



TVSTUDY

INSTRUCTION MANUAL

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USING TVSTUDY

Launching TVStudy

To launch TVStudy on the Mac, simply double-click on the TVStudy.app icon (the .app extension may not be shown depending upon how your Finder is configured). To launch TVStudy in Linux, navigate your terminal to the directory where was TVStudy installed and then run:

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

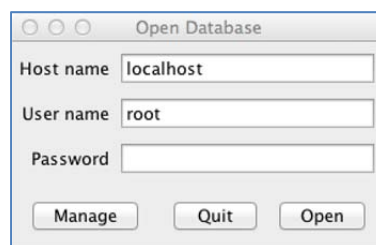
If you are running on the Mac platform and have not installed Java, you will be prompted to install it prior to launching. Additionally, on the Mac, if presented with a warning message saying that TVStudy.app is damaged or from an unknown developer, the “quarantine” security system in the MacOS may be preventing the application from running. You may be able to manually launch the application using right-click (option click if you have a one-button mouse) and selecting “open.” Alternatively, you may need to go to the System Preferences menu, choose “Security & Privacy,” and then choose the “Allow Apps Downloaded from Anywhere” option from the “General” tab. Once you have run TVStudy.app for the first time, you should be able to return your security settings to their original values and still launch TVStudy successfully, which is strongly recommended.

If you are running on the Linux platform and receive an error message that looks like this:

```
Exception in thread "main" java.lang.UnsupportedClassVersionError:  
gov/fcc/tvstudy/AppManager : Unsupported major.minor version 51.0
```

You may have two versions of Java installed and TVStudy is attempting to launch using the older one. To resolve this issue, remove the older version of Java from your system using the normal method of removing such software.

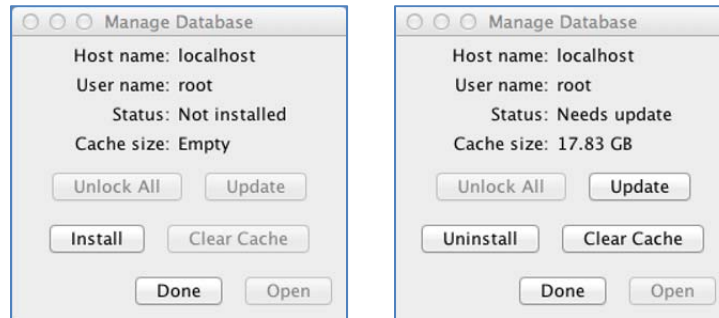
Upon opening TVStudy, you will see the Open Database window.



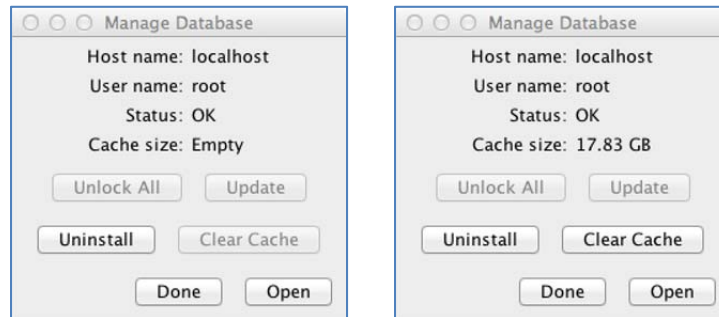
If you’re running your MySQL database server on your machine, you may need to enter “localhost” or “127.0.0.1” as your host name. You will need the user name and password to access your database. When finished, click “Open.”

Managing the TVStudy Database

If this is your first time running TVStudy, the software will open the “Manage Database” window. If not, you can open the Manage Database window by clicking “Manage” after putting your password into the “Open Database” window.

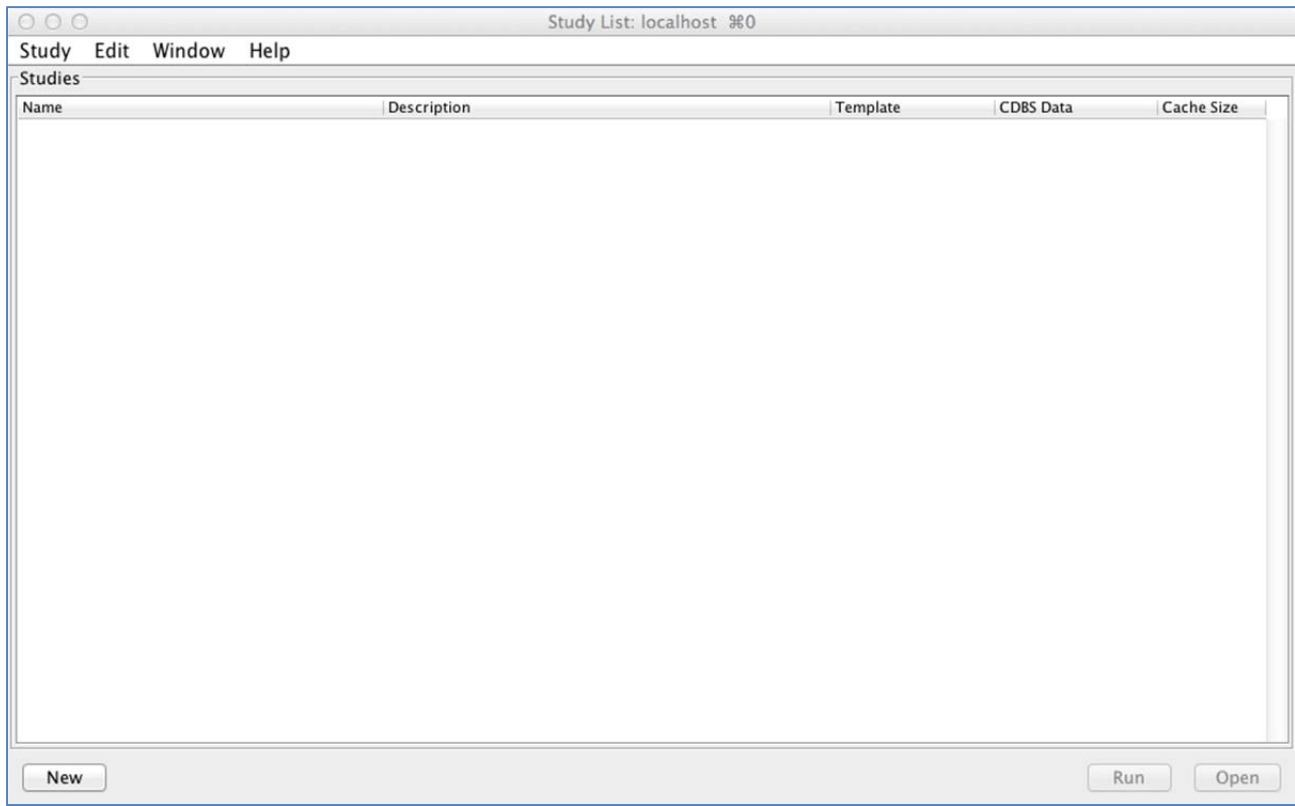


This window allows you to update your database to the latest version if you are upgrading, or install the root database for a new installation. Click “Install” or “Update,” as appropriate, and it will do so automatically, taking up to about 10 minutes.

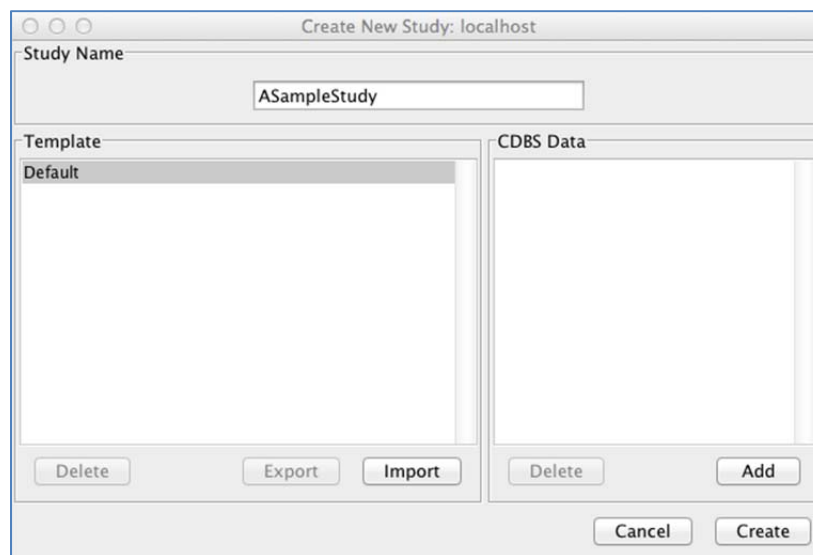


It also allows you to resolve some common database issues, such as locked databases preventing you from gaining access to the Study List window, corrupt database, or cache problems by clicking the appropriate buttons.

Creating a New Study



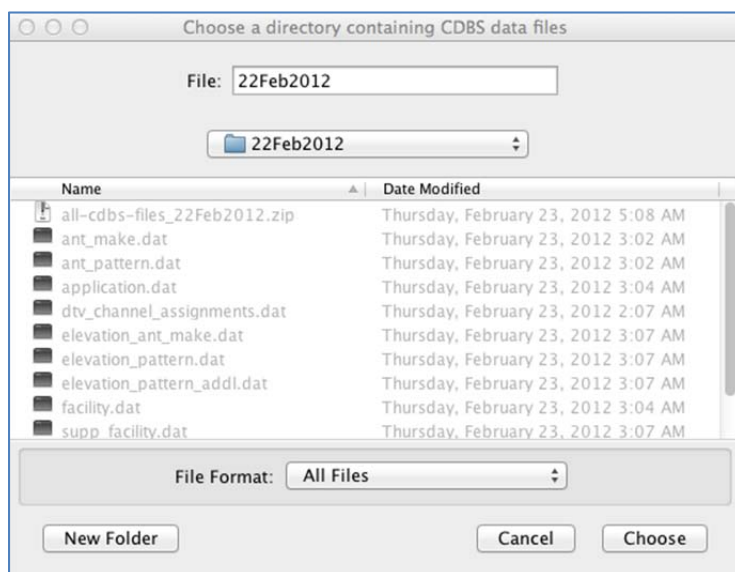
The first time opening the software, you will see an empty Study List window, as shown above. To begin, click the “New” button at the bottom left corner.



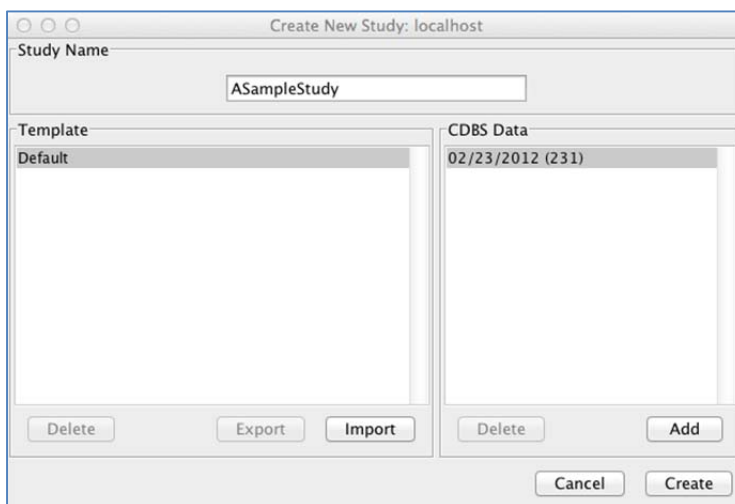
This is the interface for creating a study. In “Study Name,” choose a name for your study. You will want to avoid special characters and limit the length to a reasonable number of characters, since this name is used to create the path for your output files.

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 the same results. Learn how to create and manage study templates on page 53.

At the right, you must choose from the various CDBS databases on your system, or add a new one. Click Add and navigate to the directory containing the database files you wish to import. Usually this will be your cdbb directory.



In the image above, the 22Feb2012 directory that was included with the TVStudy installation files has been selected. Click “Choose.” You will be prompted to give the database a name, which is optional. If you are doing a number of studies with different databases, naming the database may prove useful in helping to keep them organized. Either click “OK” to use the default name, or after entering a name, click “OK.” Clicking “Cancel” will prevent the database from being imported.



After a brief wait while the database files are imported, you should now see your database in the pane on the right. It is named with the most recent date reflected in the database along with the number of records that have that date. Select it and click “Create.”

Open Study: localhost/ASampleStudy #1

Edit Window Help

Please set study parameter values; these cannot be changed later.

General CDBS

Check individual DTS transmitter distances ☐ Revert

Spherical earth distance 111.15 Revert

Rule limit extra distance 162 Revert

Co-channel MX distance 30 Revert

First TV channel 2 Revert

Last TV channel 51 Revert

Cancel OK

Once the study is created, you should see the above parameter setting window. The values in the two tabs in this window cannot be changed once you have set them, since they impact the way data are retrieved from your CDBS database. If these parameters could be changed, then searches conducted prior to the change would give different results than searches conducted after the change, which could lead to inconsistent data.

Open Study: localhost/ASampleStudy #1

Edit Window Help

Please set study parameter values; these cannot be changed later.

General CDBS

Respect CDBS DA flag ☐ Revert

Use generic patterns for Canadian records ☒ Revert

Mexican digital ERP, VHF low 45 Revert

Mexican digital HAAT, VHF low 305 Revert

Mexican digital ERP, VHF high 160 Revert

Mexican digital HAAT, VHF high 305 Revert

Mexican digital ERP, UHF 1000 Revert

Mexican digital HAAT, UHF 365 Revert

Mexican analog ERP, VHF low 100 Revert

Mexican analog HAAT, VHF low 305 Revert

Mexican analog ERP, VHF high 316 Revert

Mexican analog HAAT, VHF high 305 Revert

Mexican analog ERP, UHF 5000 Revert

Mexican analog HAAT, UHF 610 Revert

Cancel OK

Initial (Fixed) Study Parameters

General

Check individual DTS transmitter distances – 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.

Spherical earth distance – 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.

Rule limit extra distance – This constant controls the distance in kilometers beyond the distance specified in OET Bulletin No. 69 that a distance-based query will search for interferers. Adding extra distance can help ensure that all possible interferers are considered.

Co-channel MX distance – This constant determines when two stations are considered to be mutually exclusive 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.

First and Last channels – These constants set the channel limits used for importing data from CDBS. This can be useful in the Mexican border region where stations may still exist above channel 51.

CDBS

Respect CDBS DA flag – In CDBS, there are a number of 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).

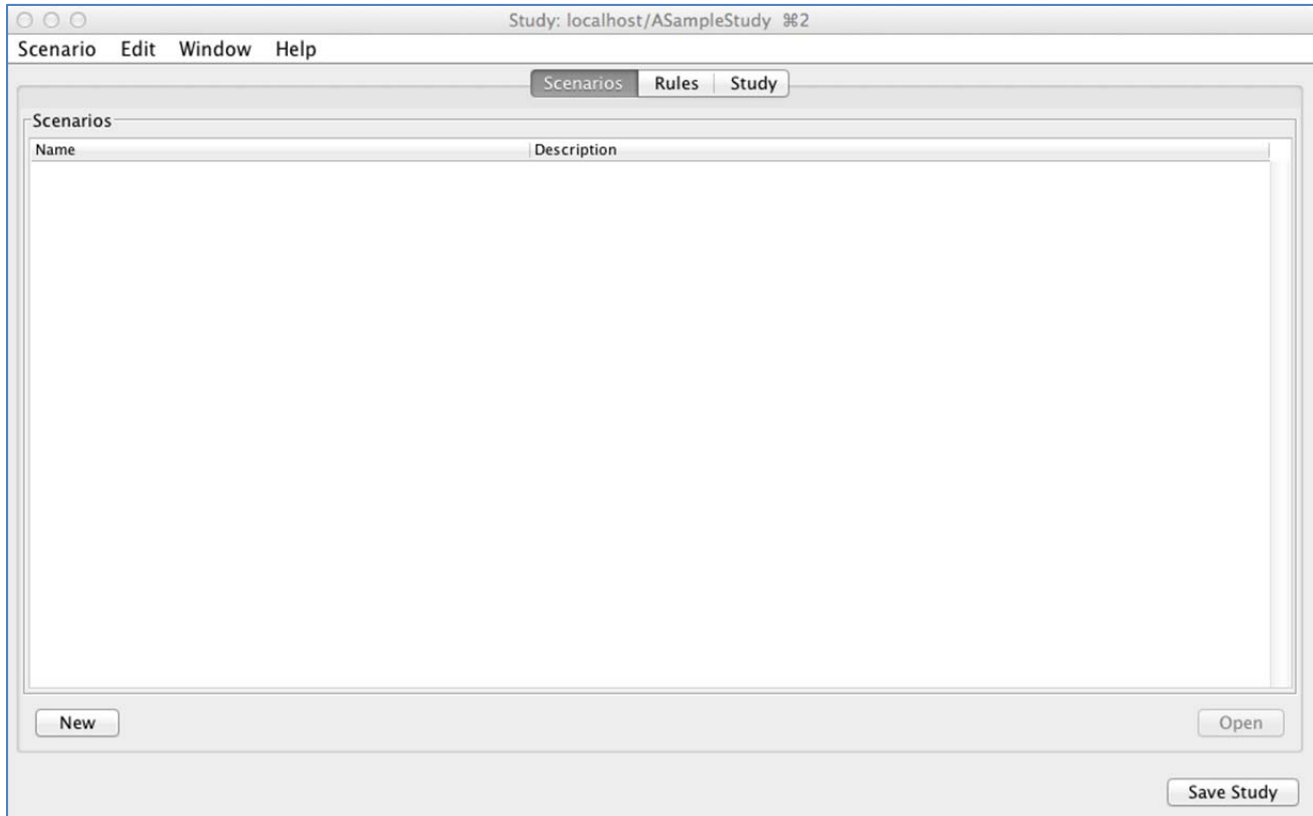
Use generic patterns for Canadian records – If checked, the generic OET69 elevation pattern will be applied to Canadian records. If unchecked, no elevation pattern will be used.

Mexican ERP and HAAT values – In CDBS, there are a number of Mexican allotments that lack ERP and HAAT values. These settings control what ERP and HAAT values are assigned to those allotments.

Once you are satisfied with these parameters, click “OK.”

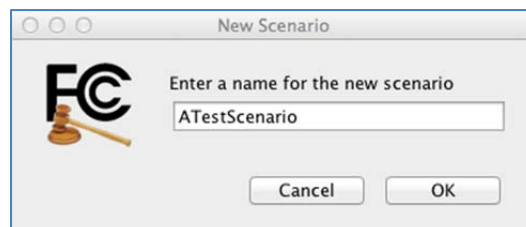
Creating a New Scenario

Once a study has been created, we can turn to the Study window. There are three tabs in this window: Scenarios, Rules, and Study.



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 as specified in the study.

The first step is to create a new scenario, which is done using the Scenarios tab. 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.”

Scenario: localhost/ASampleStudy/ATestScenario %1

Station Edit Window Help

Scenario Name

ATestScenario

Scenario Description

This is the description of a test scenario.

Stations

Des	Und	Facility ID	Call Sign	Channel	Status	File Number	City	State	Country
-----	-----	-------------	-----------	---------	--------	-------------	------	-------	---------

Add Remove View

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.

There are two types of stations you can add to a scenario. A “desired” station is one that will be evaluated for coverage only (it cannot cause interference to other stations). An “undesired” station is one that will only be a potential interference source for desired stations—its coverage is not calculated beyond the minimum necessary to determine interference. You can (and normally should) evaluate a station for both coverage and interference, such that a station evaluated for coverage and incoming interference can also cause interference to other stations.

Adding Station(s) to a Scenario

Adding Individual Stations

There are several ways to add stations to a scenario. To add one existing station at a time, click “Add” at the bottom left corner.

There are a variety of search parameters to choose from. Enter values into one or more of the fields and click “Search.” Each of the search fields is restrictive (*i.e.*, a logical *and*).

Call Sign	Channel	Status	File Number	City	State
WRCF-LP	D35	CP MOD	BMPDTA20111121AYK	ORLANDO	FL
WRCB	D13	LIC	BLCDT20110729ACZ	CHATTANOOGA	TN
WRC-TV	D48	APP	BXPCDT20111013AGX	WASHINGTON	DC
WRCX-LP	D40	CP	BDFCDTL20090507ABE	DAYTON	OH
WRCX-LP	N40	LIC	BLTTL20090223AAQ	DAYTON	OH
WRCB	D13	LIC	BXLCDT20070912AAO	CHATTANOOGA	TN
WRCF-LP	N29	LIC	BLTTL20001020AAD	ORLANDO	FL
WRC-TV	D48	LIC	BLCDT20000216AAT	WASHINGTON	DC
WRCBTV	D13	GRANT	BPRM20000328AAG	CHATTANOOGA	TN

Facility ID 47904 N 38-56-24.0 W 77-04-54.0 312.0 m 813 kW

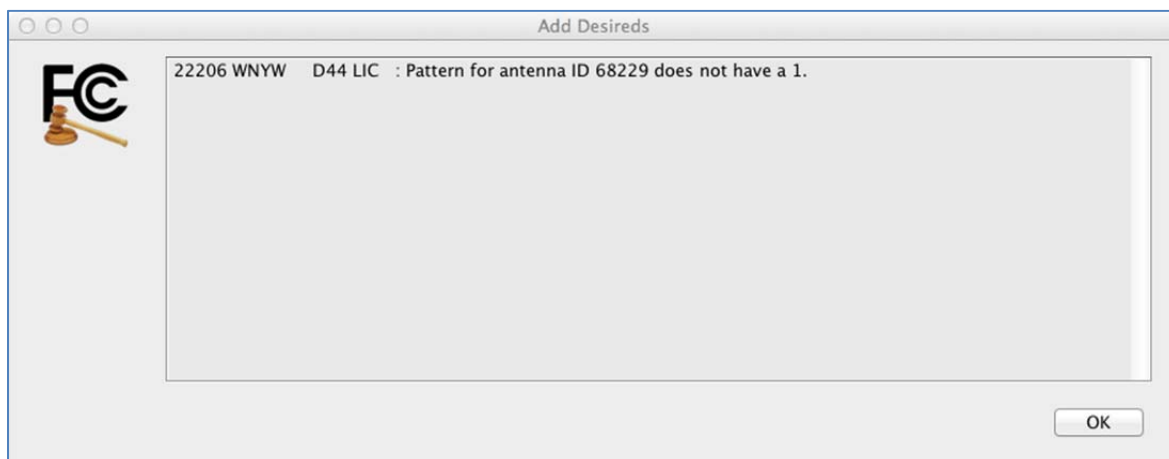
Multiple records matching the search criteria may be returned. In the pane at the bottom, select the record that you wish to add to your scenario and click “Use.”

The screenshot shows a window titled "Scenario: localhost/ASampleStudy/ATestScenario %1". The window has a menu bar with "Station", "Edit", "Window", and "Help". Below the menu bar, there are two sections: "Scenario Name" and "Scenario Description". The "Scenario Name" section contains a text box with "ATestScenario". The "Scenario Description" section contains a text box with "This is the description of a test scenario." Below these sections is a "Stations" section containing a table with the following columns: "Des", "Und", "Facility ID", "Call Sign", "Channel", "Status", "File Number", "City", "State", and "Country". The table has one row with the following values: "Des" (checked), "Und" (checked), "47904", "WRC-TV", "D48", "LIC", "BLCDT20000216AAT", "WASHINGTON", "DC", and "US". Below the table are three buttons: "Add", "Remove", and "View".

Des	Und	Facility ID	Call Sign	Channel	Status	File Number	City	State	Country
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	47904	WRC-TV	D48	LIC	BLCDT20000216AAT	WASHINGTON	DC	US

TVStudy will warn you of any unusual conditions it encounters (see page 15) 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.

CDBS Data Warnings



CDBS data warnings will not prevent execution of a study; they are provided to alert you to potentially undesirable 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.

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, 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 that the ERP was entered in dBk instead of ERP, and is converted to kilowatts.

Using ERP value from max_erp_any_angle – 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 11.1 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, usually meaning the tilt orientation (azimuth) was not entered in CDBS. This may not be an error if the tilt orientation is actually toward 0. 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 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 (*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 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 0 or 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 are missing a 1.0 maximum relative field point, usually because the antenna is at an odd rotation but the data are 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 applies a generic pattern, if allowed. 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 depression angles(s) outside the range $-90 \leq \theta \leq 90^\circ$.

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

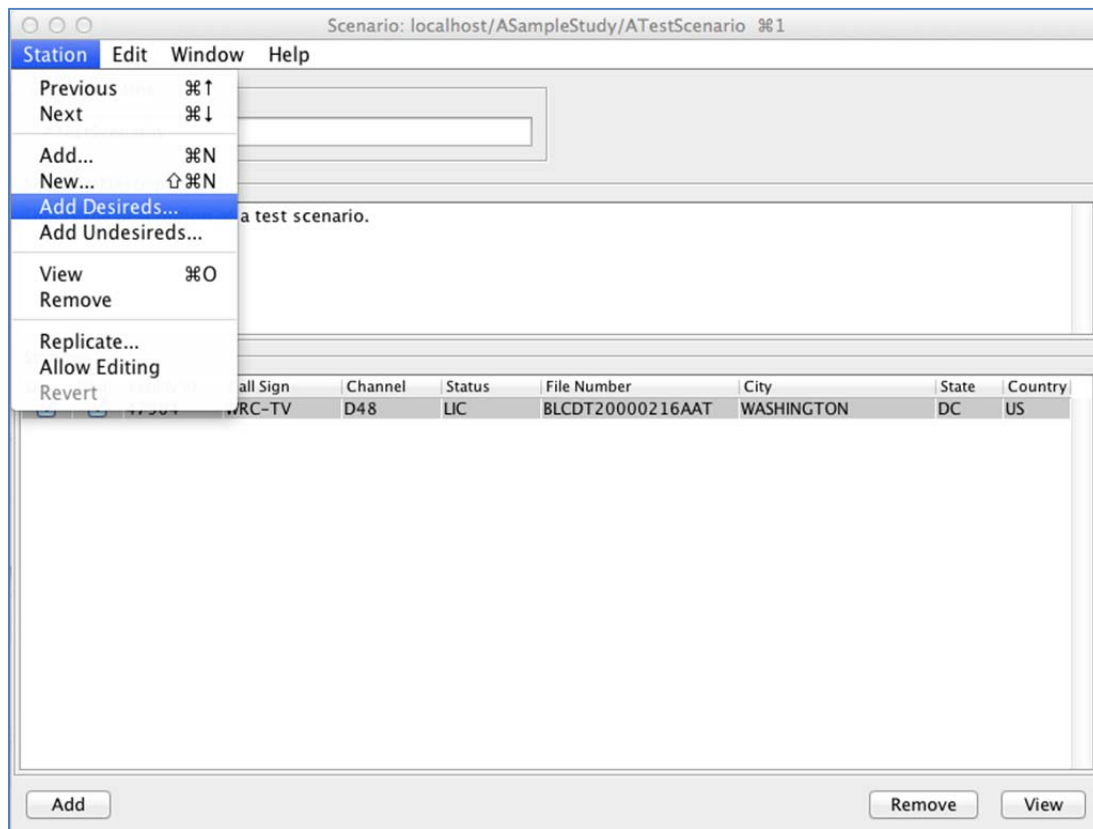
Relative field out of range – Pattern had field value(s) less than 0 or greater than 1.

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 record in a given study; if the same record is used again in a different scenario, the warnings do not appear.

Adding Desired 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, from the Station drop-down menu, select “Add Desireds...”

There are four common search methods shown on this screen, along with a pane to enter “Additional SQL for query WHERE clause.” This allows you to enter custom search parameters based on any field in CDBS. For example, you could enter the following query and your search would only return results that are within the Canadian border zone, excluding any that fail to meet other criteria selected in the other part of the window:

```
tv_eng_data.border_code = 'C'
```

For a full set of query examples, please see Appendix J on page 75.

Also note the three checkboxes at the top 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 are added as desired, but not undesired, to prevent one or both from receiving 100% interference.

Prefer operating facilities – By default, this search window prefers the “newest” record in CDBS (*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.

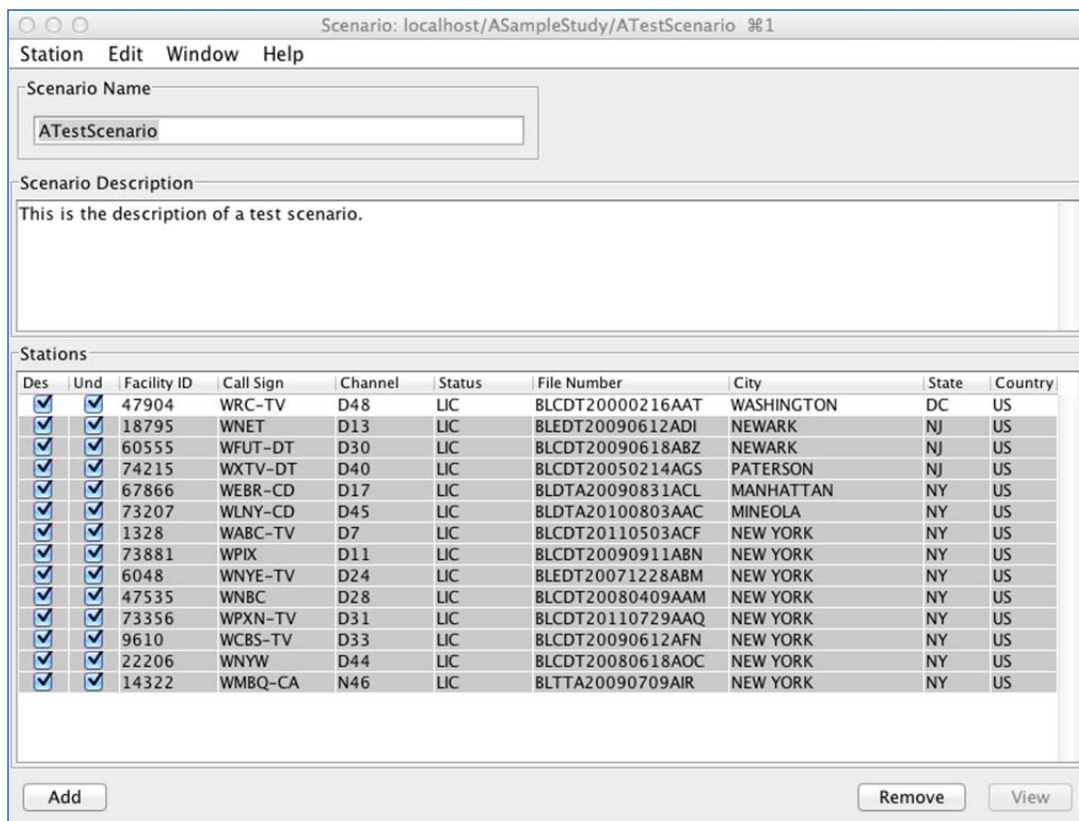
Add stations as desired-only – Stations added with Add Desireds function are automatically added as both desired and undesired. If you check this box, the records will be added as desired only.

When finished, click “Add Desireds.”

After reviewing CDBS data warning messages (see page 15), 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.



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.

Adding Undesired Stations

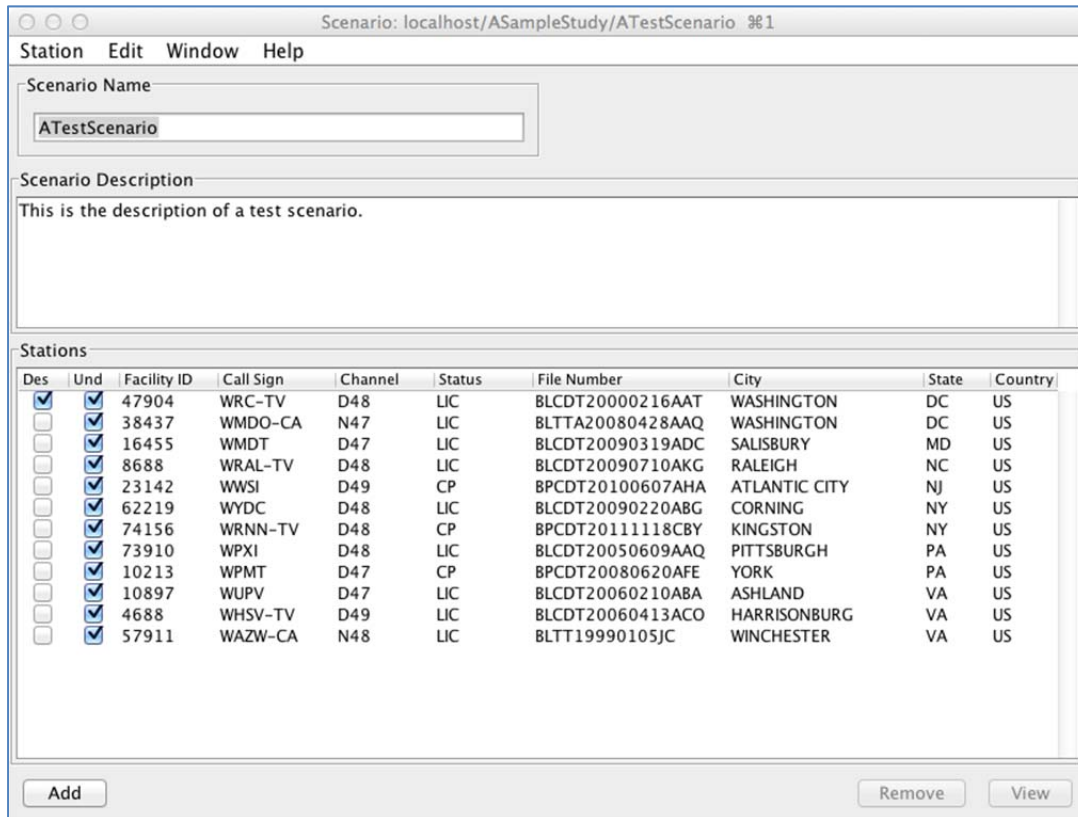
You can add undesired stations to the study in the same way that desired stations are added. Choose “Add Undesireds...” from the Station dropdown menu.

As with the search for desired stations, you can set the parameters here to narrow your search for undesired stations. However, only stations that meet the rules to be considered for your desired stations will be added, regardless of the other parameters. For example, if you only have desired stations in Texas and you set TVStudy to only search for undesired stations in Canada, TVStudy will return no results.

When you are satisfied, click “Add Undesireds.”



After reviewing CDBS data warning messages (see page 15), if any, click “OK.” TVStudy then reports the number of stations that were added to the results.



You can tell the added stations are undesired because the “Und” checkbox is checked while the “Des” checkbox is unchecked.

Undesired stations can be added at any time so long as there is at least one desired station to analyze.

Adding New Stations

Finally, it is possible to add new stations that do not appear in CDBS. To do this, select “New” from the Station dropdown menu.

You will have to specify a facility ID, country, and station class. These values cannot be changed later. If you are studying a new facility unrelated to an existing one, you will want to choose a facility ID that is not being used by another TV station.

Engineering parameters can be entered in this window into any active field, including the antenna pattern, which is addressed on page 27.

To modify a CDBS record, rather than creating a new station, see page 23.

When finished, click “OK.” Your new record will appear in the scenario. As with the other record addition methods, you can then uncheck the appropriate boxes to make a station undesired- or desired-only.

Modifying 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. Note that changing the channel of a station causes that station to be replicated onto a new channel automatically when the study is run.

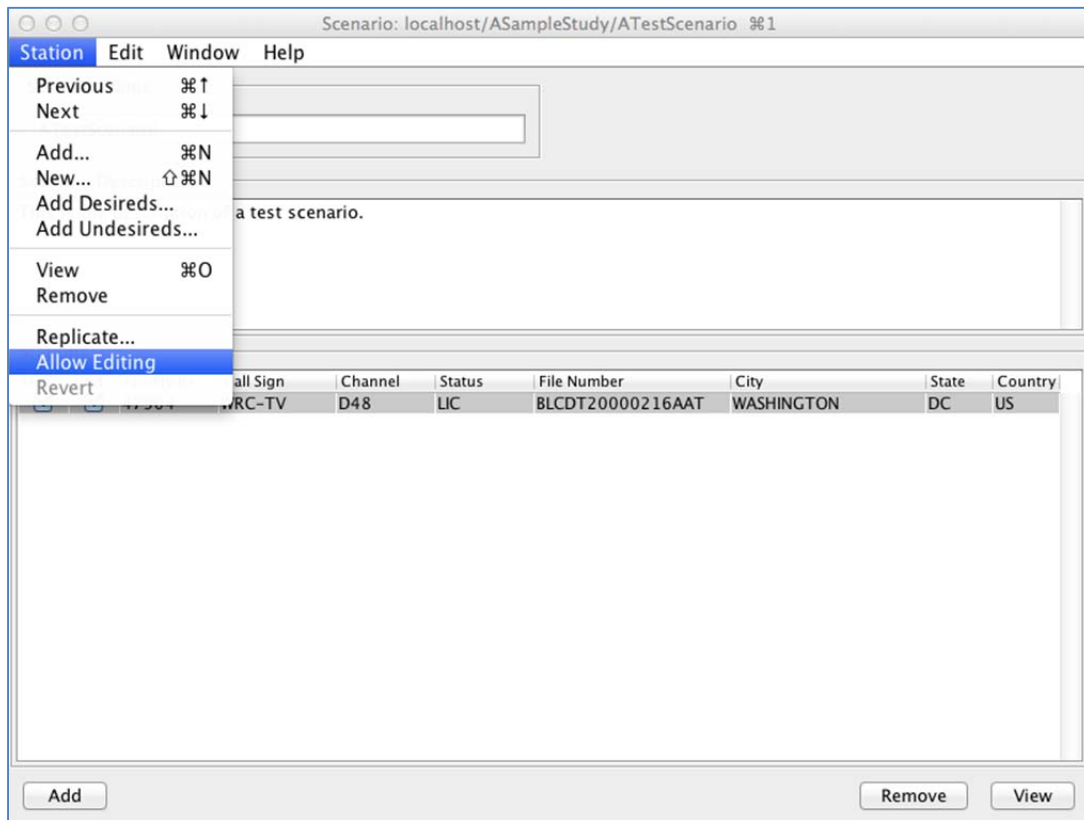
Modifying and Reverting Stations

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

Station Data: localhost/ASampleStudy/ATestScenario/WRC-TV

Facility ID 47904	Service Digital TV	Country U.S.	Call Sign WRC-TV	Status LIC
File Number BLCDT20000216AAT	City WASHINGTON	State DC	Zone I	
Channel 48	Frequency Offset (none)	Emission Mask (n/a)		
Latitude (NAD27) N 38 ° 56 ' 24.00 "		Longitude (NAD27) W 77 ° 4 ' 54.00 "		
Height AMSL, m 312.0	HAAT, m 242.0	Peak ERP, kW 813	Azimuth Pattern (none) Orient. 0.0	
Elevation Pattern (none)		Elec. Tilt 0.75 Mech. Tilt 0.00 Tilt Orient. 0.0		
View		Use generic vertical pattern <input checked="" type="checkbox"/>		
OK				

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. However, it is also possible that the values in CDBS may not be what you wish to use. 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.

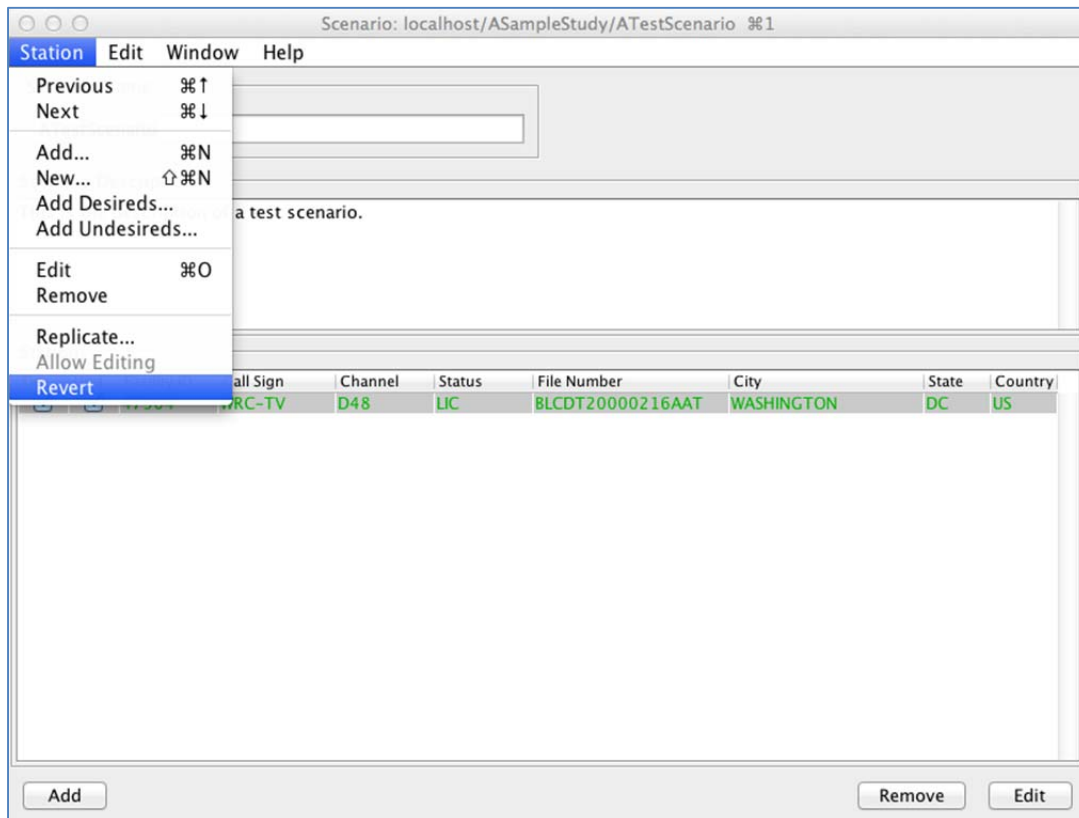


The appropriate window opens and you can make the edits you wish to the relevant parameters in the record.

Station Data: localhost/ASampleStudy/ATestScenario/WRC-TV

Facility ID 47904	Service Digital TV	Country U.S.	Call Sign WRC-TV	Status LIC
File Number BLCDT20000216AAT	City WASHINGTON	State DC	Zone I	
Channel 48	Frequency Offset (none)	Emission Mask (n/a)		
Latitude (NAD27) N 38 ° 56 ' 24.00 "		Longitude (NAD27) W 77 ° 4 ' 54.00 "		
Height AMSL, m 312.0	HAAT, m 242.0	Peak ERP, kW 813	Azimuth Pattern (none) Orient. 0.0 Edit	
Elevation Pattern (none) Edit Elec. Tilt 0.75 Mech. Tilt 0.00 Tilt Orient. 0.0 <input checked="" type="checkbox"/> Use generic vertical pattern				
				Cancel OK

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.



Editable records appear in **green** in the Scenario window. If you want to revert back to the original CDBS record values, choose "Revert" from the Station dropdown menu.

Viewing and Modifying 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.”

DTS Station Data: localhost/ASampleStudy/ASampleScenario/WTVE

Facility ID 55305	Country U.S.	Call Sign WTVE	Status LIC
City READING		State PA	Zone I
Channel 25		File Number BLCDT20100405ABM	

Reference point and distance

Latitude (NAD27)
N 40 ° 19 ' 52.00 "

Longitude (NAD27)
W 75 ° 41 ' 41.00 "

Distance, km
(table)

Record	Latitude	Longitude	Height, m	ERP, kW
Reference	40 19 52.20 N	75 41 41.30 W	533.0	900
Site 1	40 21 15.57 N	75 53 56.96 W	365.7	0.763
Site 2	40 02 29.56 N	75 14 12.89 W	443.6	126

View OK

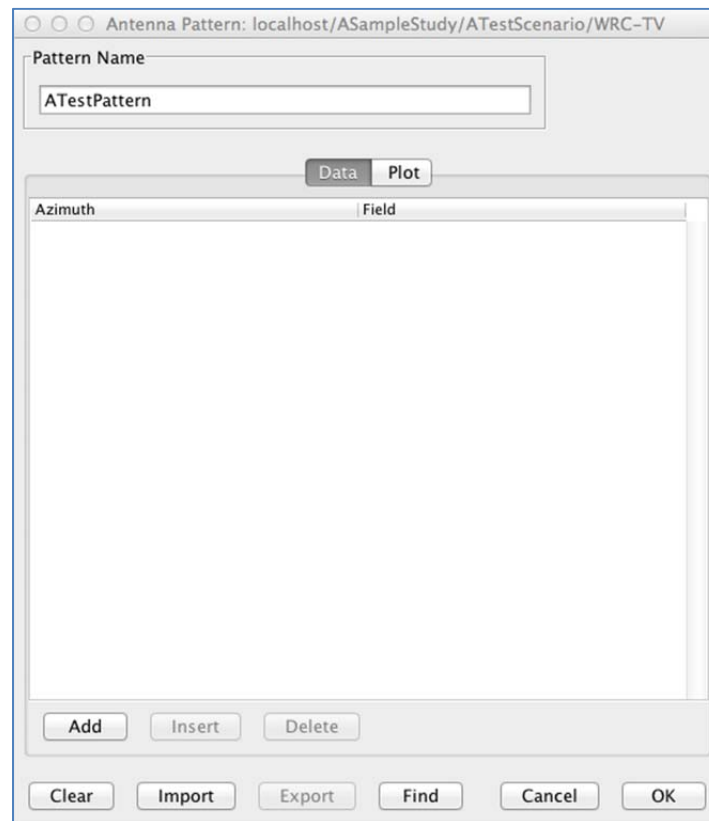
Instead of going straight to the transmitter information screen, you are given information about the facility, the reference point coordinates and reference distance, as well as the various station data records associated with the record. Select one and click “View.”

Station Data: localhost/ASampleStudy/ASampleScenario/WTVE/Site 1

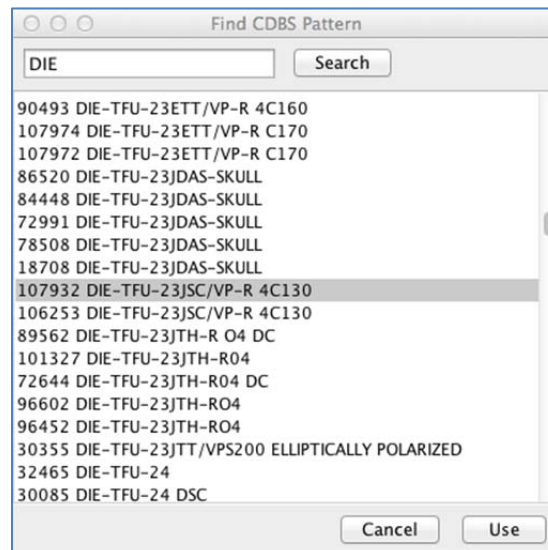
Facility ID 55305	Service Digital TV DTS	Country U.S.	Call Sign WTVE	Status LIC
File Number BLCDT20100405ABM	City READING	State PA	Zone I	
Channel 25	Frequency Offset (none)	Emission Mask (n/a)	Site Number 1 App. ID 1361451	
Latitude (NAD27) N 40 ° 21 ' 15.57 "		Longitude (NAD27) W 75 ° 53 ' 56.96 "		
Height AMSL, m 365.7	HAAT, m 225.3	Peak ERP, kW 0.763	Azimuth Pattern RFS-DX32B-07 Orient. 302.0 View	
Elevation Pattern RFS-DX32B-07 View				
Elec. Tilt 0.70				
Mech. Tilt 0.00				
Tilt Orient. 0.0				
<input checked="" type="checkbox"/> May use generic pattern when needed				
OK				

Here, you see the normal screen for editing a record in TVStudy. You may now view and modify the record in the same way that you would for any non-DTS facility.

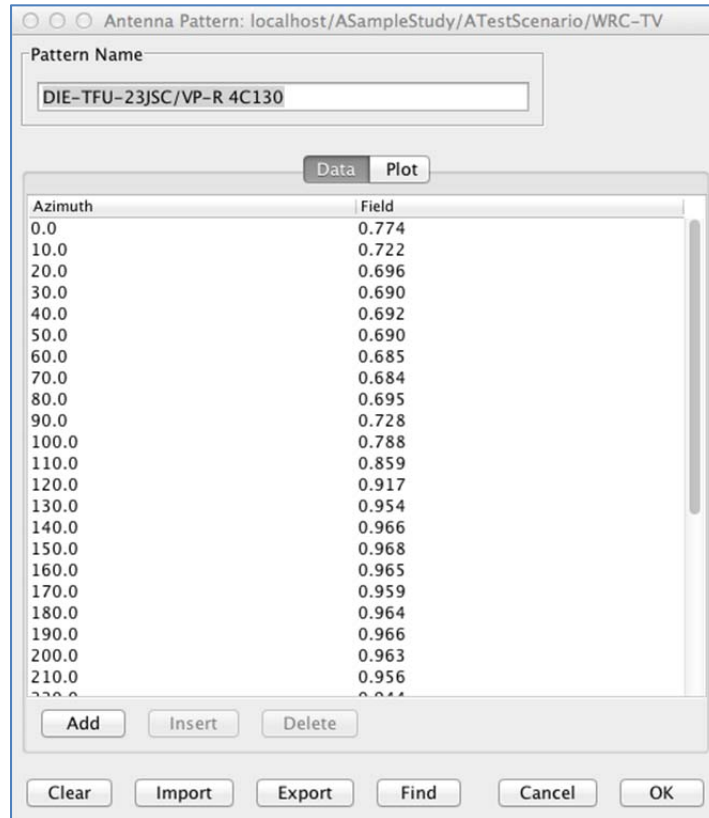
Antenna Pattern Editor



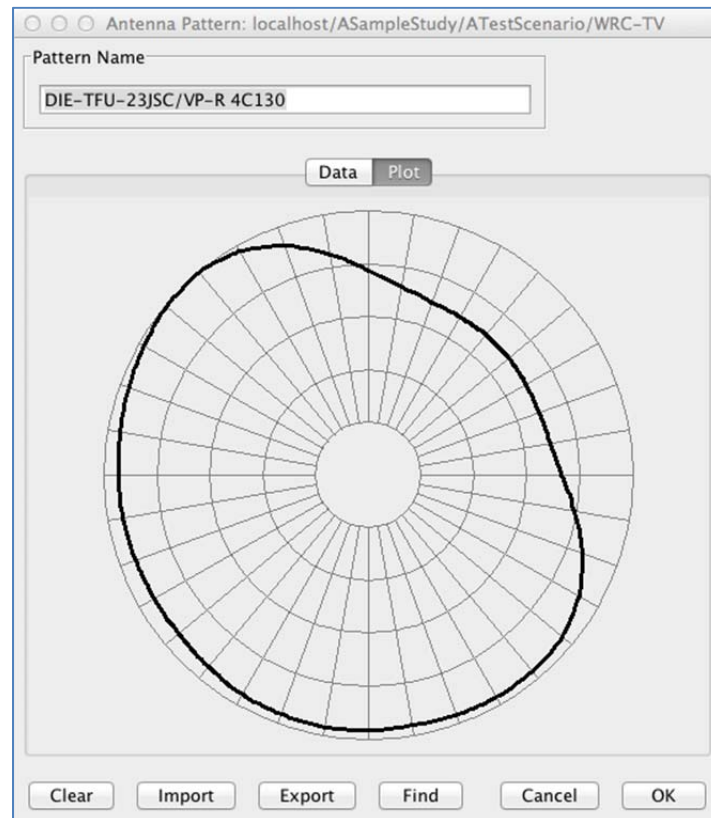
When editing or creating a record, by clicking “Edit” for the azimuth pattern or elevation pattern, you can either retrieve an existing pattern from CDBS or manually specify your own pattern. You can also use this window to view, create, or modify patterns in CDBS records.



Click on “Find” to search for an existing antenna pattern to use. You can search by make, model, or antenna ID number. Note that manufacturer names and model numbering conventions may not be strictly followed in CDBS records. When you locate the desired pattern, click “Use.”

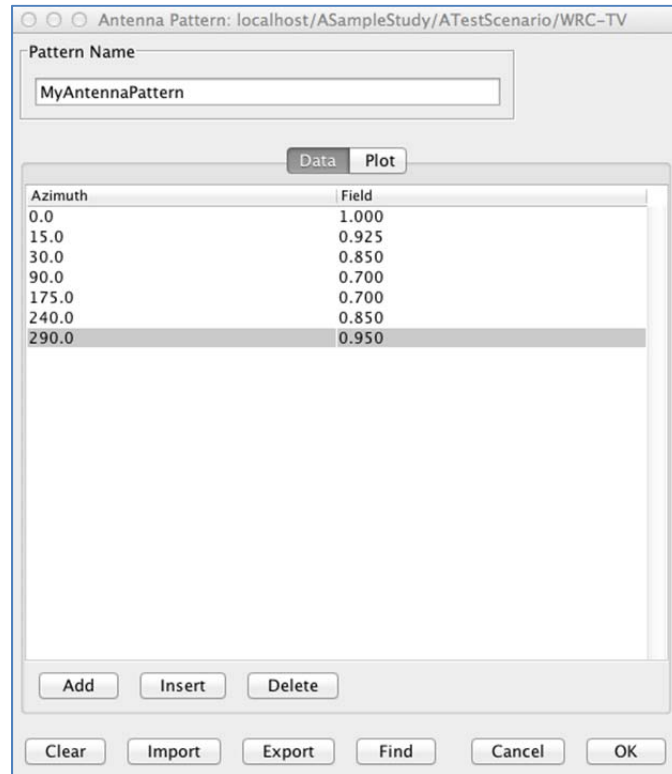


Here you can see that the field values now appear in the Pattern Data area. You can click and edit the values if you wish. To see the antenna pattern graphically as a polar plot, click on the “Plot” tab.

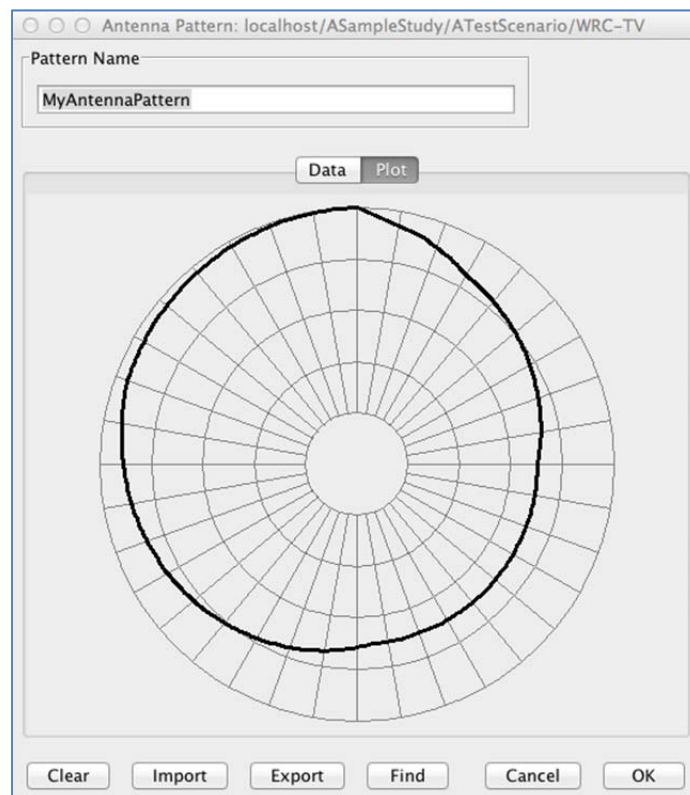


You can Import and Export antenna patterns using the “Import” and “Export” buttons. A CSV file is produced on Export and is required on Import. TVStudy will interpolate between the azimuth angles provided, so you can provide as many or as few azimuth values as you wish.

If you want to go revert to an omni-directional pattern, click on “Clear” and an omni pattern will be substituted.



Arbitrary antenna patterns can also be created by using the “Add” button 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.



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

When finished, click “OK,” and the Station Data window will open. If you are finished editing your record, then click “OK.”

Again, at this point, if you want to revert back to the CDBS record antenna pattern values, choose “Revert” from the Station dropdown menu once back at the Scenario window.

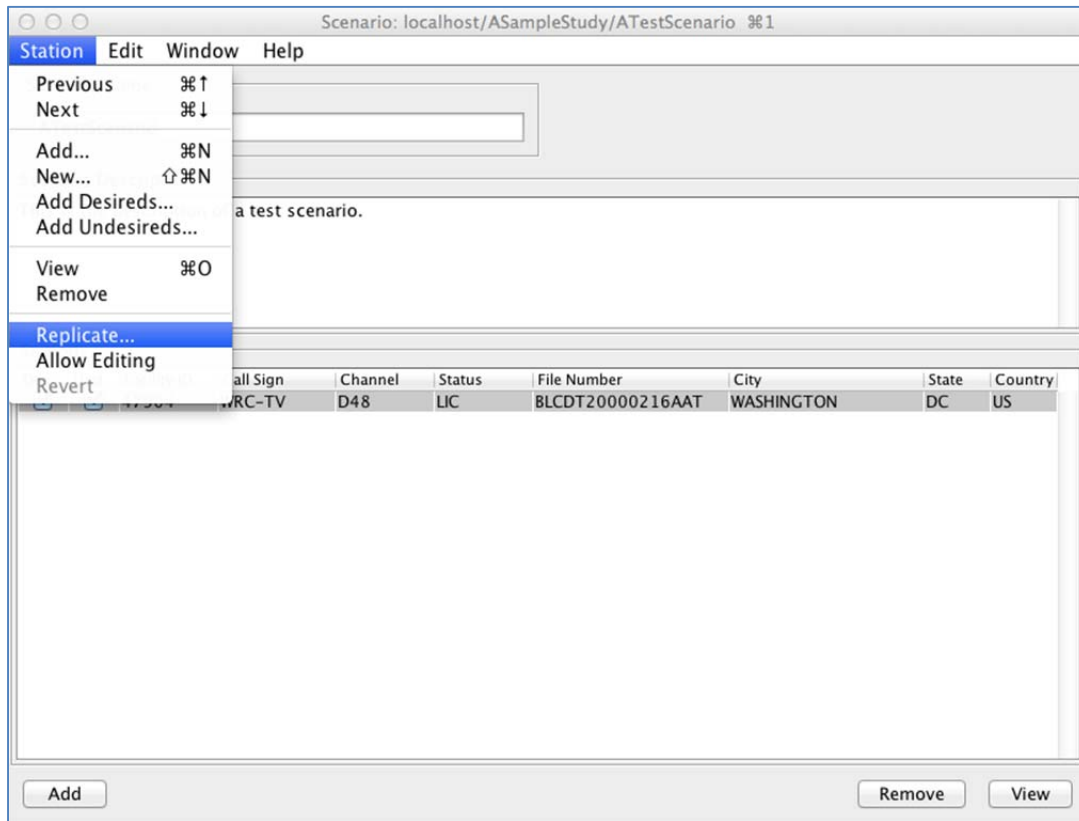
The screenshot shows the 'Station Data' window for a station named 'WRC-TV'. The window is titled 'Station Data: localhost/ASampleStudy/ATestScenario/WRC-TV'. It contains several sections for data entry:

- Facility ID:** 47904
- Service:** Digital TV
- Country:** U.S.
- Call Sign:** WRC-TV
- Status:** LIC
- File Number:** BLCDT20000216AAT
- City:** WASHINGTON
- State:** DC
- Zone:** I
- Channel:** 48
- Frequency Offset:** (none)
- Emission Mask:** (n/a)
- Latitude (NAD27):** N 38° 56' 24.00"
- Longitude (NAD27):** W 77° 4' 54.00"
- Height AMSL, m:** 312.0
- HAAT, m:** 242.0
- Peak ERP, kW:** 813
- Azimuth Pattern:**
 - MyAntennaPattern:** Edit
 - Orient.:** 160.0
- Elevation Pattern:**
 - (none):** Edit
 - Elec. Tilt:** 0.75
 - Mech. Tilt:** 0.00
 - Tilt Orient.:** 0.0
 - ☒ Use generic vertical pattern

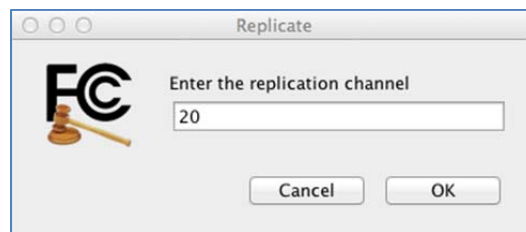
At the bottom right, there are 'Cancel' and 'OK' buttons.

The antenna name will now appear in the Azimuth Pattern section, and you can control the rotation of the antenna by adjusting the number of degrees listed in the “Orient.” field.

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."

The screenshot shows the TVStudy application window titled "Scenario: localhost/ASampleStudy/ATestScenario %1". The window has a menu bar with "Station", "Edit", "Window", and "Help". Below the menu bar, there are three main sections:

- Scenario Name:** A text field containing "ATestScenario".
- Scenario Description:** A text area containing "This is the description of a test scenario."
- Stations:** A table with columns: Des, Und, Facility ID, Call Sign, Channel, Status, File Number, City, State, and Country. The table contains one row with the following data: Des (checked), Und (checked), Facility ID (47904), Call Sign (WRC-TV), Channel (D20 (D48)), Status (LIC), File Number (BLCDT20000216AAT), City (WASHINGTON), State (DC), and Country (US).

At the bottom of the window, there are three buttons: "Add", "Remove", and "View".

Des	Und	Facility ID	Call Sign	Channel	Status	File Number	City	State	Country
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	47904	WRC-TV	D20 (D48)	LIC	BLCDT20000216AAT	WASHINGTON	DC	US

In the above example, you can see that the “Channel” column now shows D20 as the replication channel, while (D48) 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 any stations to new analog channels.

Station Data: localhost/ASampleStudy/ATestScenario/WRC-TV

Facility ID 47904	Service Digital TV	Country U.S.	Call Sign WRC-TV	Status LIC
File Number BLCDT20000216AAT	City WASHINGTON	State DC	Zone I	
Channel 20 replicated from D48	Frequency Offset (none)	Emission Mask (n/a)		
Latitude (NAD27) N 38 ° 56 ' 24.00 "		Longitude (NAD27) W 77 ° 4 ' 54.00 "		
Height AMSL, m 312.0	HAAT, m 242.0	Peak ERP, kW 0.001	Azimuth Pattern (none) Orient. 0.0 View	
Elevation Pattern (none) View Elec. Tilt 0.00 Mech. Tilt 0.00 Tilt Orient. 0.0 <input checked="" type="checkbox"/> Use generic vertical pattern				

OK

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. So, 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, choosing "Revert" from the Station menu will return the replicated station to its original channel.

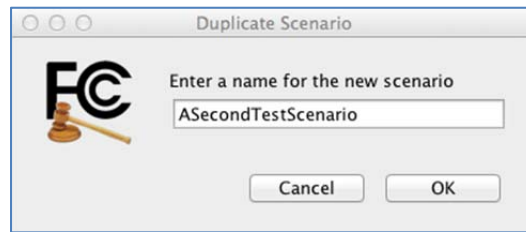
When you are satisfied with your scenario, close the Scenario window and return to the Study window.

Managing Scenarios

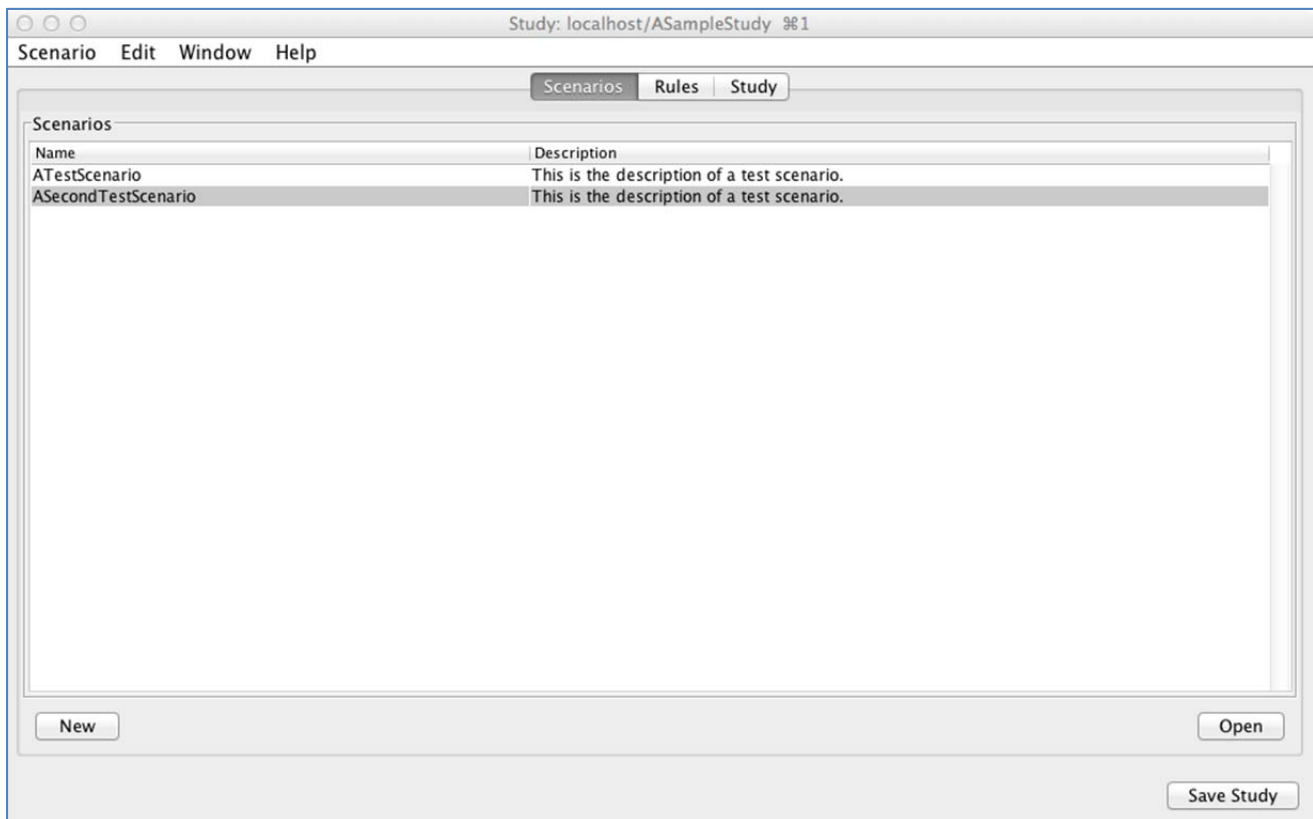
Duplicating a Scenario

One useful feature in TVStudy is that you can duplicate a scenario. This can be useful if you want to study the exact same stations while varying one or more of the study parameter values.

Choose the “Duplicate...” option from the Scenario dropdown menu.



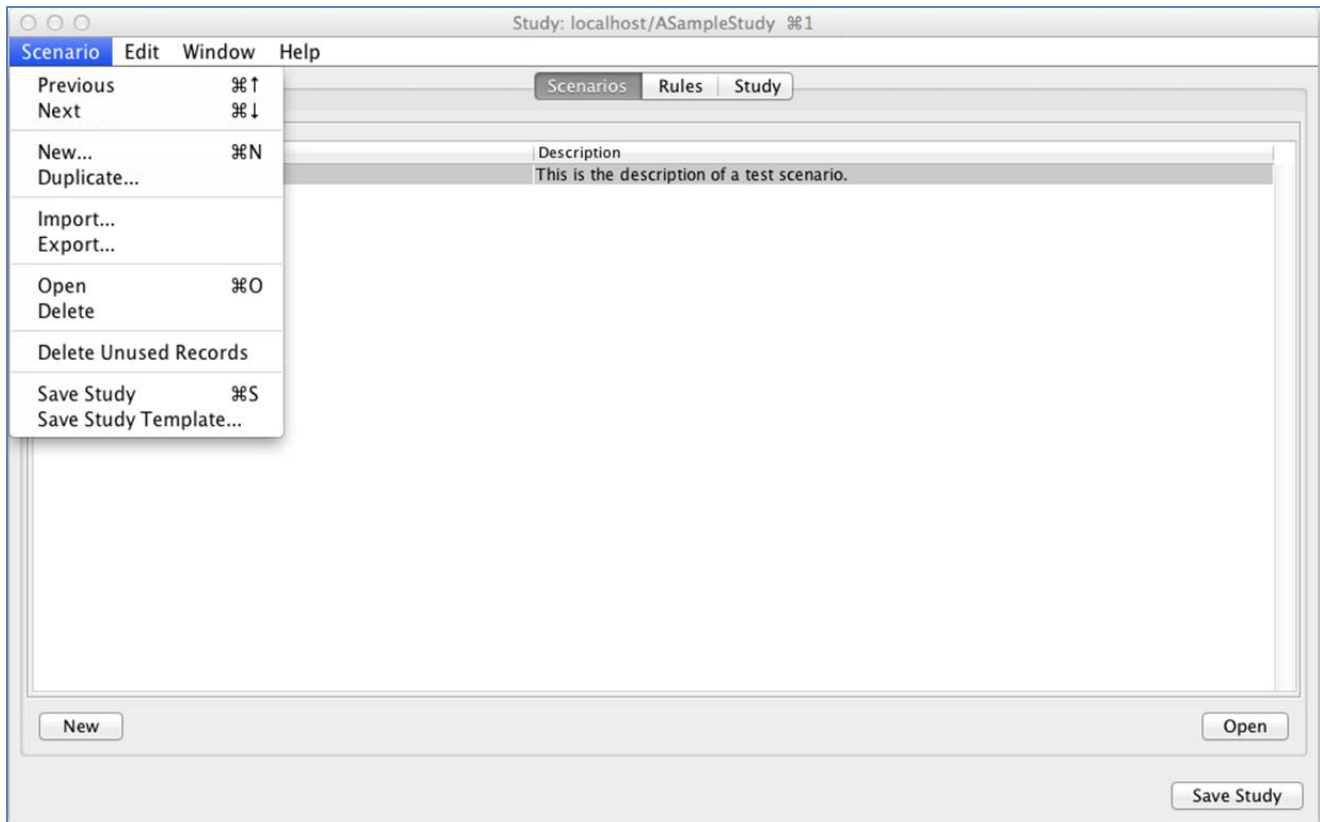
You are prompted to give the new scenario a name. You will want to avoid special characters and limit the length to a reasonable number of characters, since this name is used as part of the path for your output files. TVStudy immediately opens up the new duplicate scenario for you, on the assumption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

Another useful feature is the ability to import and export scenarios. This can be useful for comparing the results of a scenario across multiple studies. You can also delete scenarios that are no longer required.



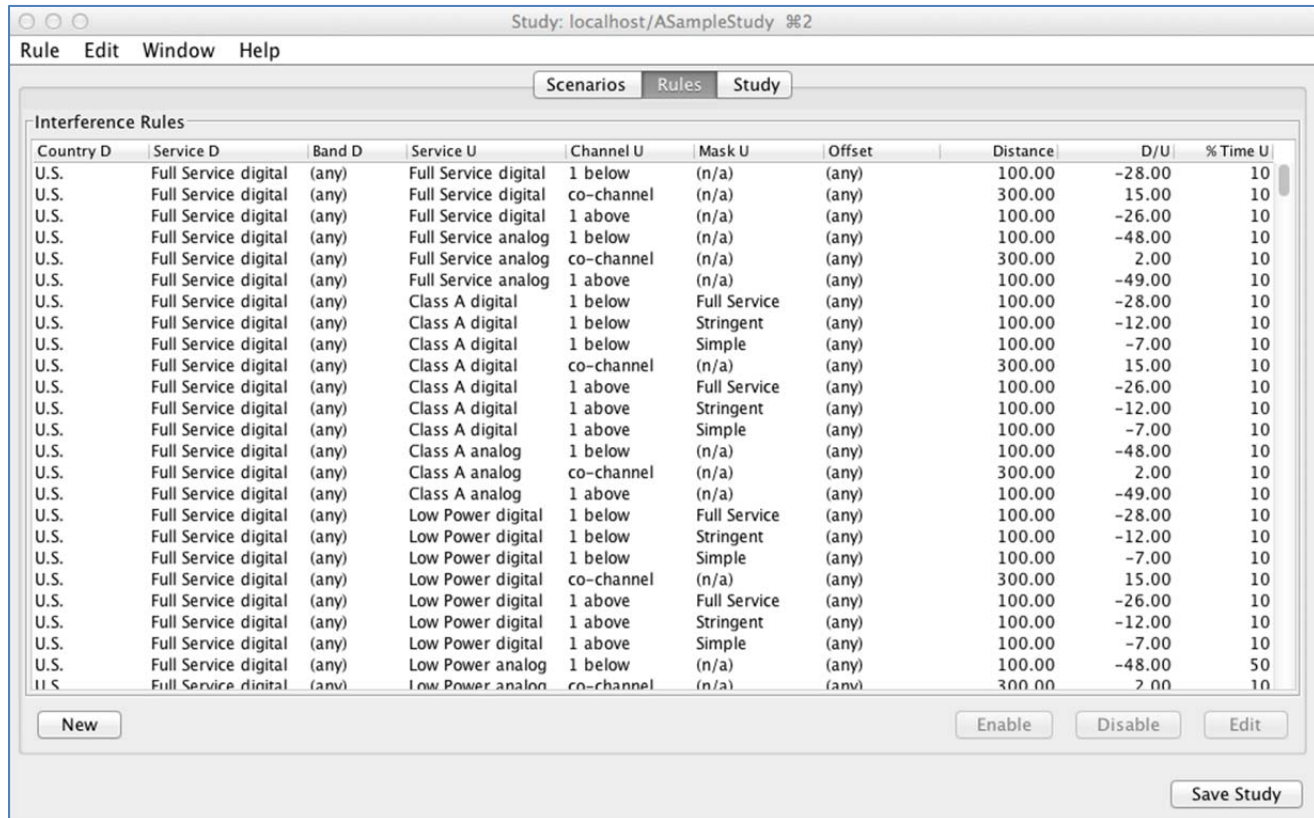
To export a scenario, select “Export...” from the Scenario dropdown menu. The file is exported as an XML file, so navigate to where you would like to save it, give it a name, and click “Save.” See Appendix I for details on the XML file format.

To import a scenario, select “Import...” from the Scenario dropdown menu. 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.

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 edit them, disable or enable them, and you can change multiple parameters at once using “Enable/Disable by Type” in the Rule menu.



Setting the Study Parameters

The next step is to configure the study parameters. Click the “Study” tab.

The screenshot shows the 'Study' configuration window in TVStudy. The window title is 'Study: localhost/ASampleStudy 2'. It has a menu bar with 'Study', 'Edit', 'Window', and 'Help'. Below the menu bar are three tabs: 'Scenarios', 'Rules', and 'Study', with 'Study' being the active tab. The 'Study' tab contains three main sections: 'Study Name' with a text field containing 'ASampleStudy'; 'Study Description' with a large text area containing 'A description for your sample study.'; and 'Study Parameters' which is a sub-window with its own tabs: 'General', 'CDBS', 'Patterns', 'Contours', 'Replication', 'Pathloss', 'Service', and 'Clutter'. The 'General' tab is active and shows several parameters: 'Grid type' (Global), 'Cell size' (2), 'Average terrain database' (3-second), 'Average terrain profile resolution' (10), 'Path-loss terrain database' (3-second), and 'Path-loss profile resolution' (10). Each parameter has a 'Revert' button next to it. A 'Save Study' button is located at the bottom right of the 'Study Parameters' sub-window.

As with the description field for the Scenario, 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 List window when looking at your studies.

The Study Parameters section is broken up into tabs, which contain parameters that are generally related to each other. There are many parameters that can be adjusted as desired. It is important to record the parameter values used in a particular study so that it can be duplicated. The parameter values used in a run are memorialized in the Report (.txt) output file.

Adjustable Study Parameters

Below is a description of the parameters that can be adjusted by the user to improve modeling of a particular scenario. Each of these parameters can “revert” to the default value set in the study template by clicking the “Revert” button to the right of the parameter in question. To revert all of the values to the defaults for that study’s template, choose “Revert All Parameters” from the “Study” drop-down menu.

General

Grid type – Type of cell grid used to measure coverage area and population in the study.

Global – Generates a uniform, global grid that all stations share.

Local – Generates grids that are unique to each station location.

Cell size – Nominal length of each side of a square grid cell, in kilometers.

Average terrain database – Terrain database used to calculate the height above average terrain of the transmitting antenna. TVStudy includes support for 30-second, 3-second, and 1-second terrain data.¹

Average terrain profile resolution – Number of points per kilometer used to calculate the average terrain along each radial.

Path-loss terrain database – Terrain database used for Longley-Rice calculations. TVStudy includes support for 30-second, 3-second, and 1-second terrain data.¹

Path-loss terrain profile resolution – Number of points per kilometer used for Longley-Rice path loss calculations.

U.S. population² – Source of U.S. population (Census) data. TVStudy includes population data from the U.S. Census for 2000 and 2010.

Canadian population² – Source of Canadian population data. TVStudy includes population data from the Canadian Census for 2006 and 2011.

Mexican population² – Source of Mexican population data. TVStudy includes population data from the Mexican Census for 2010.

Round population coordinates – The FCC’s Media Bureau television application processing software, called “tv_process,” rounds Census Block coordinates to the nearest integer second. If checked, TVStudy will round population coordinates in the same way.

Check individual DTS transmitter distances cannot be changed after creating the study.

Spherical earth distance cannot be changed after creating the study.

Rule limit extra distance cannot be changed after creating the study.

¹ The search order for terrain databases is usually CDED, CEM, NED, USGS, SRTM, GTOPO.

² 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.

Co-channel MX distance cannot be changed after creating the study.
Minimum channel cannot be changed after creating the study.
Maximum channel cannot be changed after creating the study.

CDBS values in this tab cannot be changed after creating the study.

Patterns

Depression angle method – Controls how depression angles are calculated.

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 – Controls how mechanical beam tilt is applied.

Never – Never apply mechanical beam tilt values.

Always – The mechanical beam tilt values specified in CDBS will always be applied to the antenna elevation pattern.

Real patterns only – The mechanical beam tilt values specified in CDBS will only be applied to stations for which real elevation patterns are provided (either from CDBS or user-entered).

Mirror generic patterns – 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 – These options control how beam tilt is applied to the generic OET Bulletin No. 69 elevation pattern.

None – Assumes a 0.75° beam tilt for all stations.

Full – Adds the values in CDBS to a 0.75° beam tilt for all stations.

Offset – Subtracts 0.75° from the generic pattern, then adds the value in CDBS. This setting results in maximum radiation in the elevation plane being at the depression angle specified in CDBS for that station.

Invert negative tilts – Although beam tilt angles are conventionally angles of depression (*i.e.*, 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 records give negative values for beam tilt. If checked, any negative electrical beam tilt values in CDBS will be assumed to be positive and thus ensures that maximum radiation is always at or below the horizontal.

Digital receive antenna f/b – These fields control the front to back ratio (in decibels) of the receive antenna used for DTV (ATSC) stations.

Analog receive antenna f/b – These fields control the front to back ratio (in decibels) of the receive antenna used for analog (NTSC) stations.

Contours

Use real elevation patterns for contours – Allows the use of actual antenna elevation patterns for contour projection for all stations. If not selected, generic patterns are always used, even if actual elevation pattern is available.

Digital full-service contour – Controls the relevant thresholds (for each band) used to project the noise-limited service contours.

Digital Class A/LPTV contour – Controls the relevant thresholds used to project the protected service contours.

Analog full-service contour – Controls the relevant thresholds used to project the service contours.

Analog Class A/LPTV contour – Controls the relevant thresholds used to project the protected service contours.

Use UHF dipole adjustment – Controls whether or not a “dipole adjustment” is applied to the service threshold at UHF.

Dipole center frequency – Sets the center frequency for the UHF dipole adjustment.

Propagation curve set, digital – Controls which F-curve set is used to calculate the contour for digital stations.

Propagation curve set, analog – Controls which F-curve set is used to calculate the contour for analog stations.

Truncate DTS service area – If checked, TVStudy limits the coverage areas of DTS stations to the DTS distance limits.

DTS distance limit – By default, these are the DTS coverage limits specified in the Table of Distances³. These values are used only if Truncate DTS service area is checked.

HAAT radial count – Number of radials used to determine height above average terrain.

Minimum HAAT – Minimum height above average terrain used to project contours.

Contour radial count – Number of radials used to project the service or protected contour. Contour distances are interpolated between the specified radials.

Service distance limit – These options restrict the Longley-Rice prediction area to within these distances, primarily for use with Canadian stations.

³ See 47CFR §73.626(c).

Replication

Replication method – Controls how replication of stations onto different channels is performed.

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 ERP – These values set the minimum ERP that will be used in replication of full-service stations.

Digital full-service maximum ERP – These values set the maximum ERP that will be used in replication of full-service stations.

Digital Class A/LPTV minimum ERP – These values set the minimum ERP that will be used in replication of Class A and LPTV stations.

Digital Class A/LPTV maximum ERP – These values set the maximum ERP that will be used in replication of Class A and LPTV stations.

Pathloss⁴

Longley-Rice error handling – Controls how TVStudy handles the kwx=3 warning flag.

Disregard – Accepts the path loss result from Longley-Rice.

Assume service – Assumes service in all flagged cells (note that warnings can be triggered either by a desired station or an undesired station).

Assume interference – Assumes interference in all flagged cells.

Receiver height AGL – Receive antenna height above ground, in meters.

Minimum transmitter height AGL – Minimum transmit antenna height above ground, in meters.

Digital desired % location – Longley-Rice statistical parameter specifying the percentage of locations expected to get service.

Digital desired % time – Longley-Rice statistical parameter specifying the percentage of time a receiver is expected to get service.

Digital desired % confidence – Longley-Rice statistical parameter specifying the confidence (aka situational variability) that a receiver is expected to get service.

Digital undesired % location – Longley-Rice statistical parameter specifying the percentage of locations expected to get interference.

⁴ See NTIA Report 82-100, April 1982 for further explanation of the Longley Rice model path loss parameters.

Digital undesired % confidence – Longley-Rice statistical parameter specifying the confidence (aka situational variability) that a receiver is expected to get interference.

Analog desired % location – Longley-Rice statistical parameter specifying the percentage of locations expected to get service.

Analog desired % time – Longley-Rice statistical parameter specifying the percentage of time a receiver is expected to get service.

Analog desired % confidence – Longley-Rice statistical parameter specifying the confidence (aka situational variability) that a receiver is expected to get service.

Analog undesired % location – Longley-Rice statistical parameter specifying the percentage of locations expected to get interference.

Analog undesired % confidence – Longley-Rice statistical parameter specifying the confidence (aka situational variability) that a receiver is expected to get interference.

Signal polarization – Polarization of transmitted signal.

Atmospheric refractivity – Refractivity referenced to mean sea level, in N-units.

Ground permittivity – Relative ground permittivity.

Ground conductivity – Ground conductivity in Siemens per meter.

Longley-Rice service mode – Longley-Rice model parameter.

Longley-Rice climate type – Climactic zone.

Service

Set service thresholds – If unchecked, the same parameters are used for Longley-Rice calculations as are used for contour calculations.

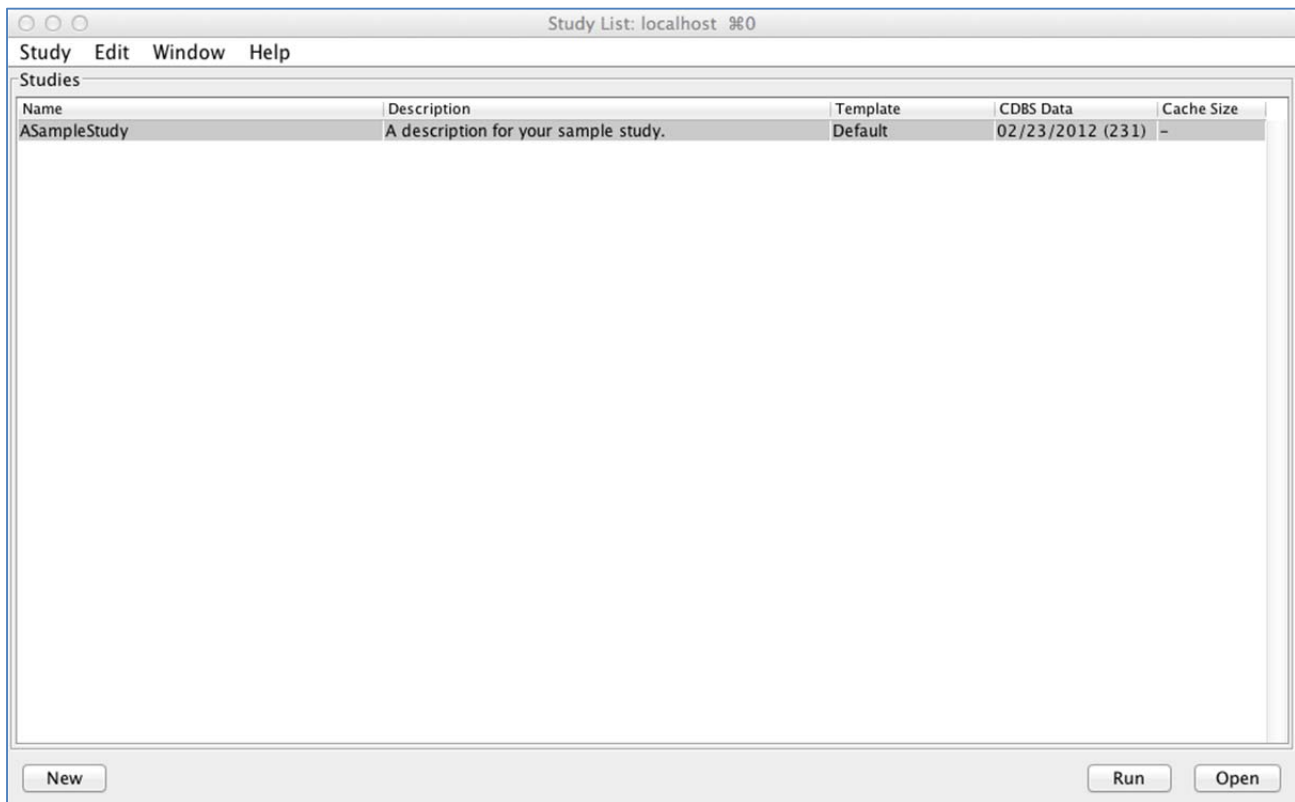
The remaining parameters match those of the Contours tab, but if the “Set service thresholds” box is checked, the values in this tab apply only to Longley-Rice calculations.

Clutter – adjustments are applied as specified in OET Bulletin No. 73, and can be turned on or off.

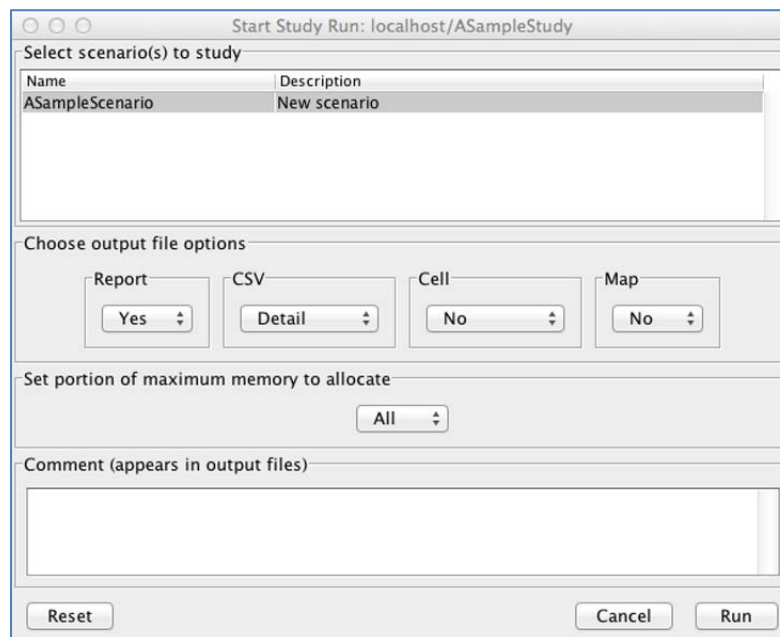
When finished with your study, click “Save Study” and close the Study window.

Running Your Study

Running a Basic Study



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



Click on the scenario(s) you wish to run. 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.

You can now select the types of output you would like.

Report (tvstudy.txt) – This is a textual report listing all of the study parameters along with the stations and their coverage areas.

CSV (tvstudy.csv) – Creates CSV files.

Detail – This is a detailed CSV output file showing the station's coverage and interference, as well as which stations are causing the interference.

Summary – If several scenarios are run at once, the summary output will list them all in one spreadsheet rather across several "Detail" spreadsheets.

Parameters (parameters.csv) – Creates a CSV output file listing the parameters used in the study.

Desired only – The CSV file contains only desired stations.

All stations – The CSV file contains all stations, desired and undesired.

Cell (tvstudy.cel) – Creates a text file showing cell-by-cell results for your scenario(s).

Detail – 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.

Summary – This is an abbreviated version which leaves out many of the details of the study except for the population and whether the cell has service or not.

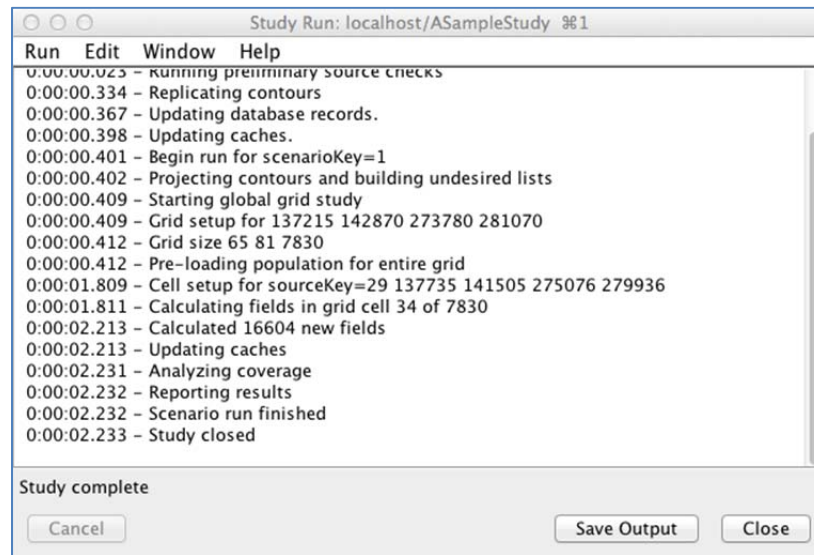
Map (various) – Creates a set of ESRI Shape Files for mapping the results of the scenario(s).

Points (points.csv) – Creates a CSV output listing all the cells used in the study.

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 comments to be included in your report, CSV, and/or cell file(s).

When you are satisfied, click "Run."



The run window is relatively simple. While running, it indicates what it is doing, and has a Cancel button.

Important: If you choose to cancel (abort) a study while it is running, avoid doing so when the last line in the output window reads “Updating Caches” as this can lead to corruption.

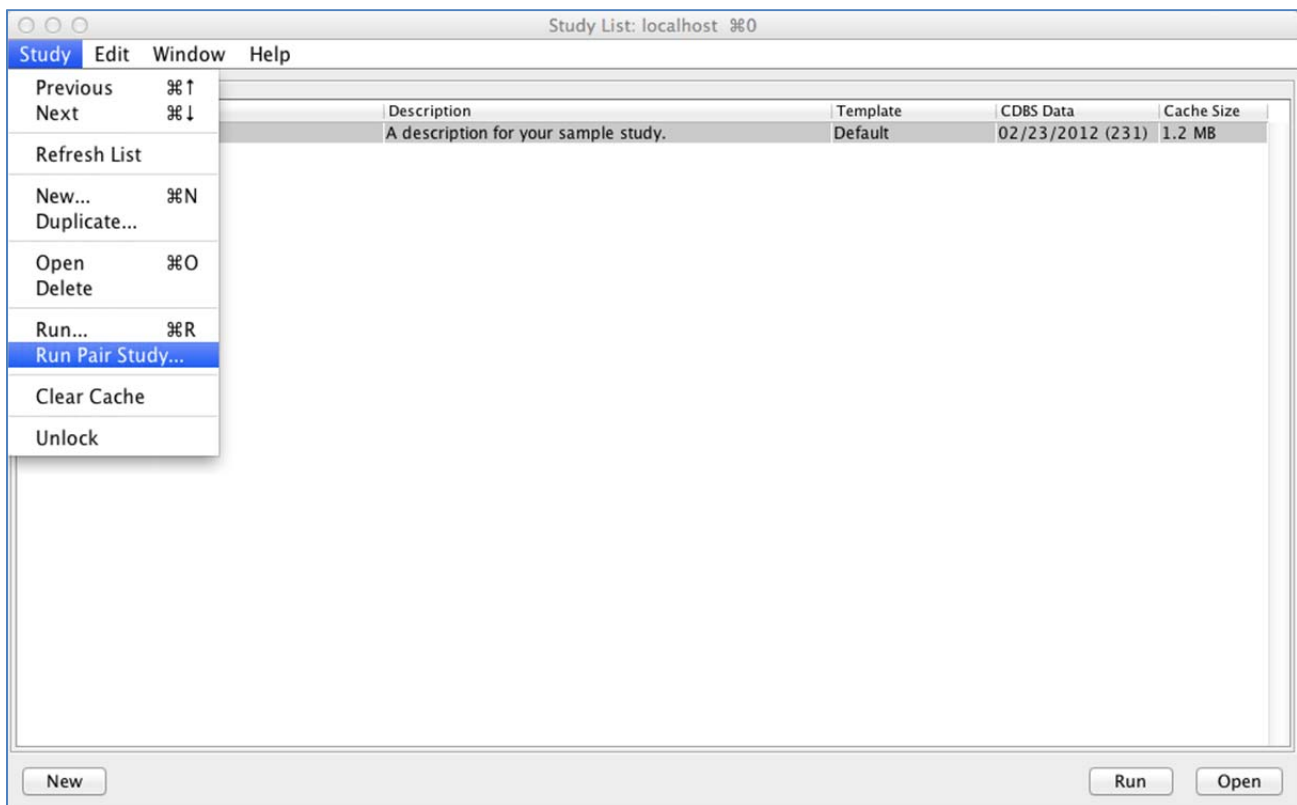
When the run is finished, you can save the contents of the run window to a file by selecting the Save Output option. Click “Close” and return to the Study List window.

Your output files have been placed in a directory structure within the “out” directory. The folder structure follows the format of `../out/<servername>/<studyname>/<scenarioName>`.

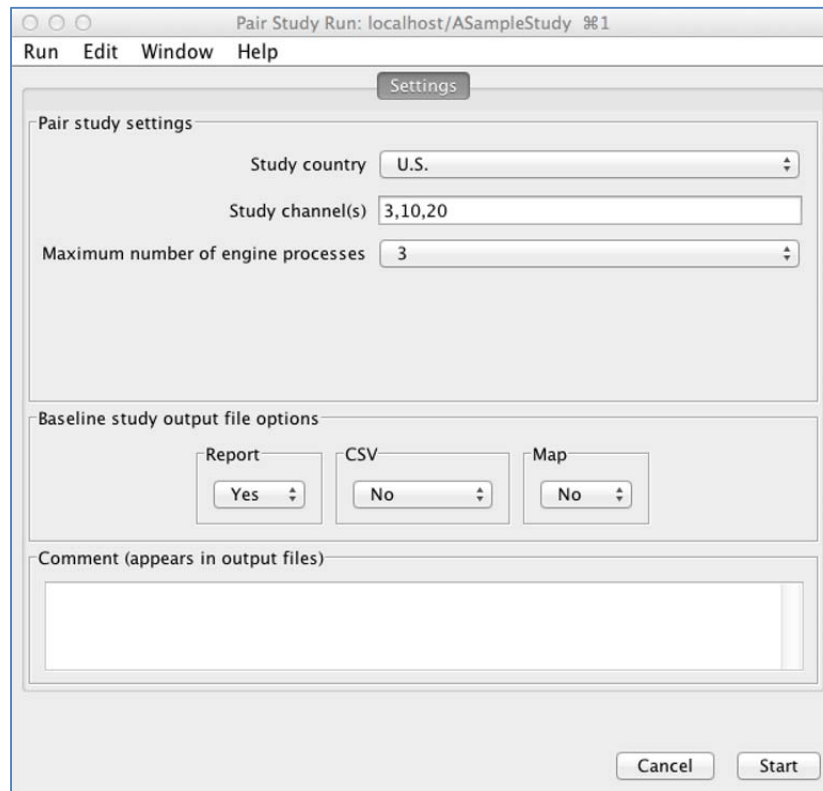
Running a Pair Study

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 an output, which is a set of CSV files with a 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 these 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.



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

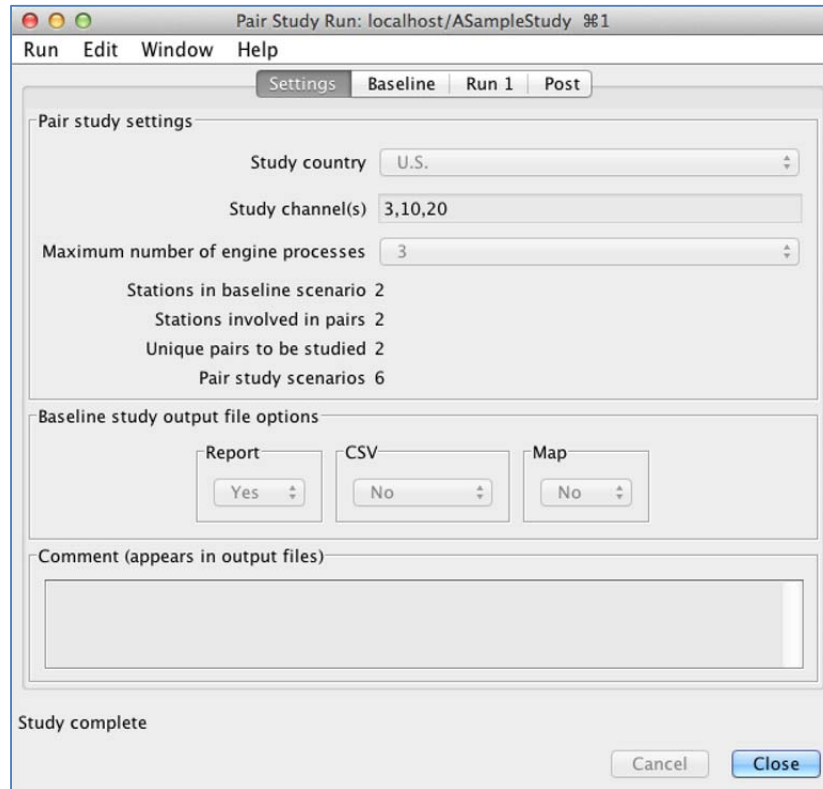


In the Run Pair Study window, enter the country you wish to study (or all countries), the channel(s) on which you wish to run your pair study (these channels are the co-channel study, the associated adjacent channels are determined automatically), and then choose the number of processors (CPUs) you would like to use. 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 the standard Report, CSV, and Map output files. You can select the output files desired; the Report file is recommended for producing a record of the study parameters used for the pair study. The Cell file output is unavailable in a pair study, but the normal pair study output files provide cell-level data. (See Appendix H.)

The pair study may consume as much RAM as is determined to be free by TVStudy. You should avoid running other studies with TVStudy while the pair study is running.

When you are satisfied, click “Start.”



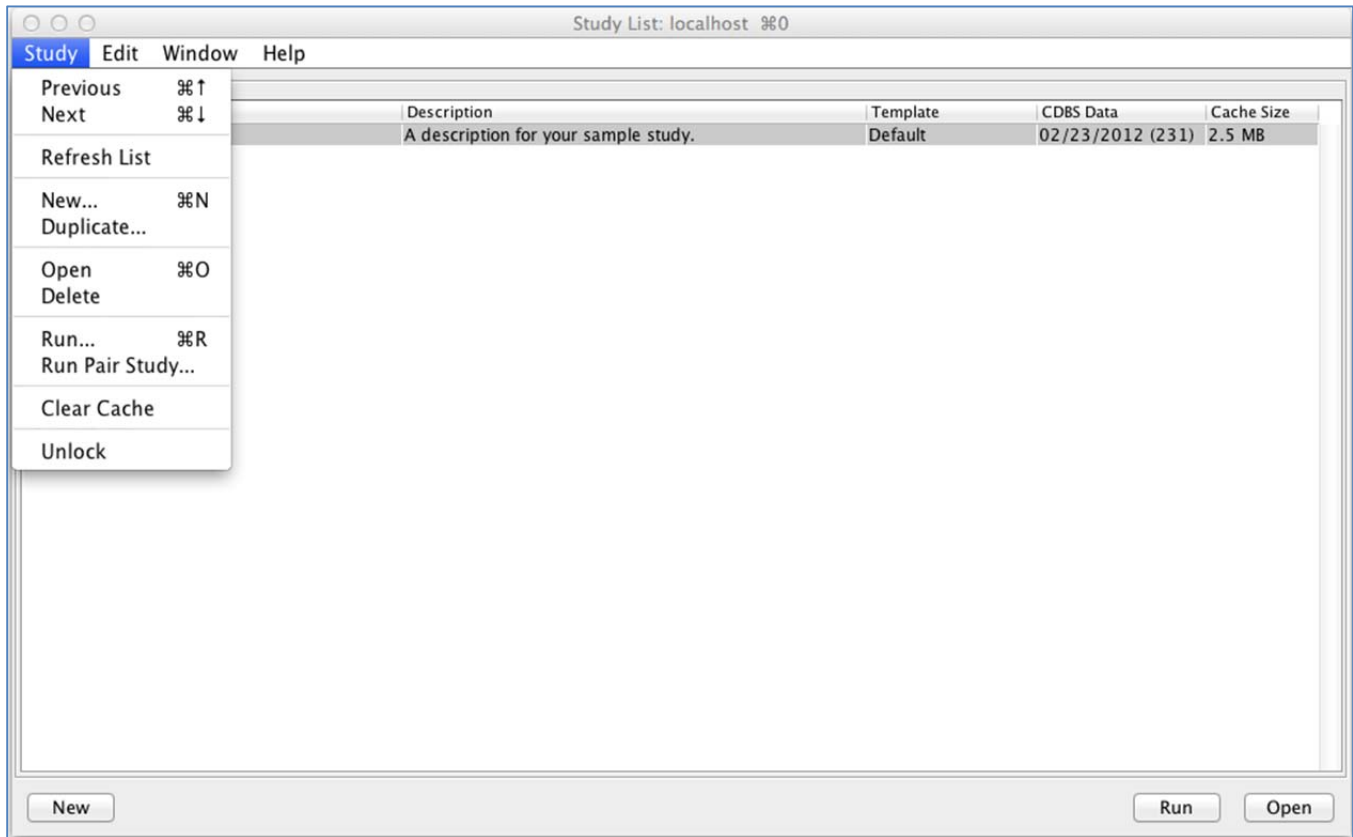
As the pair study runs, you can monitor its progress by clicking the various tabs as they appear. It will first calculate the numbers of stations and pairs to be studied. Then it will run a baseline study of the stations on their original channels to determine existing interference conditions. The software then will then take a sufficiently large run and break it into as many pieces as the number of assigned processors, and will run pair studies for every combination. Finally, the resulting data is output to the appropriate "out" directory, leaving six files which are documented in Appendix H.

When you click "Close," the software will restore the database to its normal state.

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.

Refreshing the Study List

Because TVStudy is designed for use in a multi-user environment, 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 list. The list is refreshed automatically once per minute; to refresh the study list immediately, select “Refresh List” from the Study dropdown menu.

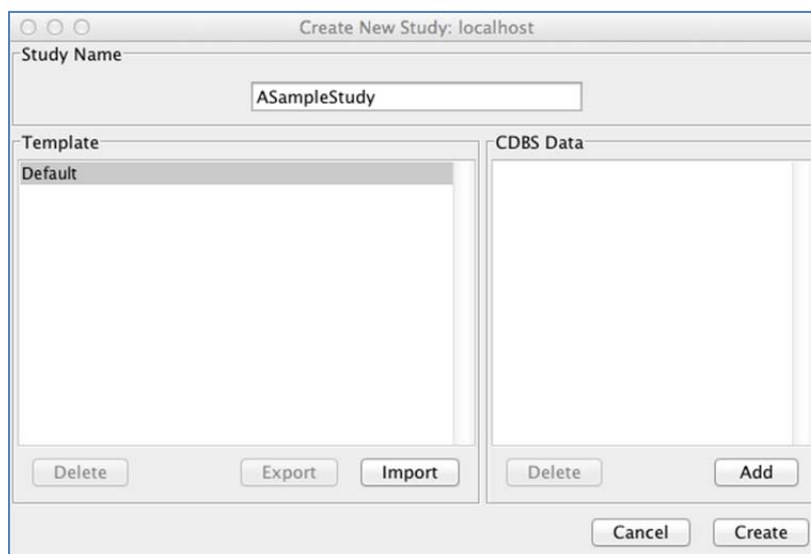
Managing Study Templates

If you have a set of parameters that you would like to use regularly, you may want to consider creating a template.

Creating a Study Template

To create a study 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 software will then ask whether the template should be “locked.” A “locked” template cannot have any of its study parameters changed, thus ensuring that anyone using that template always uses the same study parameters. Once you’ve created a template, you will have the option of selecting it each time you create a study, so you do not have to manually select the various study parameters.

Exporting a Study Template

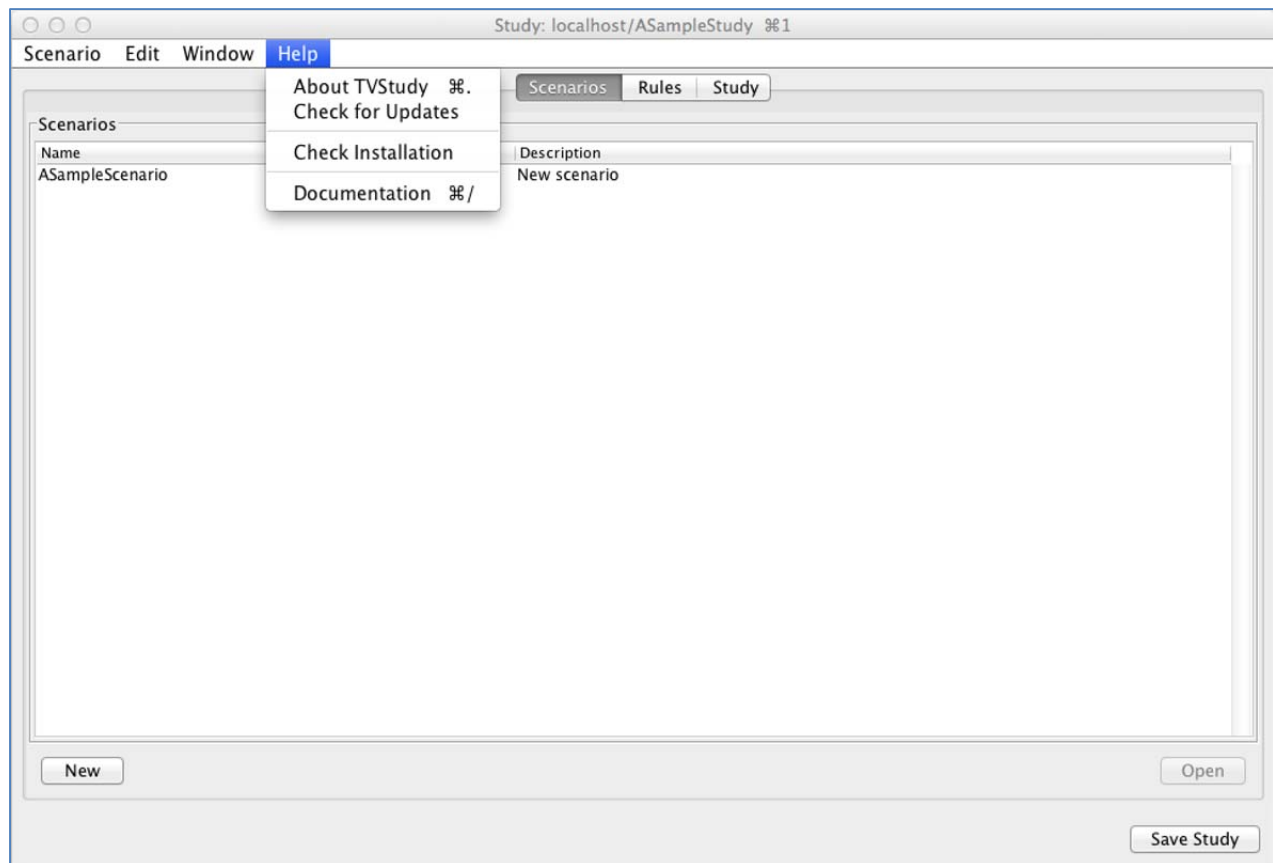


You can also share your study templates with others. To do so, click New in the Study List window. Click the template you wish to export, and then click “Export.” You are now prompted to give the study template a name. Do so, and then click “Export.” You can now share your study template with others.

Importing a Study Template

To import a study template that has been shared with you, click New in the Study List window. 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 available for you to choose when creating studies.

Using the TVStudy Help Menu



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

About TVStudy

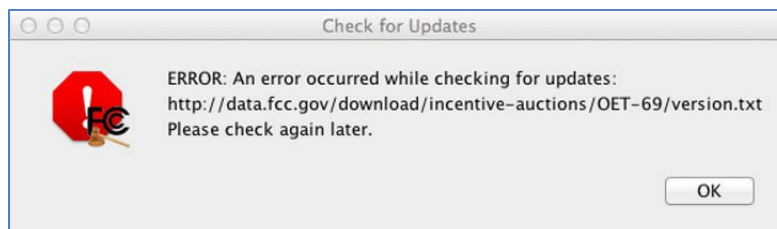


The About TVStudy menu option shows you the version number of both the graphical user interface (GUI) and the TVStudy engine. This may be helpful for troubleshooting issues if an upgrade from one version to another does not complete successfully.

Check for Updates

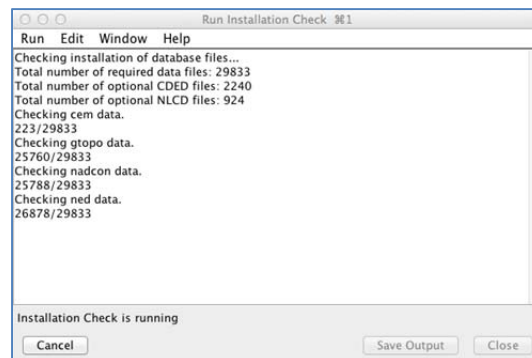


The Check for Updates menu option queries the TVStudy host server (<http://data.fcc.gov/download/incentive-auctions/OET-69/>) to determine if a newer version of TVStudy is available. Depending on the results of that query, one of the above messages will display.



If TVStudy is unable to reach the server for any reason while querying for a newer version, an error message like the one above may display.

Check Installation



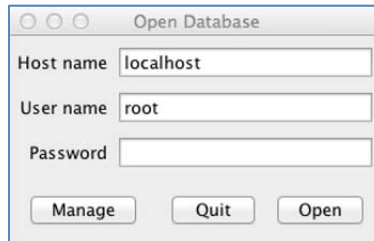
This option verifies all of the files in the dbase directory to ensure that none of the files are corrupt, missing, or inaccessible. It requires the Terrain Database Test and Verification Utility in order to function, which is available as a separate download on the TVStudy website. The utility must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

Documentation

The Documentation menu option will display this manual. Note that this manual must be located in the /help directory of TVStudy.

Closing TVStudy

When closing TVStudy on the Mac, you must take care never to 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 the 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 List window, and select “Unlock” from the Study dropdown menu.

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 List 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 pair 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. To clear such unused records, open the study in question, then select “Delete Unused Records” from the Scenario dropdown menu.

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

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 actual 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 used to identify a station.

File Number

This is a number denoting a specific filing in CDBS. It consists of a prefix to indicate the type of filing, and an Application Reference Number (ARN) to make it unique.

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, or to the country in which the evaluation point is located.

Service Type

1 = Digital TV Full Service (CDBS: DT, DD, DS, DX, DR, DM, DN)

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

3 = Digital TV Class A (CDBS: DC)

4 = Analog TV Class A (CDBS: CA)

5 = Digital LPTV or Translator (CDBS: LD)

6 = Analog LPTV or Translator (CDBS: TX, TB)

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**, and 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 Application ID number, if available.

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 Rules section 73.626(c), or it may be a custom value from the CDBS record.

DA (Directional Antenna)

DA = Directional Antenna

ND = Not Directional

Ant (Antenna) ID

CDBS Antenna ID number, if available.

Azimuth

Degrees of rotation applied to the antenna pattern.

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.

Field Count

Indicates how many transmitters are in a DTS (Distributed Transmission System) network. The reference point is not included in this count. If the facility is not a DTS, value is **1**.

Clutter

Indicates what clutter correction was applied to the cell. If **0**, clutter was not enabled. Otherwise, the clutter category (**1-10**) is indicated. The clutter categories are listed in OET Bulletin No. 73 Table 3.

Result Code

1 = Interference-free service

2 = Interference

3 = No service

11 = Interference-free service, but encountered the kwx=3 warning

12 = Interference, but encountered the kwx=3 warning

13 = No service, but encountered the kwx=3 warning

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. This value is only valid for north latitude and west longitude, and will otherwise be -1.

Service Flag

0 = Does not have service

1 = Has service

KWX Flag

0 = Does not have the kwx=3 warning flag

3 = Has the kwx=3 warning flag

Status

APP = Application filed

CP = Construction Permit granted

CP MOD = Modification to Construction Permit granted

GRANT = Allotment Granted

LIC = Licensed facility

STA = Special Temporary Authority

APPENDIX B

Format of the Summary CSV File

The file is labeled “tvstudy.csv” and appears within the out/<servername>/<study> directory. It can contain data from multiple scenarios.

```
TVStudy Version Number, Database Server, Study Key
Scenario Name, Comment
Fac ID, File Number, Country Key for Station, Service Type, Channel, Country Key for
Area/Pop, Noise Lim Area, Noise Lim Pop, Terr Lim Area, Terr Lim Pop, Ix Lim
Area, Ix Lim Pop
```

APPENDIX C

Format of the Parameters Output File

The file is labeled “parameters.csv” and appears within the out/<servername>/<study>/<scenario> directory. It contains all of the parameters used in the computation of coverage and interference for all the stations in the scenario.

TVStudy Version Number

Database Server

CDBS Used

Study Name

Fac ID, Source Key, DTS Key, Site, File Number, App ID, Country Key for Station, Des
Flag, Und Flag, Channel, From Channel, City, State, Lat, Lon, DTS Distance,
RCAMSL, HAAT, ERP, DA, Ant ID, Rotation, E Beam Tilt, Service Type, Country Key
for Area/Pop, Noise Lim Area, Noise Lim Pop, Terr Lim Area, Terr Lim Pop, Ix Lim
Area, Ix Lim Pop,, Antenna Information,, [Extra Azimuth, Extra Field Value, ...]

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.

APPENDIX D

Format of the Summary Cell Output File

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

Global Grid Mode

```
[scenario]
Database Server
Study Name
Scenario Name
Timestamp
Cell Size, Grid Type, Cell Latitude Size
[comment]
Comment
[endcomment]
[sources]
Source Key, Country Key, Service Type, Channel, Fac ID, Lat Index South Limit, Lon
    Index East Limit, Lat Index North Limit, Lon Index West Limit, 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, Point Area, Point Pop, Clutter
R, Source Key, 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.

Please note that 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, Lat Index, Lon Index, Point Area, Point Pop, Clutter
[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.

APPENDIX E

Format of the Detailed Cell Output File

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

Global Grid Mode

```
[scenario]
Database Server
Study Name
Scenario Name
Timestamp
Cell Size, Grid Type, Cell Latitude Size
[comment]
Comment
[endcomment]
[sources]
Source Key, Des Flag, Und Flag, Country Key, Service Type, Channel, Service Level,
    Field Count, Fac ID, Lat Index South Limit, Lon Index East Limit, Lat Index North
    Limit, Lon Index West Limit, 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, Point Lat, Point Lon, Point Area, Point Pop, Clutter
D, Source Key, Field Strength, Bearing, 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
[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 station that provides service to the cell. Similarly, each “D” line can have multiple “U” (undesired) and “DU” (D/U ratio) lines, for each undesired station that interferes with the desired station. However, there is not a guarantee that “U” records will always follow a “D”, nor that a “DU” record will always follow a “U”, as KWX=3 errors may abort the analysis and the subsequent records will not be generated.

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.

Notes About the Detailed Cell Output File

If a KWX=3 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.

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 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 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 in to 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.

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, Point Lat, Point Lon, Point Area, Point Pop,
  Clutter
D, Field Strength, Bearing, 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", as KWX=3 errors may abort the analysis 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.

APPENDIX F

Notes About Opening the ESRI Shape Files

TVStudy produces four sets of standard ESRI shape files:

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

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

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

sources.shp – This file contains the various transmitter locations for stations studied.

For those unfamiliar with Shape Files, four components are required for the files to work properly. Do not delete the .dbf, .prj, or .shx 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, which runs on Windows, Mac, and Linux, and is available at: <http://qgis.org>. Compatibility has been confirmed with QGIS version 2.0 (Dufour).

To produce useful maps using Quantum GIS, you will need to obtain Shape Files separate from those produced by TVStudy, such as files containing political boundary data. A collection of such files can be found here: <http://nationalatlas.gov/atlasftp.html?openChapters=chpbound>

To add shape files to QGIS, you can simply drag the shape file into the “Layers” pane at the left.

The coverpts.shp shape file uses the same set of result codes as noted in Appendix A, 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 assigns 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

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.

APPENDIX G

Format of the Points Output File

The file is labeled “points.csv” and appears within the `out/<servername>/<study>/<scenario>` directory. It contains all of the cells used in a single scenario.

Lat Index, Lon Index, Country Key, Point Key, Point Lat, Point Lon, Point Elevation,
Point Area, Point Pop, Clutter

APPENDIX H

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, Status, File Number

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

Fac ID, Channel, Country Key of 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 of 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, 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

APPENDIX I

Format of the Scenario XML Output

```

<SCENARIO NAME="name">
  <DESCRIPTION>
    description text
  </DESCRIPTION>
  <SOURCE (see attributes below)>
    <APAT>
      azimuth,field
    .
    .
  </APAT>
  <EPAT>
    depression,field
  .
  .
  </EPAT>
  <MPAT>
    azimuth,depression,field
  .
  .
  </MPAT>
  <DTS_SOURCE (see attributes below)>
    <APAT>
    </APAT>
    <EPAT>
    </EPAT>
    <MPAT>
    </MPAT>
  </DTS_SOURCE>
  .
  .
</SOURCE>
.
</SCENARIO>

```

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.

When a station record is non-editable in the exporting scenario (meaning it is based directly on a CDBS record), the SOURCE will be just a reference to the CDBS record. In that case it will not enclose any other elements, and will appear as shown below.

<SOURCE (attributes)/>

Only the DESIRED, UNDESIRED, LOCKED, CDBS_ID, and REPLICATE attributes may appear. The LOCKED flag will always be "true" (the record is non-editable), and the CDBS_ID attribute provides the CDBS application ID. All data for the record will be loaded directly from CDBS when the scenario is imported. If the application ID is not found in the importing study's version of CDBS, 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, 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 ID to exist in the version of CDBS used by the importing study. The record will be in the imported scenario regardless, however if the application ID does not exist in CDBS of course it will not be possible to revert to the original CDBS record. When exporting a scenario, if it is expected that some CDBS records may not exist in the study where the scenario will be imported, make all of those records editable prior to exporting.

SOURCE Attributes That Should Always Appear

DESIRED="true|false"

The desired flag in the scenario.

UNDESIRED="true|false"

The undesired flag in the scenario.

LOCKED="true|false"

Indicates if the station record is editable, locked records are non-editable. Locked records occur only when the record comes directly from CDBS and has not be edited, other than possibly by replication to a different channel, see REPLICATE.

CDBS_ID="application ID"

For records based on CDBS, the application ID uniquely identifying the record.

REPLICATE="replication channel"

Indicates the record is to be replicated, and provides the replication channel. When an editable record (LOCKED="false") is replicated, the SOURCE and contained elements provide all data for the original pre-replication record. The replication record will be generated automatically by the importing study.

SOURCE Attributes Appearing Only When LOCKED="false"

ID="facility ID"

CDBS facility ID or equivalent user-entered value for a record that is not based on CDBS

SERVICE="service code"

CDBS service code for the station, "DT", "LD", etc.

COUNTRY="country code"

Station country: "US", "CA", or "MX"

CHANNEL="channel"

Station channel (original channel for a replication)

DTS_LATITUDE="latitude"

DTS_LONGITUDE="longitude"

Latitude and longitude of DTS reference point, NAD27 degrees north and west. These appear only for a DTS operation, they provide the reference point coordinates for the DTS "table of distances" truncation check.

CALL_SIGN="call"

Call sign.

CITY="city"

City of license

STATE="state"

State of license

ZONE="zone"

TV Zone: "1", "2", or "3".

STATUS="status"

Record status: "APP", "CP", "CP MOD", "LIC", "GRANT", or "STA"

FILE_NUMBER="file_number"

FCC file number

OFFSET="offset"

Offset code: "Z", "+", or "-". In the case of no offset, the attribute does not appear.

MASK="mask"

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).

LATITUDE="latitude"

LONGITUDE="longitude"

Transmitter location coordinates, NAD27 datum, positive degrees north and west.

HAMSL="hamsl"

Antenna height AMSL, meters.

HAAT="haat"

Antenna HAAT, meters.

ERP="erp"

Peak horizontal ERP, kilowatts.

HAS_APAT="true|false"

True if the record has azimuth-plane pattern data (an APAT element).

APAT_NAME="name"

Identifying name of the azimuth pattern.

APAT_ORIENT="azimuth"

Azimuth pattern orientation, degrees true.

HAS_EPAT="true|false"

True if the record has a conventional elevation-plane pattern (an EPAT element).

EPAT_NAME="name"

Identifying name of the elevation pattern.

HAS_MPAT="true|false"

True if the record has a "matrix" elevation pattern (an MPAT element).

MPAT_NAME="name"

Identifying name of the matrix elevation pattern.

USE_GENERIC="true|false"

True if a generic elevation pattern may be used for the record in the absence of EPAT or MPAT data

EPAT_ETILT="tilt"

Elevation pattern electrical tilt, degrees of depression. The tilt attributes are always included; tilt may be applied to either an EPAT or a generic elevation pattern according to study parameter settings.

EPAT_MTILT="tilt"

Elevation pattern mechanical tilt, degrees of depression.

EPAT_ORIENT="azimuth"

Orientation of mechanical tilt, degrees true.

DTS_SOURCE Attributes

A DTS_SOURCE may contain only a subset of the SOURCE attributes, as listed below. All other attributes are either not relevant, or will implicitly have the same values as the enclosing SOURCE, *i.e.*, the channel.

CALL_SIGN
CITY
STATE
ZONE
STATUS
FILE_NUMBER
OFFSET
MASK
LATITUDE
LONGITUDE
HAMSL
HAAT
ERP
HAS_APAT
APAT_NAME
APAT_ORIENT
HAS_EPAT
EPAT_NAME
HAS_MPAT
MPAT_NAME
USE_GENERIC
EPAT_ETILT
EPAT_MTILT
EPAT_ORIENT

APPENDIX J

Examples of Additional SQL for Query WHERE Clause

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

Choose a state	facility.comm_state = 'VA'
Choose multiples states	facility.comm_state IN('VA','DC','MD')
Choose a city of license	facility.comm_state = 'MD' AND facility.comm_city = 'Baltimore'
Choose a channel	tv_eng_data.station_channel = 51
Choose a range of channels	tv_eng_data.station_channel >= 14 AND tv_eng_data.station_channel <= 20
Choose only Zone I	tv_eng_data.fac_zone = 1
Choose Canadian border region	tv_eng_data.border_code = 'C'

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

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

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