

5.3 Spectrum Dominance

The Silvus radios come with special features that allow it to analyze the frequency spectrum as it is deployed in the field. This will give a network administrator some powerful tools to deploy a functioning network. If there is interference on a channel, the spectrum dominance features in the Silvus radios will allow a way to detect it, and find the channel with the least amount of interference.

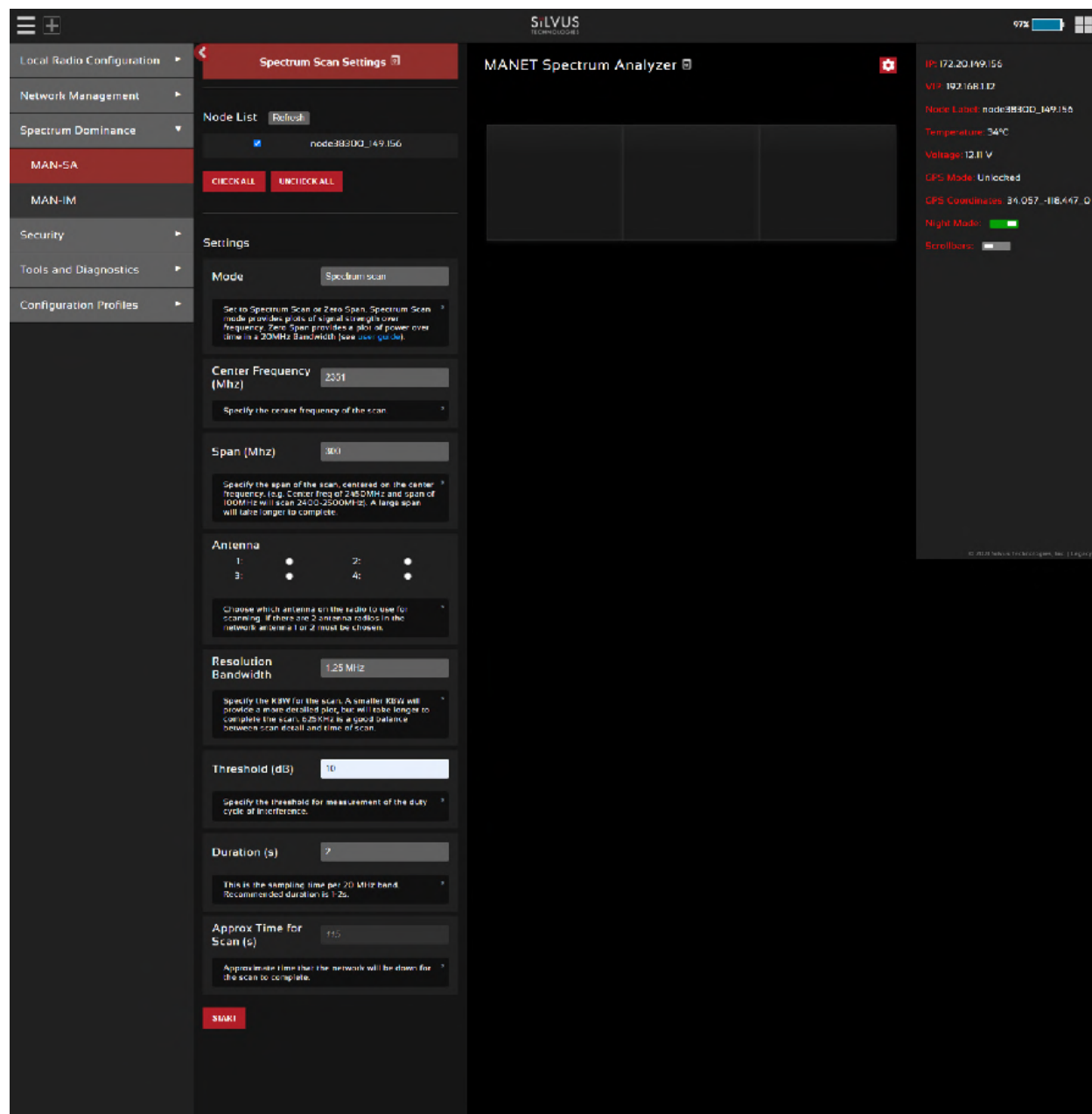


Figure 65 Spectrum Dominance

5.3.1 Spectrum Analyzer

The first tool in the Spectrum Dominance section is the spectrum analyzer. The spectrum scan feature turns a Silvus network of radios into a distributed spectrum analyzer. When a scan is initiated, each selected radio in the network will go offline, perform a scan of the requested range, and report back.

5.3.1.1 Spectrum Analyzer Settings

Spectrum Scan Settings

Node List Refresh

☒ node25905 101.49	☒ node30225 118.17
☒ node31327 122.95	☒ node51475 201.19
☒ node51539 201.83	

Settings

Mode: Spectrum scan

Center Frequency (Mhz): 2350

Span (Mhz): 300

Antenna:

1: ☒	2: ☐
3: ☐	4: ☐

Resolution Bandwidth: 1.25 MHz

Threshold (dB): 10

Duration (s): 2

This is the sampling time per 20 MHz band. Recommended duration is 1-2s.

Approx Time for Scan (s): 115

START

Figure 66 Spectrum Scan Settings

Clicking the settings icon (⚙️) at the top right of the window will show the settings panel as shown in **Figure 66 Spectrum Scan Settings**. The node list shows the list of nodes currently connected into the mesh network. Any nodes selected will be used as part of the spectrum scan. Nodes that are unchecked will resume normal operation. Note that an unchecked node will continue transmitting in the frequency channel it is operating in and its transmission will show up in the scan results of scanning radios.

Mode – Set to Spectrum Scan or Zero Span. Spectrum Scan mode provides plots of signal strength over frequency. Zero Span provides a plot of power over time in a 20MHz Bandwidth (see **Figure 69 Zero Span Results** below)

Spectrum Scan Mode:

Center Frequency – Specify the center frequency of the scan.

Span – Specify the span of the scan, centered on the center frequency. (e.g. Center freq of 2450MHz and span of 100MHz will scan 2400-2500MHz). A large span will take longer to complete.

Antenna Mask – Choose which antenna on the radio to use for scanning. If there are 2 antenna radios in the network antenna 1 or 2 must be chosen.

Resolution Bandwidth – Specify the RBW for the scan. A smaller RBW will provide a more detailed plot, but will take longer to complete the scan. 625KHz is a good balance between scan detail and time of scan.

Threshold – Specify the threshold for measurement of the duty cycle of interference.

Duration – Duration of each scan. A longer duration will provide better accuracy but will take longer to complete.

Approximate time for scan – Approximate time that the network will be down for the scan to complete.

5.3.1.2 Spectrum Scan Results

Figure 67 Spectrum Scan Results below shows the results from a scan of a network of 6 radios. The checkboxes at the top allow users to show or hide plots from specific radios. The three plots provided are:

Average – Displays the average power over the time duration specified in the settings.

Peak – Displays the peak power seen at any point during the scan for each frequency. This is the equivalent of the 'Max Hold' feature on common spectrum analyzers.

Threshold – Displays the duty cycle of interference stronger than the user specified 'Threshold' power. In the example above, the threshold was set to 5dB. The plot is showing the percentage of time that the measured power is more than 5dB above the radio's noise floor.



Figure 67 Spectrum Scan Results

5.3.1.3 Zero Span Mode

The screenshot shows the Spectrum Scan Settings interface. At the top, there is a back arrow and the title "Spectrum Scan Settings". Below the title is a "Node List" section with a "Refresh" button. The node list contains five nodes: node25905_101.49, node30225_118.17, node31327_122.95, node51475_201.19, and node51539_201.63. Below the node list is a "Settings" section. The "Mode" is set to "Zero span". The "Center Frequency (Mhz)" is set to "2250". The "Sampling rate (Msps)" is set to "0.3". The "Antenna" section shows four options: 1, 2, 3, and 4, with radio buttons next to each. The "Duration (s)" is set to "2". Below the duration, there is a note: "This is the sampling time per 20 MHz band. Recommended duration is 1-2s." The "Approx Time for Scan (s)" is set to "27". At the bottom, there is a red "START" button.

Figure 68 Zero Span Settings

In the Zero Span mode, the radio will provide a plot of the power measured in a 20MHz bandwidth across time. Zero Span can only be conducted on one radio in the network at a time. Other radios in the network will continue to operate and transmit so a zero span scan should not be conducted within the same frequency that the mesh network is operating in.

Center Frequency – Specify the center frequency of the scan.

Sampling Rate – Set the sampling rate of the scan. (0.3Msps recommended)

Antenna Mask – Choose which antenna on the radio to use for scanning. If there are 2 antenna radios in the network antenna 1 or 2 must be chosen.

Duration – Duration of each scan. A longer duration will provide better accuracy but will take longer to complete.

Approximated time for scan – Approximate time that the network will be down for the scan to complete.



Figure 69 Zero Span Results

5.3.2 MAN-IM (MANET Interference Monitoring)

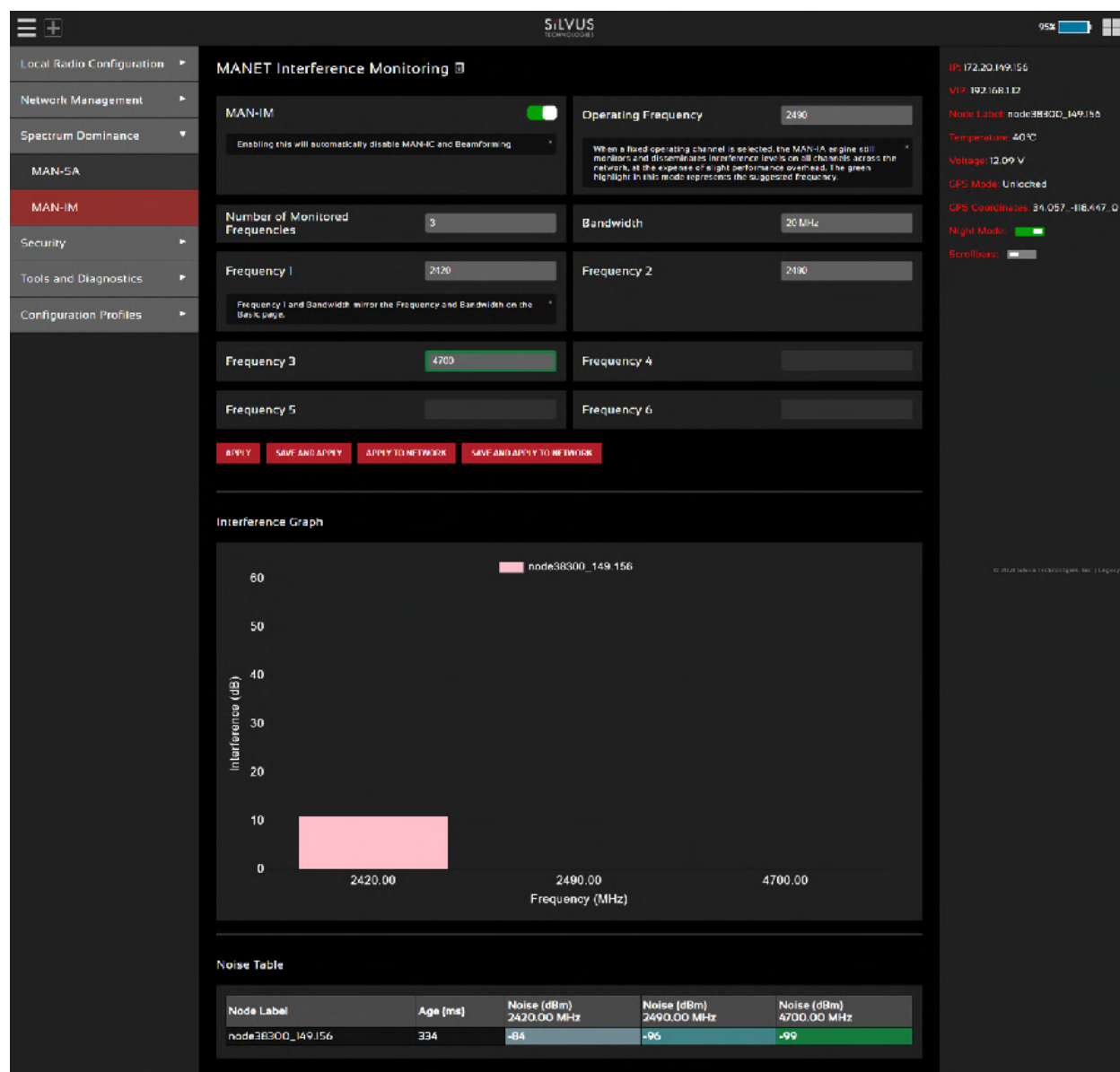


Figure 70 MAN-IM

MAN-IM is a feature that has been developed to help live monitor the interference levels on several frequencies. When monitoring these frequencies, you can decide whether the network would benefit from changing channels to a less congested frequency. When enabling MAN-IM you will automatically disable Tx beamforming.

Configuring MAN-IM:

MAN-IM- The first parameter in the menu allows enabling or disabling the MAN-IM feature. All radios within a network should have this enabled in order to operate properly.

Operating Frequency- You can quickly jump between operating frequencies that are listed in the MAN-IM frequency list. Select the operating frequency from the drop down menu and click apply or save and apply to change the operating frequency.

Number of Valid Frequencies- This configuration is the number of channels that the MAN-IM feature will monitor. All radios within a network should have this configured the same in order to operate properly.

Bandwidth- This is the bandwidth of the channels. All radios within a network should have this configured the same in order to operate properly. This setting will override the bandwidth setting on the 'Basic' page.

Frequencies- These are the center frequencies of the channels to be monitored. Frequency 1 will override the Frequency setting on the 'Basic' page. All radios within a network should have the same frequency set in order to operate properly.

Configuration changes can be propagated to the entire network by clicking 'Apply to Network' or 'Save and Apply to Network'. Note that this update will take around 1-2 minutes to take effect.

MAN-IM Metrics

Once configured, the MAN-IM functionality of the network can be monitored in real-time. The bar graph is a visual representation of the interference on each channel at each node. It will show the reported noise level measured by each radio in the network, in each channel being monitored.

The 'Age' field indicates the time since the last update received from each node in the network.

The frequency with the lowest reported amount of interference will be highlighted in green.

NOTE: transition time will get longer if the number of hops in the network increases and as traffic increases.

5.3.3 MAN-IA (MANET Interference Avoidance) (License enabled)

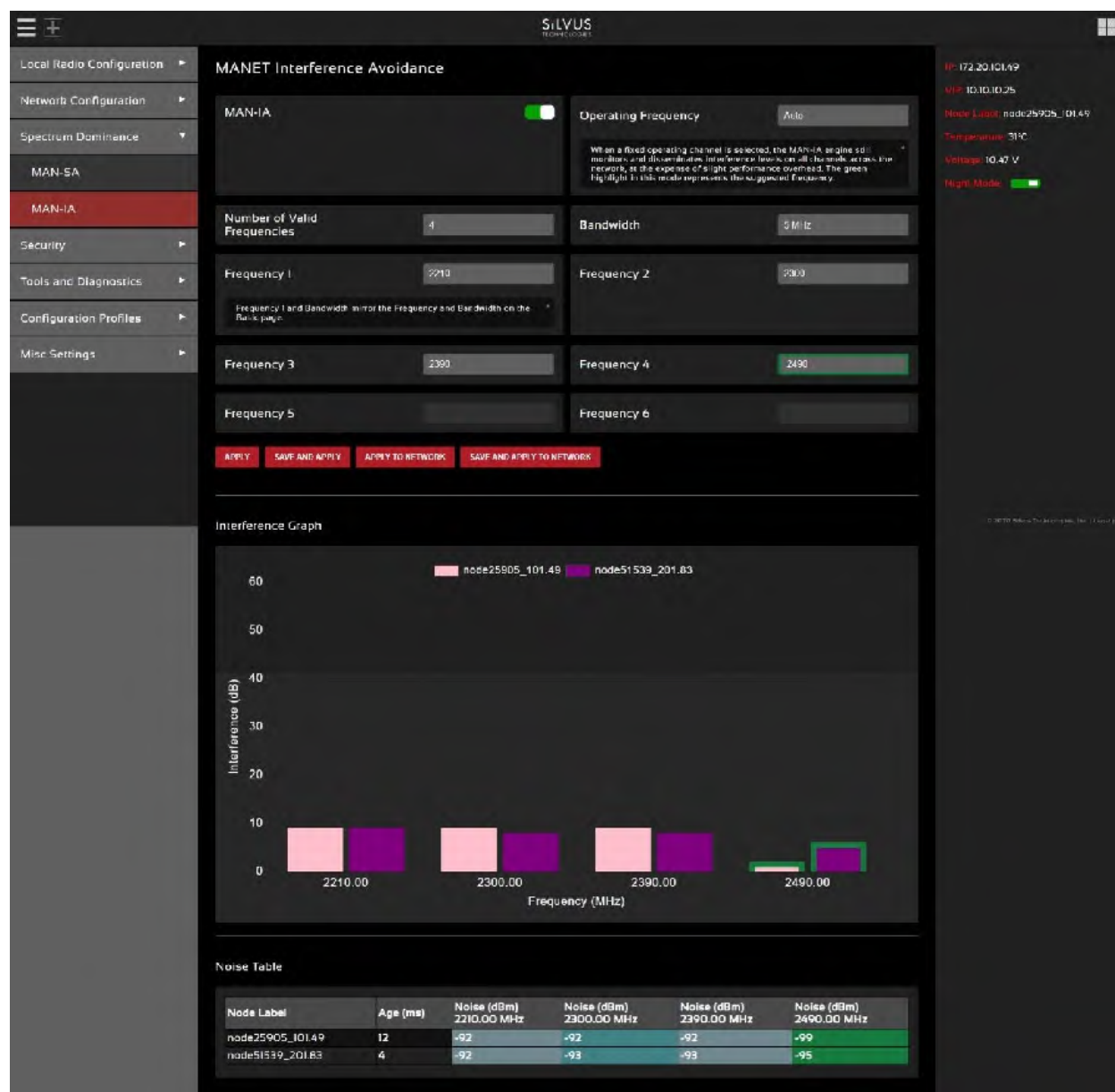


Figure 71 MAN-IA

MANET Interference Avoidance (MAN-IA) is a license enabled feature that provides Silvus radios the capability to monitor interference and dynamically configure the network to avoid congested spectrum. MAN-IA allows a network administrator to select up to 6 preset frequencies for each radio in the network to monitor in real-time, with no impact on normal network operations. If another channel is

cleaner and has less interference than the current channel, the network will rapidly move to the better channel. MAN-IA will disable Tx beamforming.

Configuring MAN-IA:

The MAN-IA feature will require a software license on each node that will participate in the MAN-IA enabled network. The MAN-IA feature is not a part of the standard StreamScape release.

MAN-IA can be configured from the 'MAN-IA' tab in the radio GUI, as shown above.

MAN-IA- The first parameter in the menu allows enabling or disabling the MAN-IA feature. All radios within a network should have this enabled in order to operate properly.

Operating Frequency- When set to 'Auto' mode, the radios will share interference information and automatically change to the channel which is determined to be the best for the network to operate on. The chosen channel will be highlighted in green. Note that 'Auto' mode will have some additional network overhead. If this setting is set to a fixed frequency, the radios will no longer automatically change frequencies. In this case, the channel highlighted in green will be the suggested best channel. All radios within a network should have this configured the same in order to operate properly.

Number of Valid Frequencies- This configuration is the number of channels that the MAN-IA feature will monitor and jump between. All radios within a network should have this configured the same in order to operate properly.

Bandwidth- This is the bandwidth of the channels. All radios within a network should have this configured the same in order to operate properly. This setting will override the bandwidth setting on the 'Basic' page.

Frequencies- These are the center frequencies of the channels to be monitored and jump between. Frequency 1 will override the Frequency setting on the 'Basic' page. All radios within a network should have the same frequency set in order to operate properly.

Configuration changes can be propagated to the entire network by clicking 'Apply to Network' or 'Save and Apply to Network'. Note that this update will take around 1-2 minutes to take effect.

MAN-IA Metrics

Once configured, the MAN-IA functionality of the network can be monitored in real-time. The bar graph is a visual representation of the interference on each channel at each node. It will show the reported noise level measured by each radio in the network, in each channel being monitored.

The 'Age' field indicates the time since the last update received from each node in the network.

The frequency currently being occupied will be highlighted in green and will change as the network moves to different channels.

NOTE: MAN-IA currently only takes into account interference levels in making decisions for the best operating channel. The user will need to take into consideration propagation characteristics when operating across different bands.

NOTE: transition time will get longer if the number of hops in the network increases and as traffic increases.

5.3.4 MAN-IC (MANET Interference Cancellation) (License enabled)



Figure 72: MAN-IC Configuration Page

MANET Interference Cancellation (MAN-IC) allows a Silvus network to maintain high throughput in the presence of otherwise harmful interference. This feature employs a sophisticated MIMO signal processing technique to nullify the offending interfering signals while maintaining reliable communications with other StreamCaster radios.

To enable MAN-IC, simply toggle the feature 'On' from the MAN-IC page in the Spectrum Dominance section of StreamScape. You can choose to enable it on only the local radio, or the entire network. Nodes with MAN-IC enabled will be displayed in the Network Topology as a triangle as shown in **Figure 73** below.

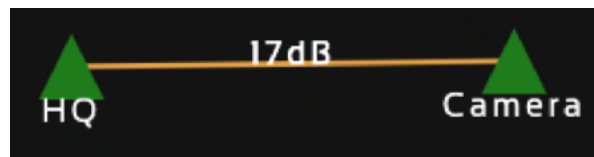


Figure 73: MAN-IC Nodes Displayed as Triangles in Network Topology

When hovering over a node with MAN-IC enabled, the Node Statistics Pop-up will report the Front-end interference and the Post MAN-IC interference. The difference between these two is roughly the amount of interference protection MAN-IC is providing.

5.4 Security

The Security section of StreamScope allows users to enable/disable encryption, upgrade radios, and load license files for enabling features such as AES encryption.

5.4.1 Encryption

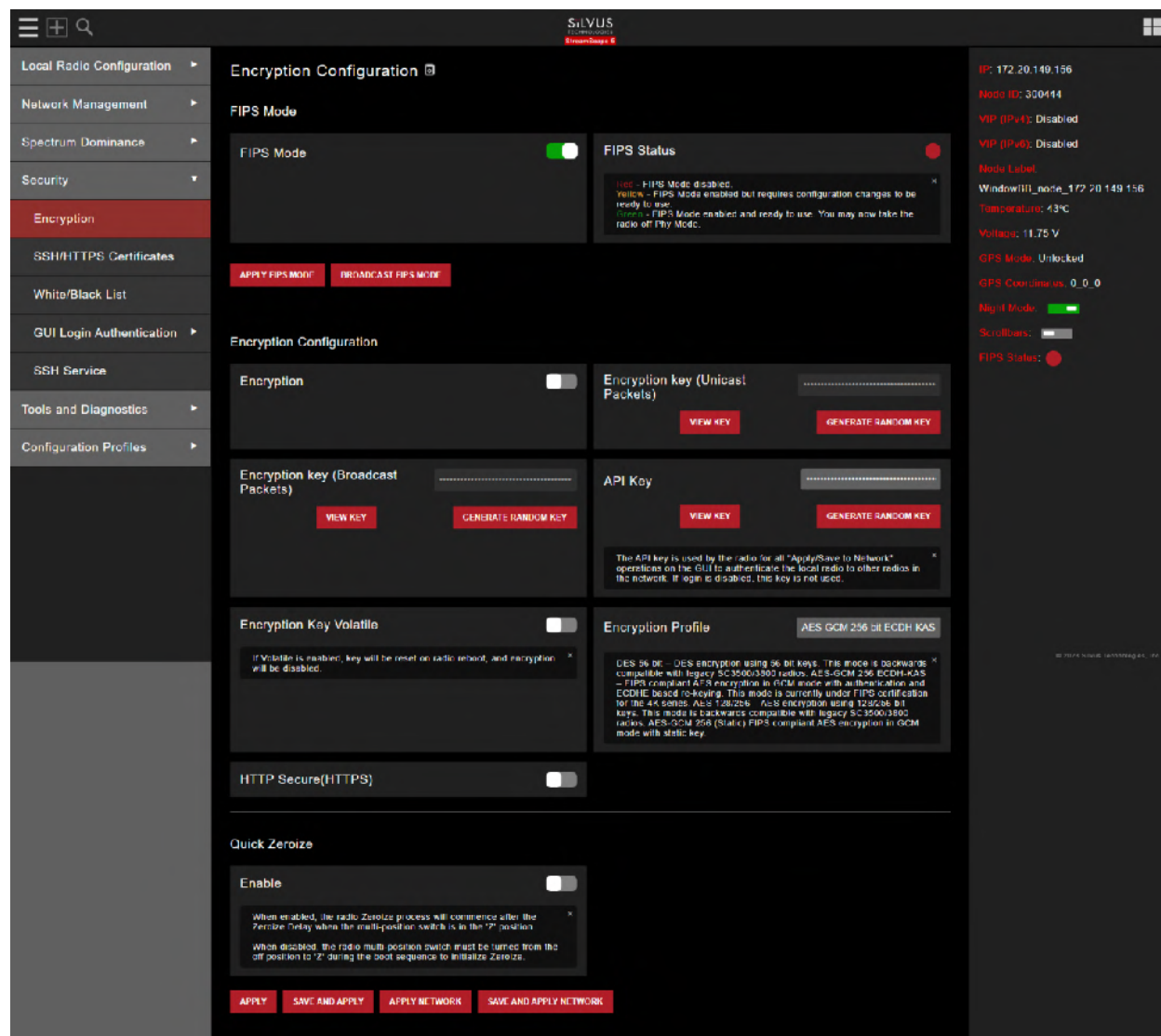


Figure 74 Security (Encryption)

- **Encryption:** Enable or disable encryption.

- **FIPS Mode:** Enabling FIPS mode is the first step to making the radio FIPS compliant (see Section 6.1 Enable FIPS Mode for details). Enabling/disabling will require a reboot and will erase all setting profiles, reset the encryption key, both SSH keys, the HTTPS certificate, and the login passwords to their factory default. Enabling will also turn on HTTPS and Login Authentication. After reboot, the operator must perform the following steps to complete the FIPS compliant process. There is also a broadcast FIPS mode button that will enable FIPS mode on every radio on the network, and then force a reboot with all passwords set to default.
 - Update the web login password to something other than “HelloWorld”
 - Create new SSH keys and HTTPS certificate.
 - Update encryption key or click “Generate Encryption Key” and save.
- **Encryption Key:** Set an encryption key if encryption is enabled. This needs to match on all radios that want to join the same network. If AES-GCM 256 is selected a key for unicast traffic as well as broadcast packets will need to be set. The generate random key button will generate a random key that could be used. The view button will display the key.
- **API key:** The API key is used by the radio for all "Apply/Save to Network" operations on the GUI to authenticate the local radio to other radios in the network. If login is disabled, this key is not used.
- **Encryption Key Volatile:** If volatile is enabled, key will be reset on radio reboot, and encryption will be disabled.
- **Encryption Profile:** Choose between various encryption profiles. Available options are:
 - **DES 56 bit** – DES encryption using 56 bit keys. This mode is backwards compatible with legacy SC3500/3800 radios.
 - **AES 128/256** – AES encryption using 128/256 bit keys. This mode is backwards compatible with legacy SC3500/3800 radios.
 - **AES-GCM 256 ECDH-KAS** – FIPS compliant AES encryption in GCM mode with authentication and ECDHE based re-keying. This is the recommended mode on the 4K series as it is the most secure and provides the highest throughput under varied conditions. FIPS certification for the 4C42/44 radio models.
- **HTTP Secure (HTTPS):** Enable or disable HTTPS access to StreamScape.
- **Quick Zeroize:** When enabled, the radio Zeroize process will commence after the Zeroize Delay when the multi-position switch is in the 'Z' position. When disabled, the radio multi-position switch must be turned from the off position to 'Z' during the boot sequence to initialize zeroize.

5.4.2 SSH/HTTPS Certificates

The screenshot displays the Silvus StreamCaster 4000 series MIMO Radio web interface. The left sidebar contains a navigation menu with the following items: Local Radio Configuration, Network Configuration, Spectrum Dominance, Security, Encryption, **SSH/HTTPS Certificates**, White/Black List, GUI Login Authentication, Tools and Diagnostics, and Configuration Profiles. The main content area is titled 'SSH/HTTPS Certificates' and is divided into three sections:

- Manage Login Keys:** This section includes a text area for 'Add a SSH Login Key' with instructions: 'SSH keys are used to authenticate users. The public key is used to verify the user's identity, and the private key is used to sign the user's identity. Don't paste the private part of the SSH key. Paste the public part, which is usually contained in the file ~/.ssh/id_rsa.pub and begins with "ecdsa-sha2-nistp256:".
- Manage Host Keys:** This section includes a text area for 'Add a SSH Host Key' with instructions: 'SSH keys are used to authenticate hosts. The public key is used to verify the host's identity, and the private key is used to sign the host's identity. Don't paste the private part of the SSH key. Paste the public part, which is usually contained in the file ~/.ssh/id_rsa.pub and begins with "ecdsa-sha2-nistp256:".
- Manage HTTPS Certificates:** This section includes a text area for 'Add a HTTPS Certificate' with instructions: 'HTTPS certificates are used to authenticate the radio. The certificate must be appended by the private key file in the default example.

Each section has a 'GENERATE [KEY/CERTIFICATE] AND SAVE' button and an 'ADD [KEY/CERTIFICATE] AND SAVE' button. The right sidebar shows system status information: IP: 172.20.100.72, VIP: Disabled, Mode: Local, node25672 100.72, Temperature: 41.11, Voltage: 12.00 V, and Night Mode:

Figure 75 Security (SSH/HTTPS Certificates)

This page is used to manage the radio's SSH login keys, SSH host key, and HTTPS Certificate. All key pairs used are elliptic curves.

- **SSH Login Keys:** In order to SSH into the radio, you must first generate a key pair and upload the public key onto the radio. A common way this is done on a computer is through the command ``ssh-keygen -t ecdsa -b 521``. You will need to do this for each machine that wants to SSH into the radio, or you can share a single key pair amongst machines.
- **SSH Host Key:** This key is used for authenticating the radio to all machines that want to connect to it via SSH. A common way this key is generated on a computer is ``openssl ecparam -name secp521r1 -genkey -noout -out yourfilename``. You may either upload your own key or generate one on the radio. Once you upload/generate a new key, the previous one is gone. You can get the original key by Factory Reset -> Zeroize. (Note that the generated text from the above command will encode both a private and public key in the text).
- **HTTPS Certificate:** This certificate is used to establish a HTTPS connection. If you are using a factory default or radio generated certificate and haven't added an exception of this certificate to your browser, you will see a message like below from your browser. This is because the certificate is signed by the radio and not a trusted Certificate Authority. You can bypass this by clicking "ADVANCED" in chrome, (or adding an exception in Firefox). The simplest way to generate a new certificate is to click "Generate Certificate and Save" button. If you are on HTTPS when you do this, you must also refresh the page. If you want to generate your own certificate, you must first generate a key pair (secp256r1, secp384r1, or secp521r1). Then create a X.509 certificate and append your private key to it. Copy the certificate text to the "Add a HTTPS Certificate" section, then click "Add Certificate and Save."

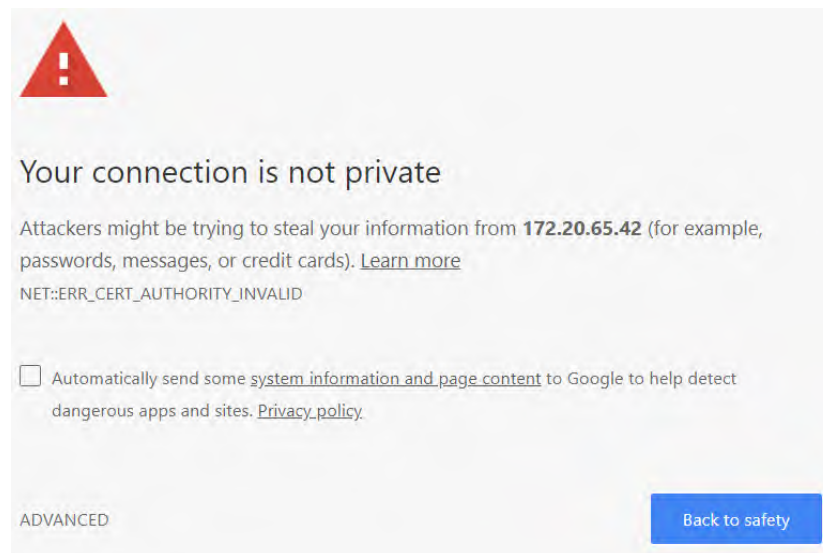


Figure 76 (Chrome Browser Warning)

5.4.3 White/Black List

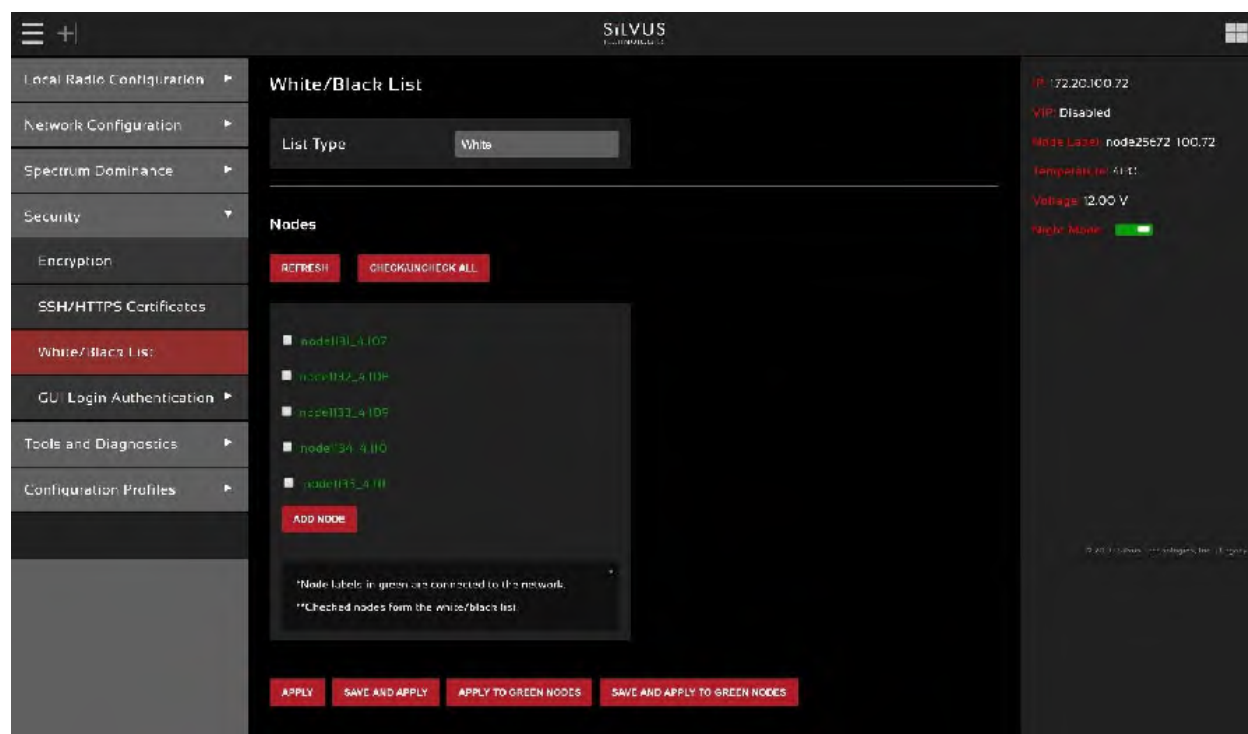


Figure 77 Security (White/Black List)

This page is to add a level of security in the mesh network. It will only allow the radio to mesh with radios on the white list, or to never mesh with radios on the black list.

White List: a list of radio IP addresses that you deem safe to connect to.

Black List: a list of radio IP addresses that you do not want to connect to.

While you can create either a White List or a Black List to reach the same result, you cannot use both lists at the same time. When you select the list type of either White or Black, it will automatically populate all radios that the radio is currently connected to. You can also add radios that are not currently connected to the network by adding the last two octets of the IP address of those radios.

5.4.4 GUI/Login Authentication

5.4.4.1 Admin

The screenshot displays the Admin page of the StreamCaster 4000 series MIMO Radio. The left sidebar contains a navigation menu with the following items: Local Radio Configuration, Network Management, Spectrum Dominance, Security, Encryption, SSH/HTTPS Certificates, White/Black List, GUI Login Authentication, Admin (highlighted), SSH Service, Tools and Diagnostics, and Configuration Profiles. The main content area is titled 'Admin' and contains several sections:

- Login Authentication:** A toggle switch is turned off. A note states: 'If enabled, access to the web interface will require login credentials.'
- Password Complexity:** A toggle switch is turned on. A note states: 'This enforces the password to have at least 1 lowercase, 1 uppercase, 1 digit and 1 special character. It also applies configured minimum password length and minimum password change settings to new passwords. Note: this only applies to new passwords, not existing ones.'
- Login Settings:**
 - Max Login Attempts:** Set to 3. A note states: 'After failing to login via HTTP, console (or GUI) or serial console user login attempt times, you will be locked out from logging in for X seconds.'
 - Lockout Period (seconds):** Set to 600.
 - Idle Timeout (seconds):** Set to 300. A note states: 'Serial login will logout after X seconds of inactivity.'
 - GUI Idle Timeout (minutes):** Set to 5. A note states: 'If login is enabled, the web interface will logout after X minutes of inactivity.'
 - Display Notice of Use on Serial:** A toggle switch is turned on. A note states: 'If enabled, will display notice of use message on serial interface.'
 - Disable Concurrent Sessions:** A toggle switch is turned off. A note states: 'enable this to prevent concurrent GUI/API sessions.'
- Notice of Use:** A text area containing the following text: 'After failing to login via HTTP, console (or GUI) or serial console user login attempt times, you will be locked out from logging in for X seconds.'
- Password Complexity:**
 - Minimum Password Length:** Set to 5. A note states: 'This configures the minimum length required for the password.'
 - Minimum Password Change:** Set to 5. A note states: 'This configures at least of how many positions the new password should differ from the old password.'
- User Management:**
 - Username:** Set to 'admin'.
 - Current Password:** A text input field.
 - New Password:** A text input field.
 - Confirm Password:** A text input field.
- Create User:**
 - Username:** A text input field.
 - Role:** Set to 'Admin'.
 - New Password:** A text input field.
 - Confirm Password:** A text input field.

At the bottom of the page, there are two buttons: 'APPLY' and 'SAVE AND APPLY'.

Figure 78 Admin page

The Admin page provides the option of password protecting access to StreamCaster. There are several parameters that can enforce various security measures in regards with the Login Authentication. There are three levels of login authentication, Basic, Advanced, and Admin, each with increasing privileges on

the GUI and backend API. The basic login would give access to local radio configs, network management, and tools and diagnostics. The Advanced login will give you everything in Basic plus spectrum dominance and configuration profiles (everything except security). The admin gives you full access to the GUI.

- **Login Authentication:** This will enable the requirement to enter a password in order to access the radio GUI.
- **Password Complexity:** This will enforce the password to have at least 1 lowercase, 1 uppercase, 1 digit, and 1 special character. It also applies configured minimum password length and minimum password change settings to new passwords. Note, this only applies to new passwords, not existing ones.
- **Max Login Attempts:** After failing to login via HTTP cookie (or GUI) or serial console Max-Login-Attempt times, you will be locked out from logging in for X seconds.
- **Lockout Period:** The amount of time that the radio login will be locked out if the max login attempts are reached.
- **Idle Timeout:** Serial login will logout after X seconds of inactivity.
- **GUI Idle Timeout:** If login is enabled, the web interface will logout after X minutes of inactivity.
- **Display Notice of Use on Serial:** If enabled, will display notice of use message on serial interface.
- **Disable Concurrent Sessions:** Enable this to prevent concurrent GUI/API sessions.
- **Minimum Password Length:** This configures the minimum length required for the password.
- **Minimum Password Change:** This configures at least in how many positions the new password should differ from the old password.
- **User Management:** This section allows you to reset the password for various user profiles.
- **Create user:** This section allows you to create new users and configure their role/permission levels.

To enable, set the Login Authentication to Enable and click apply or save and apply. Once Login Authentication is enabled, access to Streamscope will require a username and password as shown below. To change the password, click “Change Password,” then select the username whose password will change, type the Admin password, then type the new password.

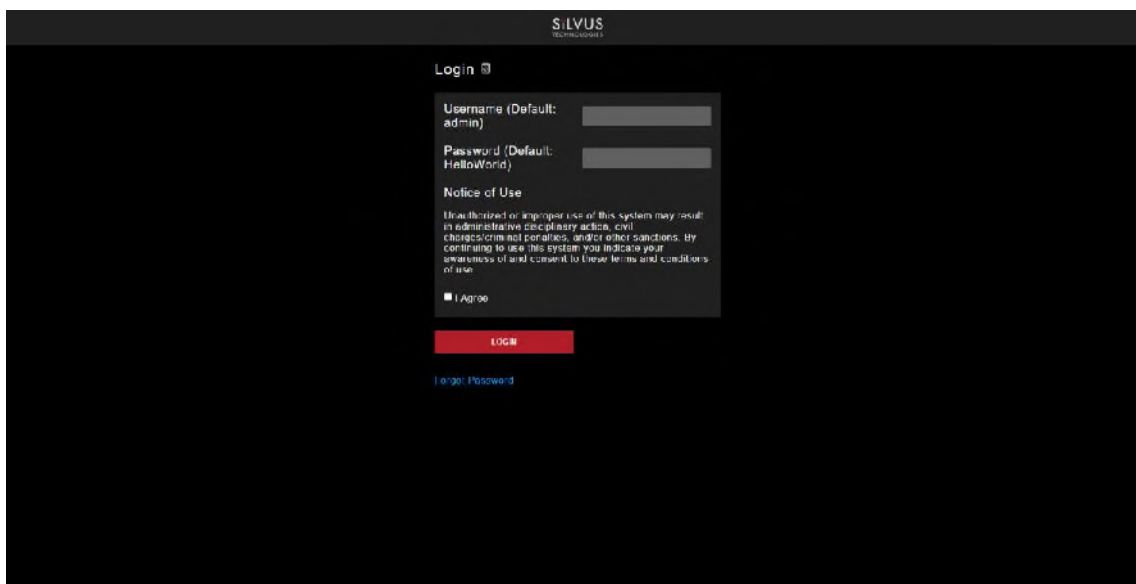


Figure 79 Login

Reset Password:

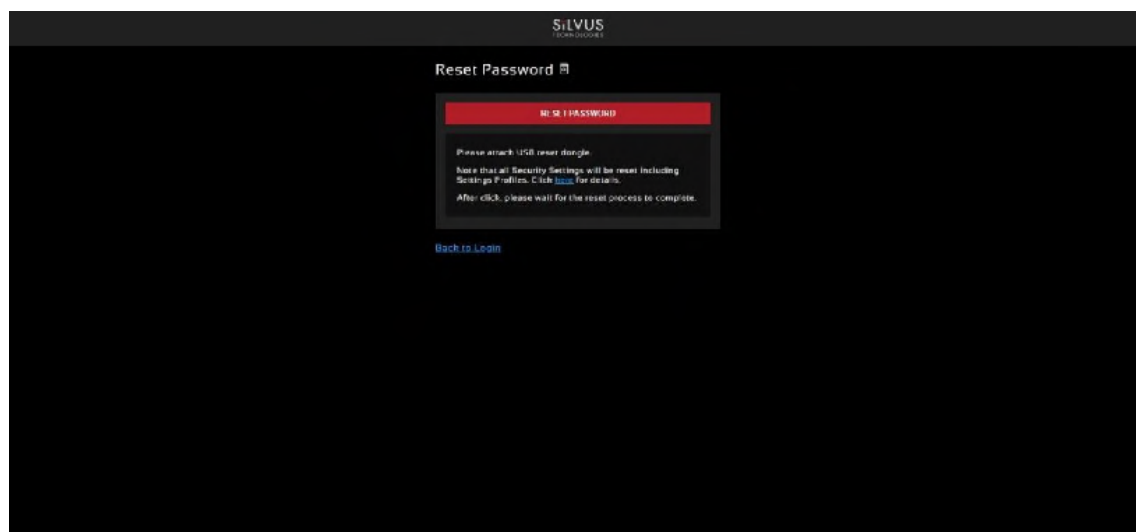


Figure 80 Reset Password

If a user forgets the password, click “Forgot Password.” They can reset the password using a USB flash drive and a password reset key provided by Silvus. On the USB, the password reset key file must be called reset_pass.txt.signed. Note that since the SC3500 and SC3800 do not have USB ports, you will not be able to set a password for these radios.

This will set login passwords and all security keys to their defaults. This includes the Encryption Key, SSH Login Key, SSH Host Key, HTTPS Certificate, and Encryption Key Volatile. It will also erase all settings

profiles. Also, if FIPS mode is off, it will turn off HTTPS and login mode. The current FIPS mode will not be changed.

5.4.5 SSH Service

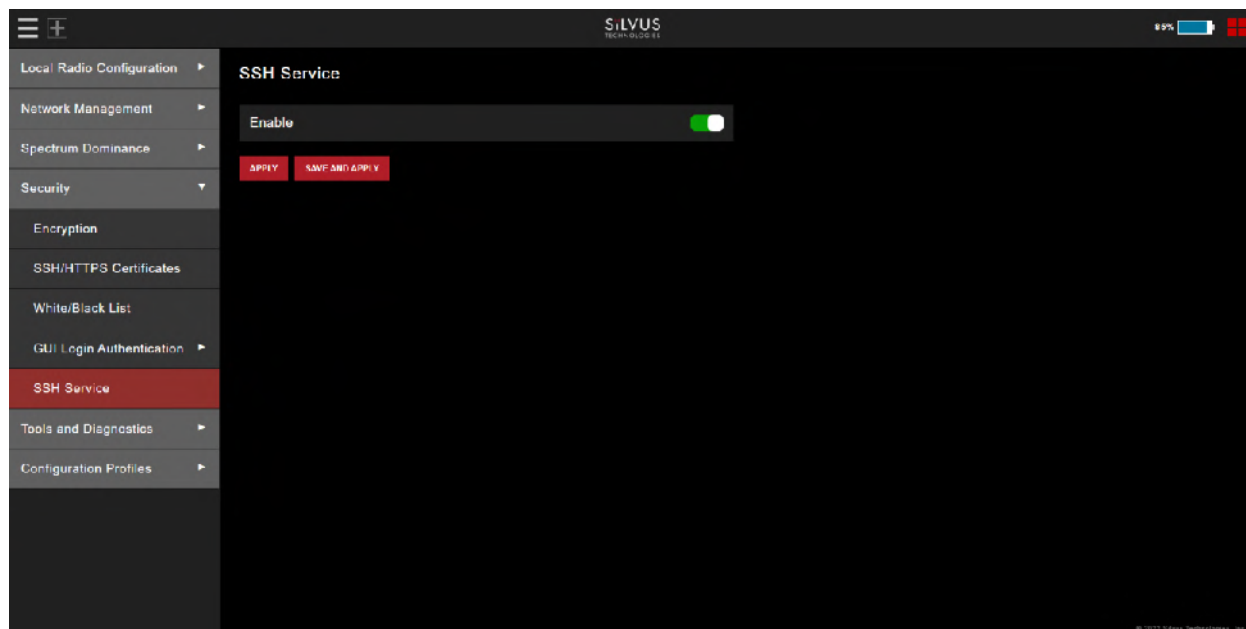


Figure 81 SSH Service

This setting will enable/disable the SSH service on the radio. When enabled, SSH server will run on TCP port 22. When disabled, TCP port 22 will be closed/inaccessible.

5.5 Tools and Diagnostics

In this section, you will find the sections of the GUI that will provide you with details about the firmware version of the radio. You will also have the option to upload new firmware, as well as access some faults/indicators, factory reset, change languages, and a log tracking some security access to the radio.

5.5.1 Firmware and Licenses

5.5.1.1 Build Information



Figure 82 Build Information

The 'Build Information' page provides information about the hardware and firmware loaded onto the radio, as well as the changelog of the currently loaded and past firmware revisions. The current firmware version loaded on the radio will be listed under Build Tag line on this page.

5.5.1.2 Firmware Upgrade

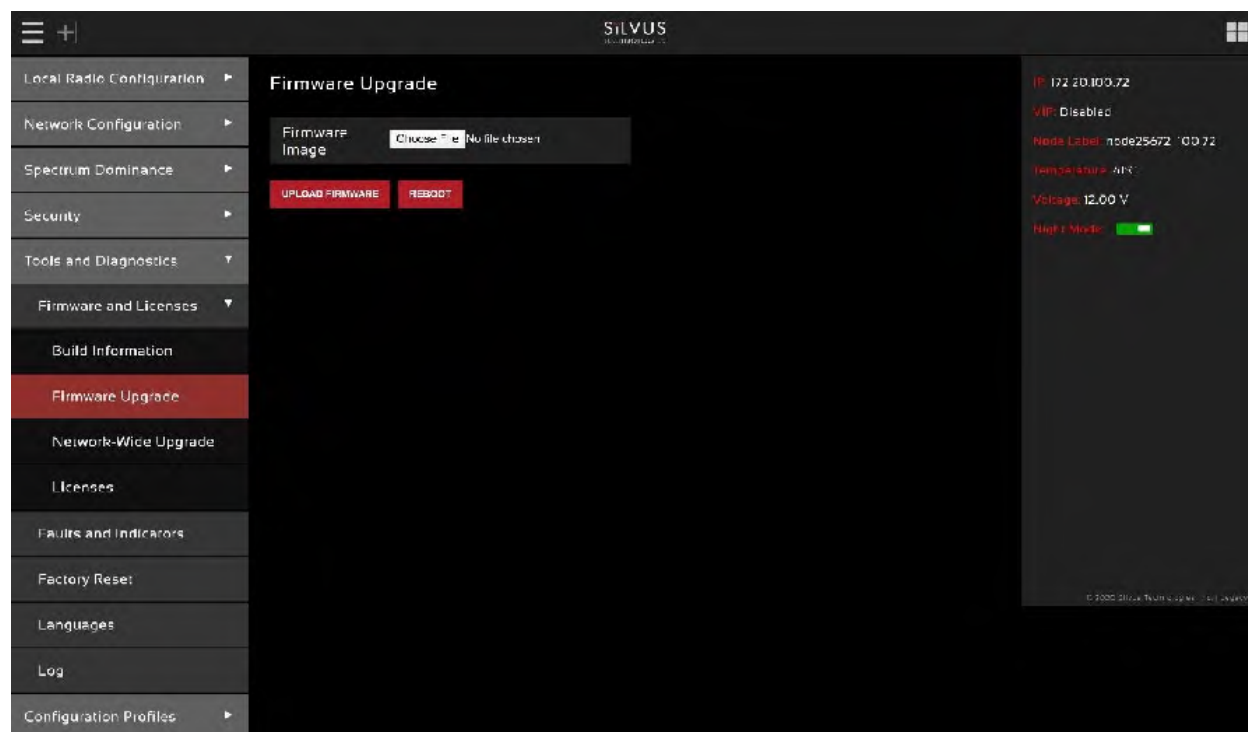


Figure 83 Tools and Diagnostics (Firmware Upgrade)

The firmware can be upgraded by simply choosing the upgrade image from your desktop and uploading it to the radio. This field can be used to upgrade the radio root file system, linux kernel, or uboot.

In firmware version 4.0.3.10 the user manual was removed from the GUI. In firmware version 4.0.3.14 it has been made an option to reload the user manual back into the radio via the firmware upgrade page. Load the user manual image into the firmware image file selector and click upload firmware. This will load the user manual back into the radio.

5.5.1.3 Network-Wide Upgrade

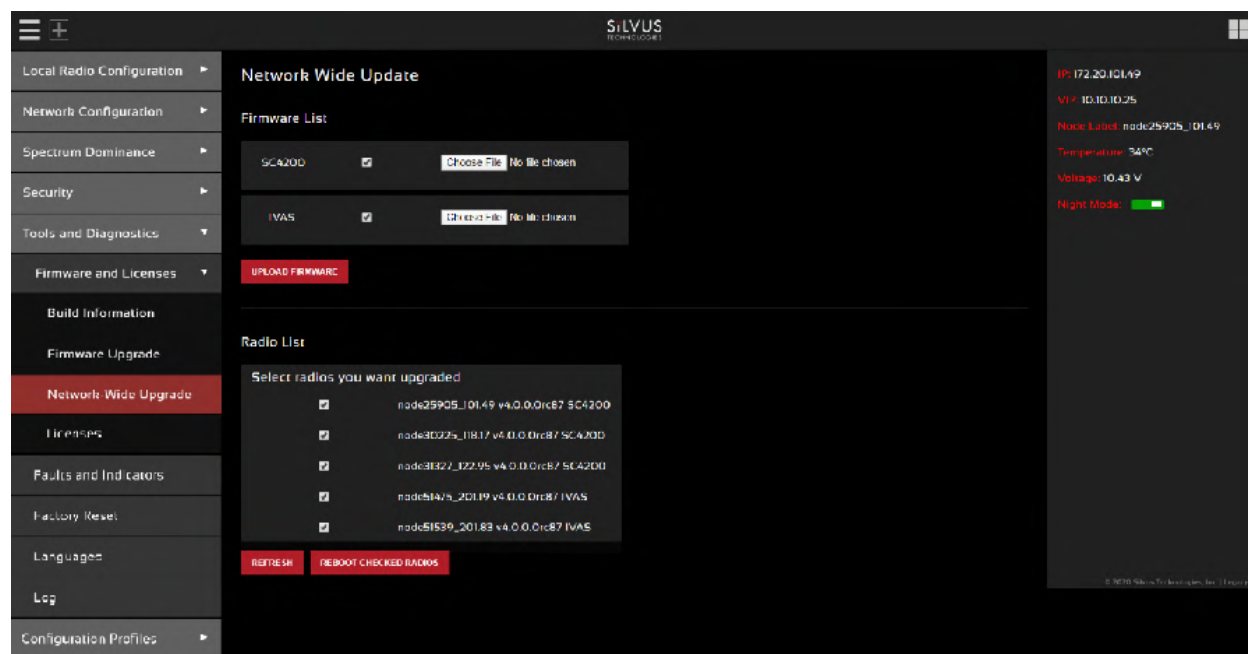


Figure 84 Tools and Diagnostics (Network-Wide Upgrade)

Starting with firmware version 3.12.6.8, multiple radios within the same network can be upgraded all at once. Users can simply choose the appropriate firmware file for the corresponding radio models to apply the upgrade to all the radios in the network. Currently, this feature is not available in HTTPS mode.

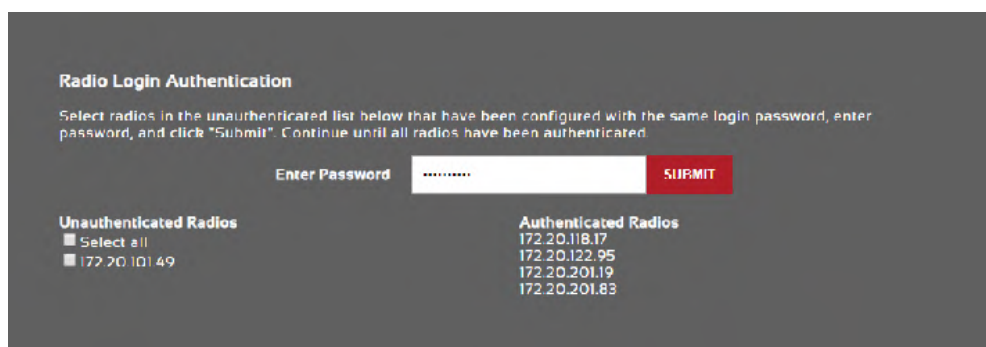


Figure 85 Radio Login Authentication during Network-Wide Upgrade

If you attempt a network wide update, and the login authentication is enabled on some radios, you will need to enter the radio's login authentication password in order to proceed. The window asking for the password can be seen on **Figure 85 Radio Login Authentication during Network-Wide Upgrade** above.

5.5.1.4 Licenses

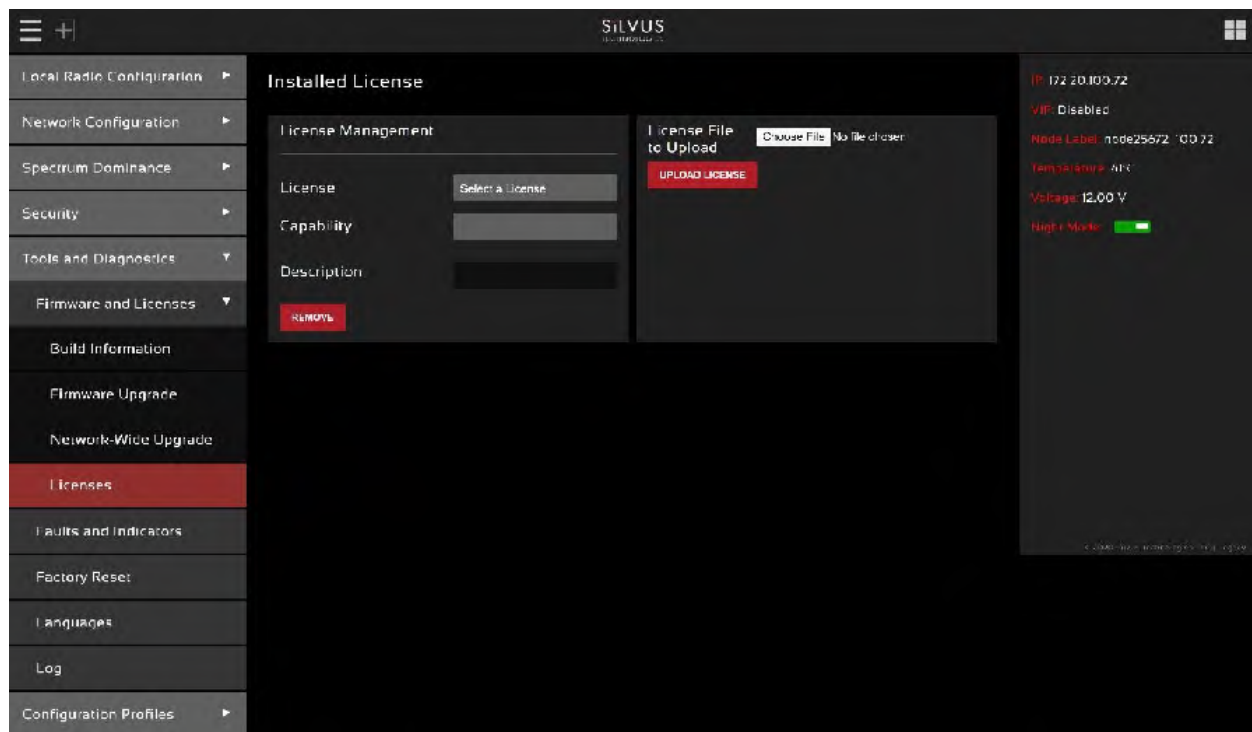


Figure 86 Tools and Diagnostics (Licenses)

Features such as encryption levels and frequency ranges can be enabled by licenses obtained from Silvus. New license keys can be uploaded to the radio on this page. Upload license button will load the license selected to the local radio only. The broadcast license button will load licenses to all radios on the network. Please note that the license files are targeted on an IP specific basis, so the license you use with this feature must incorporate all IP radios in the mesh. If there is a radio without the IP in that license, the upload will fail for that particular radio only.

5.5.2 Faults and Indicators

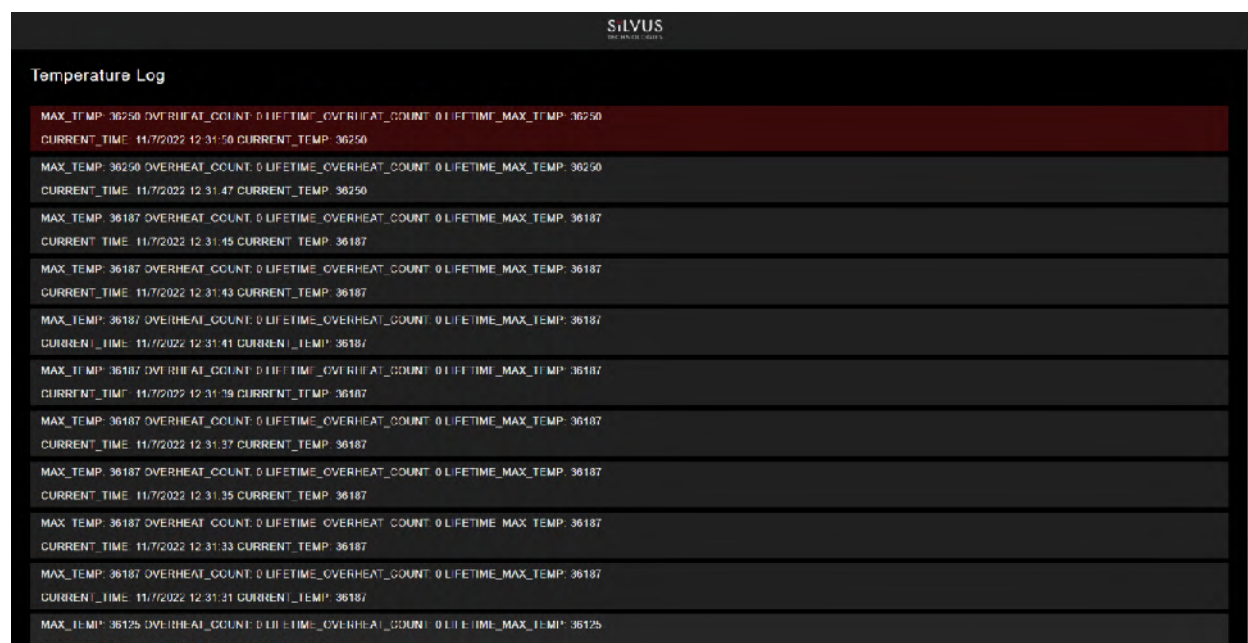
The screenshot displays the 'Faults and Indicators' configuration page in the SILVUS web interface. The left sidebar lists various system settings, with 'Faults and Indicators' currently selected. The main content area is divided into several configuration sections:

- Temperature Reporting Configuration:** Includes fields for Reporting Mode (set to 'Disable reporting'), Reporting IP (10.1.1.3), Reporting Port (30000), Reporting Period (5s), Min. Threshold (75°C), and Max. Threshold (85°C). A 'Node Temperature Log' section features a 'VIEW LOG' button.
- RSSI Reporting Configuration:** Includes a 'Reporting' toggle (disabled), Reporting IP (10.1.1.4), Reporting Port (30000), and Reporting Period (10ms).
- LED Configuration:** Includes a 'Status Reporting' toggle (enabled) and a 'Brightness Control' slider ranging from 'Low' to 'High'.
- Voltage Monitor:** Shows a current voltage of 202 mV. It includes fields for Reporting Mode (Disable), Reporting IP, Reporting Port, Reporting Period (s), Min. Threshold (V), and Max. Threshold (V).
- Broadcast Discovery:** Includes a 'Discovery' toggle (disabled), Reporting Interval (ms), Destination IP, Source Port, Destination Port, and Destination MAC Address.

At the bottom of the configuration sections are three buttons: 'APPLY', 'SAVE AND APPLY', and 'DOWNLOAD INFO'. On the right side of the interface, a status panel provides real-time information: IP (172.20.11.22), VIP (IPv4) (Disabled), VIP (IPv6) (Disabled), Node Label (node2838 11.22), Temperature (41°C), Voltage (12.00 V), GPS Mode (Unlocked), GPS Coordinates (38.13562516339005, -77.30516992521), Night Mode (indicated by a green bar), and Scrollers (indicated by a slider).

Figure 87 Faults and Indicators Page

The Faults and Indicators page allows the user to specify an IP and Port number for Temperature and RSSI (Receiver Signal Strength Indication) reports to be delivered to. This is useful for users that intend to feed this information into some other platform for analysis and recording. Section 9 gives more information on the format of streaming reports. You can also click on the node temperature log to open another window that shows the current output of what the temperature report would output. See below **Figure 88 Temperature log example**.



MAX_TEMP	OVERHEAT_COUNT	LIFETIME_OVERHEAT_COUNT	LIFETIME_MAX_TEMP	CURRENT_TIME	CURRENT_TEMP
36250	0	0	36250	11/7/2022 12:31:50	36250
36250	0	0	36250	11/7/2022 12:31:47	36250
36187	0	0	36187	11/7/2022 12:31:45	36187
36187	0	0	36187	11/7/2022 12:31:43	36187
36187	0	0	36187	11/7/2022 12:31:41	36187
36187	0	0	36187	11/7/2022 12:31:39	36187
36187	0	0	36187	11/7/2022 12:31:37	36187
36187	0	0	36187	11/7/2022 12:31:35	36187
36187	0	0	36187	11/7/2022 12:31:33	36187
36187	0	0	36187	11/7/2022 12:31:31	36187
36125	0	0	36125	11/7/2022 12:31:29	36125

Figure 88 Temperature log example

Temperature Thresholds

In addition to receiving temperature reports, this page can be used to set minimum and maximum temperature thresholds for the radio. The StreamCaster™ family of radios is equipped with on board temperature sensors which are monitored to prevent overheating. Once a radio reaches the maximum temperature threshold, the radio will begin to reduce its transmission time until the temperature falls below the minimum temperature threshold. By default, the min and max values are 75C and 85C respectively.

RSSI Reporting Configuration

This setting allows the users to report the RSSI values every few milliseconds base on users setting.

LED Configuration

This setting allows the user to disable or enable the LED on the faceplate of the radio. Also has a slide bar to control LED brightness level.

Voltage Monitor

Radios built on or after Jan 1, 2015 have the ability to monitor the input voltage, displayed here.

Broadcast Discovery

This feature is used to send radio information packets periodically to a server. Information sent will include the node ID, virtual IP address, frequency, and bandwidth of the radio.

5.5.4 Languages

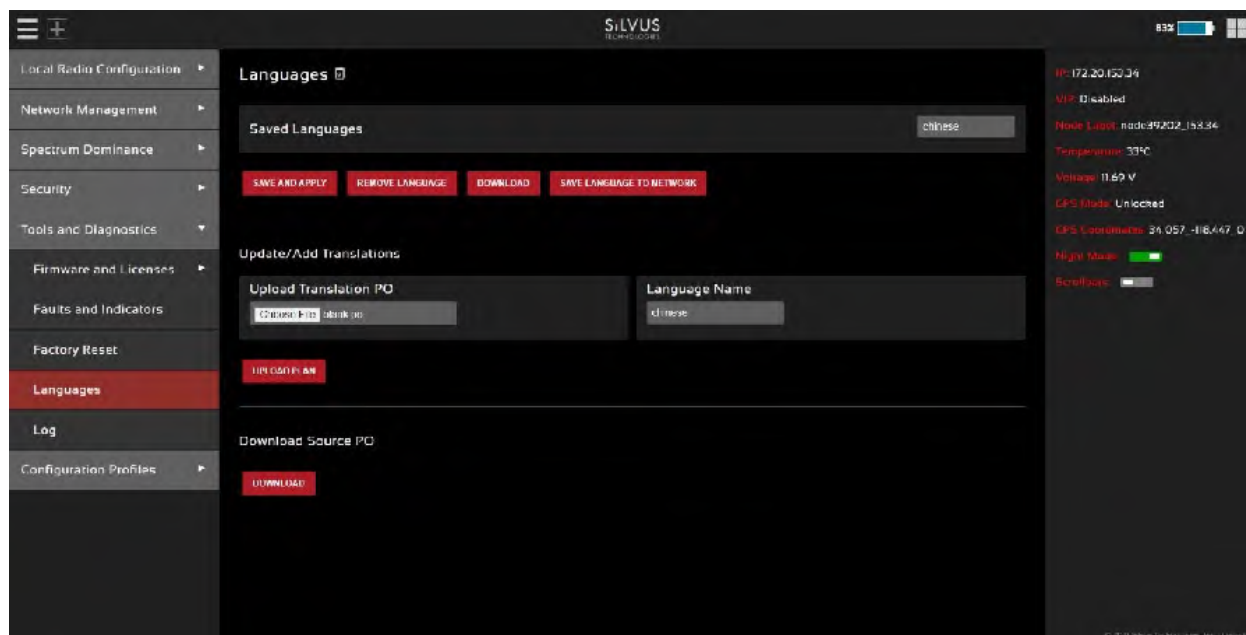
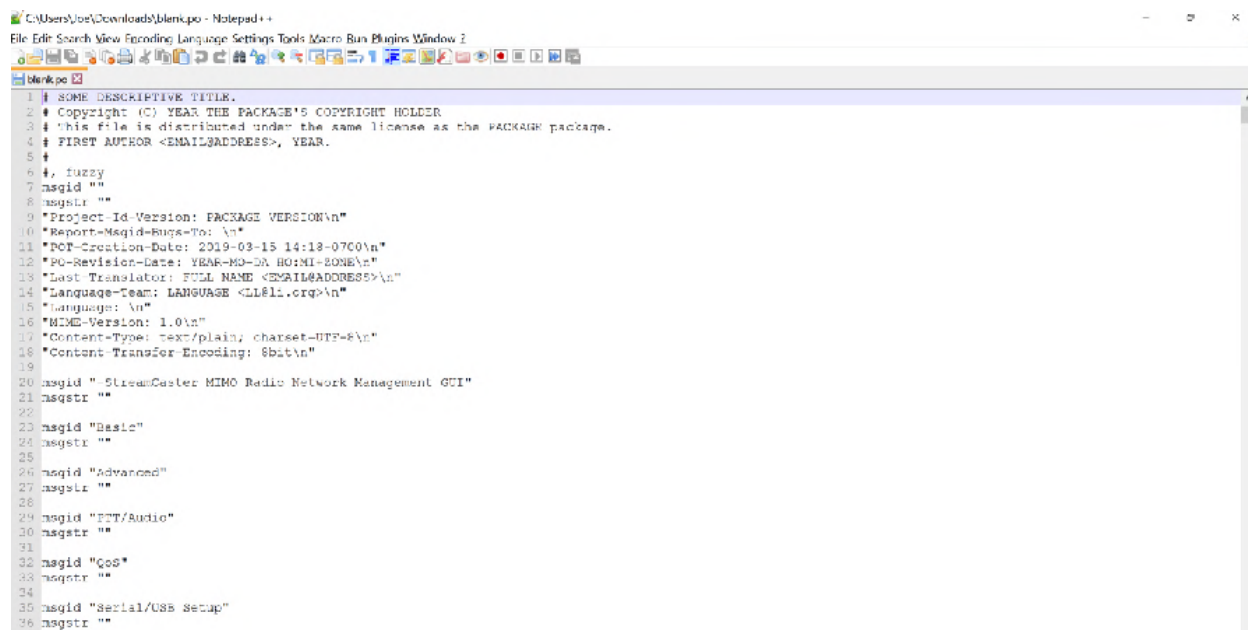


Figure 90 Tools and Diagnostics (Languages)

In this tab you will be able to edit and update the GUI into any language you choose. To do this, you would download the Source PO File as per the button on the bottom of this page. Once you have the source PO file, you can open it to edit in any plain text editor, however it may be easier to read in Notepad++.



```

1 # SOME DESCRIPTIVE TITLE.
2 # Copyright (C) YEAR THE PACKAGE'S COPYRIGHT HOLDER
3 # This file is distributed under the same license as the PACKAGE package.
4 # FIRST AUTHOR <EMAIL@ADDRESS>, YEAR.
5 #
6 #, fuzzy
7 msgid ""
8 msgstr ""
9 "Project-Id-Version: PACKAGE VERSION\n"
10 "Report-Msgid-Bugs-To: \n"
11 "POT-Creation-Date: 2019-03-15 14:18-0700\n"
12 "PO-Revision-Date: YEAR-MO-DA HO:MI-ZONE\n"
13 "Last-Translator: FULL NAME <EMAIL@ADDRESS>\n"
14 "Language-Team: LANGUAGE <LL@L.org>\n"
15 "Language: \n"
16 "MIME-Version: 1.0\n"
17 "Content-Type: text/plain; charset=UTF-8\n"
18 "Content-Transfer-Encoding: 8bit\n"
19
20 msgid "StreamCaster MIMO Radio Network Management GUI"
21 msgstr ""
22
23 msgid "Basic"
24 msgstr ""
25
26 msgid "Advanced"
27 msgstr ""
28
29 msgid "FFT/Audio"
30 msgstr ""
31
32 msgid "Cos"
33 msgstr ""
34
35 msgid "Serial/USB Setup"
36 msgstr ""

```

Figure 91 example Source PO file for custom languages

To create a language profile in another language other than English, please follow below steps:

1. Enter the translated words from msgid into the msgstr"" after the original word or phrase.
2. Save the revised source PO file
3. Enter the language you have translated the words for into the field labeled Language Name.
4. Click on choose file and select the source PO file that you revised and saved.
5. Click on upload plan.
6. After the plan has been uploaded, you should be able to select which language plan you would like to use under the drop-down menu of saved languages.
7. Select the language you would like viewed in the GUI, click save and apply.

To remove a previously saved language, please see below steps:

1. select the language that you want to remove from the drop-down menu of saved languages.
2. Click on remove language button to remove the selected saved language. That saved language will no longer be an option for you to view.

In order to download a previously loaded language file, see below steps:

1. Select the language file from the drop-down menu of saved languages.
2. Click on the download button. You will download the source PO file that is associated with the language you selected under saved languages.

When a new firmware edition for the Silvus radio is released, there may be new texts that will require updated language translation. In order to update the po file in a new firmware edition you would need to download the old translated file, then the new blank po file from the new firmware edition. The new appended entries should be seen at the bottom of the new po file. Copy paste these new entries to your translated file (append), and translate new entries.

5.5.5 Log

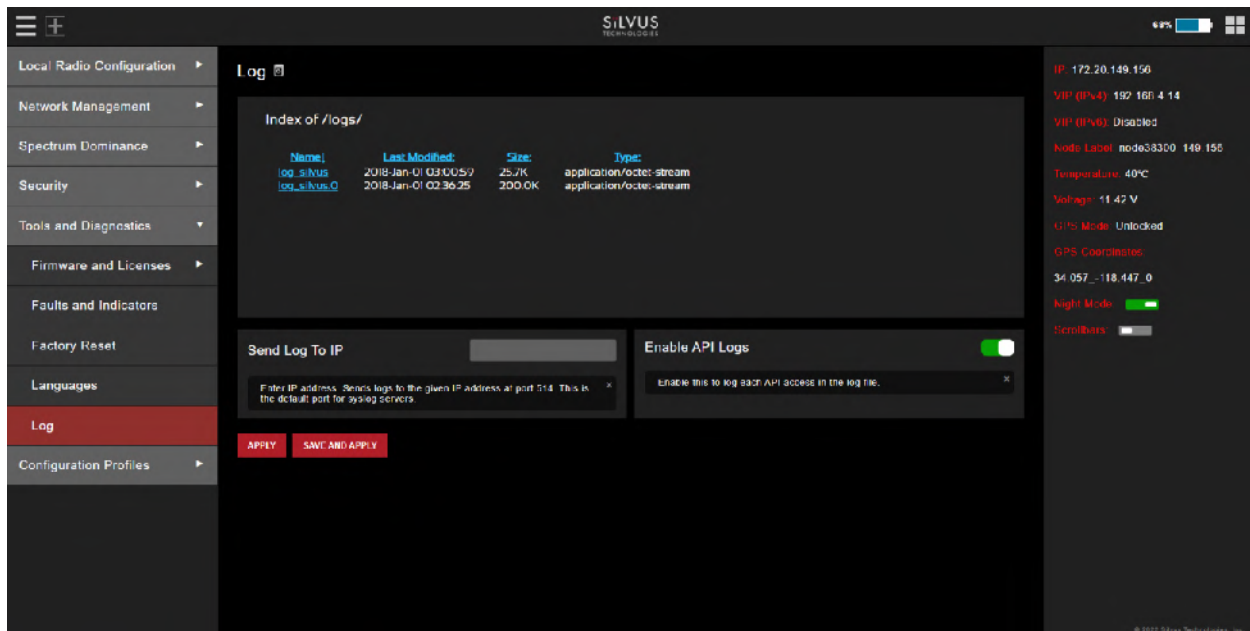


Figure 92 Security (Log)

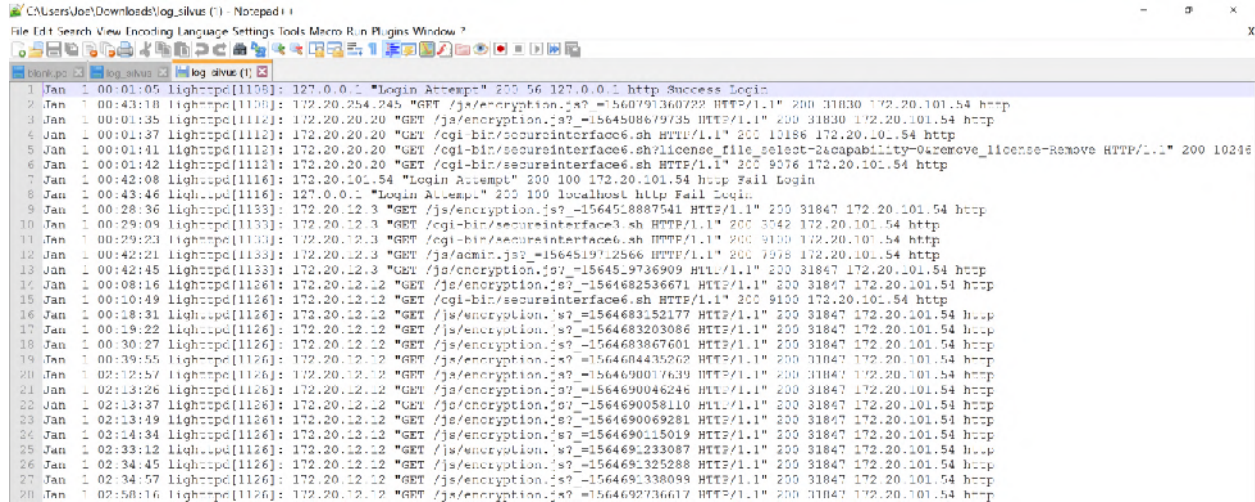
The log tab tracks some security events that happen within the radio. Below is a list of events that the log keeps track of:

- Successful/unsuccessful login attempts when login authentication is turned on.
- Visits to the license tab (shown as secureinterface6.sh), upgrade tab (secureinterface3.sh) and encryption tab.

- Enable API log to include a detailed log of API access.

You can enter an ip address in the "Send Log to" text box. This will send the logs to that ip at port 514. It is compatible with Syslog servers.

Example of the log can be seen below.



```

1 Jan 1 00:01:05 lighttpd[1110]: 172.0.0.1 "Login Attempt" 200 56 172.0.0.1 http Success Login
2 Jan 1 00:43:10 lighttpd[1110]: 172.20.254.245 "GET /js/encryption.js?_1560791360722 HTTP/1.1" 200 31830 172.20.101.54 http
3 Jan 1 00:01:35 lighttpd[1112]: 172.20.20.20 "GET /js/encryption.js?_1564508679735 HTTP/1.1" 200 31830 172.20.101.54 http
4 Jan 1 00:01:37 lighttpd[1112]: 172.20.20.20 "GET /cgi-bin/secureinterface6.sh HTTP/1.1" 200 10186 172.20.101.54 http
5 Jan 1 00:01:41 lighttpd[1112]: 172.20.20.20 "GET /cgi-bin/secureinterface6.sh?license_file_select=2&capability=0&remove_license=Remove HTTP/1.1" 200 10245
6 Jan 1 00:01:42 lighttpd[1112]: 172.20.20.20 "GET /cgi-bin/secureinterface6.sh HTTP/1.1" 200 9076 172.20.101.54 http
7 Jan 1 00:42:08 lighttpd[1116]: 172.20.101.54 "Login Attempt" 200 100 172.20.101.54 http Fail Login
8 Jan 1 00:43:46 lighttpd[1116]: 172.0.0.1 "Login Attempt" 200 100 localhost http Fail Login
9 Jan 1 00:28:36 lighttpd[1133]: 172.20.12.3 "GET /js/encryption.js?_1564518887541 HTTP/1.1" 200 31847 172.20.101.54 http
10 Jan 1 00:29:09 lighttpd[1133]: 172.20.12.3 "GET /cgi-bin/secureinterface3.sh HTTP/1.1" 200 3042 172.20.101.54 http
11 Jan 1 00:29:23 lighttpd[1133]: 172.20.12.3 "GET /cgi-bin/secureinterface6.sh HTTP/1.1" 200 9100 172.20.101.54 http
12 Jan 1 00:42:21 lighttpd[1133]: 172.20.12.3 "GET /js/admin.js?_1564519712566 HTTP/1.1" 200 7978 172.20.101.54 http
13 Jan 1 00:42:45 lighttpd[1133]: 172.20.12.3 "GET /js/encryption.js?_1564519736909 HTTP/1.1" 200 31847 172.20.101.54 http
14 Jan 1 00:08:16 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564682536671 HTTP/1.1" 200 31847 172.20.101.54 http
15 Jan 1 00:10:49 lighttpd[1126]: 172.20.12.12 "GET /cgi-bin/secureinterface6.sh HTTP/1.1" 200 9100 172.20.101.54 http
16 Jan 1 00:18:31 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564683152177 HTTP/1.1" 200 31847 172.20.101.54 http
17 Jan 1 00:19:22 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564683203086 HTTP/1.1" 200 31847 172.20.101.54 http
18 Jan 1 00:30:27 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564683867601 HTTP/1.1" 200 31847 172.20.101.54 http
19 Jan 1 00:39:55 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564684435262 HTTP/1.1" 200 31847 172.20.101.54 http
20 Jan 1 02:12:57 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564690077639 HTTP/1.1" 200 31847 172.20.101.54 http
21 Jan 1 02:13:26 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564690046246 HTTP/1.1" 200 31847 172.20.101.54 http
22 Jan 1 02:13:37 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564690058110 HTTP/1.1" 200 31847 172.20.101.54 http
23 Jan 1 02:13:49 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564690069281 HTTP/1.1" 200 31847 172.20.101.54 http
24 Jan 1 02:14:34 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564690150119 HTTP/1.1" 200 31847 172.20.101.54 http
25 Jan 1 02:33:12 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564691233087 HTTP/1.1" 200 31847 172.20.101.54 http
26 Jan 1 02:34:45 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564691325288 HTTP/1.1" 200 31847 172.20.101.54 http
27 Jan 1 02:34:57 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564691338098 HTTP/1.1" 200 31847 172.20.101.54 http
28 Jan 1 02:50:16 lighttpd[1126]: 172.20.12.12 "GET /js/encryption.js?_1564692736617 HTTP/1.1" 200 31847 172.20.101.54 http

```

Figure 93 Example of security log

The first data listed in the log is the date and time that the occurrence happened. You can manually input the date and time of the radio under the Network Manager>Map Overlay tab under CoT feature. However, upon a reboot, the time will no longer be accurate.

Please disregard the lighttpd [xxxx] as this will be likely removed in updated firmware versions. The format of the details listed in the log after lighttpd [xxxx] is as follows:

"a b c d e http/https"

a = IP address of remote host

b = HTTP request-line

c = HTTP status code

d = bytes sent for the body

e = HTTP request host name

5.6 Configuration Profiles

Under the configuration profiles section you will be able to configure profile settings for the radio, and save them to a file to distribute to other radios. You will also be able to customize the multi-position switch in this section.

5.6.1 Settings profile

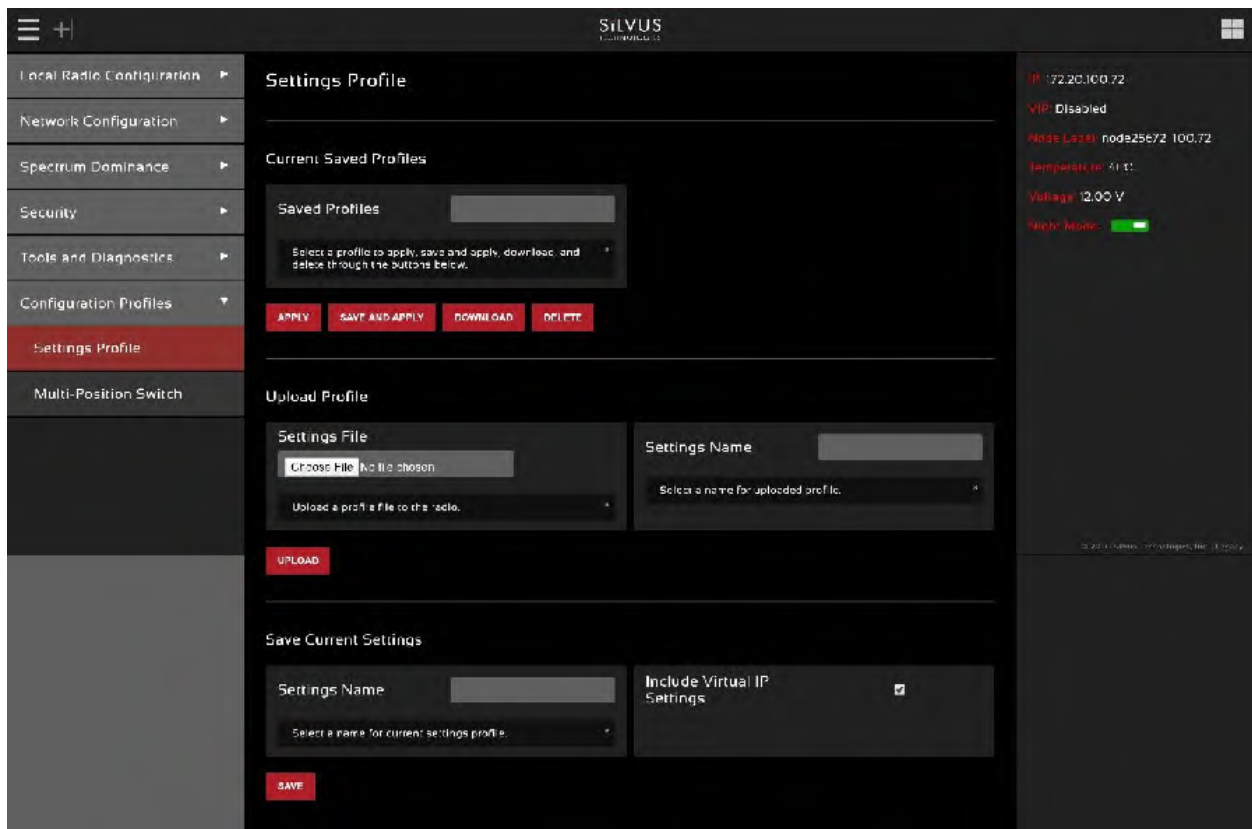


Figure 94 Configuration Profiles (Setting Profile)

- **Current Saved Profiles:** Select a saved profile and apply the settings to use the selected profile. The profile stored can be downloaded or deleted.
- **Upload Profile:** Select a downloaded profile from the computer and upload to the radio as a saved profile.
- **Save Current Settings:** Store the current settings on to the radio for future access. Note that the FIPS mode setting is not saved in the profile. You must manually enable/disable it after applying the profile.

5.6.2 MPS (Multi-Position Switch) (not available on SL4200)

	1	2	3	4	5	6	7	8	9	10	11	12	13
Fragmentation Threshold	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024	1024
Burst Time	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Frequency	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200
Bandwidth	10	10	10	10	10	10	10	10	10	10	10	10	10
Link Distance	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Training Symbols	7	1	2	3	4	5	6	7	8	9	10	11	12
Network ID	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Total Transmit Power	10	12	13	14	15	16	17	18	19	20	21	22	23
PTT Tail Group	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000	10000000
PTT Speaker Volume	10	20	30	40	50	60	70	80	90	100	110	120	130
Radio Mode	1	2	3	4	5	6	7	8	9	10	11	12	13
Routing Beacon MCS	1	2	3	4	5	6	7	8	9	10	11	12	13
Routing Beacon Period	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

Figure 95 Multi-Position Switch

The Multi-Position Switch allows you to change various settings of the radio by using the new physical switch position, no web GUI required (This is not available on all radios).

You must first configure the settings you want to correspond with each switch position. Switch positions 1 through 13 are listed in a table with parameters listed that can be configured. To show more configuration parameters click the red boxed gear icon to the top right of the table. Configuration parameters will be shown as seen in below **Figure 96 additional configuration parameters for MPS**.



Figure 96 additional configuration parameters for MPS

Available parameters that can be configured by the MPS include link distance, total transmit power, routing beacon period, fragmentation threshold, training symbols, burst time, routing beacon MCS, radio mode, frequency, bandwidth, network ID, PTT talk group, and PTT speaker volume. Position 1 will always be associated with the parameters originally saved in the radio. Once MPS parameters have been saved into the table, click save and apply to save the settings to the radio. MPS switch parameters will be checked once every second.

When the MPS switch is turned, the LED light on the radio will quickly flash green. This means the settings are being applied for this position. When the LED stops quickly flashing, the settings have been applied.

Any time settings are updated from the GUI without using the MPS page (i.e. Basic Tab, PTT/Audio Tab), position 1 will be updated with those results. The blue highlighted column shows the current position of the physical switch.

If the radio boots up in position “Z” (second to last position on the MPS), the radio will perform a physical MPS zeroize function. This action will reset all passwords, reset all settings in the Security tab to default, and will perform a factory reset on all other settings. After zeroize has been completed, a radio reboot will be required to ensure all settings are zeroized.

6. FIPS Mode

6.1 Enable FIPS Mode

The following changes are required to make the radio FIPS 140-3 Level 2 Compliant. The additional steps when compared to FIPS in SS4 are newly added requirements to the FIPS standard.

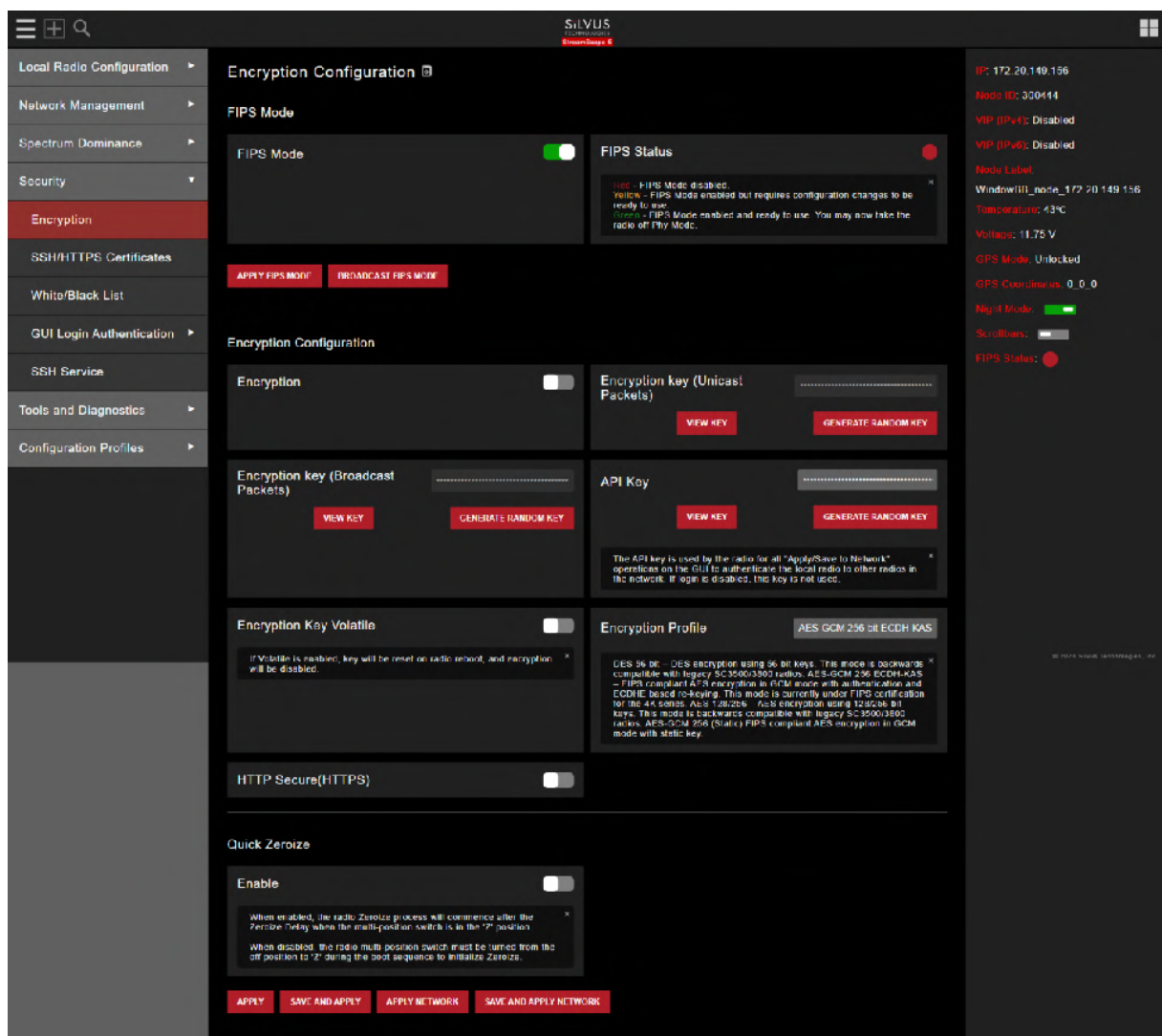


Figure 97 FIPS mode

1. Enable FIPS mode under Security -> Encryption tab. This will require a reboot and will erase all setting profiles, reset the encryption key, both SSH keys, the HTTPS certificate, and the login passwords to their factory default. It will also turn on HTTPS and Login Authentication.

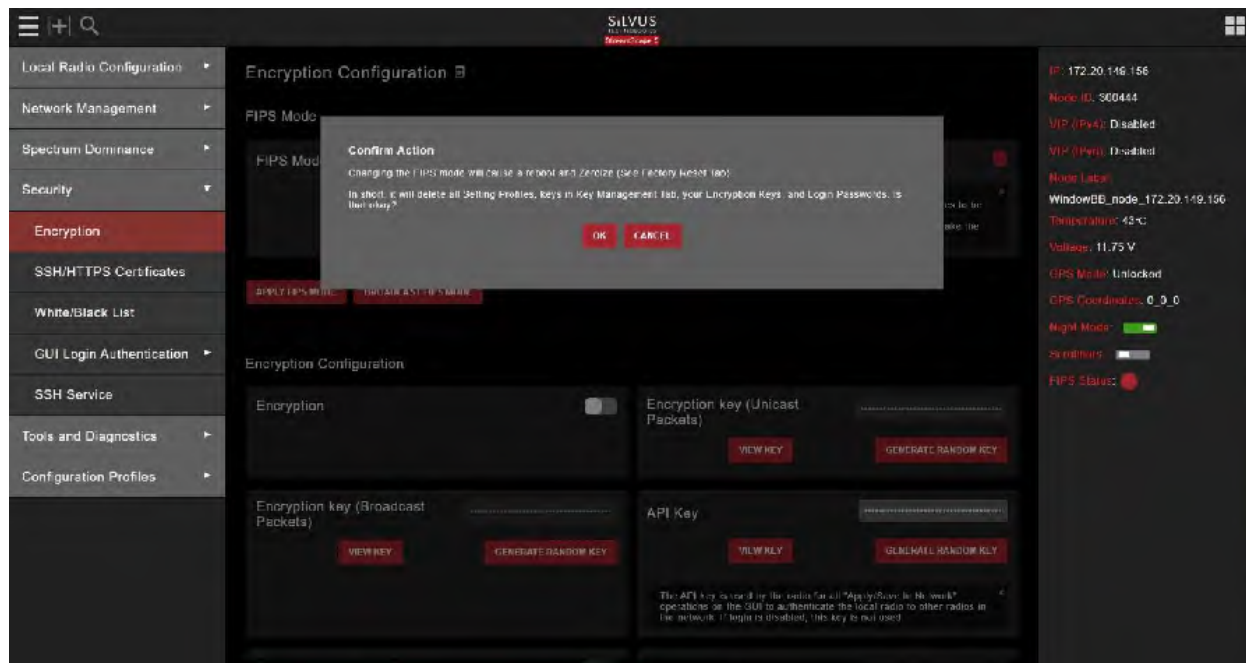


Figure 98 Confirm Action (enable FIPS)

2. After the radio comes back online, HTTPS will be enabled and if you do not have certs pre-saved on your browser you will need to tell the browser to proceed even though the security certificate is not trusted.

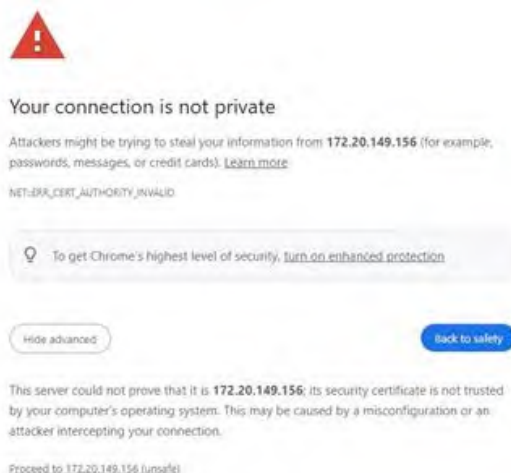


Figure 99 HTTPS cert warning

3. After you proceed to the radio IP address, you will need to use default login credentials to continue.

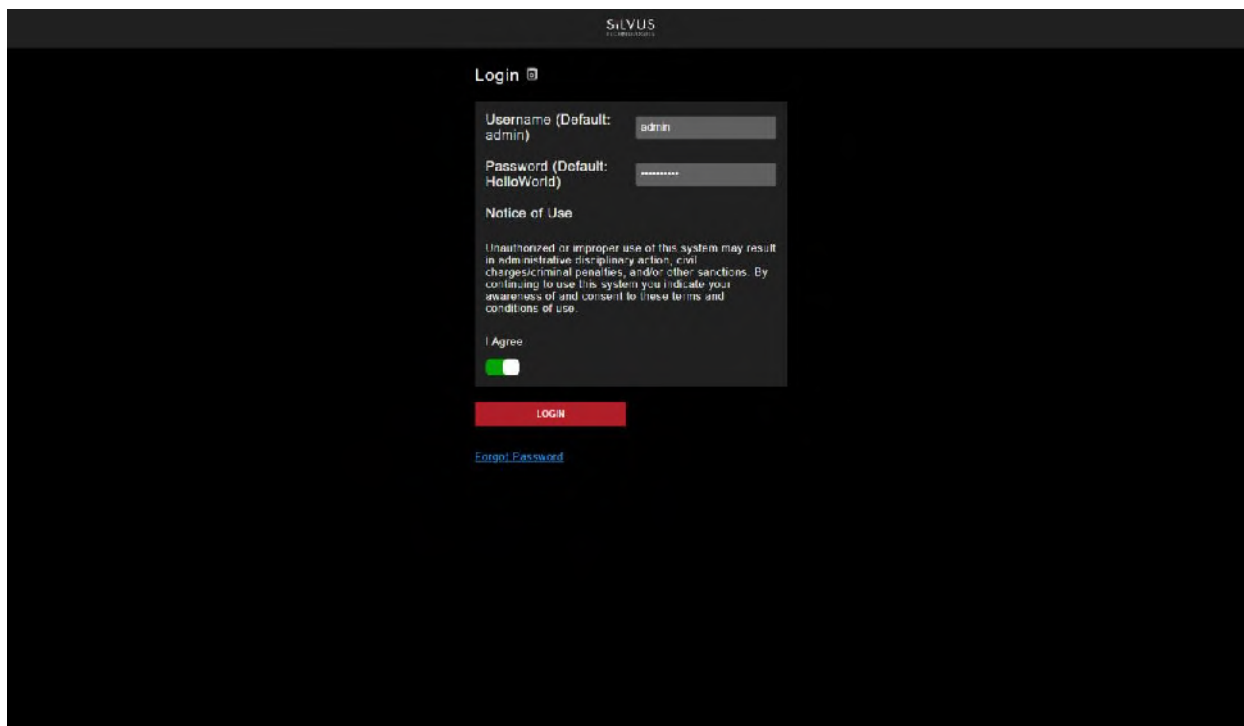


Figure 100 Default login authentication

4. After logging in to the GUI, and navigating to security/encryption section of the GUI, you will be prompted to complete additional steps to enable FIPS.

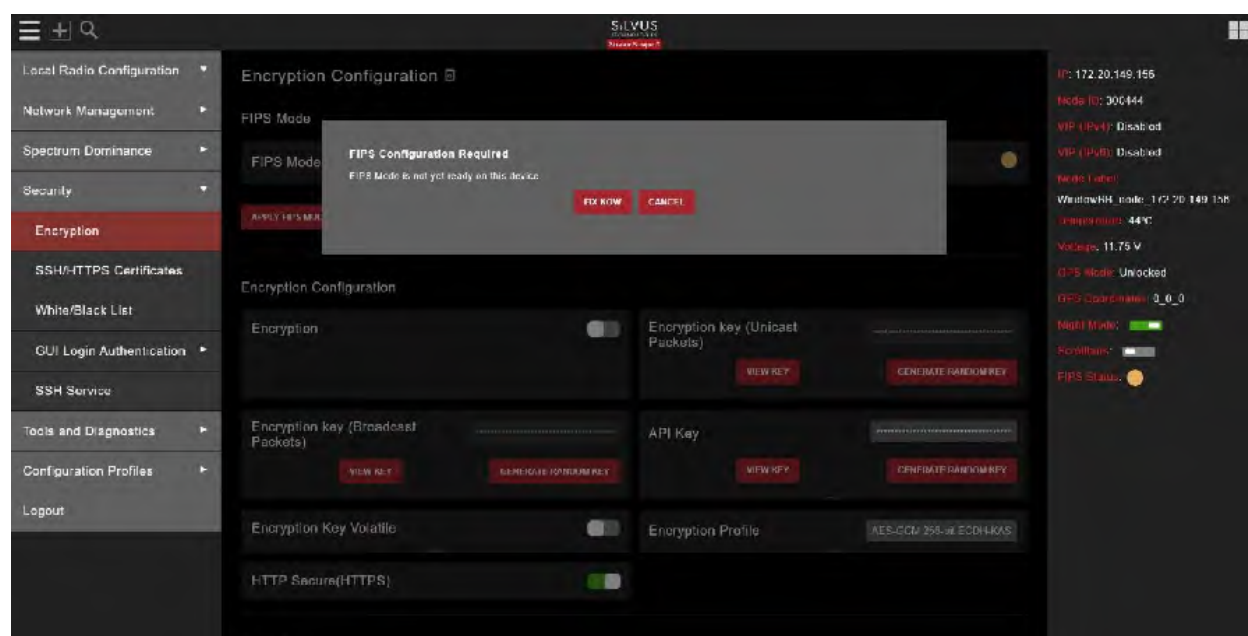


Figure 101 FIPS Configuration Required

5. A list of setting changes will need to be completed before FIPS can be considered as active. Figure 103 list all items that need to be completed. The first item is password complexity. Note that each section will be highlighted by a red dot in the top right corner which indicates the step has not yet been completed. Configuring each section and applying or saving it correctly will change the color of this indicator to green, letting the user know to move onto configuring the next section.

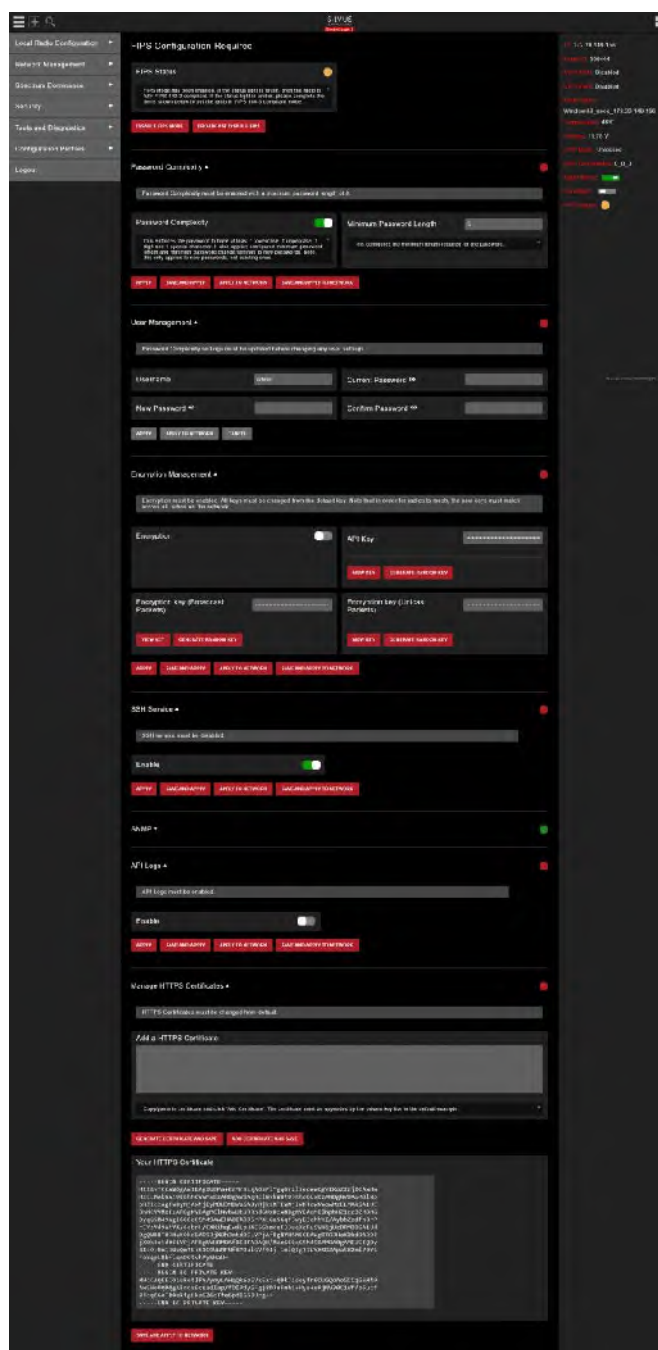


Figure 102 List of actions for FIPs

- The next item is user management passwords need to be changed from default. All three usernames for admin, advanced, and basic will need to be changed.

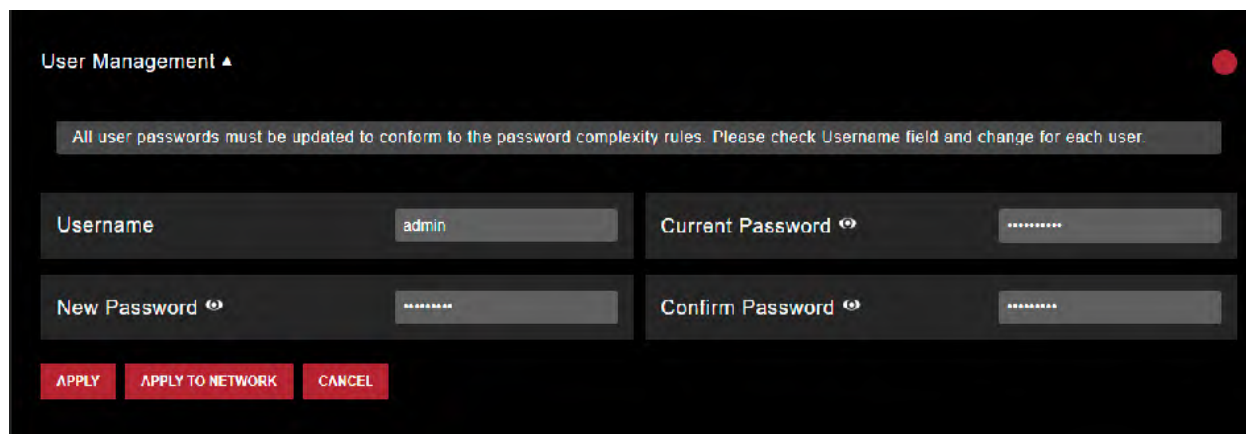


Figure 103 FIPS (user management)

7. Next section will require you to enable encryption, and change the encryption keys from the default settings.

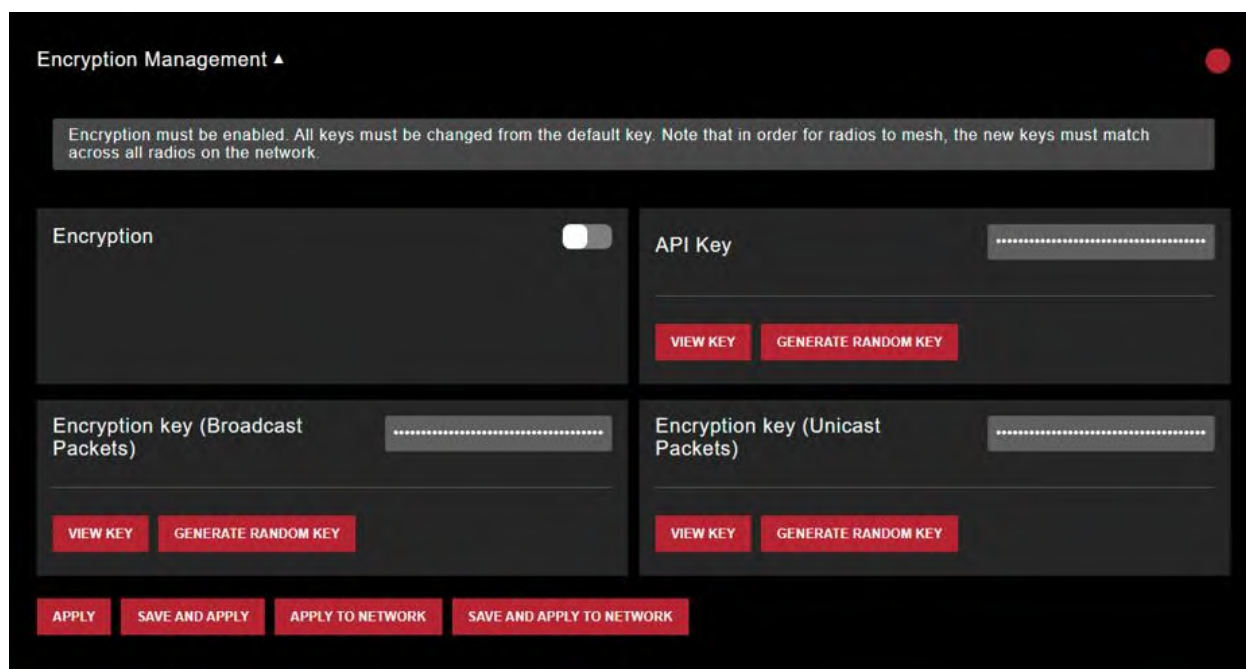


Figure 104 FIPS (encryption management)

8. Next section will ask you to disable SSH service.

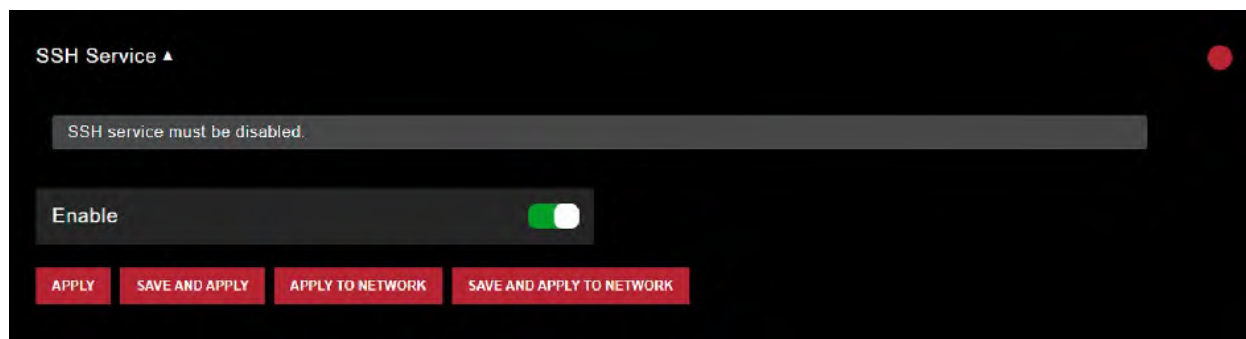


Figure 105 FIPS (SSH service)

9. The next section has SNMP disabled as default. But SNMP cannot be enabled for FIPS compliance.
10. In the next section API logs must be enabled. The API log will keep a log of all API calls made to the radio, including things done in the GUI.

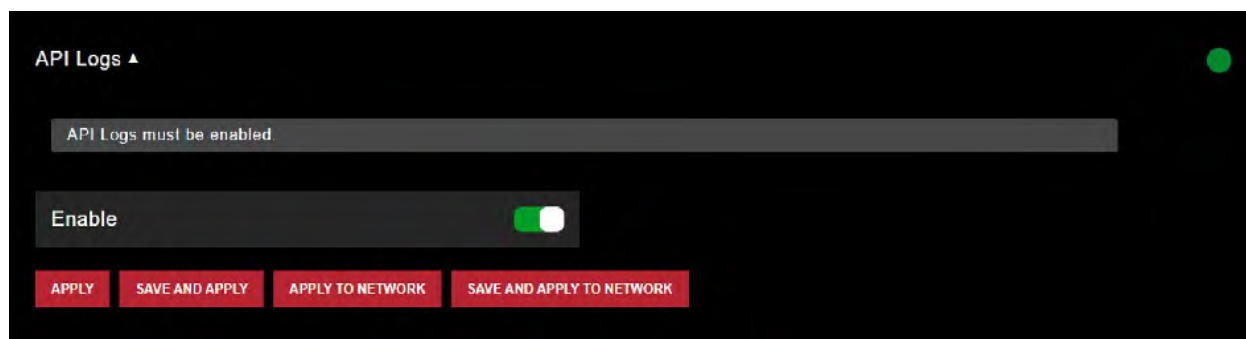


Figure 106 FIPS (API logs)

11. Next section will have you generate HTTPS certificates that are not the default.

Manage HTTPS Certificates ▲

HTTPS Certificates must be changed from default.

Add a HTTPS Certificate

GENERATE CERTIFICATE AND SAVE

ADD CERTIFICATE AND SAVE

Your HTTPS Certificate

```

-----BEGIN CERTIFICATE-----
MIIBvTCCAwoGAwIBAgIUePa+EzMr3LgAOSPlYgqOr2lzeowwCgYIKoZIzj0EAwMw
MzELMAkGA1UEBhMCVVMxEzARBgNVBAGMClNvbWUtU3RhdGUxZDZANBgNVBAoMB1Np
bHZ1czAgFw0yMjAxMjE5MDU3MDVaGA8yMjk1MTEwNjIwNTcwNVowMzELMAkGA1UE
BhMCVVMxEzARBgNVBAGMClNvbWUtU3RhdGUxZDZANBgNVBAoMB1NpBHZ1czBZMBMG
ByqGSM49AgEGCCqGSM49AwEHA0IABJ6rPXLGnSGqf3wyD3chhYI/AybhZodfh8rP
rEYzVd9AtVX/6ebnH/CXKihqEwdLpH4C5GhmenE33uqXdRuSVK6jUzBRMB0GA1Ud
DgQWBBoT0Hak0kdDAD9JjXoh3otd0CLVPjAFBgNVHSMEGDAwBToT0Hak0kdDAD9J
jXoh3otd0CLVPjAPBgNVHRMBAf8EBTADAQH/MAoGCCqGSM49BAMDA0gAMEUCIQDy
84cO+UmI3WuQmTL+KIC9UWRfNf8P3ulGV/94j+1miQIgT7UYXS0ZApatX2m170Y5
FokqpLRhf1qnD9tvhAySHAU=
-----END CERTIFICATE-----
-----BEGIN EC PRIVATE KEY-----
MHCCAQEEIOiuketlRY/ynyLAHQk6bEVkExt+QDk3ideyfn60UGQoAoGCCqGSM49
AwEHoUQDQgAEnqs9csadIap/fdIPdyGFgj8D3uFmh1+Hys+sRjNV30C1Vf/p5ucf
8JcKGoTB0ukfgLkaGZ6cTfe6pd1G5Jurg==
-----END EC PRIVATE KEY-----

```

SAVE AND APPLY TO NETWORK

Figure 107 FIPS (HTTPS certs)

- Once you have finished this step, you will see the FIPS configuration required steps to be complete, and the indicator changed from an orange color to a green color.

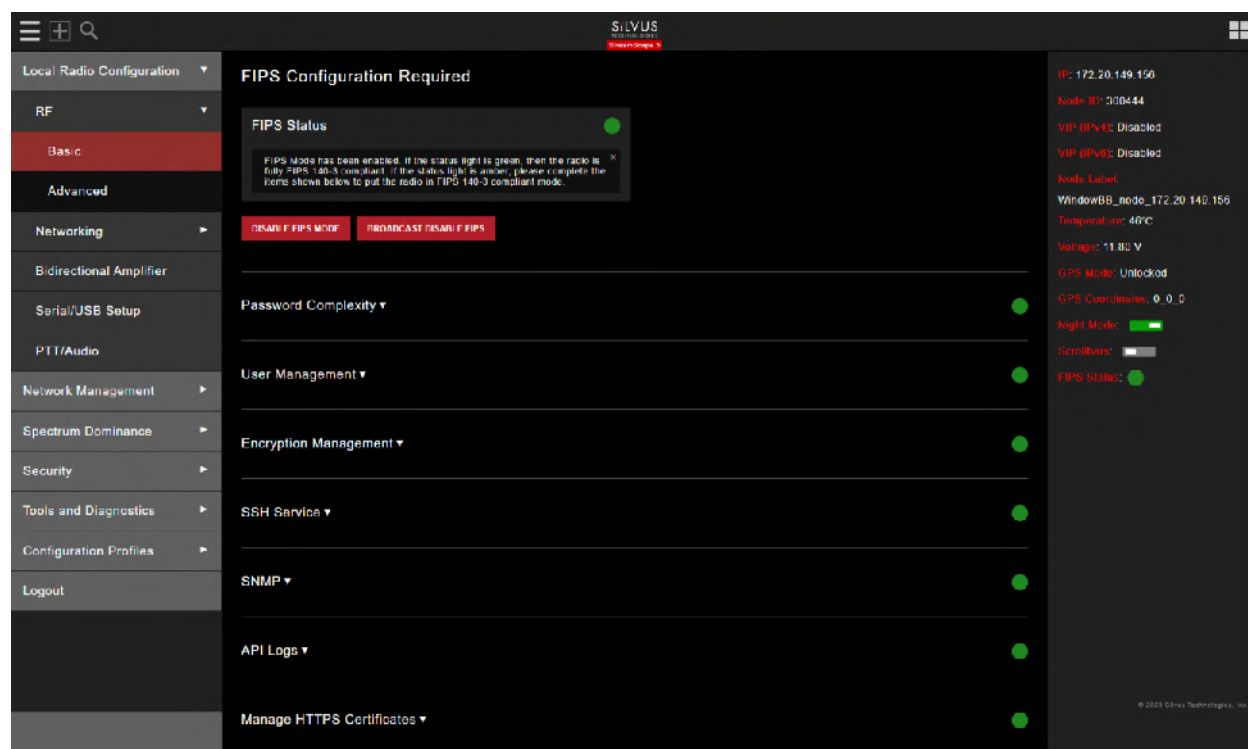


Figure 108 FIPS configuration complete

6.1.1 Potential User Errors

- Do not use the same encryption key you were using in non FIPS mode because these may have been broadcasted in plain text. Generate new ones once in FIPS mode.

6.2 List of Security Parameters

- **Passwords (Basic, Advanced, and Admin User):** Used to login to the radio as either Basic, Advanced, or Admin user.
- **Encryption Key (also called RF-Auth-Key):** This is a 256-bit sequence, represented as 64 hex numbers. It is used to establish an encrypted connection in a network.
- **SSH Host Key:** This key is used for authenticating the radio to all machines that want to connect to it via SSH.
- **SSH Login Key(s):** These are ecdsa private/public key pairs. They are used for authorizing SSH access to the radios. These key pairs are used instead of passwords since they are more secure.
- **TLS Host Key (also called HTTPS Certificate):** This certificate is used to establish a HTTPS connection. The underlying elliptic curve keys can be either secp256r1, secp384r1, or secp521r1.

7. Wired Backbone

Wired Backbone extends the StreamCaster mesh functionality over LAN (Ethernet) and WAN (Internet) links. This feature is transparent to end-users - they do not have to re-configure their devices in any manner to use this feature.

The StreamCaster routing protocol will automatically detect and route data on wired links to preserve air bandwidth.

7.1 LAN Backbone

The LAN backbone feature allows more than one radio to be connected to a LAN.

7.1.1 Implementation

One of these radios must be configured as a “gateway” radio. This radio then begins listening promiscuously on its ethernet interface to “register” all devices on the LAN as being connected to the gateway radio. At the same time, it auto-detects other non-gateway radios connected to the LAN and establishes “wired” links to them. StreamScape Web GUI will show LAN links with the link label of “wired” and turn the link color black in order to differentiate from wireless links.

The non-gateway radios do not register any devices, they merely act as relays. The gateway radio will forward traffic originating from the LAN, destined for a device attached to a wireless radio, to the non-gateway radio that is closest to the destination. Similarly, any traffic originating from a device attached to a remote wireless radio, destined to a device on the LAN will be forwarded by non-gateway radios to the gateway radio. The gateway radio will then send it to the device.

Currently we support data rates of up to 80 Mbps on the LAN without encryption. Since all LAN traffic goes via the gateway radio, this is the upper limit of all traffic that can enter or go out of the LAN from/to devices connected to wireless radios. Of course, this limit does not affect the throughput between two devices connected directly to the LAN backbone.

7.1.2 Use Case

Consider the following scenario. A business wants to do video monitoring of its grounds. High speed LAN hookups are available only in the HQ building. They want to use the StreamCaster radios on towers to

provide complete coverage of the grounds. All video feeds are sent back and displayed at the HQ. To conserve air bandwidth and possible interference to other users, we want video data to go through the high-speed LAN backbone as much as possible. The below diagram shows the scenario.

Towers 1-3 are equipped with IP cameras attached to StreamCaster radios 1-3. Radios 4-6 are mounted on three sides of the HQ building with their Ethernet interfaces connected to the high-speed LAN. Tower 1 can only communicate wirelessly with radio 4, Tower 3 with radio 5 and Tower 2 with radio 6. Video from Tower 1 will flow wirelessly to radio 4, then via the LAN backbone to the HQ viewer which is also attached to the LAN backbone. Even though the radios 4-6 may communicate wirelessly, they will choose to do so via the LAN backbone.

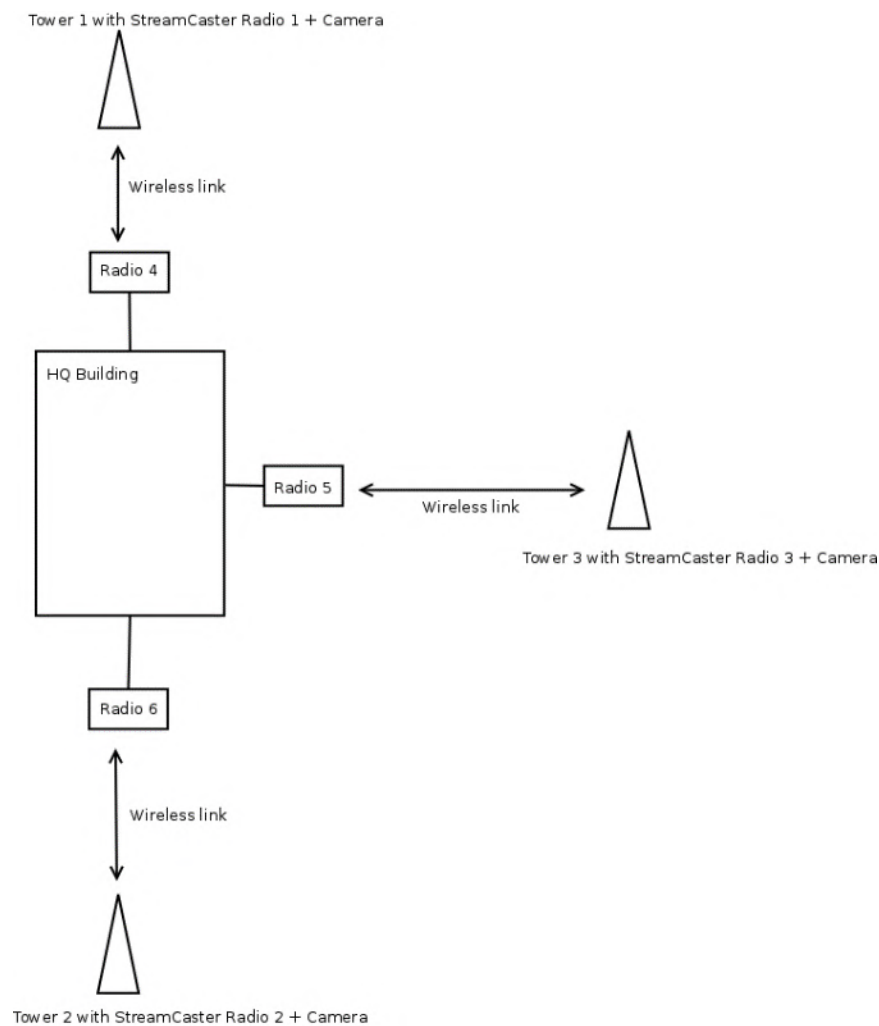


Figure 109 LAN Backbone Example

7.2 WAN Backbone with Roaming

The WAN backbone feature allows the wireless mesh network to extend over Internet links. Multiple geographically separate “sites” can be connected into one single layer 2 network as long as each site has an uplink to the Internet. The roaming feature allows mobile devices connected to StreamCaster radios to roam from one site to another without any network re-configuration.

7.2.1 Implementation

Each site wishing to become part of the wireless mesh needs to connect one StreamCaster radio to its LAN. Such a radio has to be configured to connect to a remote VPN server using the N2N protocol. Radios from multiple sites will be connected at layer 2 via the N2N VPN server creating a single broadcast domain for such nodes. By broadcasting routing packets in this domain, the nodes will auto-detect each other and establish WAN links. Such links will appear on the StreamScape GUI with a link label of “wired” and turn the link color black in order to differentiate from wireless links.

The N2N VPN server will try to establish peer-to-peer links between the radios if it can. Under some cases (e.g. symmetric NATs), this is not possible, in which case traffic between the peers is relayed by the N2N server.

The N2N server can be hosted at any server with a public IP on the Internet. As a proof-of-concept, a server has been set up on Amazon Web Services. Currently we support up to 30 Mbps unencrypted between any two sites.

7.2.2 Use Case

Consider a military scenario where a platoon of soldiers begins its mission at an HQ, then breaks up into two groups. Each group has at least one soldier with an uplink to the Internet (provided by a 4G card). The HQ also has an uplink to the Internet. Every soldier and the HQ have a StreamCaster radio attached to their devices.

The soldiers in the two groups want seamless and transparent communication between 1) other soldiers in the same group 2) soldiers in the other group 3) back to HQ. Some lone soldiers (e.g. Soldier A with a StreamCaster radio) may break up from each group and move about on their own. As they get close to group 1, 2 or the HQ, they should be able to immediately establish communication and talk to all other soldiers in the network.

The StreamCaster radios connected to the uplinks in Group 1-2 and the HQ will automatically connect and form WAN links.

Note that the WAN and LAN backbone are complementary features. E.g. at the HQ, multiple radios can be connected to a LAN backbone so that any approaching soldier or group has a direct line of sight wireless connection to the HQ.

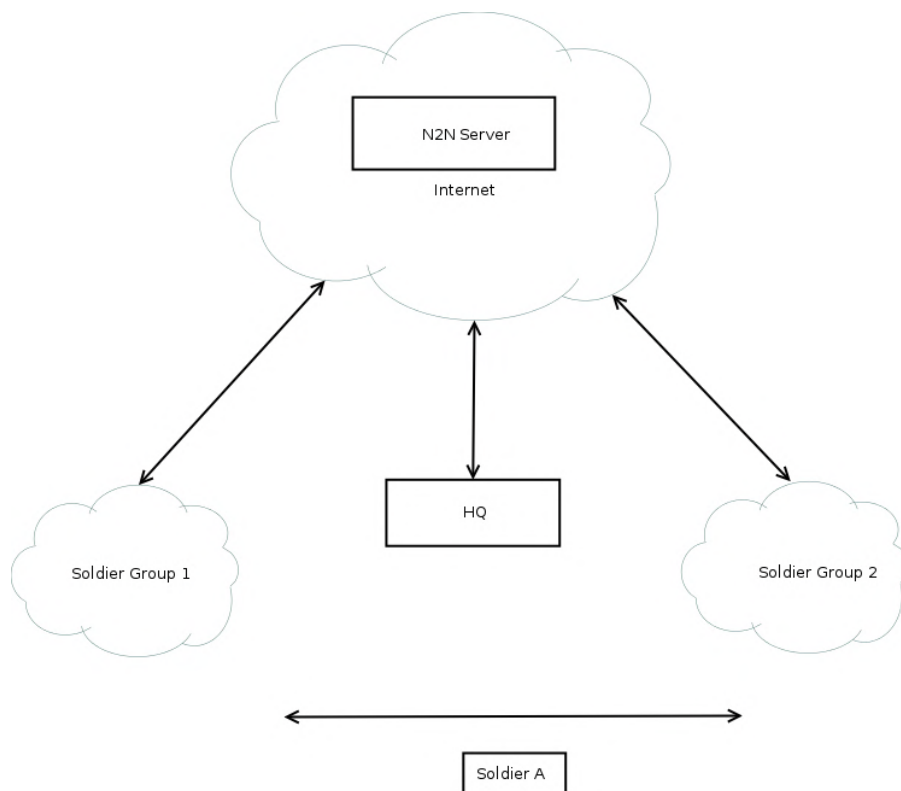


Figure 110 WAN Backbone Example

8. Custom Frequency Plan

8.1 Accessing and Installing CFP

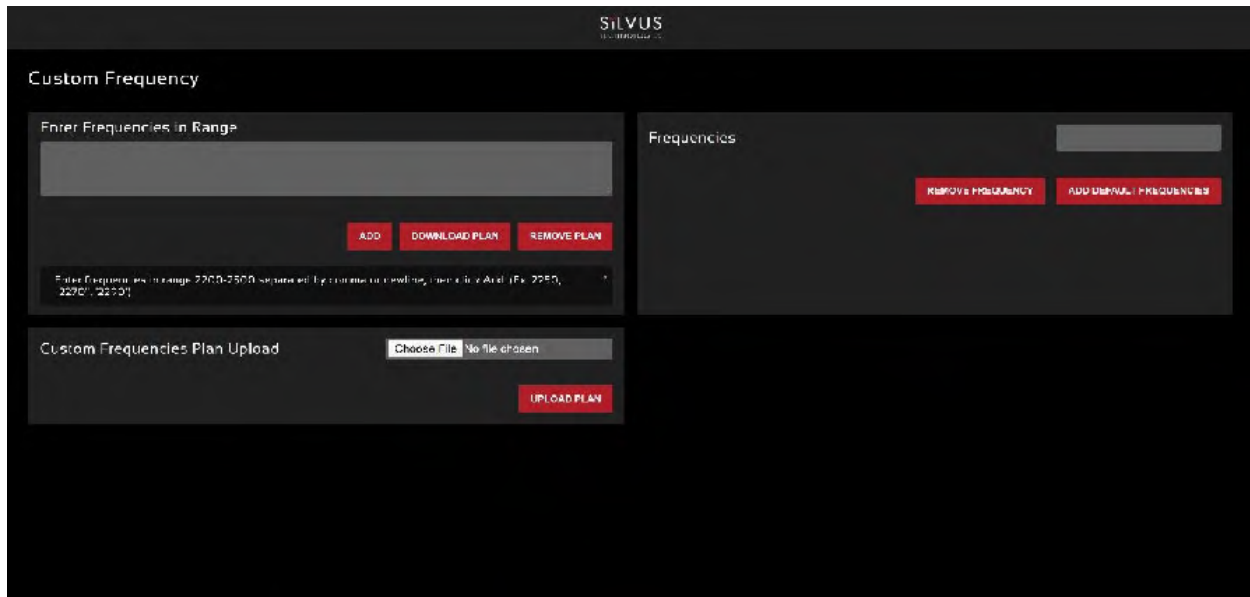


Figure 111 Custom Frequency Page

There are two ways to install the frequency plan. The first method is simpler. Users can simply click on *Create Custom Frequencies* below the frequency selection drop down to get to the custom frequency page shown in **Figure 111 Custom Frequency Page**.

- **Add:** Add the frequencies in the text box to the list
- **Download Plan:** Download the current frequency plan to a file that can be uploaded to other radios.
- **Remove Plan:** Removing the entire frequency plan. If this field is left empty, the radio will use the default frequency plan.
- **Remove Frequency:** Remove the currently selected frequency.
- **Add Default Frequencies:** The radios come with a list of default center frequencies. If you would like this list of default center frequencies in your custom list of frequencies, please select this button.
- **Custom Frequencies Plan Upload:** Upload a set of custom frequency plan from a file.

The second method requires accessing the hidden Custom Frequency Plan page. Note radios on older firmware only support this method.

The hidden Custom Frequency Plan page can be accessed via http://<radio IP>/custom_freq.sh

The interface will allow an upload of a custom frequency plan file which should be in the following format:

```
{
  "type": "custom_frequency_plan",
  "name": "cfp_example",
  "description": "CFP Example",
  "frequencies": [
    "2412",
    "2417",
    "2422",
    "2427",
    "2432",
    "2437",
    "2442",
    "2447",
    "2452",
    "2457",
    "2462",
    "2467",
    "2472",
    "5745",
    "5765",
    "5785",
    "5805",
    "5825"
  ]
}
```

(Put the above format in a Text file. Name/description can be changed)

Custom Frequency Plan Text file example:

<https://drive.google.com/file/d/0ByThlCSjgHe1TDMtZ2xDXzhEblE/view?usp=sharing>

The numbers can be changed to the frequencies desired. The name of the text file does not matter in order to be utilized. After uploading the file, the web interface will be populated with the Custom Frequency Plan.

Note:

Once installed, the Custom Frequency Plan will be cross-checked with hardware capability and the licensed frequency range previously installed on the radio. The Custom Frequency Plan will only change what is displayed. It will not give new frequencies that are previously out of licensed range.

9. Streaming Response

Some users may be interested in streaming specific information from the radio e.g. RSSI, noise floor, temperature, etc. After enabling the response, they need using the above commands, the radio will transmit the desired information in the form of UDP packets to a specific IP address and port. The format of each report message will be in the type-length-value format as shown below:

TYPE LENGTH VALUE TYPE LENGTH VALUE ...

- TYPE and LENGTH will be 16-bit unsigned integers in network-endian format.
- TYPE indicates the kind of information being transmitted. Pre-defined types are listed later in this document.
- LENGTH indicates the length of the VALUE field in bytes, including the terminating null byte.
- VALUE will be ASCII-encoded text terminated with a null byte ('\0').
- A single report will comprise of a set of type-length-value fields beginning with a “begin” report type. It will have a type which is specific to the type of report being generated, length of 1 byte and a value of an empty string (“”). Note the empty string is still null terminated.
- Each report will end with an end of report which has type 1 (type = end of report, length = 1, value = “”).
- The empty string listed above has a NULL character and has length 1. Any length number in the streaming report includes the NULL character
- A UDP packet may contain more than one report.
- The UDP packets have a maximum size of 1400 bytes.

9.1 RSSI and Noise Floor Reporting

The type/length/value for RSSI and noise floor reporting are listed in the following table:

Report Type	Data Type	Information
5009	Empty string ""	Begin of RSSI report
5010	Float	Revision number for RSSI report
5011	String	172.20.xx.xx IP of radio
5012	String	Virtual IP of radio
5000	Integer	Raw signal power of first antenna, represented in full dBm steps.
5001	Integer	Raw signal power of second antenna represented in full dBm steps.
5002	Integer	Raw signal power of third antenna represented in full dBm steps.
5003	Integer	Raw signal power of fourth antenna represented in full dBm steps.
5004	Integer	Raw noise power represented in full dBm steps.
5005	32-bit integer	Sync signal power (from digital domain, see note below).
5006	32-bit integer	Sync noise power (from digital domain, see note below).
5007	16-bit integer	Node ID of the transmitter radio that triggered the receiver to send an RSSI report packet.
5008	32-bit integer	Report sequence number, increments for every report, resets after 9999.
1	Empty string ""	End of report.

Table 27 RSSI Reporting Format

Note:

The sync noise and power (types 5005, 5006) are special values obtained after packet processing in the digital domain. They cannot be directly compared to the raw signal and noise values. To obtain an SNR from these values the user needs to run the below formula on these values:

X = sync signal power;

Y = sync noise power;

$Z = (Y - X) / 51$

$SNR_mw = (X - 12 * Z) / (64 * Z)$

$SNR_db = 10 * \log(SNR_mw) / \log(10)$

SNR_db is the SNR in dB and it is averaged across all antennae.

The SNR obtained above is more accurate when the real SNR goes below 10 dB. Above 10 dB, the SNR obtained from the raw signal and noise values are more accurate.

Below is an example of the RSSI report:

Report Type	Length	Information
5009	1	""
5010	4	"1.0"
5008	5	"2333"
5000	5	"-43"
5001	5	"-31"
5002	5	"-28"
5003	5	"-66"
5004	5	"-190"
5005	8	"8604568"
5006	8	"8861322"
5007	5	"1025"
1	1	""

Table 28 Sample RSSI Report

The corresponding raw UDP dump in hexadecimal format is attached below. For the purpose of easier reading, each byte is separated by a space, and each item is separated by a new line. The real streaming report is continuous without any spaces or newlines and is currently 109 bytes long.

13 ffffff91 0 1 0

13 ffffff92 0 4 31 2e 30 0

13 ffffff90 0 5 32 33 33 33 0

13 ffffff88 0 5 20 2d 34 33 0
13 ffffff89 0 5 20 2d 33 31 0
13 ffffff8a 0 5 20 2d 32 38 0
13 ffffff8b 0 5 20 2d 36 36 0
13 ffffff8c 0 5 2d 31 39 30 0
13 ffffff8d 0 a 20 20 38 36 30 34 35 36 38 0
13 ffffff8e 0 a 20 20 38 38 36 31 33 32 32 0
13 ffffff8f 0 5 31 30 32 35 0
0 1 0 1 0

9.2 Temperature Reporting

The type, length and value for temperature reporting are listed in the following table:

Report Type	Data Type	Data
8	Empty string ""	Begin of temperature report.
9	Float	Revision number for temperature report.
2	Integer	Current Temperature on the radio.
3	Integer	Maximum Temperature reached on the radio after last booting.
4	Integer	Overheat Count: number of times the radio temperature has exceeded temp_reporting_max_threshold.
1	Empty string ""	End of report

Table 29 Temperature Reporting Format

9.3 Voltage Reporting

The type, length and value for voltage reporting are listed in the following table:

Report Type	Data Type	Data
4001	START REPORT	Indicates start of voltage monitoring report
1	END REPORT	Indicates end of report
4003	REVISION_REPORT	Indicates revision of this report, currently always "1.1"
4004	CUR_VOLTAGE_REPORT	Current voltage value as a floating point string
4005	MIN_VOLTAGE_REPORT	Minimum voltage seen so far, as a floating point string
4006	MAX_VOLTAGE_REPORT	Maximum voltage seen so far, as a floating point string
4007	UNDERVOLTAGE_COUNT_REPORT	Number of times voltage dropped below min threshold, as an integer string
4008	OVERVOLTAGE_COUNT_REPORT	Number of times voltage spiked above max threshold, as an integer string.

Table 30 Voltage Reporting Format

10. Setting up an Iperf Test

10.1 Required Equipment

- Two laptops with jperf installed. It is beyond the scope of this manual to cover the installation and operation of these tools. The laptops must be on the same subnet but not necessarily the same subnet as the radios (172.20.xx.yy). It is not required for the user to set a secondary IP address on the radio to perform this test. It is recommended the iperf or jperf tests are first conducted between the laptops using an Ethernet switch or cross-over Ethernet cable between them to verify the laptops and iperf/jperf tools.
- Two or more StreamCaster radios properly configured.

10.2 Running Iperf Test

- Connect a laptop to one StreamCaster radio using the Ethernet cable.
- Connect the other laptop to another StreamCaster radio.
- Power up the radios and verify the radios are booted and connected wirelessly.
- At the receiver side type the following in a terminal
 - `iperf -s -u -i 1`
- At the transmitter side type the following in a terminal
 - `iperf -c receiver_laptop_ip_address -u -i 1 -b 1M -t 60`

11. Precautions and Recommendations

11.1 Saving the Radio Configuration

It is very important that the radio does not lose power during any configuration changes in which the user requests a “save and apply” operation. Partial saving of the configuration to the radio due to power interruption may disable the radio requiring reprogramming at the factory. Also, please wait for a “done” feedback at the web interface before proceeding to any other configuration changes.

12. Troubleshooting

12.1 Intermittent Link

- In a long range scenario if SNR is good but link drops unexpectedly check link distance parameter and make sure that the link distance is set the same on all radios and sufficiently large enough.
- Check interference levels as strong interference can result in an intermittent link.

13. FCC Notice

13.1 FCC Identifier: N2S-SC3500

Silvus Model #: SC3500-243541

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antenna: 3dB Omni (AOV3T245515575)

Bandwidth: 20MHz

Maximum Output Power across Frequency Range #1: 495.28mW from 2427MHz to 2447MHz

Maximum Output Power across Frequency Range #2: 493.62mW from 5745MHz to 5830MHz

13.2 FCC Identifier: N2S-SC3822

Silvus model #: SC3822-245580

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antenna: 3dB Omni (AOV3T245515575)

Bandwidth: 20MHz

Maximum Output Power across Frequency Range #1: 268.64mW from 2420MHz to 2450MHz

Maximum Output Power across Frequency Range #2: 329.02mW from 5760MHz to 5810MHz

13.3 FCC Identifier: N2S-SC42-245

Silvus model #: SC4210-245-BB, SC4240-245-BB

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antenna: 2.1dBi Omni Antennas (AOV2S230515)

Bandwidth: 10MHz

Maximum Output Power @ Frequency #1: 810.17mW @ 2430MHz

Maximum Output Power @ Frequency #2: 795.3mW @ 2440MHz

13.4 FCC Identifier: N2S-SC44-245

Silvus model #: SC4410-235-SBST, SC4480-235-SBST

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antenna: 2.1dBi Omni Antennas (AOV2S230515)

Bandwidth: 10MHz

Maximum Output Power @ Frequency #1: 582.1mW @ 2430MHz

Maximum Output Power @ Frequency #2: 523.6mW @ 2440MHz

13.5 FCC Identifier: N2S-SC42-520

Silvus model #: SC4210E-520-BB, SC4240E-520-BB

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antenna: 6dBi Omni Antennas (Peak Antennas CO520-6-LS)

Bandwidth: 20MHz

Maximum Output Power @ Frequency #1: 414.03mW @ 5220MHz

Maximum Output Power @ Frequency #2: 498.92mW @ 5240MHz

13.6 FCC Identifier: N2S-SC44-520

Silvus model #: SC4410E-520-SBST, SC4480E-520-SBST

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antenna: 6dBi Omni Antennas (Peak Antennas CO520-6-LS)

Bandwidth: 20MHz

Maximum Output Power @ Frequency #1: 241.48mW @ 5220MHz

Maximum Output Power @ Frequency #2: 246.52mW @ 5240MHz

13.7 FCC Identifier: N2S-SC42E-245

Silvus model #: SC4210E-245-EB
Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.1dBi Omni Antennas (Silvus AOV2D230515) & 4dBi Omni Antennas (Silvus AOV4S235)

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power @ Frequency #1: 789.84mW @ 2430MHz

Maximum 10MHz Bandwidth Output Power @ Frequency #2: 790.06mW @ 2440MHz

Bandwidth: 20MHz

Maximum 20MHz Bandwidth Output Power @ Frequency #1: 123.82mW @ 2440MHz

13.8 FCC Identifier: N2S-SC42E-235470

Silvus model #: SC4240E-235470-BB

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.5dBi Omni Antennas (Silvus part# 1001-071)

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power @ Frequency #1: 891.25mW @ 4945MHz, 4950MHz, 4955MHz, 4960MHz, 4965MHz, 4970MHz

Maximum 10MHz Bandwidth Output Power @ Frequency #2: 955mW @ 4975MHz, 4980MHz, 4985MHz

13.9 FCC Identifier: N2S-SC44E-235470

Silvus model #: SC4480E-235470-SBST

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.5dBi Omni Antennas (Silvus part# 1001-071)

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power @ Frequency #1: 912mW @ 4945MHz, 4950MHz, 4955MHz

Maximum 10MHz Bandwidth Output Power @ Frequency #2: 933.25mW @ 4960MHz, 4965MHz, 4970MHz

Maximum 10MHz Bandwidth Output Power @ Frequency #3: 912mW @ 4975MHz, 4980MHz, 4985MHz

13.10 FCC ID: N2S-SL42-245

Silvus model #: SL4210-245-SB

Equipment Class: Digital Transmission System

Antennas: 2.1dBi Omni Antennas (Silvus part# 1001-071)

Bandwidth: 1.25, 2.5 or 5MHz

Maximum 5MHz Bandwidth Output Power @ Frequency #1: 950.6mW @ 2412MHz

Maximum 5MHz Bandwidth Output Power @ Frequency #2: 862.98mW @ 2440MHz

Maximum 5MHz Bandwidth Output Power @ Frequency #3: 968.28mW @ 2462MHz

Maximum output power for 5MHz @ operating frequency spectrum should not exceed 27dBm/antenna

13.11 FCC ID: N2S-SL4210-245-OEM (Modular Certification)

The product SL4210-245-O is approved for modular certification by FCC under the following ID:
FCC ID: N2S-SL4210-245-OEM



Figure 112 Silvus Radio Model SL4210-235-O

- Equipment Class: Digital Transmission System
- Frequency band: S-band, 2200-2500 MHz
- Maximum output power/antenna: 0.5W, 27dBm
- Bandwidth: 1.25, 2.5 or 5MHz
- Maximum 5MHz Bandwidth Output Power @ Frequency #1: (BACL test report)
- Maximum 5MHz Bandwidth Output Power @ Frequency #2: (BACL test report)
- Maximum 5MHz Bandwidth Output Power @ Frequency #3: (BACL test report)
- Maximum output power for 5MHz @ operating frequency spectrum should not exceed 27dBm/0.5W/antenna
- Recommended Antennas: 2.1dBi Omni Antennas (Silvus part# AOV2D230515G-TM) or equivalent for FCC 2.109 & 15.247 RF Exposure compliance
- DC supply: the customer provides DC power from their own DC supply source; the supply should be fused for 5-amp circuit.

Modular approval allows installation in different end-use products by an OEM with limited or no additional testing or equipment authorization for the transmitter function provided by the SL4210-245-O:

- ❖ No additional transmitter compliance testing is required if the module is operated with an approved antenna.
- ❖ No additional transmitter compliance testing is required if the module is operated with the same general type of antenna listed as approved in the SL4210-245-O documentation.
- ❖ Acceptable antennas must be of equal or less far field gain than the antenna previously authorized under the same FCC ID and must have similar in band and out of band characteristics.

The end-product must comply with all applicable FCC equipment authorizations, regulations, requirements and equipment functions not associated with the SL4210-245-O.

Compliance must be demonstrated to regulations for other transmitter components within the host product, to requirements for unintentional radiators (Part 15B), and to additional authorization requirements for the non-transmitter functions.

The OEM applying the SL4210-245-O is required to include all FCC statements and warnings detailed in the following sections to the end-product labeling and in the finished product manual.

13.11.1 Product Label

A statement must be included on the exterior of the final OEM product which communicates that the device identified by the FCC ID number is contained within the product. Include the statement:

- Contains FCC ID: N2S-SL4210-245-OEM

Additionally, the OEM must include the following statements on the exterior of the finished product:

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

13.11.2 User Manual (Customer end-product)

Any user documentation that accompanies the end-product must include the following information in a location that is easily read:

- To comply with FCC's RF radiation exposure requirements, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 20 cm is maintained between the reader (antenna) & user's/nearby people's body at all times and must not be collocated or operating in conjunction with another antenna or transmitter.

The finished product manual must contain the following statement:

- **WARNING:** The Federal Communications Commission warns that changes or modifications of the radio module within this device not expressly approved by Silvus Technologies, Inc. could void the user's authority to operate the equipment.

In the case where an OEM seeks class B (residential) limits for the host product, the finished product manual must contain the following statement:

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

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

In the case where an OEM seeks the lesser category of a Class A digital device for their finished product, the following statement must be included in the manual of the finished product:

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

13.11.3 OEM Accessories

Accessories for the SL4200 OEM unit are detailed below:

Silvus PN	Description
SC42E-OEM-2	RF connector, right angle SMP (f) to TNC (f); 38 mm length
SC22-OEM-6	RF connector right angle SMP (f) to SMA (f); 21 mm length
SC22-OEM-6-75mm	75 mm length
SC22-OEM-6-150mm	150 mm length
SC22-OEM-6-155mm	155 mm length
SC22-OEM-6-240mm	240 mm length
SC22-OEM-6-750mm	750 mm length
SL42-OEM-CK	Mating connector kit (6 connectors, less RF, with extra crimp pins)
SL42-OEM-L200	Status LED (200 mm wire leads; Red/Green color)
SL42-OEM-S0	2-pos On/Off rotary switch (no wires, contacts only)

Table 31 SL4200 OEM Accessories

13.11.4 Interface Connections

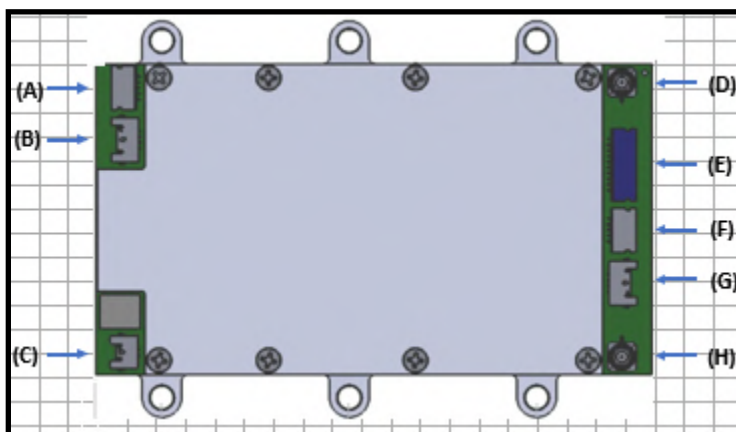


Figure 113 SL4200 OEM Connector Diagram

Fig Ref	PCB Nom	Description	Connector Type	Vendor	MPN Mating Connector
A	USB1	USB1	Header RA 5-POS (1mm)	JST Sales	SHLP-05V-S-B
B	USB PD	USB-PD (9V only)	Header RA 4-POS (1mm)	Molex	50376404013
C	VBAT	VBAT (9V - 32V)	Header RA 3-POS (1mm)	Molex	50376403013
D	1	RF-1	SMP Straight Jack (Male)	Amphenol	See accessories
E	RS232	Serial & Misc	Header RA 10-POS (1mm)	JST Sales	SHLP-10V-S-B
F	USB0	USB0	Header RA 5-POS (1mm)	JST Sales	SHLP-05V-S-B
G	ONOFF	Status LED/Power Switch	Header RA 4-POS (1mm)	Molex	50376404013
H	2	RF-2	SMP Straight Jack (Male)	Amphenol	See accessories

Table 32 SL4200 Interfaces

Connection pin-outs are detailed in [StreamCaster Lite SL4200 OEM Integration](#).

13.11.5 DC Power Consumption & Heat Management requirements

The SL4200 OEM radio has a maximum native RF output power of 500 mW/antenna. Power consumption varies from 4.8 Watts (not transmitting) to 17 Watts depending on the transmit duty cycle, transmit power, frequency band used and if USB devices are connected. Average power consumption will be proportional to the transmit duty cycle. Peak power is 25 Watts (2.8A @ 9VDC, 2.1A @ 12 VDC) @burst transmissions for 100 micro-seconds.

When using a USB-C PD power source, the source must be rated to supply 3.0A @ 9 VDC. The external power source must be sized to meet this peak requirement. When using VBAT input the voltage range is 9.0 to 32.0 VDC. However, the radio is most power efficient when operating at 15VDC.

The recommended heat management details are in the [StreamCaster Lite SL4200 OEM Integration Manual](#).

13.12 FCC ID: N2S-SC421-235

Silvus model #: SC4210EP-235-BB, SC4210EP-235F-BB, SC4210EP-235-EB, SC4210EP-235F-EB
Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.1dBi Omni Antennas (Silvus part# AOV2D230515, vendor pn# 1001-071)

Band: 2.4GHz ISM

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power: 177.83mW @ 2440MHz

Maximum output power for 10MHz @ operating frequency spectrum should not exceed 20dBm/antenna

13.13 FCC ID: N2S-SC424-235

Silvus model #: SC4240EP-235-BB, SC4240EP-235F-BB, SC4240EP-235-EB, SC4240EP-235F-EB
Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.1dBi Omni Antennas (Silvus part# AOV2D230515, vendor pn# 1001-071)

Band: 2.4GHz ISM

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power: 177.83mW @ 2440MHz

Maximum output power for 10MHz @ operating frequency spectrum should not exceed 20dBm/antenna

13.14 FCC ID: N2S-SC42A-235

Silvus model #: SC42A0EP-235-BB, SC42A0EP-235F-BB, SC42A0EP-235-EB, SC42A0EP-235F-EB
Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.1dBi Omni Antennas (Silvus part# AOV2D230515, vendor pn# 1001-071)

Band: 2.4GHz ISM

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power: 190.55mW @ 2440MHz

Maximum output power for 10MHz @ operating frequency spectrum should not exceed 20dBm/antenna

13.15 FCC ID: N2S-SC421-235467

Silvus model #: SC4210EP-235467-BB, SC4210EP-235467F-BB, SC4210EP-235467-EB, SC4210EP-235467F-EB

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.1dBi Omni Antennas (Silvus part# AOV2D230515, vendor pn# 1001-071)

Band: 2.4GHz ISM

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power: 186.21mW @ 2440MHz

Maximum output power for 10MHz @ operating frequency spectrum should not exceed 20dBm/antenna

13.16 FCC ID: N2S-SC424-235467

Silvus model #: SC4240EP-235467-BB, SC4240EP-235467F-BB, SC4240EP-235467-EB, SC4240EP-235467F-EB

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.1dBi Omni Antennas (Silvus part# AOV2D230515, vendor pn# 1001-071)

Band: 2.4GHz ISM

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power: 165.96mW @ 2440MHz

Maximum output power for 10MHz @ operating frequency spectrum should not exceed 20dBm/antenna

13.17 FCC ID: N2S-SC42A8-235467

Silvus model #: SC42A8EP-235467-BB, SC42A8EP-235467F-BB, SC42A8EP-235467-EB, SC42A8EP-235467F-EB

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.1dBi Omni Antennas (Silvus part# AOV2D230515, vendor pn# 1001-071)

Band: 2.4GHz ISM

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power: 173.78mW @ 2440MHz

Maximum output power for 10MHz @ operating frequency spectrum should not exceed 20dBm/antenna

13.18 FCC ID: N2S-SC441-235

Silvus model #: SC4410E-235-SBST, SC4410E-235F-SBST

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.1dBi Omni Antennas (Silvus part# AOV2D230515, vendor pn# 1001-071)

Band: 2.4GHz ISM

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power: 169.82mW @ 2440MHz

Maximum output power for 10MHz @ operating frequency spectrum should not exceed 17dBm/antenna

13.19 FCC ID: N2S-SC448-235

Silvus model #: SC4480E-235-SBST, SC4480E-235F-SBST

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.1dBi Omni Antennas (Silvus part# AOV2D230515, vendor pn# 1001-071)

Band: 2.4GHz ISM

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power: 190.55mW @ 2440MHz

Maximum output power for 10MHz @ operating frequency spectrum should not exceed 17dBm/antenna

13.20 FCC ID: N2S-SC44K-235

Silvus model #: SC44K0E-235-SBST, SC44K0E-235F-SBST

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.1dBi Omni Antennas (Silvus part# AOV2D230515, vendor pn# 1001-071)

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power: 165.96W @ 2440MHz

Maximum output power for 10MHz @ operating frequency spectrum should not exceed 17dBm/antenna

13.21 FCC ID: N2S-SC441-235467

Silvus model #: SC4410E-235467-SBST, SC4410E-235467F-SBST

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.1dBi Omni Antennas (Silvus part# AOV2D230515, vendor pn# 1001-071)

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power: 204.17mW @ 2440MHz

Maximum output power for 10MHz @ operating frequency spectrum should not exceed 17dBm/antenna

13.22 FCC ID: N2S-SC448-235467

Silvus model #: SC4480E-235467-SBST, SC4480E-235467F-SBST

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.1dBi Omni Antennas (Silvus part# AOV2D230515, vendor pn# 1001-071)

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power: 186.21mW @ 2440MHz

Maximum output power for 10MHz @ operating frequency spectrum should not exceed 17dBm/antenna

13.23 FCC ID: N2S-SC44KG-235467

Silvus model #: SC44KGE-235467-SBST, SC44KGE-235467F-SBST

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate FCC requirements:

Antennas: 2.1dBi Omni Antennas (Silvus part# AOV2D230515, vendor pn# 1001-071)

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power: 194.98mW @ 2440MHz

Maximum output power for 10MHz @ operating frequency spectrum should not exceed 17dBm/antenna

13.24 Common Notes

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

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

In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of the manufacturer could void the user's authority to operate the equipment.

To satisfy RF exposure requirements, this device and its antennas must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

14. EU-CE Markings

14.1 (-206 models)

The following Silvus Technologies models are declared to conform to CE Mark requirements:

Silvus P/N: SC4240-206-EB, SC4480-206-SBST, SC4240E-206-EB, SC4480E-206-SBST
SC4240E-206-BB

Relevant standards:

ETSI EN 302 064 V2.1.1 (2016-09), Wireless Video Links, Harmonized Standard

ETSI EN 301 489-1 V2.2.0 (2017-03), EMC, Common Technical Requirements

ETSI EN 301 489-28 V1.1.1 (2004-09), EMC, Specific conditions for wireless digital video links

EN 60950-1, Information Technology Equipment, Safety

Frequency range: 2025-2110 MHz

Maximum RF power: 500 mW per channel, up to a maximum EIRP of 1.6 watts for the SC4240-206-EB, SC4240E-206-EB, SC4240E-206-BB and 3.2 watts for the SC4480-206-SBST, SC4480E-206-SBST

Antenna: 2.15dBi Omni Antennas (AOV2D230515)

Cable: Silvus cable assembly (SC22-PRICBL02-6)

External Bandpass Filter:

Microwave Filter Co. model 3813

(a filter of equivalent performance may also be used, contact Silvus Technologies customer support for more information)

AC Adapter (if used): EDAC Power Electronics EA10523C-120 (this adapter is approved for indoor use only) (this adapter was certified by the manufacturer to IEC 60950-1)

External DC supply: If the customer provides DC power from their own source, the supply should be fused for a 5-amp circuit.

Safe Working Distance:

Maintain safe working distance of minimum 20cm. For more details, refer to TUV report no. SD72128709-0617A-0617C, "Radio Frequency Exposure Verification of the Silvus Technologies Inc. StreamCaster SC420-206 and SC4480 Tactical MIMO Radio EN 62311 January 2008" (copy of

report available upon request). The CE Mark Technical File is available upon request for inspection.

To satisfy RF exposure requirements, this device and its antennas must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter, except in accordance with RED RF Exposure requirements.

This equipment has been constructed so that the product complies with the requirement of with Article 10(2) as it can be operated in at least one Member State as examined and the product is compliant with Article 10(10) as it has no restrictions on putting into service in all EU member states.

See restrictions mentioned in ERC Recommendation 25-10, Table 7-C2, for guidance of restrictions applicable to specific countries.

Table 7-C2: additional information regarding the national conditions for the identified tuning ranges for video PMSE applications - Band C2

Frequency Band	Country	Implementation	Conditions/remarks
C2 2026-2110 MHz	AUT	L*	Max. 10MHz Channels, max. 20dBW eirp, 2070-2085 MHz: Restricted to Broadcasters only, 2086-2110 MHz: Restricted in for frigates and private users
	AZE	Y*	On a secondary basis
	BEL	L	11 IS old MW link systems for FMSS - Military use in 2025-2110 MHz
	BUL	Y	ECG Report 215: Available for Cordless Cameras, Portable video links and Mobile video links
	CZE	Y*	The band may be used in the coordination with the Ministry of Defense of the Czech Republic: https://www.czr.mil.cz/sites/default/files/obrazek/obrazek-rsmp-p-06_09-2014-07_en.pdf , now version is available only in czech https://www.czr.mil.cz/sites/default/files/obrazek/obrazek-rsmp-p-06_09-2014-07_en.pdf
	DE	N	Deviations from the specifications in the Frequency Plan (Frepf) could be permitted for a limited time in accordance with §50 TRG. This is provided that the frequency usages indicated in the Frequency Ordinance (FregV) and the Frequency Plan are not adversely affected (for more details see: https://www.bundesnetzagentur.de/cdn_01120/L/Sachgebiete/elektromunikation/Unternehmen_Institutionen/frequenzen/pezielleAnwendungen/KurzzeitlicheNutzung/kurzzeitlicheNutzung.html)
	UNK	Y*	
	L	N	Band not available
	EST	L*	2025-25-2110 MHz, SAR/SAR: See Regulation of Ministry of Communication and Cultural Affairs 21.05.2013 No.35. Otherwise government use
	FR	L*	Temporary licenses, eirp max. 30 dBW. Use of 10 MHz bandwidth centered on 2055 MHz and 2085 MHz for ground to ground link and 10 MHz bandwidth centered on 2085 MHz and 2105 MHz for air-to-ground link. Coordination required between assigning authorities (a Defense and Space) regarding the use of the other available bands in order to avoid harmful interference. ARCELIT Decision 2016-1530
	FIN	L*	Cordless cameras, temporary use on a case-by-case basis. Standard EN 302069. Other use includes military use and space operation
	GI	Y*	Technology and application remain but typically used for wireless cameras, typically licensed at 100 mW eirp
	GEO	L*	
	GRC	L*	Cordless Cameras, Portable/Mobile video links, 2087 to 2106.5 MHz: not available (exclusive use by security services)
	HUNG	N	Band not available (governmental use). However, the band may be used for short term FMSE use if the user demand makes it necessary at certain occasions like main events. In this case the authority handles the requests on a case-by-case basis and if the frequency use can be authorised the users receive an individual license
	HOL	L*	2070-2110 MHz for FMSS-OR only
*possible implementation status: Y = the whole band is available for FMSS, L = Limited availability, N = the band is not available for FMSS, * = individual license may be required, ! = restrictions apply (e.g. geographical restrictions)			

Table 33 Additional Restrictions on Band C2

EU DECLARATION OF CONFORMITY

Number: *STDOC1001*

Name and address of the Manufacturer

Silvus Technologies, Inc.,
10990 Wilshire Blvd., Suite #1500
Los Angeles, CA 90024 U.S.A

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Object of the declaration

Product information

StreamCaster SC4240-206-EB, SC4480-206-SBST, SC4240E-206-EB, SC4480E-206-SBST

Additional information

SW version : v3.12.6.4 for SC4240-206-EB and SC4480-206-SBST
HW version : C5 for SC4240-206-EB, B1 for SC4480-206-SBST

SW version : v3.17.1.1 for SC4240E-206-EB and SC4480E-SBST
HW version : C7 for SC4240E-206-EB and B1 for SC4480E-SBST

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

- References to the relevant harmonised standards used or references to the technical specifications in relation to which conformity is declared

Radio Equipment Directive 2014/53/EU

EN 301 489-1 V2.1.1
EN 301 489-28 V1.1.1
EN 302 064 V2.1.1
EN 60950-1:2006+A11:2009+A1:2010+A12:2011+A2:2013
EN62311:2008

RoHS Directive 2011/65/EU

EN 50581:2012

The notified body

Name: TÜV SÜD American
Number:1929

performed

- a conformity assessment of the technical construction file

and issued the certificate

CB-19-0102

Additional information

N/A

Signed for and on behalf of: Silvus Technologies

Authorised Representative:

Name and Surname / Function:

Weijun Zhu, Vice President of Engineering

Date of issue:

8-12-2019



1/1

EU DECLARATION OF CONFORMITY

Number: *STDOC1001*

Name and address of the Manufacturer

Silvus Technologies, Inc.,
10990 Wilshire Blvd., Suite #1500
Los Angeles, CA 90024 U.S.A

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Object of the declaration

Product information

StreamCaster SC4240E-206-BB

Additional information

SW version : v3.17.1.1
HW version : B7

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

- References to the relevant harmonised standards used or references to the technical specifications in relation to which conformity is declared

Radio Equipment Directive 2014/53/EU

EN 301 489-1 V2.1.1
EN 301 489-28 V1.1.1
EN 302 064 V2.1.1
EN
60950-1:2006+A11:2009+A1:2010
+A12:2011+A2:2013
EN62311:2008

RoHS Directive 2011/65/EU

EN 50581:2012

The notified body

Name: TÜV SÜD American
Number:1929

performed

a conformity assessment of the technical construction file

and issued the certificate

CB-19-0102

Additional information

N/A

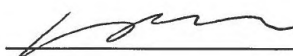
Signed for and on behalf of: Silvus Technologies

Authorised Representative:

Name and Surname / Function:

Weijun Zhu, Vice President of Engineering

Date of issue: *1-7-2020*



1/1

14.2 (-139 Models)

The following Silvus Technologies models are declared to conform to CE Mark requirements:

Silvus P/N: SC4240EP-139-BB, SC4240EP-139-EB, SC4480E-139-SBST

Relevant standards:

ETSI EN 302 064 V2.1.1 (2016-09), Wireless Video Links, Harmonized Standard

ETSI EN 301 489-1 V2.2.0 (2017-03), EMC, Common Technical Requirements

ETSI EN 301 489-28 V1.1.1 (2004-09), EMC, Specific conditions for wireless digital video links

EN 62368-1, Product Safety Standard

Frequency range: 1350-1440 MHz

Maximum RF power: 2W per channel, up to a maximum EIRP of 4 watts for the SC4240EP-139-BB, SC4240EP-139-EB and 8 watts for the SC4480E-139-SBST

Antenna: 2.1dBi Omni Antennas (AOV2S192)

Cable: Silvus cable assembly (SC22-PRICBL02-6)

External Bandpass Filter:

Microwave Filter Co. model 3813

(a filter of equivalent performance may also be used, contact Silvus Technologies customer support for more information)

AC Adapter (if used): EDAC Power Electronics EA10523C-120 (this adapter is approved for indoor use only) (this adapter was certified by the manufacturer to IEC 60950-1)

External DC supply: If the customer provides DC power from their own source, the supply should be fused for a 5-amp circuit.

Safe Working Distance:

Maintain safe working distance of minimum 20cm. For more details, refer to TUV report no. 7217985B, "Radio Frequency Exposure Verification of the Silvus Technologies Inc. StreamCaster SC4240EP-139 and SC4480E-139 Tactical MIMO Radio EN 62311 January 2008" (copy of report available upon request). The CE Mark Technical File is available upon request for inspection.

To satisfy RF exposure requirements, this device and its antennas must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter, except in accordance with RED RF Exposure requirements.

This equipment has been constructed so that the product complies with the requirement of with Article 10(2) as it can be operated in at least one Member State as examined and the product is compliant with Article 10(10) as it has no restrictions on putting into service in all EU member states.

See restrictions mentioned in ERC Recommendation 25-10, Table 7-C2, for guidance of restrictions applicable to specific countries.

Table 7-C2: additional information regarding the national conditions for the identified tuning ranges for video PMSE applications - Band C2

Frequency Band	Country	Implementation	Condition/remarks
C2 2025-2110 MHz	AUT	Y ⁺	Max. 10 MHz Channels, max. 20dBSM ERP, 2070-2075.0 MHz Reserved to Dispositives only 2080-2110 MHz Reserved to Dispositives and private users
	AZE	Y ⁺	On a secondary basis
	BEL	L	FDS old MW link systems for FMSE Military use in 2025-2110 MHz
	BUL	Y ⁺	ECC Report 219. Available for Cordless Cameras, Portable video links and Mobile video links
	CZE	Y ⁺	This band may be used in the coordination with the Ministry of Defence of the Czech Republic: https://www.cdu.cz/cdu/obsah/default.htm/obsah/actual-rsnp-c-06-00-20-14-07_en.pdf , new version is available only in czech https://www.cdu.cz/obsah/default.htm/obsah/cdu/vyvaz-k-uplatneni-onpominok-k-ovrtu-oprateni-dle-nove-puvabny-casovny-ovrtu-dle-noveho-casovneho-pravidla-2017-ysj-on-komunikacni-systemu-1900-2200-mhz/fba/kyj/y-j-05-2017.pdf
	FI	N	Provelikens from the specifications in the Frequency Ordinance (FregO) cannot be permitted for a limited time in accordance with §50 TRG. This is provided that the frequency usages indicated in the I frequency Ordinance (I regv) and the I frequency /I an are not adversely affected (for more details see: https://www.bonde.se/legislation/decision_1412/LULSachgreder/Telekommunikation/Urtillsamman/Insulationen/I-regven/Specialanvandningen/Kurze/fzuckhuncn/kurze/fzuckhuncn-nr-node.html)
	UNK	Y ⁺	
	L	N	Used not available
	PST	Y ⁺	2025-25-2110 MHz SAP/SAO. See Regulation of Ministry of Communication and Economical Affairs 21.05.2013 No.35. Otherwise governmental use
	FR	Y ⁺	Temporary licenses, e.g. p. max = 10 dBSM Use of 10 MHz bandwidths centered on 2055 MHz and 2085 MHz for ground-to-ground link and 10 MHz bandwidth centered on 2085 MHz and 2105 MHz for air-to-ground link. Coordination required between assigning authorities (for Distance and Space) regarding the use of the other available bands in order to avoid harmful interference. A/RULP Decision 2016 1120
	FIN	Y ⁺	Cordless cameras, temporary use on a case-by-case basis. Standard EN 302064. Other use includes military use and space operation
	GR	Y ⁺	Technology used application remains but typically used for wireless cameras, typically licensed at 100 mW/e.u.p
GEO	L ⁺		
GRC	L ⁺	Cordless Cameras, Portable/Mobile video links, 2087.5-2108.5 MHz : not available (exclusive use by security services)	
HUNG	N	Used not available (governmental use). However, the band may be used for short term LMSL use if the user demand makes it necessary at certain occasions like main events. In this case the authority handles the requests on a case-by-case basis and if the frequency use can be authorised the users receive an individual licence	
HOL	L ⁺	2070-2110 MHz for ENG-DE only	
ossible implementation status: Y = the whole band is available for LMSL L = Limited availability N = the band is not available for LMSL + = individual licence may be required I = restrictions apply (e.g. geographical restrictions)			

Table 34 Additional Restrictions on Band C2

EU DECLARATION OF CONFORMITY

Number: 10045C000

Name and address of the Manufacturer

Silvus Technologies, Inc.,
10990 Wilshire Blvd., Suite #1500
Los Angeles, CA 90024 U.S.A

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Object of the declaration

Product information

StreamCaster:
SC4240EP-139-BB, SC4240EP-139-EB, SC4480E-139-SBST

Additional information SW version : v4.0.2.7 (all models)
HW version : B1: SC4480E-139-SBST
B7: SC4240EP-139-BB
C7: SC4240EP-139-EB

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

- References to the relevant harmonised standards used or references to the technical specifications in relation to which conformity is declared

Radio Equipment Directive 2014/53/EU

RoHS Directive 2011/65/EU

EN 301 489-1 V2.1.1
EN 301 489-28 V1.1.1
EN 302 064 V2.1.1
EN 62368-1
EN62311:2008

EN 50581:2012

The notified body

Name: TÜV SÜD America
Number: 1929

performed

- a conformity assessment of the technical construction file

and issued the certificate

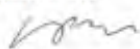
NB06 002138 0004 Rev. 00

Additional information

N/A

Signed for and on behalf of: Silvus Technologies Inc

Authorised Representative:



Name and Surname / Function:

Weijun Zhu, Vice President of Engineering

Date of Issue:

March 2, 2023

14.3 (-235467 Models)

The following Silvus Technologies models are declared to conform to CE Mark requirements:

Silvus P/N: SC4240EP-235467-BB, SC4240EP-235467-EB, SC4480E-235467-SBST

Relevant standards:

ETSI EN 302 064 V2.1.1 (2016-09), Wireless Video Links, Harmonized Standard

ETSI EN 301 489-1 V2.2.0 (2017-03), EMC, Common Technical Requirements

ETSI EN 301 489-28 V1.1.1 (2004-09), EMC, Specific conditions for wireless digital video links

EN 62368-1, Product Safety Standard

Frequency range: S band (2200MHz to 2500MHz)

C-1 band (4400MHz to 4940MHz)

Maximum RF power: 2W per channel, up to a maximum EIRP of 4 watts for the SC4240EP-235467-BB, SC4240EP-235467-EB and 8 Watts for the SC4480E-235467-SBST

Antenna: 1.8-1.9dBi Dual Bands Omni Antennas (AOV2D235515G)

Cable: Silvus cable assembly (SC22-PRICBL02-6)

External Bandpass Filter:

Microwave Filter Co. model 3813

(a filter of equivalent performance may also be used, contact Silvus Technologies customer support for more information)

AC Adapter (if used): EDAC Power Electronics EA10523C-120 (this adapter is approved for indoor use only) (this adapter was certified by the manufacturer to IEC 60950-1)

External DC supply: If the customer provides DC power from their own source, the supply should be fused for a 5-amp circuit.

Safe Working Distance:

Maintain safe working distance of minimum 20cm. For more details, refer to TUV report no. 72171985D, "Radio Frequency Exposure Verification of the Silvus Technologies Inc. StreamCaster SC4240EP-235467 and SC4480E-235467 Tactical MIMO Radio EN 62311 January 2008" (copy of report available upon request). The CE Mark Technical File is available upon request for inspection.

To satisfy RF exposure requirements, this device and its antennas must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter, except in accordance with RED RF Exposure requirements.

This equipment has been constructed so that the product complies with the requirement of with Article 10(2) as it can be operated in at least one Member State as examined and the product is compliant with Article 10(10) as it has no restrictions on putting into service in all EU member states.

See restrictions mentioned in ERC Recommendation 25-10, Table 7-C2, for guidance of restrictions applicable to specific countries.

Table 7-C2: additional information regarding the national conditions for the identified tuning ranges for video PMSE applications - Band C2

Frequency Band	Country	Implementation	Conditions/remarks
C2 2025-2110 MHz	AIT	I*	Max. 10 MHz Channels, max. 20dBW eq., 2070-2100 MHz. Restricted to broadcasters only 2080-2110 MHz. Restricted to the brigades and private users
	AZE	Y*	On a secondary basis
	BEL	I	PMSE old MW link systems for PMSE. Military use in 2025-2110 MHz
	BUL	Y*	ERC Report 210. Available for Cordless Cameras, Portable video links and Mobile video links
	CZE	Y*	This band may be used in the coordination with the Ministry of Defense of the Czech Republic: https://www.czu.cz/sites/default/files/obsahove-dal-rs-up-p_00_09-2014-07_en.pdf , new version is available only in Czech https://www.czu.cz/sites/default/files/obsahove-dal-rs-up-p_00_09-2014-07_en.pdf
	FI	N	Deviations from the specifications in the Frequency Plan (FreqP) could be permitted for a limited time in accordance with §50 TRG. This is provided that the frequency usages indicated in the I frequency Ordinance (I reqv) and the I frequency Plan are not adversely affected (for more details see: https://www.bundesnetzagentur.de/SharedDocs/Pressemitteilungen/EN/2016/06/20160620_kurzzeitliche_abweichungen_vom_frequenzplan.html)
	UNK	Y*	
	L	N	Band not available
	EST	I*	2025-25-2110 MHz SARISAN. See Regulation of Ministry of Communication and Economical Affairs 21.05.2015 No. 35. Otherwise governmental use
	FR	I*	Temporary licenses, max. 10 dBW. Use of 10 MHz bandwidth centered on 2055 MHz and 2085 MHz for ground-to-ground link and 10 MHz bandwidth centered on 2065 MHz and 2105 MHz for air-to-ground link. Coordination required between assigning authorities (for Distance and Space) regarding the use of the other available bands in order to avoid harmful interference. ARESLIP Decision 2016-1123
	FIN	I*	Cordless cameras, temporary use on a case-by-case basis. Standard EN 302064. Other use includes military use and space operation
	GI	Y*	Technology used application neutral but typically used for wireless cameras, typically licensed at 100 mW e.i.p.
	GEO	L*	
	GRC	L*	Cordless Cameras, Portable/Mobile video links, 2087.5-2108.5 MHz (not available (exclusive use by security services))
	HUN	N	Band not available (governmental use). However, the band may be used for short term TMSL use if the user demand makes it necessary at certain occasions like main events. In this case the authority handles the requests on a case-by-case basis and if the frequency use can be authorised the users receive an individual license
	HOL	L*	2070-2110 MHz for EN3-06 only

Possible implementation status: Y = the whole band is available for TMSL; L = Limited availability; N = the band is not available for TMSL; * = individual licence may be required; † = restrictions apply (e.g. geographical restrictions)

Table 35 Additional Restrictions on Band C2

EU DECLARATION OF CONFORMITY

Number: 10046C000

Name and address of the Manufacturer

Silvus Technologies, Inc.,
10990 Wilshire Blvd., Suite #1500
Los Angeles, CA 90024 U.S.A

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Object of the declaration

Product information

StreamCaster:
SC4240EP-235467-BB, SC4240EP-235467-EB, SC4480E-235467-SBST

Additional information

SW version : v4.0.2.7 (all models)
HW version : B1: SC4480E-235467-SBST
B7: SC4240EP-235467-BB
C7: SC4240EP-235467-EB

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

- References to the relevant harmonised standards used or references to the technical specifications in relation to which conformity is declared

Radio Equipment Directive 2014/53/EU

EN 301 489-1 V2.1.1
EN 301 489-28 V1.1.1
EN 302 064 V2.1.1
EN 62368-1
EN62311:2008

RoHS Directive 2011/65/EU

EN 50581:2012

The notified body

Name: TÜV SÜD America
Number: 1929

performed

- a conformity assessment of the technical construction file

and issued the certificate

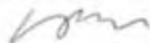
NB06 002138 0005 Rev. 00

Additional information

N/A

Signed for and on behalf of: Silvus Technologies Inc

Authorised Representative:



Name and Surname / Function:

WeiJun Zhu, Vice President of Engineering

Date of Issue:

March 2, 2023

15. ISED Canada Notice

15.1 IC: 24980-SC42E245

Silvus model #: SC4210E-245-EB. Note that the SC4210E is a subset of the generic SC4200E, the "1" in the model # indicates it is a 1-watt maximum output power product or if lower the limits found by the ISED testing.

Equipment Class: Digital Transmission System

The following parameters must be used to be compliant to the appropriate ISED requirements:

Antennas: 2.1dBi Omni Antennas (Silvus AOV2D230515) & 4dBi Omni Antennas (Silvus AOV4S235)

Bandwidth: 10MHz

Maximum 10MHz Bandwidth Output Power @ Frequency #1: 789.84mW @ 2430MHz

Maximum 10MHz Bandwidth Output Power @ Frequency #2: 790.06mW @ 2440MHz

Bandwidth: 20MHz

Maximum 20MHz Bandwidth Output Power @ Frequency #1: 123.82mW @ 2440MHz

Modulation and Coding Schemes tested: MCS0 to MCS15

15.2 Software License

A Software License is used to ensure only parameters and limits that are allowed by the ISED certificate shown in section 15.1 can be selected. These parameters include Frequency, Output Power, Modulation and Bandwidth.

15.3 Firmware Encryption

The details of our Firmware Encryption are considered proprietary and are discussed in depth in the submitted document SC4210E-245 Circuit Description v1.2 section 1.5. Also described is the method to ensure only Silvus released firmware and Software License can be loaded on the product. This will ensure

only the parameters and limits that are allowed by the Industry Canada certificate shown in section 15.1 can be selected.

15.4 IC Statement: English

This radio transmitter SC24980-SC4210E245 has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

1. Omnidirectional antenna, Silvus P/N A0VD230515, maximum antenna gain 2.1 dBi, 50 ohm
2. Omnidirectional antenna, Silvus P/N A0V4S235, maximum antenna gain 4dBi, 50 ohm

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.*
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.*

15.5 IC Statement: French

Le présent émetteur radio [identifier le dispositif par son numéro de certification d'ISED] a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenna énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

1. Omnidirectional d'onde, Silvus P/N A0VD230515, le gain max 2.1 dBi, 50 ohm
2. Omnidirectional d'onde, Silvus P/N A0V4S235, le gain max 4 dBi, 50 ohm

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) *L'appareil ne doit pas produire de brouillage;*
(2) *L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

15.6 Radiation Exposure Statement: English

Radiation Exposure Statement:

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 32 cm between the radiator and your body.

15.7 Radiation Exposure Statement: French

Déclaration d'exposition aux radiations

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 32 cm de distance entre la source de rayonnement et votre corps.

16. MIC Japan Notice

16.1 ID: 211-210701

Silvus model #: SC4210P-245-O. Note that the SC4210P is a subset of the generic SC4200P, the "1" in the model # indicates it is a 1-watt maximum output power product or if lower the limits found by the MIC testing.

Equipment Class: 2.4GHz Band for Unmanned Mobile Image Transfer System

The following parameters must be used to be compliant to the appropriate MIC requirements:

Antennas:

3dBi Omni Antennas (Silvus ABV3S235)

2.15dBi Omni Antennas (C-Astral OMNI2G4)

3dBi Omni Antennas (Silvus AO2D3S235F-SF)

3dBi Omni Antennas (Silvus AOM3S240F-SF)

1dBi Omni Antennas (Silvus AOV2D235515S-TM)

Bandwidth: 4.5MHz

Maximum 4.5MHz Bandwidth Output Power @ Frequency #1: 910mW @ 2486MHz

Maximum 4.5MHz Bandwidth Output Power @ Frequency #2: 870mW @ 2491MHz

Bandwidth: 9MHz

Maximum 9MHz Bandwidth Output Power @ Frequency #1: 880mW @ 2489MHz

Modulation and Coding Schemes tested: MCS0 to MCS15

16.2 ID: 011-210045

Silvus model #: SC4210P-576-O. Note that the SC4210P is a subset of the generic SC4200P, the "1" in the model # indicates it is a 1-watt maximum output power product or if lower the limits found by the MIC testing.

Equipment Class: 5.7GHz Band for Unmanned Mobile Image Transmission System

The following parameters must be used to be compliant to the appropriate MIC requirements:

Antennas:

2.3dBi Omni Antennas (Silvus AOV2D235515S-TM, also Southwest Antenna 1001-253)

2.15dBi Omni Antennas (Silvus AOV2S520G-TM, also Southwest Antenna 1001-128)

2.15dBi Omni Antennas (C-Astral OMNI5G7)

3dBi Omni Antennas (Silvus AO2D3S)

3dBi Omni Antennas (Silvus AOV3T245515575-TM, also L-Com HG2458RD-TM)

Bandwidth: 4.5MHz

Maximum 4.5MHz Bandwidth Output Power @ Frequency Low: 29.78dBm @ 5625.5MHz

Maximum 4.5MHz Bandwidth Output Power @ Frequency Mid: 29.8dBm @ 5702.5MHz

Maximum 4.5MHz Bandwidth Output Power @ Frequency High: 29.76dBm @ 5752.5MHz

Bandwidth: 9MHz

Maximum 9MHz Bandwidth Output Power @ Frequency Low: 29.72dBm @ 5655MHz

Maximum 9MHz Bandwidth Output Power @ Frequency Mid: 29.82dBm @ 5695MHz

Maximum 9MHz Bandwidth Output Power @ Frequency Low: 29.82dBm @ 5750MHz

Bandwidth: 19.7MHz

Maximum 19.7MHz Bandwidth Output Power @ Frequency Low: 29.6dBm @ 5660MHz

Maximum 19.7MHz Bandwidth Output Power @ Frequency Mid: 29.74dBm @ 5700MHz

Maximum 19.7MHz Bandwidth Output Power @ Frequency High: 29.66dBm @ 5745MHz

Modulation and Coding Schemes tested: MCS0 to MCS15

16.3 Software License

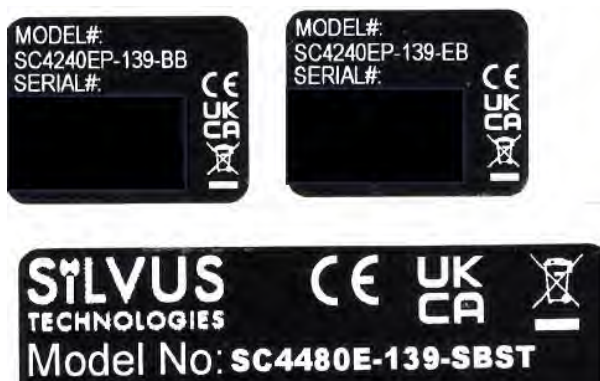
A Software License is used to ensure only parameters and limits that are allowed by the MIC certificates shown in sections 16.1 & 16.2 can be selected. These parameters include Frequency, Output Power, Modulation and Bandwidth.

16.4 Firmware Encryption

The details of our Firmware Encryption are considered proprietary and are discussed in depth in the submitted document SC4210P-576-O Circuit Description v1.3 section 1.5. Also described is the method to ensure only Silvus released firmware and Software License can be loaded on the product. This will ensure only the parameters and limits that are allowed by the MIC certificate shown in section 16.1 & 16.2 can be selected.

17. UKCA Markings

17.1 (-139 Models)



The following Silvus Technologies models are declared to conform to UKCA Mark requirements:

Silvus P/N: SC4240EP-139-BB, SC4240EP-139-EB, SC4480E-139-SBST

Relevant standards:

- EN 302 064 V2.1.1, Wireless Video Links, Harmonized Standard
- EN 301 489-1 V2.2.0, EMC, Common Technical Requirements
- EN 301 489-28 V1.1.1, EMC, Specific conditions for wireless digital video links
- EN 62368-1, Product Safety Standard

Frequency range: 1350-1440 MHz

Maximum RF power: 2W per channel, up to a maximum EIRP of 4 watts for the SC4240EP-139-BB, SC4240EP-139-EB and 8 watts for the SC4480E-139-SBST

Antenna: 2.1dBi Omni Antennas (AOV2S192)

Cable: Silvus cable assembly (SC22-PRICBL02-6)

External Bandpass Filter: Microwave Filter Co. model 3813 (a filter of equivalent performance may also be used, contact Silvus Technologies customer support for more information)

AC Adapter (if used): EDAC Power Electronics EA10523C-120 (this adapter is approved for indoor use only) (this adapter was certified by the manufacturer to IEC 60950-1)

External DC supply: If the customer provides DC power from their own source, the supply should be fused for a 5-amp circuit.

Safe Working Distance:

Maintain safe working distance of minimum 20cm. For more details, refer to TUV report no.

7217985B, "Radio Frequency Exposure Verification of the Silvus Technologies Inc. StreamCaster SC4240EP-139 and SC4480E-139 Tactical MIMO Radio EN 62311 January 2008" (copy of report available upon request). The UKCA Mark Technical File is available upon request for inspection.

To satisfy RF exposure requirements, this device and its antennas must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter, except in accordance with RF Exposure requirements.

See restrictions mentioned in ERC Recommendation 25-10, Table 7-C2, for guidance of restrictions applicable to specific countries.

Table 7-C2: additional information regarding the national conditions for the identified tuning ranges for video PMSE applications - Band C2

Frequency Band	Country	Implementation	Conditions/remarks
C2 2025-2110 MHz	AUT	L ⁺	Max. 10MHz Channels, max. 20dBW eirp, 2070-2095 MHz Restricted to Downlink only 2085-2110 MHz Restricted to Geostationary and private users
	AZE	Y ⁺	On a secondary basis
	BEL	L	FDS old MW link systems for FMSF Military use in 2025-2110 MHz
	BUL	Y ⁺	ECC Report 219 Available for Cordless Cameras, Portable video links and Mobile video links
	CZE	Y ⁺	The band may be used at the coordination with the Ministry of Defence of the Czech Republic (https://www.cz.cz/mos/default/fms/obsah/actual-rsp-up-06-09-2014-07_en.pdf , new version is available only in czech https://www.ctu.cz/ofis/default/fika/obsah/czu/vyvo-k-uplatneni-pripominek-na-vrtis-opatreni-ofisekvality-radioelektroniky-a-li-radionechovnost-i-p-o-dle-zk-2017-ysc-schvativniho-systemu-1800-2200-mhz-fm-ukryty-jp-05-07-17.pdf)
	DE	N	Provisions from the specifications in the Frequency Plan (FreqP) could be permitted for a limited time in accordance with §50 TRG This is provided that the frequency usages indicated in the Frequency Ordinance (FreqV) and the Frequency Plan are not adversely affected [for more details see: https://www.bundesnetzagentur.de/urich_1412/L/Sachgebiete/telekommunikation/Unternehmen/_Installationen/_frequenzen/Spezialanforderungen/Kurzzeitfunkplan/kurzzeitfunk-plan-de.html]
	UNK	Y ⁺	
	LT	N	Band not available
	PST	L ⁺	2075-25-2110 MHz SARP-SA3 See Regulation of Ministry of Communication and Economical Affairs 21.05.2013 No.35 Otherwise governmental use
	FR	L ⁺	Temporary licenses, e.i.r.p. max = -10 dBW Use of 10 MHz bandwidth centered on 2055 MHz and 2085 MHz for ground-to-ground link and 10 MHz bandwidth centered on 2065 MHz and 2105 MHz for air-to-ground link Coordination required between assigning authorities (la Defense and Space) regarding the use of the other available bands in order to avoid harmful interference. ARSLP Decision 2016 1199
	FIN	L ⁺	Cordless cameras, temporary use on a case-by-case basis. Standard EN 302064. Other use includes military use and space operation
	GE	Y ^(L)	Technology and application remain but typically used for wireless cameras, typically licensed at 100 mW ERP
	GEO	L ⁺	
	GRC	L ⁺	Cordless Cameras, Portable/Mobile video links, 2087,5–2108,5 MHz ; not available (exclusive use by security services)
	HKG	N	Band not available (governmental use). However, the band may be used for short term TMSL use if the user demand makes it necessary at certain occasions like main events. In the case the authority handles the requests on a case-by-case basis and if the frequency use can be authorised the users receive an individual license.
	HOL	L ⁺	2070-2110 MHz for ENS-06 only

*possible implementation status: Y=the whole band is available for TMSL L=Limited availability N=the band is not available for TMSL + Individual licence may be required f restrictions apply (e.g. geographical restrictions)

Table 32 Additional Restrictions on Band C2

Annex A UK DECLARATION OF CONFORMITY

NOTE – THIS IS NOT A TEMPLATE. It is the responsibility of the manufacturer and / or the authorised representative to produce the Declaration of Conformity with suitable content. This is purely for consideration of what should be included and should not be used as a template. Other UK regulations if applicable may be additionally required on the Declaration of Conformity or Declaration of Conformity dossier.

We, **Silvus Technologies Inc.**

(Manufacturer's name)

Of

10990 Wilshire Blvd, Los Angeles, CA 90024

(Address)

Declare under our sole responsibility that the product:

StreamCaster:

SC4240EP-139-BB, SC4240EP-139-EB, SC4480E-139-SBST

(Detailed description of product including batch or serial number, name, type, model, and, where necessary, a colour image; where applicable a description of accessories and components, and software, which allow the radio equipment to operate as intended and covered by the declaration of conformity)

to which this declaration relates, is in conformity with the following designated standards and/or technical specifications

(References to standards/specifications must be listed with their identification number and version and, where applicable, date of issue)

Regulation 6(1)(a) [Health & Safety]: EN 62368-1:2014, EN 62311:2008

Regulation 6(1)(b) [EMC]: EN 301 489-1 V2.2.0 , EN 301 489 -28 V1.1.1

Regulation 6(2) [Spectrum Usage]: EN 302 064 V2.1.1

Regulation 6A [Additional essential requirements]:

We hereby declare that the above-named product is in conformity to the requirements of the Radio Equipment Regulations 2017 with the involvement of the following UK Market Conformity Assessment Body under Schedule 3 Module B of the Regulation. (Where the Certification Body Type Examination Certificate / involvement is only for limited Regulations, i.e. Regulation 6(2) only this should be explicitly stated here).

TUV SUD America Inc, 401 Edgewater Place #500, Wakefield, MA, 01880, USA

Approved Body:

1929

Type Examination
Certificate No:

**UKCB2 002138
0006 Rev. 00**

The technical documentation relevant to the above equipment will be held at:
Silvus Technologies Inc. 10990 Wilshire Blvd, Los Angeles, CA 90024

(Name and address of the UK Authorised Representative, if applicable and formally appointed by the manufacturer)

11/17/2023



(Signature of authorised person)

Grant Denoon

(Date)

San Diego, CA, USA

(Name of authorised person)

Director of RF Engineering

(Place of issue: e.g. City/town, and Country)

(Job title)

17.2 (-235467 Models)



The following Silvus Technologies models are declared to conform to UKCA Mark requirements:

Silvus P/N: SC4240EP-235467-BB, SC4240EP-235467-EB, SC4480E-235467-SBST

Relevant standards:

- EN 302 064 V2.1.1, Wireless Video Links, Harmonized Standard
- EN 301 489-1 V2.2.0, EMC, Common Technical Requirements
- EN 301 489-28 V1.1.1, EMC, Specific conditions for wireless digital video links
- EN 62368-1, Product Safety Standard

Frequency range: S band (2200MHz to 2500MHz)
C-1 band (4400MHz to 4940MHz)

Maximum RF power: 2W per channel, up to a maximum EIRP of 4 watts for the SC4240EP-235467-BB, SC4240EP-235467-EB and 8 Watts for the SC4480E-235467-SBST

Antenna: 1.8-1.9dBi Dual Bands Omni Antennas (AOV2D235515G) Cable: Silvus cable assembly (SC22-PRICBL02-6)

External Bandpass Filter: Microwave Filter Co. model 3813 (a filter of equivalent performance may also be used, contact Silvus Technologies customer support for more information)

AC Adapter (if used): EDAC Power Electronics EA10523C-120 (this adapter is approved for indoor use only) (this adapter was certified by the manufacturer to IEC 60950-1)

External DC supply: If the customer provides DC power from their own source, the supply should be fused for a 5-amp circuit.

Safe Working Distance:

Maintain safe working distance of minimum 20cm. For more details, refer to TUV report no. 72171985D, "Radio Frequency Exposure Verification of the Silvus Technologies Inc. StreamCaster SC4240EP-235467 and SC4480E-235467 Tactical MIMO Radio EN 62311 January 2008" (copy of report available upon request). The UKCA Mark Technical File is available upon request for inspection.

To satisfy RF exposure requirements, this device and its antennas must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter, except in accordance with RF Exposure requirements.

See restrictions mentioned in ERC Recommendation 25-10, Table 7-C2, for guidance of restrictions applicable to specific countries.

Table 7-C2: additional information regarding the national conditions for the identified tuning ranges for video PMSE applications - Band C2

Frequency Band	Country	Implementation	Conditions/remarks
C2 2025-2110 MHz	AIT	L*	Max. 18MHz Channels, max. 20dBW ERP, 2070-2085 MHz. Restricted to Base Stations only. 2080-2110 MHz. Restricted to the landmobile and private users.
	A7T	Y*	On a secondary basis.
	FIN	L	PRS old MIMO link systems for PMSE. Military use in 2025-2110 MHz.
	BUL	Y*	ECG Report 210. Available for Cordless Cameras, Portable video links and Mobile video links.
	CZE	Y*	This band may be used in the coordination with the Ministry of Defence of the Czech Republic. https://www.mv.cz/nr/obsah/default.htm/obsah/vefstal-rs-up-pi-06-09-2014-07-on.pdf , new version is available only in Czech https://www.dtu.cz/ofic/default/files/obsah/cou/vyzva-k-upolacni-opominko-k-use-ve-vefstal-rs-up-pi-06-09-2014-07-on.pdf .
	IL	N	Deviations from the specifications in the Frequency Plan (Frep) shall be permitted for a limited time in accordance with 550 TRG. This is provided that the frequency changes indicated in the Frequency Ordinance (I regy) and the Frequency Plan are not adversely affected (for more details see: https://www.bundesnetzagentur.de/Content/NavigationItem/4122333/Sachgebiete/Telekommunikation/Unternehmen_Institutionen/Frequenzen/Systeme/Anwendungen/Kurztzteile/Kurztzteile/Kurztzteile/Kurztzteile.html).
	UNK	Y*	
	L	N	Band not available.
	FST	L*	2075-2079 MHz SARFAS. See Regulation of Ministry of Communication and Economical Affairs 21.05.2015 No. 35. Otherwise governmental use.
	F	L*	Temporary licenses, eirp max. -40 dBW. Use of 10 MHz bandwidth centered on 2055 MHz and 2085 MHz for ground-to-ground link and 10 MHz bandwidth centered on 2065 MHz and 2105 MHz for air-to-ground link. Coordination required between assigning authorities (for Defense and Space) regarding the use of the other available bands in order to avoid harmful interference. AIRUL Decision 2016.1103.
	FIN	L*	Cordless cameras, temporary use on a case-by-case basis. Standard EN 302064. Other use includes military use and space operation.
	CI	Y*	Technology (not application) reserved for typically used for wireless cameras, typically licensed at 100 mW ERP.
	GEO	L*	
	GRC	L*	Cordless Cameras, Portable/Mobile video links, 2087.5-2108.5 MHz (not available (exclusive use by security services)).
	IND	N	Band not available (governmental use). However, the band may be used for short term TMSL use if the user demand makes it necessary at certain occasions like main events. In this case the authority handles the requests on a case-by-case basis and if the frequency use can be authorised the users receive an individual license.
	HOL	L*	2070-2110 MHz for EHS-GE only.

Possible implementation status: Y = the whole band is available for TMSL; L = Limited availability; N = the band is not available for TMSL; * = individual licence may be required; † = restrictions apply (e.g. geographical restrictions).

Table 33 Additional Restrictions on Band C2

Annex A UK DECLARATION OF CONFORMITY

NOTE – THIS IS NOT A TEMPLATE. It is the responsibility of the manufacturer and / or the authorised representative to produce the Declaration of Conformity with suitable content. This is purely for consideration of what should be included and should not be used as a template. Other UK regulations if applicable may be additionally required on the Declaration of Conformity or Declaration of Conformity dossier.

We, **Silvus Technologies Inc.**

(Manufacturer's name)

Of

10990 Wilshire Blvd, Los Angeles, CA 90024

(Address)

Declare under our sole responsibility that the product:

StreamCaster:

SC4240EP-235467-BB, SC4240EP-235467-EB, SC4480E-235467-SBST

(Detailed description of product including batch or serial number, name, type, model, and, where necessary, a colour image; where applicable a description of accessories and components, and software, which allow the radio equipment to operate as intended and covered by the declaration of conformity)

to which this declaration relates, is in conformity with the following designated standards and/or technical specifications

(References to standards/specifications must be listed with their identification number and version and, where applicable, date of issue)

Regulation 6(1)(a) [Health & Safety]: EN 62368-1:2014, EN 62311:2008

Regulation 6(1)(b) [EMC]: EN 301 489-1 V2.2.0, EN 301 489 -28 V1.1.1

Regulation 6(2) [Spectrum Usage]: EN 302 064 V2.1.1

Regulation 6A [Additional essential requirements]:

We hereby declare that the above-named product is in conformity to the requirements of the Radio Equipment Regulations 2017 with the involvement of the following UK Market Conformity Assessment Body under Schedule 3 Module B of the Regulation. (Where the Certification Body Type Examination Certificate / involvement is only for limited Regulations, i.e. Regulation 6(2) only this should be explicitly stated here).

TUV SUD America Inc, 401 Edgewater Place #500, Wakefield, MA, 01880, USA

Approved Body:

1929

Type Examination
Certificate No:

**UKCB2 002138
0007 Rev. 00**

The technical documentation relevant to the above equipment will be held at:
Silvus Technologies Inc, 10990 Wilshire Blvd, Los Angeles, CA 90024

(Name and address of the UK Authorised Representative, if applicable and formally appointed by the manufacturer)

11/17/2023

(Signature of authorised person)

Grant Denoon

(Date)

San Diego, CA, USA

(Name of authorised person)

Director of RF Engineering

(Place of issue; e.g. City/town, and Country)

(Job title)