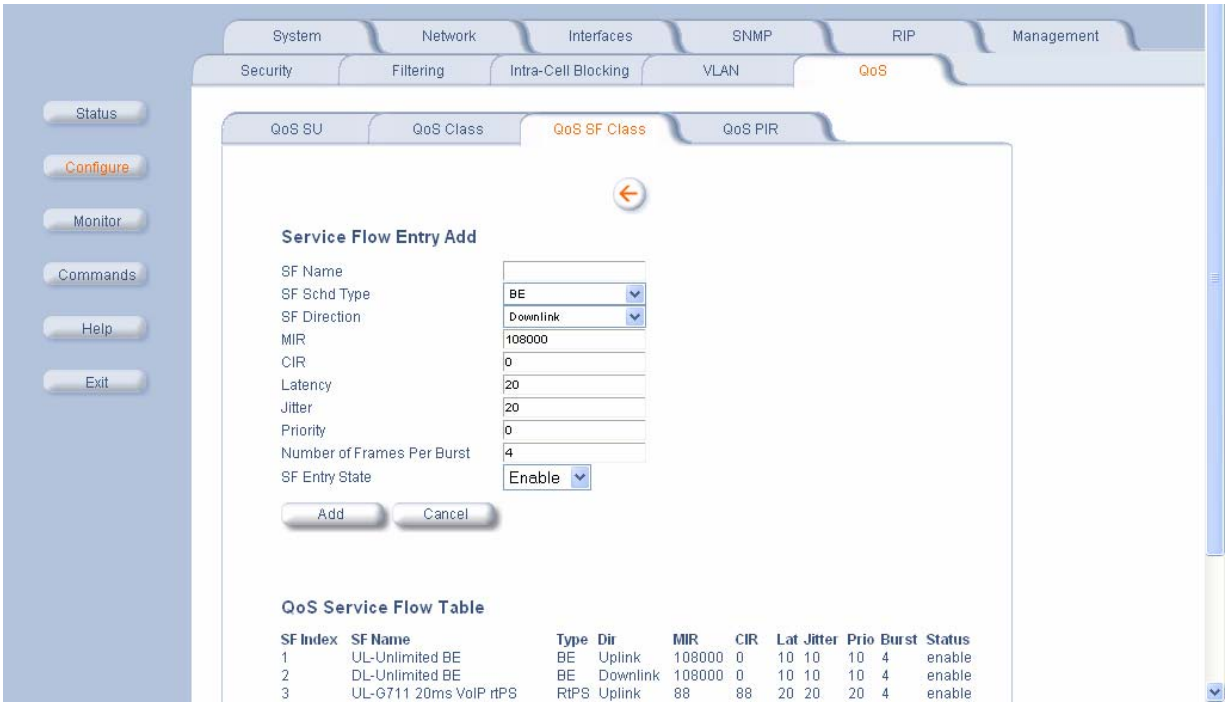


QoS SFC Configuration

Click the **Configure** button, the **QoS** tab and the **QoS SF Class** sub-tab. The 7 predefined SFCs are shown.



To add entries to the SFC Table, click the **Add Table Entries** button.



Field Descriptions

SF Name

Enter the name of the SF class you want to add.

SF Schd Type

This field can be set to **BE** (Best Effort) or **RtPS** (Real-Time Polling Service).

SF Direction

This field can be set to **Downlink** (DL: traffic from BSU to SU) or **Uplink** (UL: traffic from SU to BSU).

MIR (Maximum Information Rate)

The maximum sustained data rate specified in units of 1 Kbps from 8 Kbps up to the maximum rate of 108000 Kbps per SU.

CIR (Committed Information Rate)

The minimum reserved traffic rate specified in units of 1 Kbps from 0 Kbps up to the maximum rate of 10000 Kbps per SU.

Latency

The maximum allowed latency specified in increments of 5 ms steps from a minimum of 5 ms up to a maximum of 100 ms.

Jitter

The maximum tolerable jitter specified in increments of 5 ms steps from a minimum of 0 ms up to the Maximum Latency (in ms).

Priority

The priority of this SFC from zero (0) to seven (7), 0 being the lowest, 7 being the highest.

Number of Frames per Burst

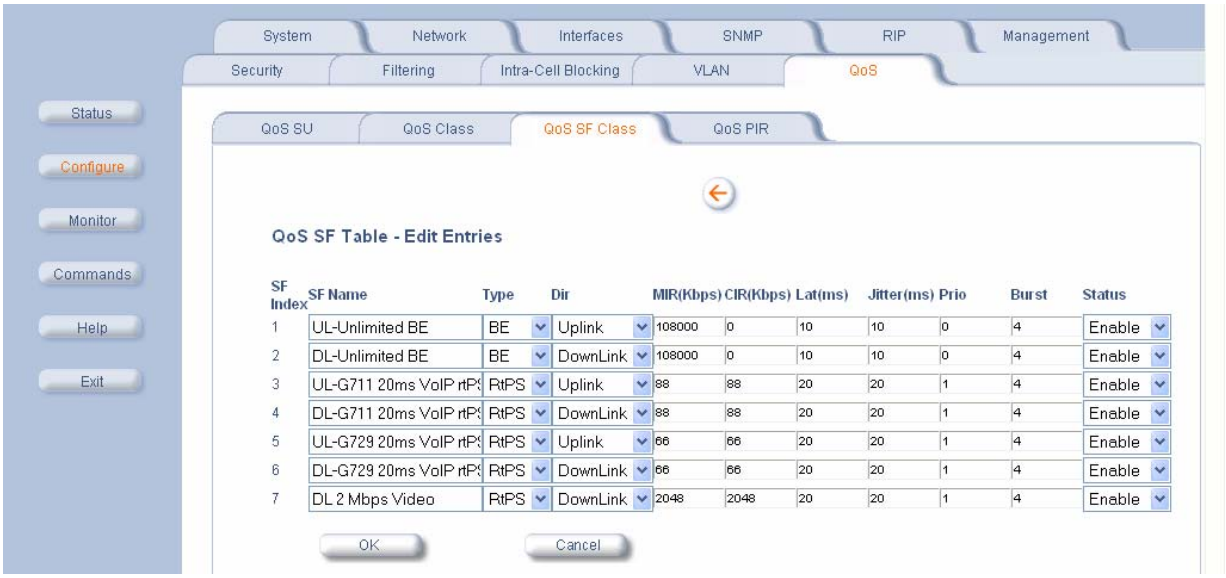
The Maximum number of data messages in a Multi-Frame burst from one (1) to four (4), which affects the percentage of the maximum throughput of the system according to the table on page 62.

SF Entry State

This field can be set to **Enable**, **Disable**, or **Delete**.

Click **Add** to add the entry. The new entry will show up on the screen taking up the next sequential index entry.

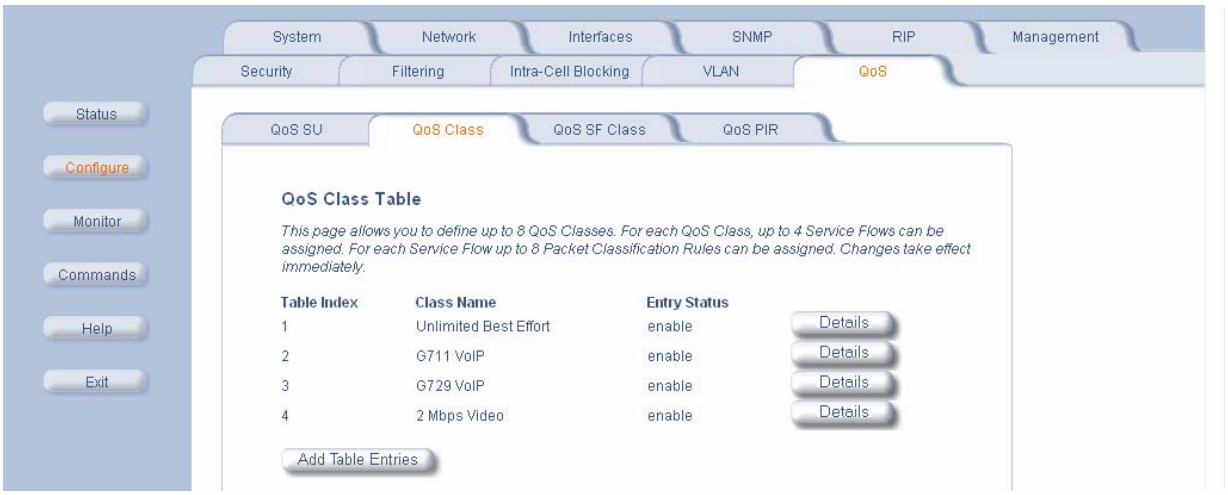
To make changes to the entries of the SFC Table, click the **Edit/Delete Table Entries** button.



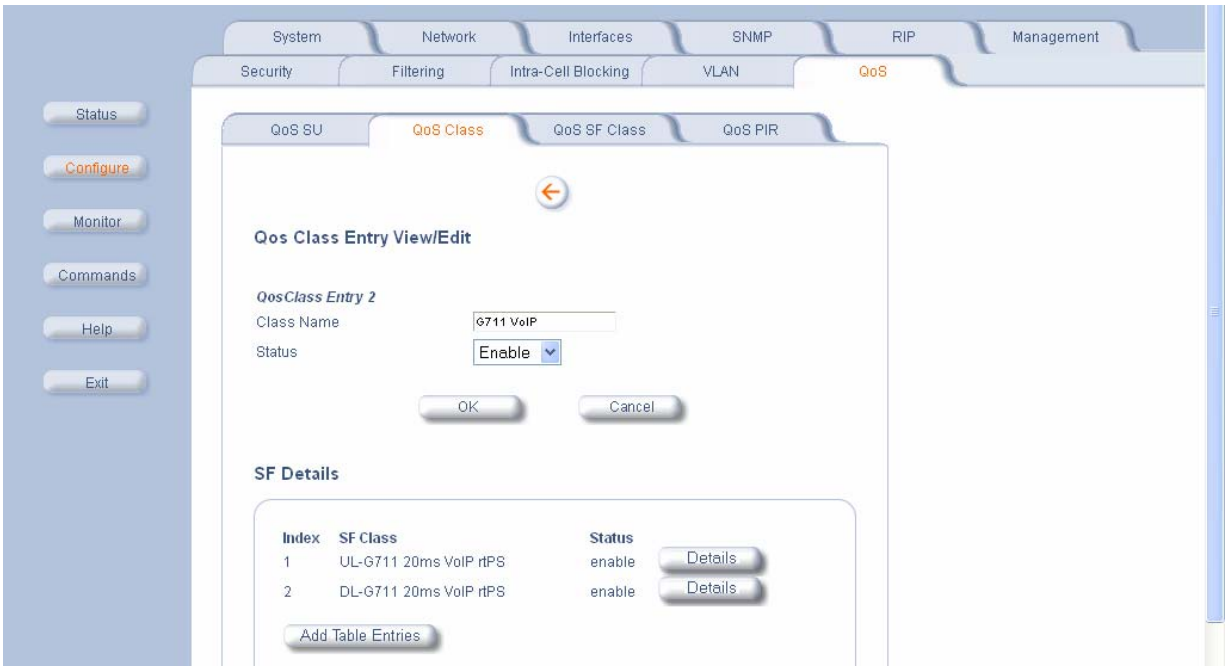
Enter your changes and click **OK**. To delete an entry, click the **Status** drop-down box and select **Delete**, then click **OK**.

QoS Class Configuration

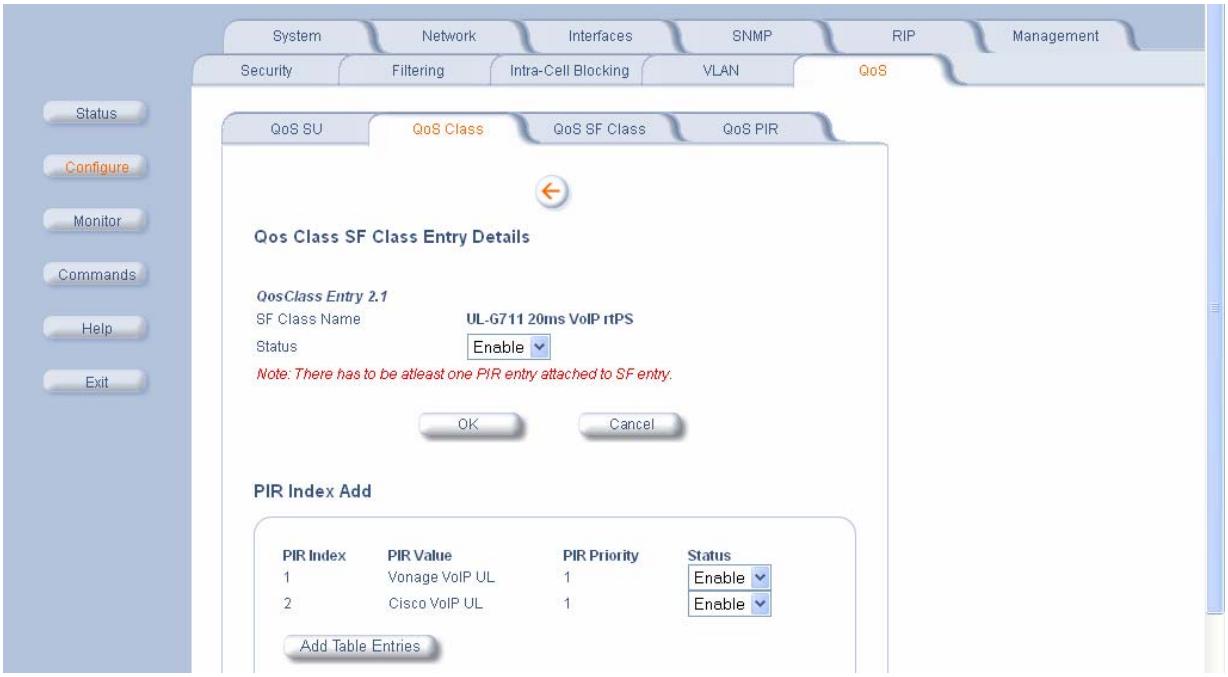
Click the **Configure** button, the **QoS** tab and the **QoS Class** sub-tab. The 4 predefined QoS classes are shown.



To view/edit a QoS Class click on its **Details** button. You may enable, disable or delete this QoS Class entry by clicking on the **Status** drop-down box and then clicking **OK**. You may also edit an existing SFC associated to this QoS class, or add a new SFC.



To edit an existing SFC associated to this QoS Class click its **Details** button. You may enable, disable or delete this SFC entry by clicking on the **Status** drop-down box and then clicking **OK**. You may also delete a PIR associated to this SFC by clicking on the **Status** drop-down box and then clicking **OK**, or add a new PIR to this SFC.



To add more PIRs to this SFC click the **Add Table Entries** button.

Field Descriptions

PIR Table Reference Index

Select one of the possible PIRs that have been previously configured from the drop-down box.

PIR Priority

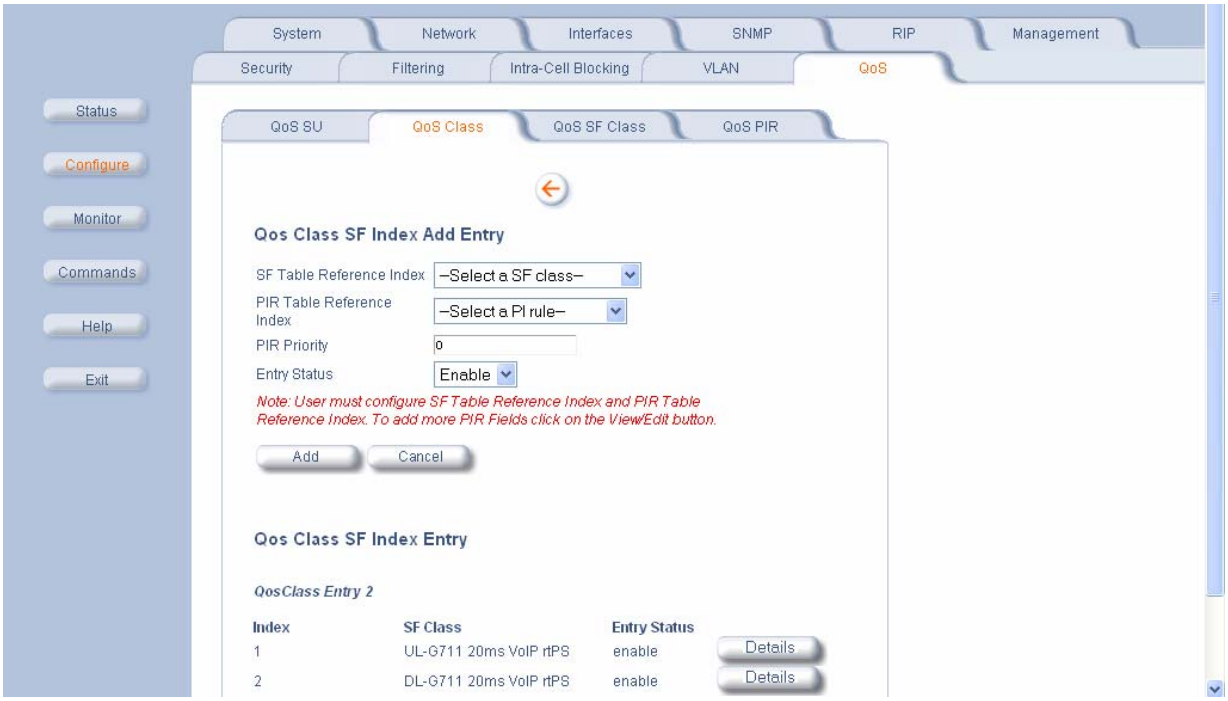
This priority per rule defines the order of execution of PIRs during packet identification process. The PIR priority is a number in the range 0-63, with priority 63 being executed first, and priority 0 being executed last. The PIR priority is defined within a QoS class, and can be different for the same PIR in some other QoS class. If all PIRs within one QoS class have the same priority, the order of execution of PIR rules will be defined by the order of definition of SFCs, and by the order of definition of PIRs in each SFC, within that QoS class.

Entry Status

This field is always set to **Enable**.

Click **Add** to add the entry. The new entry will show up on the screen taking up the next sequential index entry. You may delete any PIR entry by clicking on the **Status** drop-down box.

Back to the QoS Class screen on page 100, to add a new SFC and associate it to this QoS Class click the **Add Table Entries** button.



Field Descriptions

SF Table Reference Index

Select one of the possible SFCs that have been previously configured from the drop-down box to associate to this QoS Class.

PIR Table Reference Index

Select one of the possible PIRs that have been previously configured from the drop-down box to associate to this SFC.

PIR Priority

This priority per rule defines the order of execution of PIRs during packet identification process. The PIR priority is a number in the range 0-63, with priority 63 being executed first, and priority 0 being executed last. The PIR priority is defined within a QoS class, and can be different for the same PIR in some other QoS class. If all PIRs within one QoS class have the same priority, the order of execution of PIR rules will be defined by the order of definition of SFCs, and by the order of definition of PIRs in each SFC, within that QoS class.

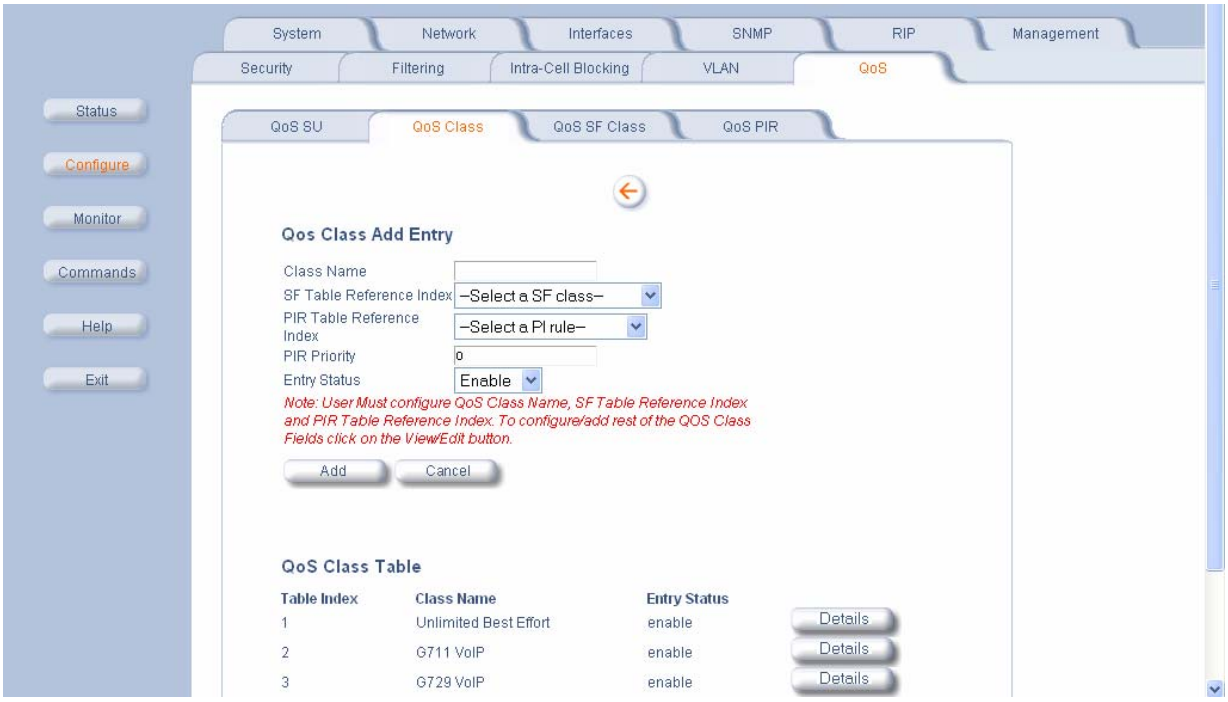
Entry Status

This field is always set to **Enable**.

Click **Add** to add the entry. The new entry will show up on the screen taking up the next sequential index entry.

From this screen you may also edit an existing SFC by clicking on its **Details** button. This will take you to the same QoS Class SF Class Entry Details screen on page 101.

Finally, to add a new QoS Class click the **Add Table Entries** button on the screen on page 100.



Field Descriptions

Class Name

Enter the name of the QoS class you want to add.

SF Table Reference Index

Select one of the possible SFCs that have been previously configured from the drop-down box to associate to this QoS Class.

PIR Table Reference Index

Select one of the possible PIRs that have been previously configured from the drop-down box to associate to this SFC.

PIR Priority

This priority per rule defines the order of execution of PIRs during packet identification process. The PIR priority is a number in the range 0-63, with priority 63 being executed first, and priority 0 being executed last. The PIR priority is defined within a QoS class, and can be different for the same PIR in some other QoS class. If all PIRs within one QoS class have the same priority, the order of execution of PIR rules will be defined by the order of definition of SFCs, and by the order of definition of PIRs in each SFC, within that QoS class.

Entry Status

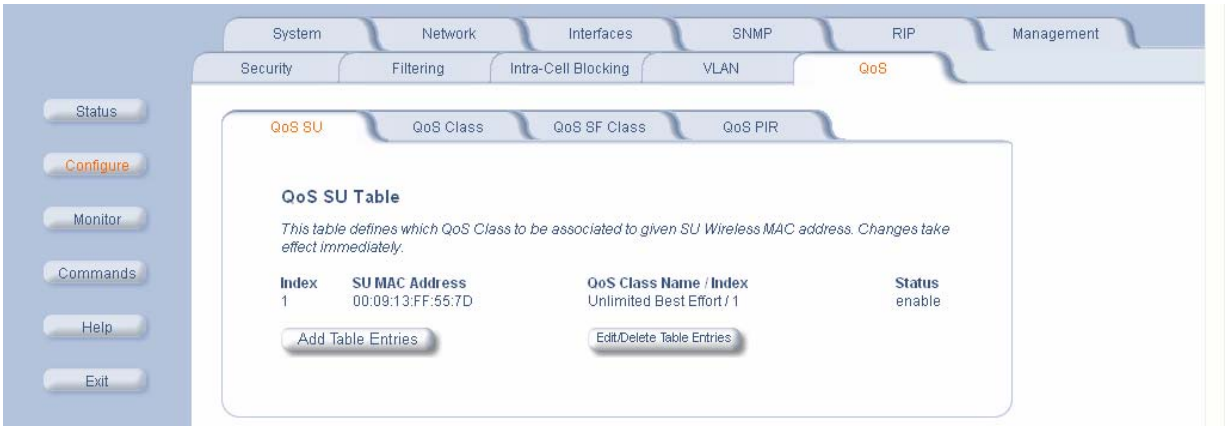
This field is always set to **Enable**.

Click **Add** to add the entry. The new entry will show up on the screen taking up the next sequential index entry.

From this screen you may also edit an existing QoS Class by clicking on its **Details** button. This will take you to the same QoS Class Entry View/Edit screen on page 100.

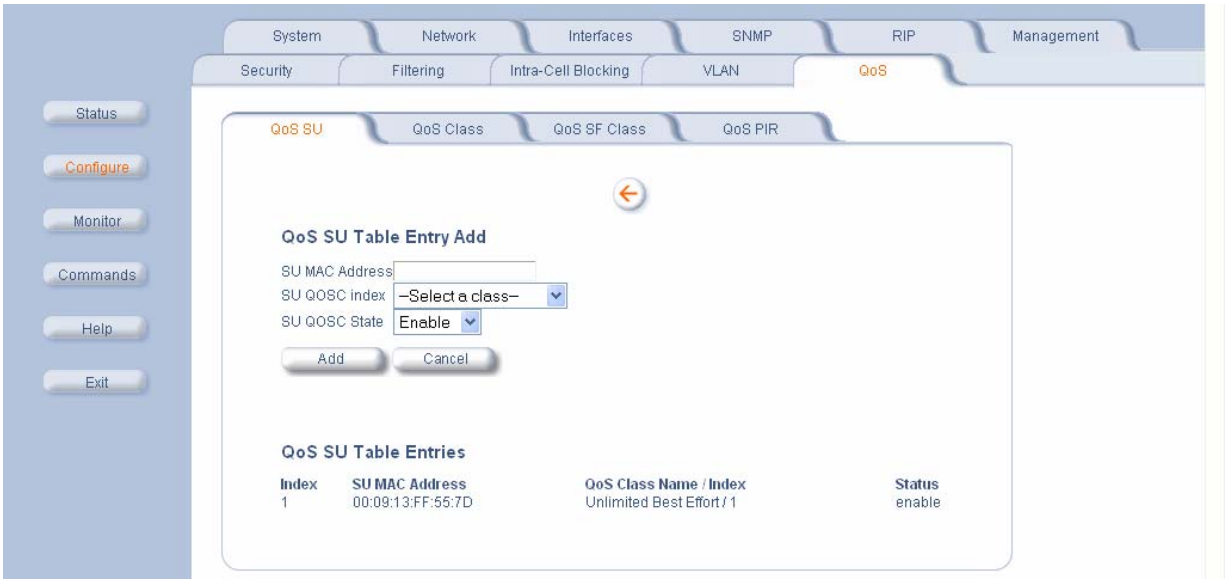
QoS SU Configuration

Click the **Configure** button, the **QoS** tab and the **QoS SU** sub-tab.



This screen defines which QoS Classes will be associated to which given SUs by using their MAC addresses.

To add entries to the QoS SU Table, click the **Add Table Entries** button.



Field Descriptions

SU MAC Address

The MAC Address of the SU you want to associate to a specific QoS Class.

SU QOSC Index

Select one of the possible QoS Classes that have been previously configured from the drop-down box to associate to this SU.

SU QOSC State

This field can be set to **Enable**, **Disable**, or **Delete**.

Click **Add** to add the entry. The new entry will show up on the screen taking up the next sequential index entry.

To make changes to QoS SU Table, click the **Edit/Delete Table Entries** button.

Enter your changes and click **OK**. To delete an entry, click the **Status** drop-down box and select **Delete**, then click **OK**.

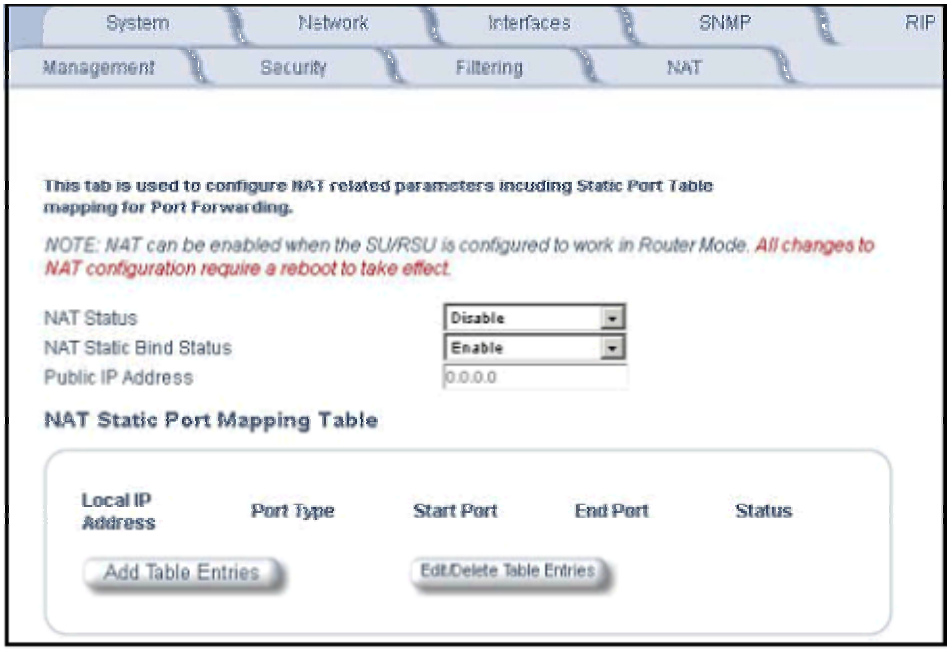
12) SU Access to the Public Network (NAT)

The NAT (Network Address Translation) feature lets hosts on the Ethernet side of the SU transparently access the public network through the Base Station. All hosts in the private network can have simultaneous access to the public network.

Note: The NAT tab is available for SUs in **Routing** mode only. The SU supports NAPT (Network Address Port Translation) where all private IP addresses are mapped to a single public IP address, and does not support Basic NAT (where private IP addresses are mapped to a pool of public IP addresses).

Both ***dynamic mapping*** (allowing private hosts to access hosts in the public network) and ***static mapping*** (allowing public hosts to access hosts in the private network) are supported.

- In dynamic mapping, the SU maps the private IP addresses and its transport identifiers to transport identifiers of a single Public IP address as they originate sessions to the public network. This is used only for outbound access.
- Static mapping is used to provide inbound access. The SU maps a private IP address and its local port to a fixed public port of the global IP address. This is used to provide inbound access to a local server for hosts in the public network. Static port mapping allows only one server of a particular type. Up to 1000 ports (500 UDP and 500 TCP) are supported.



Field Descriptions

NAT Status

Enables or disables the NAT feature. NAT can be enabled only for SUs in Routing mode. The default is disabled.

Note: Changes to NAT parameters including the NAT Static Port Mapping Table require a reboot to take effect.

NAT Static Bind Status

Enables or disables the NAT Static Bind status (static mapping) to allow public hosts to access hosts in a private network. The default is disabled.

Public IP Address

The NAT Public IP address is the wireless interface IP address.

NAT Feature Interactions

When NAT is enabled, the DHCP Relay Agent feature is not supported (DHCP Relay Agent must be disabled before NAT is enabled) and RIP updates are not sent or received.

You can configure a DHCP server to allocate IP addresses to hosts on the Ethernet side of the SU/Base Station (see ***DHCP Server***).

NAT Static Port Mapping Table

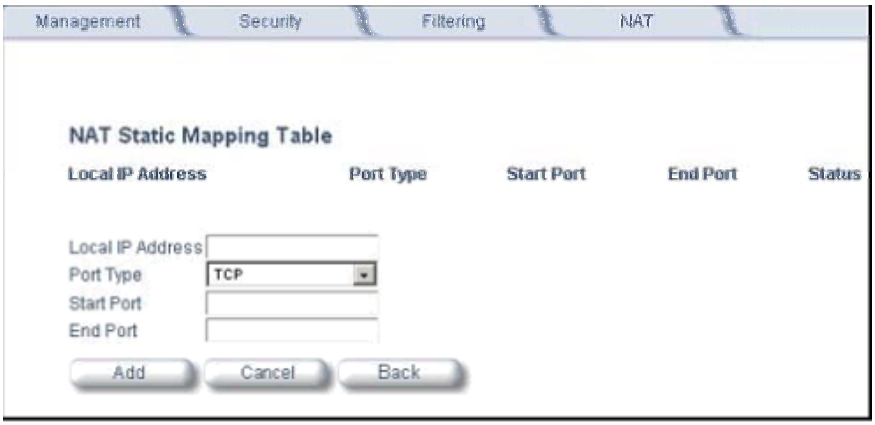
Adding entries to the NAT Static Mapping Table lets the configured hosts in a private address realm on the Ethernet side of the SU be accessible from access hosts in the public network without using Network Address Port Translation (NAPT). Up to 1000 entries can be configured (500 UDP ports and 500 TCP ports).

Adding Entries

To add an entry:

1. Click the **Add Table Entries** button.
2. Enter the **Local IP Address** of the host on the Ethernet side of the SU.
3. Select the **Port Type**: **TCP**, **UDP**, or **Both**.
4. Enter the **Start Port** and **End Port**

5. Set **Status** to **Enable** or **Disable**.
6. Click **OK**.



Supported Session Protocols

The NAT feature supports the following session protocols for both inbound and outbound access with the required support, applications, and limitations given in the following table.

Certain Internet applications require an Application Level Gateway (ALG) to provide the required transparency for an application running on a host in a private network to connect to its counterpart running on a host in the public network. An ALG may interact with NAT to set up state information, use NAT state information, modify application specific payload and perform the tasks necessary to get the application running across address realms.

No more than one server of a particular type is supported within the private network behind the SU.

These VPN protocols are supported with their corresponding ALGs: IPsec, PPTP, L2TP.

Supported Session Protocols			
Protocol	**Support**	**Applications**	**Limitations**
ICMP	ICMP ALG	Ping	
FTP	FTP ALG	File transfer	
H.323	H.323 ALG	Multimedia conferencing	
HTTP	Port mapping for inbound connection.	Web browser	
TFTP	Port mapping for inbound connection.	File transfer	
Telnet	Port mapping for inbound connection.	Remote login	
CUSeeMe	Port mapping for inbound and outbound connection.	Video conferencing	One user is allowed for video conferencing
IMAP	Port mapping for inbound connection.	Mail	
PNM	Port mapping for inbound connection.	Streaming media with Real Player	
POP3	Port mapping for inbound connection.	E-mail	
SMTP	Port mapping for inbound connection.	E-mail	Mails with IP addresses of MTAs or using IP addresses in place of FQDN are not supported (requires SMTP ALG).

Supported Session Protocols			
Protocol	**Support**	**Applications**	**Limitations**
RTSP	Port mapping for inbound connection.	Streaming audio/video with Quick Time and Real Player	
ICQ	Port mapping for inbound connection.	Chat and file transfer	Each host using ICQ needs to be mapped for different ports.
IRC	Port mapping for inbound connection.	Chat and file transfer	Each host using IRC needs to be mapped for different ports.
MSN Messenger	Port mapping for inbound and outbound connection.	Conference and Share files with Net meeting	Only one user is allowed for net meeting.
Net2Phone	Port mapping for inbound and outbound connection.	Voice communication	
IP Multicast	Pass Through	Multicasting	
Stream works	Port mapping for inbound connection.	Streaming video	
Quake	Port mapping for inbound connection.	Games	When a Quake server is configured within the private network behind a SU, the SU cannot provide information about that server on the public network. Also, certain Quake servers do not let multiple users log in using the same IP address, in which case only one Quake user is allowed.

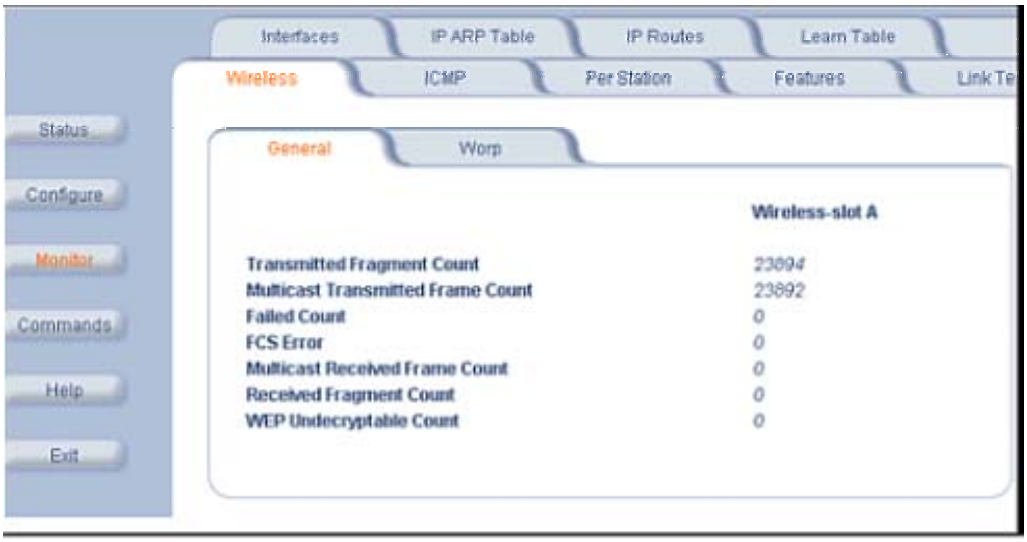
MONITOR SETTINGS AND PERFORMANCE

Use this section of the interface to obtain detailed information about the settings and performance of the unit. The following tabs appear in the **Monitor** section: Wireless, ICMP, Per Station, Features, Link Test, Interfaces, IP ARP Table, IP Routes, Learn Table, RIP, and Radius. The **Radius** tab is available on Base Stations only. The RIP tab is relevant only in Routing mode.

1) Monitor the Wireless Interface

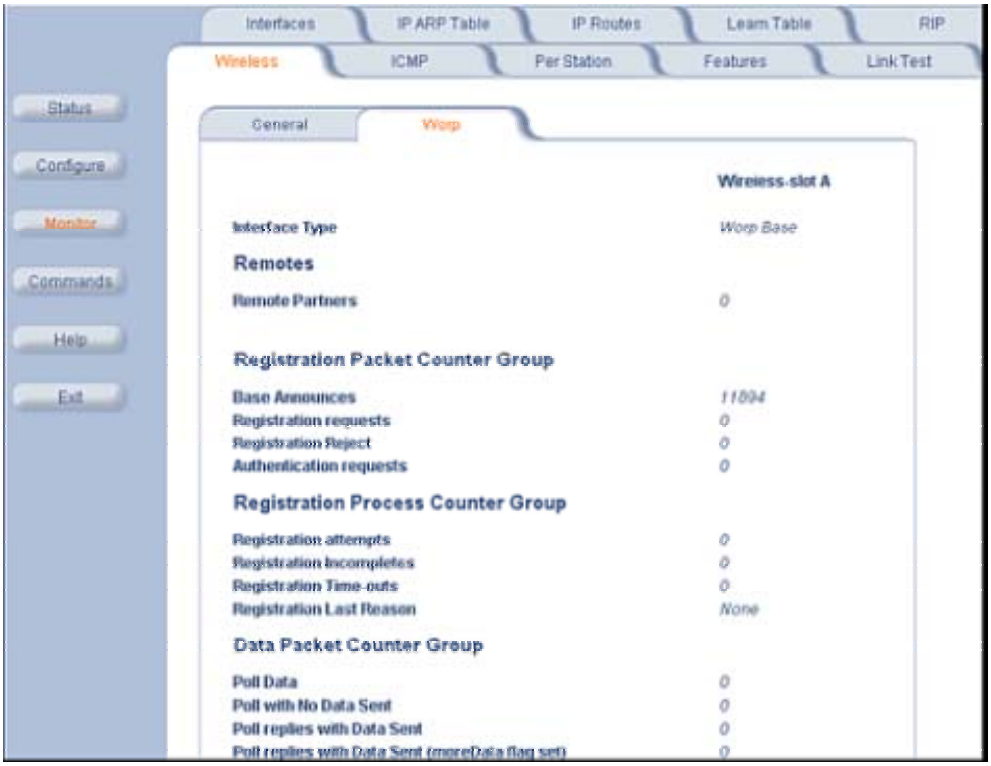
General Performance

Click the **Monitor** button and the **General** tab to monitor the general performance of the wireless interface.



WORP Interface Performance

Click the **Monitor** button, the **Wireless** tab, and the **WORP** tab to monitor the performance of the WORP Base or WORP SU interfaces.



The **Registration Last Reason** field indicates either a successful registration (a value of 1) or it indicates the reason why the last registration failed.

Registration Request Messages

Possible values for the **Registration Last Reason** field are as follows:

None = Successful registration

2 = Maximum number of SUs reached

3 = Authentication failure

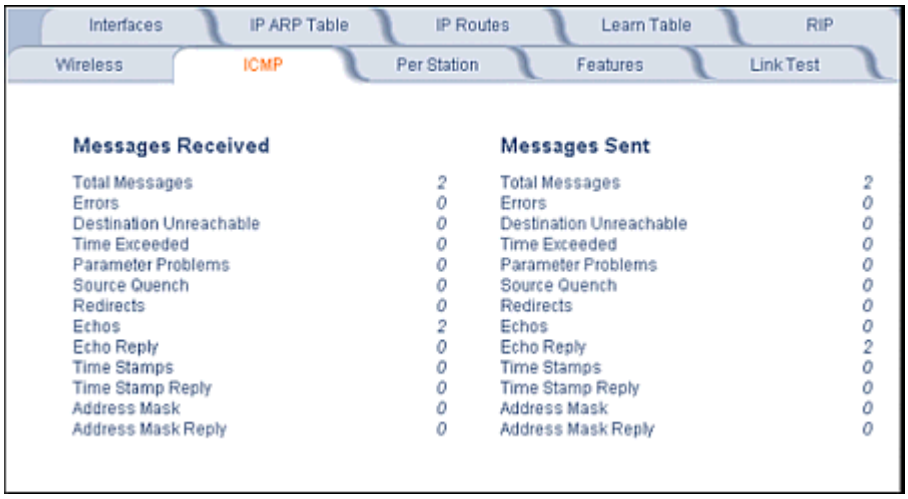
4 = Roaming

5 = No response from SU within the Registration Timeout Period

6 = Low Signal Quality

2) View ICMP Messages

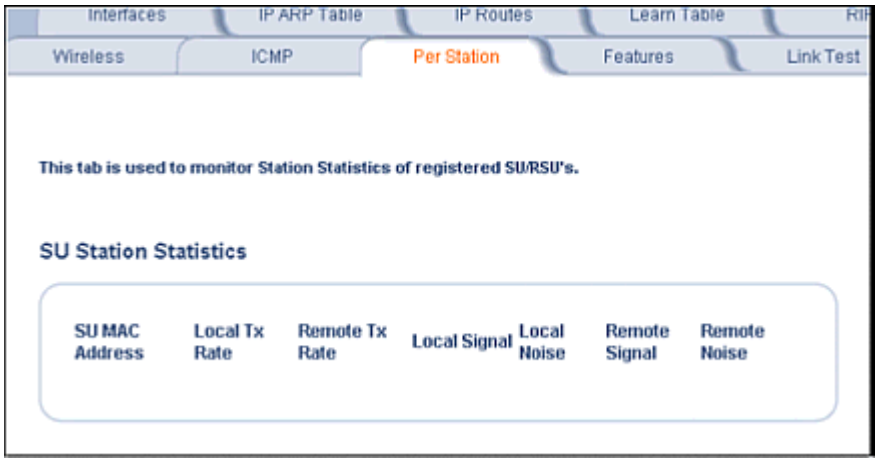
Click the **Monitor** button and the **ICMP** tab to view the number of ICMP messages send and received by the unit. It includes **ping**, **route**, and **host unreachable** messages.



3) View Per Station Statistics

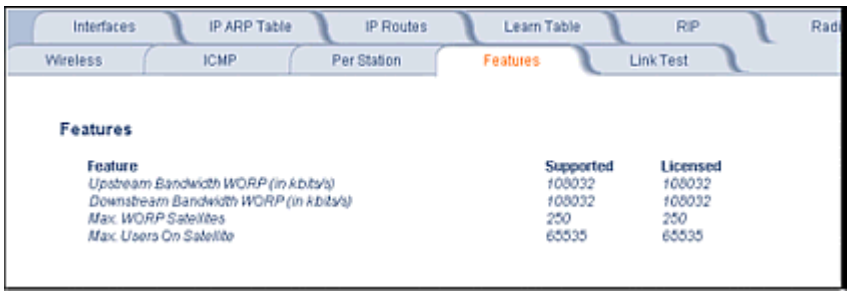
Click the **Monitor** button and the **Per Station** tab to view Station Statistics. On the SU, the “Per Station” page shows statistics of the BSU to which the SU is registered. On the BSU, it shows statistics of all the SU’s connected to the BSU.

The page’s statistics refresh every 4 seconds.



4) View Features Supported

Click the **Monitor** button and the **Features** tab to view the following information:



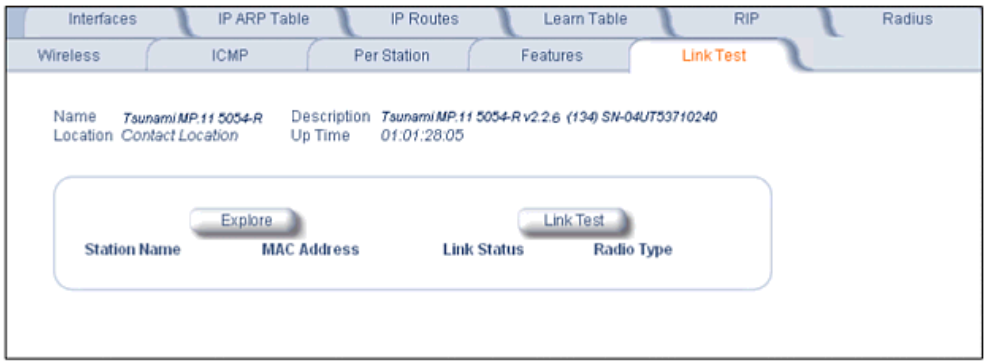
Note: A Base Station shows how many WORP SUs it can support; the Subscriber Unit and Residential Subscriber Unit shows how many Ethernet hosts they support on their Ethernet port as the "Max Users on Satellite" parameter.

5) Test Link Quality

Click the **Monitor** button and the **Link Test** tab to find out which wireless stations are in range and to check their link quality.

Note: Link Test requires Internet Explorer version 6.0 or later. Earlier versions do not support Link Test.

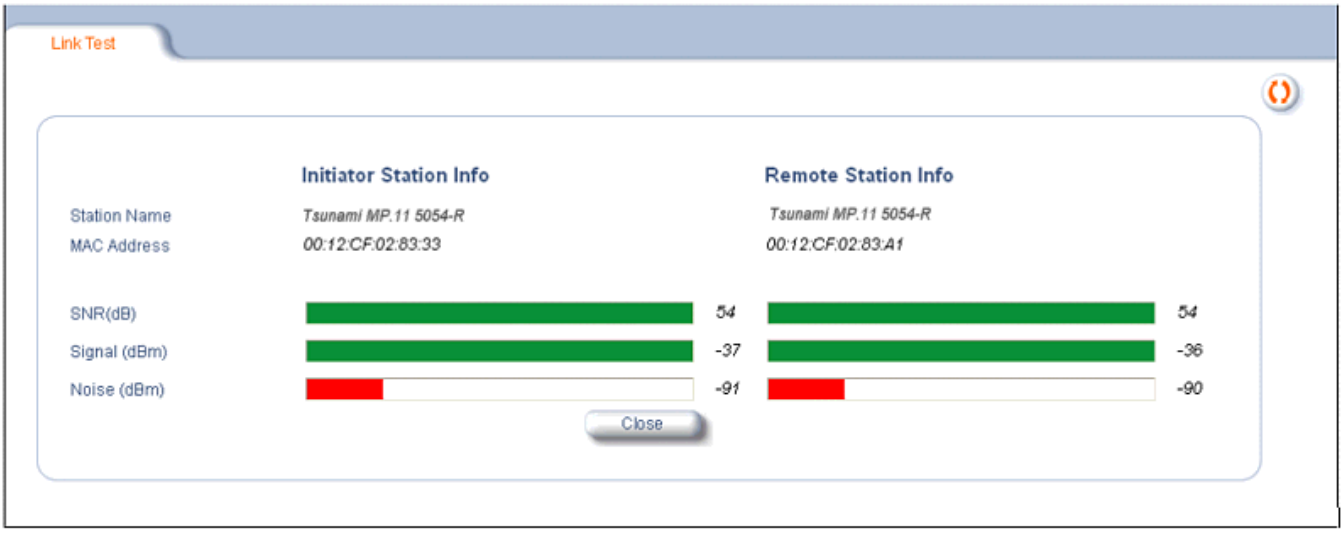
Link Test for the unit reports the Signal-to-Noise Ratio (SNR) value; the higher this number, the better the signal quality. Further, it reports the signal level and noise level in dBm. The latter two are approximations of the level at which the unit receives the signal of the peer unit and the background noise.



- **Explore** from a BSU displays all its registered SUs.
- **Explore** from an SU displays only the BSU with which it is registered.

All stations displayed after "Explore" come up "Disabled." Select a station by changing **Disabled** to **Start** and click the **Link Test** button. You can change multiple stations to **Start**, but only the last station in the list is displayed as the remote partner when you click the **Link Test** button. See the following figure:

The Link Test provides SNR, Signal, and Noise information.

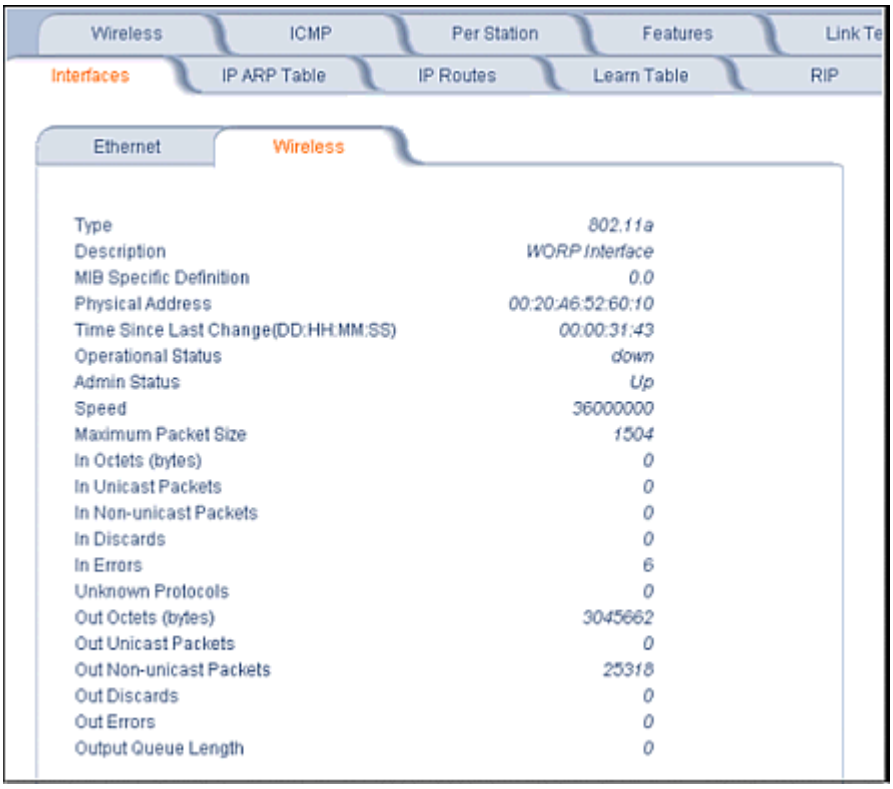


Link Test stops when you close the **Link Test** page.

6) Monitor Interfaces

Click the **Monitor** button and the **Interfaces** tab to view detailed information about the IP-layer performance of the unit's interfaces. There are two sub-tabs: **Wireless** and **Ethernet**.

The following figure shows the **Wireless** interface; the same information is provided for the Ethernet interface on the **Ethernet** sub-tab.

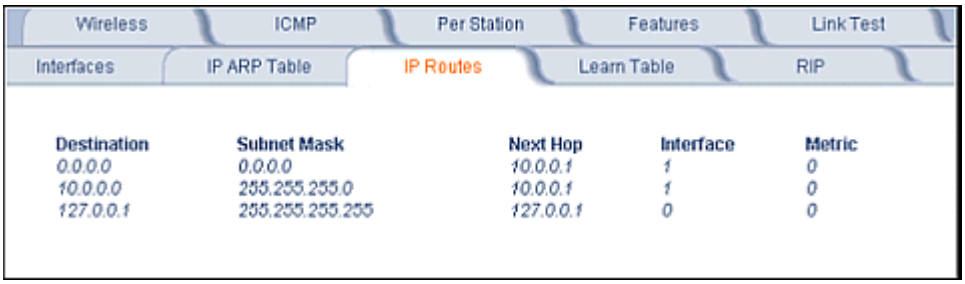


7) View IP and MAC Address Mapping

Click the **Monitor** button and the **IP ARP Tabl**e tab to view the mapping of the IP and MAC addresses of all units registered at the BSU. This information is based upon the Address Resolution Protocol (ARP).

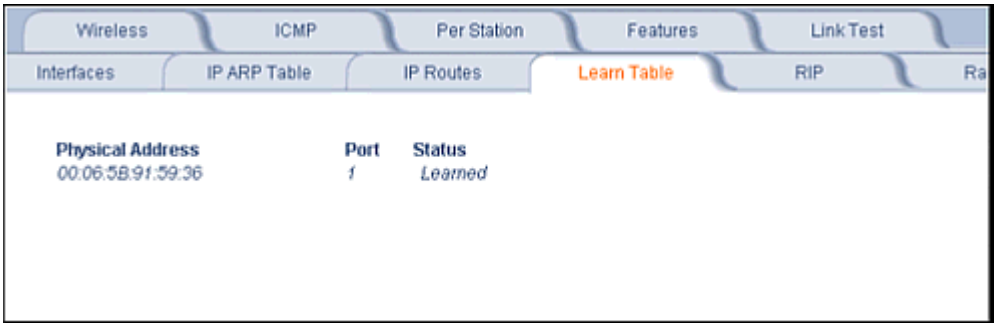
8) View Active IP Routes

Click the **Monitor** button and the **IP Routes** tab to view all active IP routes of the unit. These can be either **static** or **dynamic** (obtained through RIP). This tab is available only in **Routing** mode, and you can add routes only when in **Routing** mode.



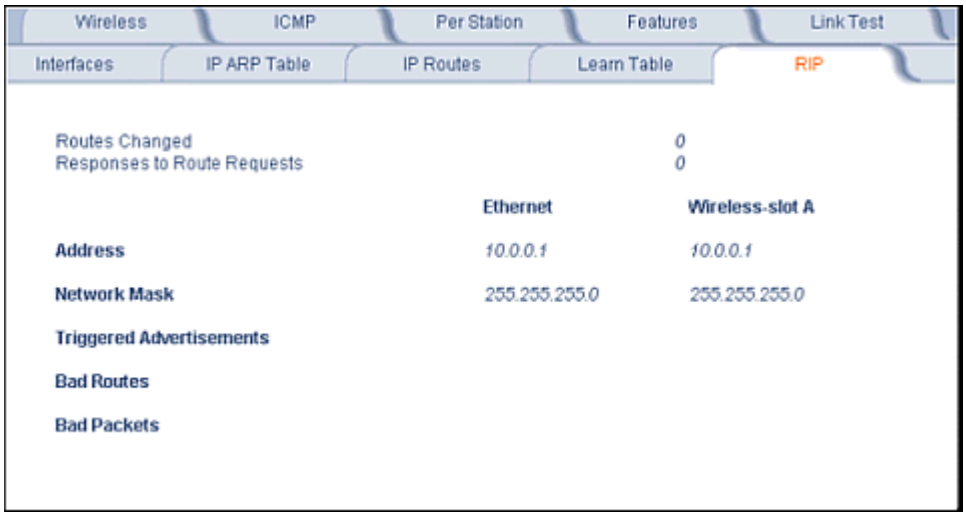
9) View All Detected MAC Addresses (Learn Table)

Click the **Monitor** button and the **Learn Table** tab to view all MAC addresses the unit has detected on an interface. The **Learn Table** displays information relating to network bridging. It reports the MAC address for each node that the device has learned is on the network and the interface on which the node was detected. There can be up to 10,000 entries in the **Learn Table**. This tab is only available in **Bridge** mode.



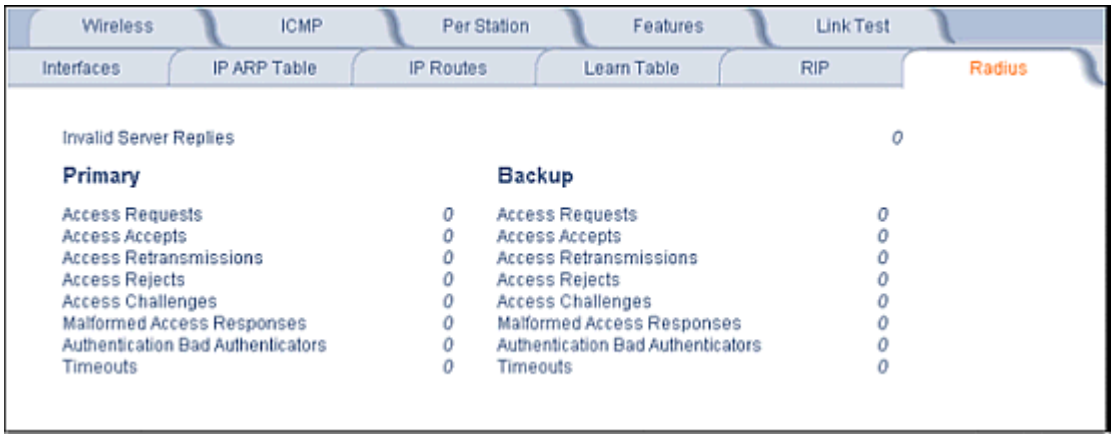
10) View RIP Data

Click the **Monitor** button and the **RIP** tab to view Routing Internet Protocol data for the Ethernet and Wireless interfaces.



11) View RADIUS Traffic Information

Click the **Monitor** button and the **Radius** tab to view information about the traffic exchanged with a RADIUS server.



12) View Temperature Log

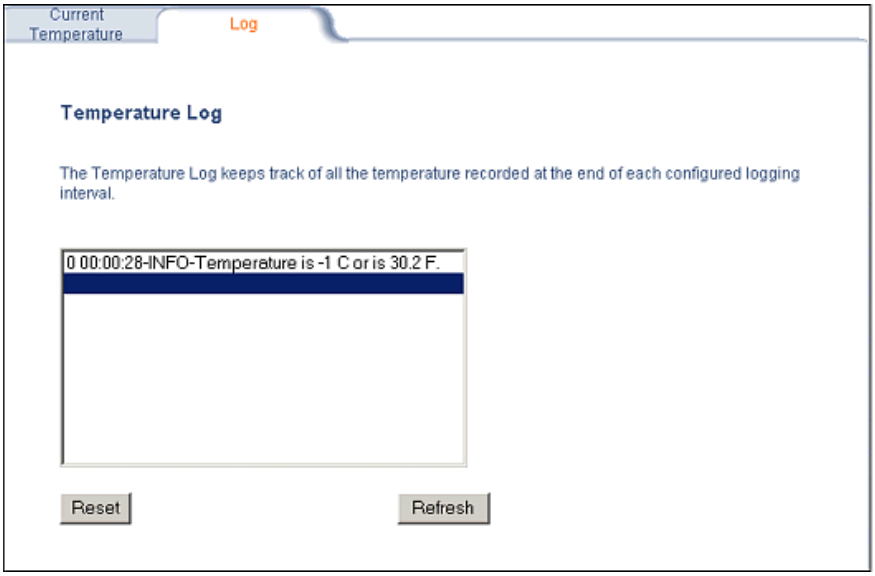
The feature for reporting and logging internal unit temperature observes and reports the internal temperature of the unit. Temperature is logged and an SNMP trap sent when the internal temperature crosses the limit of 0ºC to 55ºC (at 5 degrees before the limit, the unit issues a warning trap).

You can select a recording interval from one to sixty minutes, in 5-minute increments on the **Configure: System** tab. A log file holds the recorded data. The log can hold at least 576 entries (two days with the refresh time of 5 minutes). For further analysis, the log can be exported to a text file with a new line feed as a line separator.

The Temperature Log contains two sub-tabs.

- The **Current Temperature** tab indicates the unit's current temperature. The current temperature value is refreshed every 4 seconds.

- The **Log** tab keeps track of the temperature recorded at the end of each configured logging interval. You can reset or refresh the log using the **Reset** and **Refresh** buttons.

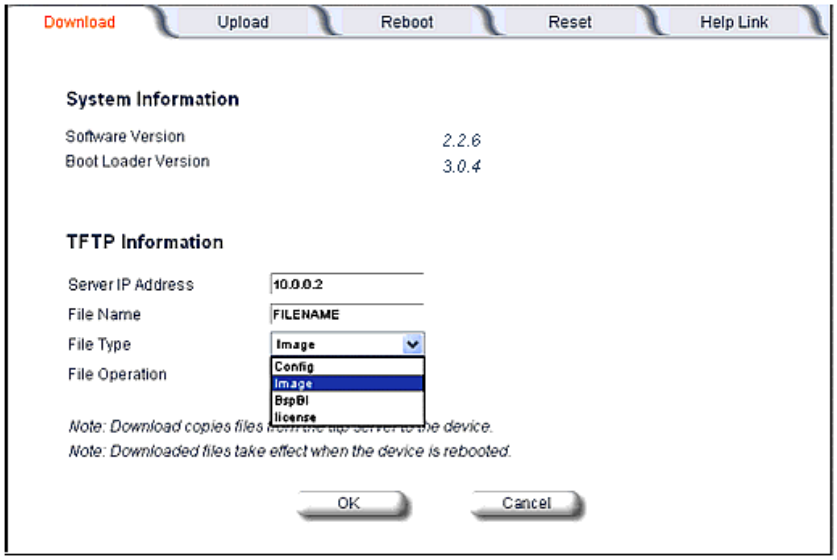


ISSUE COMMANDS

This section describes the commands that you can issue with the Web Interface. The following tabs are in the **Commands** section: **Download**, **Upload**, **Downgrade**, **Reboot**, **Reset**, and **Help Link**.

1) Download Files

Click the **Commands** button and the **Download** tab to download image, configuration, and license files to the unit.



Server IP address

Enter the TFTP **Server IP address**. (Double-click the TFTP server icon on your desktop and locate the IP address assigned to the TFTP server.)

File Name

Enter the name of the file to be downloaded.

File Type

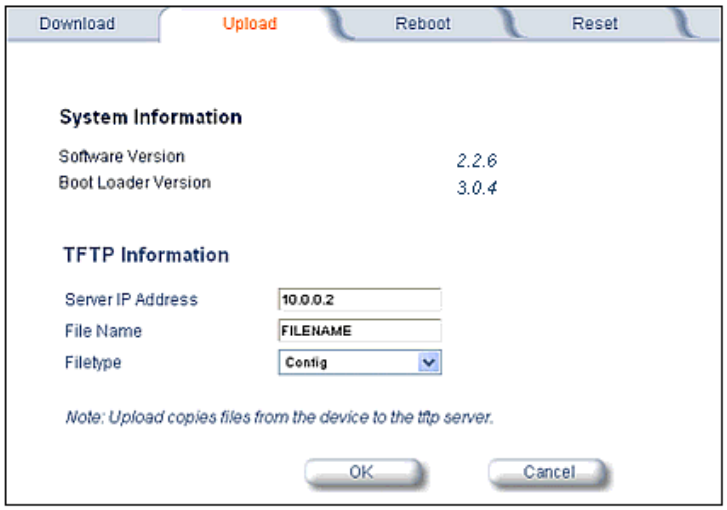
Config, image, BspBl, or **license.**

File Operation

Download or **Download and Reboot.**

2) Upload a Configuration File

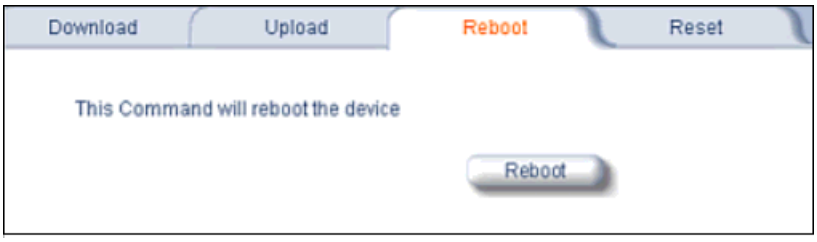
Click the **Commands** button and the **Upload** tab to upload a configuration file from the unit. Enter **Server IP Address**, **File Name**, select a **Filetype**, and click **OK**.



Filetype can be configured as **Templog**, **Eventlog**, or **Config**.

3) Reboot the Device

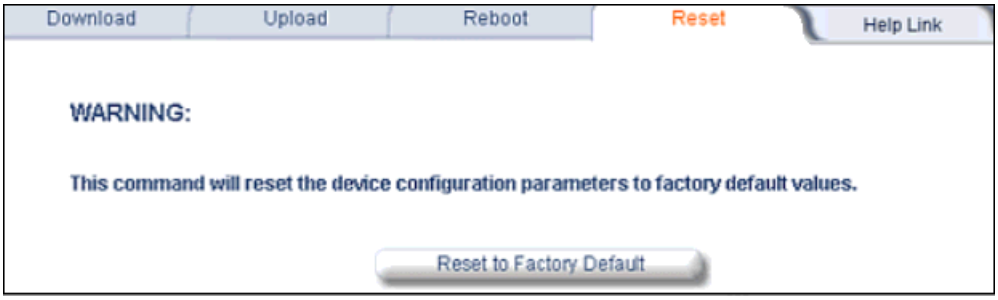
Click the **Commands** button and the **Reboot** tab to restart the unit's embedded software. Configuration changes are saved and the unit is reset.



CAUTION: Rebooting the unit causes all users currently connected to lose their connection to the network until the unit has completed the restart process and resumed operation.

4) Reset the Device

Click the **Commands** button and the **Reset** tab to restore the configuration of the unit to the factory default values.



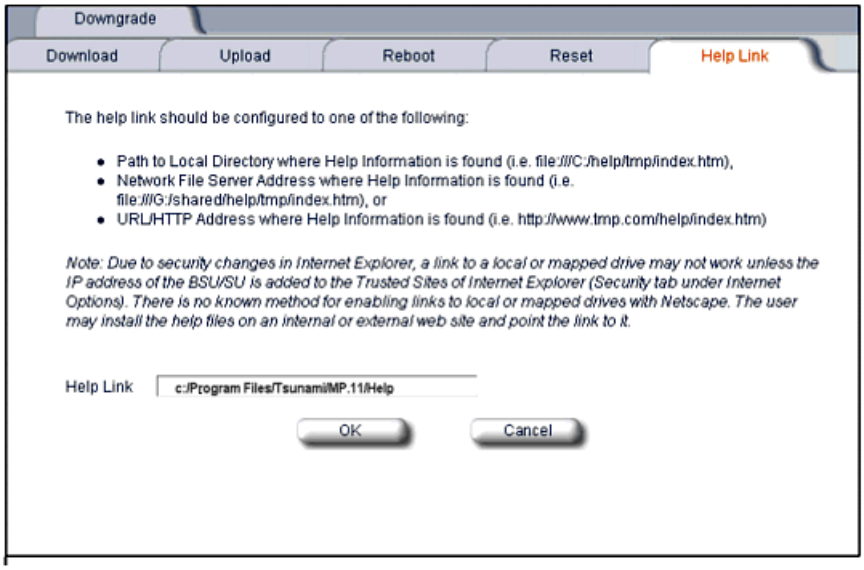
You can also reset the unit by disconnecting and reconnecting the unit's power. Because this resets the unit's current IP address, a new IP address must be assigned.

CAUTION: Resetting the unit to its factory default configuration permanently overwrites all changes made to the unit. The unit reboots automatically after this command has been issued.

5) Set the Help Link Location

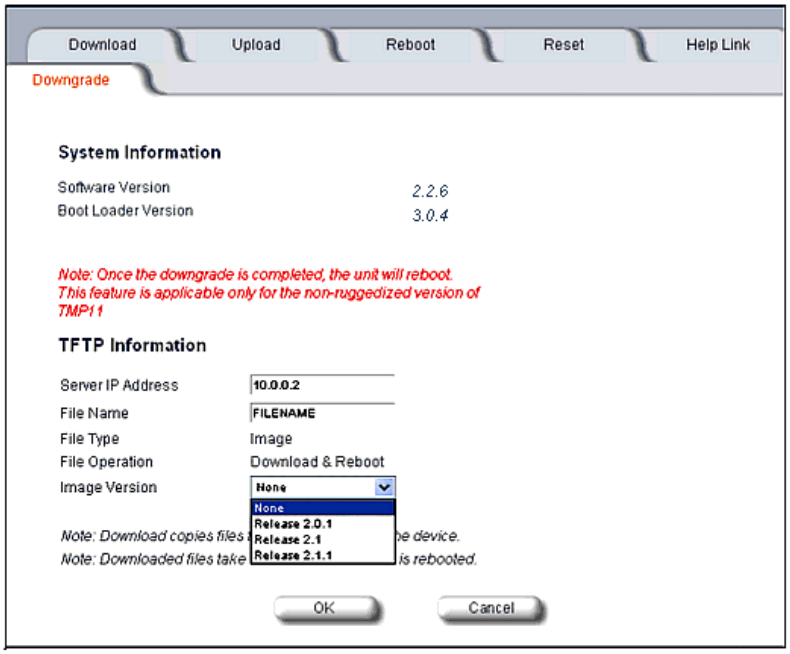
Click the **Commands** button and the **Help Link** tab to set the location of the help files of the Web Interface. Upon installation, the help files are installed in the **C:\Program Files\Tsunami\MP.11\Help** folder.

If you want to place these files on a shared drive, copy the **Help** folder to the new location and specify the new path in the **Help Link** box.



6) Downgrade to a Previous Release

Click the **Commands** button and the **Downgrade** tab to downgrade to a previous release. Downgrade currently is supported only to release 2.0.1 and later. Once you enter this command, the unit is downgraded to the specified release and is automatically rebooted. The filename specified and the filename of the image selected for downgrade must be the same version. The unit will download the file, re-format the configuration to match the version, and reboot to put the image into effect.



Chapter 6. Procedures

This chapter contains a set of procedures, as described in the following table:

Procedure	Description
TFTP Server Setup	Prepares the TFTP server for transferring files to and from the unit. This procedure is used by the other procedures that transfer files.
Image File Download	Upgrades the embedded software.
Configuration Backup	Saves the configuration of the unit.
Configuration Restore	Restores a previous configuration through configuration file download.
Soft Reset to Factory Default	Resets the unit to the factory default settings through the Web or Command Line Interface.
Hard Reset to Factory Default	In some cases, it may be necessary to revert to the factory default settings (for example, if you cannot access the unit or you lost the password for the Web Interface.
Force Reload	Completely resets the unit and erases the embedded software. Use this procedure only as a last resort if the unit does not boot and the "Hard Reset to Factory Default" procedure did not help. If you perform a "Forced Reload," you must download a new image file as described in "Image File Download with the Boot Loader."
Image File Download with the Boot Loader	If the unit does not contain embedded software, or the embedded software is corrupt, you can use this procedure to download a new image file.

TFTP SERVER SETUP

A Trivial File Transfer Protocol (TFTP) server lets you transfer files across a network. You can upload files from the unit for backup or copying, and you can download the files for configuration and Image upgrades. The SolarWinds TFTP server software is located on the product installation CD, or can be downloaded from http://support.proxim.com . You can also download the latest TFTP software from Solarwind's Web.

Note: If a TFTP server is not available in the network, you can perform similar file transfer operations using the HTTP interface.

To download or upload a file, you must connect to the computer with the TFTP server through the unit's Ethernet port. This can be any computer in the network or a computer connected to the unit with a cross-over Ethernet cable. For information about installing the TFTP server, see "Installing Documentation and Software" on page 15.

Ensure that the upload or download directory is correctly set, the required file is present in the directory, and the TFTP server is running. ***The TFTP server must be running only during file upload and download.*** You can check the connectivity between the unit and the TFTP server by pinging the unit from the computer that hosts the TFTP server. The ping program should show replies from the unit.

WEB INTERFACE IMAGE FILE DOWNLOAD

In some cases, it may be necessary to upgrade the unit's embedded software by downloading an image file. To download an image file through the Web Interface:

1. Set up the TFTP server as described in "TFTP Server Setup" on page 119.
2. Access the unit as described in "Web Interface Overview" on page 24.
3. Click the **Commands** button and the **Download** tab.
4. Fill in the following details:

   Server IP Address <IP address TFTP server>

   File Name <image file name>

   File Type Image

   File Operation Download
5. Click **OK** to start the file transfer.

The unit downloads the image file. The TFTP server program should show download activity after a few seconds. When the download is complete, the unit is ready to start the embedded software upon reboot.

CONFIGURATION BACKUP

You can back up the unit configuration by uploading the configuration file. You can use this file to restore the configuration or to configure another unit (see "Configuration Restore" on page 121).

To upload a configuration file through the Web Interface:

1. Set up the TFTP server as described in "TFTP Server Setup" on page 119.
2. Access the unit as described in "Web Interface Overview" on page 24.
3. Click the **Commands** button and the **Upload** tab.
4. Fill in the following details:
   Server IP Address <IP address TFTP server>
   File Name <configuration file name>
   File Type Config
   File Operation Upload
5. Click **OK** to start the file transfer.

The unit uploads the configuration file. The TFTP server program should show upload activity after a few seconds. When the upload is complete, the configuration is backed up.

CONFIGURATION RESTORE

You can restore the configuration of the unit by downloading a configuration file. The configuration file contains the configuration information of a unit.

To download a configuration file through the Web Interface:

1. Set up the TFTP server as described in "TFTP Server Setup" on page 119.
2. Access the unit as described in "Web Interface Overview" on page 24.
3. Click the **Commands** button and the **Download** tab.
4. Fill in the following details:
   Server IP Address <IP address TFTP server>
   File Name <configuration file name>
   File Type Config
   File Operation Download
5. Click **OK** to start the file transfer.

The unit downloads the configuration file. The TFTP server program should show download activity after a few seconds. When the download is complete and the system rebooted, the configuration is restored.

SOFT RESET TO FACTORY DEFAULT

If necessary, you can reset the unit to the factory default settings. Resetting to default settings means that you must configure the unit anew.

To reset to factory default settings using the Web Interface:

1. Click the **Commands** button and the **Reset** tab.
2. Click the **Reset to Factory Default** button.

The device configuration parameter values are reset to their factory default values.

If you do not have access to the unit, you can use the procedure described in "Hard Reset to Factory Default" below as an alternative.

HARD RESET TO FACTORY DEFAULT

If you cannot access the unit or you have lost its password, you can reset the unit to the factory default settings. Resetting to default settings means you must configure the unit anew.

To reset to factory default settings, press and hold the RELOAD button on the side of the unit's power supply for a minimum of 5 seconds but no more than 10 seconds. The configuration is deleted from the unit and the unit reboots, writing and using a default configuration.

Caution! If you hold the RELOAD button for longer than 20 seconds, you may go into Forced Reload mode, which erases the unit's embedded software. This software image must be reloaded through an Ethernet connection with a TFTP server. The image filename to be downloaded can be configured with either ScanTool through the Ethernet interface or with the Boot Loader CLI through the serial port to make the unit functional again.

FORCED RELOAD

With Forced Reload, you bring the unit into bootloader mode by erasing the embedded software. Use this procedure only as a last resort if the unit does not boot and the "Reset to Factory Defaults" procedure did not help. If you perform a Forced Reload, you must download a new image file with the Boot Loader (see "Image File Download with the Boot Loader" below).

To do a forced reload:

1. Disconnect and reconnect power to the unit; the unit resets and the LEDs flash.
2. Immediately press and hold the RELOAD button on the side of the unit's power supply for about 20 seconds. Image and configuration are deleted from the unit.
3. Follow the procedure "Image File Download with the Boot Loader" to download an image file.

IMAGE FILE DOWNLOAD WITH THE BOOTLOADER

The following procedures download an image file to the unit after the embedded software has been erased with **Forced Reload** or when the embedded software cannot be started by the Boot Loader.

A new image file can be downloaded to the unit with ScanTool or the Command Line Interface through the unit's serial port. In both cases, the file is transferred through Ethernet with TFTP. Because the CLI serial port option requires a serial RS-232C cable, Proxim recommends the ScanTool option.

Download with ScanTool

To download an image file with the ScanTool:

1. Set up the TFTP server as described in "TFTP Server Setup" on page 119.
2. Run ScanTool on a computer that is connected to the same LAN subnet as the unit. ScanTool scans the subnet for units and displays the found units in the main window. If in **Forced Reload**, ScanTool does not find the device until the unit bootloader times out from its default operation to download an image. Click **Rescan** to re-scan the subnet and update the display until the unit shows up in Bootloader mode.
3. Select the unit to which you want to download an image file and click Change.
4. Ensure that **IP Address Type Static** is selected and fill in the following details:
    - **Password**
    - **IP Address** and **Subnet Mask** of the unit.
    - **TFTP Server IP Address** and, if necessary, the **Gateway IP Address** of the TFTP server.
    - **Image File Name** of the file with the new image.
5. Click **OK** to start the file transfer.

    The unit downloads the image file. The TFTP server program should show download activity after a few seconds. When the download is complete, the LED pattern should return to **reboot** state. the unit is ready to start the embedded software.

After a Forced Reload procedure, the unit returns to factory default settings and must be reconfigured. ScanTool can be used to set the system name and IP address.

To access the unit see "Chapter 3. Management Overview" on page 21.

Download with CLI

To use the CLI through the serial port of the unit, you need a connector cable with a male RJ11 and a female DB9 connector (included with the unit) and an ASCII terminal program such as HyperTerminal. Proxim recommends you switch off the unit and the computer before connecting or disconnecting the serial RS-232C cable.

To download an image file:

1. Set up the TFTP server as described in “TFTP Server Setup” on page 119.
2. Start the terminal program (such as HyperTerminal), set the following connection properties, and then connect:

COM port	(for example COM1 or COM2, to which the unit serial port is connected)
Bits per second	9600
Data bits	8
Stop bits	1
Flow control	None
Parity	None

3. Disconnect and reconnect power to reset the unit; the terminal program displays Power On Self Test (POST) messages.
4. When the **`Sending Traps to SNMP manager periodically`** message is displayed after about 30 seconds, press the **ENTER** key.
5. The command prompt is displayed; enter the following commands:

```
set ipaddr <IP address nit>
set ipsubmask <subnet mask>
set ipaddrtype static
set tftpipaddr <IP address TFTP server>
set tftpfilename <image file name>
set ipgw <gateway IP address>
reboot
```

For example:

```
set ipaddr 10.0.0.12
set ipsubmask 255.255.255.0
set ipaddrtype static
set tftpipaddr 10.0.0.20
set tftpfilename image.bin
set ipgw 10.0.0.30
reboot
```

The unit reboots and downloads the image file. The TFTP server program should show download activity after a few seconds. When the download is complete, the unit is ready for configuration.

To access the unit see “Chapter 3. Management Overview” on page 21. Note that the IP configuration in normal operation differs from the IP configuration of the Boot Loader.

Chapter 7. Troubleshooting

This chapter helps you to isolate and solve problems with your unit. In the event this chapter does not provide a solution, or the solution does not solve your problem, check our support website at http://support.proxim.com/

Before you start troubleshooting, it is important that you have checked the details in the product documentation. For details about RADIUS, TFTP, terminal and telnet programs, and Web browsers, refer to their appropriate documentation.

In some cases, rebooting the unit clears the problem. If nothing else helps, consider a "Soft Reset to Factory Defaults" (on page 34) or a "Forced Reload" (on page 122). The Forced Reload option requires you to download a new image file to the unit.

CONNECTIVITY ISSUES

The issues described in this section relate to the connections of the unit.

Unit Does Not Boot

The unit shows no activity (the power LED is off).

1. Ensure that the power supply is properly working and correctly connected.
2. Ensure that all cables are correctly connected.
3. Check the power source.
4. If you are using an Active Ethernet splitter, ensure that the voltage is correct.

Serial Link Does Not Work

The unit cannot be reached through the serial port.

1. Check the cable connection between the unit and the computer.
2. Ensure that the correct COM port is used.
3. Start the terminal program; set the following connection properties (also see "HyperTerminal Connection Properties" in the *Tsunami MP.11 Reference Manual*), and then connect.

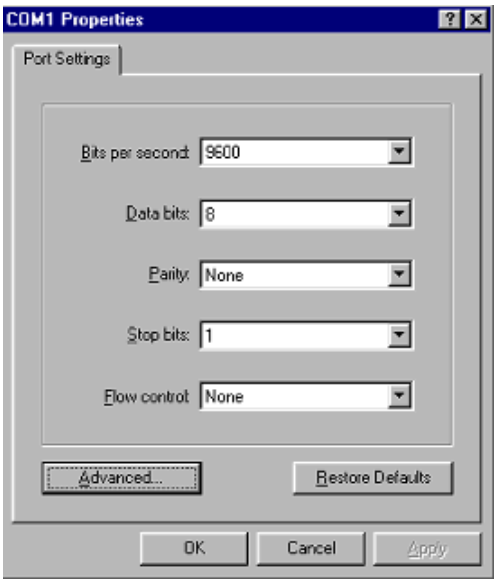
COM port	For example, COM1 or COM2, to which the unit serial port is connected
Bits per second	9600
Data bits	0
Stop bits	1
Flow control	None
Parity	None
Line ends	Carriage return with line feed

4. Ensure that the unit and the computer use the same serial port configuration parameters.
5. Disconnect and reconnect power to reset the unit. The terminal program displays Power On Self Tests (POST) messages and displays the following after approximately 90 seconds:
   `Please enter password:`

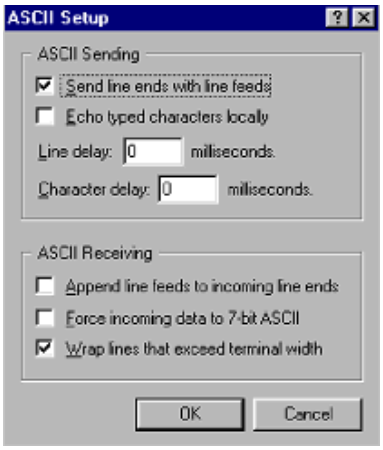
HyperTerminal Connection Problems

The serial connection properties can be found in HyperTerminal as follows:

1. Start HyperTerminal and select **Properties** from the **File** menu.
2. Select **Direct to Com 1** in the **Connect using:** drop-down list (depending upon the COM port you use); then click **Configure**. A window such as the following is displayed:



3. Make the necessary changes and click **OK**.
4. Click the **Settings** tab and then **ASCII Setup…**. A window similar to the following is displayed:



5. Ensure that **Send line ends with line feeds** is selected and click **OK** twice. HyperTerminal is now correctly configured.

Ethernet Link Does Not Work

First check the Ethernet LED;

GREEN	Power is on, the unit is up, and the Ethernet link is also up..
BLINKING GREEN	Power is on, the unit is coming up and the Ethernet is down.

Verify pass-through versus cross-over cable.

Cannot use the Web Interface

1. Open a command prompt window and enter **`ping`** `<ip address unit>` (for example **`ping 10.0.0.1`**).
   If the unit does not respond, make sure that you have the correct IP address.
   If the unit responds, the Ethernet connection is working properly, continue with this procedure.

2. Ensure that you are using one of the following Web browsers:
    - Microsoft Internet Explorer version 5.0 or later (Version 6.0 or later recommended)
    - Netscape version 6.0 or later.
3. Ensure that you are not using a proxy server for the connection with your Web browser.
4. Ensure that you have not exceeded the maximum number of Web Interface or CLI sessions.
5. Double-check the physical network connections. Use a well-known unit to ensure the network connection is properly functioning.
6. Perform network infrastructure troubleshooting (check switches, routers, and so on).

COMMUNICATION ISSUES

Two Units Are Unable to Communicate Wirelessly

If a wireless link is possible after testing two units within close distance of each other, then there are two possible reasons why wireless connectivity is not possible while the MP.11 units are at their desired locations:

- There may be a problem in the RF path, for example, a bad connector attachment (this is the most common problem in installations) or a bad cable (water ingress).

  Note: The cables can be swapped with known good ones as a temporary solution to verify cable quality.

- Another reason may be related to an interference problem caused by a high signal level from another unit. This can be checked by changing the frequency and then verifying whether another channel works better or by changing the polarization as a way of avoiding the interfering signal. To know in advance how much interference is present in a given environment, a Spectrum Analyzer can be attached to a (temporary) antenna for measuring the signal levels on all available Channels.

  Note: The antennas are usually not the problem, unless mounted upside down causing the drain hole to be quickly filled with radome.

If a wireless link is not possible after testing two units within close distance of each other, then the problem is either hardware or configuration related, such as a wrong Network name, Encryption key, Network Secret or Base Station Name. To eliminate these issues from being a factor, resetting the both units to factory defaults is the recommended solution.

If a wireless link is not possible after resetting the units and verifying that one unit is a BSU with WORP Base interface configured and the other is a Satellite, then the problem is not configuration related and the only remaining reason is a possible hw problem. Acquiring a third MP.11 and then testing it amongst the existing units will help pinpoint the broken unit.

SETUP AND CONFIGURATION ISSUES

The following issues relate to setup and configuration problems.

Lost Password

If you lost your password, you must reset the unit to the default settings. See “Hard Reset to Factory Default” on page 121. The default password is **public**.

If you record your password, keep it in a safe place.

The Unit Responds Slowly

If the unit takes a long time to become available, it could mean that:

- No DHCP server is available.
- The IP address of the unit is already in use.

  Verify that the IP address is assigned only to the unit. Do this by switching off the unit and then pinging the IP address. If there is a response to the ping, another device in the network is using the same IP address. If the unit uses a static IP address, switching to DHCP mode could remedy this problem. Also see "Setting the IP Address" on page 22.
- There is too much network traffic.

Web Interface Does Not Work

If you cannot connect to the unit Web server through the network:

1. Connect a computer to the serial port of the unit and check the HTTP status. The HTTP status can restrict HTTP access at different interfaces. For more information, see "Serial Port" in the *Tsunami MP.11 Reference Manual*.
2. Open a command prompt window and enter:

   `ping` `<ip address unit>` (for example `ping 10.0.0.1`)

   If the unit does not respond, ensure that you have the correct IP address. If the unit responds, the Ethernet connection is working properly, continue with this procedure.
3. Ensure that you are using one of the following Web browsers:
   - Microsoft Internet Explorer version 5.0 or later (Version 6.0 or later recommended)
   - Netscape version 6.0 or later
4. Ensure that you are not using a proxy server for the connection with your Web browser.
5. Ensure that you have not exceeded the maximum number of Web Interface sessions.

Command Line Interface Does Not Work

If you cannot connect to the unit through the network:

1. Connect a computer to the serial port of the unit and check the SNMP table. The SNMP table can restrict telnet or HTTP access. For more information, see "Serial Port" in the *Tsunami MP.11 Reference Manual*.
2. Open a command prompt window and enter: **`ping`** `<ip address unit>`
   (for example **`ping 10.0.0.1`**).
   - If the unit does not respond, ensure that you have the correct IP address.
   - If the unit responds, the Ethernet connection is working properly; continue with this procedure.
3. Ensure that you have not exceeded the maximum number of CLI sessions.

TFTP Server Does Not Work

With TFTP, you can transfer files to and from the unit. Also see "TFTP Server Setup" on page 119. If a TFTP server is not properly configured and running, you cannot upload and download files. The TFTP server:

- Can be situated either local or remote
- Must have a valid IP address
- Must be set for send and receive without time-out
- Must be running only during file upload and download

If the TFTP server does not upload or download files, it could mean:

- The TFTP server is not running
- The IP address of the TFTP server is invalid

- The upload or download directory is not correctly set
- The file name is not correct

Online Help Is Not Available

Online help is not available.

1. Make sure that the Help files are installed on your computer or server. Also see “Installing Documentation and Software” on page 16.
2. Verify whether the path of the help files in the Web Interface refers to the correct directory. See “Help” on page 118.

Changes Do Not Take Effect

Changes made in the Web Interface do not take effect:

1. Restart your Web browser. Log into the unit again and make changes. Reboot the unit when prompted to do so.
2. Wait until the reboot is completed before accessing the unit again.

VLAN OPERATION ISSUES

Verifying Proper Operation of the VLAN Feature

The correct VLAN configuration can be verified by “pinging” wired hosts from both sides of the device and the network switch. Traffic can be “sniffed” on the wired (Ethernet) network. Packets generated by hosts and viewed on one of the backbones should contain IEEE 802.1Q compliant VLAN headers when in Transparent mode. The VLAN ID in the headers should correspond to one of the VLAN Management IDs configured for the unit in Trunk mode.

The correct VLAN assignment can be verified by pinging:

- The unit to ensure connectivity
- The switch to ensure VLAN properties
- Hosts past the switch to confirm the switch is functional

Ultimately, traffic can be “sniffed” on the Ethernet interface using third-party packages. Most problems can be avoided by ensuring that 802.1Q compliant VLAN tags containing the proper VLAN ID have been inserted in the bridged frames. The VLAN ID in the header should correspond to the assigned VLAN.

What if network traffic is being directed to a nonexistent host?

- All sessions are disconnected, traffic is lost, and a manual override is necessary.
- Workaround: You can configure the switch to mimic the nonexistent host.

TROUBLESHOOTING LINK PROBLEMS

While wireless networking emerges more and more, the number of wireless connections to networks grows every day. The Tsunami MP.11 is one of the successful product families used by customers today who enjoy the day after day high-speed, cost-effective connections. To successfully use the connections, technicians must be able to troubleshoot the system effectively. This section gives hints on how a Tsunami MP.11 network could be analyzed in the case of “no link,” a situation in which the customer thinks that the link is down because there is no traffic being passed.

The four general reasons that a wireless link may not work are related to:

- Hardware

- Configuration
- Path issues (such as distance, cable loss, obstacles)

- Environment (anything that is outside the equipment and not part of the path itself)

You have tested the equipment in the office and have verified that the hardware and configurations are sound. The path calculation has been reviewed, and the path has been double-checked for obstacles and canceling reflections. Still, the user reports that the link does not work.

Most likely, the problem reported is caused by the environment or by improper tests to verify the connection. This article assumes that the test method, cabling, antennas, and antenna alignment have been checked. Always do this before checking the environment.

General Check

Two general checks are recommended before taking any action:

- Check whether the software version at both sides is the most current

- Check for any reported alarm messages in the Event Log

Statistics Check

Interference and other negative environment factors always have an impact on the number of correctly received frames. The Tsunami MP.11 models give detailed information about transmission errors in the Web interface, under **Monitor**.

The windows that are important for validating the health of the link are

Monitor / Wireless / General (Lowest level of the wireless network)

Check FCS errors: Rising FCS errors indicate interference or low fade margin. So does **Failed count**. If only one of those is high, this indicates that a source of interference is significant near one end of the link/

Monitor / Interfaces / Wireless (One level higher than Wireless / General)

The information is given after the wireless Ethernet frame is converted into a normal Ethernet frame. The parameters shown are part of the so-called MIB-II.

Both operational and admin status should be **up**. An admin status of **down** indicates that the interface is configured to be down.

In Discards and **Out Discards** indicate overload of the buffers, likely caused by network traffic, which is too heavy.

In Errors and **Out Errors** should never happen; however, it might happen if a frame's FCS was correct while the content was still invalid.

Monitor / Wireless / WORP (Statistics on WORP)

WORP runs on top of normal Ethernet, which means that the WORP frame is in fact the data field of the Ethernet frame. **Send Failure** or **Send Retries** must be low in comparison to **Send Success**. **Low** is about 1%. The same applies for **Receive Success** versus **Receive Retries** and **Receive Failures**. Note that the **Receive Failures** and **Retries** can be inaccurate. A frame from the remote site might have been transmitted without even being received; therefore, the count of that frame might not have been added to the statistics and the receiver simply could not know that there was a frame.

Remote Partners indicates how many SUs are connected (in case of a BSU) or whether a Base is connected (in case of a Subscriber).

Base Announces should increase continuously.

Registration Requests and **Authentication Requests** should be divisible by 3. WORP is designed in a way that each registration sequence starts with 3 identical requests. It is not a problem if, once in a while, one of those requests is missing. Missing requests frequently is to be avoided.

Monitor / Per Station (Information per connected remote partner)

Check that the received signal level (RSL) is the same on both sides; this should be the case if output power is the same. Two different RSLs indicate a broken transmitter or receiver. A significant difference between Local Noise and Remote Noise could indicate a source of interference near the site with the highest noise/. Normally, noise is about –80 dBm at 36 Mbps. This number can vary from situation to situation, of course, also in a healthy environment.

Monitor / Link Test (Information used by Administrators for on-the-spot checking)

Check the received signal level (RSL) and noise level. Compare the RSL with the values from path analysis. If the figures differ significantly from the values recorded at the Per Station window, check for environment conditions that change over time.

Analyzing the Spectrum

The ultimate way to discover whether there is a source of interference is to use a spectrum analyzer. Usually, the antenna is connected to the analyzer when measuring. By turning the antenna 360 degrees, one can check from which direction the interference is coming. The analyzer will also display the frequencies and the level of signal is detected.

Proxim recommends performing the test at various locations to find the most ideal location for the equipment.

Avoiding Interference

When a source of interference is identified and when the level and frequencies are known, the next step is to avoid the interference. Some of the following actions can be tried:

- Changing the channel to a frequency away from the interference is the first step in avoiding interference. For countries that require DFS, it might be not possible to manually select a different frequency.
- Each antenna has a polarization; try to change to a polarization different from the interferer.
- A small beam antenna looks only in one particular direction. Because of the higher gain of such an antenna, lowering the output power or adding extra attenuation might be required to stay legal. This solution cannot help when the source of interference is right behind the remote site.
- Lowering the antennas can help avoid seeing interference from far away.

Move the antennas to a different location on the premises. This causes the devices to look from a different angle, causing a different pattern in the reception of the signals. Use obstructions such as buildings, when possible, to shield from the interference.

Conclusion

A spectrum analyzer can be a great help to identify whether interference might be causing link problems on Tsunami MP.11 systems.

Before checking for interference, the link should be verified by testing in an isolated environment, to make sure that hardware works and your configurations are correct. The path analysis, cabling and antennas should be checked as well.

Statistics in the web interface under Monitor tell if there is a link, if the link is healthy, and a continuous test can be done using the Link Test.

Appendix A. Country Codes/Channels

In the CLI and MIB browser, the country code is set using the string code, as shown in the following example.

Example: To set Taiwan as the country:
`set syscountrycode tw`

The following tables contain information on frequency band availability, DFS requirements (802.11a only), and allowed channels/center frequencies for specific countries. Transmit Power Control is available for all countries. See the following tables:

MODEL 2454-R (2.4 GHZ)

Model 2454-R (2.4 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Band	Allowed Channels (Center Freq) for 5 MHz, 10 MHz and 20 MHz
Albenia (AL)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Algeria (DZ)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Argentina (AR)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Armenia (AM)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Australia (AU)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Austria (AT)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Azerbaijan (AZ)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Bahrain (BH)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Belarus (BY)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Belgium (BE)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Belize (BZ)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Bolivia (BO)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Brazil (BR),	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Brunei Darussalam (BN)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Bulgaria (BG)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Canada (CA)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462)
China (CN)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Colombia (CO)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462)
Costa Rica (CR)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Croatia (HR)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Cyprus (CY)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Denmark (DK)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Dominican Republic (DO)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462)
Egypt (EG)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)

Model 2454-R (2.4 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Band	Allowed Channels (Center Freq) for 5 MHz, 10 MHz and 20 MHz
El Salvador (SV)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Estonia (EE)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Finland (FI)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
France (FR)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Georgia (GE)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Germany (DE)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Greece (GR)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Guatemala (GT)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462)
Honduras (HN)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Hong Kong (HK)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Hungary (HU)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Iceland (IS)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
India (IN)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Indonesia (ID)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Iran (IR)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Ireland (IE)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Israel (IL)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Italy (IT)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Japan (JP)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Jordon (JO)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Kazakhstan (KZ)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Korea Republic (KR)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Kuwait (KW)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Latvia (LV)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Lebanon (LB)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Liechtenstein (LI)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Lithuania (LT)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Luxembourg (LU)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Macau (MO)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Macedonia (MK)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Malaysia (MY)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Malta (MT)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)

Model 2454-R (2.4 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Band	Allowed Channels (Center Freq) for 5 MHz, 10 MHz and 20 MHz
Mexico (MX)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462)
Monaco (MC)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Morocco (MA)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Netherlands (NL)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
New Zealand (NZ)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
North Korea (KP)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Norway (NO)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Oman (OM)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Pakistan (PK)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Panama (PA)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462)
Peru (PE)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Philippines (PH)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Poland (PL)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Portugal (PT)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Puerto Rico (PR)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462)
Quatar (QA)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Romania (RO)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Russia (RU)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Saudia Arabia (SA)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Singapore (SG)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Slovak Republic (SK)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Slovenia (SI)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
South Africa (ZA)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Spain (ES)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Sweden (SE)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Switzerland (CH)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Syria (SY)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Taiwan (TW)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Thailand (TH)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Trinidad and Tobago (TT)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Tunisia (TN)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Turkey (TR)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)

Model 2454-R (2.4 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Band	Allowed Channels (Center Freq) for 5 MHz, 10 MHz and 20 MHz
Ukraine (UA)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Ukraine (UA)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
United Arab Emirates (AE)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
United Kingdom (GB)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Uruguay (UY)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
USA (US)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462)
Uzbekistan (UZ)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Vietnam (VN)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Yemen (YE)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)
Zimbabwe (ZW)	2.4 GHz	**1** (2412), **2** (2417), **3** (2422), **4** (2427), **5** (2432), **6** (2437), **7** (2442), **8** (2447), **9** (2452), **10** (2457), **11** (2462), **12** (2467), **13** (2472)

MODEL 5054-R (5.8 GHZ)

Model 5054-R (5.8 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Bands	DFS	Allowed Channels (Center Freq)		
			20 MHz	10 MHz	5 MHz
Argentina (AR)	5.25 - 5.35 GHz and 5.725 - 5.825 GHz	No	**56** (5280), **60** (5300), **64** (5320), **149** (5745), **153** (5765), **157** (5785), **161** (5805)	**56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805)	**56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805)
Australia (AU)	5.725 - 5.85 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Austria (AT)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Belgium (BE)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)

Model 5054-R (5.8 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Bands	DFS	Allowed Channels (Center Freq)		
			20 MHz	10 MHz	5 MHz
Belize (BZ)	5.725 - 5.85 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Bolivia (BO)	5.725 - 5.85 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Brazil (BR)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Brazil1 (BR1)	5.725 - 5.85 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Brunei Darussalam (BN)	5.725 - 5.85 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Bulgaria (BG)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Canada (CA)	5.25 - 5.35 GHz and 5.725 - 5.85 GHz	No	**56** (5280), **60** (5300), **64** (5320), **149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
China (CN)	5.725 - 5.85 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Colombia (CO)	5.25 - 5.35 GHz and 5.725 - 5.85 GHz	No	**56** (5280), **60** (5300), **64** (5320), **149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)

Model 5054-R (5.8 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Bands	DFS	Allowed Channels (Center Freq)		
			20 MHz	10 MHz	5 MHz
Cyprus (CY)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Denmark (DK)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Dominican Republic (DO)	5.25 - 5.35 GHz and 5.725 - 5.85 GHz	No	**56** (5280), **60** (5300), **64** (5320), **149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Estonia (EE)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Finland (FI)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
France (FR)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)

Model 5054-R (5.8 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Bands	DFS	Allowed Channels (Center Freq)		
			20 MHz	10 MHz	5 MHz
Germany (DE)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Greece (GR)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Guatemala (GT)	5.25 - 5.35 GHz and 5.725 - 5.85 GHz	No	**56** (5280), **60** (5300), **64** (5320), **149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Hong Kong (HK)	5.725 - 5.85 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Hungary (HU)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Iceland (IS)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
India (IN)	5.15 - 5.35 GHz and 5.725 - 5.825 GHz	No	**36** (5180), **40** (5200), **44** (5220), **48** (5240), **52** (5260), **56** (5280), **60** (5300), **64** (5320), **149** (5745), **153** (5765), **157** (5785), **161** (5805)	**36** (5180), **38** (5190), **40** (5200), **42** (5210), **44** (5220), **46** (5230), **48** (5240), **50** (5250), **52** (5260), **54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815)	**36** (5180), **37** (5185), **38** (5190), **39** (5195), **40** (5200), **41** (5205), **42** (5210), **43** (5215), **44** (5220), **45** (5225), **46** (5230), **47** (5235), **48** (5240), **49** (5245), **50** (5250), **51** (5255), **52** (5260), **53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815)

Model 5054-R (5.8 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Bands	DFS	Allowed Channels (Center Freq)		
			20 MHz	10 MHz	5 MHz
Iran (IR)	5.725 - 5.85 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Ireland (IE)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Ireland 5.8 GHz (IE1)	5.725 - 5.85 GHz	Yes	**147** (5735), **151** (5755), **155** (5775), **167** (5835)	**145** (5725), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **163** (5815), **165** (5825), **167** (5835), **169** (5845)	**145** (5725), **146** (5730), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835), **168** (5840), **169** (5845), **170** (5850)
Italy (IT)	5.47 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Japan (JP)	5.25 - 5.35 GHz	Yes	**56** (5280), **60** (5300), **64** (5320)	**54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330)	**53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335)
Japan1 (JP1)	5.15 - 5.25 GHz	No	**36** (5180), **40** (5200), **44** (5220), **48** (5240)	**36** (5180), **38** (5190), **40** (5200), **42** (5210), **44** (5220), **46** (5230), **48** (5240)	**36** (5180), **37** (5185), **38** (5190), **39** (5195), **40** (5200), **41** (5205), **42** (5210), **43** (5215), **44** (5220), **45** (5225), **46** (5230), **47** (5235), **48** (5240)
Japan2 (JP2)	5.25 - 5.35 GHz	No	**36** (5180), **40** (5200), **44** (5220), **48** (5240)	**36** (5180), **38** (5190), **40** (5200), **42** (5210), **44** (5220), **46** (5230), **48** (5240)	**36** (5180), **37** (5185), **38** (5190), **39** (5195), **40** (5200), **41** (5205), **42** (5210), **43** (5215), **44** (5220), **45** (5225), **46** (5230), **47** (5235), **48** (5240)
Korea Republic (KR)	5.725 - 5.825 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805)	**147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815)	**147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815)
Korea Republic2 (KR2)	5.725 - 5.825 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805)	**147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815)	**147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815)
Latvia (LV)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)

Model 5054-R (5.8 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Bands	DFS	Allowed Channels (Center Freq)		
			20 MHz	10 MHz	5 MHz
Liechtenstein (LI)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Lithuania (LT)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Luxembourg (LU)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Macau (MO)	5.725 - 5.85 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Malaysia (MY)	5.25 - 5.35 GHz and 5.725 - 5.85 GHz	No	**56** (5280), **60** (5300), **64** (5320), **149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Malta (MT)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Mexico (MX)	5.725 - 5.85 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)

Model 5054-R (5.8 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Bands	DFS	Allowed Channels (Center Freq)		
			20 MHz	10 MHz	5 MHz
Netherlands (NL)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
New Zealand (NZ)	5.725 - 5.85 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
North Korea (KP)	5.725 - 5.825 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805)	**147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815)	**147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815)
Norway (NO)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Panama (PA)	5.25 - 5.35 GHz and 5.725 - 5.85 GHz	No	**56** (5280), **60** (5300), **64** (5320), **149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Philippines (PH)	5.25 - 5.35 GHz and 5.725 - 5.85 GHz	No	**56** (5280), **60** (5300), **64** (5320), **149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Poland (PL)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)

Model 5054-R (5.8 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Bands	DFS	Allowed Channels (Center Freq)		
			20 MHz	10 MHz	5 MHz
Portugal (PT)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Puerto Rico (PR)	5.25 - 5.35 GHz and 5.725 - 5.85 GHz	No	**56** (5280), **60** (5300), **64** (5320), **149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Russia (RU)	5.15 - 5.85 GHz	No	**30** (5150), **34** (5170), **38** (5190), **42** (5210), **46** (5230), **50** (5250), **54** (5270), **58** (5290), **62** (5310), **66** (5330), **70** (5350), **74** (5370), **78** (5390), **82** (5410), **86** (5430), **90** (5450), **94** (5470), **98** (5490), **102** (5510), **106** (5530), **110** (5550), **114** (5570), **118** (5590), **122** (5610), **126** (5630), **130** (5650), **134** (5670), **138** (5690), **142** (5710), **146** (5730), **150** (5750), **154** (5770), **158** (5790), **162** (5810), **166** (5830), **170** (5850)	**30** (5150), **32** (5160), **34** (5170), **36** (5180) **38** (5190), **40** (5200), **42** (5210), **44** (5220), **46** (5230), **48** (5240), **50** (5250), **52** (5260), **54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330), **68** (5340), **70** (5350), **72** (5360), **74** (5370), **76** (5380), **78** (5390), **80** (5400), **82** (5410), **84** (5420), **86** (5430), **88** (5440), **90** (5450), **92** (5460), **94** (5470), **96** (5480), **98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710), **144** (5720), **146** (5730), **148** (5740), **150** (5750), **152** (5760), **154** (5770), **156** (5780), **158** (5790), **160** (5800), **162** (5810), **164** (5820), **166** (5830), **168** (5840), **170** (5850)	**30** (5150), **31** (5155), **32** (5160), **33** (5165), **34** (5170), **35** (5175), **36** (5180), **37** (5185), **38** (5190), **39** (5195), **40** (5200), **41** (5205), **42** (5210), **43** (5215), **44** (5220), **45** (5225), **46** (5230), **47** (5235), **48** (5240), **49** (5245), **50** (5250), **51** (5255), **52** (5260), **53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335), **68** (5340), **69** (5345), **70** (5350), **71** (5355), **72** (5360), **73** (5365), **74** (5370), **75** (5375), **76** (5380), **77** (5385), **78** (5390), **79** (5395), **80** (5400), **81** (5405), **82** (5410), **83** (5415), **84** (5420), **85** (5425), **86** (5430), **87** (5435), **88** (5440), **89** (5445), **90** (5450), **91** (5455), **92** (5460), **93** (5465), **94** (5470), **95** (5475), **96** (5480), **97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710), **143** (5715), **144** (5720), **145** (5725), **146** (5730), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835), **168** (5840), **169** (5845), **170** (5850)
Saudi Arabia (SA)	5.15 - 5.35 GHz and 5.725 - 5.825 GHz	No	**36** (5180), **40** (5200), **44** (5220), **48** (5240), **52** (5260), **56** (5280), **60** (5300), **64** (5320), **149** (5745), **153** (5765), **157** (5785), **161** (5805)	**36** (5180), **38** (5190), **40** (5200), **42** (5210), **44** (5220), **46** (5230), **48** (5240), **50** (5250), **52** (5260), **54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815)	**36** (5180), **37** (5185), **38** (5190), **39** (5195), **40** (5200), **41** (5205), **42** (5210), **43** (5215), **44** (5220), **45** (5225), **46** (5230), **47** (5235), **48** (5240), **49** (5245), **50** (5250), **51** (5255), **52** (5260), **53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815)

Model 5054-R (5.8 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Bands	DFS	Allowed Channels (Center Freq)		
			20 MHz	10 MHz	5 MHz
Singapore (SG)	5.15 - 5.25 GHz and 5.725 - 5.85 GHz	No	**36** (5180), **40** (5200), **44** (5220), **48** (5240), **149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**36** (5180), **38** (5190), **40** (5200), **42** (5210), **44** (5220), **46** (5230), **48** (5240), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**36** (5180), **37** (5185), **38** (5190), **39** (5195), **40** (5200), **41** (5205), **42** (5210), **43** (5215), **44** (5220), **45** (5225), **46** (5230), **47** (5235), **48** (5240), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Slovak Republic (SK)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Slovenia (SI)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
South Africa (ZA)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Spain (ES)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Sweden (SE)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)

Model 5054-R (5.8 GHz) Channels/Frequencies by Country

Country (Code)	Frequency Bands	DFS	Allowed Channels (Center Freq)		
			20 MHz	10 MHz	5 MHz
Switzerland (CH)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
Taiwan (158)	5.25 - 5.35 GHz and 5.725 - 5.825 GHz	No	**56** (5280), **60** (5300), **64** (5320), **149** (5745), **153** (5765), **157** (5785), **161** (5805)	**54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815)	**53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815)
Thailand (TH)	5.725 - 5.825 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805)	**147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815)	**147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815)
United Kingdom (GB)	5.47 - 5.725 GHz	Yes	**100** (5500), **104** (5520), **108** (5540), **112** (5560), **116** (5580), **120** (5600), **124** (5620), **128** (5640), **132** (5660), **136** (5680), **140** (5700)	**98** (5490), **100** (5500), **102** (5510), **104** (5520), **106** (5530), **108** (5540), **110** (5550), **112** (5560), **114** (5570), **116** (5580), **118** (5590), **120** (5600), **122** (5610), **124** (5620), **126** (5630), **128** (5640), **130** (5650), **132** (5660), **134** (5670), **136** (5680), **138** (5690), **140** (5700), **142** (5710)	**97** (5485), **98** (5490), **99** (5495), **100** (5500), **101** (5505), **102** (5510), **103** (5515), **104** (5520), **105** (5525), **106** (5530), **107** (5535), **108** (5540), **109** (5545), **110** (5550), **111** (5555), **112** (5560), **113** (5565), **114** (5570), **115** (5575), **116** (5580), **117** (5585), **118** (5590), **119** (5595), **120** (5600), **121** (5605), **122** (5610), **123** (5615), **124** (5620), **125** (5625), **126** (5630), **127** (5635), **128** (5640), **129** (5645), **130** (5650), **131** (5655), **132** (5660), **133** (5665), **134** (5670), **135** (5675), **136** (5680), **137** (5685), **138** (5690), **139** (5695), **140** (5700), **141** (5705), **142** (5710)
United Kingdom 5.8 GHz (GB1)	5.725 - 5.85 GHz	Yes	**147** (5735), **151** (5755), **155** (5775), **167** (5835)	**145** (5725), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **163** (5815), **165** (5825), **167** (5835), **169** (5845)	**145** (5725), **146** (5730), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835), **168** (5840), **169** (5845), **170** (5850)
United States (US)	5.25 - 5.35 GHz and 5.725 - 5.85 GHz	No	**56** (5280), **60** (5300), **64** (5320), **149** (5745), **153** (5765), **157** (5785), **161** (5805), **165** (5825)	**54** (5270), **56** (5280), **58** (5290), **60** (5300), **62** (5310), **64** (5320), **66** (5330), **147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815), **165** (5825), **167** (5835)	**53** (5265), **54** (5270), **55** (5275), **56** (5280), **57** (5285), **58** (5290), **59** (5295), **60** (5300), **61** (5305), **62** (5310), **63** (5315), **64** (5320), **65** (5325), **66** (5330), **67** (5335), **147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815), **164** (5820), **165** (5825), **166** (5830), **167** (5835)
Uruguay (UY)	5.725 - 5.825 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805)	**147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815)	**147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815)
Venezuela (VE)	5.725 - 5.825 GHz	No	**149** (5745), **153** (5765), **157** (5785), **161** (5805)	**147** (5735), **149** (5745), **151** (5755), **153** (5765), **155** (5775), **157** (5785), **159** (5795), **161** (5805), **163** (5815)	**147** (5735), **148** (5740), **149** (5745), **150** (5750), **151** (5755), **152** (5760), **153** (5765), **154** (5770), **155** (5775), **156** (5780), **157** (5785), **158** (5790), **159** (5795), **160** (5800), **161** (5805), **162** (5810), **163** (5815)

Appendix B. Technical Specifications

Part Numbers **(North America region)**	**Model 2454-R Base Station Unit** • 2454-BSUR-US-WORLD — Tsunami MP.11 Model 2454-R Base Station Unit with Type-N Connector – US PSU -WORLD **Subscriber Unit** • 2454-SUA-US-WORLD — Tsunami MP.11 Model 2454-R Subscriber Unit with Type-N Connector – US PSU -WORLD • 2454-SUR-US-WORLD — Tsunami MP.11 Model 2454-R Subscriber Unit with Integrated 16-dBi Antenna – US PSU -WORLD **Model 5054-R Base Station Unit** • 5054-BSUR-US — Tsunami MP.11 Model 5054-R Base Station Unit with Type-N Connector – US PSU **Subscriber Unit** • 5054-SUA-US — Tsunami MP.11 Model 5054-R Subscriber Unit with Type-N Connector – US PSU • 5054-SUR-US — Tsunami MP.11 Model 5054-R Subscriber Unit with Integrated 23-dBi Antenna – US PSU
Part Numbers **(Europe and Middle East regions)**	**Model 2454-R Base Station Unit** • 2454-BSUR-EU — Tsunami MP.11 Model 2454-R Base Station Unit with Type-N Connector – Europe PSU • 2454-BSUR-UK — Tsunami MP.11 Model 2454-R Base Station Unit with Type-N Connector – UK PSU **Subscriber Unit** • 2454-SUA-EU — Tsunami MP.11 Model 2454-R Subscriber Unit with Type-N Connector – Europe PSU • 2454-SUA-UK — Tsunami MP.11 Model 2454-R Subscriber Unit with Type-N Connector – UK PSU • 2454-SUR-EU — Tsunami MP.11 Model 2454-R Subscriber Unit with Integrated 16-dBi Antenna – Europe PSU • 2454-SUR-UK — Tsunami MP.11 Model 2454-R Subscriber Unit with Integrated 16-dBi Antenna – UK PSU **Model 5054-R Base Station Unit** • 5054-BSUR-EU — Tsunami MP.11 Model 5054-R Base Station Unit with Type-N Connector – Europe PSU • 5054-BSUR-UK — Tsunami MP.11 Model 5054-R Base Station Unit with Type-N Connector – UK PSU **Subscriber Unit** • 5054-SUA-EU — Tsunami MP.11 Model 5054-R Subscriber Unit with Type-N Connector – Europe PSU • 5054-SUA-UK — Tsunami MP.11 Model 5054-R Subscriber Unit with Type-N Connector – UK PSU • 5054-SUR-EU — Tsunami MP.11 Model 5054-R Subscriber Unit with Integrated 23-dBi Antenna – Europe PSU • 5054-SUR-UK — Tsunami MP.11 Model 5054-R Subscriber Unit with Integrated 23-dBi Antenna – UK PSU

Part Numbers

(Asia Pacific region)

Model 2454-R
Base Station Unit

• 2454-BSUR-AU	Tsunami MP.11 Model 2454-R Base Station Unit with Type-N Connector – Australia PSU
• 2454-BSUR-UK	Tsunami MP.11 Model 2454-R Base Station Unit with Type-N Connector – UK PSU
• 2454-BSUR-US	Tsunami MP.11 Model 2454-R Base Station Unit with Type-N Connector – US PSU
• 2454-BSUR-EU	Tsunami MP.11 Model 2454-R Base Station Unit with Type-N Connector – Europe PSU
• 2454-BSUR-CN	Tsunami MP.11 Model 2454-R Base Station Unit with Type-N Connector – China PSU
• 2454-BSUR-SK	Tsunami MP.11 Model 2454-R Base Station Unit with Type-N Connector – South Korea PSU
• 2454-BSUR-US-WORLD	Tsunami MP.11 Model 2454-R Base Station Unit with Type-N Connector – US/CAN PSU – WORLD

Subscriber Unit

• 2454-SUA-AU	Tsunami MP.11 Model 2454-R Subscriber Unit with Type-N Connector – Australia PSU
• 2454-SUA-UK	Tsunami MP.11 Model 2454-R Subscriber Unit with Type-N Connector – UK PSU
• 2454-SUA-US	Tsunami MP.11 Model 2454-R Subscriber Unit with Type-N Connector – US PSU
• 2454-SUA-EU	Tsunami MP.11 Model 2454-R Subscriber Unit with Type-N Connector – EU PSU
• 2454-SUA-CN	Tsunami MP.11 Model 2454-R Subscriber Unit with Type-N Connector – China PSU
• 2454-SUA-SK	Tsunami MP.11 Model 2454-R Subscriber Unit with Type-N Connector – South Korea PSU
• 2454-SUA-US WORLD	Tsunami MP.11 Model 2454-R Subscriber Unit with Type-N Connector – US/CAN PSU – WORLD
• 2454-SUR-AU	Tsunami MP.11 Model 2454-R Subscriber Unit with Integrated 16-dBi Antenna – Australia PSU
• 2454-SUR-UK	Tsunami MP.11 Model 2454-R Subscriber Unit with Integrated 16-dBi Antenna – UK PSU
• 2454-SUR-US	Tsunami MP.11 Model 2454-R Subscriber Unit with Integrated 16-dBi Antenna – US PSU
• 2454-SUR-EU	Tsunami MP.11 Model 2454-R Subscriber Unit with Integrated 16-dBi Antenna – EU PSU
• 2454-SUR-CN	Tsunami MP.11 Model 2454-R Subscriber Unit with Integrated 16-dBi Antenna – China PSU
• 2454-SUR-SK	Tsunami MP.11 Model 2454-R Subscriber Unit with Integrated 16-dBi Antenna – South Korea PSU
• 2454-SUR-US-WORLD	Tsunami MP.11 Model 2454-R Subscriber Unit with Integrated 16-dBi Antenna – US/CAN PSU - WORLD

Model 5054-R
Base Station Unit

• 5054-BSUR-AU	Tsunami MP.11 Model 5054-R Base Station Unit with Type-N Connector – Australia PSU
• 5054-BSUR-UK	Tsunami MP.11 Model 5054-R Base Station Unit with Type-N Connector – UK PSU
• 5054-BSUR-US	Tsunami MP.11 Model 5054-R Base Station Unit with Type-N Connector – US PSU
• 5054-BSUR-EU	Tsunami MP.11 Model 5054-R Base Station Unit with Type-N Connector – Europe PSU
• 5054-BSUR-US-WORLD	Tsunami MP.11 Model 5054-R Base Station Unit with Type-N Connector – US/CAN PSU - WORLD

	Subscriber Unit • 5054-SUA-AU — Tsunami MP.11 Model 5054-R Subscriber Unit with Type-N Connector – Australia PSU • 5054-SUA-UK — Tsunami MP.11 Model 5054-R Subscriber Unit with Type-N Connector – UK PSU • 5054-SUA-US — Tsunami MP.11 Model 5054-R Subscriber Unit with Type-N Connector – US PSU • 5054-SUA-EU — Tsunami MP.11 Model 5054-R Subscriber Unit with Type-N Connector – EU PSU • 5054-SUA-US-WORLD — Tsunami MP.11 Model 5054-R Subscriber Unit with Type-N Connector – US/CAN PSU - WORLD • 5054-SUR-AU — Tsunami MP.11 Model 5054-R Subscriber Unit with Integrated 23-dBi Antenna – Australia PSU • 5054-SUR-UK — Tsunami MP.11 Model 5054-R Subscriber Unit with Integrated 23-dBi Antenna – UK PSU • 5054-SUR-US — Tsunami MP.11 Model 5054-R Subscriber Unit with Integrated 23-dBi Antenna – US PSU • 5054-SUR-EU — Tsunami MP.11 Model 5054-R Subscriber Unit with Integrated 23-dBi Antenna – EU PSU • 5054-SUR-US-WORLD — Tsunami MP.11 Model 5054-R Subscriber Unit with Integrated 23-dBi Antenna – US/CAN PSU - WORLD
Part Numbers **(Caribbean and Latin America region)**	**Model 2454-R Base Station Unit** • 2454-BSUR-US — Tsunami MP.11 Model 2454-R Base Station Unit with Type-N Connector – US PSU **Subscriber Unit** • 2454-SUA-US — Tsunami MP.11 Model 2454-R Subscriber Unit with Type-N Connector – US PSU • 2454-SUR-US — Tsunami MP.11 Model 2454-R Subscriber Unit with Integrated 23-dBi Antenna – US PSU **Model 5054-R Base Station Unit** • 5054-BSUR-US — Tsunami MP.11 Model 5054-R Base Station Unit with Type-N Connector – US PSU • 5054-BSUR-BR — Tsunami MP.11 Model 5054-R Base Station Unit with Type-N Connector – Brazil PSU **Subscriber Unit** • 5054-SUA-US — Tsunami MP.11 Model 5054-R Subscriber Unit with Type-N Connector – US PSU • 5054-SUA-BR — Tsunami MP.11 Model 5054-R Subscriber Unit with Type-N Connector – Brazil PSU • 5054-SUR-US — Tsunami MP.11 Model 5054-R Subscriber Unit with Integrated 23-dBi Antenna – US PSU • 5054-SUR-BR — Tsunami MP.11 Model 5054-R Subscriber Unit with Integrated 23-dBi Antenna – Brazil PSU
Part Numbers (Universal)	**Accessories** • 848 274 163 — Surge Arrestor 0-3 GHz - Standard-N Female to Female • 5054-SURGE — Surge Arrestor 5 GHz - Standard-N Female to Female • 848 274 171 — 20 ft Low Loss Antenna Cable St-N - Male-Male LMR 200 • 848 332 789 — 20 ft Low Loss Antenna Cable St-N - Male-Male LMR 400 • 848 274 197 — 50 ft Low Loss Antenna Cable St-N - Male-Male LMR 400 • 848 274 205 — 75 ft Low Loss Antenna Cable St-N - Male-Male LMR 400 • 69828 — 6 ft Low Loss Antenna Cable St-N - Male-Male LMR 600 • 5054-LMR600-50 — 50 ft Low Loss Antenna Cable St-N - Male-Male LMR 600 • 70251 — PoE (Power over Ethernet) Surge Arrestor for Tsunami MP.11 and QuickBridge.11

Outdoor Ethernet Cables

- 69819 — 25m outdoor, terminated CAT5 cable for Tsunami MP.11 or QB.11 with three RJ-45 and one weather-proof Ethernet port cap
- 69820 — 50m outdoor, terminated CAT5 cable for Tsunami MP.11 or QB.11 with three RJ-45 and one weather-proof Ethernet port cap
- 69821 — 75m outdoor, terminated CAT5 cable for Tsunami MP.11 or QB.11 with three RJ-45 and one weather-proof Ethernet port cap

Power Injector

- 69823 — Spare Power DC Injector for Tsunami MP.11 or QB.11 (-R model ONLY)

2.4 GHz Antennas

- 848 515 722 — 5 dBi Omni-Directional Vehicle Antenna w/Integrated 250 cm cable
- 848 312 591 — 7 dBi Omni-Directional Base Station Antenna - St-N Female
- 848 515 698 — 10 dBi Omni-Directional Base Station Antenna - St-N Female
- 848 515 706 — 12 dBi Directional Wide Angle Antenna (120 degrees) - St-N Female
- 2411WA12-STN — 12 dBi Wide Angle Antenna with Integrated 2 m cable (st-N) Mountable on Window or Flat Surface
- 848 515 714 — 24 dBi Directional Antenna (Parabolic Grid) - St-N Female
- 2400-SA60-14 — 14dBi Directional sector antenna (60 degrees) 2.4GHz St-N Female

5 GHz Antennas

- 5054-PA-18 — 18 dBi Panel Antenna - St-N Female - 5.25 - 5.875 GHz
- 5054-PA-23 — 23 dBi Panel Antenna - St-N Female - 5.725 - 5.875 GHz
- 5054-OA-8 — 8 dBi Omni Directional Antenna - St-N Female - 5.47-5.850 GHz
- 5054-OA-10 — 10 dBi Omni Directional Antenna - St-N Female - 5.47-5.850 GHz
- 5054-SA120-14 — 14 dBi Sector Antenna - St-N Female - 5.25-5.850 GHz - 120 degrees
- 5054-SA60-17 — 17 dBi Sector Antenna - St-N Female - 5.25-5.850 GHz - 60 degrees

Regulatory Approvals and Frequency Ranges for 2454-R[1]

Model 2454-R

Country	Number of Channels				Certification
North America					
USA	(GHz)	5MHz	10MHz	20MHz	Yes
Canada	2.40 - 2.4835	11	Up to 11	Up to 11	
Mexico	2.40 - 2.472	13	Up to 13	Up to 13	
EU Countries					
Austria	(GHz)	5MHz	10MHz	20MHz	Yes
Belgium	• 2.40 - 2.4835	13	Up to 13	Up to 13	
Cyprus					
Czech Republic					
Denmark					
Estonia					
Finland					
France					

Germany					
Greece					
Hungary					
Ireland					
Italy					
Latvia					
Luxemburg					
Lithuania					
Malta					
Netherlands					
Poland					
Portugal					
Spain					
Sweden					
Slovakia					
Slovenia					
United Kingdom	(GHz)	5MHz	10MHz	20MHz	Yes
	2.40 - 2.4835	13	Up to 13	Up to 13	
Other European Countries					
Iceland					
Liechtenstein	(GHz)	5MHz	10MHz	20MHz	Yes
Norway	2.40 - 2.4835	13	Up to 13	Up to 13	
Switzerland					
South America					
Brazil	(GHz)	5MHz	10MHz	20MHz	In Process
	2.40 - 2.4835	13	Up to 13	Up to 13	
APAC					
Australia	(GHz)	5MHz	10MHz	20MHz	Yes
New Zealand	2.40 - 2.4835	13	Up to 13	Up to 13	
Japan					
Hong Kong					

	S. Korea China Taiwan
Regulatory Approvals and Frequency Ranges for 5054-R1	**Model 5054-R**

Country	Number of Channels				Certification
North America					
USA	(GHz)	5MHz	10MHz	20MHz	
	5.25 - 5.35	Up to 15	Up to 7	Up to 3	
	5.725 - 5.85	Up to 21	Up to 11	Up to 5	
Canada	(GHz)	5MHz	10MHz	20MHz	Yes
	5.25 - 5.35	Up to 15	Up to 7	Up to 3	
	5.725 - 5.85	Up to 21	Up to 11	Up to 5	
Mexico	(GHz)	5MHz	10MHz	20MHz	
	5.725 - 5.85	Up to 21	Up to 11	Up to 5	
EU Countries					
Austria Belgium Cyprus Czech Republic Denmark Estonia Finland France Germany Greece Hungary Italy Latvia Luxemburg Lithuania Malta Netherlands	(GHz)	5MHz	10MHz	20MHz	Yes
	5.47 - 5.70	Up to 46	Up to 23	Up to 11	

Poland					
Portugal					
Spain					
Sweden					
Slovakia					
Slovenia					
United Kingdom	(GHz)	5MHz	10MHz	20MHz	Yes
Ireland	5.47 - 5.70	Up to 46	Up to 23	Up to 11	
	5.725 - 5.85	Up to 23	Up to 11	Up to 4	
Other European Countries					
Iceland					
Liechtenstein	(GHz)	5MHz	10MHz	20MHz	Yes
Norway	5.47 - 5.70	Up to 46	Up to 23	Up to 11	
Switzerland					
Russia	(GHz)	5MHz	10MHz	20MHz	In Process
	5.15 - 5.85	Up to 141	Up to 71	Up to 36	
South America					
Brazil	(GHz)	5MHz	10MHz	20MHz	Yes
	5.47-5.70	Up to 46	Up to 23	Up to 11	
	5.725 - 5.85	Up to 19	Up to 10	Up to 5	
Argentina	(GHz)	5MHz	10MHz	20MHz	Yes
	5.25-5.35	Up to 9	Up to 5	Up to 3	
	5.725 - 5.85	Up to 13	Up to 7	Up to 4	
Colombia	(GHz)	5MHz	10MHz	20MHz	Yes
	5.25-5.35	Up to 15	Up to 7	Up to 3	
	5.725 - 5.85	Up to 21	Up to 11	Up to 5	
APAC					
Australia	(GHz)	5MHz	10MHz	20MHz	Yes
New Zealand	5.725 - 5.85	Up to 21	Up to 11	Up to 5	
Hong Kong					
S. Korea	(GHz)	5MHz	10MHz	20MHz	Yes

China	5.725-5.85	Up to 17	Up to 9	Up to 5	
Taiwan	(GHz)	5MHz	10MHz	20MHz	Yes
	5.25-5.35	Up to 15	Up to 7	Up to 3	
	5.725-5.85	Up to 17	Up to 9	Up to 5	
Singapore	(GHz)	5MHz	10MHz	20MHz	In Process
	5.15-5.25	Up to 13	Up to 7	Up to 4	
	5.725-5.825	Up to 17	Up to 9	Up to 5	
India	(GHz)	5MHz	10MHz	20MHz	In Process
	5.15-5.35	Up to 32	Up to 16	Up to 7	
	5.725-5.825	Up to 17	Up to 9	Up to 5	

Integrated Antenna Specification

Model 2454-R
Subscriber Unit with Integrated 16-dBi Antenna

- Part Number 2454-SUR-xx
- Frequency range 2.4 to 2.5 GHz
- Nominal Impedance 50 Ohms
- Gain 16 dBi
- Front-to-Back Ratio 25 dB
- HPBW/vertical 22 degrees
- HPBW/horizontal 15 degrees
- Cross Polarization 20 dB
- Power handling 1 W
- VSWR 1.5 : 1 Max

Model 5054-R
Subscriber Unit with Integrated 23-dBi Antenna

- Part Number 5054-SUR-xx
- Frequency range 5250 - 5875 MHz
- Nominal Impedance 50 ohms
- Gain 23 dBi
- Front-to-Back Ratio 35 dB
- HPBW/vertical 9 degrees
- HPBW/horizontal 9 degrees
- Cross Polarization 23 dB
- Power handling 1 W (cw)
- VSWR 2.0 : 1 Max

RF Modulation and over-the-air rates

Model 2454-R and 5054-R
OFDM (Orthogonal Frequency Division Multiplexing)

	20 MHz Channels	10 MHz Channels	5 MHz Channels
• BPSK	6 and 9 Mbps	3 and 4.5 Mbps	2.25 and 1.5 Mbps
• QPSK	12 and 18 Mbps	6 and 9 Mbps	3 and 4.5 Mbps
• 16-QAM	24 and 36 Mbps	12 and 18 Mbps	6 and 9 Mbps

- Maximum Packet Size 1522 Bytes

Wireless Protocol

- WORP (Wireless Outdoor Router Protocol)

Device Interface

Ethernet

- Auto-sensing 10/100BASE-TX Ethernet

Antenna Connector for BSU and SU with Type-N Connector

- Standard Type-N Female

Network Architecture Type

- Infrastructure

Receive Sensitivity (BER=10-6)

Model 2454-R

Modulation	40 MHz Channels Turbo Mode (US only)	20 MHz Channels Standard Mode	10 MHz Channels Standard Mode	5 MHz Channels Standard Mode
64QAM ¾	-66 dBm @108Mbps	-69 dBm @54Mbps	-72 dBm @36Mbps	-75 dBm @18Mbps
64QAM ½	-68 dBm @96Mbps	-72 dBm @48Mbps	-75 dBm @24Mbps	-78 dBm @12Mbps
16QAM ¾	-75dBm @72Mbps	-77 dBm @36Mbps	-80 dBm @18Mbps	-83 dBm @9Mbps
16QAM ½	-78dBm @48Mbps	-80 dBm @24Mbps	-83 dBm @12Mbps	-86 dBm @6Mbps
QPSK ¾	-81dBm @36Mbps	-83 dBm @18Mbps	-86 dBm @9Mbps	-89 dBm @4.5Mbps
QPSK ½	-83 dBm @24Mbps	-86 dBm @12Mbps	-89 dBm @6Mbps	-92 dBm @3Mbps
BPSK ¾	-84 dBm @18Mbps	-87 dBm @9Mbps	-90 dBm @4.5Mbps	-93 dBm @2.25Mbps
BPSK ½	-85 dBm @12Mbps	-88 dBm @6Mbps	-91 dBm @3Mbps	-94 dBm @1.5Mbps

Model 5054-R

Modulation	40 MHz Channels Turbo Mode (US only)	20 MHz Channels Standard Mode	10 MHz Channels Standard Mode	5 MHz Channels Standard Mode
64QAM ¾	-66 dBm @108Mbps	-69 dBm @54Mbps	-72 dBm @36Mbps	-75 dBm @18Mbps
64QAM ½	-68 dBm @96Mbps	-72 dBm @48Mbps	-75 dBm @24Mbps	-78 dBm @12Mbps
16QAM ¾	-75dBm @72Mbps	-77 dBm @36Mbps	-80 dBm @18Mbps	-83 dBm @9Mbps
16QAM ½	-78dBm @48Mbps	-80 dBm @24Mbps	-83 dBm @12Mbps	-86 dBm @6Mbps
QPSK ¾	-81dBm @36Mbps	-83 dBm @18Mbps	-86 dBm @9Mbps	-89 dBm @4.5Mbps
QPSK ½	-83 dBm @24Mbps	-86 dBm @12Mbps	-89 dBm @6Mbps	-92 dBm @3Mbps
BPSK ¾	-84 dBm @18Mbps	-87 dBm @9Mbps	-90 dBm @4.5Mbps	-93 dBm @2.25Mbps
BPSK ½	-85 dBm @12Mbps	-88 dBm @6Mbps	-91 dBm @3Mbps	-94 dBm @1.5Mbps

Model 5054-R-LR

Modulation	40 MHz Channels Turbo Mode (US only)	20 MHz Channels Standard Mode	10 MHz Channels Standard Mode	5 MHz Channels Standard Mode
64 QAM ¾	-70 dBm @ 108 Mbps	-73 dBm @ 54 Mbps	-73 dBm @ 36 Mbps	-76 dBm @ 18 Mbps
64 QAM ½	-72 dBm @ 96 Mbps	-75 dBm @ 48 Mbps	-76 dBm @ 24 Mbps	-79 dBm @ 12 Mbps
16 QAM ¾	-74 dBm @ 72 Mbps	-84 dBm @ 36 Mbps	-81 dBm @ 18 Mbps	-83 dBm @ 9 Mbps
16 QAM ½	-78 dBm @ 48 Mbps	-85 dBm @ 24 Mbps	-84 dBm @ 12 Mbps	-86 dBm @ 6 Mbps
QPSK ¾	-81 dBm @ 36 Mbps	-89 dBm @ 18 Mbps	-87 dBm @ 9 Mbps	-89 dBm @ 4.5 Mbps
QPSK ½	-83 dBm @ 24 Mbps	-90 dBm @ 12 Mbps	-90 dBm @ 6 Mbps	-92 dBm @ 3 Mbps
BPSK ¾	-84 dBm @ 18 Mbps	-93 dBm @ 9 Mbps	-81 dBm @ 4.5 Mbps	-93 dBm @ 2.25 Mbps
BPSK ½	-85 dBm @ 12 Mbps	-94 dBm @ 6 Mbps	-91 dBm @ 3 Mbps	-95 dBm @ 1.5 Mbps

Maximum Throughput (Mbps)

Model 2454-R

Data rate	20 MHz Channels	10 MHz Channels	5 MHz Channels Standard Mode
54Mbps	30 Mbps		
48Mbps	28 Mbps		
36Mbps	18 Mbps		
24Mbps	14 Mbps		
18Mbps	12 Mbps	12 Mbps	
12Mbps	9 Mbps	9 Mbps	
9Mbps	7 Mbps	7 Mbps	6.8 Mbps
6Mbps	5 Mbps	5 Mbps	5 Mbps
4.5Mbps		4 Mbps	4 Mbps
3Mbps		2 Mbps	2.7 Mbps
2.25Mbps			2 Mbps
1Mbps			1.4 Mbps

Model 5054-R

Data rate	40 MHz Channels Turbo Mode (US Only)	20 MHz Channels Standard Mode	10 MHz Channels Standard Mode	5 MHz Channels Standard Mode
108Mbps Turbo 54	31 Mbps			

	96Mbps Turbo 48	28 Mbps			
	72Mbps Turbo 36	28 Mbps			
	48Mbps Turbo 24	28 Mbps			
	36Mbps Turbo 18	24 Mbps			
	24Mbps Turbo 12	19 Mbps			
	54Mbps		29 Mbps		
	48Mbps		27 Mbps		
	36Mbps		22 Mbps		
	24Mbps		16 Mbps	16 Mbps	
	18Mbps		13 Mbps	13 Mbps	
	12Mbps		9 Mbps	9 Mbps	
	9Mbps		7 Mbps	7 Mbps	7 Mbps
	6Mbps		5 Mbps	5 Mbps	4.7 Mbps
	4.5Mbps			3.6 Mbps	3.8 Mbps
	3Mbps			2.4 Mbps	2.7 Mbps
	2.25Mbps				2 Mbps
	1Mbps				1.2 Mbps

**Maximum-throughput data with release 2.3, as measured with test equipment under controlled lab conditions and best performing packet size. In some instances, data compression yields throughput equal to the configured data rate. Actual throughput performance in the field may vary.*

Latency

< 10ms typical at maximum throughput*

** under throughput test conditions indicated above*

Transmit Power Settings

Model 2454-R

	6-24 Mbps @ 20 MHz 16QAM ½; QPSK ¾; QPSK ½; BPSK ¾; BPSK ½	**36 Mbps @ 20 MHz** 16QAM ¾	**48 Mbps @ 20 MHz** 64QAM ½	**54 Mbps @ 20 MHz** 64QAM ¾
2.400-2.483 GHz	16 dBm	16 dBm	14 dBm	13 dBm

Output Power Attenuation: 0 - 18dB, in 3dB steps

Output Power Values will have a tolerance of +- 1.5 dB

Model 5054-R

	6-24 Mbps @ 20 MHz 16QAM ½; QPSK ¾; QPSK ½; BPSK ¾; BPSK ½	**36 Mbps @ 20 MHz** 16QAM ¾	**48 Mbps @ 20 MHz** 64QAM ½	**54 Mbps @ 20 MHz** 64QAM ¾
5.15-5.35 GHz	15 dBm	13 dBm	12 dBm	11 dBm
5.47-5.725 GHz	16 dBm	13 dBm		
5.725-5.850 GHz	16 dBm	13 dBm		

Output Power Attenuation: 0 - 18dB, in 3dB steps

Output Power Values will have a tolerance of +- 1.5 dB

Model 5054-R-LR

	6-24 Mbps @ 20 MHz 16QAM ½; QPSK ¾; QPSK ½; BPSK ¾; BPSK ½	**36 Mbps @ 20 MHz** 16QAM ¾	**48 Mbps @ 20 MHz** 64QAM ½	**54 Mbps @ 20 MHz** 64QAM ¾
5.15-5.35 GHz	20 dBm	20 dBm	20 dBm	20 dBm
5.725-5.850 GHz	25 dBm	23 dBm	22 dBm	20 dBm

Range Information for 5054-R[2]

Integrated Antenna

	36 Mbps	6 Mbps
5.15-5.35 GHz (US)	1.2mi/2.0km	3.0mi/4.8km
5.47-5.7GHz (ETSI)	1.1mi/1.8km	3.1mi/5.0km
5.725-5.850 (US)	2.1mi/3.8km	6.4mi/10.3km

External Antenna

	36 Mbps	6 Mbps
5.15-5.35 GHz (US)	1.2mi/2.0km	3.2mi/5.1km
5.47-5.7GHz (ETSI)	1.1mi/1.8km	3.1mi/5.0km
5.725-5.850 (US)	4.1mi/6.6km	12.5mi/20.1km

Minimum fade margin; 99.995% or better availability; average terrain/climate; no unusual multipath; proper path clearance (0.6F1).

Distance calculations for 5 and 10 MHz channels are comparable for ETSI regulatory domains. Proper TPC

<table>
<tr><td></td><td>settings (-9dB@20MHz, -12dB@10MHz, -15dB@5MHz), should be set to meet power density rules.</td></tr>
<tr><td>Range information for 2454-R²</td><td>Integrated Antenna
<table>
<tr><th></th><th>36 Mbps</th><th>6 Mbps</th></tr>
<tr><td>2.4-2.4835GHz (US)</td><td>2.1mi/3.4km</td><td>6.9mi/11.1km</td></tr>
<tr><td>2.4-2.8 GHz (ETSI)</td><td>0.7mi/1.1km</td><td>2.6mi/4.2km</td></tr>
</table>
External Antenna (23dBi SU antenna)
<table>
<tr><th></th><th>36 Mbps</th><th>6 Mbps</th></tr>
<tr><td>2.4-2.4835GHz (US)</td><td>3.4mi/5.5km</td><td>11.4mi/18.3km</td></tr>
<tr><td>2.4-2.8 GHz (ETSI)</td><td>0.7mi/1.1km</td><td>2.6mi/4.2km</td></tr>
</table>
Minimum fade margin; 99.995% or better availability; average terrain/climate; no unusual multipath; proper path clearance (0.6F1).</td></tr>
<tr><td>System Processor and Memory</td><td>• 166MHz Motorola 8241 processor
• 16 Mbytes RAM
• 8 Mbytes FLASH</td></tr>
<tr><td>Software Specification</td><td><u>Base Station and Subscriber Units</u>
• Miscellaneous
  ◦ WORP protocol
  ◦ Dynamic Data Rate Selection
  ◦ Transmit Power Control
  ◦ Antenna Alignment
  ◦ Integrity Check for Software Upload
  ◦ 5, 10, and 20MHz channels
• Satellite Density
  ◦ Dynamic Frequency Selection
• Redundancy
  ◦ Spanning Tree (802.1D)
• Bridging and Routing
  ◦ Bridge (802.1d)
  ◦ IP/ RIPv1 (RFC 1058)
  ◦ IP/ RIPv2 (RFC 1388)
  ◦ CIDR (RFC 1519)
  ◦ ICMP (RFC 792)
  ◦ IP (RFC 791)
  ◦ ARP (RFC 826)
• Filtering
  ◦ Ethernet protocol (Ethertype)
  ◦ Static MAC
  ◦ Storm threshold
  ◦ IP address
  ◦ Broadcast protocol</td></tr>
</table>

	• Services
	  • DHCP Server (RFC 2131)
	  • DHCP Client (RFC 2131)
	  • Bi-Directional Bandwidth Control
	
	• VLAN
	  • 802.1Q
	
	• Security Features
	  • MAC Authentication
	  • Radius MAC Access Control
	  • WEP/AES-OCB encryption
	  • RADIUS (RFC 2138)
	
	• Mobility
	  • Subscriber Unit Roaming
	
	Base Station Unit
	• Filtering
	  • Intra Cell Blocking
	
	Subscriber Unit
	• Services
	  • NAT (RFC 3022)
	  • DHCP Relay (RFC 2131)

Security	• WORP provides critical feature support for secure long-range wireless deployments in unlicensed frequency spectrum. • MD5 (embedded in WORP) authentication between BSU and SU. • Filter based on packet information such as unicast/multicast/ broadcast MAC or IP. • Secure “over the air encryption” with WEP, WEP+, and AES, and AES-CCB. • Authentication via Radius • Intracell blocking allows the BSU to act as the central policy enforcer for SU to SU communications.
Management	• SU/BSU statistics • Link Test • Temperature logging • SNMPv1/v2 RFC 1157 • SNMP v2c RFC 1907 • HTTP Server RFC 2616 • Telnet RFC 855 • TFTP client RFC 783 • CLI • MIB-II RFC 1213 • Ethernet-like MIB RFC 1643 • Bridge MIB RFC 1493 • 802.3MAU RFC 2668 • 802.11 MIB • Remote reboot (reload) or reset to factory default via power injector • Private MIB

	• Orinoco MIB
Antenna Alignment Tools	• Audible Tone • CLI output
Status LEDs	• Two indicators on the RJ-45 connector to indicate power, wireless traffic, and Ethernet traffic
Local Configuration Support	**RS-232 Serial port** • RJ11 port built-into the unit • DB9 Female via a converter (included)
Compliance and Standards	**Safety** • UL 60950, UL50 • CSA 22.2 No. 60950-00 • IEC 60950 3rd Ed (1999) **Radio Approvals** • USA FCC 15.107, 15-109; 15-203-15.205, 15.207, 15.209; 15.247; 15.401-15.407 • Canada RSS-102; RSS-210; ICES-003 • Europe (ETSI) EN 301.893; EN 300.328; EN 301.489-1; EN 301.489-17; EN 300-440; EN50371 • ARIB STD-T71, STD 33, STD 66 **EMI and Susceptibility (Class B)** • USA FCC Part 15.107 • Canada ICES-003 **Water and Dust Proof** • NEMA4/IP56
Electrical	**5054-R / 2454-R POE Power Injector** • Custom Power over Ethernet (802.3af compatible) • Input: Voltage 110 to 250 VAC (47-63Hz) • Output: 48V @ 420mA MAX (injected into the Cat-5 Cable) • Pin for Remote reboot (reload) or reset to factory default **5054-R / 2454-R Outdoor Radio Unit** • Power Consumption: 7.5W typical. Up to 20 Watts across full operating temperature range. • Input: Voltage 42 to 60 VDC
Dimensions	**Base Station and Subscriber Unit** • Packaged: 14.57 in x 13.70 in x 8.19 in (370 mm x 348 mm x 208 mm) **Base Station and Subscriber Unit with Type-N Connector** • Unpackaged: 10.5 in x 10.5 in x 3.25 in (267 mm x 267 mm x 83 mm) **Subscriber Unit with Integrated 23-dBi Antenna** • Unpackaged: 12.60 in x 12.60 in x 3.50 in (320 mm x 320 mm x 89 mm)
Weight	**Base Station and Subscriber Unit with Type-N Connector** • Packaged weight: 9.2 lbs (4.2 kg) • Unpackaged weight: 5.5 lbs (2.49 kg) Unit-only, .45 lbs (.20 kg) for power supply

	Subscriber Unit with Integrated 23-dBi or 16-dBi Antenna • Packaged weight: 10.1 lbs (4.6 kg) • Unpackaged weight: 6.0 lbs (2.72 kg) Unit-only, .45 lbs (.20 kg) for power supply
Environmental	**Operating** • -33º to 60ºC (-27.5º to 140º Fahrenheit) • 100% humidity • Wind loading: 125mph **Storage** • -55º to 80ºC (-41º to 176º Fahrenheit) • 100% humidity
Packaging Contents	**Base Station or Subscriber Unit** • One Tsunami MP.11 Model 2454-R or 5054-R Base Station or Subscriber Unit • One wall/ pole mounting bracket • One Power-Over-Ethernet injector for Model 2454-R or 5054-R • One country specific power cord • One Ethernet cable weather-proof plug • One Documentation and Software CD-ROM
MTBF	• 100,000 hrs
Warranty	• One year

1 Check with the local regulatory agency for certain restrictions

2 - PMP configuration using USA regulations for L and U bands, ETSI regulations for M bands
- Clear LOS
- 99.995% availability
- Sector antenna (17dBi, 60-degrees) at BSU with short 1dB jumper cable
- Fade margin minimum of 10dB to 2 miles, 0.2dB additional fade margin for every 0.1 mile to 15dB
- Predicted availability >99.990% (one-way) for all configurations
- Distance calculations for 5 and 10 MHz channels are comparable for ETSI regulatory domains. Proper TPC settings (3 and 6dB) respectively, should be set to meet power density rules. Increased distances are possible in the US with proper link engineering.

Appendix C. Lightning Protection

Lightning protection is used to maximize the reliability of communications equipment by safely re-directing current from a lightning strike or a power surge traveling along the Cat 5 Ethernet cabling to ground using the shortest path possible. Designing a proper grounding system prior to installing any communications equipment is critical to minimize the possibility of equipment damage, void warranties, and cause serious injury.

The surge arrestor (sometimes referred to as a lightning protector) can protect your sensitive electronic equipment from high-voltage surges caused by discharges and transients at the PoE.

Proxim Wireless offers superior lightning and surge protection for Tsunami MP.11 and Tsunami QuickBridge.11 products. Contact your reseller or distributor for more information.

Technical Support

If you are having a problem using a Proxim WAN product and cannot resolve it with the information in the product documentation, gather the following information and contact Proxim Technical Support at http://support.proxim.com/:

- What kind of network are you using?
- What were you doing when the error occurred?
- What error message did you see?
- Can you reproduce the problem?

Be sure to obtain an RMA number at http://www.proxim.com/support/rmaservices/ before sending any equipment to Proxim for repair.

Email Support

To receive E-mail technical support, be sure to include the serial number of the product(s) in question. The serial number should be on the product and conform to the following format: ##AT########, ##UT########, or ##R7########. We are unable to respond to your inquiry without this information.

Telephone Support

Telephone support is available M-F 8:00 AM to 6:00 PM, Pacific Time. Use the following telephone numbers:

USA and Canada: 1-866-674-6626 (Toll Free)

International: +1-408-542-5390

Proxim Web Site Support

Search Knowledgebase:	http://support.proxim.com/
Download latest software and documentation:	http://support.proxim.com/

Statement of Warranty

Warranty Coverage – Proxim Wireless Corporation warrants that its Products are manufactured solely from new parts, conform substantially to specifications, and will be free of defects in material and workmanship for a Warranty Period of **1 year** from the date of purchase.

Repair or Replacement – In the event a Product fails to perform in accordance with its specification during the Warranty Period, Proxim offers return-to-factory repair or replacement, with a thirty (30) business-day turnaround from the date of receipt of the defective Product at a Proxim Wireless Corporation Repair Center. When Proxim has reasonably determined that a returned Product is defective and is still under Warranty, Proxim shall, at its option, either: (a) repair the defective Product; (b) replace the defective Product with a refurbished Product that is equivalent to the original; or (c) where repair or replacement cannot be accomplished, refund the price paid for the defective Product. The Warranty Period for repaired or replacement Products shall be ninety (90) days or the remainder of the original Warranty Period, whichever is longer. This constitutes Buyer's sole and exclusive remedy and Proxim's sole and exclusive liability under this Warranty.

Limitations of Warranty – The express warranties set forth in this Agreement will not apply to defects in a Product caused; (i) through no fault of Proxim during shipment to or from Buyer, (ii) by the use of software other than that provided with or installed in the Product, (iii) by the use or operation of the Product in an application or environment other than that intended or recommended by Proxim, (iv) by modifications, alterations, or repairs made to the Product by any party other than Proxim or Proxim's authorized repair partners, (v) by the Product being subjected to unusual physical or electrical stress, or (vii) by failure of Buyer to comply with any of the return procedures specified in this Statement of Warranty.

Support Procedures – Buyer should return defective LAN Products[1] within the first 30 days to the merchant from which the Products were purchased. Buyer can contact a Proxim Customer Service Center either by telephone or via web. Calls for support for Products that are near the end of their warranty period should be made not longer than seven (7) days after expiration of warranty. Repair of Products that are out of warranty will be subject to a repair fee. Contact information is shown below. Additional support information can be found at Proxim's web site at http://support.proxim.com.

LAN Products[1]:	Domestic calls:	1-866-674-6626	(24 hours per day, 7 days per week)
	International calls:	1-408-542-5390	
WAN Products[2]:	Domestic calls:	1-866-674-6626	(8:00 A.M. – 5:00 P.M, M-F Pacific Time)
	International calls:	1-408-542-5390	

When contacting the Customer Service Center for support, Buyer should be prepared to provide the Product description and serial number and a description of the problem. The serial number should be on the Product.

In the event the Customer Service Center determines that the problem can be corrected with a software update, Buyer might be instructed to download the update from Proxim's web site or, if that's not possible, the update will be sent to Buyer. In the event the Customer Service Center instructs Buyer to return the Product to Proxim for repair or replacement, the Customer Service Center will provide Buyer a Return Material Authorization ("RMA") number and shipping instructions. Buyer must return the defective Product to Proxim, properly packaged to prevent damage, shipping prepaid, with the RMA number prominently displayed on the outside of the container.

Calls to the Customer Service Center for reasons other than Product failure will not be accepted unless Buyer has purchased a Proxim Service Contract or the call is made within the first thirty (30) days of the Product's invoice date. Calls that are outside of the 30-day free support time will be charged a fee of $25.00 (US Dollars) per Support Call.

If Proxim reasonably determines that a returned Product is not defective or is not covered by the terms of this Warranty, Buyer shall be charged a service charge and return shipping charges.

Other Information

Other Adapter Cards – Proxim does not support internal mini-PCI devices that are built into laptop computers, even if identified as "ORiNOCO" devices. Customers having such devices should contact the laptop vendor's technical support for assistance.

For support for a PCMCIA card carrying a brand name other than Proxim, ORiNOCO, Lucent, Wavelan, or Skyline, Customer should contact the brand vendor's technical support for assistance.

[1] LAN products include: ORiNOCO

[2] WAN products include: Lynx, Tsunami, Tsunami MP, Tsunami QuickBridge