



TVSTUDY

INSTRUCTION MANUAL

Office of Engineering and Technology
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USING TVSTUDY

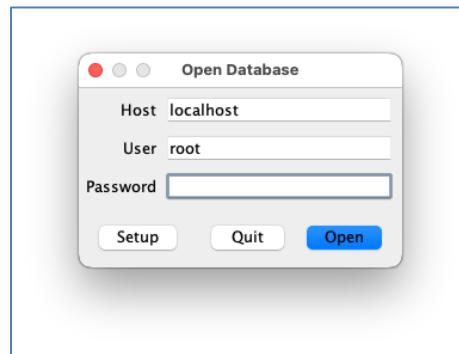
Launching TVStudy

To launch TVStudy, navigate your terminal to the directory where TVStudy was installed and then type and run:

```
java -jar tvstudy.jar
```

If you receive any error messages, you should check the TVStudy Installation and Upgrade Guide and/or the [TVStudy FAQ](#) for information on common errors and how to resolve them.

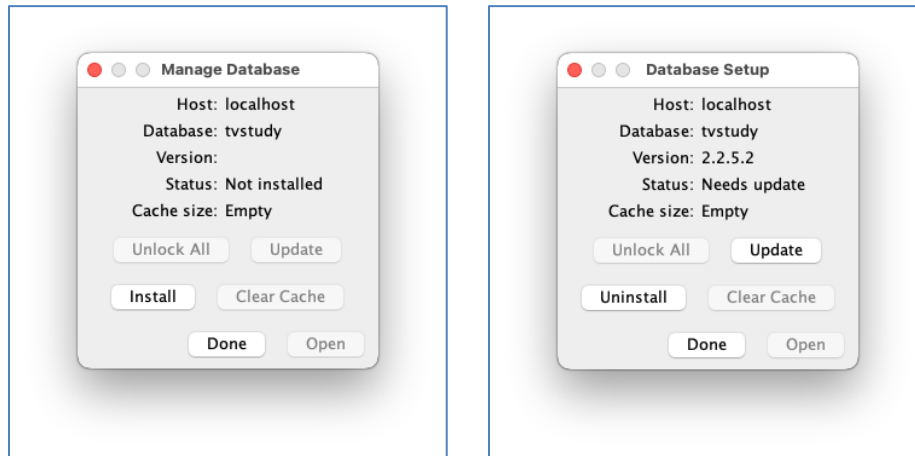
Upon opening TVStudy, you will see the Open Database window.



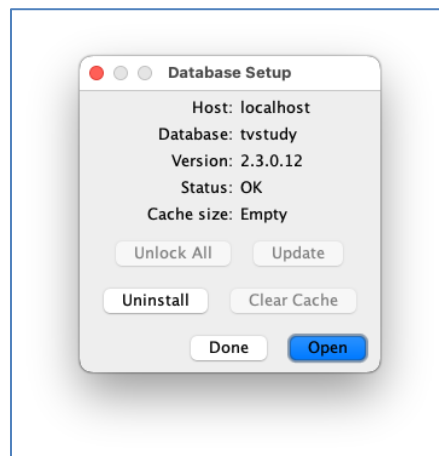
If you're running your MySQL database server on your machine, you may need to enter "localhost" or "127.0.0.1" as your host name. You will need the user name and password to access your database. When finished, click "Open."

Managing the TVStudy Database

If this is your first time running a new or updated version of TVStudy, the software will open the “Database Setup” window. If not, you can open the Database Setup window by clicking “Setup” after putting your password into the “Open Database” window.

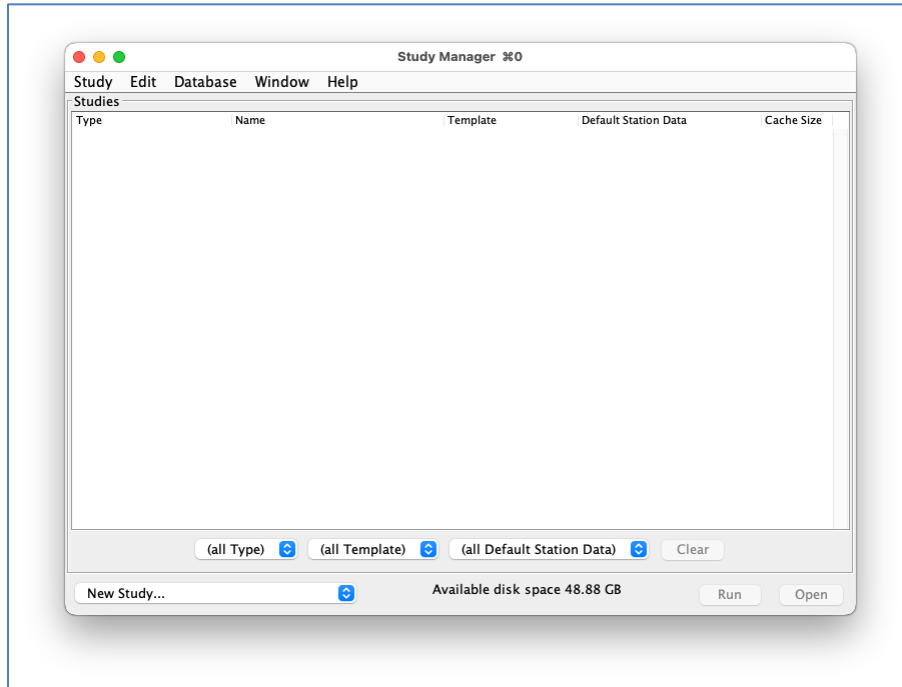


This window allows you to either update your database to the latest version if you are upgrading, or install the root database for a new installation. Click “Install” or “Update,” as appropriate, and it will do so automatically, taking up to or more than about 20 minutes, depending on the speed of your computer.



This window also allows you to resolve some common database issues, such as locked databases preventing you from gaining access to the Study Manager window, corrupt database, or cache problems by clicking the appropriate buttons.

Study Manager Window



The first time opening the software you will see an empty Study Manager window, as shown above. This window will allow you to see your studies and configure TVStudy for use. In TVStudy, datasets and templates are managed from the Database drop-down menu.

The study names in this window are color coded according to their status. A full list of the possible colors in the Study Manager window is provided below.

Blue indicates a study that has a description, which can be viewed by hovering over the blue text.

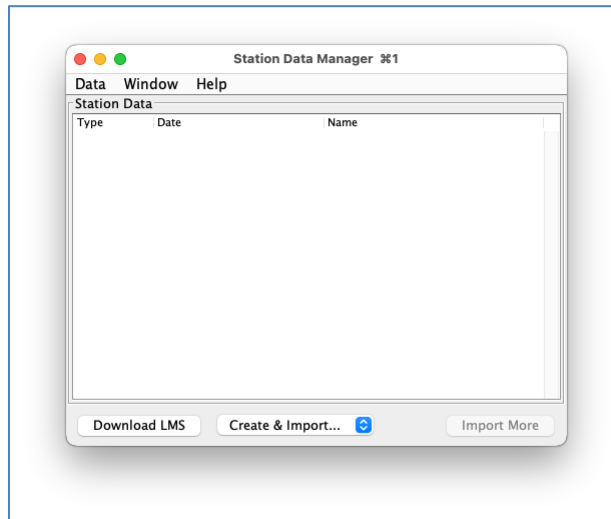
Green indicates a study that is open for editing.

Red indicates a study that is locked and presently being run.

Gray indicates a study that is locked for some reason other than running.

Managing Datasets

TVStudy has the capability of performing various types of analyses pertaining to broadcasting. In order to use TVStudy to run analyses, you should import at least one LMS dataset. If you are looking to conduct an OET Bulletin No. 74 analysis, a dataset of wireless sites and antenna patterns is also required (see Appendix B). To import a dataset, begin by opening the Database menu and choosing Station Data Manager.



At the bottom left corner, note that you can choose whether to Download a current LMS dataset directly from the Internet or Create & Import a previously-downloaded dataset from your hard drive.

To download directly from the Internet, click the “Download LMS” button.¹ The download and import will then begin, taking several minutes depending on the speed of your Internet connection.²

Please note that downloading LMS again will remove the previous copy, effectively replacing it with the newly-downloaded data, unless it has been renamed or the appropriate preference set (see page 86). If it has been renamed or the preference set, then it will remain and the newly-downloaded data will appear along-side the previous dataset.

When a dataset is removed, either through automatic update or via manual removal, its name has “(deleted)” appended to it in other parts of the software. It is no longer available for use, but its use in creating the given study remains noted.

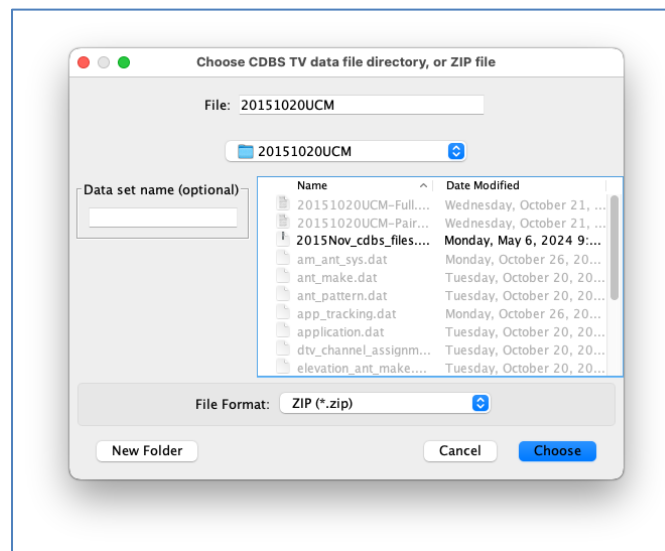
¹ Please note that CDBS does not contain coordinates for TV station applications filed after April 2017 or any data on FM technical applications filed after September 2019. Also note that use of CDBS datasets in TVStudy is no longer recommended and, in the case of TV Interference Check studies, no longer permitted.

² If you have trouble downloading LMS from within TVStudy, you may try downloading it directly from the FCC website with your web browser and importing it with the Import function. To download today’s LMS dataset, see: <https://enterpriseefiling.fcc.gov/dataentry/public/tv/lmsDatabase.html>

To import a dataset, you should have an appropriate dataset ready. These may include previously downloaded LMS or CDBS³ datasets, wireless datasets, ISED Canada⁴ datasets, or datasets stored in TVStudy XML or text formats.⁵ click the “Create & Import” drop-down and choose the type of dataset you would like to import. There are several options here:

- LMS – Zipped or extracted, otherwise in its original format.
- Wireless – See Appendix B for the format, or a TVStudy XML file can be imported.
- TVStudy TV – Choose tvstatio.dbf from an ISED download, or a TVStudy XML or CSV file.
- TVStudy FM – Choose fmstatio.dbf from an ISED download, or a TVStudy XML or CSV file.
- CDBS TV – Zipped or extracted, otherwise in its original format. Must import FM separately.
- CDBS FM – Zipped or extracted, otherwise in its original format. Must import TV separately.

Navigate to the location containing your data files for import.



In the pane at the side of the window, you can give the dataset an optional name, otherwise a default name comprised of the data type and the most recent date found in the data will be created. If you are creating a number of studies using different datasets, naming each dataset may prove useful in keeping them organized. Click “Choose” to import the dataset. Clicking “Cancel” will prevent the dataset from being imported. If you are importing a wireless dataset, a second window will appear asking you to choose the associated wireless antenna pattern dataset.

For an import of CDBS or LMS data to be successful, TVStudy needs, at a minimum, the files listed in Appendix B. A complete dataset file set should always import successfully so long as the set is not corrupt.

³ To download today’s CDBS dataset, see: <https://www.fcc.gov/media/radio/cdbb-database-public-files>

⁴ To download the current ISED Canada dataset, see: http://sms-sgs.ic.gc.ca/eic/site/sms-sgs-prod.nsf/eng/h_00015.html#Database

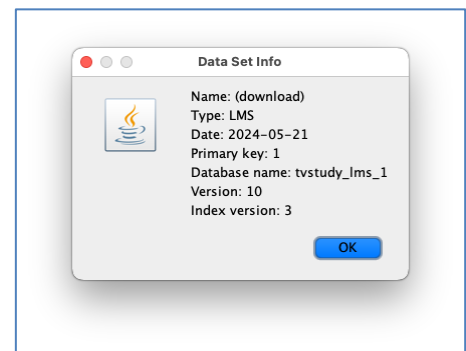
⁵ See Appendix G and **Error! Reference source not found..**

After a brief wait while the dataset files are imported, you should now see your dataset in the list.⁶ To rename or delete a dataset, simply click the Data menu and choose Rename or Delete, respectively.

The “Import More” button allows the import of more data into existing Wireless, TVStudy TV, or TVStudy FM datasets. For example, if you have an XML file and a spreadsheet, or two XML files, you could import the first one, then use Import More to add the second one to the dataset containing the first.

In the event TVStudy crashes while doing an import in Wireless, TVStudy TV, or TVStudy FM datasets, you may need to use the “Unlock” menu option in the “Data” drop-down menu to unlock the dataset so you can import more data. During import, the data set is locked to prevent concurrent imports when a database server is shared by multiple users.

If you want details on the dataset, you can click it and then choose “Get Info” from the “Data” drop-down menu. This will provide information on how the dataset is loaded into TVStudy, which may prove useful in certain circumstances that are beyond the scope of this document.



Please note that if you receive an error message when importing an older CDBS dataset, it may be the result of an incompatibility between TVStudy and the CDBS data. On December 2, 2014, the application.dat file was modified, and TVStudy 1.3.2 was the first version which properly handled the new format. However, TVStudy no longer handles the previous format by default. In the lib/ directory, a command line utility called fix_application is provided to adjust the format of an older application.dat to be compatible with the current version.

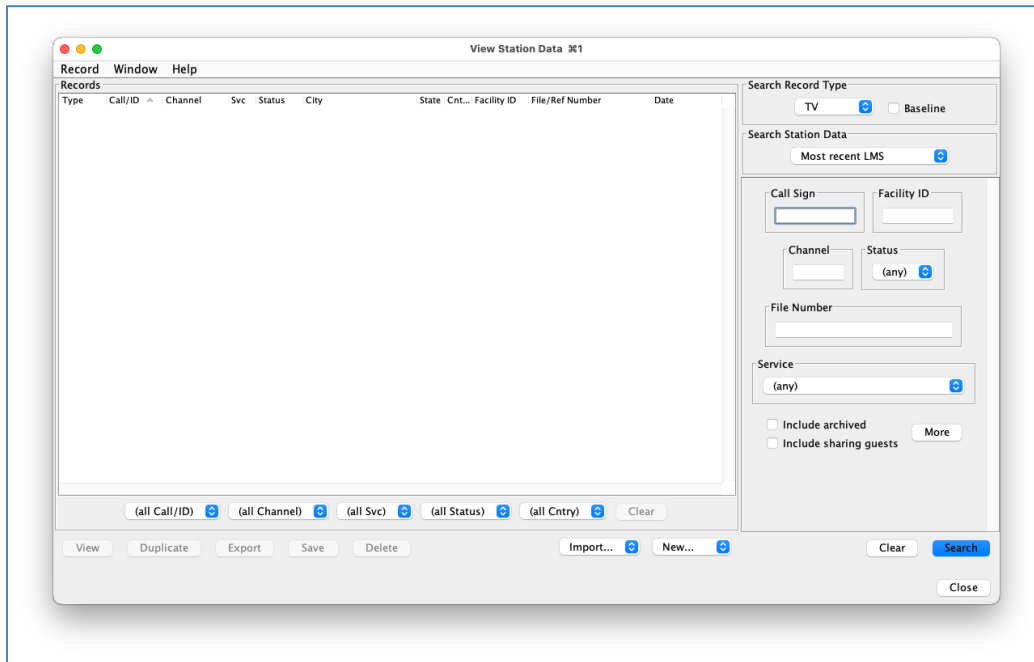
Additionally, attempting to import the November 2015 CDBS Extracts (or older) provided for incentive auction-related analysis into TVStudy 2.x will result in an error that the app_tracking.dat and am_ant_sys.dat files are missing. To correct this, simply download copies of those files from the current CDBS download files on the FCC website and place them in the directory with the extracts. The datasets should then import successfully.

⁶ TVStudy will flag any inconsistencies it finds in the LMS data. These inconsistencies may or may not impact the results, but in very large numbers may indicate issues with the underlying dataset.

View and Manage Dataset Records

TVStudy has the ability to view the data contained in a dataset without first creating a study. You can also use this mode to create user records for later use, or import or export individual station records.

To access this feature, go to the Database menu and choose “View Station Data.”



User Records

In the Search Station data drop-down list there is an additional dataset available other than those previously imported: “User records”. User records are records imported or entered by the TVStudy user. User records exist to allow users to check the results of alternate station parameters with interference studies.

Viewing Records

To view a record, at the right side of the window, choose which Record Type you would like to search from “Search Record Type” and the dataset you would like to use from “Search Station Data”, or if you prefer the most recent LMS data, leave it on that option. Choose your search parameters, if any, and then click “Search”. Matching results will appear in the pane at the left. If a resulting call sign is shown in blue, that indicates that hovering over that call sign will display additional information, including whether the record is a DRT or baseline record, the licensee name (LMS only), and any available channel sharing parameters (LMS only). When you select one of the results and click “View” you will see the data associated with the record. Any set of results can be filtered using the filter options below the Records pane.

Note the “More” button. This allows you to search by other criteria not included in the main search window. Additionally, the “Additional SQL for WHERE clause” section allows you to enter custom search parameters based on any field in CDBS or LMS. For example, when using an LMS dataset, you could enter the following query and your search would only return results that are within Zone I, excluding any that fail to meet other criteria selected in the other part of the window:

```
application_facility.afac_facility_zone_code = 1
```

For a full set of query examples, please see Appendix on page 127.

Comparing Records

TVStudy allows you to compare records, highlighting the differences to make them easy to see. To do so, click on a record you wish to compare, then select “Compare” from the “Record” drop-down menu. Without closing the Compare Records window, go back to the View Station Data window, then search for a second record you wish to compare (if it’s not already displayed), click on it, then select “Compare” from the “Record” drop-down menu again.

Field	Record 1	Record 2
Call sign	WBRA-TV	WBRA-TV
Service	TV digital	TV digital
Channel	D3	D13
Status	LIC	CP
City	ROANOKE	ROANOKE
State	VA	VA
Country	U.S.	U.S.
Facility ID	5981	5981
File number	BLANK0000047419	BLANK0000213023
Site number	1	1
Latitude	37 11 46.00 N	37 11 46.00 N
Longitude	80 09 16.00 W	80 09 16.00 W
Zone	II	II
Height AMSL	1195.0 m	1208.4 m
HAAT	614.3 m	630.6 m
Peak ERP	9.80 kW	66.0 kW
Frequency offset		
Record type	LMS	LMS
Station data	LMS 2024-05-21	LMS 2024-05-21
Record ID	25076f91872a40e701872ead3f5f0285	25076f91872a40e701872ead3f5f0285
Date	2018-03-02	2023-03-29
Horizontal pattern	Omnidirectional	Dielectric-THV-10A13/VP-R C150 (ID 1010589)
Vertical pattern	Generic	Generic
Electrical tilt	0.00 deg	1.00 deg
Mechanical tilt	0.00 deg	0.00 deg
Mechanical tilt orientation	0.0 deg	0.0 deg

The differences are highlighted in red and give the ability to eyeball any differences. You are not limited to comparing just two records; you may also compare a third record by leaving the Compare Records window open and following the same procedure as when you added the second record above.

Importing and Exporting Records

From this window, it is possible to import CSV records into the User records database or export CSV records from any dataset.⁷

To import a record, simply click the “Import” button and locate the CSV file containing the record you wish to import. Select the record, click “Import”, and your record will be imported. Once you are satisfied, click “Save” and the record will be added to the User records database. Regardless of the type of station(s) you are importing from CSV, TVStudy will ask you to select an existing CDBS/LMS dataset to resolve any references that may be contained in the imported CSV file.

To export a record, select the record you wish to export by searching in this window, then click “Export”. Navigate to the directory in which you would like to save your exported record, enter a name for your export file, and then click “Export”.

⁷ Versions of TVStudy prior to 2.3.0 supported the use of XML files to import and export station records. This is no longer supported beginning with version 2.3.0.

Creating and Deleting Records

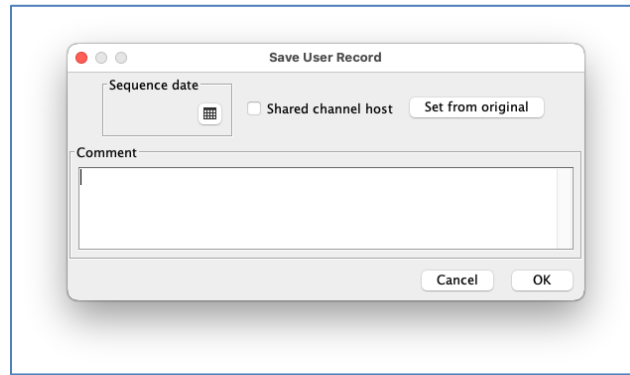
You can also manually create records to add to the User records database from this window, either by entering the parameters by hand or by duplicating an existing record and modifying it prior to saving.

Creating a new record and duplicating an existing record are nearly identical processes. The difference, as you might expect, is that when duplicating an existing record, the new record's values are pre-populated with the data from the record being duplicated. This is useful for creating new records at existing locations, whether these are intended to represent new stations to be located on an existing tower or modifications to existing stations.

If you wish to duplicate a record, use the search function to search for the record you wish to duplicate. When you've found it, click it, and then click "Duplicate". Otherwise, click the "New" drop-down and choose the type of record you wish to create. For this example, we will look at a new TV user record.

Enter the parameters for the station in this window. This window is seen with minor variations throughout TVStudy for creating and modifying individual TV station parameters. Please note that when entering coordinates, you can enter decimal degrees in the degree field and after pressing "Tab," the software will automatically fill in the minutes and seconds.

When you are satisfied with the station parameters you have entered, click "OK". (More information on the "Pattern" options can be found starting on page 17, and settings in the "Service Area" section, seen when creating or editing records inside a scenario, can be found on page 22.) If you wish to save the record to the User records database, click "Save" when you're back in the "Browse Station Data" window.

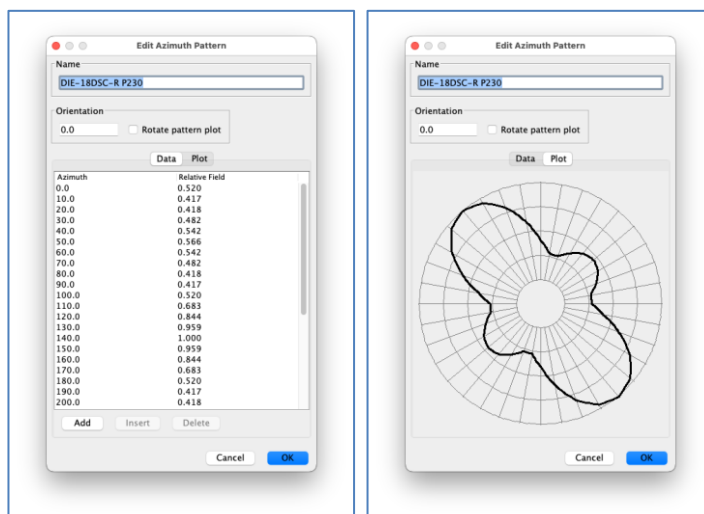


The Save User Record window will display. All of these are optional; if you're uncertain, you can simply click "OK" to save without setting any of them. You can choose to give the record a comment, set a sequence date for it, or indicate whether or not it is a shared channel host. The comment is strictly informative, while the date and shared channel indicator allow the record to be treated like any other LMS record in TV Interference Check studies. Alternatively, if you've duplicated an existing record, you can click the "Set from original" button to have it populate the sequence date and shared channel status from the original record.

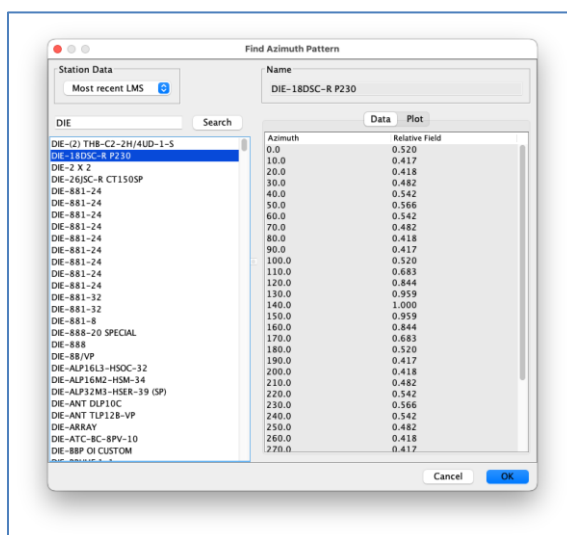
To delete a User record, simply click the record in the View Station Data window and then click the "Delete" button.

Note that if you wish to create a DTS, you can pre-populate the reference point and the reference facility by duplicating an existing TV digital record and then setting the service to "TV digital DTS". You may then add sites by searching the database for existing records in a similar manner to duplicating or creating a non-DTS facility using the "Add Site" drop-down at the bottom left corner of the window (see page 24).

Antenna Pattern Editor – Azimuth Patterns



When editing or creating a record, there are various options for working with antenna patterns. By clicking “View” or “Edit” for an existing pattern, you can either view or edit the existing pattern for the record with the window shown above. By clicking the “Plot” tab, you can see a visualization of the antenna pattern. Please note that transmit antenna patterns in TVStudy are defined with linear relative field values, not in dB, with 1.000 indicating the direction of maximum radiation.

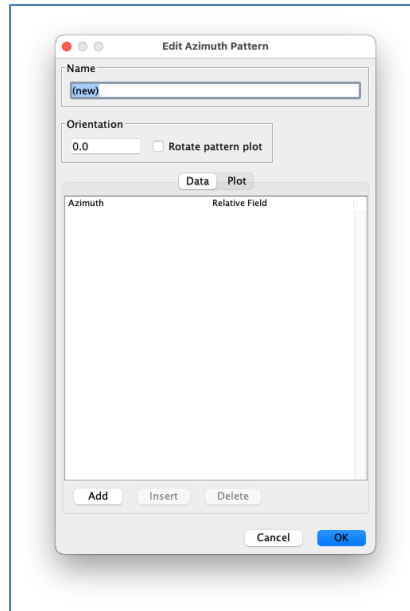


To retrieve an existing pattern from a dataset, choose the “Change” drop-down menu and select “Search...”

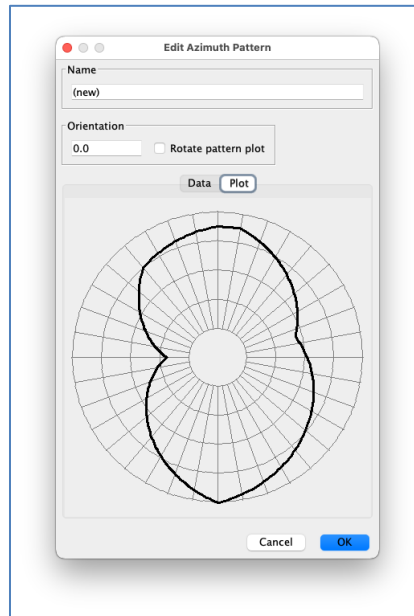
In the pane at the left, you can search for an existing antenna pattern to use. For TV or FM antennas, you can search by make, model, or antenna ID number. For wireless antennas, you can search by antenna ID or antenna name. Note that manufacturer names and model numbering conventions may not be strictly followed in CDBS/LMS records. As with the View/Edit window, you can use the “Plot” tab to visualize the selected antenna. When you locate the desired pattern, click “OK” and the data for that pattern will be added to the record.

You can Import and Export antenna patterns using the “Import” option from the “Change” drop-down and the “Export” button. A CSV file is produced on Export for azimuth patterns and is required on Import. TVStudy will interpolate between the azimuth angles provided, so you can provide as many or as few azimuth values as you wish. It is advised that your pattern include all maxima and minima.

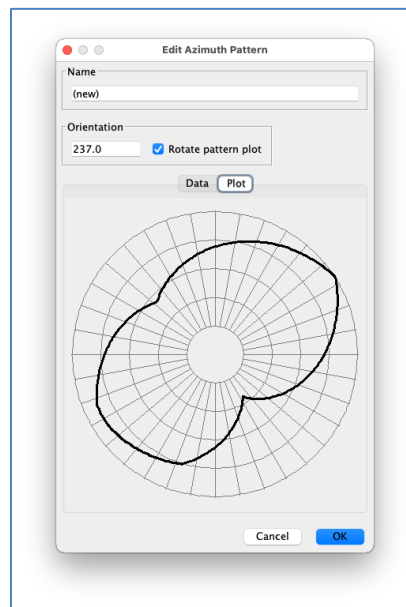
If you want to specify an omni-directional pattern, click on “Change” and select “Remove.” All field values will be deleted, thus producing an omni.



Custom antenna patterns can also be created by using the “Change” drop-down and choosing “New” to add azimuths and field values. TVStudy will interpolate between the angles provided, so you can provide data for as many or as few azimuth values as you wish. It is strongly advised that your pattern include all maxima and minima.



The antenna pattern can be displayed graphically by clicking the “Plot” tab, just as with antenna patterns contained in CDBS/LMS/wireless datasets.



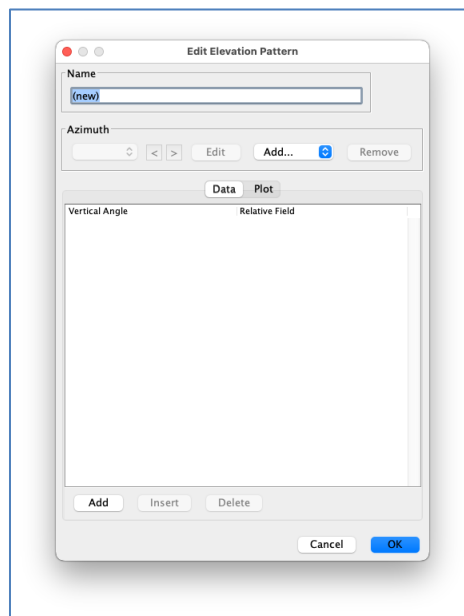
Additionally, by checking the “Rotate pattern plot” checkbox and setting a value, you can rotate your antenna pattern. The rotated pattern value represents the pattern rotation with respect to true north, N degrees ET. Valid pattern orientation values are 0 through 359.9 degrees, but specifying a value outside of that range will automatically convert it to the associated valid value.

When finished, click “Save.” The antenna name and any rotation will now appear in the Azimuth Pattern section of the Station Data window.

Antenna Pattern Editor – Elevation and Matrix Patterns

An elevation pattern is used in conjunction with an azimuth pattern to produce a 3-dimensional representation of an antenna. A matrix pattern, by contrast, is used when the antenna is not symmetrical; it allows for an antenna with different azimuth patterns at varying depression angles. When filing a 3-dimensional representation of an antenna with the FCC, it is recommended that you file an azimuth pattern and an elevation pattern, with or without any mechanical beam tilt, unless it is entirely impossible to accurately characterize the antenna that way, in which case you should use a matrix pattern.

If you wish to view, create, or edit an elevation or matrix pattern, use the controls in the Elevation Pattern section.



These features function like the antenna pattern editor for azimuth patterns, but provide options to allow the viewing, creating, or editing a matrix pattern, if desired. To create or edit a matrix pattern, rather than an elevation pattern, you can either import a CSV which separates each azimuth's field values into separate columns, or import or create elevation patterns for each azimuth of the matrix pattern within the pattern editor. Please note that while this may not seem to be the most intuitive way to manage matrix patterns, it is the manner in which they are stored and managed in LMS.

The depression angle values found in elevation patterns and beam tilts are defined in TVStudy as a positive number being a downward tilt. As such, 90 degrees represents an angle pointing straight down, while -90 degrees represents an angle pointing straight up.

Also note that if you edit an elevation pattern and do not provide a field value at 90 degrees below the horizon (straight down), TVStudy will hold the last value. So if the last value provided is a 0.2 field value at 20 degrees, TVStudy will assume that the 0.2 field value is a uniform value used all the way to 90 degrees. To have it diminish to 0.001 by linear interpolation, the minimum value allowed by TVStudy, set a 0.001 field value at 90 degrees.

TVStudy allows you to export elevation and matrix patterns in LMS-compatible XML format using the Export button. Simply select “.xml” as your file type. Note that it is possible for a TVStudy matrix pattern to be in a format that is technically compatible with LMS but which still cannot be uploaded. The LMS format assumes all elevation pattern slices in the matrix will have the same set of depression angles tabulated, but TVStudy allows the tabulations to vary between azimuths. TVStudy will check for this condition and warn if the pattern appears incompatible with LMS, but the data can still be exported.

Finally, note that matrix patterns are stored in TVStudy as a series of elevation patterns, all normalized to 1, with the azimuth pattern used to determine what that 1 value is scaled to. If constructing a matrix pattern within TVStudy, as opposed to importing one, be sure that your pattern is constructed in this way.

Service Area Settings

TVStudy allows for the evaluation of stations based on alternate areas besides the standard FCC contour. Some of these options can be selected study-wide in the Contours section of the Parameters tab, but those settings can be overridden by adjusting the setting for an individual station record.

The options are as follows:

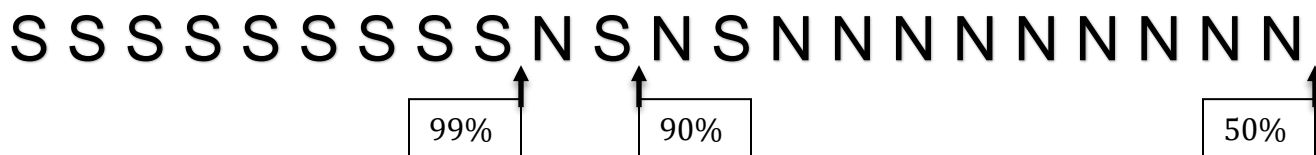
- **Default contour** – Uses the default settings provided for in the study.
- **FCC curves contour** – Uses the FCC F(50,90) curves contour at the level in Cont. Level.
- **FCC contour plus distance** – Uses the FCC F(50,90) curves contour at the level in Cont. Level, then adds the distance in km provided in Mode Arg.
- **FCC contour plus percent** – Uses the FCC F(50,90) curves contour at the level in Cont. Level, then adds the percentage distance provided in Mode Arg.
- **L-R contour percent above** – See next page.
- **L-R contour length above** – See next page.
- **L-R contour length below** – See next page.
- **L-R contour line fit** – Uses a best-fit straight line to the projected fields at incremental distances along a radial.
- **Constant distance** – Uses a circle of radius in km given in Mode Arg.
- **Geography fixed** – Uses a fixed-location geography; select from the Geography drop-down.
- **Geography relocated** – Uses a geography whose center point is relocated to that of the station coordinates; select from the Geography drop-down. (See page 28 for more on geographies.)
- **Unrestricted** – Uses a circle of fixed radius defined in the “Maximum desired signal distance” study parameter.

Each of the Longley-Rice contour methods uses a selection of parameter settings found in the L-R Contours tab in combination with the settings found in the Contours tab.

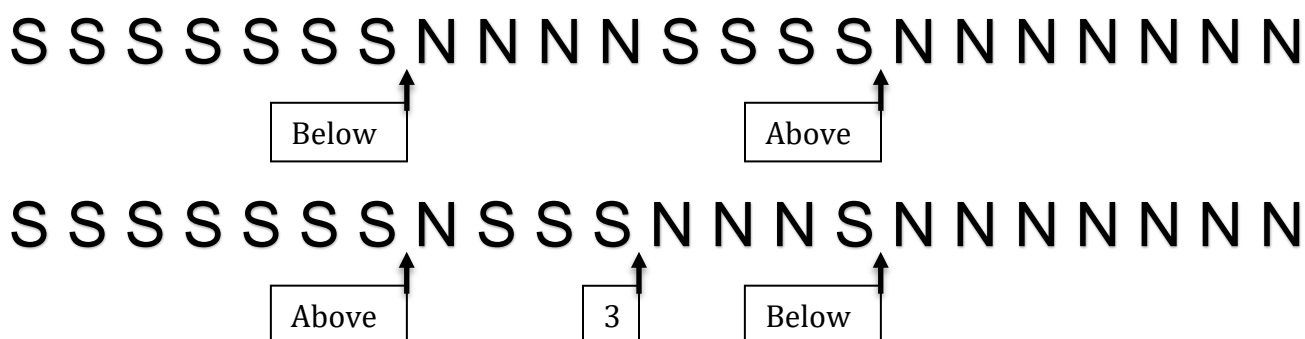
Details of how each of the Longley-Rice length and percentage contour methods functions can be found on the next page.

This page will explain the Longley-Rice length and percentage contour options. In each case, a selection of points is used to calculate path-loss along each radial surrounding the transmitter. Note that in the example graphics, S represent a Service point, while N represents a No service point.

Longley-Rice Contour Percent Above draws the contour line at a distance where the percentage of service points is met. In the example seen below, the transmitter is assumed to be at the left edge.



Longley-Rice Contour Length Above/Below each draw the contour line based on consecutive service or no service points. For the Above case, it moves from the transmitter toward the edge, and is the last time the Mode Arg. number of kilometers are above service. For the Below case, it moves from the edge toward the transmitter, and is the last time the Mode Arg. Number of kilometers are below service. See the two examples below, where Mode Arg. is assumed to be set to 4 and the transmitter is assumed to be at the left edge.



In the first of the two examples, if Mode Arg. had been set to 5 instead of 4, the locations of the Above and Below contours would be flipped.

In the second of the two examples, had Mode Arg. been set to 3 instead of 4, both the Above and Below cases would have drawn the contour at the point labeled "3", while a setting of 1 would have flipped the locations of the Above and Below contours in that example. This shows how the setting can impact where the contour is drawn even for the same terrain path.

Viewing DTS Facilities

Distributed Transmission System (DTS) facilities have multiple transmitter sites for a single facility ID and record. The method for viewing these is slightly different from the method for conventional stations. To begin, select a DTS station and click “View.”

Instead of going straight to the transmitter information screen, you are given information about the facility, the reference point coordinates, and reference distance. Across the top are tabs showing the various station data records associated with the record. Click one.

Now you see the normal screen for viewing or editing a record in TVStudy. You may view the record in the same way that you would for any non-DTS facility. When you create or duplicate a DTS, you will use a similar interface; make note of the “Add Site” drop-down and “Remove Site” button at the bottom left. The “Remove Site” button is self-explanatory; the “Add Site” drop-down allows you to start from scratch creating a new site, duplicate an existing site in the current DTS to create a new site, or use a search result to create a new site based on parameters of some existing transmission facility.

The “Time delay” field is optional and used only for DTS Self-Interference mode. You can enable the parameter for DTS Self-Interference mode in the Analysis menu of a study. This will use the time delay parameters to determine whether the DTS has internal interference using a very simple model determined principally by signal levels and time delay.

Managing Study Templates

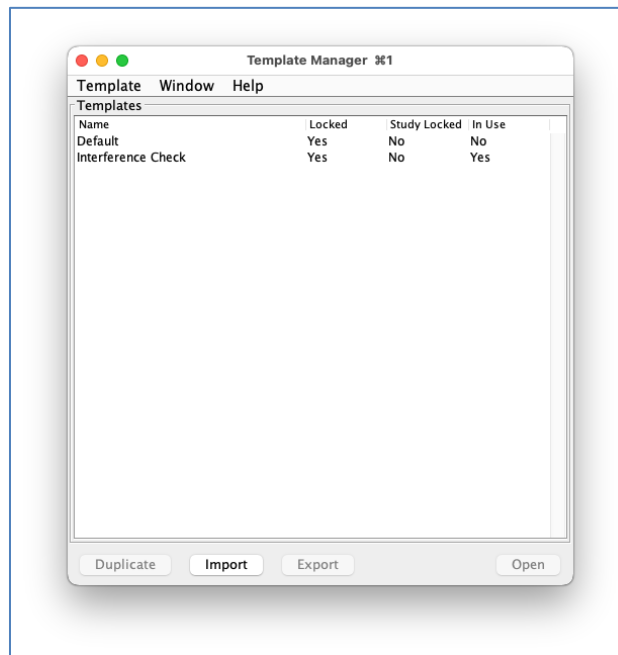
TVStudy comes with a default template with typical study parameter settings; however, if you have a set of parameters that you would like to use regularly, you may want to consider creating a customized template for your studies. Once you've created or imported a custom template, you will have the option of selecting it when you create a study so you do not have to manually adjust the various study parameters.

Creating a Study Template

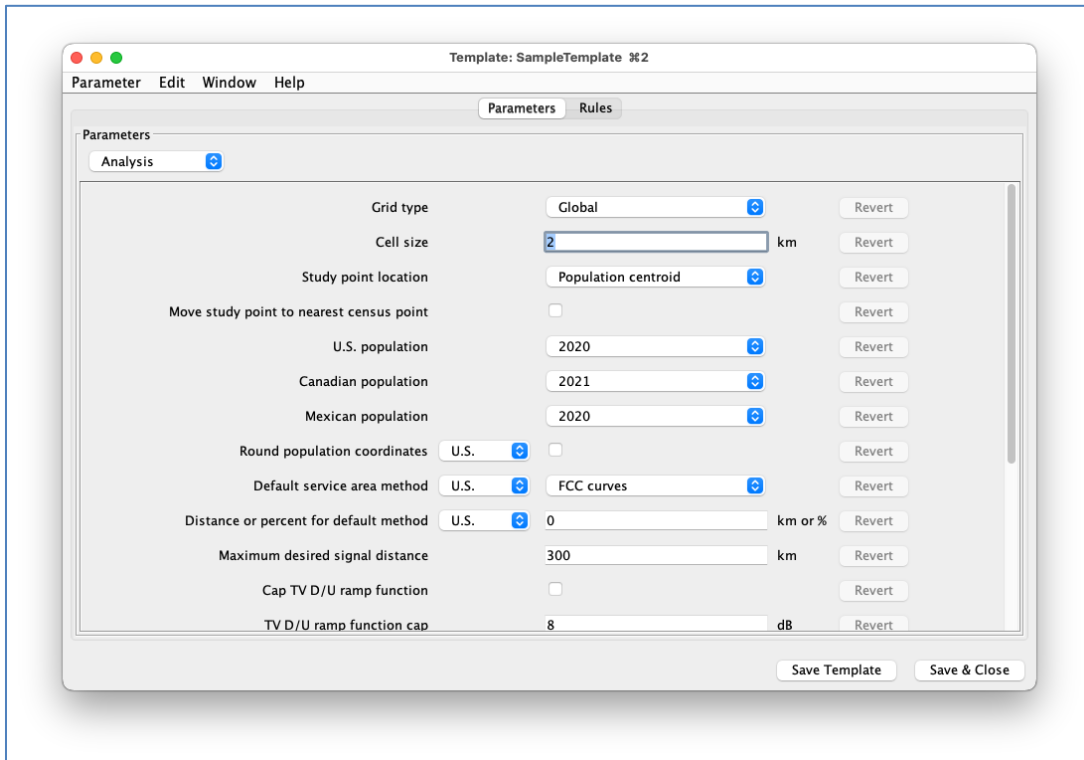
There are two ways to create a study template.

One way is to use the parameters of an existing study as your template. Enter the Study window with the study whose parameters you wish to use as your template and select "Save Study Template" from the Study dropdown menu. Give your template a name, and then click "OK."

The other way is to use the Template Manager. From the Study Manager window, open the Database menu and click "Template Manager".



Click the line named "Default" and click the "Duplicate" button.

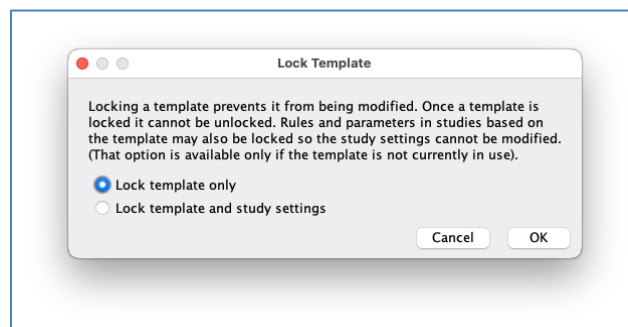


After providing your new template with a name, you are presented with an interface like the one found in the Study window, where you can set the rules and parameters as desired. (See pages 62 and 63.) When finished, simply click “Save Template” at the bottom right.

Locking a Study Template

The purpose of locking a template is to ensure that the study parameters and interference rules defined by the template cannot change in the future, so study results will remain consistent and comparable over time. There are two lock levels, and the second is more restrictive than the first. Once a template is locked it cannot be unlocked, nor can the lock level be changed.

To lock a study template, open the template in the Template Manager. Then click the Template menu and click on “Save and Lock”.



TVStudy will then ask how you want the template locked.

Lock template only – The first lock level prevents the template from being edited. Any new study using a locked template will have the same initial/default parameters and rules as any past study using that template. However, with this first lock level the parameters and rules may still be edited within a given study using the template, so individual studies can still be customized. A template may be locked at the first level even if existing studies are using the template.

Lock template and study settings – This lock level also prevents the template from being edited as above, but in addition it prevents the parameters and rules from being edited within any study using the template. Using a template locked at the second level means the parameters and rules are always exactly the same in every study using the template; the settings can never be changed. This provides the highest level of assurance that study results will not vary due to parameter or rule changes. A template cannot be locked at the second level if any existing studies are using the template.

Note: A template must be locked with “Lock template only” in order to be used in an interference check study. Neither a study locked with “Lock template and study settings” nor an unlocked template can be used. This restriction is necessary to support multi-user installations of TVStudy where an administrator determines the study configuration for all users. This also allows results for studies run through the web interface to be cached, since the results remain valid as long as the template is not changed. Additionally, since the wireless frequency and bandwidth are template settings, templates intended to be used for wireless studies should be either unlocked or locked with the “Lock template only” setting unless users are sure the same frequency and bandwidth are required for every study.

Exporting or Importing a Study Template

You can also share a study templates with others. To do so, click the template you wish to export, and then click “Export.” You are now prompted to give the study template file a name. Do so, and then click “Export.” You can now share your study template with others.

To import a study template that has been shared with you, click “Import,” then navigate to the location where the template is saved. Select the desired template file, then click “Import.” The study template will now be shown in the Template Manager window and be available for you to choose when creating studies.

Deleting a Study Template

If a template is not in use for any studies, it is possible to delete the template. To do so, simply click the template within the Template Manager, then from the Template menu, click on “Delete”.

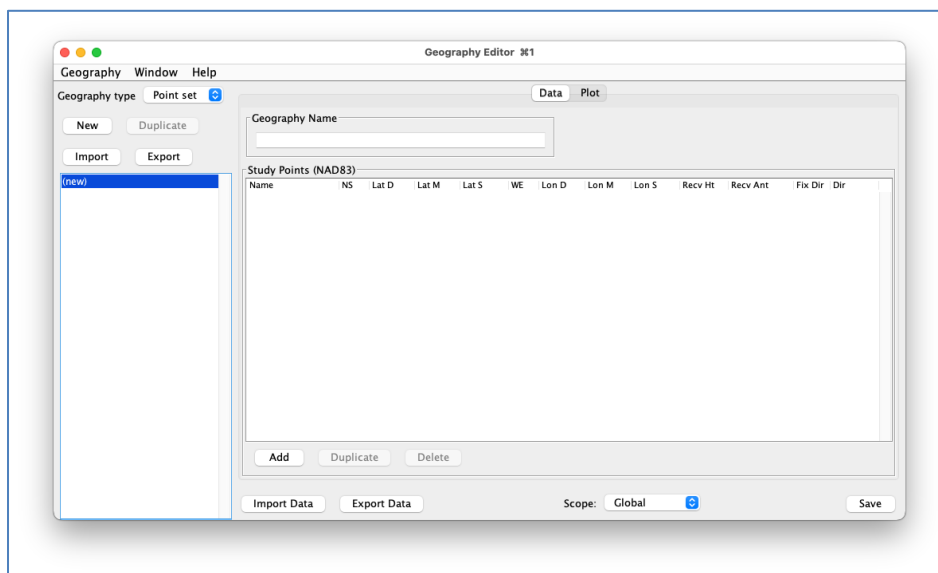
Using the Geography Editor

The Geography Editor is used to define or modify study points or study areas other than station-specific TV service contour areas. The Geography Editor is found in the Database drop-down menu and can be accessed from various other locations in the user interface.

The Geography Editor has two panes. The pane at the left contains a list of geographies, selectable by type, while the pane at the right provides a way to view, create, or edit the details of those geographies.

Creating a New Geography

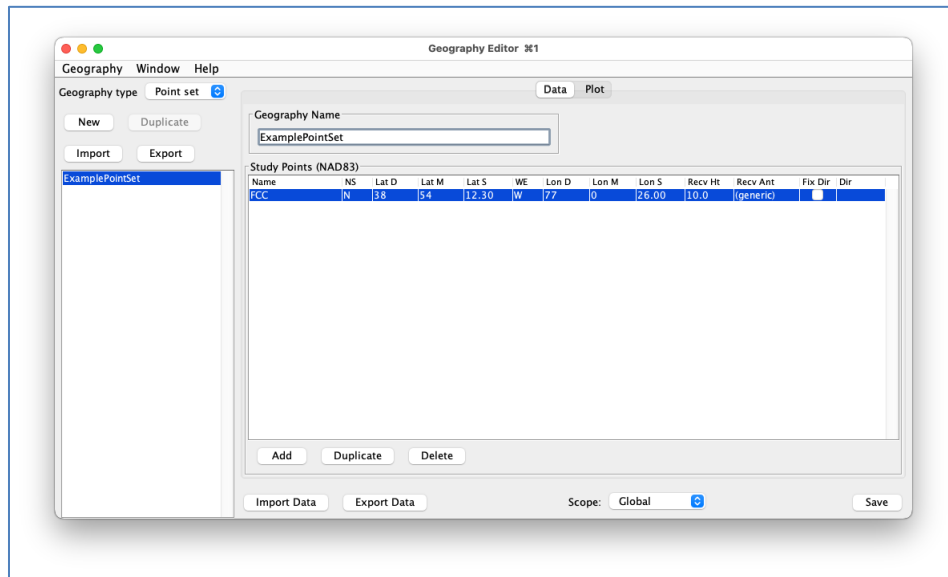
To create a geography, choose the type of geography you wish to create from the drop-down at the top of the left pane, then click on the “New” button.



In the pane at the left, a new geography has been added without a name. To the right, at the top of the pane, enter a name for the new geography in the “Geography Name” field. By default, this name is populated as “New”, but TVStudy will not allow you to save the study with that name. Once you have done so, you can set the appropriate attributes for the new geography. There is also a Plot tab which will show a plot of the selected geography.

Please note that the box, circle, and sector geographies are projected into latitude and longitude using the spherical bearing and distance method. For the box, that means the east-west distance between any two opposite points at the same latitude will be the width distance. For the circle or sectors circular arcs, the spherical distance between the center and any point on the circumference will be the radius. If those geographies are shown on a map, they may look slightly distorted depending on the forward map projection being used, since that projection may not be the exact inverse of the spherical method. Using the “azimuthal equidistant” projection method with the geography center as the projection point would produce an exact box or circle.

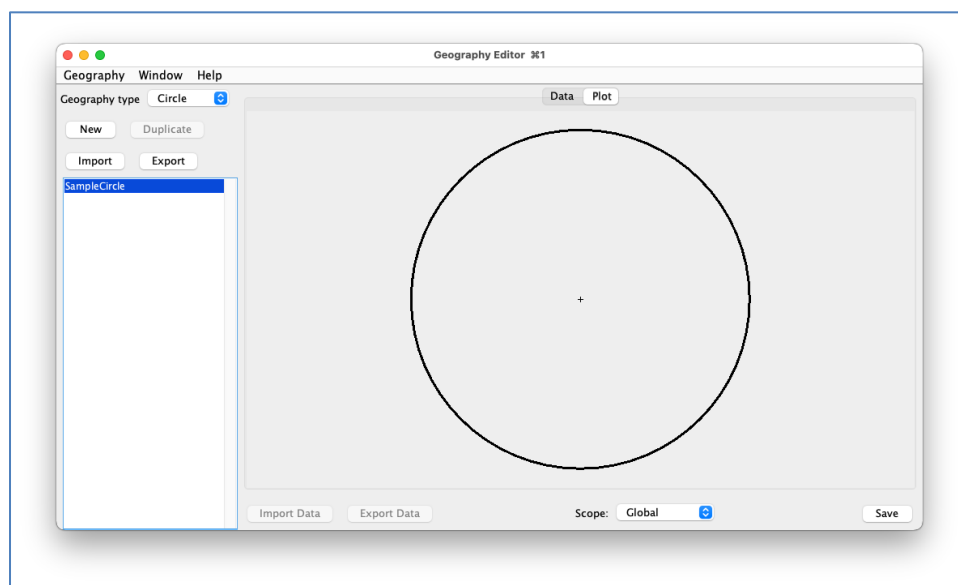
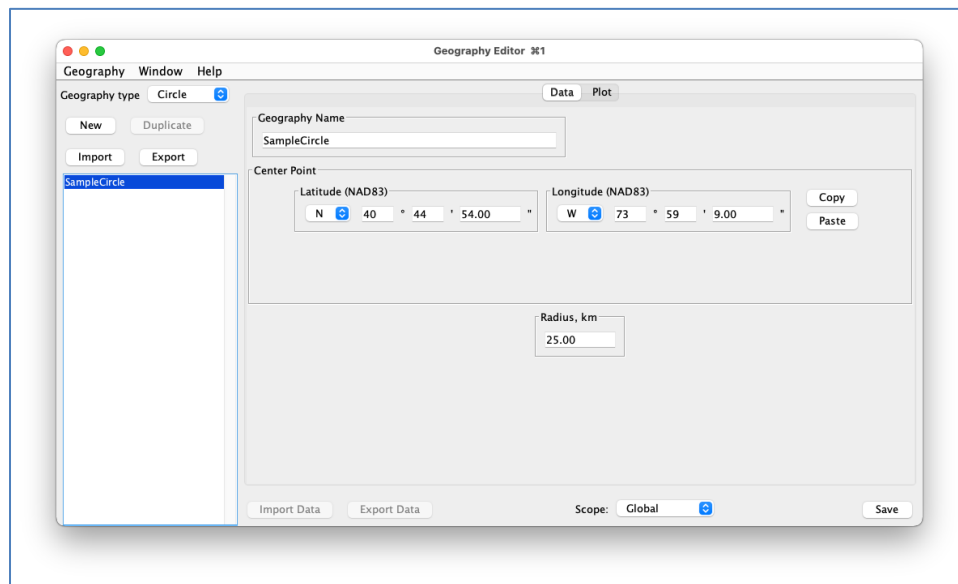
Creating a Point Set Geography



Each point has a name (which is optional), a set of NAD83 coordinates, a receive antenna height in meters, an ability to choose a receive antenna pattern (see page 37), and an ability to fix the direction of the receive antenna pattern.

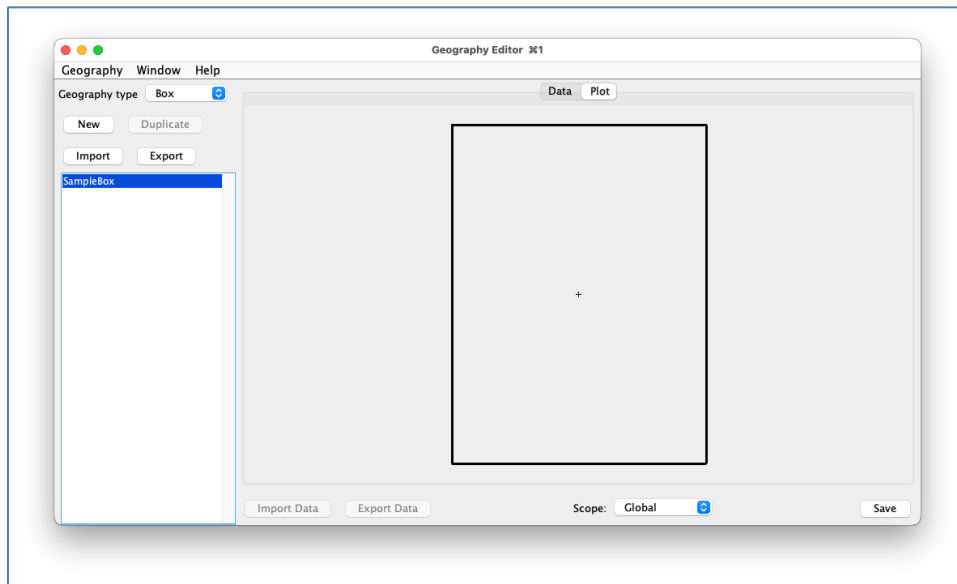
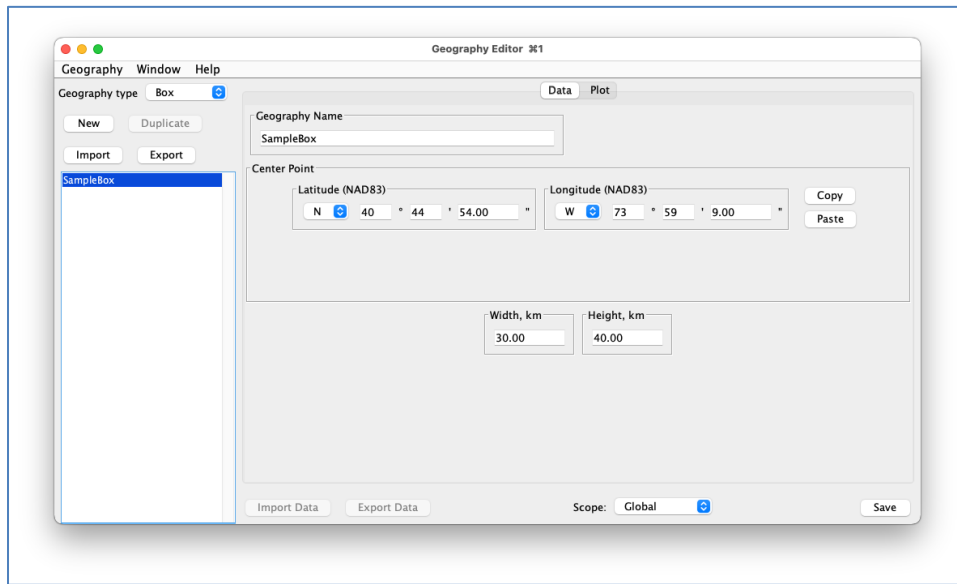
From here you can add as many points as you would like, delete points, or duplicate points. Duplicating points can be helpful if you wish to test a given location for different heights, patterns, and/or fixed orientations. When entering coordinates, you can enter decimal degrees in the degree field and the software will automatically fill in the minutes and seconds when you press “Tab”. In addition, you can import or export points in CSV format using the “Import Data” and “Export Data” buttons (see page 34).

Creating and Viewing a Circle Geography



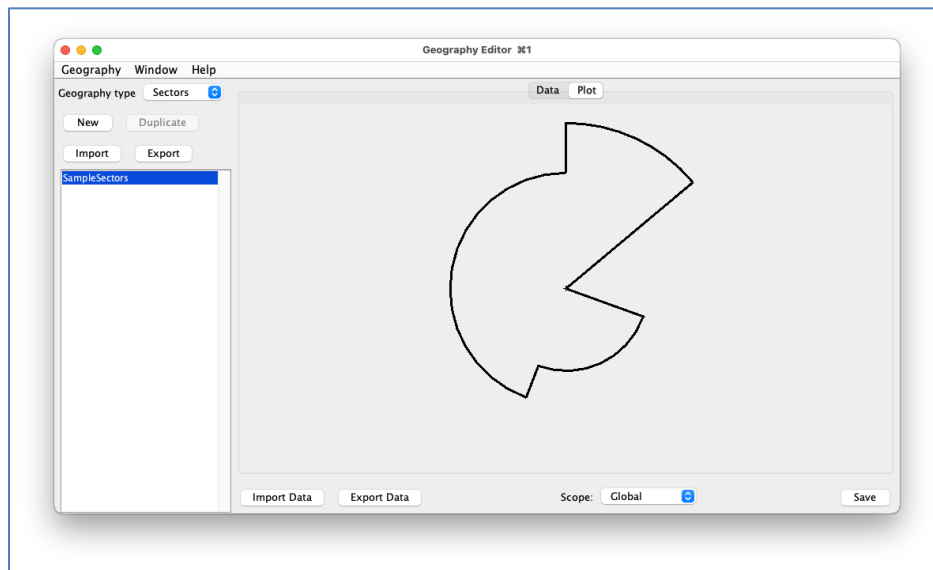
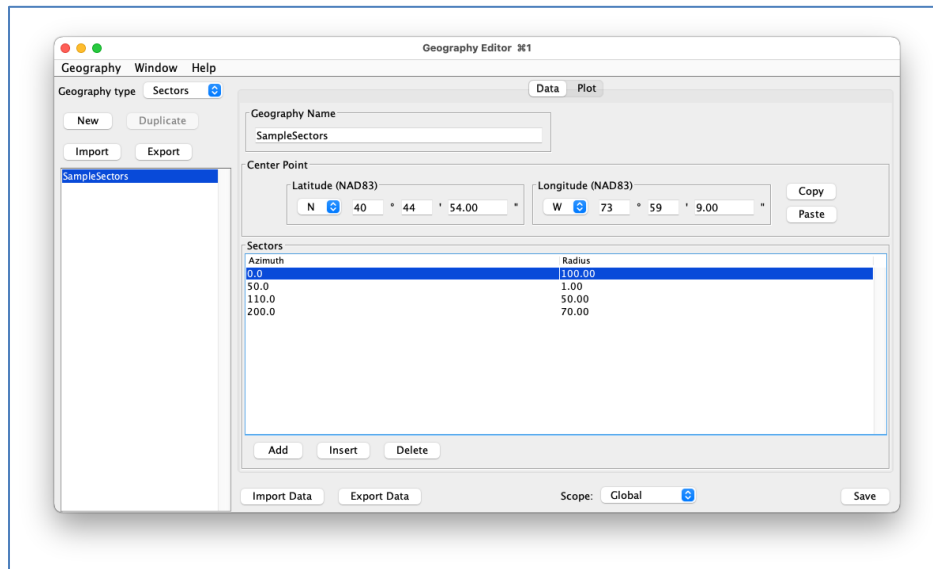
A circle geography has a name, a set of NAD83 coordinates at its center, and a radius in km, as seen above.

Creating and Viewing a Box Geography



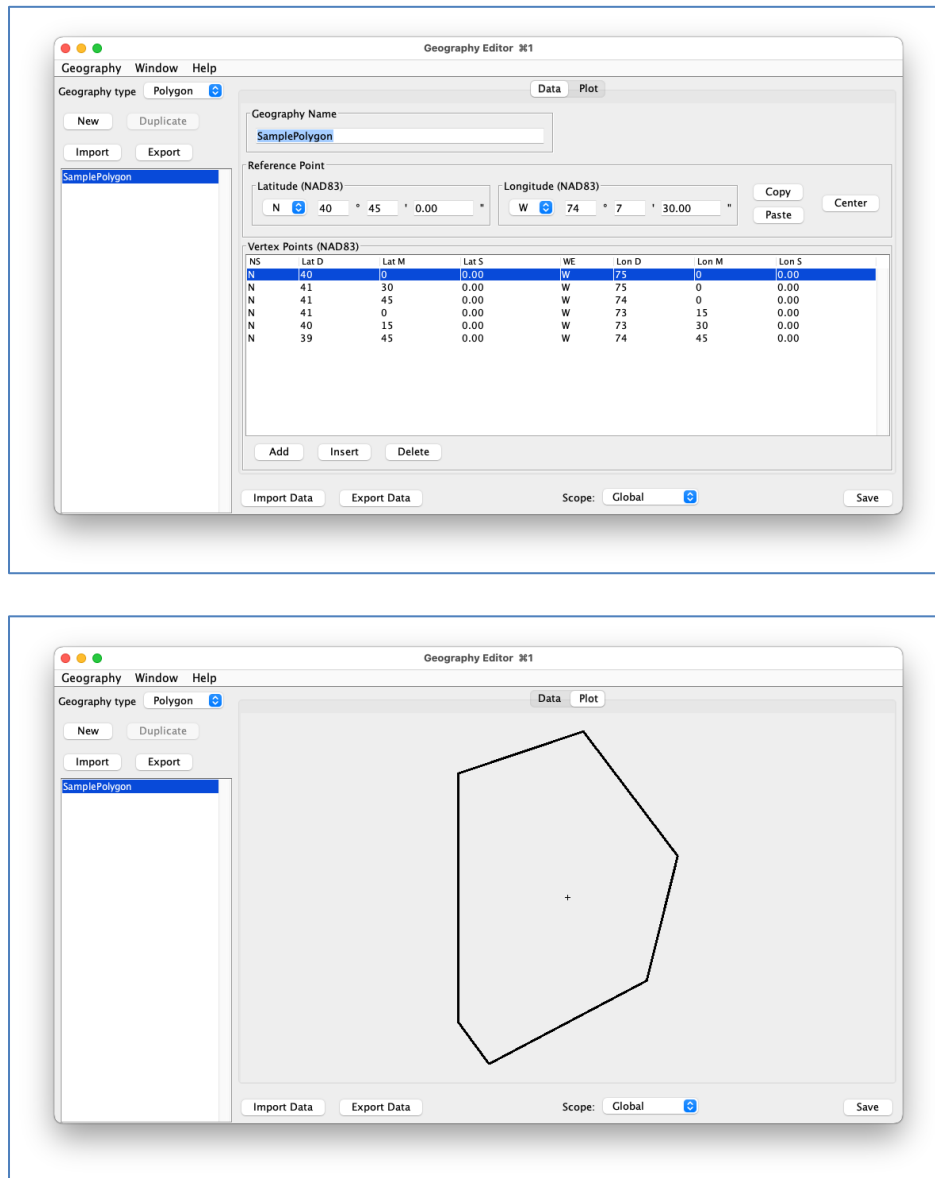
A box geography has a name, a set of NAD83 coordinates at its center, and height and width values in km, as seen above.

Creating and Viewing a Sectors Geography



A sectors geography has a name, a set of NAD83 coordinates at its center, and a collection of degree and radius (km) measurements making up a collection of sectors, as seen above. Please note that the sectors must be input in order by azimuth, starting at 0 degrees.

Creating and Viewing a Polygon Geography



A polygon geography has a name, a set of NAD83 reference coordinates which may or may not be at the center, and a collection of vertex points, as seen above. Clicking the “Center” button will set the reference coordinates to the center of the polygon.

Managing Geographies

At the top left corner of the window, you can manage geographies by duplicating an entire geography or by importing/exporting geographies.

Geographies can be imported and exported as text files without a header row (using the Import Data and Export Data buttons) or as XML files (using the Import and Export buttons). Before importing your text file using Import Data, the type of geography to match your file data must be selected in the drop-down window and an appropriate Geography created to contain the data. For point sets, four comma separated fields are used in this format with a row for each point in the set:

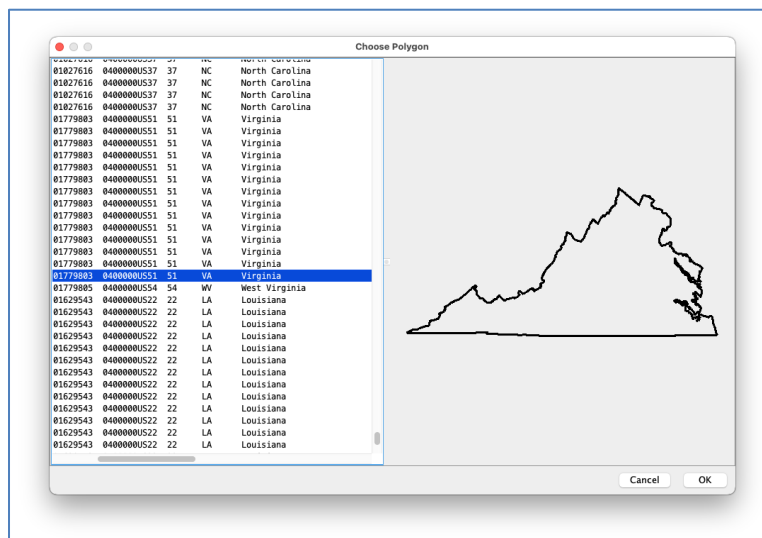
<pointname>,<latitude>,<longitude>,<receiveheight>

For a sectors geography, the format is a single row of data specifying each sector start and end angle as well as radius with semi-colons separating each sector area:

```
<0>,<radius1>,<sector1endangle>;<sector1endangle>,<radius2><sector2endangle>;<sector2endangle>,<radius3>,<360>
```

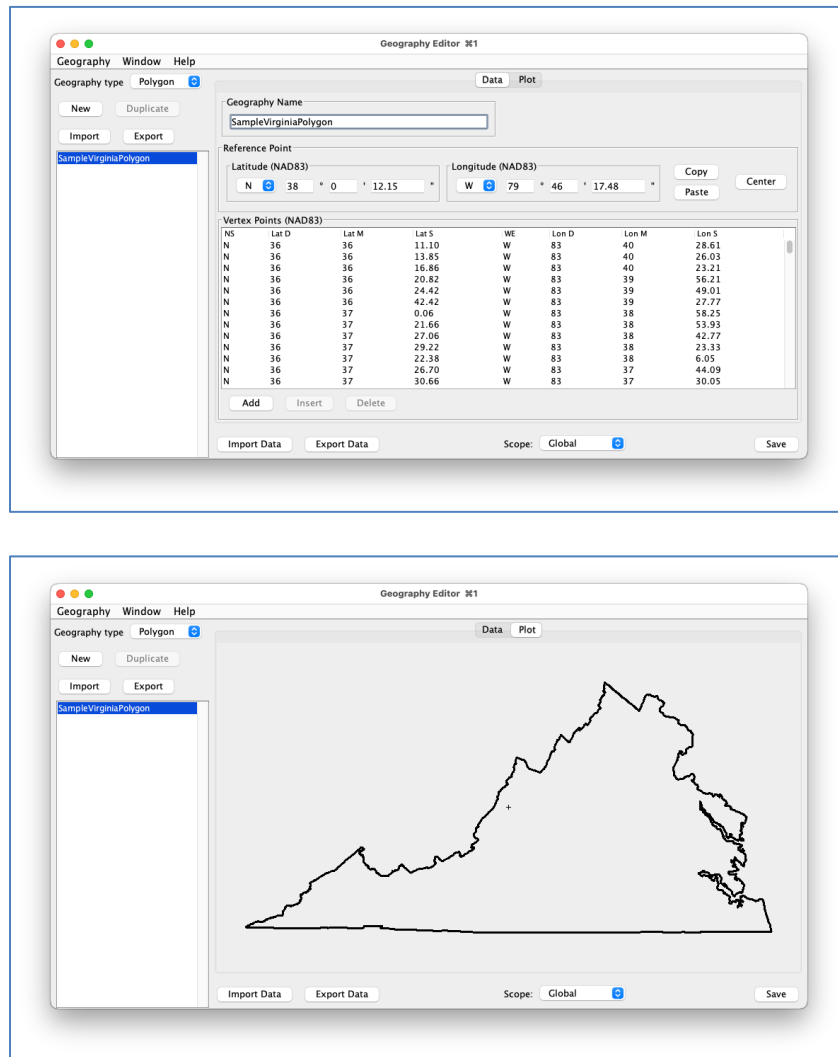
For polygons, two comma separated fields of latitude and longitude with a row for each vertex point. Circle and box geographies cannot be imported or exported via text files.

A particularly useful function of TVStudy's geography editor is the ability to import polygons from ShapeFiles. To do this, be sure "Polygon" is the selected geography type, create a new Polygon geography, then click "Import Data". Navigate to the ShapeFile you wish to import the polygon from and click "Import".



If the Shapefile contains multiple polygons, TVStudy gives you the ability to choose which polygon to import. The pane at the left shows the attributes for each polygon. Clicking one will show its shape on the right, to help ensure you've selected the correct one. When you've selected the correct one, click "OK".

Please note that TVStudy's geography editor only allows the import of individual polygons and not shapes made up of multiple polygons. Thus, as seen in the example image above, the bulk of the state of Virginia is being imported without the Eastern Shore because they are two separate polygons which make up a single shape in the ShapeFile. Only one polygon or the other can be imported or used at a time.



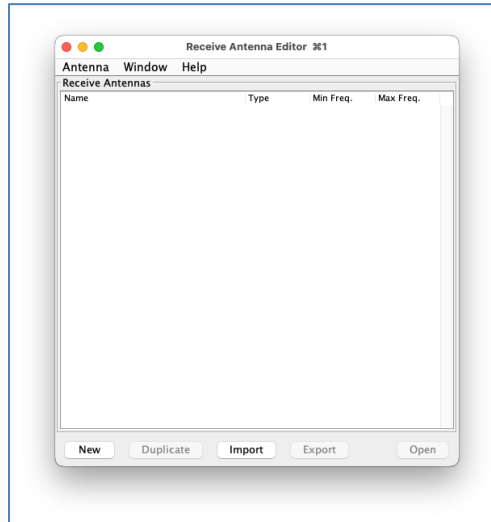
The reference point is automatically set to the center at import, and the name can be set as with any other polygon.

When exporting a Point Set geography to an XML file, an option is available to include receive antenna data in the export for points that do not use the generic antenna. When a Point Set with antenna data is imported, new receive antennas may be added to the database as needed. However, if an existing antenna is an exact match to the XML data, including the name and the entire pattern tabulation, that existing antenna will be assigned to imported points. When importing a point set without antenna data, existing antennas will be assigned based just on a name match, and if there is no match, the point will revert to the generic antenna.

One additional feature of Geographies is their “scope.” A geography created from a Geography Editor window opened elsewhere in the software will limit the availability of that geography to the location it is found in. For example, if the Geography Editor is opened from within a study, then the geography will only be available within that study. If you wish to make it available to other studies, its scope would need to be changed to “Global” and this can be done with the Scope drop-down at the bottom of the window opened from within the study in which it was created. Scope can only ever be made broader, not narrower.

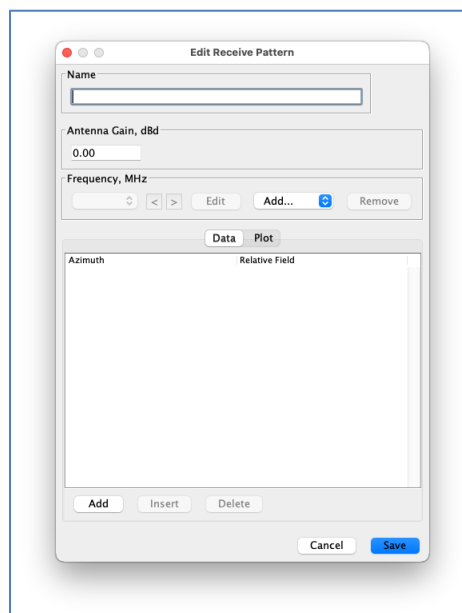
Using the Receive Antenna Editor

The receive antenna editor allows for the creation, editing, importing, and exporting of receive antenna patterns for use in Points mode studies. To access the editor, select it from the Database menu.



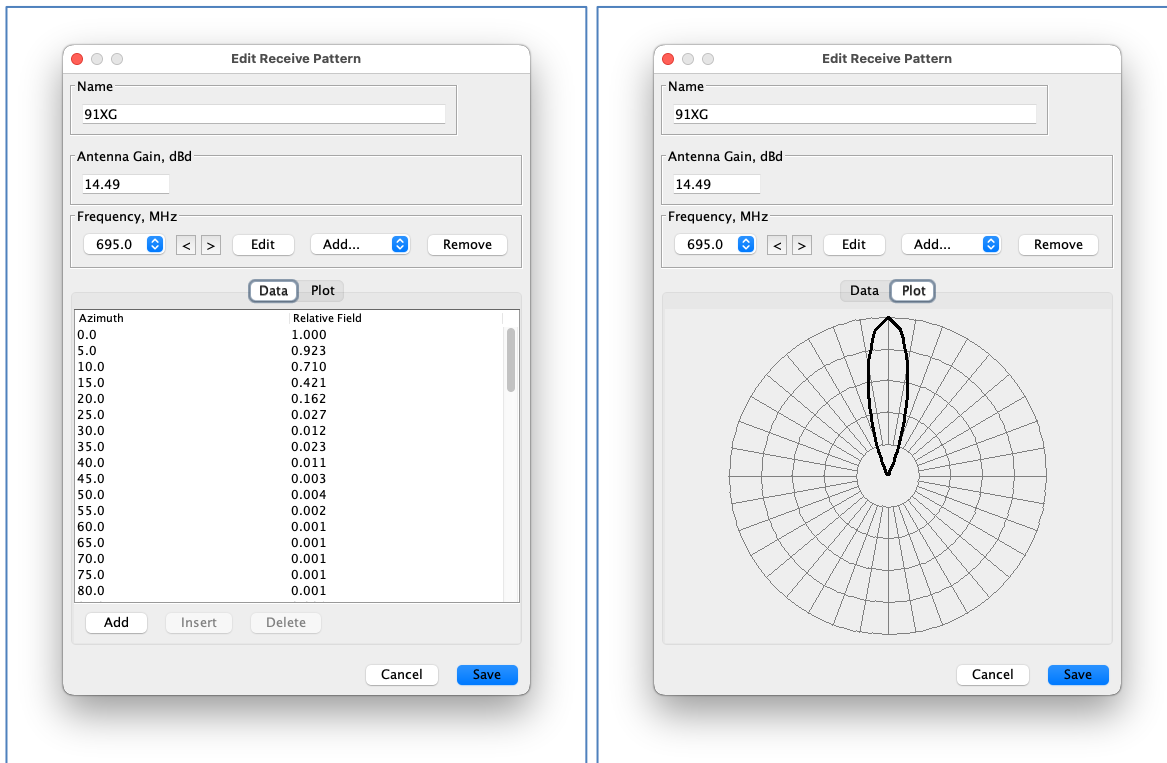
Creating a Receive Antenna Pattern

To create a receive antenna pattern, click “New”.



Though similar to the Antenna Pattern Editor (see page 17), there are two key differences. First, a receive antenna pattern can have different patterns at different frequencies, though this is not required. Values are interpolated between frequencies when a specific frequency is unavailable. Second, the maximum gain in dBd for the antenna at any frequency must be provided in the field at the top.

In addition, it is possible to import an antenna pattern specified in absolute dB and TVStudy will automatically convert it into the appropriate format. The only thing that needs to be done manually is entering the gain value; as noted above, this value must be in dBd, so if the values in the file are in dBi, subtract 2.15 from the maximum value in the file and put the result in that field. Please note that in a receive antenna covering multiple frequencies, the gain is the maximum gain at any frequency; all other values should be relative to that maximum value. Additionally, be sure that the 1 value is at the 0 degree azimuth so that TVStudy correctly orients the antenna when it is used. (See page 29 for information on orienting the pattern in a point set geography.)



If you use the Import or Export functions from within this window, a pattern can be imported or exported for a single frequency. Using Import or Export from the Receive Antenna Editor window allows for the import or export of antenna patterns covering multiple frequencies at once. If an antenna is used for a frequency it does not support, the last value is held, much like with elevation patterns.

Managing Output Settings

TVStudy allows the user to save and use preset collections of output files that can be selected from a drop-down list.

Types of Output Files

TVStudy has a wide array of output files to choose from. Please note that all outputs featuring geographic coordinates are in the NAD83 datum.

Not listed below are the **tvstudy_settings.txt** file, which contains all of the rules and study parameters used in the study and is always output, and **tvixstudy.txt** which is always output when a TV Interference Check study is run and imitates the output of the *tv_process* software previously used by the Media Bureau's Video Division for application processing. Also not listed are the pair study output files, which are always output when a pair study is run (see Appendix F).

Reports tab

Detailed results, text (tvstudy.txt) – Provides textual files listing all the stations and their coverage areas for each scenario.

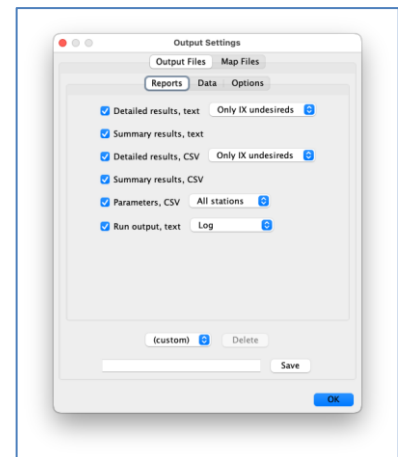
Summary results, text (tvstudy.txt) – Same as above, but in a condensed form. If several scenarios are run at once, the summary output file will lump them all together into one output file.

Detailed results, CSV (tvstudy.csv) – Provides detailed CSV output files showing service and interference, as well as which station(s) are causing interference.

Summary results, CSV (tvstudy.csv) – Same as above, but in a condensed form. If several scenarios are run at once, the summary output file will lump them all together into one output file.

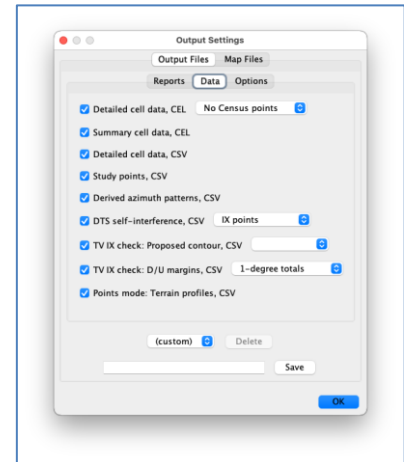
Parameters, CSV (parameters.csv) – Provides a CSV output file listing all the stations parameters used in the study. You may choose to output the parameters of all stations or just desired stations, but the output is otherwise identical. The Antenna Information section gives the field value for each 10-degree increment of azimuth. If any other important field values exist at other azimuths, they are given as Extra Field Values, which show the Azimuth followed by the Field Value, repeating until all have been provided.

Run output, text (log.txt) – Saves the run log and/or interference check summary report for any given study. This is particularly useful if you have a number of studies queued to run in a sequence.



Data tab

Detailed cell data, CEL (tvstudy.cel) – Creates a text file showing cell-by-cell results for your scenario(s). This is a highly detailed list of output for every cell evaluated for every station in the scenario, including the D/U ratios, exact study point coordinates, and other values that may be useful for post-processing. This file may be very large. You may choose whether or not to output rows containing all of the Census points used in determining the population contained in a cell for non-points mode studies. (See Appendix D.)



Summary cell data, CEL (tvstudy.cel) – Similar to the above, but this output leaves out many of the details of the study except for the population of the cell and whether the cell has service or not. If several scenarios are run at once, the summary output file will lump them all together into one output file. (See Appendix D.)

Detailed cell data, CSV (various) - This is a set of three to five comma separated text files with very detailed information on the calculated field strengths and D/U ratios in every grid cell in the study. The number of files created depends on the type of study being performed. (See Appendix D.)

Study points, CSV (points.csv) - Creates a CSV output listing all the cells used in the study along with their populations.

Derived azimuth patterns, CSV (hpat-<app info>.csv) – Creates a CSV output of each radial plus the field value determined for it. This is particularly useful for stations with mechanical tilt or a matrix pattern when the “Derive azimuth pattern checkbox” study parameter is checked.

DTS self-interference, CSV – Creates a CSV output containing cell-by-cell information about DTS self-interference for relevant stations in the scenario. This includes both D/U and time delay information for each cell. Only cells which have service but have self-interference are included. You may choose to exclude any points that contain no population.

TV IX check: Proposed contour, CSV (tvixcontour.csv, tvixcontour_base.csv, and/or tvixcontour_dts files) – This output provides CSV output files showing the contours produced when testing the proposal against the 1% expansion test or when the proposal is a DTS which triggers the new F(50,50) rules. Note that ERP is given in dBk. If neither test is conducted, the files are not produced. ShapeFiles or KML files can also be optionally produced containing the proposal, baseline, and baseline plus 1% contours.

TV IX check: D/U margins, CSV (margins.csv) – This output provides a very simple CSV output file for each failure case in a TV IX check study which shows, for each azimuth or in each cell, as selected, the amount of adjustment (in dB) necessary to eliminate the interference in that azimuth, plus the count of population impacted. You may choose to exclude any points that contain no population.

Points: Terrain profiles, CSV (profile-<callsign>_<channel>_<service type>_<status>-<pointname>.csv) This setting is only applicable for studies run in the points mode and will generate a terrain path profile file between each station and each point in a point set. The resultant files have two fields; distance in kilometers from transmit point to evaluation point and terrain elevation in meters above mean sea level.

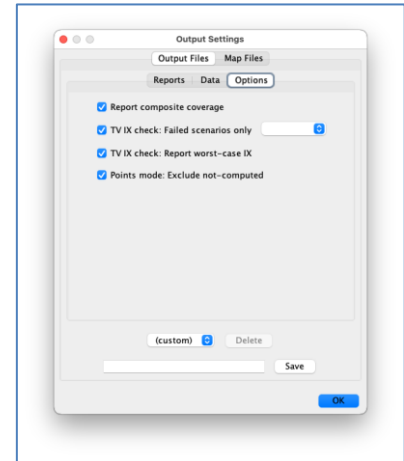
Options tab

Report composite coverage (various) – Creates additional output files and adds lines to existing ones to include the composite coverage for all desired stations within a scenario. This can be useful when studying a station along with its translators to determine total coverage.

TV IX check: Failed scenarios only (tvixstudy.txt) – This setting provides requested detailed outputs, such as Map data, only for failure cases. You can choose whether or not MX cases are preserved in all cases.

TV IX check: Report worst-case IX – This setting permits the Report tab to show the worst-case interference for all impacted stations, not just failure cases.

Points mode: Exclude not-computed – This setting adjusts the output files in Points mode to exclude stations that are not evaluated for any point in the scenario.



Types of Map Files

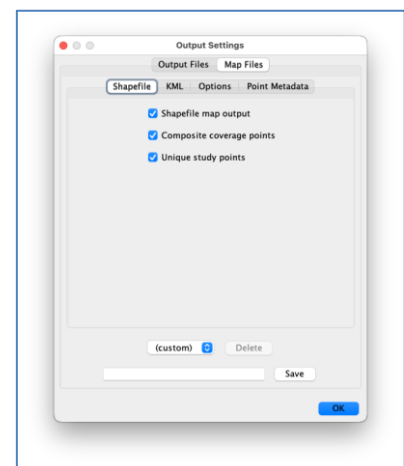
The Map Output tab lists various options controlling the map and map metadata outputs. These outputs have their own separate presets.

Shapefile tab

ShapeFile map output (various) - Creates a set of ESRI ShapeFiles for the results of the scenario(s). (See Appendix E.)

Composite coverage points (cmpcvpts) – Outputs an ESRI ShapeFile that contains the composite coverage for all the stations in the scenario. (See Appendix E.)

Unique study points – Outputs an ESRI ShapeFile that contains a single symbol at each evaluation point containing point-specific data fields such as population and households. (See Appendix E.)



KML tab

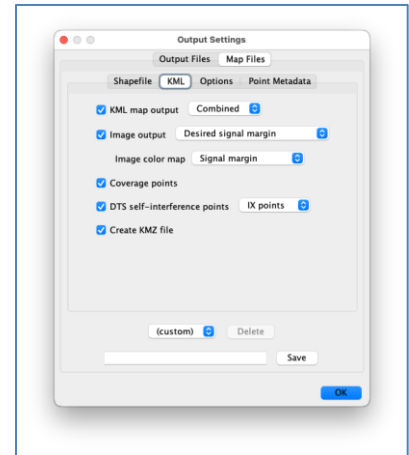
KML map output (various) - Creates a set of Google KML files for the results of the scenario(s). “Combined” will show all stations in a single layer, including a composite image map if “Image Output” is enabled, while “By station” will show each desired station in a separate layer. (See Appendix E.)

Image output – TVStudy can produce an image output file with an associated KML for overlay on Google Maps. This option will only be available if GhostScript is installed on your system and a symbolic link to the “gs” executable is placed in your lib/ directory. (See the Installation and Upgrade Guide for discussion of how to configure this feature.) Additionally, the colors for the image output can be set in the Image Color Map drop-down menu. (See page 43 for information on Image Color Maps.)

Coverage points – By default, the KML output format does not output a coverpts file because it’s of limited utility in most cases. This option allows for the output of a KML coverpts file.

DTS self-interference points – Creates an output file showing DTS self-interference. You may choose to include only points with interference or all points.

Create KMZ file – Creates a KMZ file consisting of the various KML files and images, if selected, in the output.

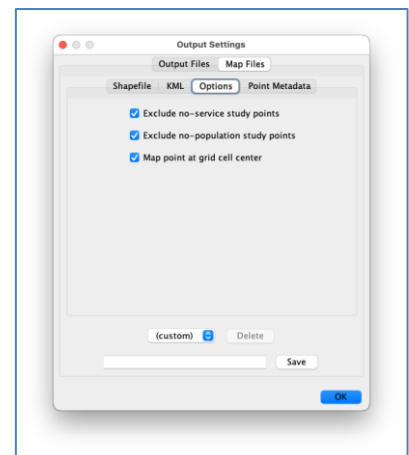


Options tab

Exclude no-service points – Excludes any points without service from the map outputs.

Exclude no-population points – Excludes any points without population from the map outputs.

Map point at grid cell center – Places the map point at the cell center for display purposes regardless of the centroid type used in the study.



Point Metadata tab

Study point coordinates – Includes as attributes the coordinates of each study point.

Area, population, households – Includes as attributes the area, population, and household count for each cell.

Study point ground height – Includes as an attribute the ground elevation of the study point.

Land cover and clutter – Includes as attributes the land cover and clutter category for each cell, if the clutter adjustment study option is used.

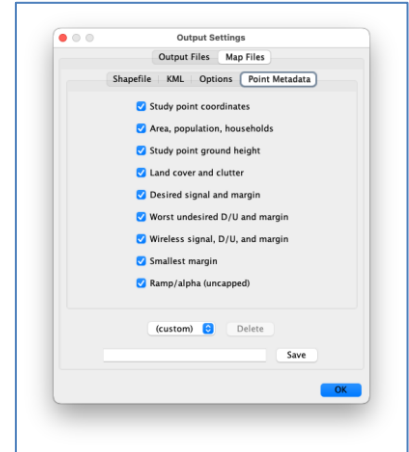
Desired signal and margin – Includes as attributes the desired signal level and margin above threshold for each cell.

Worst undesired D/U and margin – Includes as attributes the worst case undesired D/U and margin above threshold for each cell.

Wireless signal, D/U, and margin – Includes as attributes the wireless signal level, D/U, and margin above threshold for each cell.

Smallest margin – Includes as attributes the smallest margin from the four options above and which of the four is responsible for the number provided.

Ramp/alpha (uncapped) – Includes as an attribute the D/U Ramp function (or OET74 Alpha factor) adjustment for each cell.



Saving and Deleting Settings Presets

Managing presets for output file settings is very simple. To save a new collection of settings, set accordingly, enter the name at the bottom, and click Save. If the name matches an existing name, TVStudy will overwrite the existing saved settings without a confirmation prompt.

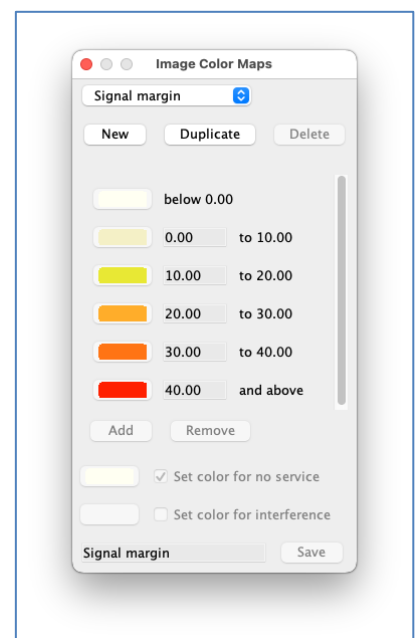
To delete a collection of settings, choose it from the drop-down at the bottom and click “Delete”.

Configuring Image Color Maps

When using the KML image output, TVStudy writes a map image with certain pre-defined colors. In order to work with color maps, choose Image Color Maps from the Database drop-down menu.

There are several pre-existing color maps, but you can create a new one or duplicate and modify an existing one for use in creating maps in whatever color scheme is desired. Just set it up as you prefer, name your color map in the field at the bottom, and click Save.

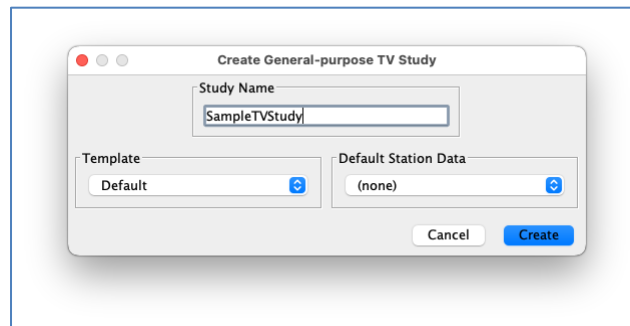
You may also delete existing custom color maps by selecting from the drop-down menu at the top and then clicking Delete.



Creating a New General-purpose Study

General-purpose studies can be used to study coverage and interference between either groups of TV stations or groups of FM stations. The example provided here will cover TV stations; however, a short section explaining the differences that an FM station presents can be found on page 64.

To begin, choose “General-purpose TV” or “General-purpose FM” from the “New study” drop-down menu at the bottom left corner.



This is the interface for creating a General-purpose study. In “Study Name,” choose a name for your study. You will want to avoid special characters and limit the length to a reasonable number of characters, since this name is used to create the path for your output files by default.

At the left, you must choose a template to use. The Default template will always be present. Additional templates may be added to allow you to pre-select parameters for your study. The FCC may distribute templates for specific types of studies to help ensure that TVStudy users obtain consistent results. Learn how to create and manage study templates on page 25.

At the right, you may choose a CDBS/LMS dataset to use as the default for the study. Learn how to import and manage datasets on page 9.

When you’re satisfied with your name, template, and dataset, click “Create.”

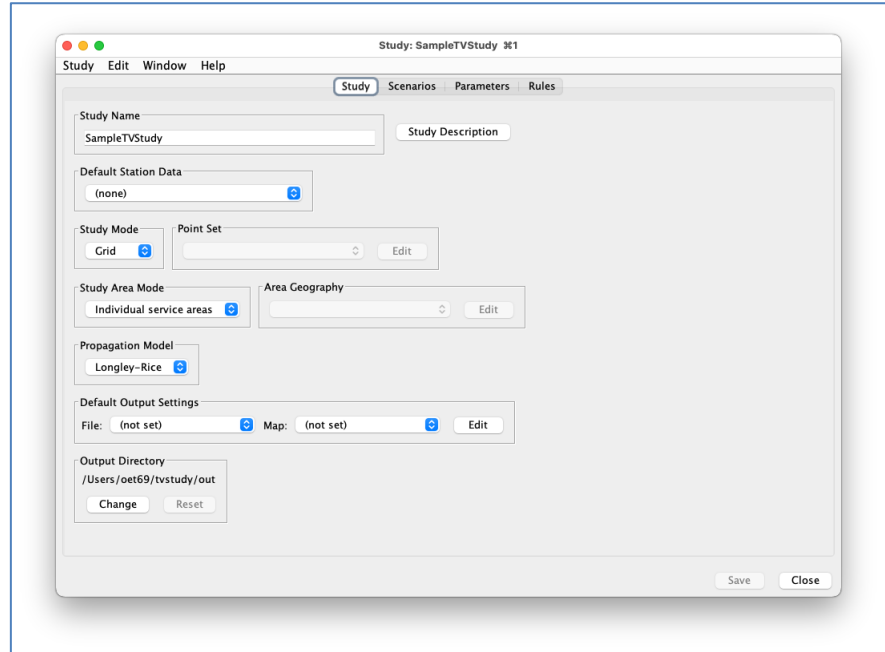
Once a study has been created, you are shown the Study window. There are four tabs in this window: Study, Parameters, Rules, and Scenarios. When creating or opening a study, the window automatically opens to the “Scenario” tab.

The Study tab allows you to set various study options.

Study Name – Sets the name of the study.

Study Description – The description field is a place to store notes and details about this study for future reference.

The description is not only shown here, but also in the Study Manager window when hovering over their names, and in the Activity Queue window.



Default Station Data –

Sets the default station data to use when adding stations to a scenario. If set to (none), the most recent compatible station data is used.

Study Mode/Point Set – Sets the study mode and, when Points is selected, the point set to use for the study. Grid mode is the standard behavior used to model stations. Points mode grants the ability to evaluate coverage and interference at specific points rather than within an automatically generated grid. The point set can be selected from the drop-down menu, and point sets are created in the Geography Editor as described on page 29.

Study Area Mode/Area Geography – Sets the study area mode and, when Fixed Geography is selected, the geography to use in the study. This option allows for stations to be evaluated using a contour method, as is typical, or by one of two alternative means. Fixed Geography is useful for evaluating the coverage of stations within a geography. For example, a station could evaluate its coverage within its DMA, regardless of contour boundary. Alternatively, Unrestricted replaces the contour with a fixed distance defined in the “Maximum desired signal distance” study parameter. Settings other than Individual service areas overrides those service area settings for individual stations in most cases.

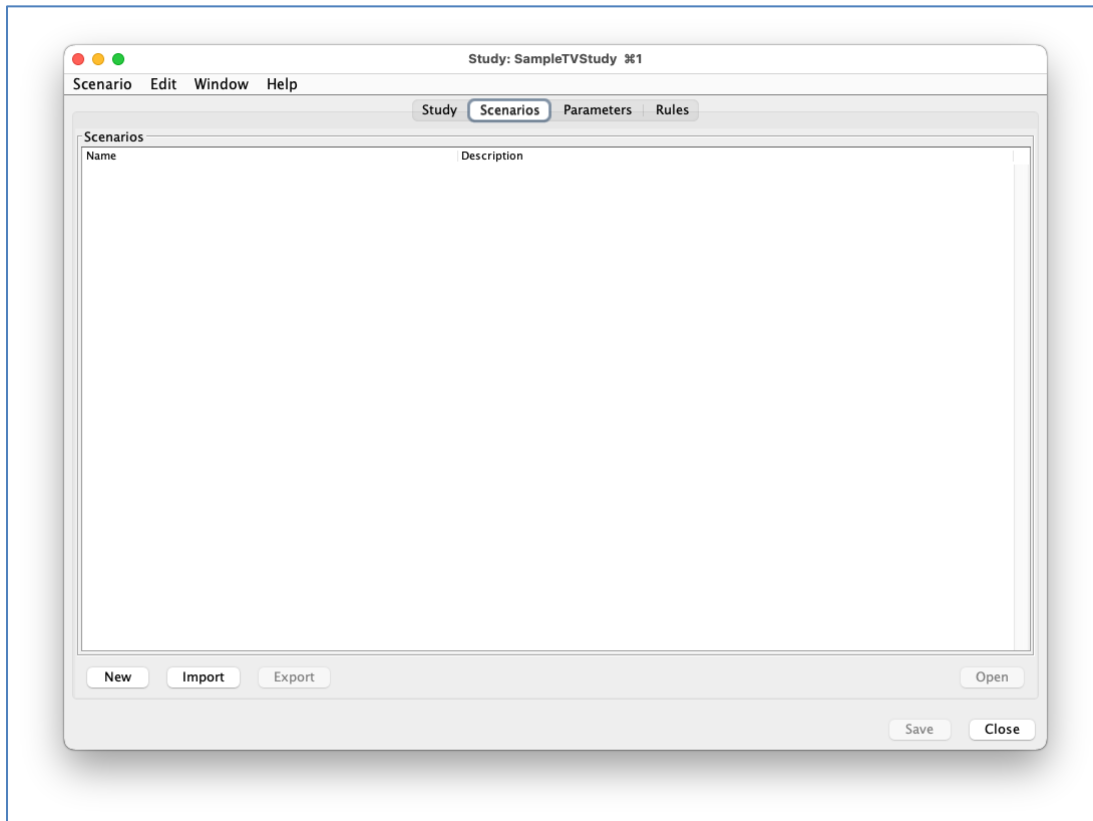
Propagation Model – Sets the propagation model to use for the study. By default, TVStudy uses of Longley-Rice, but also has examples permitting the use of the FCC curves as if it were a propagation model, as well as Free Space. TVStudy provides an API for writing code to support custom models as well; see the Installation and Upgrade Guide for details.

Default Output Settings – If left unset, these default to the “last used” output settings. Otherwise, if set, any time the study is run, the options defined here will be set by default.

Output Directory – Sets the directory in which output files will be written.

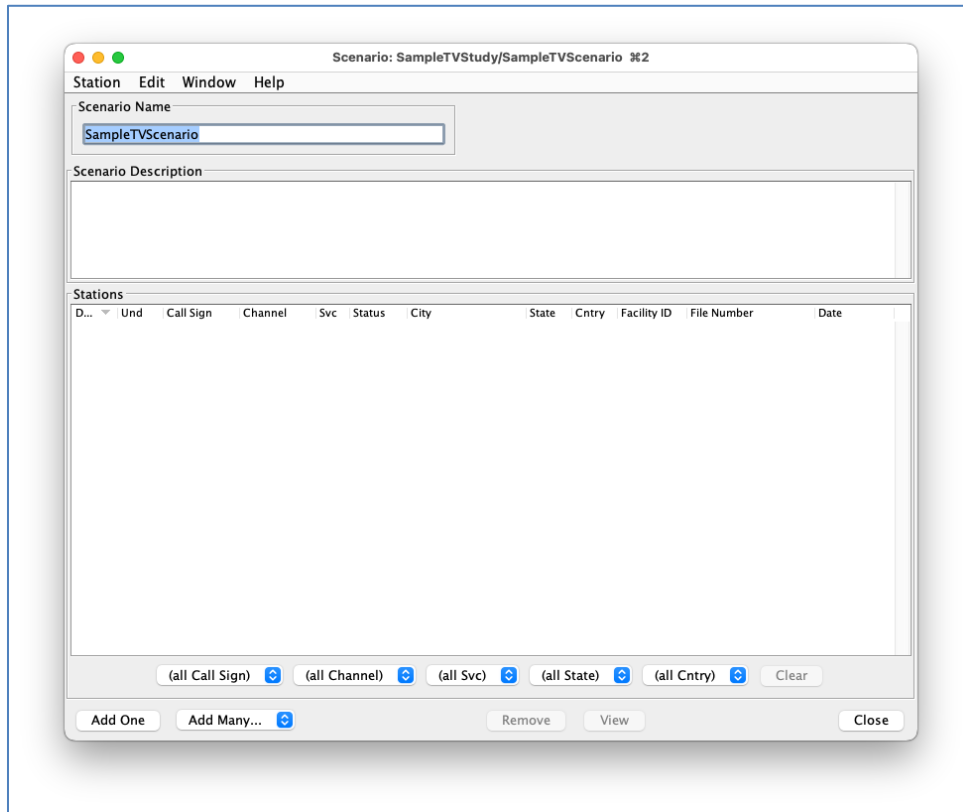
Creating a New Scenario

The next step is to create a new Scenario. To do this, switch to the Scenario tab.



Key concepts: A “study” is a set of parameters that are used to analyze stations. A “scenario” is a specific set of stations to be considered. Each scenario is independent of the other scenarios, but utilizes all of the parameters specified in the study.

Begin by clicking “New” at the bottom left corner. You will be prompted to give the scenario a name. As with the study name, you will want to avoid special characters and limit the length to a reasonable number of characters, since this name is used to create the path for your output files. Then click “OK.”



You are given a blank “Scenario” window. The description field is a place to store notes and details about this scenario for your own future reference. The description is not only shown here, but also in the Study window when looking at your scenarios.

Key concepts: There are two primary types of stations you can add to a scenario. A “desired” station is one that will be evaluated for coverage and interference to the coverage area. An “undesired” station is one that will only be a potential interference source for desired stations. You can (and normally should) evaluate a station as both desired and undesired at the same time, such that a station evaluated for coverage and incoming interference can also cause interference to other stations, though there may be cases in which a station should be only one or the other. Each scenario requires at least one desired station.

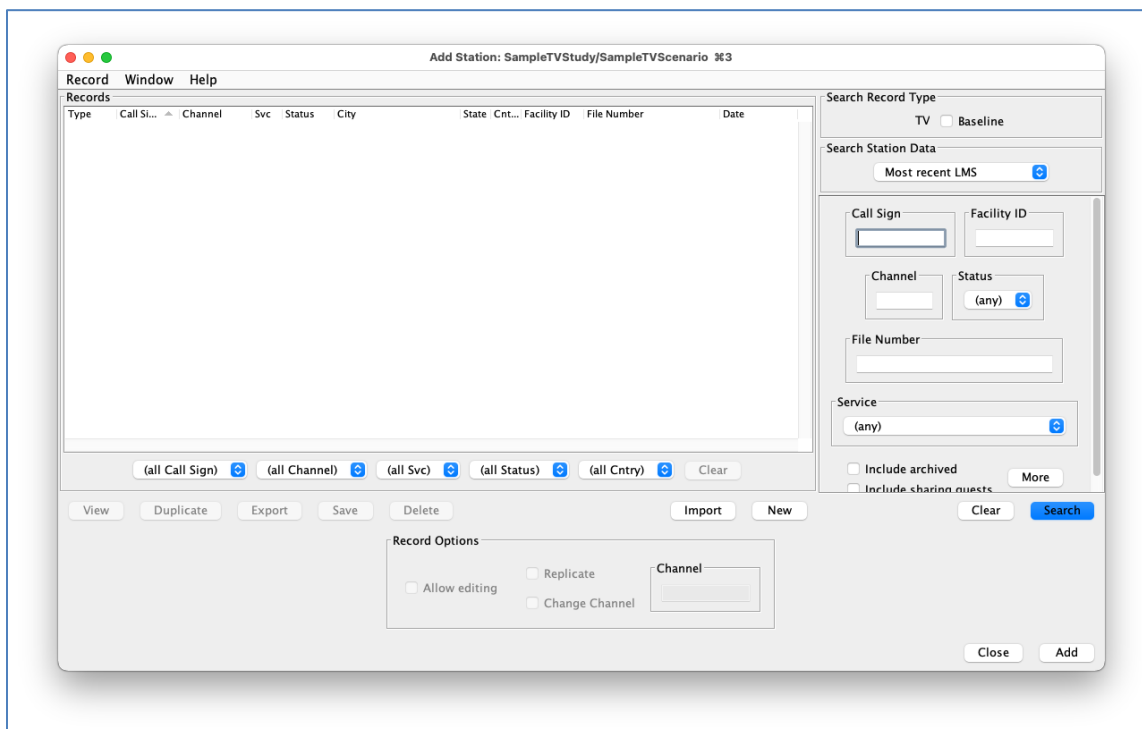
There is a third type of station you can add known as “protected,” which is shorthand for a desired station that may be impacted by an undesired station. Generally, users will not need to use this option.

Adding Station(s) to a Scenario

There are two ways to add stations to a scenario.

Adding Individual Stations or New Stations

To add one station at a time, click “Add One” at the bottom left corner.

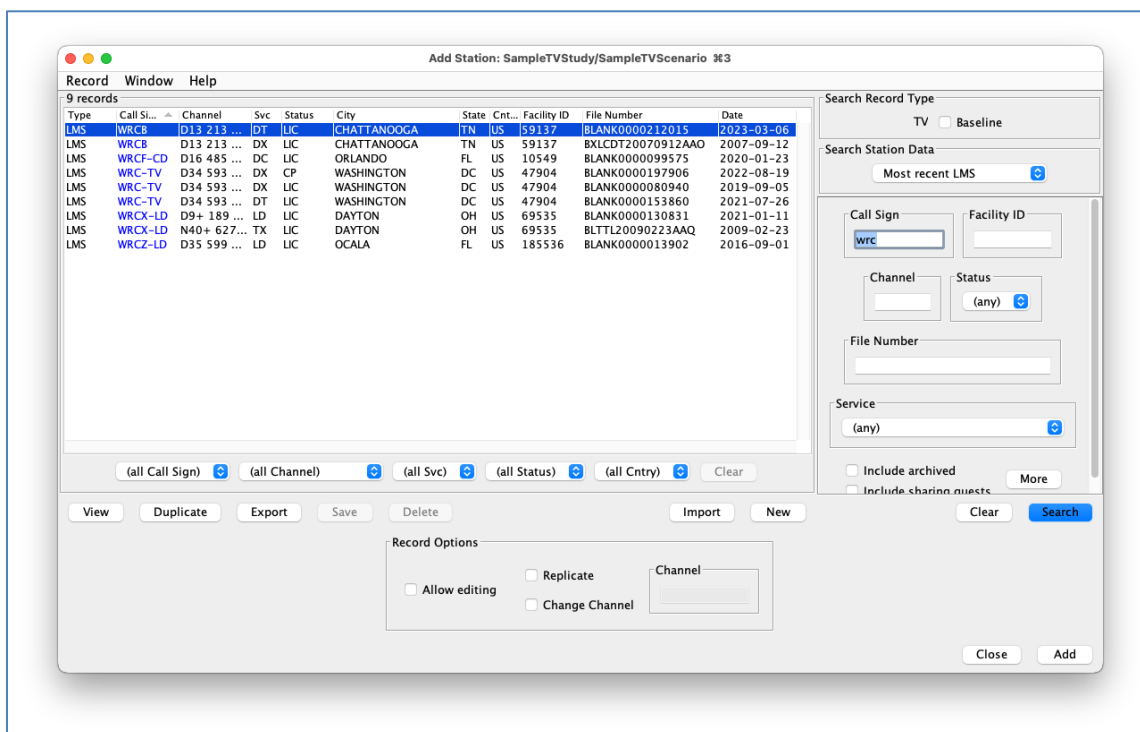


The Add Station window shown strongly resembles the View Station Data window detailed on page 12 and can be operated in the same way. The key difference here is the added functionality at the bottom which allows records to be editable or replicated, and of course the “Add” button which places the record into the scenario. For more information on editing and replicating records, see page 55.

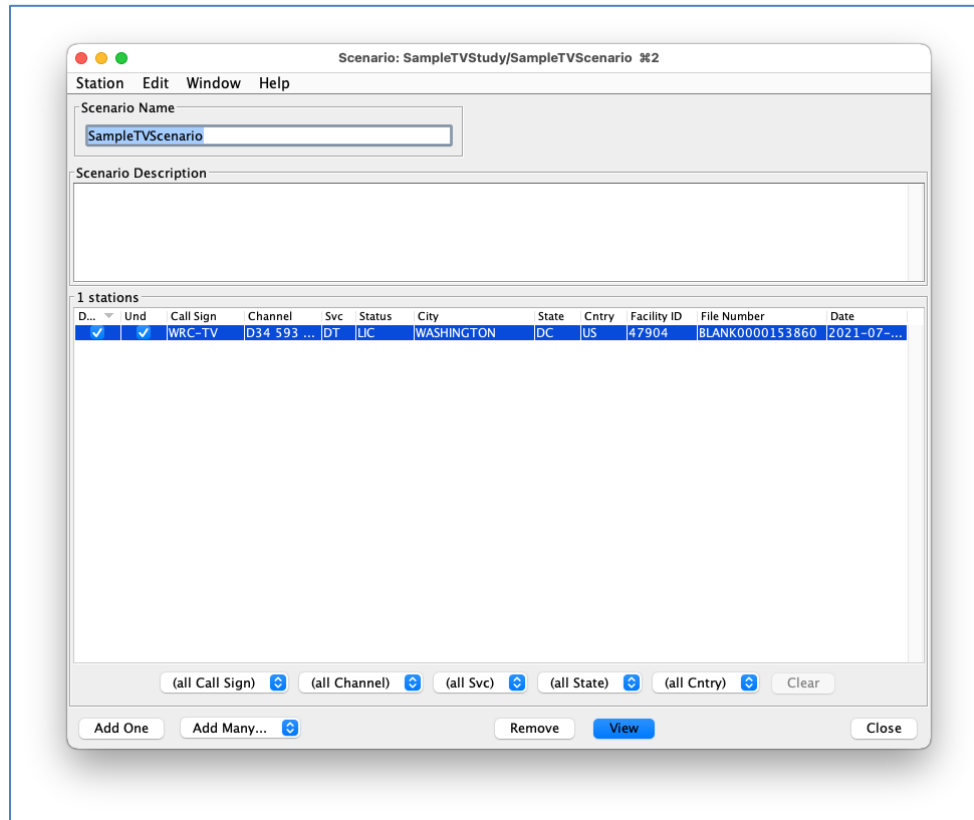
One minor difference from the behavior of the View Station Data window is that you may still use the “New” button to create a new record or the “Import” button to import a record, but you are not required to then save the record to the User records database. If you do wish to save your record to the User records database, simply click “Save” before clicking “Add”. If not, simply create the record and click “Add” without first clicking “Save”.

If you are using an existing record from a dataset, once you select the record that you wish to add to your scenario and choose any editing or replication options, click “Add” in order to add the station to your scenario. The Add Station window will remain open to allow you to add additional individual stations, or you may click “Close” to return to the Scenario window.

Note that you can add records from datasets other than the one associated with the study. These records are added to the study itself and not to the User records database.

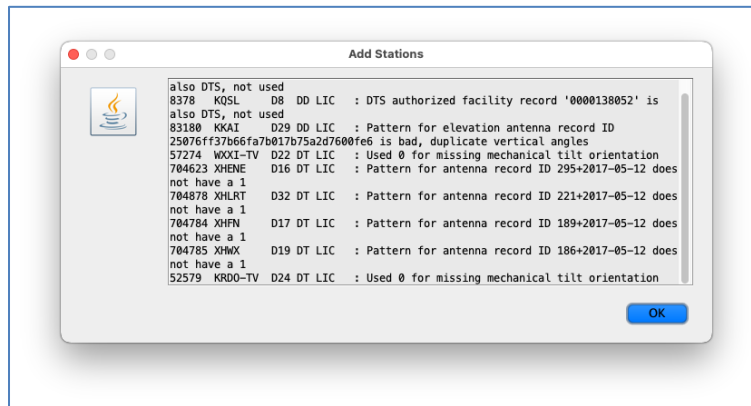


TVStudy will warn you of any unusual conditions it encounters (see page 51) and then add the station to your scenario. By default, stations added in this method are assumed to be both desired and undesired, which is shown in the above Scenario window. To make it undesired only, uncheck the box in the “Des” (Desired) column. To make it desired only, uncheck the box in the “Und” (Undesired) column. Unchecking both boxes will omit the station from evaluation.



By clicking and dragging, or by using the usual method for your operating system to select multiple items, you can remove the selected stations from the scenario by clicking the “Remove” button at the bottom right, or modify their desired or undesired status all at once using the options in the Edit drop-down menu.

CDBS/LMS Data Warnings



CDBS/LMS data warnings will not prevent execution of a study; they are provided to alert you to potentially anomalous conditions that may affect the results of the study. Each warning message includes the facility ID, call sign, channel, and status of the record that triggered the warning.

DTS authorized facility record is also DTS, not used – If a DTS station has an authorized facility that is, itself, a DTS, then it cannot be used. TVStudy warns that it is not using that record, and is instead attempting to fall back on an alternative record to use as the authorized facility.

Used default for missing ERP/HAAT – If the search returns one or more Mexican allotments missing values for ERP and/or HAAT, TVStudy warns you that it is defaulting to the values you assigned when the study was created.

Derived missing AMSL from HAAT – If a station or allotment is missing its antenna radiation center height above mean sea level (RCAMSL), TVStudy will calculate it from the height above average terrain (HAAT) value using the selected terrain database. This should only appear on non-US records.

Converted ERP from dBk to kilowatts – If a station has an ERP less than or equal to 0, it is assumed the ERP was entered in dBk instead of kW, and the value is converted to kilowatts.

Using ERP value from max_erp_any_angle – When using CDBS data, if a station has a value in the max_erp_any_angle field greater than that of the effective_erp field, TVStudy will use the max_erp_any_angle value.

Transposed mechanical tilt parameters – Some stations with mechanical beam tilt have reversed values for the mechanical tilt (depression) angle and the tilt orientation (azimuth). If a record has a tilt value greater than 11.1 degrees, TVStudy will swap the values.

Ignored out-of-range electrical/mechanical tilt – The value in the noted field is less than -10 or greater than 16 degrees. TVStudy substitutes a value of 0.

Used 0 for missing mechanical tilt orientation – The mechanical tilt is non-zero but the tilt orientation is 0, which may mean that the tilt orientation (azimuth N degrees ET) was not entered

in CDBS/LMS. This may not be an error if the tilt orientation is actually toward N 0 degrees ET. The user should independently verify the correct parameters and edit the record if necessary.

Antenna ID <#> not found – No pattern data exists for the station’s antenna ID number. TVStudy assumes the station is omni-directional.

Pattern does not have a 1 – Some antenna horizontal plane (azimuth) patterns in CDBS/LMS are missing a 1.0 maximum relative field point, usually because a station has its maximum at a value between the azimuth values supported by CDBS/LMS (*i.e.*, every 10 degrees). TVStudy warns you about this condition, but takes no corrective action.

Pattern for antenna ID <#> is bad, <msg> – Some antenna horizontal plane (azimuth) patterns in CDBS/LMS contain errors (listed below) and TVStudy assumes the antenna is omni-directional:

Azimuth out of range – Pattern had azimuth(s) less than 0 or greater than 359.999.

Duplicate azimuths – Pattern had two or more field values given for the same azimuth.

Relative field out of range – Pattern had field value(s) less than or equal to 0 or field value(s) greater than 1.

Not enough points – Pattern had fewer than two points.

Elevation antenna ID <#> not found – No data exists for the station’s elevation antenna ID number. TVStudy applies a generic pattern, if allowed. If the pattern is supposed to be a matrix pattern, TVStudy also assumes the station is omni-directional.

Elevation pattern does not have a 1 – Some antenna elevation patterns in CDBS/LMS are missing a 1.0 maximum relative field point, usually because the antenna is at an odd rotation but the data is entered only every 10 degrees. TVStudy warns you about this condition, but takes no corrective action.

Elevation pattern for antenna ID <#> is bad, <msg> – Some antenna elevation patterns in CDBS contain errors, and TVStudy instead applies a generic pattern, if allowed. (By default, the generic pattern is not allowed for wireless records.) If the pattern is supposed to be a matrix pattern, TVStudy also assumes the station is omni-directional and appends “**at azimuth <#>**” to the end of the message.

Depression out of range – Pattern had elevation angle(s) outside the range $-90 \leq \theta \leq 90^\circ$.

Duplicate depression angles – Pattern had two or more field values given for the same elevation angle.

Relative field out of range – Pattern had field value(s) less than or equal to 0 or field value(s) greater than 1.

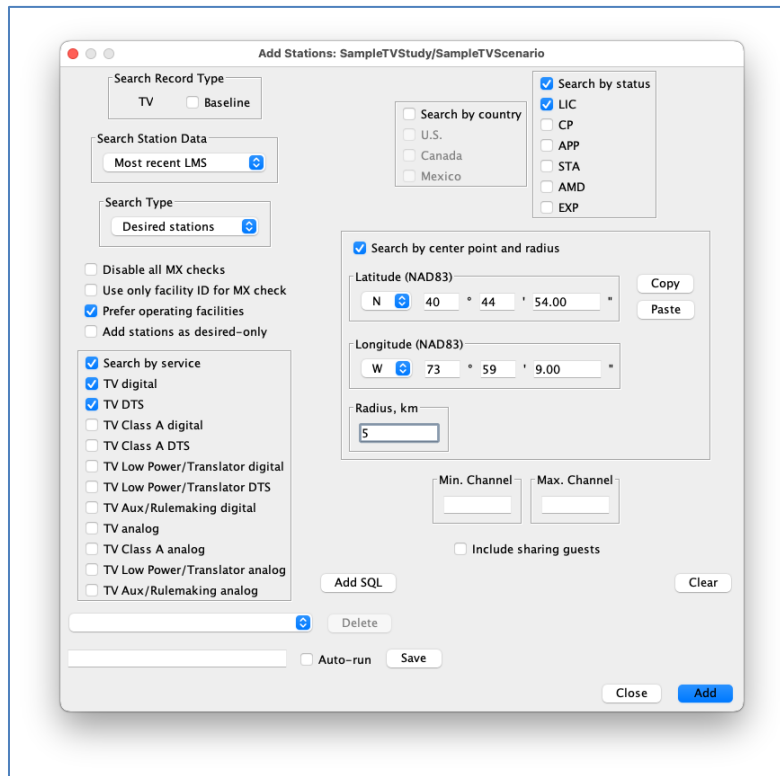
Pattern data not found – Pattern data was not successfully loaded.

Not enough points – Pattern had fewer than two points.

Important: Warning messages will only appear once for a given CDBS/LMS record in a given study; if the same record is used again in a different scenario, the warnings do not appear.

Adding Multiple Stations with a Search

It is not necessary to add stations one at a time. You can add multiple stations at once using a search function. To access this, click “Add Many” at the bottom left corner of the scenario window and choose whether you wish to add Desired, Undesired, or Protected stations.



There are several search methods shown on this screen, along with the button to Add SQL. There are also some additional options worth noting.

At the top left, you can choose from which dataset you wish to add stations to the scenario. Users may add stations from any imported dataset into a given study.

Immediately below that, you can choose whether the stations you seek to add here are desired, undesired, or protected stations. If you choose to add undesired or protected stations, only stations that meet the rules to be considered for your desired or undesired stations will be added, respectively, regardless of the other parameters. For example, if you only have desired stations in Texas and you set TVStudy to only search for undesired or protected stations in Canada, TVStudy will return no results. This also means that you must have at least one desired station in your scenario in order to add undesired stations, or one undesired station in order to add protected stations.

Also note the three checkboxes at the left side of the window.

Disable all MX checks – This option disables all mutual exclusivity (MX) checks in the software. Checking this box is not recommended unless you are specifically checking two stations at the same location and channel. Any stations added with this checkbox selected

are added as desired, but not undesired, to prevent any stations from receiving excessive interference.

Use only facility ID for MX check – As opposed to the previous option, which disables all MX checks, this disables all of the MX checks except the one that checks that no duplicate facility IDs appear in the scenario.

Prefer operating facilities – By default, this search window prefers the “newest” record in CDBS/LMS (*i.e.*, applications outrank construction permits outrank licenses). Checking “Prefer operating facilities” flips the order. A pending license will outrank a license will outrank a construction permit will outrank an application.

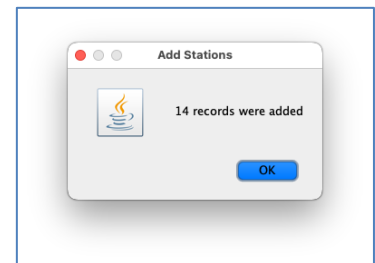
Add stations as desired-only – By default, stations added with the “Desired stations” search type are automatically added as both desired and undesired. If you check this box, the records will be added as desired only.

Finally, if you are running multiple Add Many queries across multiple scenarios, the bottom of the window allows you to save or retrieve those queries. A saved search selection menu, name field, and “Save” and “Delete” buttons are found at the bottom of the search dialog. At the bottom of the scenario editor window is a menu listing available searches. That menu will always have three default choices, “Desired,” “Undesired,” and “Protected,” which open the search dialog with nothing set other than the Search Type, but if any searches are saved, those saved searches will also appear. Other saved search selections appearing in the scenario editor menu may open the search dialog configured for the saved search, or a saved search may also run immediately when selected without opening the dialog if it is set to “Auto-run”. In the search dialog next to the “Save” button is an “Auto-run” check-box. If that is checked when the search is saved, it will run automatically when selected from the scenario editor menu. Saved searches with the auto-run setting have “(auto)” following the name in the menu for clarity. auto-run is not triggered when selecting a saved search from the menu in the search dialog itself. If you need to edit an auto-run search, first open the search dialog using some other selection (such as “Desired,” “Undesired,” or “Protected”), then select the auto-run saved search from the menu at the bottom of the dialog. Note that while a saved search preserves all search settings in the search dialog, including any SQL code entered with the “Add SQL” button, it does not preserve the station data selection. When choosing an auto-run saved search from the scenario editor, the study’s default station data will be used for the search. If the study does not have a default station data set, selecting an auto-run search will use the application-wide default.

When finished, click “Add”.

After reviewing CDBS/LMS data warning messages (see page 51), if any, click “OK.”

TVStudy then tells you how many stations it found. Click “OK,” and now you will see the stations you selected appear in your scenario.



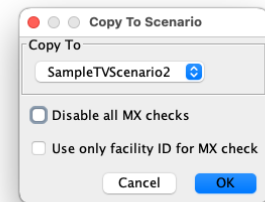
Copying, Editing, and Replicating Station(s) in a Scenario

One way of providing additional flexibility when studying stations in TVStudy is to allow modification of a station's engineering parameters.

Copying Stations to Other Scenarios

To copy a station to another scenario, click the station you wish to copy, then select "Copy to Scenario" from the "Station" drop-down menu.

Select which scenario you would like it copied to, along with any relevant MX check settings (see page 53), then click OK.



Editing and Reverting Stations

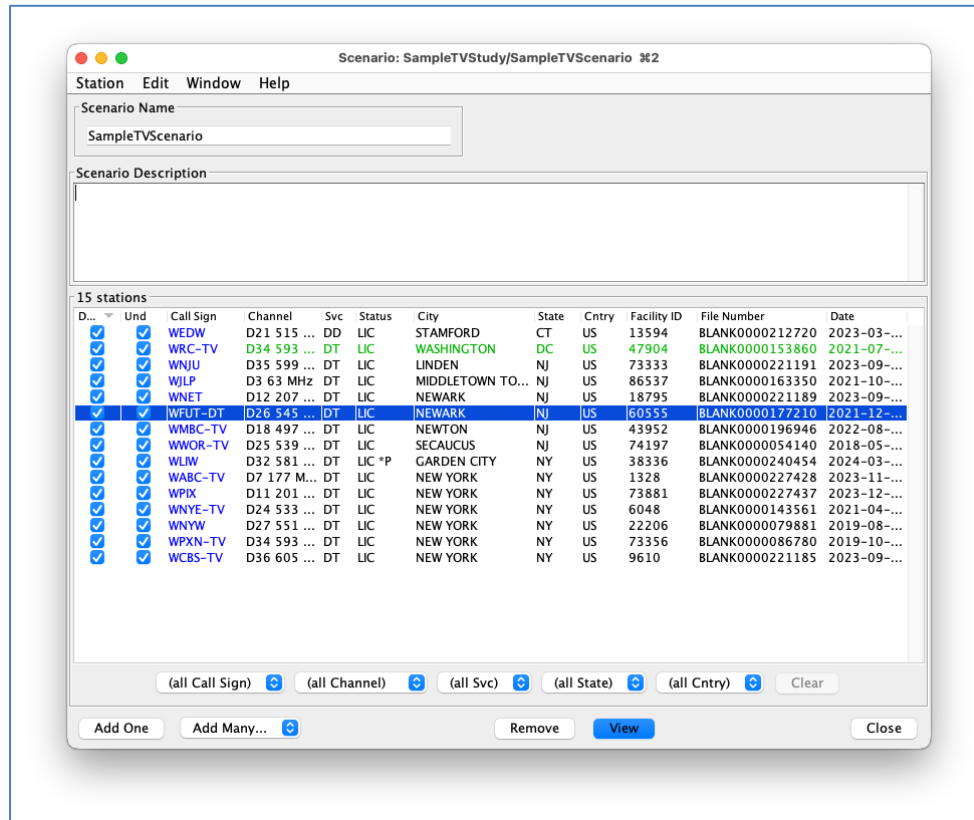
To view details about a record, click "View" at the bottom right corner of the Scenario window.

Note that the parameters in this window are grayed out and cannot be edited; this is a feature of TVStudy. An entry that cannot be edited is known to be consistent across multiple scenarios. As such, any calculations made about its coverage and/or interference can be cached and reused in other scenarios in the study. However, it is also possible that the values in CDBS/LMS may not be what you wish to use in a given scenario. By clicking "OK" and going back to the Scenario window, you can choose "Allow Editing" from the Station drop-down menu and edit the record.

The appropriate window opens and you can make the edits you wish to the relevant parameters in the record.

Some values cannot be changed, such as the country or service, but the other values can be adjusted as desired. Note that if you set the “Height AMSL” field to “-999”, TVStudy will compute the height AMSL from the HAAT value. Similarly, setting the “HAAT” field to “-999” will cause TVStudy to compute the HAAT from the height AMSL value. If both values are set to “-999”, TVStudy will assume the transmitter is above the ground by the value given in the Minimum transmitter height AGL parameter in the Propagation menu. It will add that height to the ground elevation to derive the height AMSL and then compute the HAAT accordingly.

When you’re finished, click “OK”.



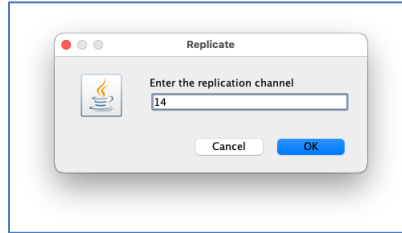
Editable records appear in **green** in the Scenario window.

You also have the option to import or export records via CSV (see page 14) or save an edited record as a User record for use elsewhere in TVStudy (see page 15) via the options in the Station drop-down menu.

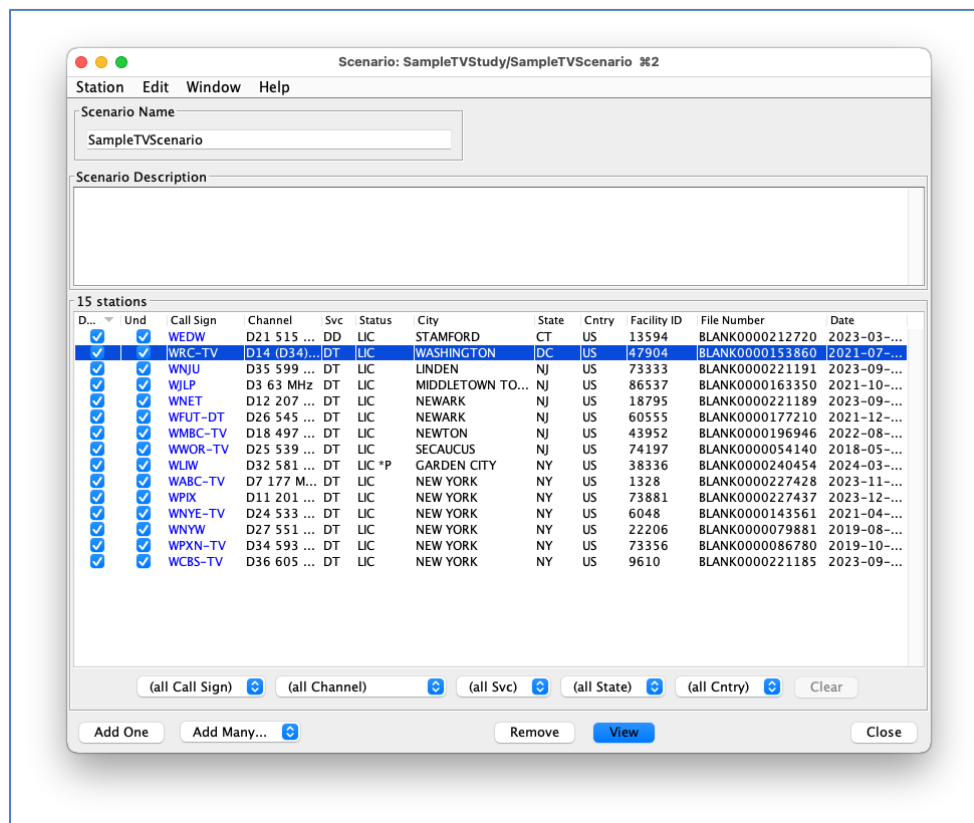
If you want to revert back to the original unedited record values, click the record(s) in question and choose “Revert” from the Station dropdown menu.

Replicating Stations

A feature of TVStudy is that you can choose to replicate a station's coverage on a different channel. To do so, select "Replicate..." from the Station dropdown menu.



Enter the channel you wish to replicate to and click "OK."



In the above example, you can see that the "Channel" column now shows D14 as the replication channel, while (D34) appears in parentheses to show the station's original channel number.

Replication of either an analog or digital record will produce a digital replication. TVStudy will not replicate stations to new analog channels under any circumstance.

Station Data: SampleTVStudy/SampleTVScenario/WRC-TV

Service TV digital	Facility ID 47904	Record ID LMS 2024-05-21 25076ff37ace293a017acfb7182c02d1	Country U.S.
Call Sign WRC-TV	Channel 14 473 MHz replicated from D34	Status LIC	City WASHINGTON
			State DC
File Number BLANK0000153860	Zone I	Freq. Offset (none)	Emission Mask (n/a)
Latitude (NAD83) N 38 ° 56 ' 24.00 "	Longitude (NAD83) W 77 ° 4 ' 53.00 "	Copy Paste	Site Number 1
Height AMSL, ... 312.2	HAAT, m 244.0	Peak ERP, kW 0.001	Azimuth Pattern (none) Orient. 0.0 View Export
Service Area Default contour Mode Arg. km or % Cont. Level dBu 0.00 (default) Geography (none) Edit	Elevation Pattern (none) Elec. Tilt 0.90 Mech. Tilt 0.00 Tilt Orient. 0.0 View Export <input checked="" type="checkbox"/> May use generic pattern when needed		

Close

If you view the replicated record prior to running a study, you will note that the ERP is now listed as 0.001 kW. The replication power level is not determined until runtime. TVStudy, upon running the study, will increase the ERP as needed until the station is replicated on the new channel, after which viewing this record will show the resulting ERP.

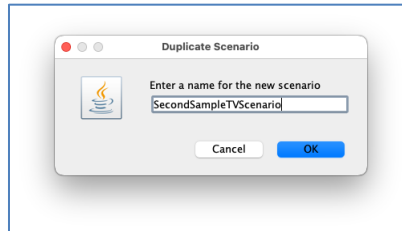
As with Editable records, clicking the record(s) and choosing “Revert” from the Station menu will return the replicated station to its original channel.

When you are satisfied with your scenario, close the Scenario window and return to the Study window.

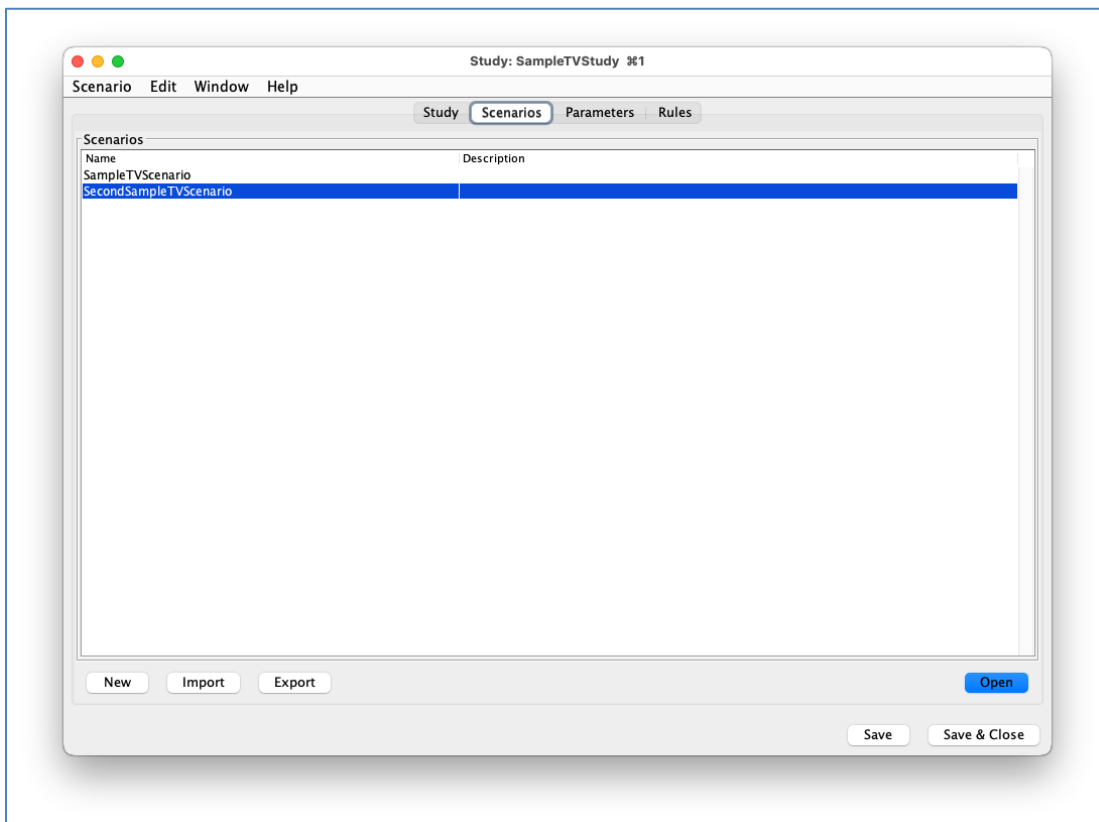
Managing Scenarios

Duplicating a Scenario

To duplicate a scenario, click the scenario you wish to duplicate and choose the “Duplicate...” option from the Scenario dropdown menu.



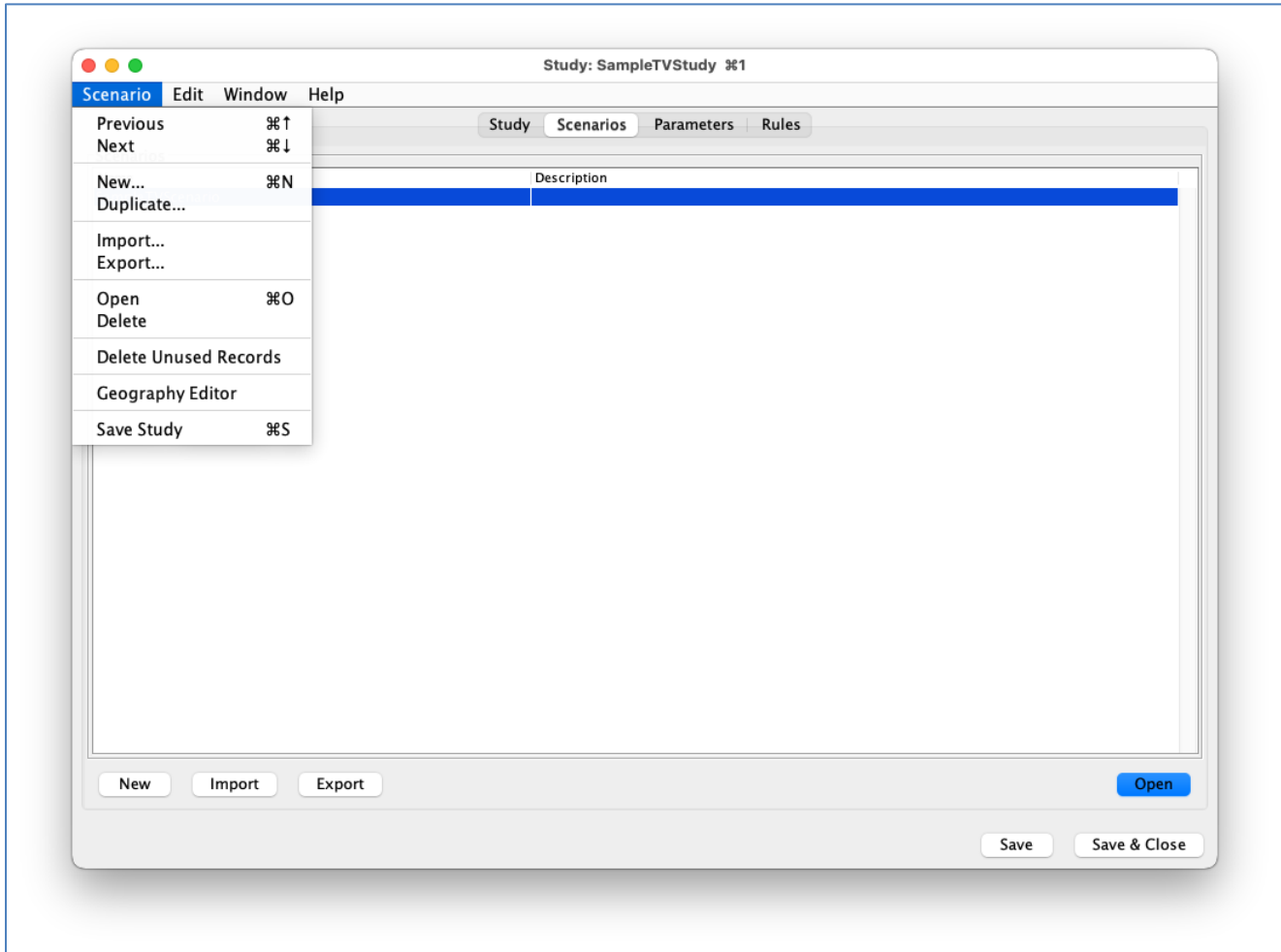
You are prompted to give the new scenario a name. You will want to avoid special characters and limit the length to a reasonable number of characters, since this name is used as part of the path for your output files. TVStudy immediately opens the new duplicate scenario for you, on the assumption that you will immediately wish to make some modifications.



When finished, close the scenario and both scenarios will be visible in the Study window.

Importing, Exporting, and Deleting Scenarios

Importing and exporting scenarios can be useful for comparing the results of a scenario across multiple studies. You can also delete scenarios that are no longer required.



To export a scenario, click “Export” at the bottom left. The file is exported as an XML file, so navigate to where you would like to save it, give it a name, and click “Save.” See Appendix G for details on the XML file format.

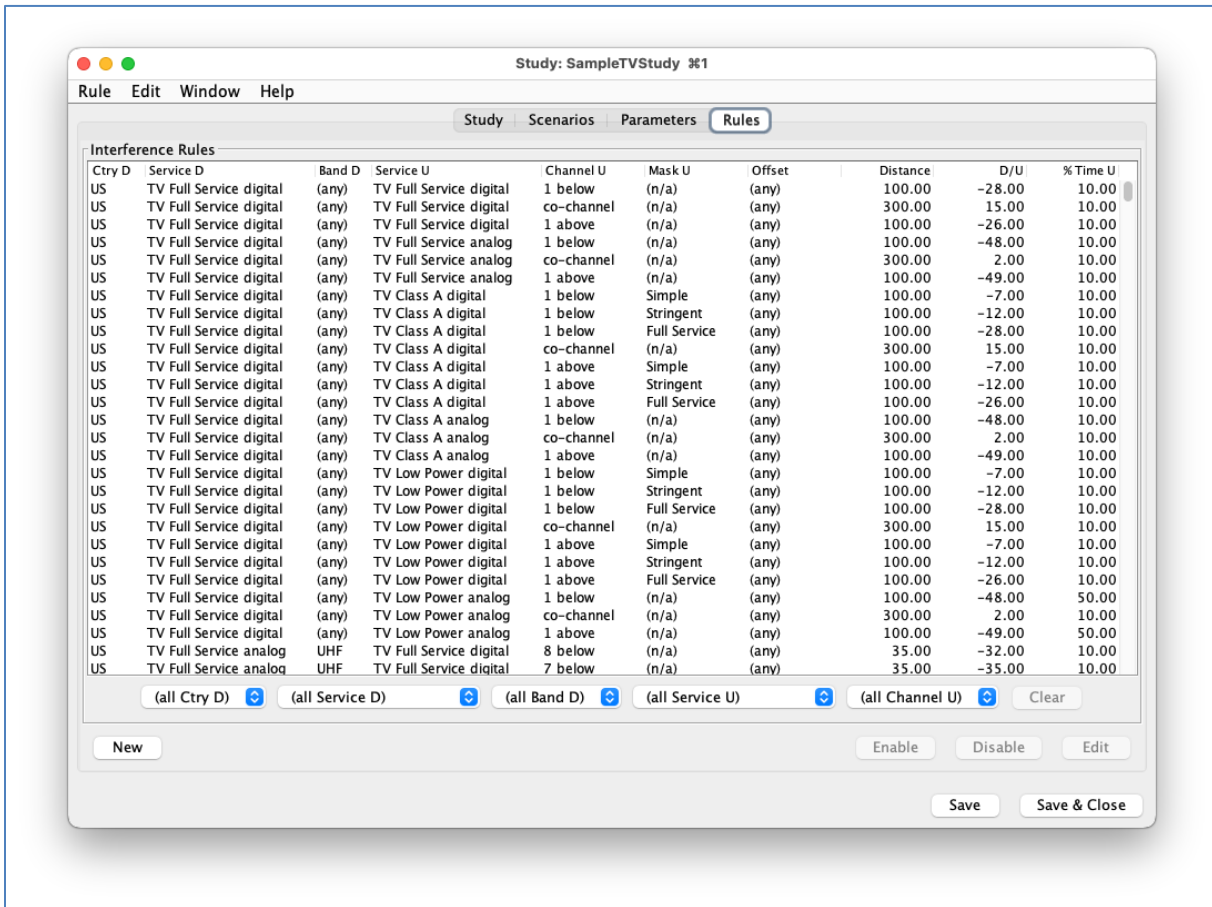
To import a scenario, click “Import” at the bottom left. Navigate to where the file you wish to import is located, click on it, and click “Open.”

To delete a scenario, click on the scenario you would like to delete, then select “Delete” from the Scenario dropdown menu.

If you receive a message that TVStudy is out of keys and you have previously deleted stations or scenarios from a study, try using the “Delete Unused Records” option. This will remove records which are kept in a study even after they are deleted in case they are needed again. This will free keys for use in the study.

Examining the Study Rules

Clicking on the Rules tab will show you all of the rules that are used in this study. These are the values specified in OET Bulletin No. 69 or suggested by the FCC, and are typically not changed. You can filter them, edit them, disable or enable them, and you can change multiple parameters at once using “Enable/Disable by Type” in the Rule menu.

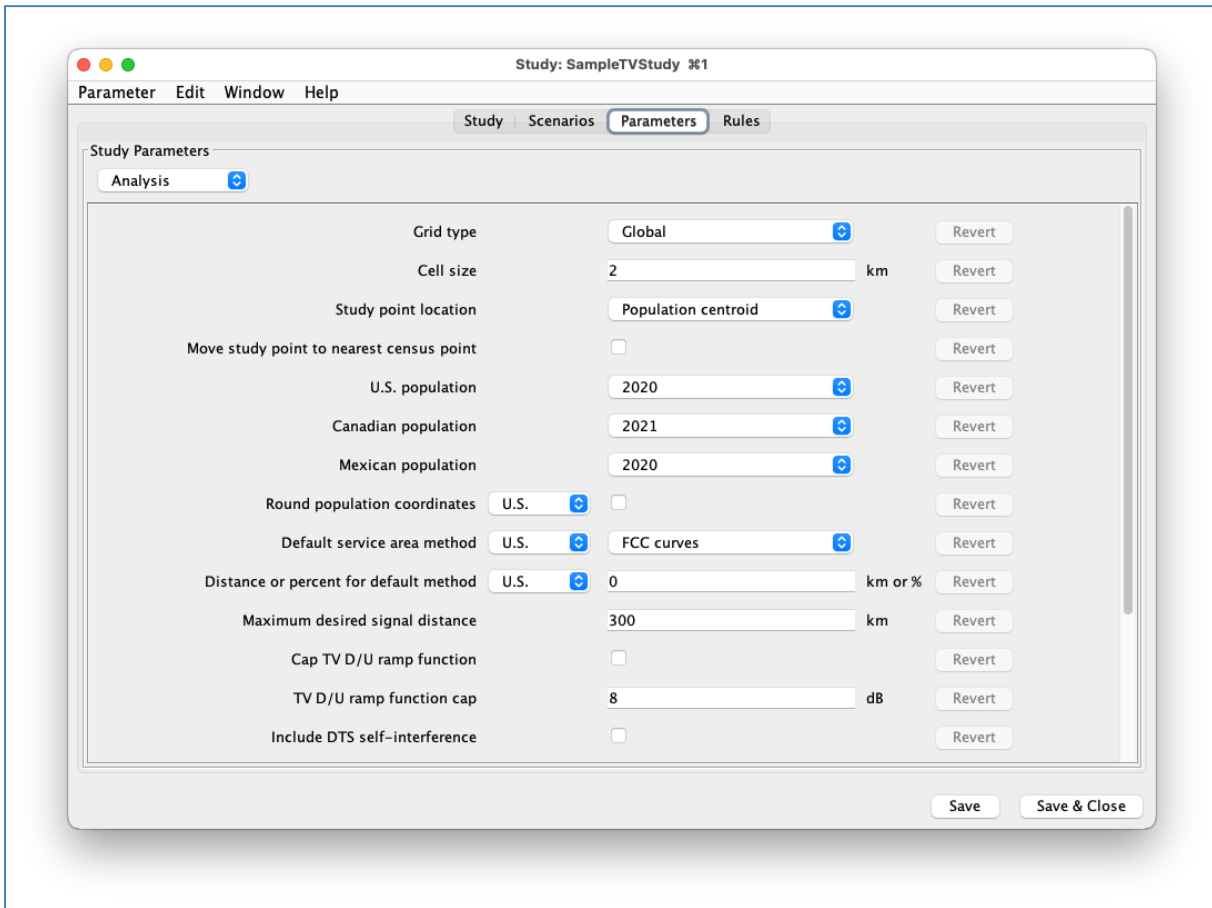


You can filter rules by type in order to more easily locate rules you wish to view or modify. Simply use the dropdowns in the “Filter” area. To remove the filtering, click the “Clear” button at the right.

Study templates also include values for the rules, meaning that if you devise a set of custom rules and then save or export a study template, the rules specified will be included.

Setting the Study Parameters

To set study parameters, click the “Parameters” tab.



The Study Parameters section is broken up into groups accessed by a dropdown, which contain parameters that are generally related to each other. There are many parameters that can be adjusted as desired. The parameter settings are memorialized in the TVStudy Settings output file which can be used by others to duplicate your study settings. To see a complete list of these parameters, please see Appendix A.

When finished with your study, click “Save Study” and close the Study window, or click “Save & Close”.

Differences with an FM General Purpose Study

FM General Purpose studies are nearly identical to TV General Purpose studies, with two exceptions.

53rd and 54th Adjacent Rules

TVStudy has support for 53rd and 54th adjacent interference calculations. While this is contained in the Rules tab like any other rule, it behaves slightly differently from other rules. While the D/U ratio is given as 0 dB for these cases, that D/U ratio is only triggered if the field strength in the cell for both stations is at least 91 dBu. This value and behavior was determined by the FCC in NPRM FCC 88-87 and R&O FCC 89-64, in docket 86-144.

IBOC Interference

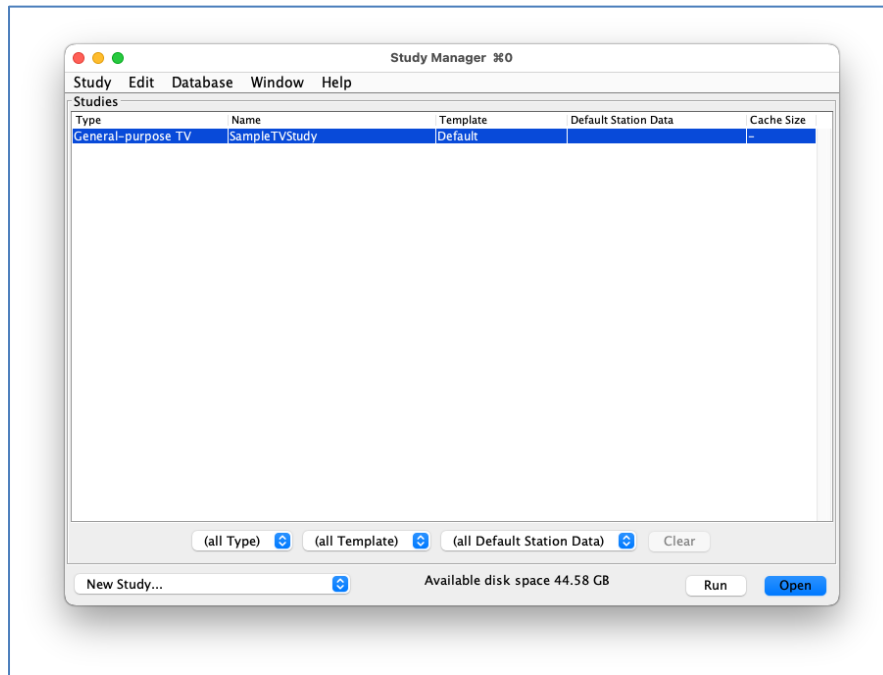
TVStudy has support for computing interference caused by IBOC transmissions of adjacent channel FM stations, which can be turned on or off with a parameter setting in the Analysis tab. As such, when viewing or modifying a station, you will see an extra field, as shown in the picture here:

TVStudy uses CDBS to determine whether or not a station is operating with IBOC in order to prepopulate the IBOC digital checkbox for each station added to a scenario. It further attempts to determine the power of the IBOC signal from CDBS records, but if it cannot for any reason, it assumes the default -20 dBc power value.

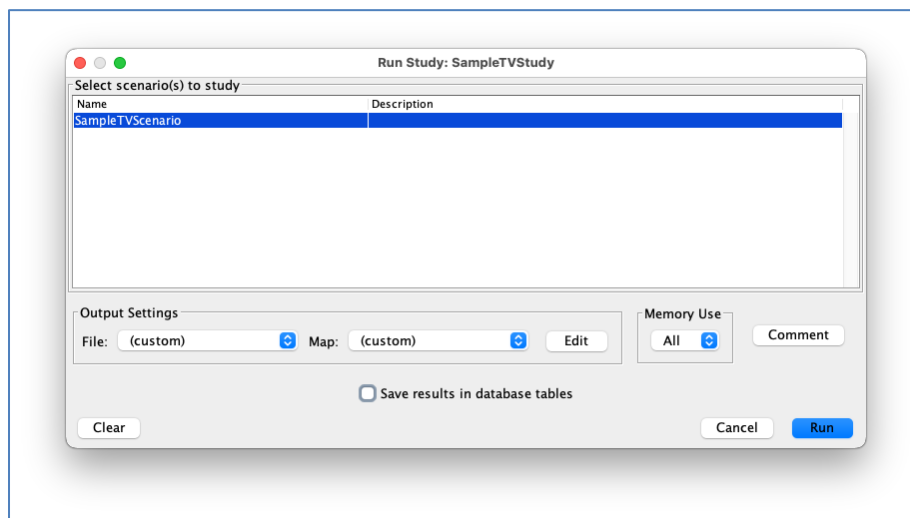
The presence of interference is calculated based on the formula that was used to determine the F(50,10) contour overlap prohibition as proposed by iBiquity and NPR and adopted by the FCC in DA 10-208 (page 6). Using the standard FCC adjacent channel interference rules, this interference is masked up to -14 dBc and only alters results at power levels higher than that value.

Running Your Study

Running a General-purpose Study



To run a study, click on the study you wish to execute, then click “Run” at the bottom right corner.



By default, all of the scenarios are selected to be run, but you may click on the scenario(s) you wish to run if you wish to only run some or one of the scenarios included. If you select no scenario(s), TVStudy will do some initial calculations, such as contour projection, and cache the resulting data for future scenario runs. However, this will produce no output data.

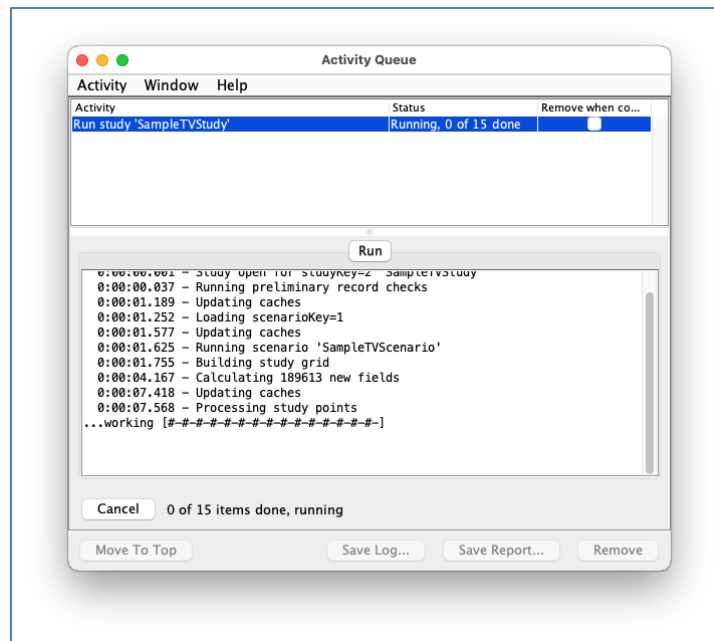
Next, you can select the output files you wish to output from this run. Details on the output file configuration can be found on page 39.

You are then able to select the amount of free memory to be used in your study. If you plan to run more than one study at a time, it may be useful to allocate only a fraction of the available memory to a particular run.

You can also add a comment to be included in your report, CSV, and/or cell file(s).

Finally, for grid-based analyses, you can choose whether or not to save the results in database tables. This can give you the ability to analyze your results within TVStudy. (See page 69.)

When you are satisfied, click “Run.”



The Activity Queue window is relatively simple. At the top, a queue of all the study runs that are running, queued to run, or have finished without being removed are listed. The current one is highlighted, and can be viewed at the bottom. While running, the bottom pane indicates what TVStudy is doing, gives an estimate of how much time may be remaining, and has a Cancel button.

At the bottom left is a "Move to Top" button which allows you to move a highlighted queued study run to the top of the queue beneath the currently running study.

When the run is finished, you can save the contents of the Activity Queue window to a file by selecting the "Save Log" option. Click “Remove” to remove a completed study from the pane at the top. If no studies are remaining, the “Remove” button becomes a “Close” button which will return you to the Study Manager window.

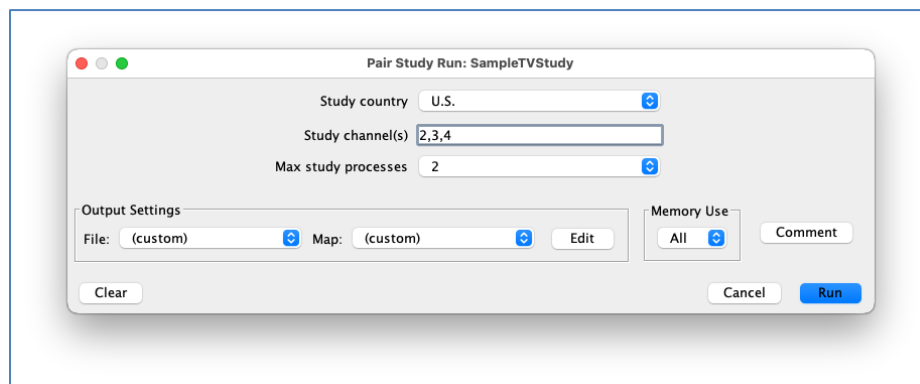
If another location has not been set, by default your output files have been placed in a directory within the “out” directory.

Running a Pair Study

One of the key features of TVStudy is the ability study arbitrary pairs of stations on one or more specified channels to see whether they can coexist based on some interference criteria. This is called a “pair study.” A pair study takes every pair of stations and studies them on the same channel (co-channel) as well as with each station placed lower-adjacent and upper-adjacent to the other, in order to determine interference levels in each channel relationship. The pair study produces a set of CSV files with cell-by-cell determinations of service and interference designed to be input into post-processing software. These instructions will show you how to run a pair study. Post-processing this data is not part of TVStudy and is not covered in this manual.

First, in order to successfully run a pair study, your Study must have a single Scenario. In addition, no stations from Guam, American Samoa, or any other location in the southern or eastern hemispheres can be included, and TVStudy cannot run a pair study if any stations north of 73 degrees latitude are included.

In the Study Manager window, choose “Run Pair Study...” from the Study dropdown menu.

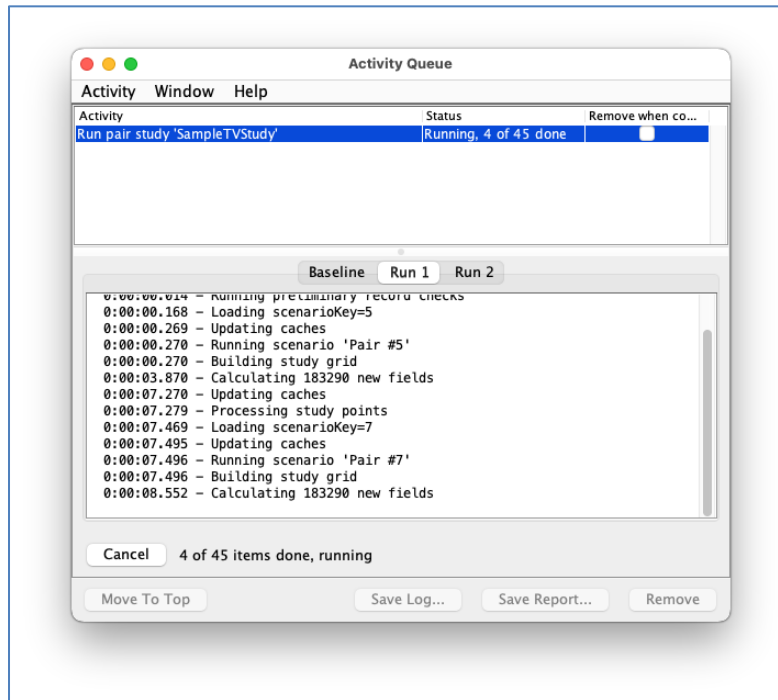


In the Run Pair Study window, enter the country you wish to study (or All countries), the channel(s) on which you wish to run your pair study (these channels are the co-channel study, the associated adjacent channels are determined automatically), and then choose the number of processes you would like to use. TVStudy will offer you as many processes as you have processors or cores as reported by your operating system, and it is recommended that you run at least one less than the maximum number provided, to allow for database access overhead without causing the system to slow down. Attempting to run more than 10 channels at a time is not recommended due to various memory constraints. If your computer has a small amount of RAM, more restrictive limits (*i.e.*, fewer than 10 channels) may apply.

The software can also produce many of the standard output files for the baseline. (See page 39.) The Cell file output is unavailable in a pair study, but the normal pair study output files provide cell-level data. (See Appendix F.)

The pair study may consume as much RAM as is determined to be free by TVStudy. If you try to run other studies while TVStudy is executing a pair study, the software will queue those studies to run after the pair study is complete, or you can limit the amount of memory used as in a normal study run. You can also set a comment to be included with your output files.

When you are satisfied, click “Start.”



Pair studies are contained in the same Activity Queue window as other studies. As the pair study runs, you can monitor its progress by clicking the various tabs as they appear in the bottom pane. It will first calculate the numbers of stations and pairs to be studied, and then it will run a baseline study of the stations on their original channels to determine existing interference conditions. Next, the software will take a sufficiently large run and break it into as many pieces as the number of assigned processes, and will run pair studies for every combination. Finally, the resulting data is post-processed and then output to the appropriate “out” directory, leaving six files which are documented in Appendix F.

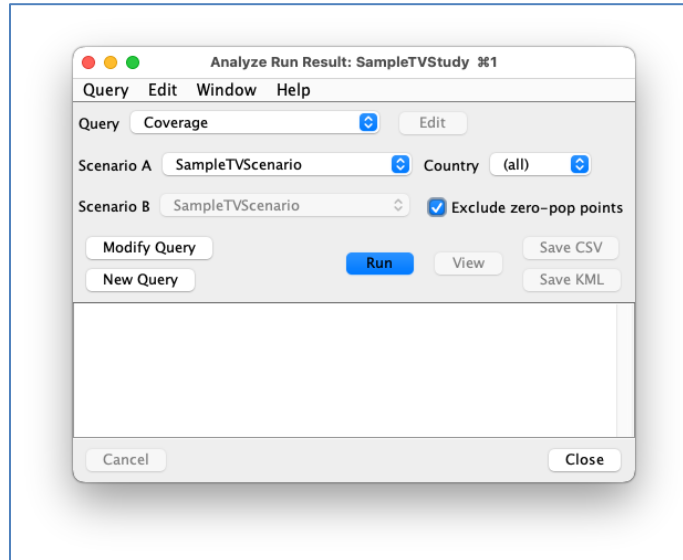
When you click “Remove,” the software will restore the database to its normal state.

Note that running a pair study will clear any results analysis data (see next page) from the database, and you will have to rerun your study normally in order to repopulate that data.

Analyzing the Results of General-Purpose Studies

TVStudy has the ability to perform analysis on the results of grid-based General-purpose studies, including the ability to conduct loss and gain analyses between the results of multiple scenarios in a study. In order to set it up, simply check the “Save results in database tables” checkbox in the Run window before running your study. Then, from the Study Manager window, with your study highlighted, select “Analyze Run Result...” from the “Study” drop-down menu.

Included Analysis Options



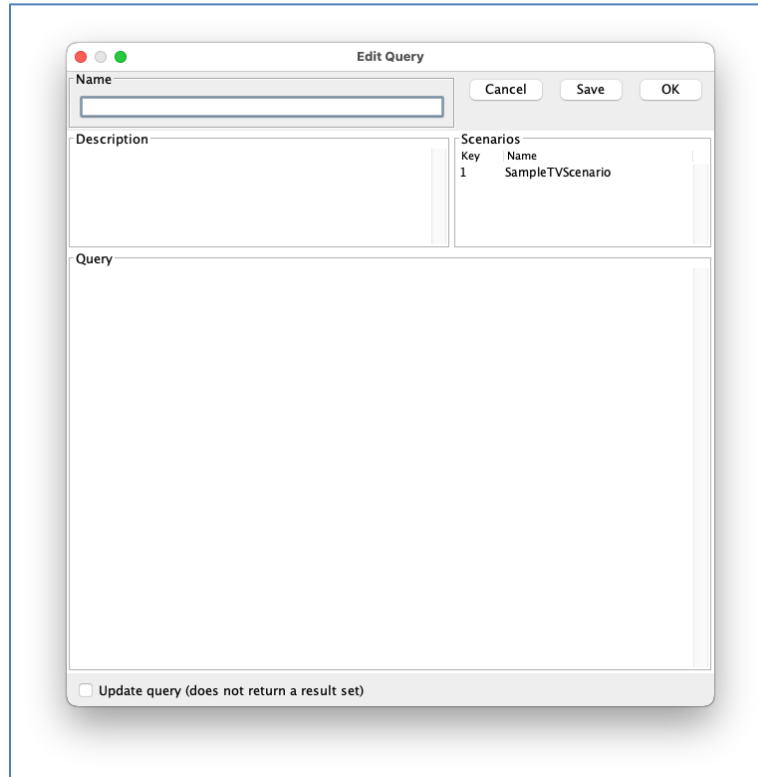
There are four analysis types included with TVStudy.

- **Coverage** – A simple analysis of the total area, population, and households of the scenario.
- **Coverage loss** – Calculates the area, population, and households lost when comparing Scenario A to Scenario B, without considering any gains.
- **Coverage gain** – Calculates the area, population, and households gained when comparing Scenario A to Scenario B, without considering any losses.
- **Coverage overlap** – Calculates the area, population, and households retained when comparing Scenario A to Scenario B.

The results are summarized in the text pane in the bottom half of the window. The resulting detailed data can be separately output as a CSV and/or KML file for use outside TVStudy, or viewed in a table. There is also an option to exclude zero-pop points, which can make the CSV and/or KML outputs more immediately useful.

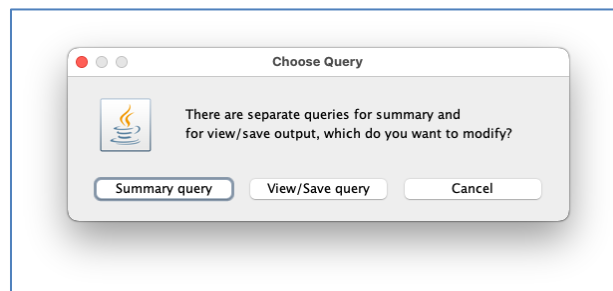
Creating a Custom Analysis

Alternatively, it is possible to conduct alternate analyses by creating a new query or custom-modifying an existing query. To create a new query, simply click New Query.

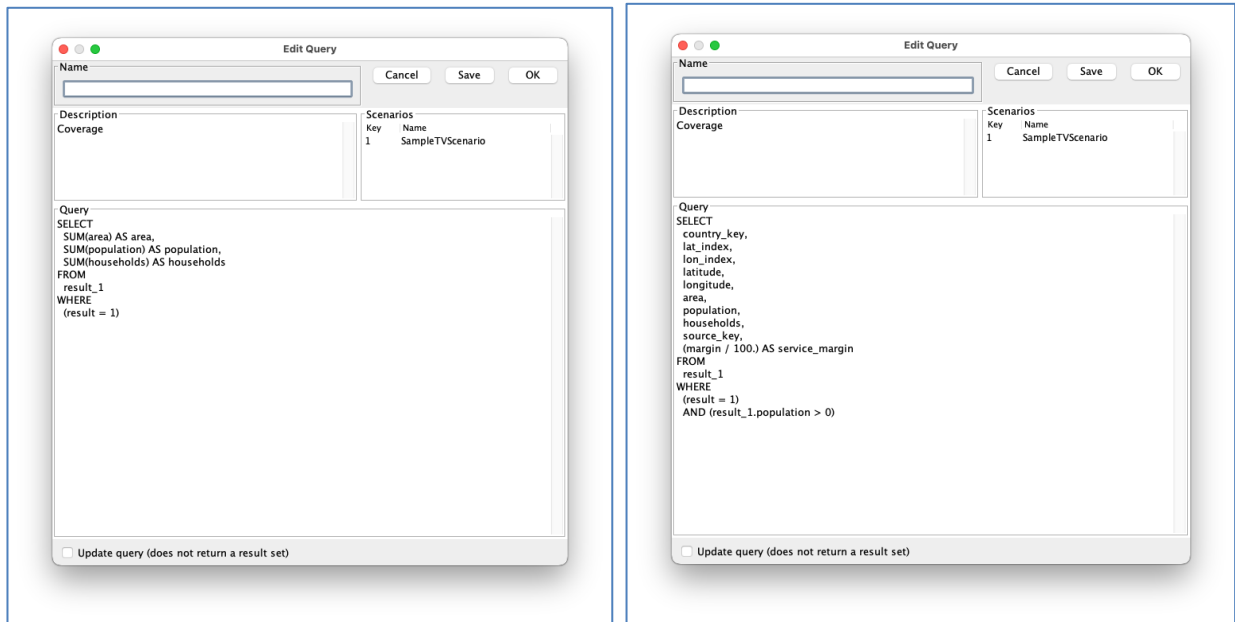


You can then write a MySQL query consistent with the steps and information found on the next page.

To use an existing query as the basis for a new one, first select the type of query from the drop-down menu, then click on Modify Query.



As these analyses have two different queries, it will ask you which one you want to modify. The summary query is the one that appears in the Analyze Run Results pane, while the View/Save query is the one that results in CSV or map output data.



Once you choose, you are given a window with the text of the existing query that you can use to create an alternate query. When finished, you have the option of either clicking OK and using it just this once, or naming and saving it for analyzing the results of scenarios in other studies in the future.

To draw data from a specific scenario, the table name is “result_<key>” (without quotation marks), where <key> is replaced with the number given in the “Key” column. The data contained in each scenario’s table is:

country_key	TINYINT	1 for US; 2 for Canada; 3 for Mexico.
lat_index	INT	Latitude of cell’s southeast corner in integer seconds.
lon_index	INT	Longitude of cell’s southeast corner in integer seconds.
latitude	DOUBLE	Latitude of the study point in decimal degrees.
longitude	DOUBLE	Longitude of the study point in decimal degrees (positive west).
area	DOUBLE	Area of the cell.
population	INT	Total population of the cell.
households	INT	Total households of the cell.
source_key	SMALLINT	Primary key of station record providing strongest service in the cell.
margin	SMALLINT	Margin in mB (divide by 100 for dB) for above source_key.
result	TINYINT	1 for Service; 2 for Interference; 3 for No Service.
service_count	TINYINT	Total number of stations providing service in the cell.

To output results to a KML file, the query must return results for each point of interest that have at least the fields latitude and longitude; any other fields in the results will be added to the point symbols in the KML file as metadata.

Further details on the construction of such queries are beyond the scope of this document.

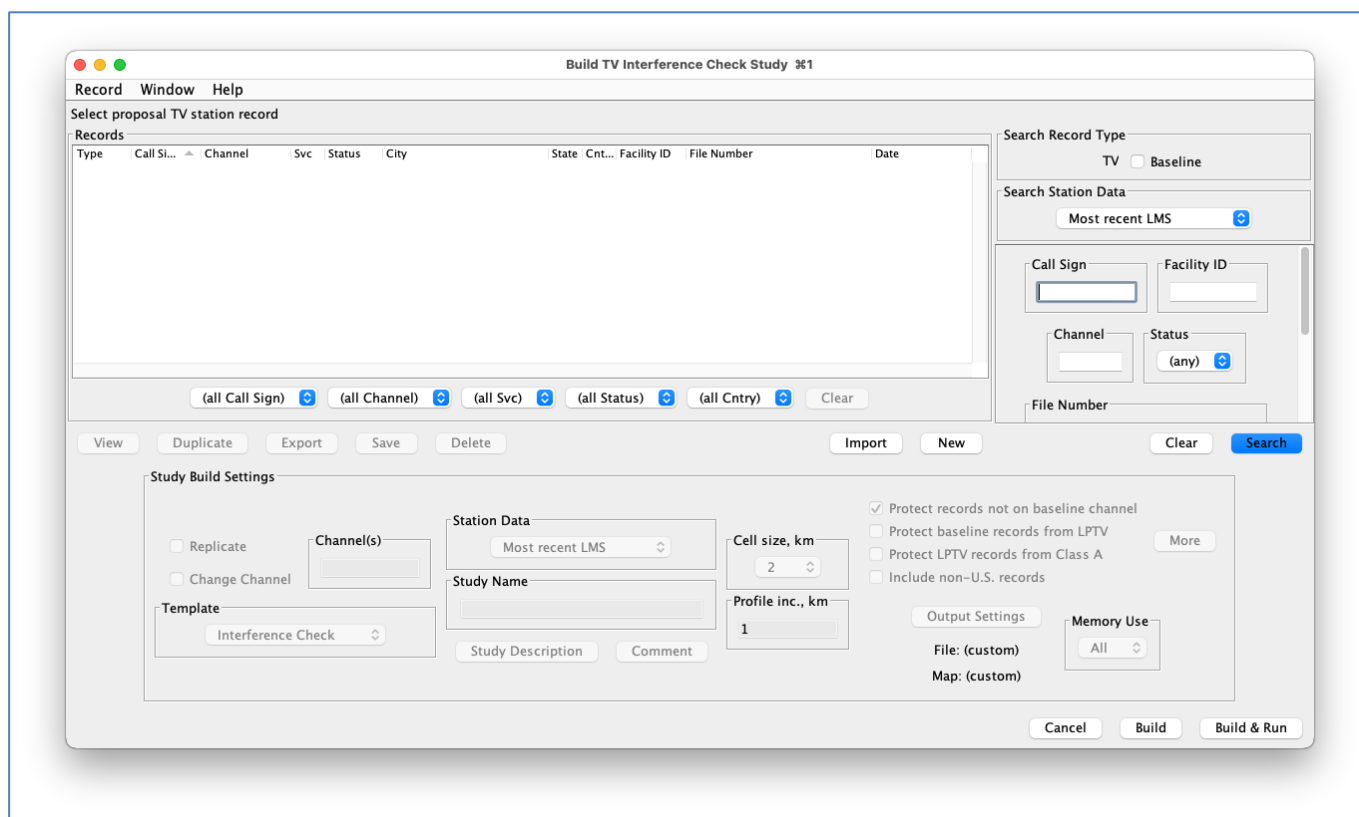
Configuring and Creating TV Interference Check Studies

TVStudy has the ability to run TV interference check studies; the kind of study that the FCC Media Bureau's *tv_process* software was previously used to produce for TV application processing, in which new applications can be evaluated to determine whether or not they meet the FCC's interference standards.

Creating and Running an Interference Check Study with the Wizard

Before creating a TV Interference Check study, you first need to be sure to import at least one LMS dataset, so that the TV Interference Check mode has a source from which to build studies.

Much of the process of creating and running an interference check study is automated, but you must start the process. To begin, from the Study Manager window, click "New study" and choose "TV interference check".



The Interference Check Study window strongly resembles the View Station Data window detailed on page 12 and can be operated in the same way. The key difference here is the added functionality at the bottom. This allows you to set the study description, cell size, profile resolution, and other items to modify the construction of the study.

(Note: A template must be locked with "Lock template only" in order to be used in an Interference Check study. Neither a template locked with "Lock template and study settings" nor an unlocked template can be used. See page 26.)

At the left, you will find two channel change options. If you choose to replicate, TVStudy will adjust the ERP to retain the existing contour size. If you choose to Change Channel, it will change the channel without adjusting the ERP. In either case, the Channel(s) field allows the selection of multiple channels at once, either separated by commas or ranges indicated with dashes, such as: 15, 31, 33-36.

Among the various settings, you will find a collection of checkboxes toward the right. The first checkbox is designed to assist in post-Incentive Auction application processing; if unchecked, applications dated before April 13, 2017 are only included in the study if the channel matches the channel in the baseline, preventing pre-auction records from being considered. The second checkbox was for LPTVs for planning immediately post-Incentive Auction; in the initial 90-day filing period, it may have been difficult for an LPTV station to determine what full-power and Class A facilities to protect until those stations filed their applications. This checkbox allowed an LPTV station to be tested against those baseline facilities before such applications had been filed. The next checkbox determines whether LPTV stations are included when evaluating a Class A application, and is now always on for applications filed after the end of the First Priority filing window and checked by default for all others. The final checkbox allows you to choose to include non-US records in the study build.

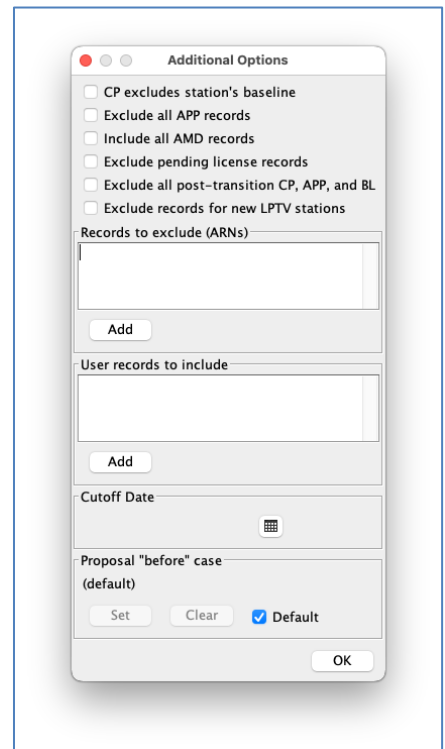
The More button provides additional options to customize your study. First is an option to treat CPs as if they are licenses for the purposes of building studies and thus exclude Baseline records if a CP is present. The next four options allow the exclusion of all applications, inclusion of all amendments in review status, exclusion of all pending records, exclusion of all post-transition records, or exclusion of all new LPTV applications. The next-to-last option allows studies to be conducted on the current universe of stations, rather than considering the post-repack environment. The last option excludes applications for new LPTV stations, which are ignored when filing for displacement.

After that, there is a box allowing you to exclude records from the analysis. To do so, put the ARN for each file number to be excluded on a separate line in the “Records to exclude (ARNs)” box. (As an example, if you wish to exclude BLCDDT-20090714AAW, you would input only 20090714AAW, leaving off the BLCDDT prefix. For LMS-filed records, input the entire file number, for example, 0000003746. For baseline records, input the facility ID.) You can also exclude groups of records based on call sign or facility ID. To do so, use the following syntax:

```
$facilityid = 70309
$callsign = WVIR-TV
```

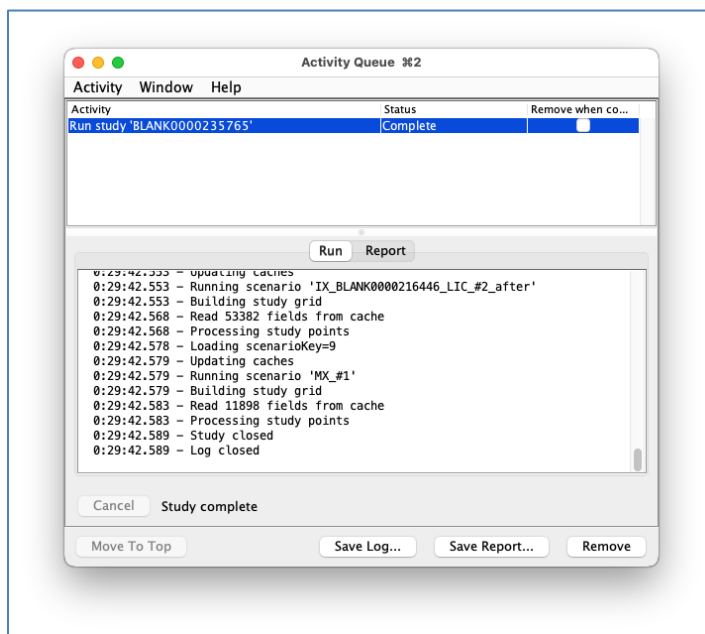
The next box allows you to include additional User records in your study. To do so, simply add the numerical Record ID(s) for the User record in question, with one on each line. To find this, view your User record(s) and look for the Record ID at the top of the View window.

In both boxes, you can use the respective “Add” buttons to search for records you wish to exclude or include.

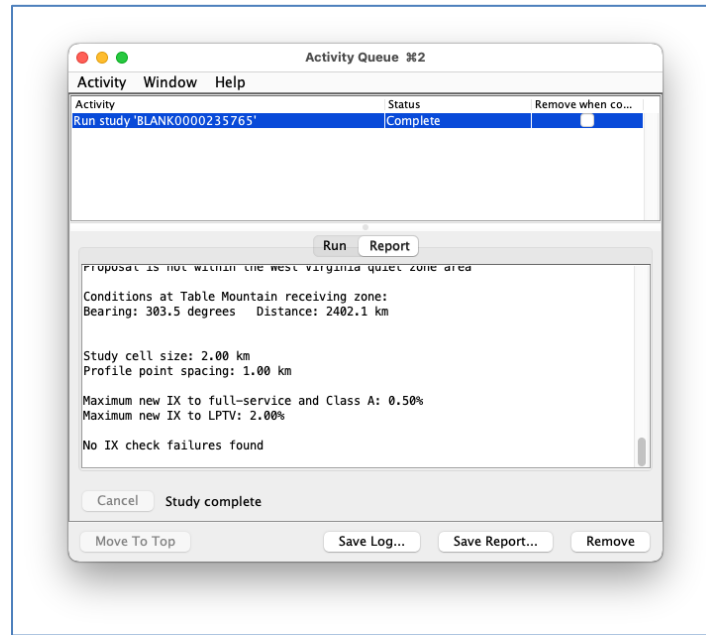


Below that is the Cut-off Date, which prevents applications filed after the date selected from being included in the study. Finally, you can select your study's "before" case, if it is different from the typical baseline value used for most full-power and Class A stations. This is particularly useful when evaluating channel swaps or determining absolute interference caused, but otherwise may be of limited utility. Note that the "before" case must be MX with the proposal, so to evaluate a swapped station, you may need to duplicate the other station's record and give it the same facility ID and channel number as your proposal, saving it as a User record, in order to use it as a "before" case. Click OK when finished in the More window.

When you are satisfied that you have selected or created the proper record with the proper study settings, click "Build and Run." (If you want to modify the study before it runs, you can instead choose "Build".) TVStudy will then warn you about any data issues it encounters (see page 51) and automatically generate the necessary scenarios and begin to run.



The Activity Queue window is the same as that used for General-purpose and Pair Study runs, with a pane of studies at the top and the selected study at the bottom. The bottom pane has a single Cancel button, like the General-purpose study, but now the pane has two tabs.



In addition to the Run tab that is present in General-purpose studies, Interference Check mode also has a Report tab, which contains a summary of the results of the coverage study when it is finished. This output mimics the output that *tv_process* would have provided, including a mention of whether or not an interference check has passed or failed. To save this output, click "Save Report..." at the bottom right. You can also save the log file and remove the study from the Activity Queue window at the bottom right.

Your output files, including the *tvixstudy.txt* file which mimics the output of *tv_process* are placed in a directory within the "out" directory, assuming the default output file location setting has not been changed.

Using the Advanced Mode

The Advanced mode allows you to create a TV Interference Check study from scratch, rather than having the wizard pre-select facilities to include. After creating one, you will be immediately prompted to add a proposal record. After that, the functionality for creating a study is identical to that of editing one in Advanced Mode. See the next section for more information.

Editing a TV Interference Check Study

Once created, whether by the wizard or in Advanced mode, TV Interference Check studies are fully configurable. While most of the features, such as study parameters, are identical to other study types, the Scenarios are configured differently. The explanation below will assume that you are working with a wizard-built scenario.

First, there are three types of scenarios shown. The first scenario is the "Proposal" scenario, containing the proposal and its "before" case, if it has one. The next group of scenarios are the "Protected Facility" scenarios, containing protected facilities. The final group of scenarios are the "Proposal Coverage" scenarios, which contain facilities that could potentially cause incoming interference.

In the Protected Facility and Proposal Coverage scenarios, the proposal application and the “before” case from the Proposal scenario do not appear. TVStudy, at run time, will apply those to each scenario, which allows any adjustments to the facilities in the Proposal scenario to reflect in all other scenarios at once. Within each scenario, some stations appear with the “Und” checkbox checked, and others are unchecked. If the wizard was used, it pre-calculates whether interference can ever occur to the protected station. If it can, “Und” is checked, and it will be considered for interference into the protected facility. If it cannot, then the station is included in the scenario since it is within the distance, but “Und” is unchecked since it does not need to be evaluated. **Important:** Despite this, it is kept in the scenario since, if it is MX with any other station in the scenario that does cause interference, scenarios need to be created with and without the interfering record.

Note that if you create a new scenario, you will be prompted to choose a protected facility, and then you may be prompted to select whether or not it is a "pre-baseline" record. In most cases, you will not be creating a pre-baseline record, but you may wish to do this if the record represents a facility that will cease to exist after the post-auction transition.

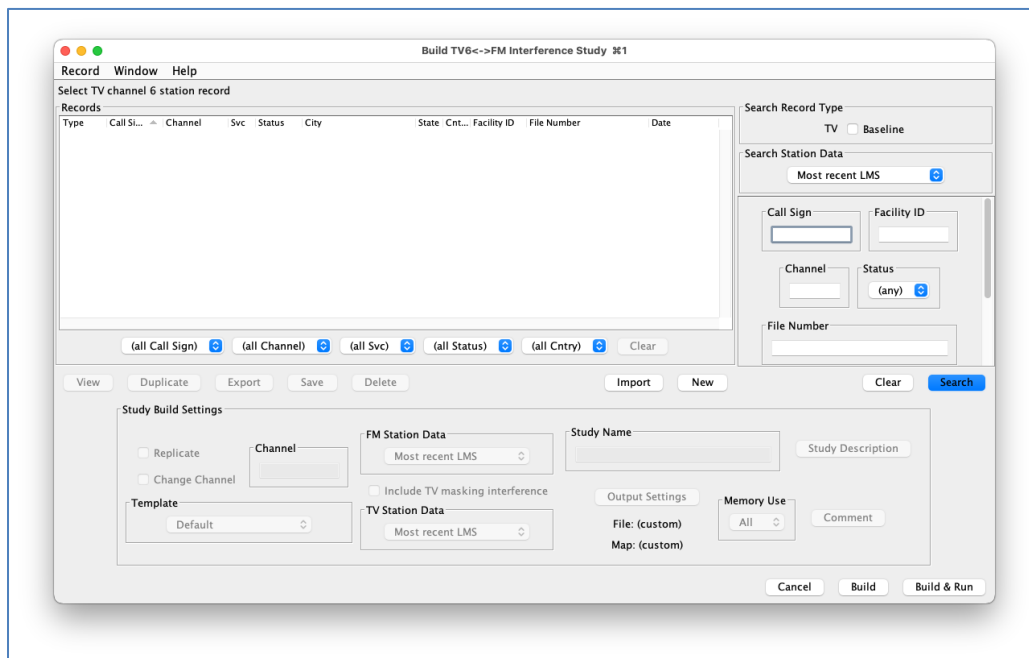
Creating a New TV6<->FM Study

TVStudy has the ability to run interference studies to determine interference between TV Channel 6 and FM. The study evaluates interference in both directions at once and can evaluate a single desired TV channel 6 station along with an assortment of undesired TV Channels 5 and 6 stations as well as both desired and undesired FM stations in the 88-92 MHz range.

In the TV into FM direction, the rule is simply that a showing must be made, with no explicit requirement of what the showing must contain. OET used some of the studies provided during the DTV transition as a basis for a method of computing this interference potential in TVStudy. In addition, an NPR study from 2009 was used as the basis for an alternative model for predicting FM interference into digital TV Channel 6. TVStudy allows the use of either this new method or the existing method via a study parameter (see page 98), and OET would appreciate informal user feedback on these alternative models. **Important:** Users are on notice that suitable procedures have not been established to define interference to digital television from FM stations through a notice and comment rulemaking, and that the results obtained from the use of this feature are therefore not binding on licensees or the Commission.

Using the TV6<->FM Study Wizard

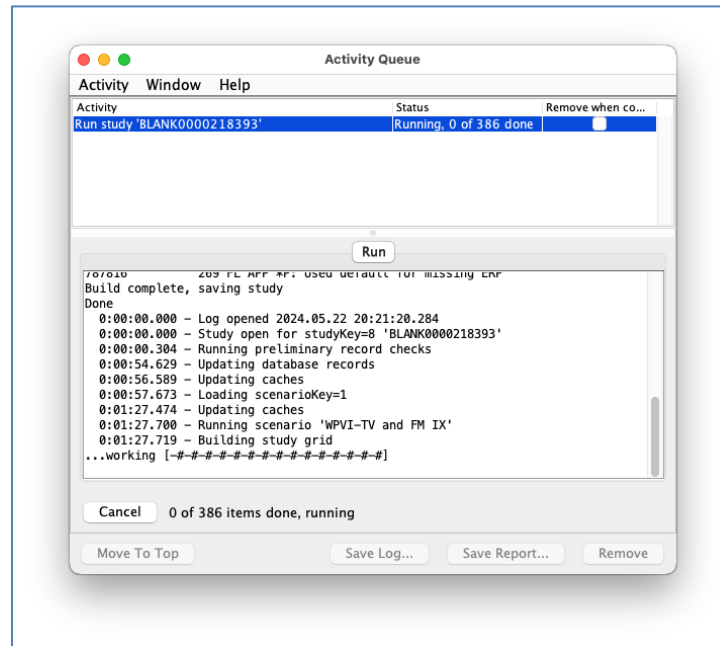
To create a TV6<->FM study using the study wizard, choose “TV6<->FM Interference” from the “New study” drop-down menu at the bottom left corner.



TVStudy now asks for the selection of a TV station, using the normal screens for selecting stations from a dataset. At the bottom are different options that apply only to TV6<->FM studies.

First, at the left, you can replicate or change the channel of a station not on channel 6 to channel 6 in order to evaluate it. You can also edit a record without saving for use in your study without using the replication function using the Duplicate function.

Next, select the FM station data you wish to use. You can also choose to include or exclude TV masking interference and choose the dataset from which to gather stations that might cause it. The name, description, output files settings, and memory usage can also be set here. Then you can either Build the study or Build & Run. Building the study allows you to modify it before running, while Building and Running starts the run as soon as the build is complete.



When finished, the result files, which are otherwise identical to the General-purpose output files, will show coverage and interference for both TV channel 6 and FM.

Using the Advanced Mode

The Advanced mode works exactly the same way as a General-purpose study, except that you will be immediately prompted to add a channel 6 TV station as soon as you create a scenario within the study. Then simply add FM and other channel 5 and 6 TV stations as desired. For more information, see the instructions for working with General-purpose studies on page 44.

Creating and Running Wireless to TV Interference Studies

Wireless to TV interference studies in TVStudy apply the procedures described in OET Bulletin No. 74⁸ to determine interference between wireless and a single victim TV station.

Culling distances are based on the distance between the closest point on the TV station contour and the location of the wireless site and distances are calculated in TVStudy using the cosine method of calculating distances. If you wish to edit the culling distances, you can do so on the wireless tab of the study parameters so long as the study settings of the study template are not locked.

Please note that TVStudy can evaluate interference with respect to analog TV stations, but all of the spectral overlap and D/U parameters for analog are the same as for digital, which may or may not be appropriate, so this behavior is considered experimental.

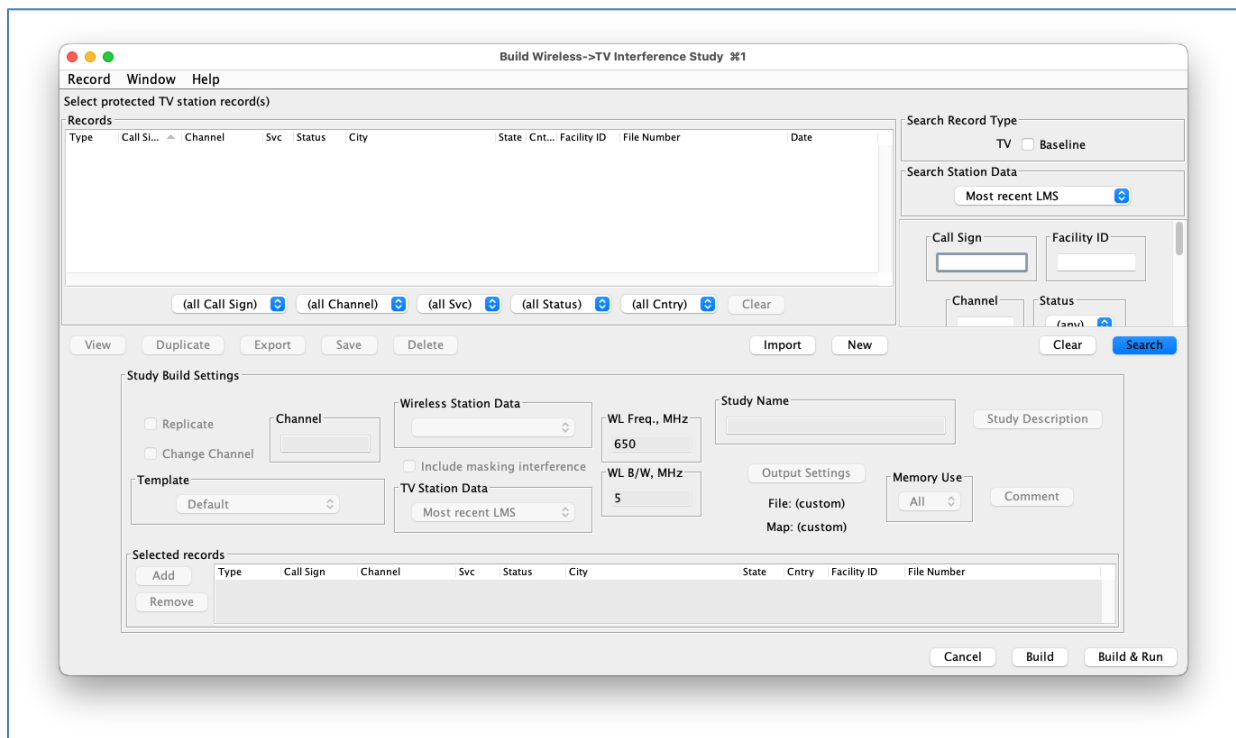
There are two ways to set up and run a Wireless to TV interference study; via the study wizard or using the advanced wireless to TV study windows.

Using the Wireless to TV Study Wizard

To create a wireless to TV interference study using the study wizard, you will first need to import a wireless site dataset and corresponding wireless antenna dataset. See the “Managing Datasets” on page 9 and Appendix B on page 100 of this manual for information on how to do this.

Once you have imported your wireless/antenna datasets, you are ready to create a new Wireless to TV interference study using the study wizard. To begin, choose “Wireless to TV Interference” from the “New study” drop-down menu at the bottom left corner.

⁸ <https://www.fcc.gov/bureaus/oet/info/documents/bulletins/oet74/OET74.pdf>



At the top of the window, you can search for and choose the victim TV station from any of the existing CDBS/LMS datasets or you can import or create a new a TV station record to serve as the victim TV station. To search an existing dataset, select the dataset from the top drop-down menu and enter any other search criteria. To list all TV stations in a dataset, simply click the “Search” button without entering any other criteria. You can also filter search results using the filter criteria below the search results window. In order to select more than one station to build studies with, use the “Add” button at the bottom left to add each record you wish to study to the “Selected records” pane at the bottom. In this way, the wizard will allow you to set up multiple victim station studies at once. Alternatively, you can select a single station and then click “Build & Run” to test a single station without using the “Selected Records” pane.

To import a TV station via XML you can click on the “Import” button and select your XML file with the TV station data. You will be asked to choose an existing CDBS/LMS dataset to resolve any XML references to record IDs. You can also create a new TV user record from this window by clicking on the “New” button and filling in the TV user record form and then clicking “Save”.

Near the bottom of the window, in “Study Name,” type a name for your study. You will want to avoid special characters and limit the length to a reasonable number of characters, since this name is used to create the path for your output files.

Below that, you must choose a study template to use. The Default template will always be present. Additional templates may be added to allow you to pre-select parameters for your study. The FCC may distribute templates for specific types of studies to help ensure that TVStudy users obtain consistent results. Learn how to create and manage study templates on page 25.

Immediately beneath that is a button which will allow you to add a description of your study.

To the right, you must choose a wireless dataset to use to find interferers for the study. Additionally, you can choose whether or not masking TV interference is to be considered and, if so, from which database those interfering stations should be retrieved.

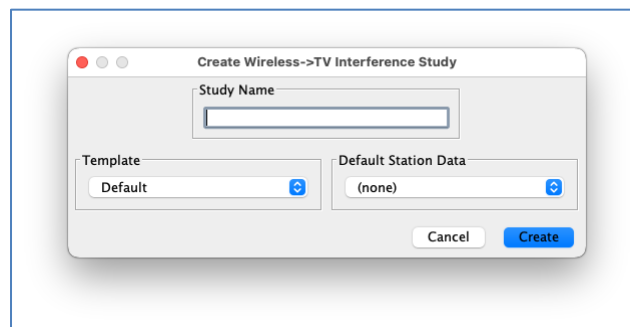
Finally, enter the appropriate wireless frequency and bandwidth to evaluate against the victim TV station in question. The study settings of the template selected must be unlocked in order to set the appropriate wireless center frequency and bandwidth.

Once you have completed all of the above, click “Build” to build the study or “Build & Run” to both build the study and run the analysis. If you have selected a database from which to pull masking TV interferers, your study will include any undesired co-channel or adjacent channel TV stations within the distance specified by the rules in the template.

Using the Advanced Mode

If you wish to create a wireless to TV interference study via XML import or create multiple scenarios within the same study, you can use the advanced mode to create an empty study and then add one or more scenarios.

To build a new scenario in the advanced mode, click “New” at the bottom of the Study window and select “Wireless to TV Interference (advanced)”.

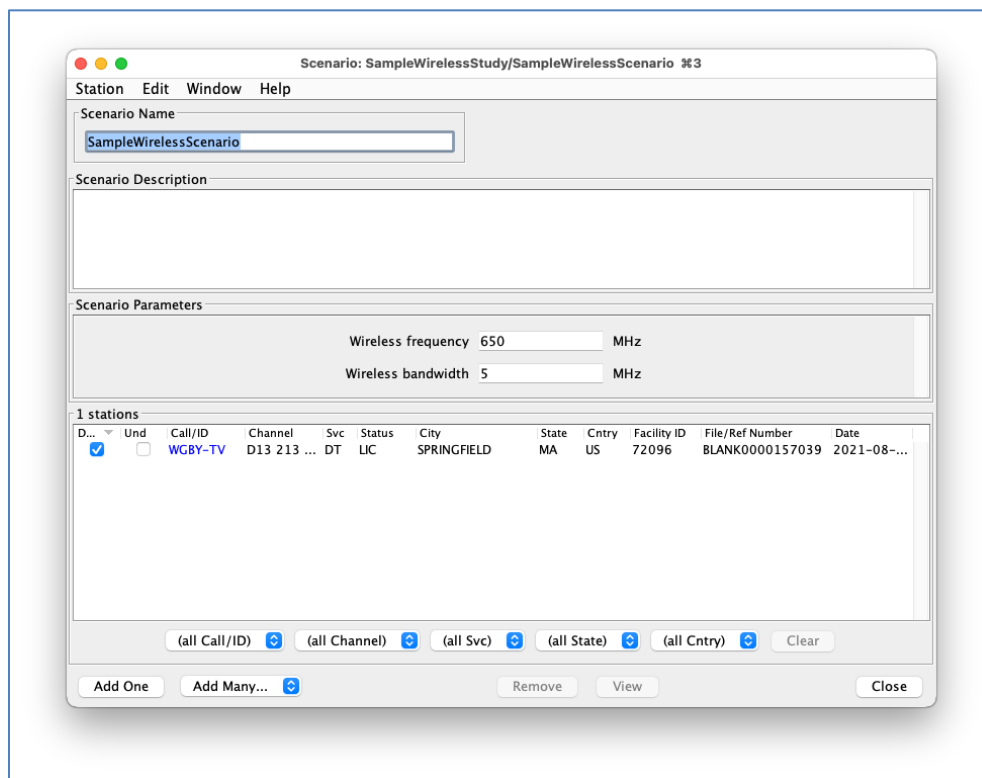


Provide a Study name, select the study template to use, and select the CDBS/LMS TV station dataset for the study to use. Once you have done this, click “Create”.

An empty study window will appear, similar to that of the General-purpose study modes. From this window you can import one or many XML scenarios or you can manually build the scenario from existing databases. To import an entire scenario, click on the “Import” button at the bottom of the window and select your XML scenario file.

To manually add a scenario, click on the “New” button at the bottom of the study window. A New Scenario window will appear which allows you to select your victim TV station from any of the existing TV databases. If desired, you can import a single TV station record from an XML file or create a new TV user record. At the bottom of the window, provide a name for your new scenario. Finally, click “Create” at the bottom right corner of the screen to create your new scenario.

Note that once you have selected your victim TV station, you will be unable to remove it from the scenario. The only way to change your victim TV station is to create a new scenario.



To add interferers to your new scenario, click on the “Add One” or “Add Many” button. Select the wireless database from which you want to import new interfering sites. If you are only adding one new site, enter the search criteria, import a new interfering site from XML, or create a new one from scratch.

When adding many, all relevant sites in the database which you select are added. If you are adding sites from a TV database, all TV stations within distances as specified by the rules will be added to the scenario. When adding sites from a wireless database, all sites in the selected database will be added to the scenario.

Be sure to set your wireless frequency and wireless bandwidth as appropriate.

To run the study, Save and Close the study, and then click the Run button in the Study Manager window. An Activity Queue window similar to that of the General-purpose study mode will appear. For more information on how to use it, see page 65.

Managing Studies

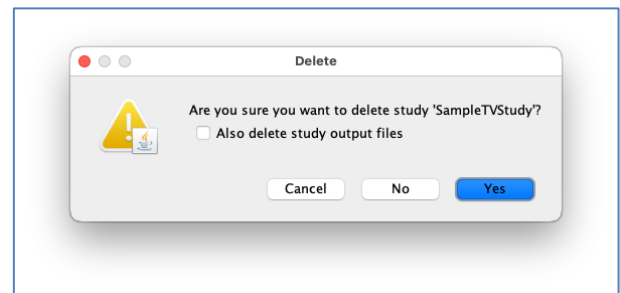
Duplicating a Study

Much like duplicating a scenario, you can also duplicate an entire study. To do so, select “Duplicate” from the Study dropdown menu. You are prompted to give the duplicated study a name, and then TVStudy immediately opens up the new duplicate study for you, on the assumption that you will immediately wish to make modifications. When finished, simply close the Study window as usual and you will now be able to see both studies.

Deleting Studies

To delete a study, click on the study, then select “Delete” from the Study drop-down menu. If you wish to delete multiple studies, you may hold the Ctrl or Command key, as appropriate for your operating system, and select multiple studies before choosing the “Delete” menu option.

You will be allowed to choose whether or not to delete the associated output files. This will only work if those data files have not been relocated and the study name has not been changed. If you’ve selected multiple studies, you will also be offered a “Yes to all” option to avoid having to confirm the deletion for each study.



Refreshing the Study Manager

TVStudy is designed for use in a multi-user environment, so it is possible for studies to be created by several users working simultaneously. However, these may not immediately automatically display in each user’s study manager. The list is refreshed automatically once per minute; to refresh the study manager immediately, select “Refresh List” from the Study dropdown menu.

Unlocking Studies and Editors

If a study appears in gray, this means that it is locked. In a multi-user environment, this may mean another user is currently editing the study, and the study is locked to prevent conflicting edits. However, in a single-user environment this often comes about when the software is closed incorrectly or crashes. In these cases, TVStudy provides an option to unlock a study.

To unlock a study, click the study, then choose “Unlock” from the “Study” drop-down menu.

Similarly, geographies and receive antenna patterns can suffer from conflicting edits and have a similar locking function. Should you find that one or both are locked, choose “Clear Edit Lock” from the “Database” drop-down menu.

Get Info

To get additional technical details on how a study is stored in TVStudy, choose “Get Info” from the “Study” drop-down menu. This will provide information such as the output file directory and the study’s primary key in the MySQL database.

Using Folders

Studies can be organized into folders. This is a purely visual feature for organizing studies in the Study Manager window, meaning that the folders do not get reflected in the locations of the output files when running a study. Note that once folders are in use, it is possible to temporarily return to the “flat” view without folders by choosing “Hide Folders” from the Study drop-down menu.

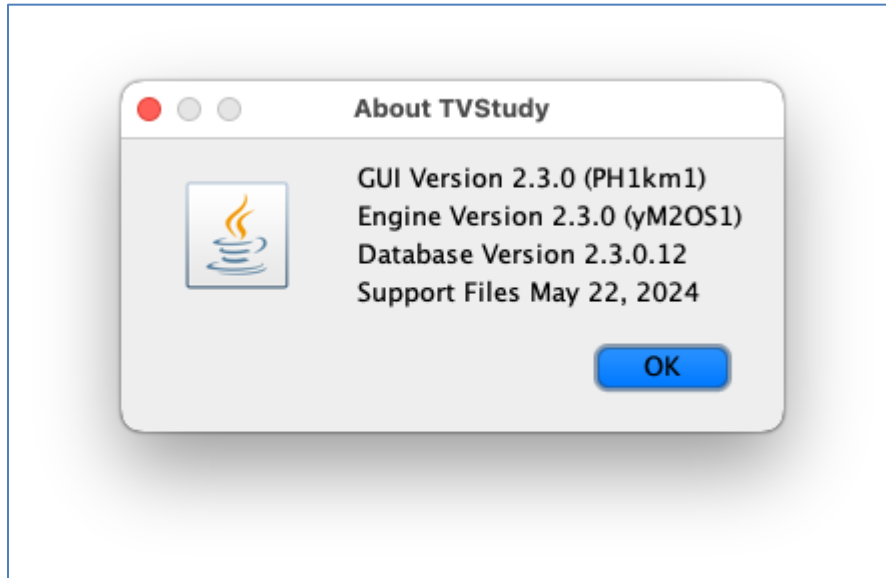
To use folders, first create one by selecting “New Folder” from the Study drop-down menu and providing a name. Note that you can also rename folders from the Study menu. To move a study into a folder, click on the study and then choose the folder in question from the Move To Folder item in the Study drop-down menu.

To delete a folder, first you must empty its contents, either by deleting them or moving them to either another folder or back to the main level. Then, select the folder you wish to delete and choose Delete from the Study drop-down menu.

Using the TVStudy Help Menu

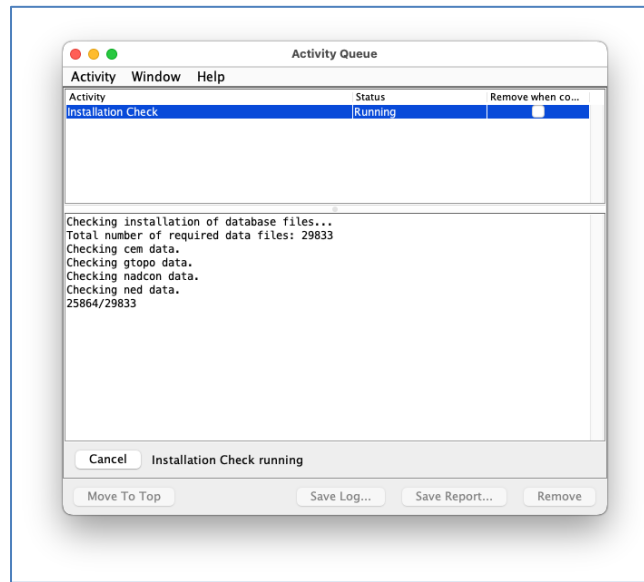
The TVStudy Help menu has four options, designed to help you use and maintain TVStudy.

About TVStudy



The About TVStudy menu option shows you the version number of the graphical user interface (GUI), the TVStudy engine, the database, and the support files. This may be helpful for troubleshooting issues if an upgrade from one version to another does not complete successfully.

Check Installation

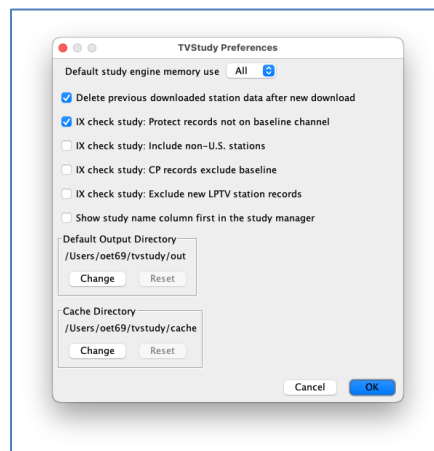


This option verifies all of the files in the dbase directory to ensure that none of the files are corrupt, missing, or inaccessible. It requires the Terrain Database Test and Verification Utility in order to function, which is available as a separate download on the TVStudy website. The utility must be placed in the dbase/ directory.

Documentation

The Documentation menu option will display this manual. Note that a copy of this manual must be located in the help/ directory of TVStudy and be named "manual.pdf".

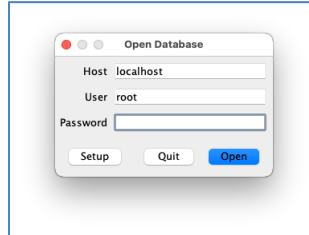
Preferences



The Preferences menu option will display a short set of preference settings that may be adjusted for TVStudy. Note that changing the Output Directory or Cache Directory will not relocate those existing directories, and will only write new data to the newly-specified location.

Closing TVStudy

When closing TVStudy on the Mac, never use the quit (⌘Q) command. This can leave the database in an unclean state, and any unsaved changes will be lost. Instead, you should always quit by using the red dot (●) in the top left corner of each window, until you are back at the “Open Database” window.



In the “Open Database” window, click “Quit.” The quit button will become active only when all of the other TVStudy windows are closed and it is safe to quit.

Troubleshooting TVStudy

If you find you are unable to open a study, the study may be locked. A study is locked when it is being edited, either by you or another user, or when it is being used to run a study. If a study fails part way through, it may leave the database in an unclean state, including a state in which a lock may remain on the study in question even though that study is not in use. To resolve this, click on the study in question in the Study Manager window, and select “Unlock” from the Study dropdown menu. (See page 83.)

It is uncommon, but not impossible, to experience data corruption issues or similar unexplained events, and you may want to try remedying them by clearing the cache. TVStudy creates a large number of cache files in order to make multiple scenario runs in a study run faster, but if this cache becomes corrupt, unexpected behavior could occur. To clear the cache, click on the study in question in the Study Manager window, and select “Clear Cache” from the Study dropdown menu. Cache data files can also consume a large amount of disk space that can be recovered by clearing the cache on studies that are not actively being used. Once the cache is cleared, the calculations used to create the cached results will have to be repeated.

Should you encounter any lingering issues after conducting a study, you may consider clearing out unused records. The “Run Pair Study...” function creates multiple scenarios that are hidden from the user, but remain stored in cache after the run is finished, and other study types which have replicated records in them can also leave hidden records behind. To clear such records, open the study in question, then select “Delete Unused Records” from the Scenario dropdown menu.

Many others issues are discussed in the [TVStudy FAQ](#), so be sure to check there for information.

Contact Information

If you encounter any problems and wish to speak with someone at the FCC about TVStudy, please e-mail Mark J. Colombo at the following address: mark.colombo@fcc.gov

APPENDIX A

Study Parameters

This appendix lists all of the study parameters available. It also notes which parameters can be set differently for **Each country** versus which apply to **All countries**, as well as which kinds of studies each is available for. (“**T**” means TV and wireless to TV, “**X**” means TV IX Check only, “**W**” means wireless to TV only, “**F**” means FM, “**6**” means TV6<->FM.)

Analysis

Grid type	All countries	T			
Type of cell grid used to measure coverage area and population in the study. <ul style="list-style-type: none"> Global – Generates a uniform, global grid that all stations share. Local – Generates grids unique to each station location. (Not permitted for OET-74.) 					
Cell size	All countries	T	6	F	
Nominal length of each side of a square grid cell, in kilometers.					
Study point location	All countries	T	6	F	
In conjunction with the next parameter, controls where the study point is located in each cell. <ul style="list-style-type: none"> Population centroid – The study point is at the population-weighted centroid of the cell. Cell center – The study point is at the center of the cell. Largest population – The study point is at the Census point with the largest amount of population contained in the cell. All population – Use all of the population points individually. In this mode, each cell could have multiple study points. Highest elevation – The study point is at the point of highest elevation in the cell. 					
Move study point to nearest Census point	All countries	T	6	F	
Determines whether the study point is moved to the nearest Census point, if applicable.					
U.S. population⁹		T	6	F	
Data is available from the U.S. Census for 2000, 2010, and 2020.					
Canadian population⁹		T	6	F	
Data is available from the Canadian Census for 2006, 2011, 2016, and 2021.					
Mexican population⁹		T	6	F	
Data is available from the Mexican Census for 2010 and 2020.					
Round population coordinates	Each country	T			
The FCC’s Media Bureau tv_process application processing software rounds Census Block coordinates to the nearest integer second. If checked, TVStudy will round population coordinates in the same way.					
Default service area method	Each country	T	6	F	
Method used for defining the study area for each station. These are described in full on page 22. <ul style="list-style-type: none"> FCC curves FCC plus distance FCC plus percent Longley-Rice percent above Longley-Rice length above Longley-Rice length below Longley-Rice line fit Constant distance 					

⁹ Selecting “None” will disable population counting for that country and TVStudy will not report land area separately for that country; total land area will instead be reported.

Distance or percent for default method	Each country	T	6	F	
If applicable, the distance in km or percent number associated with the default contour method.					
Maximum desired signal distance	All countries	T	6	F	
A limit on any terrain-sensitive desired signal calculation in any mode, similar to the distance limits in interference rules which restrict undesired signal calculations. It does not directly limit distances to FCC contours, but it does apply to grid points within a contour. Points inside a contour but beyond the distance limit are not actually studied; in these cases, the desired field strength is set to -999 and undesired signals are not calculated.					
Cap TV D/U ramp function	All countries	T	6		
Allows a cap to be placed on the value of the D/U ramp function for TV stations.					
TV D/U ramp function cap	All countries	T	6		
If enabled by the above parameter setting, the cap on the D/U ramp function for TV stations.					
Adjust FM D/U for IBOC	All countries		6	F	
When checked, applies a formula derived from the formula defined in DA 10-208 to calculate IBOC interference to adjacent-channel FM stations. When unchecked, the presence of IBOC interference is ignored.					
Include DTS self-interference	All countries	T	6		
Include calculations for DTS self-interference.					
Propagation speed	All countries	T	6		
For DTS self-interference, the propagation speed used to compute the arrival times of the signals of the multiple DTS transmitters.					
Pre-arrival time limit	All countries	T	6		
Amount of time before arrival of the strongest DTS transmitter signal that a receiver is expected to be able to handle.					
Post-arrival time limit	All countries	T	6		
Amount of time after arrival of the strongest DTS transmitter signal that a receiver is expected to be able to handle.					
Required D/U	All countries	T	6		
For signals arriving before the pre-arrival time limit or after the post-arrival time limit, the D/U ratio required for interference-free reception of strongest DTS transmitter signal.					
Undesired % time	All countries	T	6		
The undesired time percentage used to determine if DTS self-interference occurs.					

CDBS/LMS

Respect DA flag	All countries	T	6	F	
In CDBS/LMS, there may be stations which have an antenna pattern ID specified, but are flagged as “non-directional.” The default behavior of TVStudy is to ignore the flag and use the antenna pattern specified, if present. Checking this box means that the flag will always be respected (potentially ignoring directional antenna pattern data when present), and this box is now checked by default in the Interference Check template.					
HAAT radial count	Each country	T	6	F	
Defines the number of radials used to compute HAAT for TV and FM stations.					
Mexican ERP and HAAT values		T	6	F	
In CDBS/LMS, there may be Mexican allotments that lack ERP and HAAT values. These settings control what ERP and HAAT values are assigned to those allotments.					
[First/Last] TV channel	All countries	T	6		
Sets the lower/upper channel limit used for importing data from CDBS/LMS.					

Search

Check individual DTS transmitter distances	All countries	T	6		
When checked, this option uses the culling distance with regard to each DTS transmitter site to determine potential interference cells or stations, rather than only using the reference coordinates. When unchecked, only the reference coordinates are used to determine potential interference cells or stations.					
Co-channel MX distance	All countries	T	6	F	
This constant determines when two stations are considered to be mutually exclusive (MX) for the purposes of creating a scenario. Setting this value to zero disables this check; however, other checks for mutual exclusivity may still be applied, such as when the city, state, country, and channel are all the same between two records.					
Rule limit extra distances (and break points)	All countries	T	6	F	
These constants control the distance in kilometers beyond the distance specified in OET Bulletin No. 69 that a distance-based query will search for interferers for stations. Adding extra distance can help ensure that all possible interferers are considered. For stations which are not full-power UHF, the ERP will be normalized to the full-power UHF value before applying the distances here, and the break points are in kilometers and adjustable as well.					
Use maximum signal distance as rule extra	All countries	T	6	F	
Uses the maximum signal distance found in the Analysis tab as the rule limit extra distance, ignoring all other values.					
Spherical earth distance	All countries	T	6	F	
This constant specifies the spherical earth distance in kilometers per degree of arc. This constant is used for distance and bearing calculations as well as calculating depression angles in True Geometry mode.					

Contours

Contour radial count	Each country	T	6	F	
Number of radials used to project the contour. If using the FCC curves contour method and this value is different from Contour HAAT radial count, HAAT values are interpolated between lookup values.					
[Digital/Analog] TV full-service contour	Each country	T	6		
Controls the relevant thresholds (for each band) used to project the TV service contours.					
[Digital/Analog] Class A/LPTV contour	Each country	T	6		
Controls the relevant thresholds (for each band) used to project the LPTV and Class A TV service contours.					
Use UHF dipole adjustment	Each country	T			
Controls whether or not a “dipole adjustment” is applied to the service threshold at UHF.					
Dipole center frequency	Each country	T			
Sets the center frequency for the UHF dipole adjustment.					
FM full-service [(all)/class B/class B1] contour	Each country		6	F	
Controls the relevant thresholds used to project the service contours.					
[FM NCE/LPFM/FM translator] contour	Each country		6	F	
Controls the relevant thresholds used to project the service contours.					
TV contour maximum distance	Each country	T	6		
These options restrict the propagation model prediction area to within these distances. A setting of 0 disables them.					

FCC Contours

Average terrain database	All countries	T	6	F	
Terrain database used for contour calculations. ¹⁰					
Average terrain profile resolution	Each country	T	6	F	
Number of points per kilometer used to calculate the average terrain along each radial for a TV or FM station.					
Use elevation patterns	Each country	T	6	F	
Controls how elevation patterns are used to project contours. <ul style="list-style-type: none"> • Never – The elevation pattern is never used to project contours. • Full-service TV only – The elevation pattern is used to project contours for full-service TV stations only. • All stations – The elevation pattern is always used to project contours for every station regardless of class. 					
Use real elevation patterns	Each country	T	6	F	
Allows the use of actual antenna elevation patterns for contour projection for all stations. If not selected, generic patterns are always used, or no elevation pattern is used if the “Use generic patterns by default” parameter is also unchecked, even if actual elevation pattern is available.					

¹⁰ TVStudy includes 30-second, 3-second, and 1-second terrain data. The search order for terrain databases is usually CDED, CEM, NED, USGS, SRTM, then GTOPO. This search order applies if data is missing from the preferred terrain database, beginning with the preferred database for the selected terrain database. This means that if 3-second terrain is selected, it will search other 3-second terrain databases, then the 30-second GTOPO terrain database, but not the 1-second terrain databases.

Derive azimuth pattern	Each country	T	6	F	
For stations with mechanical beam tilt and real elevation patterns, computes an azimuth pattern for use when projecting the contour.					
FCC curve set, [digital/analog/FM]	Each country	T	6	F	
Controls which F-curve set is used to calculate the contour for digital TV/analog TV/FM stations.					
Lookup method below curve minimum distance	All countries	T	6	F	
<p>In certain cases, station power may be so low that there is no contour distance available from which to project the contour. In these cases, you can choose TVStudy's behavior.</p> <ul style="list-style-type: none"> • Free-space – When no curves data is available, use free-space calculations. • Scaled free-space – When no curves data is available, use free-space calculations but scale them to prevent discontinuities with the curves data. • None – When no curves data is available, use the value of the last available data point. 					
Contour HAAT radial count	Each country	T	6	F	
Number of radials to use for HAAT lookup during contour projection. This setting is ignored if using one of the Longley-Rice contour methods.					
Contour HAAT radial count, LPTV	Each country	T	6	F	
Number of radials to use for HAAT lookup during contour projection for LPTV stations. This setting is ignored if using one of the Longley-Rice contour methods.					
Minimum HAAT	Each country	T	6	F	
Minimum height above average terrain used to project contours.					
Average terrain [start/end] distance	Each country	T	6	F	
Distance where terrain samples begin/end for calculation of HAAT and projection of contours.					
Truncate DTS service area	All countries	T	6		
If checked, TVStudy limits the coverage areas of DTS stations to the DTS distance limits.					
DTS distance limit	All countries	T	6		
By default, these are the DTS coverage limits specified in the Table of Distances ¹¹ . These values are used only if Truncate DTS service area is checked and no value is provided in the station record. The F(50,50) and F(50,10) values found in the 2021 DTS rules are hard-coded, and if a distance value is provided in the station record, are computed at run time.					

L-R Contours

Terrain database	All countries	T	6	F	
Terrain database used for Longley-Rice contour calculations. ¹²					
Profile resolution	All countries	T	6	F	
Number of points per kilometer used to retrieve the terrain path profile along each radial for a TV or FM station.					
Calculation distance increment	All countries	T	6	F	
Target distance between calculated signal points along each radial. Calculations occur at the profile distances.					

¹¹ See 47CFR §73.626(c).

¹² TVStudy includes 30-second, 3-second, and 1-second terrain data. The search order for terrain databases is usually CDED, CEM, NED, USGS, SRTM, then GTOPO. This search order applies if data is missing from the preferred terrain database, beginning with the preferred database for the selected terrain database. This means that if 3-second terrain is selected, it will search other 3-second terrain databases, then the 30-second GTOPO terrain database, but not the 1-second terrain databases.

[Digital/Analog] desired % location	All countries	T	6	F	
Longley-Rice statistical parameter specifying the percentage of locations expected to get service.					
[Digital/Analog] desired % time	All countries	T	6	F	
Longley-Rice statistical parameter specifying the percentage of time service is expected.					
[Digital/Analog] desired % confidence	All countries	T	6	F	
Longley-Rice statistical parameter specifying the confidence (situational variability) that service is expected.					
[Digital/Analog] undesired % location	All countries	T	6	F	
Longley-Rice statistical parameter specifying the percentage of locations expected to get interference.					
[Digital/Analog] undesired % confidence	All countries	T	6	F	
Longley-Rice statistical parameter specifying the confidence (situational variability) interference is expected.					
Receiver height AGL	All countries	T	6	F	
Receive antenna height above ground, in meters.					
Signal polarization	All countries	T	6	F	
Polarization of transmitted signal.					
Atmospheric refractivity	All countries	T	6	F	
Refractivity referenced to mean sea level, in N-units.					
Ground permittivity	All countries	T	6	F	
Relative ground permittivity.					
Ground conductivity	All countries	T	6	F	
Ground conductivity in Siemens per meter.					
Service mode	All countries	T	6	F	
Longley-Rice model parameter.					
Climate type	All countries	T	6	F	
Climactic zone.					

TV Replication

Replication method	Each country	T	6		
Controls how replication of stations onto different channels is performed. <ul style="list-style-type: none"> • Derive Pattern – Adjusts the ERP and antenna pattern to closely match the original contour. This usually results in a change to the azimuth pattern of the station. • Equal Area – Adjusts the ERP to match the geographic area enclosed by the original contour. This setting maintains the original azimuth pattern but may slightly change the contour distances. 					
Digital full-service [minimum/maximum] ERP	Each country	T	6		
These values set the minimum/maximum ERP used in replication of full-service stations on each TV band.					
Digital Class A/LPTV [minimum/maximum] ERP	Each country	T	6		
These values set the minimum/maximum ERP used in replication of Class A and LPTV stations on each TV band.					

Patterns

(These parameters only apply to TVStudy's handling of TV or FM antenna patterns.)

Depression angle method	Each country	T	6	F	
Controls how depression angles are calculated. <ul style="list-style-type: none"> • Effective height – This method approximates the depression angle using height above ground level, mirroring the behavior of tv_process. • True geometry – This method calculates the actual depression angle using curved-Earth geometry and heights above mean sea level. 					
Use mechanical beam tilt	Each country	T	6	F	
<ul style="list-style-type: none"> • Never – Never apply mechanical beam tilt values. • Always – The mechanical beam tilt values specified in CDBS/LMS will always be applied to the antenna elevation pattern. • Real patterns only – The mechanical beam tilt values specified in CDBS/LMS will only be applied to stations for which real elevation patterns are provided (either from CDBS/LMS or user-entered). 					
Use generic patterns by default	Each country	T	6	F	
If checked, the generic OET69 elevation pattern will be applied. If unchecked, a non-directional elevation pattern will be used.					
Mirror generic patterns	Each country	T	6	F	
The generic OET Bulletin No. 69 elevation pattern does not specify field values for depression angles less than 0.75° and so a value of 1.0 is assumed above that depression angle. Checking this box creates a symmetric elevation pattern with a maximum field value of 1.0 at 0.75° (or some other depression angle, depending upon the other parameter settings).					
Beam tilt on generic patterns	Each country	T	6	F	
These options control how beam tilt is applied to the generic OET Bulletin 69 elevation pattern. <ul style="list-style-type: none"> • None – Assumes a 0.75° beam tilt for all stations. • Full – Adds the values in CDBS/LMS to a 0.75° beam tilt for all stations. • Offset – Subtracts 0.75° from the generic pattern, then adds the value in CDBS/LMS. This setting results in maximum radiation in the elevation plane being at the depression angle specified in CDBS for that station. 					
Double generic pattern values	Each country	T	6		
These options control when the generic OET Bulletin No. 69 elevation pattern field values are doubled when used with LPTV and Class A TV stations. <ul style="list-style-type: none"> • Never – The values are never doubled for any station(s). • LPTV only – The values are doubled for LPTV stations but not for Class A stations. • LPTV and Class A – The values are doubled for both LPTV stations and Class A stations. 					
Invert negative tilts	Each country	T	6	F	
Although beam tilts are conventionally angles of depression (<i>i.e.</i> , below the horizontal, so that a value of 90 means straight down and -90 means straight up), and radiation above the horizon is required to be minimized under FCC rules, some CDBS/LMS records give negative values for beam tilt. If checked, any negative electrical beam tilt values in CDBS/LMS will be assumed to be positive and thus ensures that maximum radiation is always at or below the horizontal.					
[Digital/Analog/FM] receive antenna f/b	All countries	T	6	F	
These fields control the front to back ratio (in decibels referenced to a dipole (dBd)) of the receive antenna used for digital TV, analog TV, and FM stations.					

Propagation

Terrain database	All countries	T	6	F	
Terrain database used for propagation calculations. ¹²					
Profile resolution	Each country	T	6	F	
Number of points per kilometer used to determine the path profile for Longley-Rice path loss calculations from TV or FM stations.					
Model error handling	Each country	T	6	F	
Controls how TVStudy handles model warning flags. Note that warnings can be triggered either by a desired station or an undesired station, and each is specific to a given signal path. <ul style="list-style-type: none"> • Disregard – Accepts the path loss result from the model. (Always applied to the desired TV signal for D/U calculations involving wireless interferers.) • Assume service – Assumes service for warnings on desired signal paths and no interference for warnings on undesired signal paths. • Assume interference – Assumes no service for warnings on desired signal paths and interference for warnings on undesired signal paths. 					
Receiver height AGL	All countries	T	6	F	
Receive antenna height above ground, in meters.					
Minimum transmitter height AGL	All countries	T	6	F	
Minimum transmit antenna height above ground, in meters.					
[Digital/Analog] desired % location	All countries	T	6	F	
Longley-Rice statistical parameter specifying the percentage of locations expected to get service.					
[Digital/Analog] desired % time	All countries	T	6	F	
Longley-Rice statistical parameter specifying the percentage of time service is expected.					
[Digital/Analog] desired % confidence	All countries	T	6	F	
Longley-Rice statistical parameter specifying the confidence (situational variability) that service is expected.					
[Digital/Analog] undesired % location	All countries	T	6	F	
Longley-Rice statistical parameter specifying the percentage of locations expected to get interference.					
[Digital/Analog] undesired % confidence	All countries	T	6	F	
Longley-Rice statistical parameter specifying the confidence (situational variability) interference is expected.					
Signal polarization	All countries	T	6	F	
Polarization of transmitted signal.					
Atmospheric refractivity	All countries	T	6	F	
Refractivity referenced to mean sea level, in N-units.					
Ground permittivity	All countries	T	6	F	
Relative ground permittivity.					
Ground conductivity	All countries	T	6	F	
Ground conductivity in Siemens per meter.					
Service mode	All countries	T	6	F	
Longley-Rice model parameter.					
Climate type	All countries	T	6	F	
Climactic zone.					

Service

Set service thresholds	All countries	T	6	F	
If checked, these thresholds are used for Longley-Rice calculations in lieu of the thresholds used for contour calculations. If unchecked, the same thresholds are used for Longley-Rice calculations as are used for contour calculations.					
Digital [full-service/Class A/LPTV] threshold	Each country	T	6	F	
Controls the thresholds (for each band) used to project the noise-limited service contours.					
Analog [full-service/Class A/LPTV] threshold	Each country	T	6	F	
Controls the thresholds (for each TV band) used to project the protected service contours.					
Use UHF dipole adjustment	Each country	T	6		
Controls whether or not a “dipole adjustment” is applied to the service threshold at UHF.					
Dipole center frequency	Each country	T	6		
Sets the center frequency for the UHF dipole adjustment.					
FM full-service [(all)/class B/class B1] threshold	Each country		6	F	
Controls the relevant thresholds used to project the service contours.					
[FM NCE/LPFM/FM translator] threshold	Each country		6	F	
Controls the relevant thresholds used to project the service contours.					

Clutter

Apply clutter adjustments	All countries	T	6	F	
If checked, clutter adjustments are applied as specified in OET Bulletin No. 73.					
Land cover database	All countries	T	6	F	
Controls whether the 2006, 2011, 2016, or 2021 land cover database is used.					
[Category, band]	Each country	T	6	F	
Controls the clutter adjustment factor for each band in each of ten categories specified in OET Bulletin No. 73.					
[Category mapping]	All countries	T	6	F	
Allows users to modify the mapping between the sixteen land cover categories in the NLCD database and the ten clutter categories specified in OET Bulletin No. 73.					

TV IX Check

Maximum new interference		X			
Percentage of permitted new interference to full power TV stations					
Maximum new interference to LPTV		X			
Percentage of permitted new interference to LPTV and Class A TV station.					
Check proposal vs. baseline		X			
Controls whether or not the TV IX Check mode checks for contour extension percentage and population reduction.					
Maximum contour extension from baseline		X			
Sets the percentage of contour extension permitted.					
Maximum population reduction from baseline		X			
Sets the percentage of population reduction permitted.					
Masked interference warning threshold		X			
Sets a minimum threshold for warning that MX-related interference may be undetected by TVStudy. Setting this value to 0 will disable the warning.					

Wireless

Required D/U	Each overlap	W			
Controls the D/U threshold applied based on wireless to TV channel spectral overlap value.					
Culling Distances	Each overlap	W			
Controls the culling distance from the protected TV contour based on spectral overlap, wireless site HAAT, and wireless site ERP					
Cap alpha factor	All overlaps	W			
Allows a cap to be placed on the value of the α factor.					
Alpha factor cap	All overlaps	W			
If enabled by the above parameter setting, the cap on the α factor in dB.					
Average terrain profile resolution	All overlaps	W			
Number of points per kilometer used to calculate the average terrain along each radial from the wireless station.					
Propagation profile resolution	All overlaps	W			
Number of points per kilometer used to calculate the path profile along each radial from the wireless station.					
HAAT radial count	All overlaps	W			
Number of radials used to determine the HAAT of the wireless station.					
Depression angle method	All overlaps	W			
Controls how depression angles are calculated. <ul style="list-style-type: none"> • Effective height – This method approximates the depression angle using height above ground level, mirroring the behavior of tv_process. • True geometry – This method calculates the actual depression angle using curved-Earth geometry and heights above mean sea level. 					
Use mechanical beam tilt	All overlaps	W			
If selected, TVStudy will use mechanical tilt as specified in the wireless antenna dataset.					
Mirror generic patterns	All overlaps	W			
If a wireless site uses the OET-69 generic elevation pattern this option allows for the mirroring of the pattern above and below the maximum relative field strength value.					
Minimum transmitter height AGL	All overlaps	W			
Specifies the minimum wireless transmitter height above ground level. If TVStudy finds the site is below this level based on the RCAMSL value provide it will adjust the transmitter height.					
Undesired % location	All overlaps	W			
Statistical parameter of location probability for wireless station path loss.					
Undesired % time	All overlaps	W			
Statistical parameter of time probability for wireless station path loss.					
Undesired % confidence	All overlaps	W			
Statistical parameter of confidence probability for wireless station path loss.					
Signal polarization	All overlaps	W			
Polarization of wireless transmitted signal.					
Service mode	All overlaps	W			
Propagation model parameter.					

TV6 <-> FM

FM undesired culling distances	All countries		6		
Culling distances for FM undesired stations.					
FM to TV D/U curves	All countries		6		
Table of values for the curves (73.525) method.					
FM to DTV D/U method	All countries		6		
Allows the selection of the curves (73.525) or fixed (based on NPR measurements) method of determining interference from FM into digital TV channel 6.					
FM to DTV fixed D/U table	All countries		6		
Table of values for the fixed method.					
FM undesired % time	All countries		6		
Longley-Rice statistical parameter of time probability for FM stations.					
DTV undesired culling distances	All countries		6		
Culling distances for DTV undesired stations.					
DTV to FM base D/U	All countries		6		
Base D/U ratio used to determine interference from digital TV into FM.					
TV/DTV undesired % time	All countries		6		
Longley-Rice statistical parameter of time probability for TV stations.					

Scenario

Wireless frequency	All countries	W			
Controls the center frequency of wireless emissions in wireless-to-TV interference studies.					
Wireless bandwidth	All countries	W			
Controls the bandwidth of wireless emissions in wireless-to-TV interference studies.					

APPENDIX B

Files Required to Import a Dataset

FCC Datasets

The following files are required for TVStudy to successfully import a CDBS TV dataset:

- am_ant_sys.dat
- ant_make.dat
- ant_pattern.dat
- application.dat
- app_tracking.dat
- dtv_channel_assignments.dat
- elevation_ant_make.dat
- elevation_pattern.dat
- elevation_pattern_addl.dat
- facility.dat
- tv_app_indicators.dat
- tv_eng_data.dat

The following files are required for TVStudy to successfully import a CDBS FM dataset:

- ant_make.dat
- ant_pattern.dat
- application.dat
- app_tracking.dat
- elevation_ant_make.dat
- elevation_pattern.dat
- elevation_pattern_addl.dat
- facility.dat
- fm_eng_data.dat
- fm_app_indicators.dat
- if_notification.dat

Please note that CDBS does not contain coordinates for TV station applications filed after April 2017 or any data on FM technical applications filed after September 2019, and that use of CDBS datasets in TVStudy is no longer recommended, and in the case of TV Interference Check studies, no longer permitted.

The following files are required for TVStudy to successfully import an LMS dataset:

- application.dat
- application_facility.dat
- app_am_antenna.dat¹³
- app_antenna.dat
- app_antenna_elevation_pattern.dat
- app_antenna_field_value.dat
- app_antenna_frequency.dat
- app_dtv_channel_assignment.dat
- app_location.dat
- app_mm_application.dat¹³
- digital_notification.dat¹³
- facility.dat
- facility_applicant.dat¹³
- license_filing_version.dat
- lkp_antenna.dat
- lkp_antenna_field_value.dat
- lkp_dtv_allotment.dat
- shared_channel.dat¹³

¹³ Indicates an optional file, but note that some information may be absent from TVStudy without these files. For example, without app_am_antenna, TV Interference Check studies will lack information on AM stations, and without digital_notification, information about IBOC will be missing from all FM studies. It is highly recommended that such files be included if available.

Text Formats

The TVStudy text format allows for the import of datasets from various types of text-based data files. You may import files that end with either .csv, .txt, or .dat extensions. The required columns in each are the same; the difference is which character is used to separate the columns. A CSV file has columns separated by commas, a TXT file has columns separated by tabs, and a DAT file has columns separated by pipe characters. Use of quotes around text that contains the separator character is supported. None of these files should have header rows. Optional fields may be left blank, but the blanks must be in the row for import to succeed.

All three data types use the same format for the antenna pattern. This is what a row looks like for azimuth and elevation patterns:

Field Name	Type	Description
Ant ID	Integer	This must be a value greater than zero (0). This field should tie back to either the Az Ant ID or El Ant ID field in the text file.
Pattern Type	Char(1)	"A" for azimuth pattern, "E" for elevation pattern
Pattern Name	Char(255)	Must not contain ' ', ',', or new line characters.
Pattern Points	Float;float	Each field contains a degree value and a relative field value separated by a semicolon. For example, "0;1.0,10;0.95,20;0.89, ...". There must be at least two points in a pattern. For an azimuth pattern, the degree values must be in the range 0 to 359.999. For an elevation pattern, the degree range is -90 to 90. In either case, the degree values must appear in order with no duplication. Relative field values must be greater than 0 and less than or equal to 1. If a pattern does not contain at least one point with relative field of 1 a warning message will be generated, but import will continue.

For matrix patterns, it is slightly different, with multiple rows used to define the matrix pattern. However, both types of records can be in the same file, since the "M" triggers the software to expect an extra field.

Field Name	Type	Description
Ant ID	Integer	This must be a value greater than zero (0). This field should tie back to either the El Ant ID field in the text file and be the same for each azimuth of the matrix pattern.
Pattern Type	Char(1)	Must be "M".
Pattern Name	Char(255)	Must not contain ' ', ',', or new line characters. Ignored after the first row of the matrix pattern.
Azimuth	Float	The azimuth of the elevation pattern to be given in the following field.
Pattern Points	Float;float	Same as for elevation patterns above.

Wireless Datasets

Field Name	Type	Description
Cell Site ID	Char(12)	This must not be blank and cannot contain ' ', ',' or new line characters.
Sector ID	Integer	This optional field is concatenated with the Cell Site ID to form the wireless "callsign" in TVStudy GUI and reports.
Latitude (degrees)	Float	This field is NAD 83 with positive decimal degrees indicating northern hemisphere. This field must contain a value in the range -75 to +75 degrees.
Longitude (degrees)	Float	This field is NAD 83 with negative decimal degrees indicating western hemisphere. This field must contain a value in the range -180 to +180 degrees.
Hgt AMSL (m)	Float	This is the base station transmit antenna radiation center height above mean sea level (AMSL) in meters.
HAAT (m)	Float	This is the base station transmit antenna radiation center height above average terrain (HAAT) in meters. This must be a value between -1000 and +10000 meters. The value -999 will cause HAAT to be calculated by TVStudy.
ERP (kW)	Float	This is the base station effective radiated power in kilowatts. This field must contain a value between 0.00001 and 5000.
Az Ant ID	Integer	This is a pointer to the azimuth pattern in the associated antenna dataset. 0 or blank means omni-directional antenna; otherwise this number must be greater than zero. If a pattern data for an ID does not exist, an omni-directional pattern will be applied during the study.
Az Orientation (deg true N)	Float	0 means true north. If blank, the default is 0, otherwise the value must be in the range -360 to +360 degrees.
El Ant ID	Integer	This is a pointer to the elevation pattern in the associated antenna dataset. 0 or blank means omni-directional antenna; otherwise this field must be greater than zero.
ETilt (degrees)	Float	Electrical tilt where positive degrees is downward tilt. If blank, defaults to 0, otherwise the value must be in the range -10 to +11.1 degrees.
MTilt (degrees)	Float	Mechanical tilt where positive degrees is downward tilt. If blank, defaults to 0, otherwise the value must be in the range -10 to 11.1 degrees.
MTilt Orientation (degrees)	Float	0 means true north. If this is blank or not present the default is the azimuth pattern orientation, otherwise the value must be in the range -360 to +360 degrees.
Reference Data	Char(22)	Optional field. This field is available for short notes about site.
City	Char(20)	Optional field. City associated with wireless site.
State	Char(2)	Optional field.
Country Code	Char(2)	"US", "CA", or "MX". When missing, it is assumed to be "US".

TVStudy TV

The following table describes the layout of a text file that contains TV records. DTS records have a different format, which varies on which piece of the DTS it is reflecting, than non-DTS records. “Y” indicates a field is required; “X” indicates that it is optional; “--” indicates it is to be left blank; “0” means to place a zero in that field, and “DTS” means that you should put “DTS” or “DD” in that field. Descriptions are only given if different from the wireless section above or if not included in the wireless section.

Field Name	Type	Description	Non-DTS	DTS Parent	DTS Ref.	DTS Site
Callsign	Char(12)	This must not be blank and cannot contain ‘ ’, ‘,’ or new line characters.	Y	Y	--	--
Service	Char(3)	May use CDBS- or LMS-style service type codes from the parentheticals in Appendix C.	Y	“DTS”	Y	--
Channel	Integer	Channel number.	Y	Y	Y	--
Status	Char(3)	Station status.	X	X	X	--
File Number	Char(255)	File number.	X	X	X	--
Facility ID	Integer	Facility ID number.	Y	Y	--	--
City	Char(20)	See wireless.	Y	Y	--	--
State	Char(2)	See wireless.	Y	Y	--	--
Country Code	Char(2)	“US”, “CA”, or “MX”.	Y	Y	--	--
Zone	Integer	1, 2, or 3.	X	X	X	--
Site No.	Integer	DTS or DRT site number. Else 1.	Y	“P”	“R”	Y
Latitude (deg)	Float	See wireless.	Y	Y	Y	Y
Longitude (deg)	Float	See wireless, except that positive decimal degrees indicate western hemisphere for TV.	Y	Y	Y	Y
Hgt AMSL (m)	Float	See wireless.	Y	--	Y	Y
HAAT (m)	Float	See wireless.	X	--	X	X
ERP (kW)	Float	See wireless.	Y	--	Y	Y
Azimuth Ant ID	Integer	See wireless.	X	--	X	X
Az Orientation (deg true N)	Float	See wireless.	X	--	X	X
Elevation Ant ID	Integer	See wireless.	X	--	X	X
ETilt (deg)	Float	See wireless.	X	--	X	X
MTilt (deg)	Float	See wireless.	X	--	X	X
MTilt Orientation (deg)	Float	See wireless.	X	--	X	X
Emission Mask	Char(1)	See Appendix C.	X	--	X	X
Offset	Char(1)		X	--	X	--
Radius/sectors	Text	For a DTS, either radius in km, or sectors as given in the Managing Geographies section on page 34.	--	X	--	--

TVStudy FM

Like the TVStudy TV, the TVStudy FM format is presented as a table indicating which fields are required (“Y”) or optional (“X”).

Field Name	Type	Description	Req?
Callsign	Char(12)	This must not be blank and cannot contain ‘ ’, ‘,’ or new line characters.	Y
Service	Char(3)	Service type codes from the parentheses in Appendix C.	Y
Channel	Integer	Channel number (200-300).	Y
Class	Char(2)	Station class.	Y
Status	Char(3)	Station status.	X
File Number	Char(255)	File number.	X
Facility ID	Integer	Facility ID number.	Y
City	Char(20)	See wireless.	Y
State	Char(2)	See wireless.	Y
Country Code	Char(2)	“US”, “CA”, or “MX”.	Y
Latitude (deg)	Float	See wireless.	Y
Longitude (deg)	Float	See wireless, except that positive decimal degrees indicate western hemisphere for TV.	Y
Hgt AMSL (m)	Float	See wireless.	Y
HAAT (m)	Float	See wireless.	X
ERP (kW)	Float	See wireless.	Y
IBOC percent	Float	Percentage of ERP used for IBOC ERP. This may be given as a decimal 0.01-0.1, or as a percentage 1 to 10.	X
Azimuth Ant ID	Integer	See wireless.	X
Az Orientation (deg true N)	Float	See wireless.	X
Elevation Ant ID	Integer	See wireless.	X
ETilt (deg)	Float	See wireless.	X
MTilt (deg)	Float	See wireless.	X
MTilt Orientation (deg)	Float	See wireless.	X

APPENDIX C

Output File Data

To make the various output files smaller and easier for a computer to use, a number of numerical codes are used to replace words in the output. A key for translating these, as well as a list of definitions of certain other terms used within the Appendices, is provided below. In all following appendices, spaces after commas are included for legibility and are not found in the output files.

Study Key

This is a unique identifier for a given study.

Fac (Facility) ID

The Facility ID is a unique integer in CDBS/LMS used to identify a station.

File Number

This is a number denoting a specific filing in CDBS/LMS. For applications filed in CDBS, it consists of a prefix to indicate the type of filing, and an Application Reference Number (ARN) to make it unique. LMS-filed applications only have an ARN in the form of a 10-digit integer.

Country Key

1 = United States

2 = Canada

3 = Mexico

Country keys can appear in the results for two purposes. They can either refer the country from which the station being evaluated originates (Cntry), or to the country in which the evaluation point is located (InCntry).

Country Code

US = United States

CA = Canada

MX = Mexico

Country codes are used in XML files and in some of the summary reports.

Service Type

1 = Digital TV Full Service (CDBS: DT, DD, DS, DX, DR, DM, DN; LMS: DTV, DTX, DTS)

2 = Analog TV Full Service (CDBS: TV, TS, TA, TR, NM, NN; LMS: ATV)

3 = Digital TV Class A (CDBS: DC; LMS: DCA)

4 = Analog TV Class A (CDBS: CA; LMS: ACA)

5 = Digital LPTV or Translator (CDBS: LD; LMS: LPD, LPT, DRT)

6 = Analog LPTV or Translator (CDBS: TX, TB; LMS: LPA, LPX)

11 = Wireless sites (WL)

21 = FM Full Service (CDBS/LMS: FM, FS, FA, FR)

22 = FM Low Power (CDBS/LMS: FL)

23 = FM Translator or Booster (CDBS/LMS: FX, FB)

Source Key

This is a unique identifier for a given station facility within a scenario. This is a temporary key assigned within each study and thus will change for the same station from study to study.

DTS Key

This is a key for DTS record sets. A DTS station has multiple records, always listed together in the file. The first is a record called the parent. The Source Key from the parent record appears in the DTS Key field for all related records. On the actual parent record, the Source Key is the same as the DTS Key. The parent always has Site value of **0**. Among the other records with the same DTS Key but other Source Key values, one of those will also have Site value of **0**; that is the reference facility record. That record may have different file number, application ID, and channel than the parent; it provides a bounding contour only. Other records with the same DTS Key and Sites other than 0 are the actual DTS transmitter sources. Those all have the same identifying information and channel shown on the parent record, so that information is not repeated.

Site

Site number. For DTS records it is used to identify the different records in a group for a DTS operation. See “DTS Key” discussion.

App (Application) ID

CDBS or LMS Application ID number, if available. For User records, contains “UserRecord-“ followed by the internal ID number of the User record.

Des (Desired) Flag

0 = Station was not studied as desired; its coverage was not evaluated

1 = Station was studied as desired; its coverage was evaluated

Und (Undesired) Flag

0 = Station was not studied as undesired; it could not cause interference to desired stations

1 = Station was studied as undesired; it may contribute interference to desired stations

From Channel

When the station service is being replicated on a different channel from its original channel, this column shows the original channel.

DTS Distance

For a DTS parent record, this is the distance limit around the reference point. This may be from the distance table in FCC Rule section 73.626(c), or it may be a custom value from the database record.

DA (Directional Antenna)

Flag that specifies whether or not an antenna is directional in the azimuth direction.

DA = Directional Antenna

ND = Non-Directional Antenna

Ant (Antenna) ID

Antenna ID number, if available.

Rotation

Degrees of clockwise azimuth rotation applied to the antenna pattern.

Offset

0 = N/A

2 = Plus

1 = Zero

3 = Minus

Mask Filter

0 = N/A (Analog) or Full-Service (Digital)

2 = Stringent

1 = Simple

3 = Full-Service

Mask Type

S = Simple

T = Stringent

F = Full-service

Grid Type

1 = Local

2 = Global

Cell Latitude Size

This is the size of each cell in seconds with regard to latitude, since it is uniform across the grid.

Lat Index, Lon Index

Index keys for a study grid cell, given as the coordinates of the cell's southeast corner in integer arc-seconds. These are for identification and relative location only; actual coverage calculations occur at discrete points within each cell, one point for each country with population in the cell.

Clutter

Indicates which clutter type and corresponding field strength adjustment was applied to the cell. If **0**, clutter was not enabled. Otherwise, the clutter type (**1-10**) is indicated. The clutter types are listed in OET Bulletin No. 73, Table 3, and at the end of this section.

Result Code

1 = Interference-free service

2 = Interference

3 = No service

11 = Interference-free service, but encountered a warning flag

12 = Interference, but encountered a warning flag

13 = No service, but encountered a warning flag

Causes Ix (Interference)

0 = Does not cause interference

1 = Causes interference

Point Key

Single integer index key for a study grid cell, primarily used in pair studies. In the global mode, the Point Key is undefined for cell sizes less than 0.5 km and for grid cells outside of the northern and western hemispheres. The Point Key algorithm was designed to produce a 32-bit integer single key to help reduce storage size for SQL tables containing pair study output data. At cell sizes less than 0.5 km the number of bits required to enumerate all cells may exceed the 32-bit integer range, so the Point Key cannot be defined.

Service Flag

0 = Does not have service

1 = Has service

KWX Flag

0 = Does not have a warning flag

= Has a warning flag (1-4)

Status

APP = Application filed

CP = Construction Permit granted

CP MOD = Modification to CP granted

GRANT = Allotment Granted

LIC = Licensed facility

STA = Special Temporary Authority

Channel Description

In the tvstudy.txt file, station channel numbers are listed in a four-part coding scheme as M#CO, where:

- "M" is either "N" or "D" for Analog or Digital, respectively,
- "#" is the channel number,
- "C" is the station class and will be "A" for Class A or "L" for LPTV stations (Full-power stations will not have a value), and
- "O" is the channel offset (for analog stations only) and will be "-", "z", or "+".

Key

LatIndex-LonIndex-CountryKey = This field is comprised of hyphen separated values of integer seconds for the grid cell south east corner and the country key for the grid cell.

Root Sum Square

This is the square root of the power summation of all the wireless received field strength after receiver antenna discrimination in a single grid cell.

$$RSS = 20 * \log_{10} \left(\sum \left(10^{\left(\frac{dB\mu + G_r}{20} \right)^2} \right)^{\frac{1}{2}} \right) = 10 * \log_{10} \left(\sum 10^{\left(\frac{dB\mu + G_r}{10} \right)} \right)$$

SNR Factor

This is the same value as the provided by the D/U ramp function and is defined as alpha (α) in OET Bulletin No. 74.

In SA

This is 1 if the point is inside the contour and 0 if the point is outside.

LandCoverType (Only available from the points series (shp, kml, or csv) of files)

0 = Open Water	8 = Evergreen forest
1 = Perennial ice/snow	9 = Mixed forest
2 = Developed open space	10 = Shrub/scrub
3 = Developed low intensity	11 = Grassland/herbaceous
4 = Developed medium intensity	12 = Pasture/hay
5 = Developed high intensity	13 = Cultivated crops
6 = Barren land (rock/sand/clay)	14 = Woody wetlands
7 = Deciduous forest	15 = Emergent herbaceous forest

ClutterType

1 = Open land	6 = Wetland
2 = Agricultural	7 = Residential
3 = Rangeland	8 = Mixed urban / Buildings
4 = Water	9 = Commercial / Industrial
5 = Forest land	10 = Snow and Ice

APPENDIX D

Formats of the Cell Output Files

Format of the Summary Cell Output File

The file is labeled “tvstudy.cel” and appears within the <out>/<study> directory. It contains summary data for all scenarios that were selected to run.

Global Grid Mode

```
[scenario]
Database Server
Database Used
Study Name
Scenario Name
Timestamp
Cell Size, Grid Type, Cell Latitude Size
[comment]
Comment
[endcomment]
[sources]
Source Key, Des Flag, Und Flag, Country Key for Station, Service Type, Channel, Fac
    ID, Site, File Number, Call Sign
[endsources]
[grid]
Lat Index South Limit, Lon Index East Limit, Lat Index North Limit, Lon Index West
    Limit
[cell]
Lat Index, Lon Index
P, Country Key for Point, Point Area, Point Pop, Point Households, Clutter
R, Source Key, Site, Result Code
[endcell]
[endgrid]
[endscenario]
```

Each cell can have multiple “P” (point) entries, one for each country that has a study point in the cell. Each “P” line may be followed by multiple “R” (result) entries, one for each station that provides service at that point. **Note:** A cell file may contain study grids that overlap. Thus, there may be multiple [grid] blocks that overlap, some containing data for the same desired stations. See detailed notes below.

Local Grid Mode

The local grid mode has the same format, except the [cell]/[endcell] blocks will be replaced with:

```
[source]
Source key
R, Country Key for Point, Lat Index, Lon Index, Point Area, Point Pop, Point
    Households, Clutter, Result Code
[endsource]
```

Each source block contains "R" lines for all study points considered for one station only. Each desired station will have a separate source block.

Points Mode

```
[scenario]
Database Server
Database Used
Study Name
Scenario Name
Timestamp
Cell Size, Grid Type, Cell Latitude Size
[comment]
Comment
[endcomment]
[sources]
Source Key, Des Flag, Und Flag, Country Key for Station, Service Type, Channel, Fac
    ID, Site, File Number, Call Sign
[endsources]
[points]
P, Country Key for Point, Point Elevation, Point Receive Height, Clutter
R, Source Key, Site, Result Code
[endpoints]
[endscenario]
```

Each "P" line may be followed by multiple "R" (result) entries, one for each station that provides service at that point.

Format of the Detailed Cell Output File

The file is labeled “tvstudy.cel” and appears within the <out>/<study>/<scenario> directory. It contains data from only one scenario.

Global Grid Mode

```
[scenario]
Database Server
Database Used
Study Name
Scenario Name
Timestamp
Cell Size, Grid Type, Cell Latitude Size
[comment]
Comment
[endcomment]
[sources]
Source Key, Des Flag, Und Flag, Country Key for Station, Service Type, Channel,
    Service Level, Number of DTS Sites, Fac ID, Site, [Lat Index South Limit, Lon
    Index East Limit, Lat Index North Limit, Lon Index West Limit,] File Number, Call
    Sign, Site
[endsources]
[grid]
Lat Index South Limit, Lon Index East Limit, Lat Index North Limit, Lon Index West
    Limit
[cell]
Lat Index, Lon Index
P, Country Key for Point, Point Lat, Point Lon, Point Area, Point Pop, Point
    Households, Clutter
C, Census Block ID, Block Pop, Block Households
D, Source Key, Site, Field Strength, Reverse Bearing, Bearing, ERP (dBk), KWX Flag,
    Service Flag
S, Site, Time Delay, Field Strength, Bearing, Receive Pattern Adjustment, Causes Ix
DS, D/U Ratio, Rule Value for Comparison, D/U Ramp Function Adjustment
U, Source Key, Field Strength, Bearing, Receive Pattern Adjustment, KWX Flag, Causes
    Ix
DU, D/U Ratio, Rule Value for Comparison, D/U Ramp Function Adjustment
[endcell]
[endgrid]
[endscenario]
```

Each cell can have multiple “P” (point) entries, one for each country with a study point in the cell. Each “P” line is followed by one or more “D” (desired) entries, one for each desired station whose contour covers the population centroid point described by the “P” line. Similarly, each “D” line can have multiple “U” (undesired) and “DU” (D/U ratio) lines, for each undesired station that is within the culling distance of the desired station as specified by the study rules. However, there is not a guarantee that “U” records always follow a “D”, nor that a “DU” record will always follow a “U”, since Longley-Rice warnings may abort the analysis for that grid cell if TVStudy is set to “Assume Service” or “Assume Interference” and the subsequent records will not be generated.

In the [sources] section, undesired stations do not have Lat Index Limit values.

Please note that a tvstudy.cel file may contain study grids that overlap. Thus, there may be multiple overlapping [grid] blocks, each containing data for the same desired stations. See the detailed notes on the following page.

Local Grid Mode

For a study run in local grid mode, the [cell]/[endcell] blocks are replaced by blocks in the following format:

```
[source]
Source Key
P, Lat Index, Lon Index, Country Key for Point, Point Lat, Point Lon, Point Area,
  Point Pop, Point Households, Clutter
D, Site, Field Strength, Reverse Bearing, Bearing, ERP (dBk), KWX Flag, Service Flag
U, Source Key, Field Strength, Bearing, Receive Pattern Adjustment, KWX Flag, Causes
  Ix
DU, D/U Ratio, Rule Value for Comparison, D/U Ramp Function Adjustment
[endsource]
```

Each block will have multiple "P" lines, one for each study point considered for one station only. Each "P" line is followed by just one "D" line for that station. "D" lines may be followed by multiple "U" and "DU" lines for all undesired stations checked at that point. Each desired station will have a separate source block. However, there is not a guarantee that "U" records will always follow a "D", nor that a "DU" record will always follow a "U", since Longley-Rice warnings may abort the analysis for that grid cell if TVStudy is set to "Assume Service" or "Assume Interference" when warnings occur and the subsequent records will not be generated.

In local grid mode, each [grid] block encloses just one [source] block, for the desired station that defined the grid. The [scenario] block will therefore typically enclose multiple [grid] blocks, one for each station studied.

A line containing [abort] may appear at any point in the data, indicating an error occurred and there is no further data for the scenario; all open data blocks are implicitly closed. When it appears, [abort] does not necessarily indicate the end of the file; another [scenario] block may begin immediately after.

Points Mode

For a study run in points mode, the [cell]/[endcell] blocks are replaced by blocks in this format:

```
[points]
Lat Index, Lon Index
P, Point Name, Country Key for Point, Point Lat, Point Lon, Point Elevation, Point
  Receive Height, Clutter
D, Source Key, Site, Field Strength, DSigAdj, DServAdj, Reverse Bearing, Bearing,
  ERP (dBk), KWX Flag, Service Flag
S, Site, Time Delay, Field Strength, Bearing, Receive Pattern Adjustment, Causes Ix
DS, D/U Ratio, Rule Value for Comparison, D/U Ramp Function Adjustment
U, Source Key, Field Strength, Bearing, Receive Pattern Adjustment, KWX Flag, Causes
  Ix
DU, D/U Ratio, Rule Value for Comparison, D/U Ramp Function Adjustment
[endpoints]
```


Each “P” line is followed by one or more “D” (desired) entries, one for each desired station whose contour covers the population centroid point described by the “P” line. Similarly, each “D” line can have multiple “U” (undesired) and “DU” (D/U ratio) lines, for each undesired station that is within the culling distance of the desired station as specified by the study rules. However, there is not a guarantee that “U” records always follow a “D”, nor that a “DU” record will always follow a “U”, since Longley-Rice warnings may abort the analysis for that grid cell if TVStudy is set to “Assume Service” or “Assume Interference” and the subsequent records will not be generated.

DSigAdj and DServAdj are described in the Detail CSV Cell File Points mode section of this Appendix.

Notes About the Detailed Cell Output File

If a Longley-Rice error occurs and the study was not configured to disregard errors, an error on a “D” record means that there will not be any “U” records following, regardless of whether or not any fields were actually calculated. The cell was counted as interference-free service, or ignored as no service, depending on the study configuration.

Likewise, an error on a “U” record means that there will not be any following “DU” record, since the undesired station was ignored or counted as an interferer, depending on the study configuration.

The “C” records only appear when the Census block output is chosen. This provides each Census block ID (and associated population and household count) included in each cell.

When evaluating a desired DTS, there will only be one set of values in the “D” record. Those are for the single DTS transmitter providing the strongest field strength in the cell. When evaluating an undesired DTS, the fields after “Source Key” in the “U” line repeat for each transmitter in the DTS that causes interference. Then, the following “DU” line is the result of applying the receive pattern corrections to each field strength and summing the resulting values in power.

The “U” line, thus, looks like this:

```
U, Source Key, Site Number, Field Strength, Bearing, Receive Pattern Adjustment, KWX
  Flag, Site Number, Field Strength, Bearing, Receive Pattern Adjustment, KWX Flag,
  [...] Causes Ix
```

The bearing fields in the “D” and “U” records are bearings from the cell study point back to the station, used to determine receive antenna pattern adjustments.

The D/U ratio value in the “DU” record is based on applying the receive pattern corrections to the undesired signals, and also summing the pattern-adjusted undesired signals from all DTS transmitters.

The “S” and “DS” records only appear when conducting a DTS self-interference study. Like the repeating “U” line when an undesired source is a DTS, the “S” line repeats similarly:

```
S, Site Number, Time Delay, Field Strength, Bearing, Receive Pattern Adjustment,
  Site Number, Time Delay, Field Strength, Bearing, Receive Pattern Adjustment,
  [...] Causes Ix
```

The DU Ramp Function Adjustment field in a “DU” record is non-zero for co-channel interference to a DTV desired, the required D/U ratio is adjusted by the appropriate amount before comparing to the actual D/U to determine interference.

When a cell has population in multiple countries, the cell is studied at multiple distinct study points, one based on the population from each country. In that case there will be multiple “P” records, one for each country. A portion of the area in such a cell is counted in each country, proportional to that country’s population in the cells versus the total from all countries.

In global grid mode, each [grid] block will contain many [cell] blocks, one for every cell in the grid, which may span the coverage areas of multiple stations. However, even in global mode there may be multiple [grid] blocks within a [scenario] block, because the total area of a large study is automatically partitioned into sub-grids to manage memory allocation. Typically, studies conducted on computer systems with more physical memory (RAM) will have fewer study grids than systems with less physical memory. Those separate grids may overlap, so it is possible for the same cells to appear in more than one grid, in each case with a different set of desired stations. In other words, a particular [cell] block is not guaranteed to contain all results for that cell; data for the cell may be fragmented in several [grid] blocks.

A line containing [abort] may appear at any point in the data, indicating an error occurred and there is no further data for the scenario; all open data blocks are implicitly closed. When it appears, [abort] does not necessarily indicate the end of the file; another [scenario] block may begin immediately after.

Format of Detail CSV Cell Output File

Selecting the Detail CSV output option produces three to five comma separated value (CSV) files depending on the type of analysis performed. All files are placed in the <out>/<study>/<scenario>/<cellcsv> directory and none of the files contain a header row.

CSV output file	TVStudy Analysis type	
	Wireless -> TV Interference	All other Study Types
sources.csv	X	X
D_CelData.csv	X	X
U_CelData.csv	X	X
U_eNBCelData.csv	X	--
U_iRSSCelData.csv	X	--

sources.csv. This file lists all the sources considered in the analysis and is output for all types of analyses. It lists both desired and undesired sources as well as other pertinent information. This comma separated file contains 12 fields as follows.

Field_1.	Source Key	Field_7.	Service Threshold
Field_2.	Desired Flag	Field_8.	Number of DTS sites
Field_3.	Undesired Flag	Field_9.	Facility ID
Field_4.	Source Country Key	Field_10.	Site Number
Field_5.	Service Type	Field_11.	File Number
Field_6.	Channel	Field_12.	Call sign

D_CelData.csv. This file lists, for each grid cell or point studied, information about the desired signal.

U_CelData.csv. This file lists, for each grid cell or point studied, the desired TV signal strength versus a single undesired TV signal strength as well as the results of the D/U ratio analysis. If the undesired TV stations is a DTS station, then each DTS location is listed on a separate line with the "Site Number" field distinguishing between sites. However, the D/U ratio shown is based on the aggregate field strength of all DTS sites.

U_eNBCelData.csv. This file lists, for each grid cell or point studied, the desired TV signal strength versus a single wireless station. This file has a separate row for each wireless station versus each grid cell or study point within the desired TV station's protected contour.

U_iRSSCelData.csv. This file lists for each grid cell or point studied, the desired TV signal strength versus the root sum square value of all the wireless stations that pass the OET Bulletin No. 74 culling rules.

With the exception of the sources.csv file, the information contained in the detail CSV cell files depends on whether the study is run in Grid or Points mode.

Grid Mode outputs: Detail CSV Cell fields and field order for studies run in Grid Mode.

	CSV output file:				
	D = D_CelData.csv		U = U_CelData.csv		
	eNB = U_eNBCelData.csv		iRSS = U_iRSSCelData.csv		
Field	D	U	eNB	iRSS	Description
key	1	1	1	1	<Lat Index>-<Lon Index>-<country Key>
ptLat	2	2	2	2	Latitude of study point in NAD83
ptLon	3	3	3	3	Longitude of study point in NAD83
ptArea	4	4	4	4	Area of study grid in square kilometers
ptPop	5	5	5	5	Population of study grid
ptHouse	6	6	6	6	Number of households in study grid
ptClutter	7				Clutter category associated with study point
USrcKey		7	7		Source Key of the undesired transmitter
USiteNo		8			Site number of the undesired TV DTS transmitter.
DSrcKey	8	9	8	7	Source key of the desired transmitter
DSiteNo	9	10	9	8	Site number of the desired DTS transmitter
DField	10	11	10	9	Field strength of desired transmitter in dB μ V/m
R2Tbear	11				Bearing from receive point to transmitter location (deg true)
T2Rbear	12				Bearing from transmitter location to receive point (deg true)
T2Rerp	13				ERP of transmitter in direction of receiver (dBk)
Srvc	14	12	11	10	Service flag. 1= Desired field strength above service threshold
iRSS				11	Aggregate receive signal strength of multiple undesired wireless transmitters in dB μ V/m
UField		13	12		Field strength of undesired transmitter
RxPatAdj		14	13		Receive antenna pattern adjustment in dB
R2T _D bear		15	14		Bearing from receive point to desired transmitter location (deg true)
DUratio		16		12	D/U ratio in dB
DUthres		17		13	D/U threshold before any adjustment
SNRfac		18		14	S/N adjustment factor in dB
ix		19		15	Interference flag. 1 = interference is predicted
Dkwx	15	20	15	16	Propagation model kwx error flag for desired path
Ukwx		21	16		Propagation model kwx error flag for undesired path

Points Mode outputs: Detail CSV Cell fields and field order for studies run in Points Mode.

	CSV output file: D = D_CelData.csv eNB = U_eNBCelData.csv					U = U_CelData.csv iRSS = U_iRSSCelData.csv
Field	D	U	eNB	iRSS	Description	
PointName	1	1	1	1	Point Name	
CountryKey	2	2	2	2	Country Key of the point	
ptLat	3	3	3	3	See grid mode table	
ptLon	4	4	4	4	See grid mode table	
ptElev	5	5	5	5	See grid mode table	
RxHgt	6	6	6	6	Receiver height in meters AGL	
ptClutter	7				See grid mode table	
USrcKey		7	7		See grid mode table	
USiteNo		8			See grid mode table	
DSrcKey	8	9	8	7	See grid mode table	
DSiteNo	9	10	9	8	See grid mode table	
DField	10	11	10	9	See grid mode table	
DSigAdj	11	12	11	10	Desired signal adjustment. If the point set includes a custom receive antenna pattern/orientation, this value is the relative receive antenna gain (dB) in the direction of the transmitter.	
DSrvcAdj	12	13	12	11	Desired signal service level adjustment. Since the service threshold is based on OET-69 planning factors, this field is the difference between the OET-69 planning factor antenna gain and the gain of the custom antenna. If the OET-69 generic antenna pattern is used this value is zero.	
R2Tbear	13				See grid mode table	
T2Rbear	14				See grid mode table	
T2Rerp	15				See grid mode table	
Srvc	16	14	13	12	See grid mode table	
iRSS				13	See grid mode table	
UField		15	14		See grid mode table	
RxPatAdj		16	15		See grid mode table	
R2TDbear		17	16		See grid mode table	
DURatio		18		14	See grid mode table	
DUthres		19		15	See grid mode table	
SNRfac		20		16	See grid mode table	
ix		21		17	See grid mode table	
Dkwx	17	22	17	18	See grid mode table	
Ukwx		23	18		See grid mode table	

APPENDIX E

Notes About Opening the Map Output Files

ESRI ShapeFiles Format

TVStudy produces several sets of map output files in ESRI ShapeFile format:

contours – This file contains the coverage contours projected by TVStudy.

coverpts – This file contains the Longley-Rice study points and their result codes.

cmpcvpts – This file is output only when the composite coverage option is selected. It contains the same information as the basic coverpts file, but contains the best-case result for each cell across the stations included in the composite. It also does not contain many of the additional attribute columns that coverpts supports.

points – This file contains the Longley-Rice study points and their area and population counts.

selfix – This file contains the location, population, and level of any calculated DTS self-interference. If there is one dominant undesired, its site number, individual signal level, and arrival time delta are also shown. "Dominant" means if that one undesired were removed from the RSS, the self-interference would be eliminated.

dsources/usources – These files contain the locations of all the transmitters studied. For wireless to TV studies, these files contain both the location of the single desired TV transmitter and the location of all the undesired wireless sites and TV stations included in the study.

For those unfamiliar with ESRI Shape Files, all four pieces are required for the files to work properly. Do not delete any of the files.

There are many software applications available for opening and manipulating the ESRI Shape Files that are output by TVStudy. One free piece of software the FCC has used for this task is Quantum GIS (QGIS), which runs on Windows, Mac, and Linux, and is available at: <http://qgis.org>

To produce useful maps using QGIS, you will need to obtain ShapeFiles separate from those produced by TVStudy, such as files containing political boundary data.

To add output map files to QGIS, you can simply drag the shape file into the "Layers" pane at the left.

The coverpts output file uses the same set of result codes as noted in Appendix C, and you can thus assign a different color to each result code. To get to the properties window, where such assignments can be made, double-click the appropriate shape file in the "Layers" pane at the left. Available for download is a file called TVStudyTemplate.qml, which is a template that works with the ESRI ShapeFile output format to assign the following colors to each class of points:

1 or 11 = Interference-free service	= Green
2 or 12 = Cell contains interference	= Red
3 or 13 = Cell receives no service	= Blue

Please note that when using Points mode rather than Grid mode, the coverpts output file produced is inverted. The points are placed at the transmit locations with the appropriate service code included, allowing a map to be produced showing the locations of the stations relative to the evaluated point(s).

The sources output map file includes both desired and undesired transmitter locations as well as information on their RCAMSL, HAAT, ERP and antenna orientation. QGIS allows you to specify the symbol color and rotation based on the associated metadata in the sources ESRI Shapefile. Example QGIS templates that work with wireless to TV generated “sources” ShapeFile outputs based on ERP and HAAT are available for download (“WirelessRuleBasedERP.qml” and “WirelessRuleBasedHAAT.qml”)

The map may initially appear distorted. To correct this, locate the “Project Properties” menu option, then check the “Enable ‘on the fly’ CRS transformation” checkbox. Finally, select one of the NAD83 coordinate systems and map projections appropriate to the area under consideration, and the map should redraw in a less distorted manner.

No support for QGIS is provided beyond the simple instructions included in this Appendix.

Finally, note that the attributes in the ShapeFiles can vary based on the map output options selected when the study is run.

- Study point coordinates – Adds two columns.
- Area, population, households – Adds three columns.
- Land cover and clutter – Adds three columns (the third indicates the clutter database used).
- Desired signal and margin – Adds three columns (the third is the DTS Site Number).
- Worst undesired D/U and margin – Adds three columns (the third is the Source Key for the station causing the D/U ratio/margin noted).
- Wireless signal, D/U, and margin – Adds three columns only, but only if a Wireless to TV interference study is being conducted.
- Smallest margin – Adds one column.
- Ramp/alpha (uncapped) – Adds one column.

KML Format

TVStudy can also output maps in the KML format for Google Earth. For best results, be sure that GhostScript is installed as described in the TVStudy Installation and Upgrade Guide.

KML output can be produced as a KML file structure, or combined into a single KMZ file for distribution. Contained within it, depending on options selected, you may find options to turn on or off:

- Contours
- Labeled points for the desired stations
- Labeled points for the undesired stations
- Longley-Rice coverage map based on the selected image color maps
- Study points icons

Many of the options controlling the inclusion of these can be turned on and off when the study is run.

The Longley-Rice maps will only be available as an option if GhostScript is installed and configured for use with TVStudy. These maps are produced as tile maps compatible with Google Earth, which should improve detail and performance.

APPENDIX F

Format of the Pair Study Output Files

stations.csv – This file lists all of the stations in the pair study.

Fac ID, Channel, Des Flag, Und Flag, Service Type, Call Sign, City of License, State of License, Country Key for Station, Status, File Number, Latitude, Longitude

baseline.csv – This file provides the baseline interference and service information.

Fac ID, Channel, Country Key for Point, Noise Lim Area, Noise Lim Pop, Terr Lim Area, Terr Lim Pop, Ix Lim Area, Ix Lim Pop

replication.csv – This file lists replicated parameters for each station on each replicated channel.

Fac ID, Replication Channel, Country Key for Point, Noise Lim Area, Noise Lim Pop, Terr Lim Area, Terr Lim Pop

points.csv – This file provides information on the location of each study point.

Point Key, Lat Index, Lon Index, Country Key of Point, Point Lat, Point Lon, Point Area, Point Pop

service.csv – This file provides information on whether or not there is service at a given point.

Point Key, Fac ID, Channel, Service Flag

interference.csv – This file shows the points with interference along with which paired station causes the interference to that point.

Point Key, Fac ID, Channel, Ix Fac ID, Ix Channel

Please note that all outputs featuring geographic coordinates are in the NAD83 format.

APPENDIX G

Format of the Scenario XML Output

```

<TVSTUDY VERSION="105000">
<SCENARIO NAME="name">
  <DESCRIPTION>
    description text
  </DESCRIPTION>
  <PARAMETER KEY=(see below)>
    <VALUE INDEX="0" (see below)>/VALUE>
  </PARAMETER>
  <SOURCE (see attributes below)>
    <APAT>
      azimuth,relative field
    .
    .
    </APAT>
    <EPAT>
      depression,relative field
    .
    .
    </EPAT>
    <MPAT>
      azimuth,depression,relative field
    .
    .
    </MPAT>
  </SOURCE>
  .
  .
</SCENARIO>
</TVSTUDY>

```

A SOURCE may contain an APAT providing azimuth pattern data, and either an EPAT (elevation) or MPAT (matrix) providing elevation pattern data. If MPAT data is provided, APAT will also be provided. The MPAT data is normalized so each elevation pattern slice at each azimuth contains a 1.0, and the APAT data provides values at matching azimuths with the relative scaling for each slice.

A DTS operation has the reference facility (bounding contour facility) parameters in the SOURCE attributes; individual DTS transmitters in the operation are provided by DTS_SOURCE elements within the SOURCE. The attribute SITE_NUMBER is only used within the DTS_SOURCE element with SITE_NUMBER="0" referring to the reference site.

```

<SOURCE (See attributes below)>
  <DTS_SOURCE (see attributes below)>
    <APAT>
    </APAT>
    <EPAT>
    </EPAT>
  </DTS_SOURCE>
</SOURCE>

```

If the XML source is a TV station, its attributes can be read directly from an associated CDBS/LMS dataset. In this case, only the DESIRED, UNDESIRED, LOCKED, RECORD_ID, SERVICE and REPLICATE attributes are required for TVStudy version 2.x XML source files. The SERVICE attribute is not required for XML sources built in earlier versions of TVStudy. The LOCKED flag will always be "true" (the record is non-editable), and the RECORD_ID attribute provides the CDBS application ID or LMS record ID. All data for the record will be loaded directly from CDBS/LMS dataset when the scenario is imported. If the application or record ID is not found in the importing study's version of CDBS/LMS, the SOURCE entry is ignored (a warning message will be shown during import in that case).

If a record is editable (LOCKED="false"), even when the source for the record is CDBS/LMS, all record data is provided in the export in SOURCE attributes and enclosed elements. In that case it will not be necessary for the application or record ID to exist in the version of CDBS/LMS used by the importing study. The record will be in the imported scenario regardless, however if the application or record ID does not exist in CDBS/LMS of course it will not be possible to revert to the original CDBS/LMS record. When exporting a scenario, if it is expected that some records may not exist in the study dataset where the scenario will be imported, make all of those records editable prior to exporting.

If the XML source is a wireless base station, all attributes for the base station must be pulled from the XML file.

SCENARIO Attributes

When exporting a Wireless to TV Interference scenario, the wireless frequency (KEY="355") and bandwidth (KEY="356") are included as attributes of the SCENARIO. These take the following format.

```
<SCENARIO>
<PARAMETER KEY="355">
  <VALUE INDEX="0">(wireless center frequency in MHz)</VALUE>
</PARAMETER>
<PARAMETER KEY="356">
  <VALUE INDEX="0">(wireless bandwidth in MHz)</VALUE>
</PARAMETER>
</SCENARIO>
```

This allows these wireless scenario-specific parameter values to be included with the scenario XML file.

SOURCE Attributes

The following table lists the source attributes and indicates if they are required, optional or not applicable for each type of source.

R = Required

RL = Required only if source is locked

NA = Not applicable (ignored)

RU = Required only if source is unlocked

O = Optional

Attribute	Value	TV	DTS	FM	WL	Comment
LOCKED	"true false"	R	NA	R	R	Indicates if the station record is editable, locked records are non-editable. If the source data is to be read directly from CDBS/LMS then the record must be LOCKED="true"
DESIRED	"true false"	R	NA	R	NA	This attribute is only required when the source is part of a scenario element.
UNDESIRED	"true false"	R	NA	R	NA	This attribute is only required when the source is part of a scenario element.
RECORD_ID	"application ID"	RL	NA	RL	NA	In versions of TVStudy prior to 2.0.0, this field is replaced by CDBS_ID. RECORD_ID is appropriate for both CDBS and LMS datasets.
SERVICE	"service code"	R	R	R	R	(e.g. "DT", "WL", "FM")
REPLICATE	"replication channel"	O	NA	NA	NA	Only required when creating a replicated TV station. Can be used with LOCKED="true" or LOCKED="false"
CHANNEL	"channel"	RU	NA	RU	NA	TV or FM channel
ID	"facility id"	RU	NA	RU	NA	CDBS facility ID or equivalent user-entered value for a record that is not based on CDBS
SITE_NUMBER	"dts or drt site numb"	NA	R	NA	NA	Applicable only to the <DTS_SOURCE> element
CELL_SITE_ID	"cell site id"	NA	NA	NA	R	This field plus the SECTOR_ID attribute and is used as the call sign for TVStudy reports.
SECTOR_ID	"sector id"	NA	NA	NA	O	This field is appended to the CELL_SITE_ID attribute with a hyphen separator to form the site call sign used for TVStudy reports.
CLASS	"fm_class"	NA	NA	RU	NA	(e.g. "A", "B1", "C0", etc.)
COUNTRY	"country code"	RU	NA	RU	R	Station country: "US", "CA", or "MX"

Attribute	Value	TV	DTS	FM	WL	Comment
DRT	"true false"	O	NA	NA	NA	If false or missing TVStudy assumes that the station is not a digital replacement translator
LATITUDE83	"latitude"	RU	R	RU	R	Can be decimal degrees with positive for Northern hemisphere or DMS_H.
LONGITUDE83	"longitude"	RU	R	RU	R	Can be decimal degrees <i>with positive for Western hemisphere</i> or DMS_H.
CALL_SIGN	"call"	RU	NA	RU	NA	
CITY	"city"	RU	NA	RU	O	
STATE	"state"	RU	NA	RU	O	
ZONE	"zone"	O	NA	NA	NA	TV Zone: "1", "2", or "3".
STATUS	"status"	O	NA	O	NA	Record status: "APP", "CP", "CP MOD", "LIC", "GRANT", or "STA"
MOD_TYPE	1	O	O	NA	NA	Modulation Type: Place holder for future TVStudy enhancements. This attribute is not currently used.
FILE_NUMBER	"file_number"	O	NA	O	NA	
IBOC	"true false"	NA	NA	O	NA	Only needed if IBOC employed, if missing assumed to be false
IBOC_ERP	"iboc_erp"	NA	NA	O	NA	In kW; if missing assumed to be -20 dBc
OFFSET	"offset"	O	NA	NA	NA	Offset code: "Z", "+", or "-". In the case of no offset, the attribute does not appear.
MASK	"mask type"	O	NA	NA	NA	Emission mask code: "S", "T", or "F"; appears only if mask setting is relevant to the record service (usually low-power television and similar records)
HAMSL	"hamsl"	RU	R	RU	R	Antenna height in meters above mean sea level. Entering -999 will cause this value to be calculated if a value is given for HAAT
HAAT	"haat"	RU	R	RU	R	Antenna height above average terrain. Entering a value of -999 will cause this value to be calculated if a value is given for HAMSL
ERP	"erp"	RU	R	RU	R	Peak horizontal effective radiated power, kW
HAS_APAT	"true false"	O	O	O	O	If false or missing, then any APAT data included in XML record will be ignored.
USE_GENERIC	"true false"	O	O	O	O	If false or missing, then generic elevation pattern will not be applied when elevation pattern is missing

Attribute	Value	TV	DTS	FM	WL	Comment
ANTENNA_ID	"x"	0	0	0	0	Reference integer to antenna pattern. This field is for informational purposes only. Imported XML stations must include the antenna pattern data in the XML file or use omni-directional by default.
APAT_NAME	"name"	0	0	0	0	
APAT_ORIENT	"azimuth"	0	0	0	0	Degrees true north. If missing, then azimuth orientation is set to 0
HAS_EPAT	"true false"	0	0	0	0	If false or missing, then any EPAT data included in XML record will be ignored
EPAT_NAME	"name"	0	0	0	0	
EPAT_ETILT	"tilt"	0	0	0	0	Elevation pattern electrical tilt, degrees of depression.
EPAT_MTILT	"tilt"	0	0	0	0	Elevation pattern mechanical tilt, degrees of depression
EPAT_ORIENT	"azimuth"	0	0	0	0	Orientation of mechanical tilt, degrees true north
HAS_MPAT	"true false"	0	0	0	NA	If false or missing, then any MPAT data included in an XML record will be ignored
MPAT_NAME	"name"	0	0	0	NA	Identifying name of the matrix elevation pattern.

APPENDIX H

Examples of Valid Input for “Add SQL”

CDBS and LMS

The following table contains several common examples of Additional SQL, which may be used in searches for stations. It is by no means exhaustive but should cover some of the most common use cases for LMS datasets.

Choose a state	<code>application_facility.afac_community_state_code = 'VA'</code>
Choose multiple states	<code>application_facility.afac_community_state_code IN('VA', 'DC', 'MD')</code>
Choose a city of license	<code>application_facility.afac_community_state_code = 'VA' AND application_facility.afac_community_city = 'Roanoke'</code>
Choose a channel	<code>application_facility.afac_channel = 36</code>
Choose a range of channels	<code>application_facility.afac_channel >= 14 AND application_facility.afac_channel <= 20</code>
Choose only Zone I	<code>application_facility.afac_facility_zone_code = 1</code>

Any of these statements can be linked together using the AND operator, the OR operator, and/or parentheses. Please consult a SQL guide for further details.

Please note that if you attempt to search by transmitter parameters such as power or height, DTS records may not be properly included due to the way they are stored in the database. To work around this, use a sub-select, shown in this example for searching for stations that have an ERP under 50 watts:

```
app_location.aloc_aapp_application_id IN
  (SELECT app_location.aloc_aapp_application_id
   FROM app_location
   JOIN app_antenna
   ON (app_antenna.aant_aloc_loc_record_id =
       app_location.aloc_loc_record_id) JOIN app_antenna_frequency
   ON (app_antenna_frequency.aafq_aant_antenna_record_id =
       app_antenna.aant_antenna_record_id)
   WHERE (app_antenna_frequency.aafq_power_erp_kw < 0.05))
```

For a list of fields in CDBS, please see the following web page:

<http://www.fcc.gov/ftp/Bureaus/MB/Databases/cdb/ readme.html>

For a list of fields in LMS, please see the following PDF:

<https://enterprise.filing.fcc.gov/dataentry/api/download/lmschema>

Wireless, TVStudy TV, and TVStudy FM

Records within Wireless, TVStudy TV, and TVStudy FM datasets imported from CSV, XML, or DBF files are stored in a table named "source". The following fields are available for SQL searches in any context using this table format, for all record types.

source_key	Integer	
record_type	Integer	1 = TV, 2 = WL, 3 = FM
service_key	Integer	Possible values are given below.
call_sign	Char (12)	
city	Char (20)	
state	Char (2)	
country_key	Integer	1 = US, 2 = Canada, 3 = Mexico
file_number	Char (255)	
latitude	Double	
longitude	Double	
height_amsl	Float	
overall_haat	Float	
peak_erp	Float	
antenna_id	Char (255)	
has_horizontal_pattern	Boolean	
horizontal_pattern_name	Char (255)	
horizontal_pattern_orientation	Float	
has_vertical_pattern	Boolean	
vertical_pattern_name	Char (255)	
vertical_pattern_electrical_tilt	Float	
vertical_pattern_mechanical_tilt	Float	
vertical_pattern_mechanical_tilt_orientation	Float	
has_matrix_pattern	Boolean	
matrix_pattern_name	Char (255)	
use_generic_vertical_pattern	Boolean	

The source_key value is a primary key and is unique for all records in a given dataset.

Additional fields used only for wireless records are listed below. The service_key field will always contain the same value in all wireless records so is not useful for searching.

sector_id	Char (3)
-----------	----------

The following are some examples of SQL statements that can be used to find wireless base stations within a Wireless dataset:

Choose by cell site ID	source.call_sign LIKE "PEA103%"
Choose by sector orientation	source.horizontal_pattern_orientation >= 0 AND source.horizontal_pattern_orientation <= 45
Choose by city	source.city = "Front Royal"

Additional fields for TV records are listed below.

facility_id	Integer	
is_drt	Boolean	
channel	Integer	
zone_key	Integer	1 = I, 2 = II, 3 = III
status	Char (6)	
frequency_offset_key	Integer	1 = z, 2 = +, 3 = -
emission_mask_key	Integer	1 = S, 2 = T, 3 = F
dts_maximum_distance	Double	
dts_sectors	Char (5000)	
site_number	Integer	
dts_time_delay	Double	
parent_source_key	Integer	

Possible service_key values for TV are 1 = DT, 2 = DD, 3 = DC, 4 = LD, 5 = TV, 6 = CA, 7 = TX, 8 = DX, 9 = TS.

A TV DTS facility is described by a set of records beginning with a parent grouping record, a reference facility record with site_number = 0, and one or more transmitter records with site_number > 0. All of the records in the group have unique source_key values; the reference facility and transmitter records are tied to the parent by the parent_source_key value.

Additional fields for FM records are listed below.

facility_id	Integer	
is_iboc	Boolean	
station_class	Integer	1 = C, 2 = C0, 3 = C1, 4 = C2, 5 = C3, 6 = B, 7 = B1, 8 = A, 9 = D, 10 = L1, 11 = L2
channel	Integer	
status	Char (6)	
iboc_fraction	Float	

Possible service_key values for FM are 31 = FM, 32 = FL, 33 = FX, 34 = FB, 35 = FS.

User Records

User records are stored within TVStudy within a table named "user_record". The following fields are available for SQL searches from the user_record table.

user_record_id	integer
record_type	integer
xml_data	text
facility_id	integer
service_key	integer
call_sign	char(12)
status	char(6)
channel	integer
city	char(20)
state	char(2)
country	char(2)
file_number	char(22)
comment	text

Please note that the technical parameters for the record are contained within the xml_data field in for format of an XML SOURCE record.