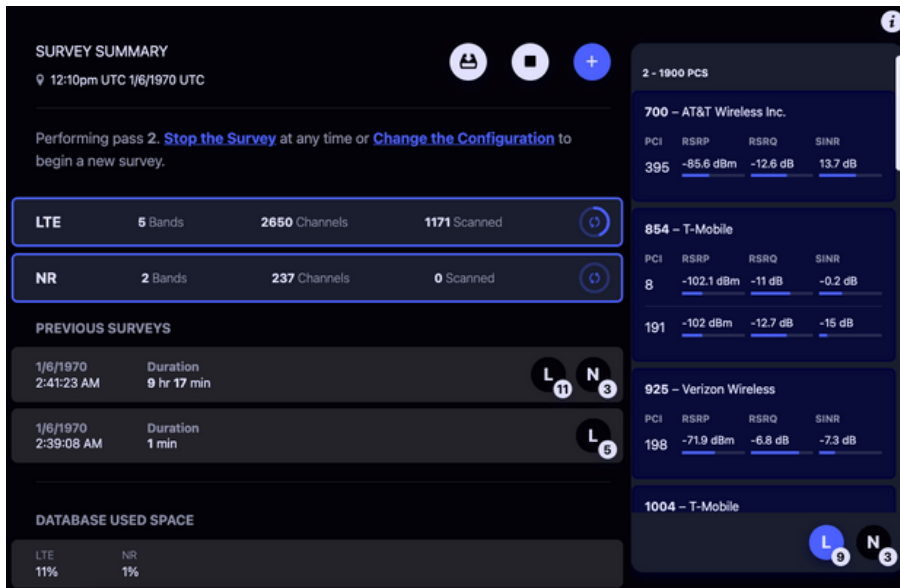


USER MANUAL

V2.20.0 - OCTOBER 09, 2023



CHANGELOG

Revision	Date	Description	Author
2.20.0	2023-10-09	Updates to survey name	SS
2.19.6	2023-08-22	General Release Updates	PK
2.19.5	2023-06-26	Updates after Factory Acceptance Test - with Export Type addition	PK
2.19.4	2023-05-15	Complete rewrite of the UI	PK
2.16.0	2021-10-06	Updated to reflect latest release	SS
2.15.0	2021-07-22	Updated to reflect latest release	SS
2.13.0	2020-12-28	Updated to reflect latest release	SS
2.12.2	2020-11-02	Removed unsupported export types	SS
2.12.0	2020-10-28	Cover new features for latest release	SS
2.11.1	2020-03-06	Initial Release of PDF	SS

TABLE OF CONTENTS

Overview	5
Survey Configuration	6
Blind Survey	7
Starting a Survey	8
Presets	9
Save As New Preset	10
Importing and Exporting Presets	12
Frequency Range	14
Monitor Channels	15
Presets	18
Survey Summary	20
Active Survey	20
Current Survey Pass Info	20
Quick Link Controls	21
Technology Summary	22
Channel List	23
Technology Selector	24
Stop Current Survey	25
Restart Selected Survey	25
Channel Details	25
System Information Blocks	27
Export	30
GNS	30
CSV	30
Previous Surveys	31
Database Used Space	32
Delete Surveys	33
Changing the Name of a Survey	35
System Information View	36
System Info	36
License Info	36
Uploading a New License File	37
Temporary License Files	37
System Options	38
Delete All Surveys	38
Download Logs	38
Export Type	38
Radio Enabled	38
Rx Ports	38
Custom Rx Port Names	39

Color Theme	39
Appendix A - Database Memory Management	40
Appendix B - Setup Help	41
Copying to Your Epiq Radio's Host Machine	41
Installation	41
Debian with Sidekiq™ installed	41
Matchstiq™ S-Series	42
Matchstiq™ Z2	42
Matchstiq™ Z3u	42
Open in Browser	42
Appendix C - Troubleshooting	43
Setup/Installation	43
Skylight Core Scanner Troubleshooting	43
GPS	43
Error Starting CDMA2k Survey with No Bands Selected	43
Appendix D - Terms	44

OVERVIEW

The Skylight Web UI is a Skylight client that supports [Survey](#) configuration and viewing Survey results. When Skylight is configured to `scan`, the UI will display results as they come in, organizing them by technology and frequency band. To change the [configuration](#), click the plus button at the top of the page.

SURVEY CONFIGURATION

Skylight offers two configuration modes: Blind Survey and Monitor Channels. Click the plus button at the top of the page to enter the Survey Configuration mode.

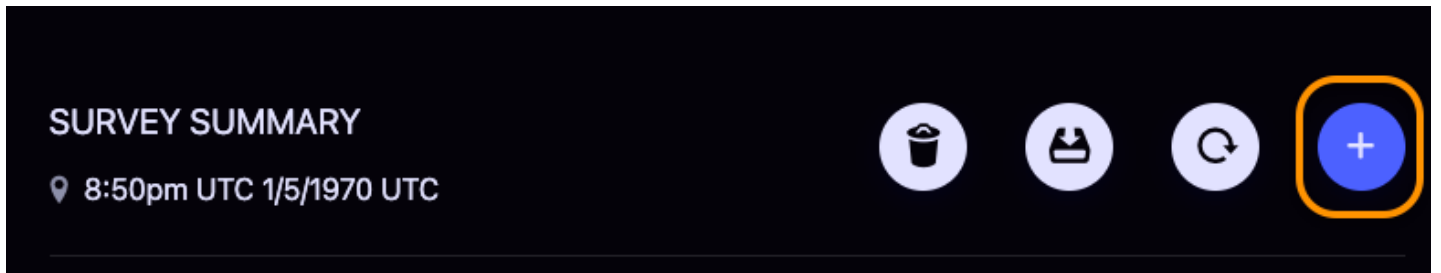


Figure 1: Plus Button

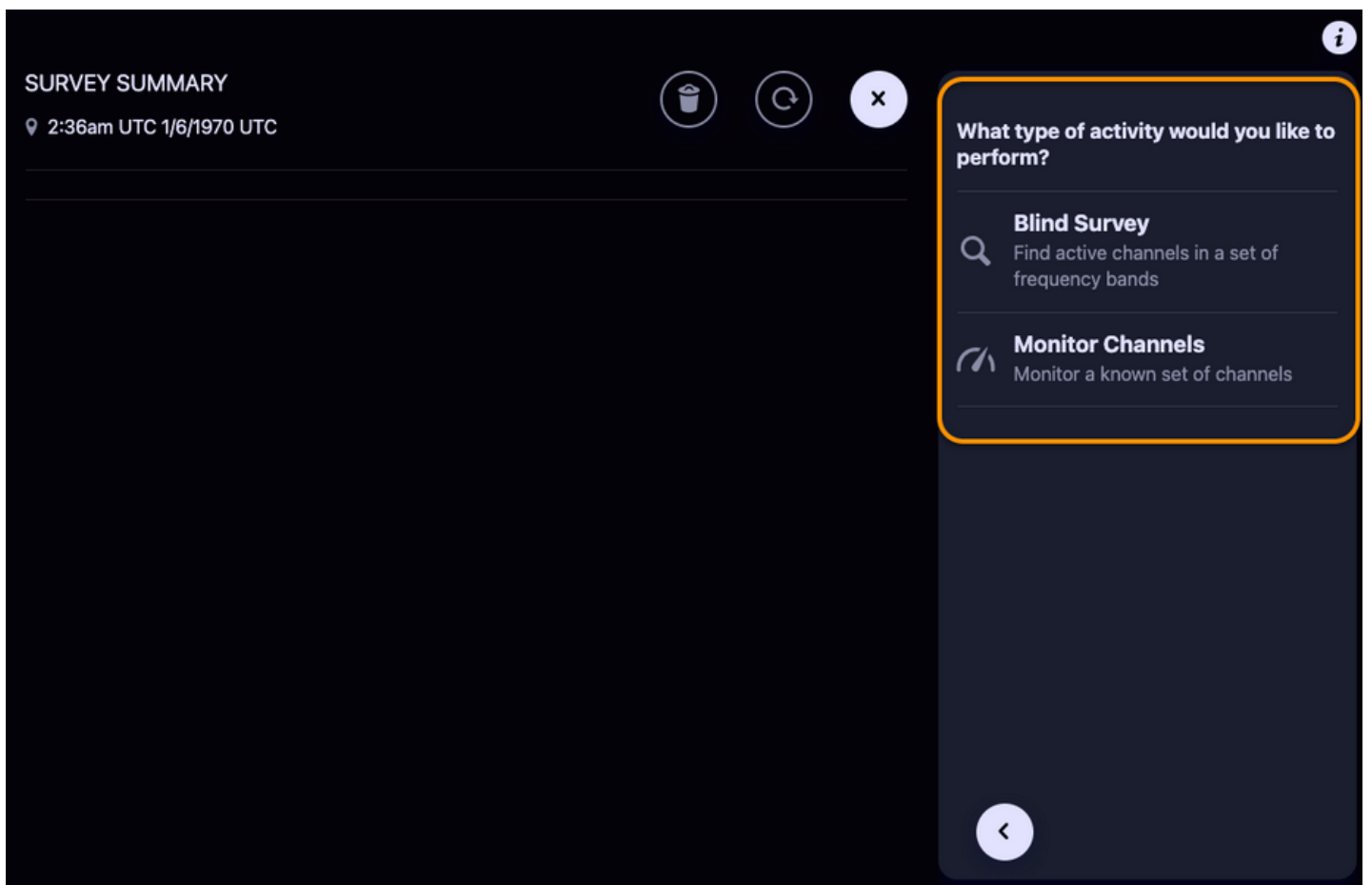


Figure 2: Survey Configuration Modes

BLIND SURVEY

A blind survey allows a user to select licensed technologies and bands to survey. A technology is turned on/off by clicking the toggle button next to that technology. When a technology is first turned on, all bands for that technology will be scanned by default. Turn bands on/off by using the band toggle buttons or by clicking the `Add All` or `Remove All` buttons.

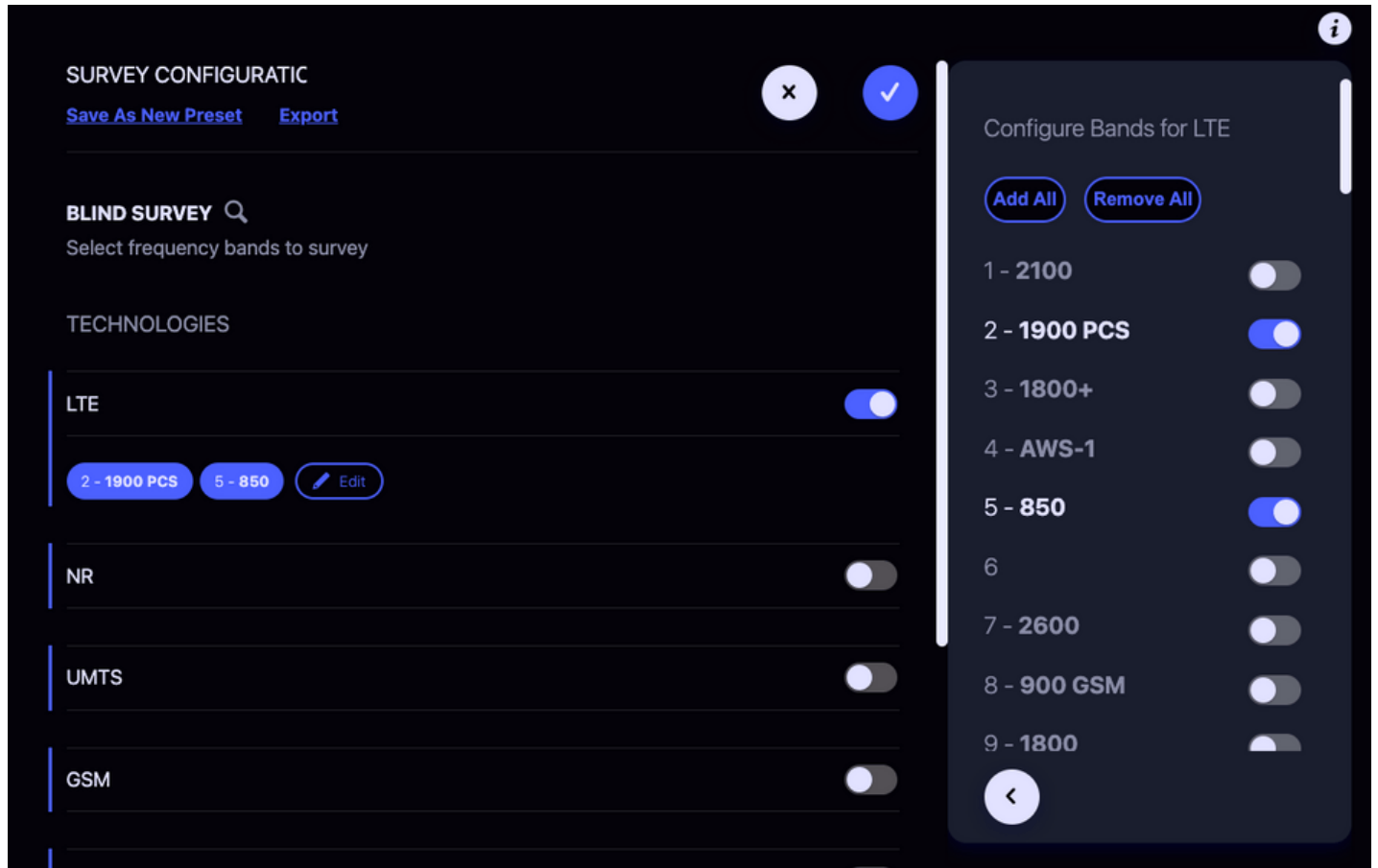


Figure 3: Configured Survey

STARTING A SURVEY

Click the Checkmark button when you are satisfied with your selections and ready to start the survey. This will send the configuration parameters to Skylight and the survey will start. You may name the survey before starting by entering a name in the survey name field *before* pressing the Checkmark button. If you have selected a [preset](#), the name will be pre-populated with the preset's name.

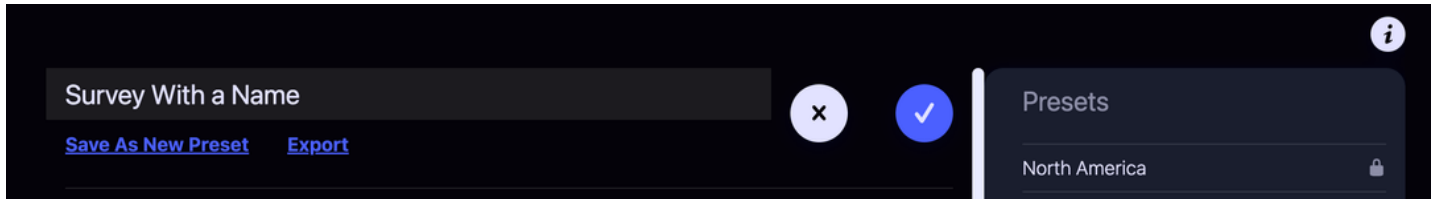


Figure 4: Name, then start a new survey

NOTE: It is possible to change the name after a survey has started (see [Changing the Name of a Survey](#)).

PRESETS

Skylight includes several Regional Presets that can be used, as-is, or changed for a Blind Survey configuration.

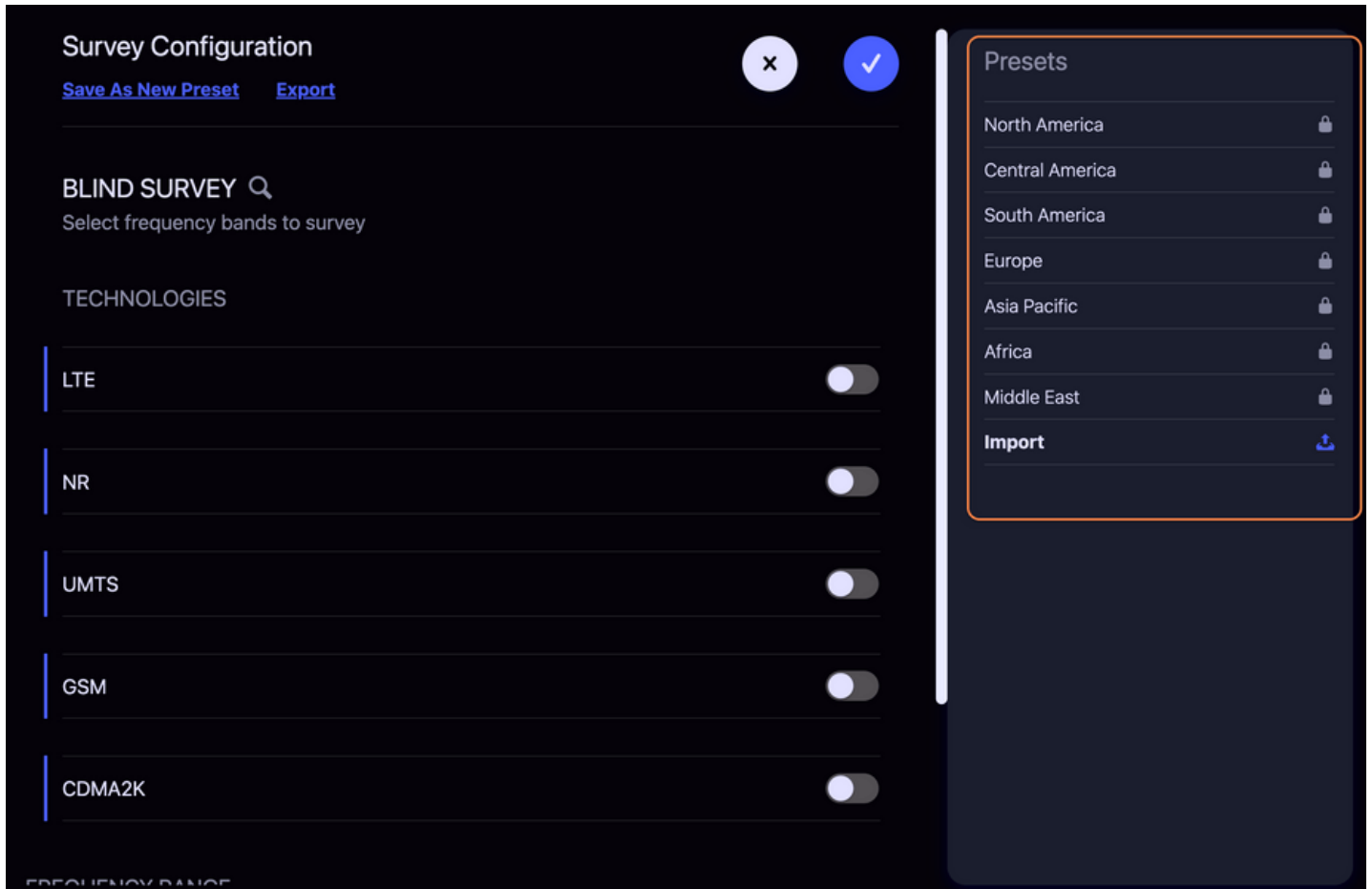


Figure 5: Config Presets

Save As New Preset

It is possible to save a Survey Configuration as a preset to be recalled later. Click [Save as New Preset](#) to save the currently displaying configuration as a preset. If the link is disabled, click in the name to enable text entry. Enter a unique name and click save.

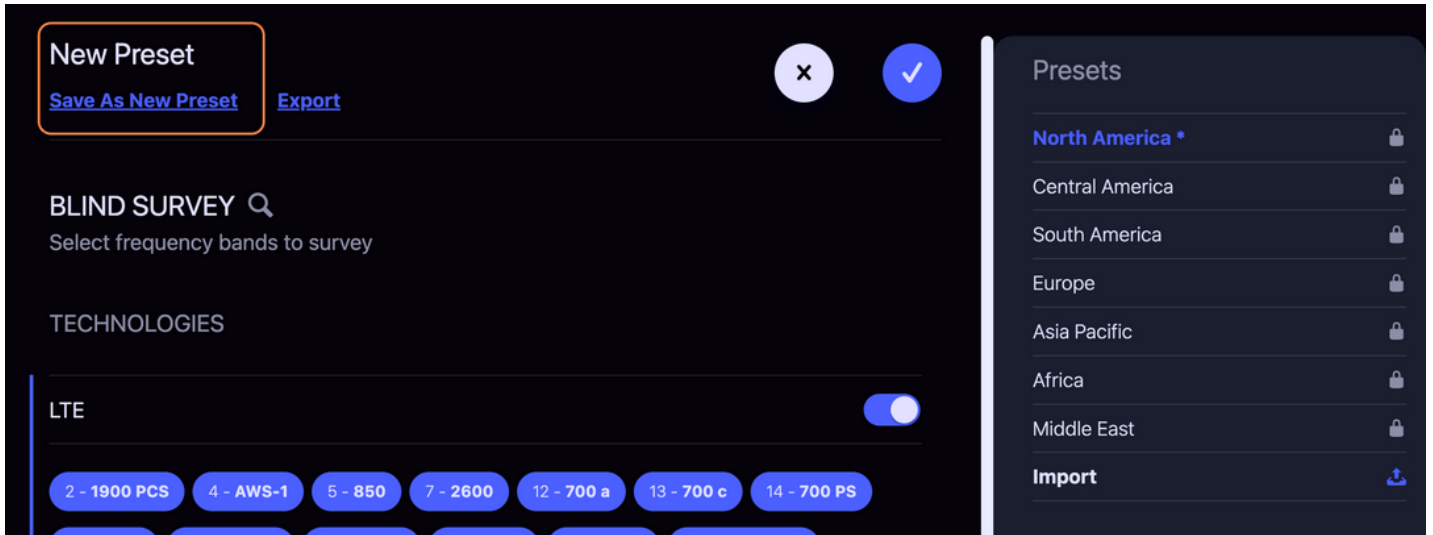


Figure 6: save a preset

NOTE: User Presets are saved in the browser, so they will not be present when connecting to Skylight from another machine or browser. User Presets will also not be saved when using a private window.

After saving or selecting a preset, the available controls change to include [Save](#) and [Save As](#) links.

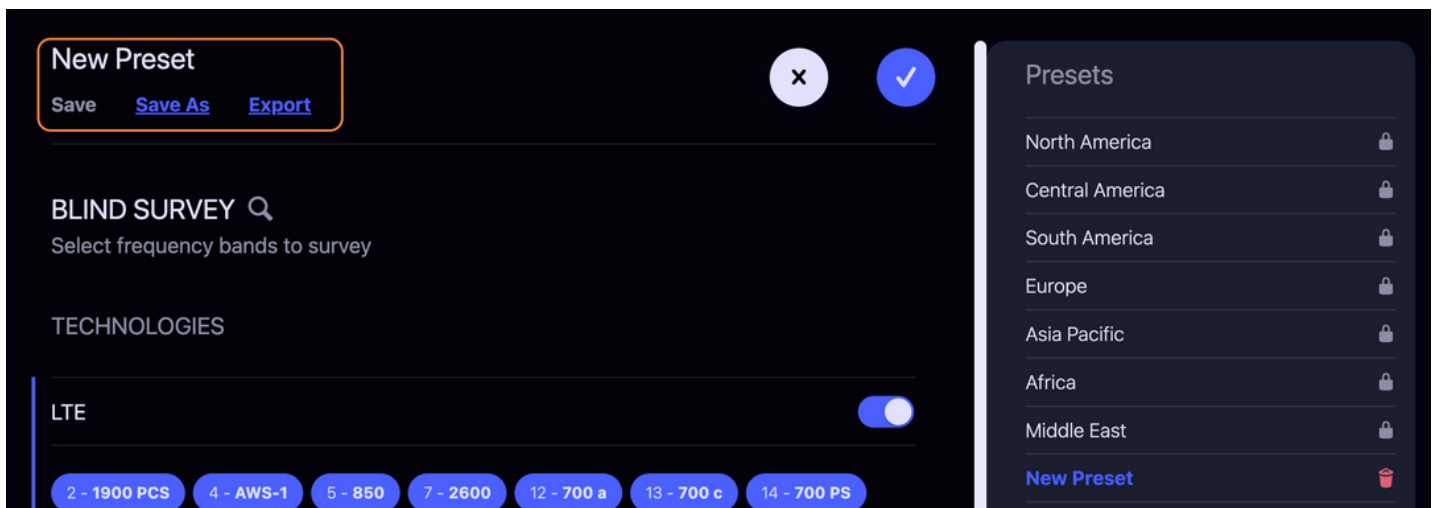


Figure 7: save a preset2

The [Save](#) link is initially disabled. It will be enabled if changes are made to the selected preset configuration or a new preset name is entered.

The [Save As](#) link will create a copy of the currently selected preset including any changes that have been made. If the name has been changed, the new name will be used. If the name has not been

changed, the current name will be used along with a counter suffix.

Importing and Exporting Presets

To export your current configuration to a file that can be loaded onto another system, from the Configuration view, click the `Export` link and your current working configuration (whether you have applied it or not) will be downloaded to a JSON file that can be imported to another system.

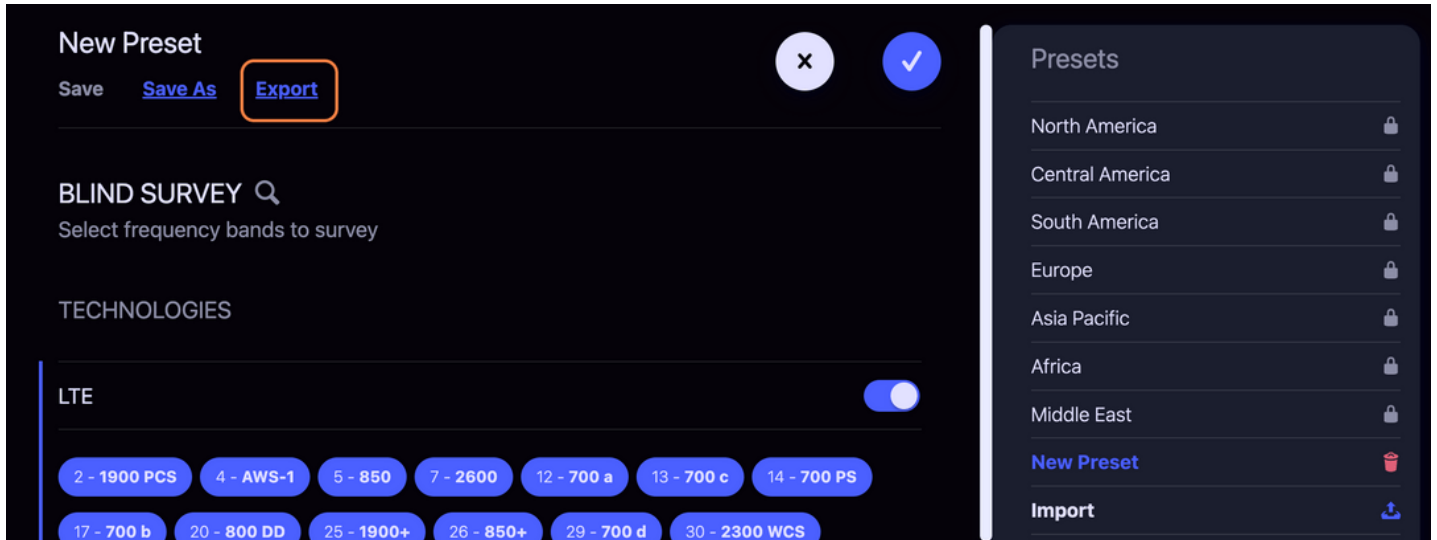


Figure 8: Export a Preset

To import a previously saved configuration, click the `Import` button, then select the file from the file browser.

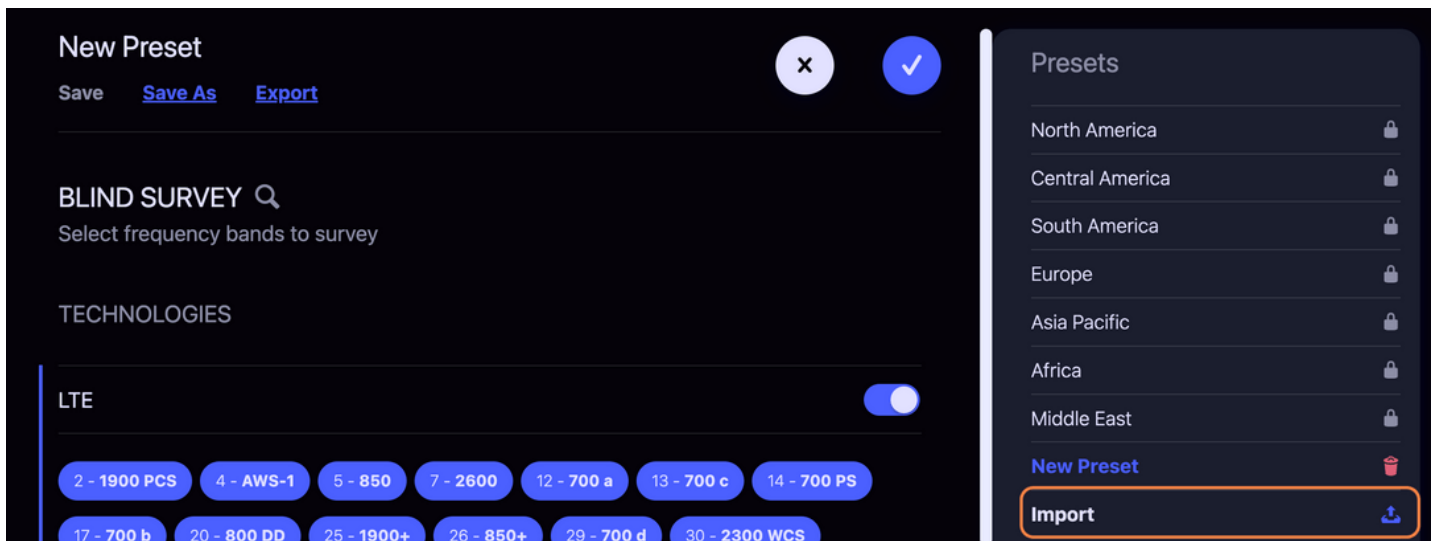


Figure 9: Import a Preset

Example Preset Files: `my-skylight-preset.json`

```
{
  "config": {
    "address": "127.0.0.1:7531",
    "rx_port": "J3",
    "survey_parameters": [
      {
        "tech": "gsm",
        "bands": [
          {
            "band": "PCS1900",
            "channels": []
          }
        ],
        "type": "band"
      },
      {
        "tech": "lte",
        "bands": [
          {
            "band": "2",
            "channels": []
          },
          {
            "band": "5",
            "channels": []
          }
        ],
        "type": "band"
      },
      {
        "tech": "nr",
        "bands": [
          {
            "band": "2",
            "channels": []
          },
          {
            "band": "5",
            "channels": []
          }
        ],
        "type": "band"
      }
    ]
  },
  "name": "New Preset"
}
```

FREQUENCY RANGE

Use the frequency range controls at the bottom of the configuration panel to find matching bands for any licensed technology. Enter the lower and upper bounds of the range you're interested in and then click the `Get Matching Bands` button. This will then enable any licensed technologies and bands that match any portion of the entered frequency range.

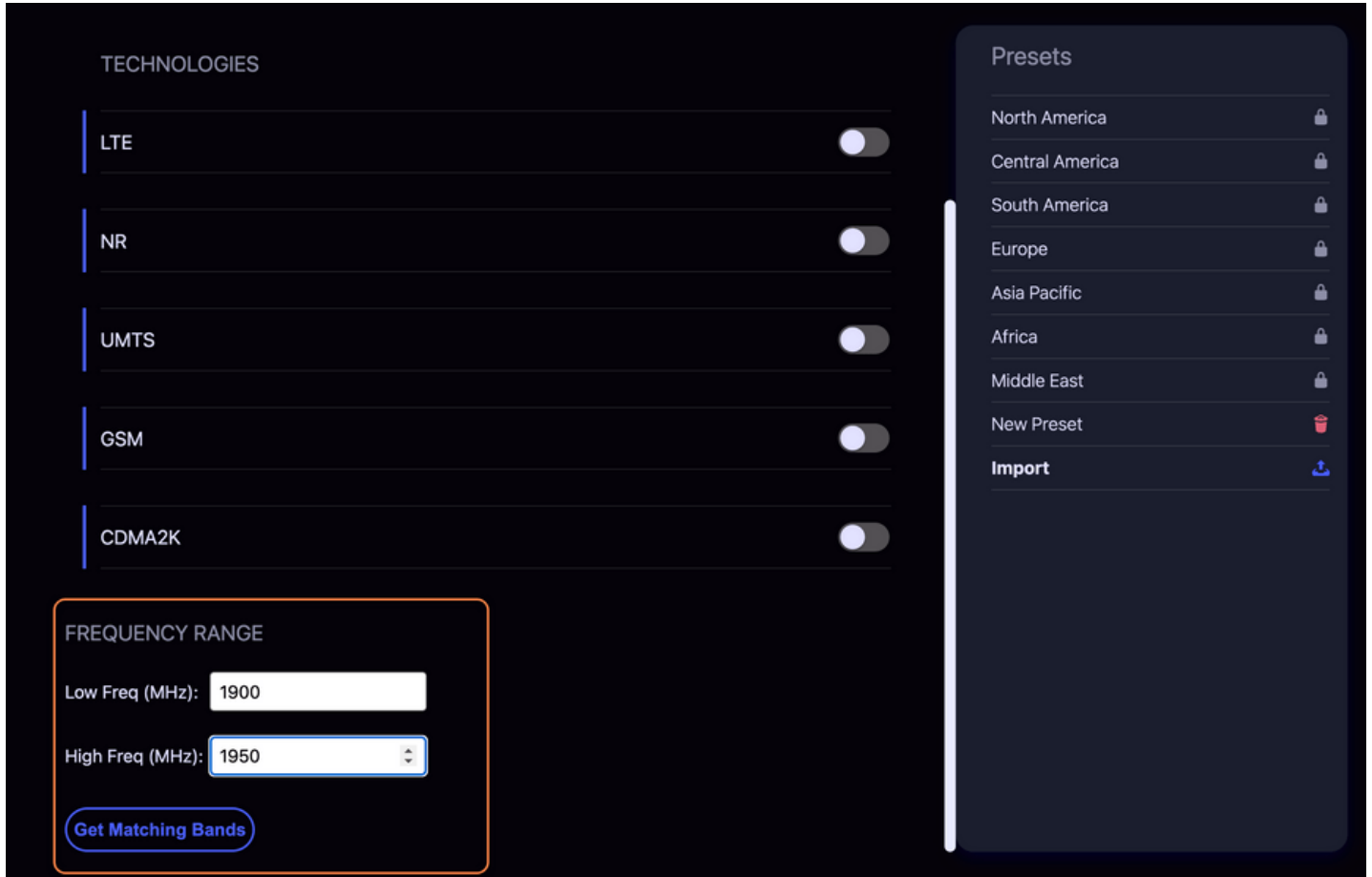


Figure 10: Frequency Range

MONITOR CHANNELS

Monitor Channels is a mode that allows a user to select specific bands and channels to Survey.

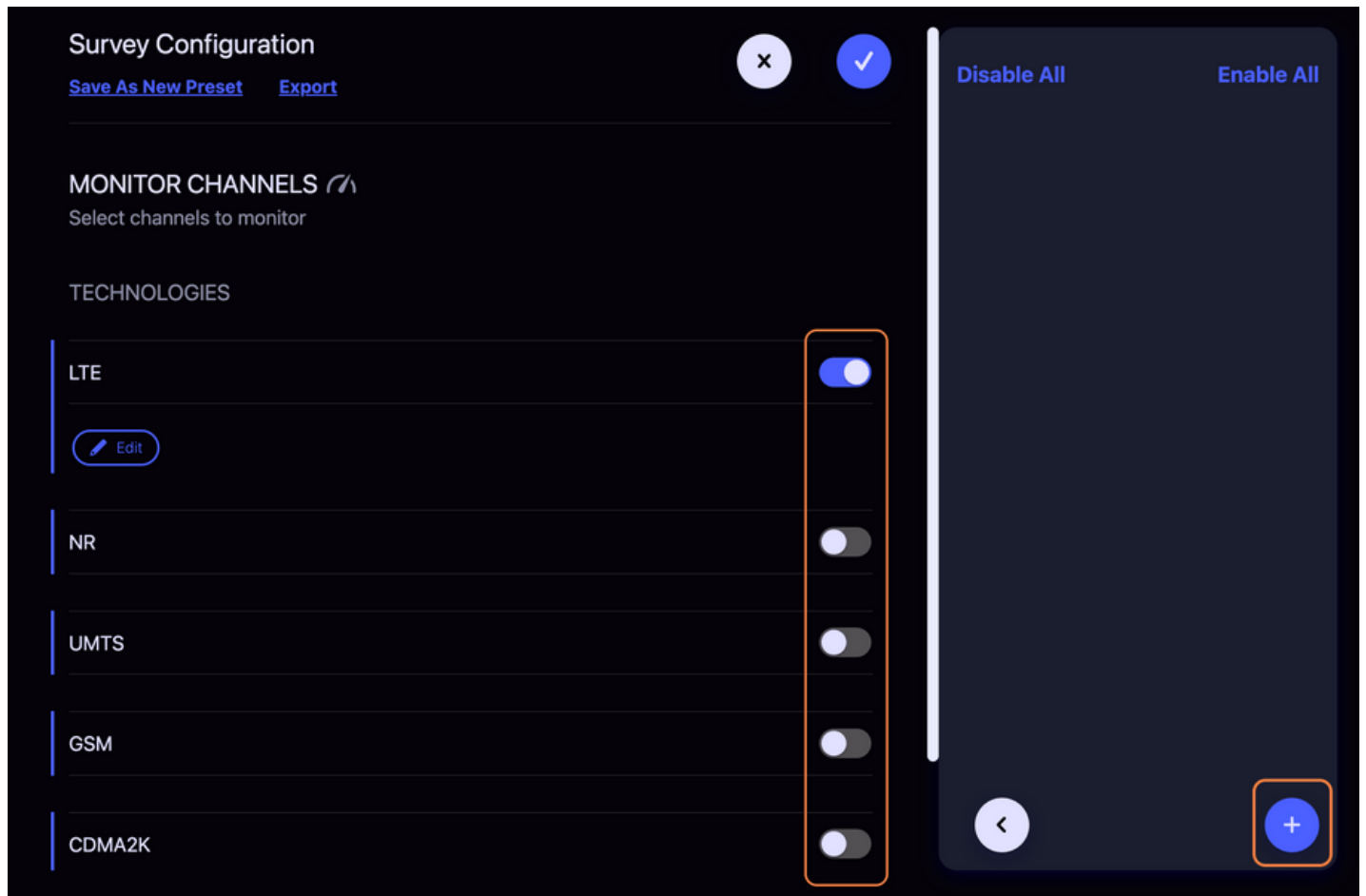


Figure 11: Monitor Channels

NOTE: If a previous survey is selected before starting the configuration of a new Monitor Channels survey, any decoded channels from the selected survey are automatically added to the configuration.

To add channels, first enable a technology using the toggle button next to the technology. Then, click the blue plus button and click a band. And finally, enter any channel numbers you wish to monitor one at a time. Click the gray plus button to add each number to the configuration. Repeat these steps as needed.

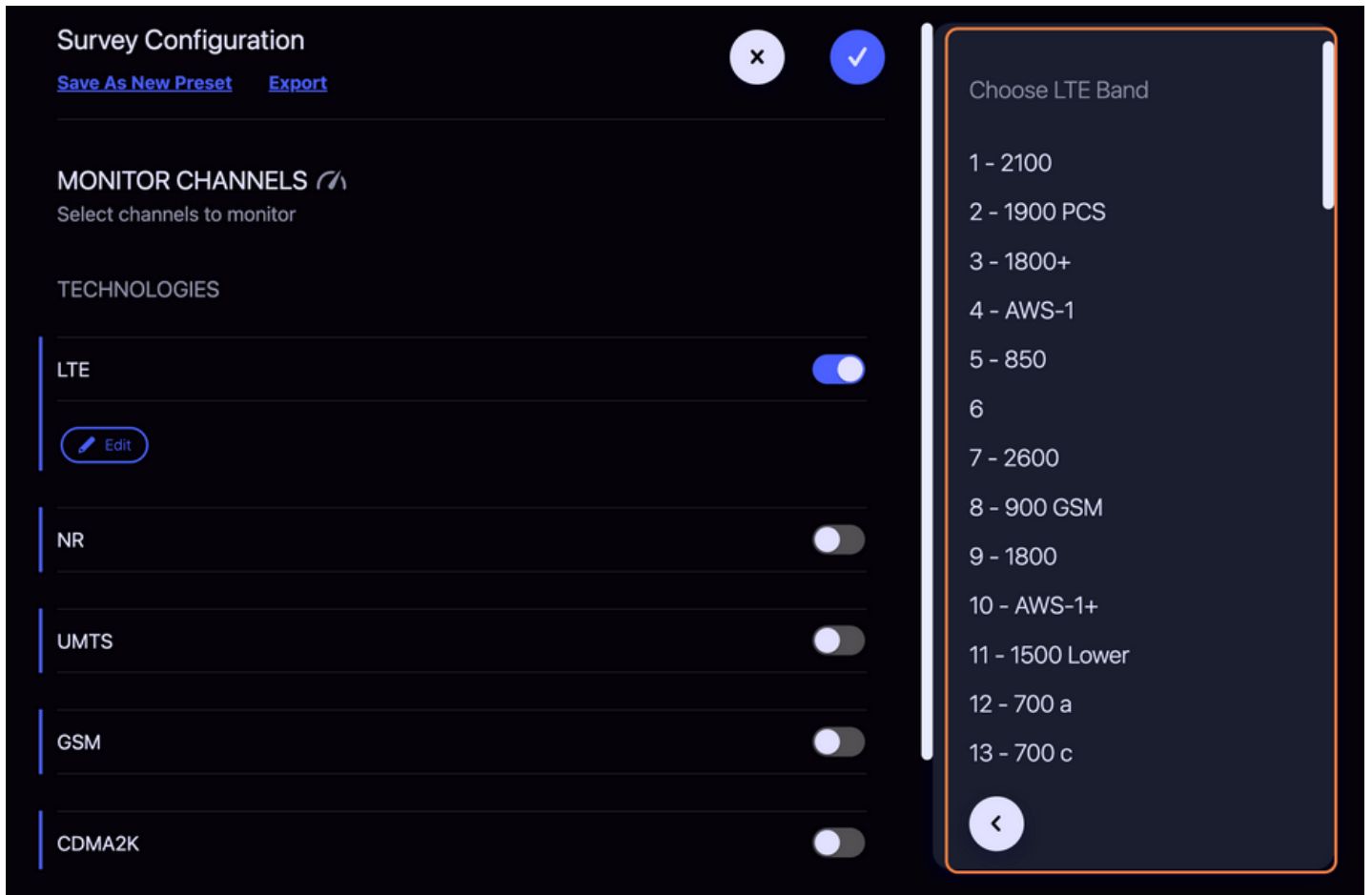


Figure 12: Choose Band

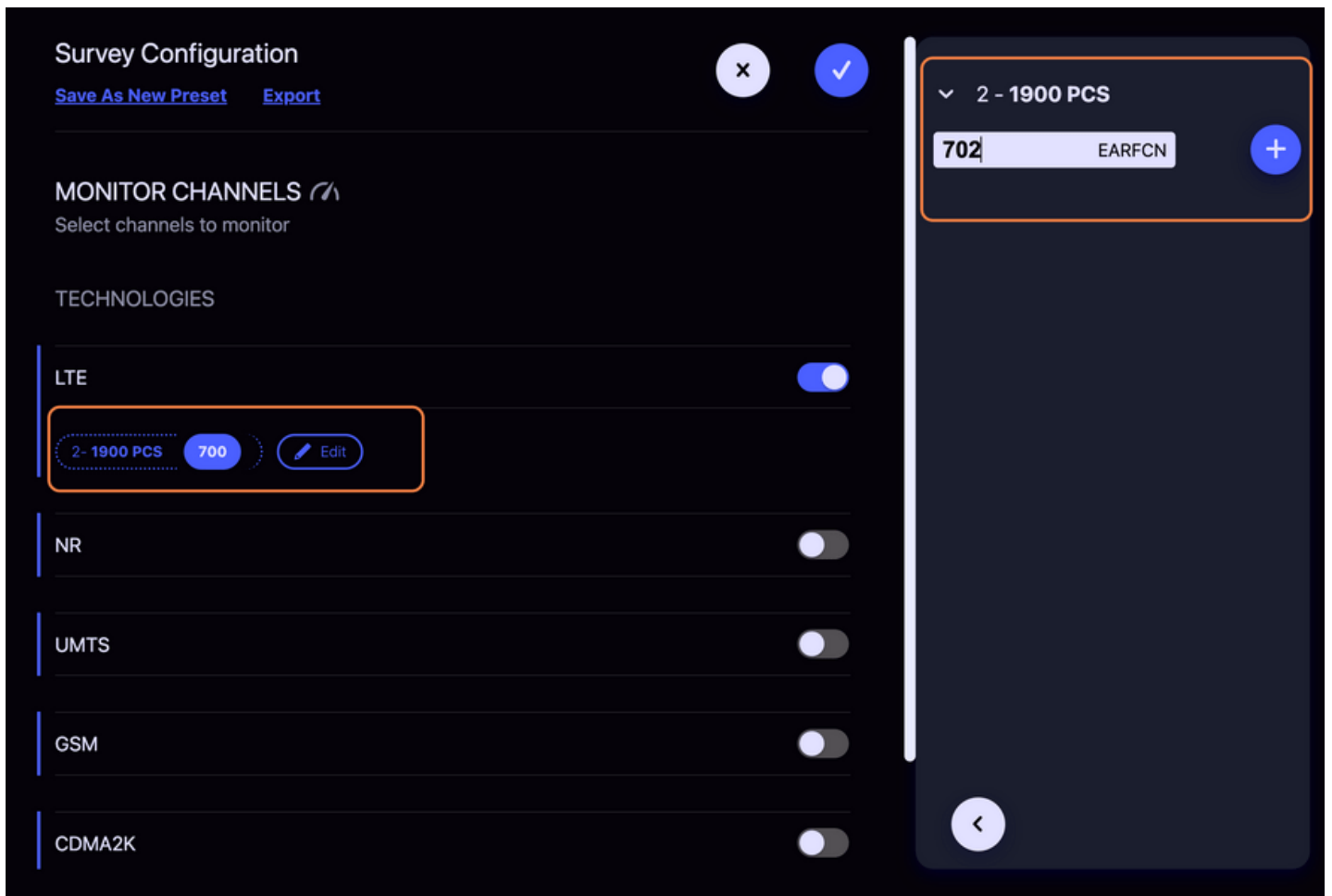


Figure 13: Channel Entry

If an invalid channel number is entered, an error will be displayed after clicking the plus button.

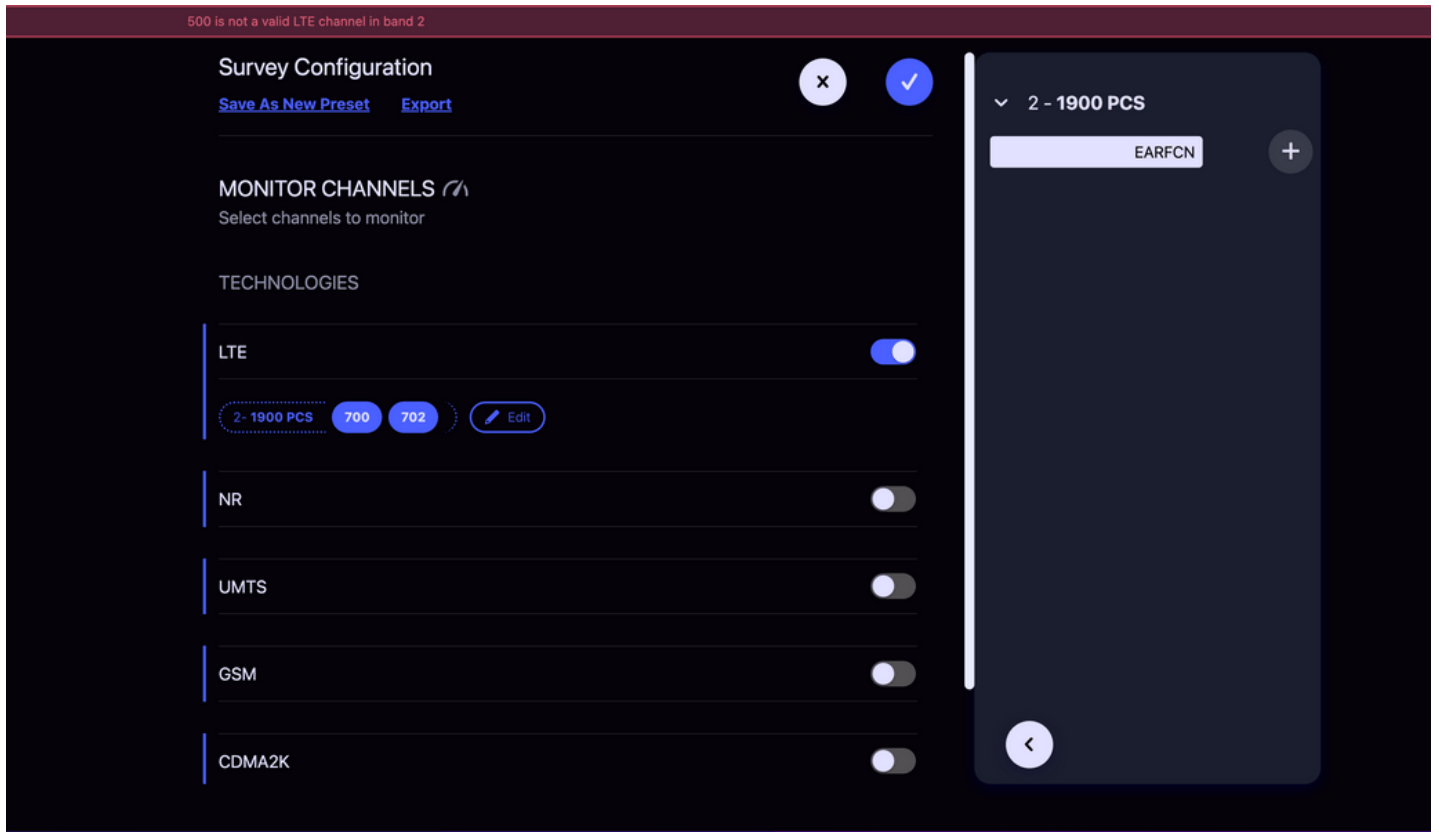


Figure 14: Channel Error

NOTE: If a previously added channel is entered again, the channel will be removed from the configuration.

Enable/Disable All buttons are available at the top of the channel list to quickly change the configured channels. Enabled channels have a blue border and will appear in the channel list below their respective technology.

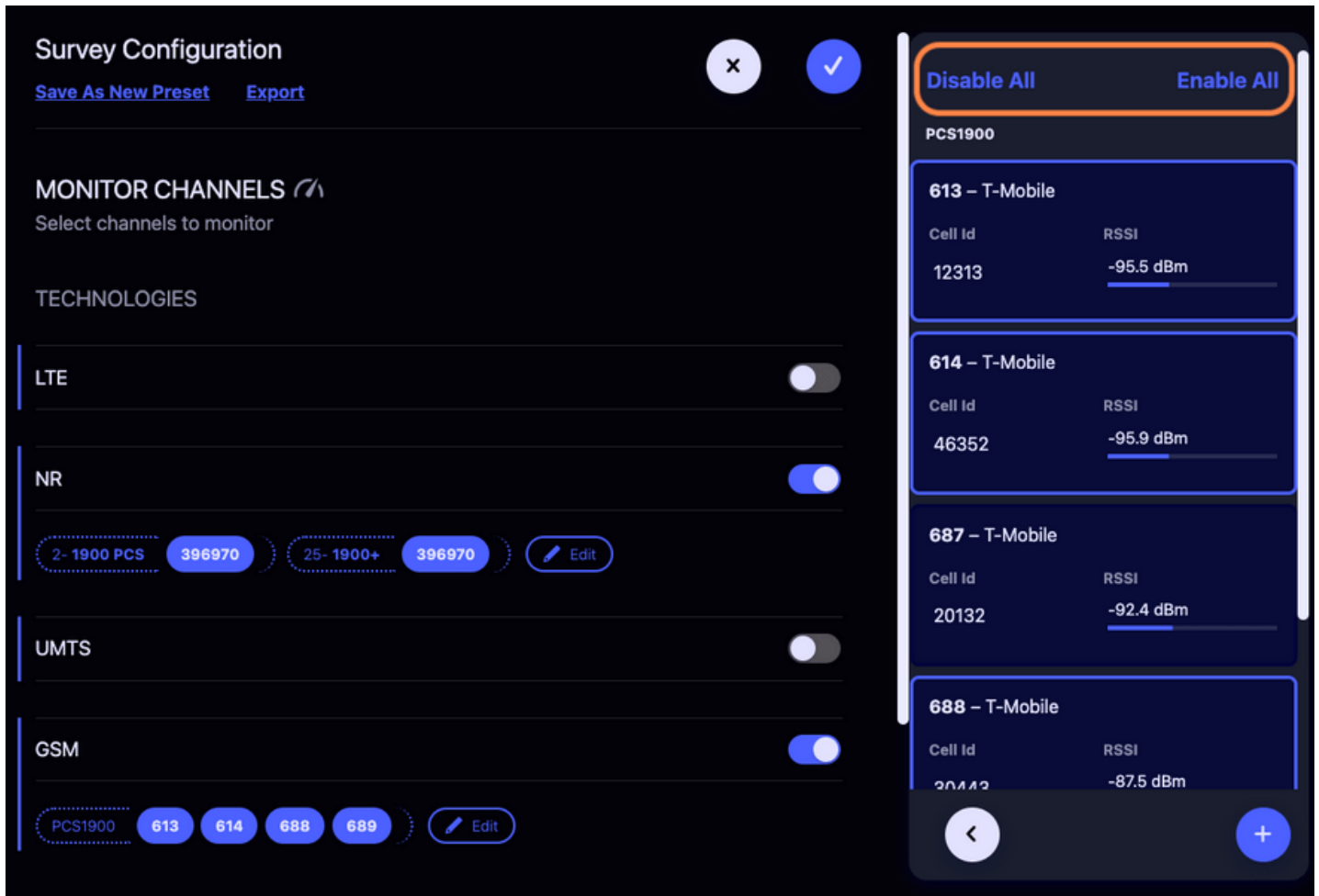


Figure 15: Enable Disable All

NOTE: A single channel can be selected by disabling all channels and then selecting the channel of interest from the list.

PRESETS

Monitor Channels configurations can be saved as presets, imported, and exported similarly to how these features work for Blind Survey.

```
my-channel-specific-preset.json
```

```
{
  "config": {
    "address": "127.0.0.1:7531",
    "rx_port": "J3",
    "survey_parameters": [
      {
        "tech": "lte",
        "type": "band",
        "bands": [
          {
            "band": "2",
            "channels": ["700", "702", "705", "777"]
          }
        ]
      }
    ]
  },
  "name": "lte band 2 - 700"
}
```

SURVEY SUMMARY

ACTIVE SURVEY

If there is currently an active survey, its status will show in the main panel above the Previous Surveys list.

CURRENT SURVEY PASS INFO

Skylight tracks the number of passes that have been performed and reports that value to the Skylight Web UI. This value is displayed above the configured [Survey Summary](#)

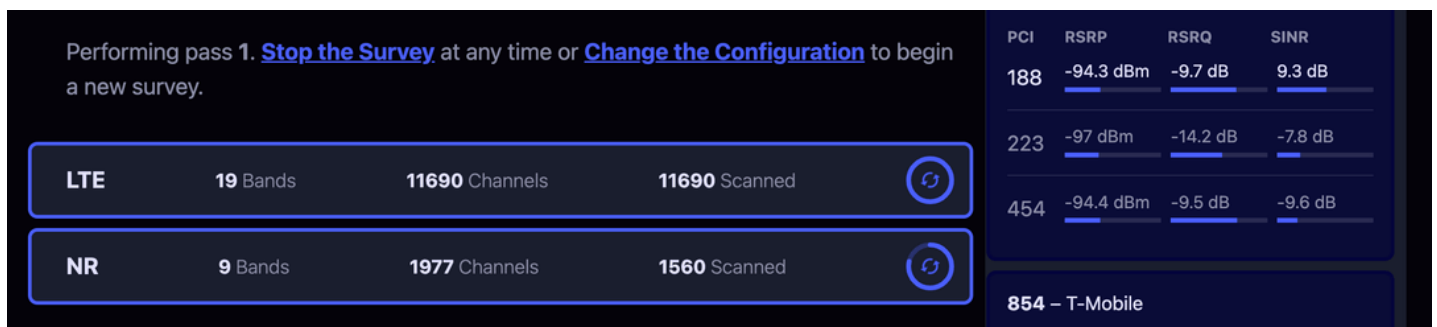


Figure 16: Active Survey

QUICK LINK CONTROLS

There are links to Stop the Survey and Change the Configuration above the [Survey Summary](#).

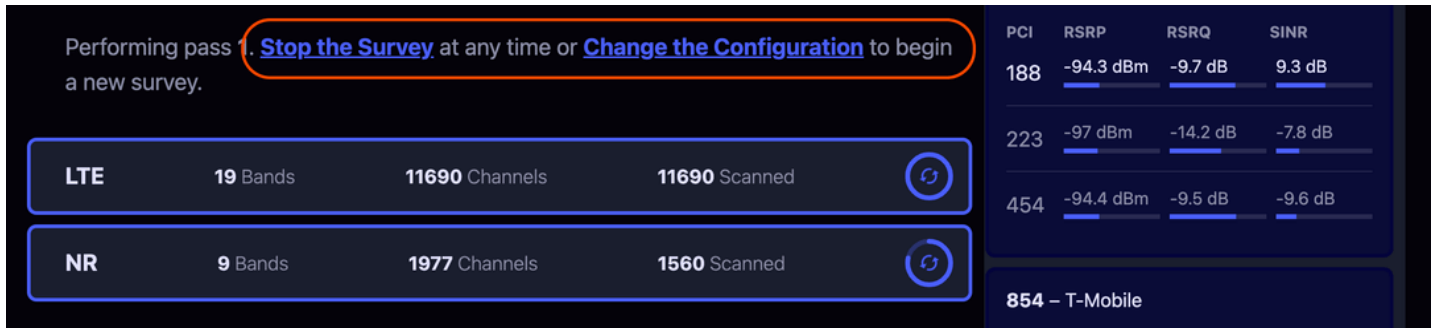


Figure 17: Quick Links

TECHNOLOGY SUMMARY

Skylight is attempting to decode each of the candidate channels within the configured bands. Iteration progress is shown for each technology and represents the number of channels scanned out of the total number of channels configured. Once all of the circular progress indicators are solid blue, a full Survey iteration of all configured technologies and bands has been completed. The progress indicators will reset at the start of the next pass.

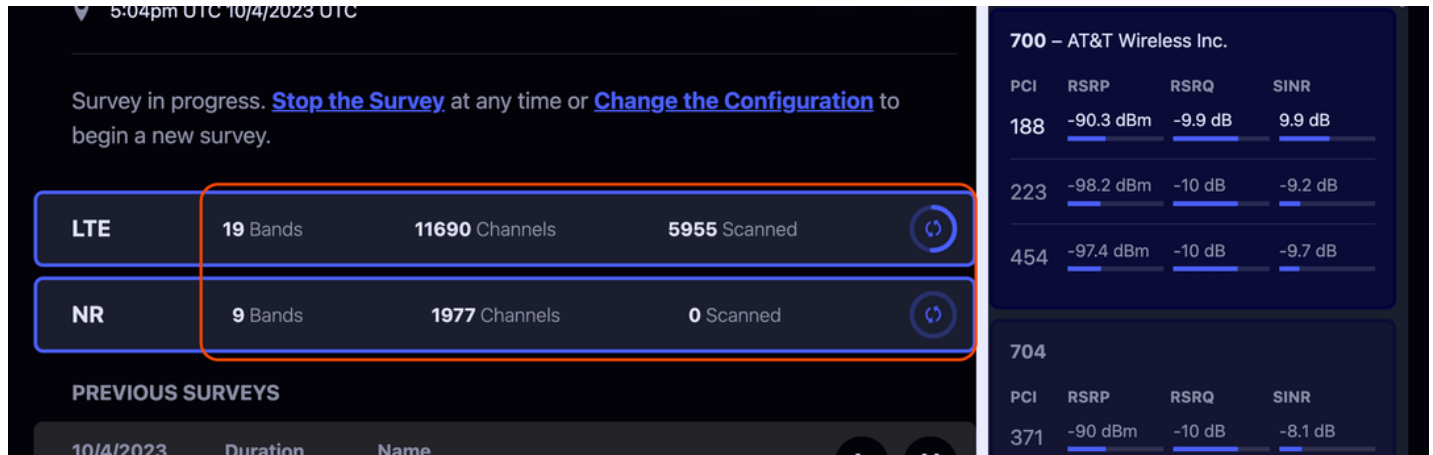


Figure 18: Technology Summary

CHANNEL LIST

The Channel List displays the cellular base stations discovered by Skylight for the selected technology. The list contains unique entries sorted by channel number within the frequency band in which they were found. Select a channel to see its [Channel Details](#).

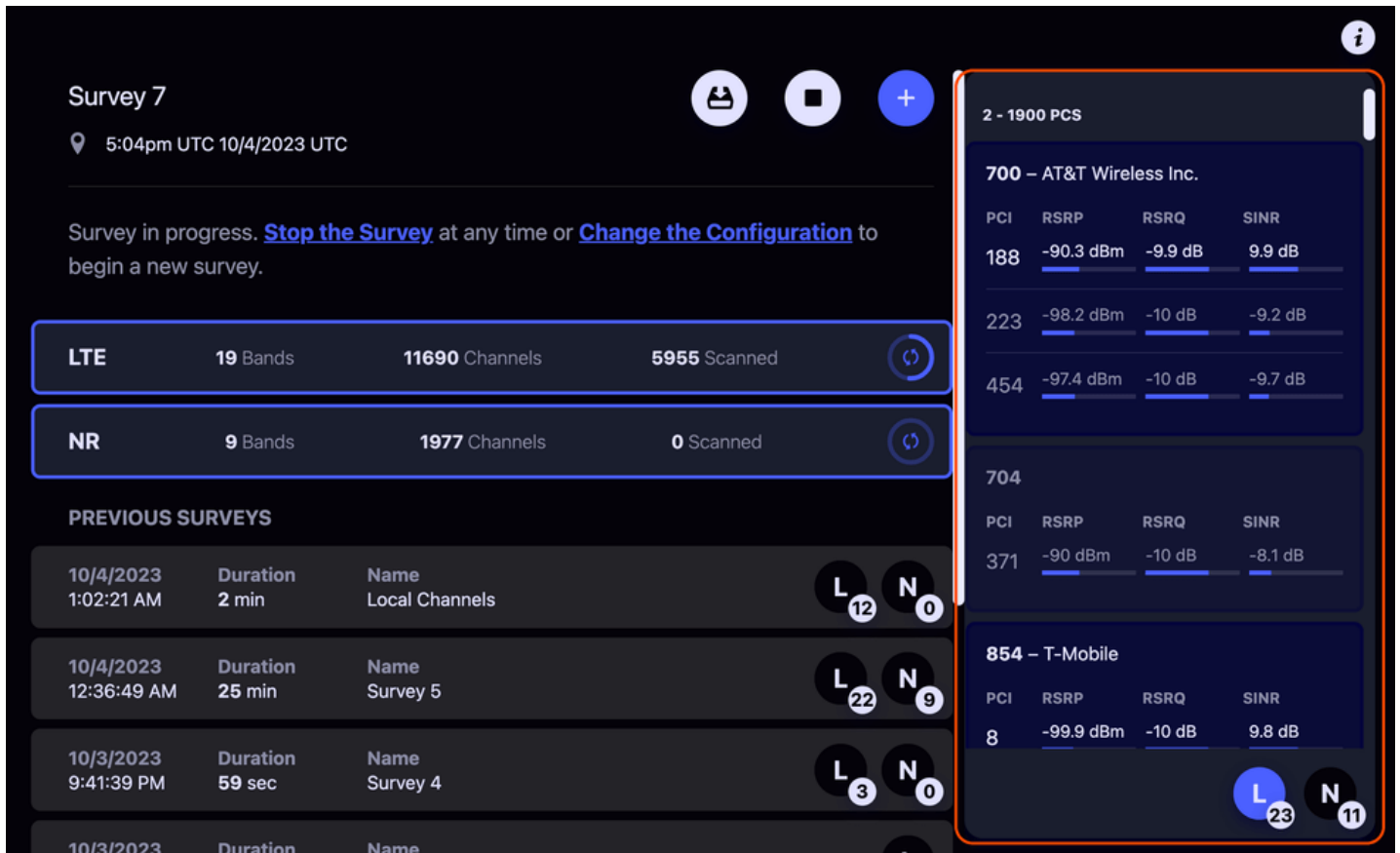


Figure 19: channel list

NOTE: If you connect the UI while Skylight is already running, the UI may take a few moments to load the channels already found during the current survey. The UI will display `loading...` in this case.

NOTE: Cells are listed with the following info

- **GSM:** ARFCN, Cell ID, RSSI
- **CDMA2k:** Channel Number, Pilot Pn, RSSI, EC_I0
- **UMTS:** UARFCN, PSC, RSSI, SRXLEV, RSCP
- **LTE:** EARFCN, PCI, Provider (if decoded), RSRP, RSRQ, SINR
- **NR:** NRARFCN, PCI, Provider (if decoded), RSRP, RSRQ, SINR

NOTE: For LTE and NR, when multiple PCIs are detected at a given carrier channel, they are sorted by SINR

TECHNOLOGY SELECTOR

Use the Technology Selector at the bottom right of the window to choose which technology is shown in the channel list for the currently selected survey. There is a badge on each selector to indicate how many unique, fully decoded channels have been identified for each technology.



Figure 20: technology selector

NOTE: The number on the badge may be less than the number of entries shown in the channel list. The channel list potentially shows multiple entries for overlapping bands and will display results that do not contain uniquely identifying information.

NOTE: Uniqueness is determined by the following properties for each technology

- **GSM:** Cell Id, Mcc, Mnc, Lac
- **CDMA2k:** Frequency, PilotPn, BaseId
- **UMTS:** Cell Id
- **LTE:** Cell Identity
- **NR:** Frequency, Pci

STOP CURRENT SURVEY

While a Survey is in progress, a Stop button is displayed in the top center of the UI (when no channels are selected in the [Channel List](#)). Pressing this button will cause Skylight to discontinue looking for channels, making it idle.



Figure 21: Stop Current Survey

NOTE: After stopping a survey, please wait for the Stop button to change to the Restart button before trying to start or restart a survey.

RESTART SELECTED SURVEY

While Skylight is idle, the Stop button is replaced with a Restart button. This allows the user to quickly restart a survey using the currently selected survey's configuration.



Figure 22: Restart Survey

CHANNEL DETAILS

When a channel is selected in the [Channel List](#), a panel with details for that channel is displayed.

TIP: To return to the [Survey Summary](#), either de-select the channel or click the blue back button at the top of the Channel Details section.

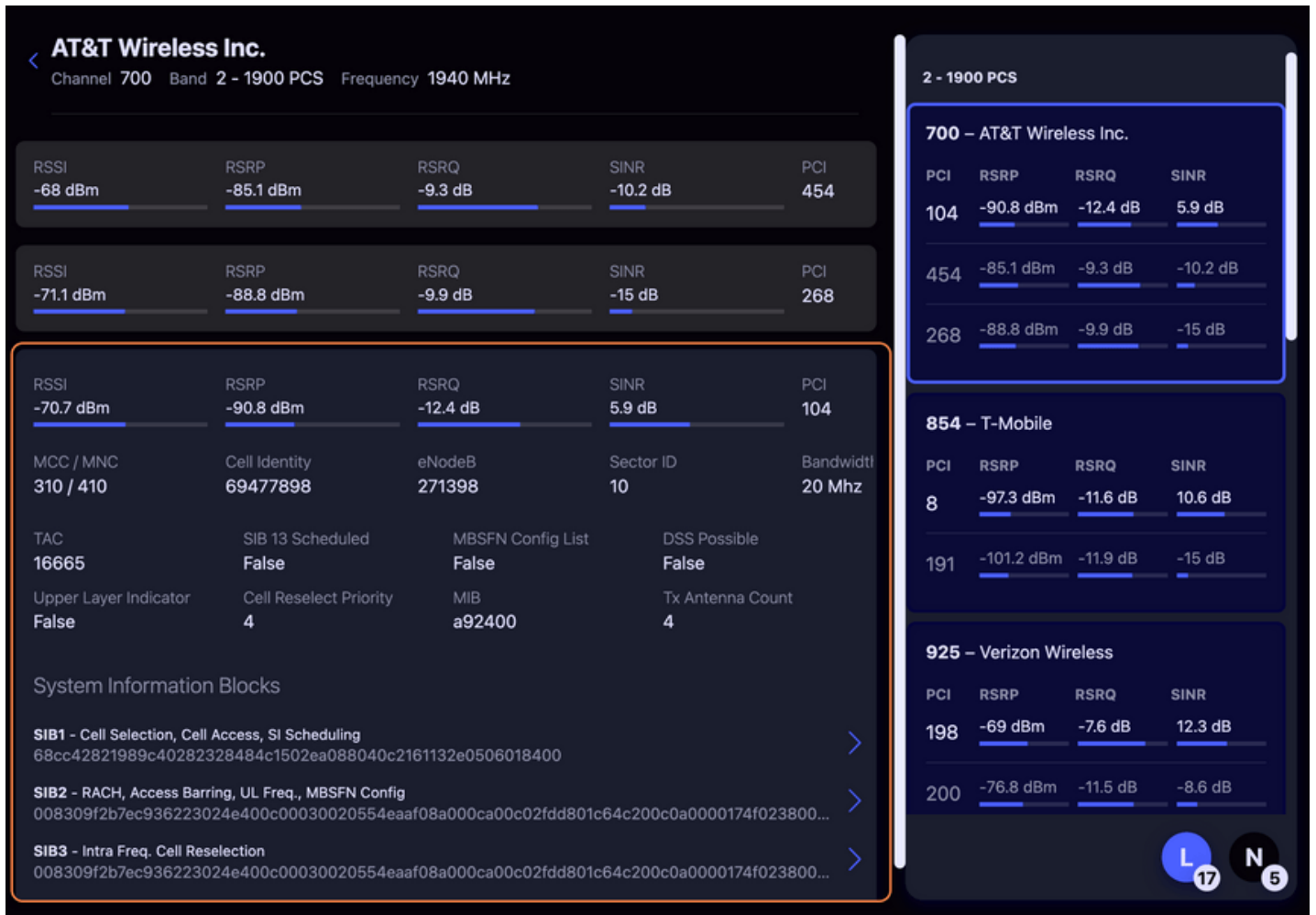


Figure 23: channel details

The first row for each PCI contains the latest signal strength and quality metrics available for the selected channel (available measurements are technology-specific). If a cell has had additional details decoded, such as network identification and configuration, they will be shown next.

Sometimes the same cell is listed multiple times, under overlapping frequency bands. When this is scenario detected by the scanner, a link to the cell most-likely to match the network configuration is provided in the Channel Details.

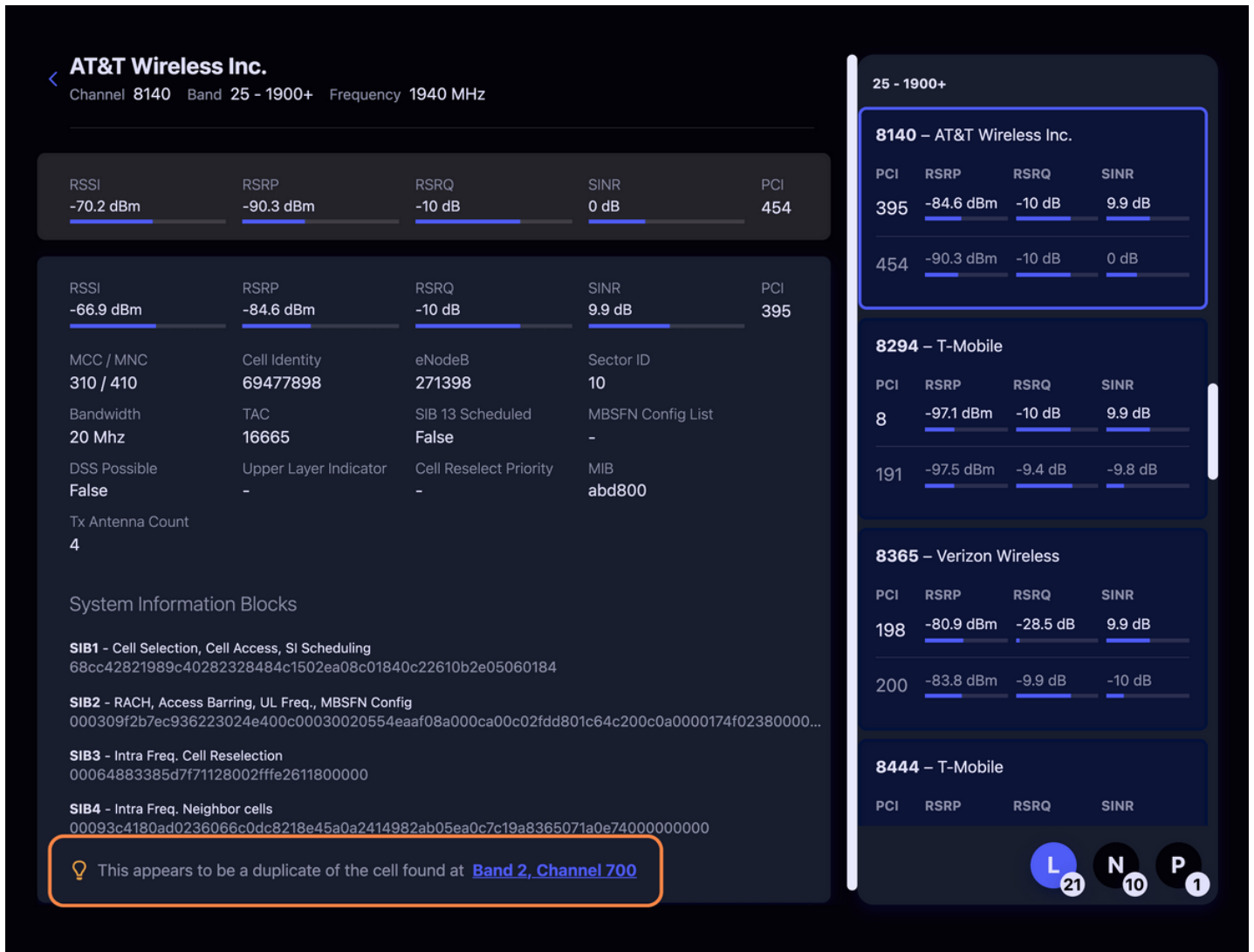


Figure 24: Duplicate Cell entry

NOTE: There are several ways to implement Dynamic Spectrum Sharing (DSS) using a channel's system information. Skylight detects the version where a MBSFN Config List is present and SIB13 is not scheduled. This implementation is shown with the `DSS Possible` field in the Channel Details.

SYSTEM INFORMATION BLOCKS

System Information Blocks that have been decoded are shown below the Channel Details. Clicking on one of the listed SIBs will show the fully decoded system information.

NOTE: When SIBs are scheduled together the network operator concatenates the individual SIBs into a single BCCH-DL-SCH message. This combined message is displayed in the Skylight UI for each SIB. In the example image below, SIBs 2 and 3 as well as SIBs 5 and 8 are scheduled together.

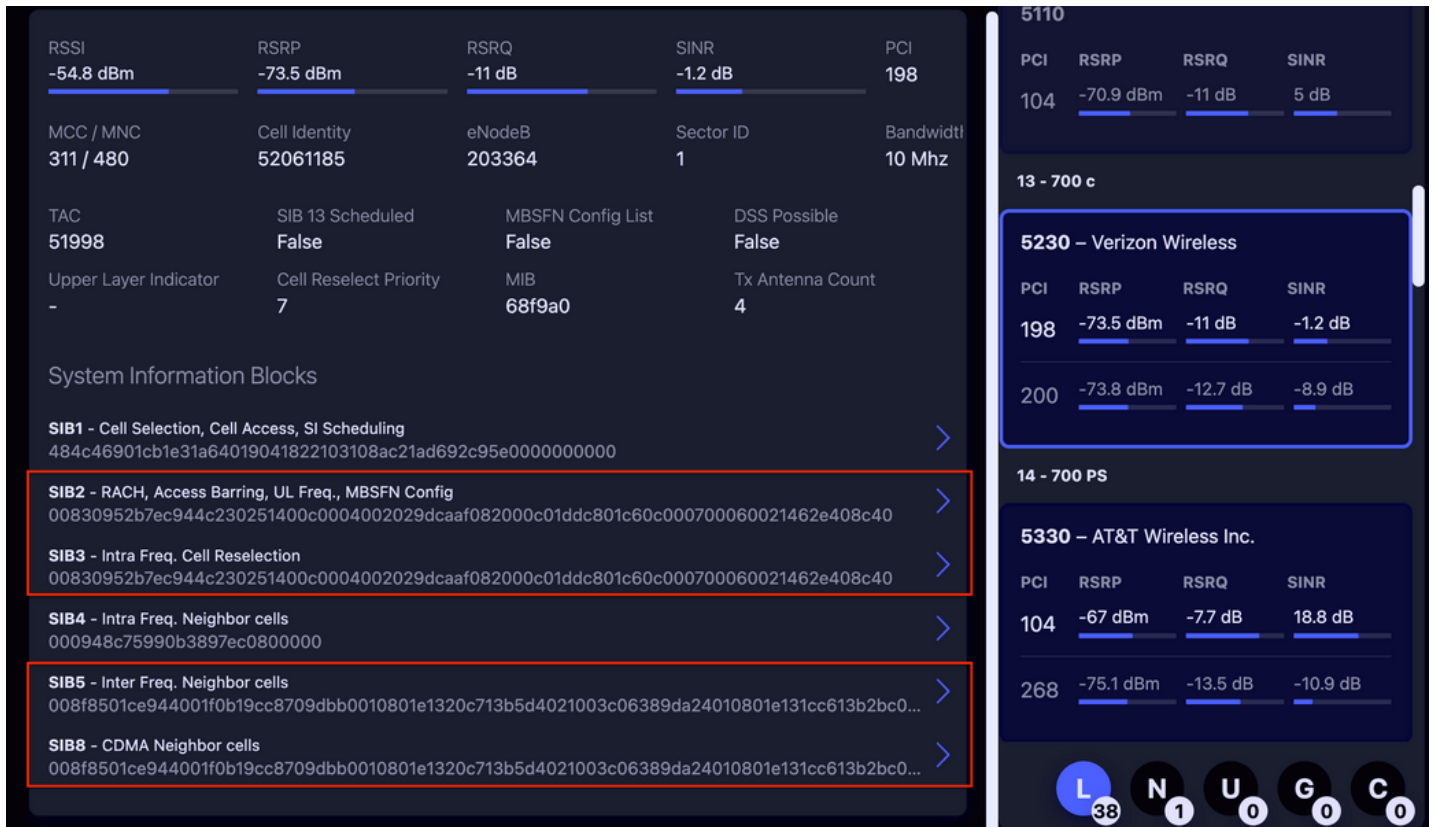


Figure 25: Combined SIB Hex

NOTE: Viewing the fully decoded system information is only available for LTE and NR.

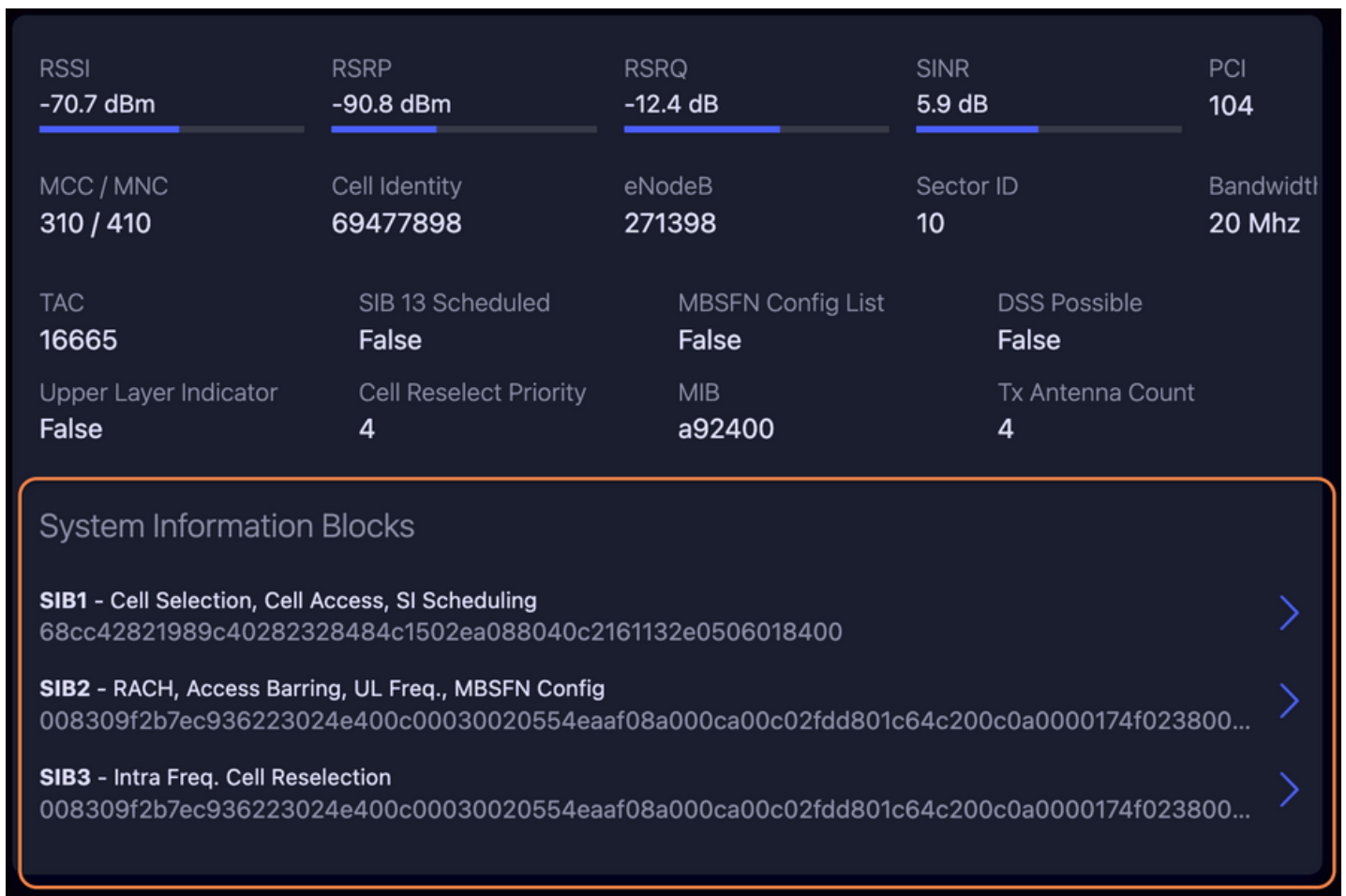


Figure 26: System Information Blocks

AT&T Wireless Inc.
Channel 700 Band 2 - 1900 PCS Frequency 1940 MHz

SIB1 Cell Selection, Cell Access, SI Scheduling

Unpacked Encoding Rules (UPER)
68cc42821989c40282328484c1502ea088040c2161132e0506018400

JSON Encoding Rules (JER)

- cellAccessRelatedInfo 6 keys
 - cellBarred: **notBarred**
 - cellIdentity: **424260a0**
 - csg-Indication: **false**
 - intraFreqReselection: **allowed**
- plmn-IdentityList 2 items
 - 0 2 keys
 - 1 2 keys
- trackingAreaCode: **4119**
- cellSelectionInfo 1 key
 - q-RxLevMin: **-65**
 - freqBandIndicator: **2**
- nonCriticalExtension 2 keys
 - lateNonCriticalExtension: **0x8300**
- nonCriticalExtension 2 keys
 - cellSelectionInfo-v920 1 key
 - ims-EmergencySupport-r9: **true**
- p-Max: **23**

SIB1
Cell Selection, Cell Access, SI Scheduling

SIB2
RACH, Access Barring, UL Freq., MBSFN Config

SIB3
Intra Freq. Cell Reselection

Figure 27: JSON Encoding Rules

EXPORT

To download the complete set of scan records for the currently selected survey, select a survey shown in the [Survey Summary](#) and click the Export link.

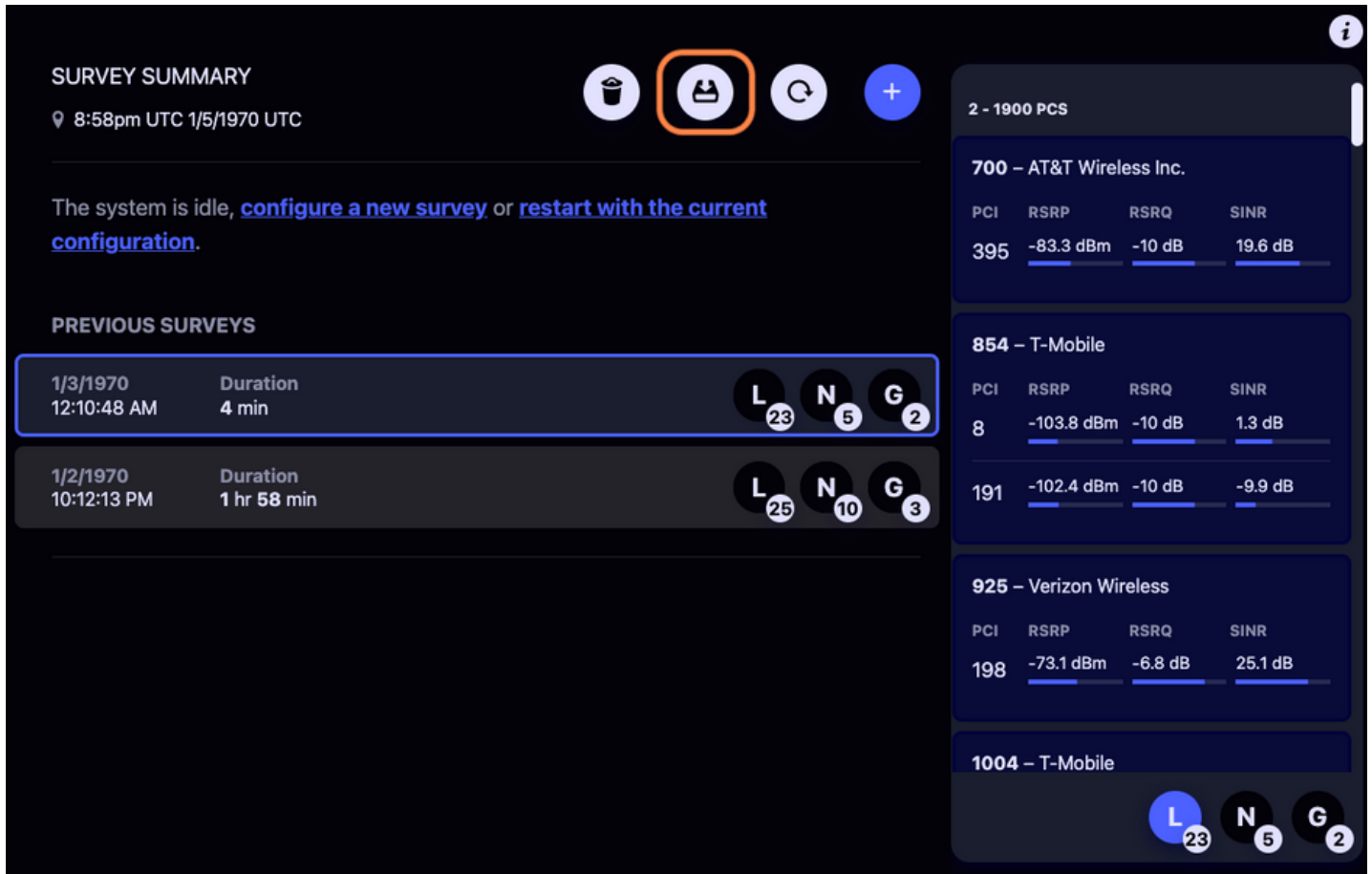


Figure 28: Export Scans Button

Once you click the export link, the Web UI will download individual files, one per configured technology, until all of them are done.

The survey scan records are downloaded in the format chosen in the [System Options](#) section of the [System Information View](#). The supported Skylight survey export formats are:

- [Generic Network Survey \(GNS\)](#)
- [Comma Separated Values \(CSV\)](#)

GNS

All scan records that were captured for the selected survey will be downloaded into individual `.gns` files per configured technology.

CSV

All scan records that were captured for the selected survey will be downloaded into individual `.csv` files per configured technology.

PREVIOUS SURVEYS

All previously completed surveys and a summary of their results will be shown in the Previous Surveys list in the main panel. A user can click on any of these surveys to view the individual results observed for that survey or export the results from that survey.



Figure 29: Previous Surveys

DATABASE USED SPACE

The percentage of available space being used by each technology is displayed in this section, which can be found below the Previous Surveys. This information can be used to inform a user when they should export and delete surveys to free up space.

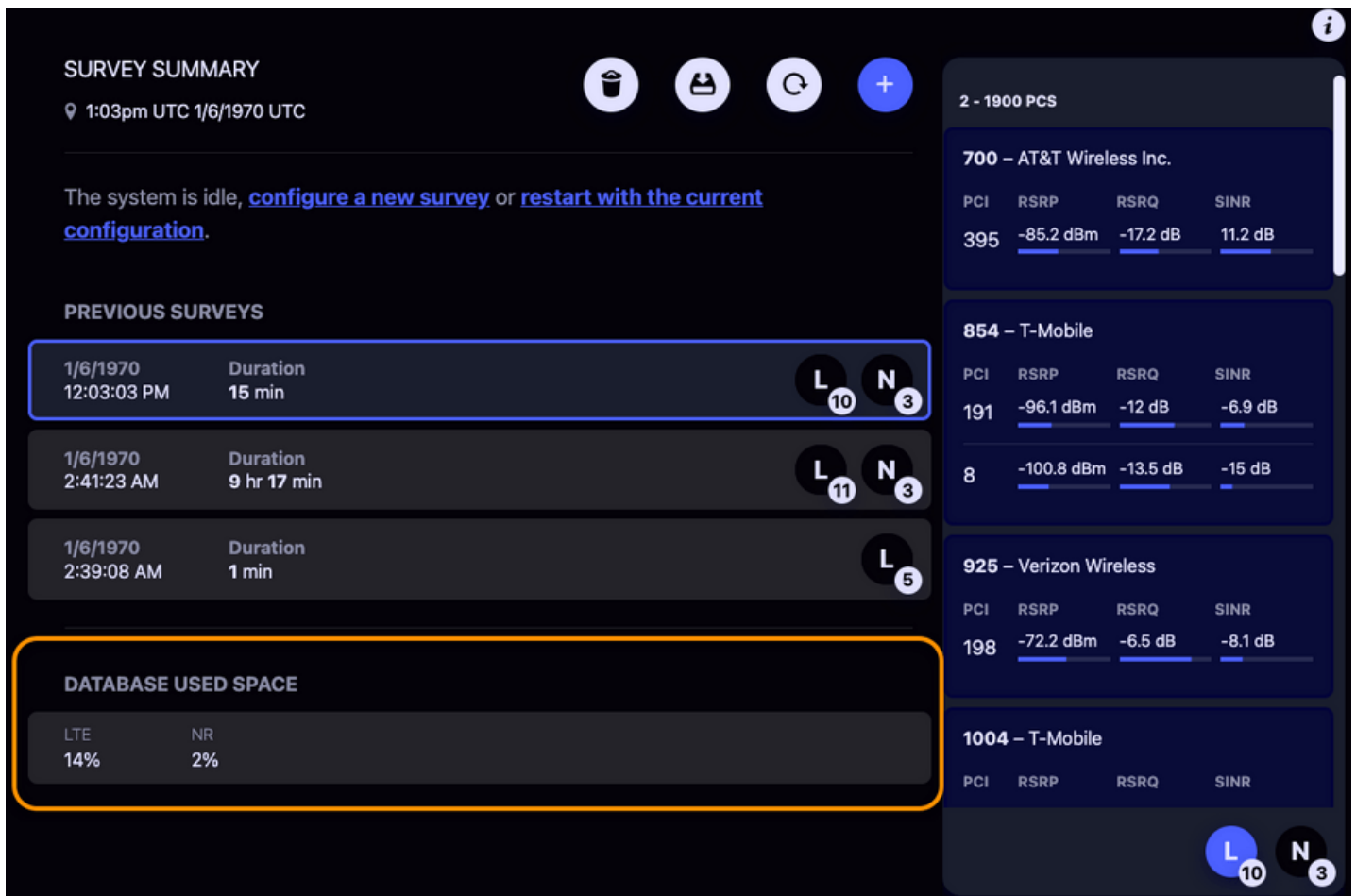


Figure 30: Database Used Space

NOTE: When the number of scan results grows larger than the allowed limits, the database automatically deletes the oldest scan results for the technology that has exceeded its limits.

DELETE SURVEYS

Delete Survey mode can be entered by clicking the Trash Can.

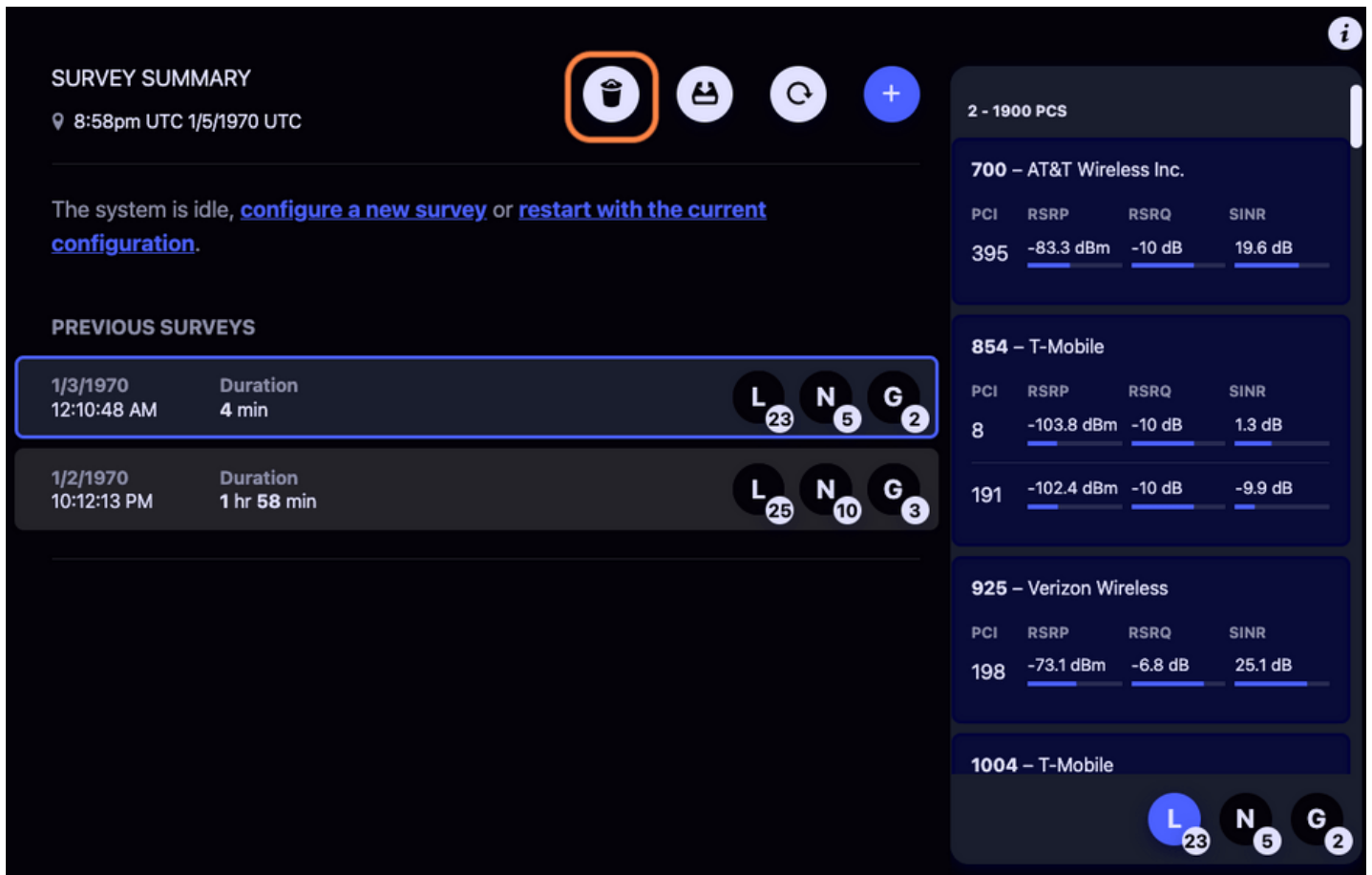


Figure 31: Trash Can

Select the survey(s) you wish to delete and then click the blue checkmark to confirm deletion.

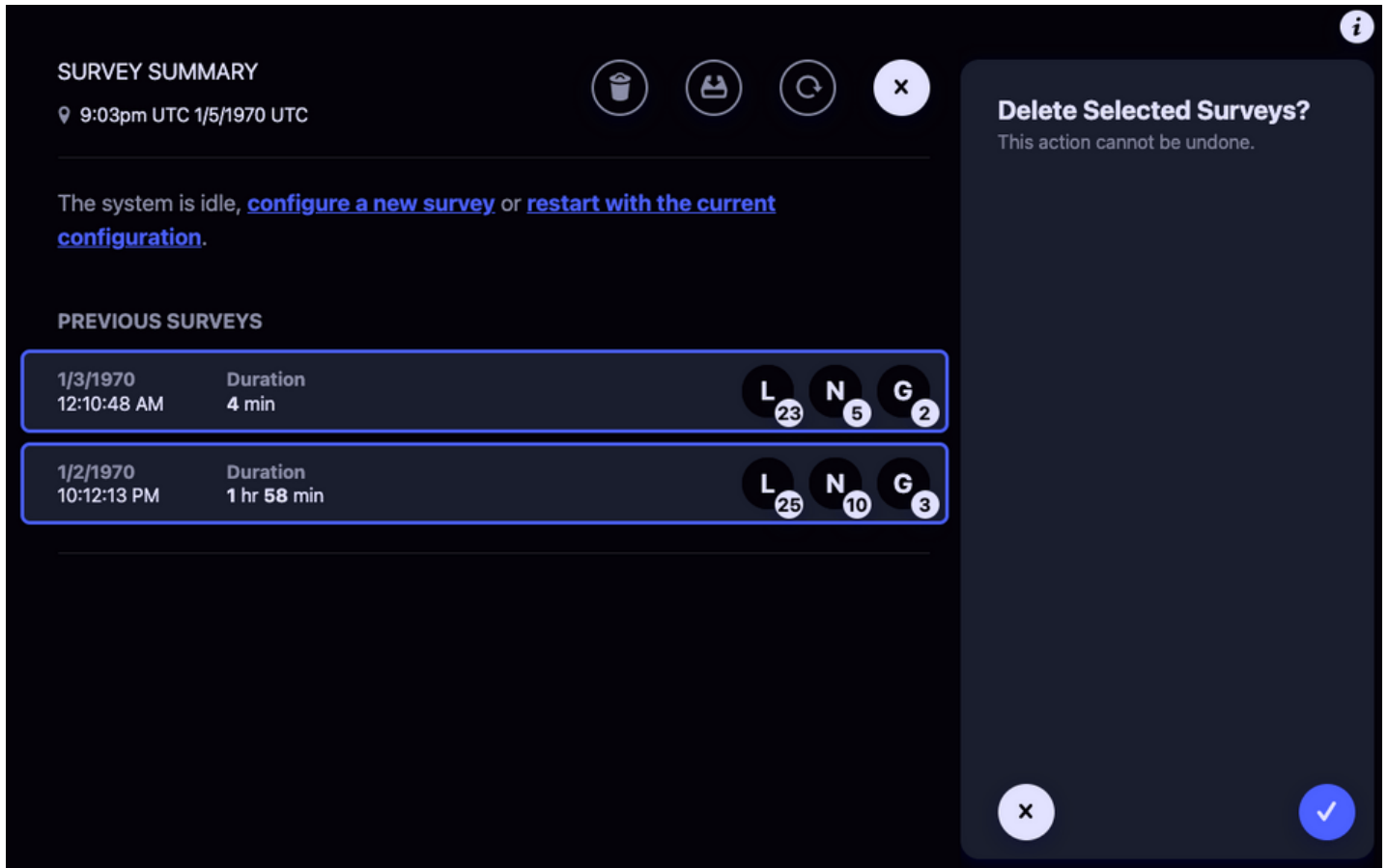


Figure 32: Delete Surveys

NOTE: Deleted surveys can not be recovered.

CHANGING THE NAME OF A SURVEY

The selected Survey's name can be changed by clicking its name toward the top of the screen. To apply the name change, hit the `Enter` key or click the "Save" link that appears below the edited name. To cancel changing the name, hit the `Esc` key or click the "Cancel" link that appears below the edited name.

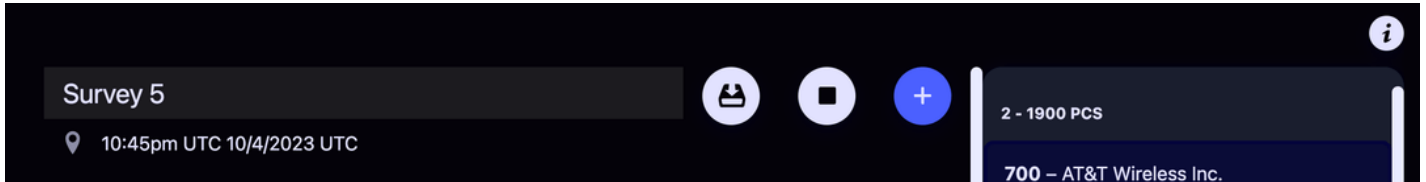


Figure 33: Click the Survey's Name to Change it

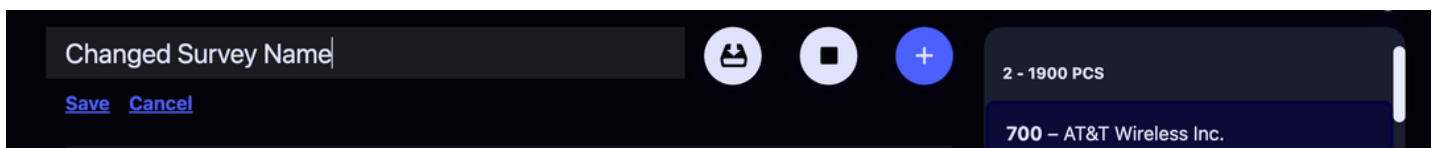


Figure 34: Rename the Selected Survey

NOTE: If a Survey does not have a name, it will be listed by its id number, e.g. "Survey 5"

SYSTEM INFORMATION VIEW

The System Information View is accessed by clicking the **i** button at the top right of the page.

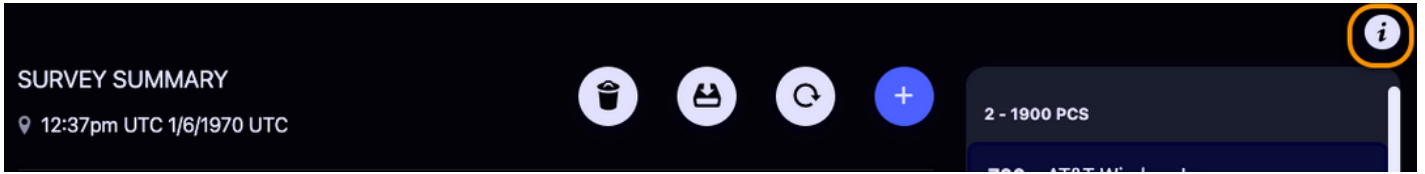


Figure 35: System Information Button

SYSTEM INFO

The system Serial Number and installed version information is displayed here.



Figure 36: System Info

LICENSE INFO

The Product License and currently licensed technologies are shown here.



Figure 37: License Info

UPLOADING A NEW LICENSE FILE

To upload a new license file, click the `Choose File` button and use your operating system's file browser to select the license file provided to you by Epiq Solutions. The new license will be effective immediately after the file is uploaded and verified by Skylight.

NOTE: Skylight will automatically be set to idle if a license file is uploaded while a survey is currently running.

TEMPORARY LICENSE FILES

A temporary license will be denoted by its expiration date.



Figure 38: An Expiring License

SYSTEM OPTIONS

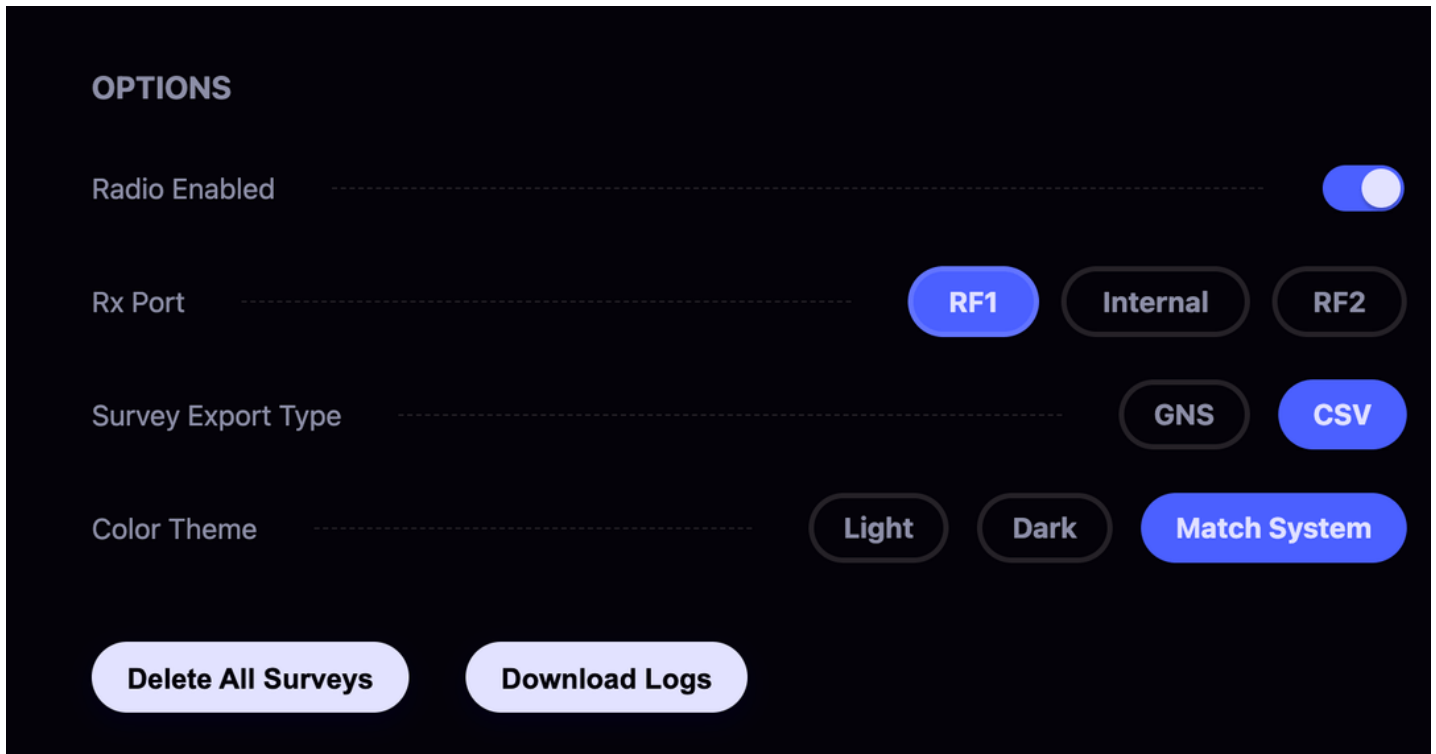


Figure 39: System Options

DELETE ALL SURVEYS

All surveys in the database will be removed.

DOWNLOAD LOGS

A *tar.gz* archive containing the Skylight logs will be downloaded. This is used to export debug information that [Epiq Solutions](#) may request.

EXPORT TYPE

The option chosen here determines the file format in which Skylight Surveys are [exported](#).

RADIO ENABLED

This determines whether or not Skylight has control of the radio and can be used to ensure that other applications are able to access the radio.

NOTE: When the radio is disabled, the user can not restart or configure a new survey. The radio must be enabled to access those features.

RX PORTS

On platforms that support multiple Rx RF inputs, the Survey Configuration provides an option for selecting which input is used for the Skylight Survey.

NOTE: Rx Ports information will not load if the radio is disabled. Enable the radio and refresh the page to load the information.

CUSTOM RX PORT NAMES

By default, Rx Port names use the libsidekiq naming convention, but it is possible to provide custom names by placing a file named `rx-port-defs.json` in the same directory as the Skylight Web Server binary and restarting the service. For example, on a x86 Debian system with a Sidekiq™ Mini PCIe card installed, a file with the following contents could be placed in the location: `/opt/epiq/skylight-web-ui/rx-port-defs.json`

```
{
  "rx_ports": [
    {
      "radio_rx_port_name": "J2",
      "user_rx_port_name": "Bob"
    },
    {
      "radio_rx_port_name": "J1",
      "user_rx_port_name": "Alice"
    }
  ]
}
```

COLOR THEME

Users can now choose between light, dark, and system color themes.

NOTE: The default color theme is `Match System` and the screenshots presented in this user manual show the dark theme.

APPENDIX A - DATABASE MEMORY MANAGEMENT

The Skylight scan results database limits the total number of survey and Physical Layer measurements on a per technology basis that it stores in order to prevent the database from taking up too much space. When the number of scan results grows larger than the allowed limits the database automatically deletes the oldest scan results for the technology that has exceeded its limits. A JSON file located in the installation directory can be used to control the table limits. The configuration file is named `skylight-ws-database-config.json` and an example is provided below. Change the integer values as needed to adjust the limits.

```
{
  "gsm_config": {
    "max_scan_results": 128
  },
  "cdma2k_config": {
    "max_scan_results": 128
  },
  "umts_config": {
    "max_scan_results": 128,
    "min_secs_between_saved_phy_measurements": 1
  },
  "lte_config": {
    "max_scan_results": 10000,
    "min_secs_between_saved_phy_measurements": 1
  },
  "nr_config": {
    "max_scan_results": 10000,
    "min_secs_between_saved_phy_measurements": 1
  },
  "p25_config": {
    "max_scan_results": 10000
  }
}
```


APPENDIX B - SETUP HELP

This section provides instructions for installing the Skylight Web UI package on one of the supported platforms:

- [Sidekiq Enabled Debian x86 Host](#)
- [Matchstiq S-Series](#)
- [Matchstiq Z-Series](#)

NOTE: Installation of a compatible version of Skylight is a prerequisite.

COPYING TO YOUR EPIQ RADIO'S HOST MACHINE

In order to install the package on the host machine, you'll first need to copy it to the host (see [Installation](#) for the package name for each supported platform). Make sure you have a network connection to the host and, in a shell, copy the archive to the host's `/tmp` directory:

```
scp /path/to/skylight-web-ui_<VERSION>_<PLATFORM-SPECIFIC> <username>@<ip-address>:/tmp/  
# enter password if prompted
```

Where `username` is likely `sidekiq` for an Epiq-provided, Sidekiq™-enabled laptop and `root` for a Matchstiq and `ip-address` is the address of the radio host machine.

NOTE: The default IP address on a Matchstiq™ S-Series is `192.168.2.140`. If using a USB OTG adapter to connect to the Matchstiq's USB port, the default IP address is `192.168.3.99`. The default IP Address on a Matchstiq™ Z2 is `192.168.3.1` and the default on a Matchstiq™ Z3u is `192.168.0.15`

Now, in the same shell, `ssh` into the host if you are installing on a Matchstiq™ platform or remotely installing on a different Sidekiq™-enabled host.

```
ssh <username>@<ip-address>  
# enter password if prompted
```

INSTALLATION

DEBIAN WITH SIDEKIQ™ INSTALLED

```
sudo dpkg -i /<PATH-TO>/skylight-web-ui_<VERSION>_amd64.deb
```

MATCHSTIQ™ S-SERIES

```
opkg install /<PATH-TO>/skylight-web-ui_<VERSION>_imx6.ipk
```

MATCHSTIQ™ Z2

```
opkg install /<PATH-TO>/skylight-web-ui_<VERSION>_armhf.ipk
```

MATCHSTIQ™ Z3U

```
sudo dpkg -i /<PATH-TO>/skylight-web-ui_<VERSION>_arm64.deb
```

Where `<PATH-TO>` is `tmp` if you followed the instructions in [Copying to Your Epiq Radio's Host Machine](#)

OPEN IN BROWSER

Once the installation completes successfully, the service will be started automatically and you can open the UI in your web browser.

On Matchstiq™ Platform or Sidekiq™-enabled Laptop, when accessing remotely:

```
http://<ip-address-of-host>:3030
```

NOTE: The default IP address on a Matchstiq S-Series is `192.168.2.140`. If using a USB OTG adapter to connect to the Matchstiq's USB port, the default IP address is `192.168.3.99`. The default IP Address on Matchstiq Matchstiq™ Z2 is `192.168.3.1` and the default on a Matchstiq™ Z3u is `192.168.0.15`

On Sidekiq™-enabled Laptop, if you want to access the UI from the same laptop:

```
http://localhost:3030
```

APPENDIX C - TROUBLESHOOTING

Below are some common issues you may encounter when using the Skylight Web UI

SETUP/INSTALLATION

See [Appendix B](#) if you need instructions on installing the Skylight UI.

SKYLIGHT CORE SCANNER TROUBLESHOOTING

If there is a problem with the Skylight Core Scanner, the UI will display `Unexpectedly lost connection to scanner application` and the configured RATs should be highlighted red.

Please verify that the `skylight` service is running; see the Skylight Core Scanner User's Guide and ICD for more information on how to interact with the service.

GPS

On a Matchstiq™ Z3u, the `gpsd` service is off by default. To manually turn the service on, first `ssh` to the Matchstiq™ Z3u:

```
ssh <username>@<ip-address>
# enter password if prompted
```

Then execute the following command:

```
sudo systemctl start gpsd
```

To enable the `gpsd` service to automatically start:

```
sudo systemctl enable gpsd
```

ERROR STARTING CDMA2K SURVEY WITH NO BANDS SELECTED

If `CDMA2K` is enabled during Survey Configuration and no bands are explicitly enabled, the UI will attempt to configure the Skylight Core Scanner to survey all bands. This configuration will result in an error and the survey will not start. To work around this error, manually enable all bands by clicking the toggle button next to each band's name.

APPENDIX D - TERMS

An attempt to clarify some of the otherwise ambiguous terminology used in this User Manual.

Term **Use**

Survey	An individual Survey refers to all of the results reported by Skylight for a given configuration
scan	Represents the mode reported by Skylight when it is actively performing a Survey
Scans	Refers to an individual entry stored in Skylight's database. For example: when exporting a Survey, the result will be a collection of Scans

